






# Chapter 3

## Cooling, heating and ventilation systems

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### Degrees of difficulty

<p><b>Easy</b>, suitable for novice with little experience</p> 	<p><b>Fairly easy</b>, suitable for beginner with some experience</p> 	<p><b>Fairly difficult</b>, suitable for competent DIY mechanic</p> 	<p><b>Difficult</b>, suitable for experienced DIY mechanic</p> 	<p><b>Very difficult</b>, suitable for expert DIY or professional</p> 
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### Specifications

#### General

Expansion tank cap opening pressure	1.0 bars
Antifreeze type	See end of <i>Weekly checks</i>
Cooling system capacity	See Chapter 1A or 1B Specifications

#### Thermostat

Opening temperatures:	
3.5 litre petrol and 200 TDi engines	82°C
3.9 litre petrol and 300 TDi engines	88°C

#### Torque wrench settings

	Nm	lbf ft
Coolant pump nut and bolts (diesel)	26	19
Coolant pump housing bolts (petrol)*	28	21
Cooling fan mounting bolts	35	26
Radiator oil/fluid cooler unions	30	22
Thermostat housing bolts	28	21

\*Long bolts must be coated with thread-locking fluid - see text

### 1 General information and precautions

#### General information

The cooling system is of pressurised type, comprising a belt-driven coolant pump, an aluminium crossflow radiator, the cooling fan, and a thermostat. The radiator incorporates an oil cooler on diesel engines; on petrol engines, a coolant supply is taken to a heat exchanger on the oil filter mounting.

The system functions as follows. Cold coolant from the radiator passes through the

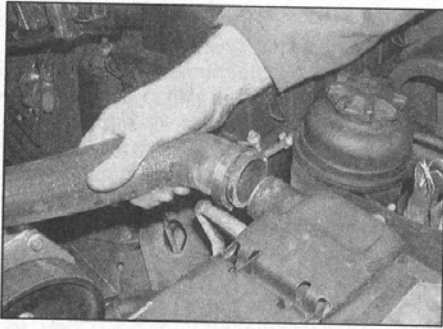
hose to the coolant pump, where it is pumped around the cylinder block and head passages. After cooling the cylinder bores, combustion surfaces and valve seats, the coolant reaches the underside of the thermostat, which is initially closed. The coolant passes through the heater, and is returned via the cylinder block to the coolant pump.

When the engine is cold, the coolant circulates only through the cylinder block, cylinder head(s), expansion tank and heater. When the coolant reaches a predetermined temperature, the thermostat opens, and the coolant passes through 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. Once it has passed through the radiator, the coolant is cooled and the cycle is repeated.

The cooling fan is driven via a viscous coupling. The viscous coupling varies the fan speed, according to engine temperature. At low temperatures, the coupling provides very little resistance between the fan and pump pulley, so only a slight amount of drive is transmitted to the cooling fan. As the temperature of the coupling increases, so does its internal resistance, therefore increasing drive to the cooling fan.

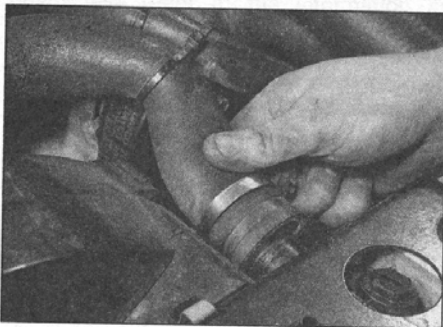
Refer to Section 11 for information on the air conditioning system.



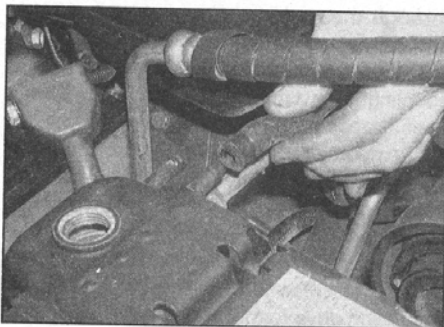
2.3 Disconnecting the radiator top hose (petrol model)

**Precautions**

**Warning:** Do not attempt to remove the expansion tank filler cap, nor 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 can be 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.



3.4a Disconnecting the top hose (diesel model)



3.4b Disconnecting the expansion tank hose - petrol model...

**Warning:** Do not allow antifreeze to come into contact with skin or 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.

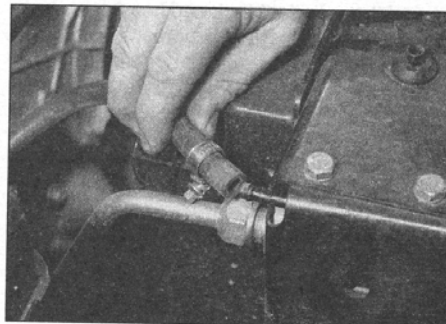
**Warning:** Refer to Section 11 for precautions to be observed when working on models with air conditioning.

**2 Cooling system hoses - disconnection and renewal**

**Note:** Refer to the warnings given in Section 1 of this Chapter before proceeding.

- 1 If the checks described in Chapter 1A or 1B reveal a faulty hose, it must be renewed as follows.
- 2 First drain the cooling system (see the relevant part of Chapter 1). If the coolant is not due for renewal, it may be re-used if it is collected in a clean container.
- 3 To disconnect a hose, use a screwdriver to slacken the clips, then move them along the hose, clear of the relevant inlet/outlet union. Carefully work the hose free (see illustration). The hoses can be removed with relative ease when new - on an older vehicle, they may have stuck.
- 4 If a hose proves stubborn, try to release it by rotating it on its unions before attempting to work it off. Gently prise the end of the hose with a blunt instrument (such as a flat-bladed screwdriver), but do not apply too much force, and take care not to damage the pipe stubs or hoses. Note in particular that the radiator hose unions are fragile; do not use excessive force when attempting to remove the hoses.

**HAYNES HINT** If all else fails, cut the hose with a sharp knife, then slit it so that it can be peeled off in two pieces. While expensive, this is preferable to buying a new radiator. Check first, however, that a new hose is readily available.



3.4c ... disconnecting the expansion tank hose - diesel model

5 Before fitting a hose, make sure the pipe unions are clean. On an older engine, there is often a build-up of crusty white deposits, which should be cleaned off to provide a better seal.

6 When fitting a hose, first slide the clips onto the hose, then work the hose into position. If clamp-type clips were originally fitted, it is a good idea to replace them with screw-type clips when refitting the hose. If the hose is stiff, use a little washing-up liquid as a lubricant, or soften the hose by soaking it in hot water.

7 Work the hose into position, checking that it is correctly routed, then slide each clip along the hose until it passes over the flared end of the relevant inlet/outlet union, before tightening the clips securely.

8 Refill the cooling system with reference to the relevant part of Chapter 1.

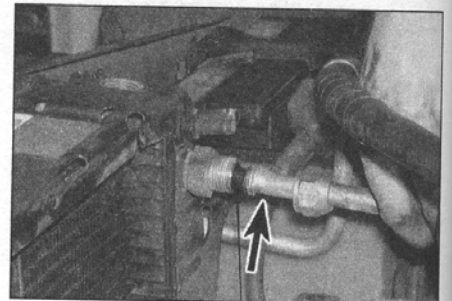
9 Check thoroughly for leaks as soon as possible after disturbing any part of the cooling system.

**3 Radiator - removal, inspection and refitting**

**HAYNES HINT** If leakage is the reason for wanting to remove the radiator, bear in mind that minor leaks can be often be cured using a radiator sealant with the radiator in situ.

**Removal**

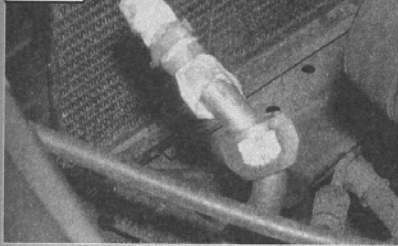
- 1 Disconnect the battery negative lead.
- 2 Drain the cooling system as described in the relevant part of Chapter 1.
- 3 Remove the cooling fan and cowl as described in Section 5.
- 4 Slacken the retaining clips, and detach the expansion tank hose, and the top and bottom hoses from the radiator (see illustrations).
- 5 Slacken the union nuts and disconnect the engine oil cooler pipes from the radiator (see illustration). Be prepared for some oil or coolant spillage as the pipes are disconnected; plug or cap the pipe and cooler



3.5 ... then slacken the union nut and disconnect the oil cooler pipe (arrowed) from the radiator



**HAYNES**  
**HINT**



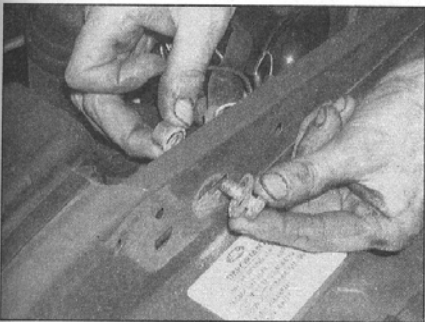
**Cut the finger from an old pair of rubber gloves, and secure it to the cooler pipe with a strong elastic band, to prevent loss of oil/fluid**

unions, to minimise fluid loss and to prevent dirt entering the lubrication system (see **Haynes Hint**).

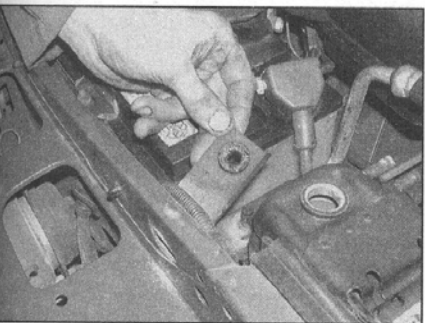
6 On models with automatic transmission, slacken the union nuts and disconnect the fluid pipes from the radiator (see illustration). Be prepared for fluid spillage, and be sure to plug or cap over the open unions, to prevent dirt from entering the transmission.

7 On diesel engines, slacken the retaining clips, and disconnect both hoses from the intercooler (see illustration).

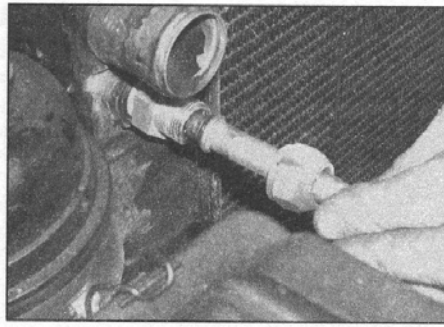
8 Unscrew the mounting bracket retaining nuts and bolts, then free both mounting brackets from the radiator, and recover the upper mounting rubbers. Support the left-hand mounting bracket so that the fluid does



**3.8a Undo the radiator mounting bracket nuts and bolts ...**



**3.8c ... and remove the right-hand mounting bracket**



**3.6 Disconnect the transmission fluid cooler pipes from the radiator**

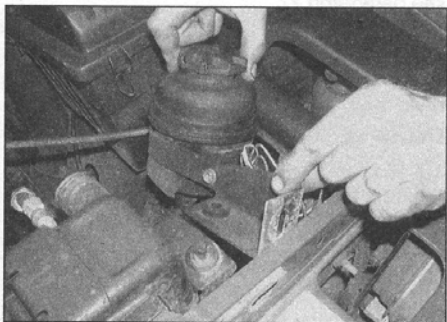
not spill from the power steering reservoir (see illustrations).

9 Lift the radiator assembly out from the engine compartment, and recover its lower mounting rubbers (see illustrations). On vehicles with air conditioning, in order to remove the radiator, it may first be necessary to undo the air conditioning compressor mounting bolts and reposition the compressor slightly to gain the necessary clearance required - **DO NOT disconnect any of the refrigerant lines**.

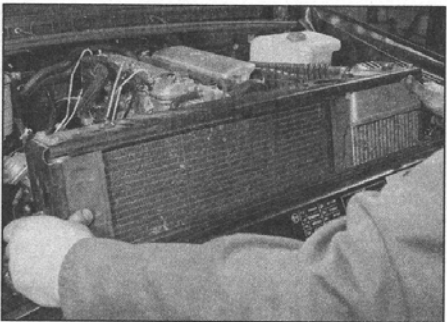
10 Examine the mounting rubbers for signs of damage or deterioration, and renew if necessary.

#### **Refitting**

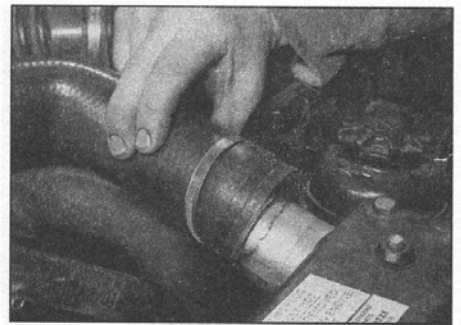
11 Fit the lower mounting rubbers, then manoeuvre the radiator assembly into position, making sure that its lower mounting pegs are correctly engaged.



**3.8b ... move the power steering fluid reservoir and left-hand bracket clear ...**



**3.9a Lifting the radiator assembly out of position - diesel model ...**



**3.7 Slacken the retaining clips, and disconnect the hoses from the intercooler**

12 Install the upper mounting rubbers and mounting brackets, and securely tighten their retaining nuts and bolts.

13 Reconnect the cooling system and intercooler hoses (as applicable), and securely tighten their retaining clips.

14 Reconnect the oil cooler pipes, and securely tighten their union nuts. Where applicable, similarly reconnect the automatic transmission fluid cooler pipes.

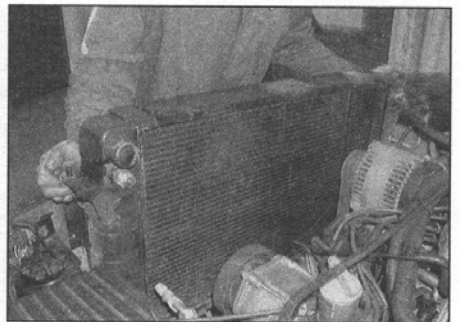
15 Refit the cooling fan and cowl as described in Section 5, then refill the cooling system as described in the relevant part of Chapter 1.

#### **4 Thermostat - removal, testing and refitting**

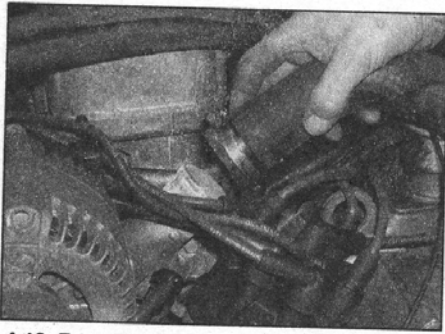
1 As the thermostat ages, it will become slower to react to changes in water temperature. Ultimately, the unit may stick in the open or closed position, and this causes problems. A thermostat which is stuck open will result in a very slow warm-up; a thermostat which is stuck shut will lead to rapid overheating.

2 Before assuming the thermostat is to blame for a cooling system problem, check the coolant level. If the system is draining due to a leak, or has not been properly filled, there may be an airlock in the system (see *Coolant renewal* in the relevant part of Chapter 1).

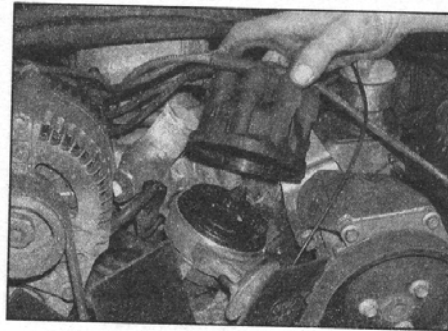
3 If the engine seems to be taking a long time to warm up (based on heater output or temperature gauge operation), the thermostat is probably stuck open.



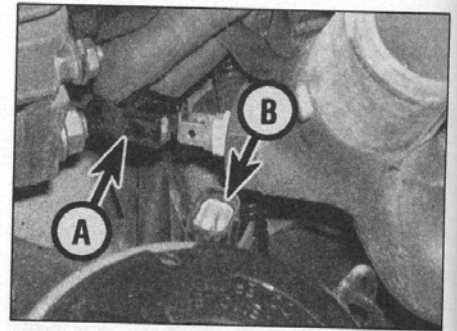
**3.9b ... and petrol model**



4.13 Removing the radiator top hose from the thermostat housing



4.14 Take off the distributor cap



4.15 Disconnect the temperature switch (A) and distributor wiring plug (B)

4 Equally, a lengthy warm-up period might suggest that the thermostat is missing - it may have been removed or inadvertently omitted by a previous owner or mechanic. Don't drive the vehicle without a thermostat - exhaust emissions and fuel economy will suffer.

5 If the engine runs hot, use your hand to check the temperature of the radiator top hose. If the hose isn't hot, but the engine is, the thermostat is probably stuck closed, preventing the coolant inside the engine from escaping to the radiator - renew the thermostat. Again, this problem may also be due to an airlock (see *Coolant renewal* in the relevant part of Chapter 1).

6 If the radiator top hose is hot, it means that the coolant is flowing and the thermostat is open. Consult the *Fault finding* section at the end of this manual to assist in tracing possible cooling system faults.

7 To gain a rough idea of whether the

thermostat is working properly when the engine is warming up, without dismantling the system, proceed as follows.

8 With the engine completely cold, start the engine and let it idle, while checking the temperature of the radiator top hose. Periodically check the temperature indicated on the coolant temperature gauge - if overheating is indicated, switch the engine off immediately.

9 The top hose should feel cold for some time as the engine warms up, and should then get warm quite quickly as the thermostat opens.

10 The above is not a precise or definitive test of thermostat operation, but if the system does not perform as described, remove and test the thermostat as described below.

### Removal

**Note:** A new thermostat housing gasket and sealing ring will be required on refitting - also see paragraph 27.

11 Disconnect the battery negative lead.

12 Drain the cooling system as described in the relevant part of Chapter 1, and proceed as described under the relevant sub-heading.

### Petrol engines

13 Slacken the retaining clip, and disconnect the top hose from the thermostat housing (see illustration).

14 Remove the distributor cap as described in Chapter 1A, Section 8 (see illustration).

15 On models with air conditioning, disconnect the wiring from the temperature switch screwed into the front of the thermostat cover. To improve access, also

disconnect the wiring plug on the distributor body (see illustration).

16 Slacken and remove the retaining bolts, recover the washers, and remove the thermostat housing cover from the engine (see illustrations).

17 Withdraw the thermostat from its housing, noting its fitted position, and recover its sealing ring (see illustrations).

### 200 TDi diesel engine

18 Slacken the retaining clip, and disconnect the coolant hose from the thermostat housing.

19 Slacken and remove the retaining bolts, and remove the thermostat housing cover from the engine. Recover the housing gasket, and discard it.

20 Withdraw the thermostat from its housing.

### 300 TDi diesel engine

21 Slacken the retaining clip, and disconnect the coolant hose(s) from the thermostat housing.

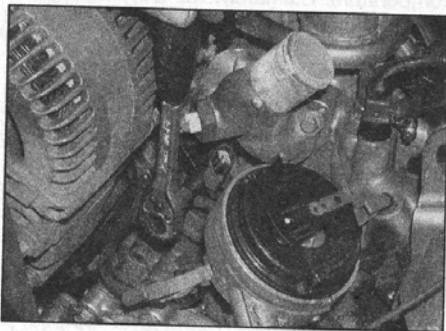
22 Disconnect the wiring connectors from the switches which are screwed into the underside of the thermostat cover (where fitted).

23 Slacken and remove the retaining bolts, and remove the thermostat housing cover from the engine (see illustration).

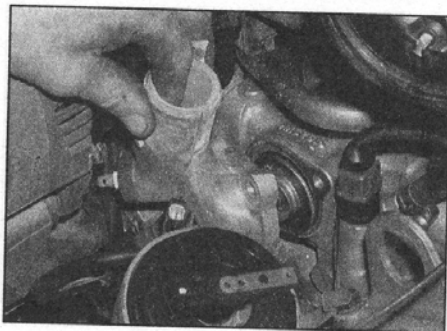
24 Withdraw the thermostat from its housing, and recover its sealing ring.

### Testing

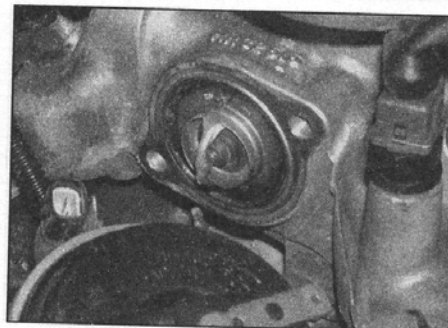
25 To test it fully, suspend the (closed) thermostat on a length of string in a container of cold water, with a thermometer beside it;



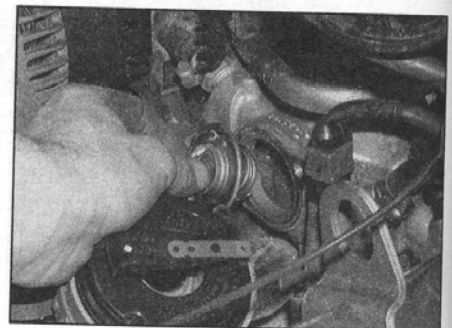
4.16a Slacken the housing cover bolts ...



4.16b ... then withdraw the cover for access to the thermostat

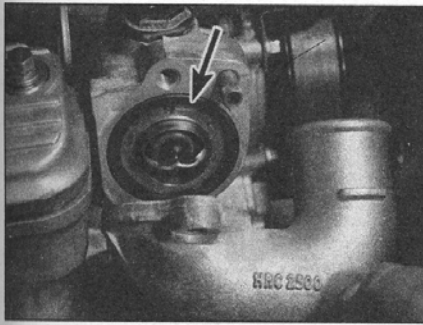


4.17a Note the correct fitted position of the thermostat ...



4.17b ... then remove it from the housing





**4.23** On 300 TDi engines, remove the housing cover then withdraw the thermostat and recover its sealing ring (arrowed)

ensure that neither touches the side of the container.

**26** Heat the water, and check the temperature at which the thermostat begins to open; compare this value with that specified. This value is also stamped on the thermostat body. It's difficult to check the fully-open temperature, because this occurs very near the boiling point of water at normal atmospheric pressure. If the temperature at which the thermostat began to open was as specified, then it is most likely that the thermostat's OK. Remove the thermostat and allow it to cool down; check that it closes fully.

**27** If the thermostat does not open and close as described, or if it sticks in either position, it must be renewed. Frankly, if there is any question about the operation of the thermostat, renew it - they are not expensive.

### Refitting

**28** Refitting is the reverse of the relevant removal procedure, using a new gasket/sealing ring (as applicable), and making sure that the thermostat is correctly seated in its housing (see illustration). Tighten the housing retaining bolts to the specified torque. On petrol engines, the jiggle pin/vent hole must be positioned uppermost. On completion, refill the cooling system as described in the relevant part of Chapter 1.

### 5 Cooling fan and viscous coupling - removal and refitting

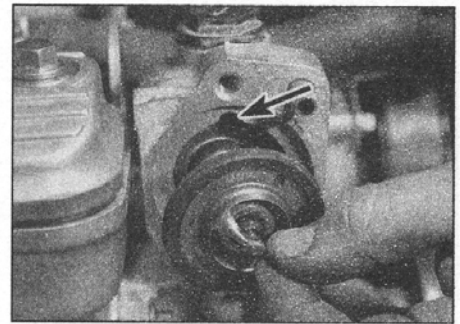
**Note:** A special slim open-ended spanner will be required to remove the fan and viscous coupling assembly. On the project vehicles seen, petrol engines had a 36 mm nut, and diesel engines a 32 mm nut.

### Removal

**1** Disconnect the battery negative lead.

**2** Where applicable, release the two wire clips and lift out the upper section of the fan cowl - this is not essential for removing the fan, but it will improve access (see illustrations).

**3** Hold the coolant pump pulley against rotation, by wedging a long screwdriver across two of the pulley bolts. Using the special open-ended spanner, unscrew the viscous coupling from the coolant pump/camshaft (see illustration). **Note:** On diesel engines, the viscous coupling has a



**4.28** On 300 TDi engines, ensure that the thermostat is correctly engaged with the housing cut-out (arrowed) so its TOP marking is uppermost

*left-hand thread - ie it unscrews clockwise.*

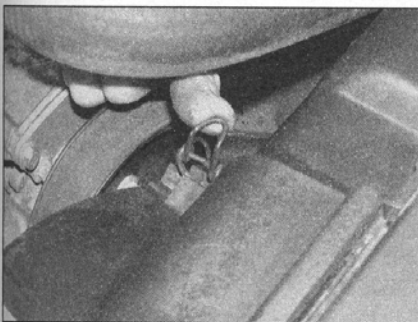
**4** On 200 TDi engines, remove the fan and coupling assembly, then undo the two upper retaining nuts, and manoeuvre the fan cowl out from the engine compartment.

**5** On all other engines, lift out the fan and coupling assembly. If necessary, undo the retaining nuts, release the remaining clips, and remove the remainder of the cowl (see illustrations).

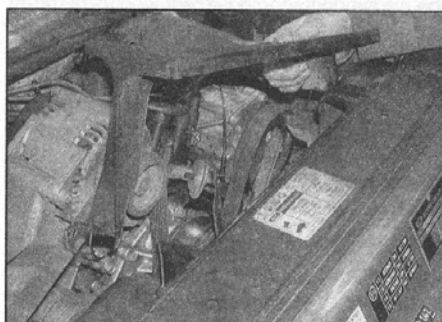
**6** On all models, if necessary, slacken and remove the retaining bolts, and separate the cooling fan from the coupling, noting which way around the fan is fitted.

### Refitting

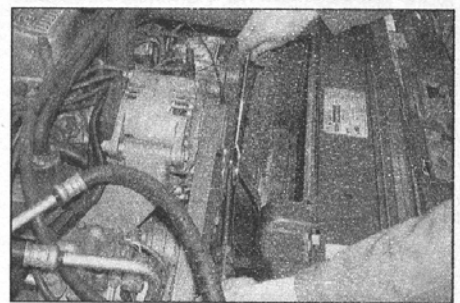
**7** Where necessary, refit the fan to the viscous coupling and tighten its retaining bolts to the specified torque. Make sure that



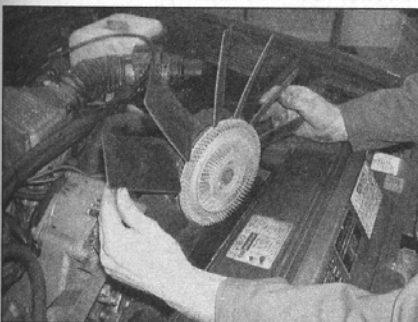
**5.2a** Release the two clips ...



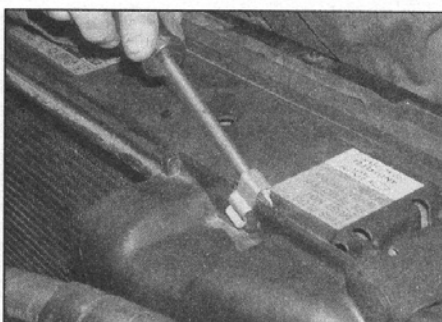
**5.2b** ... and lift out the fan cowl access panel



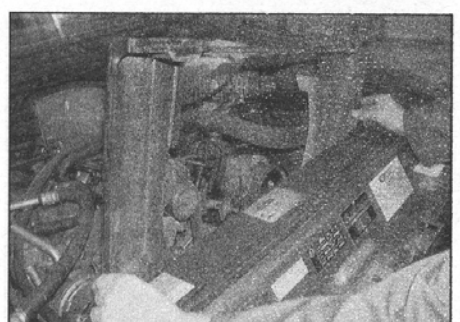
**5.3** Hold the pulley against rotation, and use a special cranked spanner to loosen the viscous fan nut



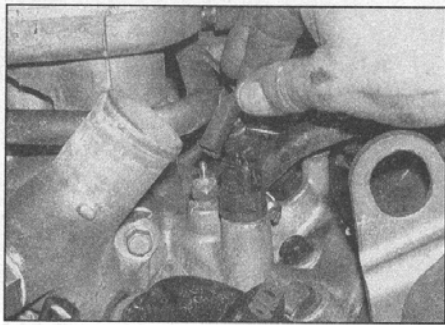
**5.5a** Removing the fan and viscous coupling



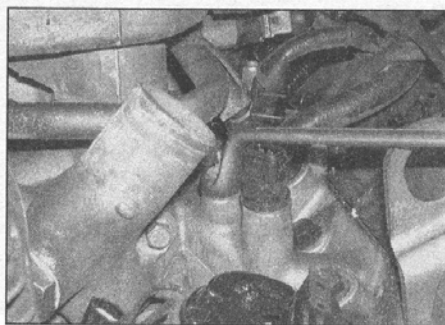
**5.5b** If necessary, release the clips ...



**5.5c** ... and remove the main cowl from the radiator



6.9a Disconnect the wiring plug . . .



6.9b . . . then unscrew the sender from its location (later petrol model shown) . . .



6.9c . . . and withdraw it

the fan is fitted the correct way round; the fan should be marked FRONT on one side, this side should face the radiator when the fan is installed. **Note:** *If the fan is fitted the wrong way round, the efficiency of the cooling system will be significantly reduced.*

**8** Further refitting is a reversal of removal. Bear in mind that, on diesel engines, the coupling is screwed on anti-clockwise.

**6 Cooling system electrical switches - testing, removal and refitting**



**Coolant temperature gauge sender**

**Testing**

**1** The coolant temperature gauge, mounted in the instrument panel, is fed with a stabilised voltage supply from the instrument panel feed (via the 'ignition' switch and a fuse), and its earth is controlled by the sender.

**2** The sender is screwed into the thermostat housing on diesel models, while petrol models have the sender screwed into the inlet manifold, behind the distributor (the smaller of the two plugs visible on fuel injection models). The sender contains a thermistor, which consists of an electronic component whose electrical resistance decreases at a predetermined rate as its temperature rises. When the coolant is cold, the sender resistance is high, current flow through the gauge is reduced, and the gauge needle

points towards the cold end of the scale. If the sender is faulty, it must be renewed.

**3** If the gauge develops a fault, first check the other instruments; if they do not work at all, check the instrument panel electrical feed. If the readings are erratic, there may be a fault in the voltage resistor, which will necessitate renewal of the printed circuit (see Chapter 13, Section 10). If the fault lies in the temperature gauge alone, check it as follows.

**4** If the gauge needle remains at the cold end of the scale, disconnect the sender wire, and earth it to the cylinder head. If the needle then deflects when the 'ignition' is switched on, the sender unit is proved faulty, and should be renewed. If the needle still does not move, remove the instrument panel (Chapter 13) and check the continuity of the wiring between the sender unit and the gauge, and the feed to the gauge unit. If continuity is shown, and the fault still exists, then the gauge is faulty, and the gauge unit should be renewed.

**5** If the gauge needle remains at the hot end of the scale when the 'ignition' is switched on, the sender unit is proved faulty and should be renewed. If the needle still does not move, check the remainder of the circuit as described previously.

**Removal**

**6** Either partially drain the cooling system to just below the level of the sender (see the relevant part of Chapter 1), or have ready a suitable plug which can be used to plug the sender aperture whilst it is removed. If a plug

is used, take great care not to damage the sender unit threads, and do not use anything which will allow foreign matter to enter the cooling system.

**7** On petrol models, remove the distributor cap as described in Chapter 1A, Section 8. Also disconnect the top hose from the thermostat housing, taking precautions against spillage if the cooling system has only been partially drained.

**8** Disconnect the battery negative lead.

**9** Disconnect the wiring from the sender, then unscrew the unit; recover the sealing washer (where fitted). On later petrol models, a 12 mm cranked spanner will be needed - if this is not available, it may be necessary to remove the injection system temperature sender for access (see illustrations).

**Refitting**

**10** If the sender unit was fitted with a sealing washer, fit a new washer. Where no washer was fitted, ensure that the sender threads are clean, and apply a smear of suitable sealant to them.

**11** Refit the sender, tightening it securely, and reconnect the wiring.

**12** Top-up the cooling system as described in the relevant part of Chapter 1.

**13** On completion, start the engine and check the operation of the temperature gauge. Also check for coolant leaks.

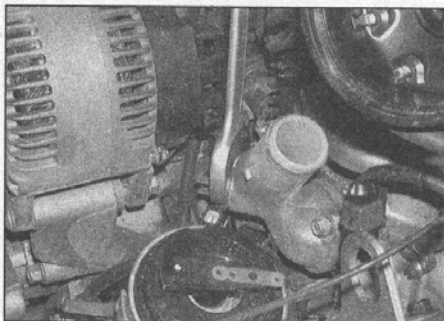
**Air conditioning system fan temperature switch**

**14** The switch screwed into the thermostat housing controls the fans for the air conditioning system, and can be removed as follows. *Do not attempt to remove the pressure switches which are fitted to the air conditioning refrigerant lines; these cannot be removed without first discharging the air conditioning system (see Section 11).*

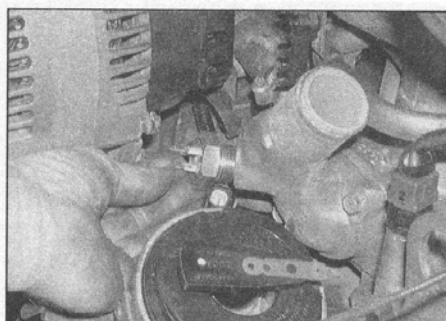
**15** To improve access, remove the upper section of the fan cowl and, on petrol models, the distributor cap (Chapter 1A, Section 8).

**16** Disconnect the wiring plug from the switch.

**17** To unscrew the switch from the housing, a large spanner is required. On the (petrol) project car, this proved to be a 1 1/8 in size, and access was still not easy (see illustrations). If the required spanner is not available, the best option is to remove the thermostat housing as

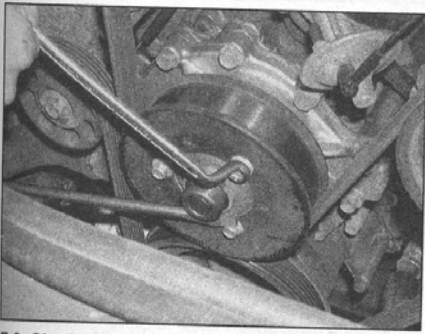


6.17a Using a large spanner, loosen . . .



6.17b . . . then unscrew and remove the air conditioning fan temperature switch





7.3 Slacken the coolant pump pulley bolts, using a screwdriver to prevent rotation

described in Section 4, grip the switch in a vice, and (effectively) unscrew the housing from the switch.

18 On refitting, coat the threads of the switch with a smear of suitable sealant, and tighten securely. If the thermostat housing had to be removed, refit it as described in Section 4, using a new gasket/sealing ring.

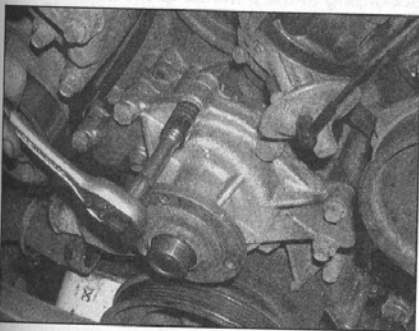
### Fuel injection system temperature switch

19 Refer to Chapter 4B, Section 6.

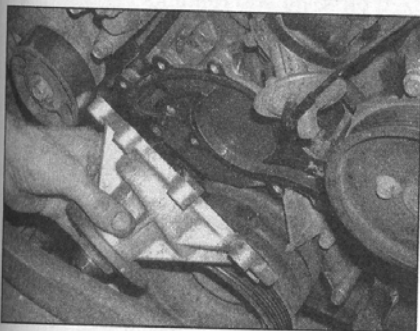
### 7 Coolant pump - removal and refitting

#### Removal

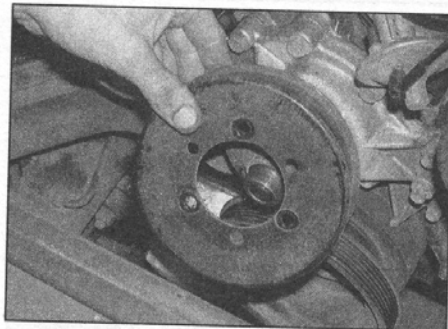
1 Drain the cooling system as described in



7.7 Slacken and remove the pump retaining bolts



7.8 Removing the coolant pump



7.5 Remove the pulley, noting its fitted orientation

Chapter 1A or 1B, and proceed as described under the relevant sub-heading.

#### Petrol engines

2 Remove the cooling fan and viscous coupling as described in Section 5.

3 Slacken, but do not remove, the bolts securing the pulley to the coolant pump. Hold the pulley against rotation using a large screwdriver between the pulley hub and one of the bolts (see illustration).

4 Remove the coolant (water) pump drivebelt as described in Chapter 1A, Section 16.

5 Unscrew the retaining bolts and remove the drive pulley, noting which way around it is fitted (see illustration).

6 Slacken the retaining clip, and disconnect the coolant hose from the pump (see illustration).

7 Evenly and progressively slacken and remove the pump retaining bolts (see illustration). Note each bolt's correct fitted location, as they are of different lengths and sizes. It was found that, on inspection, the location of the three long (11 mm fitting) bolts was obvious, and confusion is unlikely in practice.

8 Remove the pump assembly from the engine, and recover the gasket (see illustration).

#### 200 TDi diesel engine

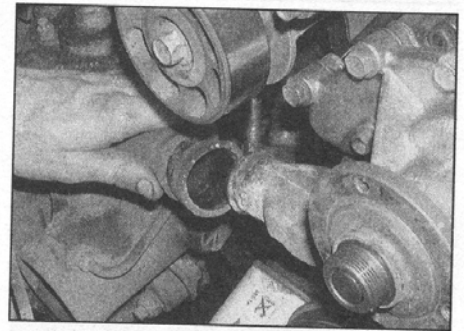
9 Remove the cooling fan and viscous coupling as described in Section 5.

10 Slacken the bolts securing the pulley to the coolant pump.

11 Remove the coolant pump drivebelt as described in Chapter 1B, Section 17.



7.21 On 300 TDi engines, unscrew the retaining bolts . . .



7.6 Slacken the hose clip, then disconnect the bottom hose from the pump

12 Unscrew the retaining bolts and remove the drive pulley, noting which way around it is fitted.

13 Slacken the retaining clip, and disconnect the coolant hose from the top of the pump.

14 Evenly and progressively slacken and remove the pump retaining nut and bolts. Note each bolt's correct fitted location, as they are of different lengths.

15 Remove the pump assembly from the engine, and recover the gasket.

#### 300 TDi diesel engine

16 To improve access, slacken the retaining clips, and remove the radiator top hose and the intercooler top hose.

17 Slacken the bolts securing the pulleys to the coolant pump and power steering pump.

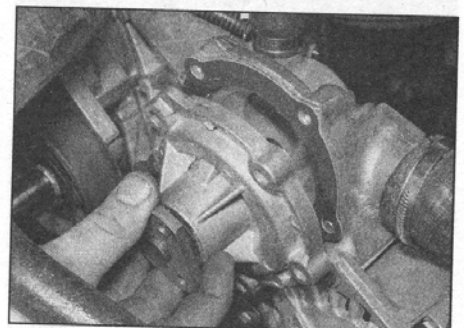
18 Remove the auxiliary drivebelt as described in Chapter 1, Section 17.

19 To improve access, undo the auxiliary drivebelt tensioner retaining nut, then slide the tensioner assembly off its retaining stud. Alternatively, the tensioner can be left in position, but this will mean the tensioner arm will have to be lifted to access the lower retaining bolts.

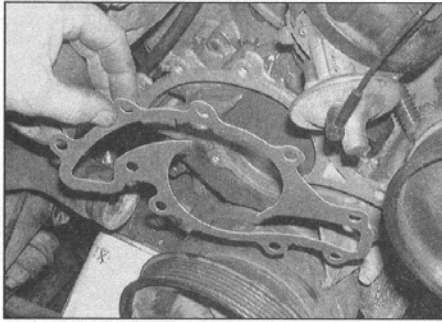
20 Unscrew the retaining bolts, and remove both the coolant pump and power steering pump drive pulleys, noting which way around each one is fitted.

21 Evenly and progressively slacken and remove the pump retaining nut and bolts. Note each bolt's correct fitted location, as they are of different lengths (see illustration).

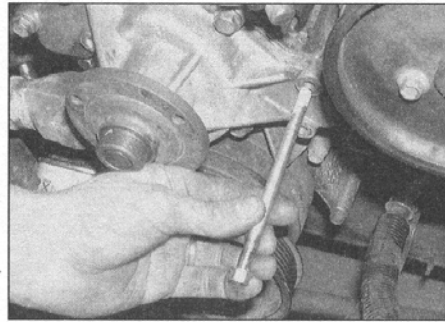
22 Remove the pump assembly from the engine, and recover the gasket (see illustration).



7.22 . . . and remove the coolant pump from the front of the engine



7.24 Use a little grease or sealant to stick the new gasket in position



7.26a Fit the coolant pump bolts - one of the long ones shown

## Refitting

### Petrol engines

23 Ensure that the pump and cylinder block mating surfaces are clean and dry.

24 Apply a smear of grease or sealant to the new pump gasket, and position it on the pump housing (see illustration).

25 Clean the threads of the long coolant pump retaining bolts (which pass through the housing and screw into the cylinder block) and apply a smear of suitable sealant to each one's threads. Land Rover recommend Loctite 572 thread lubricant-sealant, available from dealers.

26 Install the coolant pump and refit the retaining bolts, making sure that each one is installed in its correct position (see illustrations). Tighten all by hand, then go around in a diagonal sequence, and evenly and progressively tighten them to the specified torque setting.

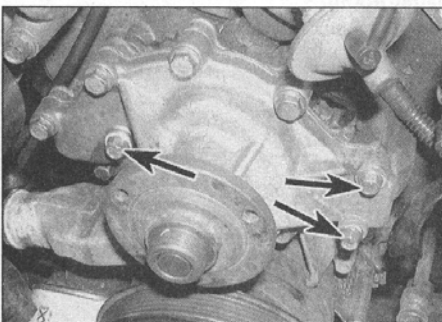
27 Reconnect the hose to the pump, and securely tighten its retaining clip.

28 Refit the drive pulley, making sure that it is the correct way around, then refit the drivebelt as described in Chapter 1A, Section 16. Once the belt is correctly tensioned, securely tighten the pulley retaining bolts.

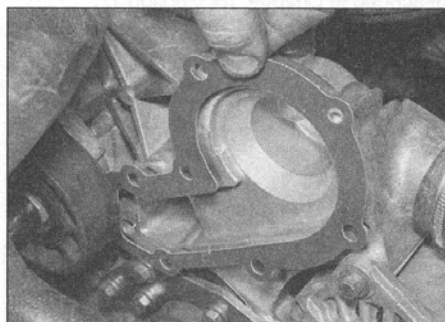
29 Refit the cooling fan and coupling as described in Section 5, then refill the cooling system as described in Chapter 1A.

### 200 TDi diesel engine

30 Ensure that the pump and cylinder block mating surfaces are clean and dry.



7.26b Locations (arrowed) of the three long bolts



7.37 On refitting, ensure that the housing mating surfaces are clean and dry, and fit a new gasket

31 Apply a smear of silicone grease to the new pump gasket, and position it on the pump housing.

32 Clean the threads of the long coolant pump retaining bolts (which pass through the housing and screw into the cylinder block) and apply a smear of suitable sealant to each one's threads.

33 Install the retaining bolts, making sure that each one is installed in its correct position. Also refit the retaining nut. Tighten all by hand, then go around in a diagonal sequence, and evenly and progressively tighten them to the specified torque setting.

34 Reconnect the hose to the top of the pump, and securely tighten its retaining clip.

35 Refit the drive pulley, making sure that it is the correct way around, then refit the drivebelt as described in Chapter 1B, Section 17. Once the belt is correctly tensioned, securely tighten the pulley retaining bolts.

36 Refit the cooling fan and coupling as described in Section 5, then refill the cooling system as described in Chapter 1B.

### 300 TDi diesel engine

37 Ensure that the pump and cylinder block mating surfaces are clean and dry, then fit a new gasket to the housing (see illustration).

38 Install the coolant pump and refit the retaining bolts, making sure that each one is installed in its correct position. Tighten all the bolts by hand, then go around in a diagonal sequence, and evenly and progressively tighten each one to the specified torque.

39 Refit the drive pulleys to the coolant and power steering pumps, making sure that both are fitted the correct way around.

40 Slide the tensioner assembly onto its stud. Make sure that the tensioner locating pins are correctly engaged with the mounting bracket, then refit the retaining nut and tighten it securely.

41 Refit the auxiliary drivebelt as described in Chapter 1B, Section 17, then securely tighten all the pulley retaining bolts.

42 Refit the intercooler and coolant hoses, and securely tighten their retaining clips.

43 Refill the cooling system as described in Chapter 1B.

## 8 Heating and ventilation system - general information

1 The heating/ventilation system consists of a four-speed blower motor, face-level vents in the centre and at each end of the fascia, and air ducts to the front footwells.

2 The control unit is located in the fascia, and the controls operate flap valves to deflect and mix the air flowing through the various parts of the heating/ventilation system. The flap valves are contained in the air distribution housing, which acts as a central distribution unit, passing air to the various ducts and vents.

3 Cold air enters the system through the grille at the rear of the engine compartment.

4 The airflow, which can be boosted by the blower, 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. If warm air is required, the cold air is passed through the heater matrix, which is heated by the engine coolant.

5 A recirculation lever 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.

## 9 Heater/ventilation components - removal and refitting

### Heater/ventilation control unit

#### Early models (pre-March 1994)

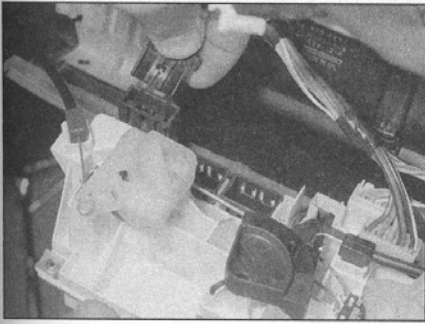
1 Disconnect the battery negative terminal.  
2 Remove the fascia panel assembly as described in Chapter 12.

3 Mark the wiring connectors for identification purposes, then disconnect the wiring from the heater/ventilation control unit switches.

4 Undo the retaining screw, and remove the switches from the control unit.

5 Release the retaining clip, and disconnect the cable from the temperature control lever.





**9.9** On later (March 1994 onwards) models, disconnect the wiring connectors . . .

6 Undo the retaining bolts, and lower the control unit assembly out of position. On models with air conditioning, as the unit is removed, disconnect the temperature control potentiometer wiring connector, and free its arm from the control lever. If necessary, the potentiometer can then be removed.

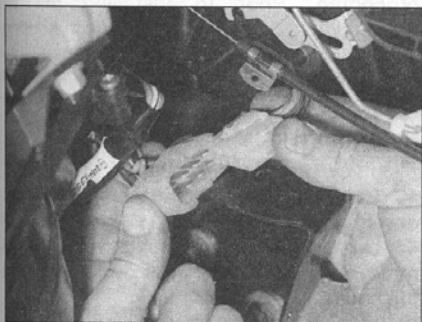
7 Refitting is the reverse of removal, making sure that all wiring is correctly routed and securely reconnected.

#### Later models (March 1994 onwards)

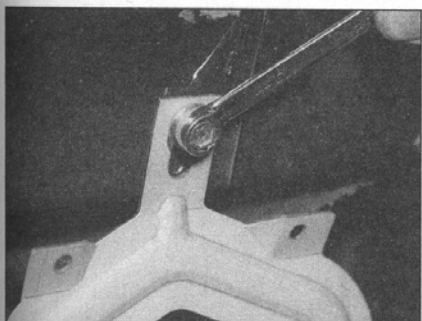
8 Remove the facia centre vent panel as described in Chapter 12.

9 Disconnect the wiring connectors from the rear of the control unit (see illustration).

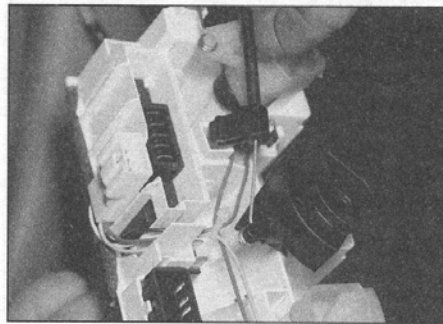
10 Noting each cable's correct fitted location, release each heater outer cable retaining clip, and release them from the rear



**9.25** Disconnect the wiring connectors . . .



**9.26a** . . . then undo the retaining nuts and bolt . . .



**9.10** . . . then release the retaining clips and detach the control cables from the rear of the heater control unit

of the unit (see illustration). Remove the control unit from the facia.

11 On refitting, reconnect each cable to its original location on the control unit. Temporarily refit the control knobs to the unit, and check the operation of each cable before proceeding further. The remainder of refitting is a direct reversal of the removal procedure.

#### Air distribution housing assembly

##### Early models (pre-March 1994)

12 Drain the cooling system as described in the relevant part of Chapter 1.

13 Working in the engine compartment, slacken the retaining clips and disconnect the coolant hoses from the heater matrix unions.

14 Remove the facia panel assembly as described in Chapter 12.

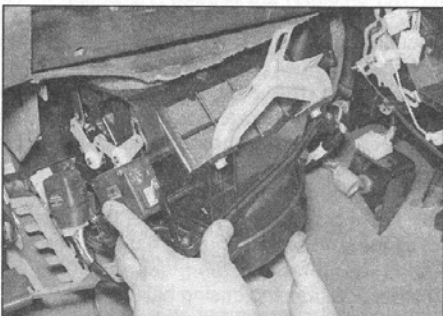
15 Free the rear passenger heater ducts and facia vent ducts from the air distribution housing.

16 Trace the wiring back from the heater blower motor, and disconnect it at the wiring connector.

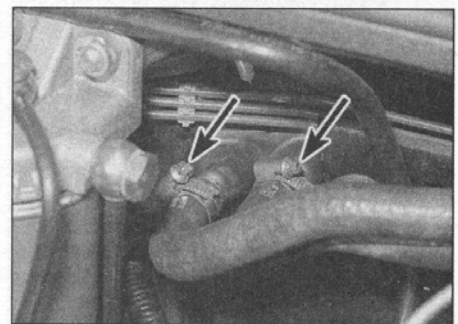
17 Noting their correct fitted locations, disconnect the wiring connectors from the heater control switches.

18 Disconnect the wiring connectors from the air recirculation solenoid which is mounted onto the blower motor cover. Also disconnect the vacuum supply hose from the solenoid.

19 On models with air conditioning, disconnect the wiring connector from the temperature control potentiometer.



**9.26b** . . . and manoeuvre the blower motor housing out of position



**9.23** Slacken the retaining clips, and disconnect the coolant hoses from the heater matrix unions (arrowed)

20 Slacken and remove the four retaining bolts, then manoeuvre the air distribution housing assembly out of position. **Note:** Keep the matrix unions uppermost as the matrix is removed, to reduce coolant spillage.

21 Refitting is the reverse of removal.



**Mop up any spilt coolant immediately, and wipe the affected area with a damp cloth to prevent staining.**

##### Later models (March 1994 onwards) without air conditioning

22 Drain the cooling system as described in the relevant part of Chapter 1.

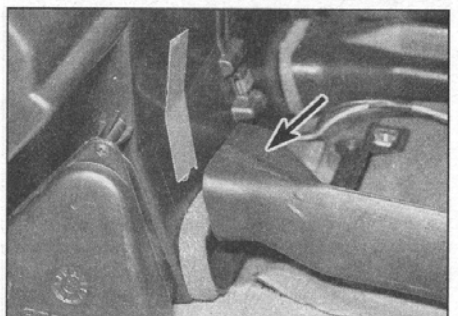
23 Working in the engine compartment, slacken the retaining clips and disconnect the coolant hoses from the heater matrix unions (see illustration).

24 Remove the facia panel assembly as described in Chapter 12.

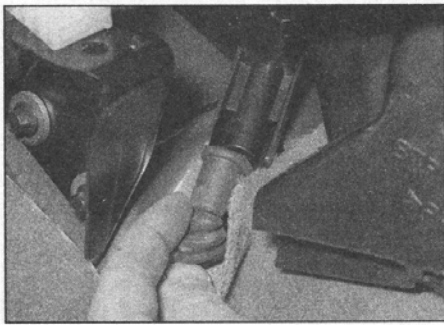
25 Disconnect the wiring connectors from the blower motor housing components (see illustration).

26 Slacken and remove the retaining nuts and bolt, then disengage the blower motor housing from the air distribution housing, and remove it from the vehicle (see illustrations).

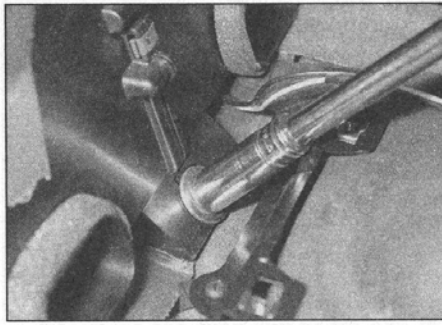
27 Disconnect the rear passenger footwell ducts and the rubber drain hoses from the base of the housing (see illustrations).



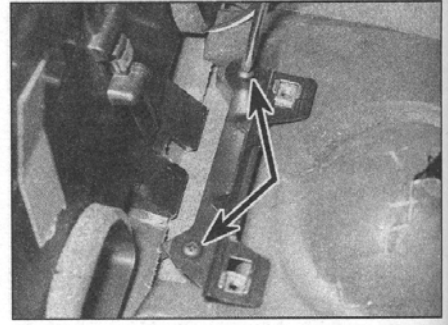
**9.27a** Disconnect the rear passenger ducts . . .



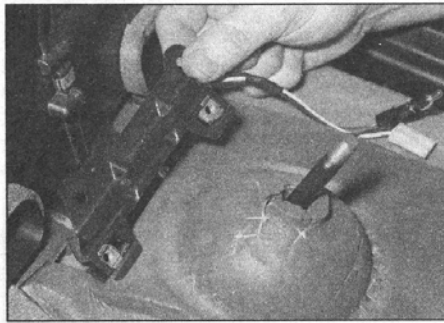
9.27b ... and the drain hoses ...



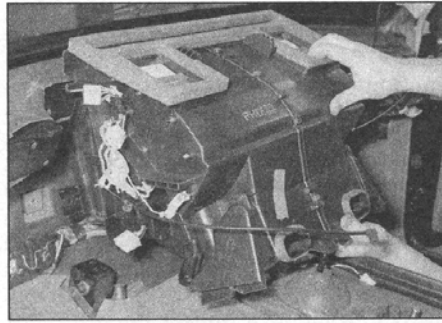
9.29 ... then undo the air distribution housing retaining bolts



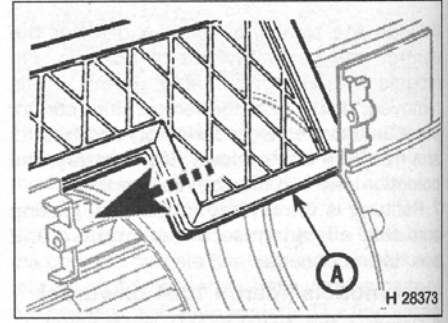
9.30a Undo the two retaining screws (arrowed) ...



9.30b ... and remove the centre console bracket ...



9.31 ... then withdraw the air distribution housing from the vehicle



9.38 On early (pre-March 1994) models, position the inlet flap (A) as shown when separating the air distribution housing casing halves

**28** Disconnect the wiring connectors from the right-hand side of the air distribution housing.

**29** Slacken and remove the bolts securing the air distribution housing to the bulkhead (see illustration).

**30** Manoeuvre the housing assembly out of position, noting that it may be necessary to undo the retaining screws and remove the centre console bracket to allow the housing to be removed (see illustrations).

**31** Ease the assembly away from the bulkhead, and remove it from the vehicle (see illustration). **Note:** Keep the matrix unions uppermost as the matrix is removed, to reduce coolant spillage. Mop up any spilt coolant immediately, and wipe the affected area with a damp cloth to prevent staining. Recover the mounting rubber from the air distribution housing locating peg.

**32** Refitting is a reverse of the removal

procedure, making sure that the air distribution housing and blower motor housing are correctly joined.

**Later models (March 1994 onwards) with air conditioning**

**33** On models with air conditioning, it is not possible to remove the air distribution housing without opening the refrigerant circuit (See Section 11). Therefore, this task must be entrusted to a Land Rover dealer.

**Heater matrix**

**Early models (pre-March 1994)**

**34** Remove the air distribution housing as described above.

**35** Release the retaining clips, and detach the left-hand duct outlet union from the housing.

**36** Carefully release its retaining clip, then disconnect the left-hand vent control rod from the housing.

**37** Release the retaining clips and circlips securing the two halves of the air distribution housing together.

**38** Position the inlet flap correctly, then carefully slide its lower edge through the gap between the blower motor housing and outer case, whilst at the same time separating each half of the housing (see illustration).

**39** Make a note of the correct fitted location of all the distribution housing flaps, to use as a guide on refitting, then separate the air distribution housing casing halves.

**40** Remove the pad from around the heater matrix coolant hose unions, then remove the matrix access panel.

**41** Carefully withdraw the heater matrix from the housing, complete with its sponge packing.

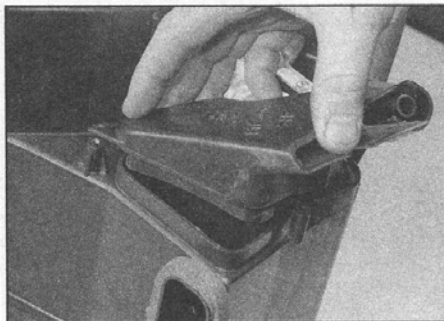
**42** Refitting is the reverse of the removal procedure. Prior to installing the air distribution housing, check that each housing ventilation flap is correctly clipped into position, and opens and closes easily and smoothly.

**Later models (March 1994 onwards) without air conditioning**

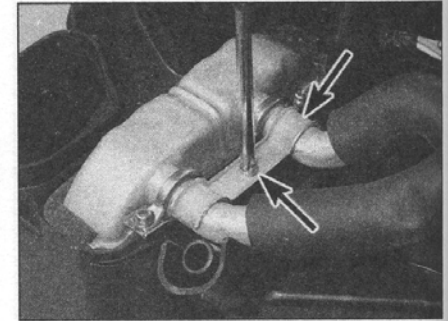
**43** Remove the air distribution housing as described above.

**44** Undo the two retaining screws, and remove the right-hand front duct outlet from the housing (see illustration).

**45** Undo the retaining screw, and remove the heater matrix pipe retaining clip from the right-hand side of the air distribution housing.

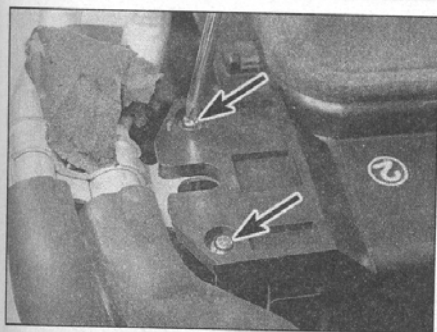


9.44 Removing the right-hand front duct from the housing

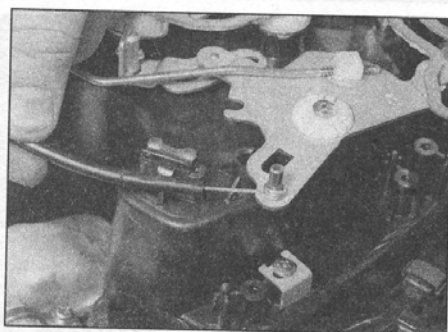


9.45a Undo the retaining screw, and remove the pipe retaining clip (arrowed) ...

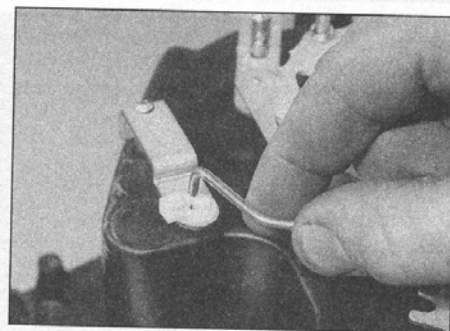




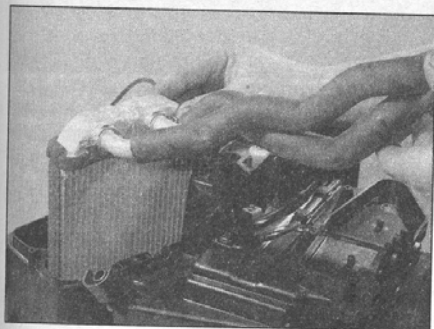
9.45b ... then undo the two screws (arrowed) securing the pipes to the front of the distribution housing



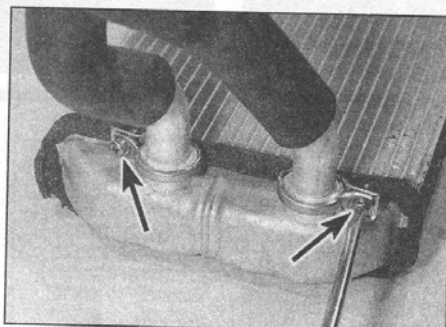
9.46a To allow the matrix to be removed, disconnect the cable ...



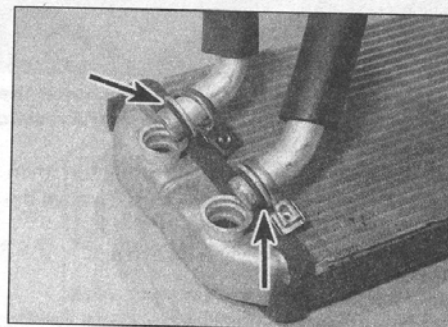
9.46b ... and free the relevant housing link rod



9.46c Slide the matrix and pipe assembly out of the housing ...



9.46d ... slacken the two retaining clips (arrowed) ...



9.46e ... then detach the pipes and recover the O-ring seals (arrowed)

Undo the two screws, and free the pipes from the front of the housing (see illustrations).

46 Slide the heater matrix assembly, complete with hoses, out from the air distribution housing, noting that it may be necessary to detach the housing link rod and free the cable retaining clip to allow this. With the matrix removed, slacken the retaining clips and detach the pipes from the matrix. Recover the O-rings from the pipe unions, and discard them (see illustrations).

47 Refitting is the reverse of removal, using new O-rings on the pipe unions.

#### Later models (March 1994 onwards) with air conditioning

48 On models with air conditioning, it is not possible to remove the heater matrix without opening the refrigerant circuit (see Section 11). Therefore, this task must be entrusted to a Land Rover dealer.

#### Heater blower motor

##### Early models (pre-March 1994)

49 Separate the air distribution housing casing as described above in paragraphs 34 to 39.

50 Release the wiring grommet, then undo the retaining screws securing the left-hand motor end cover in position.

51 Carefully detach the vacuum diaphragm unit from the inlet flap, then ease the cover away from the distribution housing. Free the blower motor resistor from its retaining clips, and remove the cover.

52 Release the blower motor retaining clips,

and withdraw the motor assembly, complete with resistor, from the left-hand casing half.

53 Refitting is a reverse of the removal procedure. Prior to installing the air distribution housing, check that each housing ventilation flap is correctly clipped into position, and opens and closes easily and smoothly.

##### Later models (March 1994 onwards)

54 Open up the glovebox, release its hinge springs, then slacken and remove the hinge retaining screws and remove the glovebox from the fascia.

55 Release the clips and remove the undercover panel from the passenger side of the fascia, to gain access to the blower motor.

56 Disconnect the motor wiring connector, then undo the three retaining screws, and lower the motor assembly out from the housing (see illustration).

57 If necessary, release the retaining clip, lift off the fan, then undo the retaining screws and separate the motor and casing.

58 Refitting is the reverse of removal, making sure that an airtight seal is made between the blower motor housing and the air distribution housing.

#### Heater blower motor resistor

##### Early models (pre-March 1994)

59 Remove the air distribution housing as described above.

60 Release the wiring grommet, then undo the retaining screws securing the left-hand motor end cover in position.

61 Carefully detach the vacuum diaphragm unit from the inlet flap, then ease the cover away from the distribution housing. Free the blower motor resistor from its retaining clips, and remove the cover.

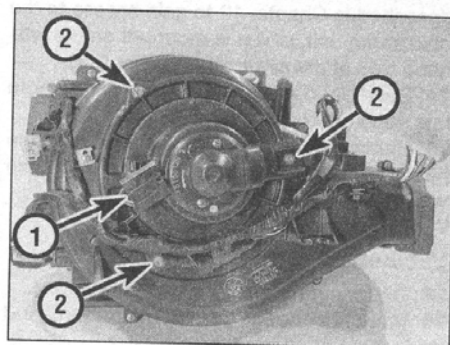
62 Make identification marks on the wiring connectors, disconnect them from the resistor, and remove the resistor.

63 Refitting is the reverse of removal, making sure that the wiring connectors are correctly reconnected.

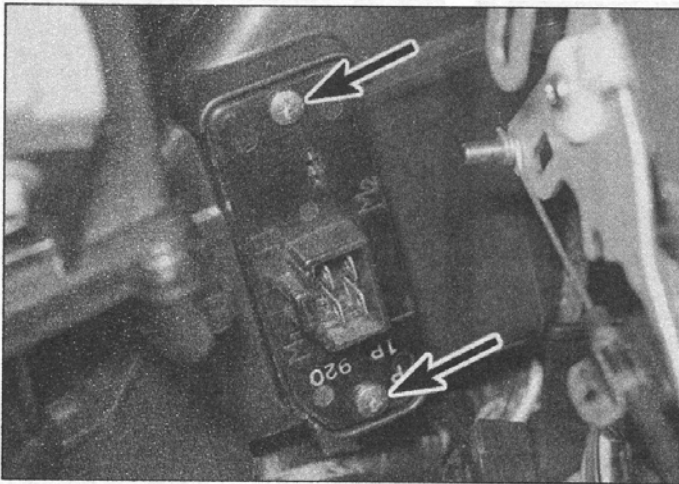
##### Later models (March 1994 onwards)

64 Disconnect the battery negative terminal.

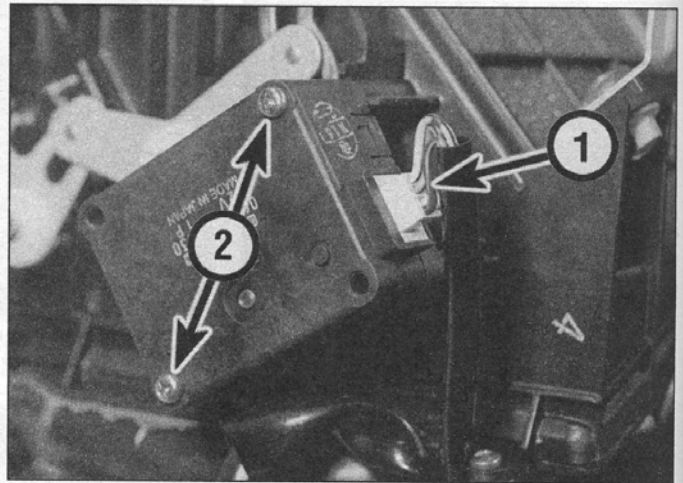
65 Open up the glovebox, and release its hinge springs. This will allow the lid to be fully opened, so that access can be gained to the blower motor resistor, which is mounted on the side of the blower motor housing.



9.56 Blower motor wiring connector (1) and retaining screws (2) - shown with housing removed for clarity



9.66 Disconnect the wiring connector, then undo the retaining screws (arrowed) and remove the resistor from the housing



9.83 Air recirculation flap solenoid wiring connector (1) and retaining screws (2)

66 Disconnect the wiring connector, then undo the two retaining screws and remove the resistor unit (see illustration).

67 Refitting is the reverse of removal.

**Air recirculation flap system components - early models (pre-March 1994)**

**Switch**

68 Refer to Chapter 13.

**Solenoid valve**

69 Remove the facia panel assembly as described in Chapter 12 to gain access to the solenoid, which is mounted on the left-hand side of the air distribution housing.

70 Mark the wiring connectors for identification, and disconnect them from the solenoid.

71 Disconnect the vacuum hoses from the solenoid, then undo the retaining screw and remove the solenoid.

72 Refitting is reverse of removal, making sure that the wiring connectors are correctly reconnected.

**Vacuum diaphragm unit**

73 Remove the facia panel assembly as described in Chapter 12 to gain access to the diaphragm unit, which is mounted on the left-hand side of the air distribution housing.

74 Carefully detach the vacuum diaphragm unit pushrod from the inlet flap.

75 Disconnect the vacuum hose, then undo the retaining screws and remove the unit from the vehicle.

76 Refitting is the reverse of removal.

**Vacuum reservoir**

77 Disconnect the battery negative lead.

78 Mark the hoses for identification, and disconnect them from the reservoir.

79 Undo the retaining nuts and washers, and remove the reservoir from the engine compartment.

**Air recirculation flap system components - later models (March 1994 onwards)**

**Switch**

80 Refer to Chapter 13.

**Solenoid unit**

81 Disconnect the battery negative terminal.

82 Open up the glovebox, and release its hinge springs. This will allow the lid to be fully opened, so that access can be gained to the solenoid unit, which is mounted on the side of the blower motor housing.

83 Disconnect the wiring connector and undo the two solenoid retaining screws (see illustration).

84 Pivot the retaining clip away from the solenoid link rod, then free the rod from the housing and remove the solenoid unit.

85 Refitting is the reverse of removal.

**10 Heater/ventilation vents - removal and refitting**

**Removal**

**Early models (pre-March 1994)**

1 Remove the facia panel assembly as described in Chapter 12.

2 To remove a side vent, release the retaining clips and disconnect the duct, then push the duct out from behind the facia.

3 To remove a centre vent, undo the retaining nuts and free the duct housing from the rear of the facia. The centre vents can then be pushed out of position.

**Later models (March 1994 onwards)**

4 The centre vents are an integral part of the facia centre panel, and are not available separately. Refer to Chapter 12 for centre panel removal and refitting details.

5 To remove a side vent, first remove the facia

panel assembly as described in Chapter 12. The vent can then be pushed out from behind the facia.

**Refitting**

6 Refitting is the reverse of the relevant removal procedure.

**11 Air conditioning system - general information and precautions**

**General information**

1 An air conditioning system is available on certain models. It enables the temperature of incoming air 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 (see illustration opposite). 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 an 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 cools the evaporator. The refrigerant returns to the compressor and the cycle begins again.

3 Air blown through the evaporator passes to the air distribution unit, where it is mixed with hot air blown through the heater matrix, to achieve the desired temperature in the passenger compartment.

4 The heating side of the system works in the same way as on models without air conditioning (see Section 8).

5 The operation of the system is controlled electronically by the coolant temperature switches (see Section 6), which are screwed into the thermostat housing, and pressure switches which are screwed into the



compressor high-pressure line. Any problems with the system should be referred to a Land Rover dealer.

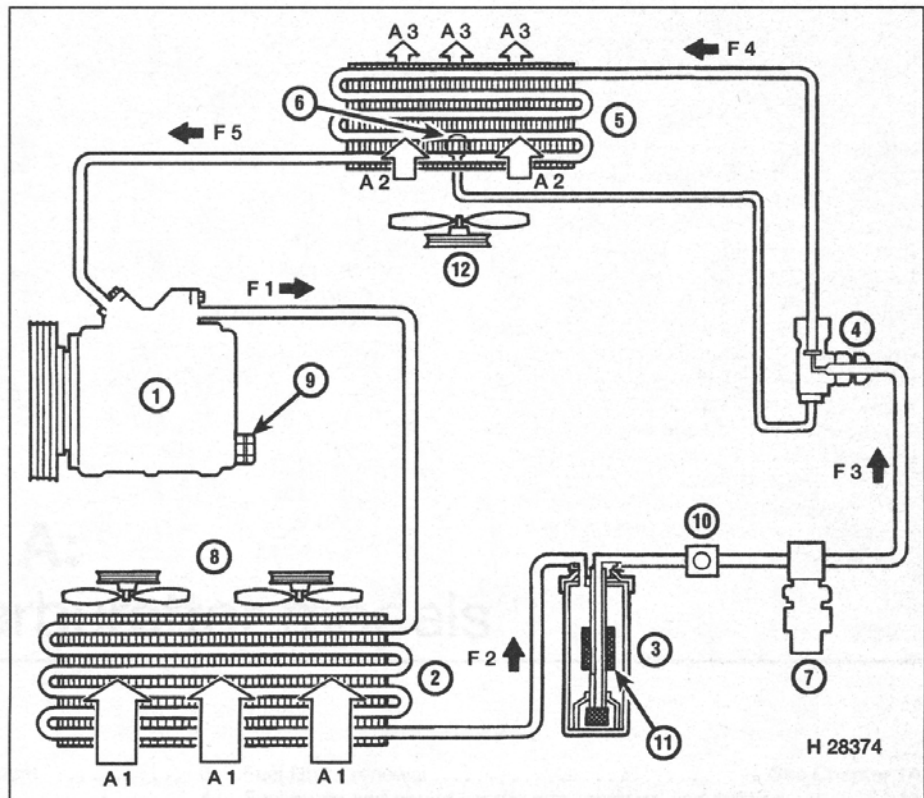
**Precautions**

6 When an air conditioning system is fitted, it is necessary to observe special precautions whenever dealing with any part of the system, and its associated components. If for any reason the system must be disconnected, entrust this task to your Land Rover dealer or a refrigeration engineer.

**Warning: The refrigeration circuit contains a liquid refrigerant (Freon), and it is therefore dangerous to disconnect any part of the system without specialised knowledge and equipment.**

7 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.

8 Do not operate the air conditioning system if it is known to be short of refrigerant, as this may damage the compressor.



**11.2 Schematic layout of the air conditioning system components**

- 1 Compressor
- 2 Condenser
- 3 Receiver/drier
- 4 Thermostatic expansion valve
- 5 Evaporator
- 6 Capillary tube
- 7 Dual pressure switch
- 8 Cooling fans
- 9 Compressor high-pressure relief valve
- 10 Refrigerant sight glass
- 11 Drying agent
- 12 Blower motor

- A1 Air flow through condenser
- A2 Air flow through fan and evaporator
- A3 Cooled air supply to vehicle interior
- F1 High-pressure high-temperature refrigerant vapour
- F2 High-pressure slightly subcooled refrigerant
- F3 High-pressure slightly subcooled refrigerant liquid with moisture, vapour and foreign matter removed
- F4 Low-pressure low-temperature mixed liquid and vapour
- F5 Low-pressure slightly superheated refrigerant vapour

**12 Air conditioning system components - removal and refitting**



**Warning: Do not attempt to open the refrigerant circuit. Refer to the precautions given in Section 11.**

1 The only operation which can be carried out easily without discharging the refrigerant is renewal of the compressor drivebelt, which is covered in *Auxiliary drivebelt checking and renewal* in the relevant part of Chapter 1. All other operations must be referred to a Land Rover dealer or an air conditioning specialist.

2 If necessary, the compressor can be unbolted and moved aside, *without disconnecting its flexible hoses*, after removing the drivebelt.