
ENGINE COOLING

ENGINE COOLING

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14109000277

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GENERAL INFORMATION

14100010279

The cooling system is designed to keep every part of the engine at appropriate temperature in whatever condition the engine may be operated.

The cooling method is of the water-cooled, pressure forced circulation type in which the water pump pressurizes coolant and circulates it throughout the engine. If the coolant temperature exceeds the prescribed temperature, the thermostat opens to circulate the coolant through the radiator as well so that the heat absorbed by the coolant may be radiated into the air.

The water pump is of the centrifugal type and is driven by the timing belt <GDI> or drive belt <MPI> from the crankshaft.

The radiator is the corrugated fin, down flow type and is cooled by the electrical radiator fan.

For vehicles with GDI, the cooling fans are controlled by a fan controller and the engine-ECU depending on driving conditions.

For vehicles with MPI, the cooling fan is controlled by the engine-ECU in accordance with the engine running condition.

Items		Specifications
Radiator	Performance kJ/h	129,768

SERVICE SPECIFICATIONS

14100030282

Items			Standard value	Limit
Radiator cap opening pressure kPa			74 – 103	64
Range of coolant antifreeze concentration of radiator %			30 – 60	–
Thermostat	Valve opening temperature of thermostat °C	GDI	85 ± 1.5	–
		MPI	88	–
	Full-opening temperature of thermostat °C	GDI	98	–
		MPI	100	–
	Valve lift (at 95°C) mm	GDI	8.5 or more	–
		MPI	8.0 or more	–

LUBRICANT

14100040193

Items	Quantity ℓ
HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT	6

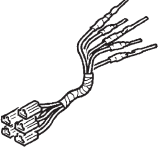
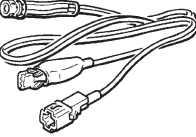
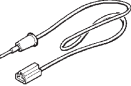

SEALANTS

14100050219

Items	Specified sealant	Remarks
Cylinder block drain plug	3M Nut Locking Part No. 4171 or equivalent	Drying sealant
Water pump, Thermostat case assembly <GDI>	Mitsubishi Genuine Parts No. MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOL

14100060038

Tool	Number	Name	Use
<p>A</p>  <p>B</p>  <p>C</p>  <p>D</p>  <p>C991223</p>	<p>MB991223</p> <p>A: MB991219</p> <p>B: MB991220</p> <p>C: MB991221</p> <p>D: MB991222</p>	<p>Harness set</p> <p>A: Test harness</p> <p>B: LED harness</p> <p>C: LED harness adapter</p> <p>D: probe</p>	<p>Measurement of terminal voltage</p> <p>A: Connector pin contact pressure inspection</p> <p>B: Power circuit inspection</p> <p>C: Power circuit inspection</p> <p>D: Commercial tester connection</p>

TROUBLESHOOTING

14100560019

INSPECTION CHART FOR TROUBLE SYMPTOMS

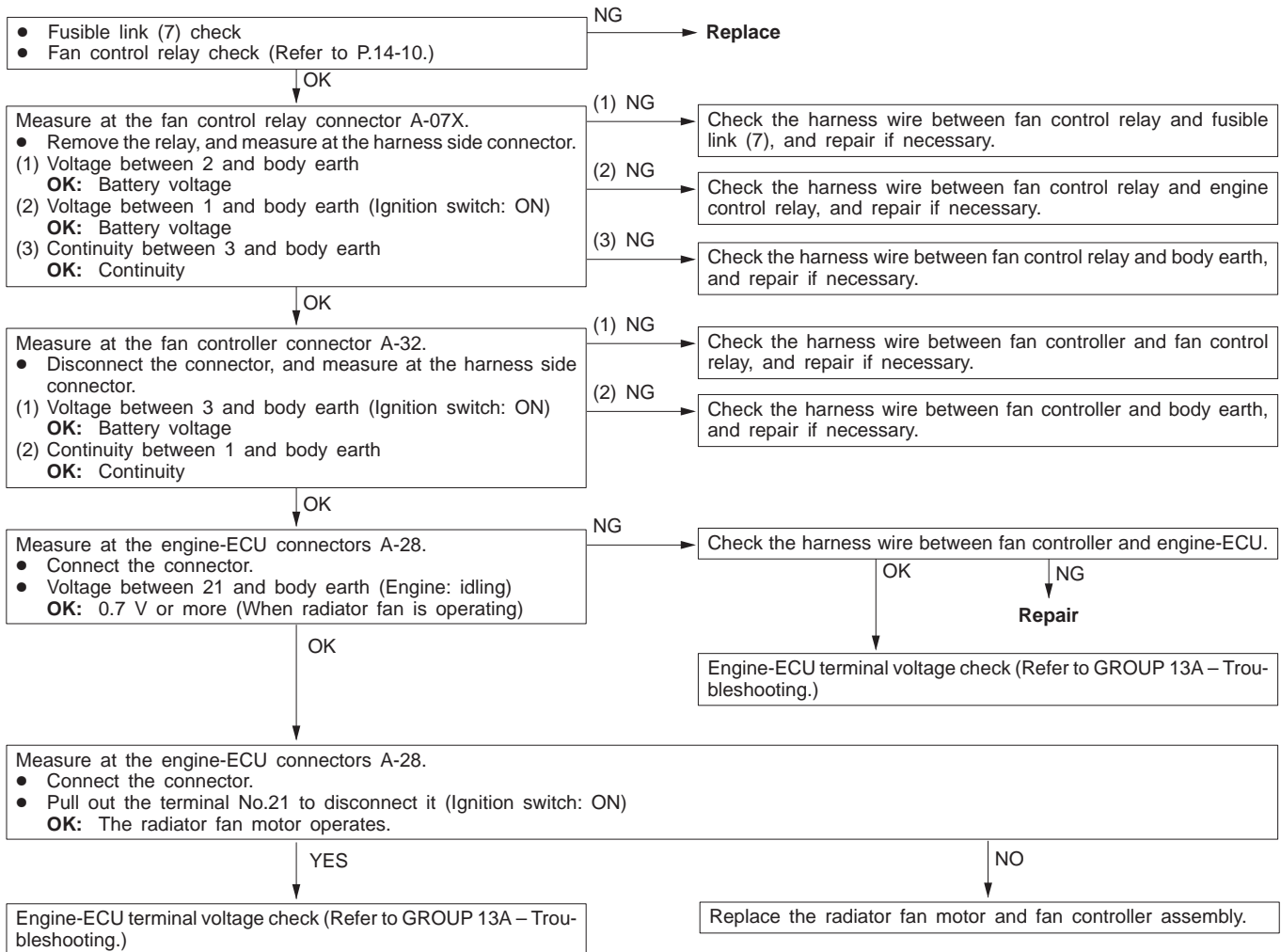
Trouble symptoms	Inspection procedure No.	Reference page
Radiator fan and condenser fan do not operate. <Vehicles with A/C> Radiator fan does not operate. <Vehicles without A/C>	1	14-3
Radiator fan and condenser fan do not change speed or stop. <Vehicles with A/C> Radiator fan does not change speed or stop. <Vehicles without A/C>	2	14-6
Radiator fan does not operate. <Vehicles with A/C>	3	14-7
Condenser fan does not operate. <Vehicles with A/C>	4	14-7

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 1

Radiator fan and condenser fan do not operate. <Vehicles with A/C> Radiator fan does not operate. <Vehicles without A/C>	Probable cause
The cause could be a malfunction of the fan controller power supply or earth circuit. The cause could also be a malfunction of the fan controller or the engine-ECU.	<ul style="list-style-type: none"> ● Malfunction of fusible link ● Malfunction of fan control relay ● Malfunction of fan controller ● Malfunction of engine-ECU ● Malfunction of wiring harness or connector

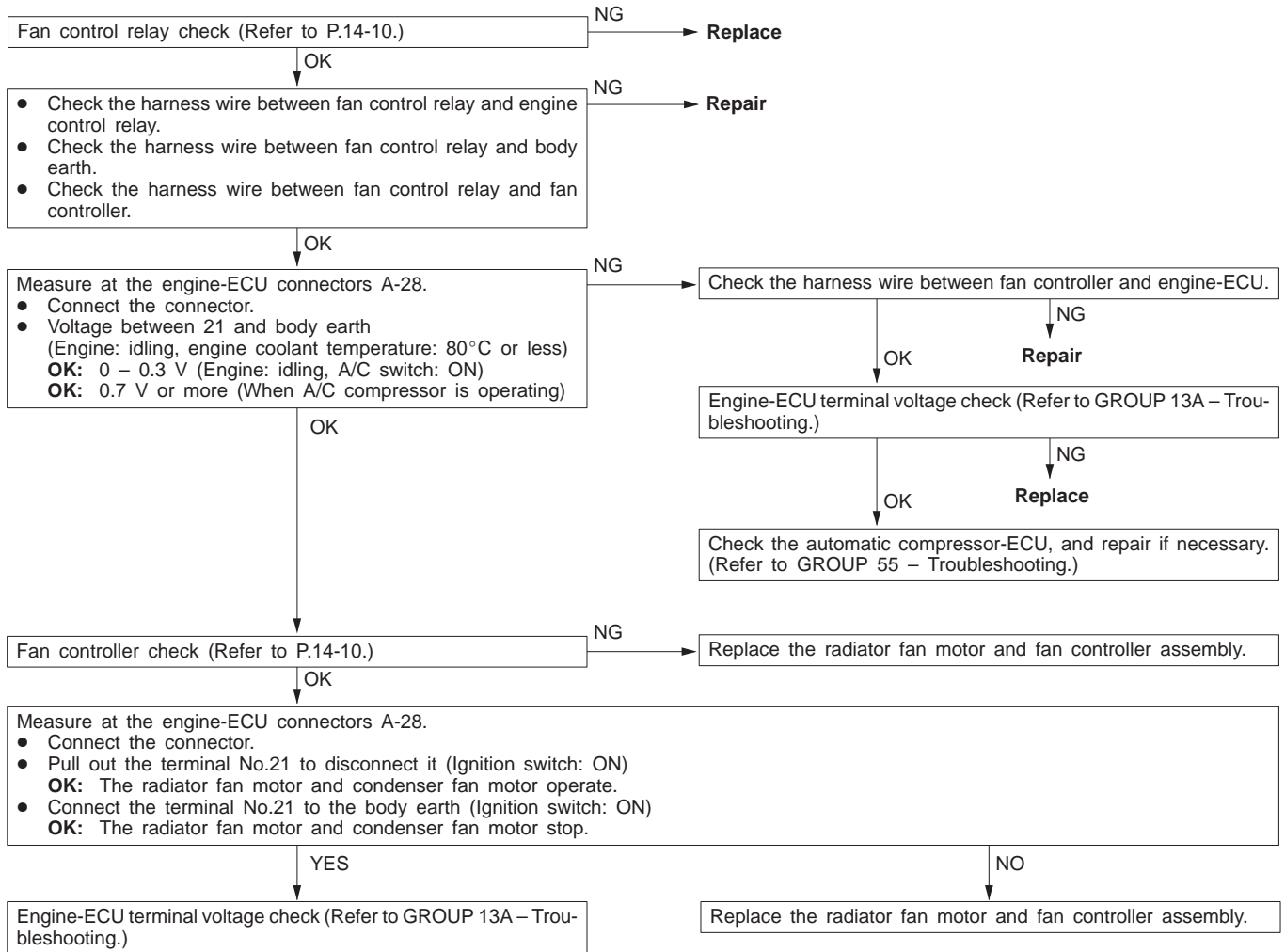
<Vehicles without A/C>



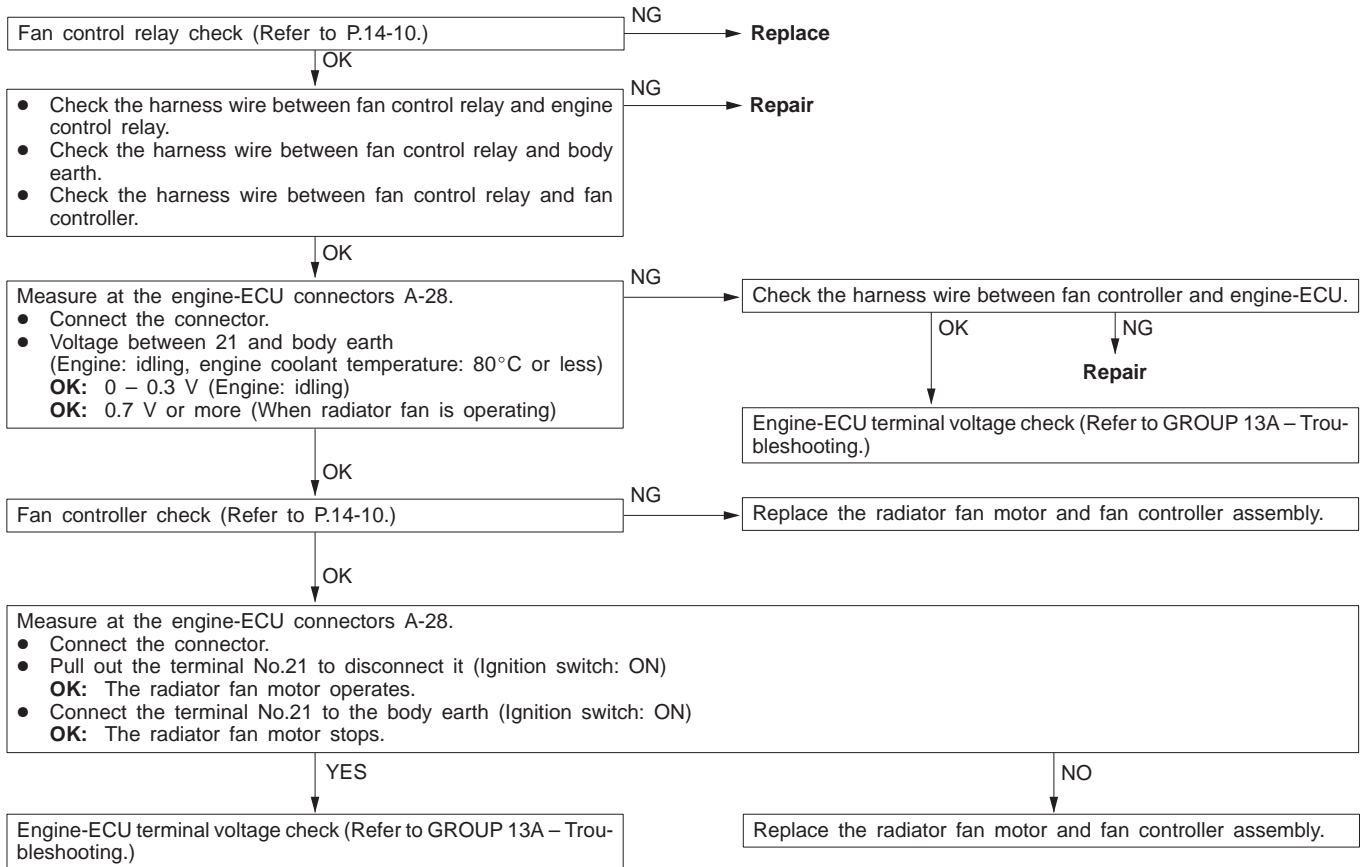
Inspection Procedure 2

<p>Radiator fan and condenser fan do not change speed or stop. <Vehicles with A/C> Radiator fan does not change speed or stop. <Vehicles without A/C></p>	<p>Probable cause</p>
<p>The fan controller carries out step-free control of the radiator fan motor and the condenser fan motor speeds using signals transmitted from the engine-ECU.</p>	<ul style="list-style-type: none"> ● Malfunction of fan control relay ● Malfunction of fan controller ● Malfunction of engine-ECU ● Malfunction of wiring harness or connector

<Vehicles with A/C>



<Vehicles without A/C>



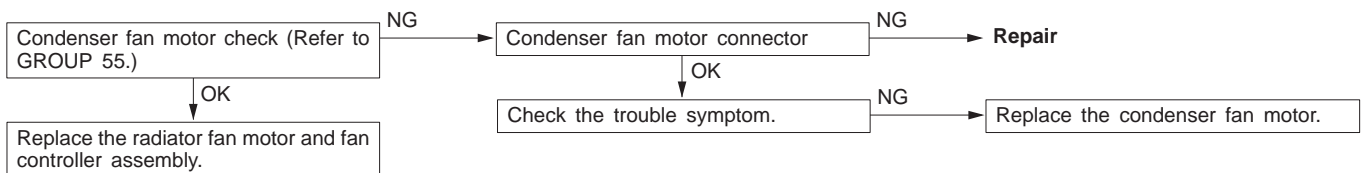
Inspection Procedure 3

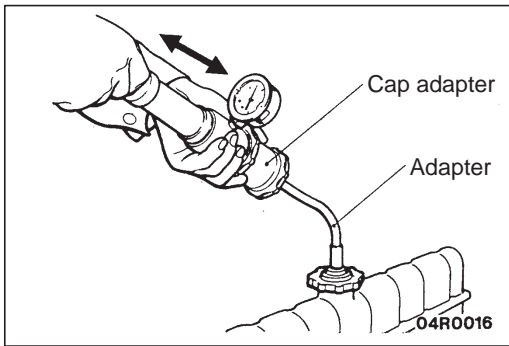
Radiator fan does not operate. <Vehicles with A/C>	Probable cause
The cause could be a malfunction of the radiator fan motor or an open circuit between the fan controller and the radiator fan motor.	<ul style="list-style-type: none"> Malfunction of radiator fan motor Open circuit between fan controller and radiator fan motor

Replace the radiator fan motor and fan controller assembly.

Inspection Procedure 4

Condenser fan does not operate. <Vehicles with A/C>	Probable cause
The cause could be a malfunction of the condenser fan motor or of the fan controller.	<ul style="list-style-type: none"> Malfunction of condenser fan motor Malfunction of fan controller Malfunction of wiring harness or connector





ON-VEHICLE SERVICE

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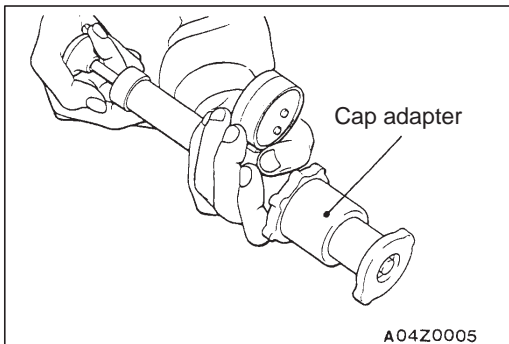
ENGINE COOLANT LEAK CHECKING

1. Confirm that the coolant level is up to the filler neck. Install a radiator cap tester, adapter and cap adapter to the filler neck, and apply 160 kPa pressure, and then check for leakage from the radiator hose or connections.

Caution

- (1) Be sure to completely clean away any moisture from the places checked.
- (2) When the tester is taken out, be careful not to spill any coolant from it.
- (3) Be careful, when installing and removing the tester and when testing, not to deform the radiator filler neck.

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



RADIATOR CAP VALVE OPENING PRESSURE CHECK

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

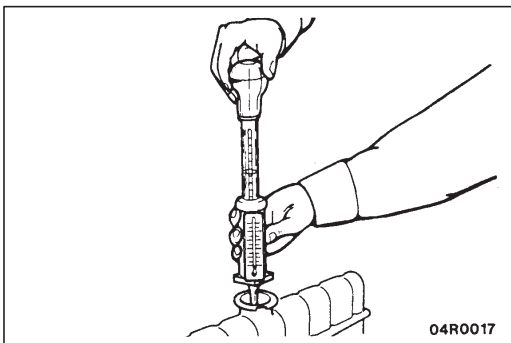
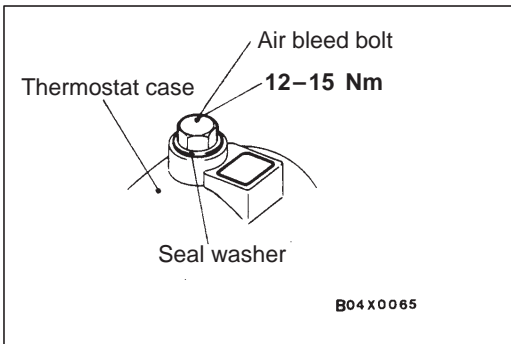
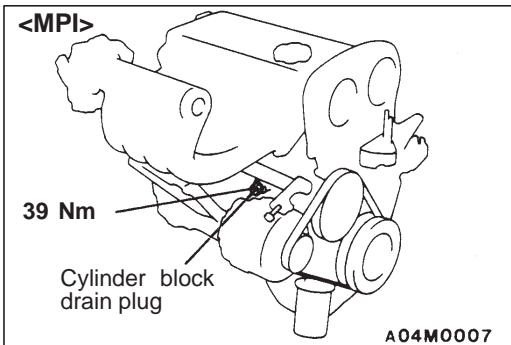
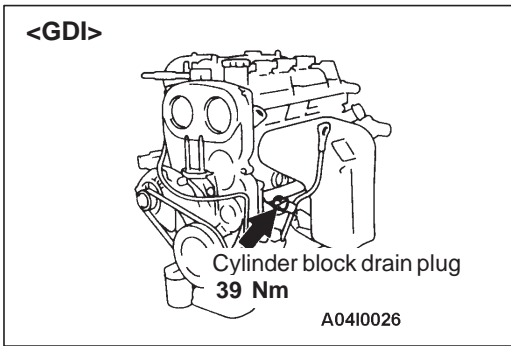
Standard value: 75 – 105 kPa

Limit: 65 kPa

3. 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.



ENGINE COOLANT REPLACEMENT

14100120323

1. Drain the engine coolant by removing the drain plug and then the radiator cap.
2. Remove the drain plug from the cylinder block to drain the engine coolant.
3. Remove the reserve tank to drain the engine coolant.
4. When the engine coolant has drained, pour in water from the radiator cap to clean the engine coolant line.

5. Coat the thread of the cylinder block drain plug with the specified sealant and tighten to the specified torque.

Specified sealant:

3M Nut Locking Part No. 4171 or equivalent

6. Securely tighten the radiator drain plug.
7. Install the reserve tank.
8. Remove the air bleed bolt and replace the seal washer.
9. Fill the radiator until the engine coolant flows from the air bleed bolt section, and then close the air bleed bolt.
10. Slowly pour the engine coolant into the mouth of the radiator until the radiator is full, and pour also into the reserve tank up to the FULL line.

Recommended antifreeze:

HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT

Quantity: 6 ℓ

NOTE

For Norway, the non-amine type of antifreeze should be used.

11. Install the radiator cap securely.
12. Start the engine and warm the engine until the thermostat opens. (Touch the radiator hose with your hand to check that warm water is flowing.)
13. After the thermostat opens, race the engine several times, and then stop the engine.
14. Cool down the engine, and then pour engine coolant into the reserve tank until the level reaches the FULL line. If the level is low, repeat the operation from step 11.

CONCENTRATION MEASUREMENT

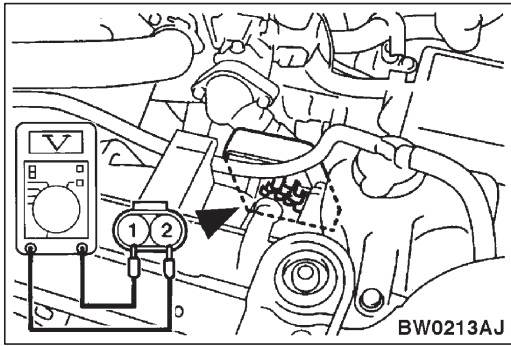
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Measure the temperature and specific gravity of the engine coolant to check the antifreeze concentration.

Standard value: 30-60% (allowable concentration range)

RECOMMENDED ANTIFREEZE

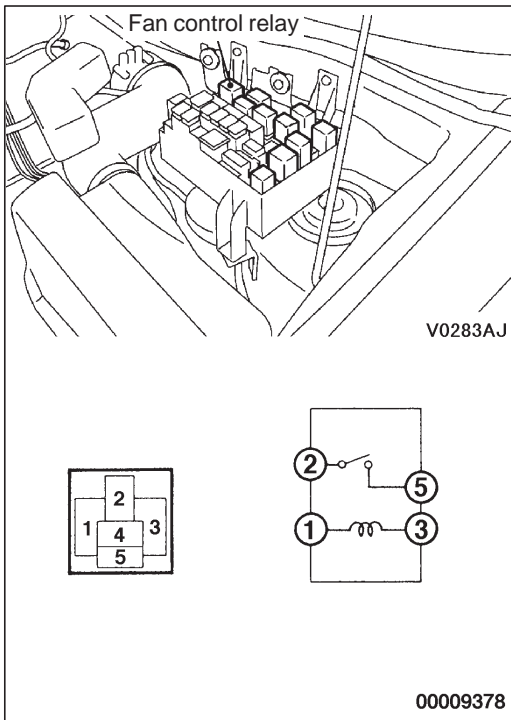
Antifreeze	Allowable concentration
HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT	30-60%



FAN CONTROLLER CHECK <GDI>

14100610011

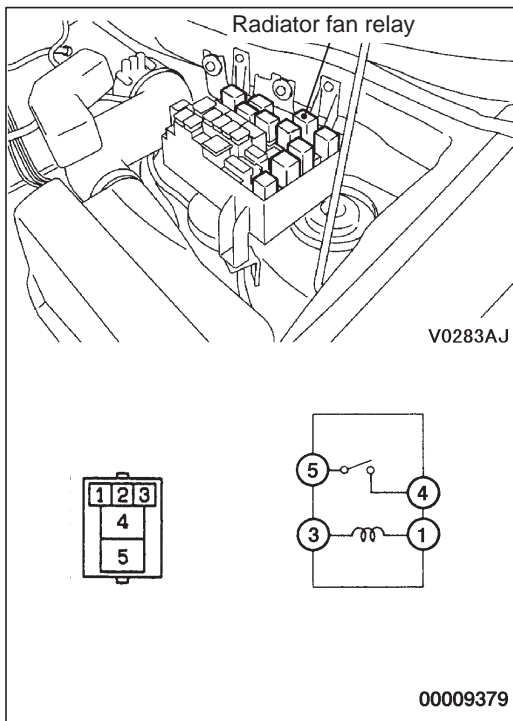
1. Disconnect the condenser fan motor connector.
2. Start the engine and run it at idle.
3. Turn the A/C switch to ON and maintain the coolant temperature at 80°C or less.
4. When measuring the voltage between the fan controller-side connector terminals, check that the value changes repeatedly as indicated by (1) – (3) below.
 - (1) 0 V
 - (2) 8.2 ± 2.6 V
 - (3) Battery voltage ± 2.6 V
5. If the voltage does not repeatedly change as indicated, replace the radiator fan motor and the fan controller assembly.



FAN CONTROL RELAY CONTINUITY CHECK <GDI>

14100620014

Battery voltage	Terminal No.			
	1	2	3	5
When current is not supplied	○		○	
When current is supplied	⊕	○	⊖	○



RADIATOR FAN RELAY CONTINUITY CHECK <MPI>

14100620014

Battery voltage	Terminal No.			
	1	3	4	5
When current is not supplied	○	○		
When current is supplied	⊖	⊕		○

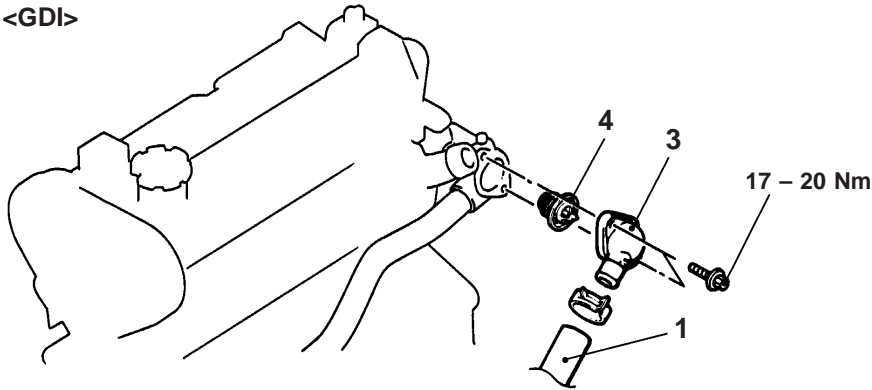
THERMOSTAT

14100240357

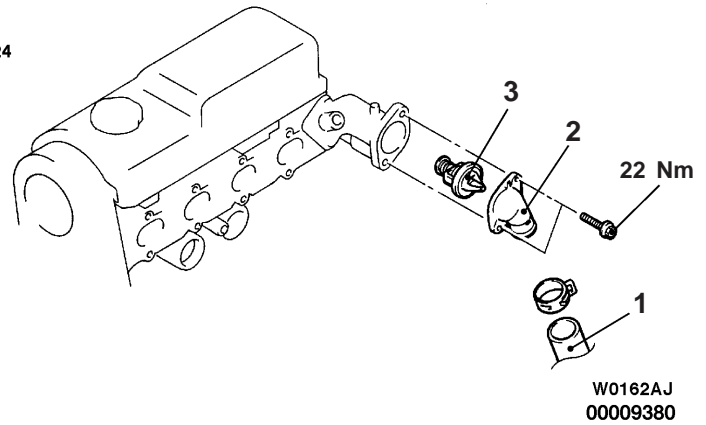
REMOVAL AND INSTALLATION

- Pre-removal and Post-installation Operation**
- Engine Coolant Draining and Supplying (Refer to P.14-9.)
 - Air Cleaner Removal and Installation

<GDI>



<MPI>



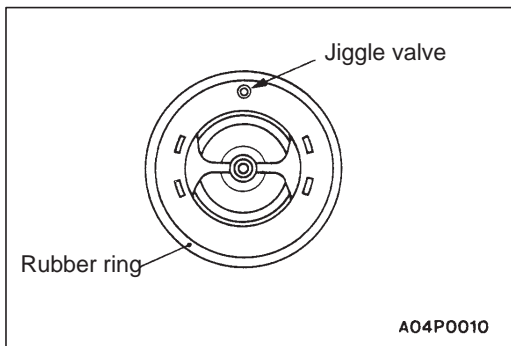
Removal steps

- ◀A▶ ▶B◀ 1. Radiator lower hose connection
- ▶A◀ 2. Water inlet fitting
- ▶A◀ 3. Thermostat

REMOVAL SERVICE POINT

◀A▶ **RADIATOR LOWER HOSE DISCONNECTION**

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.



INSTALLATION SERVICE POINTS

►A◄ THERMOSTAT INSTALLATION

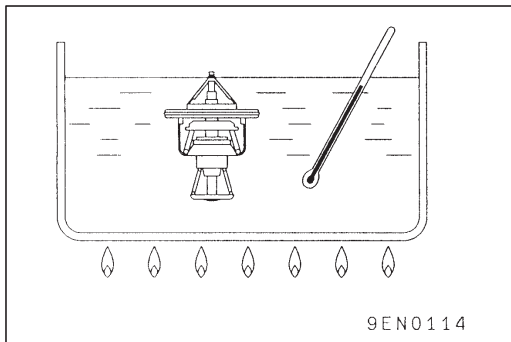
Install the thermostat so that the jiggle valve is facing straight up.

Caution

Make absolutely sure that no oil is adhering to the rubber ring of the thermostat. In addition, be careful not to fold over or scratch the rubber ring when inserting. If the rubber ring is damaged, replace the thermostat.

►B◄ RADIATOR LOWER HOSE CONNECTION

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.



INSPECTION

14100250350

THERMOSTAT CHECK

1. Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature.

Standard value:

Valve opening temperature:

<GDI> $85 \pm 1.5^{\circ}\text{C}$

<MPI> 88°C

2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.

Standard value:

Full-opening temperature:

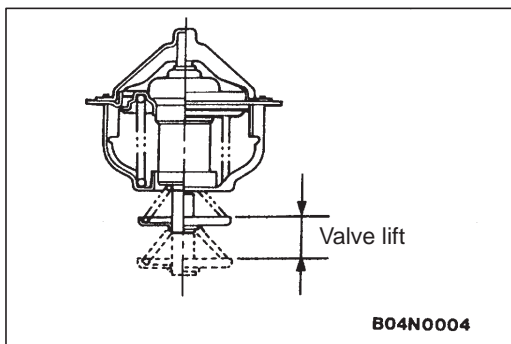
<GDI> 98°C

<MPI> 100°C

Amount of valve lift:

<GDI> 8.5 mm or more

<MPI> 8.0 mm or more



NOTE

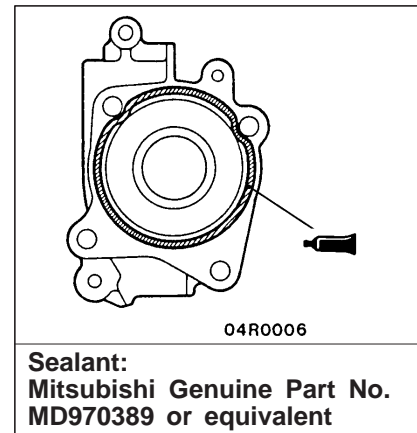
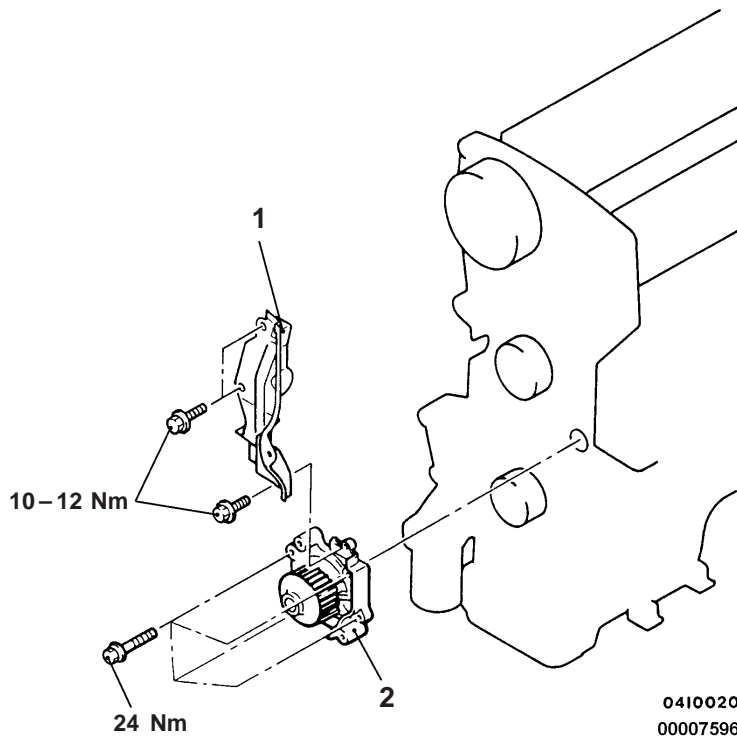
Measure the valve height when the thermostat is fully closed, and use this measurement to calculate the valve height when the thermostat is fully open.

WATER PUMP**REMOVAL AND INSTALLATION**

<GDI>

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying
(Refer to P.14-9.)
- Timing Belt Removal and Installation
(Refer to GROUP 11A.)
- Idler Pulley Removal and Installation
(Refer to GROUP 11A.)

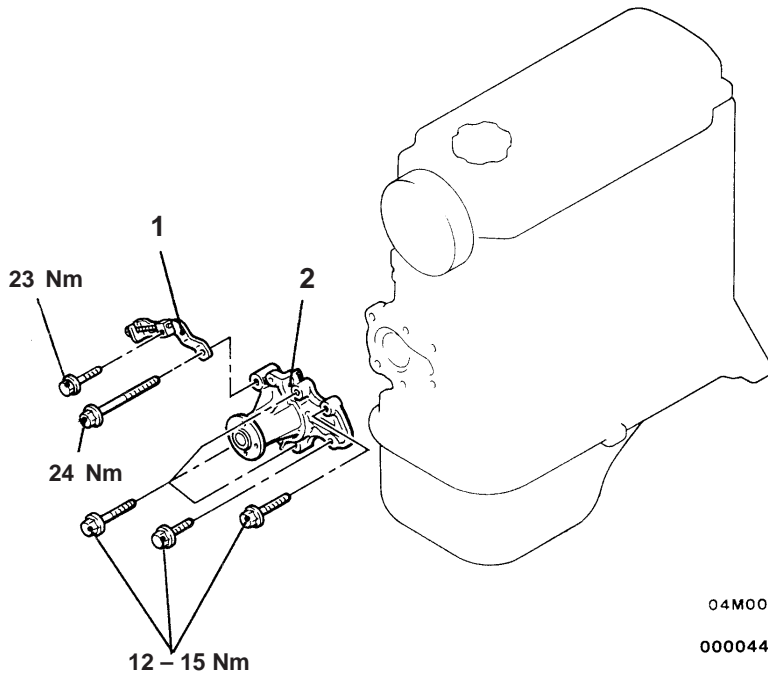
**Removal steps**

- ▶◀
1. Timing belt rear cover
 2. Water pump

<MPI>

Pre-removal and Post-installation Operation

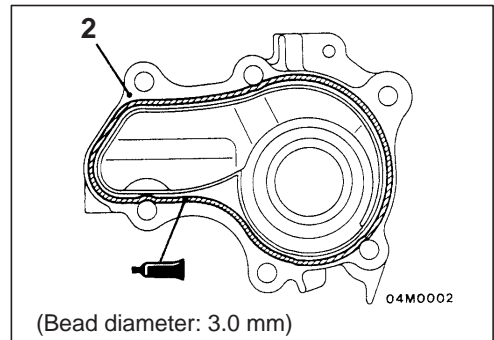
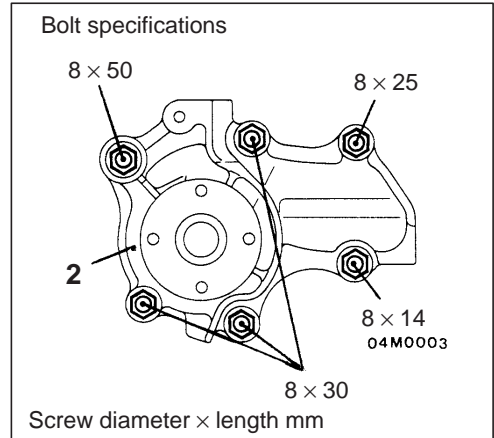
- Engine Coolant Draining and Supplying
(Refer to P.14-9.)
- Timing Belt Removal and Installation
(Refer to GROUP 11B.)



04M0026
00004473

Removal steps

- ▶A◀ 1. Alternator brace
▶A◀ 2. Water pump



Sealant:
Mitsubishi Genuine Part No.
MD970389 or equivalent

INSTALLATION SERVICE POINT

▶A◀ **WATER PUMP INSTALLATION**

Squeeze out the sealant from the tube evenly and apply it so that there is not too much sealant and no places without sealant.

Specified Sealant:

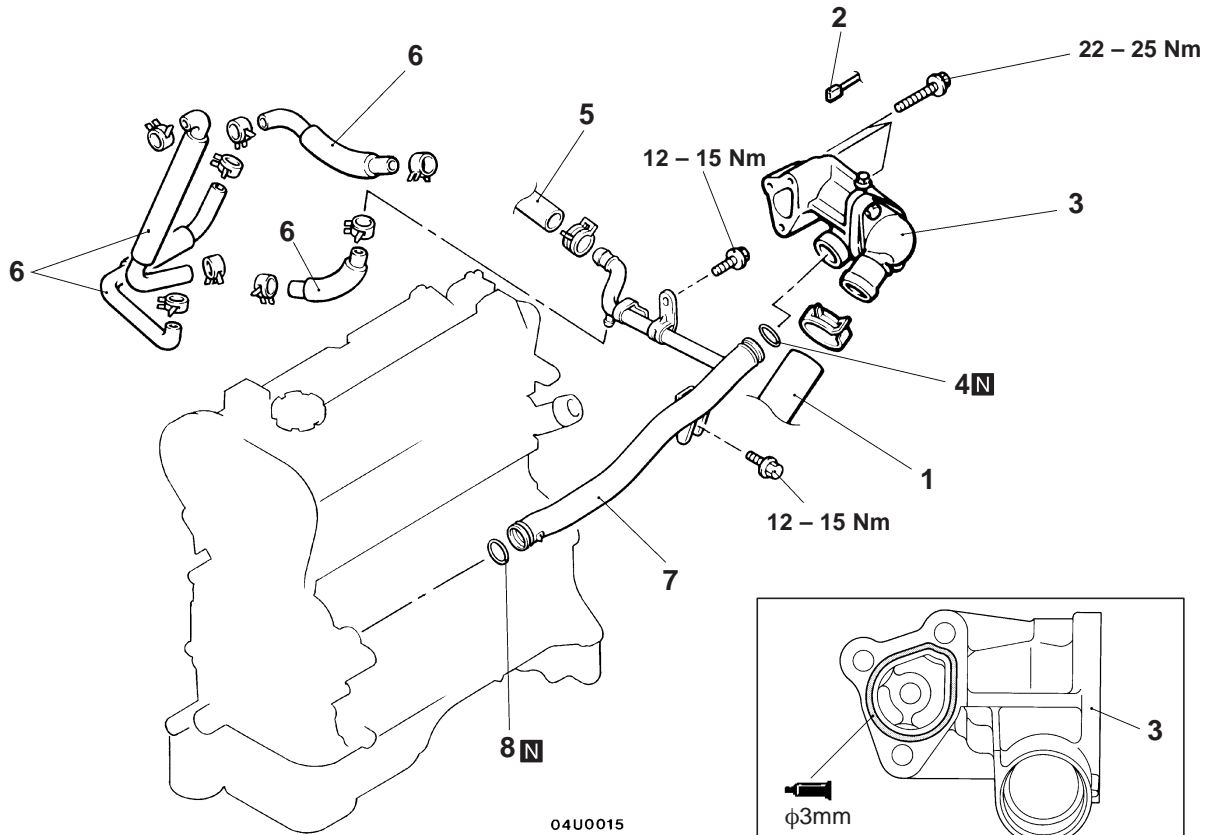
Mitsubishi Genuine Parts No. MD970389 or equivalent

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

<GDI>

- Pre-removal and Post-installation Operation**
- Engine Coolant Draining and Suppling (Refer to P.14-9.)
 - Engine Cover Removal and Installation
 - Air Cleaner Removal and Installation



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00007142

Sealant:
Mitsubishi Genuine Part No.
MD970389 or equivalent

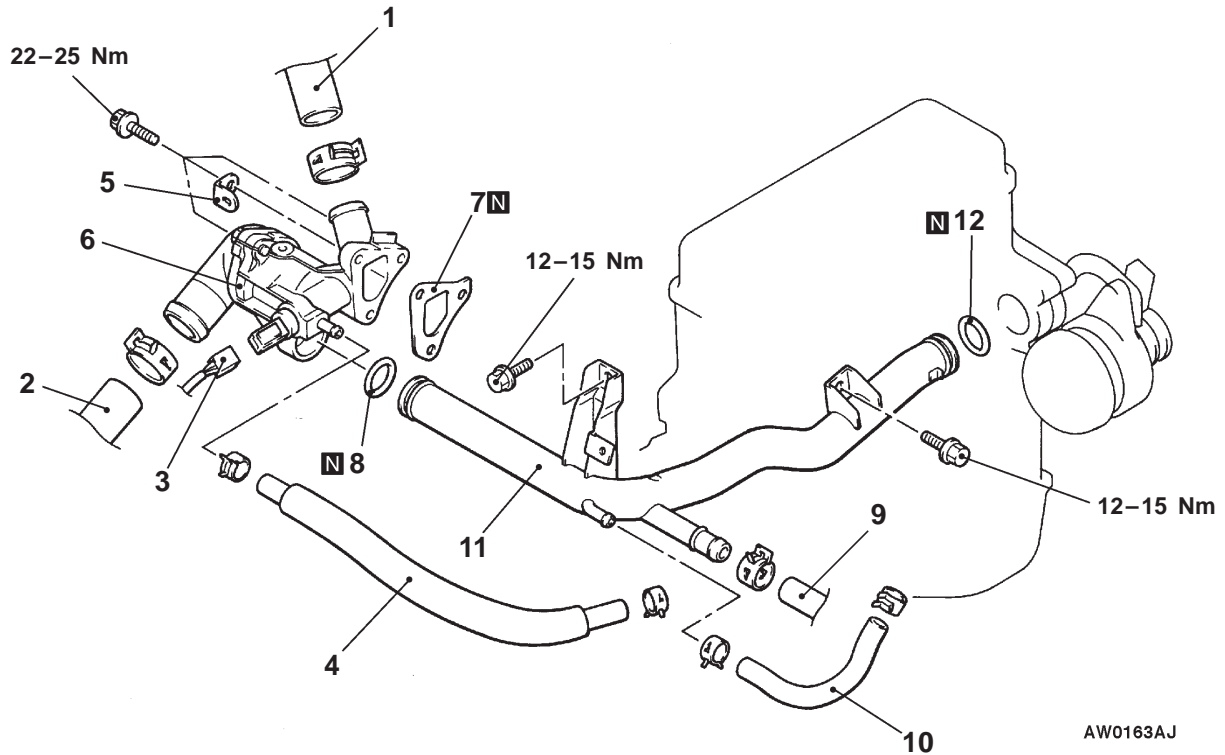
Removal steps

- | | | |
|--------------------------------------|--|---|
| <p>◀A▶ ▶C▶</p> <p>▶B▶</p> <p>▶A▶</p> | <p>1. Radiator lower hose connection</p> <p>2. Engine coolant temperature gauge unit connector</p> <p>3. Thermostat case assembly</p> <p>4. O-ring</p> | <p>5. Heater hose connection</p> <ul style="list-style-type: none"> • Intake manifold (Refer to GROUP 15.) <p>6. Water hose</p> <p>7. Water inlet pipe assembly</p> <p>▶A▶ 8. O-ring</p> |
|--------------------------------------|--|---|

<MPI>

Pre-removal and Post-Installation Operation

- Engine Coolant Draining and Supplying
(Refer to P.14-9.)
- Air Cleaner Removal and Installation



AW0163AJ

Removal steps



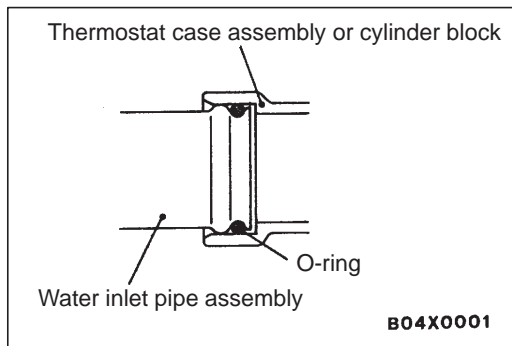
1. Radiator upper hose connection
2. Radiator lower hose connection
3. Harness connector connection
4. Water hose
5. Harness clamp
6. Thermostat case assembly

7. Gasket
8. O-ring
9. Heater hose connection
10. Water hose
11. Water inlet pipe assembly
12. O-ring

REMOVAL SERVICE POINT

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.



INSTALLATION SERVICE POINTS

▶A◀ O-RING INSTALLATION

Insert the O-ring to the water inlet pipe assembly, and coat the outer circumference of the O-ring with water or engine coolant.

Caution

Do not allow engine oil or other greases to adhere to the O-ring

▶B◀ /THERMOSTAT CASE ASSEMBLY INSTALLATION

Squeeze out the sealant from the tube evenly and apply it so that there is not too much sealant and no places without sealant.

Specified Sealant:

Mitsubishi Genuine Parts No. MD970389 or equivalent

▶C◀ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE CONNECTION

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

INSPECTION

14100340101

WATER PIPE AND HOSE CHECK

Check the water pipe and hose for cracks, damage, clog and replace them if necessary.

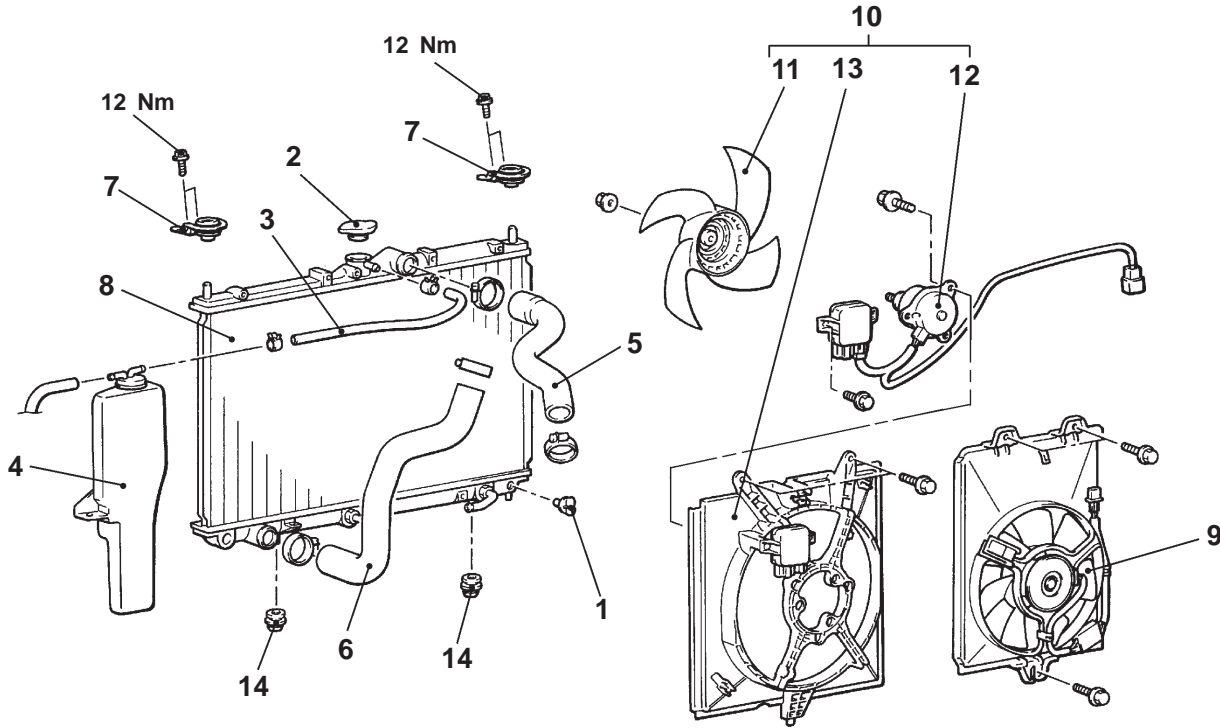
RADIATOR

14100150391

REMOVAL AND INSTALLATION

Pre-removal and Post-Installation Operation

- Engine Coolant Draining and Supplying
(Refer to P.14-9.)
- Air Cleaner Removal and Installation



AW0164AJ

Radiator removal steps

1. Drain plug
2. Radiator cap
3. Overflow hose
4. Reserve tank
5. Radiator upper hose
6. Radiator lower hose
7. Upper insulator
8. Radiator assembly
9. Condenser fan motor assembly
10. Radiator fan motor assembly
14. Lower insulator



Radiator fan motor and condenser fan motor assembly removal steps

1. Drain plug
2. Radiator cap
3. Overflow hose
5. Radiator upper hose
9. Condenser fan motor assembly
10. Radiator fan motor assembly
11. Radiator fan
12. Radiator fan motor and radiator fan controller assembly <GDI> or radiator fan motor <MPI>
13. Radiator shroud



REMOVAL SERVICE POINT**◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION**

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINT**▶A◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION**

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

ENGINE COOLING

CONTENTS

GENERAL	2	WATER PUMP <F9Q1>	5
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SEALANT	2	RADIATOR FAN <F9Q1>	8
THERMOSTAT <4G93-GDI>	3	RADIATOR <F9Q1>	10
THERMOSTAT <F9Q1>	4		

GENERAL

OUTLINE OF CHANGES

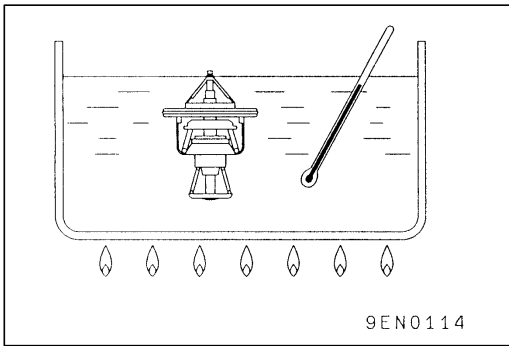
- Since the thermostat of 4G93-GDI engine is changed, the service procedures are made.
 - Since the water hose is changed because of adopting the resin intake manifold, the service procedures are made.
 - Since F9Q1 diesel engine is added, the service procedures are made.
- Other service procedures are the same as before.

SERVICE SPECIFICATIONS

Items		Standard value
Thermostat <4G93-GDI>	Valve opening temperature of thermostat °C	82 ± 1.5
	Full-opening temperature of thermostat °C	95
	Valve lift (at 95°C) mm	8.5 or more

SEALANT

Items	Specified sealant	Remarks
Thermostat case assembly <4G93-GDI> Water pump <F9Q1>	Mitsubishi Genuine Parts No. MD970389 or equivalent	Semi-drying sealant



THERMOSTAT <4G93-GDI>

INSPECTION

THERMOSTAT CHECK

1. Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature.

Standard value:

Valve opening temperature: $82 \pm 1.5^{\circ}\text{C}$

2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.

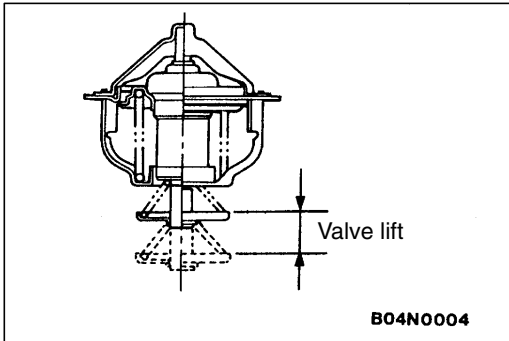
Standard value:

Full-opening temperature: 95°C

Amount of valve lift: 8.5 mm or more

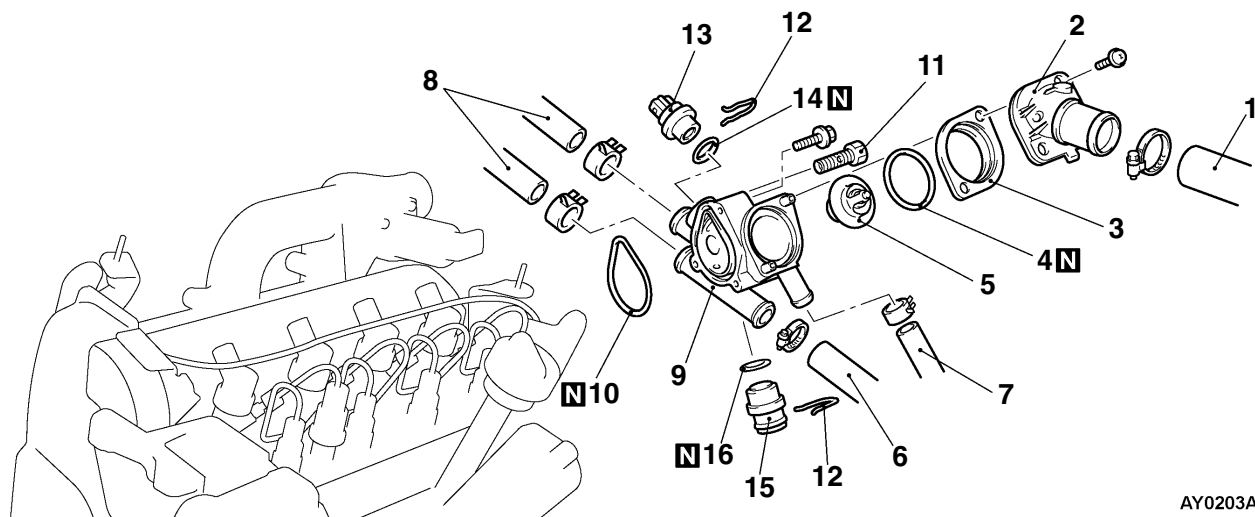
NOTE

Measure the valve height when the thermostat is fully closed, and use this measurement to calculate the valve height when the thermostat is fully open.



THERMOSTAT <F9Q1>**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

- Engine Coolant Draining and Supplying
- Air Cleaner Removal and Installation
(Refer to GROUP 15.)



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Removal steps

- | | | |
|-------------------------------|--|---|
| <p>◀A▶ ▶A◀</p> <p>◀A▶ ▶A◀</p> | <ol style="list-style-type: none"> 1. Radiator upper hose connection 2. Water inlet fitting 3. Plate 4. O-ring 5. Thermostat 6. Water hose connection 7. Radiator lower hose connection 8. Heater hoses connection | <ol style="list-style-type: none"> 9. Thermostat housing 10. O-ring 11. Bleed screw 12. Clip 13. Engine coolant temperature sensor 14. O-ring 15. Plug 16. O-ring |
|-------------------------------|--|---|

REMOVAL SERVICE POINT**▶A◀ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION**

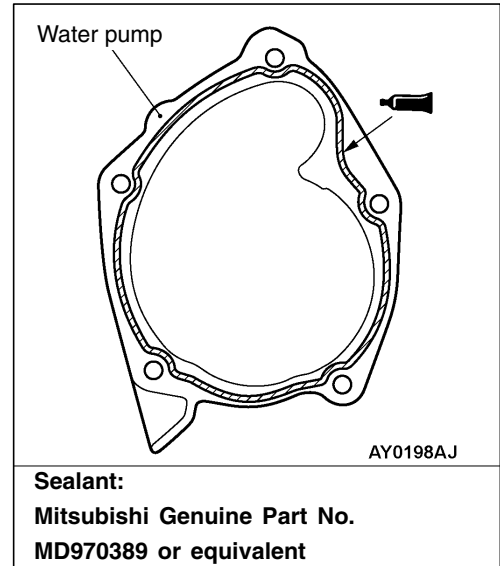
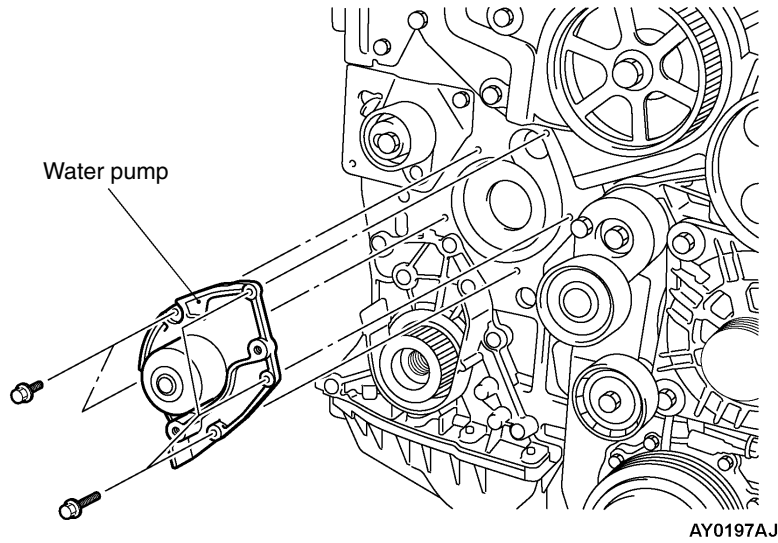
After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINT**▶A◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION**

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

WATER PUMP <F9Q1>**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

- Engine Coolant Draining and Supplying
- Timing Belt Removal and Installation
(Refer to GROUP 11A.)

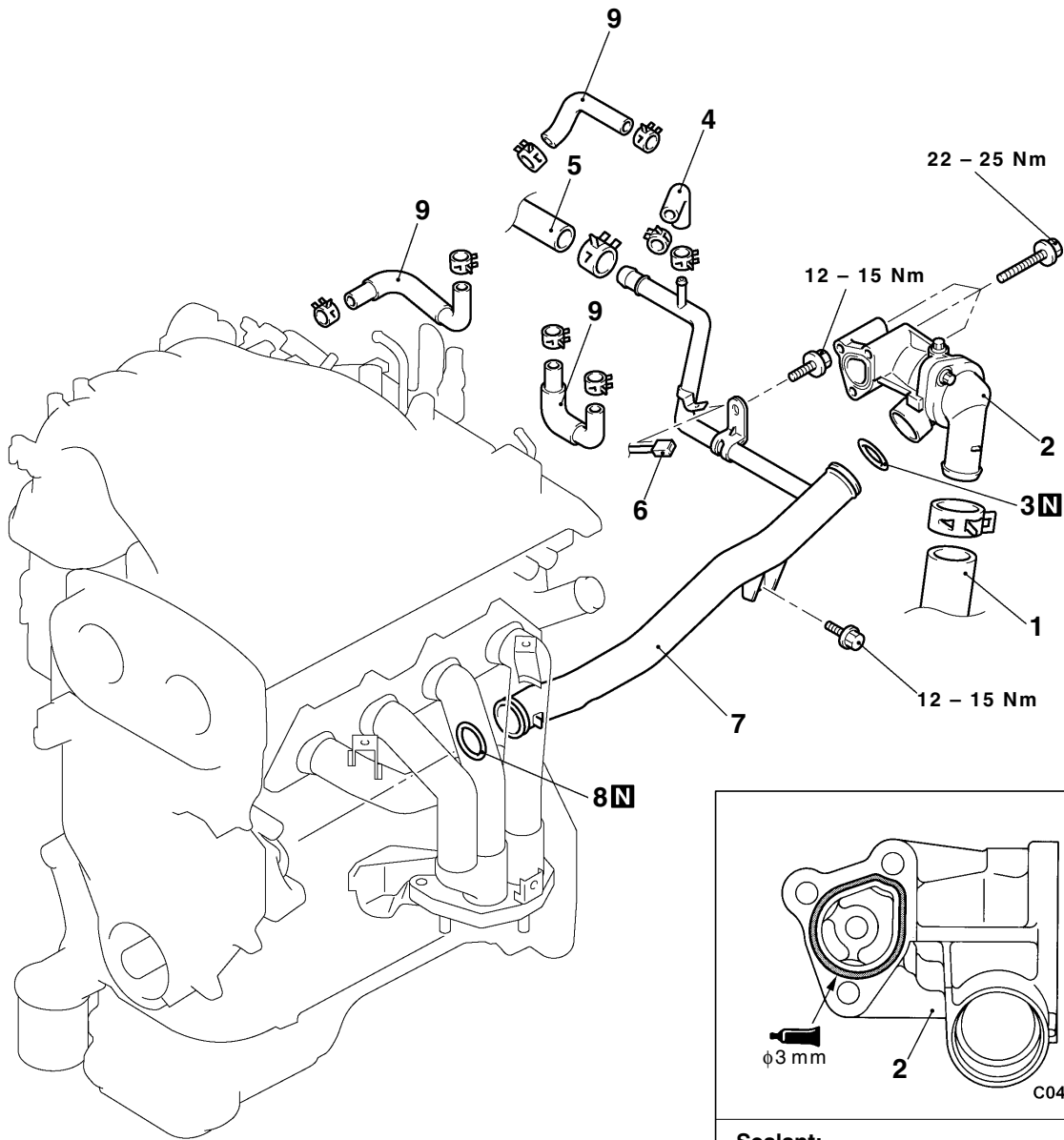


WATER HOSE AND WATER PIPE <4G93-GDI>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Under Cover Removal and Installation
- Engine Coolant Draining and Supplying
- Air Cleaner Removal and Installation
- Engine Cover and Control Wiring Harness Removal and Installation (Refer to GROUP 11A – Camshaft, Camshaft Oil Seal.)



AX0607AU

Sealant:
Mitsubishi Genuine Part No.
MD970389 or equivalent

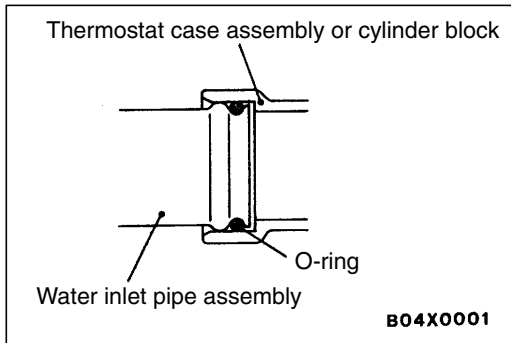
Removal steps

- ◀A▶
- ▶C▶
- ▶B▶
- ▶A▶
- 1. Radiator lower hose connection
- 2. Thermostat case assembly
- 3. O-ring
- 4. Water hose
- 5. Heater hose connection

- ▶A▶
- 6. Detonation sensor connector
- 7. Water inlet pipe
- 8. O-ring
- 9. Water hoses

REMOVAL SERVICE POINT**◀A▶ RADIATOR LOWER HOSE DISCONNECTION**

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

**INSTALLATION SERVICE POINTS****▶A◀ O-RING INSTALLATION**

Insert the O-ring to the water inlet pipe assembly, and coat the outer circumference of the O-ring with water or engine coolant.

Caution

Do not allow engine oil or other greases to adhere to the O-ring.

▶B◀ THERMOSTAT CASE ASSEMBLY INSTALLATION

Squeeze out the sealant from the tube evenly and apply it so that there is not too much sealant and no places without sealant.

Specified Sealant:

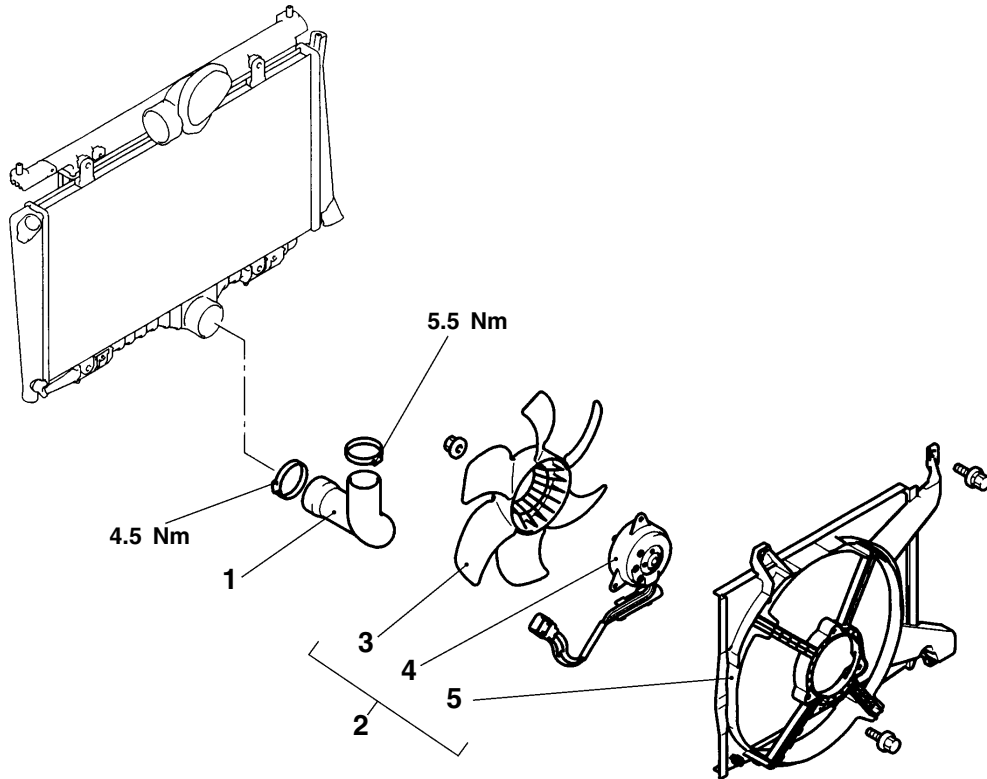
Mitsubishi Genuine Parts No. MD970389 or equivalent

▶C◀ RADIATOR LOWER HOSE CONNECTION

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

RADIATOR FAN <F9Q1>**REMOVAL AND INSTALLATION**

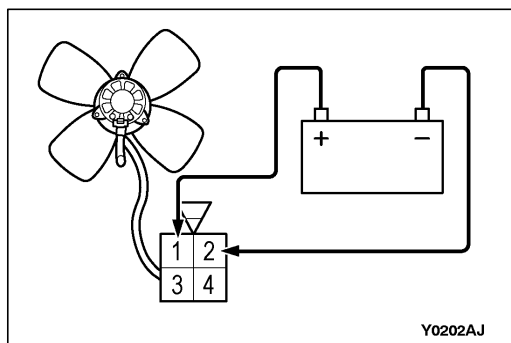
Pre-removal and Post-Installation Operation
Under Cover Removal and Installation



AY0178AJ

Removal steps

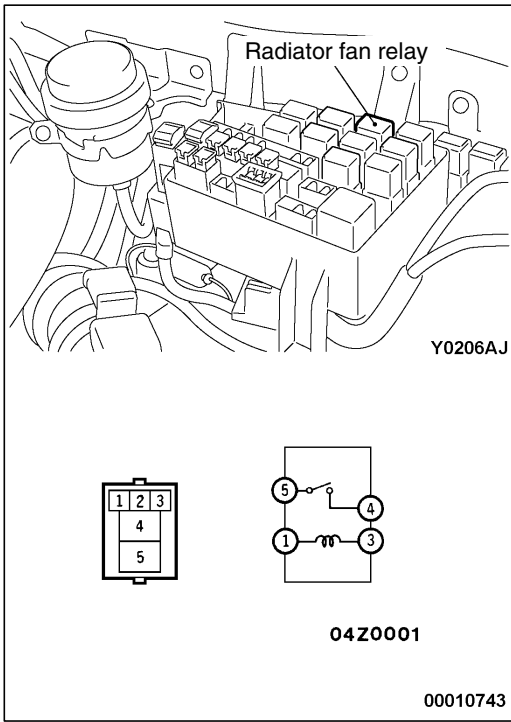
1. Air hose
 - Centermember (Refer to GROUP 32.)
2. Radiator fan motor assembly
3. Radiator fan
4. Radiator fan motor
5. Radiator shroud



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INSPECTION**RADIATOR FAN MOTOR CHECK**

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

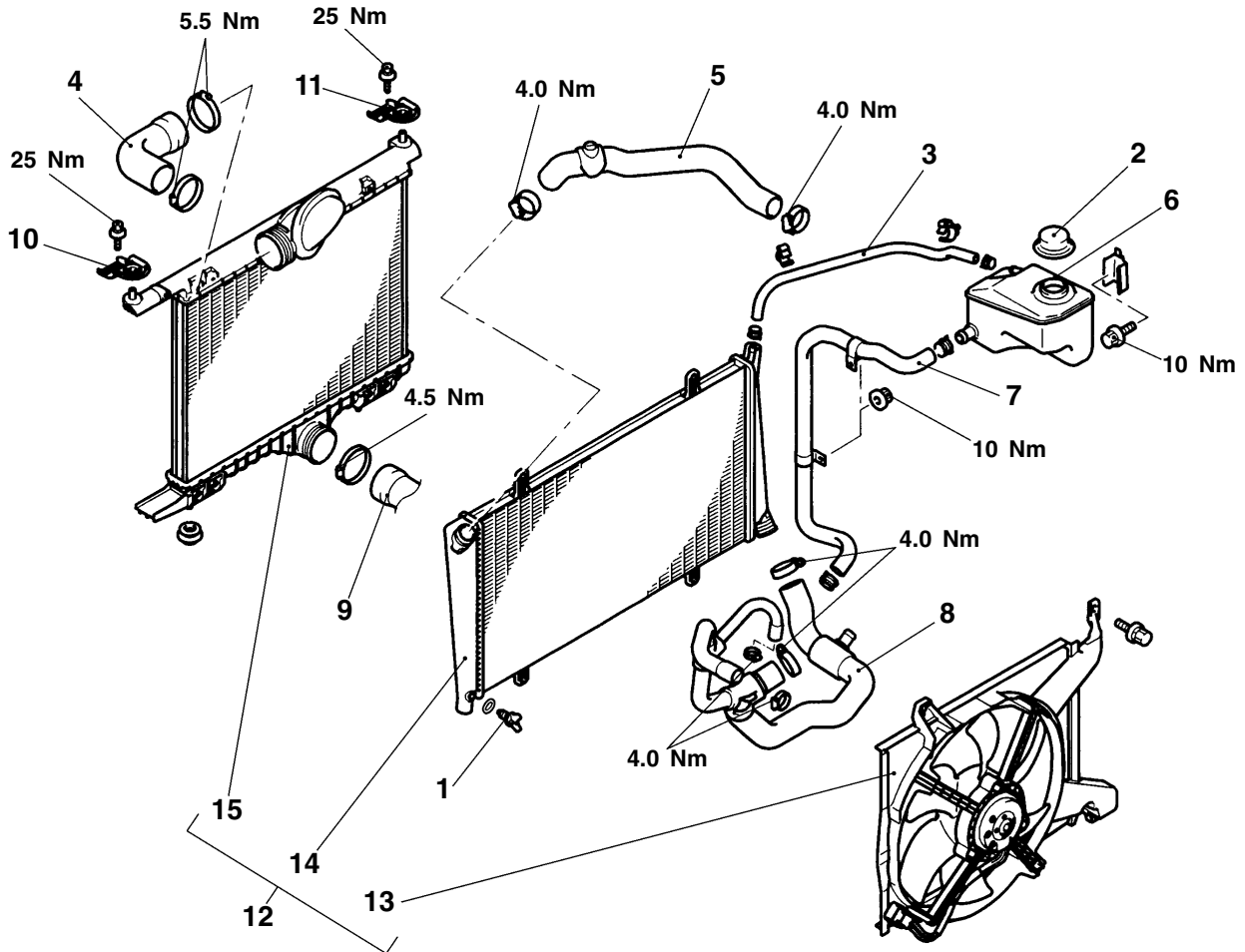


RADIATOR FAN RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	3	4	5
Not supplied	○	○		
Supplied	⊖	⊕	○	○

RADIATOR <F9Q1>**REMOVAL AND INSTALLATION****Pre-removal and Post-Installation Operation**

- Engine Coolant Draining and Supplying
- Air Cleaner Removal and Installation
(Refer to GROUP 15.)



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Removal steps

- | | |
|-------------------------------|---|
| <p>◀A▶ ▶A▶</p> <p>◀A▶ ▶A▶</p> | <ol style="list-style-type: none"> 1. Drain plug 2. Pressure cap 3. Deration hose 4. Air hose 5. Radiator upper hose 6. Hot bottle tank 7. Filler hose assembly 8. Radiator lower hose 9. Air hose connection 10. Upper insulator (L.H.) 11. Upper insulator (R.H.) 12. Radiator fan motor, radiator and intercooler assembly 13. Radiator fan motor assembly 14. Radiator assembly 15. Intercooler assembly |
|-------------------------------|---|

REMOVAL SERVICE POINT**◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION**

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINT**▶A◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION**

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

NOTES