

GROUP 14

ENGINE COOLING

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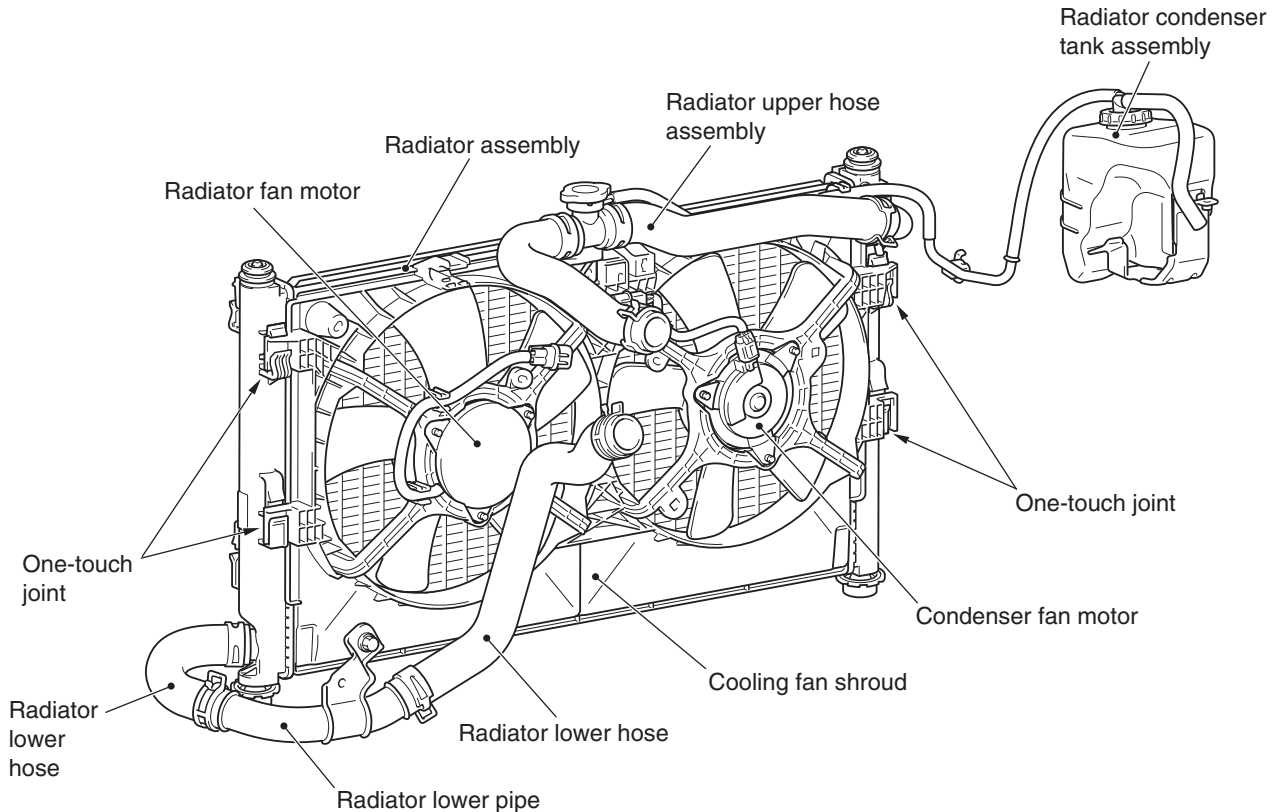
GENERAL INFORMATION

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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 temper-

ature, 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 impeller type and is driven by the drive belt from the crankshaft. The radiator is the corrugated fin, cross flow type.

CONSTRUCTION DIAGRAM



AC705530AC

SERVICE SPECIFICATIONS

M1141000301204

Item		Standard value	Limit
	Valve opening pressure of radiator cap kPa (psi)	93 -123 (14 -18)	Minimum 83 (12)
Thermostat	Valve opening temperature of thermostat °C (°F)	76.5 ± 1.5 (170 ± 3)	-
	Full-opening temperature of thermostat °C (°F)	90 (194)	-
	Valve lift mm (in)	8.5 (0.33) or more	-

COOLANT

M1141000401115

Item	Quantity dm ³ (qt)
Long life antifreeze coolant or an equivalent	7.5 (7.9)

SEALANT

M1141000501112

Item	Specified sealant
Engine coolant temperature sensor	Three bond 1324N, LOCTITE 262 or equivalent

ENGINE COOLING DIAGNOSIS

INTRODUCTION

M1141005300422

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

TROUBLESHOOTING STRATEGY

M1141005200414

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

1. Gather information from the customer.

2. Verify that the condition described by the customer exists.
3. Find the malfunction by following the Symptom Chart.
4. Verify that the malfunction is eliminated.

SYMPTOM CHART

M1141005600650

Symptom	Inspection procedure	Reference page
Coolant leak	1	P.14-4
Engine overheating	2	P.14-5
Radiator fan and condenser fan do not operate	3	P.14-6

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

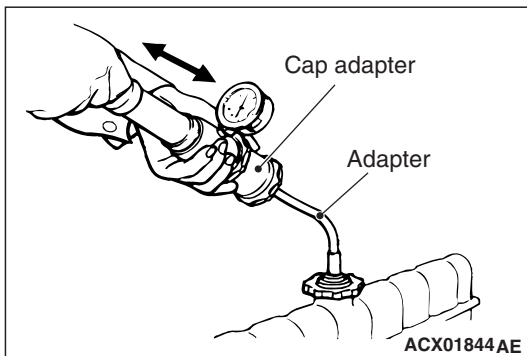
- Be sure to completely clean away any moisture from the places checked.
- When the tester is removed, be careful not to spill any coolant.
- When installing and removing the tester and when testing, be careful not to deform the filler neck of the radiator.

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 the coolant (Refer to [P.14-17](#)). Then go to Step 5.

NO : 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.

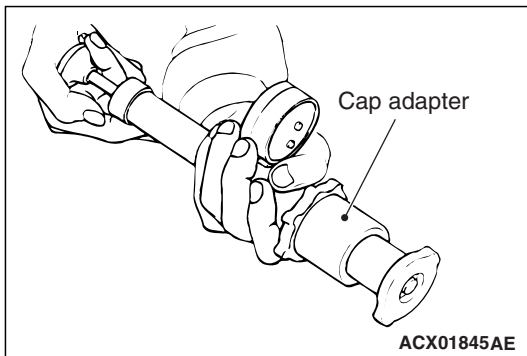
Minimum limit: 83 kPa (12 psi)

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.14-25](#).

Q: Does the thermostat operate correctly?

YES : Go to Step 4.

NO : Replace the thermostat (Refer to [P.14-23](#)). 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) [P.00-64](#).

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.

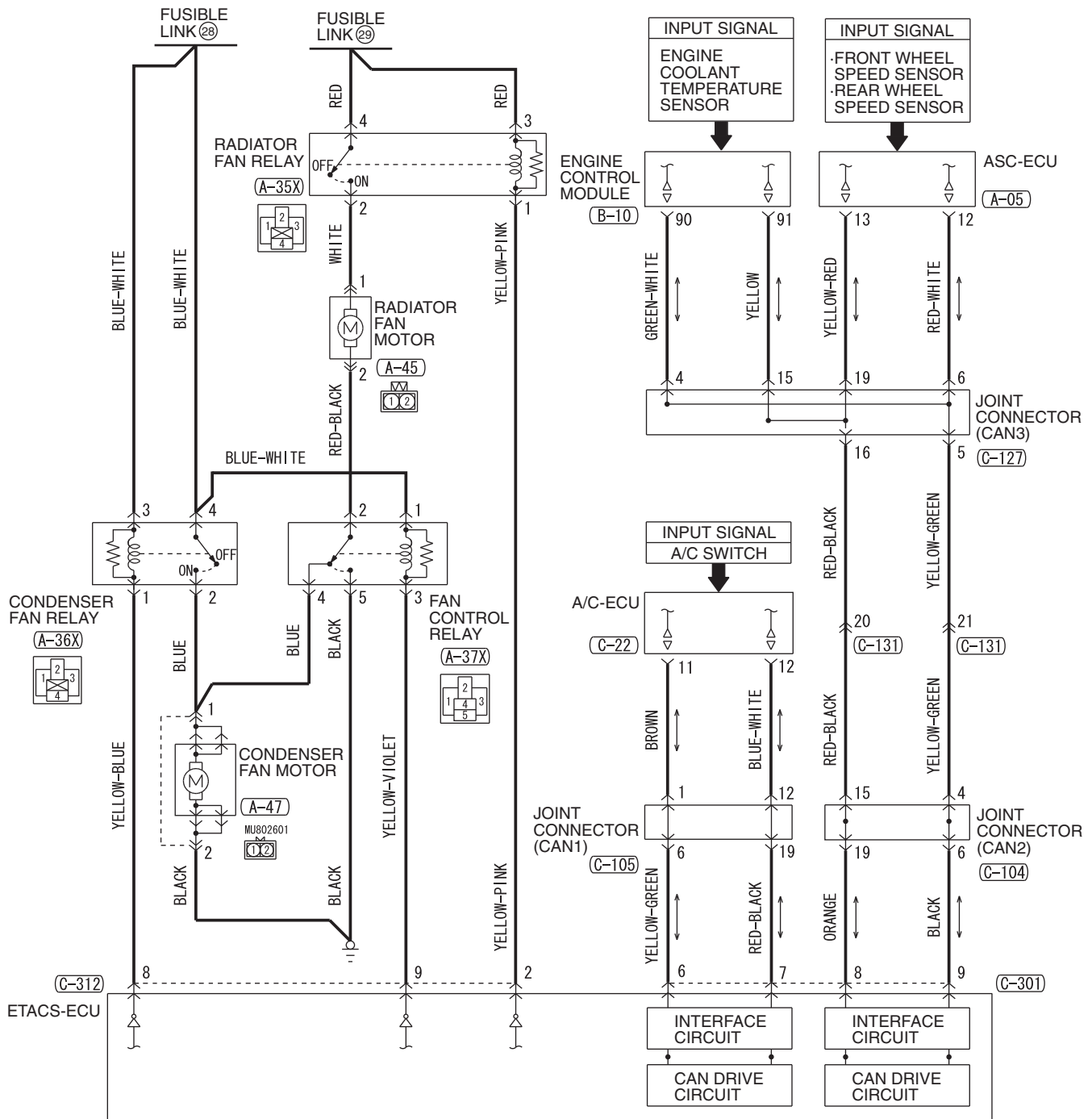
Q: Is the engine coolant temperature abnormally high?

YES : Return to Step 2.

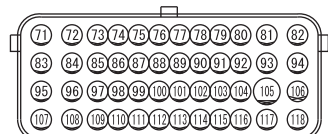
NO : The procedure is complete.

Inspection Procedure 3: Radiator Fan and Condenser Fan do not Operate

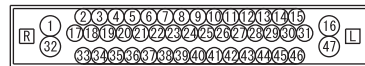
Radiator Fan and Condenser Fan Drive Circuit <M/T>



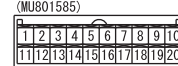
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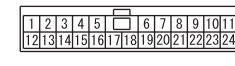
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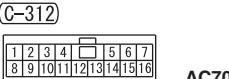
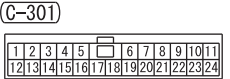
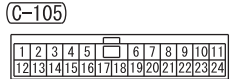
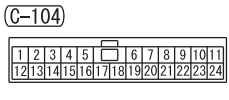
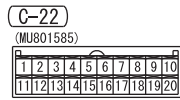
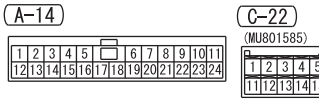
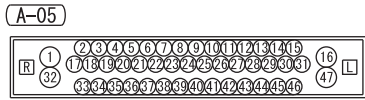
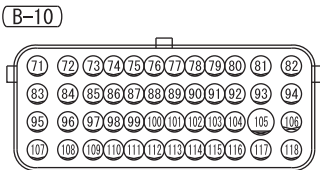
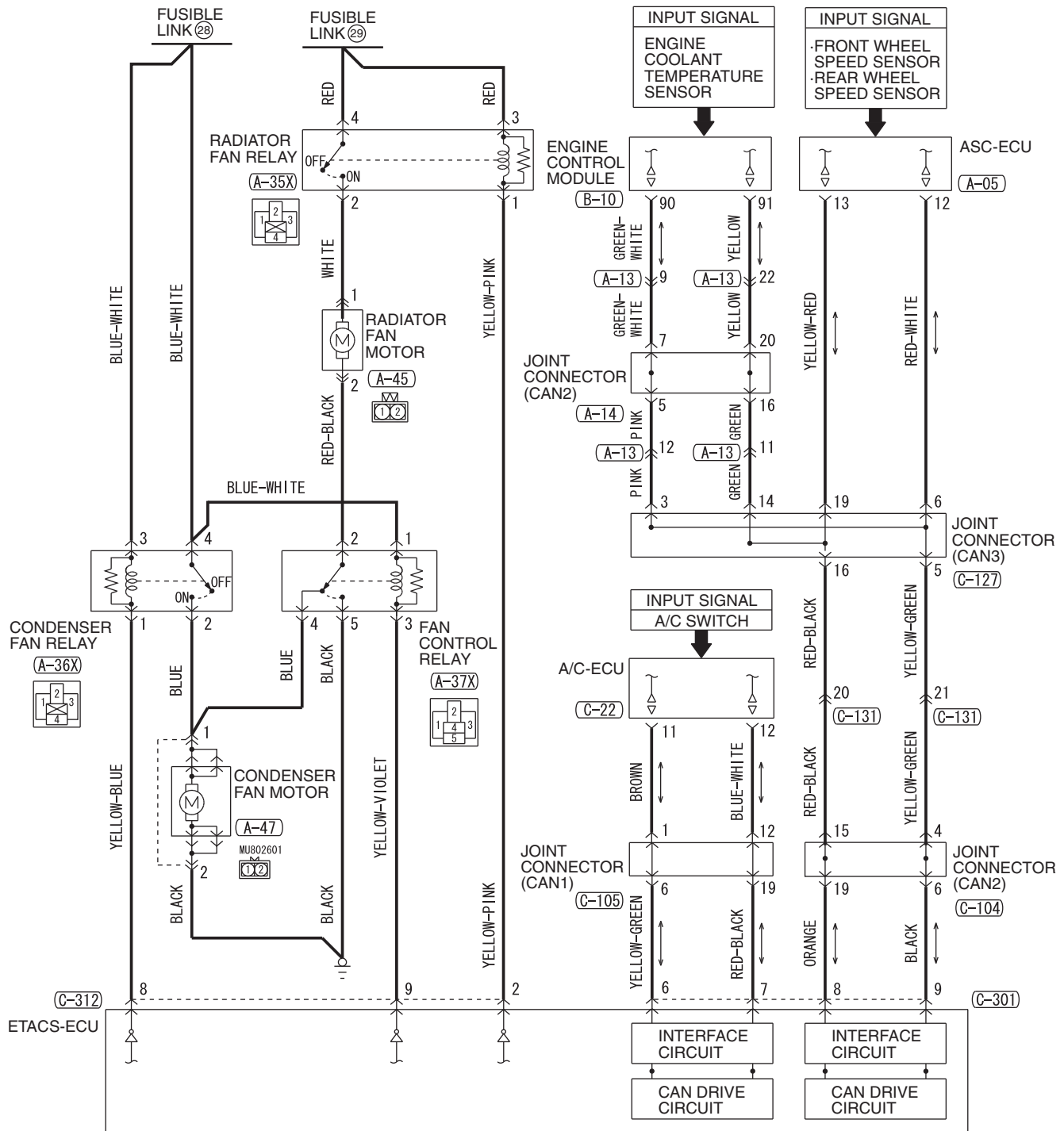
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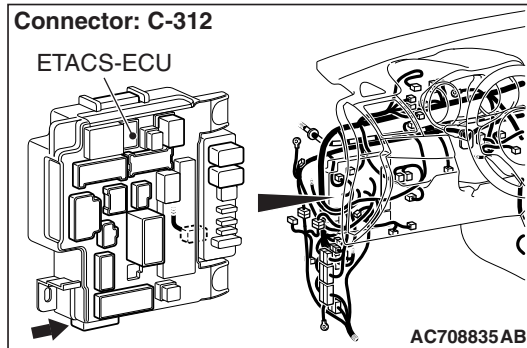
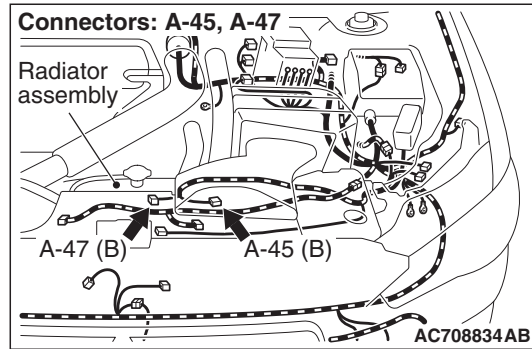
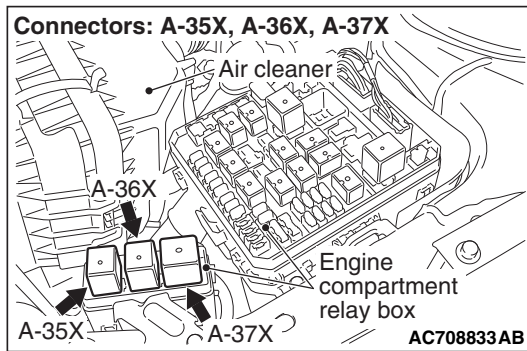
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Radiator Fan and Condenser Fan Drive Circuit <TC-SST>



AC708952AB



CIRCUIT OPERATION

- The engine control module (ECM) transmits the rotation signals of radiator fan and condenser fan, based on the engine coolant temperature signal from the engine coolant temperature sensor, the vehicle speed signal from the wheel speed sensor via the ASC-ECU, and the A/C switch signal from the A/C-ECU using the CAN bus line.
- The rotation signals of radiator fan and condenser fan, using the CAN bus line from ECM, turn ON/OFF of the radiator fan relay, condenser fan relay, and fan control relay via ETACS-ECU, to control the radiator fan and condenser fan rotation.

TECHNICAL DESCRIPTION

- When the radiator fan and condenser fan do not operate, the wiring harness/connector, fan motor, relay, and ETACS-ECU may have a failure.

- The radiator fan and condenser fan do not operate also when the CAN bus line, MFI system, or ETACS system have a failure.

TROUBLESHOOTING HINTS

- Malfunction of CAN bus line.
- Damaged wiring harness or connector.
- Malfunction of MFI system.
- Malfunction of ASC system.
- Malfunction of the A/C system.
- Malfunction of ETACS system.
- Malfunction of fusible link number 28.
- Malfunction of fusible link number 29.
- Malfunction of radiator fan relay.
- Malfunction of condenser fan relay.
- Malfunction of fan control relay.
- Malfunction of radiator fan motor.
- Malfunction of condenser fan motor.
- Malfunction of ETACS-ECU.
- Malfunction of ECM.

DIAGNOSTIC PROCEDURE

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: M.U.T.-III USB Cable
 - MB991910: M.U.T.-III Main Harness A
- MB991223: Harness Set
- MB992006: Extra Fine Probe

⚠ CAUTION

If there is any problem in the CAN bus lines, an incorrect diagnostic trouble code (DTC) may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, Trouble code diagnosis [P.54C-9](#).)

STEP 1. Using scan tool MB991958, check the CAN bus line diagnostics.

Use scan tool to diagnose the CAN bus line (Refer to GROUP 54C, Explanation About The Scan Tool Can Bus Diagnostics [P.54C-9](#)).

Q: Is the diagnostic trouble code set?

YES : Go to Step 2.

NO : Repair the CAN bus line (Refer to GROUP 54C, Diagnosis –Can Bus Diagnostic Table [P.54C-15](#)). Then go to Step 23.

STEP 2. Using scan tool MB991958, check the MFI system actuator test.

Using scan tool to check the MFI system actuator test (Refer to GROUP 13A, MFI Diagnosis –Diagnostic Function [P.13A-9](#)).

- Item 14: Cooling fan
(Refer to GROUP 13A, MFI Diagnosis –Actuator Test Reference Table [P.13A-840](#))

Q: Is the check result normal?

YES : Go to Step 22.

NO : Go to Step 3.

STEP 3. Using scan tool MB991958, read the MFI system DTC.

Using scan tool to read the MFI system DTC (Refer to GROUP 13A, MFI Diagnosis –Diagnostic Function [P.13A-9](#)).

Q: Is any DTC set?

YES : Repair the MFI system (Refer to GROUP 13A, MFI Diagnosis –Diagnostic Trouble Code Chart [P.13A-48](#)). Then go to Step 23.

NO : Go to Step 4.

STEP 4. Using scan tool MB991958, read the ASC system DTC.

Using scan tool to read the ASC system DTC (Refer to GROUP 35C, Diagnosis –Diagnostic Function [P.35C-8](#).)

Q: Is any DTC set?

YES : Repair the ASC system (Refer to GROUP 35C, Diagnosis –Diagnostic Trouble Code Chart [P.35C-22](#).) Then go to Step 23.

NO : Go to Step 5.

STEP 5. Using scan tool MB991958, read the A/C system DTC.

Using scan tool to read the A/C system DTC (Refer to GROUP 55, Auto A/C Diagnosis –Diagnostic Function [P.55-7.](#))

Q: Is any DTC set?

YES : Repair the A/C system (Refer to GROUP 55, Auto A/C Diagnosis –Diagnostic Trouble Code Chart [P.55-10.](#)) Then go to Step 23.

NO : Go to Step 6.

STEP 6. Using scan tool MB991958, read the ETACS system DTC.

Using scan tool to read the ETACS system DTC (Refer to GROUP 54A, ETACS, Troubleshooting –Diagnostic Function [P.54A-643.](#))

Q: Is any DTC set?

YES : Repair the ETACS system (Refer to GROUP 54A, ETACS, Troubleshooting –Diagnostic Trouble Code Chart [P.54A-646.](#)) Then go to Step 23.

NO : Go to Step 7.

STEP 7. Measure the terminal voltage at ETACS-ECU connector C-312.

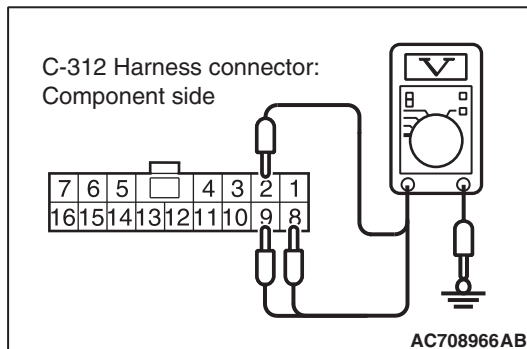
- (1) Disconnect the ETACS-ECU connector C-312, and measure at front wiring harness connector side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the terminal voltage between ETACS-ECU connector C-312 terminal number 2 and body ground, between ETACS-ECU connector C-312 terminal number 8 and body ground, and between ETACS-ECU connector C-312 terminal number 9 and body ground.

OK: Battery positive voltage

Q: Is the check result normal?

YES : Go to Step 13.

NO : Go to Step 8.

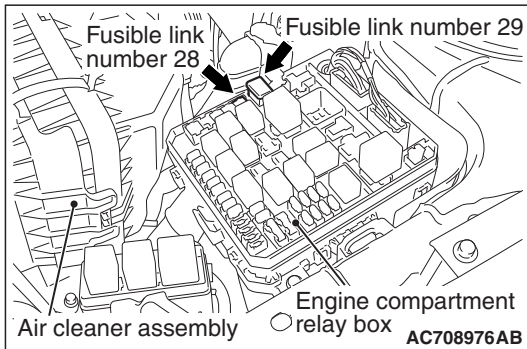
**STEP 8. Check the radiator fan relay connector A-35X, condenser fan relay connector A-36X, fan control relay connector A-37X, and ETACS-ECU connector C-312, for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

Refer to GROUP 00E, Harness Connector Inspection [P.00E-2.](#)

Q: Is the connectors and terminals in good condition?

YES : Go to Step 9.

NO : Repair or replace the damaged connector. Then go to Step 23.



STEP 9. Check the harness wire between fusible link number 28 and condenser fan relay connector A-36X terminal number 3, between fusible link number 28 and condenser fan relay connector A-36X terminal number 4, between condenser fan relay connector A-36X terminal number 4 and fan control relay connector A-37X terminal number 1, and between fusible link number 29 and radiator fan relay connector A-35X terminal number 3, for damage.

- Check harness wire for open/short circuit and damage.

Q: Is the harness wires in good condition?

YES : Go to Step 10.

NO : Repair or replace the damaged harness wire. Then go to Step 23.

STEP 10. Check the harness wire between radiator fan relay connector A-35X terminal number 1 and ETACS-ECU connector C-312 terminal number 2, between condenser fan relay connector A-36X terminal number 1 and ETACS-ECU connector C-312 terminal number 8, and between fan control relay connector A-37X terminal number 3 and ETACS-ECU connector C-312 terminal number 9, for damage.

- Check harness wire for open/short circuit and damage.

Q: Is the harness wires in good condition?

YES : Go to Step 11.

NO : Repair or replace the damaged harness wire. Then go to Step 23.

STEP 11. Check the radiator fan relay, condenser fan relay, and fan control relay.

Refer to [P.14-20](#).

Q: Is the relay in good condition?

YES : Go to Step 12.

NO : Replace the damaged relay. Then go to Step 23.

STEP 12. Check the fusible link number 28 and fusible link number 29.

Q: Is the fusible link in good condition?

YES : Go to Step 20.

NO : Replace the damaged fusible link. Then go to Step 23.

STEP 13. Check the radiator fan relay connector A-35X, condenser fan relay connector A-36X, fan control relay connector A-37X, radiator fan motor connector A-45, and condenser fan motor connector A-47, for loose, corroded or damaged terminals, or terminals pushed back in the connector.

Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#).

Q: Is the connectors and terminals in good condition?

YES : Go to Step 14.

NO : Repair or replace the damaged connector. Then go to Step 23.

STEP 14. Check the harness wire between fusible link number 28 and condenser fan relay connector A-36X terminal number 4, and between fusible link number 29 and radiator fan relay connector A-35X terminal number 4, for damage.

- Check harness wire for open/short circuit and damage.

Q: Is the harness wires in good condition?

YES : Go to Step 15.

NO : Repair or replace the damaged harness wire. Then go to Step 23.

STEP 15. Check the harness wire between radiator fan relay connector A-35X terminal number 2 and radiator fan motor connector A-45 terminal number 1, and between condenser fan relay connector A-36X terminal number 2 and condenser fan motor connector A-47 terminal number 1, for damage.

- Check harness wire for open/short circuit and damage.

Q: Is the harness wires in good condition?

YES : Go to Step 16.

NO : Repair or replace the damaged harness wire. Then go to Step 23.

STEP 16. Check the harness wire between radiator fan motor connector A-45 terminal number 2 and fan control relay connector A-37X terminal number 2, and between condenser fan motor connector A-47 terminal number 2 and body ground, for damage.

- Check harness wire for open/short circuit and damage.

Q: Is the harness wires in good condition?

YES : Go to Step 17.

NO : Repair or replace the damaged harness wire. Then go to Step 23.

STEP 17. Check the harness wire between fan control relay connector A-37X terminal number 4 and condenser fan motor connector A-47 terminal number 1, and between fan control relay connector A-37X terminal number 5 and body ground, for damage.

- Check harness wire for open/short circuit and damage.

Q: Is the harness wires in good condition?

YES : Go to Step 18.

NO : Repair or replace the damaged harness wire. Then go to Step 23.

STEP 18. Check the radiator fan relay, condenser fan relay, and fan control relay.

Refer to [P.14-20](#).

Q: Is the relay in good condition?

YES : Go to Step 19.

NO : Replace the damaged relay. Then go to Step 23.

STEP 19. Check the radiator fan motor and condenser fan motor.

Refer to [P.14-21](#).

Q: Is the fan motor in good condition?

YES : Go to Step 20.

NO : Replace the damaged fan motor (Refer to [P.14-32](#).) Then go to Step 23.

STEP 20. Using scan tool MB991958, read the ETACS system DTC.

Using scan tool to read the ETACS system DTC (Refer to GROUP 54A, ETACS, Troubleshooting –Diagnostic Function [P.54A-643](#)).

Q: Is any DTC set?

YES : Replace the ETACS-ECU (Refer to GROUP 54A, ETACS –ETACS-ECU [P.54A-742](#).) Then go to Step 23.

NO : Go to Step 21.

STEP 21. Using scan tool MB991958, check the MFI system actuator test.

Using scan tool to check the MFI system actuator test (Refer to GROUP 13A, MFI Diagnosis –Diagnostic Function [P.13A-9](#)).

- Item 14: Cooling fan
(Refer to GROUP 13A, MFI Diagnosis –Actuator Test Reference Table [P.13A-840](#))

Q: Is the check result normal?

YES : Go to Step 22.

NO : Replace the ECM [Refer to GROUP 13A, Engine Control Module (ECM) [P.13A-888](#).] Then go to Step 23.

STEP 22. Check the symptoms.

Q: Does the radiator fan and condenser fan operate normal?

YES : An intermittent malfunction is suspected (Refer to GROUP 00, How to use troubleshooting –How to Cope with Intermittent Malfunction [P.00-15](#)).

NO : Replace the ECM [Refer to GROUP 13A, Engine Control Module (ECM) [P.13A-888](#).] Then go to Step 23.

STEP 23. Check the symptoms.

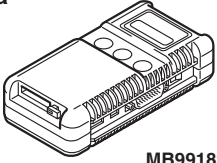
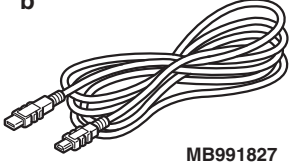
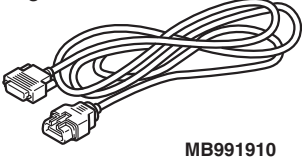
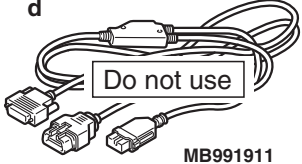
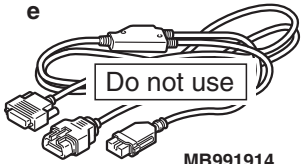
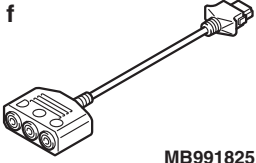
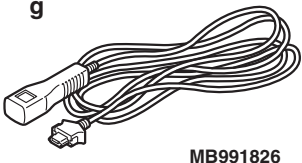
Q: Does the radiator fan and condenser fan operate normal?


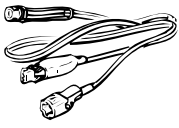
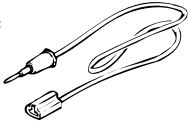

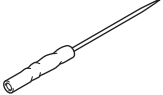
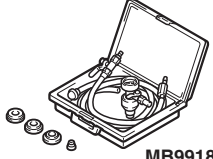
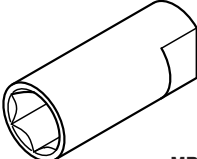
YES : The procedure is complete.

NO : Return to Step 1.

SPECIAL TOOLS

M1141000601487

Tool	Tool number and name	Supersession	Application
<p>a</p>  <p>MB991824</p> <p>b</p>  <p>MB991827</p> <p>c</p>  <p>MB991910</p> <p>d</p>  <p>MB991911</p> <p>e</p>  <p>MB991914</p> <p>f</p>  <p>MB991825</p> <p>g</p>  <p>MB991826 MB991958</p>	<p>MB991958</p> <p>a: MB991824 b: MB991827 c: MB991910 d: MB991911 e: MB991914 f: MB991825 g: MB991826</p> <p>Scan tool (M.U.T.-III sub assembly)</p> <p>a: Vehicle communication interface (V. C. I.)</p> <p>b: M.U.T.-III USB cable</p> <p>c: M.U.T.-III main harness A (Vehicles with CAN communication system)</p> <p>d: M.U.T.-III main harness B (Vehicles without CAN communication system)</p> <p>e: M.U.T.-III main harness C (for Chrysler models only)</p> <p>f: M.U.T.-III measurement adapter</p> <p>g: M.U.T.-III trigger harness</p>	<p>MB991824-KIT</p> <p><i>NOTE: g: MB991826 M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.</i></p>	<p>CAUTION</p> <p>For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.</p> <ul style="list-style-type: none"> • Checking diagnostic trouble code (DTC). • Checking actuator test.

Tool	Tool number and name	Supersession	Application
<p>a</p>  <p>b</p>  <p>c</p>  <p>d</p>  <p>MB991223</p>	<p>MB991223</p> <p>a: MB991219 b: MB991220 c: MB991221 d: MB991222</p> <p>Harness set</p> <p>a: Test harness b: LED harness c: LED harness adaptor d: Probe</p>	<p>General service tools</p>	<p>Checking the continuity and measuring the voltage at the harness connector</p>
 <p>MB992006</p>	<p>MB992006</p> <p>Extra fine probe</p>	<p>General service tool</p>	<p>Continuity check and voltage measurement at harness wire or connector for loose, corroded or damaged terminals, or terminals pushed back in the connector.</p>
 <p>MB991871</p>	<p>MB991871</p> <p>LLC changer</p>	<p>General service tool</p>	<p>Coolant refilling</p>
 <p>MB992042</p>	<p>MB992042</p> <p>Water temp sensor wrench</p>	<p>MB992042-01</p>	<p>Engine coolant temperature sensor removal and installation</p>

ON-VEHICLE SERVICE

ENGINE COOLANT LEAK CHECK

M1141001000849

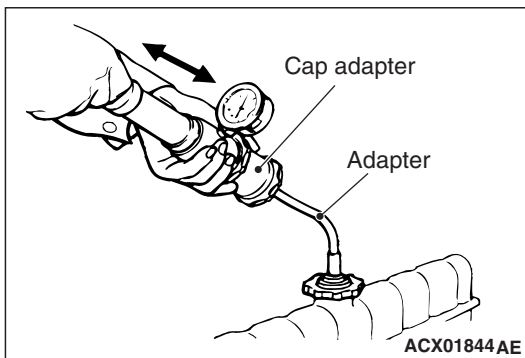
⚠ WARNING

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 OPENING PRESSURE CHECK

M1141001301003

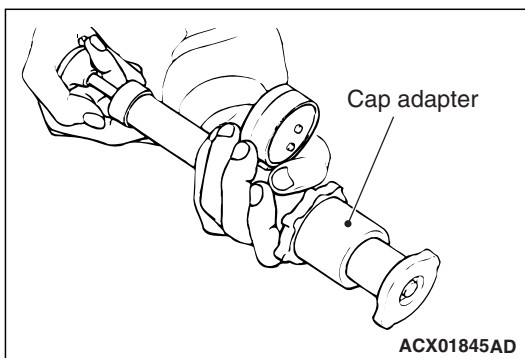
NOTE: Be sure that the cap is clean before testing. Rust or other foreign material on the cap seal will cause an improper reading.

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 CHANGE

M1141001201459

Required Special Tool:

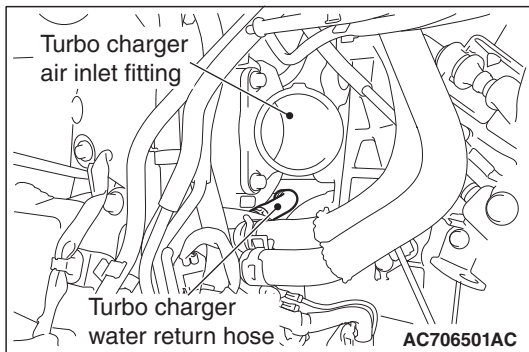
- MB991871: LLC changer

1. Remove the engine room under cover front A (RH). (Refer to GROUP 51, Under Cover [P.51-15](#))

⚠ 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.

2. Drain the water from the radiator, heater core and engine after unplugging the radiator drain plug and removing the radiator cap.
3. Remove the engine room under cover front B. (Refer to GROUP 51, Under Cover P.51-15)
4. Remove the air cleaner intake hose. (Refer to GROUP 15, Air Cleaner P.15-11)
5. Remove the turbocharger compressor bracket. (Refer to GROUP 15, Exhaust Manifold and Turbocharger Assembly P.15-18)
6. Disconnect the turbocharger water return hose and drain the coolant in the water jacket.
7. Remove the radiator condenser tank and drain the coolant.
8. Drain the coolant then clean the path of the coolant by injecting water into the radiator from the radiator cap area.
9. Connect the turbocharger water return hose.
10. Securely tighten the drain plug of the radiator.
11. Reinstall the radiator condenser tank.

**⚠ 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.

12. 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 engine coolant up to the top of the radiator port. A convenient mixture is a 50% water and 50% antifreeze solution [freezing point: -31° C (-23.8 ° F)].

Recommended antifreeze: Long Life Antifreeze Coolant or an equivalent

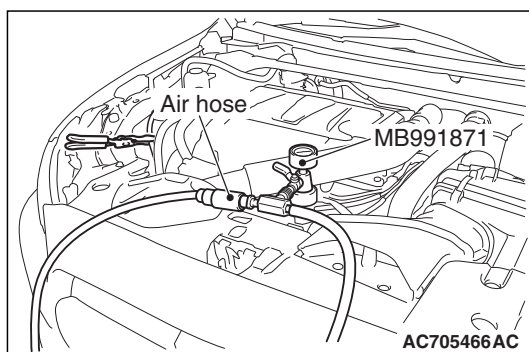
Quantity: 7.5 dm³ (7.9 quarts)

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

13. Tighten the radiator cap securely.
14. Remove the radiator condenser tank cap, and add the engine coolant up to the "FULL" line.
15. Turn the A/C switch to OFF position to start the engine and warm up until the cooling fan operates.

NOTE: This step opens the thermostat fully.

16. Rev the engine several times and then stop it. Check that there are no coolant leaks.



17. Remove the radiator cap with the engine cool, and then refill the engine coolant up to the top of the radiator port.
18. Tighten the radiator cap securely.

⚠ CAUTION

Do not overfill the radiator condenser tank.

19. Remove the radiator condenser tank cap, and add the engine coolant up to the "FULL" line.
20. Install the turbocharger compressor bracket. (Refer to GROUP 15, Exhaust Manifold and Turbocharger Assembly [P.15-18](#))
21. Install the air cleaner intake hose. (Refer to GROUP 15, Air Cleaner [P.15-11](#))
22. Remove the engine room under cover front B and engine room under cover front A (RH). (Refer to GROUP 51, Under Cover [P.51-15](#))

WATER PUMP COOLANT LEAK CHECK

M1141008600080

If a residue of the coolant draining is found on the drain hole, the vapor hole and the installation surface, check the water pump leakage by following method.

1. Wipe off the residue of the coolant draining on the water pump.

⚠ WARNING

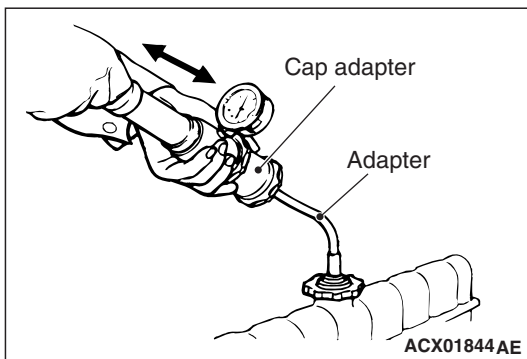
Make sure that the coolant is cold when removing the radiator cap.

2. Remove the radiator cap.

⚠ CAUTION

Do not pressures 100 kPa (15 psi) or more.

3. Install the radiator tester and pressures at 100 kPa (15 psi).
4. Hold the pressurized state for 20 minutes, and check that the water leakage from the drain hole, the vapor hole or the installation surface of the water pump.
5. Remove the radiator tester, and install the radiator cap.
6. Warm up the engine, let it idle for 20 minutes and stop it.
7. After stopping the engine, and check that the water leakage from the drain hole, the vapor hole or the installation surface of the water pump.
8. If the water leakage is found in step 4 or 7, replace the water pump. (Refer to [P.14-26](#).)



ENGINE COOLANT CONCENTRATION TEST

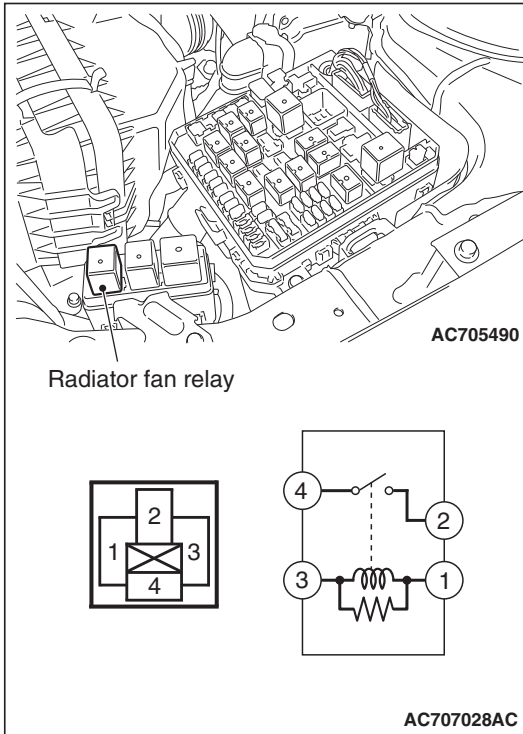
M1141001101009

Refer to GROUP 00 –Recommended Lubricants and Lubricant Capacities Table [P.00-54](#).

COOLING FAN RELAY CONTINUITY CHECK

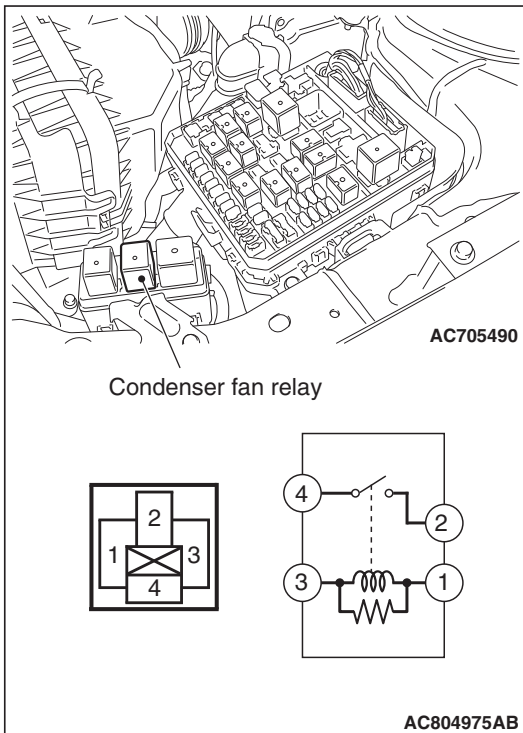
M1141006201409

RADIATOR FAN RELAY CHECK



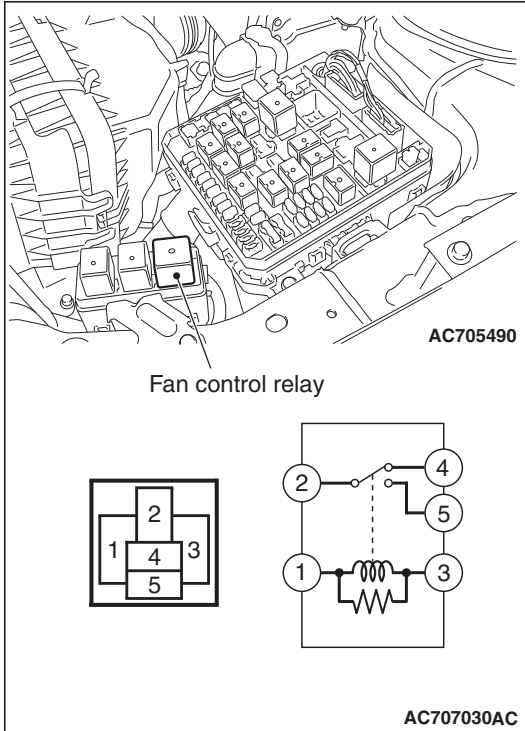
Battery voltage	Terminal No. to be connected to tester	Continuity test results
Not applied	2 -4	Open circuit
Connect terminal No. 3 and battery (+) terminal. Connect terminal No. 1 and battery (-) terminal.		Continuity (Less than 2 ohms)

CONDENSER FAN RELAY CHECK



Battery voltage	Terminal No. to be connected to tester	Continuity test results
Not applied	2 -4	Open circuit
Connect terminal No.3 and battery (+) terminal. Connect terminal No.1 and battery (-) terminal.		Continuity (Less than 2 ohms)

FAN CONTROL RELAY CHECK

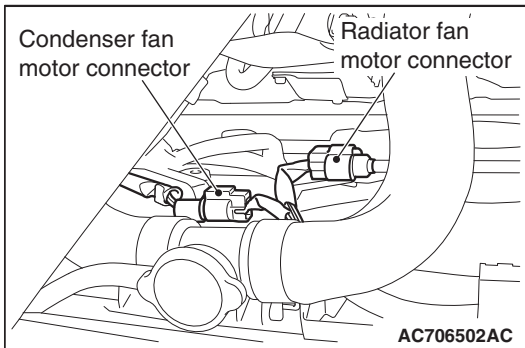


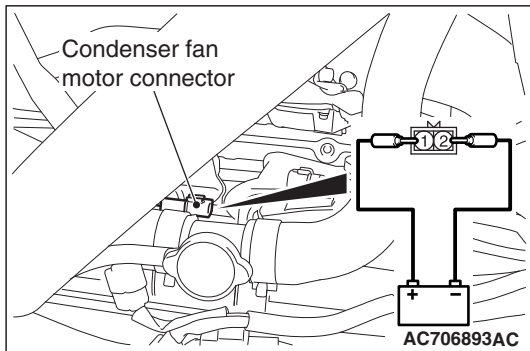
Battery voltage	Terminal No. to be connected to tester	Continuity test results
Not applied	2 -4	Continuity (Less than 2 ohms)
	2 -5	Open circuit
Connect terminal No. 1 and battery (+) terminal. Connect terminal No. 3 and battery (-) terminal.	2 -5	Continuity (Less than 2 ohms)
	2 -4	Open circuit

COOLING FAN MOTOR CHECK

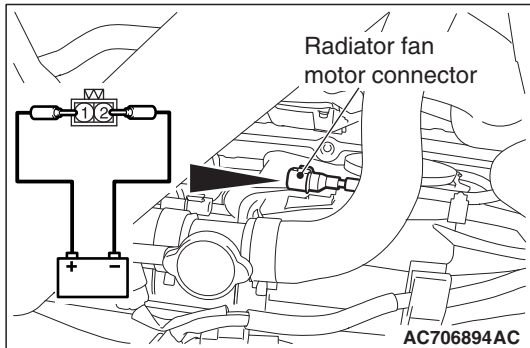
M1141007600225

1. Disconnect the fan motor connector.





2. Check that the fan motor runs when a positive battery terminal is connected to the fan motor-side connector terminal No.1, and terminal No.2 is grounded. Also check to see that there is no abnormal sound emitted from the fan motor at this time.
3. If the fan motor is defective, replace it (Refer to [P.14-32](#)).



THERMOSTAT

REMOVAL AND INSTALLATION

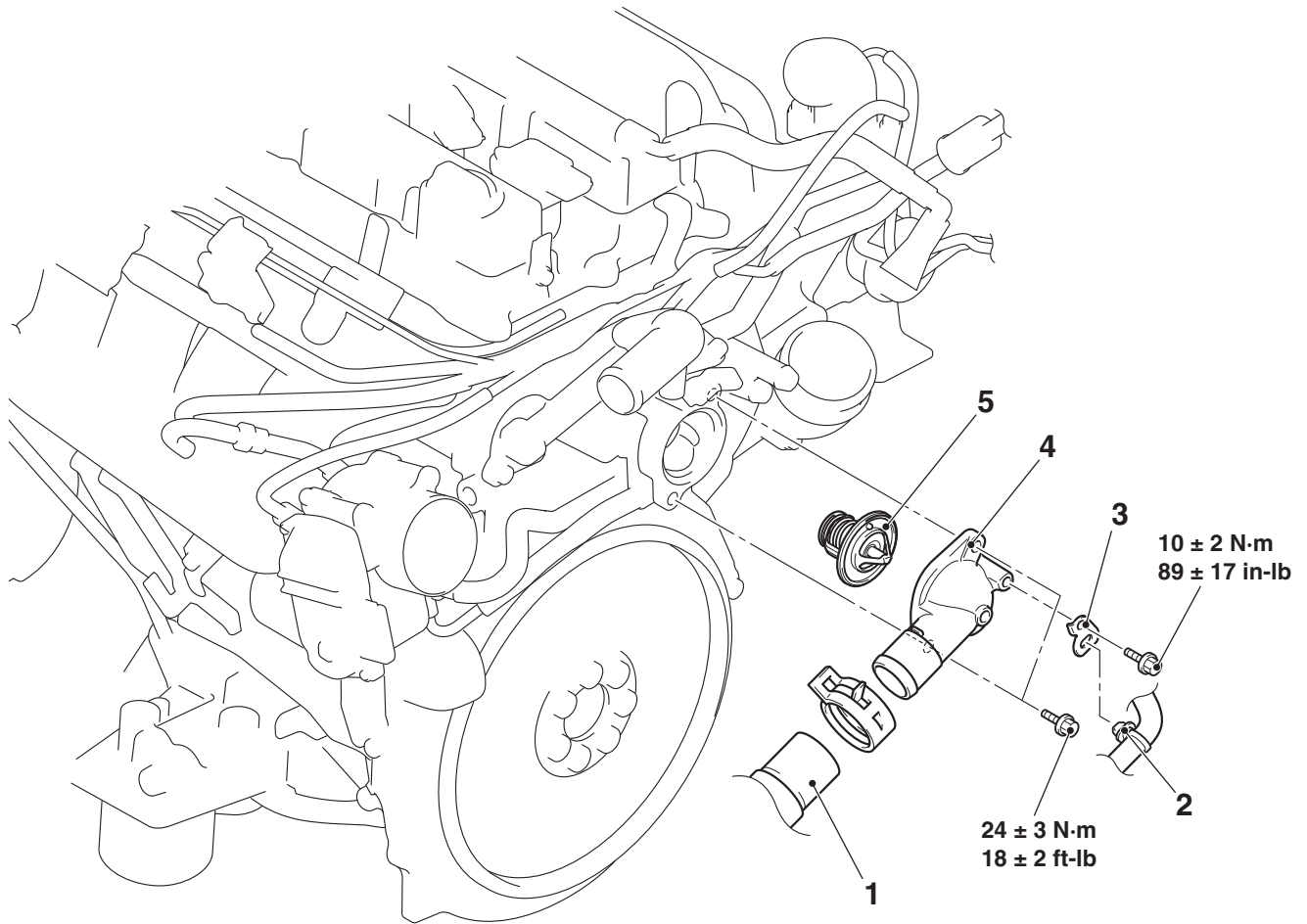
M1141002402772

Pre-removal operation

- Engine Coolant Draining (Refer to P.14-17).
- Engine Upper Cover Removal (Refer to GROUP 16, Ignition System –Ignition Coil P.16-40).
- Air Cleaner Intake Hose Removal (Refer to GROUP 15, Air Cleaner P.15-11).

Post-installation operation

- Air Cleaner Intake Hose Installation (Refer to GROUP 15, Air Cleaner P.15-11).
- Engine Upper Cover Installation (Refer to GROUP 16, Ignition System –Ignition Coil P.16-40).
- Engine Coolant Refilling (Refer to P.14-17).



AC705834 AC

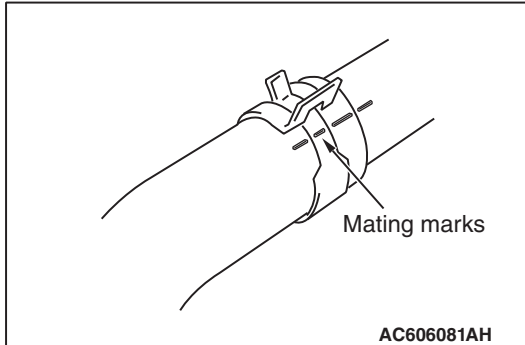
- <<A>> >>B<<
- Removal steps**
1. Radiator lower hose connection
 2. Control wiring harness clamp connection

- Removal steps (Continued)**
3. Harness bracket
 4. Cooling water inlet hose fitting
 5. Thermostat
- >>A<<

REMOVAL SERVICE POINT

<<A>> RADIATOR LOWER HOSE DISCONNECTION

Make mating marks on the radiator lower hose and the hose clamp as shown to install them in the original position. Then, remove them.



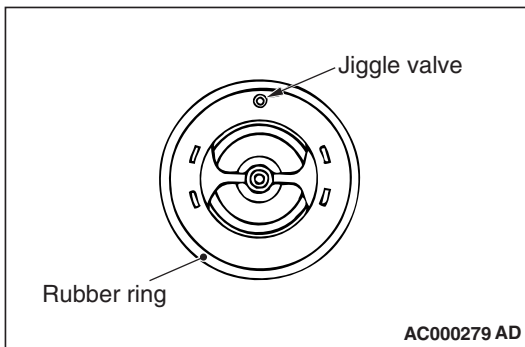
INSTALLATION SERVICE POINTS

>>A<< THERMOSTAT INSTALLATION

⚠ CAUTION

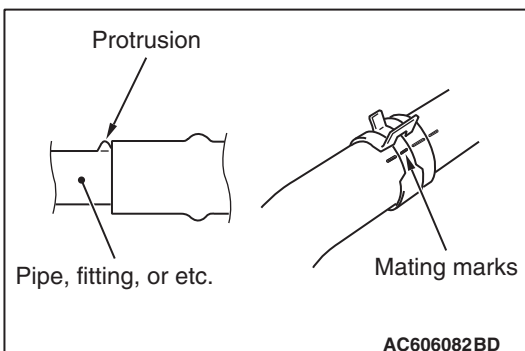
Make absolutely sure that no oil adheres to the rubber ring of the thermostat. Also do not fold or scratch the rubber ring during installation.

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



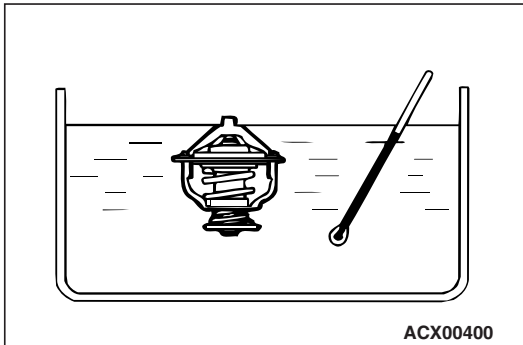
INSPECTION

M1141002501055

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: $76.5 \pm 1.5^{\circ}\text{C}$ ($170 \pm 3^{\circ}\text{F}$)



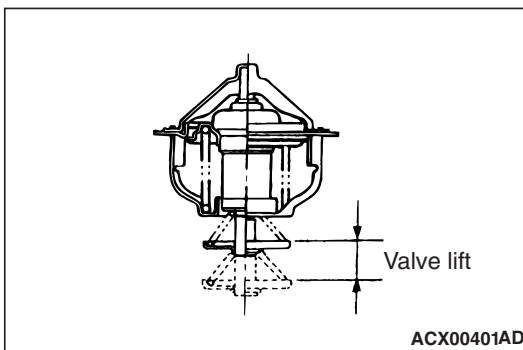
2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.

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: 90°C (194°F)

Amount of valve lift: 8.5 mm (0.33 inch) or more



WATER PUMP

REMOVAL AND INSTALLATION

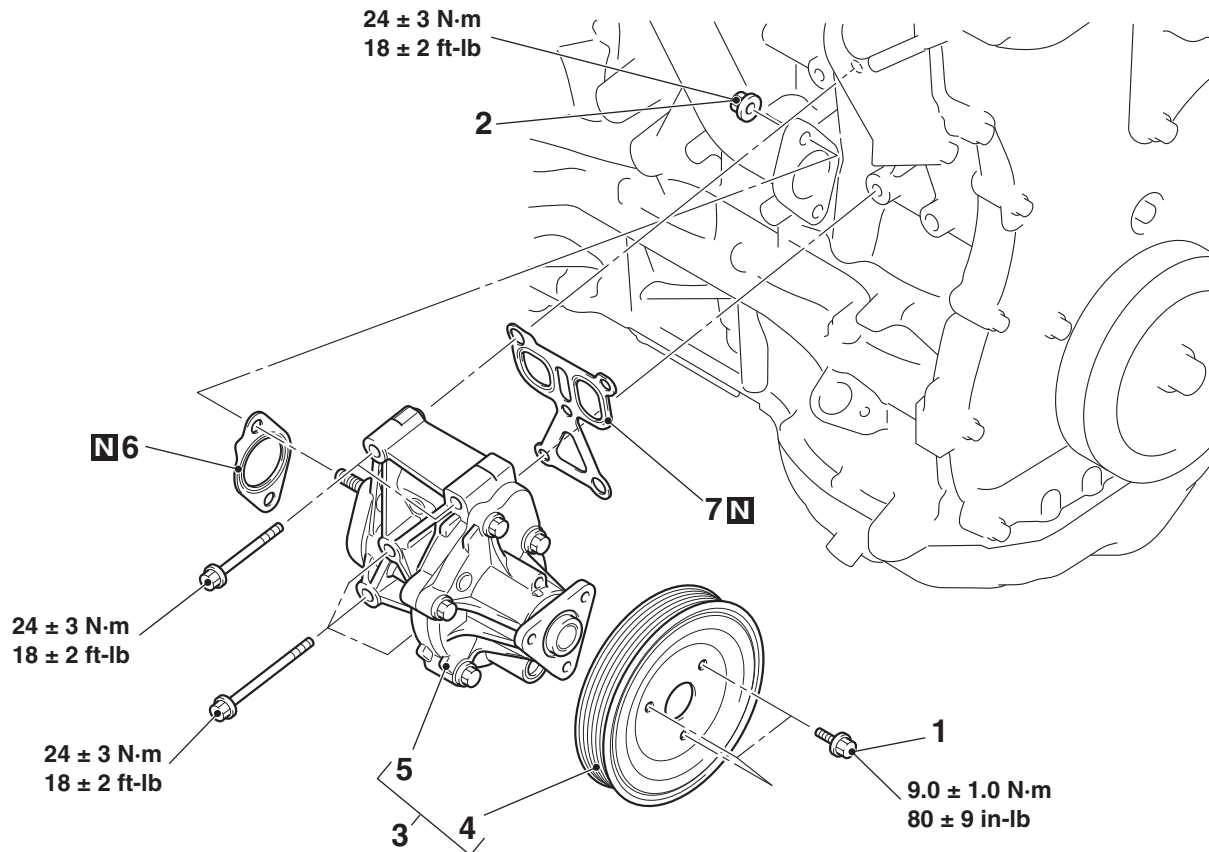
M1141002701800

Pre-removal operation

- Engine Coolant Draining (Refer to P.14-17).
- Drive Belt Removal (Refer to GROUP 11A, Crankshaft Pulley P.11A-21).
- Engine Upper Cover Removal (Refer to GROUP 16, Ignition System –Ignition Coil P.16-40).
- Strut Tower Bar Removal (Refer to GROUP 42A, Strut Tower Bar P.42A-14).

Post-installation operation

- Drive Belt Installation (Refer to GROUP 11A, Crankshaft Pulley P.11A-21).
- Drive Belt Tension Check (Refer to GROUP 11A, Engine Adjustment –Drive Belt Tension Check and Adjustment P.11A-7).
- Strut Tower Bar Installation (Refer to GROUP 42A, Strut Tower Bar P.42A-14).
- Engine Upper Cover Installation (Refer to GROUP 16, Ignition System –Ignition Coil P.16-40).
- Engine Coolant Refilling (Refer to P.14-17).



AC705835AC

Removal steps

1. Water pump pulley mounting bolts
2. Water pump inlet pipe mounting nuts
3. Water pump pulley and water pump assembly

Removal steps (Continued)

4. Water pump pulley
5. Water pump
6. Cooling water line gasket
7. Water pump gasket

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

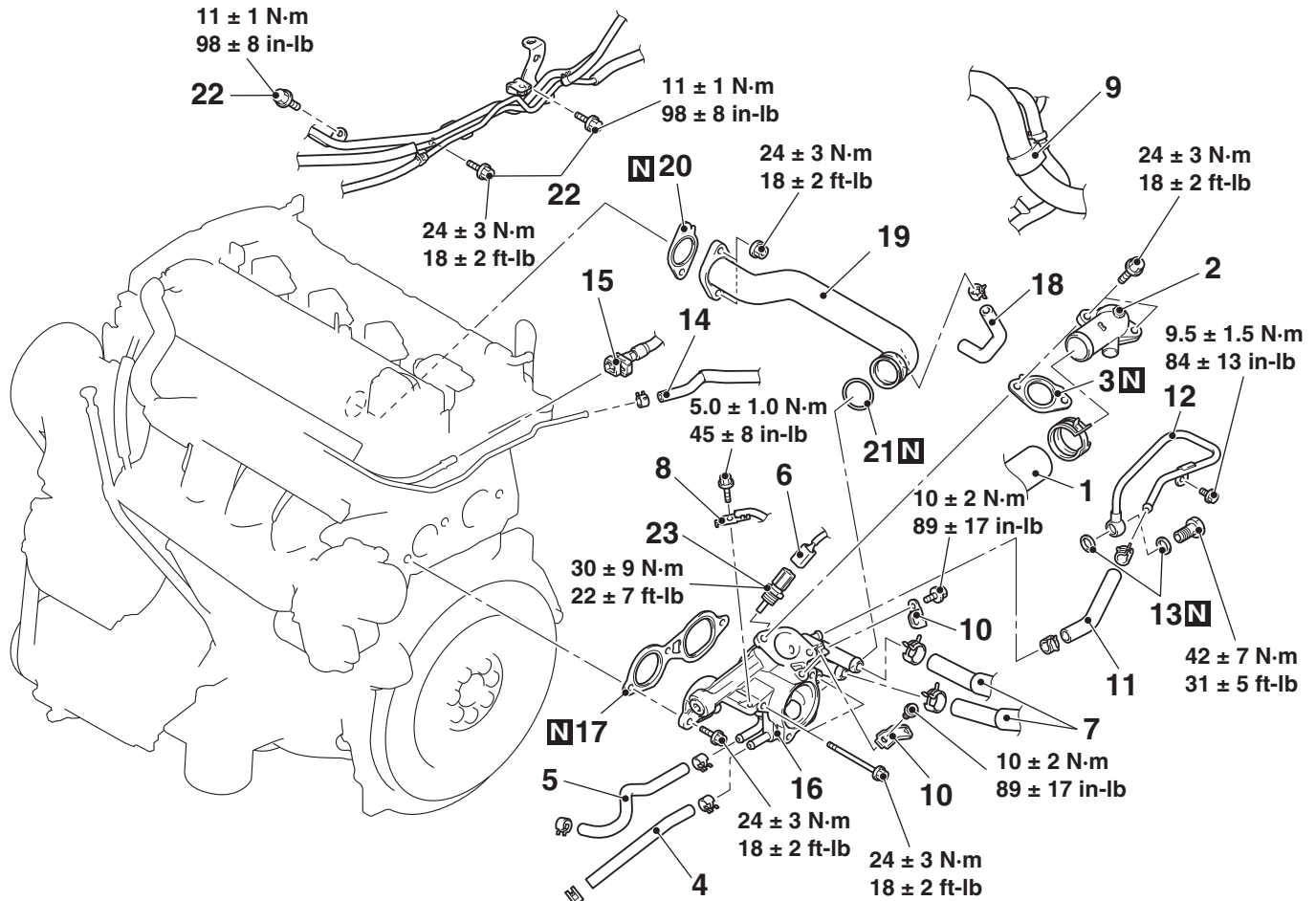
M1141003303373

Pre-removal operation

- Engine Coolant Draining (Refer to P.14-17).
- Engine Upper Cover Removal (Refer to GROUP 16, Ignition System –Ignition Coil P.16-40).
- Air Cleaner Assembly Removal (Refer to GROUP 15, Air Cleaner P.15-11).
- Thermostat Removal (Refer to P.14-23).

Post-installation operation

- Thermostat Installation (Refer to P.14-23).
- Air Cleaner Assembly Installation (Refer to GROUP 15, Air Cleaner P.15-11).
- Engine Upper Cover Installation (Refer to GROUP 16, Ignition System –Ignition Coil P.16-40).
- Engine Coolant Refilling (Refer to P.14-17).



AC705836AC

- <<A>> >>D<<
- Thermostat case removal steps**
1. Radiator upper hose
 2. Cooling water outlet hose fitting
 3. Cooling water outlet hose fitting gasket
 4. Cooling water line hose
 5. Cooling water line hose
 6. Engine coolant temperature sensor connector connection
 7. Heater hose connection
 8. Ground cable connection
 9. Control wiring harness connection
 10. Harness bracket

<> >>B<<

- Thermostat case removal steps (Continued)**
11. Turbocharger water feed hose
 12. Turbocharger water feed pipe
 13. Gasket
 14. Fuel return hose connection
 15. Fuel high-pressure hose connection
 16. Thermostat case
 17. Thermostat case gasket
- Water pump inlet pipe removal steps**
16. Thermostat case
 17. Thermostat case gasket

Water pump inlet pipe removal steps (Continued)

- Turbocharger assembly (Refer to GROUP 15, Exhaust Manifold and Turbocharger Assembly P.15-18)
- 18. Turbocharger water return hose
- 19. Water pump inlet pipe
- 20. Cooling water line gasket
- >>C<< 21. O-ring

Engine coolant temperature sensor removal steps

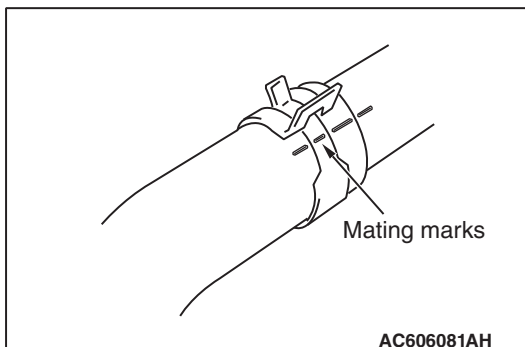
- <> >>B<< 14. Fuel return hose connection
- 15. Fuel high-pressure hose connection
- 22. Emission control vacuum hose and pipe assembly mounting bolts
- 6. Engine coolant temperature sensor connector
- <<C>> >>A<< 23. Engine coolant temperature sensor

Required Special Tool:

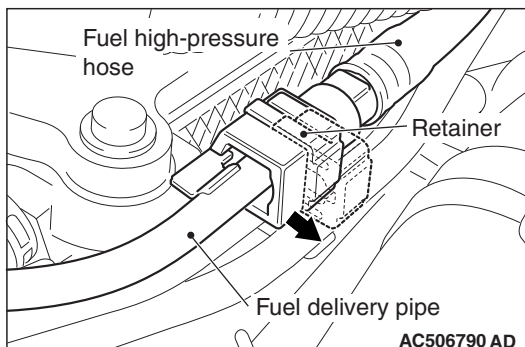
- MB992042: Water Temp Sensor Wrench

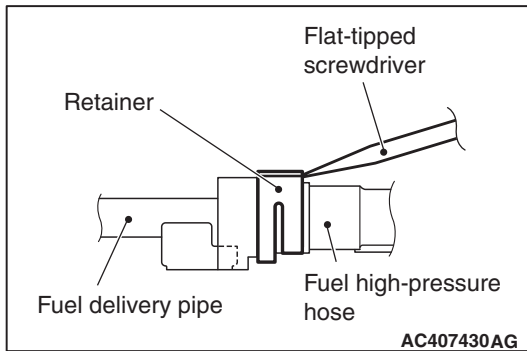
REMOVAL SERVICE POINTS**<<A>> RADIATOR UPPER HOSE DISCONNECTION**

Make mating marks on the radiator upper hose and the hose clamp as shown to install them in the original position. Then, remove them.

**<> FUEL HIGH-PRESSURE HOSE DISCONNECTION**

1. Follow the steps below to unlock the fuel high-pressure hose connector.

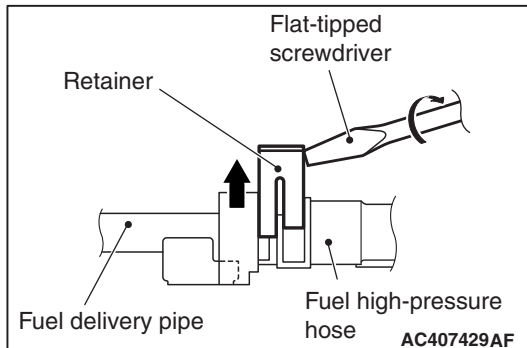




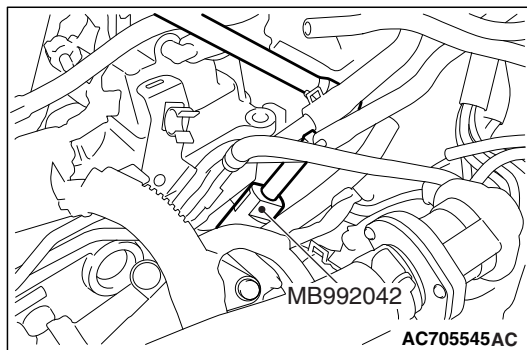
- (1) Insert a flat-tipped screwdriver [6 mm (0.24 inch) wide and 1 mm (0.04inch) thick] into the retainer of the fuel high-pressure hose connector.

⚠ CAUTION

When pushing up the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.



- (2) Turn the flat-tipped screwdriver inserted into the retainer by 90 degrees angle to push up the retainer and unlock the fuel high-pressure hose connector.
2. Remove the fuel high-pressure hose.



<<C>> ENGINE COOLANT TEMPERATURE SENSOR REMOVAL

Use special tool MB992042 to remove the engine coolant temperature sensor.

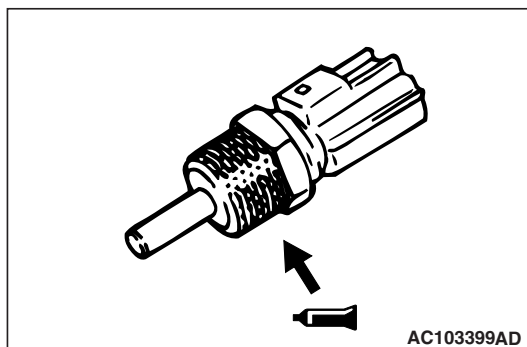
INSTALLATION SERVICE POINTS

>>A<< ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION

1. Apply sealant to the engine coolant temperature sensor thread.

Specified sealant: Three bond 1324N or equivalent

NOTE: Install the engine coolant temperature sensor immediately after applying sealant.

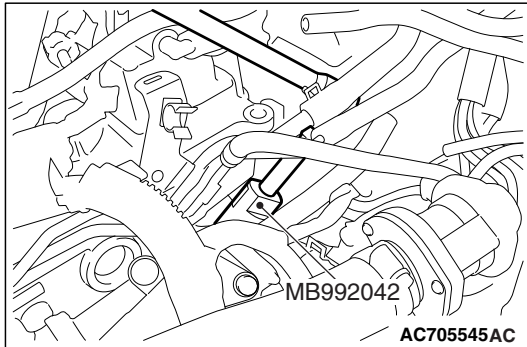


⚠ CAUTION

After the installation, until a sufficient period of time (one hour or more) elapses, do not apply the oil or water to the sealant application area or start the engine.

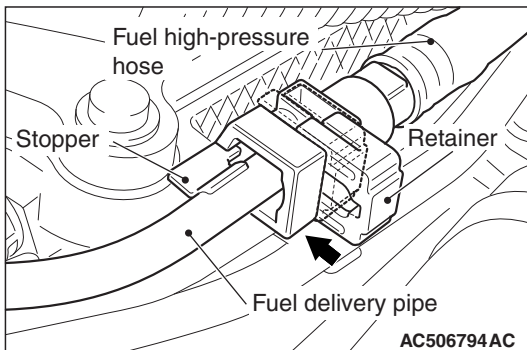
2. Use special tool MB992042 to tighten the engine coolant temperature sensor to the specified torque.

Tightening torque: 30 ± 9 N·m (22 ± 7 ft·lb)

**>>B<< FUEL HIGH-PRESSURE HOSE CONNECTION****⚠ CAUTION**

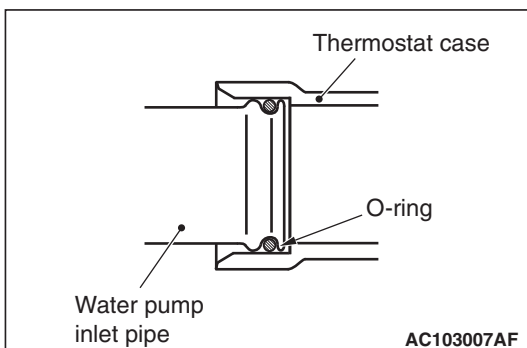
- When pushing in the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.
- After the installation of the fuel high-pressure hose, slightly pull the fuel high-pressure hose to check that it is connected securely. At this time, also check that there is approximately 1 mm (0.04inch) play.

1. Securely insert the fuel rail stopper into the fuel high-pressure hose connector groove to install the fuel high-pressure hose to the fuel rail.
2. Push in the retainer of the fuel high-pressure hose connector to lock the fuel high-pressure hose and fuel rail.

**>>C<< O-RING INSTALLATION****⚠ CAUTION**

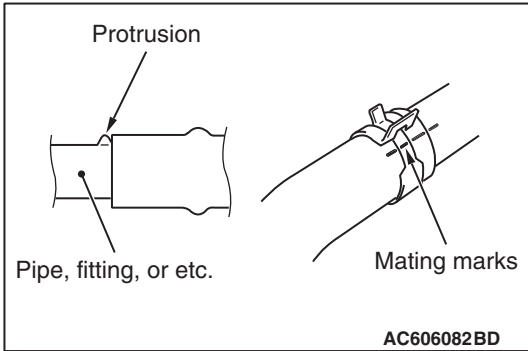
Avoid adhesion of engine oil or grease to the O-ring.

Fit the O-ring in the water pump inlet pipe groove, wet the O-ring circumference or the pipe mounting area inner wall, and then insert the O-ring.



>>D<< RADIATOR UPPER HOSE CONNECTION

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



INSPECTION

M1141003400650

WATER PIPE AND HOSE CHECK

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

RADIATOR

REMOVAL AND INSTALLATION

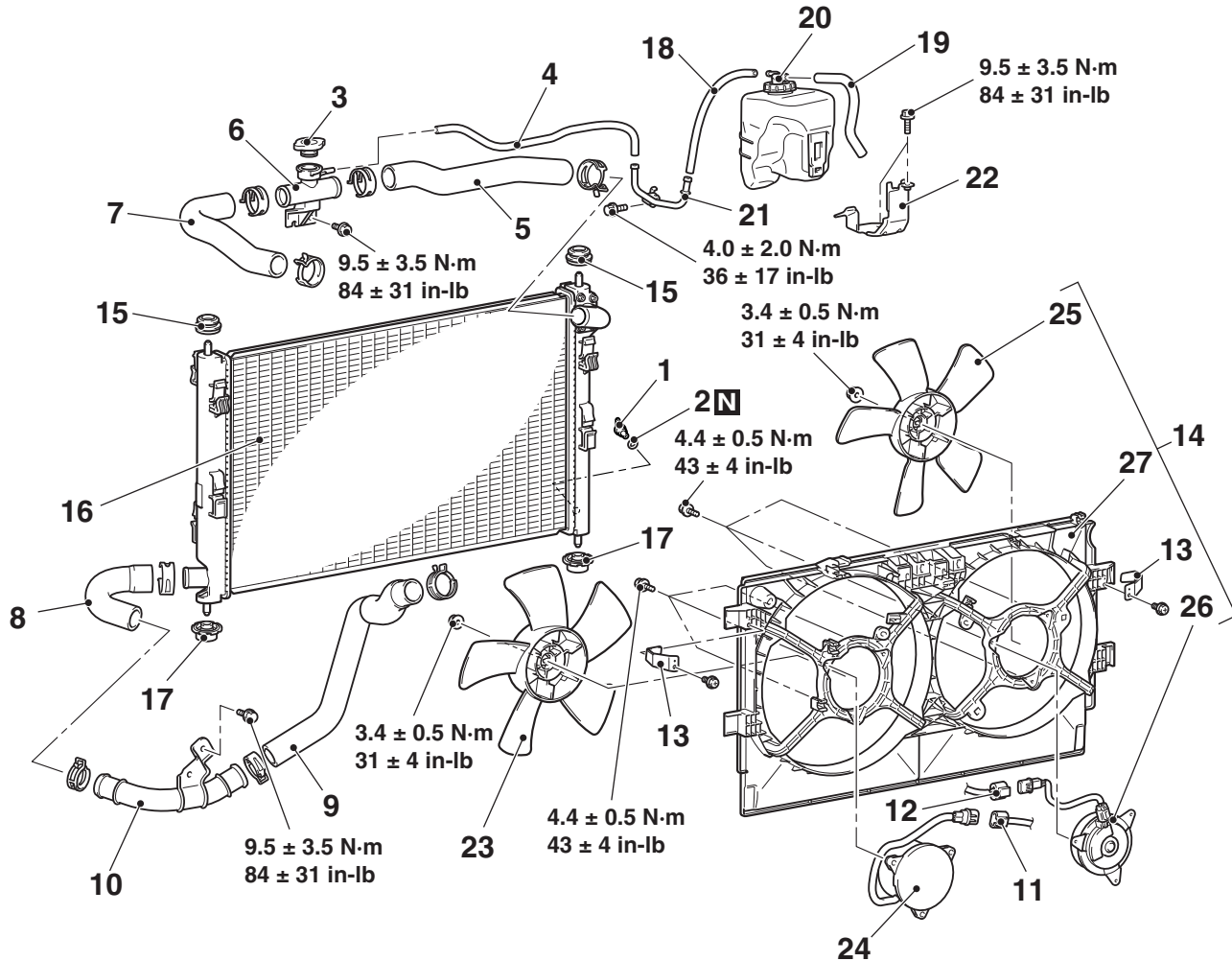
M1141001503241

Pre-removal operation

- Engine Room Under Cover Front A and Engine Room Under Cover Center Removal (Refer to GROUP 51, Under Cover P.51-15).
- Engine coolant Draining (Refer to P.14-17).
- Charge Air Cooler Intake Hose B and Charge Air Cooler Intake Pipe B Removal (Refer to GROUP 15, Charge Air Cooler P.15-12).

Post-installation operation

- Charge Air Cooler Intake Hose B and Charge Air Cooler Intake Pipe B Installation (Refer to GROUP 15, Charge Air Cooler P.15-12).
- Engine coolant Refilling and Check (Refer to P.14-17).
- Engine Room Under Cover Front A and Engine Room Under Cover Center Installation (Refer to GROUP 51, Under Cover P.51-15).



AC710570AB

Radiator removal steps

1. Radiator drain plug
2. O-ring
3. Radiator cap
4. Radiator condenser tank hose
5. Radiator upper hose
6. Radiator cap assembly
7. Radiator upper hose
8. Radiator lower hose
9. Radiator lower hose
10. Radiator lower pipe assembly
11. Radiator fan motor connector connection

<<A>> >>A<<
<<A>> >>A<<
<<A>> >>A<<
<<A>> >>A<<

<>
<>

Radiator removal steps

12. Condenser fan motor connector connection
- Front end upper bar (Refer to GROUP 42A, Loose Panel P.42A-198)
13. Bracket
14. Fan, fan motor and fan shroud assembly
15. Support upper insulator
16. Radiator assembly
17. Support lower insulator
18. Radiator condenser tank hose

Radiator removal steps

19. Radiator condenser tank hose
20. Radiator condenser tank
21. Radiator condenser tank pipe
22. Radiator condenser tank bracket <>

Fan shroud removal steps

4. Radiator condenser tank hose
5. Radiator upper hose
6. Radiator cap assembly
11. Radiator fan motor connector
12. Condenser fan motor connector

Fan shroud removal steps

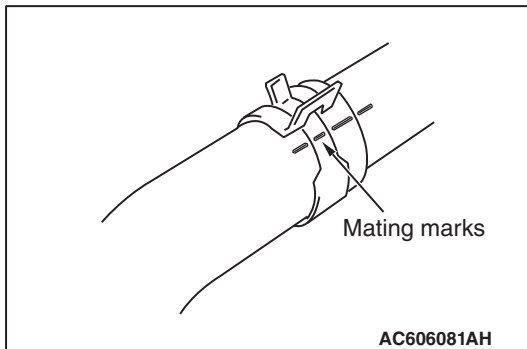
- Front end upper bar (Refer to GROUP 42A, Loose Panel P.42A-198)
13. Bracket
 14. Fan, fan motor and fan shroud assembly
 23. Radiator fan
 24. Radiator fan motor
 25. Condenser fan
 26. Condenser fan motor
 27. Fan shroud

<<A>> >>A<<

REMOVAL SERVICE POINTS

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

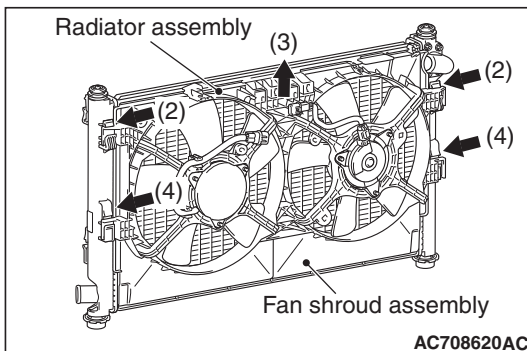
Make mating marks on the radiator hose and the hose clamp as shown to install them in the original position. Then, remove them.

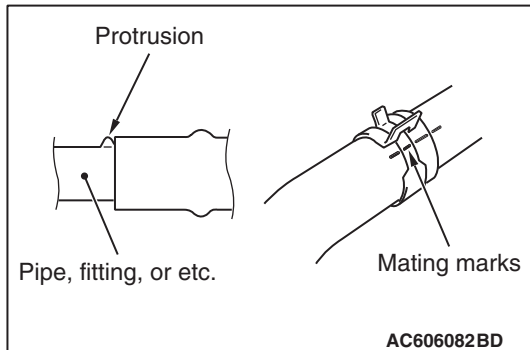


<> BRACKET/FAN, FAN MOTOR AND FAN SHROUD ASSEMBLY REMOVAL

Remove the fan, fan motor, and fan shroud assembly from the radiator assembly with the following steps.

1. Remove the bracket.
2. Release the upper locks of the radiator assembly from the fan, fan motor, and fan shroud assembly.
3. Slightly raise the fan, fan motor, and fan shroud assembly.
4. Release the lower locks of the radiator assembly from the fan, fan motor, and fan shroud assembly. Then, remove the fan, fan motor, and fan shroud assembly from the radiator assembly.



INSTALLATION SERVICE POINT**>>A<< RADIATOR LOWER HOSE/RADIATOR
UPPER HOSE INSTALLATION**

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