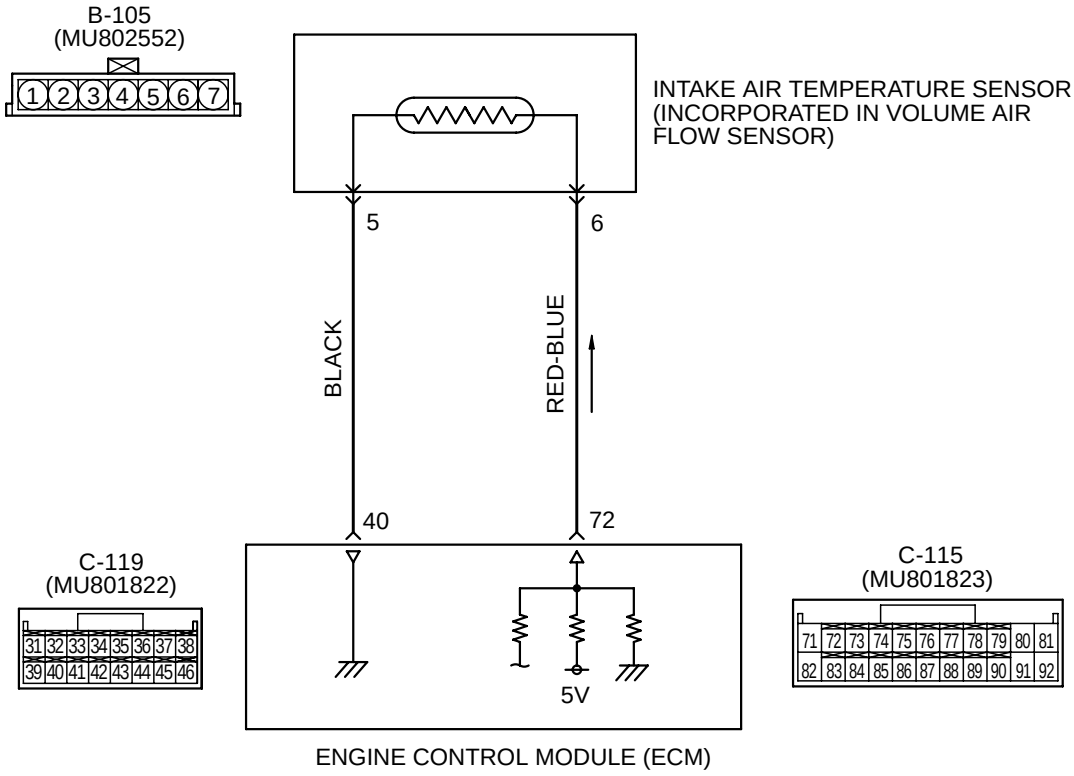
DTC P0111: INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE PROBLEM

Intake Air Temperature Sensor Circuit



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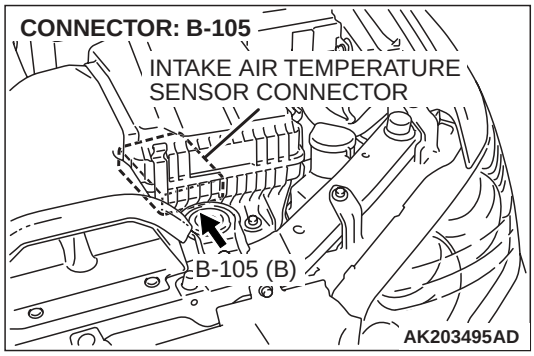
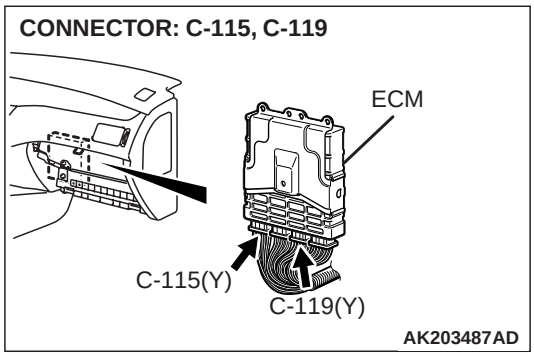




CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 6) from the ECM (terminal No. 72) via the resistor in the ECM. The ground terminal (terminal No. 5) is grounded with ECM (terminal No. 40).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The intake air temperature sensor converts the intake air temperature to a voltage.
- The ECM checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- Repeat 5 or more times: drive[*1], stop[*2].

TSB Revision

Drive[*1]: vehicle speed higher than 50 km/h (31 mph) lasting a total of more than 60 seconds.

Stop[*2]: vehicle speed lower than 1.5 km/h (0.9 mph) lasting more than 30 seconds.

Judgement Criteria

- Changes in the intake air temperature is lower than 1°C (1.8°F).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Intake air temperature sensor failed.
- Open intake air temperature sensor circuit, harness damage, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

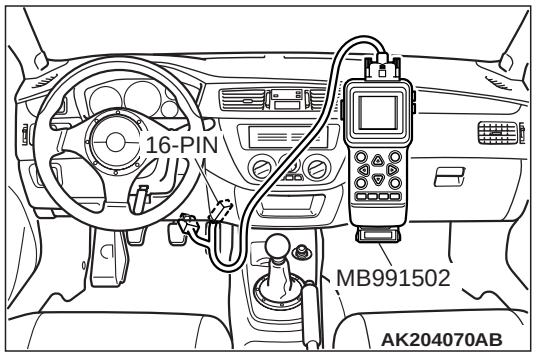
- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

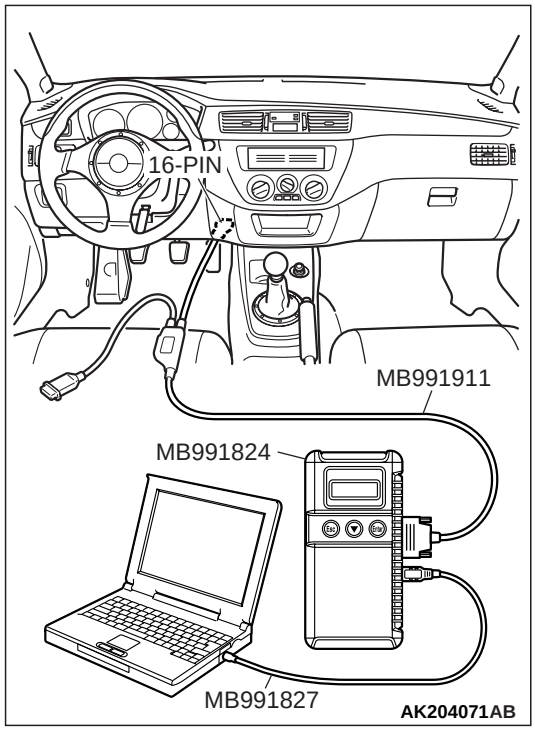
STEP 1. Using scan tool MB991502 or MB991958, check data list item 13: Intake Air Temperature Sensor.

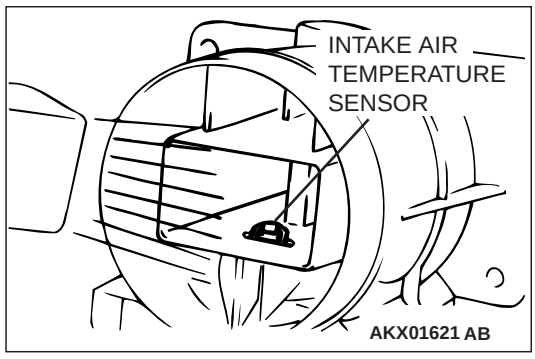
⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Remove the air intake hose from the volume airflow sensor.
(3) Turn the ignition switch to the "ON" position.
(4) Set scan tool MB991502 or MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.







(5) Heating the sensor using a hair drier.
- The indicated temperature increases.

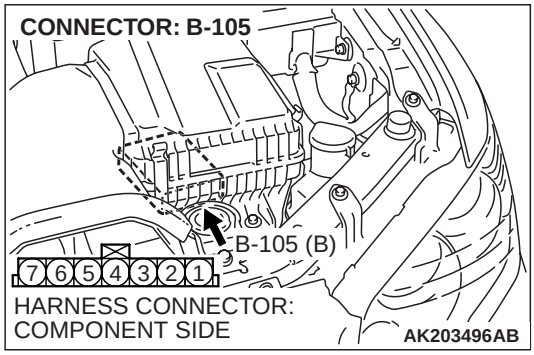
NOTE: Do not allow it to increase over 80°C (176°F).

(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Attach the air intake hose.

Q: Is the sensor operating properly?

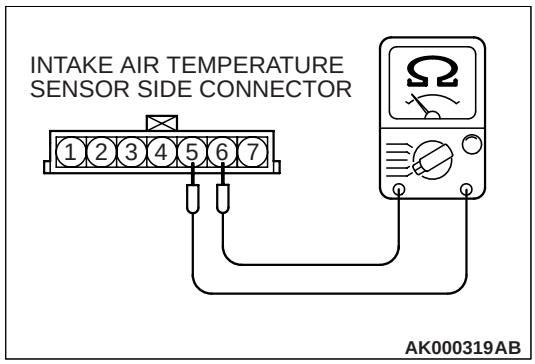
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

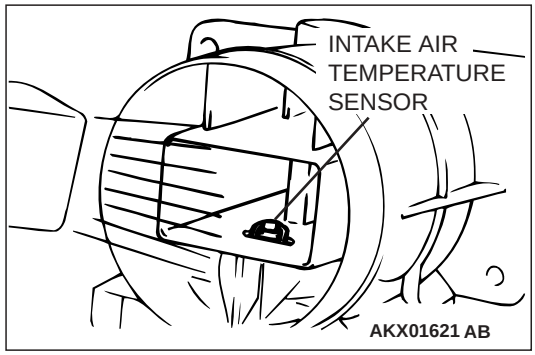


STEP 2. Check the intake air temperature sensor.

(1) Disconnect the intake air temperature sensor connector B-105.



(2) Measure the resistance between intake air temperature sensor side connector terminals No. 5 and No. 6.



(3) Measure resistance while heating the sensor using a hair drier.

Standard value:
13 – 17 kΩ [at –20°C (–4°F)]
5.3 – 6.7 kΩ [at 0°C (32°F)]
2.3 – 3.0 kΩ [at 20°C (68°F)]
1.0 – 1.5 kΩ [at 40°C (104°F)]
0.56 – 0.76 kΩ [at 60°C (140°F)]
0.30 – 0.42 kΩ [at 80°C (176°F)]

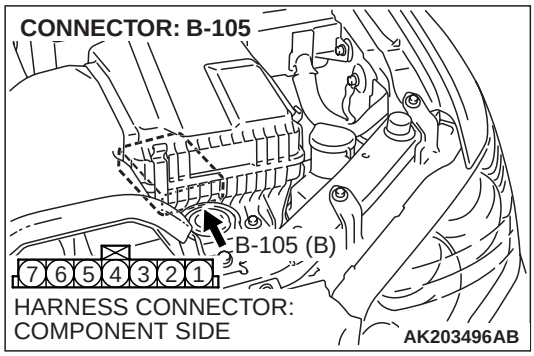
Q: Is the resistance at the standard value?

YES : Go to Step 3.
NO : Replace the volume airflow sensor. Then go to Step 9.

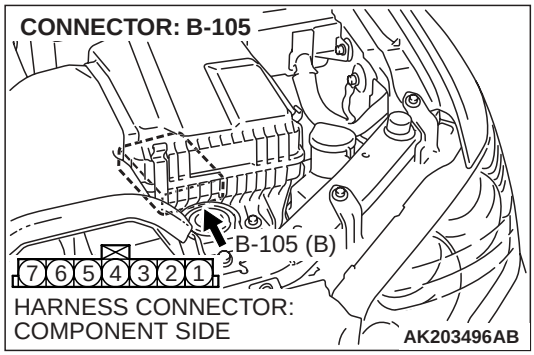
STEP 3. Check harness connector B-105 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

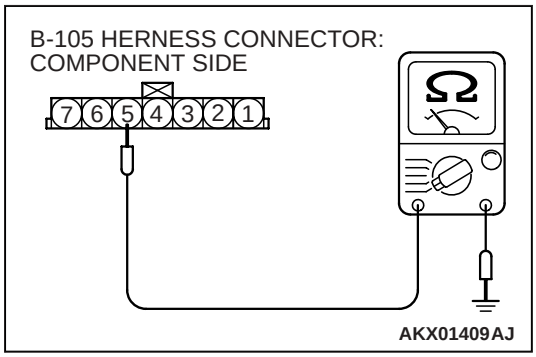
YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.



STEP 4. Check for continuity at intake air temperature sensor harness side connector B-105.



(1) Disconnect connector B-105 and measure at the harness side.

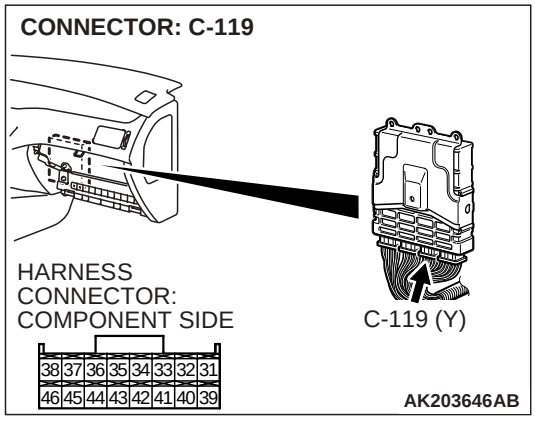


(2) Check for the continuity between terminal No. 5 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

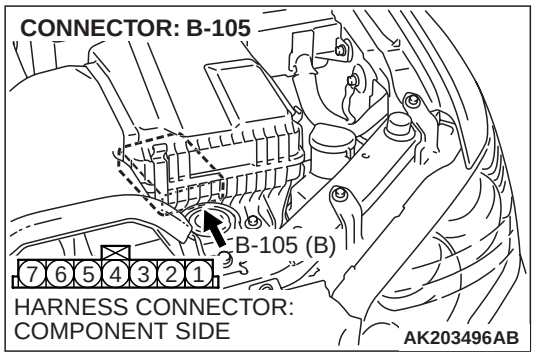
YES : Go to Step 7.
NO : Go to Step 5.

STEP 5. Check harness connector C-119 at ECM for damage.



Q: Is the harness connector in good condition?

YES : Go to Step 6.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.

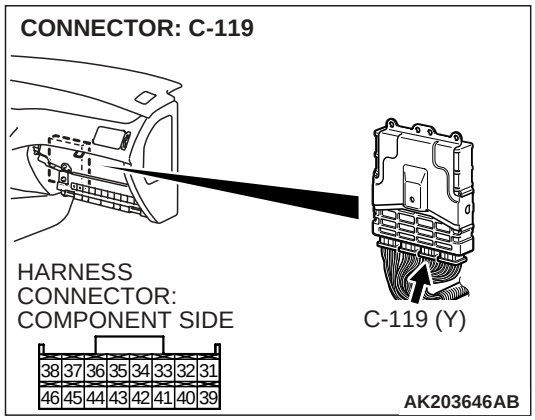


STEP 6. Check for open circuit and harness damage between intake air temperature sensor connector B-105 and ECM connector C-119.

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 9.

NO : Repair it. Then go to Step 9.

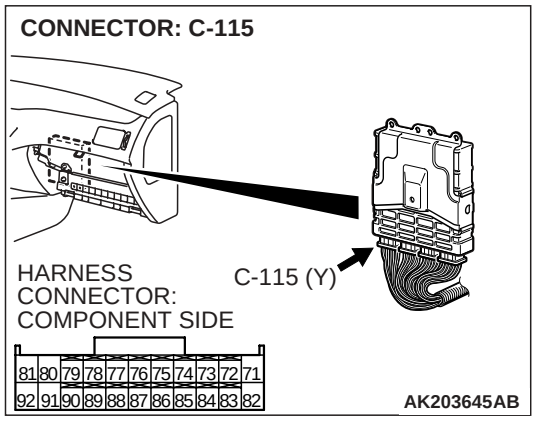


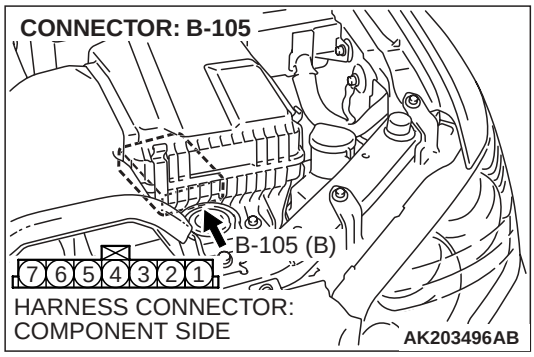
STEP 7. Check harness connector C-115 at ECM for damage.

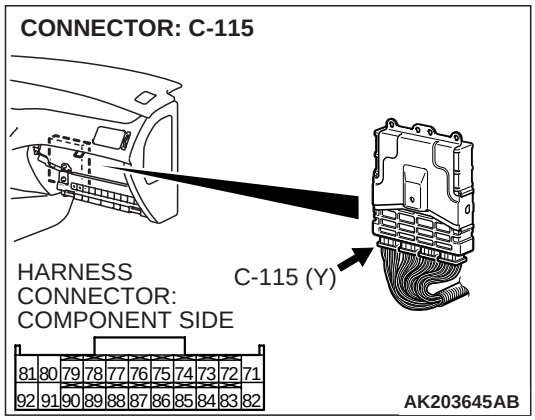
Q: Is the harness connector in good condition?

YES : Go to Step 8.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9







STEP 8. Check for open circuit and harness damage between intake air temperature sensor connector B-105 and ECM connector C-115.

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 9. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

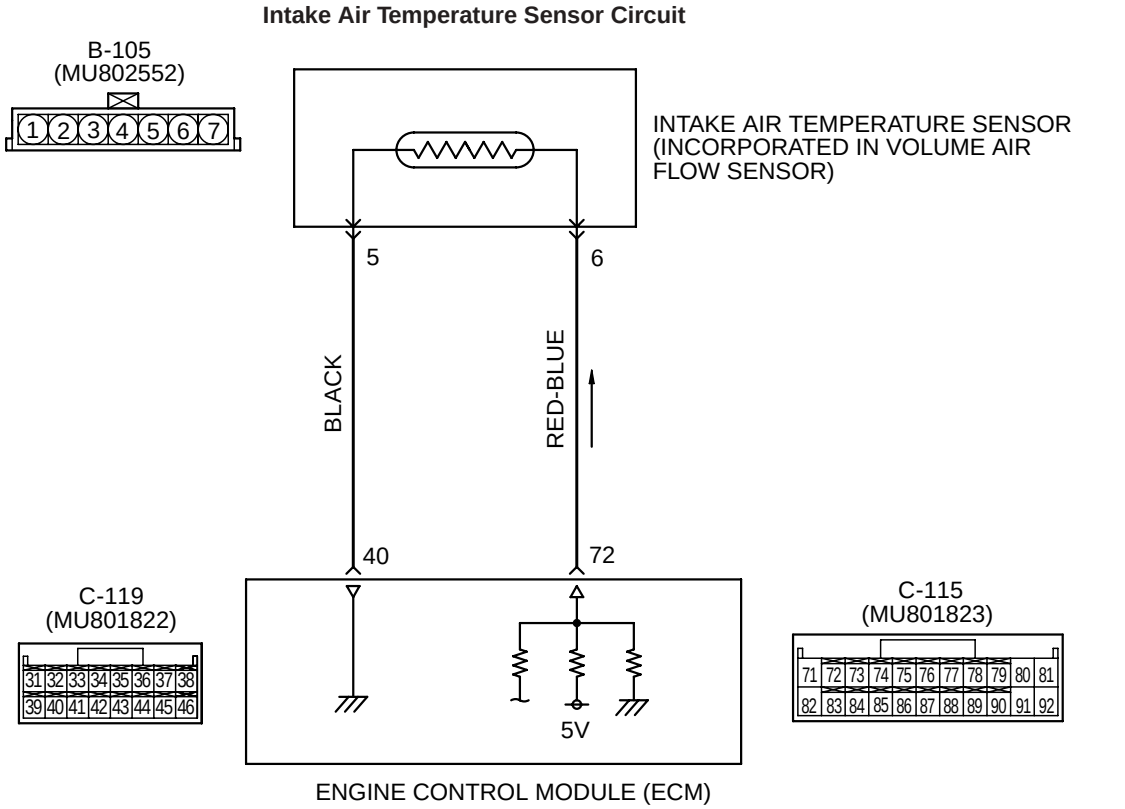
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0111 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0112: INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT



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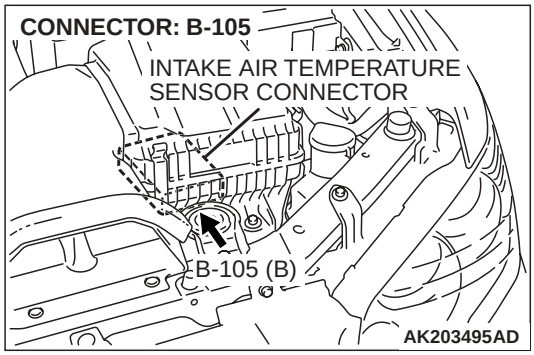
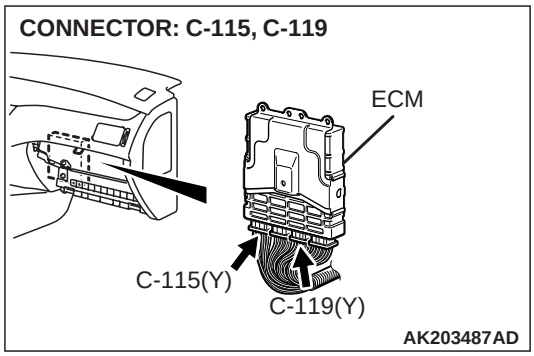




CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 6) from the ECM (terminal No. 72) via the resistor in the ECM. The ground terminal (terminal No. 5) is grounded with ECM (terminal No. 40).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The intake air temperature sensor converts the intake air temperature to a voltage.
- The ECM checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the staring sequence was completed.

TSB Revision

Judgement Criteria

- Intake air temperature sensor output voltage has continued to be 0.2 volt or lower [corresponding to an air intake temperature of 115°C (239°F) or higher] for 2 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Intake air temperature sensor failed.
- Shorted intake air temperature sensor circuit, or connector damage.
- ECM failed.

DIAGNOSIS

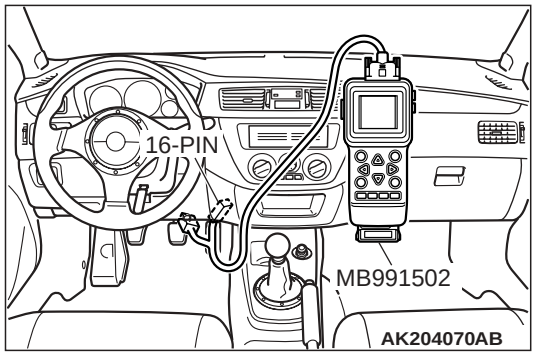
Required Special Tools:

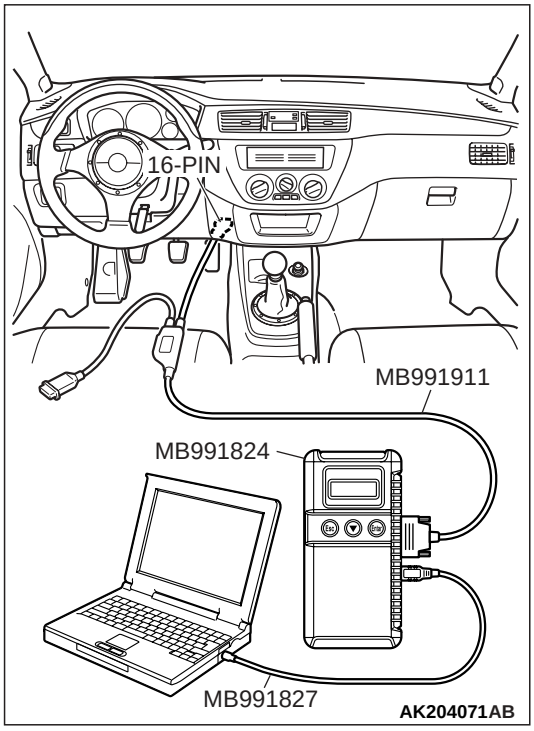
- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

STEP 1. Using scan tool MB991502 or MB991958, check data list item 13: Intake Air Temperature Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.



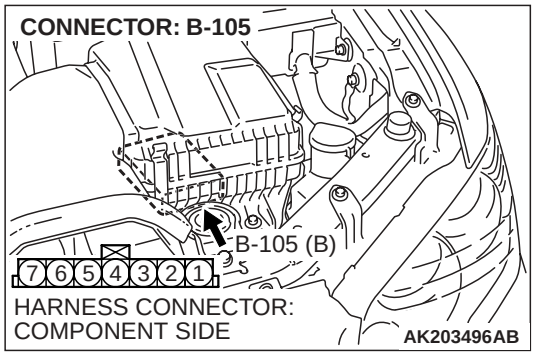


(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
  - The intake air temperature and temperature shown with the scan tool should approximately match.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

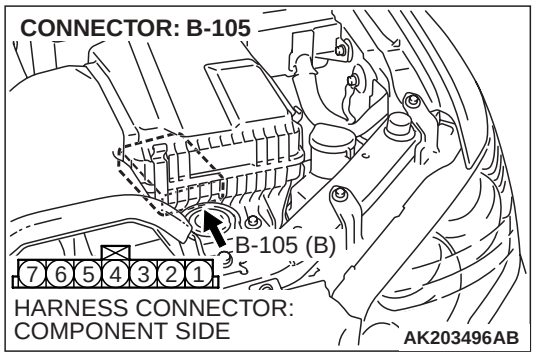


STEP 2. Check harness connector B-105 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

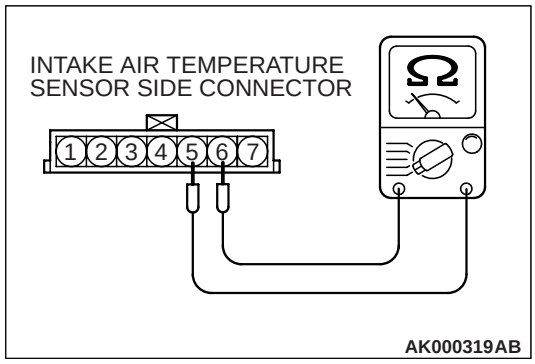
YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 6.



STEP 3. Check the intake air temperature sensor.

(1) Disconnect the intake air temperature sensor connector B-105.



(2) Measure the resistance between intake air temperature sensor side connector terminal No. 5 and No. 6.
- There should be continuity. (0.30 – 1.0 kΩ)

Q: Is the measured resistance between 0.30 and 1.0 kΩ?

YES : Go to Step 4.

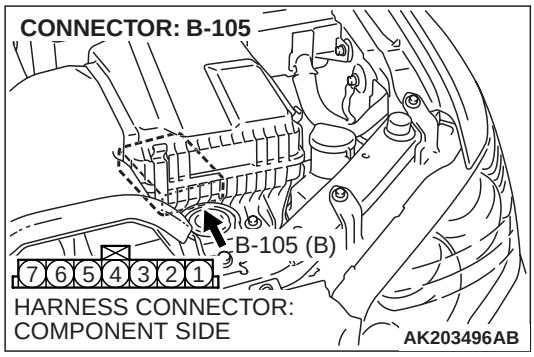
NO : Replace the volume airflow sensor. Then go to Step 6.

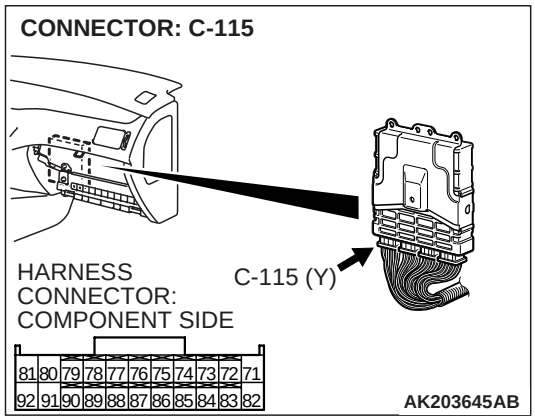
STEP 4. Check for short circuit to ground between intake air temperature sensor connector B-105 and ECM connector C-115.

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 6.



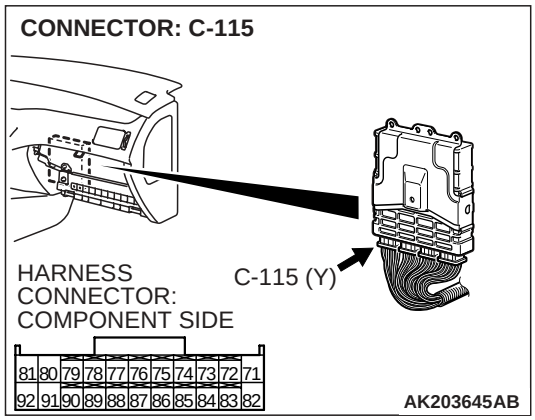


STEP 5. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Replace the ECM. Then go to Step 6.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 6.



STEP 6. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

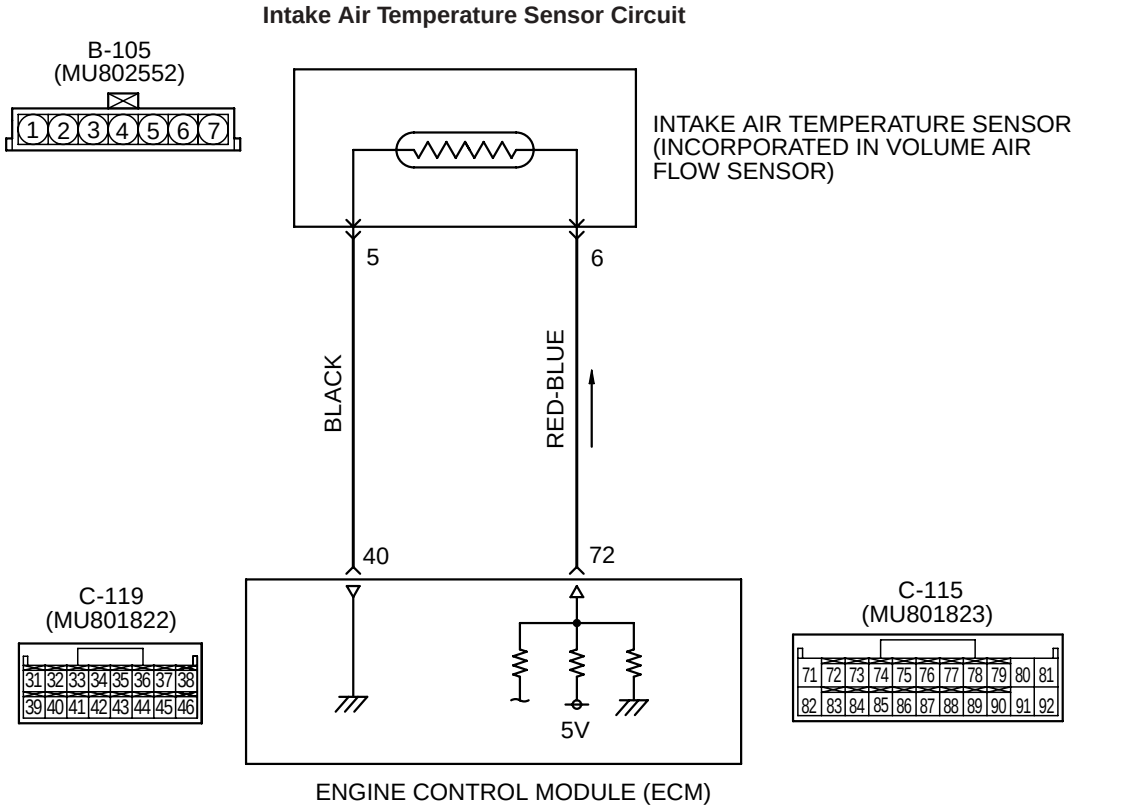
Q: Is DTC P0112 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

TSB Revision

DTC P0113: INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT



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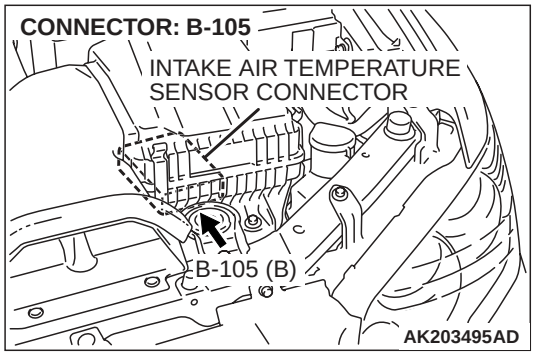
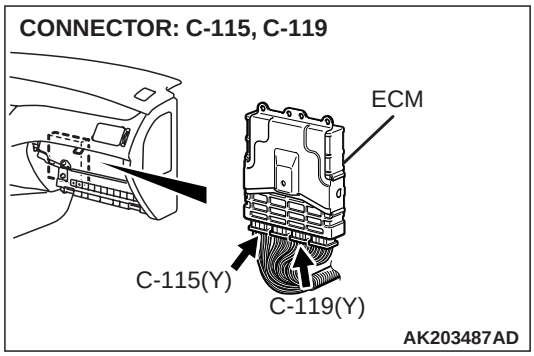




CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 6) from the ECM (terminal No. 72) via the resistor in the ECM. The ground terminal (terminal No. 5) is grounded with ECM (terminal No. 40).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The intake air temperature sensor converts the intake air temperature to a voltage.
- The ECM checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the staring sequence was completed.

TSB Revision

Judgement Criteria

- Intake air temperature sensor output voltage has continued to be 4.6 volts or higher [corresponding to an air intake temperature of –40°C (–40°F) or lower] for 2 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Intake air temperature sensor failed.
- Open intake air temperature sensor circuit, or loose connector.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

STEP 1. Using scan tool MB991502 or MB991958, check data list item 13: Intake Air Temperature Sensor.

⚠ CAUTION

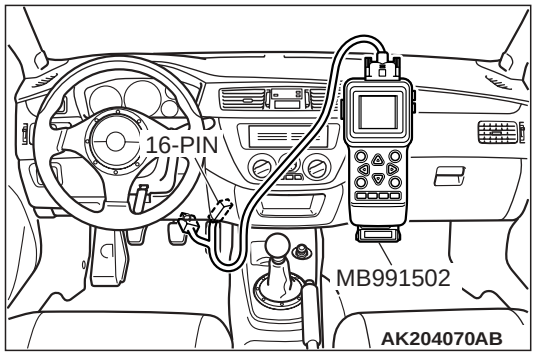
To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

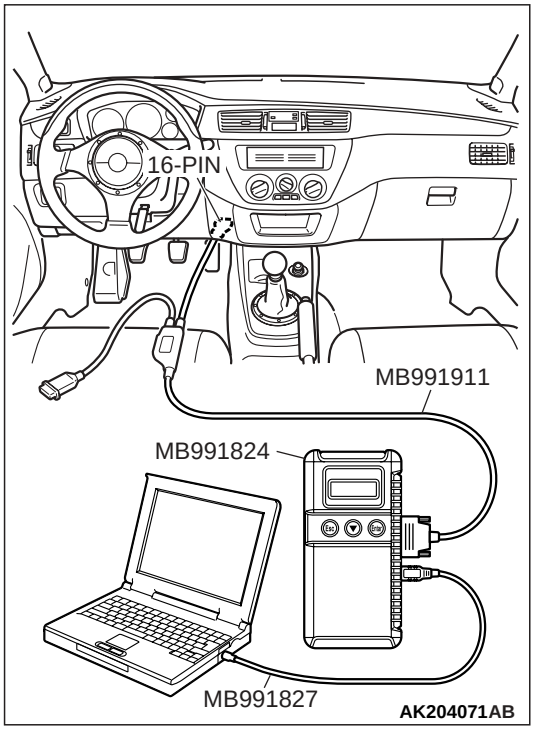
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
  - The intake air temperature and temperature shown with the scan tool should approximately match.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

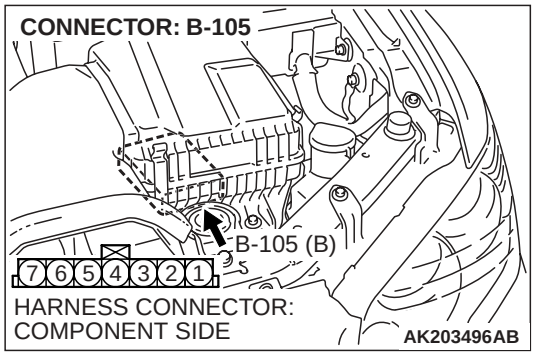
Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.





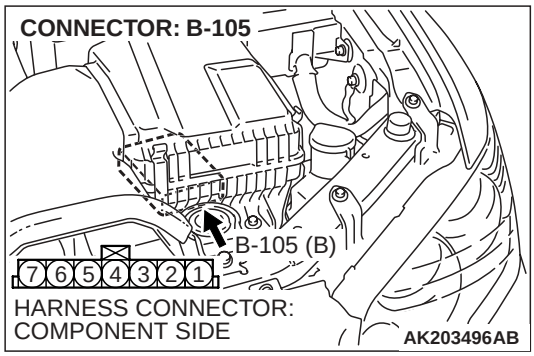


STEP 2. Check harness connector B-105 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

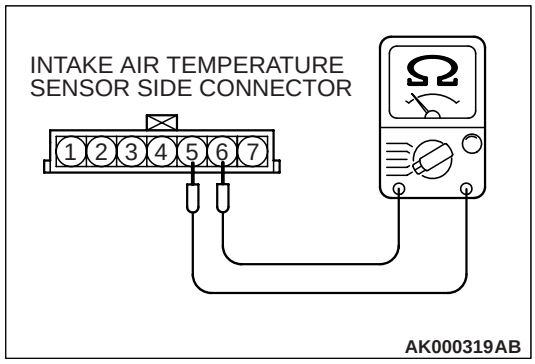
YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.



STEP 3. Check the intake air temperature sensor.

(1) Disconnect the intake air temperature sensor connector B-105.



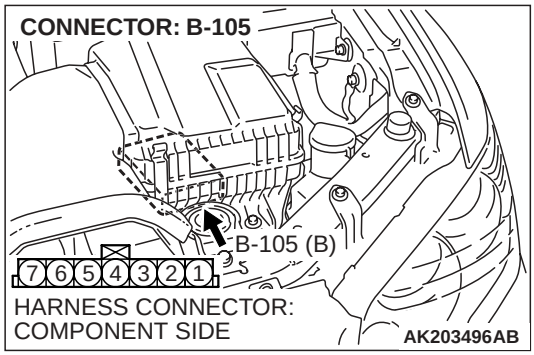
(2) Measure the resistance between intake air temperature sensor side connector terminal No. 5 and No. 6.
- There should be continuity. (0.30 – 1.0 kΩ)

Q: Is the measured resistance between 0.3 and 1.0 kΩ?

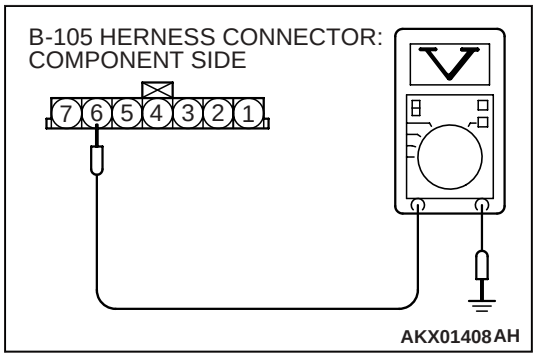
YES : Go to Step 4.

NO : Replace the volume airflow sensor. Then go to Step 11.

STEP 4. Measure the sensor supply voltage at intake air temperature sensor harness side connector B-105.



(1) Disconnect connector B-105 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.



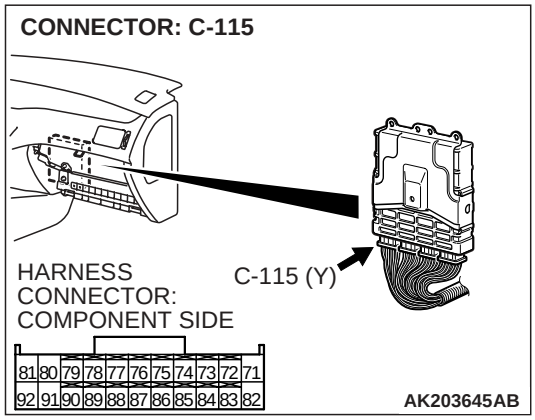
(3) Measure the voltage between terminal No. 6 and ground.
- Voltage should measure between 4.5 and 4.9 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

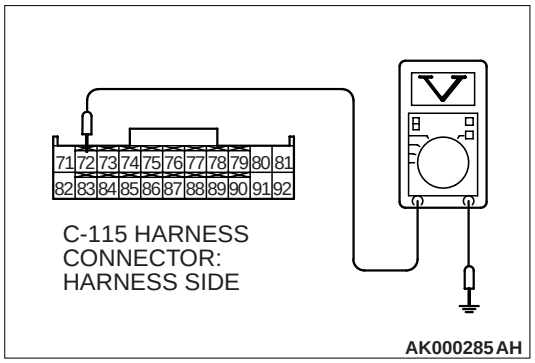
Q: Is the measured voltage between 4.5 and 4.9 volts?

YES : Go to Step 8.
NO : Go to Step 5.

STEP 5. Measure the sensor supply voltage at ECM connector C-115 by backprobing.



(1) Do not disconnect the ECM connector C-115.
(2) Disconnect the intake air temperature sensor connector B-105.
(3) Turn the ignition switch to the "ON" position.

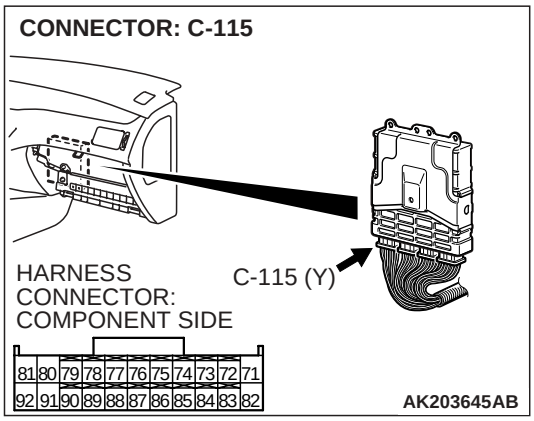


(4) Measure the voltage between terminal No. 72 and ground by backprobing.
- Voltage should measure between 4.5 and 4.9 volts.

(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.5 and 4.9 volts?

YES : Go to Step 6.
NO : Go to Step 7.

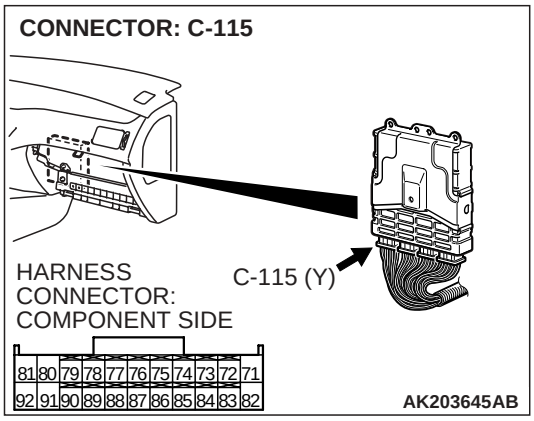


STEP 6. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between intake air temperature sensor connector B-105 and ECM connector C-115 because of open circuit. Then go to Step 11.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.



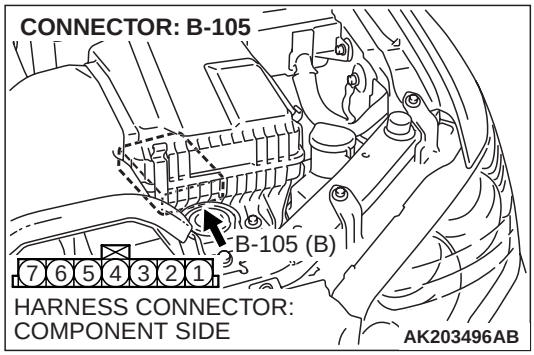
STEP 7. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

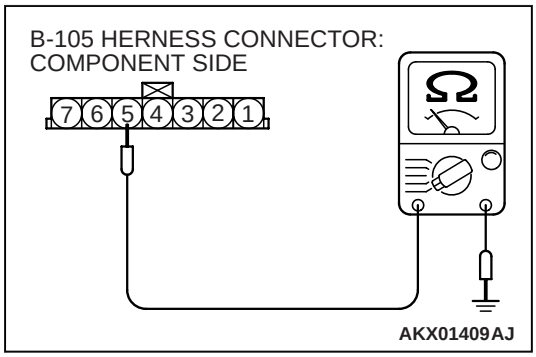
YES : Replace the ECM. Then go to Step 11.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

STEP 8. Check for continuity at intake air temperature sensor harness side connector B-105.



(1) Disconnect connector B-105 and measure at the harness side.

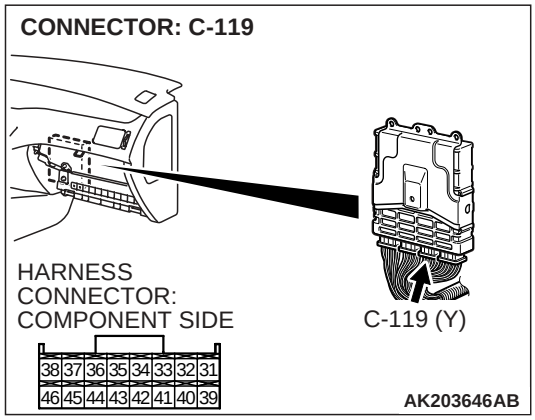


(2) Check for the continuity between terminal No. 5 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

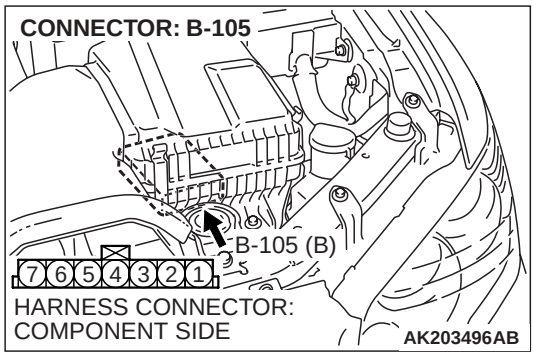
YES : Replace the ECM. Then go to Step 11.
NO : Go to Step 9.

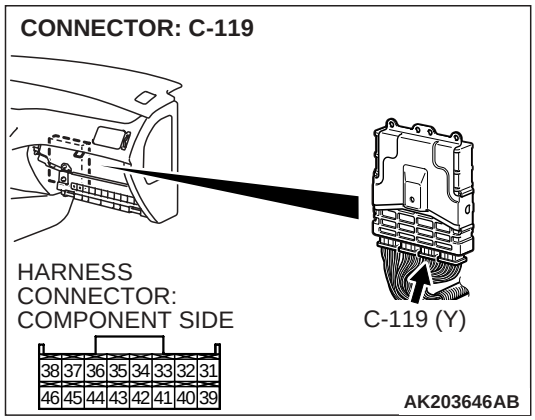
STEP 9. Check harness connector C-119 at ECM for damage.



Q: Is the harness connector in good condition?

YES : Go to Step 10.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.





STEP 10. Check for open circuit between intake air temperature sensor connector B-105 and ECM connector C-119.

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 11.

NO : Repair it. Then go to Step 11.

STEP 11. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

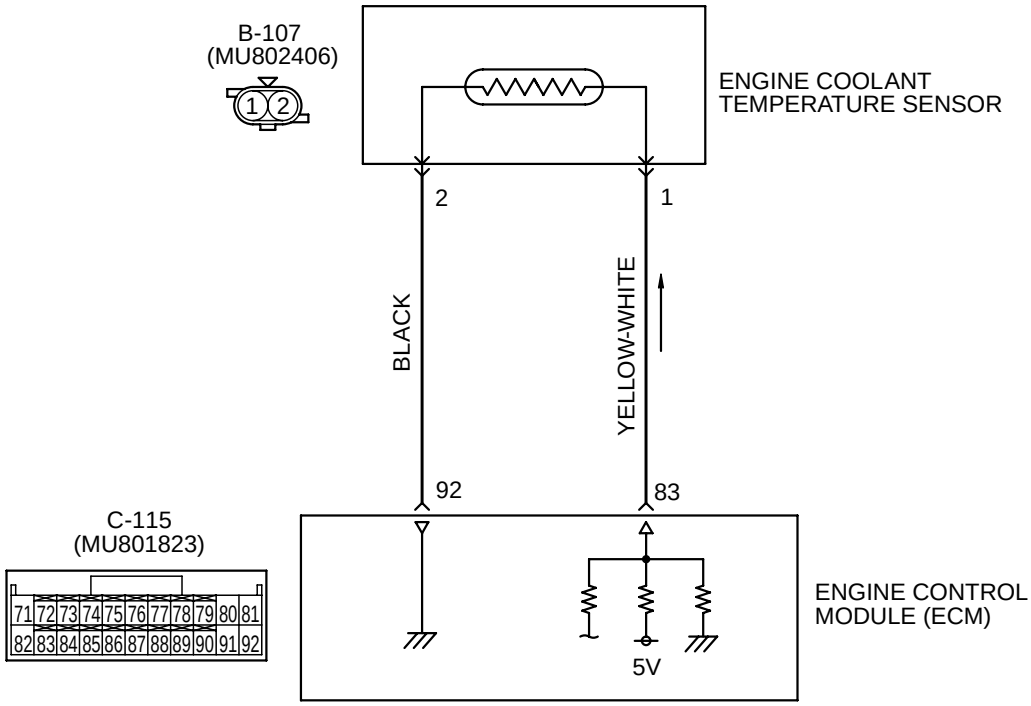
Q: Is DTC P0113 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0116: ENGINE COOLANT TEMPERATURE CIRCUIT RANGE/PERFORMANCE PROBLEM

Enging Coolant Temperature Sensor Circuit



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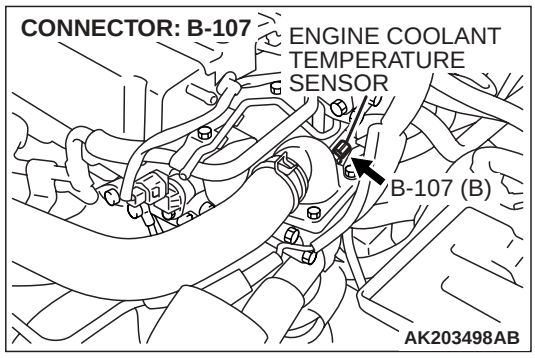
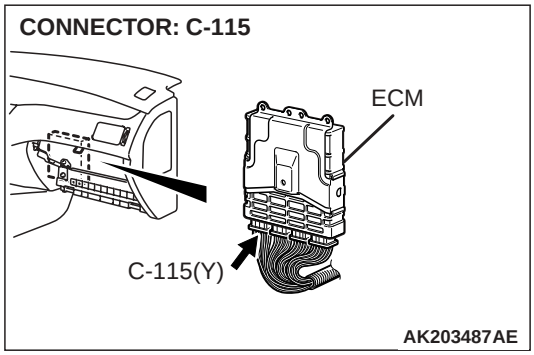




CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 83) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 92).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- Engine coolant temperature was 7°C (44.6°F) or more immediately before the engine was stopped at the last drive.

TSB Revision

- Engine coolant temperature was 7°C (44.6°F) or more when the engine started.

Judgement Criteria

- Engine coolant temperature fluctuates within 1°C (1.8°F) after five minutes have passed since the engine was started.
- However, time is not counted if any of the following conditions are met.
  1. Intake air temperature is 60°C (140°F) or more.
  2. Volume airflow sensor output frequency is 70 Hz or less.
  3. During fuel shut-off operation.
- The ECM monitors for this condition once during the drive cycle.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Engine coolant temperature sensor failed.
- Harness damage or connector damage.
- ECM failed.

DIAGNOSIS

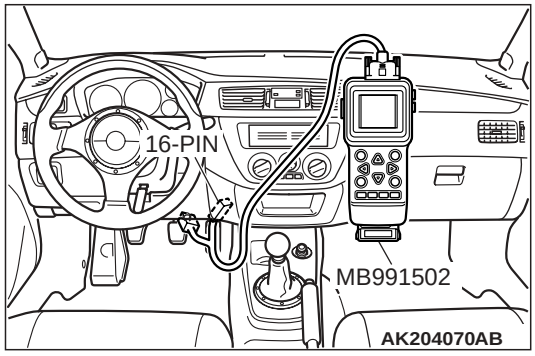
Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

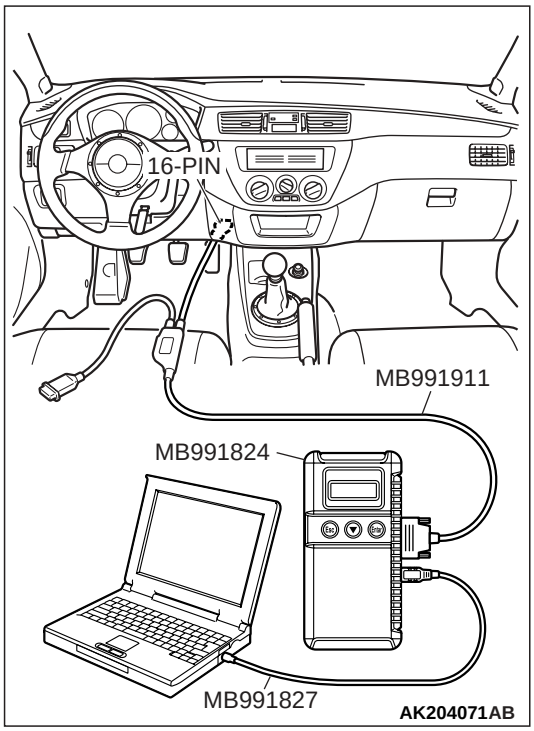
STEP 1. Using scan tool MB991502 or MB991958, check data list item 21: Engine Coolant Temperature Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.



(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately match.
(4) Turn the ignition switch to the "LOCK" (OFF) position.



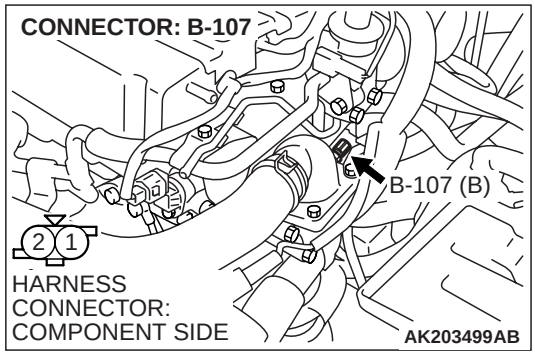
Q: Is the sensor operating properly?

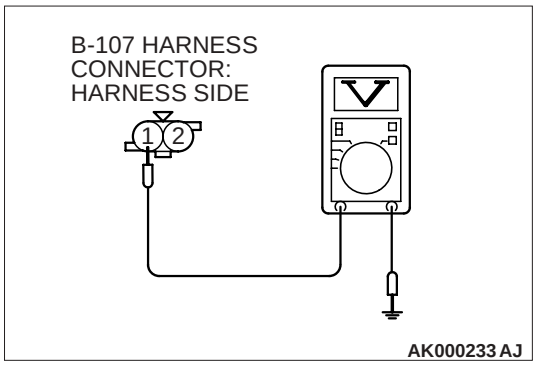
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at engine coolant temperature sensor connector B-107 by backprobing.

(1) Do not disconnect connector B-107.
(2) Turn the ignition switch to the "ON" position.





(3) Measure the voltage between terminal No. 1 and ground by backprobing.
- When engine coolant temperature is –20°C (–4°F), voltage should be between 3.9 and 4.5 volts.
- When engine coolant temperature is 0°C (32°F), voltage should be between 3.2 and 3.8 volts.
- When engine coolant temperature is 20°C (68°F), voltage should be between 2.3 and 2.9 volts.
- When engine coolant temperature is 40°C (104°F), voltage should be between 1.3 and 1.9 volts.
- When engine coolant temperature is 60°C (140°F), voltage should be between 0.7 and 1.3 volts.
- When engine coolant temperature is 80°C (176°F), voltage should be between 0.3 and 0.9 volt.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

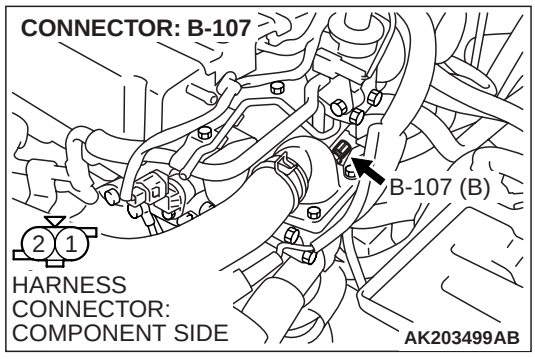
Q: Is the measured voltage within the specified range?

YES : Go to Step 3.
NO : Go to Step 5.

STEP 3. Check harness connector B-107 at the engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

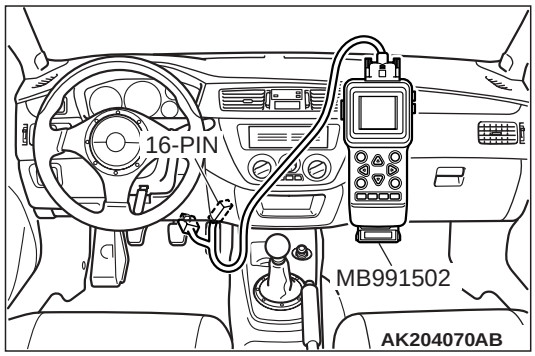
YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.



STEP 4. Using scan tool MB991502 or MB991958, check data list item 21: Engine Coolant Temperature Sensor.

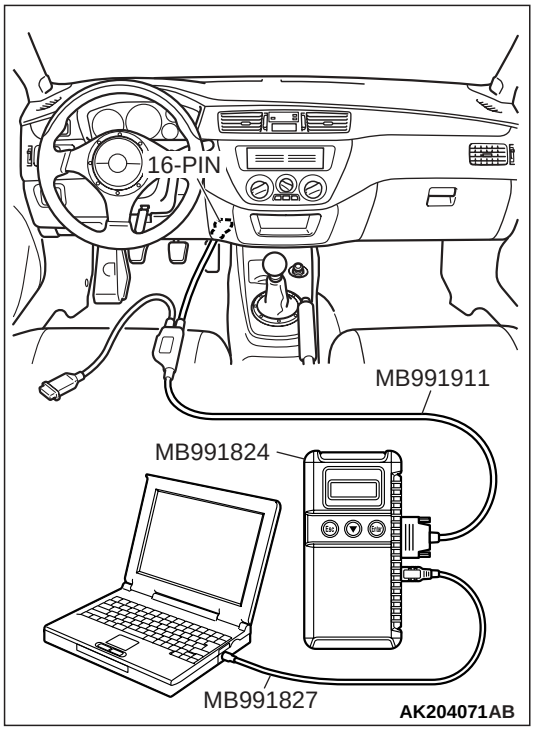
⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.



(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
- The engine coolant temperature and temperature shown with the scan tool should approximately match.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

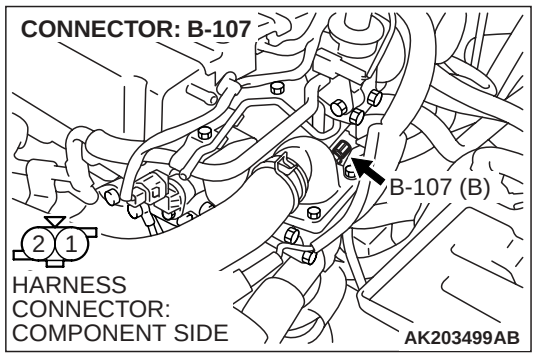


Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Replace the ECM. Then go to Step 14.

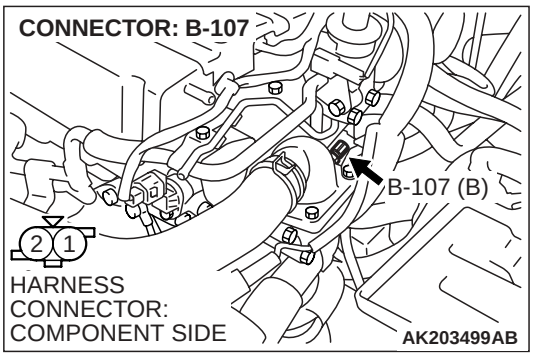
STEP 5. Check harness connector B-107 at engine coolant temperature sensor for damage.



Q: Is the harness connector in good condition?

YES : Go to Step 6.

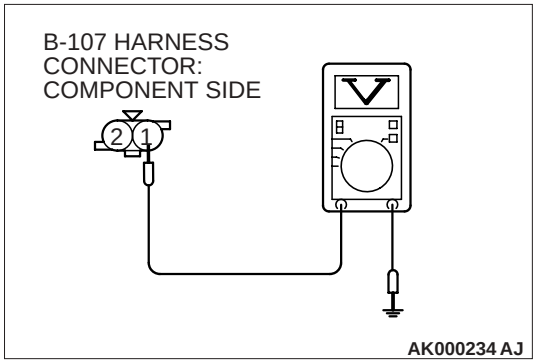
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.



STEP 6. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-107.

(1) Disconnect connector B-107 and measure at the harness side.

(2) Turn the ignition switch to the "ON" position.

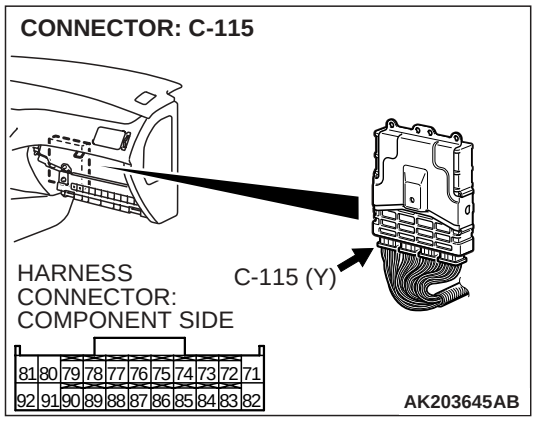


(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should measure between 4.5 and 4.9 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.5 and 4.9 volts?

YES : Go to Step 8.
NO : Go to Step 7.



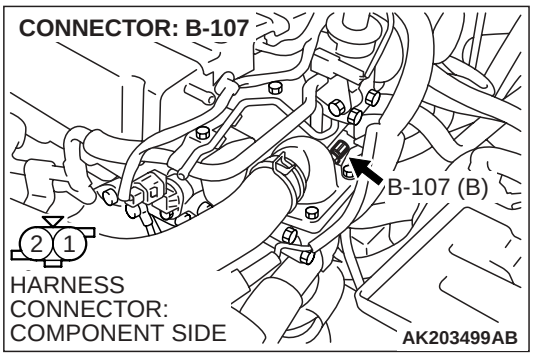
STEP 7. Check harness connector C-115 at ECM for damage.

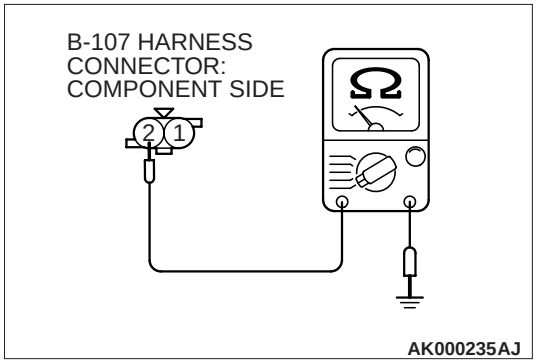
Q: Is the harness connector in good condition?

YES : Replace the ECM. Then go to Step 14.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 8. Check for continuity at engine coolant temperature sensor harness side connector B-107.

(1) Disconnect connector B-107 and measure at the harness side.





(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

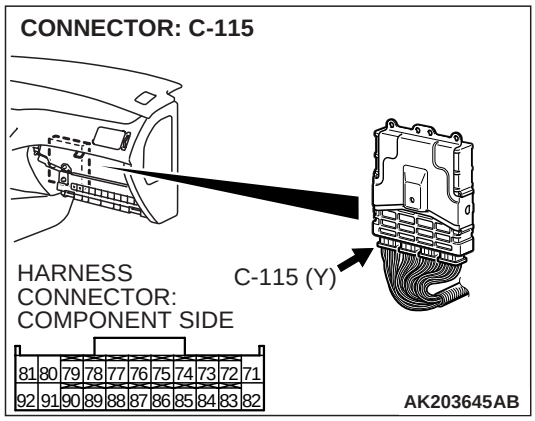
Q: Does continuity exist?

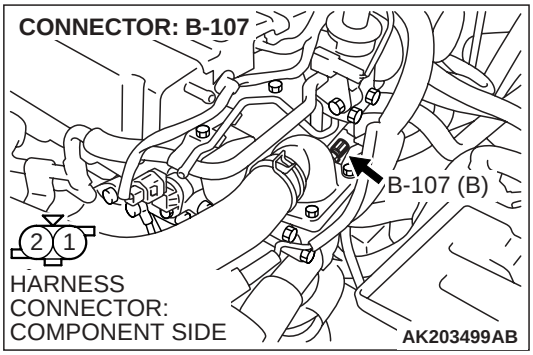
YES : Go to Step 11.
NO : Go to Step 9.

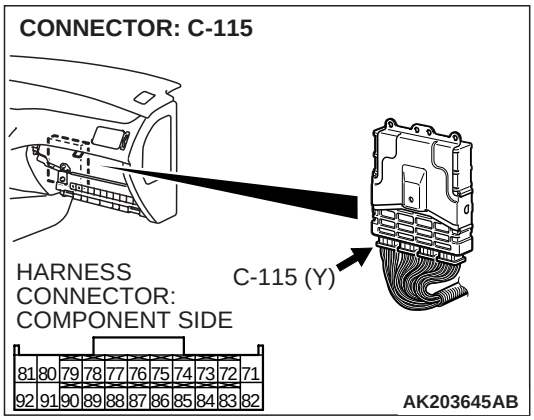
STEP 9. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.





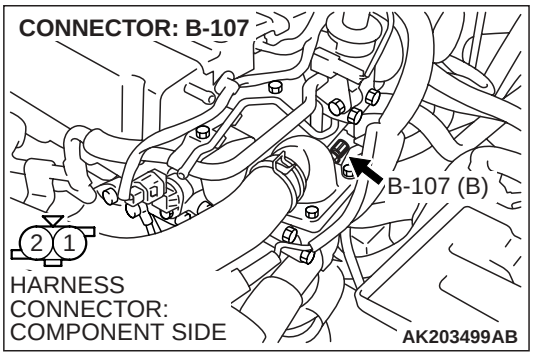


STEP 10. Check for harness damage between engine coolant temperature sensor connector B-107 (terminal No. 2) and ECM connector C-115 (terminal No. 92).

Q: Is the harness wire in good condition?

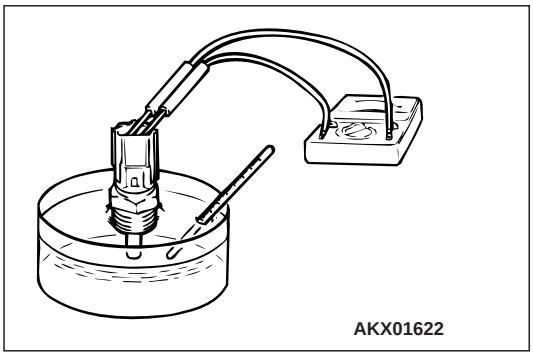
YES : Replace the ECM. Then go to Step 14.

NO : Repair it. Then go to Step 14.



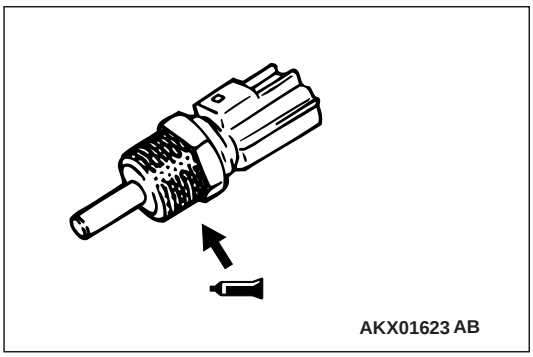
STEP 11. Check the engine coolant temperature sensor.

(1) Disconnect the engine coolant temperature sensor connector B-107.
(2) Remove the engine coolant temperature sensor.



(3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:
14 – 17 kΩ [at –20°C (–4°F)]
5.1 – 6.5 kΩ [at 0°C (32°F)]
2.1 – 2.7 kΩ [at 20°C (68°F)]
0.9 – 1.3 kΩ [at 40°C (104°F)]
0.48 – 0.68 kΩ [at 60°C (140°F)]
0.26 – 0.36 kΩ [at 80°C (176°F)]



(4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.
(5) Install the engine coolant temperature sensor, and tighten to the specified torque.

Tightening torque: 29 ± 10 N·m (22 ± 6 ft-lb)

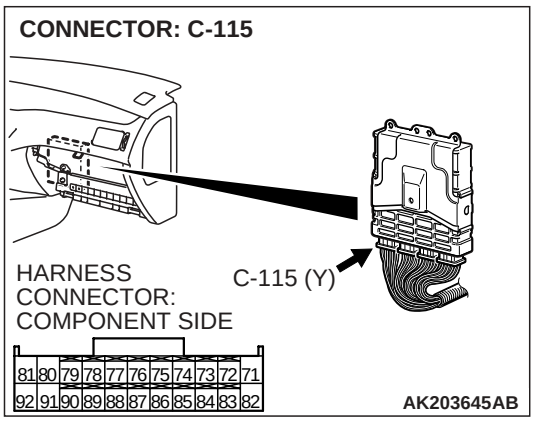
Q: Is the resistance at the standard value?

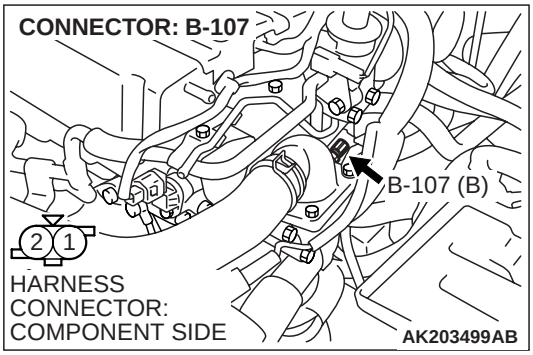
YES : Go to Step 12.
NO : Replace the engine coolant temperature sensor. Then go to Step 14.

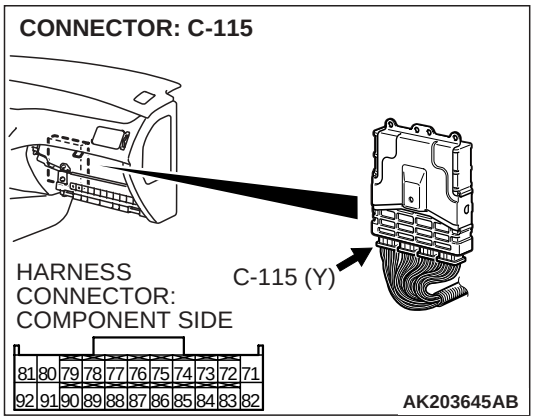
STEP 12. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 13.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.







STEP 13. Check for harness damage between engine coolant temperature sensor connector B-107 (terminal No. 1) and ECM connector C-115 (terminal No. 83).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 14.

NO : Repair it. Then go to Step 14.

STEP 14. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

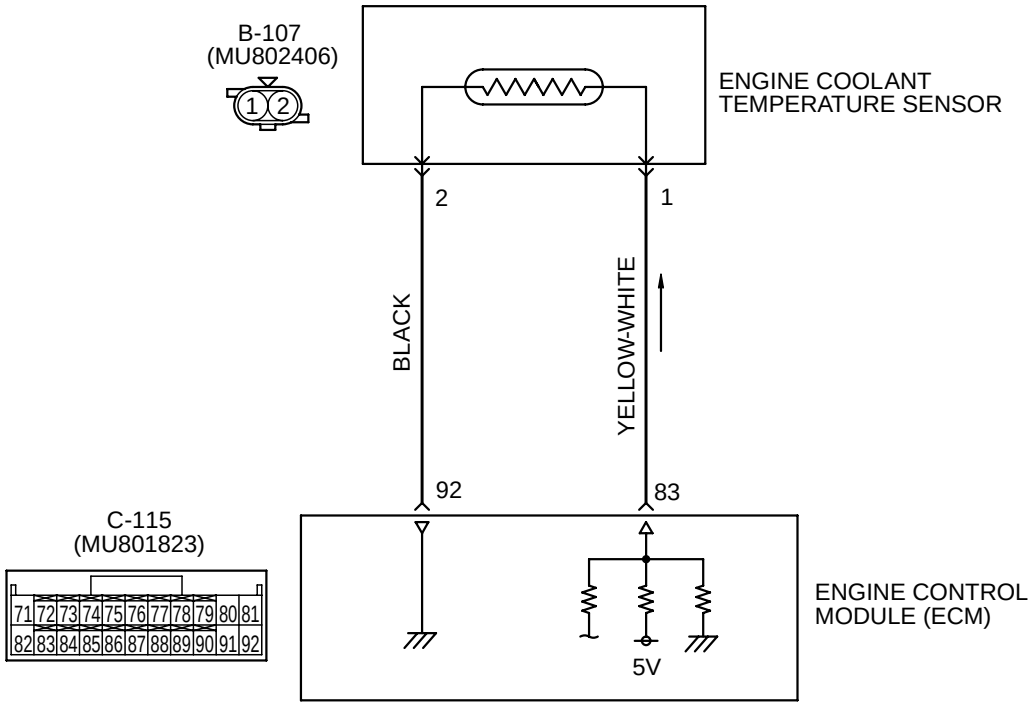
Q: Is DTC P0116 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0117: ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

Enging Coolant Temperature Sensor Circuit



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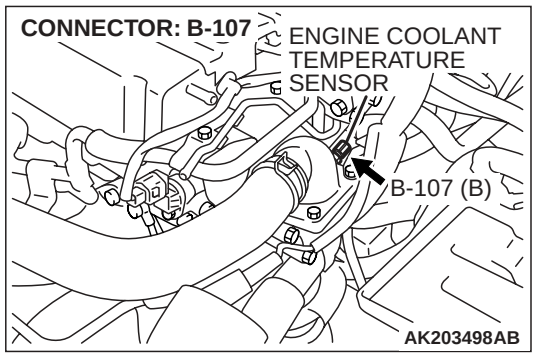
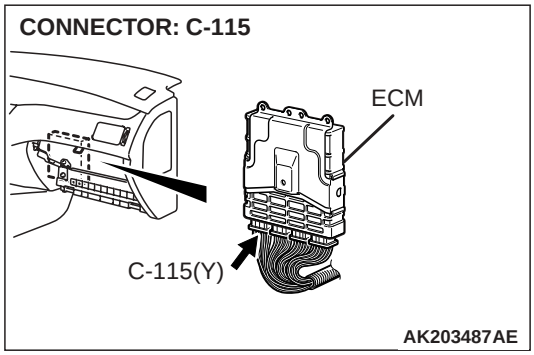




CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 83) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 92).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the engine starting sequence was completed.

TSB Revision

Judgement Criteria

- Engine coolant temperature sensor output voltage has continued to be 0.1 volt or lower [corresponding to a coolant temperature of 140°C (284°F) or higher] for 2 seconds.

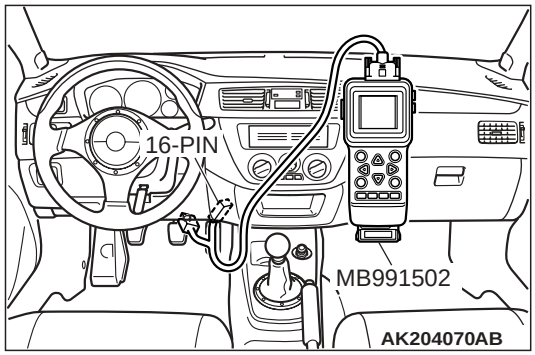
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

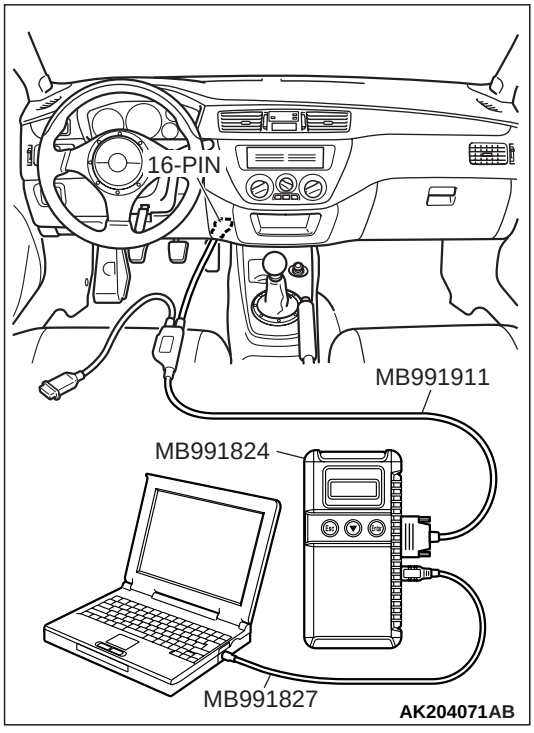
- Engine coolant temperature sensor failed.
- Open or shorted engine coolant temperature sensor circuit, or loose connector.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B





STEP 1. Using scan tool MB991502 or MB991958, check data list item 21: Engine Coolant Temperature Sensor.

⚠ CAUTION

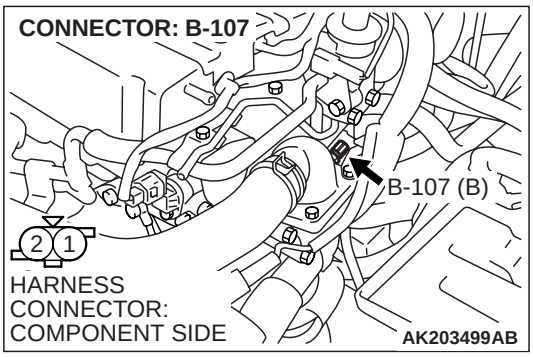
To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately match.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

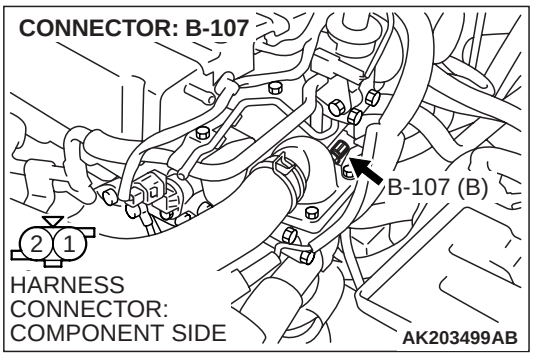


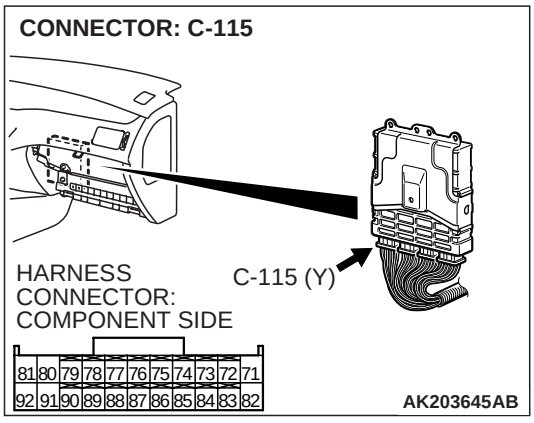
STEP 2. Check harness connector B-107 at the engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 6.



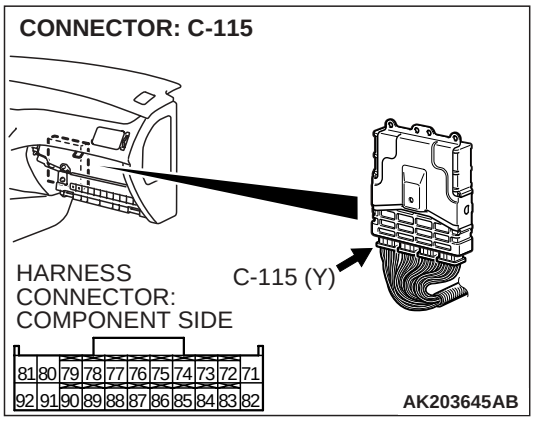


STEP 3. Check for short circuit to ground between engine coolant temperature sensor connector B-107 and ECM connector C-115.

Q: Is the harness wire in good condition?

YES : Go to Step 4.

NO : Repair it. Then go to Step 6.

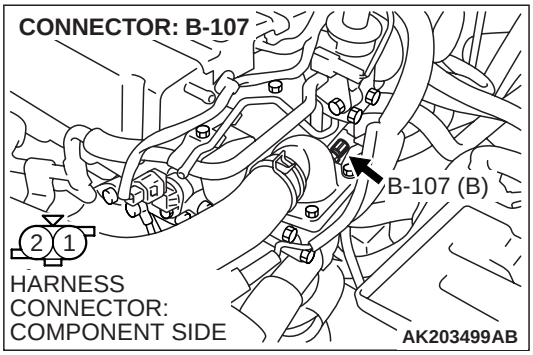


STEP 4. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

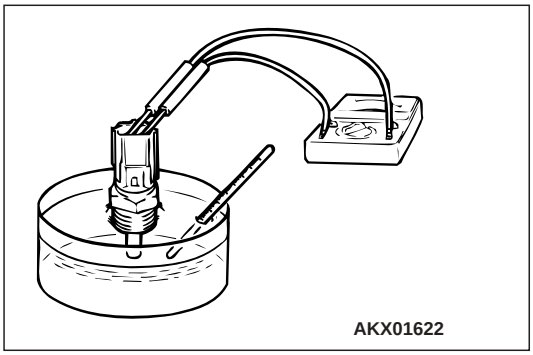
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 6.



STEP 5. Check the engine coolant temperature sensor.

(1) Disconnect the engine coolant temperature sensor connector B-107.

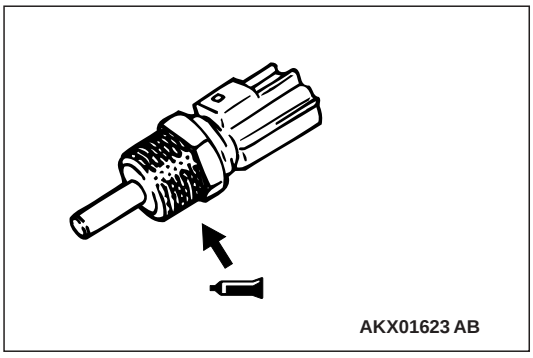
(2) Remove the engine coolant temperature sensor.



(3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:

14 – 17 kΩ [at –20°C (–4°F)]
5.1 – 6.5 kΩ [at 0°C (32°F)]
2.1 – 2.7 kΩ [at 20°C (68°F)]
0.9 – 1.3 kΩ [at 40°C (104°F)]
0.48 – 0.68 kΩ [at 60°C (140°F)]
0.26 – 0.36 kΩ [at 80°C (176°F)]



(4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.

(5) Install the engine coolant temperature sensor, and tighten to the specified torque.

Tightening torque: 29 ± 10 N·m (22 ± 6 ft-lb)

Q: Is the resistance at the standard value?

YES : Replace the ECM. Then go to Step 6.

NO : Replace the engine coolant temperature sensor. Then go to Step 6.

STEP 6. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

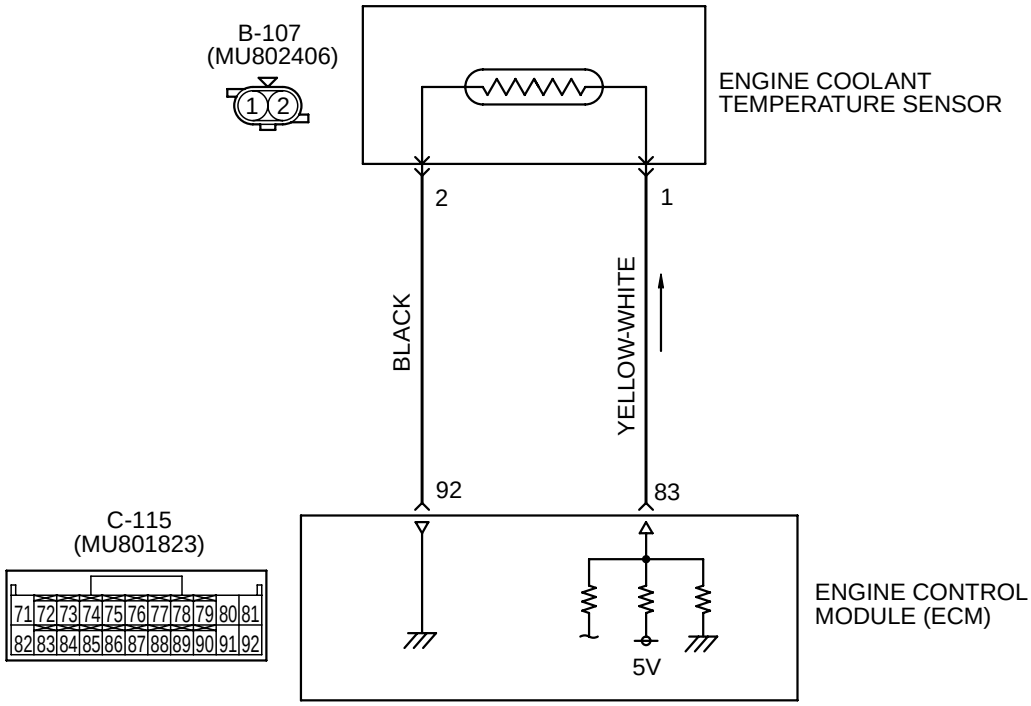
Q: Is DTC P0117 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0118: ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

Enging Coolant Temperature Sensor Circuit



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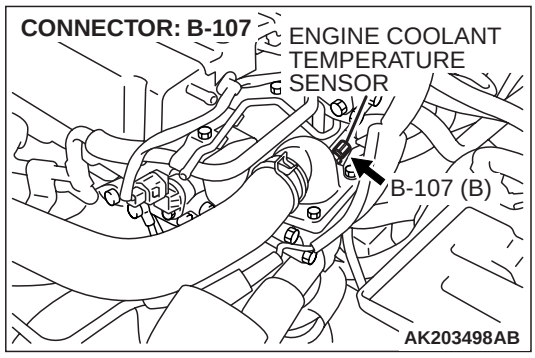
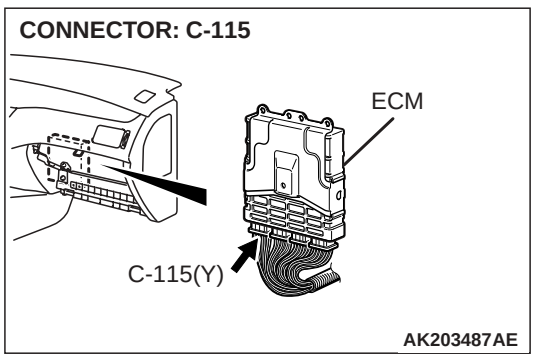




TSB Revision

CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 83) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 92).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the engine starting sequence was completed.

Judgement Criteria

- Engine coolant temperature sensor output voltage has continued to be 4.6 volts or higher [corresponding to a coolant temperature of –45°C (–49°F) or lower] for 2 seconds.

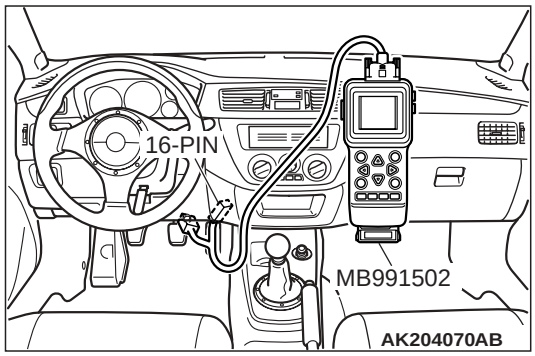
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Engine coolant temperature sensor failed.
- Open or shorted engine coolant temperature sensor circuit, or loose connector.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B



STEP 1. Using scan tool MB991502 or MB991958, check data list item 21: Engine Coolant Temperature Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

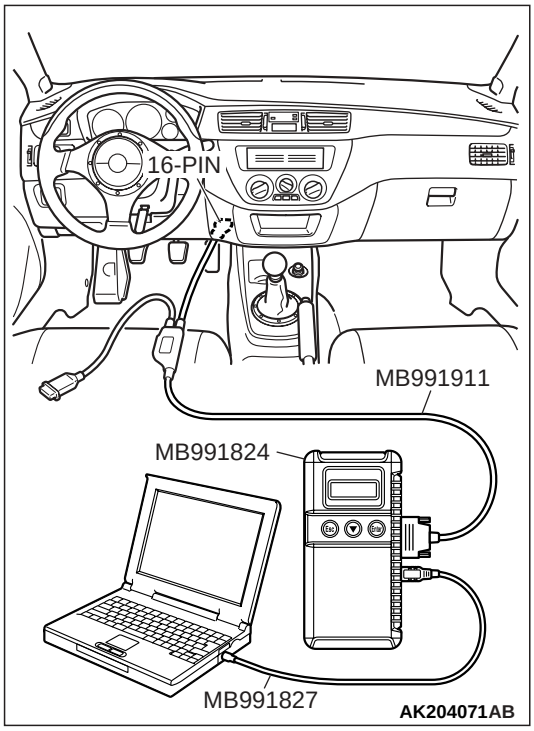
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
- The engine coolant temperature and temperature shown with the scan tool should approximately match.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

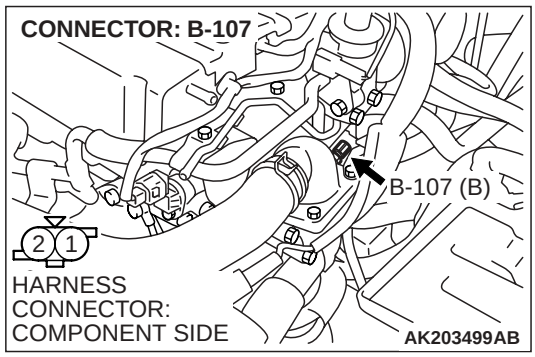


STEP 2. Check harness connector B-107 at the engine coolant temperature sensor for damage.

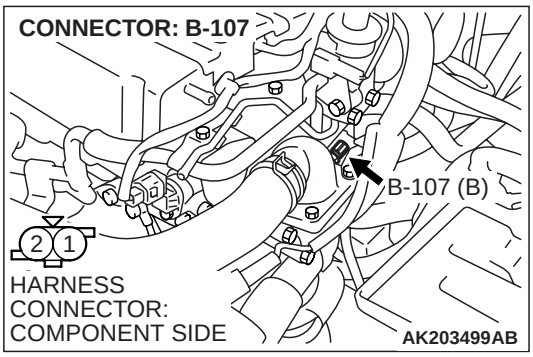
Q: Is the harness connector in good condition?

YES : Go to Step 3.

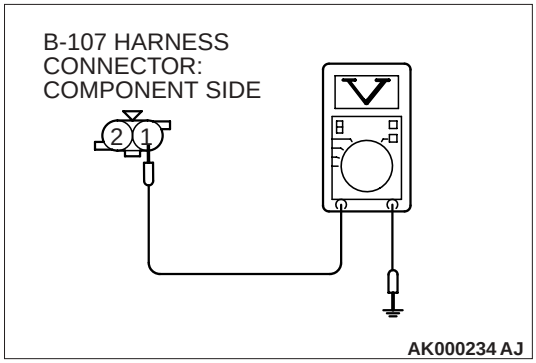
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.



STEP 3. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-107.



(1) Disconnect connector B-107 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.



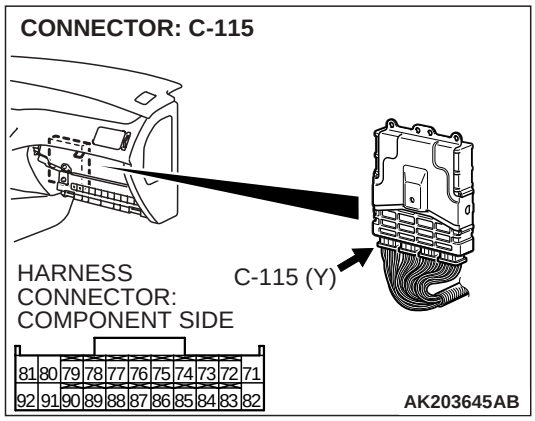
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should measure between 4.5 and 4.9 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

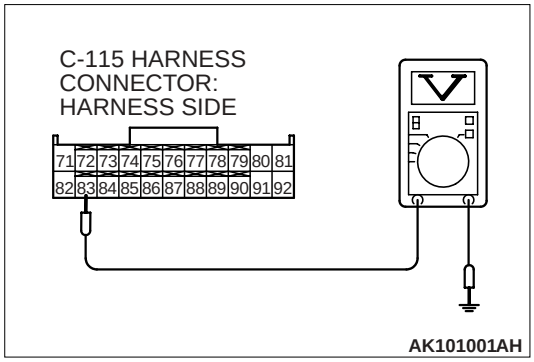
Q: Is the measured voltage between 4.5 and 4.9 volts?

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

STEP 4. Measure the sensor supply voltage at ECM connector C-115 by backprobing.



(1) Do not disconnect the ECM connector C-115.
(2) Disconnect the engine coolant temperature sensor connector B-107.
(3) Turn the ignition switch to the "ON" position.

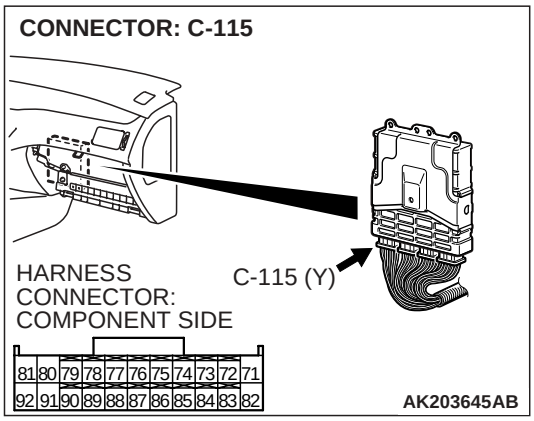


(4) Measure the voltage between terminal No. 83 and ground by backprobing.
- Voltage should measure between 4.5 and 4.9 volts.

(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.5 and 4.9 volts?

YES : Go to Step 5.
NO : Go to Step 6.

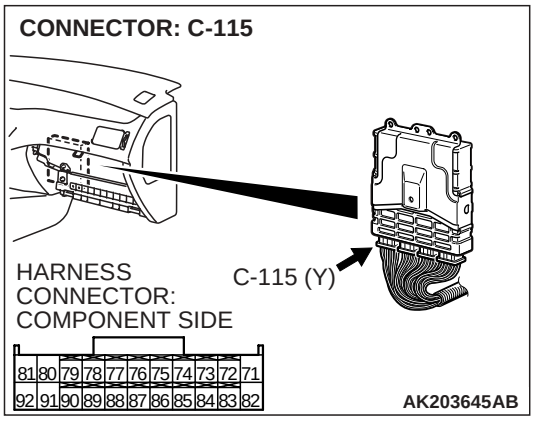


STEP 5. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between engine coolant temperature sensor connector B-107 and ECM connector C-115 because of open circuit. Then go to Step 11.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.



STEP 6. Check harness connector C-115 at ECM for damage.

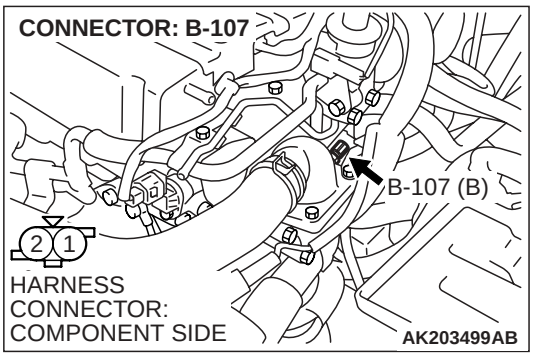
Q: Is the harness connector in good condition?

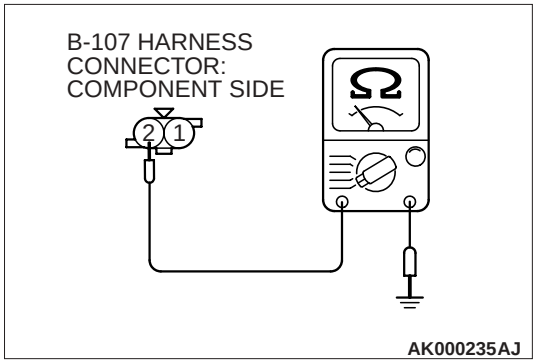
YES : Replace the ECM. Then go to Step 11.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

STEP 7. Check for continuity at engine coolant temperature sensor harness side connector B-107.

(1) Disconnect connector B-107 and measure at the harness side.





(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

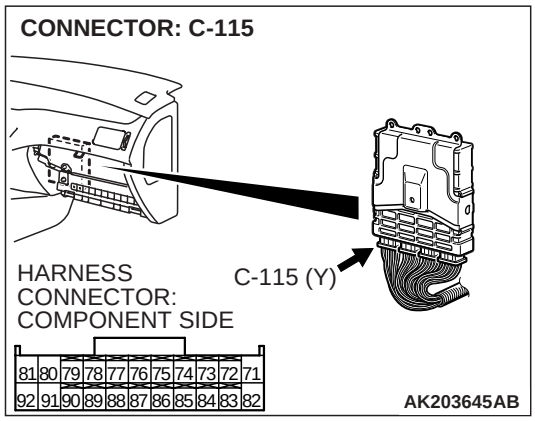
Q: Does continuity exist?

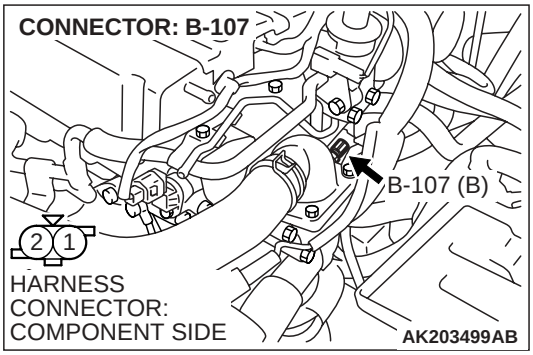
YES : Go to Step 10.
NO : Go to Step 8.

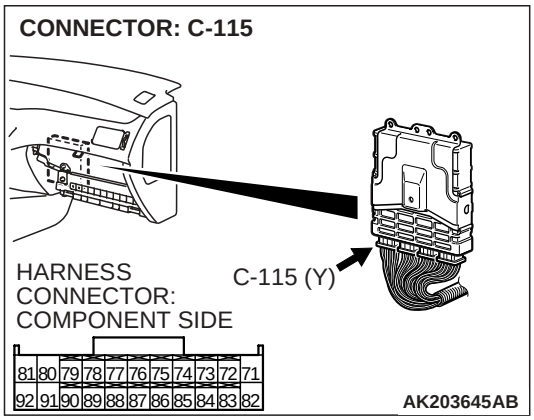
STEP 8. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.





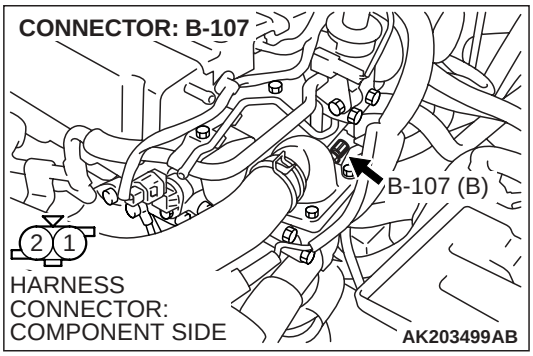


STEP 9. Check for open circuit between engine coolant sensor connector B-107 (terminal No. 2) and ECM connector C-115 (terminal No. 92).

Q: Is the harness wire in good condition?

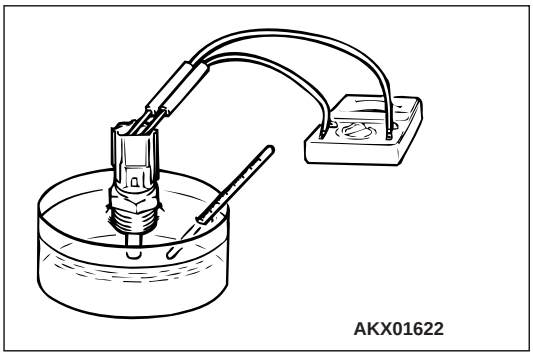
YES : Replace the ECM. Then go to Step 11.

NO : Repair it. Then go to Step 11.



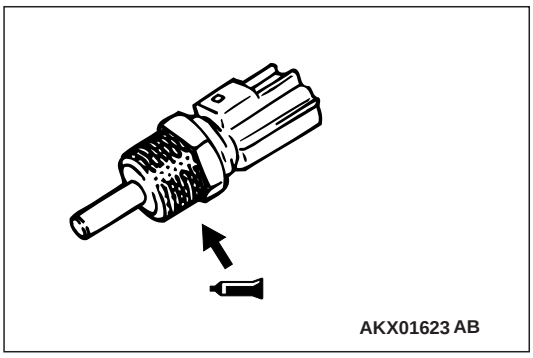
STEP 10. Check the engine coolant temperature sensor.

(1) Disconnect the engine coolant temperature sensor connector B-107.
(2) Remove the engine coolant temperature sensor.



(3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:
14 – 17 kΩ [at –20°C (–4°F)]
5.1 – 6.5 kΩ [at 0°C (32°F)]
2.1 – 2.7 kΩ [at 20°C (68°F)]
0.9 – 1.3 kΩ [at 40°C (104°F)]
0.48 – 0.68 kΩ [at 60°C (140°F)]
0.26 – 0.36 kΩ [at 80°C (176°F)]



(4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.
(5) Install the engine coolant temperature sensor, and tighten to the specified torque.

Tightening torque: 29 ± 10 N·m (22 ± 6 ft-lb)

Q: Is the resistance at the standard value?

YES : Replace the ECM. Then go to Step 11.
NO : Replace the engine coolant temperature sensor. Then go to Step 11.

STEP 11. Perform the OBD-II drive cycle.

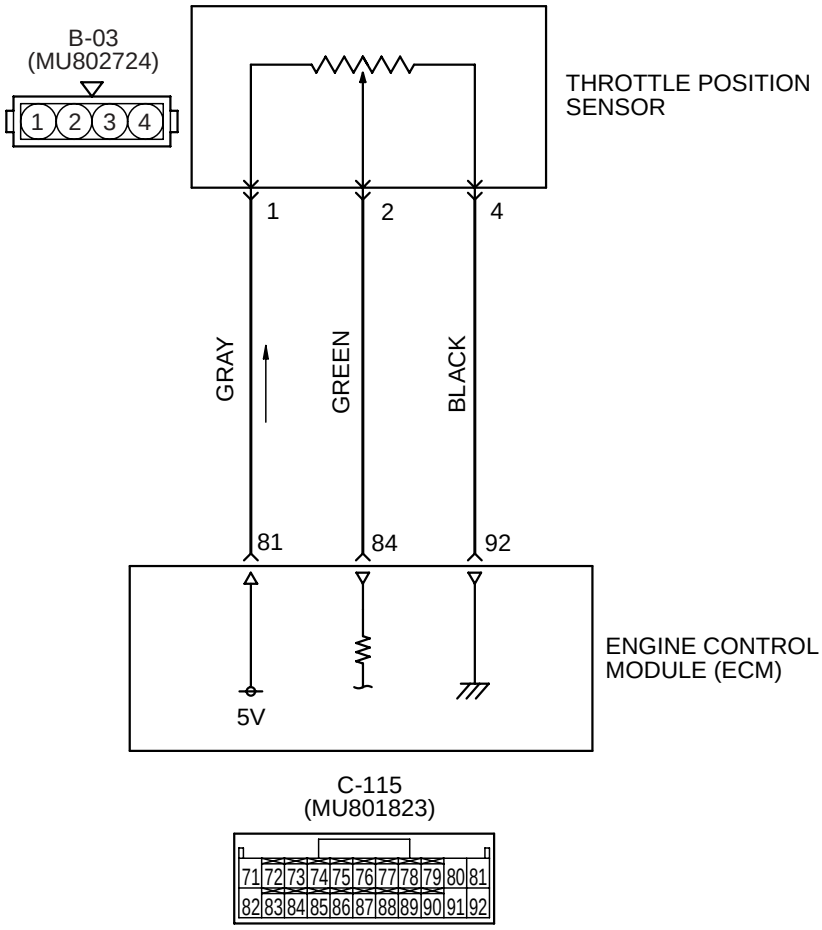
(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0118 set?

YES : Repeat the troubleshooting.
NO : The procedure is complete.

DTC P0121: THROTTLE POSITION SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

Throttle Position Sensor (TPS) Circuit



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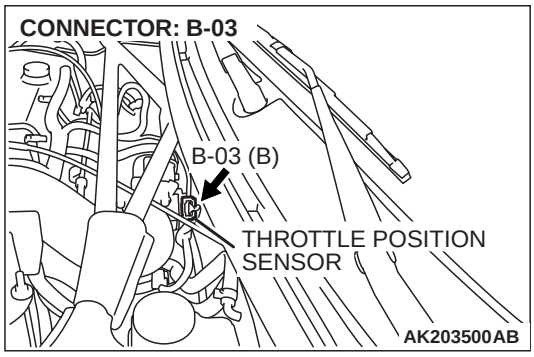
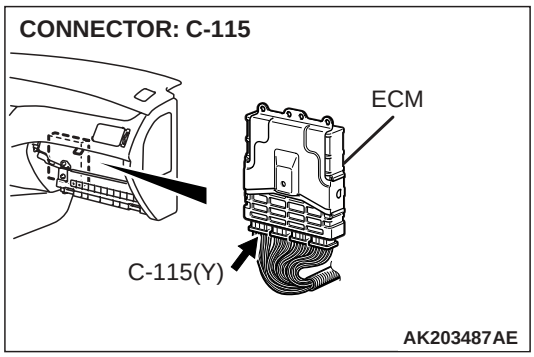




CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor power terminal (terminal No. 1) from the ECM (terminal No. 81).
  The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 92).
- When the throttle valve shaft is turned from the idle position to the fully opened position, the resistor between the throttle position sensor output terminal (terminal No. 2) and ground terminal will increase according to the rotation.

TSB Revision

TECHNICAL DESCRIPTION

- The throttle position sensor outputs voltage which corresponds to the throttle valve opening angle.
- The ECM checks whether the voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the staring sequence was completed.
- Engine speed is higher than 2,000 r/min.
- Volumetric efficiency is higher than 60 percent.

Judgement Criteria

- Throttle position sensor output voltage has continued to be 0.8 volt or lower for 2 seconds.

Check Conditions

- 2 seconds or more have passed since the staring sequence was completed.
- Engine speed is lower than 3,000 r/min.
- Volumetric efficiency is lower than 30 percent.

Judgement Criteria

- Throttle position sensor output voltage has continued to be 4.6 volts or higher for 2 seconds.

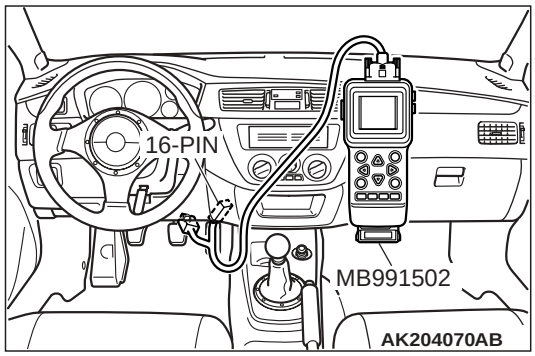
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

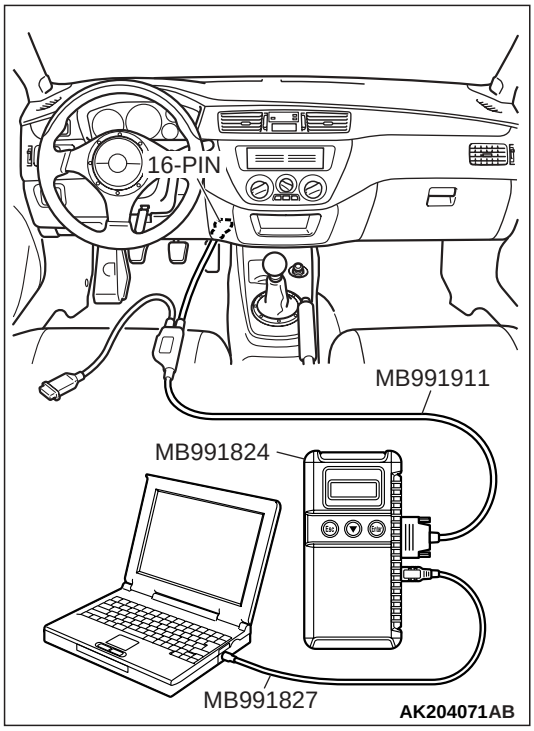
- Throttle position sensor failed or incorrectly adjusted.
- Open throttle position sensor circuit, harness damage, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B





STEP 1. Using scan tool MB991502 or MB991958, check data list item 14: Throttle Position Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

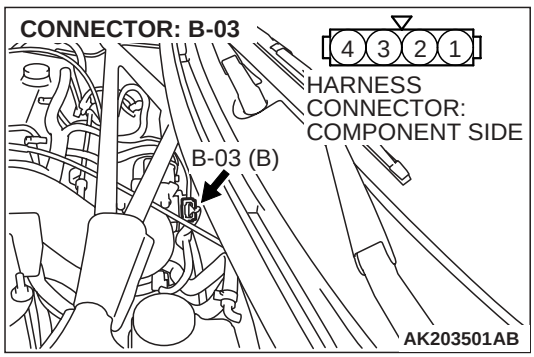
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 14, Throttle Position Sensor.
- With the throttle valve in the idle position, voltage should measure between 0.535 and 0.735 volt.
- With the throttle valve in the full-open position, voltage should measure between 4.5 and 5.0 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.



STEP 2. Check harness connector B-03 at throttle position sensor for damage.

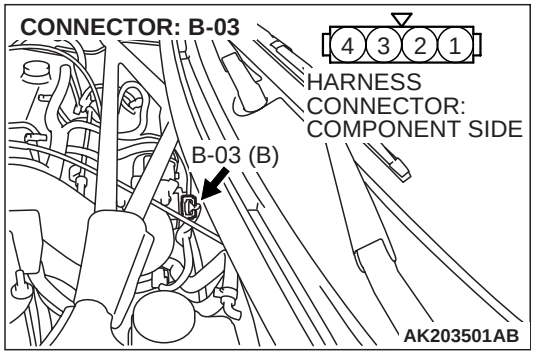
Q: Is the harness connector in good condition?

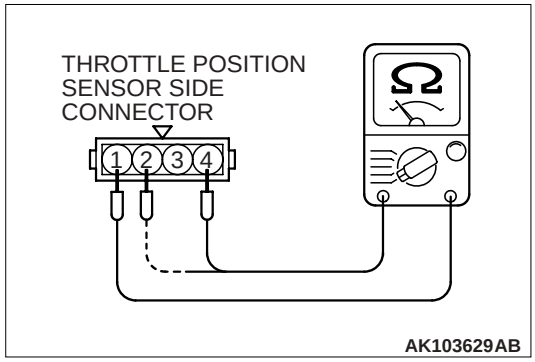
YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP3. Check the throttle position sensor.

(1) Disconnect connector B-03.





(2) Measure the resistance between throttle position sensor side connector terminal No. 1 and No. 4.

Standard value: 3.5 – 6.5 kΩ

(3) Measure resistance between the throttle position sensor side connector terminal No. 1 and No. 2.

(4) Move the throttle valve from the idle position to the full-open position.

- Resistance should change smoothly in proportion to the opening angle of the throttle valve.

Q: Is the resistance normal?

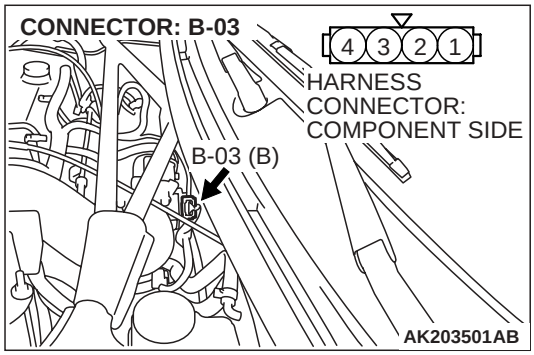
YES : Go to Step 4.

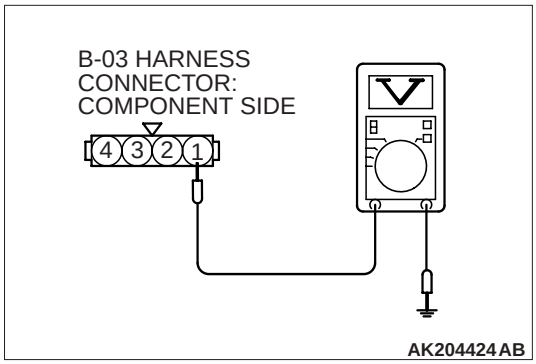
NO : Replace the throttle position sensor. Refer to GROUP 13A, Throttle Body Assembly – Disassembly and Assembly P.13A-780. Then go to Step 14.

STEP 4. Measure the sensor supply voltage at throttle position sensor harness side connector B-03.

(1) Disconnect connector B-03 and measure at the harness side.

(2) Turn the ignition switch to the "ON" position.





(3) Measure the voltage between terminal No. 1 and ground.

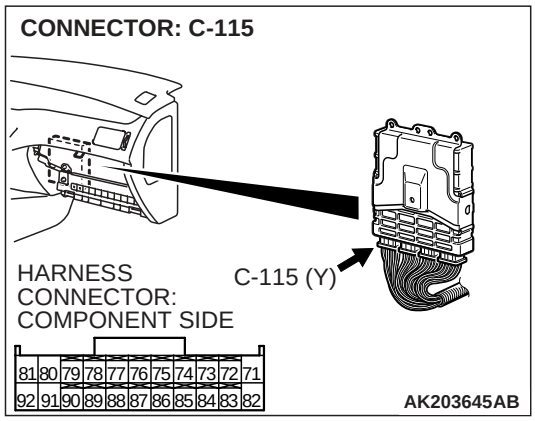
- Voltage should measure between 4.8 and 5.2 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.8 and 5.2 volts?

YES : Go to Step 7.

NO : Go to Step 5.

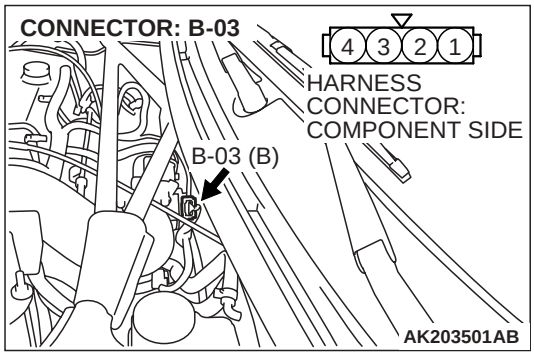


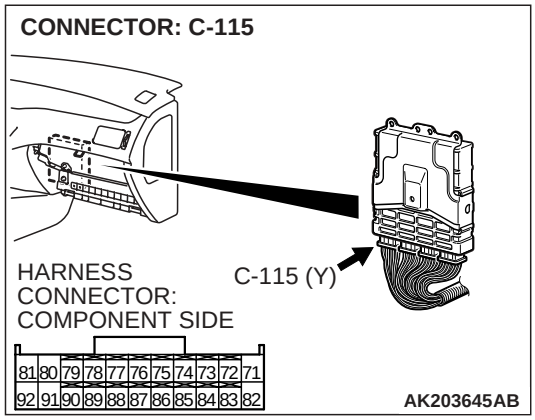
STEP 5. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.





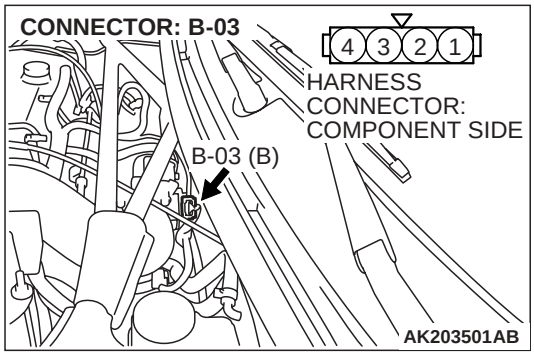
STEP 6. Check for harness damage between throttle position sensor connector B-03 (terminal No. 1) and ECM connector C-115 (terminal No. 81).

Q: Is the harness wire in good condition?

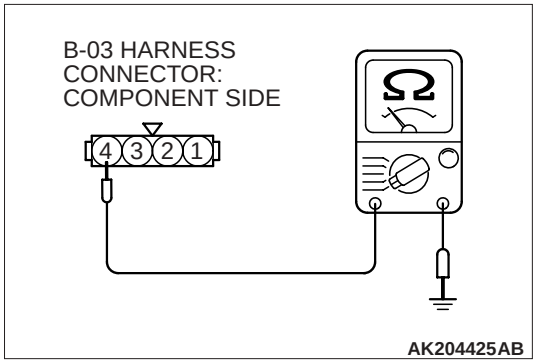
YES : Replace the ECM. Then go to Step 14.

NO : Repair it. Then go to Step 14.

STEP 7. Check for continuity at throttle position sensor harness side connector B-03.



(1) Disconnect connector B-03 and measure at the harness side.

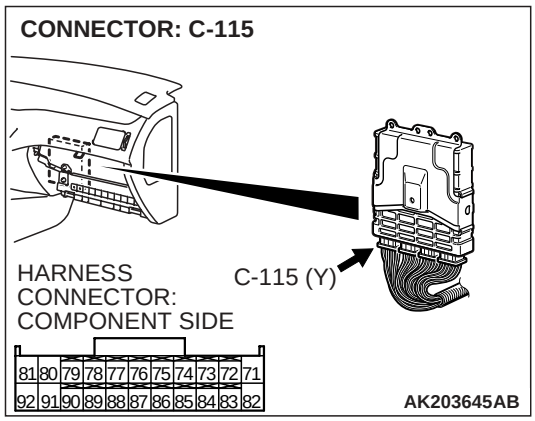


(2) Measure the continuity between terminal No. 4 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

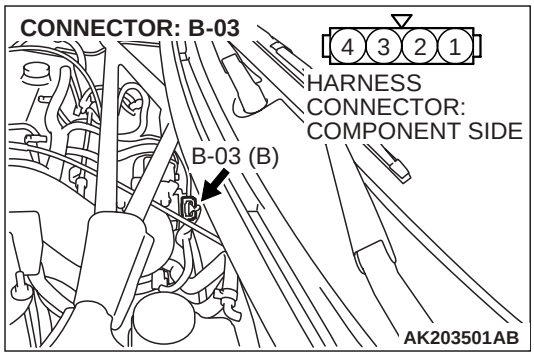
YES : Go to Step 10.
NO : Go to Step 8.

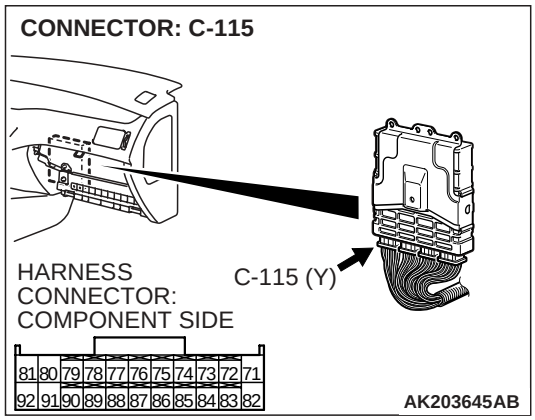
STEP 8. Check harness connector C-115 at ECM for damage.



Q: Is the harness connector in good condition?

YES : Go to Step 9.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.



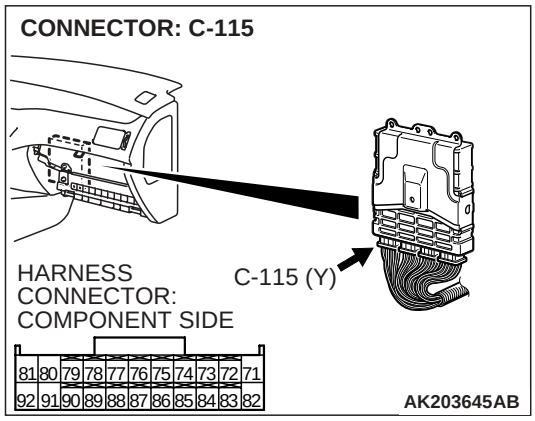


STEP 9. Check for open circuit and harness damage between throttle position sensor connector B-03 (terminal No. 4) and ECM connector C-115 (terminal No. 92).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 14.

NO : Repair it. Then go to Step 14.

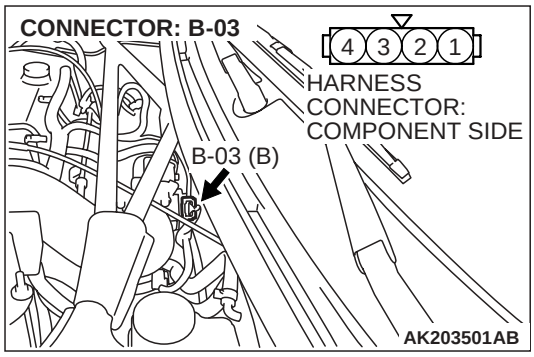


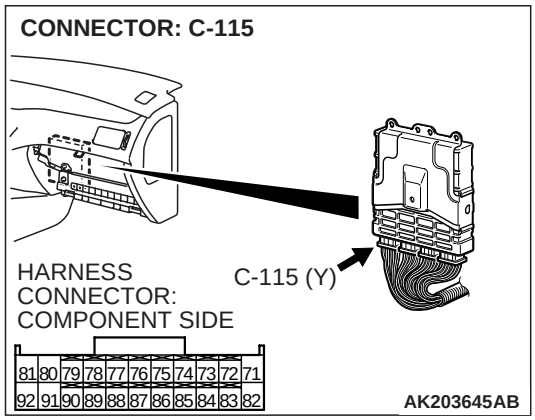
STEP 10. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 11.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.





STEP 11. Check for harness damage between throttle position sensor connector B-03 (terminal No. 2) and ECM connector C-115 (terminal No. 84).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.

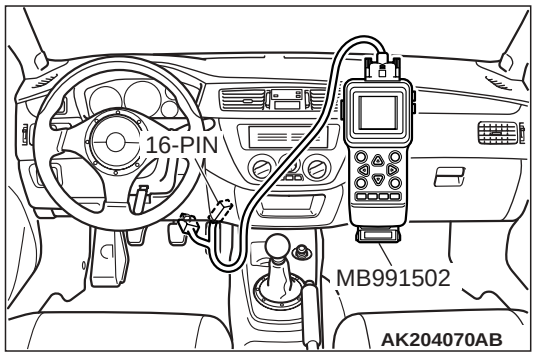
STEP 12. Check the incorrectly adjusted throttle position sensor.

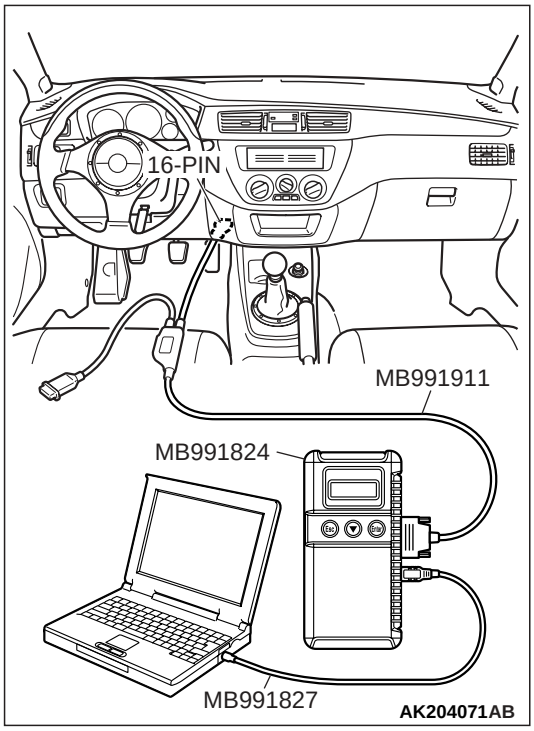
Refer to GROUP 13A, Throttle Position Sensor Adjustment P.13A-758.

Q: Is the output voltage normal?

YES : Go to Step 13.

NO : Adjust it. Then go to Step 14.





STEP 13. Using scan tool MB991502 or MB991958, check data list item 14: Throttle Position Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 14, Throttle Position Sensor.
- With the throttle valve in the idle position, voltage should measure between 0.535 and 0.735 volt.
- With the throttle valve in the full-open position, voltage should measure between 4.5 and 5.0 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.
NO : Replace the ECM. Then go to Step 14.

STEP 14. Perform the OBD-II drive cycle.

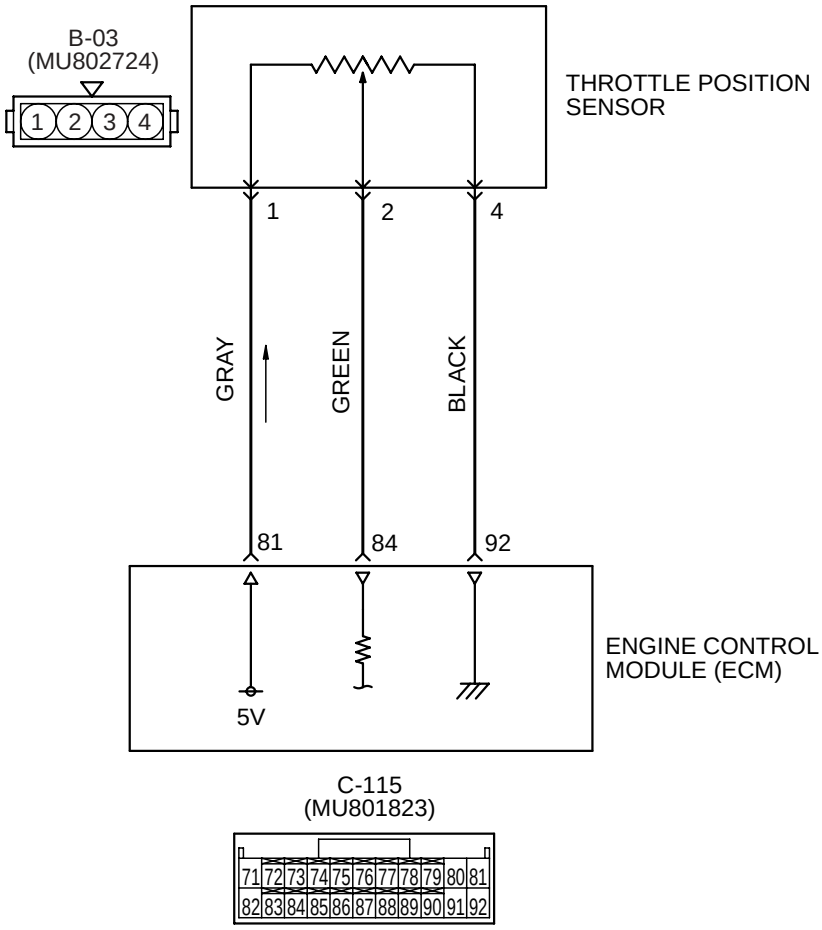
(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0121 set?

YES : Repeat the troubleshooting.
NO : The procedure is complete.

DTC P0122: THROTTLE POSITION SENSOR CIRCUIT LOW INPUT

Throttle Position Sensor (TPS) Circuit



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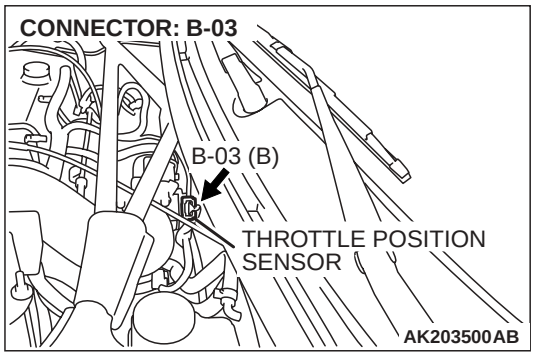
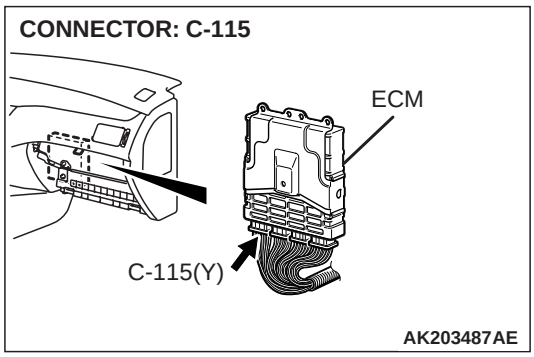




CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor power terminal (terminal No. 1) from the ECM (terminal No. 81).
  The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 92).
- When the throttle valve shaft is turned from the idle position to the fully opened position, the resistor between the throttle position sensor output terminal (terminal No. 2) and ground terminal will increase according to the rotation.

TSB Revision

TECHNICAL DESCRIPTION

- The throttle position sensor outputs voltage which corresponds to the throttle valve opening angle.
- The ECM checks whether the voltage is within a specified range. In addition, it checks that the voltage output does not become too high while the engine is at idle.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the starting sequence was completed.

Judgement Criteria

- Throttle position sensor output voltage has continued to be 0.2 volt or lower for 2 seconds.

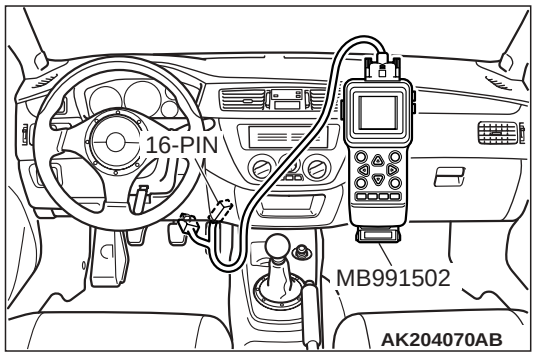
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

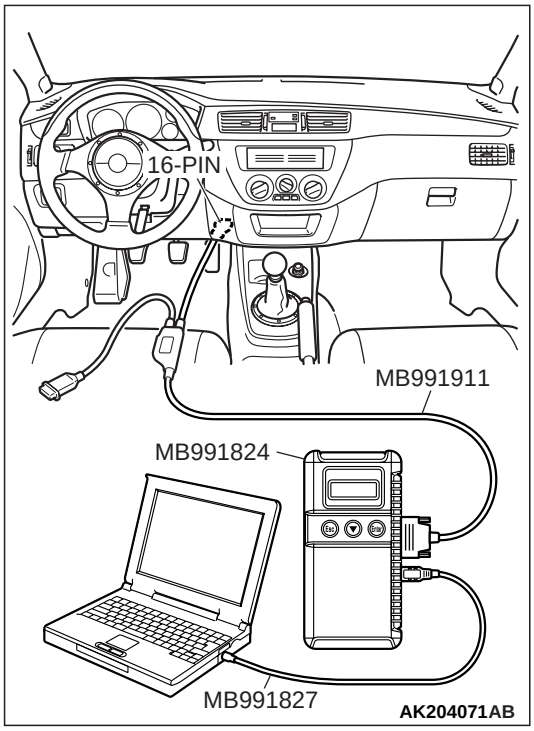
- Throttle position sensor failed or incorrectly adjusted.
- Open or shorted throttle position sensor circuit, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B





STEP 1. Using scan tool MB991502 or MB991958, check data list item 14: Throttle Position Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

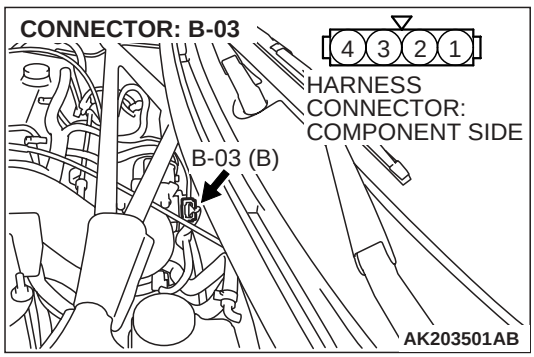
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 14, Throttle Position Sensor.
- With the throttle valve in the idle position, voltage should measure between 0.535 and 0.735 volt.
- With the throttle valve in the full-open position, voltage should measure between 4.5 and 5.0 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.



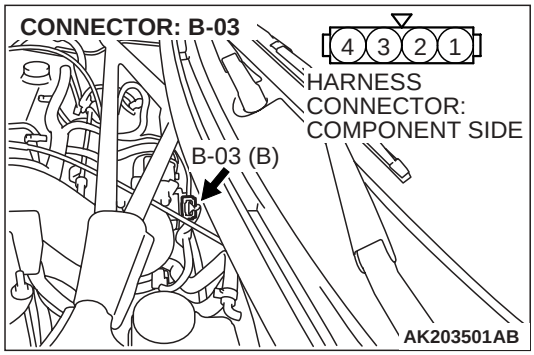
STEP 2. Check harness connector B-03 at throttle position sensor for damage.

Q: Is the harness connector in good condition?

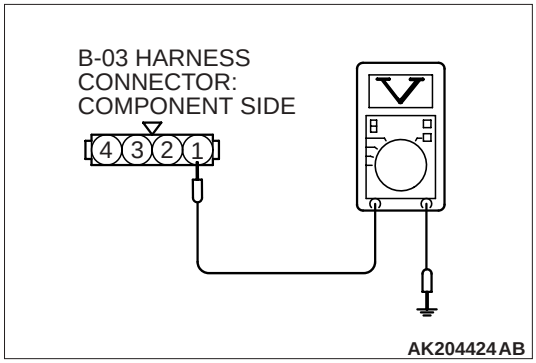
YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

STEP 3. Measure the sensor supply voltage at throttle position sensor harness side connector B-03.



(1) Disconnect connector B-03 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.



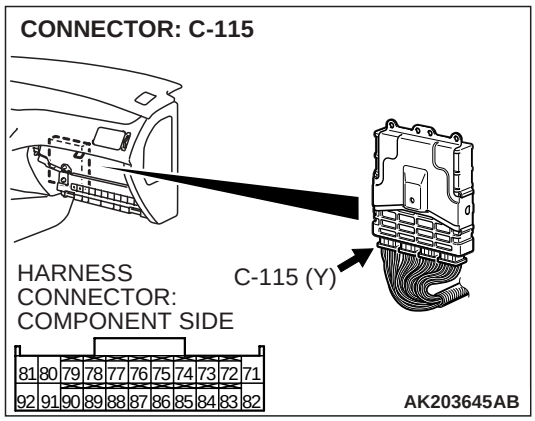
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should measure between 4.8 and 5.2 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.8 and 5.2 volts?

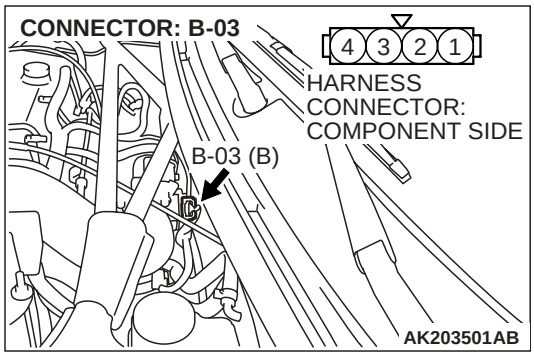
YES : Go to Step 6.
NO : Go to Step 4.

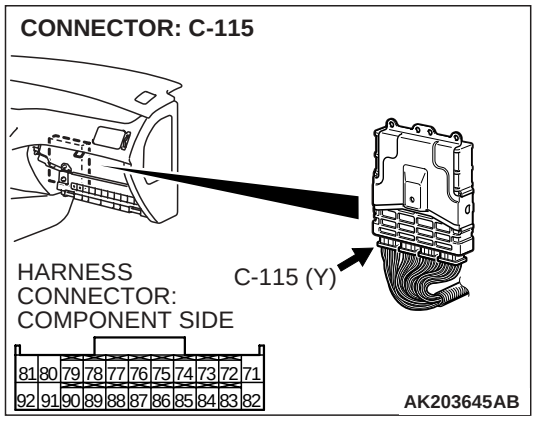
STEP 4. Check harness connector C-115 at ECM for damage.



Q: Is the harness connector in good condition?

YES : Go to Step 5.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.



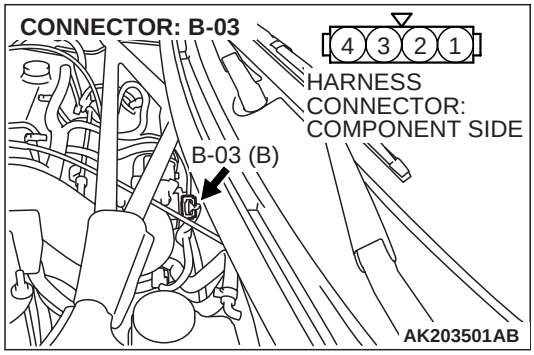


STEP 5. Check for open circuit and short circuit to ground between throttle position sensor connector B-03 (terminal No. 1) and ECM connector C-115 (terminal No. 81).

Q: Is the harness wire in good condition?

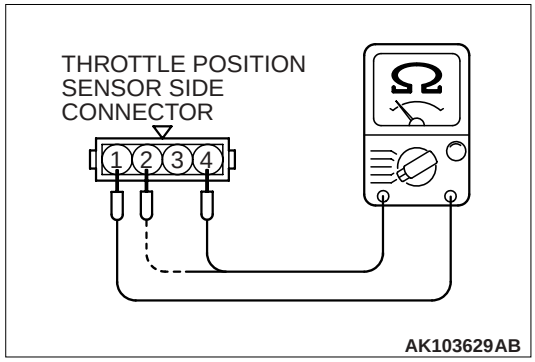
YES : Replace the ECM. Then go to Step 10.

NO : Repair it. Then go to Step 10.



STEP 6. Check the throttle position sensor.

(1) Disconnect connector B-03.



(2) Measure the resistance between throttle position sensor side connector terminal No. 1 and No. 4.

Standard value: 3.5 – 6.5 kΩ

(3) Measure resistance between the throttle position sensor side connector terminal No. 1 and No. 2.

(4) Move the throttle valve from the idle position to the full-open position.

- Resistance should change smoothly in proportion to the opening angle of the throttle valve.

Q: Is the resistance normal?

YES : Go to Step 7.

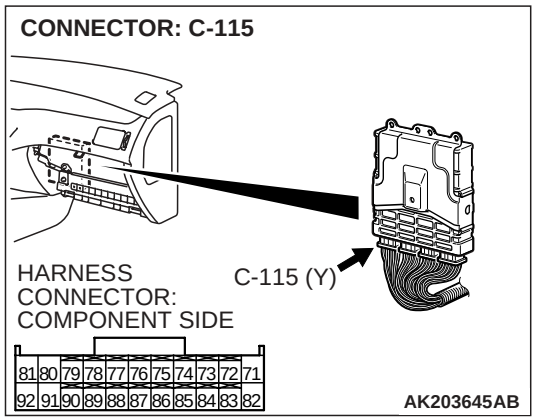
NO : Replace the throttle position sensor. Refer to GROUP 13A, Throttle Body Assembly – Disassembly and Assembly P.13A-780. Then go to Step 10.

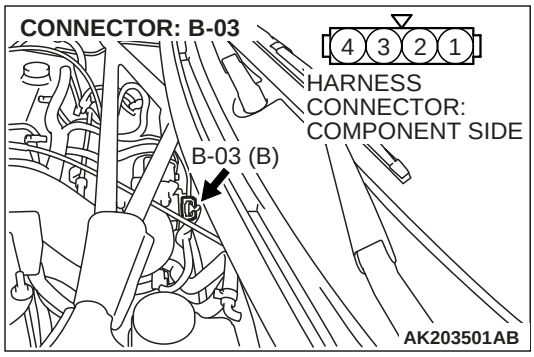
STEP 7. Check harness connector C-115 at ECM for damage.

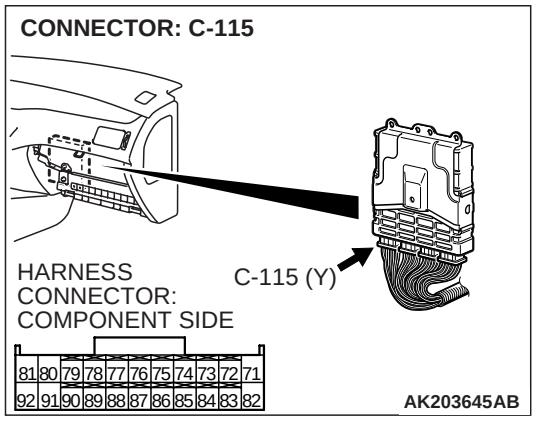
Q: Is the harness connector in good condition?

YES : Go to Step 8.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.





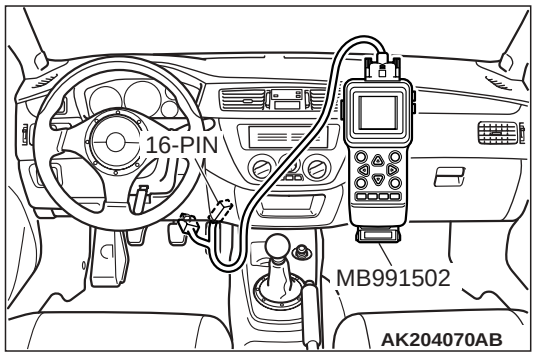


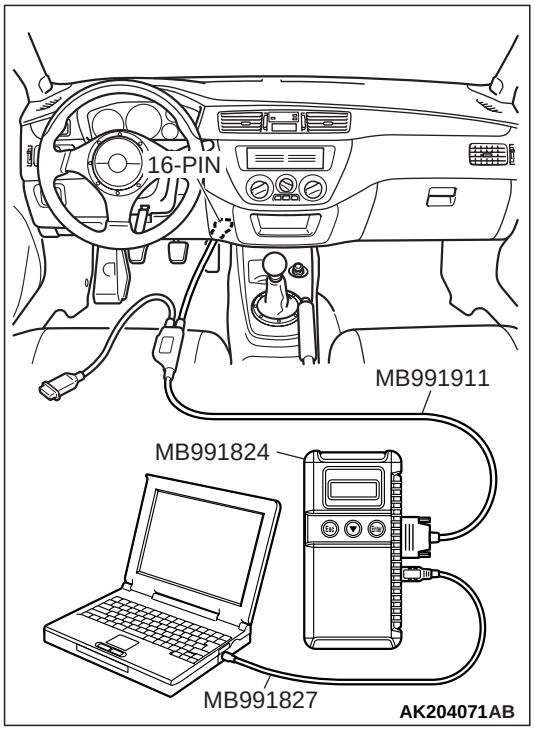
STEP 8. Check for open circuit and short circuit to ground between throttle position sensor connector B-03 (terminal No. 2) and ECM connector C-115 (terminal No. 84).

Q: Is the harness wire in good condition?

YES : Go to Step 9.

NO : Repair it. Then go to Step 10.





STEP 9. Using scan tool MB991502 or MB991958, check data list item 14: Throttle Position Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 14, Throttle Position Sensor.
- With the throttle valve in the idle position, voltage should measure between 0.535 and 0.735 volt.
- With the throttle valve in the full-open position, voltage should measure between 4.5 and 5.0 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.
NO : Replace the ECM. Then go to Step 10.

STEP 10. Perform the OBD-II drive cycle.

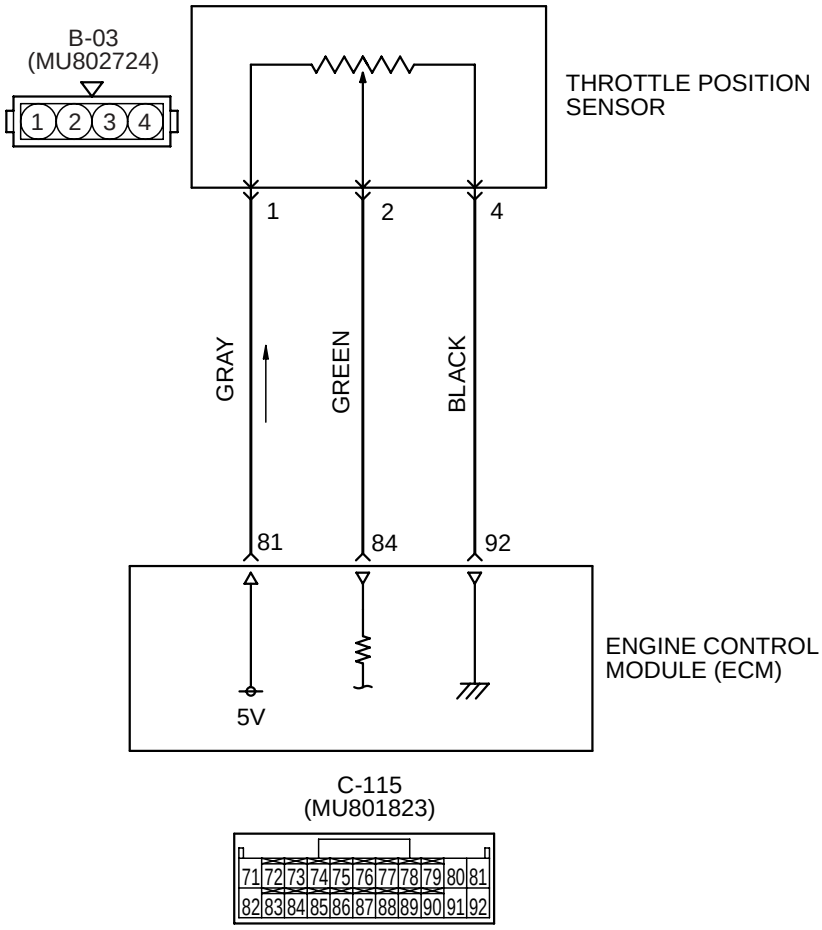
(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0122 set?

YES : Repeat the troubleshooting.
NO : The procedure is complete.

DTC P0123: THROTTLE POSITION SENSOR CIRCUIT HIGH INPUT

Throttle Position Sensor (TPS) Circuit



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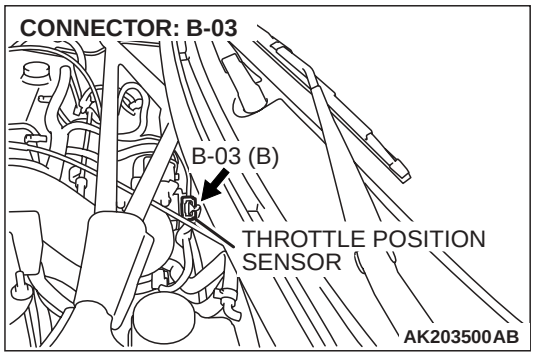
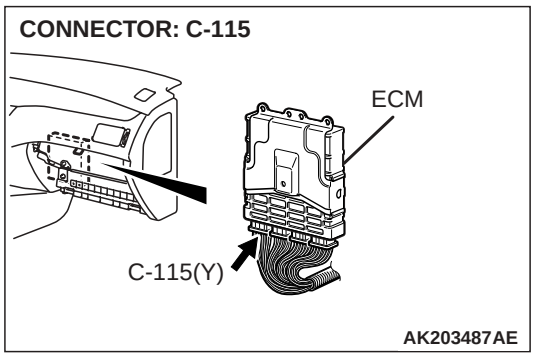




CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor power terminal (terminal No. 1) from the ECM (terminal No. 81).
  The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 92).
- When the throttle valve shaft is turned from the idle position to the fully opened position, the resistor between the throttle position sensor output terminal (terminal No. 2) and ground terminal will increase according to the rotation.

TSB Revision

TECHNICAL DESCRIPTION

- The throttle position sensor outputs voltage which corresponds to the throttle valve opening angle.
- The ECM checks whether the voltage is within a specified range. In addition, it checks that the voltage output does not become too high while the engine is at idle.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the starting sequence was completed.
- Engine speed is lower than 1,000 r/min.
- Volumetric efficiency is lower than 60 percent.

Judgement Criteria

- Throttle position sensor output voltage has continued to be 2 volts or higher for 2 seconds.

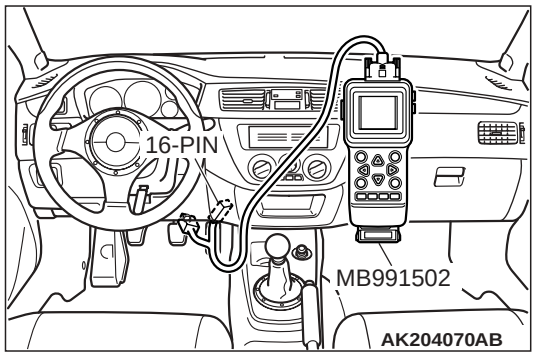
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

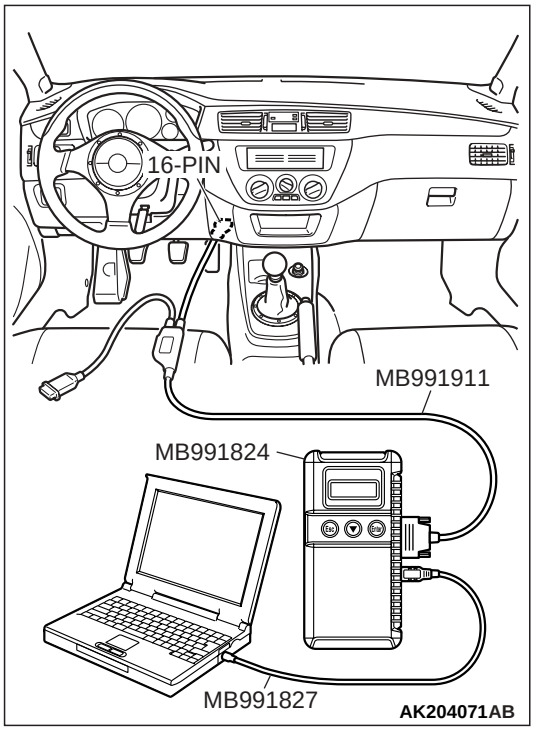
- Throttle position sensor failed or incorrectly adjusted.
- Open throttle position sensor circuit, harness damage, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B





STEP 1. Using scan tool MB991502 or MB991958, check data list item 14: Throttle Position Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

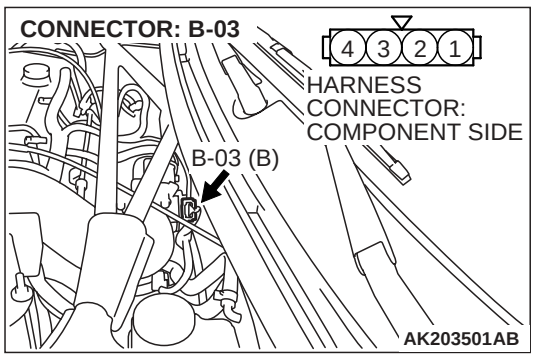
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 14, Throttle Position Sensor.
- With the throttle valve in the idle position, voltage should measure between 0.535 and 0.735 volt.
- With the throttle valve in the full-open position, voltage should measure between 4.5 and 5.0 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.



STEP 2. Check harness connector B-03 at throttle position sensor for damage.

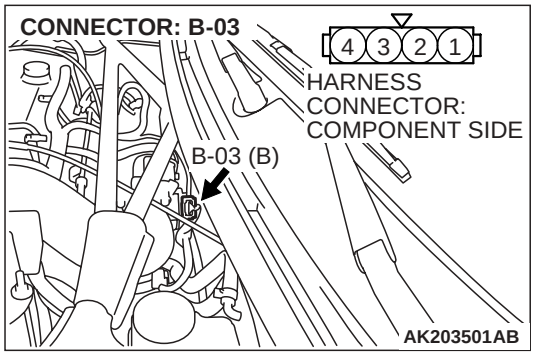
Q: Is the harness connector in good condition?

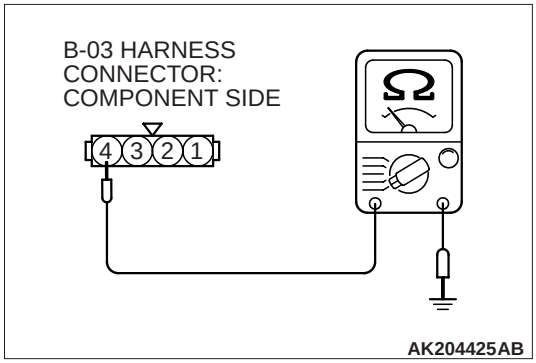
YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

STEP 3. Check for continuity at throttle position sensor harness side connector B-03.

(1) Disconnect connector B-03 and measure at the harness side.





(2) Measure the continuity between terminal No. 4 and ground.
- Should be less than 2 ohms.

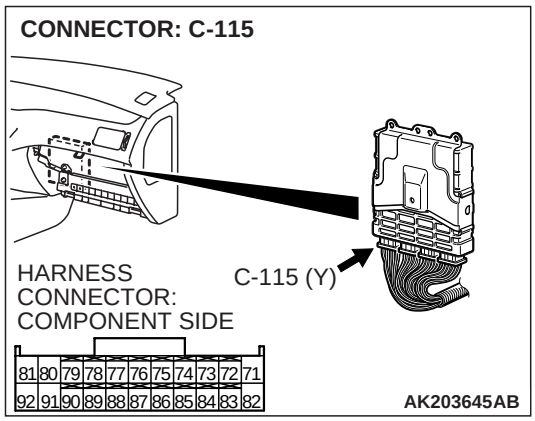
Q: Does continuity exist?

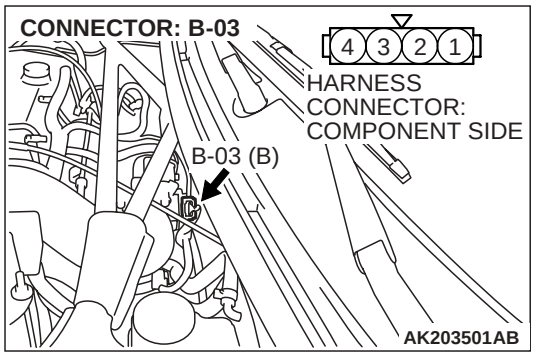
YES : Go to Step 6.
NO : Go to Step 4.

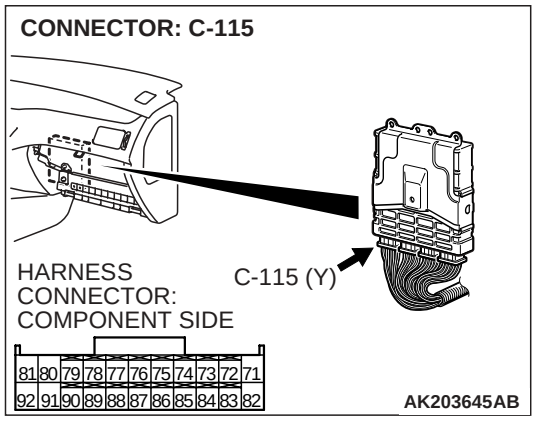
STEP 4. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.





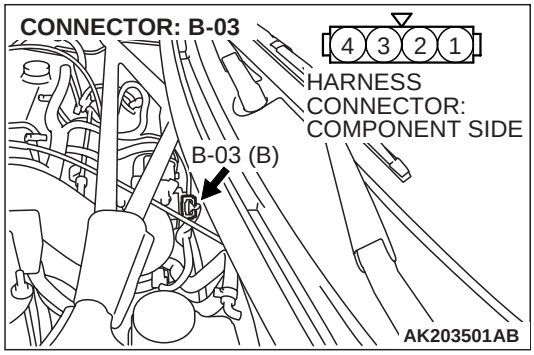


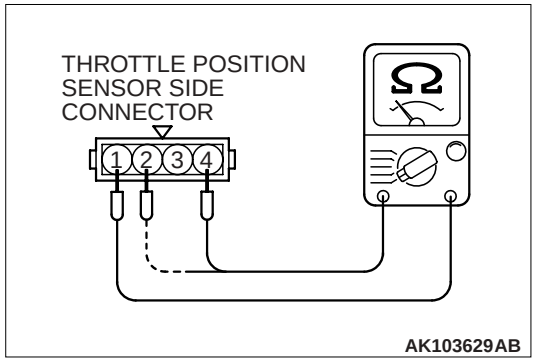
STEP 5. Check for open circuit and harness damage between throttle position sensor connector B-03 (terminal No. 4) and ECM connector C-115 (terminal No. 92).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 8.

NO : Repair it. Then go to Step 8.





STEP 6. Check the throttle position sensor.

(1) Disconnect connector B-03.

(2) Measure the resistance between throttle position sensor side connector terminal No. 1 and No. 4.

Standard value: 3.5 – 6.5 kΩ

(3) Measure resistance between the throttle position sensor side connector terminal No. 1 and No. 2.

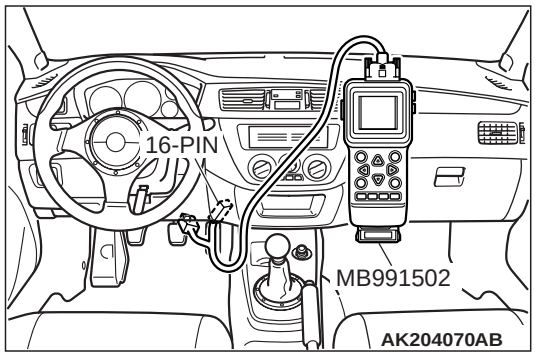
(4) Move the throttle valve from the idle position to the full-open position.

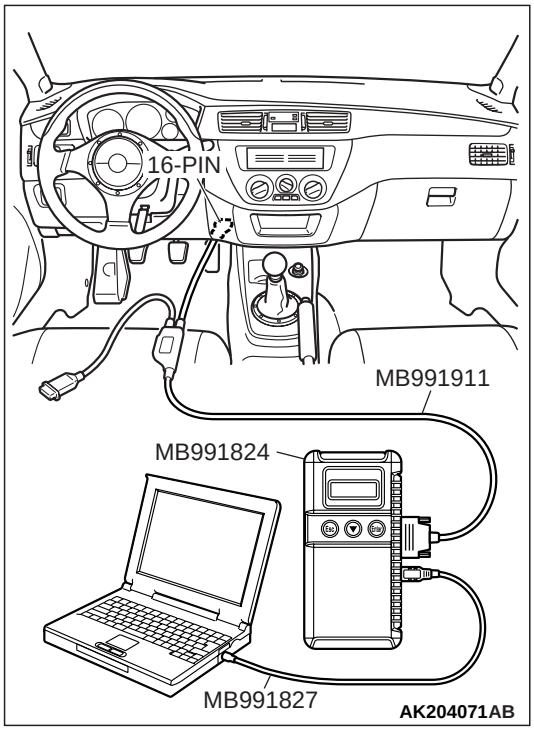
- Resistance should change smoothly in proportion to the opening angle of the throttle valve.

Q: Is the resistance normal?

YES : Go to Step 7.

NO : Replace the throttle position sensor. Refer to GROUP 13A, Throttle Body Assembly – Disassembly and Assembly P.13A-780, Throttle Body. Then go to Step 8.





STEP 7. Using scan tool MB991502 or MB991958, check data list item 14: Throttle Position Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 14, Throttle Position Sensor.
- With the throttle valve in the idle position, voltage should measure between 0.535 and 0.735 volt.
- With the throttle valve in the full-open position, voltage should measure between 4.5 and 5.0 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.
NO : Replace the ECM. Then go to Step 8.

STEP 8. Perform the OBD-II drive cycle.

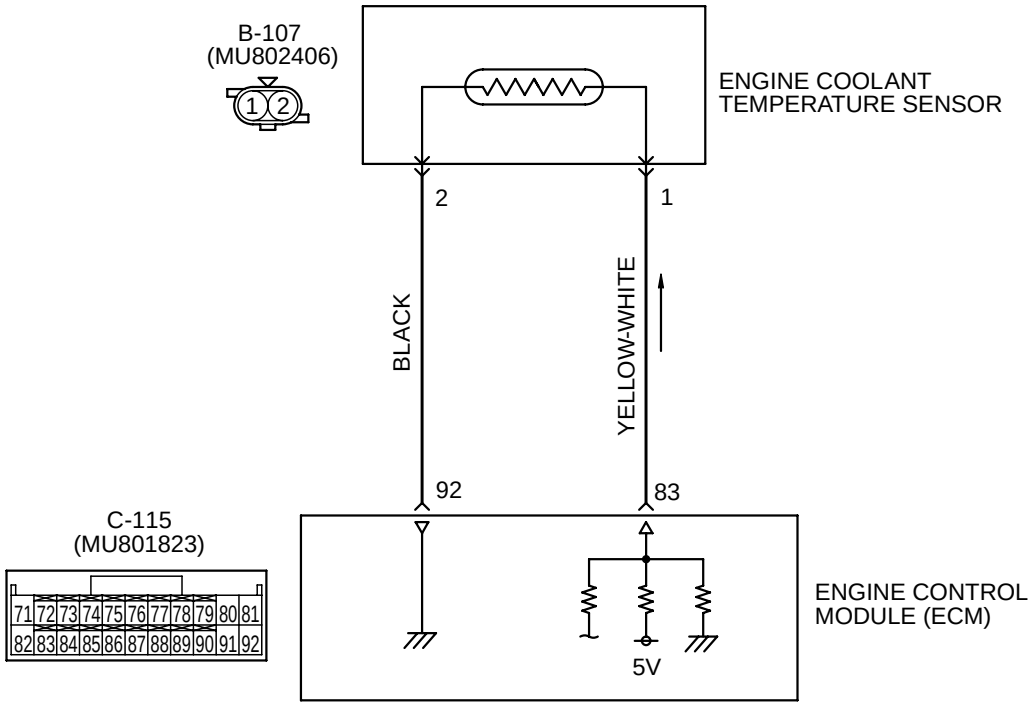
(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0123 set?

YES : Repeat the troubleshooting.
NO : The procedure is complete.

DTC P0125: INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

Enging Coolant Temperature Sensor Circuit



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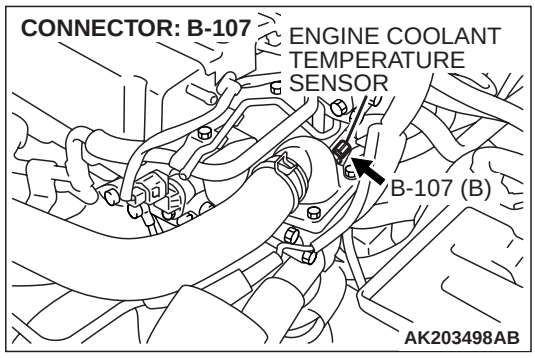
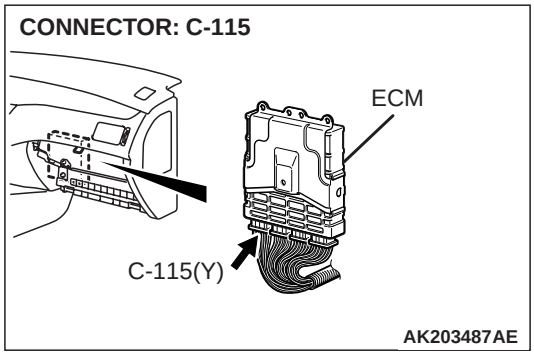




CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 83) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 92).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions, Judgement Criteria

- Engine coolant temperature decreases from higher than 40°C (104°F) to lower than 40°C (104°F).

TSB Revision

- Then the engine coolant temperature has continued to be 40°C (104°F) or lower for five minutes.

Check Conditions, Judgement Criteria

- About 60 – 300 seconds have passed for the engine coolant temperature to rise to about 7°C (44.6°F) after starting sequence was completed.
- However, time is not counted when fuel is shut off.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Engine coolant temperature sensor failed.
- Harness damage in engine coolant temperature sensor circuit, or connector damage.
- ECM failed.

DIAGNOSIS

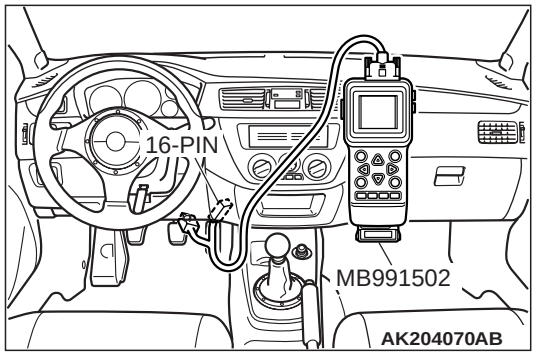
Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

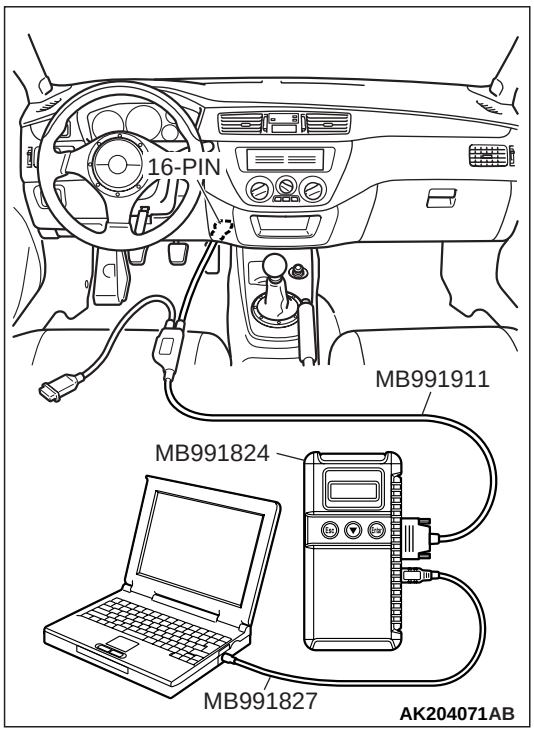
STEP 1. Using scan tool MB991502 or MB991958, check data list item 21: Engine Coolant Temperature Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.



(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately match.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

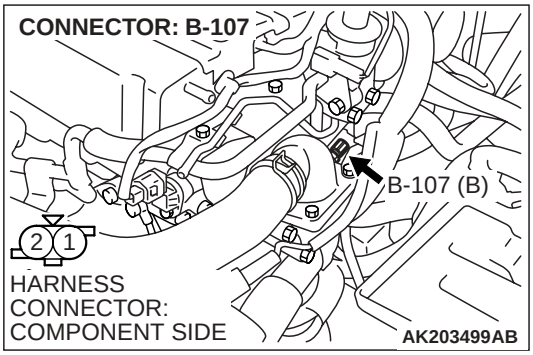


Q: Is the sensor operating properly?

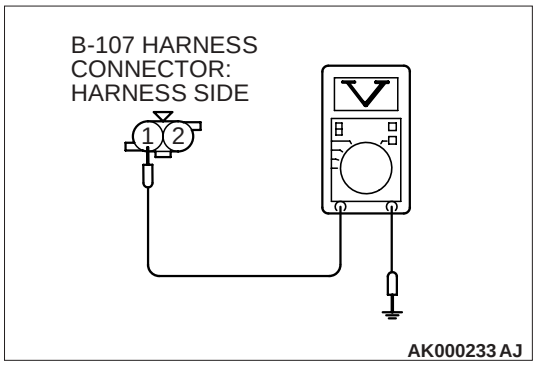
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at engine coolant temperature sensor connector B-107 by backprobing.



(1) Do not disconnect connector B-107.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 1 and ground by backprobing.
- When engine coolant temperature is –20°C (–4°F), voltage should be between 3.9 and 4.5 volts.
- When engine coolant temperature is 0°C (32°F), voltage should be between 3.2 and 3.8 volts.
- When engine coolant temperature is 20°C (68°F), voltage should be between 2.3 and 2.9 volts.
- When engine coolant temperature is 40°C (104°F), voltage should be between 1.3 and 1.9 volts.
- When engine coolant temperature is 60°C (140°F), voltage should be between 0.7 and 1.3 volts.
- When engine coolant temperature is 80°C (176°F), voltage should be between 0.3 and 0.9 volt.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

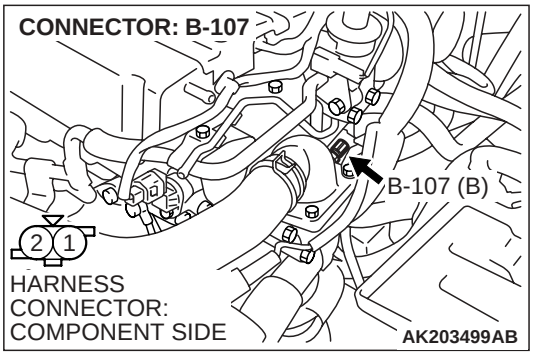
Q: Is the measured voltage within the specified range?

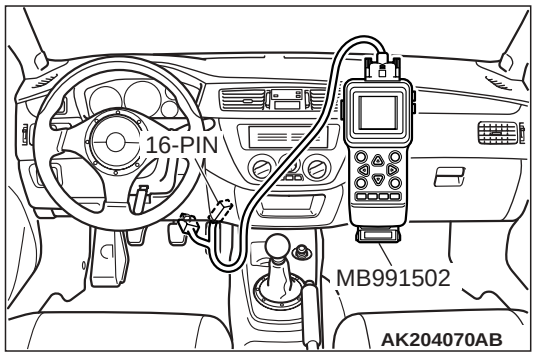
YES : Go to Step 3.
NO : Go to Step 5.

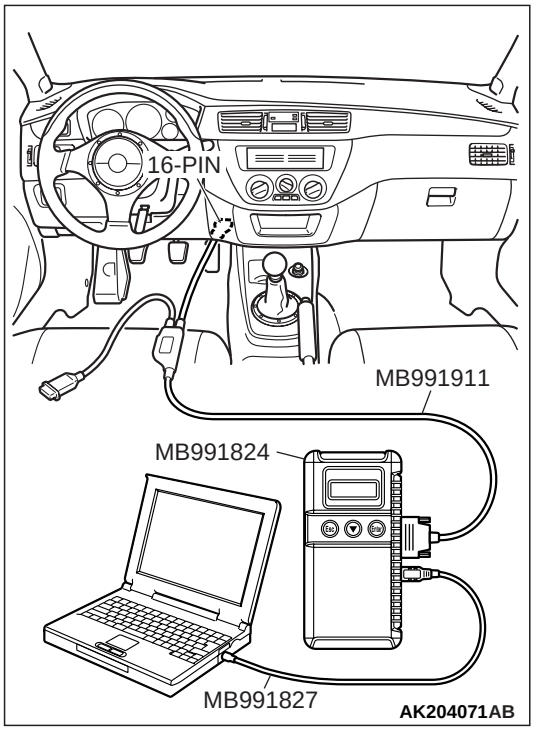
STEP 3. Check harness connector B-107 at the engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.







STEP 4. Using scan tool MB991502 or MB991958, check data list item 21: Engine Coolant Temperature Sensor.

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

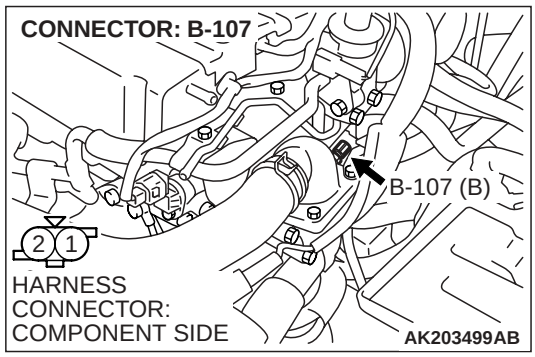
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
- The engine coolant temperature and temperature shown with the scan tool should approximately match.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Replace the ECM. Then go to Step 14.



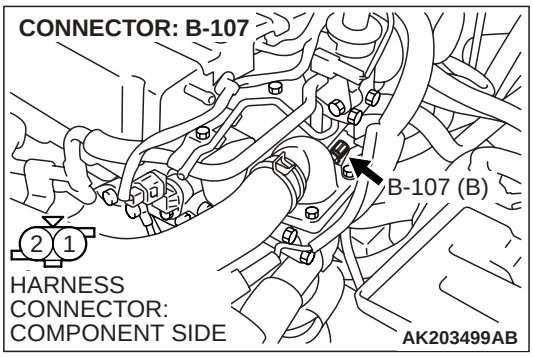
STEP 5. Check harness connector B-107 at engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

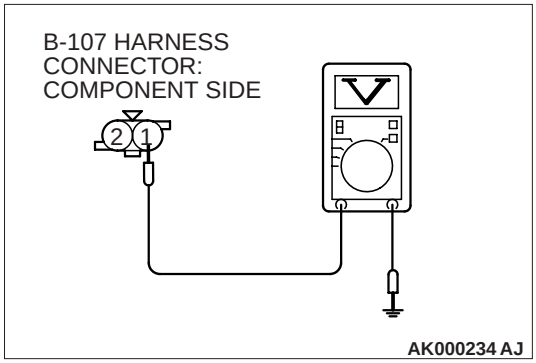
YES : Go to Step 6.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 6. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-107.



(1) Disconnect connector B-107 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.



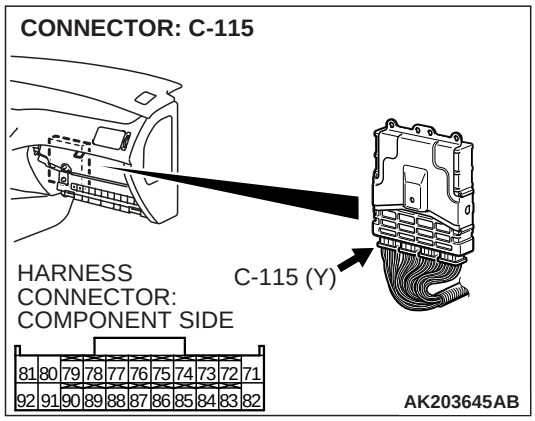
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should measure between 4.5 and 4.9 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.5 and 4.9 volts?

YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check harness connector C-115 at ECM for damage.

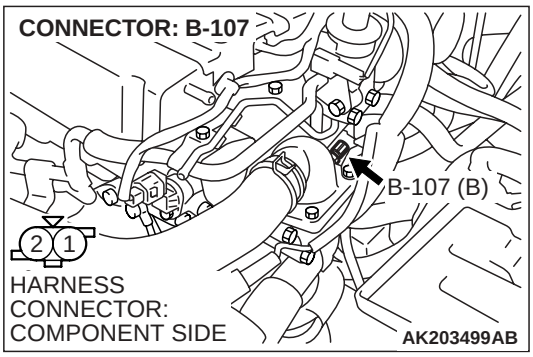


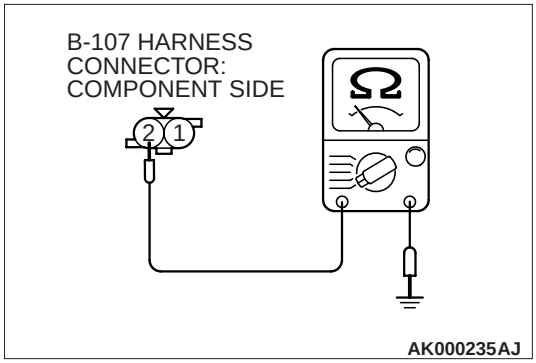
Q: Is the harness connector in good condition?

YES : Replace the ECM. Then go to Step 14.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 8. Check for continuity at engine coolant temperature sensor harness side connector B-107.

(1) Disconnect connector B-107 and measure at the harness side.





(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

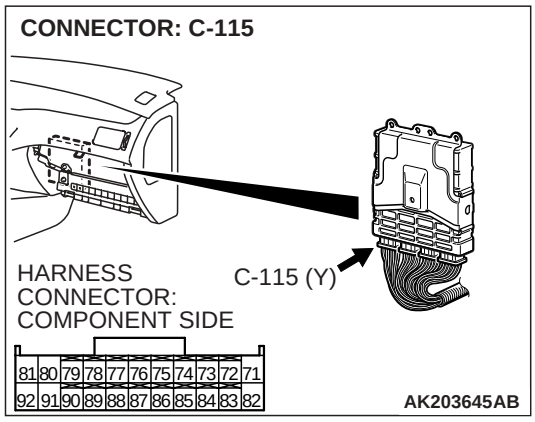
Q: Does continuity exist?

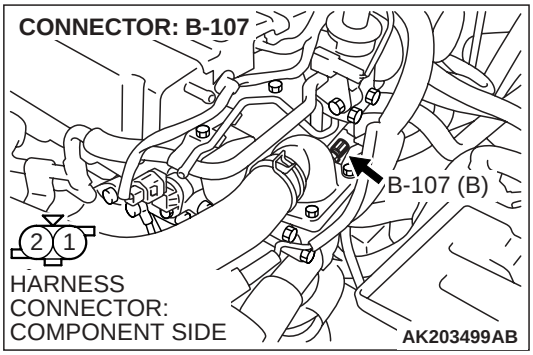
YES : Go to Step 11.
NO : Go to Step 9.

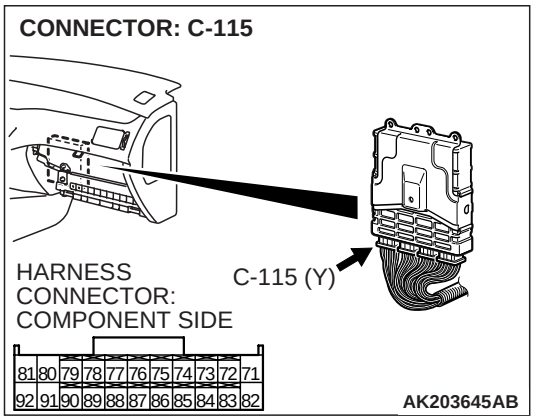
STEP 9. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.





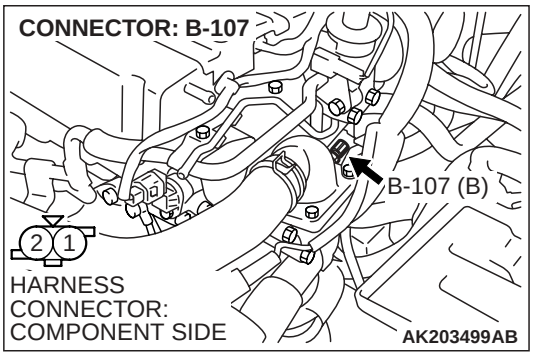


STEP 10. Check for harness damage between engine coolant temperature sensor connector B-107 (terminal No. 2) and ECM connector C-115 (terminal No. 92).

Q: Is the harness wire in good condition?

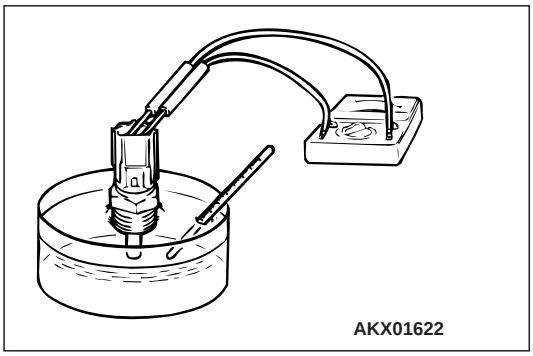
YES : Replace the ECM. Then go to Step 14.

NO : Repair it. Then go to Step 14.



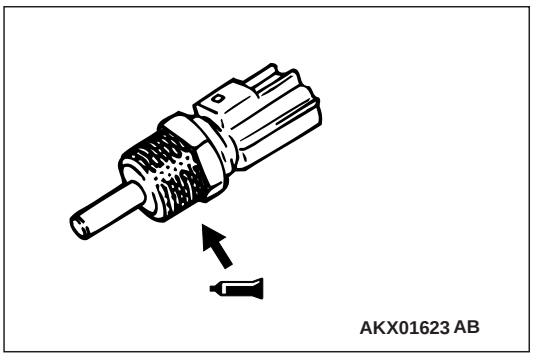
STEP 11. Check the engine coolant temperature sensor.

(1) Disconnect the engine coolant temperature sensor connector B-107.
(2) Remove the engine coolant temperature sensor.



(3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:
14 – 17 kΩ [at –20°C (–4°F)]
5.1 – 6.5 kΩ [at 0°C (32°F)]
2.1 – 2.7 kΩ [at 20°C (68°F)]
0.9 – 1.3 kΩ [at 40°C (104°F)]
0.48 – 0.68 kΩ [at 60°C (140°F)]
0.26 – 0.36 kΩ [at 80°C (176°F)]



(4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.
(5) Install the engine coolant temperature sensor, and tighten to the specified torque.

Tightening torque: 29 ± 10 N·m (22 ± 6 ft-lb)

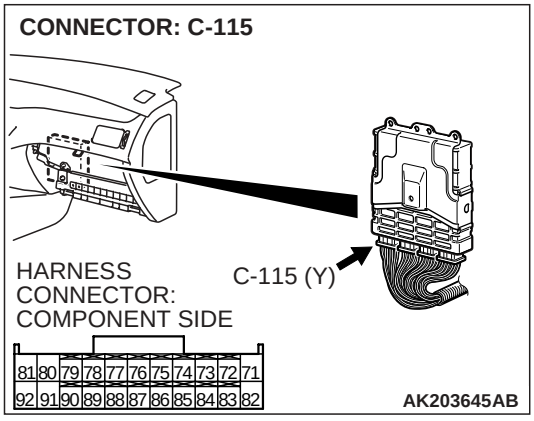
Q: Is the resistance at the standard value?

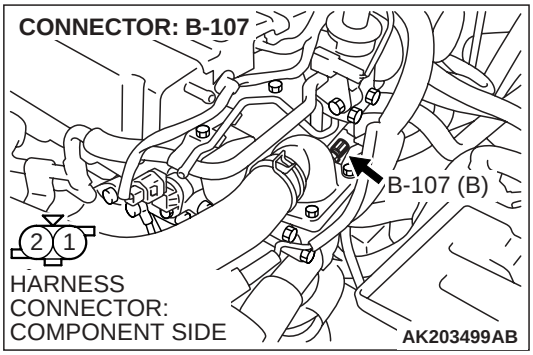
YES : Go to Step 12.
NO : Replace the engine coolant temperature sensor. Then go to Step 14.

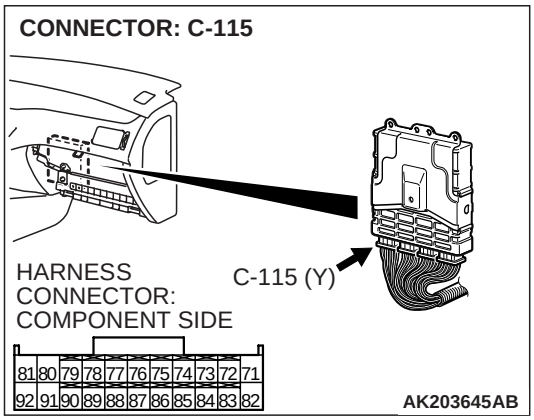
STEP 12. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 13.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.







STEP 13. Check for harness damage between engine coolant temperature sensor connector B-107 (terminal No. 1) and ECM connector C-115 (terminal No. 83).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 14.

NO : Repair it. Then go to Step 14.

STEP 14. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0125 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0128 : COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

TECHNICAL DESCRIPTION

- The ECM checks the time for the engine coolant temperature to reach the judgment temperature.

DTC SET CONDITIONS

Check Conditions

- Engine coolant temperature is between –10°C (14°F) and 77°C (171°F) when the engine is started.
- The engine coolant temperature – intake air temperature is 5°C (9°F) or less when the engine is started.
- The intake air temperature when the engine is started – intake air temperature is 5°C (9°F) or less.
- The volume airflow sensors output frequency is in the low frequency (50 – 100 Hz or less) state for 400 seconds or less.

Judgment Criteria

- The time for the engine coolant temperature to rise to 77°C (171°F) takes longer than approximately 9 to 14.5 minutes.
- The ECM monitors for this condition once during the drive cycle.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- The thermostat is faulty
- ECM failed.

DIAGNOSIS

STEP 1. Check the cooling system.
Refer to GROUP 14, Engine Cooling Diagnosis P.14-3.

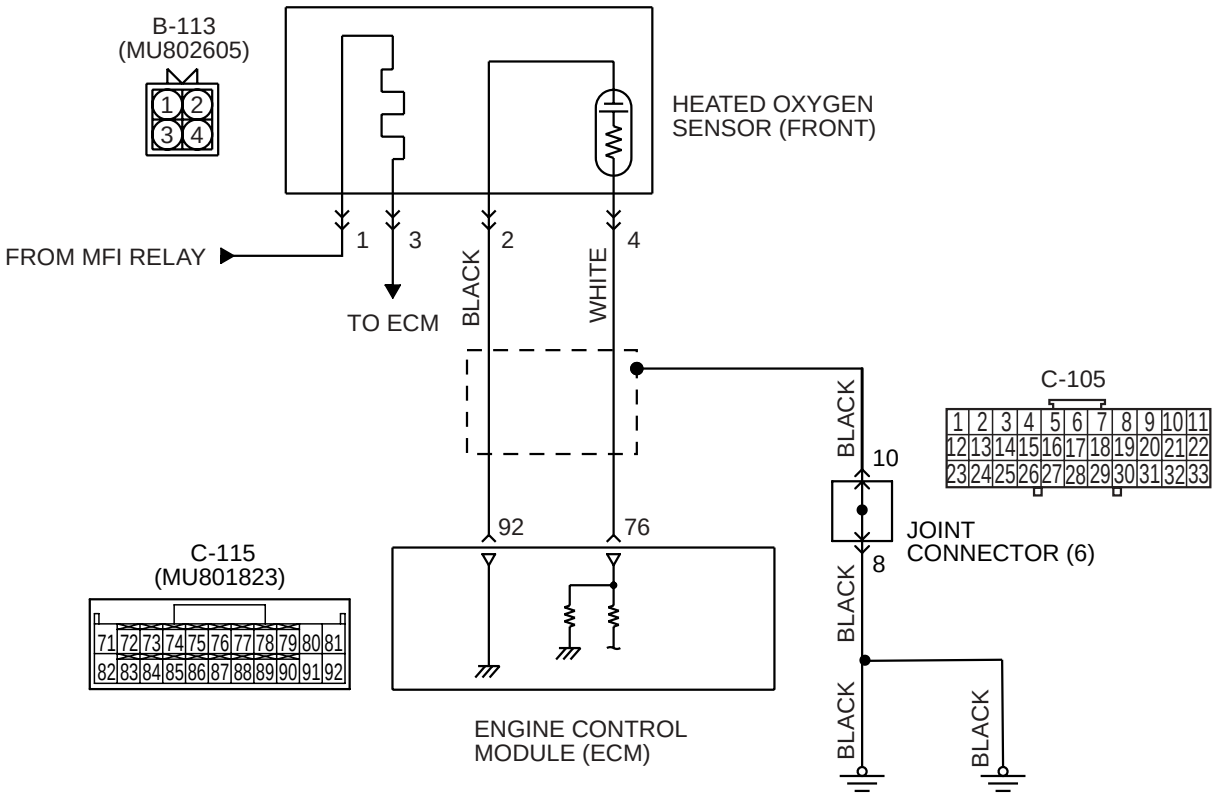
Q: Is the cooling system normal?

YES : Replace the ECM. Then check that the DTC P0128 does not reset.

NO : Repair it. Then check that the DTC P0128 does not reset.

DTC P0130: HEATED OXYGEN SENSOR CIRCUIT (SENSOR 1)

Heated Oxygen Sensor (front) Circuit



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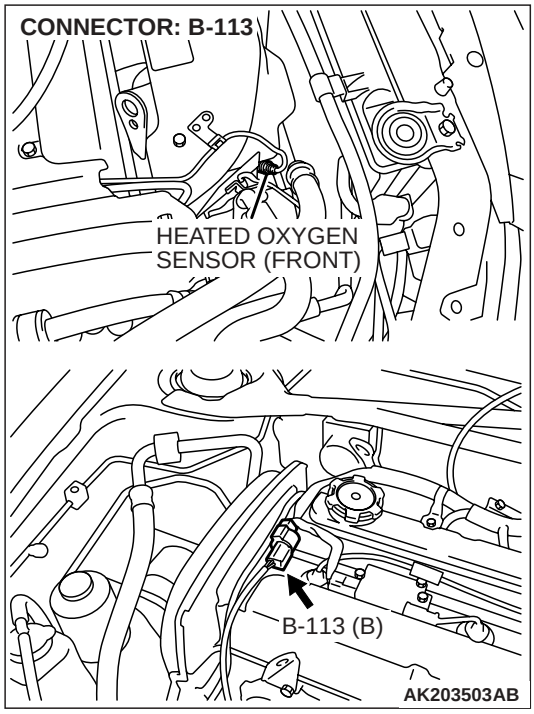
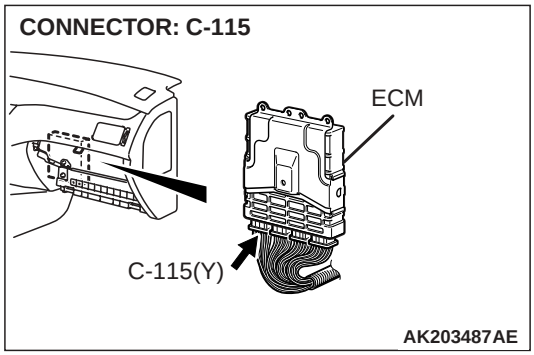
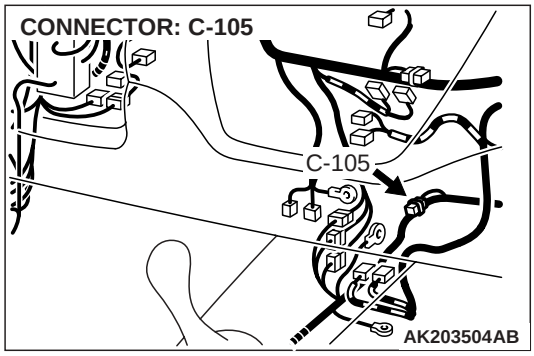






CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 76) from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 92).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM also checks for an open circuit in the heated oxygen sensor (front) output line.

DTC SET CONDITIONS

Check Conditions

- 3 minutes or more have passed since the starting sequence was completed.
- Heated oxygen sensor (front) signal voltage has continued to be 0.2 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Monitoring time: 7 seconds.

Judgment Criteria

- Input voltage supplied to the ECM interface circuit is higher than 4.5 volts when 5 volts is applied to the heated oxygen sensor (front) output line via a resistor.
- The ECM monitors for this condition once during the drive cycle.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

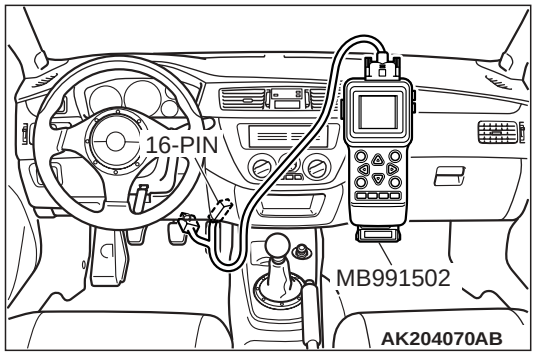
- Heated oxygen sensor (front) deteriorated.
- Open or shorted circuit in heated oxygen sensor (front) output line or harness damage.
- Open circuit in heated oxygen sensor (front) ground line or harness damage.
- ECM failed.

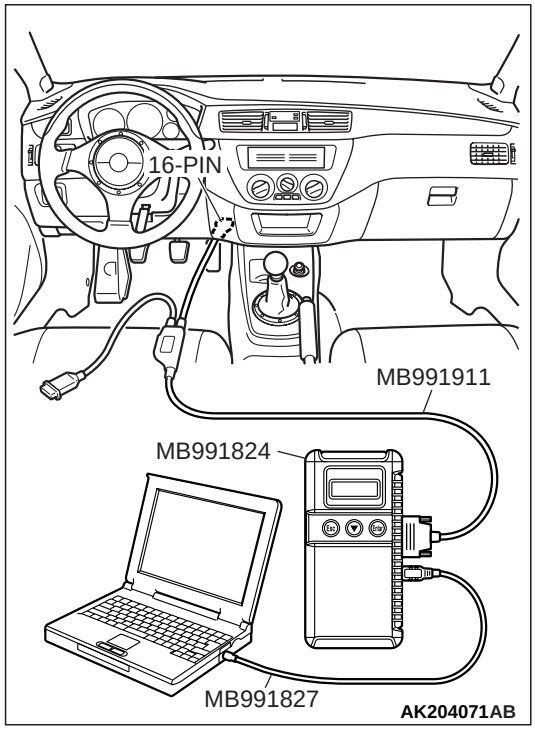
DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B
- MD998464: Test Harness

STEP 1. Using scan tool MB991502 or MB991958, check data list item 11: Heated Oxygen Sensor (front).





⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
  - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
  - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt and 0.6 to 1.0 volt alternately.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

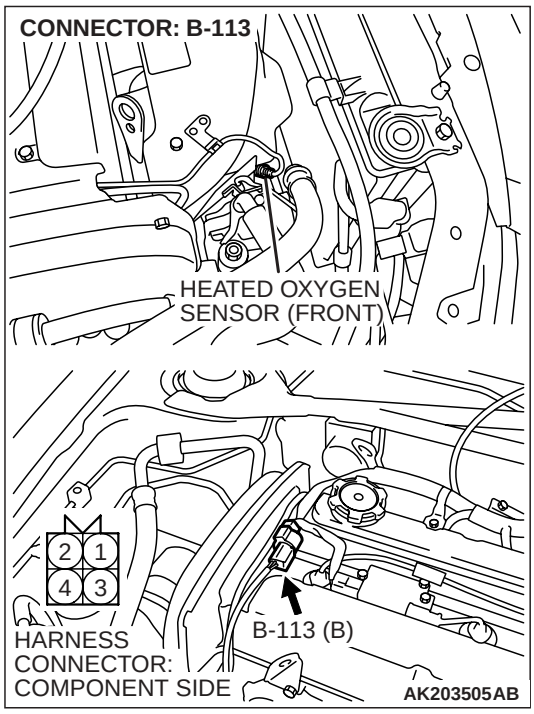
Q: Is the sensor operating properly?

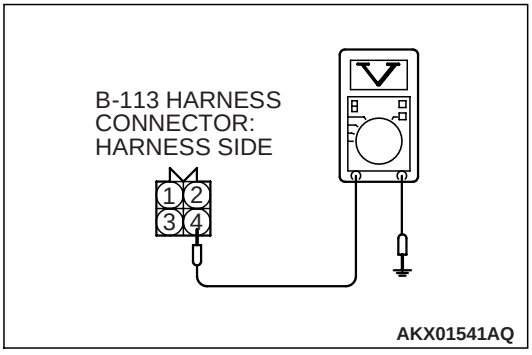
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at heated oxygen sensor (front) connector B-113 by backprobing.

(1) Do not disconnect connector B-113.
(2) Start the engine and run at idle.



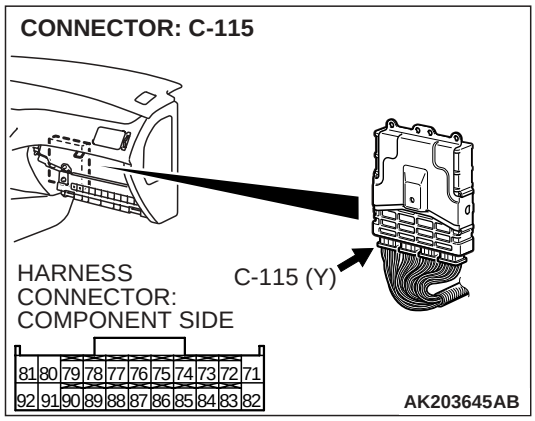


(3) Measure the voltage between terminal No. 4 and ground by backprobing.
- Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

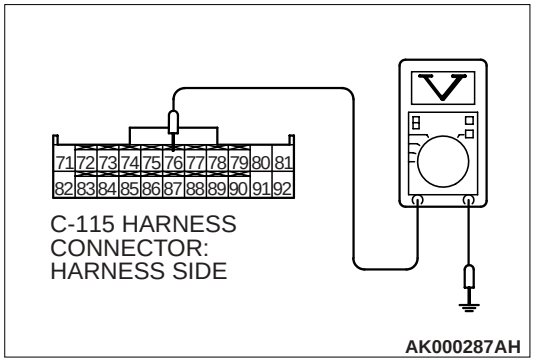
Q: Is the measured voltage within the specified range?

YES : Go to Step 3.
NO : Go to Step 7.



STEP 3. Measure the sensor output voltage at ECM connector C-115 by backprobing.

(1) Do not disconnect connector C-115.
(2) Start the engine and run at idle.

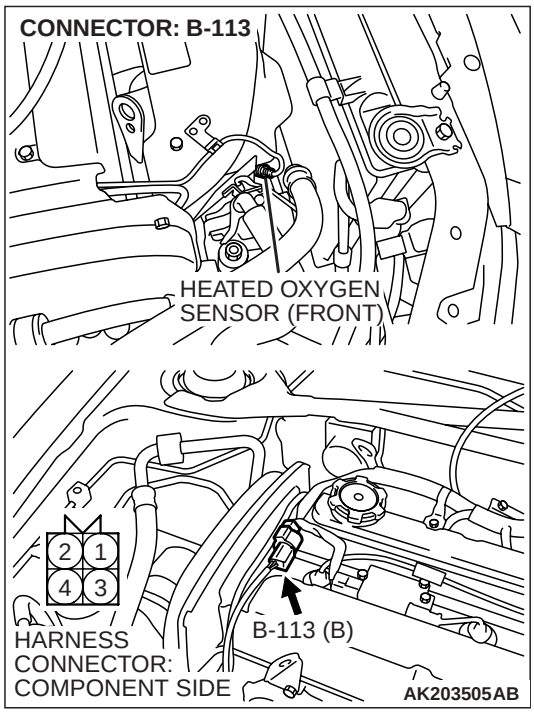


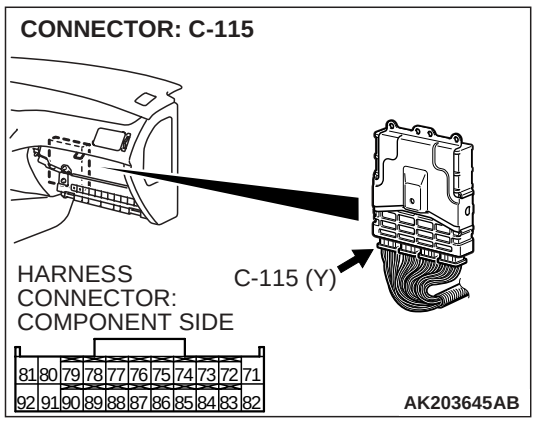
(3) Measure the voltage between terminal No. 76 and ground by backprobing.
- Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage within the specified range?

YES : Go to Step 4.
NO : Go to Step 6.



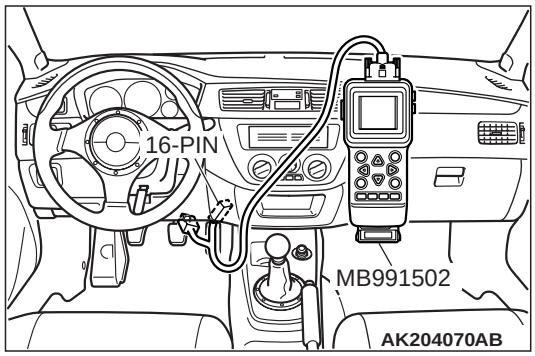


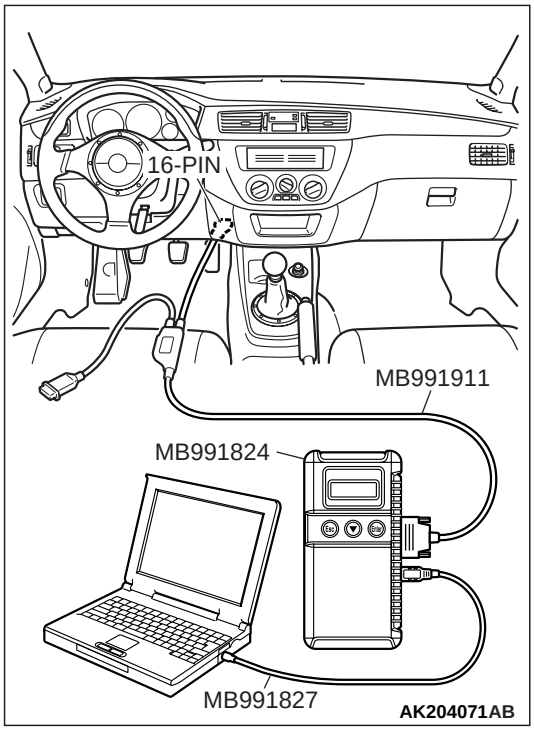
STEP 4. Check connector B-113 at heated oxygen sensor (front) and connector C-115 at ECM for damage.

Q: Is the connector in good condition?

YES : Go to Step 5.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.





STEP 5. Using scan tool MB991502 or MB991958, check data list item 11: Heated Oxygen Sensor (front).

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

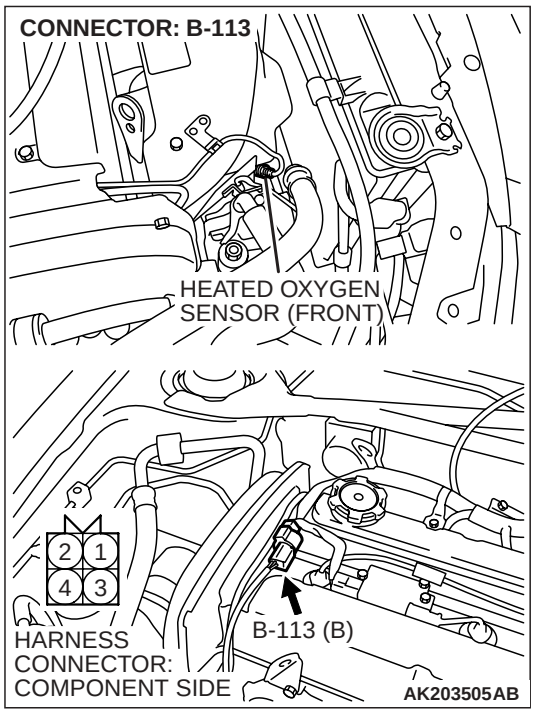
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
- Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
- Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt and 0.6 to 1.0 volt alternately.

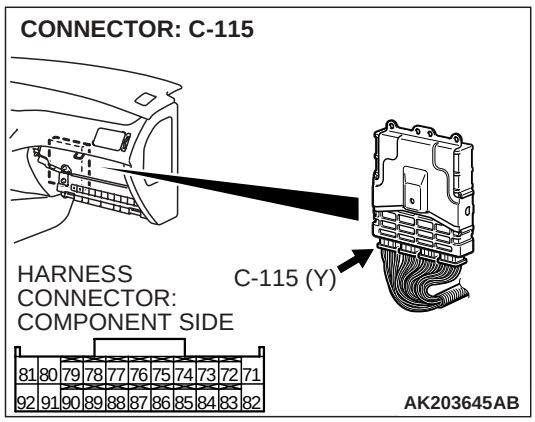
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Replace the ECM. Then go to Step 15.



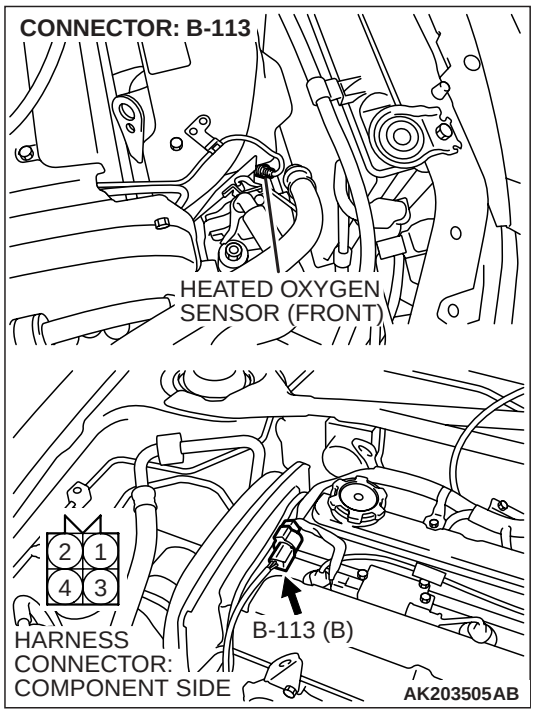


STEP 6. Check harness connector B-113 at heated oxygen sensor (front) and connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76) because of open circuit or harness damage. Then go to Step 15.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.



STEP 7. Check harness connector B-113 at heated oxygen sensor (front) for damage.

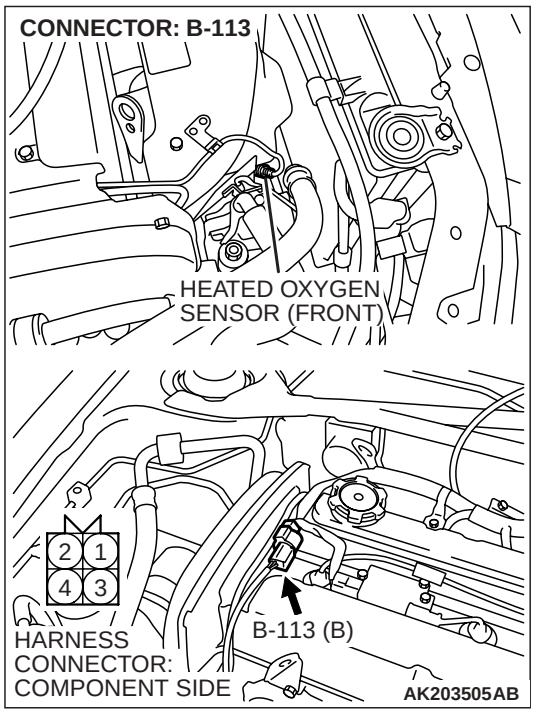
Q: Is the harness connector in good condition?

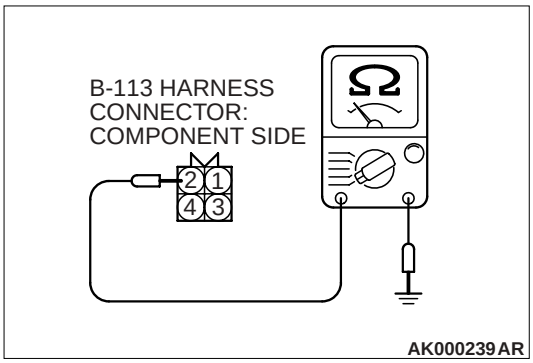
YES : Go to Step 8.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

STEP 8. Check for continuity at heated oxygen sensor (front) harness side connector B-113.

(1) Disconnect connector B-113 and measure at the harness side.





(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

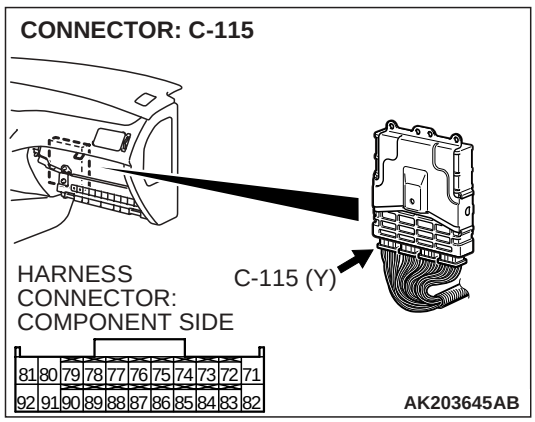
Q: Does continuity exist?

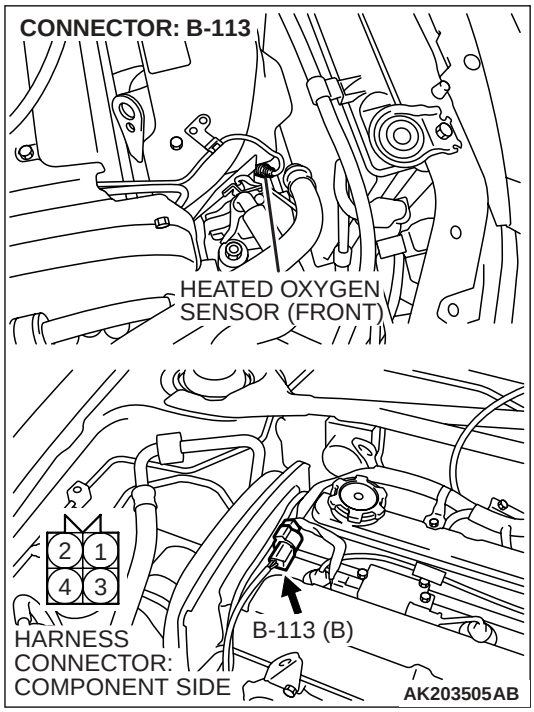
YES : Go to Step 11.
NO : Go to Step 9.

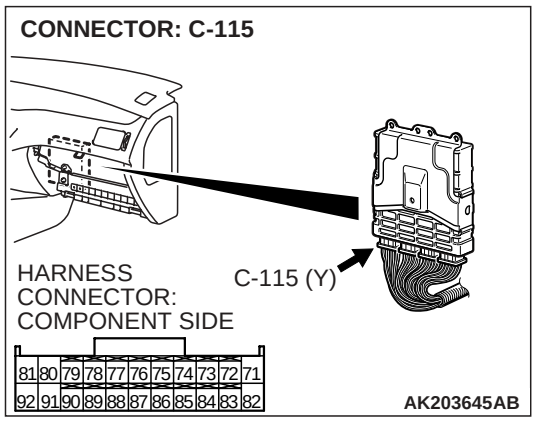
STEP 9. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.





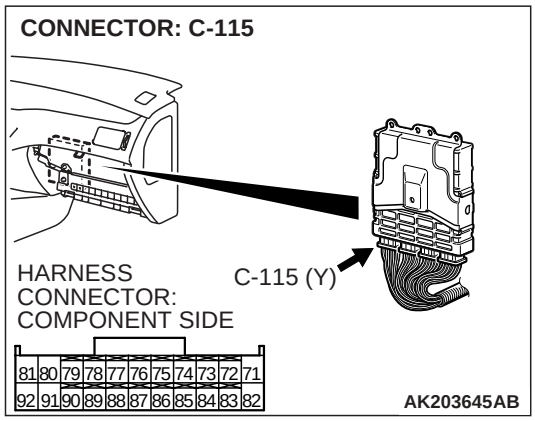


STEP 10. Check for open circuit and harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 2) and ECM connector C-115 (terminal No. 92).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 15.

NO : Repair it. Then go to Step 15.

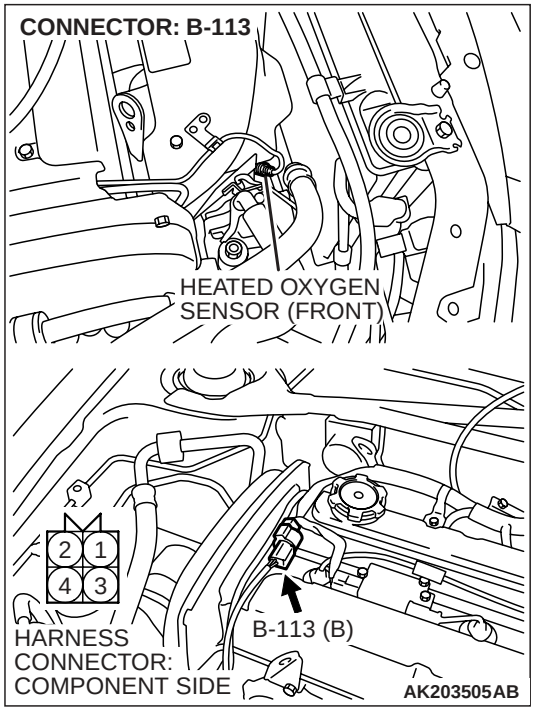


STEP 11. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 12.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

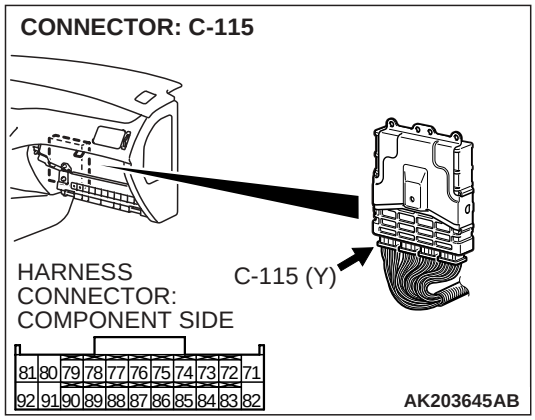


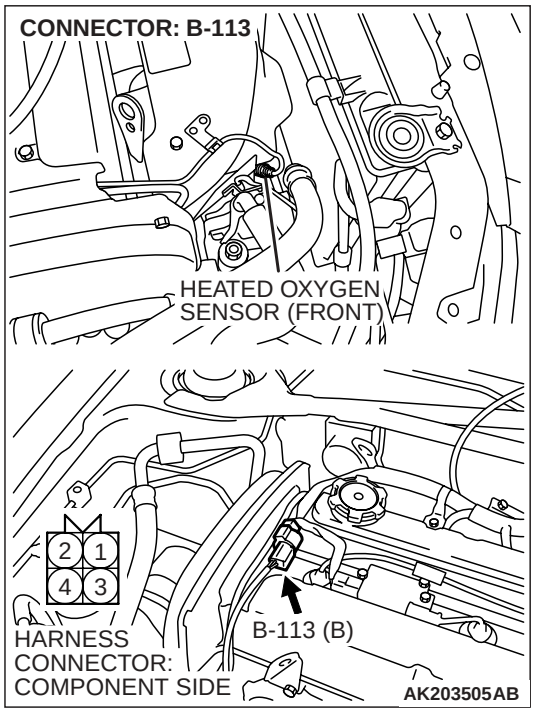
STEP 12. Check for harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 2) and ECM connector C-115 (terminal No. 92).

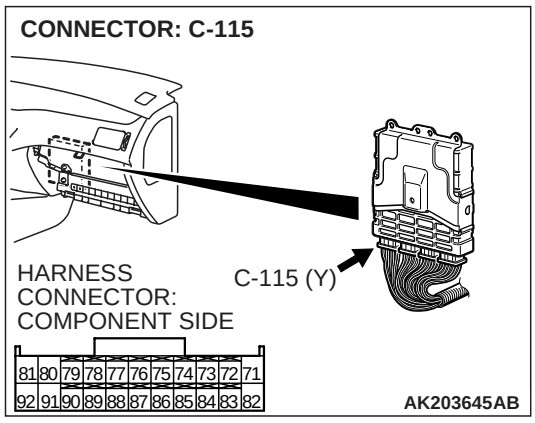
Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 15.





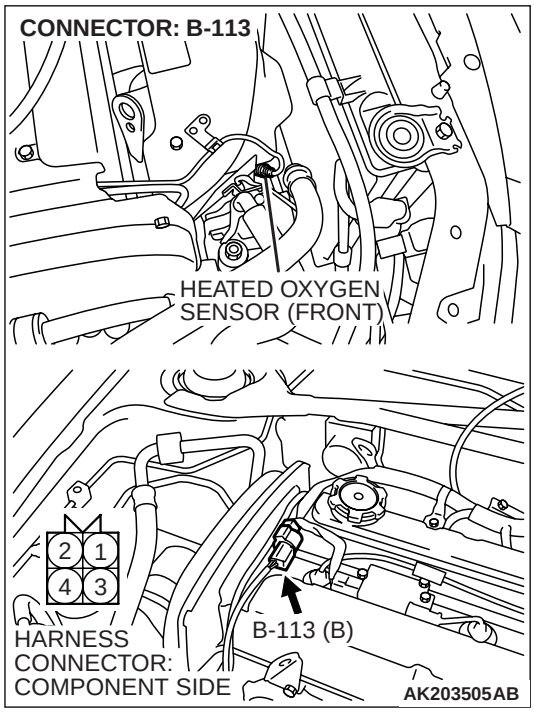


STEP 13. Check for short circuit to ground and harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76).

Q: Is the harness wire in good condition?

YES : Go to Step 14.

NO : Repair it. Then go to Step 15.

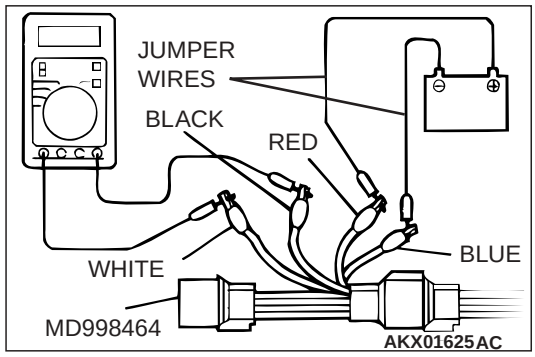


STEP 14. Check the heated oxygen sensor (front).

(1) Disconnect the heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464, to the connector on the heated oxygen sensor (front) side.
(2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.

⚠ CAUTION

Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (front).



(3) Use the jumper wires to connect terminal No. 1 (red clip) to the positive battery terminal and terminal No. 3 (blue clip) to the negative battery terminal.
(4) Connect a digital volt meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
(5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Replace the ECM. Then go to Step 15.
NO : Replace the heated oxygen sensor (front). Then go to Step 15.

STEP 15. Perform the OBD-II drive cycle.

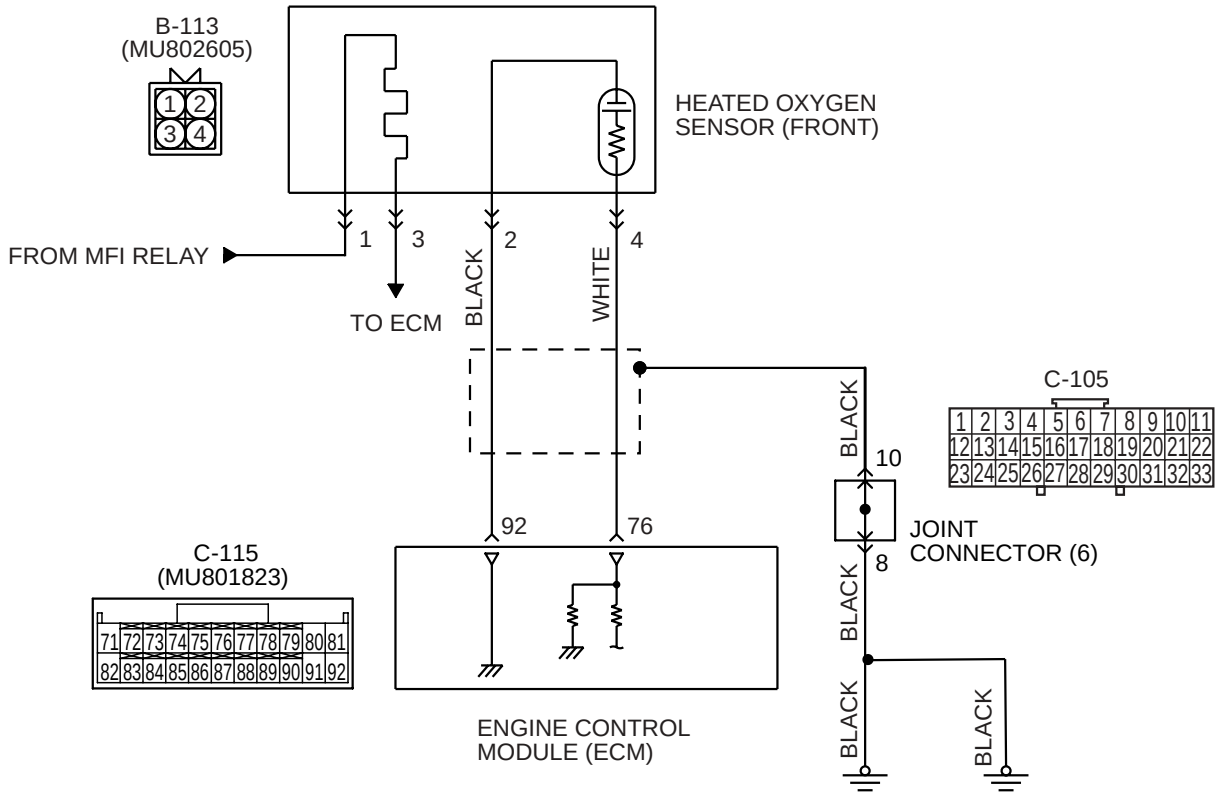
(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0130 set?

YES : Repeat the troubleshooting.
NO : The procedure is complete.

DTC P0131: HEATED OXYGEN SENSOR CIRCUIT LOW VOLTAGE (SENSOR 1)

Heated Oxygen Sensor (front) Circuit



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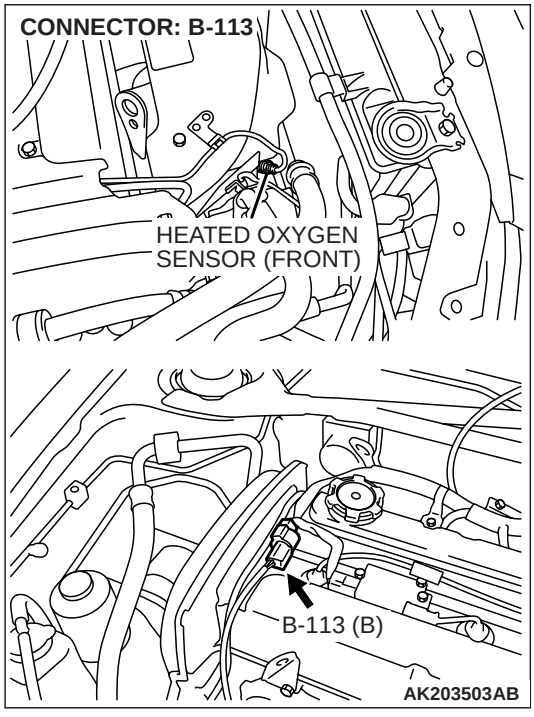
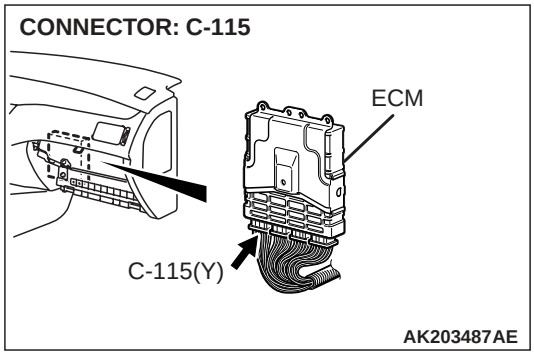
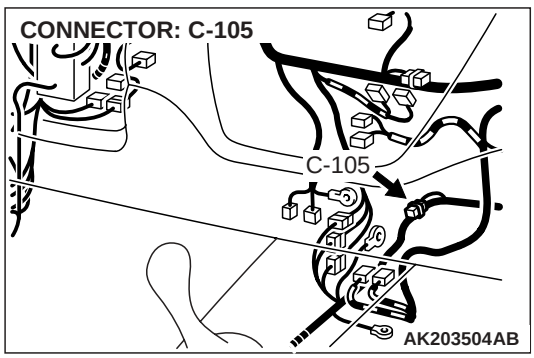






TSB Revision

CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 76) from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 92).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM also checks for an open circuit in the heated oxygen sensor (front) output line.

DTC SET CONDITIONS

Check Conditions

- 3 minutes or more have passed since the starting sequence was completed.
- Heated oxygen sensor (front) signal voltage has continued to be 0.2 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Volume airflow sensor output frequency is 56 Hz or more.
- At least 20 seconds have passed since fuel shut off control was canceled.
- After the ignition switch is turned ON, the changes in the output voltage of the heated oxygen sensor (front) is lower than 0.078 volt.
- Monitoring time: 10 seconds.

Judgement Criteria

- Making the air/fuel ratio 15 percent for 10 seconds richer does not result in raising the heated oxygen sensor (front) output voltage beyond 0.2 volt.
- The ECM monitors for this condition once during the drive cycle.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

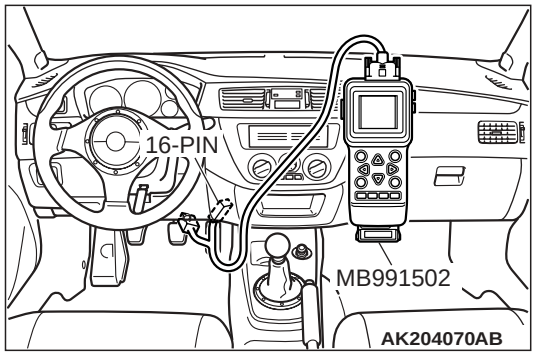
- Heated oxygen sensor (front) deteriorated.
- Short circuit in heated oxygen sensor (front) output line.
- Connector damage.
- ECM failed.

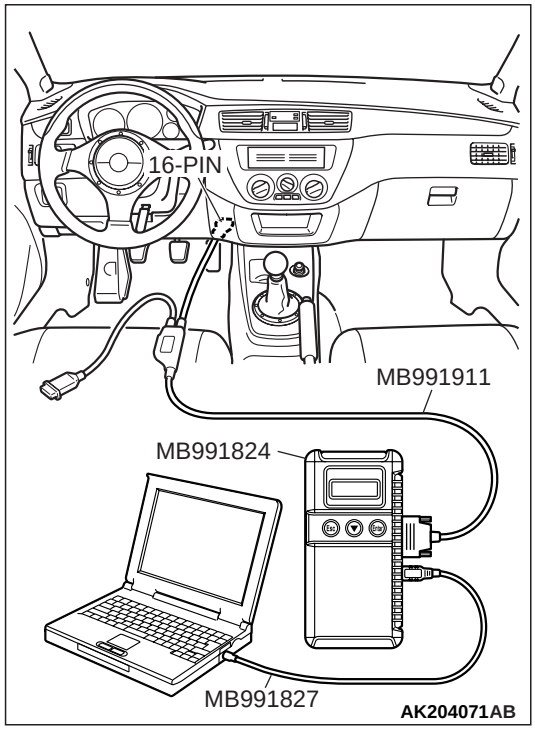
DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B
- MD998464: Test Harness

STEP 1. Using scan tool MB991502 or MB991958, check data list item 11: Heated Oxygen Sensor (front).





⚠ CAUTION

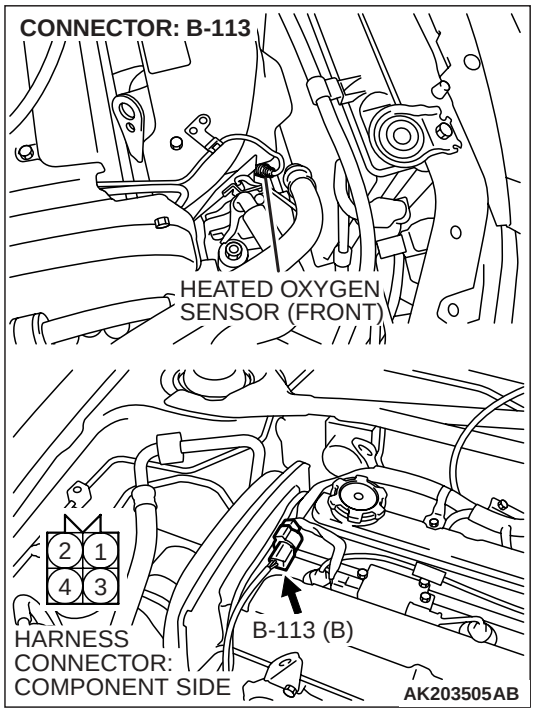
To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
  - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
  - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt and 0.6 to 1.0 volt alternately.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

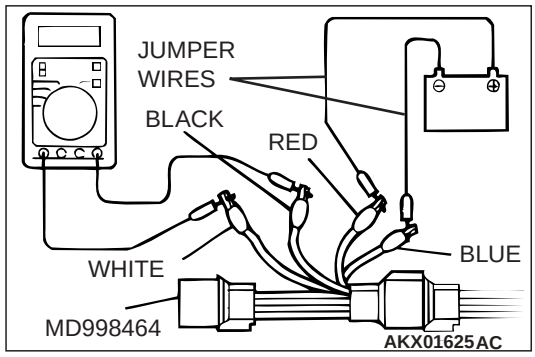


STEP 2. Check the heated oxygen sensor (front).

(1) Disconnect the heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464, to the connector on the heated oxygen sensor (front) side.
(2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.

⚠ CAUTION

Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (front).

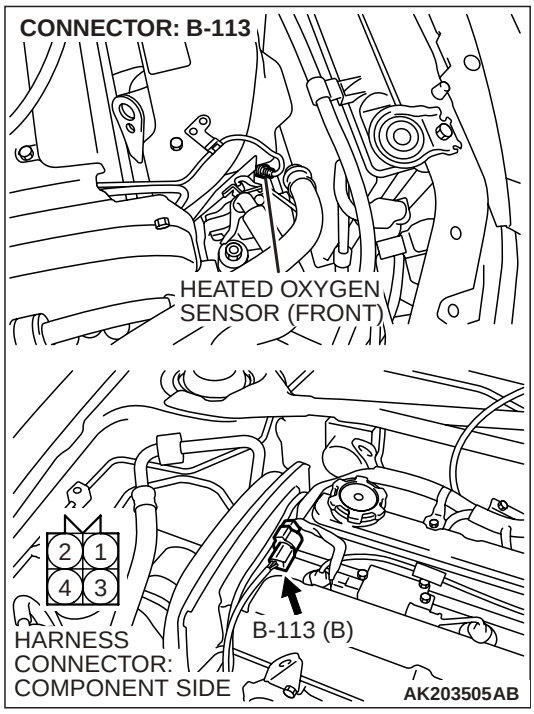


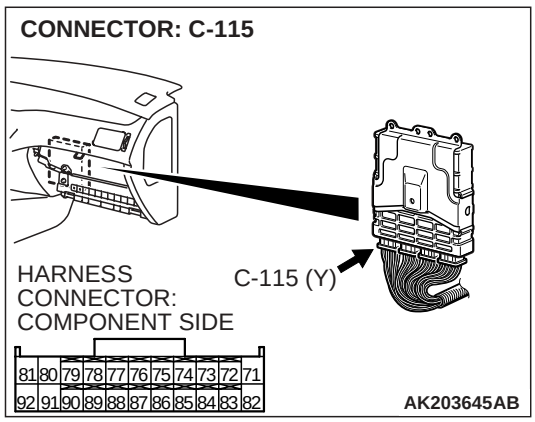
(3) Use the jumper wires to connect terminal No. 1 (red clip) to the positive battery terminal and terminal No. 3 (blue clip) to the negative battery terminal.
(4) Connect a digital volt meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
(5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 3.
NO : Replace the heated oxygen sensor (front). Then go to Step 5.



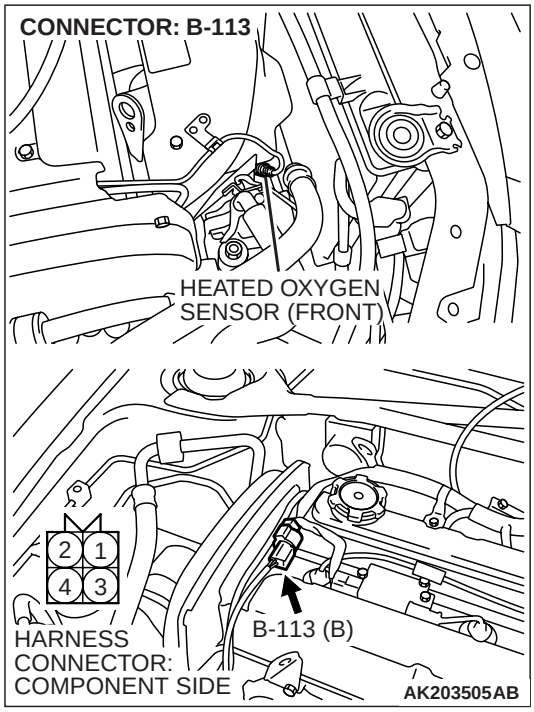


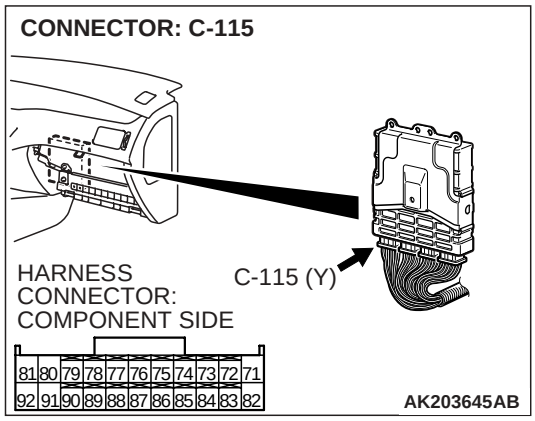
STEP 3. Check harness connector B-113 at heated oxygen sensor (front) and connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 5.





STEP 4. Check for short circuit to ground between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 5.

NO : Repair it. Then go to Step 5.

STEP 5. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

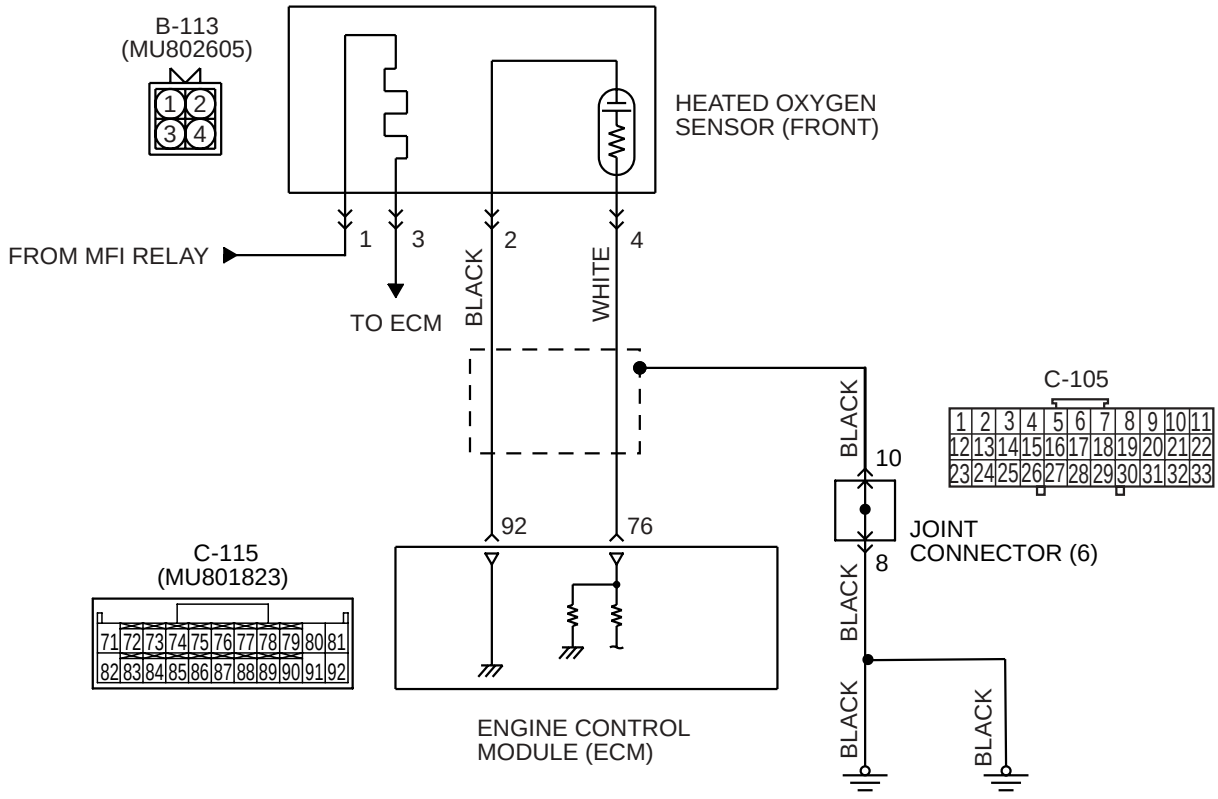
Q: Is DTC P0131 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0132: HEATED OXYGEN SENSOR CIRCUIT HIGH VOLTAGE (SENSOR 1)

Heated Oxygen Sensor (front) Circuit



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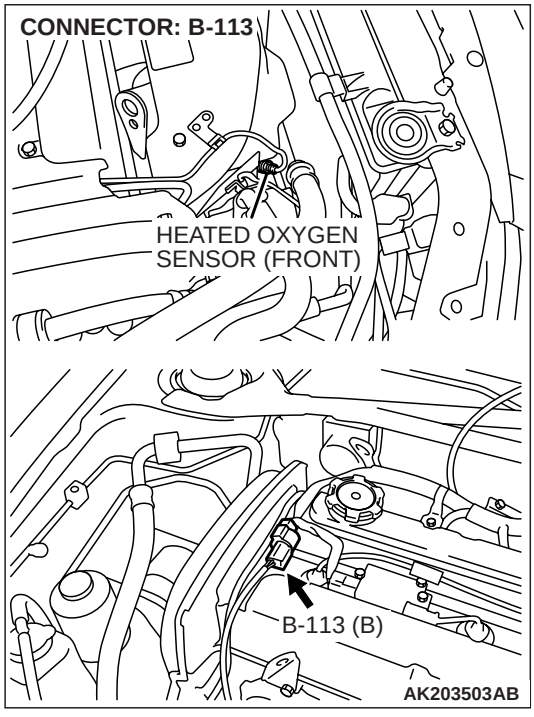
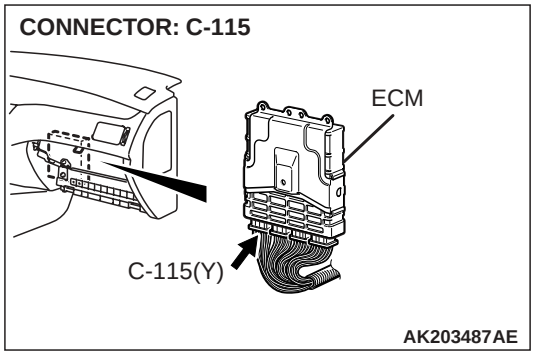
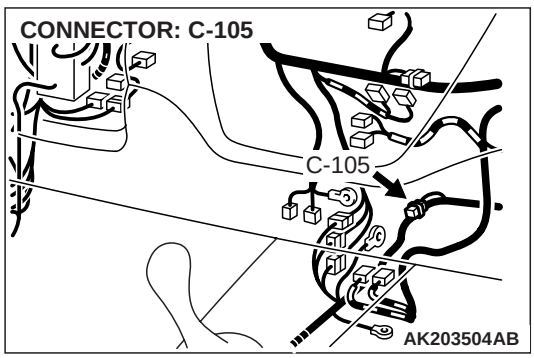






TSB Revision

CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 76) from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 92).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM also checks for an open circuit in the heated oxygen sensor (front) output line.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the starting sequence was completed.

Judgment Criteria

- Heated oxygen sensor (front) output voltage has continued to be 1.2 volts or higher for 2 seconds.

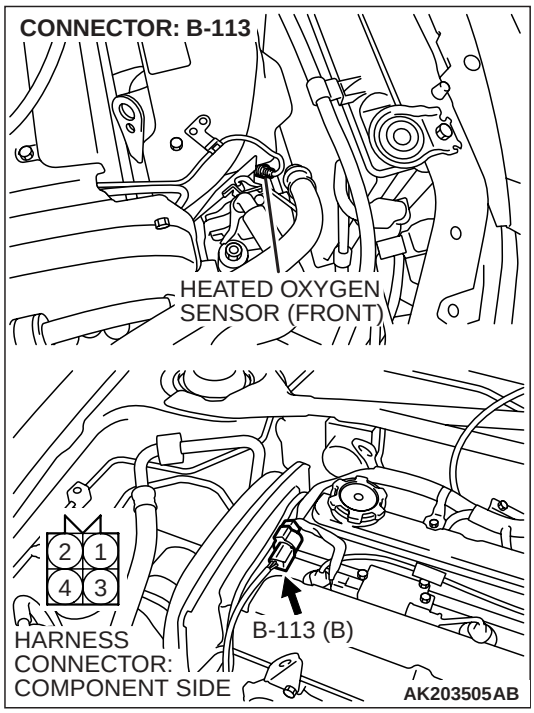
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

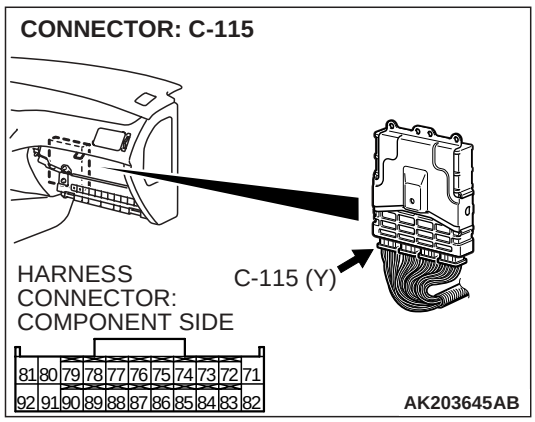
- Heated oxygen sensor (front) deteriorated.
- Short circuit in heated oxygen sensor (front) output line.
- Connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

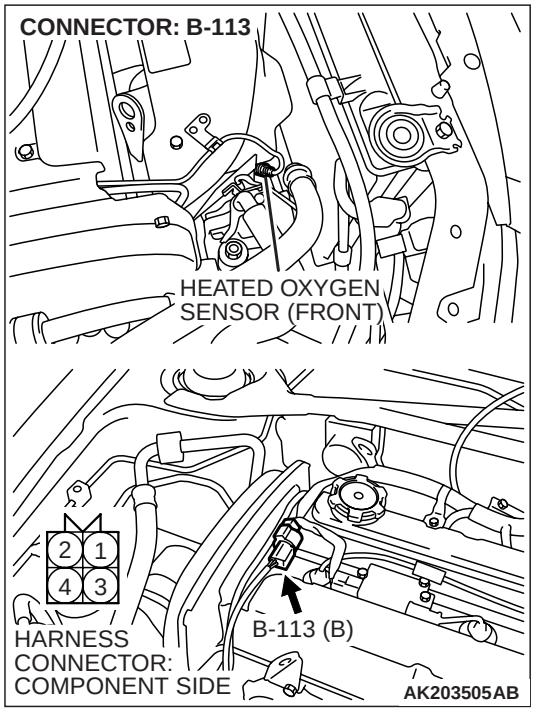
- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

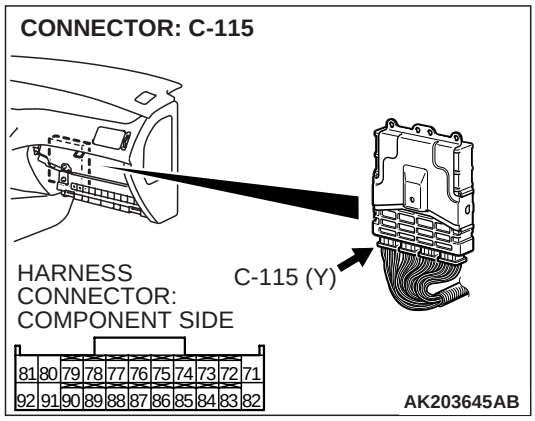




STEP 1. Check harness connector B-113 at heated oxygen sensor (front) and connector C-115 at ECM for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 2.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 3.





STEP 2. Check for short circuit to power supply between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 3.

NO : Repair it. Then go to Step 3.

STEP 3. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

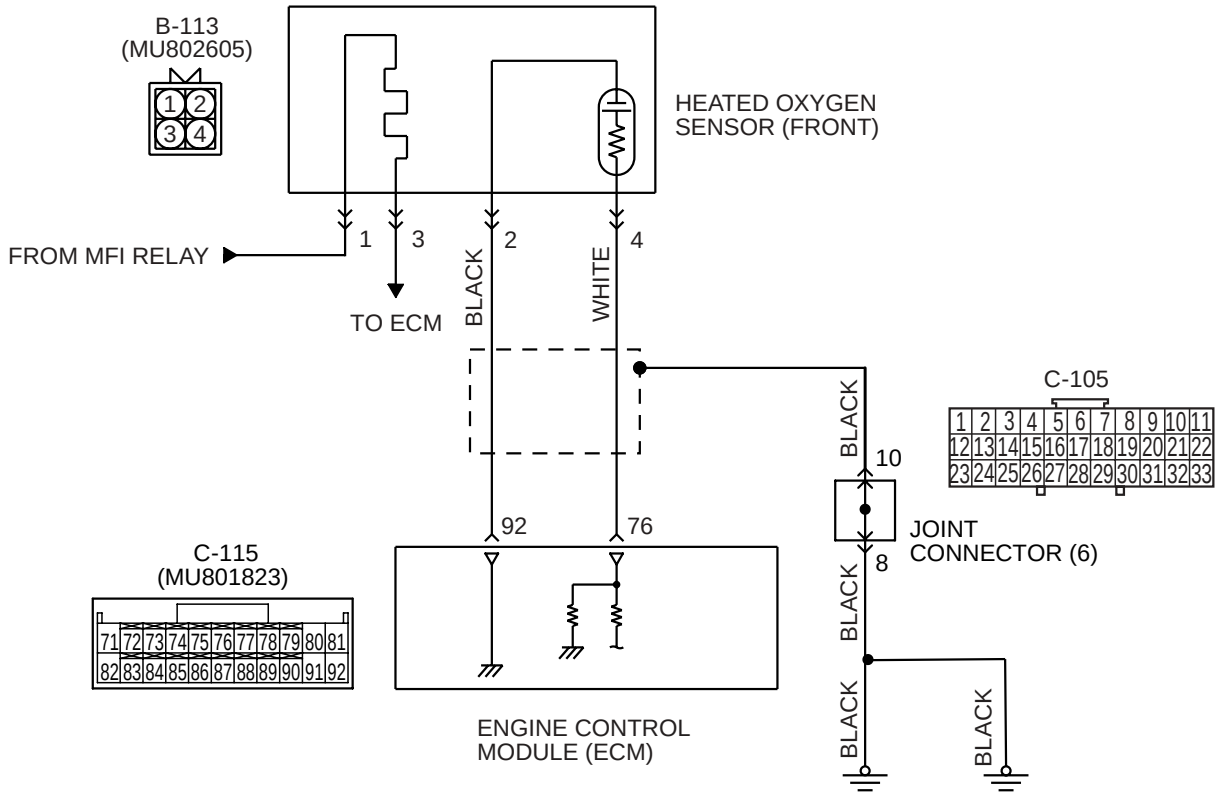
Q: Is DTC P0132 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0133: HEATED OXYGEN SENSOR CIRCUIT SLOW RESPONSE (SENSOR 1)

Heated Oxygen Sensor (front) Circuit



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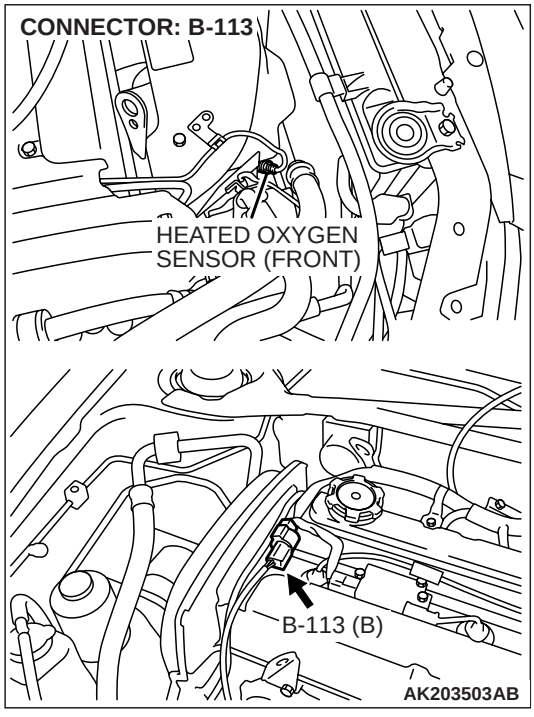
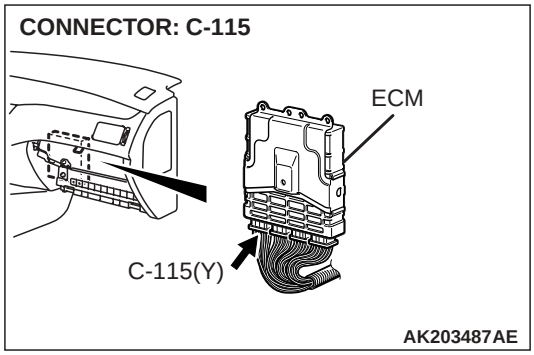
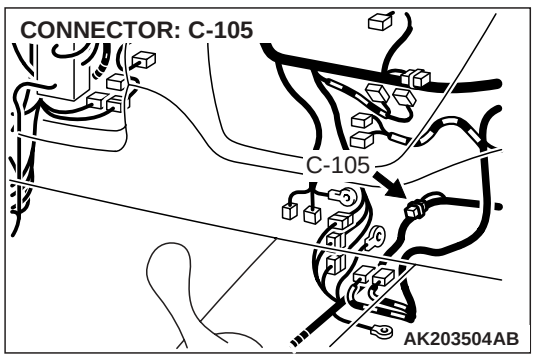






TSB Revision

CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 76) from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 92).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM also checks for an open circuit in the heated oxygen sensor (front) output line.

DTC SET CONDITIONS

Check Conditions

- Engine coolant temperature is higher than 50°C (122°F).
- Engine speed is at between 1,200 and 3,000 r/min.
- Volumetric efficiency is at between 20 and 60 percent.
- Under the closed loop air/fuel control.
- Short-term fuel trim is at between –25 percent and +25 percent.
- The throttle valve is open.
- More than 2 seconds have elapsed after the above mentioned conditions have been met.
- The ECM monitors for this condition for 7 cycles of 10 seconds each during the drive cycle.

Judgment Criteria

- The heated oxygen sensor (front) sends "lean" and "rich" signals alternately 9 times or less for 10 seconds.

NOTE: If the sensor switching frequency is lower than the Judgment Criteria due to the MB991502 or MB991958 OBD-II test Mode – H02S Test Results, it is assumed that the heated oxygen sensor has deteriorated. If it is higher, it is assumed that the harness is damaged or has a short circuit.
If the heated oxygen sensor signal voltage has not changed even once (lean/rich) after the DTC was erased, the sensor switch time will display as 0 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

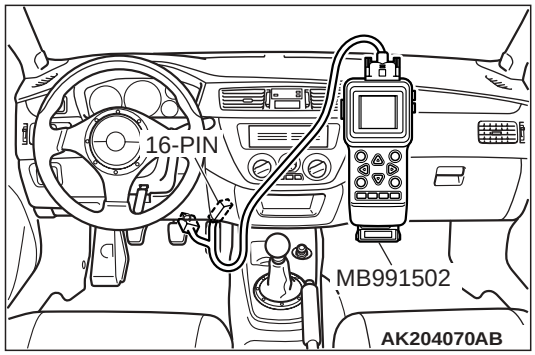
- Heated oxygen sensor (front) deteriorated.
- Connector damage.
- ECM failed.

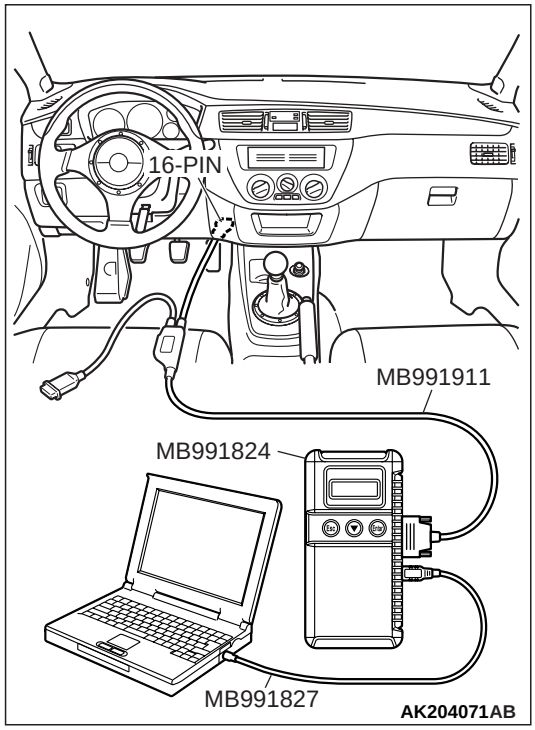
DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B
- MD998464: Test Harness

STEP 1. Using scan tool MB991502 or MB991958, check data list item 11: Heated Oxygen Sensor (front).





⚠ CAUTION

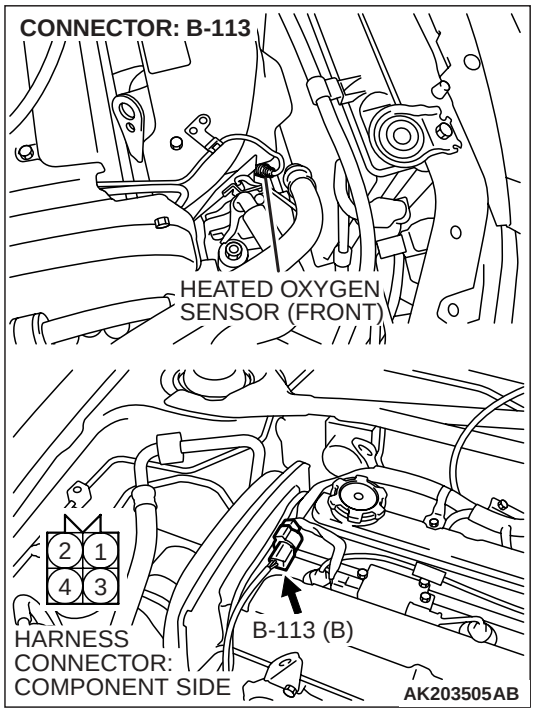
To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
(4) Warm up the engine, 2,500 r/min.
  - Output voltage repeats 0.4 volt or less and 0.6 – 1.0 volt 10 times or more within 10 seconds.
(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

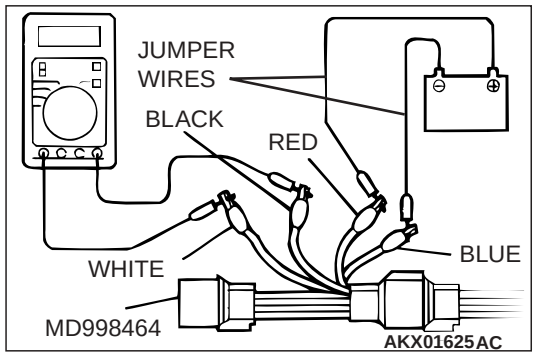


STEP 2. Check the heated oxygen sensor (front).

(1) Disconnect the heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464, to the connector on the heated oxygen sensor (front) side.
(2) Warm up the engine until engine coolant 80°C (176°F) or higher.

⚠ CAUTION

Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (front).

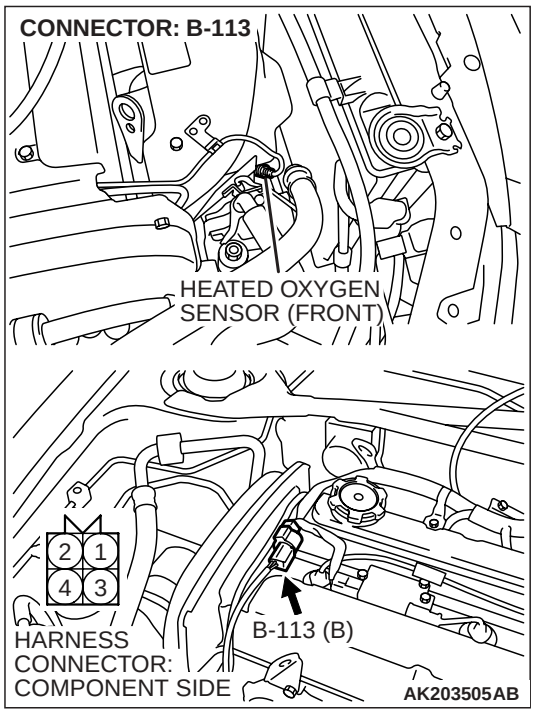


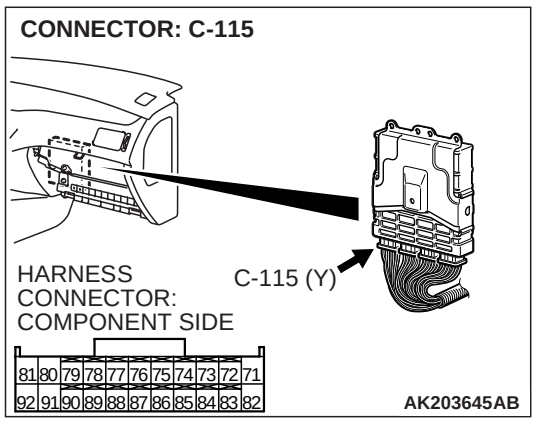
(3) Use the jumper wires to connect terminal No. 1 (red clip) to the positive battery terminal and terminal No. 3 (blue clip) to the negative battery terminal.
(4) Connect a digital volt meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
(5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 3.
NO : Replace the heated oxygen sensor (front). Then go to Step 4.





STEP 3. Check harness connector B-113 at heated oxygen sensor (front) and connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Replace the ECM. Then go to Step 4.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 4.

STEP 4. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0133 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0134: HEATED OXYGEN SENSOR CIRCUIT NO ACTIVITY DETECTED (SENSOR 1)

Heated Oxygen Sensor Circuit No Activity Detected (sensor 1) Circuit

- Refer to, DTC P0130 Heated Oxygen Sensor (front) Circuit P.13A-156.
- Refer to, DTC P0201, P0202, P0203, P0204 – Injector Circuit P.13A-267.

CIRCUIT OPERATION

- Refer to, DTC P0130 Heated Oxygen Sensor (front) Circuit P.13A-156.
- Refer to, DTC P0201, P0202, P0203, P0204 – Injector Circuit P.13A-267.

TECHNICAL DESCRIPTION

- The ECM effects air/fuel ratio feedback control in accordance with the signals from the heater oxygen sensor (front).
- If the heated oxygen sensor (front) has deteriorated, corrections will be made by the heated oxygen sensor (rear).
- DTC P0134 becomes stored in memory if a failure is detected in the above air/fuel ratio feedback control system.

DTC SET CONDITIONS

Check Conditions

- Thirty seconds or more have passed since the starting sequence was completed.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is at between 30 and 100 percent.
- Throttle position sensor output voltage is lower than 4.3 volts.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgment Criteria

- Heated oxygen sensor (front) output voltage does not get across 0.5 volt within about 30 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

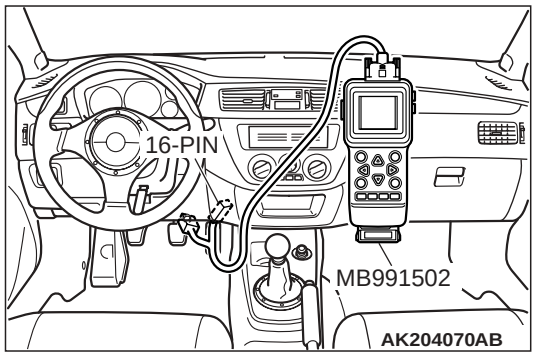
- Heated oxygen sensor (front) deteriorated.
- Harness damage in heated oxygen sensor (front) output line.
- Heated oxygen sensor (rear) deteriorated.

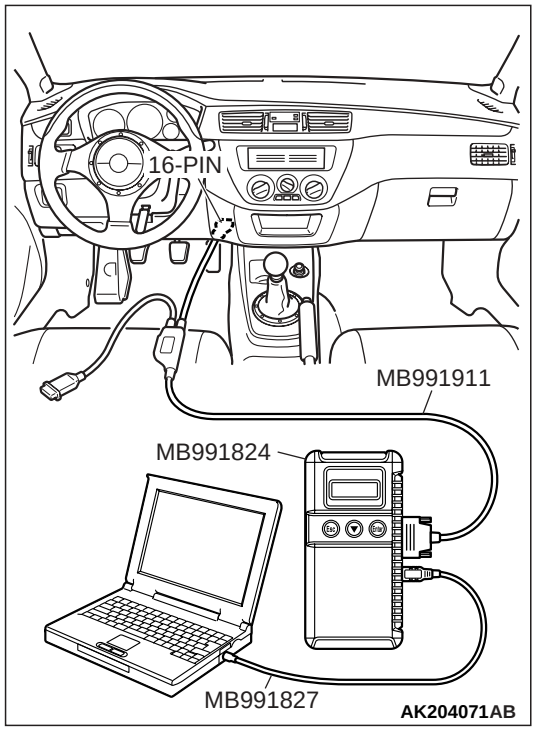
  NOTE: When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor output voltage will deviate from the voltage when the sensor was new (normally 0.5 volt at stoichiometric ratio). This deviation will be corrected by the heated oxygen sensor (rear).
  If the heated oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the heated oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the heated oxygen sensor (front) output voltage decreases, without intersecting with 0.5 volt. As a result, there is a possibility of DTC P0134 becoming registered.
- Open circuit in injector.
- Harness damage in injector circuit.
- Connector damage.
- ECM failed.
- Exhaust leak.
- Air drawn in from gaps in gasket, seal, etc.
- Incorrect fuel pressure.

DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B
- MD998464: Test Harness





STEP 1. Using scan tool MB991502 or MB991958, check data list item 59: Heated Oxygen Sensor (rear).

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
- Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 2.
NO : Refer to, DTC P0136 – Heated Oxygen Sensor Circuit (Sensor 2) P.13A-201, DTC P0137 – Heated Oxygen Sensor Circuit Low Voltage (sensor 2) P.13A-211, DTC P0138 – Heated Oxygen Sensor Circuit High Voltage (sensor 2) P.13A-216, DTC P0139 – Heated Oxygen Sensor Circuit Slow Response (sensor 2) P.13A-220,

STEP 2. Check for exhaust leaks.

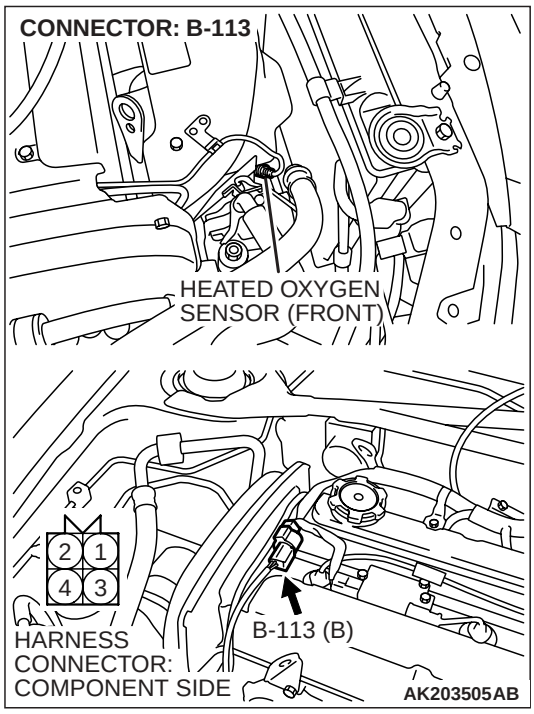
Q: Are there any abnormalities?

YES : Repair it. Then go to Step 12.
NO : Go to Step 3.

STEP 3. Check for intake system vacuum leaks.

Q: Are there any abnormalities?

YES : Repair it. Then go to Step 12.
NO : Go to Step 4.

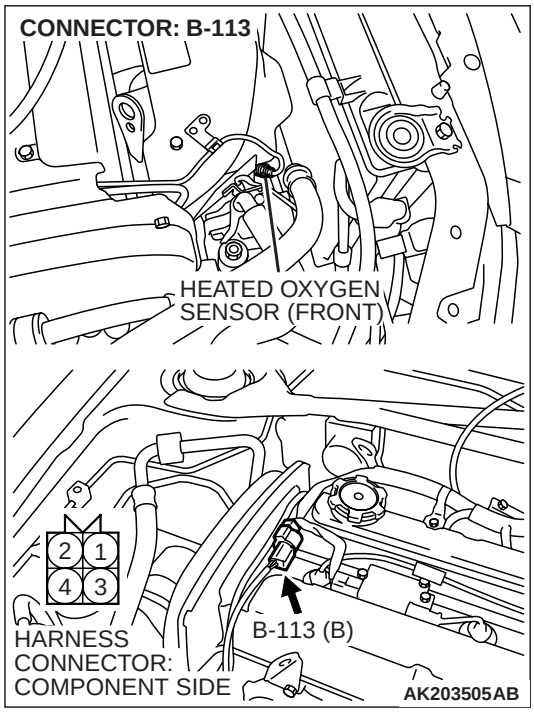


STEP 4. Check harness connector B-113 at the heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

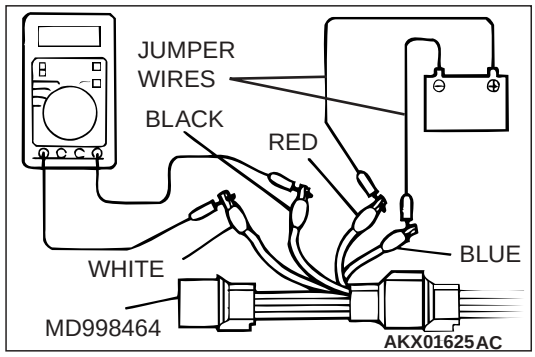


STEP 5. Check the heated oxygen sensor (front).

(1) Disconnect the heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464 to the connector on the heated oxygen sensor (front) side.
(2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.

⚠ CAUTION

Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (front).



(3) Use the jumper wires to connect terminal No. 1 (red clip) to the positive battery terminal and terminal No. 3 (blue clip) to the negative battery terminal.
(4) Connect a digital volt meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
(5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

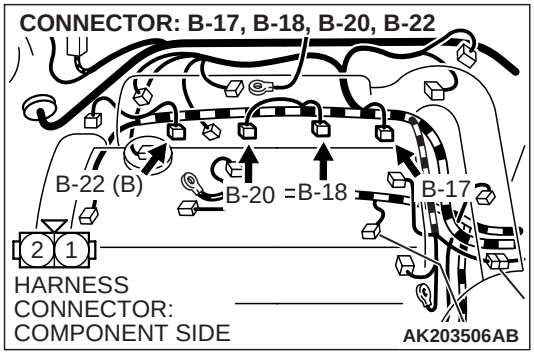
Q: Is the voltage between 0.6 and 1.0 volt?

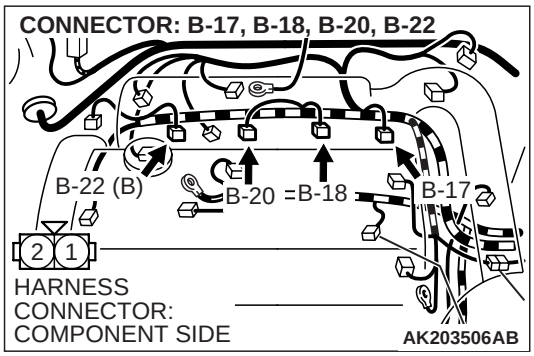
YES : Go to Step 6.
NO : Replace the heated oxygen sensor (front). Then go to Step 12.

STEP 6. Check harness connectors B-17, B-18, B-20, B-22 at injector for damage.

Q: Is the harness connector in good condition?

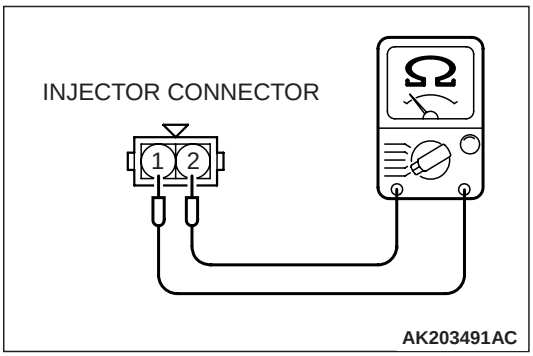
YES : Go to Step 7.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.





STEP 7. Check the injector.

(1) Disconnect each injector connector.



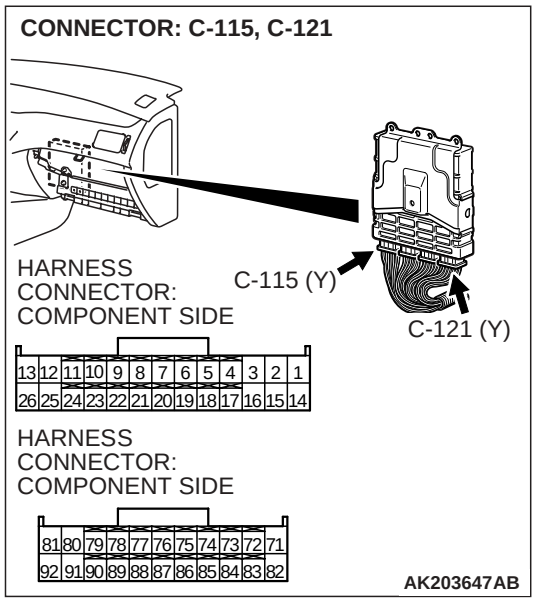
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 2 – 3 ohms [at 20°C (68°F)]

Q: Is the resistance between 2 and 3 ohms [at 20°C (68°F)]?

YES : Go to Step 9.

NO : Replace the injector. Then go to Step 12.

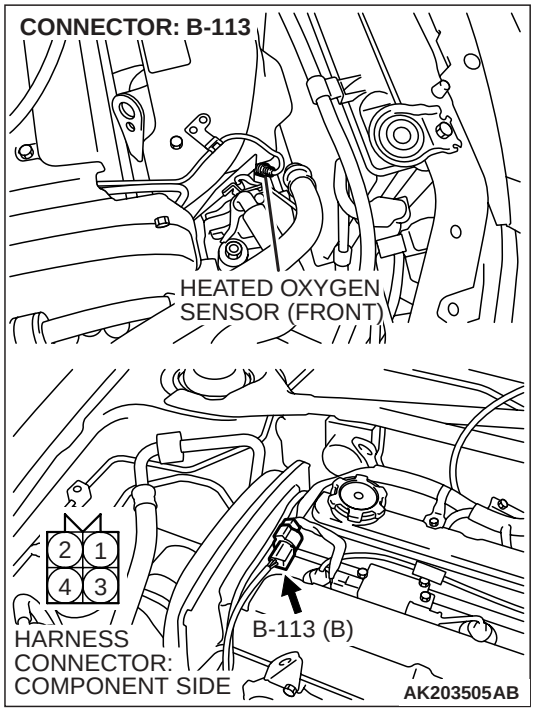


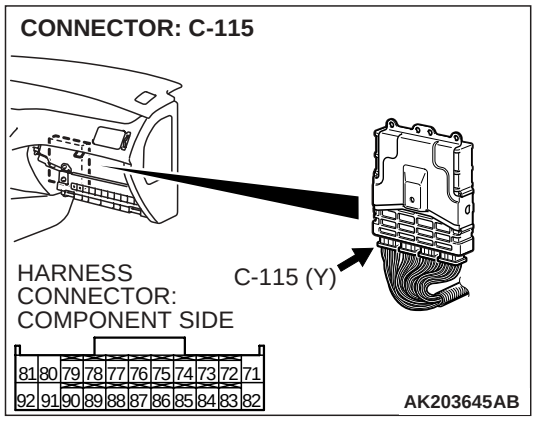
STEP 8. Check harness connectors C-115, C-121 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



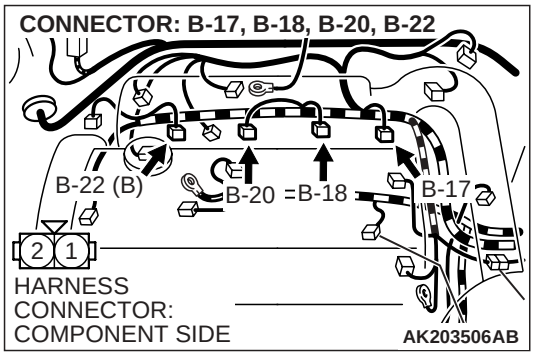


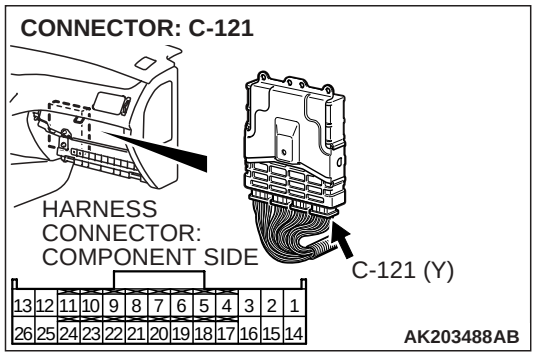
STEP 9. Check for harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between injector connectors B-17, B-18, B-20, B-22 and ECM connector C-121.

a. Check the harness wire between injector connector B-22 (terminal No. 2) and ECM connector C-121 (terminal No. 1) at No. 1 cylinder.
b. Check the harness wire between injector connector B-20 (terminal No. 2) and ECM connector C-121 (terminal No. 14) at No. 2 cylinder.
c. Check the harness wire between injector connector B-18 (terminal No. 2) and ECM connector C-121 (terminal No. 2) at No. 3 cylinder.
d. Check the harness wire between injector connector B-17 (terminal No. 2) and ECM connector C-121 (terminal No. 15) at No. 4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 11.
NO : Repair it. Then go to Step 12.

STEP 11. Check the fuel pressure.

Refer to GROUP 13A, Oh-vehicle Service – Fuel Pressure Test P.13A-762.

Q: Is the fuel pressure normal?

YES : Replace the ECM. Then go to Step 12.
NO : Repair it. Then go to Step 12.

STEP 12. Perform the OBD-II drive cycle.

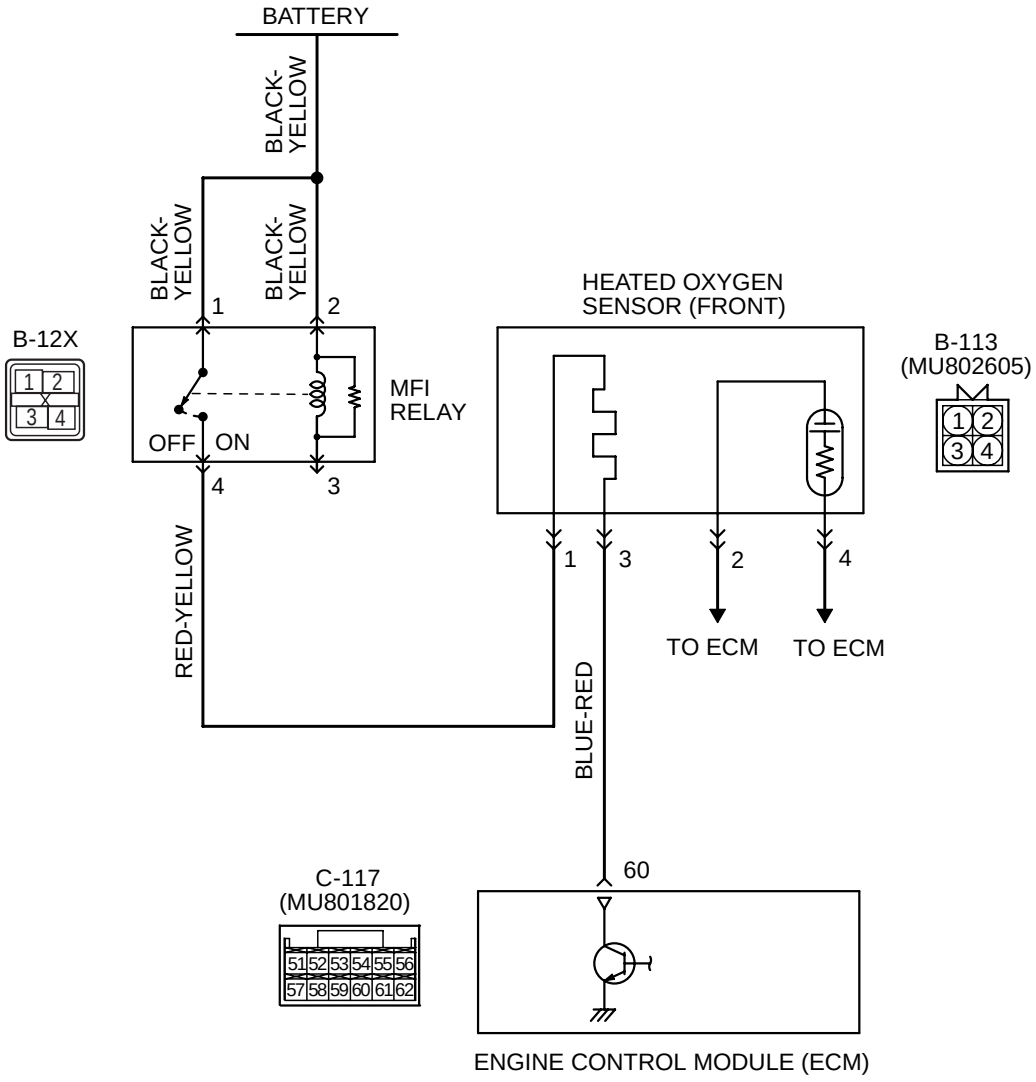
(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0134 set?

YES : Repeat the troubleshooting.
NO : The procedure is complete.

DTC P0135: HEATED OXYGEN SENSOR HEATER CIRCUIT (SENSOR 1)

Heated Oxygen Sensor (front) Heater Circuit



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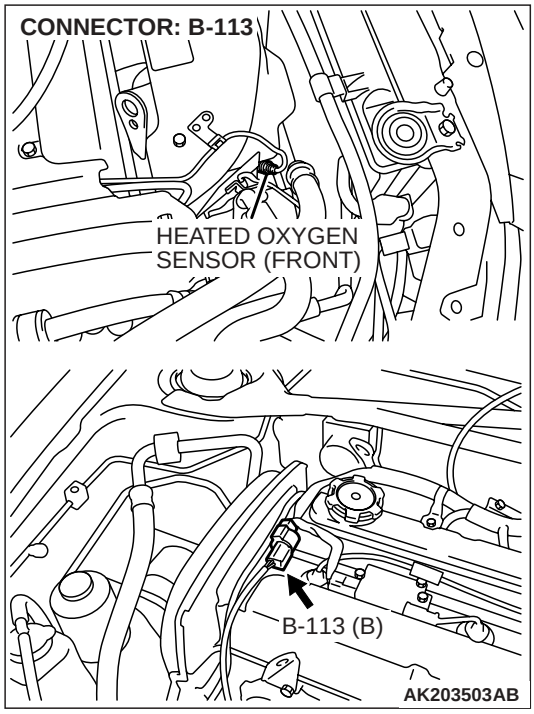
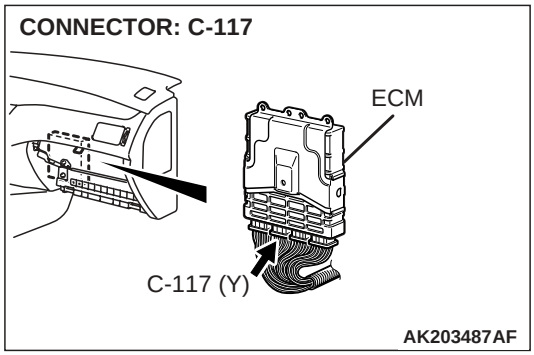
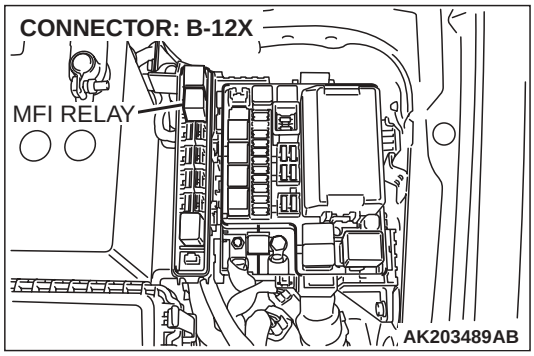






CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the heated oxygen sensor (front) heater.
- The ECM (terminal No. 60) controls continuity to the heated oxygen sensor (front) heater by turning the power transistor in the ECM "ON" and "OFF".

TECHNICAL DESCRIPTION

- The ECM checks whether the heater current is within a specified range when the heater is energized.

DTC SET CONDITIONS

Check Conditions

- 60 seconds have elapsed from the start of the previous monitoring.
- Engine coolant temperature is higher than 20°C (68°F).
- While the heated oxygen sensor (front) heater is on.
- Battery positive voltage is at between 11 and 16 volts.

Judgment Criteria

- The heated oxygen sensor (front) heater current has continued to be lower than 0.16 ampere or higher than 7.5 ampere for 4 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Open or shorted heated oxygen sensor (front) heater circuit, harness damage, or connector damage.
- Open circuit in heated oxygen sensor (front) heater.
- ECM failed.

DIAGNOSIS

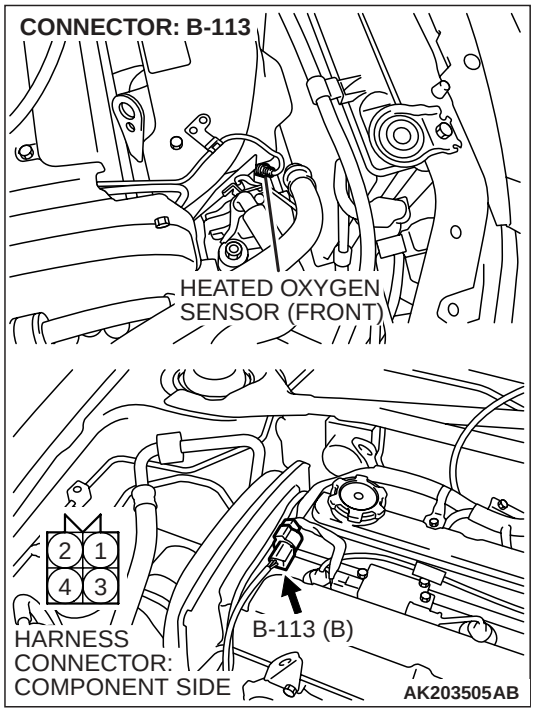
Required Special Tool:
- MD998464: Test Harness

STEP 1. Check connector B-113 at the heated oxygen sensor (front) for damage.

Q: Is the connector in good condition?

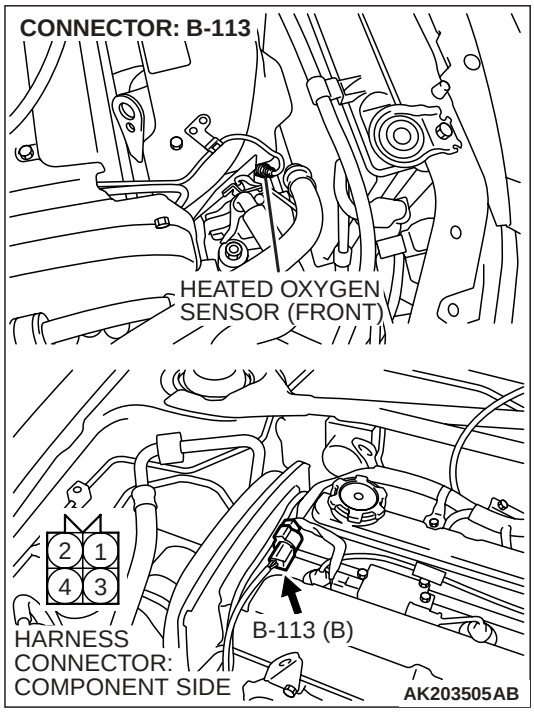
YES : Go to Step 2.

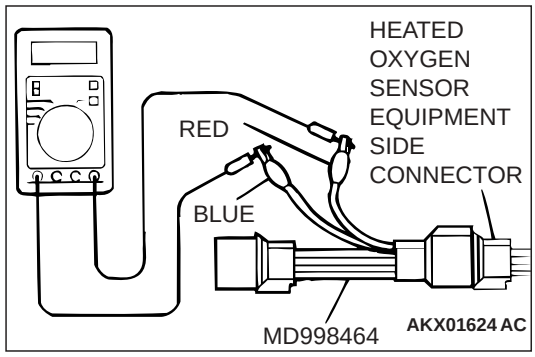
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 2. Check the heated oxygen sensor (front).

(1) Disconnect heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464, to the connector on the heated oxygen (front) sensor side.





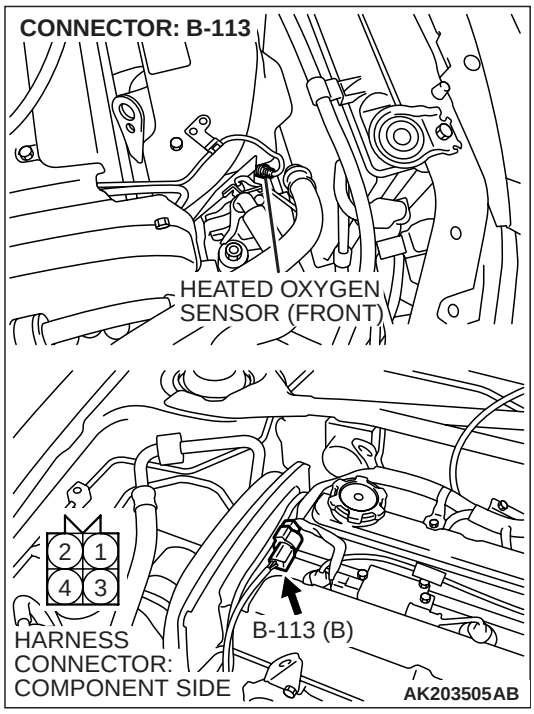
(2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 4.5 – 8.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 4.5 and 8.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

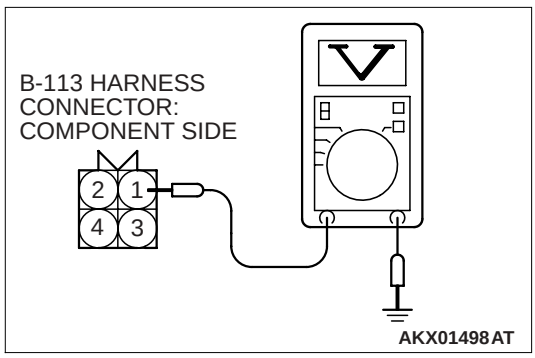
NO : Replace the heated oxygen sensor (front). Then go to Step 12.



STEP 3. Measure the power supply voltage at heated oxygen sensor (front) harness side connector B-113.

(1) Disconnect connector B-113 and measure at the harness side.

(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should measure battery positive voltage.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is battery positive voltage (approximately 12 volts) present?

YES : Go to Step 5.

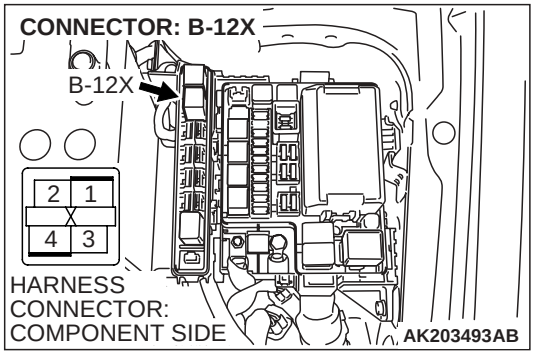
NO : Go to Step 4.

STEP 4. Check connector B-12X at the MFI relay for damage.

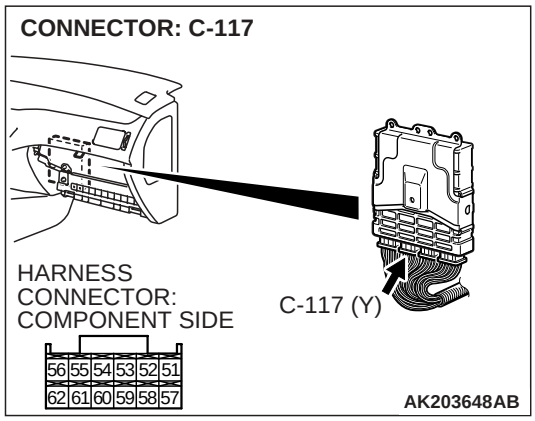
Q: Is the connector in good condition?

YES : Repair harness wire between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (front) connector B-113 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

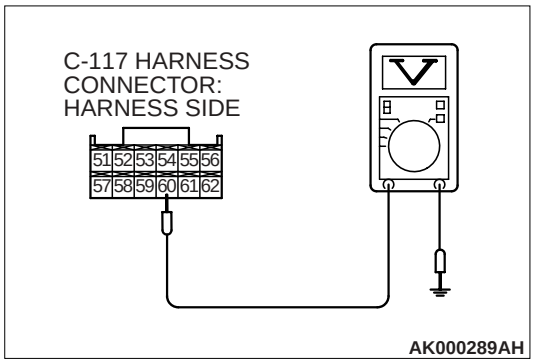
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 5. Measure the power supply voltage at ECM connector C-117 by backprobing.



(1) Do not disconnect connector C-117.
(2) Turn the ignition switch to the "ON" position.



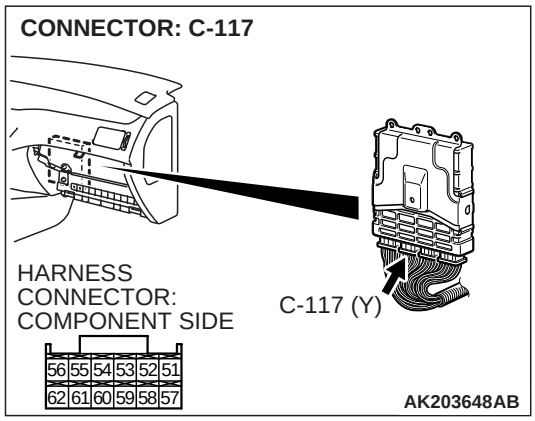
(3) Measure the voltage between terminal No. 60 and ground by backprobing.
- Voltage should measure battery positive voltage.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is battery positive voltage (approximately 12 volts) present?

YES : Go to Step 8.
NO : Go to Step 6.

STEP 6. Check connector C-117 at ECM for damage.



Q: Is the connector in good condition?

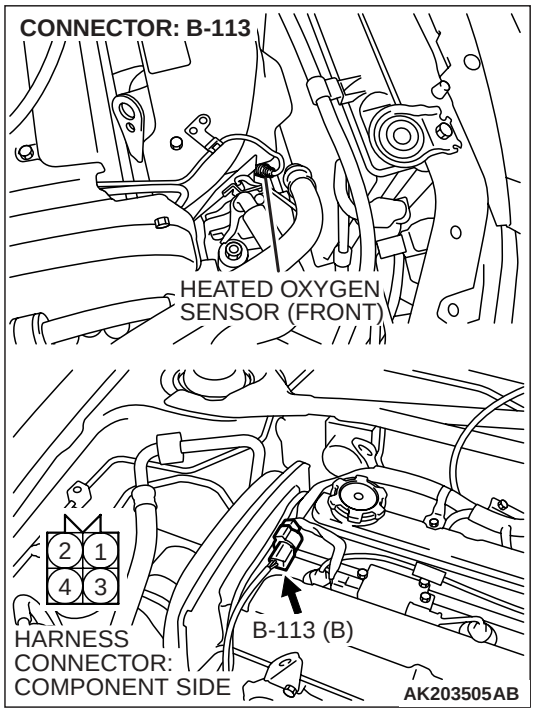
YES : Go to Step 7.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

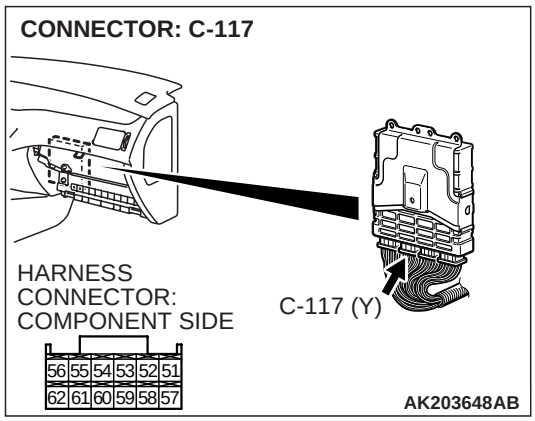
STEP 7. Check for open circuit and short circuit to ground between heated oxygen sensor (front) connector B-113 (terminal No. 3) and ECM connector C-117 (terminal No. 60).

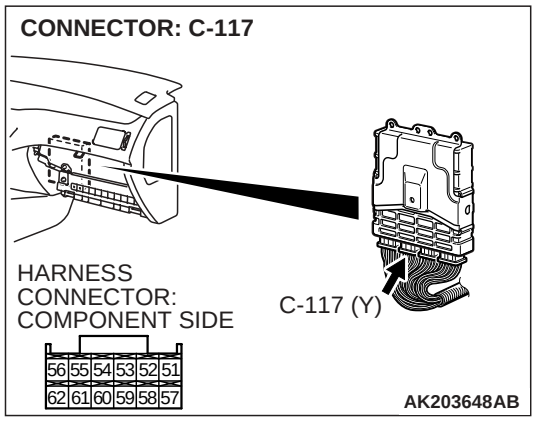
Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 12.

NO : Repair it. Then go to Step 12.





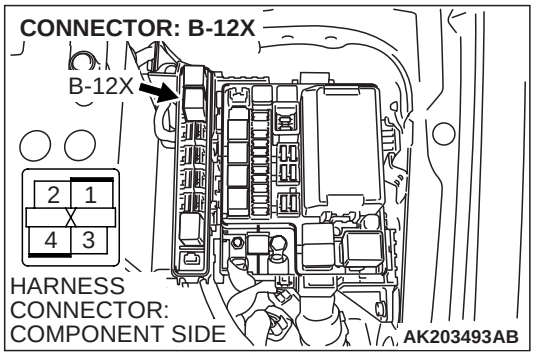


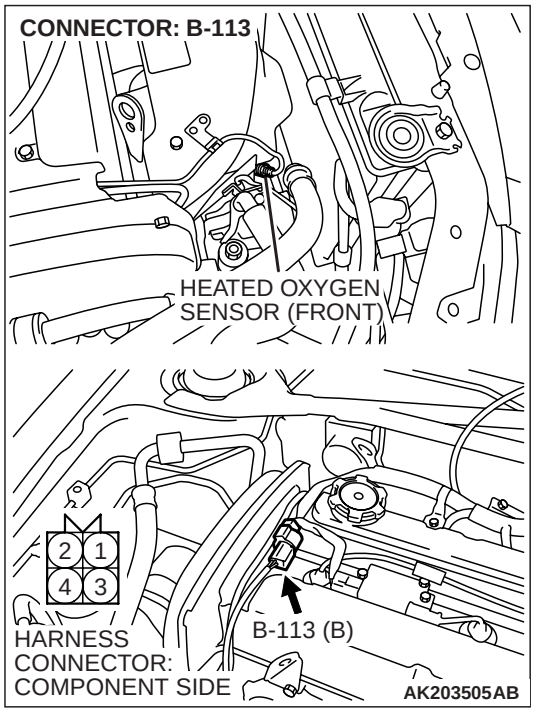
STEP 8. Check harness connector C-117 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



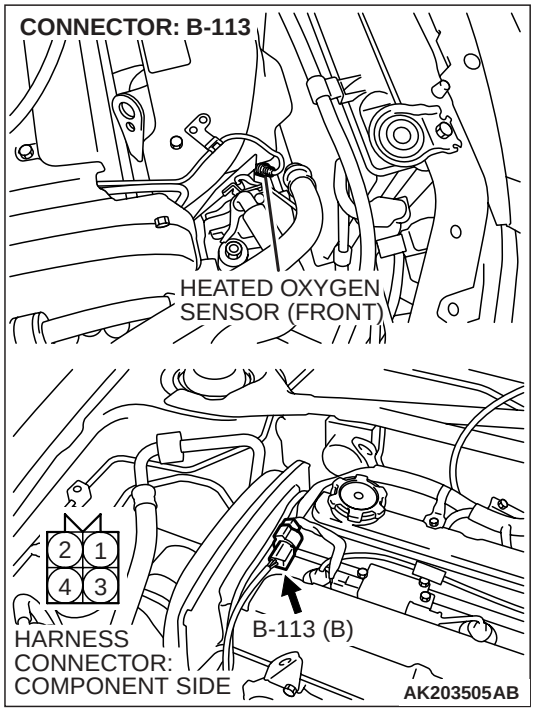


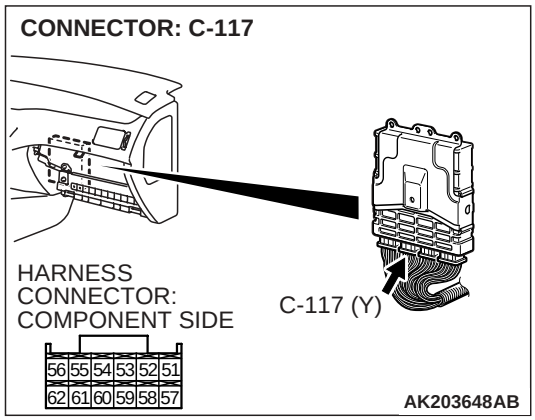
STEP 9. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (front) connector B-113 (terminal No. 1).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 3) and ECM connector C-117 (terminal No. 60).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Retest the system.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0135 set?

YES : Replace the ECM. Then go to Step 12.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

STEP 12. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

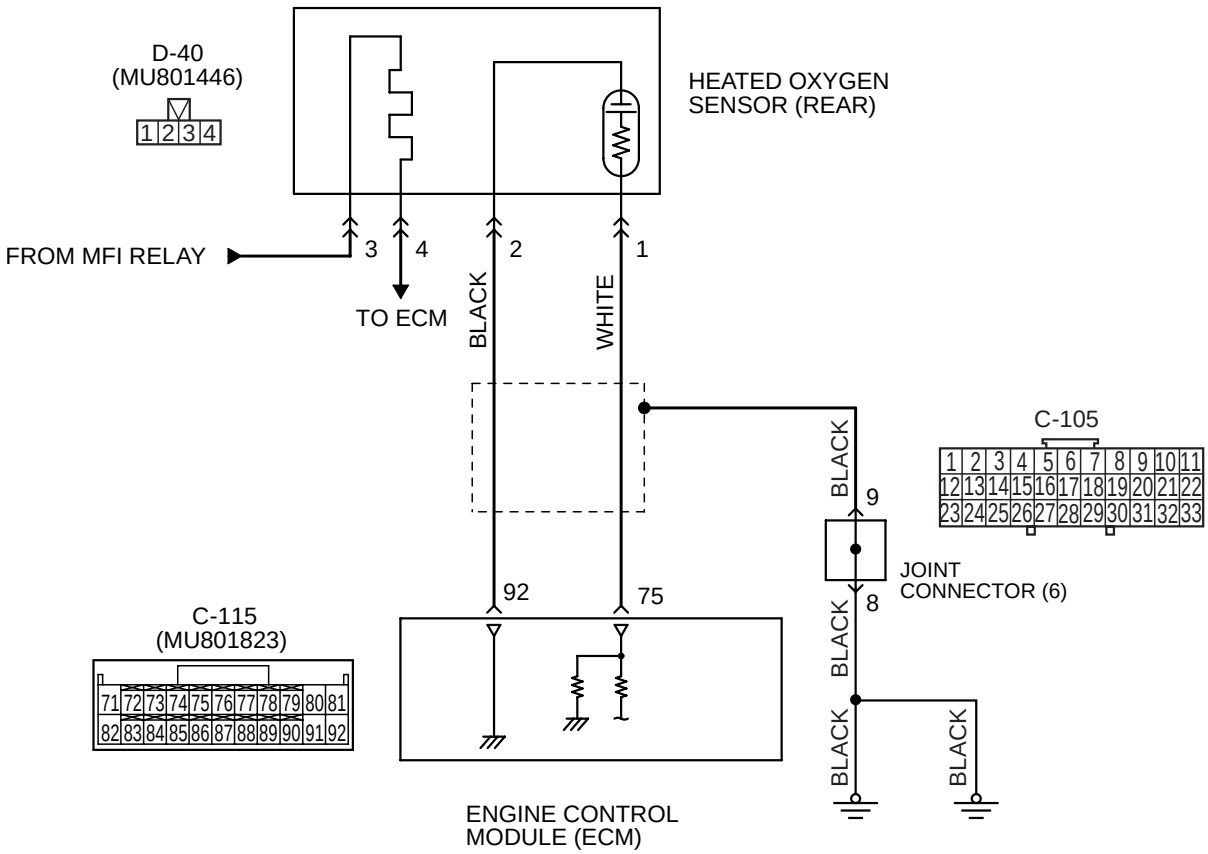
Q: Is DTC P0135 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0136: HEATED OXYGEN SENSOR CIRCUIT HIGH VOLTAGE (SENSOR 2)

Heated Oxygen Sensor (rear) Circuit



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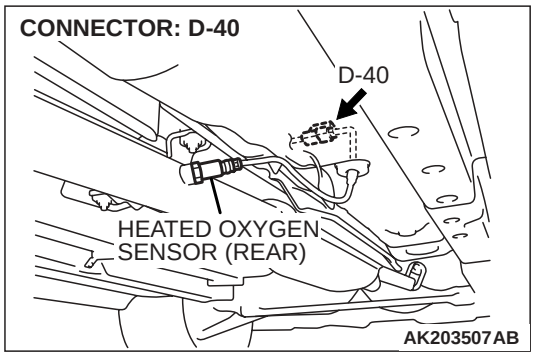
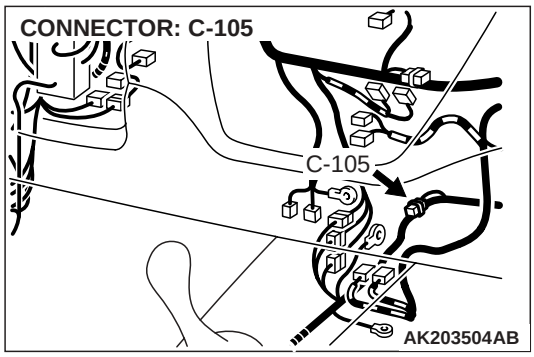
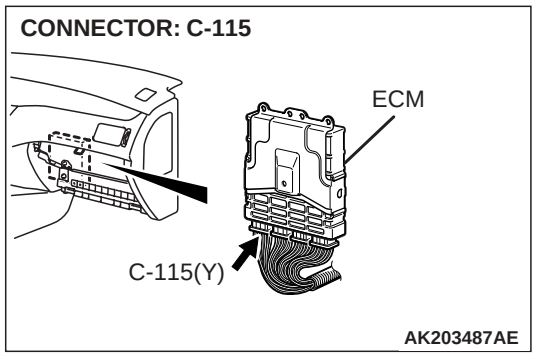






CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 75) from the output terminal (terminal No. 1) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 92).

TECHNICAL DESCRIPTION

- The output signal of the heated oxygen sensor (front) is compensated by the output signal of the heated oxygen sensor (rear).
- The ECM checks for an open circuit in the heated oxygen sensor (rear) output line.

DTC SET CONDITIONS

Check Conditions

- 3 minutes or more have passed since the starting sequence was completed.
- Heated oxygen sensor (rear) signal voltage has continued to be 0.15 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Monitoring time: 7 seconds.

Judgment Criteria

- Input voltage supplied to the ECM interface circuit is higher than 4.5 volts when 5 volts is applied to the heated oxygen sensor (rear) output line via a resistor.
- The ECM monitors for this condition once during the drive cycle.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

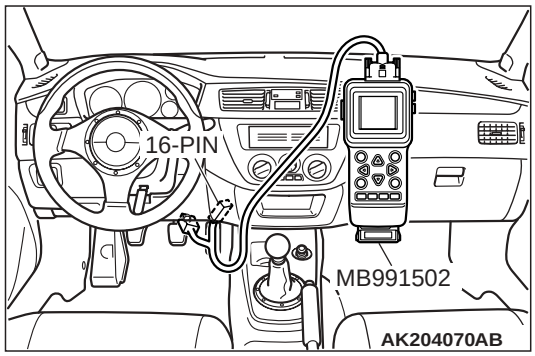
- Heated oxygen sensor (rear) failed.
- Open or short circuit in heated oxygen sensor (rear) output line, or harness damage.
- Open circuit in heated oxygen sensor (rear) ground line, or harness damage.
- Connector damage.
- ECM failed.

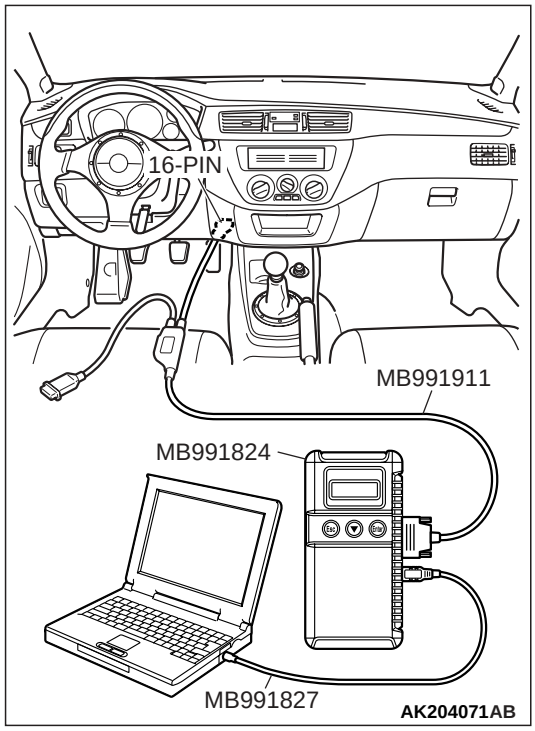
DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B
- MB991658: Test Harness Set

TSB Revision





STEP 1. Using scan tool MB991502 or MB991958, check data list item 59: Heated Oxygen Sensor (rear).

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
- Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

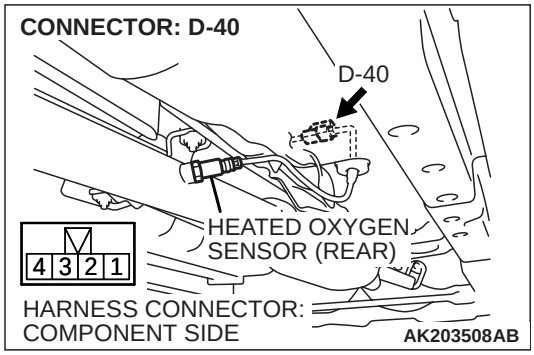
Q: Is the sensor operating properly?

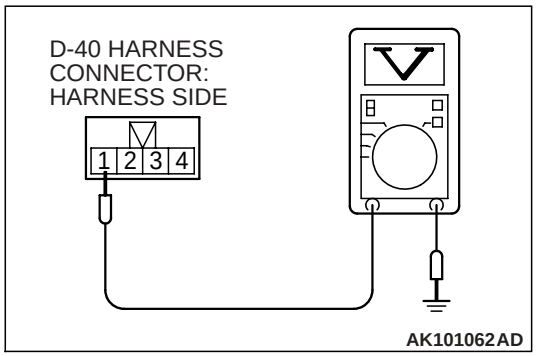
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at heated oxygen sensor (rear) connector D-40 by backprobing.

(1) Do not disconnect connector D-40.
(2) Start the engine and run at idle.





(3) Measure the voltage between terminal No. 1 and ground by backprobing.
- Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

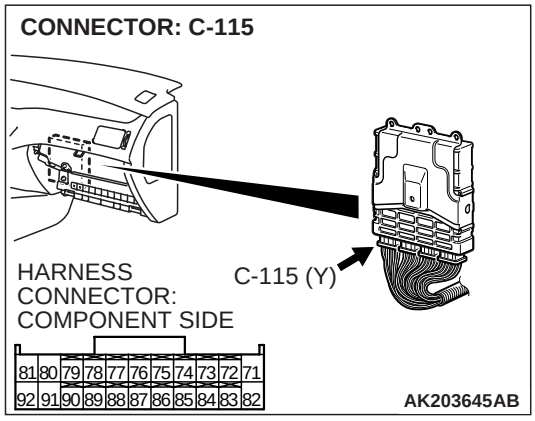
(4) Turn the ignition switch to the "LOCK" (OFF) position.

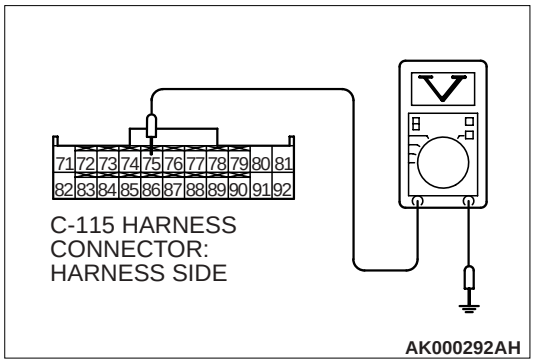
Q: Is the measured voltage within the specified range?

YES : Go to Step 3.
NO : Go to Step 7.

STEP 3. Measure the sensor output voltage at ECM connector C-115 by backprobing.

(1) Do not disconnect connector C-115.
(2) Start the engine and run at idle.



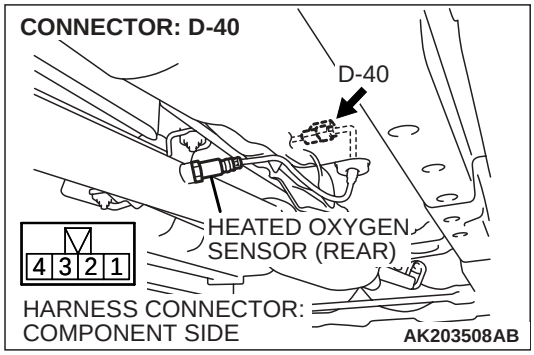


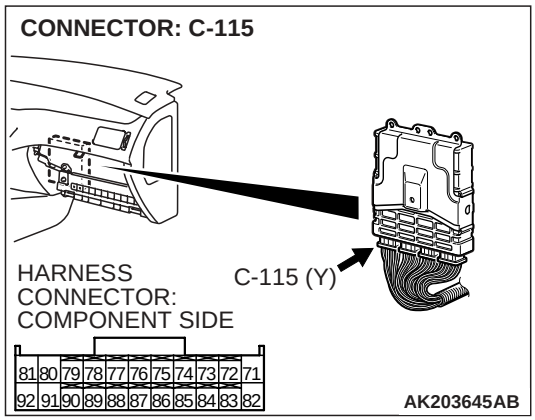
(3) Measure the voltage between terminal No. 75 and ground by backprobing.
- Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage within the specified range?

YES : Go to Step 4.
NO : Go to Step 6.



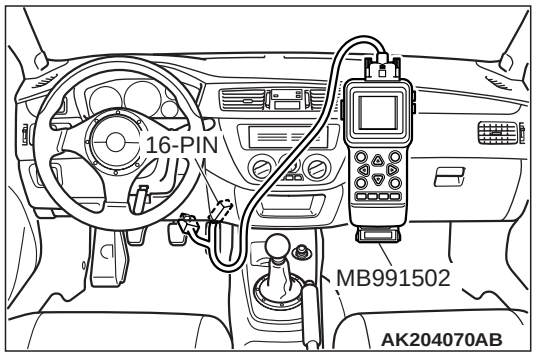


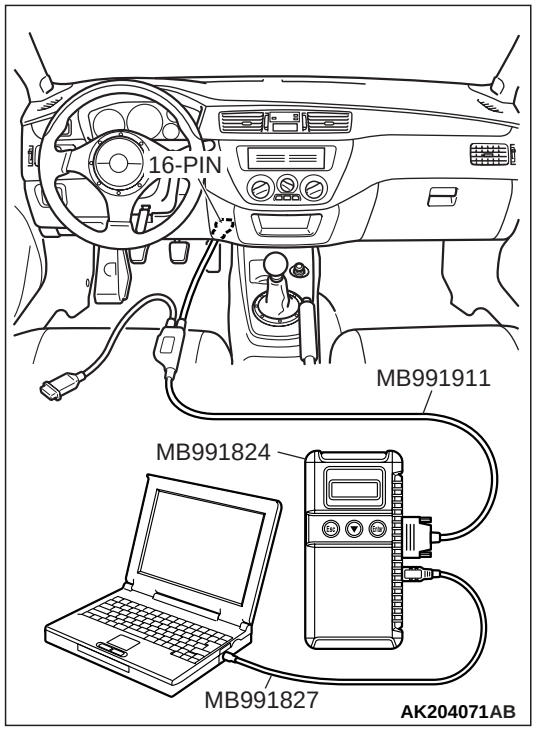
STEP 4. Check harness connector D-40 at heated oxygen sensor (rear) and connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.





STEP 5. Using scan tool MB991502 or MB991958, check data list item 59: Heated Oxygen Sensor (rear).

⚠ CAUTION

To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

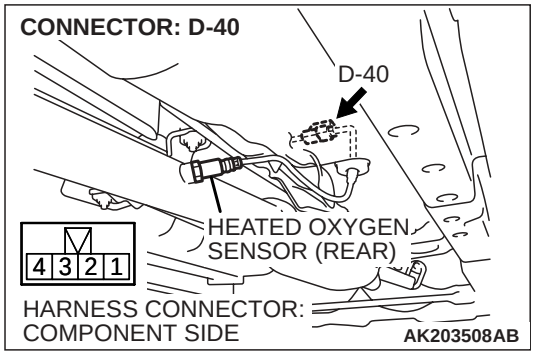
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
- Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

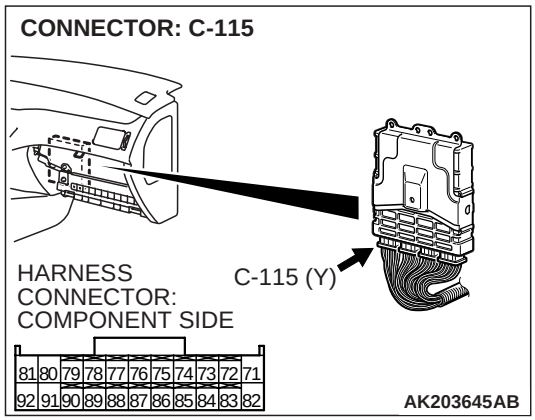
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Replace the ECM. Then go to Step 14.



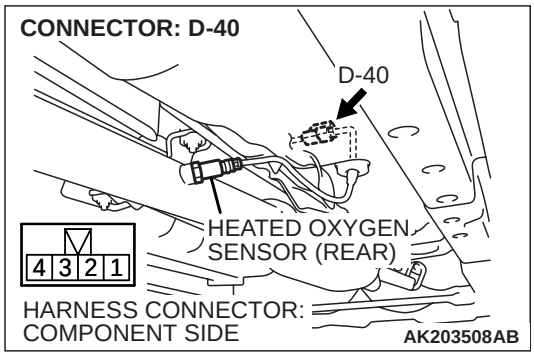


STEP 6. Check harness connector D-40 at heated oxygen sensor (rear) and connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between heated oxygen sensor (rear) connector D-40 (terminal No. 1) and ECM connector C-115 (terminal No. 75) because of open circuit or harness damage. Then go to Step 14.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.



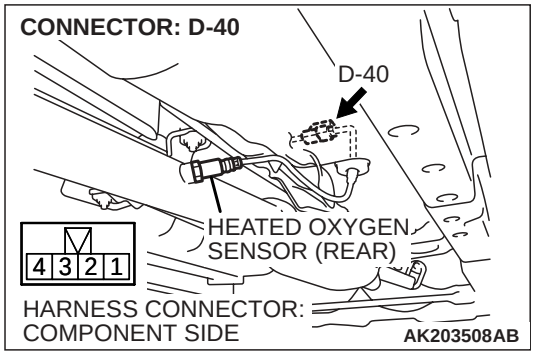
STEP 7. Check harness connector D-40 at heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

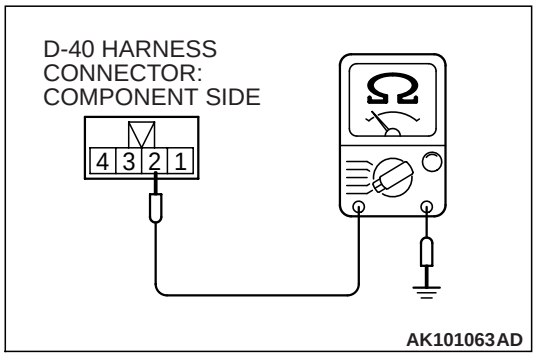
YES : Go to Step 8.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 8. Check for continuity at heated oxygen sensor (rear) harness side connector D-40.



(1) Disconnect connector D-40 and measure at the harness side.

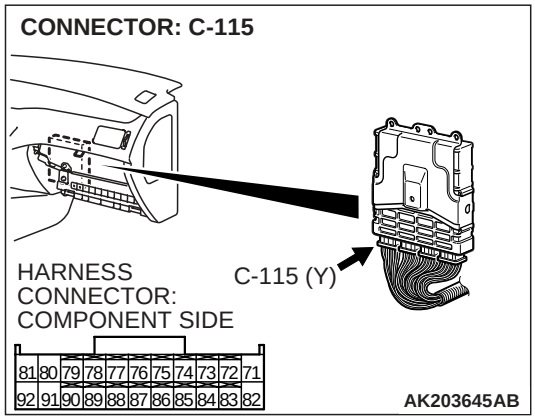


(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 11.
NO : Go to Step 9.

STEP 9. Check harness connector C-115 at ECM for damage.



Q: Is the harness connector in good condition?

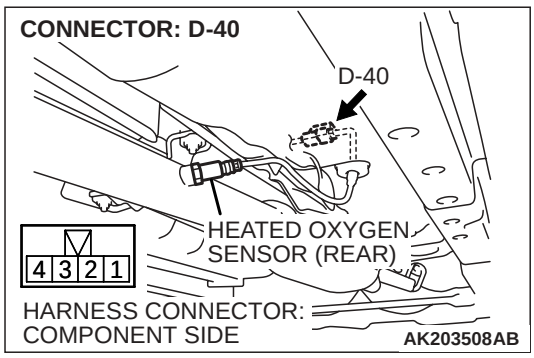
YES : Go to Step 10.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

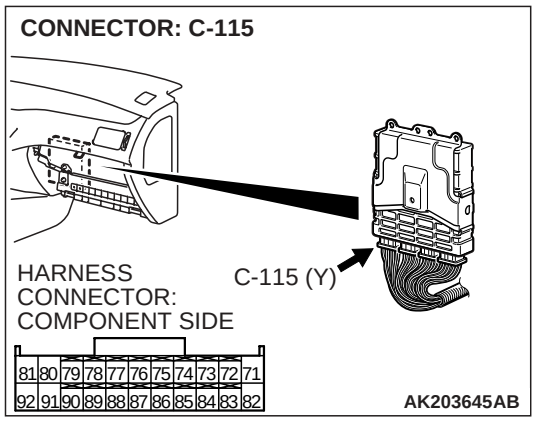
STEP 10. Check for open circuit and harness damage between heated oxygen sensor (rear) connector D-40 (terminal No. 2) and ECM connector C-115 (terminal No. 92).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 14.

NO : Repair it. Then go to Step 14.



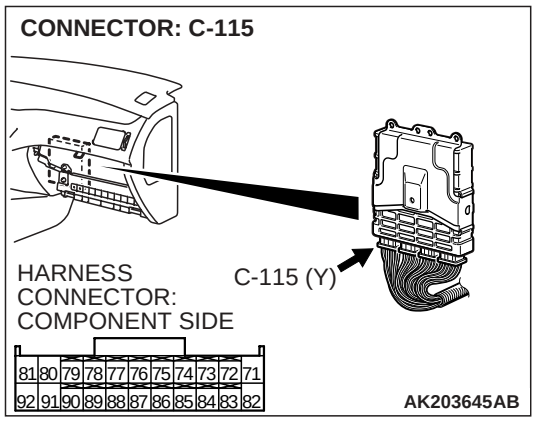


STEP 11. Check harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 12.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

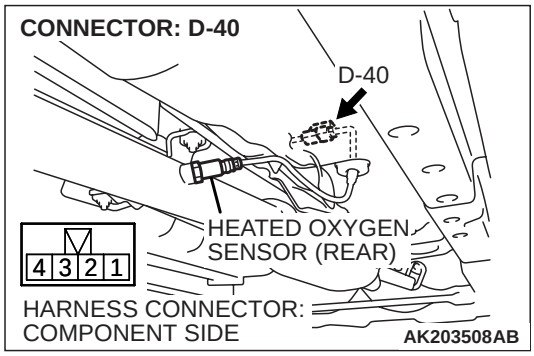


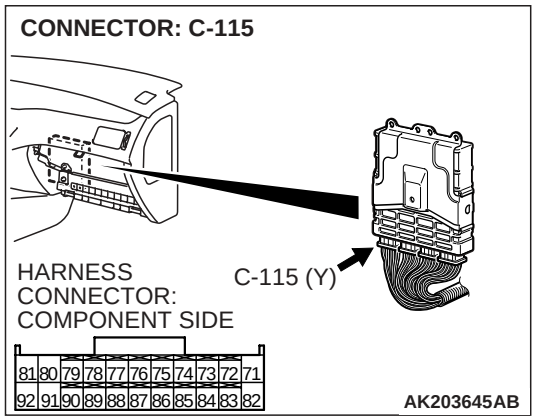
STEP 12. Check for harness damage between heated oxygen sensor (rear) connector D-40 (terminal No. 2) and ECM connector C-115 (terminal No. 92).

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 14.





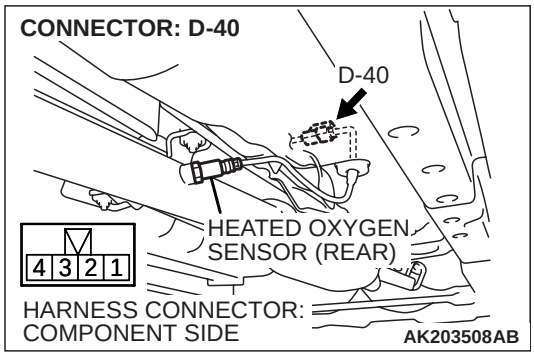
STEP 13. Check the heated oxygen sensor (rear).

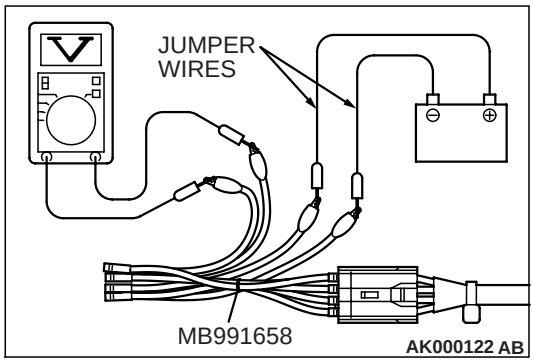
(1) Disconnect the heated oxygen sensor (rear) connector D-40 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (front) side.

(2) Warm up the engine until engine coolant 80°C (176°F) or higher.

⚠ CAUTION

Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (rear).





(3) Use the jumper wires to connect terminal No. 3 to the positive battery terminal and terminal No. 4 to the negative battery terminal.

(4) Connect a digital volt meter between terminal No. 1 and terminal No. 2.

(5) While repeatedly revving the engine, measure the heated oxygen sensor (rear) output voltage.

Standard value: 0.6 – 1.0 volt

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Replace the ECM. Then go to Step 14.

NO : Replace the heated oxygen sensor (rear). Then go to Step 14.

TSB Revision

STEP 14. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

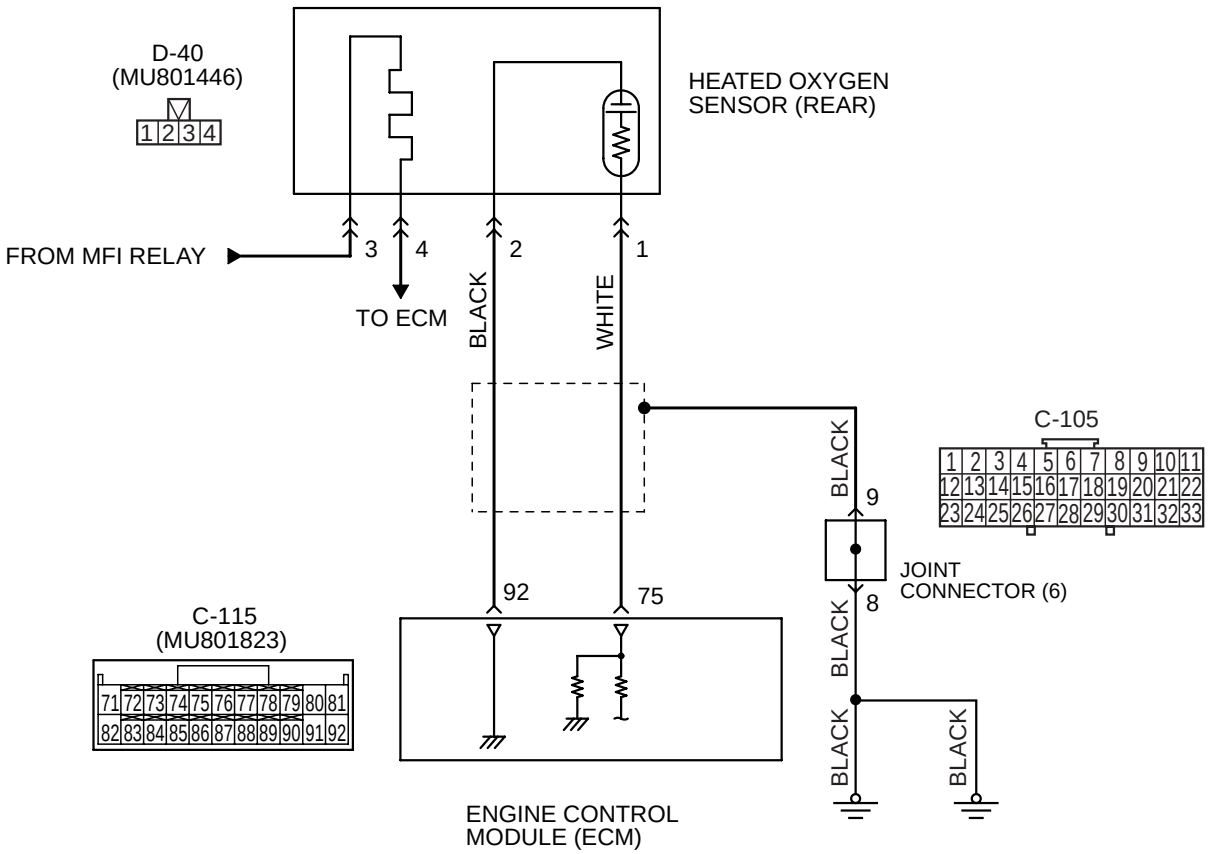
Q: Is DTC P0136 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0137: HEATED OXYGEN SENSOR CIRCUIT LOW VOLTAGE (SENSOR 2)

Heated Oxygen Sensor (rear) Circuit



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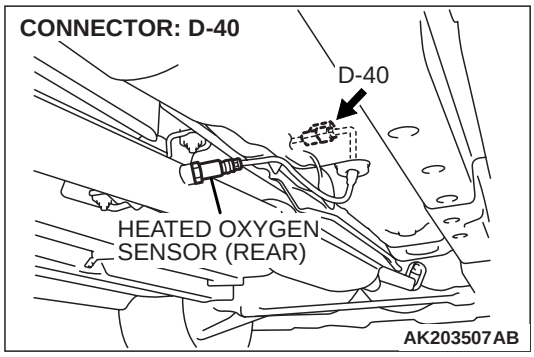
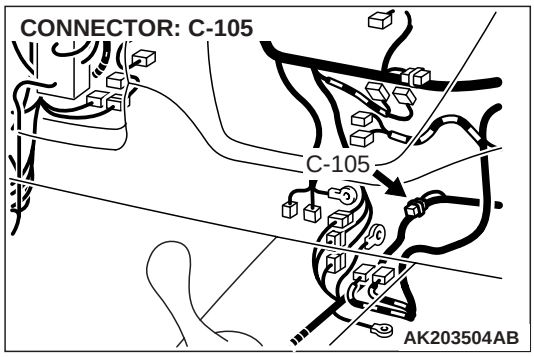
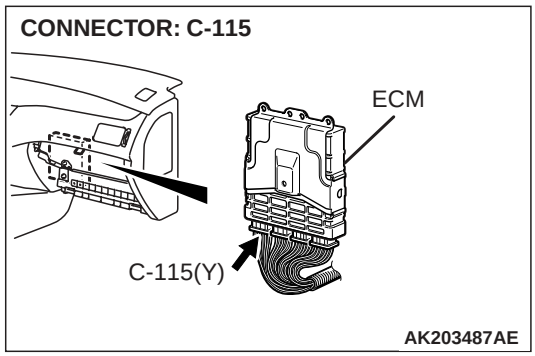






CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 75) from the output terminal (terminal No. 1) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 92).

TECHNICAL DESCRIPTION

- The output signal of the heated oxygen sensor (front) is compensated by the output signal of the heated oxygen sensor (rear).
- The ECM checks for an open circuit in the heated oxygen sensor (rear) output line.

DTC SET CONDITIONS

Check Conditions

- 3 minutes or more have passed since the starting sequence was completed.
- Heated oxygen sensor (rear) signal voltage has continued to be 0.15 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Volume airflow sensor output frequency is 56 Hz or more.
- At least 20 seconds have passed since fuel shut off control was canceled.
- The heated oxygen sensor (front) outputs 0.5 volt or more.
- After the ignition switch is turned ON, the changes in the output voltage of the heated oxygen sensor (rear) is lower than 0.078 volt.
- Monitoring time: 10 seconds.

Judgement Criteria

- Making the air/fuel ratio 15 percent richer for 10 seconds does not result in raising the heated oxygen sensor (rear) output voltage beyond 0.15 volt.
- The ECM monitors for this condition once during the drive cycle.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

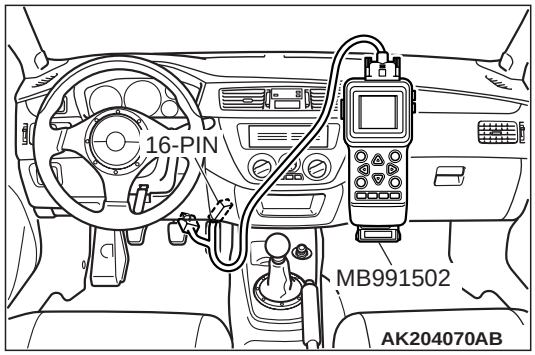
- Heated oxygen sensor (rear) failed.
- Short circuit in heated oxygen sensor (rear) output line.
- Connector damage.
- ECM failed.

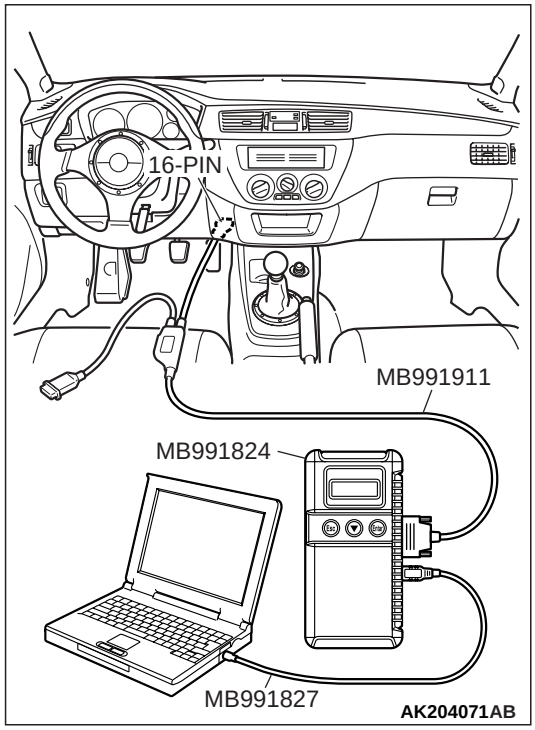
DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B
- MB991658: Test Harness Set

STEP 1. Using scan tool MB991502 or MB991958, check data list item 59: Heated Oxygen Sensor (rear).





⚠ CAUTION

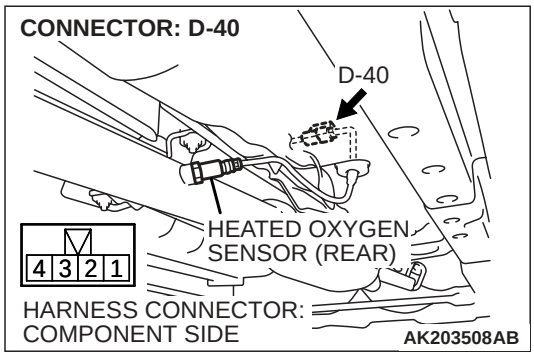
To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

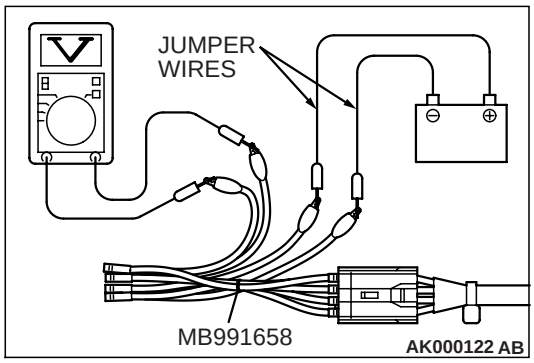
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
  - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Go to Step 2.





STEP 2. Check the heated oxygen sensor (rear).

(1) Disconnect the heated oxygen sensor (rear) connector D-40 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (front) side.
(2) Warm up the engine until engine coolant 80°C (176°F) or higher.

⚠ CAUTION
Be very careful when connecting the jumper wires; incorrect connection can damage the right bank heated oxygen sensor (rear).

(3) Use the jumper wires to connect terminal No. 3 to the positive battery terminal and terminal No. 4 to the negative battery terminal.
(4) Connect a digital volt meter between terminal No. 1 and terminal No. 2.
(5) While repeatedly revving the engine, measure the heated oxygen sensor (rear) output voltage.

Standard value: 0.6 – 1.0 volt

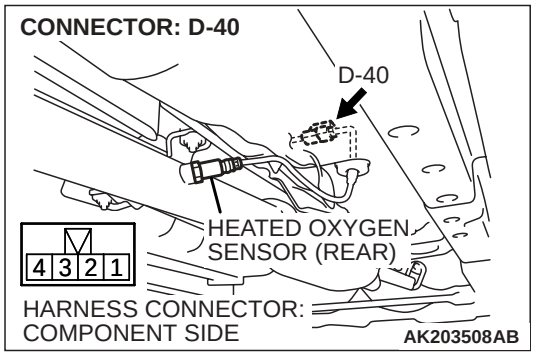
Q: Is the voltage between 0.6 and 1.0 volt?

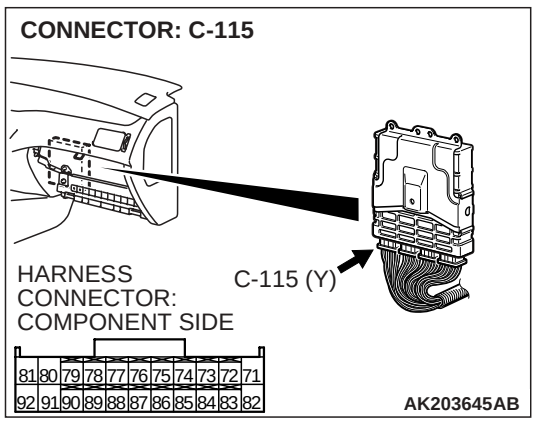
YES : Go to Step 3.
NO : Replace the heated oxygen sensor (rear). Then go to Step 5.

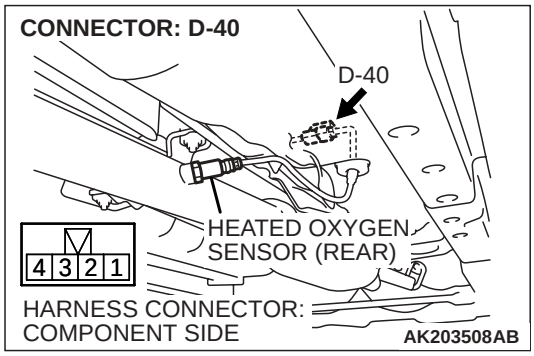
STEP 3. Check harness connector D-40 at heated oxygen sensor (rear) and connector C-115 at ECM for damage.

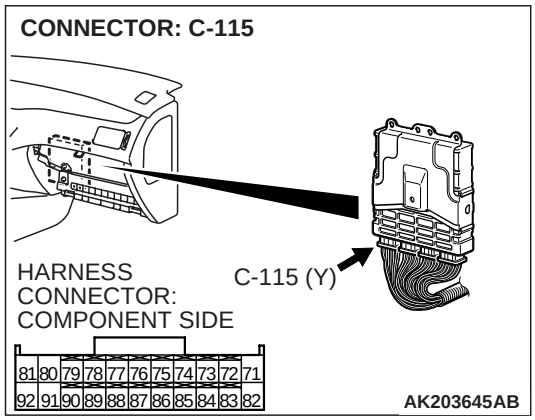
Q: Is the harness connector in good condition?

YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 5.









STEP 4. Check for short circuit to ground between heated oxygen sensor (rear) connector D-40 (terminal No. 1) and ECM connector C-115 (terminal No. 75).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 5.

NO : Repair it. Then go to Step 5.

STEP 5. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

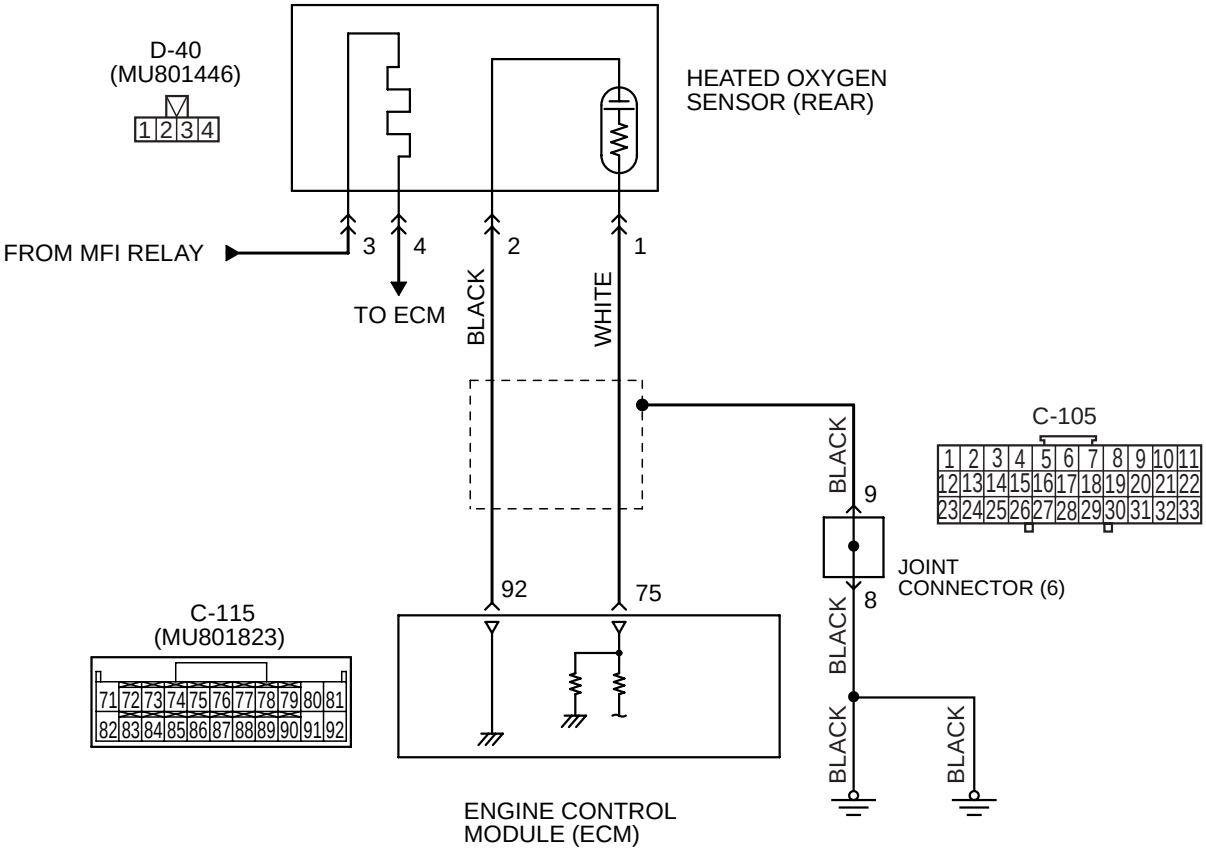
Q: Is DTC P0137 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0138: HEATED OXYGEN SENSOR CIRCUIT HIGH VOLTAGE (SENSOR 2)

Heated Oxygen Sensor (rear) Circuit



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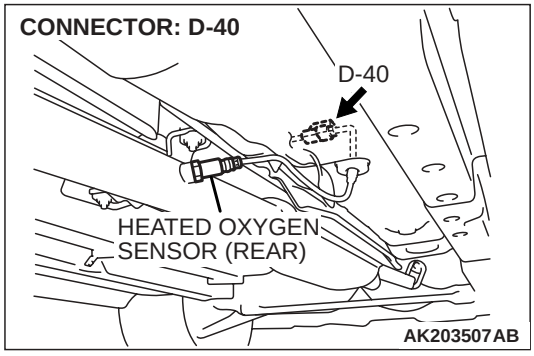

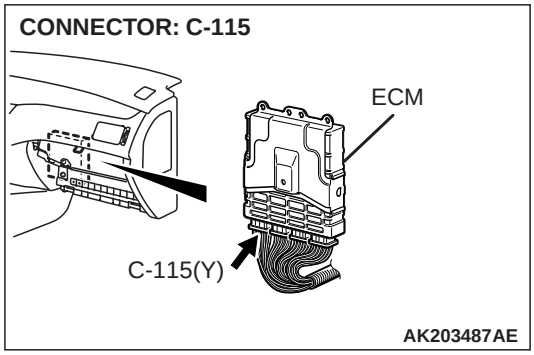

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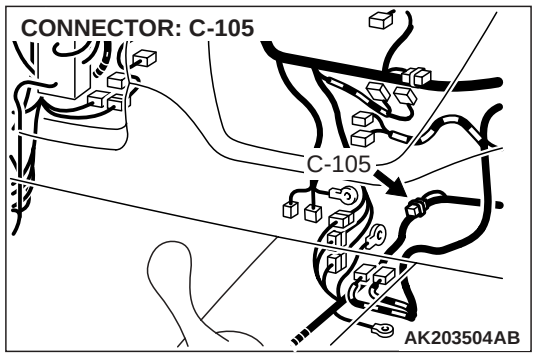


CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 75) from the output terminal (terminal No. 1) of the heated oxygen sensor (rear).
- Terminal 2 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 92).

TECHNICAL DESCRIPTION

- The output signal of the heated oxygen sensor (front) is compensated by the output signal of the heated oxygen sensor (rear).
- The ECM checks for an open circuit in the heated oxygen sensor (rear) output line.

DTC SET CONDITIONS

Check Conditions

- 2 seconds or more have passed since the starting sequence was completed.

Judgment Criteria

- Heated oxygen sensor (rear) output voltage has continued to be 1.2 volts or higher for 2 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (rear) failed.
- Short circuit in heated oxygen sensor (rear) output line.
- Connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

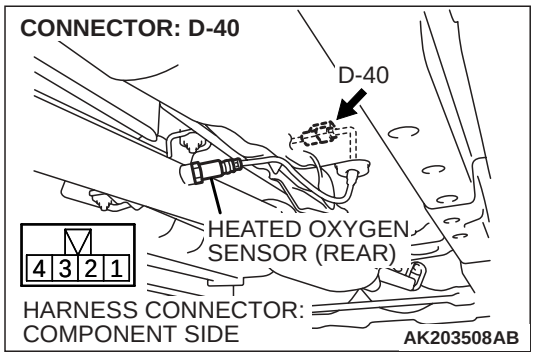
- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

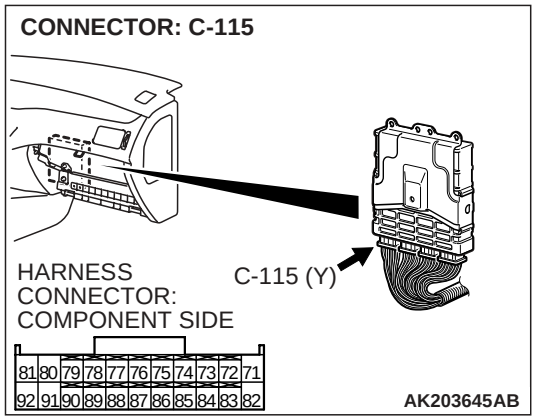
STEP 1. Check harness connector D-40 at heated oxygen sensor (rear) and harness connector C-115 at ECM for damage.

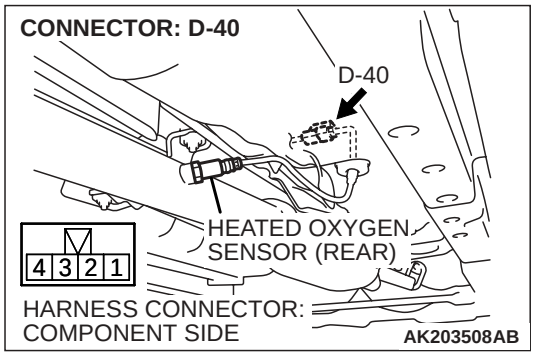
Q: Is the harness connector in good condition?

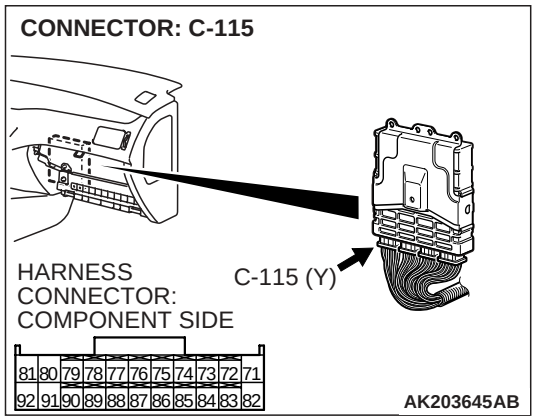
YES : Go to Step 2.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 3.









STEP 2. Check for short circuit to power supply between heated oxygen sensor (rear) connector D-40 (terminal No. 1) and ECM connector C-115 (terminal No. 75).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 3.

NO : Repair it. Then go to Step 3.

STEP 3. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

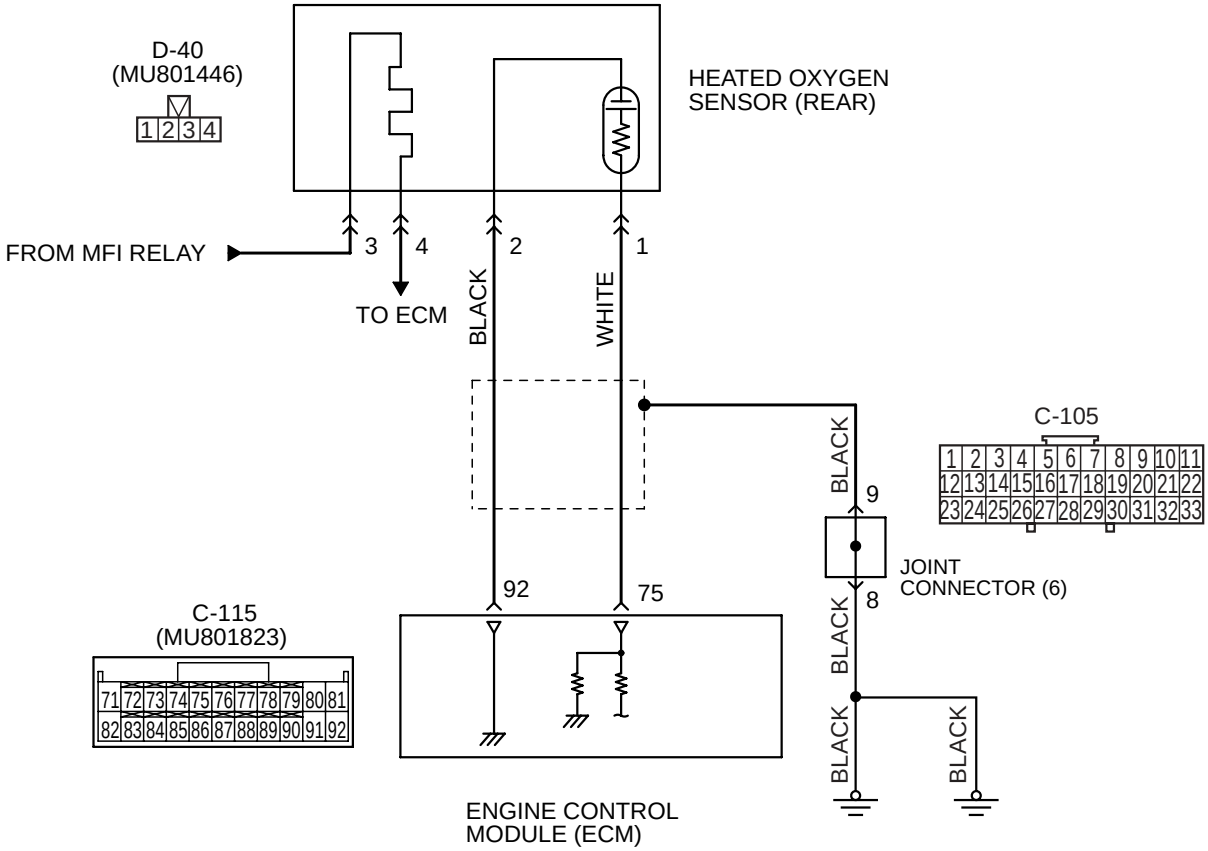
Q: Is DTC P0138 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0139: HEATED OXYGEN SENSOR CIRCUIT SLOW RESPONSE (SENSOR 2)

Heated Oxygen Sensor (rear) Circuit



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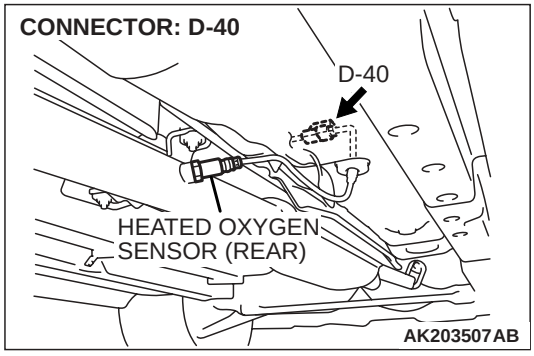

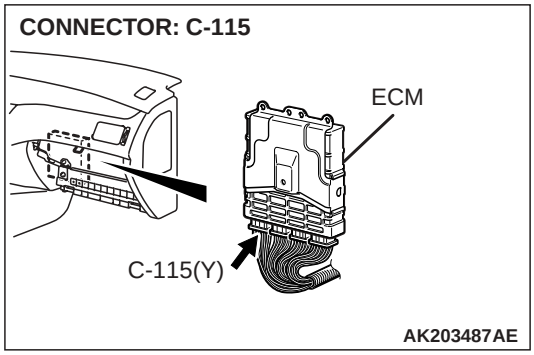

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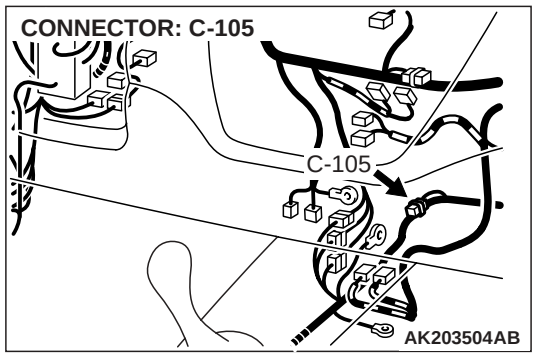


CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 75) from the output terminal (terminal No. 1) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 92).

TECHNICAL DESCRIPTION

- The output signal of the heated oxygen sensor (front) is compensated by the output signal of the heated oxygen sensor (rear).
- The ECM checks for an open circuit in the heated oxygen sensor (rear) output line.

DTC SET CONDITIONS

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative volume airflow sensor output frequency for every 2 seconds is higher than 10,000 Hz.
- Repeat 3 or more times: drive[*1], stop[*2].

Drive[*1]:

- Engine speed is higher than 1,500 r/min.
- Volumetric efficiency is higher than 40 percent.
- Vehicle speed is higher than 30 km/h (18.7 mph).
- A total of more than 10 seconds have elapsed with the above mentioned conditions, and more than 2 seconds have elapsed with the fuel shut off.

Stop[*2]:

- Vehicle speed is lower than 1.5 km/h (0.9 mph).

Judgement Criteria

- Change in the output voltage of the heated oxygen sensor (rear) is lower than 0.313 volt.

  NOTE: Monitoring stops after fuel has been shut off for more than 38 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

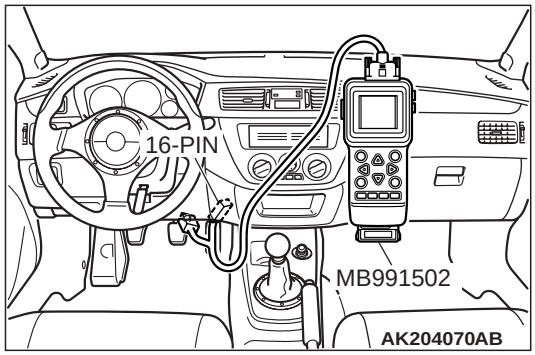
- Heated oxygen sensor (rear) failed.
- Connector damage.
- ECM failed.

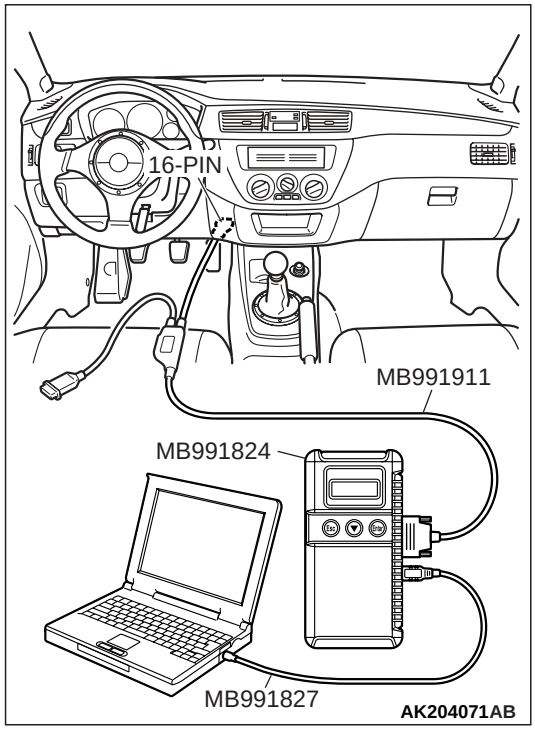
DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B
- MB991658: Test Harness Set

STEP 1. Using scan tool MB991502 or MB991958, check data list item 59: Heated Oxygen Sensor (rear).





⚠ **CAUTION**

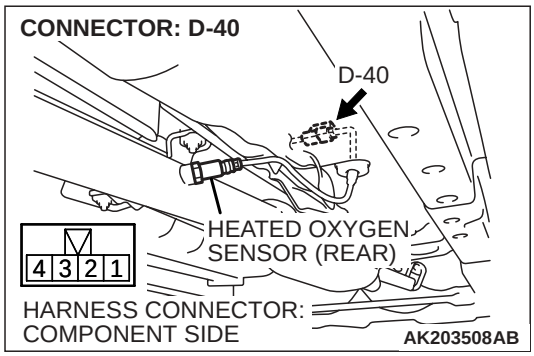
To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

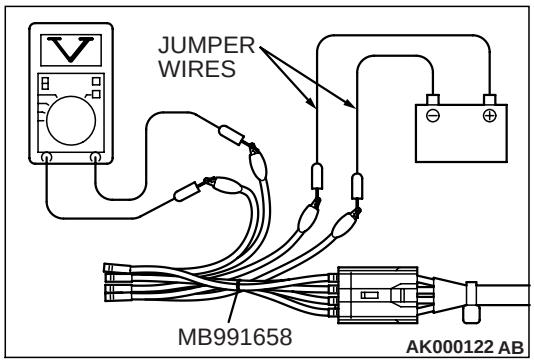
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
(4) Warm up the engine.
  - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

NO : Replace the heated oxygen sensor (rear). Then go to Step 2.





STEP 2. Check the heated oxygen sensor (rear).

(1) Disconnect the heated oxygen sensor (rear) connector D-40 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (front) side.
(2) Warm up the engine until engine coolant 80°C (176°F) or higher.

⚠ CAUTION

Be very careful when connecting the jumper wires; incorrect connection can damage the right bank heated oxygen sensor (rear).

(3) Use the jumper wires to connect terminal No. 3 to the positive battery terminal and terminal No. 4 to the negative battery terminal.
(4) Connect a digital volt meter between terminal No. 1 and terminal No. 2.
(5) While repeatedly revving the engine, measure the heated oxygen sensor (rear) output voltage.

Standard value: 0.6 – 1.0 volt

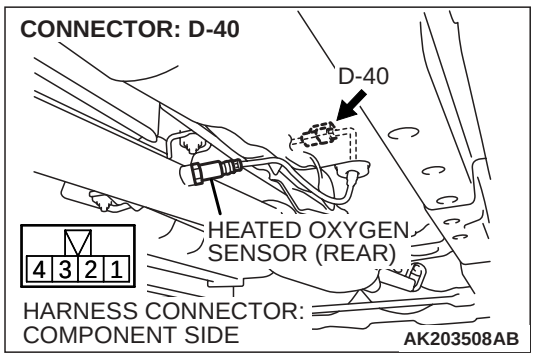
Q: Is the voltage between 0.6 and 1.0 volt?

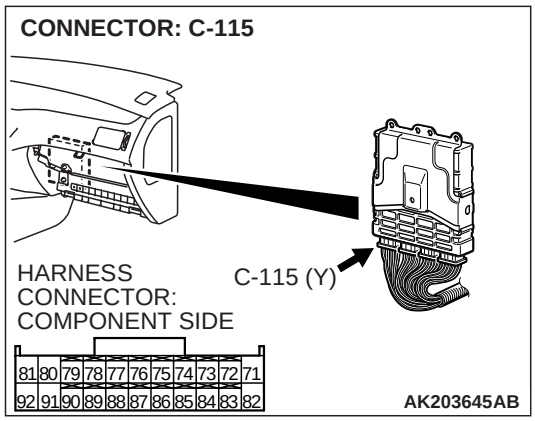
YES : Go to Step 3.
NO : Replace the heated oxygen sensor (rear). Then go to Step 4.

STEP 3. Check harness connector D-40 at heated oxygen sensor (rear) and harness connector C-115 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 4.





STEP 4. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 4 – Heated Oxygen Sensor Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

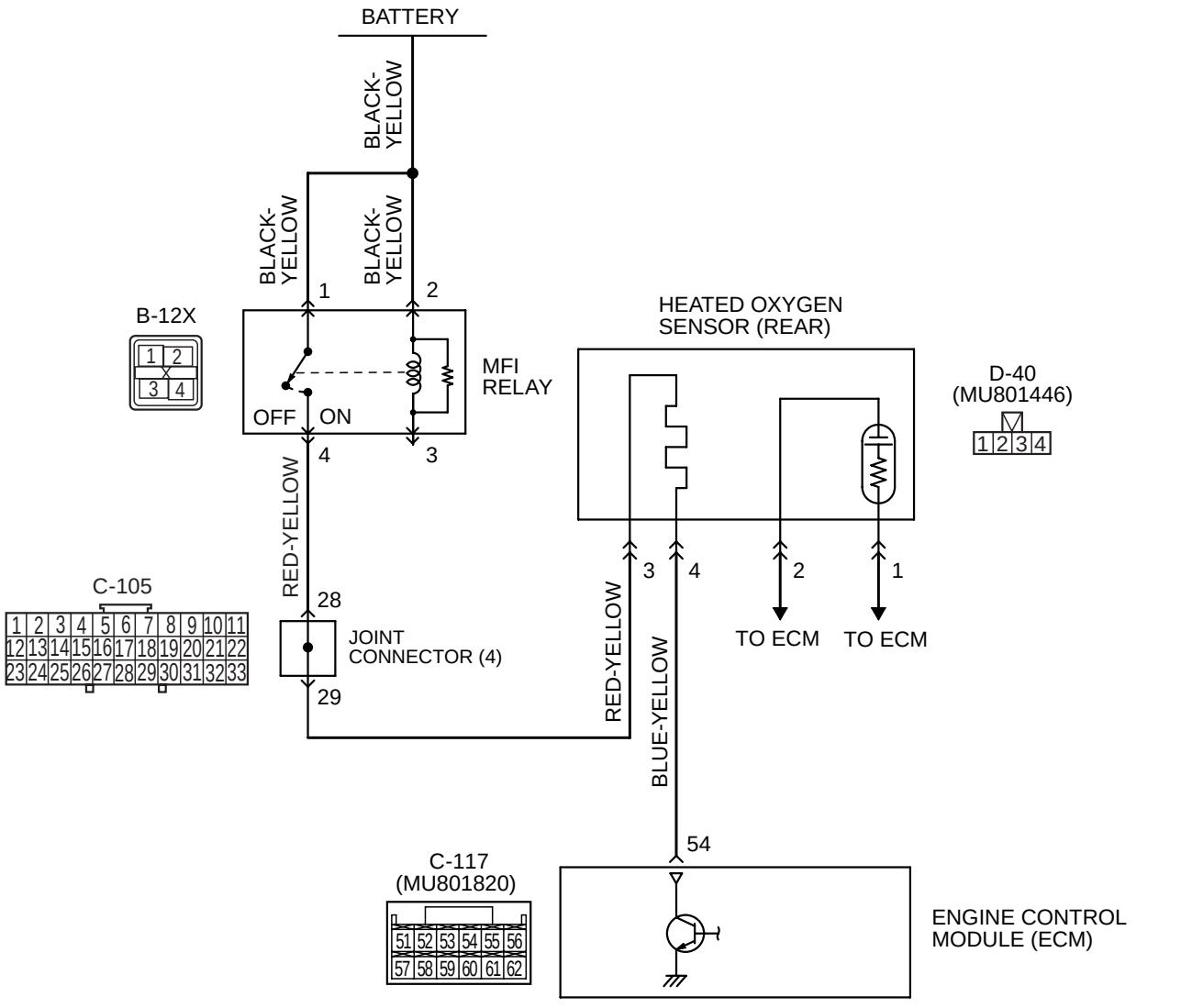
Q: Is DTC P0139 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0141: HEATED OXYGEN SENSOR HEATER CIRCUIT (SENSOR 2)

Heated Oxygen Sensor (rear) Heater Circuit



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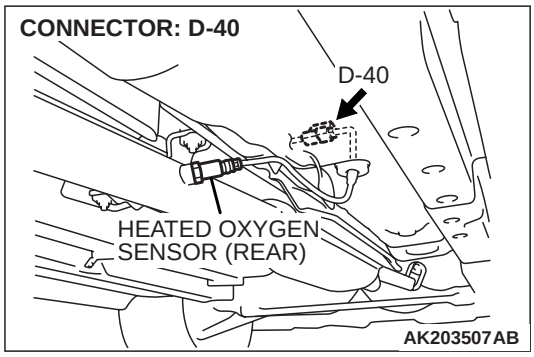
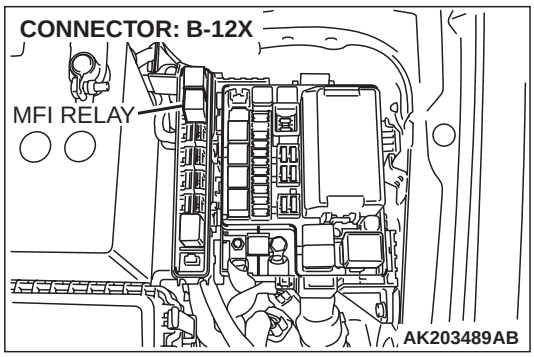
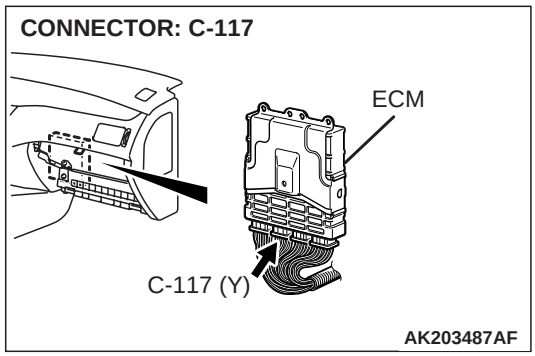
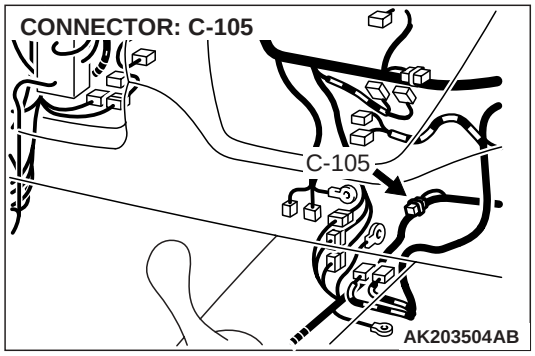








CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the heated oxygen sensor (rear) heater.
- The ECM (terminal No. 54) controls continuity to the heated oxygen sensor (rear) heater by turning the power transistor in the ECM "ON" and "OFF".

BACKGROUND

- The ECM checks whether the heater current is within a specified range when the heater is energized.

DTC SET CONDITIONS

Check Conditions

- 60 seconds have elapsed from the start of the previous monitoring.
- Engine coolant temperature is higher than 20°C (68°F).
- While the heated oxygen sensor (rear) heater is on.
- Battery positive voltage is at between 11 and 16 volts.

Judgment Criteria

- The heated oxygen sensor (rear) heater current has continued to be lower than 0.16 ampere or higher than 5.0 ampere for 4 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Open or shorted heated oxygen sensor (rear) heater circuit, or harness damage.
- Open circuit in heated oxygen sensor (rear) heater.
- Connector damage.
- ECM failed.

DIAGNOSIS

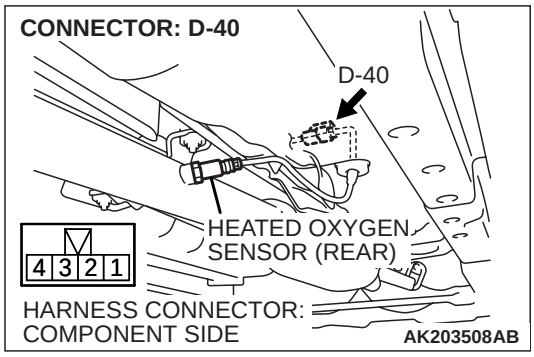
Required Special Tool:
- MB991658: Test Harness Set

STEP 1. Check connector D-40 at the heated oxygen sensor (rear) for damage.

Q: Is the connector in good condition?

YES : Go to Step 2.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 2. Check the heated oxygen sensor (rear).

(1) Disconnect heated oxygen sensor (rear) connector D-40 and connect test harness special tool, MB991658, to the connector on the heated oxygen (rear) sensor side.

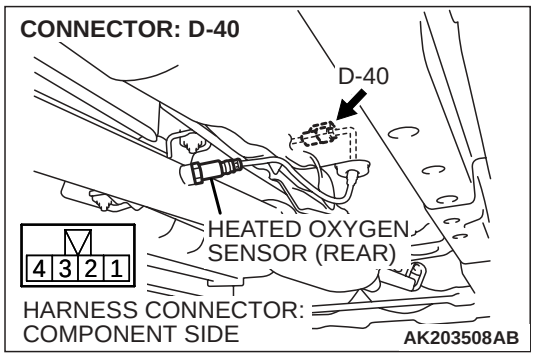
(2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

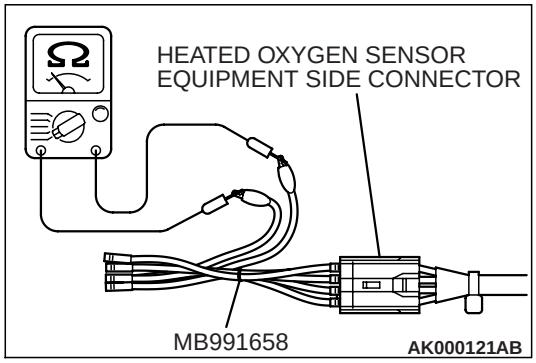
Standard value: 11 – 18 ohms [at 20°C (68°F)]

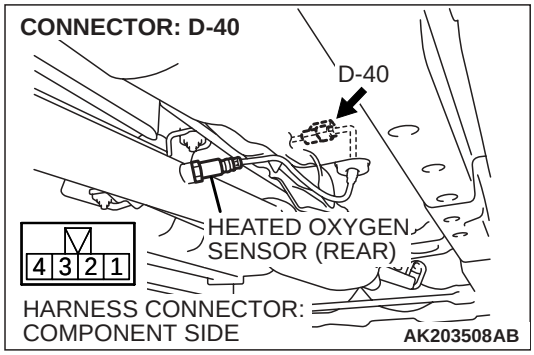
Q: Is the measured resistance between 11 and 18 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the heated oxygen sensor (rear). Then go to Step 12.



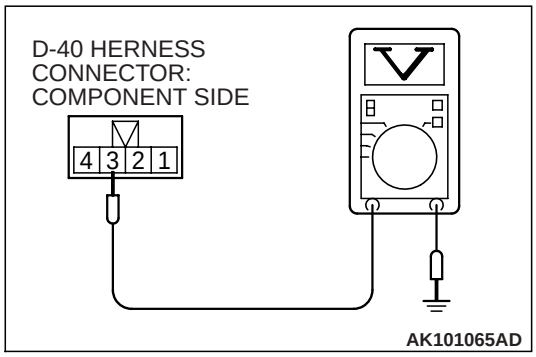




STEP 3. Measure the power supply voltage at heated oxygen sensor (rear) harness side connector D-40.

(1) Disconnect connector D-40 and measure at the harness side.

(2) Turn the ignition switch to the "ON" position.



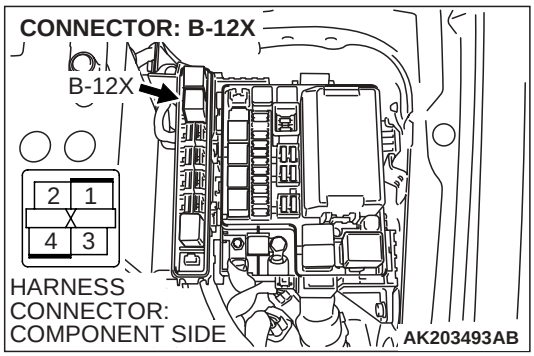
(3) Measure the voltage between terminal No. 3 and ground.
- Voltage should measure battery positive voltage.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is battery positive voltage (approximately 12 volts) present?

YES : Go to Step 5.

NO : Go to Step 4.



STEP 4. Check harness connector B-12X at the MFI relay for damage.

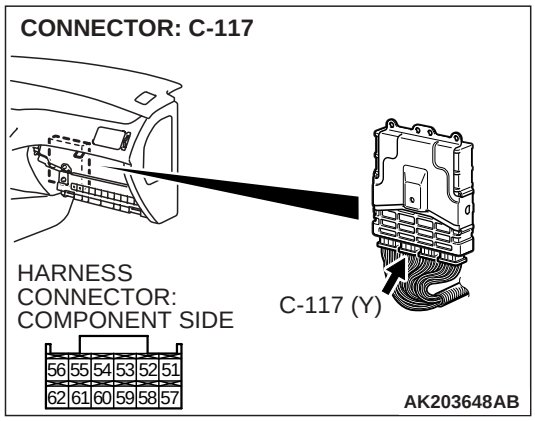
Q: Is the connector in good condition?

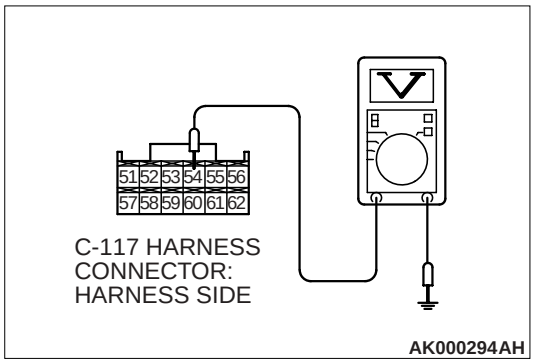
YES : Check connector C-105 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If intermediate connector is in good condition, repair harness wire between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (rear) connector D-40 (terminal No. 3) because of open circuit or short circuit to ground. Then go to Step 12.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

STEP 5. Measure the power supply voltage at ECM connector C-117 by backprobing.

(1) Do not disconnect connector C-117.
(2) Turn the ignition switch to the "ON" position.





(3) Measure the voltage between terminal No. 54 and ground by backprobing.
- Voltage should measure battery positive voltage.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

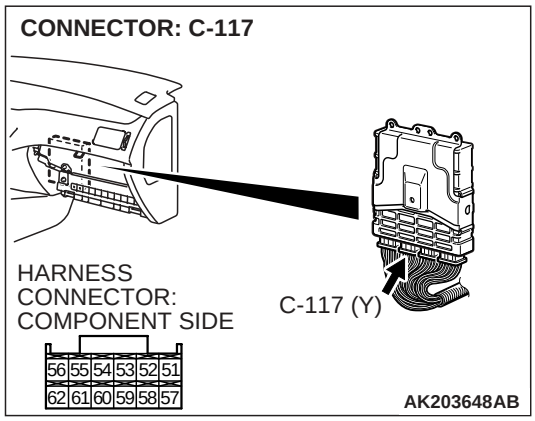
Q: Is battery positive voltage (approximately 12 volts) present?

YES : Go to Step 8.
NO : Go to Step 6.

STEP 6. Check connector C-117 at ECM for damage.

Q: Is the connector in good condition?

YES : Go to Step 7.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

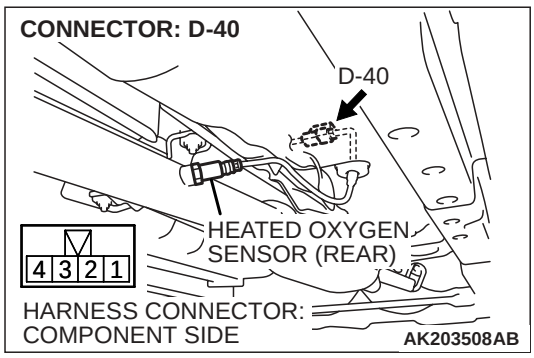


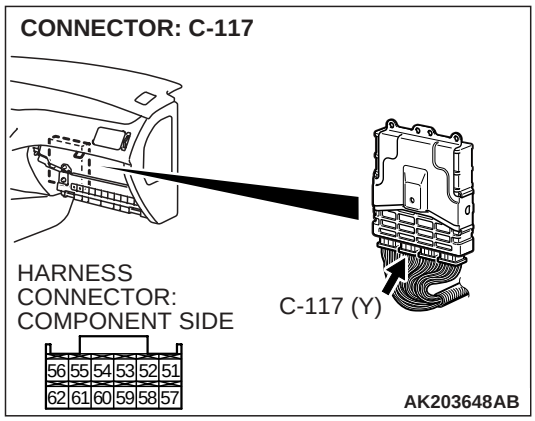
STEP 7. Check for open circuit and short circuit to ground between heated oxygen sensor (rear) connector D-40 (terminal No. 4) and ECM connector C-117 (terminal No. 54).

Q: Is the harness wire in good condition?

YES : Replace the ECM. Then go to Step 12.

NO : Repair it. Then go to Step 12.



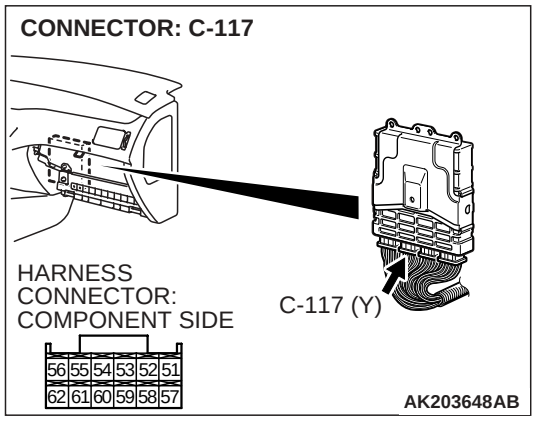


STEP 8. Check connector C-117 at ECM for damage.

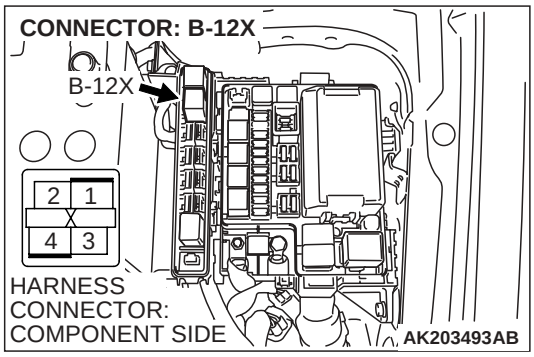
Q: Is the connector in good condition?

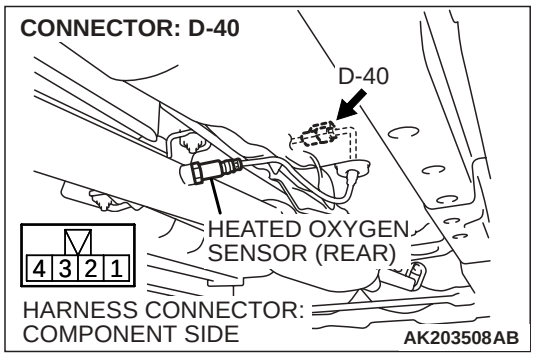
YES : Go to Step 9.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 9. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (rear) connector D-40 (terminal No. 3).



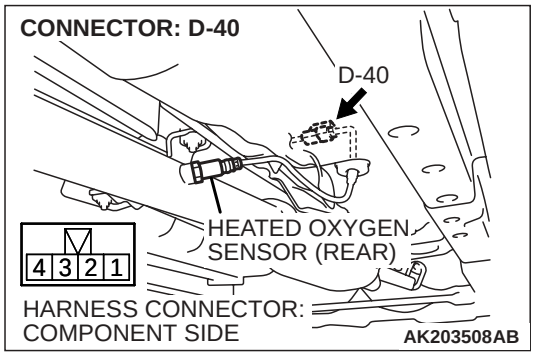


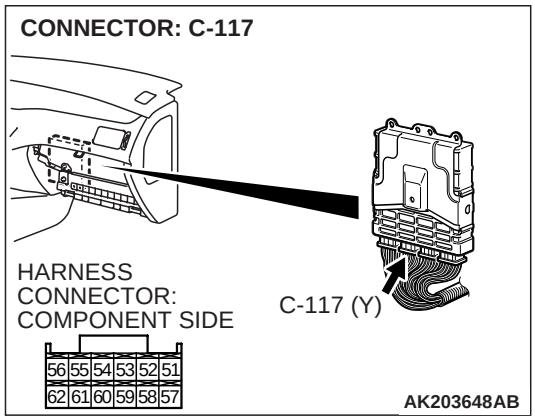
NOTE: Check harness after checking intermediate connector C-105. If intermediate connectors is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between heated oxygen sensor (rear) connector D-40 (terminal No. 4) and ECM connector C-117 (terminal No. 54).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Retest the system.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0141 set?

YES : Replace the ECM. Then go to Step 12.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points P.00-6.

STEP 12. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0141 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0171: SYSTEM TOO LEAN

System too Lean Circuit
- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction. P.13A-267

CIRCUIT OPERATION
- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction. P.13A-267

TECHNICAL DESCRIPTION
- If a malfunction occurs in the fuel system, the fuel trim value becomes too large.
- The ECM checks whether the fuel trim value is within a specified range.

DTC SET CONDITIONS

Check Conditions
- Engine coolant temperature is lower than approximately 100°C (212°F) when the engine is started.
- Intake air temperature is lower than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 56 Hz or more.

Judgment Criteria
- Long-term fuel trim has continued to be higher than +12.5 percent for 5 seconds.

or
- Short-term fuel trim has continued to be higher than +10.0 percent for 5 seconds.

Check Conditions
- Engine coolant temperature is lower than approximately 100°C (212°F) when the engine is started.
- Intake air temperature is lower than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 56 Hz or less.

Judgment Criteria
- Long-term fuel trim has continued to be higher than +12.5 percent for 5 seconds.

or
- Short-term fuel trim has continued to be higher than +15 percent for 5 seconds.

Check Conditions
- Engine coolant temperature is higher than approximately 100°C (212°F) when the engine is started.
- Intake air temperature is higher than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 56 Hz or more.

Judgment Criteria
- Long-term fuel trim has continued to be higher than +12.5 percent for 5 seconds.

or
- Short-term fuel trim has continued to be higher than +20.0 percent for 5 seconds.

Check Conditions
- Engine coolant temperature is higher than approximately 100°C (212°F) when the engine is started.
- Intake air temperature is higher than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 56 Hz or less.

Judgment Criteria
- Long-term fuel trim has continued to be higher than +12.5 percent for 5 seconds.

or
- Short-term fuel trim has continued to be higher than +25.0 percent for 5 seconds.

Check Conditions
- Engine coolant temperature is higher than 77°C (171°F).
- Under the closed loop air/fuel ratio control.

Judgment Criteria
- Long-term fuel trim has continued to be +12.5 percent for 5 seconds.

or
- Short-term fuel trim has continued to be +25.0 percent for 5 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)
- Volume airflow sensor failed.
- Injector failed.

TSB Revision

- Incorrect fuel pressure.
- Air drawn in from gaps in gasket, seals, etc.
- Heated oxygen sensor failed.
- Engine coolant temperature sensor failed.
- Intake air temperature sensor failed.
- Barometric pressure sensor failed.
- Use of incorrect or contaminated fuel.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

STEP 1. Check for exhaust leaks.

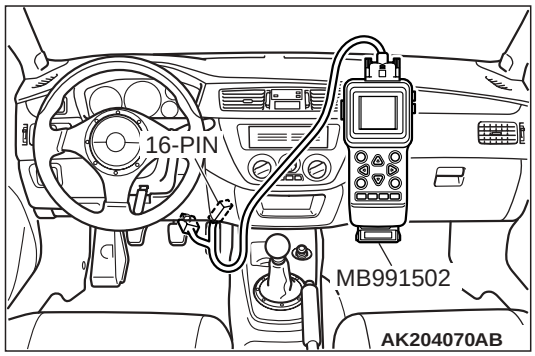
Q: Are there any abnormalities?

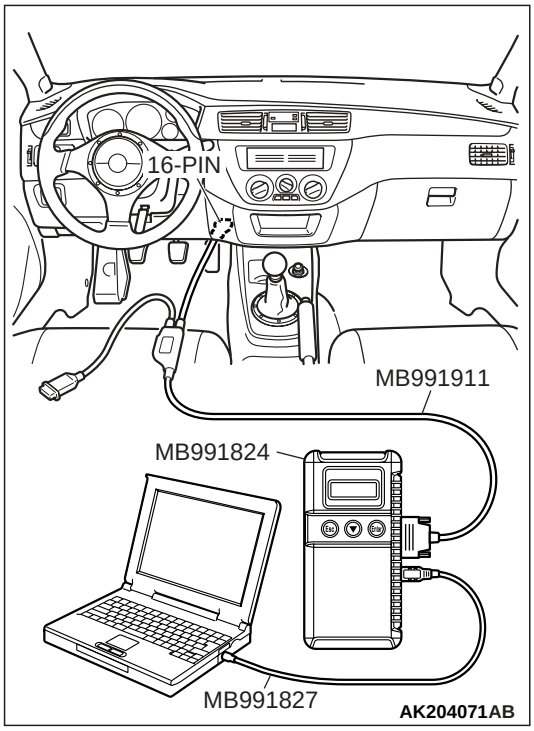
YES : Go to Step 2.
NO : Repair it. Then go to Step 14.

STEP 2. Check for intake system vacuum leaks.

Q: Are there any abnormalities?

YES : Go to Step 3.
NO : Repair it. Then go to Step 14.





STEP 3. Using scan tool MB991502 or MB991958, check data list item 12: Volume Airflow Sensor.

⚠ CAUTION

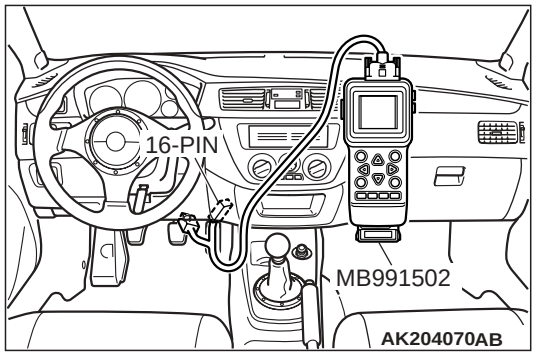
To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

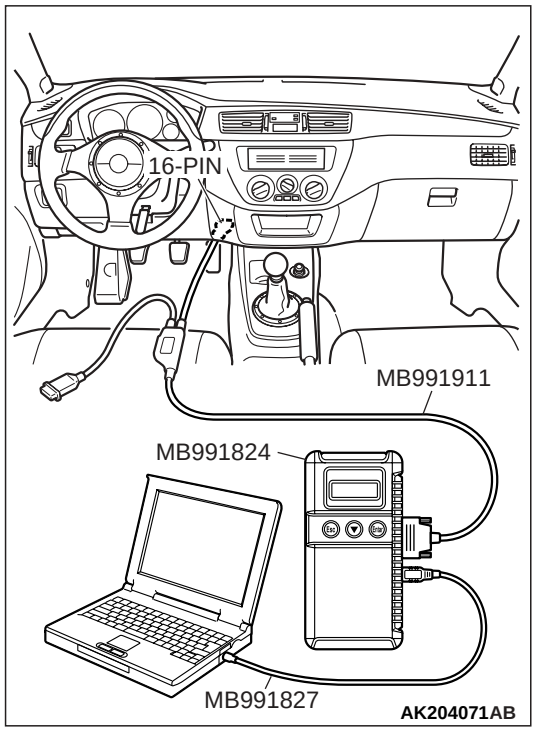
(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 12, Volume Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- When idling, between 17 and 43 Hz (between 2 and 7 gm/s).
- When 2,500 r/min, between 40 and 100 Hz (between 5 and 16 gm/s).

(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 4.
NO : Refer to, DTC P0101 – Volume Airflow Circuit Range/ Performance Problem P.13A-38, DTC P0102 – Volume Airflow Circuit Low Input P.13A-45.





STEP 4. Using scan tool MB991502 or MB991958, check data list item 13: Intake Air Temperature Sensor.

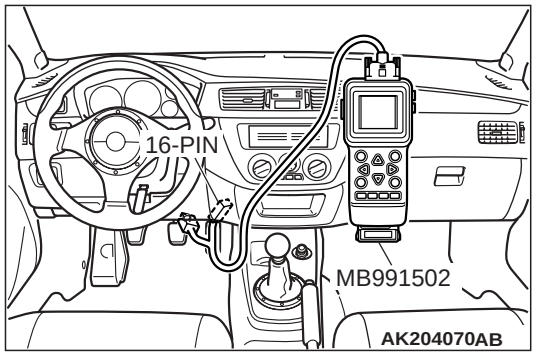
(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991502 or MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
- The intake air temperature and temperature shown with the scan tool should approximately match.

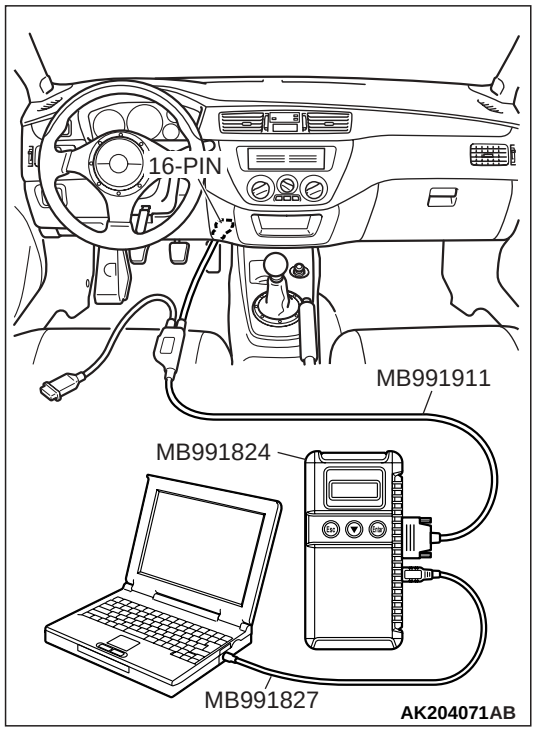
(3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 5.

NO : Refer to, DTC P0111 – Intake Air Temperature Circuit Range/Performance Problem P.13A-83, DTC P0112 – Intake Air Temperature Circuit Low Input P.13A-90, DTC P0113 – Intake Air Temperature Circuit High Input P.13A-94.





STEP 5. Using scan tool MB991502 or MB991958, check data list item 21: Engine Coolant Temperature Sensor.

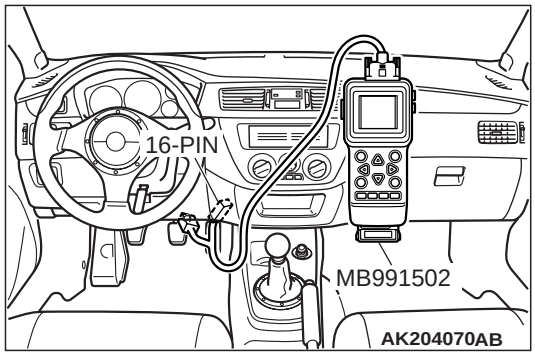
(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991502 or MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
- The engine coolant temperature and temperature shown with the scan tool should approximately match.

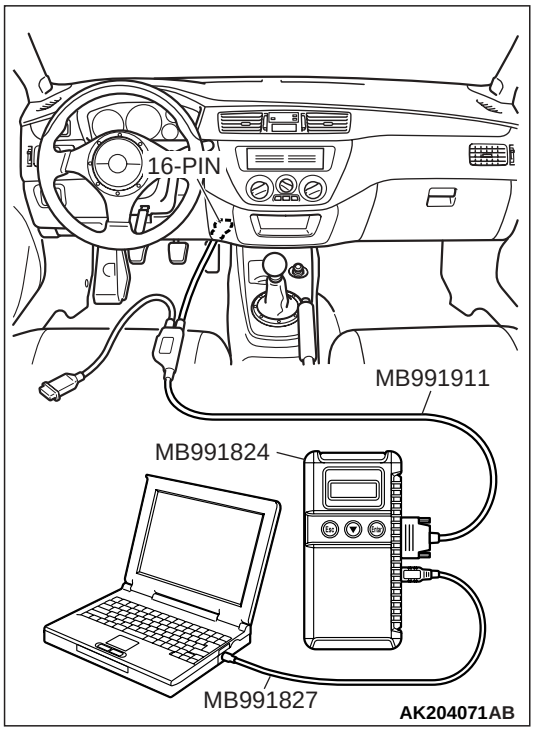
(3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 6.

NO : Refer to, DTC P0116 – Engine Coolant Temperature Circuit Range/Performance Problem P.13A-101, DTC P0117 – Engine Coolant Temperature Circuit Low Input P.13A-111, DTC P0118 – Engine Coolant Temperature Circuit High Input P.13A-115.





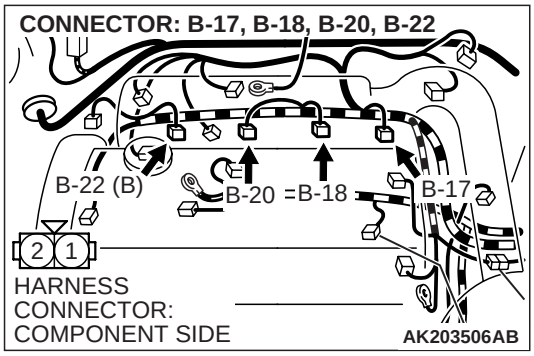
STEP 6. Using scan tool MB991502 or MB991958, check data list item 25: Barometric Pressure Sensor.

(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991502 or MB991958 to the data reading mode for item 25, Barometric Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

(3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

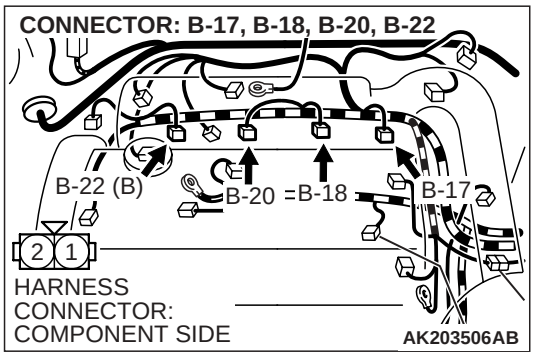
YES : Go to Step 7.
NO : Refer to, DTC P0106 – Barometric Pressure Circuit Range/Performance Problem P.13A-53, DTC P0107 – Barometric Pressure Circuit Low Input P.13A-59, DTC P0108 – Barometric Pressure Circuit High Input P.13A-73.



STEP 7. Check connectors B-17, B-18, B-20, B-22 at injector for damage.

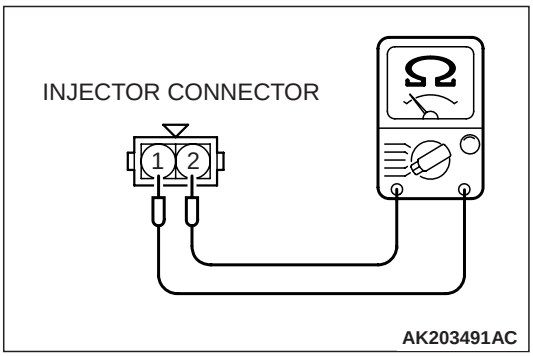
Q: Is the connector in good condition?

YES : Go to Step 8.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.



STEP 8. Check the injector.

(1) Disconnect each injector connector.



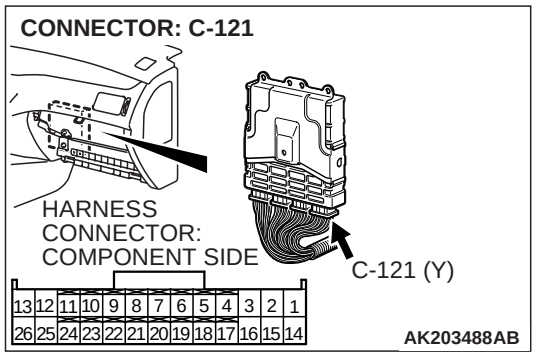
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 2 – 3 ohms [at 20°C (68°F)]

Q: Is the resistance between 2 and 3 ohms [at 20°C (68°F)]?

YES : Go to Step 10.

NO : Replace the injector. Then go to Step 14.

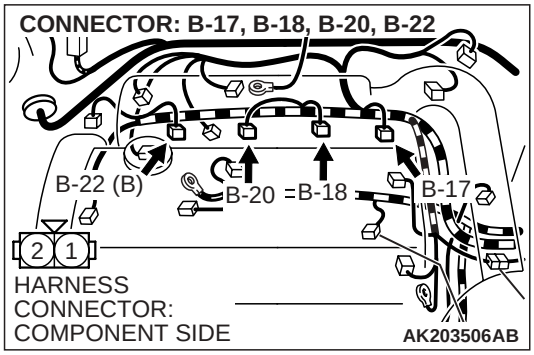


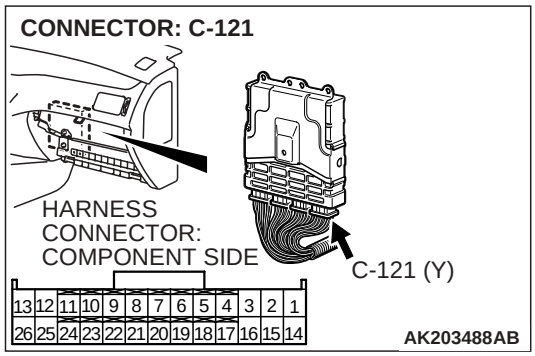
STEP 9. Check connector C-121 at ECM for damage.

Q: Is the connector in good condition?

YES : Go to Step 10.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.





STEP 10. Check for harness damage between injector connector and ECM connector.

a. Check the harness wire between injector connector B-22 (terminal No. 2) and ECM connector C-121 (terminal No. 1) at No. 1 cylinder.
b. Check the harness wire between injector connector B-20 (terminal No. 2) and ECM connector C-121 (terminal No. 14) at No. 2 cylinder.
c. Check the harness wire between injector connector B-18 (terminal No. 2) and ECM connector C-121 (terminal No. 2) at No. 3 cylinder.
d. Check the harness wire between injector connector B-17 (terminal No. 2) and ECM connector C-121 (terminal No. 15) at No. 4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 11.
NO : Repair it. Then go to Step 14.

STEP 11. Check the fuel pressure.

Refer to GROUP 13A, On-vehicle Service – Fuel Pressure Test P.13A-762.

Q: Is the fuel pressure normal?

YES : Go to Step 12.
NO : Repair or replace it. Then go to Step 14.

STEP 12. Check for entry of foreign matter (water, kerosene, etc.) into fuel.

Q: Are there any abnormalities?

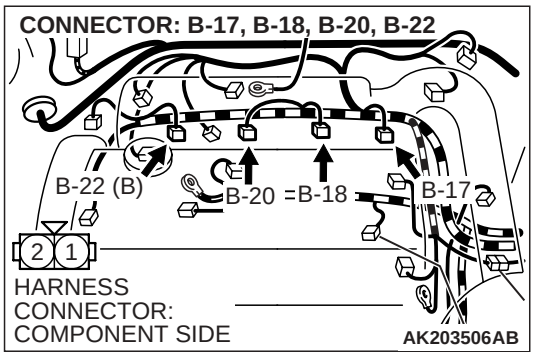
YES : Replace the fuel. Then go to Step 14.
NO : Go to Step 13.

STEP 13. Replace the injector.

(1) Replace the injector.
(2) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor P.13A-6.
(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0171 set?

YES : Replace the ECM. Then go to Step 14.
NO : The procedure is complete.



STEP 14. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0171 set?

YES : Repeat the troubleshooting.
NO : The procedure is complete.

DTC P0172: SYSTEM TOO RICH

System too Rich Circuit

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction P.13A-267.

CIRCUIT OPERATION

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction P.13A-267.

TECHNICAL DESCRIPTION

- If a malfunction occurs in the fuel system, the fuel trim value becomes too small.
- The ECM checks whether the fuel trim value is within a specified range.

DTC SET CONDITIONS

Check Conditions

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 56 Hz or more.

Judgment Criteria

- Long-term fuel trim has continued to be lower than –12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be lower than –10 percent for 5 seconds.

Check Conditions

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 56 Hz or less.

Judgment Criteria

- Long-term fuel trim has continued to be lower than –12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be lower than –15.0 percent for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than 77°C (171°F).
- Under the closed loop air/fuel ratio control.

Judgment Criteria

- Long-term fuel trim has continued to be –12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be –25.0 percent for 5 seconds.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

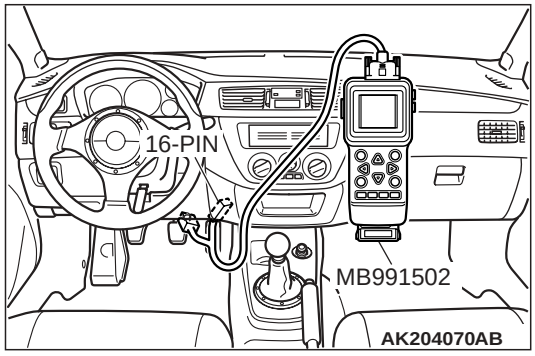
- Volume airflow sensor failed.
- Injector failed.
- Incorrect fuel pressure.
- Engine coolant temperature sensor failed.
- Intake air temperature sensor failed.
- Barometric pressure sensor failed.
- Harness damage in injector circuit, or connector damage.
- ECM failed.

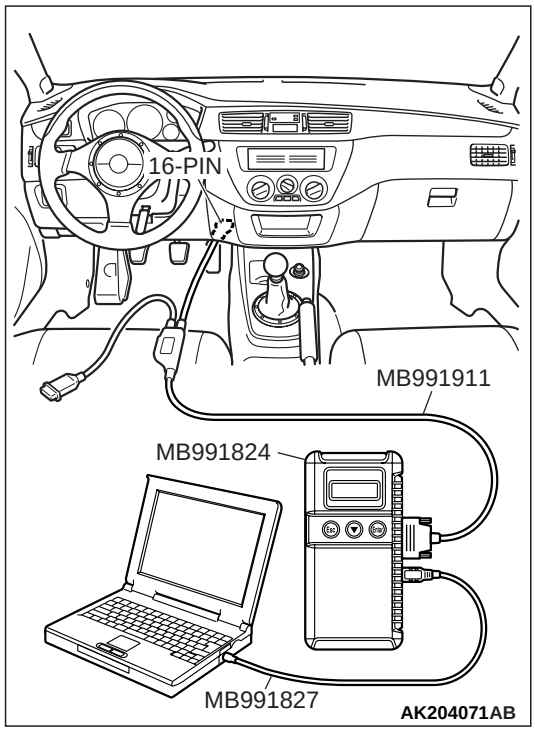
DIAGNOSIS

Required Special Tools:

- MB991502: Scan Tool (MUT-II)
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

STEP 1. Using scan tool MB991502 or MB991958, check data list item 12: Volume Airflow Sensor.





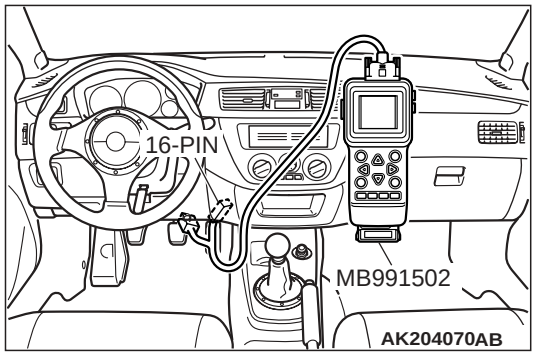
⚠ CAUTION

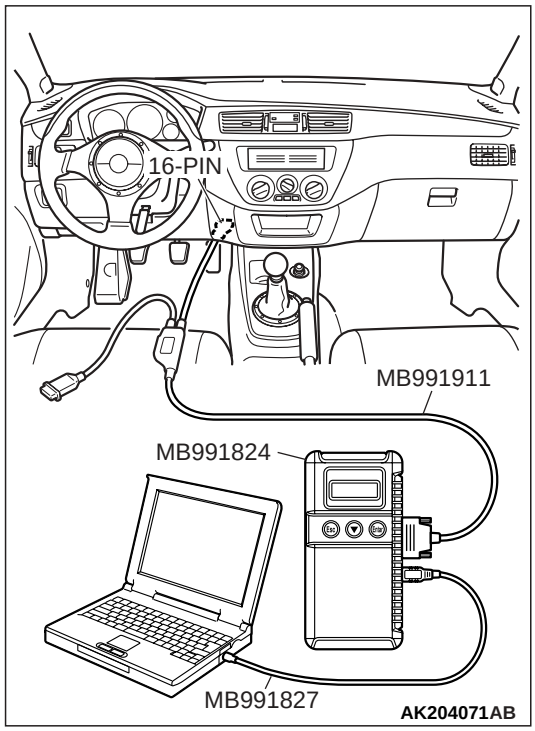
To prevent damage to scan tool MB991502 or MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502 or MB991958.

(1) Connect scan tool MB991502 or MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991502 or MB991958 to the data reading mode for item 12, Volume Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 96°C (176°F to 205°F).
  - When idling, between 17 and 43 Hz (between 2 and 7 gm/s).
  - When 2,500 r/min, between 40 and 100 Hz (between 5 and 16 gm/s).
(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 2.
NO : Refer to, DTC P0101 – Volume Airflow Circuit Range/Performance Problem P.13A-38, DTC P0102 – Volume Airflow Circuit Low Input P.13A-45.





STEP 2. Using scan tool MB991502 or MB991958, check data list item 13: Intake Air Temperature Sensor.

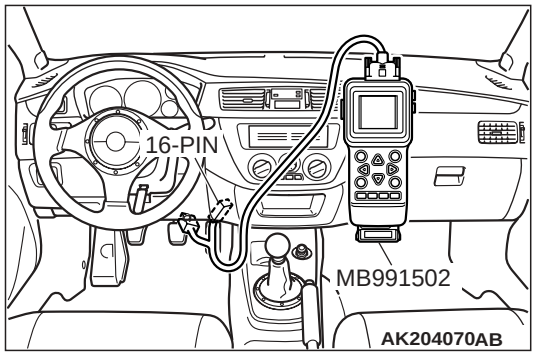
(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991502 or MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
- The intake air temperature and temperature shown with the scan tool should approximately match.

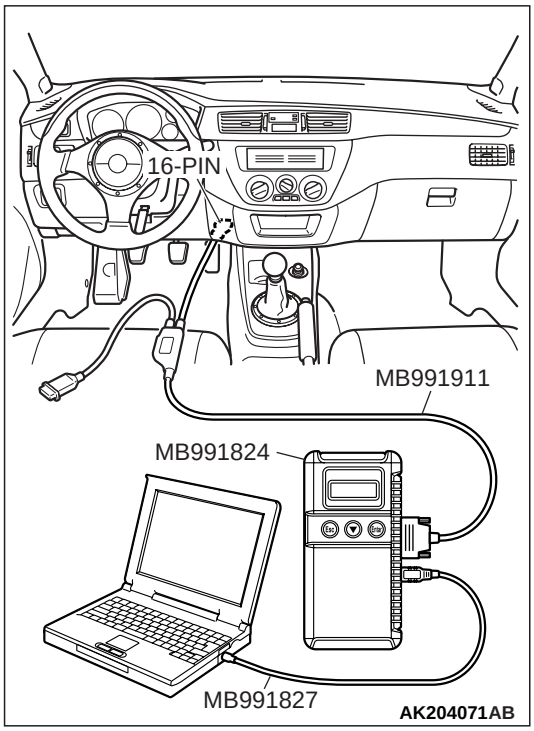
(3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 3.

NO : Refer to, DTC P0111 – Intake Air Temperature Circuit Range/Performance Problem P.13A-83, DTC P0112 – Intake Air Temperature Circuit Low Input P.13A-90, DTC P0113 – Intake Air Temperature Circuit High Input P.13A-94.





STEP 3. Using scan tool MB991502 or MB991958, check data list item 21: Engine Coolant Temperature Sensor.

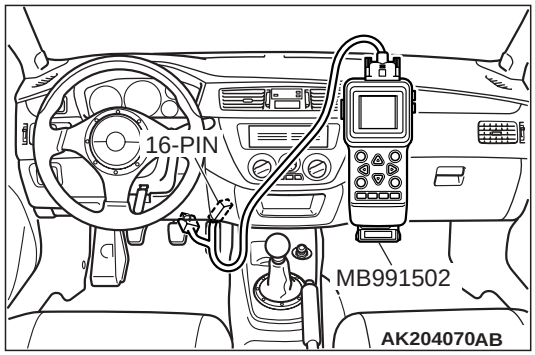
(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991502 or MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
- The engine coolant temperature and temperature shown with the scan tool should approximately match.

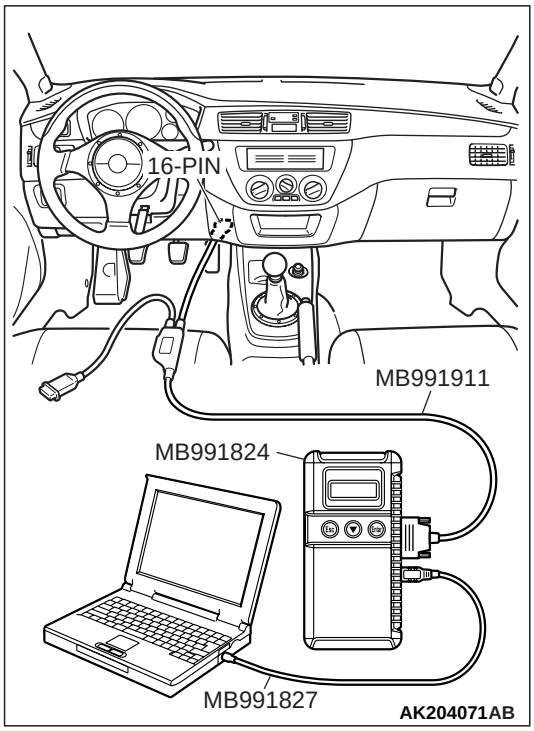
(3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 4.

NO : Refer to, DTC P0116 – Engine Coolant Temperature Circuit Range/Performance Problem P.13A-101, DTC P0117 – Engine Coolant Temperature Circuit Low Input P.13A-111, DTC P0118 – Engine Coolant Temperature Circuit High Input P.13A-115.





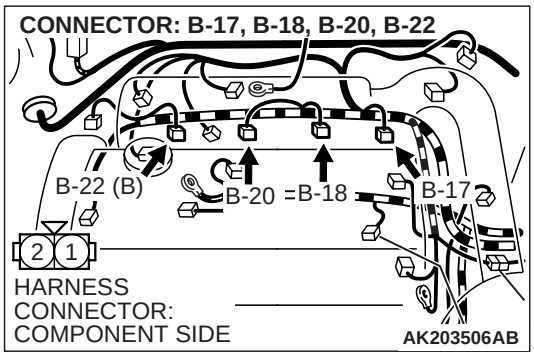
STEP 4. Using scan tool MB991502 or MB991958, check data list item 25: Barometric Pressure Sensor.

(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991502 or MB991958 to the data reading mode for item 25, Barometric Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

(3) Turn the ignition switch to the "LOCK" (OFF) position.

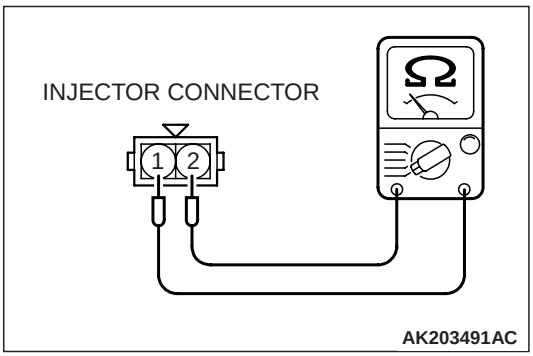
Q: Is the sensor operating properly?

YES : Go to Step 5.
NO : Refer to, DTC P0106 – Barometric Pressure Circuit Range/Performance Problem P.13A-53, DTC P0107 – Barometric Pressure Circuit Low Input P.13A-59, DTC P0108 – Barometric Pressure Circuit High Input P.13A-73.



STEP 5. Check the injector.

(1) Disconnect each injector connector.



(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 2 – 3 ohms [at 20°C (68°F)]

Q: Is the resistance between 2 and 3 ohms [at 20°C (68°F)]?

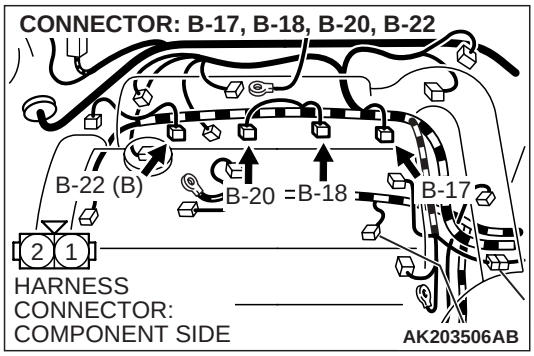
YES : Go to Step 6.
NO : Replace the injector. Then go to Step 8.

STEP 6. Check the fuel pressure.

Refer to GROUP 13A, On-vehicle Service – Fuel Pressure Test P.13A-762.

Q: Is the fuel pressure normal?

YES : Go to Step 7.
NO : Repair or replace it. Then go to Step 8.



STEP 7. Replace the injector.

(1) Replace the injector.
(2) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor P.13A-6.
(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0172 set?

YES : Replace the ECM. Then go to Step 8.
NO : The procedure is complete.

STEP 8. Perform the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to GROUP 13A, Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0172 set?

YES : Repeat the troubleshooting.
NO : The procedure is complete.

TSB Revision