

## GROUP 14

# ENGINE COOLING

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## GENERAL DESCRIPTION


M1141000100401

- 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 drive belt from the crankshaft. The radiator is the corrugated fin, down flow type.

## SPECIAL TOOL

M1141000600279

TOOL	TOOL NUMBER AND NAME	SUPERSESSON	APPLICATION
 MB991871	MB991871 LLC changer	General service tool	Coolant refilling

## ENGINE COOLING DIAGNOSIS

### INTRODUCTION

M1141005300347

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 and fan assemblies. Possible faults include low coolant, contamination, belt loosening and component damage.

### TROUBLESHOOTING STRATEGY

M1141005200340

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.

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

## SYMPTOM CHART

M1141005600393

SYMPTOM	INSPECTION PROCEDURE	REFERENCE PAGE
Coolant leak	1	14-3
Engine overheating	2	14-4
Radiator fan and condenser fan do not operate	3	14-4
Radiator fan and condenser fan do not change speed or stop	4	14-20
Radiator fan does not operate	5	14-25
Condenser fan does not operate	6	14-25

## 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 being burned by hot coolant.*

##### **⚠ CAUTION**

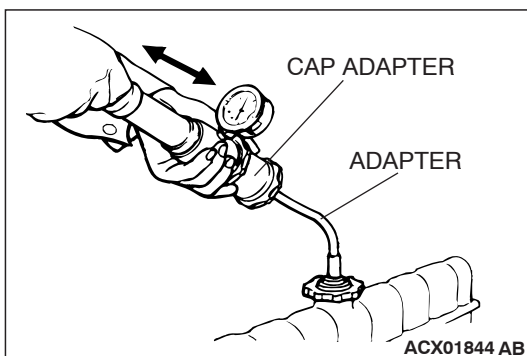
- Be sure to completely clean away any moisture from the places checked.
- When the tester is removed, be careful not to spill any coolant.
- When installing and removing the tester and when testing, be careful not to deform the filler neck of the radiator.

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: Is there still coolant leakage?**

**YES :** Return to Step 1.

**NO :** The procedure is complete.

---

**INSPECTION PROCEDURE 2: Engine Overheating**

---

**DIAGNOSIS**

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**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.14-27](#).

**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.

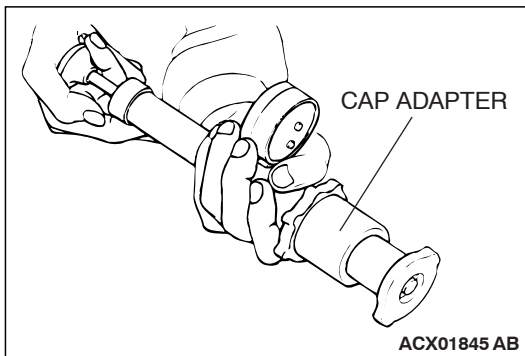
**Minimum limit: 83 kPa (12 psi)**

**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 38.

**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 (Check Condition). <3.8L Engine>39 .

**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**

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**CIRCUIT OPERATION**

- The fan controller is powered from fusible link No.2.
- The engine-ECU uses input signals from the A/C switch, the water temperature sensor unit and the vehicle speed sensor <M/T> or the output shaft speed sensor <A/T> to control the speed of the radiator fan motor and the condenser fan motor.
- The engine-ECU controls the fan controller to activate the radiator fan motor and the condenser fan motor.

**TECHNICAL DESCRIPTION**

- The cause could be a malfunction of the fan controller power supply or earth circuit.
- If the communication line wiring harness between the fan controller and the engine-ECU is short-circuited to earth, the radiator fan motor and the condenser fan motor will not rotate.

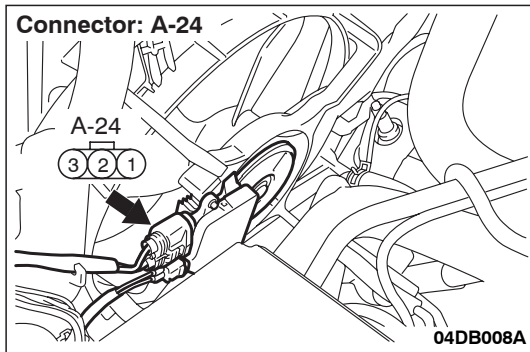
- The cause could also be a malfunction of input signal from the A/C switch, the water temperature sensor unit and the vehicle speed sensor <M/T> or the output shaft speed sensor <A/T> to the engine-ECU.
- The cause could also be a malfunction of the fan controller or the engine-ECU.

**TROUBLESHOOTING HINTS**

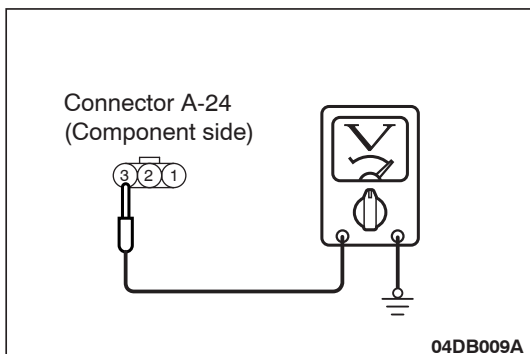
- Malfunction of fusible link No.2
- Malfunction of fan control relay
- Malfunction of cooling fan motor and fan controller
- Malfunction of engine-ECU.
- Damaged wiring harness or connector
- Refer to component locations GROUP-1
- Refer to configuration diagrams GROUP-1
- Refer to circuit diagrams GROUP-1

## DIAGNOSIS

**STEP 1. Measure the power supply voltage at fan controller connector A-24.**



- (1) Disconnect fan controller connector A-24 and measure wiring harness side connector.
- (2) Turn the ignition switch to the "ON" position.



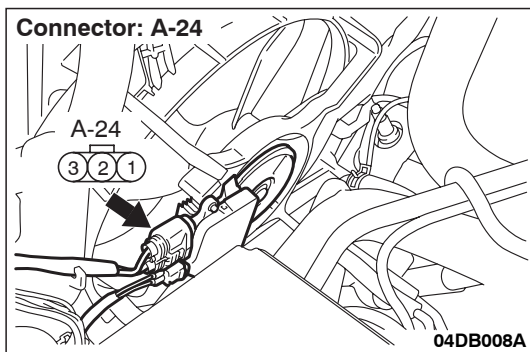
- (3) Measure the voltage between fan controller connector A-24 terminal 3 and body earth.
  - The voltage should measure system voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.
- (5) Connect fan controller connector A-24.

**Q: Is the measured voltage system voltage?**

**YES :** Go to Step 17.

**NO :** Go to Step 2.

**STEP 2. Check the fan controller connector A-24.**

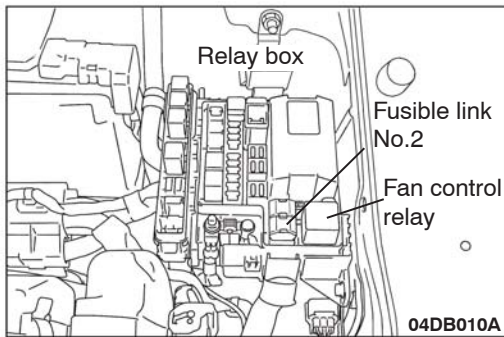


**Q: Is the connector in good condition?**

**YES :** Go to Step 3.

**NO :** Repair or replace the connector. Then go to Step 24.

**STEP 3. Check the fusible link No.2.**

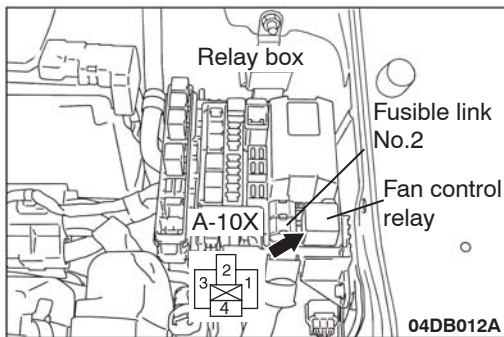


**Q: Is the fusible link No.2 in good condition?**

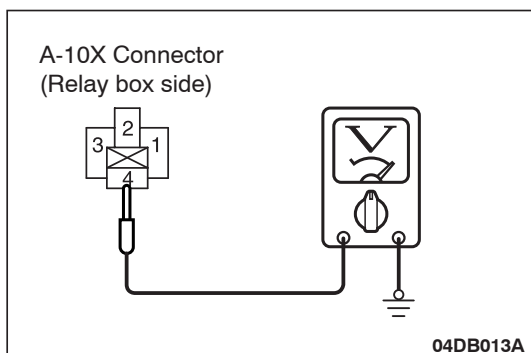
**YES :** Go to Step 4.

**NO :** Replace the fusible link No.2. Then go to Step 24.

**STEP 4. Measure the power supply voltage at fan control relay connector A-10X.**



- (1) Disconnect fan control relay connector A-10X (remove the fan control relay) and measure relay box side connector.
- (2) Turn the ignition switch to the "ON" position.



- (3) Measure the voltage between fan control relay connector A-10X terminal 4 and body earth.
  - The voltage should measure system voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.
- (5) Connect fan control relay connector A-10X (install the fan control relay).

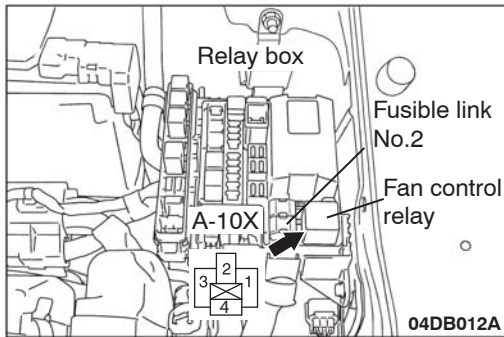
**Q: Is the measured voltage system voltage?**

**YES :** Go to Step 7.

**NO :** Go to Step 5.

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**STEP 5. Check the fan control relay connector A-10X.**



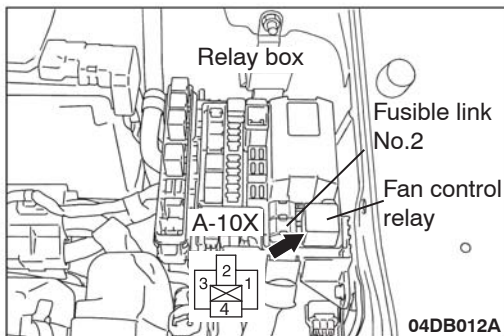
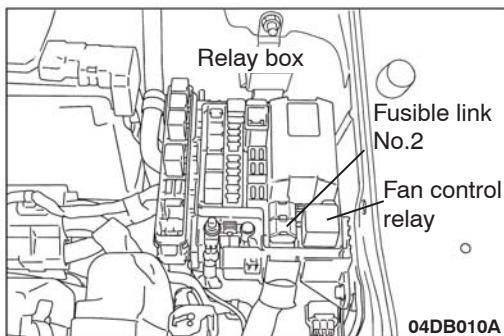
**Q: Is the connector in good condition?**

**YES :** Go to Step 6.

**NO :** Repair the connector or replace the relay box. Then go to Step 24.

---

**STEP 6. Check the harness wire between fusible link No.2 and fan control relay connector A-10X terminal 4.**



**Q: Is the harness wire in good condition?**

**YES :** An intermittent malfunction is suspected (Refer to GROUP 00 - How to use troubleshooting 00-7).

**NO :** Repair the damaged harness wire. Then go to Step 24.

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**STEP 7. Check the fan control relay.**

Refer to 14-31.

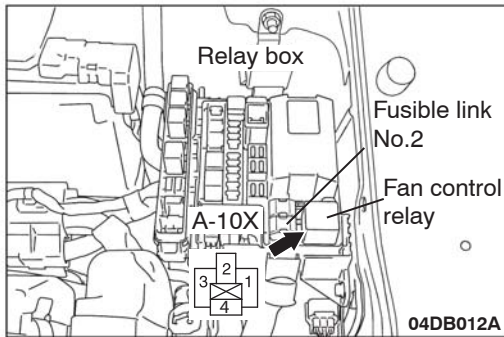
**Q: Is the fan control relay in good condition?**

**YES :** Go to Step 8.

**NO :** Replace the fan control relay. Then go to Step 24.



**STEP 8. Check the fan control relay connector A-10X.**

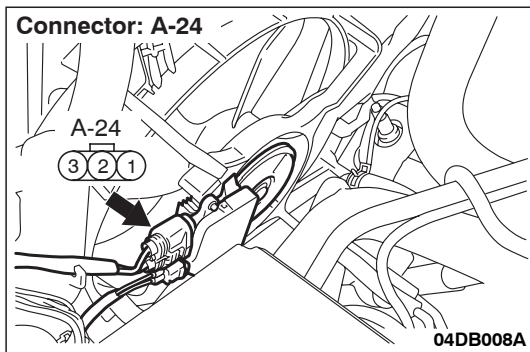
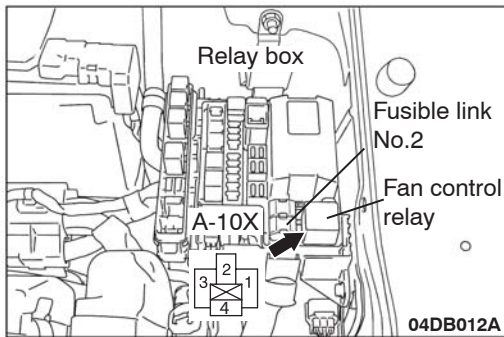


**Q: Is the connector in good condition?**

**YES :** Go to Step 9.

**NO :** Repair the connector or replace the relay box. Then go to Step 24.

**STEP 9. Check the harness wire between fan control relay connector A-10X terminal 2 and fan controller connector A-24 terminal 3.**

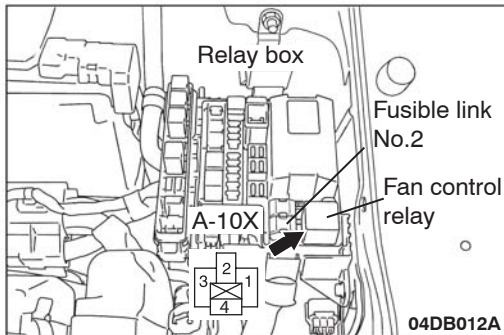


**Q: Is the harness wire in good condition?**

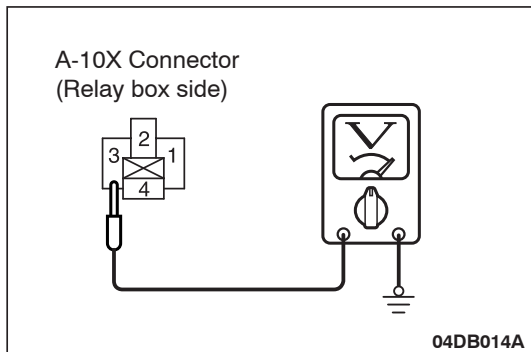
**YES :** Go to Step 10.

**NO :** Repair the damaged harness wire. Then go to Step 24.

**STEP 10. Measure the terminal voltage at fan control relay connector A-10X.**



- (1) Disconnect fan control relay connector A-10X (remove the fan control relay) and measure relay box side connector.
- (2) Turn the ignition switch to the "ON" position.



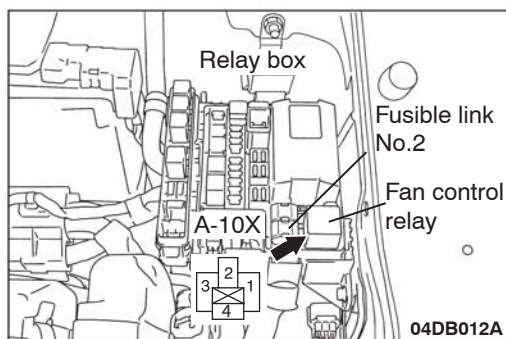
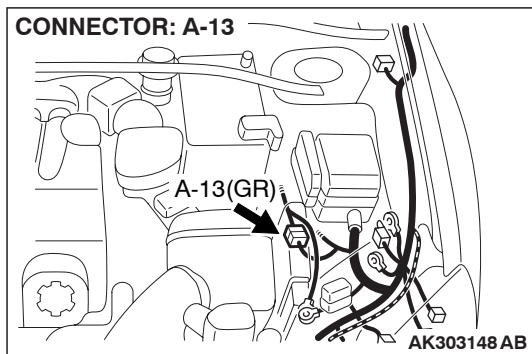
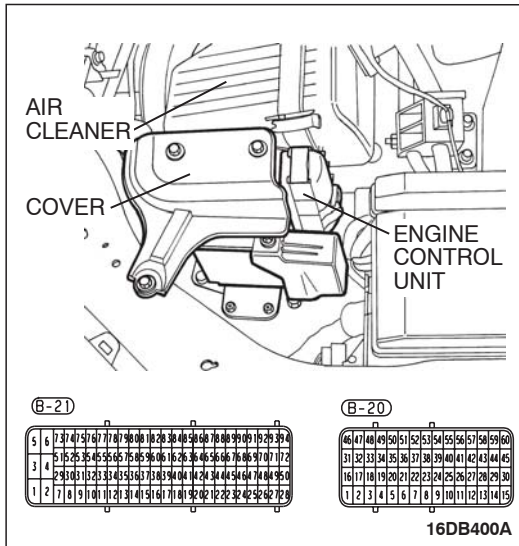
- (3) Measure the voltage between fan control relay connector A-10X terminal 3 and body earth.
  - The voltage should measure system voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.
- (5) Connect fan control relay connector A-10X (install the fan control relay).

**Q: Is the measured voltage system voltage?**

**YES :** Go to Step 13.

**NO :** Go to Step 11.

**STEP 11. Check the ECU connector B-21, intermediate connector A-13 and fan control relay connector A-10X.**

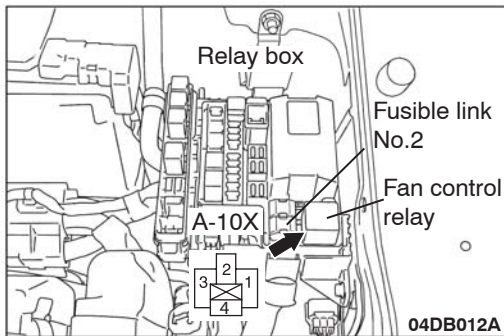
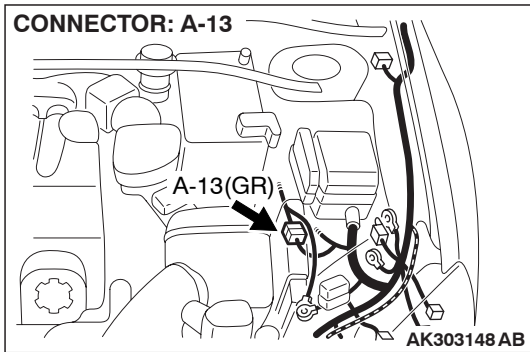


**Q: Are there connectors in good condition?**

**YES :** Go to Step 12.

**NO :** Repair or replace the connector. Then go to Step 24.

**STEP 12.** Check the harness wire between intermediate connector A-13 terminal 2 and fan control relay connector A-10X terminal 3.

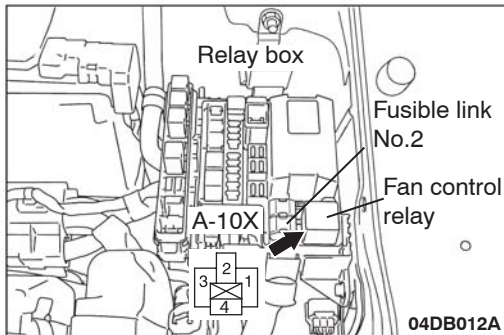


**Q: Are these harness wires in good condition?**

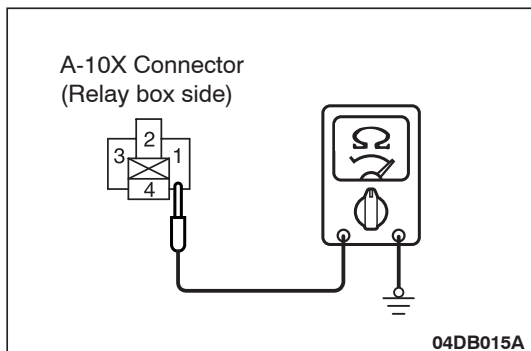
**YES :** An intermittent malfunction is suspected (Refer to [00-7](#)).

**NO :** Repair the damaged harness wire. Then go to Step 24.

**STEP 13. Check the continuity between fan control relay connector A-10X and body earth.**



- (1) Disconnect fan control relay connector A-10X (remove the fan control relay) and measure relay box side connector.



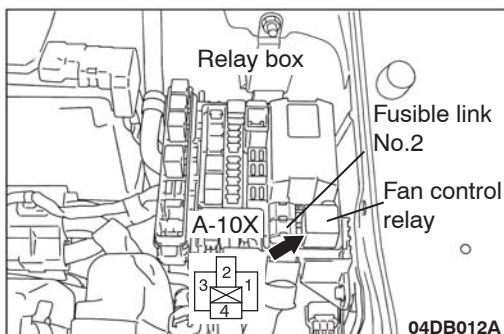
- (2) Measure the resistance between fan control relay connector A-10X terminal 1 and body earth.
- Continuity exists.
- (3) Connect fan control relay connector A-10X (install the fan control relay).

**Q: Does the continuity exists?**

**YES :** An intermittent malfunction is suspected (Refer to [00-7](#)).

**NO :** Go to Step 14.

**STEP 14. Check the fan control relay connector A-10X.**



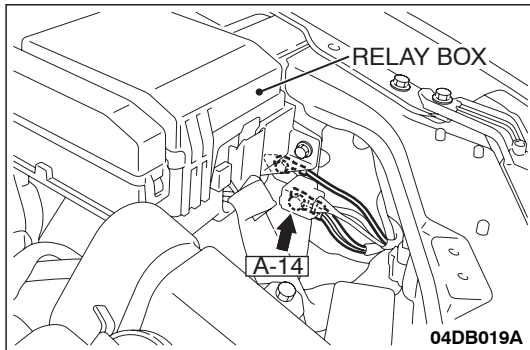
**Q: Is the connector in good condition?**

**YES :** Go to Step 15.

**NO :** Repair the connector or replace the relay box. Then go to Step 24.

---

**STEP 15. Check the earth connector A-14.**



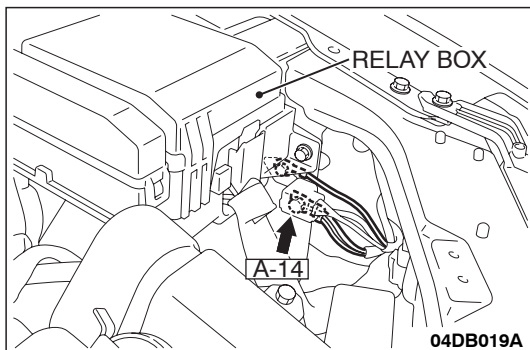
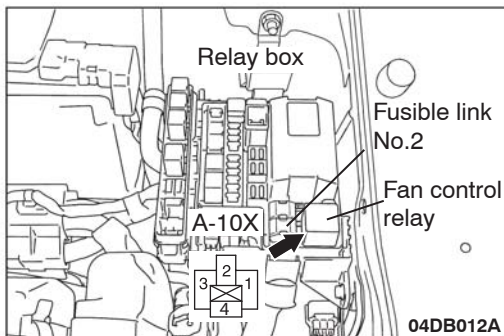
**Q: Is the connector in good condition?**

**YES :** Go to Step 16.

**NO :** Repair or replace the connector. Then go to Step 24.

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**STEP 16. Check the harness wire between fan control relay connector A-10X terminal 1 and body earth connector A-14 terminal 6.**

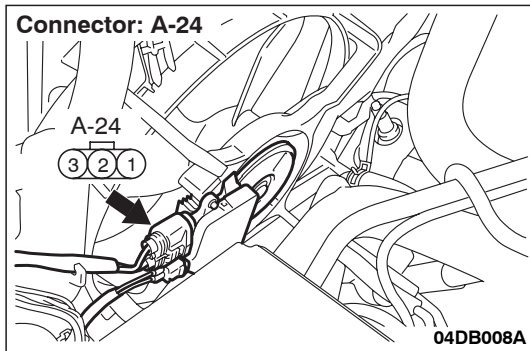


**Q: Is the harness wire in good condition?**

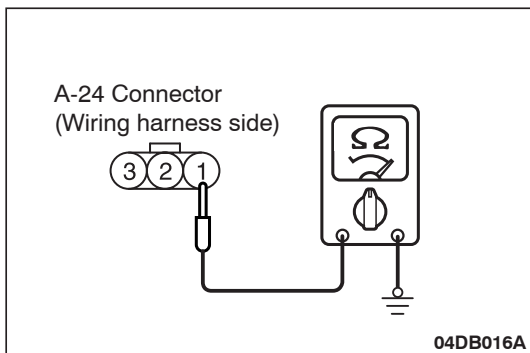
**YES :** An intermittent malfunction is suspected (Refer to GROUP 00 - How to use troubleshooting [00-7](#)).

**NO :** Repair the damaged harness wire. Then go to Step 24.

**STEP 17. Check the continuity between fan controller connector A-24 and body earth.**



- (1) Disconnect fan controller connector A-24 and measure wiring harness side connector.



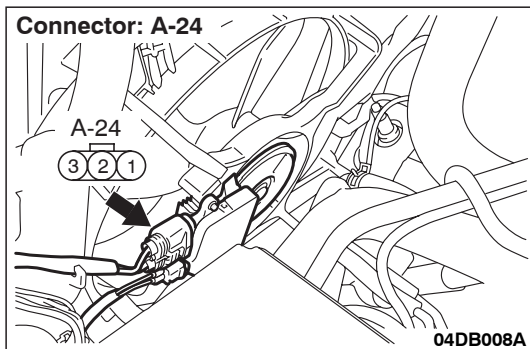
- (2) Measure the resistance between fan controller connector A-24 terminal 1 and body earth.
- Continuity exists.
- (3) Connect fan controller connector A-24.

**Q: Does the continuity exist?**

**YES :** Go to Step 20.

**NO :** Go to Step 18.

**STEP 18. Check the fan controller connector A-24.**

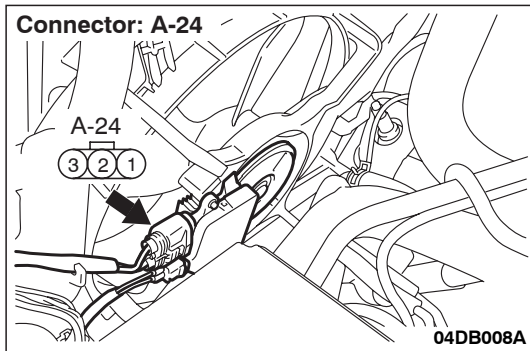


**Q: Is the connector in good condition?**

**YES :** Go to Step 19.

**NO :** Repair or replace the connector. Then go to Step 24.

**STEP 19.** Check the harness wire between fan controller connector A-24 terminal 1 and body earth.



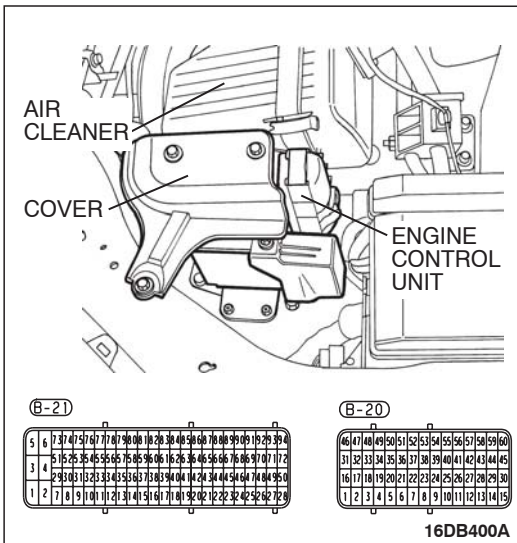
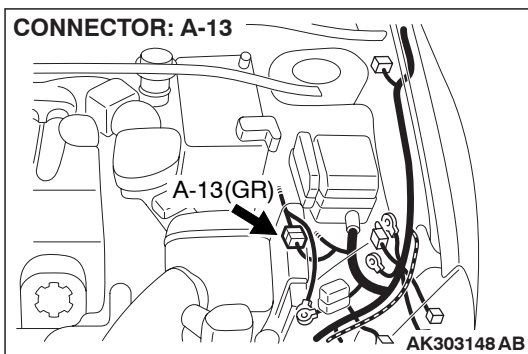
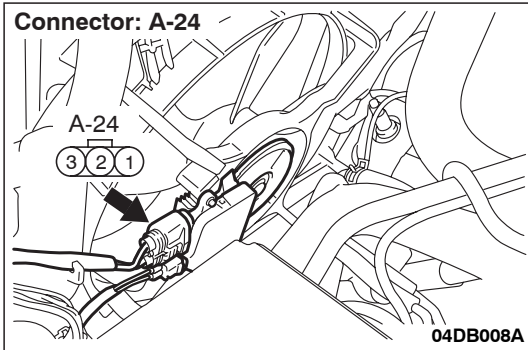
**Q: Is the harness wire in good condition?**

**YES :** An intermittent malfunction is suspected (Refer to GROUP 00 - How to use troubleshooting [00-7](#)).

**NO :** Repair the damaged harness wire. Then go to Step 24.



**STEP 20.** Check the fan controller connector A-24, intermediate connector A-13 and engine-ECU connector B-21.



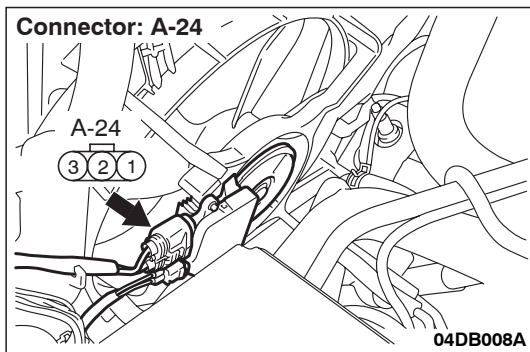
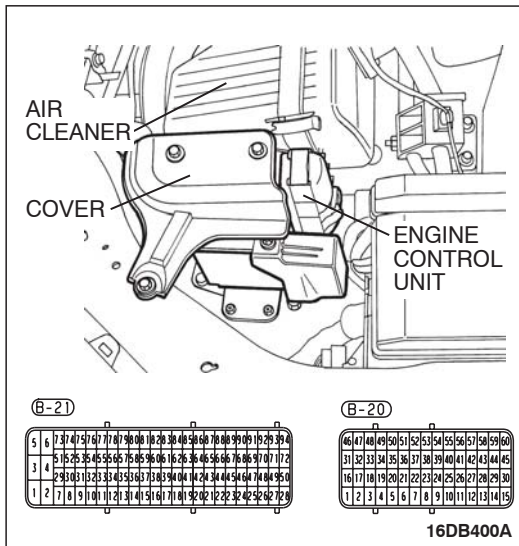
**Q: Are these connectors in good condition?**

**YES :** Go to Step 21.

**NO :** Repair or replace the connector. Then go to Step 24.



**STEP 22. Check the fan controller.**



- (1) Disconnect fan controller connector A-24.

- (2) Back out connector terminal pin 2 from connector housing.
- (3) Reconnect the connector with connector terminal pin 2 still removed.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check for the cooling fan operation.
  - The cooling fan rotates. (with connector terminal pin 2 disconnected)
- (6) Check for the cooling fan operation.
  - Using a suitable probe connect the fan controller terminal 2 at controller side to earth. The cooling fan stops. (When pin 2 of fan controller is connected to earth)
- (7) Turn the ignition switch to the "OFF" position.
- (8) Disconnect fan controller connector A-24, and re-locate connector terminal pin 2 into connector housing.
- (9) Reconnect the connector with connector terminal pin 2 installed correctly.

**Q: Does the cooling fan rotate? And when the fan controller pin 2 is connected to the body earth, does the cooling fan stop?**

**YES :** Go to Step 23.

**NO :** Replace the fan motor and fan controller (Refer to 14-25). Then go to Step 24.

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**STEP 23. MUT-III self-diag code**

Check if an MPI system self-diag code is set. (Refer to GROUP 13A - Trouble shooting [13A-5](#)).

**Q: Diagnosis code set?**

**YES** : Inspection chart for diagnosis code (Refer to GROUP 13A - Trouble shooting [13A-17](#))

**NO** : Replace the engine-ECU (Refer to GROUP 13A, Engine-ECU [13A-675](#) ). Then go to Step 24.

---

**STEP 24. Check the symptoms.****Q: Does the radiator fan motor and the condenser fan motor operate correctly?**

**YES** : This symptom is complete.

**NO** : Return to Step 1.

---

**INSPECTION PROCEDURE 4: Radiator Fan and Condenser Fan do not Change Speed or Stop**

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**Radiator Fan and Condenser Fan Drive Circuit**

Refer to 5.

**TECHNICAL DESCRIPTION**

- The cause could be a malfunction of the fan controller power supply or earth circuit.
- If the communication line wiring harness between the fan controller and the engine-ECU is short-circuited to earth, the radiator fan motor and the condenser fan motor will not rotate.

- The cause could also be a malfunction of input signal from the A/C switch, the water temperature sensor unit and the vehicle speed sensor <M/T> or the output shaft speed sensor <A/T> to the engine-ECU.
- The cause could also be a malfunction of the fan controller or the engine-ECU.

**TROUBLESHOOTING HINTS**

- Malfunction of fusible link No.2
- Malfunction of fan control relay
- Malfunction of cooling fan motor
- Malfunction of fan controller
- Malfunction of engine-ECU
- Damaged wiring harness or connector

**DIAGNOSIS**

---

**STEP 1. Check the fan control relay.**

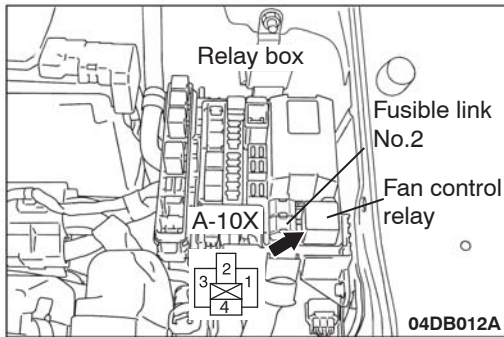
Refer to [14-31](#).

**Q: Is the fan control relay in good condition?**

**YES** : Go to Step 2.

**NO** : Replace the fan control relay. Then go to Step 8.

**STEP 2. Check the fan control relay connector A-10X.**

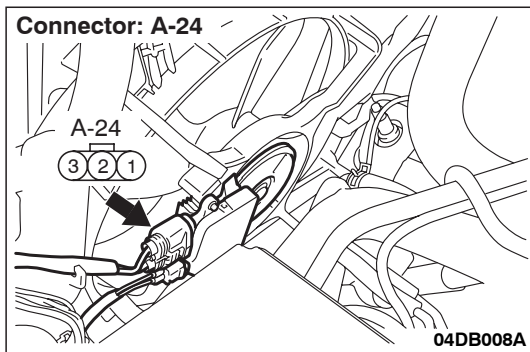
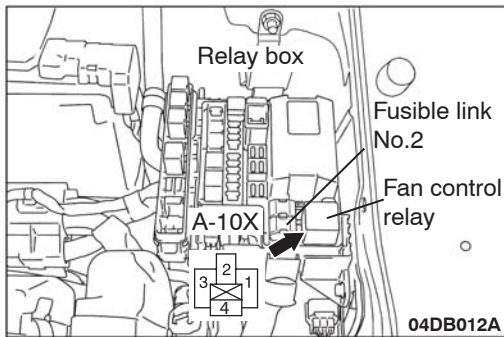


**Q: Is the connector in good condition?**

**YES :** Go to Step 3.

**NO :** Repair the connector or replace the relay box. Then go to Step 8.

**STEP 3. Check the harness wire between fan control relay connector A-10X terminal 2 and fan controller connector A-24 terminal 3.**

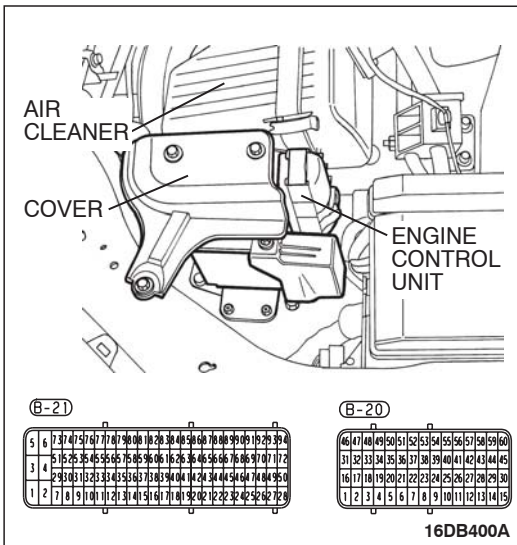
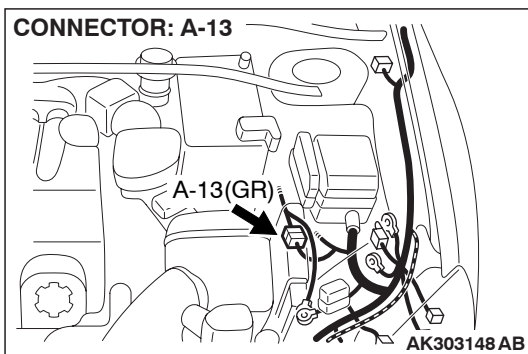
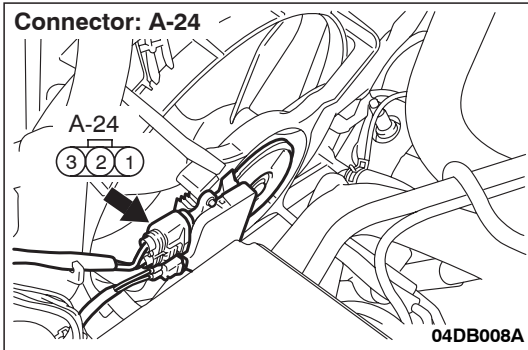


**Q: Is the harness wire in good condition?**

**YES :** Go to Step 4.

**NO :** Repair the damaged harness wire. Then go to Step 8.

**STEP 4.** Check the fan controller connector A-24, intermediate connector A-13 and engine-ECU connector B-21.

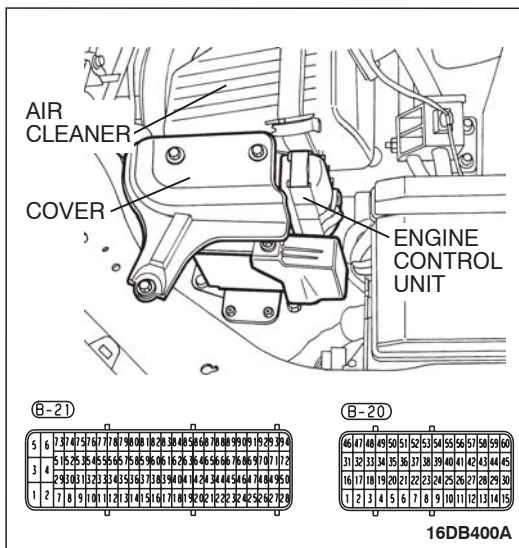
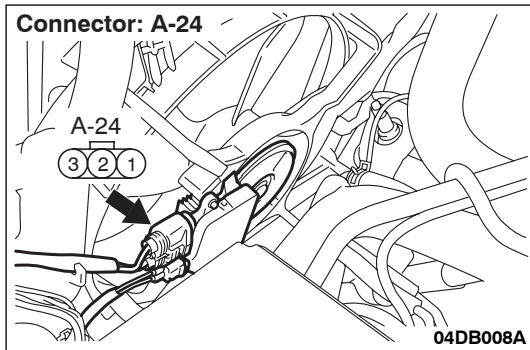


**Q: Are these connectors in good condition?**

**YES :** Go to Step 5.

**NO :** Repair or replace the connector. Then go to Step 8.

**STEP 5. Check the harness wire between fan controller connector A-24 terminal 2 and engine-ECU connector B-21 terminal 71.**

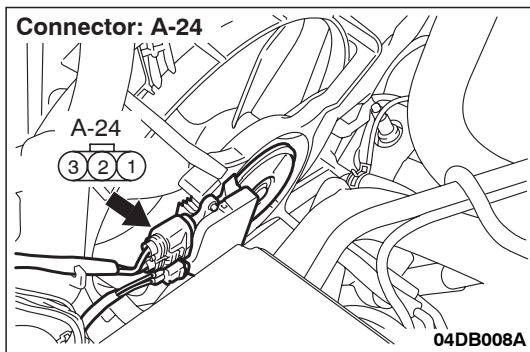
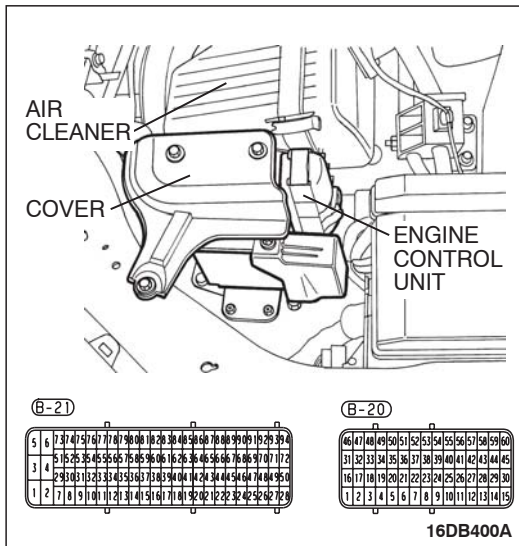


**Q: Are these harness wires in good condition?**

**YES :** Go to Step 6.

**NO :** Repair the damaged harness wire. Then go to Step 8.

**STEP 6. Check the fan controller.**



- (1) Disconnect fan controller connector A-24.

- (2) Back out connector terminal pin 2 from connector housing.
- (3) Reconnect the connector with connector terminal pin 2 still removed.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check for the cooling fan operation.
  - The cooling fan rotates. (with connector terminal pin 2 disconnected)
- (6) Check for the cooling fan operation.
  - Using a suitable probe connect the fan controller terminal 2 at controller side to earth. The cooling fan stops. (When pin 2 of fan controller is connected to earth)
- (7) Turn the ignition switch to the "OFF" position.
- (8) Disconnect fan controller connector A-24, and re-locate connector terminal pin 2 into connector housing.
- (9) Reconnect the connector with connector terminal pin 2 installed correctly.

**Q: Does the cooling fan rotate? And when the fan controller pin 2 is connected to the body earth, does the cooling fan stop?**

**YES :** Go to Step 7.

**NO :** Replace the fan motor and fan controller (Refer to 14-25). Then go to Step 8.



---

**STEP 7. MUT-III self-diag code**

Check if an MPI system self-diag code is set. (Refer to GROUP 13A - Trouble shooting [13A-5](#))

**Q: Diagnosis code set?**

**YES** : Inspection chart for diagnosis code (Refer to GROUP 13A - Trouble shooting [13A-5](#))

**NO** : Replace the engine-ECU (Refer to GROUP 13A, Engine-ECU [13A-675](#) ) Then go to Step 8 .

---

**STEP 8. Check the symptoms.****Q: Does the radiator fan motor and the condenser fan motor operate correctly?**

**YES** : This symptom is complete.

**NO** : Return to Step 1.

---

**INSPECTION PROCEDURE 5: Radiator Fan does not Operate**

---

**Radiator Fan and Condenser Fan Drive Circuit****TECHNICAL DESCRIPTION**

The cause could be a malfunction of the radiator fan motor or an open circuit between the fan controller and the radiator fan motor.

**TROUBLESHOOTING HINTS**

- Malfunction of radiator fan motor
- Malfunction of fan controller
- Refer to component locations GROUP-1
- Refer to configuration diagrams GROUP-1
- Refer to circuit diagrams GROUP-1

**DIAGNOSIS**

Replace the radiator fan motor and fan controller assembly.

**Q: Does the radiator fan operate correctly?**

**YES** : There is no action to be taken?

**NO** : Repair the wiring harness between the fan controller and the radiator fan motor.

---

**INSPECTION PROCEDURE 6: Condenser Fan does not Operate**

---

**Radiator Fan and Condenser Fan Drive Circuit****TECHNICAL DESCRIPTION**

The cause could be a malfunction of the condenser fan motor or fan controller.

**TROUBLESHOOTING HINTS**

- Malfunction of condenser fan motor
- Malfunction of fan controller
- Refer to component locations GROUP-1
- Refer to configuration diagrams GROUP-1
- Refer to circuit diagrams GROUP-1

## DIAGNOSIS

### STEP 1. Check the condenser fan motor.

Condenser fan motor check. (Refer to GROUP 55, Condenser and Condenser Fan Motor.

**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 controller.

Refer to 29.

**Q: Is the fan controller in good condition?**

**YES :** Go to Step 3.

**NO :** Replace the fan motor and fan controller (Refer to 14-25). Then go to Step 3.

### STEP 3. Check the symptoms.

**Q: Do the condenser fan operate?**

**YES :** This symptom is complete.

**NO :** Return to Step 1.

## ON-VEHICLE SERVICE

### ENGINE COOLANT LEAK CHECK

M1141001000333

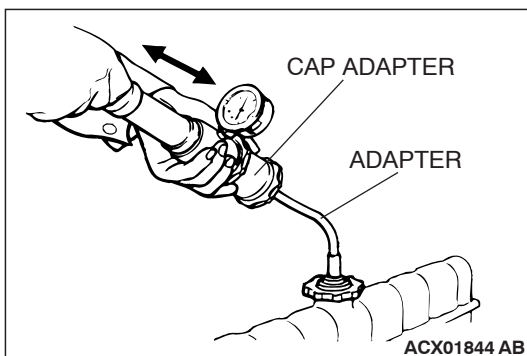
#### **WARNING**

*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

M1141001300419

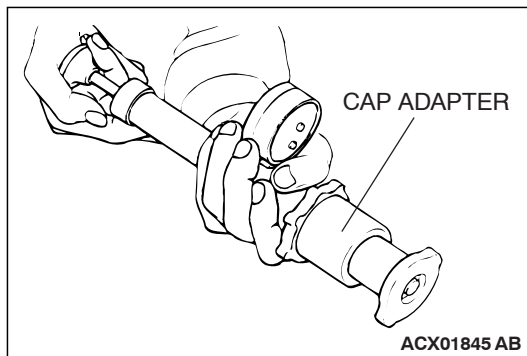
*NOTE: Be sure that the cap is clean before testing. Rust or other foreign material on the cap seal will cause an improper reading.*

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

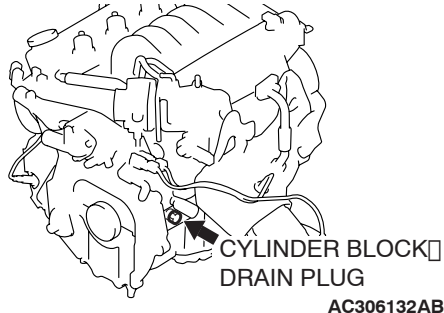
M1141001200478

### **WARNING**

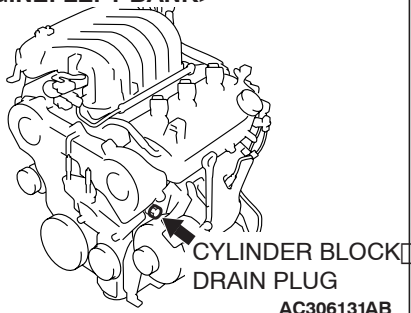
***When removing the radiator cap, use care to avoid contact with hot coolant or steam. Place a shop towel over the cap and turn the cap counterclockwise a little to let the pressure escape through the vinyl tube. After relieving the steam pressure, remove the cap by slowly turning it counterclockwise.***

1. Drain the water from the radiator, heater core and engine after unplugging the radiator drain plug and removing the radiator cap.

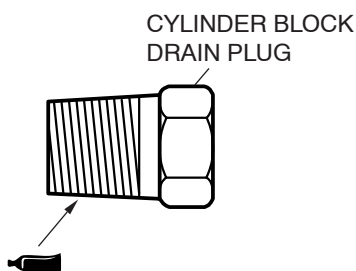
<3.8L ENGINE: RIGHT BANK>



<3.8L ENGINE: LEFT BANK>



<3.8L ENGINE: LEFT BANK>



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.

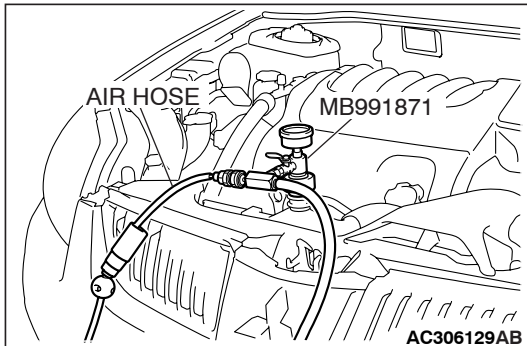
5. Apply the designated sealant to the screw area of the cylinder block drain plug, and then tighten to the standard torque.

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

**Tightening torque:**

**39 ± 5 N·m**

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.
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:  $-31^{\circ}\text{C}$  ( $-32.8^{\circ}\text{F}$ )].

**Recommended antifreeze: Long Life Antifreeze Coolant or an equivalent**

**Quantity:  
8.7 Litres**

*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.

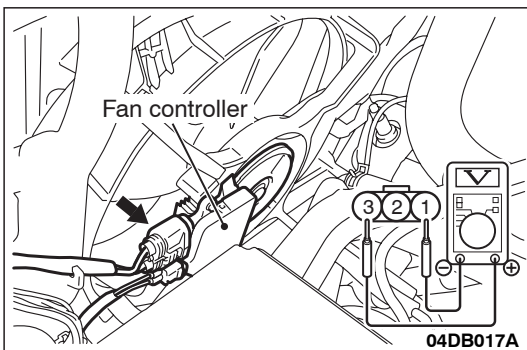
**ENGINE COOLANT CONCENTRATION TEST**

M1141001100396

Refer to GROUP 00, RECOMMENDED LUBRICANTS AND LUBRICANT CAPACITIES TABLE 35.

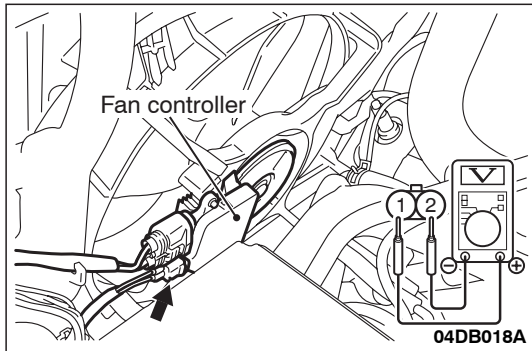
**FAN CONTROLLER CHECK**

M1141007400113



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

**Standard value: System voltage**



3. Connect the fan controller 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 controller-side connector terminals.

**Standard value: 1V 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 controller-side connector terminals while the fan is running. The voltage should repeat the values below.

**Standard value:**

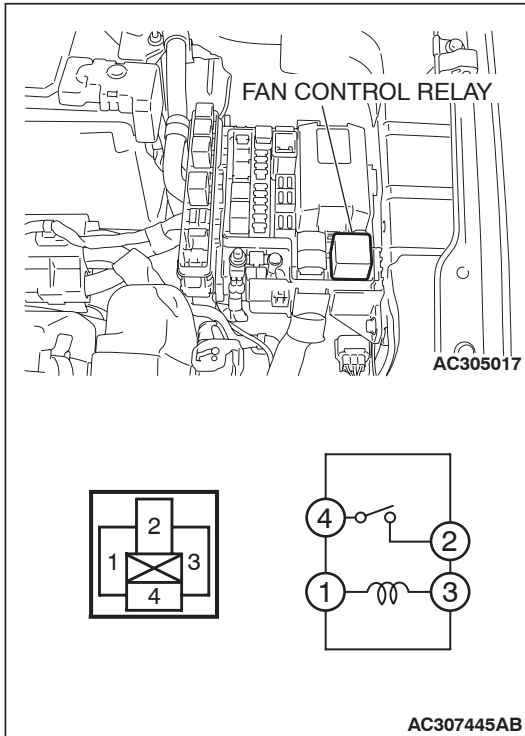
**$8.2 \pm 2.6 \text{ V}$**

**System voltage  $\pm 2.6 \text{ V}$**

8. If the voltage does not repeatedly change as indicated, replace the cooling fan motor and fan controller.

## FAN CONTROL RELAY CONTINUITY CHECK

M1141006200310



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

## REMOVAL AND INSTALLATION

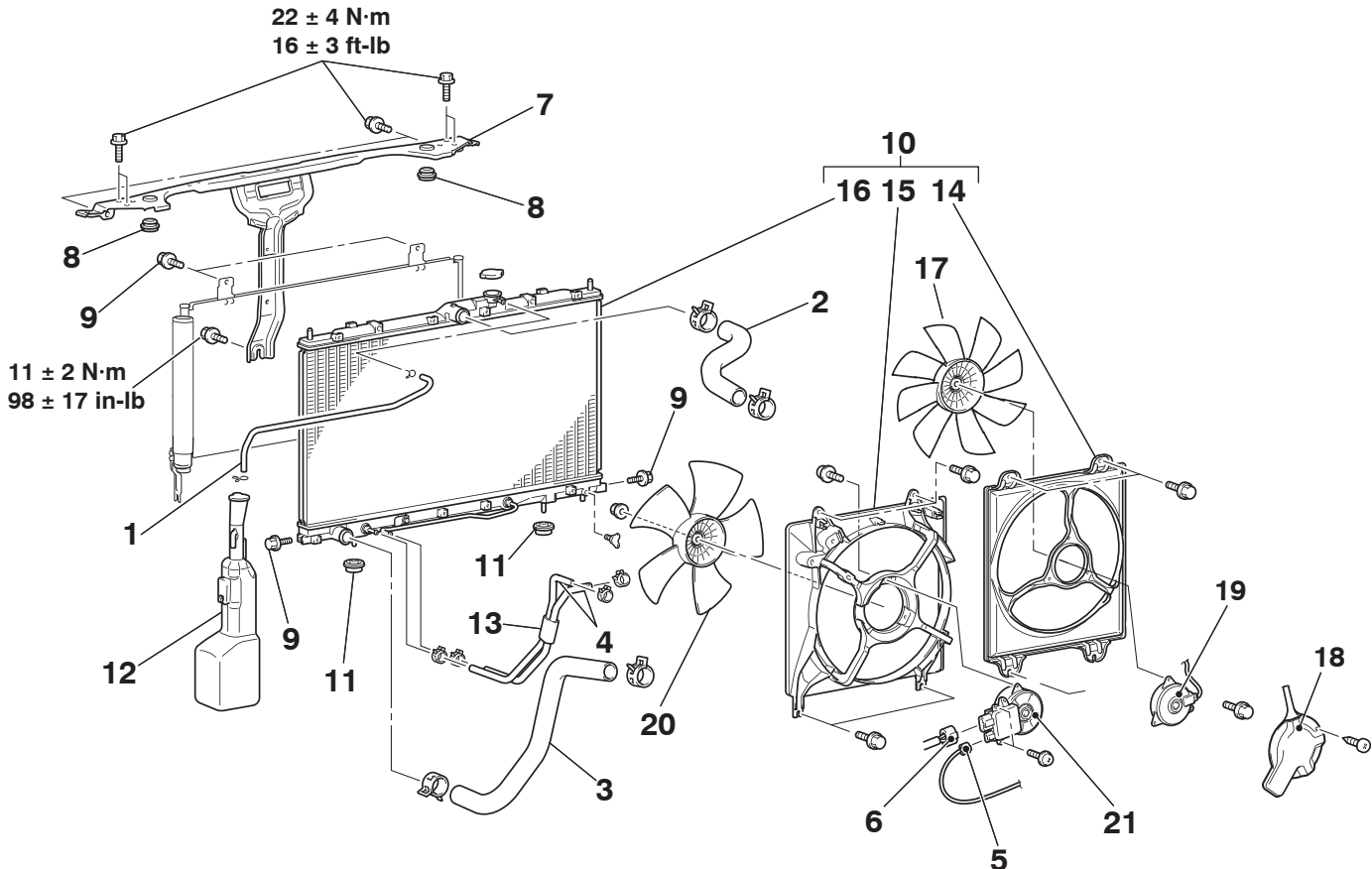
M1141001500521

**Pre-removal Operation**

- Engine Coolant Draining (Refer to 27).
- Air Cleaner Removal (Refer to GROUP 15, Air Cleaner 4).

**Post-installation Operation**

- Air Cleaner Installation (Refer to GROUP 15 4).
- Engine Coolant Refilling and Level Check (Refer to 27).
- A/T Fluid Refilling and Level Check (Refer to GROUP 00, Maintenance Service 45).



04DB007A

**RADIATOR REMOVAL STEPS**

- <<A>> >>A<< <<A>> >>A<< <<B>>
1. RADIATOR CONDENSER TANK HOSE
  2. RADIATOR UPPER HOSE
  3. RADIATOR LOWER HOSE
  4. A/T OIL COOLER HOSE CONNECTION
  5. CONDENSER FAN MOTOR CONNECTOR
  6. FAN CONTROLLER CONNECTOR
  - HOOD LATCH (REFER TO GROUP 42, HOOD 8).
  7. FRONT END STRUCTURE BAR
  8. UPPER INSULATOR
  9. CONDENSER BOLTS
  10. RADIATOR ASSEMBLY
  11. LOWER INSULATOR

**RADIATOR REMOVAL STEPS**

12. RADIATOR CONDENSER TANK ASSEMBLY
13. A/T OIL COOLER HOSE
14. CONDENSER FAN SHROUD ASSEMBLY
15. COOLING FAN SHROUD ASSEMBLY
16. RADIATOR

**FAN MOTOR REMOVAL STEPS**

- <<A>> >>A<<
1. RADIATOR CONDENSER TANK HOSE
  5. CONDENSER FAN MOTOR CONNECTOR
  3. RADIATOR UPPER HOSE
  6. FAN MOTOR CONNECTOR
  12. RADIATOR CONDENSER TANK ASSEMBLY



**FAN MOTOR REMOVAL STEPS**

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& FAN CONTROLLER

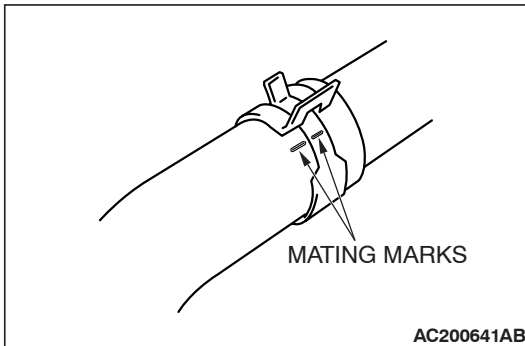
**RADIATOR CONDENSER TANK REMOVAL STEPS**

- UNDER COVER (LH)
  - AIR INTAKE DUCT (REFER TO GROUP 15, AIR CLEANER 4).
1. RADIATOR CONDENSER TANK HOSE
  5. CONDENSER FAN MOTOR CONNECTOR
  6. FAN MOTOR CONNECTOR
  12. 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.



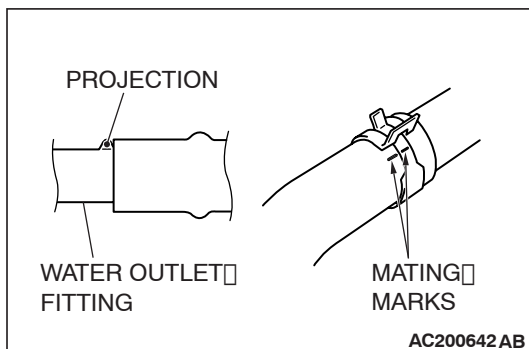
### <<B>> A/T OIL COOLER HOSE REMOVAL

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.



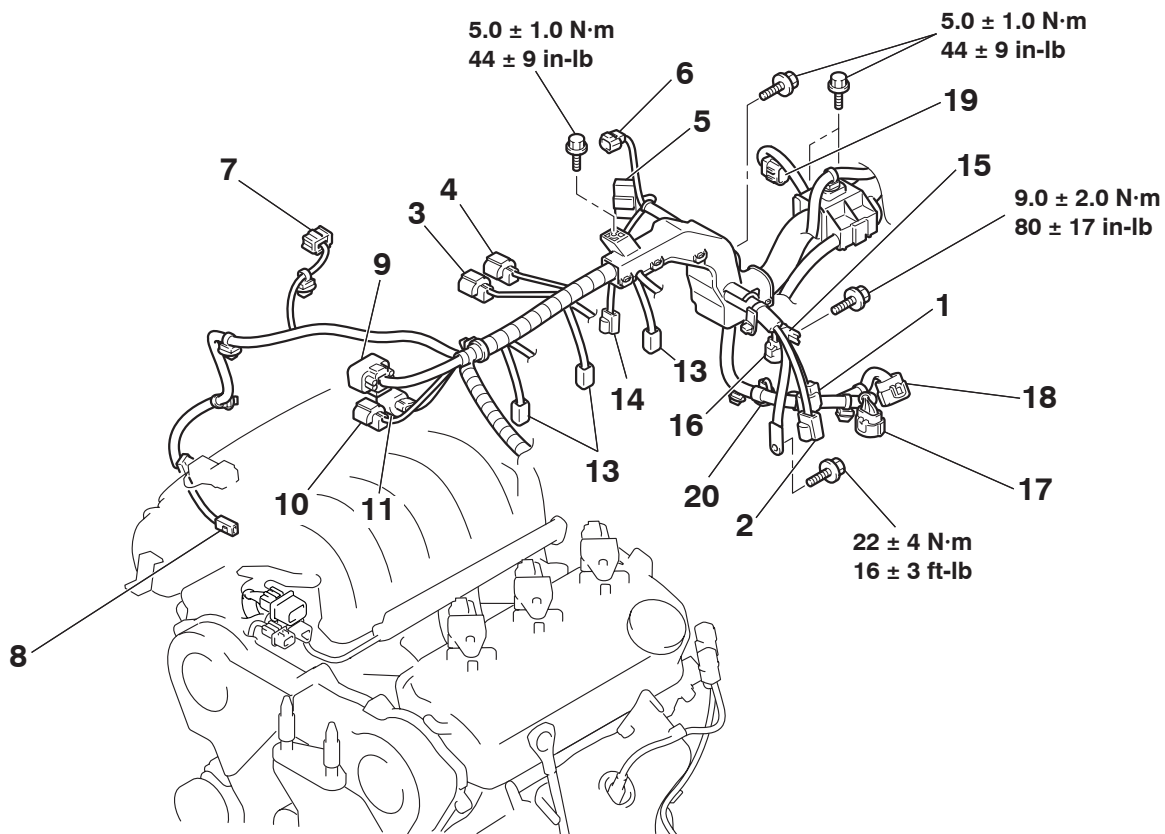
# THERMOSTAT

## REMOVAL AND INSTALLATION

M1141002400475

**Pre-removal and Post-installation Operation**

- Engine Coolant Draining and Refilling (Refer to 27).
- Engine Cover Removal and Installation (Refer to GROUP 11C, Engine Assembly 11A-14).
- Engine Control Unit (ECU) Removal and Installation (Refer to GROUP 00, General 00-7).
- Air Cleaner Removal and Installation (Refer to GROUP 15, Air Cleaner 4).
- Strut Tower Bar Removal and Installation (Refer to GROUP 42, Strut Tower Bar 12).
- Battery and Battery Tray Removal and Installation



04DB006A

**REMOVAL STEPS**

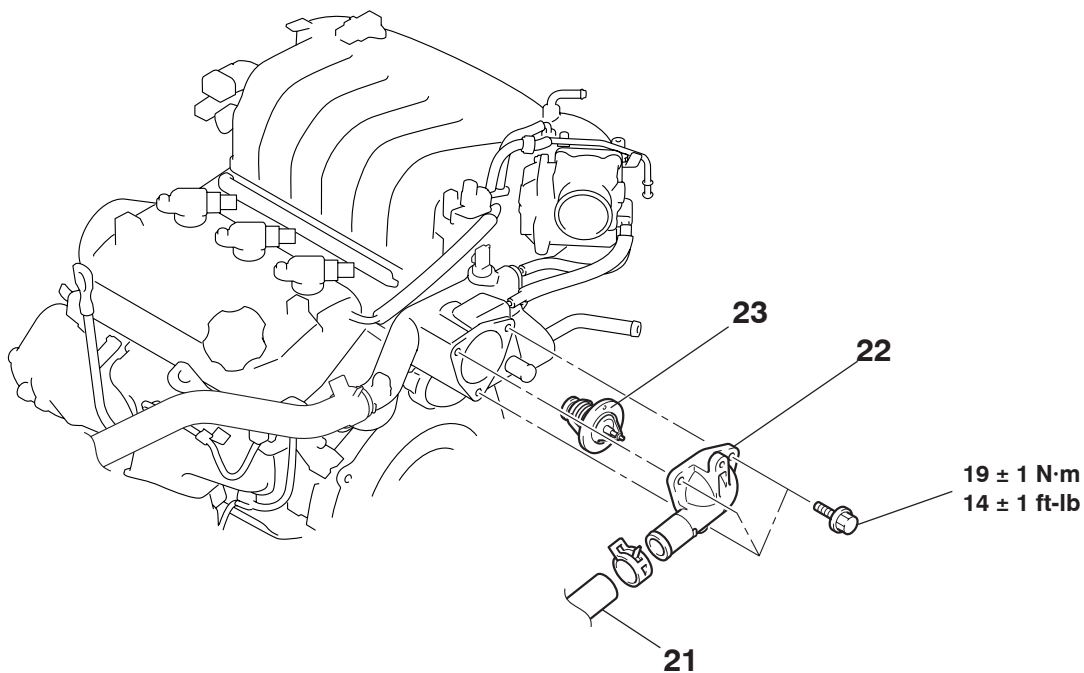
1. LEFT BANK HEATED OXYGEN SENSOR (REAR) CONNECTOR
2. LEFT BANK HEATED OXYGEN SENSOR (FRONT) CONNECTOR
3. RIGHT BANK HEATED OXYGEN SENSOR (REAR) CONNECTOR
4. RIGHT BANK HEATED OXYGEN SENSOR (FRONT) CONNECTOR
5. THROTTLE BODY ASSEMBLY CONNECTOR
6. EVAPORATIVE EMISSION PURGE SOLENOID CONNECTOR

**REMOVAL STEPS (Continued)**

7. MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR
8. POWER STEERING PRESSURE SWITCH CONNECTOR
9. CONTROL WIRING HARNESS AND WIRING HARNESS COMBINATION CONNECTOR
10. KNOCK SENSOR CONNECTOR
11. CRANKSHAFT POSITION SENSOR CONNECTOR
13. INJECTOR CONNECTOR

**REMOVAL STEPS (Continued)**

14. ENGINE COOLANT  
TEMPERATURE SENSOR  
CONNECTOR
15. CAPACITOR CONNECTOR
16. CAMSHAFT POSITION SENSOR  
CONNECTOR
17. INHIBITOR SWITCH SENSOR  
CONNECTOR
18. A/T CONTROL SOLENOID VALVE  
ASSEMBLY CONNECTOR
19. OUTPUT SHAFT SPEED  
SENSOR CONNECTOR
20. INPUT SHAFT SPEED SENSOR  
CONNECTOR



AC306959AB

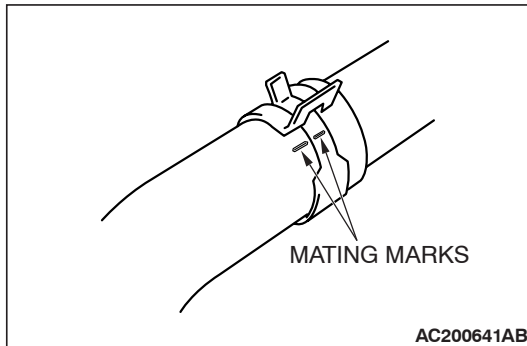
- <<A>> >>B<< 21. RADIATOR LOWER HOSE  
CONNECTION

- >>A<< **REMOVAL STEPS (Continued)**  
22. WATER INLET FITTING  
23. THERMOSTAT

## REMOVAL SERVICE POINT

### <<A>> RADIATOR LOWER HOSE DISCONNECTION

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



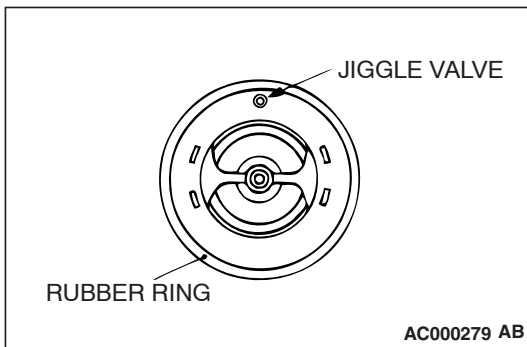
## INSTALLATION SERVICE POINTS

### >>A<< THERMOSTAT INSTALLATION

#### CAUTION

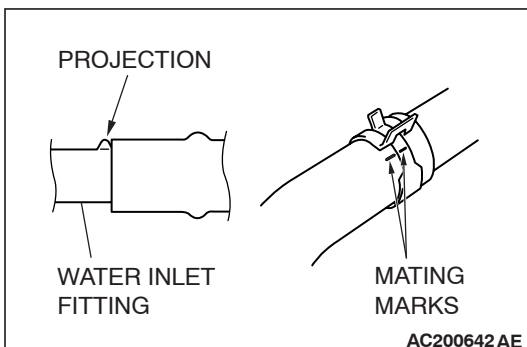
Make absolutely sure that no oil adheres to the rubber ring of the thermostat. Also do not fold or scratch the rubber ring during installation.

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

M1141002500450

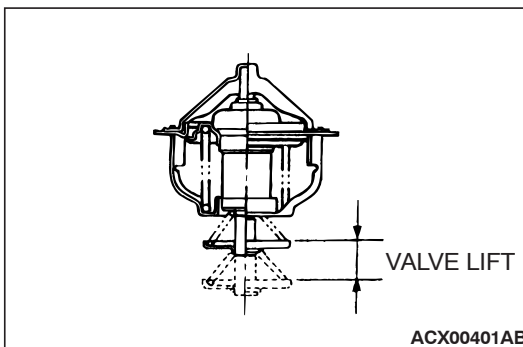
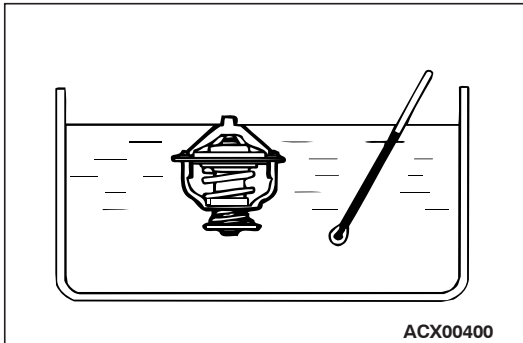
### Thermostat Check

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

**Standard value:**

**Valve opening temperature:**

**$88 \pm 1.5^{\circ}\text{C}$  ( $190 \pm 3^{\circ}\text{F}$ )**



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:**

**$100^{\circ}\text{C}$  ( $212^{\circ}\text{F}$ )**

**Amount of valve lift:**

**9.0 mm (0.35 inch) or more**

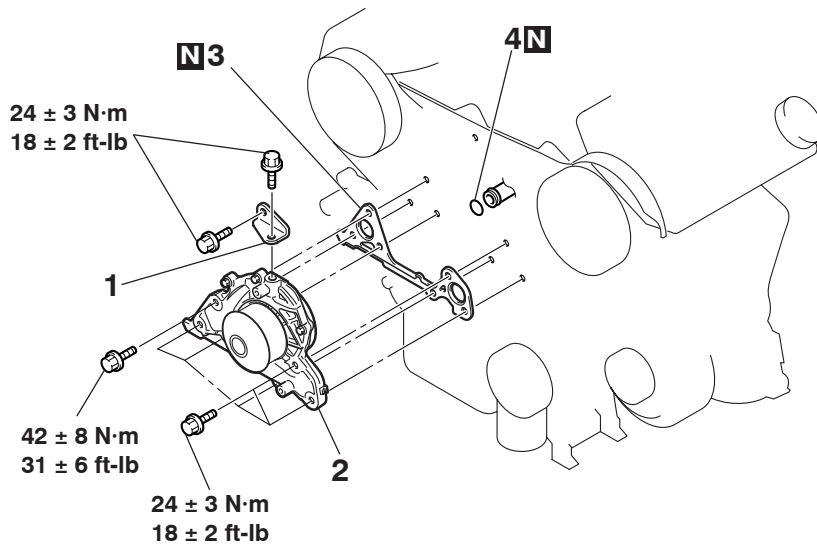
# WATER PUMP

## REMOVAL AND INSTALLATION

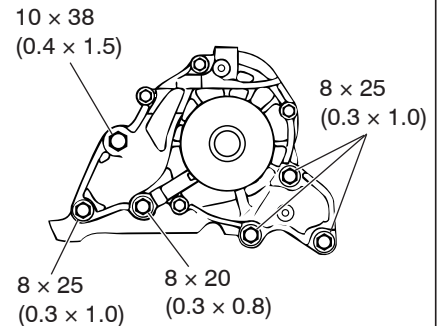
M1141002700498

### Pre-removal and Post-installation Operation

- Engine Coolant Draining and Refilling (Refer to 27).
- Timing Belt Removal and Installation (Refer to GROUP 11C, Timing Belt 11A-46).
- Crankshaft Position Sensor Removal and Installation (Refer to GROUP 16, Crankshaft Position Sensor 35).



### BOLT SPECIFICATIONS



THREAD DIAMETER × LENGTH mm(in)

AC205662AB

### REMOVAL STEPS

1. WATER PUMP BRACKET
2. WATER PUMP

### REMOVAL STEPS (Continued)

3. WATER PUMP GASKET
4. O-RING

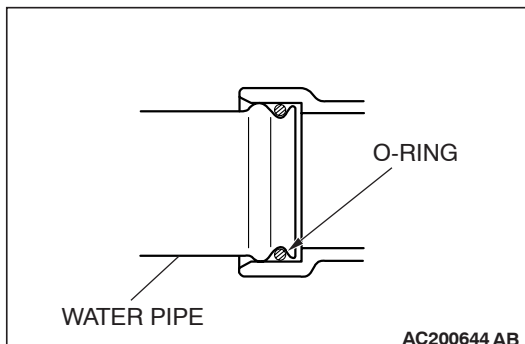
## INSTALLATION SERVICE POINT

### >>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.



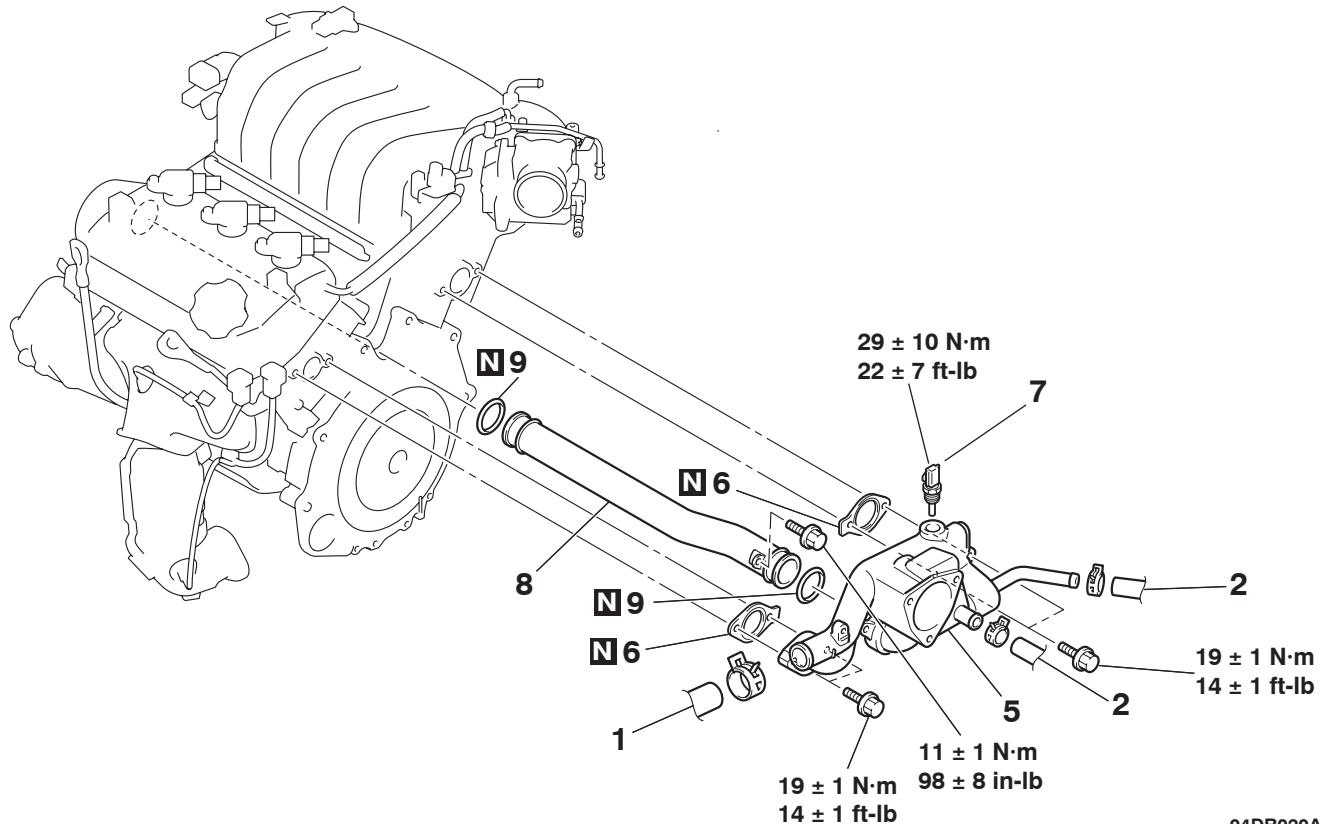
AC200644 AB

# WATER HOSE AND WATER PIPE

## REMOVAL AND INSTALLATION

M1141003300493

**Pre-removal and Post-installation Operation**  
Thermostat Removal and Installation (Refer to 35).



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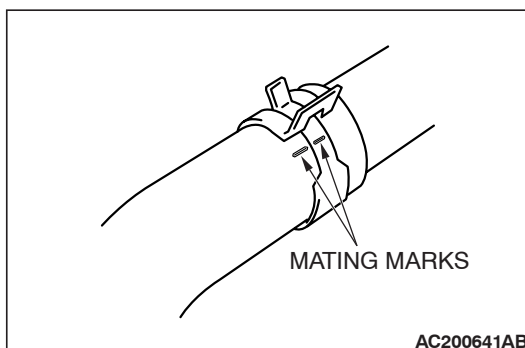
- REMOVAL STEPS**
- <<A>> >>C<<
1. RADIATOR UPPER HOSE CONNECTION
  2. HEATER HOSE CONNECTION
  5. THERMOSTAT HOUSING
  6. GASKET

- REMOVAL STEPS (Continued)**
- >>B<<
7. ENGINE COOLANT TEMPERATURE SENSOR
  8. WATER PUMP INLET PIPE
  - >>A<< 9. O-RING

## REMOVAL SERVICE POINT

### <<A>> RADIATOR UPPER HOSE DISCONNECTION

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





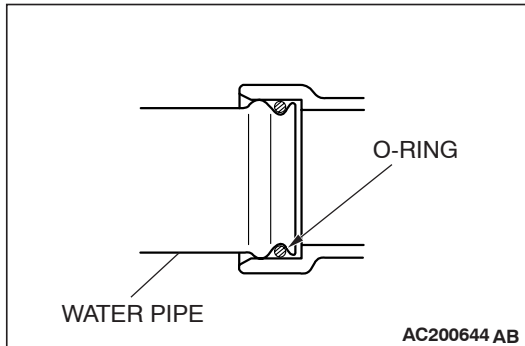
## INSTALLATION SERVICE POINTS

### >>A<< O-RING INSTALLATION

#### CAUTION

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

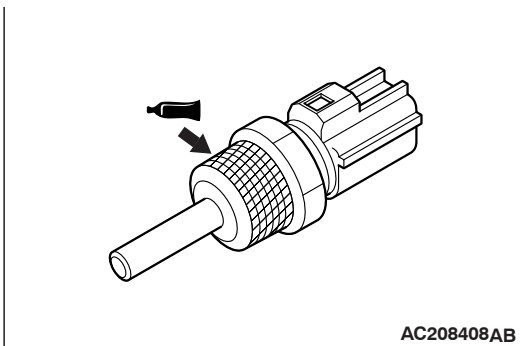
Insert the O-ring to the water pipe, and coat the outer portion of the O-ring with water or engine coolant.



### >>B<< ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION

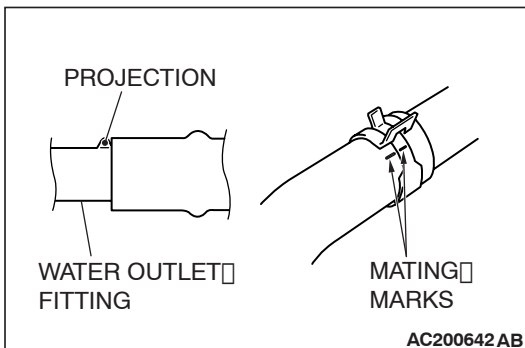
Apply the specified sealant to the thread of the engine coolant temperature sensor, and then tighten it to the specified torque.

**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

M1141003400337

### Water Pipe and Hose Check

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

# SPECIFICATIONS

## FASTENER TIGHTENING SPECIFICATIONS

M1141005000346

ITEM		SPECIFICATION
Cylinder block drain plug		39 ± 5 N·m (29 ± 3 ft-lb)
<b>Radiator</b>		
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)
<b>Thermostat</b>		
Control harness bolt		5.0 ± 1.0 N·m (44 ± 9 in-lb)
Grounding bolt	M6	9.0 ± 2.0 N·m (80 ± 17 in-lb)
	M8	22 ± 4 N·m (16 ± 3 ft-lb)
Water inlet fitting bolt		19 ± 1 N·m (14 ± 1 ft-lb)
<b>Water hose and water pipe</b>		
Engine coolant temperature sensor		29 ± 10 N·m
Thermostat housing bolt		19 ± 1 N·m (14 ± 1 ft-lb)
Water pump inlet pipe		11 ± 1 N·m (98 ± 8 ft-lb)
<b>Water pump</b>		
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

M1141000300449

ITEM		STANDARD VALUE	LIMIT
Fan Controller V	A/C OFF	1 or less	-
	A/C ON	Repeat $8.2 \pm 2.6$ System voltage $\pm 2.6$	-
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)	3.8L Engine	$88 \pm 1.5$ ( $190 \pm 3$ )
			-
	Full-opening temperature of thermostat °C (°F)	3.8L Engine	100 (212)
			-
	Valve lift mm (in)	3.8L Engine	9.0 (0.35) or more
			-

## CAPACITIES

M1141005100138

ITEM		QUANTITY dm <sup>3</sup> (qt)
Long life antifreeze coolant or an equivalent	3.8L Engine	8.7 (9.2)

## SEALANTS

M1141000500368

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

