

Fuel Charging and Controls - V8 5.0L Petrol -

Torque Specifications

• WARNINGS:



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



CAUTION: Before disconnecting or removing components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

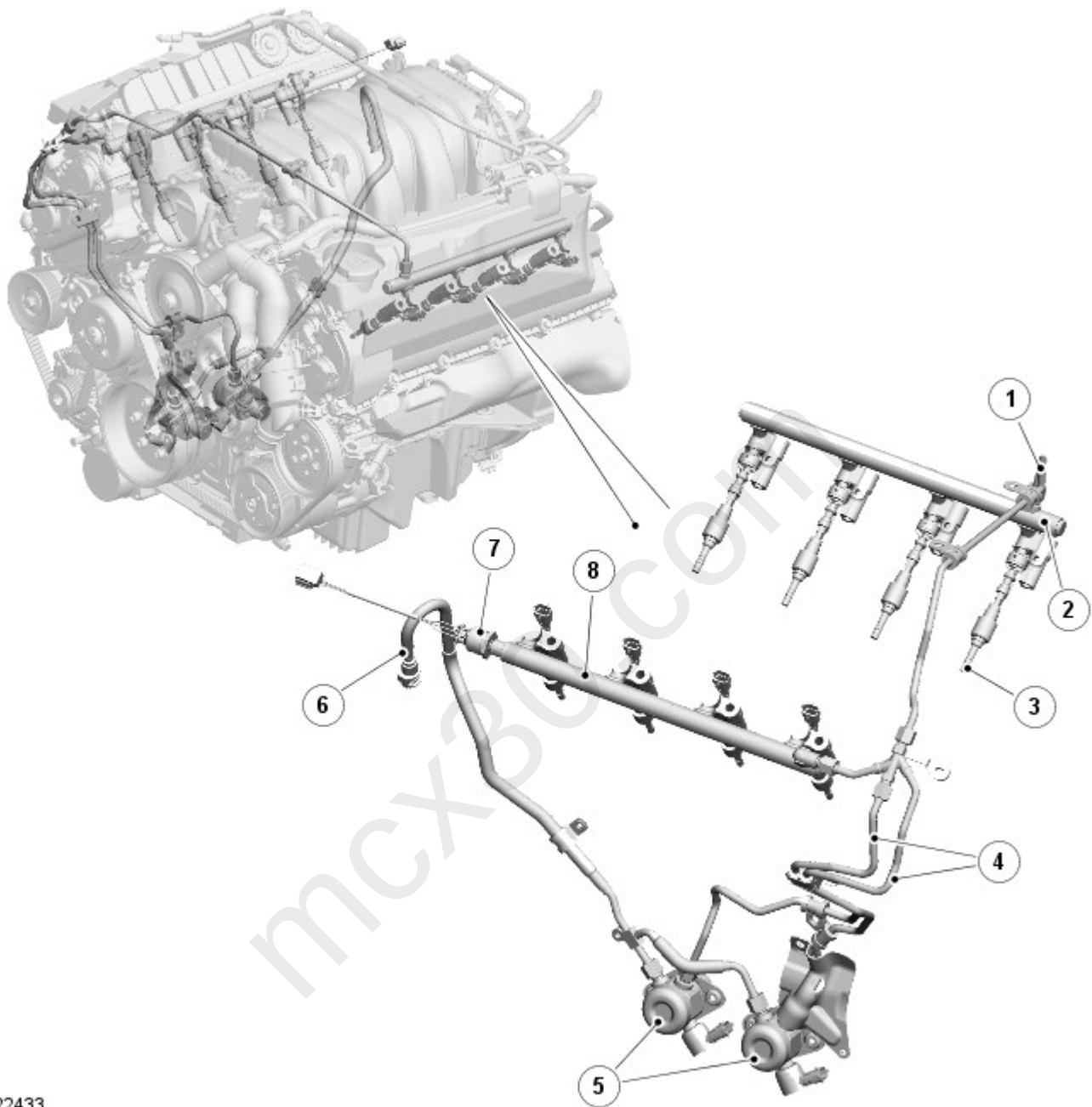
• **NOTE:** Tighten the fuel rail high pressure fuel pump fuel line unions and fuel rail crossover pipe unions as it is instructed in service manual.

Description	Nm	lb-ft	lb-in
Ignition coil-on-plugs retaining bolts	7	-	62
Spark plugs	20	15	-
Fuel rail retaining bolt	Stage 1 - 20 Stage 2 - 30	Stage 1 - 15 Stage 2 - 22	-
Fuel rail crossover pipe unions	21	15	-
Fuel rail crossover pipe retaining bolts	8	-	71
Fuel pressure regulator	33	24	-
Fuel rail high pressure fuel pump fuel line unions	21	15	-
Fuel rail high pressure fuel pump fuel line M8 bolt	25	18	-
Fuel rail high pressure fuel pump fuel line M6 bolt	11	8	-
Fuel rail high pressure fuel pump fuel line M5 nut	6	-	53
Fuel rail high pressure fuel pump fuel line shield M10 bolt	29	21	-
Fuel rail high pressure fuel pump torx bolts	11	9	-
Throttle body retaining bolts	17	13	-

Fuel Charging and Controls - V8 5.0L Petrol - Fuel Charging and Controls

Description and Operation

COMPONENT LOCATION



E122433

Item	Part Number	Description
1	-	Crossover tube
2	-	LH (left hand) fuel rail
3	-	Fuel injector (8 off)
4	-	HP (high pressure) fuel lines
5	-	HP fuel pumps and covers
6	-	LP (low pressure) fuel lines
7	-	FRP (fuel rail pressure) sensor
8	-	RH (right hand) fuel rail

INTRODUCTION

The fuel charging and controls system is a gasoline DI (direct injection) system controlled by the [ECM \(engine control module\)](#).

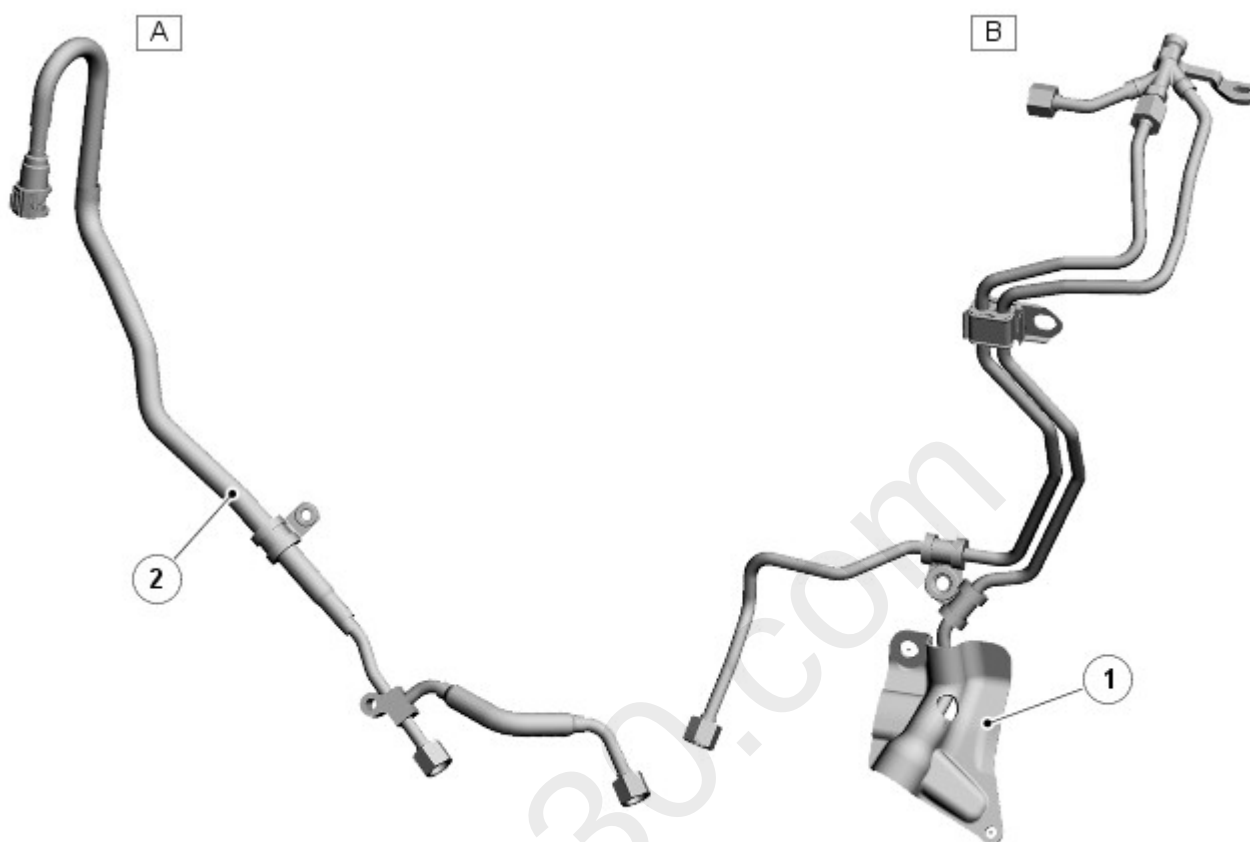
The fuel charging and controls system consists of:

- LP and HP fuel lines.
- Two HP fuel pumps.

- Two fuel rails and a crossover tube.
- A FRP (fuel rail pressure) sensor.
- Eight fuel injectors.

LP fuel from the pump in the fuel tank is pressurized by the HP fuel pumps and supplied to the fuel injectors via the fuel rails and crossover tube. The ECM controls the fuel injectors and HP fuel pumps to inject the required volume of fuel into the combustion chambers.

LOW AND HIGH PRESSURE FUEL LINES



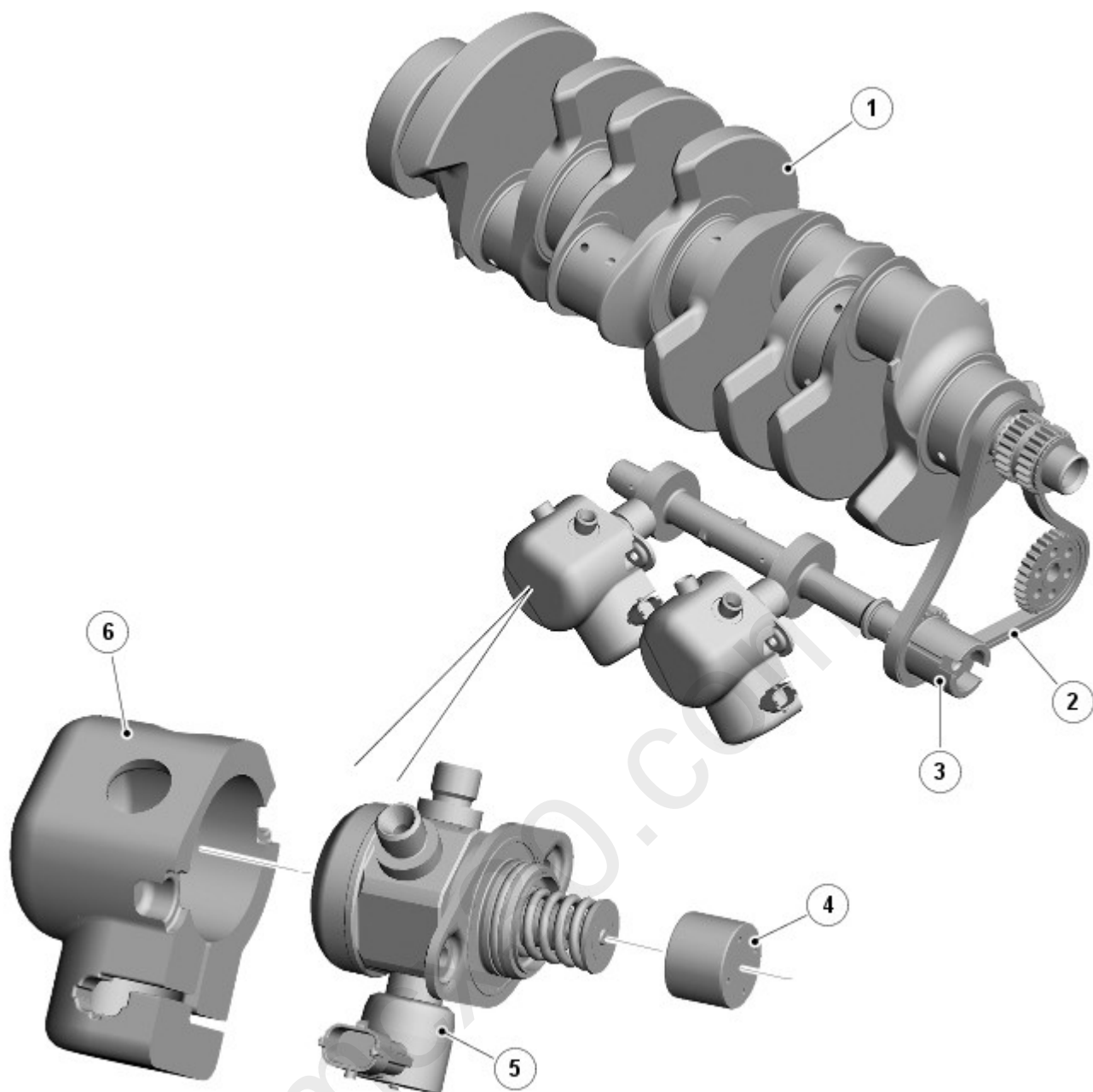
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Item	Part Number	Description
A	-	LP fuel lines
B	-	HP fuel lines
1	-	Acoustic cover
2	-	Heat reflective and insulation sleeves

The LP fuel line connects the HP fuel pumps to the fuel delivery line from the fuel tank and lines system. A quick release connector at the start of the LP fuel line is held in a clip integrated into the LH (left-hand) ignition coils cover. P-clips secure the LP fuel line to the rear of each cylinder head and to the RH (right-hand) side of the cylinder block. A heat reflective and insulation sleeves are installed on the LP fuel line where it runs behind the RH exhaust manifold.

The HP fuel lines connect the HP fuel pumps to the RH fuel rail and the crossover tube. Two P-clips and a pipe clamp attach the HP fuel lines to the cylinder block and the RH cylinder head respectively. An integral bracket on the front HP fuel line is attached to a stud on the front-upper RH timing cover. An acoustic cover is installed on the bottom of the front HP fuel line.

HIGH PRESSURE FUEL PUMPS



E114701

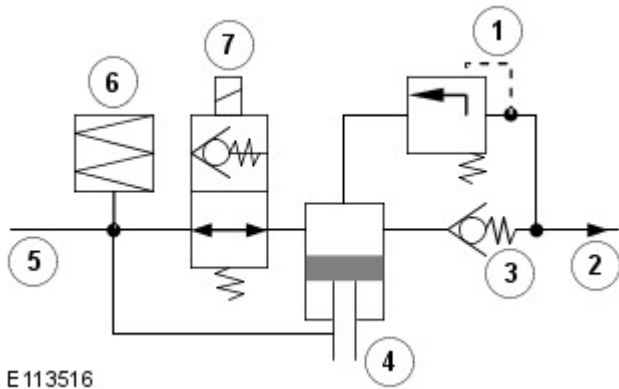
Item	Part Number	Description
1	-	Crankshaft
2	-	Auxiliary drive chain
3	-	Auxiliary camshaft
4	-	Tappet
5	-	HP fuel pump
6	-	Acoustic cover

The two HP fuel pumps are identical mechanically-driven pumps installed on the [RH](#) side of the sump body, behind the generator. An O-ring seals each of the HP fuel pumps in the sump body. The front HP fuel pump is identified as No. 1 pump; the rear HP fuel pump is identified as No. 2 pump. An acoustic cover is installed on each of the HP fuel pumps.

The HP fuel pumps are single-plunger pumps. The plunger of each pump extends through the sump body and the carrier of the auxiliary camshaft. A tappet on the end each plunger is operated by a two-lobe cam on the auxiliary camshaft. A spring installed on the outside of the plunger ensures the plunger and tappet remain in contact with the cam.

The auxiliary camshaft is driven by the crankshaft, via the auxiliary drive chain, at engine speed. The auxiliary camshaft is timed to match the pump delivery strokes with crankshaft position.

HP Fuel Pump Schematic



E113516

Item	Part Number	Description
1	-	PRV (pressure relief valve)
2	-	To HP fuel lines
3	-	Check valve
4	-	Plunger
5	-	From LP fuel lines
6	-	Damper chamber
7	-	Fuel metering valve

In addition to the plunger, each HP fuel pump contains:

- A damper chamber
- A fuel metering valve
- A check valve
- A PRV.

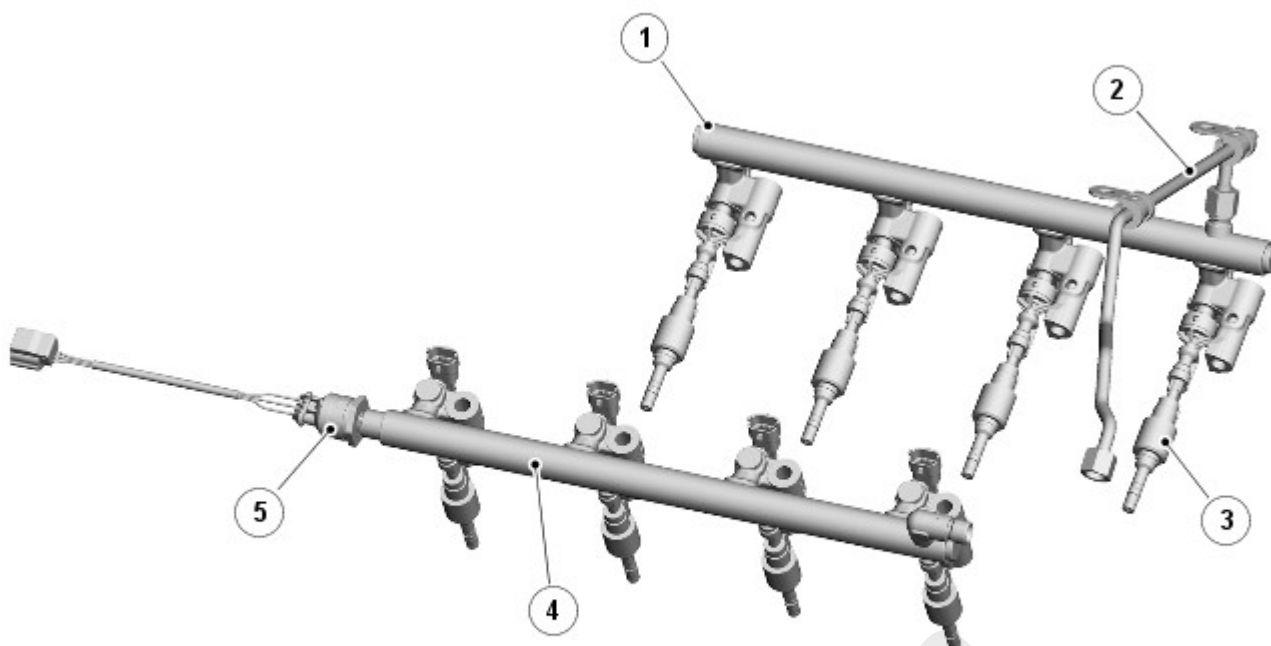
The damper absorbs pressure pulses from the plunger when the fuel metering valve is open at the start of the delivery stroke.

The fuel metering valve regulates the output pressure from the HP fuel pump. The fuel metering valve is a normally open solenoid valve controlled by the [ECM](#). During the inlet stroke of the plunger the fuel metering valve is de-energized, which allows LP fuel into the pumping chamber. The [ECM](#) energizes the fuel metering valve closed during the delivery stroke of the plunger, which forces the fuel in the pumping chamber through the check valve into the HP lines. By changing the closing point of the fuel metering valve, the [ECM](#) can determine the volume of fuel output during the delivery stroke, and thus the pressure in the HP side of the system.

The check valve prevents the return of HP fuel to the pumping chamber during the inlet stroke of the plunger.

The PRV protects the HP side of the system from excessive pressure if there is a failure of the fuel metering valve. If the pump delivery pressure increases to 195 - 204 bar (2828 - 2959 lbf/in²), the PRV opens and returns fuel to the inlet side of the plunger.

FUEL RAILS AND CROSSOVER TUBE



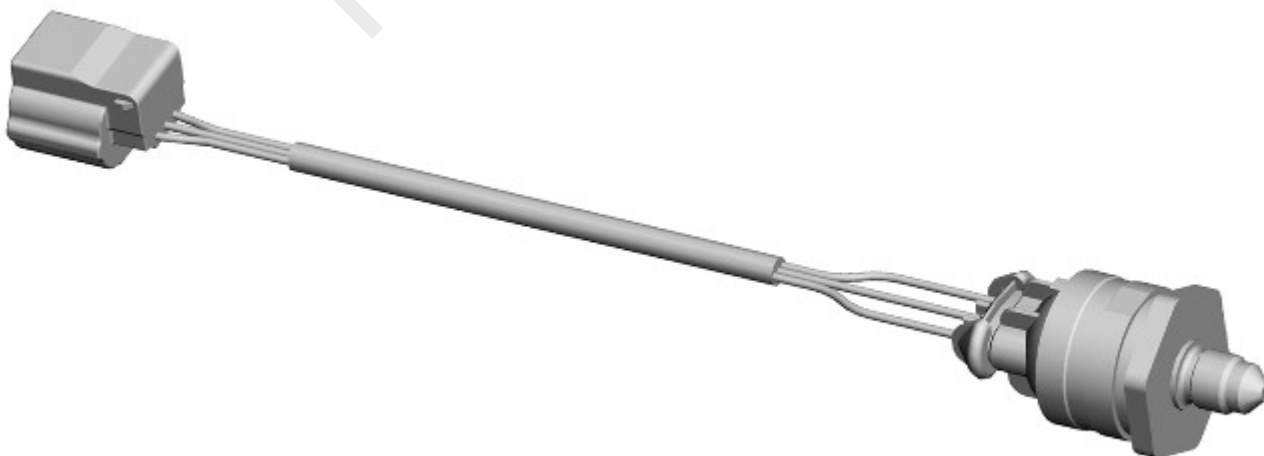
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Item	Part Number	Description
1	-	LH fuel rail
2	-	Crossover tube
3	-	Fuel injector
4	-	RH fuel rail
5	-	FRP sensor

The fuel rails and crossover tube are made from stainless steel. Bolts attach each fuel rail to the related cylinder head. The crossover tube connects the front high pressure line to the [LH](#) fuel rail, which ensures there is equal pressure in the two fuel rails. Two P-clips attach the crossover tube to the intake manifold.

The rear of the [RH](#) fuel rail incorporates a threaded boss for installation of the [FRP](#) sensor.

FUEL RAIL PRESSURE SENSOR

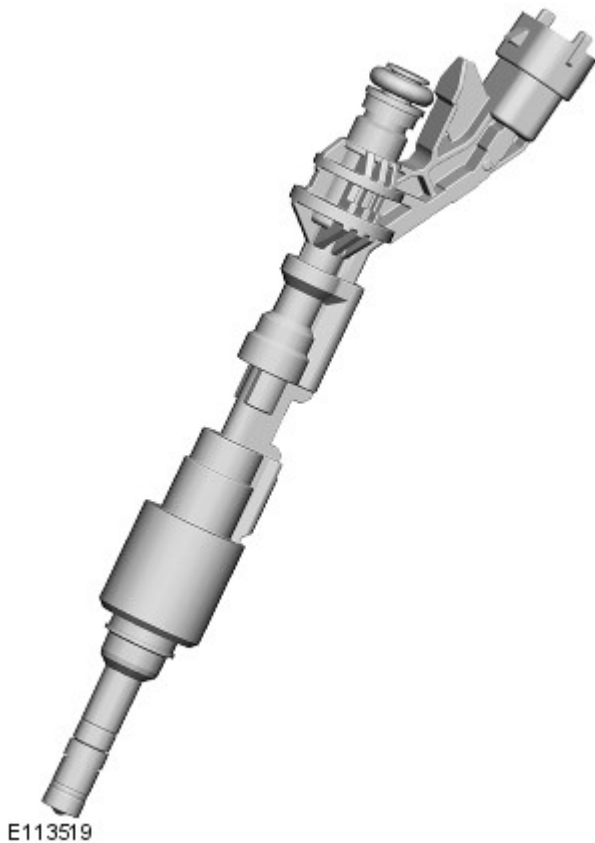


E113518

The [FRP](#) sensor provides the [ECM](#) with a continuous signal of fuel rail pressure. The [FRP](#) sensor is installed in the rear of the [RH](#) fuel rail. The [FRP](#) sensor is screwed into a threaded boss in the fuel rail. A flying lead and three pin connector provides the interface with the engine harness.

The [FRP](#) sensor contains a steel diaphragm fitted with strain gages, which are incorporated into a Wheatstone bridge. The output from the Wheatstone bridge is processed by the [ECM](#) to derive a pressure value.

FUEL INJECTORS



The fuel injectors spray fuel from the fuel rail directly into the combustion chambers. The fuel injectors are installed close to the center of the combustion chambers, between the inlet and exhaust valves and next to the spark plug.

The fuel injectors are a push fit in the fuel rails and the cylinder heads. On each fuel injector, a rubber O-ring seals the head of the fuel injector in the fuel rail. A teflon ring seals the nozzle of the fuel injector in the cylinder head. A clamp locks each fuel injector to the fuel rail.

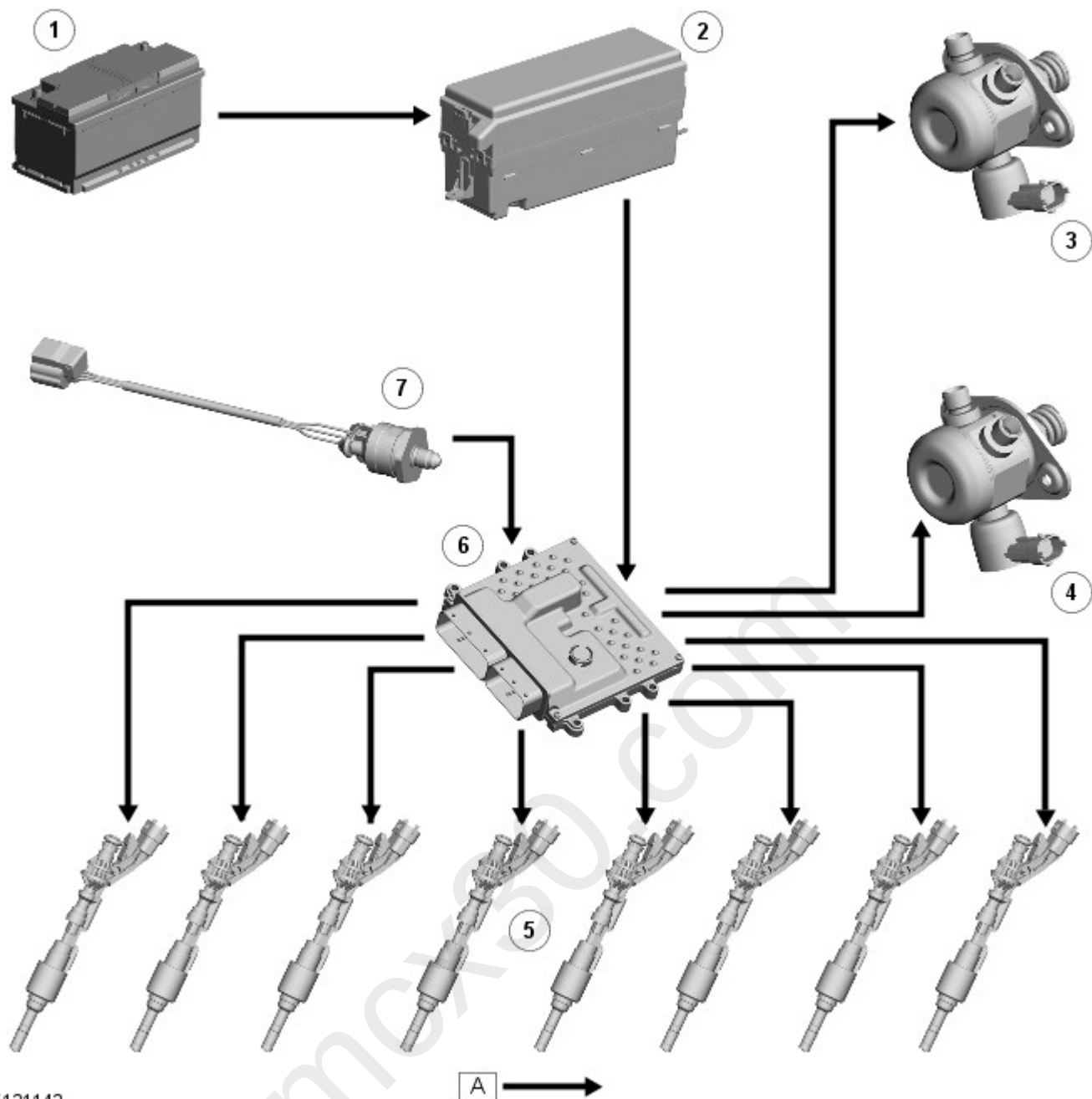
Each fuel injector contains a solenoid-operated needle valve, which opens when the solenoid winding is energized. While the needle valve is open, fuel is sprayed into the combustion chamber. The solenoid winding is connected to a power feed and a ground from the [ECM](#), which operates the fuel injectors with a two stage power supply. Initially the [ECM](#) supplies the fuel injectors with 65 V, then once the boost current reaches 11 A the power supply is switched to battery voltage. The [ECM](#) meters the amount of fuel injected into the combustion chambers by adjusting the time that the solenoid winding is energized.

There are six holes around the tip of the nozzle through which the fuel is sprayed. Two of the holes direct fuel below the spark plug. The other four holes direct fuel evenly around the remainder of the combustion chamber.

If a fuel injector fails, the engine will suffer from unstable idle speed, poor [NVH \(noise, vibration and harshness\)](#) and poor emissions performance.

CONTROL DIAGRAM

- [NOTE: A = Hardwired](#)



E121142

Item	Part Number	Description
1	-	Battery
2	-	EJB (engine junction box) (ECM relay)
3	-	No. 1 HP fuel pump
4	-	No. 2 HP fuel pump
5	-	Fuel injectors
6	-	ECM
7	-	FRP sensor

PRINCIPLES OF OPERATION

The [ECM](#) controls the output from the HP fuel pumps to deliver the required volume of fuel at pressures up to 150 bar (2175 lbf/in²).

The [ECM](#) also uses the signal from the [FRP](#) sensor to calculate the time the fuel injectors need to be energized to deliver the correct mass of fuel to the combustion chambers.

Fuel Charging and Controls - V8 5.0L Petrol - Fuel Charging and Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel charging and controls system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: [Fuel Charging and Controls](#) (303-04F Fuel Charging and Controls - V8 5.0L Petrol, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.

- **NOTE:** Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

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

Visual Inspection

Mechanical	Electrical
● Fuel level ● Fuel leaks ● Damaged fuel lines ● Damaged push connect fittings ● Fuel contamination/grade/quality ● Throttle body ● Damaged fuel tank filler pipe cap ● Damaged fuel tank filler pipe	● Fuses ● Loose or corroded electrical connectors ● Harnesses ● Sensor(s) ● Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Engine cranks, but does not fire	● Engine breather system disconnected/restricted ● Ignition system ● Fuel system ● Electronic engine control	Ensure the engine breather system is free from restriction and is correctly installed. Check for ignition system, fuel system and electronic engine control DTCs and refer to the relevant DTC Index
Engine cranks and fires, but will not start	● Evaporative emissions purge valve ● Fuel pump ● Spark plugs ● HT short to ground (tracking) check rubber boots for cracks/damage ● Ignition system	Check for evaporative emissions, fuel system and ignition system related DTCs and refer to the relevant DTC Index
Difficult cold start	● Engine coolant level/anti-freeze content ● Battery ● Electronic engine controls ● Exhaust Gas Recirculation (EGR) valve stuck open ● Fuel pump ● Purge valve	Check the engine coolant level and condition. Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine controls, engine emissions, fuel system and evaporative emissions system related DTCs and refer to the relevant DTC Index
Difficult hot start	● Injector leak ● Electronic engine control ● Purge valve ● Fuel pump ● Ignition system ● EGR valve stuck open	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	● Injector leak ● Electronic engine control ● Purge valve ● Fuel pump ● Ignition system ● EGR valve stuck open	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index

Symptom	Possible Causes	Action
Engine stalls soon after start	- Breather system disconnected/restricted - ECM relay - Electronic engine control - Ignition system - Air intake system restricted - Air leakage - Fuel lines	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine control, ignition system and fuel system related DTCs and refer to the relevant DTC Index. Check for blockage in air filter element and air intake system. Check for air leakage in air intake system
Engine hesitates/poor acceleration	- Fuel pressure, fuel pump, fuel lines - Injector leak - Air leakage - Electronic engine control - Throttle motor - Restricted accelerator pedal travel (carpet, etc) - Ignition system - EGR valve stuck open - Transmission malfunction	Check for fuel system related DTCs and refer to the relevant DTC Index. Check for injector leak, install new injector as required. Check for air leakage in air intake system. Ensure accelerator pedal is free from restriction. Check for electronic engine controls, ignition, engine emission system and transmission related DTCs and refer to the relevant DTC Index
Engine backfires	- Fuel pump/lines - Air leakage - Electronic engine controls - Ignition system - Sticking variable camshaft timing (VCT) hub	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls, ignition system and VCT system related DTCs and refer to the relevant DTC Index
Engine surges	- Fuel pump/lines - Electronic engine controls - Throttle motor - Ignition system	Check for fuel system failures. Check for electronic engine controls, throttle system and ignition system related DTCs and refer to the relevant DTC Index
Engine detonates/knocks	- Fuel pump/lines - Air leakage - Electronic engine controls - Sticking VCT hub	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls and VCT system related DTCs and refer to the relevant DTC Index
No throttle response	- Electronic engine controls - Throttle motor	Check for electronic engine controls and throttle system related DTCs and refer to the relevant DTC Index
Poor throttle response	- Breather system disconnected/restricted - Electronic engine control - Transmission malfunction - Traction control event - Air leakage	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine controls, transmission and traction control related DTCs and refer to the related DTC Index. Check for air leakage in intake air system

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: [Diagnostic Trouble Code \(DTC\) Index - V8 5.0L Petrol, DTC: Engine Control Module \(PCM\)](#) (100-00 General Information, Description and Operation).

Fuel Charging and Controls - V8 5.0L Petrol - Fuel Injection Component Cleaning

General Procedures

General Equipment

Pneumatic vacuum gun

Cleaning

• WARNINGS:



Do not carry out any repairs to the fuel system with the engine running. Failure to follow this instruction may result in personal injury.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



Place the vehicle in a well ventilated, quarantined area and arrange 'No Smoking/Petrol Fumes' signs about the vehicle.



Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

• CAUTIONS:



Before using the cleaning fluid, protect all electrical components and connectors with lint-free non-flocking material.



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



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



Make sure that clean non-plated tools are used. Clean tools using a new brush that will not lose its bristles, prior to starting work on the vehicle.



Use a steel topped workbench and cover it with clean, lint-free non-flocking material.



Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

1. Using a new brush that will not lose its bristles, brush the components being removed and the surrounding area.
2. Using a pneumatic vacuum gun, remove all traces of foreign material.

General Equipment: [Pneumatic vacuum gun](#)

Fuel Charging and Controls - V8 5.0L Petrol - Fuel Injection Component Cleaning Using Pressure Cleaner

General Procedures

Cleaning

• WARNINGS:



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



Place the vehicle in a well ventilated, quarantined area and arrange 'No Smoking/Petrol Fumes' signs about the vehicle.



Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



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• CAUTIONS:



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



Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.



Before using the cleaning fluid, protect all electrical components and connectors with lint-free non-flocking material.

• NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1.



1. CAUTION: Make sure the correct additive is used in this step. Failure to carry out this instruction may cause damage to the vehicle.

- Open the fuel filler door and remove the cap.
- Empty the fuel additive into the fuel filler pipe.
- Install the fuel filler cap and close the fuel filler door.

2. Refer to: [Engine Cover - V8 5.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Release the breather from the air intake elbow.



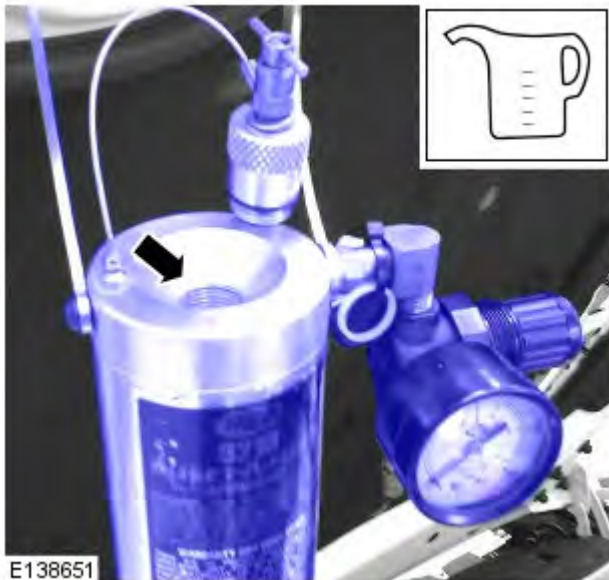
E138648

4.  **CAUTION:** Make sure the correct additive is used in this step. Failure to carry out this instruction may cause damage to the vehicle.

Install the cleaning equipment to a suitable location under the hood.



E138649



5.

- Remove the cleaning equipment filler cap.
- Empty the induction system cleaning fluid into the cleaning equipment.
- Install the filler cap.



6. Position the intake system cleaning tool into intake elbow and secure with the clamp.



7.

- Connect a suitable compressed air line to the cleaning equipment.
- Set the pressure to 4 bar.

8. Start and run the engine.

9.

- Open the ball valve on the cleaning equipment and allow the cleaning fluid to spray into the intake elbow.
- Raise the engine speed to 1200 rpm and hold until the cleaning fluid spray has stopped.



E138653

10.

- Close the ball valve.
- Release the air pressure in the cleaning equipment.
- Disconnect the air line.

11. Connect the breather to the air intake elbow.



E138648

12. Refer to: [Engine Cover - V8 5.0L Petrol](#) (501-05 Interior Trim and Ornammentation, Removal and Installation).

13.

- Start the engine.
- Allow the engine to idle for 30 seconds.

- Raise the engine speed to 1500 rpm and hold for 3 minutes until a temperature of 70°C is achieved.
- Allow the engine to idle for 30 seconds.
- Switch off the engine.

14. Connect the approved diagnostic equipment to the vehicle.

15. Follow on screen prompts and check for DTC's (Diagnostic Trouble Codes).

16. Clear the DTC's following the on screen procedure.

17. Disconnect the approved diagnostic equipment from the vehicle.

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Fuel Charging and Controls - V8 5.0L Petrol - Fuel Injectors

Removal and Installation

Removal

1. Refer to: [Fuel Rail LH](#) (303-04F Fuel Charging and Controls - V8 5.0L Petrol, Removal and Installation).

Installation

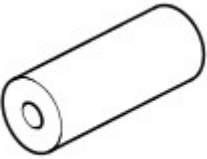
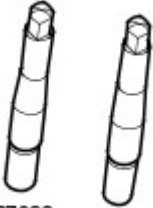
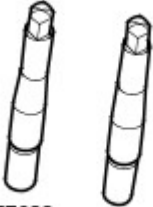
1. Refer to: [Fuel Rail LH](#) (303-04F Fuel Charging and Controls - V8 5.0L Petrol, Removal and Installation).

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Fuel Charging and Controls - V8 5.0L Petrol - Fuel Rail LH

Removal and Installation

Special Tool(s)

 E115268	303-1450 Spark Plug Remover/Installer
 E114526	310-197 Fuel Injector Remover
 E107680	310-198 Teflon seal installer
 E107681	310-199 Teflon seal re-shape tool
 E107682	310-200-01 Fuel Rail Installation Guide Pins - Threaded
 E107682	310-200-02 Fuel Rail Installation Guide Pins - Unthreaded

Removal

• CAUTIONS:



Make sure that tools and equipment are clean and free of foreign material and lubricant.



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

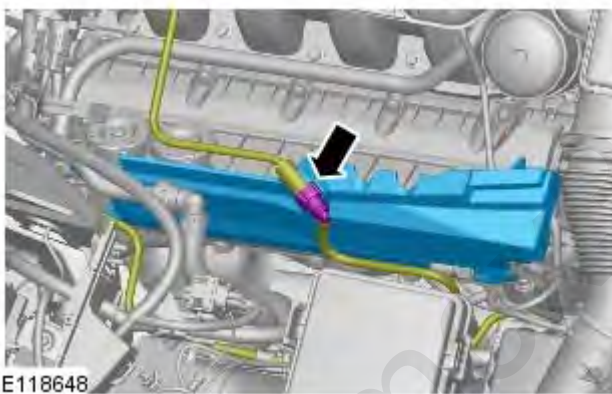
- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: **Some variation in the illustrations may occur, but the essential information is always correct.**

All vehicles

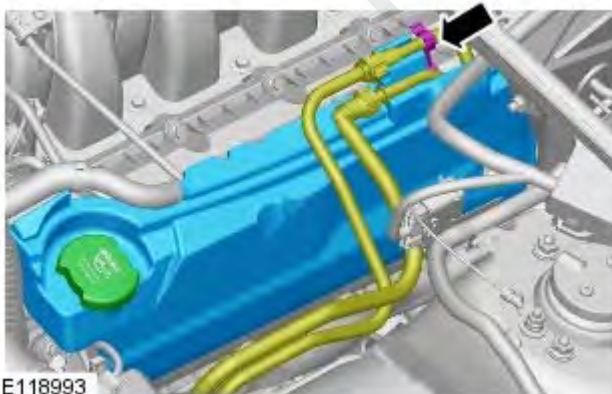
1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V8 5.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
4. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

5. Refer to: [Engine Cover - V8 5.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
6. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).

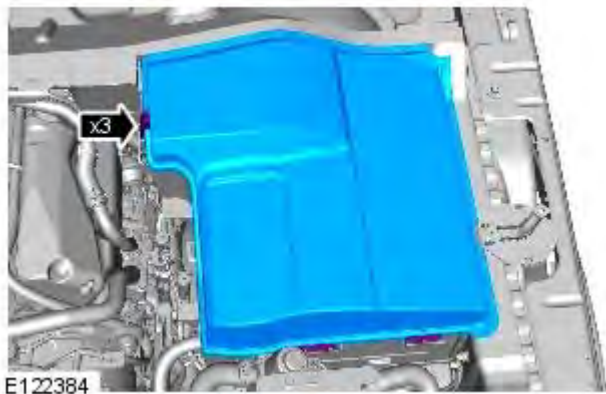


7.  CAUTION: Be prepared to collect escaping fluids.



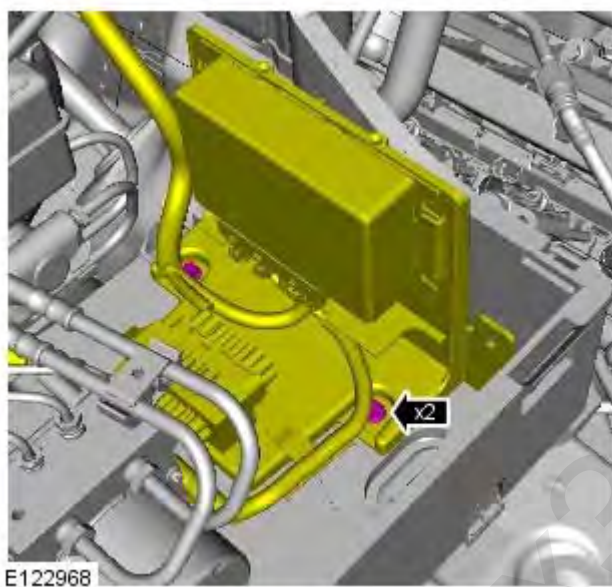
8.  CAUTION: Be prepared to collect escaping fluids.

9. Refer to: [Evaporative Emission Canister Purge Valve](#) (303-13B Evaporative Emissions - V8 5.0L Petrol, Removal and Installation).

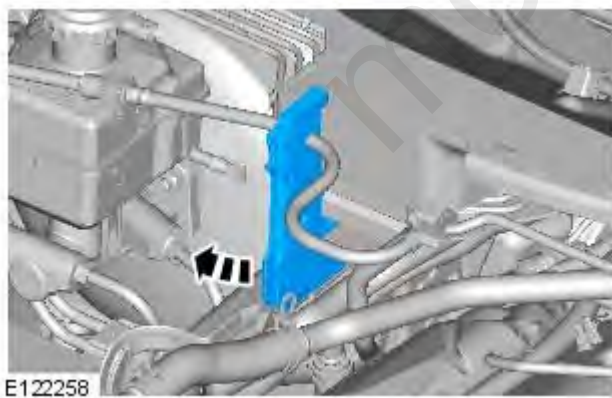


10.

Left-hand drive vehicles



11. **11.** NOTE: Right-hand shown, left-hand similar.

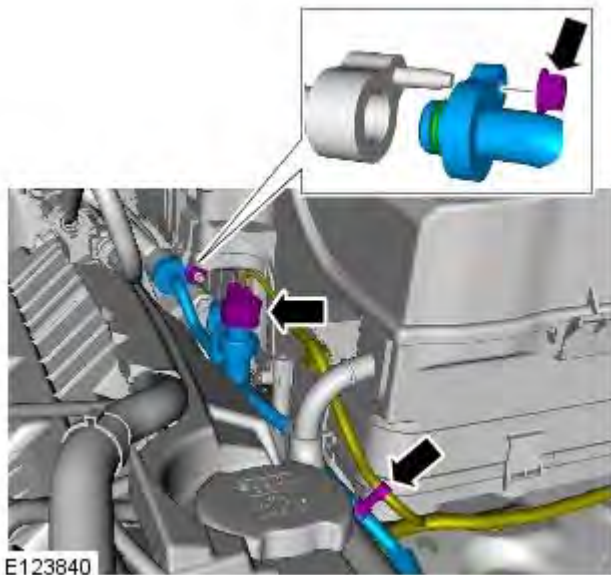


12. **12.** NOTE: Right-hand shown, left-hand similar.

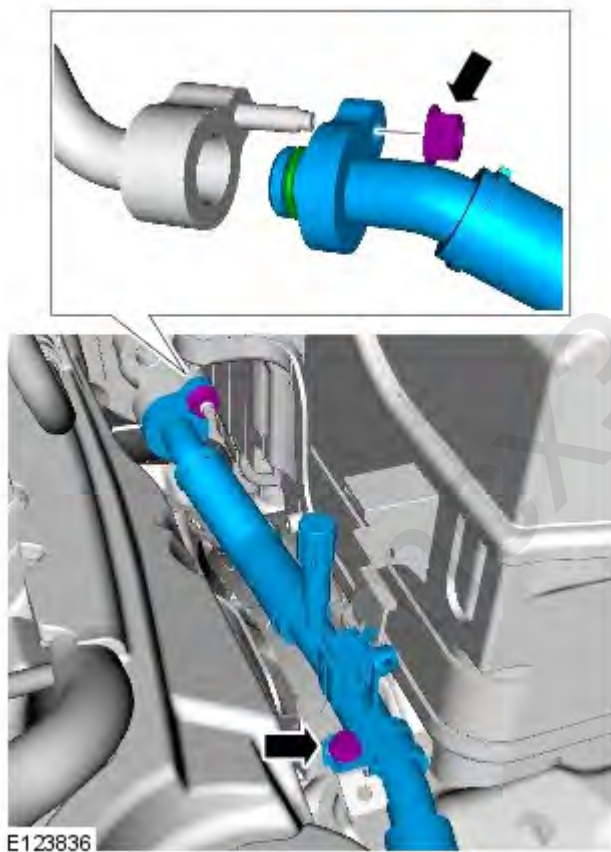
Right-hand drive vehicles

13. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

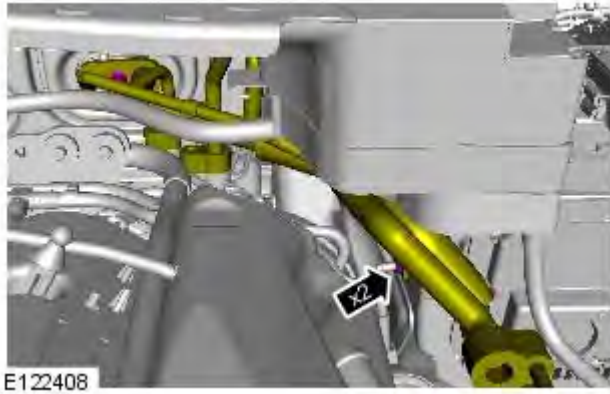
All vehicles



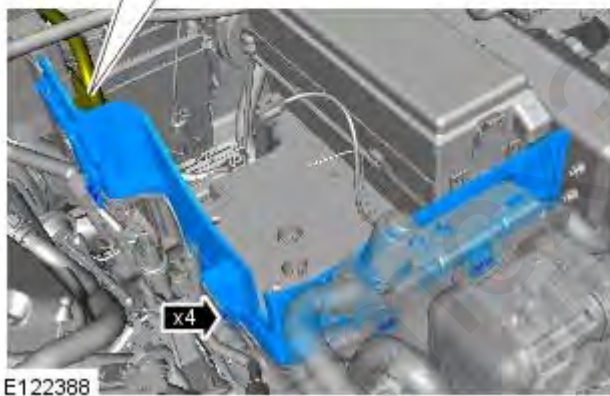
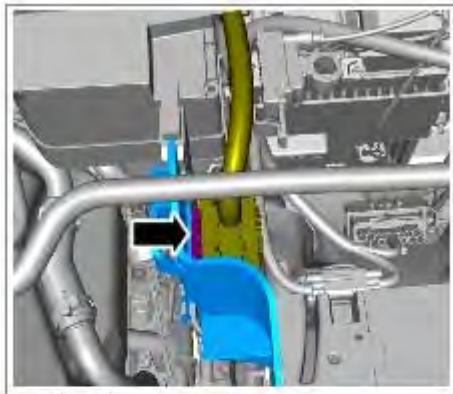
14. **14.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.
Discard the O-ring seal.



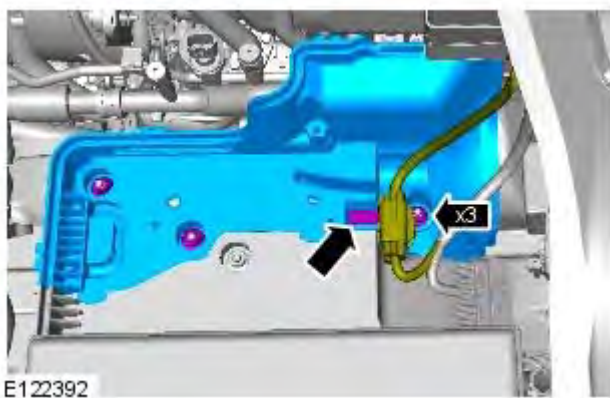
15. **15.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.
Discard the O-ring seal.



16. **16.**  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.
Discard the O-ring seal.

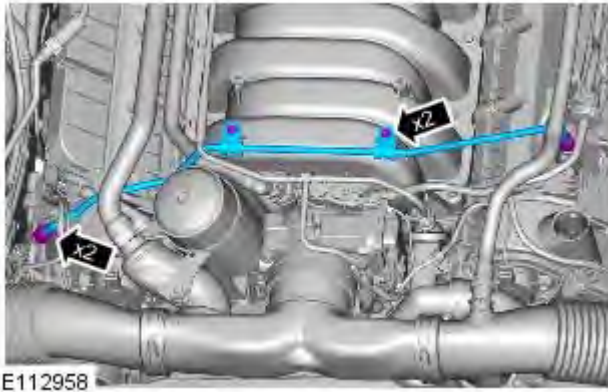


17.



18.

19. Refer to: [Fuel Injection Component Cleaning](#) (303-04F Fuel Charging and Controls - V8 5.0L Petrol, General Procedures).



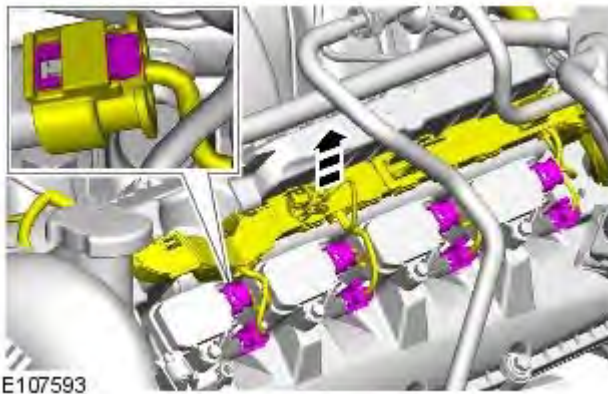
20. **20. CAUTIONS:**



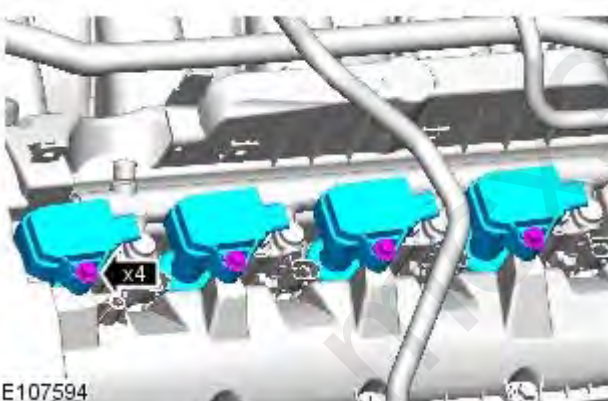
Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.



21.

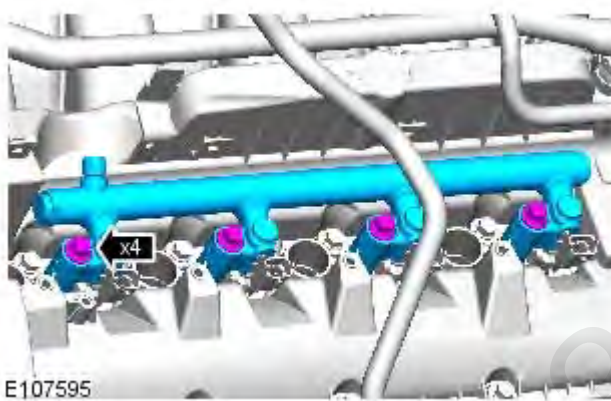


22.

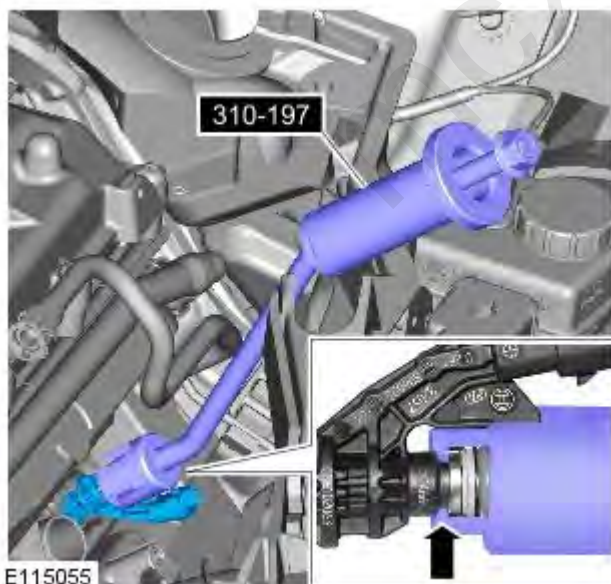


23. **23.** NOTE: RH illustration shown, LH is similar.

Special Tool(s): [303-1450](#)



24. **24.**  CAUTION: Make a note of the fuel injector clamp alignment to the fuel rail prior to removal.



25. **25.** CAUTIONS:

 Make sure that the special tool is located correctly to the fuel injector prior to removing the fuel injector.

 Make sure that the special tool is held square to the fuel injector during removal.

 Make sure that all open ports are covered to prevent any foreign material ingress.

Special Tool(s): [310-197](#)



E115057

26. **26.**  **CAUTION:** If the fuel injector is being removed without a new component being installed, the fuel injector clamp must remain with the fuel injector it is removed with.



E115058

27. **27.** **CAUTIONS:**



Do not use a knife to remove the Teflon seal as damage could occur to the fuel injector.



Do not cut the Teflon seal too deep as damage could occur to the fuel injector.



Pinch the Teflon seal to allow the tool to cut the Teflon seal without damaging the fuel injector.



E115059

28. **28.**  **CAUTION:** Do not use any sharp tools to remove the O-ring seal as damage could occur to the fuel injector.

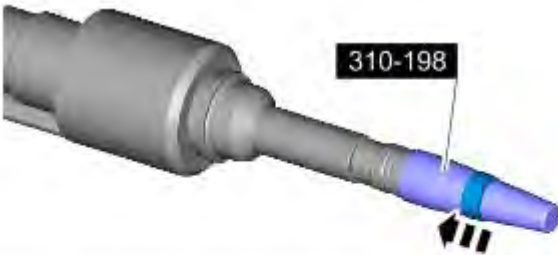
All vehicles

1.



E115059

2. *Special Tool(s):* [310-198](#)



E115060

3. *Special Tool(s):* [310-199](#)



E115062



E115057

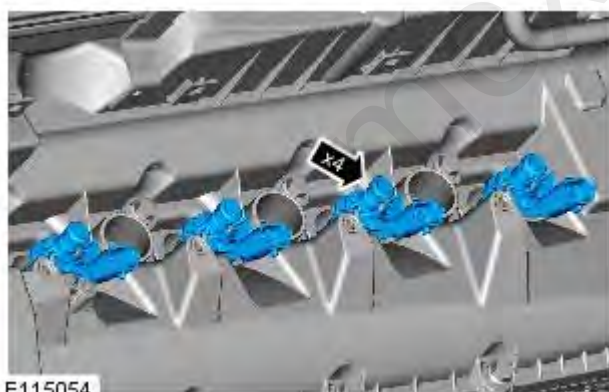
4.  **CAUTION:** If the original fuel injector is being installed, the original fuel injector clamp must be installed with the fuel injector it was removed with.



E107596

5.  **CAUTION:** If a new cylinder head has been installed then the special tool 310-200-02 without the thread must be used to install the fuel rail.

Special Tool(s): [310-200-01](#), [310-200-02](#)

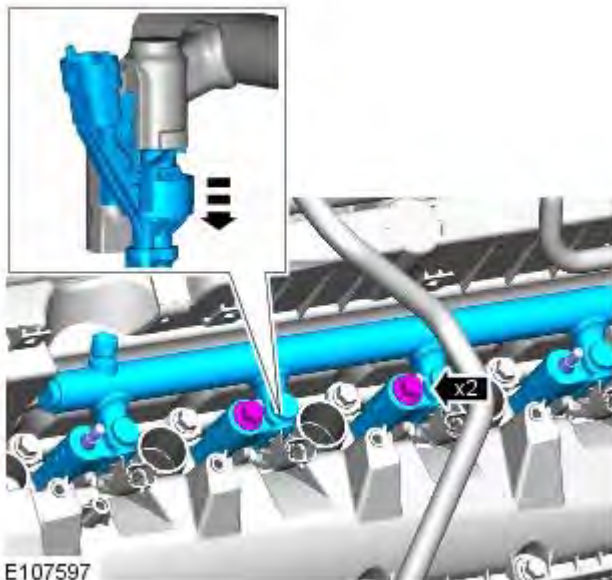


E115054

6. **CAUTIONS:**

 Make sure that the area around the open fuel injector ports are clean and free of foreign material and lubricant prior to installing the fuel injector.

 When installing the fuel injector(s), make sure that the Teflon seal is clean and free of foreign material and lubricant.



7. **7. CAUTIONS:**

 If new fuel injectors are installed, a new injector clamp must be installed.

 Make sure that the fuel injector is aligned and installed into the fuel rail correctly, as noted in the removal step.

 Tighten the fuel rail retaining bolts a turn at a time until the correct torque is achieved.

• **NOTE:** Lubricate the fuel injector O-ring seals with clean engine oil.

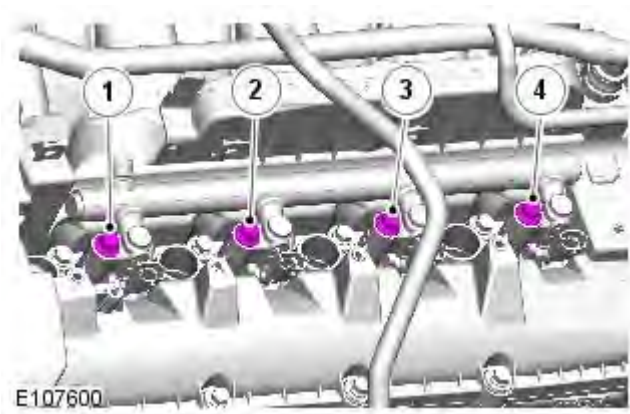
Torque: 20 Nm



8. *Special Tool(s):* [310-200-01](#), [310-200-02](#)



9. *Torque:* 20 Nm



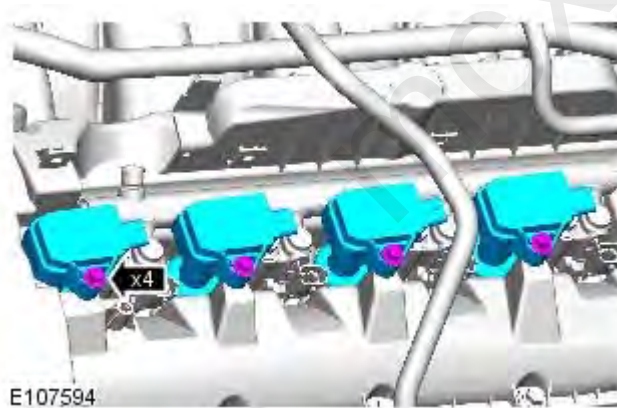
10. **10.** NOTE: Tighten the bolts in the indicated sequence.

- *Torque:*
 - Bolt 2 30 Nm
 - Bolt 3 30 Nm
 - Bolt 1 30 Nm
 - Bolt 4 30 Nm

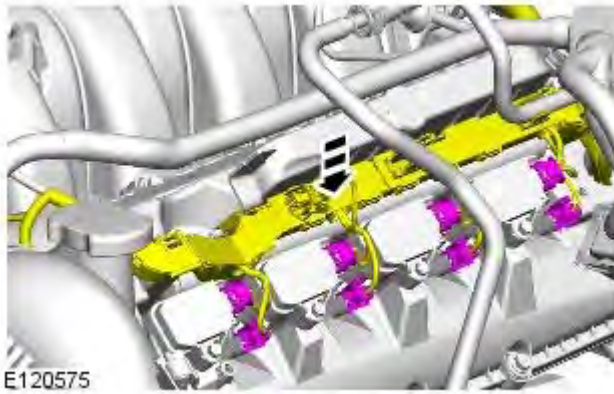


11. **11.** NOTE: RH illustration shown, LH is similar.

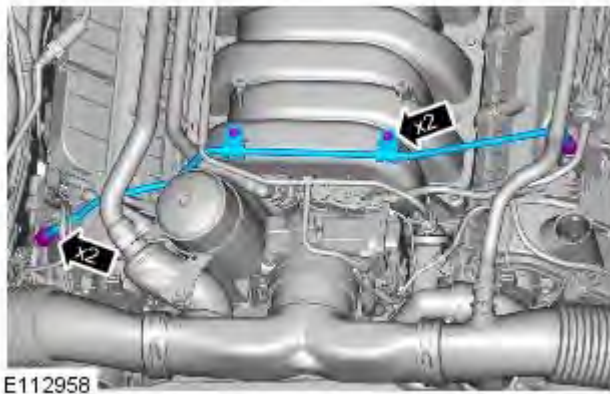
Special Tool(s): 303-1450
Torque: 20 Nm



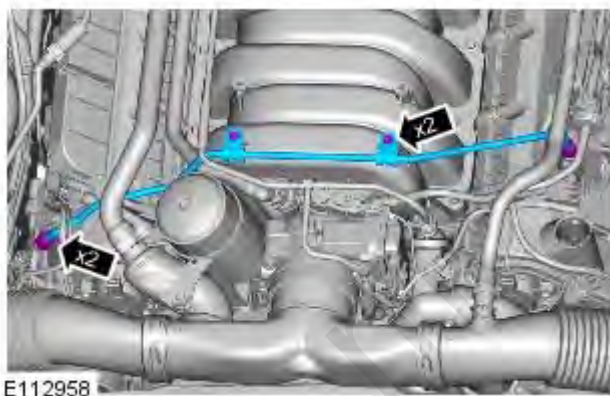
12. *Torque:* 7 Nm



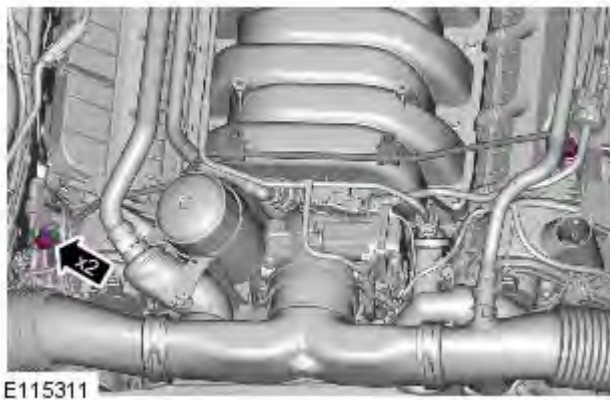
13.



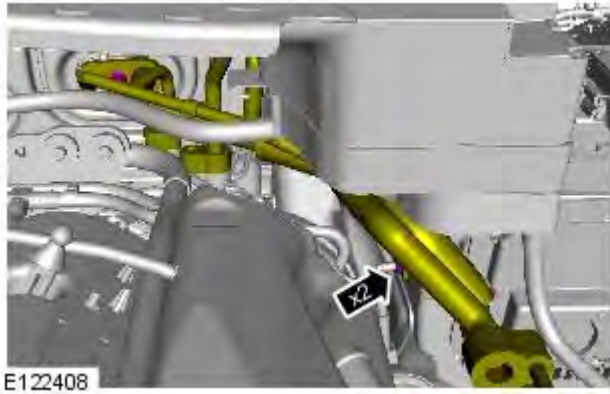
14.  **CAUTION:** Lubricate only the union threads with clean engine oil.
- NOTE: Do not tighten at this stage.
 - NOTE: Remove and discard the blanking caps.



15. *Torque:*
 Unions 21 Nm
 Bolts 8 Nm

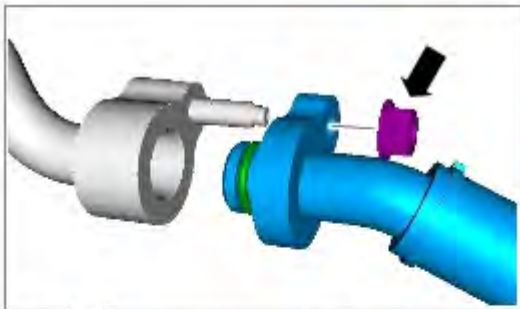


16. *Torque:* 21 Nm



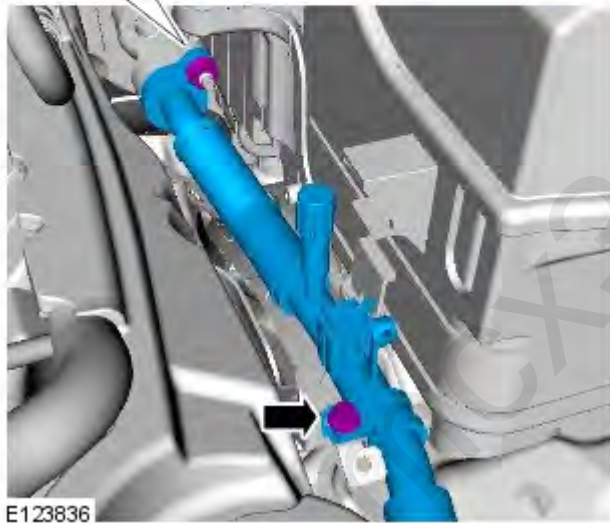
17. Install new O-ring seals.

Torque: 12 Nm



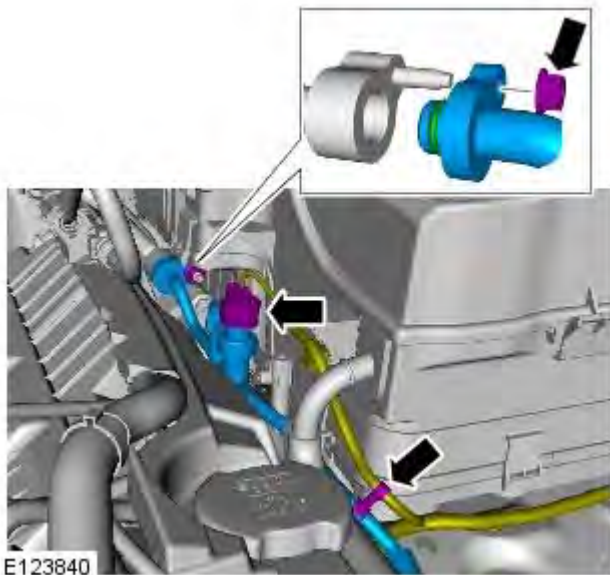
18. Install new O-ring seals.

Torque: 12 Nm

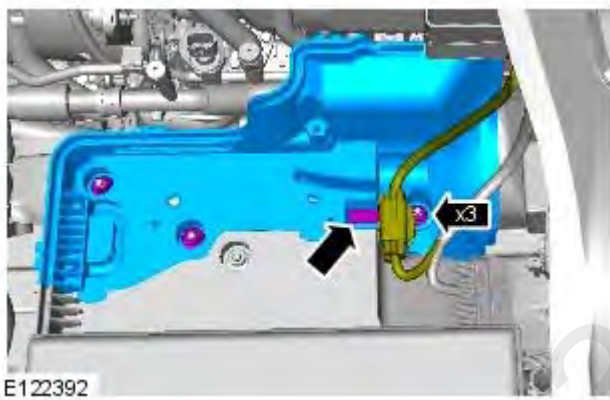


19. Install new O-ring seals.

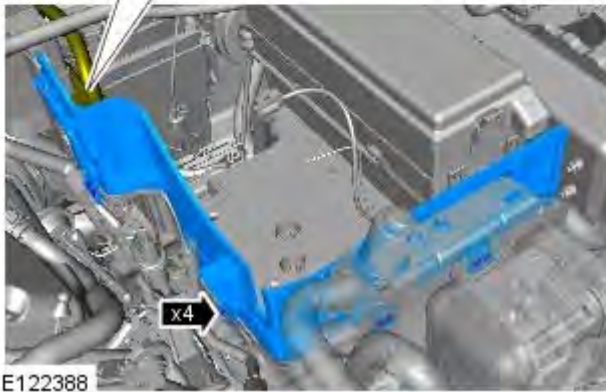
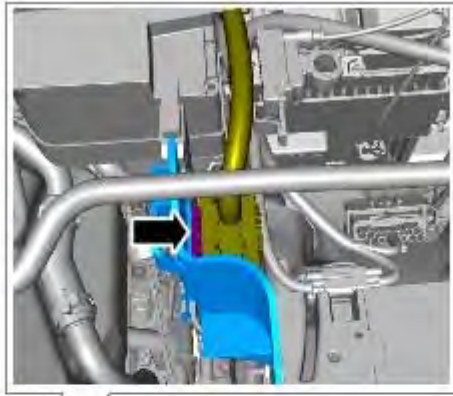
Torque: 12 Nm



20. *Torque:* 12 Nm



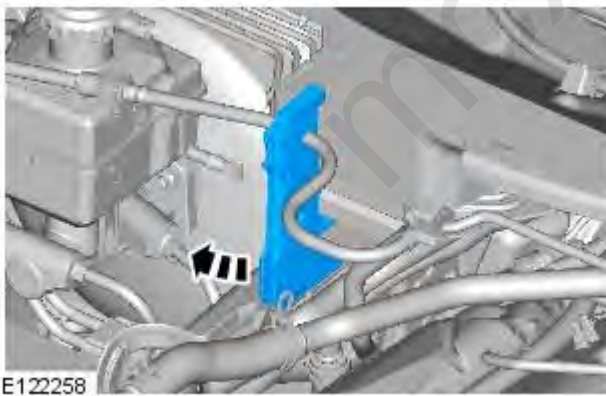
21.



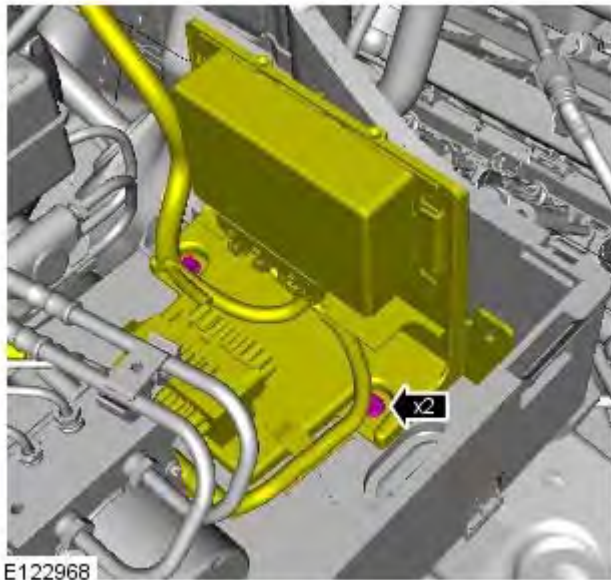
Right-hand drive vehicles

22. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

Left-hand drive vehicles



23. **23.** NOTE: Right-hand shown, left-hand similar.

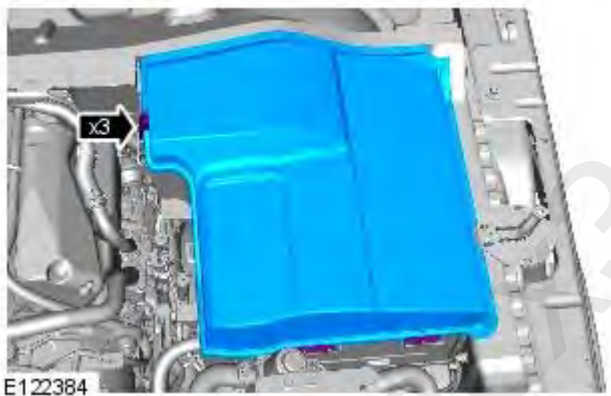


24. **24.** NOTE: Right-hand shown, left-hand similar.

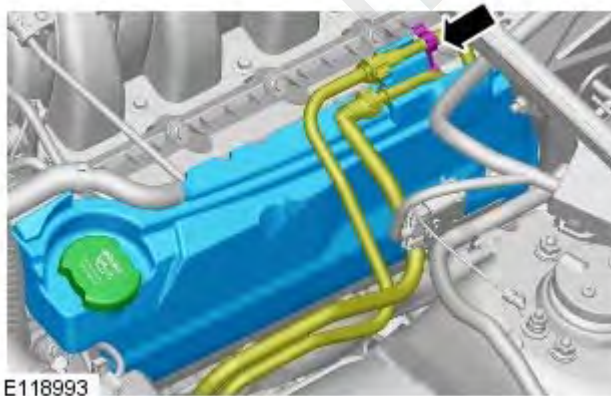
Torque: 10 Nm

All vehicles

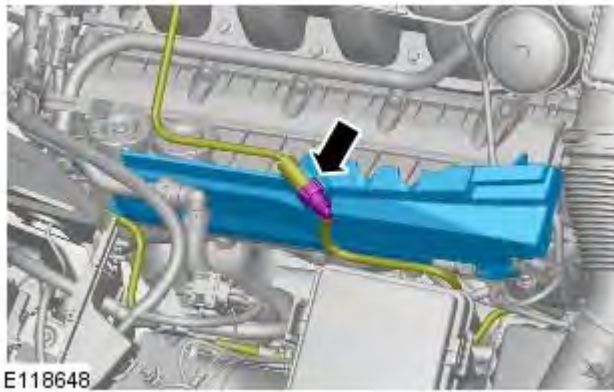
25. Refer to: [Evaporative Emission Canister Purge Valve](#) (303-13B Evaporative Emissions - V8 5.0L Petrol, Removal and Installation).



26.



27.



28. **28.**  CAUTION: Be prepared to collect escaping fluids.

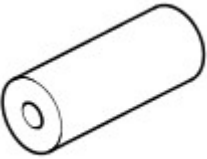
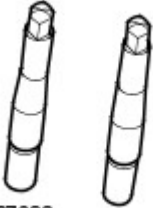
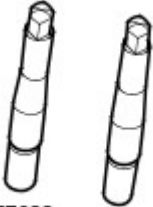
29. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).
30. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
31. Refer to: [Engine Cover - V8 5.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
32. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Fuel Charging and Controls - V8 5.0L Petrol - Fuel Rail RH

Removal and Installation

Special Tool(s)

 E115268	303-1450 Spark Plug Remover/Installer
 E114526	310-197 Fuel Injector Remover
 E107680	310-198 Teflon seal installer
 E107681	310-199 Teflon seal re-shape tool
 E107682	310-200-01 Fuel Rail Installation Guide Pins - Threaded
 E107682	310-200-02 Fuel Rail Installation Guide Pins - Unthreaded

Removal

• CAUTIONS:



Make sure that tools and equipment are clean and free of foreign material and lubricant.



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

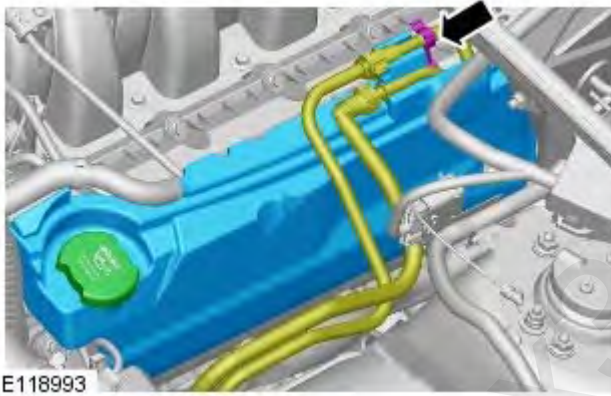
- NOTE: Removal steps in this procedure may contain installation details.
- NOTE: **Some variation in the illustrations may occur, but the essential information is always correct.**

All vehicles

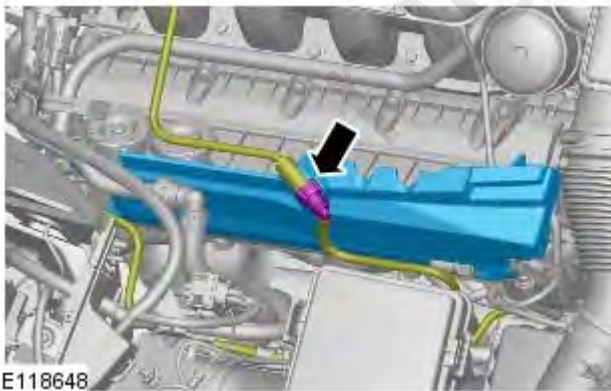
1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V8 5.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

4. Refer to: [Engine Cover - V8 5.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
5. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).

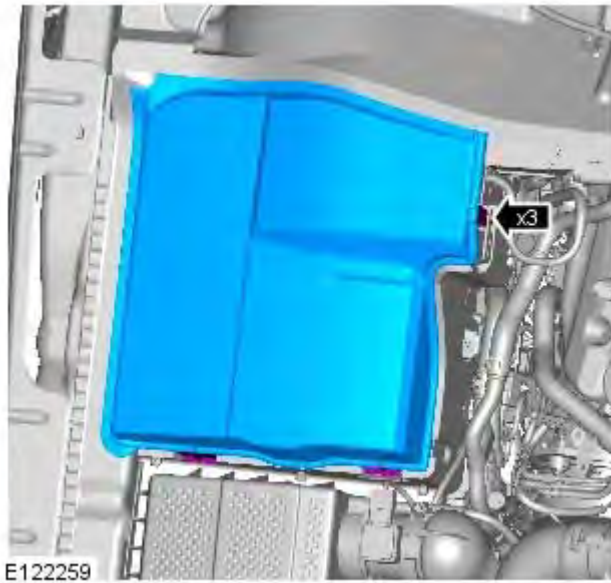


6.  CAUTION: Be prepared to collect escaping fluids.



7.  CAUTION: Be prepared to collect escaping fluids.

8.

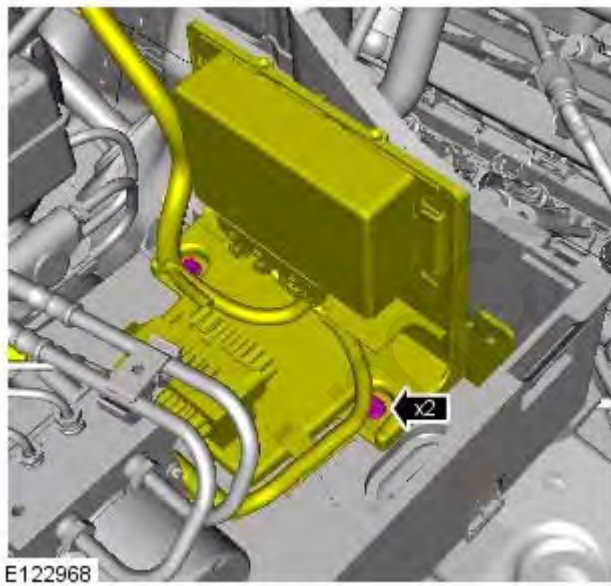


Left-hand drive vehicles

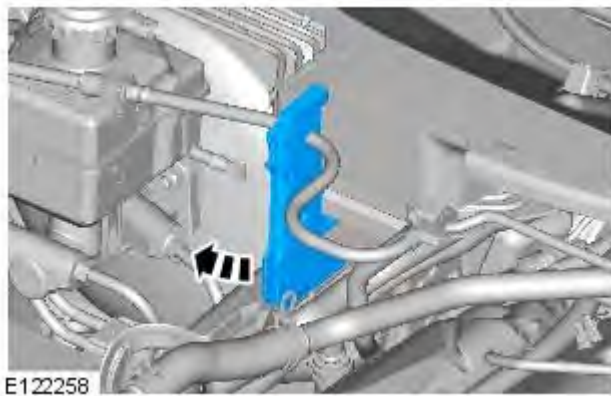
9. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

Right-hand drive vehicles

10.

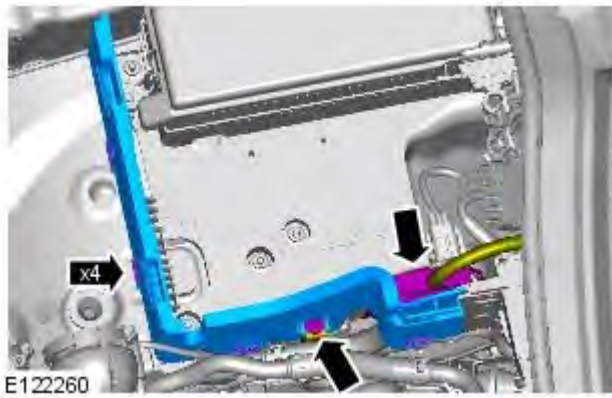


11.

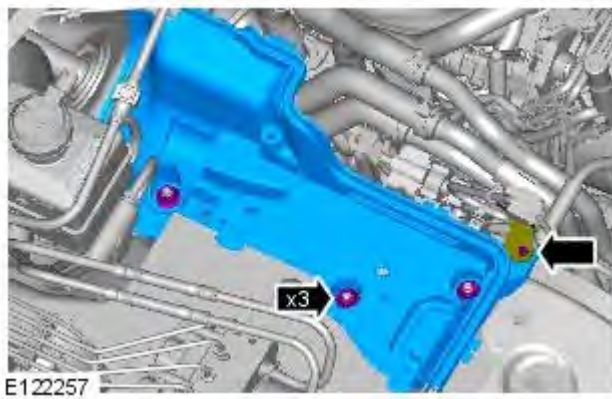


All vehicles

12.



13.



14. Refer to: [Fuel Injection Component Cleaning](#) (303-04F Fuel Charging and Controls - V8 5.0L Petrol, General Procedures).

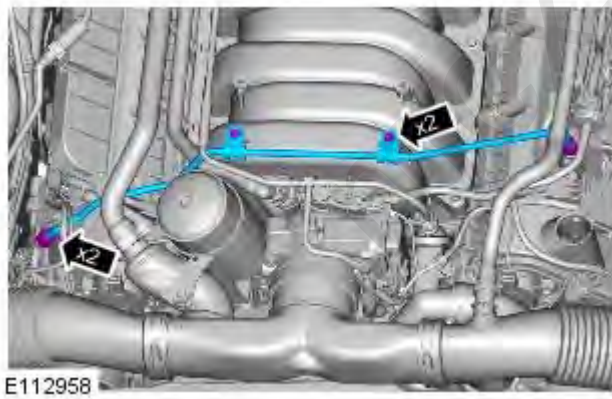
15. **15. CAUTIONS:**



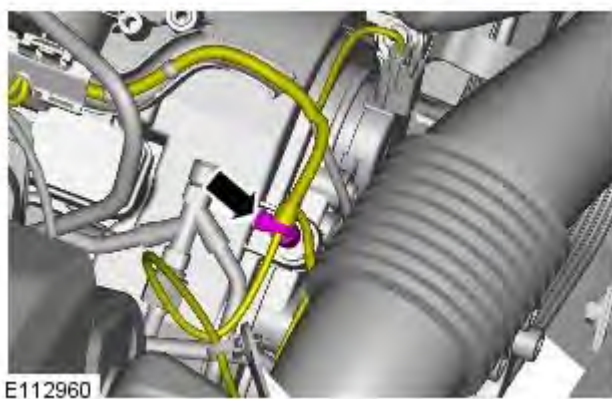
Be prepared to collect escaping fluids.

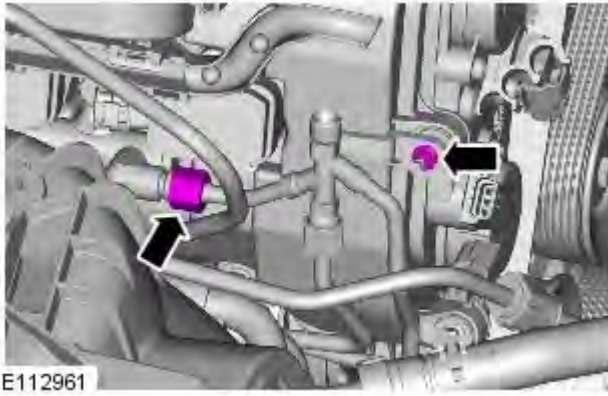


Make sure that all openings are sealed. Use new blanking caps.



16.





17. **17. CAUTIONS:**



Be prepared to collect escaping fluids.

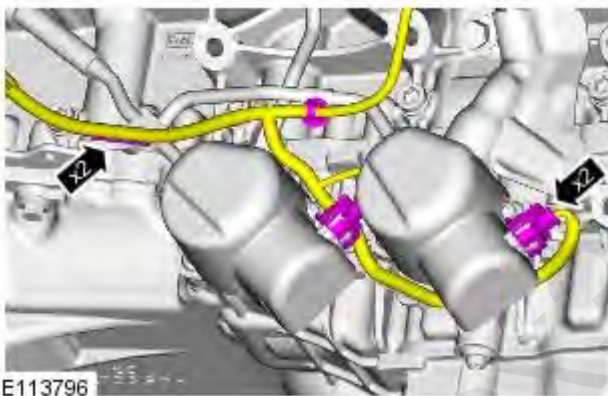


Make sure that all openings are sealed. Use new blanking caps.

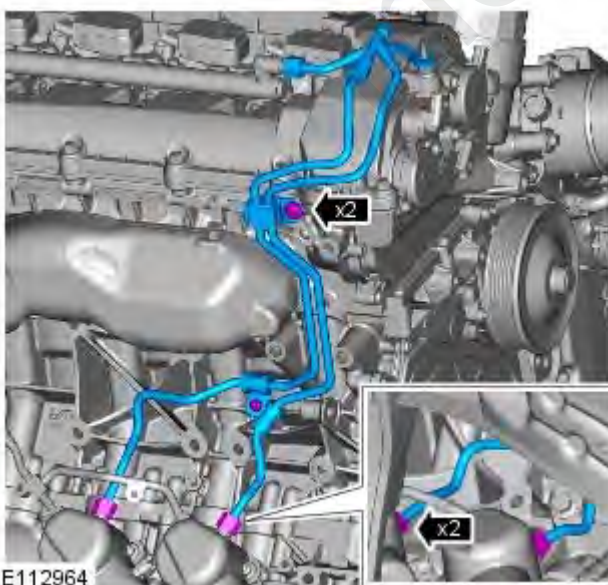
18. **18. ⚠ WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

19. Refer to: [Steering Gear - V8 5.0L Petrol](#) (211-02 Power Steering, Removal and Installation).



20. **20. NOTE:** Engine shown removed for clarity.



21. **21. CAUTIONS:**



Be prepared to collect escaping fluids.



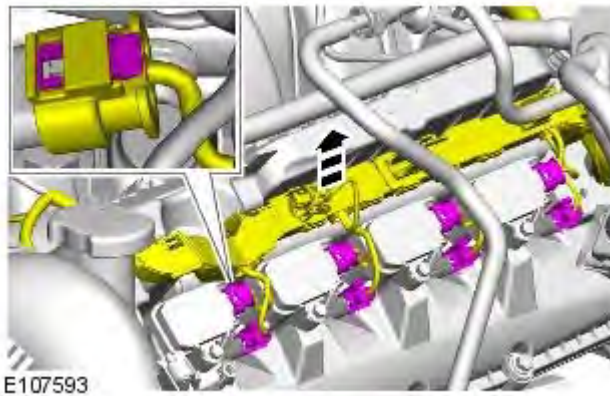
Make sure that all openings are sealed. Use new blanking caps.

- NOTE: Engine shown removed for clarity.

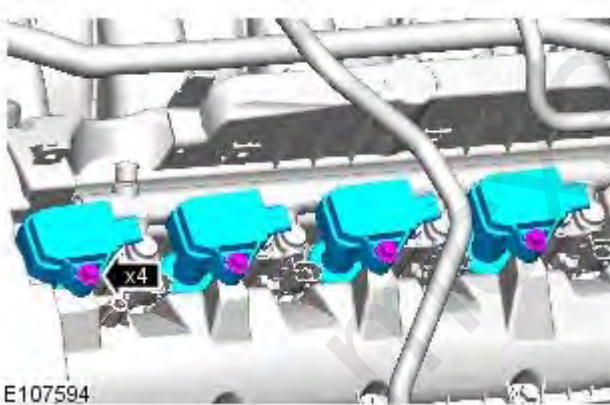
22. Lower the vehicle.



23.



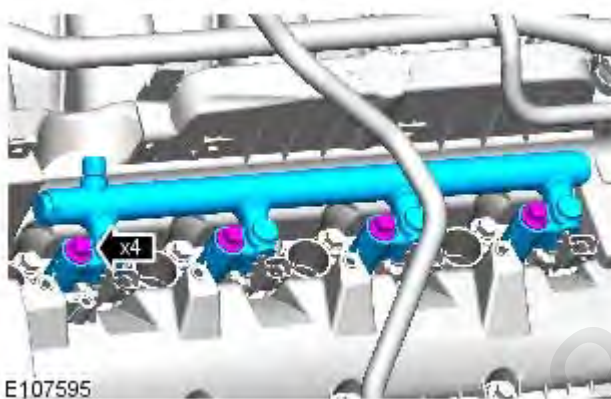
24. **24.** NOTE: LH illustration shown, RH is similar.



25. **25.** NOTE: LH illustration shown, RH is similar.

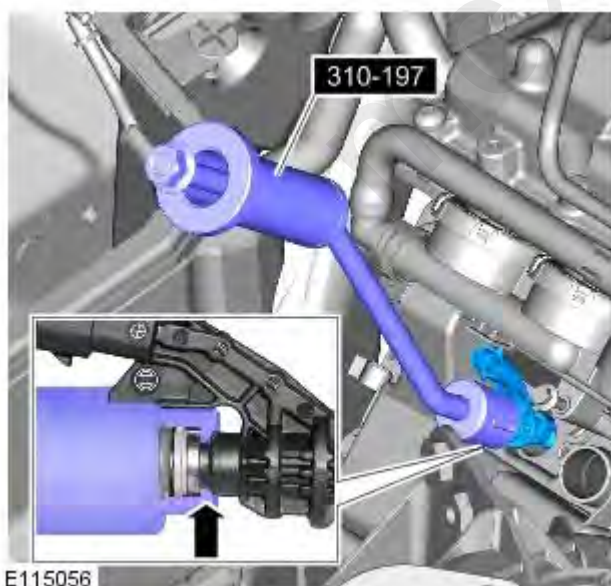


26. *Special Tool(s):* [303-1450](#)



27. **27.**  **CAUTION:** Make a note of the fuel injector clamp alignment to the fuel rail prior to removal.

- **NOTE:** LH illustration shown, RH is similar.



28. **28.** **CAUTIONS:**

 Make sure that the special tool is located correctly to the fuel injector prior to removing the fuel injector.

 Make sure that the special tool is held square to the fuel injector during removal.

 Make sure that all open ports are covered to prevent any foreign material ingress.

Special Tool(s): [310-197](#)



E115057

29. **29.**  **CAUTION:** If the fuel injector is being removed without a new component being installed, the fuel injector clamp must remain with the fuel injector it is removed with.



E115058

30. **30.** **CAUTIONS:**



Do not use a knife to remove the Teflon seal as damage could occur to the fuel injector.



Do not cut the Teflon seal too deep as damage could occur to the fuel injector.



Pinch the Teflon seal to allow the tool to cut the Teflon seal without damaging the fuel injector.



E115059

31. **31.**  **CAUTION:** Do not use any sharp tools to remove the O-ring seal as damage could occur to the fuel injector.

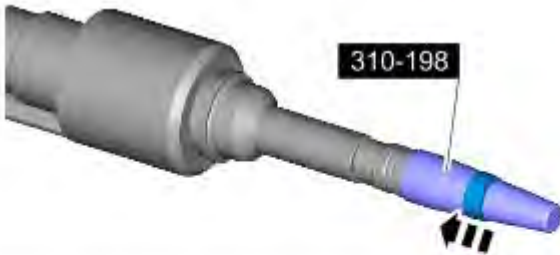
All vehicles

1.



E115059

2. *Special Tool(s):* [310-198](#)



E115060

3. *Special Tool(s):* [310-199](#)



E115062



E115057

4.  **CAUTION:** If the original fuel injector is being installed, the original fuel injector clamp must be installed with the fuel injector it was removed with.

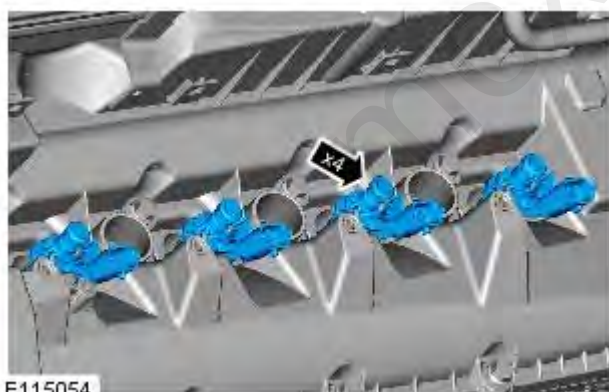


E107596

5.  **CAUTION:** If a new cylinder head has been installed then the special tool 310-200-02 without the thread must be used to install the fuel rail.

• **NOTE:** LH illustration shown, RH is similar.

Special Tool(s): [310-200-01](#), [310-200-02](#)



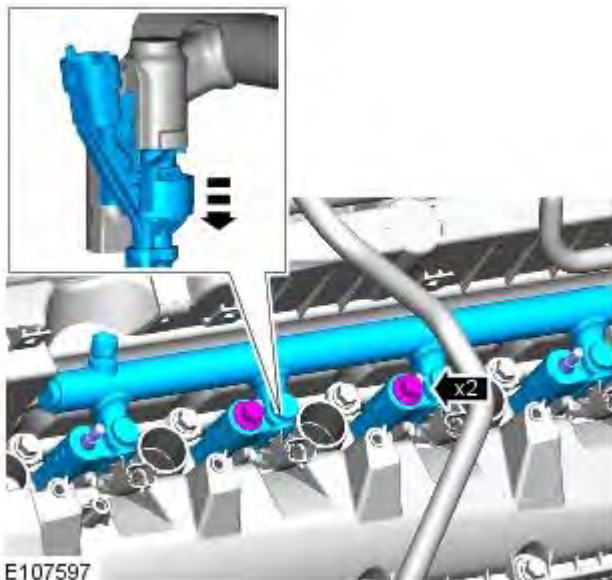
E115054

6. **CAUTIONS:**

 Make sure that the area around the open fuel injector ports are clean and free of foreign material and lubricant prior to installing the fuel injector.

 When installing the fuel injector(s), make sure that the Teflon seal is clean and free of foreign material and lubricant.

• **NOTE:** LH illustration shown, RH is similar.



7. **7. CAUTIONS:**

 If new fuel injectors are installed, a new injector clamp must be installed.

 Make sure that the fuel injector is aligned and installed into the fuel rail correctly, as noted in the removal step.

 Tighten the fuel rail retaining bolts a turn at a time until the correct torque is achieved.

- NOTE: Lubricate the fuel injector O-ring seals with clean engine oil.

- NOTE: LH illustration shown, RH is similar.

Torque: 20 Nm



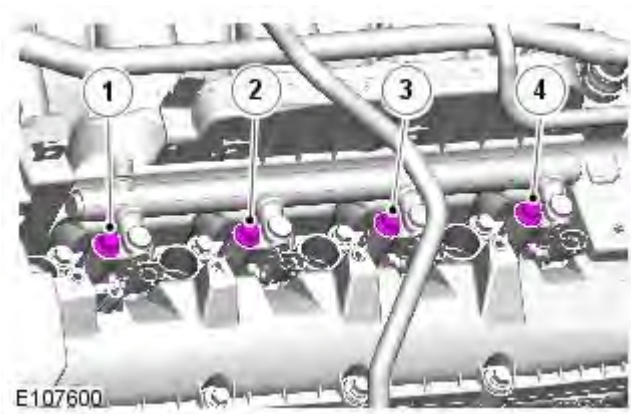
8. **8. NOTE:** LH illustration shown, RH is similar.

Special Tool(s): [310-200-01](#), [310-200-02](#)



9. **9. NOTE:** LH illustration shown, RH is similar.

Torque: 20 Nm



10. **10.** NOTE: Tighten the bolts in the indicated sequence.

• NOTE: LH illustration shown, RH is similar.

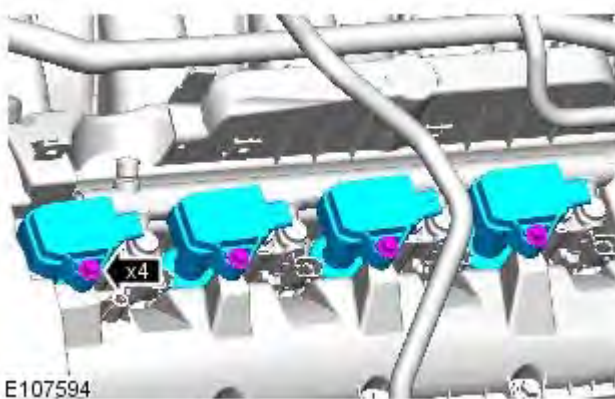
- *Torque:*
 - Bolt 2 30 Nm
 - Bolt 3 30 Nm
 - Bolt 1 30 Nm
 - Bolt 4 30 Nm



11.

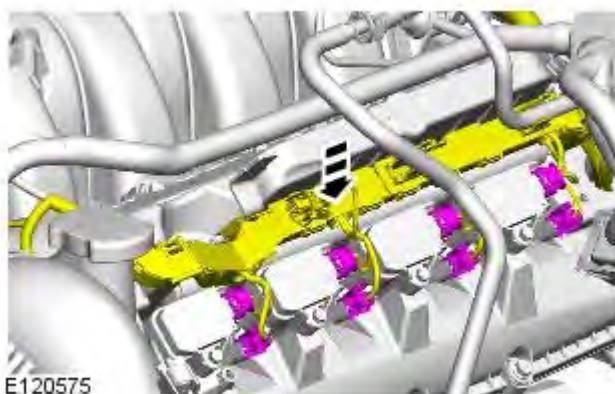


12. *Special Tool(s):* [303-1450](#)
Torque: 20 Nm



13. **13.** NOTE: LH illustration shown, RH is similar.

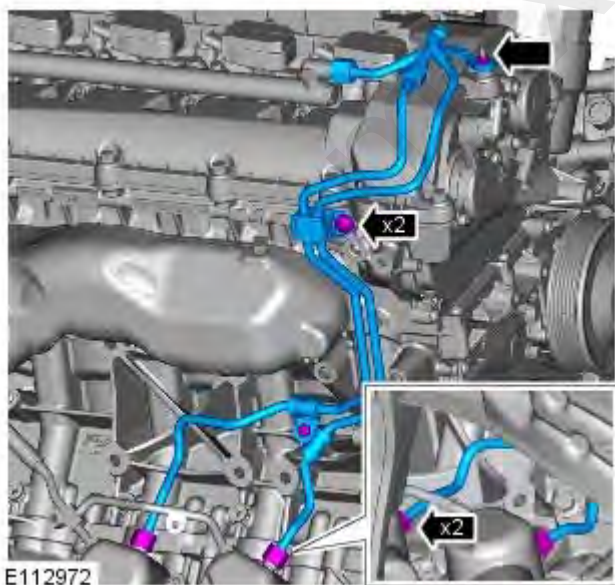
Torque: 7 Nm



14. **14.** NOTE: LH illustration shown, RH is similar.

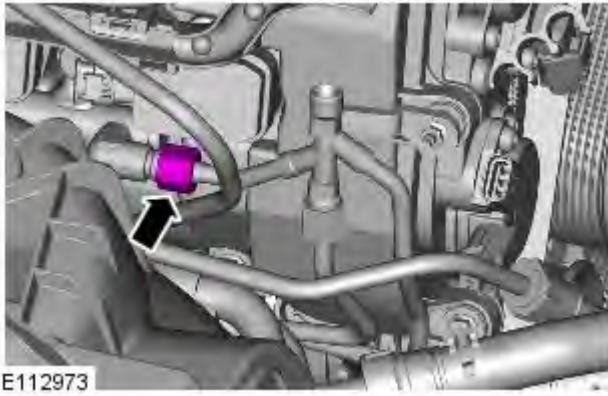
15. **15.**  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.



16. **16.**  **CAUTION:** Lubricate only the union threads with clean engine oil.
- NOTE: Engine shown removed for clarity.
 - NOTE: Install the bolt and unions finger tight before final tightening.
 - NOTE: Remove and discard the blanking caps.

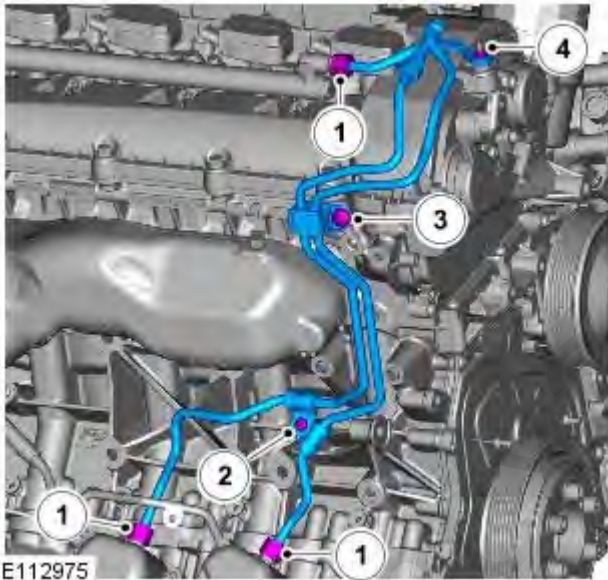
17. Lower the vehicle.



18. **18.** NOTE: Do not tighten at this stage.
- NOTE: Remove and discard the blanking caps.

19. **19.**  WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

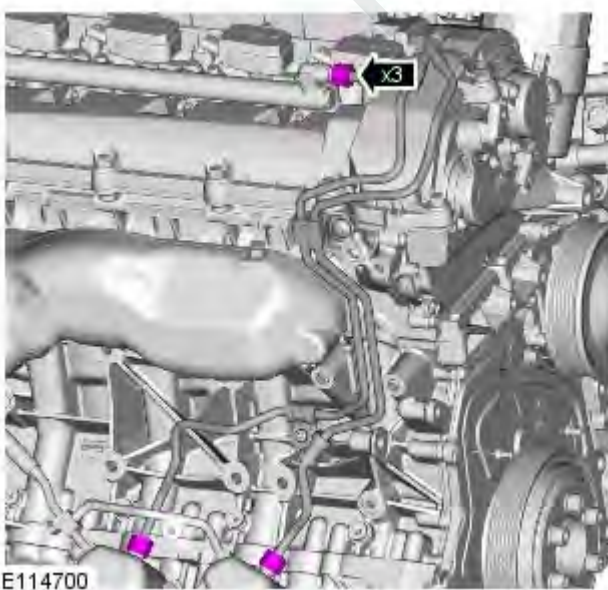
Raise and support the vehicle.



20. **20.** NOTE: Engine shown removed for clarity.

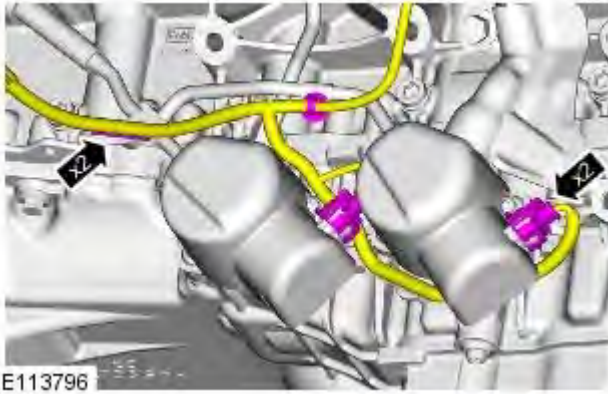
Torque:

- Unions (1) 21 Nm
- M6 (2) 11 Nm
- M8 (3) 25 Nm
- M5 nut (4) 6 Nm



21. **21.** NOTE: Engine shown removed for clarity.

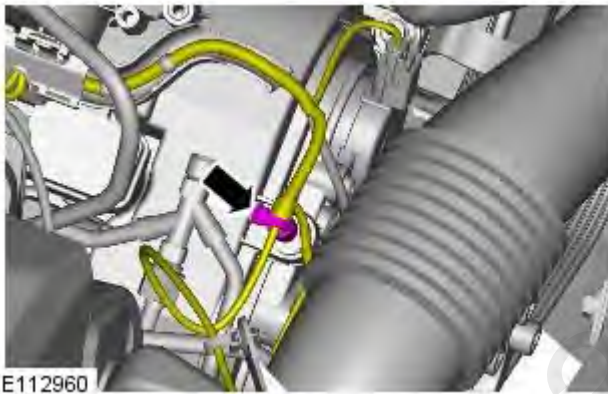
Torque: 21 Nm



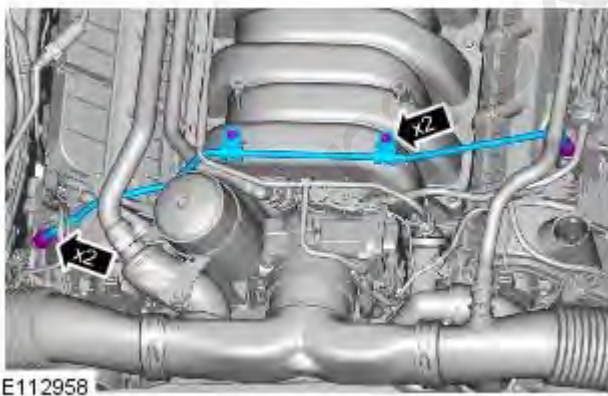
22. **22.** NOTE: Engine shown removed for clarity.

23. Refer to: [Steering Gear - V8 5.0L Petrol](#) (211-02 Power Steering, Removal and Installation).

24. Lower the vehicle.

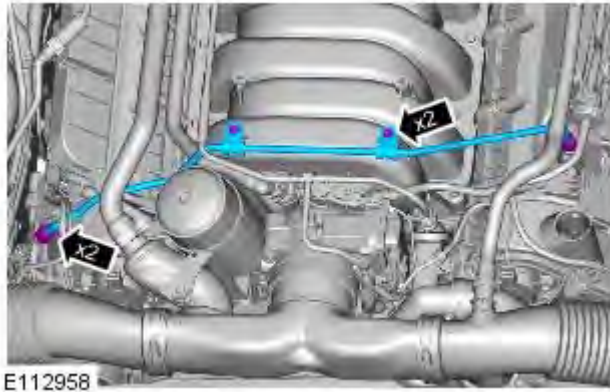


25.

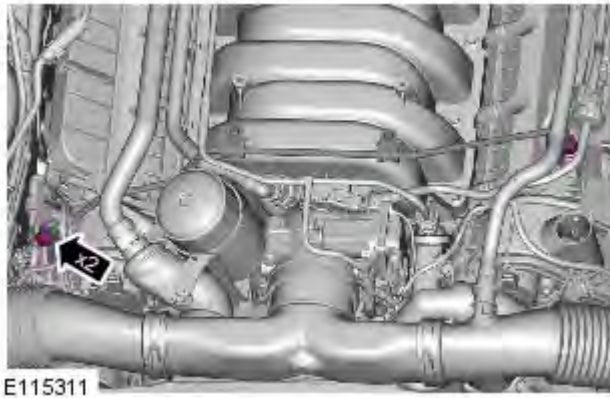


26. **26.**  CAUTION: Lubricate only the union threads with clean engine oil.

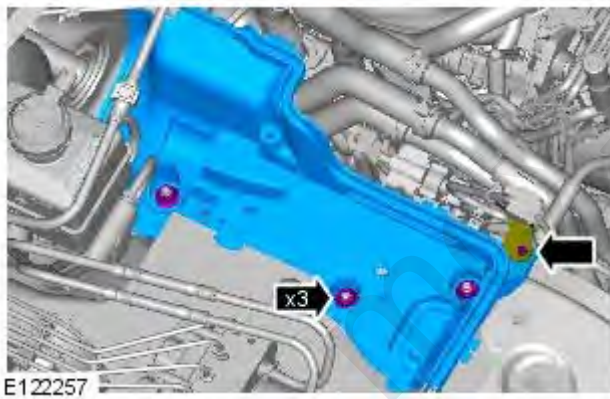
- NOTE: Do not tighten at this stage.
- NOTE: Remove and discard the blanking caps.



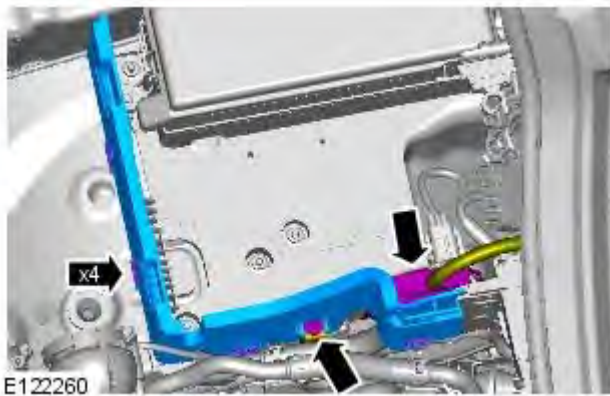
27. *Torque:*
 Unions 21 Nm
 Bolts 8 Nm



28. *Torque:* 21 Nm

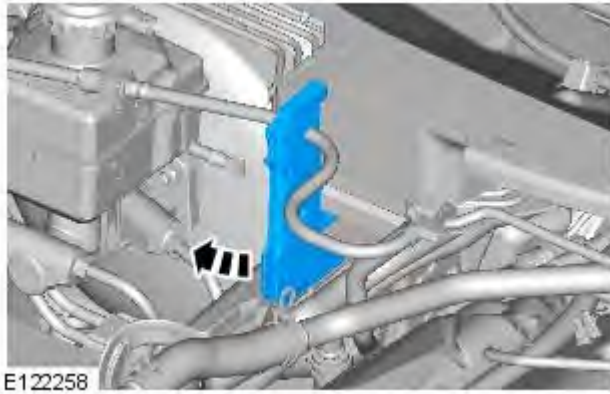


29. *Torque:* 12 Nm

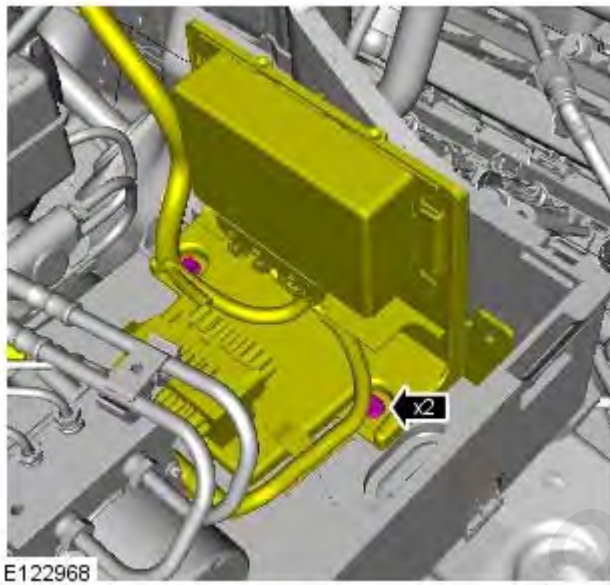


- 30.

Right-hand drive vehicles



31.

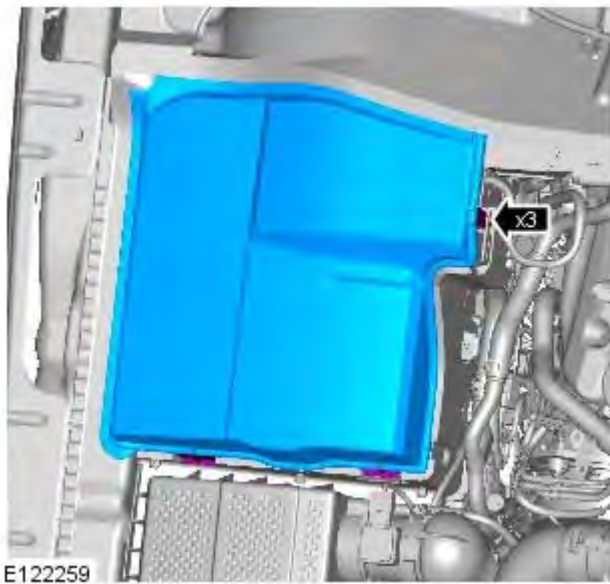


32. Torque: 10 Nm

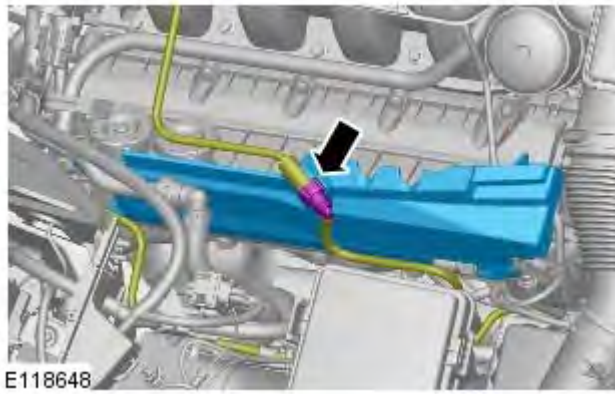
Left-hand drive vehicles

33. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

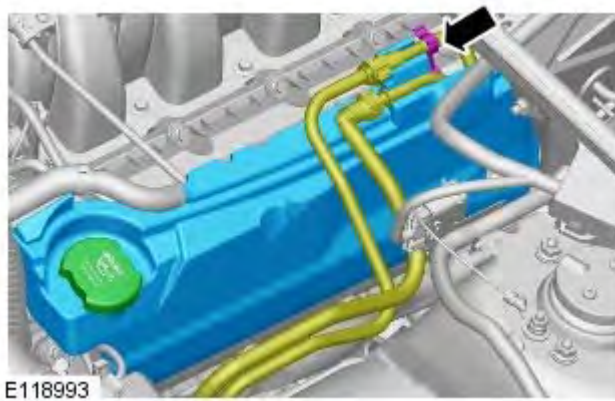
All vehicles



34.



35.



36.

37. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).

38. Refer to: [Engine Cover - V8 5.0L Petrol](#) (501-05 Interior Trim and Oramentation, Removal and Installation).

39. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Fuel Charging and Controls - V8 5.0L Petrol - Left-Hand Fuel Rail High-Pressure Fuel Pump

Removal and Installation

Removal

- CAUTIONS:



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



Make sure that tools and equipment are clean, free of foreign material and lubricant.

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

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

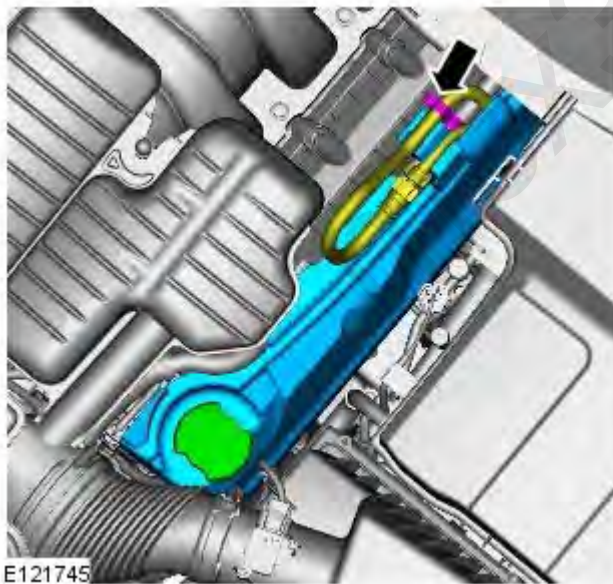
1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

2. Refer to: [Fuel System Pressure Release - V8 5.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).

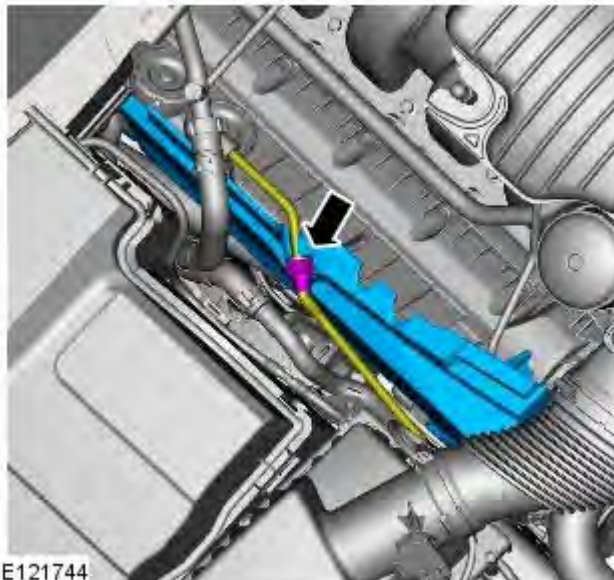
3. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

4. Refer to: [Engine Oil Draining and Filling](#) (303-01D Engine - V8 5.0L Petrol, General Procedures).

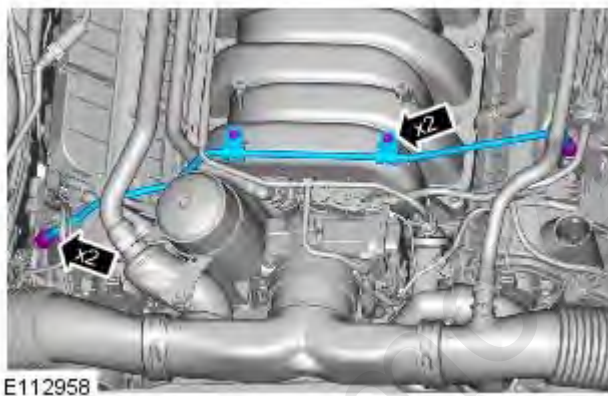


5.  CAUTION: Be prepared to collect escaping fluids.



6.

7. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).
8. Refer to: [Fuel Injection Component Cleaning](#) (303-04F Fuel Charging and Controls - V8 5.0L Petrol, General Procedures).



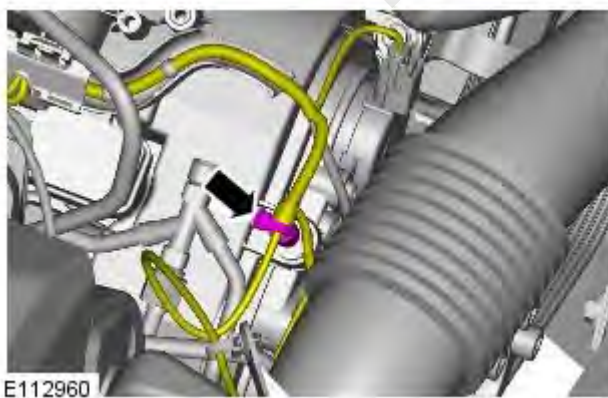
9. **9. CAUTIONS:**



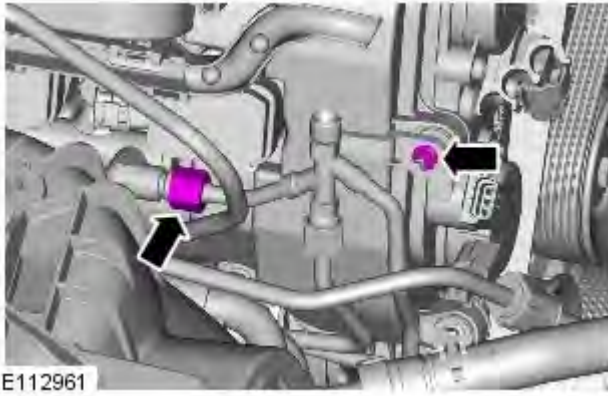
Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.



10.



11. **11. CAUTIONS:**



Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.

12. **12.**  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

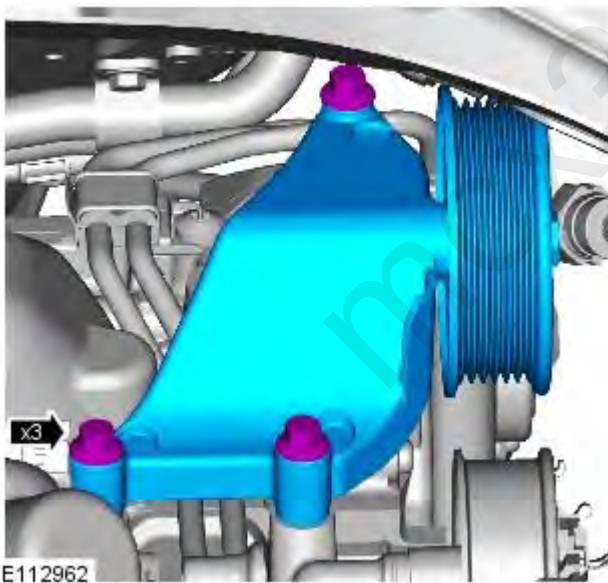
Raise and support the vehicle.

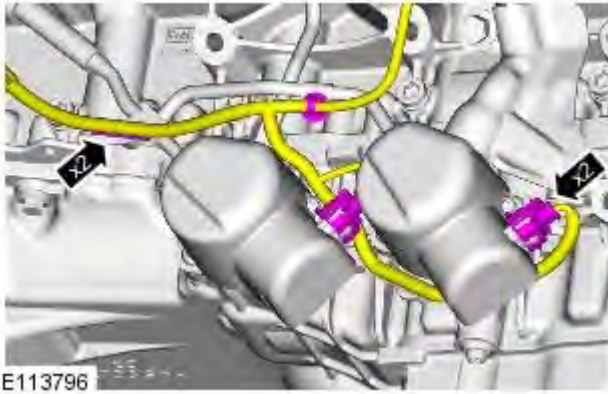
13. Refer to: [Steering Gear - V8 5.0L Petrol](#) (211-02 Power Steering, Removal and Installation).

14. Refer to: [Engine Mount RH](#) (303-01D Engine - V8 5.0L Petrol, Removal and Installation).

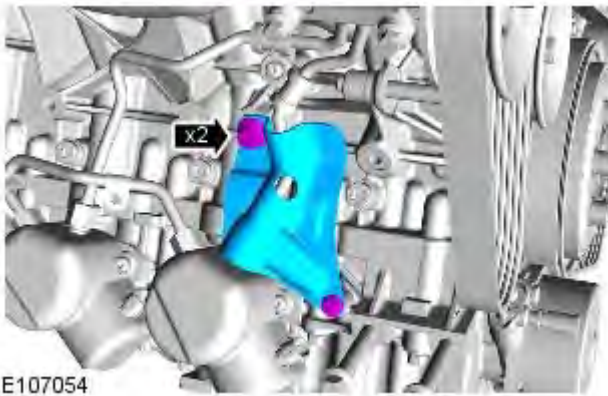
15. Refer to: [Generator](#) (414-02D Generator and Regulator - V8 5.0L Petrol, Removal and Installation).

16.

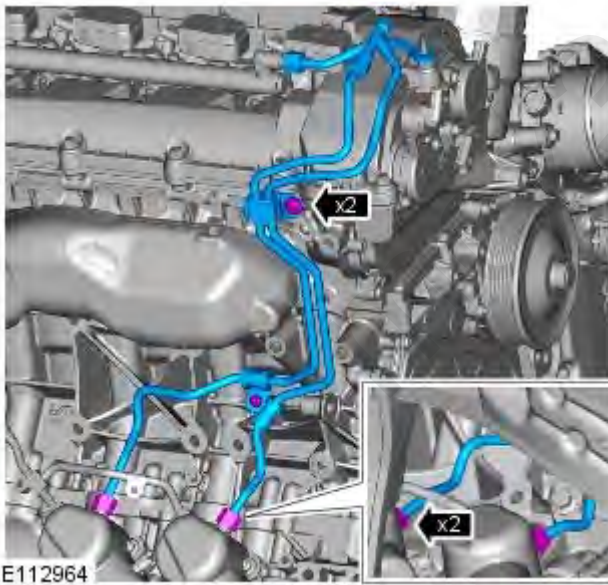




17. **17.** NOTE: Engine shown removed for clarity.



18. **18.** NOTE: Engine shown removed for clarity.



19. **19.** CAUTIONS:



Be prepared to collect escaping fluids.

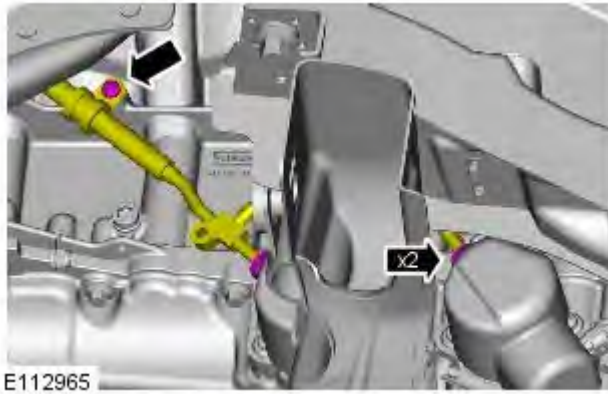


Make sure that all openings are sealed. Use new blanking caps.



Remove and discard the high-pressure fuel supply lines.

- NOTE: Engine shown removed for clarity.



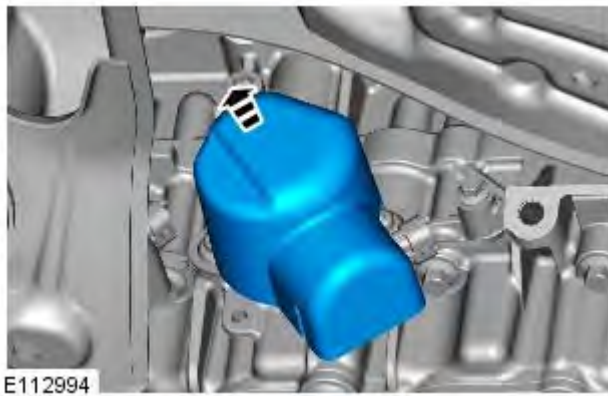
20. **20. CAUTIONS:**



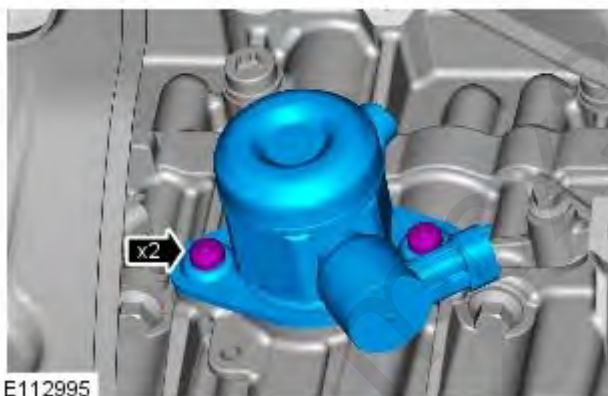
Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.



21.



22. **22. CAUTION:** Be prepared to collect escaping fluids.

Loosen the Torx screws a turn each at a time.

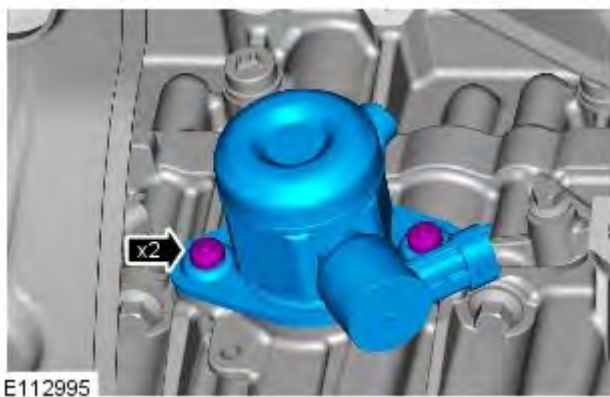


23. **23. CAUTION:** Be prepared to collect escaping fluids.

Installation



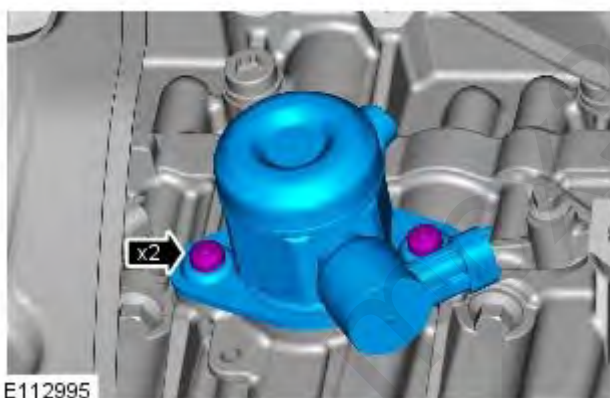
1. **NOTE:** Lubricate the fuel rail high-pressure fuel pump bucket with clean engine oil.



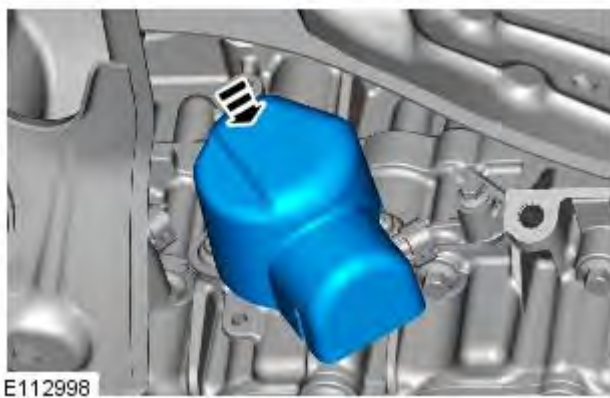
2. **CAUTION:** Tighten the Torx screws a turn at a time until the correct torque is achieved.

- **NOTE:** Lubricate the fuel rail high-pressure fuel pump O-ring seal with clean engine oil.

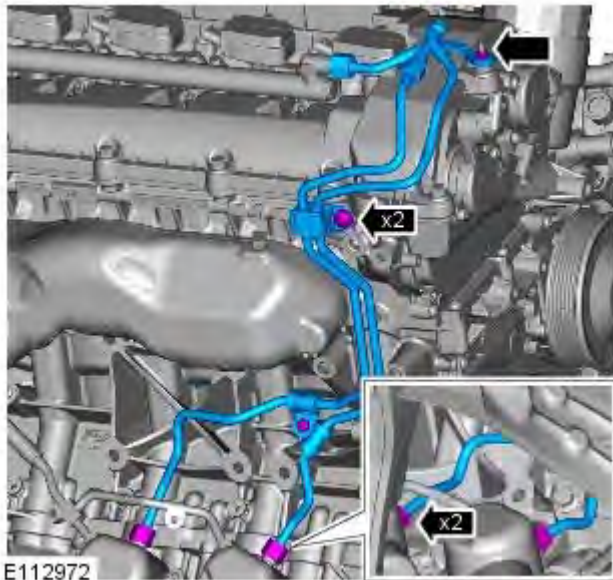
Torque: 11 Nm



3. Loosen the Torx screws half a turn each.



- 4.



5. **5. CAUTIONS:**

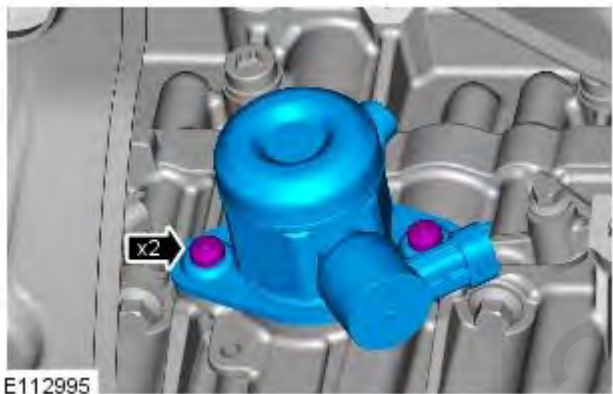


Install new high-pressure fuel supply lines.



Lubricate only the union threads with clean engine oil.

- NOTE: Remove and discard the blanking caps.
- NOTE: Engine shown removed for clarity.
- NOTE: Install the bolt and unions fully finger tight before final tightening.

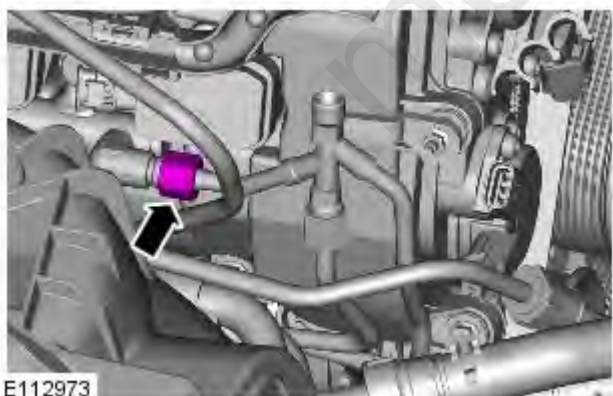


6. **6. CAUTION:** Care must be taken when positioning the fuel rail high-pressure fuel pump cover to one side.

- NOTE: Fuel rail high-pressure fuel pump cover shown removed for clarity.

Torque: 11 Nm

7. Lower the vehicle.

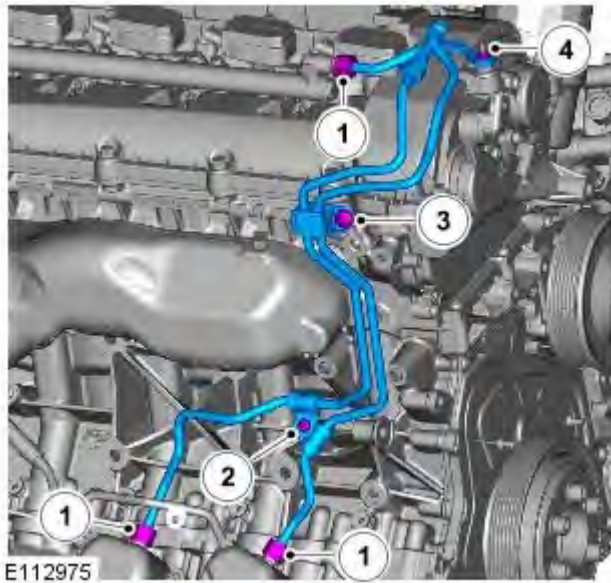


8. **8. NOTE:** Do not tighten at this stage.

- NOTE: Remove and discard the blanking caps.

9. **9. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

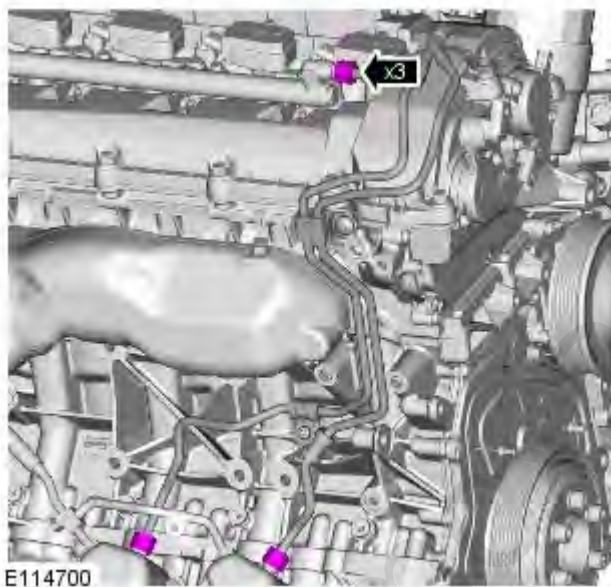
Raise and support the vehicle.



10. **10.** NOTE: Engine shown removed for clarity.

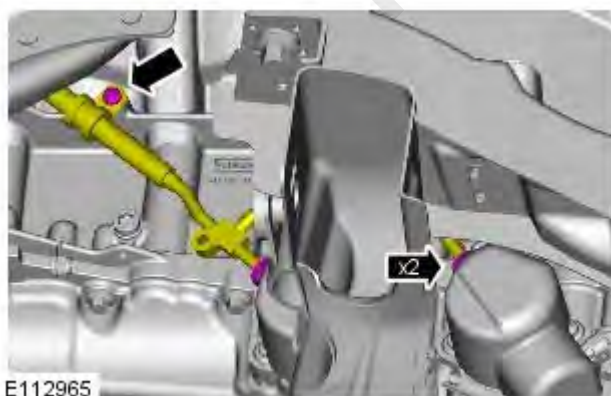
Torque:

Unions (1) 21 Nm
 M6 (2) 11 Nm
 M8 (3) 25 Nm
 M5 nut (4) 6 Nm



11. **11.** NOTE: Engine shown removed for clarity.

Torque: 21 Nm

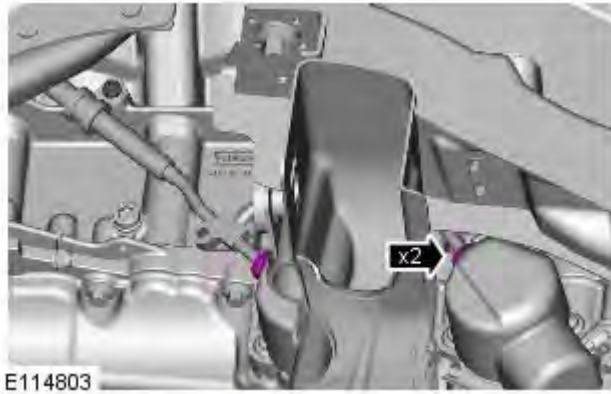


12. **12.** NOTE: Install the bolt and unions finger tight before final tightening.

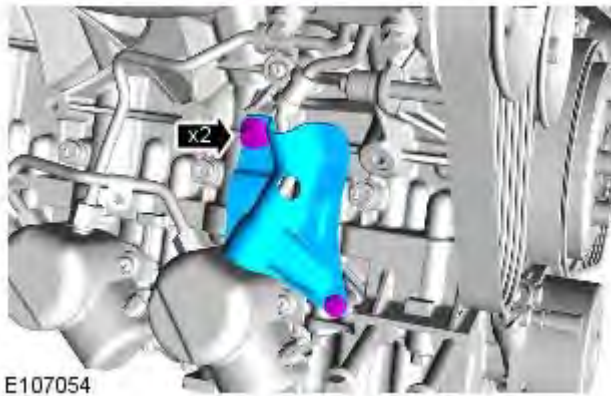
- NOTE: Remove and discard the blanking caps.

Torque:

Unions 21 Nm
 M6 11 Nm

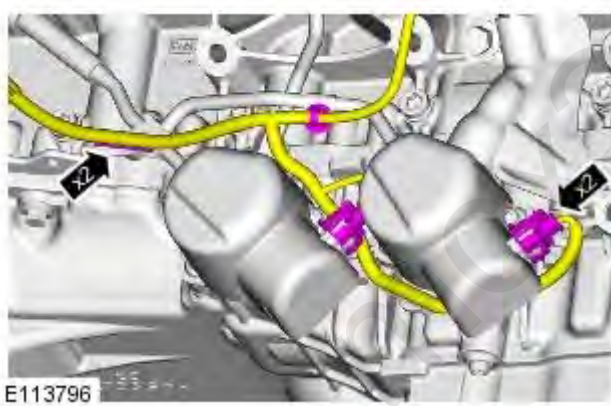


13. Torque: 21 Nm

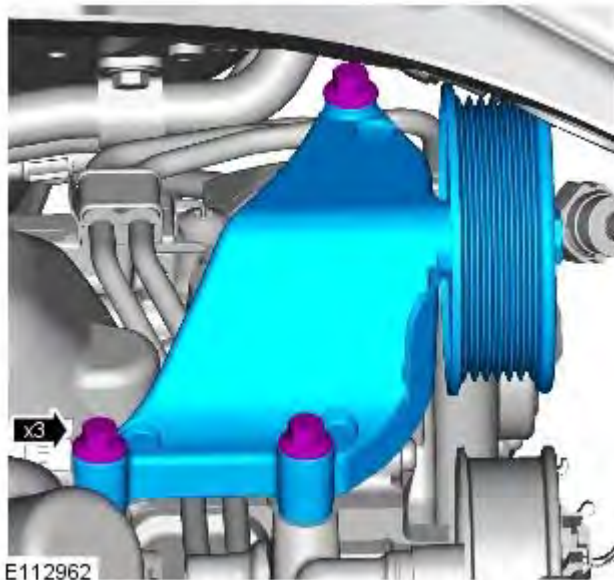


14. **14.** NOTE: Engine shown removed for clarity.

Torque:
M10 29 Nm
M6 11 Nm

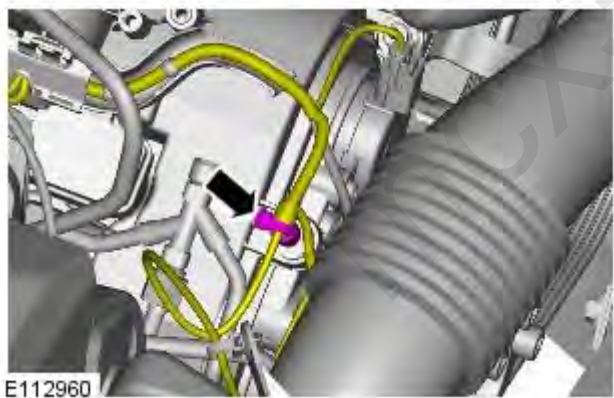


15. **15.** NOTE: Engine shown removed for clarity.

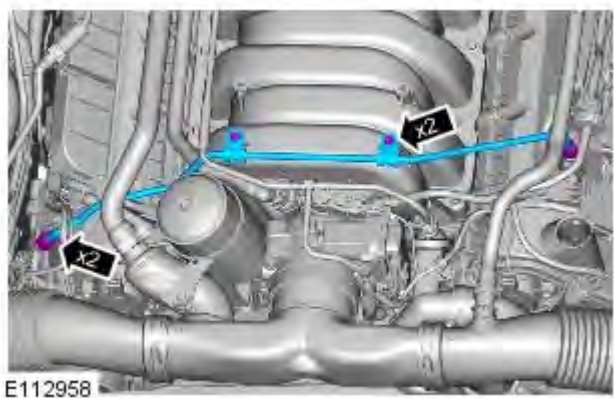


16. Torque: 25 Nm

17. Refer to: [Generator](#) (414-02D Generator and Regulator - V8 5.0L Petrol, Removal and Installation).
18. Refer to: [Engine Mount RH](#) (303-01D Engine - V8 5.0L Petrol, Removal and Installation).
19. Refer to: [Steering Gear - V8 5.0L Petrol](#) (211-02 Power Steering, Removal and Installation).
20. Lower the vehicle.

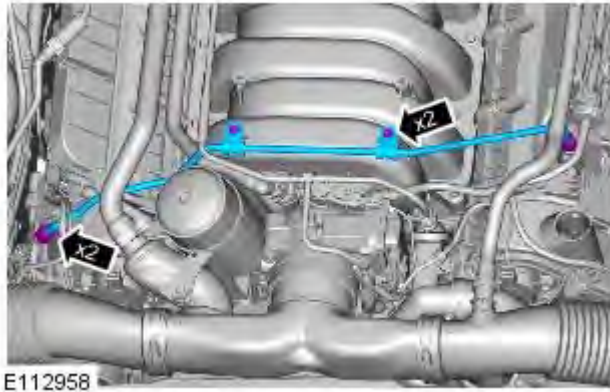


21.

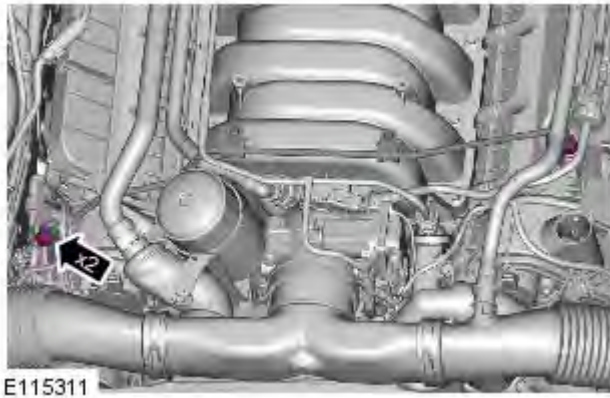


22. **22.** NOTE: Lubricate the union threads with clean engine oil.

- NOTE: Do not tighten at this stage.
- NOTE: Remove and discard the blanking caps.

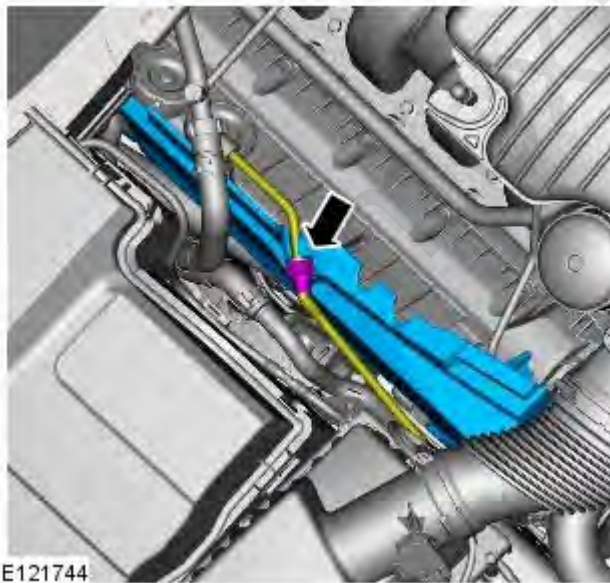


23. *Torque:*
 Unions 21 Nm
 Bolts 8 Nm

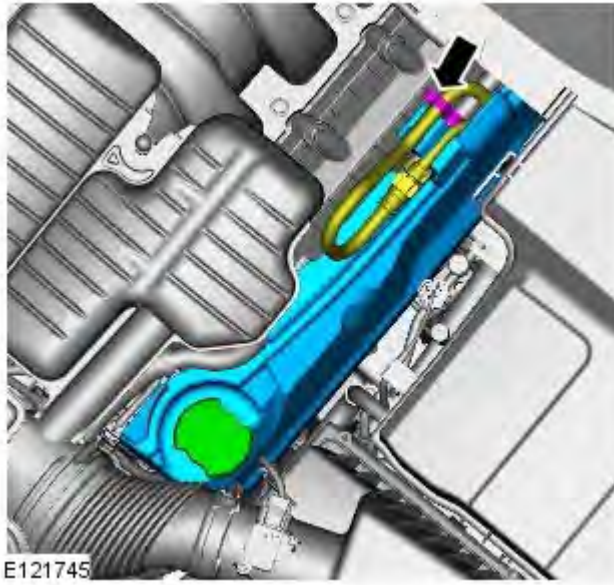


24. *Torque:* 21 Nm

25. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).



- 26.



27.

28. Refer to: [Engine Oil Draining and Filling](#) (303-01D Engine - V8 5.0L Petrol, General Procedures).

29. Connect the battery ground cable.

Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

Fuel Charging and Controls - V8 5.0L Petrol - Right-Hand Fuel Rail High-Pressure Fuel Pump

Removal and Installation

Removal

- CAUTIONS:



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



Make sure that tools and equipment are clean, free of foreign material and lubricant.

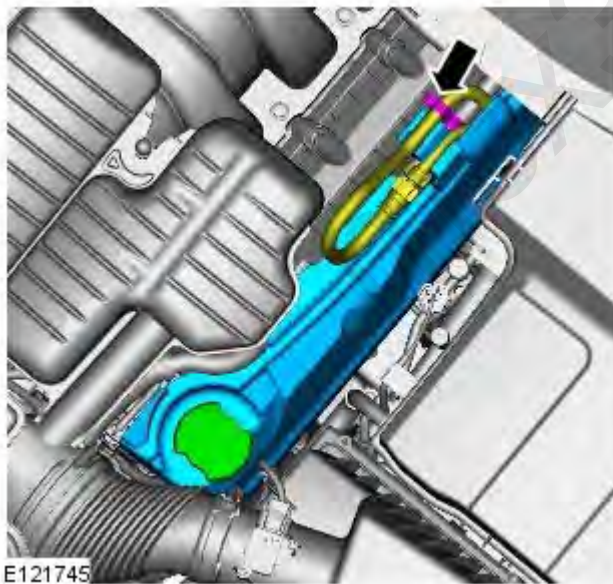
- NOTE: Removal steps in this procedure may contain installation details.

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

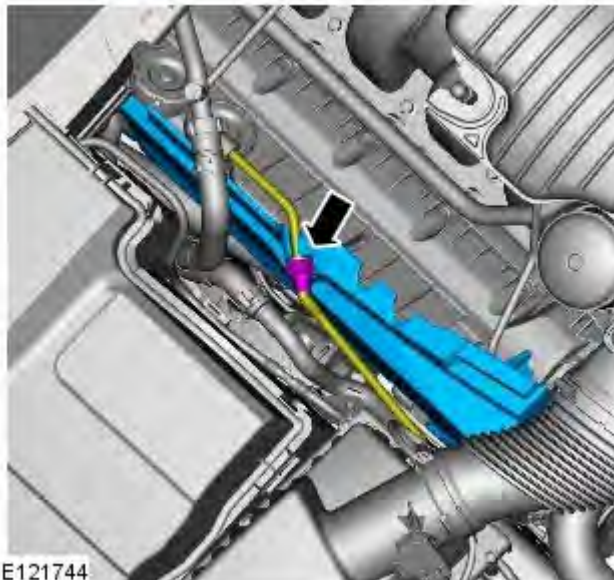
1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V8 5.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

4. Refer to: [Engine Oil Draining and Filling](#) (303-01D Engine - V8 5.0L Petrol, General Procedures).

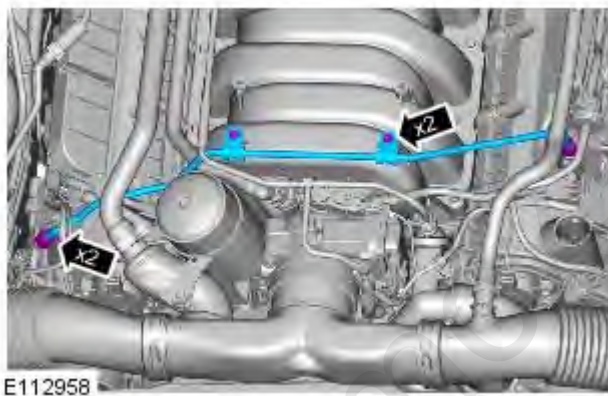


5.  CAUTION: Be prepared to collect escaping fluids.



6.

7. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).
8. Refer to: [Fuel Injection Component Cleaning](#) (303-04F Fuel Charging and Controls - V8 5.0L Petrol, General Procedures).



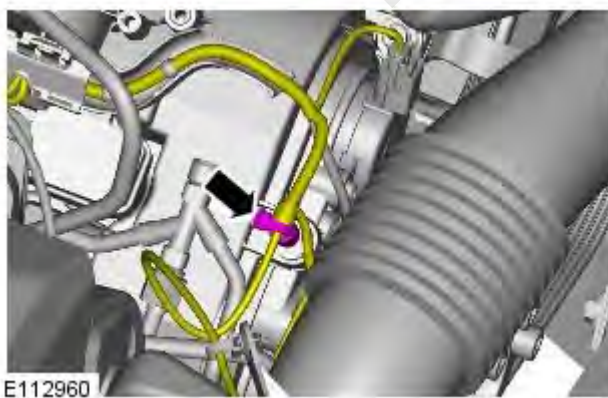
9. **9. CAUTIONS:**



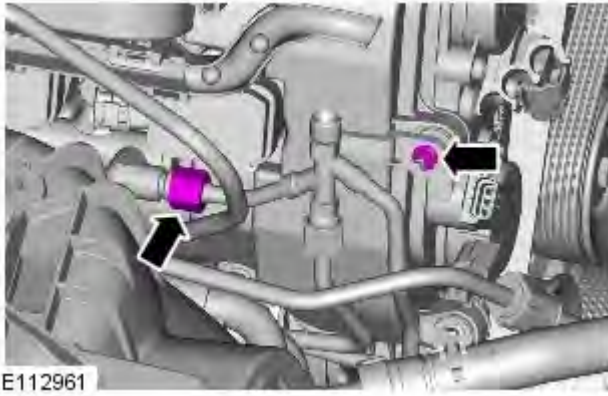
Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.



10.



11. **11. CAUTIONS:**



Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.

12. **12.**  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

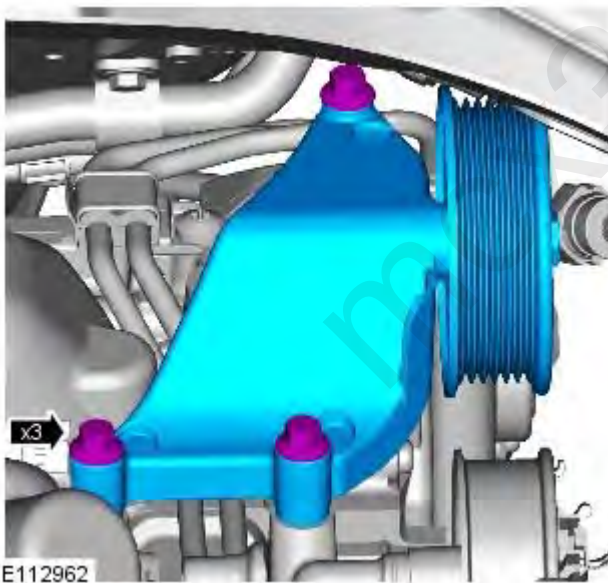
Raise and support the vehicle.

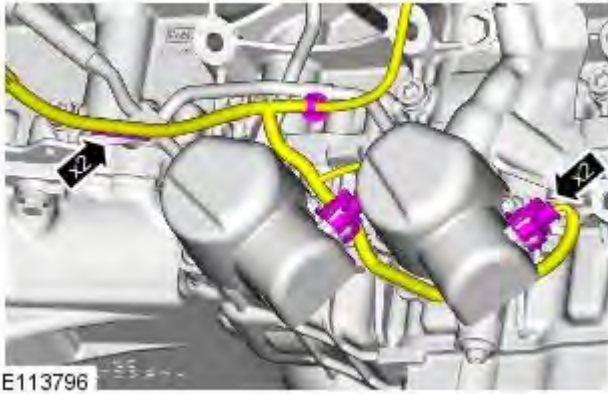
13. Refer to: [Steering Gear - V8 5.0L Petrol](#) (211-02 Power Steering, Removal and Installation).

14. Refer to: [Engine Mount RH](#) (303-01D Engine - V8 5.0L Petrol, Removal and Installation).

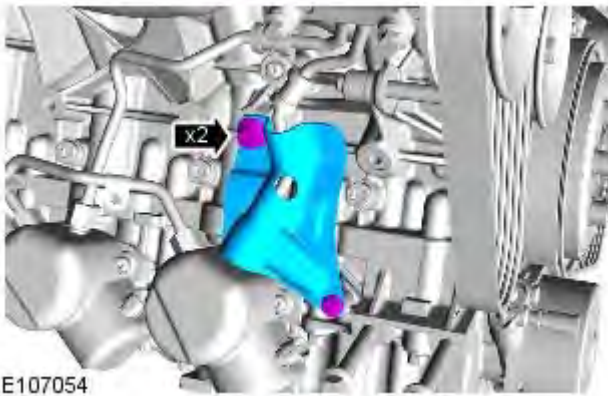
15. Refer to: [Generator](#) (414-02D Generator and Regulator - V8 5.0L Petrol, Removal and Installation).

16.

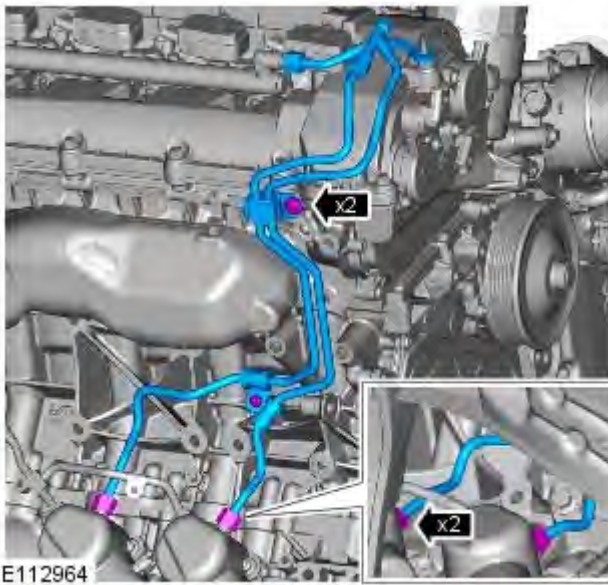




17. **17.** NOTE: Engine shown removed for clarity.



18. **18.** NOTE: Engine shown removed for clarity.



19. **19.** CAUTIONS:



Be prepared to collect escaping fluids.

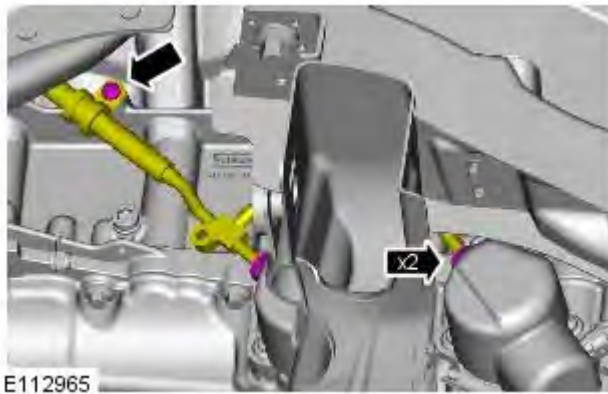


Make sure that all openings are sealed. Use new blanking caps.



Remove and discard the high-pressure fuel supply lines.

- NOTE: Engine shown removed for clarity.



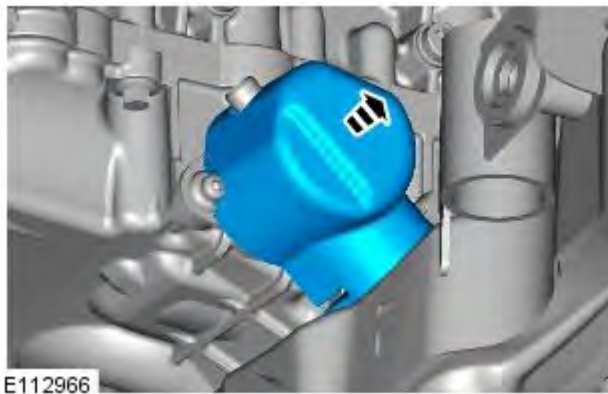
20. **20. CAUTIONS:**



Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.

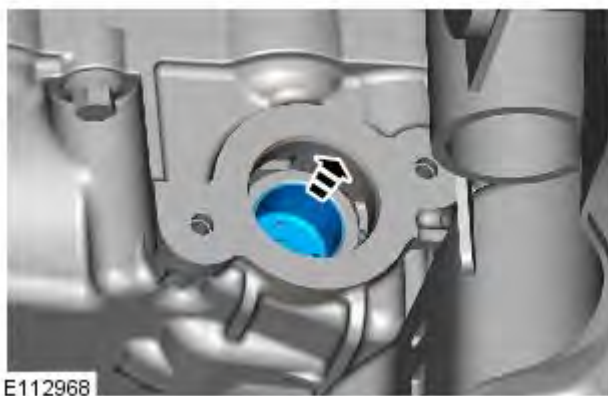


21.



22. **22. CAUTION:** Be prepared to collect escaping fluids.

Loosen the Torx screws a turn each at a time.



23. **23. CAUTION:** Be prepared to collect escaping fluids.

Installation



1. **NOTE:** Lubricate the fuel rail high-pressure fuel pump bucket with clean engine oil.



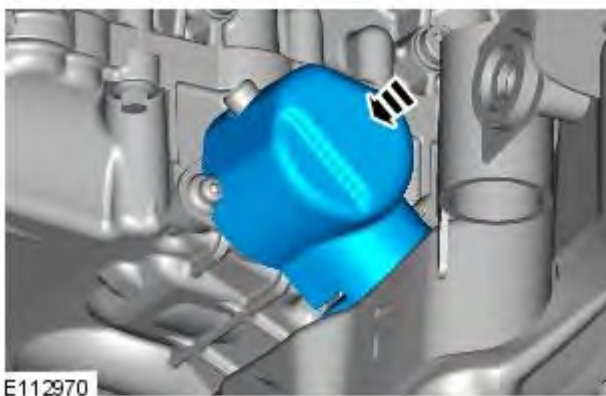
2. **CAUTION:** Tighten the Torx screws a turn at a time until the correct torque is achieved.

- **NOTE:** Lubricate the fuel rail high-pressure fuel pump O-ring seal with clean engine oil.

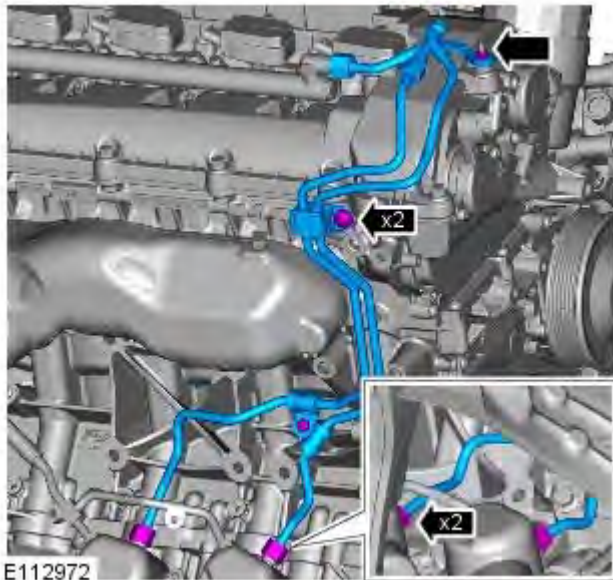
Torque: 11 Nm



3. Loosen the Torx screws half a turn each.



- 4.



5. **5. CAUTIONS:**



Install new high-pressure fuel supply lines.



Lubricate only the union threads with clean engine oil.

• NOTE: Remove and discard the blanking caps.

• NOTE: Engine shown removed for clarity.

• NOTE: Install the bolt and unions fully finger tight before final tightening.

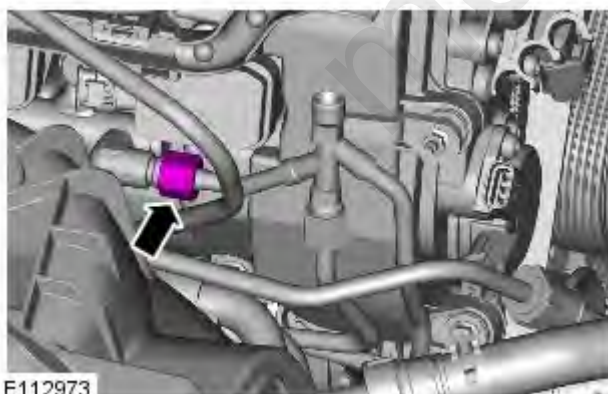


6. **6. CAUTION:** Care must be taken when positioning the fuel rail high-pressure fuel pump cover to one side.

• NOTE: Fuel rail high-pressure fuel pump cover shown removed for clarity.

Torque: 11 Nm

7. Lower the vehicle.

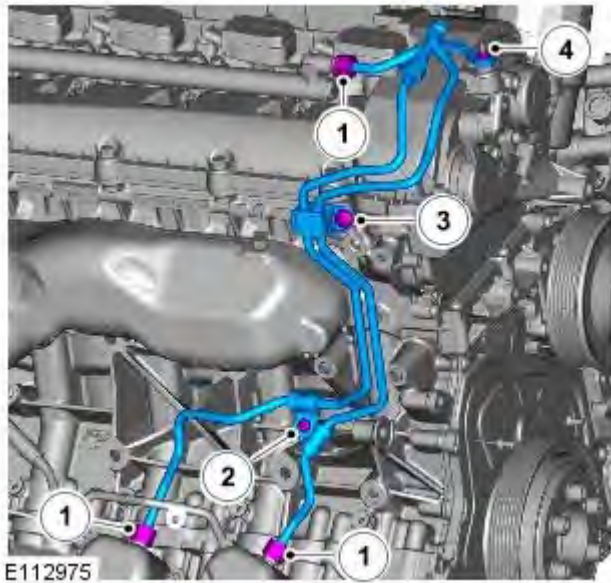


8. **8. NOTE:** Do not tighten at this stage.

• NOTE: Remove and discard the blanking caps.

9. **9. WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

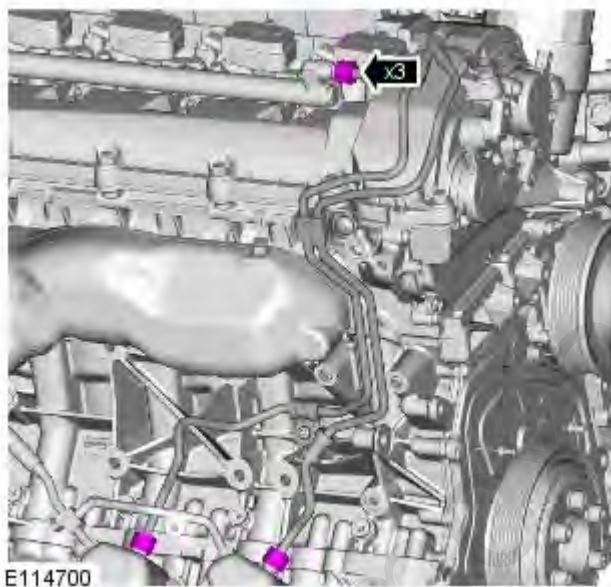
Raise and support the vehicle.



10. **10.** NOTE: Engine shown removed for clarity.

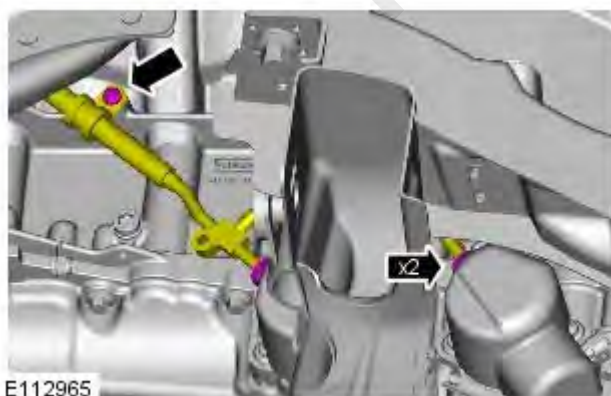
Torque:

Unions (1) 21 Nm
 M6 (2) 11 Nm
 M8 (3) 25 Nm
 M5 nut (4) 6 Nm



11. **11.** NOTE: Engine shown removed for clarity.

Torque: 21 Nm

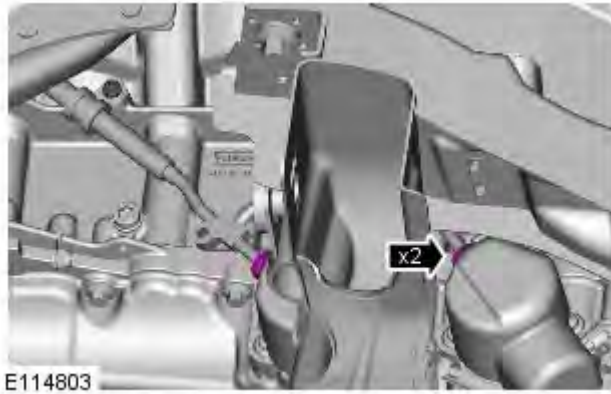


12. **12.** NOTE: Install the bolt and unions finger tight before final tightening.

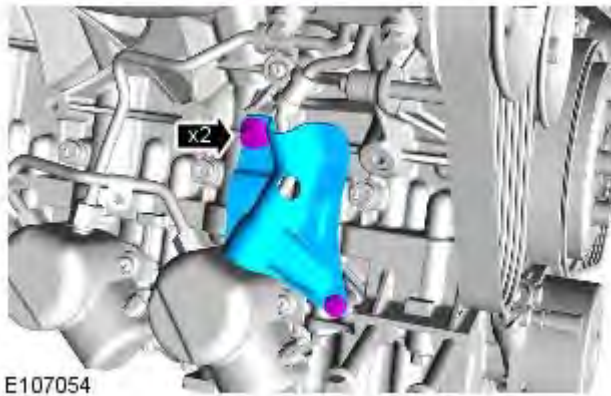
- NOTE: Remove and discard the blanking caps.

Torque:

Unions 21 Nm
 M6 11 Nm

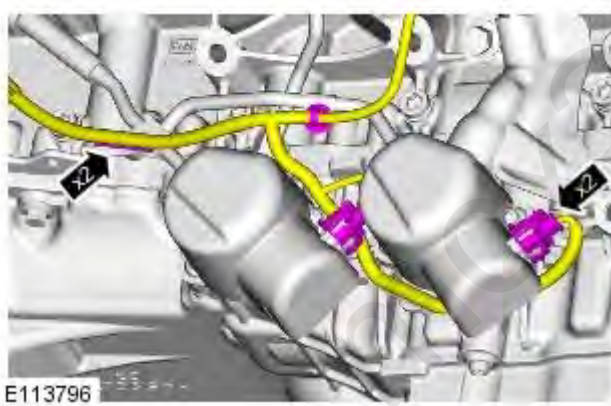


13. Torque: 21 Nm

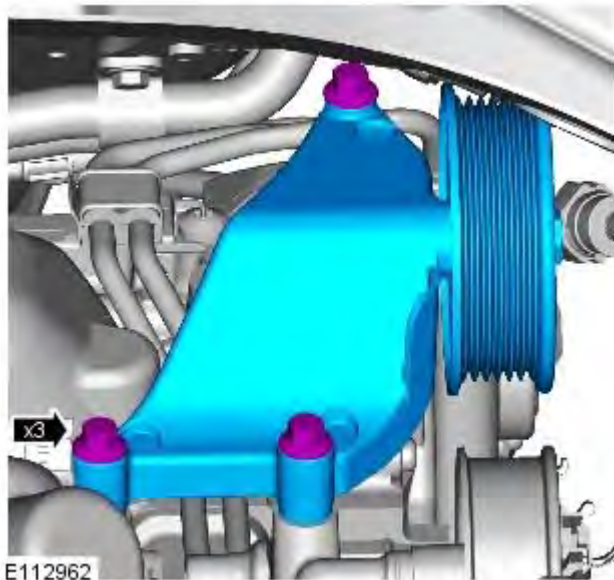


14. **14.** NOTE: Engine shown removed for clarity.

Torque:
M10 29 Nm
M6 11 Nm

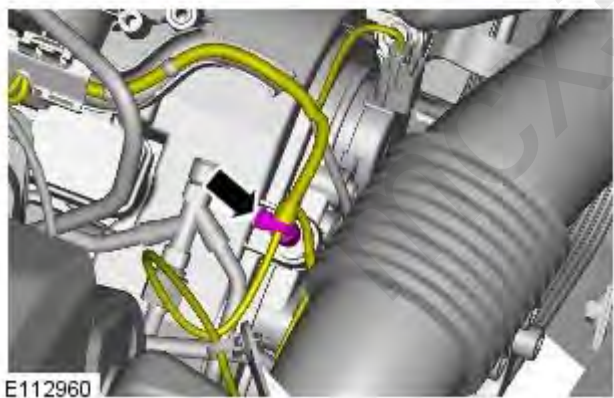


15. **15.** NOTE: Engine shown removed for clarity.

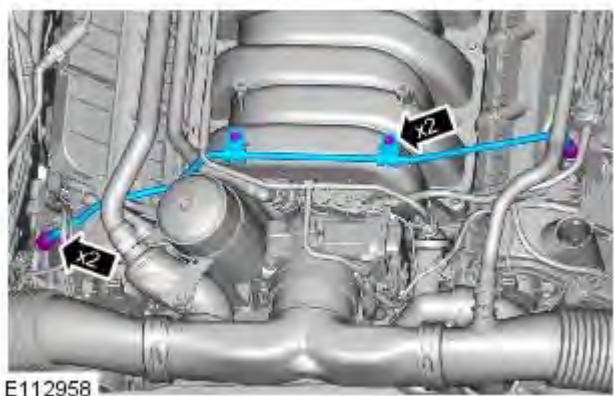


16. Torque: 25 Nm

17. Refer to: [Generator](#) (414-02D Generator and Regulator - V8 5.0L Petrol, Removal and Installation).
18. Refer to: [Engine Mount RH](#) (303-01D Engine - V8 5.0L Petrol, Removal and Installation).
19. Refer to: [Steering Gear - V8 5.0L Petrol](#) (211-02 Power Steering, Removal and Installation).
20. Lower the vehicle.

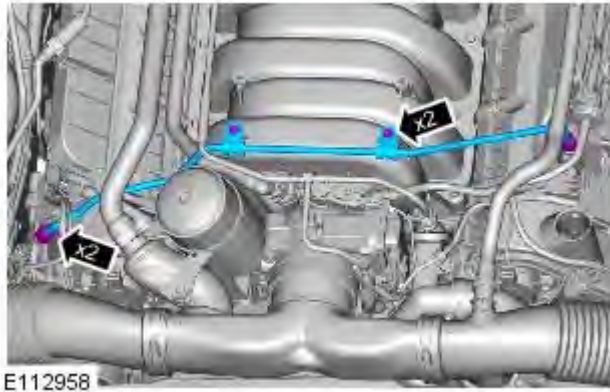


21.

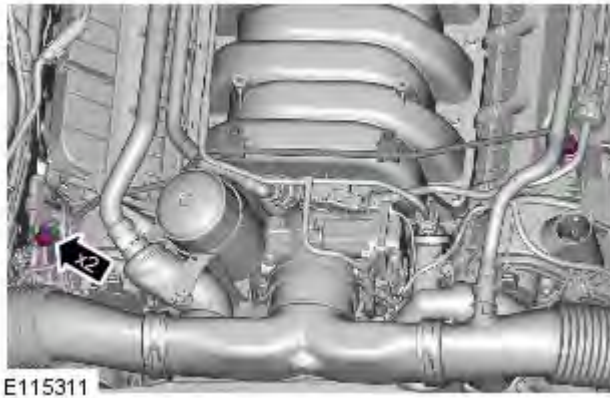


22. **22.** NOTE: Lubricate the union threads with clean engine oil.

- NOTE: Do not tighten at this stage.
- NOTE: Remove and discard the blanking caps.

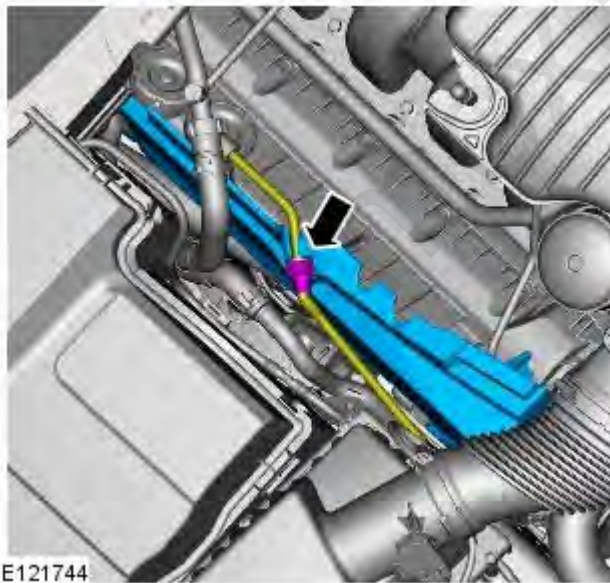


23. *Torque:*
 Unions 21 Nm
 Bolts 8 Nm

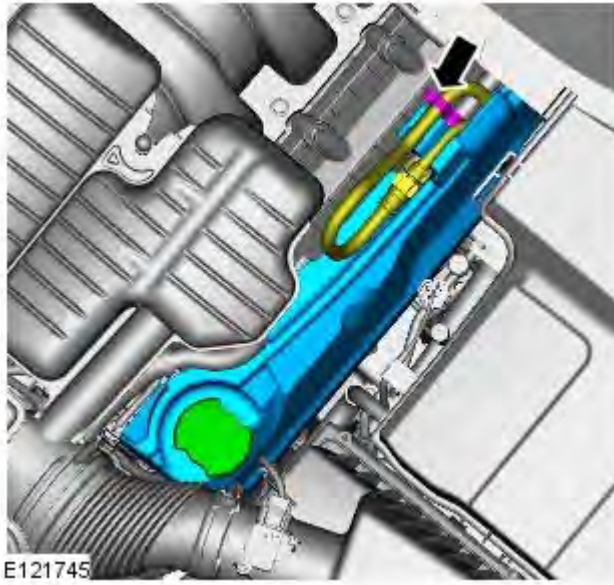


24. *Torque:* 21 Nm

25. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).



- 26.



27.

28. Refer to: [Engine Oil Draining and Filling](#) (303-01D Engine - V8 5.0L Petrol, General Procedures).

29. Connect the battery ground cable.

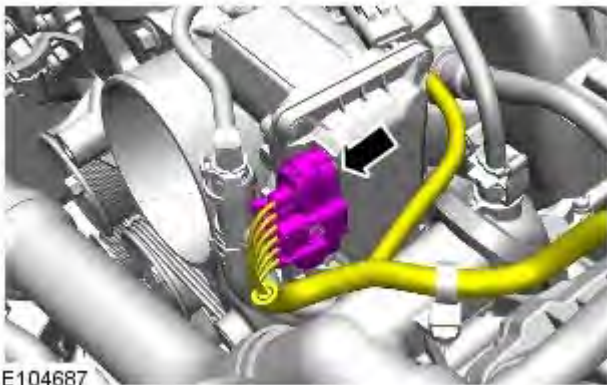
Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

Fuel Charging and Controls - V8 5.0L Petrol - Throttle Body

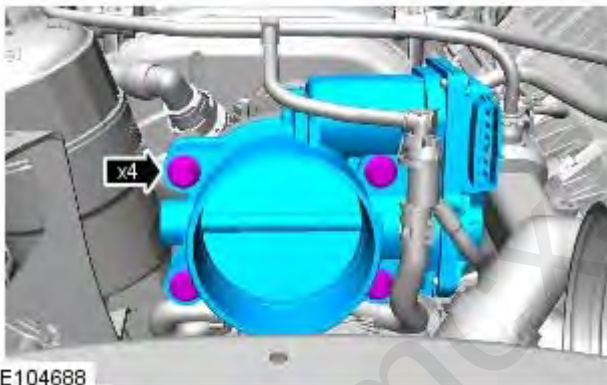
Removal and Installation

Removal

- NOTE: Removal steps in this procedure may contain installation details.
 - NOTE: Some variation in the illustrations may occur, but the essential information is always correct.
1. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12D Intake Air Distribution and Filtering - V8 5.0L Petrol, Removal and Installation).

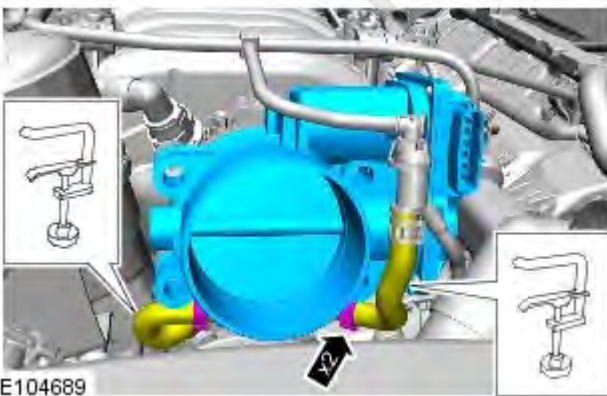


2. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.



3. **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 17 Nm



4. **CAUTIONS:**



Do not attempt to clean the throttle body bore, build up of deposits reduces air leakage past the throttle plate at the fully closed position.



Be prepared to collect escaping fluids.

- NOTE: Clamp the hose to minimize coolant loss.

- NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Installation

1. To install, reverse the removal procedure.
2. Using the approved diagnostic equipment, clear the powertrain control module (PCM) adaptations.