






Chapter 4 Part C: Fuel and exhaust systems – MEMS multi-point injection engines

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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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4C

Specifications

General

System type	Modular Engine Management System (MEMS) with indirect multi-point injection
ECU-controlled idle speed:	
Normally-aspirated engines	825 to 925 rpm
Pre-1994 turbocharged engines	825 to 925 rpm
1994-on turbocharged engines	775 to 875 rpm
Fuel octane rating	95 RON unleaded only

Fuel Pump

Type	AC electric
Output pressure:	
Normally-aspirated engines	3.2 bar
Turbocharged engines	4.3 bar
Regulated pressure range	2.8 to 3.2 bar
Delivery rate (at 3.0 bar and 12 volts):	
Normally-aspirated engines	64 litres/hour
Turbocharged engines	73 litres/hour

Turbocharger

Type	Garret T25
Wastegate opening pressure	0.43 bar


Torque wrench settings	Nm	lbf ft
Fuel filter banjo union bolts	38	28
Fuel pressure regulator retaining bolts	10	7
Brake servo hose banjo union bolt	50	37
Plenum chamber to inlet manifold	10	7
Fuel rail to inlet manifold	10	7
Fuel pump banjo union bolt	22	16
Fuel tank drain plug	50	37
Fuel tank strap locknuts	22	16
Fuel temperature sensor	15	11
Turbocharger to exhaust manifold	30	22
Turbocharger exhaust elbow bolts	25	18
Turbocharger to exhaust front pipe	10	7
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 later Rover 820i, Si, SLi and Vitesse models consists of a centrally-mounted fuel tank, electric fuel pump and indirect multi-point fuel injection, as part of the Modular Engine Management System (MEMS). A more detailed description of the 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 catalytic converter is fitted between the front and intermediate sections and a flexible joint is also 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 Remove the battery as described in Chapter 5.
- 2 Slacken the hose clip and disconnect the air intake hose between the throttle housing and air cleaner at the air cleaner end.
- 3 Undo the two bolts securing the air cleaner assembly to the mounting bracket.
- 4 Disengage the peg at the base of the air cleaner, release the unit from the intake ducts and remove it from the engine compartment.
- 5 The remaining intake ducts can now be removed as required.

Turbocharged engines

- 6 Slacken the clip and release the air intake hose on the side of the air cleaner body.
- 7 Slacken the clip and release the boost control solenoid valve hose from its connection next to the air intake hose.
- 8 Undo the two bolts on the side of the air

cleaner body and remove the unit from the engine compartment.

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

Refitting

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

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.
- 2 Unclip the square nut and release the cable from the support bracket.
- 3 Release the cable from the support clip in the engine compartment.
- 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 by turning the retainer through 90° and withdraw the cable from the car.

Refitting and adjustment

Models up to VIN 152206

- 7 Refit the cable at the pedal end using a reversal of removal.
- 8 At the throttle housing end, screw the square adjusting nut fully onto the threaded portion of the outer cable.
- 9 Connect the inner cable to the throttle lever, and locate the outer cable in the slot in the support bracket.
- 10 Hold the throttle closed then pull the outer cable away from the throttle lever until all slack and lost motion are taken up.

11 Keeping the cable in this position, screw the square nut along the threaded portion of the outer cable until it just touches the support bracket.

12 Without moving the square nut, clip it into its slot in the support bracket.

Models from VIN 152206

13 Switch the ignition on, wait five seconds then switch it off again. This will move the stepper motor to the adjustment position.

14 Refit the cable at the pedal end using a reversal of removal.

15 At the throttle housing end, screw the square adjusting nut fully onto the threaded portion of the outer cable.

16 Connect the inner cable to the throttle lever, and locate the outer cable in the slot in the support bracket.

17 Hold the throttle lever closed and check that the throttle position screw is in contact with the stepper motor pin.

18 Pull the outer cable away from the throttle lever until all slack and lost motion are taken up.

19 Keeping the cable in this position, screw the square nut along the threaded portion of the outer cable until it just touches the support bracket.

20 Without moving the square nut, clip it into its slot in the support bracket.

4 Accelerator pedal - removal and refitting

Refer to Part A, Section 4, but note that the accelerator pedal switch is only fitted to certain models.

5 Fuel system - depressurisation

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

Refer to Part B, Section 5.

6 Fuel pump - removal and refitting

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

Refer to Part A, Section 6.

7 Fuel gauge sender unit - removal and refitting

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

Refer to Part A, Section 7.

8 Fuel tank - removal, inspection and refitting

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

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 Modular Engine Management System (MEMS) is used on later models equipped with the "T" series 4-cylinder engine. It controls a multi-point fuel injection system, an emissions control system and a programmed ignition system as a total engine management package (see illustration).

One Electronic Control Unit (ECU) controls

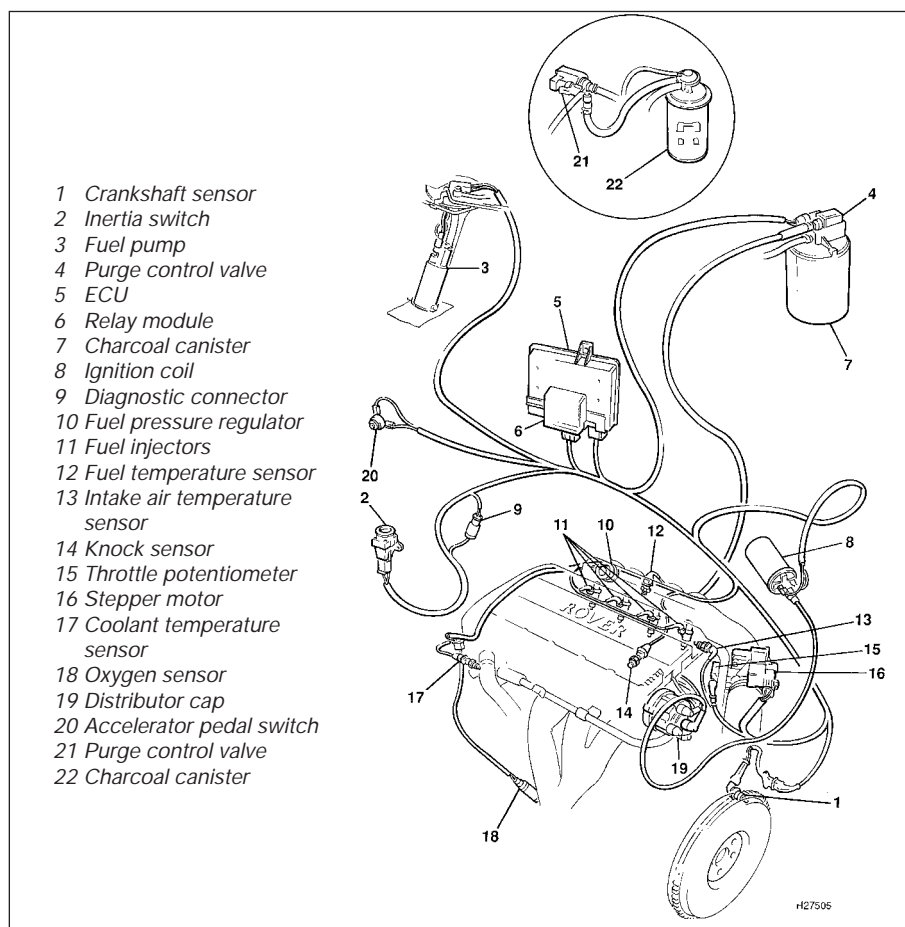
all the fuelling, emission and ignition requirements of the engine. The ECU incorporates short circuit protection and can also store information on certain intermittent faults for interrogation by computerised test equipment.

The ECU utilises a speed/density method of airflow measurement to calculate fuel delivery. This method, using the engine as a pre-calibrated vacuum pump, with its characteristics stored in the ECU, measures the air inlet temperature and inlet manifold pressure, allowing the correct amount of fuel per air density/speed to be injected.

Should certain elements of the system fail, the ECU can implement a back-up facility, allowing the system to operate at a reduced level of performance until the fault can be rectified.

A diagnostic socket allows tuning or fault diagnosis to be carried out on test equipment without disconnecting the ECU wiring harness.

On early versions of the system, an accelerator pedal switch triggers the ECU between the main fuelling map when the switch is open (accelerator pedal depressed) and idle speed control when the switch is closed (pedal released). The pedal switch also



10.1 Main components of the MEMS multi-point fuel injection system

controls an over-run fuel cut-off function. On later versions of the system, the manifold absolute pressure sensor is used to perform the functions of the pedal switch.

The ECU, in determining optimum ignition timing, receives information from the crankshaft sensor (engine speed and crankshaft position), manifold absolute pressure sensor (engine load), knock sensor (detonation), coolant temperature sensor (engine temperature) and where fitted, from the accelerator pedal switch (pedal position), to determine main fuelling or idle speed control.

It can be seen that the system is similar to the earlier fuel injection system described in Part B of this Chapter, the main differences being the method of determining airflow (there is no airflow meter) and the combining of the fuel and ignition ECUs into one unit.

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

3 As all the fuelling and ignition requirements are performed entirely by the electronic control unit, no adjustments to the system are possible. Any irregularities in idling speed stability or engine performance may indicate a fault in the system and should be referred to a dealer for diagnosis and rectification.

12 Fuel injection system components - removal and refitting



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

Intake air temperature sensor

Removal

1 Disconnect the wiring multiplug from the temperature sensor located on the inlet manifold.

2 Unscrew the sensor and remove it from the manifold.

Refitting

3 Refitting is a reversal of removal.

Throttle housing

Removal

4 Disconnect the wiring multiplugs from the stepper motor and throttle potentiometer (see illustration).

5 Slacken the clip and detach the air intake hose from the throttle housing.

6 Disconnect the accelerator cable from the throttle lever and support bracket as described in Section 3.

7 On automatic transmission models, disconnect the kick-down cable from the throttle lever and support bracket referring to Chapter 7, Part B if necessary.

8 Release the clips and disconnect the breather hoses.

9 Unscrew the four nuts securing the throttle housing to the inlet manifold and remove the throttle housing.

Refitting

10 Refitting is a reversal of removal. Reconnect and adjust the accelerator cable as described in Section 3, and on automatic transmission models, the kick-down cable as described in Chapter 7, Part B.

Throttle potentiometer

Note: If the potentiometer is being renewed, it will be necessary to have the new unit adjusted by a Rover dealer on completion.

Removal

11 Remove the throttle housing as described previously.

12 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.

13 Undo the two screws, remove the unit from the throttle housing, and recover the gasket.

Refitting

14 Refit the potentiometer and gasket, align the previously-made mark, then tighten the two retaining screws.

15 If a new unit is being fitted, position it centrally within its adjustment range.

16 Refit the throttle housing as described previously.

17 Have the potentiometer adjusted by a Rover dealer if a new unit was fitted.

Accelerator pedal switch

18 Refer to Part A, Section 4.

Fuel temperature sensor

Removal

19 Disconnect the wiring multiplug from the temperature sensor located on the fuel rail.

20 Unscrew the sensor, remove it from the fuel rail and recover the sealing washer.

Refitting

21 Refitting is a reversal of removal, but use a new sealing washer.

Fuel pressure regulator

Removal

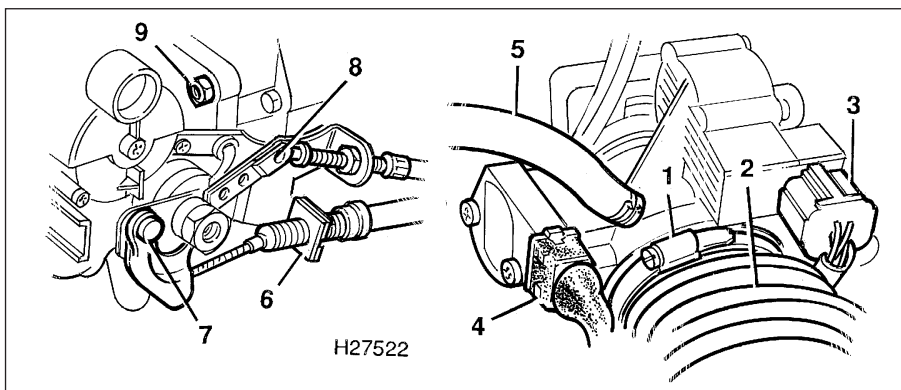
22 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

23 Relieve the fuel system pressure as described in Part B, Section 5.

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

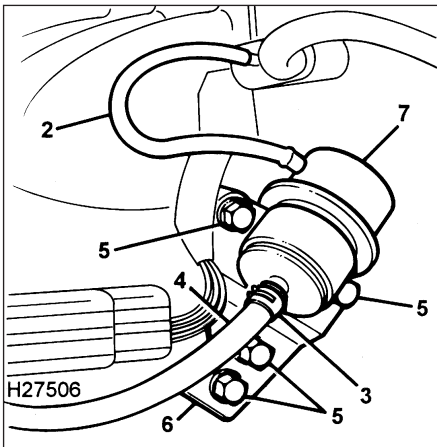
25 Release the clip and disconnect the fuel return hose from the base of the regulator.

26 Undo the regulator bracket retaining bolts, withdraw the regulator from the fuel rail and recover the O-ring seal. Plug the fuel rail while the regulator is removed.



12.4 Stepper motor and throttle potentiometer details

- | | | |
|---------------------------|---------------------------|-----------------------------|
| 1 Intake hose clip | 4 Potentiometer multiplug | 7 Cam lever |
| 2 Intake hose | 5 Breather hose | 8 Kick-down cable cam lever |
| 3 Stepper motor multiplug | 6 Throttle cable bracket | 9 Throttle housing nuts |



12.24 Fuel pressure regulator attachments

- 2 Vacuum hose
- 3 Fuel return hose clip
- 4 Fuel return hose
- 5 Regulator bracket retaining bolts
- 6 Regulator bracket
- 7 Fuel pressure regulator

Refitting

27 Refitting is a reversal of removal, but use a new O-ring seal.

Plenum chamber

Removal

- 28 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 29 Slacken the hose clip and detach the air intake trunking from the throttle housing.
- 30 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.
- 31 Disconnect the vacuum hoses at each end of the plenum chamber.

- 32 Disconnect the purge control valve hose from the plenum chamber (see illustration).
- 33 Unscrew the brake servo vacuum hose banjo union bolt and recover the two copper washers from the banjo union.
- 34 Detach the engine breather hose from the plenum chamber.
- 35 Disconnect the fuel temperature sensor wiring multiplug.
- 38 Undo the two bolts securing the plenum chamber mounting brackets to the camshaft cover.
- 39 Undo the six bolts securing the rear of the plenum chamber to the inlet manifold.
- 40 Lift the plenum chamber off the manifold, and recover the gasket.
- 41 Clean the manifold and plenum chamber mating faces and obtain a new gasket.

Refitting

42 Refitting is a reversal of removal. Use a new gasket and tighten the nuts and bolts to the specified torque.

Fuel injectors and fuel rail

Removal

- 43 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 44 Relieve the fuel system pressure as described in Part B, Section 5.
- 45 Remove the plenum chamber as described previously.
- 46 Undo the four bolts and disconnect the fuel feed hose flange bracket from the side of the fuel rail. Plug the hose and fuel rail after disconnection.
- 47 Disconnect the multiplugs from each of the four injectors and move the injector wiring harness aside.
- 48 Disconnect the vacuum hose from the top of the fuel pressure regulator.
- 49 Release the clip and disconnect the fuel return hose from the base of the regulator.

- 50 Undo the regulator bracket retaining bolts, withdraw the regulator from the fuel rail and recover the O-ring seal. Plug the fuel rail while the regulator is removed.
- 51 Undo the three bolts securing the fuel rail to the inlet manifold.
- 52 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.
- 53 Extract the retaining clips, and remove the injectors from the fuel rail. Recover the O-ring seal from each injector inlet.

Refitting

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

Electronic control unit and relay module

Removal

- 55 Lift the charcoal canister out of its mounting bracket and move it to one side.
- 56 Release the relay module from the bracket on the front of the ECU.
- 57 Disconnect the two wiring multiplugs and the vacuum hose, then undo the three bolts and remove the ECU from the mounting bracket.

Refitting

58 Refitting is a reversal of removal.

Inertia switch

Removal

- 59 Disconnect the wiring multiplug, undo the two screws and remove the switch from the engine compartment bulkhead.

Refitting

60 Refitting is a reversal of removal.

Boost control solenoid (Turbocharged engines)

Removal

- 61 Refer to Chapter 5, and remove the battery.
- 62 Slacken the clip and release the air intake hose on the side of the air cleaner body.
- 63 Slacken the clip and release the boost control solenoid valve hose from its connection next to the air intake hose on the air cleaner.
- 64 Undo the two bolts on the side of the air cleaner body and remove the unit from the engine compartment.
- 65 Release the clips and disconnect the three hoses from the boost control solenoid.
- 66 Disconnect the wiring multiplug, undo the retaining bolt and remove the solenoid from the battery tray.

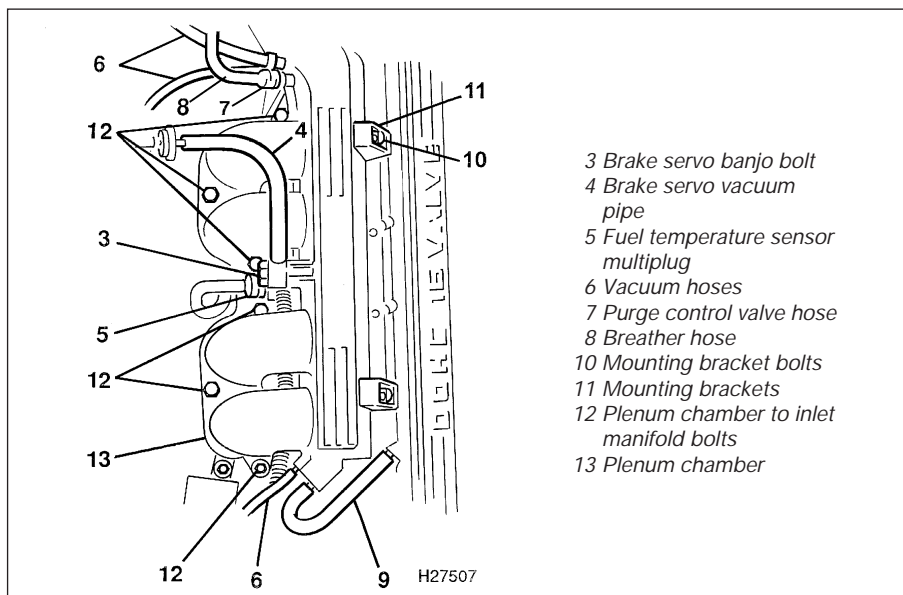
Refitting

67 Refitting is a reversal of removal.

Camshaft sensor (Turbocharged engines)

Removal

- 68 Disconnect the sensor wiring harness at the connector.



12.32 Plenum chamber attachment details

69 Undo the retaining bolt and remove the sensor from the housing on the end of the cylinder head.

Refitting

70 Refitting is a reversal of removal.

13 Turbocharger - description and precautions

Refer to Part B, Section 13.

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 assembly as described in Section 2.
- 4** Undo the two nuts and remove the oil return hose elbow from the side of the sump.
- 5** Undo the three nuts and separate the exhaust downpipe from the turbocharger outlet flange. Recover the flange gasket.
- 6** Undo the two bolts securing the coolant

pipe over the top of the exhaust manifold.

7 Release the oxygen sensor multiplug from the thermostat housing, disconnect the multiplug and remove the harness from the clip on the top hose.

8 Slacken the hose clip and remove the coolant pipe from the hose on the side of the thermostat housing.

9 Slacken the hose clip and remove the air intake hose from the turbocharger.

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

11 Disconnect the oil feed pipe union at the turbocharger.

12 Disconnect the vacuum hose at the wastegate solenoid valve.

13 Disconnect the coolant feed and return hoses at the turbocharger.

14 Release the clip on the turbocharger vacuum hose and remove the hose from the turbocharger.

15 On models without air conditioning, undo the nuts and remove the alternator heat shield.

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

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

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

Refitting

19 Refitting is a reversal of removal bearing in mind the following points:

- (a) *Use new gaskets at all the flange joints and new nuts at the turbocharger to manifold connection.*
- (b) *Tighten all nuts and bolts to the specified torque.*
- (c) *Refill the cooling system and top up the engine oil as described in Chapter 1.*

15 Turbocharger - examination and renovation

Refer to Part B, Section 15.

16 Intercooler - removal and refitting

The intercooler is removed as an assembly with the cooling system radiator. Refer to Chapter 3, Section 7 for details.

17 Exhaust system - general information and component renewal

Refer to Part A, Section 13 for exhaust system details and to Part E, Section 3, for information on the catalytic converter.