

COOLING SYSTEM

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COOLING SYSTEM

DESCRIPTION

The engine cooling system consists of a horizontal flow fin and tube type radiator with a pressure sealing cap, a coolant recovery bottle, a belt drive water pump, a thermostat and a belt driven fan.

Water is circulated by pump through cylinder block, head and then through top hose to top tank of radiator. Water passing down through radiator is cooled by air flow through radiator fins.

Heated water is drawn from cylinder head to inlet manifold and heater unit.

** An effective concentration of recommended coolant/inhibitor must be maintained in the cooling system.*

The radiator cap is a pressure sealing type. It incorporates two valves; a pressure release valve and a vacuum release valve, and has two functions:

1. To increase pressure in cooling system and thus raise boiling point of coolant.
2. In conjunction with the coolant recovery bottle, to maintain the coolant in radiator at maximum level.

The coolant recovery bottle is connected to radiator filler neck by a plastic tube. The system operates in the following manner:

As the coolant is heated it expands and pressure in the system increases. When pressure reaches a predetermined point pressure release valve in radiator cap opens and coolant is forced out of radiator and into recovery bottle.

As engine cools the coolant contracts thus creating a vacuum in radiator. The vacuum release valve in radiator cap opens and coolant is drawn back into radiator.

** Coolant recovery system will not operate if the cooling system has an air leak.*

The water pump is a centrifugal type pump. It is mounted at the front of the motor and is belt driven by a pulley mounted to crankshaft.

The electric fan is mounted to the radiator.

The thermostat is a wax pellet type and is incorporated in system to ensure quick engine warm up and to keep the engine at the optimum operating temperature.

A common misconception is that by removing the thermostat the engine will run cooler, this is incorrect, as it can quite often increase the running temperature and induce overheating. The thermostat acts as a restrictor as well as stop coolant flow in a cold engine, if you remove the restriction of the coolant flow, fast flowing coolant does not have time to disperse the store heat from the engine therefore causing the engine to run hotter.

COOLANT

The alloy content of components makes it essential that an effective coolant additive is maintained in the cooling system. Some of the properties of Tectaloy coolant are:

Coolant comes in two different colours Green and Red. Red is the more superior coolant, it has a reagent grade indicator dye built into it and as a result should any corrosive acids build up in the cooling system from exhaust gas leaking past the head gasket the coolant will change from red to brilliant yellow. If the coolant does change colour it should be replaced.

Tectaloy coolant red and green can be mixed, however as a general rule coolant manufactured by different companies should not be mixed even if the coolant is the same colour.

Glycol coolant has several properties other than anti-freeze, it will help lubricate various valves in the cooling system, thermostat slides and water pump seal surfaces. Glycol will also raise the boiling point of coolant.

Coolant Reservoir

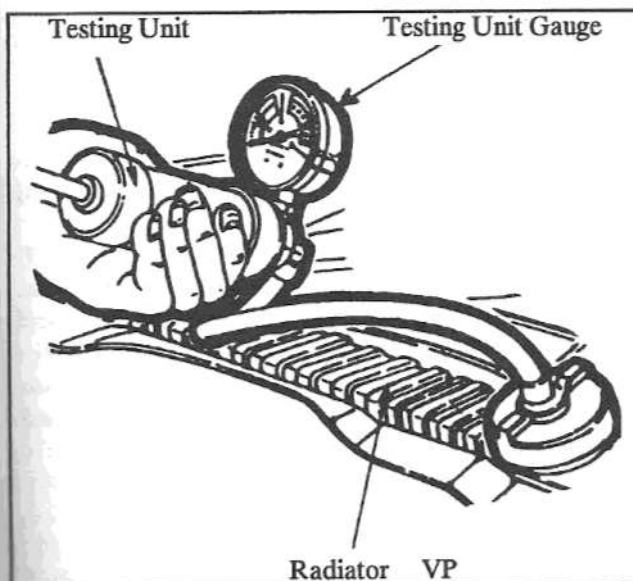


TECTALOY GLYCOL BOILING POINT CHART

Kpa Pressure	PSI Pressure	33% Glycol	55% Glycol
0	0	104.5 ⁰ C	108.5 ⁰ C
25	3.7	110.5 ⁰ C	114.0 ⁰ C
50	7.4	116.5 ⁰ C	119.5 ⁰ C
75	11.0	121.0 ⁰ C	125.0 ⁰ C
100	14.7	125.0 ⁰ C	129.0 ⁰ C
150	22.1	132.5 ⁰ C	136.0 ⁰ C
200	26.4	139.0 ⁰ C	142.5 ⁰ C

PRESSURE TESTING COOLING SYSTEM

1. Fill radiator to within 10 mm of filler neck.
2. Wipe the filler neck sealing surface clean.
3. Using a suitable adaptor, attach pressure tester to filler neck and apply a pressure of 110 to 120 kPa to the cooling system.
4. If pressure gauge holds steady, the system is satisfactory. If pressure drops, continue as follows.
5. Check all points for external leaks, if none are evident after dial gauge shows a drop in pressure, continue test.
6. Remove tester, fit radiator cap and run engine until normal operating temperature is reached, reattach tool, apply recommended pressure and increase engine speed to half throttle. Do not leave tester attached to radiator as this could cause damage to the cooling system because of excessive pressure.

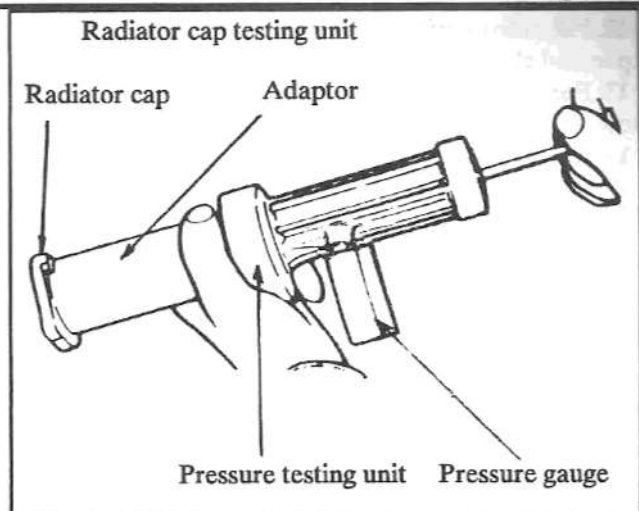


7. If needle on dial fluctuates, it indicates a combustion leak, generally the head gasket.
8. If needle on dial did not fluctuate in step (6), sharply accelerate the engine several times. If an abnormal amount of water emits from tail pipe it indicates a head gasket leak, cracked block or head.

PRESSURE TESTING RADIATOR CAP

CAUTION: To avoid scalding with steam or hot water use the following procedure when removing a radiator cap.

- * Cover cap with several layers of cloth and loosen cap to first notch to release pressure.
 - * When pressure has been released depress cap and turn to remove.
1. Attach a suitable adaptor to pressure tester.
 2. Dip radiator cap in water and lift onto tester adaptor.
 3. Apply the specified pressure to cap. If cap fails to hold pressure, replace cap.
- * When testing large caps with some pressure testers, the pressure relief orifice may be covered by the cap seal. To



overcome this situation an additional 1.5 mm hole may be drilled 10 mm below the existing hole.

TESTING COOLANT RECOVERY SYSTEM

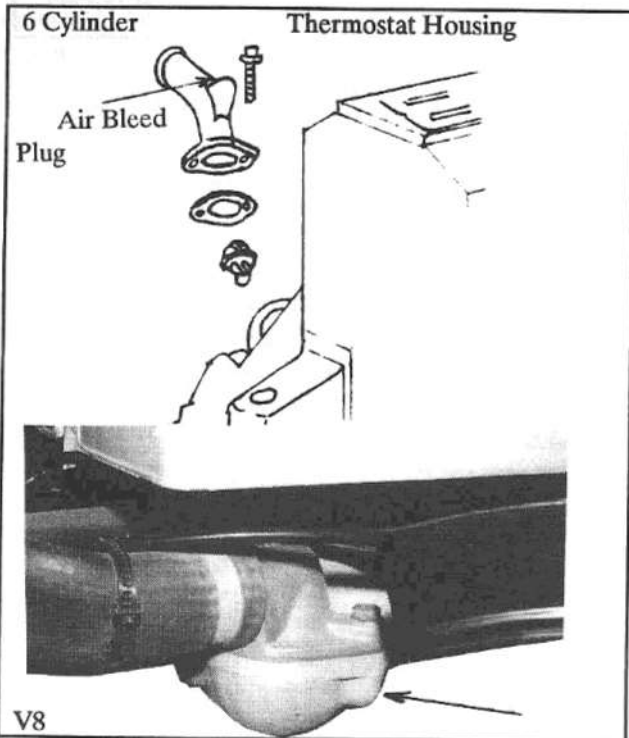
1. Check radiator, check spring action of radiator cap and seal, fit radiator cap.
 2. Loosen bottom hose clamp at radiator and slide hose rearward until a leak occurs.
 3. Check that coolant is drawn from the recovery bottle into radiator.
 4. If coolant is not drawn from recovery bottle check for leaks at radiator filler neck and overflow outlet, radiator cap, and recovery bottle hose.
- * This test should only be carried out with engine cold.
5. Seals can often weep, therefore when replacing components and gaskets it may be an advantage to use a sealant on the gasket, particularly on V6 engines.

COOLING SYSTEM FLUSHING

1. Drain the radiator and remove both radiator hoses.
2. Remove thermostat and re-install housing.
3. Connect a suitable flushing gun to thermostat housing.
4. Fit a drain hose to water pump inlet.
5. Connect flushing gun to water and compressed air supplies.
6. Fully open heater valve.
7. Restrict drain hose, fill block with water and leave water valve open.
8. Open and close air valve to agitate and force away any foreign material, continue operation until water runs clear.
9. For final block flushing, fill block with water and remove drain plug. Use air pressure until water from block drain runs clear.
10. Fit drain plug and thermostat using a new thermostat housing gasket.
11. To pressure flush radiator, disconnect two hoses from engine and attach them to radiator. Attach flushing gun hose to lower radiator tank and drain hose to top tank.

12. Fill radiator with water, leave water valve open, then open and close air valve until water runs clear.
13. For final radiator flushing, attach flushing gun to top hose and repeat flushing operation.
14. Disconnect flushing gun and fit radiator hoses.
15. Fill cooling system using rain or demineralised water, adding specified amount of recommended coolant additive.
16. Run engine for five minutes after normal operating temperature is reached to ensure no air is trapped in system.
17. Check coolant level and top up if necessary.

THERMOSTAT



Remove

1. Drain cooling system to a level below thermostat housing.
2. Remove top radiator hose from thermostat housing.
3. Remove thermostat housing to engine inlet manifold attaching bolts. Remove thermostat housing from engine inlet manifold dispose of gasket.
4. Remove thermostat.

Testing

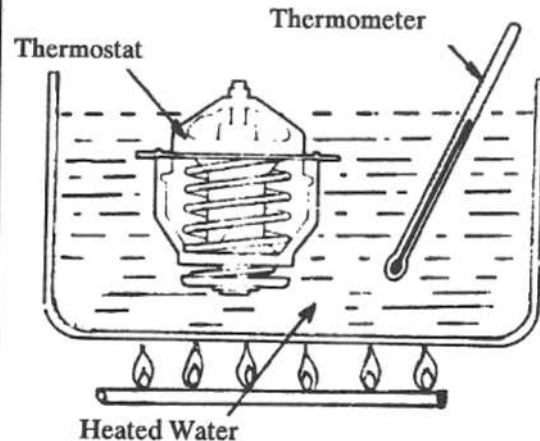
1. Immerse thermostat in container of water and raise temperature while stirring to ensure even heat distribution.
2. Measure water temperature with a suitable thermometer and check that thermostat opening temperature is within specifications.

Thermostat opening temperature; 89-93⁰ Celsius

Thermostat fully open; 106⁰ Celsius

3. If test isn't satisfactory thermostat should be replaced.

* Thermostat and thermometer should be supported so they don't contact container.



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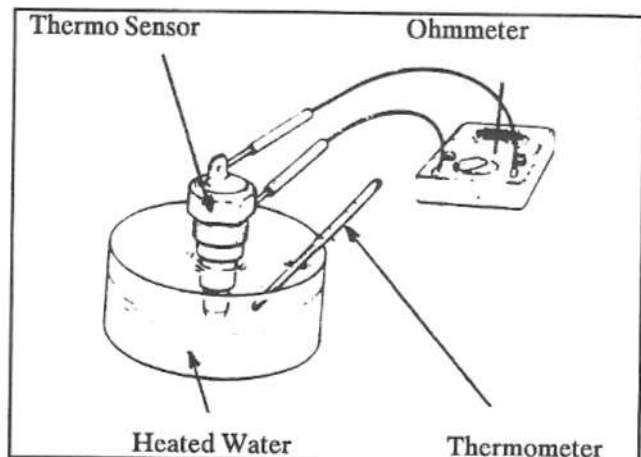
Install

1. Position thermostat, new gasket and thermostat housing onto engine inlet manifold. Fit attaching bolts and tighten to specification
Coolant outlet to cylinder head (Inlet manifold V8) attaching bolt all engines, torque specification; 16-22 Nm.
2. Install radiator lower hose to outlet housing and secure hose clamp.
3. Refill cooling system, check for cooling system leaks.
4. Start engine, and bleed cooling system of any trapped air, otherwise over heating problems may occur.

THERMO SENSOR

Testing

1. Drain cooling system and remove thermo sensor.
2. Immerse thermo sensor in a container of water and raise temperature of water while stirring to ensure even heat distribution.
3. Connect an ohmmeter across the thermosensor and using a suitable thermometer to measure water temperature, check thermo sensor operates within specified range.
NB: Thermo sensor and thermometer should be supported to ensure they don't contact the container.



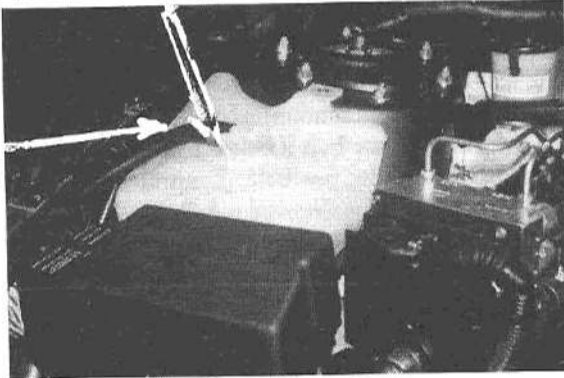
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CHECKING AND FILLING COOLING SYSTEM

Coolant Reservoir
Radiator to reservoir inlet

Max
Cold Fill



If the cooling system needs to be drained, the following instructions must be obeyed when refilling the cooling system to ensure that all air is bled from system.

1. Adjust heater control to maximum.

2. Have a coolant mixture such as Tectaloy coolant on hand to fill system.

Coolant Specification:

V6 Engine specification: HN 2043 e.g. Tectaloy VPlus +

V8 Engine specification: HN 2043 e.g. Tectaloy VPlus +

* Do not combine different types of anti-freeze or corrosion inhibitors as they may be incompatible. If a different type has been used in the cooling system rinse the system with clean water.

3. Remove air bleed screw located in the engine coolant outlet pipe.

4. Remove radiator cap and fill cooling system with coolant mixture.

5. Remove top from coolant reservoir, top up system.

6. When the coolant is cold the coolant level should be at the FULL mark. Depending on the engine temperature the level will vary.

7. Start engine and run it at 2000 rpm for 10 minutes to open thermostat and purge air from system. Fill supply tank to "FULL/MAX" mark.

8. Replace cap.

V6 - REPLACE DRIVE BELT and ADJUST BELT TENSION

1. Loosen the locknut on the automatic adjusting idler pulley mounting stud and turning the stud, relieve the tension on the drive belt.

2. Remove the belt if belt is to be removed.

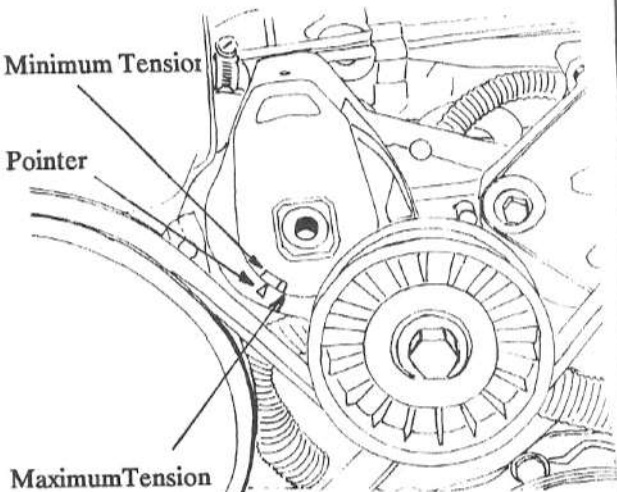
3. Install new drive belt (if applicable) on crankshaft, alternator, power steering, air conditioner and water pump pulleys.

Automatic belt tensioner

Minimum Tension

Pointer

Maximum Tension



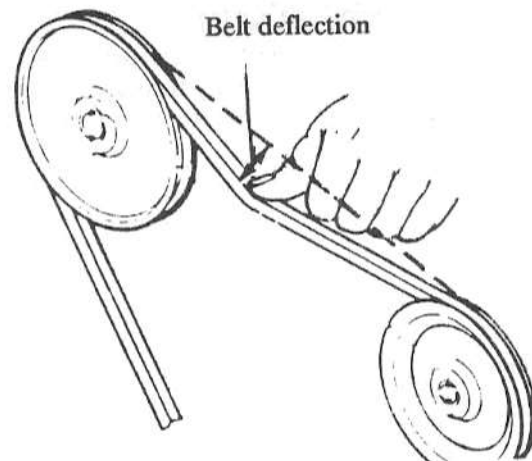
4. Adjust belt, turn the automatic adjuster idler pulley mounting stud to adjust tension.

5. Check belt wear reference marks on tensioner. Install a new belt if tension is not within reference marks.

BELT TENSION

Apply a thumb pressure of 100N (10kg) to the mid-point of the longest convenient span of belt, and noting the belt deflection as shown, check the tension of the belt.

Apply a thumb pressure of 100N (10kg) to the mid-point of the longest convenient span of belt



ALTERNATOR WATER PUMP.

NEW BELT DEFLECTION (mm) 7-8

USED BELT DEFLECTION (mm) 9-10

POWER STEERING PUMP

NEW BELT DEFLECTION (mm) 8-9

USED BELT DEFLECTION (mm) 10-11

AIRCONDITIONING

NEW BELT DEFLECTION (mm) 8-9

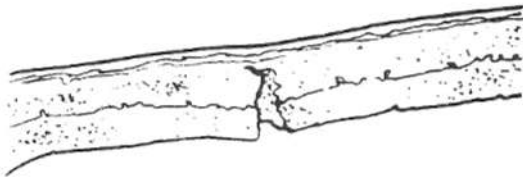
USED BELT DEFLECTION (mm) 10-11

Frayed Belt



NOTE: Ensure V surfaces make proper contact with pulleys prior to engine starting, otherwise belt damage will occur.

Glazed Belt surface and Cracking

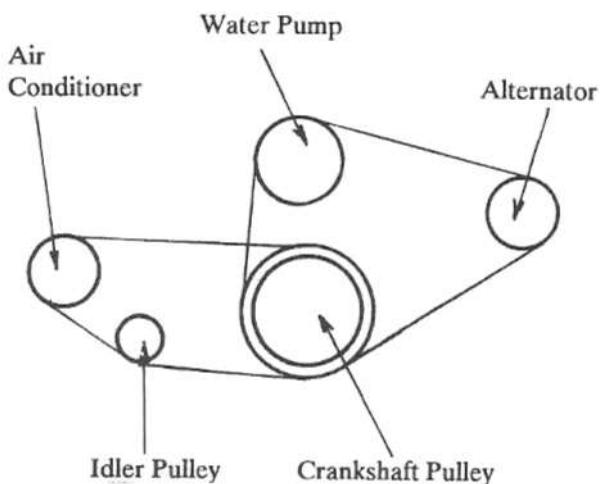


V8 - DRIVE BELT REPLACEMENT

Conditions requiring belt replacement are excessive wear, rib chunk-out, severe glazing, frayed cords, etc. Replace any belt exhibiting one of these conditions.

V8 Drive belt

Drive Belt Layout



Remove and Install

1. Loosen the locknut on the idler pulley mounting stud and turning the stud, relieve the tension on the power steering pump belt.
2. Loosen the alternator mounting bolts and the adjusting arm pivot bolt.
3. To loosen the belt, turn the adjusting nut on the alternator upper mounting bolt.
4. Remove the belt if belt is to be removed.
5. Install new fan belt (if applicable) on crankshaft, alternator and water pump pulleys.
6. As described, adjust belt. Install power steering pump belt.
7. Turn the idler pulley mounting stud to adjust to specified tension.
8. Tighten the lock nut.

Rotate automatic tensioner (V8). Remove old belt. Install new belt over pulleys.

COOLANT RECOVERY RESERVOIR

1. Remove cap (with hoses still attached) from the coolant recovery reservoir.
2. Detach tank attaching screws, remove tank.

Inspect

1. Empty contents from tank assembly and clean tank assembly with water and dry, using compressed air.
2. Check tank assembly for damage, e.g. abrasions, cracks or distortion. Replace if required.

Install

Install the tank assembly in the reverse of removal procedures, noting the following points:

1. Refill cooling recovery reservoir and cooling system with the correct coolant.
2. Check cooling system for leaks.

Coolant Reservoir
Radiator to reservoir
inletMax
Cold Fill

COOLING SYSTEM

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6 CYLINDER WATER PUMP**Remove**

1. Let the engine cool to ambient temperature (less than 50 degrees Celsius) then remove radiator cap.

* Whilst the engine coolant temperature is above 50 degrees Celsius do not remove the radiator cap, as personal injury may result.

2. Remove fan shroud and electrical fan, if you require, as this will give you a larger area to work in.

3. Loosen water pump pulley to hub bolts.

4. Remove the drive belt by loosening the bolt on the automatic belt tensioner. (This will slacken off the drive belt enabling the belt to be removed).

5. Unfasten radiator lower hose clamp at engine front cover connection, detach hose from front cover and allow coolant to drain into a suitable splash tray.

6. Remove water pump attaching bolts, remove water pump and pulley to cylinder block joining bolts.

7. Lightly tap water pump housing to separate it from the cover and spacer plate, remove gaskets and clean surfaces of any old gasket material, if the surfaces are not clean for installation the new gaskets may leak.

8. Inspect water pump for damage and excessive corrosion or worn bearings.

* The water pump is not a repairable unit, and must be replaced if it is damaged.

Install

1. Cover threads of bolts with Loctite 242 sealant or equivalent.

* Do not apply sealant to the first 2-3mm of thread on each bolt.

2. Install water pump, new gaskets, spacer plate and tighten bolts to the correct torque specifications.

Water pump to cylinder block attaching bolt torque specification - bolts: 20-40 Nm.

Water pump to front cover attaching bolt torque specification - bolts: 8-14 Nm.

3. Install pump pulley and secure bolts.

Water Pump Pulley Attaching bolts: 8-16Nm

4. Install drive belt as previously described under replace and adjust drive belt.

5. Replace the radiator hose to front cover connection and secure hose clamp. Refill cooling system.

6. Check for coolant leaks and connect battery earth cable.

7. Test drive vehicle to make sure the cooling system is working correctly.

V8 WATER PUMP**Remove**

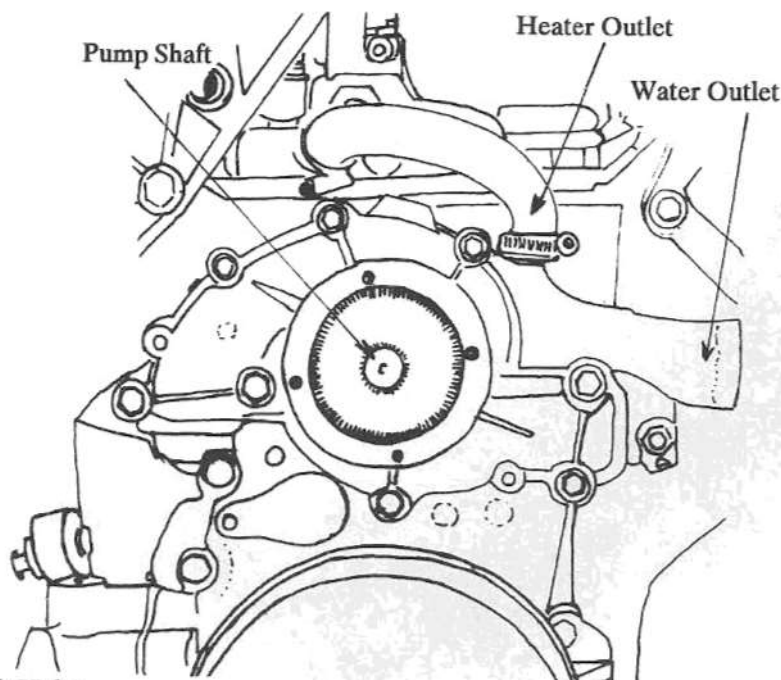
1. Let the engine cool to ambient temperature (less than 50 degrees Celsius) then remove radiator cap.

* Whilst the engine coolant temperature is above 50 degrees Celsius do not remove the radiator cap, as personal injury may result.

2. Remove fan shroud and fan and fan clutch.

4. Remove the drive belt by loosening the alternator bolts. (This will slacken off the drive belt enabling the belt to be removed).

* Water pump 6 cylinder



5. Unfasten radiator lower hose clamp at the engine connection, detach hose from engine and allow coolant to drain into a suitable splash tray.

6. Remove water pump attaching bolts, remove water pump.

7. Remove gaskets and clean surfaces of any old gasket material, if the surfaces are not clean for installation the new gaskets may leak.

8. Inspect water pump for damage and excessive corrosion or worn bearings.

** The water pump is not a repairable unit, and must be replaced if it is damaged.*

Install

1. Cover threads of bolts with Loctite 242 sealant or equivalent.

*** Do not apply sealant to the first 2-3mm of thread on each bolt.**

2. Install water pump, new gaskets, spacer plate and tighten bolts to the correct torque specifications.

Water pump to cylinder block attaching bolt torque specification - bolts: 25-30 Nm.

3. Install pump pulley, fan and fan clutch and secure bolts to specification.

Water Pump Pulley Attaching bolts: 28-35Nm

4. Install drive belt as previously described under replace and adjust drive belt.

5. Replace the radiator hose to front cover connection and secure hose clamp. Refill cooling system.

6. Check for coolant leaks and connect battery earth cable.

7. Test drive vehicle to make sure the cooling system is working correctly.

V6 RADIATOR

*** Whilst the engine coolant temperature is above 50 degrees Celsius do not remove the radiator cap or hoses, as personal injury may result.**

Remove

1. Disconnect wiring harness to cooling fan motor, push side clip on connector.

2. Remove coolant overflow hose from radiator filler neck connection.

3. Detach radiator lower hose from radiator connection and allow coolant to drain from radiator. Remove radiator upper hose from radiator.

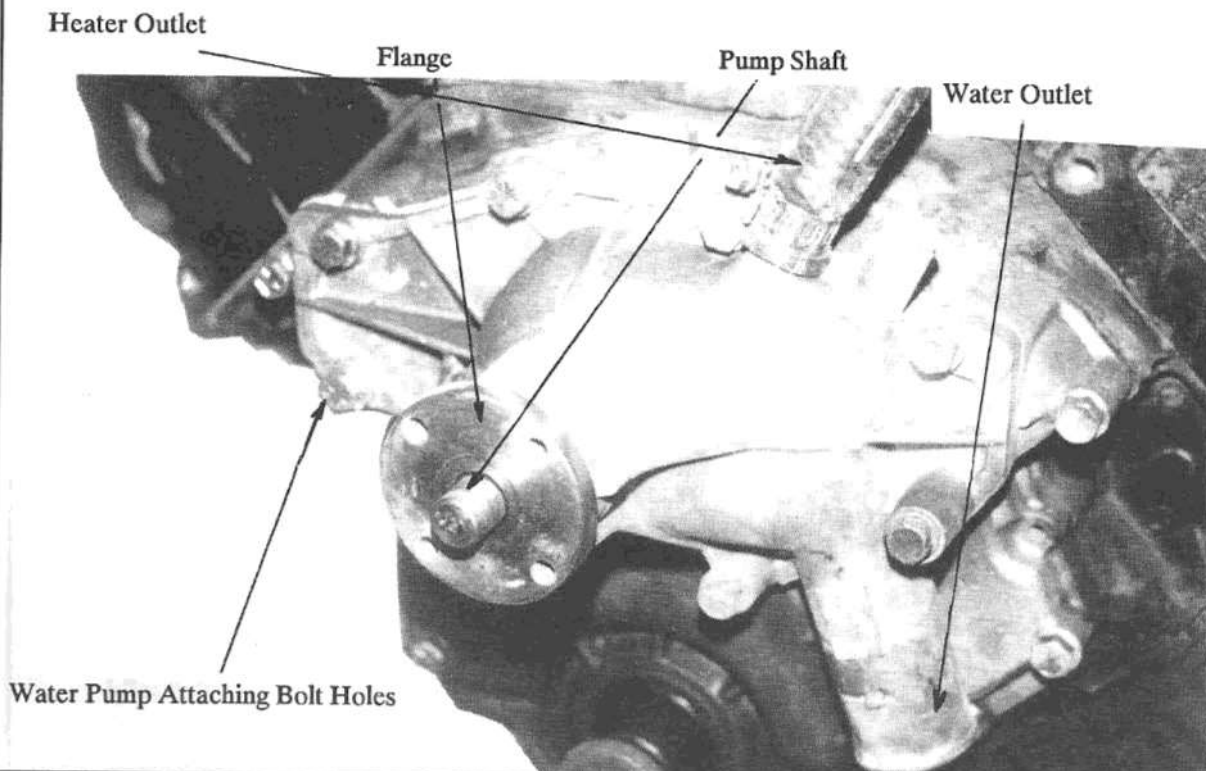
4. Loosen transmission oil cooler line hose clamps, if the vehicle is equipped with automatic transmission and disconnect hoses from radiator oil cooler unions.

6. Remove radiator from attaching clips with a screw driver.

7. Lift radiator upwards out of lower insulators and remove radiator from vehicle.

Install

V8 Water Pump



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1. Prior to installing radiator, check core to ensure that there is no foreign matter in core fins. Clean out between core fins with compressed air.

2. Install the radiator by lowering the radiator into the lower insulators. Fit the upper section of the radiator pins into the insulators.

3. Locate the front radiator shroud to the top of the radiator.

4. Install cooling fan and shroud assembly to radiator joining bolts to the correct torque specification, if removed.

Shroud to radiator attaching bolt torque : 3-4.5 Nm.

V8 RADIATOR

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4. Loosen transmission oil cooler line hose clamps, if the vehicle is equipped with automatic transmission and disconnect hoses from radiator oil cooler unions.

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Install

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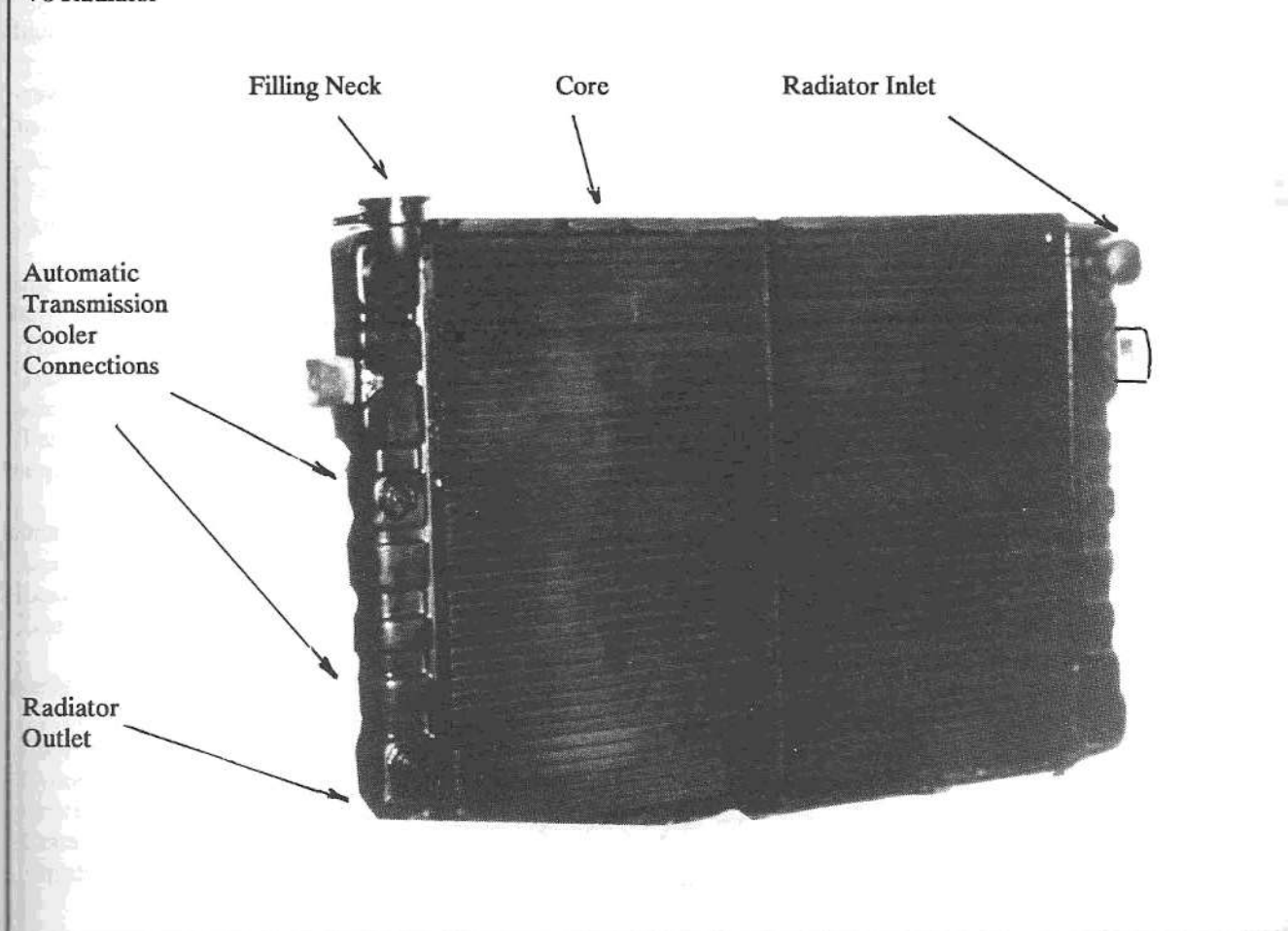
3. Locate the front radiator shroud to the top of the radiator.

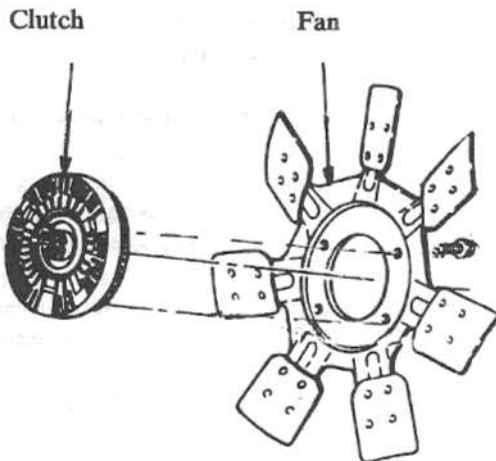
4. Install cooling fan and shroud assembly to radiator joining bolts to the correct torque specification, if removed.

Shroud to radiator attaching bolt torque : 3-4.5 Nm.

FAN CLUTCH**Fan Clutch**

As water temperature of engine and coolant in radiator increases a bi-metal coil or strip in the front of the fan

V6 Radiator

Fan Assembly

clutch regulates the amount of oil that is allowed into the drive area of the clutch. When the temperature is at its highest above 200⁰ F the drive unit allows the clutch to drive at its maximum speed.

Remove

1. Remove the radiator shroud and detach battery earth cable at battery.
2. . Remove two fan shroud retaining screws.
3. Hold the water pump hub and loosen four bolts attaching the clutch, fan and pulley to the water pump.
4. Raise the fan and the fan and clutch assembly from the vehicle together.

5. Disconnect the fan from the clutch by taking out the four bolts.

Install

1. Join the fan to the clutch and place the four bolts into position.
 3. Apply 'Loctite 242' or equal to the water pump hub bolt thread.
 4. Join the fan/clutch assembly together with the water pump on the vehicle.
 5. Tighten the four attaching bolts to the water pump hub and torque to specification.
- Torque Clutch to Water Pump specification: 40 Nm.**
6. Install the screws securing the top of the shroud to the radiator.

PROBLEM SOLVING AND DIAGNOSIS

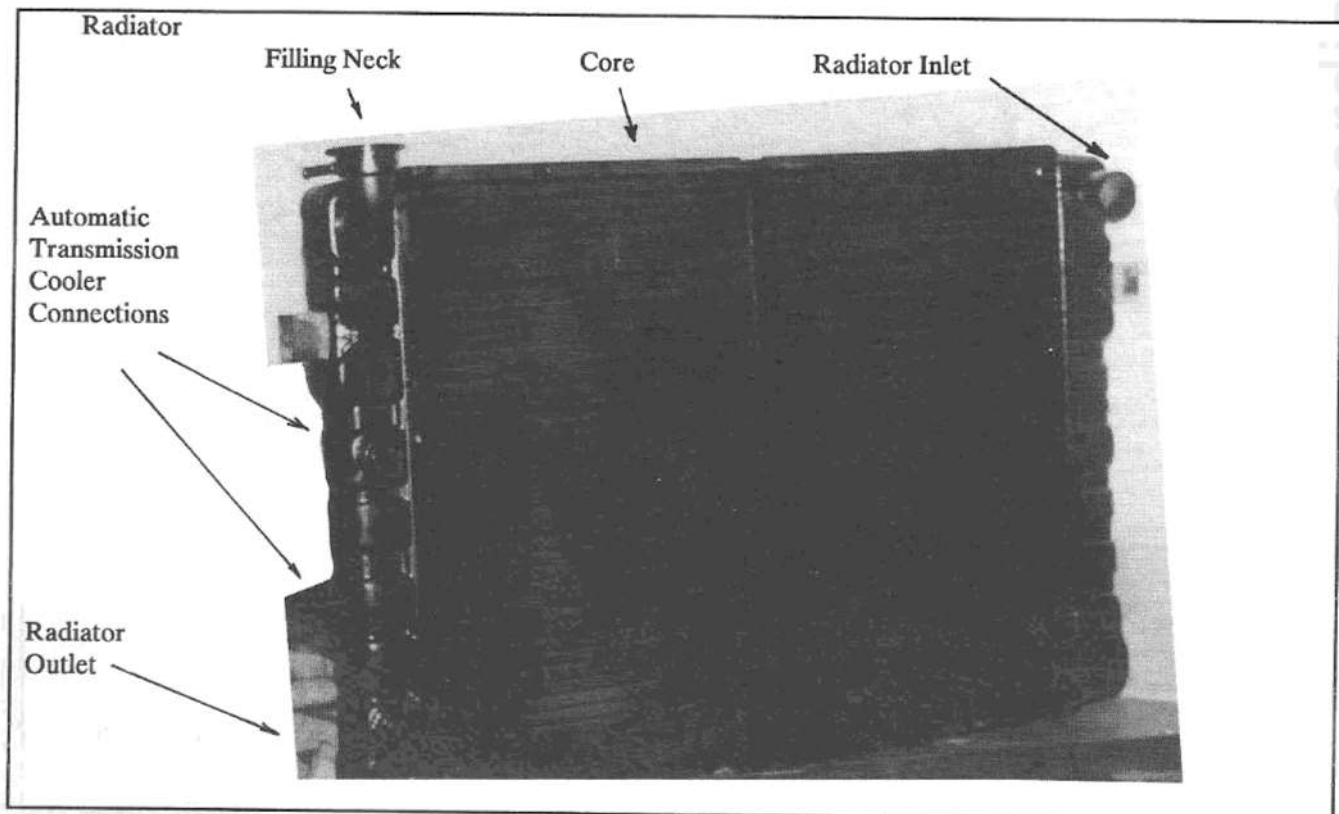
Radiator Inspection.

1. Check for damage to fins and core tubes from stones.
2. Check the fins for foreign matter such as insects, dust and mud, as this foreign matter will hinder air flow and possibly cause over heating problems.

Clean the radiator fins of any foreign matter with an air hose, blowing the air from the back of the radiator.

3. Check inside the radiator for foreign matter that could block the tubes.

A blocked radiator is the most common cause of over-heating, as the tubes become blocked with corrosion or



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fouling caused by incompatible coolants mixed in your cooling system.

There are two methods of cleaning a blocked radiator.

(a) Use a radiator flush.

(b) Pull the radiator down by removing the end tanks and clean the tubes by rodding each tube.

There are two basic types of radiator flush in the market place, one is the strong alkaline type and the other is acid based. Each of these products are suited to different types of cleaning. The acid base flushes are more effective for scale removal but nowhere near as effective as the alkaline flushes in the removal of oils and general organic materials. Acid based flushes usually have a reasonably severe attack rate on the metal components in the cooling system.

The alkaline flushes will attack aluminium components if left in contact at elevated temperatures for extended periods of time. It is most important to strictly follow the manufacture's instructions regarding the time a flush should be left in the cooling system.

Radiator flush should be seen more in the light of preventive maintenance rather than a problem solver.

Quick Reference Diagnosis Chart

Engine Overheats

- Loss of coolant.
- Belt tension incorrect.
- Radiator Fins obstructed.
- Thermostat stuck closed, or otherwise defective.
- Cooling system passage blocked by rust, scale or other foreign material.
- Water pump inoperative.
- Fan drive clutch defective.
- Ignition initial timing incorrect.

Engine Fails to Reach Normal Operating Temperature or has Wrong Indicated Temperature.

- Thermostat stuck open or of incorrect heat range.
- Temperature sending unit defective (causing gauge to indicate low engine temperature).
- Temperature gauge defective (not indicating true engine temperature) or incorrectly installed.

Loss of Coolant

- Leaking radiator, or transmission oil cooler.
- Leaking coolant supply tank.
- Loose or damaged hose connections

Water leaking.

- Cylinder head gasket defective.
- Improper tightening of cylinder head bolts.
- Cylinder block or head core plunge leaking.
- Cracked or warped cylinder head or block.
- Cracked intake manifold.
- Supply tank pressure cap defective or of the wrong type.

TESTING**Visual Inspection**

Check for leakage at:

1. All hoses and hose connections.
2. Radiator seams and radiator core.
3. All engine core plugs and drain plugs.
4. Edges of cooling system gaskets.
5. Transmission oil cooler.
6. Vehicle heating system components.
7. Water pump.
8. Examine all dipstick for evidence of engine oil contaminated with coolant.
9. Check supply tank for evidence of oil coolant (leakage at transmission oil cooler).

SPECIFICATIONS

Radiator Cap Pressure Rating (V6)	120-150 kPa
Radiator Cap Pressure Rating (V8)	100kPa
Cooling System Capacity (6 Cylinder)	10 Litres
Cooling System Capacity (V8)	12 Litres

Coolant**Coolant Corrosion Inhibitor**

V6	HN 2043	Eg. Tectaloy Plus +
V8	HN 2043	Eg. Tectaloy Plus +

Thermostat

Type Power element (wax pellet)
Start to open at 87⁰C - 90⁰C.

V6 Fully open at	106 degrees celsius max.
V8 Fully open at	100 degrees celsius max.

TORQUE WRENCH**SPECIFICATIONS****Nm**

Cylinder Block Drain Plugs	30-50
Thermostat to Inlet Manifold Bolts (V6)	20-34
Thermostat to Inlet Manifold Bolts (V8)	20-25
Water Pump to Cylinder Block Bolts	25-30
Fan Clutch to Water Pump Bolts (V8)	12-15
Shroud to Radiator Attaching Bolts	3-4.5
Oil Cooler to Side Tank Nuts	20

Memo

