

CHAPTER 4

THE COOLING SYSTEM

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4:1 Description

The cooling system is of the pressurised sealed type. Coolant circulation is assisted by a water pump driven by a belt, a thermostat preventing full circulation until normal engine operating temperature is reached, thus ensuring a rapid warm-up and good heater operation.

Air flow through the radiator is assisted by a cooling fan, which is driven through a coupling provided with a clutch unit operated by an integral thermal sensor. When the engine is cool, the coupling clutch is disconnected so that the fan is inoperative, ensuring that the engine reaches normal operating temperature as quickly as possible. When engine coolant reaches a temperature of approximately 55°C (131°F), the clutch is automatically engaged and the fan is driven to provide additional cooling.

An expansion tank containing a quantity of coolant is connected to the radiator by means of a hose. At high operating temperatures, when the coolant in the sealed system expands, excess coolant passes through the hose into the expansion tank. When the system cools, coolant from the expansion tank flows back into the radiator. With this system, no coolant loss should occur during normal operation.

4:2 Routine maintenance

Apart from an occasional check on the condition of the hoses and hose clips and a visual check on coolant level in the expansion tank, very little maintenance should be necessary. There should also be no need for regular topping up of the coolant. If regular topping up is required, the system should be examined for leaks before adding coolant.

Check the level of coolant in the expansion tank when the system is cold and top up as necessary. Note that the coolant level will rise when the engine is hot. If for any reason it is necessary to remove the expansion tank pressure cap when the engine is hot, hold the cap with a large piece of rag. Turn the cap anticlockwise and wait a few moments for the pressure to release before lifting off the cap.

It is recommended that an antifreeze solution is maintained in the system all year round. Topping up should therefore be carried out with the correct mixture of antifreeze and water to avoid weakening the solution in use.

Every two years the cooling system should be drained, flushed to remove sediment then refilled with fresh antifreeze mixture. Check that the clips are tight on all hoses

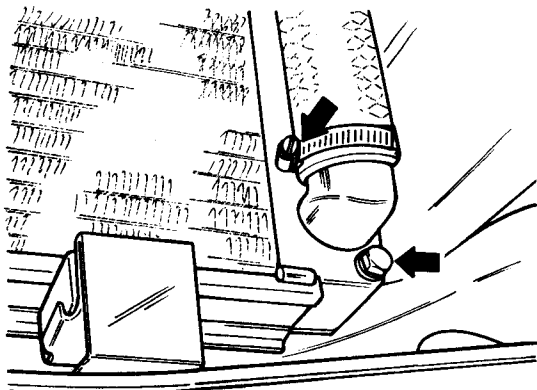


FIG 4:1 Bottom hose clip (above) and radiator drain plug (below)

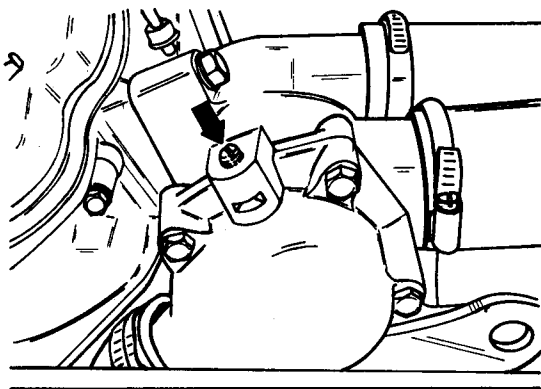


FIG 4:2 Cooling system bleed screw

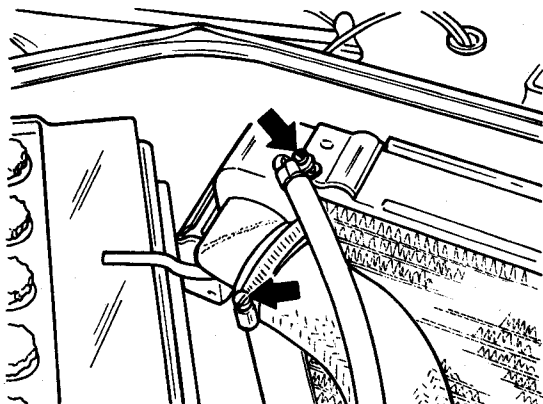


FIG 4:3 Upper hose connections

and that the expansion tank pressure cap is in good condition and sealing effectively. Loss of system pressure due to a leaking filler cap can be a cause of overheating.

Regular checks on drive belt condition and tension should be made as described in **Section 4:4**.

Draining the system:

Set the heater controls to the maximum heat position and remove the cap from the expansion tank. Remove the radiator drain plug shown by the lower arrow in **FIG 4:1** and allow the coolant to drain fully, collecting it in a clean container if it is to be re-used. Remove the expansion tank and rinse out with clean water.

Flushing:

When old coolant has drained, refit and tighten the radiator drain plug and refit the expansion tank. Fill the system with clean water through the expansion tank filler until the level in the tank is correct. Run the engine until the top radiator hose feels warm, which indicates that the thermostat has opened for complete circulation. Now completely drain the system again before the sediment has time to settle.

Filling and bleeding:

Check that the drain plug is properly fitted and that all hose clips are tight. Leave the heater control in the maximum heat position. Prepare the new antifreeze mixture according to the manufacturer's instructions. If the system is still warm, allow it to cool down as adding the cold liquid when the system is warm may crack the engine cylinder block. Fill until the level is correct in the expansion tank, then start the engine and allow it to run at a fast-idle speed. Slacken the bleed screw arrowed in **FIG 4:2** and wait until the coolant leaking past the screw is completely free of air bubbles before retightening. During the operation, add coolant as necessary to maintain the correct level in the expansion tank. On completion, switch off the engine and refit the expansion tank cap. Check the coolant level after running the engine for some time and top up if necessary.

4:3 The radiator

Removal:

Drain the cooling system as described in **Section 4:2**. Slacken the hose clip shown by the upper arrow in **FIG 4:1**, then remove the lower hose from the radiator. Refer to **FIG 4:3** and remove the upper hose and expansion tank hose from the radiator.

If a transmission oil cooler is incorporated in the radiator, detach the supply and return lines at the connections arrowed in **FIG 4:4**, plugging the lines to prevent leakage or the entry of dirt.

Detach the radiator supports on each side then carefully lift out the radiator. Note that when refitting the retainer stays must press on the radiator mounting.

Refitting:

Refitting is a reversal of the removal procedure, after which the system should be refilled with coolant and bled as described in **Section 4:2**. On models fitted with transmission cooler, check and if necessary, top up transmission fluid level as described in **Chapter 7**.

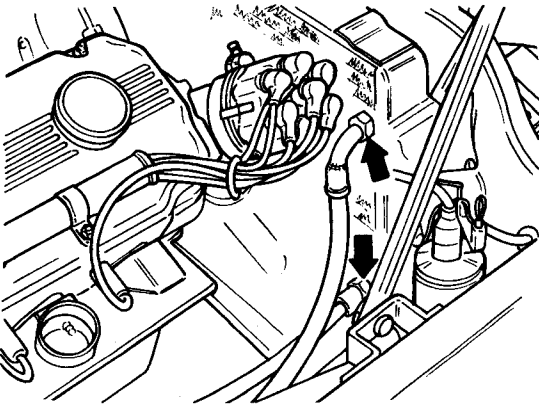


FIG 4:4 Transmission cooler line connections

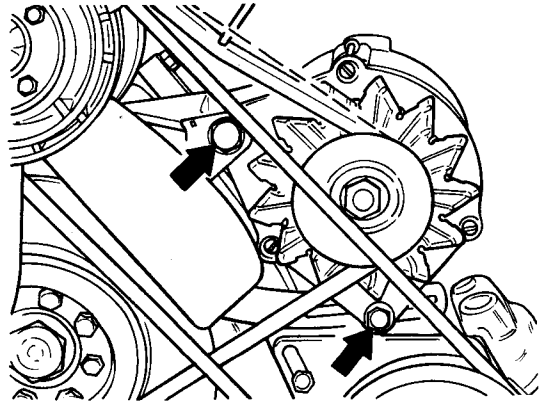


FIG 4:5 Alternator drive belt tensioning

4:4 Drive belt tensioning

The instructions in this section concern the drive belt for the alternator and water pump and fan. Drive belts for power steering pump and air conditioning system compressor, if fitted, should be checked and adjusted as described in **Chapters 10** and **13**. Correct drive belt tension is important, as a tight drive belt will cause undue wear on pulleys and component bearings, a slack belt will cause slip and, possibly, lower output from the driven components.

Alternator drive belt tension is correct when the belt can be deflected a distance of 5 to 10mm (0.2 to 0.4in) under firm hand pressure at the centre of the upper run, as shown in **FIG 4:5**. To adjust the belt tension, slacken the two alternator mounting bolts arrowed in **FIG 4:5** and swing the alternator away from the engine as required, then tighten the mounting bolts and recheck the tension. If a lever is used to move the alternator, it is important that it be used between the engine and alternator bracket only, never against the alternator body.

The belt can be removed by slackening the mountings, moving the alternator as far as possible towards the engine then releasing the belt from the pulleys. Note, however, that drive belts for air conditioning compressor and power steering pump, if fitted, must be removed first as described in **Chapters 10** and **13**.

Pulley modifications:

To improve engine cooling, later models are fitted with pulleys which differ in size from the original items to provide a higher cooling fan speed. It is recommended that earlier models be fitted with these later type pulleys to improve efficiency of the cooling system.

Pulleys can be checked by measuring their diameters as shown in **FIG 4:6**. Later pulley sizes are 162mm (6.378in) for vibration damper pulley **A** and 102mm (4.016in) for water pump and cooling fan pulley **B**. These replace pulley sizes 138mm (5.433in) and 134mm (5.276in) respectively. The correct lengths for drive belts to be used with the new pulleys are 12.5 × 1050 (**A**) and 9.5 × 1075 (**B**). Lengths for belts used with earlier pulleys are 12.5 × 1025 (**A**) and 9.5 × 1125 (**B**).

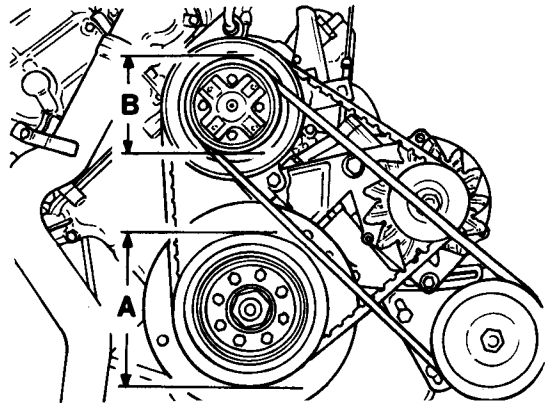


FIG 4:6 Checking pulley diameters

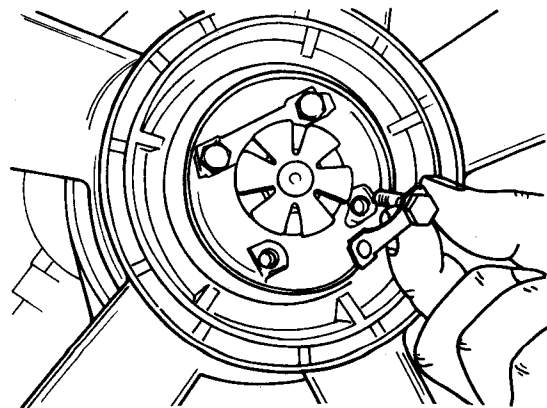


FIG 4:7 Cooling fan removal

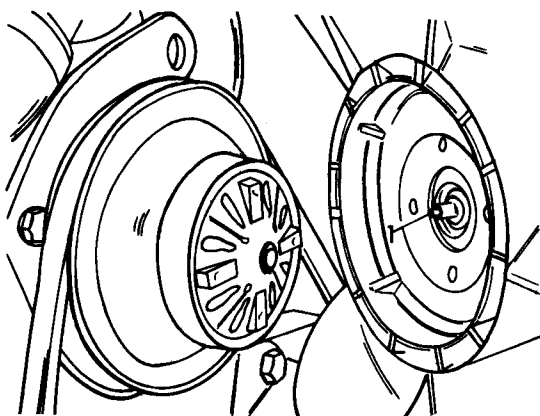


FIG 4:8 Cooling fan installation

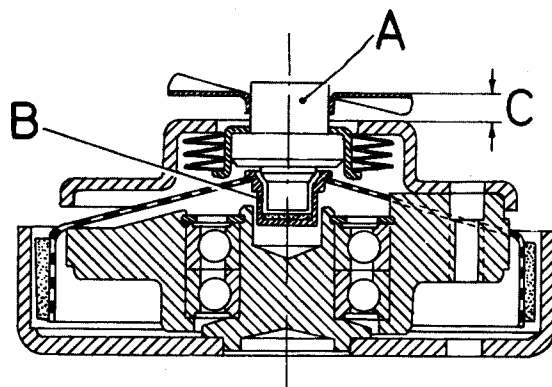


FIG 4:10 Section through fan coupling

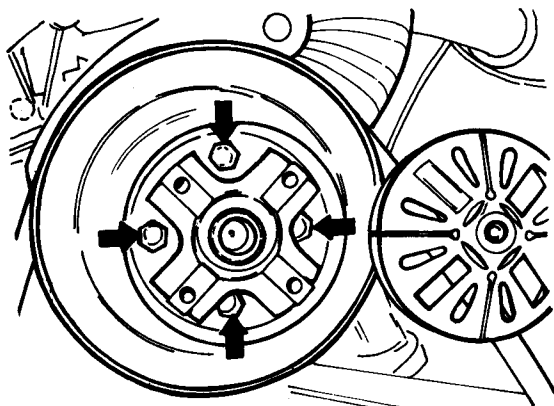


FIG 4:9 Fan coupling removal

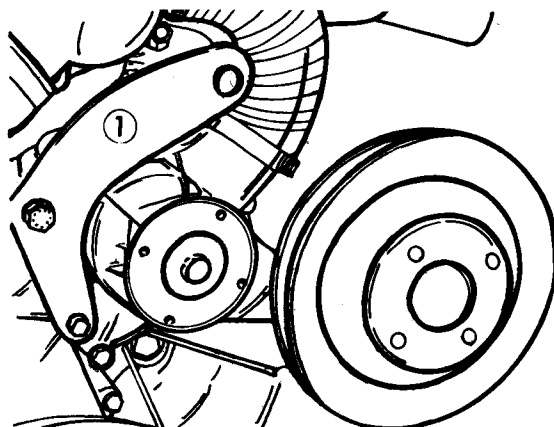


FIG 4:11 Water pump pulley and bracket

Always make sure that the correct drive belt is fitted when replacement is necessary, preferably by comparing with the original belt.

4:5 Cooling fan and coupling

Cooling fan:

To remove the fan, straighten the lockplates and remove the four fixing bolts, then detach the lockplates and pull the fan from the coupling (see FIG 4:7).

Refitting is a reversal of the removal procedure, making sure that piston 1 is in the correct position in the heat-sensing element (see FIG 4:8). Use new lockplates if the originals are not in good condition. Always use fixing bolts of the correct type, which is M6 × 25mm, otherwise it is possible for the fan to be permanently locked to the coupling. Tighten the bolts alternately and evenly then lock by bending up the lockplates.

Fan coupling:

To remove the coupling, first remove the cooling fan as described previously. Take off the drive plate then remove the clutch drum (see FIG 4:9).

If a coupling is faulty in any way it must be renewed complete, as slave element A is adjusted exactly to fit

drive plate B (see FIG 4:10). Note that gap C must be 5mm (0.197in). A faulty or inoperative coupling can be responsible for engine overheating, by failing to engage the cooling fan at the specified coolant temperature. If, for any reason, a replacement coupling assembly is not available, the fan should be temporarily locked to the coupling to prevent engine overheating. To do this, remove two of the fan securing bolts (see FIG 4:7) and replace them with two M6 × 30mm bolts. These bolts should be positioned opposite each other to maintain cooling fan balance. The fan will then be locked to the coupling and will operate at all times. This will prevent engine overheating, but may not allow the engine to reach normal operating temperature, especially during short journeys. This can be a cause of increased engine wear and high fuel consumption, so a new coupling should be installed with four bolts of the correct length as soon as possible.

4:6 The water pump

Removal:

Drain the cooling system as described in Section 4:2, then remove cooling fan coupling as described in Section 4:5. Remove the alternator drive belt as

described in **Section 4:4**. Remove the pulley from the water pump, then detach bracket 1 (see **FIG 4:11**). Disconnect the water hose from the pump, then remove the five fixing bolts and detach the pump and gasket (see **FIG 4:12**). As special press tool equipment is needed to dismantle and reassemble the water pump, the work should be carried out by a service station.

Refitting:

Clean the contact faces of the water pump and cylinder block to remove all traces of old gasket, taking care not to damage the surfaces. Refit the water pump, using a new gasket, then tighten the fixing bolts alternately and evenly. Refit the remaining components in the reverse order of removal and refill and bleed the cooling system as described in **Section 4:2**.

4:7 The thermostat

Removal:

Drain the cooling system as described in **Section 4:2**. Remove the four fixing bolts and detach the thermostat cover, there being no need to detach the hose (see **FIG 4:13**). Remove the thermostat from the housing.

Testing:

Clean the thermostat and immerse it in a container of cold water together with a 0–100°C thermometer. Heat the water and check thermostat operation. The thermostat should begin to open at 84°C (183°F) for manual transmission models, 80°C (176°F) for automatic transmission models. If the thermostat is removed from the hot water and placed into cold water it should quickly return to the closed position. If the thermostat operates satisfactorily it may be refitted, if not it must be renewed.

Refitting:

Install the thermostat in the housing, making sure that the clamp and the arrow are facing in the direction of travel (see **FIG 4:13**). Clean the housing and cover mating faces, then refit the cover using a new gasket, if fitted. Tighten the fixing bolts alternately and evenly. Fill and bleed the system as described in **Section 4:2**.

4:8 Frost precautions

With the correct coolant solution in use as described in **Section 4:2**, no additional frost precautions should be necessary. However, it is advisable to have the solution tested at intervals during the winter to make certain that it has not weakened. A hydrometer calibrated to read both specific gravity and temperature for the type of coolant in the system must be used, most garages having such equipment. Always ensure that the anti-freeze mixture used for filling the system is of sufficient strength to provide protection against freezing, according to the manufacturer's instructions.

4:9 Fault diagnosis

(a) Internal water leakage

- 1 Cracked cylinder wall
- 2 Loose cylinder head bolts
- 3 Cracked cylinder head
- 4 Faulty head gasket

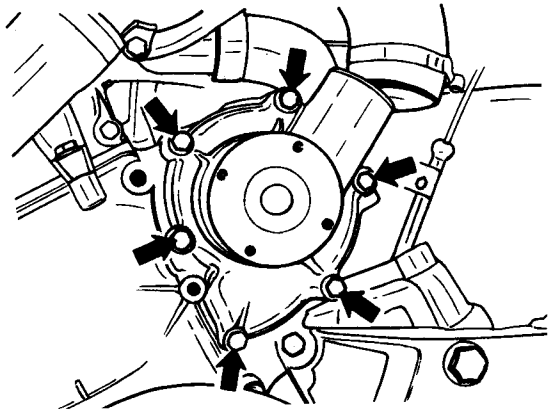


FIG 4:12 Water pump removal

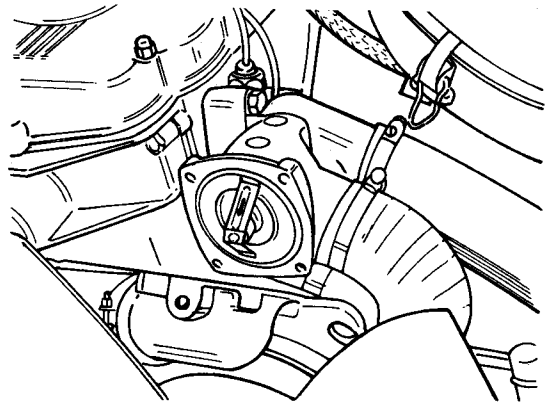


FIG 4:13 Thermostat removal

(b) Poor circulation

- 1 Radiator core blocked
- 2 Engine water passages restricted
- 3 Low water level
- 4 Loose drive belt
- 5 Defective thermostat
- 6 Perished or collapsed radiator hoses

(c) Corrosion

- 1 Impurities in the coolant
- 2 Infrequent draining and flushing

(d) Overheating

- 1 Check (b)
- 2 Faulty fan coupling
- 3 Sludge in crankcase
- 4 Faulty ignition timing
- 5 Low oil level in sump
- 6 Tight engine
- 7 Choked exhaust system
- 8 Binding brakes
- 9 Slipping clutch
- 10 Incorrect valve timing
- 11 Weak fuel mixture

NOTES