Published: 11-May-2011

Fuel Charging and Controls - V6 4.0L Petrol - Fuel Injector

Removal and Installation

Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. WARNINGS:

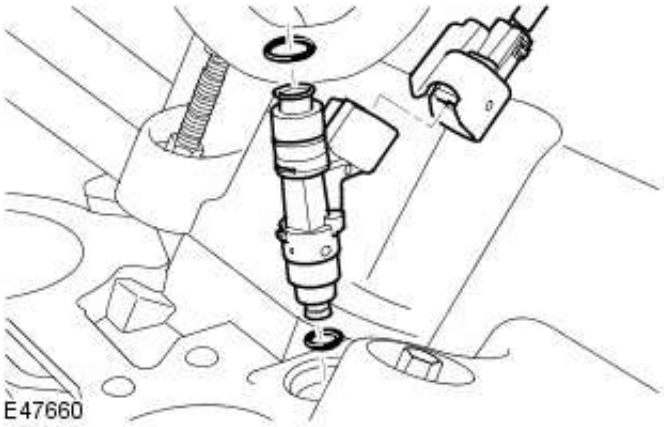
Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

CAUTION: Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Remove the fuel rail.
For additional information, refer to: Fuel Rail (303-04A Fuel Charging and Controls - V6 4.0L Petrol, Removal and Installation).

3. Remove the fuel injector.
   - Release the injector.
   - Disconnect the electrical connector.
   - Remove and discard the O-ring seal.



Installation

1. Clean the component mating faces.
2. To install, reverse the removal procedure.
   - Lubricate the new O-ring seal with clean engine oil.

Published: 11-May-2011

Fuel Charging and Controls - V8 4.4L Petrol -

General Specification

Item	Specification
Recommended fuel:	
UK and ROW except NAS	Unleaded 95 RON to EN228 Specification
NAS	Premium unleaded gasoline with a CLC or AKI octane rating of 91 or higher.
Injectors:	
Make	Denso
Type - Not NAS	2W93-9F593-BA
Type - NAS	2W93-9F593-AA

Fuel Pressures

Component	bar	psi
Fuel pump	4.5	65
Fuel Rail	4.5	65

Torque Specifications

Description	Nm	lb-ft
Engine cover mounting bracket nuts	6	4
Fuel rail Torx bolts	10	7
Intake manifold MAP sensor housing bolts	10	7
Intake manifold casting bolts	10	7
* Intake manifold bolts	20	15
Exhaust gas recirculation (EGR) valve bolts	10	7
Engine wiring harness support bracket bolts	10	7
Throttle body retaining bolts	10	7

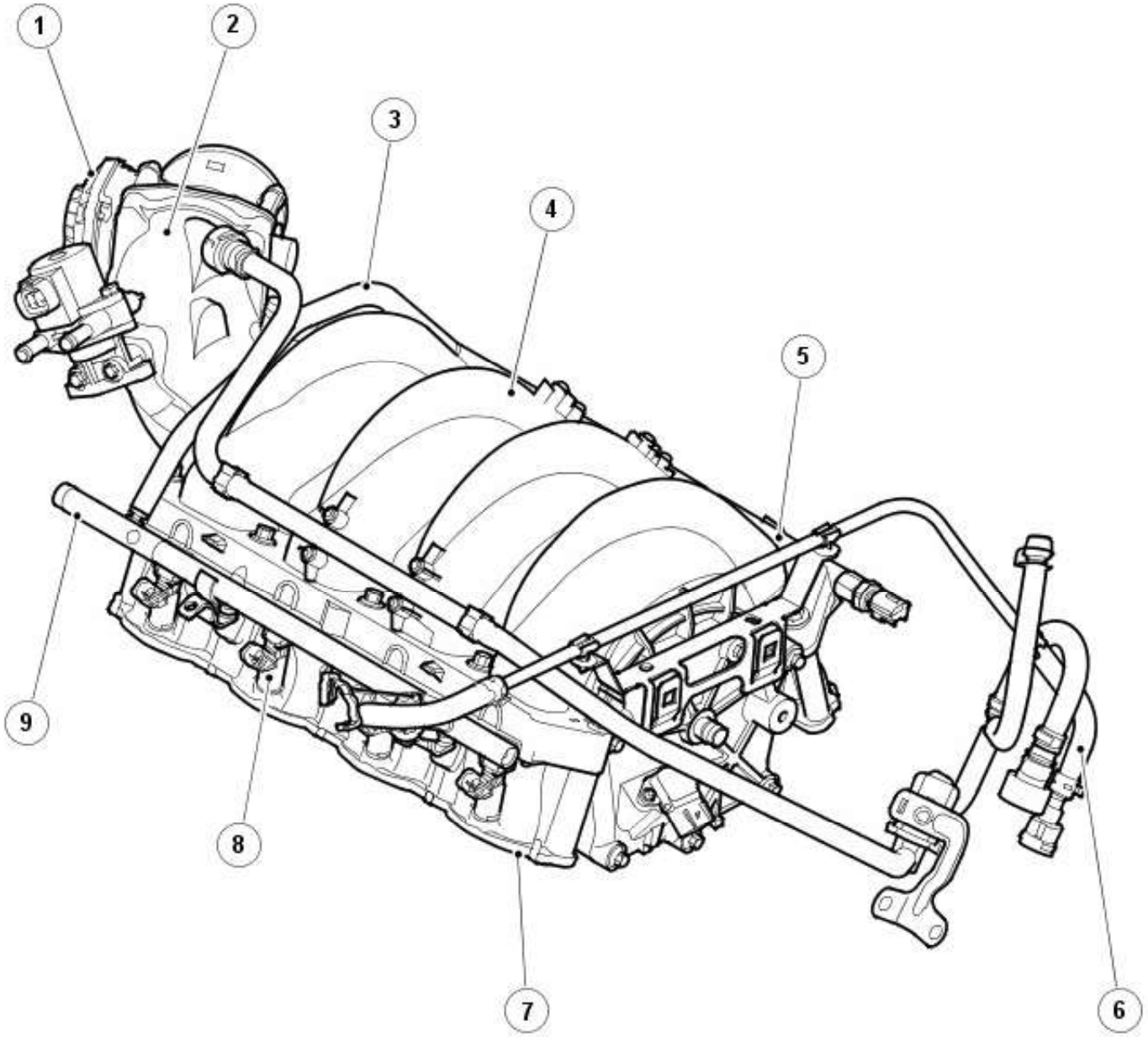
*** Tighten bolts progressively, working from the centre outwards**

Published: 11-May-2011

Fuel Charging and Controls - V8 4.4L Petrol - Fuel Charging and Controls

Description and Operation

Component Location



E50214

Item	Part Number	Description
1	-	Electronic throttle body
2	-	Induction elbow
3	-	Fuel supply cross over pipe
4	-	Intake manifold
5	-	RH fuel rail
6	-	Fuel jump hose
7	-	Injector housing
8	-	Injectors (8 of)

9	-	LH fuel rail

GENERAL

The major components of the fuel charging and control system comprise an intake manifold, a fuel pump, a fuel rail and eight injectors. The fuel pump supplies fuel from the tank at a constant pressure, via a pipe routed along the side of the transmission, to the fuel rail. The fuel rail distributes the fuel equally to each of the eight injectors. The fuel injectors, which are controlled by the Engine Control Module (ECM), are installed in the fuel rails on each side of the intake manifold. A cross over pipe connects the two fuel rails together at the front of the manifold. A Schraeder valve provides a pressure test connection for maintenance.

INTAKE MANIFOLD

The intake manifold is located on top of the engine between the two cylinder banks and is manufactured from a composite material. The manifold comprises a central chamber with eight tracts leading to the inlet ports on the engine. The air intake manifold is secured to the cylinder heads via 10 bolts.

Rubber gaskets, located in channels in the intake manifold, seal the joints between the ducts and the cylinder heads.
For additional information, refer to: Intake Air Distribution and Filtering (303-12B Intake Air Distribution and Filtering - V8 4.4L Petrol, Description and Operation).

FUEL PUMP

The submersible electric fuel pump is attached to a carrier and is located at the bottom of the swirl pot inside the fuel tank. The fuel pressure regulator, which controls the fuel pressure in the feed pipe to fuel rail, is located in the fuel manifold in the fuel tank.
For additional information, refer to: Fuel Tank and Lines (310-01B Fuel Tank and Lines - V8 4.4L Petrol, Description and Operation).

THROTTLE BODY

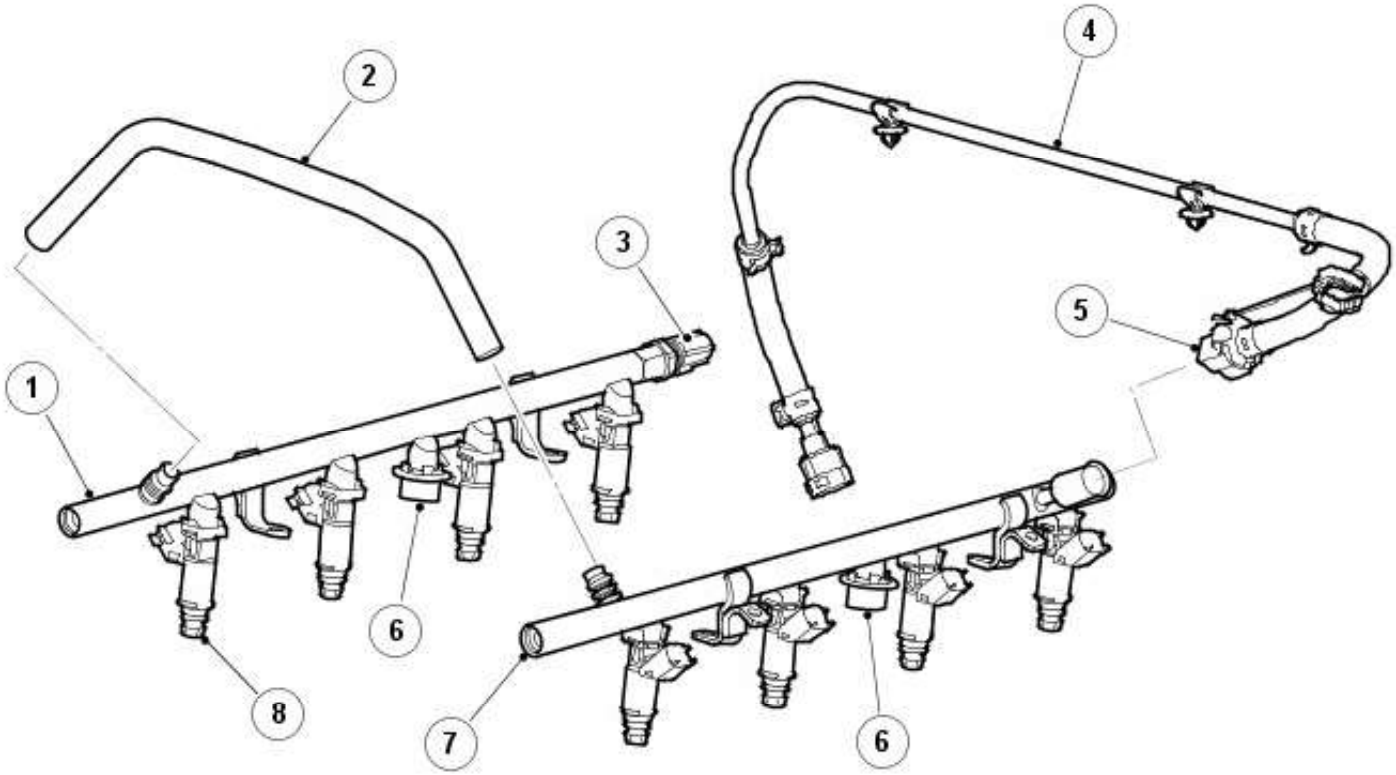
The electronic throttle body controls the engine torque and is located on the air intake manifold. It's main components are, an electronic throttle control valve, Accelerator Pedal Position (APP) sensor and the ECM.

The APP sensor determines the driver demand to control throttle opening. This value is received by the EMS and the throttle is then opened to the correct angle by means of an integral electric motor. Sensors in the throttle body are used to determine the position of the throttle plate and the rate of change in its angle.
For additional information, refer to: Electronic Engine Controls (303-14B Electronic Engine Controls - V8 4.4L Petrol, Description and Operation).

Induction Elbow

The induction elbow provides the interface between the electronic throttle body and the intake manifold. Connections on the induction elbow provide vacuum take off's for various vehicle systems. A boss on the rear of the elbow accommodates the Exhaust Gas Recirculation (EGR) valve.

FUEL RAIL



E50216

Item	Part Number	Description
1	-	RH fuel rail
2	-	Fuel supply cross over pipe
3	-	Fuel temperature sensor
4	-	Fuel jump hose
5	-	Cooper fitting
6	-	Fuel pressure accumulators
7	-	LH fuel rail
8	-	Injectors (8 of)

Each fuel rail maintains a constant fuel pressure of 4.5bar (65 psi). Four fuel injectors are installed in each injector housing and are connected to the fuel rail. 'O' ring seals are used to seal the injectors in the fuel rails and inlet manifold. A 'Cooper' style fitting is used to connect the fuel jump hose to the LH fuel rail.

A fuel pressure accumulator is attached to each of the fuel rails and a Schraeder valve is installed in the front end of the LH fuel rail to provide a pressure test connection for maintenance.

FUEL PRESSURE ACCUMULATOR

A fuel pressure accumulator is attached centrally to each of the fuel rails. The accumulators act as a damper to damp pulses from the pump and ensure that the fuel pressure in the rail and to the injectors is constant.

FUEL TEMPERATURE SENSOR

The fuel temperature sensor is located in the rear of the RH fuel rail. The sensor is an NTC sensor, which is connected to the ECM by two wires.
For additional information, refer to: Electronic Engine Controls (303-14B Electronic Engine Controls - V8 4.4L Petrol, Description and Operation).

INJECTORS

Eight, top fed, 12-jet, fuel injectors are installed in the fuel rails. Two 'O' rings seal each injector to the manifold interface and should be renewed whenever an injector is refitted to an engine. A small amount of engine oil can be applied to the 'O' rings to aid installation. No other form of lubrication should be used. The fuel jets from the injectors are directed onto the back of the intake valves.

The injectors are electromagnetic solenoid valves controlled by the ECM. Each injector contains a solenoid-operated needle valve, which is closed while the solenoid winding is de-energised. The solenoid winding is connected to a power feed from the main relay and to an earth through the ECM. The ECM switches the earth to control the opening and closing of the needle valve. While the needle valve is open, fuel is sprayed into the cylinder intake tract onto the back of the intake valves. The ECM meters the amount of fuel injected by adjusting the time that the needle valve is open.

For additional information, refer to: Electronic Engine Controls (303-14B Electronic Engine Controls - V8 4.4L Petrol, Description and Operation).

Published: 11-May-2011

Fuel Charging and Controls - V8 4.4L Petrol - Fuel Charging and Controls

Diagnosis and Testing

Overview

For information on the operation of the system, refer to the workshop manual section 303-04 - Fuel Charging and Controls.

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious mechanical or electrical faults.

Visual inspection

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

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the symptom chart or DTC index.
    - Make sure that all DTCs are cleared following rectification.

Symptom Chart

Symptom	Possible causes	Action
Engine cranks, but does not fire	• Low/Contaminated fuel • Ignition system • Fuel system • Crankshaft position (CKP) sensor • Harness • ECM fault	Check the fuel level and condition. For ignition system tests, refer to the relevant section of the workshop manual. Check for injector DTCs. For CKP and harness tests. Refer to the relevant section of the workshop manual. Refer to the warranty policy and procedures manual if a module is suspect.
Engine cranks and fires, but will not start	• Evaporative emissions purge valve • Fuel system • Spark plugs • Ignition coil failure(s)	For purge valve tests, refer to the relevant section of the workshop manual. Check for injector DTCs. For ignition system tests, refer to the relevant section of the workshop manual.
Difficult to start cold	• Check coolant anti-freeze content • Battery • Crankshaft position (CKP) sensor • Exhaust gas recirculation (EGR) valve stuck open • Fuel system • Evaporative emissions purge valve	For battery information, refer to the relevant section of the workshop manual. For CKP sensor tests, refer to the relevant section of the workshop manual. Check for injector DTCs. For purge valve tests, refer to the relevant section of the workshop manual.
Difficult to start hot	• Injector leak • Fuel system • Fuel temperature sensor • Intake air temperature (IAT) sensor	Check for injector DTCs. For fuel temperature sensor, IAT sensor and MAF sensor tests, refer to the relevant section of the workshop manual. For purge valve and ignition system tests, refer to the relevant section of the workshop manual.

	• Mass air flow (MAF) sensor • Evaporative emissions purge valve • Ignition system	
Difficult to start after hot soak (vehicle standing after engine has reached operating temperature)	• Injector leak • Fuel system • Fuel temperature sensor • IAT sensor • MAF sensor • Evaporative emissions purge valve • Ignition system	Check for injector DTCs. For fuel temperature sensor, IAT sensor and MAF sensor tests, refer to the relevant section of the workshop manual. For purge valve and ignition system tests, refer to the relevant section of the workshop manual.
Engine stalls soon after start	• Breather system disconnected/restricted • ECM relay • MAF sensor • Ignition system • Air filter restricted • Air leakage • Fuel lines	Check the engine breather system. Check the ECM relay operation. For MAF sensor and FRP sensor and ignition system tests, refer to the relevant section of the workshop manual. For air intake and fuel line information, refer to the relevant section of the workshop manual.
Engine hesitates/poor acceleration	• Fuel pump • Fuel lines • Injector leak • Fuel pressure • Air leakage • Throttle position (TP) sensors • Accelerator pedal position (APP) sensor • Throttle motor • Ignition system • EGR valve stuck • HO2 sensors • Transmission malfunction • Restricted pedal travel (carpet, etc)	For fuel pump and fuel line information, refer to the relevant section of the workshop manual. Check for injector DTCs. For intake system checks, TP sensor and APP sensor tests, refer to the relevant section of the workshop manual. For throttle motor tests refer to the guided diagnostic routine on the approved diagnostic system. For ignition system tests, refer to the relevant section of the workshop manual. Check for DTCs relating to HO2 sensors, refer to the DTC index. For transmission information, refer to the relevant section of the workshop manual. Check the accelerator pedal travel.
Engine backfires	• Fuel pump • Fuel lines • Air leakage • MAF sensor • APP sensor • HO2 sensors • Ignition system	For fuel pump and fuel line and intake system information, refer to the relevant section of the workshop manual. For MAF sensor and APP sensor tests, refer to the relevant section of the workshop manual. Check for DTCs relating to HO2 sensors, refer to the DTC index. For ignition system tests, refer to the relevant section of the workshop manual.
Engine surges	• Fuel pump • Fuel lines • MAF sensor • Harness • TP sensors • Throttle motor • Ignition system	For fuel pump and fuel line information, refer to the relevant section of the workshop manual. For MAF sensor and TP sensor tests, refer to the relevant section of the workshop manual. For throttle motor tests refer to the guided diagnostic routine on the approved diagnostic system. For ignition system tests, refer to the relevant section of the workshop manual.
Engine detonates/knocks	• Fuel pump • Fuel lines • Fuel quality • Knock sensor (KS)/circuit malfunction • MAF sensor • HO2 sensors • Air leakage • BARO sensor malfunction (internal ECM fault)	For fuel pump and fuel line information, refer to the relevant section of the workshop manual. For FRP sensor, MAF sensor and knock sensor tests, refer to the relevant section of the workshop manual. Check for DTCs relating to HO2 sensors, refer to the DTC index. For intake system, refer to the relevant section of the workshop manual. Refer to the warranty policy and procedures manual if a module is suspect.

No throttle response	• APP sensor malfunction • TP sensors • Throttle motor	For APP sensor and TP sensor tests, refer to the relevant section of the workshop manual. For throttle motor tests refer to the guided diagnostic routine on the approved diagnostic system.
Poor throttle response	• APP sensor malfunction • TP sensors • ECT sensor • MAF sensor • Transmission malfunction • Traction control event • Air leakage • Breather system disconnected/restricted	For APP sensor, TP sensor, ECT sensor and MAF sensor tests, refer to the relevant section of the workshop manual. For transmission information, refer to the relevant section of the workshop manual. For intake system checks, refer to the relevant section of the workshop manual. For breather system checks, refer to the relevant section of the workshop manual.

DTC index

• NOTE: Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).

• NOTE: For a full list of ECM DTCs, refer to workshop manual section 303-14 - Electronic Engine Controls.

DTC	Description	Possible Causes	Action
P008700	Fuel rail/system pressure too low	• Fuel rail pressure (FRP) sensor disconnected • FRP sensor to ECM sensing circuit short circuit to ground • FRP sensor supply circuit high resistance • FRP sensor failure • Fuel line leak • Restricted fuel line • Fuel pump module circuit high resistance • Fuel pump module circuit short circuit to ground • Fuel pump module failure	For FRP sensor tests, refer to the relevant workshop manual section. Check the fuel lines, check the fuel pressure and the fuel pump module circuits.
P008800	Fuel rail/system pressure too high	• Fuel rail pressure (FRP) sensor to ECM wiring (supply/sense): short circuit to each other • FRP sensor to ECM sense circuit short circuit to power • FRP sensor failure • Fuel pressure control valve (FPCV) fault • Fuel pump module circuit short circuit to power • Fuel pump module failure	For FRP sensor tests, refer to the relevant workshop manual section. Check the fuel lines, check the fuel pressure and the fuel pump module circuits.
P017100	System Too Lean (Bank 1)	• Air intake leak between MAF	Check the intake air system for leaks, etc. Check the fuel system for restrictions, DTCs, etc. Check the exhaust system

		sensor and cylinder head • MAF sensor fault (low intake air flow) • Fuel filter/system restriction • Low fuel pressure • Fuel injector restriction • Exhaust leak (before catalyst) • Evaporative emission system fault	for leaks, etc. Check for evaporative emission DTCs.
P017200	System Too Rich (Bank 1)	• Restricted air filter • High fuel pressure • Leaking fuel injector(s) • Oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) • MAF sensor fault • Evaporative emission system fault	Check the intake air system for restrictions, etc. Check the fuel system for leaks, DTCs, etc. Check the oil condition. Check for MAF sensor and evaporative emission DTCs.
P017400	System Too Lean (Bank 2)	• Air intake leak between MAF sensor and cylinder head • MAF sensor fault (low intake air flow) • Fuel filter/system restriction • Low fuel pressure • Fuel injector restriction • Exhaust leak (before catalyst) • Evaporative emission system fault	Check the intake air system for leaks, etc. Check the fuel system for restrictions, DTCs, etc. Check the exhaust system for leaks, etc. Check for evaporative emission DTCS.
P017500	System too Rich (Bank 2)	• Restricted air filter • High fuel pressure • Leaking fuel injector(s) • Oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) • MAF sensor fault • Evaporative emission system fault	Check the intake air system for restrictions, etc. Check the fuel system for leaks, DTCs, etc. Check the oil condition. Check for MAF sensor and evaporative emission DTCs.
P020100	Cylinder 1 Injector Circuit / Open	• Injector disconnected • Injector harness wiring high	For fuel system tests, refer to the relevant workshop manual section. Refer to the guided diagnostic routine for this code on the approved diagnostic system.

		resistance, short circuit to ground • Injector failure	
P020200	Cylinder 2 Injector Circuit / Open	• Injector disconnected • Injector harness wiring high resistance, short circuit to ground • Injector failure	For fuel system tests, refer to the relevant workshop manual section. Refer to the guided diagnostic routine for this code on the approved diagnostic system.
P020300	Cylinder 3 Injector Circuit / Open	• Injector disconnected • Injector harness wiring high resistance, short circuit to ground • Injector failure	For fuel system tests, refer to the relevant workshop manual section. Refer to the guided diagnostic routine for this code on the approved diagnostic system.
P020400	Cylinder 4 Injector Circuit / Open	• Injector disconnected • Injector harness wiring high resistance, short circuit to ground • Injector failure	For fuel system tests, refer to the relevant workshop manual section. Refer to the guided diagnostic routine for this code on the approved diagnostic system.
P020500	Cylinder 5 Injector Circuit / Open	• Injector disconnected • Injector harness wiring high resistance, short circuit to ground • Injector failure	For fuel system tests, refer to the relevant workshop manual section. Refer to the guided diagnostic routine for this code on the approved diagnostic system.
P020600	Cylinder 6 Injector Circuit / Open	• Injector disconnected • Injector harness wiring high resistance, short circuit to ground • Injector failure	For fuel system tests, refer to the relevant workshop manual section. Refer to the guided diagnostic routine for this code on the approved diagnostic system.
P020700	Cylinder 7 Injector Circuit/Open	• Injector disconnected • Injector harness wiring high resistance, short circuit to ground • Injector failure	For fuel system tests, refer to the relevant workshop manual section. Refer to the guided diagnostic routine for this code on the approved diagnostic system.
P020800	Cylinder 8 Injector Circuit/Open	• Injector disconnected • Injector harness wiring high resistance, short circuit to ground • Injector failure	For fuel system tests, refer to the relevant workshop manual section. Refer to the guided diagnostic routine for this code on the approved diagnostic system.
P210129	Throttle Actuator A Control Motor Circuit Range/Performance	• Jammed throttle blade, gearing or motor	Check for fuel charging DTCs and a message in the instrument cluster. Rectify as necessary. If the problem persists, renew the throttle body. Refer to the relevant workshop manual section.
P210164	Throttle Actuator A Control Motor Circuit Range/Performance	• Jammed throttle blade, gearing or motor	Check for fuel charging DTCs and a message in the instrument cluster. Rectify as necessary. If the problem persists, renew the throttle body. Refer to the relevant workshop manual section.
P210329	Throttle Actuator A Control Motor Circuit High	• Throttle Actuator control circuit short circuit to power	Check the electric throttle unit and circuits. Refer to the electrical guides. Clear the DTCs and test for normal operation. Refer to the guided diagnostic routine for this code

		• ECM fault	on the approved diagnostic system. Refer to the warranty policy and procedure manual if an ECM is suspect.
P210364	Throttle Actuator A Control Motor Circuit High	• Control circuit short circuit to power • ECM fault	Check the electric throttle unit and circuits. Refer to the electrical guides. Clear the DTCs and test for normal operation. Refer to the guided diagnostic routine for this code on the approved diagnostic system. Refer to the warranty policy and procedure manual if an ECM is suspect.
P210500	Throttle Motor Control System - Forced Engine Shutdown	• Throttle MIL request due to fuel cut	Check for DTCs indicating the reason for the fuel cut. Follow the action indicated for those DTCs.
P210629	Throttle Actuator Control System - Forced Limited Power	• Intended reduced availability fault (limp home)	Check for fuel charging DTCs and a message in the instrument cluster. Rectify as necessary. If the problem persists, renew the throttle body. Refer to the relevant workshop manual section.
P210664	Throttle Actuator Control System - Forced Limited Power	• Intended reduced availability fault (limp home)	Check for fuel charging DTCs and a message in the instrument cluster. Rectify as necessary. If the problem persists, renew the throttle body. Refer to the relevant workshop manual section.
P211800	Throttle Actuator Control Motor Current Range/Performance	• Throttle motor over current condition detected • ECM fault	Refer to the electrical guides and check the wiring between the ECM and throttle actuator. Refer to the guided diagnostic routine for this code on the approved diagnostic system. Refer to the warranty policy and procedures manual if an ECM is suspect.
P211900	Throttle Actuator Control Throttle Body Range/Performance	• Throttle spring faulty	Check the throttle return spring on the throttle body. Repair/renew as necessary. Check for fuel charging DTCs and a message in the instrument cluster. Rectify as necessary. If the problem persists, renew the throttle body. Refer to the relevant workshop manual section.

Published: 11-May-2011

Fuel Charging and Controls - V8 4.4L Petrol - Fuel Rail

Removal and Installation

Special Tool(s)	
	Fuel spring lock decoupling tool 310-D005

Removal

• 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.

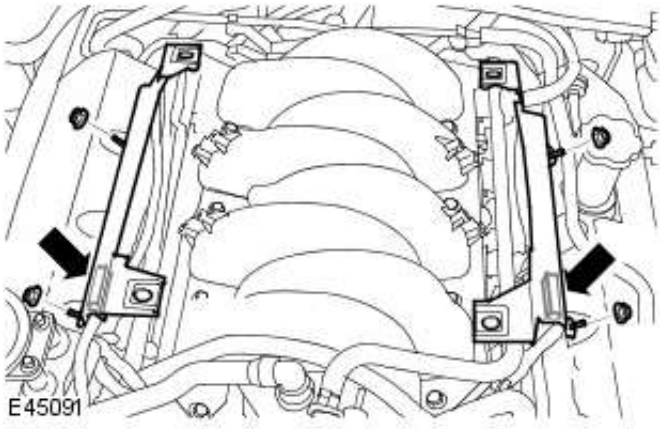
Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. Remove the engine cover.
For additional information, refer to: Engine Cover - V8 4.4L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

3. Remove the engine cover studs.

- Release the electrical connectors from the engine cover brackets.
- Remove the 4 nuts.

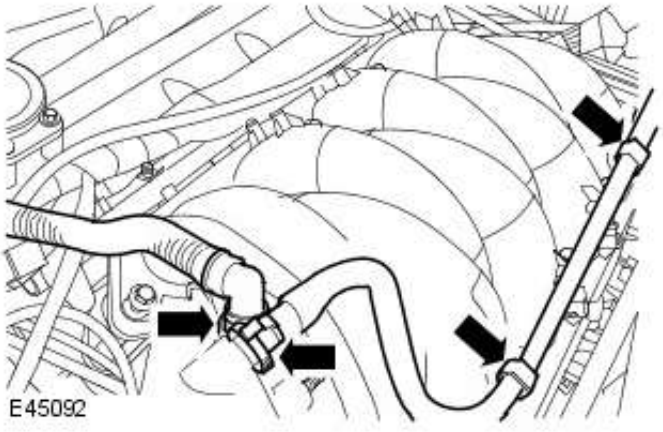


4. CAUTION: Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

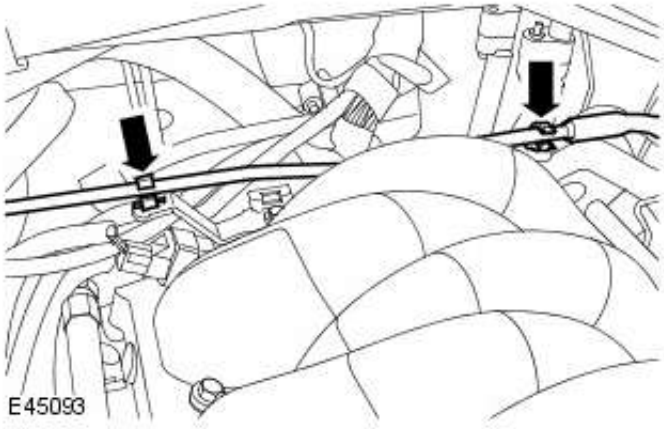
Disconnect the crankcase vent hoses.

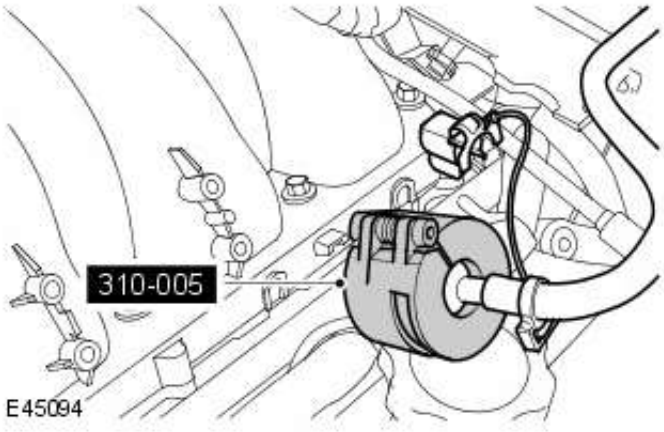
5. Disconnect the evaporative emission hose from the intake manifold assembly.

6. Release the evaporative loss control valve from the intake manifold mounting, move the hose assembly aside for access.



7. Release the fuel pipe from the clips.

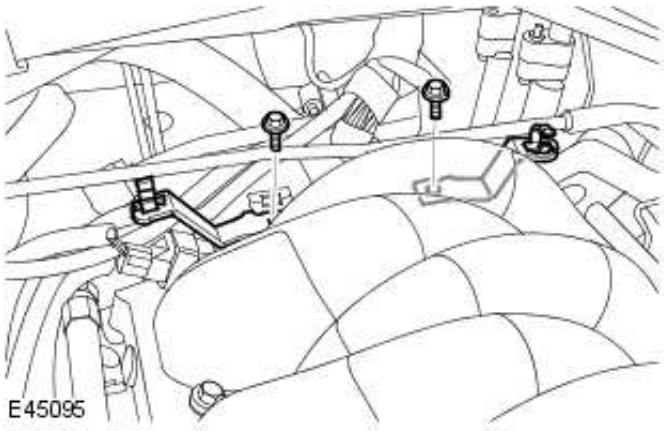




8. WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Using the special tool, disconnect the fuel line.

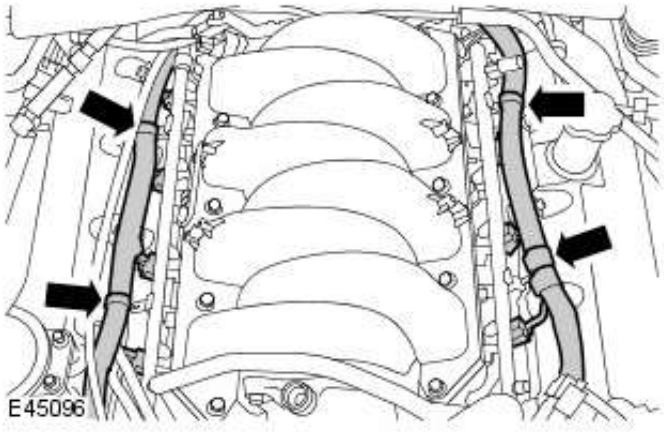
- Position an absorbent cloth to collect fluid spillage.



9. Position the wiring harness support bracket aside for access.

- Remove the 2 bolts.

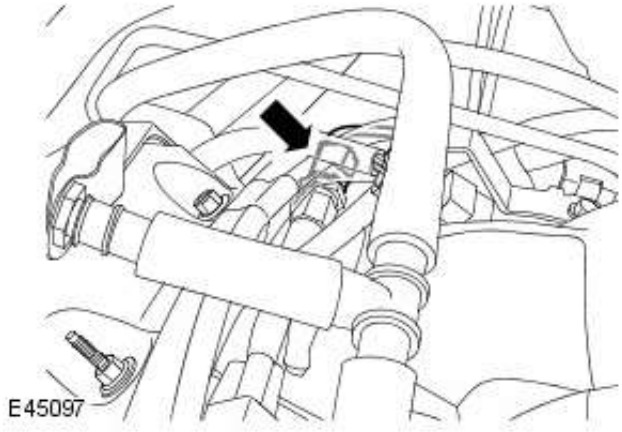
10. Release the engine wiring harness clips from the fuel rail.



11. Disconnect the fuel injector electrical connectors.

12. Disconnect the engine gas recirculation modulator electrical connection.

13. Disconnect the fuel temperature sensor electrical connector.

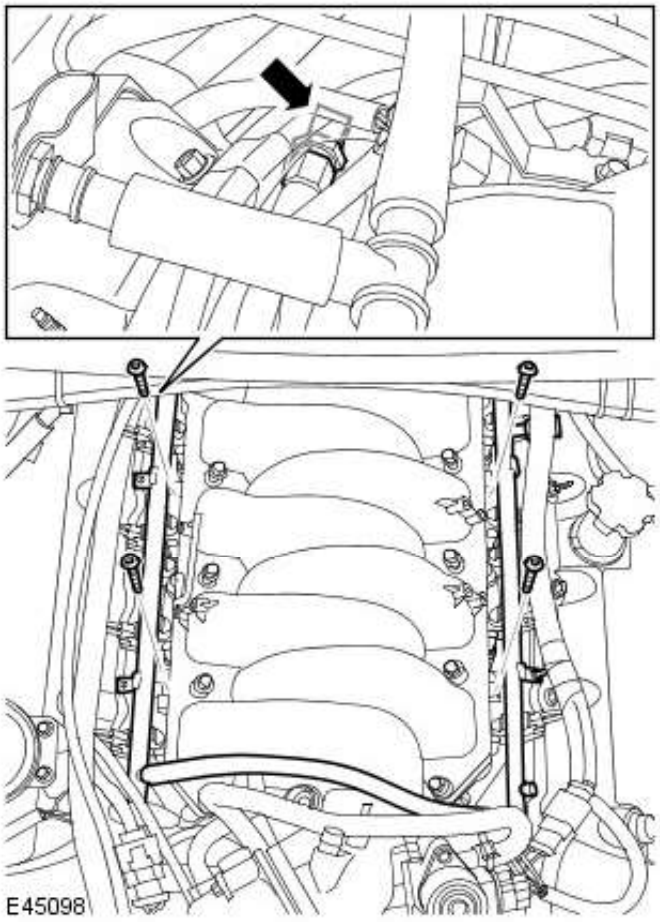


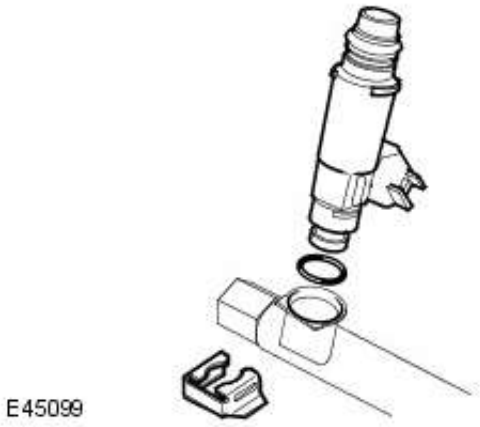
14. NOTE: Do not disassemble further if the component is removed for access only.

Remove the fuel rail.

- Remove the 4 Torx bolts.
- Remove and discard the fuel injector O-ring seals.

15. Remove the fuel temperature sensor.





16. Remove the fuel injectors.

- Remove the retaining clips.
- Release the fuel injectors.
- Remove and discard the fuel injector O-ring seals.

Installation

1. Clean the components.

2. Install the fuel injectors to the fuel rail.

- Install fuel injector O-ring seals.
- Lubricate the O-ring seals with clean engine oil.
- Install the fuel injectors.
- Secure the fuel injector retaining clips.

3. Clean the components.

4. Install the fuel temperature sensor.

- Apply sealant to the sensor thread.

5. Install the fuel rail.
   - Install fuel injector O-ring seals.
   - Lubricate the O-ring seals with clean engine oil.
   - Tighten the Torx bolts to 10 Nm (7 lb.ft).
6. Connect the fuel temperature sensor electrical connector.
7. Connect the fuel injector electrical connectors.
8. Connect the engine wiring harness to the intake manifold.
9. Install the engine wiring harness support bracket.
   - Tighten the bolts to 10 Nm (7 lb.ft).
10. Connect the fuel line to the fuel rail.
    - Clean the component mating faces.
    - Position the fuel pipe into clips.
11. Install the evaporative loss valve assembly to the intake manifold bracket and connect the hose.
    - Clean the component mating faces.
12. Connect the crankcase vent hoses.
    - Clean the component mating faces.
13. Install the engine cover mounting brackets.
    - Tighten the nuts to 6 Nm (4 lb.ft).
    - Attach the wiring harness connector blocks to the brackets.
14. Install the engine cover.
    For additional information, refer to: Engine Cover - V8 4.4L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).
15. Connect the battery ground cable.

Published: 11-May-2011

Fuel Charging and Controls - V8 4.4L Petrol - Fuel Injectors

Removal and Installation

Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2. WARNINGS:

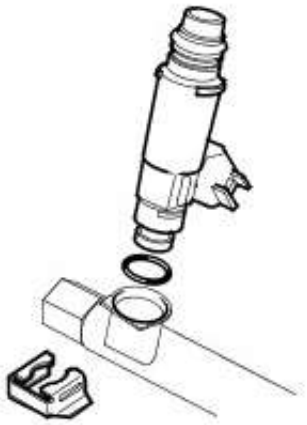
Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

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.

CAUTION: Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Remove the fuel rail.
For additional information, refer to: Intake Manifold Assembly (303-04B Fuel Charging and Controls - V8 4.4L Petrol, Removal and Installation).

3. Remove the fuel injectors.
   - Release the 8 clips.
   - Discard the fuel injector O-ring seals.



Installation

1. Clean the component mating faces.
2. To install, reverse the removal procedure.
   - Install fuel injector O-ring seals.
   - Lubricate the O-ring seals with clean engine oil.

Published: 11-May-2011

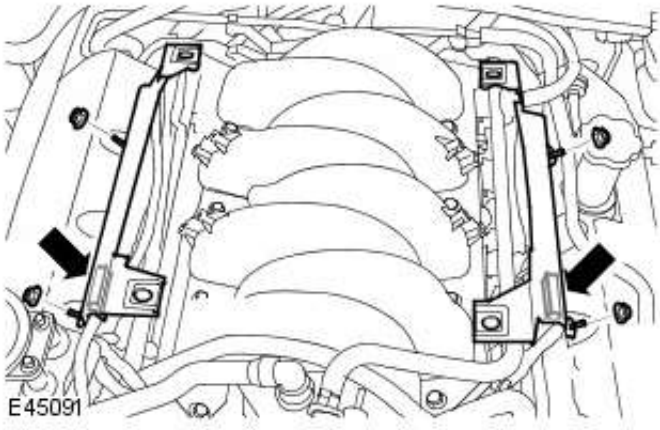
Fuel Charging and Controls - V8 4.4L Petrol - Intake Manifold Assembly

Removal and Installation

Special Tool(s)	
 E45289	Fuel spring lock decoupling tool 310-005

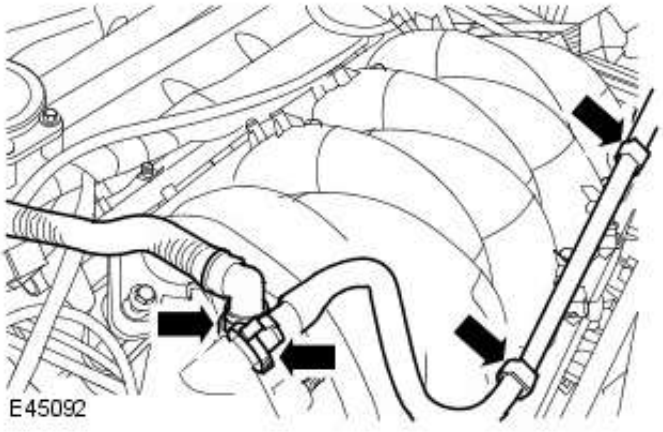
Removal

1. Secure the hood in the service position.
   - Release the support struts.
2. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
3. Remove the throttle body gasket.
   For additional information, refer to: Throttle Body Gasket (303-04B Fuel Charging and Controls - V8 4.4L Petrol, Removal and Installation).
4. Remove the engine cover brackets.
   - Release the electrical connectors from the engine cover brackets.
   - Remove the 4 nuts.

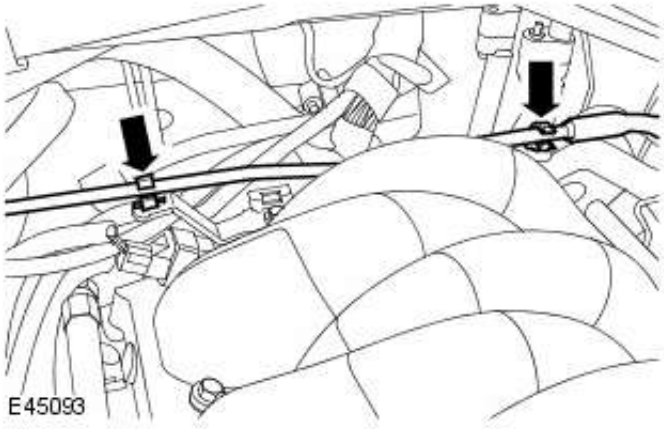


5. CAUTION: Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

   Disconnect the crankcase vent hoses.
6. Disconnect the evaporative emission hose from the intake manifold assembly.
7. Release the evaporative loss control valve from the intake manifold mounting, move the hose assembly aside for access.

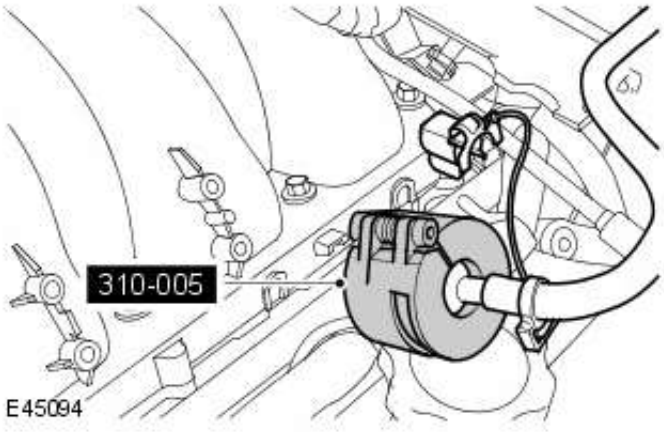


8. Release the fuel pipe from the clips.



9. Using the special tool, disconnect the fuel line.

- Position an absorbent cloth to collect fluid spillage.

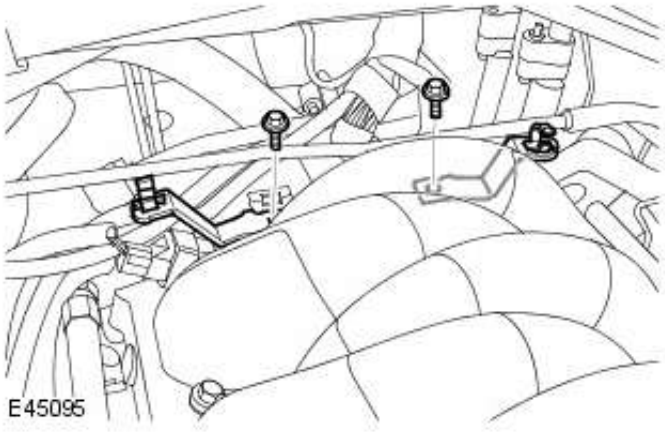


10. Release the camshaft position (CMP) sensor connector block from the intake manifold assembly.

11. Position the wiring harness support bracket aside for

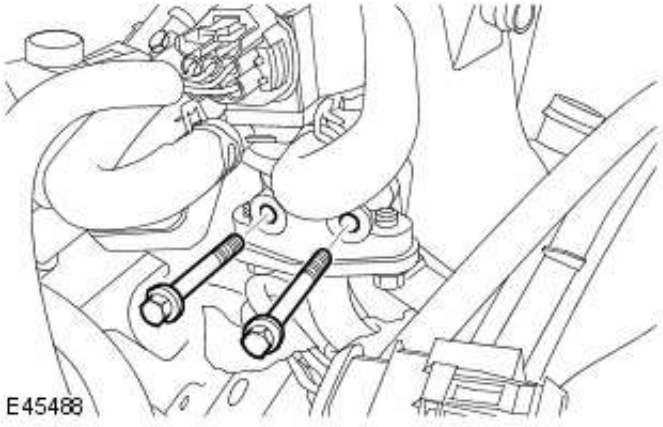
access.

- Remove the 2 bolts.



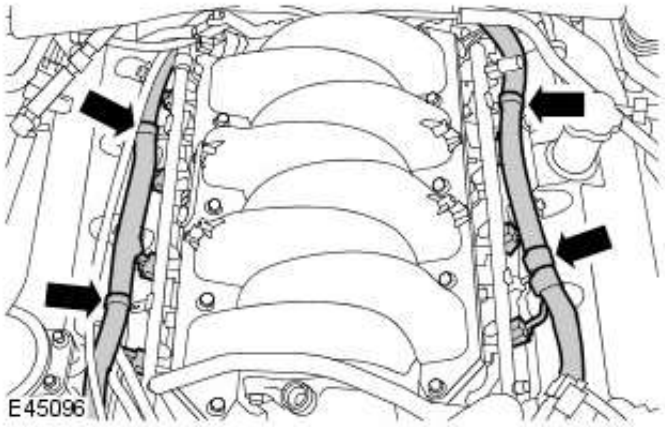
12. Release the EGR valve.

- Remove the 2 bolts.
- Discard the gasket.

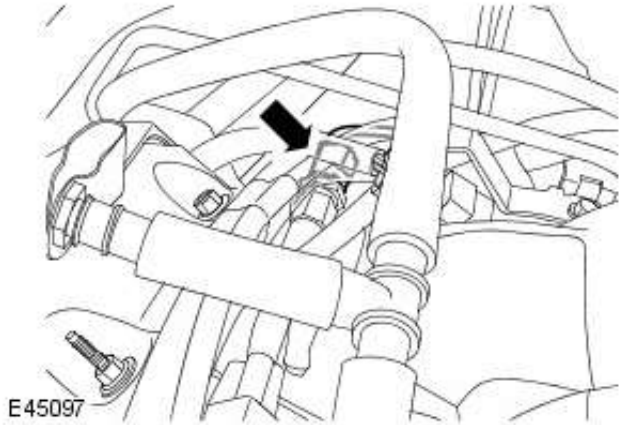


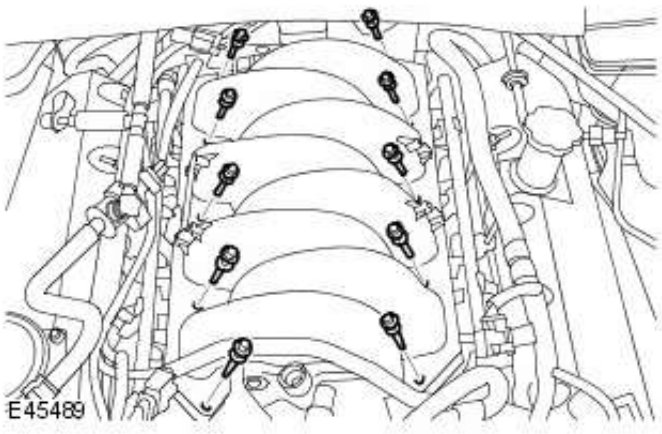
13. Release the engine wiring harness clips from the fuel rail.

14. Disconnect the fuel injector electrical connectors.

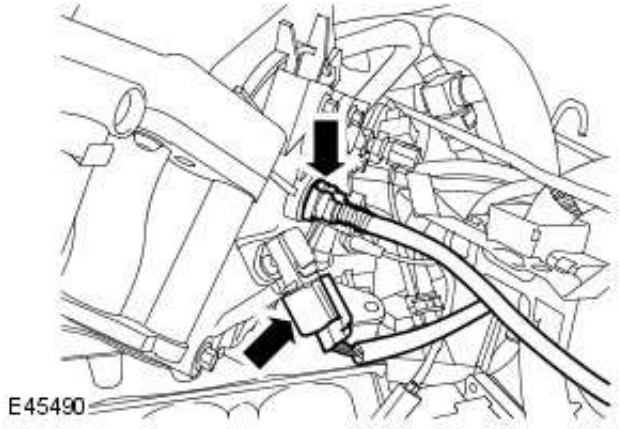


15. Disconnect the fuel temperature sensor electrical connector.





16. Remove the 10 intake manifold bolts.



17. Remove the intake manifold.

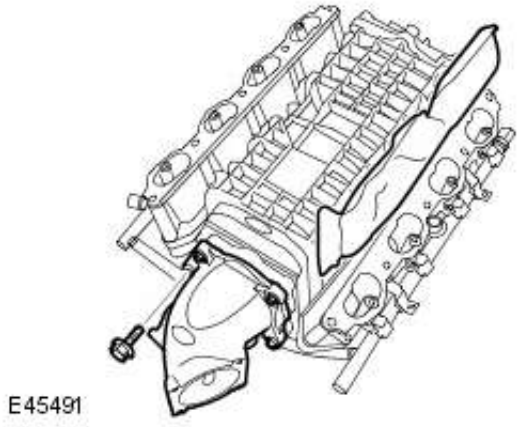
- Disconnect the mass air flow (MAF) sensor electrical connector.
- Disconnect the brake booster vacuum hose from the intake manifold.
- Discard the gaskets.

18. NOTE: Do not disassemble further if the component is removed for access only.

Remove the NVH pad from the RH side of the intake manifold.

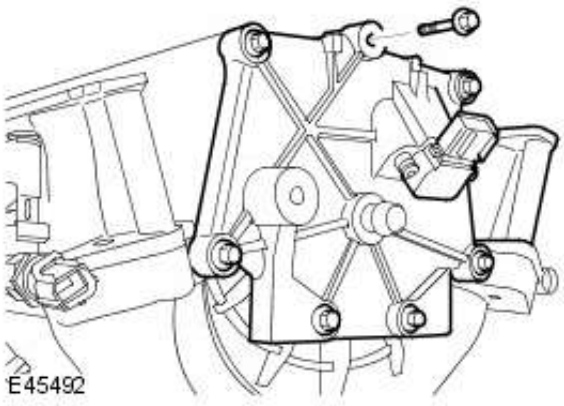
19. Remove the intake manifold casting.

- Disconnect the vacuum hose from the intake manifold.
- Remove the 4 bolts.



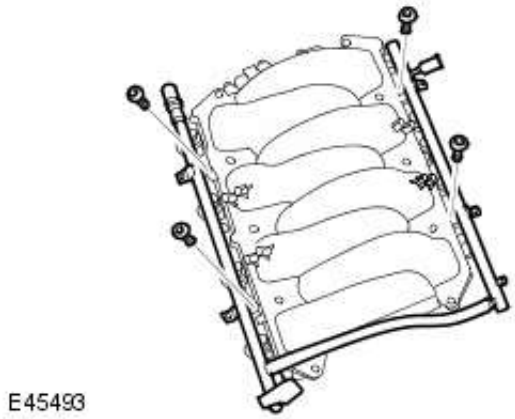
20. Remove the intake manifold MAP sensor housing.

- Remove the 7 bolts.


E45492

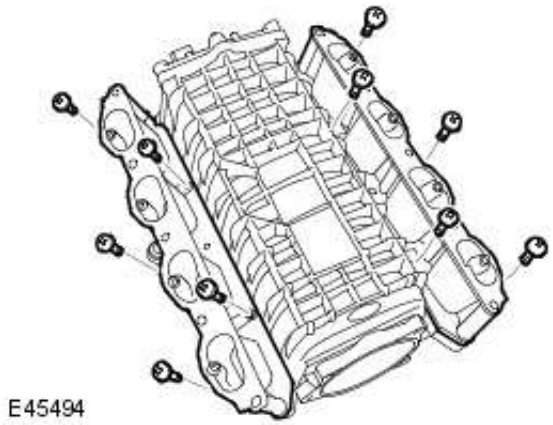
21. Remove the fuel rail.

- Remove the 4 Torx bolts.
- Release the fuel injectors.
- Discard the fuel injector O-ring seals.


E45493

22. Remove the fuel injector housings.

- Remove the 10 Torx screws.
- Release the fuel injector housings and discard the gaskets.


E45494

Installation

1. Install the fuel injector housings.

- Clean the component mating faces.
- Install the gaskets.
- Install the Torx screws.

2. Install the fuel rail.

- Clean the component mating faces.
- Install fuel injector O-ring seals.
- Lubricate the O-ring seals with clean engine oil.
- Tighten the 4 Torx bolts to 10 Nm (7 lb.ft).

3. Install the intake manifold MAP sensor housing.
   - Clean the component mating faces.
   - Tighten the 7 bolts to 10 Nm (7 lb.ft).
4. Install the intake manifold casting.
   - Clean the component mating faces.
   - Install the 4 bolts and tighten to 10 Nm (7 lb.ft).
5. Install the NVH pad to the RH side of the intake manifold.
6. Clean the components.
7. With assistance, install the intake manifold.
   - Install the gaskets.
   - Connect the mass air flow (MAF) sensor electrical connector.
   - Connect the brake booster vacuum hose to the intake manifold.
8. Install the bolts.
   - Evenly and progressively tighten the bolts to 20 Nm (15 lb.ft).
9. Connect the fuel temperature sensor electrical connector.
10. Connect the fuel injector electrical connectors.
11. Connect the engine wiring harness to the intake manifold.
12. Install the EGR valve.
   - Install a new gasket.
   - Tighten the bolts to 10 Nm (7 lb.ft).
13. Install the engine wiring harness support bracket.
   - Tighten the bolts to 10 Nm (7 lb.ft).
14. Position the CMP sensor electrical connector block, to the intake manifold.
15. Connect the fuel line to the fuel rail.
   - Clean the component mating faces.
   - Position the fuel pipe into clips.
16. Install the evaporative loss valve assembly to the intake manifold bracket and connect the hose.
   - Clean the component mating faces.
17. Connect the crankcase vent hoses.
   - Clean the component mating faces.
18. Install the engine cover mounting brackets.
   - Tighten the nuts to 6 Nm (4 lb.ft).
   - Attach the wiring harness connector blocks to the brackets.
19. Install the throttle body gasket.
    For additional information, refer to: Throttle Body Gasket (303-04B Fuel Charging and Controls - V8 4.4L Petrol,

Removal and Installation).

20. Connect the battery ground cable.
21. Connect the hood support struts.

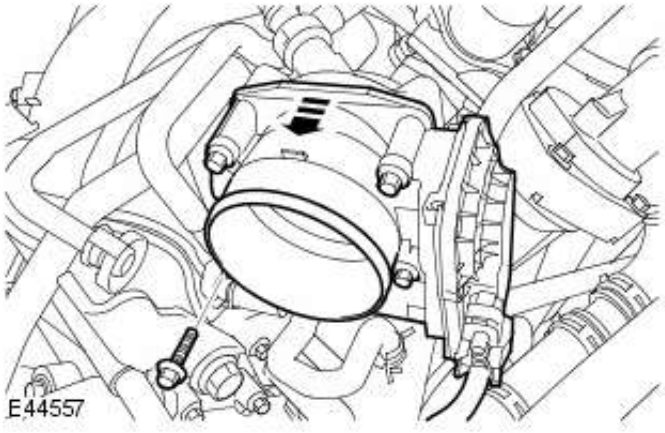
Published: 11-May-2011

Fuel Charging and Controls - V8 4.4L Petrol - Throttle Body Gasket

Removal and Installation

Removal

1. Disconnect the battery ground cable.
   For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the engine cover.
   For additional information, refer to: Engine Cover - V8 4.4L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the air intake resonator. For additional information, refer to: Intake Air Resonator (303-12B Intake Air Distribution and Filtering - V8 4.4L Petrol, Removal and Installation).
4. Release the throttle body.
   - Remove the 4 bolts.
   - Remove and discard the throttle body gasket.



Installation

1. Install the throttle body.
   - Clean the components.
   - Install a new gasket.
   - Tighten the 4 bolts to 10 Nm (7 lb.ft).
2. Install the air intake resonator. For additional information, refer to: Intake Air Resonator (303-12B Intake Air Distribution and Filtering - V8 4.4L Petrol, Removal and Installation).
3. Install the engine cover.
   For additional information, refer to: Engine Cover - V8 4.4L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Connect the battery ground cable.
5. Using the approved diagnostic equipment, clear the powertrain control module (PCM) adaptions.