Chapter 4 Part B: Fuel and exhaust systems – Lucas multi-point injection engines

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

General

System type	Indirect multi-point injection with microprocessor control
ECU-controlled idle speed:	
Manual transmission models	850 to 950 rpm
Automatic transmission models	800 to 900 rpm
Base idle speed:	
Manual transmission models	725 to 775 rpm
Automatic transmission models	675 to 725 rpm
Idle mixture CO content:	
Non-catalyst equipped engines	0.5 to 1.5%
Catalyst equipped engines	0.25%
Throttle potentiometer voltage	315 to 335 mV
Fuel octane rating	97 RON leaded or 95 RON unleaded

Fuel Pump

Type:	
Normally-aspirated engines	Nippon Denso, electric
Turbocharged engines	AC electric
Output pressure:	
Normally-aspirated engines	4.1 bar
Turbocharged engines	5.5 bar
Regulated pressure range	3.0 to 2.3 bar
Delivery rate (at 3.0 bars and 12 volts):	
Normally-aspirated engines	70 litres/hour
Turbocharged engines	120 litres/hour

Turbocharger

Type	Garret T25
Wastegate opening pressure	0.34 to 0.36 bar

Torque wrench settings	Nm	lbf ft
Fuel filter banjo union bolts	50	37
Brake servo hose banjo union bolt	50	37
Fuel pump banjo union bolt	22	16
Fuel tank drain plug	50	37
Fuel tank strap locknuts	18	13
Exhaust front pipe to manifold	30	22
Exhaust section flange nuts	30	22
Exhaust heat shield retaining bolts	25	18

1 General information and precautions

The fuel system used on earlier Rover 820i, Si, SLi and Turbo models consists of a centrally-mounted fuel tank, electric fuel pump and indirect multi-point fuel injection (MPi) system, together with its related electrical and mechanical components. A more detailed description of the MPi system is contained in Section 10.

The exhaust system consists of a front, intermediate and rear section, suspended from the underbody on rubber mountings, and bolted to a cast iron manifold at the front. A ball-and-socket universal joint is incorporated in the front section, to allow for engine and exhaust system movement.

Precautions

Warning: Many of the procedures in this Chapter require the removal of fuel lines and connections, which may result in some fuel spillage. 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. Don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses, and have a Class B type fire extinguisher on hand. Before carrying out any operation on the fuel system, refer also 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.

Reference must also be made to Chapter 5, Section 1 for precautionary notes concerning the ignition system and battery disconnection, and to any further safety-related text contained within the appropriate Section, before working on the vehicle.

Certain adjustment points in the fuel system are protected by tamperproof caps, plugs or seals. In some territories, it is an offence to drive a vehicle with broken or missing tamperproof seals. Before disturbing a tamperproof seal, first check that no local or national laws will be broken by doing so, and fit a new tamperproof seal after adjustment is complete, where required by law. Do not break tamperproof seals on any vehicle whilst it is still under warranty.

When working on fuel system components, scrupulous cleanliness must be observed and care must be taken not to introduce any foreign matter into the fuel lines or components.

2 Air cleaner assembly - removal and refitting

Note: *Air cleaner element renewal is described in Chapter 1.*

Removal

Normally-aspirated engines

1 Slacken the hose clip and disconnect the air trunking at the throttle housing **(see illustration)**.

2 Disconnect the airflow meter wiring connector, and release the cable from the support clip.

3 Undo the two air cleaner body and airflow meter support bracket bolts, and the two bolts securing the forward air trunking to its support bracket **(see illustration)**.

4 Withdraw the air cleaner body, complete with airflow meter and forward air trunking, release the trunking from the connecting duct at the front of the car, and remove the assembly from the engine compartment.

5 If the cold air side intake is to be removed, refer to Chapter 5 and remove the battery.

6 Undo the bolt securing the side intake to the body, and remove the intake and duct.

Turbocharged engines

7 Remove the battery as described in Chapter 5, then undo the bolts and lift out the battery tray.

8 Undo the wastegate control solenoid valve retaining screw and move the valve aside.

9 Disconnect the airflow meter wiring multiplug.

10 Undo the three mounting bracket retaining bolts.

11 Release the two clips securing the heat shield to the heater pipe and remove the heat shield.

12 Slacken the clip securing the air intake hose to the turbocharger and release the hose. Remove the breather hose from the intake hose.

13 Disconnect the wiring multiplug from the wastegate control solenoid valve.

14 Release the air cleaner assembly from the intake duct and carefully lift out the air cleaner, airflow meter and mounting bracket.

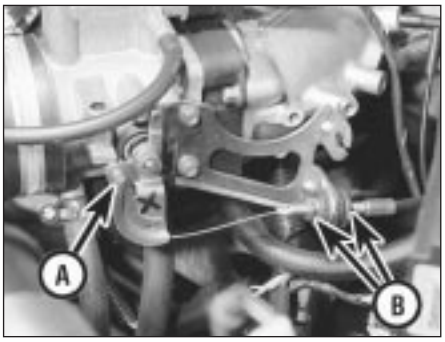
15 The remaining intake ducts can now be removed as required.

Refitting

16 Refitting is a reversal of removal, but ensure that all the ducts and trunking are fully engaged before tightening the various retaining bolts.

2.1 Disconnect the air trunking at the throttle housing

2.3 Forward air trunking to support bracket bolt



3.1 Accelerator cable end fitting attachment at the throttle lever (A), and outer cable locknuts (B)

3 Accelerator cable - removal, refitting and adjustment

Removal

1 Open the throttle fully by hand, and slip the inner cable end out of the slot on the throttle lever **(see illustration)**.
2 Slacken the outer cable locknuts, and fully unscrew the outer locknut, nearest to the cable end.
3 Remove the washer and rubber bush, then withdraw the cable from the support bracket.
4 From inside the car, release the turnbuckles and lift out the trim panel over the clutch, brake and accelerator pedals.
5 Prise the retaining clip from the top of the accelerator pedal, and disconnect the inner cable.
6 Release the cable from the engine compartment bulkhead, and from the support clips, and withdraw the complete cable from the car.

Refitting

7 Refitting is a reversal of removal. Adjust the cable initially by means of the outer cable locknuts, to give a small amount of free play with the throttle closed. On completion, check the engine base idle speed as described in Section 11.

4 Accelerator pedal - removal and refitting

Refer to Part A, Section 4.

5 Fuel system - depressurisation

Warning: Refer to the precautions contained in Section 1 before proceeding.

1 The fuel system referred to in this Chapter is defined as the fuel tank and tank-mounted fuel pump/fuel gauge sender unit, the fuel filter, the fuel pressure regulator, the fuel injectors, and the metal pipes and flexible hoses of the fuel lines between these components. Most of these contain fuel which will be under pressure while the engine is running and/or while the ignition is switched on.
2 The pressure will remain for some time after the ignition has been switched off, and must be relieved before any of these components are disturbed for servicing or repair work.
3 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
4 Place absorbent rags around the bleed screw in the centre of the fuel filter outlet union banjo bolt, then slowly unscrew the bleed screw to relieve the system pressure.
5 Once the pressure has been completely relieved, tighten the bleed screw and dispose of the rags safely.

6 Fuel pump - removal and refitting

Refer to Part A, Section 6.

7 Fuel gauge sender unit - removal and refitting

Refer to Part A, Section 7.

8 Fuel tank - removal, inspection and refitting

Refer to Part A, Section 8.

9 Unleaded petrol - general information and usage

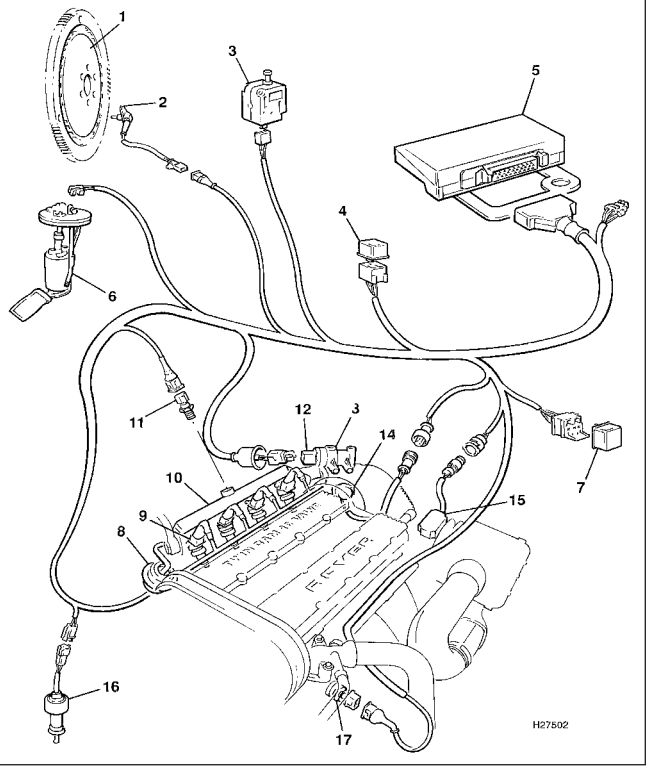
Refer to Part A, Section 9.

10 Fuel injection system - general information

The multi-point fuel injection (MPi) system is a microprocessor-controlled fuel management system, designed to overcome the limitations associated with conventional carburettor induction. This is achieved by continuously monitoring the engine using various sensors, whose data is input to the fuel system Electronic Control Unit (ECU). Based on this information, the ECU program and memory then determine the exact amount of fuel necessary, which is then injected directly into the inlet manifold, for all actual and anticipated driving conditions.

The main components of the system and their individual operation are as follows **(see illustration)**.

1 Flywheel reluctor ring
2 Crankshaft sensor
3 Inertia switch
4 Fuel pump relay
5 Fuel ECU
6 Fuel pump
7 Fuel system main relay
8 Fuel pressure regulator
9 Fuel injector
10 Fuel rail
11 Fuel temperature switch
12 Idle speed stepper motor
13 Throttle housing
14 Throttle potentiometer
15 Airflow meter
16 Speedometer transducer
17 Coolant temperature sensor



10.2 Main components of the multi-point fuel injection system

4B

Fuel ECU: The fuel ECU is a microprocessor, which controls the entire operation of the fuel system. Contained in the ECU memory is a program which controls the fuel supply to the injectors, and their opening duration. The program enters sub-routines to alter these parameters, according to inputs from the other components of the system. In addition to this, the engine idle speed is also controlled by the ECU, which uses a stepper motor to open or close an air valve as required.

Fuel injectors: Each fuel injector consists of a solenoid-operated needle valve, which opens under commands from the fuel ECU. Fuel from the fuel rail is then delivered through the injector nozzle into the inlet manifold.

Coolant temperature sensor: This resistive device is screwed into the thermostat housing, where its element is in direct contact with the engine coolant. Changes in coolant temperature are detected by the ECU as a change in sensor resistance.

Airflow meter: This contains two resistive elements mounted in the intake air stream, one of which is heated by a current passing through it. Air passing over the heated wire alters its resistance by cooling it, while the temperature of the air is sensed by the other wire. An electronic module within the airflow meter monitors the reaction of the elements to the airflow, and provides a proportional signal to the ECU.

Throttle potentiometer: The potentiometer is a variable resistor, attached to the throttle shaft in the throttle housing. The unit is supplied with a constant input voltage, and as the resistance of the potentiometer varies with throttle shaft movement, the output voltage is proportionally affected. This allows the fuel ECU to determine throttle valve position, and rate of change.

Idle speed stepper motor: This is a small electric motor, having two control windings to enable it to rotate in either direction. Under a signal from the fuel ECU, the stepper motor will rotate in whichever direction is necessary, to open or close the air valve in the throttle housing. This allows air to bypass the throttle valve and maintain a stabilised idling speed.

Fuel pump: The fuel pump is a self-priming centrifugal unit, located in the fuel tank, and totally submerged in the fuel. Fuel is supplied under pressure from the pump, through an in-line filter, to the fuel rail and fuel pressure regulator.

Fuel pressure regulator: The regulator is a vacuum-operated mechanical device, which ensures that the pressure differential between fuel in the fuel rail and fuel in the inlet manifold is maintained at a constant value. As manifold depression increases, the regulated fuel pressure is reduced in direct proportion. When fuel pressure in the fuel rail exceeds the regulator setting, the regulator opens to allow fuel to return via the return line to the tank.

Relays: The main relay is energised when the ignition is switched on, and provides the fuel ECU supply voltage. The fuel relay is energised by the fuel ECU for a short period after the ignition is initially switched on, and then continuously when the engine is running.

Fuel temperature switch: The fuel temperature switch contacts remain open during normal engine operation, and only closes when the temperature of the fuel in the fuel rail exceeds a preset value. When the contacts close, a signal is sent to the fuel ECU, overriding the coolant thermistor signal. The ECU then alters the opening duration of the injectors accordingly, to minimise the effects of fuel vaporisation.

Inertia switch: The switch is a mechanically-controlled accelerator, connected in the electrical circuit between the ignition switch and the fuel ECU and fuel relay. Under violent deceleration or impact, the switch trips out, and cuts off the supply voltage. Depressing a button on the switch body resets the switch.

11 Fuel injection system - testing and adjustment

Testing

1 If a fault appears in the fuel injection system, first ensure that all the system wiring connectors are securely connected and free of corrosion. Then ensure that the fault is not due to poor maintenance; ie, check that the air cleaner filter element is clean, the spark plugs are in good condition and correctly gapped, the cylinder compression pressures are correct, and that the engine breather hoses are clear and undamaged, referring to the relevant Sections of this Chapter, and to Chapters 1 and 2 for further information.

2 If these checks fail to reveal the cause of the problem, the vehicle should be taken to a suitably equipped Rover dealer for testing on Rover dedicated test equipment. This equipment will locate the fault quickly and simply, alleviating the need to test all the system components individually, which is a time-consuming operation that carries an element of risk of damaging the ECU.

Adjustment

Engine tuning procedure

3 Before making any changes to the settings of the fuel injection system, ensure that the spark plug gaps are correctly set, the air cleaner element is clean, there are no leaks in the exhaust system, and the ignition system is operating correctly. Ensure that all breather and vacuum hoses are connected, and that none are perished or kinked.

4 Check that there is at least 5.0 mm of free play in the accelerator cable, and that the throttle lever rests against its stop in the released condition. Adjust the cable as described in Section 3 if necessary.

5 Temperature effects, and engine and transmission oil drag, can adversely influence the idle speed and mixture settings, and it is important that the following warm-up procedure is adopted before attempting any adjustments.

6 Drive the car on the road for approximately two to four miles, dependent on summer or winter conditions, in a normal manner, without excessive load, engine speed or road speed.

7 Return the car to the working area, and without switching off the engine, connect an exhaust gas analyser (CO meter) in accordance with the equipment manufacturer's instructions. The analyser should be warmed up, correctly calibrated and ready for immediate use. Commence the adjustment procedure described below immediately.

8 If, during the adjustment procedure, the cooling fan operates, or if adjustment is not completed within two minutes, accelerate the engine to 2000 rpm, and hold this speed for ten seconds. Repeat this every two minutes until the adjustments are completed.

Base idle speed and mixture adjustment

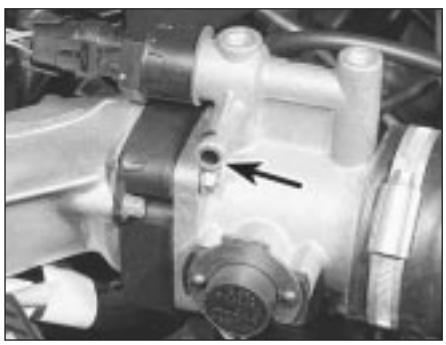
Note: *On models equipped with a catalytic converter, all adjustments should be entrusted to a Rover dealer. Any maladjustment of the system settings could have an adverse effect on the operation of the emission control equipment.*

9 The fuel injection system is such that the engine idle speed and mixture settings are controlled by the fuel ECU. Unless a new component has been fitted, the idle speed or mixture screws have been tampered with, or the idle quality is unsatisfactory, no adjustment should be necessary. If, however, the settings are to be altered, an accurate exhaust gas analyser (CO meter), tachometer, and voltmeter will be required.

10 Refer to the engine tuning procedure information contained above before starting.

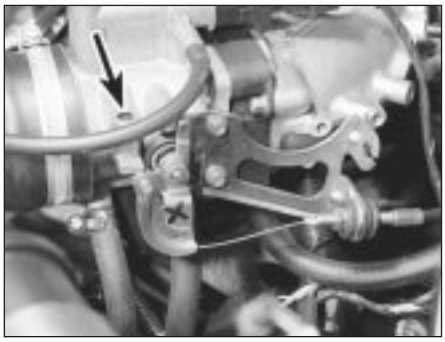
11 Switch off all electrical accessories, and ensure that they remain switched off throughout the adjustment procedure.

12 With the engine idling and the exhaust gas analyser connected, take a reading of the exhaust gas CO content. If this is not as given in the Specifications, hook out the tamperproof plug over the idle mixture adjustment screw, and turn the screw clockwise to enrich the mixture, or anti-clockwise to weaken it as necessary **(see illustration)**.

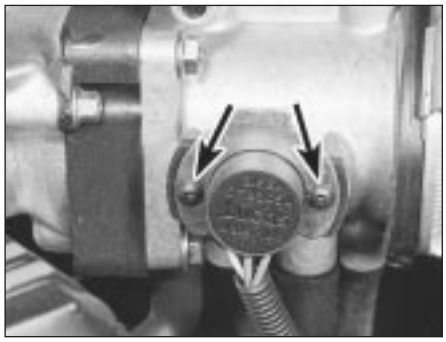


11.12 Idle mixture adjustment screw tamperproof plug (arrowed)

11.14 Disconnect the stepper motor wiring multiplug



11.17 Base idle speed adjusting screw tamperproof plug (arrowed)



11.23 Throttle potentiometer retaining screws (arrowed)

13 With the CO content correctly adjusted, switch off the engine and connect a tachometer according to the manufacturer's instructions.

14 Before adjusting the base idle speed, the stepper motor must be cycled to its fully-extended position, using the following procedure:

(a) Switch on the ignition.
(b) Disconnect the stepper motor wiring multiplug on the top of the throttle housing **(see illustration)**.
(c) Switch off the ignition, wait five seconds, and reconnect the stepper motor multiplug.
(d) Switch on the ignition, wait five seconds, and disconnect the stepper motor multiplug again.
(e) Switch off the ignition, wait five seconds, and reconnect the stepper motor multiplug.
(f) Switch on the ignition, wait five seconds, and disconnect the stepper motor multiplug once more. The stepper motor is now fully extended.

15 Start the engine, and allow it to idle until normal operating temperature is again reached.

16 Check the reading on the tachometer, and compare this with the base idle speed figure given in the Specifications.

17 If adjustment is necessary, hook out the tamperproof plug over the idle speed adjusting screw, and turn the adjusting screw as necessary to achieve the correct setting **(see illustration)**.

18 Increase the engine speed to 2000 rpm for ten seconds, then return it to idle.

19 Recheck the exhaust CO content, as described earlier in this Section.

20 Switch off the ignition, and pull back the dust cover over the throttle potentiometer wiring multiplug.

21 Insert the probes from the voltmeter into the back of the multiplug so that the voltmeter black lead is connected to the pink/black wire, and the red lead is connected to the light green/pink wire.

22 Select millivolts on the voltmeter, then switch on the ignition.

23 Check that the reading on the voltmeter scale is now equal to the throttle potentiometer voltage, as given in the Specifications. If this is not the case, slacken the two retaining screws, and slowly move the potentiometer body until the correct reading is obtained **(see illustration)**. Tighten the screws securely.

24 Open and close the throttle several times, then with it closed, check the voltmeter reading once more. Repeat the adjustment if the reading is now outside the specified tolerance.

25 With the adjustments complete, switch off the engine and disconnect the test instruments.

12 Fuel injection system components - removal and refitting

Note: *Refer to the precautions contained in Section 1 before proceeding.*

Airflow meter - normally-aspirated engines

Removal

1 Slacken the hose clip and detach the air trunking from the airflow meter **(see illustration)**.

2 Release the airflow meter wiring harness from its retaining clip, and disconnect the wiring multiplug.

3 Undo the two bolts securing the unit to its mounting bracket, withdraw the unit from the air cleaner body, and recover the seal.

Refitting

4 Refitting is a reversal of removal.

Airflow meter - turbocharged engines

Removal

5 Remove the air cleaner and airflow meter assembly as described in Section 2.

6 Slacken the clip and disconnect the turbocharger intake hose from the airflow meter.

7 Undo the four bolts and three nuts and separate the airflow meter from the air cleaner and bracket assembly.

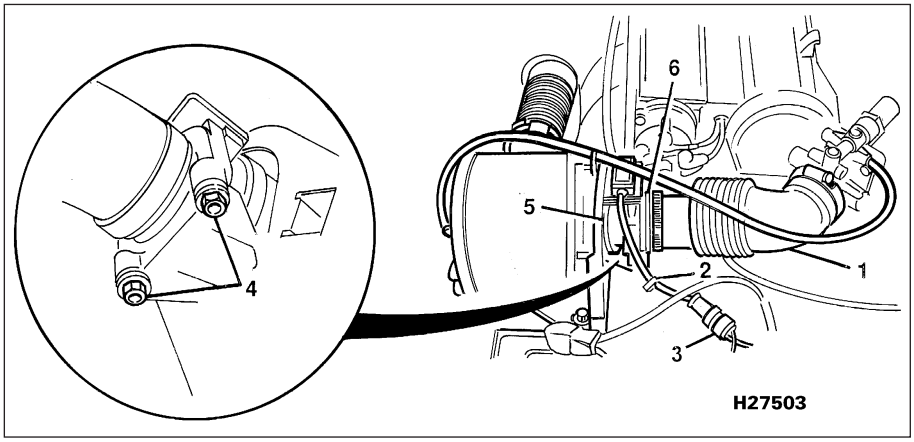
Refitting

8 Refitting is a reversal of removal.

Idle speed stepper motor

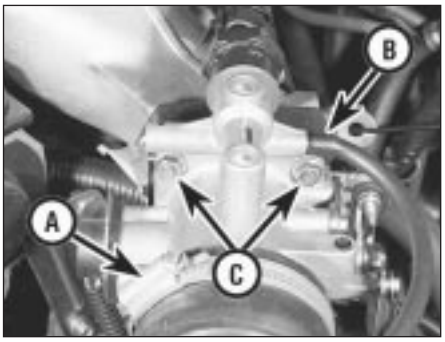
Removal

9 Slide back the rubber dust cover (where fitted), and disconnect the stepper motor wiring multiplug.



12.1 Airflow meter attachments

1 Air trunking
2 Wiring harness retaining clip
3 Wiring multiplug
4 Retaining bolts
5 Airflow meter
6 Seal location



12.18 Air intake trunking retaining clip (A), air valve hose (B), and throttle housing upper retaining nuts (C)

12.30 Fuel temperature switch wiring multiplug

12.36 Vacuum hose connections at the throttle housing end of the plenum chamber

10 Using a 32 mm spanner, unscrew the stepper motor from the throttle housing.

Refitting

11 Refitting is a reversal of removal.

Throttle potentiometer

Removal

12 Disconnect the throttle potentiometer wiring harness multiplug.
13 Using a dab of paint, mark the position of the potentiometer in relation to the throttle housing, so that if the original unit is refitted, its position can be restored.
14 Undo the two screws, remove the unit from the throttle housing, and recover the gasket (see illustration 11.23).

Refitting

15 Refit the potentiometer and gasket, align the previously-made mark, then tighten the two retaining screws. If a new unit is being fitted, position it centrally within its adjustment range.
16 Adjust the base idle speed and mixture settings as described in Section 11.

Throttle housing

Removal

17 Drain the cooling system as described in Chapter 1.
18 Slacken the hose clip and detach the air intake trunking from the throttle housing **(see illustration)**.
19 Disconnect the throttle potentiometer and stepper motor wiring multiplugs.
20 Disconnect the air valve hose from the top of the housing, and the breather hose from below.
21 Slacken the clips and disconnect the two coolant hoses from the housing.
22 Open the throttle fully by hand, and slip the accelerator inner cable end out of the slot on the throttle lever.
23 Slacken the outer cable locknuts, and unscrew the outer locknut, nearest to the cable end, fully.
24 Remove the washer and rubber bush, then withdraw the accelerator cable from the support bracket.
25 On automatic transmission models, disconnect the kickdown cable using the same procedure as for the accelerator cable.
26 Undo the four retaining nuts and remove the throttle housing from its mounting.
27 If further dismantling is required, the stepper motor and throttle potentiometer can be removed, as described earlier in this Section.

Refitting

28 Refitting is a reversal of removal. Refill the cooling system as described in Chapter 1 and, on automatic transmission models, adjust the kickdown cable as described in Chapter 7, Part B. Adjust the base idle speed and mixture settings as described in Section 11 on completion.

Fuel temperature switch

Removal

29 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
30 Disconnect the wiring multiplug from the temperature switch, located in the centre of the fuel rail behind the plenum chamber **(see illustration)**.
31 Unscrew the switch and remove it from the fuel rail.

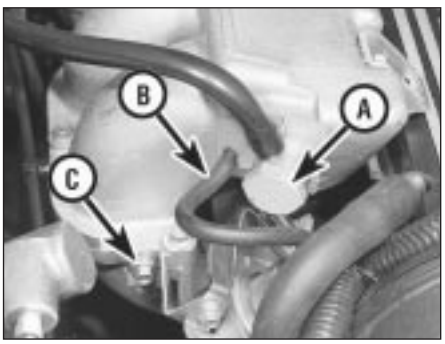
Refitting

32 Refitting is a reversal of removal.

Plenum chamber

Removal

33 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
34 Slacken the hose clip and detach the air intake trunking from the throttle housing.
35 Undo the four nuts securing the throttle housing to the plenum
chamber, ease the housing off the studs, and move it slightly to one side.
36 Disconnect the two vacuum hoses at the throttle housing end of the plenum chamber **(see illustration)**.
37 At the other end of the plenum chamber, unscrew the brake servo vacuum hose banjo union bolt, disconnect the vacuum hose adjacent to the banjo union, and undo the fuel pressure regulator mounting bracket bolt **(see illustration)**. Recover the two copper washers from the banjo union, and note that the hose locates between two locating pegs in its fitted position.
38 Remove the fuel temperature switch as described previously.
39 Undo the two bolts securing the plenum chamber mounting brackets to the camshaft cover **(see illustration)**.
40 Undo the six bolts securing the rear of the

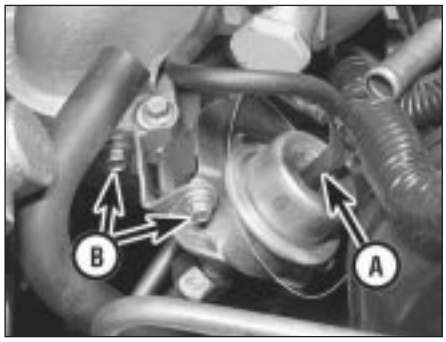


12.37 Brake servo vacuum hose banjo union (A), additional vacuum hose (B), and fuel pressure regulator mounting bracket bolt (C)

12.39 Plenum chamber mounting bracket to camshaft cover bolt (arrowed)

12.40 Plenum chamber to inlet manifold retaining bolt locations

12.46 Detach the breather hose from the camshaft cover



12.47 Fuel pressure regulator vacuum hose (A) and mounting bracket bolts (B)

plenum chamber to the inlet manifold **(see illustration)**.

41 Lift the plenum chamber off the manifold, and recover the four locating sleeves and O-ring seals.

42 Clean the manifold and plenum chamber mating faces, and renew the O-ring seals if they show any sign of deterioration.

Refitting

43 Refitting is a reversal of removal. Fit the locating sleeves to the manifold before the O-ring seals, and tighten all nuts and bolts securely.

Fuel pressure regulator

Removal

44 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

45 Relieve the fuel system pressure as described in Section 5.

46 Detach the breather hose from the camshaft cover, and move the hose aside **(see illustration)**.

47 Disconnect the vacuum hose from the top of the regulator **(see illustration)**.

48 Unscrew the fuel return hose union from the base of the regulator.

49 Undo the regulator bracket retaining bolts, and withdraw the regulator from the fuel rail.

Refitting

50 Refitting is a reversal of removal.

Fuel injectors

Removal

51 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

52 Relieve the fuel system pressure as described in Section 5.

53 Remove the plenum chamber and fuel temperature switch as described previously.

54 Detach the breather hose from the camshaft cover, and move the hose aside.

55 Disconnect the fuel pressure regulator vacuum hose.

56 Undo the fuel pressure regulator mounting bracket bolts.

57 Undo the union nut, and disconnect the fuel supply hose from the fuel rail.

58 Undo the union nut, and disconnect the fuel return hose from the fuel pressure regulator.

59 Disconnect the multiplugs from each of the four injectors **(see illustration)**.

60 Undo the two bolts securing the fuel rail to the inlet manifold.

61 Ease the four injectors out of their inlet manifold locations, and lift up the injector and fuel rail assembly. Recover the O-ring seal from each injector outlet.

62 Extract the retaining clips, and remove the injectors from the fuel rail. Recover the O-ring seal from each injector inlet.

Refitting

63 Refitting is a reversal of removal, but renew the injector inlet and outlet O-rings.

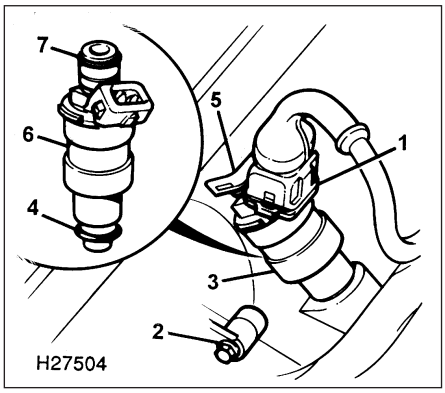
Electronic control unit (ECU)

Removal

64 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

65 Slide the driver's seat fully forwards.

66 From under the driver's seat, undo the two screws and lift off the ECU cover.



12.59 Fuel injector and fuel rail details

1 Injector multiplug
2 Fuel rail retaining bolt
3 Fuel injector location on inlet manifold
4 Injector outlet O-ring seal
5 Injector to fuel rail retaining clip
6 Injector body
7 Injector inlet O-ring seal

67 Undo the bolt securing the rear of the mounting bracket to the floor **(see illustration)**.

68 Slide the driver's seat fully rearwards, and undo the two bolts securing the front of the mounting bracket to the floor.

69 Withdraw the ECU and mounting bracket assembly from under the seat.

70 Depress the multiplug retaining tab, and pull the plug straight from the socket.

71 Remove the ECU from the car.

Refitting

72 Refitting is a reversal of removal.

Resonator unit

Refer to Part A, Section 12.

Inertia switch

Refer to Part A, Section 12.

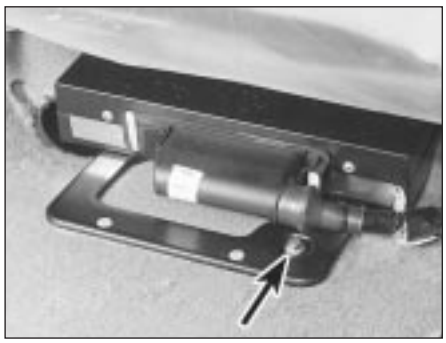
13 Turbocharger - description and precautions

4B

Description

1 On turbocharged engines, the turbocharger increases engine efficiency by raising the pressure in the inlet manifold above atmospheric pressure. Instead of the air simply being sucked into the cylinders, it is forced in.

2 Energy for the operation of the turbocharger comes from the exhaust gas.



12.67 ECU mounting bracket retaining bolt (arrowed)

The gas flows through a specially-shaped housing (the turbine housing) and in so doing, spins the turbine wheel. The turbine wheel is attached to a shaft, at the end of which is another vaned wheel known as the compressor wheel. The compressor wheel spins in its own housing, and compresses the inlet air on the way to the inlet manifold.

3 Boost pressure (the pressure in the inlet manifold) is limited by a wastegate, which diverts the exhaust gas away from the turbine wheel in response to a pressure-sensitive actuator.

4 The turbo shaft is pressure-lubricated by an oil feed pipe from the main oil gallery. The shaft “floats” on a cushion of oil. A drain pipe returns the oil to the sump.

Precautions

5 The turbocharger operates at extremely high speeds and temperatures. Certain precautions must be observed, to avoid premature failure of the turbo, or injury to the operator.

6 Do not operate the turbo with any of its parts exposed, or with any of its hoses removed. Foreign objects falling onto the rotating vanes could cause excessive damage, and (if ejected) personal injury.

7 Do not race the engine immediately after start-up, especially if it is cold. Give the oil a few seconds to circulate.

8 Always allow the engine to return to idle speed before switching it off - do not blip the throttle and switch off, as this will leave the turbo spinning without lubrication.

9 Allow the engine to idle for several minutes before switching off after a high-speed run.

10 Observe the recommended intervals for oil and filter changing, and use a reputable oil of the specified quality. Neglect of oil changing, or use of inferior oil, can cause carbon formation on the turbo shaft, leading to subsequent failure.

14 **Turbocharger** - removal and refitting

Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Drain the cooling system as described in Chapter 1.

3 Remove the air cleaner complete with airflow meter assembly as described in Section 2.

4 Undo the bolts and remove the heat shield behind the alternator.

5 Slacken the two clips and remove the oil return hose at the base of the turbocharger.

6 Slacken the two hose clips and remove air the outlet hose from the turbocharger.

7 Disconnect the vacuum hose at the wastegate solenoid valve.

8 Disconnect the oil feed pipe unions at the turbocharger.

9 Disconnect the coolant feed and return hoses at the turbocharger and engine pipe outlets.

10 Remove the engine oil dipstick and release the dipstick tube from its upper attachments.

11 Release the hose clips and support brackets and remove the coolant pipe over the top of the exhaust manifold.

12 Disconnect the wiring multiplug connector above the alternator and release the cable harness from its clips.

13 Disconnect the wastegate control solenoid wiring.

14 Undo the three nuts and separate the exhaust downpipe from the turbocharger outlet flange.

15 Undo the exhaust manifold retaining nuts and withdraw the manifold complete with turbocharger assembly off the studs. Recover the manifold gasket.

16 Undo the nuts securing the turbocharger to the exhaust manifold and remove the turbocharger. Recover the flange gasket .

17 Thoroughly clean all the joint mating faces prior to refitting.

Refitting

18 Refitting is a reversal of removal, but use new gaskets at all the flange joints. Refill the cooling system and top-up the engine oil as described in Chapter 1 on completion.

15 **Turbocharger** - examination and renovation

1 With the turbocharger removed, inspect the housing for cracks or other visible damage.

2 Spin the turbine or the compressor wheel, to verify that the shaft is intact and to feel for excessive shake or roughness. Some play is normal, since in use, the shaft is “floating” on a film of oil. Check that the wheel vanes are undamaged.

3 If the exhaust or induction passages are oil-contaminated, the turbo shaft oil seals have probably failed.

4 No DIY repair of the turbo is possible. A new unit may be available on an exchange basis.

16 **Exhaust system** - general information and component renewal

Refer to Part A, Section 13 and, on vehicles equipped with a catalytic converter, to Part E, Section 3.