

COOLING

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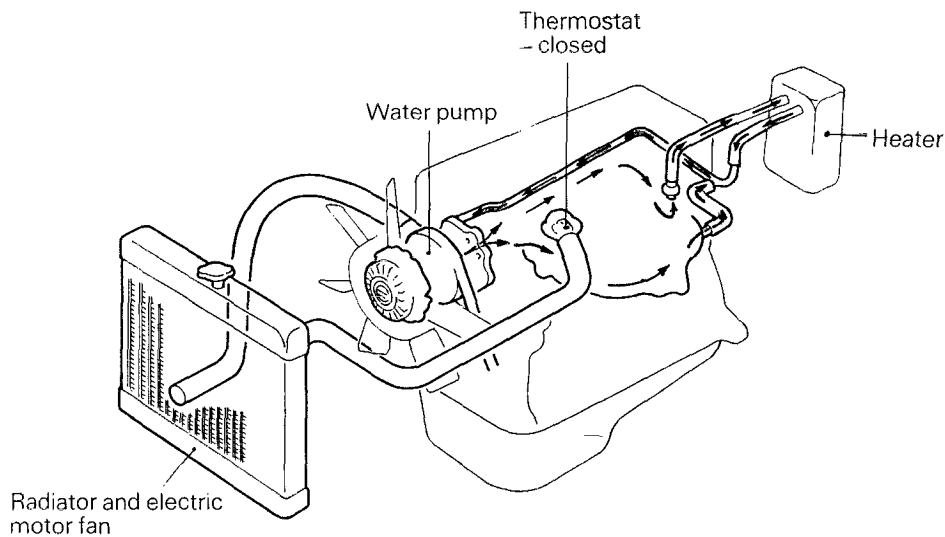
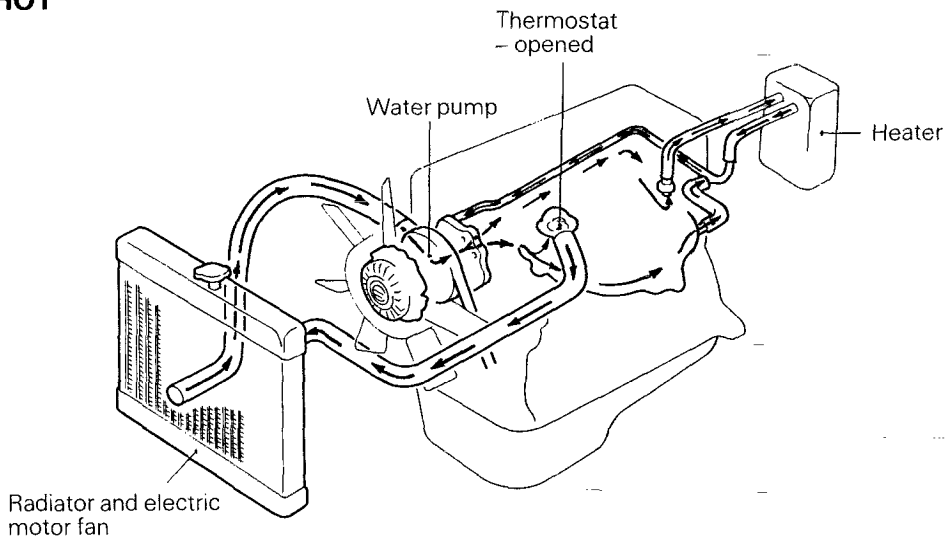
GENERAL INFORMATION

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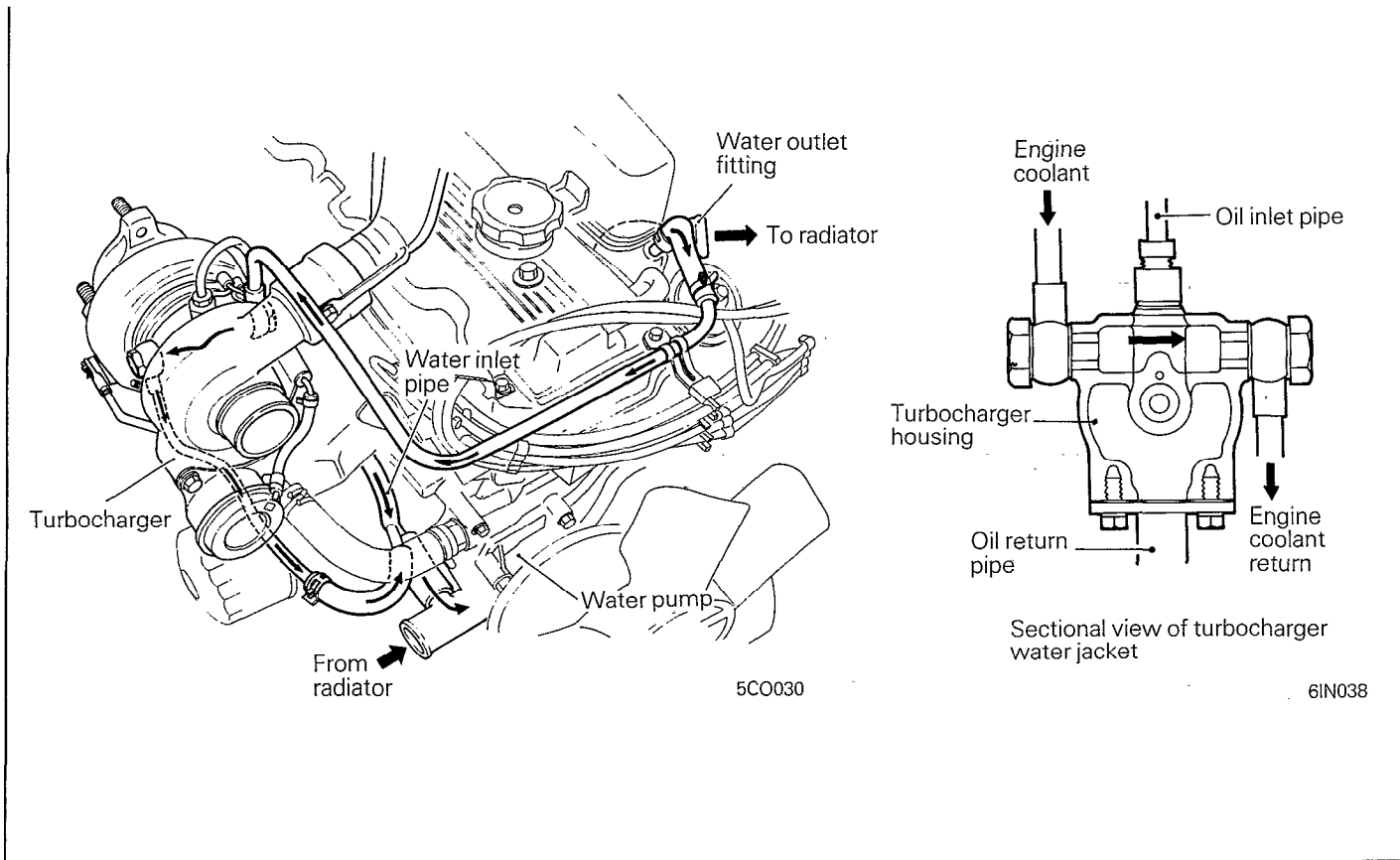
The cooling system consists of a radiator, fan, electric fan motor, water pump, thermostat, hose, radiator cap (pressure cap), engine coolant reserve tank, engine coolant temperature sensor, electric fan motor relay and automatic transmission oil cooler.

SYSTEM OPERATION

When the cold and hot engines are operated, engine coolant is controlled as shown in the following illustration.

ENGINE COLD**ENGINE HOT**

The routing and plumbing for turbocharger coolant are as shown below. To maintain turbocharger, engine coolant is constantly kept flowing through the turbocharger bearing housing water jacket. Water hoses and pipes are laid to provide closed loop flow of engine coolant from the intake manifold to the turbocharger housing to the water inlet pipe.



THERMOSTAT

The thermostat housing is located near No. 1 port in the intake manifold so that the thermostat may be removed and inspected easily.

The thermostat is a wax pellet type. The jiggle valve is installed in the air vent located in the thermostat flange. When the engine is not running, it makes easy the bleeding of air from engine coolant. When the engine is running (the thermostat is in closed state), the jiggle valve is closed to reduce the time required for engine warm-up and prevent the engine from overcooling.

WATER PUMP

The water pump consists of a diecast aluminum body, stamped steel impeller, seal and grease-filled bearing shaft. It is driven by the crankshaft pulley through the V-ribbed belt.

ELECTRIC FAN

The electrically driven cooling fan is installed to control the engine coolant temperature efficiently and reduce loss of engine output.

SPECIFICATIONS

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GENERAL SPECIFICATIONS

Cooling method	Water-cooling, forced circulation type
Radiator	
Type	Pressurized corrugated fin type
Radiator cap	
High pressure valve opening pressure kPa (psi)	74 – 103 (11 – 15)
Vacuum valve opening pressure kPa (psi)	–5 (–0.7) or less
Radiator fan motor No. 1	
Type	Direct current ferrite magnet type
Rated load torque Ncm (in.lbs.)	35.6 (2.6)
rpm (with the fan attached) rpm	1,750 – 2,250
Current A	9 – 11
Radiator fan motor No. 2 (Vehicles with a manual transmission)	
Type	Direct current ferrite magnet type
Rated load torque Ncm (in.lbs.)	20 (1.4)
rpm (with the fan attached) rpm	1,750 – 2,250
Current A	5.7 – 7.7
Radiator fan motor No. 2 (Vehicles with an automatic transmission)	
Type	Direct current ferrite magnet type
Rated load torque Ncm (in.lbs.)	35.6 (2.6)
rpm (with the fan attached) rpm	1,750 – 2,250
Current A	9 – 11
Thermosensor No. 1	
Operating temperature °C (°F)	
OFF → ON	82 – 88 (180 – 190)
ON → OFF	78 – 87 (172 – 189)
Thermosensor No. 2	
Operating temperature °C (°F)	
OFF → ON	97 – 103 (207 – 217)
ON → OFF	93 – 102 (199 – 216)
Radiator fan motor relay	
Exciting coil rated current A	0.074 – 0.106
Maximum contact current capacity A	20
Range of voltage used V	10 – 15
Voltage drop between terminals V	0.2 or less
Water pump	Impeller of centrifugal type
Thermostat	
Type	Wax type with jiggle valve
Valve opening temperature °C (°F)	88 (190)
Full-opening temperature °C (°F)	100 (212) at valve lift of 8 mm (.31 in.)
Identification mark	88 (Stamped on flange)
Drive belt	
Length mm (in.)	964 (37.95) HM type

Engine coolant temperature gauge unit Type Resistance Ω	Thermistor type 104 at 70°C (158°F) 24 at 115°C (234°F)
Engine coolant temperature sensor for ECI system Type Resistance Ω	Thermistor type 16,200 at -20°C (-4°F) 2,450 at 20°C (68°F) 296 at 80°C (176°F)

SERVICE SPECIFICATIONS

N07CB--

Items	Specifications
Standard value	
Opening pressure of radiator cap high pressure valve kPa (psi)	75 – 105 (11 – 15)
Engine coolant concentration %	30 – 60
Drive belt deflection mm (in.)	7 – 10 (.28 – .39)
Thermostat	
Opening valve temperature °C (°F)	88 (190)
Full-open temperature °C (°F)	100 (212)
Limit	
Opening pressure of radiator cap high pressure valve kPa (psi)	65 (9.2)

TORQUE SPECIFICATIONS

N07CC--

Items	Nm	ft.lbs.
Shroud to radiator	11 – 14	8 – 10
Thermosensor	14 – 16	10 – 12
Alternator support bolt and nut	20 – 24	15 – 18
Alternator brace bolt	12 – 14	9 – 10
Water pump	12 – 15	9 – 10
Water pump pulley bolt and nut	10 – 12	7.3 – 8.6
Engine coolant temperature gauge unit	30 – 40	22 – 28
Engine coolant temperature sensor	20 – 40	15 – 28
Water outlet fitting	17 – 20	13 – 14
Eye bolt for water pipe	35 – 50	25 – 36
Engine coolant temperature switch (Vehicles with an air conditioner)	10 – 14	7 – 10

LUBRICANTS

N07CD--

Items	Specified lubricants	Quantity
Engine coolant lit. (qts.)	High quality ethylene glycol	* 8.73 (9.22)

NOTE

* Includes 0.70 liter (0.74 qt.) in reserve tank

SEALANTS

N07CE-

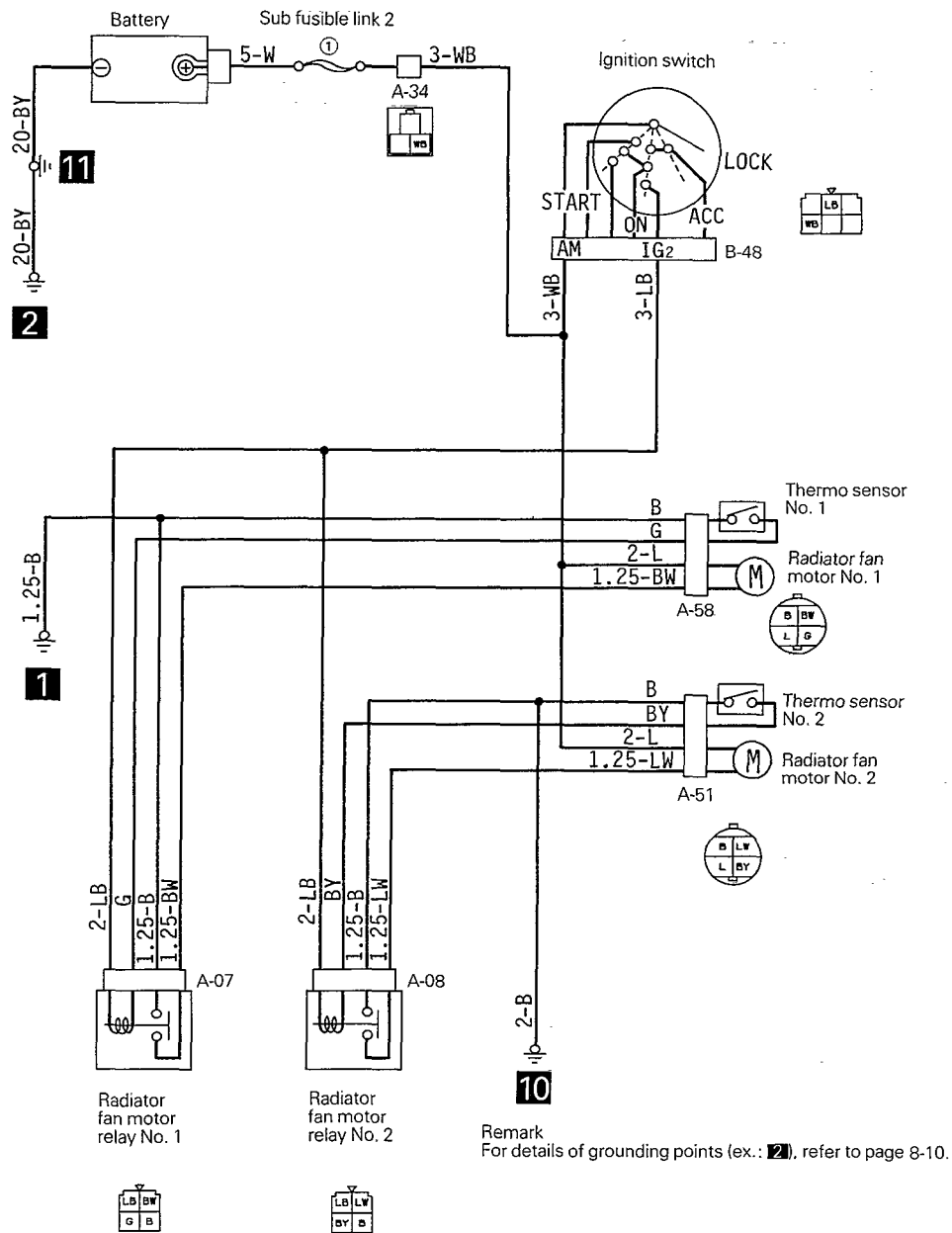
Items	Specified sealant	Quantity
Engine coolant temperature gauge unit	MOPAR Part No. 4318034 or equivalent	As required
Engine coolant temperature sensor	MOPAR Part No. 4318034 or equivalent	As required
Engine coolant temperature switch	MOPAR Part No. 4318034 or equivalent	As required

TROUBLESHOOTING

N07EAAG

Symptom	Probable cause	Remedy
Overheat	Insufficient engine coolant	Refill
	Antifreeze concentration too high	Correct anti-freeze concentration
	Loose or broken drive belt	Replace
	Inoperative electrical cooling fan	
	Faulty thermosensor	Replace
	Faulty electrical motor	Replace
	Faulty radiator fan relay	Replace
	Damaged or blocked (improper ventilated) radiator fins	Correct
	Water leaks	
	Damaged radiator core joint	Replace
Corroded or cracked hoses (radiator hose, heater hose, etc.)	Replace	
Loose bolt or leaking gasket in water outlet fitting (thermostat)	Correct or replace	
Loose water pump mounting bolt or leaking gasket	Correct or replace	
Faulty radiator cap valve or setting of spring	Replace	
Faulty thermostat operation	Replace	
Faulty water pump	Replace	
Water passage clogged with slime or rust deposit or foreign substance	Clean	
No rise in temperature	Faulty thermostat	Replace

CIRCUIT DIAGRAM

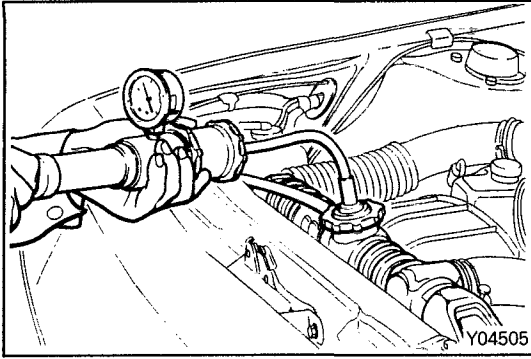


Wire color code
 B: Black Br: Brown G: Green Gr: Gray L: Blue Lg: Light green
 Ll: Light blue O: Orange P: Pink R: Red Y: Yellow W: White

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OPERATION

- With the ignition switch at the "ON" position, let the engine coolant temperature reach 85°C (185°F), and the thermosensor No. 1 will be turned "ON" and current will flow from the radiator fan motor relay No. 1 (contacts) to thermosensor No. 1 to ground to close the contacts of radiator fan motor relay No. 1.
- Then current flows from the radiator fan motor relay No. 1 (contacts) to radiator fan motor No. 1 to ground to run the radiator fan motor No. 1.
- When engine coolant temperature reaches 100°C (212°F), the thermosensor No. 2 is turned "ON", and current will flow from radiator fan motor relay No. 2 (coil) to thermosensor No. 2 to ground to close the contacts of radiator fan motor relay No. 2.
- So, current flows from radiator fan motor relay No. 2 (contacts) to radiator fan motor No. 2 to ground to run the radiator fan motor No. 2.



SERVICE ADJUSTMENT PROCEDURES

N07FAAB

ENGINE COOLANT LEAK CHECK

1. Loosen radiator cap.
2. Confirm that the engine 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) pressure. Hold for two minutes in that condition, while checking for leakage from the radiator, hose or connections.

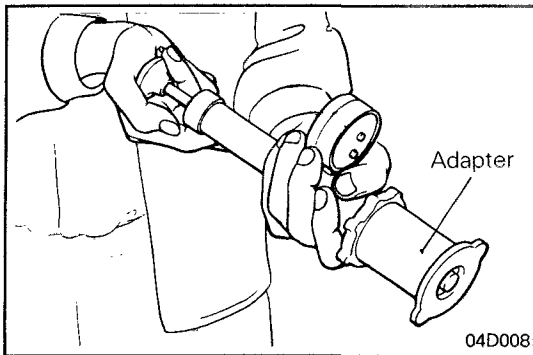
Caution

Be sure to completely clean away any moisture from the places checked.

When the tester is removed, be careful not to spill any coolant from it.

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

N07FBAE

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

High pressure valve opening pressure:

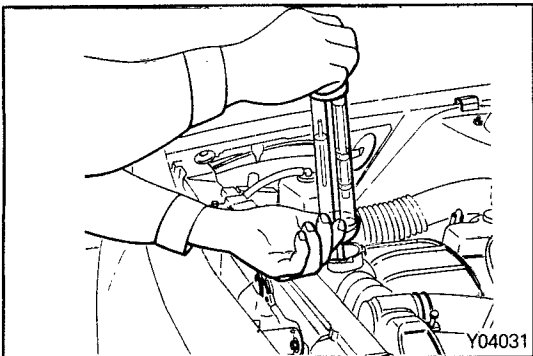
Limit 65 kPa (9.2 psi)

Standard value 75 – 105 kPa (11 – 15 psi)

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

N07FDAD

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

Standard value: 30 – 60 %

RELATION BETWEEN ENGINE COOLANT CONCENTRATION AND SPECIFIC GRAVITY

The following table is applicable only to the specified engine coolant, HIGH QUALITY ETHYLENE GLYCOL (ANTIFREEZE) COOLANT.

Engine coolant temperature °C (°F) and specific gravity					Freezing temperature °C (°F)	Safe operating temperature °C (°F)	Engine 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

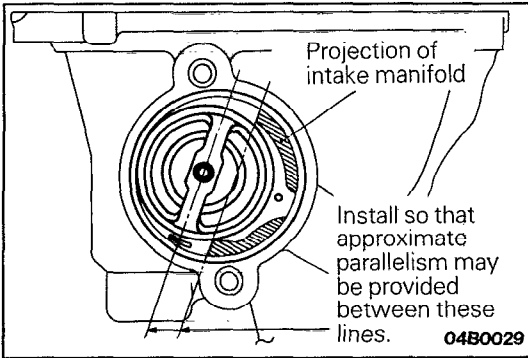
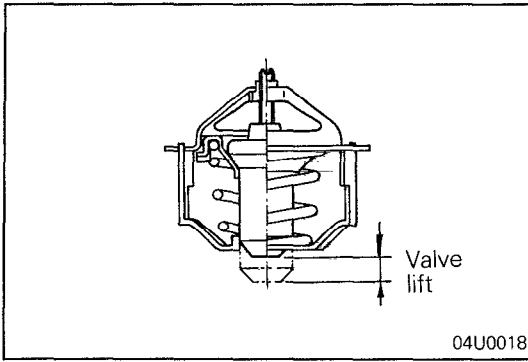
The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at the engine coolant temperature of 20°C (68°F).

Caution

- 1. If the concentration of the engine 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.**
- 2. Do not use a mixture of different brands of anti-freeze.**

Standard value:Opening valve temperature **88°C (190°F)**Full-open temperature **100°C (212°F)****NOTE**

Measure valve height when fully closed. Calculate lift by measuring the height when fully open.

**SERVICE POINT OF INSTALLATION**

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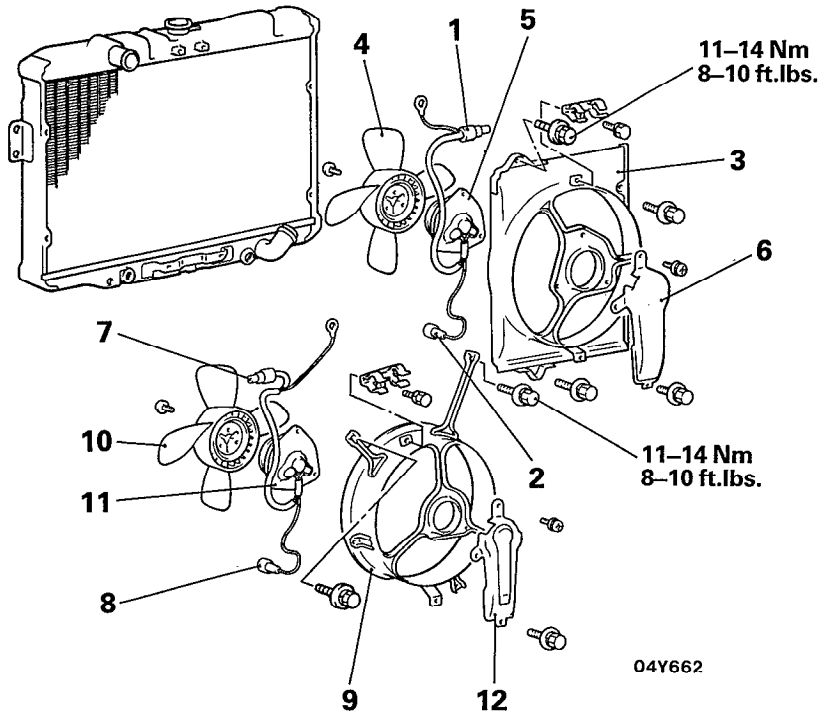
5. INSTALLATION OF THERMOSTAT

Install the thermostat to the intake manifold as illustrated.

Caution

Be careful not to install the thermostat obliquely by fitting the thermostat flange in the spot facing provided in the intake manifold.

COOLING FAN REMOVAL AND INSTALLATION



Removal steps

- 1. Fan motor connection
- 2. Connector cap
- ↔ ↔ 3. Shroud
- ↔ 4. Fan
- ↔ 5. Motor No. 1
- 6. Air duct

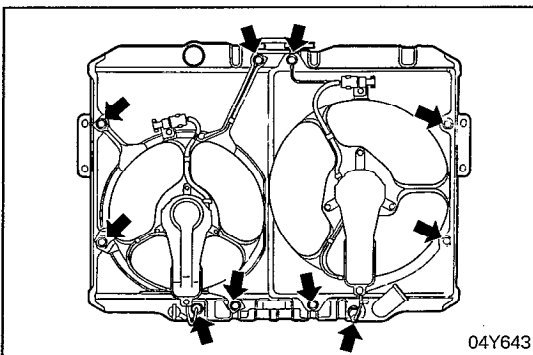
Air conditioner fan removal steps

- 7. Fan motor connection
- 8. Connector cap
- ↔ ↔ 9. Shroud
- ↔ 10. Fan
- ↔ 11. Motor No. 2
- 12. Air duct

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ↔: Refer to "Service Points of Removal".
- (3) ↔: Refer to "Service Points of Installation".

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SERVICE POINTS OF REMOVAL

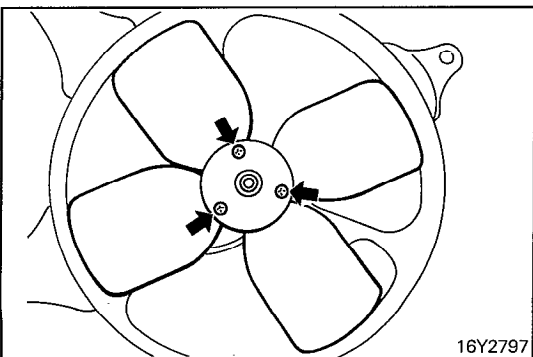
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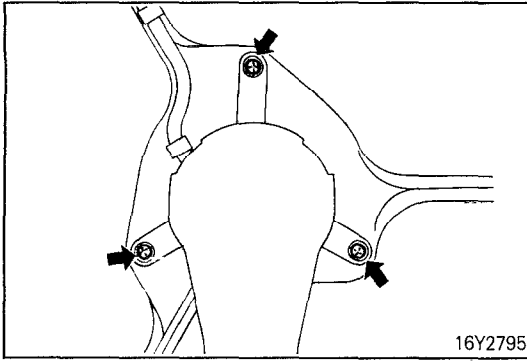
3. REMOVAL OF SHROUD / 9. SHROUD

Disconnect the radiator fan motor connectors, remove the shroud mounting bolts, then remove the radiator fan motor from the radiator.

4. REMOVAL OF FAN / 10. FAN

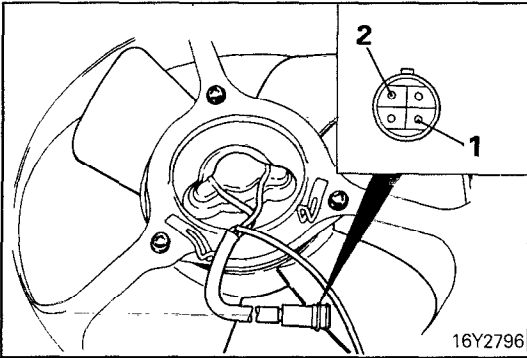
Separate the fan from the fan motor.





5. REMOVAL OF MOTOR NO. 1 / 11. MOTOR NO. 2

Remove the motor from the shroud.

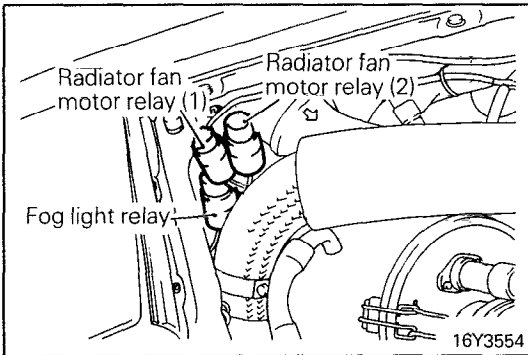


INSPECTION

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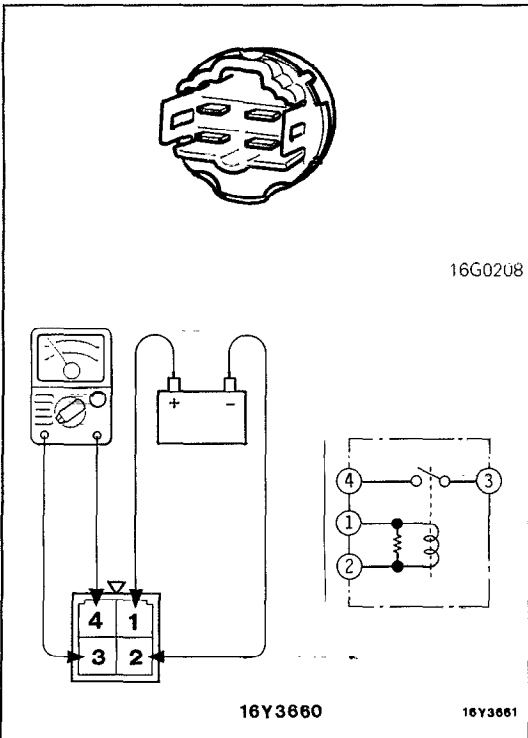
RADIATOR FAN MOTOR NO. 1 AND NO. 2

Apply the battery voltage to the terminal "1" and ground the terminal "2", then make sure that the motor turns smoothly.



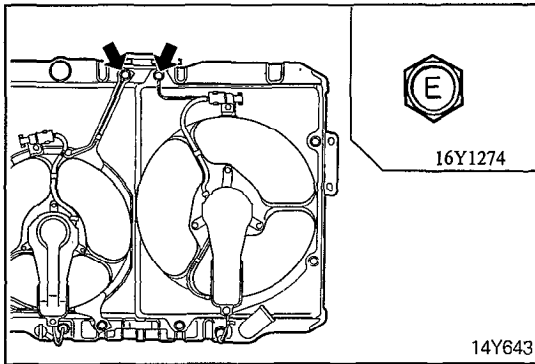
RADIATOR FAN MOTOR RELAY

(1) Remove the radiator fan motor relay.



(2) Check continuity between terminals when the battery voltage is applied to the terminal 1 and the terminal 2 is grounded.

Voltage applied	Terminals 3 – 4	Conductive
Voltage not applied	Terminals 3 – 4	Non-conductive
	Terminals 1 – 2	Conductive

**SERVICE POINTS OF INSTALLATION**

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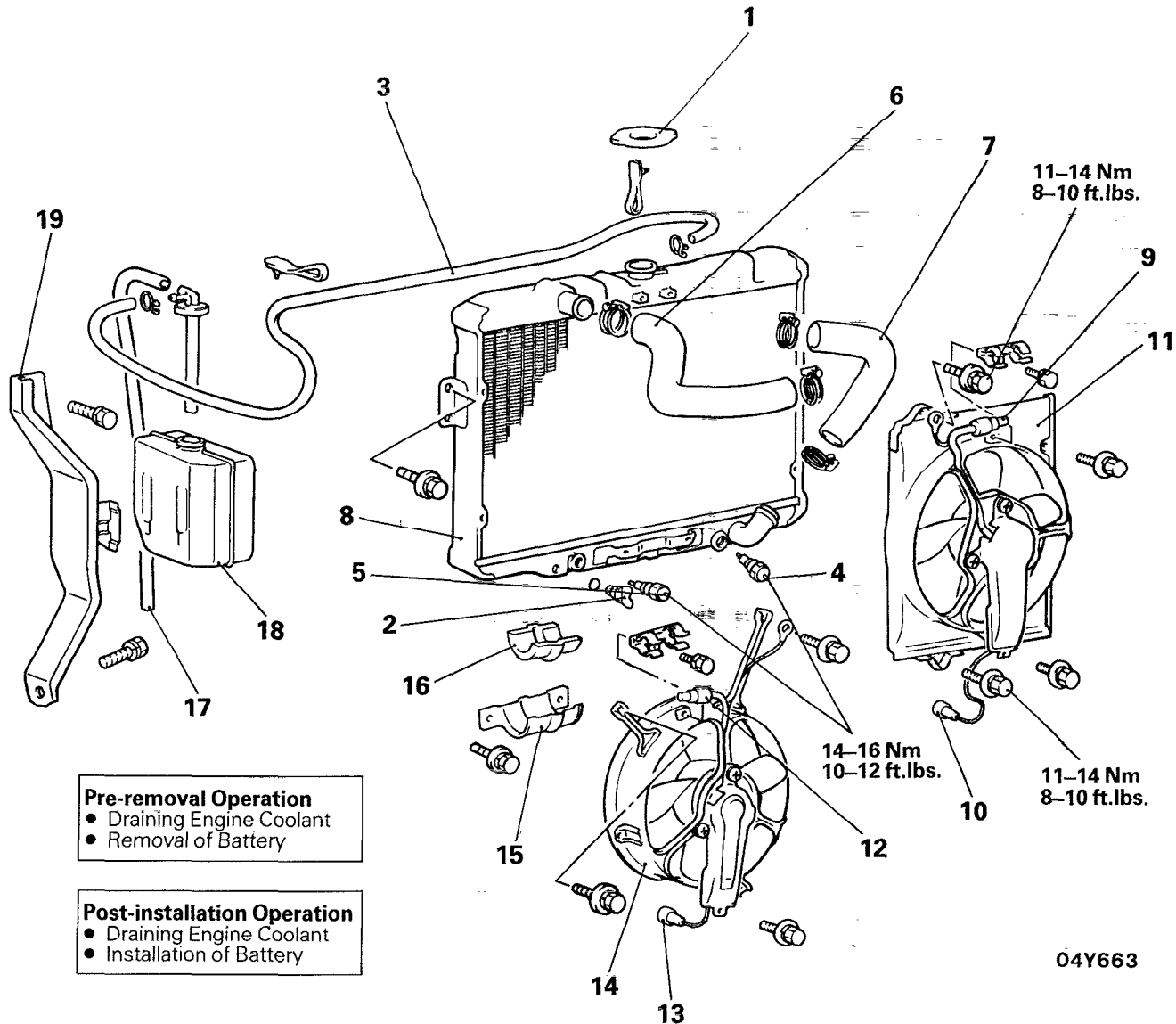
3. INSTALLATION OF SHROUD / 9. SHROUD

When installing the shroud, tighten also the radiator motor ground wires with the bolts.

RADIATOR

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REMOVAL AND INSTALLATION

**Pre-removal Operation**

- Draining Engine Coolant
- Removal of Battery

Post-installation Operation

- Draining Engine Coolant
- Installation of Battery

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Radiator removal steps

- 1. Radiator cap
- ↔ 2. Drain plug
- 3. Overflow tube connection
- 9. Fan motor connection
- 10. Connector cap
- 4. Thermosensor No. 1
- 5. Thermosensor No. 2
- 6. Radiator upper hose connection
- 7. Radiator lower hose connection
- 8. Radiator
- ↔ ↔ 11. Shroud
- 12. Fan motor connection
- 13. Connector cap
- ↔ ↔ 14. Shroud
- 15. Radiator bracket
- 16. Radiator support insulator

Reserve tank removal steps

- 3. Overflow tube connection
- 17. Overflow tube
- 18. Reserve tank
- 19. Reserve tank bracket

NOTE

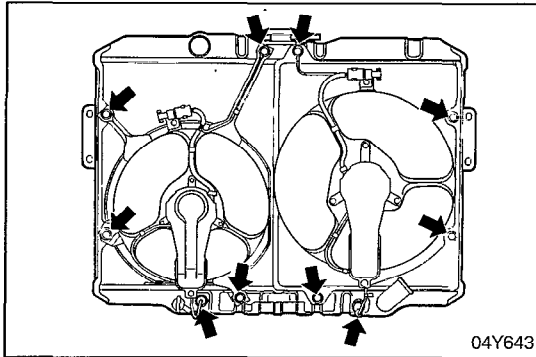
- (1) Reverse the removal procedures to reinstall.
- (2) ↔: Refer to "Service Points of Removal".
- (3) ↔↔: Refer to "Service Points of Installation".

SERVICE POINTS OF REMOVAL

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2. REMOVAL OF DRAIN PLUG

Set the temperature control lever of heater control to the hot position and drain engine coolant.



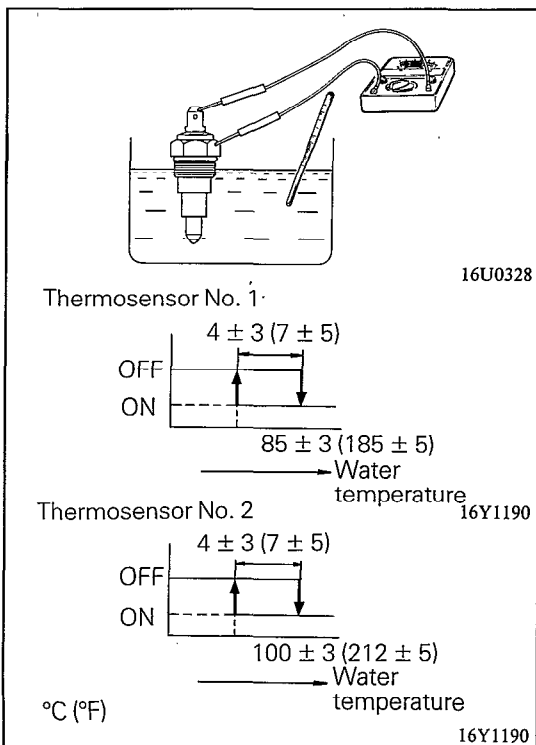
11. REMOVAL OF SHROUD / 14. SHROUD

Disconnect the thermosensor and radiator fan motor connectors, remove the shroud mounting bolts, then remove the radiator fan motor from the radiator.

INSPECTION

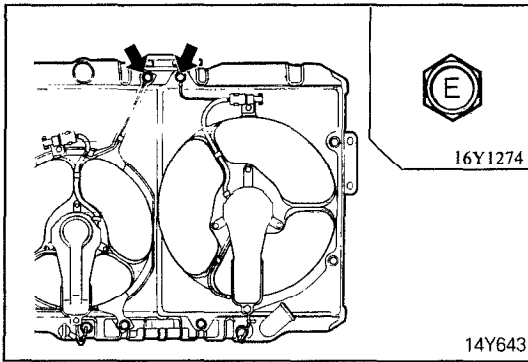
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- Check the radiator fins for bends, breaks, or plugs.
- Check the radiator for corrosion, damage, rust or scale.
- Check the radiator hoses for cracks, damage or wear.
- Check the reserve tank for damage.
- Check the radiator cap spring for damage.
- Check the radiator cap seal for cracks or damage.
- Check the engine coolant for contamination.



THERMOSENSOR

Check for continuity with the thermosensor in hot water.

**SERVICE POINTS OF INSTALLATION**

N07QDAD

11. INSTALLATION OF SHROUD / 14. SHROUD

When installing the shroud to the radiator, be sure to tighten the ground wires with the bolts which serves also for mounting the shroud.

Connect the thermosensor to the connector and install the cap on the thermosensor to project it from water.

NOTE

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

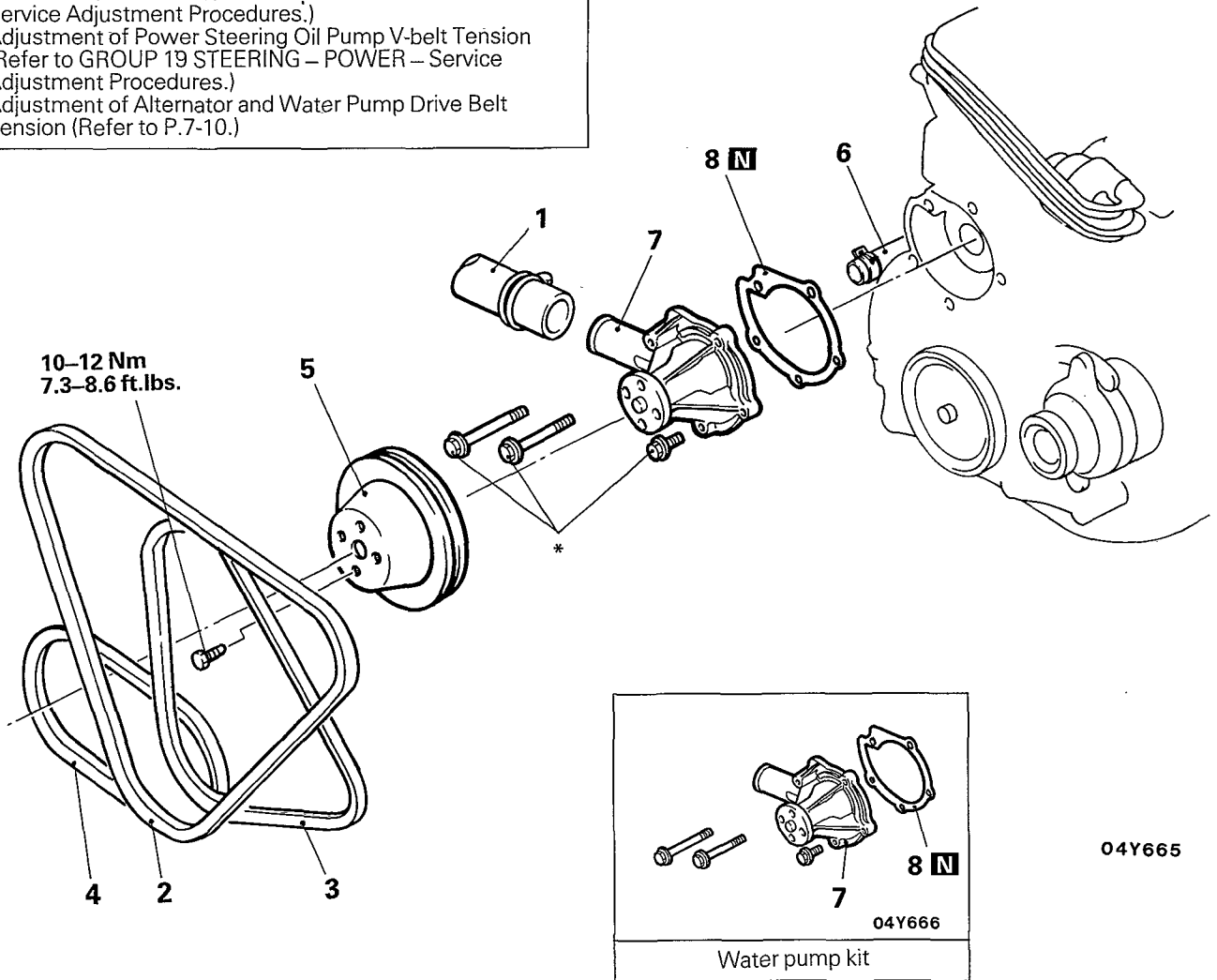
WATER PUMP REMOVAL AND INSTALLATION

Pre-removal Operation

- Draining Engine Coolant
- Removal of Battery

Post-installation Operation

- Refilling Engine Coolant
- Installation of Battery
- Adjustment of Air Conditioner Compressor V-belt Tension (Refer to GROUP 24 HEATERS AND AIR CONDITIONING – Service Adjustment Procedures.)
- Adjustment of Power Steering Oil Pump V-belt Tension (Refer to GROUP 19 STEERING – POWER – Service Adjustment Procedures.)
- Adjustment of Alternator and Water Pump Drive Belt Tension (Refer to P.7-10.)



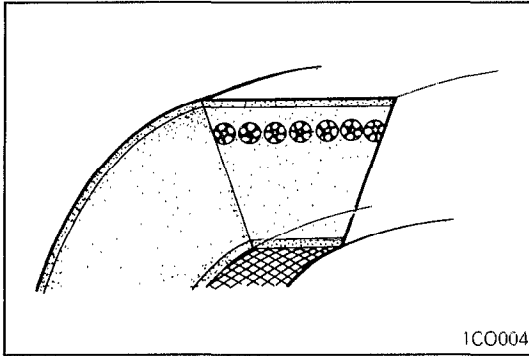
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Removal steps

1. Radiator lower hose connection
2. Air conditioner compressor V-belt
3. Alternator and water pump drive belt
4. Power steering oil pump V-belt
5. Water pump pulley
6. Heater hose connection
- ◆◆ 7. Water pump
8. Water pump gasket

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◆◆: Refer to "Service Points of Installation".
- (3) **N**: Non-reusable parts
- (4) For torque required for tightening the water pump bolts marked with *, refer to Installation of Water Pump.



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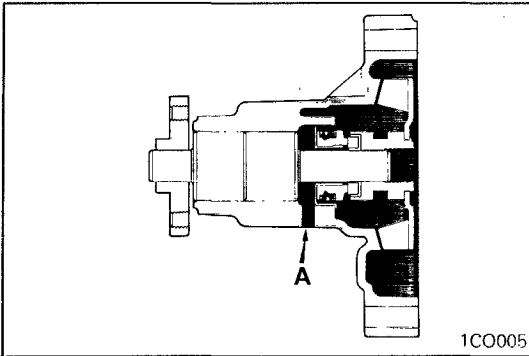
INSPECTION

N07MDAH

DRIVE BELT FOR ALTERNATOR

A belt which has following defects should be replaced.

- Damaged, peeled or cracked surface.
- Oily or greasy surface.
- A belt worn to such an extent that it is in contact with bottom of V groove in pulley.
- Worn or hardened rubber.



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WATER PUMP

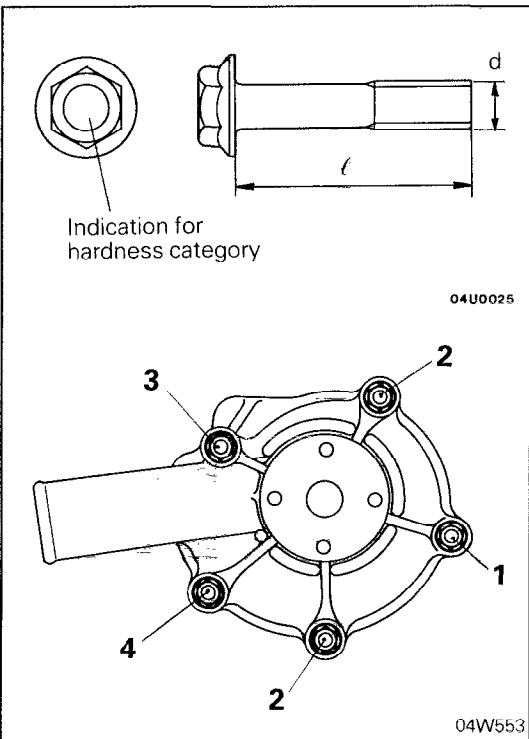
- Check each part for cracks, damage or wear, and replace the water pump assembly if necessary.
- Check the bearing for damage, abnormal noise and sluggish rotation, and replace the water pump assembly if necessary.
- Check the seal unit for leaks, and replace the water pump assembly if necessary.
- Check for water leakage. If water leaks from hole "A", seal unit is leaking. Replace as an assembly.

SERVICE POINT OF INSTALLATION

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7. INSTALLATION OF WATER PUMP

Water pump installation bolt size are different and caution must be paid to ensure that they are properly installed.



No.	Hardness category (Head mark)	d x l mm (in.)	Torque Nm (ft.lbs.)
1	4T	8 x 23 (.31 x .90)	12 – 15 (9 – 10)
2	4T	8 x 28 (.31 x 1.10)	
3	4T	8 x 88 (.31 x 3.46)	
4	4T	8 x 78 (.31 x 3.07)	

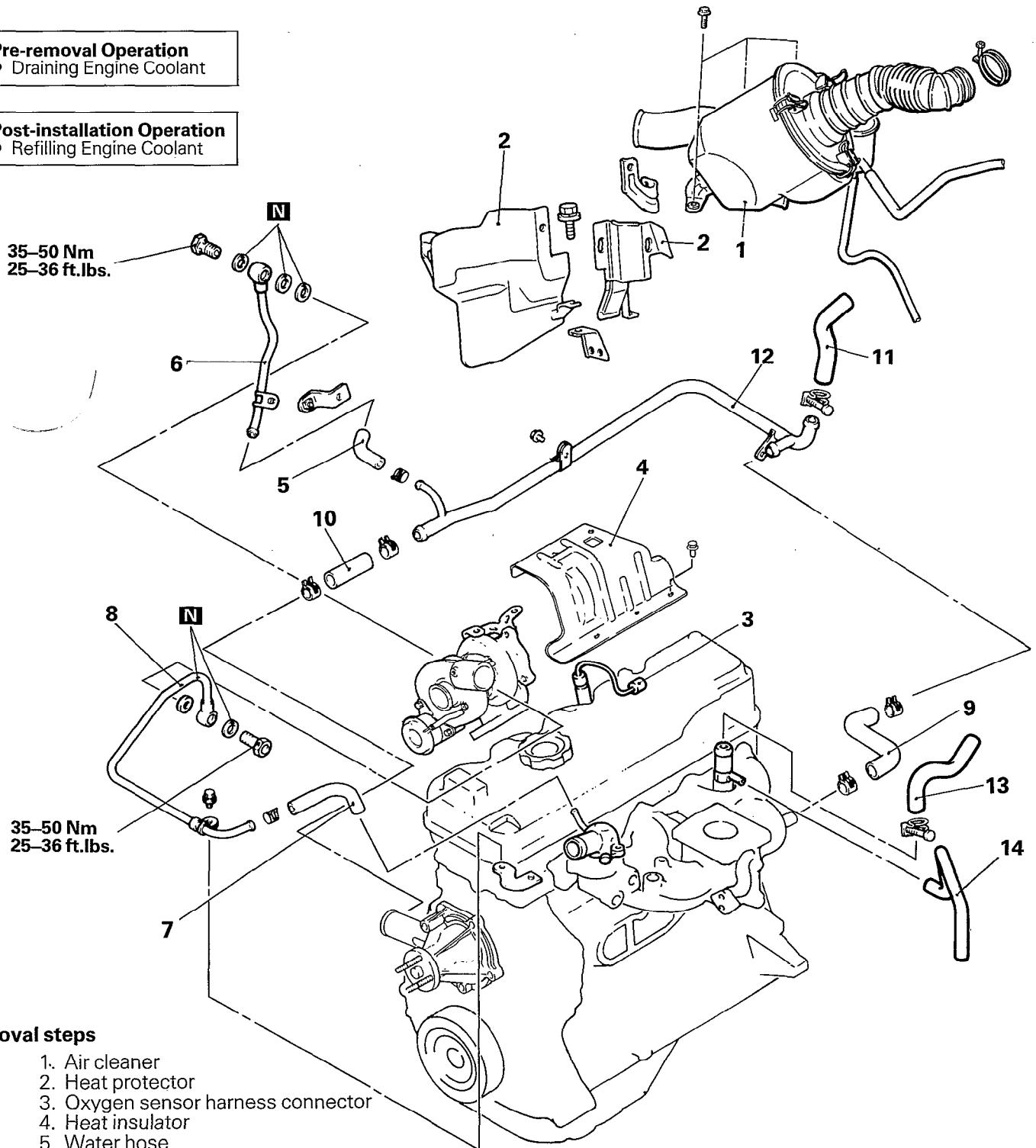
WATER HOSE AND PIPE REMOVAL AND INSTALLATION

Pre-removal Operation

- Draining Engine Coolant

Post-installation Operation

- Refilling Engine Coolant



Removal steps

1. Air cleaner
2. Heat protector
3. Oxygen sensor harness connector
4. Heat insulator
5. Water hose
6. Water pipe "B"
7. Water hose
8. Water pipe "A"
9. Water hose
10. Water hose
11. Water hose A (heater) connection
12. Heater pipe assembly
13. Water hose B (heater)
14. Water hose connection

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) **N**: Non-reusable parts

ENGINE COOLANT TEMPERATURE GAUGE UNIT

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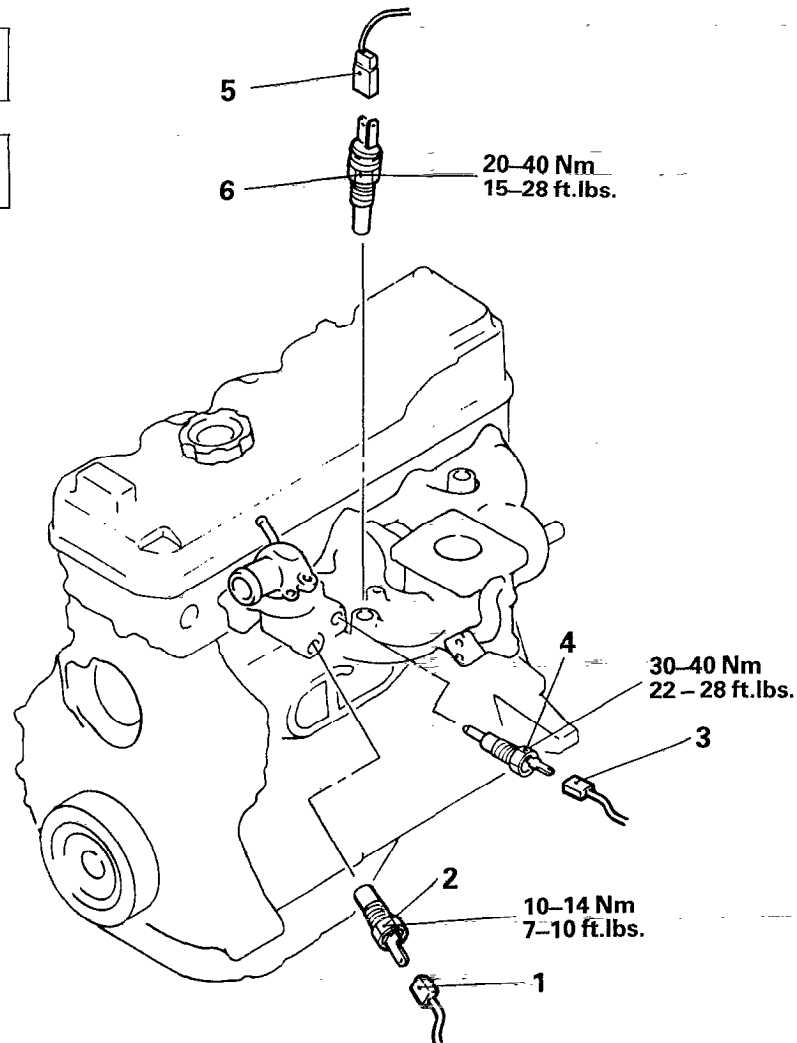
REMOVAL AND INSTALLATION

Pre-removal Operation

- Draining Engine Coolant

Post-installation Operation

- Refilling Engine Coolant



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Removal steps

1. Engine coolant temperature switch harness connection (Vehicles with an air conditioner)
- ◄◄ ◄◄ 2. Engine coolant temperature switch (Vehicles with an air conditioner)
3. Engine coolant temperature gauge unit harness connection
- ◄◄ ◄◄ 4. Engine coolant temperature gauge unit
5. Engine coolant temperature sensor harness connection
- ◄◄ ◄◄ 6. Engine coolant temperature sensor

NOTE

- (1) Reverse the removal procedures to reinstall.
- (2) ◄◄: Refer to "Service Points of Removal".
- (3) ◄◄: Refer to "Service Points of Installation".

SERVICE POINTS OF REMOVAL

N070CAC

2. REMOVAL OF ENGINE COOLANT TEMPERATURE SWITCH (Vehicles with an air conditioner) / 4. ENGINE COOLANT TEMPERATURE GAUGE UNIT / 6. ENGINE COOLANT TEMPERATURE SENSOR

- (1) Drain cooling system down to gauge unit level or below.
- (2) Disconnect the battery ground cable and disconnect harness from the gauge unit.
- (3) Remove the engine coolant temperature gauge unit.

INSPECTION

N07QDAE

ENGINE COOLANT TEMPERATURE GAUGE UNIT

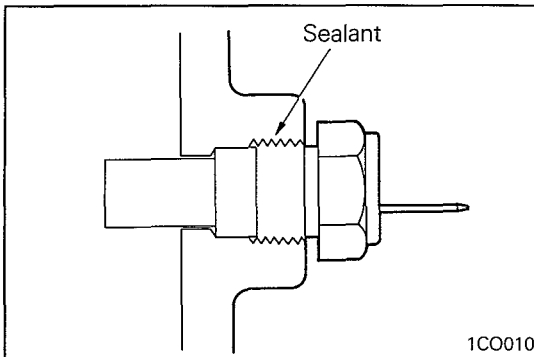
Refer to GROUP 8 ELECTRICAL – Meters and Gauges.

ENGINE COOLANT TEMPERATURE SENSOR

Refer to GROUP 14 FUEL (ECI) SYSTEM.

ENGINE COOLANT TEMPERATURE SWITCH (VEHICLES WITH AN AIR CONDITIONER)

Refer to GROUP 24 HEATERS AND AIR CONDITIONING – Service Adjustment Procedures.

**SERVICE POINTS OF INSTALLATION**

N07OEAS

6. INSTALLATION OF ENGINE COOLANT TEMPERATURE SENSOR / 4. ENGINE COOLANT TEMPERATURE GAUGE UNIT / 2. ENGINE COOLANT TEMPERATURE SWITCH (Vehicles with an air conditioner)

- (1) Apply sealant to threaded portion and tighten.

Specified sealant: MOPAR Part No. 4318034 or equivalent

- (2) Connect the harness to engine coolant temperature gauge unit.
- (3) Connect battery ground cable.
- (4) Refill cooling system.

Caution

Do not use an impact wrench to install the engine coolant temperature gauge unit, engine coolant temperature sensor, and engine coolant temperature switch.

