






Chapter 4 Part D: Electronic Fuel Injection (EFI) system

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Degrees of difficulty

Easy , suitable for novice with little experience		Fairly easy , suitable for beginner with some experience		Fairly difficult , suitable for competent DIY mechanic		Difficult , suitable for experienced DIY mechanic		Very difficult , suitable for expert DIY or professional	
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Specifications

General

System type	Multi-point electronic fuel injection
Application	1.6 litre engines from 1990
Control pressure (engine running)	2.3 to 2.5 bar (33 to 36 lbf/in ²)

Fuel requirement

Fuel octane rating	95 RON (unleaded) or 97 RON (leaded)
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Torque wrench setting

	Nm	lbf ft
Fuel filter unions	14 to 20	11 to 15

1 General information and precautions

General information

From the 1990 model year, an Electronic Fuel Injection (EFI) system controlled by the Electronic Engine Control IV (EEC IV) system, and incorporating an Electronic Distributorless Ignition system (E-DIS 4) is used on all 1.6 litre fuel injection models. The system is designed to meet the requirements of the European 15.04 exhaust emission control laws.

Those components more easily related to the ignition system are described in Chapter 5, Part B. Those relating to the fuel system are described in this Section.

The engine management and fuel systems are best described by dividing them into two separate sub-systems the air inlet system, and the fuel system.

Air inlet system

The volume of air drawn into the system depends on air pressure and density, throttle valve position, engine speed and the cleanliness of the air cleaner element.

The EEC IV module evaluates these factors through the Air Charge Temperature (ACT) sensor, Manifold Absolute Pressure (MAP) sensor and Throttle Position Sensor (TPS), and controls the engine idle speed via the Idle Speed Control Valve (ISCV).

The air cleaner is similar to that used on earlier fuel injection models. A flexible hose connected to the valve cover acts as a cylinder head and crankcase breather. A further connection leads to the idle speed control valve. The valve is controlled by the EEC IV module, and operates by varying the size and opening duration of an auxiliary air passage, which by-passes the throttle valve. A throttle housing bolted to the upper section of the inlet manifold houses the throttle valve and TPS. The TPS measures throttle opening.

The MAP sensor, mounted on the engine bulkhead and connected to the inlet manifold by a vacuum pipe and electrically to the EEC IV module, measures the vacuum in the inlet manifold. If the MAP sensor fails in service, the EEC IV module uses the TPS to provide one of three values:

- a) Idle
- b) Part load
- c) Full load

Inlet air temperature is measured by an electrically resistive element in the air charge temperature sensor (ACT) screwed into the upper half of the inlet manifold. This supplies information to the EEC IV module.

Fuel system

The fuel pump and fuel level sender unit are contained in an integral unit in the fuel tank.

The fuel pump is electric, and its electrical supply is provided via a relay controlled by the EEC IV module. When the ignition is switched on, the fuel pump is given a lead-in time of approximately one second in order to build up pressure in the system. The pump also incorporates a non-return valve which prevents system pressure dropping after the ignition is switched off, to improve the warm start characteristics.

An inertia switch (located under the spare wheel in the luggage compartment), installed between the fuel pump relay and the fuel pump will break the supply to the pump in the event of sudden impact, thus switching off the pump. If the switch has been activated, the reset button will be in the raised position.

A fuel rail is bolted to the lower section of the inlet manifold. The fuel rail acts as a fuel reservoir for the four fuel injectors, and locates the injectors in the inlet manifold.

A fuel filter is installed between the fuel pump and the fuel rail.

A fuel pressure regulator, mounted on the return end of the fuel rail and connected by a pipe to the inlet manifold to sense manifold pressure, controls fuel pressure in the fuel rail. Excess fuel is returned to the fuel tank.

The fuel injectors are electro-magnetically operated, and the volume of fuel injected is regulated by varying the electrical pulse duration which is computed by the EEC IV module.

A "limited operation strategy" (LOS) means that the vehicle is still driveable (albeit at reduced power and efficiency) in the event of a failure in the EEC IV module or its sensors.

Precautions

Note: Following disconnection of the battery, all Keep Alive Memory (KAM) values will be erased from the EEC IV system module memory, which may result in erratic idle, engine surge, hesitation and a general deterioration of driving characteristics.



Warning: Many of the procedures in this Chapter entail the removal of fuel pipes and connections which may result in some fuel spillage. Before carrying out any operation on the fuel system refer to the precautions given in Safety First! at the beginning of this manual and follow them implicitly. Petrol is a highly dangerous and volatile liquid and the precautions necessary when handling it cannot be overstressed

Refer to the precautions given in Part B of this Chapter for models with mechanical fuel injection.

2 Air cleaner - removal and refitting

The procedure is similar to that described in Part B of this Chapter for models with mechanical fuel injection.

3 Fuel tank - removal and refitting

The procedure is as described in Part A of this Chapter for carburettor engines.

4 Throttle cable - adjustment, removal and refitting

The procedure is similar to that described in Part A of this Chapter for carburettor engines.

5 Accelerator pedal - removal and refitting

The procedure is the same as described in Part A of this Chapter for carburettor models.

6 Fuel system - depressurising



Warning: The fuel system will remain pressurised after the engine is switched off. Comply with relevant safety precautions

during this operation and refer to the "Safety First" Section at the beginning of this manual before proceeding

- 1 Disconnect the battery negative lead.
- 2 Position a suitable container beneath the fuel filter.
- 3 Cover the outlet union on the filter with a wad of absorbent cloth to minimise the risk of fuel spray, then slowly loosen the outlet union and allow the pressure to dissipate.
- 4 Tighten the union on completion unless the filter is to be renewed.
- 5 The system will remain depressurised until the fuel pump is primed prior to starting the engine. Remove the container and cloth on completion.

7 Fuel pump - removal and refitting

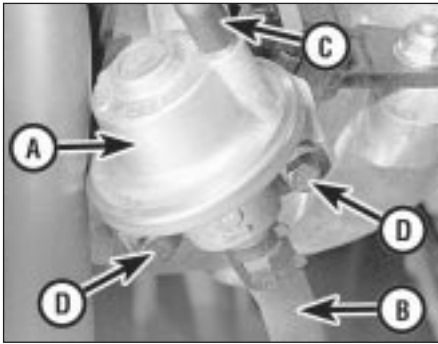
The fuel pump is integral with the fuel level sender unit in the fuel tank. Removal and refitting are as described in Part C of this Chapter for models with the CFI system.

8 Fuel pressure regulator - removal and refitting

Note: Refer to the precautions at the end of Section 1 before proceeding. A new sealing ring will be required on refitting.

Removal

- 1 Disconnect the battery negative lead.
- 2 Depressurise the fuel system as described in Section 6.
- 3 Disconnect the fuel return hose from the regulator. Be prepared for fuel spillage and



8.3 Fuel pressure regulator assembly - 1.6 EFI engine

A Regulator
B Fuel return hose (to tank)
C Vacuum hose
D Securing bolts

take adequate fire precautions (see illustration).

4 Disconnect the vacuum hose from the regulator.

5 Unscrew the two securing bolts and withdraw the regulator from the fuel rail.

6 Recover the sealing ring.

Refitting

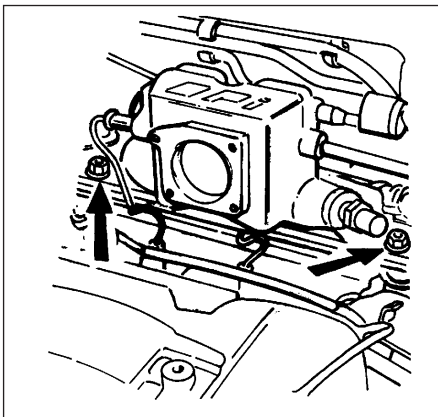
7 Refitting is a reversal of removal, but use a new sealing ring, and on completion, switch the ignition on and off five times without cranking the engine and check for fuel leaks.

9 Throttle housing - removal and refitting

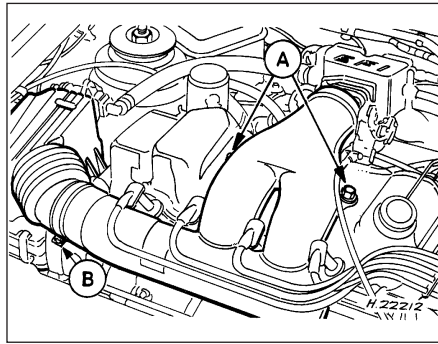
Note: A new gasket must be used on refitting.

Removal

- 1 Disconnect the battery negative lead.
- 2 Depressurise the fuel system as described in Section 6.
- 3 Remove the air inlet pipe (see illustration).
- 4 Disconnect the throttle cable from the throttle valve linkage, then unbolt the cable bracket from the housing.



10.5 Fuel injection wiring harness securing nuts (arrowed) - 1.6 EFI engine



9.3 Air inlet pipe securing screws (A) and hose securing clip (B) - 1.6 EFI engine

5 Disconnect the throttle position sensor wiring plug.

6 Unscrew the four securing nuts, and withdraw the throttle housing from the inlet manifold. Recover the gasket.

Refitting

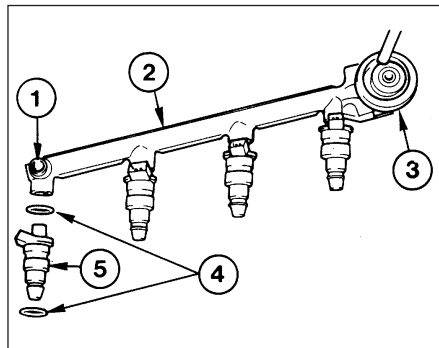
7 Refitting is a reversal of removal, but use a new gasket between the throttle housing and the inlet manifold.

10 Fuel injectors - removal and refitting

Note: Refer to the precautions at the end of Section 1 before proceeding. New injector seals will be required on refitting.

Removal

- 1 Disconnect the battery negative lead.
- 2 Depressurise the fuel system as described in Section 6.
- 3 Remove the throttle housing as described in Section 9.
- 4 Disconnect the wiring plugs from the fuel injectors, air charge temperature sensor, and engine coolant temperature sensor.
- 5 Remove the two fuel injection wiring harness securing nuts, and position the wiring harness clear of the fuel rail (see illustration).



10.8 Fuel rail and injector assembly - 1.6 EFI engine

1 Fuel inlet
2 Fuel rail
3 Pressure regulator
4 Seals
5 Injector

6 Disconnect the fuel supply hose from the fuel rail, and disconnect the fuel return hose and the vacuum hose from the pressure regulator.

7 Unscrew the two fuel rail securing bolts, and remove the fuel rail, complete with injectors.

8 To remove the injectors, simply pull them from the fuel rail. Recover the O-ring seals (see illustration).

Refitting

9 Refitting is a reversal of removal, but note that new seals must be fitted to all injectors even if only one injector has been renewed, and all the seals must be lubricated with clean engine oil before fitting to the injectors.

11 Throttle Position Sensor (TPS) - removal and refitting

Removal

Note: During this procedure, ensure that the sensor wiper is not rotated beyond its normal operating arc

- 1 Disconnect the battery negative lead.
- 2 Disconnect the wiring plug from the sensor (see illustration).
- 3 Remove the two securing screws, and withdraw the sensor from the throttle valve shaft.

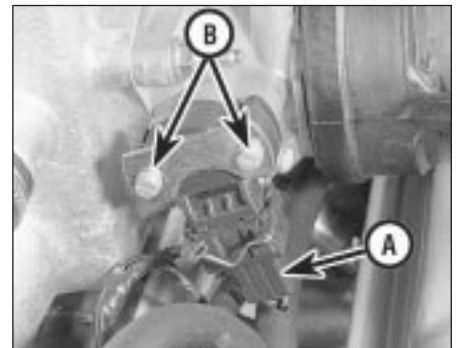
Refitting

4 Refitting is a reversal of removal, ensuring that the moulded side of the sensor faces the throttle housing, and that the flat on the sensor wiper engages with the flat on the throttle shaft.

12 Idle Speed Control Valve (ISCV) - removal, cleaning and refitting

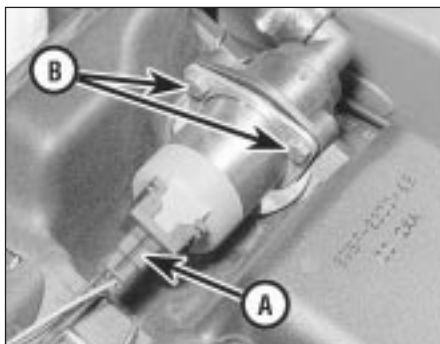
Removal

- 1 Disconnect the battery negative lead.



11.2 Throttle position sensor - 1.6 EFI engine

A Wiring plug
B Securing screws



12.2 Idle speed control valve - 1.6 EFI engine

A Wiring plug B Securing bolts

2 Disconnect the valve wiring plug (see illustration).

3 Unscrew the two securing bolts, and withdraw the valve from the air cleaner housing.

Cleaning

4 Remove the valve as described earlier in this Section.

5 Immerse the valve in a container of clean petrol and allow it to soak for approximately three minutes.

6 Use a clean paint brush to clean the bore, slots and piston of the valve.

7 Using a small screwdriver, carefully move the piston up and down in the bore (do not use the slots to do this), then rinse the valve with petrol and dry it, preferably using compressed air (see illustration).

8 Refit the valve as described in the following paragraphs.

Refitting

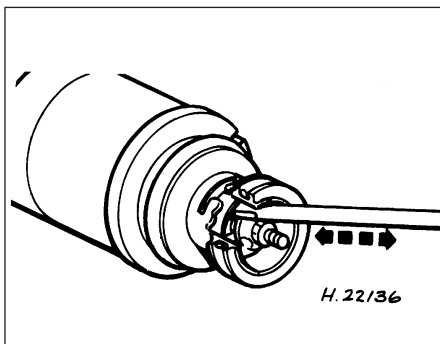
9 Refitting is a reversal of removal, ensuring that the mating faces of the valve and air cleaner are clean.

10 On completion, start the engine and check that the idle speed is stable, and that there are no air leaks. Warm the engine up to normal operating temperature, then switch on all available electrical loads and check that the idle speed is maintained.

13 Manifold Absolute Pressure (MAP) sensor - removal and refitting

Removal

- 1 Disconnect the battery negative lead.
- 2 Disconnect the sensor wiring plug. Do not pull on the wiring.
- 3 Disconnect the vacuum hose from the sensor.
- 4 Remove the two securing screws and withdraw the sensor from the engine compartment bulkhead.



12.7 Using a screwdriver to move the idle speed control valve piston - 1.6 EFI engine

Refitting

5 Refitting is a reversal of removal, but note that the fuel trap in the vacuum line between the inlet manifold and the sensor should be fitted with the white end towards the sensor.

14 Air Charge Temperature (ACT) sensor - removal and refitting

Removal

- 1 The air charge temperature sensor is screwed into the inlet manifold (see illustration).
- 2 Disconnect the battery negative lead.
- 3 Disconnect the sensor wiring plug. Do not pull on the wiring.
- 4 Unscrew the sensor from the inlet manifold.

Refitting

5 Refitting is a reversal of removal, but apply suitable sealer to the sensor threads.

15 Engine Coolant Temperature (ECT) sensor - removal and refitting

Removal

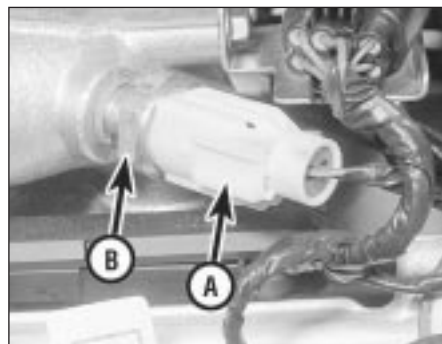
- 1 The sensor is screwed into the cylinder block below the inlet manifold.
- 2 Disconnect the battery negative lead.
- 3 Drain the cooling system as described in Chapter 1.
- 4 Disconnect the sensor wiring plug.
- 5 Unscrew the sensor from the cylinder block.

Refitting

6 Refitting is a reversal of removal, but on completion refill the cooling system as described in Chapter 1.

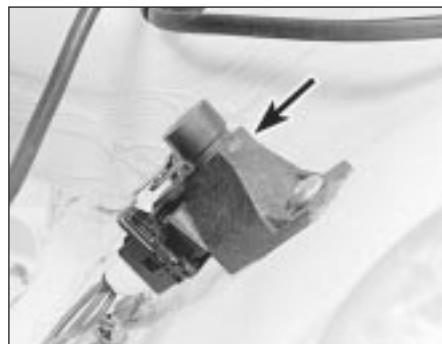
16 Speed sender unit - removal and refitting

The sender unit is similar to that used with the fuel computer described in Chapter 12.



14.1 Air charge temperature sensor - 1.6 EFI engine

A Wiring plug B Sensor



17.1 Mixture (CO) adjustment potentiometer (arrowed) - 1.6 EFI engine

17 Mixture (CO) adjustment potentiometer - removal and refitting

Removal

- 1 The potentiometer is located on the side of the left-hand suspension turret (see illustration).
- 2 Disconnect the battery negative lead.
- 3 Disconnect the potentiometer wiring plug.
- 4 Remove the securing screw and withdraw the potentiometer.

Refitting

5 Refitting is a reversal of removal, but on completion check and if necessary adjust the mixture as described earlier in this Chapter 1.

18 Fuel cut-off (inertia) switch - removal and refitting

The procedure is as described in Part C of this Chapter for models with the CFI system.

19 EEC IV module - removal and refitting

The procedure is as described in Part C of this Chapter for models with the CFI system.