

Chapter 3

Cooling, heating and air conditioning systems

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Degrees of difficulty

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

Coolant

Mixture type	See Chapter 1
Cooling system capacity	See Chapter 1

System pressure

Pressure test	1.2 bars - should hold this pressure for at least 10 seconds
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Expansion tank filler cap

Pressure rating	1.2 bars approximately - see cap for actual value
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Thermostat

Starts to open	85°C to 89°C
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Coolant temperature sensor

Resistance:	
At 0°C	89 to 102 kilohms
At 20°C	35 to 40 kilohms
At 100°C	1.9 to 2.5 kilohms
At 120°C	1.0 to 1.4 kilohms

Air conditioning system

Refrigerant	R12 or R134a
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Torque wrench settings	Nm	lbf ft
Thermostat housing/water outlet:		
HCS engine	18 to 22	13 to 16
CVH engine	9 to 12	7 to 9
Zetec engine	18 to 22	13 to 16
Water pump pulley	8 to 12	6 to 9
Water pump retaining bolts:		
HCS engine	7 to 10	5 to 7
CVH engine	7 to 10	5 to 7
Zetec engine	16 to 20	12 to 15
Coolant temperature gauge sender:		
HCS engine	5 to 7	3.5 to 5
CVH engine	5 to 7	3.5 to 5
Zetec engine	6 to 10	4 to 7
Coolant temperature sensor:		
HCS engine	20 to 25	15 to 18
CVH engine	18 to 20	13 to 15
Zetec engine	12 to 18	9 to 13
Radiator retaining bolts	20 to 27	15 to 20
Cooling fan motor-to-shroud	9 to 12	7 to 9
Cooling fan shroud-to-radiator	3 to 5	2 to 3.5
Heater housing to body	7 to 11	5 to 8
Air conditioning system components:		
Condenser to side member	7 to 9	5 to 7
Shroud to radiator	3 to 5	2 to 3.5
Dehydrator to radiator bracket	5 to 8	3.5 to 6
High pressure switch to dehydrator	12 to 15	9 to 11
Expansion valve to evaporator	4 to 5	3 to 3.5
Air conditioner housing to cowl panel	6 to 8	4 to 6
Low and high pressure pipes to compressor	20 to 26	15 to 19
Low pressure liquid pipe to expansion valve	6 to 8	4 to 6
Dehydrator connecting pipe to condenser	14 to 19	10 to 14
Pipes to dehydrator	14 to 19	10 to 14
Compressor to bracket	20 to 27	15 to 20
Compressor driveplate to compressor	11 to 16	8 to 12

1 General information

Engine cooling system

The cooling system is of the pressurised type consisting of a belt-driven pump, aluminium crossflow radiator, expansion tank, electric cooling fan and a thermostat. The system functions as follows. Cold coolant in the bottom of the radiator passes through the bottom hose to the water pump, where it is pumped around the cylinder block and head passages. After cooling the cylinder bores, combustion surfaces and valve seats, the coolant reaches the underside of the thermostat, which is initially closed. The coolant passes through the heater and inlet manifold and is returned to the water pump.

When the engine is cold, the coolant circulates through the cylinder block, cylinder head, heater and inlet manifold. When the coolant reaches a predetermined temperature, the thermostat opens, and the coolant then passes through the top hose to the radiator. As the coolant circulates through the radiator, it is cooled by the inrush of air when the car is in forward motion. Airflow is

supplemented by the action of the electric cooling fan when necessary. Upon reaching the bottom of the radiator, the coolant is now cooled, and the cycle is repeated.

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

The electric cooling fan, mounted behind the radiator, is controlled by a thermostatic switch. At a predetermined coolant temperature, the switch contacts close, thus actuating the fan.



Warning: DO NOT attempt to remove the expansion tank filler cap, or to disturb any part of the cooling system, while it or the engine is hot, as there is a very great risk of scalding. If the expansion tank filler cap must be removed before the engine and radiator have fully cooled down (even though this is not recommended) the pressure in the cooling system must first be released. Cover the cap with a thick layer of cloth, to avoid scalding, and slowly unscrew the filler cap until a hissing sound can be heard. When the hissing has stopped, showing that pressure is released, slowly unscrew the filler cap

further until it can be removed; if more hissing sounds are heard, wait until they have stopped before unscrewing the cap completely. At all times, keep well away from the filler opening.

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

Never leave antifreeze lying around in an open container, or in a puddle in the driveway or on the garage floor. Children and pets are attracted by its sweet smell, but antifreeze can be fatal if ingested.

Warning: If the engine is hot, the electric cooling fan may start rotating even if the engine is not running, so be careful to keep hands, hair and loose clothing well clear when working in the engine compartment.

Heating system

The heating system consists of a blower fan and heater matrix (radiator) located in the heater unit, with hoses connecting the heater matrix to the engine cooling system. Hot engine coolant is circulated through the heater matrix. When the heater temperature control on the fascia is operated, a flap door opens to expose the heater matrix to the

passenger compartment. Air entering the vehicle passes over the matrix and is thus heated - the supply of air can be supplemented by operating the blower fan as required.

Air conditioning system

See Section 13.

2 Antifreeze - general information



Warning: Do not allow antifreeze to come in contact with your skin, or with the 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 have collection centres which will see that antifreeze is disposed of safely.

The cooling system should be filled with a water/ethylene glycol-based antifreeze solution, of a strength which will prevent freezing down to at least -25°C, or lower if the local climate requires it. Antifreeze also provides protection against corrosion, and increases the coolant boiling point.

The cooling system should be maintained according to the schedule described in Chapter 1. If antifreeze is used that is not to Ford's specification, old or contaminated coolant mixtures are likely to cause damage, and encourage the formation of corrosion and scale in the system. Use distilled water with the antifreeze, if available - if not, be sure to use only soft water. Clean rainwater is suitable.

Before adding antifreeze, check all hoses and hose connections, because antifreeze tends to leak through very small openings. Engines don't normally consume coolant, so if the level falls regularly, find the cause and correct it.



4.3A Detaching the expansion tank top hose from the thermostat housing on the HCS engine. Thermostatic switch is also shown (arrowed)

The exact mixture of antifreeze-to-water which you should use depends on the relative weather conditions. The mixture should contain at least 40% antifreeze, but not more than 70%. Consult the mixture ratio chart on the antifreeze container before adding coolant. Hydrometers are available at most automotive accessory shops to test the coolant. Use only good-quality ethylene-glycol-based antifreeze which meets the vehicle manufacturer's specifications.

3 Cooling system hoses - disconnection and renewal



Note: Refer to the warnings given in Section 1 of this Chapter before starting work.

1 If the checks described in Chapter 1 reveal a faulty hose, it must be renewed as follows.

2 First drain the cooling system (see Chapter 1); if the antifreeze is not due for renewal, the drained coolant may be re-used, if it is collected in a clean container.

3 To disconnect any hose, use a pair of pliers to release the spring clamps (or a screwdriver to slacken screw-type clamps), then move them along the hose clear of the union. Carefully work the hose off its stubs. The hoses can be removed with relative ease when new - on an older car, they may have stuck.

4 If a hose proves stubborn, try to release it by rotating it on its unions before attempting to work it off. Gently prise the end of the hose with a blunt instrument (such as a flat-bladed screwdriver), but do not apply too much force, and take care not to damage the pipe stubs or hoses. Note in particular that the radiator hose unions are fragile; do not use excessive force when attempting to remove the hoses. If all else fails, cut the hose with a sharp knife, then slit it so that it can be peeled off in two pieces. While expensive, this is preferable to buying a new radiator. Check first, however, that a new hose is readily available.

5 When refitting a hose, first slide the clamps onto the hose, then work the hose onto its unions. If the hose is stiff, use soap (or



4.3B Detaching the heater hose from the thermostat housing (CVH engine)

washing-up liquid) as a lubricant, or soften it by soaking it in boiling water, but take care to avoid scalding.

6 Work each hose end fully onto its union, then check that the hose is settled correctly and is properly routed. Slide each clip along the hose until it is behind the union flared end, before tightening it securely.

7 Refill the system with coolant (see Chapter 1).

8 Check carefully for leaks as soon as possible after disturbing any part of the cooling system.

4 Thermostat - removal, testing and refitting



Note: Refer to the warnings given in Section 1 of this Chapter before starting work.

Removal

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Drain the cooling system (see Chapter 1).

HCS and CVH engines

3 Loosen the clips, and disconnect the radiator top hose and expansion tank hose (HCS engines) or the radiator top hose, expansion tank hose and heater hose (CVH engines) from the thermostat housing (see illustrations).

4 Disconnect the thermostatic switch wire multi-plug from the thermostat housing.

5 Unscrew the retaining bolts, and remove the thermostat housing (see illustration).

6 Remove the gasket from the mating face of the thermostat housing, then using suitable pliers, compress the thermostat retaining clip and remove it from the housing. Extract the thermostat from the housing (noting its direction of fitting) and where applicable, remove the O-ring seal (see illustrations).

Zetec engines

7 Disconnect the expansion tank hose and the radiator top hose from the thermostat housing's water outlet.

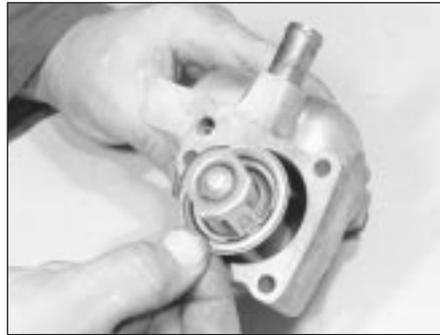


4.5 Removing the thermostat housing (CVH engine)

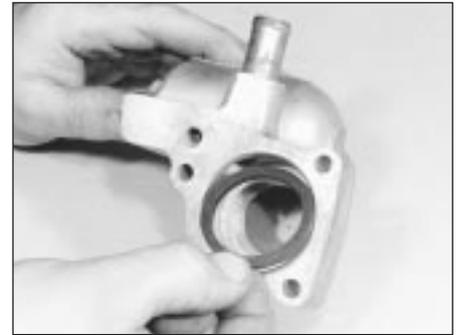
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4.6A Release the retaining clip . . .



4.6B . . . extract the thermostat . . .



4.6C . . . and where applicable, remove the O-ring seal

8 Unscrew the retaining bolts, and remove the water outlet from the thermostat housing (see illustration).

9 Withdraw the thermostat from the housing noting the position of the air bleed valve, and how the thermostat is installed (which end is facing outwards).

Testing

General check

10 Before assuming the thermostat is to blame for a cooling system problem, check the coolant level, auxiliary drivebelt tension and condition (see Chapter 1) and temperature gauge operation. When checking the coolant level, don't rely on the fact that the expansion bottle is full - where possible,



4.8 Unscrew the retaining bolts, and remove the water outlet from the thermostat housing

remove the radiator cap and check the level in the radiator.

11 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. Renew the thermostat.

12 If the engine runs hot, use your hand to check the temperature of the radiator top hose. If the hose isn't hot, but the engine is, the thermostat is probably stuck closed, preventing the coolant inside the engine from escaping to the radiator - renew the thermostat.



Caution: Don't drive the vehicle without a thermostat. The lack of a thermostat will slow warm-up time. The engine management system's ECU will then stay in warm-up mode for longer than necessary, causing emissions and fuel economy to suffer.

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

Thermostat test

14 If the thermostat remains in the open position at room temperature, it is faulty, and must be renewed as a matter of course.

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

ensure that neither touches the side of the container (see illustration).

16 Heat the water, and check the temperature at which the thermostat begins to open; compare this value with that specified. It's not possible to check the fully-open temperature, because this occurs above the boiling point of water at normal atmospheric pressure. If the temperature at which the thermostat began to open was as specified, then it is most likely that the thermostat's OK. Remove the thermostat, and allow it to cool down; check that it closes fully.

17 If the thermostat does not open and close as described, if it sticks in either position, or if it does not open at the specified temperature, it must be renewed.

Refitting

All models

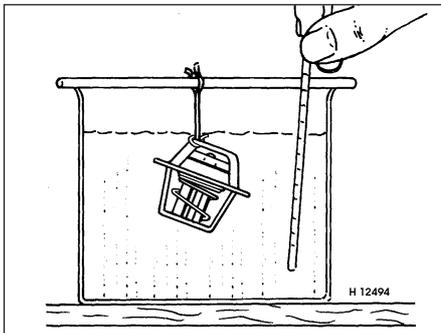
18 Refitting is a reversal of removal. Clean the mating surfaces carefully, and renew the thermostat's O-ring seal or housing gasket, as applicable (see illustration).

19 On Zetec engines, ensure that the thermostat is fitted with its air bleed valve uppermost (see illustration).

20 Tighten the thermostat housing/water outlet bolts to the specified torque wrench setting.

21 Refill the cooling system (see Chapter 1).

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



4.15 Testing the thermostat



4.18 Use a new gasket when refitting the thermostat housing



4.19 Ensure that the thermostat is fitted as shown



5.2A Cooling fan thermostatic switch location (arrowed) in the thermostat housing (CVH engine)



5.2B Cooling fan thermostatic switch location (arrowed) in the radiator top hose (Zetec engine)



5.5A Detach the cooling fan motor wiring connector . . .

5 Radiator electric cooling fan assembly - testing, removal and refitting



Note: Refer to the warnings given in Section 1 of this Chapter before starting work.

Testing

1 If it is suspected that the cooling fan is not operating when high engine temperature would normally require it to do so, first check the relevant fuses and relays (see Chapter 12).

2 Detach the wiring multi-plug from the thermostatic switch, which is located in the thermostat housing on HCS and CVH engines, or in the radiator top hose on Zetec engines (see illustrations). Using a suitable piece of wire, bridge the two connections within the plug. Switch the ignition on and check if the cooling fan operates. If the fan now operates, the thermostatic switch is at fault, and should be renewed as described in Section 6. Remove the bridging wire from the plug, and reconnect the wiring connector to complete the test.

3 If the fan failed to operate in the previous test, either the fan motor is at fault, or there is a fault in the wiring loom (see Chapter 12 for testing details).

Removal

Note: Refer to Section 14 for removal and

refitting procedures on models equipped with air conditioning.

4 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

5 Detach the wiring multi-plug from the fan motor, and then unclip and remove the wiring from the retaining clips on the shroud (see illustrations). Also where applicable, disconnect the coolant heater hose from the location clips on the cooling fan shroud, or unscrew the metal coolant pipe retaining bolts.

6 Unscrew the two nuts (one each side) securing the cooling fan shroud to the radiator (see illustration).

7 Lift the fan unit complete with its shroud so that the shroud is clear of the radiator

attachments, then lower and remove the assembly from underneath the vehicle (see illustration). Take care not to damage the core of the radiator as the fan assembly is withdrawn.

8 If required, the fan motor can be detached from the shroud by unscrewing the three retaining nuts (see illustration).

Refitting

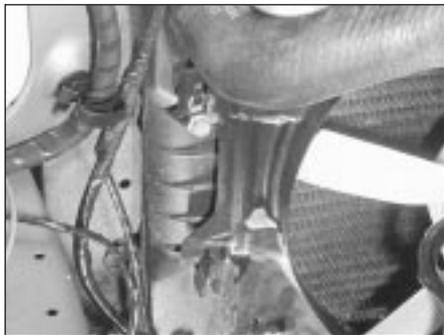
9 Refitting is a reversal of the removal procedure. Tighten the shroud-to-radiator bolts and the fan-to-shroud nuts to the specified torque setting. Ensure that the wiring connection is cleanly and securely made, and locate the loom in the retaining clips.



5.5B . . . and release the wiring from the shroud/motor support arm . . .



5.5C . . . and from the locating clip



5.6 Cooling fan shroud-to-radiator retaining nut



5.7 Withdrawing the cooling fan shroud and motor from under the vehicle



5.8 Fan motor-to-shroud nuts (arrowed)

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



Note: Refer to the warnings given in Section 1 of this Chapter before starting work.

Coolant temperature gauge sender

Testing

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

2 If the gauge indicates overheating at any time, consult the "Fault finding" section at the end of this manual, to assist in tracing possible cooling system faults.

3 If the gauge indicates overheating shortly after the engine is started from cold, unplug the coolant temperature sender's electrical connector. The sender is located below the thermostat housing on HCS engines, adjacent to the thermostat housing on CVH engines, and on the forward-facing side of the thermostat housing on Zetec engines. If the gauge reading now drops, renew the sender. If the reading remains high, the wire to the gauge may be shorted to earth, or the gauge is faulty.

4 If the gauge fails to indicate after the engine has been warmed up (approximately 10 minutes) and the fuses are known to be sound, switch off the engine. Unplug the sender's electrical connector, and use a jumper wire to ground the connector to a clean earth point (bare metal) on the engine. Switch on the ignition without starting the engine. If the gauge now indicates Hot, renew the sender.

5 If the gauge still does not work, the circuit may be open, or the gauge may be faulty. See Chapter 12 for additional information.

Removal

6 Refer to Chapter 4 and remove the air cleaner or air inlet hoses, according to engine type as necessary, to gain access to the sender unit.

7 Drain the cooling system (see Chapter 1).

8 On the Zetec engine, disconnect the expansion tank coolant hose and the radiator top hose from the thermostat housing's water outlet.

9 Unplug the electrical connector from the sender unit.

10 Unscrew the sender and withdraw it.

Refitting

11 Clean as thoroughly as possible the sender unit location, then apply a light coat of sealant to the sender's threads. Screw in the sender, tighten it to the specified torque wrench setting, and plug in its electrical connector.

12 Reconnect the hoses, and refit any components disconnected for access. Top-up the cooling system (see Chapter 1) and run the engine. Check for leaks and proper gauge operation.

Engine coolant temperature sensor

Testing

13 Disconnect the battery negative (earth) lead (see Chapter 5, Section 1).

14 Locate the coolant temperature sensor, which will be found below the inlet manifold on HCS engines, on the side or centre of the inlet manifold on CVH engines, or on top of the thermostat housing on Zetec engines. Once located, refer to Chapter 4 and remove the air cleaner or air inlet hoses, according to engine type as necessary, to improve access to the sensor unit.

15 Unplug the electrical connector from the sensor.

16 Using an ohmmeter, measure the resistance between the sensor terminals. Depending on the temperature of the sensor tip, the resistance measured will vary, but should be within the broad limits given in the Specifications Section of this Chapter. If the sensor's temperature is varied - by removing it (see below) and placing it in a freezer for a while, or by warming it gently - its resistance should alter accordingly.

17 If the results obtained show the sensor to be faulty, renew it.

18 On completion, plug in the connector and refit any components removed for access, then reconnect the battery.

Removal

19 Disconnect the battery negative (earth) lead (see Chapter 5, Section 1).

20 Locate the sensor as described previously, and remove any components as necessary for access.

21 Drain the cooling system (see Chapter 1).

22 Unplug the electrical connector from the sensor.

23 Unscrew the sensor and withdraw it.

Refitting

24 Clean as thoroughly as possible the sensor location, then apply a light coat of sealant to the sensor's threads. Refit and tighten the sensor to the specified torque wrench setting, and plug in its electrical connector.

25 Top-up the cooling system (see Chapter 1) and run the engine, checking for leaks.



7.6A Detach the top hose . . .

Radiator electric cooling fan thermostatic switch

Testing

26 Refer to the procedures contained in Section 5.

Removal

27 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

28 Drain the cooling system (see Chapter 1).

29 Disconnect the wiring multi-plug from the thermostatic switch, and then unscrew the switch from the thermostat housing or radiator top hose, as applicable. Remove the sealing washer.

Refitting

30 Refitting is a reversal of removal, but fit a new sealing washer and tighten the switch securely. Refill the cooling system as described in Chapter 1, then reconnect the battery.

7 Radiator and expansion tank - removal, inspection and refitting



Note: Refer to the warnings given in Section 1 of this Chapter before starting work.

Radiator

Removal

Note: If leakage is the reason for removing the radiator, bear in mind that minor leaks can often be cured using a radiator sealant with the radiator in situ.

1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 On carburettor engines, refer to Chapter 4A and remove the air cleaner inlet if necessary, for access.

3 Drain the cooling system (see Chapter 1).

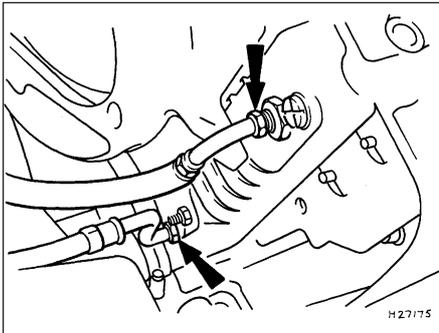
4 Remove the cooling fan assembly as described in Section 5.

5 Apply the handbrake, then raise and support the vehicle at the front end on axle stands.

6 Loosen off their retaining clips, and detach the top, bottom and expansion tank hoses from the radiator (see illustrations).



7.6B . . . the bottom hose and expansion tank hose from the radiator

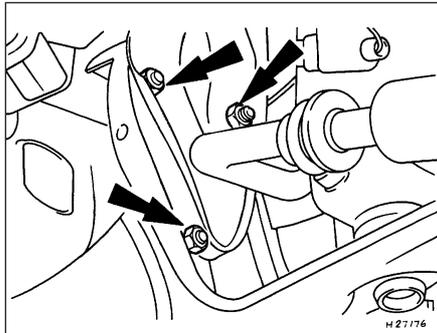


7.7A Automatic transmission fluid cooling pipe connections to the radiator (arrowed)

7 Where applicable, disconnect the automatic transmission fluid cooling pipes from the radiator - be prepared for fluid loss (see illustration). As they are disconnected, plug the fluid hoses and connections, to prevent further loss of fluid and the ingress of dirt into the system. If air conditioning is fitted, remove the splash shield (see paragraph 9), then undo the three retaining nuts and detach the air conditioning condenser from the side of the radiator side deflector (see illustration).

8 Unscrew the two retaining bolts on each side of the radiator (underneath the radiator), then supporting it, lower the radiator clear of the mounting studs at the top, and carefully withdraw it from underneath the front end of the vehicle (see illustration).

9 Detach the rubber mounts, the side



7.7B Air conditioner condenser retaining nuts (arrowed)

deflectors and the bottom mounting from the radiator. If required, the splash shield can be removed from the radiator by undoing the six retaining screws or drilling out the pop-rivets and extracting the retaining clips (according to type) (see illustrations).

10 With the radiator removed, it can be inspected for leaks and damage. If it needs repair, have a radiator specialist or dealer service department perform the work, as special techniques are required.

11 Insects and dirt can be removed from the radiator with a garden hose or a soft brush. Don't bend the cooling fins as this is done.

Refitting

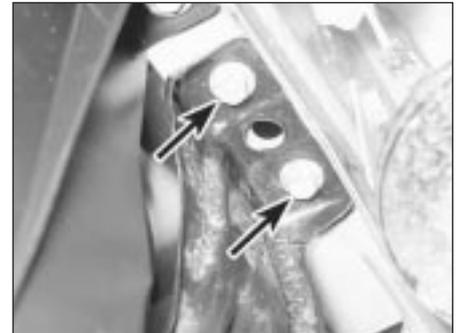
12 Refitting is a reversal of removal, but check the mounting bushes, and if necessary renew them. If the splash shield was detached from the base of the radiator, refit it using new pop-rivets or retaining clips, according to type (see illustration). Refill the cooling system with reference to Chapter 1. On automatic transmission models check, and if necessary top-up, the automatic transmission fluid level.

Expansion tank

Removal

13 Partially drain the cooling system, so that the coolant level drops below the expansion tank. Refer to Chapter 1 for details.

14 Where fitted, withdraw the power steering fluid reservoir from the side of the expansion tank, and move it aside as far as the hoses will permit.



7.8 Radiator retaining bolts (arrowed)

15 Before disconnecting the coolant hoses from the expansion tank, it is advisable to clamp them just short of their connections to the expansion tank, to prevent spillage of coolant and the ingress of air when they are detached.

16 Loosen off the coolant hose clips at the expansion tank, and detach the hoses from it. If they are not clamped, secure them so that their ends are raised, to minimise coolant spillage.

17 Unscrew the two retaining screws, and remove the expansion tank from the inner wing panel.

Refitting

18 Refit in the reverse order of removal. Top-up the cooling system as described in Chapter 1.

8 Water pump (HCS engine) - removal and refitting



Note: Refer to the warnings given in Section 1 of this Chapter before starting work.

Removal

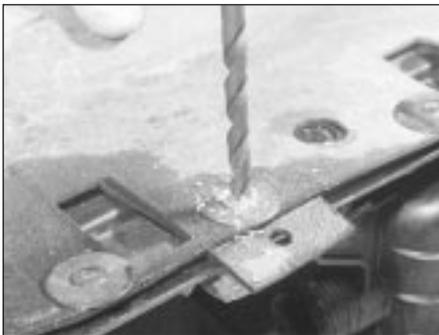
1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

2 Drain the cooling system (see Chapter 1).

3 Slacken the water pump pulley retaining bolts, then remove the auxiliary drivebelt as described in Chapter 1 (see illustration).



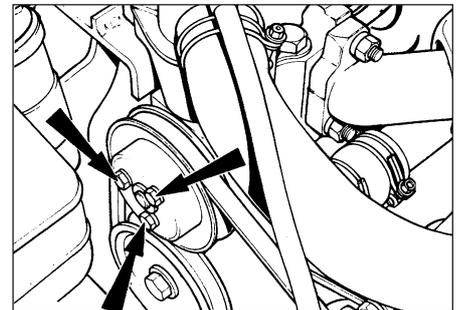
7.9A Radiator mounting rubber



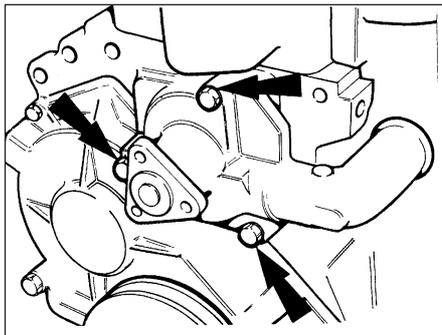
7.9B Drilling out a radiator-to-splash shield rivet



7.12 Pop-riveting the anti-splash shield to the radiator



8.3 Slacken the water pump drivebelt pulley retaining bolts (arrowed) while the drivebelt is still in place

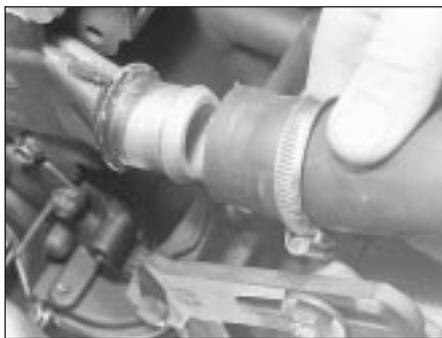


8.6 Unscrew the water pump retaining bolts (arrowed)

- 4 Remove the retaining bolts, and remove the drivebelt pulley from the water pump.
- 5 Loosen off the coolant hose securing clips, and disconnect the hoses from the water pump.
- 6 Unscrew the retaining bolts, and withdraw the water pump from the engine (see illustration).

Refitting

- 7 Clean all traces of gasket from the engine and the water pump mating faces. Ensure that the mating faces are clean and dry. Note that the water pump gasket fitted during production is integral with the timing cover gasket, and this will need to be cut away using a sharp knife, keeping as close to the timing cover as possible.
- 8 No provision is made for the repair of the



9.4 Detach the coolant hose from the water pump



9.5 Removing the water pump from the CVH engine



8.9 Refitting the water pump to the engine. Note the new gasket

- water pump; if it is noisy or defective in any way, it must be renewed.
- 9 Refitting is a reversal of the removal procedure. Use a new gasket, lightly smeared with jointing compound, and tighten the retaining bolts to the specified torque setting (see illustration).
 - 10 Refit and adjust the auxiliary drivebelt as described in Chapter 1.
 - 11 Refill the cooling system as described in Chapter 1, and reconnect the battery.

9 Water pump (CVH engine) - removal and refitting

Note: Refer to the warnings given in Section 1 of this Chapter before starting work.

Removal

- 1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 2 Drain the cooling system (see Chapter 1).
- 3 Remove the timing belt and tensioner (see Chapter 2B). If the belt is fouled with coolant, it must be renewed as a matter of course.
- 4 Loosen off the coolant hose retaining clip, and detach the coolant hose from the water pump (see illustration).
- 5 Unscrew and remove the four bolts securing the water pump to the front end face of the cylinder block, and then withdraw the pump from the vehicle (see illustration).



10.5 Unscrew the bolts (arrowed) to remove the water pump

Refitting

- 6 Clean the engine water pump mating faces. Ensure that the mating faces are clean and dry.
- 7 No provision is made for the repair of the water pump; if it is noisy or defective in any way, it must be renewed.
- 8 Refitting is a reversal of the removal procedure. Tighten the retaining bolts to the specified torque, and ensure that the coolant hose connection to the water pump is securely made.
- 9 Refit the timing belt and tensioner as described in Chapter 2B.
- 10 Top-up the cooling system as described in Chapter 1, and reconnect the battery.

10 Water pump (Zetec engine) - removal and refitting



Note: Refer to the warnings given in Section 1 of this Chapter before starting work.

Removal

- 1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 2 Drain the cooling system (see Chapter 1).
- 3 Remove the timing belt and tensioner (see Chapter 2C). If the belt is fouled with coolant, it must be renewed as a matter of course.
- 4 Disconnect the radiator bottom hose from the pump union. It is easier to reach this union if the power steering pump is unbolted and moved aside, as described in Chapter 10. There is no need to disconnect any of the power steering system hoses.
- 5 Unbolt and remove the water pump (see illustration). If the pump is to be renewed, unbolt the timing belt guide pulleys, and transfer them to the new pump.

Refitting

- 6 Clean the mating surfaces carefully; the gasket must be renewed whenever it is disturbed (see illustration).
- 7 On refitting, use grease to stick the new gasket in place, refit the pump, and tighten the pump bolts to the specified torque wrench setting.



10.6 Always use a new gasket, and clean all mating surfaces carefully

8 The remainder of refitting is a reversal of the removal procedure. Refit the timing belt and tensioner as described in Chapter 2C, noting that a new tensioner spring and retaining pin must be fitted if the timing belt has been removed for the first time. Tighten all fasteners to the specified torque wrench settings, and refill the system with coolant as described in Chapter 1.

11 Heater/ventilation components - removal and refitting



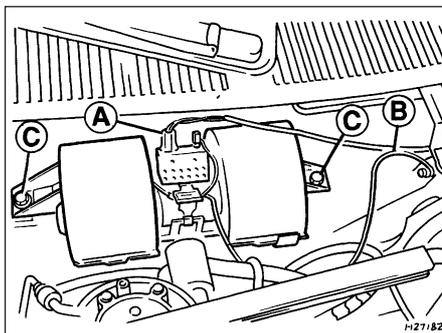
Heater blower motor

Removal

- 1 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 2 For improved access, refer to Chapter 4 for details, and remove the air cleaner (where applicable).
- 3 Peel back the seal strip from the top edge of the bulkhead.
- 4 Cut the ties and detach the hose and wiring loom from the bulkhead.
- 5 Undo the six retaining bolts, and remove the cover from the air chamber (see illustration).
- 6 Release the heater blower cover from its guides, and remove it.
- 7 Disconnect the wires from the blower motor, then undo the two retaining nuts and withdraw the blower motor from the air chamber (see illustration).
- 8 To remove the motor from its housing, prise free the locking clips and release the securing lugs using a pin punch (see illustration). Detach the connector from the blower resistor unit, bend the retaining tabs up, and then separate the motor (with resistor) from the retainer. Remove the motor from the housing.

Refitting

- 9 Refitting is a reversal of the removal procedure. When reassembling the blower motor housing covers, ensure that the locating lugs are fully engaged.



11.7 Heater blower motor unit

- A Resistor multi-plug
B Earth lead
C Blower unit securing nuts

Heater blower motor resistor

Removal

- 10 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 11 For improved access, refer to Chapter 4 for details, and remove the air cleaner (where applicable).
- 12 Peel back the seal strip from the top edge of the bulkhead.
- 13 Cut the ties and detach the hose and wiring loom from the bulkhead.
- 14 Undo the six retaining bolts, and remove the cover from the air chamber.
- 15 Detach the wiring connector and the multi-plug from the resistor unit. Bend up the securing tabs, and withdraw the resistor unit from the heater motor assembly.

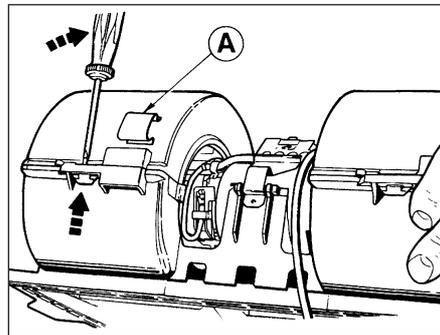
Refitting

- 16 Refit in the reverse order of removal. Ensure that the resistor retaining tabs are fully engaged and secure.

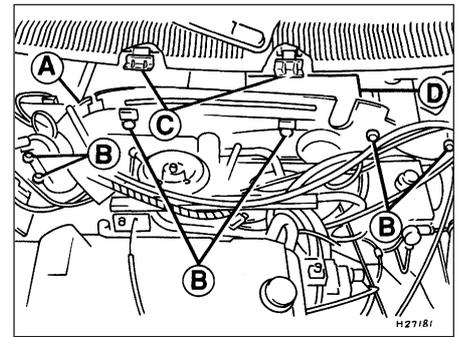
Heater unit and matrix

Removal

- 17 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).
- 18 Drain the cooling system as described in Chapter 1.
- 19 Undo the retaining clips, and detach the heater coolant supply and return hoses at their bulkhead connections (see illustration).
- 20 A small amount of coolant (about half a litre), will have remained in the heater matrix after draining. In order to prevent the possibility of the coolant spilling onto the carpets during the removal of the heater, it is advisable to blow through one of the connections to eject the remaining coolant out through the other open connection.
- 21 Undo the two retaining screws, and detach the heater matrix cover plate and gasket from the bulkhead.
- 22 Refer to Chapter 12 for details, and remove the radio/cassette unit from the facia.
- 23 Undo the two retaining screws, and remove the stowage unit from under the radio/cassette aperture.
- 24 Peel back the front door weatherstrip (seal) from the "A" pillar adjacent to the facia.



11.8 Heater blower unit locking clip (A) removal

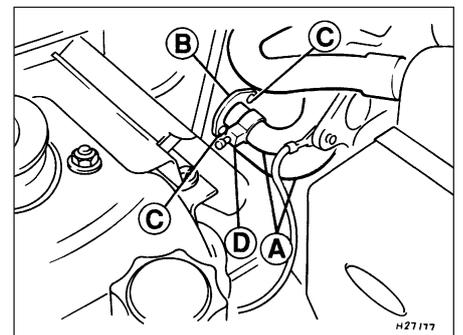


11.5 Air chamber and associated components

- A Bulkhead cover
B Cover retaining bolts
C Blower cover guides
D Blower cover

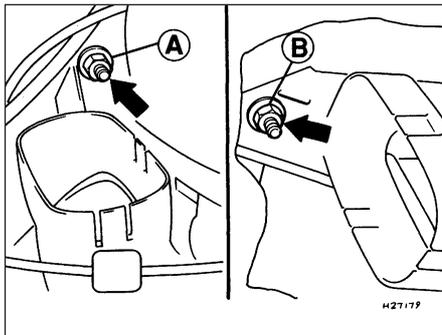
Undo the retaining screw, and remove the "A" pillar trim. Repeat the procedure on the opposite side.

- 25 Undo the two retaining screws, and remove the upper steering column shroud.
- 26 Similarly, undo the four retaining screws and remove the lower steering column shroud.
- 27 Referring to Chapter 11, undo the facia retaining screws as necessary.
- 28 Undo the single retaining screw, and withdraw the multi-function switch from the steering column. Disconnect the wiring multi-plugs.
- 29 Refer to Chapter 11 for details, and remove the centre console.
- 30 Pull free the covers from the right- and left-hand heater control levers, then unclip and disconnect the cables from their connections on the heater unit each side.
- 31 Prise free the cover from each of the three facia securing bolt apertures on the top face of the facia, also the cover from the radio/cassette recess.
- 32 Unscrew and remove the ten Torx-type retaining bolts, and pull the facia rearwards to partially withdraw it, taking care not to stretch the wiring harnesses under the facia (see Chapter 11).



11.19 Coolant heater hose connections to heater at bulkhead

- A Coolant hoses
B Cover plate
C Screws
D Clip



11.35 Left-hand (A) and right-hand (B) heater housing securing nuts (arrowed)

33 Pull free the footwell air vent from the heater housing connection.

34 Pull free the air ducts from the heater housing connections (two each side, and two in the centre).

35 Undo the two retaining nuts, and disconnect the heater housing from the cowl panel by withdrawing it downwards and removing it from the side (see illustration).

36 To remove the heater matrix (radiator) from the heater unit, undo the two retaining screws and carefully withdraw it (see illustration).

Refitting

37 Refitting is a reversal of the removal procedure. When fitting the heater unit into position, engage the lugs of its flange with the support bracket on the cowl panel, and guide the matrix into position through the opening in the bulkhead.

38 Check that all wiring, coolant hose and air duct connections are securely made. Tighten the housing retaining nuts to the specified torque.

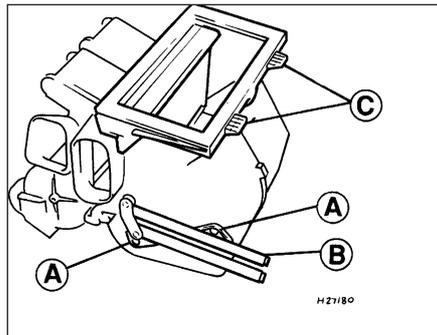
39 On completion, refill the cooling system as described in Chapter 1, then reconnect the battery.

Face-level air vent (right-hand)

Removal

40 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

41 Undo the two retaining screws from its



11.36 Heater unit showing matrix retaining screws (A), matrix (B) and unit locating lugs (C)

upper edge, and withdraw the instrument panel surround.

42 Undo the two retaining screws, and withdraw the face-level vent from the fascia. Where applicable, detach the wiring connectors from the switches in the panel.

Refitting

43 Refitting is the reversal of removal.

Face-level air vent (left-hand)

Removal

44 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

45 Open the glovebox lid, then unscrew the vent retaining screw from the underside of the box roof (directly under the vent). Carefully prise free and remove the vent (see illustration).

Refitting

46 Refitting is the reversal of removal.

Face-level air vent (centre)

Removal

47 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

48 Undo the two retaining screws from its upper edge, and withdraw the instrument panel surround.

49 Carefully prise free the three heater/fresh air and blower/air conditioning switch control knobs. Loosen off the centre air vent retaining screws, and partially withdraw the air vent unit



11.45 Prising free the left-hand side vent

just enough to allow access to the wiring connectors on the inside face of the unit (see illustrations).

50 Where applicable, disconnect the wiring multi-plugs from the heated rear window and rear foglight or heated windscreen switches, then remove the centre air vent unit.

Refitting

51 Refitting is the reversal of removal.

12 Heater/air conditioning controls - removal and refitting



Heater/air conditioning control panel

Removal

1 Remove the centre face-level air vent as described in the previous Section.

2 Pull free the covers, then disconnect the control cables from each side of the heater unit. The right-hand side cable operates the temperature control valve, and the left-hand cable operates the air distribution valve (see illustration).

3 Undo the two screws securing the heater control panel to the fascia. Withdraw the panel from the fascia just enough to allow the heater blower/air conditioning switch wiring plug to be detached, then fully withdraw the control panel, and feed the control cables through the fascia aperture (see illustrations).



11.49A Prise free the control knobs . . .



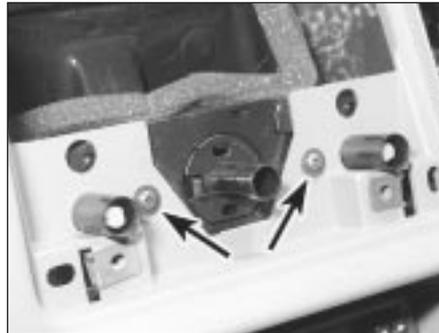
11.49B . . . undo the retaining screws . . .



11.49C . . . and partially withdraw the air vent unit



12.2 Heater temperature control cable connection on the right-hand side of the heater unit



12.3A Control panel retaining screws (arrowed)



12.3B Control panel removal

Refitting

4 Refit in the reverse order of removal. Ensure that the control cables are correctly re-routed (with no tight bends). Check that the cables and the wiring connectors are securely refitted.

Heater/air conditioning control cables

Removal

5 Remove the control panel as previously described.
 6 Bend the retaining tabs straight, and then detach the cover from the baseplate to open the heater control unit (see illustration).
 7 Cut the cable retaining clips free, then release the cables from the toothed guide strips to remove them. Note that the retaining clips will need to be renewed during reassembly.

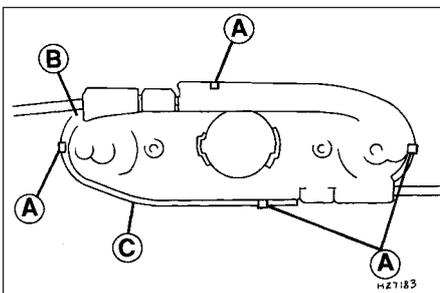
Refitting

8 Refitting is a reversal of the removal procedure.

13 Air conditioning system - general information and precautions

General information

The air conditioning system consists of a condenser mounted in front of the radiator, an evaporator mounted adjacent to the heater matrix, a compressor mounted on the engine,



12.6 Heater control unit retaining tabs (A), cover (B) and baseplate (C)

a dehydrator, and the plumbing connecting all of the above components (see illustration).

A blower fan forces the warmer air of the passenger compartment through the evaporator core (rather like 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.

Precautions

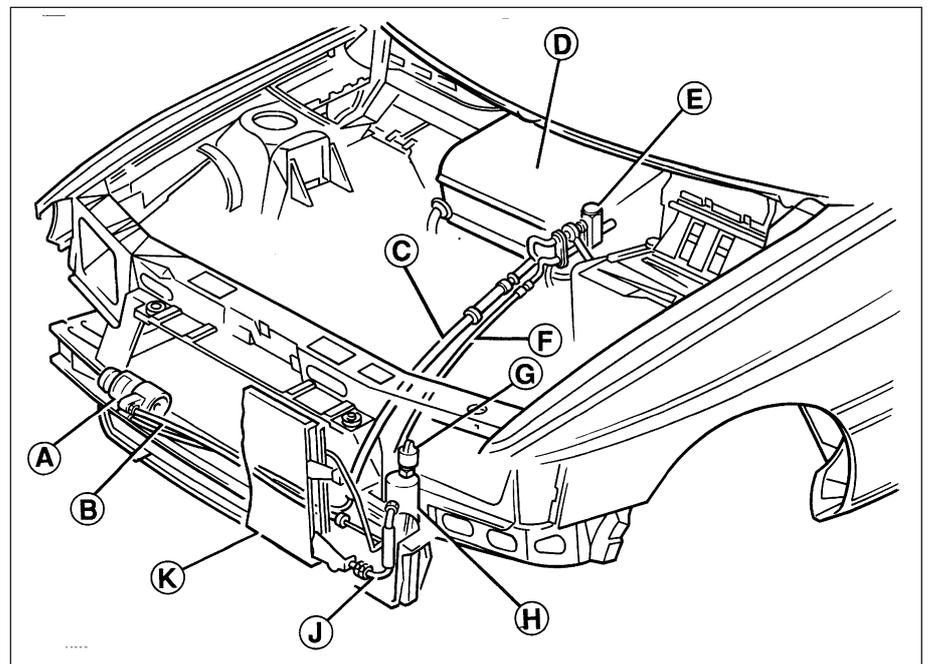


Warning: The air conditioning system is under high pressure. Do not loosen any fittings or remove any components until after the system has been discharged. Air conditioning refrigerant should be properly discharged into an approved type of

container, at a dealer service department or an automotive air conditioning repair facility capable of handling the refrigerant safely. Always wear eye protection when disconnecting air conditioning system fittings.

When an air conditioning system is fitted, it is necessary to observe the following special precautions whenever dealing with any part of the system, its associated components, and any items which necessitate disconnection of the system:

- a) While the refrigerant used on later models - R134a - is less damaging to the environment than the previously-used R12, both are very dangerous substances. They must not be allowed into contact with the skin or eyes, or there is a risk of



13.1 Air conditioning system layout

- A Compressor
- B Compressor-to-condenser pipe
- C Compressor-to-expansion valve
- D Evaporator and blower
- E Expansion valve
- F Expansion valve-to-dehydrator pipe
- G High-pressure switch
- H Dehydrator
- J Dehydrator-to-condenser pipe
- K Condenser

frostbite. They must also not be discharged in an enclosed space, as there is a risk of suffocation. The refrigerant is heavier than air, and so must never be discharged over a pit.

- b) The refrigerant must not be allowed to come in contact with a naked flame, otherwise a poisonous gas will be created - under certain circumstances, this can form an explosive mixture with air. For similar reasons, smoking in the presence of refrigerant is highly dangerous, particularly if the vapour is inhaled through a lighted cigarette.
- c) Never discharge the system to the atmosphere - R134a is not an ozone-depleting ChloroFluoroCarbon (CFC) as is R12, but is instead a hydrofluorocarbon, which causes environmental damage by contributing to the "greenhouse effect" if released into the atmosphere.
- d) R134a refrigerant must not be mixed with R12: the system uses different seals (now green-coloured, previously black) and has different fittings requiring different tools, so that there is no chance of the two types of refrigerant becoming mixed accidentally.
- e) If for any reason the system must be disconnected, entrust this task to your Ford dealer or a refrigeration engineer.
- f) It is essential that the system be professionally discharged prior to using any form of heat - welding, soldering, brazing, etc - in the vicinity of the system, before having the vehicle oven-dried at a temperature exceeding 70°C after repainting, and before disconnecting any part of the system.

14 Air conditioning system components - removal and refitting



Warning: Refer to the precautions given in the previous Section before proceeding.

Note: This Section refers to the components of the air conditioning system itself - refer to Sections 11 and 12 for details of components common to the heating/ventilation system.

Condenser

- 1 Have the refrigerant discharged at a dealer service department or an automotive air conditioning repair facility.
- 2 Disconnect the battery negative (earth) lead (see Chapter 5, Section 1).
- 3 Secure the radiator to the front body panel using string or wire to prevent it dropping when the mounting bracket is removed in a subsequent operation.
- 4 Apply the handbrake, then raise the front of the vehicle and securely support it on axle stands.
- 5 Undo the six plastic screws, and remove the cover from under the condenser/radiator mounting bracket.

6 Using the Ford service tool 34-001, disconnect the refrigerant lines from the condenser. Immediately cap the open fittings, to prevent the entry of dirt and moisture.

7 Undo the two bolts and one nut securing the dehydrator to the condenser/radiator mounting bracket, and move the dehydrator to one side.

8 Undo the two bolts each side securing the condenser/radiator mounting bracket to the body side members.

9 Detach the condenser and mounting bracket from the right-hand then the left-hand upper radiator mountings, and withdraw the assembly from under the car.

10 Release the clips and remove the air deflector from the condenser, then undo the two nuts and remove the mounting bracket. If required, unscrew the two mountings.

11 Refitting is the reversal of removal.

12 Have the system evacuated, charged and leak-tested by the specialist who discharged it.

Evaporator and blower motor

13 Have the refrigerant discharged at a dealer service department or an automotive air conditioning repair facility.

14 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1), followed by the positive lead, then remove the battery from its location.

15 For improved access, refer to Chapter 4 for details, and remove the air cleaner (where applicable).

16 Peel back the seal strip from the top edge of the bulkhead.

17 Cut the ties and detach the hose and wiring loom from the bulkhead.

18 Undo the three bolts, and detach the air conditioning pipe gasket retaining plate complete with gasket, from the bulkhead.

19 Undo the six retaining bolts, and remove the cover from the air chamber.

20 Release the evaporator housing cover from its guides and remove it.

21 Undo the retaining bolt, and disconnect the compressor low-pressure pipe and the dehydrator liquid pipe from the front of the expansion valve.

22 Disconnect the blower motor resistor multi-plug, and disconnect the blower motor earth lead at the connection on the body.

23 At the vacuum reservoir, disconnect the multi-plugs for the vacuum motor switch and de-ice switch, and detach the two vacuum hoses. Undo the screw and remove the vacuum reservoir assembly from the evaporator housing.

24 Disconnect the two condensation hoses from the front of the evaporator housing.

25 Undo the two bolts and two nuts, and remove the evaporator housing from the vehicle.

26 From the side of the evaporator housing, release the vacuum motor linkage clamp screw, then undo the two nuts and remove the vacuum motor. Undo the two screws

securing the de-ice switch, and withdraw the switch sensor.

27 Disconnect the blower motor resistor wiring plug, then undo the three screws and withdraw the evaporator housing cover.

28 Undo the two screws, release all the retaining clips securing the upper and lower halves of the evaporator housing, and lift off the upper half.

29 Undo the two screws, and detach the expansion valve from the side of the evaporator. Recover the valve seals.

30 Lift the evaporator out of the lower half of the housing.

31 To remove the blower motor, undo the securing bolt from the motor retaining strap, and lift out the motor.

32 Refitting is a reversal of the removal procedure, but use new seals where applicable, and tighten all fastenings to the specified torque wrench settings (where given).

33 Have the system evacuated, charged and leak-tested by the specialist who discharged it.

Compressor

34 Have the refrigerant discharged at a dealer service department or an automotive air conditioning repair facility.

35 Disconnect the battery negative (earth) lead (see Chapter 5, Section 1).

36 Apply the handbrake, then raise the front of the vehicle and securely support it on axle stands.

37 Remove the auxiliary drivebelt (see Chapter 1).

38 Undo the six plastic screws, and remove the cover from under the condenser/radiator mounting bracket.

39 Disconnect the compressor clutch wiring multi-plug, then undo the retaining bolt to detach the compressor high- and low-pressure pipes.

40 Undo the four bolts, and remove the compressor from its mounting bracket. **Note:** Keep the compressor level during handling and storage. If the compressor has seized, or if you find metal particles in the refrigerant lines, the system must be flushed out by an air conditioning technician, and the dehydrator must be renewed.

41 Refit the compressor in the reverse order of removal; renew all seals disturbed.

42 Have the system evacuated, charged and leak-tested by the specialist that discharged it.

Dehydrator

43 Have the refrigerant discharged at a dealer service department or an automotive air conditioning repair facility.

44 Disconnect the battery negative (earth) lead (see Chapter 5, Section 1).

45 Unscrew the pipe to the expansion valve and the compressor connecting pipe at the dehydrator.

46 Disconnect the high-pressure switch

multi-plug, then remove the high-pressure switch.

47 Apply the handbrake, then raise the front of the vehicle and securely support it on axle stands.

48 Undo the six plastic screws, and remove the cover from under the condenser/radiator mounting bracket.

49 Undo the two bolts and one nut securing the dehydrator to the condenser/radiator mounting bracket, and remove the dehydrator from under the vehicle.

50 Refit the dehydrator in the reverse order of removal; renew all seals disturbed.

51 Have the system evacuated, charged and leak-tested by the specialist that discharged it.

Electric cooling fan motor

52 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1).

53 Detach the wiring multi-plugs from the air conditioning fan motor and the motor resistor. Cut free the cable ties securing the wires to the bracket.

54 Working from above, unscrew the left-hand retaining nut from the fan motor support frame. Apply the handbrake, then raise and support the vehicle, then working from underneath, unscrew and remove the right-hand retaining nut from the support frame.

55 Undo the four retaining bolts, and detach the transmission brace (where fitted) from the bearer and transmission flange.

56 Remove the starter motor (Chapter 5).

57 Detach and remove the exhaust downpipe (Chapter 4).

58 Lift the support frame and fan motor from the mounting each side, and withdraw it from underneath the vehicle. If required, undo the three retaining nuts and detach the fan unit from the support frame (see illustration).

59 Refit in the reverse order of removal. Tighten all fastenings to their specified torque wrench settings (where given). Ensure that all wiring connections are securely made and, where applicable, relocate the wiring using new cable ties.

De-ice switch

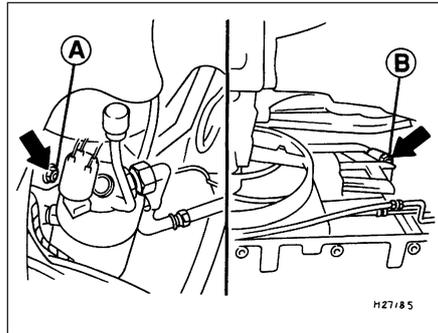
60 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1), followed by the positive lead, then remove the battery from its location.

61 For improved access, refer to Chapter 4 for details, and remove the air cleaner (where applicable).

62 Peel back the seal strip from the top edge of the bulkhead.

63 Cut the ties and detach the hose and wiring loom from the bulkhead.

64 Undo the three bolts, and detach the air conditioning pipe gasket retaining plate complete with gasket, from the bulkhead.



14.58 Left-hand (A) and right-hand (B) fan motor-to-support frame retaining nuts (arrowed)

65 Undo the six retaining bolts, and remove the cover from the air chamber.

66 Release the evaporator housing cover from its guides and remove it.

67 At the vacuum reservoir, disconnect the multi-plugs for the vacuum motor switch and de-ice switch, and detach the two vacuum hoses. Undo the screw, and remove the vacuum reservoir assembly from the evaporator housing.

68 Undo the two bolts and two nuts, and remove the evaporator housing from the vehicle.

69 Undo the two screws securing the de-ice switch, and withdraw the switch from the housing.

70 Refitting is a reversal of the removal procedure.

Air conditioning control switch

71 The switch is located in the main heating and ventilation control panel. Remove the control panel from the fascia as described in Section 12, then unclip the air conditioning/blower motor switch from the control unit.

72 Disconnect the wiring multi-plug and the light lead from the switch.

73 Refit in the reverse order of removal.

Vacuum motor switch

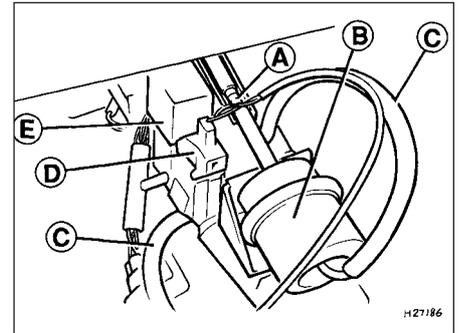
74 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1), followed by the positive lead, then remove the battery from its location.

75 Detach the wiring multi-plug from the vacuum motor switch, then undo the two retaining screws and remove the switch from the vacuum reservoir.

76 Refit in the reverse order of removal, but ensure that the seal is seated correctly.

Vacuum motor

77 Disconnect the battery negative (earth) lead (refer to Chapter 5, Section 1), followed by the positive lead, then remove the battery from its location.



14.84 Vacuum motor assembly

A Vacuum motor linkage clamp screw

B Vacuum motor

C Vacuum hoses

D Vacuum motor switch

E De-ice switch

78 For improved access, refer to Chapter 4 for details, and remove the air cleaner (where applicable).

79 Peel back the seal strip from the top edge of the bulkhead.

80 Cut the ties and detach the hose and wiring loom from the bulkhead.

81 Undo the three bolts, and detach the air conditioning pipe gasket retaining plate complete with gasket, from the bulkhead.

82 Undo the six retaining bolts and remove the cover from the air chamber.

83 Release the evaporator housing cover from its guides and remove it.

84 From the side of the evaporator housing, release the vacuum motor linkage clamp screw, then undo the two nuts and remove the vacuum motor. As it is withdrawn, detach the vacuum hose (see illustration).

85 Refit in the reverse order of the removal. Ensure that the vacuum hose and wiring connections are securely made. Renew the cable ties to relocate the wiring to the bulkhead cover.

Vacuum reservoir

86 Proceed as described in paragraphs 77 to 83 inclusive above, then continue as follows.

87 Detach the two vacuum hoses from the vacuum reservoir. Detach the wiring multi-plug from the vacuum motor switch, then undo the retaining screw and remove the vacuum reservoir from the evaporator housing.

88 Undo the two retaining screws and remove the vacuum motor switch from the reservoir.

89 Refit in the reverse order of the removal. Ensure that the vacuum hose and wiring connections are securely made. Renew the cable ties to relocate the wiring to the bulkhead cover.