






Chapter 5 Engine electrical systems

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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

System type. 12-volt, negative earth

Battery

Type.	Lead acid
Make.	Fulmen, Delco or Steco
Charge condition:	
Poor.	12.5 volts
Normal.	12.6 volts
Good.	12.7 volts

Ignition system

System type*:	
1124 cc models, and 1360 cc (K2D and KDY engine) models.	Breakerless electronic, with distributor
1360 cc (KDX engine) models.	Static (distributorless) system, controlled by engine management ECU
1580 cc, 1761 cc, 1905 cc (D6E engine) and 1998 cc 8-valve models	Static (distributorless) system controlled by engine management ECU
1905 cc (DKZ engine) models.	Distributor-type system, control led by engine management ECU
1998 cc 16-valve models.	Static (distributorless) "sequential" system, controlled by engine management ECU

*Refer to text for further information on each system

Ignition system (continued)

Firing order. . . . .	.1-3-4-2 (No 1 cylinder at transmission end of engine)
Ignition timing:	
1124 cc models, and 1360 cc (K2D and KDY engine) models. . . . .	.8° BTDC @ 750 rpm
All other models. . . . .	.Controlled by ECU - see text
Ignition HT coil resistances*:	
1124 cc models, and 1360 cc (K2D and KDY engine) models:	
Primary windings. . . . .	.0.8 ohms
Secondary windings. . . . .	.6500 ohms
1360 cc (KDX engine) models. . . . .	.N/A
1580 cc and 1905 cc models:	
Primary windings. . . . .	.0.8 ohms
Secondary windings - Bosch coil. . . . .	.14 600 ohms
Secondary windings - Valeo coil. . . . .	.8600 ohms
1761 cc models. . . . .	.N/A
1998 cc 8-valve models:	
Primary windings - Bosch coil. . . . .	.0.5 ohms
Primary windings - Valeo coil. . . . .	.0.8 ohms
Secondary windings. . . . .	.N/A
1998 cc 16-valve models:	
Primary windings. . . . .	.0.65 ohms
Secondary windings. . . . .	.N/A

**Values given are accurate only when the coil is at 20°C. Where no values are quoted, refer to your Citroen dealer for advice. See text for further information.*

Alternator

Type.Valeo, Bosch or Mitsubishi

Starter motor

Type.Valeo or Bosch

1 General information and precautions

General information

The engine electrical system includes all charging, starting and ignition system components. Because of their engine-related functions, these components are covered separately from the body electrical devices such as the lights, instruments, etc (which are covered in Chapter 12).

The electrical system is of the 12-volt negative earth type.

The battery is of the low-maintenance or "maintenance-free" ("sealed for life") type, and is charged by the 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.

Refer to Section 5 for further information on the various ignition systems.

Precautions

Further details of the various systems are given in the relevant Sections of this Chapter. While some repair procedures are given, the usual course of action is to renew the

component concerned. The owner whose interest extends beyond mere component renewal should obtain a copy of the "Automobile Electrical & Electronic Systems Manual", available from the publishers of this manual.

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. In addition to the precautions given in "Safety first!" at the beginning of this manual, observe the following when working on the system.

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

Do not reverse the battery connections. Components such as the alternator, fuel injection electronic control unit, or any other components having semi-conductor circuitry, could be irreparably damaged.

If the engine is being started using jump leads and a slave battery, connect the batteries *positive-to-positive* and *negative-to-negative* (see "Booster battery (jump) starting"). This also applies when connecting a battery charger.

Never disconnect the battery terminals, the alternator, any electrical wiring or any test instruments when the engine is running.

Do not allow the engine to turn the alternator when the alternator is not connected.

Never "test" for alternator output by "flashing" the output lead to earth.

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

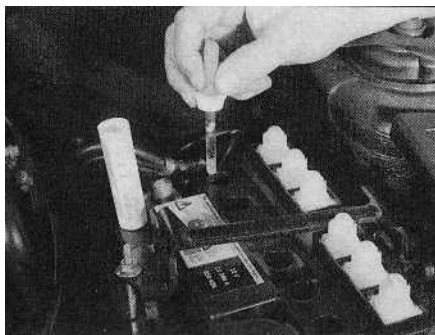
Always ensure that the battery negative lead is disconnected when working on the electrical system.

Before using electric-arc welding equipment on the car, disconnect the battery, alternator and components such as the fuel injection/ignition electronic control unit, to protect them from the risk of damage.

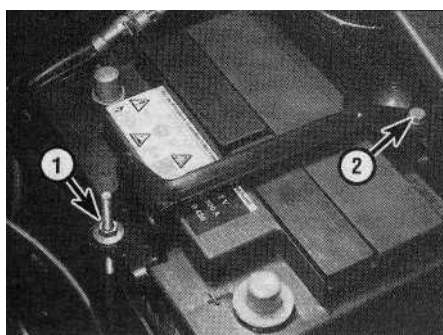
The radio/cassette unit fitted as standard equipment by Citroen is equipped with a built-in security code, to deter thieves. If the power source to the unit is cut, the anti-theft system will activate. Even if the power source is immediately reconnected, the radio/cassette unit will not function until the correct security code has been entered. Therefore, if you do not know the correct security code for the radio/cassette unit, *do not* disconnect the battery negative terminal of the battery, or remove the radio/cassette unit from the vehicle. Refer to "Radio/cassette unit anti-theft system precaution" Section at the beginning of this manual for details of how to enter the security code.

2 Electrical fault finding - general information

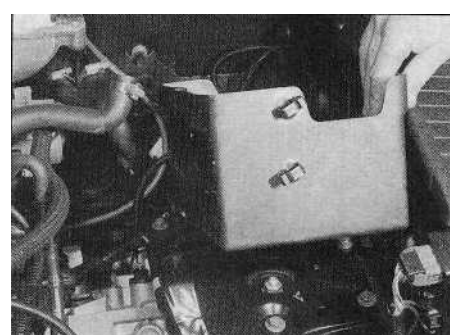
Refer to Chapter 12, Section 2.



3.1 Using a hydrometer to check the battery electrolyte specific gravity



4.4 Battery clamp plate securing nut (1) and bolt (2)



4.6 Removing the plastic battery tray

3 Battery - testing and charging

Standard and low-maintenance battery - testing

1 If the vehicle covers a small annual mileage, it is worthwhile checking the specific gravity of the electrolyte every three months, to determine the state of charge of the battery. Use a hydrometer (these are readily-available from motor accessory outlets) to make the check, and compare the results with the following table (**see illustration**). Note that the specific gravity readings assume an electrolyte temperature of 15°C (60°F); for every 10°C (18°F) below 15°C (60°F), subtract 0.007. For every 10°C (18°F) above 15°C (60°F), add 0.007.

Ambient temperature above 25°C (77°F)	Ambient temperature below 25°C (77°F)
---------------------------------------	---------------------------------------

Fully-charged 1.210 to 1.230 1.270 to 1.290

70% charged 1.170 to 1.190 1.230 to 1.250

Fully-discharged 1.050 to 1.070 1.110 to 1.130

2 If the battery condition is suspect, first check the specific gravity of electrolyte in each cell. A variation of 0.040 or more between any cells indicates loss of electrolyte or deterioration of the internal plates.

3 If the specific gravity variation is 0.040 or more, the battery should be renewed. If the cell variation is satisfactory but the battery is discharged, it should be charged as described later in this Section.

Maintenance-free battery - testing

4 In cases where a "sealed for life" maintenance-free battery is fitted, topping-up and testing of the electrolyte in each cell is not possible. The condition of the battery can therefore only be tested using a battery condition indicator or a voltmeter.

5 Certain models may be fitted with a "Delco" type maintenance-free battery, with a built-in charge condition indicator. The indicator is located in the top of the battery casing, and indicates the condition of the battery by 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. Do not attempt to charge, load or jump-start a battery when the indicator shows clear/yellow.

6 If testing the battery using a voltmeter, connect the voltmeter across the battery, and compare the result with those given in the Specifications under "charge condition". The test is only accurate if the battery has not been subjected to any kind of charge for the previous six hours. If this is not the case, switch on the headlights for 30 seconds, then switch them off and wait four to five minutes before testing the battery. All other electrical circuits must be switched off, so check that the doors and tailgate are fully shut when making the test.

7 Voltage readings corresponding to the various states of charge are given in the Specifications.

8 If the battery is to be charged, remove it from the vehicle (Section 4) and charge it as described later in this Section.

Standard and low-maintenance battery - charging

Note: The following is intended as a guide only. Always refer to the manufacturer's recommendations (often printed on a label attached to the battery) before charging a battery.

9 Charge the battery at a rate of 3.5 to 4 amps, and continue to charge the battery at this rate until no further rise in specific gravity is noted over a four-hour period.

10 Alternatively, a trickle charger, charging at the rate of 1.5 amps, can safely be used overnight.

11 Special rapid "boost" charges, which are claimed to restore the power of the battery in 1 to 2 hours, are not recommended, as they can cause serious damage to the battery plates through overheating.

12 While charging the battery, note that the

temperature of the electrolyte should never exceed 37.8°C (100°F).

Maintenance-free battery - charging

Note: The following is intended as a guide only. Always refer to the battery manufacturer's recommendations (often printed on a label attached to the battery) before charging.

13 This battery type takes considerably longer to fully recharge than the standard type, the time taken being dependent on the extent of discharge, but it can take anything up to three days.

14 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. Using this method, the battery should be useable within three hours, giving a voltage reading of 12.5 volts, but this is for a partially-discharged battery; as mentioned, full charging can take considerably longer.

15 If the battery is to be charged from a fully-discharged state (condition reading less than 12.2 volts), have it recharged by your Citroën dealer or local automotive electrician, as the charge rate is higher, and constant supervision during charging is necessary.

4 Battery - removal and refitting

Removal

1 The battery is located on the left-hand side 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 nut and the bolt securing the battery clamp plate, then lift the clamp plate from the top of the battery (**see illustration**).

5 Lift the battery from the plastic tray.

6 If desired, the plastic tray can be lifted from the metal support plate, after unclipping any relevant hoses and wiring from its sides (**see illustration**).

Refitting

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

5 Ignition system - general information

1124 cc and 1360 cc carburettor models

1 On 1124 cc and 1360 cc carburettor models, a breakerless electronic ignition system is used. The system basically comprises the HT ignition coil and the distributor, both of which are mounted on the left-hand end of the cylinder head, the distributor being driven off the end of the camshaft.

2 The distributor contains a reluctor mounted onto its shaft, and a magnet and stator fixed to its body. The ignition amplifier unit is also mounted onto the side of the distributor body. The system operates as follows.

3 When the ignition is switched on but the engine is stationary, the transistors in the amplifier unit prevent current flowing through the ignition system primary (LT) circuit.

4 As the crankshaft rotates, the reluctor moves through the magnetic field created by the stator. When the reluctor teeth are in alignment with the stator projections, a small AC voltage is created. The amplifier unit uses this voltage to switch the transistors in the unit and complete the ignition system primary (LT) circuit.

5 As the reluctor teeth move out of alignment with the stator projections, the AC voltage changes, and the transistors in the amplifier unit are switched again to interrupt the primary (LT) circuit. This causes a high voltage to be induced in the coil secondary (HT) windings, which then travels down the HT lead to the distributor and onto the relevant spark plug.

6 A TDC sensor is fitted to the rear of the flywheel, but the sensor is not part of the ignition system; it is for diagnostic purposes only.

1124 cc and early 1360 cc fuel-injected models

7 On 1124 cc and early 1360 cc (KDY engine) fuel-injected models equipped with the Bosch Monopoint A2.2 fuel injection system, a breakerless electronic ignition system is fitted. This operates in the same way as that described above for the carburettor models.

8 In addition to the system components described above, the system is equipped with an ignition timing retard system. This limits the nitrous oxide (Nox) content of the exhaust

gases by reducing the ignition advance at certain engine temperatures. The system is controlled by the fuel injection electronic control unit (ECU). The ECU has control over an electrically-operated solenoid valve, mounted in the left-hand rear corner of the engine compartment, which is fitted in the vacuum pipe linking the distributor vacuum diaphragm unit to the inlet manifold (**see illustration**). At certain engine temperatures, the ECU switches off the solenoid valve, which then cuts off the vacuum supply to the distributor vacuum diaphragm, thereby reducing the ignition advance.

9 A TDC sensor is fitted to the rear of the flywheel, but the sensor is not part of the ignition system; it is for diagnostic purposes only.

Later 1360 cc fuel-injected models, and all 1580 cc and 1761 cc models

10 On later 1360 cc models (KDX engine), and all 1580 cc and 1761 cc models, the ignition system is integrated with the fuel injection system, to form a combined engine management system under the control of one ECU (refer to Chapter 4 for further information).

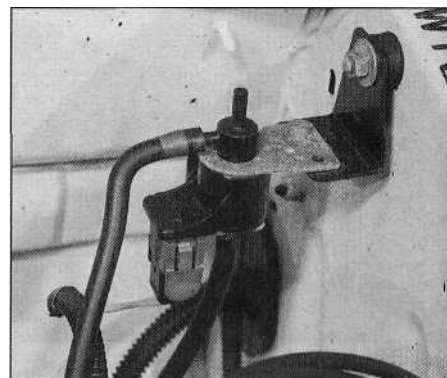
11 The ignition side of the system is of the static (distributorless) type, consisting simply of a four-output ignition coil. The ignition coil actually consists of two separate HT coils, which supply two cylinders each (one coil supplies cylinders 1 and 4, the other cylinders 2 and 3). Under the control of the ECU, the ignition coil operates on the "wasted-spark" principle. The spark plugs are fired in two pairs, twice for every complete cycle of the engine. One plug of each pair will fire on a compression stroke, and one on an exhaust stroke; the spark on the exhaust stroke has no effect on the running of the engine, and is therefore "wasted". The ECU uses the inputs from the various sensors to calculate the required ignition advance setting and coil charging time.

1905 cc models

12 On 1905 cc models, the ignition system is integrated with the fuel injection system, to form a combined engine management system under the control of one ECU via the ignition amplifier module. (Refer to Chapter 4 for further information.) However, two different ignition set-ups are used, depending on engine type.

13 On models not equipped with a catalytic converter (D6E engine with Bosch Motronic MP3.1 system), the ignition system is of the static (distributorless) type, with a four-output ignition coil. The system functions as described above, in paragraph 11.

14 On models with a catalytic converter (DKZ engine with Bosch Motronic M1.3 system), the ignition system uses a



5.8 Ignition timing retard system solenoid valve -1124 cc and early 1360 cc fuel-injected models

conventional HT coil and distributor to distribute the HT voltage to the relevant spark plug.

1998 cc 8-valve models

16 On 1998 cc 8-valve models, the ignition system is as described above for later 1360 cc, 1580 cc and 1761 cc models, but with the addition of a knock sensor incorporated into the ignition system. The knock sensor is mounted onto the cylinder head, and operates as described below for 1998 cc 16-valve models.

1998 cc 16-valve models

17 The ignition system on 1998 cc 16-valve models is of the static (distributorless) type. However, the system differs from the other static systems in that it is a "sequential" system, with each plug sparking individually once every cycle of the engine, rather than operating on the "wasted-spark" principle where the plugs spark in pairs, firing twice for every cycle of the engine.

18 The ignition system components consist of two amplifier modules, four ignition HT coils, and a knock sensor. The ignition system is integrated with the fuel injection system, to form a combined engine management system under the control of one ECU via the ignition amplifier modules. Refer to Chapter 4 for further information.

19 Each ignition amplifier module operates two HT coils; the ignition HT coils are integral with the plug caps, and are pushed directly onto the spark plugs, one for each plug. This removes the need for any HT leads connecting the coils to the plugs. The ECU uses the inputs from the various sensors to calculate the required ignition advance setting and coil charging time.

20 The knock sensor is mounted onto the cylinder head, and prevents the engine "pinking" under load. The sensor detects abnormal vibration, and is thus able to detect the knocking which occurs when the engine starts to "pink" (pre-ignite). The knock sensor sends an electrical signal to the ECU, which in turn retards the ignition advance setting until the "pinking" ceases.

6 Ignition system - testing



Ignition systems with a distributor

Note: Refer to the precautions given in Section 1 of this Chapter before starting work. Always switch off the ignition before disconnecting or connecting any component, and when using a multi-meter to check resistances.

General

1 The components of electronic ignition systems 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 the failure of any of the system's components. 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 an 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 HT coil or amplifier unit will be damaged. Similarly, *never* try to "diagnose" misfires by pulling off one HT lead at a time.

Engine will not start

3 If the engine either will not turn 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), disconnect the ignition coil HT lead from the distributor cap and earth it, then note the voltage reading obtained while turning the engine on the starter for (no more than) ten seconds. If the reading obtained is less than approximately 9.5 volts, first check the battery, starter motor and charging system as described in the relevant Sections of this Chapter.

4 If the engine turns at normal speed but will not start, check the HT circuit by connecting a timing light (following the equipment manufacturer's instructions) and turning the engine 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, using the information given in Chapter 1.

5 If there is a spark, check the fuel system for faults, referring to the relevant Part of Chapter 4 for further information.

6 If there is still no spark, check the voltage at the ignition HT coil "+" terminal; it should be the same as the battery voltage (ie, at least

11.7 volts). If the voltage at the coil is less than battery voltage by 1 volt or more, check the feed back through the fusebox and ignition switch to the battery and its earth, until the fault is found.

7 If the feed to the HT coil is sound, check the coil's primary and secondary winding resistance as described later in this Section. Renew the coil if faulty, but be check carefully the condition of the LT connections themselves before doing so, to ensure that the fault is not due to dirty or poorly-fastened connectors.

8 If the HT coil is in good condition, the fault is probably within the amplifier unit or distributor stator assembly (1124 cc and 1360 cc models) or the engine management ECU (1905 cc models). Testing of these components should be entrusted to a Citroen dealer.

Engine misfires

9 An irregular misfire suggests either a loose connection or intermittent fault on the primary circuit, or an HT fault on the coil side of the rotor arm.

10 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 above.

11 Check that the HT coil, the distributor cap and the HT leads are clean and dry. Check the leads themselves and the spark plugs (by substitution, if necessary), then check the distributor cap, carbon brush and rotor arm as described in Chapter 1.

12 Regular misfiring is almost certainly due to a fault in the distributor cap, HT leads or spark plugs. Use a timing light (paragraph 4 above) to check whether HT voltage is present at all leads.

13 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.

14 If no HT voltage is present, check the HT coil; its secondary windings may be breaking down under load.

Static (distributorless) ignition systems

15 If a fault appears in the engine management (fuel injection/ignition) system, first ensure that the fault is not due to a poor electrical connection, or to poor maintenance; ie, check that the air cleaner filter element is clean, that the spark plugs are in good condition and correctly gapped, and that the engine breather hoses are clear and undamaged. Refer to Chapter 1 for further information. Also check that the accelerator cable is correctly adjusted, as described in Chapter 4. If the engine is running very

roughly, check the compression pressures as described in Chapter 2, and the valve clearances (1360 cc models only) as described in Chapter 1.

16 If these checks fail to reveal the cause of the problem, the vehicle should be taken to a suitably-equipped Citroen dealer for testing. A wiring block connector is incorporated in the engine management circuit, into which a special electronic diagnostic tester can be plugged. The tester will locate the fault quickly and simply, alleviating the need to test all the system components individually, which is a time-consuming operation that carries a high risk of damaging the ECU.

17 The only ignition system checks which can be carried out by the home mechanic are those described in Chapter 1 relating to the spark plugs, and also the ignition coil test described in this Chapter. If necessary, the system wiring and wiring connectors can be checked as described in Chapter 12, ensuring that the ECU wiring connector(s) have first been disconnected.

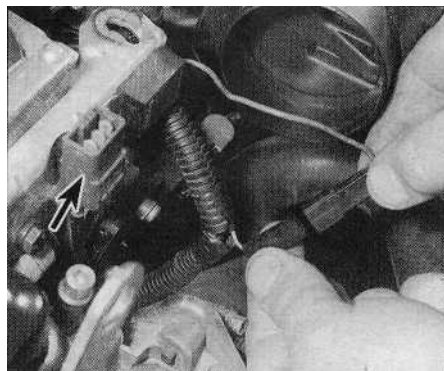
7 Ignition HT coil(s) - removal, testing and refitting



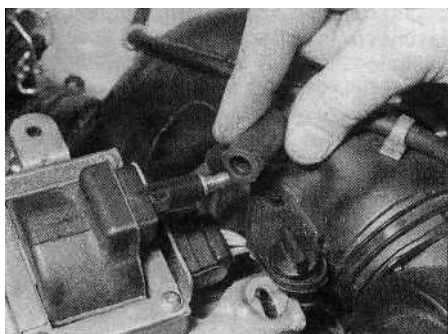
Removal

1124 cc and 1360 cc models with a distributor

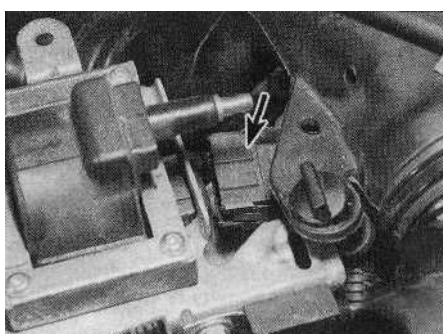
- 1 Disconnect the battery negative terminal.
- 2 Disconnect the hot-air intake hose from the exhaust manifold shroud and air temperature control valve, and remove it from the engine. Release the intake duct fastener, and position the duct clear of the coil.
- 3 Disconnect the wiring connector from the capacitor mounted on the coil mounting bracket, and release the TDC sensor wiring connector from the front of the bracket (see illustration).
- 4 Disconnect the HT lead from the coil, then



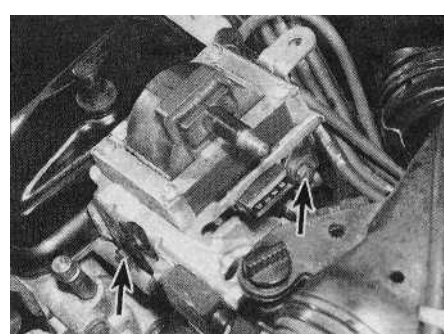
7.3 On 1124 cc and 1360 cc models, disconnect the capacitor wiring connector, and release the TDC sensor connector (arrowed)...



7.4a ... then disconnect the HT lead ...



7.4b ... and wiring connector (arrowed) from the ignition HT coil



7.5a Undo the two retaining bolts (arrowed)...

depress the retaining clip and disconnect the coil wiring connector (**see illustrations**).

5 Slacken and remove the two retaining bolts, and remove the coil and mounting bracket from the cylinder head (**see illustrations**). Where necessary, slacken and remove the four screws and nuts, and separate the HT coil and mounting bracket.

1905 cc models with a distributor

6 Disconnect the battery negative terminal.

7 Depress the retaining clip, and disconnect the wiring connector from the ignition HT coil.

8 Disconnect the HT lead from the coil.

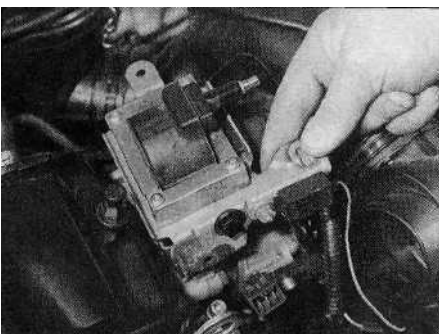
9 Slacken and remove the four HT coil retaining screws, and remove the coil from the top of the inlet manifold.

1360 cc and 1905 cc models (distributorless system), and all 1580 cc, 1761 cc and 1998 cc 8-valve models

10 Disconnect the battery negative terminal. The ignition HT coil is mounted on the left-hand end of the cylinder head.

11 Depress the retaining clip, and disconnect the wiring connector from the HT coil (**see illustration**).

12 Make a note of the correct fitted positions of the HT leads, then disconnect them from the coil terminals. Note that, on genuine Citroen leads, each HT lead is marked with its cylinder number, indicated by blocks printed near the end of the lead; the coil terminals are also numbered for identification.



7.5b ... and remove the coil and mounting bracket from the engine

13 Undo the four retaining screws securing the coil to its mounting bracket, and remove it from the engine compartment.

1998 cc 16-valve models

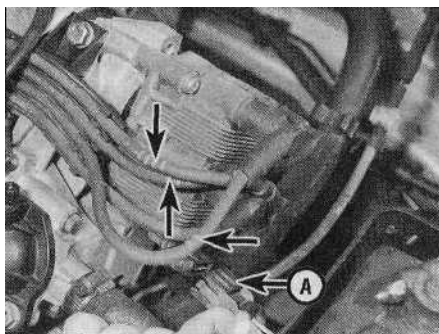
14 Disconnect the battery negative terminal. There are four separate ignition HT coils, one on the top of each spark plug.

15 To gain access to the coils, undo the eight retaining bolts, noting the correct fitted position of the wiring clip, and remove the access cover from the centre of the cylinder head cover.

16 To remove an HT coil, depress the retaining clip and disconnect the wiring connector, then pull the coil off the spark plug and remove it along with its rubber seal.

Testing

17 Testing the coil involves using a multimeter set to its resistance function, to check the primary (LT "+" to "-" terminals) and secondary (LT "+" to HT lead terminal) windings for continuity. Bear in mind that on the four-output, static type HT coil, there are two sets of each windings. Compare the results obtained to those given in the Specifications at the start of this Chapter, where available. Note that the resistance of the coil windings will vary slightly according to the coil temperature; the results in the Specifications are approximate values, and are accurate only when the coil is at 20°C.



7.11 Disconnecting the wiring connector (A) from the ignition HT coil - 1580 cc engine shown. Note the HT lead markings (arrowed)

Where no values are quoted, refer to your Citroen dealer for advice.

18 Check that there is no continuity between the HT lead terminal and the coil body/mounting bracket.

19 If the coil is thought to be faulty, have your findings confirmed by a Citroen dealer or other specialist before renewing the coil.

Refitting

20 Refitting is a reversal of the removal procedure, ensuring that the wiring connectors are securely reconnected and, where necessary, that the HT leads are correctly connected.

8 Distributor - removal and refitting

Removal

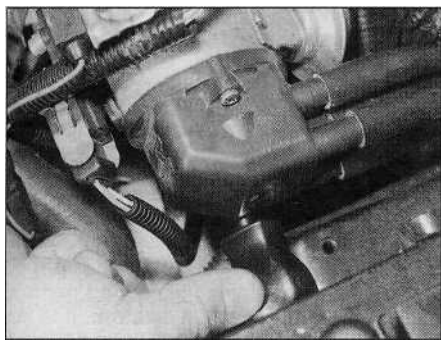
1124 cc and 1360 cc models

1 Disconnect the battery negative terminal. If necessary, to improve access to the distributor, remove the ignition HT coil as described in Section 7, and the air intake duct as described in Chapter 4 (as appropriate).

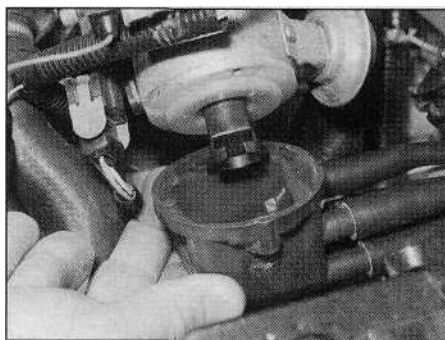
2 Peel back the waterproof cover, slacken and remove the distributor cap retaining screws, then remove the cap and position it clear of the distributor body (**see illustrations**). Recover the seal from the cap.



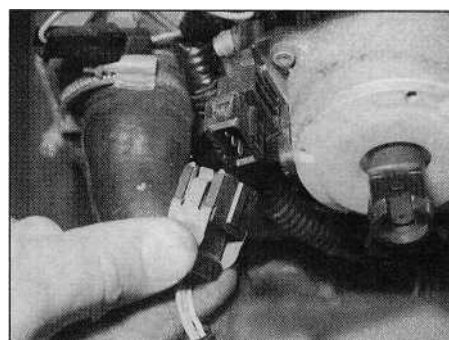
8.2a Peel back the waterproof cover ...



8.2b ... then undo the retaining screws...



8.2c ... and remove the cap from the end of the distributor



8.3a Disconnect the distributor wiring connector ...

3 Depress the retaining clip, and disconnect the wiring connector from the distributor. Disconnect the hose from the vacuum diaphragm unit (**see illustrations**).

4 Check the cylinder head and distributor flange for signs of alignment marks. If no marks are visible, using a scribe or a marker pen, mark the relationship of the distributor body to the cylinder head. Slacken and remove the two mounting nuts and retaining plates, and withdraw the distributor from the cylinder head (**see illustration**). Remove the O-ring from the end of the distributor body, and discard it; a new one must be used on refitting.

1905 cc models

5 Disconnect the battery negative terminal. If necessary, to improve access to the distributor, remove the airflow meter as described in Chapter 4.

6 Peel back the waterproof cover, slacken and remove the distributor cap retaining screws, then remove the cap and position it clear of the distributor body. Recover the seal from the cap.

7 Slacken and remove the two mounting bolts and washers, and withdraw the distributor from the cylinder head. Remove the O-ring from the end of the distributor body, and discard it; a new one must be used on refitting.

Refitting

8 Lubricate the new O-ring with a smear of engine oil, and fit it to the groove in the distributor body. Examine the distributor cap seal for wear or damage, and renew if necessary.

9 Align the distributor rotor shaft drive coupling key with the slots in the camshaft end, noting that the slots are offset to ensure that the distributor can only be fitted in one position. Carefully insert the distributor into the cylinder head, rotating the rotor arm slightly to ensure the coupling is correctly engaged.

1124 cc and 1360 cc models

10 Align the marks noted or made on removal, and install the distributor retaining plates and nuts, tightening them only lightly.

11 Ensure that the seal is correctly located in its groove, then refit the cap assembly to the distributor and tighten its retaining screws securely. Fold the waterproof cover back over the distributor cap, ensuring that it is correctly located.

12 Reconnect the vacuum hose to the diaphragm unit and the distributor wiring connector. Where necessary, refit the ignition HT coil as described in Section 7, and the air intake duct as described in Chapter 4.

13 Check and, if necessary, adjust the ignition timing as described in Section 10, then fully tighten the distributor mounting nuts.

1905 cc models

14 Refit the distributor mounting bolts and washers and tighten the bolts.

15 Ensure that the seal is correctly located in its groove, then refit the cap assembly to the distributor and tighten its retaining screws securely. Fold the waterproof cover back over the distributor cap, ensuring that it is correctly located.

16 Where necessary, refit the airflow meter as described in the relevant Part of Chapter 4.

9 Ignition system amplifier unit(s) - removal and refitting



Removal

1 Disconnect the battery negative terminal.

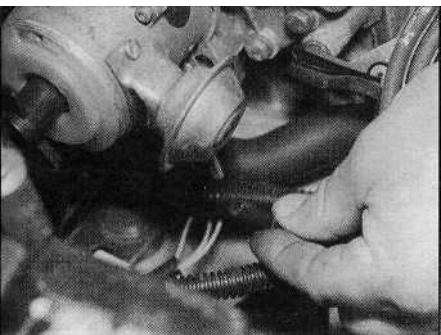
1124 cc and 1360 cc models

2 The amplifier unit is mounted onto the side of the distributor body (**see illustration**).

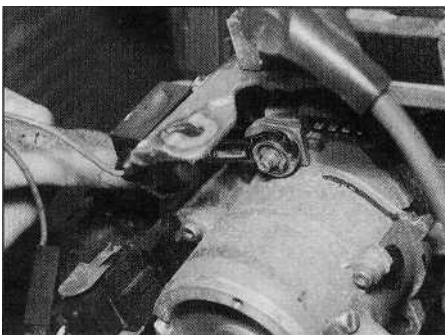
3 To improve access to the unit, disengage the hot-air intake hose from the control valve and manifold shroud, and remove it from the vehicle. Disconnect the wiring connector, undo the two retaining screws and remove the amplifier unit.

1905 cc models

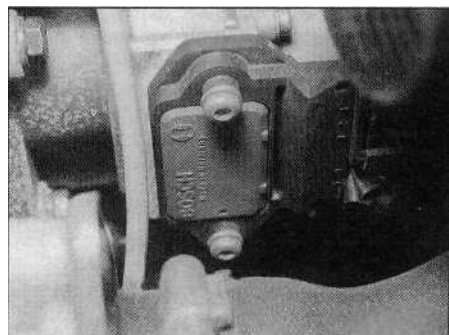
4 The amplifier unit is situated in the right-hand rear corner of the engine compartment,



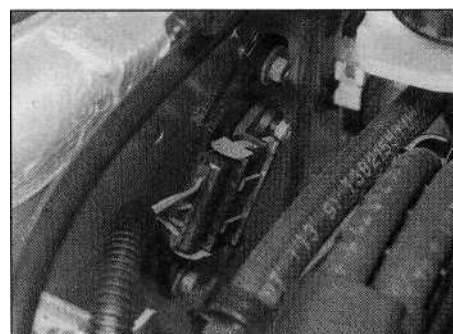
8.3b ... and the vacuum diaphragm hose...



8.4 ... then undo the retaining nuts and remove the distributor



9.2 On 1124 cc and 1360 cc models, the ignition amplifier unit is secured to the side of the distributor by two screws



9.4 On 1905 cc models, the ignition amplifier unit is situated in the right-hand corner of the engine compartment

mounted onto the wing valance (see illustration).

5 To remove the unit, disconnect the wiring connector, undo the two retaining screws and remove the amplifier from its mounting bracket.

1998 cc 16-valve models

6 Both amplifier units are situated in the left-hand rear corner of the engine compartment, mounted onto the wing valance (see illustration).

7 To remove either unit, disconnect the wiring connector, undo the two retaining screws and remove the amplifier unit from its mounting bracket.

Refitting

8 Refitting is a reverse of the removal procedure.

10 Ignition timing-checking and adjustment

1124 cc and 1360 cc models with a distributor

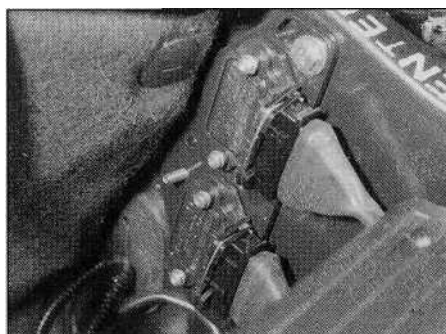
1 To check the ignition timing, a stroboscopic timing light will be required. It is also recommended that the flywheel timing mark is highlighted as follows.

2 Remove the plug from the aperture on the front of the transmission clutch housing. Using a socket and suitable extension bar on the crankshaft pulley bolt, slowly turn the engine over until the timing mark (a straight line) scribed on the edge of the flywheel appears in the aperture. Highlight the line with quick-drying white paint - typist's correction fluid is ideal (see illustrations).

3 Start the engine, allow it to warm up to normal operating temperature, and then stop it.

4 Disconnect the vacuum hose from the distributor diaphragm, and plug the hose end.

5 Connect the timing light to No 1 cylinder spark plug lead (No 1 cylinder is at the transmission end of the engine) as described in the timing light manufacturer's instructions.

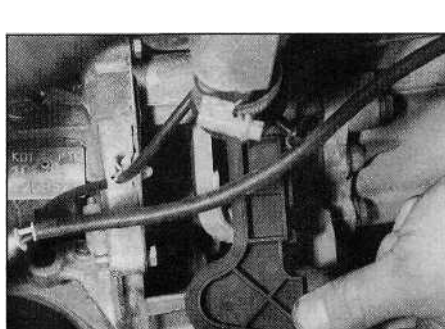


9.6 On 1998 cc 16-valve models, both ignition amplifier units are situated in the left-hand corner of the engine compartment

6 Start the engine, allowing it to idle at the specified speed, and point the timing light at the transmission housing aperture. The flywheel timing mark should be aligned with the appropriate notch on the timing plate (refer to the Specifications for the correct timing setting). The numbers on the plate indicate degrees Before Top Dead Centre (BTDC).

7 If adjustment is necessary, slacken the two distributor mounting nuts, then slowly rotate the distributor body as required until the flywheel mark and the timing plate notch are brought into alignment. Once the marks are correctly aligned, hold the distributor stationary and tighten its mounting nuts. Recheck that the timing marks are still correctly aligned and, if necessary, repeat the adjustment procedure.

8 When the timing is correctly set, increase the engine speed, and check that the pulley mark advances to beyond the beginning of the timing plate reference marks, returning to the specified mark when the engine is allowed to idle. This shows that the centrifugal advance mechanism is functioning; if a detailed check is thought necessary, this must be left to a Citroen dealer having the necessary equipment. Reconnect the vacuum hose to the distributor, and repeat the check. The rate of advance should significantly increase if the vacuum diaphragm is



10.2a On 1124 cc and 1360 cc models with a distributor, remove the plug from the transmission housing ...

functioning correctly, but again a detailed check must be left to a Citroen dealer.

9 When the ignition timing is correct, stop the engine and disconnect the timing light.

All other models (distributorless ignition system)

10 On models with static (distributorless) ignition systems, there are no timing marks on the flywheel or crankshaft pulley. The timing is constantly being monitored and adjusted by the engine management ECU, and nominal values cannot be given. Therefore, it is not possible for the home mechanic to check the ignition timing.

11 The only way in which the ignition timing can be checked is using special electronic test equipment, connected to the engine management system diagnostic connector (refer to Chapter 4 for further information).

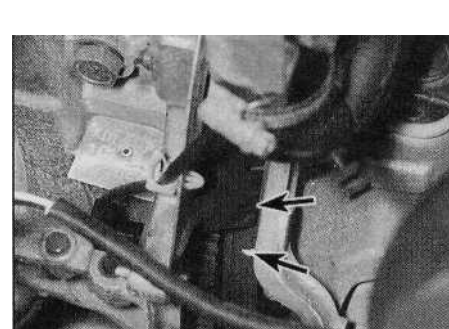
12 On 1580 cc models and 1998 cc 8-valve models, with Magneti Marelli engine management systems, and 1761 cc models with the Bosch Motronic MP5.1 system, adjustment of the ignition timing is possible. However, adjustments can be made only by re-programming the ECU using the special test equipment.

13 On all other models, with Bosch engine management systems, no adjustment of the ignition timing is possible. Should the ignition timing be incorrect, then a fault must be present in the engine management system.

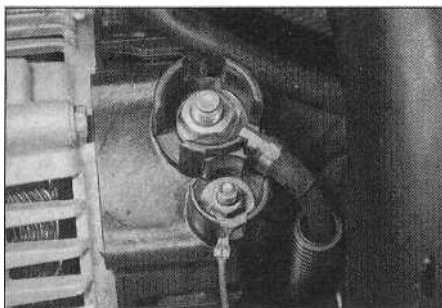
11 Charging system - testing

Note: Refer to the warnings given in "Safety first!" and in Section 1 of this Chapter before starting work.

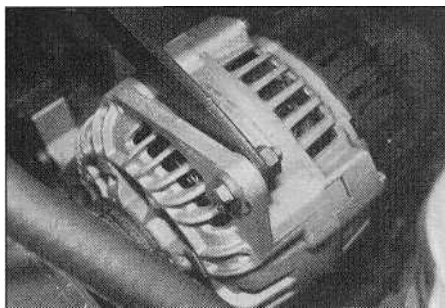
1 If the ignition/no-charge warning light fails to illuminate when the ignition is switched on, first check the alternator wiring connections for security. If satisfactory, check that the warning light bulb has not blown, and that the bulbholder is secure in its location in the instrument panel. If the light still fails to illuminate, check the continuity of the warning



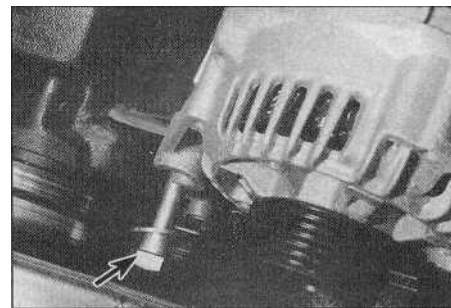
10.2b ... to reveal the timing plate and flywheel timing mark (arrowed)



13.3 Undo the retaining nuts and disconnect the wiring from the alternator - 1905 cc model shown



13.4a Slacken and remove the alternator upper mounting bolt...



13.4b ... and lower bolt (arrowed), and manoeuvre out the alternator -1998 cc 8-valve model shown

light feed wire from the alternator to the bulbholder. If all is satisfactory, the alternator is at fault, and should be renewed or taken to an auto-electrician for testing and repair.

2 If the ignition warning light illuminates when the engine is running, stop the engine. Check that the drivebelt is correctly tensioned (refer to Section 12) and that the alternator connections are secure. If all is so far satisfactory, check the alternator brushes and slip rings as described in Section 14. If the fault persists, the alternator should be renewed, or taken to an auto-electrician for testing and repair.

3 If the alternator output is suspect even though the warning light functions correctly, the regulated voltage may be checked as follows.

4 Connect a voltmeter across the battery terminals, and start the engine.

5 Increase the engine speed until the voltmeter reading remains steady; the reading should be approximately 12 to 13 volts, and no more than 14 volts.

6 Switch on as many electrical accessories (eg, the headlights, heated rear window and heater blower) as possible, and check that the alternator maintains the regulated voltage at around 13 to 14 volts.

7 If the regulated voltage is not as stated, the fault may be due to worn brushes, weak brush springs, a faulty voltage regulator, a faulty diode, a severed phase winding, or worn or damaged slip rings. The brushes and slip rings may be checked (see Section 14), but if

the fault persists, the alternator should be renewed, or taken to an auto-electrician for testing and repair.

12 Alternator drivebelt - removal, refitting and tensioning

1 Refer to the procedure given for the auxiliary drivebelt in Chapter 1.

13 Alternator - removal and refitting

Removal

1 Disconnect the battery negative lead.

2 Slacken the auxiliary drivebelt as described in Chapter 1, and disengage it from the alternator pulley.

3 Remove the rubber covers (where fitted) from the alternator terminals, then unscrew the retaining nuts and disconnect the wiring from the rear of the alternator (see illustration).

4 Unscrew the nut and/or bolt securing the alternator to the upper mounting bracket. Unscrew the lower nut and/or mounting bolt, or undo the nut securing the adjuster bolt bracket to the alternator (as applicable). Note that, where a long through-bolt is used to secure the alternator in position, the bolt does not need to be fully removed; the alternator can be disengaged from the bolt once it has been slackened sufficiently (see illustrations).

On some models, it may be necessary to remove the drivebelt idler/tensioner pulley to gain access to the alternator mounting nuts and bolts (depending on specification).

5 Manoeuvre the alternator away from its mounting brackets and out from the engine compartment.

Refitting

6 Refitting is a reversal of removal, tensioning the auxiliary drivebelt as described in Chapter 1, and ensuring that the alternator mountings are securely tightened.

14 Alternator brushes and regulator - inspection and renewal

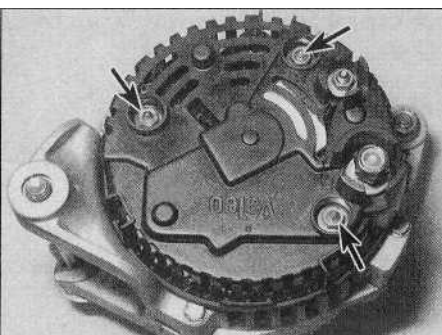
1 Remove the alternator as described in Section 13.

Valeo alternator

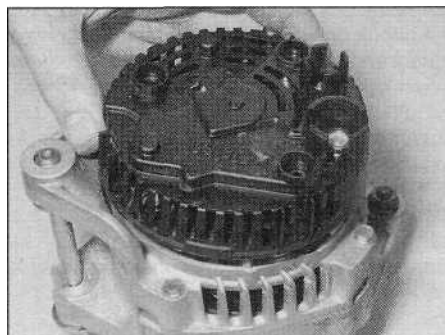
2 Where applicable, scrape the sealing compound from the rear plastic cover, to expose the three rear cover retaining nuts (see illustration).

3 Undo the retaining nuts and remove the rear cover (see illustration).

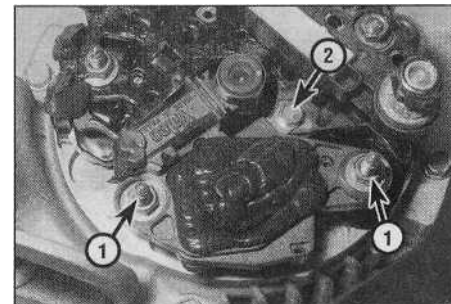
4 If necessary, scrape the sealing compound from the rear of the alternator to expose the regulator/brush holder assembly fixings. The assembly is retained by two nuts and a single screw (see illustration).



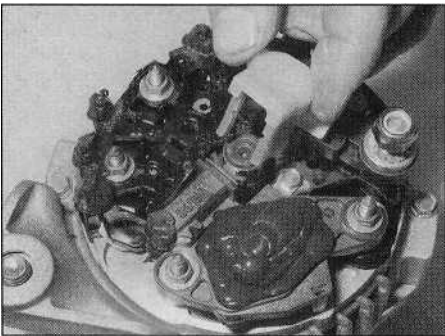
14.2 On the Valeo alternator, undo the three retaining nuts (arrowed)...



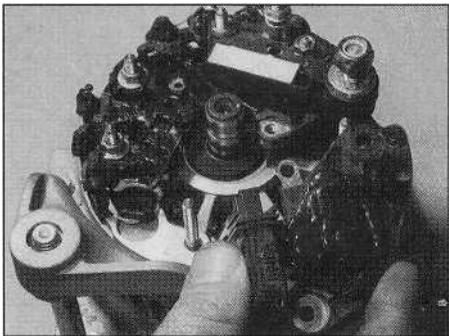
14.3 ... and withdraw the rear cover



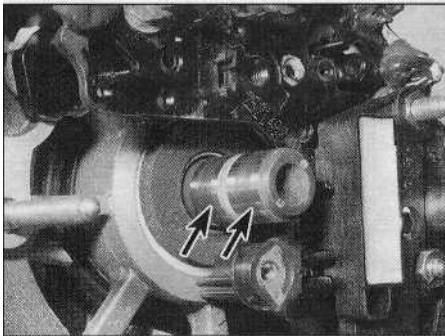
14.4 Alternator brush/regulator assembly retaining nuts (1) and screw (2) - Valeo alternator



14.5 Removing the cover from the armature shaft - Valeo alternator



14.6 Removing the brush/regulator assembly - Valeo alternator



14.9 Ensure the alternator slip-rings (arrowed) are clean and undamaged

- 5 Pull the plastic cover from the rear of the armature shaft (**see illustration**).
- 6 Undo the retaining nuts and screw, and withdraw the regulator/brush holder assembly from the rear of the alternator (**see illustration**).
- 7 Measure the protrusion of each brush from the its holder. No minimum dimension is specified by the manufacturers, but excessive wear should be self-evident. If either brush requires renewal, the complete regulator/brush holder assembly must be renewed. It is not possible to renew the brushes separately.
- 8 If the brushes are still serviceable, clean them with a petrol-moistened cloth. Check that the brush spring tension is equal for both brushes, and provides a reasonable pressure. The brushes must move freely in their holders.
- 9 Clean the alternator slip-rings with a petrol-moistened cloth (**see illustration**). Check for signs of scoring, burning or severe pitting on the surface of the slip-rings. It may be possible to have the slip rings renovated by an electrical specialist.
- 10 Refit the regulator/brush holder assembly using a reverse of the removal procedure.
- 11 Refit the alternator as described in Section 13.
- Bosch alternator**
- 12 Unclip the cover from the rear of the alternator.
- 13 If necessary, scrape the sealing compound from the rear of the alternator, to expose the regulator/brush holder assembly retaining screws. Slacken and remove the two retaining screws, and remove the regulator/brush holder from the rear of the alternator.
- 14 Examine the alternator components as described above in paragraphs 7 to 9.
- 15 Refit the regulator/brush holder assembly, and securely tighten its retaining screws.
- 16 Clip the rear cover onto the alternator, and refit the alternator as described in Section 13.

Mitsubishi alternator

- 17 At the time of writing, no information on the Mitsubishi alternator was available.

Although the components differ in detail, the same basic principles outlined previously for the Valeo alternator are applicable.

15 Starting system - testing

Note: Refer to the precautions given in "Safety first!" and in Section 1 of this Chapter before starting work.

- 1 If the starter motor fails to operate when the ignition key is turned to the appropriate position, the following possible causes may be to blame.
- (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 is faulty.*
 - (d) *The starter motor is mechanically or electrically defective.*

2 To check the battery, switch on the headlights. If they dim after a few seconds, this indicates that the battery is discharged - recharge (see Section 3) or renew the battery. If the headlights glow brightly, operate the ignition switch and observe the lights. If they dim, then this indicates that current is reaching the starter motor - therefore, the fault must lie in the starter motor. If the lights continue to glow brightly (and no clicking sound can be heard from the starter motor solenoid), this indicates that there is a fault in the circuit or solenoid - refer to the following paragraphs. If the starter motor turns slowly when operated, but the battery is in good condition, then this indicates that either the starter motor is faulty, or there is considerable resistance somewhere in the circuit.

3 If a fault in the circuit is suspected, disconnect the battery leads (including the earth connection to the body), the starter/solenoid wiring, and the engine/transmission earth strap. Thoroughly clean the connections, reconnect the leads and wiring, then use a voltmeter or test light to check that full battery voltage is available at the battery positive lead connection to the

solenoid, and that the earth is sound. Smear petroleum jelly around the battery terminals to prevent corrosion - corroded connections are among the most frequent causes of electrical system faults.

4 If the battery and all connections are in good condition, check the circuit by disconnecting the wire from the solenoid blade terminal. Connect a voltmeter or test light between the wire end and a good earth (such as the battery negative terminal), and check that the wire is live when the ignition switch is turned to the "start" position. If it is, then the circuit is sound - if not, the circuit wiring can be checked as described in Chapter 12, Section 2.

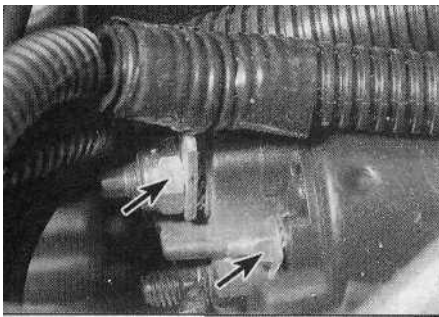
5 The solenoid contacts can be checked by connecting a voltmeter or test light between the battery positive feed connection on the starter side of the solenoid, and earth. When the ignition switch is turned to the "start" position, there should be a reading or lighted bulb, as applicable. If there is no reading or lighted bulb, the solenoid is faulty, and should be renewed.

6 If the circuit and solenoid are proved sound, the fault must lie in the starter motor. Begin checking the starter motor by removing it (see Section 16), and checking the brushes (see Section 17). If the fault does not lie in the brushes, the motor windings must be faulty. In this event, it may be possible to have the starter motor overhauled by a specialist, but check on the availability and cost of spares before proceeding, as it may prove more economical to obtain a new or exchange motor.

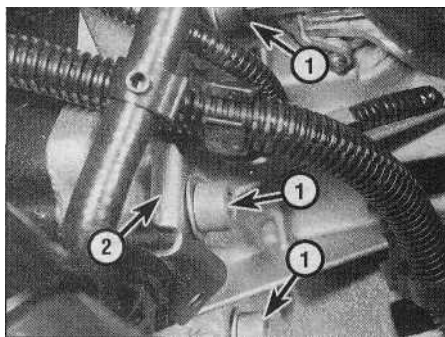
16 Starter motor - removal and refitting

Removal

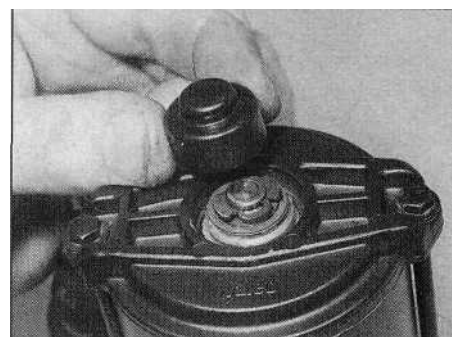
- 1 Disconnect the battery negative lead.
- 2 On 1124 cc, 1360 cc models and 1998 cc 16-valve models, to improve access to the motor, remove the air cleaner housing and mounting bracket, as described in Chapter 4.
- 3 On all models, so that access to the motor can be gained both from above and below,



16.4 Unscrew the two retaining nuts (arrowed) and disconnect the wiring from the rear of the starter motor - 1905 cc model shown



16.5 Unscrew the starter motor securing bolts (1). Note the location of the bracket (2) - 1905 cc model shown



17.2 On the Valeo starter motor, remove the plastic cap from the end of the starter motor armature shaft...

firmly apply the handbrake, then jack up the front of the vehicle and support it on axle stands.

4 Slacken and remove the two retaining nuts, and disconnect the wiring from the rear of the starter motor (**see illustration**). Recover the washers under the nuts.

5 Working at the rear of the starter motor, undo the three mounting bolts, supporting the motor as the bolts are withdrawn. Recover the washers from under the bolt heads, and note the locations of any wiring or hose brackets secured by the bolts (**see illustration**). Note that on 1580 cc and larger-engined models, the top retaining bolt may foul the clutch release mechanism as it is withdrawn, but there is no need to withdraw it completely to remove the starter motor.

6 Manoeuvre the starter motor out from underneath the engine.

Refitting

7 Refitting is a reversal of removal, ensuring that any wiring or hose brackets are in place under the bolt heads, as noted prior to removal.

17 Starter motor - brush renewal

Valeo starter motor

1 No minimum brush length is specified by the manufacturers, but it should be self-evident if the brushes are worn to the extent

where renewal is required. With the motor removed as described in Section 16, proceed as follows.

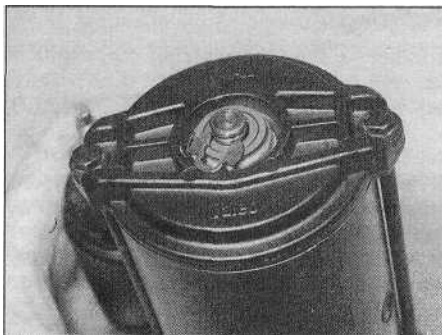
2 Carefully prise the plastic cap from the end of the armature shaft, using a screwdriver or similar tool (**see illustration**).

3 Prise the C-clip from the end of the armature shaft, and recover the shim (**see illustrations**).

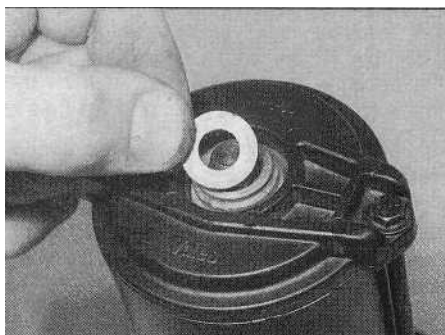
4 Unscrew the two through-bolts, then withdraw the end cover from the motor casing, and recover the shim from the armature shaft (**see illustrations**). Do not mix up the shim with the one removed in the previous paragraph.

5 Carefully pull the brush plate from the end of the armature (**see illustration**).

6 Using a suitable screwdriver, release the



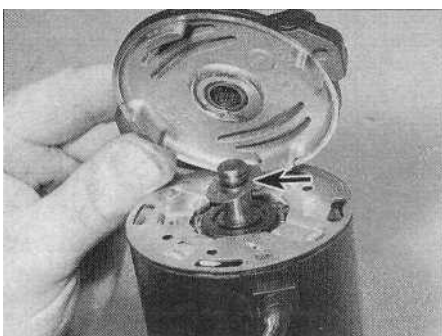
17.3a ... then prise off the C-clip ...



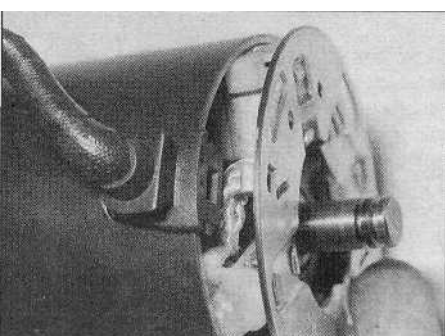
17.3b ... and recover the shim



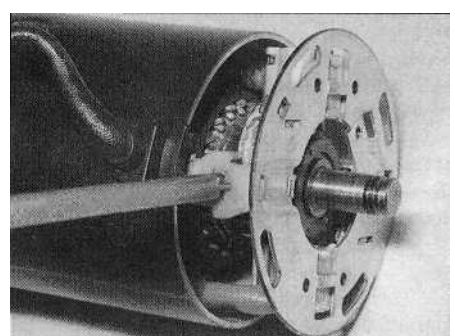
17.4a Remove the through-bolts ...



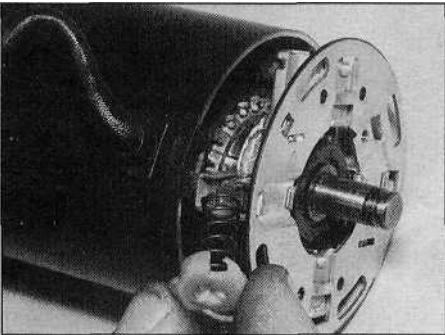
17.4b ... then withdraw the end cover, and recover the shim (arrowed)



17.5 Carefully pull the brush plate from the end of the armature ...



17.6a ... then, using a screwdriver ...



17.6b ... release the brush retainers ...

brush retainers, and withdraw the brushes from the brush holders (see illustrations).

7 Unsolder the brush leads, or release them from the clips on the brush plate, as applicable.

8 Fit the new brushes. Solder the leads into position, or secure them to the brush plate by bending the securing clips into position, as applicable.

9 Fit the brush plate over the end of the armature shaft, leaving enough clearance to fit the brushes. Note that, when finally fitted, the lug on the brush plate must locate in the corresponding hole in the motor casing.

10 Push the brushes into their holders, so that they rest against the commutator on the armature shaft.

11 Carefully fit the brush retainers, complete with springs, and secure them to retain the brushes.

12 Check that the brushes are seated on the commutator, then slide the brush plate down the armature shaft until the lug on the brush plate engages with the hole in the motor casing.

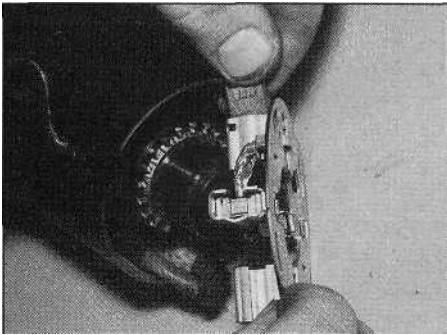
13 Further refitting is a reversal of removal, ensuring that the shims are fitted to the armature shaft as noted before removal.

Bosch starter motor

14 At the time of writing, no specific information was available for the Bosch starter motor. Although the components differ in detail, the same basic principles outlined previously for the Valeo starter motor are equally applicable.

18 Ignition switch - removal and refitting

1 The ignition switch is integral with the steering column lock, and can be removed as described in Chapter 10.



17.6c ... and withdraw the brushes from the brush holders

19 Oil pressure warning light switch - removal and refitting

Removal

Note: If the switch was originally fitted using a sealing ring, a new sealing ring should be used on refitting.

1 The switch is located at the front of the cylinder block, above the oil filter mounting. Note that on some models, access to the switch may be improved if the vehicle is jacked up and supported on axle stands, so that the switch can be reached from underneath.

2 Disconnect the battery negative lead.

3 Remove the protective sleeve from the wiring plug (where applicable), then disconnect the wiring from the switch.

4 Unscrew the switch from the cylinder block, and recover the sealing ring, where applicable. Be prepared for oil spillage, and if the switch is to be left removed from the engine for any length of time, plug the hole in the cylinder block.

Refitting

5 Examine the sealing ring for signs of damage or deterioration, and if necessary, renew it. If no sealing ring was originally fitted, apply a smear of sealing compound to the

threads of the switch prior to refitting.

6 Refit the switch, tightening it securely, and reconnect the wiring connector.

7 Lower the vehicle to the ground, then check and, if necessary, top-up the engine oil as described in Chapter 1.

20 Oil level sensor - removal and refitting

1 The sensor is located at the rear left-hand side of the cylinder block.

2 The removal and refitting procedure is as described for the oil pressure switch in Section 19 (see illustration). Access is most easily obtained from underneath the vehicle.

21 Oil temperature sensor - removal and refitting

Removal

1 The oil temperature sensor is screwed into the rear of the sump (see illustration).

2 To gain access to the sensor, firmly apply the handbrake, then jack up the front of the vehicle and support it on axle stands.

3 Drain the engine oil into a clean container, then refit and tighten the drain plug (see Chapter 1).

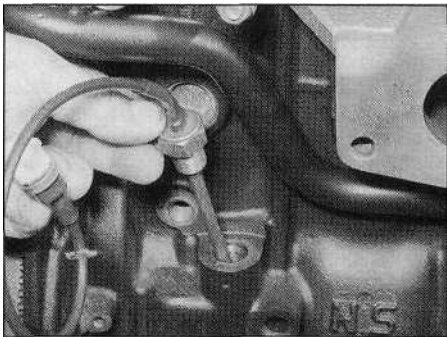
4 Undo the nut, and disconnect the wiring connector. Unscrew the sensor from the sump, and remove it from underneath the vehicle along with its sealing ring (where fitted).

Refitting

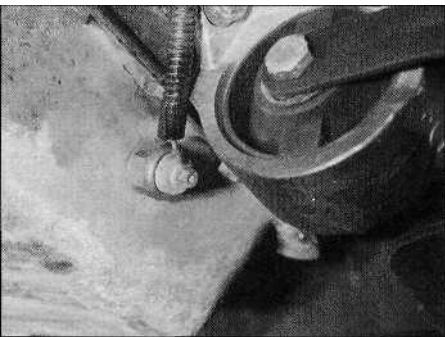
5 Examine the sealing ring for signs of damage or deterioration, and if necessary, renew it. If no sealing ring was originally fitted, apply a smear of sealing compound to the threads of the sensor prior to refitting.

6 Refit the sensor, tightening it securely, and reconnect the wiring connector, securely tightening its retaining nut.

7 Lower the vehicle to the ground, and refill the engine with oil as described in Chapter 1.



20.2 Removing the oil level sensor from the cylinder block



21.1 Oil temperature sensor is screwed into the rear of the sump