

## Description and Operation

### Introduction



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

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

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

### SECTION CONTENT

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

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

### IMPORTANT INFORMATION

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

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

### Warnings, Notices and Notes

#### WARNINGS

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

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

#### NOTICES (in some publications, CAUTIONS)

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

#### NOTES

**Description and Operation**

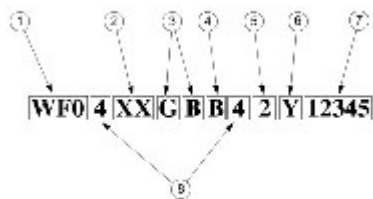
**Identification Codes**

The codes stamped or printed on the VIN plate during production enable the precise details of the vehicle build specification to be established.



Item	Part Number	Description
1	-	Visible VIN
2	-	VIN stamped into the front right wheel arch
3	-	VIN on the Vehicle identification plate attached to the B-pillar

**VIN** (an example of VIN shown)



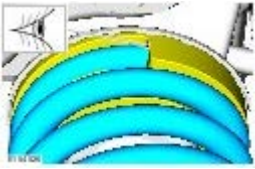
Item	Part Number	Description
1	-	VIN Position 1, 2 and 3 - World manufacturer identifier
2	-	VIN Position 5 and 6 - Constant X
3	-	VIN Position 7 and 8 - Product source company and assembly plant
4	-	VIN Position 9 - Model
5	-	VIN Position 11 - Year of manufacture
6	-	VIN Position 12 - Month of manufacture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

**VIN Encoding**

FordEtis provides a VIN encoding on the Vehicle Lookup site. Furthermore a detailed VIN coding explanation can be found in the parts catalog FordEcat.

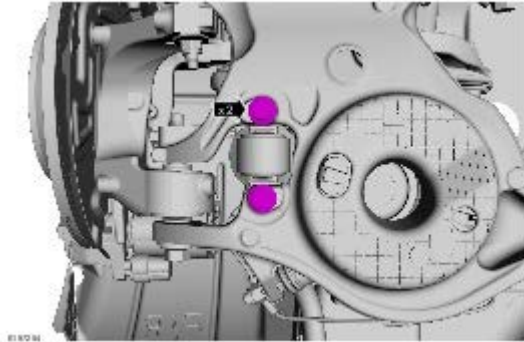
**Year of Manufacturing (VIN Position 11)**


Year	VIN Position 11
2006	6
2007	7
2008	B
2009	9
2010	A
2011	B
2012	C
2013	D



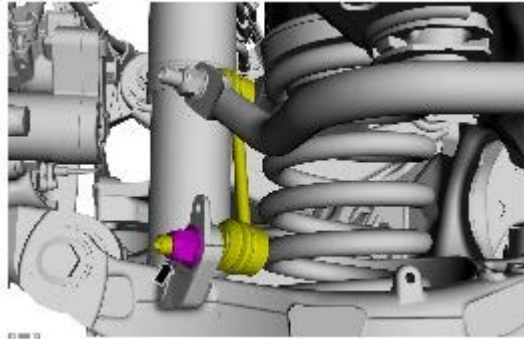
5. NOTE: Make sure that new bolts are installed.

Torque: 48 Nm

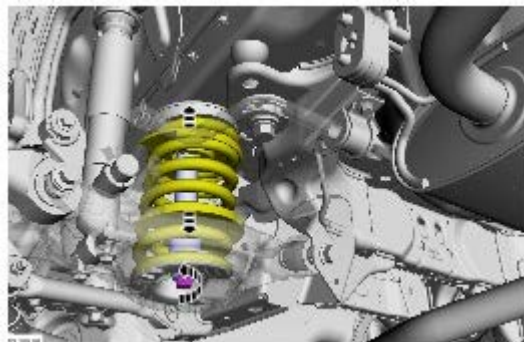


6.  NOTICE: Make sure that the ball joint ball does not rotate.  
NOTE: Make sure a new bolt is installed.

Torque: 115 Nm



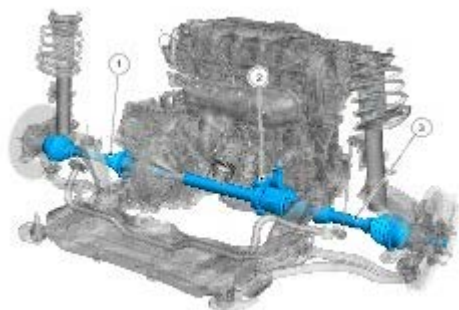
- 7.



8. Remove Special Service Tool: [204-824](#).

## Description and Operation

### Front drive halfshafts



#### Item Description

- |   |                                   |
|---|-----------------------------------|
| 1 | Left-hand halfshaft               |
| 2 | Intermediate shaft center bearing |
| 3 | Halfshaft RH                      |

### General information

- The halfshafts have constant velocity (CV) joints at both ends to provide smooth drive to the road wheels.
- The inner constant velocity joints are slip joints.
- On the wheel side, constant velocity joints without longitudinal adjustment are installed.
- The left-hand halfshaft CV joint is secured in the differential with a snap ring.
- The intermediate shaft (right-hand side) is secured in the differential by the intermediate shaft center bearing assembly.
- The wheel-side constant velocity joints are attached to the wheel hubs.

### How the halfshafts work

- The halfshafts transmit the engine torque to the wheels.
- In order to allow vertical movement of the wheels and engine, the halfshafts operate at varying lengths and angles.
- The tripod joints allow for changes in halfshaft length during axial movements.

### Handling halfshafts

NOTE: The inner constant velocity (CV) joint must not be bent at more than 18 degrees, the outer CV joint must not be bent at more than 45 degrees.

NOTE: Do not subject the tripod joint to tensile loads.

The following points must be observed during removal and installation of the halfshafts:

- Check polished surfaces and splines for damage. Do not allow the boots and the clamps to come into contact with sharp edges, the engine or the exhaust system.
- Do not drop the halfshaft as this can damage the inside of the CV joint boots without showing any signs of damage on the outside.
- Do not use halfshafts as levering tools for the installation of other components.
- Halfshafts must always hang free.
- The tripod joint can be damaged by knocks outside the joint housing.
- During removal and installation of the right-hand halfshaft always renew the bolts and the bearing shell of the center bearing.

### Wheel balancing, front

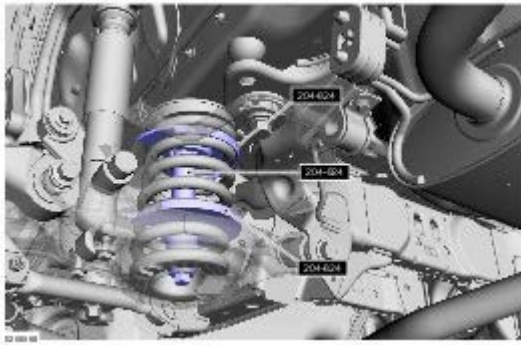
Using a portable wheel balancing unit when the vehicle is lifted completely off the ground will result in damage to the tripod joints or boots, as the joint is bent at a greater angle than its normal operating range. The joints would overheat in the process.

To use a portable balancing unit position a trolley jack under the suspension arm opposite the wheel which is being balanced. This prevents the joint from being bent too much when the vehicle is raised.

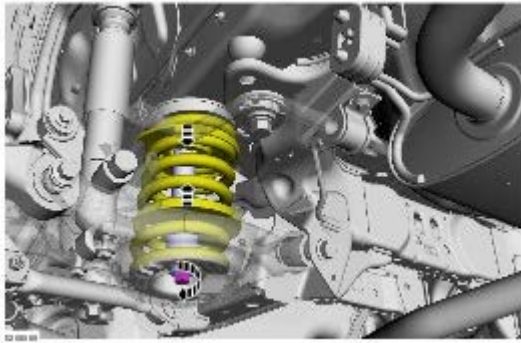
Where possible, wheels should be removed for balancing, and balanced using a stationary wheel balancing unit.

### Raising the vehicle

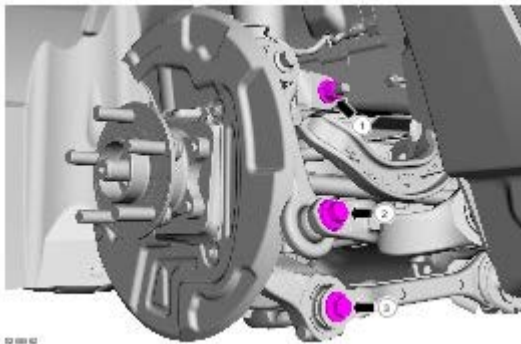
NOTE: Do not fasten a towing rope to the halfshafts.




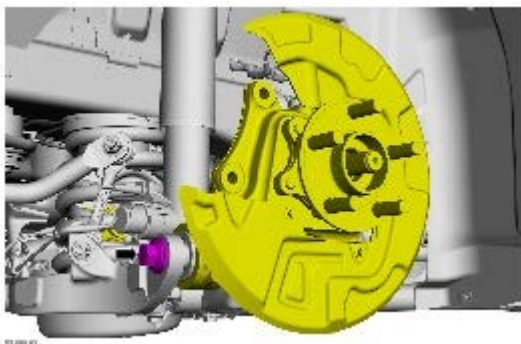
6.



7.



8.  NOTICE: Take extra care when handling the component.



9. Use the General Equipment: [Puller](#)

messages from the **RCM**, both messages are sent along the **HS-CAN 2**. If the **ABS** module determines from the inputs the vehicle is unable to travel in the intended direction, it modulates the brake pressure to the appropriate brake caliper(s) by opening and closing the appropriate solenoid valves inside the **HCU** while the hydraulic pump motor is activated.

At the same time the **ABS** module calculates how much engine torque reduction is required to reduce vehicle speed to help stabilize the vehicle and sends this torque reduction message, along with an Electronic Stability Control (ESC) event message, to the **GWM** over the **HS-CAN 2**. The **GWM** sends the torque reduction message to the **PCM** over the **HS-CAN 1** and the Electronic Stability Control (ESC) event message to the **IPC** over the **HS-CAN 3**.

When the **PCM** receives the torque reduction message, it adjusts engine timing and decreases fuel injector pulses to reduce the engine torque to the requested level. When the **IPC** receives this message, it flashes the stability/traction control indicator (sliding car icon). Once the vehicle instability has been corrected, the **ABS** module returns the solenoid valves in the **HCU** to their normal position, deactivates the hydraulic pump motor and stops sending the traction event and torque reduction messages. The **PCM** returns engine timing and fuel injectors to normal operation and the **IPC** extinguishes the stability/traction control indicator (sliding car icon).

Electronic Stability Control (ESC) does not operate with the transmission in REVERSE. Electronic Stability Control (ESC) is disabled if there is a wheel speed sensor, **RCM** stability sensor or steering angle sensor **DTC** present in the **ABS** module. Electronic Stability Control (ESC) is also disabled if there is a communication error between the **ABS** module and the **PSCM** or the **ABS** module and the **RCM**. When Electronic Stability Control (ESC) is disabled, the **ABS** module sends a message to the **GWM** along the **HS-CAN 2** which gateways the message to the **IPC** over the along the **HS-CAN 3** to illuminate the stability/traction control OFF indicator (sliding car OFF icon).

### Hill Start Assist

When the vehicle is stopped on an incline the **ABS** module holds the brake pressure for approximately 1.5 seconds while the driver transitions from the brake pedal to the accelerator pedal. This is accomplished by monitoring several **HS-CAN** messages and several sensors to determine if the vehicle is stopped and not parked, and if the vehicle is on an appropriate incline. The brake pedal message sent by the **PCM** and the wheel speed sensor inputs allow the **ABS** module to determine the vehicle has come to a complete stop.

The transmission selector lever message sent by the **PCM** informs the **ABS** module the vehicle is not parked. The stability sensor messages sent by the **RCM** enable the **ABS** module to determine if the vehicle is on an incline greater than 1.5 degrees (approximately a 3% grade). Once the above conditions have been met, the hill start assist function automatically engages. As the driver releases the brake pedal, the **ABS** module commands the **HCU** to close the isolation valves which maintain the current brake system pressure, preventing the vehicle from rolling down the incline.

Once the driver presses the accelerator pedal and the torque produced by the engine reaches a specific level, the **ABS** module gradually releases the brake pressure to make sure the vehicle is neither rolling back nor driving off until there is sufficient driving torque to move the vehicle forward (or backward if reversing up the incline). For vehicles with an automatic transmission the incline must be greater than 3.5 degrees (approximately a 6% grade), for vehicles with a manual transmission the incline must be greater than 1.5 degrees (approximately a 3% grade) and for vehicles equipped with the stop/start feature (regardless of transmission) the incline must be greater than 0.5 degrees (approximately a 1% grade).

### Supplemental Braking Assist

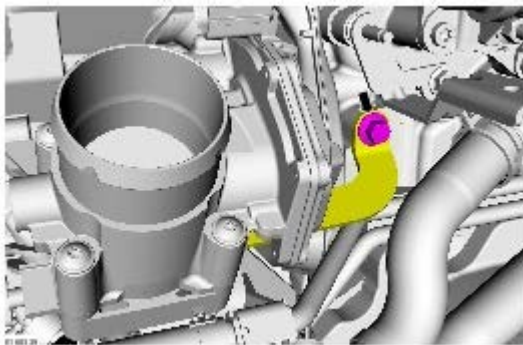
The **ABS** module uses the **HCU** and hydraulic pump motor to help bring the vehicle to a safe, controlled stop in the event of severe vacuum loss in the brake booster. The **ABS** module continually monitors the vacuum in the brake booster through the use of a vacuum sensor. When the vacuum sensor indicates vacuum is below a predetermined level, a **DTC** is set in the **ABS** module.

The **ABS** module sends a message to the **GWM** over the **HS-CAN 2** to illuminate the red brake warning indicator, the **GWM** relays this message to the **IPC** over the **HS-CAN 3**. If a low vacuum condition occurs during a braking event or if the driver attempts to stop the vehicle with a low vacuum condition in the brake booster, the **ABS** module activates the hydraulic pump motor in the **HCU** to assist with vehicle braking.

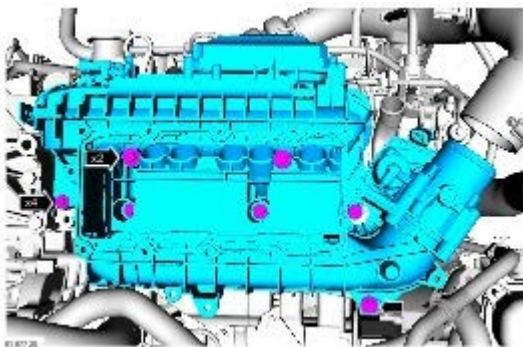
On vehicles equipped with adaptive cruise control, the **CCM** monitors the area forward of the vehicle. When an object enters this area and closes the distance gap set by the driver, the **CCM** sends either an adaptive cruise control deceleration request or a collision avoidance deceleration request to the **ABS** module over the **HS-CAN 2**. When the deceleration request message is received, the **ABS** module activates the hydraulic pump motor and



5. Torque: 18 Nm



6.

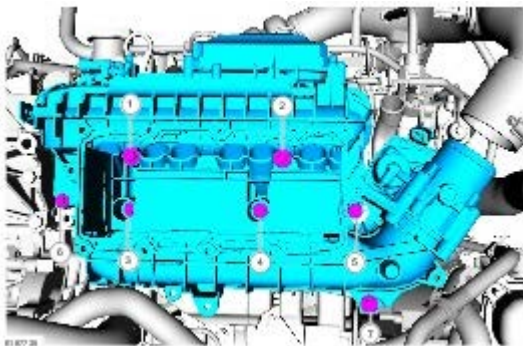


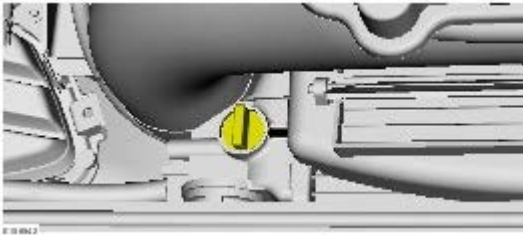
## Installation

1. To install, reverse the removal procedure.

2. Torque:

- 1-7 2 Nm
- 1-2 18 Nm
- 3-6 10 Nm
- 7 18 Nm





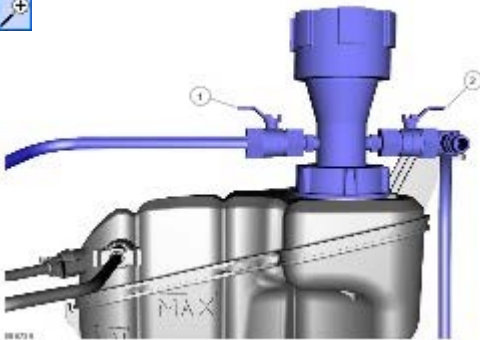
## Filling


- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
- Material: WSS-M97B44-D (Antifreeze)*
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.

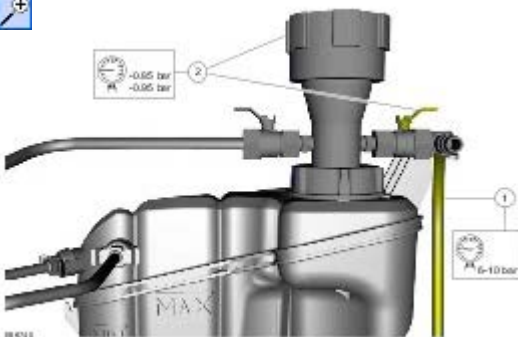
*Material: WSS-M97B44-D (Antifreeze)*

- Use the General Equipment: [Cooling System Vacuum Tester and Refiller](#)

1. Close the valve, install the coolant hose and place it into the fluid container.
  2. Close the valve and connect the compressed air hose.



- 
  - 1.
  2. Open the valve until the specified vacuum is achieved.



- Open the valve until the coolant reservoir fluid level is at the MAX mark.
  - If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.

*Material: WSS-M97B44-D (Antifreeze)*





AFR. This is known as Short Term Fuel Trim (STFT). If the same variation is registered a pre-determined number of times, a permanent correction factor is applied. This is known as Long Term Fuel Trim (LTFT), which is stored in the EEPROM. When the correction factors exceed pre-determined limits a DTC will be set in the EEPROM. If a concern is detected in either the STFT or LTFT, and it is still present on a second trip, the MIL will be switched on.

#### Heated Oxygen Sensor (HO2S) Monitor (All except vehicles with diesel engine)

This monitors the operation of the pre (upstream) and post (downstream) catalytic converter HO2S sensors. It will detect deviations in air/fuel ratios (AFR) and sensor faults.

The HO2S will cause emission increase when its response time increases too much. To diagnose a sensor a period is measured and the number of lean/rich transitions are counted. The sum of valid periods is then calculated. To avoid non-representative measurements, the period is valid only if the HO2S has been below a low threshold and above a high threshold between 2 consecutive lean/rich transitions. A failure is declared when the sum of the measured periods exceeds the sum of the corresponding limit (held within the PCM) and the MIL is illuminated.

#### Catalytic Converter Efficiency Monitor (All except vehicles with diesel engine)

The efficiency of a catalytic converter is measured by its ability to store and later release oxygen to convert harmful gases. The efficiency is reduced if the converter becomes contaminated as it ages, and at high gas flow rates, because the exhaust gas does not remain in the converter long enough to complete the conversion process.

This monitor checks for the oxygen storage capacity (OSC) of the catalytic converter. During a controlled period, the catalyst monitor sensor signal is analyzed to evaluate the OSC of the catalyst. It represents the quantity of oxygen that is really used for the oxidation-reduction reaction by the catalytic converter. If a fault has occurred with the catalyst monitor sensor during the catalyst diagnosis, a sensor diagnosis is carried out. During the controlled diagnosis phase, the catalyst monitor sensor activity is measured and is compared to the OSC of the catalyst. If this activity is high (low OSC) the MIL will be illuminated. If throughout the controlled phase, repeated several times, the downstream sensor output has not moved, the closed loop mode is delayed in order to test the sensor. If the catalyst monitor sensor is set to rich, the injection time is forced to lean and conversely if the downstream sensor is set to lean, the injection time is forced to rich until the sensor switches over or until the end of a delay. If this delay expires or the sensor does not switch, the sensor is treated as failed.

#### Combustion Noise Monitor (Vehicles with common rail fuel injection)

In diesel variants, the Combustion Noise Monitor is used to trim the fuel injection pulse lengths. Each fuel injector has an associated set of correction data that is determined during a production end of line test. The Combustion Noise Monitor is used to determine how the fuel injector characteristic changes from this initial calibration over the life of the fuel injector.

#### EGR Monitor (Vehicles with diesel engine)

The functionality of the EGR system is checked by comparing either the MAP sensor output or EGR valve lift potentiometer output (depending upon application) with expected values.

#### Diagnostic Requirements

Vehicles equipped with EOBD, can be diagnosed using the WDS. In order for the EOBD system to be invoked, a number of criteria must be met. After any repair, which could affect emissions, a trip must be carried out on the vehicle, to make sure that engine management system operates correctly.

#### Malfunction Indicator Lamp (MIL)

The MIL is located in the instrument cluster and is fitted to alert the driver to the fact that an abnormal condition has developed in the engine management system, that is having an adverse effect on emissions. In cases of misfires which are likely to cause catalytic converter damage, it is switched on immediately. With all other faults it will illuminate continuously from the second trip after the condition occurred. Under normal operation it should illuminate at key-on and go out almost as soon as the engine is started.

#### Diagnostic Trouble Codes (DTCs)

The DTCs given by the PCM are standardized, which means that generic scan tools can read results from all vehicles.

- The DTC is always a 5 digit alphanumeric code, for example "P0100".
- The first digit of a code (letter) identifies the system which has set the code. Provision has been made for a total of four systems to be identified although only the 'P' code is required for EOBD.

## Diagnosis and Testing

### General Equipment

UV leak detector

## Inspection and Verification

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

## Visual Inspection Chart

### Mechanical

- Fluid leaks.
- Visibly damaged or worn components.
- Loose or missing nuts or bolts.

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

## Transmission gear shifting or noise concerns

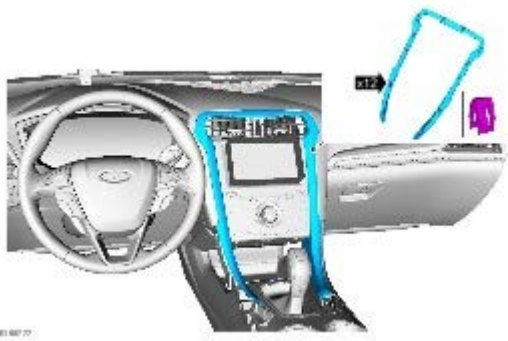
1. Check the engine and transmission support for insufficient gap between the transmission and the body.
2. Road test the vehicle.
3. If a noise occurs in various gears at the same engine speed, check if the noise also occurs in the neutral position. If it does, the noise is not caused by the transmission.
4. REFER to the Symptom Chart - Transmission Gear Shifting and Noise.

## Fluid leakage concerns

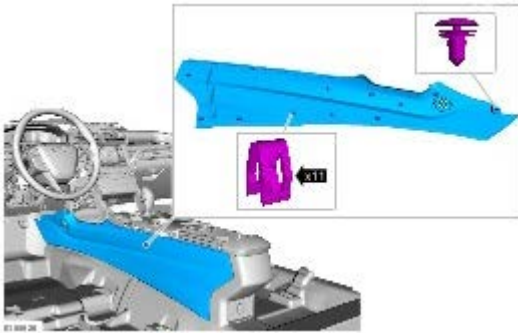
1. Check the transmission fluid level. If necessary, drain off any excess fluid.
2. Clean the transmission and the adjacent areas carefully and road test the vehicle.
3. Using a suitable UV Leak Detector, locate the leak and check whether the leaking fluid is transmission fluid, brake fluid (from the hydraulically operated clutch) or engine oil.
4. REFER to the Symptom Chart - Fluid Leakage.

## Symptom Chart - Transmission Gear Shifting and Noise

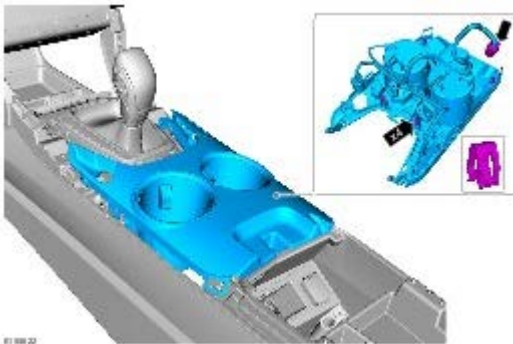
Symptom	Possible Sources	Action
High-effort gear shifting in one or more gears	* Synchronizer ring or synchronization damaged	* INSTALL a new synchronizer hub with synchronizer ring set and gear wheel as necessary.
	* Clutch does not operate correctly.	* REFER to: Clutch (308-01A, Diagnosis and Testing).
	* Selector mechanism	* REMOVE the selector mechanism and check the components. INSTALL new components as necessary.
Clashing or scratching noise during gear shifting	* Synchronizer hub or synchronizer ring damaged	* INSTALL a new synchronizer hub with synchronizer ring set and gear wheel as necessary.
	* Clutch does not operate correctly.	* REFER to: Clutch (308-01A, Diagnosis and Testing).
Gear engagement not functioning correctly	* External gearshift mechanism worn or damaged	* REFER to: <a href="#">External Controls</a> (308-06A Manual Transmission External Controls, Diagnosis and Testing).
Gear jumps out of engagement while driving	* Snap rings or synchronization components worn or damaged * Selector forks worn or damaged * Sliding sleeves worn or damaged	* INSTALL a new gear set, synchronizer unit and selector fork as necessary.
Gearshift lever feels loose	* Gearshift lever fixing.	* CHECK the gearshift lever mounting. REFER to: <a href="#">Gearshift Lever</a> (308-06A Manual Transmission External Controls, Removal and Installation).
	* External gearshift mechanism worn or damaged	* REFER to: <a href="#">External Controls</a> (308-06A Manual Transmission External Controls, Diagnosis and Testing).



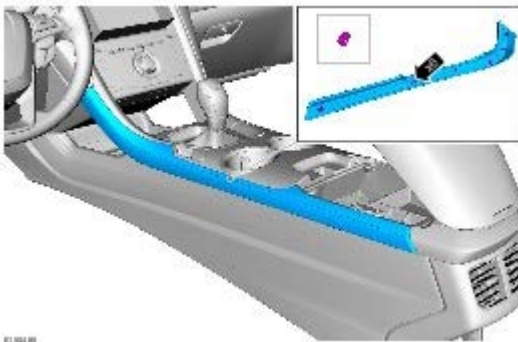
8. On both sides.



9.



10. On both sides.



11. Refer to: [Gearshift Lever Boot](#) (308-06A Manual Transmission External Controls, Removal and Installation).

12. Refer to: [Gearshift Cable Adjustment - 2.0L EcoBlue \(88kW/120PS\) \(BC\)/2.0L EcoBlue \(110kW/150PS\) \(YL\)/2.0L EcoBlue \(140kW/190PS\) \(YM\)](#) (308-06B Manual Transmission External Controls, General Procedures).  
Refer to: [Gearshift Cable Adjustment - 2.0L Duratorq-TDCi \(110kW/150PS\)/2.0L Duratorq-TDCi \(132kW/180PS\)](#) (308-06B Manual Transmission External Controls, General Procedures).


## Removal and Installation

### General Equipment

Cable Ties

### Removal

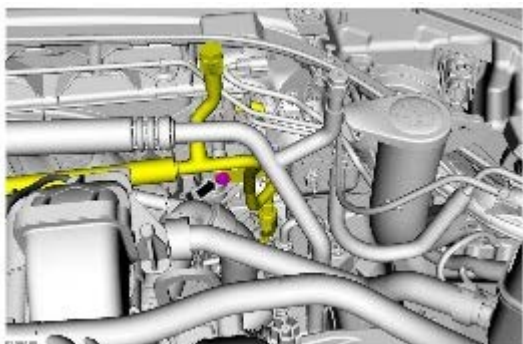
NOTE: Removal steps in this procedure may contain installation details.

-  **WARNING:** Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

Refer to: [Climate Control System Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

- Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

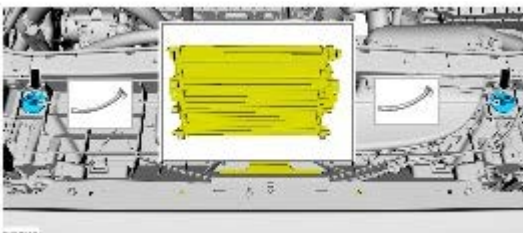
- Torque: 7 Nm



- 



- Use the General Equipment: [Cable Ties](#)



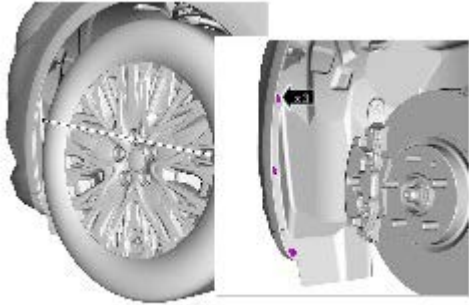
- Refer to: [Jacking and Lifting](#) (100-02 Jacking and Lifting, Description and Operation).

- If equipped.

## Removal and Installation

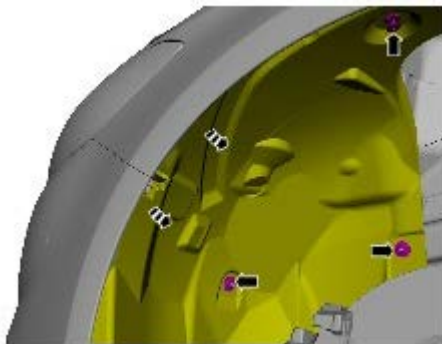
### Removal

1.



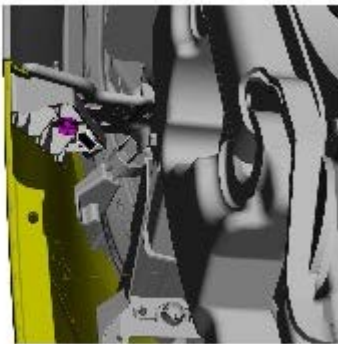
020000

2.



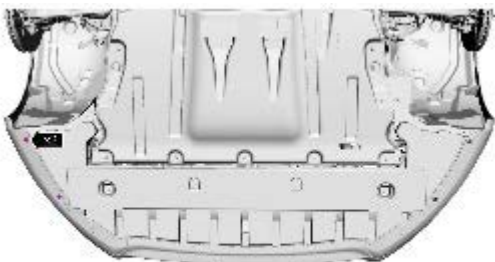
020000

3.



020000

4.



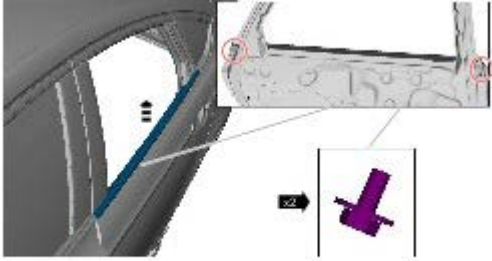
020000

## Removal and Installation

### Removal

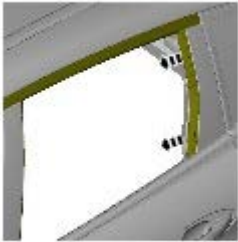
NOTE: Removal steps in this procedure may contain installation details.

1. Torque: 1.3 Nm



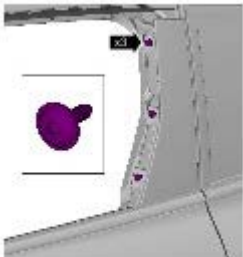
818027

- 2.



818028

3. Torque: 1.9 Nm



818029

- 4.

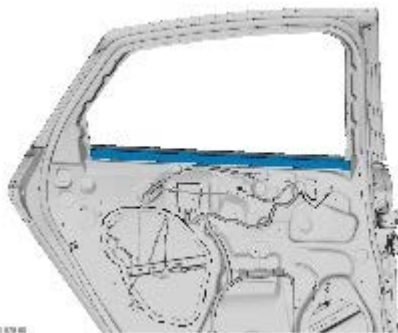


## Removal and Installation

### Removal

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

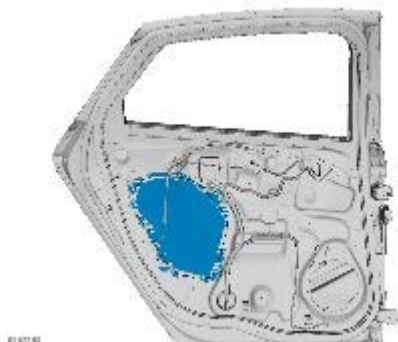
1. Refer to: [Rear Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Refer to: [Rear Door Upper Moulding](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).
- 3.



4.



5.



6.