






# Chapter 3

## Cooling system

### Contents

Coolant hoses - removal and installation . . . . .	9	Cooling system draining, flushing and refilling . . . . .	see Chapter 1
Coolant level check . . . . .	see Daily (pre-ride) checks	General information . . . . .	1
Coolant reservoir - removal and installation . . . . .	3	Radiator - removal and installation . . . . .	7
Coolant temperature gauge and sender - check and replacement . . . . .	5	Radiator pressure cap - check . . . . .	2
Cooling fan and thermostatic switch - check and replacement . . . . .	4	Thermostat - removal, check and installation . . . . .	6
Cooling system checks . . . . .	see Chapter 1	Water pump - check, removal and installation . . . . .	8

### 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 
--	---	---	--	---

### Specifications

#### Coolant

Mixture type and capacity . . . . . see Chapter 1

#### Radiator

Cap valve opening pressure . . . . . 13 to 18 psi (0.9 to 1.3 Bar)

#### Thermostat

Opening temperature . . . . . 80 to 84°C  
Valve lift . . . . . 8 mm (min) @ 95°C (for five minutes)

#### Fan switch

Cooling fan cut-in temperature . . . . . 93 to 97°C

#### Temperature gauge sender

Resistance . . . . .  
@ 50°C . . . . . 130 to 180 ohms  
@ 100°C . . . . . 25 to 30 ohms

#### Torque setting

Fan switch . . . . . 18 Nm

#### 1 General information

The cooling system uses a water/antifreeze coolant to carry away excess energy in the form of heat. The cylinders are surrounded by a water jacket from which the heated coolant is circulated by thermo-syphonic action in conjunction with a water pump, driven off the oil pump. The hot coolant passes upwards to the thermostat and through to the radiator. The coolant then flows across the radiator core, where it is cooled by the passing air, down to the water pump and back up to the engine where the cycle is repeated.

A thermostat is fitted in the system to prevent the coolant flowing through the radiator when the engine is cold, therefore

accelerating the speed at which the engine reaches normal operating temperature. A thermostatically-controlled cooling fan is also fitted to aid cooling in extreme conditions.

The complete cooling system is partially sealed and pressurised, the pressure being controlled by a valve contained in the spring-loaded radiator cap. By pressurising the coolant the boiling point is raised, preventing premature boiling in adverse conditions. The overflow pipe from the system is connected to a reservoir tank into which excess coolant is expelled under pressure. The discharged coolant automatically returns to the radiator when the engine cools.



**Warning: Do not remove the pressure cap from the radiator when the engine is hot. Scalding hot coolant and steam may be blown out under pressure, which could cause serious injury. When the engine has**

**cooled, place a thick rag, like a towel over the pressure cap; slowly rotate the cap anti-clockwise to the first stop. This procedure allows any residual pressure to escape. When the steam has stopped escaping, press down on the cap while turning it anti-clockwise and remove it.**



**Warning: Do not allow antifreeze to come in contact with your skin or painted surfaces of the motorcycle. Rinse off any 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 the local authorities about disposing of used antifreeze. Many communities will have collection centres which will see that antifreeze is disposed of safely.**

## 3•2 Cooling system

**Caution:** At all times use the specified type of antifreeze, and always mix it with distilled water in the correct proportion. The antifreeze contains corrosion inhibitors which are essential to avoid damage to the cooling system. A lack of these inhibitors could lead to a build-up of corrosion which would block the coolant passages, resulting in overheating and severe engine damage. Distilled water must be used as opposed to tap water to avoid a build-up of scale which would also block the passages.

### 2 Radiator pressure cap - check

1 If problems such as overheating or loss of coolant occur, check the entire system as described in Chapter 1. The radiator cap opening pressure should be checked by a Honda dealer with the special tester required to do the job. If the cap is defective, replace it with a new one.

### 3 Coolant reservoir - removal and installation

#### Removal

- 1 Remove the rear shock absorber (see Chapter 6).
- 2 Place a suitable container underneath the reservoir, then release the clamp securing the inlet/outlet hose (**see illustration**). Detach the hose and allow the coolant to drain into the container.
- 3 Release the clamp securing the overflow hose to the reservoir and detach the hose (**see illustration**).
- 4 Unscrew the two reservoir mounting bolts and remove the reservoir from the bike (**see illustrations**).

#### Installation

5 Installation is the reverse of removal. Make sure the hoses are correctly installed and secured with their clamps. On completion refill the reservoir as described in Chapter 1.

### 4 Cooling fan and cooling fan switch - check and replacement

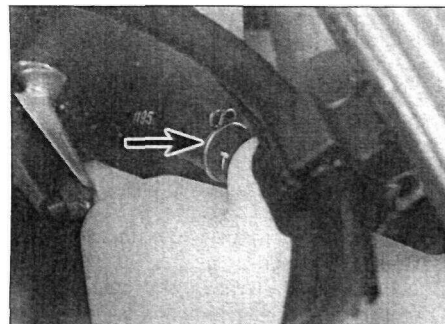
#### Cooling fan

##### Check

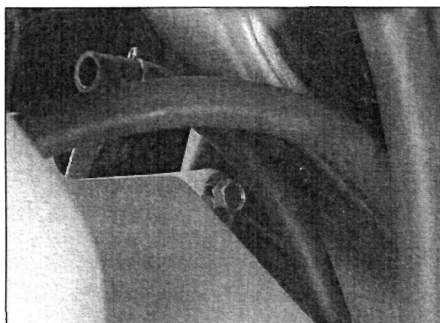
- 1 If the engine is overheating and the cooling fan isn't coming on, first check the cooling fan circuit fuse (see Chapter 9) and then the fan switch as described in Steps 8 to 12 below.
- 2 If the fan does not come on (and the fan switch is good), the fault lies in either the



3.2 The reservoir inlet/outlet hose is secured by a screw type clamp



3.3 The overflow hose is secured by a spring type clamp (arrow)



3.4a The reservoir is secured . . .



3.4b . . . by two mounting bolts

cooling fan motor or the relevant wiring. Test all the wiring and connections (see Chapter 9).

3 To test the cooling fan motor, separate the two-pin fan wiring connector behind the radiator (**see illustration**). Using a 12 volt battery and two jumper wires, connect the blue/black fan wire to the battery positive (+ve) lead and the black/blue fan wire to the battery negative (-ve) lead. Once connected the fan should operate. If it does not, and the wiring checks out OK, then the fan motor is faulty and must be replaced with a new unit.

#### Replacement



**Warning:** The engine must be completely cool before carrying out this procedure.

- 4 Remove the radiator (see Section 7).
- 5 Unscrew the three bolts securing the fan shroud and fan assembly to the radiator, noting that the lower bolt also secures the

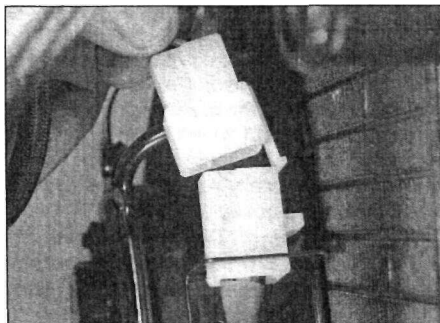
earth cable (**see illustration**). Unscrew the three nuts on the front of the fan which secure the fan assembly to the shroud and remove the shroud. The fan blade can be released from the fan motor by removing its central retaining nut.

- 6 Installation is the reverse of removal. Tighten all mounting bolts and nuts securely.
- 7 Install the radiator (see Section 7).

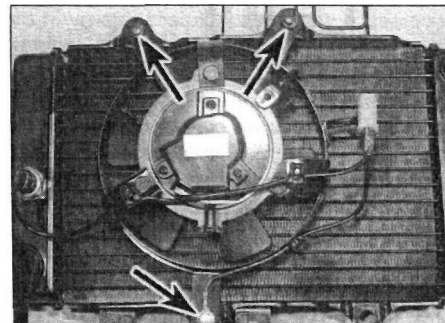
#### Cooling fan switch

##### Check

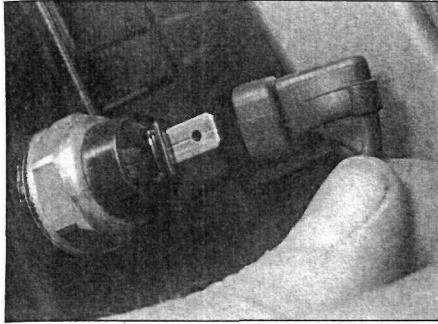
- 8 If the engine is overheating and the cooling fan isn't coming on, first check the cooling fan circuit fuse (see Chapter 9). If the fuse is blown, check the fan circuit for a short to earth (see *Fault Finding Equipment* and the wiring diagram at the end of this book).
- 9 If the fuse is good, remove the screws securing the radiator left-hand end cover and



4.3 Disconnect the fan wiring connector



4.5 Fan assembly mounting bolts (arrows). Note earth cable attached to the lower bolt



**4.9 Disconnect the fan switch wiring connector**

remove it from the radiator (**see illustration 7.3a**). Disconnect the black/blue wire from the fan switch fitted to the left-hand side of the radiator (**see illustration**). Using a jumper wire if necessary, connect the wire to earth and switch the ignition ON. The fan should come on. If it does, the fan switch is defective and must be replaced. Switch the ignition OFF. If it does not come on, the fan should be tested as described in Step 3 above.

10 If the fan works but is suspected of cutting in at the wrong temperature, a more comprehensive test of the switch can be made as follows.

11 Remove the switch from the radiator as described in Steps 13 and 14 below. Fill a small heatproof container with coolant and place it on a stove. Connect the positive (+ve) probe of an ohmmeter to the terminal of the switch and the meter negative (-ve) probe to the switch body, and using some wire or other support suspend the switch in the coolant so that just the sensing portion and the threads are submerged. Also place a thermometer capable of reading temperatures up to 110°C in the coolant so that its bulb is close to the switch. The testing set-up is similar to that used for the temperature gauge sender unit (**see illustration 5.7**). **Note:** *None of the components should be allowed to directly touch the container.*

**Warning:** *This must be done very carefully to avoid the risk of personal injury.*

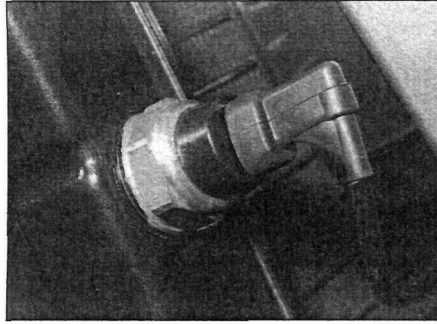
12 Initially the ohmmeter reading should be very high, indicating that the switch is open (OFF). Heat the coolant, stirring it gently. When the temperature reaches around 93 to 97°C the meter reading should drop to around zero ohms, indicating that the switch has closed (ON). Now turn the heat off. As the temperature falls below 93 to 97°C the meter reading should show infinite (very high) resistance, indicating that the switch has opened (OFF). If the meter readings obtained are different, or they are obtained at different temperatures, then the switch is faulty and must be replaced.

#### Replacement



**Warning:** *The engine must be completely cool before carrying out this procedure.*

13 Drain the cooling system (see Chapter 1).



**4.14 The fan switch is located in the left-hand side of the radiator**

14 Remove the screws securing the radiator left-hand end cover and remove it from the radiator (**see illustration 7.3a**). The fan switch is located in the left-hand side of the radiator (**see illustration**). Disconnect the wiring, then unscrew the switch and withdraw it from the radiator. Discard the O-ring as a new one must be used.

15 Fit a new O-ring and apply a suitable sealant to the switch threads, then install the switch in the radiator and tighten it to the torque setting specified at the beginning of the Chapter.

16 Reconnect the switch wiring and slip the dust cover into place. Install the radiator side cover.

17 Refill the cooling system (see Chapter 1).

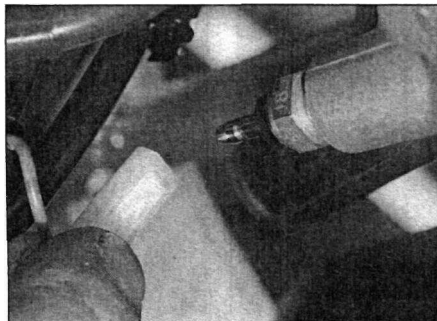
#### 5 Coolant temperature gauge and sender - check and replacement

##### Coolant temperature gauge

##### Check

1 The circuit consists of the sender mounted in the bottom of the thermostat housing and the gauge assembly mounted in the instrument panel. If the system malfunctions check first that the battery is fully charged and that the fuses are all good.

2 If the gauge is not working, remove the fuel tank (see Chapter 4) to access the sender unit. Disconnect the wire from the sender and turn the ignition switch ON (**see illustration**). The temperature gauge needle should be on



**5.2 Disconnect the temperature gauge sender wiring from the thermostat housing**

the "C" on the gauge. Now earth the sender wire on the engine. The needle should swing immediately over to the "H" on the gauge. If the needle moves as described above, the sender is proven defective and must be replaced.

**Caution:** *Do not earth the wire for any longer than is necessary to take the reading, or the gauge may be damaged.*

3 If the needle movement is still faulty, or if it does not move at all, the fault lies in the wiring or the gauge itself. Check all the relevant wiring and wiring connectors. If all appears to be well, the gauge is defective and must be replaced.

#### Replacement

4 See Chapter 9.

##### Temperature gauge sender

##### Check

5 Remove the fuel tank (see Chapter 4). The sender is fitted to the bottom of the thermostat housing (**see illustration 5.10**).

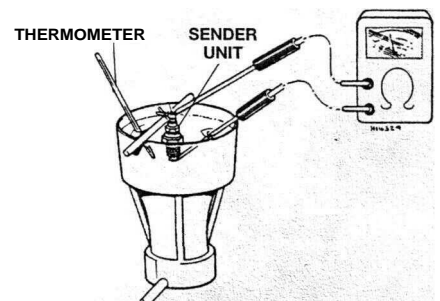
6 Disconnect the sender wiring. Using a continuity tester, check for continuity between the sender body and earth. There should be continuity (zero ohms). If there is no continuity (infinite resistance), check that the thermostat housing mounting is secure.

7 Remove the sender (see Steps 9 to 11 below). Fill a small heatproof container with coolant and place it on a stove. Using an ohmmeter, connect the positive (+ve) probe of the meter to the terminal on the sender, and the meter negative (-ve) probe to the body of the sender. Using some wire or other support suspend the sender in the coolant so that just the sensing portion and the threads are submerged. Also place a thermometer capable of reading temperatures up to 110°C in the water so that its bulb is close to the sender (**see illustration**). **Note:** *Atone of the components should be allowed to directly touch the container.*



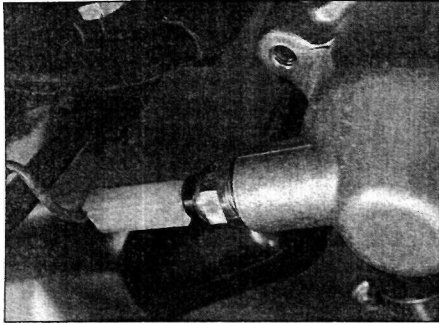
**Warning:** *This must be done very carefully to avoid the risk of personal injury.*

8 Heat the coolant, stirring it gently. When the temperature reaches around 50°C the meter should read between 130 and 180 ohms. When the temperature reaches around 100°C the



**5.7 Temperature gauge sender testing set-up**

### 3•4 Cooling system



5.10 Temperature gauge sender location

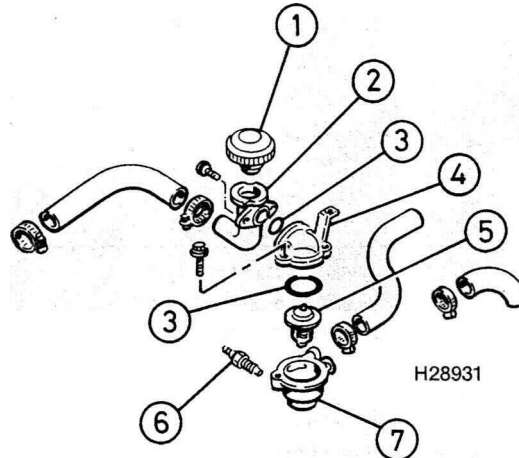
meter should read between 25 and 30 ohms. If the meter readings obtained are different, or they are obtained at different temperatures, then the sender is faulty and must be replaced.

#### Replacement



**Warning:** The engine must be completely cool before carrying out this procedure.

- 9 Drain the cooling system (see Chapter 1).
- 10 If not already done, remove the fuel tank (see Chapter 4) to gain access to the sender which is fitted to the bottom of the thermostat housing (**see illustration**). Disconnect the sender wiring.
- 11 Unscrew the sender and remove it from the thermostat housing.
- 12 Apply a smear of sealant to the threads of the new sender unit, then install it into the thermostat housing and tighten it securely. Connect the sender wiring.
- 13 Refill the cooling system (see Chapter 1), then install the fuel tank (see Chapter 4).



#### 6.3a Thermostat components

- 1 Pressure cap
- 2 Filler neck
- 3 O-ring
- 4 Thermostat cover
- 5 Thermostat
- 6 Temperature gauge sender
- 7 Thermostat housing

#### 6 Thermostat - removal, check and installation

##### Removal

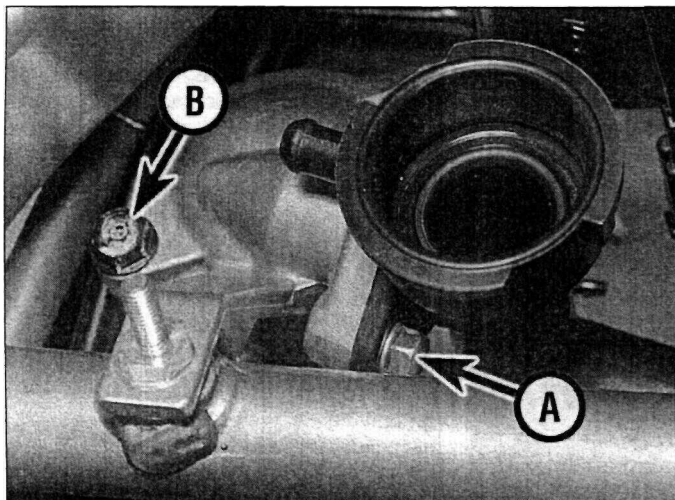
**Warning:** The engine must be completely cool before carrying out this procedure.

- 1 The thermostat is automatic in operation and should give many years service without requiring attention. In the event of a failure, the valve will probably jam open, in which case the engine will take much longer than normal to warm up. Conversely, if the valve jams shut, the coolant will be unable to circulate and the engine will overheat. Neither condition is acceptable, and the fault must be investigated promptly.
- 2 Remove the fuel tank and the air filter housing (see Chapter 4) and drain the cooling system (see Chapter 1).
- 3 The thermostat is located in the thermostat housing adjacent to the filler neck pressure cap (**see illustration**). Unscrew the two bolts

securing the thermostat cover to the filler neck, and the two bolts securing the thermostat cover to the thermostat housing (**see illustration**). Remove the cover, then withdraw the thermostat, noting how it fits. Discard the O-rings as new ones must be fitted.

##### Check

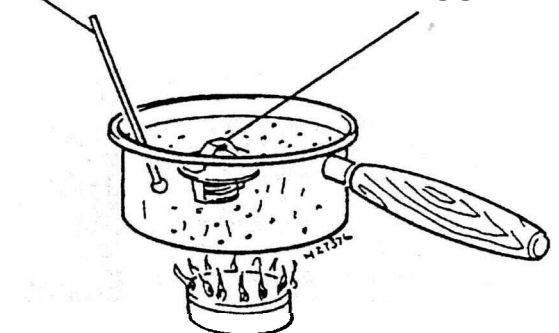
- 4 Examine the thermostat before carrying out the test. If it remains in the open position at room temperature, it should be replaced.
- 5 Suspend the thermostat by a piece of wire in a container of cold water. Place a thermometer in the water so that the bulb is close to the thermostat (**see illustration**). Heat the water, noting the temperature when the thermostat opens, and compare the result with the specifications given at the beginning of the Chapter. Also check the amount the valve opens after it has been heated at 95°C for five minutes and compare the measurement to the specifications. If the readings obtained differ from those given, the thermostat is faulty and must be replaced.



6.3b Thermostat cover-to-filler neck bolts (A) and cover-to-housing bolts (B)

#### THERMOMETER

#### THERMOSTAT



6.5 Thermostat opening check

6 In the event of thermostat failure, as an emergency measure only, it can be removed and the machine used without it. **Note:** *Take care when starting the engine from cold as it will take much longer than usual to warm up.* Ensure that a new unit is installed as soon as possible.

### Installation

7 Fit the thermostat into the housing, making sure that it slots into the grooves in the housing.

8 Fit new O-rings to the thermostat housing and the filler neck, then install the thermostat cover. Install the four cover bolts and tighten them securely.

9 Refill the cooling system (see Chapter 1).

10 Install the air filter housing and the fuel tank (see Chapter 4).

## 7 Radiator - removal and installation

### Removal

**Warning:** *The engine must be completely cool before carrying out this procedure.*

1 Drain the cooling system (see Chapter 1).

2 Trace the cooling fan wiring back from the fan and disconnect it at its connector (**see illustration 4.3**).

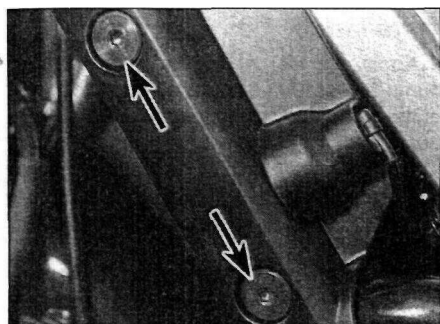
3 Remove the screws securing each radiator end cover and remove them from the radiator (**see illustration**). The ends of the stone guard slot into the end covers (**see illustration**). Remove the guard with the covers.

4 Slacken the clamps securing the top and bottom radiator hoses and detach them from the radiator (**see illustrations**).

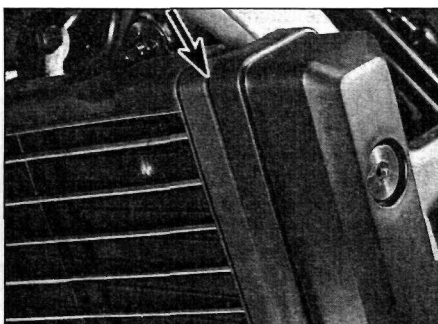
5 Unscrew the two bolts securing the bottom of the radiator to the mounting bracket (**see illustration**). Note the arrangement of the collar and rubber grommet.

6 If fitted, remove the split pin from the radiator top mounting bolt and discard it as a new one must be used. Make sure the radiator is supported, then remove the top mounting nut, bolt and collar and carefully remove the radiator assembly (**see illustration**). Note how the wiring harness fits in the guide on the top of the radiator (**see illustration**).

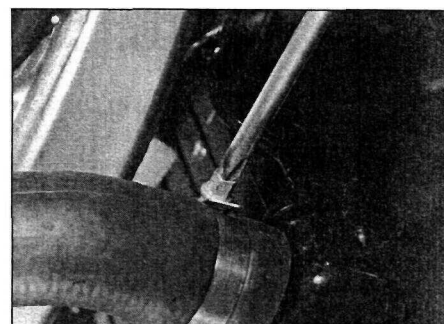
7 If necessary, remove the cooling fan (see Section 4) from the radiator.



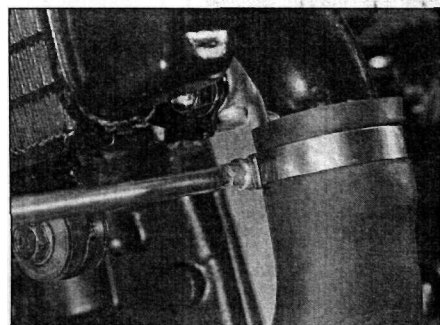
7.3a Each radiator end cover is secured by two screws (arrows)



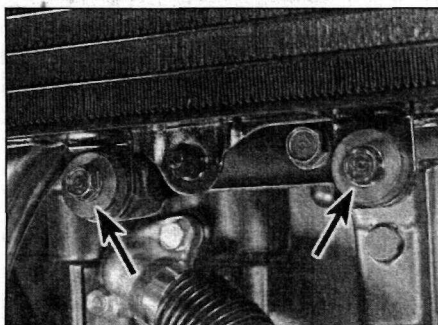
7.3b The ends of the stone guard (arrow) slot into the end covers



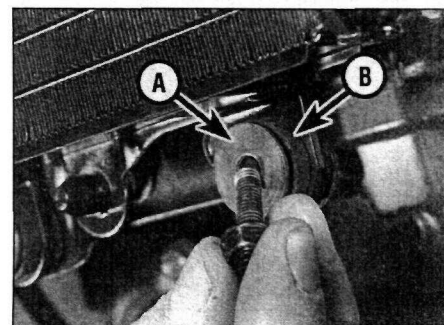
7.4a Slacken the top .



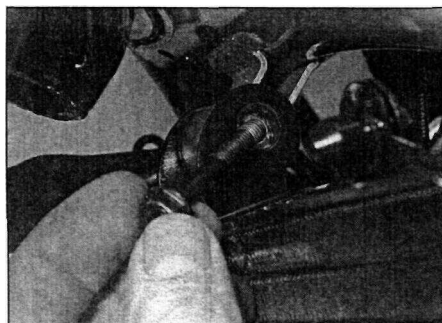
7.4b . . . and bottom radiator hose clamps



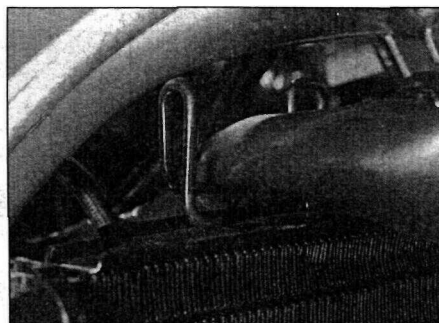
7.5a Radiator bottom mounting bolts (arrows)



7.5b Note the arrangement of the collar (A) and rubber grommet (B)



7.6a Radiator top mounting bolt



7.6b Note the wiring harness guide on the top of the radiator



## 3•6 Cooling system

8 Check the stone guard and the radiator for signs of damage and clear any dirt or debris that might obstruct air flow and inhibit cooling. If the radiator fins are badly damaged or broken the radiator must be replaced. Also check the rubber mounting grommets, and replace them if necessary.

### Installation

9 Installation is the reverse of removal, noting the following.

- Install the radiator top mounting bolt first, but do not fully tighten it. Install the bottom mounting bolts then tighten all the bolts.*
- Make sure that the fan wiring is correctly connected, and the wiring harness is located in its guide on the top of the radiator.*
- Ensure the coolant hoses are securely retained by their clamps, and use new ones if necessary.*
- On completion refill the cooling system as described in Chapter 1.*

### 8 Water pump - check, removal and installation

### Check

1 The water pump is located on the lower left-hand side of the engine. To access the pump, unscrew the gearchange linkage arm

pinch bolt and remove the linkage arm from the shaft. Unscrew the bolts securing the left-hand side crankcase rear cover and remove the cover (**see illustration 5.17a in Chapter 2**). Visually check the area around the pump for signs of leakage.

2 To prevent leakage of water from the cooling system to the lubrication system and vice versa, two seals are fitted on the pump shaft. On the underside of the pump body there is also a drainage hole (**see illustration**). If either seal fails, this hole should allow the coolant or oil to escape and prevent the oil and coolant mixing.

3 The seal on the water pump side is of the mechanical type which bears on the rear face of the impeller. The second seal, which is mounted behind the mechanical seal is of the normal feathered lip type. However, neither seal is available as a separate item as the pump is sold as an assembly. Therefore, if on inspection the drainage hole shows signs of leakage, the pump must be removed and replaced.

### Removal

4 Drain the coolant and the engine oil (see Chapter 1). Remove the crankcase rear cover as described in Step 1.

5 Unscrew the bolt securing the coolant pipe to the front of the left-hand side crankcase (**see illustration**).

6 Unscrew the bolts securing the pump cover to the pump and the pump to the crankcase and remove the cover (on J, K and M models

the drain/cover bolt will already have been removed) (**see illustration**). Discard the cover O-ring as a new one must be used. Remove the two dowels from the pump or the cover if they are loose, noting their locations. If required, unscrew the bolt securing the water pipe to the cover and remove the pipe (**see illustration**). Discard the pipe O-ring if the pipe is removed as a new one must be used.

7 Release the clamp securing the coolant hose to the water pump and detach the hose. Carefully remove the pump from the crankcase, noting how it fits. Remove the O-ring from the rear of the pump body and discard it as a new one must be used.

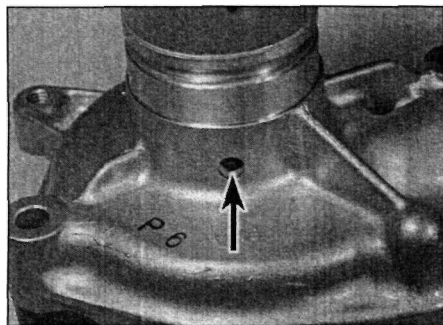
8 Wiggle the water pump impeller back-and-forth and in-and-out. If there is excessive movement the pump must be replaced. Also check for corrosion or a build-up of scale in the pump body and clean or replace the pump as necessary.

### Installation

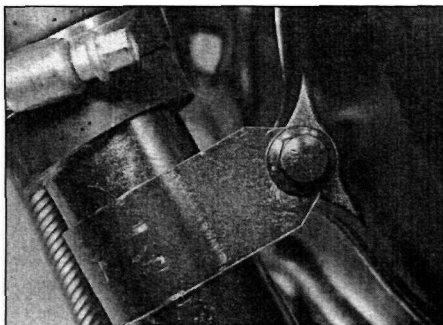
9 Apply a smear of engine oil to the new pump body O-ring and install it onto the rear of the pump body (**see illustration**). Install the pump into the crankcase, aligning the slot in the impeller shaft with the tab on the oil pump shaft (**see illustration**).

10 Attach the coolant hose to the pump and secure it with its clamp.

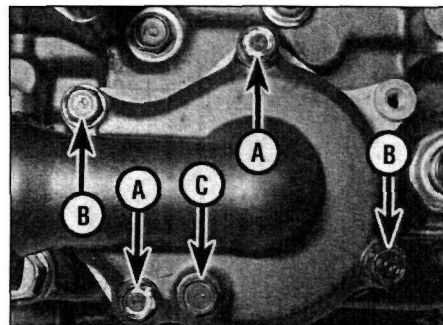
11 Apply a smear of engine oil to the new cover O-ring and install it into its groove in the pump. Install the two pump dowels into their holes in the pump.



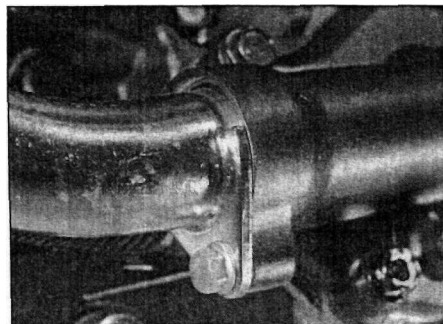
8.2 Check the pump drainage hole (arrow) for signs of leakage



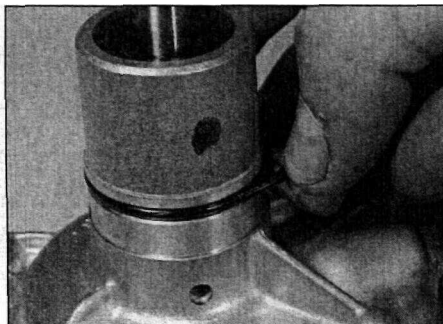
8.5 Unscrew the coolant pipe bracket bolt



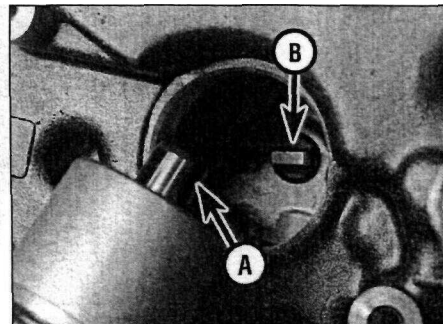
8.6a Pump cover bolts (A), pump mounting bolts (B), drain bolt (C) (P, S & T models). On J, K & M models, the drain bolt is the lower cover bolt (A)



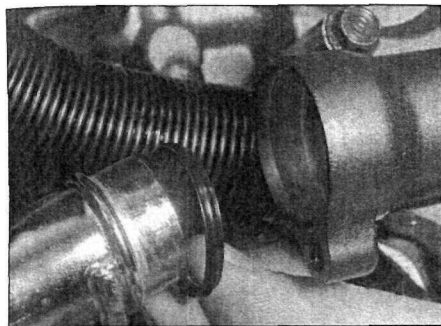
8.6b Water pipe-to-cover securing bolt



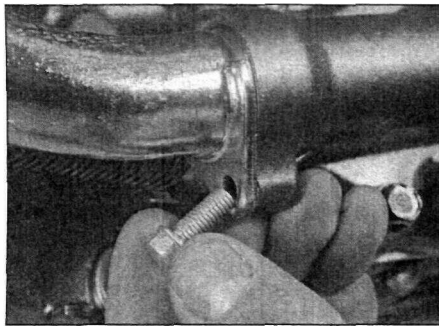
8.9a Fit a new O-ring to the pump



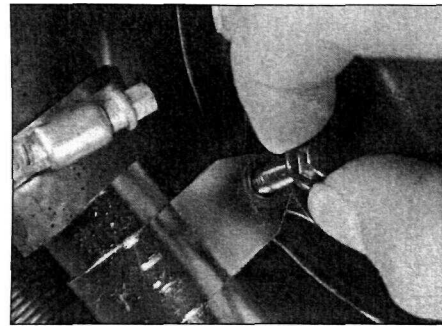
8.9b Align the slot (A) with the tab (B)



8.12a Fit a new O-ring to the pipe . . .



8.12b . . . and install it into the pump



8.14 Secure the pipe to the crankcase

12 If the coolant pipe was detached from the pump cover, apply a smear of coolant to the new pipe O-ring, then install the pipe into the cover and tighten its bolt securely (see illustrations).

13 Install the cover onto the pump, then install the four bolts and tighten them securely, using a new sealing washer on the coolant drain bolt.

14 Install the bolt securing the coolant pipe to the crankcase (see illustration).

15 Refill the cooling system (see Chapter 1).

16 Refill the engine with oil (see Chapter 1).

17 Install the crankcase rear cover and gearchange linkage arm - align the punch marks on the arm and shaft (see illustration 5.28c in Chapter 2).

### Coolant hoses - removal and installation

#### Removal

1 Before removing a hose, drain the coolant as described in Chapter 1.

2 Use a screwdriver to slacken the hose clamps, then slide them back along the hose and clear of the union spigot. The smaller-bore hoses are secured by spring clamps which can be expanded by squeezing their ears together with pliers.

3 If a hose proves stubborn, release it by rotating it on its union before working it off. If all else fails, cut the hose with a sharp knife then slit it at each union so that it can be peeled off in two pieces. Whilst this is expensive it is preferable to buying a new radiator.

**Caution: The radiator unions are fragile. Do not use excessive force when attempting to remove the hoses**

4 The water pipe inlet union to the front cylinder block can be removed by unscrewing

the two retaining bolts. If it is removed, the O-ring must be replaced. The outlet pipe from each cylinder head can be removed by unscrewing the bolt which retains it. If they are removed, their O-rings must be replaced.

5 Refer to Chapter 2, Section 14 for the coolant joint collar between the two cylinder blocks.

#### Installation

6 Slide the clips onto the hose and then work it on to its respective union.

***If the hose is difficult to push on its union, it can be softened by soaking it in very hot water, or alternatively a little soapy water can be used as a lubricant.***

7 Rotate the hose on its unions to settle it in position before sliding the clamps into place and tightening them securely.

8 If either the inlet union to the front cylinder block or the outlet pipes from the cylinder heads have been removed, fit a new O-ring, then install the union or pipes and tighten the mounting bolts securely.