Chapter 5
Engine electrical systems

Contents

Degrees of difficulty

Easy, suitable for novice with little experience 

Fairly easy, suitable for beginner with some experience 

Fairly difficult, suitable for competent DIY mechanic 

Difficult, suitable for experienced DIY mechanic 

Very difficult, suitable for expert DIY or professional 

Specifications

System type	12 volt, negative earth
Battery capacity	36, 44, 55 or 66 Ah

Alternator

Type	Bosch or Delco-Remy
Output	55 or 70 A, depending upon model
Minimum brush length:	
Bosch type alternator	5.0 mm protrusion
Delco-Remy type alternator	11.0 mm overall length

Starter motor

Type	Pre-engaged, Bosch or Delco-Remy
Minimum brush length:	
Bosch DF type starter motor	11.5 mm
Bosch DM type starter motor	3.0 mm
Bosch DW type starter motor	4.5 mm
Delco-Remy type starter motor	4.0 mm

System type

14 NV	HEI (High Energy Ignition) system
16 SV and 18 SV	MSTS-i (Microprocessor Spark Timing System)
C16 NZ, C16 NZ2 and C18 NZ	Multec, with MSTS-i
X16 SZ	Multec, with DIS (Direct Ignition System)
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

Coil

Output	16.0 to 20.0 kilovolts
Primary winding resistance (DOHC models only)	0.2 to 0.34 ohms
Secondary winding resistance (DOHC models only)	7.2 to 8.2 ohms

Distributor

Direction of rotor arm rotation	Anti-clockwise (viewed from cap)
Firing order	1-3-4-2 (No 1 cylinder at timing belt end of engine)
Dwell angle	Automatically controlled by electronic module (not adjustable)

Ignition timing

14 NV	5° BTDC
16 SV, X 16 SZ, C 16 NZ, C 16 NZ2 and C 18 NZ	10° BTDC *
18 SV and 2.0 litres models	8 to 12° BTDC *

** Ignition timing electronically controlled no adjustment possible*

Spark plugs ..... See Chapter 1 Specifications

Torque wrench setting

	Nm	lbf ft
Alternator mounting	25	18
Camshaft phase sensor disc	8	6
Camshaft phase sensor	15	11
'Compact' series alternator lower mounting bolt	35	26
'Compact' series alternator upper mounting bolts	20	15
DIS module	7	5
Inductive pulse pick-up to block	8	6
Spark plugs	25	18
Starter motor mounting bracket-to-cylinder block	25	18
Starter motor mounting:		
1.4 and 1.6 litre models	25	18
1.8 and 2.0 litre models:		
Engine side	45	33
Transmission side	75	55

1 Electrical system - general

Caution: Before carrying out any work on the vehicle electrical system, read through the precautions given in the "Safety first!" Section at the beginning of this manual, and in Section 3 of this Chapter.

1 The electrical system is of the 12 volt negative earth type, and consists of a 12 volt battery, alternator with integral voltage regulator, starter motor, and related electrical accessories, components and wiring.

2 The battery is of the maintenance-free "sealed for life" type, and is charged by an alternator, which is belt-driven from the crankshaft pulley. The starter motor is of the pre-engaged type, incorporating an integral solenoid. On starting, the solenoid moves the drive pinion into engagement with the flywheel ring gear before the starter motor is energised. Once the engine has started, a one-way clutch prevents the motor armature being driven by the engine until the pinion disengages from the flywheel.

3 It is necessary to take extra care when working on the electrical system, to avoid damage to semi-conductor devices (diodes and transistors), and to avoid the risk of personal injury. Along with the precautions given in the *"Safety first!"* Section at the beginning of this manual, take note of the following points when working on the system.

4 *Always remove rings, watches, etc. before working on the electrical system.* Even with the battery disconnected, discharge could occur if a component live terminal is earthed through a metal object. This could cause a shock or nasty burn.

5 *Do not reverse the battery connections.* Components such as the alternator, or any other component having semi-conductor circuitry, could be irreparably damaged.

6 If the engine is being started using jump leads and a slave battery, connect the batteries *positive to positive* and *negative to negative.* This also applies when connecting a battery charger.

7 Never disconnect the battery terminals, or alternator multi-plug connector, when the engine is running.

8 The battery leads and alternator wiring must be disconnected before carrying out any electric welding on the vehicle.

9 Never use an ohmmeter of the type incorporating a hand-cranked generator for circuit or continuity testing.

2 Ignition system - general

1 The ignition system is responsible for igniting the air/fuel mixture in each cylinder at the correct moment, in relation to engine speed and load. A number of different types of ignition systems are fitted to models within the range. Ranging from a basic breakerless electronic system, to a fully integrated engine management system controlling both ignition and fuel injection systems. Each system is described in further detail later in this Section.

2 The ignition system is based on feeding low tension voltage from the battery to the coil, where it is converted to high tension voltage. The high tension voltage is powerful enough to jump the spark plug gap in the cylinders many times a second under high compression pressures, providing that the system is in good condition. The low tension (or primary) circuit consists of the battery, the lead to the ignition switch. The lead from the ignition switch to the low tension coil windings and the supply terminal on the electronic module. The lead from the low tension coil windings to the control terminal on the electronic module. The high tension (or secondary) circuit consists of the high tension coil windings, the HT (high tension) lead from the coil to the distributor cap, the rotor arm, the HT leads to the spark plugs, and the spark plugs.

3 The system functions in the following manner. Current flowing through the low tension coil windings produces a magnetic field around the high tension windings. As the engine rotates, a sensor produces an electrical impulse that is amplified in the electronic module and used to switch off the low tension circuit.

4 The subsequent collapse of the magnetic field over the high tension windings produces a high tension voltage, which is then fed to the relevant spark plug through the distributor cap and rotor arm. The low tension circuit is automatically switched on again by the electronic module, to allow the magnetic field to build up again before the firing of the next spark plug. The ignition is advanced and retarded automatically, to ensure that the spark occurs at the correct instant with the engine speed and load.

HEI (High Energy Ignition) system

5 This comprises of a breakerless distributor and an electronic switching/amplifier module along with the coil and spark plugs.

6 The electrical impulse that is required to switch off the low tension circuit is generated by a magnetic trigger coil in the distributor. A trigger wheel rotates within a magnetic stator, the magnetic field being provided by a permanent magnet. The magnetic field across the two poles (stator arm and trigger wheel) is dependent on the air gap between the two poles. When the air gap is at its minimum, the trigger wheel arm is directly opposite the stator arm, and this is the trigger point. As the magnetic flux between the stator arm and trigger wheel varies, a voltage is induced in the trigger coil mounted below the trigger wheel. This voltage is sensed and then amplified by the electronic module, and used to switch off the low tension circuit. There is one trigger arm and one stator arm for each cylinder.

7 The ignition advance is a function of the distributor, and is controlled both mechanically and by a vacuum-operated system. The mechanical governor mechanism consists of two weights that move out from the distributor shaft due to centrifugal force as the engine speed rises. As the weights move outwards, they rotate the trigger wheel relative to the distributor shaft and so advance the spark. The weights are held in position by two light springs, and it is the tension of the springs that is largely responsible for correct spark advancement.

8 The vacuum control consists of a diaphragm, one side of which is connected by way of a small-bore hose to the carburettor, and the other side to the distributor. Depression in the inlet manifold and carburettor, which varies with engine speed and throttle position, causes the diaphragm to move, so moving the baseplate and advancing or retarding the spark. A fine degree of control is achieved by a spring in the diaphragm assembly.

MSTS-i (Microprocessor-controlled Spark Timing System)

9 This system comprises a "Hall-effect" distributor (or a crankshaft speed/position sensor on X 16 SZ models), a manifold pressure sensor, an oil temperature sensor, and a module, along with the coil and spark plugs.

10 On 1.6 litre models, the electrical impulse that is required to switch off the low tension circuit is generated by a sensor in the distributor. A trigger vane rotates in the gap between a permanent magnet and the sensor. The trigger vane has four cut-outs, one for each cylinder. When one of the trigger vane cut-outs is in line with the sensor, magnetic flux can pass between the magnet and the sensor. When a trigger vane segment is in line with the sensor, the magnetic flux is diverted through the trigger vane away from the sensor. The sensor senses the change in magnetic flux, and sends an impulse to the MSTS-i module, which switches off the low tension circuit.

11 On 1.8 litre models, the electrical impulse that is required to switch off the low tension circuit is generated by a crankshaft speed/position sensor, which is activated by a toothed wheel on the crankshaft. The toothed wheel has 35 equally spaced teeth, with a gap in the 36th position. The gap is used by the sensor to determine the crankshaft position relative to TDC (top dead centre) of No 1 piston.

12 Engine load information is supplied to the MSTS-i module by a pressure sensor, which is connected to the carburettor by a vacuum pipe. Additional information is supplied by an oil temperature sensor. The module selects the optimum ignition advance setting based on the information received from the sensors. The degree of advance can thus be constantly varied to suit the prevailing engine conditions.

Multec, with MSTS-i

13 The ignition system is fully electronic in operation and incorporates the Electronic Control Unit (ECU) mounted in the driver's footwell. A distributor (driven off the camshaft left-hand end and incorporating the amplifier module) as well as the octane coding plug, the spark plugs, HT leads, ignition HT coil and associated wiring.

14 The ECU controls both the ignition system and the fuel injection system, integrating the two in a complete engine management system. Refer to Chapters 4B and 4C for further information that is not detailed here.

15 For ignition the ECU receives information in the form of electrical impulses or signals from the distributor (giving it the engine speed and crankshaft position), from the coolant temperature sensor (giving it the engine temperature) and from the manifold absolute pressure sensor (giving it the load on the engine). In addition, the ECU receives input from the octane coding plug (to provide ignition timing appropriate to the grade of fuel used) and from, where fitted, the automatic transmission control unit (to smooth gear changing by retarding the ignition as changes are made).

16 All these signals are compared by the ECU with set values pre-programmed (mapped) into its memory. Considering this information, the ECU selects the ignition timing appropriate to those values and controls the ignition HT coil by way of the amplifier module accordingly.

17 The system is so sensitive that, at idle speed, the ignition timing may be constantly changing; this should be remembered if trying to check the ignition timing.

18 The system fitted to C18 NZ models, is similar to that described above, except that the amplifier module is separate. The ECU determines engine speed and crankshaft position using a sensor mounted in the right-hand front end of the engine's cylinder block; this registers with a 58-toothed disc mounted on the crankshaft so that the gap left by the missing two teeth provides a reference point, so enabling the ECU to recognise TDC.

19 Note that this simplifies the distributor's function, which is merely to distribute the HT pulse to the appropriate spark plug; it has no effect whatsoever on the ignition timing.

DIS (Direct Ignition System)

20 On all X16 SZ engines, and on C20 XE (DOHC) engines from 1993-on, a DIS (Direct Ignition System) module is used in place of the distributor and coil. On the X16 SZ engine the DIS module is attached to the camshaft housing in the position normally occupied by the distributor. On the C20 XE engine, a camshaft phase sensor is attached to the cylinder head at the non-driven end of the exhaust camshaft, in the position normally occupied by the distributor. The DIS module is attached, by a bracket, to the cylinder head at the non-driven end of the inlet camshaft.

21 The DIS module consists of two ignition coils and an electronic control module housed in a cast casing. Each ignition coil supplies two spark plugs with HT voltage. One spark is provided in a cylinder with its piston on the compression stroke, and one spark is provided to a cylinder with its piston on the exhaust stroke. This means that a "wasted spark" is supplied to one cylinder during each ignition cycle, but this has no detrimental effect. This system has the advantage that there are no moving parts (therefore there is no wear), and the system is largely maintenance-free.

Motronic M4.1 and M1.5

22 This system controls both the ignition and the fuel injection systems.

23 The Motronic module receives information from a crankshaft speed/position sensor, an engine coolant temperature sensor mounted in the thermostat housing. A throttle position sensor, an airflow meter, and on models fitted with a catalytic converter, an oxygen sensor mounted in the exhaust system (Chapter 4C).

24 The module provides outputs to control the fuel pump, fuel injectors, idle speed and ignition circuit. Using the inputs from the various sensors, the module computes the optimum ignition advance, and fuel injector pulse duration, to suit the prevailing engine conditions. This system gives very accurate control of the engine under all conditions, improving fuel consumption and driveability, and reducing exhaust gas emissions.

25 Further details of the fuel injection system components are given in Chapter 4B.

Motronic M2.5 and M2.8

26 The system is similar to that described for SOHC models, with the following differences.

27 Along with the crankshaft speed/position sensor, a "Hall-effect" distributor is used (similar to that described in this Section, with the MSTS-i system).

28 The system also incorporates a separate ignition amplifier module that transmits amplified signals from the main system module to trigger the HT pulse from the ignition coil. The module is mounted on the ignition coil's bracket/baseplate.
29 Additionally, the Motronic module receives information from a cylinder block-mounted knock sensor, which senses "knocking" (or pre-ignition) just as it begins to occur, enabling the module to retard the ignition timing, thus preventing engine damage.

Simtec 56.1

30 This system uses increased amount of electronic components 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.
31 The control unit is equipped with electronic ignition control. Called 'Microprocessor Spark Timing System, inductive triggered', (or MSTS-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).
32 The ignition coil is replaced by a dual spark ignition coil, which is switched directly by the output stages in the control unit.
33 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.
34 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.
35 The air inlet temperature sensor (NTC), is fitted in the air inlet duct between the air cleaner and the hot mass air flow meter.
36 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.
37 A knock control system is also fitted. This eliminates the need for octane number adjustment, as it is performed automatically through the control unit.

3 Electrical system - precautions

Warning: The HT voltage generated by an electronic ignition system is extremely high and, in certain circumstances, could prove fatal. Take care to avoid receiving electric shocks from the HT side of the ignition system. Do not handle HT leads, or touch the distributor or coil, when the engine is running. If tracing faults in the HT circuit, use well-insulated tools to manipulate live leads

1 It is necessary to take extra care when working on the electrical system, to avoid damage to semi-conductor devices (diodes and transistors), and to avoid the risk of personal injury. Along with the precautions given in the *"Safety first!"* Section at the beginning of this manual, take note of the following points when working on the system.
2 *Always remove rings, watches, etc. before working on the electrical system.* Even with the battery disconnected, discharge could occur if a component live terminal is earthed through a metal object. This could cause a shock or nasty burn.
3 *Do not reverse the battery connections.* Components such as the alternator, or any other component having semi-conductor circuitry, could be irreparably damaged.
4 If the engine is being started using jump leads and a slave battery, connect the batteries *positive to positive* and *negative to negative.* This also applies when connecting a battery charger.
5 Never disconnect the battery terminals, or alternator multi-plug connector, when the engine is running.
6 The battery leads and alternator wiring must be disconnected before carrying out any electric welding on the vehicle.
7 Never use an ohmmeter of the type incorporating a hand-cranked generator for circuit or continuity testing.
8 Engine management modules are very sensitive components, and certain precautions must be taken, to avoid damage to the module when working on a vehicle equipped with an engine management system, as follows.
9 When carrying out welding operations on the vehicle using electric welding equipment, the battery and alternator should be disconnected.
10 Although underbonnet-mounted modules will tolerate normal underbonnet conditions, they can be adversely affected by excess heat or moisture. If using welding equipment or pressure washing equipment near the module, take care not to direct heat, or jets of water or steam, at the module. If this cannot be avoided, remove the module from the vehicle, and protect its wiring plug with a plastic bag.
11 Before disconnecting any wiring, or removing components, always ensure that the ignition is switched off.
12 Do not attempt to improvise fault diagnosis procedures using a test lamp or multimeter, as irreparable damage could be caused to the module.
13 After working on ignition/engine management system components, ensure that all wiring is correctly reconnected before reconnecting the battery or switching on the ignition.
14 Any ignition system that uses a "Hall-effect" generator in the distributor, **cannot** be tested. Test equipment that uses its own power source (e.g. an ohmmeter), when connected to the distributor or the "Hall-effect" generator, will be damaged.

4 Ignition system testing - general

Note: *Refer to Section 3 before proceeding. Always switch off the ignition before disconnecting or connecting any component and when using a multi-meter to check resistances. Any voltmeter or multi-meter used to test ignition system components must have an impedance of 10 meg ohms or greater*
1 Electronic ignition system components are normally very reliable. Most faults are far more likely to be due to loose or dirty connections, or to "tracking" of HT voltage due to dirt, dampness or damaged insulation than to component failure. Always check all wiring thoroughly before condemning an electrical component and work methodically to eliminate all other possibilities before deciding that a particular component is faulty.
2 The old practice of checking for a spark by holding the live end of a HT lead a short distance away from the engine is not recommended. Not only is there a high risk of a powerful electric shock, but the ignition coil or amplifier module will be damaged. Similarly, never try to "diagnose" misfires by pulling off one HT lead at a time. Note also that the ECU is at risk if the system is triggered with an open (i.e., not properly earthed) HT circuit; ECU's are very expensive to replace, so take care!
3 If you are in any doubt as to your skill and ability to test an ignition system component or if you do not have the required equipment, take the vehicle to a suitably equipped Vauxhall dealer. It is better to pay the labour charges involved in having the vehicle checked by an expert than to risk damage to the system or to yourself.
4 If the engine either will not turn over at all, or only turns very slowly, check the battery and starter motor. Connect a voltmeter across the battery terminals (meter positive probe to battery positive terminal) and disconnect the ignition coil HT lead from the distributor cap and earth. Note the voltage reading obtained while turning over the engine on the starter for (no more than) ten seconds. If the reading obtained is less than approximately 9.5 volts, check the battery, battery connections, starter motor and charging system.

5 If the engine turns over at normal speed but will not start, check the HT circuit by connecting a timing light and turning the engine over on the starter motor. If the light flashes, voltage is reaching the spark plugs, so these should be checked first. If the light does not flash, check the HT leads themselves followed by the distributor cap, carbon brush and rotor arm.
6 If there is a spark, check the fuel system for faults as far as possible (Chapters 4A or 4B).
7 If there is still no spark, check the voltage at the ignition coil "+" or "15" terminal; it should be the same as the battery voltage (i.e., at least 11.7 volts). If the voltage at the coil is more than 1 volt less than that at the battery, check the connections back through the ignition switch to the battery and its earth until the fault is found. Note, however, that the ECU controls the coil's feed; do not attempt to "test" the ECU with anything other than the correct test equipment, which will be available only to a Vauxhall dealer. If any of the wires are to be checked which lead to the ECU, always first unplug the relevant connector from the ECU so that there is no risk of the ECU being damaged by the application of incorrect voltages from test equipment.
8 If the feed to the ignition coil is sound, check the coil's primary and secondary windings (refer to Section 16). Renew the coil if faulty, but check the condition of the LT connections themselves before doing so, to ensure that the fault is not due to dirty or poorly fastened connectors.
9 If the ignition coil is in good condition, the fault may be within the amplifier module or the distributor on the C16 NZ and C16 NZ2 engines, or the amplifier or the crankshaft speed/position sensor on the C18 NZ engine. A quick check of these components can be made by connecting a low-wattage bulb across the ignition coil's (disconnected) LT terminals. If the bulb flickers or flashes when the engine is turned over, the amplifier and distributor (C16 NZ and C16 NZ2 engines), or amplifier and crankshaft speed/position sensor (C18 NZ engine), are sound.
10 If this is the case, the entire LT circuit is in good condition; the fault, if it lies in the ignition system, must be in the HT circuit components. These should be checked carefully, as outlined above.
11 If the indicator or bulb does not flash, the fault is in either the amplifier or the distributor (C16 NZ and C16 NZ2 engines), or the amplifier or crankshaft speed/position sensor (C18 NZ engine). Owners should note, however, that by far the commonest cause of "failure" of either of these is a poor connection, either between the components themselves or in the LT circuit wiring connections. If such a fault is suspected, the vehicle must be taken to a suitably equipped Vauxhall dealer for testing; no information is available to eliminate these components by other means.
12 An irregular misfire suggests either a loose connection or intermittent fault on the primary circuit, or a HT fault on the coil side of the rotor arm.
13 With the ignition switched off, check carefully through the system ensuring that all connections are clean and securely fastened. If the equipment is available, check the LT circuit as described in paragraphs 7 to 11 above.
14 Check that the HT coil, the distributor cap and the HT leads are clean and dry. Check the leads and the spark plugs (by substitution, if necessary), then check the distributor cap, carbon brush and rotor arm.
15 Regular misfiring is almost certainly due to a fault in the distributor cap, HT leads or spark plugs. Use a timing light (paragraph 5, above) to check whether HT voltage is present at all leads.
16 If HT voltage is not present on any particular lead, the fault will be in that lead or in the distributor cap. If HT is present on all leads, the fault will be in the spark plugs; check and renew them if there is any doubt about their condition.
17 If no HT voltage is present, check the ignition coil; its secondary windings may be breaking down under load.
18 If all components have been checked for signs of obvious faults but the system is still thought to be faulty, take the vehicle to a Vauxhall dealer for testing on special equipment.

5 **Battery** - testing and charging

Note: *Refer to Section 3 before proceeding.*

Testing

1 Topping-up and testing of the electrolyte in each cell is not possible. The condition of the battery can therefore only be tested by observing the battery condition indicator.
2 The battery condition indicator is fitted in the top of the battery casing, and indicates the condition of the battery from its colour. If the indicator shows green, then the battery is in a good state of charge. If the indicator turns darker, eventually to black, then the battery requires charging, as described later in this Section. If the indicator shows clear/yellow, then the electrolyte level in the battery is too low to allow further use, and the battery should be renewed.

Charging

3 Do not attempt to charge, load or jump start a battery when the indicator shows clear/yellow. If the battery is to be charged, remove it from the vehicle and charge it as follows.
4 The maintenance-free type battery takes considerably longer to fully recharge than the standard type, the time taken being dependent on the extent of discharge.
5 A constant-voltage type charger is required, to be set, when connected, to 13.9 to 14.9 volts with a charger current below 25 amps.
6 If the battery is to be charged from a fully discharged state (less than 12.2 volts output), have it recharged by a Vauxhall dealer or battery specialist, as the charge rate will be high and constant supervision during charging is necessary.

6 **Battery** - removal and refitting

Note: *Refer to Section 3 before proceeding.*

Removal

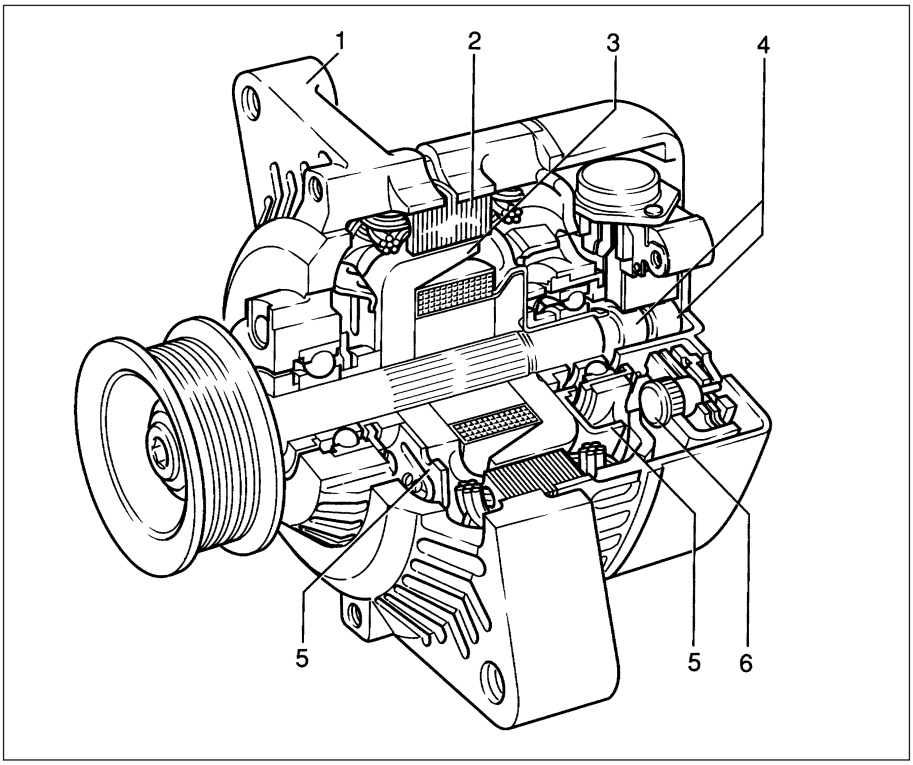
1 The battery is located at the left-hand front corner of the engine compartment.
2 Disconnect the lead(s) at the negative (earth) terminal by unscrewing the retaining nut and removing the terminal clamp.
3 Disconnect the positive terminal lead(s) in the same way.
4 Unscrew the clamp bolt sufficiently to enable the battery to be lifted from its location. Keep the battery in an upright position, to avoid spilling electrolyte on the bodywork.

Refitting

5 Refitting is a reversal of removal, but smear petroleum jelly on the terminals when reconnecting the leads, and always connect the positive lead first and the negative lead last.

7 **Alternator** - description

1 A Delco-Remy or Bosch alternator may be fitted, depending on model and engine capacity. The maximum output of the alternator varies accordingly.
2 The alternator is belt-driven from the crankshaft pulley. Cooling is provided by a fan, mounted outside the casing on the end of the rotor shaft. An integral voltage regulator is incorporated, to control the output voltage.
3 The alternator provides a charge to the battery even at very low engine speed, and consists of a coil-wound stator in which a rotor rotates. The rotor shaft is supported in ball-bearings, and slip rings are used to conduct current to and from the field coils through the carbon brushes.
4 The alternator generates ac (alternating current), which is rectified by an internal diode circuit to dc (direct current) for supply to the battery.
5 Later models are fitted with a Delco-Remy, 'compact' series alternators **(see illustration).** They use a ribbed V-belt type drivebelt with automatic tensioner. They are rigidly mounted to the engine.



7.5 Sectional view of the Delco-Remy "compact" series alternator

1 Drive end bracket
2 Stator
3 Rotor
4 Slip rings
5 Fan
6 Rectifier

8 Alternator drivebelt - removal, refitting and adjusting

V-belt type (not-ribbed)

Removal

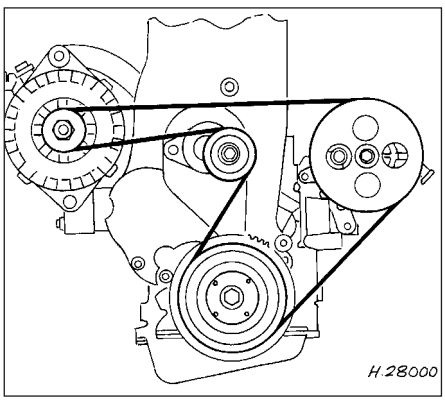
1 Disconnect the air inlet trunking from the air cleaner, and the air box or throttle body, as applicable, and remove it for improved access.
2 Correct tensioning of the drivebelt will ensure that it has a long life. Beware, however, of overtightening, as this can cause excessive wear in the alternator.
3 The belt should be inspected regularly, and if it is found to be worn, frayed or cracked, it should be renewed as a precaution against breakage in service. It is advisable to carry a spare drivebelt of the correct type in the vehicle always.
4 On models with power steering, the alternator drivebelt also drives the power steering pump.
5 To remove the belt, on 1.8 and 2.0 litre models first remove the power steering pump drivebelt, as described in Chapter 10.
6 Loosen the two alternator mounting nuts and bolts sufficiently to allow the alternator to be pivoted in towards the engine.
7 Slide the belt from the pulleys.

Refitting

8 Ensure that the correct type of belt is used, if it is being renewed. Fit the belt around the pulleys. Take up the slack in the belt by swinging the alternator away from the engine and lightly tightening the mounting nuts and bolts.

Adjusting

9 Although special tools are available for measuring the belt tension, a good approximation can be achieved if the belt is tensioned so that there is approximately 13.0 mm (0.5 in) of free movement under firm thumb pressure at the mid-point of the longest run between pulleys.
10 With the mounting bolts just holding the unit, lever the alternator away from the engine using a wooden lever at the mounting bracket end until the correct tension is achieved. Then tighten the mounting nuts and bolts. On no account lever at the free end of the alternator, as serious internal damage could be caused.



8.23 Correct routing of the ribbed V-belt

11 Where applicable, refit and tension the power steering pump drivebelt, as described in Chapter 10.
12 Refit the air inlet trunking.
13 When a new belt has been fitted, it will probably stretch slightly when it is first run, and the tension should be rechecked and if necessary adjusted after approximately 250 miles (400 km).

Ribbed V-belt type

General

14 Later models equipped with power steering are fitted with a ribbed V-belt type drivebelt in conjunction with an automatic tensioning roller. Once the belt is installed, no further adjustment is necessary as the correct tension is maintained by the automatic tensioning roller. Removal and refitting procedures are as follows.

Removal

15 For improved access, remove the air cleaner assembly and air inlet trunking.
16 If the original drivebelt is to be refitted, mark the rotational direction on the belt with chalk.
17 Using a spanner or socket on the automatic tensioning roller hexagon, turn the tensioning roller clockwise (as viewed from the right-hand side of the car) and hold it in this position. With the drivebelt tension released, slip the drivebelt off the pulleys, then allow the tensioner to return to its original position.
18 Support the engine under the sump with a jack and interposed block of wood.
19 From under the car, unbolt the right-hand engine mounting block from the body.
20 Lower the engine support jack just sufficiently to allow the drivebelt to be withdrawn from between the mounting block and the body.

Refitting

21 Slip the new drivebelt between the mounting block and body then raise the engine, by means of the jack, to its original position.
22 Clean the threads of the mounting block retaining bolts, apply locking fluid, and refit the bolts. Tighten the bolts to the specified torque (see Chapter 2A).
23 Rotate the automatic tensioner roller anti-clockwise and route the drivebelt around the pulleys as shown **(see illustration)**. With the belt correctly positioned, release the tensioner that will automatically apply the correct tension to the belt.
24 On completion, refit the air cleaner assembly and the air inlet trunking.

9.3 Disconnecting the wires from the terminals on the rear of the alternator - Delco-Remy alternator

9 Alternator- removal and refitting

Note: *Refer to Section 3 before proceeding*

Except 'compact' series alternators

Removal

1 Disconnect the battery leads.
2 Disconnect the air trunking from the air cleaner, and the air box or throttle body, as applicable, and remove it for improved access.
3 Disconnect the wiring plug, or disconnect the wires from their terminals on the rear of the alternator, noting their locations **(see illustration)**.
4 Remove the drivebelt, (Section 8).
5 Unscrew the two mounting bolts and nuts and recover any washers and insulating bushes, noting their locations. Note the earth strap attached to the top mounting bolt **(see illustration)**.
6 Withdraw the alternator, taking care not to knock or drop it, as this can cause irreparable damage.

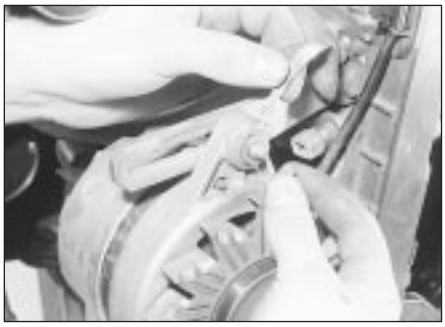
Refitting

7 Refitting is a reversal of removal, remembering the following points.
8 Ensure that the earth lead is in place on the top mounting bolt.
9 Refit and tension the drivebelt, (Section 8).

'Compact' series alternators

Removal

10 Disconnect the battery negative lead.
11 Remove the air inlet trunking and, if necessary for improved access, the air cleaner assembly.
12 Mark the rotational direction on the alternator drivebelt with chalk.
13 Using a spanner or socket on the automatic tensioning roller hexagon turn the tensioning roller clockwise (as viewed from the right-hand side of the car) and hold it in this position. With the drivebelt tension released, slip the drivebelt off the alternator pulley, then allow the tensioner to return to its original position.



9.5 Disconnecting the earth lead from the top alternator mounting bolt

14 Disconnect the electrical cable connections at the rear of the alternator.
15 Undo and remove the alternator lower mounting bolt, and slacken both upper bolts that secure the alternator mounting brackets to the engine.
16 Undo and remove both bolts that secure the alternator to its mounting brackets, noting the location of the different length bolts. Swing the brackets clear and remove the alternator from the engine.

Refitting

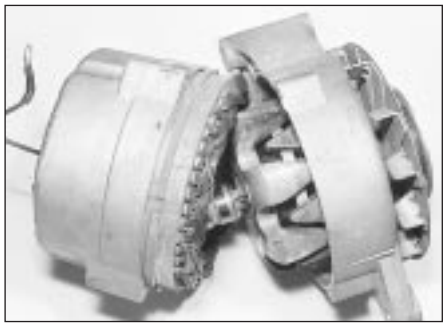
17 Refitting is a reversal of removal. Tighten the mounting bolts to the specified torque, and refit the drivebelt as described in Section 8.

10 Alternator - testing

Due to the specialist knowledge and equipment required to test or service an alternator, it is recommended that if a fault is suspected, the vehicle is taken to a dealer or a specialist. Information is limited to the inspection and renewal of the brushes. Should the alternator not charge, or the system be suspect, the following points may be checked before seeking further assistance:

a) Check the drivebelt tension, as described in Section 8
b) Check the condition of the battery and its connections - see Section 5

11.4 Alternator slip rings (arrowed) - Delco-Remy alternator



11.3 Separating the drive end housing from the slip ring end housing - Delco-Remy alternator

c) Inspect all electrical cables and connections for condition and security

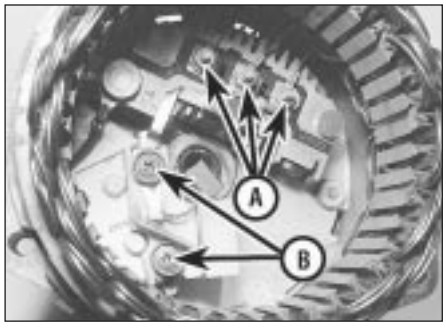
Note that if the alternator is found to be faulty, it may prove more economical to buy a factory-reconditioned unit, rather than having the existing unit overhauled.

11 Alternator brushes - removal, inspection and refitting

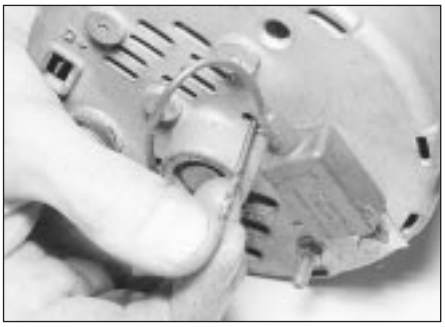
Removal

Delco-Remy type (except 'compact' series)

1 Remove the alternator, as described in Section 9
2 Scribe a line across the drive end housing and the slip ring end housing, to ensure correct alignment when reassembling.
3 Unscrew the three through-bolts, and prise the drive end housing and rotor away from the slip ring end housing and stator **(see illustration)**.
4 Check the condition of the slip rings, and if necessary clean with a rag or very fine glass paper **(see illustration)**.
5 Remove the three nuts and washers securing the stator leads to the rectifier, and lift away the stator assembly **(see illustration)**.

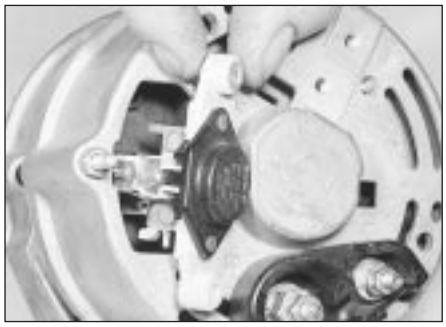


11.5 Delco-Remy alternator
A Stator lead securing nuts
B Brush holder/voltage regulator securing screws



11.15 Withdrawing the twist drill used to retain the brushes - Delco-Remy alternator

11.20A Remove the securing screws . . .



11.20B . . .and withdraw the brush holder/voltage regulator assembly - Bosch alternator

6 Remove the terminal screw and lift out the diode assembly.
7 Extract the two screws securing the brush holder and voltage regulator to the slip ring end housing, and remove the brush holder assembly. Note the insulation washers under the screw heads.
8 Check that the brushes move freely in their guides, and that the brush lengths are within the limits given in the Specifications. If any doubt exists regarding the condition of the brushes, the best policy is to renew them.
9 To fit new brushes, unsolder the old brush leads from the brush holder, and solder on the new leads in exactly the same place.
10 Check that the new brushes move freely in the guides.

Refitting

11 Before refitting the brush holder assembly, retain the brushes in the retracted position using a stiff piece of wire or a twist drill.
12 Refit the brush holder assembly so that the wire or drill protrudes through the slot in the slip ring end housing, and tighten the securing screws.
13 Refit the diode assembly and the stator assembly to the housing, ensuring that the stator leads are in their correct positions, and refit the terminal screw and nuts.
14 Assemble the drive end housing and rotor to the slip ring end housing, ensuring that the previously made marks are aligned. Insert and tighten the three through-bolts.
15 Pull the wire or drill, as applicable, from the slot in the slip ring end housing so that the brushes rest on the rotor slip rings **(see illustration)**.
16 Refit the alternator, as described in Section 9

Bosch type alternator

Removal

17 Disconnect the air trunking from the air cleaner, and the air box or throttle body, as applicable, and remove it for improved access.
18 Disconnect the battery leads.
19 If desired, to improve access further, the alternator can be removed, as described in Section 9
20 Remove the two securing screws, and withdraw the brush holder/voltage regulator assembly **(see illustrations)**.
21 Check that the brushes move freely in their guides, and that the brush lengths are within the limits given in the Specifications **(see illustration)**. If any doubt exists regarding the condition of the brushes, the best policy is to renew them as follows.
22 Hold the brush wire with a pair of pliers, and unsolder it from the brush holder. Lift away the brush. Repeat for the remaining brush.

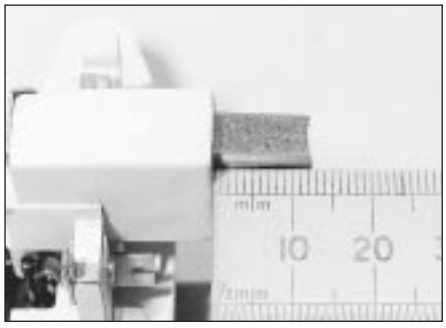
Refitting

23 Note that whenever new brushes are fitted, new brush springs should also be fitted.
24 With the new springs fitted to the brush holder, insert the new brushes, and check that they move freely in their guides. If they bind, lightly polish with a very fine file or glass paper.
25 Solder the brush wire ends to the brush holder, taking care not to allow solder to pass to the stranded wire.
26 Check the condition of the slip rings, and if necessary clean with a rag or very fine glass paper **(see illustration)**.
27 Refit the brush holder/voltage regulator assembly, and tighten the securing screws.
28 Where applicable, refit the alternator, as described in Section 9
29 Reconnect the battery leads.
30 Refit the air trunking.

Delco-Remy “compact” series

Removal

31 Remove the alternator as described in Section 9.
32 Remove the plastic cover from the rear of the alternator.
33 Undo the two bolts securing the brush holder to the rear of the alternator, noting that one of the bolts also secures the suppression capacitor.
34 Remove the suppression capacitor then withdraw the brush holder, noting the flat plug on the side.
35 Check that the brushes move freely in their holder and that the brush lengths are within the limits given in the Specifications. If any doubt exists regarding the condition of the brushes, the best policy is to renew them.



11.21 Measuring the length of an alternator brush - Bosch alternator

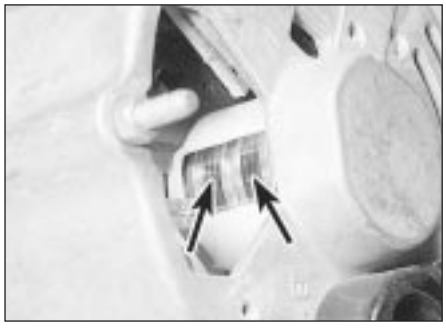
36 Check the condition of the slip rings, and if necessary clean with a rag or very fine glass paper.

Refitting

37 Refitting the brushes is a reversal of removal.

12 Starter motor - general

1 The starter motor is mounted at the rear of the cylinder block, and may be of either Delco-Remy or Bosch manufacture. Both makes are of the pre-engaged type, i.e. the drive pinion is brought into mesh with the starter ring gear on the flywheel before the main current is applied.



11.26 Alternator slip rings (arrowed) - Bosch alternator

2 When the starter switch is operated, current flows from the battery to the solenoid that is mounted on the starter body. The plunger in the solenoid moves inwards, so causing a centrally pivoted lever to push the drive pinion into mesh with the starter ring gear. When the solenoid plunger reaches the end of its travel, it closes an internal contact and full starting current flows to the starter field coils. The armature is then able to rotate the crankshaft, so starting the engine.
3 A special freewheel clutch is fitted to the starter driven pinion, so that when the engine fires and starts to operate on its own it does not drive the starter motor.
4 When the starter switch is released, the solenoid is de-energised, and a spring moves the plunger back to its rest position. This operates the pivoted lever to the withdraw the drive pinion from engagement with the starter ring.

13 Starter motor - testing

Note: *Refer to Section 3 before proceeding*

Testing

1 If the starter motor fails to turn the engine when the switch is operated, and engine seizure is not the problem, there are several other possible reasons:

a) The battery is faulty
b) The electrical connections between the switch, solenoid battery and starter motor are somewhere failing to pass the necessary current from the battery through the starter to earth
c) The solenoid switch is faulty
d) The starter motor is mechanically or electrically defective
e) The starter motor pinion and/or flywheel ring gear is badly worn, and in need of replacement

2 To check the battery, switch on the headlamps. If they dim after a few seconds, then the battery is in a discharged state. If the lamps glow brightly, operate the starter switch and see what happens to the lamps. If they dim, then power is reaching the motor, but failing to turn it. If the starter turns slowly, go on to the next check.
3 If, when the starter switch is operated, the lamps stay bright, then insufficient power is reaching the motor. Disconnect the battery and the starter/solenoid power connections, and the engine earth strap, then thoroughly clean them and refit them. Smear petroleum jelly around the battery connections to prevent corrosion. Corroded connections are the most frequent cause of electrical system malfunctions.
4 If the preceding checks and cleaning tasks have been carried out without success, a clicking noise will probably have been heard each time the starter switch was operated. This indicates that the solenoid switch was operating, but it does not necessarily follow that the main contacts were closing properly (if no clicking has been heard from the solenoid, it is certainly defective). The solenoid can be checked by connecting a voltmeter across the main cable connection on the solenoid and earth. When the switch is operated, these should be a reading on the voltmeter. If there is no reading, the solenoid unit is faulty, and should be renewed.
5 If the starter motor operates, but does not turn the engine, then it is likely that the starter pinion and/or flywheel ring gear are badly worn. If this is the case, the starter motor will normally be noisy in operation.
6 Finally, if it is established that the solenoid is not faulty, and 12 volts are reaching the starter, then the motor itself is faulty, and should be removed for inspection.

14 Starter motor - removal and refitting

Note: *Refer to Section 3 before proceeding*

Removal

1 Disconnect the battery negative lead.
2 Apply the handbrake, then jack up the front of the vehicle, and support securely on axle stands (see "*Jacking and Vehicle Support*") positioned under the body side members.
3 On DOHC models, remove the engine undershield, as described in Chapter 11.
4 Note the wiring connections on the solenoid, then disconnect them **(see illustration)**.
5 Where applicable, unscrew the bolt securing the exhaust bracket and the starter motor mounting bracket to the cylinder block **(see illustration)**.
6 Unscrew the two starter motor mounting bolts. Note that the top bolt on some models are fitted from the transmission side, and secures a wiring harness bracket **(see illustration)**.
7 Withdraw the starter motor.

Refitting

8 Refitting is a reversal of removal, but where applicable, ensure that the wiring harness bracket is in place on the top mounting bolt, and tighten all bolts to the specified torque.

15 Starter motor - overhaul

If the starter motor is thought to be suspect, it should be removed from the vehicle and taken to an auto-electrician for testing. Most auto-electricians will be able to supply and fit brushes at a reasonable cost. However, check on the cost of repairs before continuing as it may prove more economical to obtain a new or exchange motor.

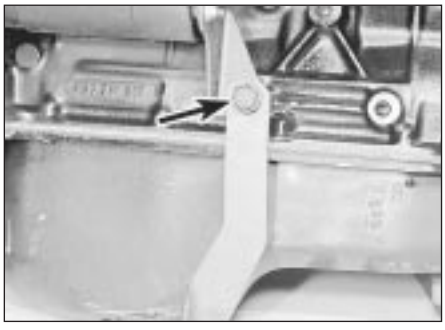
16 Ignition coil - removal, testing and refitting

Note: *Refer to Section 3 before proceeding. An ohmmeter will be required to test the coil*

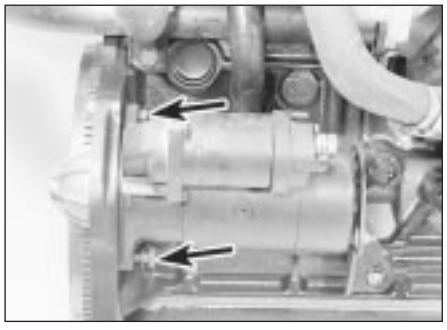
Removal

1 The ignition coil is either a cylindrical metal canister or a moulded plastic unit. It is clamped or bolted to the left-hand inner wing panel, near the suspension strut top mounting (under the power steering fluid reservoir, on

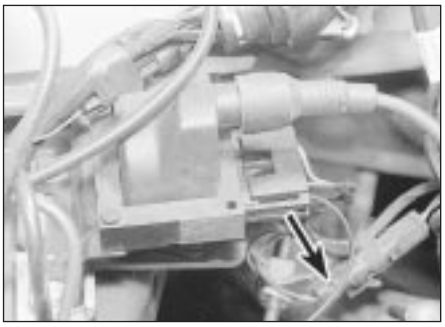
14.4 Starter motor and solenoid viewed from underneath the vehicle. Solenoid wiring connections arrowed



14.5 Starter motor mounting bracket/exhaust bracket securing bolt (arrowed) - 1.6 litre model



14.6 Starter motor securing bolts (arrowed) - 1.6 litre model (engine removed)



16.1 Ignition coil - 1.6 litre models - note ignition timing basic adjustment coding plug (arrowed)

16.3 Disconnecting the coil LT wiring plug - 2.0 litre model

models so equipped). On 14 NV, 16 SV and 18 SV models, the ignition amplifier module is mounted on the coil's bracket or baseplate **(see illustration)**.

2 Disconnect the battery negative lead.

3 Carefully note the LT wiring connections before disconnecting them **(see illustration)**.

4 Note that on models with power steering, one of the coil securing bolts also secures the power steering fluid reservoir bracket.

5 Remove the coil.

6 On models with a cylindrical type coil, the mounting clamp can be removed from the coil by loosening the clamp nut.

Testing

7 To test the coil, first disconnect the LT wiring and the HT lead. Test the coil's primary windings by connecting a multi-meter across the LT terminals ("+" or "15" and "-" or "1"). Then the secondary windings by testing across the HT terminal ("4") and one of the LT terminals (usually the "-/1" terminal, although in some cases, either terminal may serve). On 20 XEJ models, results should closely approximate the specified values. On all other models, typical primary resistances are less than 1 ohm, while secondary resistances can be expected to be in the 4000 to 12 000 ohms range.

8 If the results obtained differ significantly from those given, showing windings that are shorted or open circuit, the coil must be renewed.

Refitting

9 Refitting is a reversal of removal, however ensure correct connections. Usually they are physically different to prevent incorrect refitting. If not, use the terminal marks or numbers in conjunction with the relevant wiring diagram at the back of this manual to ensure that the connections are correctly remade. If the connections are reversed, so will the coil's polarity be. While the engine may still run, spark plug life will be reduced and poor starting and/or misfiring may follow.

10 Where applicable, ensure that the coil suppresser is in position before refitting the coil securing bolts.

17 Distributor cap and rotor arm - removal and refitting

Note: *Refer to Section 3 before proceeding*

Removal

14 NV and 16 SV models

1 Disconnect the battery negative lead.

2 Identify each HT lead for position, so that the leads can be refitted to their correct cylinders, then disconnect the leads from the spark plugs by pulling on the connectors, not the leads. Similarly, disconnect the HT lead from the coil. Pull the leads from the clips on the camshaft cover.

3 On the Bosch distributor, prise away the two spring clips with a screwdriver, and lift off the distributor cap. On the Lucas distributor, unscrew the two small bolts and lift off the cap **(see illustrations)**.

4 The rotor arm is a push fit on the end of the distributor shaft.

5 If needed, on the Bosch distributor, the plastic shield can be pulled from the end of the distributor, to allow examination of the distributor components **(see illustration)**.

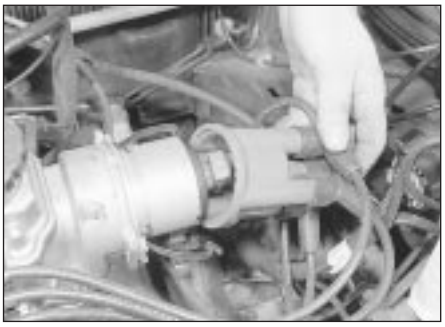
Other models, where applicable

6 Proceed as described in paragraphs 1 and 2.

7 On DOHC models (except X20 XEV), unscrew the two securing bolts and withdraw the spark plug cover from the camshaft cover.

8 Using a Torx socket, unscrew the three captive securing screws and withdraw the distributor cap **(see illustration)**.

9 Withdraw the plastic shield from the rotor arm housing. The shield is fitted in the housing, with an O-ring seal located in a groove in its periphery. Ease out the shield, taking care not to damage the rotor arm **(see illustration)**.



17.3A Removing the distributor cap - 1.6 litre model (Bosch distributor) . . .

17.3B . . .and 1.6 litre models (Lucas distributor)

17.5 Removing the rotor arm and plastic shield - 1.6 litre model (Bosch distributor)

17.8 Unscrewing a distributor cap securing screw - 2.0 litre model

17.9 Removing the plastic shield from the rotor arm housing - 2.0 litre model

10 Using an Allen key or hexagon bit, extract the two securing screws and withdraw the rotor arm, leaving the metal rotor hub in the housing **(see illustrations)**.
11 Examine the O-ring on the plastic shield, and renew if necessary.

Refitting

12 Refitting is a reversal of removal, noting that the rotor arm can only be fitted in one position. If necessary, turn the metal rotor hub so that the screw holes align with those in the rotor arm and the end of the camshaft. Ensure that the HT leads are correctly reconnected.

18 Distributor (SOHC models) - removal and refitting

Note: *Refer to Section 3 before proceeding. A tachometer and a timing light will be required to check the ignition timing on completion 14 NV and 16 SV*

Removal

1 Disconnect the battery negative lead.
2 Remove the distributor cap, as described in Section 17.
3 Disconnect the distributor wiring plug **(see illustrations)**.
4 On 14 NV models, disconnect the vacuum pipe from the diaphragm unit on the side of the distributor.
5 If the original distributor is to be refitted, make alignment marks between the distributor body and the camshaft housing, so that the distributor can be refitted in its original position.
6 Turn the crankshaft. This can be done by either using a socket or spanner on the crankshaft pulley bolt, or by engaging top gear and pushing the vehicle backwards or forwards. Bring No 1 cylinder to the firing point. No 1 cylinder is at the firing point when:

a) The relevant timing marks are aligned. On 14 NV models, the pointer on the rear timing belt cover should be aligned halfway between the two notches in the crankshaft pulley. On 16 NV models, the pointer on the rear timing belt cover should be aligned with the notch in the crankshaft pulley
b) The tip of the rotor arm is pointing to the position occupied by the No 1 cylinder HT lead terminal in the distributor cap
c) On the Bosch distributor, the rotor arm is aligned with the notch in the distributor body (remove the rotor arm and plastic shield, then refit the rotor arm to check the alignment with the notch). On the Lucas distributor, the rotor arm is approximately aligned with the **TDC** *arrow stamped in the distributor body* ***(see illustration).***

7 Unscrew the clamp nut and remove the clamp plate, then withdraw the distributor from the camshaft housing **(see illustrations)**.
8 If desired, the distributor can be dismantled, as described in Section 20.
9 Check the condition of the O-ring on the rear of the distributor body, and renew if necessary.

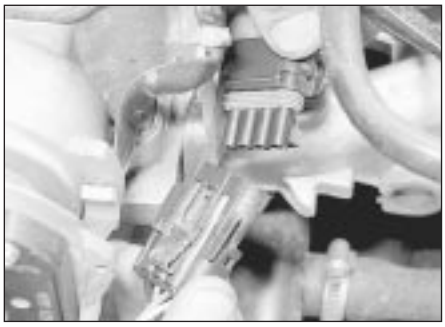
Refitting

10 Begin refitting by checking that No 1 cylinder is still at the firing point. The relevant timing marks should be aligned. If the engine has been turned whilst the distributor has

17.10A Extract the two securing screws . . .

17.10B . . .and withdraw the rotor arm - 2.0 litre model

18.3A Disconnecting the distributor wiring plug - 1.6 litre model (Bosch distributor)



18.3B Disconnecting the distributor wiring on the C16 NZ engine

18.6 TDC arrow on the Lucas distributor body

18.7A Unscrew the clamp nut . . .

18.7B . . .remove the clamp plate . . .

18.7C . . .and withdraw the distributor

been removed, check that No 1 cylinder is on its firing stroke by removing No 1 cylinder spark plug and placing a finger over the plug hole. Turn the crankshaft until compression can be felt, which indicates that No 1 piston is rising on its compression stroke. Continue turning the crankshaft until the relevant timing marks are in alignment.

11 Turn the rotor arm to the position noted in paragraph 6c, and hold the rotor arm in this position as the distributor is fitted. Note that the distributor driveshaft will only engage with the camshaft in one position. If the original distributor is being refitted, align the marks made on the distributor body and camshaft housing before removal.

12 Refit the clamp plate and nut, but do not fully tighten the nut at this stage.

13 On the Bosch distributor, remove the rotor arm, then refit the plastic shield and the rotor arm.

14 On 14 NV models, reconnect the vacuum pipe to the diaphragm unit.

15 Reconnect the distributor wiring plug.

16 Refit the distributor cap as described in Section 17.

17 Reconnect the battery negative lead.

18 Check and if necessary adjust the ignition timing, as described in Section 21.

19 Distributor (DOHC models), where applicable - removal and refitting

Removal

1 Disconnect the battery negative lead.

2 Remove the distributor cap, as described in Section 17.

3 Disconnect the distributor wiring plug.

4 Unscrew the two securing bolts, and remove the distributor from the cylinder head.

5 Examine the O-ring on the rear of the distributor, and renew if necessary.

Refitting

6 Refitting is a reversal of removal. However, note that the distributor should be fitted so that the wiring plug is positioned on the upper left-hand side of the distributor body, when viewed from the distributor cap end.

20 Distributor - dismantling, inspection and reassembly

Note: *Before contemplating dismantling of a distributor, check the cost and availability of replacement parts. It may prove more economical to renew the complete distributor assembly*

14 NV models

Dismantling

1 With the distributor removed as described in Section 18, continue as follows.

2 Pull off the rotor arm, and remove the plastic shield.

3 The top bearing plate can be removed after unscrewing the two securing screws, however (other than the vacuum diaphragm unit), no spares are available for the distributor and no adjustments are required.

4 If desired, the vacuum diaphragm unit can be removed by extracting the two securing screws and unhooking the operating arm from the distributor baseplate. Note that the screws are of differing lengths, the longer screw also secures one of the distributor cap clips.

Inspection

5 The vacuum unit can be tested by applying suction to the vacuum port, and checking that the operating rod moves into the unit as suction is applied. Remove the suction, and check that the operating rod returns to its original position. If the operating rod does not move as described, renew the vacuum unit.

6 Check the distributor cap for corrosion of the segments, and for signs of tracking, indicated by a thin black line between the segments. Make sure that the carbon brush in the centre of the cap moves freely and stands proud of the surface of the cap. Renew the cap if necessary.

7 If the metal portion of the rotor arm is badly burnt or loose, renew it. If slightly burnt or corroded; it may be cleaned with a fine file.

8 Examine the seal ring at the rear of the distributor body, and renew if necessary.

Reassembly

9 Reassembly is a reversal of dismantling, ensuring that the vacuum unit operating arm is correctly engaged with the peg on the baseplate, several attempts may be required to reconnect it.

10 Refit the distributor as described in Section 18, and then check and if necessary adjust the ignition timing, as described in Section 21.

16 SV models

Dismantling

11 With the distributor removed as described in Section 18, pull off the rotor arm and, on the Bosch distributor, remove the plastic shield.

12 Using a pin punch, carefully drive out the roll pin securing the plastic drive collar to the rear of the distributor shaft **(see illustration)**.

13 Lift off the drive collar, and remove the thrustwashers from the end of the shaft **(see illustration)**.

14 Withdraw the shaft, complete with the trigger vane, from the distributor body, and recover the thrustwashers from the shaft **(see illustration)**.

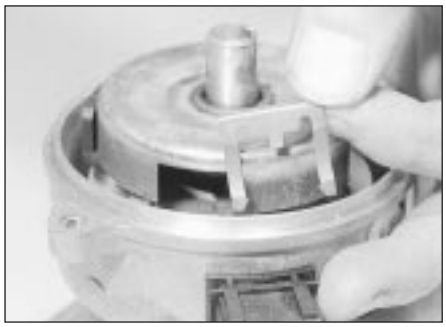
15 On the Lucas distributor, extract the spring clip from inside the body, then withdraw the terminal block. Pull the small wiring plug from inside the terminal block **(see illustrations)**.

16 Remove the screws, and lift the sensor plate from the distributor body **(see illustrations)**.

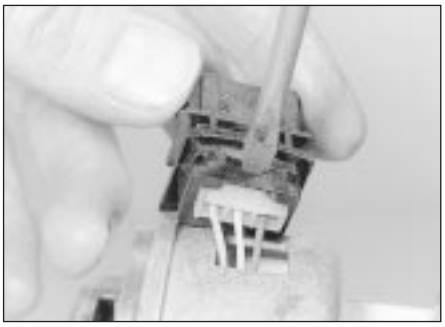
20.12 Removing the drive collar roll pin - 1.6 litre models (Bosch distributor)

20.13 Removing the thrustwashers

20.14 Recovering the thrustwashers from the shaft - 1.6 litre (Bosch distributor)

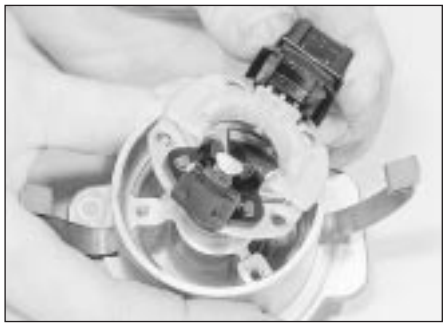


20.15A Removing the spring clip . . .



20.15B . . .and disconnecting the small wiring plug - 1.6 litre (Lucas distributor)

20.16A Remove the securing screws . . .



20.16B . . .and withdraw the sensor plate - 1.6 litre (Bosch distributor)

Inspection

17 Examine the distributor cap and rotor arm, as described in paragraphs 6 and 7. Examine the O-rings at the rear of the distributor body, and on the rear of the shaft, and renew if necessary.

Reassembly

18 Reassembly is a reversal of dismantling, ensuring that the thrustwashers are correctly located. Note that the drive collar should be refitted so that the drive peg on the collar is aligned with the groove in the top of the distributor shaft (it is possible to fit the drive collar 180° out of position).

19 Refit the distributor as described in Section 18, and then check and if necessary adjust the ignition timing, as described in Section 21.

DOHC models (where applicable)

20 The distributor cap and rotor arm can be examined as described in paragraphs 6 and 7.

21 Ignition timing - checking and adjustment

Note: *Refer to Section 3 before proceeding. A tachometer and a timing light will be required during this procedure. For details of ignition timing adjustment required to operate vehicles on unleaded petrol, refer to Section 22.*

14 NV and 16 SV models

Checking

1 Start the engine and run it until it reaches normal operating temperature, then switch off.

2 On 14 NV models, disconnect the vacuum pipe from the distributor vacuum diaphragm unit.

3 On all models use a spanner applied to the crankshaft pulley bolt to rotate the crankshaft clockwise until the notch in the pulley's inboard rim aligns with the pointer protruding from the oil pump housing. On 14 NV models, where two notches (indicating 10° and 5° BTDC respectively) are found, rotate the crankshaft until the second notch (in the direction of rotation - i.e. 5° BTDC) aligns. Use white paint or similar to emphasise the pointer and notch, to make them easier to see.

4 Connect a timing light to No 1 cylinder (nearest the timing belt end of the engine) HT lead, also a tachometer; follow the equipment manufacturer's instructions for connection.

5 Start the engine and allow it to idle - the speed should be between 700 and 1000 rpm.

6 On 14 NV models, aim the timing light at the pointer and check that it is aligned with the crankshaft pulley notch.

7 On early 16 SV models, disconnect the ignition timing basic adjustment coding plug. This can be identified by a length of Black wire joining Brown/Red and Brown/Yellow wires in a connector plug clipped to the wiring or heater/cooling system hoses beneath the battery/ignition coil (see illustration, 16.1). This causes the MSTS-i module to adopt its basic adjustment mode, sending a constant firing signal corresponding to 10° BTDC and eliminating any advance below 2000 rpm. Aim the timing light at the pointer and check that it is aligned with the crankshaft pulley notch.

8 On later 16 SV, C 16 NZ and C 16 NZ2 models, the coding plugs are no longer fitted. For accurate checking, special Vauxhall test equipment must be used which causes the MSTS module to adopt its basic adjustment mode.

9 Without access to such equipment, it is possible to check and adjust the ignition timing, accurate results cannot be guaranteed. Owners are therefore advised to have this work carried out by a suitably equipped Vauxhall dealer; at the very least, make the initial setting yourself and then have it checked as soon as possible.

10 If you do attempt to check the ignition timing yourself, note that the fixed reference mark is now an extended line embossed on the timing belt lower outer cover.

Adjustment

11 If the notch and pointer are not aligned, loosen the distributor clamp nut and turn the distributor body slightly in the required direction to align.

12 Tighten the distributor clamp nut, and check that the notch and pointer are still aligned.

20.16C Sensor plate screw (arrowed) - 1.6 litre (Lucas distributor)

13 Stop the engine, and disconnect the timing light and tachometer.

14 On 16 SV models, reconnect the basic adjustment coding plug. On 14 NV models, reconnect the vacuum pipe to the distributor vacuum diaphragm unit.

Other models

15 No adjustment of the ignition timing is possible on 1.8 and 2.0 litre models, as the adjustment is carried out automatically by the electronic control module.

16 The ignition timing can be checked by a Vauxhall dealer using specialist dedicated test equipment, if a fault is suspected.

22 Ignition timing - adjustment for use with unleaded petrol

14 NV models

1 All models with the 14 NV engine have the ignition timing adjusted for use with 95 RON unleaded petrol before they leave the factory, and no further adjustment is required.

2 Leaded petrol (98 RON) can be used if desired, with no adverse effects.

1.6, 1.8 and 2.0 SOHC models

Note: *Models equipped with a catalytic converter must be operated on 95 R0N unleaded petrol at all times, and although an octane coding plug may be fitted, it should* **not** *be tampered with*

3 Models, other than 14 NV, are equipped with an octane coding plug, which is located

22.3 Octane coding plug (arrowed) - 2.0 litre model

in a clip at the left-hand rear of the engine compartment **(see illustration)**.

4 The plug is reversible in its connector, and is marked either "A" or "98" on one side, which corresponds to the position for use with 98 RON leaded petrol. On the other side either "B" or "95", which corresponds to the position to use with 95 RON unleaded petrol. All vehicles are set for use with 95 RON unleaded petrol before they leave the factory.

5 To change the coding for use with a different type of petrol, first allow the fuel tank to become practically empty.

6 Fill the fuel tank with the required type of petrol.

7 Ensure that the ignition is switched off, then remove the coding plug from its clip and disconnect the wiring connector.

8 Rotate the plug through 180°, so that the appropriate octane mark is uppermost (see paragraph 4), then reconnect the wiring connector and refit the plug to its clip.

9 Note that using petrol with a higher octane rating than that set will not cause damage, but petrol with a lower octane rating than that set must not be used.

20 XE, C20 XE and X20 XEV models

10 The ignition coding plug found on these models is **not** an octane coding plug (although its method of operation is similar) and must not be altered from its factory setting. Its purpose is to ensure that the Motronic module uses the correct information, pre-programmed (or "mapped") into its memory, to enable the vehicle to comply with the relevant national noise and exhaust emission legislation.

11 On these models, the knock sensor circuit allows the Motronic module to compensate for differences in the octane value of the petrol used, without the need for manual intervention. Remember, however, that all catalytic converter-equipped vehicles must use unleaded petrol only. This means that these models can use any grade of unleaded petrol on sale in the UK without the need for adjustment.

23 Electronic modules - removal and refitting

Note: *Refer to Section 3 for precautions to be observed when working with electronic modules. Heat sink compound must be used when refitting the module.*

HEI module (14 NV models)

Removal

1 The module is mounted on a metal plate, beneath the ignition coil, on the left-hand side of the engine compartment.

2 Remove the ignition coil as described in Section 16, and slide the coil from its clamp.

3 The module can be removed from the mounting plate by unscrewing the two securing screws.

4 Before refitting the module, heat sink compound should be applied to the mounting plate to improve heat dissipation. If a new module is being fitted, it should be supplied with heat sink compound. Similar compounds can be bought from DIY electrical shops.

Refitting

5 Refitting is a reversal of removal.

MSTS-i module (1.6 and 1.8 litre models)

Removal

6 The module is mounted on the engine compartment bulkhead, above the steering rack **(see illustration)**.

7 Disconnect the battery negative lead.

8 If desired, for improved access, remove the air box from the top of the carburettor.

9 Disconnect the wiring plug from the module.

10 Unscrew the two securing nuts, and withdraw the module from the bulkhead.

Refitting

11 Refitting is a reversal of removal.

Motronic module

Removal

12 The module is mounted in the driver's footwell, behind the side trim panel.

23.15 Lowering the Motronic module from the footwell - 2.0 litre model

23.6 MSTS-i module location - 1.6 litre model

13 Disconnect the battery negative lead.

14 Remove the driver's footwell side trim panel, as described in Chapter 11.

15 Unscrew the three module securing screws, two at the top of the module, and a single screw at the bottom, and lower the module from the footwell **(see illustration)**.

16 Release the retaining clip, and disconnect the module wiring plug **(see illustration)**.

17 Withdraw the module, noting the plastic insulating sheet on its rear face.

Refitting

18 Refitting is a reversal of removal, but ensure that the insulating sheet is in place on the rear face of the module.

24 MSTS-i components - removal and refitting

Note: *Refer to Section 3 before proceeding. Procedures for removal and refitting of the ignition system components and electronic module are given elsewhere in the relevant Sections of this Chapter*

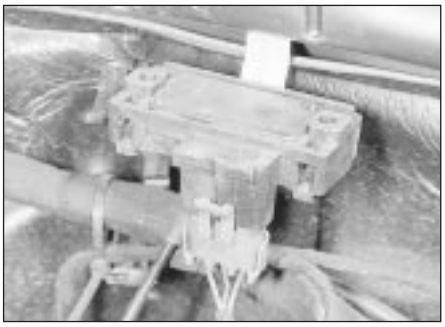
Manifold pressure sensor

Removal

1 The sensor is located on the engine compartment bulkhead, to the left of the MSTS-i module, under the edge of the windscreen cowl panel **(see illustration)**.

2 Disconnect the battery negative lead.

23.16 Releasing the Motronic module wiring plug clip - 2.0 litre model



24.1 MSTS-i manifold pressure sensor - 1.6 litre model

3 Lift up the edge of the windscreen cowl panel for access to the sensor.
4 Disconnect the sensor wiring plug, and the vacuum pipe.
5 Pull the pressure sensor upwards to release it from its bracket, and withdraw it from the vehicle.

Refitting

6 Refitting is a reversal of removal. However, on Multec models no fuel vapour trap is fitted. It is therefore essential that the sensor vacuum hose is routed so that it falls steadily from the sensor to the throttle body. This precaution prevents any fuel droplets being trapped in the sensor or hose, and allows them to drain into the inlet port.

Oil temperature sensor

Removal

7 The sensor is screwed into the inlet manifold side of the cylinder block, next to the starter motor's right-hand end.
8 The sensor can be reached quite easily from above, but if it is to be removed from beneath, ensure that the handbrake is applied, and that the vehicle is securely supported on axle stands (see "*Jacking and Vehicle Support*").
9 Disconnect the battery negative lead.
10 Disconnect the sensor wiring plug.
11 Using a spanner, unscrew the sensor and remove it **(see illustration)**. Be prepared for oil spillage, and plug the hole in the cylinder block to prevent dirt ingress and further oil loss.

24.18 Examine the crankshaft speed/position sensor sealing ring - 1.8 litre model

24.11 Unscrewing the MSTS-i oil temperature sensor - 1.6 litre model (engine removed)

Refitting

12 Refitting is a reversal of removal.

Crankshaft speed/position sensor (1.8 litre models)

Removal

13 The sensor is located on the exhaust manifold side of the engine, in the lower cylinder block behind the oil pump.
14 Disconnect the battery negative lead.
15 Release the relevant outer timing belt cover securing clips, and unclip the sensor wiring from the timing belt cover.
16 Disconnect the sensor wiring connector, noting its location.
17 Unscrew the securing bolt, and withdraw the sensor from the cylinder block **(see illustration)**.
18 Examine the sensor sealing ring, and renew if necessary **(see illustration)**.

Refitting

19 Refitting is a reversal of removal, ensuring that the sensor wiring is correctly located on the timing belt cover, and that the wiring connector is correctly located.

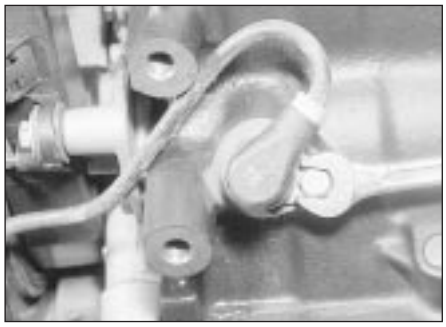
25 Motronic system components - removal and refitting

Note: *Refer to Section 3 before proceeding. Procedures for removal and refitting of the ignition system components and electronic module are given elsewhere in the relevant Sections of this Chapter. Removal and refitting procedures for all fuel injection system components are given in Chapter 4B*

Coolant temperature sensor

Removal

1 On all except 20 XEJ models, the sensor is located in the end of the thermostat housing, on the inlet manifold side of the engine.
2 On 20 XEJ models, the sensor is located in the thermostat housing, on the exhaust manifold side of the engine.
3 Disconnect the battery negative lead.
4 Partially drain the cooling system, as described in Chapter 3.



24.17 Unscrewing the crankshaft speed/position sensor securing bolt - 1.8 litre model

5 Disconnect the sensor wiring plug **(see illustration)**.
6 Using a spanner, unscrew the sensor and withdraw it from the thermostat housing.

Refitting

7 Refitting is a reversal of removal.
8 On completion, top-up the cooling system, as described in Chapter 3.

Knock sensor (DOHC models)

Removal

9 The sensor is located at the lower inlet manifold side of the cylinder block, below the idle speed adjuster, and is only accessible from below the vehicle.
10 Disconnect the battery negative lead.
11 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.
12 Remove the engine undershield, as described in Chapter 11.
13 Disconnect the sensor wiring plug.
14 Unscrew the securing bolt, and withdraw the sensor from the cylinder block.

Refitting

15 Refitting is a reversal of removal, but note that the mating faces of the sensor and cylinder block must be cleaned thoroughly before fitting the sensor.

25.5 Disconnecting the coolant temperature sensor wiring plug - 2.0 litre model (alternator removed)

26 DIS module - removal and refitting

Note: *Refer to Section 3 before proceeding.*

Removal

1 Disconnect the battery negative lead.
2 Disconnect the HT leads from the module terminals noting their locations to ensure correct refitting. Note that the HT lead cylinder numbers are stamped on the module, next to each terminal, and similar numbers appear on each HT lead.
3 Disconnect the module wiring plug.
4 On X16 SZ engines, undo the three screws and remove the module from the camshaft housing. On C20 XE engines, undo the bolts securing the DIS module mounting bracket to the cylinder head and remove the module and bracket. Note the installed position of DIS module on its mounting bracket, undo the four securing screws and separate the module from the bracket.

Refitting

5 Refitting is a reversal of removal.

27 Camshaft phase sensor (C20 XE engine) - removal and refitting

Note: *Refer to Section 3 before proceeding.*

Removal

1 The camshaft phase sensor is mounted on the end of the cylinder head in the position normally occupied by the distributor.
2 Disconnect the battery negative lead.
3 Disconnect the wiring plug then undo the phase sensor securing bolts.
4 Withdraw the phase sensor from the cylinder head, then undo the bolt and remove the phase sensor disc from the end of the camshaft.

Refitting

5 Refitting is a reversal of removal.