Chapter 4
Fuel and exhaust systems

Contents

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 

Specifications

Fuel system

	kPa	psi
Fuel pressure:		
Ignition ON, engine not running	260 to 300	38 to 44
Engine idling:		
Vacuum hose detached from fuel pressure regulator	280 to 320	40 to 46
Vacuum hose attached to fuel pressure regulator	210 to 260	30 to 38
Fuel system hold pressure	145	21
Fuel injector resistance	2.0 to 3.0 ohms	
Idle speed	Must be set by authorised service department	

Torque wrench settings

	Nm	lbf ft
Throttle body mounting bolts	19	14
Fuel rail mounting bolts	12	9

1 General information

The fuel system consists of a fuel tank, an electric fuel pump either located externally, next to the fuel tank (1988 to 1990 models) or in the fuel tank (1991 to 1994 models), an EFI fuel pump relay and main relay, an inertia switch, fuel injectors and fuel rail, an air cleaner assembly and a throttle body unit.

Multi Point Fuel Injection (MPFI) system

Multi point fuel injection uses timed impulses to sequentially inject the fuel directly into the intake port of each cylinder. The injectors are controlled by the Electronic Control Unit (ECU). The ECU monitors various engine parameters and delivers the exact amount of fuel, in the correct sequence, into the intake ports. The throttle body serves only to control the amount of air passing into the system. Because each cylinder is equipped with an injector mounted immediately adjacent to the intake valve, much better control of the fuel/air mixture ratio is possible.

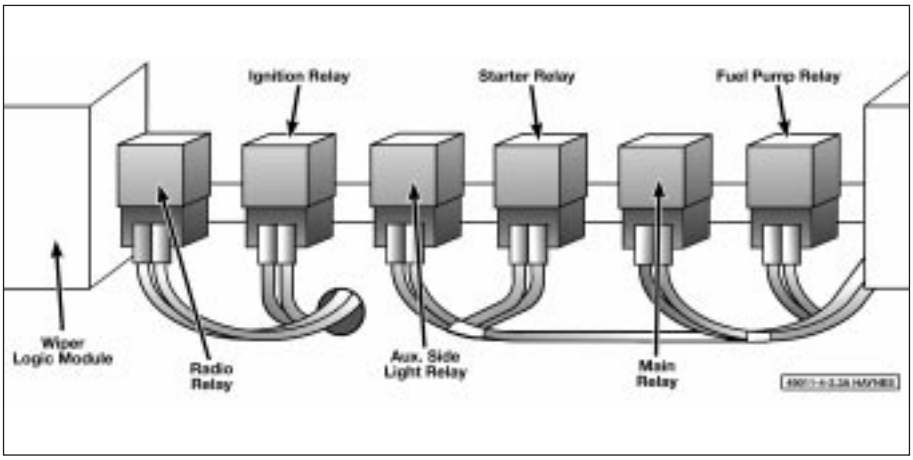
Fuel pump and lines

Fuel is circulated from the fuel tank to the fuel injection system, and back to the fuel tank, through a pair of metal lines running along the underside of the vehicle. On early models (1988 to 1990), an electric fuel pump is attached to the chassis next to the fuel tank. On later models (1991 to 1994), the fuel pump and fuel level sender unit are located inside the fuel tank. A vapour return system routes all vapours and hot fuel back to the fuel tank through a separate return line.

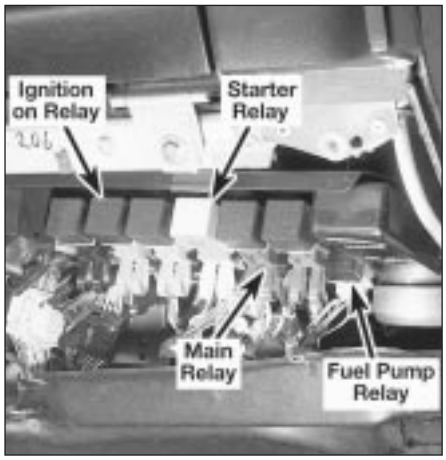
The fuel pump will operate as long as the engine is cranking or running and the ECU is receiving ignition reference pulses from the electronic ignition system (see Chapter 5). If there are no reference pulses, the fuel pump will shut off after 2 or 3 seconds.

Inertia switch

These models are equipped with an inertia switch that is wired in the circuit between the fuel pump relay, the ignition switch and the fuel pump (refer to the wiring diagrams at the end of Chapter 12). The inertia switch is a



2.3a Relay locations on a 1988 model



2.3b Relay locations on a 1989 model

special electrical device that provides circuit protection by switching off the ignition and fuel pump upon impact in the event of vehicle collision. Later Jaguar models are equipped with an additional specialised inertia switch. This later device switches OFF all ignition fed circuits, locks the fuel filler cap, locks the boot (only if doors are locked) and unlocks the doors if they are locked during the accident. All these functions are directed by the inertia switch. The inertia switch is located behind the left kick panel. Refer to Chapter 12 for more information.

Exhaust system

The exhaust system includes an exhaust manifold equipped with an exhaust oxygen sensor, a catalytic converter, an exhaust pipe, and a silencer.

The catalytic converter is an emission control device added to the exhaust system to reduce pollutants. A single-bed converter is used in combination with a three-way (reduction) catalyst. See Chapter 6 for more information regarding the catalytic converter.

2 Fuel pressure relief

Warning: Petrol is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or a clothes dryer) with a pilot light is present. Since petrol is carcinogenic, wear latex gloves when there's a possibility of being exposed to fuel, and, if you spill any fuel on your skin, rinse it off immediately with soap and water. Mop up any spills immediately and do not store fuel-soaked rags where they could ignite. The fuel system is under constant pressure, so, if any fuel lines are to be disconnected, the fuel pressure in the system must be relieved first. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.

1 Before servicing any fuel system component, you must relieve the fuel pressure to minimise the risk of fire or personal injury.

2 Remove the fuel filler cap - this will relieve any pressure built up in the tank.

3 Remove the fuel pump relay from the main relay panel **(see illustrations)**. **Note:** *These models are equipped with a fuel pump relay that is located in various areas of the vehicle depending on the year. On 1988 and 1989 models, the fuel pump relay is under the glovebox. On 1990 to 1992 models, the fuel pump relay is in the engine compartment on the left side, attached to the brake pedal hanger. On 1993 models, the fuel pump relay is in the boot. On 1994 models, it's in the engine compartment on the right side of the bulkhead. Refer to the relay location charts in Chapter 12 for additional information.*

4 Start the engine and wait for the engine to stall, then turn the ignition key to Off. Disconnect the cable from the negative terminal of the battery before beginning any work on the fuel system.

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

5 The fuel system is now depressurised.

Note: *Place a rag around the fuel line before removing any hose clamp or fitting to prevent any residual fuel from spilling onto the engine.*

2.3c On 1992 models, the fuel pump relay is located in the left rear corner of the engine compartment

3 Fuel pump/fuel pressure - check

Warning: Petrol is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the Warning in Section 2.

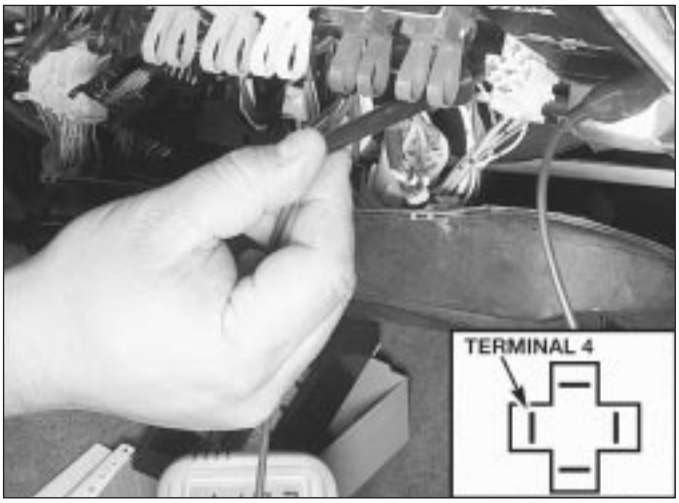
Note: *To perform the fuel pressure test, you will need to obtain a fuel pressure gauge and adapter set (fuel line fittings).*

Note: *On 1988 to 1990 models, the fuel pump may chatter excessively and the engine may stall frequently during hot weather. If stalling occurs, the engine will restart after a cool-down period. Dual fuel pumps can be installed by a dealer service department or other qualified repair facility to remedy this problem.*

Preliminary inspection

1 Should the fuel system fail to deliver the proper amount of fuel, or any fuel at all, inspect it as follows. Remove the fuel filler cap. Have an assistant turn the ignition key to the ON position (engine not running) while you listen at the fuel filler opening. You should hear a whirring sound that lasts for a couple of seconds. On 1988 to 1990 models, listen behind the left rear wheel (external fuel pump) for the fuel pump sound.

2 If you don't hear anything, check the fuel pump relay **(see illustration 2.3a, b or c)** and



3.3a Checking for battery voltage at the fuel pump relay connector (1989 model)

3.3b Checking for battery voltage to the main relay (1989 model)

circuit. If all circuits are intact and not damaged, check the inertia switch. **Note:** *The inertia switch is a special device that shuts down power to the ignition and the fuel pump in the event of an accident. See Chapter 12 for checking and resetting procedures for the inertia switch.*

3 Remove the relay and check for battery voltage to the fuel pump relay connector **(see illustration)**. If there is battery voltage present, check the relay for proper operation. Refer to the relay checking procedure in Chapter 12. **Note:** *If battery voltage is not available, check for battery voltage to the main relay* **(see illustration)***. Refer to the relay location diagrams in Chapter 12. The main relay, which is located next to the fuel pump relay, supplies voltage to the fuel pump and ignition system.*

4 If battery voltage is present, check for battery voltage directly at the fuel pump electrical connector **(see illustrations)**, within two seconds of the ignition key being turned On. If there is no voltage, check the fuel pump circuit. If there is voltage present, renew the pump (see Section 4). **Note:** *It will be necessary to raise the vehicle and support it securely on axle stands to gain access to the fuel pump electrical connectors. Have an assistant operate the ignition key and be sure to block the front wheels to avoid any movement of the vehicle.*

Operating pressure check

5 Relieve the fuel system pressure (see Section 2). Detach the cable from the negative battery terminal.

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

6 Detach the fuel line from the fuel rail and connect a fuel pressure gauge **(see illustrations)** between the fuel pulsation damper and the fuel rail. Tighten the hose clamps securely.

7 Attach the cable to the negative battery terminal. Start the engine.

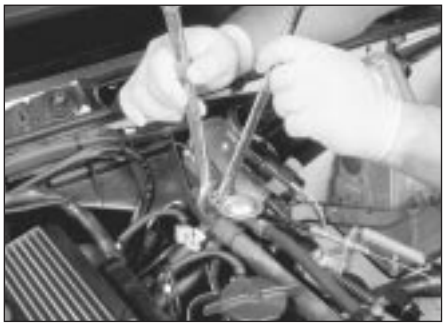
8 Note the fuel pressure and compare it with the pressure listed in this Chapter's Specifications.

9 Disconnect the vacuum hose from the fuel pressure regulator and hook up a hand-held vacuum pump **(see illustration)** to the port on the fuel pressure regulator.

10 Read the fuel pressure gauge with vacuum applied to the pressure regulator and also with no vacuum applied. The fuel pressure should decrease as vacuum increases (and increase as vacuum decreases).

3.4a Remove the rubber boot from the fuel pump electrical connector and check for voltage while an assistant turns the ignition key (1989 model shown)

3.4b Check for battery voltage to the fuel pump on the harness connector near the fuel tank on models with in-tank fuel pumps



3.6a Remove the fuel line from the fuel pulsation damper . . .

3.6b . . . then refit the fuel pressure gauge between the fuel rail and the fuel pressure damper using a T-fitting

3.9 Check fuel pressure without vacuum applied to the fuel pressure regulator, then with vacuum applied; fuel pressure should DECREASE as vacuum INCREASES

3.12 Using a pair of pliers, squeeze the return line and observe the fuel pressure increase (wrap a rag around the fuel line so you don't damage it)

11 Reconnect the vacuum hose to the regulator and check the fuel pressure at idle, comparing your reading with the value listed in this Chapter's Specifications. Disconnect the vacuum hose and watch the gauge - the pressure should jump up considerably as soon as the hose is disconnected. If it doesn't, check for a vacuum signal to the fuel pressure regulator (see Step 14).

12 If the fuel pressure is low, pinch the fuel return line shut **(see illustration)** and watch the gauge. If the pressure doesn't rise, the fuel pump is defective or there is a restriction or leak in the fuel feed line, or the pump is faulty. If the pressure rises sharply, renew the pressure regulator.

13 If the fuel pressure is too high, turn the engine off. Disconnect the fuel return line and blow through it to check for a blockage. If there is no blockage, renew the fuel pressure regulator.

14 Connect a vacuum gauge to the pressure regulator vacuum hose. Start the engine and check for vacuum **(see illustration)**. The fuel pressure regulator receives manifold vacuum that decreases (increases fuel pressure) when the engine speed is raised (acceleration). If there isn't vacuum present, check for a clogged hose or vacuum port. If the amount of vacuum is adequate but the pressure is too high, renew the fuel pressure regulator.

15 Turn the ignition switch to OFF, wait five minutes and recheck the pressure on the gauge. Compare the reading with the specified hold pressure. If the hold pressure is less than specified:

a) The fuel lines may be leaking.
b) The fuel pressure regulator may be allowing the fuel pressure to bleed through to the return line.
c) A fuel injector (or injectors) may be leaking.
d) The fuel pump may be defective.

3.14 Connect a vacuum gauge to the vacuum line leading to the fuel pressure regulator and check the vacuum source

4 Fuel pump - removal and refitting

Warning: Petrol is extremely flammable, so take extra precautions when you work on any part of the fuel system. See the Warning in Section 2.

Note 1: *On early models (1988 to 1990), an electric fuel pump is attached to the chassis next to the fuel tank. On later models (1991 to 1994), the fuel pump is inside the fuel tank.*

Note 2: *On 1988 to 1990 models, the fuel pump may chatter excessively and the engine may stall frequently during hot weather. If stalling occurs, the engine will restart after a cool-down period. Dual fuel pumps can be installed by a dealer service department or other qualified repair facility to remedy this problem.*

1 Remove the fuel tank filler cap to relieve any pressure in the fuel tank. Relieve the fuel pressure (see Section 2).

2 Disconnect the cable from the negative terminal of the battery.

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

External fuel pumps

3 Raise the vehicle and support it securely on axle stands.

4 Disconnect the fuel lines from the fuel pump.

5 Disconnect the electrical connectors from the fuel pump **(see illustration 3.4a)**.

6 Remove the fuel pump bracket retaining nuts **(see illustration)**.

7 Carefully withdraw the fuel pump from the rubber case inside the fuel pump bracket and angle the fuel pump over the rear suspension and out near the wheel on the left side of the vehicle.

8 Refitting is the reverse of removal.

In-tank fuel pumps

9 Raise the vehicle and support it securely on axle stands.

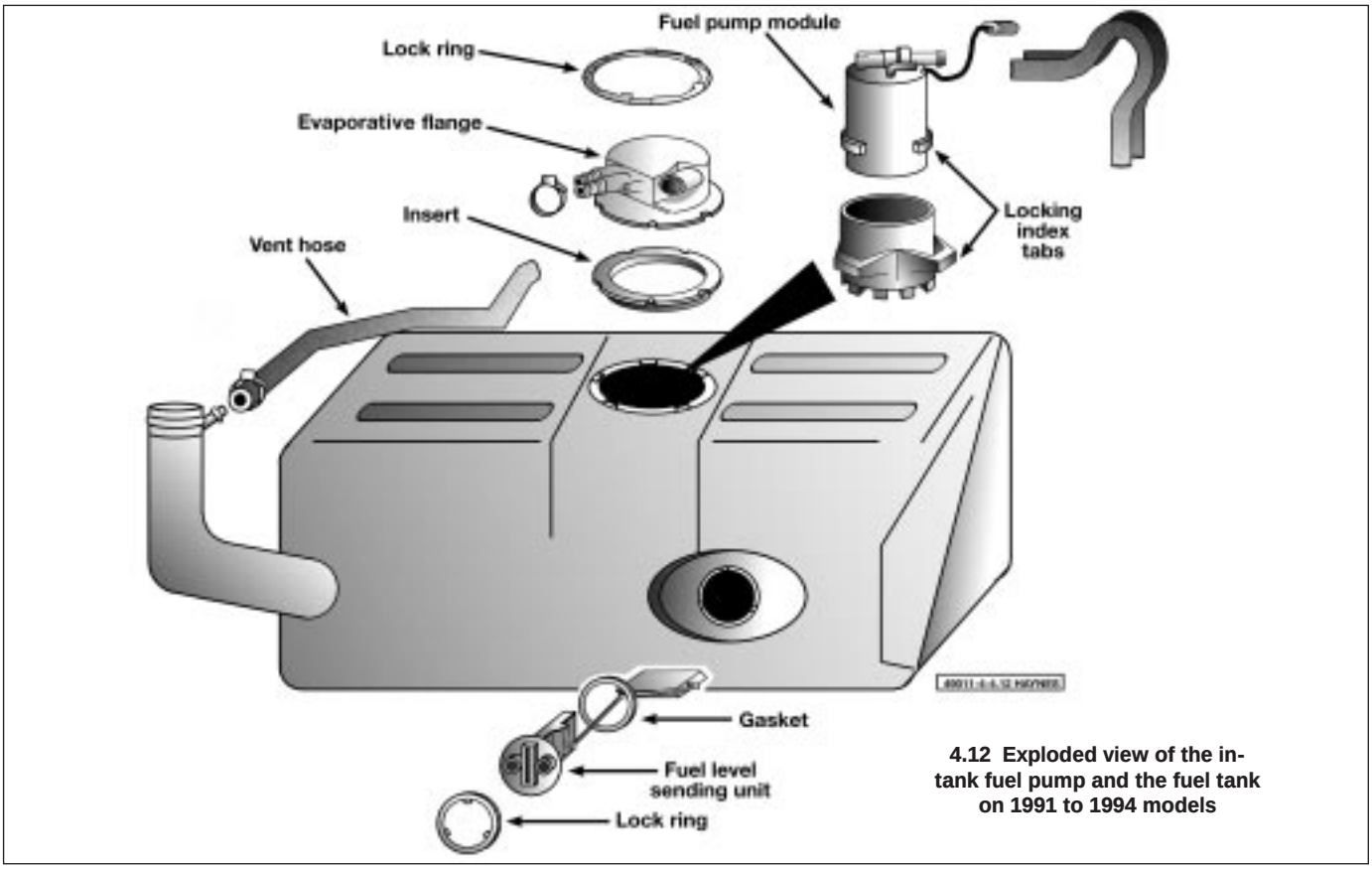
10 Disconnect the fuel pump and fuel level sender unit electrical connectors and the fuel lines.

11 Remove the fuel tank from the boot (see Section 7).

12 Disconnect the fuel lines from the evaporative flange **(see illustration)**. Remove the lock ring with a hammer and brass punch, tapping the lock ring anti-clockwise.

13 Withdraw the fuel pump module from the fuel tank. **Note:** *The fuel pump module is*

4.6 Remove the fuel pump mounting nuts (arrowed) and slide the fuel pump out of the rubber casing (1989 model shown)



4.12 Exploded view of the in-tank fuel pump and the fuel tank on 1991 to 1994 models

indexed near the bottom, therefore it will be necessary to turn the module slightly to unlock it from the rubber holder mounted on the bottom of the fuel tank.

14 Renew the fuel pump module as a single unit.

15 Refitting is the reverse of removal.

5 Fuel level sender unit - check and renewal

Warning: Petrol is highly flammable, so take precautions when you work on any part of the fuel system. See the Warning in Section 2.

Note: *Some 1994 models may be equipped with faulty fuel level sender units. A tight float rod bushing may cause the float to stick and indicate high fuel levels while the tank is almost empty.*

Check

1 Before performing any tests on the fuel level sender unit, completely fill the tank with fuel.

2 Remove the boot liner (see Chapter 12) to expose the fuel level sender unit access cover.

3 Disconnect the fuel level sender unit electrical connector located on the access cover. **Note:** *1991 to 1994 models are equipped with a fuel pump module and a sender unit assembly while 1988 and 1989 models are equipped with only the fuel level sender unit inside the tank.*

4 Position the ohmmeter probes on the electrical connector terminals **(see illustration)** and check for resistance. Use the 200 ohm scale on the ohmmeter.

5 With the fuel tank completely full, the resistance should be about 18 to 20 ohms.

6 Reconnect the electrical connector and drive it until the tank is nearly empty.

7 Check the resistance. The resistance of the sender unit should be about 190 to 200 ohms.

5.4 Connect the probes of the ohmmeter to the fuel level sender unit terminals and check the resistance of the float assembly

8 If the readings are incorrect, renew the sender unit. **Note:** *The test can also be performed with the fuel level sender unit removed from the fuel tank. Using an ohmmeter, check the resistance of the sender unit with the swing arm completely down (tank empty) and with the arm up (tank full)* **(see illustration)**. *The resistance should change steadily from 200 ohms to around 18 ohms.*

Renewal

Warning: The fuel level in the tank must be less than half full to safely remove the fuel pump/sender unit assembly from the fuel

5.8 An accurate check of the sender unit can be made by removing it from the fuel tank and observing the resistance with the float down (empty) and then extended (full)