GROUP 14

ENGINE COOLING

CONTENTS

GENERAL DESCRIPTION

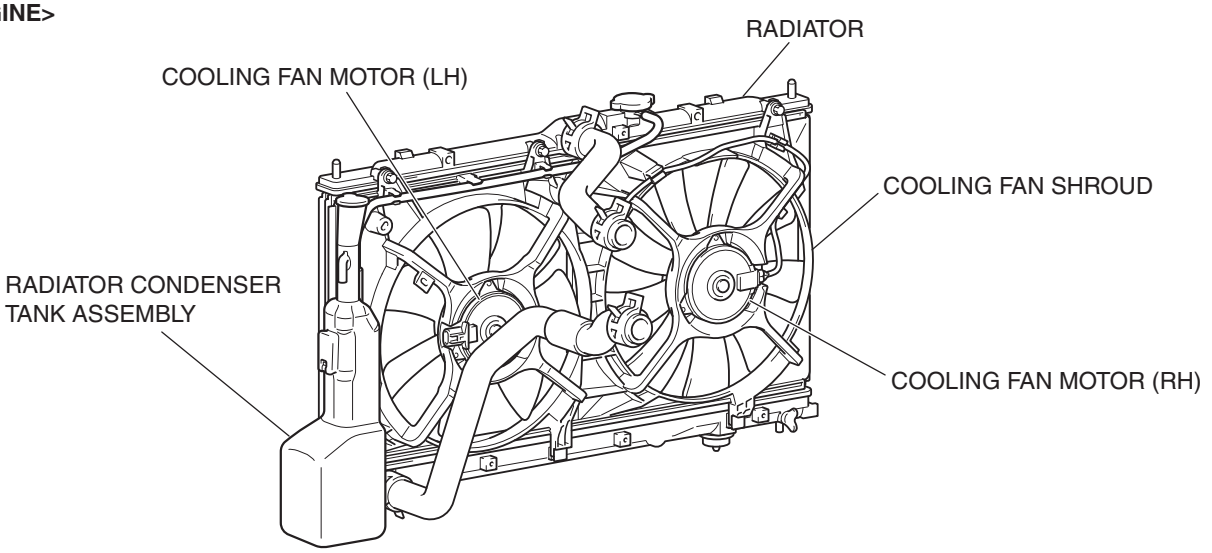
M1141000100702

The cooling system is a water-cooled pressurized, forced circulation type which offers the following features.

- To stabilize engine coolant temperature, the thermostat is located at the coolant inlet port from the radiator.
- To improve engine cooling performance and save weight, a plastic tank and aluminum radiator fins are used.
- The speed of the radiator fan is controlled by a fan controller. The engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> detects driving conditions and controls the controller so that the fan operating noise is minimized and fuel efficiency is improved.

CONSTRUCTION DIAGRAM

<2.4L ENGINE>



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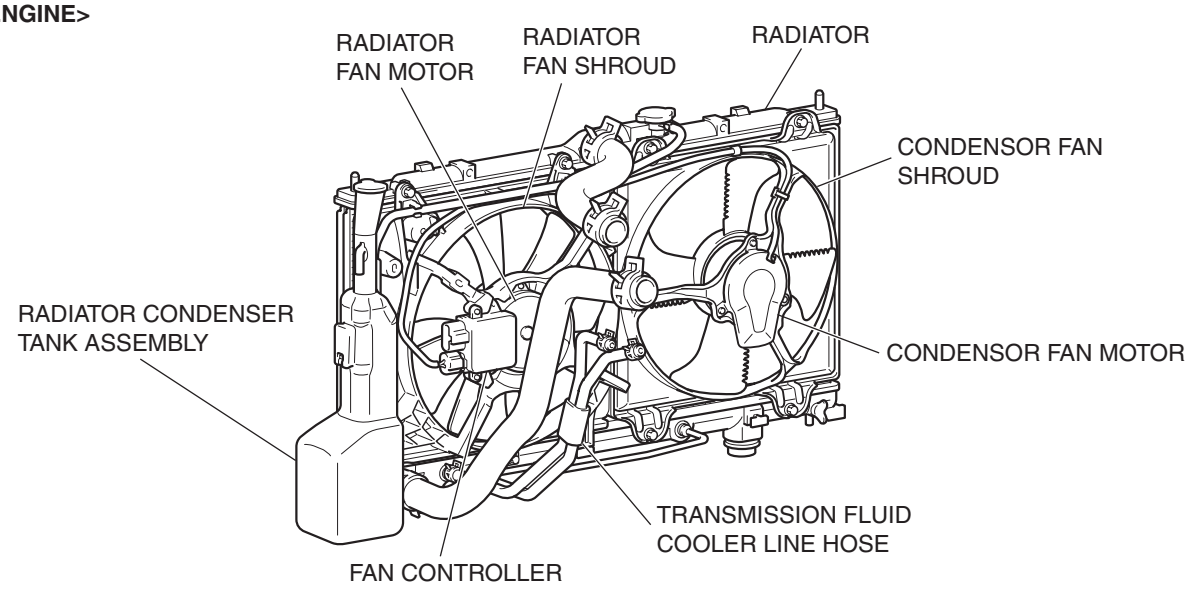
<3.8L ENGINE>



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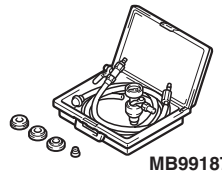
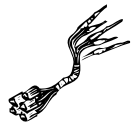
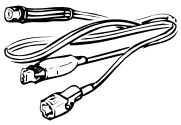
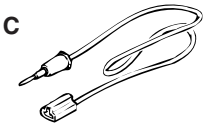
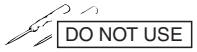
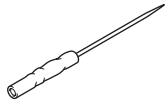
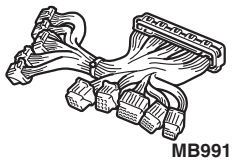
SPECIAL TOOL

M1141000600440

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
 MB991871	MB991871 LLC changer	General service tool	Coolant refilling
A  B  C  D  DO NOT USE MB991223AZ	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222 Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	General service tools	Making voltage and resistance measurement during troubleshooting A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 MB992006	MB992006 Extra fine probe	General service tool	Making voltage and resistance measurement during troubleshooting
 MB991923	MB991923 Power plant ECU check harness	MD998478-01	Measurement of ECM <M/T> or PCM <A/T> terminal voltage

ENGINE COOLING DIAGNOSIS

INTRODUCTION

M1141005300381

The system cools the engine so that it does not overheat and maintains the engine at an optimum temperature. The system components are the radiator, water pump, thermostat, condenser fan assembly. Possible faults include low coolant, contamination, belt loosening and component damage.

TROUBLESHOOTING STRATEGY

M1141005200373

Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure to find most of the engine cooling faults.

1. Gather information from the customer.
2. Verify that the condition described by the customer exists.
3. Find and repair the malfunction by following the SYMPTOM CHART.
4. Verify that the malfunction is eliminated.

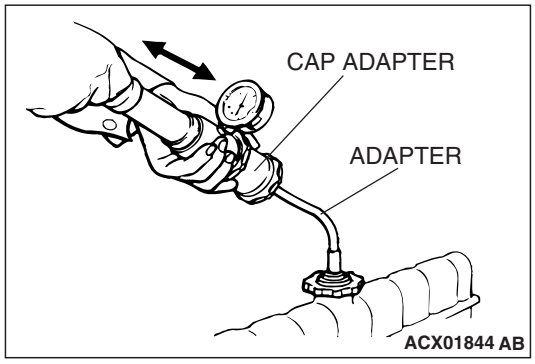
SYMPTOM CHART

M1141005600490

SYMPTOM	INSPECTION PROCEDURE	REFERENCE PAGE
Coolant Leak	1	P.14-5
Engine Overheating	2	P.14-6
Radiator Fan and Condenser Fan do not Operate <3.8L Engine>	3	P.14-7
Radiator Fan and Condenser Fan do not Change Speed or Stop <3.8L Engine>	4	P.14-14
Radiator Fan does not Operate <3.8L Engine>	5	P.14-20
Condenser Fan does not Operate <3.8L Engine>	6	P.14-20

SYMPTOM PROCEDURES

INSPECTION PROCEDURE 1: Coolant Leak



DIAGNOSIS

STEP 1. Check for coolant leaks.

⚠ ***WARNING***

When pressure testing the cooling system, slowly release cooling system pressure to avoid getting burned by hot coolant.

⚠ **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.**
- **When installing and removing the tester and when testing, be careful not to deform the filler neck of the radiator.**

Check that the coolant level is up to the filler neck. Install a radiator tester and apply 160 kPa (23 psi) pressure, and then check for leakage from the radiator hose or connections.

Q: Is leakage present from the radiator hose or connections?

YES : Repair or replace the appropriate part, then go to Step 2.

NO : There is no action to be taken.

STEP 2. Retest the system.

Q: It there still coolant leakage?

YES : Return to Step 1.

NO : The procedure is complete.

INSPECTION PROCEDURE 2: Engine Overheating

DIAGNOSIS

STEP 1. Remove the radiator cap and check for coolant contamination.

Q: Is the coolant contaminated with rust and oil?

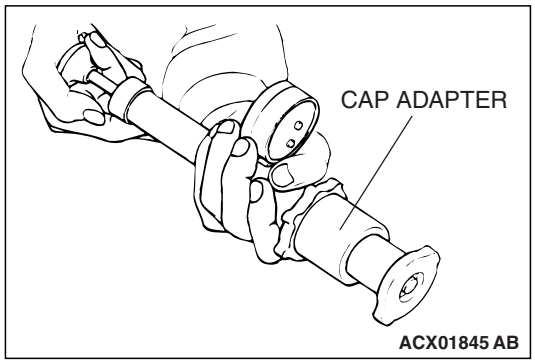
YES : Replace it. Refer to P.14-22.
NO : There is no action to be taken. Go to Step 2.

STEP 2. Check the radiator cap valve opening pressure.

NOTE: Be sure that the cap is clean before testing. Rust or other foreign material on the cap seal will cause an improper reading.

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

Minimum limit: 83 kPa (12 psi)
Standard value: 93 – 123 kPa (14 – 18 psi)



Q: Does the reading remain at or above the minimum limit?

YES : Go to Step 3.
NO : Replace the radiator cap. Then go to Step 5.

STEP 3. Check thermostat operation.

Refer to P.14-33.

Q: Does the thermostat operate correctly?

YES : Go to Step 4.
NO : Replace the thermostat, then go to Step 5.

STEP 4. Check the drive belt for slippage or damage.

Refer to GROUP 00, Maintenance Service –Drive Belts (for Generator, Power Steering Pump And Air Conditioning) (Check) P.00-52.

Q: Is the drive belt loose or damaged?

YES : Adjust or replace the drive belt, then go to Step 5.
NO : There is no action to be taken.

STEP 5. Retest the system.

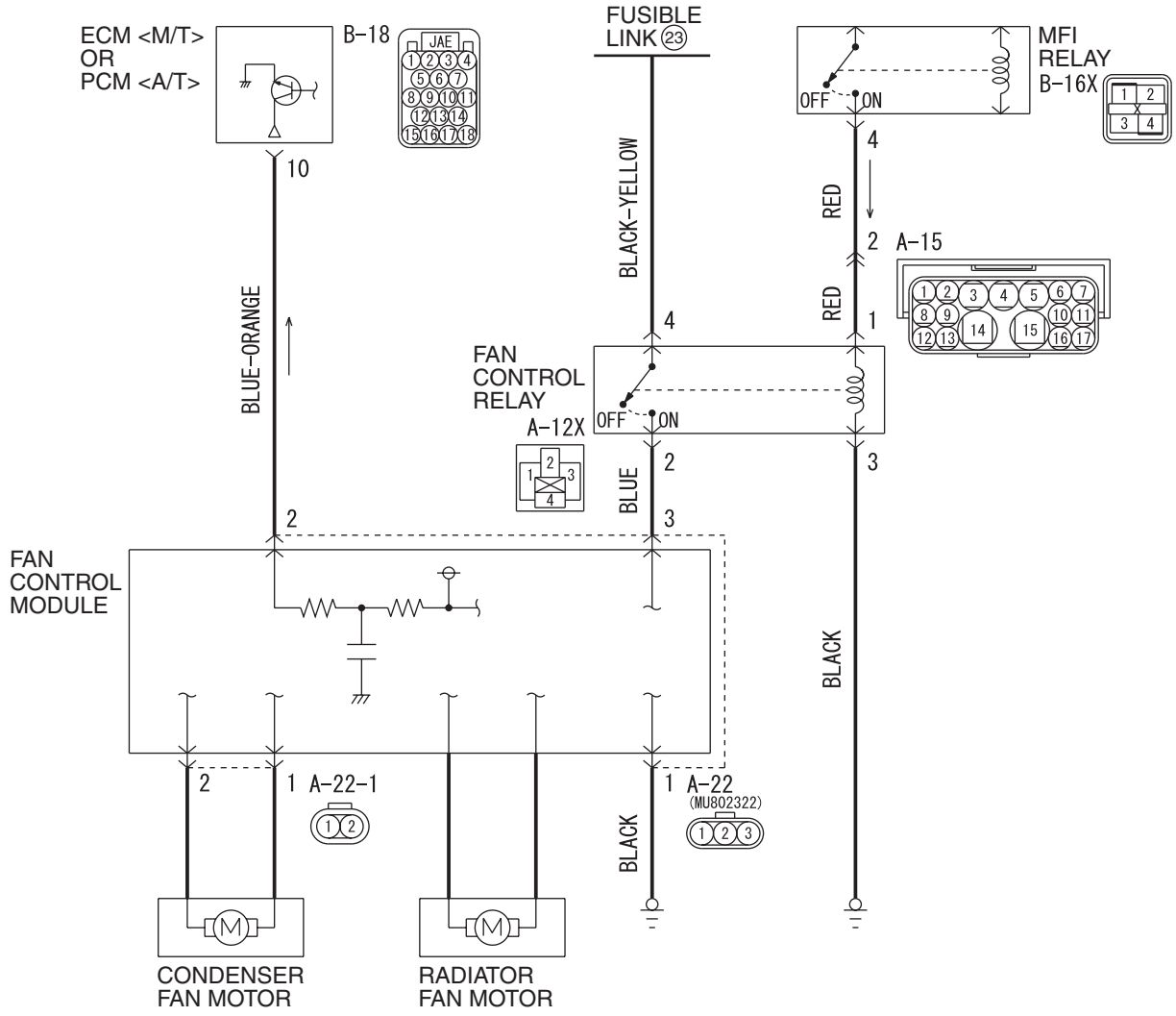
Check the engine coolant temperature.

Q: Is the engine coolant temperature abnormally high?

YES : Return to Step 2.
NO : The procedure is complete.

INSPECTION PROCEDURE 3: Radiator Fan and Condenser Fan do not Operate <3.8L Engine>

Radiator Fan and Condenser Fan Drive Circuit



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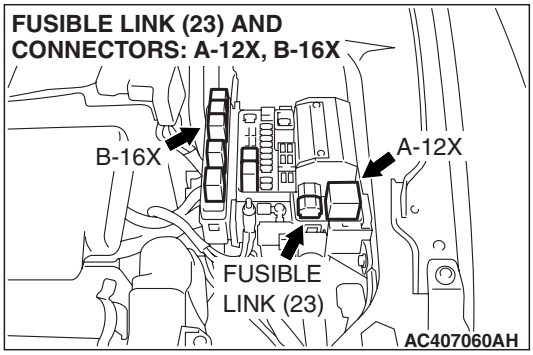

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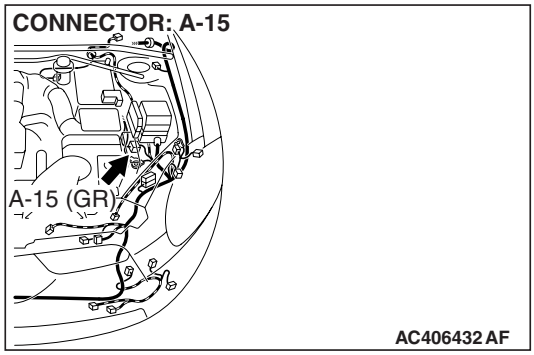

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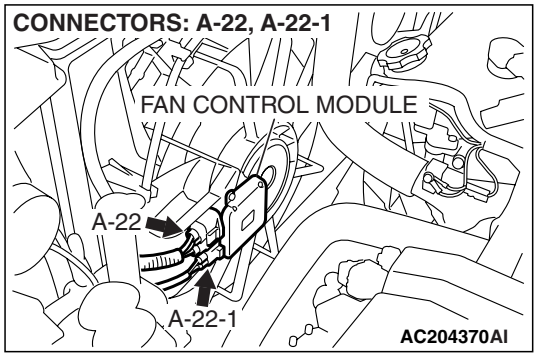
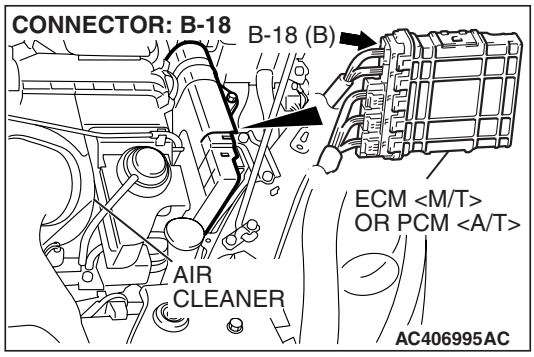




CIRCUIT OPERATION

- The fan control module is powered from fusible link number 23.
- The ECM <M/T> or PCM <A/T> judges the required revolution speed of radiator fan motor and condenser fan motor using the input signals transmitted from A/C switch, automatic compressor controller, vehicle speed sensor and engine coolant temperature sensor. The ECM <M/T> or PCM <A/T> activates the fan control module to drive the radiator fan motor and condenser fan motor.

TECHNICAL DESCRIPTION

- The cause could be a malfunction of the fan control module power supply or ground circuit.
- The cause could also be a malfunction of the fan control module or the ECM <M/T> or PCM <A/T>.

TROUBLESHOOTING HINTS

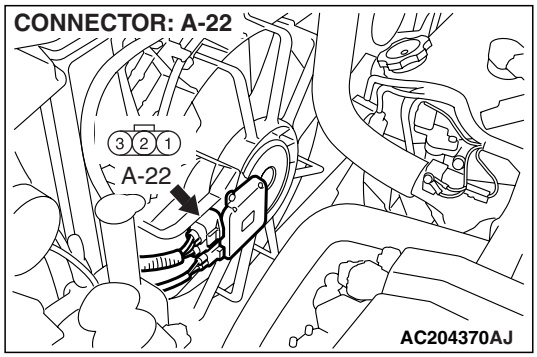
- Malfunction of fusible link
- Malfunction of fan control relay
- Malfunction of MFI relay
- Malfunction of fan control module
- Malfunction of ECM <M/T> or PCM <A/T>
- Damaged wiring harness or connector

DIAGNOSIS

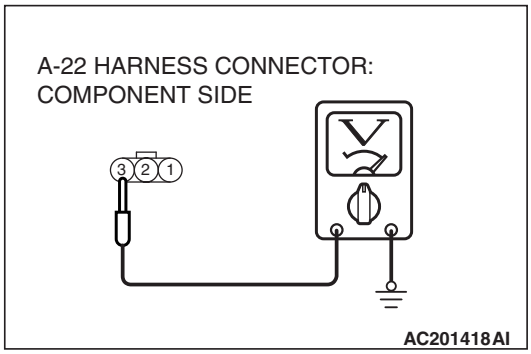
Required Special Tools:

- MB992006: Extra Fine Probe
- MB991223: Harness Set
- MB991923: Power Plant ECU Check Harness

STEP 1. Check the circuit at fan control module connector A-22 (terminal 3).



(1) Disconnect fan control module connector A-22, and measure at the harness side connector.



(2) Measure the voltage between terminal number 3 and ground.
- When the ignition switch is turned to the "ON" position, voltage should measure battery positive voltage.

Q: Is there voltage battery positive voltage when the ignition switch is turned to the "ON" position?

YES : Go to Step 8.
NO : Go to Step 2.

STEP 2. Check the fan control relay.

Refer to P.14-24.

Q: Is the fan control relay in good condition?

YES : Go to Step 3.
NO : Replace it, then go to Step 1.

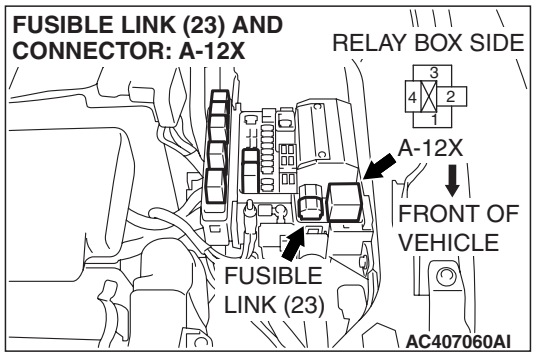
STEP 3. Check the MFI relay.

Refer to P.13B-1283.

Q: Is the MFI relay in good condition?

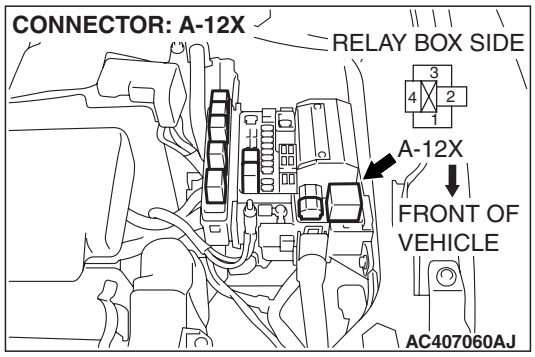
YES : Go to Step 4.
NO : Replace it, then go to Step 1.

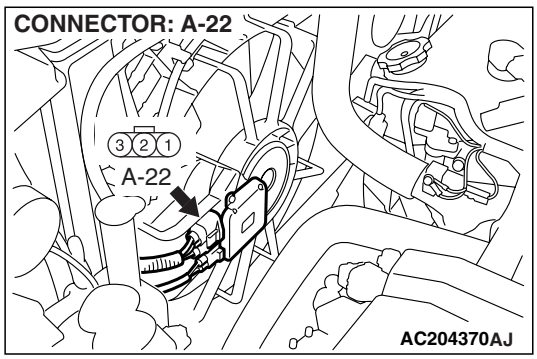
STEP 4. Check for harness damage between fusible link number 23 and fan control relay connector A-12X (terminal 4).



Q: Are the harness wires between fusible link number 23 and fan control relay connector A-12X damaged?

YES : Repair or replace them, then go to Step 14.
NO : Go to Step 5.



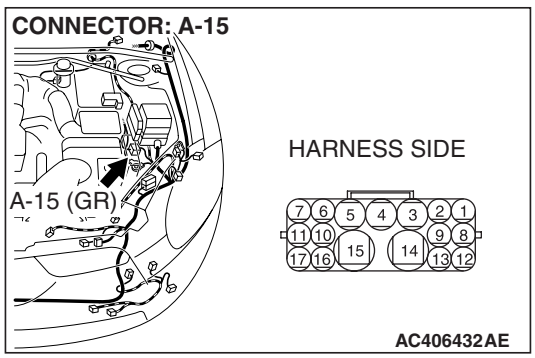


STEP 5. Check for harness damage between fan control relay connector A-12X (terminal 2) and fan control module connector A-22 (terminal 3).

Q: Are the harness wires between fan control relay connector A-12X (terminal 2) and fan control module connector A-22 (terminal 3) damaged?

YES : Repair or replace them, then go to Step 14.

NO : Go to Step 6.

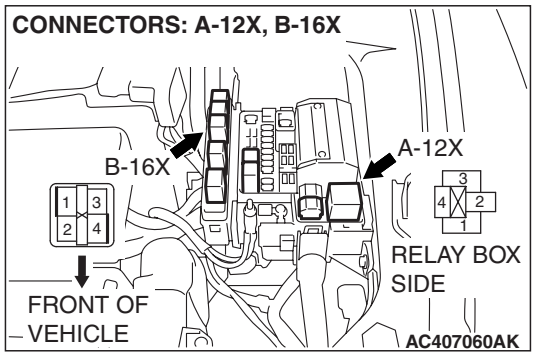


STEP 6. Check intermediate connector A-15 for loose, corroded or damaged terminals, or terminals pushed back in the connector.

Q: Are the connectors and terminals in good condition?

YES : Go to Step 7.

NO : Repair or replace the damaged components. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.



STEP 7. Check for harness damage between MFI relay connector B-16X and fan control relay connector A-12X.

Q: Are the harness wires between MFI relay connector B-16X (terminal 4) and fan control relay connector A-12X (terminal 1) damaged?

YES : Repair or replace them, then go to Step 14.

NO : Go to Step 8.

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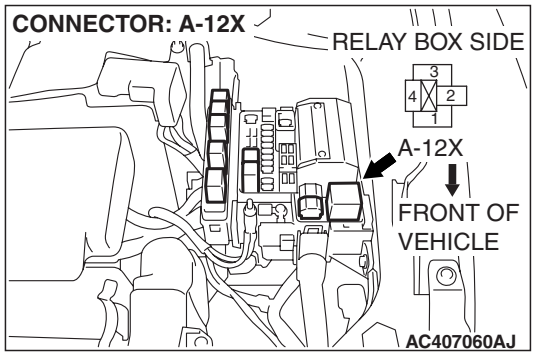
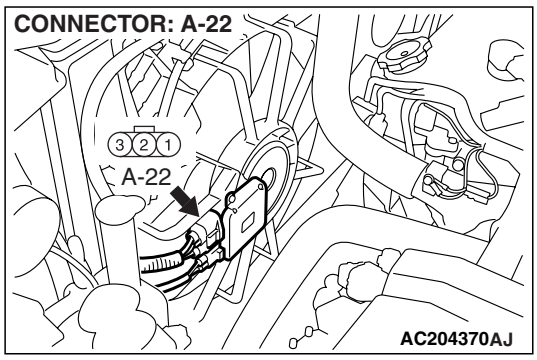


STEP 8. Check for harness damage between fan control relay connector A-12X (terminal 3) and ground.

Q: Are the harness wires between fan control relay connector A-12X (terminal 3) and ground damaged?

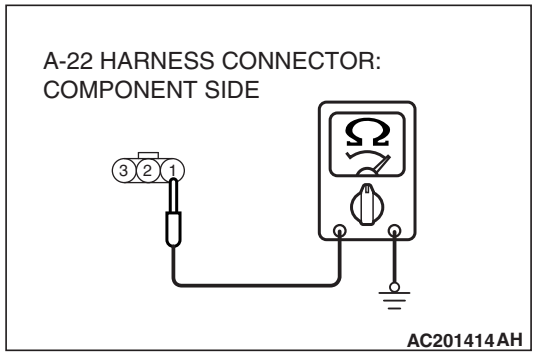
YES : Repair or replace them, then go to Step 14.

NO : Go to Step 9.



STEP 9. Check the circuit at fan control module connector A-22 (terminal 1).

(1) Disconnect fan control module connector A-22, and measure at the harness side connector.

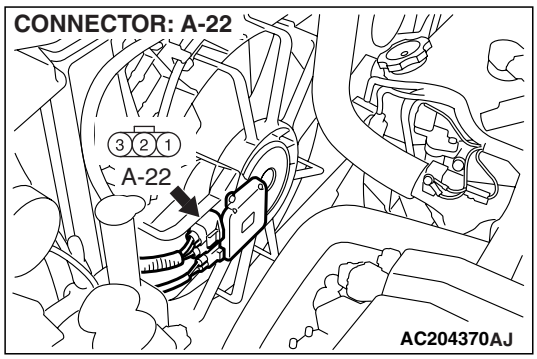


(2) Measure the resistance between terminal number 1 and ground.

Q: Is the resistance less than 2 ohms?

YES : Go to Step 11.

NO : Go to Step 10.



STEP 10. Check the harness wire between fan control module connector A-22 (terminal 1) and ground.

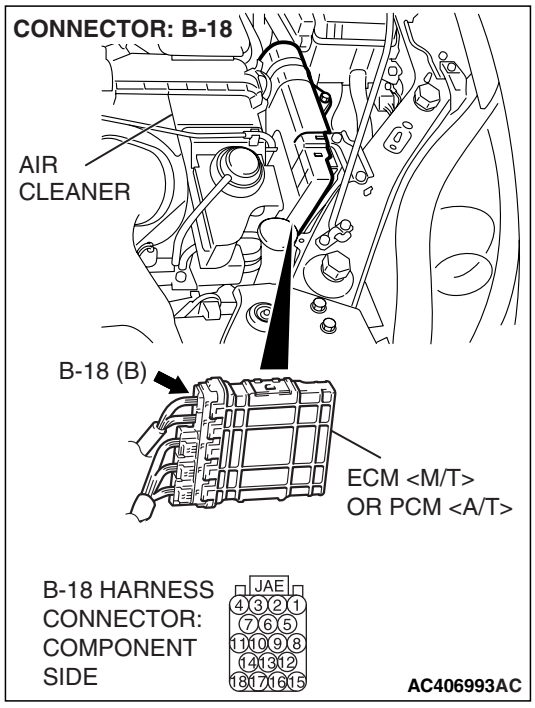
Q: Are the harness wires between fan control module connector A-22 (terminal 1) and ground damaged?

YES : Repair or replace them, then go to Step 14.

NO : Go to Step 11.

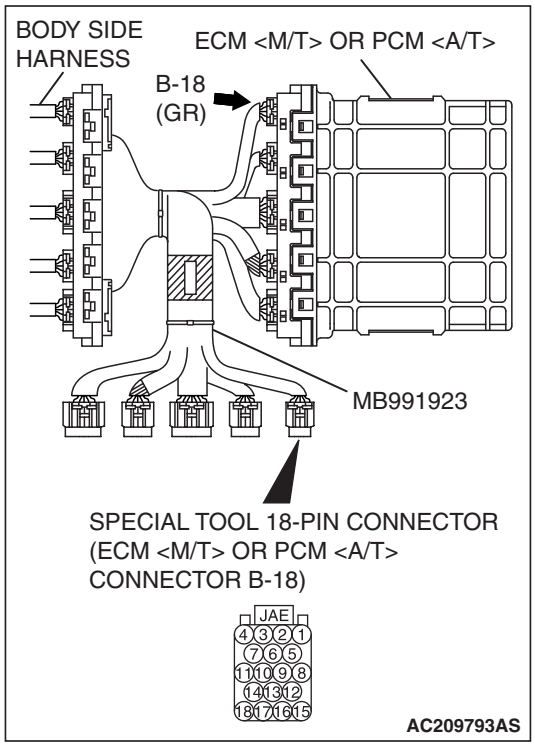
STEP 11. Measure the output circuit voltage at ECM <M/T> or PCM <A/T> connector B-18 (terminal 10) by using check harness special tool MB991923.

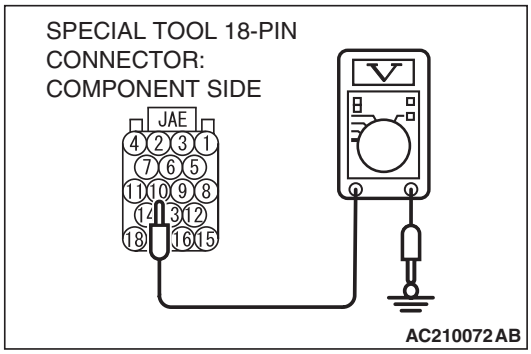
(1) Disconnect all the connectors from the ECM <M/T> or PCM <A/T>.



(2) Connect special tool MB991923 (check harness) between the ECM <M/T> or PCM <A/T> and the body-side harness connector.

(3) Start the engine and allow it to idle.



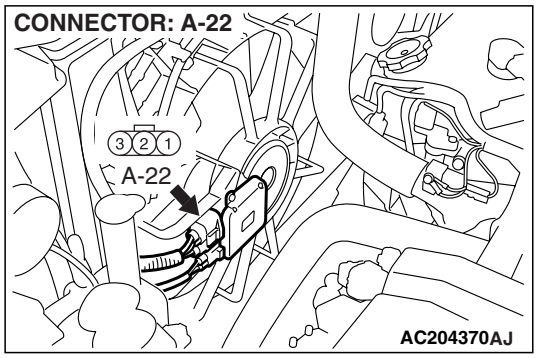


(4) Measure the voltage between terminal number 10 and ground.

Q: Is the voltage 0.7 volt or more when the radiator fan is operating?

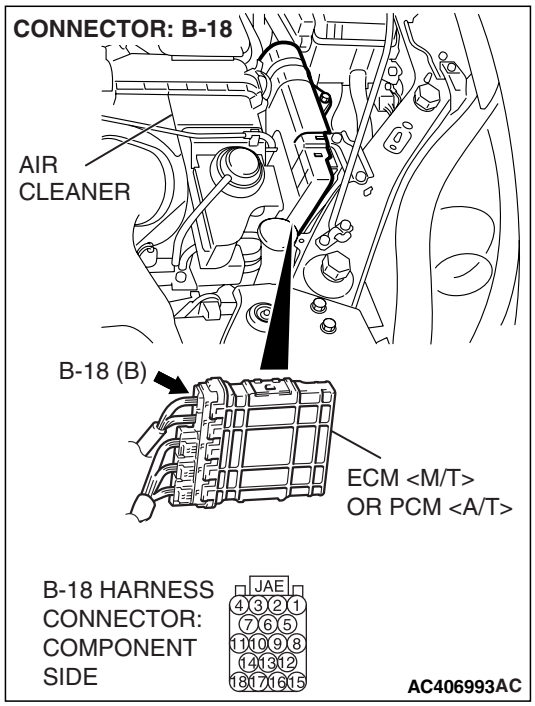
YES : Go to Step 13.
NO : Go to Step 12.

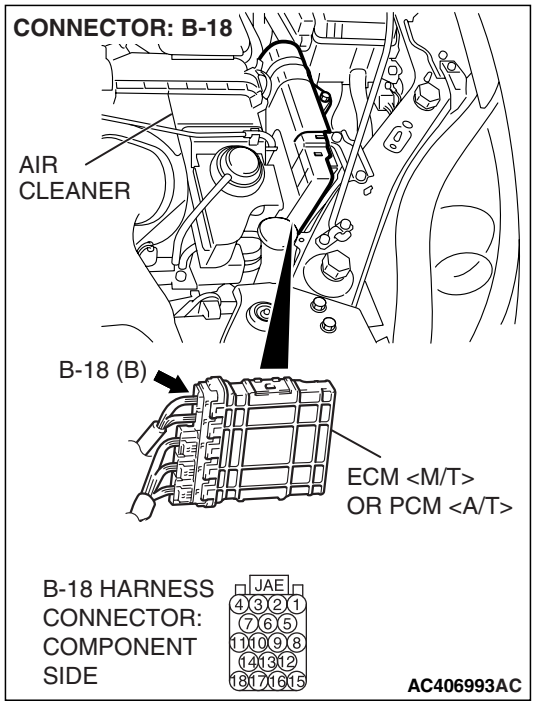
STEP 12. Check the harness wire between ECM <M/T> or PCM <A/T> connector B-18 and fan control module connector A-22.



Q: Are the harness wires between ECM <M/T> or PCM <A/T> connector B-18 (terminal 10) and fan control module connector A-22 (terminal 2) damaged?

YES : Repair or replace them, then go to Step 14.
NO : Go to Step 13.





STEP 13. Check the fan control module at ECM <M/T> or PCM <A/T> connector B-18 (terminal 10).

(1) Do not disconnect ECM <M/T> or PCM <A/T> connector B-18.
(2) Pull out terminal number 10.
(3) Turn the ignition switch to the "ON" position.

Q: Do the radiator fan motor and condenser fan motor operate?

YES : Replace the ECM <M/T> or PCM <A/T>. Then go to Step 14.
NO : Replace the radiator fan motor. Then go to Step 14.

STEP 14. Check the symptoms.

Q: Do the radiator fan and condenser fan operate correctly?

YES : The procedure is complete.
NO : Return to Step 1.

INSPECTION PROCEDURE 4: Radiator Fan and Condenser Fan do not Change Speed or Stop <3.8L Engine>

NOTE: If the engine coolant temperature reaches 110°C (230°F) or higher, the radiator fan control runs the radiator fan for up to 5 minutes even after the ignition switch is turned to the "LOCK" (OFF) position [the fan stops its rotation when the engine coolant temperature decreases to 110°C (230°F) or lower.]

Radiator Fan and Condenser Fan Drive Circuit

Refer to P.14-7.

CIRCUIT OPERATION

- The fan control module is powered from fusible link number 2.
- The ECM <M/T> or PCM <A/T> judges the required revolution speed of radiator fan motor and condenser fan motor using the input signals transmitted from A/C switch, automatic compressor controller, vehicle speed sensor and engine coolant temperature sensor. The ECM <M/T> or PCM <A/T> activates the fan control module to drive the radiator fan motor and condenser fan motor.

TECHNICAL DESCRIPTION

The fan controller has variable control of the radiator fan motor and the condenser fan motor speeds using signals transmitted from the ECM <M/T> or PCM <A/T>.

TROUBLESHOOTING HINTS

- Malfunction of fan control relay
- Malfunction of fan control module
- Malfunction of ECM <M/T> or PCM <A/T>

DIAGNOSIS

Required Special Tools:

- MB991223: Harness Set
- MB991923: Power Plant ECU Check Harness

STEP 1. Check the fan control relay.

Refer to P.14-24.

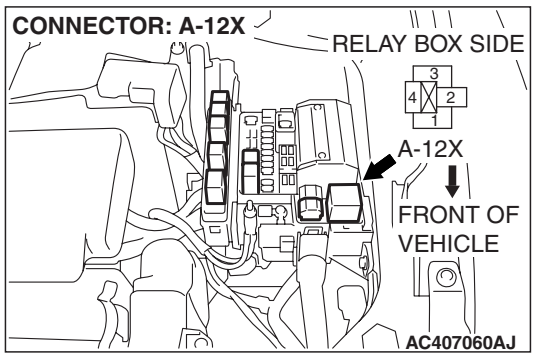
Q: Is the fan control relay in good condition?

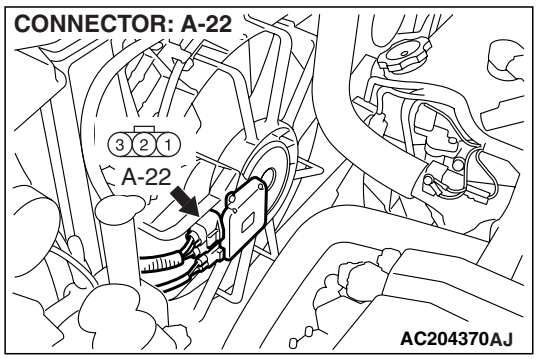
YES : Go to Step 2.
NO : Replace the part, then go to Step 7.

STEP 2. Check the harness wire between fan control relay connector A-12X (terminal 2) and fan control module connector A-22 (terminal 3).

Q: Are the harness wires between fan control relay connector A-12X and fan control module connector A-22 damaged?

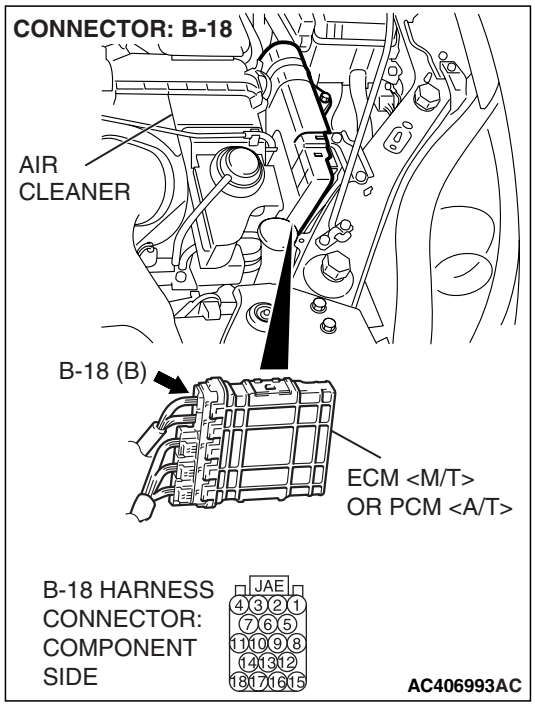
YES : Repair or replace the part, then go to Step 7.
NO : Go to Step 3.

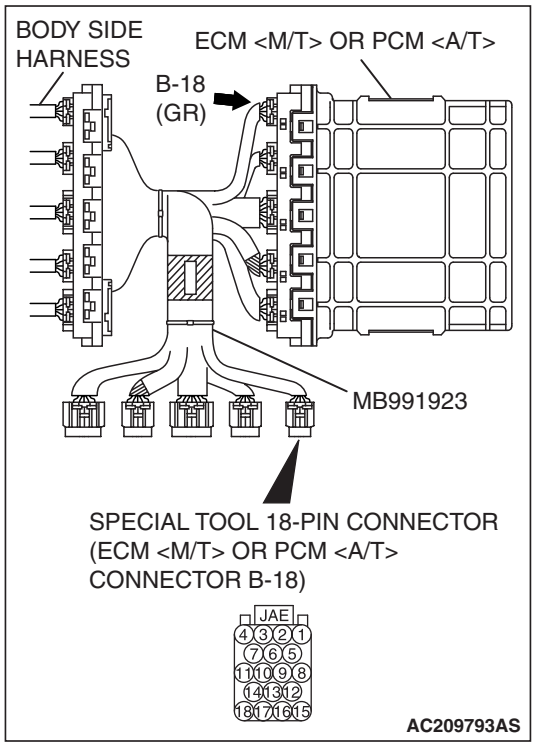




STEP 3. Measure the output circuit voltage at ECM <M/T> or PCM <A/T> connector B-18 (terminal 10) by using check harness special tool MB991923.

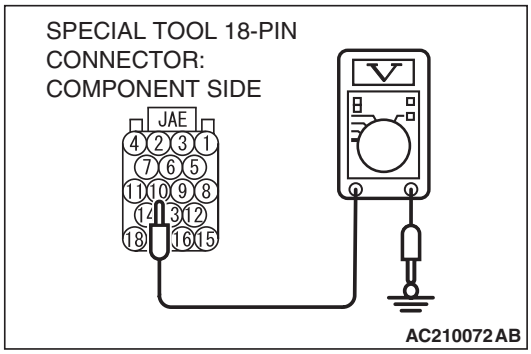
(1) Disconnect all the connectors from the ECM <M/T> or PCM <A/T>.





(2) Connect special tool MB991923 (check harness) between the ECM <M/T> or PCM <A/T> and the body-side harness connector.

(3) Start the engine and run it at idle. [Engine coolant temperature: 80° C (176° F) or less]



(4) Measure the voltage between terminal number 10 and ground.

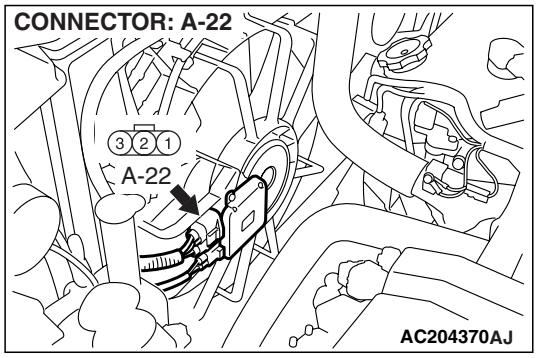
Q: Is the voltage 0 to 0.3 volt when the radiator fan is not operating?

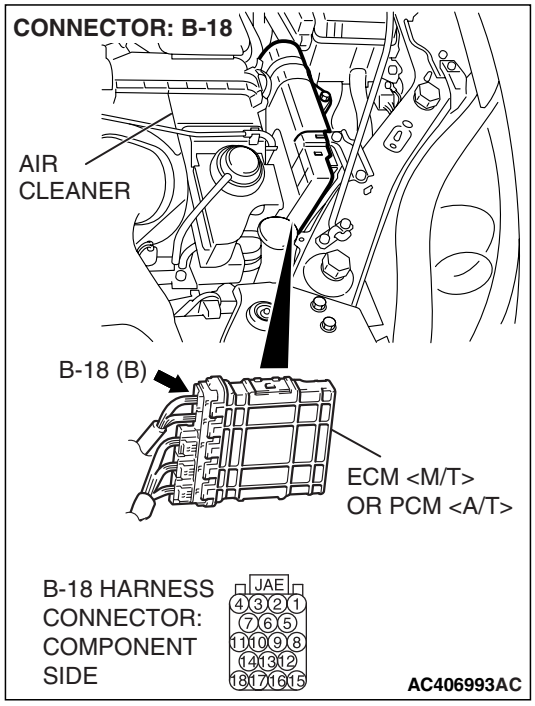
YES : Go to Step 7.
NO : Go to Step 4.

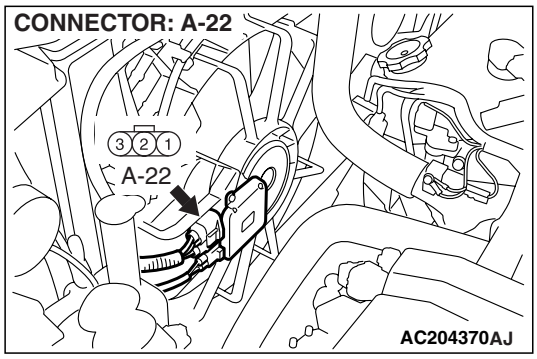
STEP 4. Check fan control module connector A-22 and ECM <M/T> or PCM <A/T> connector B-18 for loose, corroded or damaged terminals, or terminals pushed back in the connector.

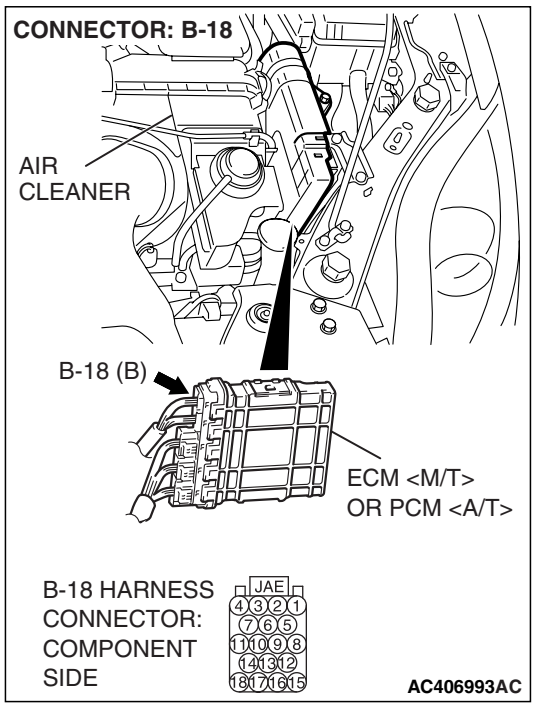
Q: Are the connectors in good condition?

YES : Go to Step 5.
NO : Repair or replace the damaged components. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.









STEP 5. Check the harness wire between ECM <M/T> or PCM <A/T> connector B-18 (terminal 10) and fan control module connector A-22 (terminal 2).

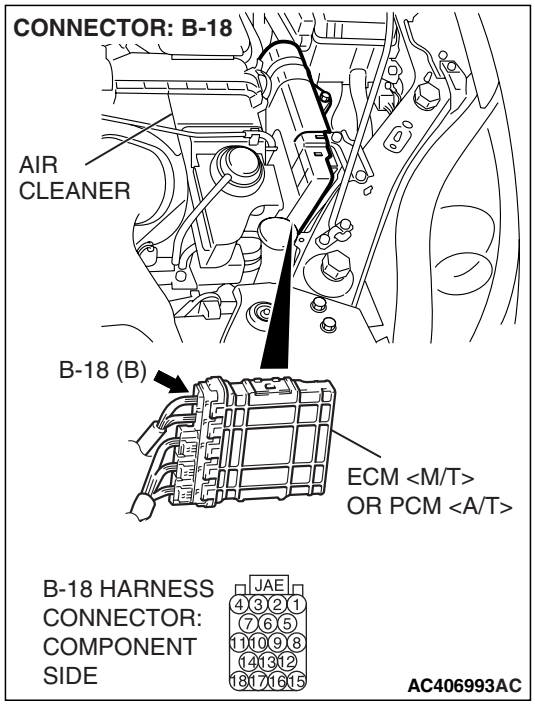
Q: Are the harness wires between ECM <M/T> or PCM <A/T> connector B-18 and fan control module connector A-22 damaged?

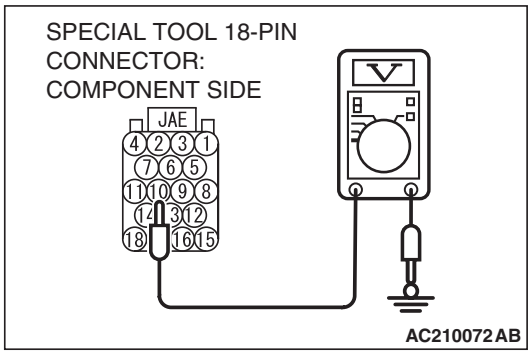
YES : Repair or replace them, then go to Step 7.

NO : Go to Step 6.

STEP 6. Check the fan control module at ECM <M/T> or PCM <A/T> connector B-18.

(1) Disconnect ECM <M/T> or PCM <A/T> connector B-18.
(2) Pull out the pin 10 and connect it to the body ground.





(3) Reconnect ECM <M/T> or PCM <A/T> connector B-18 with pin 10 still removed.
(4) Turn the ignition switch to the " ON" position.

Q: Do the radiator fan motor and condenser fan motor stop?

YES : Replace the ECM <M/T> or PCM <A/T>. Then go to Step 7.
NO : Replace the radiator fan motor. Then go to Step 7.

STEP 7. Check the symptoms.

Q: Do the radiator fan and condenser fan operate correctly?

YES : The procedure is complete.
NO : Return to Step 1.

INSPECTION PROCEDURE 5: Radiator Fan does not Operate <3.8L Engine>

TECHNICAL DESCRIPTION
The cause could be a malfunction of the radiator fan motor or an open circuit between the fan control module and the radiator fan motor.

TROUBLESHOOTING HINT
Malfunction of radiator fan motor

DIAGNOSIS
Replace the radiator fan motor.

INSPECTION PROCEDURE 6: Condenser Fan does not Operate <3.8L Engine>

Radiator Fan and Condenser Fan Drive Circuit
Refer to P.14-7.

CIRCUIT OPERATION
- The fan control module is powered from fusible link number 2.
- The ECM <M/T> or PCM <A/T> judges the required revolution speed of radiator fan motor and condenser fan motor using the input signals transmitted from A/C switch, automatic compressor controller, vehicle speed sensor and engine coolant temperature sensor. The ECM <M/T> or PCM <A/T> activates the fan control module to drive the radiator fan motor and condenser fan motor.

TECHNICAL DESCRIPTION
The cause could be a malfunction of the condenser fan motor or fan control module.

TROUBLESHOOTING HINTS
- Malfunction of condenser fan motor
- Malfunction of fan control module

DIAGNOSIS

STEP 1. Check the condenser fan motor.
Refer to GROUP 55A, Condenser and Condenser Fan Motor P.55A-212.

Q: Is the condenser fan motor in good condition?
YES : Go to Step 2.
NO : Replace the condenser fan motor, then go to Step 3.

STEP 2. Check the fan control module.
Refer to P.14-25.

Q: Is the fan control module in good condition?
YES : Go to Step 3.
NO : Replace the radiator fan motor, then go to Step 3.

STEP 3. Check the symptoms.

Q: Does the condenser fan operate correctly?
YES : The procedure is complete.
NO : Return to Step 1.

ON-VEHICLE SERVICE

ENGINE COOLANT LEAK CHECK

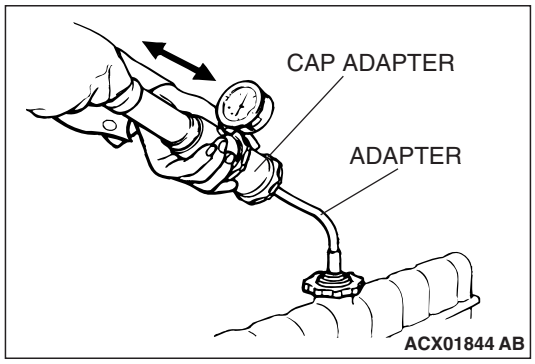
M1141001000463

⚠ *WARNING*

When pressure testing the cooling system, slowly release cooling system pressure to avoid getting burned by hot coolant.

⚠ **CAUTION**

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

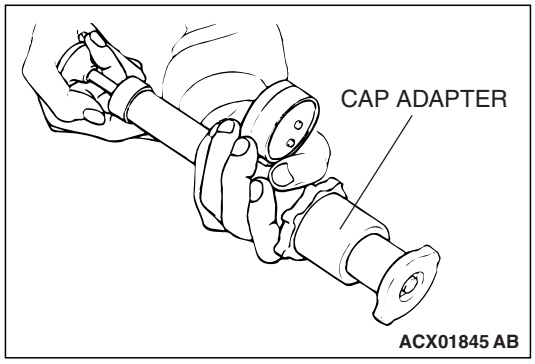


1. Check that the coolant level is up to the filler neck. Install a radiator tester and apply 160 kPa (23 psi) pressure, and then check for leakage from the radiator hose or connections.
2. If there is leakage, repair or replace the appropriate part.

RADIATOR CAP PRESSURE CHECK

M1141001300572

NOTE: Be sure that the cap is clean before testing. Rust or other foreign material on the cap seal will cause an improper reading.



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

   Minimum limit: 83 kPa (12 psi)
   Standard value: 93 – 123 kPa (14 – 18 psi)
3. Replace the radiator cap if the reading does not remain at or above the limit.

ENGINE COOLANT REPLACEMENT

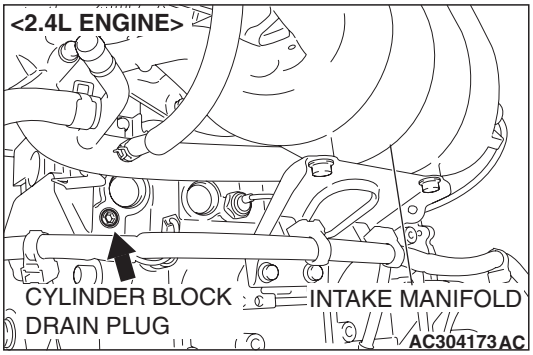
M1141001200780

⚠ ***WARNING***

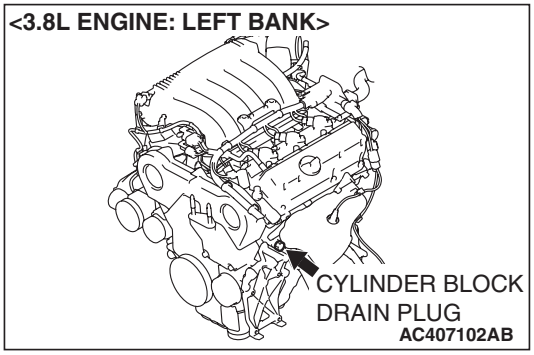
When removing the radiator cap, use care to avoid contact with hot coolant or steam. Place a shop towel over the cap and turn the cap counterclockwise a little to let the pressure escape through the vinyl tube. After relieving the steam pressure, remove the cap by slowly turning it counterclockwise.

1. Drain the water from the radiator, heater core and engine after unplugging the radiator drain plug and removing the radiator cap.
2. Drain the water in the water jacket by unplugging the drain plug of the cylinder block.
3. Remove the radiator condenser tank assembly and drain the coolant.
4. Drain the coolant then clean the path of the coolant by injecting water into the radiator from the radiator cap area.

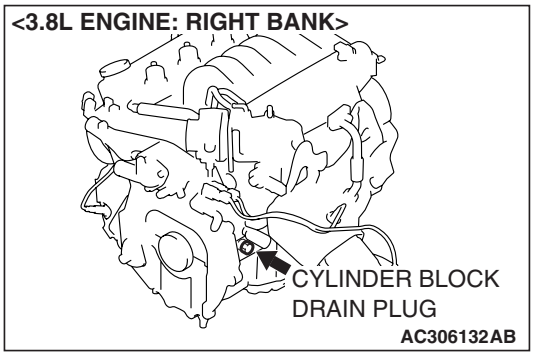
<2.4L ENGINE>



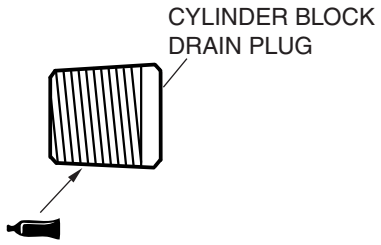
<3.8L ENGINE: LEFT BANK>



<3.8L ENGINE: RIGHT BANK>

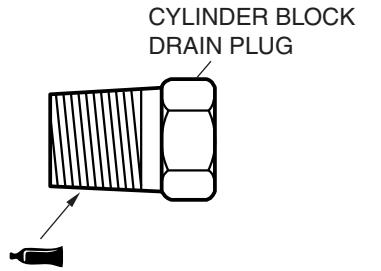


<2.4L ENGINE, 3.8L ENGINE: RIGHT BANK>



AC304677 AC

<3.8L ENGINE: LEFT BANK>



AC200625 AD

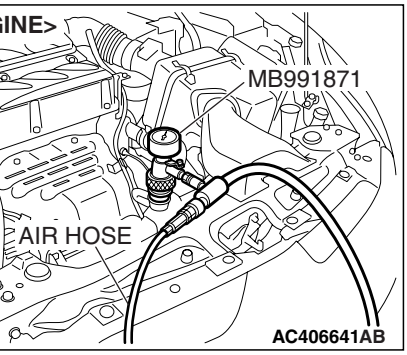
5. Apply the designated sealant to the screw area of the cylinder block drain plug, and then tighten to the standard torque.

   Specified sealant: 3M™ AAD Part No.8731 or equivalent
   Tightening torque:
   <2.4L Engine> 44 ±5 N· m (33 ±3 ft-lb)
   <3.8L Engine> 39 ±5 N· m (29 ±3 ft-lb)

6. Securely tighten the radiator drain plug.
7. Assemble the radiator condenser tank assembly.

⚠ CAUTION
Do not use alcohol or methanol anti-freeze or any engine coolants mixed with alcohol or methanol anti-freeze. The use of an improper anti-freeze can cause corrosion of the aluminum components.

<2.4L ENGINE>



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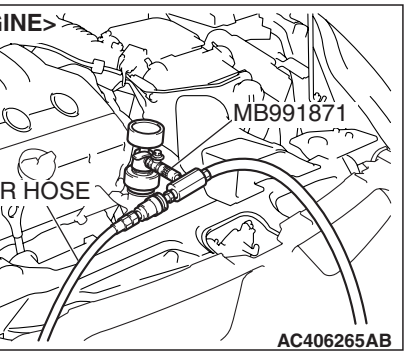
<3.8L ENGINE>



AC406265AB

8. By referring to the section on coolant, select an appropriate concentration for safe operating temperature within the range of 30 to 60%. Use special tool MB991871 to refill the coolant. A convenient mixture is a 50% water and 50% antifreeze solution [freezing point: –31° C (–32.8 ° F)].

   Recommended antifreeze: Long Life Antifreeze Coolant or an equivalent
   Quantity:
   2.4L Engine
   - **8.8 dm^3 (9.3 quarts) <M/T>**
   - **8.7 dm^3 (9.2 quarts) <A/T>**

   3.8L Engine
   - **8.1 dm^3 (8.6 quarts) <M/T>**
   - **8.0 dm^3 (8.5 quarts) <A/T>**

   NOTE: For how to use special tool MB991871, refer to its manufacturer's instructions.

9. Reinstall the radiator cap.
10. Start the engine and let it warm up until the thermostat opens.
11. After repeatedly revving the engine up to 3,000 r/min several times, stop the engine.
12. Remove the radiator cap after the engine has cooled, and pour in coolant up to the brim. Reinstall the cap.

⚠ CAUTION
Do not overfill the radiator condenser tank assembly.

13. Add coolant to the radiator condenser tank assembly between the "FULL" and "LOW" mark if necessary.

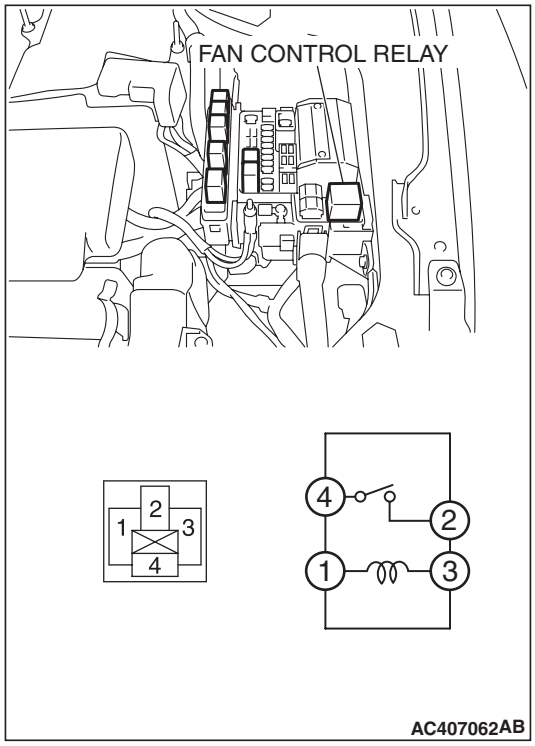
ENGINE COOLANT CONCENTRATION TEST

M1141001100556

Refer to GROUP 00, RECOMMENDED LUBRICANTS AND LUBRICANT CAPACITIES TABLE P.00-42.

FAN CONTROL RELAY CONTINUITY CHECK

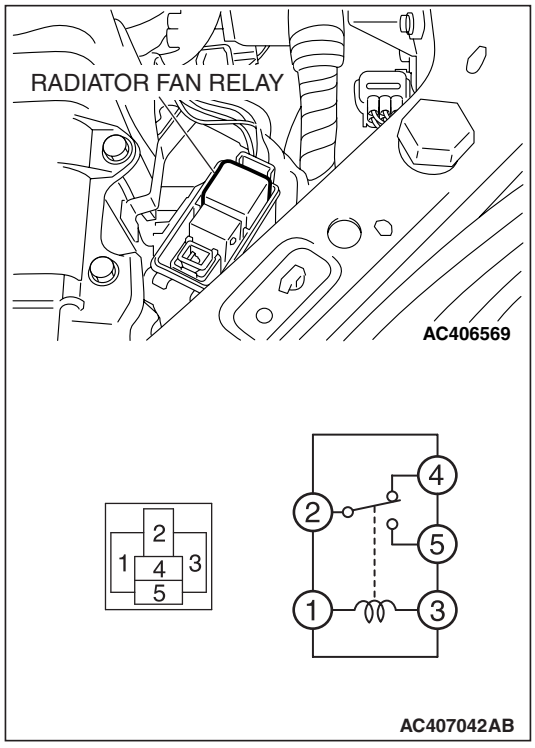
M1141006200503



BATTERY VOLTAGE	TERMINAL NO. TO BE CONNECTED TO TESTER	CONTINUITY TEST RESULTS
Not applied	4 – 2	Open circuit
Connect terminal No.3 and battery (–) terminal. Connect terminal No.1 and battery (+) terminal.	4 – 2	Less than 2 ohms

RADIATOR FAN RELAY CHECK <2.4L ENGINE>

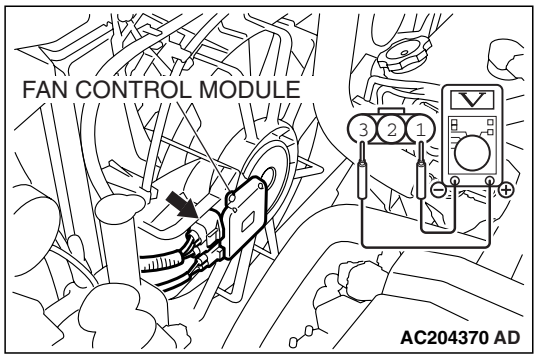
M1141004400039



BATTERY VOLTAGE	TERMINAL NO. TO BE CONNECTED TO TESTER	CONTINUITY TEST RESULTS
Not applied	2 – 4	Less than 2 ohms
	2 – 5	Open circuit
Connect terminal No.3 and battery (–) terminal. Connect terminal No.1 and battery (+) terminal.	2 – 5	Less than 2 ohms

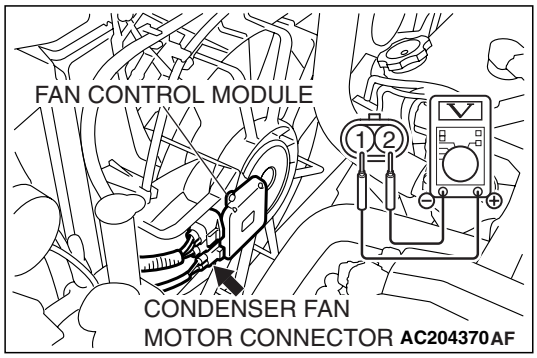
FAN CONTROL MODULE CHECK <3.8L ENGINE>

M1141007400135



1. Remove the fan control module connector.
2. Turn the ignition switch to the "ON" position, and measure the voltage between the harness-side connector terminals.

   Standard value: Battery positive voltage



3. Connect the fan control module connector, and disconnect the condenser fan motor connector.
4. Ensure that the A/C switch is off, and start the engine and run it at idle.
5. Measure the voltage between the fan control module-side connector terminals.

   Standard value: 1 volt or less

⚠ WARNING
Stay clear of the fan when the fan starts running.

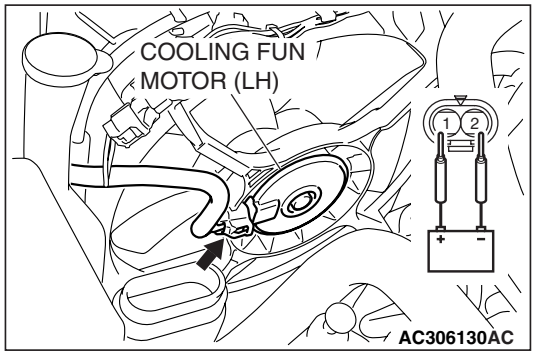
6. Turn the A/C switch to the "ON" position.
7. Measure the voltage between the fan control module-side connector terminals while the fan is running. The voltage should repeat the values 1) and 2) below.

   Standard value:
   1) 8.2 ±2.6 volts
   2) Battery positive voltage ±2.6 volts

8. If the voltage does not repeatedly change as indicated, replace the radiator fan motor.

COOLING FAN MOTOR CHECK <2.4L ENGINE>

M1141007600010



1. Remove the cooling fan motor connector.
2. Check to see that the fan motor of the radiator turns when applying battery power between the connector terminals of the radiator fan motor. Also check to see that there is no abnormal sound coming from the cooling fan motor at this time.
3. If the cooling fan motor is defective, replace it. (Refer to P.14-26.)

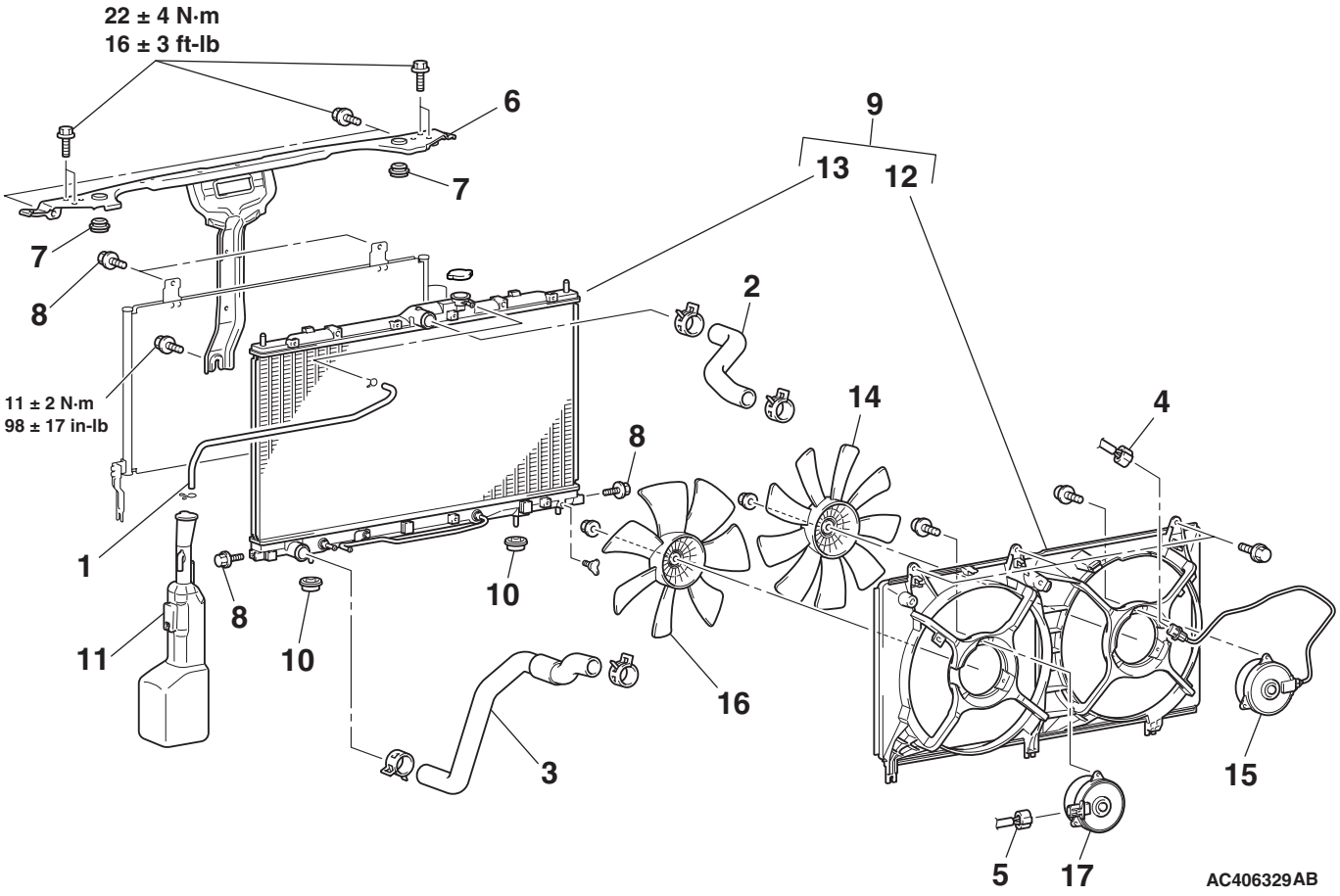
RADIATOR

REMOVAL AND INSTALLATION

M1141001500941

<2.4L ENGINE>

Pre-removal Operation	Post-installation Operation
• Engine Coolant Draining (Refer to P.14-22). • Air Cleaner Removal (Refer to GROUP 15, Air Cleaner P.15-4).	• Air Cleaner Installation (Refer to GROUP 15, Air Cleaner P.15-4). • Engine Coolant Refilling and Level Check (Refer to P.14-22). • Transmission Fluid Refilling and Level Check (Refer to GROUP 00, Maintenance Service P.00-60).



RADIATOR REMOVAL STEPS

1. RADIATOR CONDENSER TANK HOSE
<<A>> >>A<< 2. RADIATOR UPPER HOSE
<<A>> >>A<< 3. RADIATOR LOWER HOSE
4. COOLING FAN MOTOR CONNECTOR (RH)
5. COOLING FAN MOTOR CONNECTOR (LH)
• HOOD LATCH (REFER TO GROUP 42, HOOD P.42-7).
6. FRONT END STRUCTURE BAR
7. UPPER INSULATOR
8. CONDENSER BOLTS
9. RADIATOR ASSEMBLY
10. LOWER INSULATOR

RADIATOR REMOVAL STEPS

11. RADIATOR CONDENSER TANK ASSEMBLY
12. COOLING FAN SHROUD ASSEMBLY
13. RADIATOR

FAN MOTOR REMOVAL STEPS

1. RADIATOR CONDENSER TANK HOSE
<<A>> >>A<< 2. RADIATOR UPPER HOSE
4. COOLING FAN MOTOR CONNECTOR (RH)
5. COOLING FAN MOTOR CONNECTOR (LH)
11. RADIATOR CONDENSER TANK ASSEMBLY
14. COOLING FAN (RH)

TSB Revision

FAN MOTOR REMOVAL STEPS

15. COOLING FAN MOTOR (RH)
16. COOLING FAN (LH)
17. COOLING FAN MOTOR (LH)

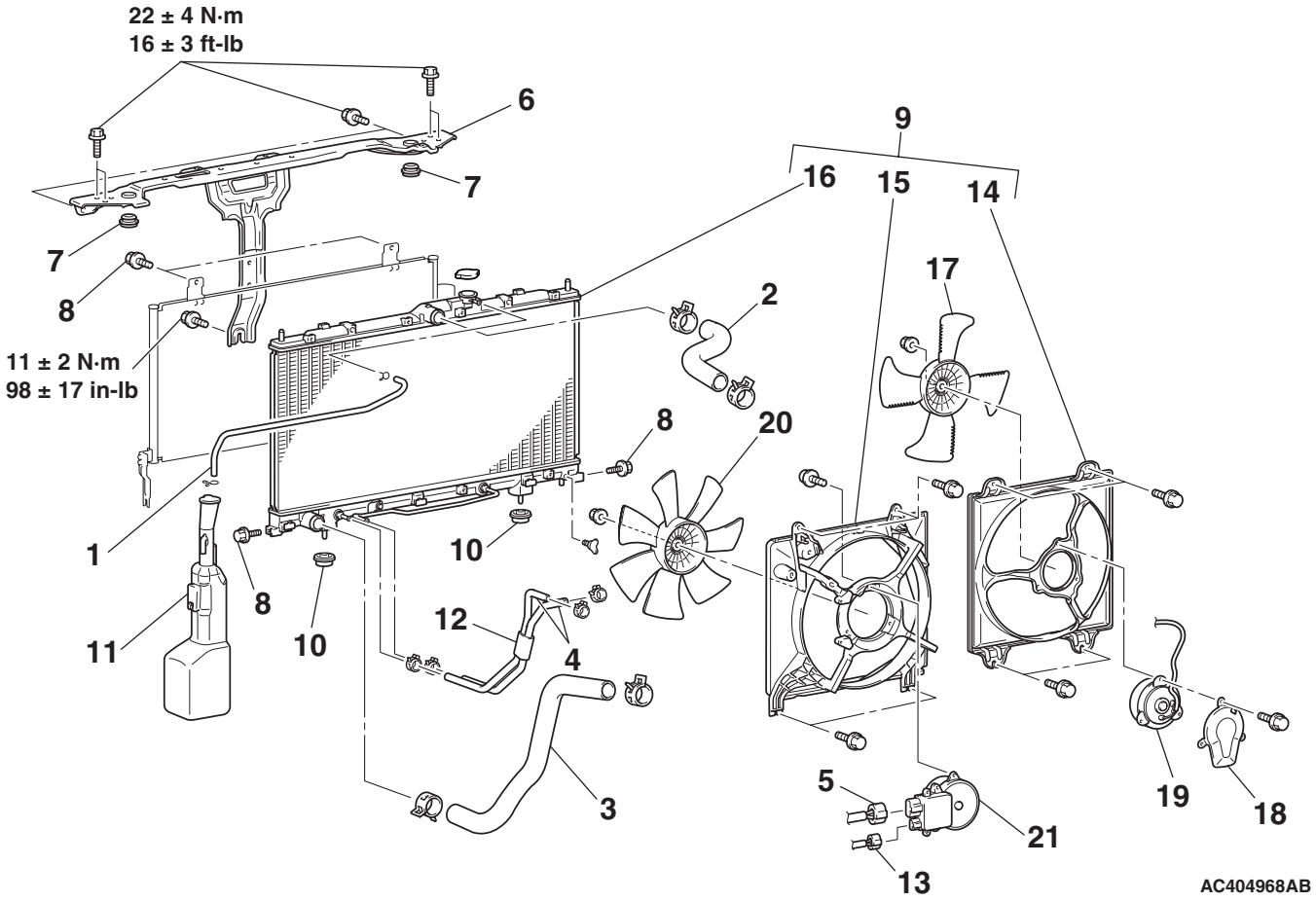
RADIATOR CONDENSER TANK REMOVAL STEPS

- UNDER COVER (LH)
- AIR CLEANER INTAKE DUCT (REFER TO GROUP 15, AIR CLEANER P.15-4).

1. RADIATOR CONDENSER TANK HOSE
5. COOLING FAN MOTOR CONNECTOR (LH)
11. RADIATOR CONDENSER TANK ASSEMBLY

<3.8L ENGINE>

Pre-removal Operation	Post-installation Operation
• Engine Coolant Draining (Refer to P.14-22). • Air Cleaner Removal (Refer to GROUP 15, Air Cleaner P.15-5).	• Air Cleaner Installation (Refer to GROUP 15, Air Cleaner P.15-5). • Engine Coolant Refilling and Level Check (Refer to P.14-22). • Transmission Fluid Refilling and Level Check (Refer to GROUP 00, Maintenance Service P.00-60).



TSB Revision

RADIATOR REMOVAL STEPS

1. RADIATOR CONDENSER TANK HOSE
<<A>> >>A<< 2. RADIATOR UPPER HOSE
<<A>> >>A<< 3. RADIATOR LOWER HOSE
<<B>> 4. TRANSMISSION FLUID COOLER LINE HOSE CONNECTION
5. FAN CONTROL MODULE CONNECTOR
• HOOD LATCH (REFER TO GROUP 42, HOOD P.42-7).
6. FRONT END STRUCTURE BAR
7. UPPER INSULATOR
8. CONDENSER BOLTS
9. RADIATOR ASSEMBLY
10. LOWER INSULATOR
11. RADIATOR CONDENSER TANK ASSEMBLY
<<B>> 12. TRANSMISSION FLUID COOLER LINE HOSE
13. CONDENSER FAN MOTOR CONNECTOR
14. CONDENSER FAN SHROUD ASSEMBLY
15. COOLING FAN SHROUD ASSEMBLY
16. RADIATOR

FAN MOTOR REMOVAL STEPS

1. RADIATOR CONDENSER TANK HOSE
5. FAN CONTROL MODULE CONNECTOR
<<A>> >>A<< 3. RADIATOR UPPER HOSE
13. CONDENSER FAN MOTOR CONNECTOR
11. RADIATOR CONDENSER TANK ASSEMBLY
14. CONDENSER FAN SHROUD ASSEMBLY
15. COOLING FAN SHROUD ASSEMBLY
17. CONDENSER FAN
18. HEAT PROTECTOR
19. CONDENSER FAN MOTOR
20. COOLING FAN
21. COOLING FAN MOTOR

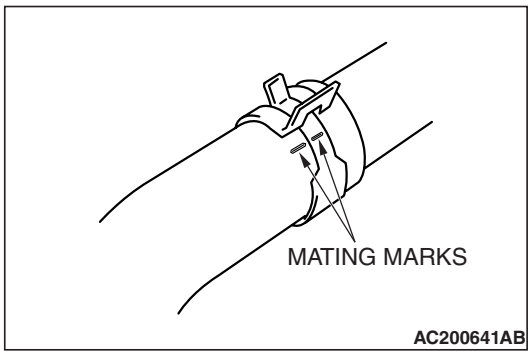
RADIATOR CONDENSER TANK REMOVAL STEPS

• UNDER COVER (LH)
• AIR CLEANER INTAKE DUCT (REFER TO GROUP 15, AIR CLEANER P.15-5).
1. RADIATOR CONDENSER TANK HOSE
5. FAN CONTROL MODULE CONNECTOR
11. RADIATOR CONDENSER TANK ASSEMBLY

REMOVAL SERVICE POINTS

<<A>> RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

Make mating marks on the radiator hose and the hose clamp. Disconnect the radiator hose.



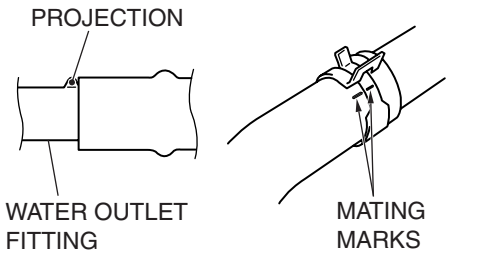
<<B>> TRANSMISSION FLUID COOLER LINE HOSE REMOVAL

After removing the hose from the radiator, plug the hose and the radiator nipple to prevent dust or foreign particles from getting in.

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.

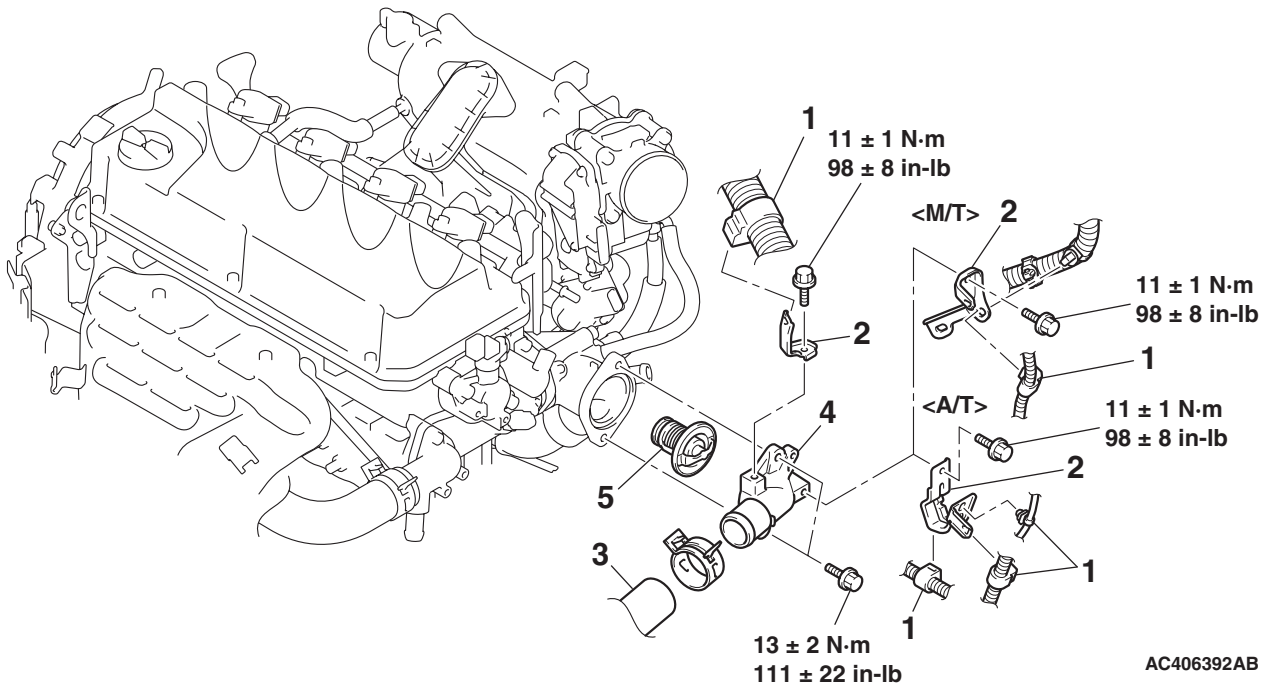


THERMOSTAT

REMOVAL AND INSTALLATION <2.4L ENGINE>

M1141002400754

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Refilling (Refer to P.14-22).
- ECM <M/T> or PCM <A/T> Removal and Installation (Refer to GROUP 13A, Engieine Control Module (ECM) and Powertrain Control Module (PCM) P.13A-1214).
- Air Cleaner Housing Cover and Air Intake Hose Removal and Installation (Refer to GROUP 15, Air Cleaner P.15-4).
- Battery and Battery Tray Removal and Installation.



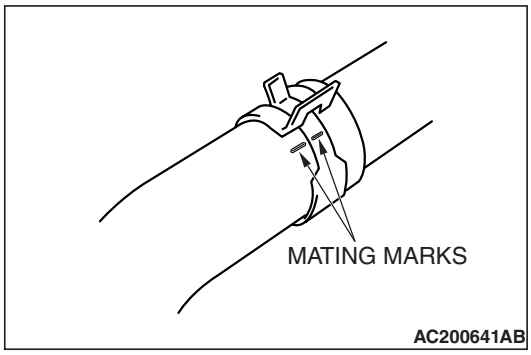
REMOVAL STEPS
1. HARNESS CONNECTION
2. HARNESS BRACKET
<<**A**>> >>**B**<< 3. RADIATOR LOWER HOSE CONNECTION

REMOVAL STEPS (Continued)
4. WATER INLET FITTING
>>**A**<< 5. THERMOSTAT

TSB Revision

REMOVAL SERVICE POINT

<<A>> RADIATOR LOWER HOSE DISCONNECTION



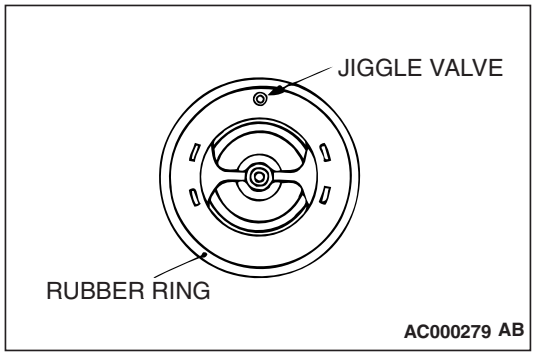
Make mating marks on the radiator hose and the hose clamp. Disconnect the radiator hose.

INSTALLATION SERVICE POINTS

>>A<< THERMOSTAT INSTALLATION

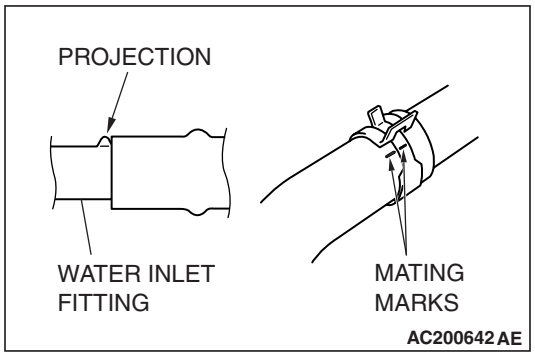
⚠ CAUTION

Make absolutely sure that no oil adheres to the rubber ring of the thermostat. Also do not fold or scratch the rubber ring during installation.



Install the thermostat so that the jiggle valve is facing straight up. Be careful not to fold or scratch the rubber ring.

>>B<< RADIATOR LOWER HOSE CONNECTION

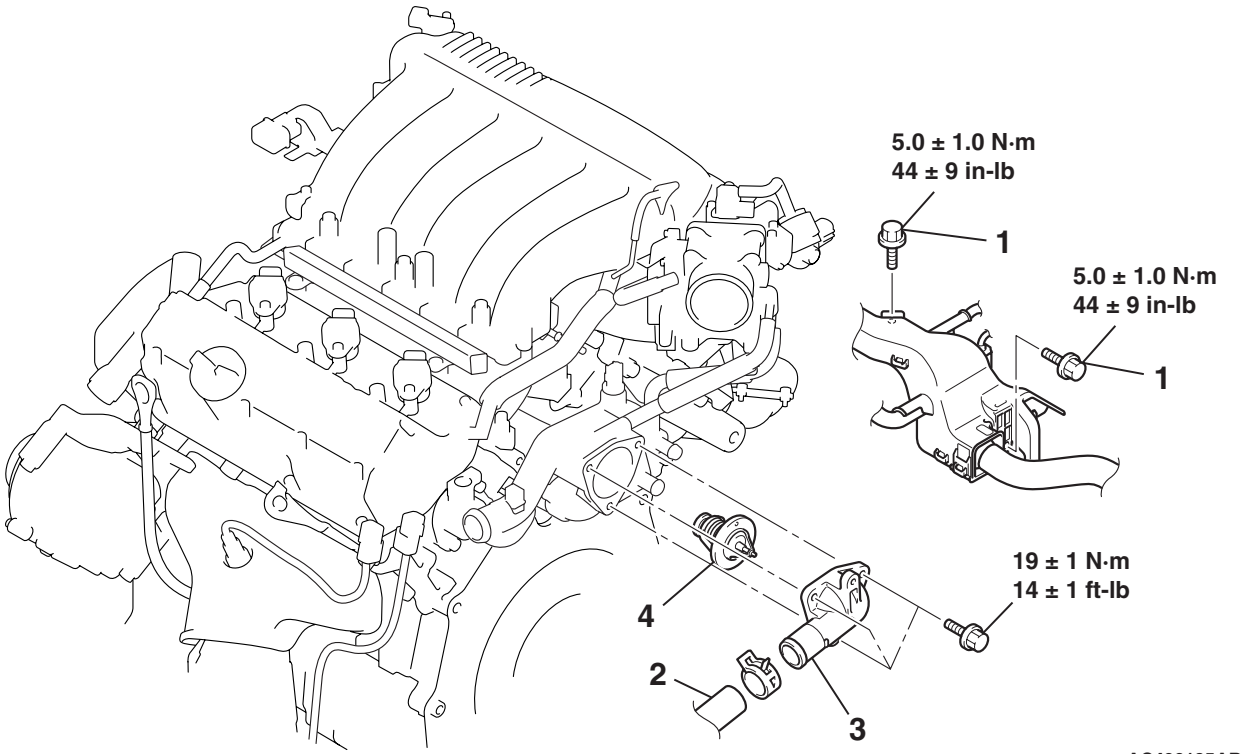


1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

REMOVAL AND INSTALLATION <3.8L ENGINE>

M1141002400776

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Refilling (Refer to P.14-22).
- Engine Cover Removal and Installation (Refer to GROUP 11C, Engine Assembly P.11C-22).
- ECM <M/T> or PCM <A/T> Removal and Installation (Refer to GROUP 13B, Engine Control Module (ECM) and Powertrain Control Module (PCM) P.13B-1295).
- Air Cleaner Removal and Installation (Refer to GROUP 15, Air Cleaner P.15-5).
- Strut Tower Bar Removal and Installation (Refer to GROUP 42, Strut Tower Bar P.42-12).
- Battery and Battery Tray Removal and Installation



AC406185AB

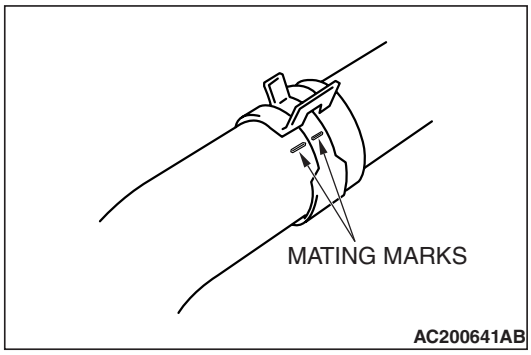
REMOVAL STEPS
1. HARNESS CONNECTION BOLTS
<<**A**>> >>**B**<< 2. RADIATOR LOWER HOSE CONNECTION

REMOVAL STEPS (Continued)
3. WATER INLET FITTING
>>**A**<< 4. THERMOSTAT

TSB Revision

REMOVAL SERVICE POINT

<<A>> RADIATOR LOWER HOSE DISCONNECTION



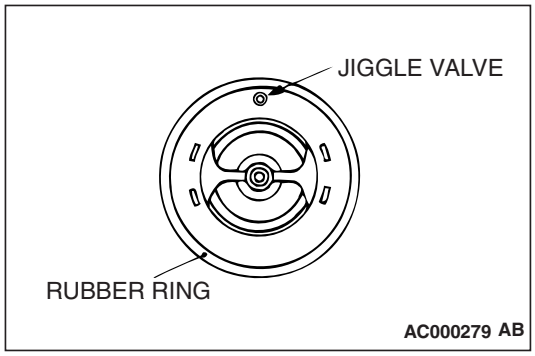
Make mating marks on the radiator hose and the hose clamp. Disconnect the radiator hose.

INSTALLATION SERVICE POINTS

>>A<< THERMOSTAT INSTALLATION

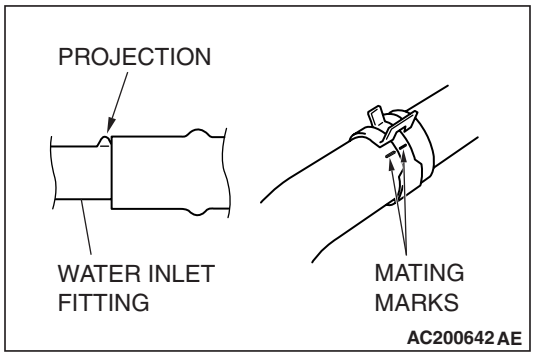
⚠ CAUTION

Make absolutely sure that no oil adheres to the rubber ring of the thermostat. Also do not fold or scratch the rubber ring during installation.



Install the thermostat so that the jiggle valve is facing straight up. Be careful not to fold or scratch the rubber ring.

>>B<< RADIATOR LOWER HOSE CONNECTION

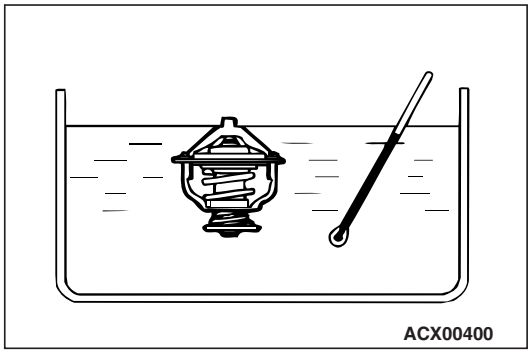


1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

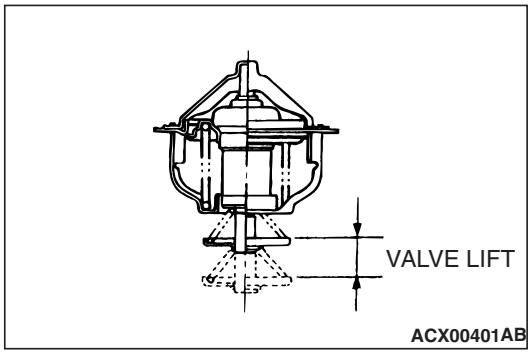
INSPECTION

M1141002500609

Thermostat Check


ACX00400

1. Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature.
   Standard value:
   Valve opening temperature: 82 ±1.5° C (180 ±3° F)



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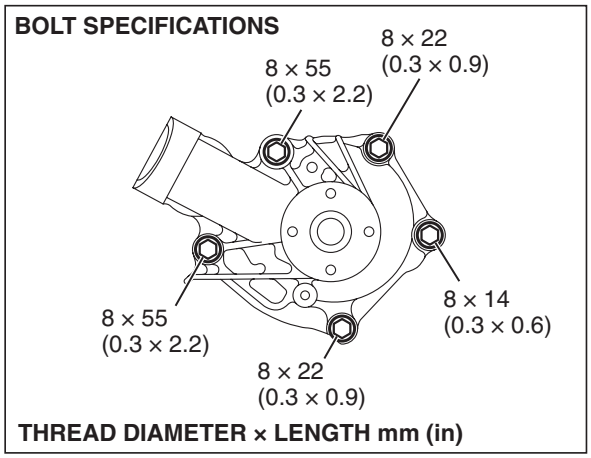
2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.
   NOTE: Measure the valve height when the thermostat is fully closed, and use this measurement to compare the valve height when the thermostat is fully open.
   Standard value:
   Full-opening temperature: 95° C (203° F)
   Amount of valve lift:
   <2.4L Engine> 8.5 mm (0.33 inch) or more
   <3.8L Engine> 9.0 mm (0.35 inch) or more

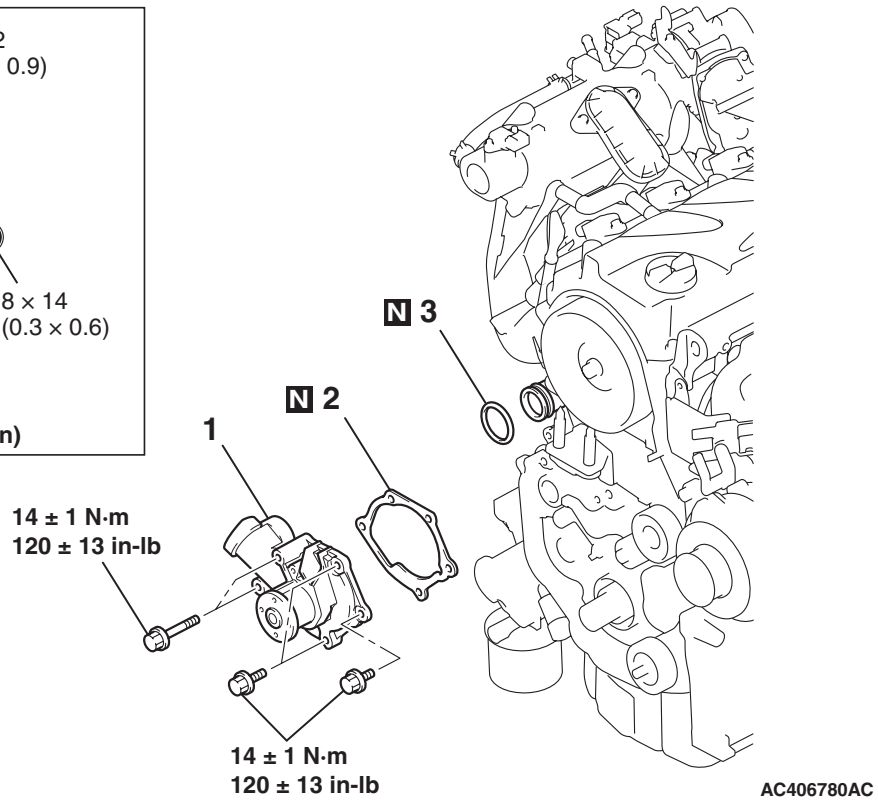
WATER PUMP

REMOVAL AND INSTALLATION <2.4L ENGINE>

M1141002700863

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Refilling (Refer to P.14-22).
- Timing Belt Removal and Installation (Refer to GROUP 11A, Timing Belt P.11A-50).





REMOVAL STEPS
1. WATER PUMP

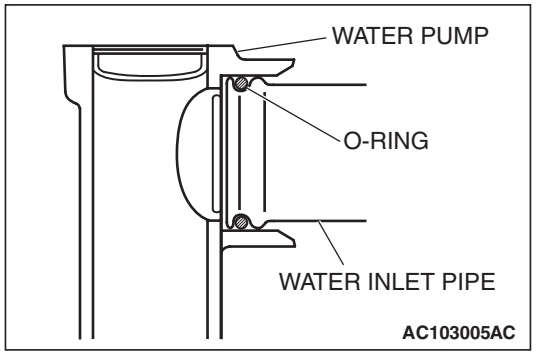
REMOVAL STEPS (Continued)
2. WATER PUMP GASKET
>>A<< 3. O-RING

INSTALLATION SERVICE POINT

>>A<< O-RING INSTALLATION

⚠ CAUTION
Do not let the O-ring get contaminated with grease or engine oil.

Fit an O-ring into the O-ring groove located at the end of the water inlet pipe and apply water or coolant to the O-ring or the inside of the mounting surface of the water pump for insertion.

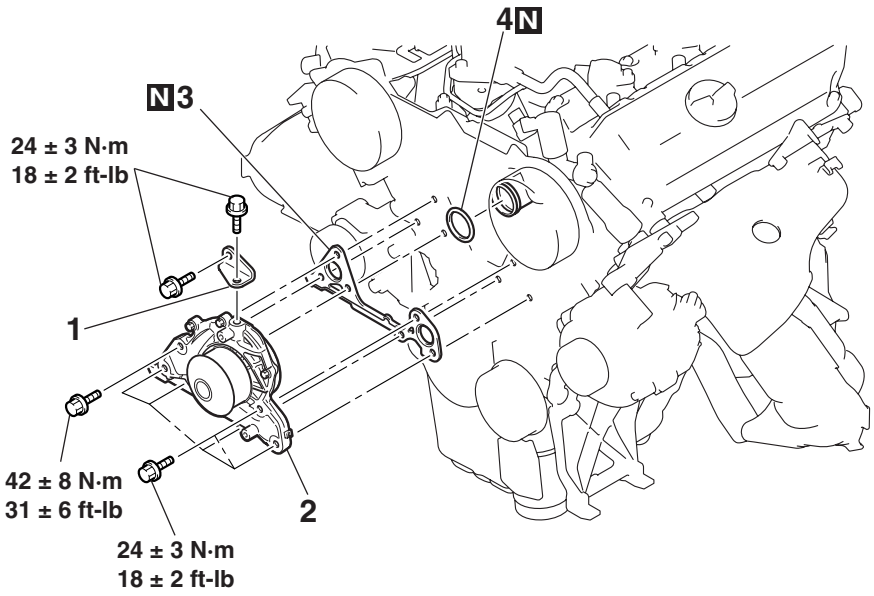


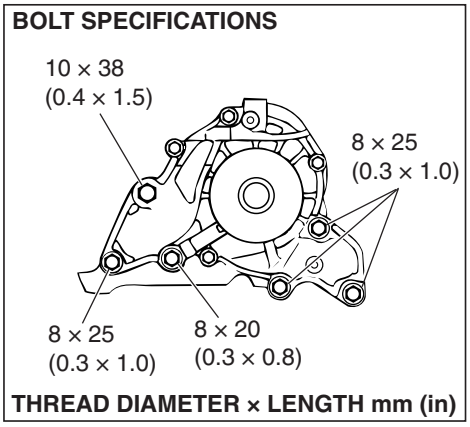
TSB Revision

REMOVAL AND INSTALLATION <3.8L ENGINE>

M1141002700885

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Refilling (Refer to P.14-22).
- Timing Belt Removal and Installation (Refer to GROUP 11C, Timing Belt P.11C-59).
- Crankshaft Position Sensor Removal and Installation (Refer to GROUP 16, Crankshaft Position Sensor P.16-45).





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REMOVAL STEPS
1. WATER PUMP BRACKET
2. WATER PUMP

REMOVAL STEPS (Continued)
3. WATER PUMP GASKET

>>A<< 4. O-RING

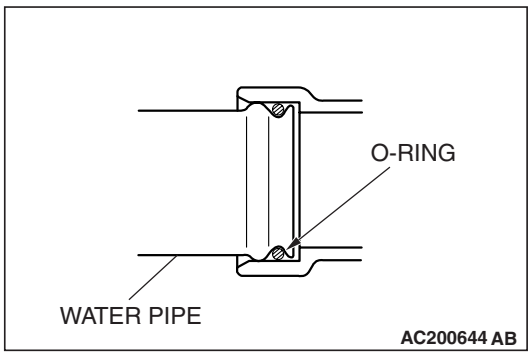
INSTALLATION SERVICE POINT

>>A<< O-RING INSTALLATION

⚠ **CAUTION**

Do not let the O-ring get contaminated with grease or engine oil.

Fit the O-ring into the groove of the water pipe ends, and apply water or coolant to the circumference of the O-ring and the pipe bores to insert the pipe assembly.



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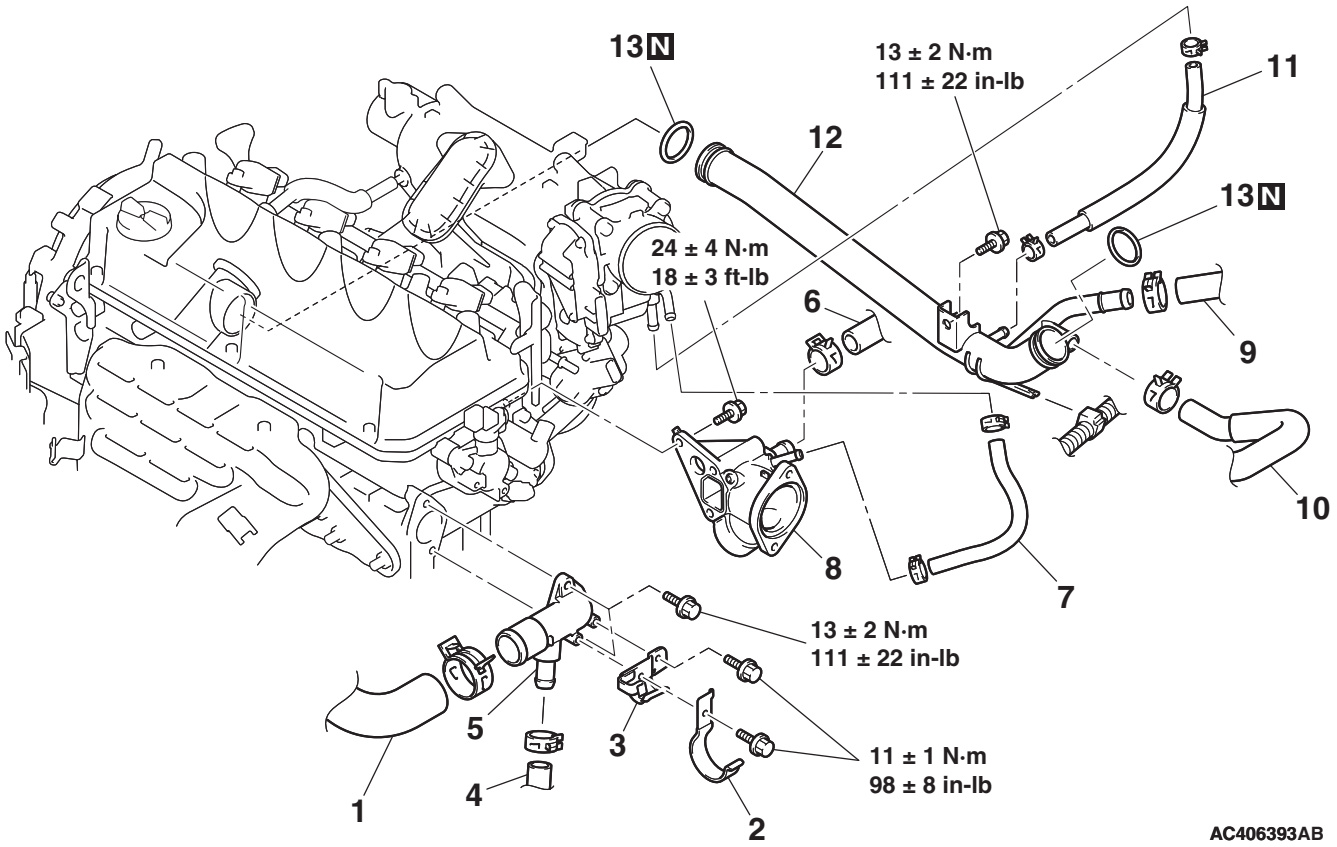
TSB Revision

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION <2.4L ENGINE>

M1141003300910

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Refilling (Refer to P.14-22).
- ECM <M/T> or PCM <A/T> Removal and Installation (Refer to GROUP 13A, Engine Control Module (ECM) and Powertrain Control Module (PCM) P.13A-1214).
- Air Cleaner Removal and Installation (Refer to GROUP 15, Air Cleaner P.15-4).
- Thermostat Removal and Installation (Refer to P.14-29).



REMOVAL STEPS

<<A>> >>C<< 1. RADIATOR UPPER HOSE CONNECTION
2. RADIATOR LOWER HOSE CLAMP
3. WATER HOSE CLAMP
4. WATER COOLER HOSE CONNECTION
>>B<< 5. WATER OUTLET FITTING
6. HEATER WATER HOSE CONNECTION

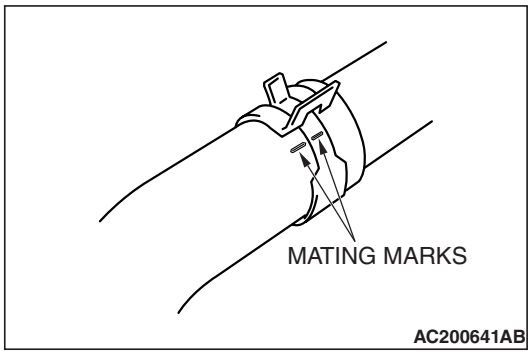
REMOVAL STEPS (Continued)

7. WATER HOSE
>>B<< 8. THERMOSTAT CASE
9. HEATER WATER HOSE CONNECTION
10. WATER COOLER HOSE CONNECTION
11. WATER HOSE
12. WATER INLET PIPE
>>A<< 13. O-RINGS

TSB Revision

REMOVAL SERVICE POINT

<<A>> RADIATOR UPPER HOSE DISCONNECTION



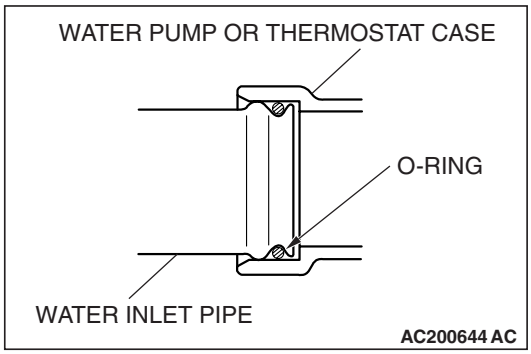
After making mating marks on the radiator hose and hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINTS

>>A<< O-RINGS INSTALLATION

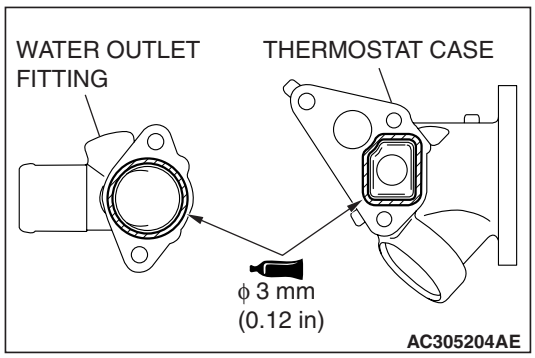
⚠ CAUTION

Do not let the O-ring get contaminated with grease or engine oil.



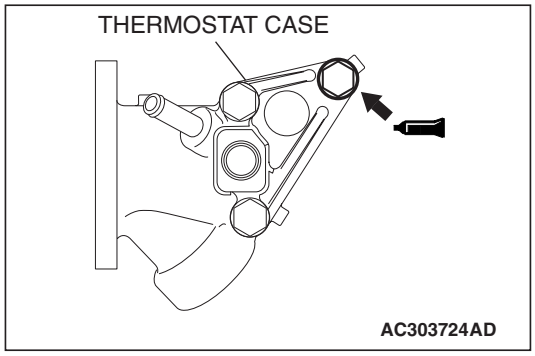
Fit an O-ring into the groove of the water inlet pipe and apply water or coolant to the circumference of the O-ring or the inside of the mounting surface of the water pump or thermostat case for insertion.

>>B<< THERMOSTAT CASE/WATER OUTLET FITTING INSTALLATION



1. Use a gasket scraper or wire brush to completely eliminate all gasket material on the gasket mounting surface.
2. Apply a bead of the sealant to the cylinder head mating surface of the thermostat case as shown.

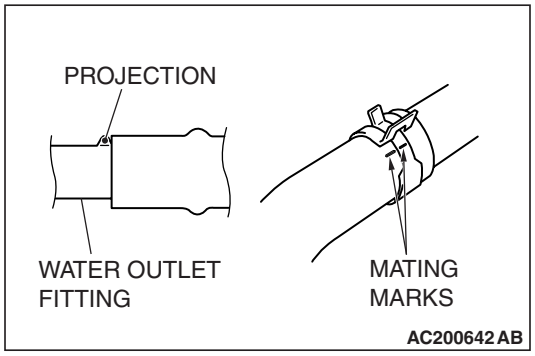
   Specified Sealant: 3M™ AAD Part No.8672, 3M™ AAD Part No.8679/8678 or equivalent



3. Apply sealant to the thread of the thermostat case bolts as shown.

   Specified Sealant: 3M™ AAD Part No.8730, 8731 or equivalent

4. With the sealant still wet (within 15 minutes after the sealant is applied), install the thermostat case. Do not apply the sealant in an area more than the required.



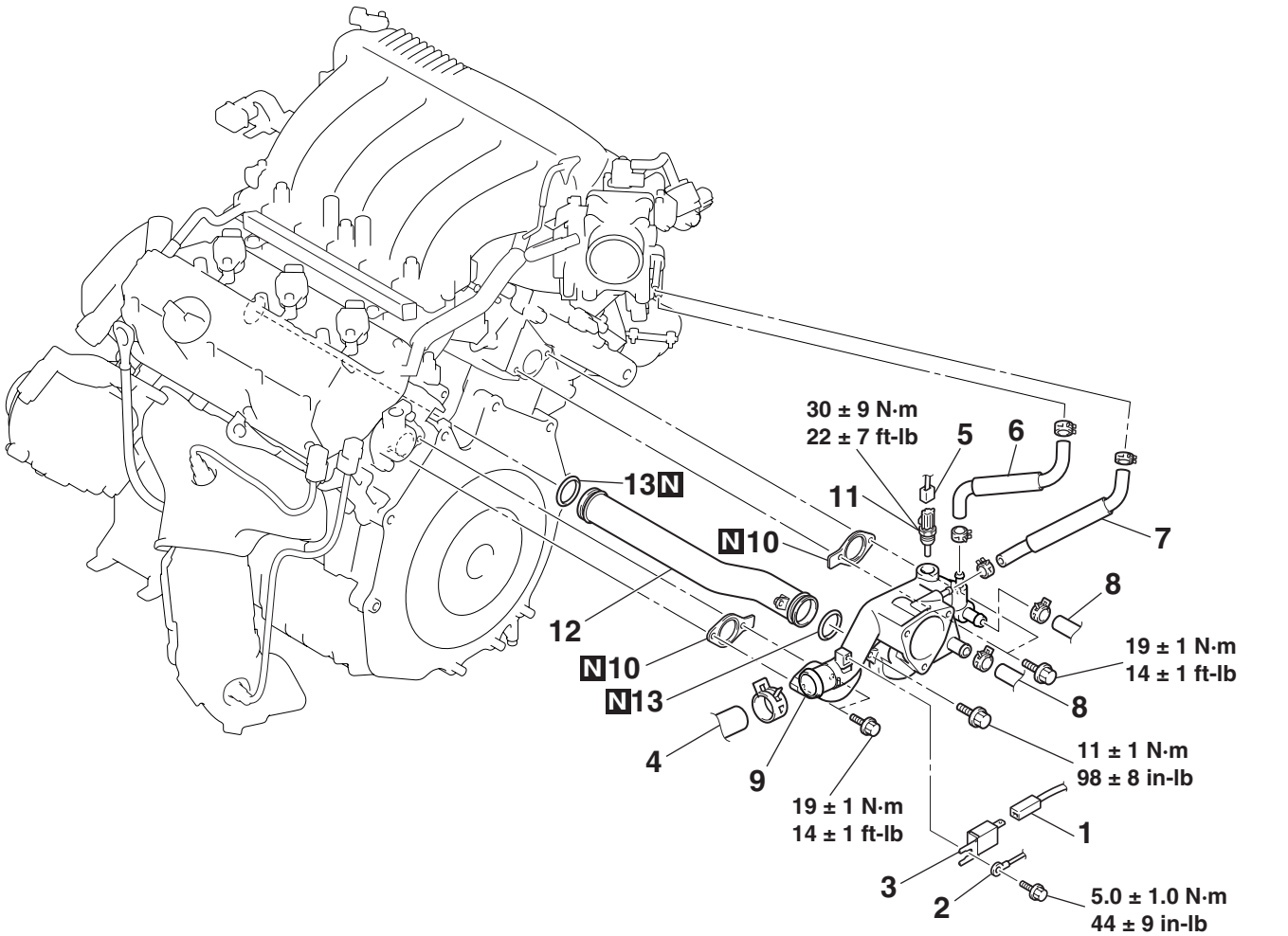
>>C<< RADIATOR UPPER HOSE CONNECTION

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

REMOVAL AND INSTALLATION <3.8L ENGINE>

M1141003300943

Pre-removal and Post-installation Operation
Thermostat Removal and Installation (Refer to P.14-31).



REMOVAL STEPS

1. CAPACITOR CONNECTOR
2. GROUNDING CONNECTION
3. CAPACITOR
<<A>> >>C<< 4. RADIATOR UPPER HOSE CONNECTION
5. ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR
6. HEATER HOSE CONNECTION

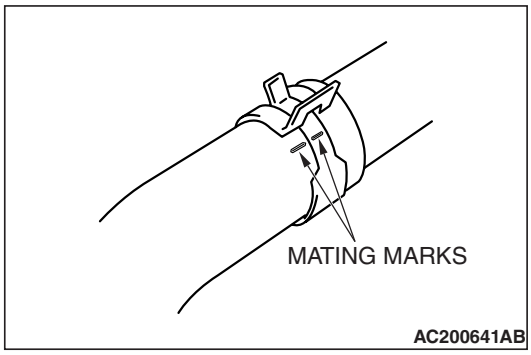
REMOVAL STEPS (Continued)

7. THROTTLE BODY WATER FEED HOSE
8. THROTTLE BODY WATER RETURN HOSE
9. THERMOSTAT HOUSING
10. GASKET
>>B<< 11. ENGINE COOLANT TEMPERATURE SENSOR
12. WATER INLET PIPE
>>A<< 13. O-RING

TSB Revision

REMOVAL SERVICE POINT

<<A>> RADIATOR UPPER HOSE DISCONNECTION

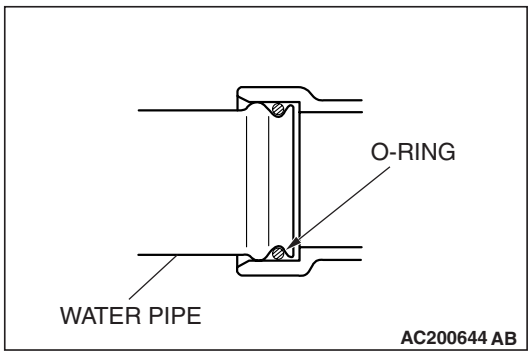


After making mating marks on the radiator hose and hose clamp, disconnect the radiator hose.

INSTALLATION SERVICE POINTS

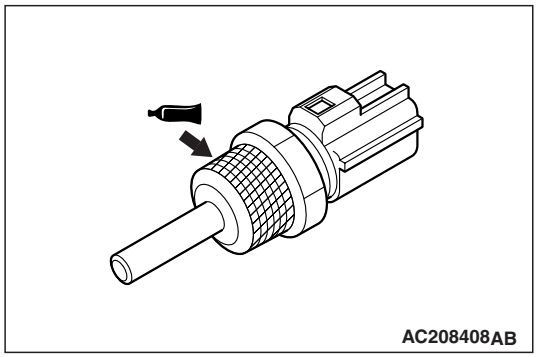
>>A<< O-RING INSTALLATION

⚠ CAUTION
Do not allow engine oil or other grease to adhere to the O-ring



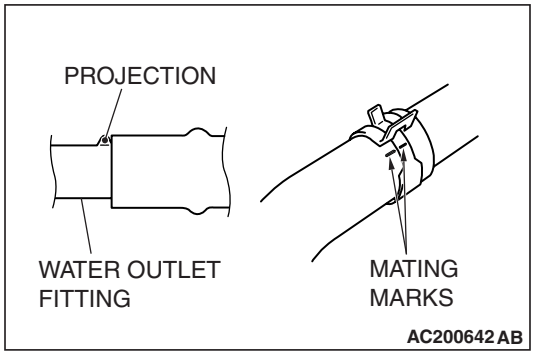
Insert the O-ring to the water pipe, and coat the outer portion of the O-ring with water or engine coolant.

>>B<< ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION



Apply the specified sealant to the thread of the engine coolant temperature sensor, and then tighten it to the specified torque.

Specified Sealant: 3M™ AAD Part No. 8731 or equivalent



>>C<< RADIATOR UPPER HOSE CONNECTION

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

INSPECTION

M1141003400434

Water Pipe and Hose Check

Check the water pipe and hose for cracks, damage and clogs. Replace them if necessary.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

M1141005000368

ITEM		SPECIFICATION
Cylinder block drain plug <2.4L Engine>		44 ± 5 N· m (33 ± 3 ft-lb)
Cylinder block drain plug <3.8L Engine>		39 ± 5 N· m (29 ± 3 ft-lb)
Radiator		
Front end structure bar bolt	M8 × 10	11 ± 2 N· m (98 ±17 in-lb)
	M8 × 20	22 ± 4 N· m (16 ± 3 ft-lb)
Thermostat <2.4L ENGINE>		
Harness bracket bolt		11 ± 1 N· m (98 ± 8 in-lb)
Water inlet fitting bolt		13 ± 2 N· m (111 ± 22 in-lb)
Thermostat <3.8L ENGINE>		
Control harness bolt		5.0 ±1.0 N· m (44 ± 9 in-lb)
Water inlet fitting bolt		19 ± 1 N· m (14 ±1 ft-lb)
Water hose and water pipe <2.4L ENGINE>		
Radiator lower hose clamp bolt		11 ± 1 N· m (98 ± 8 in-lb)
Thermostat case bolt		24 ± 4 N· m (18 ± 3 ft-lb)
Water hose clamp bolt		11 ± 1 N· m (98 ± 8 in-lb)
Water inlet pipe bolt		13 ± 2 N· m (111 ± 22 in-lb)
Water outlet fitting bolt		13 ± 2 N· m (111 ± 22 in-lb)
Water hose and water pipe <3.8L ENGINE>		
Capacitor bolt		5.0 ±1.0 N· m (44 ± 9 in-lb)
Engine coolant temperature sensor		30 ± 9 N· m (22 ±7 ft-lb)
Thermostat housing bolt		19 ±1 N· m (14 ± 1 ft-lb)
Water inlet pipe bolt		11 ±1 N· m (98 ± 8 in-lb)
Water pump <2.4L ENGINE>		
Water pump bolt		14 ±1 N· m (120 ±13 in-lb)
Water pump <3.8L ENGINE>		
Water pump bolt	M8	42 ± 8 N· m (31 ±6 ft-lb)
	M10	24 ± 3 N· m (18 ±2 ft-lb)
Water pump bracket bolt		24 ± 3 N· m (18 ±2 ft-lb)

SERVICE SPECIFICATION

M1141000300621

ITEM			STANDARD VALUE	LIMIT
Fan control module	Condenser fan motor connector voltage V	• When the A/C switch is off. • Measure the fan control module-side connector.	1 or less	–
		• When the A/C switch is "ON" position. • Measure the fan control module-side connector.	Repeat 8.2 ± 2.6 and Battery positive voltage ±2.6	–
	Fan control module connector voltage V	• When the ignition switch is "ON" position. • Measure the harness-side connector.	Battery positive voltage	–
High-pressure valve opening pressure of radiator cap kPa (psi)			93 – 123 (14 – 18)	Minimum 83 (12)
Thermostat	Valve opening temperature of thermostat °C (°F)		82 ±1.5 (180 ±3)	–
	Full-opening temperature of thermostat °C (°F)		95 (203)	–
	Valve lift mm (in)	2.4L Engine	8.5 (0.33) or more	–
		3.8L Engine	9.0 (0.35) or more	–

CAPACITIES

M1141005100150

ITEM			QUANTITY dm^3 (qt)
Long life antifreeze coolant or an equivalent	2.4L Engine	M/T	8.8 (9.3)
		A/T	8.7 (9.2)
	3.8L Engine	M/T	8.1 (8.6)
		A/T	8.0 (8.5)

SEALANTS

M1141000500584

<2.4L ENGINE>

ITEM	SPECIFIED SEALANT
Cylinder block drain plug	3M™ AAD Part No.8731 or equivalent
Thermostat case	3M™ AAD Part No.8672, 3M™ AAD Part No.8679/8678 or equivalent
Water outlet fitting	
Thermostat case bolt	3M™ AAD Part No. 8730, 8731 or equivalent

<3.8L ENGINE>

ITEM	SPECIFIED SEALANT
Cylinder block drain plug	3M™ AAD Part No.8731 or equivalent
Engine coolant temperature sensor	

NOTES