

Chapter 3

Cooling, heating and air conditioning systems

Contents

Air conditioning and heating system - check and maintenance	13	Engine oil cooler - renewal	6
Air conditioning compressor - removal and refitting	15	General information	1
Air conditioning condenser - removal and refitting	16	Heater and air conditioning blower motors -circuit check and component renewal	10
Air conditioning evaporator and expansion valve - removal and refitting	17	Heater and air conditioning control assembly - check, removal and refitting	12
Air conditioning receiver/drier - removal and refitting	14	Heater core - removal and refitting	11
Antifreeze/coolant - general information	2	Radiator, expansion tank and coolant reservoir - removal and refitting	5
Coolant level check	See Chapter 1	Thermostat - check and renewal	3
Coolant temperature sender unit - check and renewal	9	Underbonnet hose check and renewal	See Chapter 1
Cooling system check	See Chapter 1	Water pump - check	7
Cooling system draining, flushing and refilling	See Chapter 1	Water pump and pipes - renewal	8
Drivebelt check, adjustment and renewal	See Chapter 1		
Engine cooling fans - check and renewal	4		

Degrees of difficulty

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

General

Radiator cap pressure rating	13.5 to 117.5 psi
Thermostat rating	180 to 207° F

Torque wrench settings

	Nm	lbf ft
Coolant pipe to block	22 to 28	16 to 21
Fan assembly-to-drive hub nuts	22 to 28	16 to 21
Fan clutch-to-fan blade bolts	22 to 28	16 to 21
Thermostat cover bolts	22 to 28	16 to 21
Thermostat housing-to-block bolts	22 to 28	16 to 21
Water pump bolts	22 to 28	16 to 21

3

1 General information

Engine cooling system

All vehicles covered by this manual employ a pressurised engine cooling system with thermostatically-controlled coolant circulation. An impeller type water pump mounted on the front of the block pumps coolant through the engine. The coolant flows around each cylinder and toward the rear of the engine. Cast-in coolant passages direct coolant around the intake and exhaust ports, near the spark plug areas and in proximity to the exhaust valve guides.

A wax-pellet type thermostat is located in the thermostat housing at the front of the engine. During warm up, the closed thermostat prevents coolant from circulating through the radiator. When the engine reaches normal operating temperature, the thermostat opens and allows hot coolant to travel through the radiator, where it is cooled before returning to the engine.

The cooling system is sealed by a pressure-type radiator cap. This raises the boiling point of the coolant, and the higher boiling point of the coolant increases the cooling efficiency of the radiator. If the system pressure exceeds the cap pressure-relief value, the excess pressure in the system forces the spring-loaded valve inside the cap off its seat and allows the coolant to escape through the overflow tube into a coolant reservoir. When

the system cools, the excess coolant is automatically drawn from the reservoir back into the radiator. This type of cooling system is known as a closed design because coolant that escapes past the pressure cap is saved and reused.

The Jaguar cooling system on 1988 and 1989 models has both a manifold tank and a coolant recovery tank. The manifold tank is the highest point in the cooling system and is the location of the "radiator" cap (the cap is not on the radiator). The recovery tank down in the passenger's footwell collects heated coolant as described above. Models from 1990 to 1994 do not have a coolant recovery tank, but have an enlarged manifold tank. In all models, the recovery tank has a sensor in it to detect a low coolant level, and the instrument panel has a warning light to that effect.

Heating system

The heating system consists of two blower fans, one under the dash on the right and one on the left, and a heater core located within the heater/air conditioning assembly which is under the dash and behind the console. Hoses connect the heater core to the engine cooling system. Heater function is controlled by the heater/air conditioning control head on the dashboard. Hot engine coolant is circulated through the heater core. When the heater mode is activated, a flap door opens to expose the heater box to the passenger compartment. A fan switch on the control head activates the blower motor, which forces air through the core, heating the air.

Air conditioning system

The air conditioning system consists of a condenser mounted in front of the radiator, an evaporator mounted in the heat/air conditioning assembly behind the console and under the centre of the dash, a compressor mounted on the engine, a filter-drier which contains a high pressure relief valve and the plumbing connecting all of the above.

A blower fan forces the warmer air of the passenger compartment through the evaporator core (sort of a radiator-in-reverse), transferring the heat from the air to the refrigerant. The liquid refrigerant boils off into low pressure vapour, taking the heat with it when it leaves the evaporator. The compressor keeps refrigerant circulating through the system, pumping the warmed coolant through the condenser where it is cooled and then circulated back to the evaporator.

2 Antifreeze/coolant - general information

 **Warning:** Do not allow antifreeze to come in contact with your skin or painted surfaces of the vehicle. Rinse off spills immediately with



2.4 An inexpensive hydrometer can be used to test the condition of your coolant

plenty of water. Antifreeze is highly toxic if ingested. Never leave antifreeze lying around in an open container or in puddles on the floor; children and pets are attracted by it's sweet smell and may drink it. Check with local authorities about disposing of used antifreeze. Many communities have collection centres which will see that antifreeze is disposed of safely. Never dump used antifreeze on the ground or into drains.

Note: Non-toxic antifreeze is now manufactured and available at local car accessory outlets, but even these types should be disposed of properly.

The cooling system should be filled with a water/ethylene-glycol based antifreeze solution, which will prevent freezing down to at least -20° F, or lower if local climate requires it. It also provides protection against corrosion and increases the coolant boiling point.

The cooling system should be drained, flushed and refilled every 24,000 miles or every two years (see Chapter 1). The use of antifreeze solutions for periods of longer than two years is likely to cause damage and encourage the formation of rust and scale in the system. If your tap water is "hard", i.e. contains a lot of dissolved minerals, use distilled water with the antifreeze.

Before adding antifreeze to the system, check all hose connections, because antifreeze tends to leak through very minute openings. Engines do not normally consume coolant. Therefore, if the level goes down, find the cause and correct it.

The exact mixture of antifreeze-to-water you should use depends on the relative weather conditions. The mixture should contain at least 50-percent antifreeze, but should never contain more than 70-percent antifreeze. Consult the mixture ratio chart on the antifreeze container before adding coolant. Hydrometers are available at most car accessory outlets to test the ratio of antifreeze to water (see illustration). Use antifreeze which meets the vehicle manufacturer's specifications.

3 Thermostat - check and renewal



Warning: Do not attempt to remove the radiator cap, coolant or thermostat until the engine has cooled completely.

Check

1 Before assuming the thermostat is responsible for a cooling system problem, check the coolant level (Chapter 1), drivebelt tension (Chapter 1) and temperature gauge (or light) operation.

2 If the engine takes a long time to warm up (as indicated by the temperature gauge or heater operation), the thermostat is probably stuck open. Renew the thermostat.

3 If the engine runs hot, use your hand to check the temperature of the lower radiator hose.



Warning: Do this check with the engine off. Do not get your hands near the fan blades. If the hose is not hot, but the engine is, the thermostat is probably stuck in the closed position, preventing the coolant inside the engine from travelling through the radiator. Renew the thermostat. Do not drive the vehicle without a thermostat. The computer may stay in open loop and emissions and fuel economy will suffer.

4 If the lower radiator hose is hot, it means that the coolant is flowing and the thermostat is open. Consult the *Troubleshooting* section at the front of this manual for further diagnosis.

Renewal

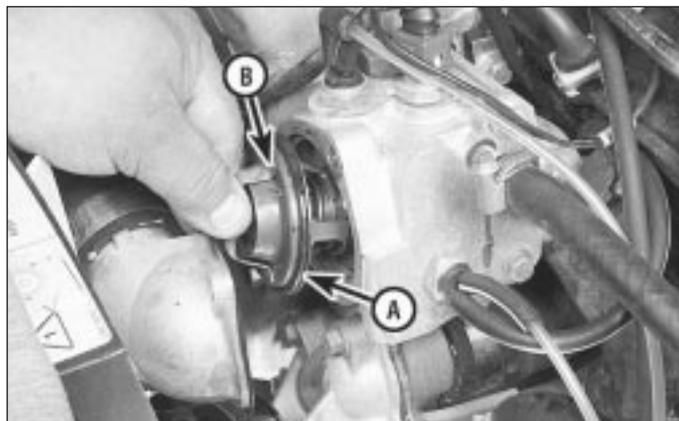
5 Disconnect the battery negative cable. **Caution:** If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

6 Drain the coolant from the radiator (see Chapter 1).

7 Remove the bolts from the thermostat cover (see illustration). If the cover doesn't



3.7 Remove the two bolts (small arrows) holding the thermostat cover to the housing (large arrow)



3.9 The thermostat is fitted with the spring end towards the cylinder head - use a new O-ring (A) and position jiggle pin (B) up

pull loose, tap it with a soft-faced hammer. Do not use a screwdriver between the cover and the thermostat housing.

8 Remove the thermostat, noting the direction in which it was installed in the housing, and thoroughly clean the sealing surfaces.

9 Refit a new O-ring onto the thermostat (see illustration). Make sure it is evenly fitted all the way around.

10 Apply a bead of RTV sealant to the thermostat housing. Refit the thermostat and housing, positioning the jiggle pin at the highest point. **Note:** The thermostat is usually marked TOP on the radiator side for proper orientation.

11 Tighten the cover fasteners to the torque listed in this Chapter's Specifications.

12 Refill the cooling system, run the engine and check for leaks and proper operation.

4 Engine cooling fans - check and renewal



Mechanical fan (1988 to 1992 models)



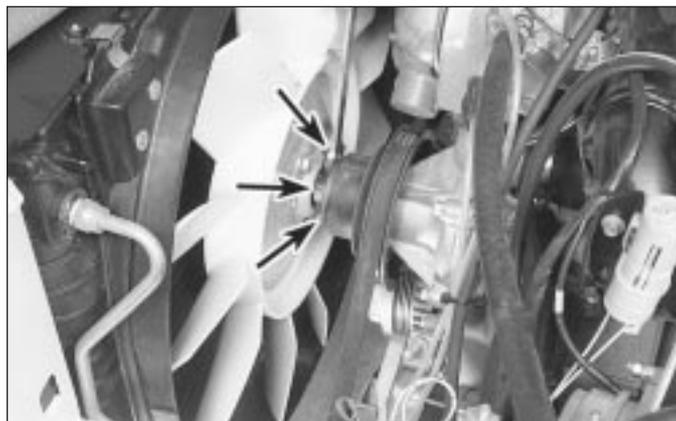
Warning: Keep hands, hair, tools and clothing away from the fan when the engine is running. To



4.9 The fan can be removed with the shroud in place by angling it out of the shroud



4.10 Pry out the two clips (arrow indicates the left one) at the top of the fan shroud and lift out the shroud



4.8 Remove the four nuts (arrows indicate three shown here) holding the fan/clutch assembly to the front of the water pump

avoid injury or damage DO NOT operate the engine with a damaged fan. Do not attempt to repair fan blades - renew a damaged fan.

Check



Warning: In order to check the fan clutch, the engine will need to be at operating temperature, so while going through checks

prior to Step 6 be careful that the ignition is NOT switched on. Severe personal injury can result!

1 Symptoms of failure of the fan clutch are continuous noisy operation, looseness, vibration and evidence of silicone fluid leaks.

2 Rock the fan back and forth by hand to check for excessive bearing play.

3 With the engine cold, turn the blades by hand. The fan should turn freely.

4 Visually inspect for substantial fluid leakage from the fan clutch assembly, a deformed bi-metal spring or grease leakage from the cooling fan bearing. If any of these conditions exist, renew the fan clutch.

5 When the engine is fully warmed up, turn off the ignition switch and disconnect the cable from the negative battery terminal. Turn the fan by hand. Some resistance should be felt. If the fan turns easily, renew the fan clutch.

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make

sure you have the correct activation code before disconnecting the battery.

Removal and refitting

6 Leave the battery cable disconnected (see the Caution in Step 5).

7 Remove the fan's drivebelt (see Chapter 1).

8 Remove the nuts holding the fan assembly to the water pump (see illustration). **Note:** You'll have to "walk" the fan assembly forward as you loosen the nuts. There is not enough room to remove them all the way at one time.

9 The fan can be removed without removing the shroud, if you are only renewing the fan or clutch (see illustration). Be careful not to allow the blades contact the radiator fins.

10 Remove the two fan shroud mounting clips at the top of the shroud (see illustration).

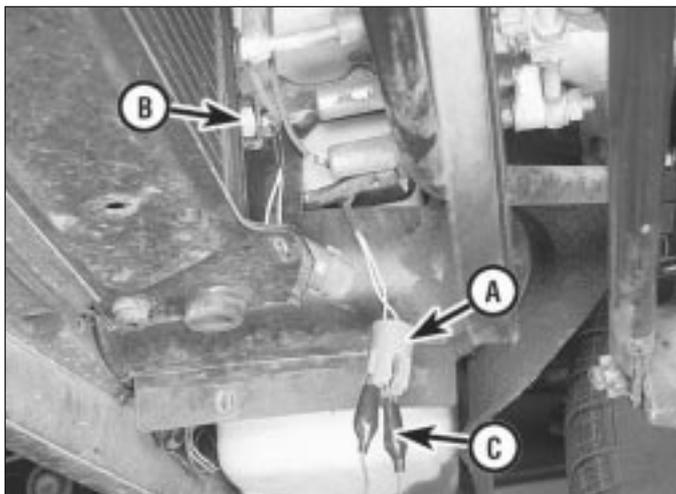
11 Lift the shroud up and out of the engine compartment. The bottom of the fan shroud does not have any fasteners. It has two tangs on the bottom that slip out of slots in the body when pulled up.

12 The fan clutch can be unbolted from the fan blade assembly for renewal (see illustration).

Caution: To prevent silicone fluid from draining from the clutch assembly into the fan drive bearing and ruining the lubricant, DON'T place the clutch in a position with the rear pointing down. Store the clutch in its upright position if possible.



4.12 Separate the fan clutch from the fan by removing the four bolts (arrowed)



4.15 Disconnect the electrical connector (A) from the thermostatic switch (B) in the radiator and bypass it with a jumper wire (C) - the fan should operate now with the ignition on



4.17 Disconnect the fan wiring connector and connect jumper wires from there directly to the positive and negative terminals of the battery - the purple wire's terminal should receive the battery power and the black wire's terminal should be earthed

13 Refitting is the reverse of removal. Tighten the fan clutch-to-fan blade bolts and the fan assembly-to-drive hub nut to the torque listed in this Chapter's Specifications.

Electric fans

Check



Warning: Keep your hands or clothing away from the fan blades at all times.

14 On 1988 through 1992 models, a single electric fan is mounted in front of the radiator, controlled by a thermostatic switch. Access to the fan is with the grille removed. The 1993 and 1994 models have a fan shroud assembly that includes two electric fans, and a "twin" thermostatic switch, with the assembly mounted on the engine side of the radiator.

15 If the electric fan does not come on at any time, bypass the thermostatic switch by disconnecting the electrical connector at the switch and connecting the two pins with a jumper wire (see illustration). If the fan now operates, renew the thermostatic switch. If the fan doesn't operate, the problem is either the fan relay or the fan motor. On 1993 and 1994 models with twin electric fans, jumpering one set of connections in the plug from the switch should make both fans operate at slow speed (fans in series) and jumpering the other two should run both fans at higher speed (fans in parallel). In normal operation, the fans operate at the higher-speed only when the air conditioning is on, or when coolant temperature exceeds 212° F. When the coolant cools down to below 200° F, the fans revert to the normal speed.

16 To renew a defective thermostatic switch, allow the vehicle to cool off and drain the coolant (see Chapter 1). Remove the switch from the radiator and refit the new switch. Connect the electrical connector and test again for proper fan operation.

17 To test an inoperative fan motor (one that doesn't come on when the engine gets hot or when the air conditioner is on), first check the fuses and/or fusible links (see Chapter 12). Then disconnect the electrical connector at the motor (refer to Chapter 11 for removal of the grille for access on front-mounted-fan models) and use fused jumper wires to connect the fan directly to the battery and to chassis ground (see illustration). If the fan still does not work, renew the fan motor.

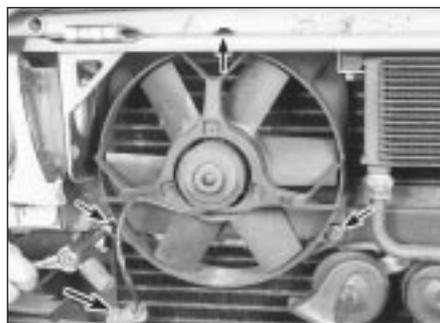


Warning: Do not allow the test clips to contact each other or any metallic part of the vehicle.

18 If the motor tested OK in the previous test but is still inoperative, then the fault lies in the relay, fuse, or wiring. The fan relay can be tested for continuity (see Chapter 12).

Renewal

19 Disconnect the negative battery cable. **Caution:** If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.



4.20 Disconnect the fan's electrical connector (large arrow) and remove the bolts (small arrows) on single-fan models - grille is removed here

20 Access the 1988 through 1992 single electric fan with the grille removed (see Chapter 11 for grille removal). Disconnect the electrical connector and remove the bolts holding the fan assembly to the body (see illustration).

21 On 1993 and 1994 models, remove the two bolts holding the fan shroud to the top of the radiator and lift the shroud/fans assembly from the vehicle.

22 If the fan on 1988 to 1992 models must be renewed, renew the fan, motor and shroud as a unit. The fan is separate from the shroud on later models.

23 Refitting is the reverse of removal. If the thermostatic switch was renewed, refill the cooling system.

5 Radiator, expansion tank and coolant reservoir - removal and refitting



Warning: Do not start this procedure until the engine is completely cool.

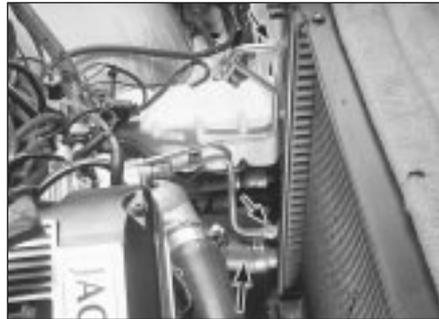
Radiator

Removal

- 1 Disconnect the negative battery cable. **Caution:** If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.
- 2 Drain the coolant into a container (see Chapter 1).
- 3 Remove both the upper and lower radiator hoses, and the small expansion tank hose from the top left of the radiator (see illustration).
- 4 Remove the cooling fan and shroud (see Section 4).



5.3 Remove the clamp and the hose going to the expansion tank



5.5a At the left side of the radiator, disconnect the automatic transmission cooler lines (small arrows) and the lower radiator hose (larger arrow)



5.5b Disconnect the power steering cooler lines (small arrows) at the right side of the radiator, and the upper radiator hose (large arrow)

5 If equipped with an automatic transmission, disconnect the cooler lines from the radiator (see illustrations). Disconnect the cooling fan switch connector (see illustration 4.15). Place a drip pan to catch the fluid and cap the fittings. **Note:** The transmission oil cooler lines enter the radiator on the left, while the power steering cooler lines attach on the right side of the radiator. On 1993 and 1994 models, the cooler fittings require a spring-lock coupling tool, normally used on fuel lines or air conditioning lines.

6 Remove the four bolts from the radiator cowl panel and take off the panel (see illustration).

7 Lift out the radiator. Be aware of dripping fluids and the sharp fins. Take care not to damage the radiator fins by contact with other parts.

8 With the radiator removed, it can be inspected for leaks, damage and internal blockage. If repairs are necessary, have a radiator specialist or dealer service department perform the work, as special techniques are required. Check the rubber mounting pads on the bottom of the radiator (see illustration). If they're cracked or damaged, get new ones before refitting the radiator.

9 Bugs and dirt can be cleaned from the radiator with compressed air and a soft brush. Don't bend the cooling fins as this is done.

Expansion tank and coolant reservoir, removal and refitting

14 The expansion tank is located at the top of the left-hand side inner wing. With the cooling system drained below the level of the expansion tank, remove the hoses, the coolant level probe and the two screws mounting it to the body (see illustration).

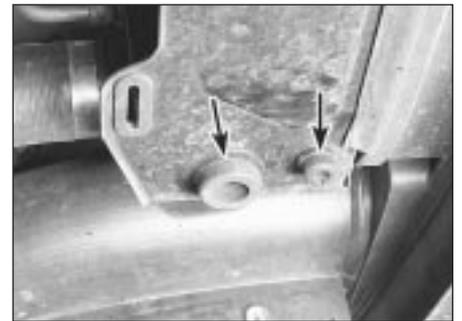
15 Wash out and inspect the reservoir for cracks and chafing. Renew it if damaged.

16 If the low-coolant level light has been showing on the instrument panel, even when the coolant level is correct, disconnect the sensor's connector and test it with an ohmmeter (see illustration). The sensor should be renewed if the resistance at the connections is over 150 ohms.

Caution: Using a long-necked funnel to add coolant can damage the sensor, which is just below the expansion tank filler neck.



5.6 Remove the bolts (arrowed) and take off the radiator cowl panel



5.8 There are rubber mounts (arrowed) for the radiator and the condenser - they must be in place when these components are reinstalled



Warning: Wear eye protection.

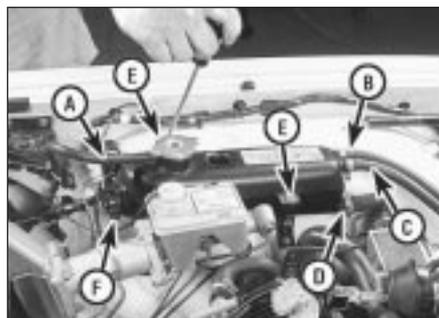
Refitting

10 Refitting is the reverse of the removal procedure. Be sure the rubber mounts are in place on the bottom of the radiator.

11 After refitting, fill the cooling system with the proper mixture of antifreeze and water. Refer to Chapter 1 if necessary.

12 Start the engine and check for leaks. Allow the engine to reach normal operating temperature, indicated by both radiator hoses becoming hot. Recheck the coolant level and add more if required.

13 On automatic transmission equipped models, check and add fluid as needed and check the power steering fluid level as well.



5.14 The expansion tank is located on the left inner wing

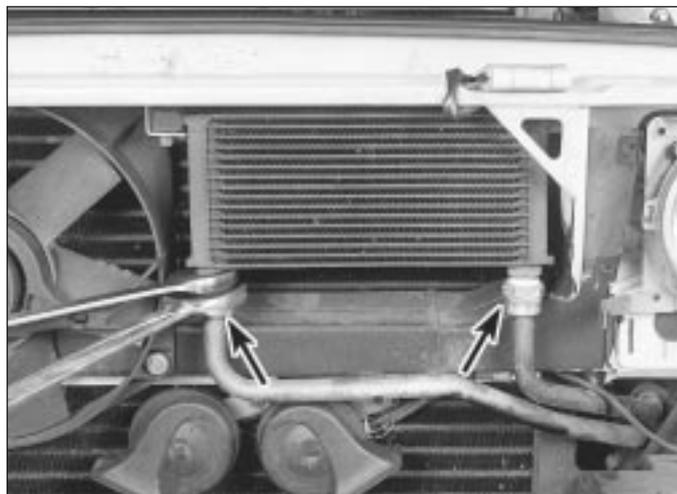
- A Hose to recovery tank (where applicable)
- B Hose to radiator
- C Hose to thermostat housing
- D Hose to water pump housing
- E Mounting screws
- F Low-coolant-level sensor



5.16 The low-coolant-level sensor can be tested with an ohmmeter - resistance should be below 150 ohms - gently use a pair of long-neck pliers to move the sensor up and down in the tank to get a reading



5.17 The recovery bottle (arrowed) on 1988 and 1989 models is located in the footwell - disconnect the hoses and the two mounting screws



6.2 Disconnect the two metal oil lines (arrowed) where they mount to the bottom of the cooler - use two spanners

17 A coolant recovery bottle is used on 1988 and 1989 models, located in the passenger's inner wing. The plastic inner wing splash shield must be removed for access to the recovery bottle (see Chapter 11). Disconnect the recovery hose and remove the mounting screws to renew the recovery bottle (see illustration). Models from 1990 on do not have the recovery bottle, but do have a larger expansion tank.

18 Refitting of either expansion tank or recovery bottle is the reverse of removal.

6 Engine oil cooler - renewal



1 Models from 1988 through 1991 have an engine oil cooler, mounted ahead of the radiator. The engine's mechanical fan draws air through the oil cooler, cooling off hot engine oil that is circulated from the engine by steel tubes. Access to the cooler is with the grille removed (refer to Chapter 11 for grille removal).

2 To renew the oil cooler, first disconnect the



6.3 Remove the mounting nuts (arrowed) to take the oil cooler out

two fittings connecting the lines to the cooler (see illustration).

Caution: *The engine should be cool for this procedure, and you should have a small drain pan handy because the fittings are on the bottom of the cooler and will probably drip some oil on dismantling.*

3 Remove the mounting nuts to take the cooler out of the vehicle (see illustration).

4 The other ends of the oil cooler tubes mount to a block just below the oil filter. With a drain pan handy, remove the nut retaining both pipes to the block.

5 Refitting the oil cooler and oil lines is the reverse of removal. When refitting the lines to the block or the cooler, use new O-rings.

7 Water pump - check



1 A failure in the water pump can cause serious engine damage due to overheating.

2 With the engine running and warmed to normal operating temperature, squeeze the upper radiator hose. If the water pump is working properly, a pressure surge should be felt as the hose is released.



Warning: *Keep hands away from fan blades!*

3 Water pumps are equipped with weep or vent holes (see illustration). If a failure occurs in the pump seal, coolant will leak from this hole. In most cases it will be necessary to use a flashlight to find the hole on the water pump by looking through the space behind the pulley just below the water pump shaft.

4 If the water pump shaft bearings fail there may be a howling sound at the front of the engine while it is running. Bearing wear can be felt if the water pump pulley is rocked up and

down. Do not mistake drivebelt slippage, which causes a squealing sound, for water pump failure. Spray automotive drivebelt dressing on the belts to eliminate the belt as a possible cause of the noise.

8 Water pump and pipes - renewal



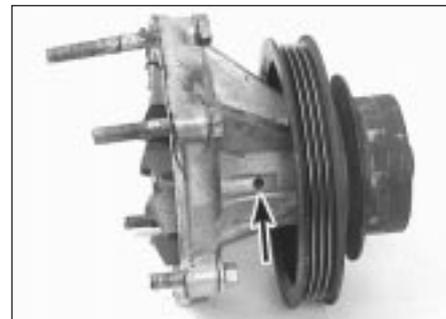
Warning: *Do not start this procedure until the engine is completely cool.*

1 Disconnect the negative battery cable and drain the cooling system (see Chapter 1).

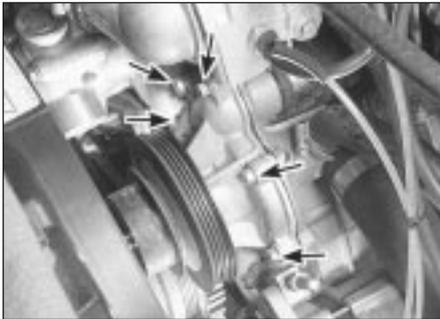
Caution: *If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.*

2 Refer to Section 4 to remove the mechanical fan and clutch (if applicable to your model).

3 Refer to Chapter 1 for removal of the drivebelts.



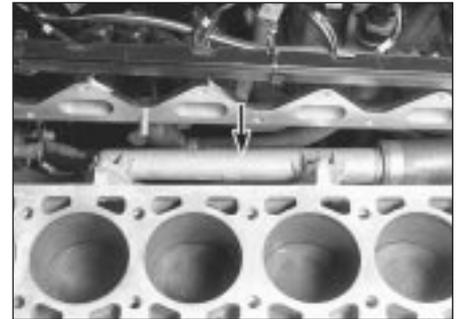
7.3 Check the weep hole (arrowed) for signs of leakage (pump removed for clarity) - grey discoloration is normal, large brown stains indicates seal failure



8.4 Remove the water pump mounting bolts (arrows indicate five visible here)



8.8a Once the water pump is removed, the rear housing (arrowed) is held in place only by the hoses - check them for leakage and condition whenever the pump is disturbed



8.8b The water pipe (arrowed) may need new gaskets where it meets the block - the pipe is best accessed from below or with the intake manifold unbolted

4 Remove the water pump mounting bolts (see illustration).

Note 1: The water pump is sold as a complete assembly, including the rear housing with the hose connections. Unless the rear housing is corroded or cracked, many Jaguar mechanics only refit the pump assembly itself, using the original rear housing with all its hoses intact. However, if the engine has a great deal of years or mileage on it, it would be a good idea to renew those hoses as well, in which case the new rear housing can be installed.

Note 2: There are three different lengths of water pump bolts. The longer bolts retain the pump and rear housing to the engine (see illustration 7.3).

5 If the pump doesn't come loose right away, tap it with a soft-faced hammer to break the gasket seal. Be careful not to hit the radiator fins with the pump during removal.

6 Thoroughly clean all sealing surfaces, removing all traces of gasket or sealant from the back of the pump and the face of the housing.

7 Apply a bead of RTV sealant to the sealing surface on the back of the pump. Refit the pump and bolts, tightening the bolts to the torque listed in this Chapter's Specifications.

8 Refit the remaining parts in the reverse order of removal. **Note:** If the pump has been renewed after many miles of usage, it's a good idea to also renew the hoses connected to the water pump housing (see illustrations). Refer to Chapter 2A for intake manifold removal to access the coolant pipes and hoses. If you have noticed water leaks or stains on the left side of the engine, the leaks may be coming from these pipes and hoses.

9 Refill the cooling system (see Chapter 1), run the engine and check for leaks and proper operation.

9 Coolant temperature sender unit - check and renewal



9.3 The coolant temperature sender unit (arrowed) is located in the top of the thermostat housing - it is the sender unit with the single wire



Warning: Do not start this procedure until the engine is completely cool.

Check

1 If the coolant temperature gauge is inoperative, check the fuses first (Chapter 12).

2 If the temperature gauge indicates excessive temperature after running awhile, see the *Fault finding* section at the rear of the manual.

3 If the temperature gauge indicates Hot as soon as the engine is started cold, disconnect the wire at the coolant temperature sender (see illustration). If the gauge reading drops, renew the sender unit. If the reading remains high, the wire to the gauge may be shorted to ground, or the gauge is faulty.

4 If the coolant temperature gauge fails to show any indication after the engine has been warmed up, (approx. 10 minutes) and the fuses checked out OK, shut off the engine. Disconnect the wire at the sender unit and, using a jumper wire, connect the wire to a clean ground on the engine. Briefly turn on the ignition without starting the engine. If the gauge now indicates Hot, renew the sender unit.

5 If the gauge fails to respond, the circuit may be open or the gauge may be faulty - see Chapter 12 for additional information.

Renewal

6 Drain the coolant (see Chapter 1).

7 Disconnect the electrical connector from the sender unit.

8 Using a deep socket or a spanner, remove the sender unit.

9 Refit the new unit and tighten it securely. Do not use thread sealant as it may electrically insulate the sender unit.

10 Reconnect the wiring connector, refill the cooling system and check for coolant leakage and proper gauge function.

10 Heating and air conditioning blower motors - circuit check and component renewal



Warning: Later models are equipped with airbags. To prevent accidental deployment of the airbag, which could cause

personal injury or damage to the airbag system, DO NOT work in the vicinity of the steering wheel or instrument panel. Jaguar recommends that, on airbag-equipped models, the following procedure should be left to a dealer service department or other repair workshop because of the special tools and techniques required to disable the airbag system.

1 Disconnect the battery negative cable.

Caution: If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

2 There are two blower motors, one under the left side of the dash and one behind the glove compartment (see illustration). If the blower doesn't work, check the fuse and all connections in the circuit for looseness and corrosion. Make sure the battery is fully charged. To access the right blower, remove the glove compartment liner, the glove compartment door and the right lower dash panel (see Chapter 11).



Warning: When working around the area behind the glove box, watch out for a strip of sheet metal bracing that has a very

sharp edge (see illustration). Apply some heavy duct tape to the edge of the brace before beginning work in this area, or you could injure your hands.

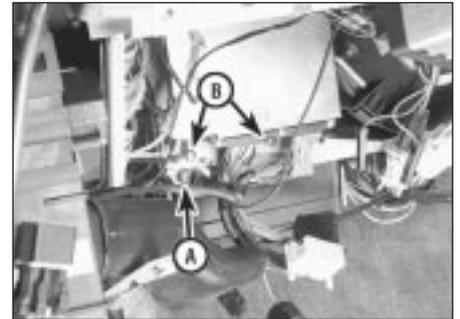
3•8 Cooling, heating and air conditioning systems



10.2a The right blower housing (arrowed) is located behind the glove box area of the dash



10.2b Apply heavy duct tape to the sharp edge of this brace (dotted line) when working behind the glove box area of the dash - the metal is very sharp



10.3a Remove the screw (A) holding the wiring harness in place, then remove the two lower cruise-control ECU screws (B) . . .



10.3b . . . then remove the upper ECU screw (arrowed) and pull down the ECU, then remove the ECU mounting plate



10.5 Two bolts (arrow indicates the left bolt) hold the top of the blower housing to the cowl



10.6 Pull down and out on the housing until it clears the sheet metal brace below it



10.7 Remove this brace rod (small arrow) for clearance to remove the left blower motor housing (large arrow)



10.10 Remove the five clips (two shown here with arrows) and one screw holding the halves of the housing together

3 Remove the screws holding the cruise-control ECU in place (see illustrations), then remove the four screws holding the ECU mounting plate in place.

4 Disconnect the vacuum lines and electrical connectors at the blower housing, identifying each connection with marked masking tape for reassembly, or write down the colour codes of the vacuum tubing. Remove the duct tape connecting the blower housing to the duct from the heater/air conditioning unit.

5 Remove the two bolts holding the top of the blower housing to the cowl (see illustration).

6 Pull down and back on the housing until it

squeezes past the metal brace below it (see illustration). It will take some force at first.

7 To access the left blower motor, remove the left-hand brace rod from the steering column forward to the body (see illustration), then repeat Steps 4 and 5 on the left blower housing. The blower housing should now drop straight down and out.

8 If the blower motor does not operate, disconnect the electrical connectors at the blower motor and connect the black wire terminal to chassis ground, and the purple wire terminal to a fused source of battery voltage. If the blower doesn't operate, it

should be renewed. If it does operate, there is a problem in the feed or earth circuit.

9 If the motor is good, but doesn't operate at any speed, the problem could be in the heater/air conditioning control assembly or the heating/air conditioning computer. Diagnosis either of these electronic components is beyond the scope of the home mechanic, and should be referred to your Jaguar dealer or other qualified repair facility.

10 If either blower motor must be renewed, remove the five clips and one screw holding the blower housing halves together (see illustration).



10.11a Separate the housing halves - the blower motor (arrowed) is attached to a plastic plate sandwiched between the two housing halves



10.11b Loosen the clamp bolt (arrowed) on the motor bracket and then pull the motor and fan out as an assembly

11 Separate the housing halves and pull up the plastic plate holding the motor and fan (see illustration). The fan doesn't come off the motor, but loosen the clamp-bolt on the motor's mount bracket and slide the motor and fan out for renewal (see illustration). **Note:** Some 1988 models had problems with cracking of the fan blades and noise from the blowers. These blowers and fans have been superseded with improved parts, available from your Jaguar dealer.

12 When either blower housing is separated, you'll find two relays mounted inside (see illustration). These are the blower isolation relay and blower relay. Before refitting the blower housing in the car, refer to Chapter 12 for testing of these relays.

13 Refitting is the reverse of removal. Check for proper operation.

11 Heater core - removal and refitting



Warning: Later model vehicles are equipped with airbags. To prevent the accidental deployment of the airbag, which could cause personal injury or damage to the airbag system, DO NOT work in the vicinity of the steering wheel or instrument panel. The manufacturer recommends that, on airbag-equipped models, the following procedure should be left to a dealer service department or other repair workshop because of the special tools and techniques required to disable the airbag system.

1 Disconnect the battery negative cable. **Caution:** If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.

2 Drain the cooling system (see Chapter 1). Disconnect the heater hoses where they enter the bulkhead (see illustration). **Note:** Use compressed air in one of the pipes to blow out any remaining coolant and collect it. This will prevent any spills on the carpeting when the heater core is removed. Plug the pipes to prevent any remaining coolant from spilling out.

3 Refer to Chapter 11 for removal of the under-dash panels on both the driver and passenger sides, and removal of the glovebox.



Warning: When working around the area behind the glove box, watch out for a strip of sheet

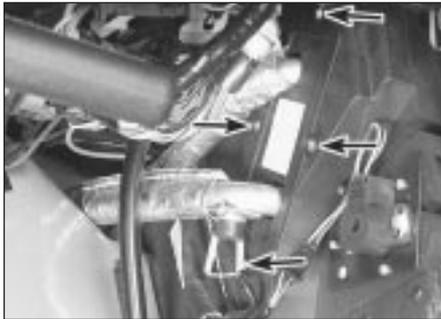
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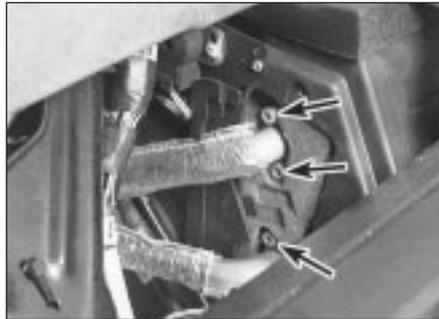
10.12 Inside the blower case are the blower and isolation relays (arrowed) - while the case is apart, test these relays for proper operation



11.2 Disconnect the heater hoses from the pipes at the bulkhead (small arrows) - the large arrow indicates the evaporator case retaining nut



11.4 Remove these screws (small arrows) to remove the plastic plate over the heater core pipes on the left side



11.5 With the cover off, remove the Allen bolts (arrows indicate three of the four) to pull the coolant pipes out of the left side of the heater core



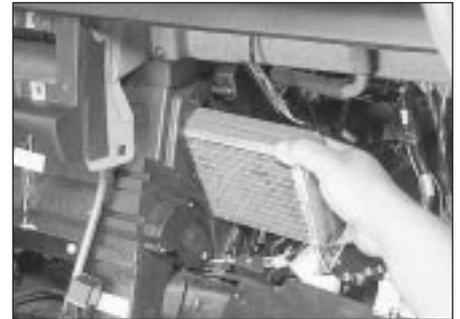
11.6a Remove three screws (one arrowed; one at the top-back and one below) to take out the climate-control computer on right side of heater/air conditioning assembly



11.6b Pull away the climate control computer (arrowed)



11.7 Remove the four screws (arrowed) and the heater core cover plate



11.8 Pull the heater core out to the right

metal bracing that has a very sharp edge (see illustration 10.2b). Apply some heavy duct tape to the edge of the brace before beginning work in this area, or you could injure your hands.

4 On the passenger's side, under the dash, remove the screws holding the plastic cover where the heater pipes enter the heater/air conditioning housing (see illustration).

5 With the cover off, there is access to remove the four Allen bolts holding the two pipes to the heater core (see illustration).

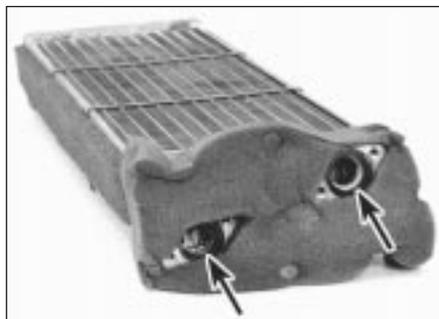
6 Move to the right side and unbolt the climate control computer and pull it down and away from the heater/air conditioning housing (see illustrations).

7 Remove the four small screws and remove the plastic plate over the heater core, right behind where the climate control computer had been (see illustration).

8 Carefully slide the heater core out from the right side of the heating/air conditioning housing (see illustration). **Note:** Keep plenty of towels or rags on the carpeting to catch any coolant that may drip.

9 Refitting is the reverse order of removal. When refitting the heater core, make sure all of the foam insulation strips are in place and refit new O-rings where the heater pipes enter the core (see illustration).

10 Refill the cooling system, reconnect the battery and run the engine. Check for leaks and proper system operation.



11.9 Retain the original foam insulation on the heater core or transfer to the new core, and replace the two O-rings (arrowed)

12 Heater and air conditioning control assembly - check, removal and refitting



Warning: Later models are equipped with airbags. To prevent the accidental deployment of the airbag, which could cause personal injury or damage to the airbag system, DO NOT work in the vicinity of the steering wheel or instrument panel. The manufacturer recommends that, on airbag-equipped models, the following procedure should be left to a dealer service department or other repair workshop

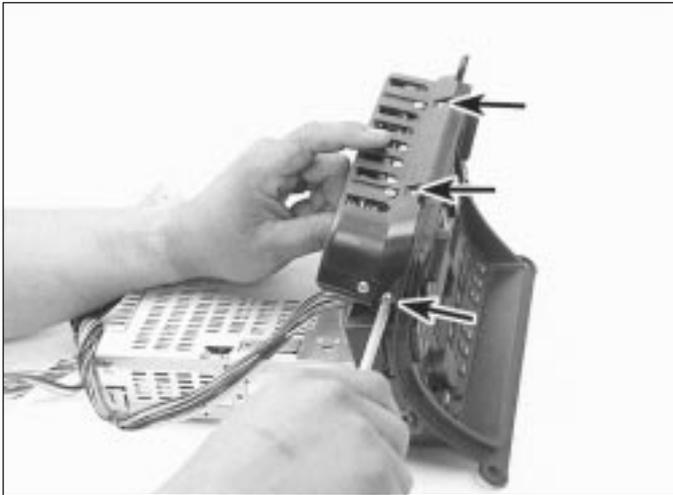
because of the special tools and techniques required to disable the airbag system.

Removal and refitting

- 1 Disconnect the battery negative cable. **Caution:** If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.
- 2 Refer to Chapter 11 for removal of the console heater control/radio assembly trim bezel.
- 3 Remove the mounting screws retaining the heater/air conditioning control assembly to the console (see illustrations). Pull the assembly out, and disconnect the electrical connectors.



12.3a Remove these six screws (arrowed) to release the control panel/radio assembly from the console



12.3b Remove the four screws (three are shown here) holding the control assembly in the control/radio housing



12.11 Check the operation of the vacuum servo motors; in this case, vacuum is applied to the servo on the right blower case - the flapper door (arrowed) should operate

4 Refitting is the reverse of the removal procedure.

5 Run the engine and check for proper functioning of the heater (and air conditioning, if equipped).

Control checks

6 The climate-control system uses an all-electronic control panel that sends digital information to the climate control computer. There is little the home mechanic can do to troubleshoot or test the system. The factory recommends that diagnosis be performed at a dealership.

7 If there is a problem in just one area of climate control, put the controls through their entire range of operation and check the system responses, i.e. set the controls to COLD, the fan to low and the temperature to 65° F. In this mode the Manual LED should be lit and the air conditioning compressor should engage. Try all of the fan speeds and try the temperature on HOT, then feel for warm air coming from the ducts. **Note:** Between each try of the different controls, wait 20 seconds or so for the heater/air conditioning system to adjust before checking for a response.

8 When each control button is pushed two times, its LED light should go on or off. Renew the control assembly if any of the warning lights don't work.

9 On 1988 and 1989 models, if the climate controls do not respond to any driver input, check with your Jaguar dealer before renewing the ECU or control panel. A service part is available (a resistor, #JLM 1901) that can be installed at one of the control panel terminals that may fix the problem without any other parts being renewed. Instructions are included with the part.

10 Check the vacuum lines to the several vacuum motors that operate the heater/air conditioning functions. Look for pinched or blocked hoses and leaks.

11 Each of the vacuum "servo motors" in the system can be checked with a hand-held vacuum pump (see illustration). Apply vacuum and watch that the door or control it operates is working.

12 Further diagnosis of the controls or climate control ECU are best left to a Jaguar dealership or other qualified repair facility.

13 Air conditioning and heating system - check and maintenance

Air conditioning system



Warning: The air conditioning system is under high pressure. Do not loosen any hose fittings or remove any components until

the system has been discharged. Air conditioning refrigerant should be properly discharged into an EPA-approved recovery/recycling unit by a dealer service department or an automotive air conditioning repair facility. Always wear eye protection when working near air conditioning system fittings.

1 The following maintenance checks should be performed on a regular basis to ensure that the air conditioner continues to operate at peak efficiency:

- Inspect the condition of the compressor drivebelt. If it is worn or deteriorated, renew it (see Chapter 1).
- Check the drivebelt tension and, if necessary, adjust it (see Chapter 1).
- Inspect the system hoses. Look for cracks, bubbles, hardening and deterioration. Inspect the hoses and all fittings for oil bubbles or seepage. If there is any evidence of wear, damage or leakage, renew the hose(s).

d) Inspect the condenser fins for leaves, bugs and any other foreign material that may have embedded itself in the fins. Use a "fin comb" or compressed air to remove debris from the condenser.

e) Make sure the system has the correct refrigerant charge.

2 It's a good idea to operate the system for about ten minutes at least once a month. This is particularly important during the winter months because long term non-use can cause hardening, and subsequent failure, of the seals.

3 Leaks in the air conditioning system are best spotted when the system is brought up to operating temperature and pressure, by running the engine with the air conditioning ON for five minutes. Shut the engine off and inspect the air conditioning hoses and connections. Traces of oil usually indicate refrigerant leaks.

4 Because of the complexity of the air conditioning system and the special equipment required to effectively work on it, accurate troubleshooting of the system should be left to a professional technician.

5 If the air conditioning system doesn't operate at all, check the fuse panel and the air conditioning relay (refer to Chapter 12 for relay locations and testing). See Sections 4, 9 and 12 for electrical checks of heating/air conditioning system components.

6 The most common cause of poor cooling is simply a low system refrigerant charge. If a noticeable drop in cool air output occurs, the following quick check will help you determine if the refrigerant level is low.

Checking the refrigerant charge

7 Warm the engine up to normal operating temperature.

8 Place the air conditioning temperature selector at the coldest setting and put the



13.9 Feel the inlet (small arrow) and outlet (large arrow) pipes at the bulkhead leading to the air conditioning evaporator (battery removed here for clarity only)



13.11 The sight glass (arrowed) is located on the top of the receiver/drier, to the right of the radiator

blower at the highest setting. Open the doors (to make sure the air conditioning system doesn't cycle off as soon as it cools the passenger compartment).

9 With the compressor engaged - the clutch will make an audible click and the centre of the clutch will rotate. After the system reaches operating temperature, feel the two pipes connected to the evaporator at the bulkhead (see illustration).

10 The pipe (thinner tubing) leading from the condenser outlet to the evaporator should be cold, and the evaporator outlet line (the thicker tubing that leads back to the compressor) should be slightly colder (3 to 10° F). If the evaporator outlet is considerably warmer than the inlet, the system needs a charge. Insert a thermometer in the centre air distribution duct while operating the air conditioning system - the temperature of the output air should be 35 to 40° F below the ambient air temperature (down to approximately 40° F). If the ambient (outside) air temperature is very high, say 110° F, the duct air temperature may be as high as 60° F, but generally the air conditioning is 30 to 50° F cooler than the ambient air. If the air isn't as cold as it used to be, the system probably needs a charge. Further inspection or testing of the system is beyond the scope of the home mechanic and should be left to a professional.

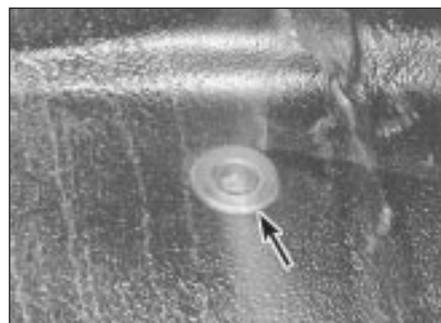
11 Inspect the sight glass (see illustration). If the refrigerant looks foamy when running, it's low. When ambient temperatures are very hot, bubbles may show in the sight glass even with the proper amount of refrigerant. With the proper amount of refrigerant, when the air conditioning is turned off, the sight glass should show refrigerant that foams, then clears. **Note:** 1993 and 1994 models are equipped with R-134a refrigerant systems and do not have a sight glass.

Heating systems

12 If the air coming out of the heater vents isn't hot, the problem could stem from any of the following causes:

- a) *The thermostat is stuck open, preventing the engine coolant from warming up enough to carry heat to the heater core. Renew the thermostat (see Section 3).*
- b) *A heater hose is blocked, preventing the flow of coolant through the heater core. Feel both heater hoses at the bulkhead. They should be hot. If one of them is cold, there is an obstruction in one of the hoses or in the heater core, or the heater control valve is shut. Detach the hoses and back flush the heater core with a water hose. If the heater core is clear but circulation is impeded, remove the two hoses and flush them out with a water hose.*
- c) *If flushing fails to remove the blockage from the heater core, the core must be renewed. (see Section 11).*

13 If the blower motor speed does not correspond to the setting selected on the blower switch, the problem could be a bad



13.16 This drain hose (arrowed) from the heater/air conditioning unit should be kept clear to allow drainage of condensation

fuse, circuit, control panel or climate control computer (see Sections 10 and 12).

14 If there isn't any air coming out of the vents:

- a) *Turn the ignition ON and activate the fan control. Place your ear at the heating/air conditioning register (vent) and listen. Most motors are audible. Can you hear the motor running?*
- b) *If you can't (and have already verified that the blower switch and the blower motor resistor are good), the blower motor itself is probably bad (see Section 10).*

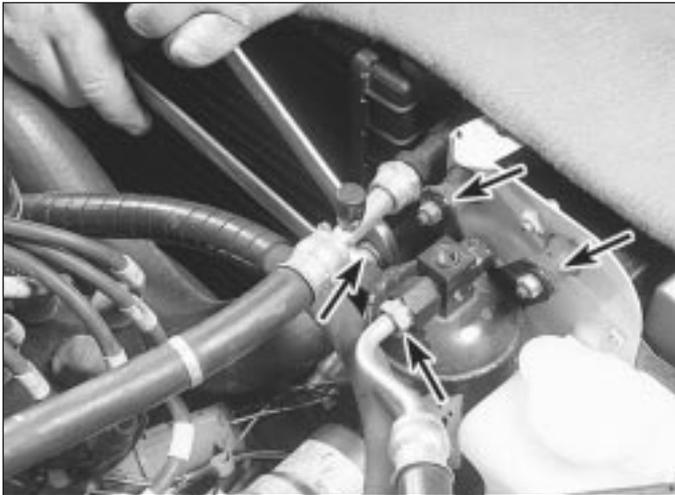
15 If the carpet under the heater core is damp, or if antifreeze vapour or steam is coming through the vents, the heater core is leaking. Remove it (see Section 11) and refit a new unit (most radiator shops will not repair a leaking heater core).

16 Inspect the drain hose from the heat/AC assembly at the right side of the bulkhead, make sure it is not clogged (see illustration). If there is a humid mist coming from the system ducts, this hose may be plugged. In some early models, the hose may have been pinched during assembly or blocked with insulation or underseal.

14 Air conditioning receiver/drier - removal and refitting



Warning: *The air conditioning system is under high pressure. Do not loosen any hose fittings or remove any components until the system has been discharged. Air conditioning refrigerant should be properly discharged into an EPA-approved recovery/recycling unit by a dealer service department or an automotive air conditioning*



14.2 After the system has been discharged, unbolt the two refrigerant lines (left arrows) from the top of the receiver/drier and cap them - use two spanners when loosening or tightening these lines - right arrows indicate the two top mounting bolts



15.4 Disconnect the electrical connector (small arrow) at the compressor, then disconnect the bolt (large arrow) at the retaining plate that holds the two hoses in place

repair facility. Always wear eye protection when working near air conditioning system fittings.

- 1 Have the refrigerant discharged and recovered by an air conditioning technician.
- 2 Disconnect the refrigerant lines (see illustration) from the receiver/drier and cap the open fittings to prevent entry of moisture.
- 3 Remove the three nuts holding the receiver/drier to the radiator support and remove the receiver/drier. **Note:** On 1993 and 1994 models, the receiver/drier is a long tubular style mounted to the top-front of the radiator support. The grille must be removed for access on these models (see Chapter 11 for grille removal).
- 4 Refitting is the reverse of removal.
- 5 Have the system evacuated, charged and leak tested by the workshop that discharged it. If the receiver/drier was renewed, have them add new refrigeration oil to the compressor, about 28 cc (one ounce). Use only the refrigerant oil compatible with the refrigerant of your system (R-12 or R-134a).

15 Air conditioning compressor - removal and refitting



Warning: The air conditioning system is under high pressure. Do not loosen any hose fittings or remove any components until the system has been discharged. Air conditioning refrigerant should be properly discharged into an EPA-approved recovery/recycling unit by a dealer service department or an automotive air conditioning repair facility. Always wear eye protection when disconnecting air conditioning system fittings.

- 1 Have the refrigerant discharged by an automotive air conditioning technician.

- 2 Disconnect the battery negative cable. **Caution:** If the stereo in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.
- 3 Remove the drivebelt from the compressor (see Chapter 1).
- 4 Detach the electrical connector and disconnect the flexible refrigerant lines (see illustration).
- 5 Unbolt the compressor and lift it from the vehicle (see illustration).
- 6 If a new or rebuilt compressor is being installed, drain the fluid from the new unit by opening the drain plug and by tilting the compressor to the rear so that any remaining oil will come out the ports in the back normally covered by the plate and hard lines. Refit the drain plug and end-plate and add 199 cc (7 fluid ounces) of new oil of a type compatible with the type refrigerant in your system.
- 7 Refitting is the reverse of removal. Renew any O-rings with new ones specifically made for the type of refrigerant in your system and lubricate them with refrigerant oil, also designed specifically for your refrigerant.
- 8 Have the system evacuated, recharged and tested by the workshop that discharged it.

16 Air conditioning condenser - removal and refitting



Warning: The air conditioning system is under high pressure. Do not loosen any hose fittings or remove any components until the system has been discharged. Air conditioning refrigerant should be properly discharged into an EPA-approved recovery/recycling unit by a dealer service department or an automotive air conditioning repair facility. Always wear eye protection when disconnecting air conditioning system fittings.

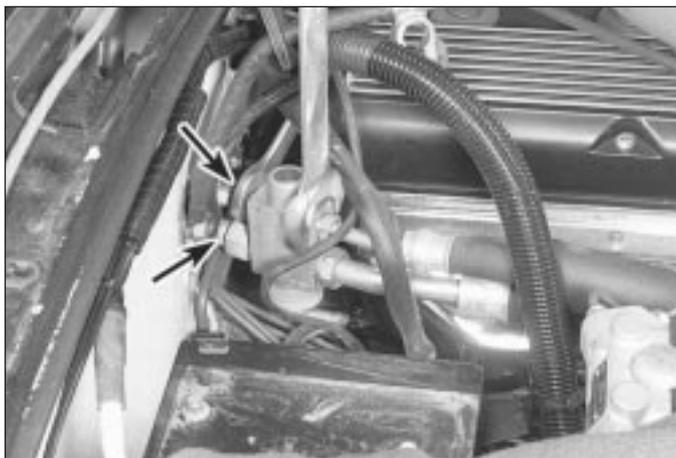
- 1 Have the refrigerant discharged and recovered by an air conditioning technician.
- 2 Remove the radiator cowl panel as described in Section 5.
- 3 Using two spanners to avoid twisting the fittings, disconnect the inlet and outlet lines from the condenser (see illustration).
- 4 Pull the condenser straight up and out of the vehicle.
- 5 Refitting is the reverse of removal. When refitting the condenser, be sure the rubber



15.5 Remove the lower mounting bolts and the adjuster bolt (arrowed)



16.3 Disconnect the two lines, then pull up on the condenser (arrowed)



17.2 Use two spanners when disconnecting the air conditioning lines (arrowed) at the bulkhead, on the backside of the expansion valve - one spanner holds the body of the expansion valve



17.4 Remove the housing retaining nut (arrowed) on the engine side of the bulkhead, near the expansion valve - another nut is on the right, near the heater core pipes

cushions fit on the mounting points and that any foam insulator strips are still in place or transferred to the new condenser.

6 Reconnect the refrigerant lines, using new O-rings. If a new condenser has been installed, add 84 cc (3 fluid ounces) of new refrigerant oil. **Note:** The oil and O-rings must be compatible with the type of refrigerant you are using.

7 Refit the remaining parts in the reverse order of removal.

8 Have the system evacuated, charged and leak tested by the workshop that discharged it.

17 Air conditioning evaporator and expansion valve - removal and refitting



Warning 1: The air conditioning system is under high pressure. Do not loosen any hose fittings or remove any components until the system has been discharged.

Air conditioning refrigerant should be properly discharged into an EPA-approved recovery/recycling unit by a dealer service department or an automotive air

conditioning repair facility. Always wear eye protection when disconnecting air conditioning system fittings.



Warning 2: Later model vehicles are equipped with airbags. To prevent the accidental deployment of the airbag, which could cause personal injury or damage to the airbag system, DO NOT work in the vicinity of the steering wheel or instrument panel. The manufacturer recommends that, on airbag-equipped models, the following procedure should be left to a dealer service department or other repair workshop because of the special tools and techniques required to disable the airbag system.

1 Refer to Chapter 11 for removal of the glove compartment, under-dash panels and console. **Note:** The removal of the heater/evaporator housing is difficult and time-consuming, much more so than the removal of the heater core (see Section 11). For some home mechanics, the job is better left to a Jaguar dealership or other qualified repair workshop.

2 Disconnect the air conditioning lines from the backside of the expansion valve (at the bulkhead, just to the right of the engine), using

two spanners (see illustration). Cap the open fittings and expansion valve after dismantling to prevent the entry of air or dirt.

3 Refer to Section 11 for moving the climate-control computer aside and disconnecting the heater core pipes.

4 From the engine side of the bulkhead, near the expansion valve, remove the nut retaining the heat/air conditioning assembly housing (see illustration). Another mounting nut is on the left side, under the wiper motor (see illustration 11.2).

5 Disconnect the defroster ducts on the left and right side of the evaporator housing (see illustration).

6 Identify all of the vacuum motor lines with masking tape and a felt pen, then disconnect the lines. **Note:** Most vacuum lines are colour-coded. Make notes on which ones go to which devices.

7 Tag and disconnect the wiring plugs connected to the heating/air conditioning housing.

8 At the bottom left and bottom right of the housing, pull off the rubber drain tubes that go into the flooring.

9 Remove the four rod-type support braces. Two support the dash, and two connect the case to the floor of the car (see illustrations).



17.5 Left duct (large arrow) can be removed by pulling off the clip (small arrow) - right duct pulls out without a clip



17.9a Unbolt the four support braces (small arrows) from the case (large arrow) and floor



17.9b Black case-support rods are held with nuts (arrowed), the gold dash-support rods are retained by a bolt/nut to the dash

10 With everything disconnected, pull the heat-air conditioning housing back and out from under the dash.

Caution: *Do not force anything. If the unit gets stuck, determine where the interference is before a duct, wire or hose is broken.*

11 Pry off the series of black metal clips connecting the main housing to the evaporator case, then separate the evaporator case and pull out the evaporator core. **Note:** *When refitting the evaporator core into the case, be sure to refit the foam insulation in the same way it was installed originally.*

12 The evaporator core can be cleaned with a "fin comb" and blown off with compressed air.

13 The expansion valve is located on the right side of the bulkhead on the engine side. To renew it, remove the battery (Chapter 5) for better access. Disconnect the lines from the back of the valve as in Step 2. Disconnect the high and low-pressure hoses from the *front* of the expansion valve (**see illustration**).

14 If the evaporator core is renewed, make sure the technician adds 1.4 ounces of new refrigerant oil (of a type compatible with your type of refrigerant) to the system.

15 The remainder of the refitting is the reverse of the removal process. Be sure to use new O-rings, and new gaskets on the expansion valve.

16 Have the system evacuated, charged and leak tested by the workshop that discharged it.



17.13 Disconnect the lines at the front of the expansion valve - always use two spanners to avoid twisting a line - one spanner holds the body of the valve