

Chapter 5 Part A:

Starting and charging systems

Contents

Alternator - removal and refitting	6	Electrical fault finding - general information	2
Alternator brushes - inspection and renewal	7	Electrical system check	See <i>Weekly checks</i>
Auxiliary drivebelt checking and renewal	See Chapter 1A or 1B	General information and precautions	1
Battery - removal and refitting	4	Ignition switch - removal and refitting	See Chapter 11
Battery - testing and charging	3	Starter motor - brush renewal	10
Battery electrolyte level check	See Chapter 1A or 1B	Starter motor - removal and refitting	9
Battery inspection	See <i>Weekly checks</i>	Starting system - testing	8
Charging system - testing	5		

Degrees of difficulty

Easy, suitable for novice with little experience



Fairly easy, suitable for beginner with some experience



Fairly difficult, suitable for competent DIY mechanic



Difficult, suitable for experienced DIY mechanic



Very difficult, suitable for expert DIY or professional



Specifications

General

Electrical system type 12-volt negative earth

Battery

Type Lead-acid, low-maintenance

Alternator

Type Lucas or Magneti-Marelli
 Rating 65, 80 or 100 amps
 Regulated voltage 13.6 to 14.4 volts
 Minimum brush length (nominal) 5 mm

Starter motor

Make and type:

Petrol models Pre-engaged, Lucas M78R
 Diesel models Pre-engaged, Paris-Rhone or Bosch, reduction-gear type

Torque wrench settings

	Nm	lbf ft
Alternator mounting bracket bolts	34	25
Alternator mountings	25	18
Starter motor mountings	45	33

1 General information and precautions

The starting and charging system is defined as the battery, alternator and starter motor, and all related wiring; 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 13). The ignition system fitted to petrol models is covered in part B of this Chapter, with the diesel engine pre-heating system covered in part C.

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

The battery is either of the low-maintenance or maintenance-free type, and is charged by the alternator, which is belt-driven from a crankshaft-mounted 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. The motor fitted to diesel models has a reduction gear mechanism, in order to achieve the high torque necessary to turn the engine against the high compression pressures encountered in a diesel engine.

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.

Precautions



Warning: 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, pre-heating electronic control unit, or any other components having semi-conductor circuitry could be irreparably damaged.

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.

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

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

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

Before using electric-arc welding equipment on the vehicle, **disconnect the battery, alternator and components such as the electronic control units**, as applicable, to protect them from the risk of damage.

Caution: The radio/cassette unit fitted as standard equipment by Land Rover may be 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 negative terminal of the battery, nor remove the radio/cassette unit from the vehicle. Refer to the manufacturer's handbook supplied with the vehicle for details of how to enter the security code.

2 Electrical fault finding - general information

Refer to Chapter 13.

3 Battery - testing and charging

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

Testing

1 If the vehicle covers a very 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 to make the check,

and compare the results obtained with the following table:

	Normal climates	Tropics
Discharged	1.080	1.120
Half-charged	1.200	1.160
Fully-charged	1.280	1.230

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

3 An accurate test of battery condition can be made by a battery specialist, using a heavy-discharge meter. Alternatively, connect a voltmeter across the battery terminals, and (where applicable) disconnect the main feed wire to the glow plugs; operate the starter motor with the headlights, heated rear window and heater blower switched on. If the voltmeter reading remains above 9.6 volts, the battery condition is satisfactory. If the voltmeter reading drops below 9.6 volts, and the battery has already been charged, it is faulty.

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.

4 In normal use, the battery should not require charging from an external source, unless it is discharged accidentally (for instance by leaving the lights on). Charging can also temporarily revive a failing battery, but if frequent recharging is required (and the alternator output is correct), the battery is worn out.

5 Unless the battery manufacturer advises differently, the charging rate in amps should be no more than one-tenth of the battery capacity in amp-hours (for instance, 6.5 amps for a 65 amp-hour battery). Most domestic battery chargers have an output of 5 amps or so, and these can safely be used overnight. Rapid 'boost' charging is not recommended; if it is not carefully controlled, it can cause serious damage to the battery plates through overheating.

6 Both battery terminal leads must be disconnected before connecting the charger leads (disconnect the negative lead first). Connect the charger leads **before** switching on at the mains. When charging is complete, switch off at the mains **before** disconnecting the charger. If this procedure is followed, there is no risk of creating a spark at the battery terminals. Continue to charge the battery until no further rise in specific gravity is noted over a four-hour period, or until vigorous gassing is observed.

7 On completion of charging, check the electrolyte level (if possible) and top-up if necessary, using distilled or de-ionised water.

4 Battery - removal and refitting

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

Removal

1 The battery is located at the front right-hand corner of the engine compartment. First check that all electrical components are switched off, in order to avoid a spark occurring as the negative lead is disconnected. Note also that if the radio has a security coding, it will be necessary to insert this code when the battery is re-connected.

2 On models from 1996 onwards, the standard anti-theft alarm system has a battery back-up facility, meaning that the alarm will still sound even if the battery is disconnected. To avoid accidentally setting off the alarm, switch the ignition on, then off, and disconnect the battery terminals as described below **within 15 seconds**. If the alarm sounds, disarm the system with the handset, then reconnect the battery, switch on the ignition, and try again.

3 Where necessary, unclip and remove the cover fitted over the battery for access. Loosen the clamp nut and bolt, and disconnect the battery negative lead.

4 Similarly, disconnect the battery positive lead.

5 Unscrew the four nuts securing the battery clamp in position. Recover the washers (see illustration).

6 Lift the clamp bracket from the studs, then lift out the battery. Take care not to drop it, as it is heavy - also try not to tilt it more than necessary.

7 Clean the battery terminal posts, clamps, tray and battery casing.

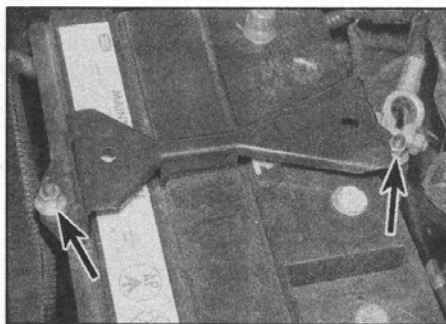
Refitting

8 Refitting is a reversal of removal, but always connect the positive terminal clamp first and the negative terminal clamp last.

5 Charging system - testing

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

1 If the charge warning light fails to illuminate when the ignition is switched on, first check the security of the alternator wiring connections. 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 light feed wire from the alternator to the bulbholder. If all is satisfactory, the alternator



4.5 Battery clamp securing nuts (arrowed)

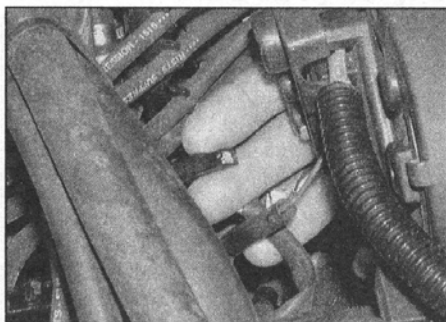
is at fault, and should be renewed or taken to an auto-electrician for testing and repair.

2 If the charge warning light illuminates when the engine is running, stop the engine and check that the drivebelt is correctly tensioned (Chapter 1A, Section 16 or Chapter 1B, Section 17) and that the alternator connections are secure. If all is so far satisfactory, check the alternator brushes and slip rings (see Section 7). 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; as a rough guide, the reading should be between 13.6 and 14.4 volts.



6.3a Disconnect the warning light wire ...

6 Switch on as many electrical accessories (headlights, heated rear window, heater blower, etc) as possible, and check that the alternator maintains the regulated voltage between 13.6 and 14.4 volts. It may be necessary to increase engine speed slightly.

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

6 Alternator - removal and refitting

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

Removal

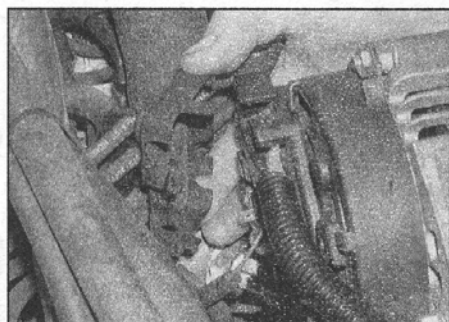
1 Disconnect the battery negative lead.

2 Remove the auxiliary drivebelt as described in Chapter 1A or 1B.

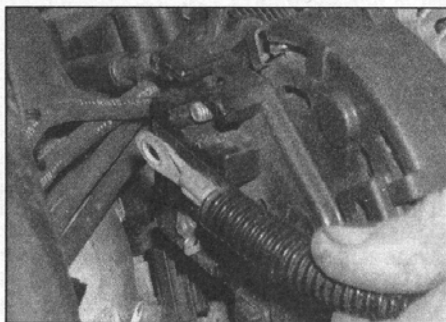
Petrol engines

3 Disconnect the electrical leads from the rear of the alternator, noting their locations (see illustrations).

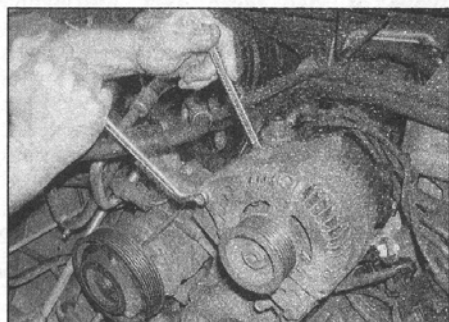
4 Remove the adjustment link bolt or upper mounting bolt, and the lower mounting bolt(s), and remove the alternator from the engine (see illustration).



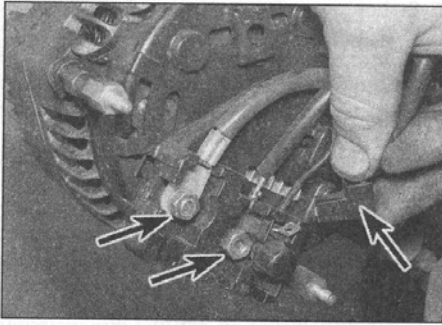
6.3b ... then unclip the rear cover ...



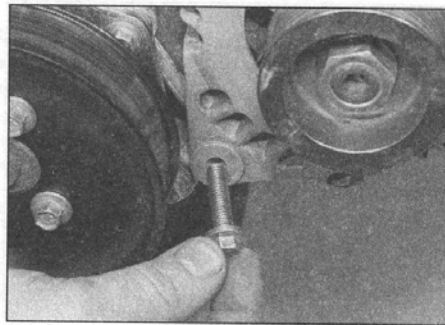
6.3c ... and remove the nuts securing the main wiring



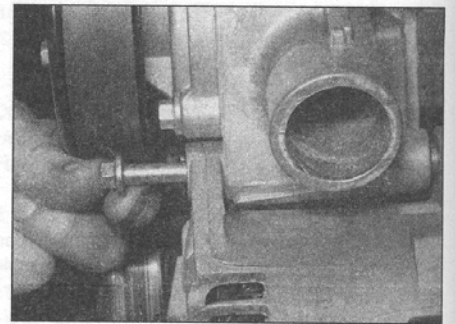
6.4 Loosen and remove the alternator mounting bolts, and remove the alternator



6.6 Disconnect the wiring (arrowed) from the rear of the alternator



6.7 Removing the alternator lower securing bolt - 300 TDI engine



6.10 Removing the alternator through-bolt - 300 TDI engine

Diesel engines

5 Where applicable, unscrew the three securing nuts, and withdraw the heat shield from the rear of the alternator to expose the wiring connections.

6 Disconnect the electrical leads from the rear of the alternator (see illustration).

7 Remove the alternator lower securing bolt. Where applicable, recover the washers, noting their locations (see illustration).

8 Working at the top of the alternator, counterhold the through-bolt, and unscrew the nut. Again recover the washers, noting their locations.

9 Where applicable, withdraw the heat shield from the rear of the through-bolt.

10 Remove the through-bolt, and withdraw the alternator from the engine (see illustration).

Refitting

11 Refitting is a reversal of removal, but refit

and tension the auxiliary drivebelt as described in the relevant part of Chapter 1.

7 Alternator brushes - inspection and renewal

Lucas alternator

1 For improved access, remove the alternator as described in Section 6.

2 If necessary, unscrew the suppressor securing nut from the through-bolt, then disconnect the wiring and withdraw the suppressor for access to the voltage regulator/brush box assembly (see illustration).

3 Remove the three screws securing the voltage regulator/brush box assembly to the rear of the alternator.

4 Tip the outside edge of the assembly

upwards, and withdraw it from its location. Disconnect the wiring plug, and withdraw the assembly from the alternator.

5 If the length of either brush is less than the minimum given in the Specifications, the complete regulator/brush box assembly must be renewed.

6 Before refitting, wipe the alternator slip rings clean with a fuel-moistened cloth. If the rings are very dirty, use fine emery paper to clean them, then wipe with the cloth.

7 Refitting is a reversal of removal, but make sure that the brushes move freely in their holders.

8 Where applicable, refit the alternator as described in Section 6.

Magneti-Marelli alternator

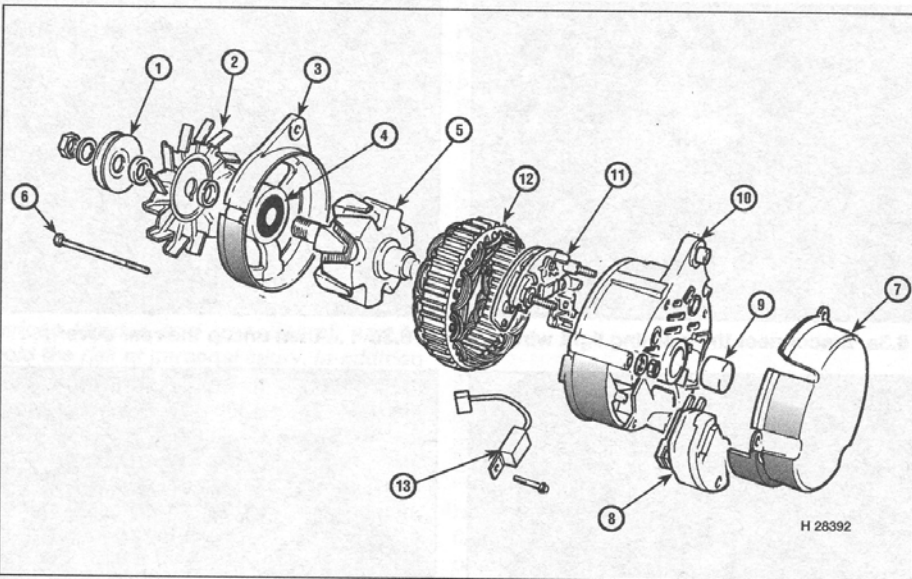
Note: Check on the availability of replacement brushes before proceeding.

9 With the alternator removed as described in Section 6, unscrew the three studs from the rear of the alternator, noting that the suppressor is secured by one of the studs (see illustration).

10 Unscrew the nut and recover the washer securing the wiring terminal to the rear of the alternator, then remove the terminal (see illustrations). Note that the suppressor wiring is connected to the terminal.

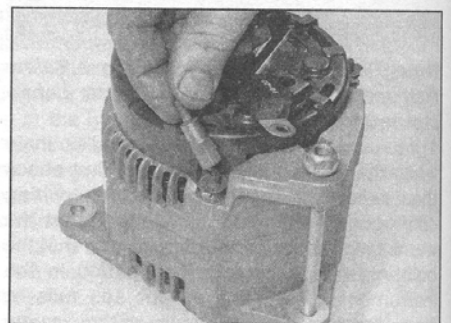
11 Withdraw the alternator rear cover (see illustration).

12 To remove a brush, remove the screw securing the brush wiring terminal to the top of the brush plate, then withdraw the wiring, spring and brush as an assembly (see illustration).

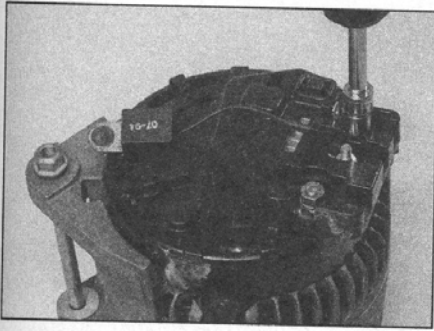


7.2 Lucas A127-type alternator

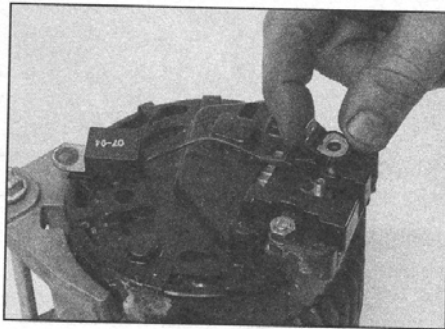
- | | | |
|---------------------|----------------------------------|--------------------------|
| 1 Pulley | 6 Through-bolt | 10 Slip ring end housing |
| 2 Fan | 7 End cover | 11 Diode pack |
| 3 Drive end housing | 8 Voltage regulator/brush holder | 12 Stator |
| 4 Bearing | 9 Bearing | 13 Suppressor |
| 5 Rotor | | |



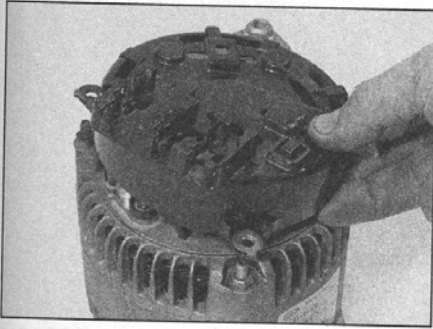
7.9 Unscrew the studs from the rear of the alternator - Marelli alternator



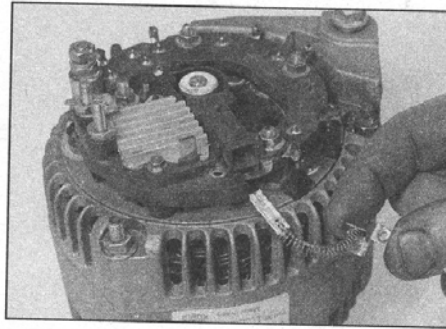
7.10a Unscrew the nut ...



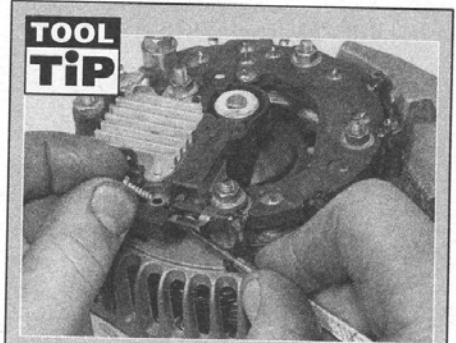
7.10b ... and remove the wiring terminal - Marelli alternator



7.11 Withdrawing the alternator rear cover - Marelli alternator



7.12 Removing an alternator brush - Marelli alternator



TOOL TIP
When fitting a brush, use a small screwdriver to push the brush into position in the brush holder, as the wiring terminal is lined up with the securing screw

13 Refitting is a reversal of removal (see Tool Tip). Make sure that the brushes move freely in their holders, and make sure that the suppressor is positioned as noted before removal.

8 Starting system - testing



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

1 If the starter motor fails to operate when the ignition key is turned to the appropriate position, the possible causes are as follows:

- The battery is faulty.
- 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.
- The solenoid is faulty.
- 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 starter 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 - see the following paragraphs. If the starter motor turns slowly when operated, but the battery is in good condition, then this indicates either that 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, the starter/solenoid wiring and the engine/transmission earth strap(s). Thoroughly clean the connections, and reconnect the leads and wiring. Use a voltmeter or test light to check that full battery voltage is available at the battery positive lead connection to the solenoid. 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, there is a fault in the ignition/starter switch or wiring.

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 9), and checking the brushes (see Section 10). If the fault does not lie in the brushes, the motor windings must be faulty. In this event, the starter motor must be renewed, unless an auto-electrical specialist can be found who will overhaul the unit at a cost significantly less than that of a new or exchange starter motor.

9 Starter motor - removal and refitting



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

Removal

1 Disconnect the battery negative lead.

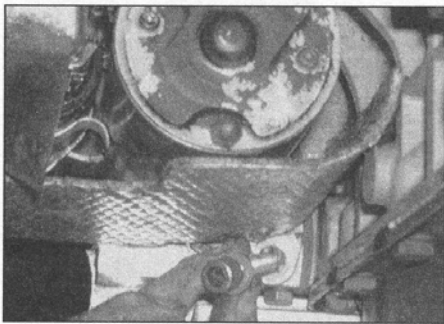
Petrol engines

Caution: On models with catalytic converters, take great care to avoid damaging the lambda sensor in the right-hand branch of the exhaust system (or its wiring) when removing the starter motor.

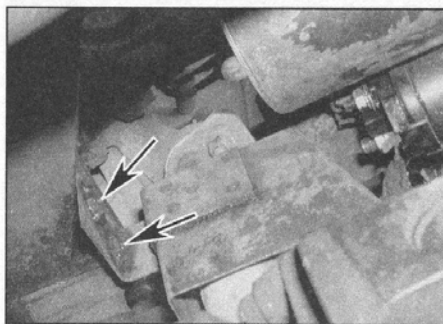
2 The starter motor is at the right-hand rear of the engine (right as seen from the driver's seat), and access is hindered by the right-hand exhaust downpipe. In view of this, wait until the engine (and exhaust) has cooled before starting work.

3 Apply the handbrake, then jack up the front of the vehicle and support on axle stands (see Jacking and vehicle support).

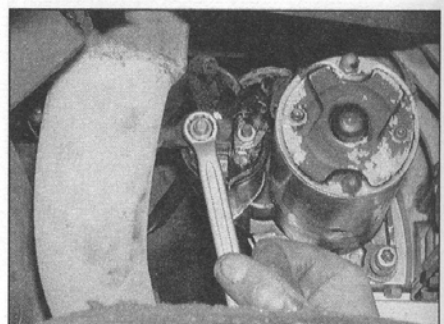
4 Using a suitable Allen key, loosen and remove the starter motor lower mounting bolt



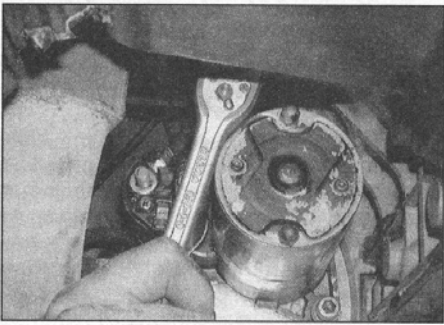
9.4 Removing the lower mounting bolt



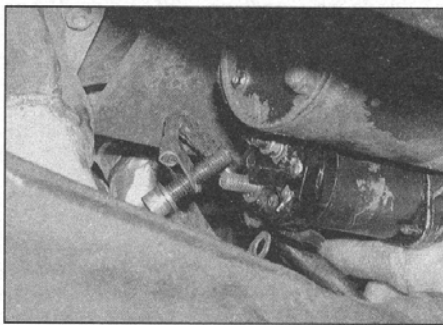
9.6 Exhaust heat shield and mounting bolts (arrowed)



9.7 Loosening the nut securing the starter motor wiring



9.8a Loosen the starter motor upper mounting bolt ...



9.8b ... and remove it - note the earth strap



9.9 Removing the starter motor

(see illustration). In the workshop, we found that access prevented using the Allen key the normal way round - with care, we used a long socket as a lever over the short end of the key. Once the heat shield is free from the mounting bolt, the lower bolt can be refitted loosely for support until the motor is finally removed.

5 The heat shield has a large spring clip which fits around the starter solenoid - manoeuvre the shield up and to one side to

release the clip, taking care not to damage the lambda sensor wiring.

6 The exhaust heat shield must also be removed from the downpipe. The two bolts securing the shield are accessed from in front of the shield, from below the vehicle (see illustration).

7 Noting their locations, and the fitted sequence of the washers, disconnect the wiring from the starter motor and solenoid (see illustration).

8 Loosen and remove the starter motor upper mounting bolt, noting the earth strap located beneath the bolt (see illustrations).

9 Remove the lower mounting bolt, then carefully withdraw the starter motor from the flywheel housing, and lower it to the ground (see illustration).

Diesel engines

10 The starter motor is located on the left-hand side of the engine, and access is most easily obtained from above.

11 On 200 TDi engines, unscrew the three securing bolts, and remove the starter motor heat shield (see illustration).

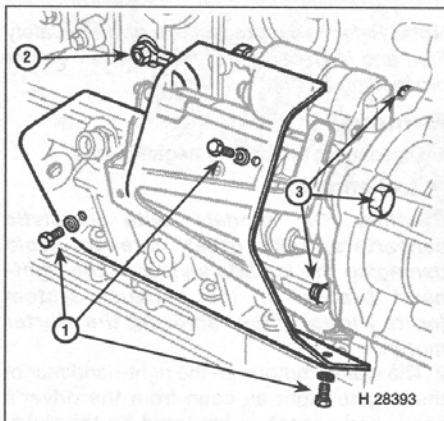
12 Disconnect the wiring from the solenoid, and where applicable release the securing clip.

13 Unbolt the earth lead from the starter motor, or the cylinder block. Note that on 300 TDi engines, the earth lead is secured by one of the starter motor mounting bolts.

14 Unscrew the securing bolt(s), and the nut, and withdraw the starter motor, complete with the heat shield bracket on 200 TDi engines (see illustration).

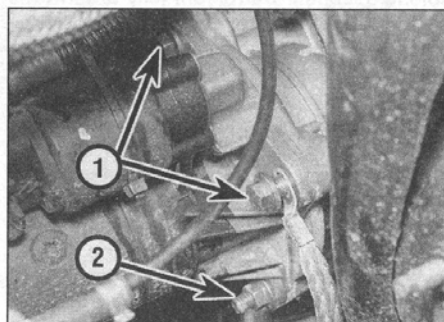
Refitting

15 Refitting is a reversal of removal. Ensure that the wiring connections and mountings are securely tightened.



9.11 Starter motor mounting details - 200 TDi engine

- 1 Heat shield securing bolts
- 2 Earth lead
- 3 Starter motor mounting bolts and nut



9.14 Starter motor securing bolts (1) and nut (2) - 300 TDi engine

10 Starter motor - brush renewal

Starter motor brush renewal is considered to be beyond the scope of the DIY mechanic, and the task should be entrusted to a Land Rover dealer, or an automotive electrical specialist.

Chapter 5 Part B:

Ignition system - petrol engines

Contents

Distributor - dismantling and reassembly	5	Ignition system - testing	2
Distributor - removal and refitting	4	Ignition timing - checking and adjustingSee Chapter 1A
General information and precautions	1	Rotor arm - renewalSee Chapter 1A
HT leads - check and renewalSee Chapter 1A	Spark plugs - renewalSee Chapter 1A
Ignition coil - removal and refitting	3		

Degrees of difficulty

Easy, suitable for novice with little experience



Fairly easy, suitable for beginner with some experience



Fairly difficult, suitable for competent DIY mechanic



Difficult, suitable for experienced DIY mechanic



Very difficult, suitable for expert DIY or professional



Specifications

General

Firing order	1-8-4-3-6-5-7-2
Location of No 1 cylinder	Pulley end left (left as seen from driver's seat - odd numbers on left bank, evens on right)

Distributor

Type	Lucas 35 DLM8
Pick-up air gap	0.20 to 0.35 mm
Pick-up coil resistance	2000 to 5000 ohms

Ignition coil

Primary winding resistance (typical)	0.5 to 1.2 ohms
Secondary resistance (typical)	3000 to 4000 ohms

1 General information and precautions

All models are fitted with the Lucas Constant Energy electronic ignition system, which is a simple distributor-based non-ECU-controlled system, designed to be a direct replacement for the contact breaker systems used on earlier Land Rover models. The system is largely maintenance-free.

The ignition system comprises eight spark plugs, nine HT leads, the distributor, amplifier unit, and an electronic ignition coil, together with its associated wiring.

The electronic ignition functions in a similar manner to a conventional system, but the contact points and condenser are replaced by a magnetic sensor (pick-up) in the distributor and a control unit (amplifier). The amplifier is mounted on the side of the distributor body. As the distributor driveshaft rotates, the magnetic impulses are fed to the amplifier,

which switches the primary circuit on and off.

No condenser is necessary, as the circuit is switched electronically with semi-conductor components.

The ignition advance is controlled mechanically by centrifugal weights, and by a vacuum capsule mounted on the side of the distributor.

Precautions

To prevent personal injury and damage to the ignition system, the following precautions must be observed when working on the ignition system. Also refer to the general precautions listed in Chapter 5A, Section 1.

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. Persons with surgically-implanted cardiac pacemaker devices should keep well clear of the ignition circuits, components and test equipment

Do not attempt to disconnect any plug lead or touch any of the HT leads when the engine is running, or being turned by the starter motor.

Ensure that the ignition is turned OFF before disconnecting any of the ignition wiring, or when connecting or disconnecting any ignition testing equipment such as a timing light.

If the HT lead is disconnected from the distributor, the lead must immediately be connected to earth and remain earthed if the engine is to be rotated by the starter motor (for example if a compression test is to be done).

If an electric arc welder is to be used on any part of the vehicle, the vehicle battery must be disconnected while welding is being done.

2 Ignition system - testing



Note: Refer to the precautions listed in Section 1 before starting work.

General

1 Most ignition system faults are likely to be due to loose or dirty connections, or to tracking (unintentional earthing) of HT voltage due to dirt, dampness or damaged insulation, rather than by 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 an electric shock, but the HT coil could 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 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), disconnect the ignition coil HT lead from the distributor cap and earth it, then 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, first check the battery, starter motor and charging systems (see Chapter 5A).

4 If the engine turns over at normal speed but will not start, check the HT circuit by connecting a timing light (following its manufacturer's instructions) 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.

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 no spark, switch on the ignition and check for voltage between both coil LT terminals and earth - in both cases, almost battery voltage should be obtained. Also check for voltage between the amplifier mounting screws and earth - almost zero volts should be obtained. Compare the results with the following:

- If the voltage at both coil terminals is low, check the ignition switch and/or wiring.
- If the voltage at the coil negative terminal only is low, check the coil and the amplifier module.
- If a significant voltage is obtained in the amplifier earth test, the amplifier should be removed, checked and cleaned. If there is no improvement, have the

amplifier tested by a Land Rover dealer or automotive electrical specialist.

7 Next, switch off the ignition, and connect the voltmeter between the battery positive terminal and the coil negative terminal (wire to amplifier module). With the ignition off, zero volts should be obtained; switch the ignition on, and the reading should still be zero. Now crank the engine, and look for an increase in voltage. If no increase is noted, this indicates that the amplifier module is not switching. Check the pick-up coil as described in paragraph 21 onwards.

8 If there is still no spark, then the problem must lie within the amplifier unit or its wiring, or possibly in the pick-up module inside the distributor (see paragraph 15 onwards).

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.

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.

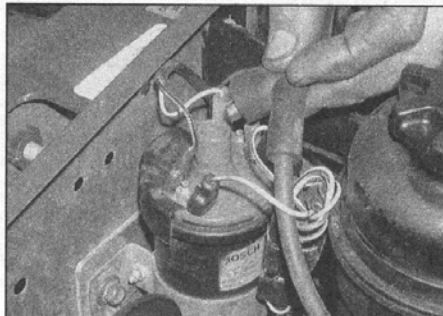
13 If HT voltage is not present on one particular lead, the fault will be in that lead or in the distributor cap. If HT voltage is present on all leads, the fault will be in the spark plugs; check and renew them if there is any doubt about their condition.

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

Ignition coil

15 With the ignition switched on, and without disconnecting the LT wiring, check for battery voltage at both the LT terminals on the ignition coil.

16 Switch off the ignition, then disconnect



3.2 Disconnect the HT lead from the ignition coil ...

the LT wiring plugs and the HT (king) lead from the ignition coil.

17 Connect a multi-meter between terminals 1 (-) and 15 (+), and check the resistance of the primary windings.

18 Connect the multi-meter between terminals 4 (HT) and 15 (+), and check the resistance of the secondary windings.

19 Values for the primary and secondary resistances are not quoted by Land Rover, but those given in the Specifications can be used as a guide.

20 If either reading is substantially different to those quoted, or if an open-circuit or zero result is obtained, the coil is suspect. Remove the coil as described in Section 3 and take it to a Land Rover dealer or automotive electrical specialist to confirm your findings before condemning the coil.

Pick-up coil

21 The pick-up coil is located inside the distributor. The pick-up coil resistance can be checked without dismantling the distributor, as follows.

22 On early models, remove the amplifier from the distributor body, as described in Section 5. On later models, disconnect the wiring plug from the side of the distributor.

23 Connect an ohmmeter between the two pick-up terminals now visible, and compare the resistance measured with that quoted in the Specifications.

24 If the resistance is outside the specified range, dismantle the distributor as described in Section 5, and fit a new pick-up coil.

25 The pick-up air gap can be checked as described in Section 5.

3 Ignition coil - removal and refitting

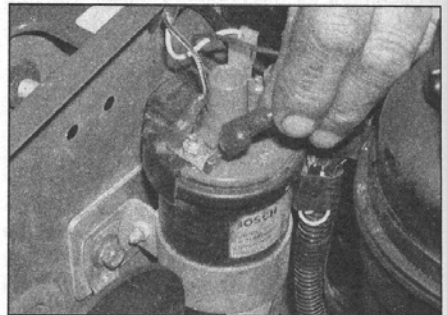


Removal

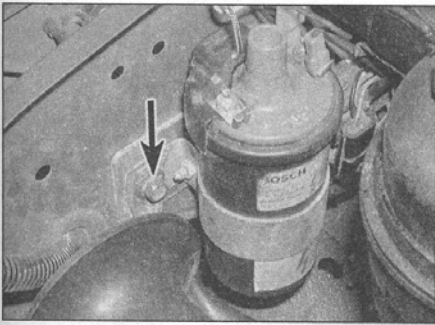
1 Disconnect the battery negative lead.

2 Disconnect the HT lead from the coil, pulling on the end fitting, not the lead itself, to avoid damage to the lead (see illustration).

3 Disconnect the LT wiring plugs from the ignition coil, noting the location of each, as they are very similar in appearance (see illustration).



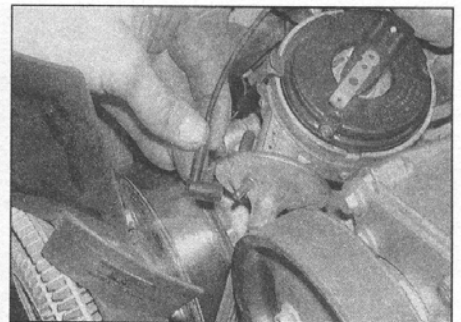
3.3 ... followed by the LT wiring



3.4a Remove the coil mounting bolts (one arrowed) . . .



3.4b . . . and remove the coil and amplifier (later model shown)



4.3 Pull off the distributor vacuum pipe

On later models where the amplifier is located on a bracket behind the coil, do not disconnect the amplifier wiring.

4 Remove the two securing bolts, recover the washers, and remove the coil (and on later models, the amplifier) from the engine compartment (**see illustrations**). Note that one of the bolts has an earth strap underneath it, and on later models, the other bolt secures a suppressor.

5 On later models, if the amplifier module is to be removed from the mounting bracket, unscrew the two mounting nuts, and disconnect the wiring plug and LT connectors.

Refitting

6 Refitting is a reversal of removal. Make sure that the earth strap connection is cleaned thoroughly, and apply a little petroleum jelly to the connection once this has been done.

4 Distributor - removal and refitting

Removal

- 1 Disconnect the battery negative lead.
- 2 Drain the cooling system as described in Chapter 1A, and disconnect the top hose from the thermostat housing.
- 3 Disconnect the vacuum pipe from the vacuum unit (**see illustration**).
- 4 On early models, disconnect the low

tension lead from the amplifier module on the side of the distributor body. On later models, disconnect the wiring plug from the side of the distributor (**see illustration**).

5 Release the clip either side, and lift the cap off the top of the distributor.

6 Set the engine to TDC with No 1 piston on compression, as described in Chapter 2A, Section 3.

7 Mark the alignment of the rotor arm to the distributor body, and mark the body of the distributor to show its relationship to the timing cover (**see illustration**).

8 Undo the clamp plate nut/bolt and remove the plate (**see illustration**). Access is not easy, and is best achieved from under the power steering pump, using a long extension handle.

9 Withdraw the distributor from the timing

cover (**see illustration**). Note that, as this is done, the rotor arm will turn away from the alignment mark made on the distributor body. If the distributor is not disturbed from this position, when refitted, the arm will turn back to the correct position. If wished, make another mark to indicate the removed position of the rotor arm.

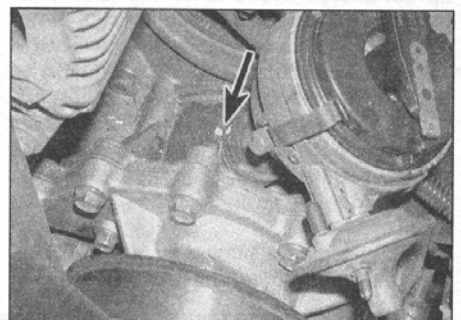
Refitting

10 Fit a new O-ring to the distributor shaft casing (**see illustration**).

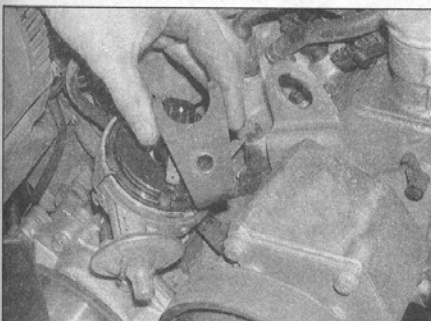
11 If the distributor is in the correct position for refitting, the rotor arm will be 30° anti-clockwise from the mark scribed on the body. This allows the distributor drivegear to engage correctly as the distributor is refitted. As the distributor is pushed home, so the gear will rotate and the marks will be correctly aligned.



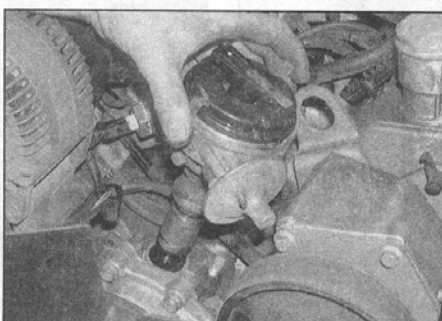
4.4 Disconnect the wiring plug from the distributor body



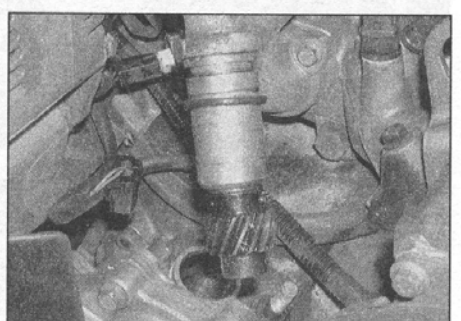
4.7 Paint an alignment mark (arrowed) between the distributor body and timing cover



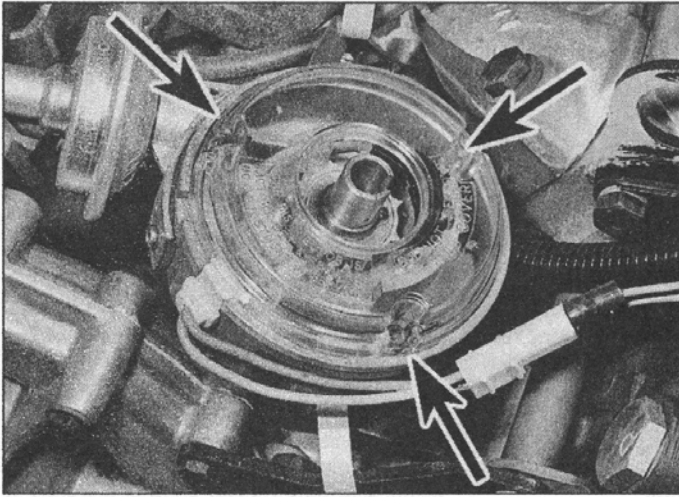
4.8 Remove the distributor clamp plate



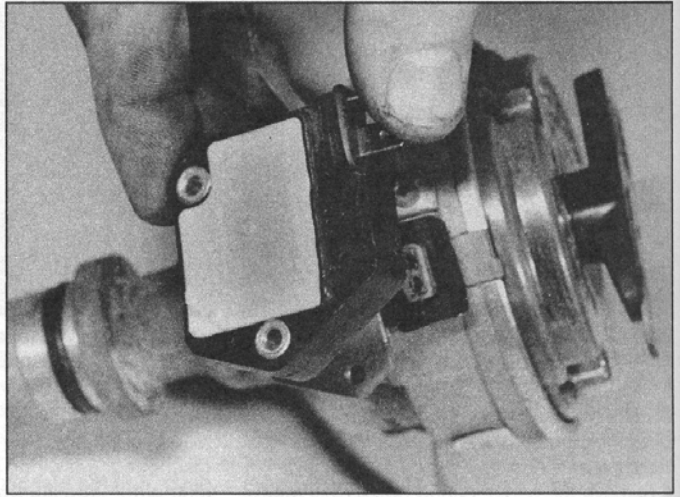
4.9 Withdrawing the distributor



4.10 Fit a new O-ring to the distributor shaft



5.2 Flash shield retaining screws (arrowed)



5.4a Removing the amplifier from the side of the distributor . . .

12 If a new distributor is being fitted, identify No 1 cylinder HT lead position on the distributor cap. Using this as a reference, set the rotor arm 30° anti-clockwise from this position. Note that most distributors have a notch cut in the upper rim, which indicates the alignment of the rotor arm with the No 1 cylinder segment.

13 Check that the engine is set to TDC with No 1 on compression, as described in Chapter 2A, Section 3.

14 Check as the distributor is offered up, that the oil pump driveshaft slot is correctly lined up to accept the end of the distributor driveshaft. If it is not in alignment, insert a screwdriver and set it to the correct position.

15 Refit the distributor so that the marks on the body and timing cover correctly aligned (where applicable). Make sure that the rotor arm turns to the No 1 HT lead position - if not, remove the distributor, reset the rotor arm as described in paragraphs 10 and 11, and try again.

16 Fit the clamp plate and nut/bolt, and secure the distributor in its original location.

17 Reconnect the wiring, and the vacuum pipe to the vacuum unit.

18 Refit the distributor cap, securing with the two clips.

19 On completion, reconnect the battery and check the ignition timing as described in Chapter 1A.

5 Distributor - dismantling and reassembly

Dismantling

1 Remove the distributor as described in Section 4.

2 Commence dismantling by withdrawing the rotor arm, then undo the three retaining screws and lift clear the plastic insulation cover (flash shield) (see illustration).

3 Undo the two screws securing the vacuum unit and withdraw the unit, disengaging the connecting rod from the pick-up baseplate peg as it is removed.

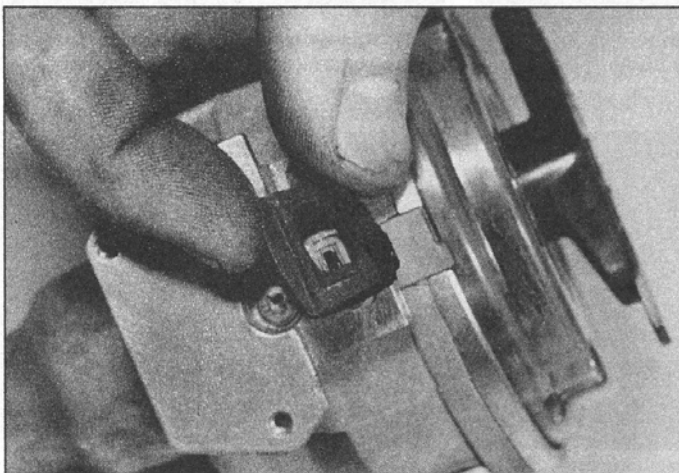
4 On early models, unscrew the two screws

and withdraw the amplifier from the side of the distributor, together with the gasket. Unscrew the two screws and remove the cast heat sink from the side of the distributor (see illustrations). **Note:** The amplifier is a sealed unit. No attempt should be made to dismantle it, as it contains beryllia, which is dangerous if handled.

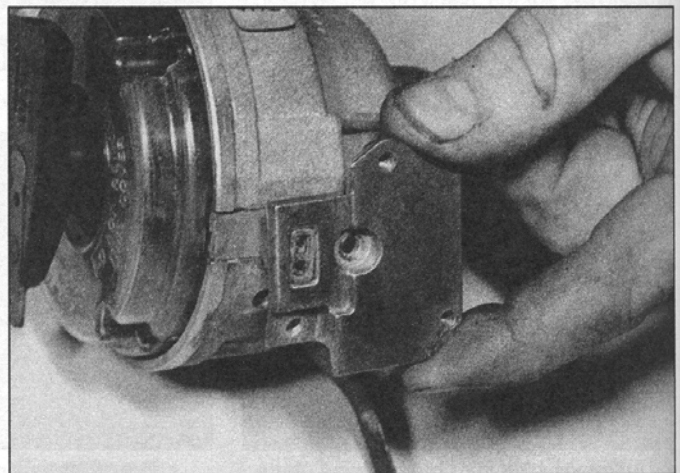
5 On all models, using a pair of circlip pliers, release the circlip securing the reluctor on the driveshaft, then withdraw the reluctor complete with the flat washer and O-ring. To assist with the removal of the reluctor, insert a small screwdriver blade under it and prise it up the shaft. Note the coupling ring located underneath the reluctor.

6 To remove the pick-up module and baseplate unit, unscrew and remove the three support pillars. Take care not to undo the two barrel nuts - these retain the pick-up module, and if disturbed, the air gap will have to be reset. Do not dismantle the distributor any further.

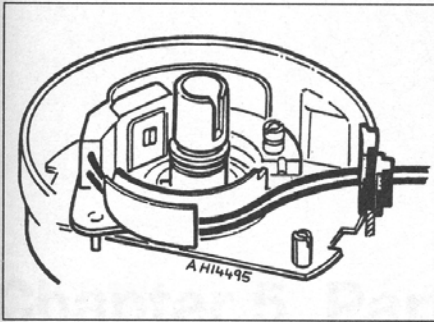
7 Clean and renew as necessary any items which are worn or suspect.



5.4b . . . followed by the gasket



5.4c Removing the cast heat sink from the side of the distributor

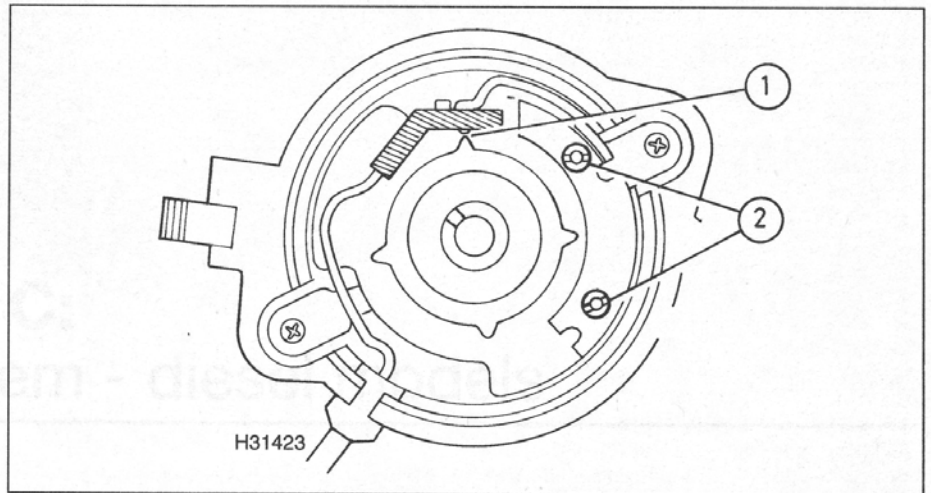


5.8 Locate the pick-up wiring in the curved guide channel

Reassembly

8 Reassembly is a reversal of the dismantling procedure, but note the following special points:

- a) When refitting the pick-up and baseplate unit, locate the pick-up leads in the curved plastic channel (see illustration).
- b) When refitting the reluctor, slide it down the shaft as far as possible, then turn the reluctor so that it engages with the coupling ring underneath the baseplate.
- c) On early models, before refitting the amplifier, apply MS4 silicone grease or an equivalent heat-conducting compound to the amplifier module backplate, the seating face on the distributor body, and to both faces of the heat sink casting.
- d) Apply three drops of clean engine oil to the felt pad in the top end of the rotor shaft.
- e) Apply grease to the vacuum unit connecting rod seal (within the unit).
- f) Apply grease to the automatic advance mechanism, the pick-up plate centre



5.12 Distributor pick-up air gap adjustment

1 Air gap 2 Barrel nuts

bearing, pre-tilt spring and contact area, and to the vacuum unit connecting peg and corresponding connecting rod hole.

- g) Prior to refitting the insulation cover check, and if necessary adjust, the pick-up air gap as described below.

Pick-up air gap adjustment

9 The air gap should only need checking when the distributor has been dismantled - it is not a routine operation.

10 If not already done, remove the distributor cap and rotor arm, then undo the three retaining screws and lift clear the plastic insulation cover (flash shield).

11 The air gap is checked by inserting a non-

ferrous feeler gauge of the specified thickness between the pick-up limb and a reluctor tooth. An ordinary (ferrous) feeler gauge will be attracted to the pick-up magnet, making accurate adjustment very difficult.

12 Where adjustment is necessary, loosen the two barrel nuts retaining the pick-up module (these will already be loosened on a new unit) and move the module/pick-up to adjust the gap (see illustration). Retighten the nuts when the gap is correct.

13 Turn the distributor shaft, and check that the air gap remains consistent as all the reluctor teeth pass the pick-up. Re-adjust if necessary.

14 On completion, refit the plastic insulation cover, rotor arm and distributor cap.






Chapter 5 Part C:

Pre-heating system - diesel models

Contents

General information	1	Pre-heating system relay/timer unit - removal and refitting	4
Glow plugs - removal, inspection and refitting	3	Stop solenoid - description, removal and refitting	5
Pre-heating system - testing	2		

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

Glow plugs

Type See Chapter 1B

Torque wrench setting

	Nm	lbf ft
Glow plugs	23	17

1 General information

Each cylinder has a heater plug (commonly called a glow plug) screwed into it. The plugs are electrically operated before, during, and a short time after, start-up when the engine is cold. Electrical feed to the glow plugs is controlled by the pre-heating control unit.

The glow plugs also provide a post-heating function, whereby the glow plugs remain switched on for a period after the engine has started. The length of time for which the glow plugs are switched on is dependent on underbonnet temperature, which is monitored by a temperature sensor located in the relay/timer unit. The electrical supply to the glow plugs will be interrupted by:

- a) *Opening of the no-load switch - a microswitch located on the fuel injection pump, which operates when the accelerator is depressed.*

- b) *The signal from the underbonnet temperature sensor when the temperature reaches a predetermined level.*

A warning light in the instrument panel tells the driver that pre-heating is taking place. When the light goes out, the engine is ready to be started. The voltage supply to the glow plugs may continue for several seconds after the light goes out. If no attempt is made to start, the timer then cuts off the supply in order to avoid draining the battery and overheating of the glow plugs.

Precautions

The heater plugs draw a very high current, and operate at very high temperatures - certain precautions must be observed when working on the system. Also refer to the general precautions listed in Chapter 5A, Section 1.

Always allow time for the glow plugs to cool before working on the system

Ensure that the battery negative lead is disconnected before working on the system, and that the ignition switch is in

the off position, unless otherwise stated. Given the high current required for the system to operate, there is a high risk of damage from short-circuits, possibly even fire. If the glow plug supply cable is disconnected for testing purposes, do not let it short out against the engine or bodywork.

Take great care when trying to verify the operation of a glow plug outside of the engine. A healthy glow plug will rapidly become hot enough to glow red-hot, presenting a significant risk of personal injury and fire if carelessly handled.

2 Pre-heating system - testing

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

1 If the system malfunctions, testing is ultimately by substitution of known good

units, but some preliminary checks may be made as follows.

2 Connect a voltmeter or 12-volt test light between the glow plug supply cable and earth (engine or vehicle metal). Make sure that the live connection is kept clear of the engine and bodywork.

3 Have an assistant switch on the 'ignition', and check that voltage is applied to the glow plugs. Note the time for which the warning light is lit, and the total time for which voltage is applied before the system cuts out. Switch off the 'ignition'.

4 At an underbonnet temperature of 20°C, typical times noted should be 5 or 6 seconds for warning light operation, followed by a further 4 to 5 seconds' supply after the light goes out (provided that the starter motor is not operated). Warning light time will increase with lower temperatures, and decrease with higher temperatures.

5 If there is no supply at all, the relay or associated wiring is at fault.

6 To locate a defective glow plug, disconnect the main supply cable and the interconnecting wire or strap from the top of the glow plugs. Be careful not to drop the nuts and washers.

7 Use a continuity tester, or a 12-volt test light connected to the battery positive terminal, to check for continuity between each glow plug terminal and earth. The resistance of a glow plug in good condition is very low (less than 1 ohm), so if the test light does not light, or the continuity tester shows a high resistance, the glow plug is certainly defective.

8 If an ammeter is available, the current draw of each glow plug can be checked. After an initial surge of around 15 to 20 amps, each plug should draw around 10 amps. Any plug which draws much more or less than this is probably defective.

9 As a final check, the glow plugs can be removed and inspected as described in Section 3.

3 Glow plugs - removal, inspection and refitting

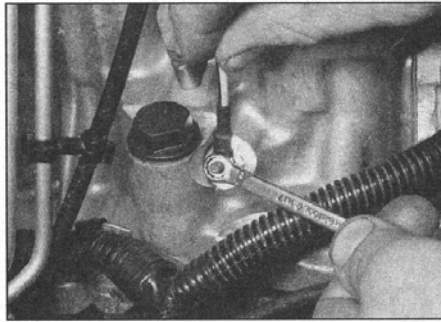


Removal

Caution: If the pre-heating system has just been energised, or if the engine has been running, the glow plugs may be very hot. Allow the system to cool before proceeding.

Note: Refer to the precautions given in Safety first! and in Section 1 of this Chapter before proceeding. Where applicable, a new crankcase ventilation valve O-ring will be required on refitting - see text.

1 Disconnect the battery negative lead.
2 If the No 1 cylinder (timing belt end glow plug is to be removed on 300 TDi engine models with air conditioning, proceed as follows:



3.4 Unscrewing a glow plug wiring nut

- a) Remove the air conditioning compressor drivebelt, as described in Chapter 1B, Section 17.
- b) Remove the four securing bolts, and move the compressor to one side, to provide access to the glow plug. DO NOT disconnect the refrigerant lines from the compressor (see Chapter 3).

3 If the No 3 cylinder glow plug is to be removed on 300 TDi engine models, remove the securing bolt, and withdraw the crankcase ventilation system valve from the valve cover. Move the valve to one side for access to the glow plug.

4 Unscrew the nut from the relevant glow plug terminal, and recover the washer (see illustration).

5 Disconnect the wiring, noting the routing if all the glow plugs are to be removed.

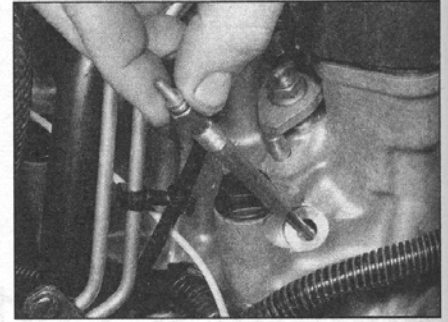
6 Unscrew the glow plug, and remove it from the cylinder head (see illustration).

Inspection

7 Inspect the glow plugs for physical damage. Burnt or eroded glow plug tips can be caused by a bad injector spray pattern. Have the injectors checked if this sort of damage is found.

8 If the glow plugs are in good physical condition, check them electrically using a 12-volt test light or continuity tester as described in Section 2.

9 The glow plugs can be energised by applying 12 volts to them to verify that they heat up evenly and in the required time. Observe the following precautions:



3.6 Removing a glow plug - 300 TDi engine

- a) Support the glow plug by clamping it carefully in a vice or self-locking pliers. Remember, it will become red-hot.
- b) Make sure that the power supply or test lead incorporates a fuse or overload trip, to protect against damage from a short-circuit.
- c) After testing, allow the glow plug to cool for several minutes before attempting to handle it.

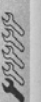
10 A glow plug in good condition will start to glow red at the tip after drawing current for 5 seconds or so. Any plug which takes much longer to start glowing, or which starts glowing in the middle instead of at the tip, is defective.

Refitting

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

- a) Apply a smear of copper-based anti-seize compound to the plug threads, and tighten the glow plugs to the specified torque. Do not overtighten, as this can damage the glow plug element.
- b) Ensure that the glow plug wiring is routed as noted before removal.
- c) Where applicable, use a new O-ring, lubricated with clean engine oil, when refitting the crankcase ventilation valve.
- d) Where applicable, refit and tension the air conditioning compressor drivebelt as described in Chapter 1B, Section 17.

4 Pre-heating system relay/timer unit - removal and refitting

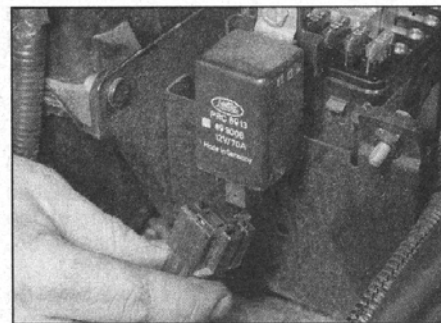


Note: Refer to the precautions given in Safety first! and in Section 1 of this Chapter before proceeding.

Removal

1 On 200 TDi engine models, the relay/timer unit is located on the right-hand side of the engine compartment bulkhead. On 300 TDi engine models, the unit is located on the right-hand side of the engine compartment, on a bracket attached to the rear of the fusebox.

2 Disconnect the battery negative lead.
3 Disconnect the wiring plug from the relay/timer unit (see illustration).



4.3 Disconnecting the wiring plug from the preheating system relay/timer unit - 300 TDi engine model

4 Unscrew the bolt, or the nut and bolt, as applicable, and withdraw the unit.

Refitting

5 Refitting is a reversal of removal.

5 Stop solenoid - description, removal and refitting



Description

1 The stop solenoid is located on the end of the fuel injection pump. Its purpose is to cut the fuel supply when the 'ignition' is switched off. If an open-circuit occurs in the solenoid or supply wiring, it will be impossible to start the engine, as the fuel will not reach the injectors. The same applies if the solenoid plunger jams in the stop position. If the solenoid jams in the run position, the engine will not stop when the 'ignition' is switched off.

2 If the solenoid has failed and the engine will not run, a temporary repair may be made by

removing the solenoid as described in the following paragraphs. Refit the solenoid body without the plunger and spring. Tape up the wire so that it cannot touch earth. The engine can now be started as usual, but it will be necessary to use the manual stop lever on the fuel injection pump (or to stall the engine in gear) to stop it.

Removal

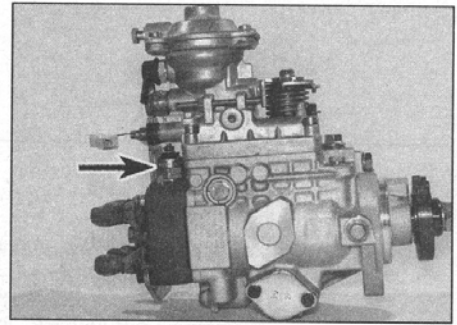
Caution : Be careful not to allow dirt into the injection pump during this procedure. A new sealing washer or O-ring must be used on refitting.

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

3 Disconnect the battery negative lead.

4 Withdraw the rubber boot (where applicable), then unscrew the terminal nut and disconnect the wire from the top of the solenoid (see illustration).

5 Carefully clean around the solenoid, then unscrew and withdraw the solenoid, and recover the sealing washer or O-ring (as



5.4 Stop solenoid location (arrowed) in the rear of the injection pump

applicable). Recover the solenoid plunger and spring if they remain in the pump. Operate the hand-priming lever on the fuel lift pump as the solenoid is removed, to flush away any dirt.

Refitting

6 Refitting is a reversal of removal, using a new sealing washer or O-ring.