

ENGINE COOLING

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14109000208

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GENERAL INFORMATION

14100010217

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 or drive belt from the crankshaft.

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

The cooling fans are controlled by a fan controller and the engine-ECU depending on driving conditions.

Items			Specifications
Radiator	Performance kJ/h	4G6	175,800
		6A1	200,900
		4D6	213,500
A/T oil cooler	Performance kJ/h	4G6	5,700
		6A1, 4D6	7,100

SERVICE SPECIFICATIONS

14100030091

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	82 ± 1.5	-
	Full-opening temperature of thermostat _C	95	-
	Valve lift (at 95_C) mm	8.5 or more	-

LUBRICANT

14100040148

Items		Quantity L
HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT	4G6, 6A1	6
	4D6	8

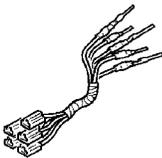
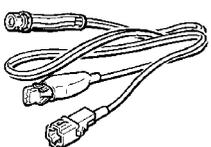
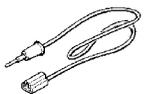
SEALANTS

14100050172

Items	Specified sealant	Remarks
Cylinder block drain plug	3M Nut Locking Part No. 4171 or equivalent	Drying sealant
Water pump <6A1>, Thermostat case assembly <4G6, 4D6>, Water outlet fitting <4D6>	Mitsubishi Genuine Parts No. MD970389 or equivalent	Semi-drying sealant

SPECIAL TOOL

1410060038

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

TROUBLESHOOTING

14100560019

INSPECTION CHART FOR TROUBLE SYMPTOMS

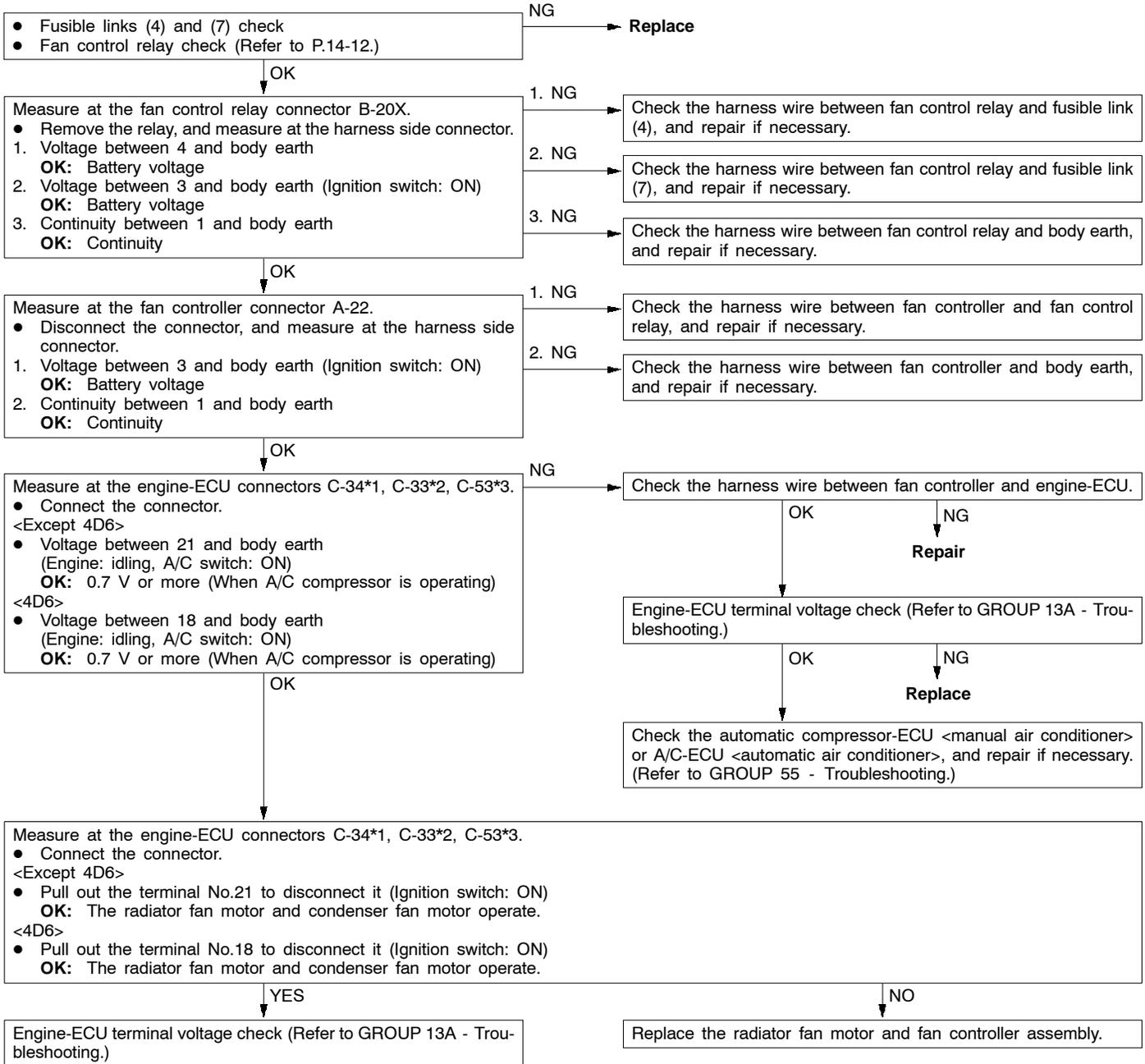
Trouble symptoms	Inspection procedure No.	Reference page
Radiator fan and condenser fan do not operate. <Vehicles with A/C> Radiator fan does not operate. <Vehicles without A/C>	1	14-3
Radiator fan and condenser fan do not change speed or stop. <Vehicles with A/C> Radiator fan does not change speed or stop. <Vehicles without A/C>	2	14-6
Radiator fan does not operate. <Vehicles with A/C>	3	14-8
Condenser fan does not operate. <Vehicles with A/C>	4	14-8

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

Inspection Procedure 1

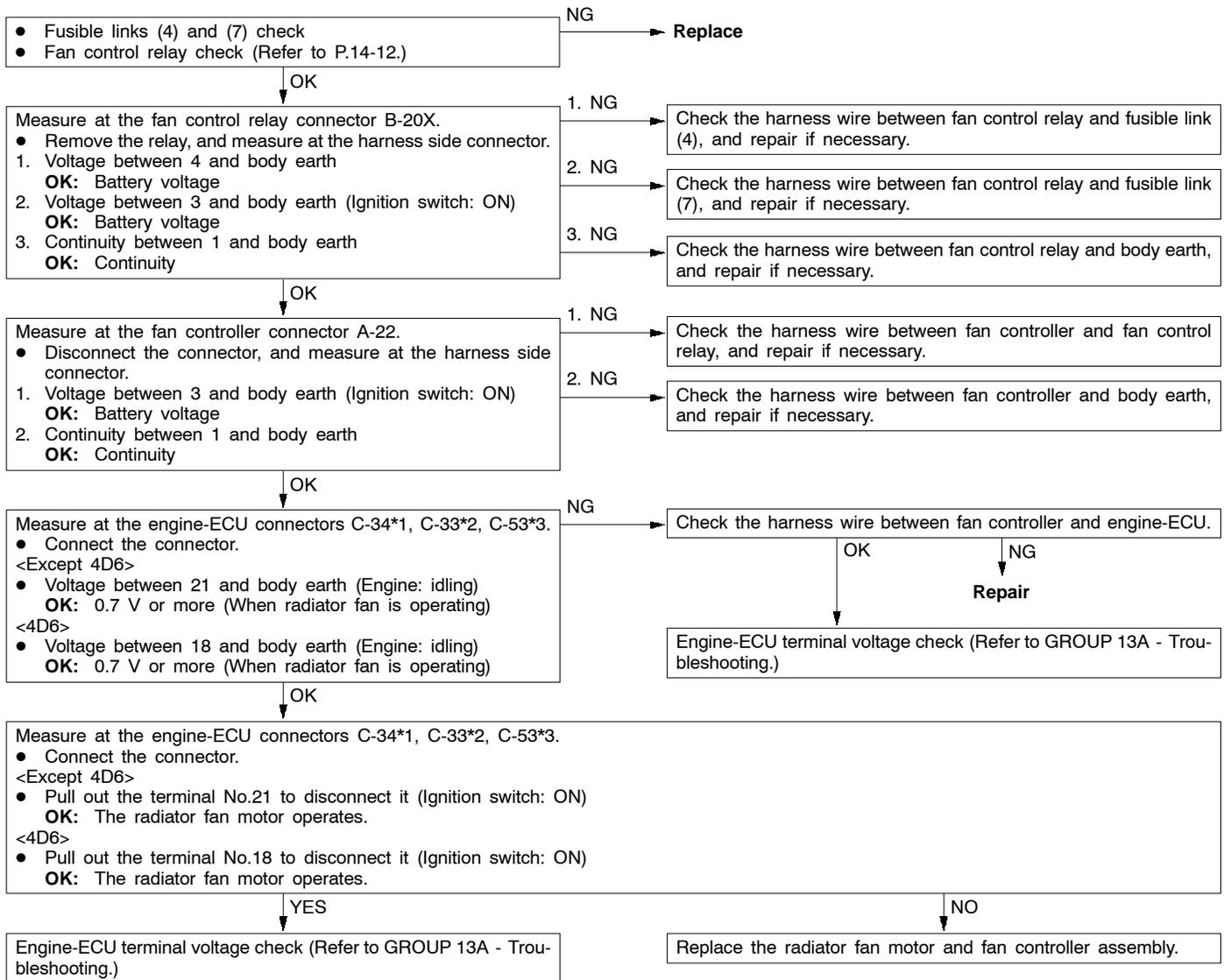
Radiator fan and condenser fan do not operate. <Vehicles with A/C> Radiator fan does not operate. <Vehicles without A/C>	Probable cause
The cause could be a malfunction of the fan controller power supply or earth circuit. The cause could also be a malfunction of the fan controller or the engine-ECU.	<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 with A/C>



NOTE
 *1: 4G6
 *2: 6A1
 *3: 4D6

<Vehicles without A/C>



NOTE

*1: 4G6

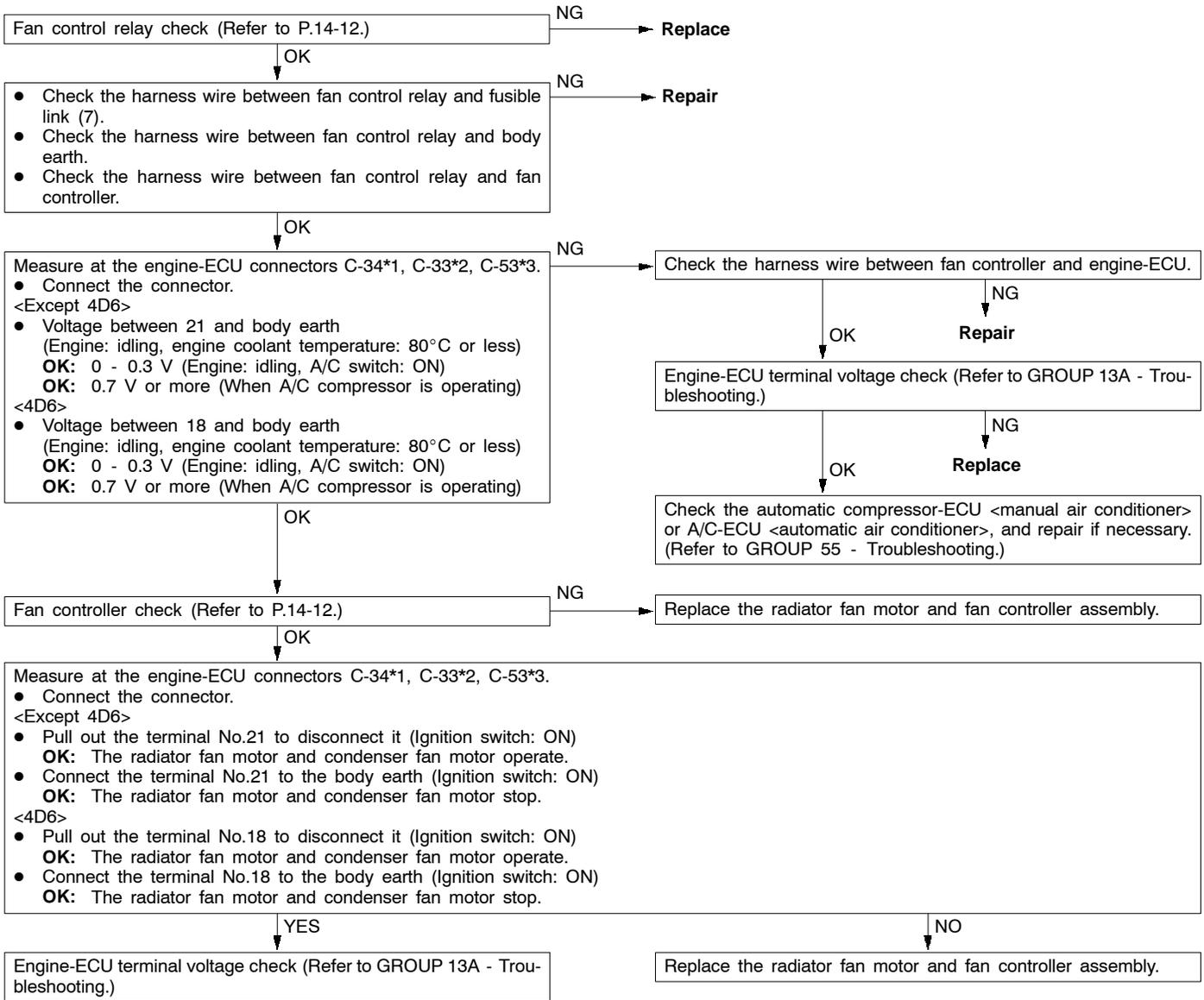
*2: 6A1

*3: 4D6

Inspection Procedure 2

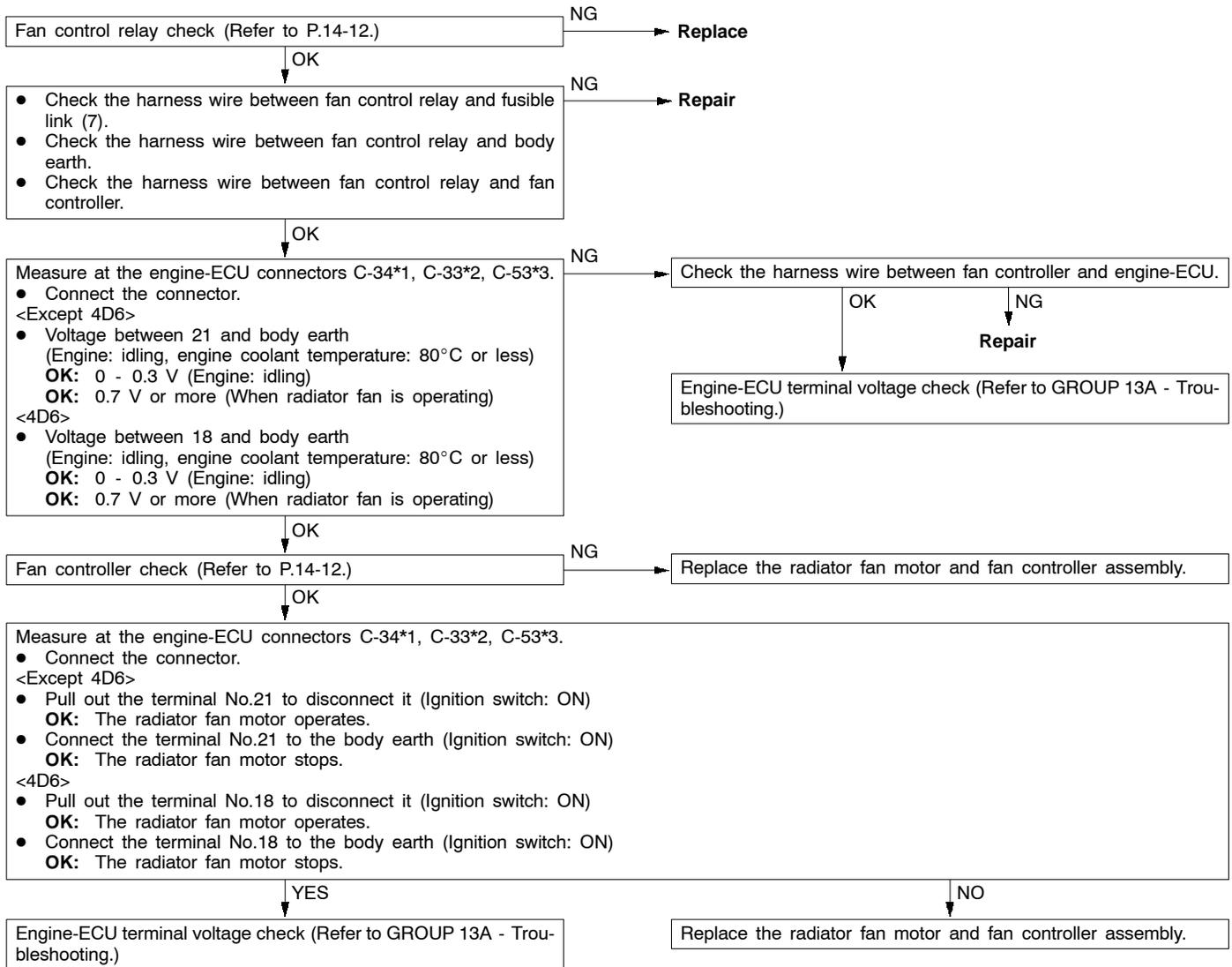
<p>Radiator fan and condenser fan do not change speed or stop. <Vehicles with A/C></p> <p>Radiator fan does not change speed or stop. <Vehicles without A/C></p>	<p>Probable cause</p>
<p>The fan controller carries out step-free control of the radiator fan motor and the condenser fan motor speeds using 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>



NOTE
 *1: 4G6
 *2: 6A1
 *3: 4D6

<Vehicles without A/C>



NOTE
 *1: 4G6
 *2: 6A1
 *3: 4D6

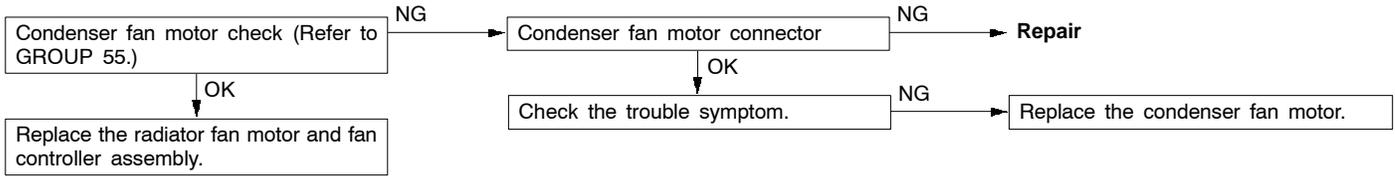
Inspection Procedure 3

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

14100100136

ENGINE COOLANT LEAK CHECKING

1. Confirm that the coolant level is up to the filler neck. Install a radiator cap tester 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 filler neck of the radiator.
2. If there is leakage, repair or replace the appropriate part.

RADIATOR CAP OPENING PRESSURE CHECK

14100130159

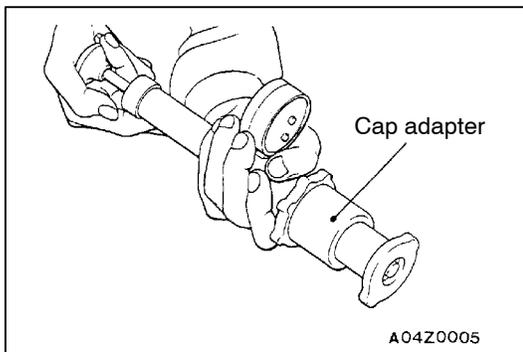
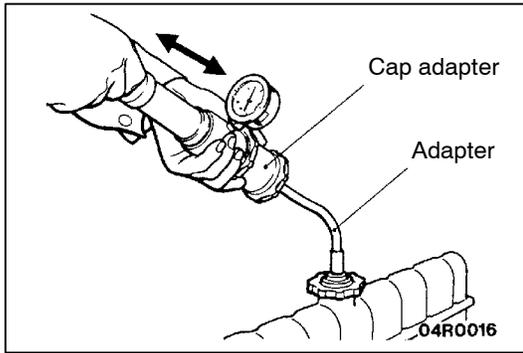
1. Use a cap adapter to attach the cap to the tester.
2. Increase the pressure until the indicator of the gauge stops moving.

Limit: 64 kPa**Standard value: 74 - 103 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.



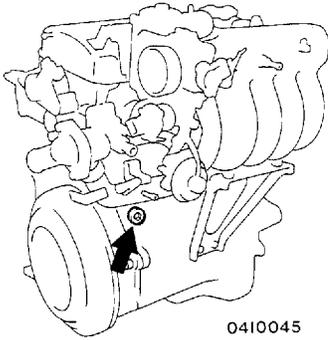
ENGINE COOLANT REPLACEMENT

14100120231

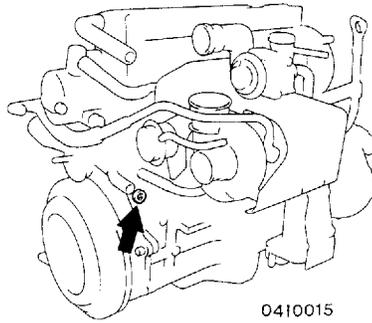
1. Drain the engine coolant by removing the drain plug and then the radiator cap.
2. Remove the drain plug from the cylinder block to drain the engine coolant.

Cylinder block drain plug

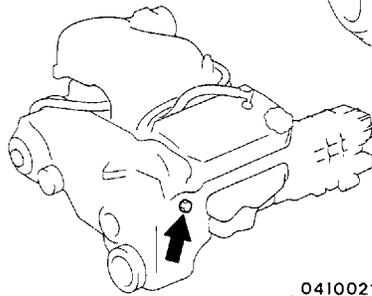
<4G6>



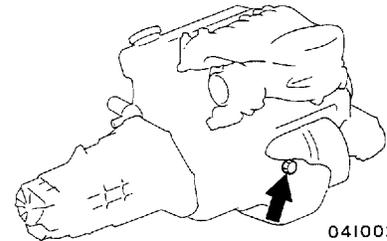
<4D6>



<6A1> Front bank



<6A1> Rear bank

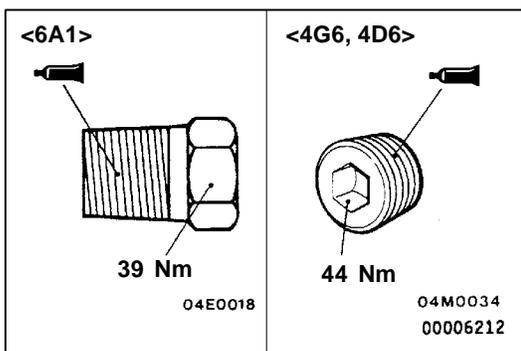


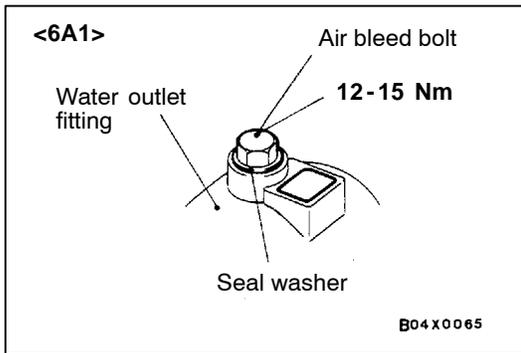
3. Remove the reserve tank to drain the engine coolant.
4. When the engine coolant has drained, pour in water from the radiator cap to clean the engine coolant line.

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:

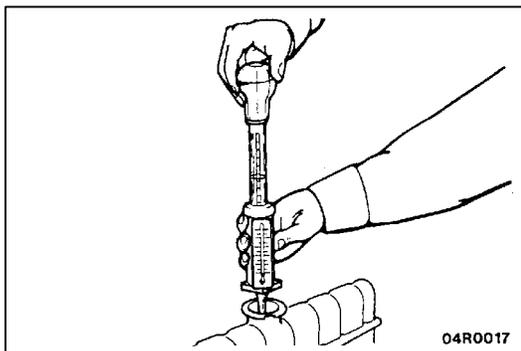
<4G6, 6A1> 6 L

<4D6> 8 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

14100110146

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

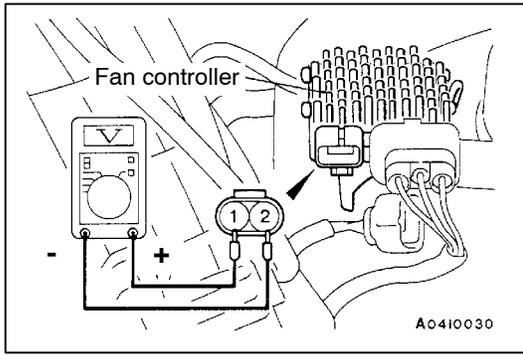
Standard value: 30 - 60 % (allowable concentration range)

RECOMMENDED ANTIFREEZE

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

Caution

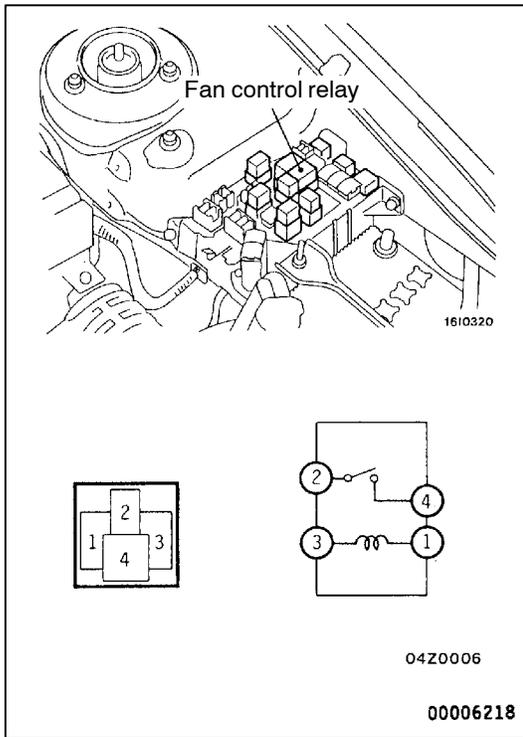
If the concentration of the antifreeze is below 30 %, the anti-corrosion property will be adversely affected. In addition, if the concentration is above 60 %, both the anti-freezing and engine cooling properties will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.



FAN CONTROLLER CHECK

14100610011

1. Remove the fan controller mounting bolt, and then 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) <4G6> 8.2 ± 2.6 V
<Except 4G6> 6.8 ± 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

14100620014

Battery voltage	Terminal No.			
	1	2	3	4
When current is not supplied	○	○	○	○
When current is supplied	⊖	○	⊕	○

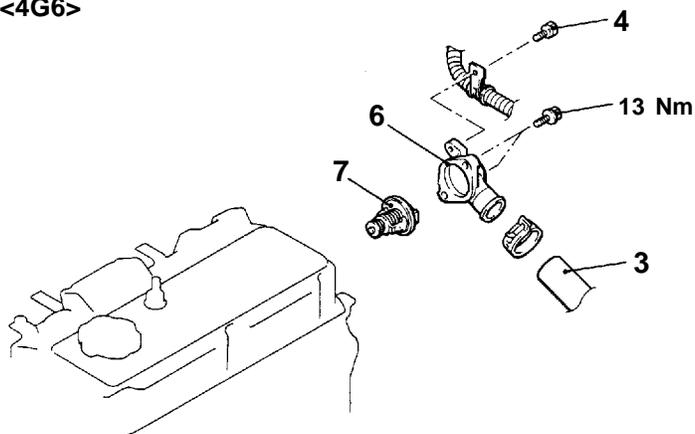
THERMOSTAT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

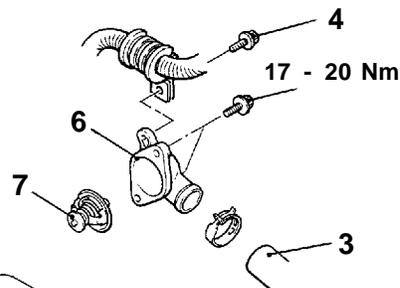
- Engine Coolant Draining and Supplying (Refer to P.14-10.)
- Air Cleaner and Air Intake Hose Assembly Removal and Installation
- Air Hose and Air Pipe Assembly Removal and Installation <4D6> (Refer to P.14-21.)

<4G6>



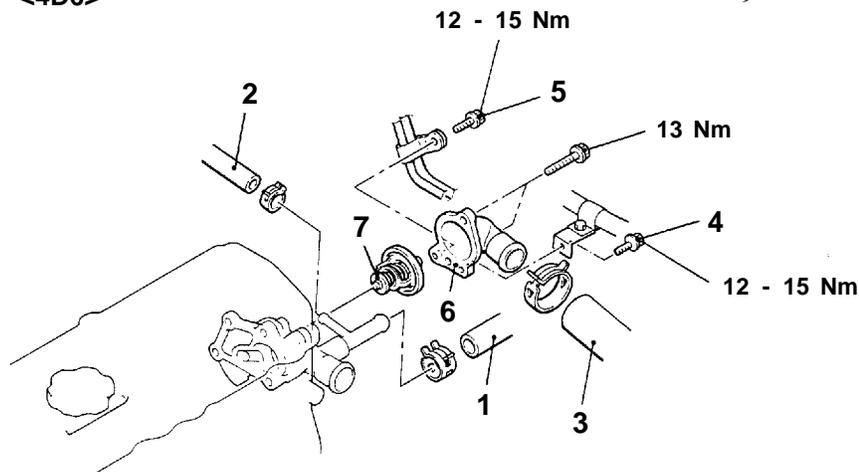
0410042

<6A1>



0410007

<4D6>



0410014

00006213

Removal steps

1. Heater hose connection <4D6>
2. Water hose connection <4D6>
3. Radiator lower hose connection
4. Control wiring harness mounting bolt
5. Fuel pipe mounting bolt <4D6>
6. Water inlet fitting
7. 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

14100250275

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.

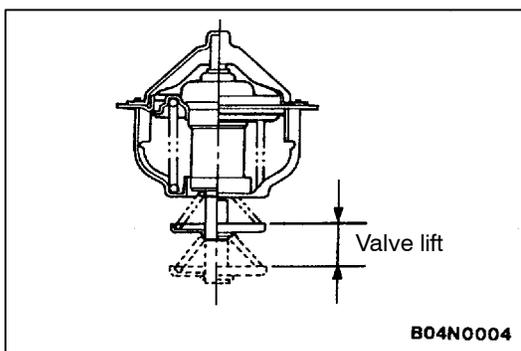
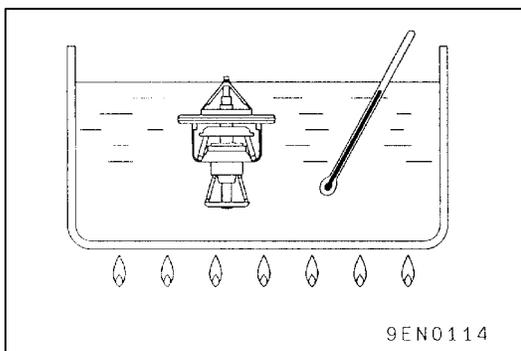
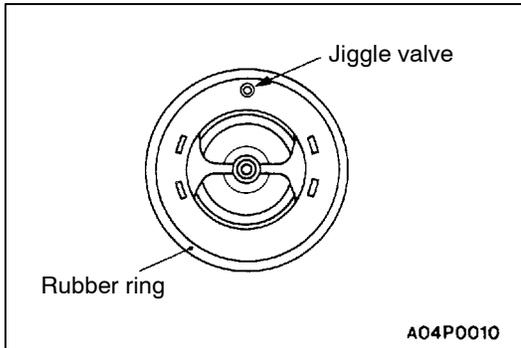
Standard value:

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.

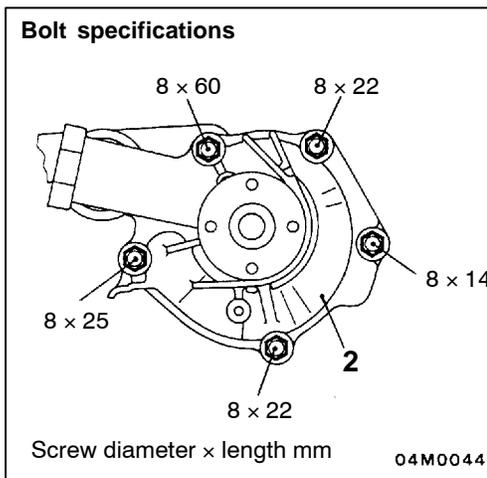
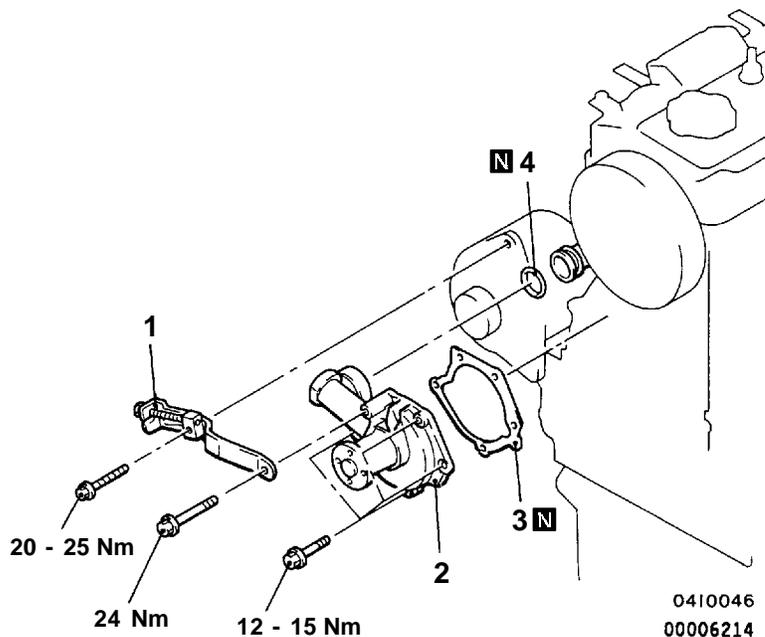


WATER PUMP <4G6>

REMOVAL AND INSTALLATION

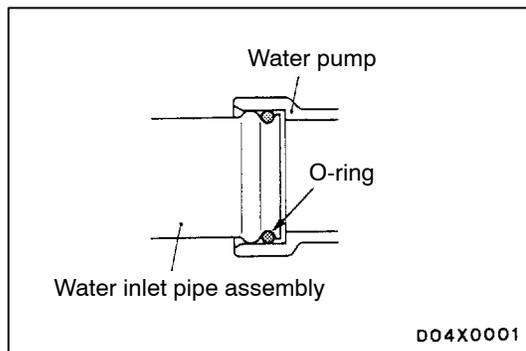
Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying (Refer to P.14-10.)
- Timing Belt Tensioner Pulley Removal and Installation (Refer to GROUP 11.)



Removal steps

1. Alternator brace
2. Water pump
3. Water pump gasket
4. O-ring



INSTALLATION SERVICE POINT

▶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

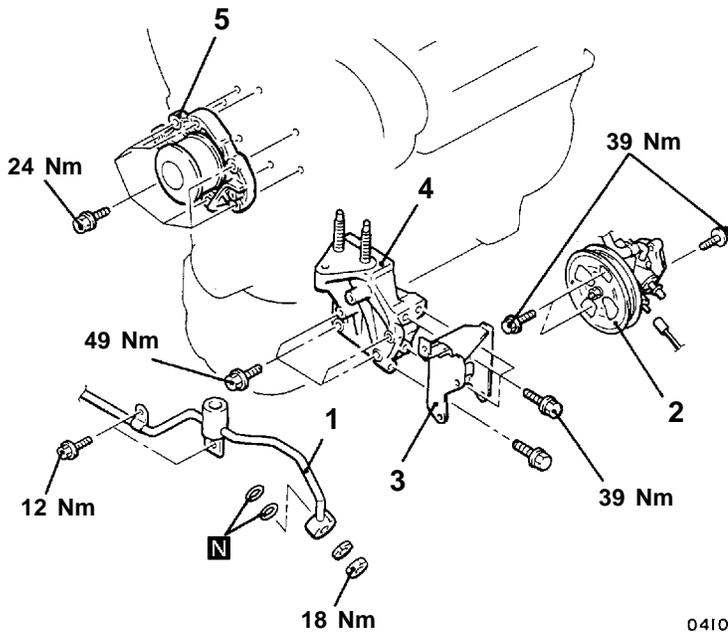
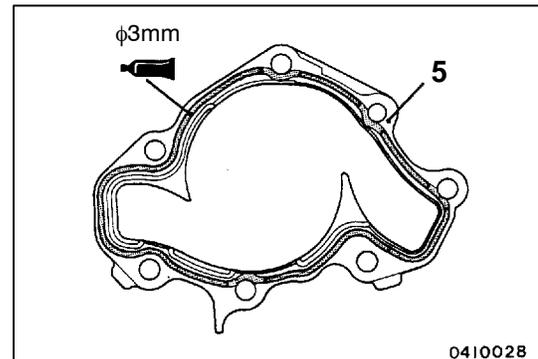
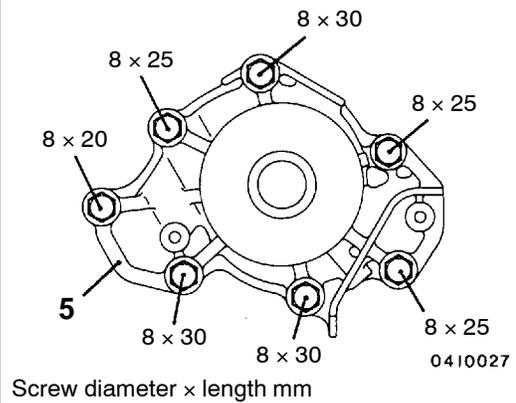
Do not allow engine oil or other greases to adhere to the O-ring

WATER PUMP <6A1>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying (Refer to P.14-10.)
- Power Steering Fluid Draining and Supplying (Refer to GROUP 37A - On-vehicle Service.)
- Radiator Removal and Installation (Refer to P.14-24.)
- A/C Compressor Removal and Installation (Refer to GROUP 55.)
- Timing Belt Removal and Installation (Refer to GROUP 11.)
- Engine Mount Bracket Removal and Installation (Refer to GROUP 32.)

0410009
00005786**Bolt specifications****Sealant:**

Mitsubishi Genuine Part No. MD970389 or equivalent

Removal steps

1. Pressure tube connection
2. Power steering oil pump assembly
3. Power steering oil pump bracket



4. Engine support bracket
5. Water pump

REMOVAL SERVICE POINT**◀A▶ POWER STEERING OIL PUMP ASSEMBLY
REMOVAL**

Remove the power steering oil pump assembly with the hoses still attached.

NOTE

Secure the removed oil pump with rope, etc. in a place where it will not be in the way when removing and installing the power steering oil pump bracket.

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:

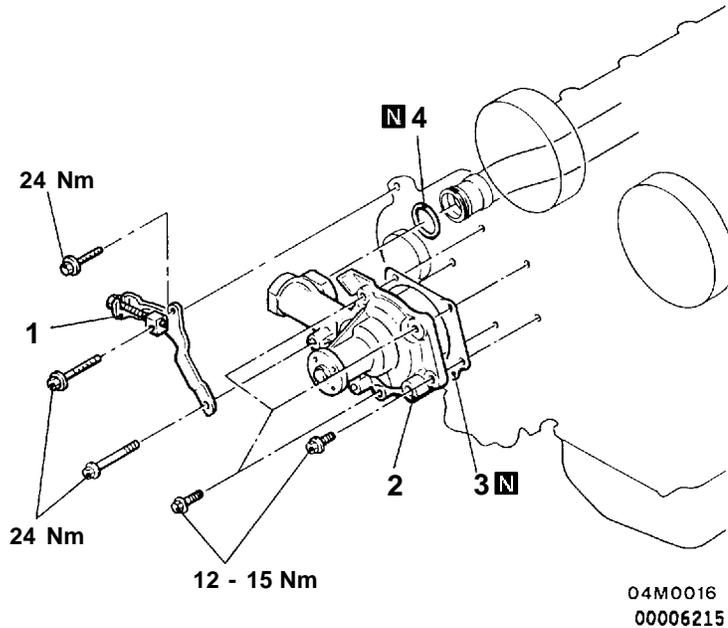
Mitsubishi Genuine Part No. MD970389 or equivalent

WATER PUMP <4D6>

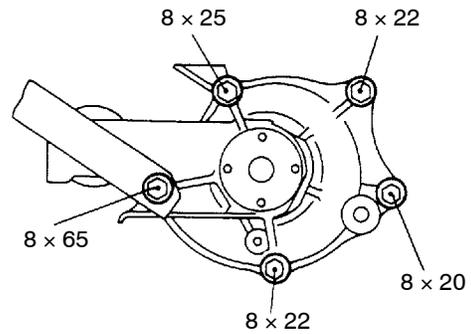
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying
(Refer to P.14-10.)
- Timing Belt Idler Pulley Removal and Installation
(Refer to GROUP 11.)



Bolt specifications

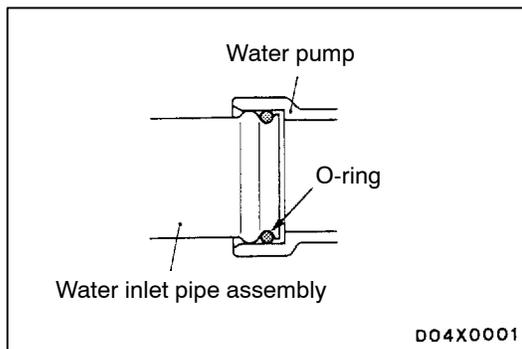


Screw diameter x length mm

04U0021

Removal steps

1. Alternator brace
2. Water pump
3. Water pump gasket
4. O-ring



INSTALLATION SERVICE POINT

▶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

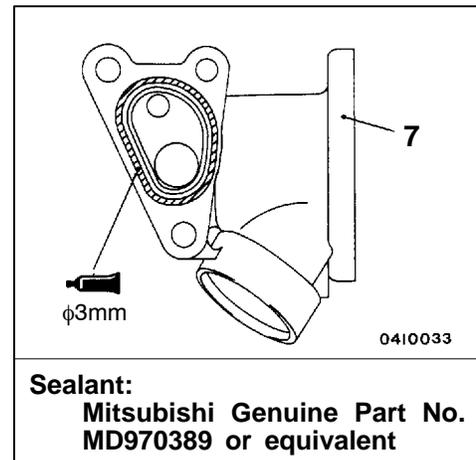
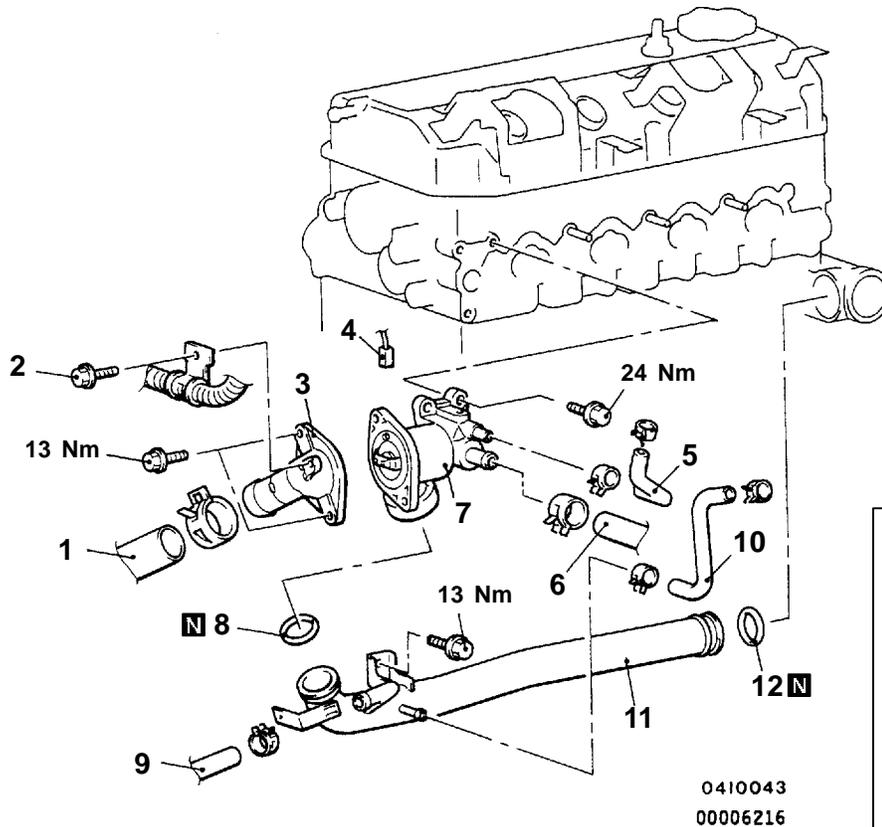
WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

<4G6>

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Suppling (Refer to P.14-10.)
- Air Cleaner and Air Intake Hose Assembly Removal and Installation

**Removal steps**

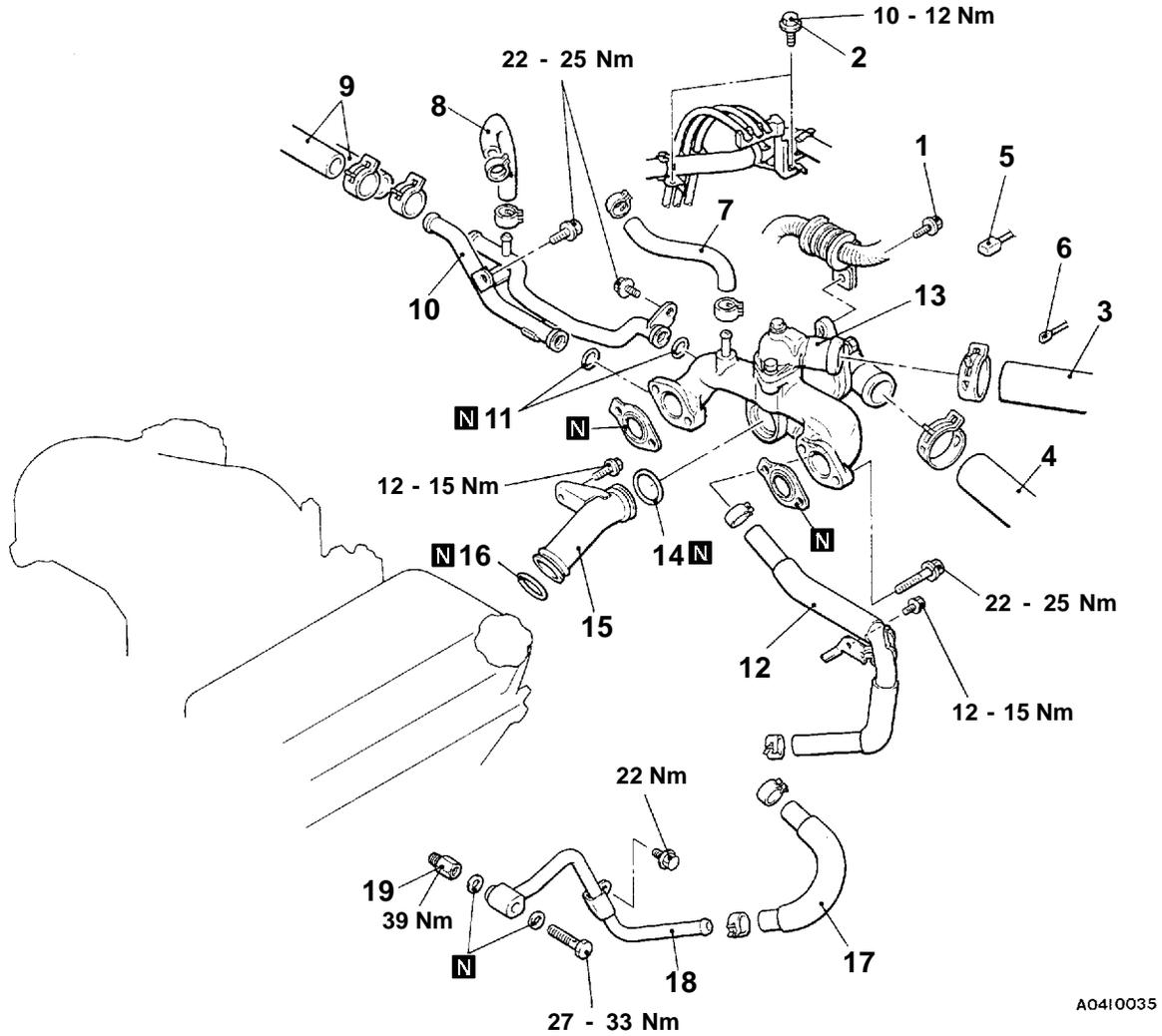
- ◀A▶ ▶C▶
1. Radiator lower hose connection
 2. Control wiring harness mounting bolt
 3. Water inlet fitting
 4. Engine coolant temperature gauge unit connector
 5. Water hose

- ▶B▶
▶A▶
6. Heater hose connection
 7. Thermostat case assembly
 8. O-ring
 9. Heater hose connection
 10. Water hose
 11. Water inlet pipe assembly
 - ▶A▶ 12. O-ring

<6A1>

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying (Refer to P.14-10.)
- Air Cleaner and Air Intake Hose Assembly Removal and Installation
- Distributor Removal and Installation (Refer to GROUP 16.)



A0410035

Removal steps

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. Control wiring harness mounting bolt</p> <p>2. Spark plug cable clamp mounting bolt</p> <p>▶A▶▶C▶▶C▶▶ 3. Radiator upper hose connection</p> <p>▶A▶▶C▶▶C▶▶ 4. Radiator lower hose connection</p> <p>5. Engine coolant temperature sensor connector</p> <p>6. Engine coolant temperature gauge unit connector</p> <p>7. Water hose</p> <p>8. Water hose</p> | <p>9. Heater hose connection</p> <p>10. Heater pipe assembly</p> <p>▶A▶▶ 11. O-ring</p> <p>▶A▶▶ 12. Water hose</p> <p>▶A▶▶ 13. Thermostat case assembly</p> <p>▶A▶▶ 14. O-ring</p> <p>▶A▶▶ 15. Water inlet pipe assembly</p> <p>▶A▶▶ 16. O-ring</p> <p>▶A▶▶ 17. Water hose</p> <p>18. Water pipe assembly</p> <p>19. Water pipe joint</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

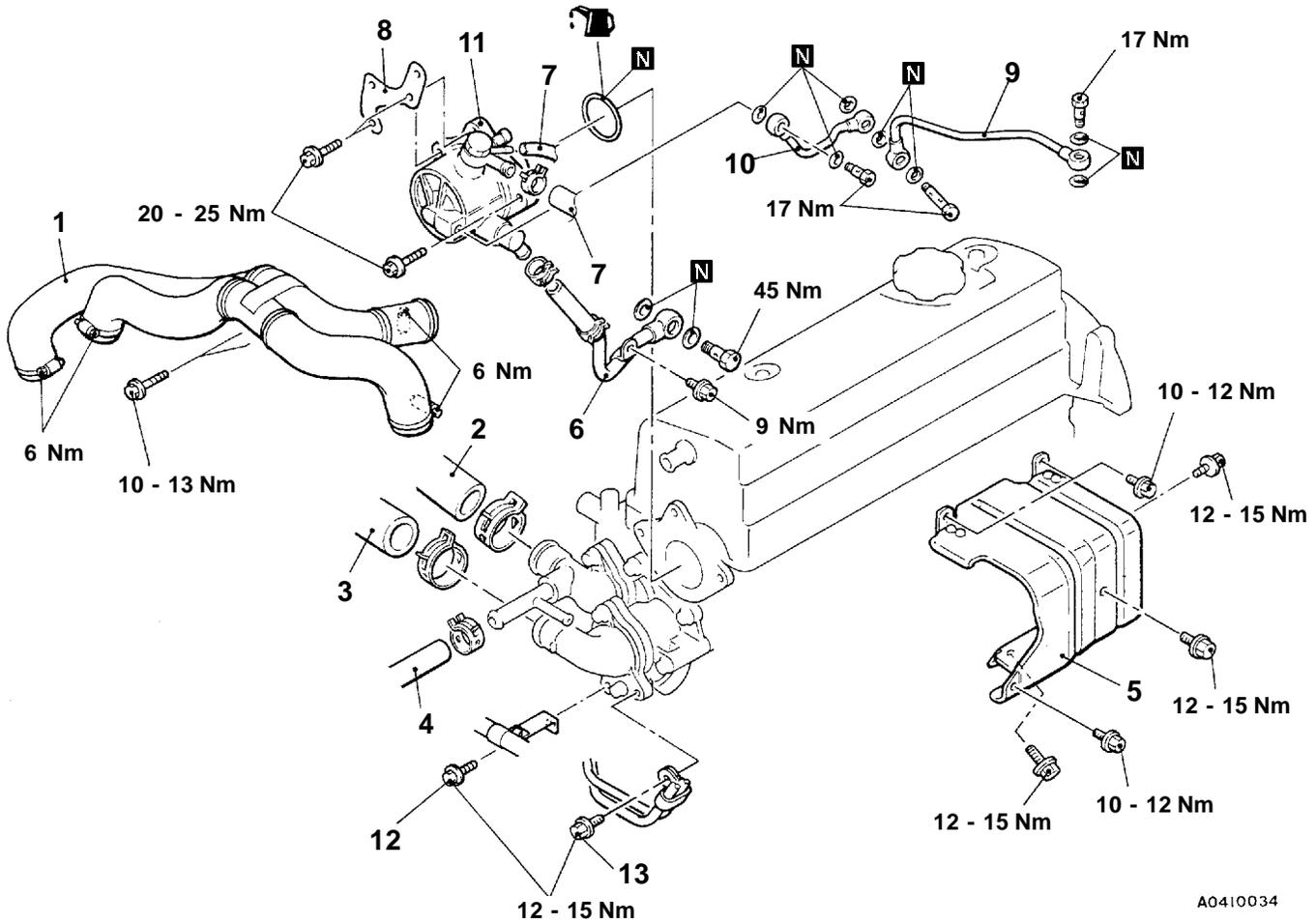
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Pre-removal operation

- Engine Coolant Draining (Refer to P.14-10.)
- Air Cleaner and Air Intake Hose Assembly Removal

Post-installation Operation

- Engine Coolant Supplying (Refer to P.14-10.)
- Engine Oil Supplying and Checking (Refer to GROUP 11 - On-vehicle Service.)
- Air Cleaner and Air Intake hose Assembly Installation



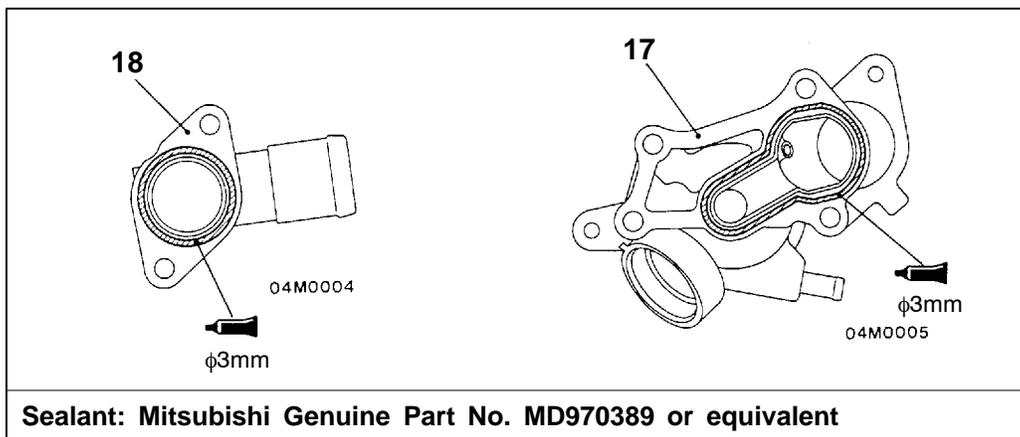
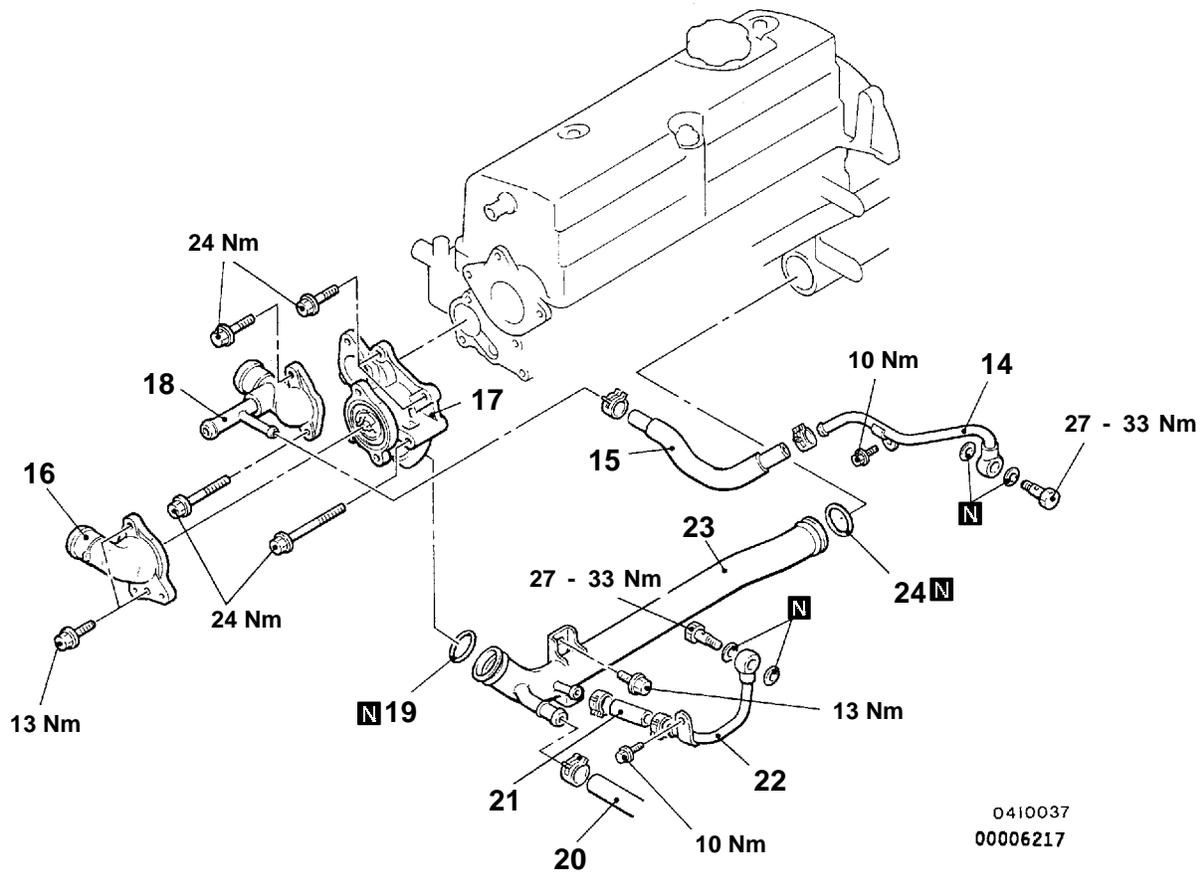
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Removal steps



1. Air hose and air pipe assembly
2. Radiator upper hose connection
3. Radiator lower hose connection
4. Heater hose connection
5. Turbocharger heat protector
6. Oil return hose and pipe assembly
7. Vacuum hose connection

8. Air pipe bracket stay
9. Oil pipe assembly
10. Oil pipe assembly
11. Vacuum pump assembly
12. Control wiring harness mounting bolt
13. Fuel pipe mounting bolt



- | | |
|----------------------------------|-------------------------------|
| 14. Water pipe assembly (A) | 20. Heater hose connection |
| 15. Water hose | 21. Water hose |
| 16. Water inlet fitting | 22. Water pipe assembly (B) |
| ▶B◀ 17. Thermostat case assembly | 23. Water inlet pipe assembly |
| ▶B◀ 18. Water outlet fitting | ▶A◀ 24. O-ring |
| ▶A◀ 19. 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 or the heater 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◀ WATER OUTLET FITTING/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/RADIATOR UPPER HOSE CONNECTION

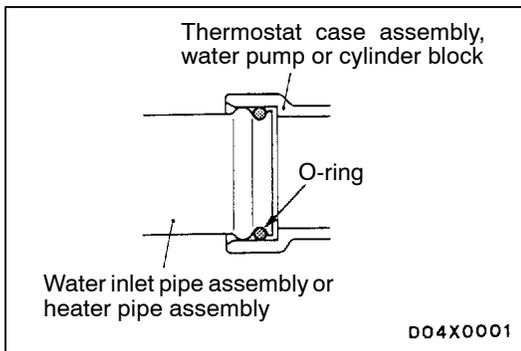
1. Insert each hose as far as the projection of the water inlet fitting or water outlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

INSPECTION

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WATER PIPE AND HOSE CHECK

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



RADIATOR

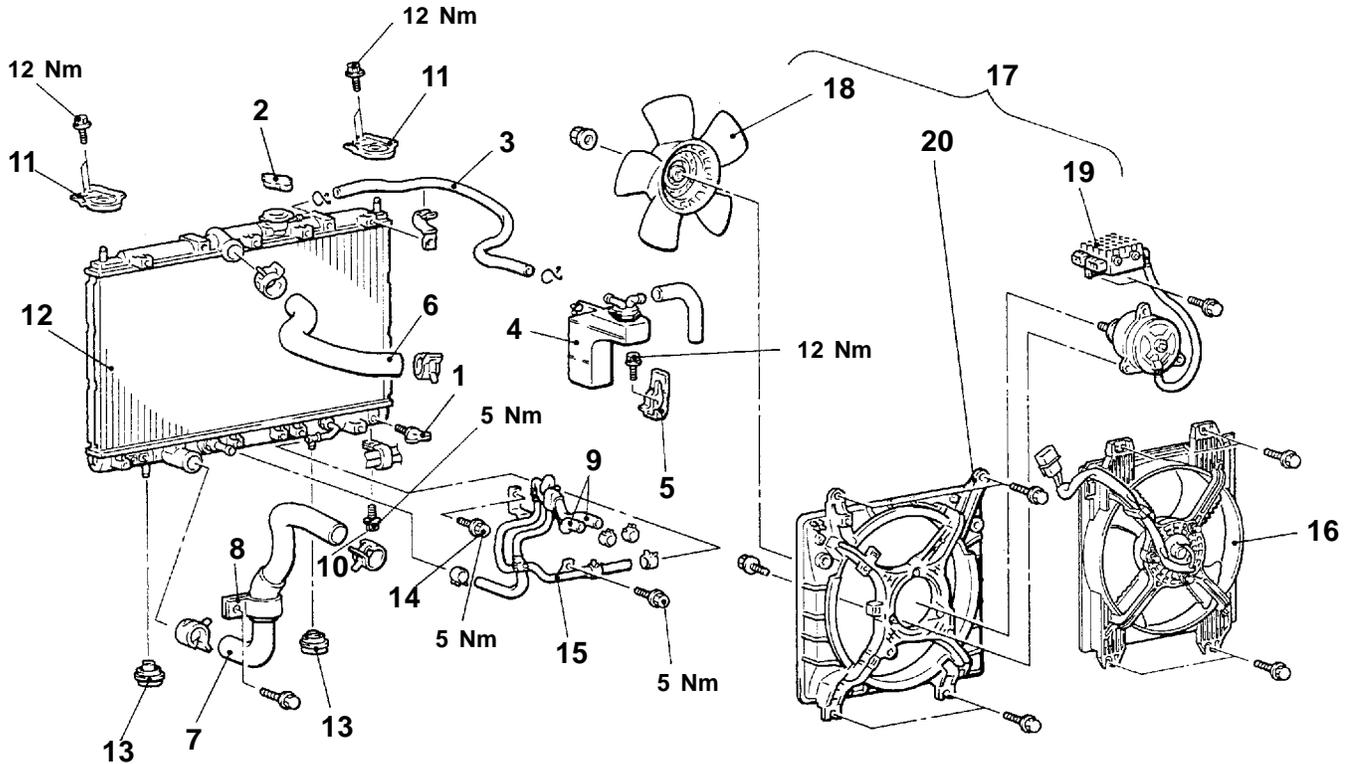
REMOVAL AND INSTALLATION

Pre-removal operation

- Engine Coolant Draining (Refer to P.14-10.)
- Air Cleaner and Air Intake Hose Assembly Removal

Post-installation Operation

- Engine Coolant Supplying (Refer to P.14-10.)
- A/T Fluid Supplying and Checking (Refer to GROUP 23 - On-vehicle Service.)
- Air Cleaner and Air Intake Hose Assembly Installation



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Radiator removal steps

1. Drain plug
2. Radiator cap
3. Overflow hose
4. Reserve tank
5. Reserve tank bracket
6. Radiator upper hose
7. Radiator lower hose
8. Clamp <6A1 - A/T>
9. Transmission fluid cooler hose connection <A/T>
10. Engine oil cooler hose mounting bolt <4D6>
11. Upper insulator
12. Radiator assembly
13. Lower insulator
14. Bolt <A/T>



15. Transmission fluid cooler hose and pipe assembly <A/T>
16. Condenser fan motor assembly <Vehicle with A/C>
17. Radiator fan motor assembly

Radiator fan motor and fan controller assembly removal steps

6. Radiator upper hose
8. Clamp <6A1 - A/T>
14. Bolt <A/T>
17. Radiator fan motor assembly
18. Fan
19. Radiator fan motor and fan controller assembly
20. Shroud



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

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

◀B▶ TRANSMISSION FLUID COOLER HOSE AND PIPE ASSEMBLY REMOVAL

After disconnecting the hoses from the radiator and the transmission, plug all of the pipes and hoses to prevent dirt and other foreign objects from getting inside.

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