

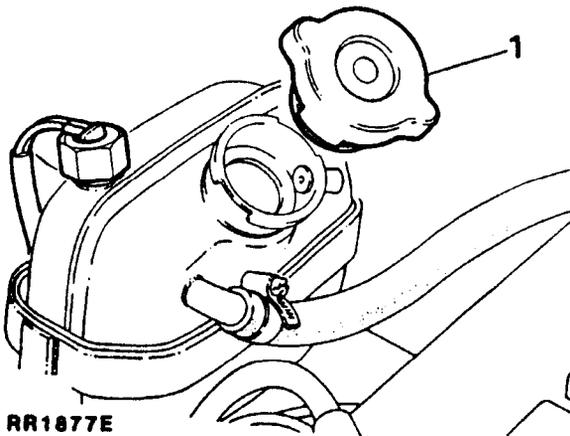
COOLANT

Drain and refill

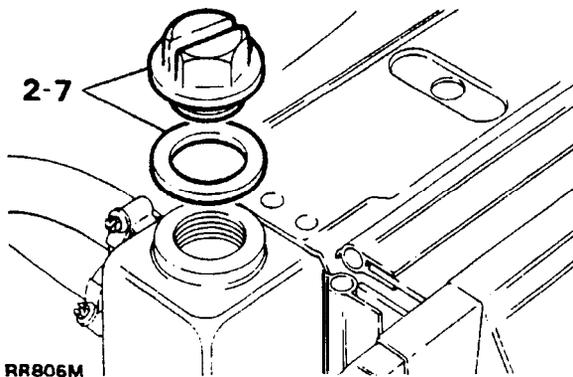
Draining

WARNING: Do not remove the expansion tank filler cap when the engine is hot because the cooling system is Pressurized and personal scalding could result.

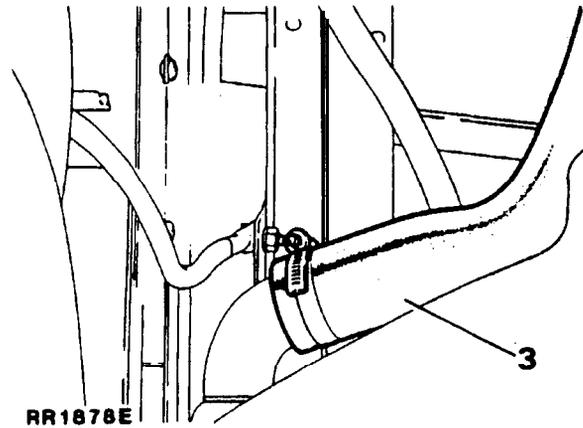
1. Remove the expansion tank filler cap by first turning it counter-clockwise a quarter of a turn to allow pressure to escape, then turn it further in the same direction and lift off.



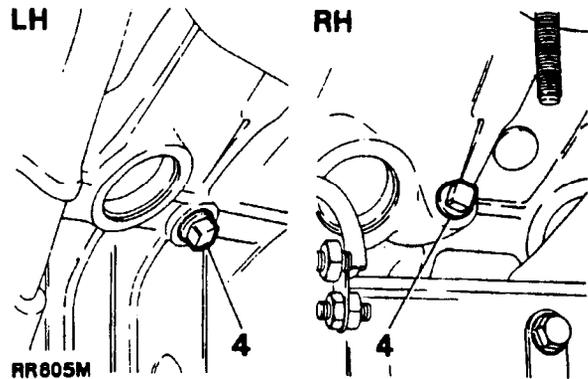
2. Remove the radiator filler plug and washer to assist drainage.



3. Disconnect the radiator bottom hose and allow the coolant to drain into a suitable container. Use a clean container if the coolant solution is to be reused. Reconnect the bottom hose after draining and tighten the hose clamp.



4. Remove the engine drain plugs, one each side of the cylinder block, beneath the exhaust manifolds. Allow the coolant to drain and refit the plugs.



See the following coolant requirements before refilling the system.

Continued

Coolant requirements

Frost precautions and engine protection.

The engine cooling system **MUST ALWAYS** be filled and topped-up with a solution of water and anti-freeze, winter and summer. **NEVER** use water alone as this may corrode the aluminium alloy.

CAUTION: Do not use salt water otherwise corrosion will occur. In certain territories where the only available natural water supply has some salt content use only rain or distilled water.

Recommended solutions

Anti-freeze: Universal anti-freeze or permanent type ethylene base, without methanol, containing a suitable inhibitor for aluminium engines and engine parts.

Use one part of anti-freeze to one part of water.

Anti-freeze can remain in the cooling system and will provide adequate protection for two years provided that the specific gravity of the coolant is checked before the onset of the second winter and topped-up with new anti-freeze as required.

Vehicles leaving the factory have the cooling system filled with 50% anti-freeze and 50% water mixture. This gives protection against frost down to minus 36°C (minus 33°F). Vehicles so filled can be identified by a label affixed to the radiator.

NOTE: Should ambient temperatures be below that stated above refer to Anti-Freeze Data in Recommended Lubricants, Fluids and Capacities in Section OS. instructions in the chart must be strictly adhered to before driving the vehicle away.

After the second winter the system should be drained and thoroughly flushed. Before adding new anti-freeze examine all joints and replace defective hoses to make sure that the system is leakproof.

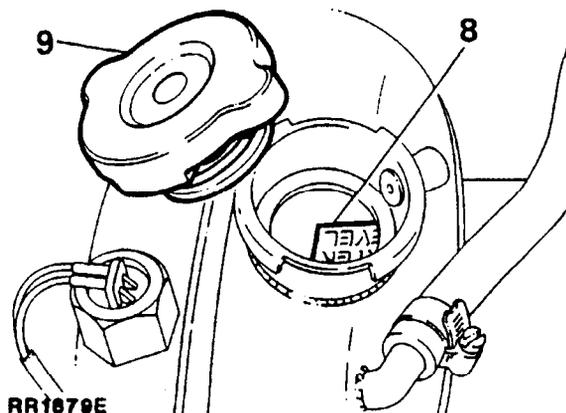
See the 'Recommended Lubricants Fluids and Capacities', Section 09, for protection quantities.

Refilling

5. Pour 4.5 litre (1 gallon) of water into the radiator.
6. Add the recommended quantity of anti-freeze.
7. Top-up the radiator with water, refit the radiator filler plug and washer and tighten.
8. Add water to the expansion tank, up to the 'WATER LEVEL' plate.

NOTE: The water level plate on later models has been deleted from the expansion tank, therefore the coolant should be filled to the top of the sensor float which is approximately 1.00 inch (25 mm) below the filler neck

9. Fit the expansion tank filler cap.



10. Run the engine until normal operating temperature is attained, that is, thermostat open.
11. Allow the engine to cool, then check the coolant level and top-up if necessary.

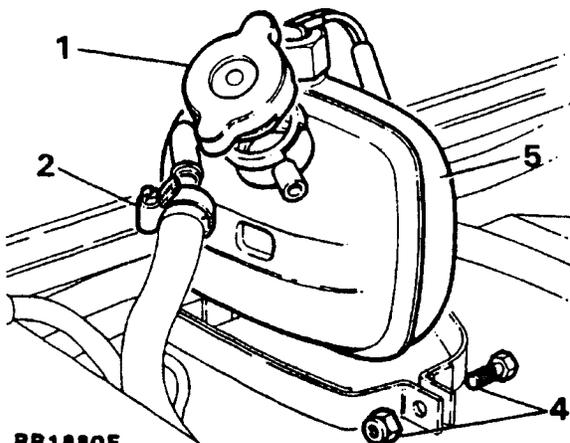
EXPANSION TANK

Remove and refit

Removing

WARNING: Do not remove the expansion tank filler cap when the engine is hot because the cooling system is pressurized and personal scalding could result.

1. Remove the expansion tank filler cap by first turning it counter-clockwise a quarter of a turn to allow pressure to escape, then turn it further in the same direction and lift off.
2. Disconnect the hose to the radiator.
3. Disconnect the multi-plug to the coolant level sensor.
4. Remove the pinch bolt.



5. Lift out the expansion tank.

Refitting

6. Reverse 1 to 5.
7. Replenish the cooling system.
8. Check for leaks around all hose connections.

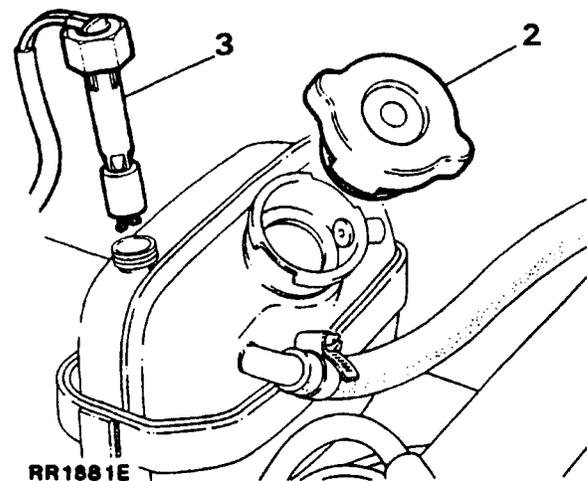
COOLANT LEVEL SENSOR

Remove and refit

Removing

WARNING: Do not remove the expansion tank filler cap when the engine is hot because the cooling system is pressurized and personal scalding could result.

1. Disconnect the multi-plug from the sensor.
2. Remove the expansion tank filler cap by first turning it counter-clockwise a quarter of a turn to allow pressure to escape, then turn it further in the same direction and lift off.
3. Release the retaining nut and withdraw the sensor from the expansion tank.



Refitting

4. Reverse the removal instructions.
5. Start engine and run until normal running temperature is attained, thermostat open, check for coolant leaks around the sensor.

FAN BELT

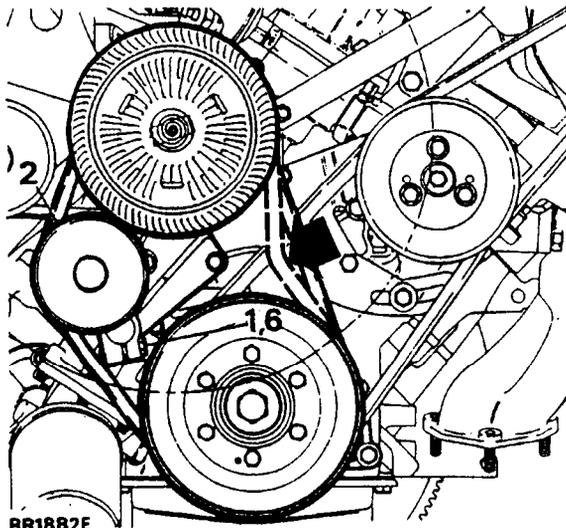
Check and adjust tension, 1 and 5 to 6

Remove and refit, 1 to 6

Removing

WARNING: Disconnect the battery negative terminal to prevent the engine being started before removing or adjusting drive belts.

1. Loosen the idler pulley pivot bolt.
2. Pivot the idler pulley inwards.
3. Lift off the fan belt.



RR1882E

Refitting

4. Locate the fan belt on the pulleys.
5. Adjust the fan belt using the idler pulley to give 4 to 6 mm (0.19 to 0.25 in) free movement when checked midway between the fan and crankshaft pulleys by hand.
6. Tighten the idler pulley pivot bolt and check the adjustment.

NOTE: Re-check the belt adjustment after approximately 1500 km (1,000 miles) running when a new belt has been fitted.

VISCOUS COUPLING, FAN BLADES, PULLEY AND FAN COWL

Viscous coupling-remove and refit 1 to 5

Fan blades-remove and refit 1 to 5 and 8

Fan cowl-remove and refit 1 to 4

Fan pulley-remove and refit 1 to 7

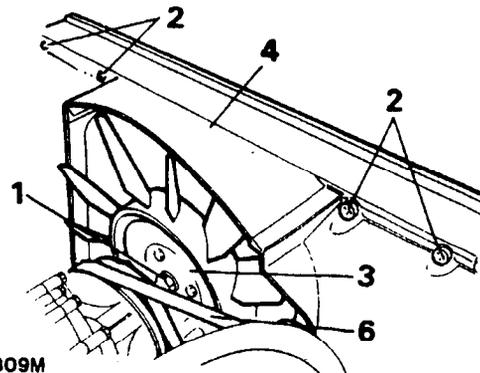
Removing

WARNING: Disconnect the battery negative terminal to prevent the engine being started before removing or adjusting drive belts.

1. Loosen the nut securing the viscous coupling and fan blade assembly to the water pump shaft.

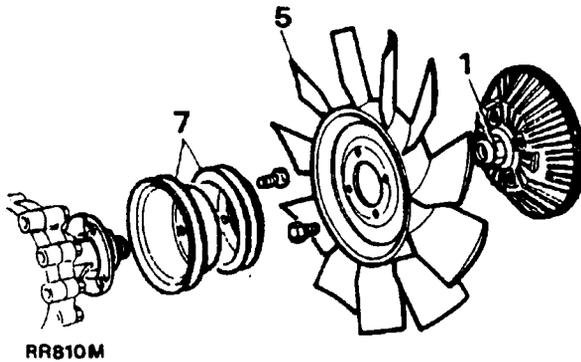
NOTE: The nut securing the viscous unit to the water pump has a left hand thread, to release the nut, turn in a clockwise direction when viewed from the front of the viscous unit.

2. Remove the four fan cowl fixings and lift the cowl out of its lower mountings.



RR809M

3. Remove the viscous coupling securing nut and withdraw the assembly.
4. Remove the fan cowl, if necessary.
5. Remove the fan blades from the viscous coupling, if necessary.
6. Remove the fan belt and, if fitted, the compressor belt.
7. Remove the pulley fixings and withdraw the pulley.



RR810M

Refitting

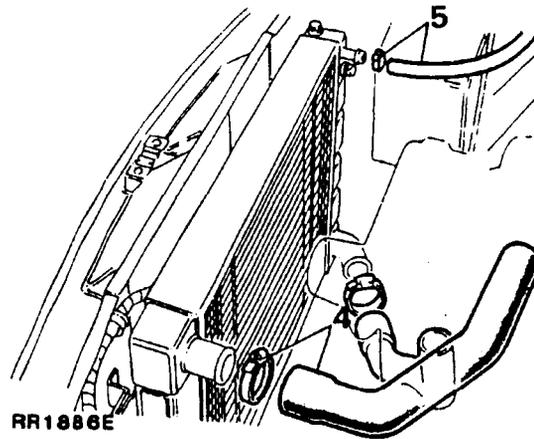
8. Reverse the above procedure, ensuring the fan blades are fitted correctly. The fan is marked **FRONT** and should be fitted with the word **FRONT** closest to the radiator. See Torque values-Section 06 for correct torque figure.
9. Adjust the fan belt and compressor belt.

RADIATOR

Remove and refit

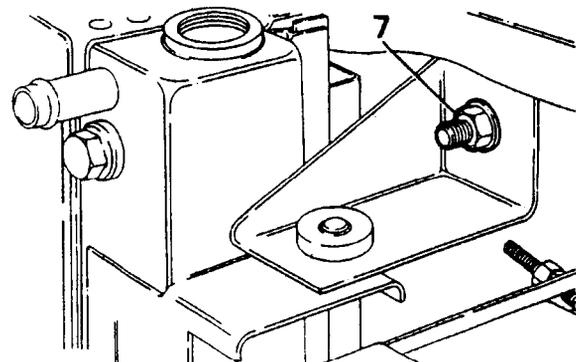
Removing

1. Drain the cooling system.
2. Remove the fan blades.
3. Remove the fan cowl.
4. Disconnect the top hose from the radiator.
5. Disconnect the hose to the expansion tank at the radiator.



RR1886E

6. Disconnect the hose to the thermostat elbow at the intake manifold.
7. Remove the fixings from each side of the radiator.



RR1887E

8. Withdraw the radiator by lifting from its locations. Check the condition of the rubber mounting pads.

Refitting

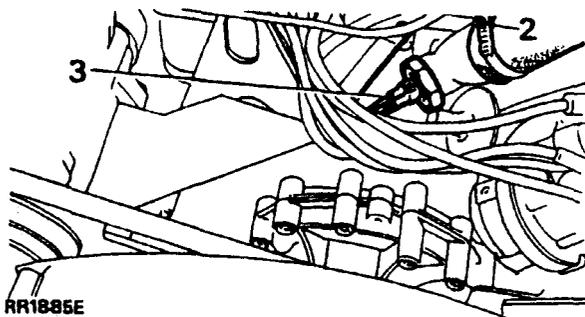
9. Reverse 1 to 8 noting the assembly order of the radiator side fixings and ensuring that the radiator sealing strips are correctly located and secure.
10. Check for coolant leaks around all hose connections.

THERMOSTAT

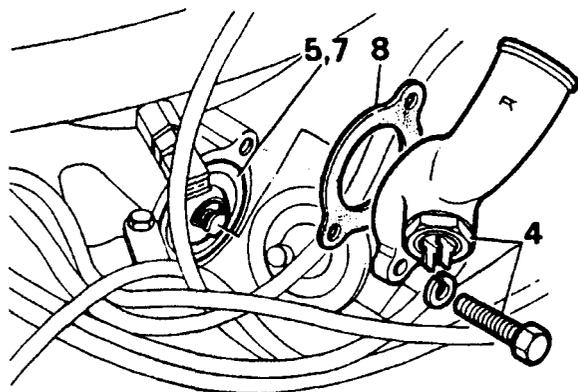
Remove and refit

Test**Removing**

1. Partially drain the cooling system, until coolant level is below thermostat housing.
2. Disconnect the hose from the thermostat housing.
3. Disconnect the electrical connections to the water temperature switch.



4. Remove the outlet elbow.
5. Withdraw the thermostat.

**Testing**

6. Note that the rating of the thermostat is 88°C (190°F). Place the thermostat in a suitable container half full of water. Heat the water and observe the temperature at which the thermostat opens. Should the thermostat open between 85°C (185°F) and 89°C (192°F) the unit is operating satisfactorily.

Refitting

7. Insert the thermostat with the jiggle pin/vent hole uppermost (12 o'clock position).
8. Using a new joint washer, fit the outlet elbow and tighten to the correct torque, see Torque values-Section 06.
9. Reverse 1 to 3.
10. Check for coolant leaks around all hose connections and joint faces.

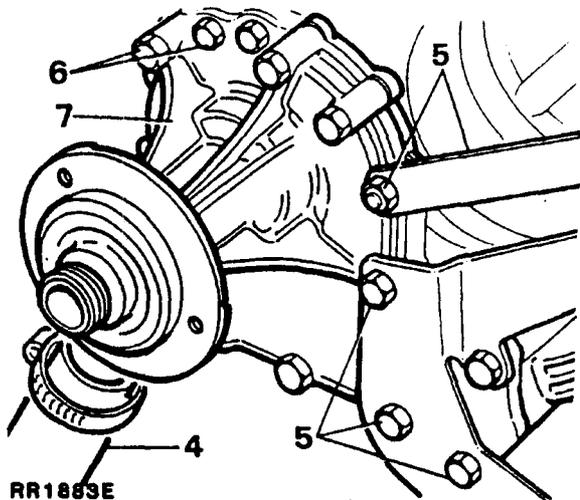
WATER PUMP

Remove and refit

Removing

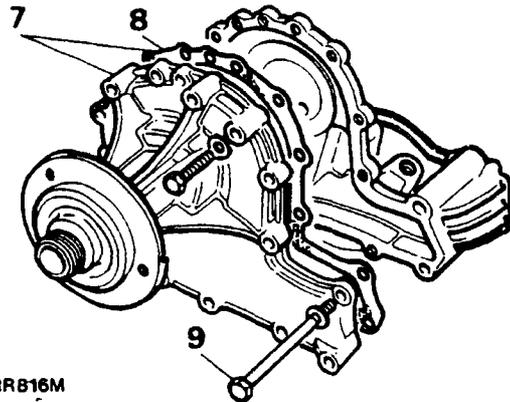
WARNING: Disconnect the battery negative terminal to prevent the engine being started before removing or adjusting drive belts.

1. Drain the engine cooling system.
2. Remove the fan belt, power steering pump and compressor belt.
3. Remove the fan blades and pulley.
4. Disconnect the inlet hose from the water pump.
5. Release the alternator adjusting link and the power Steering pump fixings.
6. Remove the remaining water pump bolts.
7. Remove the water pump and joint washer.



Refitting

8. Lightly grease a new joint washer and place it in position on the timing cover.



9. Clean the threads of the four long bolts and coat with Loctite 572 thread lubricant-sealant.
10. Locate the water pump in position.
11. Locate the alternator adjusting link and power-steering pump bracket.
12. Leave the alternator adjusting link **loose** and tighten the remaining water pump housing bolts evenly and to the correct torque, see Torque values-Section 06.
13. Connect the inlet hose to the water pump.
14. Fit the fan pulley.
15. Fit and adjust the fan belt, power steering pump belt and compressor belt.
16. Fit the fan blade assembly.
17. Refill the cooling system.
18. Check for coolant leaks around all hose connections and joint faces.

COOLING SYSTEM FAULT DIAGNOSIS

| SYMPTOM | POSSIBLE CAUSE | CURE |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4. EXTERNAL LEAKAGE | <ol style="list-style-type: none"> 1. Loose hose clamps 2. Defective rubber hose 3. Damaged radiator seams 4. Excessive wear in the water pump 5. Loose core plugs 6. Damaged gaskets 7. Leaks at the heater connections. 8. Leak at the water temperature transmitter | <ol style="list-style-type: none"> 1. Tighten 2. Replace 3. Rectify 4. Replace 5. Replace 6. Replace 7. Rectify 8. Tighten the transmitter |
| B • INTERNAL LEAKAGE | <ol style="list-style-type: none"> 1. Defective cylinder head gasket 2. Cracked cylinder wall 3. Loose cylinder head | <ol style="list-style-type: none"> 1. Replace. Check engine oil for contamination and refill if necessary 2. Replace cylinder block 3. Tighten. Check engine bolts for oil contamination and refill as necessary |
| C • WATER LOSS | <ol style="list-style-type: none"> 1. Boiling 2. Internal or external leakage 3. Restricted radiator or inoperative thermostat | <ol style="list-style-type: none"> 1. Ascertain the cause of engine overheating and correct as necessary 2. See items A and B 3. Flush radiator or replace the thermostat as necessary. |
| D • POOR CIRCULATION | <ol style="list-style-type: none"> 1. Restriction in system 2. Insufficient coolant 3. Inoperative water pump 4. Loose fan belt 5. Inoperative thermostat | <ol style="list-style-type: none"> 1. Check hoses for crimps, reverse-flush the radiator, and clear the system of rust and sludge 2. Top-up coolant 3. Replace 4. Adjust 5. Replace |

| SYMPTOM | POSSIBLE CAUSE | CURE |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| D • CORROSION | <ol style="list-style-type: none"> 1. Excessive impurity in the water 2. Infrequent flushing and draining of system 3. Incorrect anti-freeze mixtures | <ol style="list-style-type: none"> 1. Use only soft, clean water together with correct anti-freeze mixture. 2. The cooling system should be drained and flushed thoroughly at least once a year. 3. Certain anti-freeze solutions have a corrosive effect on parts of the cooling system. Only recommended solutions should be used. |
| F • OVERHEATING | <ol style="list-style-type: none"> 1. Poor circulation 2. Dirty oil and sludge in engine. 3. Radiator fins choked with chaff, mud etc. 4. Incorrect ignition timing 5. Insufficient coolant 6. Low oil level 7. Choked or damaged 8. Dragging brakes 9. Overloading vehicle 10. Driving in heavy sand or mud 11. Engine labouring on gradients 12. Low gear work 13. Excessive engine idling 14. Inaccurate temperature gauge 15. Defective thermostat | <ol style="list-style-type: none"> 1. See item D 2. Refill 3. Use air pressure from the engine side of the radiator and clean out passages thoroughly 4. Check using electronic equipment 5. See item D 6. Replenish 7. Rectify or replace exhaust pipe or muffler 8. Adjust brakes 9. In the hands of the operator 10. In the hands of the operator 11. In the hands of the operator 12. In the hands of the operator 13. In the hands of the operator 14. Check or replace 15. Check or replace |
| G • OVERCOOLING | <ol style="list-style-type: none"> 1. Defective thermostat 2. Inaccurate temperature gauge | <ol style="list-style-type: none"> 1. Check or replace 2. Check or replace |

COOLING SYSTEM • 1989 model year.

The 3.9 litre engine has a revised 'partial flow' type cooling system. A new radiator incorporates oil coolers in both end tanks • left hand side, transmission oil cooler • right hand side, engine oil cooler.

A supplementary transmission oil cooler is still fitted in front of the radiator and condenser fans.

The transmission oil high temperature warning light sensor is now fitted under the hood adjacent to the radiator end tank.

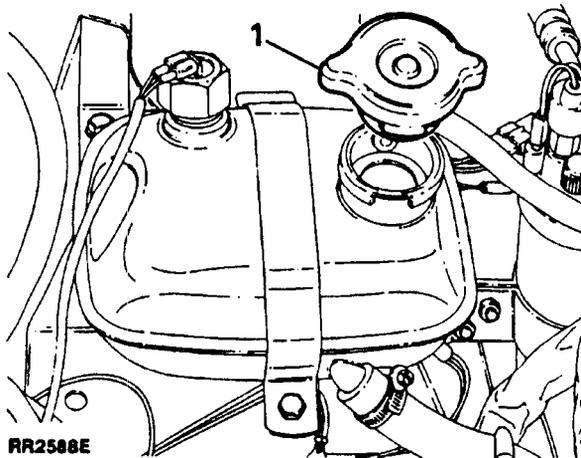
COOLANT

Drain and refill

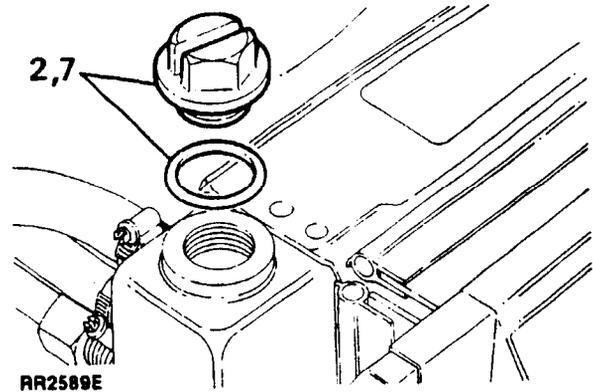
Draining

WARNING: Do not remove the expansion tank filler cap when the engine is hot, because the cooling system is pressurised and personal scalding could result.

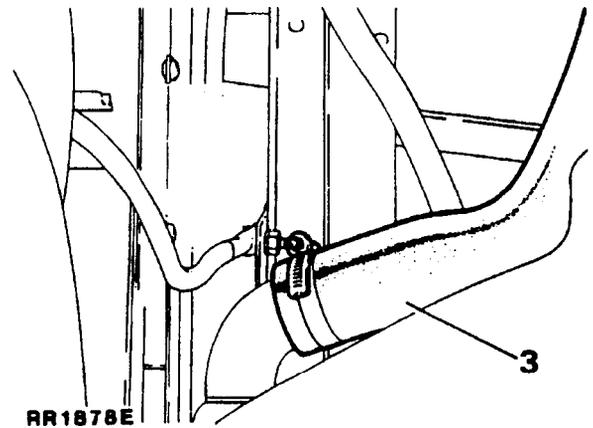
1. Remove the expansion tank filler cap by first turning it counter-clockwise a quarter of a turn to allow pressure to escape, turn it further in the same direction and lift off.



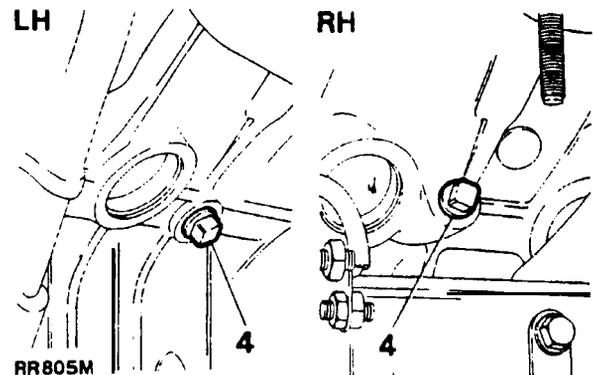
2. Remove the radiator filler plug and 'O' ring to assist drainage.



3. Disconnect the bottom hose at its junction with the radiator and allow the coolant to drain into a suitable container. Ensure that the container is clean if the coolant solution is to be re-used. Reconnect the bottom hose after draining and re-tighten the hose clamp.



4. Remove the engine drain plugs, one each side of the cylinder block, beneath the exhaust manifolds. Allow the coolant to drain, refit and tighten the plugs.

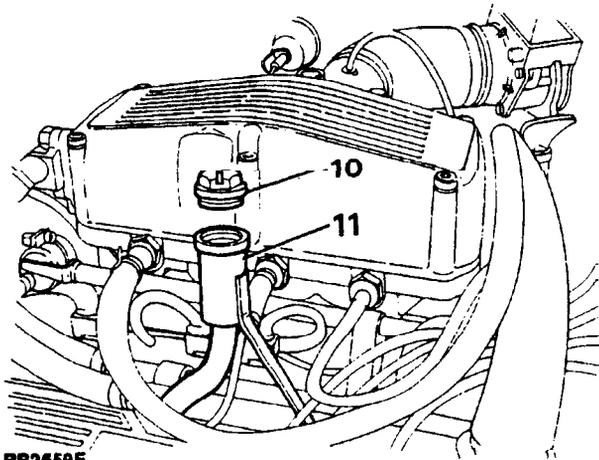


Continued

NOTE: It is not possible to drain all the coolant retained in the heater system. Flush through the system, after draining, by pouring clean water into the fill tower, (see RR2659E), with the bottom hose disconnected and engine drain plugs removed.

5. Pour the correct solution of water and anti-freeze into the expansion tank until the radiator is full.
6. Start the engine and run it until normal operating temperature is attained, topping up as necessary.
7. Refit the radiator filler plug and 'O' ring, fitting a new 'O' ring if required. Tighten to the correct torque, see Torque Values, section 06.
8. Fit the expansion tank filler cap.
9. Allow the engine to cool, check coolant level and top up the expansion tank until the level reaches the level indicator on the inside of the tank.

CAUTION: The following fill procedure **MUST** be followed if the heater pipes mounted on top of the rocker cover have been removed for any reason.



RR2659E

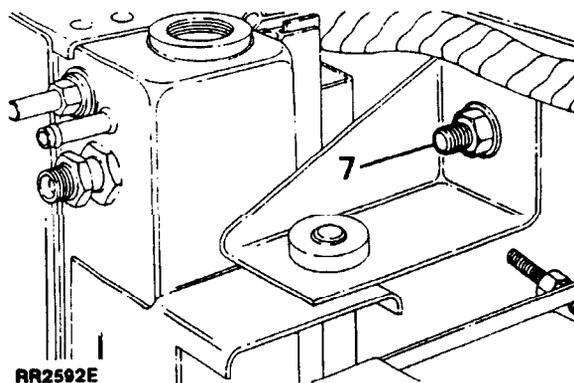
10. Remove the plug from the fill tower.
11. Briskly pour the correct solution of water and anti-freeze into the fill tower until the radiator is full.
12. Start the engine and run it until normal operating temperature is attained, topping up as necessary.
13. Refit the radiator filler and fill tower plugs, fitting new 'O' rings if required. Tighten to the correct torque, See Torque Values, section 06.
14. Fit the expansion tank filler cap.
15. Allow the engine to cool, check coolant level in the expansion tank and top up until the level reaches the level indicator on the inside of the tank.

RADIATOR/OIL COOLERS

Remove and refit

Removing

1. Drain the cooling system.
2. Remove the fan blade assembly.
3. Remove the fan cowl.
4. Disconnect the radiator top hoses.
5. Disconnect the four transmission and engine oil cooler connections to the radiator end tanks. Note that oil spillage will occur when connections are loosened. Blank off exposed oil connections.
6. Disconnect the transmission oil temperature sensor plug.
7. Remove the radiator securing brackets from each side.



RR2592E

8. Remove the radiator unit by lifting from its location. Check the condition of the rubber mounting pads.

Refitting

9. Check that the radiator sealing strips are securely located.
10. Transfer the oil cooler adaptors if fitting a new radiator.
11. Reverse the removal procedure, ensuring that oil cooler connections are tightened to the specified torque values before fitting the fan blades and cowl.
11. Clean any coolant/oil spillage from the vehicle.
12. Check all connections for coolant/oil leaks.

**RANGE
ROVER**

COOLING SYSTEM

RR2501E

Continued

