

26 - COOLING SYSTEM

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REPAIR

RADIATOR ASSEMBLY1





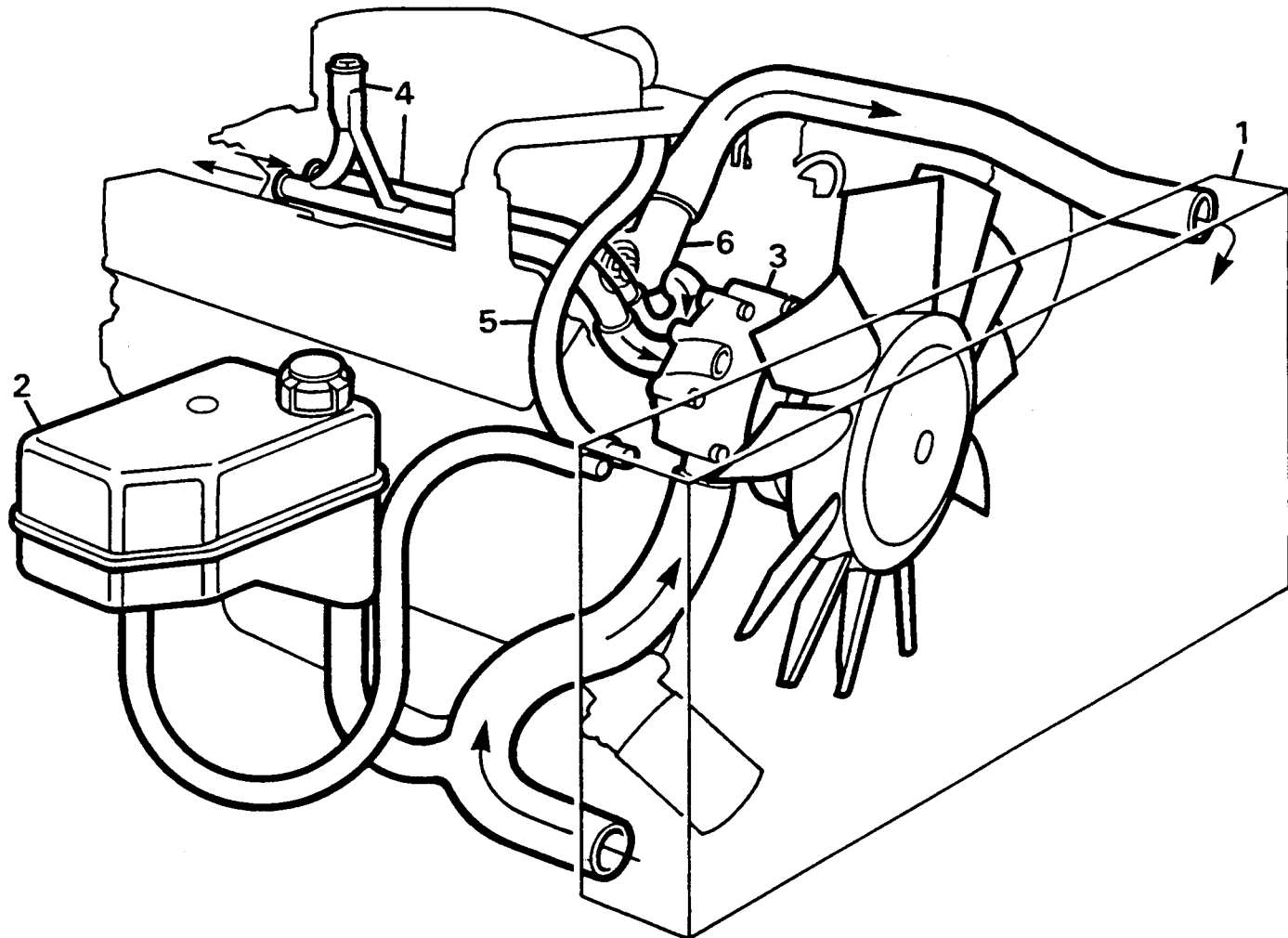
V8 PETROL ENGINE COOLING

Description

The V8 engine uses a pressurized cooling system and cross flow radiator which is supplied from a separate header tank. The coolant radiator also incorporates a section at the left hand end for cooling the transmission oil and a section at the other end for cooling the engine oil.

The belt driven viscous fan and centrifugal water pump is located in the engine front cover with ports for circulation of coolant to both banks of cylinders and cylinder heads. Coolant returns to the top of the radiator via ports in the inlet manifold where the thermostat is mounted horizontally.

Coolant also circulates through the vehicle heating system and is used to heat air entering the inlet manifold plenum chamber.



RR3532M

Coolant circulation (engine hot)

1. Cross flow radiator
2. Header tank
3. Viscous fan and water pump
4. Heater pipes and filling tower
5. Plenum chamber connection
6. Thermostat

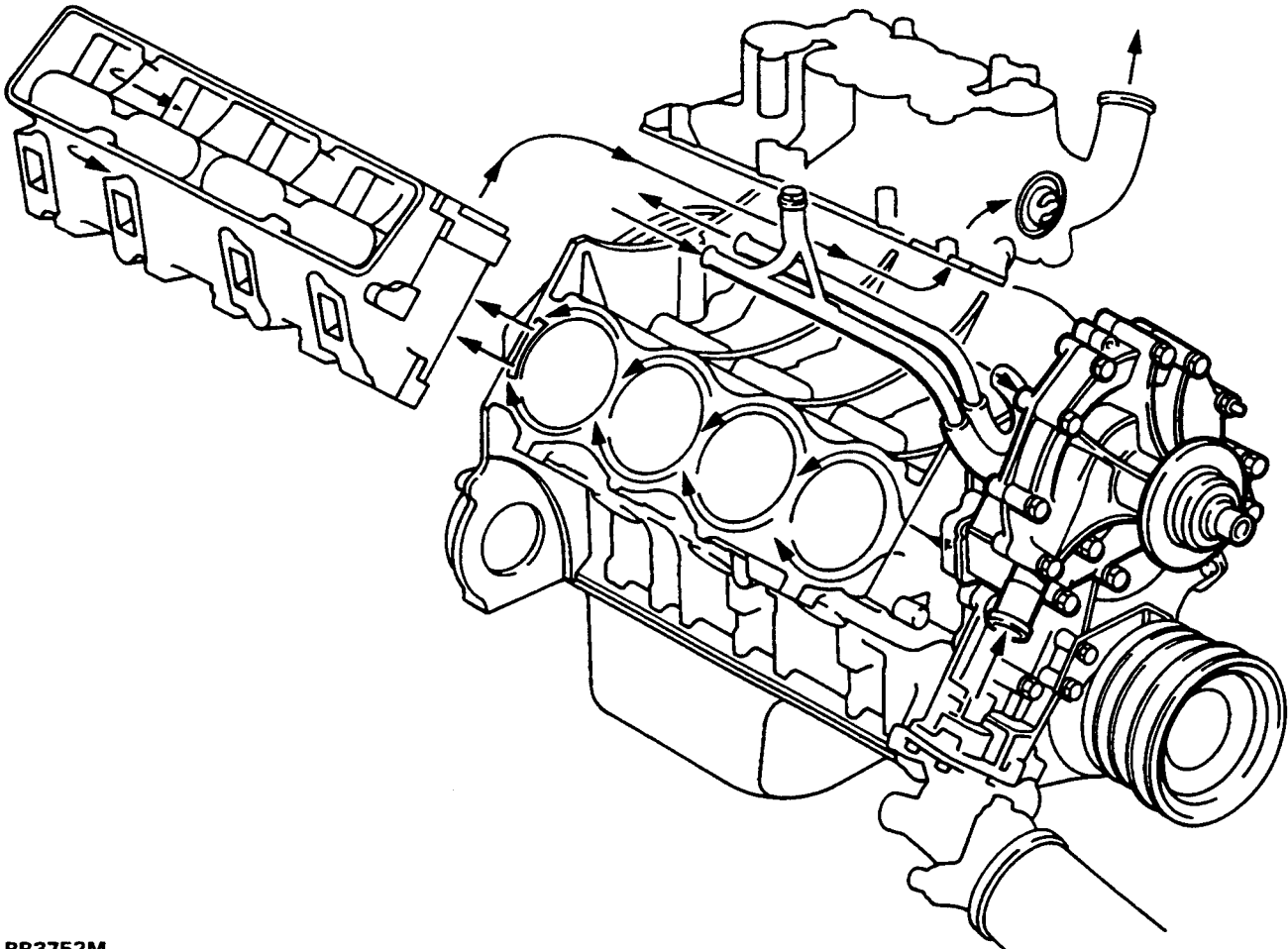
COOLANT CIRCULATION

Operation

When the engine is started from cold the thermostat prevents any coolant circulation through the radiator by closing off the top hose. During the engine warm up period, the water pump, pumps coolant around the cylinders to the rear of the cylinder block along the main galleries in both cylinder banks. At the rear of the cylinder block the coolant rises through a large port in each cylinder head/block joint face, and then flows forward to connect with ports at the front of the inlet manifold. From the manifold the coolant is carried by an external pipe to the heater unit and from the heater through another external pipe to the pump inlet.

The coolant circulation through the cylinder block and heads, does not change when normal running temperature is reached and the thermostat opens. But with the thermostat open, coolant flows through the top hose to the radiator where it is cooled and drawn back into the pump via the bottom hose.

The purpose of the 'filling tower' on the heater return pipe, is allow any air locks in the system to be purged.

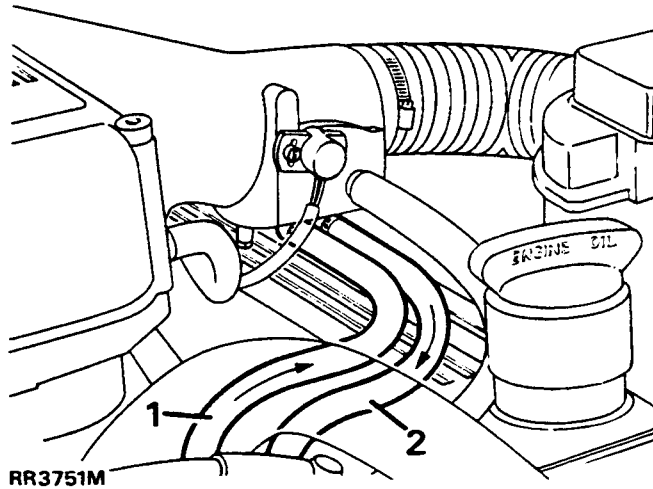


RR3752M



Plenum chamber heating

Air entering the plenum chamber is heated by a flow of coolant from the inlet manifold which returns through a long hose, to the top right corner of the radiator.

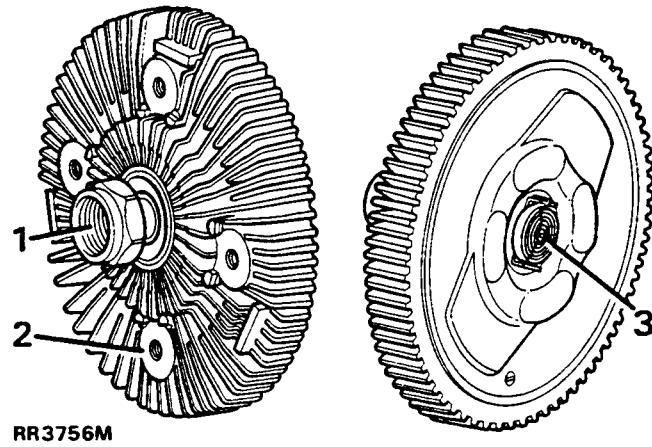


1. Hot water supply
2. Cold return to radiator

VISCOUS FAN

Description

The viscous drive unit for the engine cooling fan, provides a means of controlling the speed of the fan relative to the running temperature of the engine. The viscous unit is a type of fluid coupling, which drives the fan blades through the medium of a special 'silicone fluid' injected into the unit during manufacture.



1. Drive in from water pump spindle
2. Drive out to fan blades
3. Bi-metal

Operation

The viscous unit consists of two principal components:

An inner member 1 which is secured to water pump spindle and is driven by the fan belt.

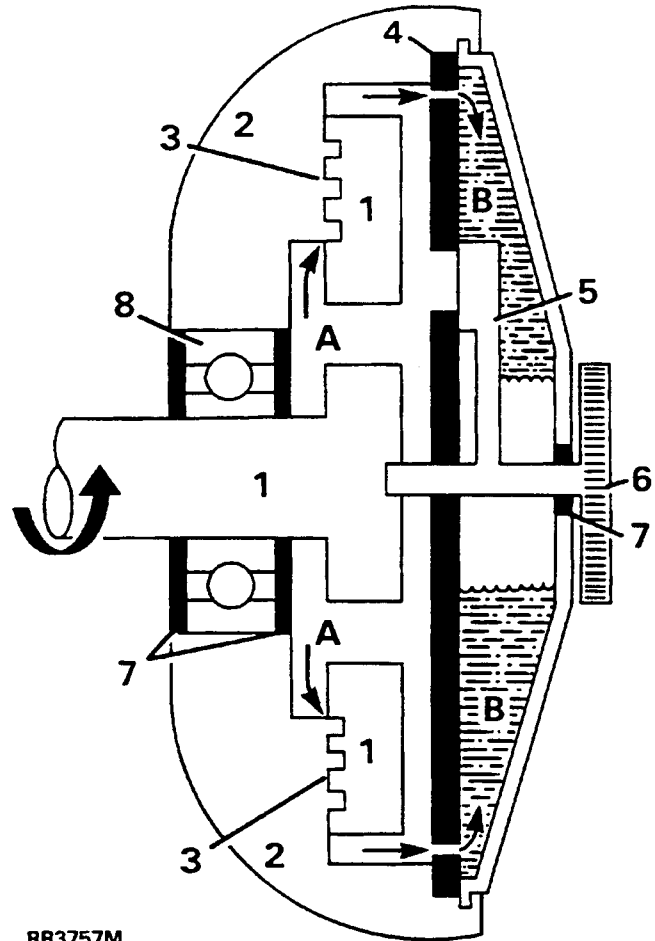
An outer member 2 which has the fan blades attached, houses the working parts and is driven through the medium of the viscous fluid.

The inner and outer members have interlocking annular grooves machined in each, with a small running clearance 3 to allow the silicone fluid to circulate through the valve plate 4.

The unit also contains a valve 5 which is controlled by an external bi-metal thermostat 6.

Starting engine from cold

During the time the engine is at rest the silicone fluid drains down, half filling chambers A and B. Thus when the engine is first started sufficient fluid is present in chamber A to provide a positive drive between the members, as is evident by the initial noise of the fan. However within a very short period of time, after starting the engine, the fan speed and noise will decline indicating that the fluid is being centrifuged into chamber B (as seen in RR3757M causing the drive to slip).



RR3757M

Viscous unit slipping (Engine at normal running temperature)

1. Inner member (drive in fast)
2. Outer member (drive out slow)
3. Running clearance
4. Valve plate
5. Valve (closed)
6. Bi-metal
7. Fluid seals
8. Ball race
- A. Fluid chamber
- B. Fluid chamber

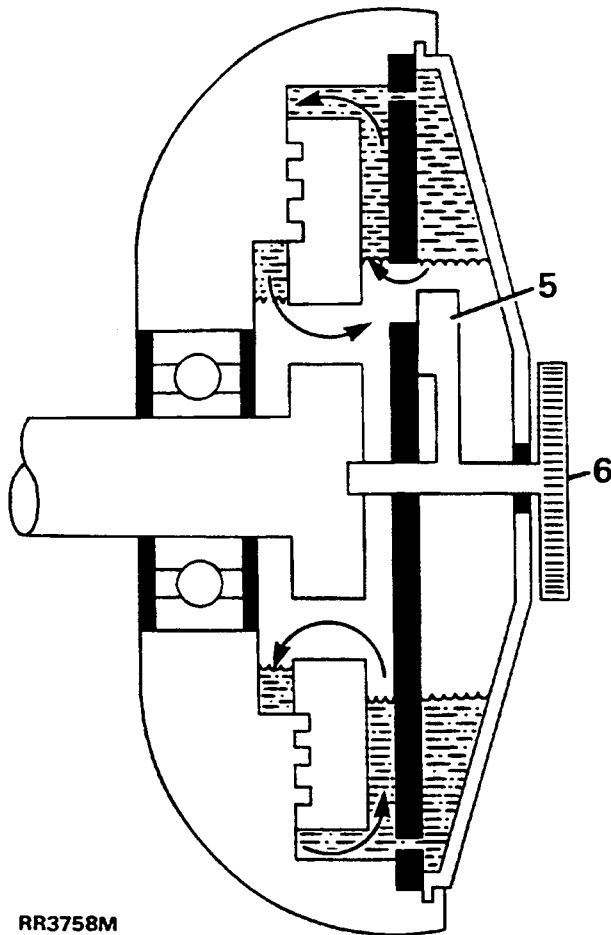
If the engine speed is increased the degree of slip will also increase to limit the maximum fan speed.



Hot conditions

When operating in high ambient temperatures or when stationary in traffic, the bi-metal thermostat will operate and open the valve port between chambers A and B.

Opening the valve (as shown in RR3758M) allows the fluid to circulate between the two members, causing the unit to couple, thus increasing the fan speed and cooling effect.



Viscous unit coupled (Hot running conditions)

Bi- metal expanded, valve (open)



ENGINE OVERHEATING

Before conducting any cooling system diagnosis: *See Description and operation, V8 Petrol Engine Cooling*

1. Is coolant level correct?
NO - Allow engine to cool, top up level to expansion tank seam.
YES - Continue.
2. Is drive belt tension correct?
NO - *See SECTION 10, Maintenance, Service schedule*
YES - Continue.
3. Is ignition timing correct?
NO - *See ELECTRICAL, Adjustment, Ignition timing*
YES - Continue.
4. Is coolant in radiator frozen?
YES - Slowly thaw and drain system. *See Adjustment, Coolant requirements*
NO - Continue.
5. Is air flow through radiator restricted or blocked?
YES - Apply air pressure from engine side of radiator to clear obstruction.
NO - Continue.
6. Are there any external leaks, from water pump, engine gaskets or the heater unit?
YES - Investigate and rectify. *See Adjustment, Coolant requirements*
NO - Continue.
7. Are fan blades fitted correct way round, concave side towards engine?
NO - Rectify.
YES - Continue.
8. Is viscous unit operating correctly? *See Description and operation, Viscous fan*
NO - Renew. *See Repair, Viscous coupling, fan blades, pulley and fan cowl*
YES - Carry out a pressure test on radiator cap and system. Check thermostat type, operation and correct fitting. *See ENGINE, Overhaul, Test and fit thermostat*
If pressure test leads you to suspect coolant leakage across gaskets, go to check 11, otherwise: Continue.
9. Are the air conditioning fans operating correctly? *See ETM, K5*
NO - Rectify.
YES - Continue.
10. Is temperature sender and gauge giving accurate readings?
NO - Substitute parts and compare readings.
YES - Continue.
11. Carry out cylinder pressure test to determine if pressure is leaking into cooling system causing over pressurising and loss of coolant.

If problem is not diagnosed, check the coolant system for engine oil contamination and engine lubrication system for coolant contamination.

If the coolant only, or both systems are contaminated, suspect cylinder head gaskets or radiator.

If only the lubrication system is contaminated with coolant, suspect inlet manifold or front cover gaskets.

ENGINE RUNS COLD

Before conducting any cooling system diagnosis: **See Description and operation, V8 Petrol Engine Cooling**

1. Check operation of viscous unit. **See Description and operation, Viscous fan**
2. Is viscous unit operating correctly?
NO - **See Repair, Viscous coupling, fan blades, pulley and fan cowl**
YES - Continue.
3. Is thermostat correct type and operating? **See ENGINE, Overhaul, Test and fit thermostat**
4. If problem is not diagnosed: Continue.
5. Are the airconditioning fans operating continuously?
YES - **See ETM, K5**
NO - Continue.
6. Is temperature sender and gauge giving accurate readings? Substitute parts and compare readings. If problem is not diagnosed repeat tests, starting at 1.



COOLANT REQUIREMENTS

Frost precautions and engine protection.

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



CAUTION: Do not use salt water otherwise corrosion will occur. In certain territories where 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 specific gravity of coolant is checked before onset of second winter and topped-up with new anti-freeze as required.

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



NOTE: Should ambient temperatures be below that stated above refer to **Anti-Freeze Data in Recommended Lubricants, Fluids and Capacities in Section 09. Instructions in chart must be strictly adhered to before driving vehicle.**

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' for protection quantities. See **LUBRICANTS, FLUIDS AND CAPACITIES, Information, Lubricants Fluids and Capacities**

COOLANT

Service repair no - 26.10.02

Drain and refill

Draining

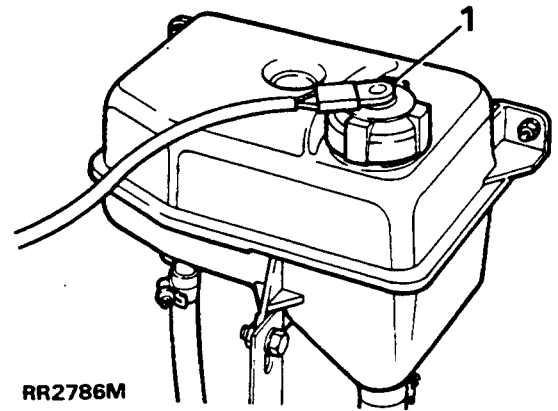
WARNING: Do not remove expansion tank filler cap when engine is hot. The cooling system is pressurised and personal scalding could result.

See coolant requirements before refilling system.

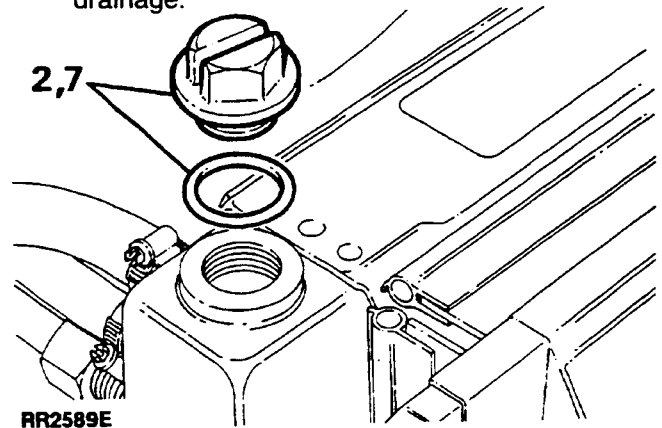
1. Remove expansion tank filler cap by slowly turning it anti-clockwise, pause to allow pressure to escape. Continue turning it in same direction and remove.



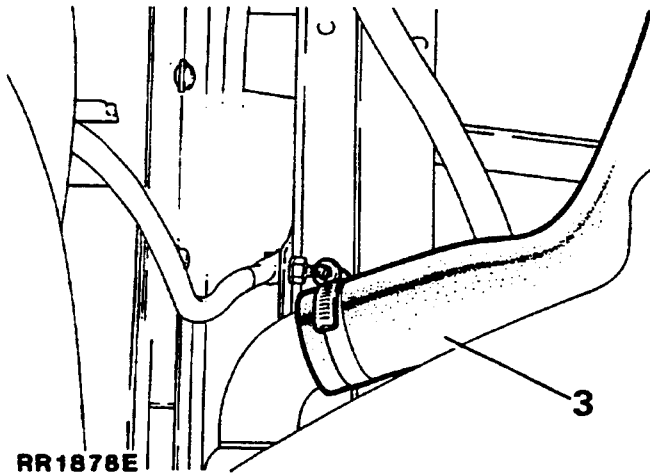
NOTE: The filler cap incorporates a low coolant sensing unit.



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

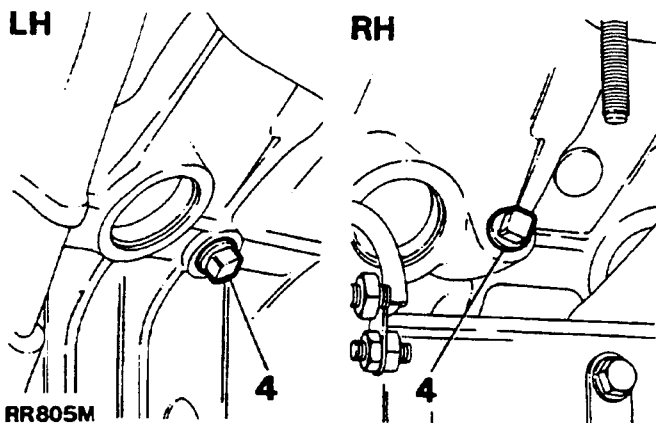


3. Disconnect bottom hose from radiator. Drain coolant into a clean container. Reconnect bottom hose, re-tighten hose clamp.



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

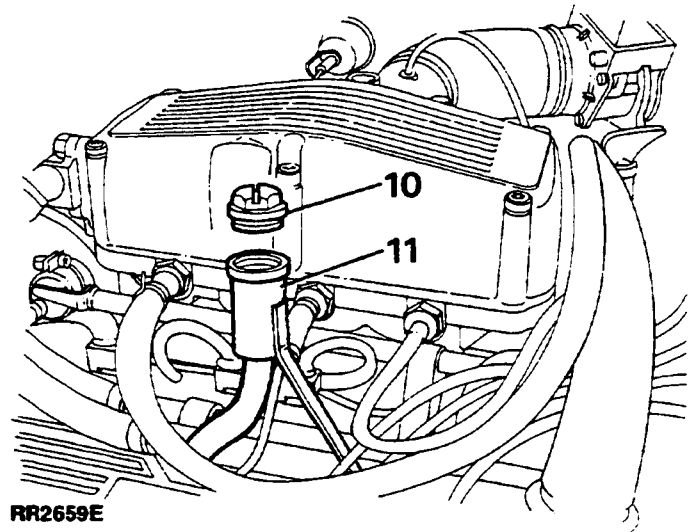
4. Remove engine drain plugs, one each side of cylinder block, beneath exhaust manifolds. Drain coolant, refit and tighten plugs.



5. Pour correct solution of water and anti-freeze into expansion tank until radiator is full.
6. Start engine, run it until normal operating temperature is attained, topping up as necessary.
7. Refit radiator filler plug and 'O' ring, with new 'O' ring if required. Tighten to **6 Nm**.
8. Fit expansion tank filler cap.
9. Allow engine to cool, check coolant level. Finally top up expansion tank until level reaches seam of expansion tank.



CAUTION: The following fill procedure must be followed whenever heater pipes mounted on top of rocker cover have been removed.



10. Remove fill tower plug.
11. Briskly pour correct solution of water and anti-freeze into fill tower until radiator is full.
12. Start engine, run it until normal operating temperature is attained, topping up as necessary.
13. Refit radiator filler plug and fill tower plug, with new 'O' rings if required. Tighten to **6 Nm**.
14. Fit expansion tank filler cap.
15. Allow engine to cool, check coolant level in expansion tank. Finally top up until level reaches seam of expansion tank.



EXPANSION TANK

Service repair no - 26.15.01

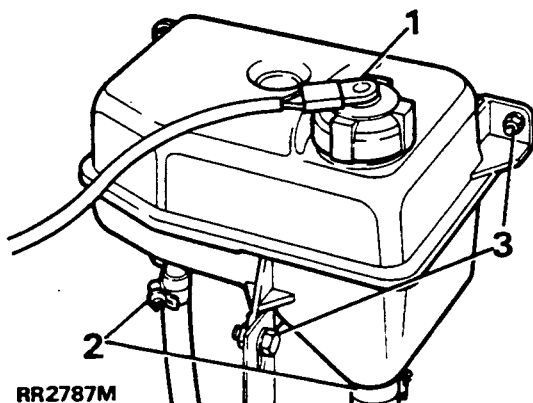
Remove and refit

Remove



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

1. Remove expansion tank filler cap by first turning it slowly anti-clockwise, pause to allow pressure to escape. Continue turning in same direction and lift off.
2. Disconnect two hoses from bottom of expansion tank, allowing coolant to drain into a suitable container.
3. Remove three fixing bolts, remove expansion tank.



Refit

4. Reverse removal procedure.
5. Replenish cooling system.
6. Check for leaks around all hose connections.

FAN BELT

Service repair no - 65.07.76

Check and adjust tension, 1 and 5 to 6

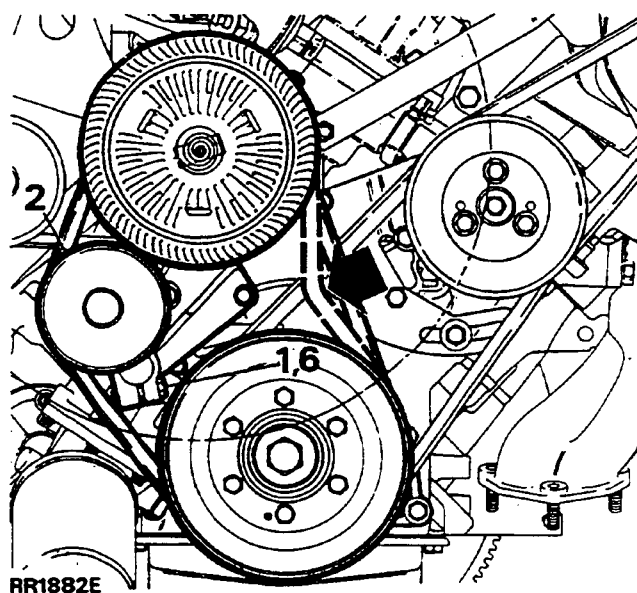
Remove and refit

Remove



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

1. Loosen idler pulley pivot bolt.
2. Pivot idler pulley inwards.
3. Remove fan belt.



Refit

4. Locate fan belt on pulleys.
5. Adjust fan belt using idler pulley to give 4 to 6 mm free movement midway between fan and crankshaft pulleys by hand.
6. Tighten idler pulley pivot bolt, recheck adjustment.



NOTE: Recheck belt adjustment after running engine at fast idle for 3 to 5 minutes when 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

Remove and refit

Remove



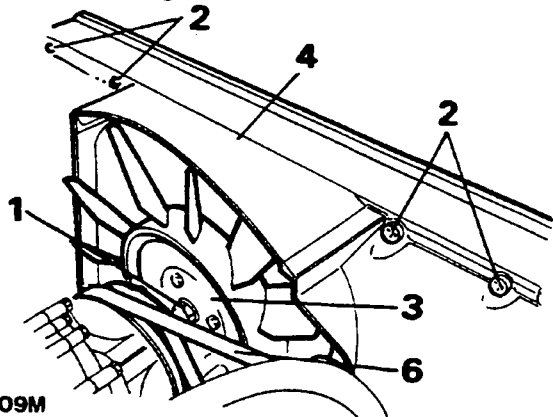
WARNING: Disconnect battery negative terminal to prevent engine being started before removing or adjusting drive belts.

1. Loosen nut securing viscous coupling/fan blade assembly to water pump.



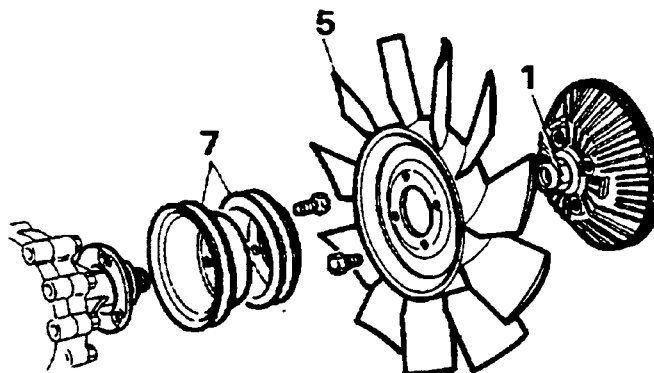
NOTE: Nut securing viscous unit to water pump has a left hand thread. Release by turning clockwise when viewed from front of viscous unit.

2. Remove four fan cowl fixings, lift cowl out of lower mountings.



RR809M

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



RR810M

Refit

8. Reverse removal procedure. Ensuring fan blades are fitted correctly. Fan is marked **FRONT** and should be fitted with word **FRONT** closest to radiator. Tighten to **30 Nm**.
9. Adjust fan belt and compressor belt. See **SECTION 10, Maintenance, Under Bonnet maintenance**



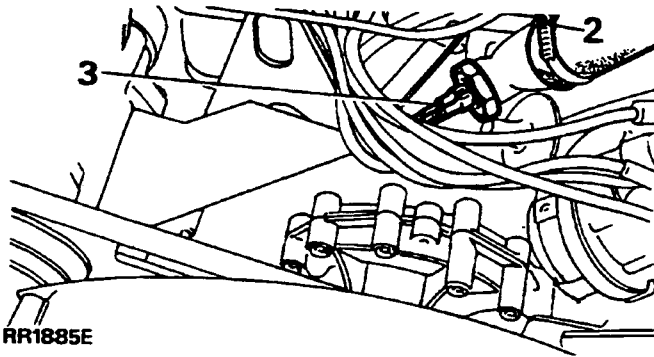
THERMOSTAT

Service repair no - 26.45.01

Remove, test and refit

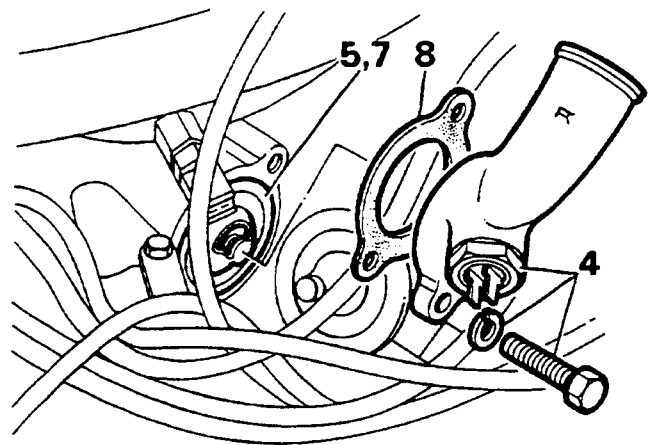
Remove

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



RR1885E

4. Remove outlet elbow.
5. Withdraw thermostat.



RR1792E

Test

6. Note rating of thermostat is 88°C (190°F). Place thermostat in a container half full of water. Heat water, observe temperature at which thermostat opens. Thermostat is satisfactory if it opens between 85°C and 89°C.

Refit

7. Insert thermostat with jiggle pin/vent hole uppermost (12 o'clock position).
8. Fit the outlet elbow and new joint washer. Tighten to **28 Nm**.
9. Reverse removal procedure. 1 to 3.
10. Check for coolant leaks around all connections and joint faces.

WATER PUMP

Service repair no - 26.50.01

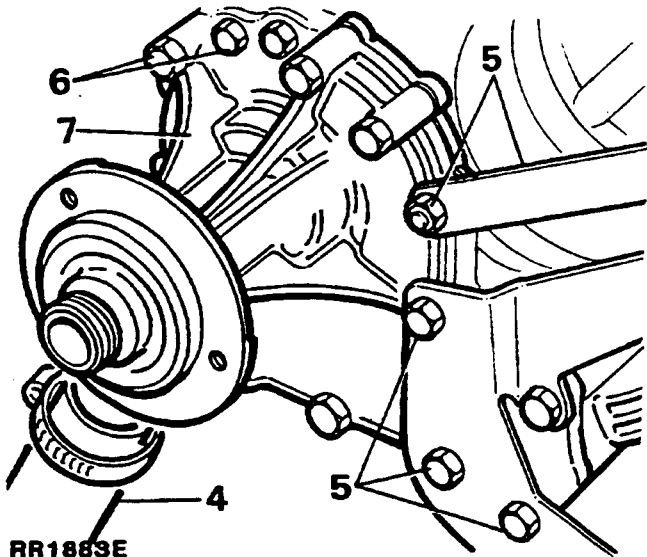
Remove and refit

Remove



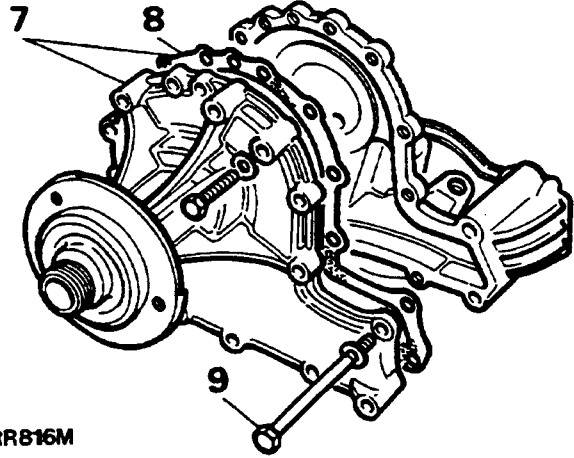
WARNING: Disconnect battery negative terminal to prevent engine being started before removing or adjusting drive belts.

1. Drain engine cooling system. *See Adjustment, Coolant*
2. Remove water pump, power steering pump and compressor belts *See SECTION 10, Maintenance, Under Bonnet Maintenance*
3. Remove fan blades and pulley. *See Viscous coupling, fan blades pulley and fan cowl*
4. Disconnect inlet hose from water pump.
5. Release alternator adjusting link and power steering pump fixings.
6. Remove remaining water pump bolts.
7. Remove water pump and joint washer.



Refit

8. Lightly grease new joint washer, position it on timing cover.



9. Clean threads of four long bolts and coat with Loctite 572 thread lubricant-sealant.
10. Locate water pump in position.
11. Locate alternator adjusting link and power-steering pump bracket.
12. Leave alternator adjusting link loose, tighten remaining water pump housing bolts evenly to 28 Nm.
13. Reverse removal procedure. 1. to 5.
14. Check for coolant leaks around all hose connections and joint faces.



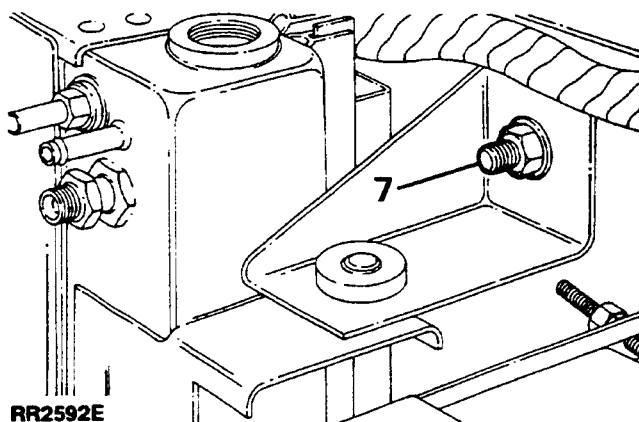
RADIATOR/OIL COOLERS

Service repair no - 26.40.01

Remove and refit

Remove

1. Drain cooling system.
2. Remove fan blade assembly - See RR 2591E.
3. Remove fan cowl.
4. Disconnect radiator top hoses.
5. Disconnect four transmission and engine oil cooler connections to radiator end tanks. Note oil spillage will occur when connections are loosened. Blank off exposed oil connections.
6. Disconnect transmission oil temperature sensor plug.
7. Remove radiator securing brackets from each side.

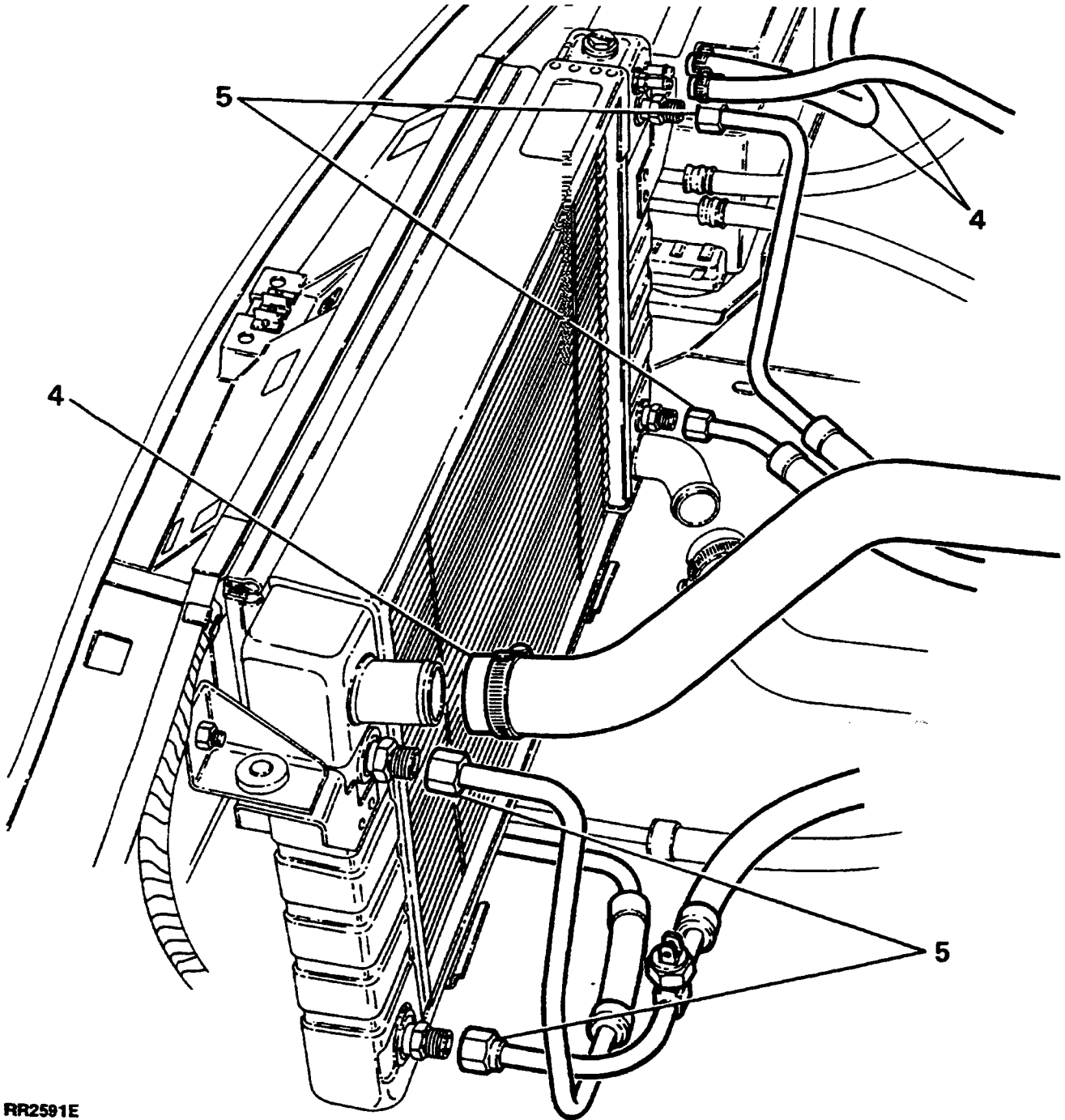


8. Remove radiator unit by lifting from its location. Check condition of rubber mounting pads.

Refit

9. Check radiator sealing strips are securely located.
10. Transfer oil cooler adaptors if fitting new radiator.
11. Reverse removal procedure. Ensure that oil cooler connections are tightened to **30 Nm** before fitting fan blades and cowl.
12. Clean coolant/oil spillage from vehicle.
13. Check all connections for coolant/oil leaks.

RADIATOR/OIL COOLERS



RR2591E



TORQUE VALUES



NOTE: Torque wrenches should be regularly checked for accuracy to ensure that all fixings are tightened to the correct torque.

	Nm
Oil cooler pipes	30
Radiator filler plug (plastic)	6
Water pump housing bolts	28
Outlet elbow bolts	28
Fan bolts	30

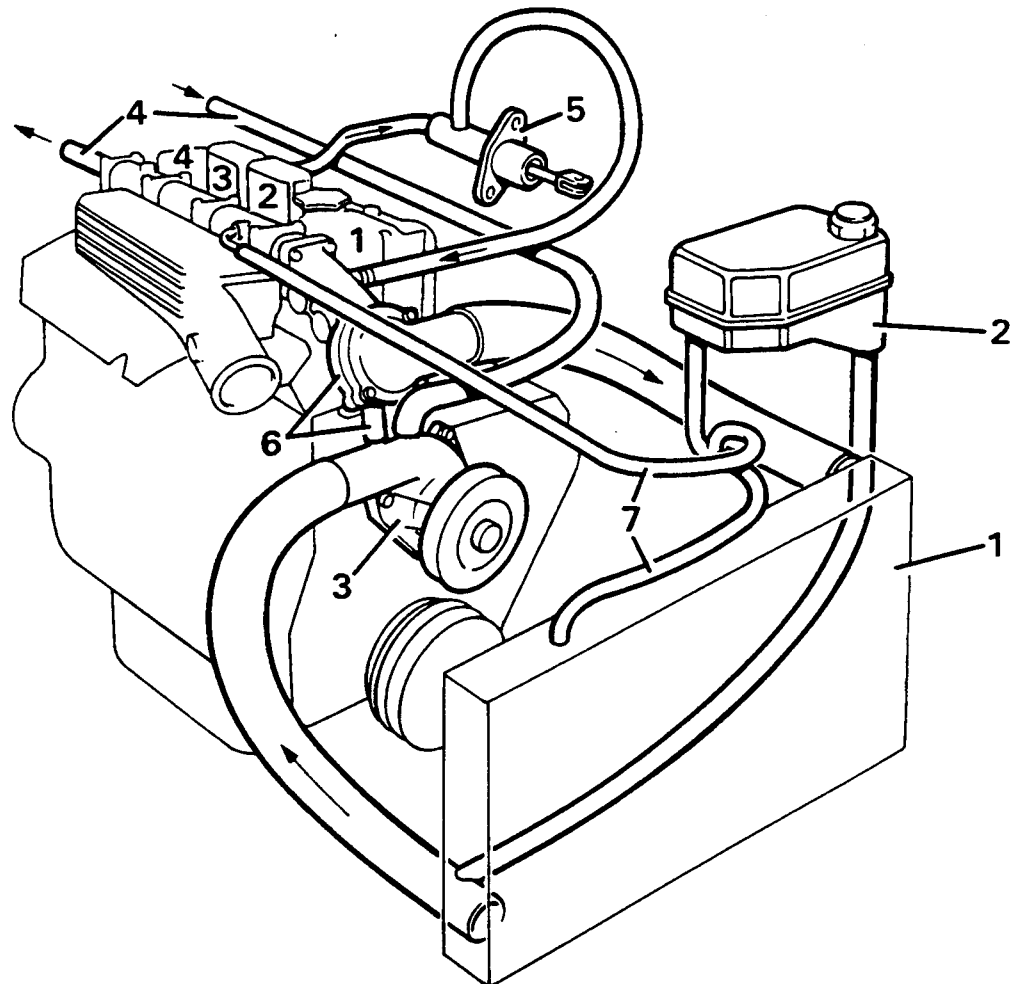


VM DIESEL ENGINE COOLING

Description

The VM engine uses a pressurized cooling system and cross flow radiator which is supplied from a separate header tank. The radiator assembly is in three sections. The largest section is for engine coolant and the other two sections which are cast in aluminium, are the engine oil cooler and the turbo charger intercooler.

A belt driven viscous fan and centrifugal water pump is located in the front of the cylinder block. Hot coolant is supplied to the heater and the fast idle thermostat through rubber hoses. Two small diameter air purge hoses connect the top of the radiator and cylinder head water gallery, to the header tank.



RR3753M

Coolant circulation (engine cold)

1. Cross flow radiator
2. Header tank
3. Viscous fan and water pump
4. Heater pipes
5. Fast idle thermostat and connections
6. By pass hose and engine thermostat
7. Air purge hoses

COOLANT CIRCULATION

Operation

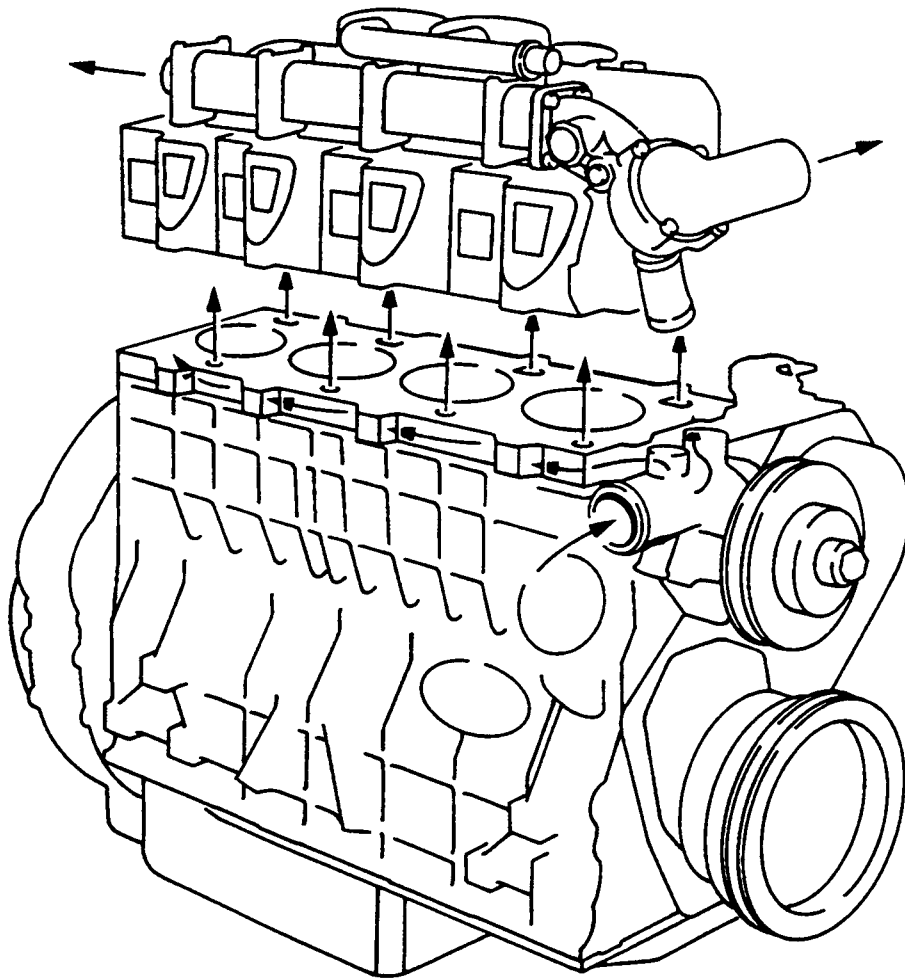
When the engine is started from cold the thermostat prevents any coolant circulation through the radiator by closing off the top hose. During the engine warm up period, the water pump, pumps coolant towards the rear of the cylinder block around each of the cylinders. Coolant as it is heated rises through ports in the cylinder block and head gasket, into each of the four separate cylinder heads. A cast aluminium water gallery which is bolted to the top of the cylinder heads, carries the coolant forwards to the thermostat, by-pass port and radiator top hose connection.

Starting from cold (thermostat closed)

While the thermostat is closed, coolant circulates around the cylinder block and cylinder heads via the by-pass. Coolant also flows from number three cylinder head through the cold start thermostat, which reduces the engine idle speed when running temperature is attained.

Engine warm (thermostat open)

When the engine reaches normal running temperature the thermostat closes off the by-pass and opens the flow to the top of the radiator.



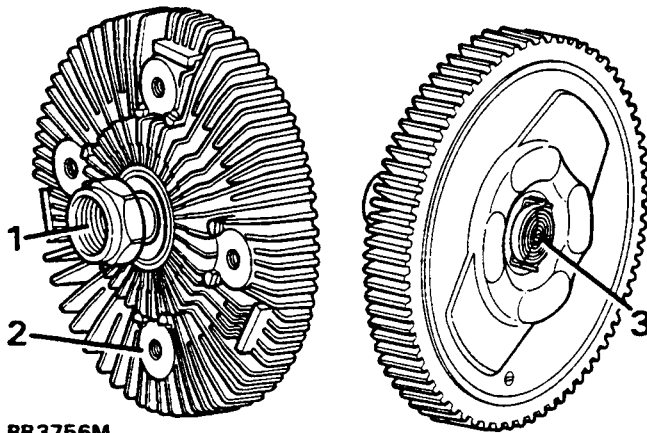
RR3759M



VISCOUS FAN

Description

The viscous drive unit for the engine cooling fan, provides a means of controlling the speed of the fan relative to the running temperature of the engine. The viscous unit is a type of fluid coupling, which drives the fan blades through the medium of a special 'silicone fluid' injected into the unit during manufacture.



RR3756M

1. Drive in from water pump spindle
2. Drive out to fan blades
3. Bi-metal

Operation

The viscous unit consists of two principal components: An inner member 1 which is secured to water pump spindle and is driven by the fan belt. An outer member 2 which has the fan blades attached, houses the working parts and is driven through the medium of the viscous fluid.

The inner and outer members have interlocking annular grooves machined in each, with a small running clearance 3 to allow the silicone fluid to circulate through the valve plate 4.

The unit also contains a valve 5 which is controlled by an external bi-metal thermostat 6.

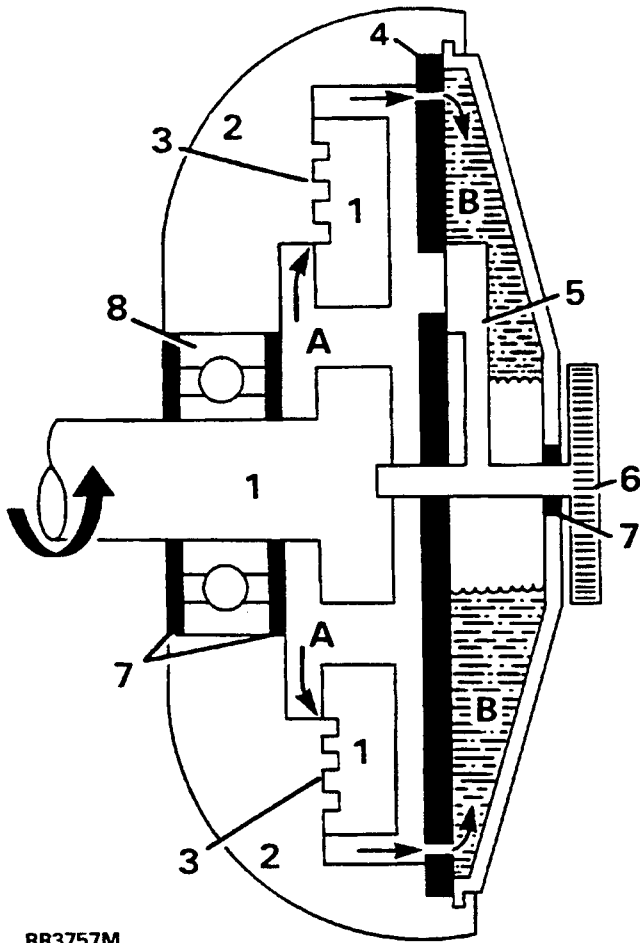
Starting engine from cold

During the time the engine is at rest the silicone fluid drains down, half filling chambers A and B. Thus when the engine is first started sufficient fluid is present in chamber A to provide a positive drive between the members, as is evident by the initial noise of the fan. However within a very short period of time, after starting the engine, the fan speed and noise will decline indicating that the fluid is being centrifuged into chamber B (as seen in RR3757M causing the drive to slip).

Hot conditions

When operating in high ambient temperatures or when stationary in traffic, the bi-metal thermostat will operate and open the valve port between chambers A and B.

Opening the valve (as shown in RR3758M) allows the fluid to circulate between the two members, causing the unit to couple, thus increasing the fan speed and cooling effect.

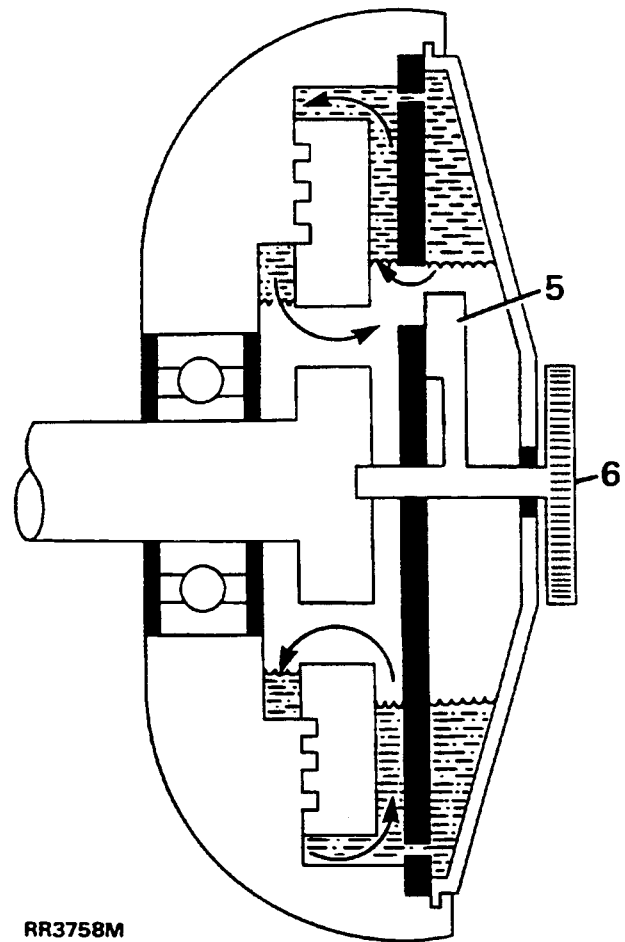


RR3757M

Viscous unit slipping (Engine at normal running temperature)

- 1. Inner member (drive in fast)
- 2. Outer member (drive out slow)
- 3. Running clearance
- 4. Valve plate
- 5. Valve (closed)
- 6. Bi-metal
- 7. Fluid seals
- 8. Ball race
- A. Fluid chamber
- B. Fluid chamber

If the engine speed is increased the degree of slip will also increase to limit the maximum fan speed.



RR3758M

Viscous unit coupled (Hot running conditions)

Bi-metal expanded, valve (open)



ENGINE OVERHEATING

Before conducting any cooling system diagnosis: *See Description and operation, VM Diesel Engine cooling*

1. Is coolant level correct?
NO - Allow engine to cool, top up level to expansion tank seam.
YES - Continue.
2. Is drive belt tension correct?
NO - *See SECTION 10, Maintenance, Under Bonnet Maintenance*
YES - Continue.
3. Is coolant in radiator frozen?
YES - Slowly thaw and drain system. *See Adjustment, Coolant requirements*
NO - Continue.
4. Is air flow through radiator restricted or blocked?
YES - Apply air pressure from engine side of radiator to clear obstruction.
NO - Continue.
5. Are there any external leaks, from water pump, engine gaskets, fast idle thermostat or the heater unit?
YES - Investigate and rectify. *See Adjustment, Coolant requirements*
NO - Continue.
6. Are fan blades fitted correct way round, concave side towards engine?
NO - Rectify.
YES - Continue
7. Is viscous unit operating correctly? *See Description and operation, Viscous fan*
NO - Renew. *See Repair, Viscous coupling, fan blades, pulley and fan cowl*
YES - Carry out a pressure test on radiator cap and system. Check thermostat type, operation and correct fitting. *See ENGINE, Overhaul, Dismantling, Overhaul and Reassembly*

If pressure test leads you to suspect coolant leakage across gaskets, go to check 10, otherwise: Continue.

8. Are the airconditioning fans operating correctly?
See ETM, K5
NO - Rectify.
YES - Continue.
9. Is temperature sender and gauge giving accurate readings?
NO - Substitute parts and compare readings.
YES - Continue.
10. Carry out cylinder pressure test to determine if pressure is leaking into cooling system causing over pressurising and loss of coolant.

If problem is not diagnosed, check the coolant system for engine oil contamination and engine lubrication system for coolant contamination.

If only the coolant system is contaminated suspect a cylinder head gasket.

If both systems are contaminated, suspect the radiator.

If only the lubrication system is contaminated with coolant, suspect leakage past cylinder liner seals or cylinder head gasket.

ENGINE RUNS COLD

Before conducting any cooling system diagnosis: *See Description and operation, VM Diesel Engine cooling*

1. Check operation of viscous unit. *See Description and operation, Viscous fan*
Is viscous unit operating correctly?
NO - *See Repair, Viscous coupling, fan blades, pulley and fan cowl*
YES - Continue.

2. Is thermostat correct type and operating? *See ENGINE, Overhaul, Dismantling, Overhaul and Reassembly*
If problem is not diagnosed: Continue.

3. Are the airconditioning fans operating continuously?
YES - *See ETM, K5*
NO - Continue.

4. Is temperature sender and gauge giving accurate readings? Substitute parts and compare readings. If problem is not diagnosed repeat tests, starting at 1.



COOLANT - VM DIESEL

Drain and refill

Drain

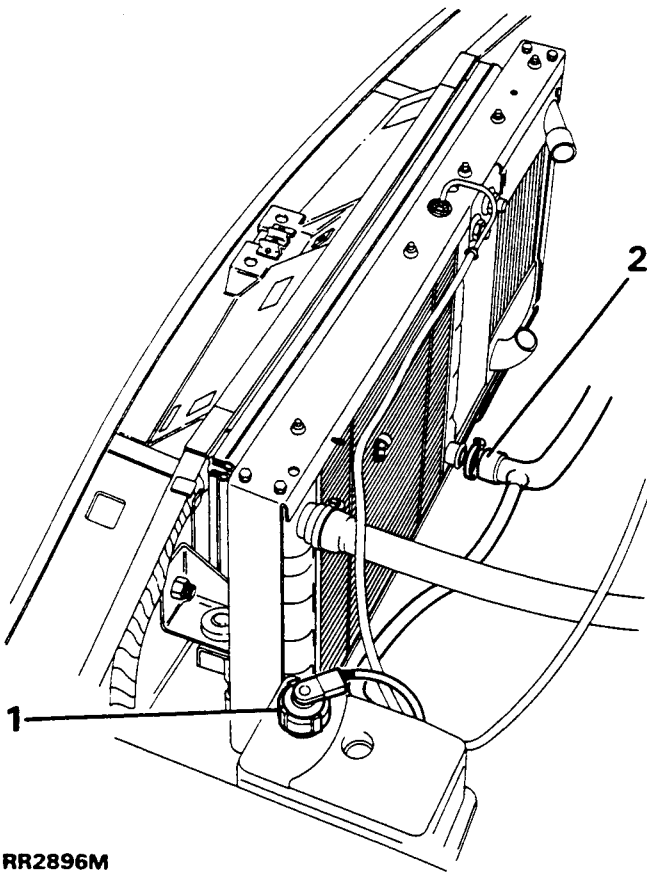


WARNING: Do not remove the expansion tank filler cap when the engine is hot. The cooling system is pressurised and personal scalding could result.



NOTE: The screwed filler cap incorporates a low coolant sensing unit.

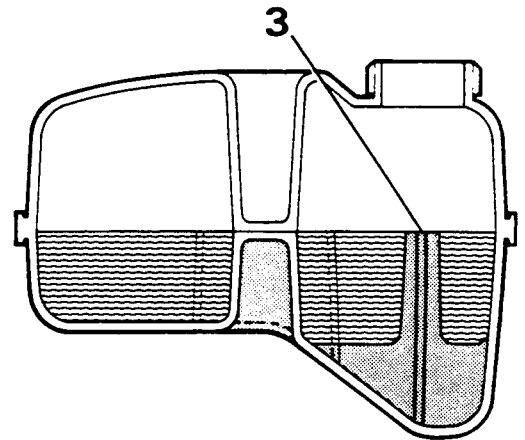
1. Remove expansion tank filler cap.
2. Disconnect bottom hose from radiator and allow coolant to drain into a container. Ensure container is clean if reusing coolant. Reconnect hose after draining and tighten hose clamp.



RR2896M

Refill

3. Add correct mix of coolant into expansion tank, to level of indicator post visible in tank. See **LUBRICANTS, FLUIDS AND CAPACITIES, Information, Anti-freeze**



RR2897M

4. Start engine and run until normal operating temperature is attained, topping up as necessary.
5. Fit expansion tank filler cap.
6. Allow engine to cool, check coolant level and top up to level indicator post.

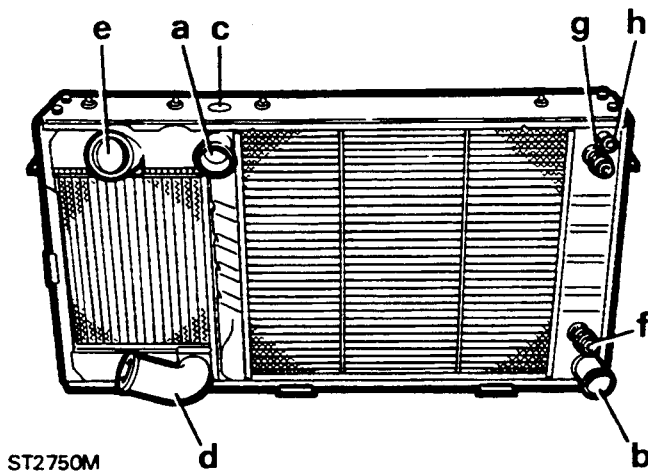


RADIATOR ASSEMBLY



NOTE: The radiator assembly comprises the engine coolant radiator, turbo-charger intercooler and the engine oil cooler.

- a. Engine coolant inlet to radiator.
- b. Engine coolant outlet to waterpump.
- c. Engine coolant filler plug.
- d. High temperature air inlet from turbo-charger.
- e. Cooled air outlet to inlet manifold.
- f. High temperature engine oil inlet to radiator.
- g. Cooled engine oil from radiator to engine.
- h. Bleed outlet to expansion tank.



Remove

1. Disconnect the battery negative lead.

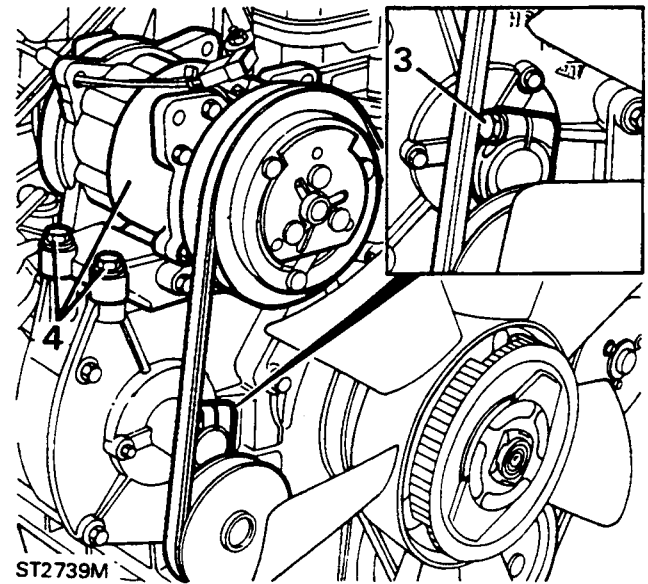


WARNING: Do not carry out the next instruction until the system is cool to avoid personal injury from scalding water.

2. Remove the expansion tank cap and radiator filler plug. Remove bottom hose from the radiator, allow coolant to drain into a suitable container.

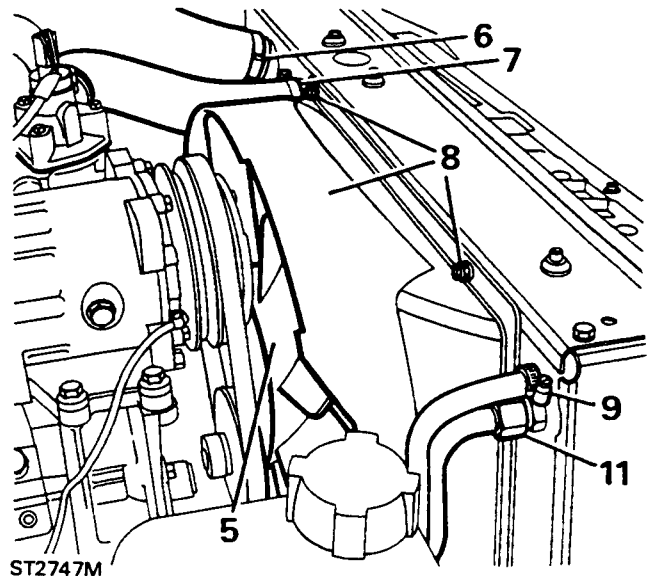
Air conditioning vehicles.

3. Release compressor drive belt tension, remove belt from the pulleys.
4. Remove the four bolts securing the compressor mounting bracket to the engine, move the compressor aside.

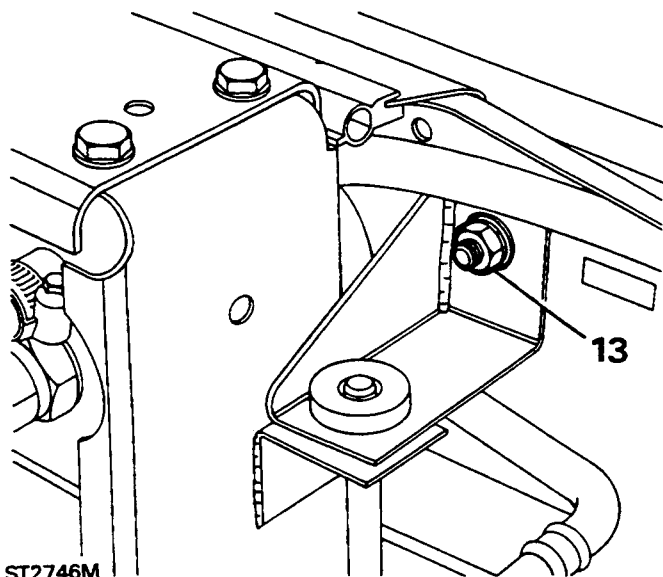


All vehicles.

5. Remove the viscous coupling and fan assembly from the water pump, note that coupling has a left hand thread.
6. Remove the hose, intercooler to manifold.
7. Remove radiator top hose.
8. Release two nuts securing fan cowl to radiator, remove the cowl.
9. Disconnect expansion tank bleed hose from radiator.
10. Disconnect turbo-charger hose at the intercooler.
11. Place a container beneath the oil cooler to catch escaping oil. Disconnect oil pipe connections. Cover, do not plug, ends of pipes to prevent entry of dirt.



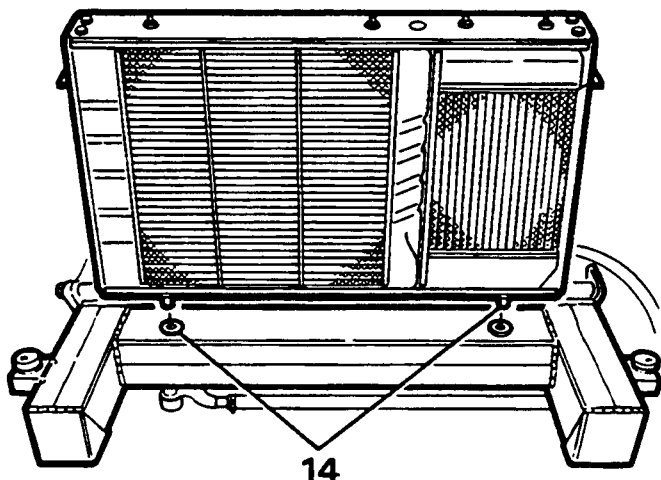
12. The radiator assembly is secured with two bolts and nuts. Viewing the radiator from the front, remove right hand nut and bolt, move the bracket, with the PAS reservoir attached, aside.
13. Remove left hand nut and bolt. Remove radiator assembly from vehicle.



ST2746M

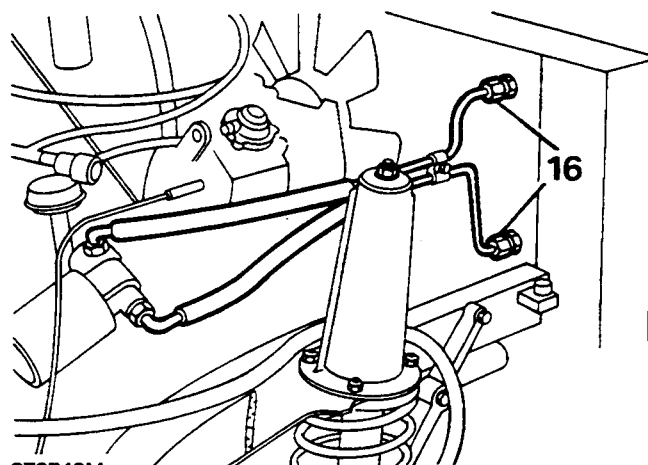
Refit

14. Lower radiator assembly into position. Ensure that the two pegs at the base of radiator locate through the two corresponding grommets in the chassis cross member.



ST2755M

15. Secure radiator brackets to body brackets. Fit PAS reservoir to right hand bracket.
16. Fit oil cooler pipes to radiator connections.

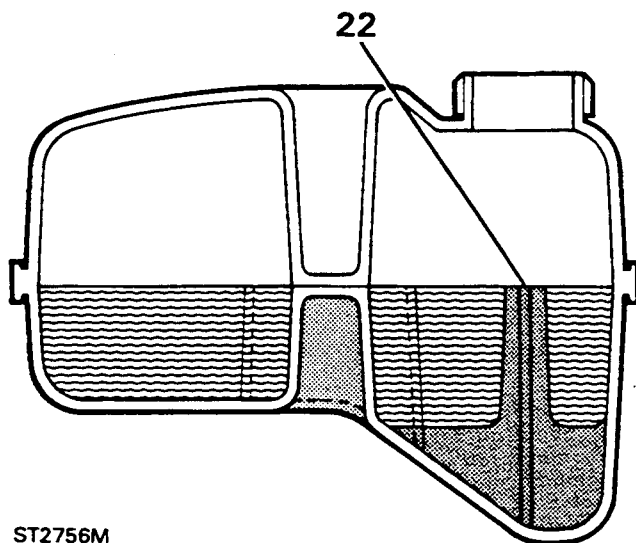
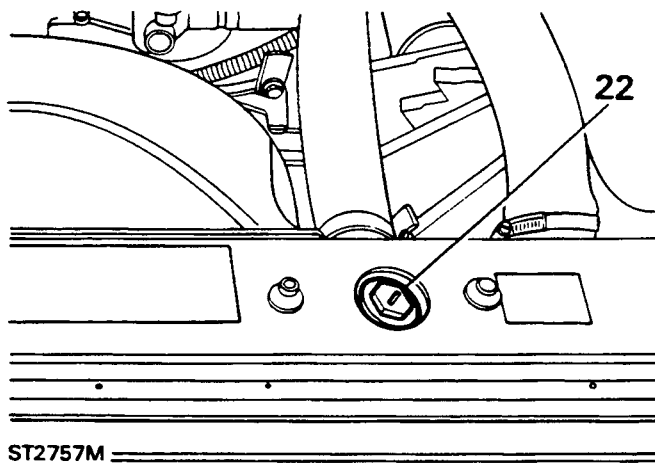


ST2740M

17. Connect expansion tank hose to radiator.
18. Connect turbo-charger to intercooler bottom hose. Connect engine coolant bottom hose.
19. Fit fan cowl. Secure with the two screws to the top of the radiator. Connect intercooler to inlet manifold hose. Connect engine coolant top hose.
20. Fit fan and viscous coupling, note that it has a left-hand thread.
21. Secure the compressor and bracket to the engine, tighten the four bolts to Tighten to **45 Nm**. Fit and tension the drive belt **See SECTION 10, Maintenance, 200Tdi Engines**



Filling Cooling System



22. Remove radiator filler plug. Fill system with a 50% solution of water and anti-freeze. Fit and tighten the plug. Check that expansion tank level is up to the level indicator. Connect the battery, start the engine and run for about five to ten minutes until the thermostat has opened. Also check for oil and coolant leaks while the engine is running. Stop the engine and allow to cool and the oil to drain back into the sump.
23. When cold, check oil level, top up as necessary.
24. Remove radiator filler plug, top up as necessary. Check coolant level in expansion tank. Fit radiator plug. Tighten to **5 Nm**
25. Check air conditioning drive belt tension.
26. Reconnect the battery negative lead.