Chapter 3 Cooling, heating and air conditioning systems

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3

Specifications

General

Radiator cap pressure rating	78 to 98 kPa
Thermostat rating	
3.0 litre	
Start to open	76 degrees C
Fully open	90 degrees C
4.2 litre	
Start to open	82 degrees C
Fully open	95 degrees C
A/C refrigerant type*	
Early systems	R-12
Later systems	R-134a

**Consult engine compartment decal*

Torque specifications

	Nm
Fan bolts	
3.0 litre	7 to 8
4.2 litre	9 to 11
Fan clutch nuts	
3.0 litre	7 to 8
4.2 litre	9 to 11
Radiator bolts	4 to 5

Torque specifications (continued)	Nm
Thermostat housing bolts	
3.0 liter	16 to 21
4.2 litre	21 to 26
Water pump-to-block bolts and nuts	
3.0 litre engine	
6 mm bolts	7 to 8
8 mm bolts	16 to 21
10 mm bolts	30 to 40
4.2 litre engine	
Bolts	16 to 19
Nuts	30 to 40

1 General information

Engine cooling system

All vehicles covered by this manual employ a pressurized 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.

The coolant reservoir serves as both the point at which fresh coolant is added to the cooling system to maintain the proper fluid level and as a holding tank for overheated coolant.

This type of cooling system is known as a closed design because coolant that escapes past the pressure cap is saved and reused.

Heating system

The heating system consists of a blower fan and heater core located within the heater box under the dashboard, the inlet and outlet hoses connecting the heater core to the engine cooling system and 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 adjacent to the heater core, 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.

Some models are equipped with a rear air conditioner which uses its own evaporator core.

2 Antifreeze - general information

Refer to illustration 2.4

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

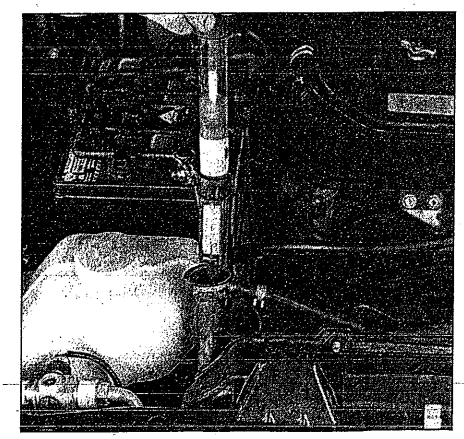
Note: *Non-toxic antifreeze is now manufactured and available at most auto parts stores, but even these types should be disposed of properly.*

The cooling system should be filled with a water/ethylene-glycol based antifreeze solution, which will prevent freezing down to at least -29 degrees C, or lower if local climate requires it. It also provides protection against corrosion and increases the coolant boiling point.

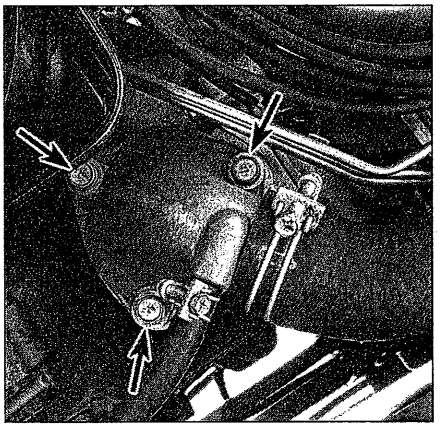
The cooling system should be drained, flushed and refilled every 48,000 kilometers or every two years (see Chapter 1). The use of antifreeze solutions for periods of longer than two years is likely to cause damage and encourage the formation of rust and scale in the system. If your tap water is "hard", 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.

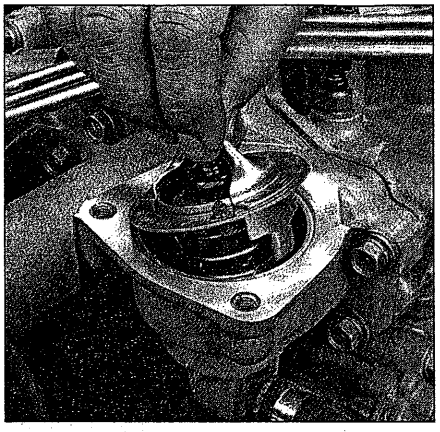
The exact mixture of antifreeze-to-water you should use depends on the relative weather conditions. The mixture should contain at least 50-percent antifreeze, but should never contain more than 70-percent antifreeze. Consult the mixture ratio chart on the antifreeze container before adding coolant. Hydrometers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



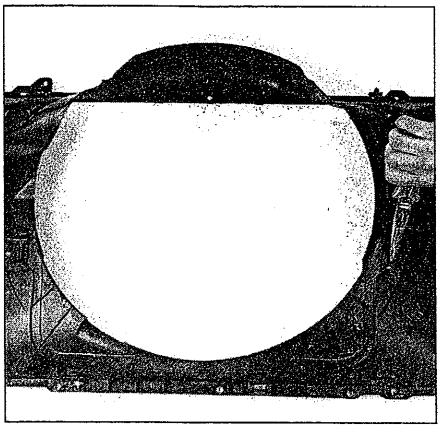
2.4 An inexpensive hydrometer can be used to test the condition of your coolant



3.7 The thermostat housing is retained by three bolts - some models have a small bypass hose attached to the top of the housing (4.2L petrol engine shown)



3.9 The thermostat is refitted with the spring end directed towards the engine



4.5a Remove the two clips . . .

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. 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 traveling through the radiator. Renew the thermostat. **Caution:** *On models equipped with fuel injection, do not drive the vehicle without a thermostat. The computer may stay in open loop and emissions and fuel economy will suffer. Carburetted models will suffer poor driveability and shortened piston ring life.*

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

Refer to illustrations 3.7 and 3.9

5 Disconnect the negative cable from the battery.

6 Drain the coolant from the radiator (see Chapter 1). Loosen the air bleed on the thermostat housing (if equipped).

7 Disconnect the small bypass hose from the thermostat housing on 4.2 litre models **(see illustration)**.

8 Detach the housing from the engine. Be prepared for some coolant spillage as the gasket seal is broken. The radiator hose can be left attached to the housing, unless the housing itself is to be renewed.

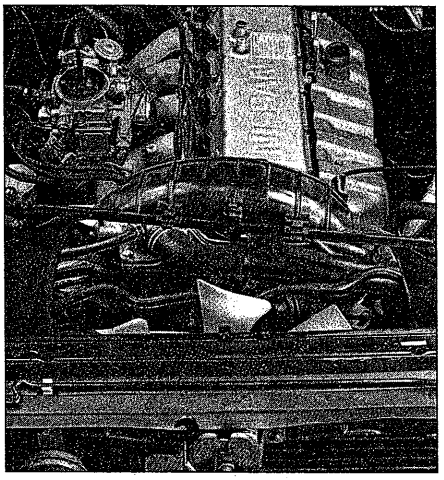
9 Remove the thermostat, noting the direction in which it was refitted in the housing, and thoroughly clean the sealing surfaces **(see illustration)**.

10 Fit a new gasket onto the thermostat.

11 Refit the thermostat and housing.

12 Tighten the housing fasteners to the torque listed in this Chapter's Specifications and refit the remaining components in the reverse order of removal.

13 Refill the cooling system (refer to *Cooling system servicing* in Chapter 1), run the engine and check for leaks and proper operation.



4.5b . . . then remove the fan shroud mounting bolts and lift the upper half off

4 Engine cooling fan/clutch assembly - check, removal and refitting

Check

1 Check the fan carefully for cracks, especially around the base of each blade. If any cracks are evident, renew the fan.

2 Check the fan clutch for fluid leakage. If it's leaking, renew the clutch.

3 Try to move the fan blades in a front-to-rear direction. If they wobble, renew the fan clutch.

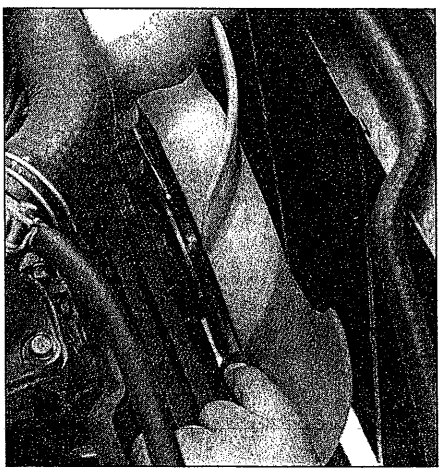
4 Spin the fan by hand. It should resist spinning (more resistance when the engine is hot). If it spins freely, or won't spin at all, renew the fan clutch.

Removal

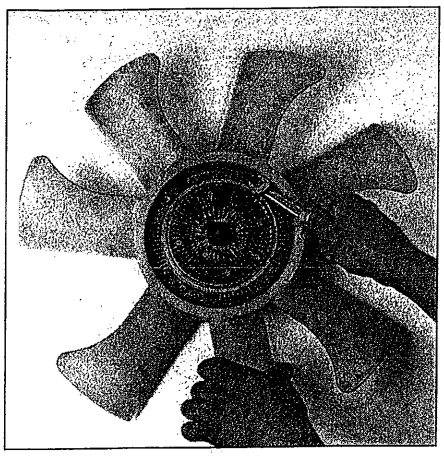
Refer to illustrations 4.5a, 4.5b, 4.6 and 4.7

5 Remove the upper half of the radiator shroud. It is retained by screws to the body and by clips to the lower half **(see illustrations)**.

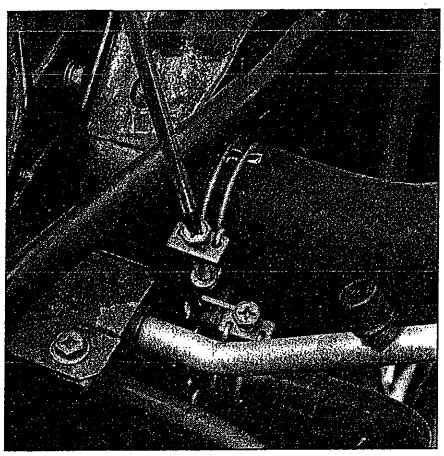
6 Remove the fan clutch mounting nuts **(see illustration)** and separate the fan/clutch assembly from the water pump.



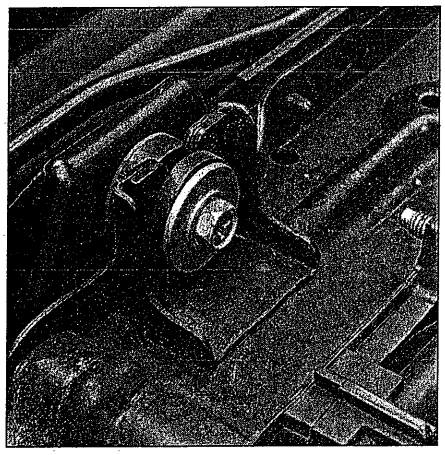
4.6 Remove the four nuts that retain the fan to the water pump and separate the fan assembly from the pump (to prevent the hub from turning, wedge a screwdriver between a nut and the fan clutch hub)



4.7 Remove the four bolts that retain the fan to the fan clutch



5.3 Loosen the clamps and detach the hoses from the radiator



5.8 Remove the radiator mounting bolts

7 Place the fan/clutch assembly on the bench and remove the fan mounting bolts **(see illustration)**.

8 Refitting is the reverse of removal.

5 Radiator and coolant reservoir - removal and refitting

Warning: *Do not start this procedure until the engine is completely cool. Wait at least two hours after running the engine.*

Radiator

Refer to illustrations 5.3 and 5.8

1 Disconnect the negative battery cable.

2 If the coolant is in good condition, drain the coolant into a clean container for reuse (see Chapter 1).

3 Disconnect both the upper and lower radiator hoses **(see illustration)**.

4 Disconnect the other hoses from the radiator (various models use different combinations of lower hoses and bypass hoses).

5 Disconnect the wiring from the temperature switch (if equipped).

6 If equipped with an automatic transmission, disconnect the cooler lines from the radiator. Place a drip pan underneath the fittings to catch the fluid, then plug the lines and fittings.

7 Remove the upper radiator shroud (see Section 4). Remove the lower shroud also.

8 Remove the radiator mounting bolts **(see illustration)**, then lift out the radiator.

9 With the radiator removed, it can be inspected for leaks, damage and internal blockage. If in need of repairs, have a professional radiator shop or dealer service department perform the work as special techniques are required.

10 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. **Warning:** *Wear eye protection when using compressed air.*

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

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

13 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.

14 On automatic transmission equipped models, check and add fluid as needed.

Coolant reservoir

15 On most models, the coolant reservoir is mounted to the inner fender by one or two screws. Remove the screw(s) and lift the reservoir from the engine compartment.

16 Pour the coolant into a container. Wash out and inspect the reservoir for cracks and chafing. Renew it if it's damaged.

17 Refitting is the reverse of removal.

6 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 7.4)**. 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.

7 Water pump - removal and refitting

Refer to illustrations 7.4 and 7.5

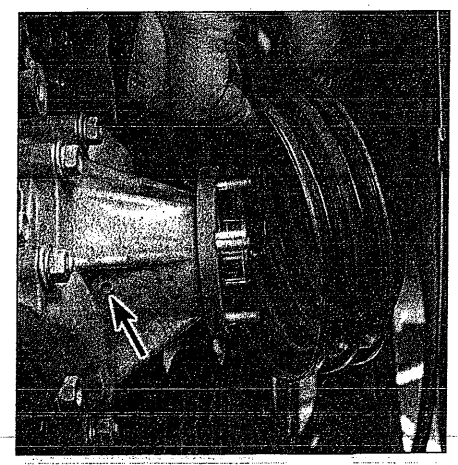
Warning: *Do not start this procedure until the engine is completely cool.*

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

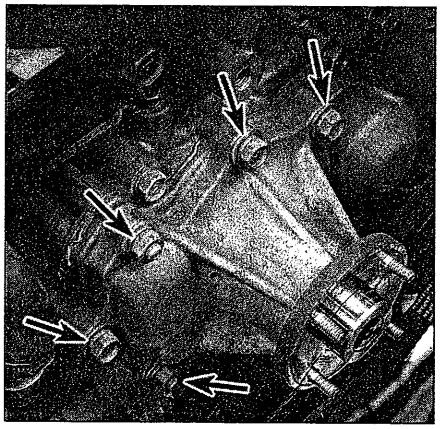
2 Remove the fan and clutch assembly (refer to Section 4). Remove the drivebelts (refer to Chapter 1).

3 If you're working on a model with a 3.0L engine, remove the timing belt (see Chapter 2).

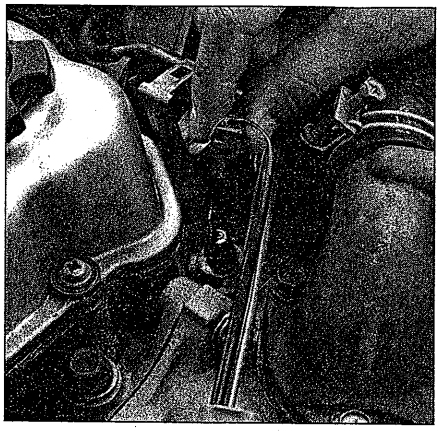
4 Remove the water pump pulley **(see illustration)**.



7.4 Remove the pulley from the water pump (arrow points to the weep hole) - 4.2L engine



7.5 Water pump mounting bolts - 4.2L petrol engine (two bolts not visible in this photo



8.7 The coolant temperature sending unit is located at the front of the engine, near the thermostat housing

9.3 Disconnect the electrical connector from the blower motor

5 Remove the water pump mounting bolts and nuts and remove the pump from the engine **(see illustration)**. If the pump sticks to the engine, knock it loose with a soft-face hammer or a hammer and a block of wood. If you're working on a 3.0 litre engine, remove the water pump bolts one at a time and lay them out on a clean surface in the exact positions in which they were removed (there are four different bolt sizes used in this application).

6 Clean the engine and (if the same pump is to be refitted) water pump sealing surfaces thoroughly with lacquer thinner or acetone, making sure to remove all traces of gasket material. Apply a 3 mm bead of RTV sealant to the pump, inboard of the mounting bolt holes, and refit it while the sealant is still wet.

7 Refitting is the reverse of removal. Tighten the fasteners to the torque(s) listed in this Chapter's Specifications.

8 Coolant temperature sending unit - check and renewal

Check

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

2 If the temperature gauge indicates excessive temperature after running awhile, see the *Troubleshooting* Section in the front 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. If the gauge reading drops, renew the sending unit. If the reading remains high, the wire to the gauge may be shorted to earth or the gauge may be faulty.

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

Refer to illustration 8.6

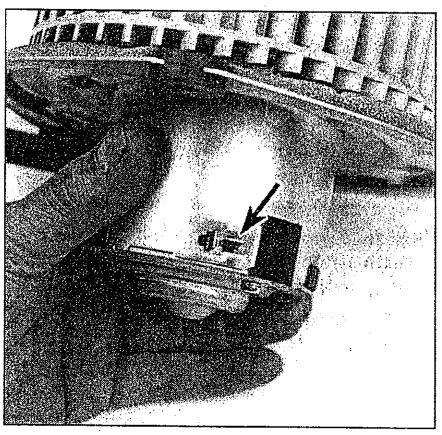
Warning: *Do not start this procedure until the engine is completely cool.*

6 Remove the radiator cap to relieve any residual pressure in the cooling system, then refit the cap.

7 Disconnect the wiring connector from the sending unit **(see illustration).**

8 Using a deep socket, remove the old sending unit.

9 Quickly refit the new unit (to minimize coolant loss) and tighten it securely. Do not use thread sealer, as it may electrically insulate the sending unit.



9.4 Connect a fused jumper wire from a battery positive source to one of the blower motor terminals, then connect the other terminal to a good earth point - the blower motor should operate

10 Reconnect the wiring connector and check for coolant leakage and proper gauge function.

9 Blower motor - check and renewal

Refer to illustrations 9.3, 9.4, 9.8, 9.9a and 9.9b

Note: *Models not equipped with rear air conditioning use only one blower, mounted under the dash on the passenger side. Models with overhead rear air conditioning use two additional small blowers located overhead in the front passenger compartment. Models with conventional rear air conditioning use one large rear blower mounted in the right rear side panel behind the air inlet grille.*

Check

1 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.

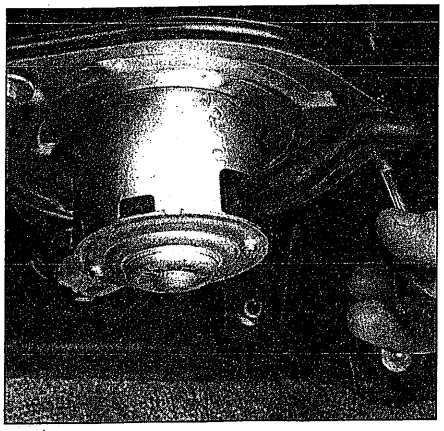
2 Locate the blower motor electrical connector for the blower in question.

3 If the blower motor does not operate, disconnect the electrical connector at the blower motor **(see illustration)**, turn the ignition key On (engine not running) and check for battery voltage with the blower speed switch ON. If battery voltage is not present, there is a problem in the ignition feed circuit.

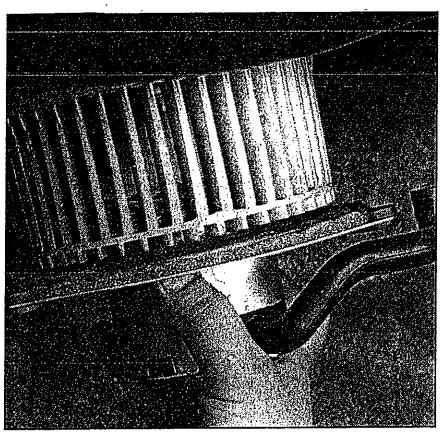
4 If battery voltage is present, reconnect the terminal to the blower motor and backprobe the correct terminal with a jumper wire connected to a good earth point. If the motor still does not operate, the motor is probably faulty. Apply fused power and earth connections to the blower motor terminals **(see illustration)**, if the motor does not operate, renew the motor.

5 If the motor is good, but doesn't operate at any speed, the heater/air conditioning control switch is probably faulty. Remove the control assembly (see Section 12) and check

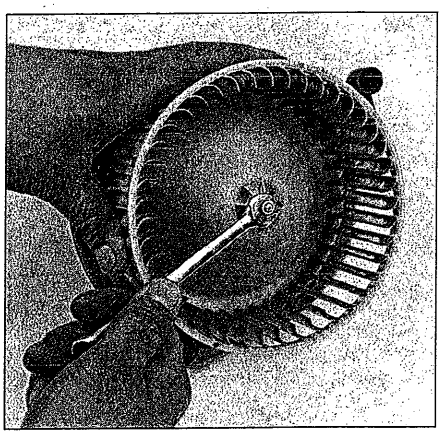
3



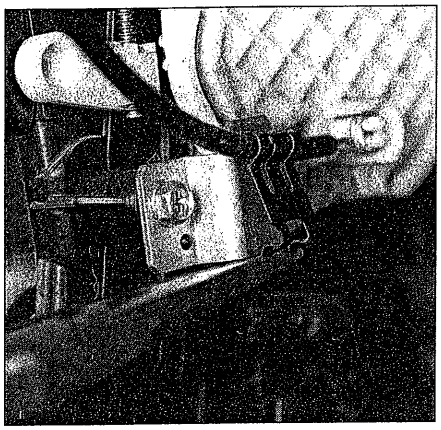
9.8 Detach the cooling hose (arrow) and remove the screws . . .



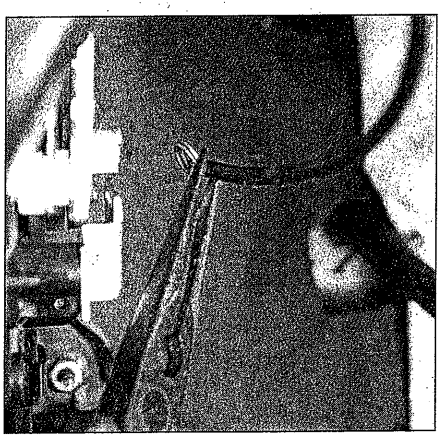
9.9a . . . remove the blower motor and fan assembly . . .



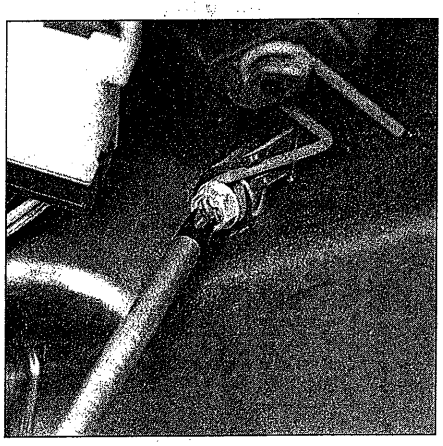
9.9b . . . then remove the retaining nut and slip the fan off the motor shaft



10.5a To detach the control cables, remove the retaining clip . . .



10.5b . . . then pull the cable end off the post



10.6a Disconnect any brackets and harness from the ducting . . .

for continuity through the switch in each position.

6 If the blower motor must be renewed, first disconnect the negative battery cable.

Renewal

7 The front blower is readily accessible. The blowers for the rear air conditioning units require removal of interior panels for access.

8 Disconnect the wiring from the motor **(see illustration 9.3)**. Disconnect the cooling hose and remove the mounting screws **(see illustration)**.

9 Lift the motor and fan out of the blower housing **(see illustration)**. The fan can be removed and reused on the new blower motor **(see illustration)**.

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

10 Heater core - removal and refitting

Refer to illustrations 10.5a, 10.5b, 10.6a through 10.6f, 10.8a, 10.8b, 10.9, 10.10, 10.11 and 10.12

1 Disconnect the negative cable from the battery.

2 Drain the cooling system (see Chapter 1).

3 Remove the entire instrument panel (refer to Chapter 11).

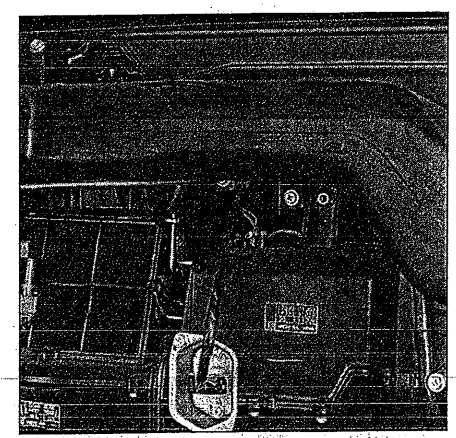
4 Working in the engine compartment, disconnect the heater hoses at the firewall.

5 Detach the heater/air conditioning control cables **(see illustrations)**. Label the cables as you disconnect them to avoid confusion later. **Note:** *Mark the cables with dabs of paint so that they may be refitted in their exact original positions.*

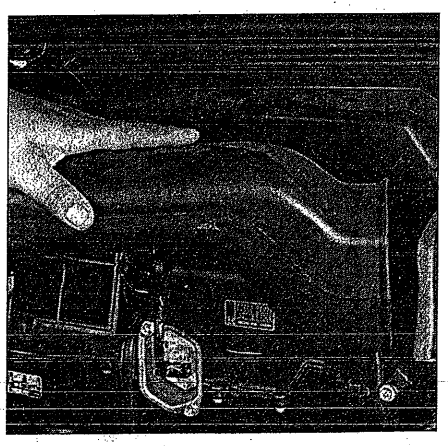
6 Remove the air ducts **(see illustrations)**.

7 Disconnect any wiring that would interfere with removal of the heater unit.

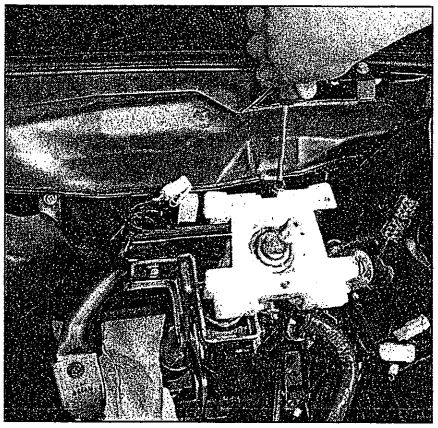
8 Remove the screws which retain the



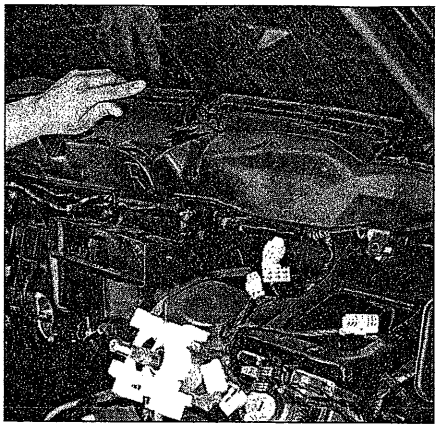
10.6b . . . remove the screws . . .



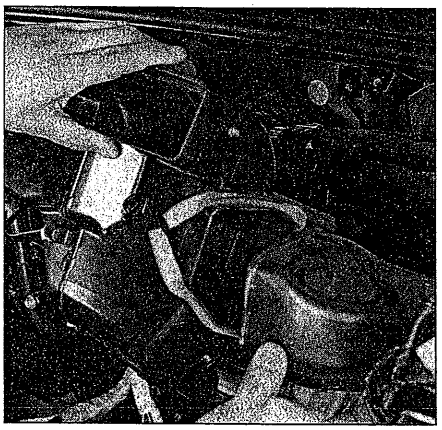
10.6c . . . and detach the left air duct



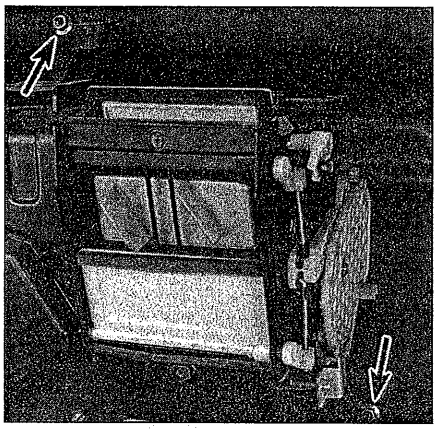
10.6d Remove the screws . . .



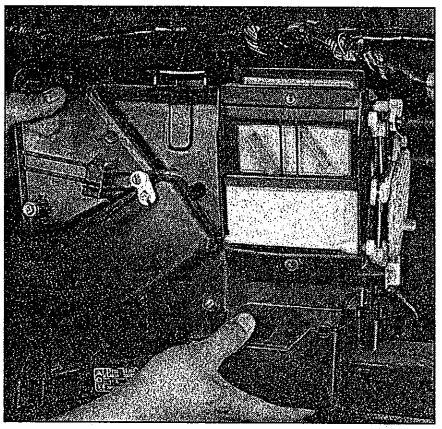
10.6e . . . and detach the defroster duct



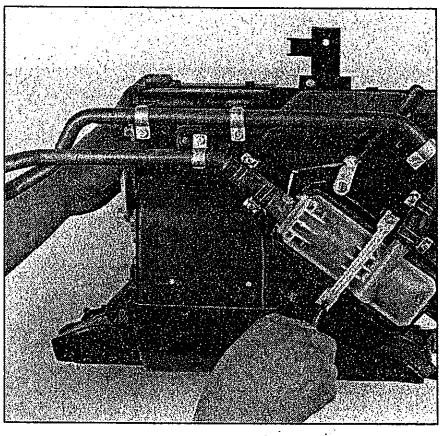
10.6f Carefully remove the centre plenum



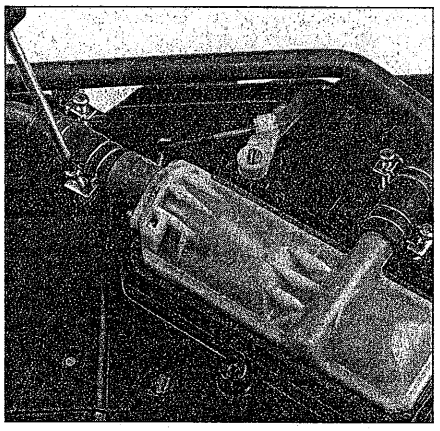
10.8a Remove the screws (arrows) . . .



10.8b . . . and detach the heater unit from the firewall

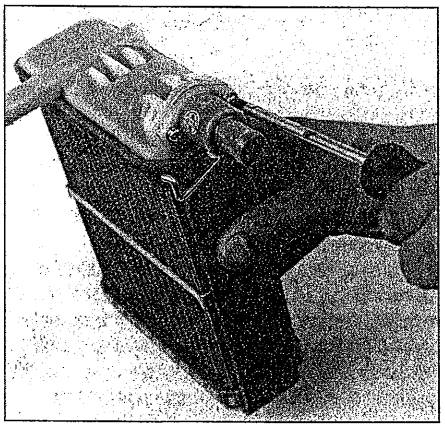


10.9 Remove the retaining strap . . .



10.10 . . . loosen the clamps and detach the hoses . . .

10.11 . . . then lift the heater core out of the case



10.12 Remove the screws and detach the water spigot from the heater core

heater unit and remove the unit from the vehicle **(see illustrations)**. Keep plenty of towels or rags on the carpeting to catch any coolant that may drip. **Caution:** *Work slowly and carefully to avoid breaking any plastic components during removal.*

9 Remove the retaining strap from the heater core **(see illustration)**.

10 Disconnect the rubber hoses from the heater core **(see illustration)**.

11 Slide the heater core out of the case **(see illustration)**.

12 Remove the water spigot from the core **(see illustration)**.

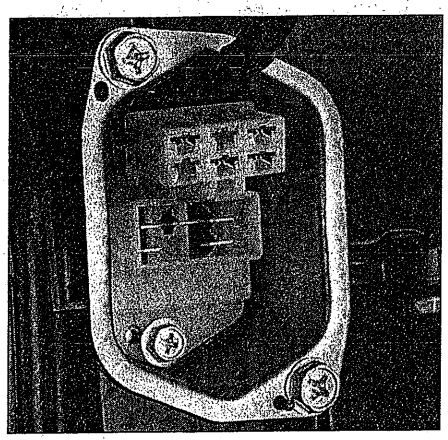
13 Refitting is the reverse order of removal.

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

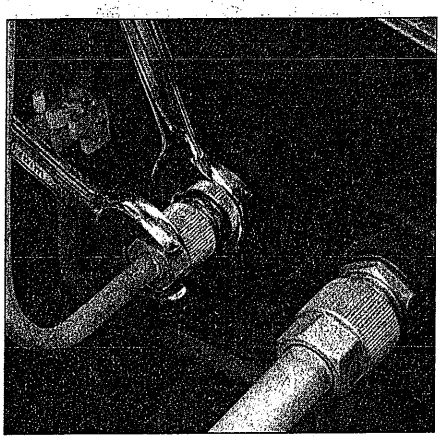
11 Air conditioning evaporator core(s) - removal and refitting

Refer to illustrations 11.4, 11.5, 11.6a, 11.6b, 11.7, 11.8, 11.9a, 11.9b, 11.10 and 11.11

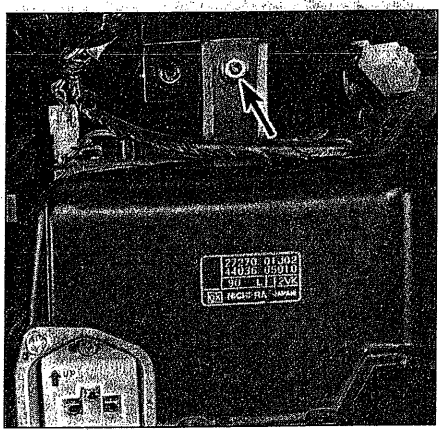
Warning: *The air conditioning system is under high pressure. Do not loosen any hose fittings or remove any components until the*



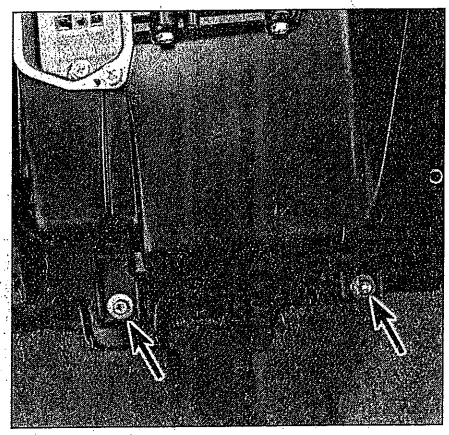
11.4 Disconnect the electrical connector from the evaporator case



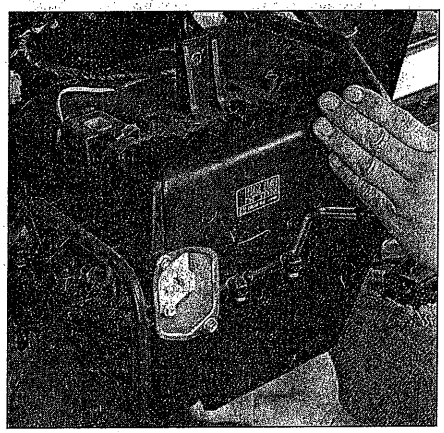
11.5 Working in the engine compartment, detach the refrigerant lines from the evaporator (use two spanners to avoid twisting the lines)



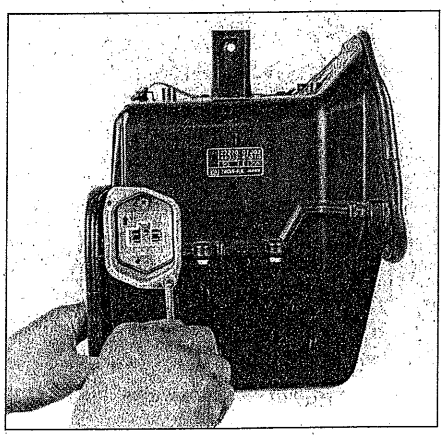
11.6a The evaporator case is secured by one nut at the top (arrow) . . .



11.6b . . . and two screws at the bottom (arrows)



11.7 Carefully guide the evaporator case out from the firewall and heater case



11.8 Remove the electrical connector

system has been discharged. Air conditioning refrigerant should be properly discharged into an 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.

Note: *Models not equipped with rear air conditioning use only one evaporator core, mounted under the dash on the passenger side. Models with overhead rear air conditioning use an additional evaporator core located overhead in the front passenger compartment. Models with conventional rear air conditioning use a rear evaporator core mounted in the right rear side panel to the rear of the control panel.*

Front evaporator core

1 Take the vehicle to an authorized repair facility to have the air conditioning system refrigerant recovered.

2 Disconnect the negative battery cable.

3 Remove the entire instrument panel (refer to Chapter 11).

4 Disconnect the wiring from the evaporator case **(see illustration)**.

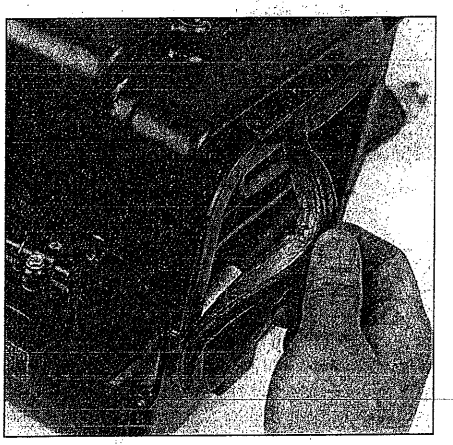
5 Disconnect the refrigerant lines from the evaporator **(see illustration)**.

6 Remove the nut and screws which secure the evaporator housing to the firewall **(see illustrations)**.

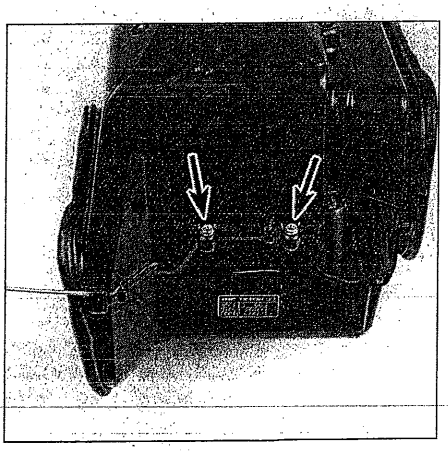
7 Pull the evaporator case carefully away from the firewall **(see illustration)**.

8 Remove the electrical connector **(see illustration)**.

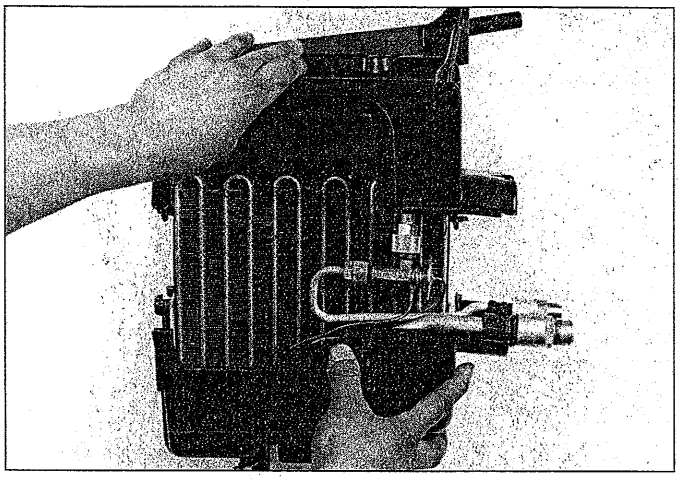
9 Peel off the rubber seal **(see illustration)**. Release the clips and remove the screws which hold the case halves together **(see illustration)**.



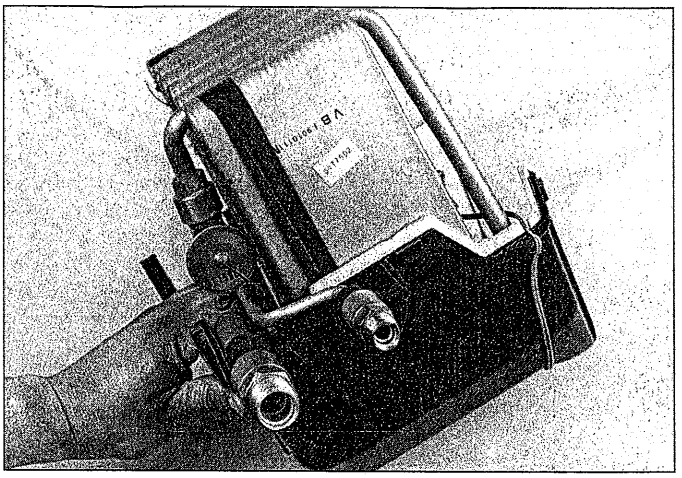
11.9a Carefully peel off the rubber seal . . .



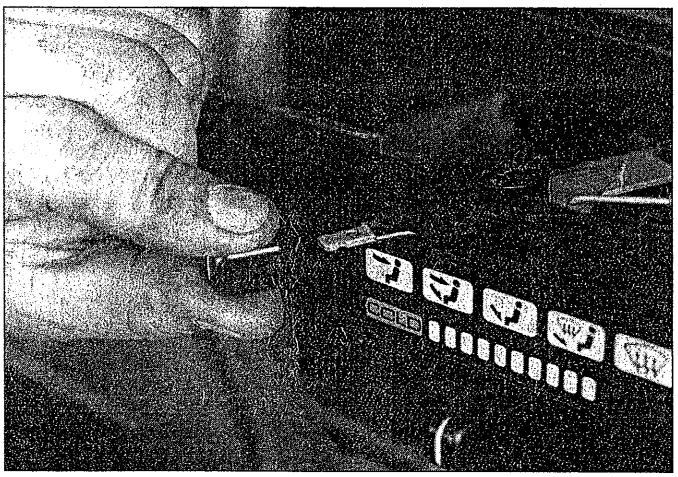
11.9b . . . then prise off the clips and remove the screws securing the case halves together



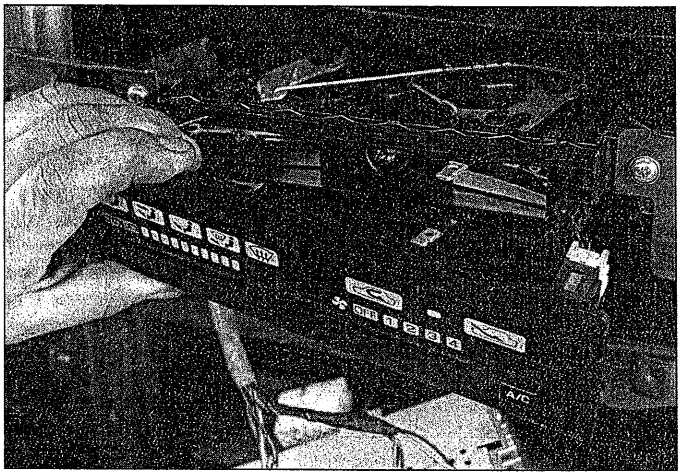
11.10 Remove the upper case half



11.11 Carefully remove the evaporator core from the lower case half



12.3a Remove the control knobs by pulling them straight off their levers



12.3b Remove the face plate and unplug the A/C switch electrical connector (if equipped)

10 Separate the two case halves **(see illustration)**.
11 Carefully remove the evaporator core **(see illustration)**.
12 Refitting is the reverse of removal. Take the vehicle to an authorized repair facility to have the air conditioning system evacuated, charged and leak tested.

Rear evaporator core

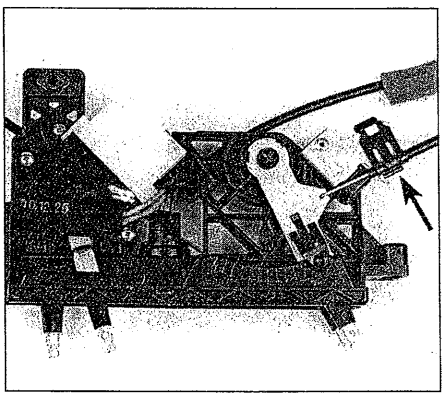
13 Take the vehicle to an authorized repair facility to have the air conditioning system refrigerant recovered.
14 Disconnect the negative battery cable.
15 Remove the interior panels over the evaporator assembly.
16 Disconnect the wiring to the unit.
17 Disconnect the refrigerant lines at the evaporator core.
18 Remove the screws which secure the evaporator case to the overhead mount or the rear wheel housing mount.
19 Remove the case from the vehicle.
20 Separate the case halves and carefully pull out the evaporator core.
21 Refitting is the reverse of removal. Take the vehicle to an authorized repair facility to have the air conditioning system evacuated, charged and leak tested.

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

Removal and refitting

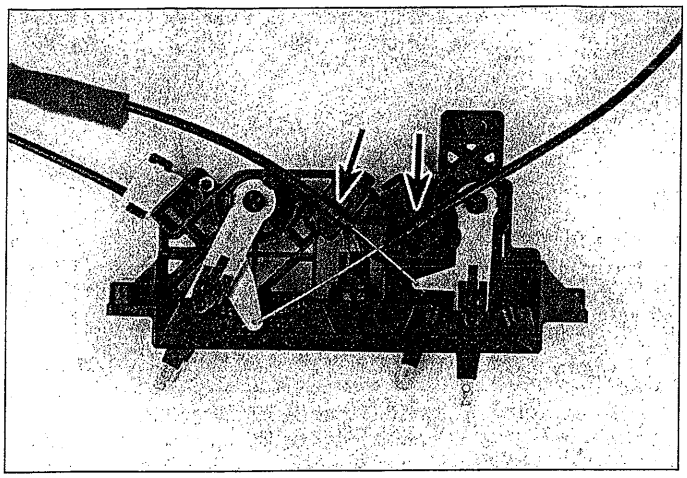
Refer to illustrations 12.3a, 12.3b, 12.7 and 12.8

1 Disconnect the negative cable from the battery.
2 Remove the centre dash panel (see Chapter 11).
3 Pull off the control knobs and remove the face plate **(see illustrations)**.
4 Remove the mounting screws located on the front of the control assembly (see Chapter 12).
5 Pull the control out slightly. Disconnect the electrical connectors.
6 Remove the inner glove compartment.
7 Disconnect the temperature control cable from the control lever **(see illustration)**.
Note: *Mark each cable with a dab of paint before disconnecting it. This will eliminate the need to perform the adjustment procedures upon reassembly.*

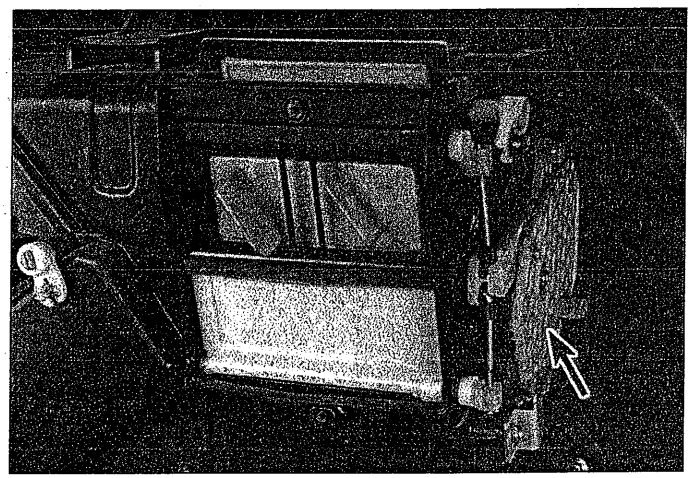


12.7 Remove the clip (arrow) and detach the temperature control cable

3



12.8 On the other side of the control unit, remove the clips (arrows) and detach the other cables from their levers



12.13 Move the link plate (arrow) fully clockwise

8 Disconnect both of the other cables from their retaining clips and from the levers which they operate **(see illustration)**.
9 Remove the bracket from the rear of the heater control unit.
10 Remove the control assembly.
11 Refitting is the reverse of the removal procedure. Adjust the cables if necessary.
12 Run the engine and check for proper functioning of the heater (and air conditioning, if equipped).

Cable and rod adjustments

Refer to illustration 12.13

Air control cable

13 Move the large side link plate fully clockwise **(see illustration)**.
14 Pull the cable casing rearward to remove all slack from the inner cable, then connect the cable and refit the clamp.

Water valve rod

15 Disconnect the temperature control cable from the air mixture door lever.
16 Push the air mix door lever away from the hose clamp.
17 Pull the control rod on the water valve towards the air mix door lever and adjust it so that there is about 2 mm between the end of the rod and the water valve lever.
18 Connect the rod to the air mix door lever.
19 Adjust the temperature control cable.

Temperature control cable

20 Set the temperature control to MAX HOT.
21 Push the cable casing and the air mix door lever to the left. Clamp the cable.

Inlet door cable

22 Set the air inlet to the RECIRC position.
23 Pull the cable casing downward. Push the inlet door lever upward.
24 Clamp the cable.

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

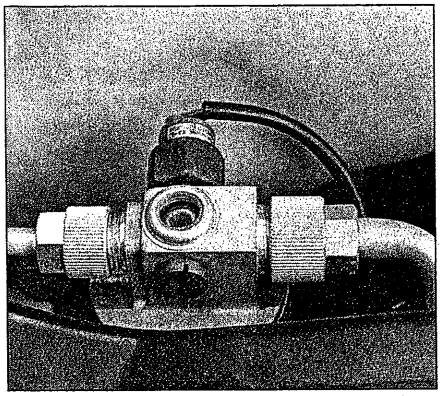
a) *Inspect the condition of the compressor drivebelt. If it is worn or deteriorated, renew it (see Chapter 1).*
b) *Check the drivebelt tension and, if necessary, adjust it (see Chapter 1).*
c) *Inspect the system hoses. Look for cracks, bubbles, hardening and deterioration. Inspect the hoses and all 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 cold weather 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, located in the fuse/relay box in the engine compartment. Refer to the appropriate Sections in this Chapter 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. For more complete information on the air conditioning system, refer to the *Haynes Automotive Heating and Air Conditioning Manual.*

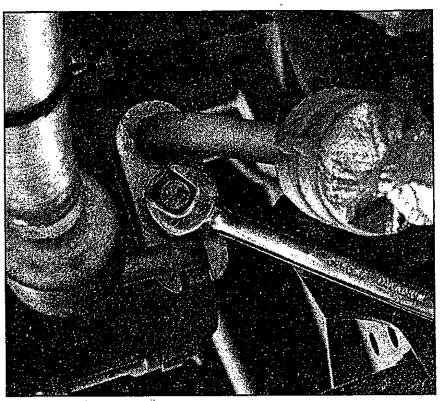
Checking the refrigerant charge

Refer to illustration 13.11

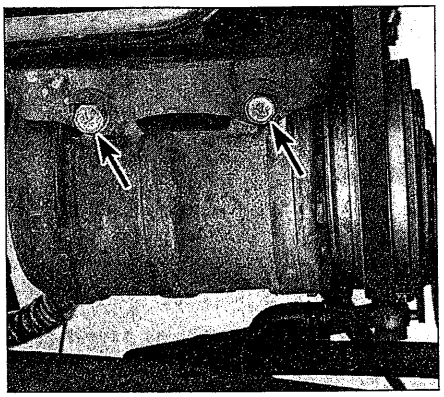
7 Warm the engine up to normal operating temperature.
8 Place the air conditioning temperature selector at the coldest setting and put the blower at the highest setting. Open the doors (to make sure the air conditioning system doesn't cycle off as soon as it cools the passenger compartment).
9 With the 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 firewall.
10 The pipe leading from the condenser outlet to the evaporator (small tubing) should be cold, and the evaporator outlet line (the larger tubing that leads back to the compressor) should be slightly colder. If the evapora-



13.11 The sight glass is located on top of the receiver/drier



15.4 Disconnect the electrical connector at the compressor, then unbolt the refrigerant line manifold from the compressor



15.5 Remove the compressor mounting bolts (arrows indicate the two bottom bolts; two more are on the top of the compressor) and remove the compressor

tor 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 15 to 20-degrees C below the ambient air temperature (down to approximately 5-degrees C). If the ambient (outside) air temperature is very high, say 45-degrees C, the duct air temperature may be as high as 16-degrees C, but generally the air conditioning is 15 to 20-degrees C 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 If the refrigerant looks foamy when running, it's low **(see illustration)**. 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.

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 firewall. 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 fuse, circuit, switch, blower motor resistor or motor.

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 9).

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 10) and refit a new unit (most radiator shops will not repair a leaking heater core).

16 Inspect the drain hose from the heater/air conditioning assembly, make sure it is not clogged.

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 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 any interfering panels. Disconnect the wiring to the dual-pressure switch on top of the receiver/drier.

3 Disconnect the refrigerant lines from the receiver/drier and cap the open fittings to prevent entry of moisture.

4 Remove the bolts and lift the receiver/drier out of the engine compartment.

5 Refitting is the reverse of removal.

6 Have the system evacuated, charged and leak tested by the shop that discharged it. If the receiver was renewed, have them add new refrigeration oil to the system, about 20 grams for R-12 systems, or 10 grams for R-134a systems. Use only the refrigerant oil compatible with the refrigerant of your system (R-12 vs. R-134a).

15 Air conditioning compressor - removal and refitting

Refer to illustrations 15.4 and 15.5

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 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 negative cable from the battery.

3 Remove the drivebelt from the compressor (see Chapter 1).

4 Detach the wiring connector and disconnect the 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 refitted, follow the directions supplied with the compressor regarding the proper level of oil prior to refitting.

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 system (R-12 vs. R-134a).

8 Have the system evacuated, recharged and leak tested by the shop that discharged it.

16 Air conditioning condenser - removal and refitting

Refer to illustration 16.3

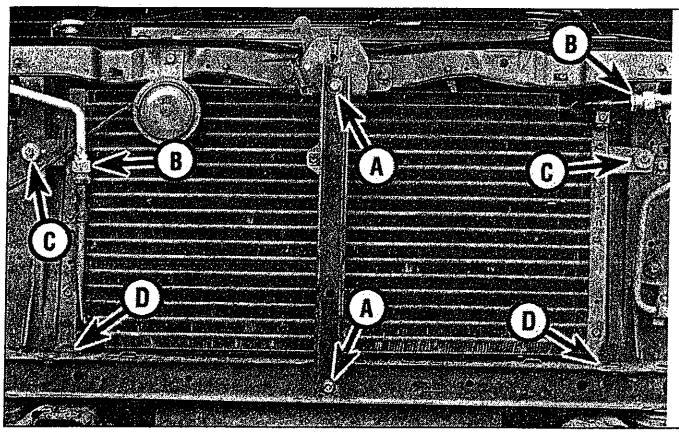
Warning: *The air conditioning system is under high pressure. Do not loosen any hose fittings or remove any components until the system has been discharged. Air conditioning refrigerant should be properly discharged into an approved recovery/recycling unit by a dealer service department or an automotive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

1 Have the refrigerant discharged by an air conditioning technician.

2 Remove the grille (refer to Chapter 11).

3 Remove the centre support brace and the horn for access. Disconnect the condenser inlet and outlet fittings **(see illustration)**. Cap the open fittings immediately to keep moisture and contamination out of the system.

4 Remove the condenser mounting bolts, pull the condenser up and forward at the top, then lift it out **(see illustration 16.3)**.



16.3 Remove the radiator support brace bolts (A) and remove the brace, detach the refrigerant lines from the condenser (B) and remove the condenser mounting bolts (C). Don't lose the lower mounting cushions (D)

5 Refit the condenser, brackets and bolts, making sure the rubber cushions fit on the mounting points properly.

6 Reconnect the refrigerant lines, using new O-rings where needed. If a new condenser has been refitted, add approximately 50 cc (1.4 to 1.7 ounces) of new refrigerant oil of the correct type (R-12 vs. R-134a).

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

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