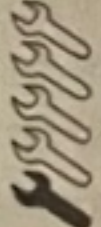
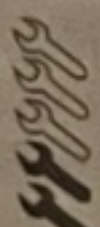
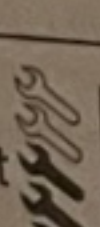
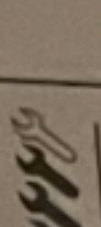
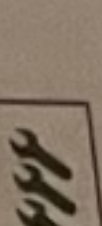


Chapter 5 Part A: Starting and charging systems

Contents

	Section number		Section number
Alternator – removal and refitting	7	Ignition switch – removal and refitting	12
Alternator brushes and regulator – inspection and renewal	8	Oil level sensor – removal and refitting	14
Alternator drivebelt – removal, refitting and tensioning	6	Oil pressure warning light switch – removal and refitting	13
Battery – removal and refitting	4	Pre/post-heating system – description and testing	15
Battery – testing and charging	3	Pre/post-heating system control unit – removal and refitting	17
Charging system – testing	5	Starter motor – removal and refitting	10
Electrical fault finding – general information	2	Starter motor – testing and overhaul	11
General information and precautions	1	Starting system – testing	9
Glow plugs – removal, inspection and refitting	16		

Degrees of difficulty

Easy, suitable for novice with little experience		Fairly easy, suitable for beginner with some experience		Fairly difficult, suitable for competent DIY mechanic		Difficult, suitable for experienced DIY mechanic		Very difficult, suitable for expert DIY or professional	
--	---	---	---	---	---	--	---	---	---

Specifications

System type	12 volt, negative earth
Battery	
Type	Lead-acid, low-maintenance or 'maintenance-free' (sealed for life)
Battery capacity	60 to 85 amp-hour (depending on model)
Charge condition	More than 12 volts
Alternator	
Type:	
Petrol engines	Bosch NC-14V 65-130A or Bosch E8-14V 75-140A
Diesel engines	Denso 14V 70 – 130A
Rated voltage	14V
Slip-ring diameter:	
Min.	15.4 mm
New	14.4 mm
Minimum brush protrusion from holder	7.5 mm
Output current:	
Bosch NC:	
At 1800 rpm	65 amps
At 6000 rpm	130 amps
Bosch E8:	
At 1800 rpm	75 amps
At 6000 rpm	140 amps
Denso:	
At 1800 rpm	70 amps
At 6000 rpm	130 amps
Starter motor	
Type	Bosch DW or Delco
Output:	
Petrol engines	1.4 to 1.8 kW
Diesel engines	2.0 kW

	Nm	lbf ft
Torque wrench settings	45	33
Alternator belt tensioner	20	15
Alternator mounting bolt:	60	44
Petrol engines		
Diesel engines	50	37
Engine mounting nut:	18	7
Right-hand side	25	
Rear	10	
Glow plugs	18	13
Oil pressure switch:	30	22
Petrol engines		
Diesel engines		
Starter motor:	45	33
Petrol engines	24	18
Diesel engines		

1 General information and precautions

General information

Because of their engine-related functions, the components of the starting and charging systems are covered separately from the body electrical devices such as the lights, instruments, etc (which are covered in Chapter 12). Refer to Part B of this Chapter for information on the ignition system.

The electrical system is of the 12 volt negative earth type. The battery fitted as original equipment is of low-maintenance or 'maintenance-free' (sealed for life) type. The battery is charged by the alternator, which is belt-driven from the crankshaft pulley. During the life of the car, the original battery may have been renewed with a standard type battery.

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/driveplate 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 ring gear. Unlike some modern starter motors, it incorporates epicyclic reduction gears between the armature and the pinion.

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.

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!* 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, electronic control modules, 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, refer to *Jump starting*.

Caution: 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 module, to protect them from the risk of damage.

2 Electrical fault finding – general information

Refer to Chapter 12.

3 Battery – testing and charging

Testing

Standard and low-maintenance battery

- 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 to make the check, and compare the results with the following table.

Note that the specific gravity readings are for an electrolyte temperature of 15°C. For 10°C below 15°C, subtract 0.007. For 10°C above 15°C, add 0.007. However, for convenience, the temperatures given in the following table are ambient (room) temperatures, above or below 25°C.

	Above 25°C	Below 25°C
Fully-charged	1.210 to 1.230	1.270 to 1.290
70% charged	1.170 to 1.190	1.230 to 1.250
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 two 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

- 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 A battery with a built-in charge condition indicator may be fitted. The indicator is located in the top of the battery casing, and indicates the condition of the battery from its colour. If the indicator shows green, then the battery is in a good state of charge. If the indicator turns darker, eventually to black, then the battery requires charging, as described in this Section. If the indicator shows 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 or load or jump start a battery when the indicator shows clear/yellow.

All battery types

- 6 If testing the battery using a voltmeter, connect the voltmeter across the battery terminals and compare the result with those given in the Specifications under 'charge condition'. This test is only accurate if the battery has not been subjected to any kind of charge or discharge in the previous six hours, including charging or

4.1 Removing

alternator. If the headlights for five minutes before testing circuits must be fully charged. If the voltage of 12.2 to 12.4 is discharged. If the battery from the vehicle described.

Charging

Note: The only. Always recommended attached battery.

Standard low-maintenance

9 Charge and connect until no over a 10. At the over 11. S claim 1 to can plat 12. tem exo

Ma

13

to

the

d

d

1



4.1 Removing the battery cover from the battery

If this is not the case, switch on the headlights for 30 seconds, then wait four to five minutes after switching off the headlights before testing the battery. All other electrical circuits must be switched off, so check (for instance) that the doors and tailgate or boot lid are fully shut when making the test.
7 If the voltage reading is less than 12.2 volts, the battery is discharged. A reading of 12.2 to 12.4 volts indicates a partially-discharged condition.
8 If the battery is to be charged, remove it from the vehicle (Section 4) and charge it as described in the following paragraphs.

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.

Standard and low-maintenance 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.

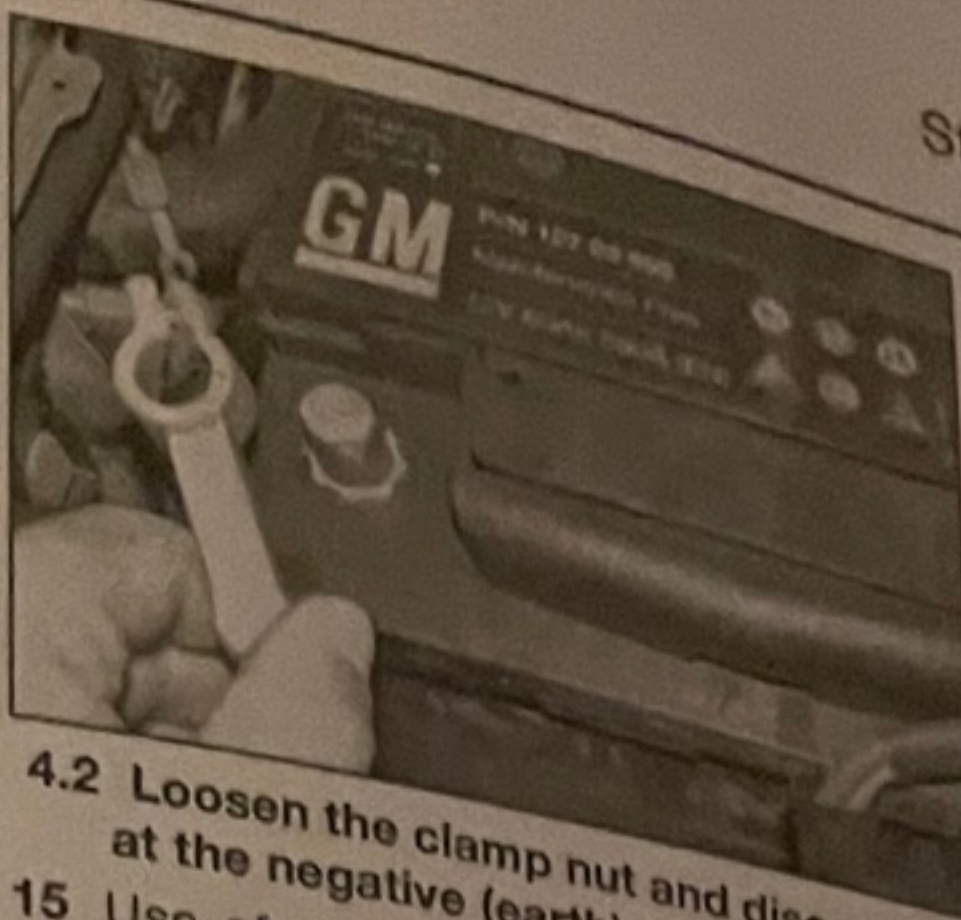
11 Specially rapid 'boost' charges, which are claimed to restore the power of the battery in 1 to 2 hours are not recommended, as they can cause serious damage to the battery plates through overheating.

12 While charging the battery, note that the temperature of the electrolyte should never exceed 38°C.

Maintenance-free battery

13 This battery type requires a longer period 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, where possible, to 13.9 to 14.9 volts with a charger current below 25 amps. Using this method, the battery should be usable within three hours, giving a voltage reading of 12.5 volts, but this is for a partially-discharged battery and, as mentioned, full-charging can take considerably longer.



4.2 Loosen the clamp nut and disconnect at the negative (earth) terminal first

15 Use of a normal trickle charger should not be detrimental to the battery, provided excessive gassing is not allowed to occur, and the battery is not allowed to become hot.

4 Battery - removal and refitting

Removal

1 The battery is located at the front left-hand side of the engine compartment. Unclip the cover from the battery (see illustration).

2 Loosen the clamp nut and disconnect the lead at the negative (earth) terminal (see illustration). Disconnect the lead at the positive terminal in the same way.

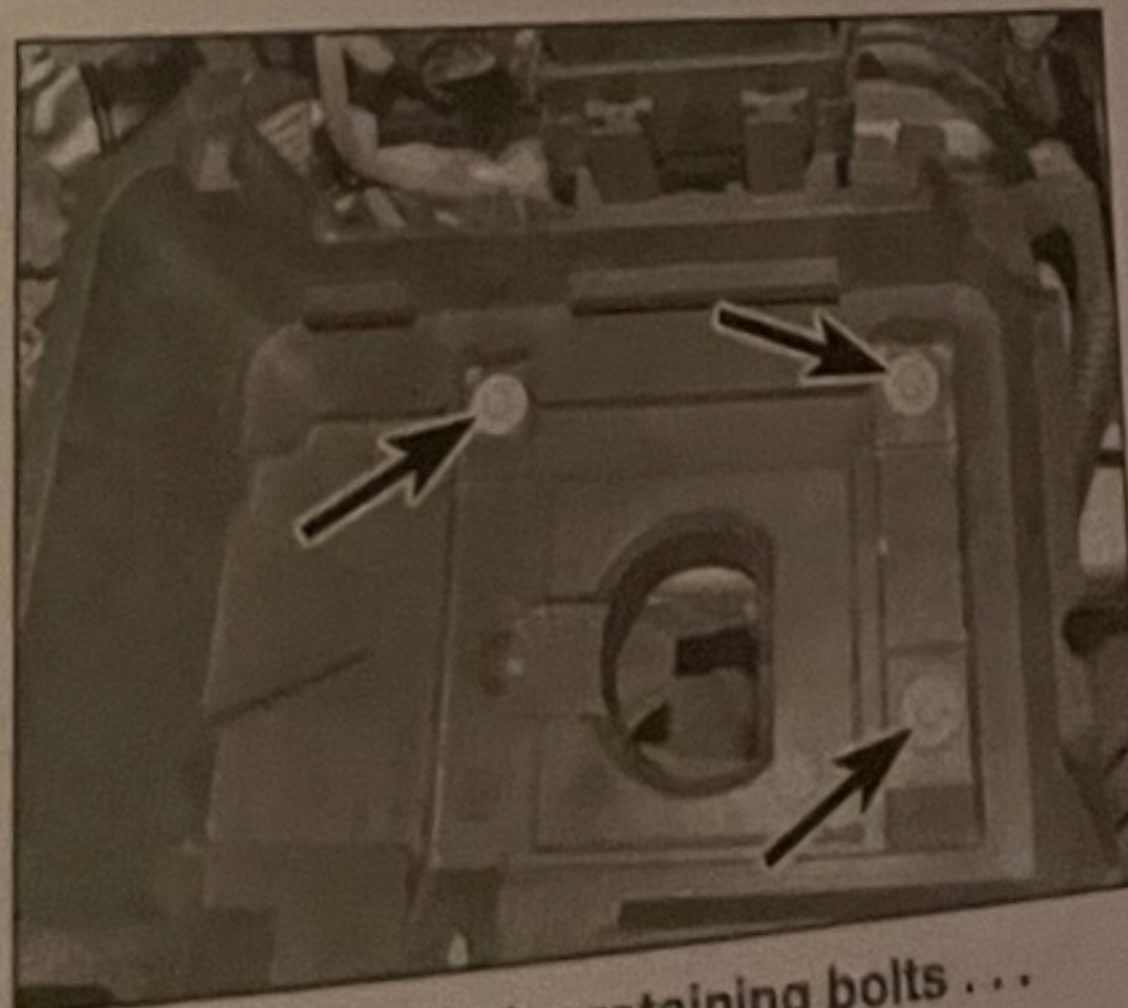
3 Unscrew the retaining bolt and remove the battery retaining clamp (see illustration) which secures the battery to the mounting bracket.

4 Lift the battery out of the engine compartment (take care not to tilt it excessively).

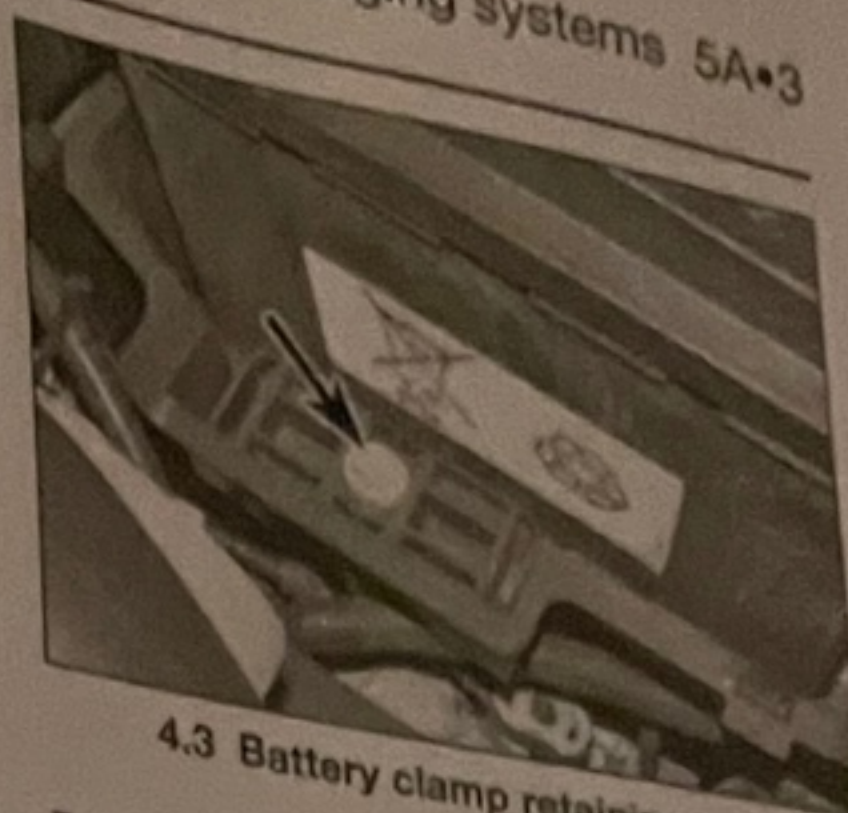
5 To remove the battery tray, undo the 3 retaining bolts and withdraw the battery tray (see illustrations). As the tray is removed, depress the clips and slide up the fusible link junction box (where fitted).

Refitting

6 Refitting is a reversal of removal. Smear petroleum jelly on the terminals after reconnecting the leads, and always reconnect the positive lead first, and the negative lead last.



4.5a Undo the retaining bolts ...



4.3 Battery clamp retaining bolt

7 After reconnection, it will be necessary to reset the clock, and date information as described in the owners handbook.

8 It may also be necessary to reset the window 'pinch protection' function as follows:

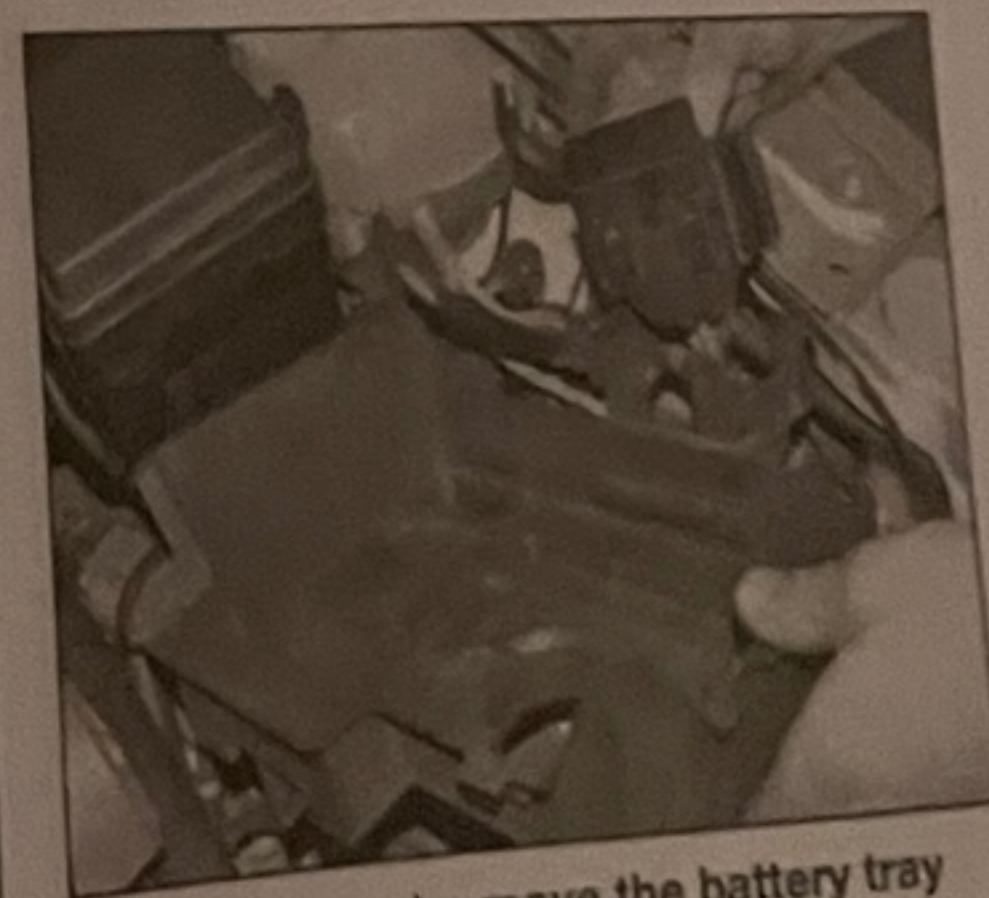
- 1) Shut the doors, start the car, and open the side window approximately 15 cm.
- 2) Close the window and hold the button in the closed position for at least 1 second after the window shuts.
- 3) Press the 'down' button and allow the window to open by itself.
- 4) Wait at least 1 second then close the window, holding the button until closing is confirmed by an audible signal.

9 In some instances, it's possible that several diagnostic fault codes may be set as a result of the battery disconnection and reconnection. These codes can be ignored, and will not be regenerated once they have been deleted. As special diagnostic equipment is needed to delete these codes, entrust this task to a Saab dealer or suitably-equipped repairer.

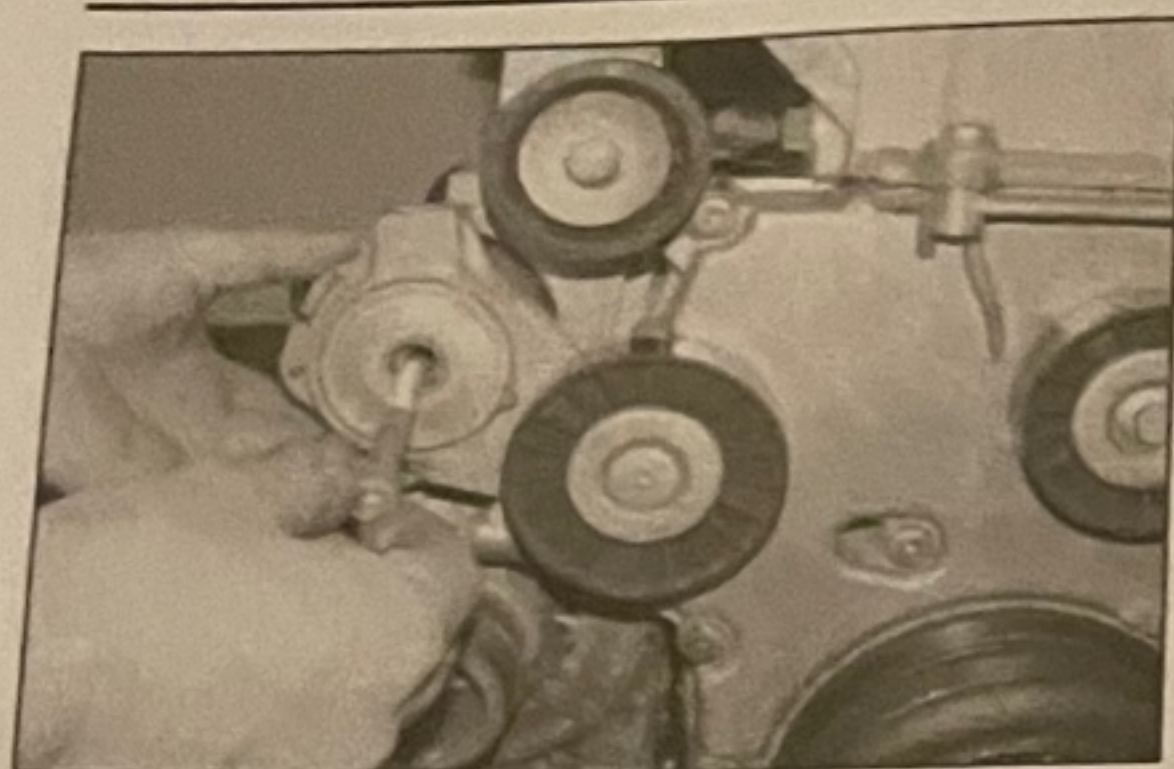
5 Charging system - testing

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

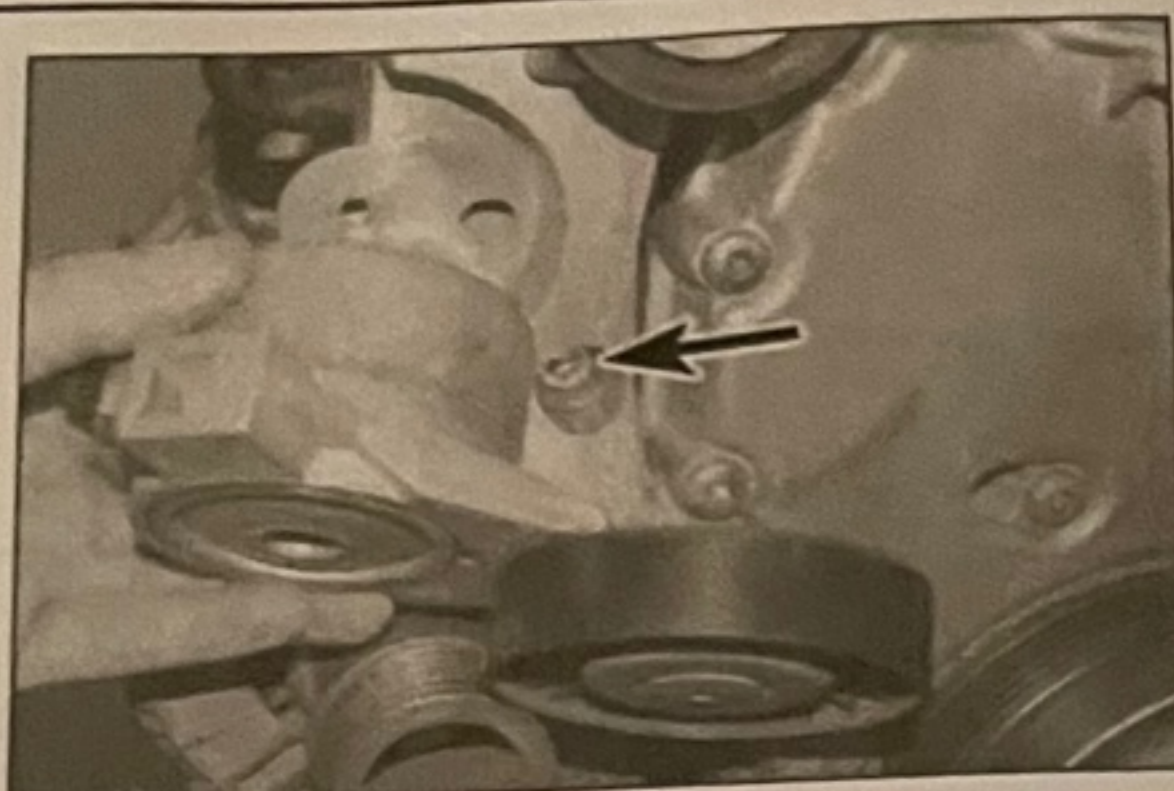
1 If the ignition/no-charge warning light does not come on when the ignition is switched on, first check the alternator wiring connections for security. If satisfactory, check that the warning light bulb has not blown, and that the bulbholder



4.5b ... and remove the battery tray



7.7 Removing the auxiliary belt tensioner . . .



7.8 . . . to access the upper alternator mounting bolt (arrowed)



7.9 Unscrew the terminal nuts (arrowed) and disconnect the wiring from the alternator

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

2 If the ignition warning light comes on when the engine is running, stop the engine. Check that the drivebelt is in tact and correctly tensioned (see Chapter 1A or 1B), and that the alternator connections are secure. If all is satisfactory, check the alternator brushes and slip-rings as described in Section 8. If the fault persists, the alternator should be taken to an auto-electrician for testing and repair, or else renewed.

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 as possible (eg, the headlights, heated rear window and heater blower), 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 8), but if the fault persists, the alternator should be taken to an auto-electrician for testing and repair, or else renewed.

6 Alternator drivebelt - removal, refitting and tensioning

Refer to the procedure given for the alternator drivebelt in Chapter 1A or 1B.

7 Alternator - removal and refitting

Removal

1 Open the bonnet and unclip the cover at the top of the engine and battery, then disconnect the battery negative lead.

2 Apply the handbrake, then jack up the front of the car and support on stands (see Jacking and vehicle support). Remove the right-hand front wheel and engine undershield, where fitted.

3 Remove the right-hand front wing plastic moulding/wheel arch liner for access to the rear of the engine.

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

Petrol models

5 Remove the intake manifold as described in Chapter 4A, Section 18.

6 Remove the front exhaust pipe section (including catalytic converter) as described in Chapter 4A, Section 20.

7 Undo the retaining bolt and remove the auxiliary belt tensioner (see illustration).

8 Unscrew and remove the alternator mounting bolt (see illustration).

9 Note the position of the wires on the alternator, then unscrew the terminal nuts and disconnect the wires (see illustration).

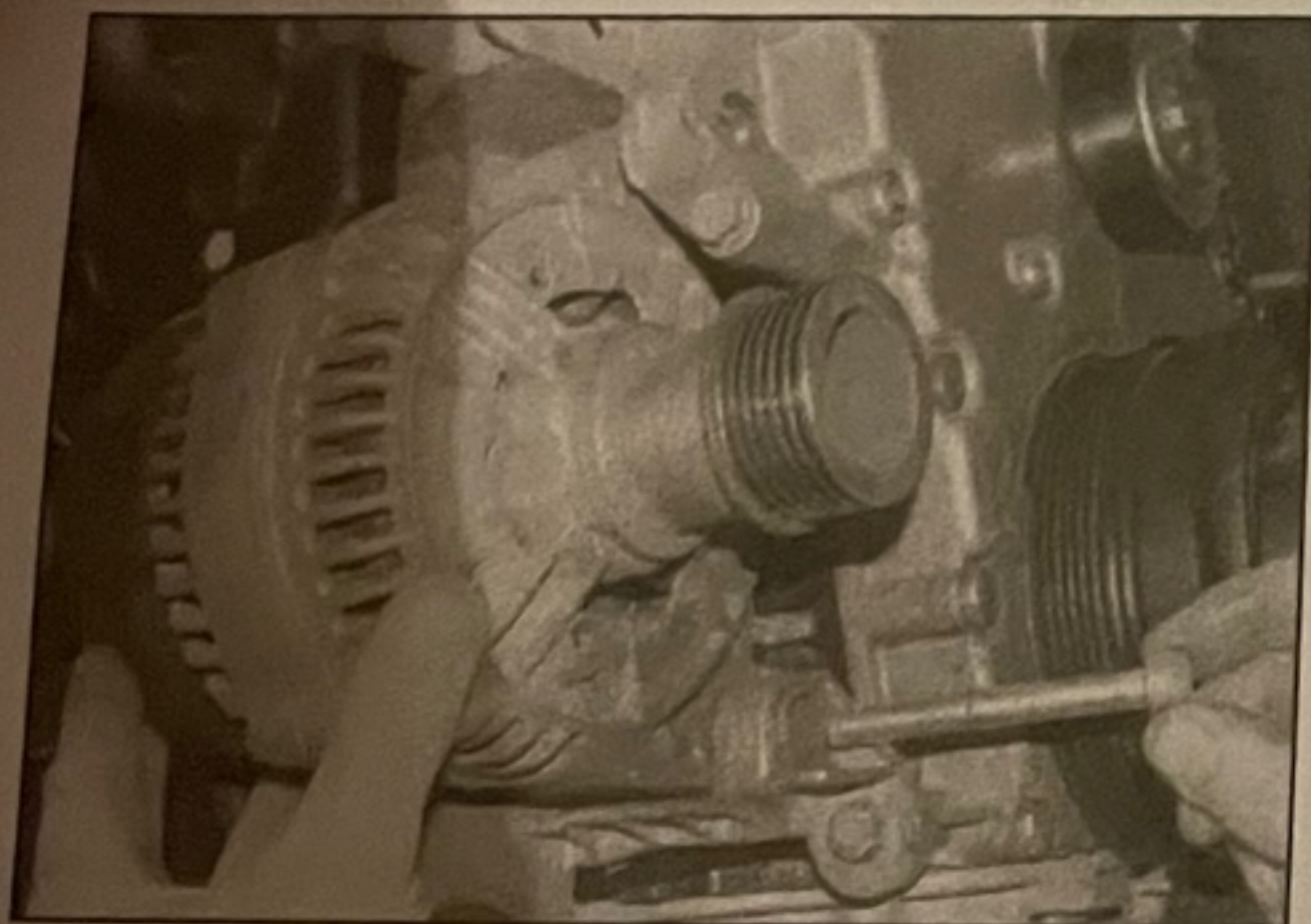
10 Unscrew the alternator lower mounting bolt (see illustration).

11 Note the alternator will be held by the mounting bracket, metal sleeve and mounting bolt holes will need to be moved outwards to release the alternator (see illustrations).

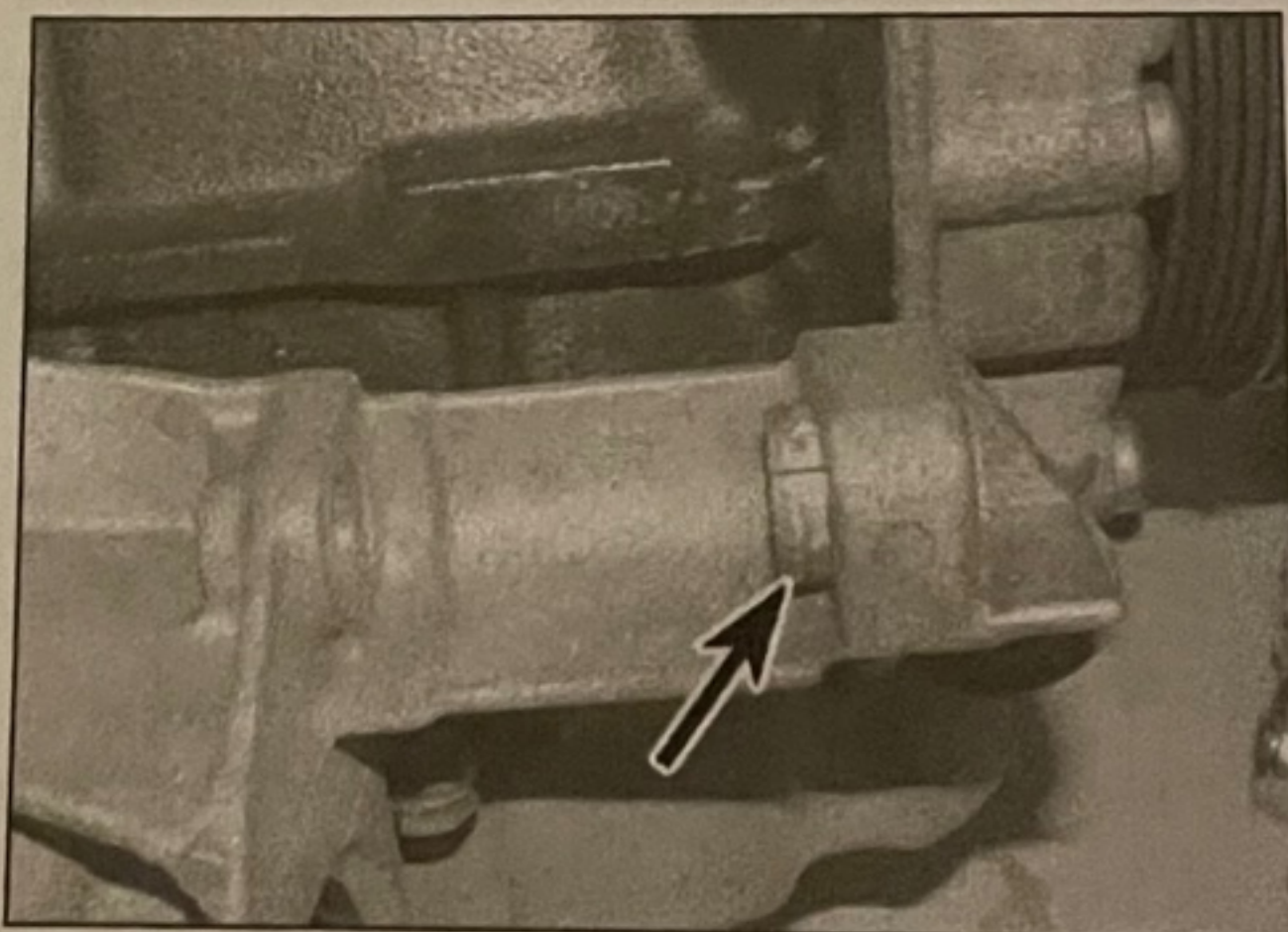
12 Lift the alternator upwards from the engine compartment to remove from the engine compartment.

Diesel models

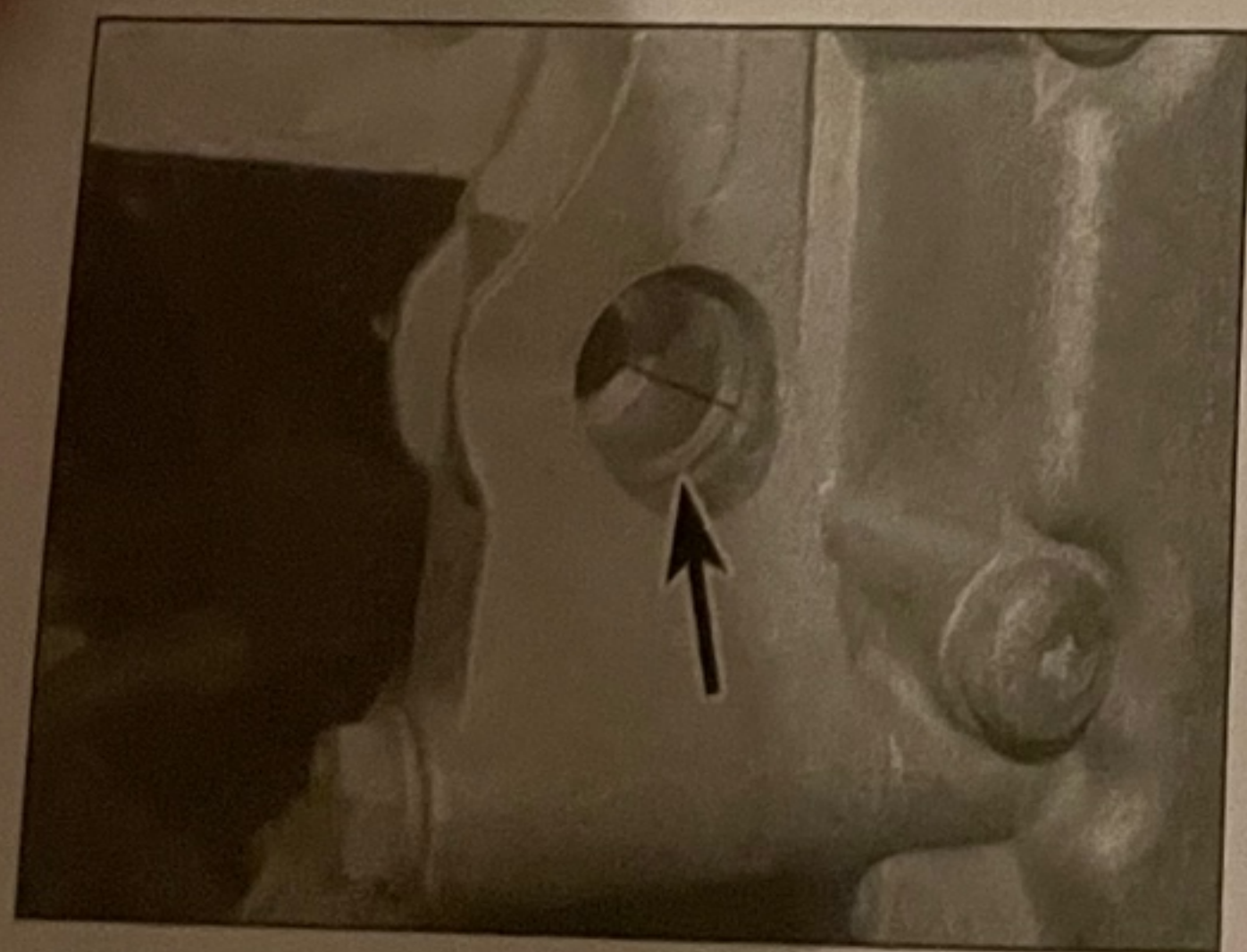
13 Remove the alternator upper mounting bolts (see illustration).



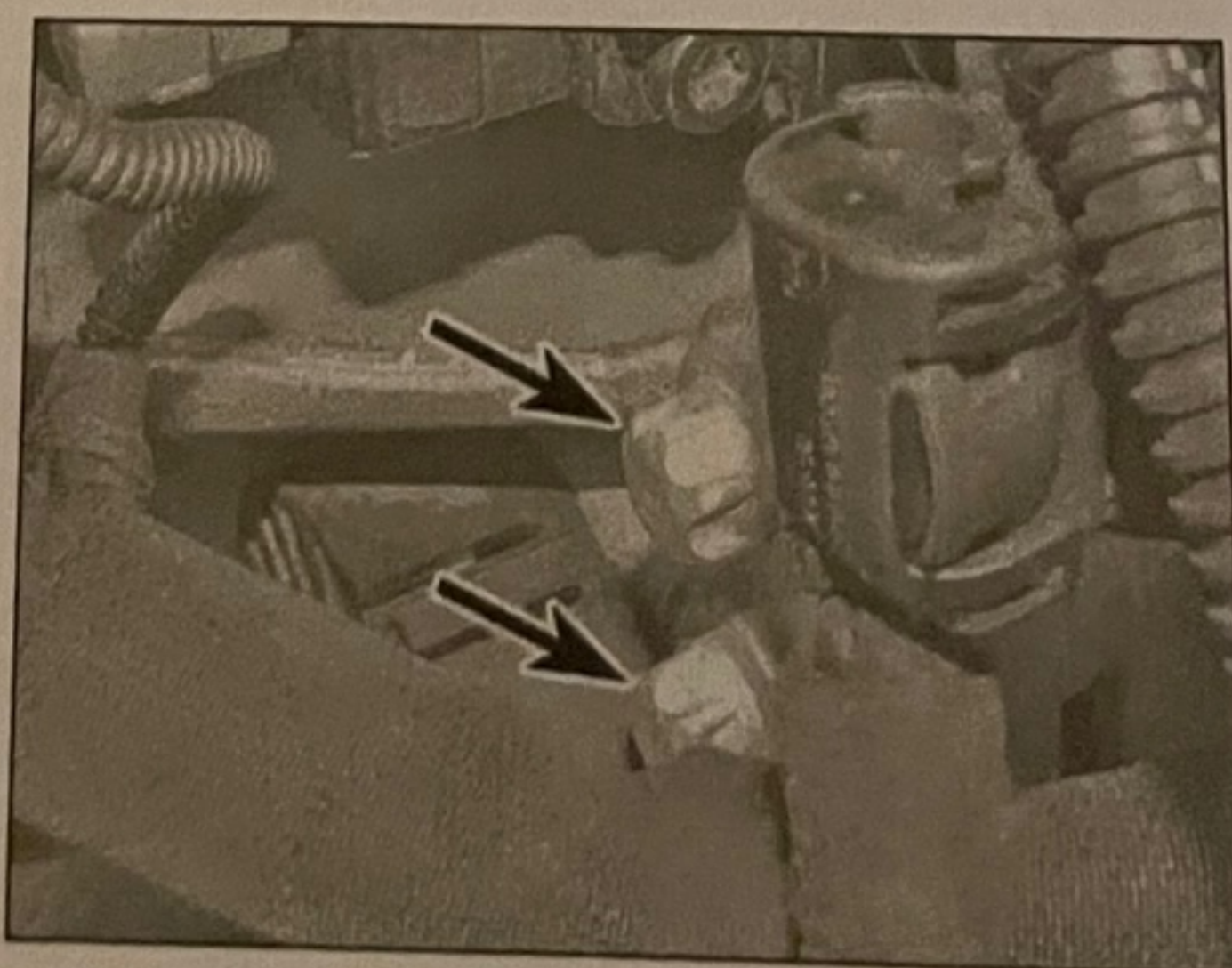
7.10 Removing the alternator lower mounting bolt



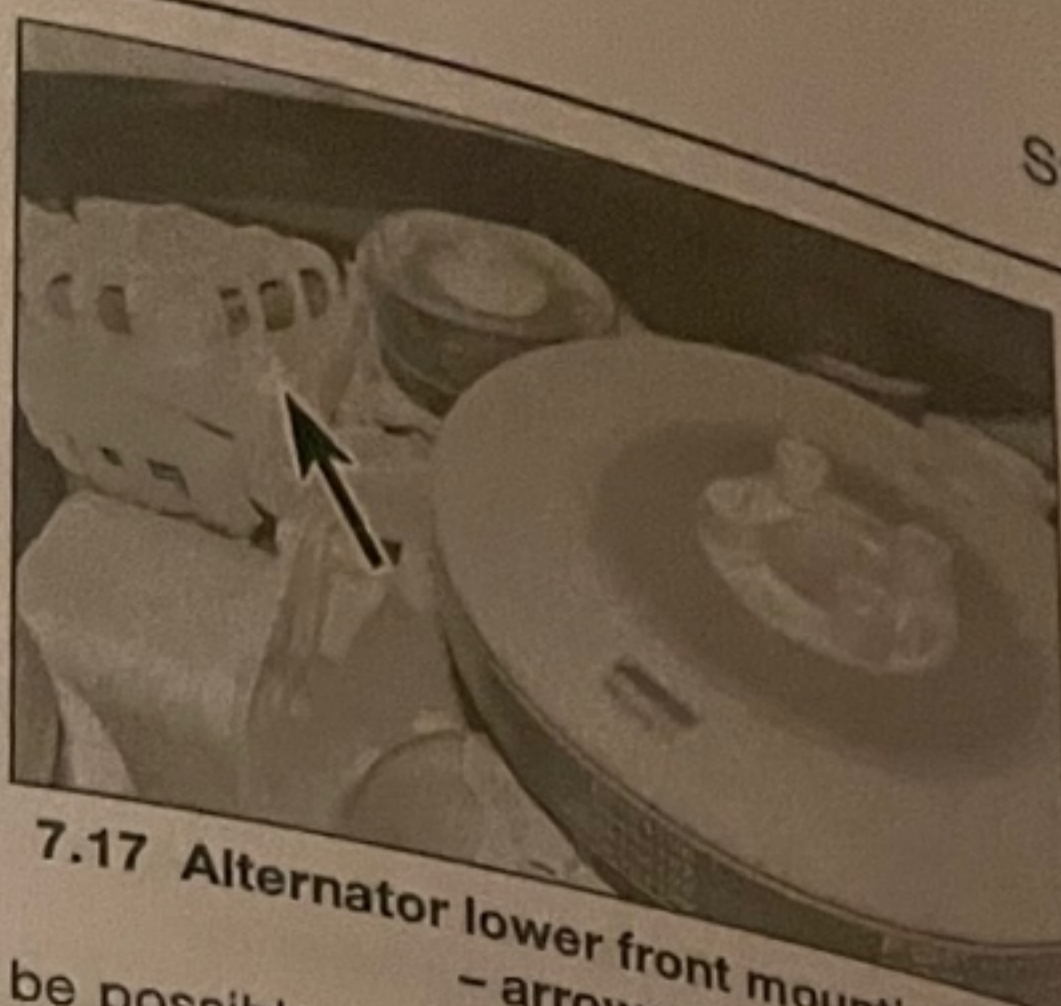
7.11a Metal sleeve (arrowed) in the mounting bracket . . .



7.11b . . . this sleeve (arrowed) will need to be tapped outwards to release the alternator



7.13 Alternator upper mounting bolts - arrowed



7.17 Alternator lower front mounting bolt - arrowed

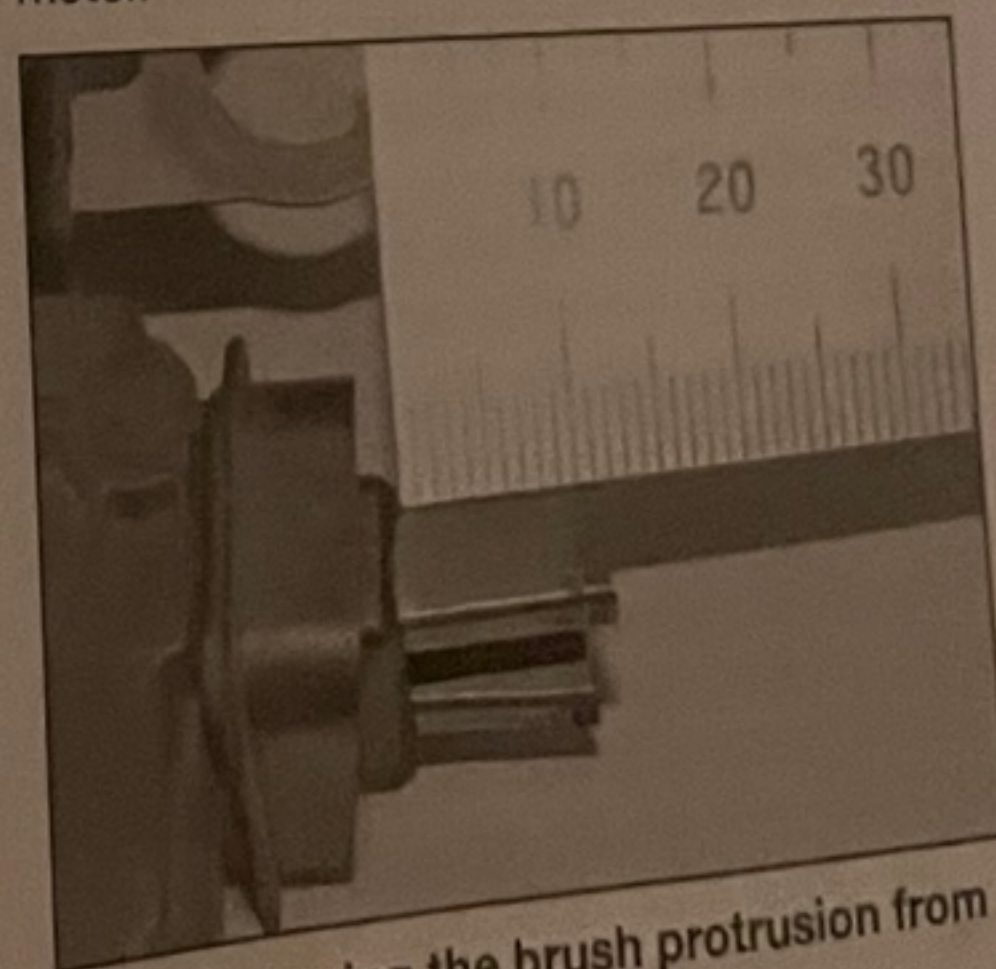
they dim, this indicates that current is reaching the starter motor - therefore, the fault must lie in the starter motor. If the lights continue to glow brightly (and no clicking sound can be heard from the starter motor solenoid), this indicates that there is a fault in the circuit or solenoid - see the following paragraphs. If the starter motor turns slowly when operated, but the battery is in good condition, then this indicates that either the starter motor is faulty, or that 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. Thoroughly clean the connections, and 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 on the solenoid, and that the earth is sound.

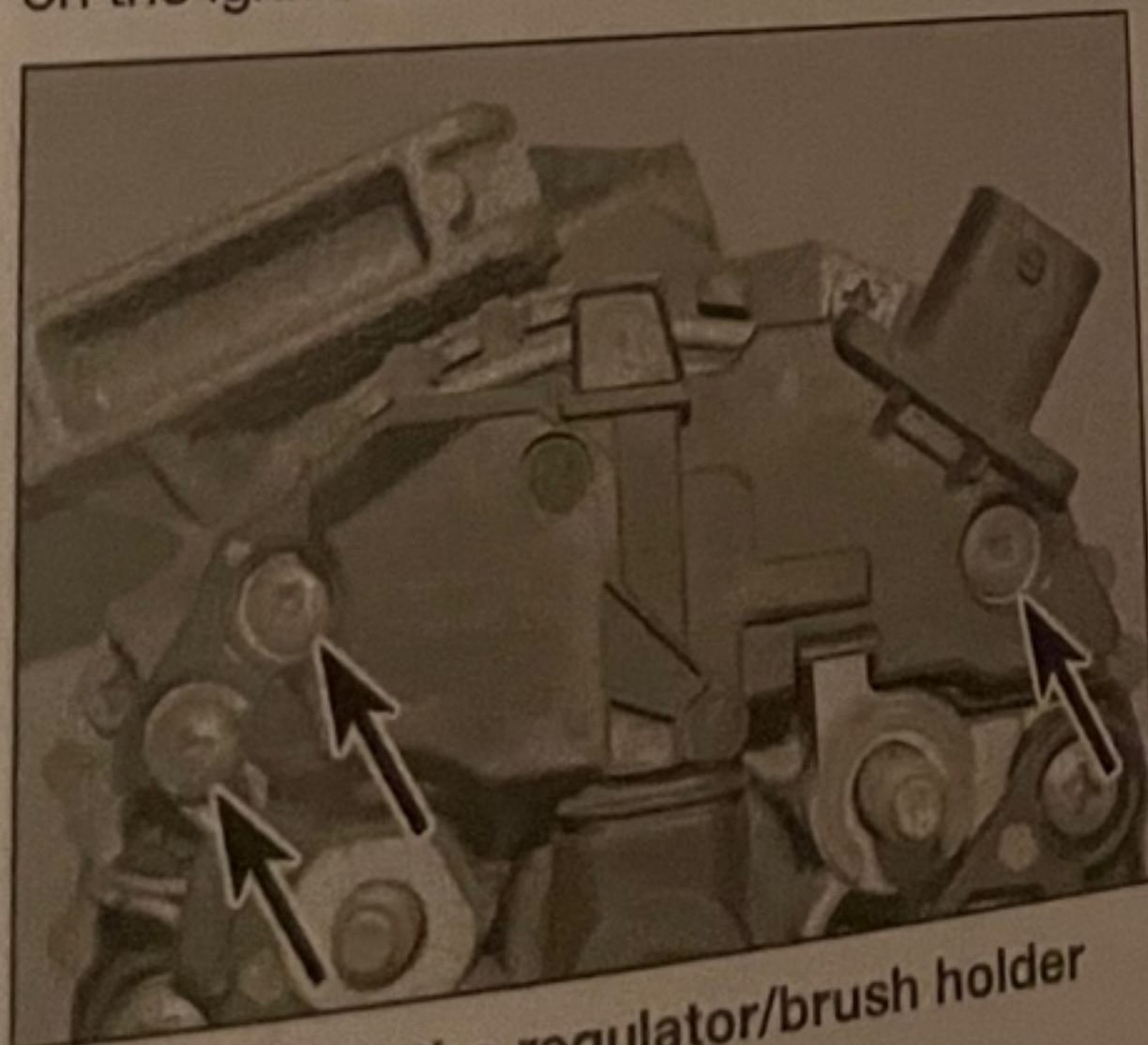
4 If the battery and all connections are in good condition, check the circuit by disconnecting the wire from the solenoid terminal. Connect a voltmeter or test light between the wire end and a good earth (such as the battery negative terminal), and check that the wire is live when the ignition switch 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.

5 The solenoid contacts can be checked by connecting a voltmeter or test light between the terminal 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 or contacts are faulty and the solenoid should be renewed.

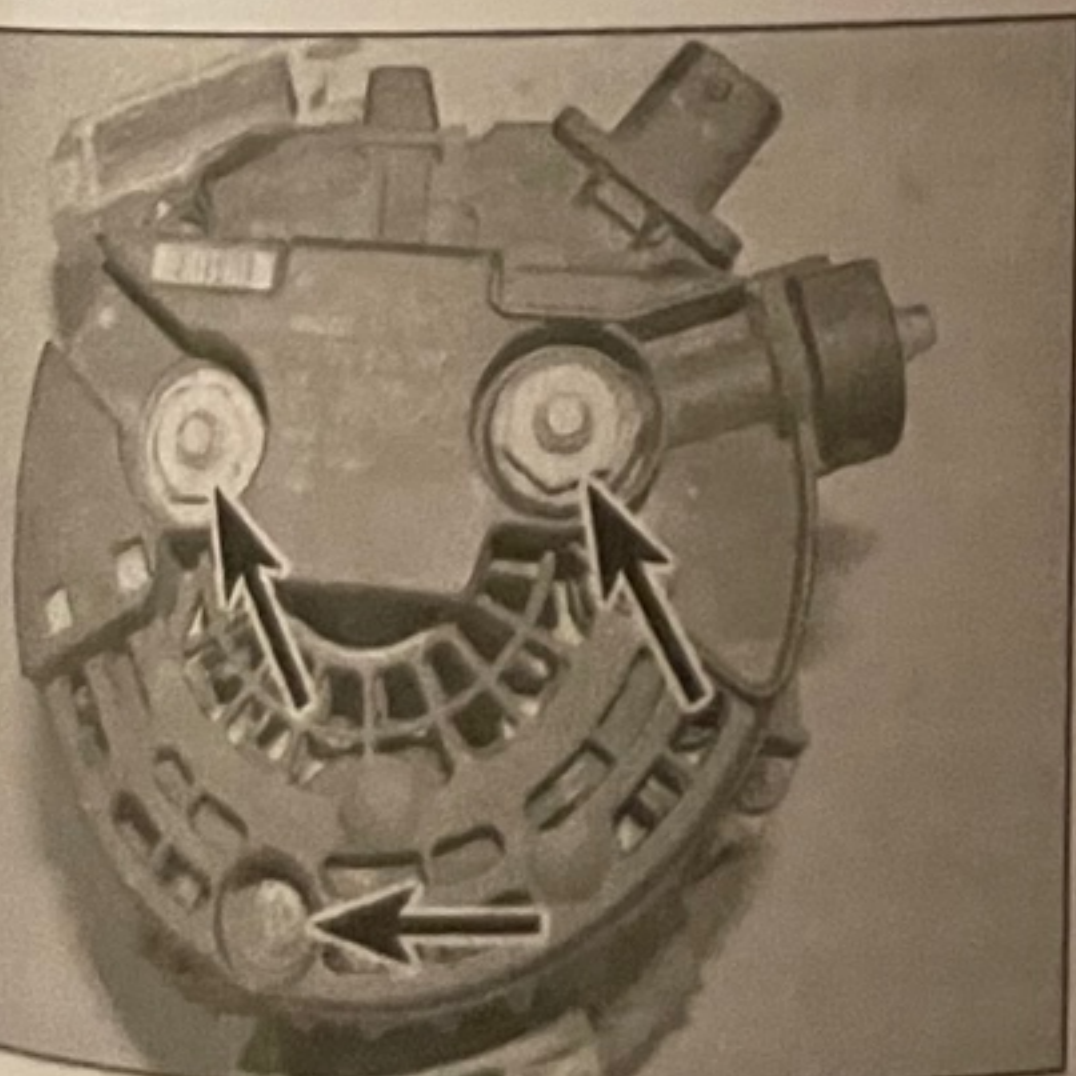
6 If the circuit and solenoid are proved sound, the fault must lie in the starter motor. Begin checking the starter motor by removing it (see Section 10), and checking the brushes (see Section 11). If the fault does not lie in the brushes, the motor windings must be faulty. In this event, it may be possible 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.



8.5 Measuring the brush protrusion from the holder



8.4 Undo the regulator/brush holder screws - arrowed



8.2 Unscrew the nuts and screw (arrowed) securing the rear cover

8 Alternator brushes and regulator - inspection and renewal

Note: The Bosch E8-14V 75-140A alternator, is shown in the illustrations, other alternators similar.

- 1 Remove the alternator as described in Section 7.
- 2 Unscrew the large terminal nuts and the screw securing the cover to the rear of the alternator (see illustration).
- 3 Using a screwdriver, carefully lever off the rear cover, and remove it from the alternator.
- 4 Unscrew and remove the retaining screws, and remove the regulator/brush holder from the rear of the alternator (see illustration).
- 5 Measure the protrusion of each brush from its holder, using a steel rule or vernier calipers (see illustration). If less than 7.5 mm, a new regulator/brush assembly should be obtained.
- 6 If the brushes are in good condition, clean them and check that they move freely in their holders.
- 7 Clean the alternator slip-rings with a fuel-moistened cloth. Check for signs of scoring or burning on the surface of the slip-rings. It may

be possible to have the slip-rings renovated by an electrical specialist.

8 Refit the regulator/brush holder assembly, and securely tighten the retaining screws.

9 Refit the cover, then insert and tighten the retaining screws and refit the large terminal nut.

10 Refit the alternator with reference to Section 7.

9 Starting system - testing

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

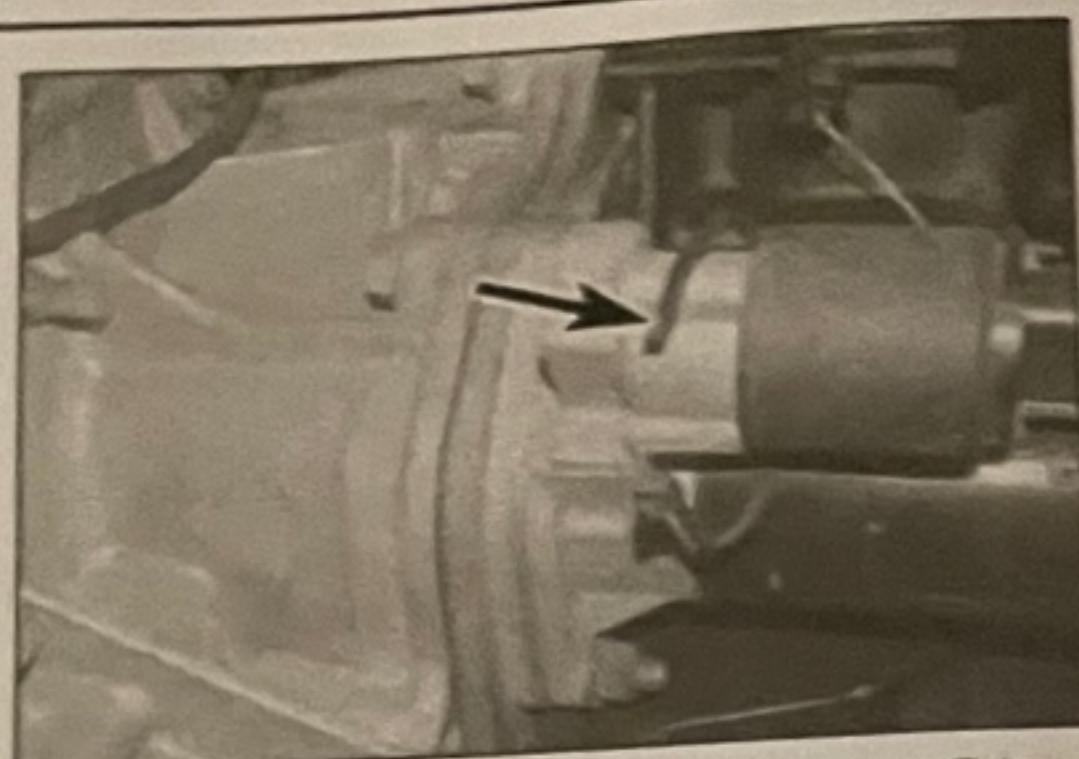
1 If the starter motor fails to operate when the ignition key is turned to the appropriate position, the following possible causes may apply:

- 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.

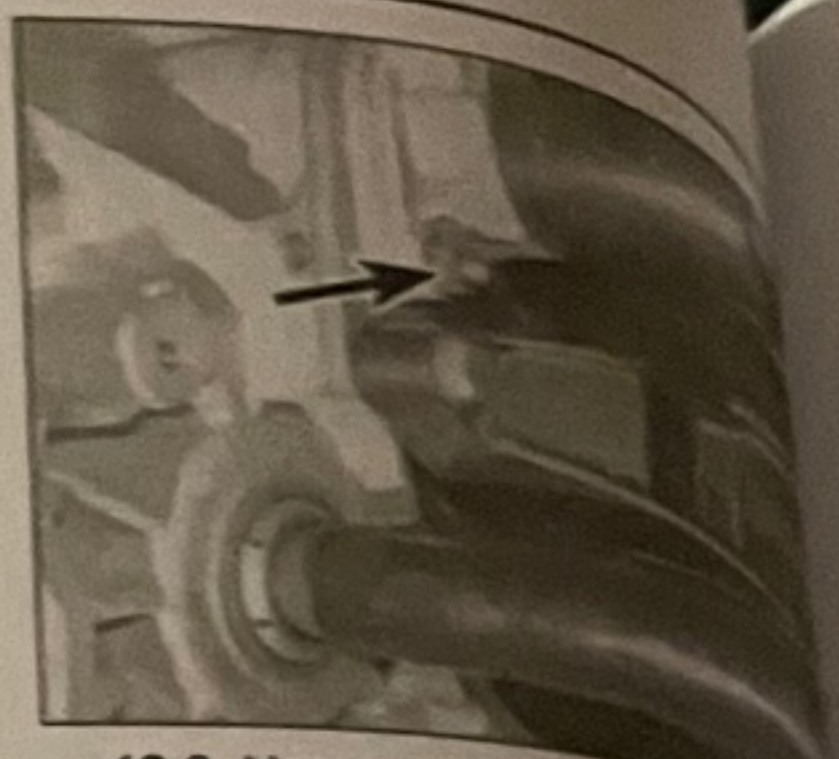
2 To check the battery, switch on the headlights. If they dim after a few seconds, this indicates that the battery is discharged - recharge (see Section 3) or renew the battery. If the headlights glow brightly, operate the starter on the ignition switch, and observe the lights. If



10.3 Withdraw the upper starter motor mounting bolt from the top of the transmission bellhousing



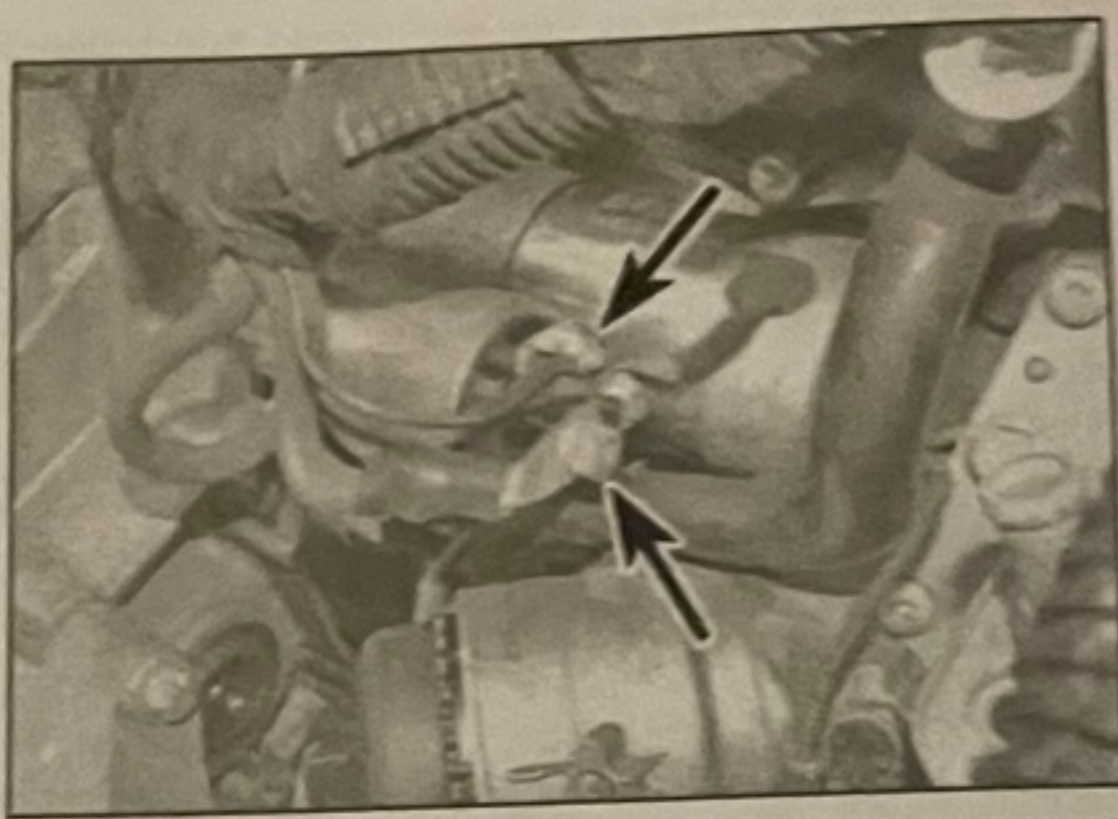
10.5 Remove the cable-tie (arrowed) to release the wiring loom



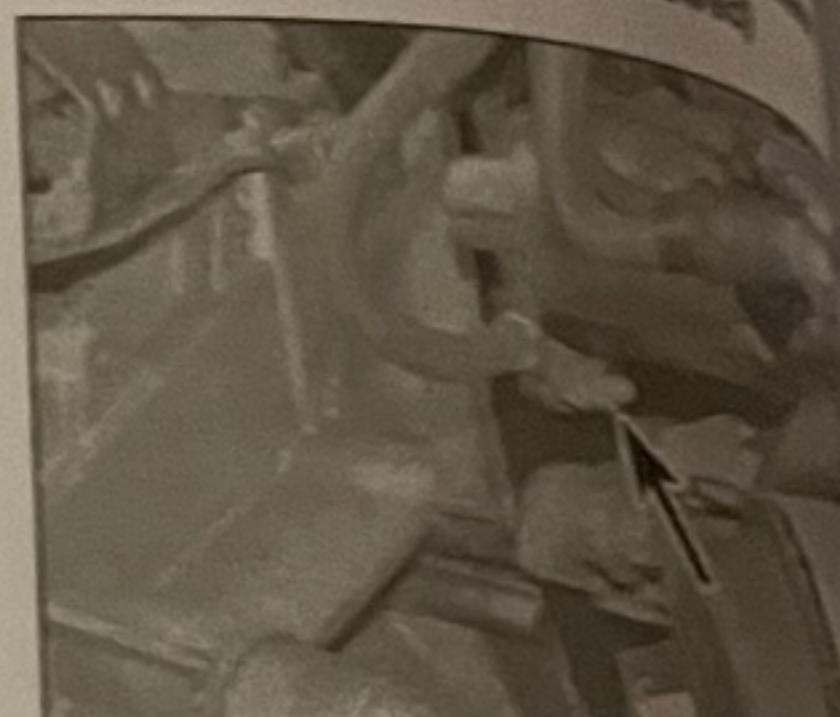
10.6 Unscrew the starter motor mounting nut (arrowed)



10.7 Undo the nuts and release the wiring harness from the support bracket



10.8 Undo the nuts (arrowed) and disconnect the starter solenoid wiring connectors



10.9 Unscrew the nut (arrowed) and disconnect the earth lead from the starter motor stud bolt

10 Starter motor – removal and refitting

Removal

- 1 The starter motor is located on the left-hand rear side of the engine, and is bolted to the engine endplate and transmission. First remove the cover from the battery and disconnect the negative lead.
- 2 Apply the handbrake, then jack up the front of the car and support on axle stands (see *Jacking and vehicle support*).

Petrol models

- 3 From inside the engine compartment, remove the starter motor upper mounting bolt (see illustration).
- 4 Unscrew the nut(s) and disconnect the wiring terminal(s) from the starter/solenoid.
- 5 Cut and release the cable-tie/strap from around the solenoid to release the wiring loom (see illustration).
- 6 From under the vehicle, unscrew the lower starter motor mounting nut, then lower the starter motor from the engine compartment (see illustration).

Diesel models

- 7 Working above the engine, remove the starter motor upper mounting bolts, and remove the bracket from the coolant pipe and wiring harness (see illustration).
- 8 Note their fitted positions, then undo the nuts and detach the electrical connections from the starter motor (see illustration).

- 9 Undo the lower mounting nut and detach the earth cable from the starter motor lower mounting stud (see illustration).
- 10 Remove the starter motor lower mounting stud by using two nuts locked together.
- 11 Manoeuvre the starter motor from position.

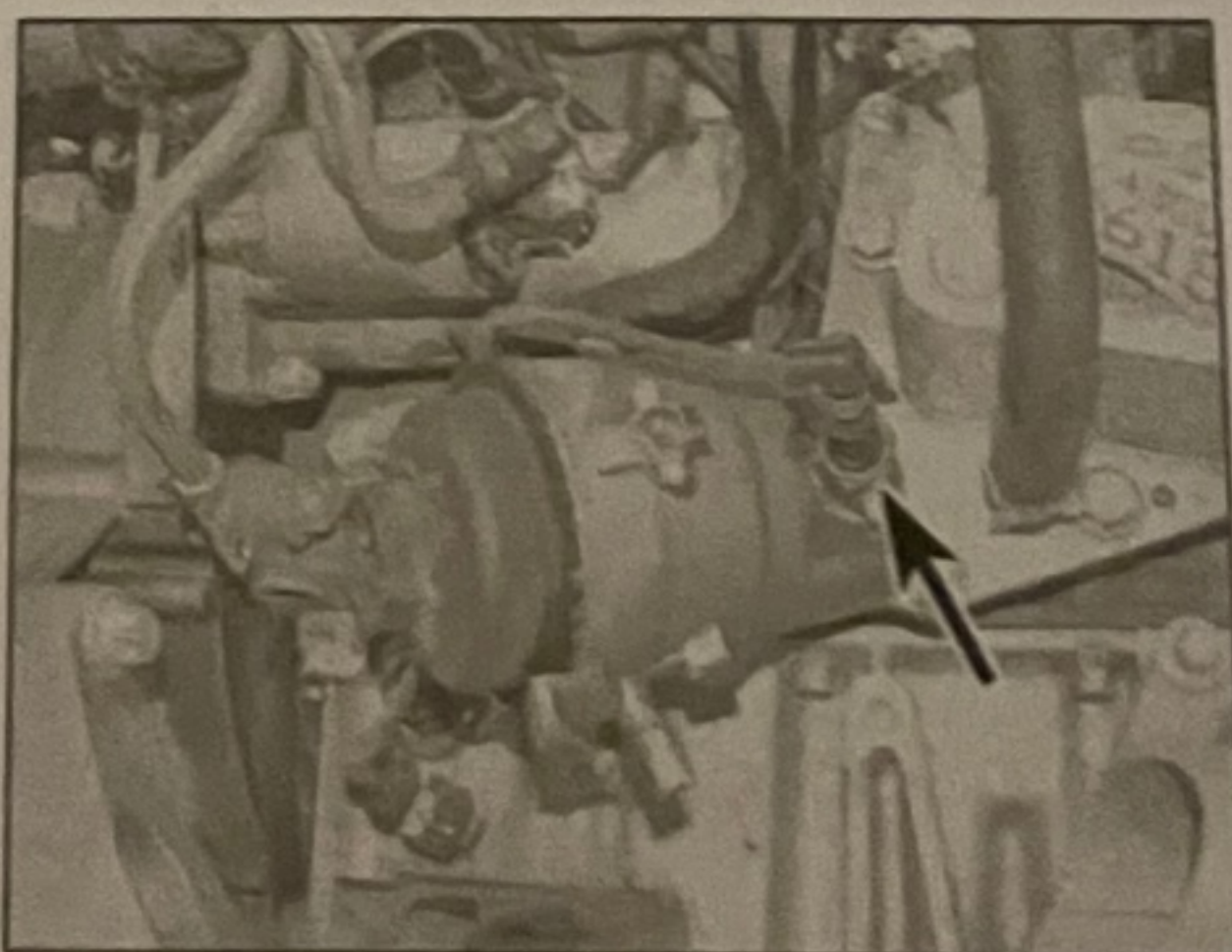
Refitting

- 12 Refitting is a reversal of removal. Tighten all wire connections securely.

11 Starter motor – testing and overhaul

Note: At the time of writing, no individual starter motor components were available from Saab. An auto-electrical specialist should be able to supply and fit parts such as brushes.

If the starter motor is thought to be defective, it should be removed from the vehicle (as



13.3 Oil pressure warning light switch – arrowed

12 Ignition switch – removal and refitting

Refer to the procedure given in Chapter Section 4, for the removal and refitting procedure.

13 Oil pressure warning light switch – removal and refitting

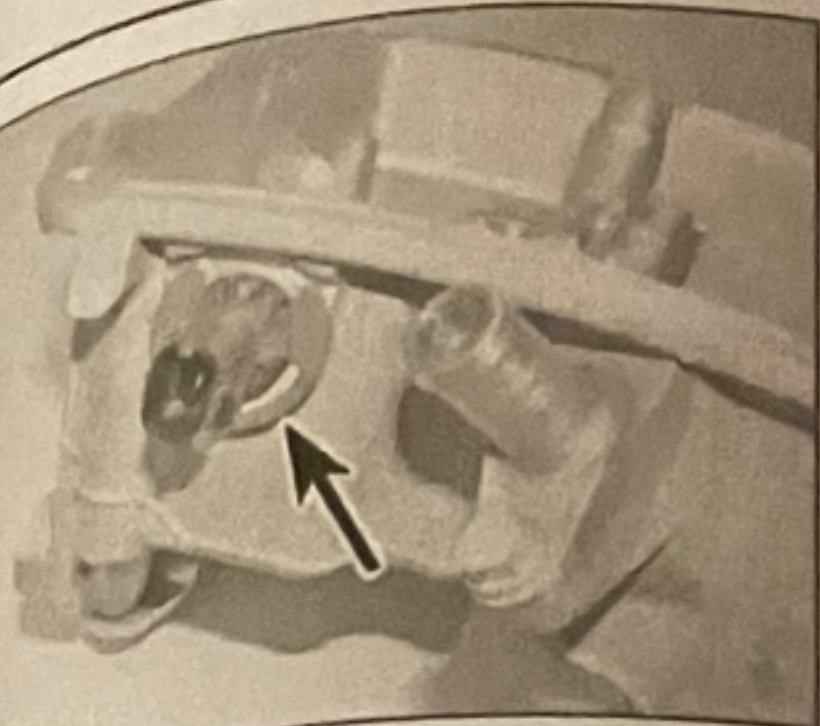
Removal

Petrol models

- 1 The switch is screwed into the front of the cylinder block, adjacent to the oil filter. To gain access to the switch, remove the plastic cover from the top of the engine.
- 2 Disconnect the wiring connector, then unscrew the switch (using a 27 mm spanner or socket) and recover the seal washer. Be prepared for oil spillage, and the switch is to be left removed from the engine for any length of time, plug the switch aperture.

Diesel models

- 3 The switch is screwed into the oil filter housing at the rear of the engine (see illustration).



14.2 Slide off the retaining clip (arrowed) and free the oil level sensor wiring connector from the sump

- 4 Firmly apply the handbrake, and then jack up the front of the car and support it securely on axle stands (see *Jacking and vehicle support*).
- 5 Undo the bolts and remove the undershield (where fitted) from beneath the engine.
- 6 Disconnect the wiring connector then unscrew the switch and recover the sealing washer. Be prepared for oil spillage, and if the switch is to be left removed from the engine for any length of time, plug the switch aperture.

Refitting

- 7 Examine the sealing washer for signs of damage or deterioration and if necessary renew.
- 8 Refit the switch and washer, tightening it to the specified torque, and reconnect the wiring connector.
- 9 On diesel engine models, refit the engine undershield.
- 10 Lower the vehicle to the ground (where applicable) and then check the oil level. If necessary, top-up the engine oil as described in *Weekly checks*.

14 Oil level sensor – removal and refitting



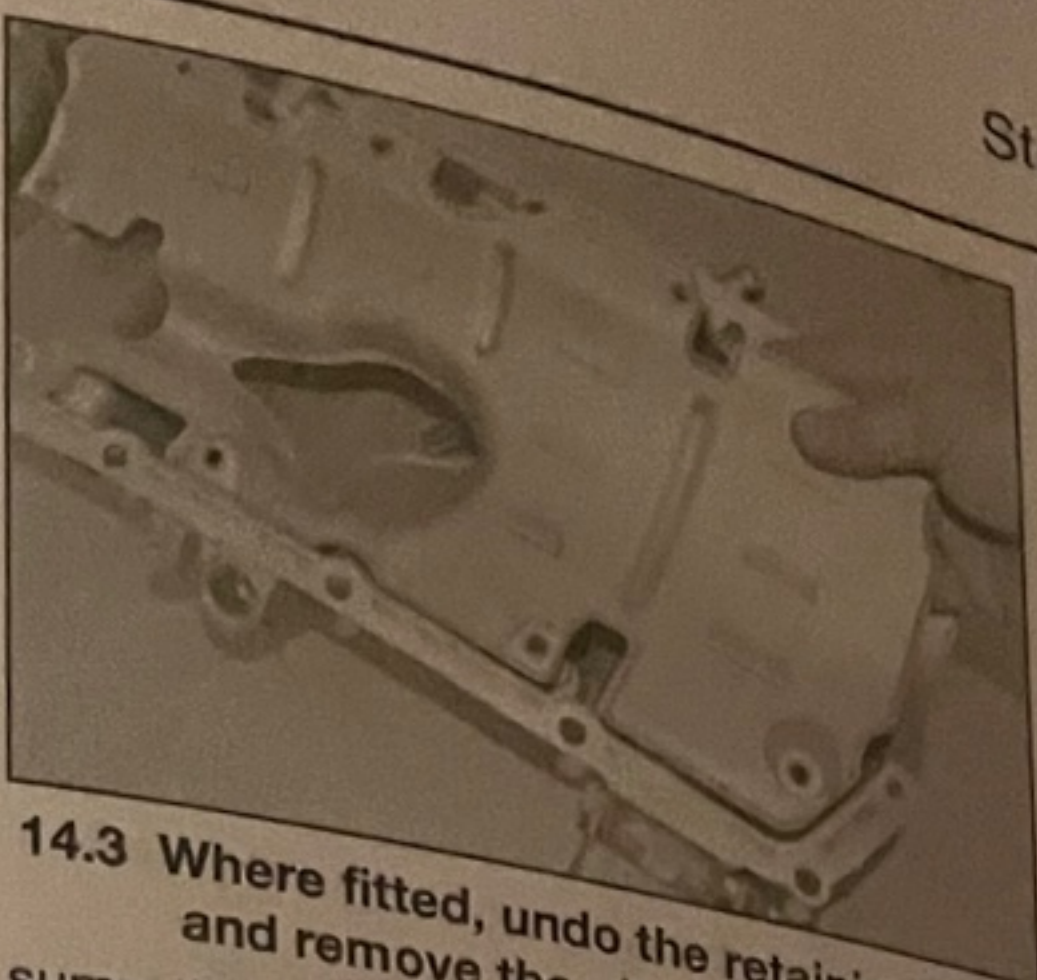
Note: Oil level sensors may not be fitted to all models, check around the sides of the sump to locate position of sensor, where fitted.

Removal

- 1 The oil level sensor is located in the sump, remove the sump as described in Chapter 2A or 2B.
- 2 With the sump removed, slide off the retaining clip and free the sensor wiring connector from the sump (see illustration).
- 3 Where fitted, undo the retaining bolts and remove the oil baffle plate from inside the sump (see illustration).
- 4 Note the correct routing of the wiring then undo the retaining bolts and remove the sensor assembly from the sump (see illustration). Check the wiring connector seal for signs or damage and renew if necessary.

Refitting

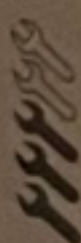
- 5 Prior to refitting remove all traces of locking compound from the sensor retaining bolt and



14.3 Where fitted, undo the retaining bolts and remove the oil baffle plate

- sump threads. Apply a drop of fresh locking compound to the bolt threads and lubricate the wiring connector seal with a smear of engine oil.
- 6 Fit the sensor, making sure the wiring is correctly routed, and securely tighten its retaining bolts. Ease the wiring connector through the sump, taking care not to damage its seal, and secure it in position with the retaining clip.
- 7 Ensure the sensor is correctly refitted then, where applicable, refit the oil baffle plate.
- 8 Refit the sump as described in Chapter 2A or 2B.

15 Pre/post-heating system – description and testing

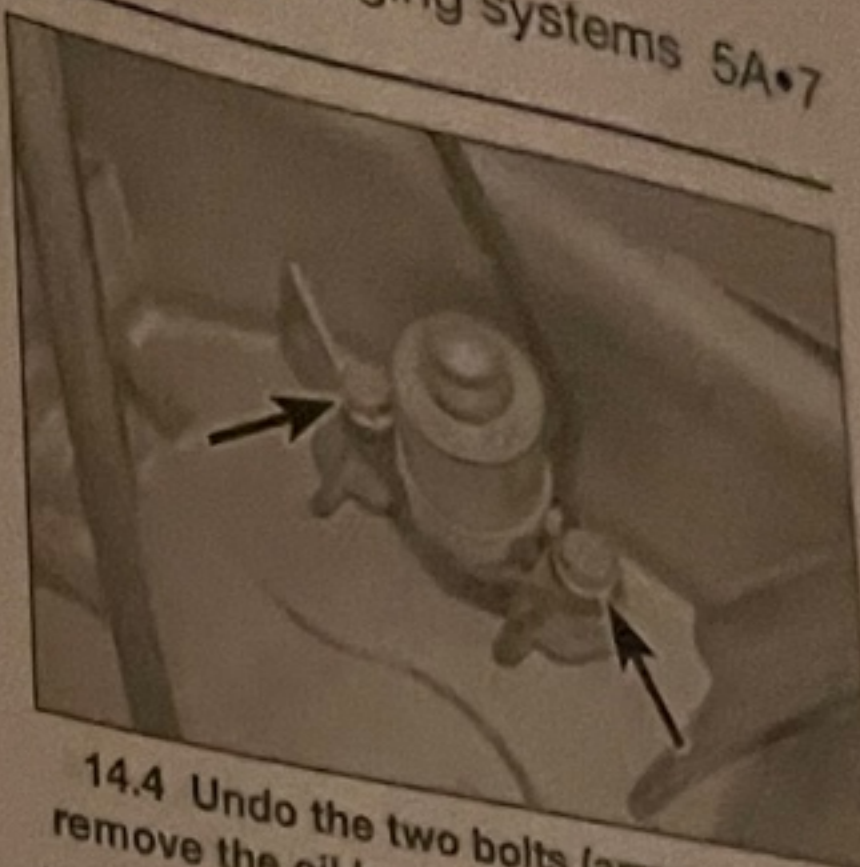


Description

- 1 Each cylinder of the engine is fitted with a heater plug (commonly called a glow plug) screwed into it. The plugs are electrically-operated before and during start-up when the engine is cold. Electrical feed to the glow plugs is controlled via the pre/post-heating system control unit.
- 2 A warning light in the instrument panel tells the driver that pre/post-heating is taking place. When the light goes out, the engine is ready to be started. The voltage supply to the glow plugs continues 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 the glow plugs.
- 3 The glow plugs also provide a 'post-heating' function, whereby the glow plugs remain switched on after the engine has started. The length of time 'post-heating' takes place is also determined by the control unit, and is dependent on engine temperature.
- 4 The fuel filter is fitted with a heating element to prevent the fuel 'waxing' in extreme cold temperature conditions and to improve combustion. The heating element is an integral part of the fuel filter housing and is controlled by the pre/post-heating system control unit.

Testing

- 5 If the system malfunctions, testing is ultimately by substitution of known good units.



14.4 Undo the two bolts (arrowed) and remove the oil level sensor from the sump but some preliminary checks may be made as follows.

- 6 Connect a voltmeter or 12 volt test lamp 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.
- 7 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.
- 8 At an underbonnet temperature of 20°C, typical times noted should be approximately 3 seconds for warning light operation. Warning light time will increase with lower temperatures and decrease with higher temperatures.
- 9 If there is no supply at all, the control unit or associated wiring is at fault.
- 10 To locate a defective glow plug, disconnect the wiring connector from each plug.
- 11 Use a continuity tester, or a 12 volt test lamp 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 lamp does not light or the continuity tester shows a high resistance, the glow plug is certainly defective.
- 12 If an ammeter is available, the current draw of each glow plug can be checked. After an initial surge of 15 to 20 amps, each plug should draw 12 amps. Any plug that draws much more or less than this is probably defective.
- 13 As a final check, the glow plugs can be removed and inspected as described in the following Section.

16 Glow plugs – removal, inspection and refitting



Caution: If the pre/post-heating system has just been energised, or if the engine has been running, the glow plugs will be very hot.

Removal

- 1 The glow plugs are located at the rear of the cylinder head above the intake manifold.

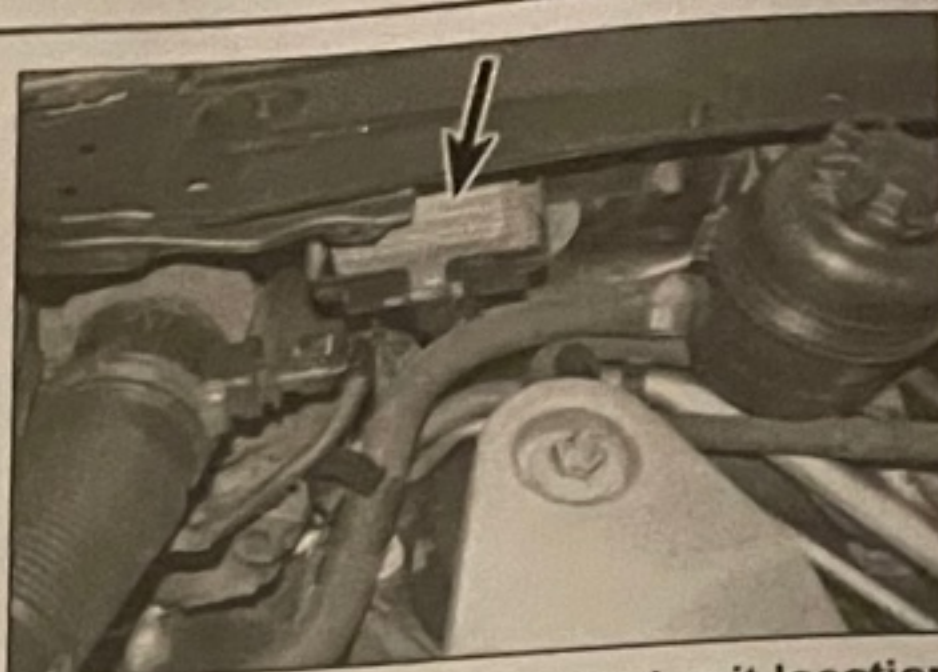


16.3 Unscrew the glow plugs and remove them from the cylinder head

- 2 Remove the plastic cover by pulling it upwards off the mounting studs.
- 3 Pull the connectors from the glow plugs, then unscrew and remove them from the cylinder head (see illustration).

Inspection

- 4 Inspect each glow plug for physical damage. Burnt or eroded glow plug tips can be caused by a bad injector spray pattern. Have the injectors checked if this type of damage is found.
- 5 If the glow plugs are in good physical condition, check them electrically using a 12 volt test lamp or continuity tester as described in the previous Section.
- 6 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.



17.1 Pre/post-heating control unit location

- 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.

- 7 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

- 8 Carefully refit the plugs and tighten to the specified torque. Do not overtighten, as this

can damage the glow plug assembly. The electrical connectors must be fitted to the glow plugs.

- 9 The remainder of refitting is a reversal of removal, checking the operation of the glow plugs on completion.

17 Pre/post-heating system control unit - removal and refitting

Note: If the control unit is to be removed, Saab's diagnostic equipment must be used to download and reset various stored codes before the old unit is removed and a new one is fitted. Entrust this task to a dealer or suitably-equipped specialist.

Note: These electronic modules are sensitive to static electricity. Before handling the unit, earth yourself by touching a metal part of the vehicle body.

Removal

- 1 The control unit is located on the right side of the engine compartment, on the inner wing panel in front of the power steering reservoir (see illustration).
- 2 Undo the retaining bolt and withdraw the control unit from the inner wing panel.
- 3 Disconnect the wiring plug from the control unit as it is removed.

Refitting

- 4 Refitting is a reversal of removal.

Chapter 10 Ignition

Contents

General information
Ignition discharge
Ignition HT coils

Degree

Easy, suitable for novice with experience

Spec

System

Direct Ignition

Ignition discharge
Capacitor
Ignition timing
Ignition timing

Firing

Torque

Crankshaft
Ignition
Spark