COOLING SYSTEM

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GENERAL

SPECIFICATIONS

Cooling method	Water-cooled, pressurized. Forced circulation with electrical fan	
Cooling system		
Quantity	6 lit (6.3 U.S.qts., 5.2 Imp.qts.)	
Radiator cap		
Main valve opening pressure	74-103 kPa (10.7-14.9 psi, 0.75-1.05 kg/cm^2)	
Vacuum valve opening pressure	-6.86 kPa (-1.OO psi, -0.07 kg/cm^2)or less	
Engine coolant pump	Centrifugal type impeller	
Thermostat		
Valve opening temperature	88° (190°F)	
Full-opening temperature	100°C (212°F)	
Engine coolant temperature sender		
Resistance	90.5-117.5 4 at 70°C (158°F) 21.3-26.34 at 115°C (239°F)	
Thermo switch A (On radiator)		
Operating temperature	[1.6 Eng.]	[1.8 Eng.]
OFF → ON	85±3°C (185±5.4°F)	90±3°C (194±5.4°F)
ON → OFF	81±3°C (177.8±5.4°F)	83°C (191.4°F) or more
Therm° switch A (On radiator)		
Operating temperature		
OFF → ON	103°C (217.4°F)	
ON → OFF	110±3°C (230±5.4°F)	
Therm° switch [On engine coolant outlet fitting]		
Operating temperature		
OFF → ON	105±3°C (221±5°F)	
ON → OFF	98°C (208.4°F) or more	
Engine coolant temperature sensor		
Resistance	2.21-2.69 kΩ at 20°C (68°F) 264-328 Ω at 80°C (176°F)	

SERVICE STANDARD

Standard value	
Coolant concentration	50% [Except tropical areas] 40% [Tropical areas]

SEALANT

Engine coolant temperature sender	Three bond No.231 or equivalent
Engine coolant temperature sensor assy	LOCTITE 962T or equivalent

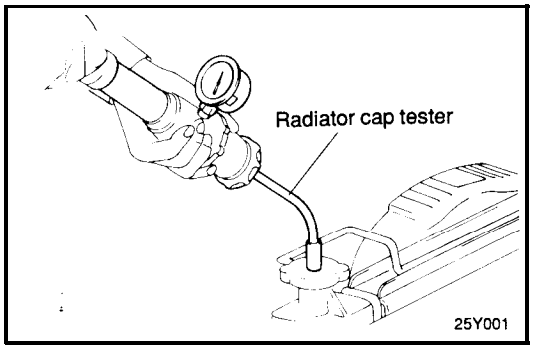
TIGHTENING TORQUE

	Nm	kg.cm	lb.ft
Generator support nut	20-25	200-250	14-18
Generator adjuster lock bolt	12-15	120-150	9-11
Engine coolant pump to cylinder block	12-15	120-150	9-11
Engine coolant pump to cylinder block (generator brace mounting)	20-27	200-270	14-20
Engine coolant pump pulley	8-10	80-100	6-7
Engine coolant temperature sender	10-12	100-120	7-9
Engine coolant temperature sensor	20-40	200-400	14-29
Engine coolant outlet fitting bolt	17-20	170-200	12-14

TROUBLESHOOTING

Symptom	Probable cause	Remedy
Low coolant level	Leakage of coolant	
	Heater or radiator hose	Repair or replace parts
	Faulty radiator cap	Tighten or replace clamps
	Thermostat housing	Replace gasket or housing
	Radiator	Replace
	Engine coolant pump	Replace parts
Clogged radiator	Foreign material in coolant	Replace coolant
Abnormally high coolant temperature	Faulty thermostat	Replace parts
	Faulty radiator cap	
	Restricted to flow in cooling system	Clear restriction or replace parts
	Loosen or missing drive belt	Adjust or replace
	Faulty engine coolant pump	Replace
	Faulty temperature sender or wiring	Repair or replace
	Faulty electric fan	Repair or replace
	Faulty thermo-switch in radiator	Replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature sender or wiring	Repair or replace
Leakage from oil cooling system	Loose connections	Tighten
	Cracked or damaged	Replace
	Hoses	
	Pipes	
	Oil cooler	
Inoperative electrical cooling fan	Damaged	Repair or replace
	Thermo sensor	
	Electrical motor	
	Radiator fan relay	
	Wiring	

COOLANT LEAK CHECK



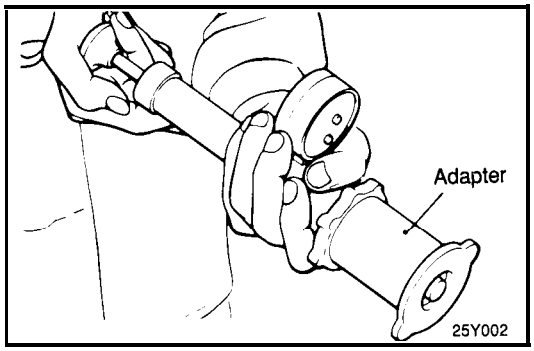
1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 150 kPa (21 psi, 1.53 kg/cm^2) pressure. Hold for two minutes, while checking for leakage from the radiator, hose or connections.

CAUTIONS

1) Radiator coolant may be extremely hot. Do not open the system while hot, or scalding water could spray out causing personal injury. Allow vehicle to cool before servicing this system.
2) Be sure to completely clean away any moisture from the places checked.
3) When the tester is removed, be careful not to spill any coolant from it.
4) Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.

4. If there is leakage, repair or replace the appropriate part.

RADIATOR CAP PRESSURE TEST



1. Use an adapter to attach the cap to the tester.
2. Increase the pressure until the indicator of the gauge stops moving.

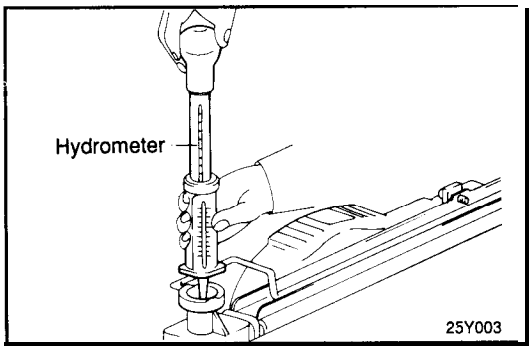
Main valve opening pressure	81-108 kPa (11.8-15.6 psi, 0.83-1.10kg/cm^2)
Limit	65 kPa (9.2 psi, 0.66 kg/cm^2)

3. Check that the pressure level is maintained at or above the limit.
4. Replace the radiator cap if the reading does not remain at or above the limit.

NOTE

Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an improper indication.

SPECIFIC GRAVITY TEST



1. Measure the specific gravity of the coolant with a hydrometer.
2. Measure the coolant temperature, and calculate the concentration from the relation between the specific and temperature, using the following table for reference.

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

Coolant temperature °C (°F) and specific gravity					Freezing temperature °C (°F)	Safe operating temperature °C (°F)	Coolant concentration (Specific volume)
10 (50)	20 (68)	30 (86)	40 (104)	50 (122)			
1.054	1.050	1.046	1.042	1.036	-16 (3.2)	-11 (12.2)	30%
1.063	1.058	1.054	1.049	1.044	-20 (-4)	-15 (5)	35%
1.071	1.067	1.062	1.057	1.052	-25 (-13)	-20 (-4)	40%
1.079	1.074	1.069	1.064	1.058	-30 (-22)	-25 (-13)	45%
1.087	1.082	1.076	1.070	1.064	-36 (-32.8)	-31 (-23.8)	50%
1.095	1.090	1.084	1.077	1.070	-42 (-44)	-37 (-35)	55%
1.103	1.098	1.092	1.084	1.076	-50 (-58)	-45 (-49)	60%

Example
The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at coolant temperature of 20°C (68°F).

CAUTION
If the concentration of the coolant is below 30%, the anti-corrosion property will be adversely affected. In addition, if the concentration is above 60%, both the anti-freeze and engine cooling properties will decrease affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.
Do not use together with another brand.

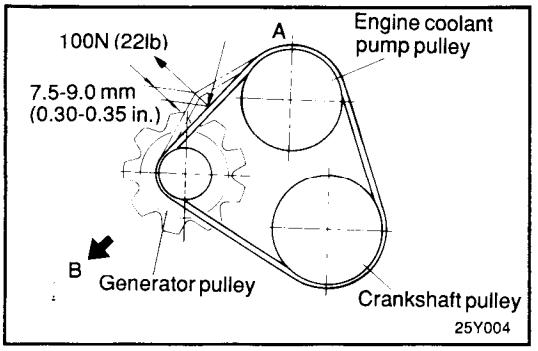
RECOMMENDED COOLANT

Antifreeze	Mixture ratio of anti-freeze in coolant	
ETHYLENE GLYCOL BASE FOR ALUMINUM	Tropical area	40%
	Other area	50%

DRIVE BELT TENSION ADJUSTMENT

The belt must be adjusted to the following specifications.
1. When 100 N (22 lb) (tension or compression) is given perpen dicularly to belt at center “A”, sag is to be "L" mm.
2. Or, tension gauge must read “T” at center “A”.

	New belt installed	Used belt installed
Deflection	7.5 - 9.0 mm (0.30-0.35 in.)	10.0 mm (0.39 in.)
Tension (T)	50 - 70 kg (110-154 lb)	40 kg (88 lb)



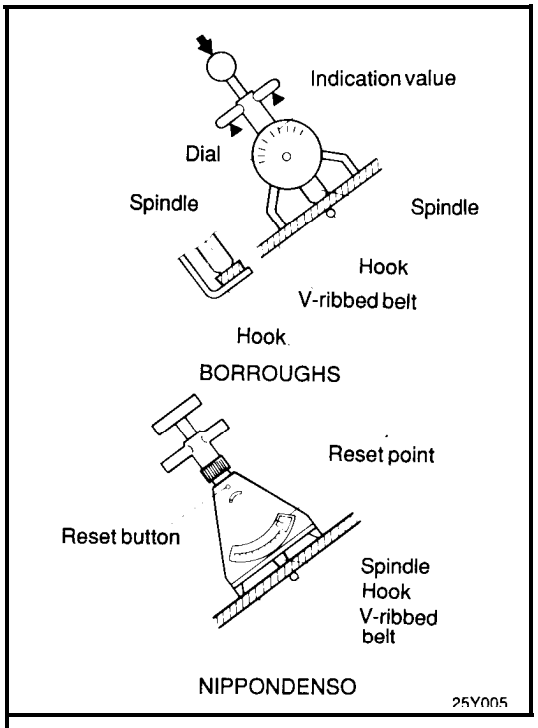
USAGE OF TENSION GAUGE

Using Tension Gauge

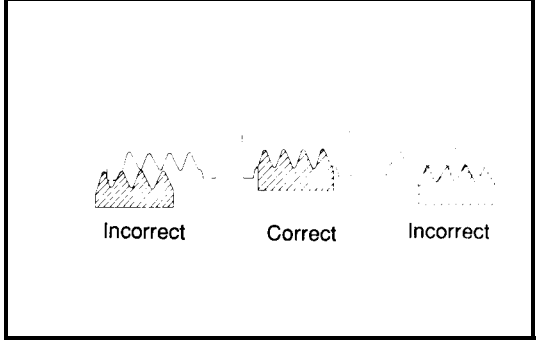
BORROUGHS BT-33-73F Type
NIPPONDENS BTG-2 Type

Measuring Method

1. Press down on the tension gauge handle and insert the belt between the spindle and hook of the gauge.
2. Release the handle and read the measurement on the gauge.



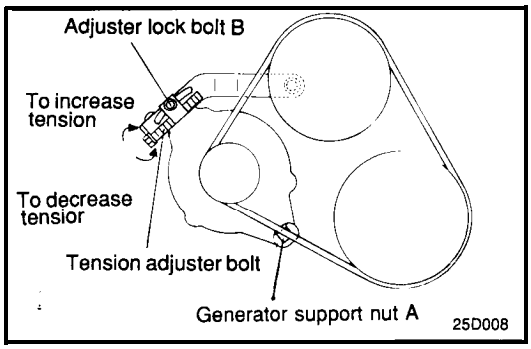
NOTE
1. Belt which had been in operation for 5 minutes or more, must be adjusted to the used belt specifications.
2. Ensure that the belt is installed correctly, as shown in the illustration.
3. A loose belt will produce a high-pitched squealing noise.
4. A belt that is too is tight will damage the generator and engine coolant pump bearings.



DRIVE BELT AND PULLEY

Removal

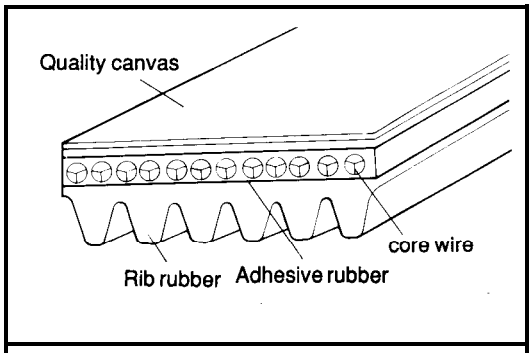
1. Loosen generator support nut “A” and the belt tension adjuster lock bolt “B”.
2. Rotate the adjuster bolt counterclockwise to relieve belt tension, and remove the belt.
3. Remove the water pump pulley bolts and remove the engine coolant pump pulley.



Tightening torque
Generator support nut A ..... **20-25 Nm (200-250 kg.cm, 14-18 lb.ft)**
Adjuster lock bolt B ..... 12-15 Nm (120-150 kg.cm, 9-11 lb.ft)

Inspection

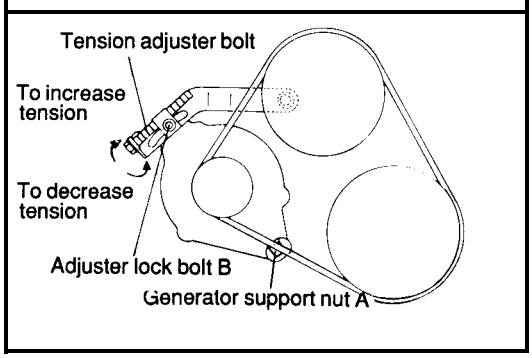
Check the following items and replace if defective.
1. Check the surface for damage, peeling or cracks.
2. Check the belt surface for oil or grease.
3. Check the rubber for worn or hardened areas.
4. Check the surface of the pulley for cracks or damage.



Installation

1. Install the engine coolant pump pulley to the engine coolant pump pulley bracket and tighten the bolts firmly.
2. After installing the belt, adjust the belt tension. See “DRIVE BELT TENSION DEFLECTION CHECK AND ADJUSTMENT”.

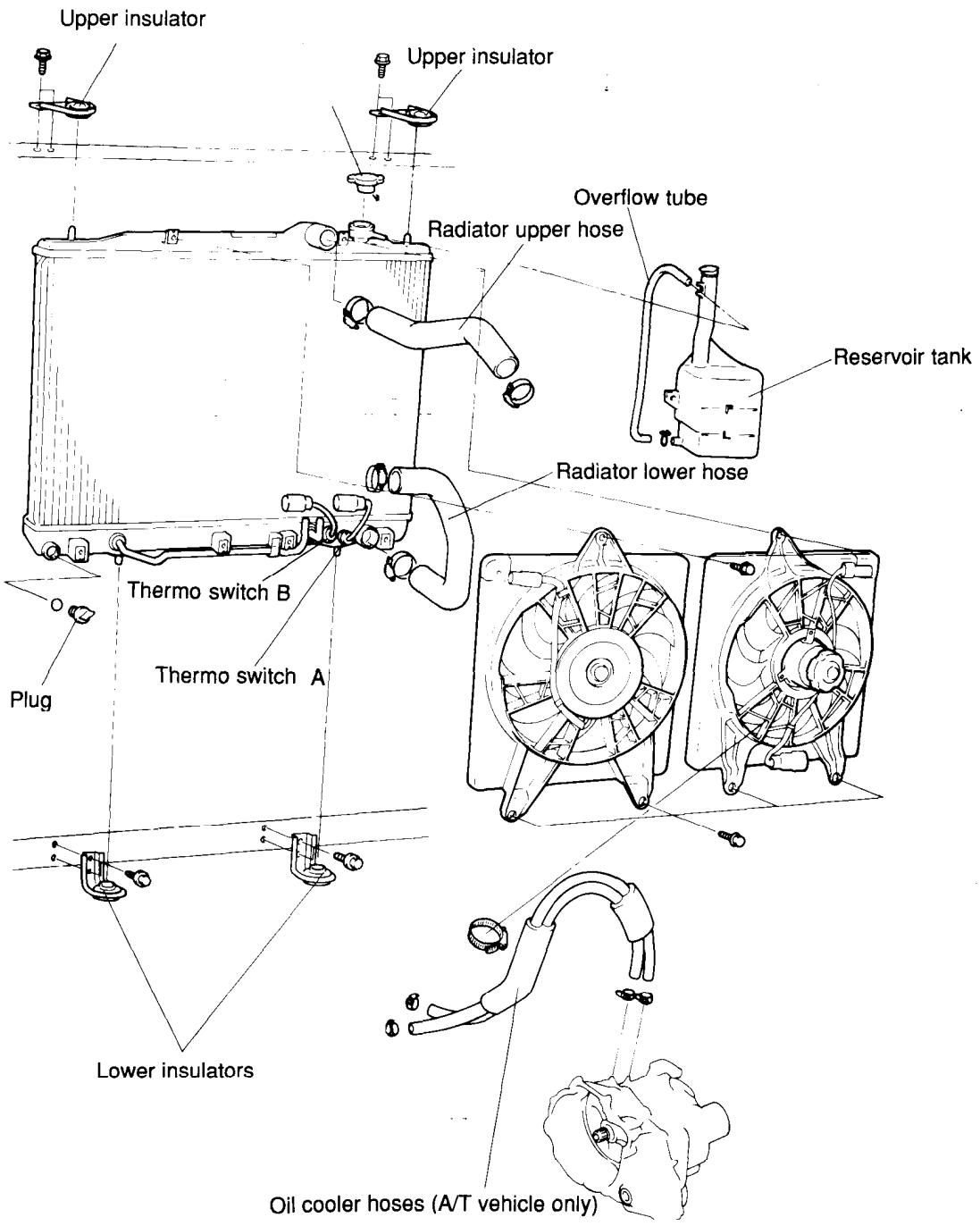
CAUTION
Note that 1.6L and 1.8L Engine V-ribbed velts are different in length.



Standard value
1.6L Engine ..... 980±5 mm
1.8L Engine ..... 990±5 mm

RADIATOR

COMPONENTS



REMOVAL

1. Disconnect the fan motor plug.
2. Set the warm engine coolant flow control knob of the heater control to the hot position.
3. Loosen the radiator drain plug to drain coolant.
4. Disconnect the upper and lower hose, and the overflow tube.
5. For vehicles with an automatic transaxle, disconnect the oil cooler hoses from the automatic transaxle.

CAUTION
Plug the ends of the oil cooler hoses and the automatic transaxle port to prevent the transaxle fluid from spilling out and foreign material from getting in.

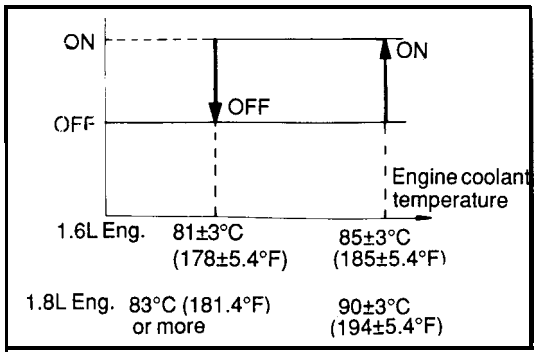
6. Remove the radiator mounting bolts.
7. Remove the radiator together with the fan motor.
8. Remove the fan motor from the radiator.

INSPECTION

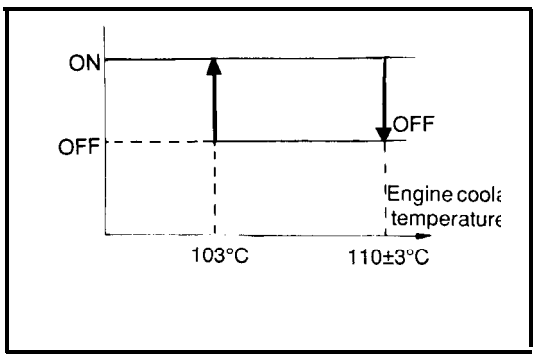
1. Check the radiator for bent, broken, or plugged fins.
2. Check the radiator for corrosion, damage, rust or scale.
3. Check the radiator hoses for cracks, damage or deterioration.
4. Check the reservoir tank for damage.
5. Check the radiator cap spring for damage. Pressure test the cap using a cooling system checker.
6. Check the radiator cap seal for cracks or damage.

7. Check for continuity with the thermo switch in hot water.
   Continuity at 85 ± 3°C (185 ± 5.4°F) [1.6L Eng.]
   90 ± 3°C (194±5.4°F) [1.8L Eng.]
   No continuity at 81±3°C (178 ±5.4°F) [1.6L Eng.]
   83°C (181.4°F) or more [1.8L Eng.]

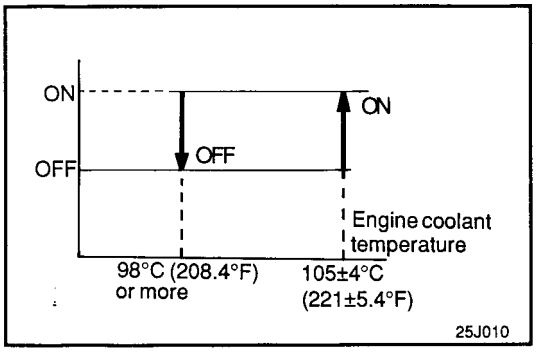
NOTE
Immerse the thermo switch in hot engine coolant up to the mounting threads to check for continuity.

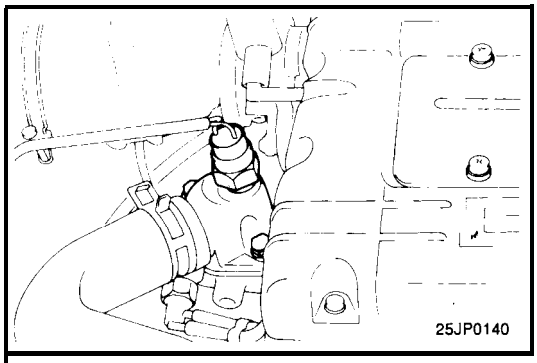


8. Check for continuity with thermo switch B in hot engine coolant
   Continuity at 103°C (217.4°F)
   No continuity at 110°C±3°C (230±5.4°F) or more



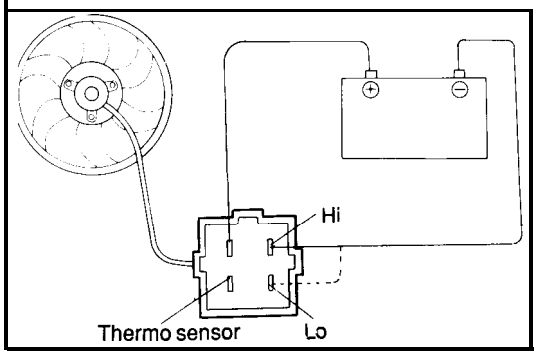
9. Check for continuity with thermo sensor on water outlet fitting in hot water.
   Continuity at 102-108°C (215.6-226.4°F)
   No continuity at 98°C (208.4°F) or more





Radiator Fan Motor

1. Check to be sure that the radiator fan rotates when battery voltage is applied between the terminals (as shown in the figure).
2. Check to see that abnormal noises are not produced while the motor is turning.

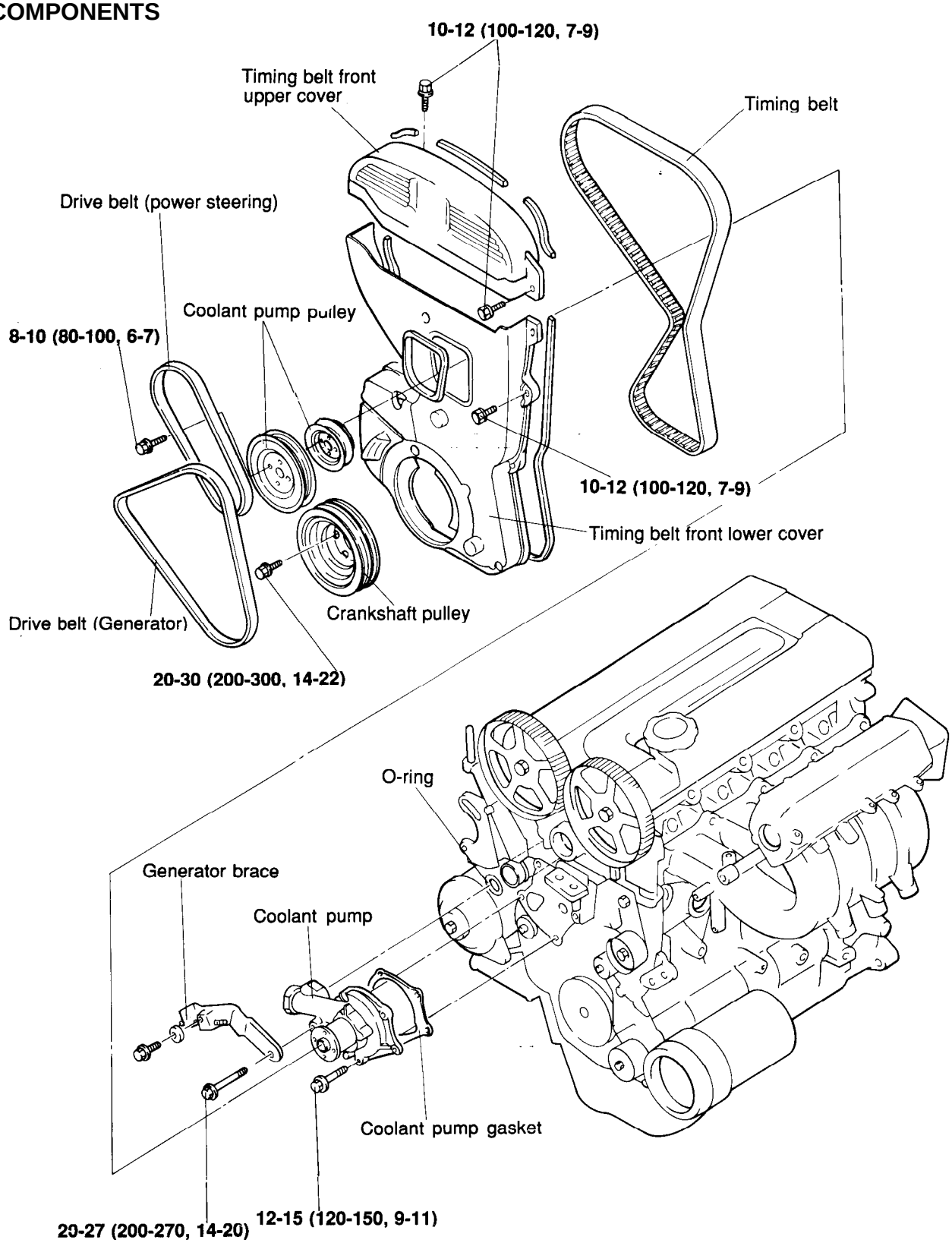


INSTALLATION

1. Fill the radiator and reservoir tank with a fresh coolant mixture.
2. Run the engine until the coolant has warmed up enough so that the thermostat valve opens, and then stop the engine.
3. Remove the radiator cap, pour in the coolant until it is up to the filler neck of the radiator, and then fill the reservoir tank to the upper level.
4. Check to be sure that there is no leakage from the radiator, hoses or connections.

ENGINE COOLANT PUMP

COMPONENTS

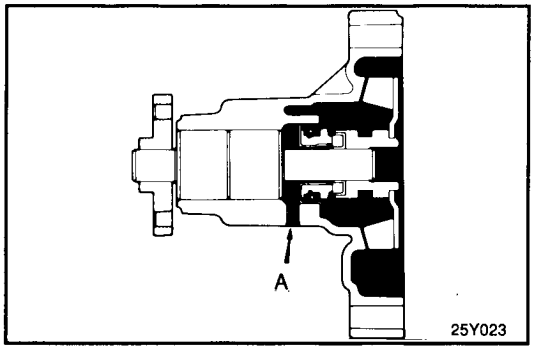


TORQUE : Nm (kg.cm, lb.ft)

REMOVAL

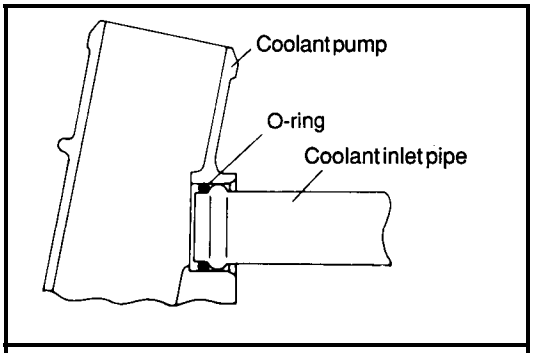
1. Drain the coolant and disconnect the radiator outlet hose and engine coolant by-pass hose from the engine coolant pump.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt tensioner.
4. Remove the engine coolant pump mounting bolts and then remove the generator brace.
5. Remove the engine coolant pump assembly from the cylinder block.

INSPECTION



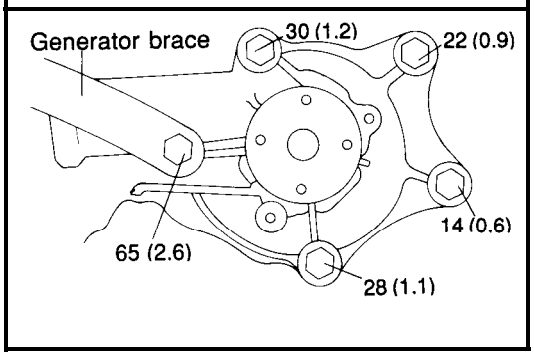
1. Check the engine coolant pump for cracks, damage or wear, and replace the engine coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the engine coolant pump assembly if necessary.
3. Check the seal unit for leaks, and replace the engine coolant pump assembly if necessary.
4. Check for water leakage. If water leaks from hole “A”, seal unit is defective. Replace engine coolant pump assembly.

INSTALLATION



1. Clean the gasket surfaces of the engine coolant pump body and the cylinder block.
2. Install the new O-ring onto the groove on the front end of the engine coolant pipe, then wet the O-ring with water. Do not apply oil or grease.
3. Install a new engine coolant pump gasket and engine coolant pump assembly. Tighten the bolts to the specified torque.

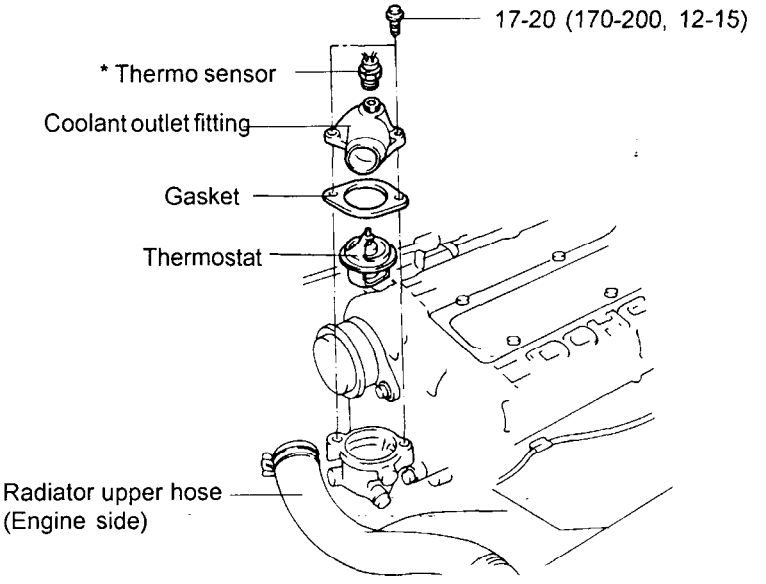
Tightening torque	
Engine coolant pump to cylinder block	
Head mark “4” bolt	12-15 Nm (120-150 kg.cm, 9-11 lb.ft)
Head mark “7” bolt	20-27 Nm (200-270 kg.cm, 14-20 lb.ft)



4. Install the timing belt tensioner and timing belt. Adjust the timing belt tension, and then install the timing belt covers.
5. Install the engine coolant pump pulley and drive belt, and then adjust the belt tension.
6. Refill the coolant.
7. Run the engine and check for leaks.

THERMOSTAT

COMPONENTS

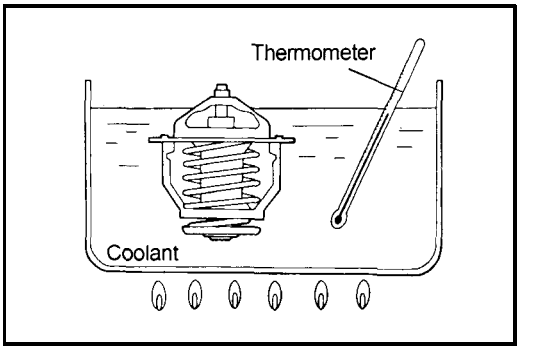


TORQUE : Nm (kg.cm, lb.ft)

REMOVAL AND INSPECTION

1. Drain the coolant down to thermostat level or below.
2. Remove the water outlet fitting and gasket.
3. Remove the thermostat.
4. Heat the thermostat as shown in the illustration.
5. Check to see if the valve operates properly.
6. Check to determine the temperature at which the valve begins to open.

Valve opening temperature	88°C(190°F)
Full opening temperature	100°C(212°F)
Valve lift (at full open)	8mm (0.31in.) or more

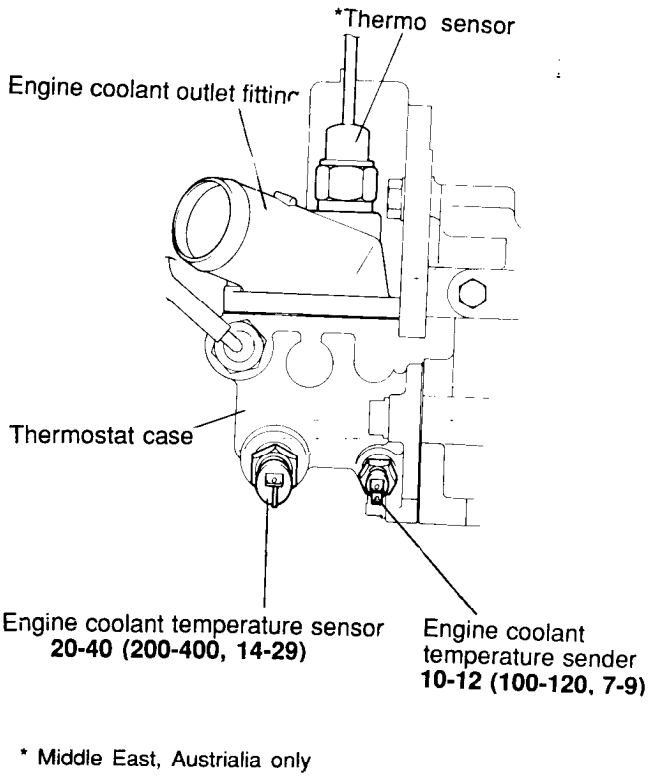


INSTALLATION

1. Check to ensure that the flange of the thermostat is correctly seated in the socket of the thermostat housing. If the thermostat is installed in the wrong direction, the bottom of the thermostat will touch the rib inside the intake manifold, making it impossible to seat the flange in position.
2. Install a new gasket and water outlet fitting.
3. Refill the coolant.

ENGINE COOLANT TEMPERATURE SENDER, SENSOR

COMPONENTS



* Middle East, Austrialia only

TORQUE : Nm (kg.cm, lb.ft)

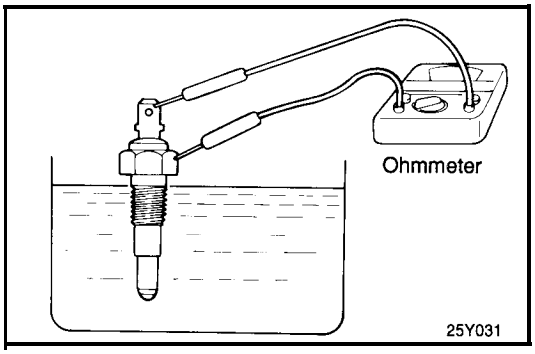
REMOVAL

1. Drain the coolant down to sender level or below.
2. Disconnect the battery ground cable and disconnect the engine harness.
3. Remove the engine coolant temperature sender and sensor.

INSPECTION

1. Heat the engine coolant temperature sender by submerging it in hot water.
2. Check that the resistance is within the specified range.

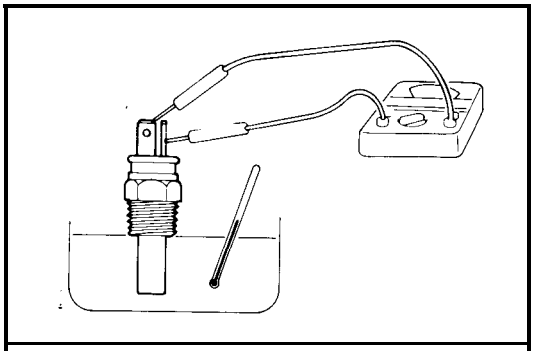
Resistance	90.5-117.5 Ω	at 70°C (158°F)
	21.3-26.3 Ω	at 115°C (239°F)



Engine Coolant Temperature Sensor

1. Heat the sensor by submerging it in hot water.
2. Check that the resistance is within the specified range.

Resistance	2.21-2.69 KΩ at 20°C (68°F) 264-328 Ω at 80°C (176°F)

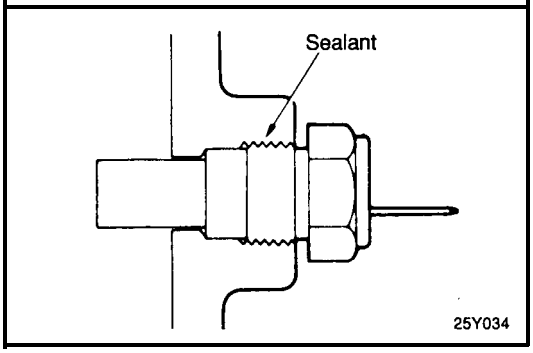


INSTALLATION

1. Apply sealant to the threaded portion and tighten to the specified torque.

Engine coolant temperature sender	Three bond NO.2310 or equivalent
Engine coolant temperature sensor	LOC TITE 962T or equivalent

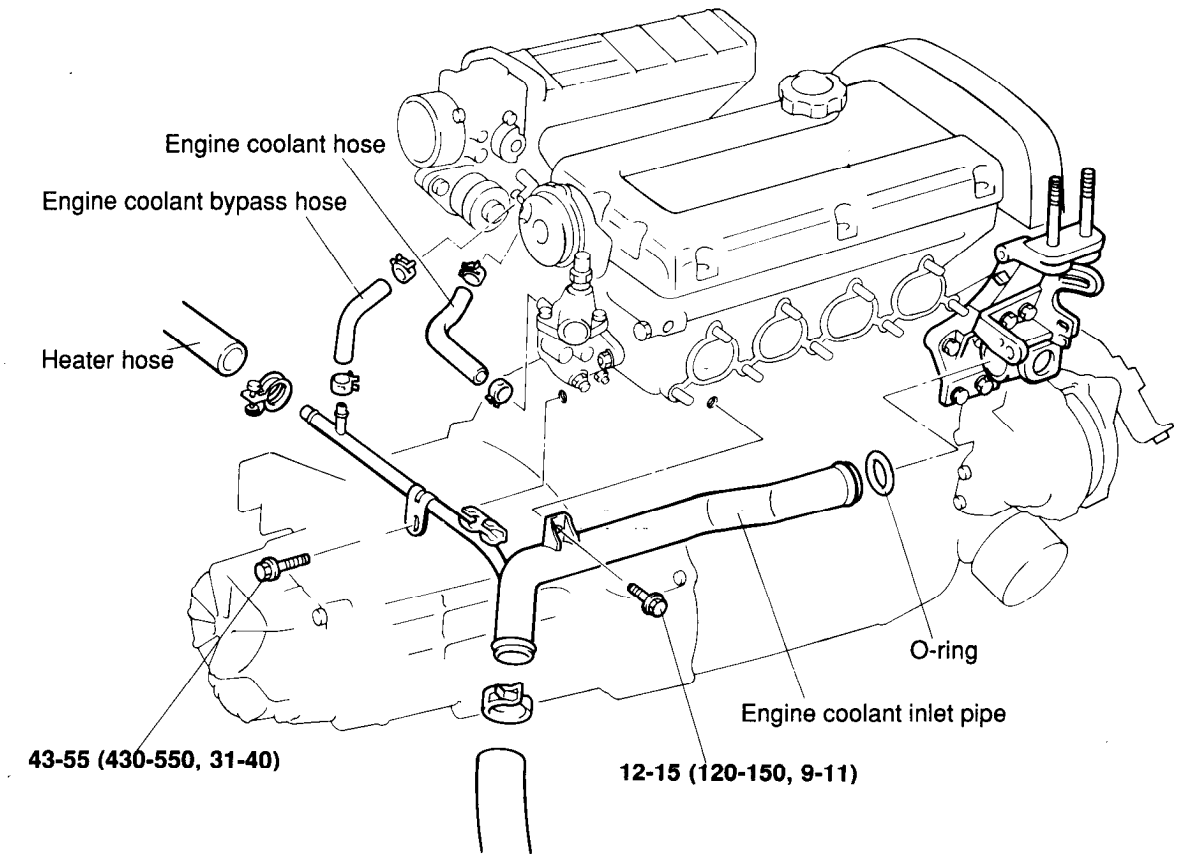
Tightening torque	
Engine coolant temperature sender	10-12 Nm (100-120 kg.cm, 7-9 lb.ft)
Engine coolant temperature sensor	20-40 Nm (200-400 kg.cm, 14-29 lb.ft)



2. Connect the harness to the engine coolant temperature sender, temperature sensor.
3. Connect the battery ground cable.
4. Refill with coolant.

ENGINE COOLANT HOSE AND PIPE

COMPONENTS



TORQUE : Nm (kg.cm, lb.ft)

INSPECTION

Check the engine coolant pipe and hose for cracks, damage, or restrictions. Replace if necessary.

INSTALLATION

Fit O-ring in the groove provided at engine coolant inlet pipe end, wet the periphery of O-ring and inset engine coolant inlet pipe.

NOTE

1. Do not apply oils or greases to water pipe O-ring.
2. Keep the engine coolant pipe connections free of sand, dust, etc.
3. Insert engine coolant pipe until its end bottoms.