

Chapter 4 Part B:

Fuel and exhaust systems - fuel injection models

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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

Injection system type:	
C16 NZ, C16 NZ2, X16 SZ and C18 NZ	Multec Central Fuel Injection
20 NE, C20 NE and 20 SEH, (up to 1990)	Motronic M4.1
20 NE, C20 NE and 20 SEH, (from 1990)	Motronic M1.5
20 XEJ and C20 XE, (up to 1993)	Motronic M2.5
C20 XE (from 1993)	Motronic M2.8
X20 XEV	Simtec 56.1
Fuel tank capacity:	
All models	63.0 ± 2 litres
Fuel octane rating *	
Leaded	98 RON (4-star)
Unleaded (refer to Chapter 5) *	95 RON (Premium)
* Note: Models fitted with a catalytic converter (engine code prefixed by 'C' or 'X'), must only be operated on unleaded fuel.	

Idle settings

Idle speed:	
C16 NZ and X16 SZ	850 ± 80 rpm
C16 NZ2	880 ± 80 rpm
C18 NZ	
Manual transmission models	880 ± 80 rpm
Automatic transmission models	830 ± 80 rpm
20 NE, C20 NE and 20 SEH	800 ± 80 rpm
20 XEJ and C20 XE	940 ± 80 rpm
X20 XEV	850 ± 160 rpm

Note: Idle speed adjustment is not possible on these models, for information only

Idle settings (continued)

Idle mixture (CO content):	
20 NE and 20 SEH	1.0 max.
20 XEJ	0.7 to 1.2%
All other models	0.3 % (at 2800 to 3200 rpm)

Fuel Pressure (regulator vacuum hose connected)

Multec	0.76 bar
Motronic 4.1:	
Feed	2.3 to 2.7 bar
Return	0.3 to 1.5 bar
Motronic 1.5:	
Feed	1.8 to 2.2 bar
Return	0.3 to 1.5 bar
Motronic 2.5	2.0 to 2.2 bar
Motronic 2.8	2.2 to 2.7 bar
Simtec 56.1	not available

Torque wrench settings

	Nm	lbf ft
All specifications as for carburettor models except for the following:		
Bracket, tank vent valve to coolant flange	8	6
Fuel distributor pipe to inlet manifold	8	6
Fuel flow damper	20	15
Fuel injector retainer	3	2
Fuel pressure regulator	2.5	2
Fuel pump clamp	4	3
Idle air control stepper motor	2.5	2
Knock sensor (X16 SZ) to block	13	10
Oxygen sensor	30	22
Throttle body mounting	20	15
Throttle body upper-to-lower section	6	4.5
Throttle potentiometer	2	1.5
Throttle valve housing to inlet manifold	9	7

1 General description

General

1 All engines available within the Cavalier range can be operated on unleaded petrol. Refer to Chapter 5 for further details. Note that models fitted with a catalytic converter must only be operated on unleaded petrol, and leaded petrol must not be used. Models with catalytic converter can be identified by the engine code, which is prefixed by the letter 'C' or 'X'.

Multec system

Note: There is no provision for the adjustment or alteration of the idle speed; if checking the idle speed, remember that it may vary constantly under ECU control.

2 The Multec system is essentially a simple method of air/fuel metering, replacing the carburettor with a single injector mounted in a throttle body. This type of system is therefore also known as Throttle Body Injection (TBI), Central Fuel Injection (CFI) or single- (or mono-) point injection. The whole system is best explained if considered as three sub-systems, these being fuel delivery, air metering and electrical control.

3 The fuel delivery system incorporates the fuel tank (with the electric fuel pump

immersed inside it), the fuel filter, the fuel injector and pressure regulator (mounted in the throttle body), and the hoses and pipes connecting them. When the ignition is switched on (or when the engine is cranking, on X16 SZ engines) the pump is supplied with voltage, by way of the pump relay and fuse 11, under the control of the Electronic Control Unit (ECU). The pump feeds through the fuel filter to the injector. Fuel pressure is controlled by the pressure regulator, which lifts to allow excess fuel to return to the tank.

4 The air metering system includes the inlet air temperature control system and the air cleaner, but its main components are in the throttle body assembly. This incorporates the injector, which sprays fuel onto the back of the throttle valve, the throttle potentiometer. This is linked to the throttle valve spindle and sends the ECU information on the rate of throttle opening by transmitting a varying voltage. The idle air control stepper motor is controlled by the ECU to maintain the idle speed.

5 The electrical side of the fuel injection system consists of the ECU and all the sensors that provide it with information, plus the actuators by which it controls the whole system's operation. The basic method of operation is as follows; note that the ignition system is controlled by the same ECU.

6 The manifold absolute pressure sensor is connected by a hose to the inlet manifold. Variations in manifold pressure are converted into graduated electrical signals that are used

by the ECU to determine the load on the engine. The throttle valve potentiometer is explained above.

7 Information on engine speed and crankshaft position comes from the distributor on C16 NZ engines and from the crankshaft speed/position sensor on C16 NZ2, X16 SZ and C18 NZ engines.

8 An odometer frequency sensor provides the ECU with information on the vehicle's road speed, and the coolant temperature sensor provides it with the engine temperature. A knock sensor located in the cylinder block between cylinders 2 and 3 on the X16 SZ engine provides additional information to the ECU by detecting pre-ignition (detonation) during the combustion process.

9 All these signals are compared by the ECU with set values pre-programmed (mapped) into its memory. Considering this information, the ECU selects the response appropriate to those values. It controls the ignition amplifier module by varying the ignition timing as required. The fuel injector is controlled by varying its pulse width the time the injector is held open, to provide a richer or weaker mixture, as appropriate. The idle air control stepper motor controls the idle speed. The fuel pump relay controls the fuel delivery and the oxygen sensor, accordingly. The mixture, idle speed and ignition timing are constantly varied by the ECU to provide the best settings for cranking, starting and engine warm-up (with either a hot or cold engine), idling,

cruising and accelerating. The injector earth is also switched off on the overrun to improve fuel economy and reduce exhaust emissions. Additionally, on the X16 SZ engine, the ECU also controls the operation of the charcoal canister purge valve in the evaporative emission control system.

10 The oxygen sensor screwed into the exhaust manifold provides the ECU with a constant feedback signal. This enables it to adjust the mixture (closed-loop control) to provide the best possible conditions for the catalytic converter to operate effectively.

11 Until the oxygen sensor is fully warmed up it gives no feedback so the ECU uses pre-programmed values (open-loop control) to determine the correct injector pulse width. When the sensor reaches its normal operating temperature, its tip (which is sensitive to oxygen) sends the ECU a varying voltage depending on the amount of oxygen in the exhaust gases. If the inlet air/fuel mixture is too rich, the exhaust gases are low in oxygen so the sensor sends a low-voltage signal. The voltage rises as the mixture weakens and the amount of oxygen rises in the exhaust gases. Peak conversion efficiency of all major pollutants occurs if the inlet air/fuel mixture is maintained at the chemically correct ratio for the complete combustion of petrol of 14.7 parts (by weight) of air to 1 part of fuel (the "stoichiometric" ratio). The sensor output voltage alters in a large step at this point, the ECU using the signal change as a reference point and correcting the inlet air/fuel mixture accordingly by altering the fuel injector pulse width.

12 In addition, the ECU senses battery voltage, incorporates diagnostic capabilities, and can both receive and transmit information by way of the diagnostic connector, thus permitting engine diagnosis and tuning by Vauxhall's TECH1, test equipment.

Motronic system

13 The Motronic type is available in several different versions, depending on model. The system is under the overall control of the Motronic engine management system (Chapter 5), which also controls the ignition timing.

14 Fuel is supplied from the rear-mounted fuel tank by an electric fuel pump mounted under the rear of the vehicle, through a pressure regulator, to the fuel rail. The fuel rail acts as a reservoir for the four fuel injectors, which inject fuel into the cylinder inlet tracts, upstream of the inlet valves. On SOHC engines, the fuel injectors receive an electrical pulse once per crankshaft revolution, which operates all four injectors simultaneously. On DOHC engines, sequential fuel injection is used, whereby each injector receives an individual electrical pulse allowing the four injectors to operate independently, which enables finer control of the fuel supply to each cylinder. The duration of the electrical pulse determines the quantity of fuel-injected, and pulse duration is computed by the Motronic module, based on the information received from the various sensors.

15 On SOHC engines, inlet air passes from the air cleaner through a vane type airflow meter, before passing to the cylinder inlet tracts through the throttle valve. A flap in the vane airflow meter is deflected in proportion to the airflow; this deflection is converted into an electrical signal, and passed to the Motronic module. A potentiometer screw located on the airflow meter provides the means of idle mixture adjustment, by altering the reference voltage supplied to the Motronic module.

16 On DOHC engines, inlet air passes from the air cleaner through a hot wire type air mass meter, before passing to the cylinder inlet tracts through a two-stage throttle body assembly. The electrical current required to maintain the temperature of the hot wire in the air mass meter is directly proportional to the mass flow rate of the air trying to cool it. The current is converted into a signal, which is passed to the Motronic module. The throttle body contains two throttle valves that open progressively, allowing high torque at part throttle, and full-throttle, high-speed "breathing" capacity. A potentiometer screw located on the air mass meter provides the means of idle mixture adjustment, by altering the reference voltage supplied to the Motronic module.

17 A throttle position sensor enables the Motronic module to compute the throttle position, and on certain models, its rate of change. Extra fuel can thus be provided for acceleration when the throttle is opened suddenly. Information from the throttle position sensor is also used to cut off the fuel supply on the overrun, thus improving fuel economy and reducing exhaust gas emissions.

18 Idle speed is controlled by a variable-orifice solenoid valve, which regulates the amount of air bypassing the throttle valve. The valve is controlled by the Motronic module; there is no provision for direct adjustment of the idle speed.

19 Additional sensors inform the Motronic module of engine coolant temperature, air temperature, and on models fitted with a catalytic converter, exhaust gas oxygen content.

20 A fuel filter is incorporated in the fuel supply line, to ensure that the fuel supplied to the injectors is clean.

21 A fuel pump cut-off relay is controlled by the Motronic module, which cuts the power to the fuel pump should the engine stop with the ignition switched on, if there is an accident. All 1993-onwards models equipped with Motronic systems, have their fuel pump located inside the fuel tank.

22 The later M2.8 system is basically the same as the earlier M2.5 system apart from the following:

- a) *Hot Film Mass Airflow Meter - The hot wire type unit used previously is replaced on the M2.8 system by a hot film mass airflow meter. The operation is the same*

except that a thin, electrically heated plate rather than a wire is used. The plate is maintained at a constant temperature by electric current as the inlet air mass passing over the plate tries to cool it. The current required to maintain the temperature of the plate is directly proportional to the mass flow rate of the inlet air. The current is converted to a signal that is passed to the Motronic module.

- b) *Inlet Air Temperature Sensor - The sensor is located in the hose between the hot film mass airflow meter and the air cleaner for precise monitoring of inlet air temperature. Signals from the sensor are used in conjunction with other sensors to indicate the occurrence of a hot start condition. The Motronic module then interprets these signals to alter injector duration accordingly.*

- c) *Throttle Valve Potentiometer - On the M2.8 system a throttle valve potentiometer replaces the throttle valve switch used previously.*

Simtec system

23 An increased amount of electronic components are used instead of mechanical parts as sensors and actuators with the Simtec engine management system. This provides more precise operating data as well as greater problem free motoring.

24 The control unit is equipped with electronic ignition control. Called 'Microprocessor Spark Timing System, inductive triggered', (or MST-i), and means that the mechanical high voltage distributor is no longer needed. It is located behind the trim panel, on the right-hand side footwell (door pillar).

25 The ignition coil is replaced by a dual spark ignition coil, which is switched directly by the output stages in the control unit.

26 A camshaft sensor will maintain emergency operation, should the crankshaft inductive pulse pick-up, malfunction. These sense TDC ('Top Dead Centre'), crankshaft angle and engine speed. The signals are used by the control unit to calculate ignition point and for fuel injection.

27 The 'hot film airflow meter' determines the mass of air taken in by the engine. The system uses this information to calculate the correct amount of fuel needed for injection in the engine.

28 The air inlet temperature sensor (NTC), is fitted in the air inlet duct between the air cleaner and the hot mass air flow meter.

29 A controlled canister purge valve is actuated by the system. The tank ventilation is monitored closely with the Lambda control (or oxygen sensor) and adaptation by the computer within the control unit.

30 A knock control system is also fitted. This eliminates the need for octane number adjustment, as it is performed automatically through the control unit.

31 This engine is also fitted with an EGR (exhaust gas recirculation) valve and secondary air injection (AIR - Air Injection Reactor), to conform to the latest European exhaust emission limits (as from 1996). The EGR returns a specific amount of exhaust gas into the combustion process. This in turn reduces the formation of nitrogen oxides (No_x). The secondary air injection system has an electrically driven air pump that injects air into the exhaust manifold, reducing the amount of CO and HC emissions.

2 Fuel injection system - precautions



Warning: Many of the procedures in this sub-Section require the removal of fuel lines and connections that 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.

The fuel injection system is pressurised, therefore extra care must be taken when disconnecting fuel lines. When disconnecting a fuel line union, loosen the union slowly, to avoid a sudden release of pressure that may cause fuel to spray out.

Fuel pressure checking must be entrusted to a Vauxhall dealer, or other specialist, who has the necessary special equipment.

3 System testing - general



General

1 Apart from basic electrical tests, there is nothing that can be done by the owner to test individual fuel system components.



4.11A Remove the securing screw . . .

2 If a fault arises, check first that it is not due to poor maintenance. Check that the air cleaner filter element is clean, the spark plugs are in good condition and correctly gapped. Check also that the engine breather hoses are clear and undamaged and that the throttle cable is correctly adjusted. If the engine is running very roughly, check the compression pressures (Chapter 1) and remember the possibility that one of the hydraulic tappets might be faulty, producing an incorrect valve clearance.

3 If the fault is thought to be due to a dirty injector, it is worth trying one of the established injector-cleaning treatments before renewing, perhaps unnecessarily, the injector.

4 If the fault persists, check the ignition system components (as far as possible).

5 If the fault is still not eliminated, work methodically through the system, checking all fuses, wiring connectors and wiring, looking for any signs of poor connections, dampness, corrosion, dirt or other faults.

6 Once the system components have been checked for signs of obvious faults, take the vehicle to a Vauxhall dealer for the full system to be tested on special equipment.

7 Do not attempt to "test" any component, but particularly the ECU, with anything other than the correct test equipment, available at a Vauxhall dealer. If any of the wires to be checked lead to a component such as the ECU, always first unplug the relevant connector from the system components so that there is no risk of the component being damaged by the application of incorrect voltages from test equipment.

4 Air cleaner - removal and refitting



Note: If 'round type' air filter is fitted, follow procedure in Chapter 4A.

Removal

1 Unclip the coolant expansion tank hose from the air cleaner cover, and move it to one side out of the way.



4.11B . . . and withdraw the resonance box



4.2 Loosening the air trunking clamp screw at the airflow meter

2 Loosen the clamp screw and disconnect the air trunking from the airflow meter (**see illustration**).

3 Disconnect the battery negative lead, then disconnect the wiring plug from the airflow meter.

4 Release the two securing clips from the left-hand side of the air cleaner cover, and unscrew the two captive securing screws from the right-hand side, then lift off the cover.

5 Lift out the filter element.

6 Loosen the preheat hoses, fastening nuts.

7 Undo the nuts securing the 2 rubber block studs which are secured through the lower half of the air cleaner housing.

8 Some models are fitted with an inlet air resonance box, to reduce induction noise. This box is located under the wheel arch, and connects to a pipe on the air inlet tube.

9 The resonance box must be removed before the air inlet tube can be removed. To do this, first apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands placed under the body side members.

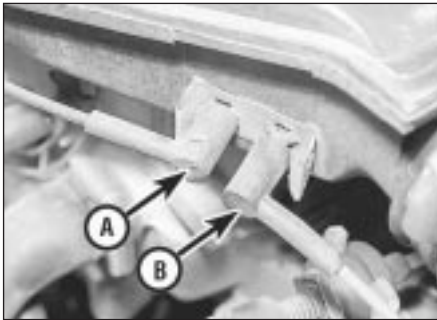
10 Remove the securing screws, and withdraw the lower splash shield from the wing to expose the resonance box.

11 Unscrew the single securing screw, and pull the resonance box from the connector tube (**see illustrations**).

12 If desired, the air inlet tube can be removed after pulling off the connector tube from under the wing (**see illustration**).



4.12 Removing the resonance box connector tube



5.2 Vacuum pipe connections to air box
A To throttle body B To air cleaner

13 Manipulate the air inlet tube to release the securing lugs from the front body panel. This is a tricky operation, and patience will be required. For improved access, the headlamp can be removed, as described in Chapter 12.

Refitting

14 Refitting of all components is a reversal of removal, noting that the air cleaner element fits with the rubber locating flange uppermost.

5 Air box - removal and refitting

Removal

1 The air box, if fitted, is secured by two or three bolts to the top of the throttle body. Take note of the routing and connections of the inlet air temperature control system vacuum pipes.

2 Disconnect the engine breather hose from the air box and the vacuum pipe from the rearmost of the throttle body's three unions (see illustration).

3 Do not lose the sealing ring as the air box is withdrawn.

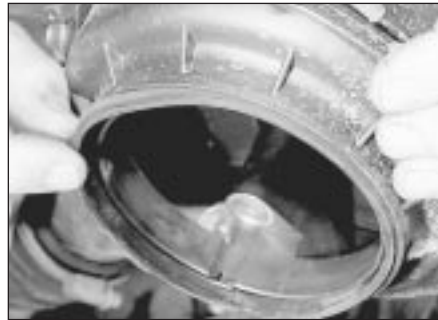
Refitting

4 On refitting, ensure that the sealing ring is seated correctly in the slot in the underside of the air box, tighten the screws, and reconnect the vacuum pipe and breather hose (see illustrations).

6 Air temperature control - description and testing

Description

1 Fitted to models with Multec systems, air temperature is controlled by a thermac switch (thermostat), mounted in the air box. When the engine is started from cold, the switch is closed to allow inlet manifold depression to act on the air temperature control valve in the air cleaner assembly. This uses a vacuum servo in the valve assembly to draw a flap valve across the cold air inlet thus allowing only (warmed) air from the exhaust manifold to enter the air cleaner.



5.4A Ensure the sealing ring is located in the air box groove

2 As the temperature of the exhaust warmed air in the air box rises, a bi-metallic strip in the thermac switch deforms. This opens the switch to shut off the depression in the air temperature control valve. The flap is then lowered gradually across the hot air inlet. Until the engine is fully warmed up to normal operating temperature, only cold air from the front of the vehicle is entering the air cleaner.

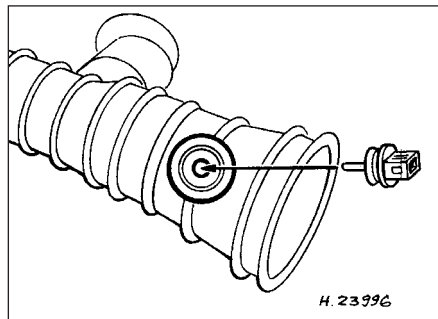
Testing

3 To check the system, allow the engine to cool down completely, then remove the air cleaner cover; the flap valve should be securely seated across the hot air inlet. Start the engine. The flap should immediately rise to close off the cold air inlet. It should then lower steadily as the engine warms until it is eventually seated across the hot air inlet again.

4 To check the thermac switch, disconnect the control valve vacuum pipe from the switch union (on the rear face of the air box) when the engine is running. With the engine cold, full inlet manifold depression should be felt sucking at the union; none at all should be felt when the engine is fully warmed up.

5 To check the air temperature control valve, remove the air cleaner cover; the flap valve should be securely seated across the hot air inlet. Disconnect the control valve vacuum pipe from the switch union on the rear face of the air box and suck hard on its end; the flap should rise to shut off the cold air inlet.

6 If either component is faulty, it must be renewed. This means renewing the air cleaner lower casing to obtain a new air temperature control valve, or renewing the air box in the case of the thermac switch.



7.4 Removing the intake air temperature sensor from the air trunking - later models



5.4B Do not overtighten the air box screws

7 Air temperature sensor (later models) - removal and refitting

Removal

1 Disconnect the battery negative lead.
2 Disconnect the wiring plug at the inlet air temperature sensor.
3 Release the hose clips and remove the air trunking then remove the inlet air temperature sensor from the trunking.

Refitting

4 Refitting is a reversal of removal but ensure that the air trunking is connected to the airflow meter as shown (see illustration).

8 Depressurising the fuel system - general



Warning: The following procedures will merely relieve the pressure in the fuel system. Remember that fuel will still be present in the system components, so take precautions before disconnecting any of them. Refer to Section 2.

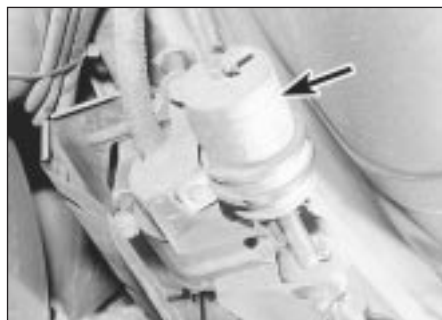
General

1 The fuel system consisting of the tank-mounted fuel pump, the fuel filter, the fuel injector and the pressure regulator in the throttle body. Metal pipes and flexible hoses of the fuel lines connect these components. All these contain fuel that will be under pressure while the engine is running and/or while the ignition is switched on.

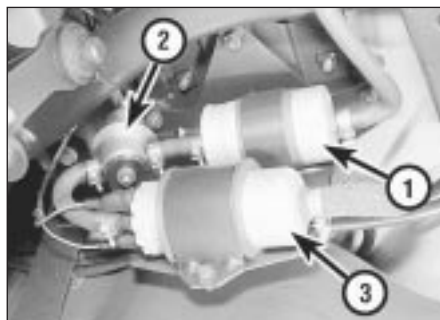
2 The pressure will remain for some time after the ignition has been switched off and must be relieved before any of these components are disturbed.

3 Remove either the fuel pump fuse (number 11) or the fuel pump relay and start the engine. Allow the engine to idle until it cuts out. Turn the engine over once or twice on the starter to ensure that all pressure is released, then switch off the ignition.

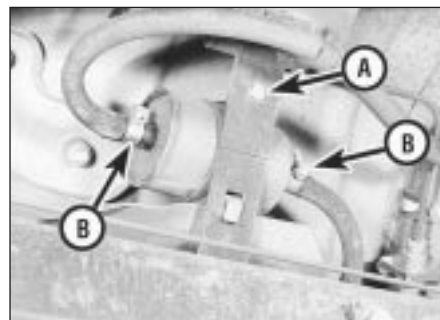
4 Do not forget to refit the fuse or relay when work is complete.



9.1A Fuel filter (arrowed) - 'out of tank', fuel pump models



9.1B Fuel component assembly - 'out of tank', fuel pump models



10.6 Fuel filter - 'in tank', fuel pump type

A Clamp screw

B Hose clips

9 Fuel filter ('Out-of-tank' fuel pump models) - removal and refitting

Note: Refer to Section 2 before proceeding

Removal

1 The fuel filter is located on the fuel pump bracket under the rear of the vehicle. Either on the right-hand side of the spare wheel well or in front of the fuel tank, depending on model (see illustrations).

2 Disconnect the battery negative lead.

3 Have a container to hand, to catch the fuel that will be released as the filter is removed.

4 Clamp the fuel hoses on either side of the filter, to minimise fuel loss when the hoses are disconnected.

5 Loosen the clamp screws, and disconnect the fuel hoses from the filter. Be prepared for fuel spillage, and take adequate fire precautions.

6 Loosen the clamp bolt(s), and withdraw the fuel filter from its bracket. Note the orientation of the flow direction arrow on the body of the filter, and the position of the "AUS" (out) marking on the filter end face.

Refitting

7 Refitting is a reversal of removal, ensuring that the flow direction markings are correctly orientated.

8 Run the engine and check for leaks on completion. If leakage is evident, stop the engine immediately, and rectify the problem without delay.

10 Fuel filter ('In-tank' fuel pump models) - removal and refitting

Note: Refer to Section 2 before proceeding

Removal

1 Depressurise the fuel system (Section 8).

2 Chock the front wheels, jack up the rear of the vehicle and support it on axle stands placed under the body side members. (see "Jacking and Vehicle Support"). The fuel filter is located at the rear of the fuel tank, on the right-hand side.

1 Fuel filter

2 Fuel flow damper

3 Fuel pump

3 Unclip the fuel hose from the filter mounting bracket.

4 Note carefully any markings on the fuel filter casing. There should be at least an arrow (showing the direction of fuel flow) pointing in the direction of the fuel supply hose leading to the engine compartment. There may also be the words "EIN" (in) and "AUS" (out) embossed in the appropriate end of the casing.

5 Clamp the fuel filter hoses, then slacken the clips and disconnect the hoses.

6 Undo the single screw to release the mounting bracket, then open the clamp with a screwdriver to remove the fuel filter (see illustration).

Refitting

7 Fit the new fuel filter using a reversal of the removal procedure, but ensure that the fuel flow direction arrow or markings point in the correct direction. Switch on the ignition and check carefully for leaks; if any signs of leakage are detected, the problem must be rectified before the engine is started.

11 Fuel pump - testing

Testing

1 If the fuel pump is functioning, it should be possible to hear it "buzzing" by listening under the rear of the vehicle when the ignition is switched on. Unless the engine is started, the fuel pump should switch off after approximately one second. If the noise produced is excessive, this may be due to a faulty fuel flow damper. The damper can be renewed referring to Section 18, if necessary.

2 If the pump appears to have failed completely, check the appropriate fuse and relay.

3 To test the fuel pump, special equipment is required, and it is recommended that any suspected faults are referred to a Vauxhall dealer.

12 Fuel pump ('Out-of-tank' fuel pump models) - removal and refitting

Note: Refer to Section 2 before proceeding

Removal

1 The fuel pump is located on a bracket under the rear of the vehicle, either on the right-hand side of the spare wheel well or in front of the fuel tank on other models.

2 Disconnect the battery negative lead.

3 Have a container to hand, to catch the fuel that will be released as the damper is removed.

4 Disconnect the wiring plug(s) from the fuel pump (see illustration).

5 Clamp the fuel hoses on either side of the damper, to minimise fuel loss when the hoses are disconnected.

6 Loosen the clamp screws, and disconnect the fuel hoses from the pump. Be prepared for fuel spillage, and take adequate fire precautions.

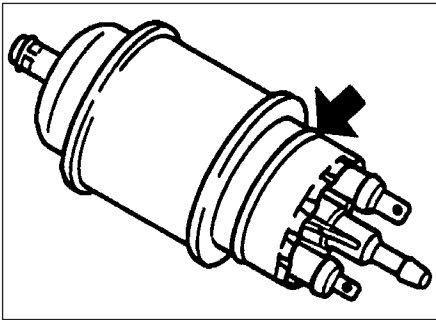
7 Loosen the clamp bolt, and slide the pump from its bracket.

Refitting

8 Refitting is a reversal of removal, ensuring that the pump is fitted the correct way round in its bracket. Push the pump into the rubber clamping sleeve as far as the rim on the pump body (see illustration).



12.4 Disconnecting a fuel pump wiring plug - 'out of tank', fuel pump model



12.8 Fuel pump clamping sleeve should rest against rim (arrowed)

9 Run the engine and check for leaks on completion. If leakage is evident, stop the engine immediately, and rectify the problem without delay.

13 Fuel pump ('In-tank' fuel pump models) - removal and refitting



Removal

1 Depressurise the fuel system (Section 8), then remove and refit the fuel filler cap to ensure that the pressure is equalised inside and outside the tank.

2 Disconnect the battery negative terminal.

3 Fold forwards the rear seat cushion. Peel back the floor covering beneath it, then remove the cover plug from the vehicle floor to reach the pump mountings (see illustration).

4 Noting exactly how it is connected, and making your own marks or notes to ensure that it can be reconnected the same way round, disconnect the wiring plug from the pump.

5 Release the securing clip and disconnect the fuel hose from the pump. Clamp or plug the hose to prevent the loss of fuel and the entry of dirt.

6 Undo the pump mounting bracket screws, then withdraw the mounting bracket and pump assembly from the tank. Note the position of the sealing ring and discard it, then cover the tank opening as a safety measure and to prevent the entry of dirt.

7 If the pump is to be renewed, first move it to a clean working area and carry out the following.

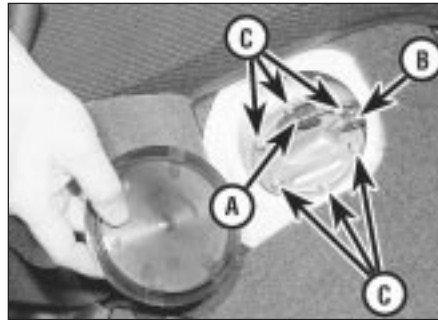
8 Prise off the filter at the base of the pump assembly, then release the securing clamp and disconnect the mounting bracket-to-pump fuel hose.

9 Making your own marks or notes to ensure that they can be reconnected the same way round, unsolder the wires connecting the pump to the mounting bracket.

10 Press the pump out of the rubber sleeve.

Refitting

11 Reassembly and refitting are the reverse of the removal and dismantling procedures, noting the following points.



13.3 Fuel pump - 'in-tank', fuel pump model

A Wiring connector C Mounting bracket screws
B Fuel hose clamp

- Ensure that the pump is seated correctly in the sleeve and that the hose is securely fastened.
- Ensure that the wires are correctly reconnected and securely soldered.
- Always renew the pump mounting bracket's sealing ring.
- Apply a few drops of sealing compound (i.e. Vauxhall part no. 90485251) to the threads of the screws, then tighten them securely, but take care not to distort the sealing ring.

14 Fuel pump relay - renewal



The relay is mounted in the engine compartment relay box (Chapter 12). Where more than one relay is fitted, the fuel pump relay is the one with the black base.

15 Fuel tank filler pipe - removal and refitting



Removal

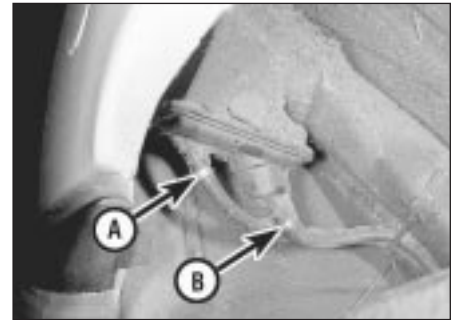
1 Syphon out any remaining fuel in the tank into a clean container that is designed for carrying petrol and is clearly marked as such.

2 Raise the bottom edge of the seal surrounding the filler neck and undo the single securing screw beneath.

3 Chock the front wheels, jack up the rear of the vehicle and support it securely on axle stands (see "Jacking and Vehicle Support") placed under the body side members.

4 Unscrew the single filler pipe mounting bolt from the underbody, then work along the length of the pipe, cutting or releasing any clips or ties securing other pipes or hoses to it. Releasing their clips, disconnect the filler and vent hoses from the pipe's lower end and the small-bore vent hoses from the unions at its upper end.

5 Having ensured that all components have been removed or disconnected which might



15.7 Vent hose connections at fuel tank filler pipe

A Charcoal canister hose
B Tank vent hose

prevent its removal, manoeuvre the pipe away from the vehicle's underside.

6 To check the operation of the pipe's anti-leak valve, invert the filler pipe and fill the lower union (now uppermost) with petrol. If the valve is functioning correctly, no petrol will leak from the other union. If petrol leaks from the other union the valve is faulty and the complete filler pipe must be renewed.

Refitting

7 Refitting is the reverse of the removal procedure, noting the following.

- Check the condition of all hoses and clips, renewing any components that are found to be worn or damaged
- When reconnecting the small-bore vent hoses to the unions at the pipe's upper end, connect the hose from the charcoal canister to the uppermost union and the vent hose from the tank itself to the lower union (see illustration).
- Replacing any that were cut on removal use the clips or ties provided to secure any other pipes or hoses to the filler pipe.
- Check carefully for signs of leaks on refilling the tank; if any signs of leakage are detected, the problem must be rectified immediately.

16 Fuel tank - removal and refitting



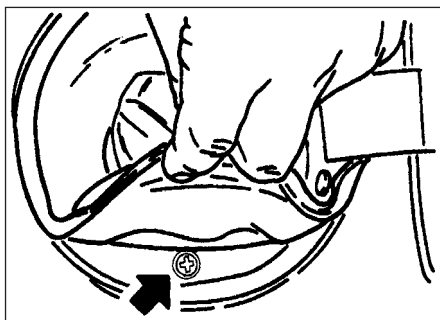
Note: Refer to Section 2 before proceeding

Removal

SOHC models

1 The procedure is similar as for models with carburettors. Refer to Chapter 4A, however note the following:

- Depressurise the fuel system (Section 8).
- On models with C16 NZ and X16 SZ engines, disconnect the exhaust system from the manifold.
- When working on the fuel tank sender unit, note that there is only one hose to be disconnected.

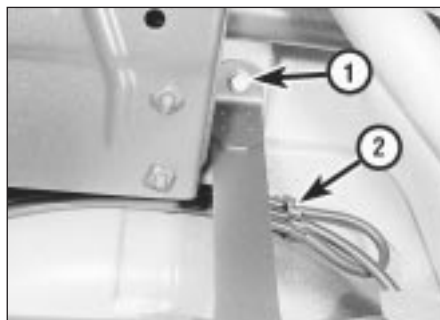


16.5 Fuel filler pipe securing screw (arrowed) - models with semi-trailing arm rear axles

- d) Disconnect the fuel pump hose and wiring as described in Section 12.
- e) When releasing the tank mounting straps, note that the fuel filter must either be moved aside or removed completely, whichever is most convenient
- f) One of the fuel hoses connects to a pipe in the side of the tank.

DOHC models

- 2 Disconnect the battery negative lead.
- 3 Siphon out any remaining fuel in the tank through the filler pipe. Siphon the fuel into a clean metal container that can be sealed.
- 4 Chock the front wheels, then jack up the rear of the vehicle, and support on axle stands placed under the body side members (see "Jacking and Vehicle Support").
- 5 Open the fuel filler flap, then pull back the rubber seal to expose the fuel filler pipe securing screw (see illustration). Remove the screw.
- 6 Release the fuel tank vent hoses from the clips on the underbody.
- 7 Support the weight of the fuel tank on a jack, with an interposed block of wood.
- 8 Unscrew the securing bolts from the tank mounting straps. Then remove the straps and lower the tank sufficiently to enable the fuel hoses, vent hoses and fuel tank sender unit wiring to be disconnected (see illustration).
- 9 Disconnect the vent hoses and the fuel tank sender unit wiring. Note the positions of the vent hoses as an aid to refitting.
- 10 Disconnect the fuel hoses from the tank and the fuel tank sender unit, making a note of the hose positions for use when refitting. Be prepared for fuel spillage, and take adequate fire precautions. Plug the open ends of the hoses, to prevent dirt ingress and further fuel loss.
- 11 Lower the fuel tank, and withdraw it from under the vehicle.
- 12 If the tank contains sediment or water, it may be cleaned out using two or three rinses with clean fuel. Shake vigorously using several changes of fuel, but before doing so, remove the fuel tank sender unit, as described in Section 17. This procedure should be carried out in a well-ventilated area, and it is vital to take adequate fire precautions - refer to the "Safety first!" Section at the beginning of this manual for further details.



16.8 Fuel tank mounting - models with semi-trailing arm rear axles

1 Strap securing bolt 2 Vent hose securing

Refitting

- 13 Any repairs to the fuel tank should be carried out by a professional.
- 14 Refitting is a reversal of removal, ensuring that all hoses are reconnected to their correct locations as noted during removal.
- 15 On completion, fill the fuel tank, then run the engine and check for leaks. If leakage is evident, stop the engine immediately, and rectify the problem without delay.

17 Fuel tank sender unit - removal and refitting

Note: Refer to Section 2 before proceeding

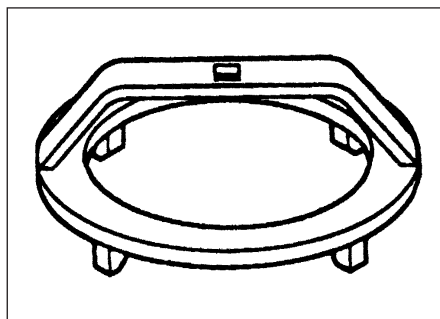
Removal

SOHC models

- 1 Remove the fuel tank, (refer to Section 16), if necessary. Note that there is only one hose connected to the sender unit. This must also be disconnected from the union on the inside of the unit before it can be withdrawn completely from the tank (see illustration).

DOHC models

- 2 Remove the fuel tank, as described in Section 16.
- 3 Make alignment marks on the sender unit and the fuel tank so that the sender unit can be refitted in its original position.
- 4 To remove the sender unit, an improvised tool must be used which engages with the



17.4 Vauxhall special tool KM-673 for removing fuel level sender units



17.1 Fuel level sender unit - models with semi-independent rear axles

cut-outs in the sender unit retaining ring. The Vauxhall special tool KM-673 for this purpose is shown (see illustration).

- 5 Withdraw the unit carefully, to avoid bending the float arm.

- 6 Recover the sealing ring.

Refitting

- 7 Refitting is a reversal of removal, remembering the following points.
- 8 Renew the sealing ring.
- 9 Ensure that the marks made on sender unit and fuel tank before removal are aligned.
- 10 Refit the fuel tank, (Section 16).

18 Fuel flow damper - removal and refitting

Note: Refer to Section 2 before proceeding

Removal

- 1 The fuel flow damper is located on the fuel pump bracket under the rear of the vehicle, on the right-hand side of the spare wheel well or in front of the fuel tank, depending on model (see illustration). The damper is positioned in the fuel feed line between the fuel pump and the fuel filter, and its purpose is to reduce pressure fluctuations in the fuel return line, thus reducing noise levels.

- 2 Disconnect the battery negative lead.
- 3 Have a container to hand, to catch the fuel that will be released as the damper is removed.



18.1 Fuel flow damper - models with semi-trailing arm rear axles

4 Clamp the fuel hoses on either side of the damper, to minimise fuel loss when the hoses are disconnected.

5 Loosen the clamp screws, and disconnect the fuel hoses from the damper. Be prepared for fuel spillage, and take adequate fire precautions.

6 Unscrew the securing nut, and withdraw the damper from the bracket.

Refitting

7 Refitting is a reversal of removal.

8 Run the engine and check for leaks on completion. If leakage is evident; stop the engine immediately, and rectify the problem without delay.

19 Throttle cable - removal, refitting and adjustment



Removal

1 This procedure is basically the same as described in Chapter 4A, but note the following.

2 Not all models are fitted with an air box. Ignore references to it, if not applicable.

3 For "carburettor" substitute "throttle body", and note that the cable bracket is bolted to the inlet manifold.

4 The throttle cable end may connect to a balljoint on the throttle valve lever, which is retained by a clip (**see illustration**).

5 If fitted, remove the air box. Refer to Section 5, if necessary.

6 Where fitted, use a pair of needle-nosed pliers to extract the wire spring clip securing the cable end balljoint to the throttle linkage. Prise the cable end off the linkage.

7 Withdraw the clip and pull the cable outer seating grommet out of the cable bracket, then release the cable as far as the bulkhead (**see illustration**).

8 Working inside the passenger compartment, remove the driver's footwell trim panel, refer to Chapter 11, if necessary.

9 Release the end of the cable's inner wire from the "keyhole" fitting at the top of the throttle pedal by easing back the spring and prising the cable end out of the slot.



19.4 Disconnecting the throttle cable end from the throttle valve lever - SOHC model

10 Prise the grommet out of the bulkhead and tie a length of string to the cable.

11 Noting carefully its routing, withdraw the cable through the bulkhead into the engine compartment; untie the string, leaving it in place, when the pedal end of the cable appears.

Refitting

12 Refitting is the reverse of the removal procedure, noting the following points.

a) *First ensure that the cable is correctly routed, then draw it through the bulkhead aperture using the string.*

b) *Ensure that the bulkhead grommet is correctly seated.*

c) *Connect the cable end to the throttle linkage. Seat the cable outer grommet in the bracket and pull it through so that the cable inner wire is just taut when the throttle linkage is held fully closed. Fit the clip to secure the cable outer in that position.*

d) *Check the throttle operation and cable adjustment, as described below.*

Adjustment

13 Refer to Chapter 4A, but for "carburettor" substitute "throttle body". If applicable, the air box must be removed.

14 First check that the pedal is at a convenient height for the driver. This setting can be adjusted by turning the pedal stop screw (it will be necessary to remove the footwell trim panel to reach the screw). Remember that the pedal must be left with enough travel for the throttle valve to open fully. Also check that the pedal pivot bushes are in good condition.

15 Returning to the engine compartment, check that the linkage pivots and balljoints are unworn and operate smoothly throughout their full travel. When the throttle valve is fully closed and the throttle pedal is released, there should be hardly any free play in the cable inner wire.

16 If adjustment is required, extract the clip securing the cable outer seating grommet in the cable bracket and replace it in the appropriate groove, so that the cable outer is repositioned correctly.



19.7 Throttle cable end grommet in bracket on inlet manifold

17 With an assistant operating the throttle pedal from the driver's seat. Check that when the pedal is fully depressed, the throttle valve is fully open. If there is insufficient pedal travel to permit this, unscrew the pedal stop screw, then reset the cable at the throttle linkage.

18 When cable adjustment is correct, refit all disturbed components.

20 Idle mixture - checking and adjustment



Note: No adjustment of idle mixture is possible on models fitted with a catalytic converter, and no adjustment of idle speed is possible with the Motronic system. Refer to Section 2 before proceeding. A tachometer and an exhaust gas analyser (CO meter) will be required to carry out adjustment on models fitted with Motronic systems.

Multec systems

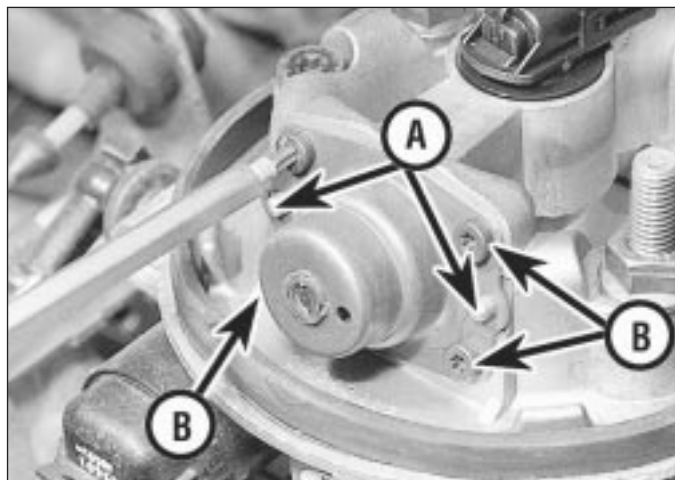
Checking

1 If the CO level reading is incorrect (or if any other symptom is encountered which causes you to suspect a fault) always check first that the air cleaner element is clean. Check also that the spark plugs are in good condition and correctly gapped. Ensure that the engine breather and vacuum hoses are clear and undamaged. Check that there are no leaks in the air inlet trunking. Check the throttle body and the manifolds for damage. Ensure that the throttle cable is correctly adjusted (see Section 19). If the engine is running very roughly, check the compression pressures (Chapter 2A) and remember the possibility that one of the hydraulic tappets might be faulty, producing an incorrect valve clearance. Check also that all wiring is in good condition, with securely fastened connectors. Check that the fuel filter has been renewed at the recommended intervals and that the exhaust system is entirely free of air leaks which might upset the operation of the catalytic converter, if fitted.

Adjustment

2 The idle mixture is controlled entirely by the ECU and there is no provision at all for any form of adjustment. Furthermore, accurate checking is not possible without the use of Vauxhall test equipment in conjunction with a good-quality, carefully calibrated exhaust gas analyser.

3 While it may be possible for owners with access to such analysers to check the mixture, the results should be regarded as no more than a rough guide. If the mixture is thought to be incorrect, the vehicle should be taken to a Vauxhall dealer for checking. If the CO level exceeds the specified value the system must be checked thoroughly by an experienced mechanic using the Vauxhall test equipment until the fault is eliminated and the defective component renewed.



21.9 Fuel pressure regulator cover
A Locating dowels B Mounting screws



21.17 Fuel pressure regulator (arrowed) - DOHC model

4 Where applicable, the only test of the catalytic converter's efficiency is to check the level of CO in the exhaust gas. This is measured at the tailpipe with the engine running (with no load) at 3000 rpm. If the CO level exceeds the specified value, the Vauxhall test equipment must be used to check the entire fuel injection/ignition system. If the engine is mechanically sound, once the system has been eliminated, the fault must lie in the converter, which must be renewed.

Motronic systems

Checking

5 In order to check the idle mixture adjustment, the following conditions must be met:

- The engine must be at normal operating temperature
- All electrical consumers (cooling fan, heater blower, headlamps etc.) must be switched off
- The spark plug gaps must be correctly adjusted see Chapter 1
- The throttle cable free play must be correctly adjusted - see Section 19
- The air inlet trunking must be free from leaks, and the air filter must be clean

Adjustment

6 Connect a tachometer and an exhaust gas analyser to the vehicle in accordance with the equipment manufacturer's instructions.

7 Start the engine and turn it at 2000 rpm for approximately 30 seconds, then allow it to idle. Check that the idle speed is within the specified limits. No adjustment of idle speed is possible, and if outside the specified limits, the problem should be referred to a dealer.

8 With the idle speed correct, check the CO level in the exhaust gas. If it is outside the specified limits, adjust by means of the idle mixture adjustment screw in the airflow meter or air mass meter, as applicable. In production, the screw is covered by a tamperproof plug; ensure that no local or national laws are being broken before removing the plug.

9 If the cooling fan cuts in during the adjustment procedure, stop the adjustments, and proceed when the cooling fan stops.

10 When the idle mixture is correctly set, stop the engine and disconnect the test equipment.

Simtec systems

11 Adjustment is not possible on these models.

21 Fuel pressure regulator - removal and refitting



Note: Refer to Section 2 before proceeding

Removal

SOHC models (except Multec systems)

1 Disconnect the battery negative lead.
2 For improved access, remove the idle speed adjuster as described in Section 22. Disconnect the wiring harness housing from the fuel injectors and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the harness housing from the injectors.

3 Position a wad of rag beneath the pressure regulator, to absorb the fuel that will be released as the regulator is removed.

4 Loosen the clamp screws and disconnect the fuel hoses from the regulator. Be prepared for fuel spillage, and take adequate fire precautions.

5 Disconnect the vacuum pipe from the top of the pressure regulator and withdraw the regulator.

SOHC models (with Multec system)

6 Depressurise the fuel system, as described in Section 8.

7 Remove the air box. Refer to Section 5, if necessary.

8 Disconnect the battery earth lead.

9 Noting the dowels locating the cover, carefully unscrew the fuel pressure regulator cover Torx-type screws (size TX 15). Ensure that the spring does not fly out as the cover is released. Remove the cover spring seat, spring and diaphragm, noting how each is fitted (see illustration).

10 The diaphragm must be renewed whenever the cover is disturbed. If any of the regulator's other components are worn or damaged, they can be renewed only as part of the throttle body upper section assembly.

DOHC models

11 Disconnect the battery negative lead.

12 Disconnect the wiring plug from the air mass meter. Recover the sealing ring.

13 Loosen the clamp screw securing the air trunking to the right-hand end of the air mass meter.

14 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body and disconnect the hose from the base of the air box, then withdraw the air box/air mass meter assembly.

15 Disconnect the two breather hoses from the rear of the camshaft cover, and move them to one side.

16 Disconnect the wiring plug from the throttle position sensor.

17 Disconnect the vacuum pipe from the top of the pressure regulator (see illustration).

18 Position a wad of rag beneath the regulator, to absorb the fuel that will be released as the regulator is removed.

19 Using a spanner or socket, and working underneath the regulator, unscrew the four Torx type securing bolts, then withdraw the regulator. Be prepared for fuel spillage, and take adequate fire precautions.

Refitting

20 Refitting is a reversal of removal, ensuring that all wires, pipes and hoses are correctly reconnected. Note that on DOHC models, the



22.2 Disconnecting the idle speed adjuster wiring plug - SOHC models (except with Multec systems)

regulator vacuum pipe should be routed over the top of the camshaft cover breather hoses.

21 On models with the Multec system note also the following:

- Fit the new diaphragm so that it locates in the throttle body groove.
- Ensure that the spring and spring seat are correctly engaged with each other and with the diaphragm and regulator cover. Then press the cover over its locating dowels and hold it in place while the screws are tightened.
- Tighten the screws carefully to the specified torque wrench setting.

22 On completion, check the regulator for leaks, pressurising the system by switching the ignition on and off several times, before the engine is started.

22 Idle speed adjuster - removal and refitting



Note: Idle speed adjustment on models fitted with Multec systems, is not possible, as it is controlled by the ECU. Refer to Section 1.

Removal

SOHC models (except Multec system)

- Disconnect the battery negative lead.
- Disconnect the wiring plug from the idle speed adjuster (**see illustration**).
- The adjuster can be removed complete with its connecting hoses, or separately, leaving the hoses in place.



23.2 Disconnecting the throttle position sensor wiring plug - early SOHC models



22.4 Withdrawing the idle speed adjuster complete with hoses - SOHC model (except with Multec systems)

- Loosen the relevant clamp screws, then disconnect the hoses, and withdraw the idle speed adjuster (**see illustration**).

DOHC models

- Disconnect the battery negative lead.
- Loosen the clamp screw, and disconnect the hose from underneath the air box on the throttle body. Remove the clamp from the hose.
- Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (**see "Jacking and Vehicle Support"**) placed under the body side members.
- Remove the engine undershield, as described in Chapter 11.
- Working underneath the vehicle, disconnect the wiring plug from the idle speed adjuster, which is located underneath the inlet manifold above the starter motor (**see illustration**).
- Loosen the clamp screw and disconnect the remaining idle speed adjuster hose from the inlet manifold, then withdraw the adjuster downwards complete with the hoses.
- If the hoses are to be removed from the adjuster, mark their locations before removal so that they can be correctly reconnected. Once the adjuster has been refitted, it is impossible to swap the hose positions.

Refitting

- Refitting is a reversal of removal. On DOHC models ensure that the idle speed adjuster rests horizontally, with the wiring routed over the top of the coolant hose. If the



23.3 Removing a throttle position sensor securing screw - SOHC early model



22.9 Idle speed adjuster (arrowed) viewed from underneath vehicle - DOHC model

wiring is routed under the coolant hose, this may cause the idle speed adjuster to be bent downwards, resulting in a restriction or fracture in the air hose to the inlet manifold.

23 Throttle position sensor - removal and refitting



Removal

SOHC models

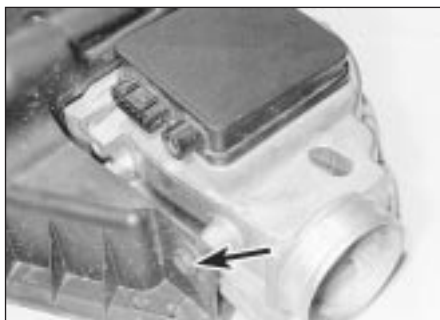
- Disconnect the battery negative lead.
- Disconnect the wiring plug from the throttle position sensor (**see illustration**).
- Remove the two securing screws and withdraw the sensor from the throttle body (**see illustration**).

DOHC models

- Disconnect the battery negative lead.
- Disconnect the wiring plug from the air mass meter. Recover the sealing ring.
- Loosen the clamp screw securing the air trunking to the right-hand end of the air mass meter.
- Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body, and disconnect the hose from the base of the air box, then withdraw the air box/air mass meter assembly.
- Disconnect the wiring plug from the throttle position sensor wiring plug (**see illustration**).



23.8 Disconnecting the throttle position sensor wiring plug - DOHC model



25.2 Airflow meter securing bolt (arrowed) - SOHC model

9 Remove the two securing screws and withdraw the sensor from the throttle body.

Refitting

10 Refitting is a reversal of removal.

11 On Motronic M4.1 system models, before tightening the securing screws, adjust the position of the sensor as follows:

- Turn the sensor body anti-clockwise until resistance is felt, then tighten the securing screws.
- When the throttle valve is opened, an audible click should be noticeable from the sensor, and similarly, this should be repeated as the throttle valve is closed.
- If necessary, adjust the position of the sensor until a click is heard just as the throttle valve begins to open.

12 On M 1.5 systems, no adjustment is required when refitting, as the sensor can only be fitted in one position.

24 Throttle valve potentiometer - removal and refitting



Removal

- Disconnect the battery negative lead.
- Disconnect the wiring plugs at the inlet air temperature sensor and at the hot film mass airflow meter.
- Undo and remove the bolts securing the air box to the throttle body. Remove the air box complete with air trunking.



26.2 Recover the sealing ring from the air mass meter wiring plug - DOHC model



25.3 Airflow meter securing bolts and reinforcing plates, and air funnel

4 Disconnect the wiring plug at the throttle valve potentiometer, then undo the two screws and withdraw the potentiometer from the throttle body.

Refitting

5 Refitting is a reversal of removal.

25 Airflow meter (if fitted) - removal and refitting



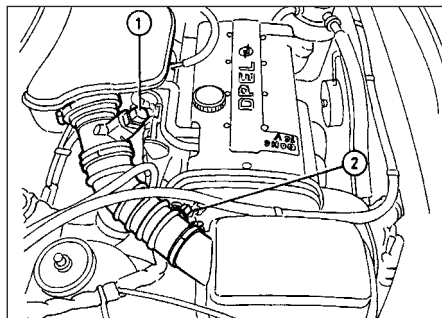
Note: If the air funnel is removed, a new gasket must be used on refitting. The airflow meter securing bolts must be coated with thread-locking compound on refitting.

Removal

- Remove the air cleaner assembly, as described in Section 4.
- Unscrew the single bolt securing the airflow meter to the front of the air cleaner cover (see illustration).
- Unscrew the four securing bolts from inside the air cleaner cover, recover the two reinforcing plates, and withdraw the airflow meter (see illustration).
- If desired, the air funnel can be unclipped from inside the air cleaner cover.

Refitting

- Refitting is a reversal of removal, remembering the following points.
- If the air funnel has been removed, refit it using a new gasket.



27.5A Hot film mass airflow meter attachments - Motronic M2.8

- Hot film mass airflow meter wiring plug
- Inlet air temperature sensor wiring plug

7 Coat the threads of the four airflow meter securing bolts that fit inside the air cleaner cover with thread-locking compound.

26 Air mass meter (if fitted) - removal and refitting



Removal

- Disconnect the battery negative lead.
- Disconnect the wiring plug from the air mass meter. Recover the sealing ring (see illustration).
- Loosen the clamp screws from the air trunking on either side of the air mass meter, then disconnect the air trunking and withdraw the meter.

Refitting

4 Refitting is a reversal of removal, but inspect the air mass meter wiring plug sealing ring and renew if necessary.

27 Hot film mass airflow meter - removal and refitting

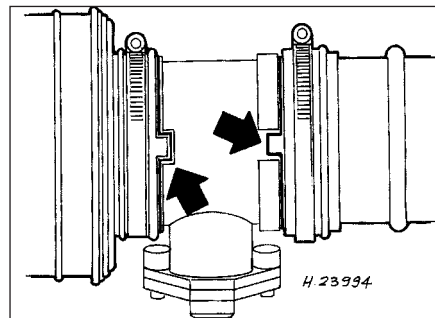


Removal

- Disconnect the battery negative lead.
- Disconnect the wiring plug at the hot film mass airflow meter and at the inlet air temperature sensor.
- Remove the upper part of the air cleaner together with the inlet air trunking and air flow meter.
- Release the hose clamps and separate the airflow meter from the inlet air trunking, noting the position of the trunking with the air flow meter. If there is any external damage replace the unit.

Refitting

5 Refitting is a reversal of removal but ensure that the air trunking is connected to the airflow meter as shown (see illustration). Also ensure that the marks on the air trunking and air box are aligned as shown (see illustration).



27.5B Correct attachment of air trunking to hot film mass airflow meter - Motronic M2.8

Arrows indicate air trunking to airflow meter alignment notches



28.6A Remove the outer . . .



28.6B . . . and inner fuel rail securing bolts . . .



28.6C . . . and lift the fuel rail from the inlet manifold (inlet manifold removed for clarity) - SOHC model

28 Fuel injectors (except Multec system) - removal and refitting



Note: Refer to Section 2 before proceeding. New O-rings must be used when refitting the injectors. Where applicable, a tachometer and an exhaust gas analyser will be required to check the idle mixture on completion

Removal

SOHC models

- 1 Disconnect the battery negative lead.
- 2 Unscrew the union nut, and disconnect the brake servo vacuum hose from the inlet manifold.
- 3 Remove the idle speed adjuster, complete with hoses, referring to Section 22 if necessary.



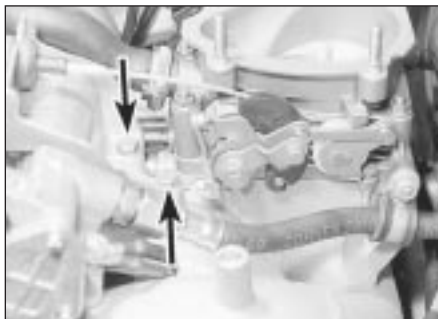
28.7A Withdraw the securing clip . . .



28.7B . . . then pull the injector from the fuel rail - SOHC model



28.9 Fit new seals to the injectors



28.22 Throttle cable bracket securing bolts (arrowed) - DOHC model

- 4 Disconnect the vacuum pipe from the top of the fuel pressure regulator.

- 5 Disconnect the wiring harness housing from the fuel injectors, and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the harness housing from the injectors.

- 6 Remove the four bolts from the brackets securing the fuel rail to the inlet manifold, then lift the fuel rail complete with fuel injectors sufficiently to enable the injector(s) to be removed (see illustrations). Take care not to strain the fuel hoses.

- 7 To remove an injector from the fuel rail, prise out the metal securing clip using a screwdriver, then pull the injector from the fuel rail (see illustrations).

Refitting

- 8 Overhaul of the fuel injectors is not

possible, as no spares are available. If faulty, an injector must be renewed.

- 9 Begin refitting by fitting new seals to both ends of each fuel injector (see illustration). Even if only one injector has been removed, new seals should be fitted to all four injectors.

- 10 Refitting is a reversal of removal, ensuring that all hoses, pipes and wires are correctly reconnected.

- 11 On completion, where applicable, check and if necessary adjust the idle mixture, as described in Section 20.

DOHC models

Removal

- 12 Disconnect the battery negative lead.

- 13 Loosen the clamp screw securing the air trunking to the left-hand end of the air mass meter.

- 14 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body, and disconnect the hose from the base of the air box, then withdraw the air box.

- 15 Position a wad of rag beneath one of the fuel hose unions on the fuel rail, to absorb the fuel that will be released as the union is disconnected.

- 16 Slowly loosen the fuel hose union to relieve the pressure in the fuel line, then disconnect the hose from the fuel rail. Be prepared for fuel spillage, and take adequate fire precautions. Plug the end of the fuel hose, to prevent dirt ingress and further fuel leakage.

- 17 Repeat paragraphs 15 and 16 for the remaining fuel hose-to-fuel rail union.

- 18 Disconnect the two breather hoses from the rear of the camshaft cover. Disconnect the larger hose from the throttle body, and remove the hose completely.

- 19 Disconnect the vacuum pipe from the top of the fuel pressure regulator.

- 20 Disconnect the wiring plug from the air mass meter. Recover the sealing ring.

- 21 Disconnect the wiring plug from the throttle position sensor.

- 22 Slide the end of the throttle cable from the throttle valve lever on the throttle body, then unbolt the cable bracket from the inlet manifold, and move it to one side (see illustration).



28.24 Earth leads secured to fuel rail stud (arrowed) - DOHC model

23 Disconnect the wiring harness housing from the fuel injectors, and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the housing from the injectors.

24 Unscrew and remove the two fuel rail securing nuts, and withdraw the fuel rail complete with fuel injectors from the inlet manifold. Note the position of the earth leads on the fuel rail securing studs (**see illustration**).

25 To remove an injector from the fuel rail, prise out the metal securing clip using a screwdriver, then pull the injector from the fuel rail

Refitting

26 Refitting is as described in paragraphs 8 to 11 inclusive.

29 Fuel injector (Multec system) - removal and refitting



Removal

1 Depressurise the fuel system (see Section 8).

2 Remove the air box (see Section 5).

3 Disconnect the battery earth lead.

4 Disconnect the wiring plug from the fuel injector (**see illustration**).

5 Undo the Torx-type screw (size TX 20) securing the fuel injector retainer to the top of



29.6 Renew injector sealing rings (arrowed)



29.4 Disconnecting the fuel injector wiring plug - Multec systems

the throttle body, remove the retainer and lift out the injector (**see illustration**). Remove and discard the injector sealing rings.

Refitting

6 Refitting is the reverse of the removal procedure, noting the following points.

- Always renew both sealing rings; apply a smear of grease to each to ease injector refitting (**see illustration**).*
- Refit the injector so that its wiring terminals point to the rear of the vehicle; locate the edge of the retainer securely in the groove at the top of the injector.*
- Apply a few drops of a thread-locking compound to the screw threads, then tighten it carefully to the specified torque wrench setting.*
- Switch on the ignition and check carefully for signs of fuel leaks; if any signs of leakage are detected, the problem must be rectified before the engine is started.*

30 Fuel injector (Multec system) - testing



1 A simple test of the injector's windings is possible for those who have a multi-meter of sufficient sensitivity. First disconnect the injector wiring plug as described in Section 29, then connect the meter (set to the appropriate resistance scale) across the injector's terminals and note the reading obtained.

2 On C18 NZ engines, the reading should be within the specified tolerance; similar results can be expected on C16NZ, C16NZ2, and X16 SZ engines.

3 If the reading differs significantly from the specified value, indicating either shorted or open circuit windings, the injector must be renewed.

4 Note that this is only a test of the injector's electrical condition; it does not test its spray pattern or performance. If the injector is thought to be faulty it is always worth trying a well known injector-cleaning treatment. If this fails, the vehicle must be taken to a Vauxhall dealer for full testing on the special test equipment.



29.5 Unscrewing the injector retainer Torx screw

31 Throttle body (except Multec system) - removal and refitting



Note: Refer to Section 2 before proceeding. A new throttle body gasket must be used on refitting

SOHC

Removal

- Disconnect the battery negative lead.
- Loosen the clamp screws securing the air trunking to the throttle body and the airflow meter, then withdraw the air trunking.
- Loosen the clamp screw, and disconnect the idle speed adjuster hose from the throttle body.
- Disconnect the camshaft cover breather hose from the throttle body.
- Disconnect the coolant hoses from the throttle body. Be prepared for coolant spillage, and clamp or plug the open ends of the hoses, to prevent further coolant loss.
- Disconnect the wiring plug from the throttle position sensor.
- Release the securing clip, then disconnect the throttle cable end balljoint from the throttle valve lever.
- Slide the throttle cable grommet from the bracket on the inlet manifold, then unhook the throttle return spring from the bracket (**see illustration**).
- Make a final check to ensure that all relevant hoses and wires have been disconnected and moved clear of the throttle body.



31.8 Unhook the throttle return spring from the bracket on the inlet manifold (inlet manifold removed for clarity)



31.10A Unscrew the securing nuts . . .

10 Unscrew the four securing nuts, and withdraw the throttle body from the inlet manifold (**see illustrations**). Access to the lower nuts is difficult and it may be necessary to move the two fuel hoses to one side for improved access. Take care not to strain the hoses.

11 Recover the gasket.

12 If desired, the throttle position sensor can be removed from the throttle body, with reference to Section 23.

Refitting

13 Refitting is a reversal of removal, remembering the following points.

14 Where applicable, refit the throttle position sensor, as described in Section 23.

15 Refit the throttle body, using a new gasket (**see illustration**).

16 Ensure that all hoses and wires are correctly reconnected and routed.

17 Check and if necessary top-up the coolant level, as described in Chapter 3.

18 Check and if necessary adjust the throttle cable free play, as described in Section 19.

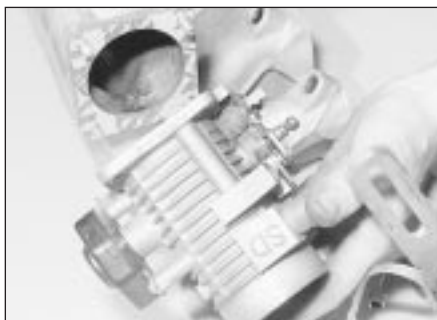
DOHC

Removal

19 Disconnect the battery negative lead.

20 Loosen the clamp screw securing the air trunking to the left-hand side of the air mass meter.

21 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to



31.10B. . . and withdraw the throttle body (inlet manifold removed for clarity) - SOHC models

the throttle body. Lift the air box from the front of the throttle body, and disconnect the hose from the base of the air box, then withdraw the air box.

22 Disconnect the wiring plug from the throttle position sensor.

23 Unscrew the retaining nut, and remove the fuel hose bracket from the left-hand side of the throttle body (**see illustration**).

24 Slide the throttle cable end from the throttle valve lever.

25 Disconnect the breather hose from the front of the throttle body.

26 Disconnect the vacuum pipe from the top of the fuel pressure regulator.

27 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected and moved clear of the throttle body.

28 Unscrew the four securing nuts, and withdraw the throttle body from the inlet manifold. Recover the gasket.

29 If desired, the throttle position sensor can be removed from the throttle body, referring to Section 31, if necessary.

30 Do not under any circumstances attempt to adjust the throttle valve linkage. If the throttle valve linkage is faulty, refer the problem to a Vauxhall dealer.

Refitting

31 Refitting is a reversal of removal, remembering the following points.

32 Where applicable, refit the throttle position sensor, as described in Section 23.

33 Refit the throttle body, using a new gasket.

34 Ensure that all hoses, pipes and wires are correctly reconnected and routed.

35 On completion, check and if necessary adjust the throttle cable free play, as described in Section 19.

32 Throttle body (Multec system) - removal and refitting



Removal

1 Depressurise the fuel system (Section 8).

2 Remove the air box (see above).

3 Disconnect the battery negative lead.

4 Disconnect the wiring plugs from the fuel injector (pressing out the wiring rubber grommet), from the idle air control stepper motor and from the potentiometer.

5 Disconnect the fuel hoses from their unions and plug them to prevent loss of fuel and the entry of dirt; label them to ensure correct refitting. Be prepared for fuel spillage and take safety precautions.

6 Disconnect the vacuum hoses and pipes from the body unions.

7 Disconnect the throttle valve operating linkage at the throttle body.

8 Undo the two nuts securing the throttle body to the inlet manifold and withdraw the body assembly; peel off and discard the gasket (**see illustration**).

9 If required, the throttle body's upper and lower sections may be separated by removing the two Torx-type securing screws; note that a new gasket must be fitted on reassembly. The fuel inlet and return unions may also be unscrewed, but note that new sealing rings must be fitted on reassembly, and the unions must be tightened securely.

Refitting

10 Refitting is the reverse of the removal procedure, noting the following points (**see illustration**).

a) *Renew all gaskets and seals, and use thread-locking compound where applicable.*



31.15 Refit the throttle body, using a new gasket



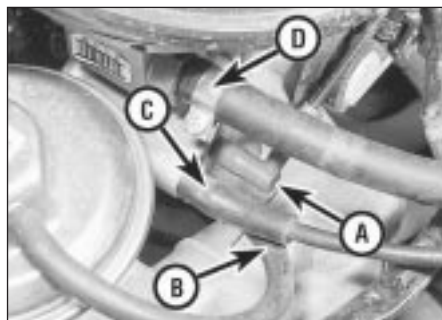
31.23 Remove the fuel hose bracket (arrowed) from the throttle body - DOHC models



32.8 Throttle body - Multec systems

A Mounting nuts

B Upper-to-lower section Torx screws



32.10 Intake air temperature control - Multec systems

- A Vacuum pipe
- B Exhaust gas recirculation valve hose
- C Charcoal canister control pipe
- D Fuel return hose

- b) Check the throttle cable operation and adjustment (see above).
- c) When reconnecting the vacuum hoses and pipes, ensure that they are connected to the front unions as shown in the accompanying photograph.
- d) As no fuel vapour trap is fitted, it is essential that the manifold absolute pressure sensor vacuum hose is routed so that it falls steadily from the sensor to the throttle body. This precaution will prevent any fuel droplets being trapped in the sensor or hose and allowing them to drain into the inlet port.
- e) Ensure that the fuel hoses are correctly reconnected; the feed hose is on the injector end of the throttle body.
- f) Switch on the ignition and check for signs of fuel leaks from all disturbed unions; if any signs of leakage are detected, the problem must be rectified before the engine is started.

33 Idle air control stepper motor - removal and refitting

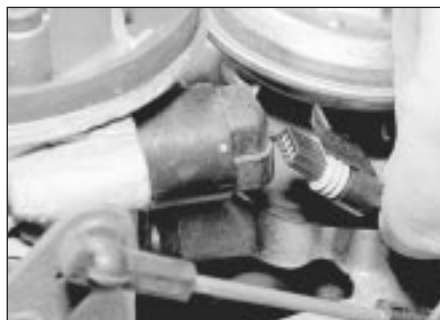


Removal

- 1 Remove the air box (see Section 5).
- 2 Disconnect the battery earth lead.



34.2 Disconnecting the throttle potentiometer wiring plug - note the mounting screws (arrowed)



33.3 Disconnecting the idle air control stepper motor wiring plug

- 3 Disconnect the wiring plug from the stepper motor (see illustration).
- 4 Undo its two screws, then withdraw the stepper motor. Remove and discard the sealing ring (see illustrations).

Refitting

- 5 Refitting is the reverse of the removal procedure, noting the following points.
 - a) Fit a new sealing ring, greasing it lightly to ease installation.
 - b) To prevent the risk of damage, either to the throttle body or to the stepper motor, if the motor's plunger tip projects more than 28 mm (1.1 in) beyond the motor's mating surface, carefully press the plunger in until its stop is reached. The stepper motor will then be reset by the ECU when the engine is restarted.
 - c) Apply a few drops of a thread-locking compound to their threads, then carefully tighten the screws to the specified torque wrench setting.

34 Throttle potentiometer - removal and refitting



Removal

- 1 Disconnect the battery negative lead.
- 2 Disconnect the wiring plug from the potentiometer (see illustration).
- 3 Unscrew the two Torx-type securing screws (size TX 25) and withdraw the potentiometer.



35.3 Withdrawing the fuel injection/ignition system ECU



33.4A Unscrew retaining screws (second screw arrowed) . . .



33.4B . . . to remove the stepper motor - renew sealing ring (arrowed)

Refitting

- 4 Refitting is the reverse of the removal procedure, noting the following points.
 - a) Install the potentiometer when the throttle valve is fully closed, and ensure that its adapter seats correctly on the throttle valve spindle.
 - b) Tighten the screws carefully to the specified torque.

35 Electronic Control Unit (ECU) - removal and refitting



Removal

- 1 Disconnect the battery negative lead.
- 2 Remove the driver's footwell side trim panel (Chapter 11).
- 3 Release the unit from its mountings and withdraw it until the wiring plugs' locking lugs can be released and the plugs can be disconnected (see illustration).
- 4 Note that the unit consists of two parts the basic control unit and the Programmable Read Only Memory (PROM). While it is possible to renew them separately, do not attempt to separate them. Faults requiring this degree of attention can be diagnosed only by an experienced mechanic using the special Vauxhall test equipment. A previously sound ECU could be seriously damaged by careless handling of the contacts between the two sub-units.

Refitting

5 Refitting is a reversal of the removal procedure, ensuring that the wiring plugs are correctly reconnected and that the unit is located securely.

36 Knock sensor and module (X16 SZ models) - removal and refitting



Removal

1 The knock sensor fitted to the X16 SZ engine is located on the cylinder block below the inlet manifold, between cylinders 2 and 3.

2 Disconnect the battery negative lead.

3 Remove the wiring and unscrew the unit from the block.

4 The module and control unit are located on the left-hand side of the engine compartment behind the battery. To remove, disconnect the wiring multiplug and remove the retaining bolts (see illustration).

5 There is no provision for testing the knock sensor or module without dedicated Vauxhall test equipment. Check for external damage and replace if necessary.

Refitting

6 Refitting is a reversal of the removal procedure, ensuring that the wiring plugs are correctly reconnected and that the units are located securely.

37 Knock sensor (Simtec system) - removal and refitting



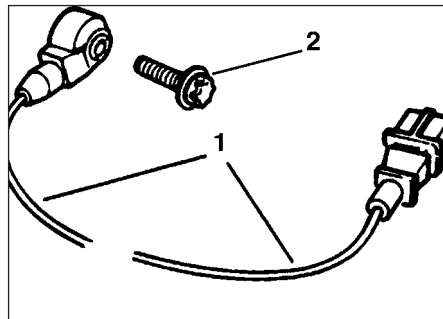
Removal

1 Disconnect the battery negative lead.

2 Disconnect wiring harness plug, from inlet air temperature sensor and wiring harness plug, from hot mass air flow meter.

3 Remove crankcase ventilation hoses.

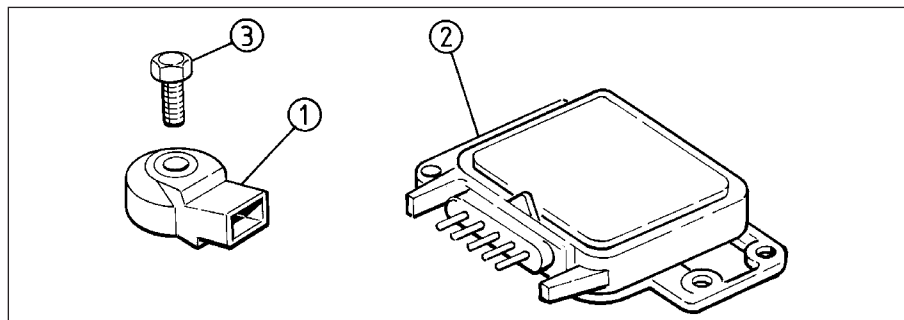
4 Remove coolant hoses from air inlet hoses, hot film mass air flow meter complete with air inlet hoses, from upper part of air cleaner and throttle body.



37.8 Knock sensor and wiring (Simtec system)

1 Sensor

2 Securing bolt



36.4 Knock sensor and module (X16 SZ models)

1 Sensor

2 Module

3 Sensor securing bolt

5 Press retaining clip for 1st and 4th cylinder injectors in plug strip (with screwdriver) towards fuel distributor pipe - lifting plug strip at the same time. On the underside of the plug strip there are a total of 6 plug connections, 4 of which are for the injectors.

6 Disconnect wiring harness plug for knock sensor from the plug strip.

7 Connect a 1 metre length of separate cable to knock sensor wiring harness plug (note routing).

8 Remove knock sensor from cylinder block (see illustration).

9 Disconnect knock sensor cable from separately attached cable, separate cable remains in engine compartment.

Refitting

10 Refitting is a reversal of removal, but note the following.

11 Before refitting ensure that the sensor is spotlessly clean. Clean the entire contact surface of the sensor must lie directly on the cylinder block. Do not use any form of washers.

12 Carefully refit sensor into the block. Tighten to the correct torque.

13 Guide knock sensor cable between ridges on inlet manifold using separate cable - ensure correct routing.

14 Remove the cable.

15 Insert the wiring harness plug for the knock sensor, into the plug strip.

16 Correctly align the spring clips for the

injectors as they may prevent engagement of the plug strip. Correct contact between the plug strip and the injector is essential.

17 When connecting plug strip, an audible 'click' should be heard.

18 Ensure that hoses are in good condition and installed securely with the two clamps.

38 Inlet manifold (SOHC without Multec) - removal and refitting



Note: Refer to warning in Section 2, before proceeding. Use a new gaskets when refitting.

Removal

1 Disconnect the battery negative lead.

2 Remove the idle speed adjuster and its hoses, referring to Section 22, if necessary.

3 Release the securing clip, then disconnect the throttle cable and balljoint from the throttle valve lever. Slide the throttle cable grommet from the bracket on the inlet manifold, and move the throttle cable to one side out of the way.

4 Loosen the clamp screw and disconnect the air trunking from the throttle body.

5 Unscrew the union nut and disconnect the brake servo vacuum hose from the inlet manifold (see illustration).

6 Disconnect the camshaft cover breather hose from the throttle body.

7 Disconnect the coolant hoses from the throttle body. Be prepared for coolant spillage, and clamp or plug the open ends of the hoses, to prevent further coolant loss.

8 Disconnect the wiring plug from the throttle position sensor.

9 Disconnect the vacuum pipe from the top of the fuel pressure regulator.

10 Disconnect the wiring harness housing from the fuel injectors and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the harness housing from the injectors.

11 Disconnect the fuel hoses from the fuel rail. Be prepared for fuel spillage, and take adequate fire precautions. Clamp or plug the open ends of the hoses, to prevent dirt ingress and further fuel leakage.



38.5 Disconnecting the brake servo vacuum hose - SOHC models

12 Unscrew and remove the top alternator mounting nut and bolt.

13 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected.

14 Unscrew the securing nuts, and withdraw the manifold from the cylinder head. Recover the gasket (**see illustrations**).

15 It is possible that some of the manifold studs may be unscrewed from the cylinder head when the manifold securing nuts are unscrewed. In this event, the studs should be screwed back into the cylinder head once the manifold has been removed, using two manifold nuts locked together.

16 If desired, the ancillary components can be removed from the manifold, referring to the relevant Chapter.

Refitting

17 Refitting is a reversal of removal, remembering the following points.

18 Where applicable refit any ancillary components to the manifold, with reference to relevant Sections of Chapters 4A or 4B.

19 If the alternator mounting bracket has been unbolted from the manifold, refit it before refitting the manifold, as access to the securing bolt is extremely limited once the manifold is in place.

20 Refit the manifold using a new gasket, and tighten the securing nuts to the specified torque.

21 Ensure that all relevant hoses, pipes and wires are correctly reconnected.

22 On completion, check and if necessary top-up the coolant level, (Chapter 3).

23 Check and if necessary adjust the throttle cable free play, as described in Chapters 4A or 4B, as applicable.

24 If any of the fuel system components have been disturbed or renewed, check and if necessary adjust the idle mixture, as described in Chapters 4A or 4B, as applicable.

39 Inlet manifold (SOHC with Multec) - removal and refitting



Removal

1 Depressurise the fuel system (Section 8).

2 Remove the air box (see Section 5).

3 Disconnect the battery negative lead.

4 Either remove the throttle body assembly (see Section 32), or disconnect the throttle cable, wiring, fuel and vacuum hoses and pipes to allow the manifold to be removed with the throttle body.

5 Drain the cooling system (see Chapter 3).

6 Continue as described in Chapter 4A, Section 26, paragraph 4 onwards.

Refitting

7 Refitting is the reverse of the removal procedure; renew all gaskets and seals disturbed.



38.14A Unscrew the securing nuts

40 Inlet manifold (DOHC models) - removal and refitting



Removal

1 Disconnect the battery negative lead.

2 Disconnect the wiring plug from the air mass meter. Recover the sealing ring.

3 Loosen the clamp screw securing the air trunking to the right-hand end of the air mass meter.

4 Using an Allen key or hexagon bit, unscrew the four bolts securing the air box to the throttle body. Lift the air box from the throttle body, and disconnect the hose from the base of the air box then withdraw the air box/air mass meter assembly.

5 Disconnect the wiring plug from the throttle position sensor.

6 Slide the throttle cable end from the throttle valve lever. Then pull the cable end grommet from the bracket on the inlet manifold and move the throttle cable to one side out of the way.

7 Disconnect the two breather hoses from the rear of the camshaft cover. Disconnect the larger hose from the throttle body, and remove the hose completely.

8 Position a wad of rag beneath one of the fuel hose unions on the fuel rail, to absorb the fuel that will be released as the union is disconnected.

9 Slowly loosen the fuel hose union, to gradually relieve the pressure in the fuel feed line, then disconnect the hose from the fuel rail. Be prepared for fuel spillage, and take adequate fire precautions. Plug the end of the fuel hose, to prevent dirt ingress and further fuel leakage.

10 Repeat paragraphs 9 and 10 for the remaining fuel hose-to-fuel rail union.

11 Disconnect the vacuum pipe from the top of the fuel pressure regulator.

12 Disconnect the wiring harness housing from the fuel injectors and move it to one side, taking care not to strain the wiring. Pull up on the wiring harness housing, and compress the wiring plug retaining clips to release the housing from the injectors.

13 Unscrew the union nut, and disconnect



38.14B ...and withdraw the inlet manifold - SOHC models

the brake servo vacuum hose from the left-hand side of the inlet manifold (**see illustration**).

14 Unscrew the retaining nut, and remove the fuel hose bracket from the left-hand side of the throttle body.

15 Unscrew the securing nuts, and disconnect the earth leads from the fuel rail securing studs at either end of the fuel rail.

16 Unscrew the securing bolt, and remove the cable/hose bracket from the left-hand end of the inlet manifold.

17 Remove the idle speed adjuster, as described in Section 22.

18 Unscrew and remove the top alternator mounting nut and bolt.

19 Make a final check to ensure that all relevant hoses, pipes and wires have been disconnected.

20 Unscrew the securing nuts, and withdraw the manifold from the cylinder head. Recover the gasket.

21 It is possible that some of the manifold studs may be unscrewed from the cylinder head when the manifold securing nuts are unscrewed. In this event, the studs should be screwed back into the cylinder head once the manifold has been removed, using two manifold nuts locked together.

22 If desired, the ancillary components can be removed from the manifold, with reference to the relevant Sections of Chapters 4A or 4B.

Refitting

23 Refitting is a reversal of the removal procedure.



40.13 Brake servo vacuum hose connection at inlet manifold (arrowed) - DOHC models