Chapter 3
Cooling, heating and ventilation systems

Contents

Degrees of difficulty

Easy, suitable for novice with little experience

Fairly easy, suitable for beginner with some experience

Fairly difficult, suitable for competent DIY mechanic

Difficult, suitable for experienced DIY mechanic

Very difficult, suitable for expert DIY or professional

Specifications

General

Expansion tank cap opening pressure	1.4 to 1.5 bars

Thermostat

Opening temperature	89°C ± 2°C

Electric cooling fan

Cut-in temperature:	
Stage 1	100° ± 2°C
Stage 2	113° ± 2°C
Cut-out temperature:	
Stage 1	96° ± 1°C
Stage 2	109° ± 1°C

Coolant temperature sensor

	Resistance (kOhm)	Voltage
At -30°C	20 to 30	Approx. 4.8
At -10°C	7.0 to 11.4	Approx. 4.5
At 20°C	2.1 to 2.9	Approx. 3.6
At 40°C	1.0 to 1.3	Approx. 2.7
At 60°C	0.565 to 0.670	Approx. 1.9
At 80°C	0.295 to 0.365	Approx. 1.2
At 90°C	0.24 to 0.26	Approx. 1.0
At 110°C	0.14 to 0.16	Approx. 0.65

Torque wrench settings

	Nm	lbf ft
Air conditioning:		
Compressor mounting:	24	18
M8 bolts	40	30
M10 bolts	18	13
Compressor refrigerant pipe connections	18	13
Condenser refrigerant pipe connections	20	15
Hose-to-compressor retaining bolts	15	11
Refrigerant pipe connection at bulkhead	13	10
Coolant temperature sensor:		
Petrol engines	22	16
Diesel engines	8	6
Electric cooling fan unit	25	18
Rigid heater pipe:		
To turbocharger	20	15
To water pump	10	7
To cylinder block	22	16
Thermostat housing:		
Petrol engines	25	18
Diesel engines	22	16
Water pump:		
Petrol engines	25	18
Diesel engines		

1 General information and precautions

The cooling system is of pressurised type, comprising a water pump driven by the auxiliary drivebelt, (petrol engines) or timing belt (diesel engines), a crossflow radiator, electric cooling fan, a thermostat, heater matrix and all associated hoses. The expansion tank is located on the left-hand side of the engine compartment. The water pump is bolted to the cylinder block.

The system functions as follows. Cold coolant in the bottom of the radiator passes through the bottom hose to the water pump, where it is pumped around the cylinder block and head passages. After cooling the cylinder bores, combustion surfaces and valve seats, the coolant reaches the underside of the thermostat, which is initially closed. The coolant passes through the heater, and is returned to the water pump. On petrol models, a small proportion of coolant is channeled from the cylinder head through the throttle body. A further amount of coolant is then channeled through the turbocharger.

When the engine is cold, the coolant circulates only through the cylinder block, cylinder head, throttle body, heater and turbocharger. When the coolant reaches a predetermined temperature, the thermostat opens, and the coolant passes through the top hose to the radiator. As the coolant circulates through the radiator, it is cooled by the inrush of air when the car is in forward motion, and also by the action of the electric cooling fan when necessary. Upon reaching the bottom of the radiator, the coolant has now cooled, and the cycle is repeated.

When the engine is at normal operating temperature, the coolant expands, and some of it is displaced into the expansion tank. Coolant collects in the tank, and is returned to the radiator when the system cools.

A double-speed electric cooling fan is mounted on the rear of the radiator, and is controlled by a thermostatic switch. At a predetermined coolant temperature, the switch/sensor actuates the fan. On models with air conditioning, two double-speed fans are fitted.

Warning: Do not attempt to remove the expansion tank filler cap, or to disturb any part of the cooling system, while the engine is hot, as there is a high risk of scalding. If the expansion tank filler cap must be removed before the engine and radiator have fully cooled (even though this is not recommended), the pressure in the cooling system must first be relieved. Cover the cap with a thick layer of cloth, to avoid scalding, and slowly unscrew the filler cap until a hissing sound is heard. When the hissing has stopped, indicating that the pressure has reduced, slowly unscrew the filler cap until it can be removed; if more hissing sounds are heard, wait until they have stopped before unscrewing the cap completely. At all times, keep well away from the filler cap opening, and protect your hands.

• Do not allow antifreeze to come into contact with your skin, or with the painted surfaces of the vehicle. Rinse off spills immediately, with plenty of water. Never leave antifreeze lying around in an open container, or in a puddle in the driveway or on the garage floor. Children and pets are attracted by its sweet smell, but antifreeze can be fatal if ingested.

• If the engine is hot, the electric cooling fan may start rotating even if the engine is not running. Be careful to keep your hands, hair and any loose clothing well clear when working in the engine compartment.

• Refer to Section 10 for precautions to be observed when working on models with air conditioning.

2 Cooling system hoses - disconnection and renewal

1 The number, routing and pecu... hoses will vary according to the ... the same basic procedure appli... commencing work, make sure the ... hoses are to hand, along with new ... if needed. It is good practice to ... hose clips at the same time as the ...

2 Drain the cooling system, as de... Chapter 1A or 1B, saving the coola... for re-use. Squirt a little penetrati... the hose clips if they are corroded.

3 Loosen and release the hose cli... hose concerned.

4 Unclip any wires, cables or ot... which may be attached to the ... removed. Make notes for refer... reassembling if necessary. The hose ... removed with relative ease when ne... on an older vehicle they may be s... outlet.

5 If a hose proves stubborn, try to ... by rotating it before attempting to ... Take care not to damage the pipe ... hoses. Note in particular that the ... stubs are fragile; do not use exces... when attempting to remove the hose.

6 Before fitting the new hose, ... stubs with washing-up liquid or ... rubber lubricant to aid fitting. Do not ... grease, which may attack the rubber.

7 Fit the hose clips over the ends ... and then fit the hose to the stub ... hose into position. When satisfied ... tighten the hose clips.

8 Refill the cooling system as de...

Chapter 1A or 1B. Run the ... that there are no leaks.

9 Top-up the coolant leve... *Weekly checks*).

3 Radiator – removal, inspecti... and refitting

***Note:** If the reason for ... is to cure a leak, bear in ... can often be cured us... added to the coolant.*

Removal

1 Drain the cooling s... Chapter 1A or 1B. T... removing the splash ... radiator. If the coola... good condition, drai... and re-use it.

2 Remove the front ... Chapter 11.

3 Loosen the clip ... hose from the up... radiator (see illust...

4 Remove the ... described in Secti...

5 On automatic ... fluid oil cooler is ... Position suitabl... radiator and tra... the oil cooler-to-... the hydraulic flu... Tape over or pl... discard the seal ... for refitting.

6 Loosen the ... the coolant re... radiator (see i...

7 Disconnec... conditioning ...

8 Loosen the ... hose from t... radiator. Alt... not accessib... coolant pu... engine (see...

9 Secure ... power stee... (dependi... crossmem...

10 Undo ... the engin... of the ra... oil coole... connecte...

11 Und... the two ... radiator ... mounti...

12 Wi... cooler ... secure... out fr... care ...

Chapter 1A or 1B. Run the engine, and check that there are no leaks.

9 Top-up the coolant level if necessary (see *Weekly checks*).

3 Radiator – removal, inspection and refitting

Note: *If the reason for removing the radiator is to cure a leak, bear in mind that minor leaks can often be cured using a radiator sealant added to the coolant.*

Removal

1 Drain the cooling system as described in Chapter 1A or 1B. This procedure includes removing the splash cover from under the radiator. If the coolant is relatively new or in good condition, drain it into a clean container and re-use it.

2 Remove the front bumper as described in Chapter 11.

3 Loosen the clip and disconnect the top hose from the upper left-hand side of the radiator **(see illustration)**.

4 Remove the electric cooling fan as described in Section 5.

5 On automatic transmission models the fluid oil cooler is incorporated in the radiator. Position suitable containers beneath the radiator and transmission, then disconnect the oil cooler-to-transmission pipes and allow the hydraulic fluid to drain **(see illustration)**. Tape over or plug the ends of the pipes, and discard the seals, as new ones will be required for refitting.

6 Loosen the securing clip and disconnect the coolant reservoir hose from the top of the radiator **(see illustration)**.

7 Disconnect the wiring from the air conditioning compressor.

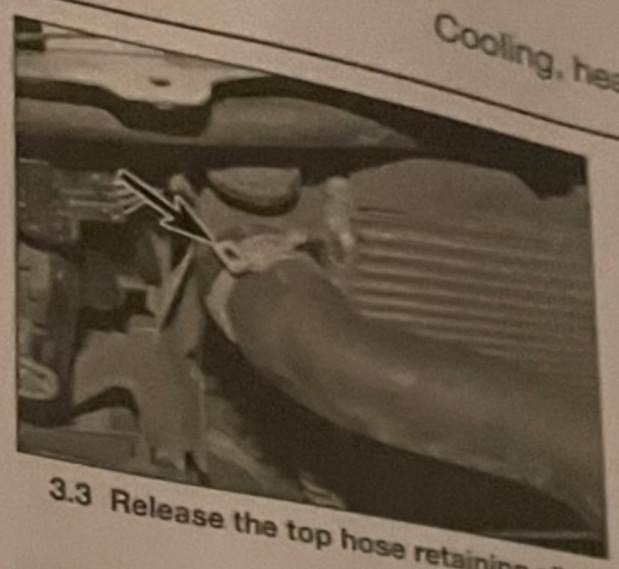
8 Loosen the clip and disconnect the bottom hose from the lower right-hand side of the radiator. Alternatively, if the radiator clip is not accessible, disconnect the hose from the coolant pump on the right-hand end of the engine **(see illustration)**.

9 Secure the air conditioning condenser, power steering fluid oil cooler and intercooler (depending on model), to the front crossmember.

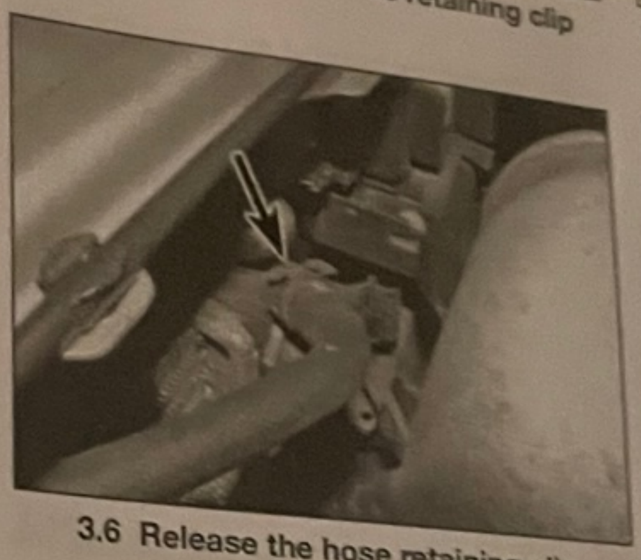
10 Undo the two retaining bolts and remove the engine oil cooler from along the bottom of the radiator **(see illustration)**. Move the oil cooler to one side with the pipes still connected, taking care not to damage them.

11 Undo the retaining nuts/bolts and remove the two mounting brackets from beneath the radiator **(see illustration)**. Check the lower mounting rubbers when the brackets are removed.

12 With the condenser, power steering fluid oil cooler and intercooler (depending on model) secure, withdraw the radiator downwards and out from under the front of the vehicle, taking care not to damage any of the cooling fins.



3.3 Release the top hose retaining clip



3.6 Release the hose retaining clip

Inspection

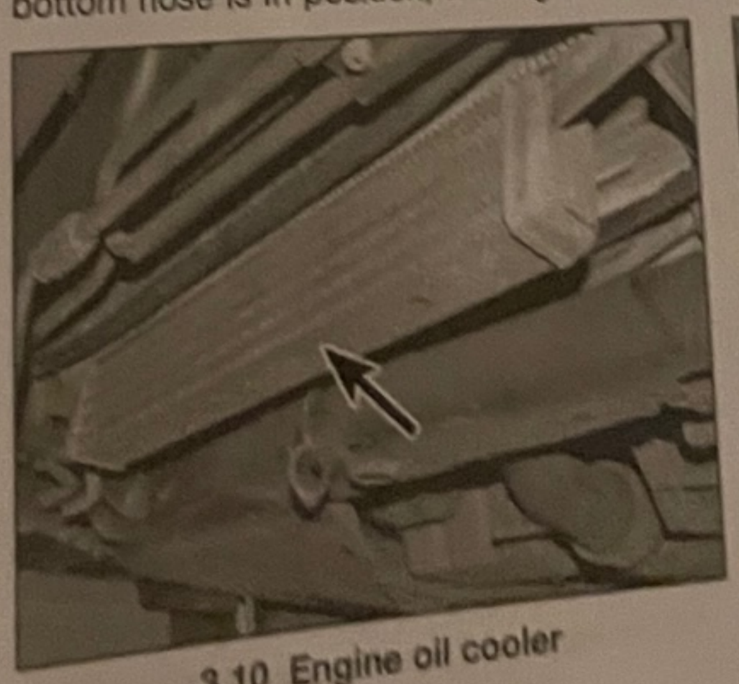
13 If the radiator has been removed due to suspected blockage, reverse-flush it as described in Chapter 1A or 1B. Clean dirt and debris from the radiator fins, using an airline or a soft brush.

14 If necessary, a radiator specialist can perform a 'flow test' on the radiator, to establish whether an internal blockage exists. A leaking radiator must be referred to a specialist for permanent repair. Do not attempt to weld or solder a leaking radiator. If the radiator is to be sent for repair, or is to be renewed, remove the cooling fan thermostatic switch.

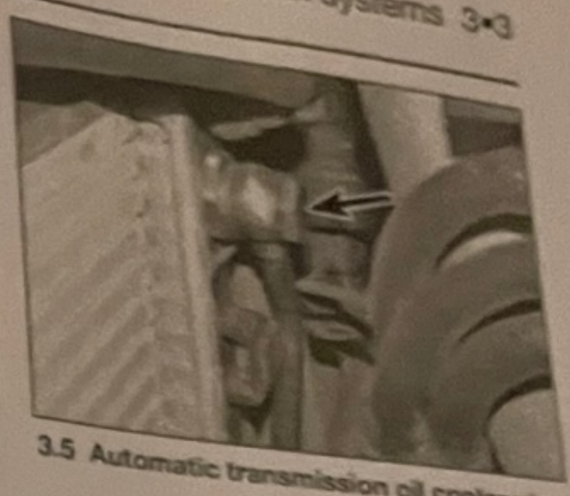
15 Inspect the condition of the upper and lower radiator mounting rubbers, and renew them if necessary.

Refitting

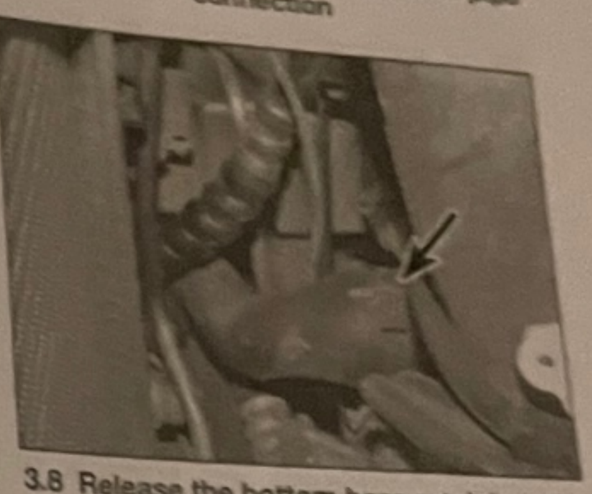
16 Before refitting the radiator, make sure the bottom hose is in position, making sure that the retaining clip will be accessible when in the car.



3.10 Engine oil cooler



3.5 Automatic transmission oil cooler pipe connection



3.8 Release the bottom hose retaining clip

17 Refit the radiator into position and fit the lower mounting brackets in place on the front crossmember. Check the mounting rubbers are located correctly on the lower pegs of the radiator and intercooler.

18 Refit the engine oil cooler to the bottom of the radiator.

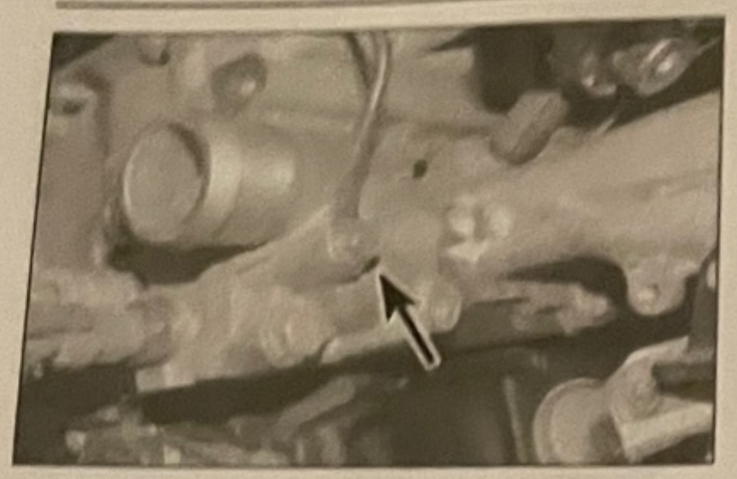
19 With the lower mounting brackets in position, release the secure ties from holding the air conditioning condenser, power steering fluid oil cooler and intercooler (depending on model), to the front crossmember.

20 Refit the bottom hose to the lower right-hand side of the radiator or coolant pump, depending on where it was removed.

21 Reconnect the wiring to the air conditioning compressor.

22 Reconnect the coolant reservoir hose to the top of the radiator and tighten the clip.

3.11 Radiator lower mounting bracket – one side shown



4.3 Earth cable bolted to the thermostat housing

23 On automatic transmission models, reconnect the oil cooler pipes (together with new sealing washers) and tighten the banjo bolts.
24 Refit the electric cooling fan with reference to Section 5.
25 Reconnect the top hose to the top of the radiator and tighten the clip.
26 Refit the front bumper as described in Chapter 11.
27 Refill and bleed the cooling system as described in Chapter 1A or 1B. Check and if necessary top-up the fluid level in the automatic transmission with reference to Chapter 1A or 1B.
28 Finally, check the cooling system for leaks.

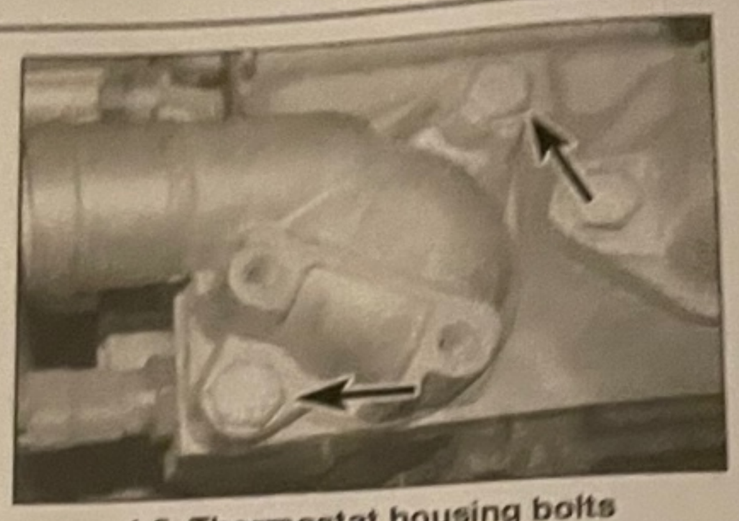
4 Thermostat – removal, testing and refitting

Removal

1 Drain the cooling system as described in Chapter 1A or 1B. This procedure includes removing the splash cover from under the radiator. If the coolant is relatively new or in good condition, drain it into a clean container and re-use it.

Petrol models

2 At the left-hand end of the cylinder head, loosen the clip and disconnect the top hose from the thermostat housing. Move the hose to one side.
3 Unscrew the bolt securing the earth cable to the thermostat housing and move the cable to one side **(see illustration)**.
4 Unbolt the hose support bracket from the thermostat housing.
5 Unscrew and remove the upper and lower mounting bolts, and withdraw the thermostat housing and thermostat from the cylinder head **(see illustration)**. Recover the sealing ring.



4.5 Thermostat housing bolts

Diesel models

6 The thermostat is located on the left-hand end of the cylinder head, and is integral with the housing.
7 Slacken the securing clips, and remove the charge air pipe from the left-hand end of the cylinder head **(see illustration)**.
8 Release the securing clips and disconnect the hoses from the thermostat housing **(see illustration)**.
9 Disconnect the coolant temperature sensor wiring plug.
10 Undo the two retaining bolts and remove the thermostat housing.

Testing

Note: *If there is any question about the operation of the thermostat, it's best to renew it – they are not usually expensive items. Testing involves heating in, or over, an open pan of boiling water, which carries with it the risk of scalding. A thermostat which has seen more than five years' service may well be past its best already.*

11 A rough test of the thermostat may be made by suspending it with a piece of string in a container full of water. Heat the water to boiling point and check that the thermostat opens. If not, renew it.
12 If a thermometer is available, the opening temperature of the thermostat can be determined and compared with that given in the Specifications. The opening temperature is normally marked on the thermostat.
13 A thermostat which fails to open when the water cools down must also be renewed.

Refitting

14 Clean the surfaces of the thermostat housing and cylinder head.
15 On petrol models, locate the thermostat and sealing ring in the cylinder head, making sure that the vent hole is located at the top. The hole is to allow air to purge from the system.
16 Refit the thermostat housing and tighten the bolts to the specified torque.
17 The remainder of the refitting procedure is the reversal of the removal procedure. On completion refill and bleed the cooling system with reference to Chapter 1A or 1B.

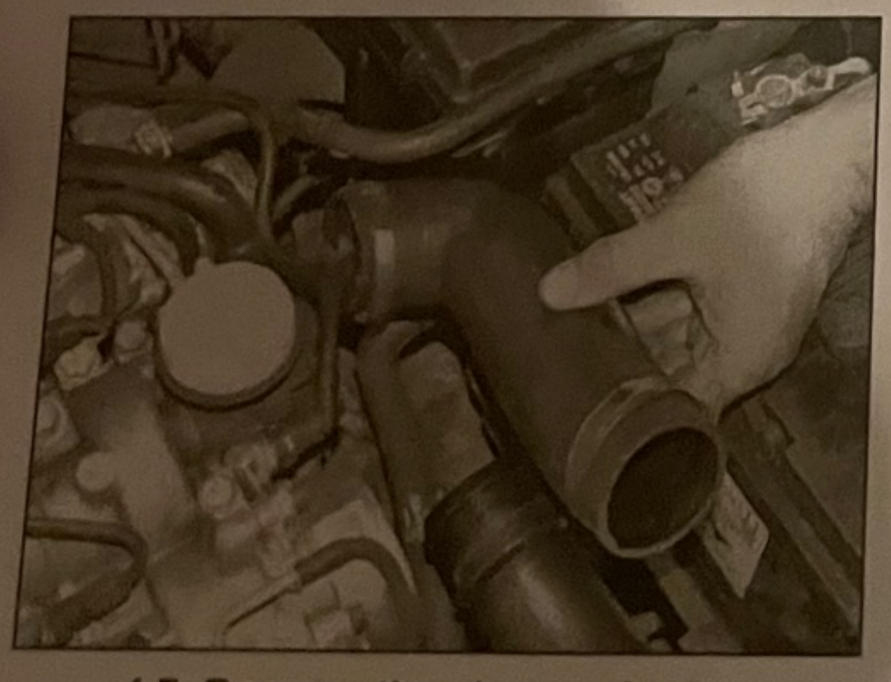
5 Electric cooling fan – testing, removal and refitting

Testing

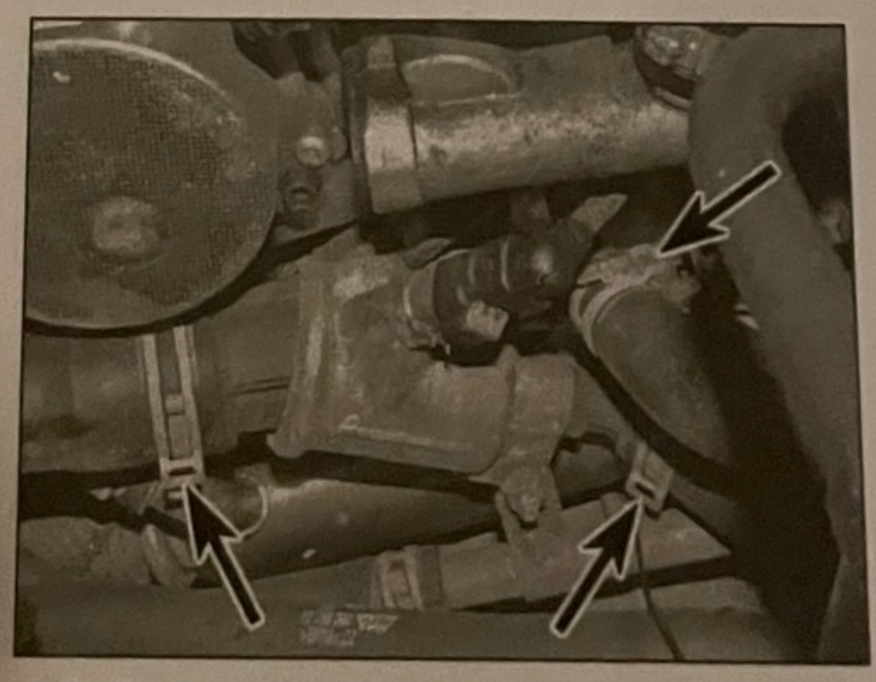
1 Current supply to the cooling fan is controlled by the DICE Control Module (see Chapter 4A, Section 23). The module is supplied with information from the coolant temperature sensor, air conditioning pressure, vehicle speed and outside temperature. Models with air conditioning are fitted with two cooling fans, controlled by the DICE Control Module.
2 If the fan does not appear to work, check that the wiring plug located on the cooling fan is intact. Note that Saab technicians use an electronic tester to interrogate the DICE Control Module for fault codes, and if necessary a Saab dealer should carry out a diagnostic check to locate the fault.
3 If the wiring is in good condition, use a voltmeter to check that 12 volts is reaching the motor when the engine temperature dictates. The motor itself can be checked by disconnecting it from the wiring loom and connecting a 12 volt supply directly to it.

Removal

4 Remove the bypass pipe and valve from the left-hand end of the cylinder head **(see illustration)**, noting that an O-ring is fitted to the turbo intake pipe.
5 Disconnect the wiring for the cooling fan from the top of the radiator **(see illustration)**.
6 Drain the cooling system as described in Chapter 1A or 1B. Note this only needs to be drained until the level in the cooling system is lower than the outlet for the top hose.
7 Loosen the clip and disconnect the top hose from the upper left-hand side of the



4.7 Remove the charge air pipe



4.8 Release the three hose retaining clips

5.4 Remove the by-pass valve

8 Release the clips holding the expansion tank vent hose to the top of the fan cowling **(see illustration)**.

9 On automatic transmission models, release the cooler pipes and wiring (where applicable) from along the bottom of the fan cowling.

10 Unscrew the bolts securing the electric cooling fan shroud to the radiator side tanks; a single bolt is located on each side of the unit **(see illustration)**.

11 Lift the electric cooling fan unit slightly and release it from the lower mounting hooks, then move the unit to one side and withdraw it from the engine compartment **(see illustration)**.

12 To remove a motor and fan blade unit, unclip the plastic cowl and wiring, and then undo the retaining screws **(see illustrations)**.

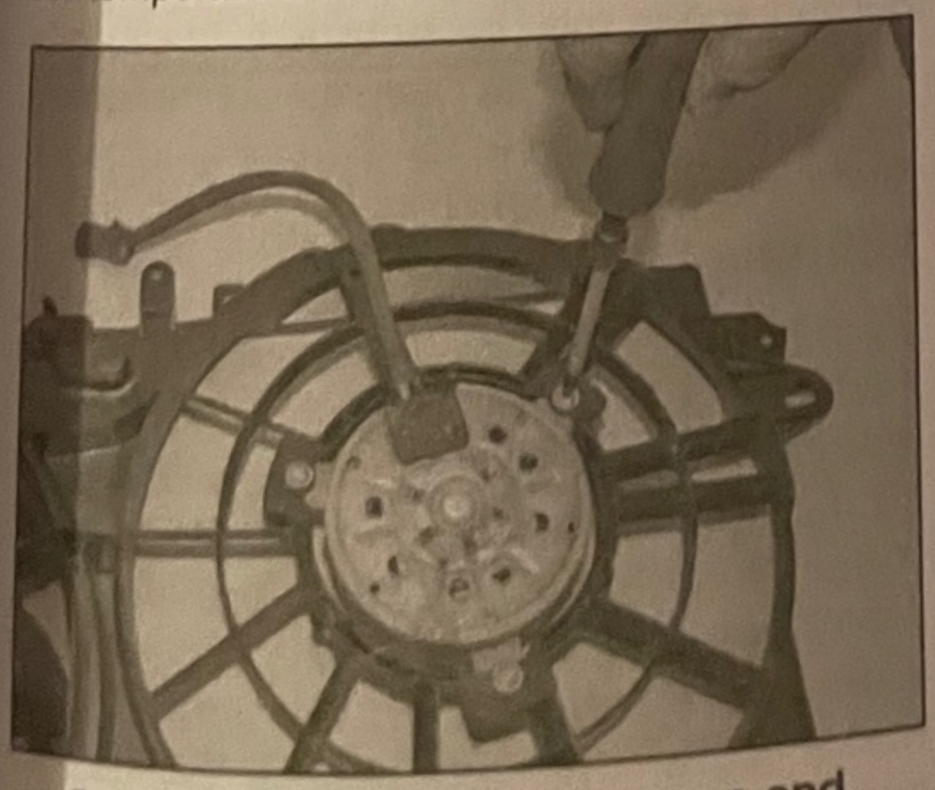
Refitting

13 Refitting is a reversal of removal but tighten the mounting bolts to the specified torque. On completion refill and bleed the cooling system with reference to Chapter 1A or 1B.

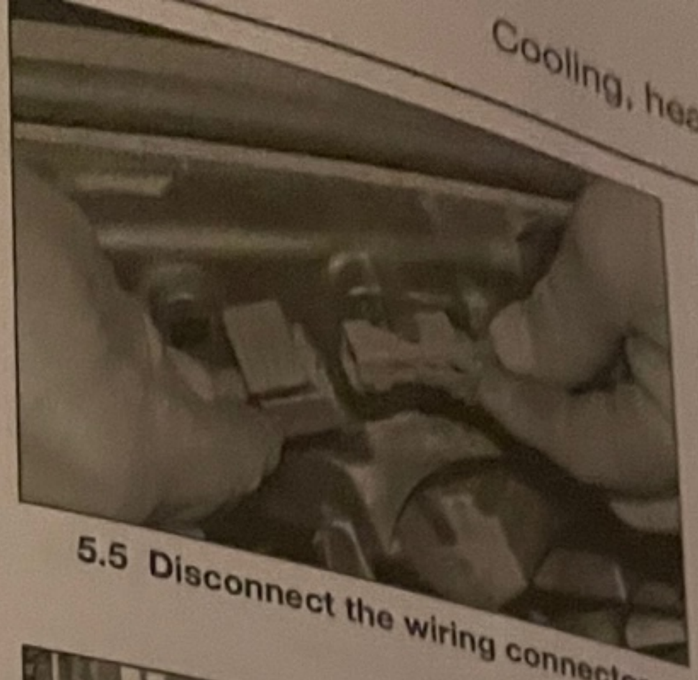
6 Coolant temperature sensor – testing, removal and refitting

Testing

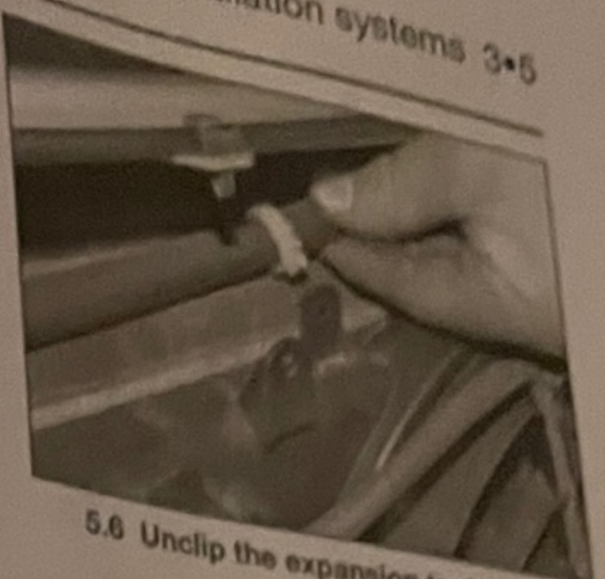
1 The engine coolant temperature sensor is located on the thermostat housing, on the left-hand end of the cylinder head. The resistance of the sensor varies according to the temperature of the coolant.



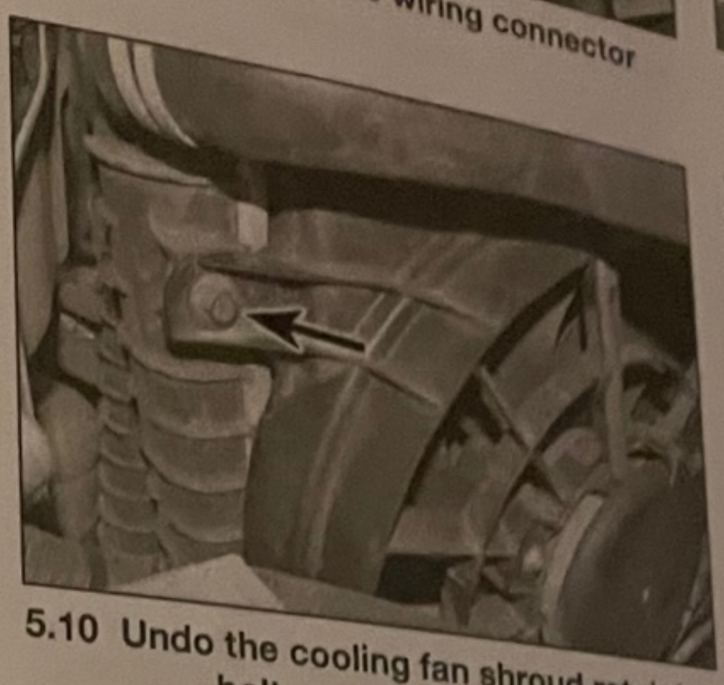
5.12c . . . then undo the screws and remove the fan motor



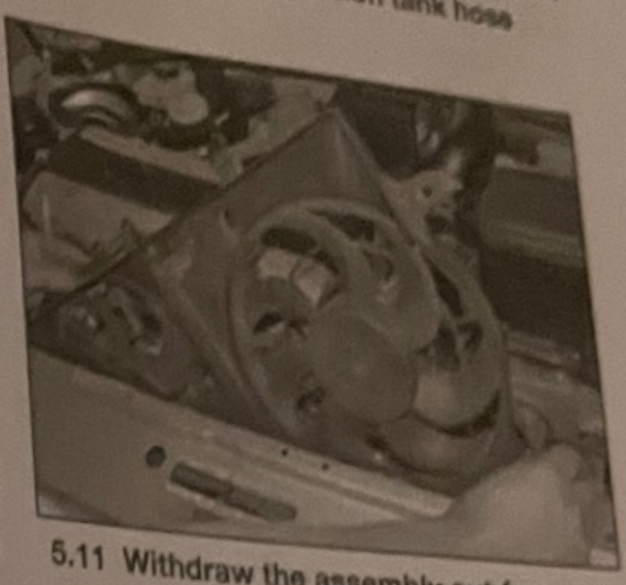
5.5 Disconnect the wiring connector



5.6 Unclip the expansion tank hose



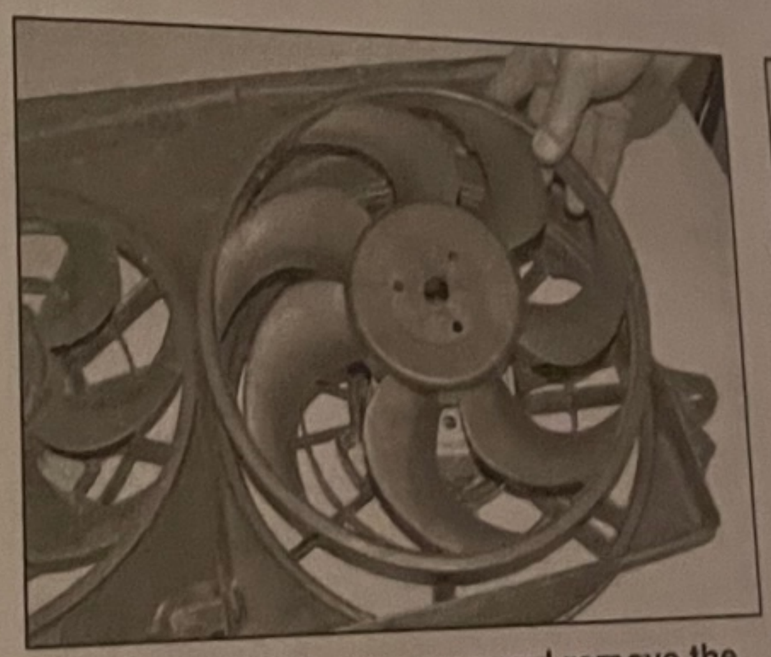
5.10 Undo the cooling fan shroud retaining bolt – one side shown



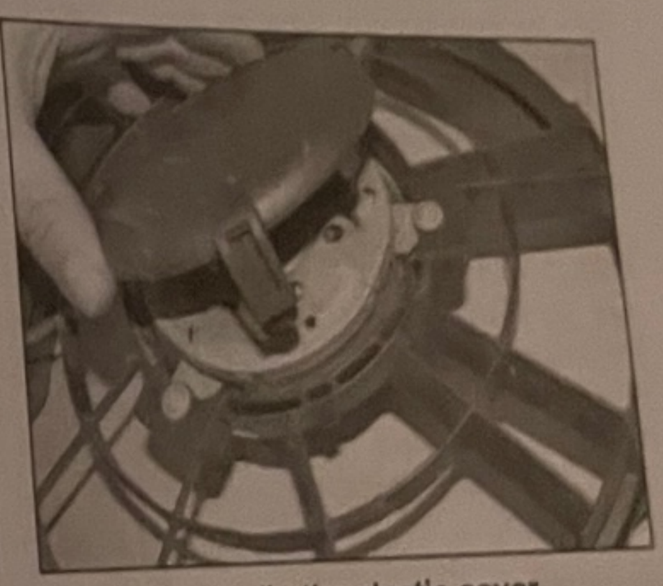
5.11 Withdraw the assembly out from the engine compartment

2 To test the sensor, disconnect the wiring at the plug then connect an ohmmeter to the sensor **(see illustration)**.

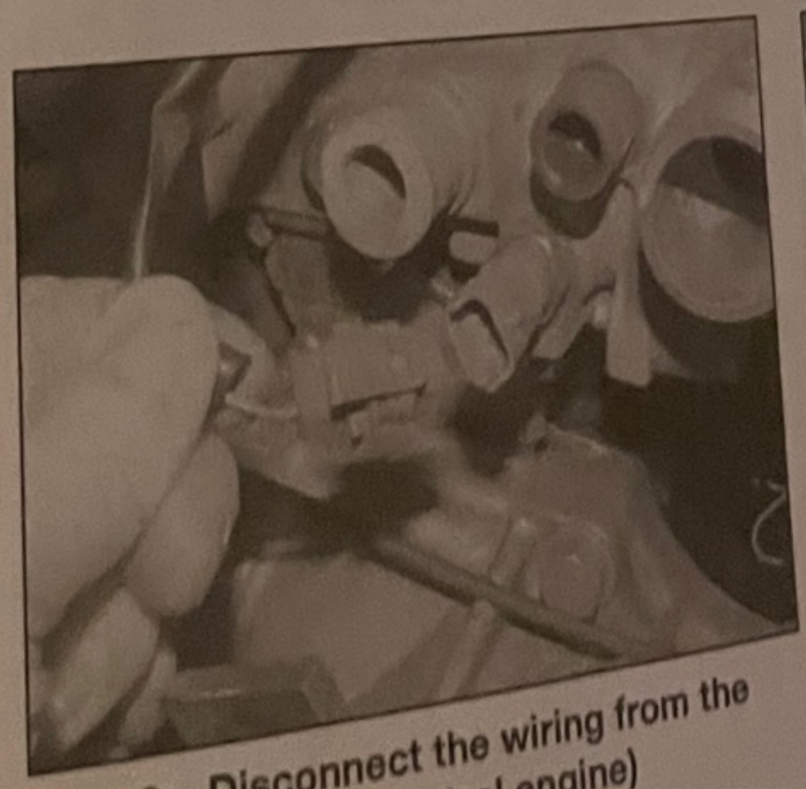
3 Determine the temperature of the coolant, then compare the resistance with the information given in the Specifications. If the reading is incorrect, the sender must be renewed.



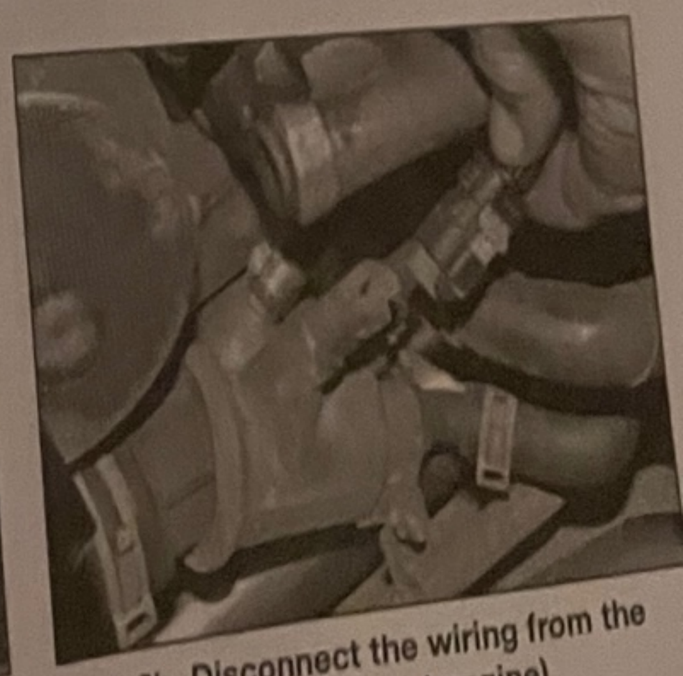
5.12a Undo the screws and remove the fan blades



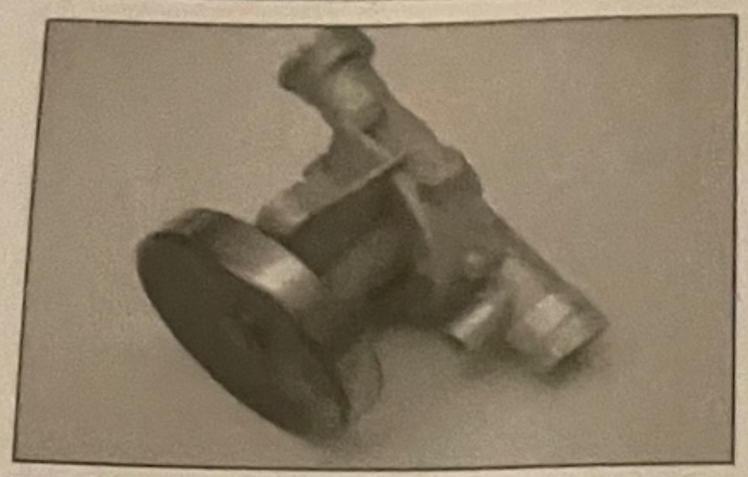
512b Unclip the plastic cover . . .



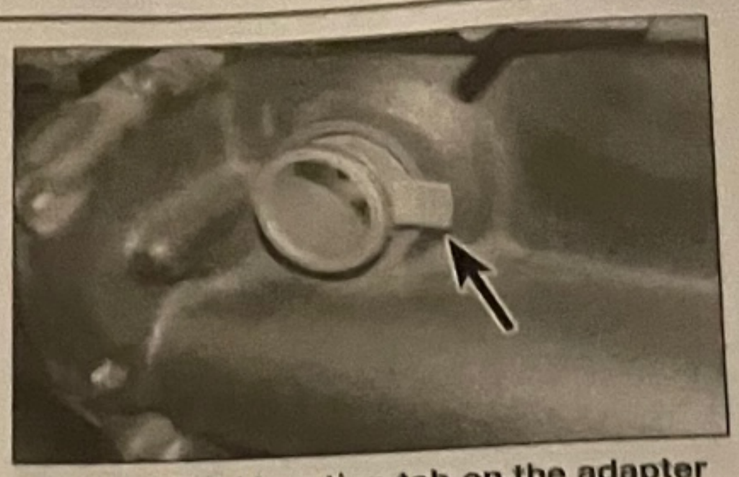
6.2a Disconnect the wiring from the sensor (petrol engine)



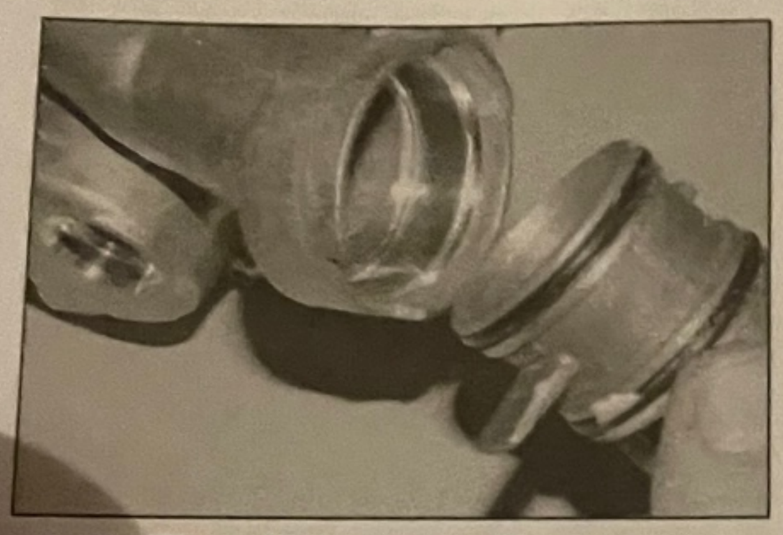
6.2b Disconnect the wiring from the sensor (diesel engine)



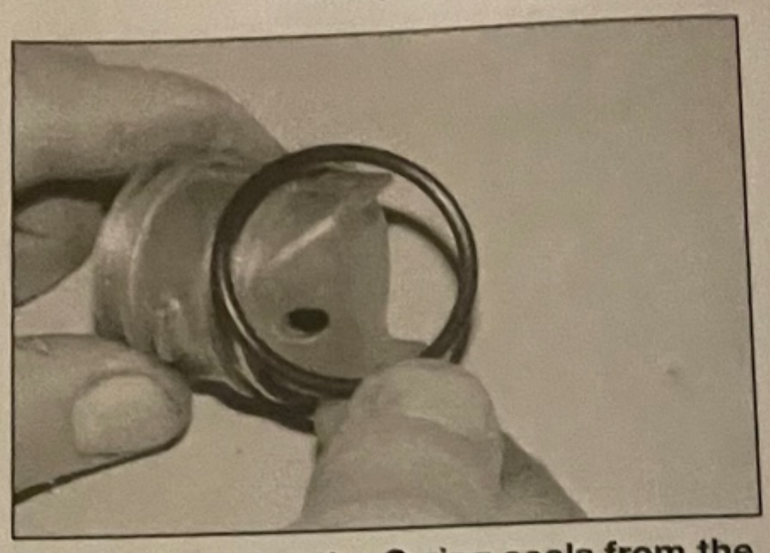
7.15 Water pump removed from the engine



7.16a 'Wide' location tab on the adapter which locates in the 'wide' cut-out on the water pump



7.16b The adapter locates in cut-outs in the water pump body



7.16c Removing the O-ring seals from the adapter

Removal

4 Drain the cooling system as described in Chapter 1A or 1B. To make access easier, remove the hose(s) from the thermostat housing.

5 Alternatively, if you do not want to drain the cooling system, the new sensor may be fitted immediately after removing the old one, or a suitable plug may be fitted in the aperture while the sensor is removed. If the latter option is used, make sure the cooling system has cooled down and then carefully loosen the expansion tank filler cap, to release any pressure in the cooling system, and then retighten the cap.

6 With the wiring disconnected, unscrew the sensor and remove it from the thermostat housing. Where applicable, remove the sealing washer.

Refitting

7 Apply some copper grease to its threads, then insert the sensor, together with a new sealing washer where applicable, and tighten it to the specified torque.

8 Reconnect the wiring.

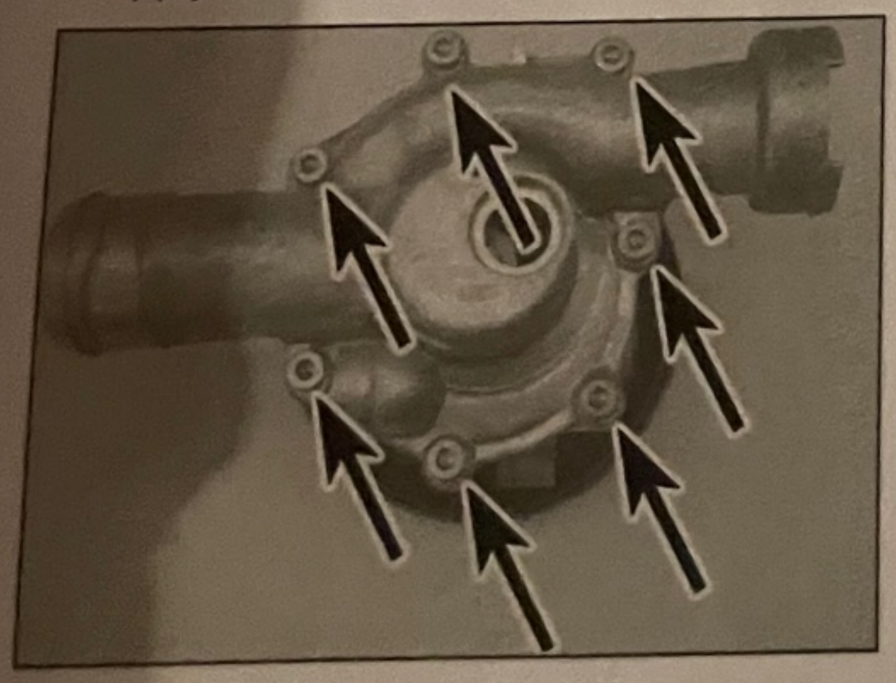
9 Refill the cooling system as described in Chapter 1A or 1B. If the system was not completely drained, top it up (*Weekly checks*).

7 Water pump – removal and refitting

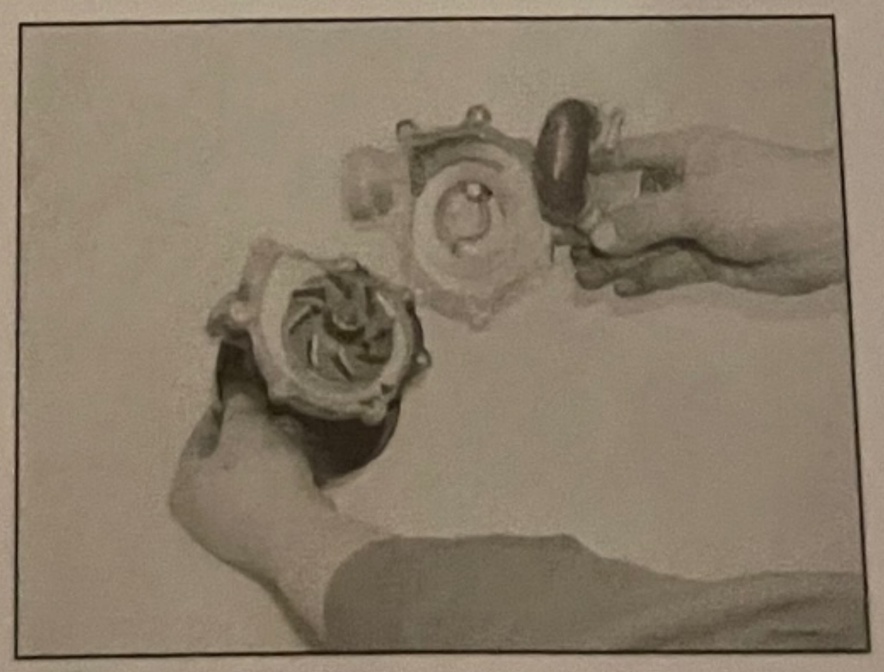
Petrol models

Removal

1 Drain the cooling system as described in Chapter 1A. This procedure includes removing the splash cover from under the radiator. If the coolant is relatively new or in good condition, drain it into a clean container and re-use it.



7.17a Unscrew the bolts . . .



7.17b . . . and separate the halves of the water pump

2 Disconnect the wiring from the [illegible] sensor in the front right-hand corner of the engine compartment, then loosen the [illegible] and remove the air hose complete with [illegible] sensor.

3 Remove the auxiliary drivebelt as described in Chapter 1A.

4 Disconnect the crankcase ventilation [illegible] and release it from the turbocharger [illegible] pipe and camshaft cover.

5 Disconnect the wiring from the turbocharger boost pressure control valve.

6 Unbolt the engine lifting eye from the cylinder head.

7 Disconnect the hoses from the turbocharger wastegate valve.

8 Disconnect the turbocharger bypass [illegible] and valve, noting that there is an O-ring seal at the connection to the turbo intake pipe.

9 Unscrew the nut and unclip the heat shield from the exhaust manifold.

10 Disconnect the crankcase ventilation hose at the quick-release coupling.

11 Remove the turbocharger intake pipe. Cover the intake aperture with tape or a plastic bag to prevent entry of dust and dirt.

12 Refer to Chapter 10 and remove the power steering pump, however, do not disconnect the fluid hoses.

13 Loosen the clip and disconnect the [illegible] hose from the water pump.

14 Unscrew the two bolts from the left-hand end of the cylinder block, and remove the rigid heater return pipe from the water pump. Recover the O-ring from the water pump. Also unscrew the bolt and remove the rigid heater supply pipe support from the turbocharger.

15 Unscrew the three coolant pump mounting bolts and carefully ease the pump from the bracket and connecting adapter on the cylinder block **(see illustration)**.

16 Remove the adapter from the cylinder block, and examine the O-ring seals for deterioration. It is recommended that new seals be fitted. Note that on later models the adapter has two location tabs of different widths which locate in the water pump. The adapter can only be fitted one way round – this ensures the correct direction of the internal channel **(see illustrations)**.

17 The water pump may be obtained as a complete unit, or alternatively just the impeller/pulley section may be obtained. To separate the two sections, first mark them in relation to each other. Unscrew the bolts and separate the halves **(see illustrations)**.

Refitting

18 If separated, clean the mating faces and assemble the halves together with a new gasket. Insert the bolts and tighten securely.

19 Refit the adapter to the cylinder block together with new O-rings. Apply a little petroleum jelly to the O-rings to help them enter the cylinder block. On later models make sure the adapter is positioned correctly.

20 Locate the water pump on the

then insert the bolts and tighten to the specified torque.

21 Refit the rigid heater pipes together with a new O-ring on the return pipe, and also refit the pipe support. Tighten the retaining bolts to the specified torque.

22 Reconnect the inlet hose to the water pump and tighten the clip.

23 Refit the power steering pump with reference to Chapter 10.

24 Refit the turbocharger intake pipe.

25 Reconnect the crankcase ventilation hose at the quick-release coupling.

26 Refit the heat shield to the exhaust manifold.

27 Reconnect the turbocharger bypass pipe and valve together with a new O-ring at the connection to the turbo intake pipe.

28 Reconnect the hoses to the turbocharger wastegate valve.

29 Refit the engine lifting eye to the cylinder head and tighten the bolt.

30 Reconnect the wiring to the turbocharger boost pressure control valve.

31 Reconnect the crankcase ventilation hose to the turbocharger intake pipe and camshaft cover.

32 Refit the auxiliary drivebelt as described in Chapter 1A.

33 Refit the air hose and airflow sensor, and reconnect the wiring.

34 Refit the splash cover beneath the radiator.

35 Refill and bleed the cooling system with reference to Chapter 1A.

Diesel models

Removal

36 On diesel engines, the water pump is driven by the timing belt. Remove the timing belt as described in Chapter 2B.

37 Undo the Allen screws and remove the water pump from the engine **(see illustration)**.

Refitting

38 Refitting is a reversal of removal, but note the following additional points:

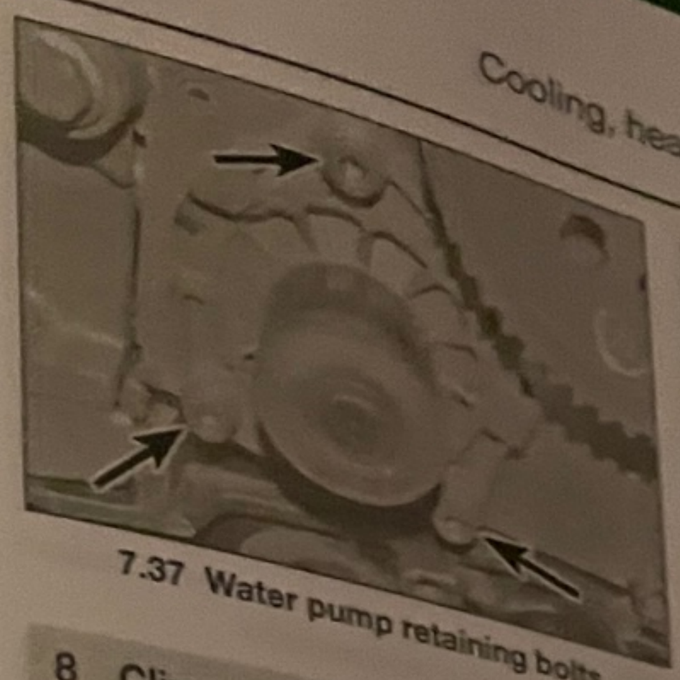
a) *Clean the pump and block contact faces.*

b) *Fit new O-rings (where applicable), and apply a little petroleum jelly to them to aid seating.*

c) *Apply a little thread-locking compound to the water pump retaining bolts.*

d) *Tighten all nuts/bolts to the specified torque where given.*

e) *Refill and bleed the cooling system with reference to Chapter 1B.*



7.37 Water pump retaining bolts

8 Climate control systems – general information

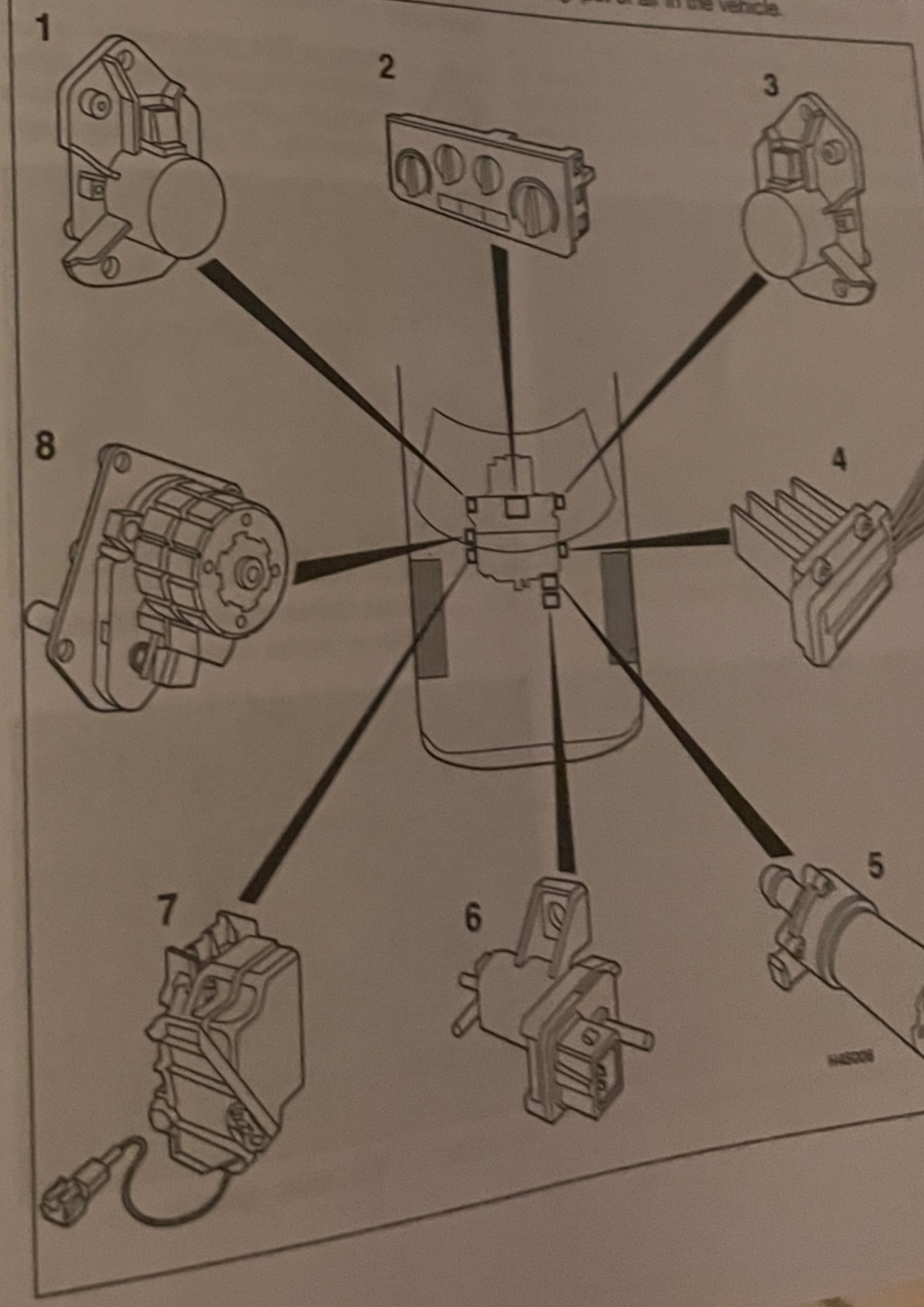
1 Two types of climate control systems are fitted – the Manual Climate Control (MCC) system and the Automatic Climate Control (ACC) system, which maintains the temperature inside the car at a selected temperature, regardless of the temperature outside the car **(see illustration)**. The basic heating/ventilation unit is common to all versions, and consists of air ducting from the centrally-located heater assembly to a central vent, and two side vents, with an extension leading from the bottom of the heater through the centre console to the rear passenger footwell area.

2 The heating and ventilation controls are mounted in the centre of the facia. Electrically controlled flap valves are contained in the air distribution housing, to divert the air to the various ducts and vents.

3 Cold air enters the system through the grille at the bottom of the windscreen. If required, the airflow is boosted by the blower, and then flows through the various ducts, according to the settings of the controls. Stale air is expelled through ducts at the rear of the vehicle behind the rear bumper. If warm air is required, the cold air is passed over the heater matrix, which is heated by the engine coolant.

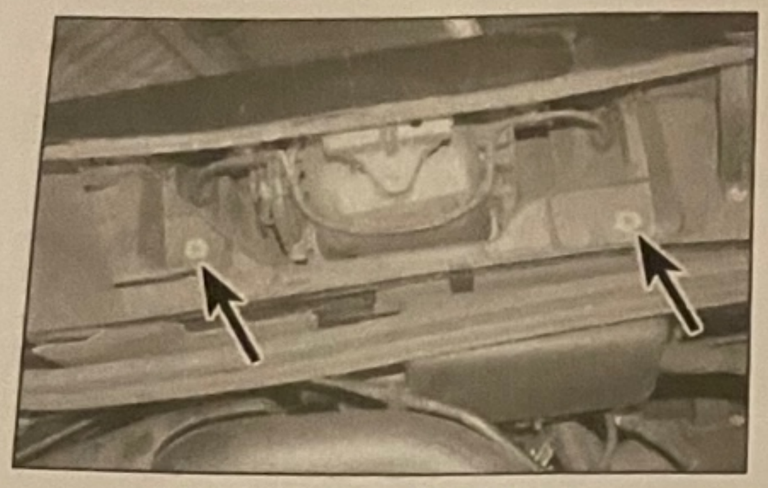
4 On all models, a recirculation switch enables the outside air supply to be closed off, while the air inside the vehicle is recirculated. This can be useful to prevent unpleasant odours entering from outside the vehicle, but should only be used briefly, as the recirculated air inside the vehicle will soon become stale.

5 A solar sensor located on top of the facia panel detects increased solar radiation, and increases the speed of the blower motor. This is necessary in order to increase the throughput of air in the vehicle.

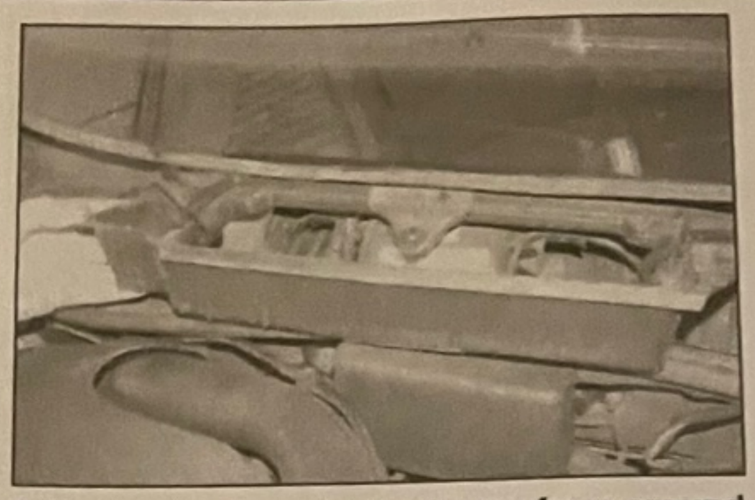


8.1 Standard heating/ventilation system

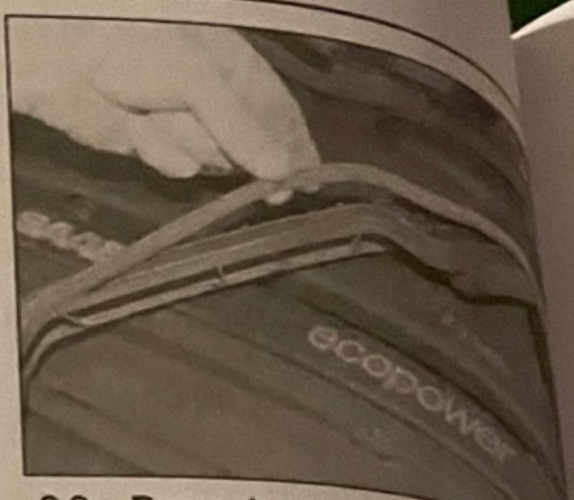
1 *Right-hand mixed air stepping motor*
2 *Control module*
3 *Left-hand mixed air stepping motor*
4 *Ventilation fan control*
5 *Circulation pump (certain versions only)*
6 *Heat exchanger shut-off valve*
7 *Air recirculation motor*
8 *Air distribution stepping motor*



9.3a Unscrew the nuts . . .



9.3b . . . then unclip the frame from around the blower motor



9.3c Removing the weatherstrip from the groove

Air conditioning

6 Air conditioning enables the temperature of air inside the car to be lowered, and also dehumidifies the air, which makes for rapid demisting and increased comfort.

7 The cooling side of the system works in the same way as a domestic refrigerator. Refrigerant gas is drawn into a belt-driven compressor, and passes into a condenser mounted in front of the radiator, where it loses heat and becomes liquid. The liquid passes through a receiver and expansion valve to an evaporator, where it changes from liquid under high pressure to gas under low pressure. This change is accompanied by a drop in temperature, which then cools the evaporator. The refrigerant returns to the compressor, and the cycle begins again.

8 Air drawn through the evaporator passes to the air distribution unit. The air conditioning system is switched on with the switch located on the heater panel.

9 The compressor operation is controlled by an electromagnetic clutch on the drive pulley. Any problems with the system should be referred to a Saab dealer or specialist.

10 The air conditioning refrigerant circuit service ports are located in front of the power steering reservoir on the right-hand side of the engine compartment on the inner wing panel and at the front left-hand corner in the front cross-panel **(see illustrations 10.5a and 10.5b)**.

11 When working on the air conditioning system, it is necessary to observe special precautions (see section 10). If for any reason the system must be evacuated, entrust this task to a Saab dealer or a suitably-equipped specialist.

Warning: The refrigeration circuit contains a liquid refrigerant under pressure, and it is therefore dangerous to disconnect any part of the system without specialist knowledge and equipment. The refrigerant is potentially dangerous, and should only be handled by qualified personnel. If it is splashed onto the skin, it can cause frostbite. It is not itself poisonous, but in the presence of a naked flame (including a cigarette) it forms a poisonous gas. Uncontrolled discharging of the refrigerant is dangerous, and potentially damaging to the environment. Do not operate the air conditioning system if it is known to be short of refrigerant, as this may damage the compressor.

9 Climate control system components – removal and refitting

Heater blower motor

1 Set the air recirculation control to OFF.

2 Remove the wiper motor and linkage as described in Chapter 12.

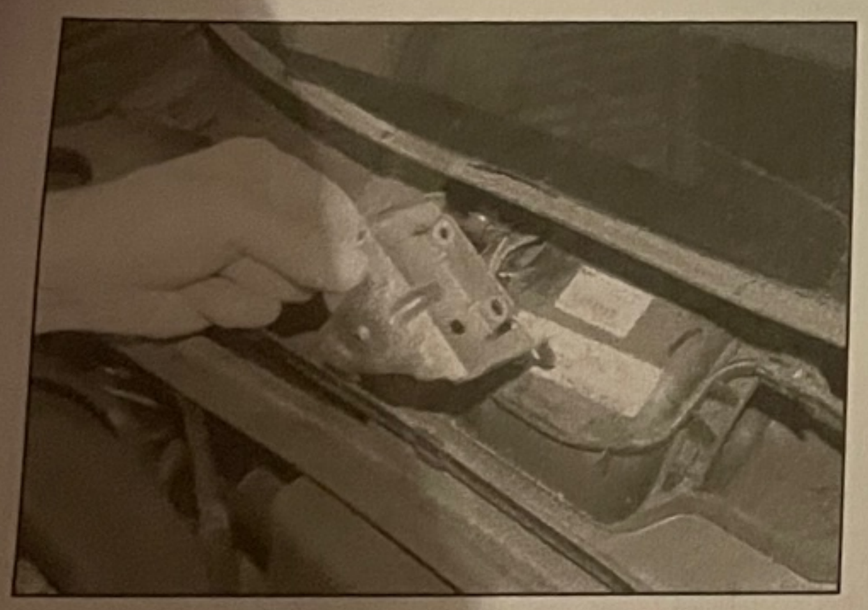
3 Unscrew the nuts then unclip the blower motor from around the blower motor. If necessary, remove the weatherstrip from the groove **(see illustrations)**.

4 Unbolt and remove the wiper arm bracket **(see illustration)**.

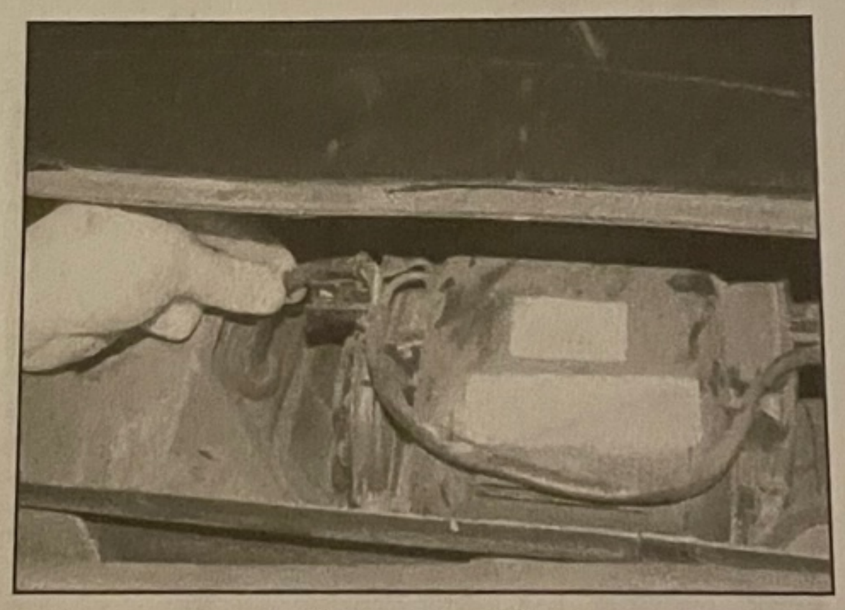
5 Release the wiring harness from the blower motor cover **(see illustration)**.

6 Undo the screws and remove the blower motor cover by lifting it to one side, at the same time releasing the wiring **(see illustrations)**.

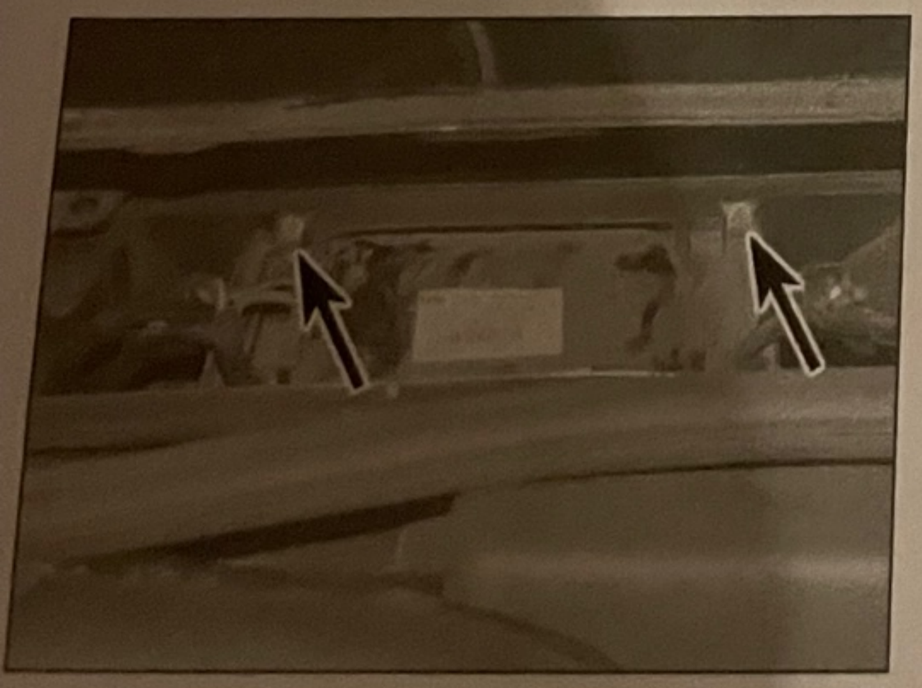
7 Lift out the blower motor sufficiently



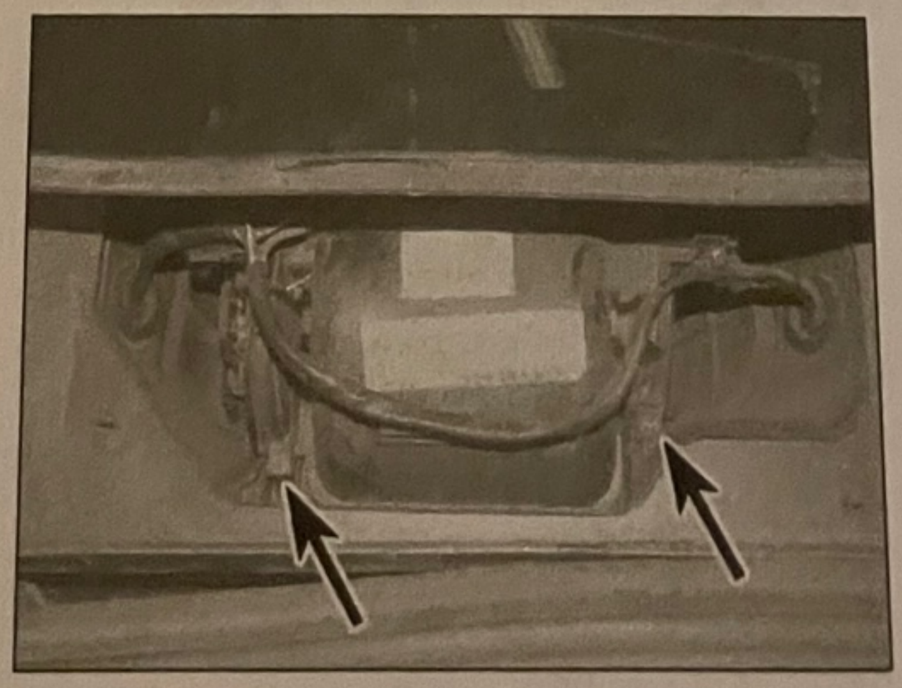
9.4 Remove the wiper arm bracket . . .



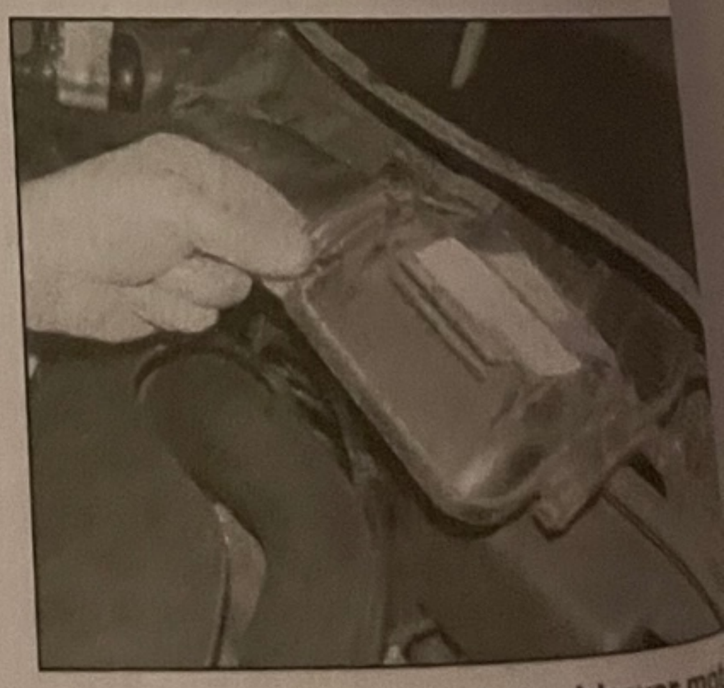
9.5 . . . release the wiring harness from the blower motor cover . . .



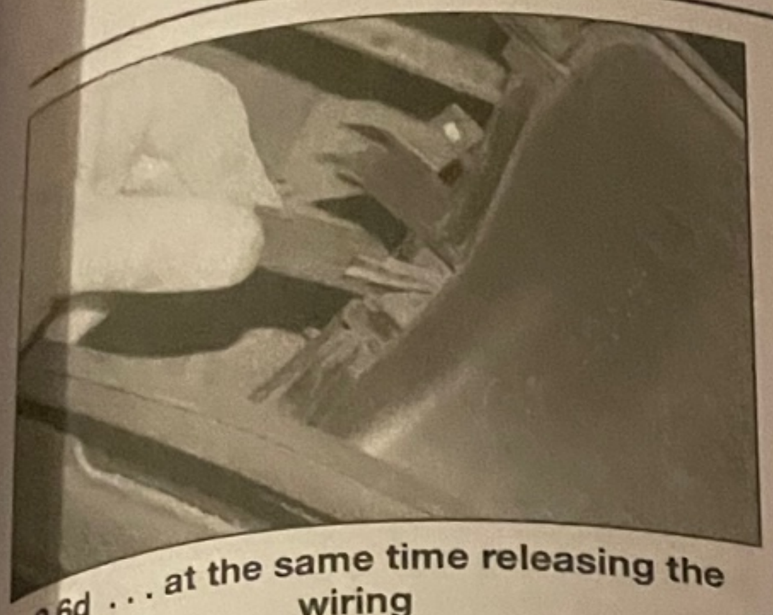
9.6a . . . undo the upper screws . . .



9.6b . . . and lower screws . . .



9.6c . . . and remove the blower motor cover . . .



9.6d . . . at the same time releasing the wiring

disconnect the wiring. Also cut the plastic cable-tie and release the wiring.

8 Withdraw the blower motor from the bulkhead. On right-hand drive models, there may be insufficient clearance between the windscreen and engine compartment rear panel, in which case the panel must be temporarily pulled back using a ratchet strap between the panel and front crossmember **(see illustration)**.

9 Refitting is a reversal of removal, but make sure that the wiring is clear of the fan before refitting the cover.

Heater matrix

10 Drain the cooling system as described in Chapter 1A or 1B. This procedure includes removing the splash cover from under the radiator. If the coolant is relatively new or in good condition, drain it into a clean container and re-use it.

11 At the rear of the engine compartment, identify the two heater hoses for position, and then disconnect them from the heater pipes. Place a container beneath the pipes to catch spilt coolant. To remove most of the coolant from the matrix, blow through one of the pipes, and the coolant will escape from the other.

12 Remove the glovebox and centre console side trim and packing with reference to Chapter 11 **(see illustration)**.

13 On right-hand drive models, undo the screws and remove the plastic bracket from the side of the heater **(see illustrations)**. On left-hand drive models, remove the air vent from the air duct on the right-hand side of the heater unit, however, do not remove the seal.

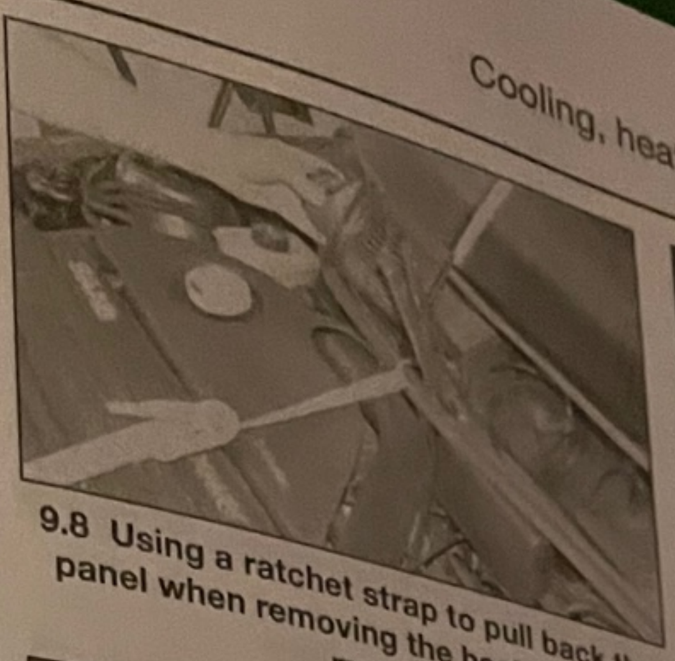
14 Undo the centre screw and remove the clamp plate, then withdraw the two pipes from the matrix. Recover the O-ring seals and check them for deterioration, renewing them as necessary **(see illustrations)**.

15 Undo the four screws and carefully slide the heater matrix from the housing **(see illustration)**.

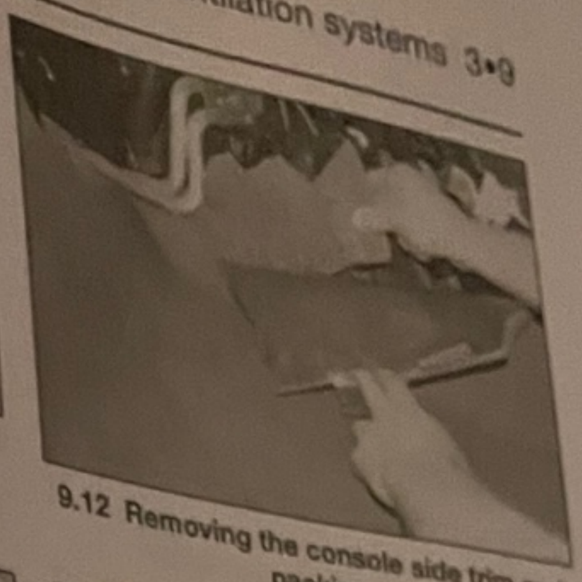
16 Refitting is a reversal of removal, but renew the O-rings and finally refill the cooling system with reference to Chapter 1A or 1B.

Heater unit

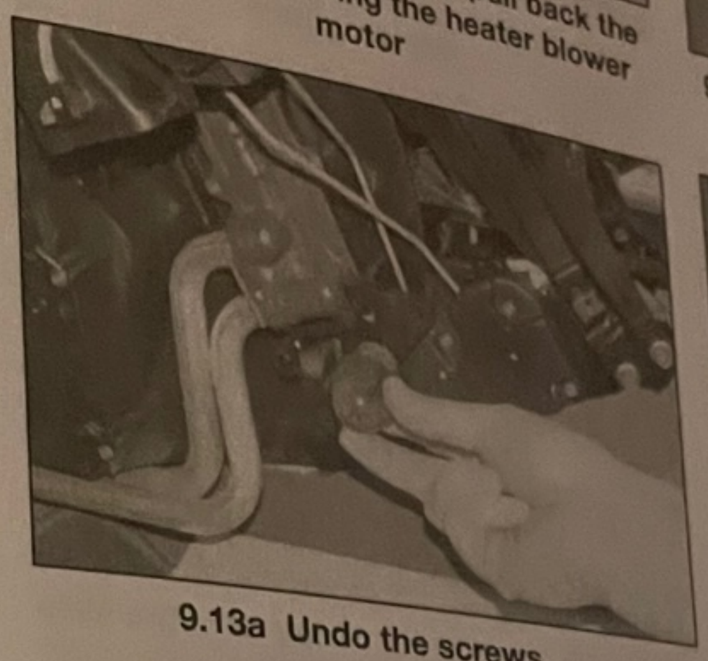
17 On models with air conditioning, the refrigerant must be evacuated by a qualified engineer.



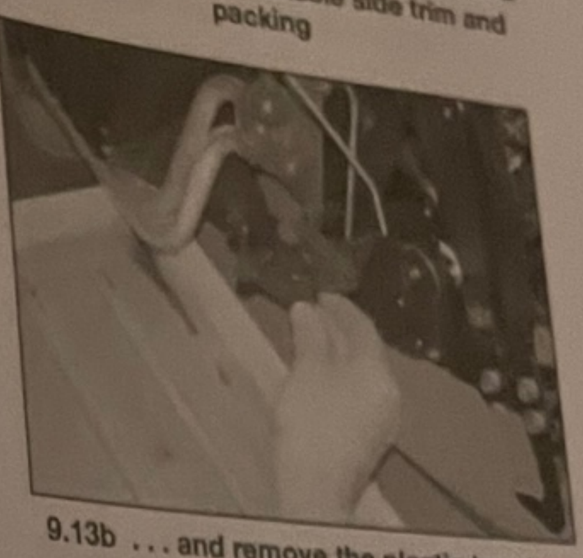
9.8 Using a ratchet strap to pull back the panel when removing the heater blower motor



9.12 Removing the console side trim and packing



9.13a Undo the screws . . .

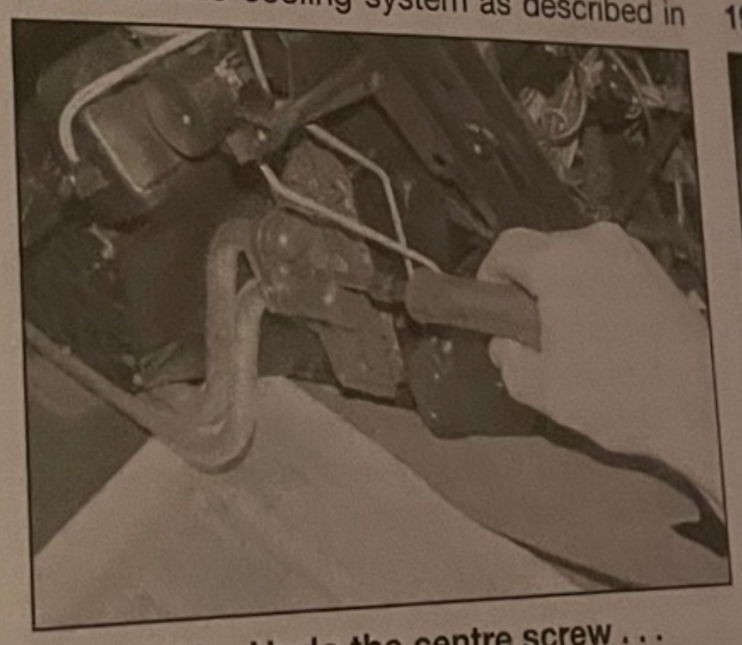


9.13b . . . and remove the plastic bracket from the side of the heater

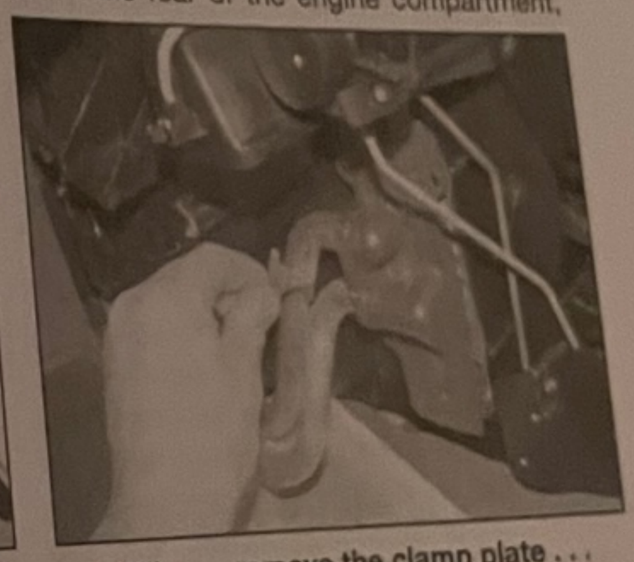
Warning: Do not attempt to carry out this work yourself, as it is potentially dangerous.

18 Drain the cooling system as described in Chapter 1A or 1B. This procedure includes removing the splash cover from under the radiator. If the coolant is relatively new or in good condition, drain it into a clean container and re-use it.

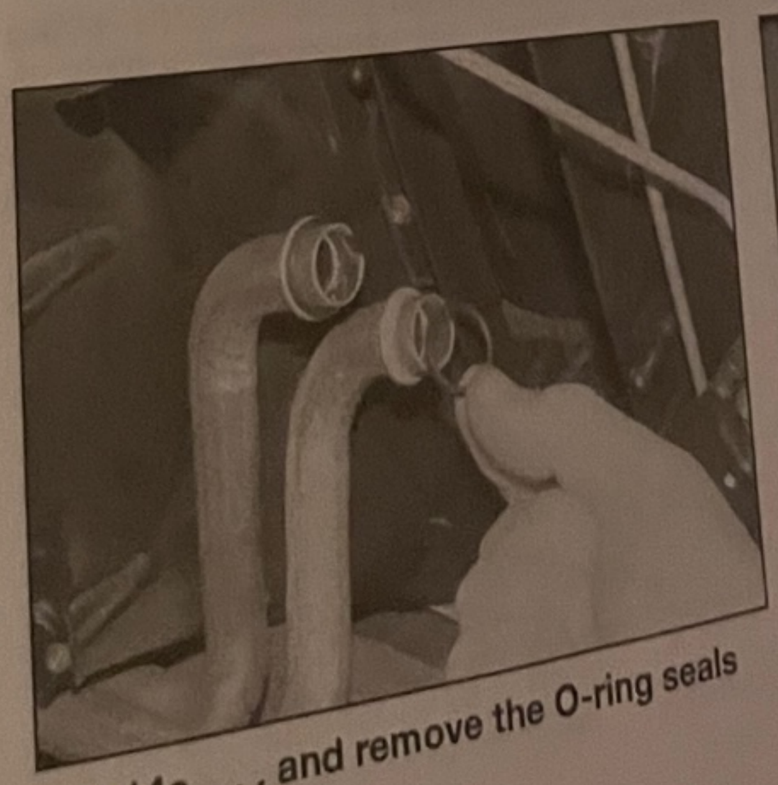
19 At the rear of the engine compartment,



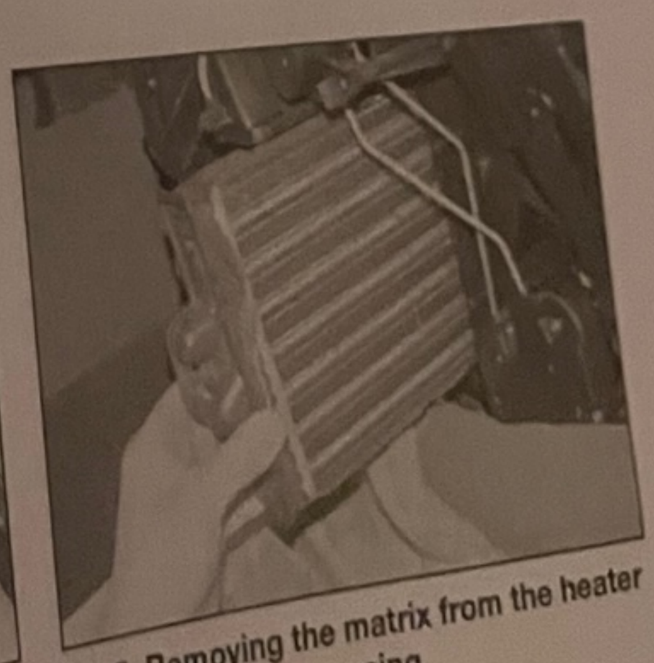
9.14a Undo the centre screw . . .



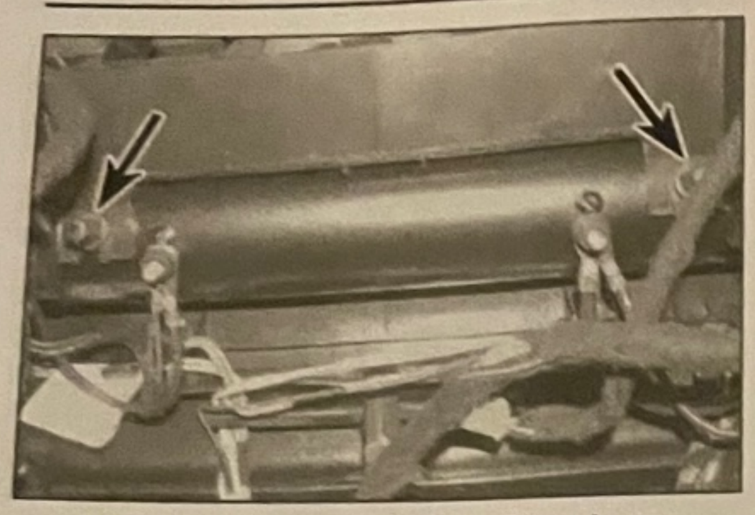
9.14b . . . remove the clamp plate . . .



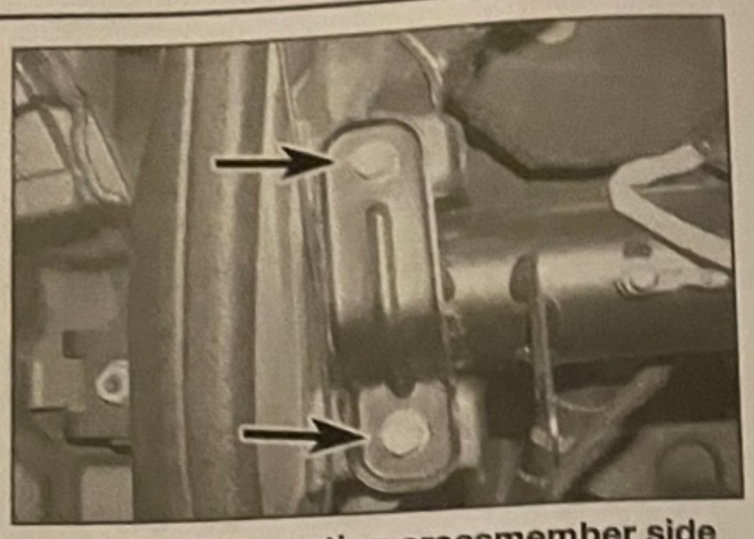
9.14c . . . and remove the O-ring seals



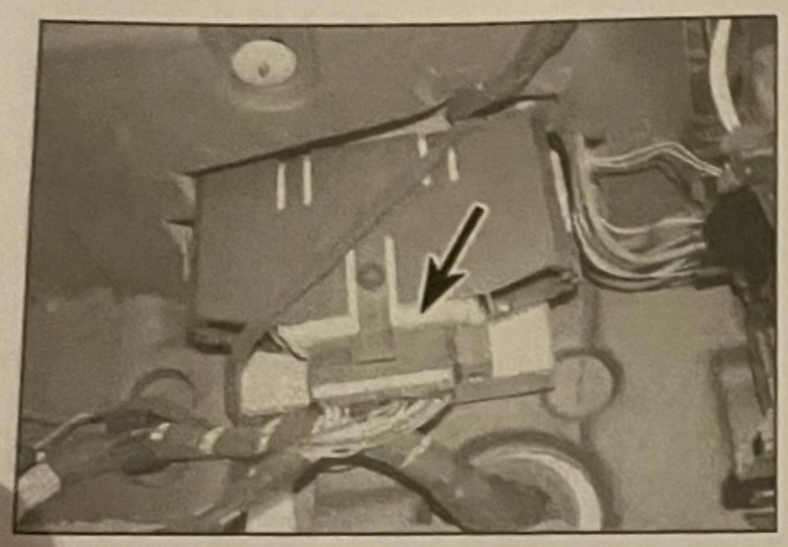
9.15 Removing the matrix from the heater housing



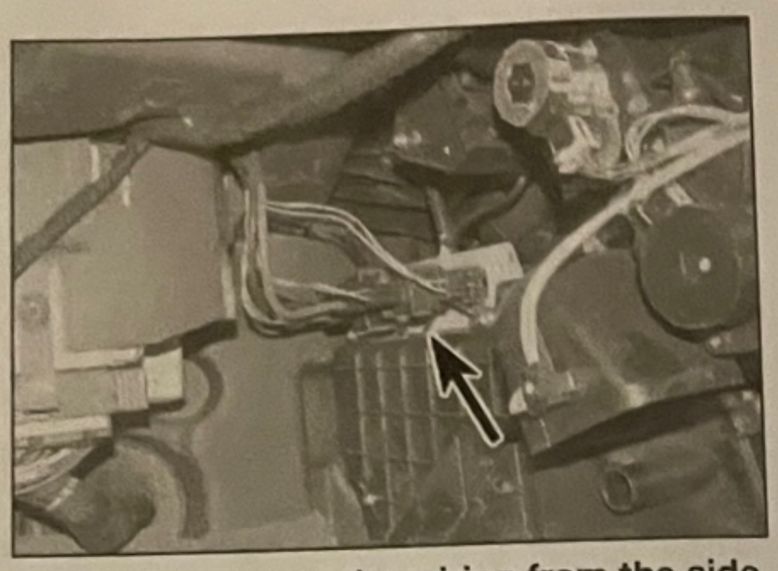
9.23 Nuts securing the wiring loom support to the crossmember



9.29 Facia mounting crossmember side retaining bolts



9.30a Disconnect the wiring from the automatic transmission control module, located next to the Trionic engine management ECU mounting box



9.30b Disconnect the wiring from the side of the heater unit

identify the two heater hoses for position, and then disconnect them from the heater pipes. Place a container beneath the pipes to catch spilt coolant. To remove most of the coolant from the matrix, blow through one of the pipes, and the coolant will escape from the other.

20 Remove the centre console and front seats as described in Chapter 11.

21 Fold up the carpet and remove the air ducts located under the front seat positions.

22 Remove the facia panel as described in Chapter 11.

23 Unscrew the nuts and remove the heater earth cables from the facia mounting crossmember. Also unscrew the nuts and detach the wiring loom support from the crossmember **(see illustration)**. Cut the plastic cable-ties securing the wiring harness as required.

24 Unscrew the nuts and remove the central wiring conduit.

25 Unscrew the nuts and remove the driver's knee shield.

26 Unbolt the relay holder and place to one side.

27 Remove the steering column as described in Chapter 10.

28 Unbolt and remove the pedal bracket, the two braces supporting the facia mounting crossmember, and the centre mounting from the crossmember.

29 Unbolt the facia mounting crossmember and withdraw it through one of the front door apertures **(see illustration)**.

30 On automatic transmission models remove the automatic transmission control module from its mounting box, and disconnect the upper wiring, then disconnect the wiring from the side of the heater unit and module to one side **(see illustration)**.

31 In the engine compartment, re... pipe leading from the intercooler to... body.

32 Remove the turbocharger by... solenoid valve holder from the bu... follows. Remove the cover, disco... wiring and unbolt the holder.

33 Either remove the heater matrix as ... earlier, or disconnect the two pipes ... matrix leaving it fitted to the heater un...

34 Unbolt and remove the expansi...

35 Disconnect the drain hoses ... heater unit.

36 Working in the engine comp... undo the heater unit mounting bolts ... bulkhead.

37 Inside the vehicle, place cloth ... floor to soak up spilled coolant, then ... rear of the heater unit and withdraw it ... gear selector housing. Remove it thro... of the front door apertures.

38 Refitting is a reversal of removal, ... the cooling system as described in Cha... or 1B. Have the air conditioning ... recharged by a qualified engineer.

Climate Control Module

Note: *If a new control module is to be ... access to Saab's TECH2 diagnostic equ... is necessary to save various stored ... which will need to be transferred to the ... unit. If necessary, entrust this task to a ... dealer or suitably-equipped specialist.*

39 Remove the audio unit as descri... Chapter 12.

40 Reach in through the radio ap... and push out the climate control uni... **illustration)**. It is secured in positi... securing clips at the top and bottom ... unit and also at each side.

41 Disconnect the wiring connecto... the unit is withdrawn from the facia ... **illustration)**.

42 On Manual Climate Control mo... (MCC), if necessary, remove the control ... by carefully pulling them from their sp... The bulbholders may also be twisted fr... rear of the unit.

43 Refitting is a reversal of removal, ... the following point:

a) *On Automatic Climate Control Modu... (ACC), the system will require calibra... by pressing the AUTO and OFF butto... simultaneously.*

Solar sensor

44 At the centre top of the facia panel ... the solar sensor cover forwards to relea... from the facia **(see illustration)**.

45 Disconnect the wiring and remov... anti-theft LED **(see illustration)**.

46 With the cover on the bench, de... and twist the solar sensor anti-clockwi... remove it from the cover **(see illustration)**.

47 Refitting is a reversal of removal ... on completion the ACC system will re...

9.40 Remove the climate control unit . . .

9.41 . . . and disconnect the wiring

9.44 Slide

calibrating ... buttons sim...

Interior

48 Carefu... with a scr...

49 Undo ... from the ...

50 Disco...

51 Refit... on comp... calibrati... buttons ...

Mixed

Driver

52 Re... the scr... and dis...

53 Pu... leadin...

54 R... as de...

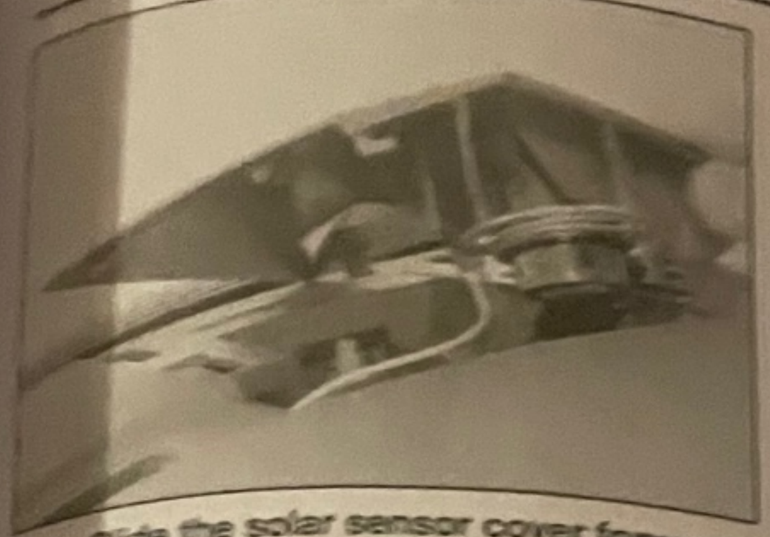
55 D... then ... remo... be r... on r...

56 ... on ... cal... bu...

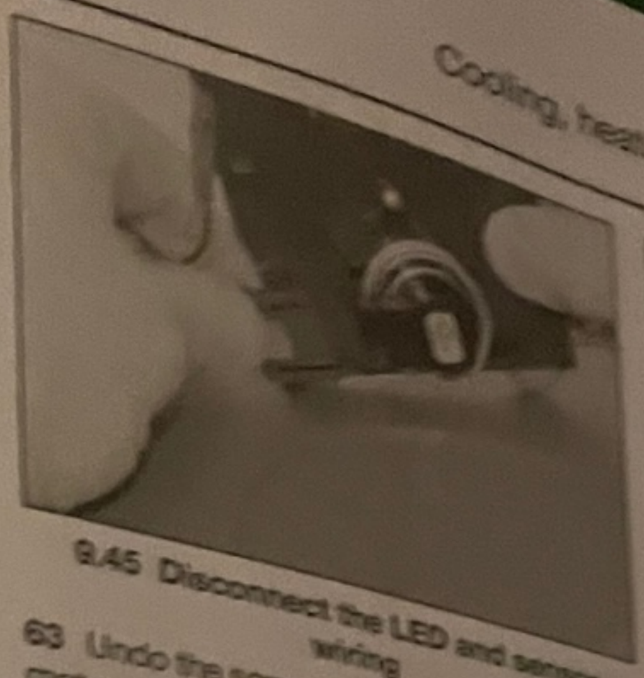
Pa...

57 ... co...

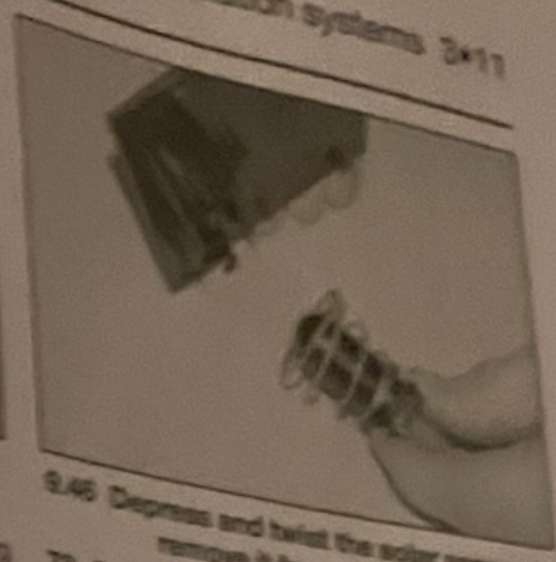
5... le...



9.44 Slide the solar sensor cover forwards and lift from the facia



9.45 Disconnect the LED and sensor wiring



9.46 Depress and twist the solar sensor to remove it from the cover

calibrating, by pressing the AUTO and OFF buttons simultaneously.

Interior temperature sensor

48 Carefully prise out the roof console lens with a screwdriver.
49 Undo the screw and remove the sensor from the clips.
50 Disconnect the wiring.
51 Refitting is a reversal of removal, but on completion the ACC system will require calibrating, by pressing the AUTO and OFF buttons simultaneously.

Mixed air sensor

Driver's side

52 Remove the facia lower trim panel, then undo the screws and remove the datalink connector and disconnect the floor lighting wiring.
53 Pull out the sensor from the air duct leading to the lower panel.
54 Remove the audio unit and control panel as described in Chapter 12 and this Section.
55 Disconnect the black upper wiring plug, then note the locations of the sensor pins and remove them from the connector. **Note:** *It may be necessary to cut the wires and fit new ones on refitting.*
56 Refitting is a reversal of removal, but on completion the ACC system will require calibrating, by pressing the AUTO and OFF buttons simultaneously.

Passenger's side

57 Remove the glovebox and the centre console side trims as described in Chapter 11.
58 Pull out the sensor from the air duct leading to the lower panel.
59 Remove the audio unit and control panel as described in Chapter 12 and this Section.
60 Disconnect the grey lower wiring plug, then note the locations of the sensor pins and remove them from the connector. **Note:** *It may be necessary to cut the wires and fit new ones on refitting.*
61 Refitting is a reversal of removal, but on completion the ACC system will require calibrating, by pressing the AUTO and OFF buttons simultaneously.

Air distribution stepping motor

62 Remove the glovebox and the centre console side trims as described in Chapter 11.
63 Undo the screws and remove the stepping motor.
64 Disconnect the wiring.
65 Refitting is a reversal of removal, but on completion the ACC system will require calibrating, by pressing the AUTO and OFF buttons simultaneously.

Air blending stepping motor

Driver's side

66 Set the air blending control to MAX HEAT or MAX COLD before commencing work.
67 Remove the facia lower trim panel, then undo the screws and remove the datalink connector and disconnect the floor lighting wiring.
68 Disconnect the wiring.
69 Undo the screws and withdraw the air blending stepping motor.
70 Refitting is a reversal of removal, but when fitting the stepping motor, hold the flap by the floor air duct to prevent the flap coming out of its mounting. On completion calibrate the ACC system by pressing the AUTO and OFF buttons simultaneously.

Passenger's side

71 Set the air blending control to MAX HEAT or MAX COLD before commencing work.
72 Remove the glovebox and the centre console side trims as described in Chapter 11.
73 Disconnect the wiring.
74 Undo the screws and withdraw the air blending stepping motor.
75 Refitting is a reversal of removal, but on completion the ACC system will require calibrating, by pressing the AUTO and OFF buttons simultaneously.

Heater blower motor control unit

Note: *The following sub-section describes removal of the control unit on a left-hand drive model. The procedure is similar for a right-hand drive model.*
76 The control unit is located on the right-hand side of the heater assembly. First, remove the facia lower trim panel from the driver's side, then undo the screws and remove the diagnostic/datalink connector and disconnect the floor lighting wiring.
77 Remove the accelerator pedal assembly (see Chapter 4A).
78 Remove the glovebox as described in Chapter 11.
79 Disconnect the two front wiring plugs located above the pollen filter. Detach the plugs from the plate and cut the plastic cable-tie.
80 Temporarily switch on the ignition and set the air recirculation flap to OFF, then switch off the ignition.
81 Remove the windscreen wiper arms (see Chapter 12), and remove the rubber seals from the spindles.
82 Pull off the weatherstrip located at the rear of the engine compartment, then undo the screws and remove the scuttle cover by lifting its front edge and pulling it from the rear retaining clips.
83 Remove the wiper motor and linkage as described in Chapter 12.
84 Unscrew the nuts then undo the frame from around the blower motor.
85 Unbolt and remove the wiper arm bracket.
86 Release the wiring harness from the blower motor cover.
87 Unbolt and remove the blower motor cover by lifting it to one side.
88 Lift out the blower motor sufficient to disconnect the wiring. Also cut the plastic cable-tie and release the wiring.
89 Note the location of the wiring harness on the blower motor control unit, then pull it up together with the rubber seal and cut the plastic cable-tie.
90 Unbolt and remove the control unit.
91 Refitting is a reversal of removal.

10 Air conditioning system – general information and precautions

1 Air conditioning is available as an option on all models. It enables the temperature of air inside the car to be lowered, and also dehumidifies the air, which makes for rapid demisting and increased comfort.
2 The cooling side of the system works in the same way as a domestic refrigerator. Refrigerant gas is drawn into a belt-driven compressor, and passes into a condenser mounted in front of the radiator, where it loses heat and becomes liquid. The liquid passes through a receiver

10.5a Low-pressure service port . . .

10.5b . . . and high-pressure service port

and expansion valve to an evaporator, where it changes from liquid under high pressure to gas under low pressure. This change is accompanied by a drop in temperature, which then cools the evaporator. The refrigerant returns to the compressor, and the cycle begins again.

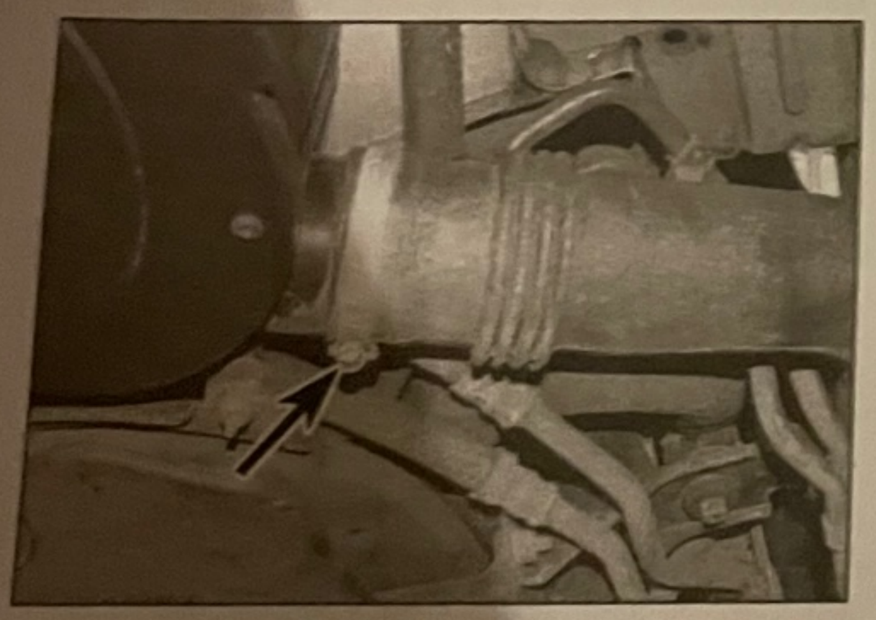
3 Air drawn through the evaporator passes to the air distribution unit. The air conditioning system is switched on with the switch located on the heater panel.

4 The compressor operation is controlled by an electromagnetic clutch on the drive pulley. Any problems with the system should be referred to a Saab dealer.

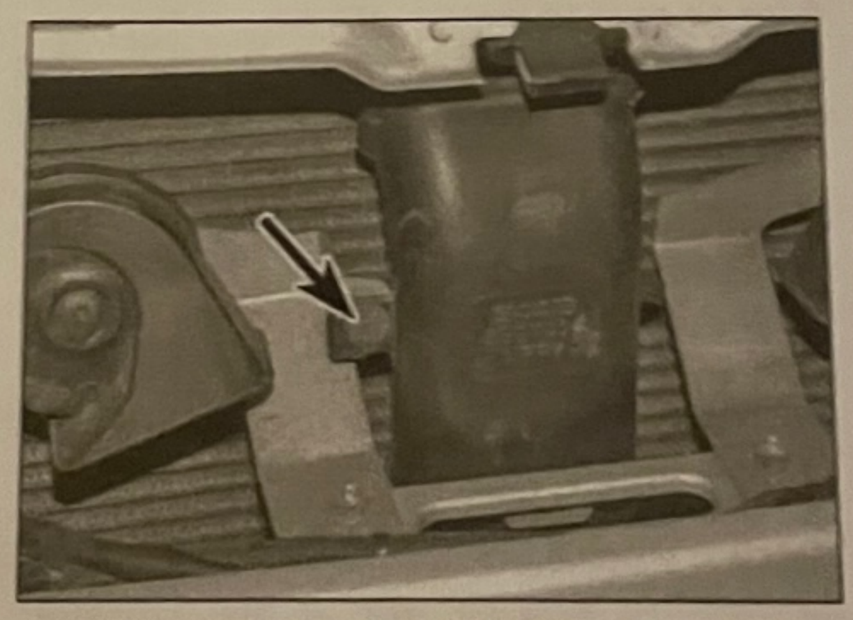
5 The air conditioning refrigerant circuit service ports are located in front of the power steering reservoir on the right-hand side of the engine compartment on the inner wing panel and at the front left-hand corner in the front cross-panel (see illustrations).

6 When working on the air conditioning system, it is necessary to observe special precautions. If for any reason the system must be disconnected, entrust this task to your Saab dealer or a refrigeration engineer.

Warning: The refrigeration circuit contains a liquid refrigerant under pressure, and it is therefore dangerous to disconnect any part of the system without specialised knowledge and equipment. The refrigerant is potentially dangerous, and should only be handled by qualified persons. If it is splashed onto the skin, it can cause frostbite. It is not itself poisonous, but in the presence of a naked flame (including a cigarette) it forms a poisonous gas. Uncontrolled discharging of the refrigerant is dangerous, and potentially damaging to the environment. Do not operate the air conditioning system if it is known to be short of refrigerant, as this may damage the compressor.



11.6a Slacken the retaining clip . . .



11.6b . . . and undo the retaining bolt

11.7a Undo the right-hand mounting bolt . . .

11.7b . . . and left-hand bolt from the power steering fluid cooler pipe

11 Air conditioning system components – removal and refitting

Warning: Do not attempt to [illegible] refrigerant circuit. Refer to the [illegible] given in Section 10.

1 These following operations [illegible] carried out after discharging the [illegible] This will need to be carried out [illegible] dealer or suitably-equipped specialist.

2 If necessary for access to any [illegible] components, the compressor [illegible] and moved aside, without disconnecting [illegible] flexible hoses, after removing the [illegible] (see Chapter 1A or 1B).

Condenser

Removal

3 Have the refrigerant circuit evacuated [illegible] suitably-equipped specialist.

4 Raise the front of the vehicle and [illegible] it securely on axle stands (see Jacking and vehicle support).

5 Remove the front bumper as described in Chapter 11.

6 Slacken the securing clip and disconnect the air intake hose from the air filter housing. Then undo the retaining bolt and remove the air intake hose from the front of the radiator (see illustrations).

7 Undo the power steering fluid cooler mounting bracket bolts and move the cooler to one side, taking care not to damage the pipes (see illustrations).

8 Disconnect the wiring connector from the switch on the right-hand side of the condenser (see illustration).

9 Undo the bolts and disconnect the refrigerant pipes from the receiver/drier (see illustration). Plug the openings to prevent contamination.

10 Undo the bolts securing the condenser to the intercooler, and then undo the two rubber mounting retaining nuts and withdraw the condenser out from under the front of the car (see illustrations).

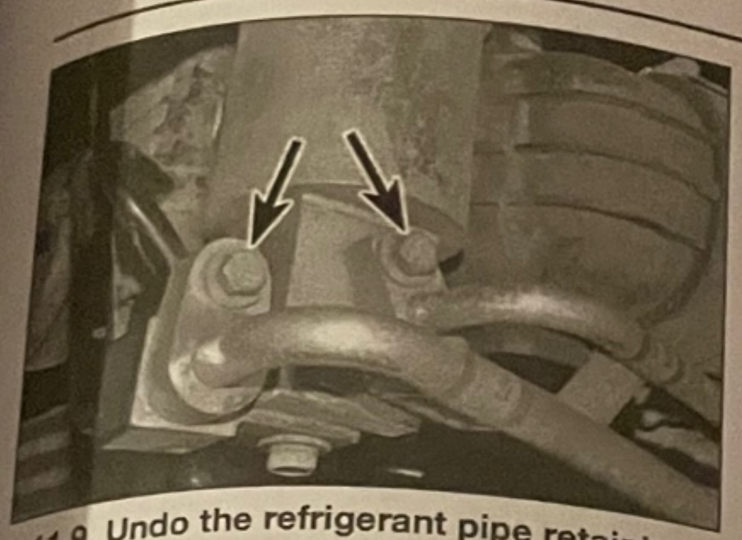
Refitting

11 Refitting is a reversal of removal, but the following points:

11.7a Undo the right-hand mounting bolt . . .

11.7b . . . and left-hand bolt from the power steering fluid cooler pipe

11.8 Disconnect the wiring connector to the switch



11.9 Undo the refrigerant pipe retaining bolts

a) Renew the pipe connection's O-ring seals.
b) Tighten the fasteners to the specified torque where given.
c) Have the refrigerant recharged by a suitably-equipped specialist.

Compressor

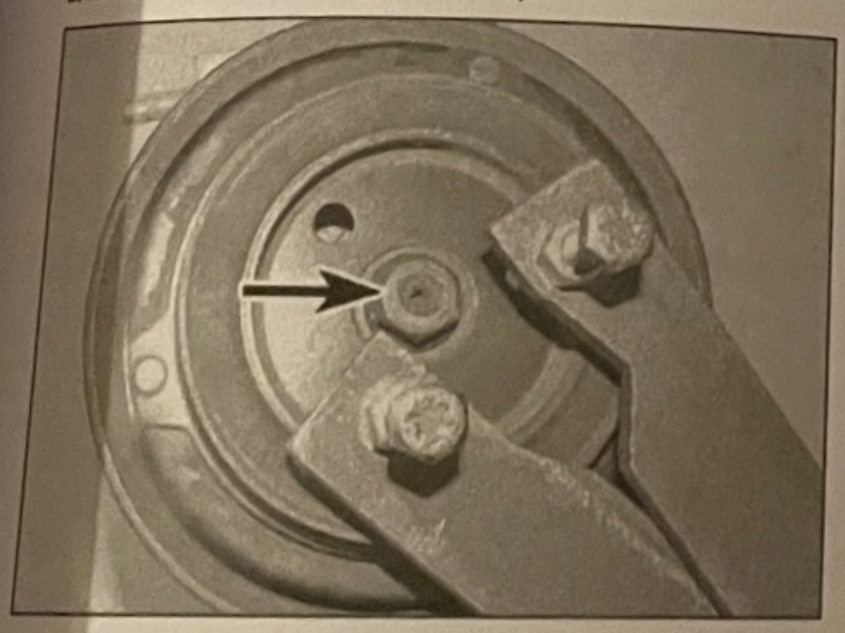
Removal

12 Have the refrigerant circuit evacuated by a suitably-equipped specialist.

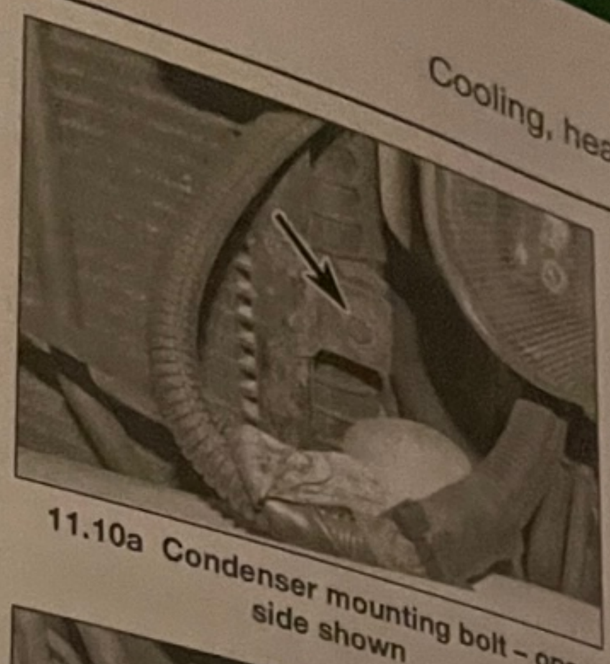
13 Raise the front of the vehicle and support it securely on axle stands (see *Jacking and vehicle support*). Undo the fasteners and remove the undershield beneath the radiator, and the one below the engine.

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

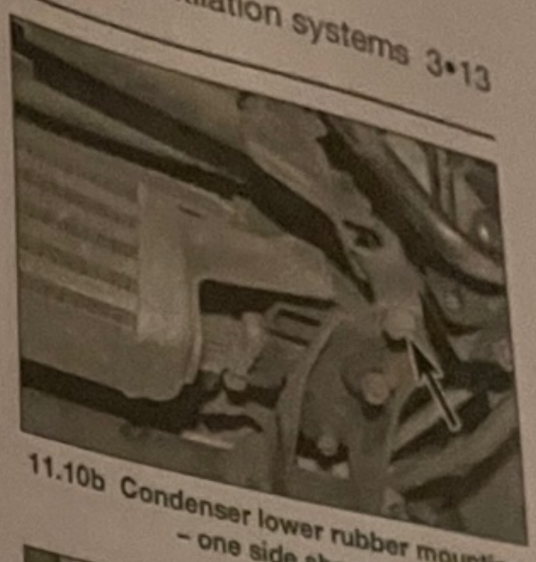
15 Where applicable, undo the screws/clamps and remove the charge air pipe attached to the engine sump.



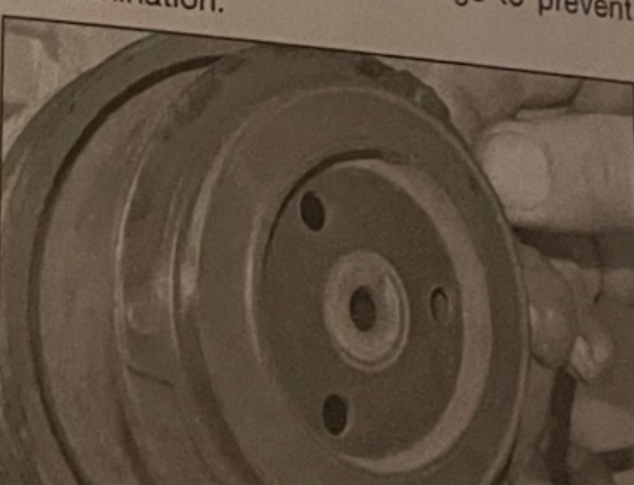
11.19a Home-made tool used to hold the cover whilst slackening the nut (arrowed)



11.10a Condenser mounting bolt – one side shown



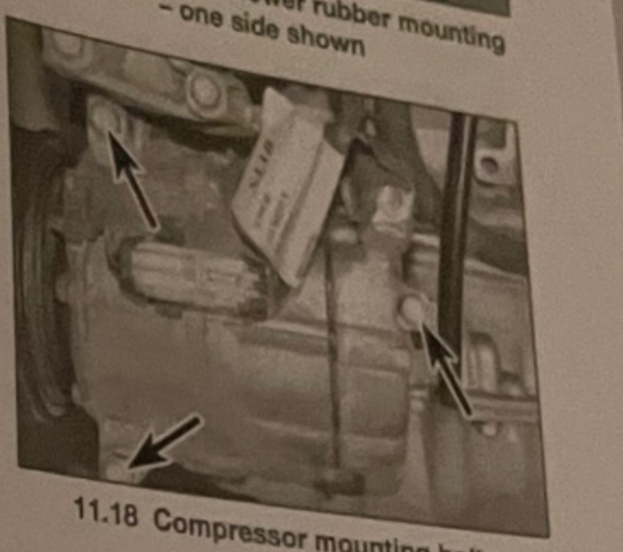
11.10b Condenser lower rubber mounting – one side shown



11.17 Refrigerant pipe securing bolts to compressor

16 Disconnect the wiring connector from the compressor.

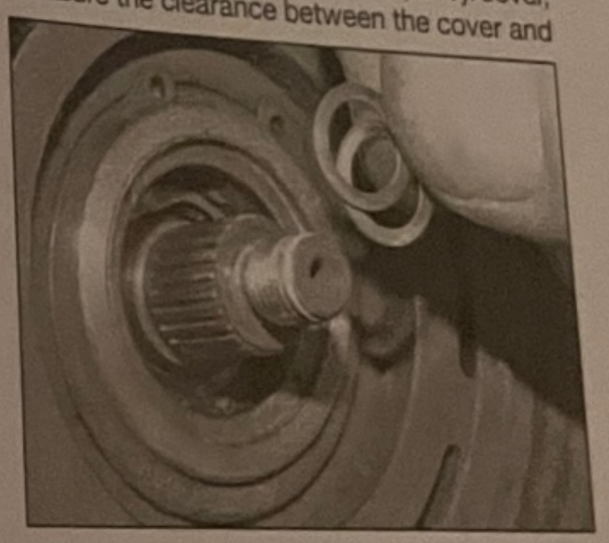
17 Undo the fastener and disconnect the refrigerant pipes from the compressor **(see illustration)**. Plug the openings to prevent contamination.



11.18 Compressor mounting bolts

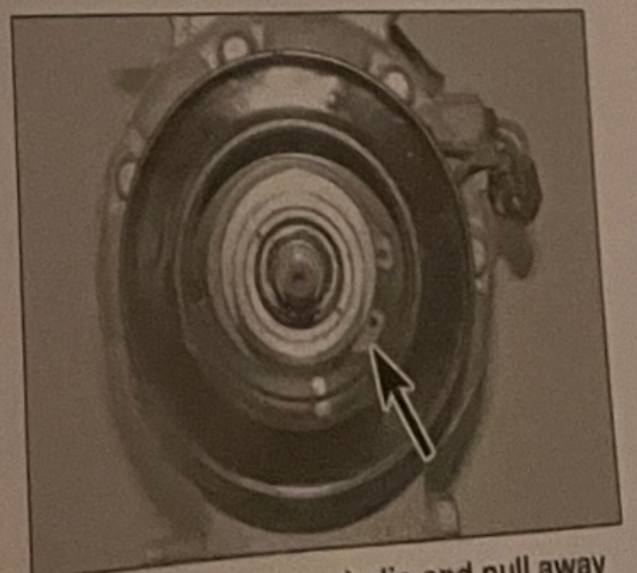
18 Undo the retaining bolts and remove the compressor **(see illustration)**.

19 If required, undo the nut and pull the drive pulley and clutch from the compressor **(see illustrations)**. When refitting the pulley/cover, measure the clearance between the cover and

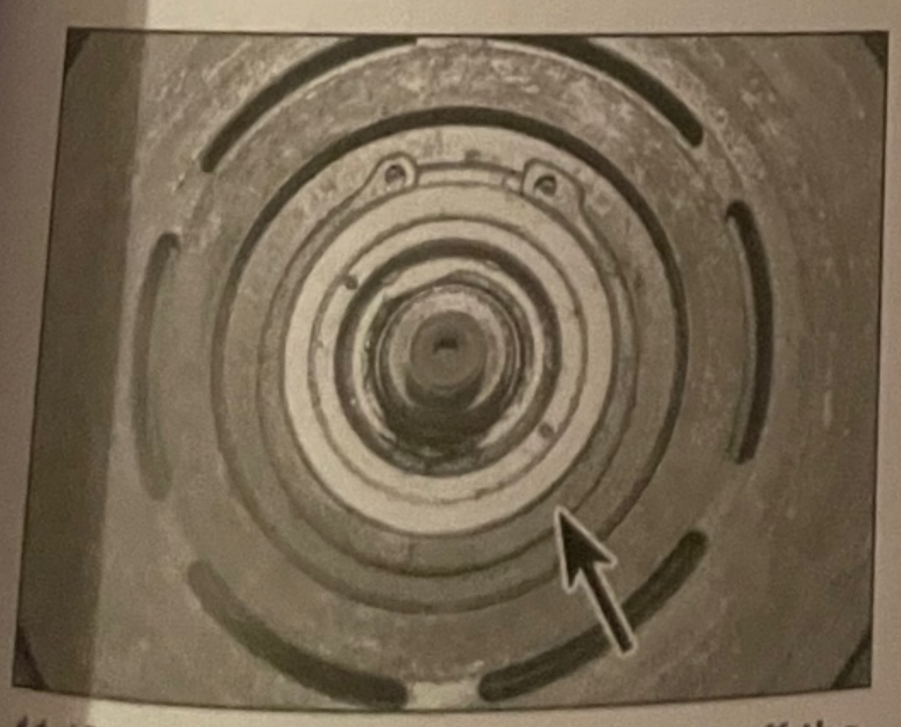


11.19c . . . and recover the shims behind it

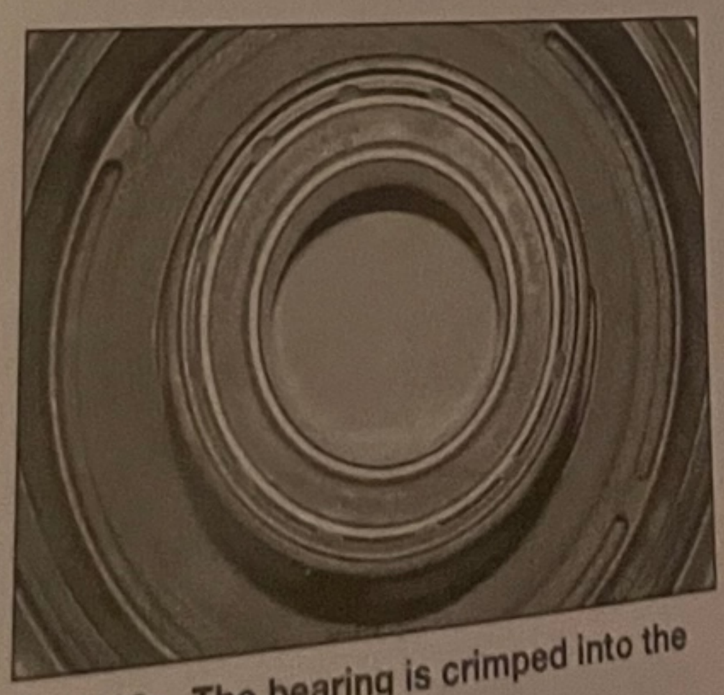
11.19b Remove the cover . . .



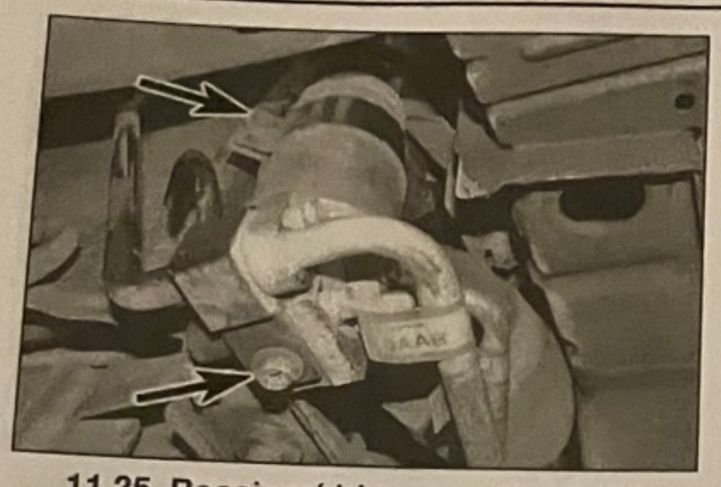
11.19f Remove the circlip and pull away the electromagnetic clutch



11.19d Remove the circlip, and pull off the friction disc/pulley and bearing



11.19e The bearing is crimped into the pulley



11.25 Receiver/drier mounting bolts

the pulley – the correct specification is 0.5 ± 0.15 mm. If necessary, adjust the clearance by adding or removing shims behind the cover.

Refitting

20 Refitting is a reversal of removal, noting the following points:

a) Renew the refrigerant pipe connection seals.
b) Tighten all fasteners to the specified torque where given.
c) Have the refrigerant circuit recharged by a suitably-equipped specialist.

Receiver/drier

Removal

21 Have the refrigerant circuit evacuated by a suitably-equipped specialist.

22 The receiver/drier located at the left-hand side front of the condenser.

23 Remove the front bumper as described in Chapter 11.

24 Undo the bolts and disconnect the refrigerant pipes from the receiver/drier **(see illustration 11.9)**. Plug the open pipes to prevent contamination.

25 Undo the two mounting bracket bolts and remove the receiver/drier **(see illustration 11.25)**.

Refitting

26 Refitting is a reversal of removal, noting the following points:

a) Renew the refrigerant pipe connection O-ring seal.
b) Tighten all fasteners to the specified torque where given.
c) Have the refrigerant circuit recharged by a suitably-equipped specialist.