Chapter 3
Cooling, heating and air conditioning systems

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Specifications

General

Expansion tank cap pressure rating	13 to 18 psi (90 to 123 kPa)
Thermostat rating (opening to fully open temperature range)	194 to 223 degrees F (90 to 106 degrees C)
Cooling system capacity	See Chapter 1
Refrigerant type	R-134a
Refrigerant capacity	Refer to HVAC specification tag

Torque specifications

	Ft-lbs (unless otherwise indicated)	Nm
Condenser inlet and outlet nuts	71 in-lbs	8
Engine oil cooler mounting bolt (four-cylinder engine)	43	58
Radiator bracket support bolts	89 in-lbs	10
Thermostat housing cover bolts	89 in-lbs	10
Water pump bolts	89 in-lbs	10
Water pump drivebelt tensioner bolt	89 in-lbs	10

1 General information

Engine cooling system

The cooling system consists of a radiator, an expansion tank, a pressure cap (located on the expansion tank), a thermostat, a cooling fan and clutch, and a belt-driven water pump.

The expansion tank (referred to by the manufacturer as a "degas bottle") functions somewhat differently than a conventional recovery tank. Designed to separate any trapped air in the coolant, it is pressurized by the radiator and has a pressure cap on top. The radiator on these models does not have a pressure cap. When the thermostat is closed, no coolant flows in the expansion tank, but when the engine is fully warmed up, coolant flows from the top of the radiator through a small hose that enters the top of the expansion tank, where the air separates and the coolant falls into a coolant reservoir in the bottom of the tank, which is fed to the cooling system through a larger hose connected to the lower radiator hose. **Warning:** *Unlike a conventional coolant recovery tank, the pressure cap on the expansion tank should never be opened after the engine has warmed up, because of the danger of severe burns caused by steam or scalding coolant.*

Coolant in the left side of the radiator circulates through the lower radiator hose to the water pump, where it is forced through coolant passages in the cylinder block. The coolant then travels up into the cylinder head, circulates around the combustion chambers and valve seats, travels out of the cylinder head past the open thermostat into the upper radiator hose and back into the radiator.

When the engine is cold, the thermostat restricts the circulation of coolant to the engine. When the minimum operating temperature is reached, the thermostat begins to open, allowing coolant to return to the radiator.

Transaxle cooling systems

Vehicles with an automatic transaxle are equipped with a transaxle cooler, located inside the radiator, which cools the transaxle fluid. The transaxle is connected to the cooler by a pair of hoses: one delivers hot transaxle fluid to the radiator and the other brings the cooled fluid back to the transaxle. Some automatics are also equipped with an auxiliary external cooler, located in front of the air conditioning condenser and the radiator.

For more information on transaxle oil coolers, refer to Chapter 7.

Engine oil cooling system

Besides the engine and transaxle cooling systems described above, engine heat is also dissipated through an external oil cooler that's integrated into the lubrication system. The oil cooler helps keep engine and oil temperatures within design limits under extreme load conditions.

The oil cooling system on these models consists of a cylindrical housing (oil cooler) mounted inline between the oil filter and the engine block, a heat exchanger inside the oil cooler and a pair of coolant hoses that deliver coolant from the radiator to the oil cooler housing.

Heating system

The heating system consists of the heater controls, the heater core, the heater blower assembly (which houses the blower motor and the blower motor resistor), and the hoses connecting the heater core to the engine cooling system. 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 heater controls activates the blower motor, which forces air through the core, heating the air.

Air conditioning system

The air conditioning system consists of the condenser, which is mounted in front of the radiator, the evaporator case assembly under the dash, a compressor mounted on the engine, and the plumbing connecting all of the above components.

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 vapor, taking the heat with it when it leaves the evaporator.

2 Antifreeze - general information

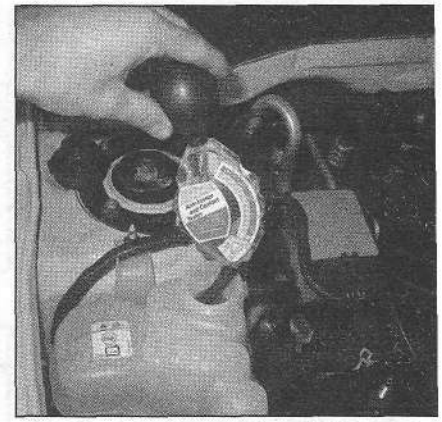
Refer to illustration 2.5

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 its sweet smell and may drink it. Check with local authorities about disposing of used antifreeze. Many communities have collection centers which will see that antifreeze is disposed of safely. Never dump used antifreeze on the ground or pour it into drains.*

Caution: *Do not mix coolants of different colors. Doing so might damage the cooling system and/or the engine. The manufacturer specifies either a green colored coolant or a yellow colored coolant to be used in these systems. Read the warning label in the engine compartment for additional information.*

Note: *Non-toxic antifreeze is now manufactured and available at local auto parts stores, but even this type must 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-degrees F (even lower in cold climates). It also provides protection agains corrosion and increases the coolant boilin point. The engines in these vehicles hav aluminum heads. Depending on the engin and model year, the specified coolant varie (see the Chapter 1 Specifications). The manu facturer recommends that the correct type o coolant be used and strongly urges that cool ant types not be mixed.



2.5 Use a hydrometer (available at auto parts stores) to test the condition of your coolant

Drain, flush and refill the cooling syste at least every other year (see Chapter 1). The use of antifreeze solutions for periods of lon ger than two years is likely to cause damag and encourage the formation of rust and scal in the system.

Before adding antifreeze to the system inspect all hose connections. Antifreeze car leak through very minute openings.

The exact mixture of antifreeze to wate which 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 container before adding coolant.

Hydrometers are available at most auto parts stores to test the coolant **(see illustration)**. Use antifreeze that meets Ford specifications for engines with aluminum heads.

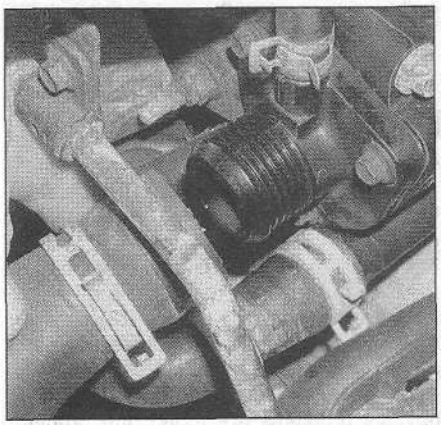
Warning: *Do not remove the coolant tank cap, drain the coolant or perform any service procedures on the cooling system until the engine has cooled completely.*

3 Thermostat - check and replacement

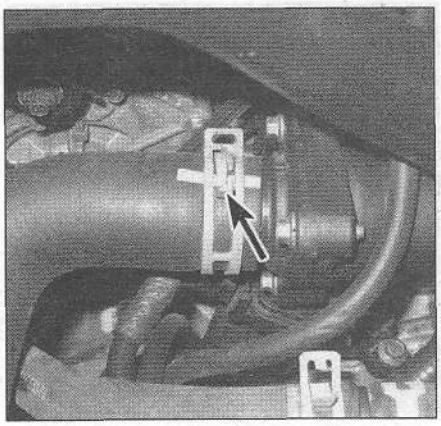
Check

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

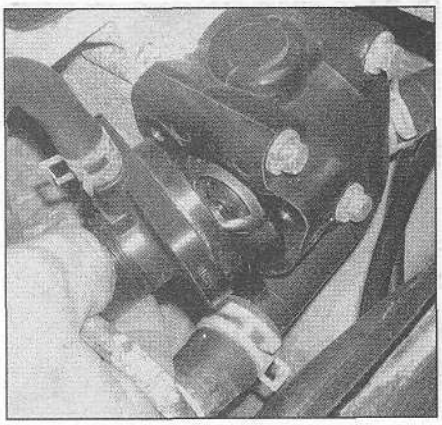
2 If the engine seems to be taking a long time to warm up, based on heater output or temperature gauge operation, the thermostat is probably stuck open. Replace the thermostat with a new one.



3.8a Disconnect the radiator hose from the thermostat housing cover - four-cylinder engine shown



3.8b Remove the spring clamp from the radiator hose at the thermostat housing cover - V6 engine shown



3.10 Remove the thermostat housing cover to access the thermostat

3 If the engine runs hot, use your hand to check the temperature of the lower radiator hose. If the hose isn't hot, but the engine is, the thermostat is probably stuck closed, preventing the coolant inside the engine from escaping to the radiator. Replace the thermostat. **Caution:** *Don't 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 cooling system diagnosis.

Replacement

Refer to illustrations 3.8a and 3.8b

Warning: *Wait until the engine is completely cool before performing this procedure.*

Note: *The thermostat and thermostat housing on 2.3L engine models are replaced as an assembly.*

5 Disconnect the cable from the negative battery terminal (see Chapter 5).

6 Drain the cooling system (see Chapter 1). If the coolant is relatively new and still in good condition, save it and reuse it.

7 Follow the lower radiator hose to the engine to locate the thermostat housing.

8 Loosen the hose clamp, then detach the hose from the fitting **(see illustrations)**. If it's stuck, grasp it near the end with a pair of adjustable pliers and twist it to break the seal, then pull it off. If the hose is old or if it has deteriorated, cut it off and install a new one.

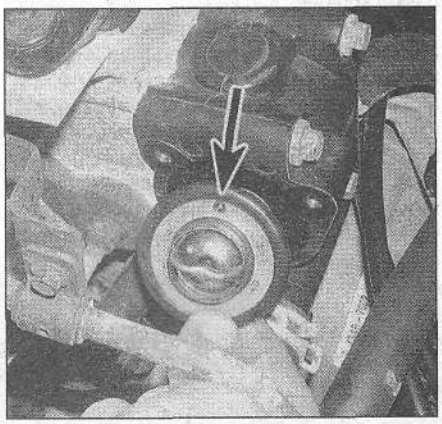
9 If the outer surface of the thermostat housing cover, which mates with the hose, is already corroded, pitted, or otherwise deteriorated, it might be damaged even more by hose removal. If it is, replace the thermostat housing cover.

Four-cylinder models

Refer to illustrations 3.10 and 3.11

10 Remove the fasteners and detach the thermostat cover **(see illustration)**. If the cover is stuck, tap it with a soft-face hammer to jar it loose. Be prepared for some coolant to spill as the gasket seal is broken.

11 Note how it's installed, which end is facing up, or out and then remove the thermostat **(see illustration)**.



3.11 Remove the thermostat from the housing, but note that the jiggle valve on the thermostat is located in the 12 o'clock position

V6 models

Refer to illustrations 3.12, 3.13a and 3.13b

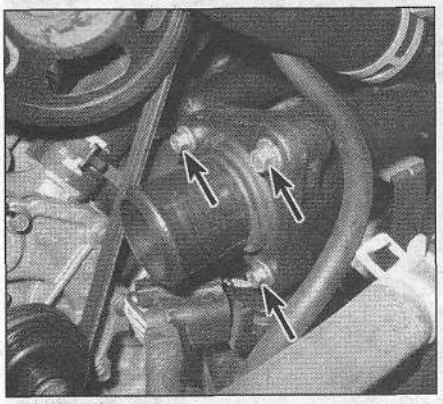
12 Remove the fasteners and detach the thermostat housing cover **(see illustration)**. If the cover is stuck, tap it with a soft-face hammer to jar it loose. Be prepared for some coolant to spill as the gasket seal is broken.

13 Note how it's installed, which end is facing up, or out, and then remove the thermostat **(see illustrations)**.

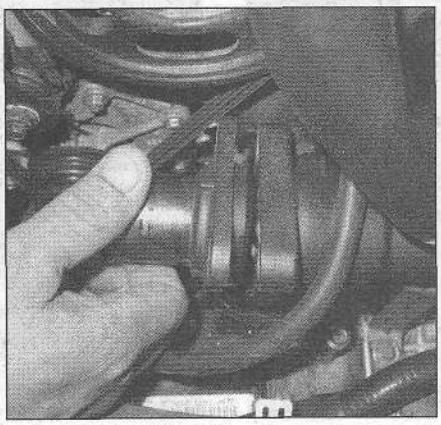
All models

Refer to illustration 3.15

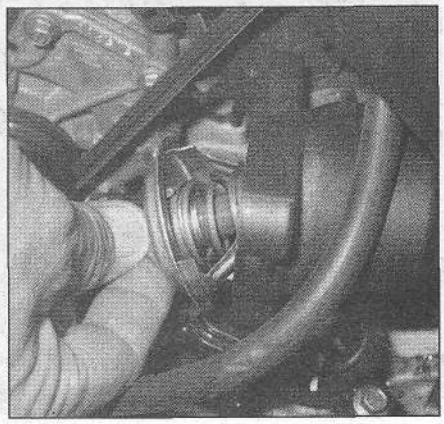
14 Remove all traces of old gasket material



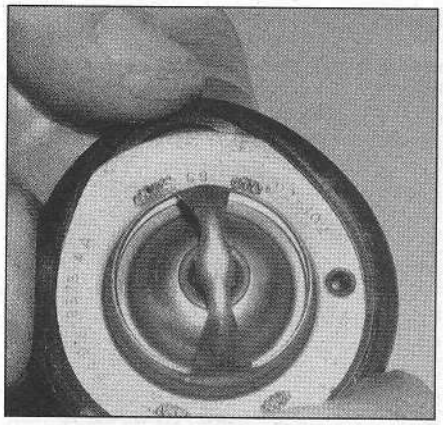
3.12 Remove the three mounting bolts to separate the thermostat housing cover from the housing



3.13a Lift off the thermostat housing cover . . .



3.13b . . . and remove the thermostat - V6 engine shown



3.15 Install a new rubber seal around the perimeter of the thermostat

and sealant from the housing and cover with a gasket scraper.

15 Install a new rubber gasket on the thermostat **(see illustration)** and then install the thermostat in the housing, spring-end first. Make sure that you install the thermostat with the "jiggle valve" at 12 o'clock **(see illustration 3.11)**. If the thermostat housing cover uses a paper gasket, dip the new gasket in water and position it on the thermostat housing with the holes in the gasket aligned with the bolt holes in the housing.

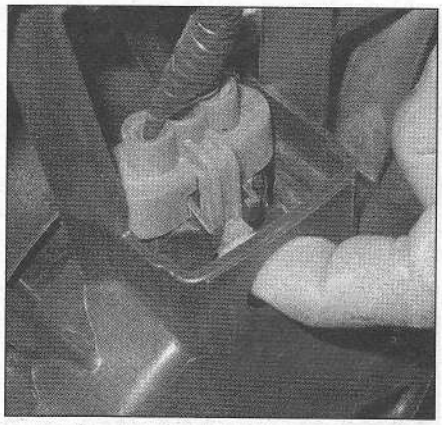
16 Install the thermostat housing cover and bolts and then tighten the bolts to the torque listed in this Chapter's Specifications.

17 Reattach the radiator hose to the thermostat housing cover. Make sure that the hose clamp is still tight. If it isn't, replace it.

18 Refill the cooling system (see Chapter 1).

19 Reconnect the battery. After you're done, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1).

20 Start the engine and allow it to reach normal operating temperature, then check for leaks and proper thermostat operation (as described in Steps 2 through 4).



4.1 Lift up on the tab lock to release the cooling fan connector

4 Engine cooling fans - check and replacement

Warning: *To avoid possible injury or damage, DO NOT operate the engine with a damaged fan. Do not attempt to repair fan blades - replace a damaged fan with a new one.*

Note 1: *Always be sure to check for blown fuses before attempting to diagnose an electrical circuit problem.*

Note 2: *Four-cylinder models are equipped with a high, a medium and a low speed cooling fan relay. V6 models are equipped with a low speed relay, a medium speed relay and two high speed fan relays that are controlled by the PCM.*

Check

Refer to illustrations 4.1, 4.3 and 4.5

1 If the engine is overheating and the cooling fan is not coming on when the engine temperature rises to an excessive level, unplug the fan motor electrical connector(s) **(see illustration)** and connect the motor directly to the battery with fused jumper wires. If the fan motor doesn't come on, replace the motor.

2 If the radiator fan motor is okay, but it isn't coming on when the engine gets hot, the fan relay might be defective. A relay is used to control a circuit by turning it on and off in response to a control decision by the Powertrain Control Module (PCM). These control circuits are fairly complex, and checking them should be left to a qualified automotive technician. Sometimes, the control system can be fixed by simply identifying and replacing a bad relay.

3 Locate the fan relays in the engine compartment fuse/relay box **(see illustration)**.

4 Test the relay (see Chapter 12).

5 If the relay is okay, check all wiring and connections to the fan motor. Refer to the wiring diagrams at the end of Chapter 12. If no obvious problems are found, the problem could be the Engine Coolant Temperature (ECT) sensor or the Powertrain Control Module (PCM). Have the cooling fan system and circuit diagnosed by a dealer service department or repair shop with the proper diagnostic equipment. **Note:** *These models are equipped with a cooling fan motor resistor. Have the resistor checked if the fan motor does not respond to the speed variations signaled by the PCM* **(see illustration)**.

Replacement

Refer to illustrations 4.12a, 4.12b, 4.13a, 4.13b, 4.15, 4.17 and 4.18

Warning 1: *Wait until the engine is completely cool before performing this procedure.*

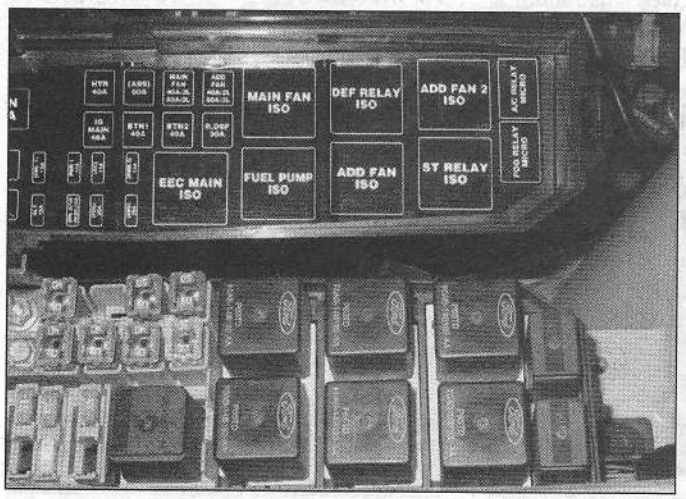
Warning 2: *2005 and later models have a Supplemental Restraint System, or Airbag sensor, mounted in the center of the radiator support bracket. It will be necessary to disarm the system prior to performing any work around the radiator, fans or other components in this area (see Chapter 12)*

6 Disconnect the cable from the negative battery terminal (see Chapter 5).

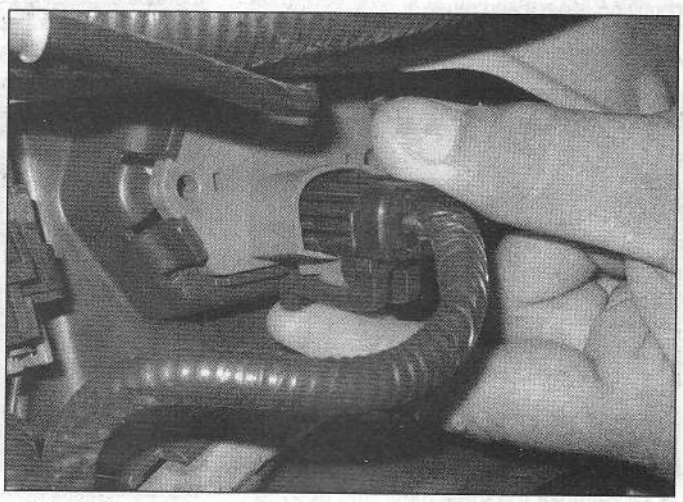
7 Disconnect the fan motor electrical connector(s) **(see illustration 4.1)**.

8 Raise the vehicle and secure it on jackstands.

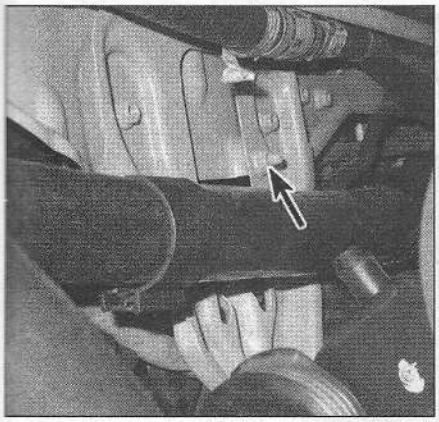
9 Drain the cooling system (see Chapter 1).



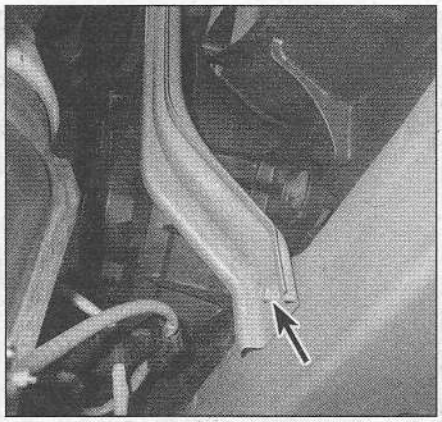
4.3 Locate the cooling fan relays in the fuse/relay box in the engine compartment



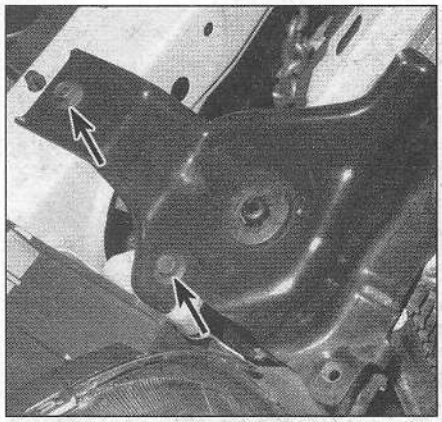
4.5 The fan motor resistor is located above the left cooling fan



4.12a Remove the bolts from the center support (upper bolt shown) . . .



4.12b . . . and the lower section of the center support



4.13a Remove the right side radiator support bracket bolts . . .

If the coolant is relatively new and still in good condition, save it and reuse it.

10 Remove the hood latch (see Chapter 11).

11 Remove the upper radiator hose **(see illustration 6.7)**. Loosen the hose clamp by squeezing the ends together. Hose clamp pliers work best, but regular pliers will work also. If the radiator hose is stuck, grasp it near the end with a pair of adjustable pliers and twist it to break the seal, then pull it off. If the hose is old or if it has deteriorated, cut it off and install a new one.

12 Remove the center support bolts **(see illustrations)** and lift the center support from the engine compartment.

13 Remove the left and right upper radiator support brackets **(see illustrations)**.

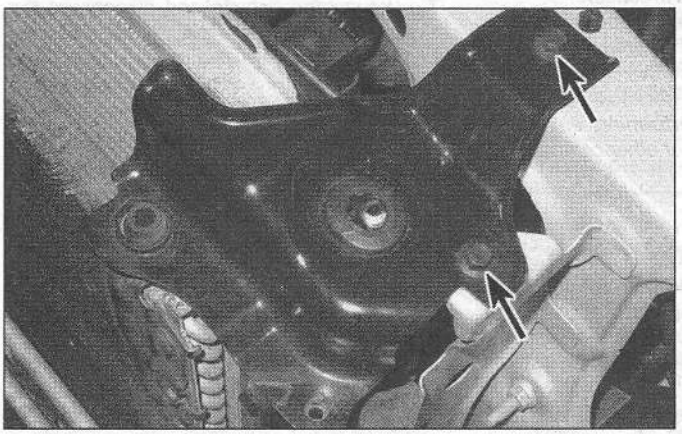
14 Tilt the radiator forward to make additional clearance for fan removal.

15 Detach the wire harness from the fan shroud, remove the upper and lower fan shroud mounting bolts **(see illustration)** and then carefully lift the fan motor and shroud out of the engine compartment as a single assembly.

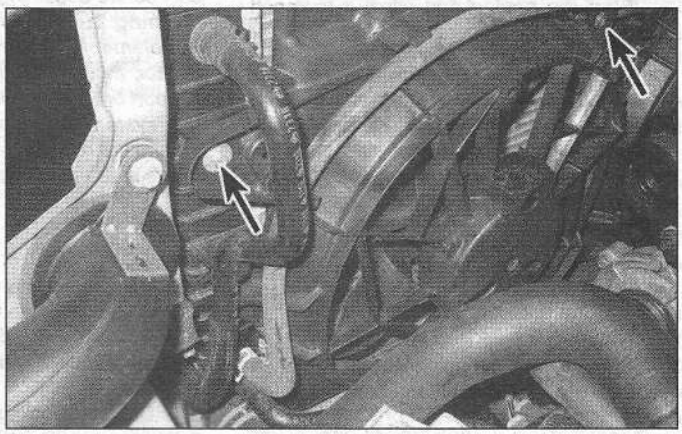
16 Remove the fan mounting screws.

17 To detach the fan blade from the motor, remove the nut or retaining clip from the motor shaft **(see illustration)**. Remove the fan blade from the motor.

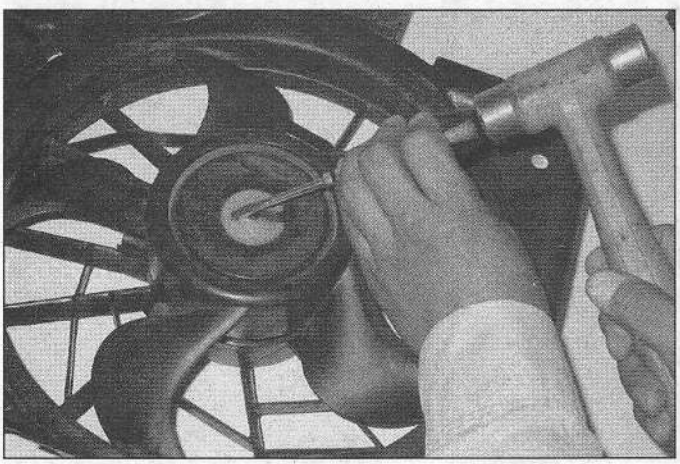
18 To detach the motor from the shroud, remove the retaining bolts **(see illustration)**. Remove the motor from the shroud.



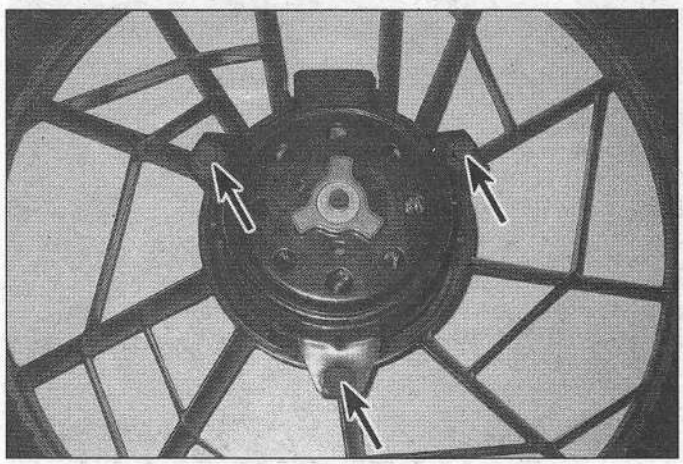
4.13b . . . and the left side radiator support bracket bolts



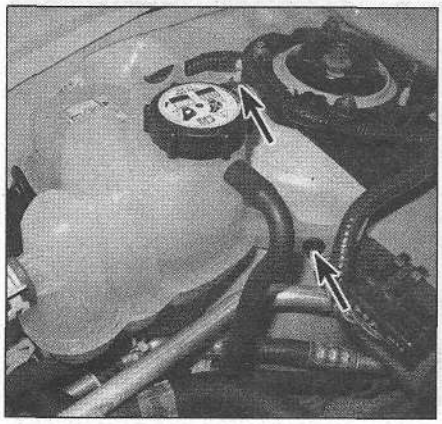
4.15 Remove the cooling fan shroud bolts - lower bolt not visible



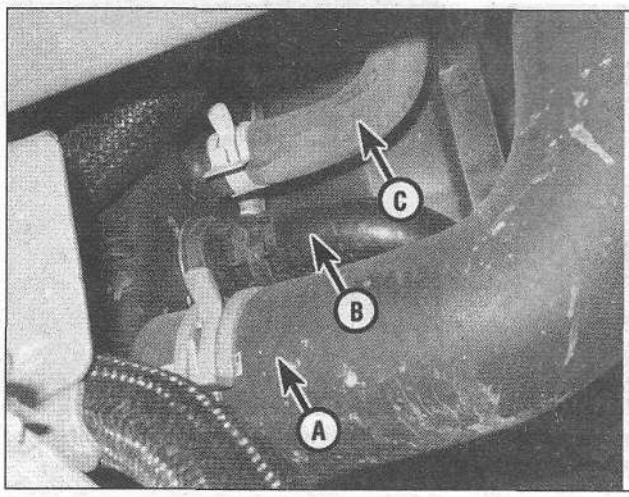
4.17 Use a flat-bladed screwdriver and drive the locking washer off the fan motor shaft



4.18 Remove the fan motor mounting bolts



5.3 Location of the expansion tank mounting nuts



6.6 Detach the hoses from the lower left side of the radiator

A Lower radiator hose
B Transaxle fluid cooler hose
C Expansion tank hose

19 Installation is the reverse of removal. **Note:** *When reinstalling the fan assembly, make sure the rubber air shields around the shroud are still in place - without them, the cooling system may not work efficiently.*

20 Reconnect the battery and refill the cooling system (see Chapter 1). After you're done, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1).

21 Start the engine and allow it to reach normal operating temperature, then check for leaks and proper operation.

5 Coolant expansion tank - removal and installation

Refer to illustration 5.3

Warning: *Wait until the engine is completely cool before beginning this procedure.*

1 Drain the cooling system (see Chapter 1).

2 Disconnect the expansion tank hose.

3 Remove the expansion tank mounting nuts **(see illustration)**. Lift the tank out of the engine compartment.

4 Clean out the tank with soapy water and a brush to remove any deposits inside. Inspect the reservoir carefully for cracks. If you find a crack, replace the reservoir.

5 Installation is the reverse of removal.

6 Radiator - removal and installation

Warning 1: *Wait until the engine is completely cool before beginning this procedure.*

Warning 2: *2005 and later models have a Supplemental Restraint System, or airbag sensor, mounted in the center of the radiator support bracket. It will be necessary to disarm the system prior to performing any work around the radiator, fans or other components in this area (see Chapter 12)*

Removal

Refer to illustration 6.6, 6.7 and 6.8

1 Disconnect the cable from the negative battery terminal (see Chapter 5).

2 Raise the vehicle and place it securely on jackstands. Remove the lower splash shields.

3 Drain the cooling system (see Chapter 1). If the coolant is relatively new and in good condition, save it and reuse it.

4 Unbolt the cooling fan shrouds from the radiator (see Section 4).

5 Remove the hood latch and the center support **(see illustrations 4.12a and 4.12b)**.

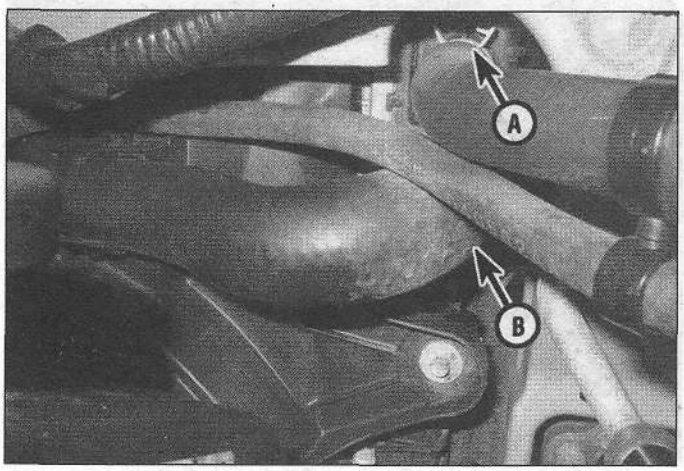
6 Disconnect the lower radiator hose and expansion tank hose from the left side tank of the radiator **(see illustration)**. If the vehicle is equipped with an automatic transaxle, also detach the cooler hose from its fitting on the side tank.

7 Lower the vehicle and disconnect the expansion tank hose and upper radiator hose from the right side of the radiator **(see illustration)**. Also, if the vehicle is equipped with an automatic transaxle, disconnect the other fluid cooler hose from the upper left side of the radiator.

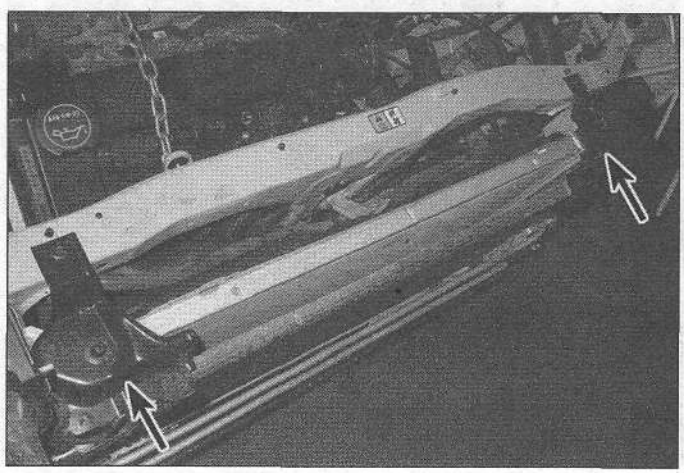
8 Remove the radiator support brackets from the radiator support beam and the radiator **(see illustration)**.

9 Carefully lift out the radiator. Don't spill coolant on the vehicle or scratch the paint. Make sure the rubber radiator insulators that fit on the bottom of the radiator and into the sockets in the body remain in place in the body for proper reinstallation of the radiator.

10 Remove bugs and dirt from the radiator with compressed air and a soft brush. Don't



6.7 Detach the expansion tank hose (A) and the upper radiator hose (B) from the upper right side of the radiator



6.8 Remove the radiator support brackets and lift out the radiator

bend the cooling fins. Inspect the radiator for leaks and damage. If it needs repair, have a radiator shop or a dealer service department do the work.

Installation

11 Inspect the rubber insulators in the lower crossmember for cracks and deterioration. Make sure that they're free of dirt and gravel. When installing the radiator, make sure that it's correctly seated on the insulators before fastening the top brackets.

12 Installation is otherwise the reverse of the removal procedure. After installation, fill the cooling system with the correct mixture of antifreeze and water (see Chapter 1).

13 Reconnect the battery. After you're done, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1).

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

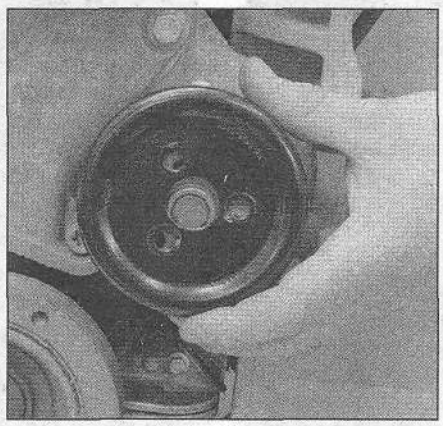
15 If you're working on an automatic transaxle equipped vehicle, check and add fluid as needed.

7 Water pump - check

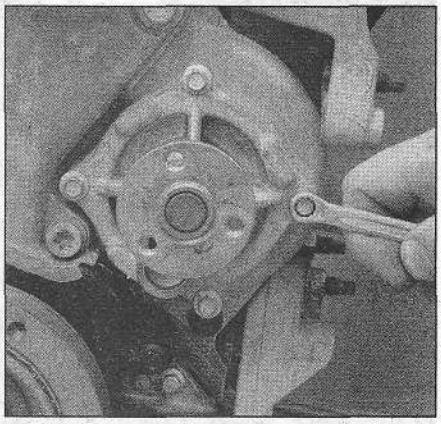
1 A failure in the water pump can cause serious engine damage due to overheating.

2 If a failure occurs in the pump seal, coolant will leak from the front cover (four-cylinder models) or the water pump housing (V6 models). **Note:** *The water pump on four-cylinder engines is mounted in the front cover and on V6 engines in a water pump housing near the thermostat housing.*

3 Water pumps are equipped with weep or vent holes. It is possible to check the water pump weep hole using a flashlight. If a failure occurs in the pump seal, coolant will leak from the hole. Use the flashlight to find the vent hole on the water pump and check for leaks.



8.6 Remove the bolts and separate the water pump pulley from the pump



8.7 Remove the water pump bolts

Note: *Some slight black staining around the weep hole is normal. If the stain is heavy brown or actual coolant is evident, replace the pump.*

4 If the water pump shaft bearings fail, there may be a howling sound near the water pump while it's running. With the engine off, shaft wear can be felt if the water pump pulley is rocked up-and-down. Don't mistake drivebelt slippage, which causes a squealing sound, for water pump bearing failure.

5 A quick water pump performance check is to put the heater on. If the pump is failing, it won't be able to efficiently circulate hot water all the way to the heater core as it should.

8 Water pump - replacement

Warning: *Wait until the engine is completely cool before beginning this procedure.*

Removal

1 Disconnect the cable from the negative battery terminal (see Chapter 5).

2 Drain the cooling system (see Chapter 1).

3 Remove the drivebelt on four-cylinder models or the water pump drivebelt on V6 models (see Chapter 1).

Four-cylinder models

Refer to illustration 8.6, 8.7 and 8.8

4 Loosen the right front wheel lug nuts. Raise the vehicle and secure it on jackstands.

5 Remove the right front wheel and the fender splash shield.

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

7 Remove the bolts attaching the water pump to the engine block and remove the pump from the engine **(see illustration)**. If the water pump is stuck, gently tap it with a soft-faced hammer to break the seal.

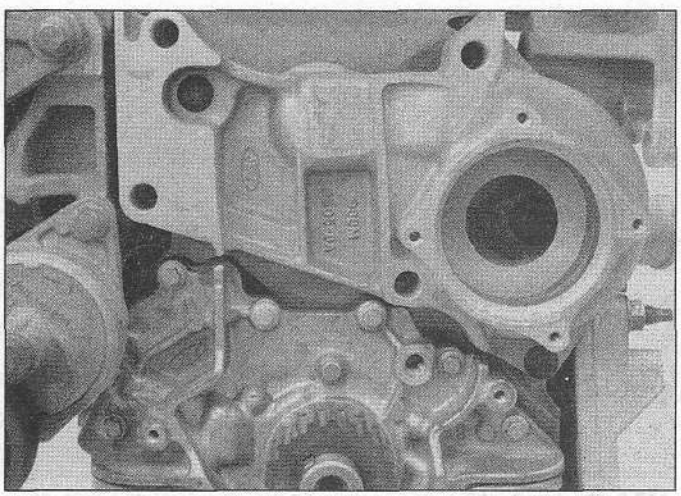
8 Clean the bolt threads and the threaded holes in the engine **(see illustration)** and remove all corrosion and sealant. Remove all traces of old gasket material from the sealing surfaces.

V6 models

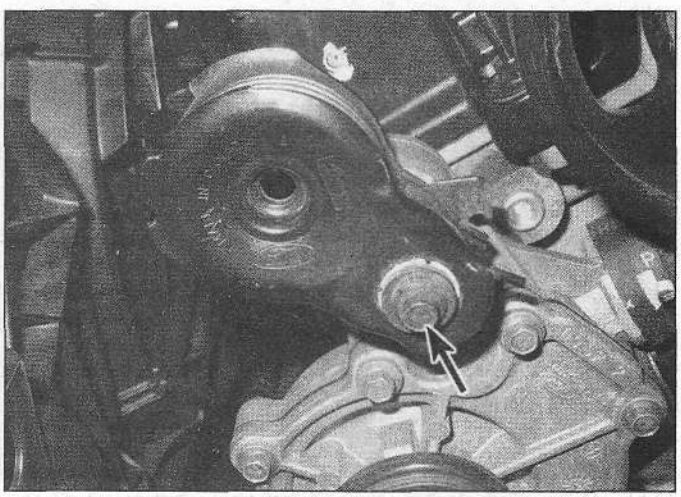
Refer to illustrations 8.10, 8.11a, 8.11b and 8.12

9 Remove the air filter housing (see Chapter 4).

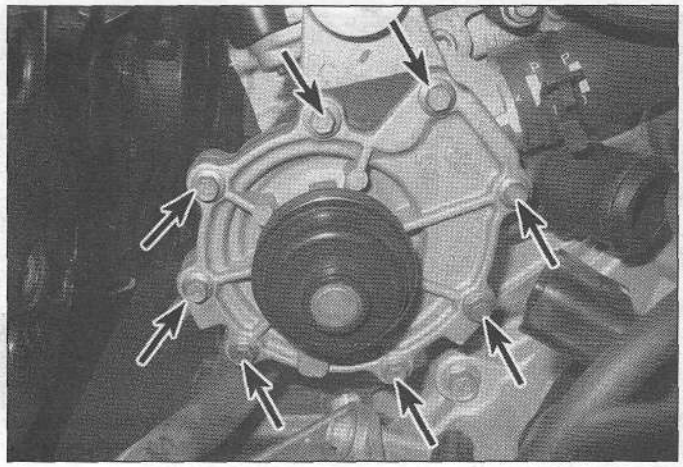
10 Remove the water pump drivebelt tensioner **(see illustration)**. If you're working on



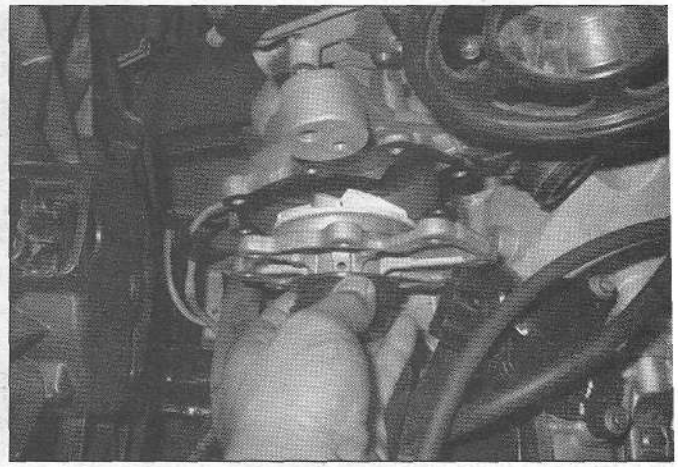
8.8 Clean the water pump bolt threads, the threaded holes in the housing and the pump mating surface of the housing



8.10 Remove the water pump drivebelt tensioner bolt



8.11a Remove the water pump bolts



8.11b Separate the water pump from the housing

a 2006 or later model, remove the water pump pulley. **Note:** *This requires a special puller that bolts to the hub of the pulley.*

11 Remove the water pump mounting bolts **(see illustrations)**.

12 Clean all the gasket and O-ring surfaces on the pump **(see illustration)** and the housing.

All models

13 Compare the new pump to the old one to make sure that they're identical.

14 Apply a thin film of RTV sealant to hold the new gasket in place during installation. **Caution:** *Make sure that the gasket is correctly positioned on the water pump and the mating surfaces are clean and free of old gasket material.* Carefully mate the pump to the water pump housing.

15 Install the water pump bolts and tighten them to the torque listed in this Chapter's Specifications.

16 The remainder of installation is the reverse of removal. Refill the cooling system (see Chapter 1) when you're done.

17 Reconnect the battery. After you're done, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1).

18 Operate the engine to check for leaks.

9 Coolant temperature sending unit - check and replacement

Warning: *Wait until the engine is completely cool before beginning this procedure.*

Note: *Four-cylinder models are equipped with a cylinder head temperature sensor instead of a coolant temperature sensor (V6 models). Refer to Chapter 6 for additional information.*

Check

1 The coolant temperature indicator system consists of a warning light or a temperature gauge on the dash and a coolant temperature sending unit mounted on the engine. On the models covered by this manual, the Cylinder Head Temperature (CHT) sensor (four cylinder models) or Engine Coolant Temperature (ECT) sensor (V6 models), which is an information sensor for the Powertrain Control Module (PCM), also functions as the coolant temperature sending unit.

2 If an overheating indication occurs check the coolant level in the system and ther make sure all connectors in the wiring harness between the sending unit and the indicator light or gauge are tight.

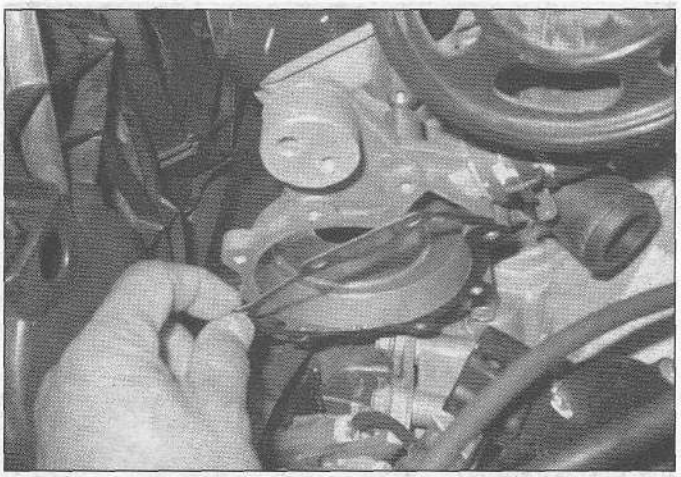
3 When the ignition switch is turned tc START and the starter motor is turning, the indicator light (if equipped) should come on. This doesn't mean the engine is overheated; it just means that the bulb is good.

4 If the light doesn't come on when the ignition key is turned to START, the bulb might be burned out, the ignition switch might be faulty or the circuit might be open.

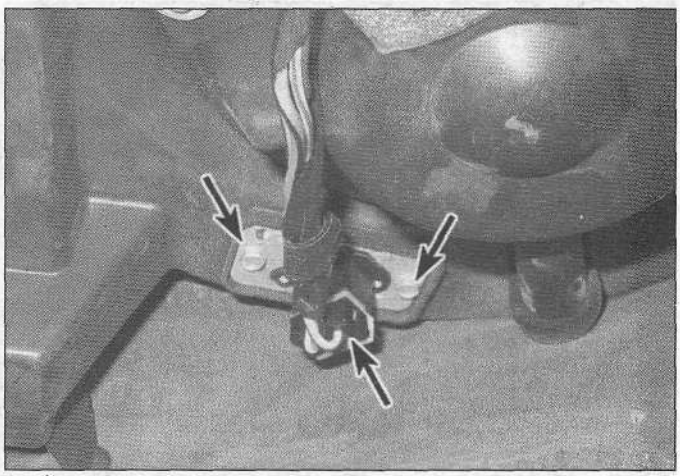
5 As soon as the engine starts, the indicator light should go out and remain off, unless the engine overheats. If the light doesn't go out, the wire between the sending unit and the light could be grounded, the sending unit might be defective, or the ignition switch might be faulty (see Chapter 12). Check the coolant to make sure it's correctly mixed; plain water, with no antifreeze, or coolant that's mainly water, might have too low a boiling point to activate the sending unit (see Chapter 1).

Replacement

6 See Chapter 6.



8.12 Remove the water pump gasket



10.2 Unplug the blower motor resistor connector, then remove the mounting screws

10 Blower motor resistor and blower motor - replacement

Warning: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disable the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Chapter 12).

Blower motor resistor

Refer to illustration 10.2

1 Remove the lower trim panel from below the glovebox (see Chapter 11).

2 Disconnect the electrical connector from the blower motor resistor **(see illustration)**.

3 Remove the blower motor resistor mounting screws and remove the resistor from the evaporator housing.

4 Installation is the reverse of removal.

Blower motor

Refer to illustrations 10.6 and 10.7

5 Remove the lower trim panel from below the glovebox (see Chapter 11).

6 Disconnect the blower motor electrical connector **(see illustration)**.

7 Remove the blower motor mounting screws **(see illustration)** and remove the blower motor.

8 Installation is the reverse of removal.

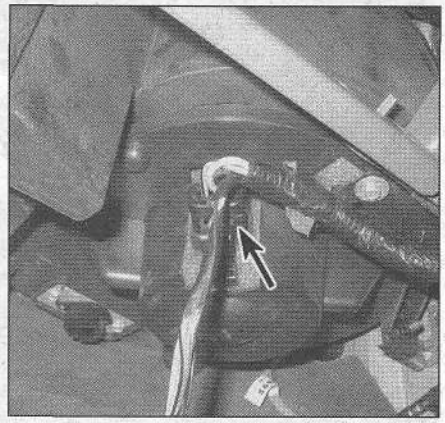
11 Heater/air conditioner control assembly - removal and installation

Refer to illustrations 11.3, 11.4a and 11.4b

Warning: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disable the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Chapter 12).

1 Disconnect the cable from the negative battery terminal (see Chapter 5).

2 Remove the dashboard center trim panel (see Chapter 11).

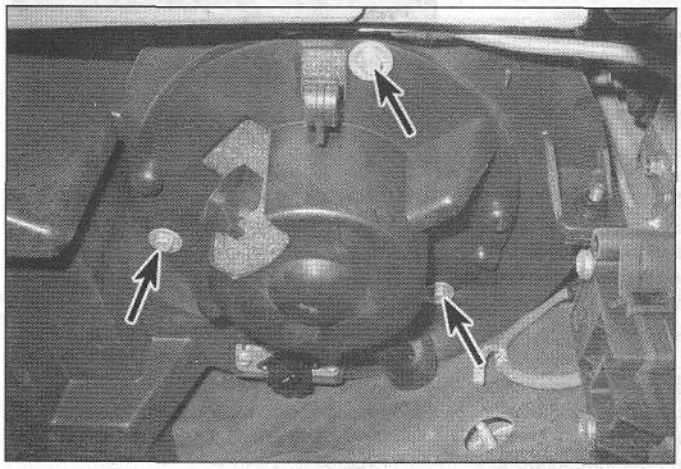


10.6 Location of the blower motor electrical connector

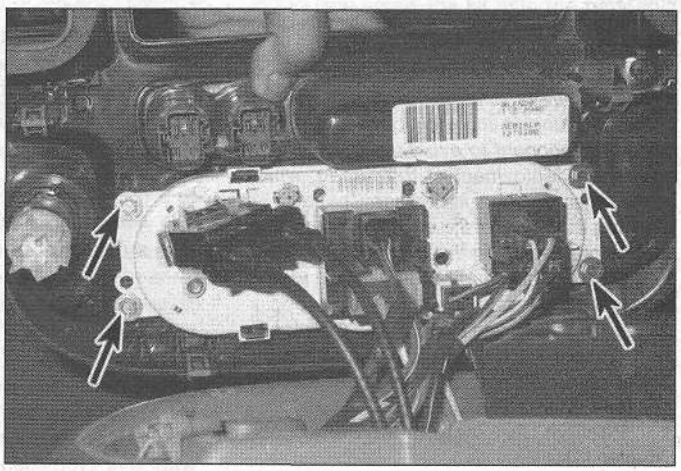
3 Remove the heater/air conditioner control assembly retaining screws **(see illustration)**.

4 Disconnect the temperature blend door control cables, the blower motor switch and temperature control switch connectors **(see illustrations)**.

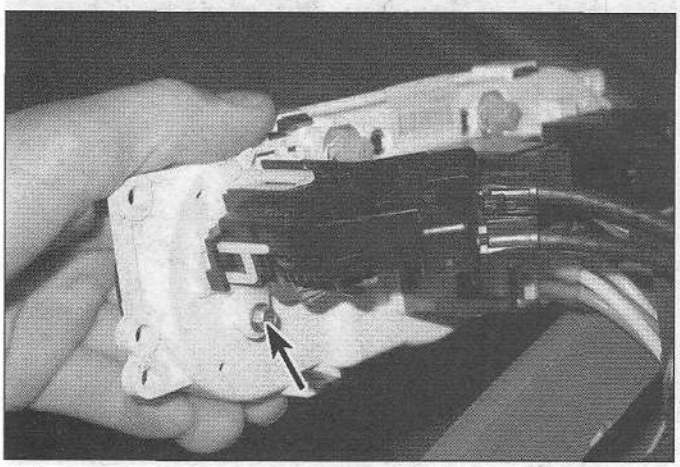
5 Installation is the reverse of removal.



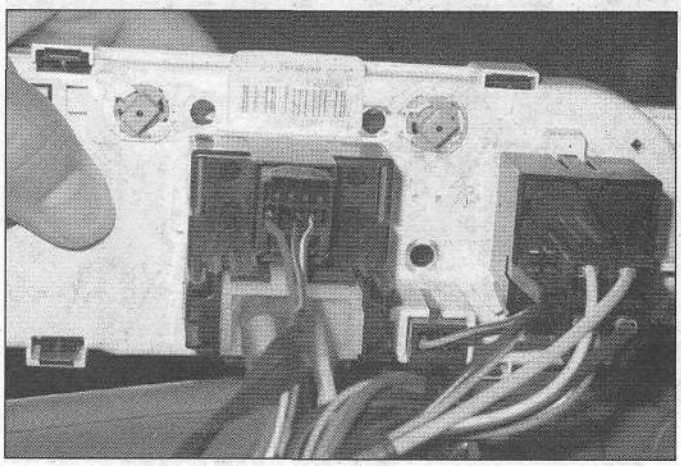
10.7 Location of the blower motor mounting screws



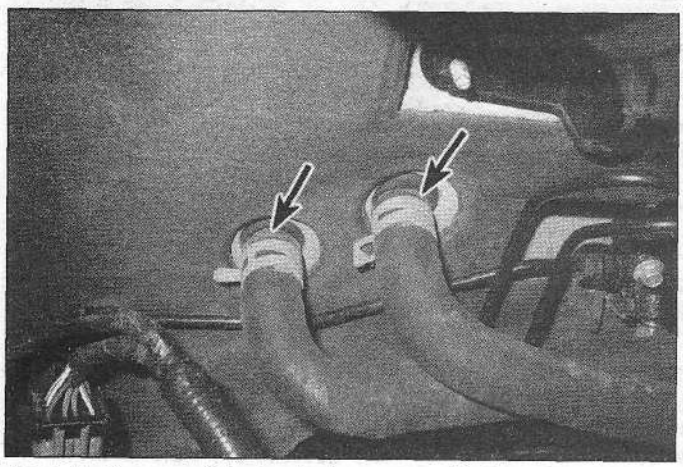
11.3 Location of the heater/air conditioner control assembly mounting screws



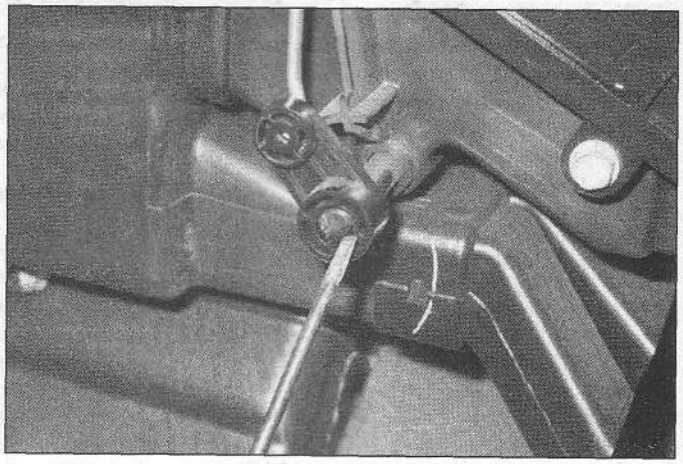
11.4a Remove the temperature blend door control cable mounting screw and separate the cable assembly from the control assembly



11.4b Release the tabs and disconnect the blower switch and temperature control switch connectors



12.2 To disconnect the heater hoses from the heater core pipes, squeeze the tabs on the spring clamps together with a pair of pliers and slide them up the hoses



12.4 Carefully pry the lever off the blend door shaft

12 Heater core - replacement

Refer to illustrations 12.2, 12.4, 12.5, 12.6 and 12.7

Warning 1: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disarm the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Chapter 12).

Warning 2: *Wait until the engine is completely cool before beginning this procedure.*

1 Disconnect the cable from the negative battery terminal (see Chapter 5).

2 Drain the cooling system (see Chapter 1), then disconnect the heater hoses from the heater core inlet and outlet pipes at the firewall **(see illustration)**.

3 Remove the instrument panel (see Chapter 11).

4 Remove the lever from the heater blend door shaft **(see illustration)**.

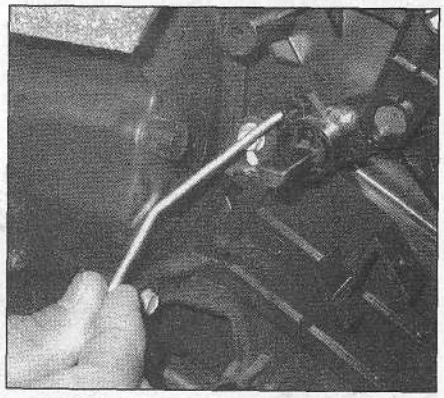
5 Remove the actuating rod from the lever **(see illustration)**.

6 Remove the heater core cover screws **(see illustration)**.

7 Pull the heater core out of the housing **(see illustration)**.

8 Installation is the reverse of removal. Don't forget to reconnect the heater core inlet and outlet hoses at the firewall.

9 Refill the cooling system (see Chapter 1) when you're done.



12.5 Remove the actuating rod from the lever

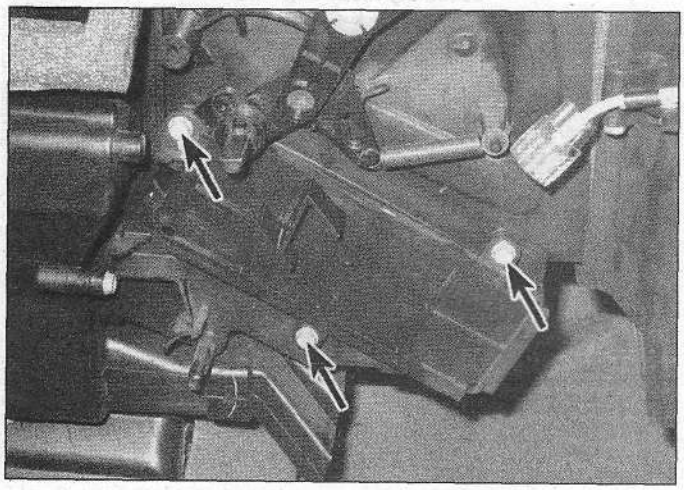
13 Air conditioning and heating system - check and maintenance

Refer to illustration 13.1

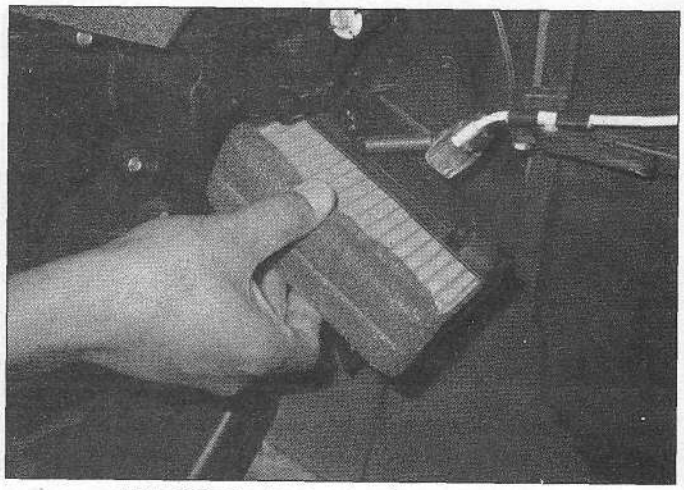
Warning: *The air conditioning system is under high pressure. Do not loosen any hose fittings or remove any components until after the system has been discharged by a dealer service department or service station. Always wear eye protection when disconnecting air conditioning system fittings.*

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

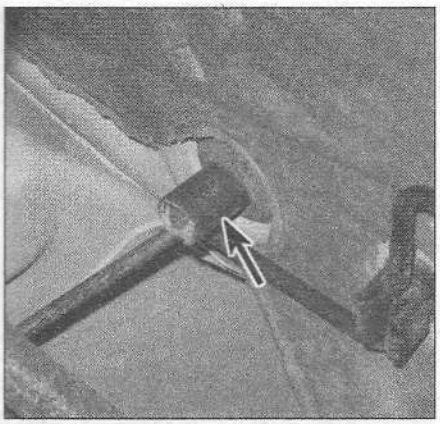
a) *Check the compressor drivebelt. If it's worn or deteriorated, replace it* (see Chapter 1).



12.6 Remove the screws and detach the cover from the HVAC housing



12.7 Slide the heater core from the housing



13.1 Look for the evaporator drain hose on the firewall; make sure it isn't plugged

b) Check the drivebelt tension and, if necessary, adjust it (see Chapter 1).

c) Check the system hoses. Look for cracks, bubbles, hard spots and deterioration. Inspect the hoses and all fittings for oil bubbles and seepage. If there's any evidence of wear, damage or leaks, replace the hose(s).

d) Inspect the condenser fins for leaves, bugs and other debris. Use a "fin comb" or compressed air to clean the condenser.

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

f) Check the evaporator housing drain tube **(see illustration)** *for blockage.*

2 It's a good idea to operate the system for about 10 minutes at least once a month, particularly during the winter. Long term non-use can cause hardening, and subsequent failure, of the seals.

3 Because of the complexity of the air conditioning system and the special equipment necessary to service it, in-depth troubleshooting and repairs are not included in this manual (refer to the *Haynes Automotive Heating and Air Conditioning Repair Manual*). However, simple checks and component replacement procedures are provided in this Chapter.

4 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

Refer to illustration 13.7

5 Warm the engine up to normal operating temperature.

6 Place the air conditioning temperature selector at the coldest setting and the blower at the highest setting. Open the vehicle doors (to make sure the air conditioning system doesn't cycle off as soon as it cools the passenger compartment).

7 With the compressor engaged - the clutch will make an audible click and the center of the clutch will rotate - feel the refrigerant line in front of the orifice tube and also right before the evaporator **(see illustration)**. The line should feel warm at the orifice tube and cold near the evaporator. If so, the system is properly charged.

8 Place a thermometer in the dashboard vent nearest the evaporator and operate the system until the indicated temperature is around 40 to 45 degrees F. If the ambient (outside) air temperature is very high, say 110 degrees F, the duct air temperature may be as high as 60 degrees F, but generally the air conditioning is 30-50 degrees F cooler than the ambient air. **Note:** *Humidity of the ambient air also affects the cooling capacity of the system. Higher ambient humidity lowers the effectiveness of the air conditioning system.*

Adding refrigerant

Refer to illustrations 13.12 and 13.15

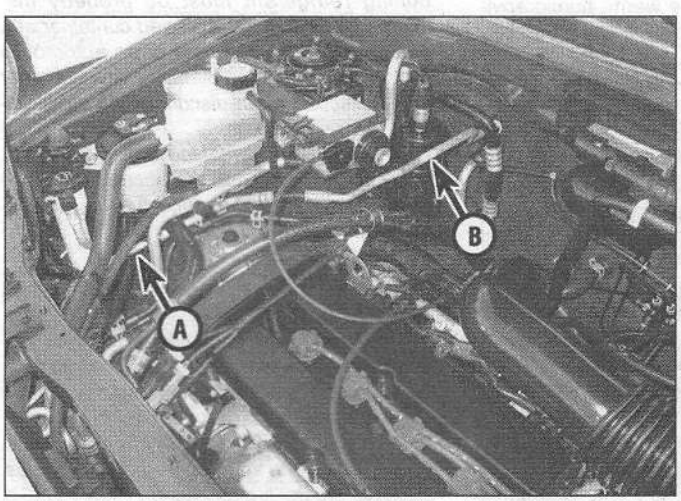
9 Buy an automotive charging kit at an auto parts store. A charging kit includes a 14-ounce can of refrigerant, a tap valve and a short section of hose that can be attached between the tap valve and the system low side service valve. Because one can of refrigerant may not be sufficient to bring the system charge up to the proper level, it's a good idea to buy an additional can. Make sure that one of the cans contains red refrigerant dye. If the system is leaking, the red dye will leak out with the refrigerant and help you pinpoint the location of the leak. **Caution:** *There are two types of refrigerant used in automotive systems; R-12 - which has been widely used on earlier models and the more environmentally-friendly R-134a used in all models covered by this manual. These two refrigerants (and their appropriate refrigerant oils) are not compatible and must never be mixed or components will be damaged. Use only R-134a refrigerant in the models covered by this manual.*

10 Hook up the charging kit by following the manufacturer's instructions. **Warning:** *DO NOT hook the charging kit hose to the system high side! The fittings on the charging kit are designed to fit* ***only*** *on the low side of the system.*

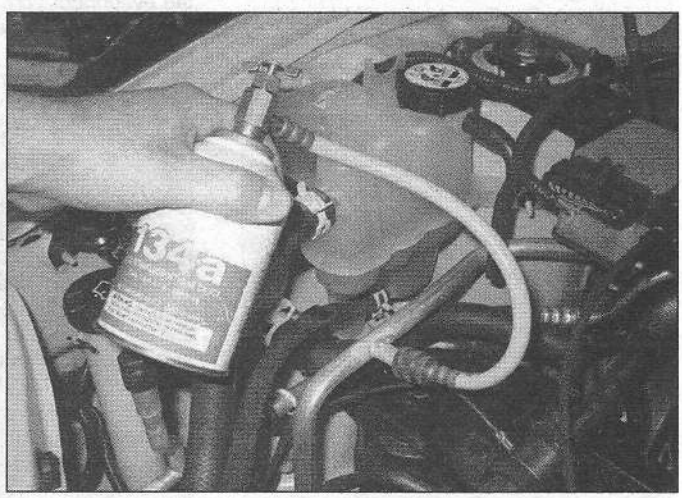
11 Back off the valve handle on the charging kit and screw the kit onto the refrigerant can, making sure first that the O-ring or rubber seal inside the threaded portion of the kit is in place. **Warning:** *Wear protective eyewear when dealing with pressurized refrigerant cans.*

12 Remove the dust cap from the low-side charging connection and attach the quick-connect fitting on the kit hose **(see illustration)**.

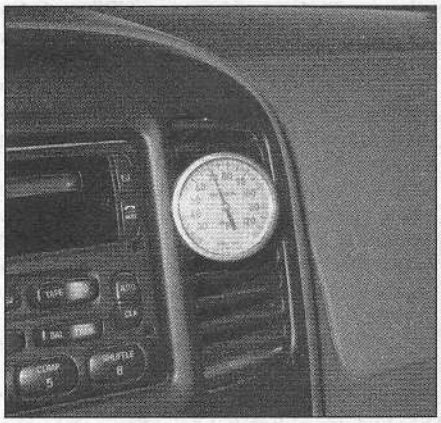
13 Warm up the engine and turn on the air conditioner. Keep the charging kit hose away from the fan and other moving parts. **Note:** *The charging process requires the compressor to be running. Your compressor may cycle off if the pressure is low due to a low charge. If the clutch cycles off, you can pull the low-pressure cycling switch plug and attach a*



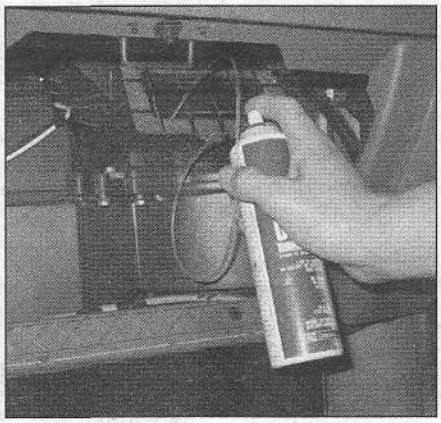
13.7 If the air conditioning system is properly charged, the refrigerant line from the condenser to the evaporator should feel warm right before the orifice tube (A) and cold near the evaporator (B)



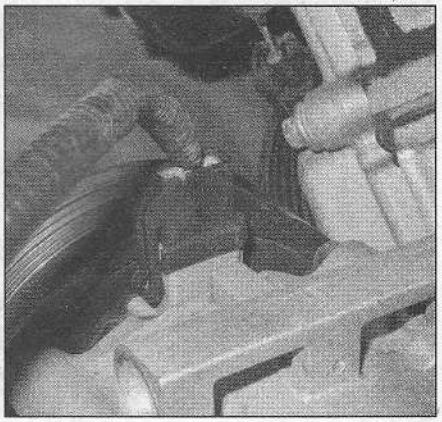
13.12 Cans of R-134A refrigerant (available at auto parts stores) can be added to the low side of the air conditioning system with a simple recharging kit (V6 engine shown)



13.15 Insert a thermometer in the center vent, turn on the air conditioning system and wait for it to cool down; depending on the humidity, the output air should be 30 to 40 degrees cooler than the ambient air temperature



13.23 Remove the glove box (see Chapter 11) and insert the nozzle of the disinfectant can into the evaporator housing by shoving it through the air recirculation door



14.5 Disconnect the connector from the compressor clutch field coil

jumper wire to the terminals in the connector. This will keep the compressor ON.

14 Turn the valve handle on the kit until the stem pierces the can, then back the handle out to release the refrigerant. You should be able to hear the rush of gas. Allow stabilization time between each addition.

15 If you have an accurate thermometer, place it in the center air conditioning vent **(see illustration)** and then note the temperature of the air coming out of the vent. A fully-charged system which is working correctly should cool down to about 40 degrees F. Generally, an air conditioning system will put out air that is 30 to 40 degrees F cooler than the ambient air. For example, if the ambient (outside) air temperature is very high (over 100 degrees F), the temperature of air coming out of the registers should be 60 to 70 degrees F.

16 When the can is empty, turn the valve handle to the closed position and release the connection from the low-side port. Replace the dust cap. **Caution:** *Never add more than one can of refrigerant to the system. If more refrigerant than that is required, the system should be evacuated and leak tested.*

17 Remove the charging kit from the can and store the kit for future use with the piercing valve in the UP position, to prevent inadvertently piercing the can on the next use.

Heating systems

18 If the carpet under the heater core is damp, or if antifreeze vapor or steam is coming through the vents, the heater core is leaking. Remove it (see Section 12) and install a new unit (most radiator shops will not repair a leaking heater core).

19 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. Replace the thermostat* (see Section 3).

b) *There is a blockage in the system, 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 replaced* (see Section 12).

Eliminating air conditioning odors

Refer to illustration 13.23

20 Unpleasant odors that often develop in air conditioning systems are caused by the growth of a fungus, usually on the surface of the evaporator core. The warm, humid environment there is a perfect breeding ground for mildew to develop.

21 The evaporator core on most vehicles is difficult to access, and factory dealerships have a lengthy, expensive process for eliminating the fungus by opening up the evaporator case and using a powerful disinfectant and rinse on the core until the fungus is gone. You can service your own system at home, but it takes something much stronger than basic household germ-killers or deodorizers.

22 Aerosol disinfectants for automotive air conditioning systems are available in most auto parts stores, but remember when shopping for them that the most effective treatments are also the most expensive. The basic procedure for using these sprays is to start by running the system in the RECIRC mode for ten minutes with the blower on its highest speed. Use the highest heat mode to dry out the system and keep the compressor from engaging by disconnecting the wiring connector at the compressor (see Section 14).

23 Make sure that the disinfectant can comes with a long spray hose. Point the nozzle through the air recirculation door so that it protrudes inside the evaporator housing **(see illustration)**, and then spray according to the manufacturer's recommendations. Try to cover the whole surface of the evaporator core, by aiming the spray up, down and sideways. Follow the manufacturer's recommendations for the length of spray and waiting time between applications.

24 Once the evaporator has been cleaned, the best way to prevent the mildew from coming back again is to make sure your evaporator housing drain tube is clear **(see illustration 13.1)**.

14 Air conditioning compressor - removal and installation

Warning: *The air conditioning system is under high pressure. DO NOT loosen any fittings or remove any components until after the system has been discharged. Air conditioning refrigerant must be properly discharged into an EPA-approved container at a dealer service department or an automotive air conditioning repair facility. Always wear eye protection when disconnecting air conditioning system fittings.*

Note: *If you are replacing the compressor, you must also replace the accumulator* (see Section 16) *and the orifice tube* (see Section 18).

Removal

Refer to illustration 14.5

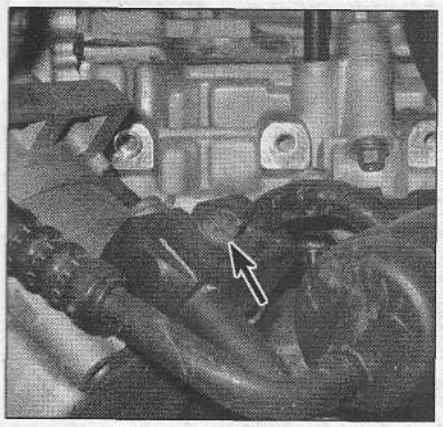
1 Have the air conditioning system discharged by a dealer service department or by an automotive air conditioning shop before proceeding (see **Warning** above).

2 Loosen the right front wheel lug nuts. Raise the vehicle and secure it on jackstands. Remove the right front wheel.

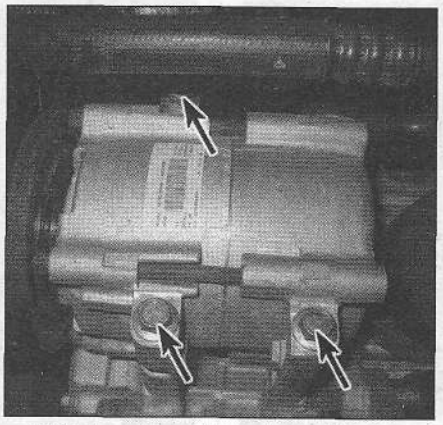
3 Remove the right front fender splash shield.

4 Remove the drivebelt (see Chapter 1).

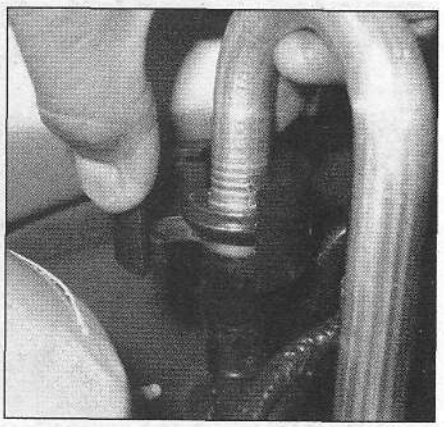
5 Disconnect the electrical connector from



14.9 Remove the inlet and outlet line manifold bolt from the compressor and separate the lines from the compressor



14.10 Location of the air conditioning compressor bolts (V6 model shown)



15.3a Install the air conditioning line spring lock tool with the lip of the tool towards the spring inside the coupling

the compressor clutch field coil **(see illustration)**.

Four-cylinder models

6 Disconnect the compressor inlet and outlet line manifold from the compressor. Remove and discard the old O-rings.

7 Remove the compressor mounting bolts and remove the compressor.

V6 models

Refer to illustrations 14.9 and 14.10

8 Disconnect the engine block heater electrical connector, if equipped.

9 Disconnect the compressor inlet and outlet line manifold from the compressor **(see illustration)**. Remove and discard the old O-rings.

10 Remove the compressor mounting bolts **(see illustration)** and remove the compressor.

Installation

11 If a new compressor is being installed, follow the directions with the compressor regarding the draining of excess oil prior to installation.

12 The clutch may have to be transferred from the original to the new compressor.

13 Before reconnecting the inlet and outlet lines to the compressor, replace all manifold O-rings and lubricate them with refrigerant oil.

14 Installation is otherwise the reverse of removal.

15 Replace the orifice tube (see Section 18).

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

15 Air conditioning accumulator - removal and installation

Refer to illustration 15.3a, 15.3b, 15.4 and 15.5

Warning: *The air conditioning system is under high pressure. DO NOT loosen any fittings or remove any components until after the system has been discharged. Air conditioning refrigerant must be properly discharged into an EPA-approved container at a dealer service department or an automotive air conditioning repair facility. Always wear eye protection when disconnecting air conditioning system fittings.*

1 Have the air conditioning system discharged by a dealer service department or by an automotive air conditioning shop before proceeding (see **Warning** above).

2 Disconnect the air conditioning pressure cycling switch electrical connector (see Section 17).

3 Disconnect the condenser line from the accumulator **(see illustrations)**. Use special spring lock coupling tools to disconnect the air conditioning line. Cap the line to prevent contamination. Remove and discard the old O-ring.

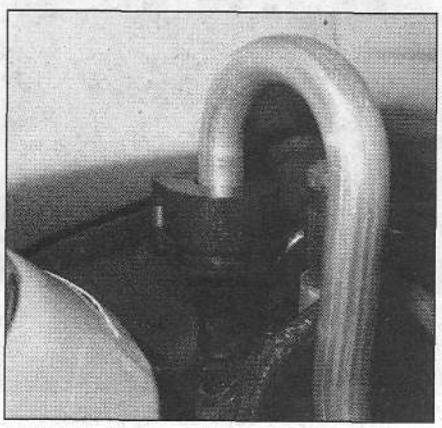
4 Disconnect the line from the accumulator to the evaporator **(see illustration)**. Cap the line to prevent contamination. Remove and discard the old O-ring.

5 Remove the accumulator mounting bracket nuts **(see illustration)** and remove the accumulator.

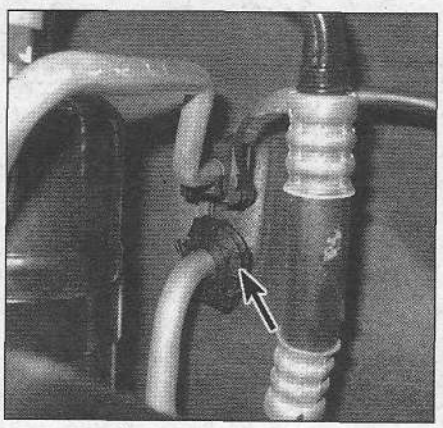
6 Replace all old O-rings. Before installing the new O-rings, coat them with refrigerant oil.

7 Installation is otherwise the reverse of removal.

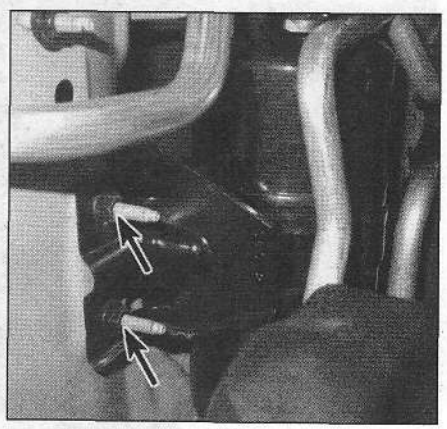
8 Take the vehicle to the shop that discharged it and have the system evacuated and recharged.



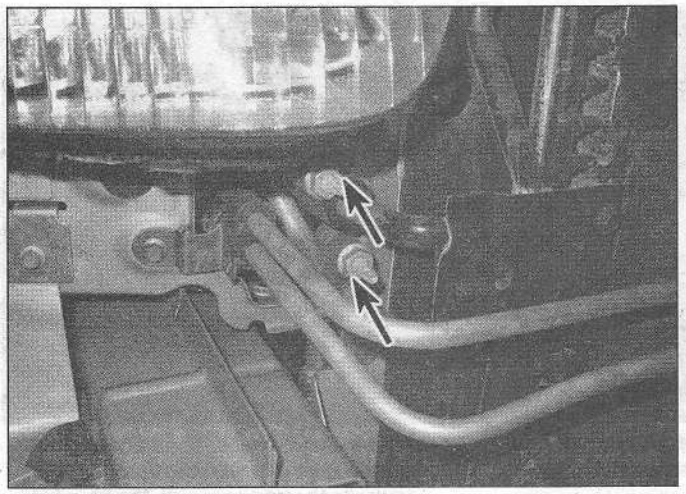
15.3b Lift up on the spring lock tool to release the coupling



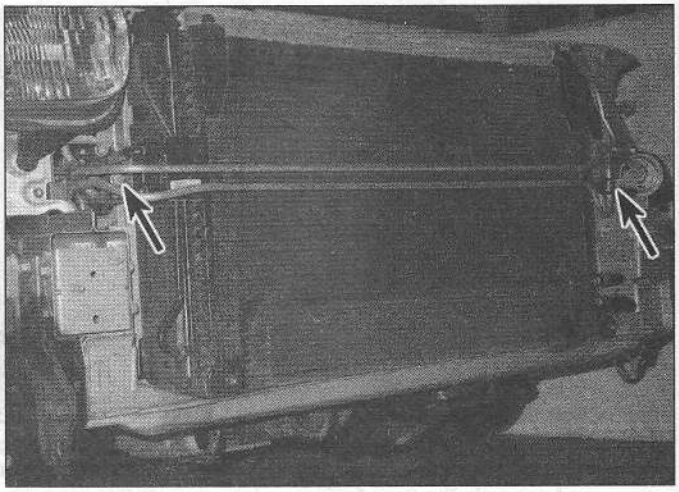
15.4 Remove the protective cover from the evaporator line coupler, then use the spring lock tool to disconnect the line



15.5 Location of the accumulator mounting nuts



16.3 Remove the nuts and disconnect the inlet and outlet refrigerant lines from the condenser



16.4 Remove the bracket bolts and position the power steering fluid cooler off to the side

16 Air conditioning condenser - removal and installation

Refer to illustration 16.3, 16.4 and 16.6

Warning: *The air conditioning system is under high pressure. DO NOT loosen any fittings or remove any components until after the system has been discharged. Air conditioning refrigerant must be properly discharged into an EPA-approved container at a dealer service department or an automotive air conditioning repair facility. Always wear eye protection when disconnecting air conditioning system fittings.*

Note: *The accumulator should be replaced if the condenser was damaged, causing the system to be open for some time (see Section 15).*

1 Have the air conditioning system discharged by a dealer service department or an automotive air conditioning shop before proceeding (see **Warning** above).

2 Remove the front bumper cover (see Chapter 11).

3 Disconnect the refrigerant inlet and outlet lines from the condenser **(see illustration)**. Cap the lines to prevent contamination.

4 Remove the power steering cooler lines from the front of the condenser and position them off to the side **(see illustration 6.8)**.

5 Remove the left and right radiator support brackets **(see illustration)**.

6 Remove the condenser **(see illustration 6.8)**. If you're going to reinstall the same condenser, store it with the line fittings facing up to prevent oil from draining out.

7 If you're going to install a new condenser, pour one ounce of refrigerant oil of the correct type into it prior to installation.

8 Before reconnecting the refrigerant lines to the condenser, be sure to coat a pair of new O-rings with refrigerant oil, install them in the refrigerant line fittings and then tighten the condenser inlet and outlet nuts to the torque listed in this Chapter's Specifications.

9 Installation is otherwise the reverse of removal.

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

17 Air conditioning pressure cycling switch - replacement

Refer to illustration 17.1

Note: *The pressure cycling switch is located on top of the accumulator. The pressure cycling switch detects low refrigerant line pressure at 22 to 28 psi, switches the A/C system off, then back on again at 40 to 47 psi. If the pressure increases over 550 psi, the pressure cut-off switch, located in the high pressure line between the compressor and the accumulator, shuts the system off. A Schrader valve in the accumulator prevents refrigerant loss during pressure cycling switch replacement.*

1 Unplug the electrical connector from the pressure cycling switch **(see illustration)**.

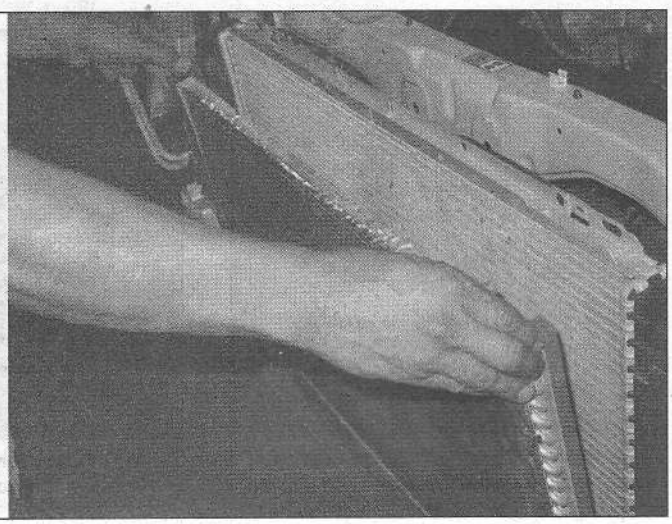
2 Unscrew the pressure cycling switch from the accumulator.

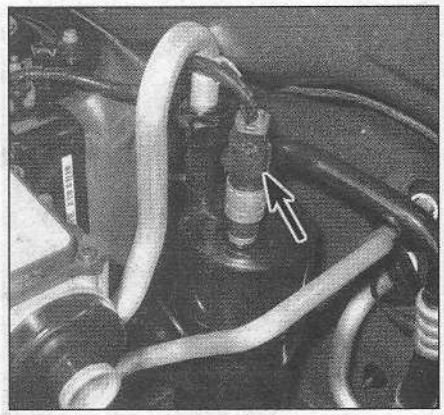
3 Lubricate the switch O-ring with clean refrigerant oil of the correct type.

4 Screw the new switch onto the accumulator threads until hand tight, then tighten it securely.

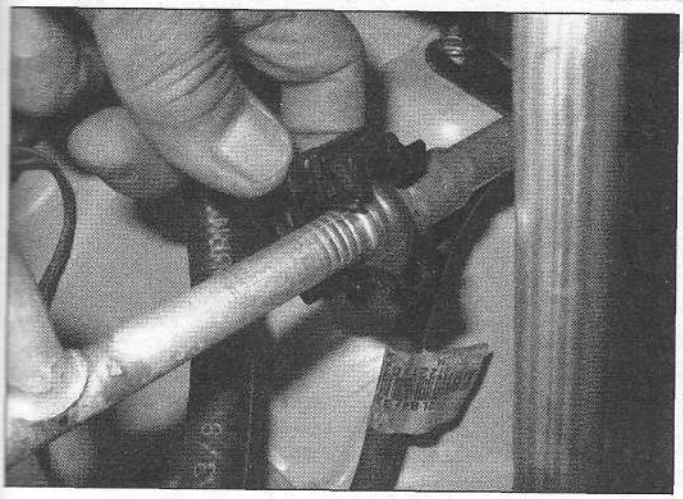
5 Reconnect the electrical connector.

16.6 Lift the condenser away from the radiator, being careful not to damage the fins on the radiator

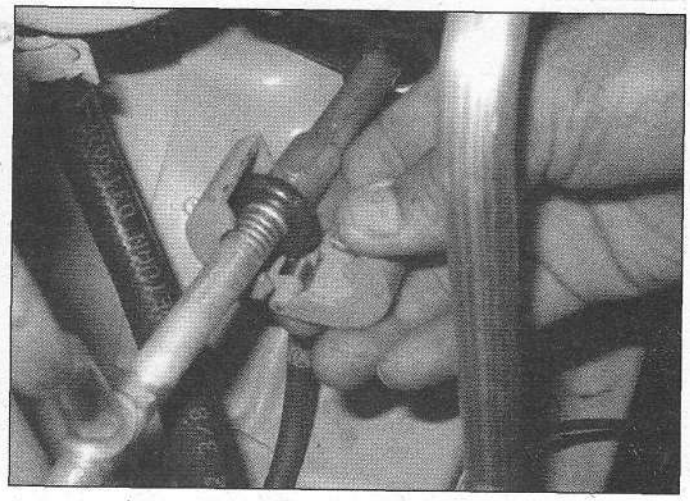




17.1 The air conditioning pressure cycling switch is mounted on top of the accumulator



18.2a Remove the protective cover from the air conditioning line coupling



18.2b Install the special spring lock tool . . .

18 Air conditioning orifice tube - removal and installation

Refer to illustrations 18.2a, 18.2b, 18.2c and 18.3

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 must 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.*

Note: *The orifice tube is located in the condenser to evaporator line. The orifice tube changes the high pressure liquid refrigerant into a low pressure liquid.*

1 Have the air conditioning system discharged by a dealer service department or by an automotive air conditioning shop before proceeding (see **Warning** above).

2 Disconnect the refrigerant line from the condenser to the evaporator **(see illustrations)**.

3 Using a pair of needle-nose pliers pull the orifice tube from the line **(see illustration)**.

4 Installation is the reverse of removal. Be sure to remove and discard the old O-rings.

5 Take the vehicle back to the shop that discharged it. Have the system evacuated, recharged and leak tested.

19 Oil cooler - removal and installation

Warning: *Wait until the engine is completely cool before beginning this procedure.*

1 Raise the vehicle and place it securely on jackstands.

2 Drain the engine coolant and the engine oil (see Chapter 1).

3 Remove the oil filter (see Chapter 1).

Four-cylinder models

4 Disconnect the two coolant hoses from the oil cooler.

5 Remove the oil cooler mounting bolt and detach the oil cooler from the engine block.

6 Be sure to install a new O-ring.

7 Installation is the reverse of removal. Tighten the oil cooler mounting bolt to the torque listed in this Chapter's Specifications.

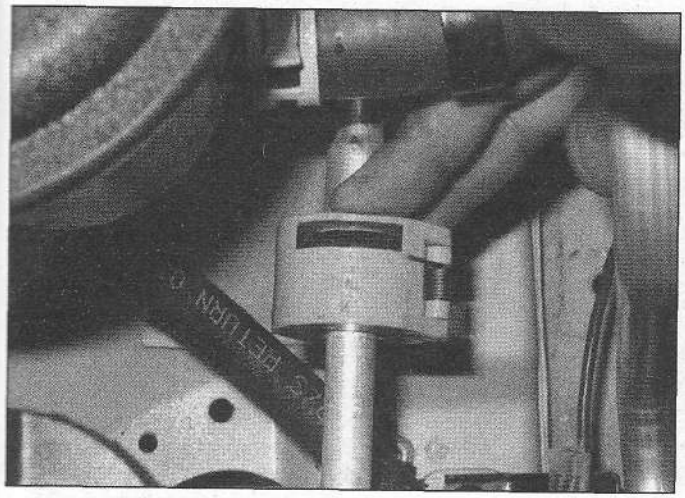
V6 models

8 Remove the two coolant hoses from the oil cooler.

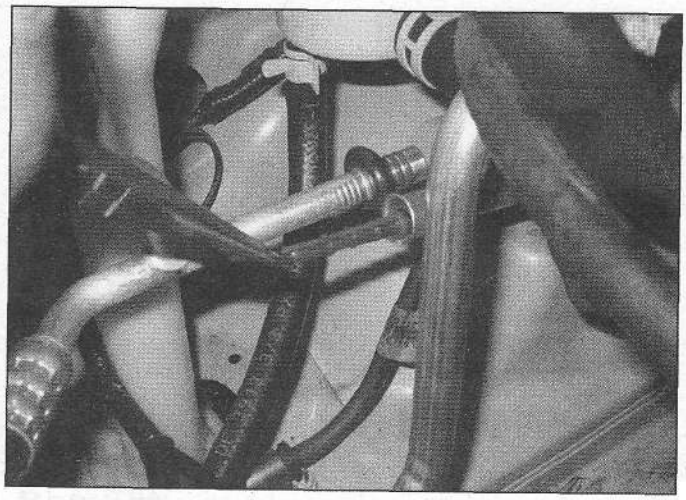
9 Unscrew the oil cooler from the engine block.

10 Be sure to use a new O-ring.

11 Installation is the reverse of removal.



18.2c . . . and release the coupler by pressing the tool into the spring



18.3 Remove the orifice tube using needle nose pliers