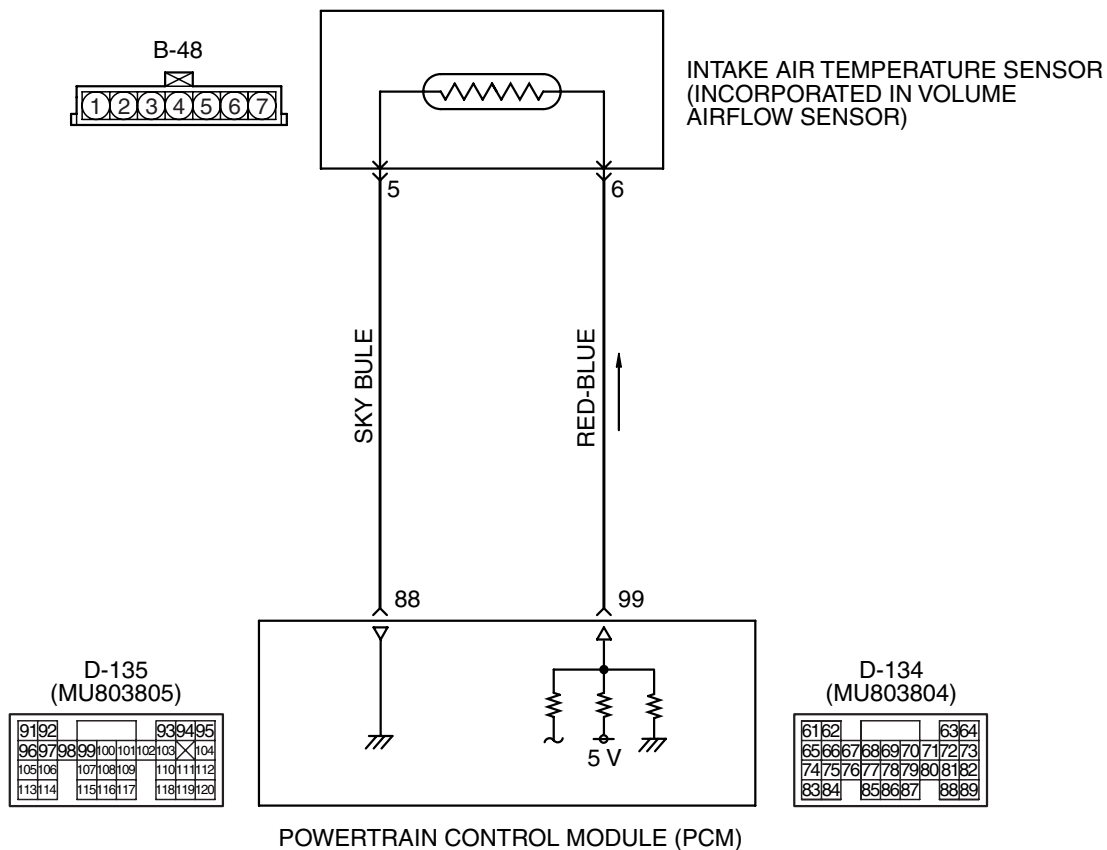
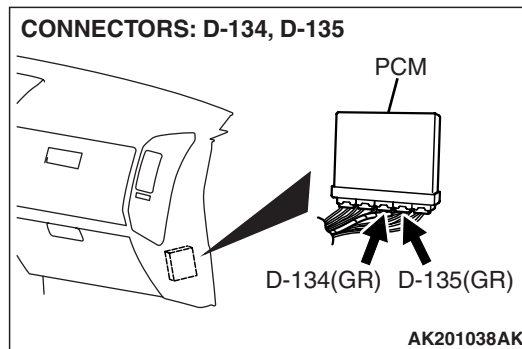
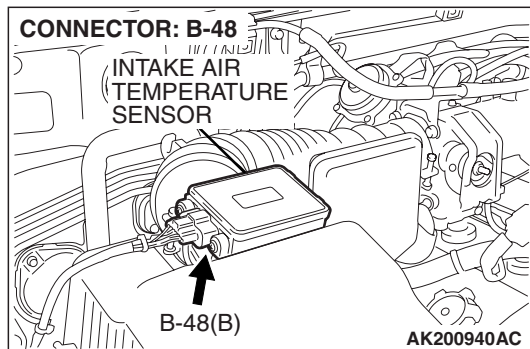


DTC P0111: Intake Air Temperature Circuit Range/Performance Problem

Intake Air Temperature Sensor Circuit



AK400928



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 6) from the PCM (terminal No. 99) via the resistor in the PCM. The ground terminal (terminal No. 5) is grounded to the PCM (terminal No. 88).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Intake air temperature sensor output voltage does not change when specified go/stop operations are repeated.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS

(Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

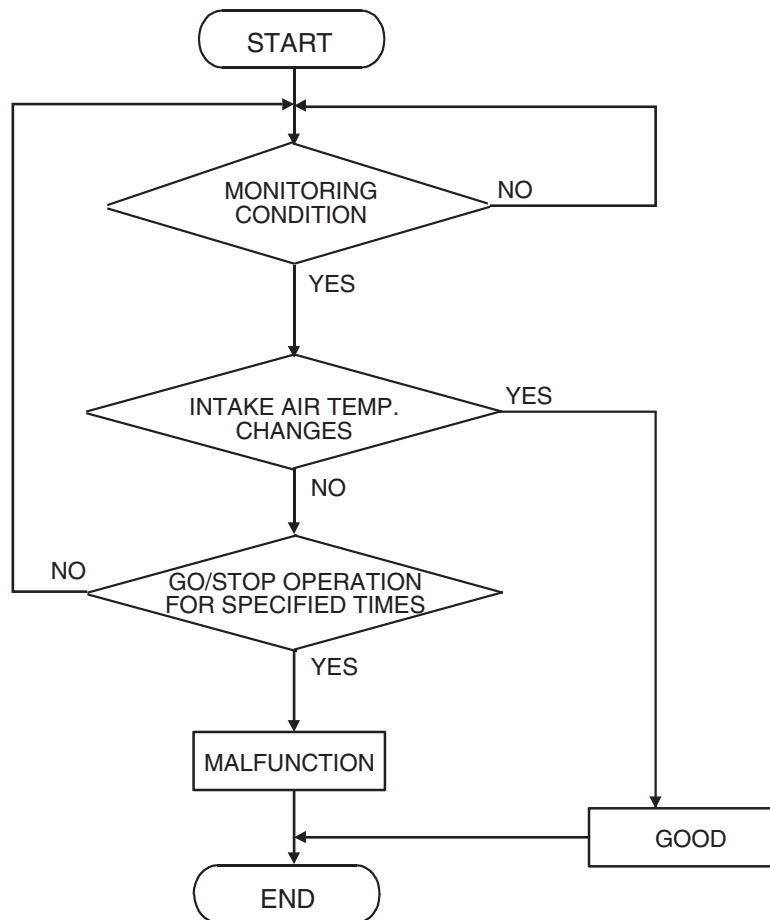
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK401000

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- Repeat 2 or more times: drive^{*1}, stop^{*2}.
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 (1 mph) lasting more than 30 seconds.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 9 [P.13A-4](#).

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

- Intake air temperature sensor failed.
- Harness damage or connector damage.
- PCM failed.

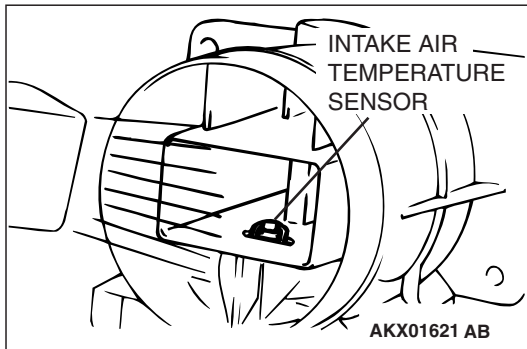
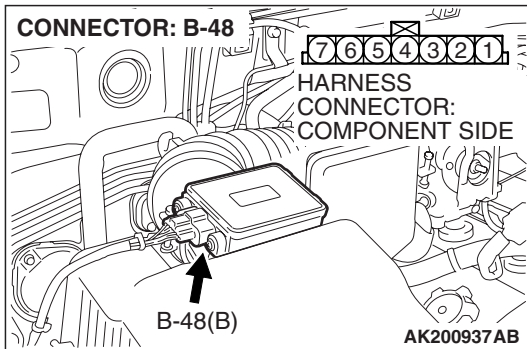
DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 13: Intake Air Temperature Sensor.**⚠ CAUTION**

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

- (1) Connect scan tool 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 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.

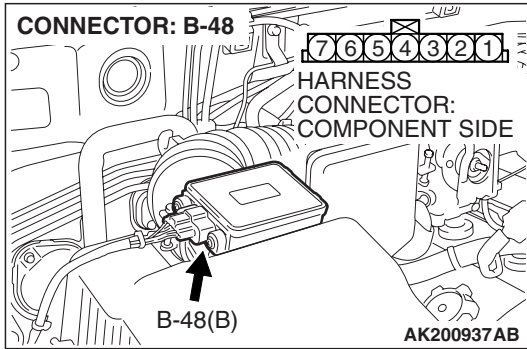
Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

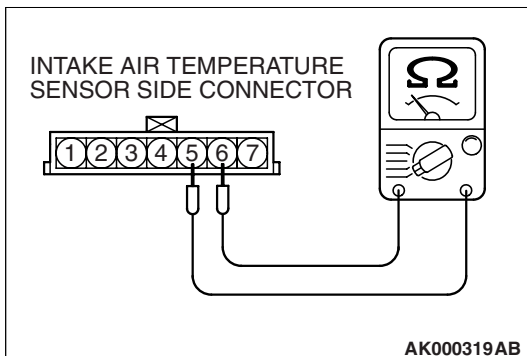
NO : Go to Step 2.

STEP 2. Check the intake air temperature sensor.

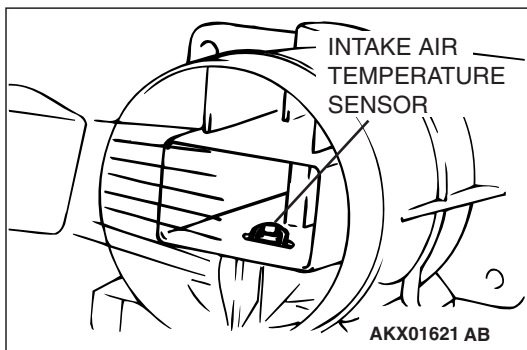
- (1) Disconnect the intake air temperature sensor connector B-48



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



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



Standard value:

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

Q: Is the resistance at the standard value?

YES : Go to Step 3.

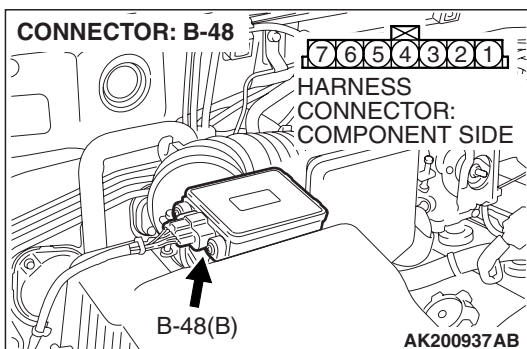
NO : Replace the volume airflow sensor. Then go to Step 9.

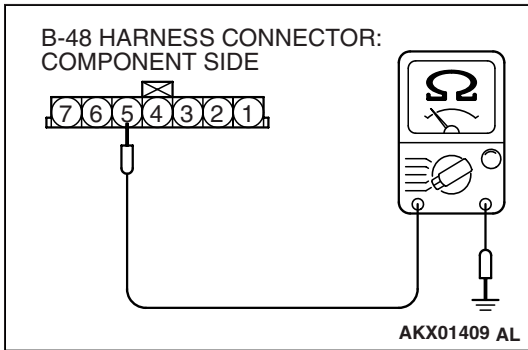
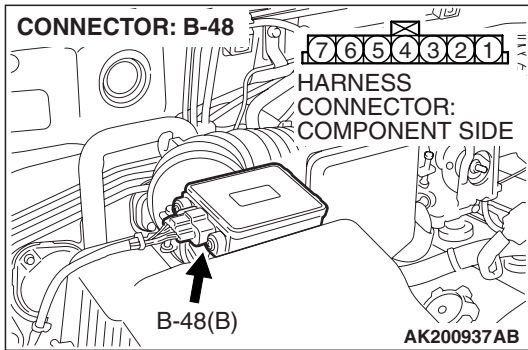
STEP 3. Check harness connector B-48 at the intake air temperature sensor for damage.

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 the continuity at intake air temperature sensor harness side connector B-48.

(1) Disconnect the connector B-48 and measure at the harness side.

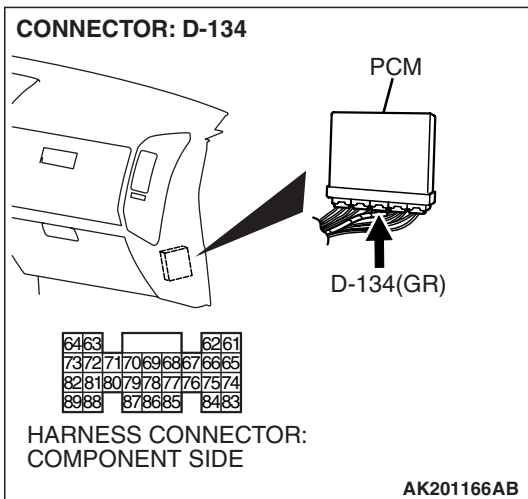
(2) Check for the continuity between terminal No. 5 and ground.

- 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 D-134 at PCM for damage.

Q: Is the harness connector in good condition?

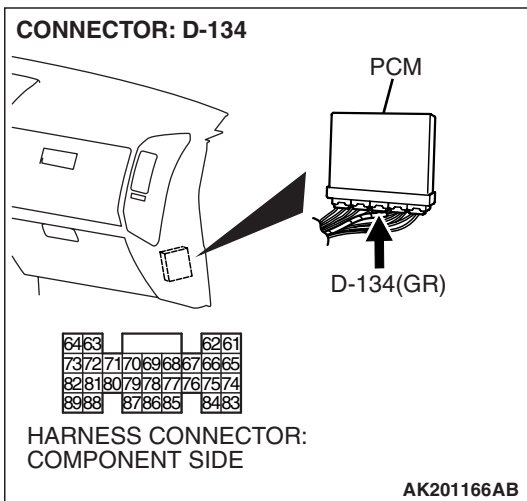
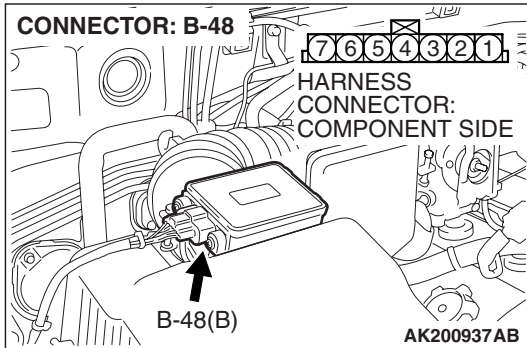
YES : Go to Step 6.

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

STEP 6. Check for harness damage between intake air temperature sensor connector B-48 (terminal No. 5) and PCM connector D-134 (terminal No. 88).

Q: Is the harness wire in good condition?

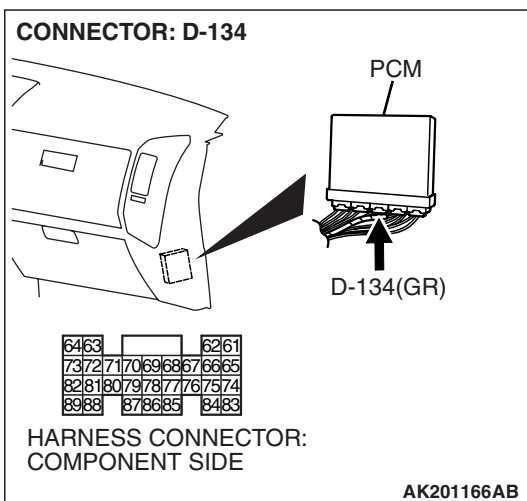
- YES :** Replace the PCM. Then go to Step 9.
- NO :** Repair it. Then go to Step 9.



STEP 7. Check harness connector D-134 at PCM for damage.

Q: Is the harness connector in good condition?

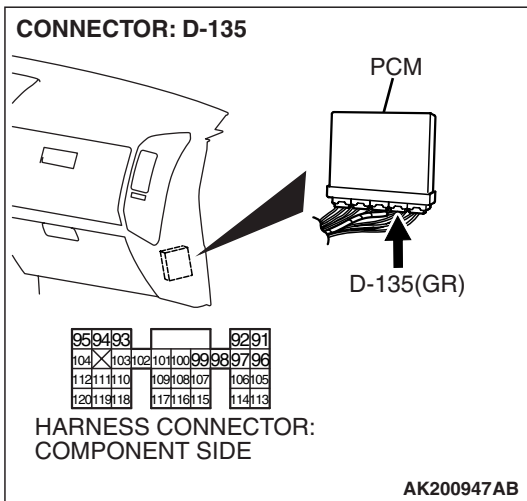
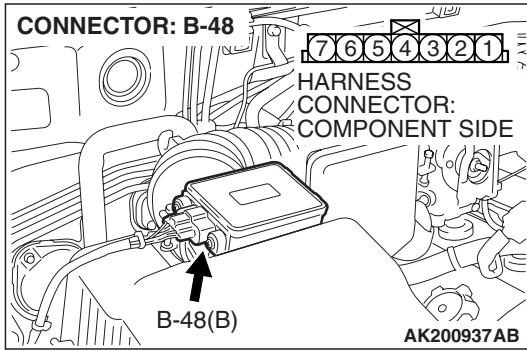
- YES :** Go to Step 8.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 9.



STEP 8. Check for harness damage between intake air temperature sensor connector B-48 (terminal No. 6) and PCM connector D-135 (terminal No. 99).

Q: Is the harness wire in good condition?

- YES :** Replace the PCM. Then go to Step 9.
- NO :** Repair it. Then go to Step 9.



STEP 9. Test the OBD-II drive cycle.

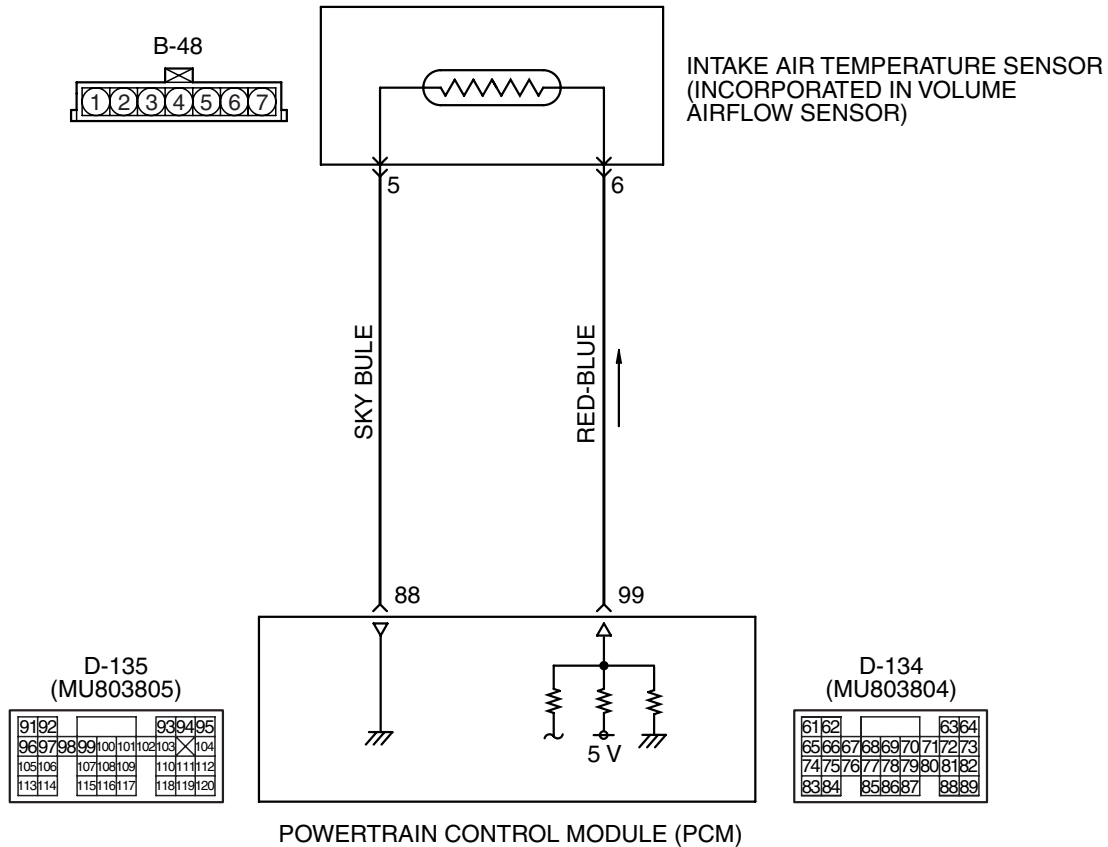
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0111 set?

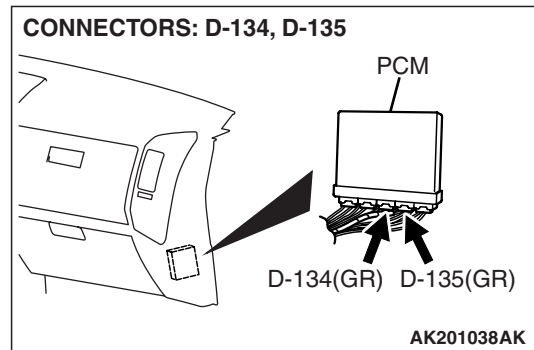
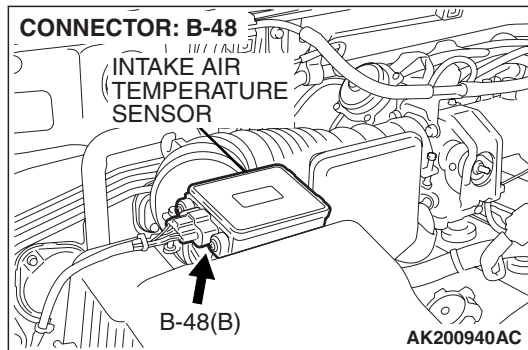
- YES :** Retry the troubleshooting.
- NO :** The inspection is complete.

DTC P0112: Intake Air Temperature Circuit Low Input

Intake Air Temperature Sensor Circuit



AK400928



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 6) from the PCM (terminal No. 99) via the resistor in the PCM. The ground terminal (terminal No. 5) is grounded to the PCM (terminal No. 88).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Intake air temperature sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

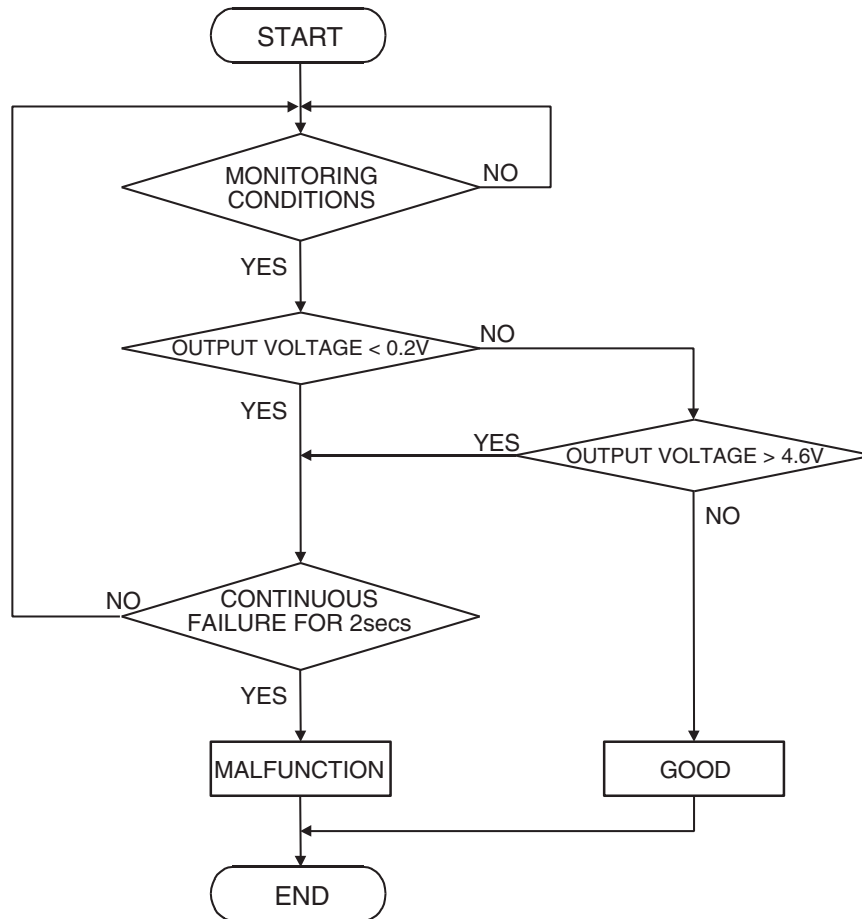
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302922

Check Condition

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

Judgement Criterion

- 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.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 20 P.13A-4.

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.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

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

⚠ CAUTION

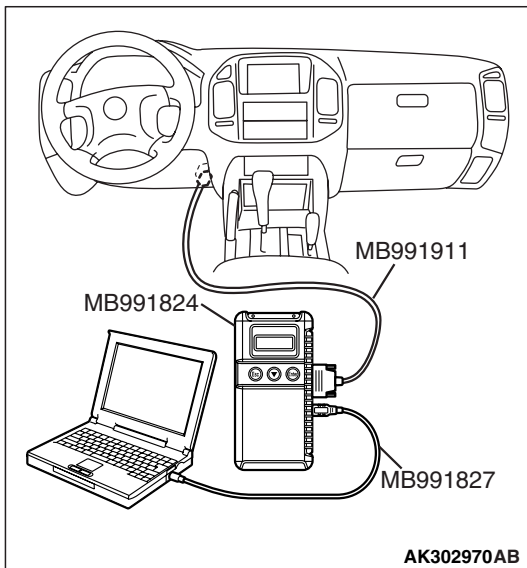
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool 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 – How to Cope with Intermittent Malfunctions P.00-13.

NO : Go to Step 2.

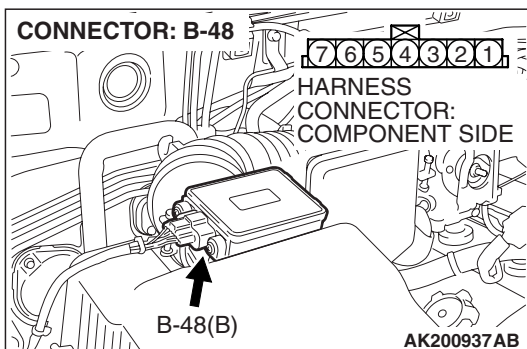


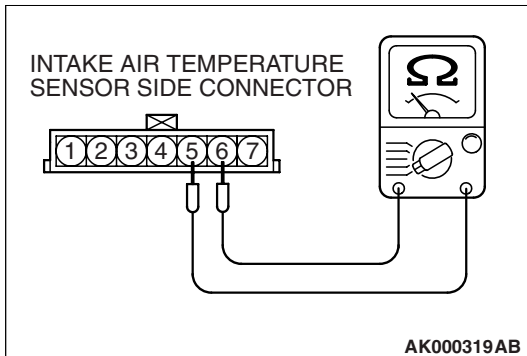
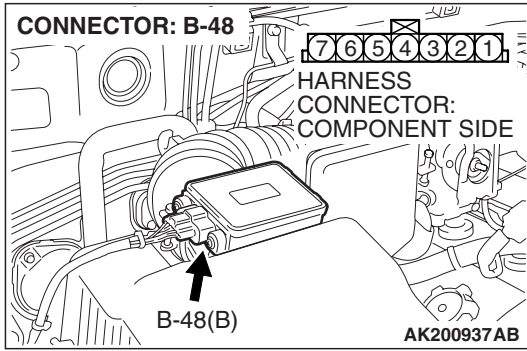
STEP 2. Check harness connector B-48 at the intake air temperature sensor for damage.

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.

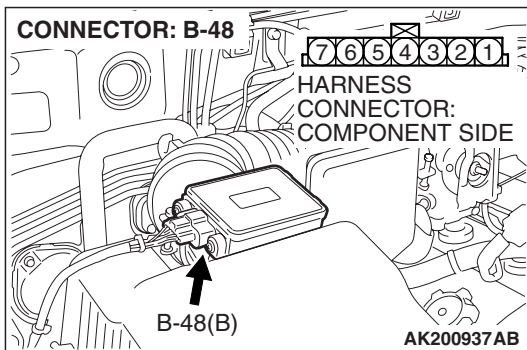
- (1) Disconnect the intake air temperature sensor connector B-48.

- (2) Measure the resistance between intake air temperature sensor side connector terminal No. 5 and No. 6.
 - There should be continuity. (0.30 – 20 kΩ)

Q: Is the resistance between 0.30 and 20 kΩ?

YES : Go to Step 4.

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

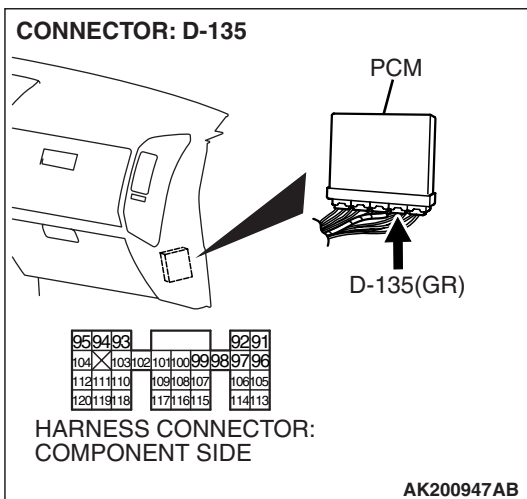


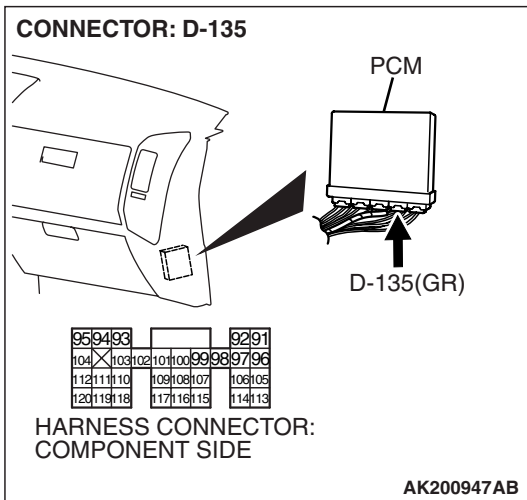
STEP 4. Check for short circuit to ground between intake air temperature sensor connector B-48 (terminal No.6) and PCM connector D-135 (terminal No. 99).

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 D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Replace the PCM. 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. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-4](#).

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

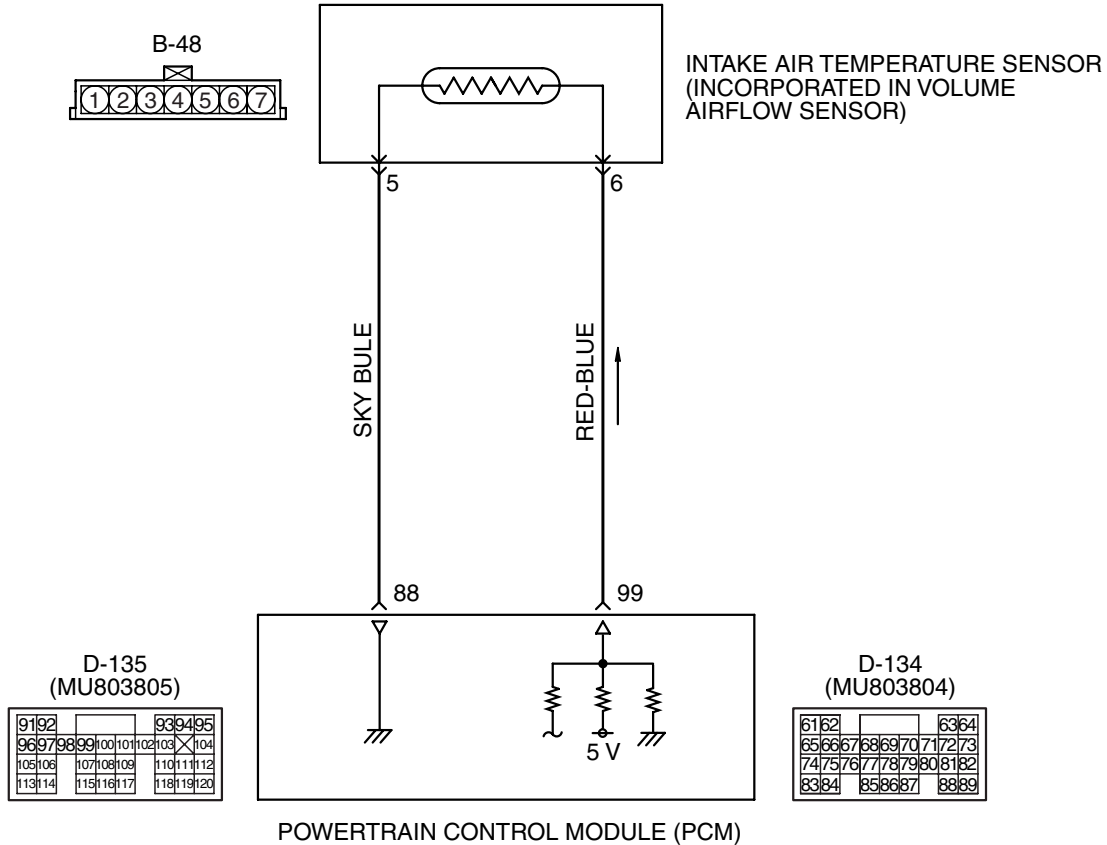
Q: Is DTC P0112 set?

YES : Retry the troubleshooting.

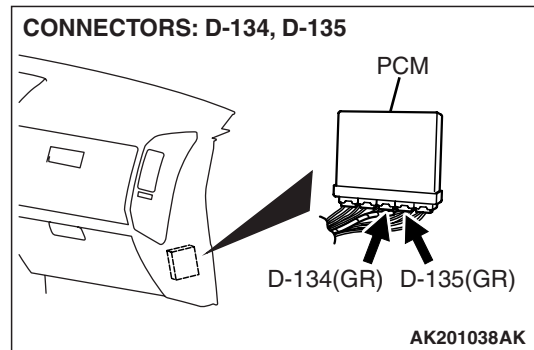
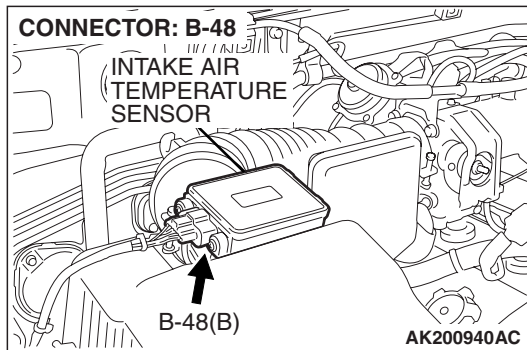
NO : The inspection is complete.

DTC P0113: Intake Air Temperature Circuit High Input

Intake Air Temperature Sensor Circuit



AK400928



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 6) from the PCM (terminal No. 99) via the resistor in the PCM. The ground terminal (terminal No. 5) is grounded to the PCM (terminal No. 88).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Intake air temperature sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

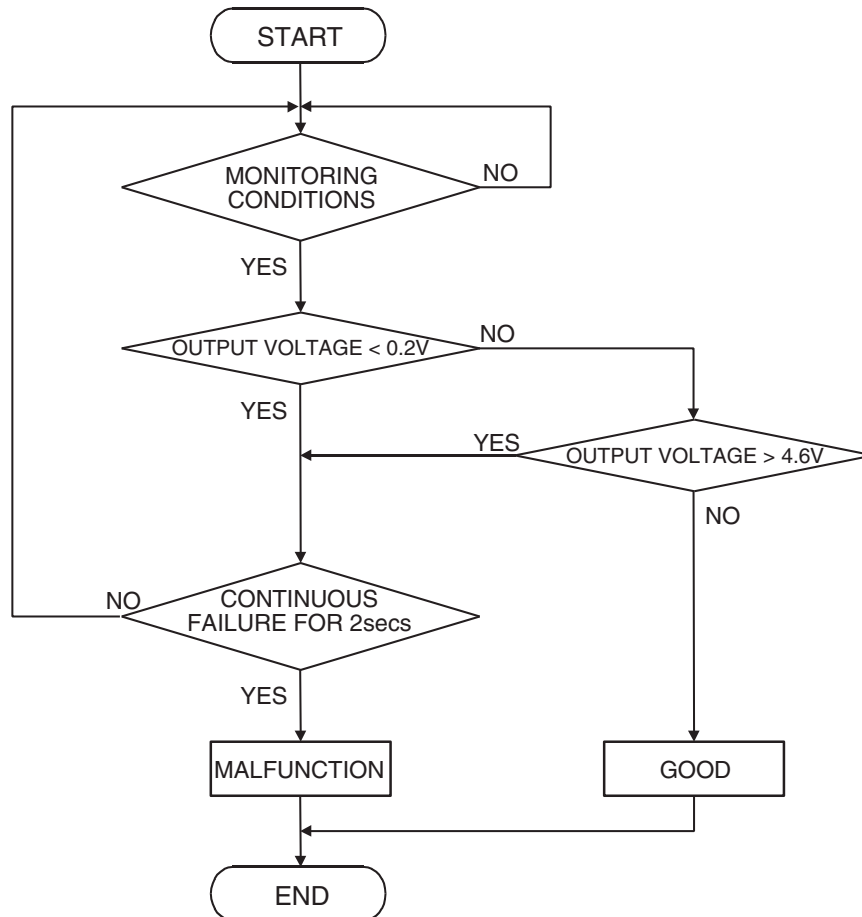
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302922

Check Condition

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

Judgement Criterion

- 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.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 20 [P.13A-4](#).

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.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 13: Intake Air Temperature Sensor.**⚠ CAUTION**

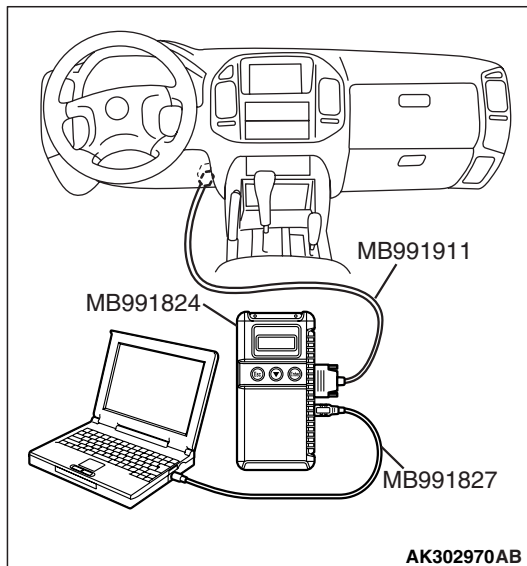
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool 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?

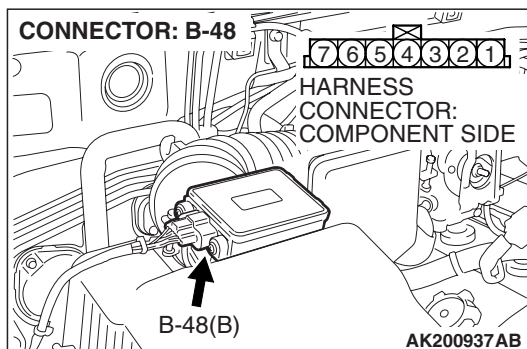
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

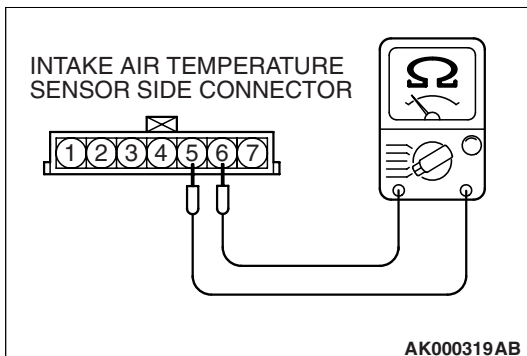
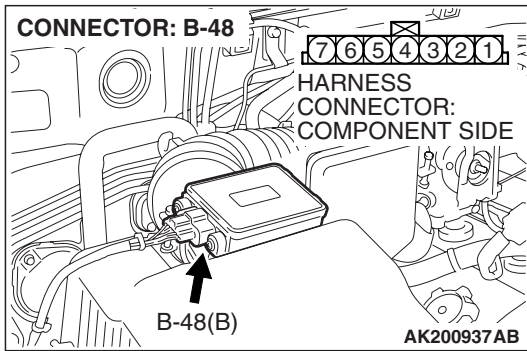
NO : Go to Step 2.

**STEP 2. Check harness connector B-48 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.

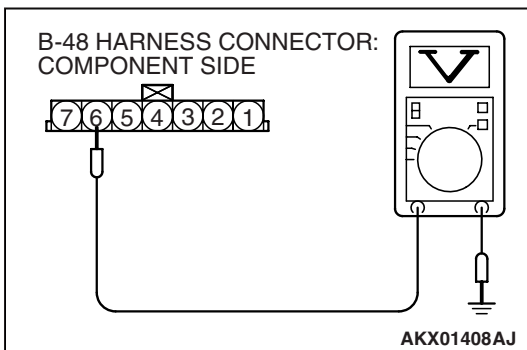
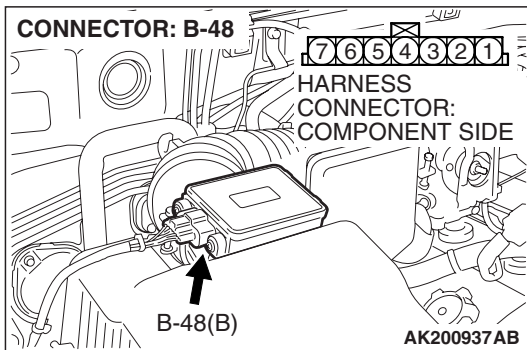
- (1) Disconnect the intake air temperature sensor connector B-48.

- (2) Measure the resistance between intake air temperature sensor side connector terminal No. 5 and No. 6.
 - There should be continuity. (0.30 – 20 k Ω)

Q: Is the resistance between 0.30 and 20 k Ω ?

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-48.

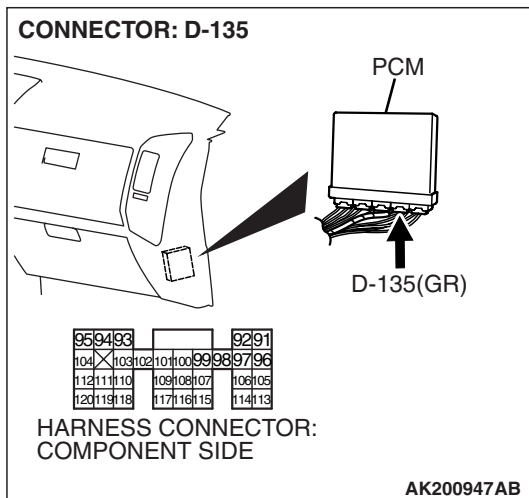
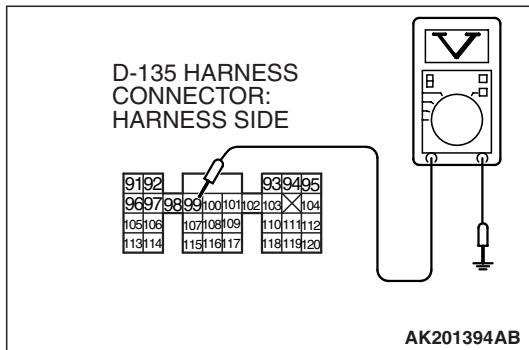
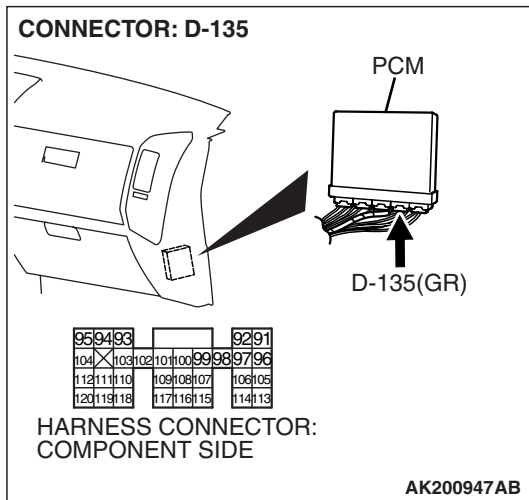
- (1) Disconnect the connector B-48 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 6 and ground.
 - Voltage should be 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 PCM connector D-135 by backprobing.

- (1) Do not disconnect the PCM connector D-135.
- (2) Disconnect the intake air temperature sensor connector B-48.
- (3) Turn the ignition switch to the "ON" position.

- (4) Measure the voltage between terminal No. 99 and ground by backprobing.
 - Voltage should be 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 D-135 at PCM for damage.

Q: Is the harness connector in good condition?

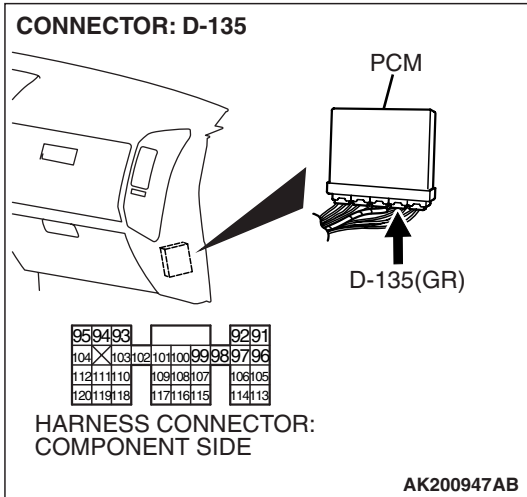
- YES :** Repair harness wire between intake air temperature sensor connector B-48 (terminal No. 6) and PCM connector D-135 (terminal No. 99) because of open circuit. Then go to Step 11.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

STEP 7. Check harness connector D-135 at PCM for damage.

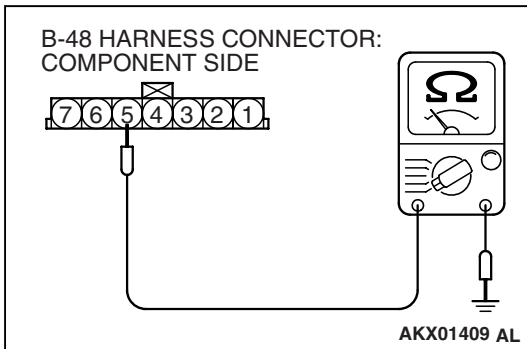
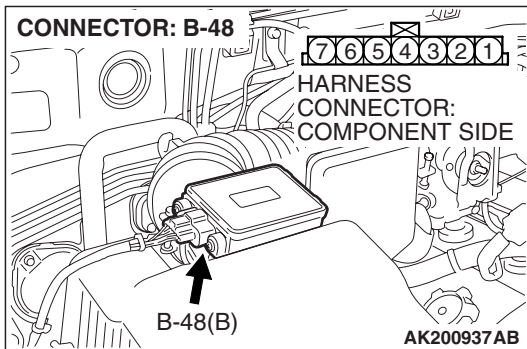
Q: Is the harness connector in good condition?

YES : Replace the PCM. 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 the continuity at intake air temperature sensor harness side connector B-48.



(1) Disconnect the connector B-48 and measure at the harness side.

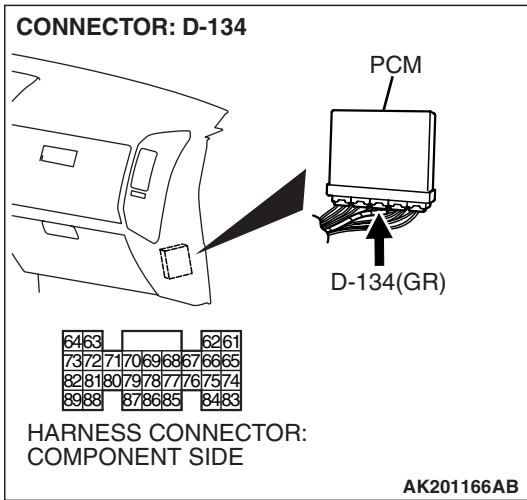
(2) Check for the continuity between terminal No. 5 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

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

NO : Go to Step 9.

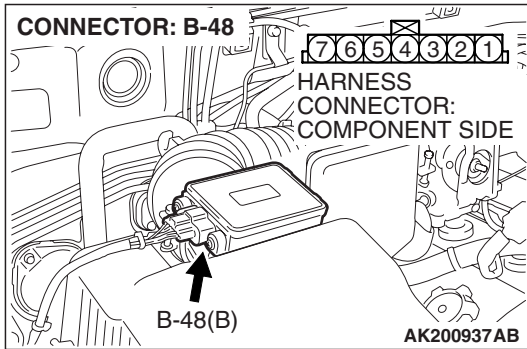


STEP 9. Check harness connector D-134 at PCM for damage.

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.

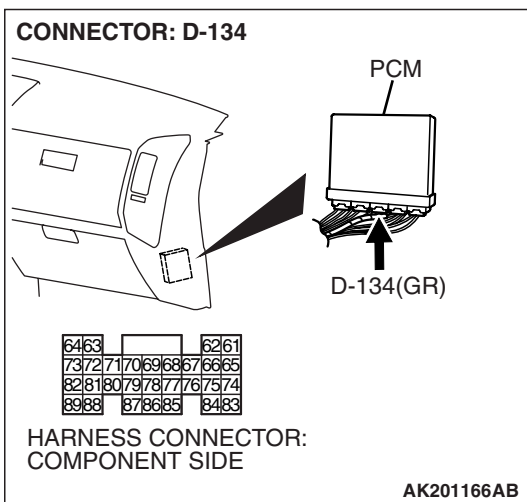


STEP 10. Check for open circuit between intake air temperature sensor connector B-48 (terminal No. 5) and PCM connector D-134 (terminal No. 88).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 11.



STEP 11. Test the OBD-II drive cycle.

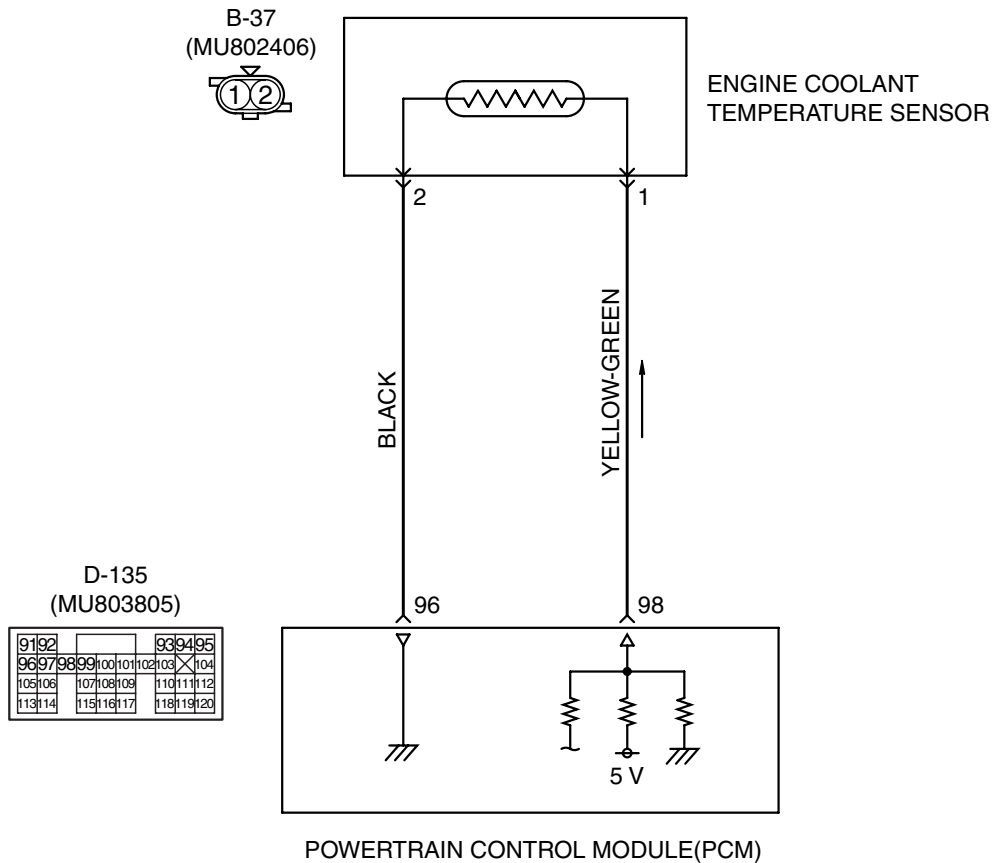
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0113 set?

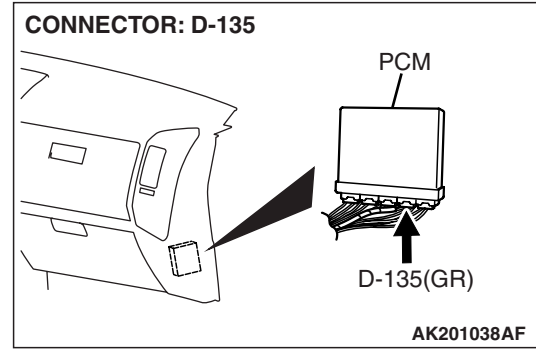
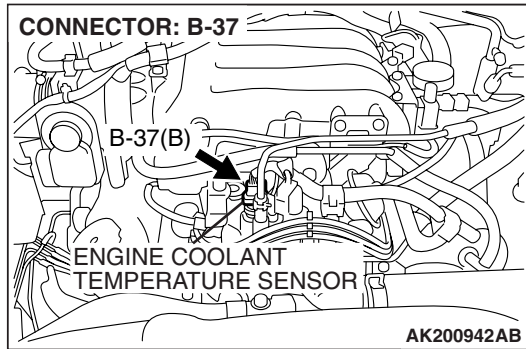
- YES :** Retry the troubleshooting.
NO : The inspection is complete.

DTC P0116: Engine Coolant Temperature Circuit Range/Performance Problem

Engine Coolant Temperature Sensor Circuit



AK302923



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 98) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded to the PCM (terminal No. 96).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Engine coolant temperature sensor output voltage does not change for specified period when engine coolant temperature at engine start is over 7°C (45°F).

MONITOR EXECUTION

Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

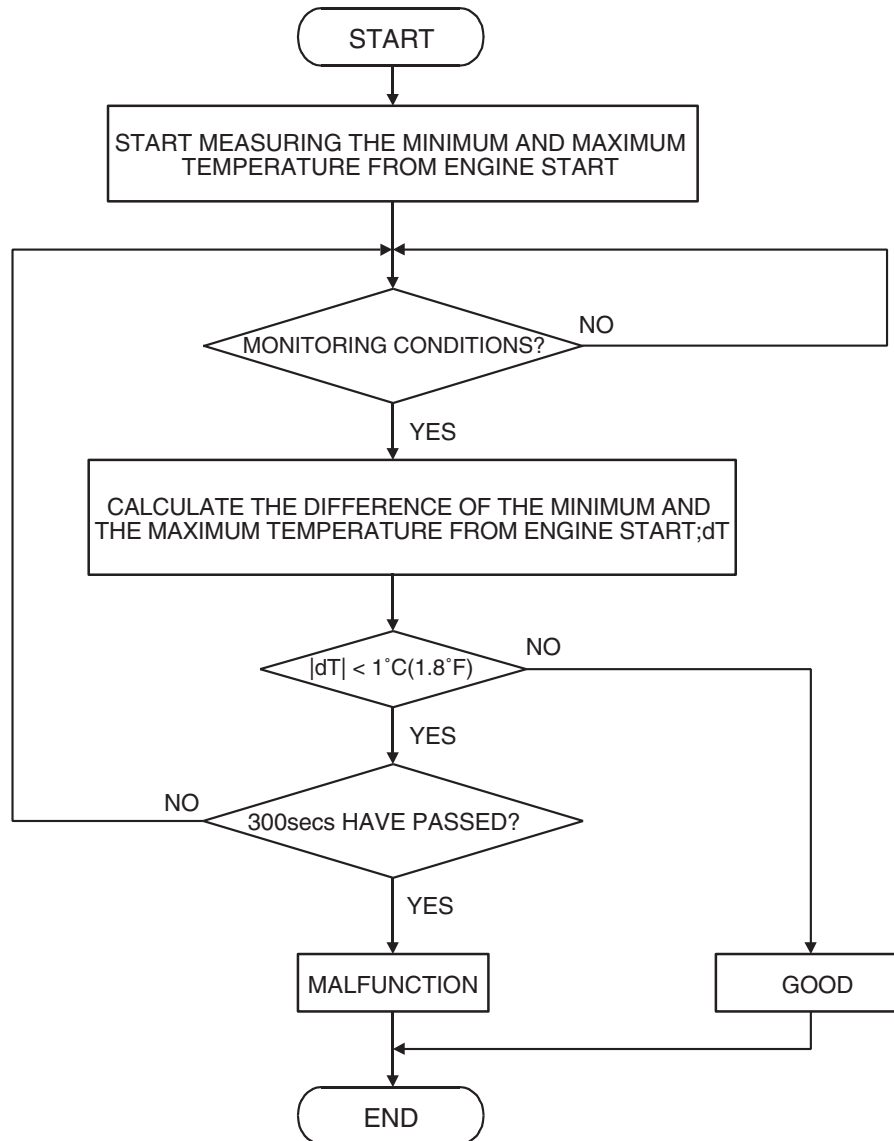
- Not applicable

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302924

Check Condition

- Engine coolant temperature was 7°C (45°F) or more when the engine started.

Judgement Criteria

- Engine coolant temperature fluctuates within 1°C (1.8°F) after 5 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.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 10 [P.13A-4](#).

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

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

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 21: Engine Coolant Temperature Sensor.**⚠ CAUTION**

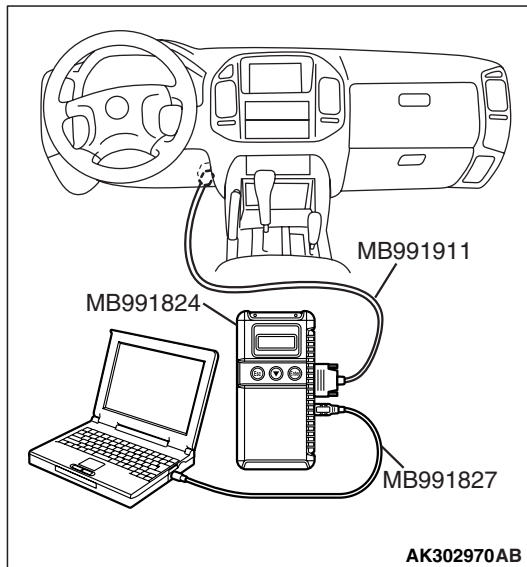
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

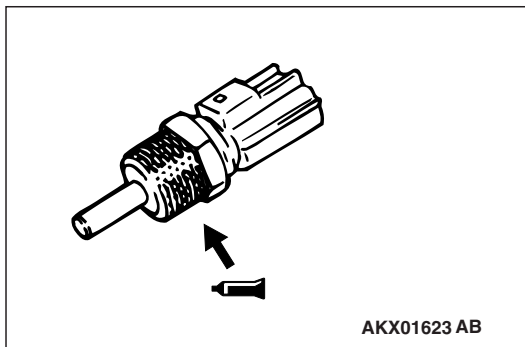
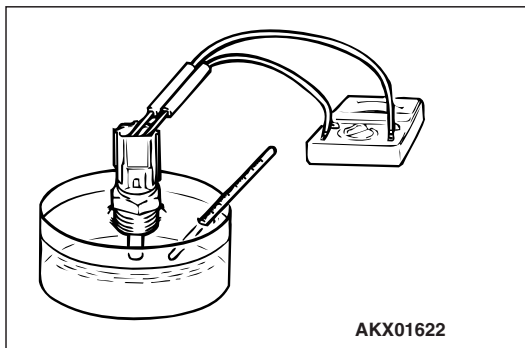
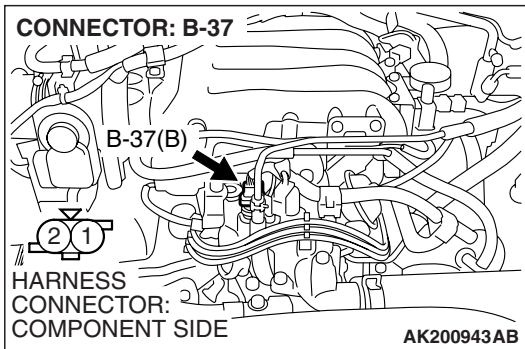
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately 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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.





STEP 2. Check the engine coolant temperature sensor.

- (1) Disconnect the engine coolant temperature sensor connector B-37.
- (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 – 0.68kΩ [at 60°C (140°F)]
- 0.26 – 0.36 kΩ [at 80°C (176°F)]

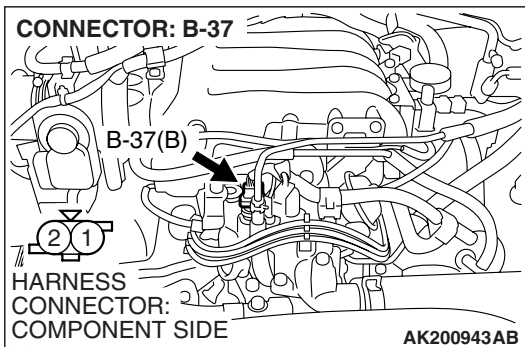
- (4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.
- (5) Install the engine coolant temperature sensor, and tighten to the specified torque.

Tightening torque: 29 ± 10 N·m (22 ± 7 ft-lb)

Q: Is the resistance at the standard value?

YES : Go to Step 3.

NO : Replace the engine coolant temperature sensor. Then go to Step 9.

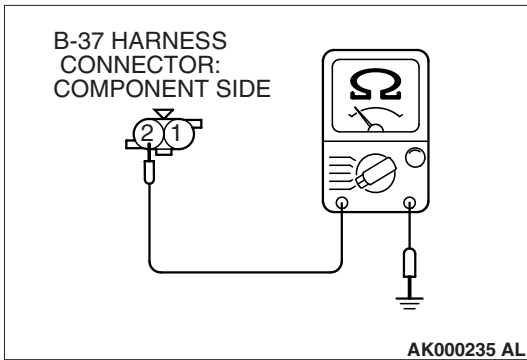
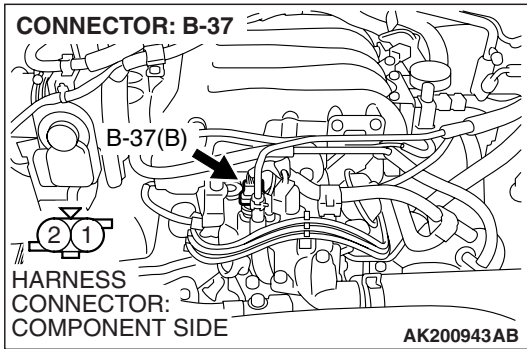


STEP 3. Check harness connector B-37 at the engine coolant temperature sensor for damage.

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 9.



STEP 4. Check the continuity at engine coolant temperature sensor harness side connector B-37.

(1) Disconnect the connector B-37 and measure at the harness side.

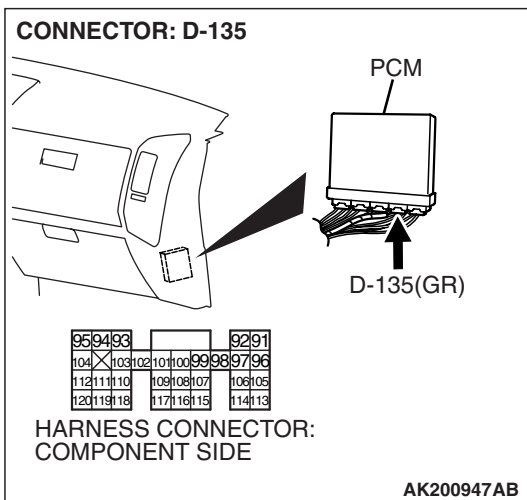
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 5.



STEP 5. Check harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

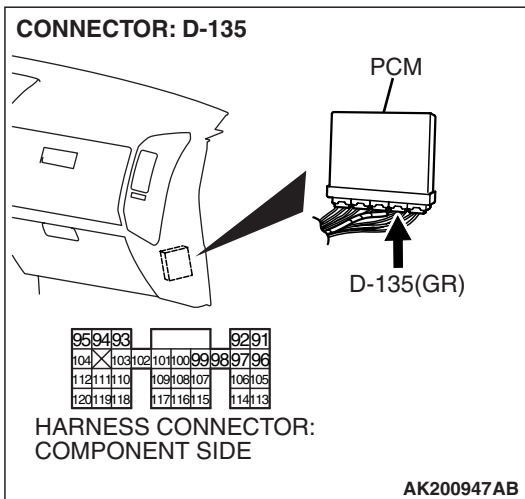
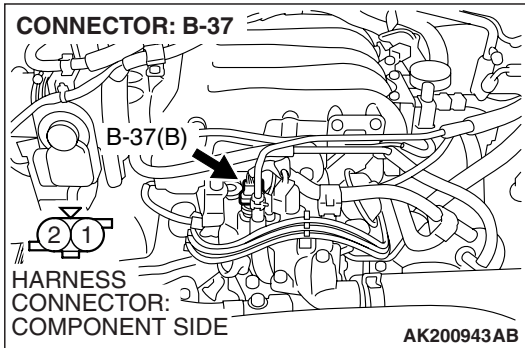
YES : Go to Step 6.

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

STEP 6. Check for harness damage between engine coolant temperature sensor connector B-37 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

Q: Is the harness wire in good condition?

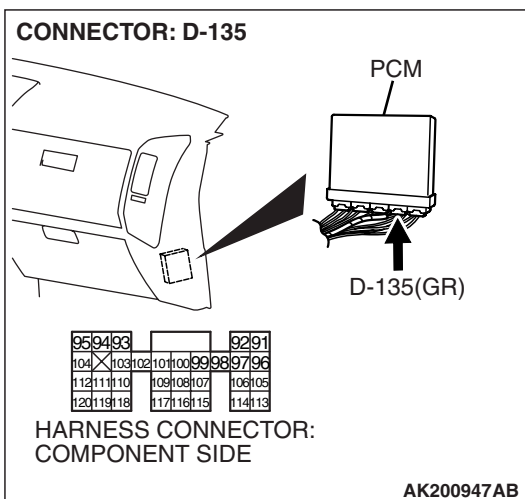
- YES :** Replace the PCM. Then go to Step 9
- NO :** Repair it. Then go to Step 9.



STEP 7. Check harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

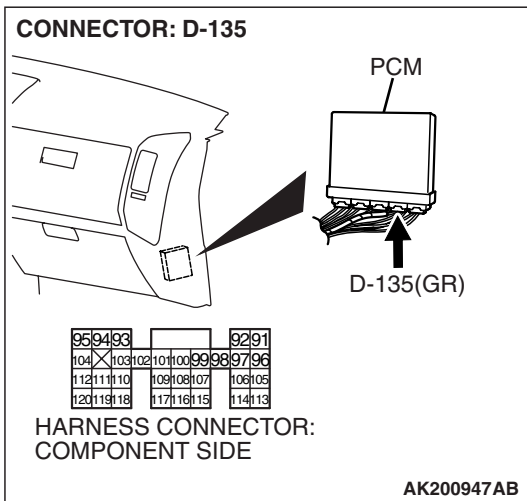
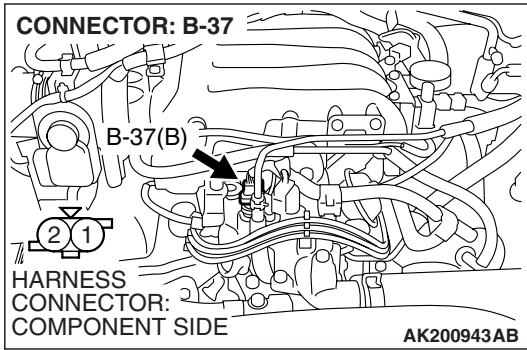
- YES :** Go to Step 8.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.



STEP 8. Check for harness damage between engine coolant temperature sensor connector B-37 (terminal No. 1) and PCM connector D-135 (terminal No. 98).

Q: Is the harness wire in good condition?

- YES :** Replace the PCM. Then go to Step 9.
- NO :** Repair it. Then go to Step 9.



STEP 9. Test the OBD-II drive cycle.

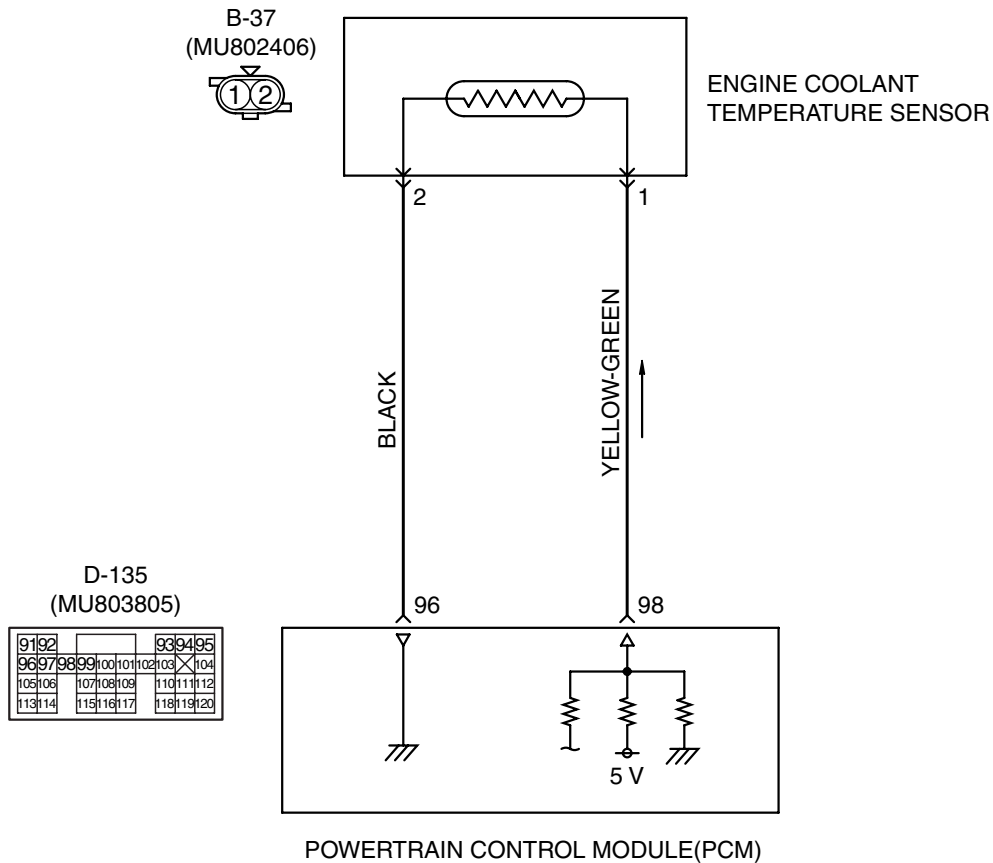
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P116 set?

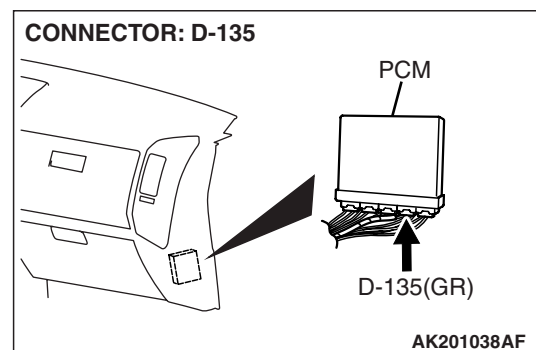
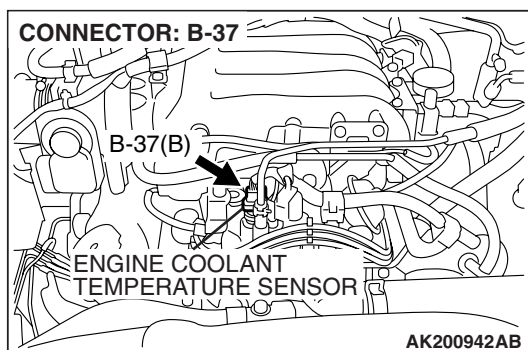
- YES :** Retry the troubleshooting.
- NO :** The inspection is complete.

DTC P0117: Engine Coolant Temperature Circuit Low Input

Engine Coolant Temperature Sensor Circuit



AK302923



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 98) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded to the PCM (terminal No. 96).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Engine coolant temperature sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

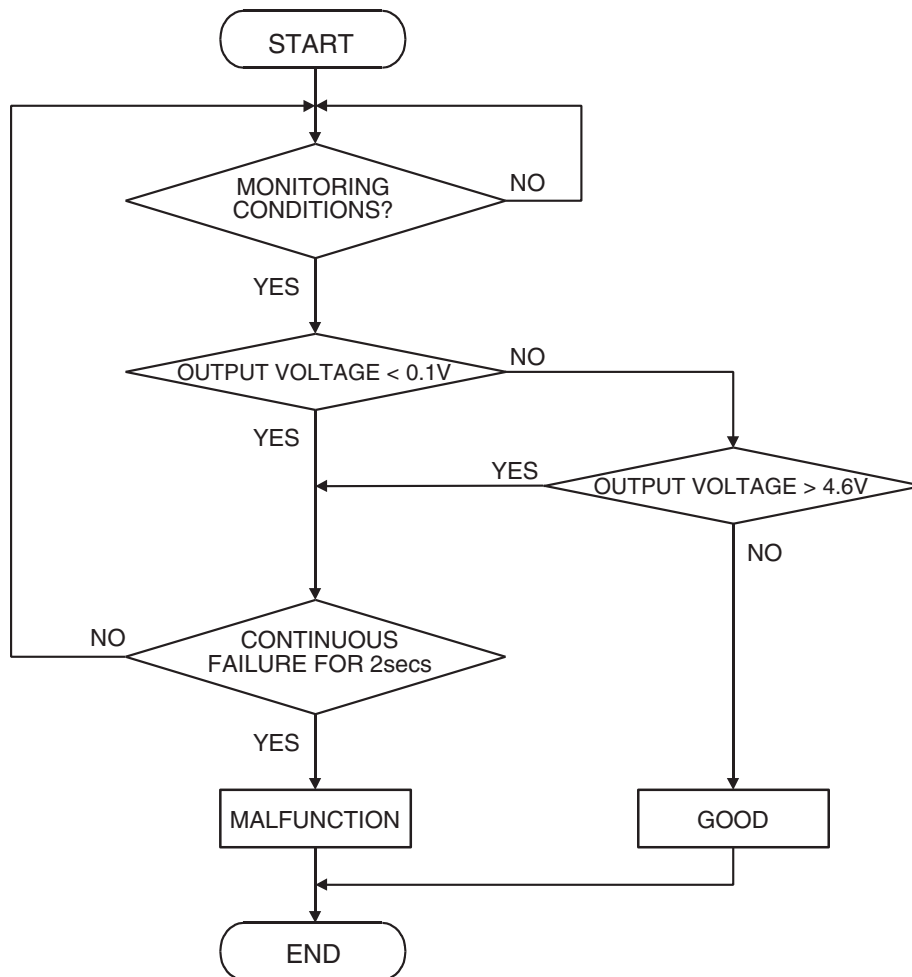
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-4](#).

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

- Engine coolant temperature sensor failed.
- Shorted engine coolant temperature sensor circuit, or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

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

⚠ CAUTION

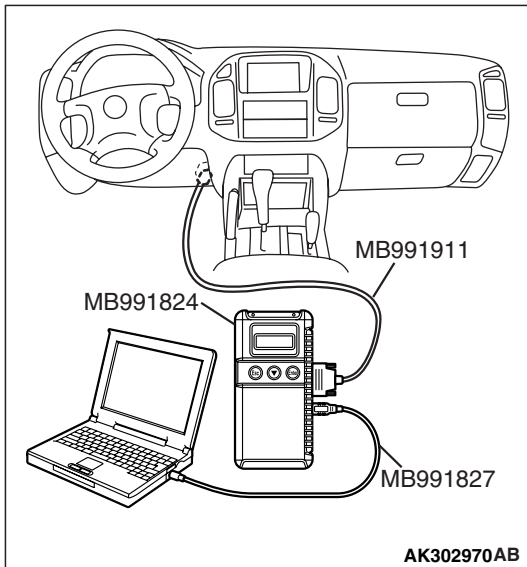
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool 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 How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.



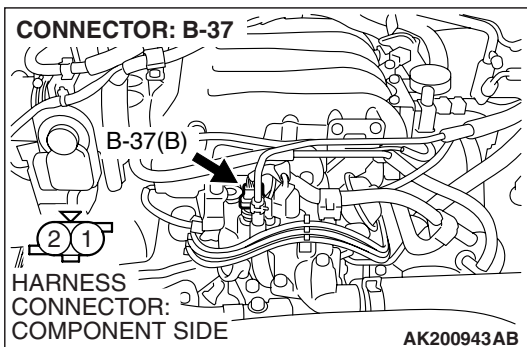
AK302970AB

STEP 2. Check harness connector B-37 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.



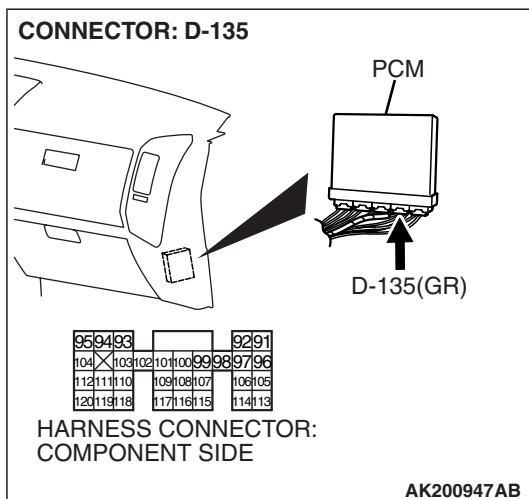
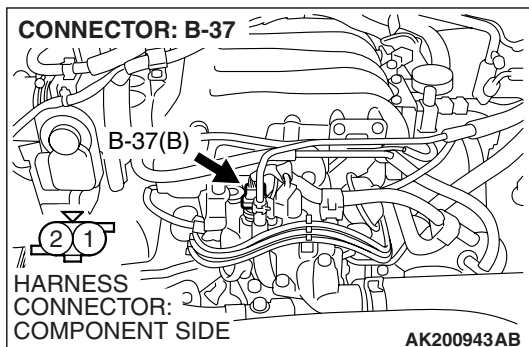
AK200943AB

STEP 3. Check for short circuit to ground between engine coolant temperature sensor connector B-37 (terminal No. 1) and PCM connector D-135 (terminal No. 98).

Q: Is the harness wire in good condition?

YES : Go to Step 4.

NO : Repair it. Then go to Step 6.

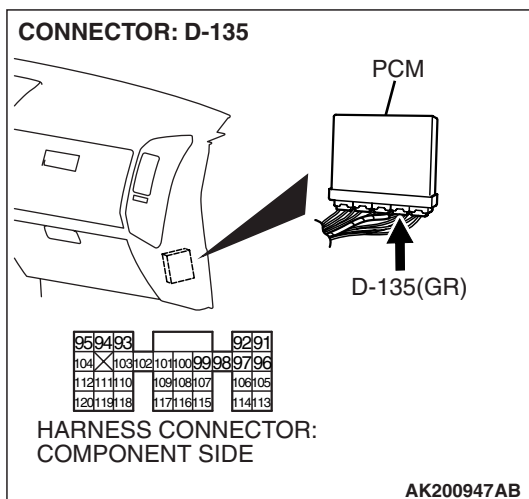


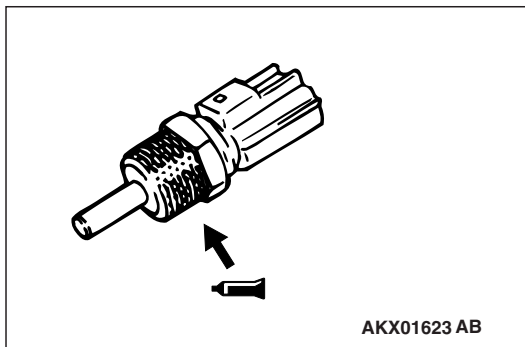
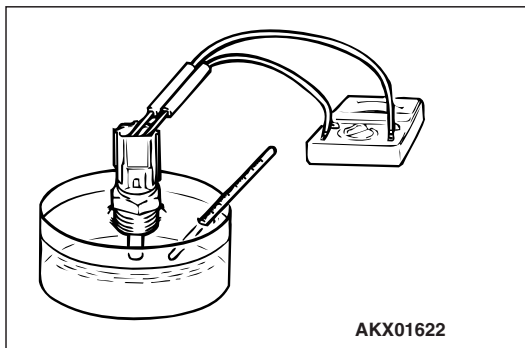
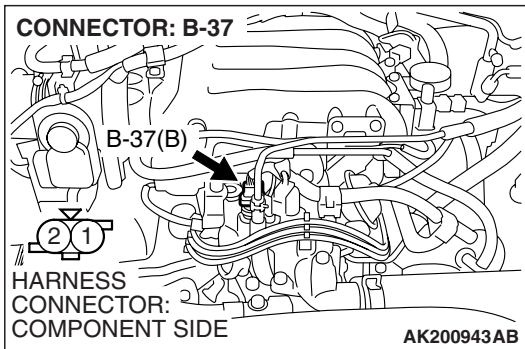
STEP 4. Check harness connector D-135 at PCM for damage.

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-37.
- (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 ± 7 ft-lb)

Q: Is the resistance at the standard value?

- YES** : Replace the PCM. Then go to Step 6.
- NO** : Replace the engine coolant temperature sensor. Then go to Step 6.

STEP 6. Test the OBD-II drive cycle.

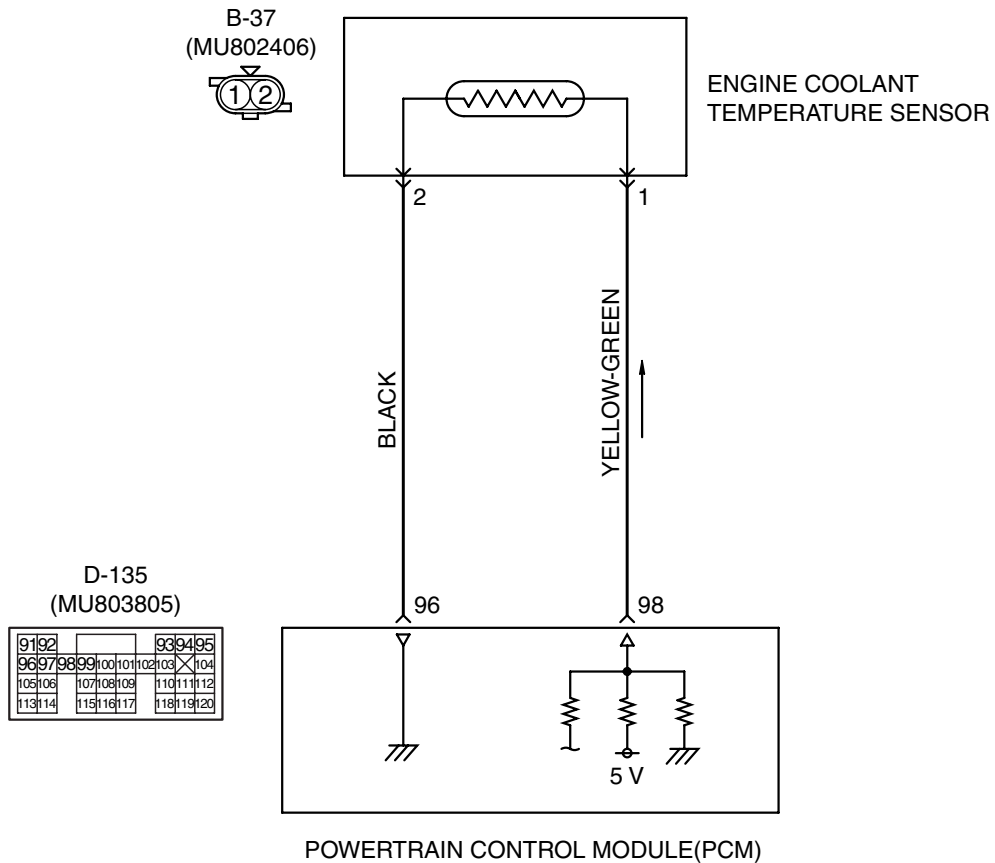
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0117 set?

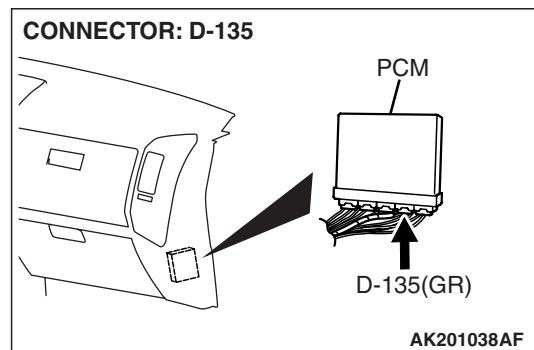
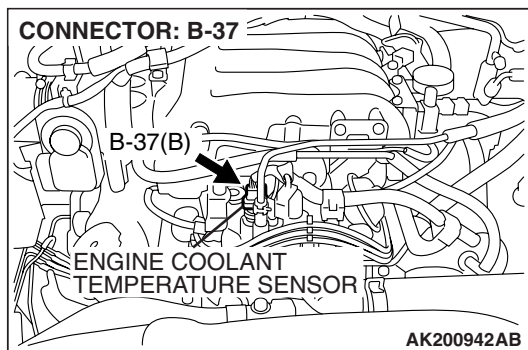
- YES** : Retry the troubleshooting.
- NO** : The inspection is complete.

DTC P0118: Engine Coolant Temperature Circuit High Input

Engine Coolant Temperature Sensor Circuit



AK302923



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 98) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded to the PCM (terminal No. 96).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Engine coolant temperature sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

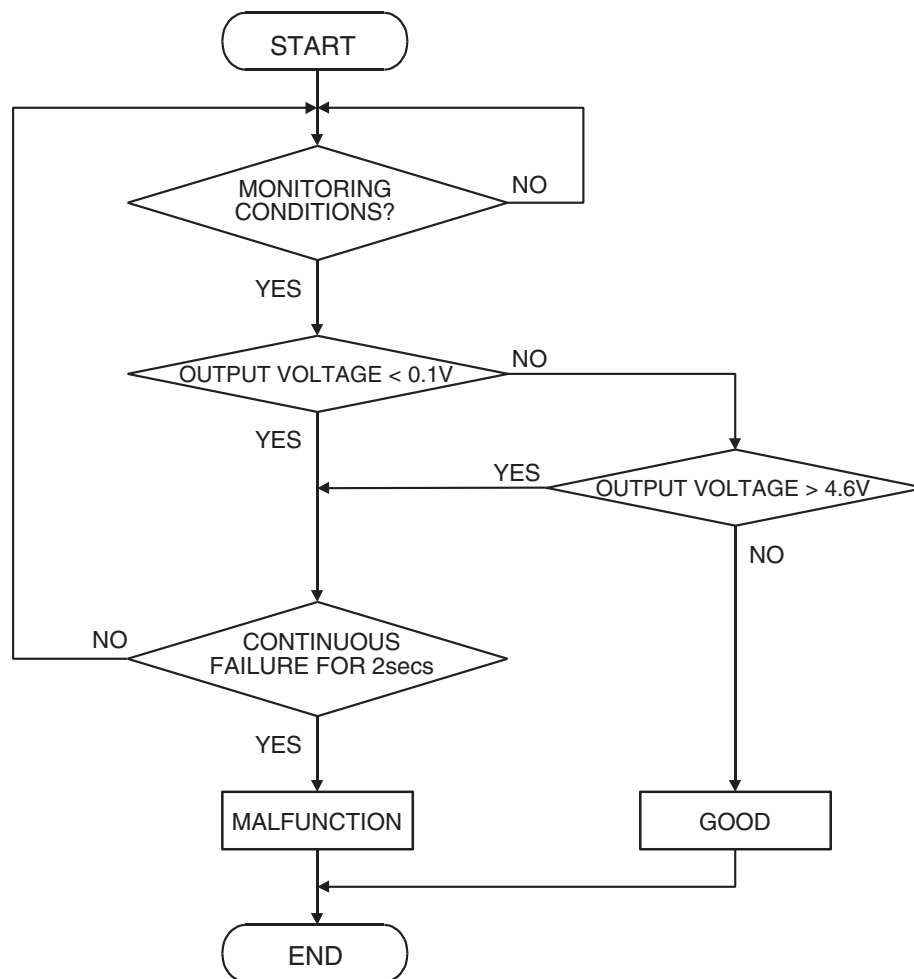
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302925

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-4](#).

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

- Engine coolant temperature sensor failed.
- Open engine coolant temperature sensor circuit, or connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 21: Engine Coolant Temperature Sensor.**⚠ CAUTION**

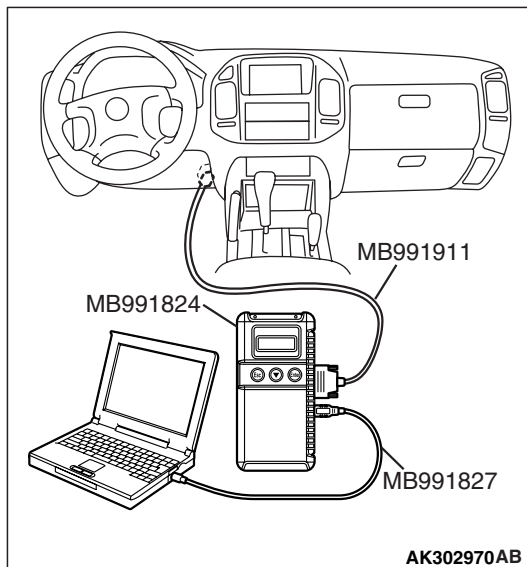
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool 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?

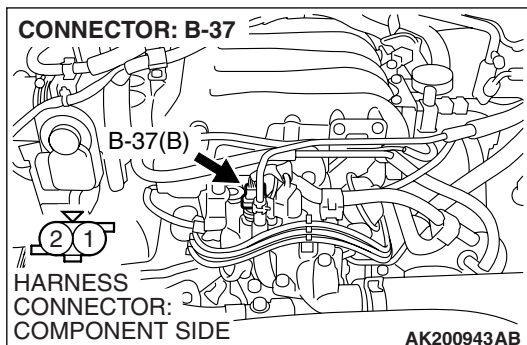
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

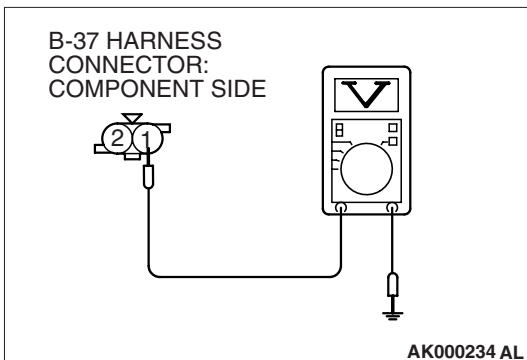
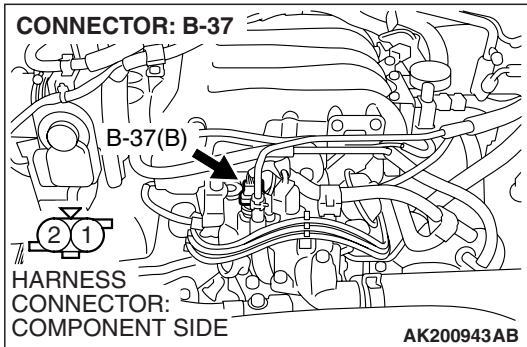
NO : Go to Step 2.

**STEP 2. Check harness connector B-37 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.





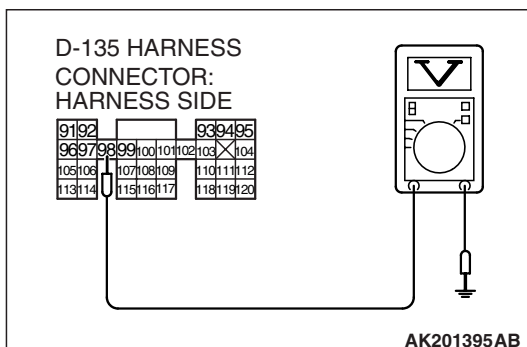
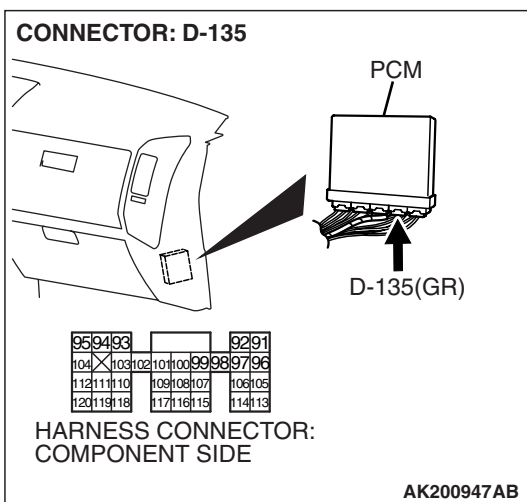
- STEP 3. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-37.**
- (1) Disconnect the connector B-37 and measure at the harness side.
 - (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be 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 PCM connector D-135 by backprobing.

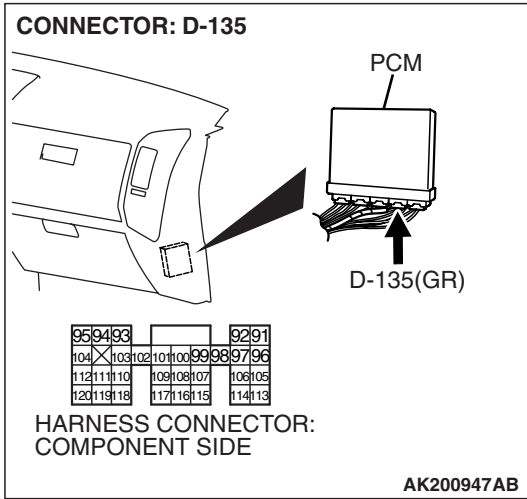
- (1) Do not disconnect the PCM connector D-135.
- (2) Disconnect the engine coolant temperature sensor connector B-37.
- (3) Turn the ignition switch to the "ON" position.

- (4) Measure the voltage between terminal No. 98 and ground.
 - Voltage should be 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.

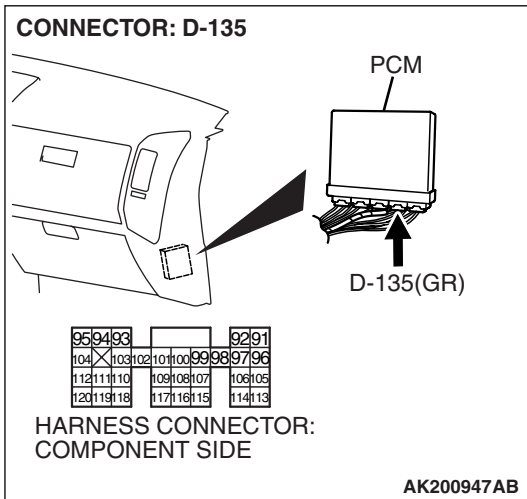


STEP 5. Check harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between engine coolant temperature sensor connector B-37 (terminal No. 1) and PCM connector D-135 (terminal No. 98) 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.



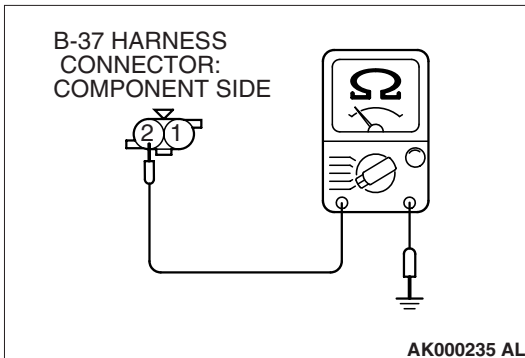
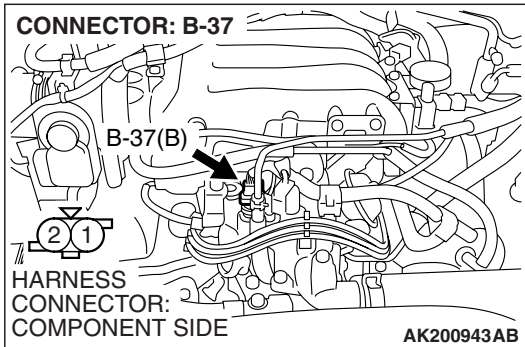
STEP 6. Check harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Replace the PCM. 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 the continuity at engine coolant temperature sensor harness side connector B-37.



- (1) Disconnect the connector B-37 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.

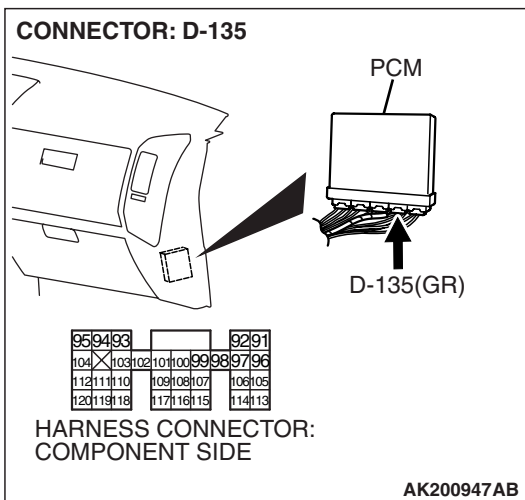
NO : Go to Step 8.

STEP 8. Check harness connector D-135 at PCM 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.

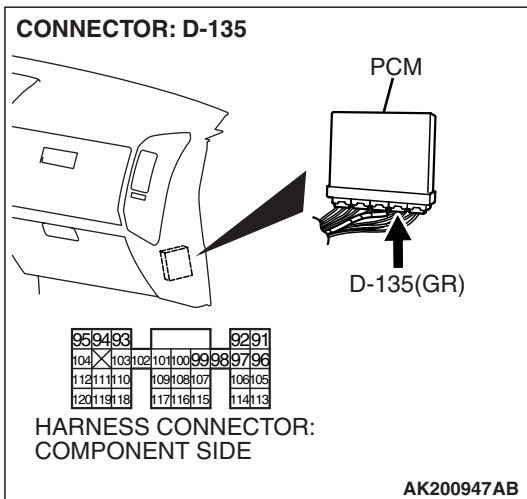
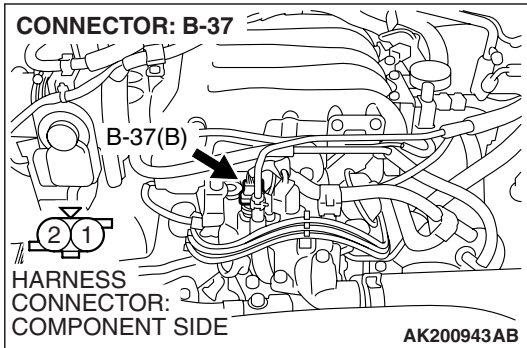


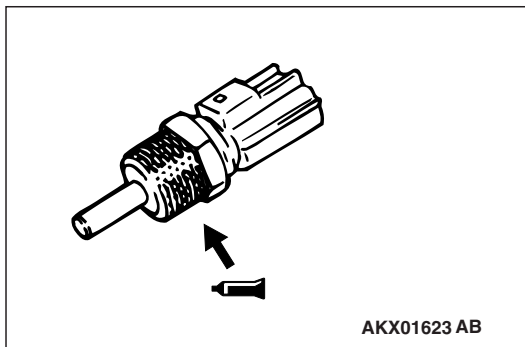
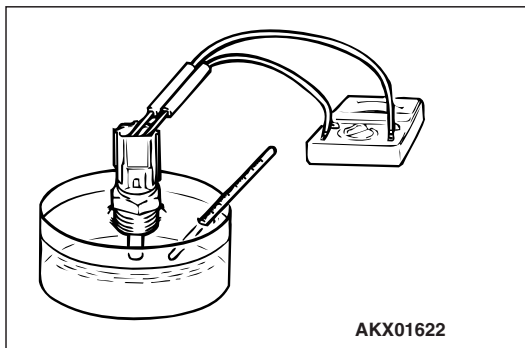
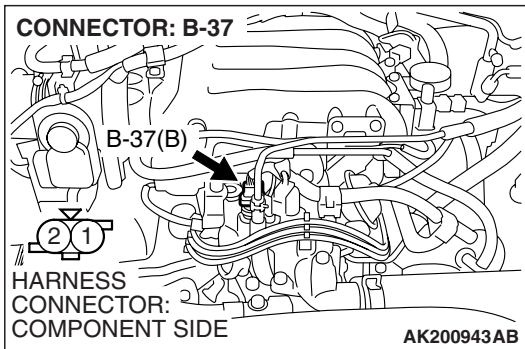
STEP 9. Check for open circuit between engine coolant sensor connector B-37 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

Q: Is the harness wire in good condition?

YES : Replace the PCM. 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-37.
- (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 ± 7 ft-lb)

Q: Is the resistance at the standard value?

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

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

STEP 11. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

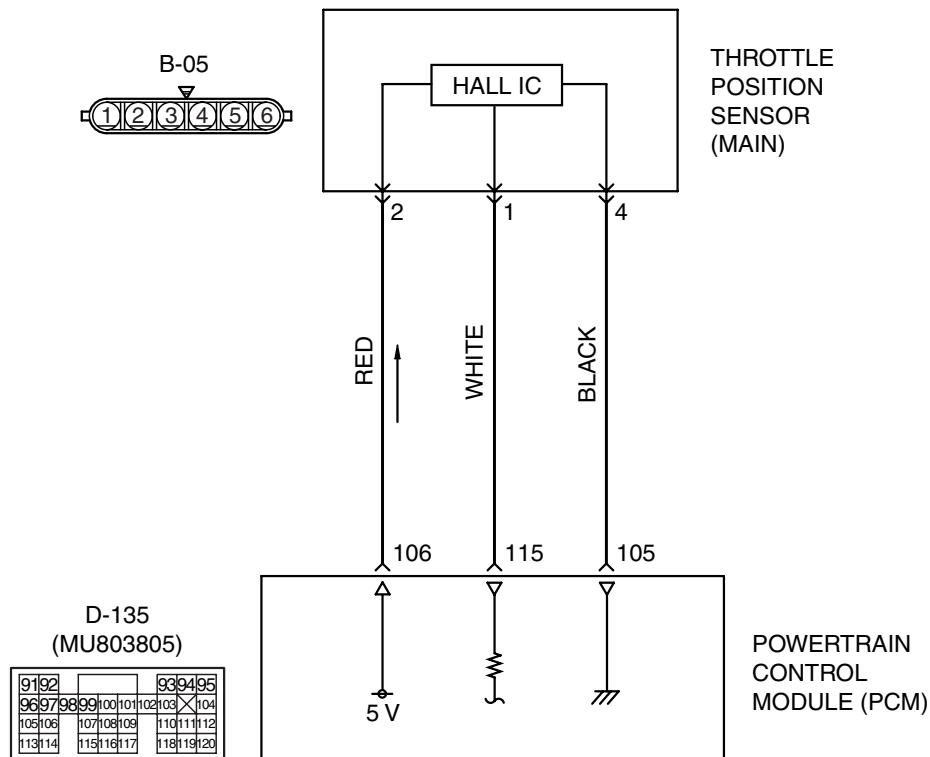
Q: Is DTC P0118 set?

YES : Retry the troubleshooting.

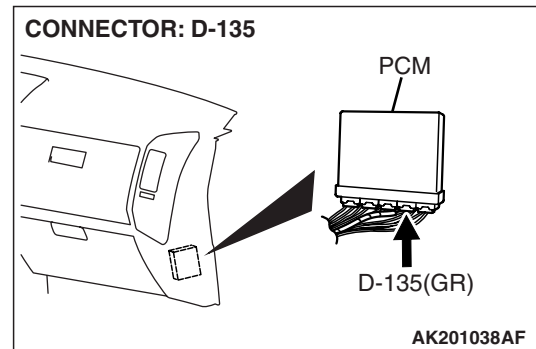
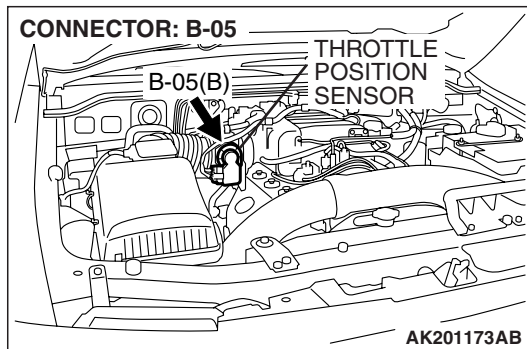
NO : The inspection is complete.

DTC P0122: Throttle Position Sensor (main) Circuit Low Input

Throttle Position Sensor (main) Circuit



AK400974



CIRCUIT OPERATION

- 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 2) from the PCM (terminal No. 106). The ground terminal (terminal No. 4) is grounded to the PCM (terminal No. 105).

TECHNICAL DESCRIPTION

- The throttle position sensor (main) outputs voltage which corresponds to the throttle valve opening angle.

- The PCM checks whether the voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Throttle position sensor (main) output voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

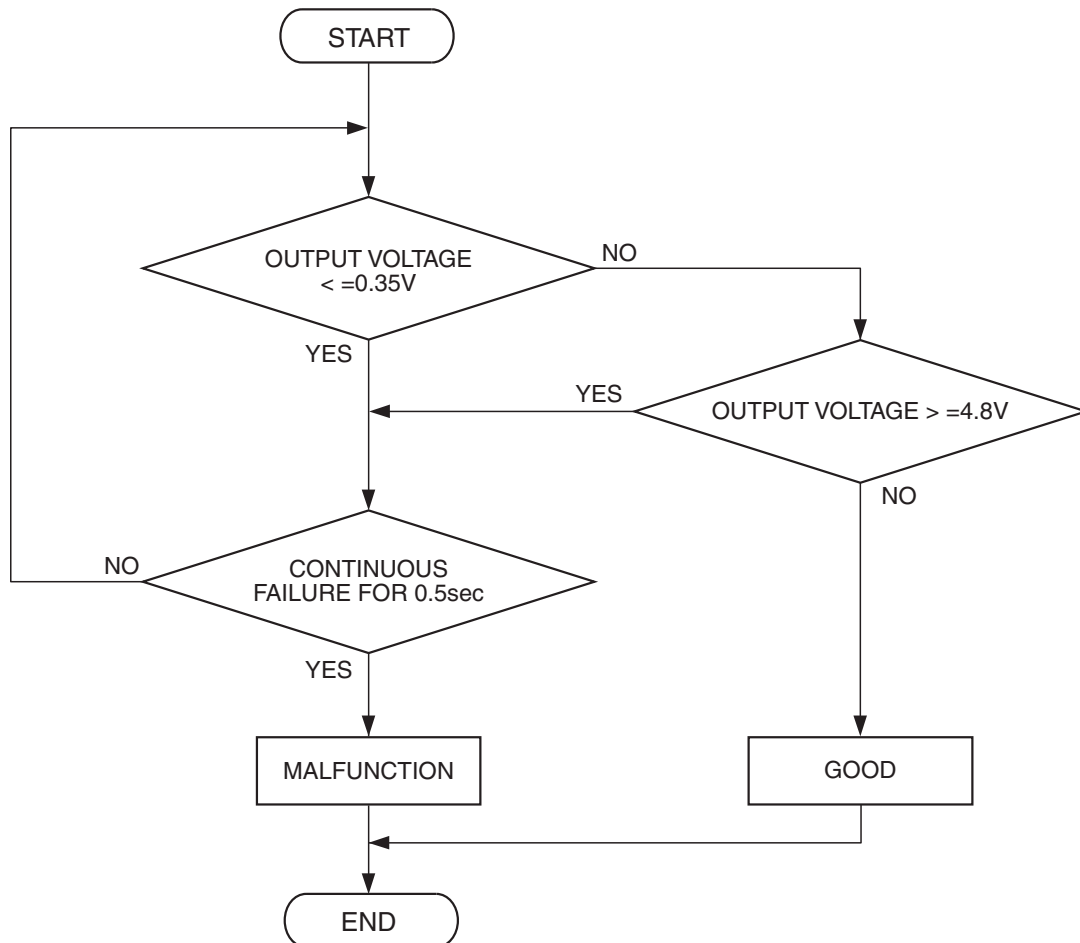
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302926

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (main) output voltage should be 0.35 volt or less for 0.5 second.

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

- Throttle position sensor failed.
- Open or shorted throttle position sensor (main) circuit, harness damage, or connector damage.
- PCM failed.

OBD-II DRIVE CYCLE PATTERN

None.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 79: Throttle Position Sensor (main).**⚠ CAUTION**

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

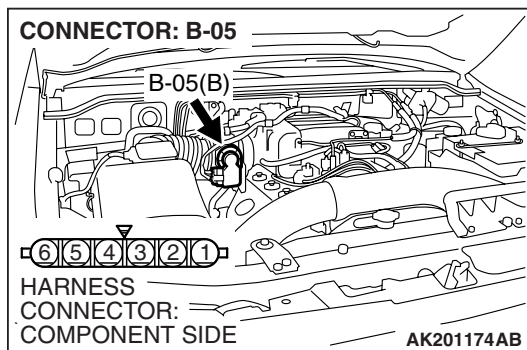
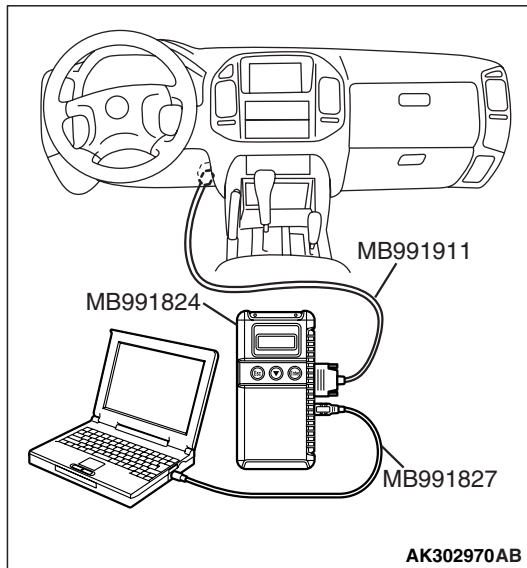
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 1, No. 2, No. 3, and No. 4.
- (6) Set scan tool MB991958 to the data reading mode for item 79, Throttle Position Sensor (main).
 - Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
 - Output voltage should be between 4.0 volts or more when the throttle valve is fully open with your finger.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

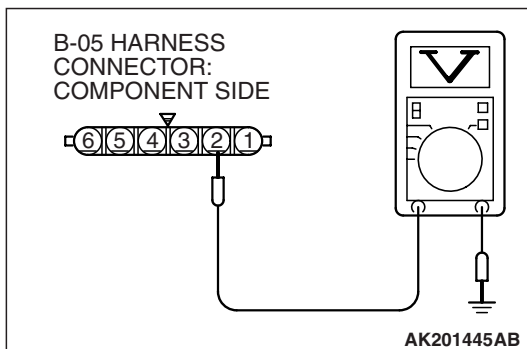
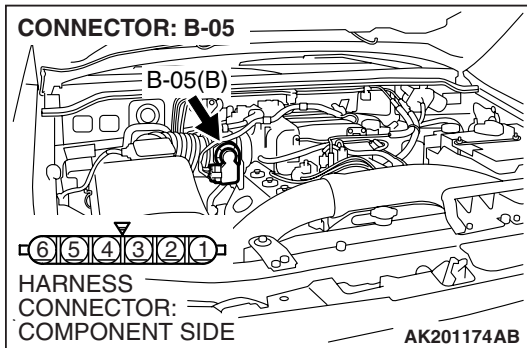
Q: Is the sensor operating properly?

- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).
- NO :** Go to Step 2.

STEP 2. Check harness connector B-05 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 11.





STEP 3. Measure the sensor supply voltage at throttle position sensor harness side connector B-05.

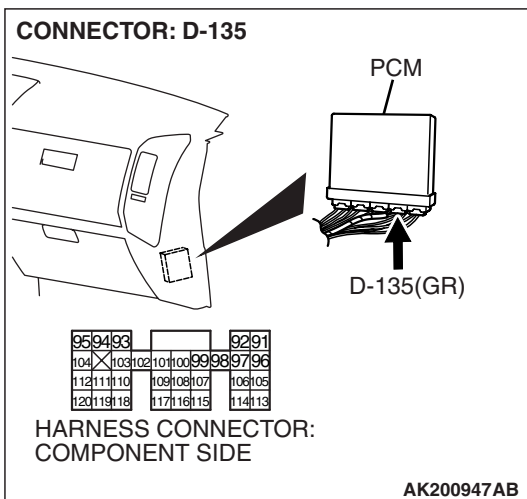
- (1) Disconnect the connector B-05 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 2 and ground.
 - Voltage should be between 4.9 and 5.1 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.9 and 5.1 volts?

YES : Go to Step 7.

NO : Go to Step 4.



STEP 4. Check harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

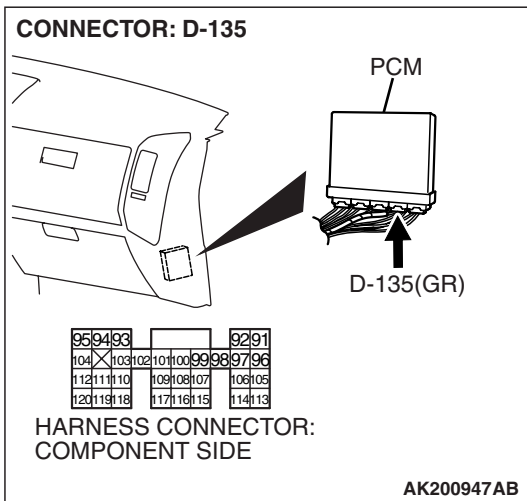
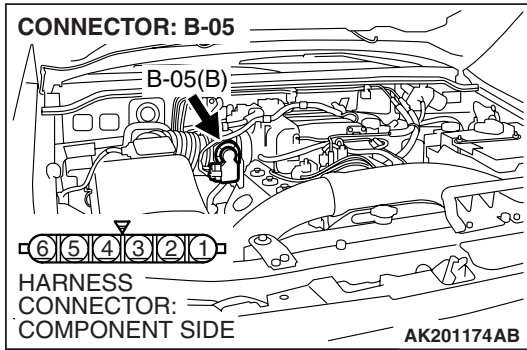
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

STEP 5. Check for open circuit and short circuit to ground between throttle position sensor connector B-05 (terminal No. 2) and PCM connector D-135 (terminal No. 106).

Q: Is the harness wire in good condition?

YES : Go to Step 6.

NO : Repair it. Then go to Step 11.



STEP 6. Using scan tool MB991958, check data list item 79: Throttle Position Sensor (main).

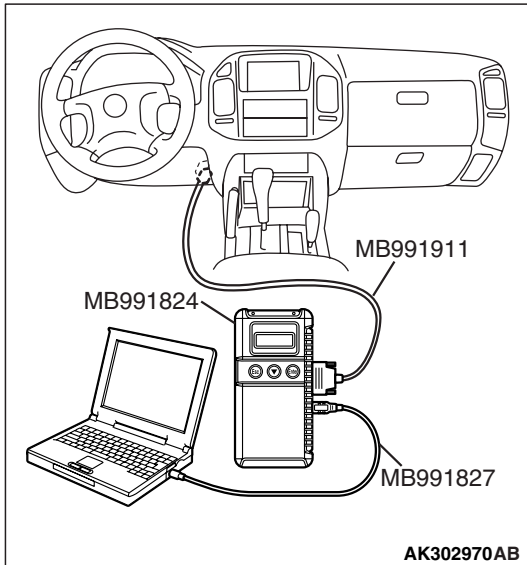
⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 1, No. 2, No. 3, and No. 4.
- (6) Set scan tool MB991958 to the data reading mode for item 79, Throttle Position Sensor (main).
 - Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
 - Output voltage should be 4.0 volts or more when the throttle valve is fully open with your finger.
- (7) 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 – How to Cope with Intermittent Malfunctions [P.00-13](#).
- NO :** Replace the PCM. Then go to Step 11.

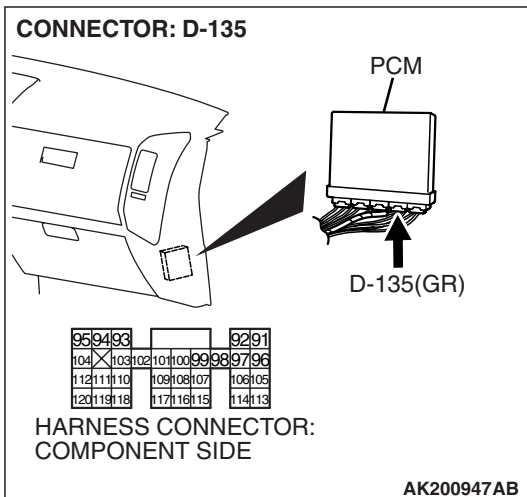


AK302970AB

STEP 7. Check harness connector D-135 at PCM 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 11.



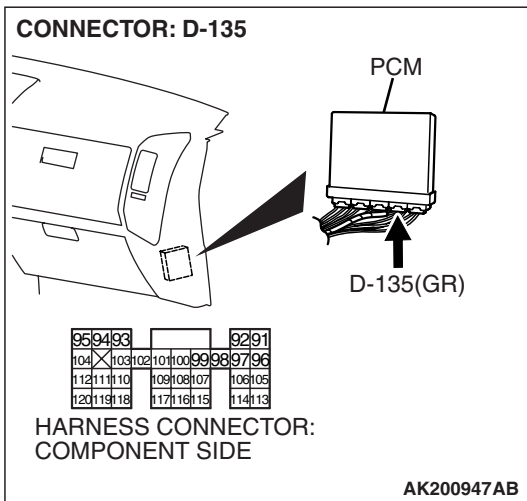
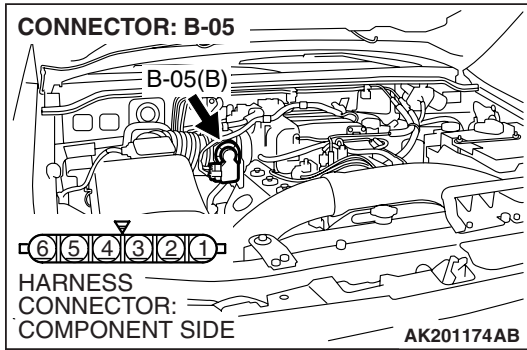
AK200947AB

STEP 8. Check for harness damage between throttle position sensor connector B-05 (terminal No. 2) and PCM connector D-135 (terminal No. 106).

Q: Is the harness wire in good condition?

YES : Go to Step 9.

NO : Repair it. Then go to Step 11.

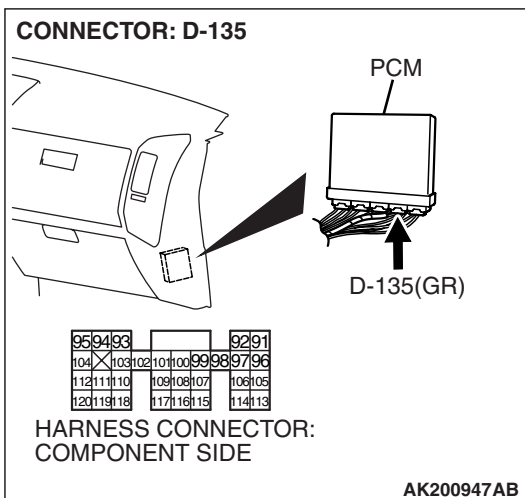
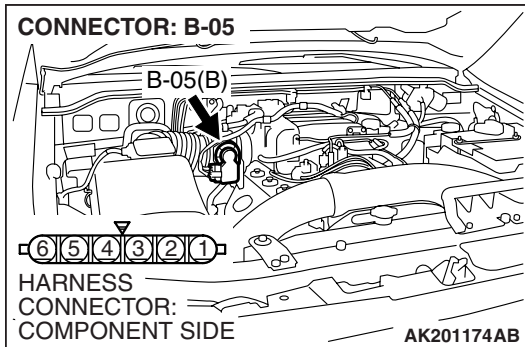


STEP 9. Check for open circuit, short circuit to ground and harness damage between throttle position sensor connector B-05 (terminal No. 1) and PCM connector D-135 (terminal No. 115).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 11.



STEP10. Replace the throttle body assembly.

- (1) Replace the throttle body assembly.
- (2) Turn the ignition switch to the "ON" position.
- (3) After the DTC has been deleted, read the DTC again.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0122 set?

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

NO : The procedure is complete.

STEP 11. Using scan tool MB991958, read the diagnostic trouble code (DTC).

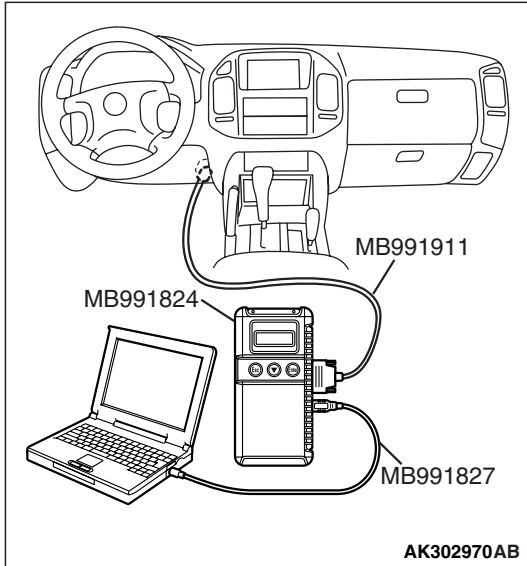
⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) After the DTC has been deleted, read the DTC again.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0122 set?

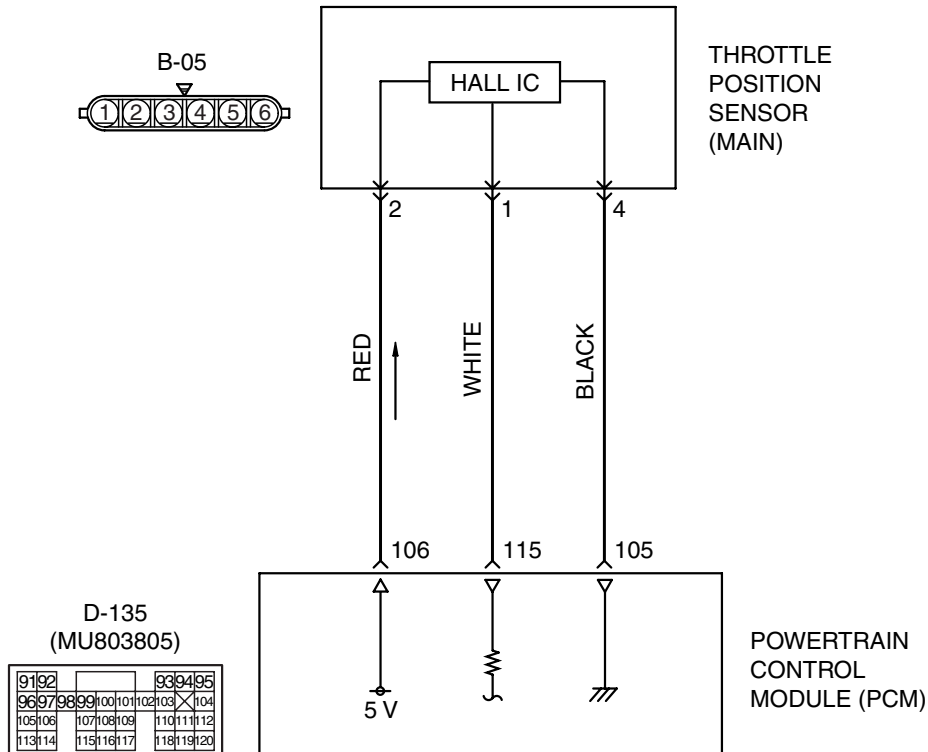
- YES :** Retry the troubleshooting.
- NO :** The inspection is complete.

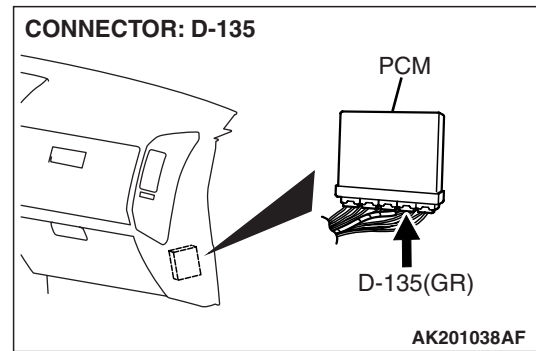
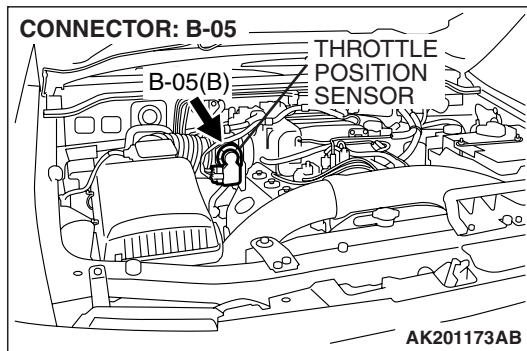


AK302970AB

DTC P0123: Throttle Position Sensor (main) Circuit high Input

Throttle Position Sensor (main) Circuit





CIRCUIT OPERATION

- 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 2) from the PCM (terminal No. 106). The ground terminal (terminal No. 4) is grounded to the PCM (terminal No. 105).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Throttle position sensor (main) output voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

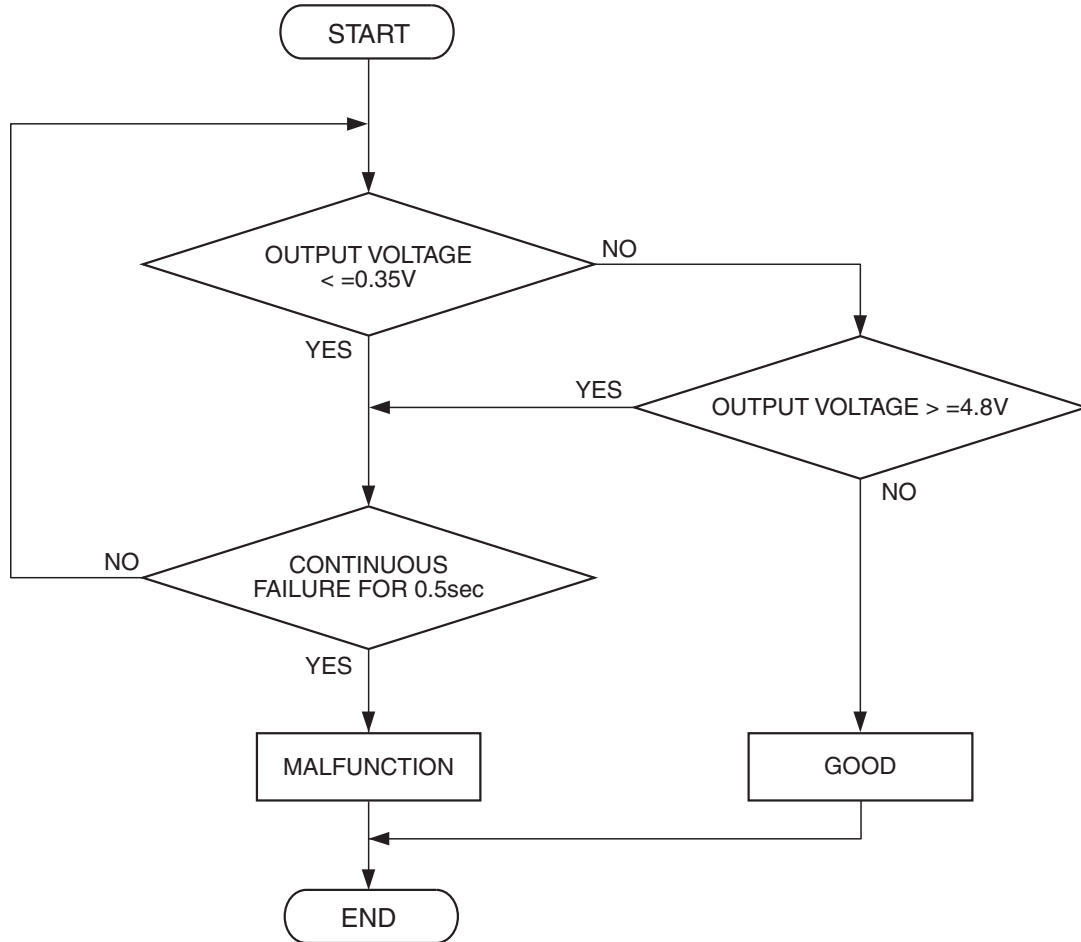
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302926

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (main) output voltage should be 4.8 volts or more for 0.5 second.

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

- Throttle position sensor failed.
- Open throttle position sensor (main) circuit, harness damage, or connector damage.
- PCM failed.

OBD-II DRIVE CYCLE PATTERN

None.

DIAGNOSIS

Required Special Tools:

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

STEP 1. Using scan tool MB991958, check data list item 79: Throttle Position Sensor (main).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 1, No. 2, No. 3, and No. 4.
- (6) Set scan tool MB991958 to the data reading mode for item 79, Throttle Position Sensor (main).
 - Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
 - Output voltage should be 4.0 volts or more when the throttle valve is fully open with your finger.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

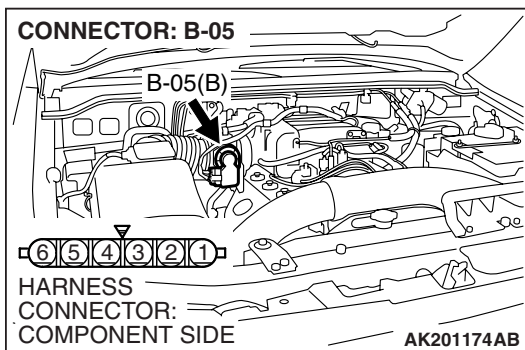
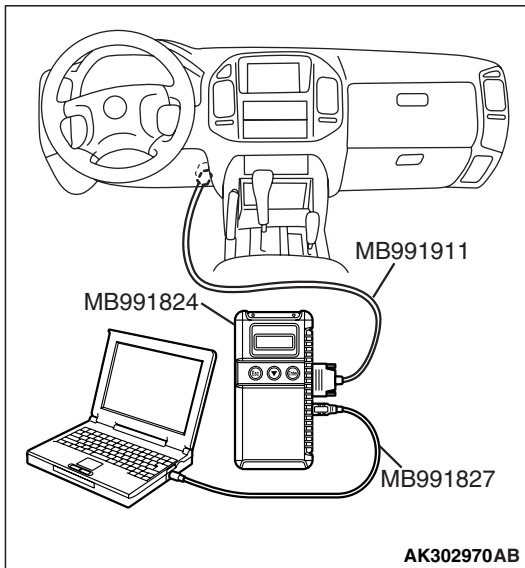
Q: Is the sensor operating properly?

- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).
- NO :** Go to Step 2.

STEP 2. Check harness connector B-05 at throttle position sensor for damage.

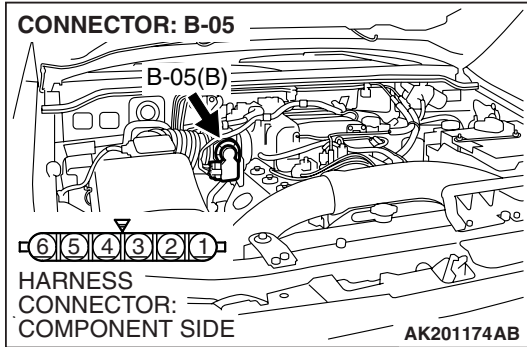
Q: Is the harness connector in good condition?

- 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 the continuity at throttle position sensor harness side connector B-05.

(1) Disconnect the connector B-05 and measure at the harness side.



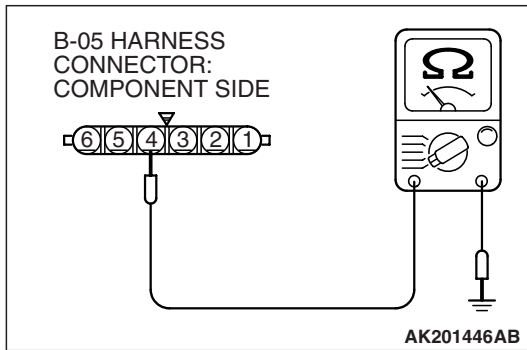
(2) Measure the continuity between terminal No. 4 and ground

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 4.

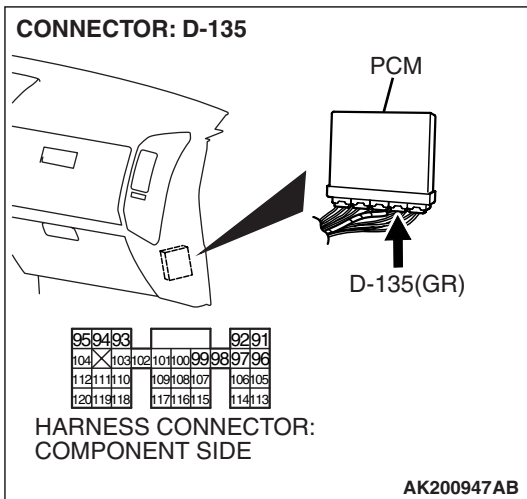


STEP 4. Check harness connector D-135 at PCM for damage.

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.

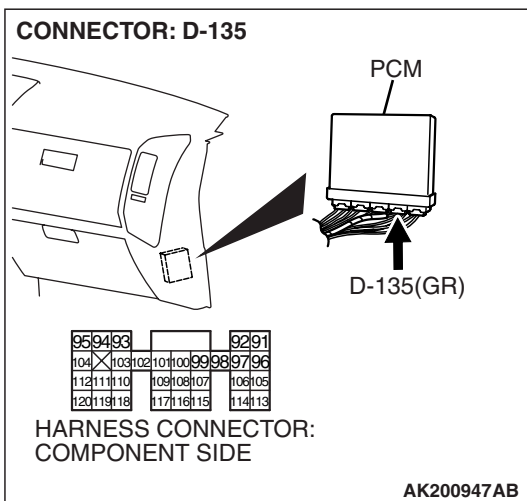
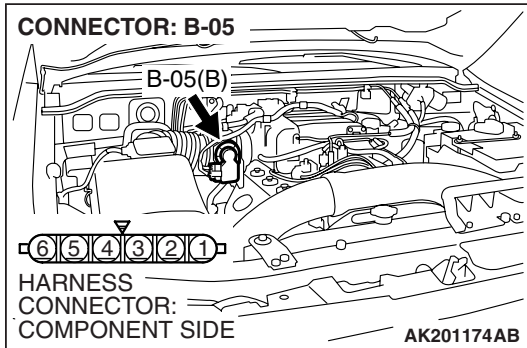


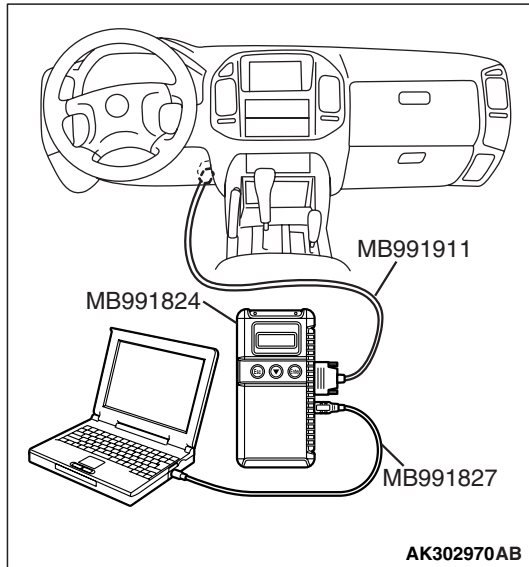
STEP 5. Check for open circuit and harness damage between throttle position sensor connector B-05 (terminal No. 4) and PCM connector D-135 (terminal No. 105).

Q: Is the harness wire in good condition?

YES : Go to Step 6.

NO : Repair it. Then go to Step 8.





STEP 6. Using scan tool MB991958, check data list item 79: Throttle Position Sensor (main).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 1, No. 2, No. 3, and No. 4.
- (6) Set scan tool MB991958 to the data reading mode for item 79, Throttle Position Sensor (main).
 - Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
 - Output voltage should be 4.0 volts or more when the throttle valve is fully open with your finger.
- (7) 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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Replace the PCM. Then go to Step 8.

STEP 7. Replace the throttle body assembly.

- (1) Replace the throttle body assembly.
- (2) Turn the ignition switch to the "ON" position.
- (3) After the DTC has been deleted, read the DTC again.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0123 set?

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

NO : The procedure is complete.

STEP 8. Using scan tool MB991958, read the diagnostic trouble code (DTC).

⚠ CAUTION

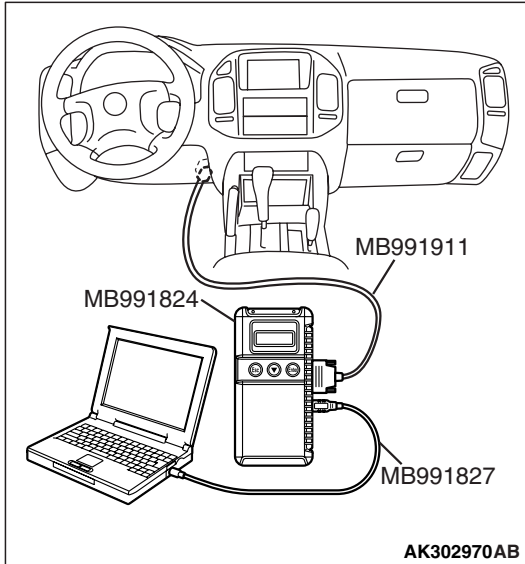
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) After the DTC has been deleted, read the DTC again.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0123 set?

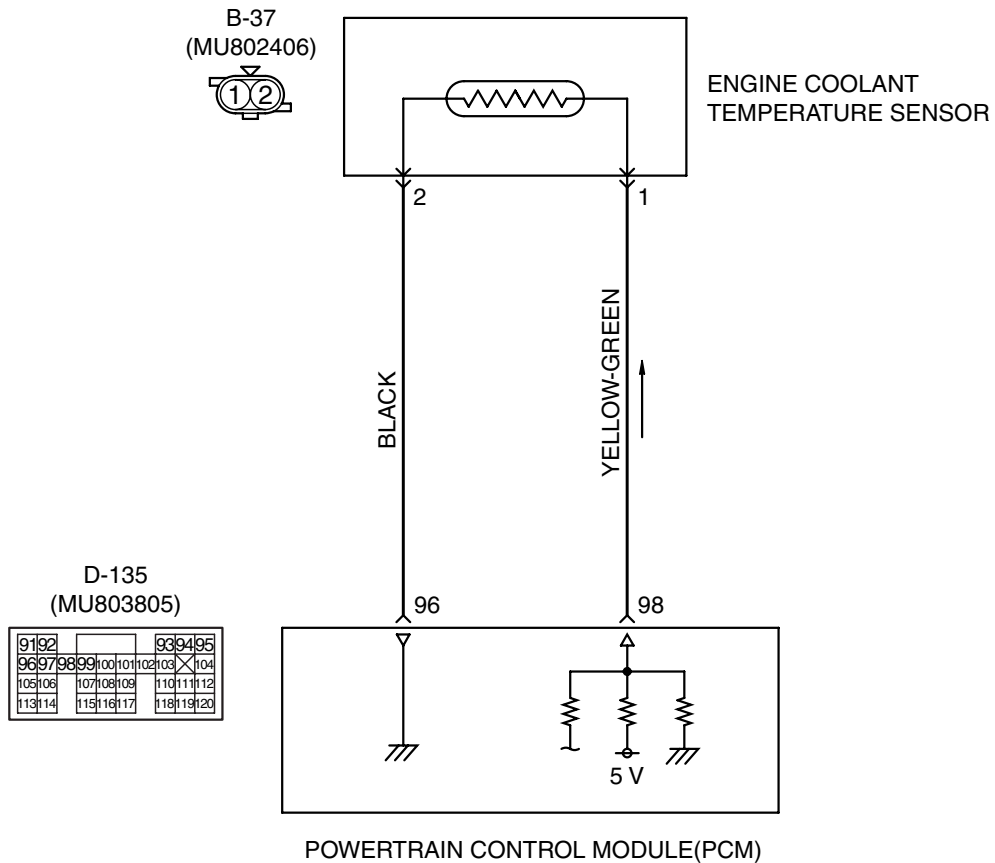
YES : Retry the troubleshooting.

NO : The inspection is complete.

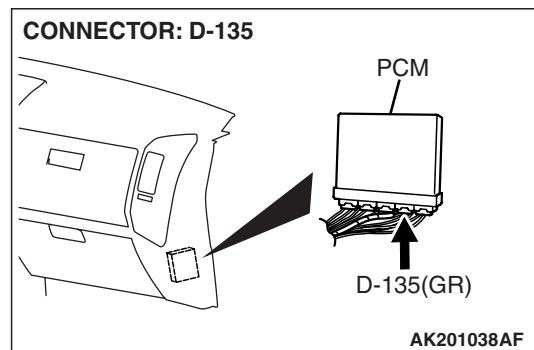
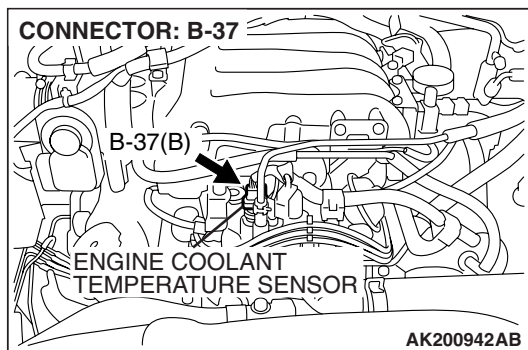


DTC P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control

Engine Coolant Temperature Sensor Circuit



AK302923



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 98) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded to the PCM (terminal No. 96).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

- Engine coolant temperature sensor output voltage drops from over 40°C (104°F) to under 40°C (104°F) and keeps under 40°C (104°F) for 5 minutes.
- Engine coolant temperature sensor output voltage does not reach close loop enable temperature within specified period when engine coolant temperature sensor output voltage at engine start is under 7°C (45°F).

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

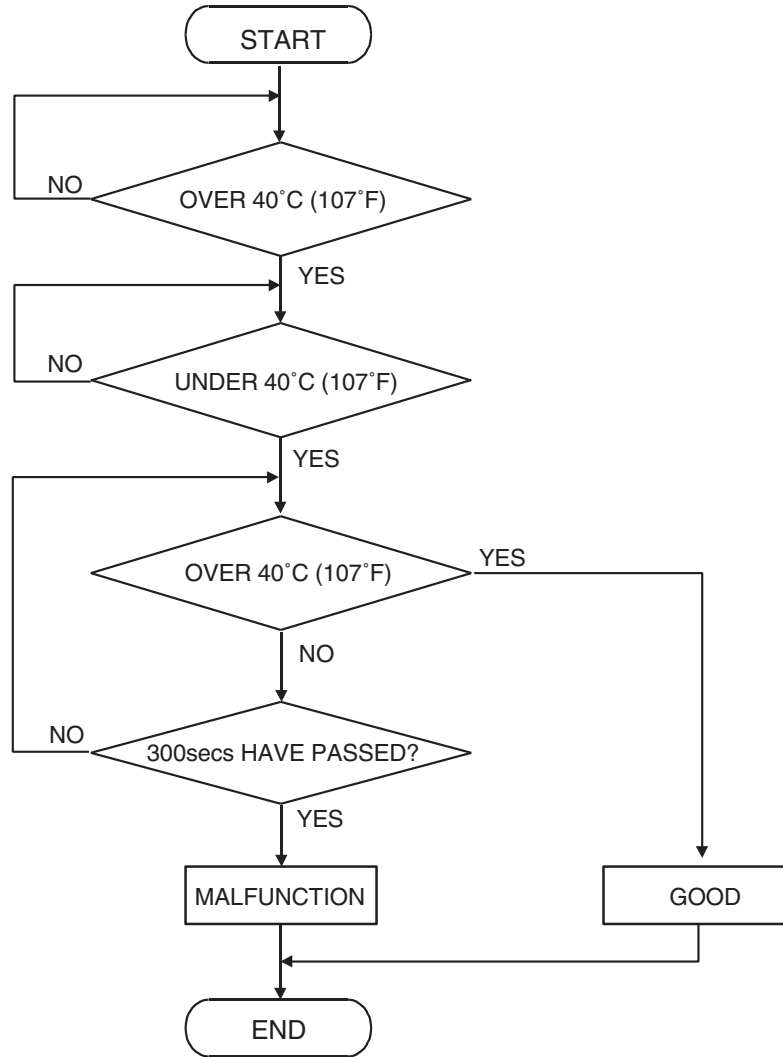
- Not applicable

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor

DTC SET CONDITIONS <Range/Performance problem – drift>

Logic Flow Chart



AK302928

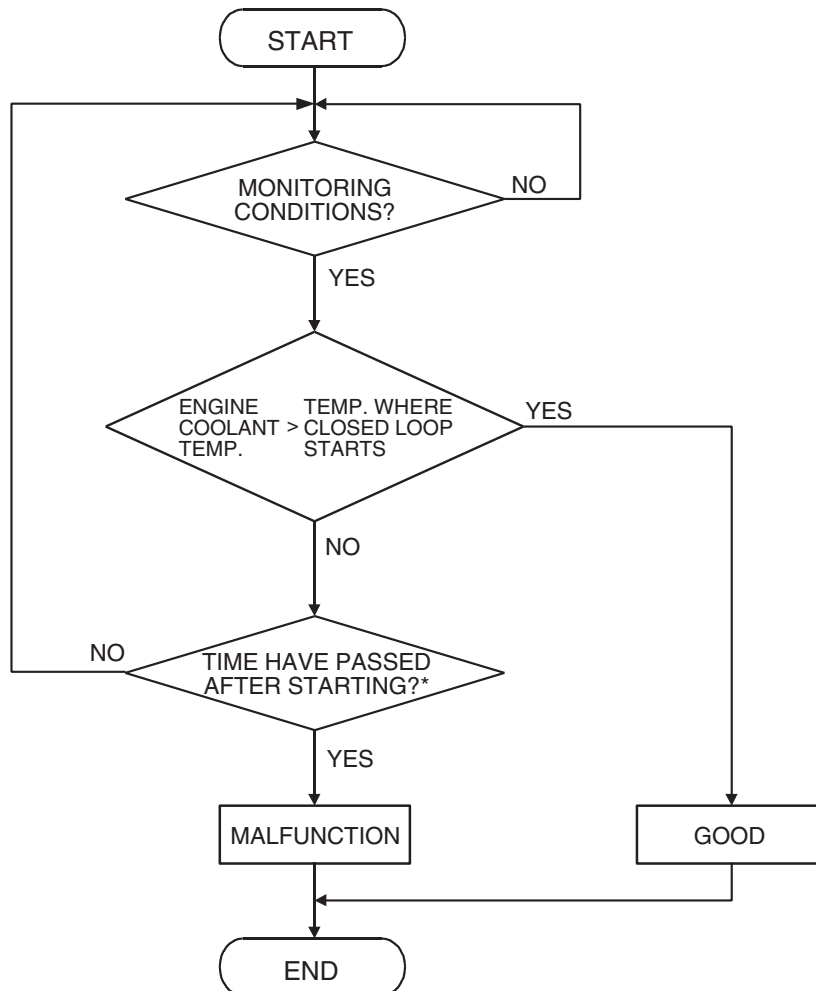
Check Condition, Judgement Criterion

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

- Then the engine coolant temperature has continued to be 40°C (104°F) or lower for 5 minutes.

DTC SET CONDITIONS <Range/Performance problem – low input (Time to reach closed loop temperature)>

Logic Flow Chart



*: SEE DTC SET CONDITIONS-SET CONDITIONS, JUDGMENT CRITERIA

AK302927

Check Condition, Judgement Criterion

- About 60 – 300 seconds have passed for the engine coolant temperature to rise to about 7°C (45°F) after the engine starting sequence was completed.
- However, time is not counted when fuel is shut off.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 [P.13A-4](#).

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.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

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

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

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool 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.

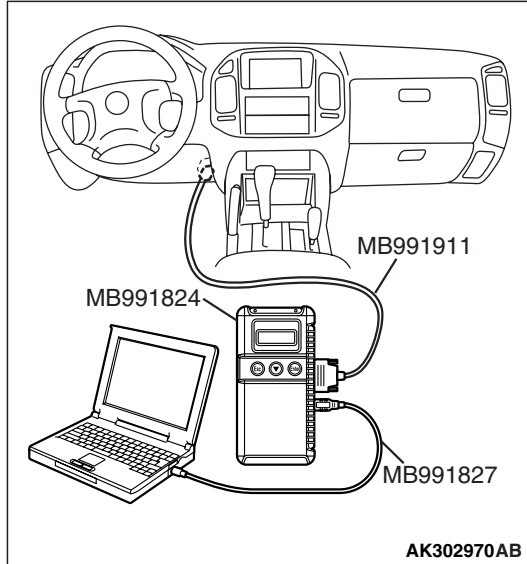
Q: Is the sensor operating properly?

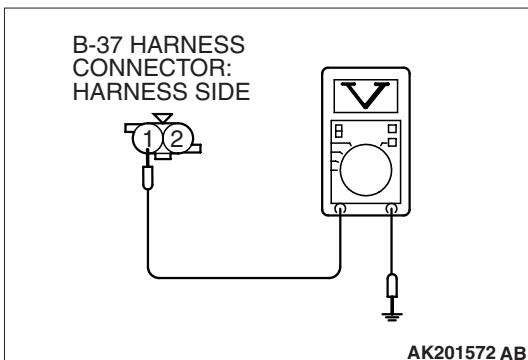
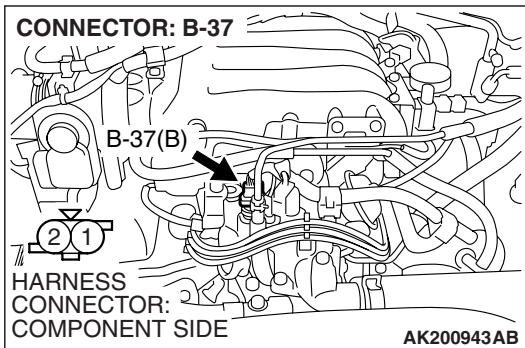
YES : It can be assumed that this malfunction is intermittent.

Refer to GROUP 00, How to Use

Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.





STEP 2. Measure the sensor output voltage at engine coolant temperature sensor connector B-37 by backprobing.

- (1) Do not disconnect the connector B-37.
- (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.

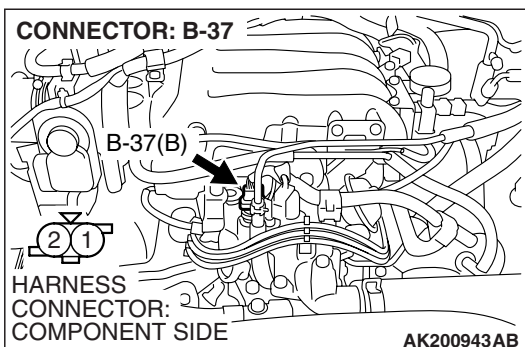
Q: Is the measured voltage normal?

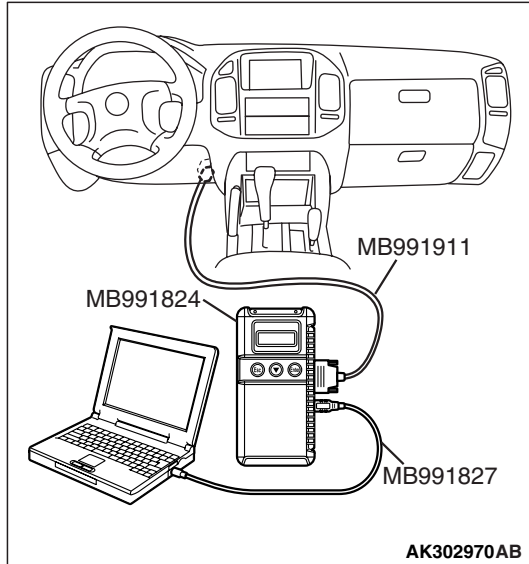
- YES** : Go to Step 3.
NO : Go to Step 5.

STEP 3. Check harness connector B-37 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 MB991958, check data list item 21: Engine Coolant Temperature Sensor.

⚠ CAUTION

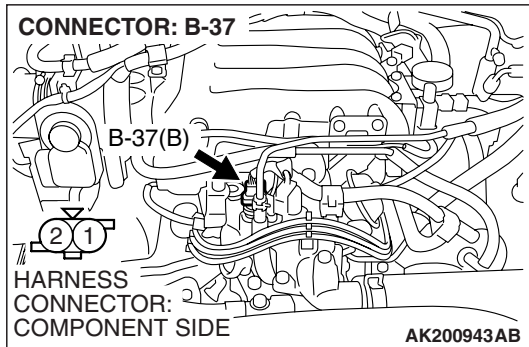
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool 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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

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

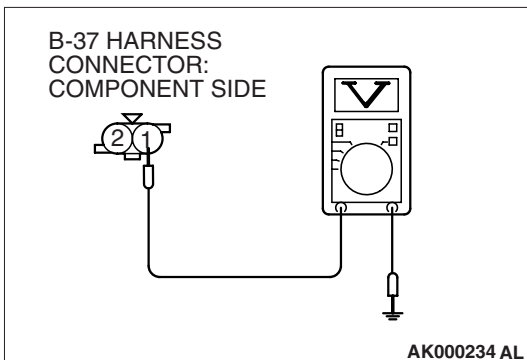
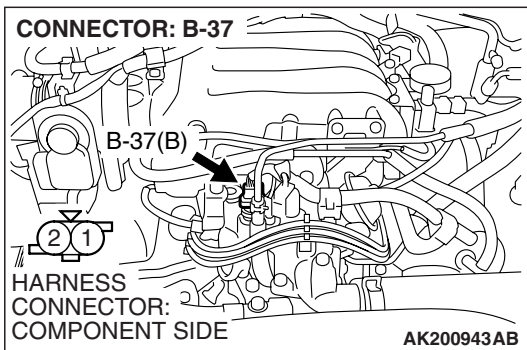


STEP 5. Check harness connector B-37 at engine coolant temperature sensor for damage.

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.



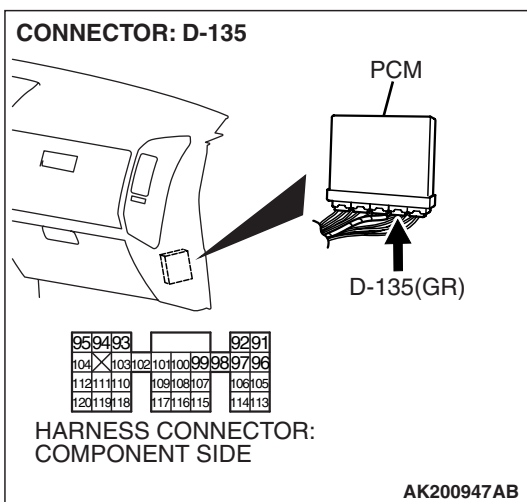
- STEP 6. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-37.**
- (1) Disconnect the connector B-37 and measure at the harness side.
 - (2) Turn the ignition switch to the "ON" position.

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

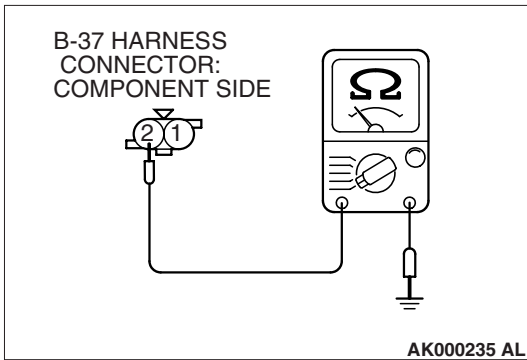
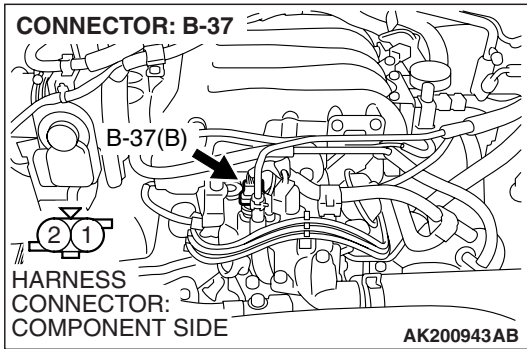


STEP 7. Check harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Replace the PCM. 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 the continuity at engine coolant temperature sensor harness side connector B-37.

(1) Disconnect the connector B-37 and measure at the harness side.

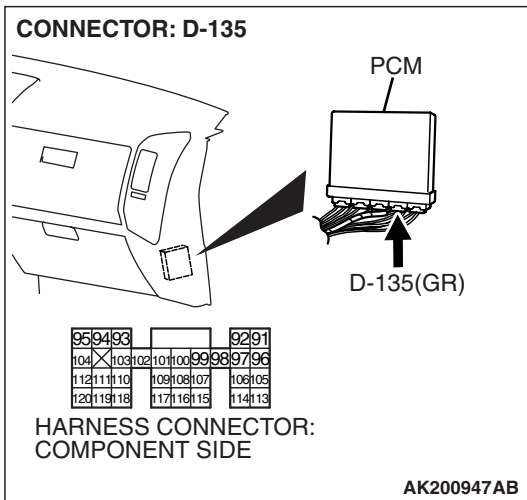
(2) Check for the continuity between terminal No. 2 and ground.

- 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 D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

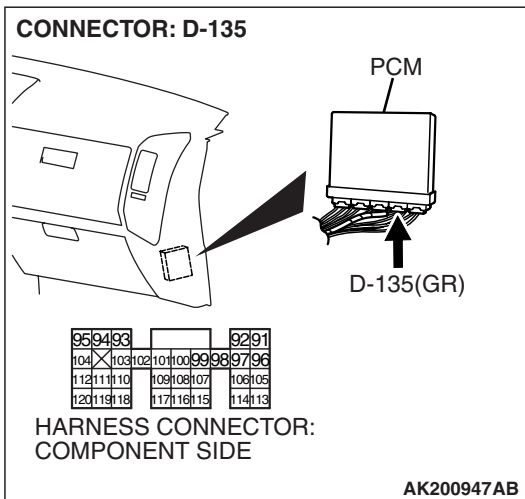
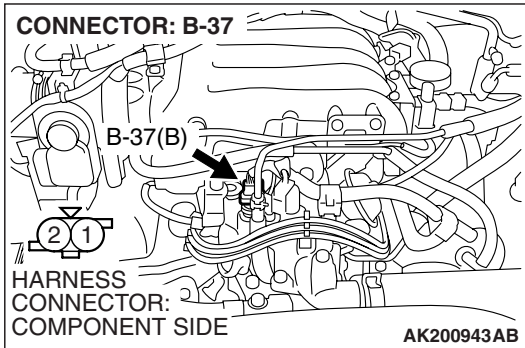
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

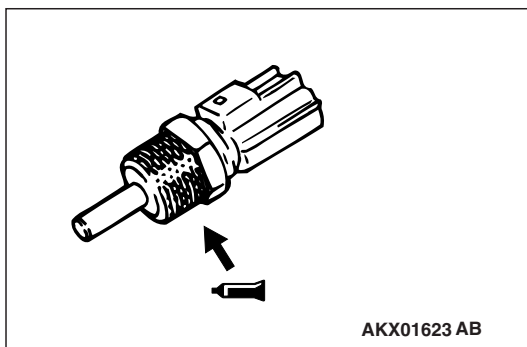
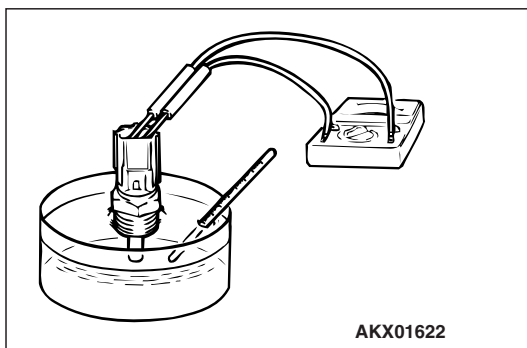
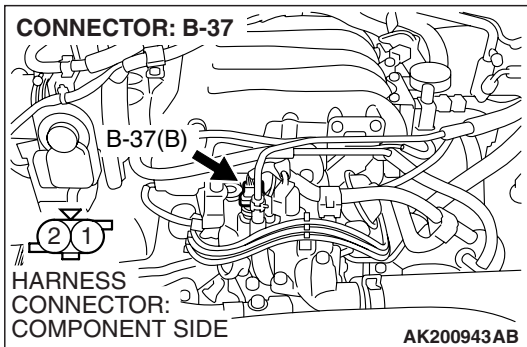
STEP 10. Check for harness damage between engine coolant temperature sensor connector B-37 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

Q: Is the harness wire in good condition?

YES : Replace the PCM. 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-37.
- (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 ± 7 ft-lb)

Q: Is the resistance at the standard value?

YES : Go to Step 12.

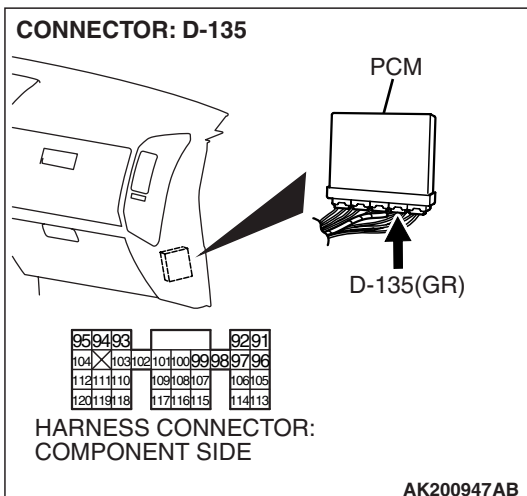
NO : Replace the engine coolant temperature sensor. Then go to Step 14.

STEP 12. Check harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 13.

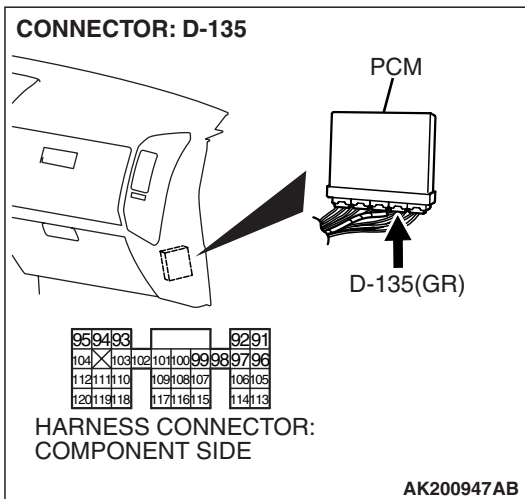
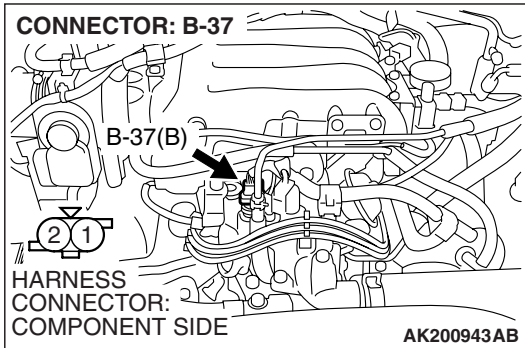
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.



STEP 13. Check for harness damage between engine coolant temperature sensor connector B-37 (terminal No. 1) and PCM connector D-135 (terminal No. 98).

Q: Is the harness wire in good condition?

- YES :** Replace the PCM. Then go to Step 14.
- NO :** Repair it. Then go to Step 14.



STEP 14. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0125 set?

- YES :** Retry the troubleshooting.
- NO :** The inspection is complete.

DTC P0128: Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)

TECHNICAL DESCRIPTION

- The PCM checks the time for the cooling water temperature to reach the judgment temperature.

DESCRIPTIONS OF MONITOR METHODS

Engine coolant temperature does not reach 77°C (171°F) within specified period after cold start.

MONITOR EXECUTION

Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Not applicable

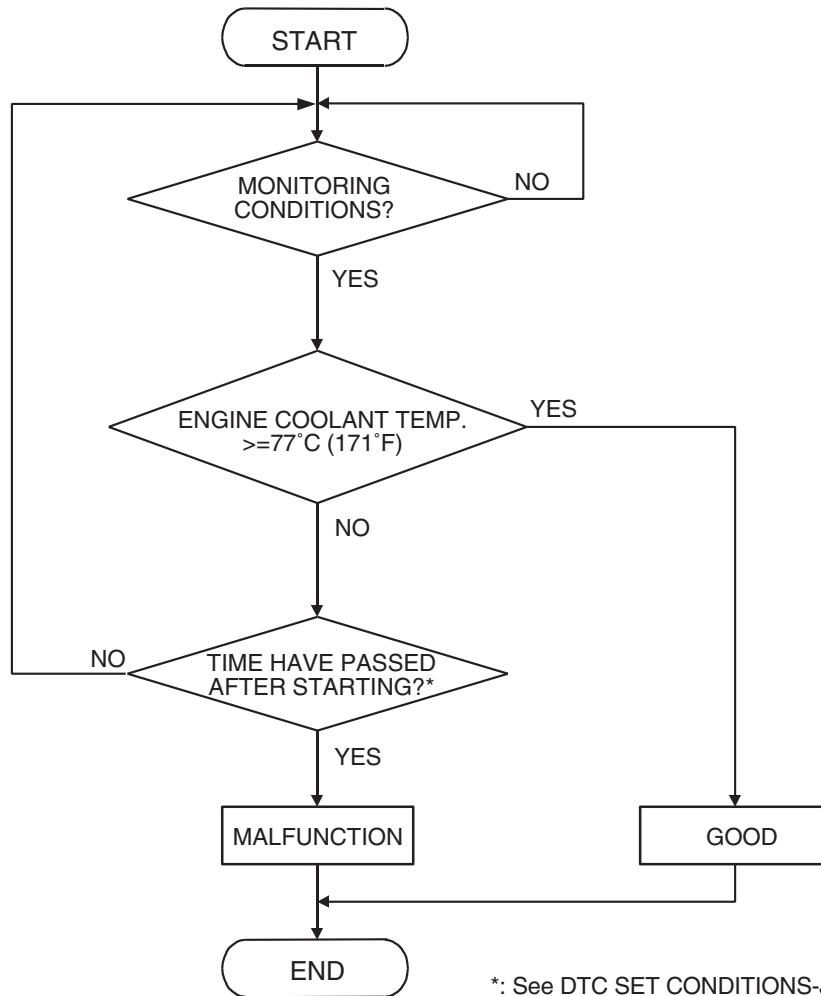
Sensor (The sensor below is determined to be normal)

- Volume airflow sensor

- Engine coolant temperature sensor
- Intake air temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



*: See DTC SET CONDITIONS-JUDGMENT CRITERIA

AK302929

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 minus intake air temperature is 5°C (9°F) or less when the engine is started.
- The intake air temperature when the engine is started minus intake air temperature is 5°C (9°F) or less.
- The volume airflow sensor output frequency is in the low frequency state for 300 seconds or less.

Judgment Criterion

- The time for the engine coolant temperature to rise to 77°C (171°F) takes longer than approximately 13 to 20 minutes.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –Pattern 11 [P.13A-4](#).

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

- The thermostat is faulty.
- PCM failed.

DIAGNOSIS

STEP 1. Check the cooling system.

Refer to GROUP 14, Engine Cooling Diagnosis P.14-2.

Q: Is the cooling system normal?

YES : Replace the PCM. Then go to Step 2.

NO : Repair it. Then go to Step 2.

STEP 2. Test the OBD-II drive cycle.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 11 P.13A-4.

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

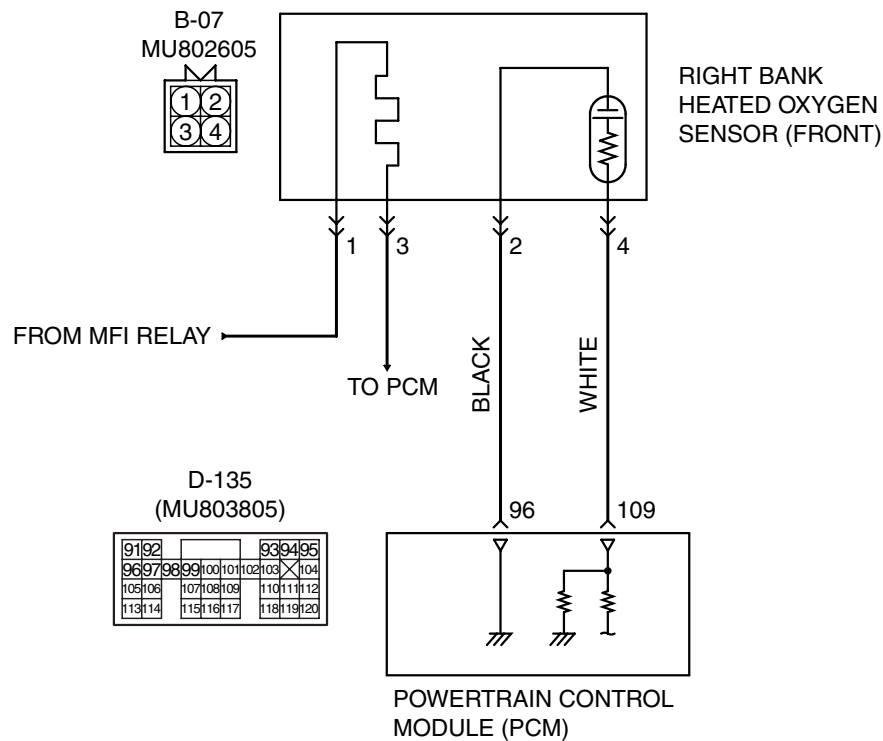
Q: Is DTC P0128 set?

YES : Retry the troubleshooting.

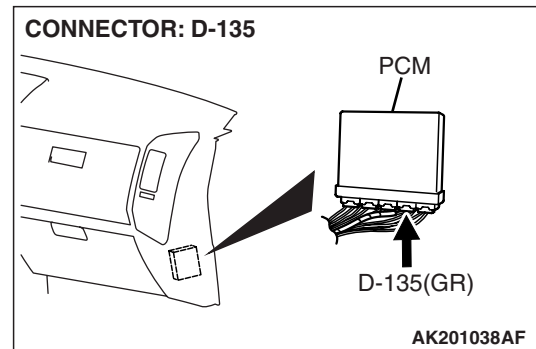
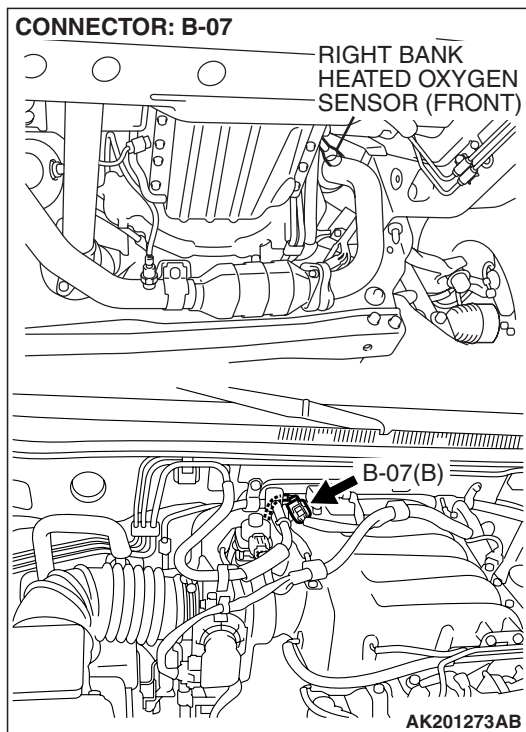
NO : The inspection is complete.

DTC P0130: Heated Oxygen Sensor (bank 1, sensor 1)

Right Bank Heated Oxygen Sensor (front) Circuit



AK501057



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 109) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (front).
- Terminal No. 2 of the right bank heated oxygen sensor (front) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

- The right bank 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 PCM.
- When the right bank heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The PCM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the right bank heated oxygen sensor (front). In addition, the PCM also checks for an open circuit in the right bank heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (front) circuit is switched to 5 volts intentionally when oxygen sensor output is low, and detects the malfunction if the output voltage changes to equal or greater than 4.5 volts. The above procedure is repeated when oxygen sensor is inactive.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

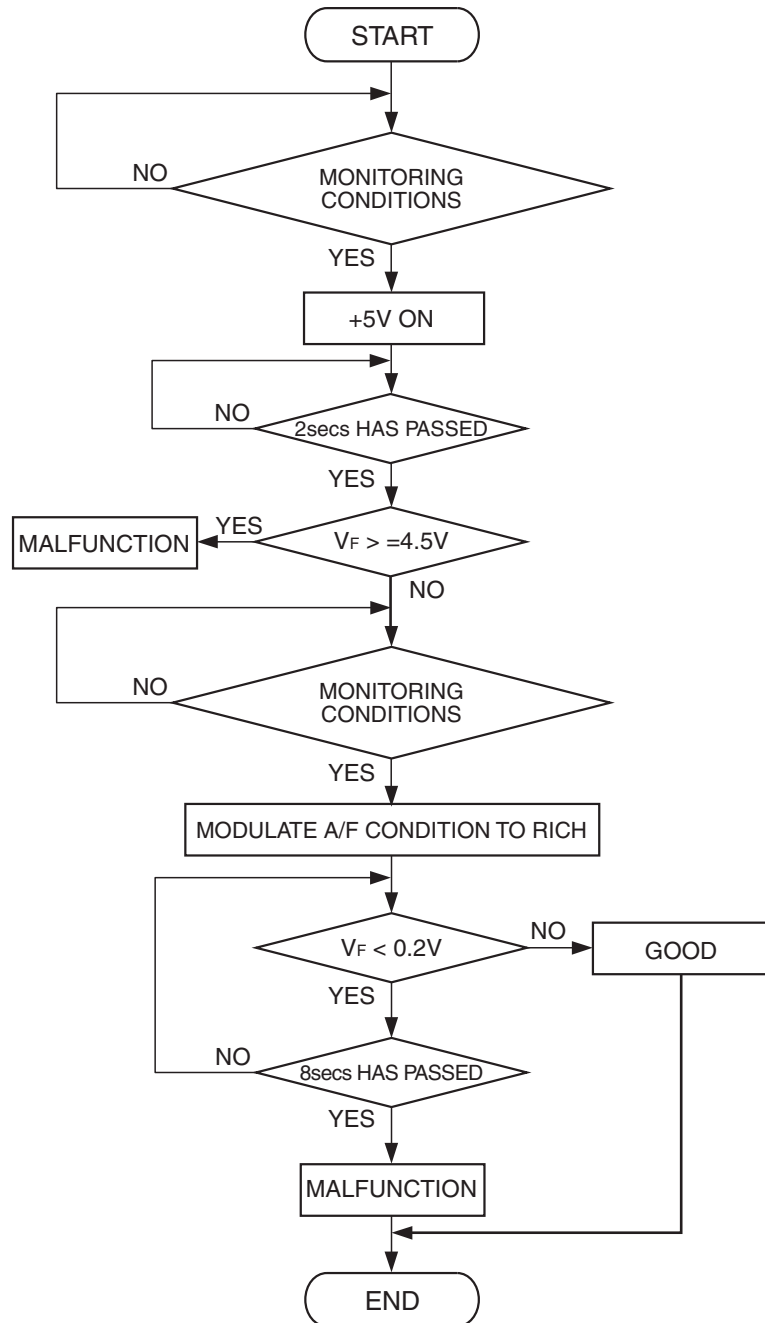
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelerator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK501058

Check Conditions

- 3 minutes or more have passed since the engine starting sequence was completed.
- Right bank 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.

Judgement Criterion

- Input voltage supplied to the PCM interface circuit is higher than 4.5 volts when 5 volts is applied to the right bank heated oxygen sensor (front) output line via a resistor.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Right bank heated oxygen sensor (front) deteriorated.
- Open or shorted circuit in right bank heated oxygen sensor (front) output line, or harness damage.
- Open circuit in right bank heated oxygen sensor (front) ground line, or harness damage.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- 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 MB991958, check data list item 39: Heated Oxygen Sensor Bank 1, Sensor 1 (right front).

CAUTION

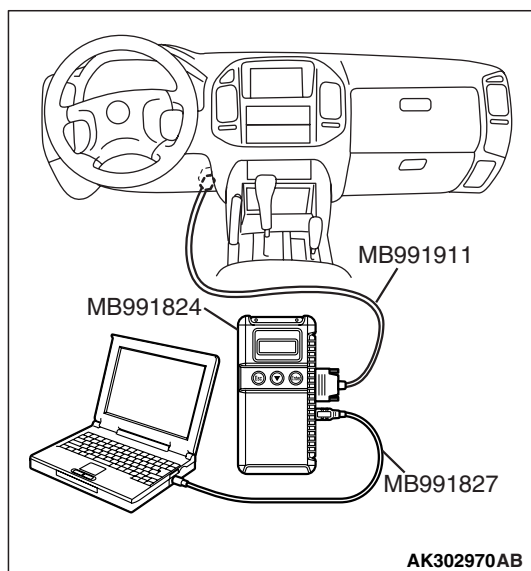
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 39, Heated Oxygen Sensor Bank 1, Sensor 1 (right front).
 - Warming up the engine. When the engine is revved, the output voltage should be 0.6 to 1.0 volt.
 - Warming 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?

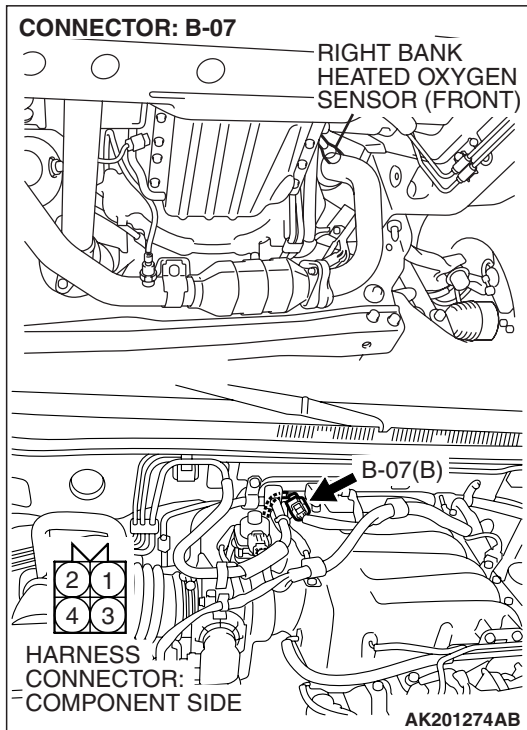
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.



STEP 2. Measure the sensor output voltage at right bank heated oxygen sensor (front) connector B-07 by backprobing

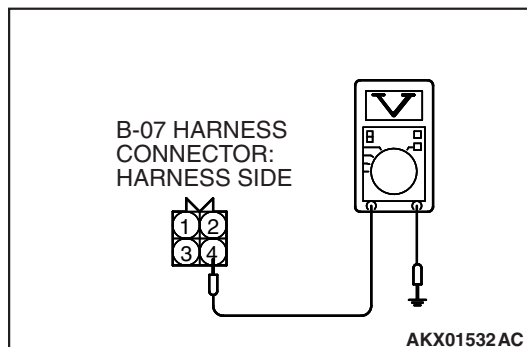
- (1) Do not disconnect the connector B-07.
- (2) Start the engine and run at idle.

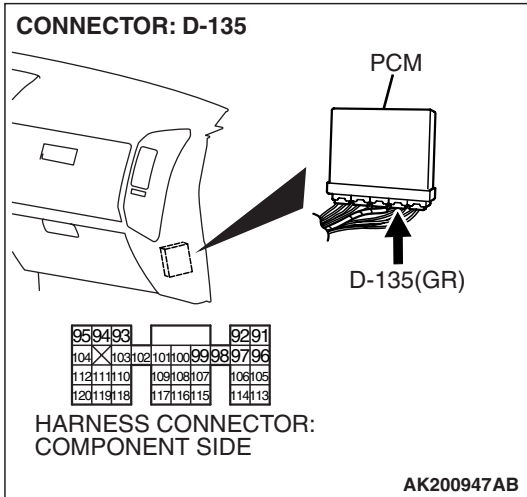


- (3) Measure the voltage between terminal No. 4 and ground by backprobing.
 - Warming up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the voltage normal?

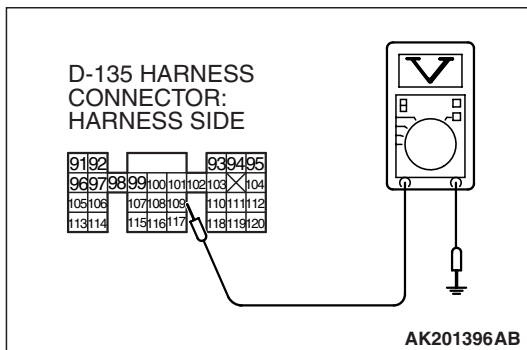
- YES** : Go to Step 3.
NO : Go to Step 7.





STEP 3. Measure the sensor output voltage at PCM connector D-135 by backprobing

- (1) Do not disconnect the connector D-135.
- (2) Start the engine and run at idle.



- (3) Measure the voltage between terminal No. 109 and ground by backprobing.
 - Warming 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 voltage normal?

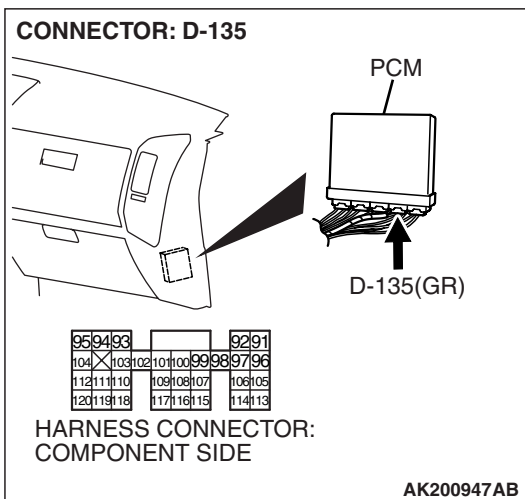
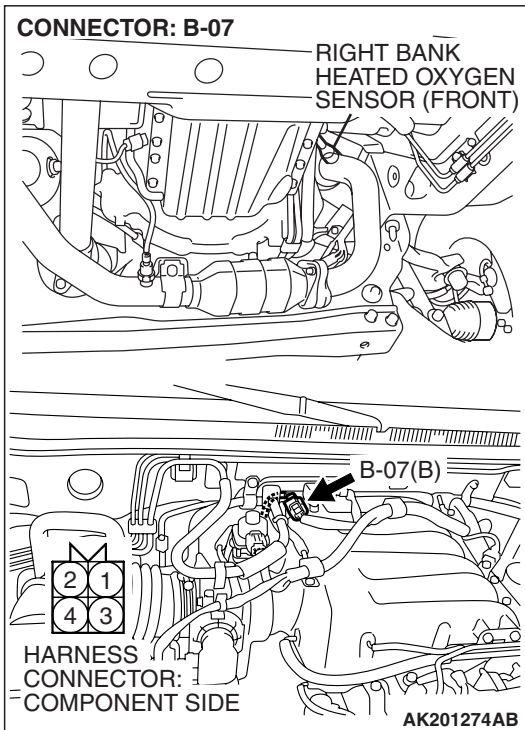
- YES :** Go to Step 4.
NO : Go to Step 6.

STEP 4. Check harness connector B-07 at right bank heated oxygen sensor (front) and harness connector D-135 at PCM 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 15.



STEP 5. Using scan tool MB991958, check data list item 39: Right Bank Heated Oxygen Sensor Bank 1, Sensor 1 (right front).

⚠ CAUTION

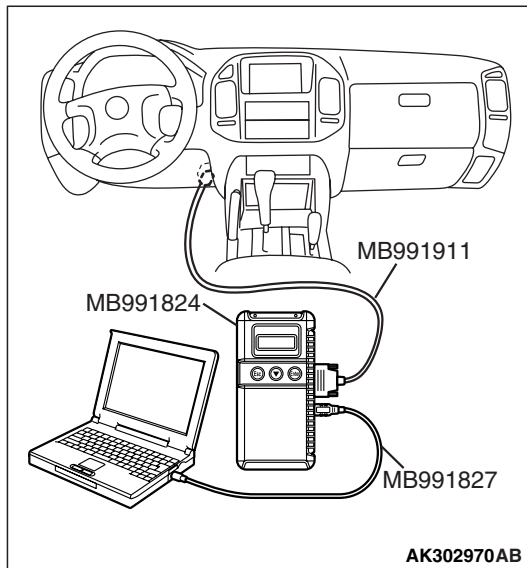
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 39, Heated Oxygen Sensor Bank 1, Sensor 1 (right front).
 - Warming up the engine. When the engine is revved, the output voltage should be 0.6 to 1.0 volt.
 - Warming 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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

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



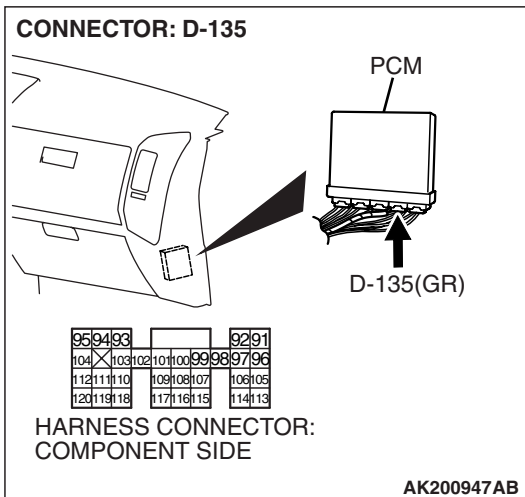
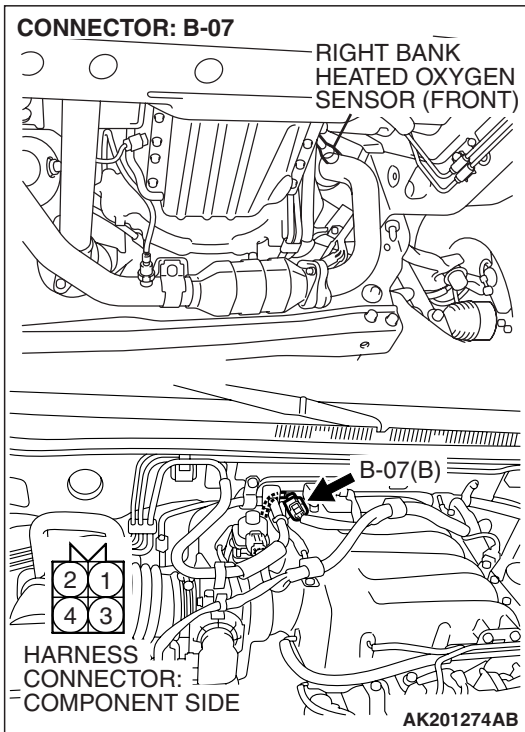
AK302970AB

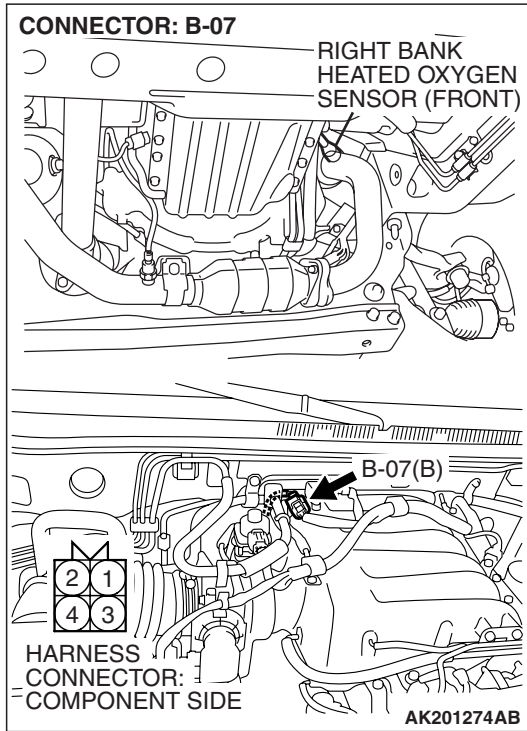
STEP 6. Check harness connector B-07 at right bank heated oxygen sensor (front) and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between right bank heated oxygen sensor (front) connector B-07 (terminal No. 4) and PCM connector D-135 (terminal No. 109) 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-07 at right bank heated oxygen sensor (front) for damage.

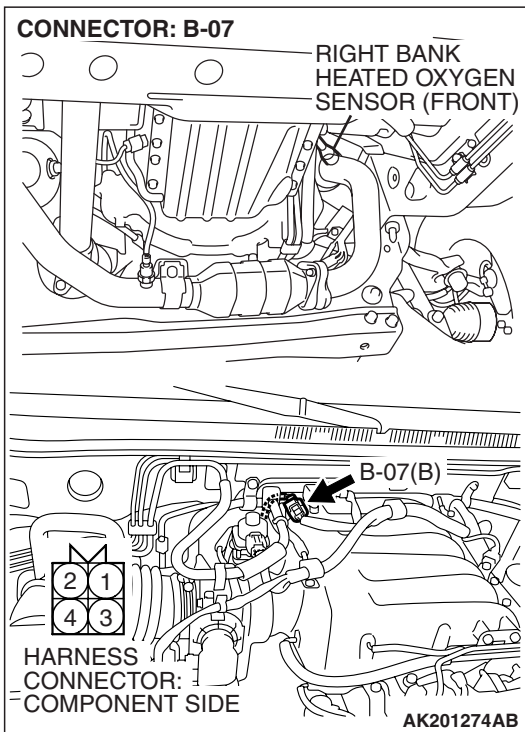
Q: Is the harness connector in good condition?

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 the continuity at right bank heated oxygen sensor (front) harness side connector B-07.

(1) Disconnect the connector B-07 and measure at the harness side.



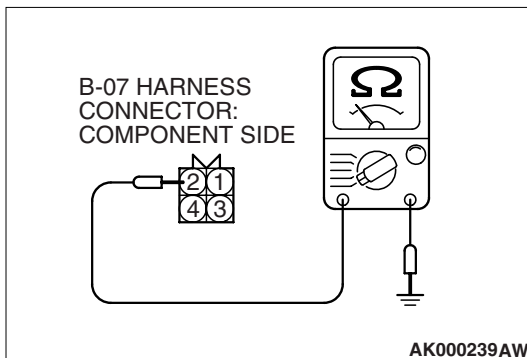
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.

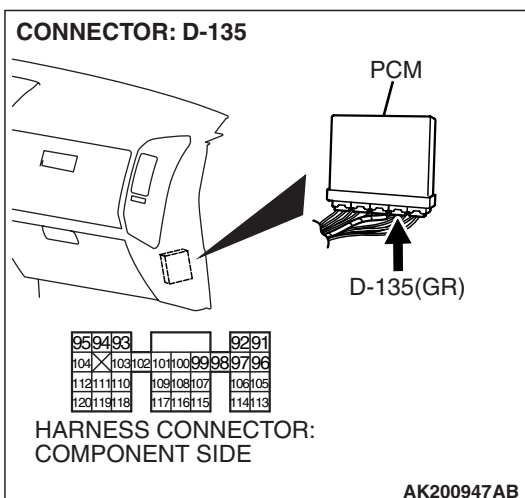


STEP 9. Check harness connector D-135 at PCM for damage.

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.

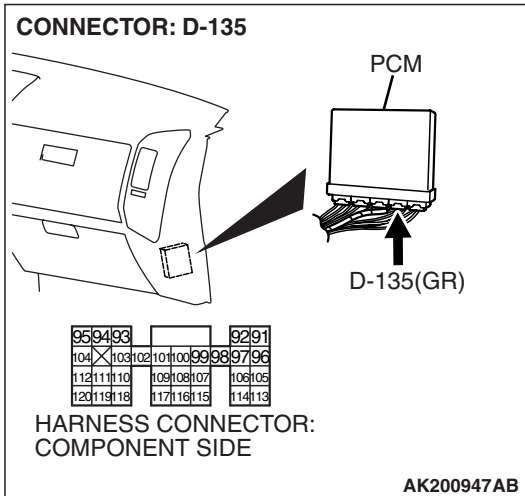
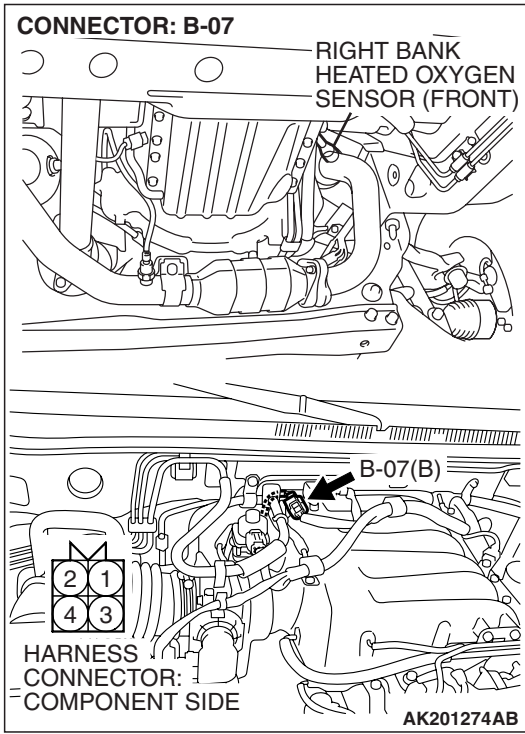


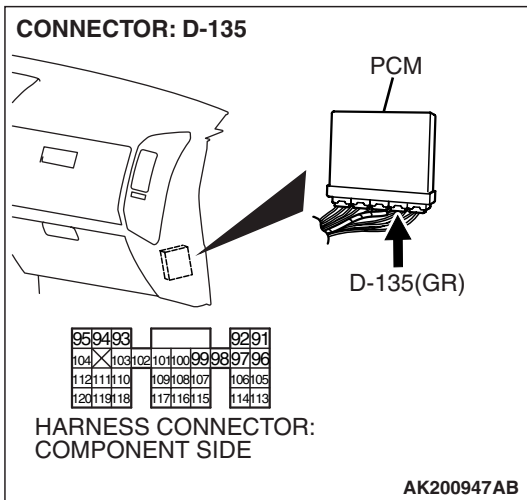
STEP 10. Check for open circuit and harness damage between right bank heated oxygen sensor (front) connector B-07 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 15.





STEP 11. Check harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 12.

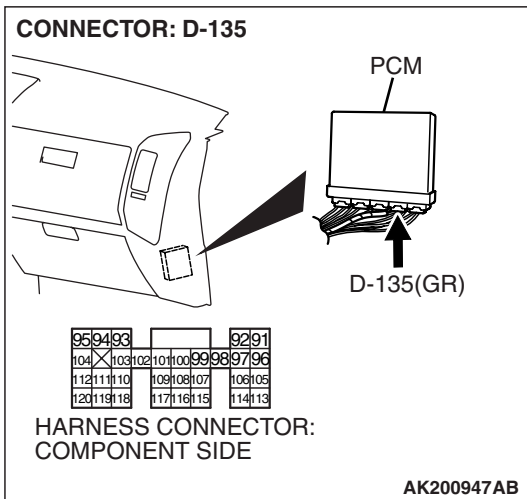
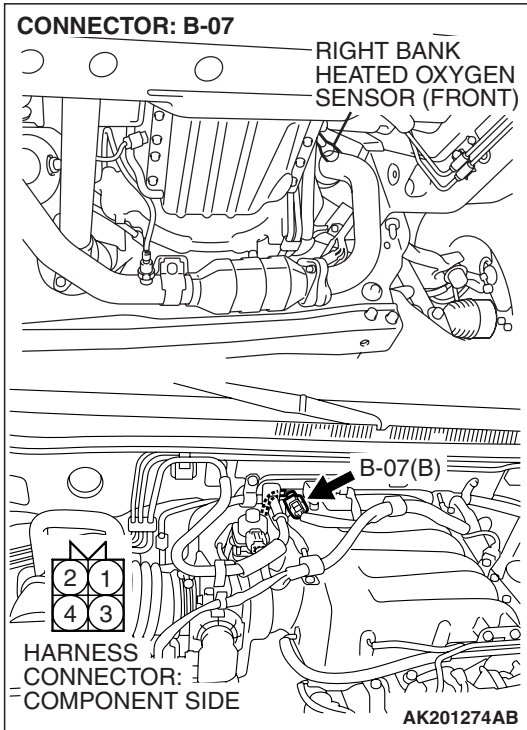
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 15.

STEP 12. Check for harness damage between right bank heated oxygen sensor (front) connector B-07 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 15.

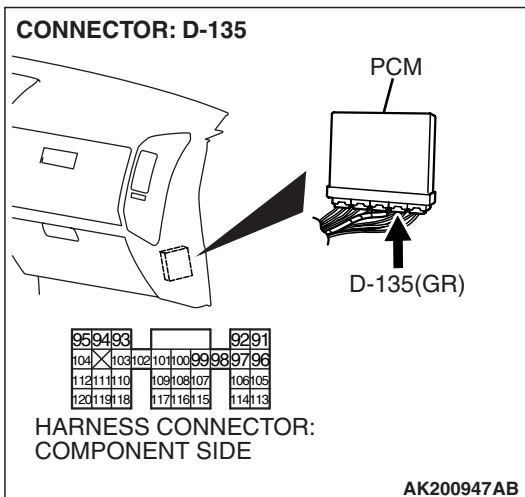
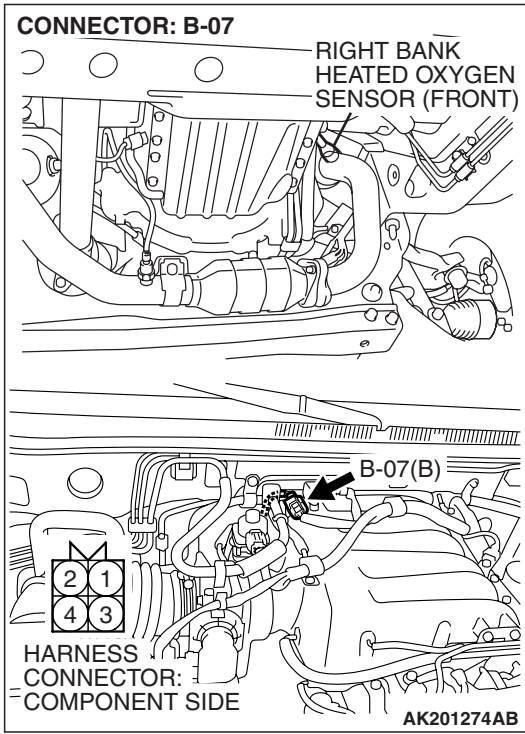


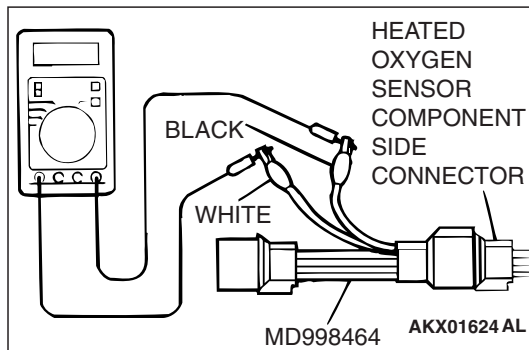
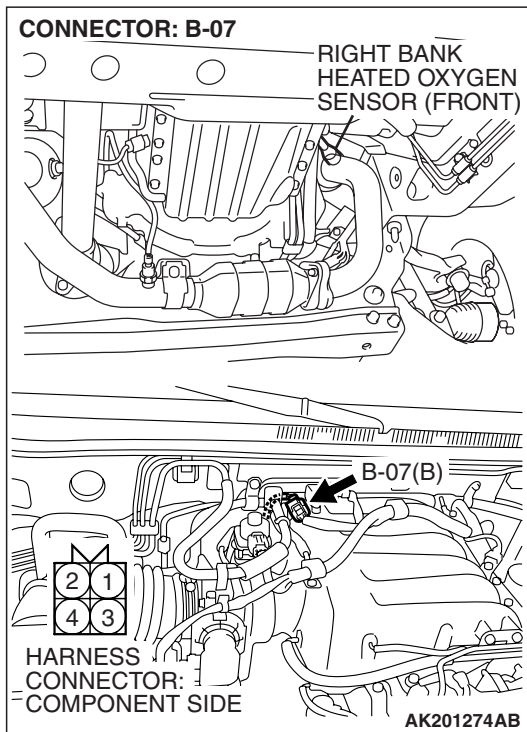
STEP 13. Check for short circuit to ground and harness damage between right bank heated oxygen sensor (front) connector B-07 (terminal No. 4) and PCM connector D-135 (terminal No. 109).

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 right bank heated oxygen sensor (front).**

- (1) Disconnect the right bank heated oxygen sensor (front) connector B-07 and connect test harness special tool MD998464 to the connector on the right bank heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the right bank heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 (red clip) and the terminal No. 3 (blue clip) of the heated oxygen sensor with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the voltage between 0.6 and 1.0 volt?

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

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

STEP 15. Test the OBD-II drive cycle.

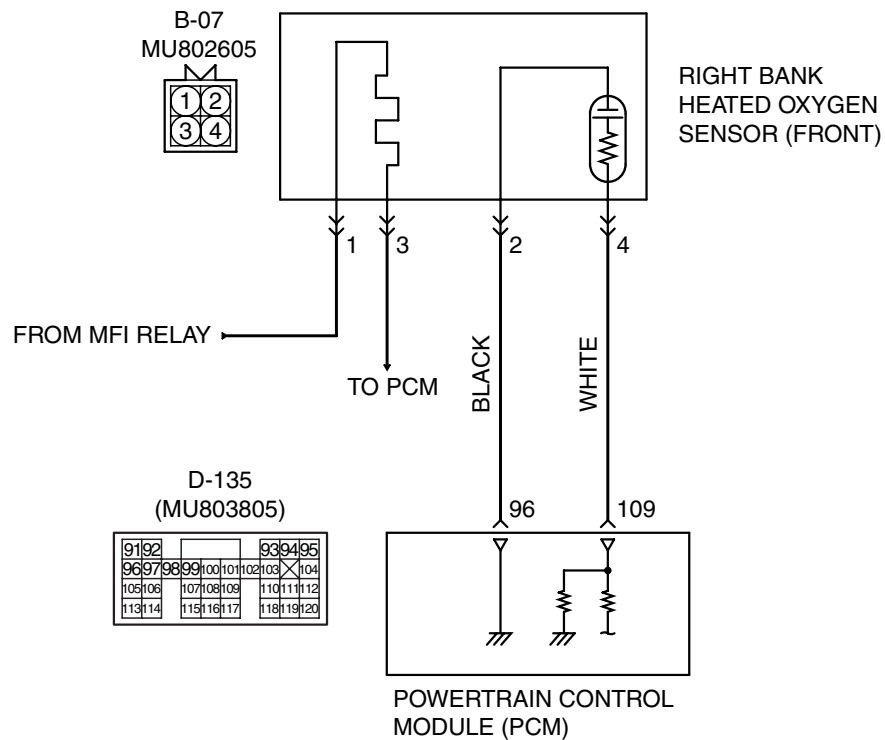
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 P.13A-4.
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0130 set?

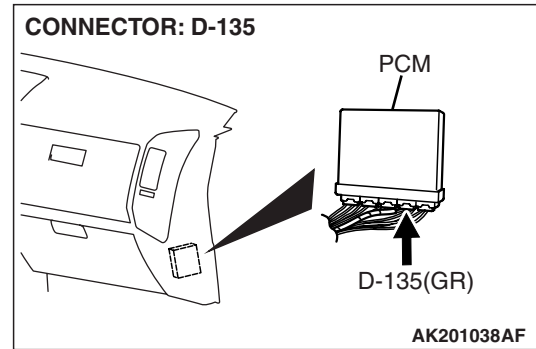
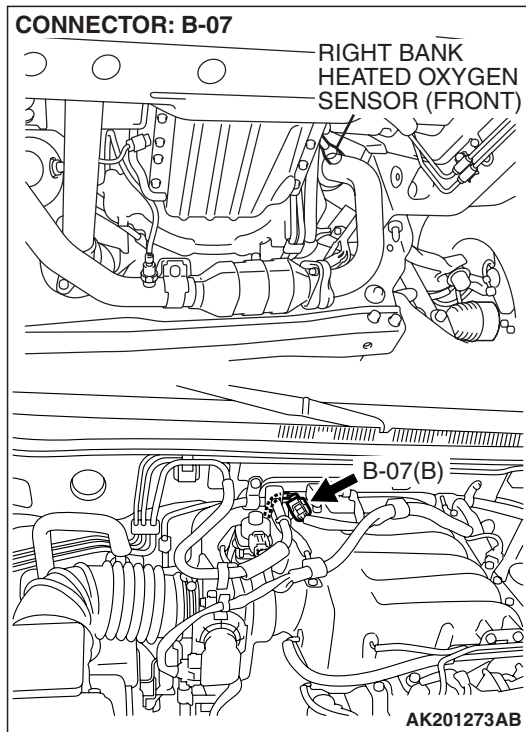
- YES :** Retry the troubleshooting.
NO : The inspection is complete.

DTC P0131: Heated Oxygen Sensor Circuit Low Voltage (bank 1, sensor 1)

Right Bank Heated Oxygen Sensor (front) Circuit



AK501057



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 109) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (front).
- Terminal No. 2 of the right bank heated oxygen sensor (front) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

- The right bank 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 PCM.
- When the right bank heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The PCM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the right bank heated oxygen sensor (front). In addition, the PCM also checks for an open circuit in the right bank heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (front) output voltage stays low when air/fuel ratio is forced to be rich. The above procedure is repeated when oxygen sensor is inactive.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

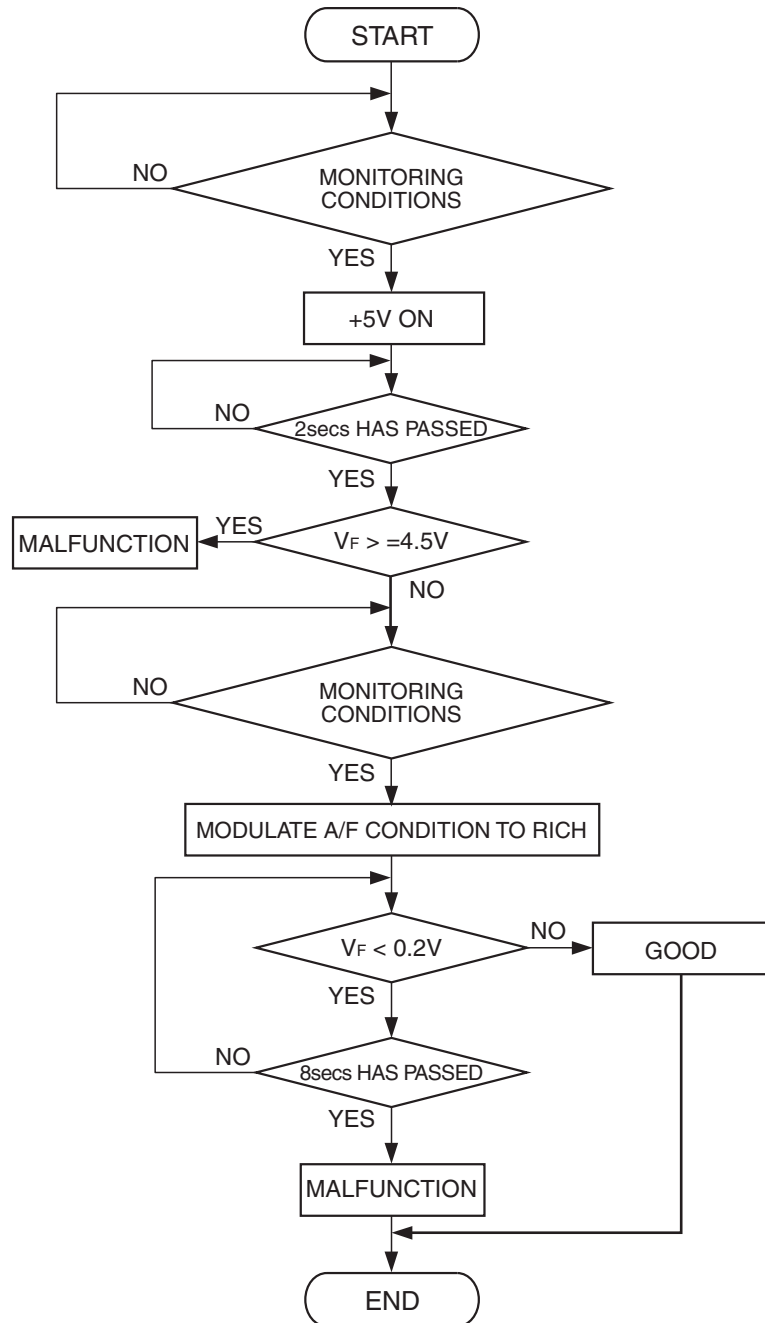
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelerator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK501058

Check Conditions

- After 2 seconds or more pass from the time when the monitor determines normally for detecting an open circuit.
- Right bank 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).
- Volume airflow sensor output frequency is higher than 100 Hz.
- At least 20 seconds have passed since fuel shut off control was canceled.

TSB Revision

Judgement Criterion

- Making the air/fuel ratio 15 percent richer for 8 seconds does not result in raising the heated oxygen sensor (front) output voltage beyond 0.2 volt.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Right bank heated oxygen sensor (front) failed.
- Short circuit in right bank heated oxygen sensor (front) output line.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- 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 MB991958, check data list item 39: Heated Oxygen Sensor Bank 1, Sensor 1 (right front).

⚠ CAUTION

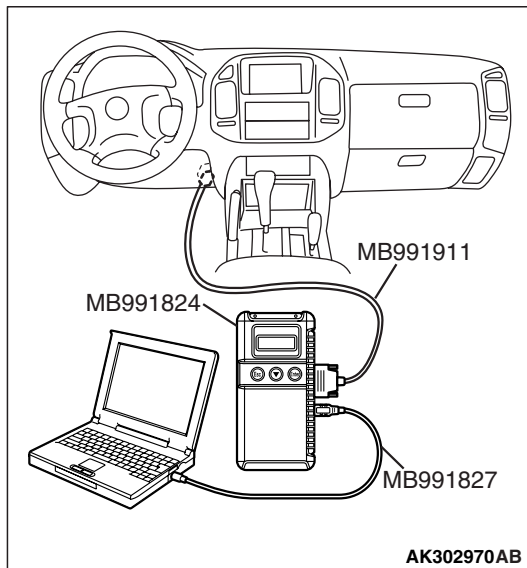
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 39, Heated Oxygen Sensor Bank 1, Sensor 1 (right 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.

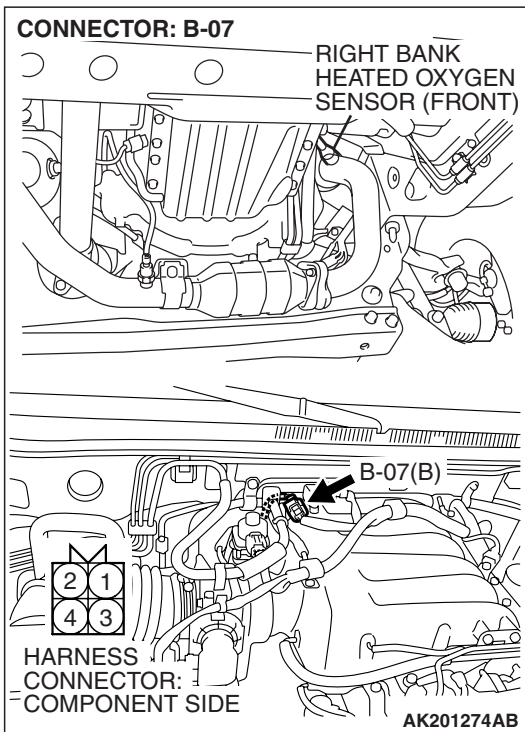
Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

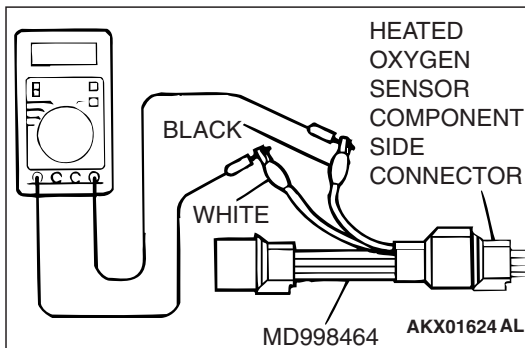
NO : Go to Step 2.



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



- (1) Disconnect the right bank heated oxygen sensor (front) connector B-07 and connect test harness special tool MD998464 to the connector on the right bank heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.



- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the right bank heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 (red clip) and the terminal No. 3 (blue clip) of the heated oxygen sensor with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 3.

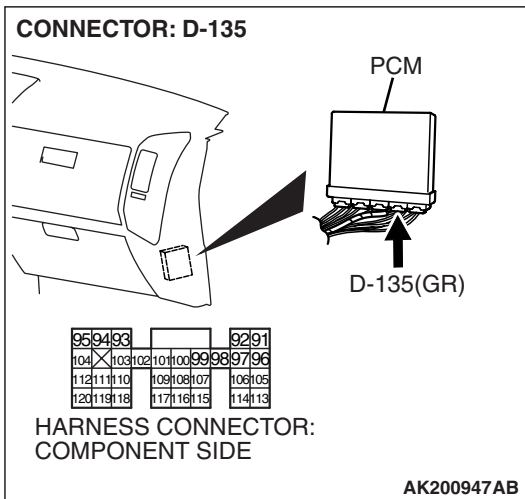
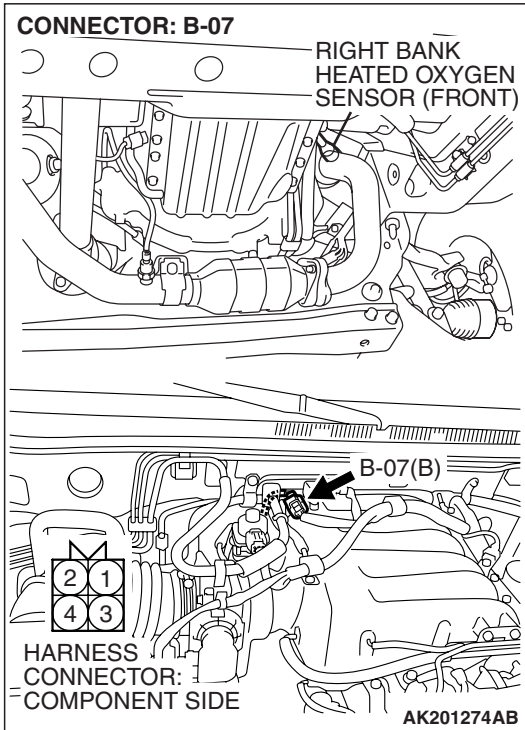
NO : Replace the right bank heated oxygen sensor (front). Then go to Step 5.

STEP 3. Check harness connector B-07 at right bank heated oxygen sensor (front) and harness connector D-135 at PCM 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.

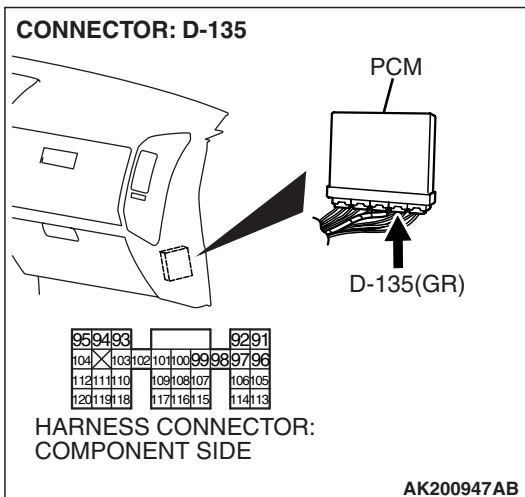
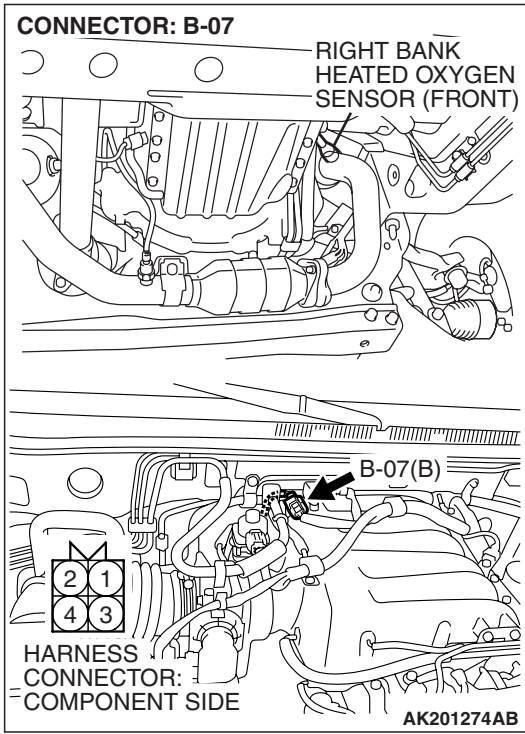


STEP 4. Check for short circuit to ground between right bank heated oxygen sensor (front) connector B-07 (terminal No. 4) and PCM connector D-135 (terminal No. 109).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 5.



STEP 5. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

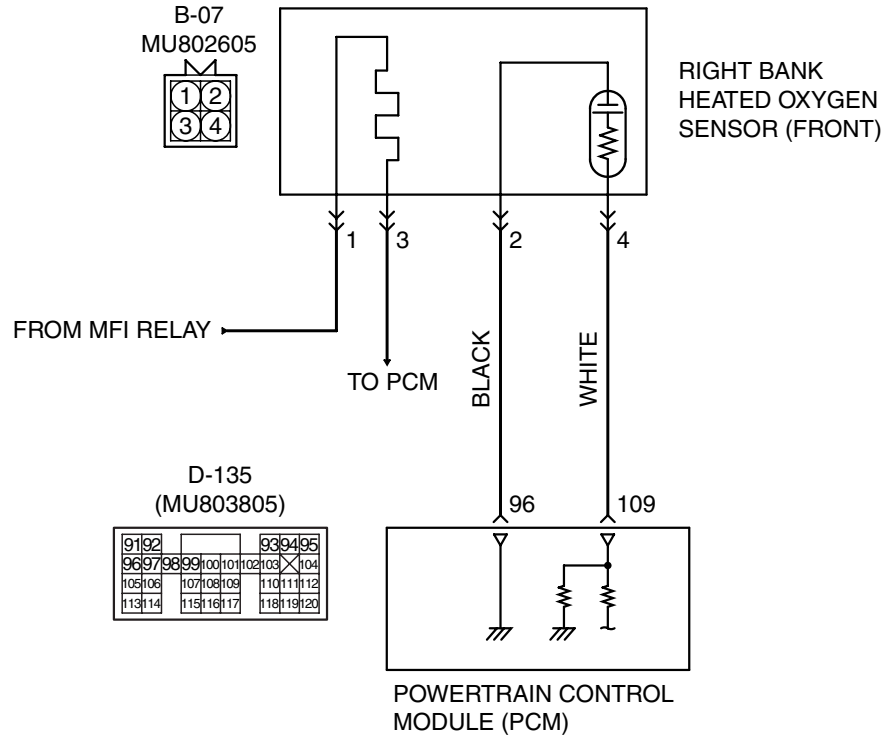
Q: Is DTC P0131 set?

YES : Retry the troubleshooting.

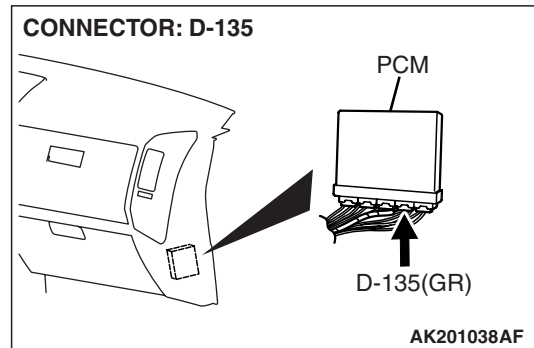
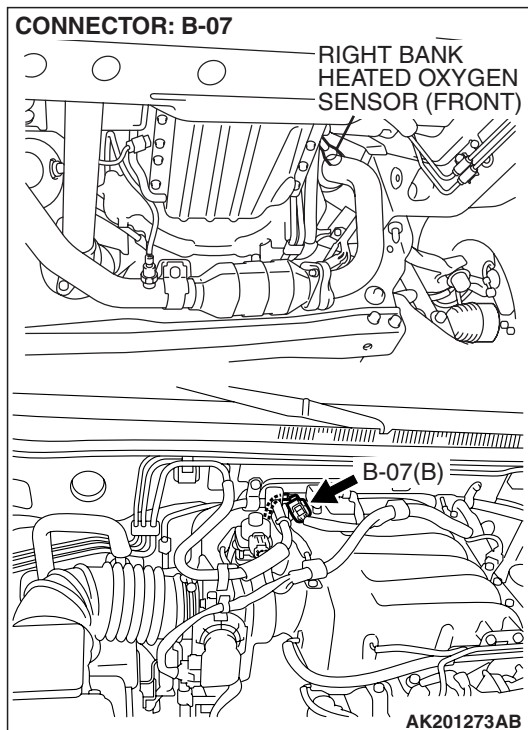
NO : The inspection is complete.

DTC P0132: Heated Oxygen Sensor Circuit High Voltage (bank 1, sensor 1)

Right Bank Heated Oxygen Sensor (front) Circuit



AK501057



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 109) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (front).
- Terminal No. 2 of the right bank heated oxygen sensor (front) is grounded with PCM (terminal No. 96).

TECHNICAL DESCRIPTION

- The right bank 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 PCM.
- When the right bank heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The PCM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the right bank heated oxygen sensor (front). In addition, the PCM also checks for an open circuit in the right bank heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (front) output voltage is over specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

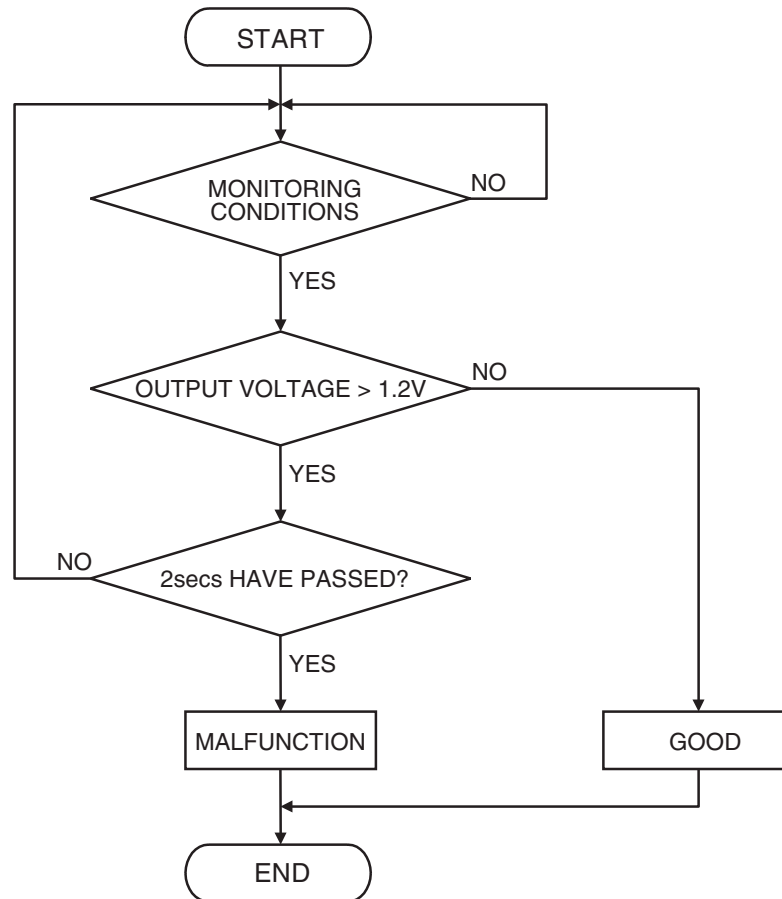
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelerator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302931

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-4](#).

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

- Short circuit in right bank heated oxygen sensor (front) output line.
- Connector damage.
- PCM failed.

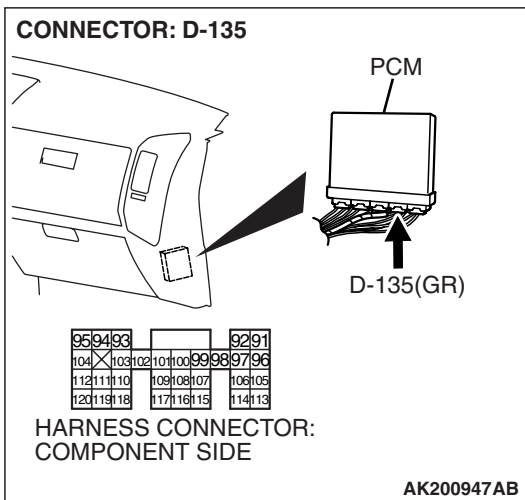
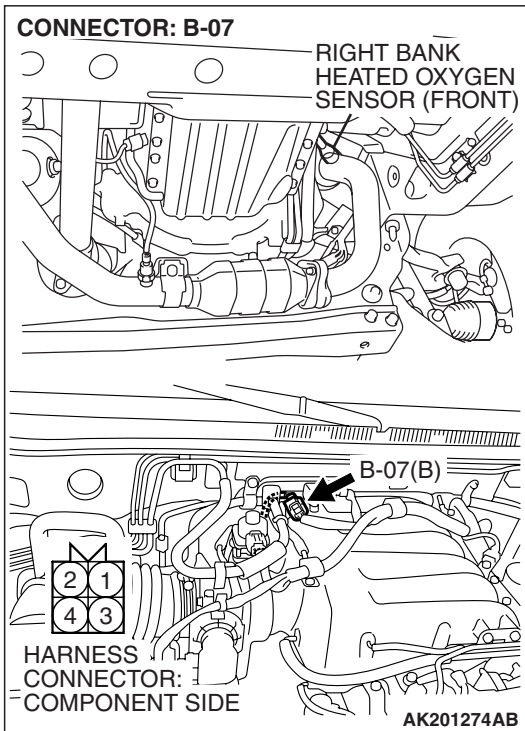
DIAGNOSIS

STEP 1. Check harness connector B-07 at right bank heated oxygen sensor (front) and harness connector D-135 at PCM 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.

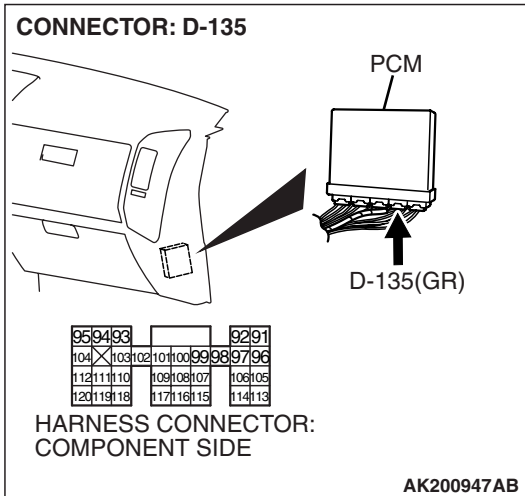
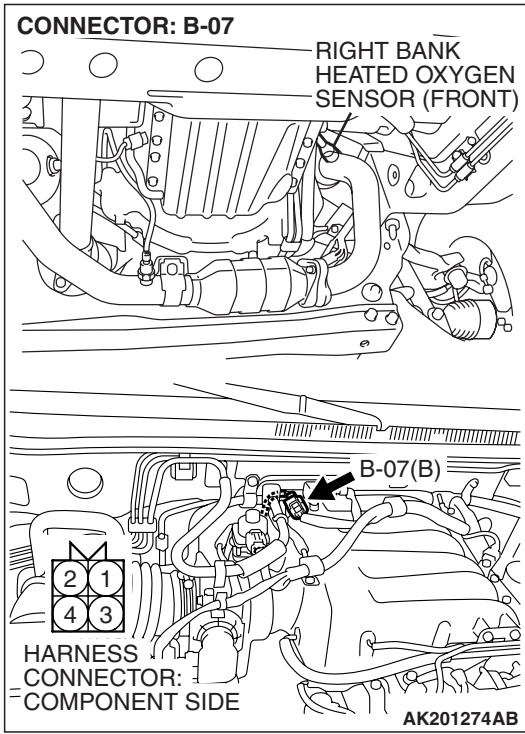


STEP 2. Check for short circuit to power supply between right bank heated oxygen sensor (front) connector B-07 (terminal No. 4) and PCM connector D-135 (terminal No. 109).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 3.



STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.
- (2) Check the diagnostic trouble code (DTC).

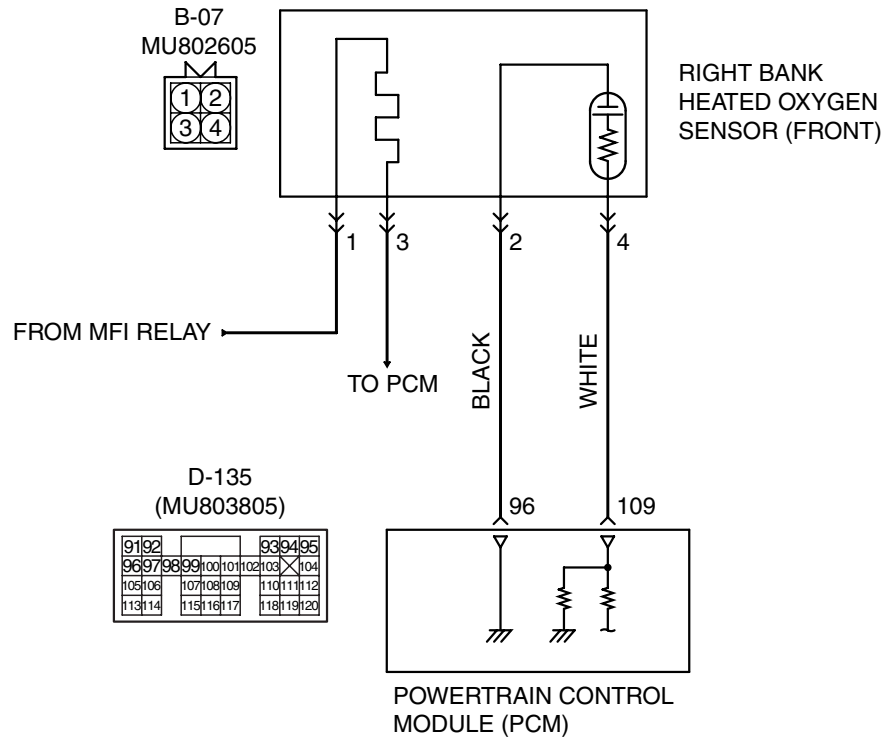
Q: Is DTC P0132 set?

YES : Retry the troubleshooting.

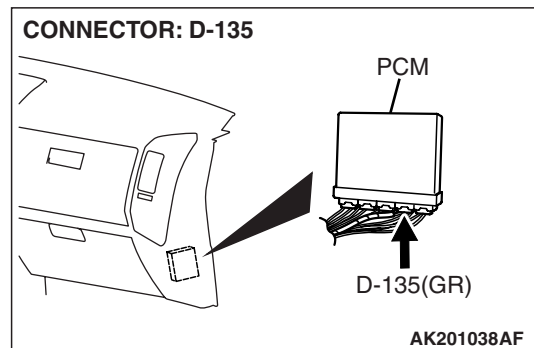
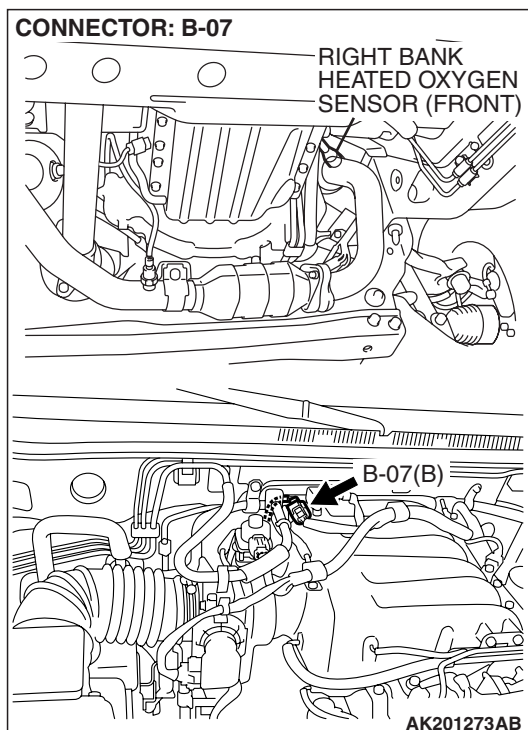
NO : The inspection is complete.

DTC P0133: Heated Oxygen Sensor Circuit Slow Response (bank 1, sensor 1)

Right Bank Heated Oxygen Sensor (front) Circuit



AK501057



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 109) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (front).
- Terminal No. 2 of the right bank heated oxygen sensor (front) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

- The right bank 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 PCM.
- When the right bank heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The PCM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the right bank heated oxygen sensor (front). In addition, the PCM also checks for an open circuit in the right bank heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (front) rich/lean switching frequency is under specified value.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

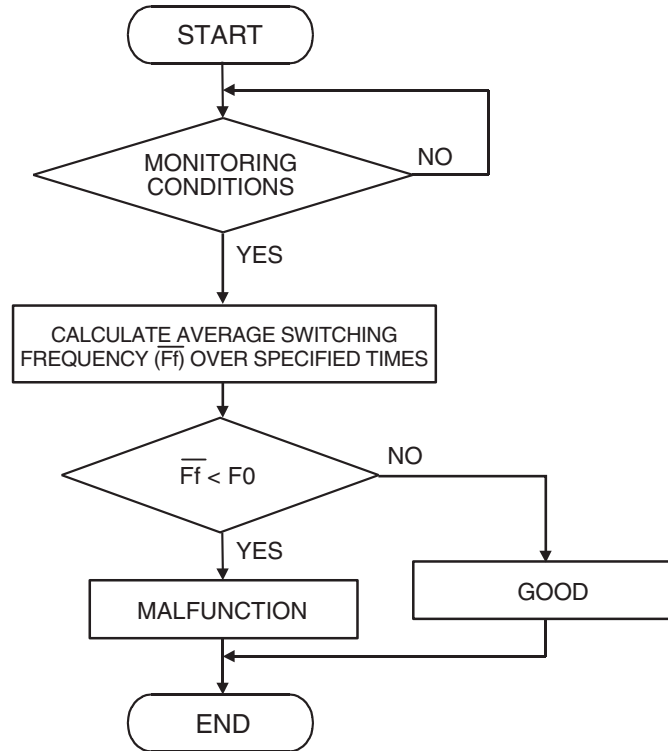
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelerator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



F0: THRESHOLD VALUE FOR AVERAGE SWITCHING FREQUENCY

AK400995

Check Conditions

- Engine coolant temperature is higher than 50°C (122°F).
- Engine speed is between 1,250 and 3,000 r/min.
- Volumetric efficiency is between 24 and 65 percent.
- Under the closed loop air/fuel control.
- The accelerator pedal is not closed.
- Short-term fuel trim is between -30 and +25 percent.
- More than 3 seconds have elapsed after the above-mentioned conditions have been met.
- The PCM monitors for this condition for 7 cycles of 12 seconds each during the drive cycle.

Judgement Criterion

- The right bank heated oxygen sensor (front) sends "lean" and "rich" signals alternately 12 times or less for 12 seconds.

NOTE: If the sensor switching frequency is lower than the Judgment Criteria due to the MUT-III 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 second.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 1 [P.13A-4](#).

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

- Right bank heated oxygen sensor (front) deteriorated.
- Connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

- 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 MB991958, check data list item 39: Heated Oxygen Sensor Bank 1, Sensor 1 (right front).

⚠ CAUTION

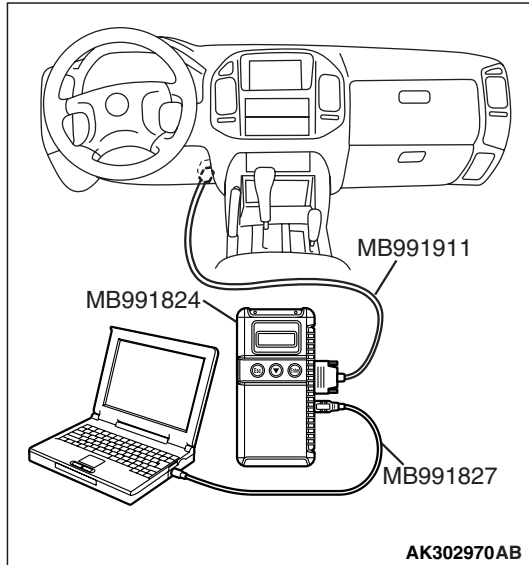
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 39, Heated Oxygen Sensor Bank 1, Sensor 1 (right 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.

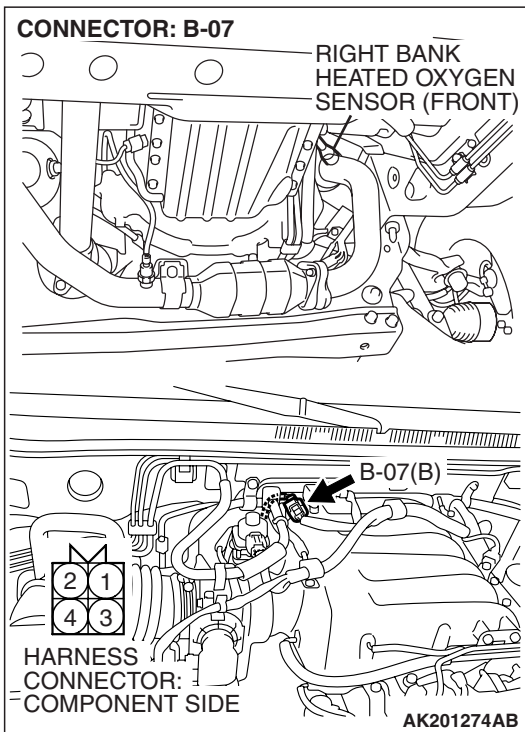
Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

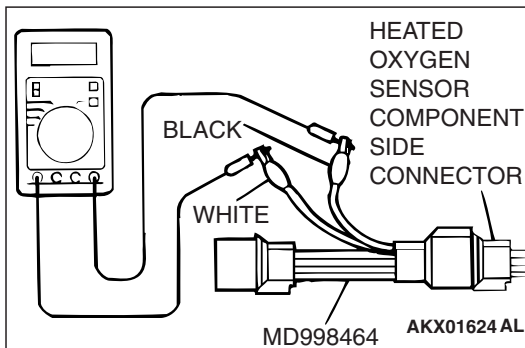
NO : Go to Step 2.



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



- (1) Disconnect the right bank heated oxygen sensor (front) connector B-07 and connect test harness special tool MD998464 to the connector on the right bank heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.



- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the right bank heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 (red clip) and the terminal No. 3 (blue clip) of the heated oxygen sensor with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the voltage between 0.6 and 1.0 volt?

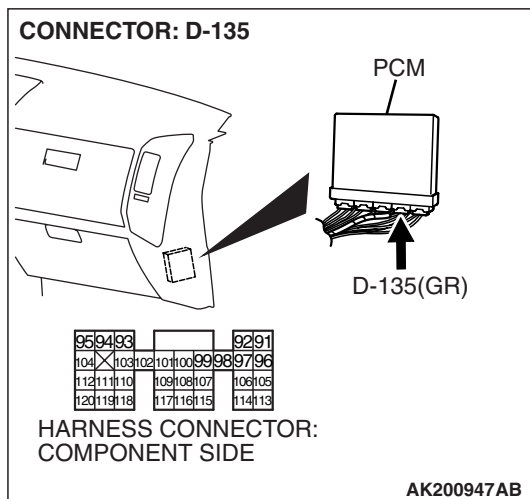
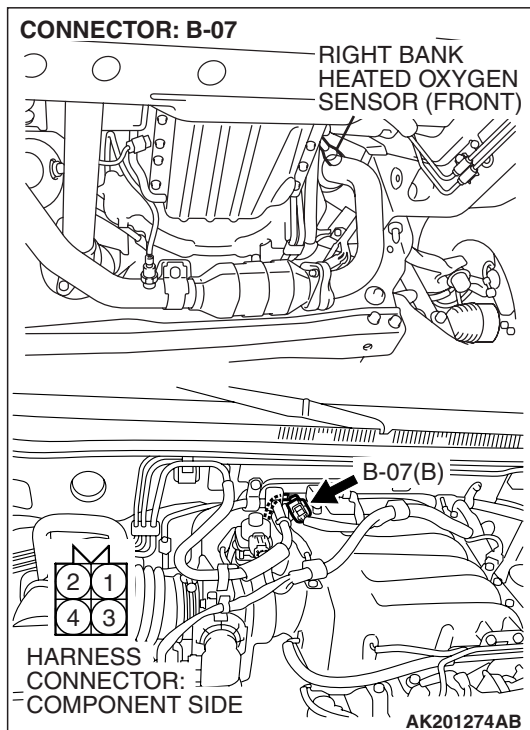
YES : Go to Step 3.

NO : Replace the right bank heated oxygen sensor (front). Then go to Step 4.

STEP 3. Check harness connector B-07 at right bank heated oxygen sensor (front) and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

- YES :** Replace the PCM. 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. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 1 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0133 set?

- YES :** Retry the troubleshooting.
- NO :** The inspection is complete.

DTC P0134: Heated Oxygen Sensor Circuit No Activity Detected (bank 1, sensor 1)

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

- Refer to DTC P0130 – Heated Oxygen Sensor Circuit (bank 1, sensor 1) [P.13A-225](#).
- Refer to DTC P0201 – P0206, Injector Circuit [P.13A-436](#).

CIRCUIT OPERATION

- Refer to DTC P0130 – Heated Oxygen Sensor Circuit (bank 1, sensor 1) [P.13A-248](#).
- Refer to DTC P0201 – P0206, Injector Circuit [P.13A-436](#).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (front) output voltage does not cross 0.5 volt within specified period.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

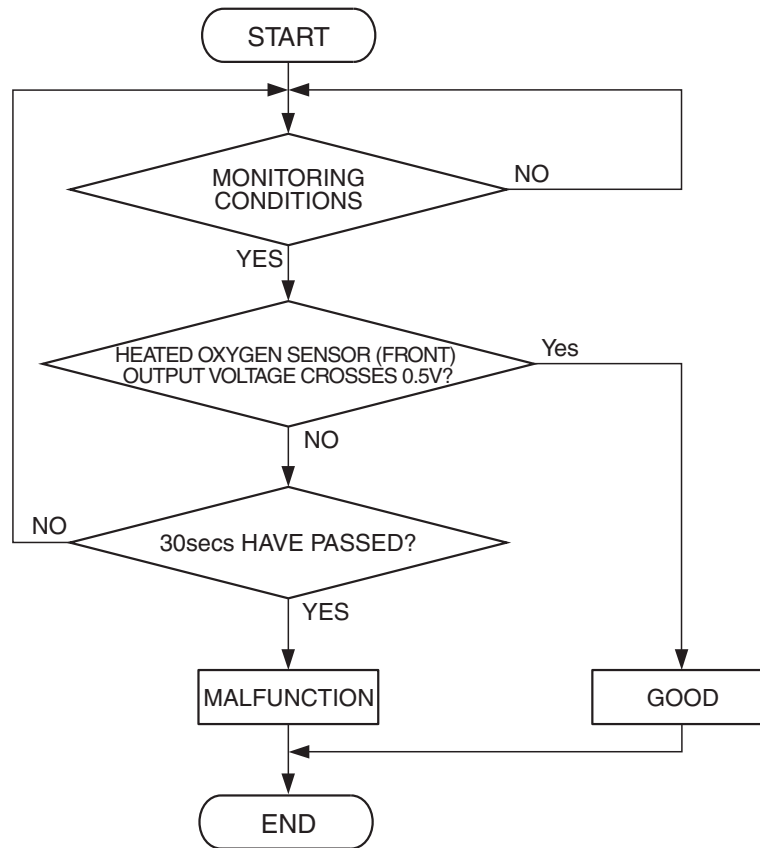
- Misfire monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302933

Check Conditions

- 20 seconds or more have passed since the engine starting sequence was completed.
- Engine coolant temperature is higher than 7°C (45°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 30 percent.
- Throttle position sensor output voltage is lower than 4 volts.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Right bank heated oxygen sensor (front) deteriorated.
- Harness damage in right bank heated oxygen sensor (front) output line.
- Right bank heated oxygen sensor (rear) deteriorated.

NOTE: When the right bank 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 right bank heated oxygen sensor (rear).

If the right bank heated oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the right bank heated oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the right bank 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 right bank injector.
- Harness damage in right bank injector circuit.
- Connector damage.
- PCM failed.
- Exhaust leak.
- Air drawn in from gaps in gasket, seals, etc.
- Incorrect fuel pressure.

DIAGNOSIS

Required Special Tools:

- 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 MB991958, check data list item 69: Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).

⚠ CAUTION

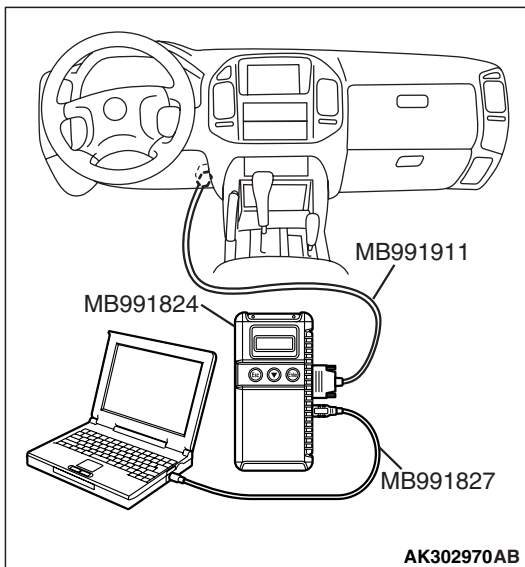
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 69, Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (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 (bank 1, sensor 2) DTC [P.13A-269](#), P0137 – Heated Oxygen Sensor Circuit Low Voltage (bank 1, sensor 2) [P.13A-285](#), DTC P0138 – Heated Oxygen Sensor Circuit High Voltage (bank 1, sensor 2) [P.13A-292](#), DTC P0139 – Heated Oxygen Sensor Circuit Slow Response (bank 1, sensor 2) [P.13A-297](#), P0140 – Heated Oxygen Sensor Circuit No Activity Detected (bank 1, sensor 2) [P.13A-301](#).

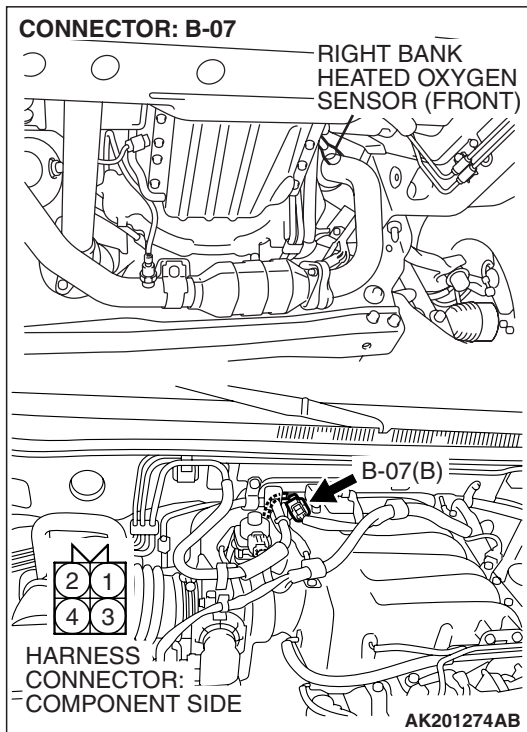


STEP 2. Check for exhaust leak.

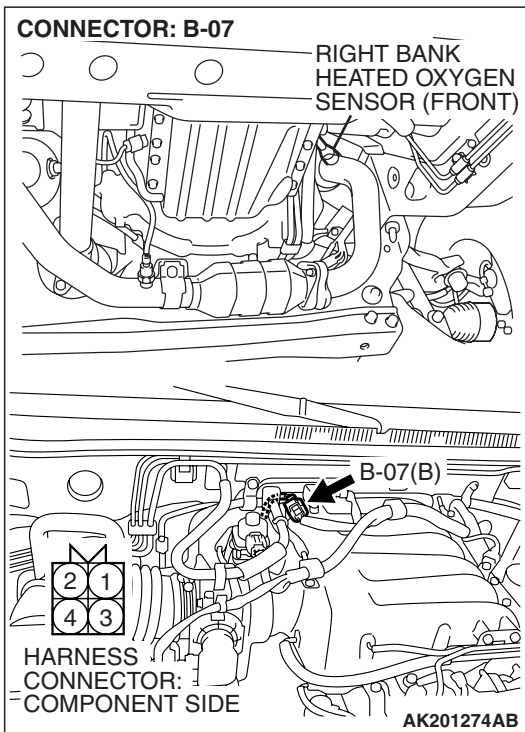
Q: Are there any abnormalities?

YES : Repair it. Then go to Step 14.

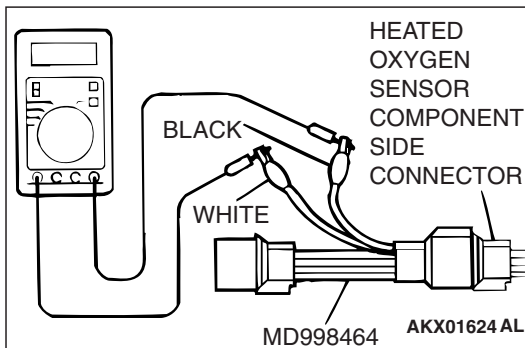
NO : Go to Step 3.

STEP 3. Check for intake system vacuum leak.**Q: Are there any abnormalities?****YES :** Repair it. Then go to Step 14.**NO :** Go to Step 4.**STEP 4. Check harness connector B-07 at the right bank 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 14.

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



- (1) Disconnect the right bank heated oxygen sensor (front) connector B-07 and connect test harness special tool MD998464 to the connector on the right bank heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.



- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the right bank heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

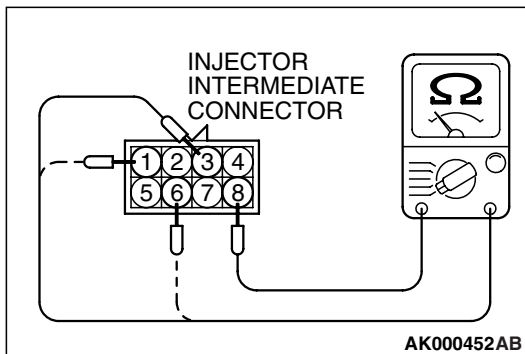
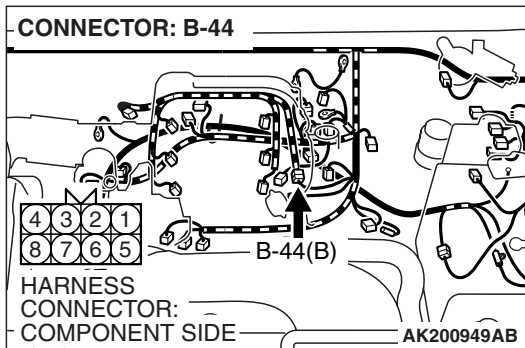
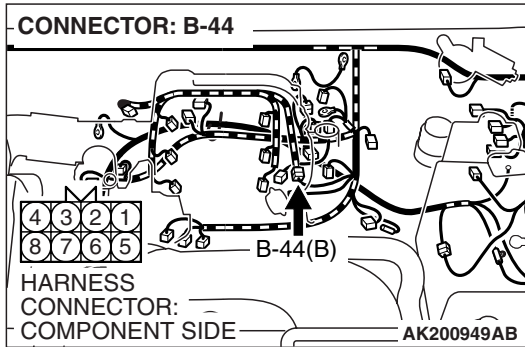
- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 (red clip) and the terminal No. 3 (blue clip) of the heated oxygen sensor with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 6.

NO : Replace the right bank heated oxygen sensor (front). Then go to Step 14.



STEP 6. Check harness connector B-44 at intermediate connector 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 14.

STEP 7. Measure the right bank injector resistance at intermediate connector B-44.

(1) Disconnect the intermediate connector B-44.

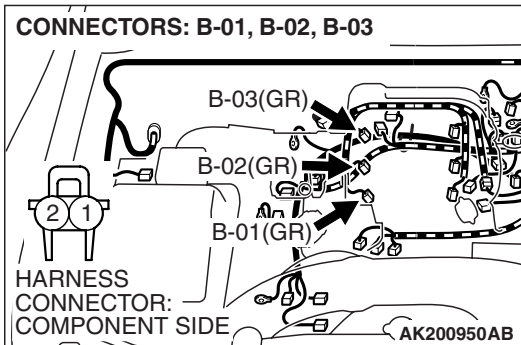
(2) Measure the resistance between each male connector side connector terminal.

- a. Measure the resistance between terminal No. 3 and No. 8 at No. 1 cylinder.
- b. Measure the resistance between terminal No. 1 and No. 8 at No. 3 cylinder.
- c. Measure the resistance between terminal No. 6 and No. 8 at No. 5 cylinder.
 - Resistance should be between 13 and 16 ohms [at 20°C (68° F)].

Q: Is the measured resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Go to Step 10.

NO : Go to Step 8.



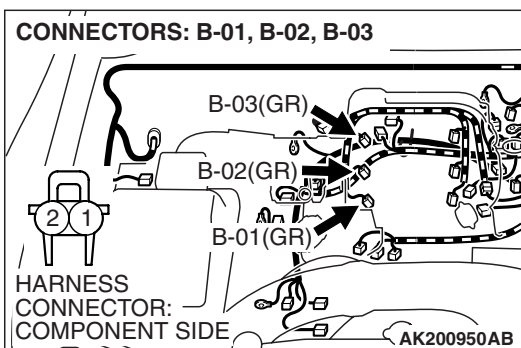
STEP 8. Check harness connector B-01, B-02, B-03 at right bank injector for damage.

- (1) Remove the intake manifold.
- (2) Check the right bank injector connector, which deviates from the standard value at Step 7.

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 the right bank injector.

- (1) Check the right bank injector, which deviates from the standard value at Step 7.

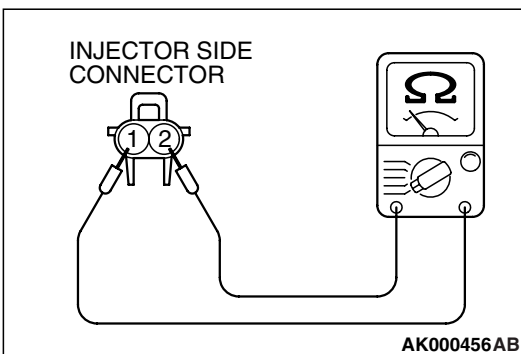
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 13 – 16 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Repair harness wire between injector intermediate connector and right bank injector connector because of harness damage. Then go to Step 14.

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

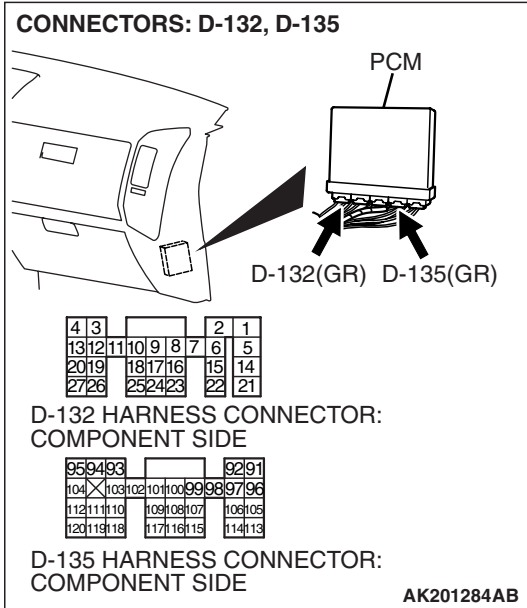


STEP 10. Check harness connector D-132, D-135 at PCM for damage.

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.

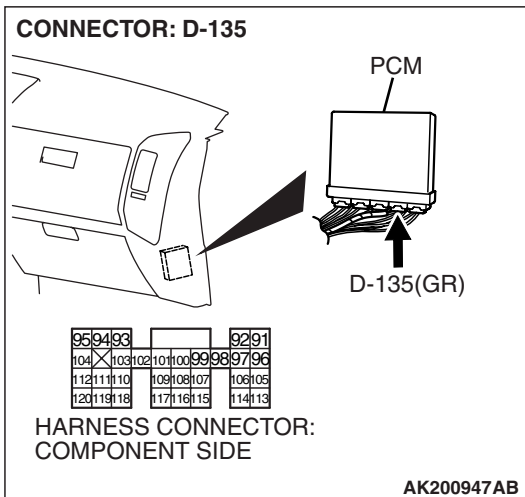
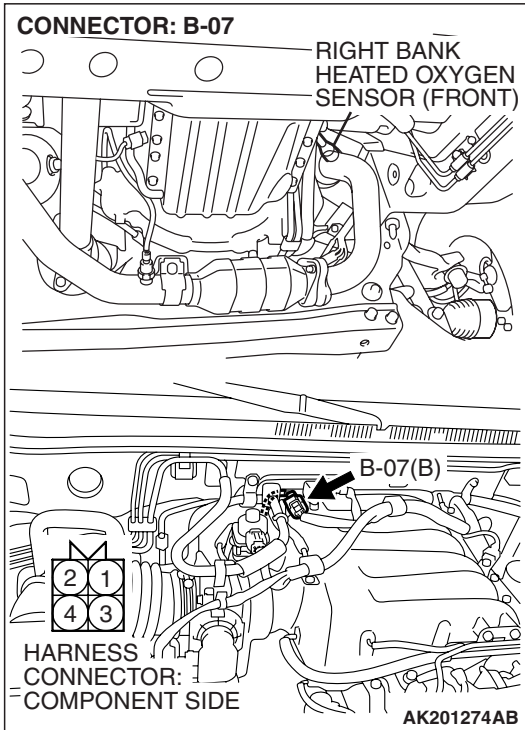


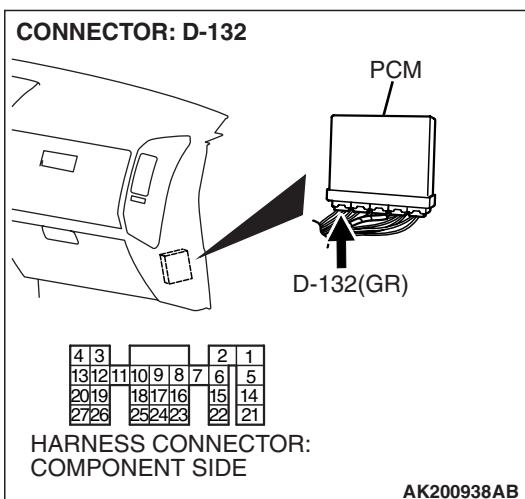
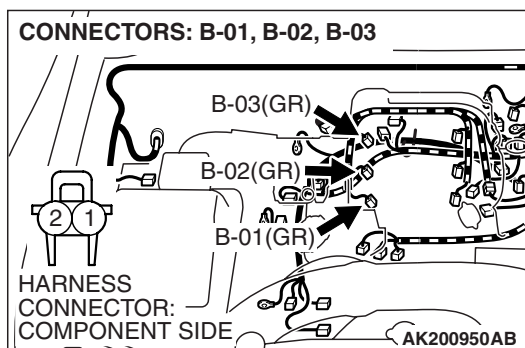
STEP 11. Check for harness damage between right bank heated oxygen sensor (front) connector B-07 (terminal No. 4) and PCM connector D-135 (terminal No. 109).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.





STEP 12. Check for harness damage between right bank injector connector and PCM connector.

- Check the harness wire between right bank injector connector B-01 (terminal No. 2) and PCM connector D-132 (terminal No. 1) at No. 1 cylinder.
- Check the harness wire between right bank injector connector B-02 (terminal No. 2) and PCM connector D-132 (terminal No. 14) at No. 3 cylinder.
- Check the harness wire between right bank injector connector B-03 (terminal No. 2) and PCM connector D-132 (terminal No. 2) at No. 5 cylinder.

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 fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-1048](#).

Q: Is the fuel pressure normal?

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

NO : Repair it. Then go to Step 14.

STEP 14. Test the OBD-II drive cycle.

- Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).
- Check the diagnostic trouble code (DTC).

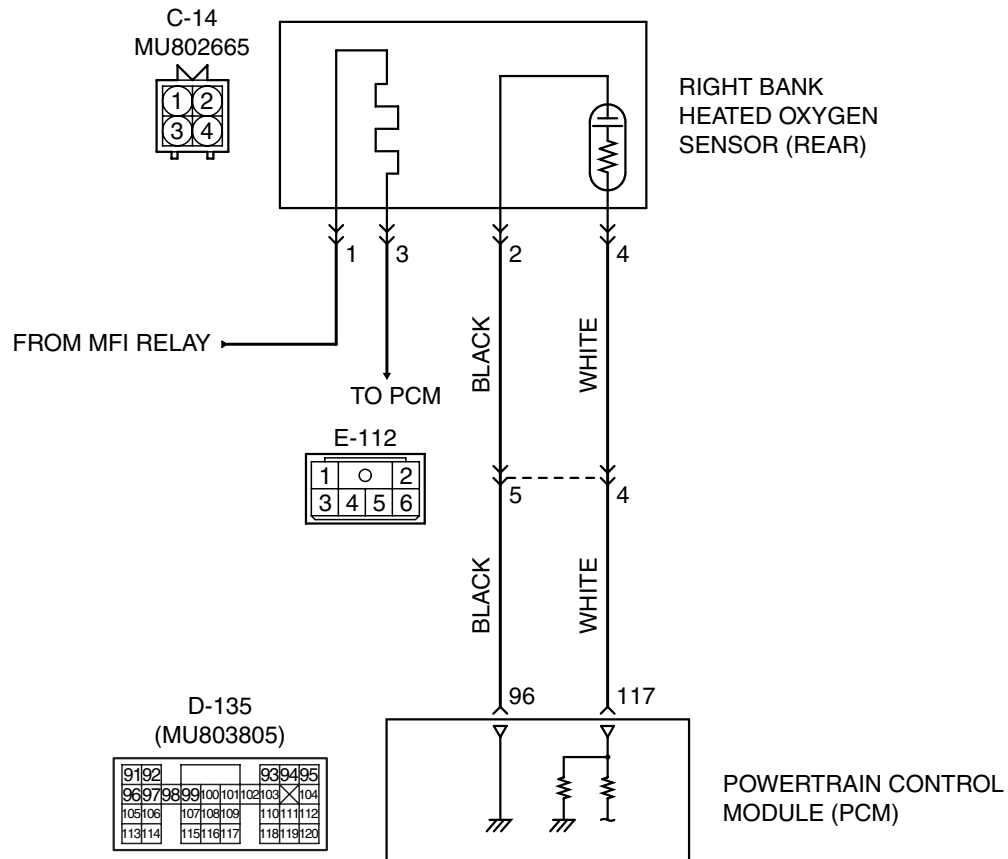
Q: Is DTC P0134 set?

YES : Retry the troubleshooting.

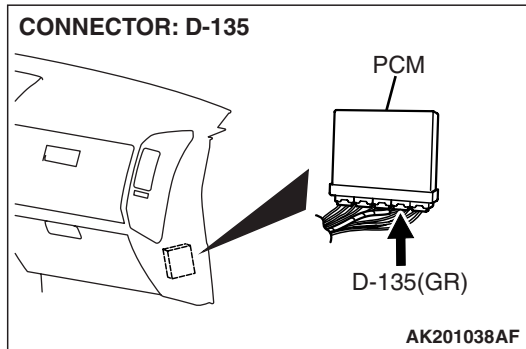
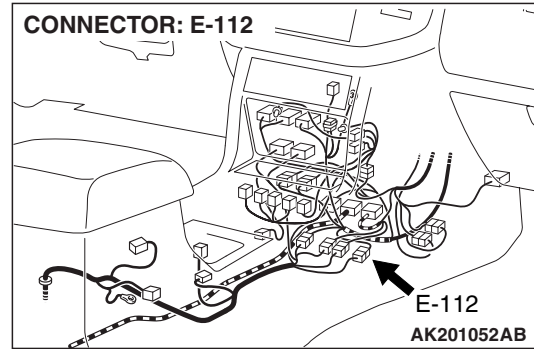
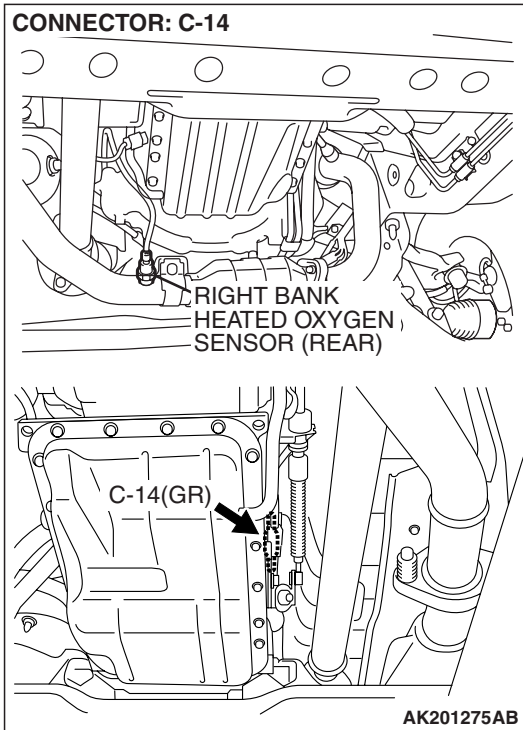
NO : The inspection is complete.

DTC P0136: Heated Oxygen Sensor Circuit (bank 1, sensor 2)

Right Bank Heated Oxygen Sensor (rear) Circuit



AK501059



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 117) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (rear).
- Terminal No. 2 of the right bank heated oxygen sensor (rear) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (rear) circuit is switched to 5 volts intentionally when oxygen sensor output is low, and detects the malfunction if the output voltage changes to equal or greater than 4.5 volts. The above procedure is repeated when oxygen sensor is inactive.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Check Conditions

- 3 minutes or more have passed since the engine starting sequence was completed.
- Right bank 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.

Judgement Criterion

- Input voltage supplied to the PCM interface circuit is higher than 4.5 volts when 5 volts is applied to the right bank heated oxygen sensor (rear) output line via a resistor.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Right bank heated oxygen sensor (rear) failed.
- Open or shorted circuit in right bank heated oxygen sensor (rear) output line, or harness damage.
- Open circuit in right bank heated oxygen sensor (rear) ground line, or harness damage.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MB991316: Test Harness

STEP 1. Using scan tool MB991958, check data list item 69: Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).

⚠ CAUTION

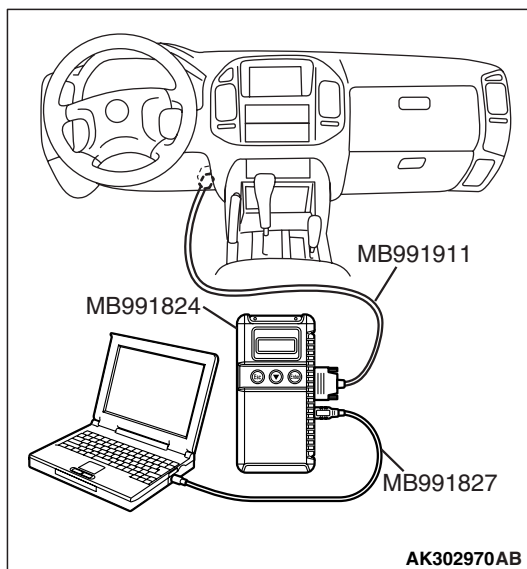
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 69, Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

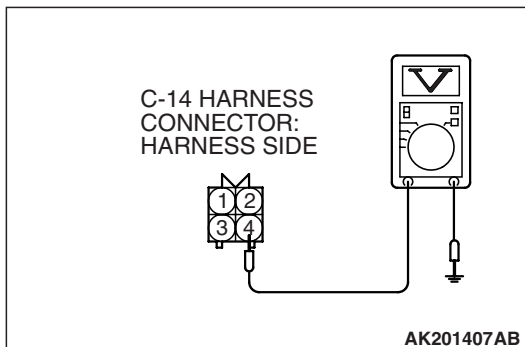
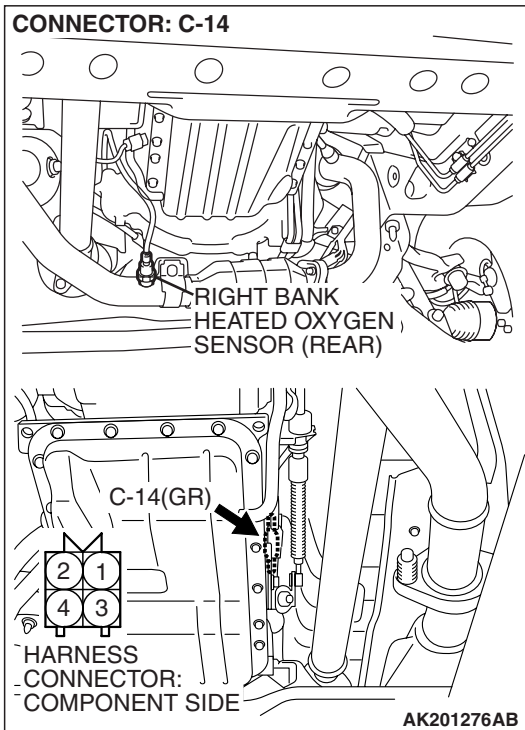
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.



STEP 2. Measure the sensor output voltage at right bank heated oxygen sensor (rear) connector C-14 by backprobing

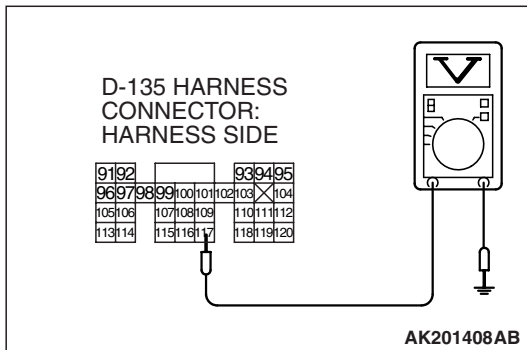
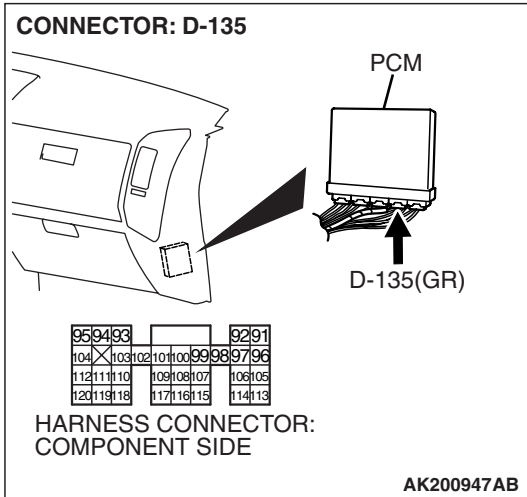
- (1) Do not disconnect the connector C-14.
- (2) Start the engine and run at idle.



- (3) Measure the voltage between terminal No. 4 and ground by backprobing.
 - Warming 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 voltage normal?

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



STEP 3. Measure the sensor output voltage at PCM connector D-135 by backprobing

- (1) Do not disconnect the connector D-135.
- (2) Start the engine and run at idle.

- (3) Measure the voltage between terminal No. 117 and ground by backprobing.
 - Warming 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 voltage normal?

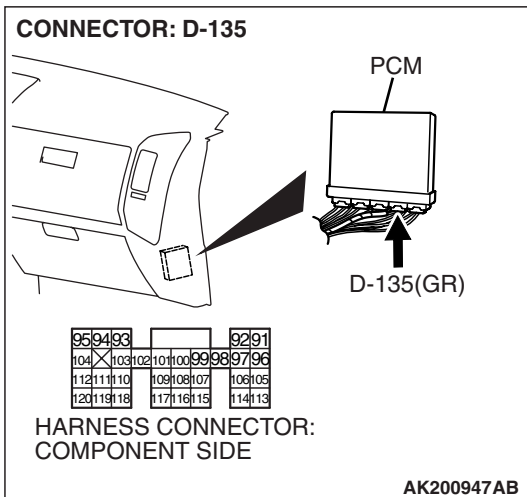
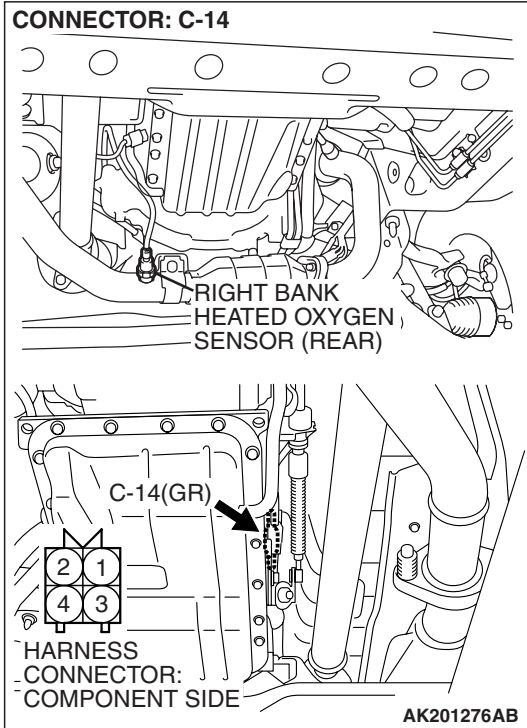
- YES :** Go to Step 4.
NO : Go to Step 6.

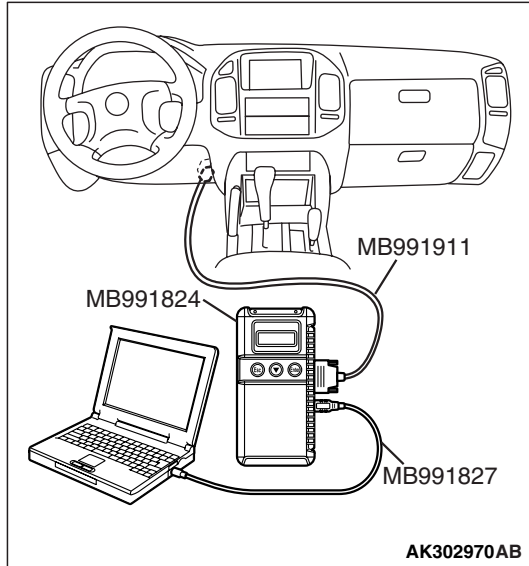
STEP 4. Check harness connector C-14 at right bank heated oxygen sensor (rear) and harness connector D-135 at PCM for damage.

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 15.





STEP 5. Using scan tool MB99158, check data list item 69: Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).

⚠ CAUTION

To prevent damage to scan tool MB99158, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB99158.

- (1) Connect scan tool MB99158 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB99158 to the data reading mode for item 69, Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

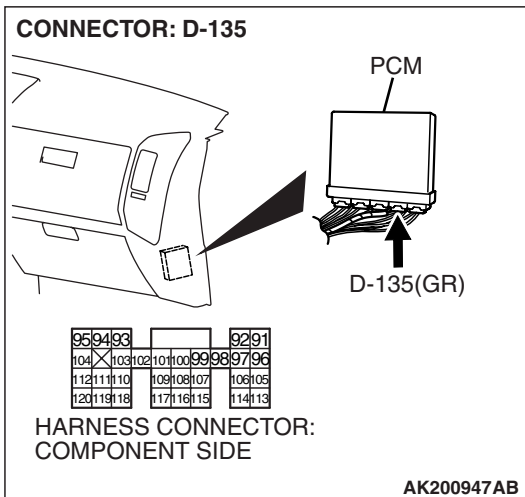
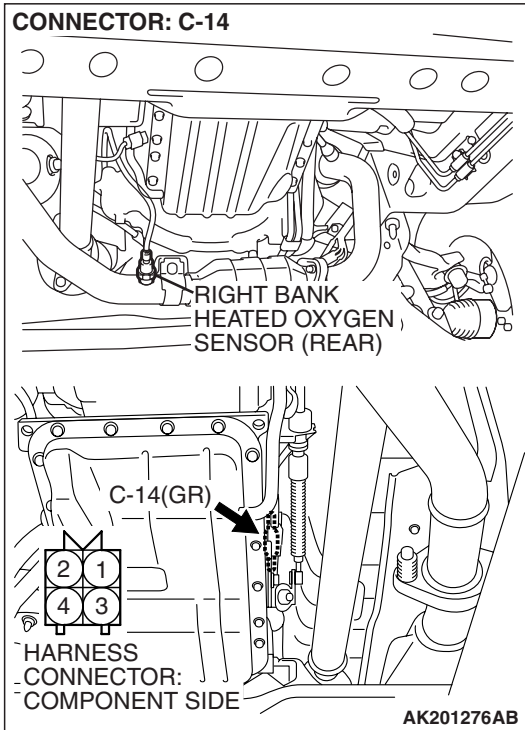
NO : Replace the PCM. Then go to Step 15.

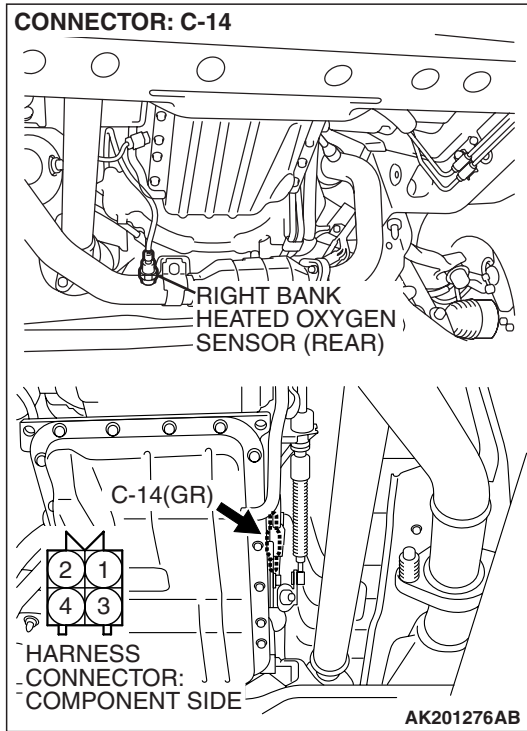
STEP 6. Check harness connector C-14 at right bank heated oxygen sensor (rear) and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector E-112 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector E-112 is in good condition, repair harness wire between right bank heated oxygen sensor (rear) connector C-14 (terminal No. 4) and PCM connector D-135 (terminal No. 117) 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.



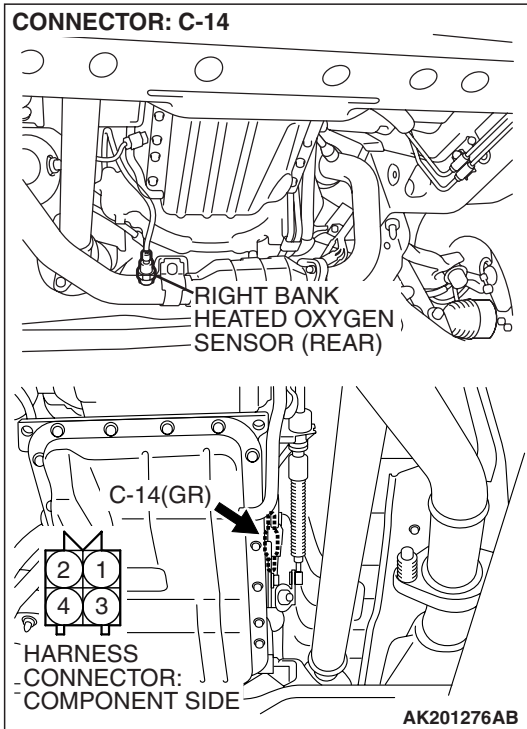


STEP 7. Check harness connector C-14 at right bank heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

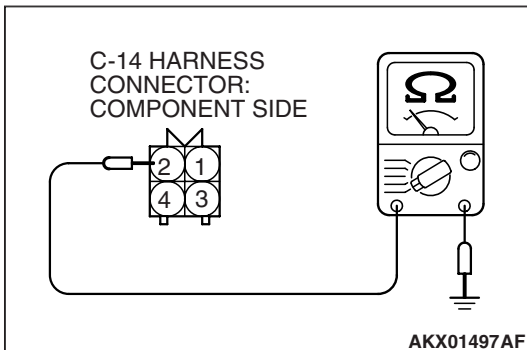
YES : Go to Step 8.

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



STEP 8. Check the continuity at right bank heated oxygen sensor (rear) harness side connector C-14.

(1) Disconnect the connector C-14 and measure at the harness side.



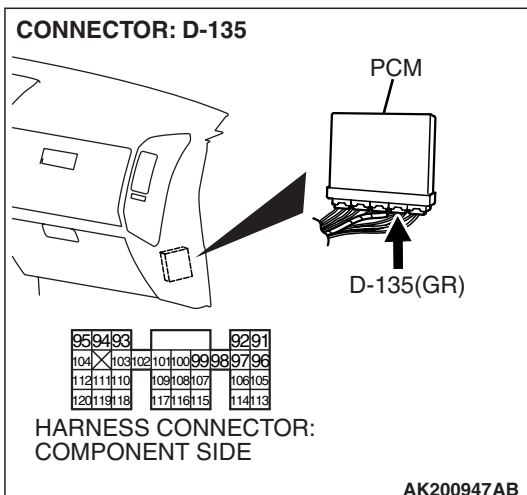
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.



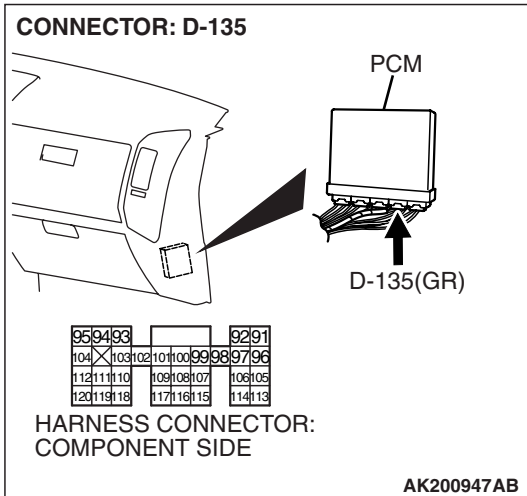
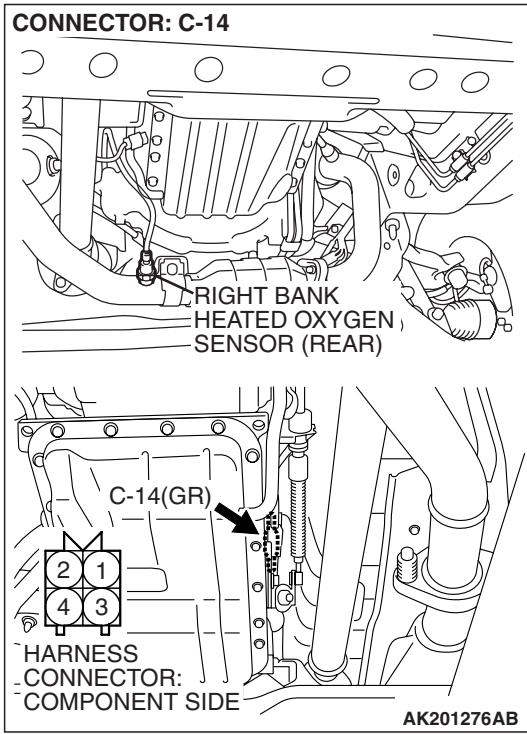
STEP 9. Check harness connector D-135 at PCM for damage.

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 right bank heated oxygen sensor (rear) connector C-14 (terminal No. 2) and PCM connector D-135 (terminal No. 96).



NOTE: Check harness after checking intermediate connector E-112. If intermediate connector E-112 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

Q: Is the harness wire in good condition?

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

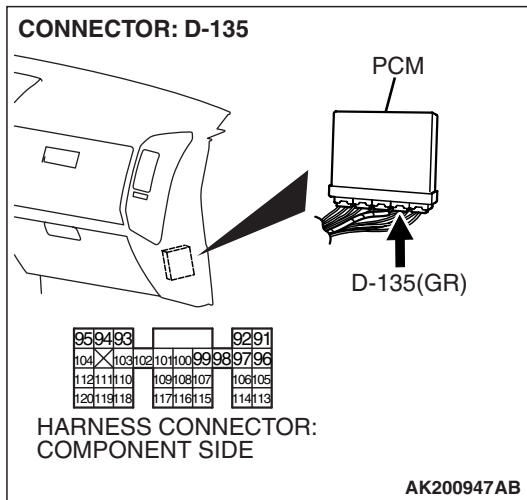
NO : Repair it. Then go to Step 15.

STEP 11. Check harness connector D-135 at PCM for damage.

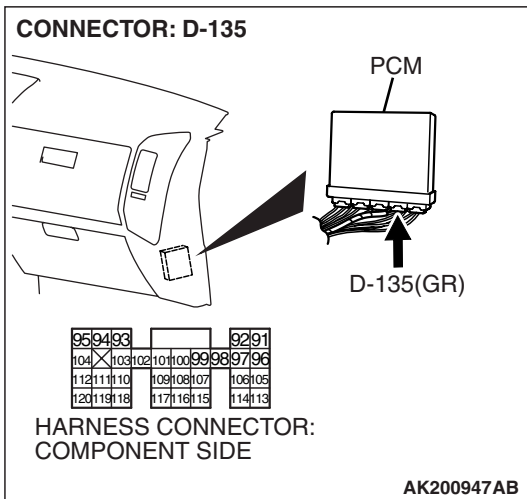
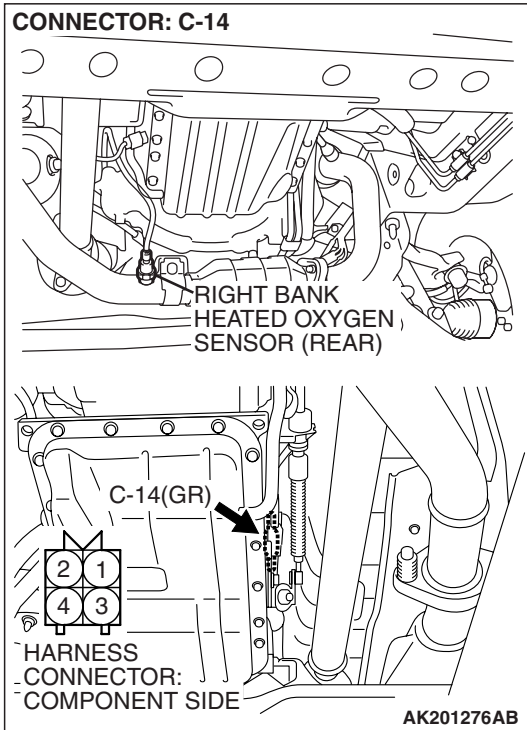
Q: Is the harness connector in good condition?

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 right bank heated oxygen sensor (rear) connector C-14 (terminal No. 2) and PCM connector D-135 (terminal No. 96).



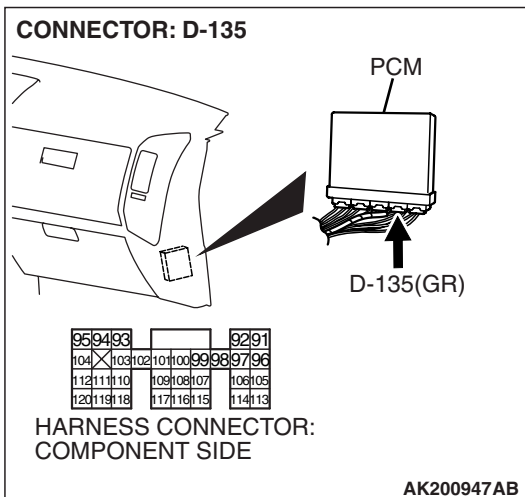
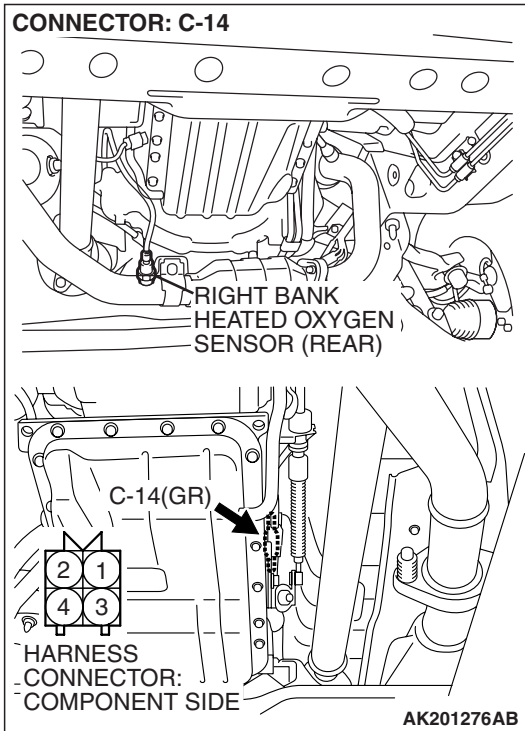
NOTE: Check harness after checking intermediate connector E-112. If intermediate connector E-112 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

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 right bank heated oxygen sensor (rear) connector C-14 (terminal No. 4) and PCM connector D-135 (terminal No. 117).

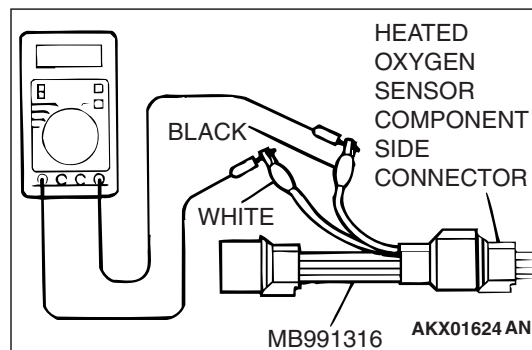
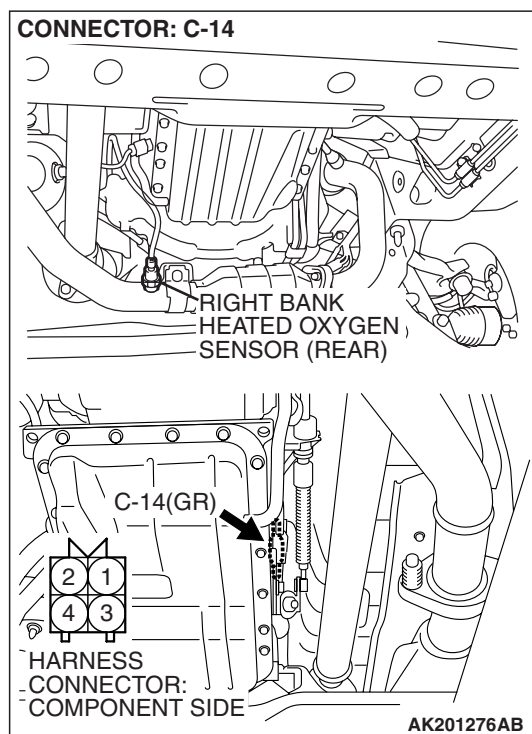


NOTE: Check harness after checking intermediate connector E-112. If intermediate connector E-112 is damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

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 right bank heated oxygen sensor (rear).**

- (1) Disconnect the right bank heated oxygen sensor (rear) connector C-14 and connect test harness special tool MB991316 to the connector on the right bank heated oxygen sensor (rear) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Drive at 50 km/h (31 mph) or more for 10 minutes.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) Measure the output voltage of heated oxygen sensor under the following driving.
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more

Standard value: 0.6 – 1.0 volt

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio.

Q: Is the voltage between 0.6 and 1.0 volt?

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

NO : Replace the right bank heated oxygen sensor (rear). Then go to Step 15.

STEP 15. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

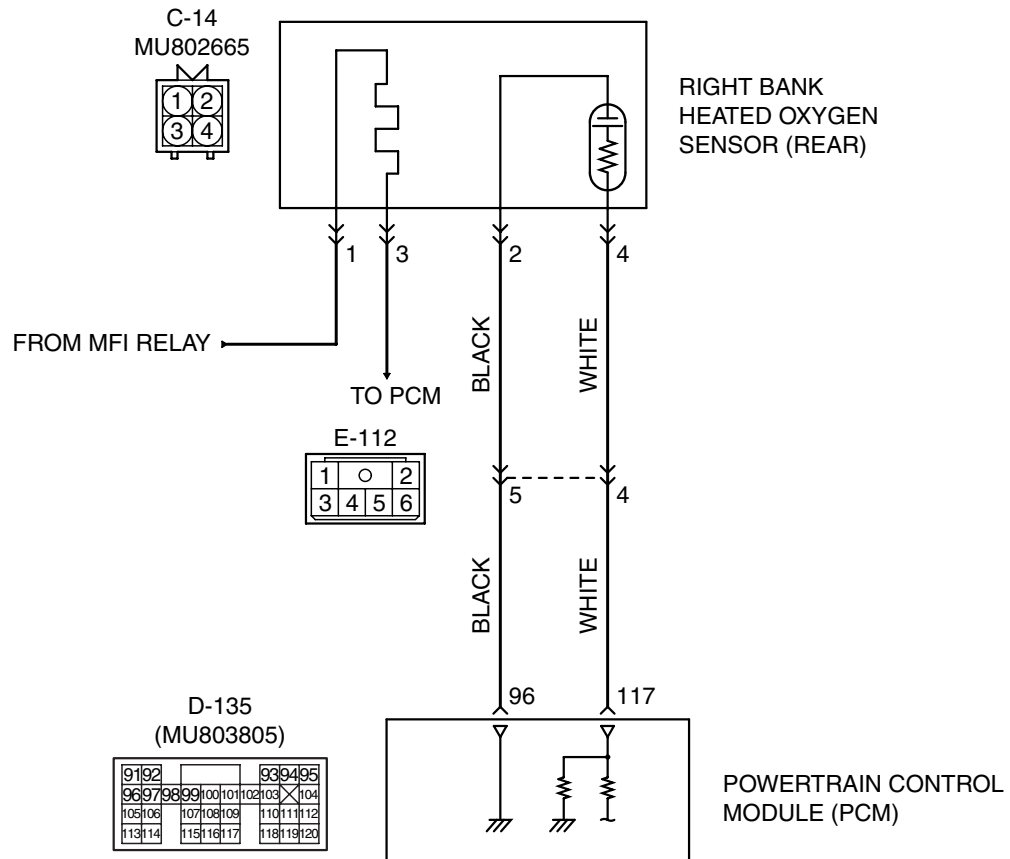
Q: Is DTC P0136 set?

YES : Retry the troubleshooting.

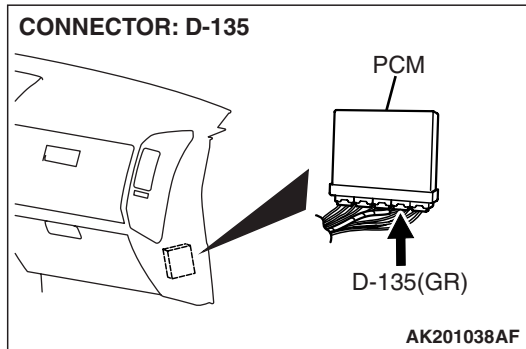
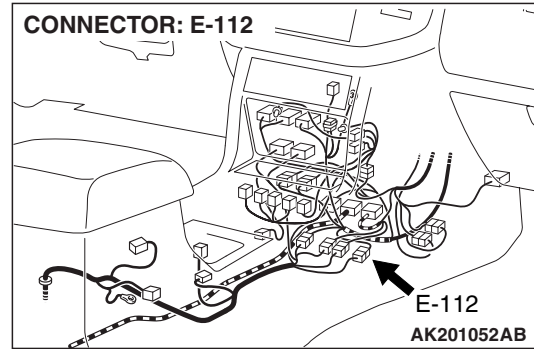
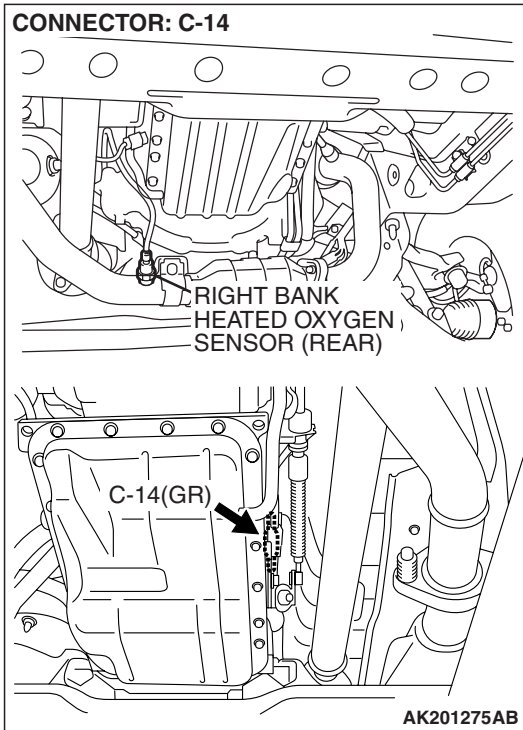
NO : The inspection is complete.

DTC P0137: Heated Oxygen Sensor Circuit Low Voltage (bank 1, sensor 2)

Right Bank Heated Oxygen Sensor (rear) Circuit



AK501059



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 117) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (rear).
- Terminal No. 2 of the right bank heated oxygen sensor (rear) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (rear) output voltage stays low when air/fuel ratio is forced to be rich. The above procedure is repeated when oxygen sensor is inactive.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

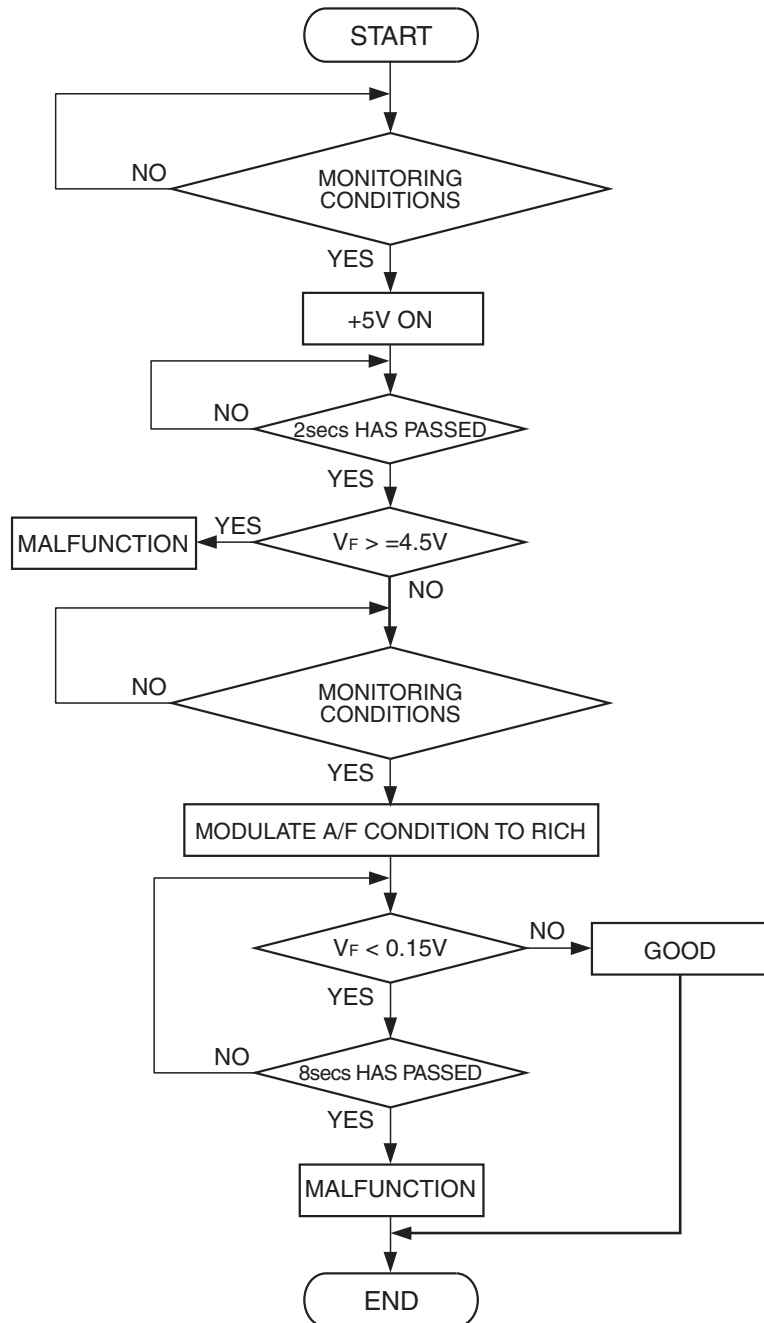
Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor

- Intake air temperature sensor
- Barometric pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

- After 2 seconds or more pass from the time when the monitor determines normally for detecting an open circuit.
- Right bank 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).
- Volume airflow sensor output frequency is higher than 100 Hz.
- At least 20 seconds have passed since fuel shut off control was canceled.

Judgement Criterion

- Making the air/fuel ratio 15 percent richer for 8 seconds does not result in raising the right bank heated oxygen sensor (rear) output voltage beyond 0.15 volt.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Right bank heated oxygen sensor (rear) failed.
- Short circuit in right bank heated oxygen sensor (rear) output line.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MB991316: Test Harness

STEP 1. Using scan tool MB991958, check data list item 69: Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).**⚠ CAUTION**

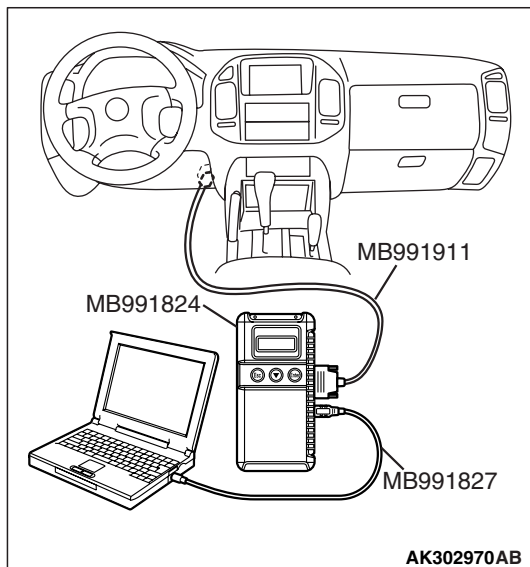
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

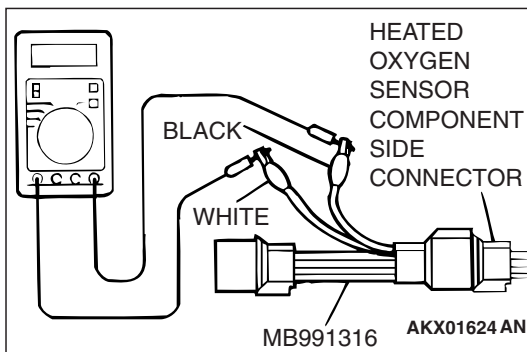
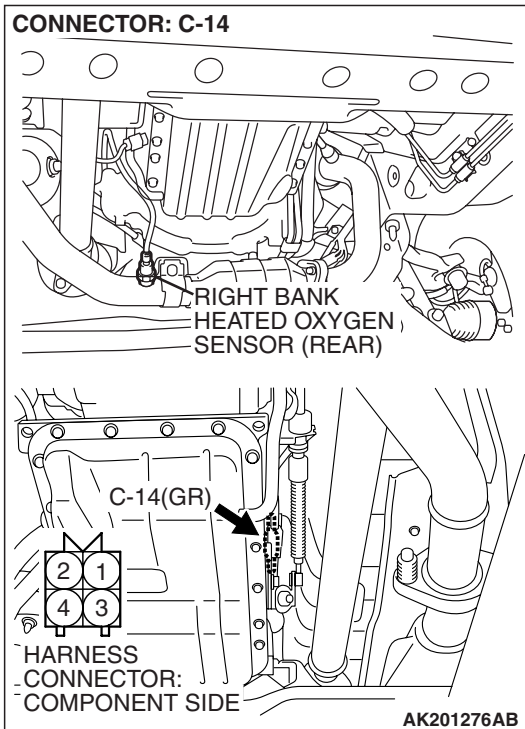
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 69, Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.





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

- (1) Disconnect the right bank heated oxygen sensor (rear) connector C-14 and connect test harness special tool MB991316 to the connector on the right bank heated oxygen sensor (rear) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Drive at 50 km/h (31 mph) or more for 10 minutes.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) Measure the output voltage of heated oxygen sensor under the following driving.
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more

Standard value: 0.6 – 1.0 volt

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio.

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 3.

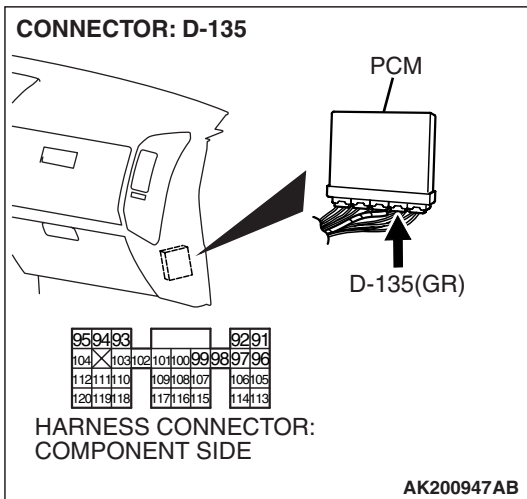
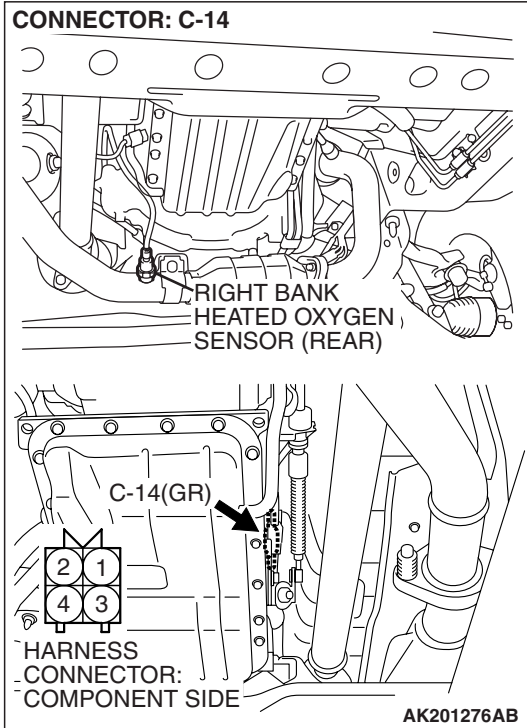
NO : Replace the right bank heated oxygen sensor (rear).
Then go to Step 5.

STEP 3. Check harness connector C-14 at right bank heated oxygen sensor (rear) and harness connector D-135 at PCM for damage.

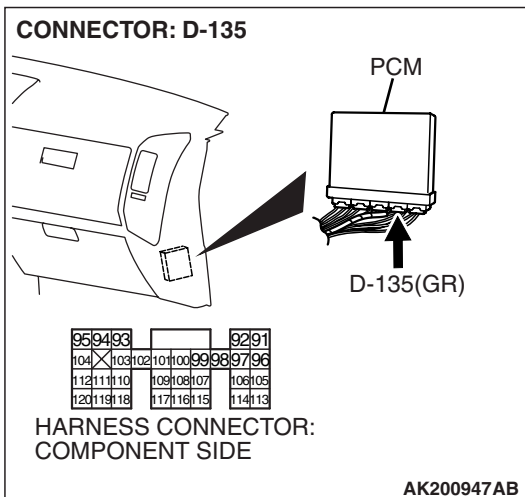
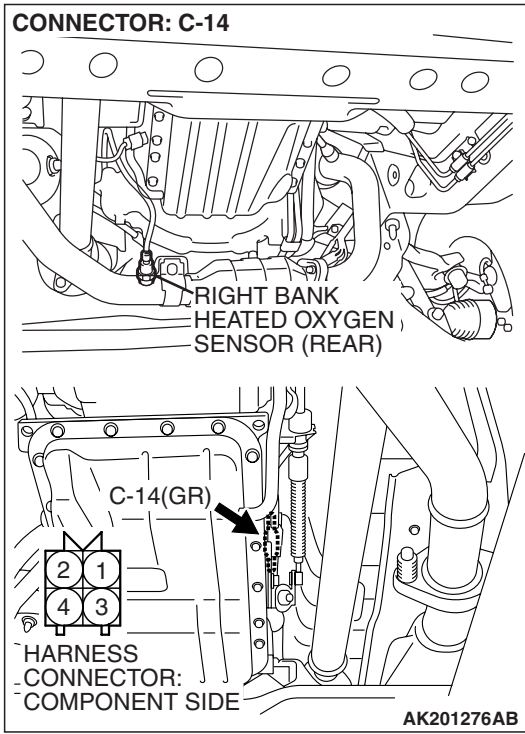
Q: Is the harness connector in good condition?

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 right bank heated oxygen sensor (rear) connector C-14 (terminal No. 4) and PCM connector D-135 (terminal No. 117).



NOTE: Check harness after checking intermediate connector, E-112. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 5.

STEP 5. Test the OBD-II drive cycle.

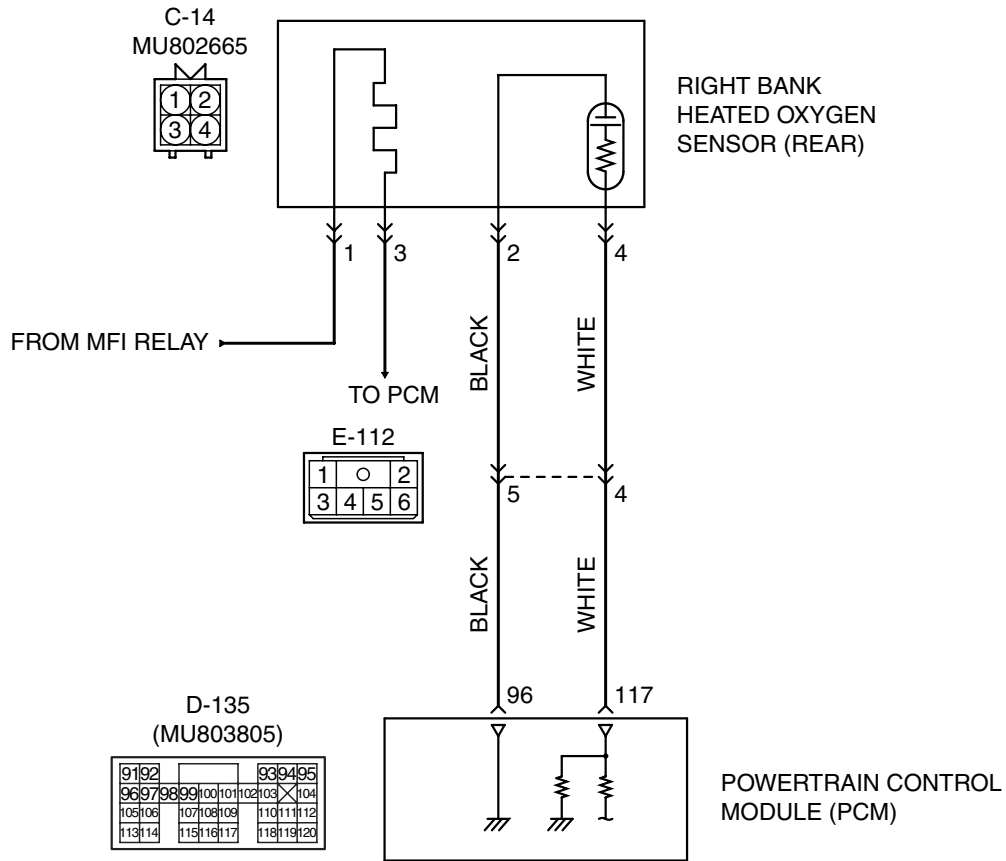
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 P.13A-4.
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0137 set?

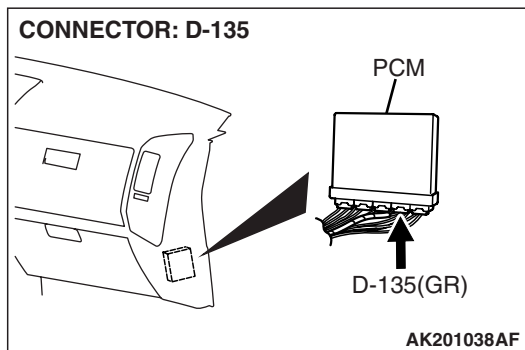
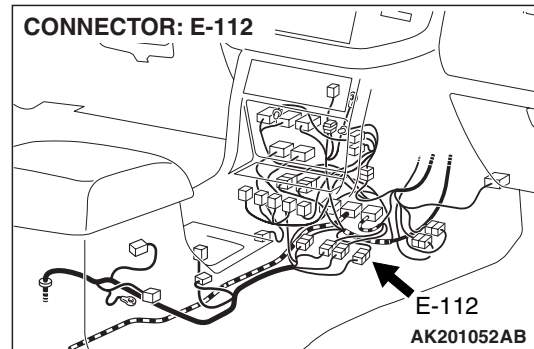
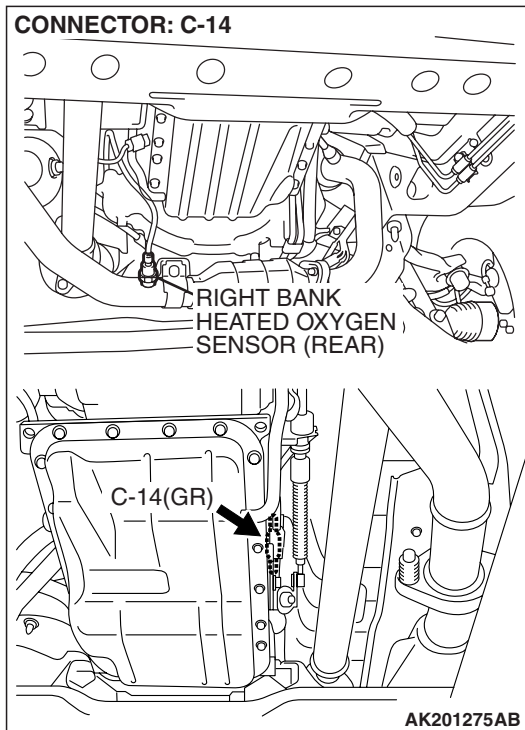
- YES :** Retry the troubleshooting.
NO : The inspection is complete.

DTC P0138: Heated Oxygen Sensor Circuit High Voltage (bank 1, sensor 2)

Right Bank Heated Oxygen Sensor (rear) Circuit



AK501059



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 117) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (rear).
- Terminal No. 2 of the right bank heated oxygen sensor (rear) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (rear) output voltage is over specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

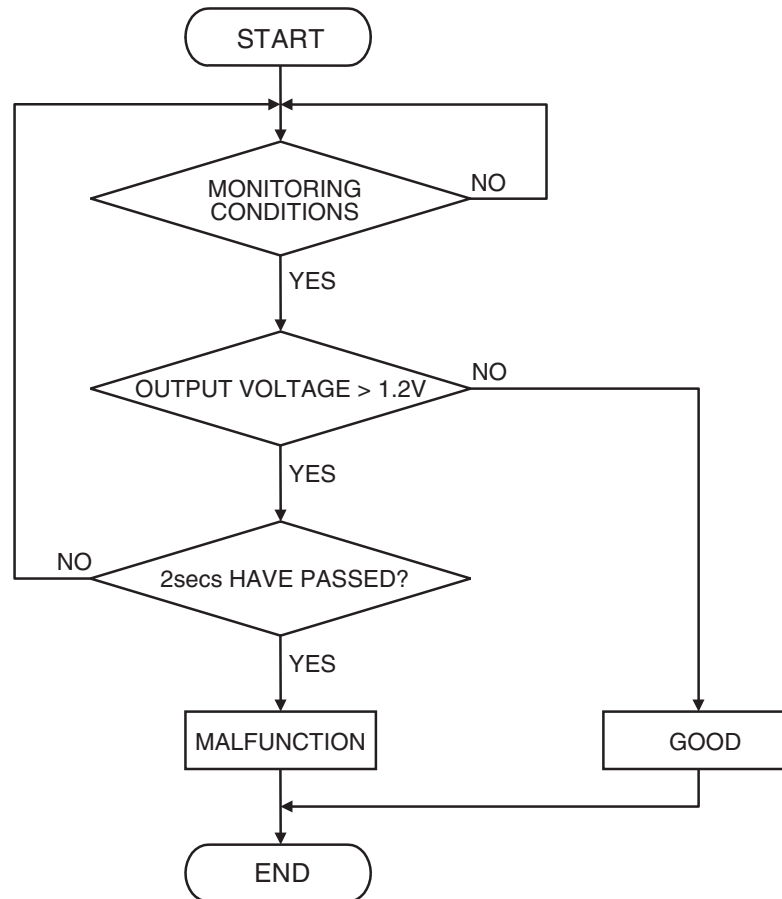
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302931

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-4](#).

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

- Short circuit in right bank heated oxygen sensor (rear) output line.
- Connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

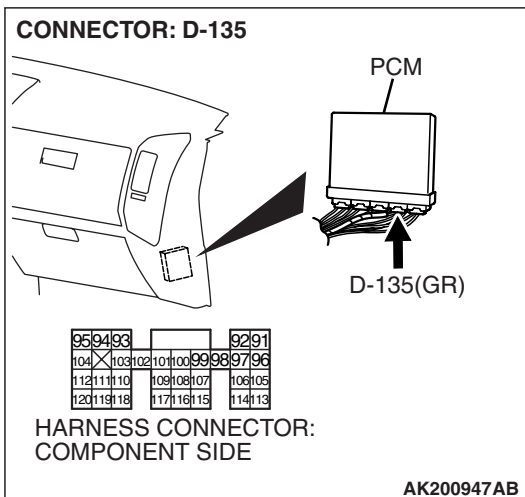
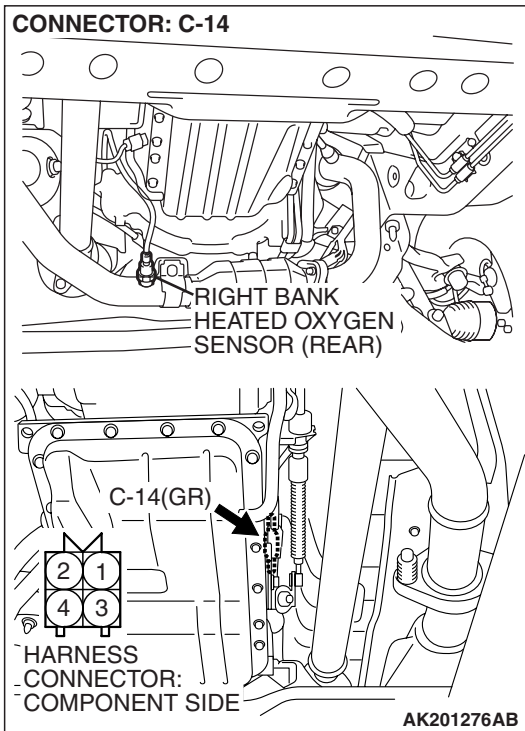
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Check harness connector C-14 at right bank heated oxygen sensor (rear) and harness connector D-135 at PCM for damage.

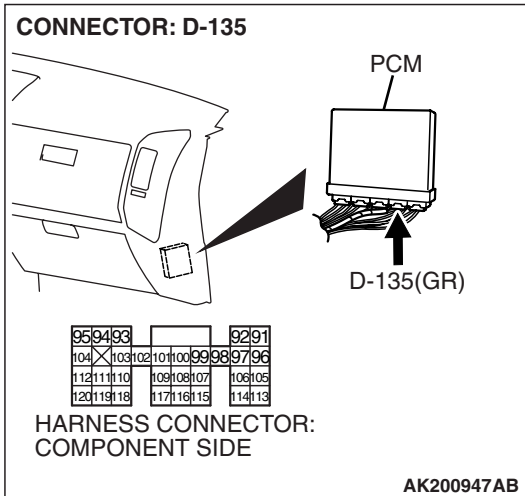
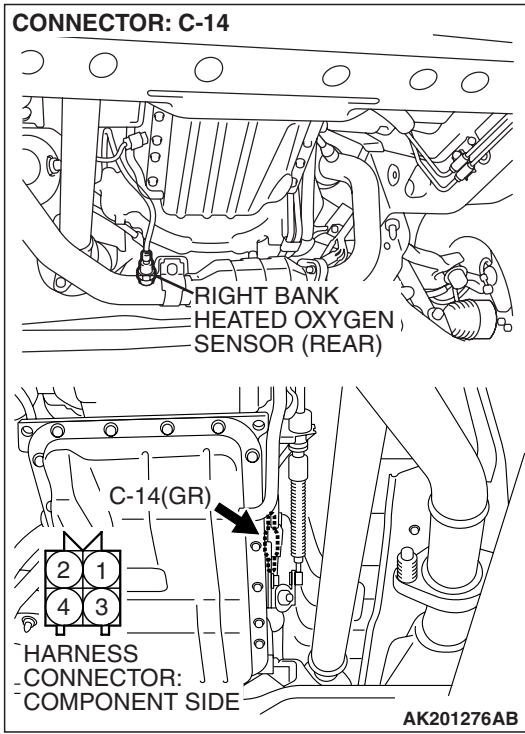
Q: Is the harness connector in good condition?

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 right bank heated oxygen sensor (rear) connector C-14 (terminal No. 4) and PCM connector D-135 (terminal No. 117).



NOTE: Check harness after checking intermediate connector E-112. If intermediate connector E-112 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 3.

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 3.

STEP 3. Test the OBD-II drive cycle.

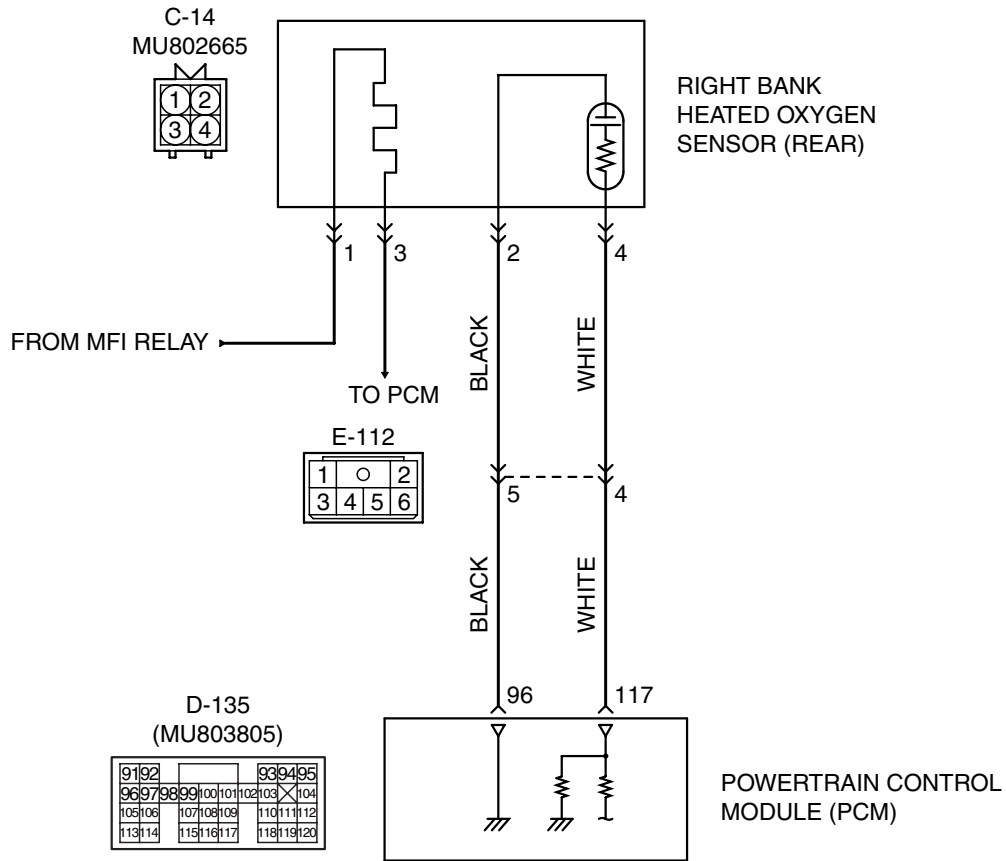
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0138 set?

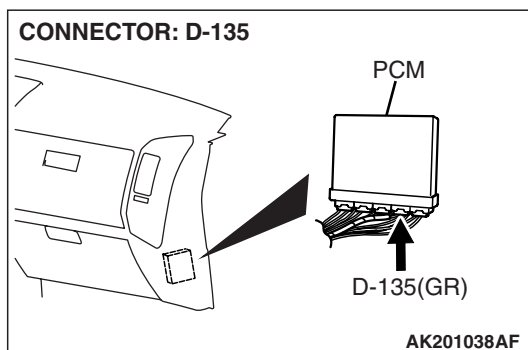
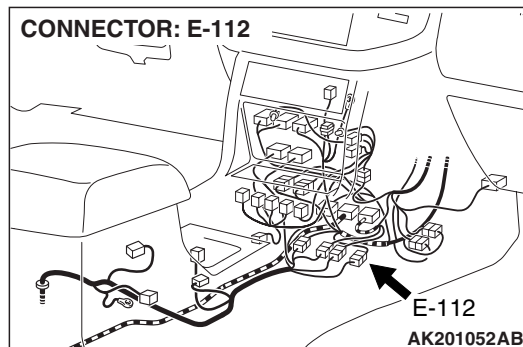
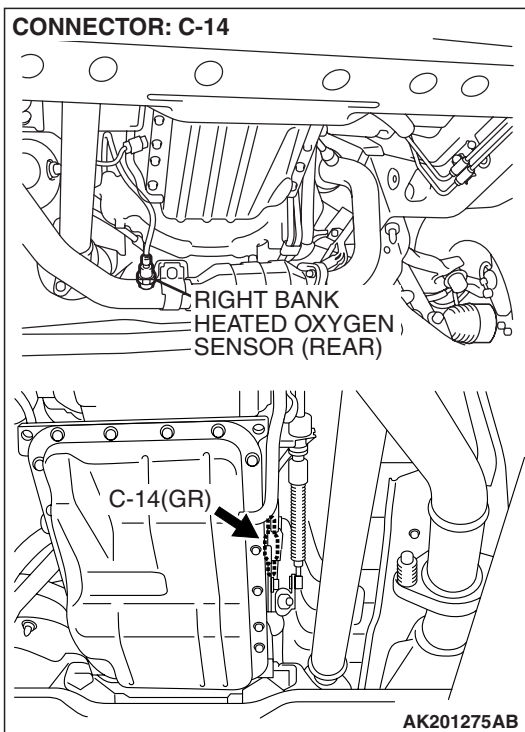
- YES :** Retry the troubleshooting.
NO : The inspection is complete.

DTC P0139: Heated Oxygen Sensor Circuit Slow Response (bank 1, sensor 2)

Right Bank Heated Oxygen Sensor (rear) Circuit



AK501059



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 117) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (rear).
- Terminal No. 2 of the right bank heated oxygen sensor (rear) is grounded with the PCM (terminal No. 96).
- The PCM applies an offset voltage of 0.5 volt to terminal No. 2 of the right bank heated oxygen sensor (rear)

TECHNICAL DESCRIPTION

- The output signal of the right bank heated oxygen sensor (front) is compensated by the output signal of the right bank heated oxygen sensor (rear).
- The PCM checks for the right bank heated oxygen sensor (rear) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (rear) output voltage does not reach 0.2 volt after fuel cut operation.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

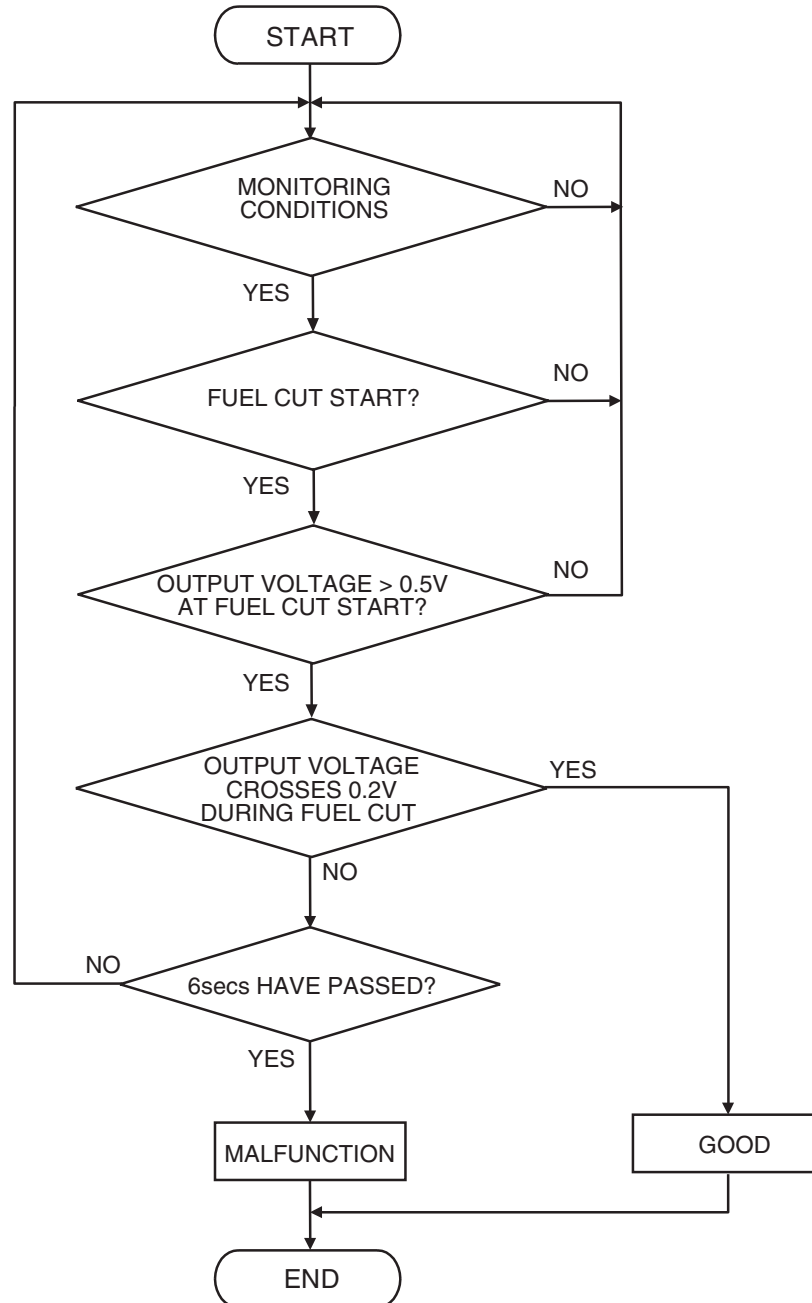
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



AK500043

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The right bank heated oxygen sensor (front) is active.
- The cumulative volume airflow sensor output is higher than 4,000 Hz.

- Fuel is being shut off.

Judgement Criterion

- Right bank oxygen sensor (rear) output voltage does not reach 0.2 volt for 6 seconds from fuel cut start.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-4](#).

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

- Right bank heated oxygen sensor (rear) failed.
- Connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

STEP 1. Replace the right bank heated oxygen sensor (rear).

- (1) Replace the right bank heated oxygen sensor (rear).
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-4](#).
- (3) Check the diagnostic trouble code (DTC).

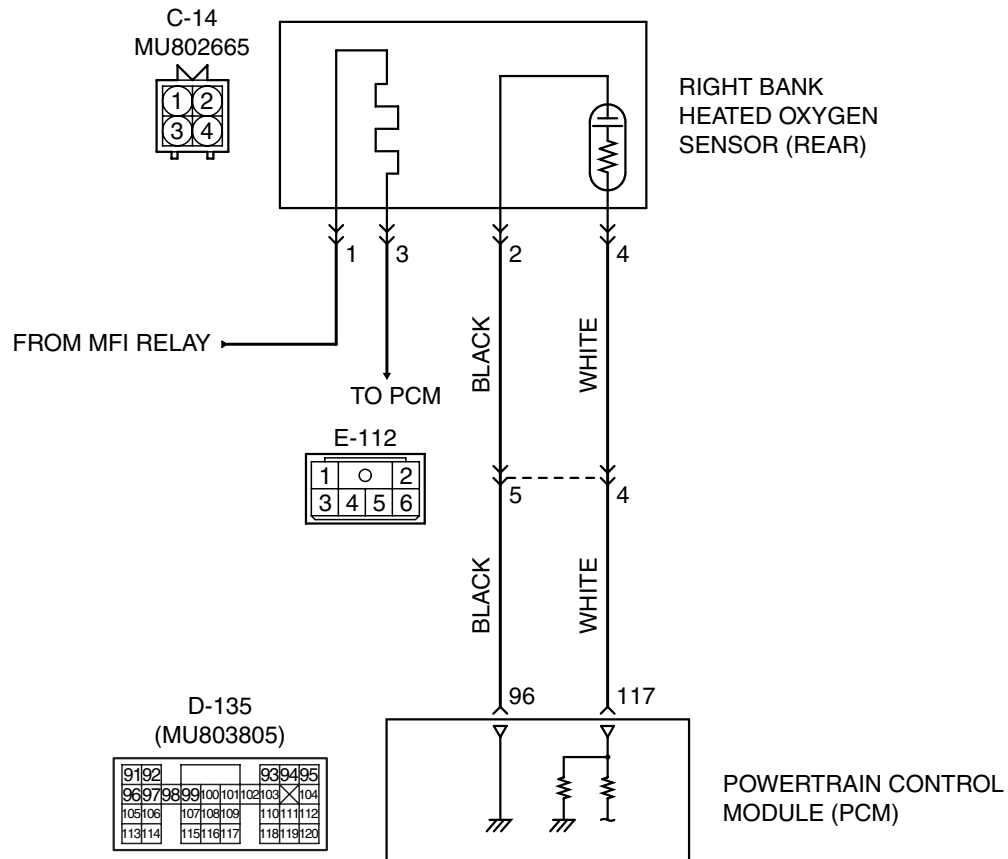
Q: Is DTC P0139 set?

YES : Refer to, P136 – Heated Oxygen Sensor Circuit (bank 1, sensor 2) [P.13A-269](#), P0137 – Heated Oxygen Sensor Circuit Low Voltage (bank 1, sensor 2) [P.13A-285](#), DTC P0138 – Heated Oxygen Sensor Circuit High Voltage (bank 1, sensor 2) [P.13A-292](#).

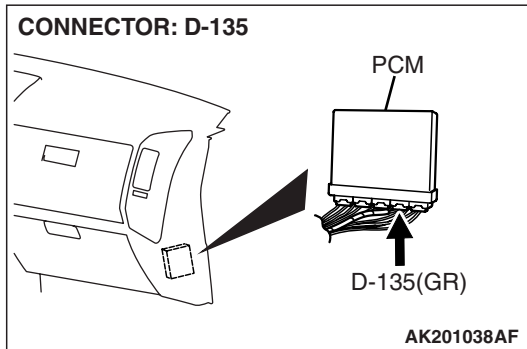
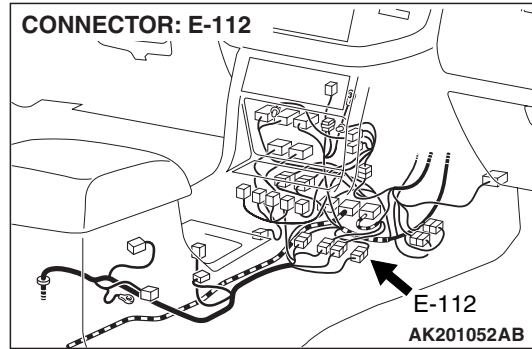
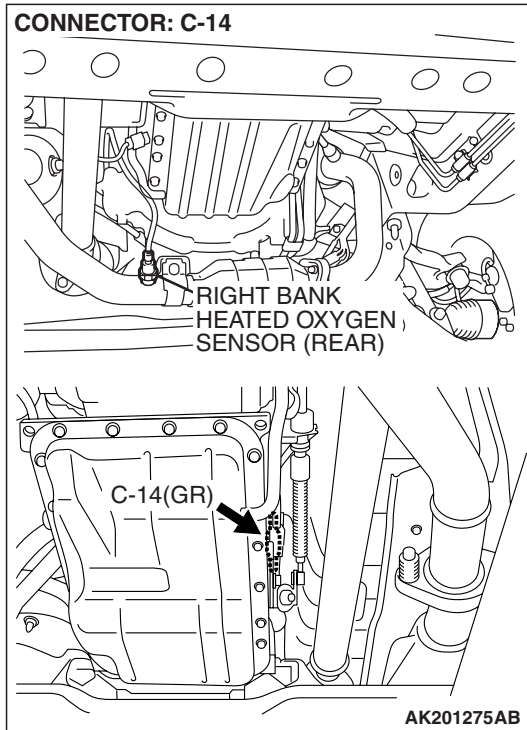
NO : The inspection is complete.

DTC P0140: Heated Oxygen Sensor Circuit No Activity Detected (bank 1, sensor 2)

Right Bank Heated Oxygen Sensor (rear) Circuit



AK501059



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 117) from the output terminal (terminal No. 4) of the right bank heated oxygen sensor (rear).
- Terminal No. 2 of the right bank heated oxygen sensor (rear) is grounded with the PCM (terminal No. 96).
- The PCM applies an offset voltage of 0.5 volt to terminal No. 2 of the right bank oxygen sensor (rear).

TECHNICAL DESCRIPTION

- The output signal of the right bank heated oxygen sensor (front) is compensated by the output signal of the right bank heated oxygen sensor (rear).

- The PCM checks for the right bank heated oxygen sensor (rear) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (rear) output voltage does not change during specified.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

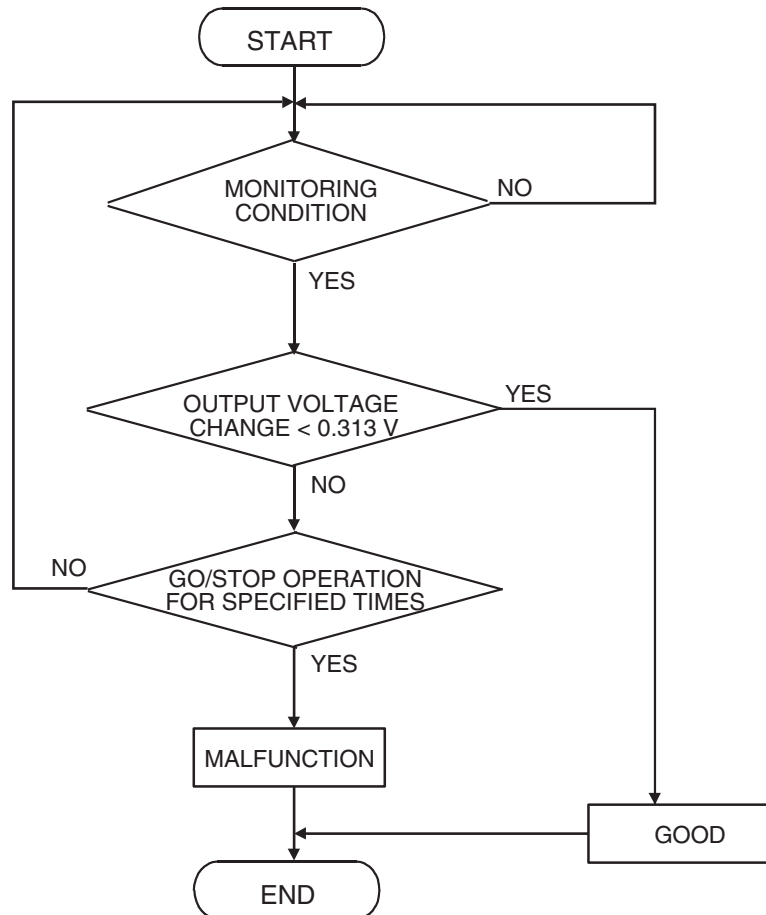
Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor

- Intake air temperature sensor
- Barometric pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302399

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The right bank heated oxygen sensor (front) is active.
- The cumulative volume airflow sensor output frequency for every 2 seconds is higher than 4,000 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 (19 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 (1.0 mph).

Judgement Criterion

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

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 13 [P.13A-4](#).

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

- Right bank heated oxygen sensor (rear) failed.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Replace the right bank heated oxygen sensor (rear).

- (1) Replace the right bank heated oxygen sensor (rear).
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 13 [P.13A-4](#).
- (3) Check the diagnostic trouble code (DTC).

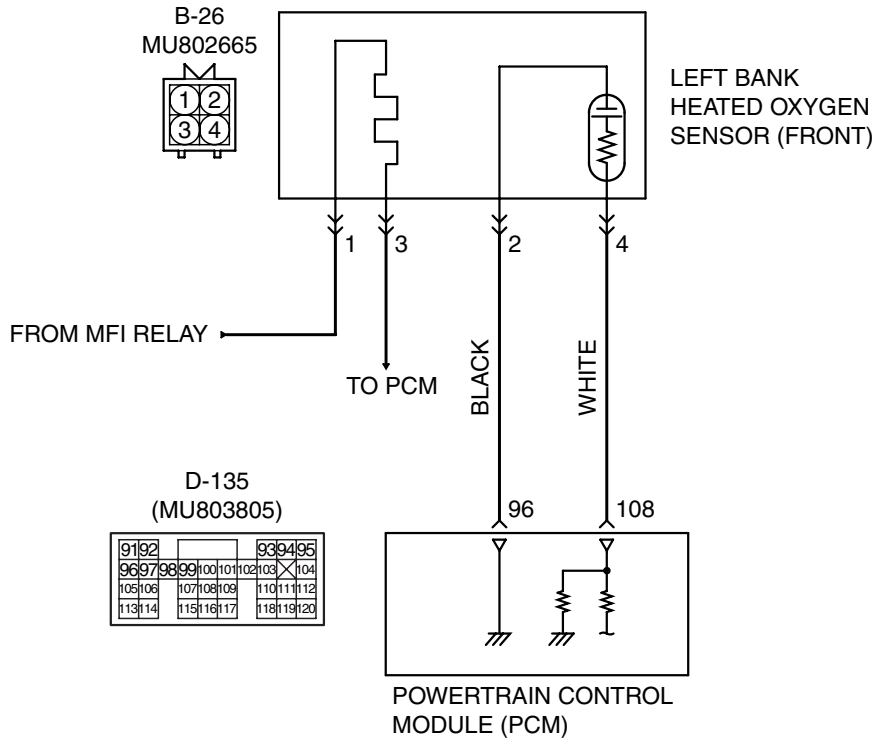
Q: Is DTC P0140 set?

YES : Refer to, P136 – Heated Oxygen Sensor Circuit (bank 1, sensor 2) [P.13A-269](#), P0137 – Heated Oxygen Sensor Circuit Low Voltage (bank 1, sensor 2) [P.13A-285](#), DTC P0138 – Heated Oxygen Sensor Circuit High Voltage (bank 1, sensor 2) [P.13A-292](#).

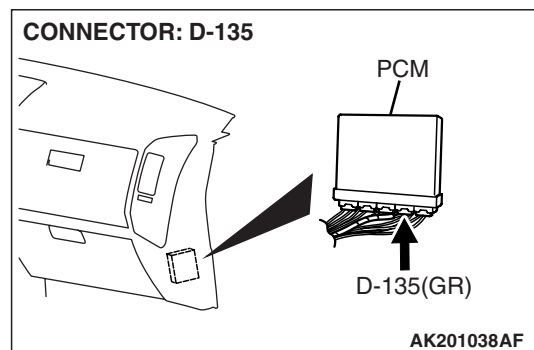
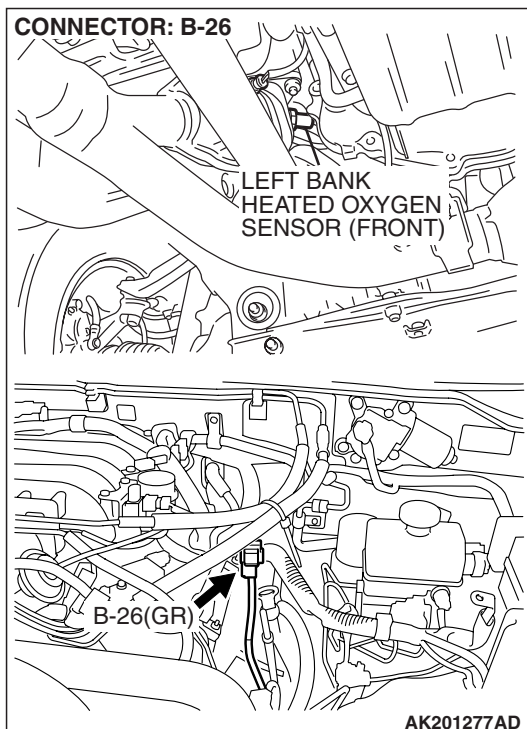
NO : The inspection is complete.

DTC P0150: Heated Oxygen Sensor Circuit (bank 2, sensor 1)

Left Bank Heated Oxygen Sensor (front) Circuit



AK501061



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 108) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (front).
- Terminal No. 2 of the left bank heated oxygen sensor (front) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (front) circuit is switched to 5 volts intentionally when oxygen sensor output is low, and detects the malfunction if the output voltage changes to equal or greater than 4.5 volts. The above procedure is repeated when oxygen sensor is inactive.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

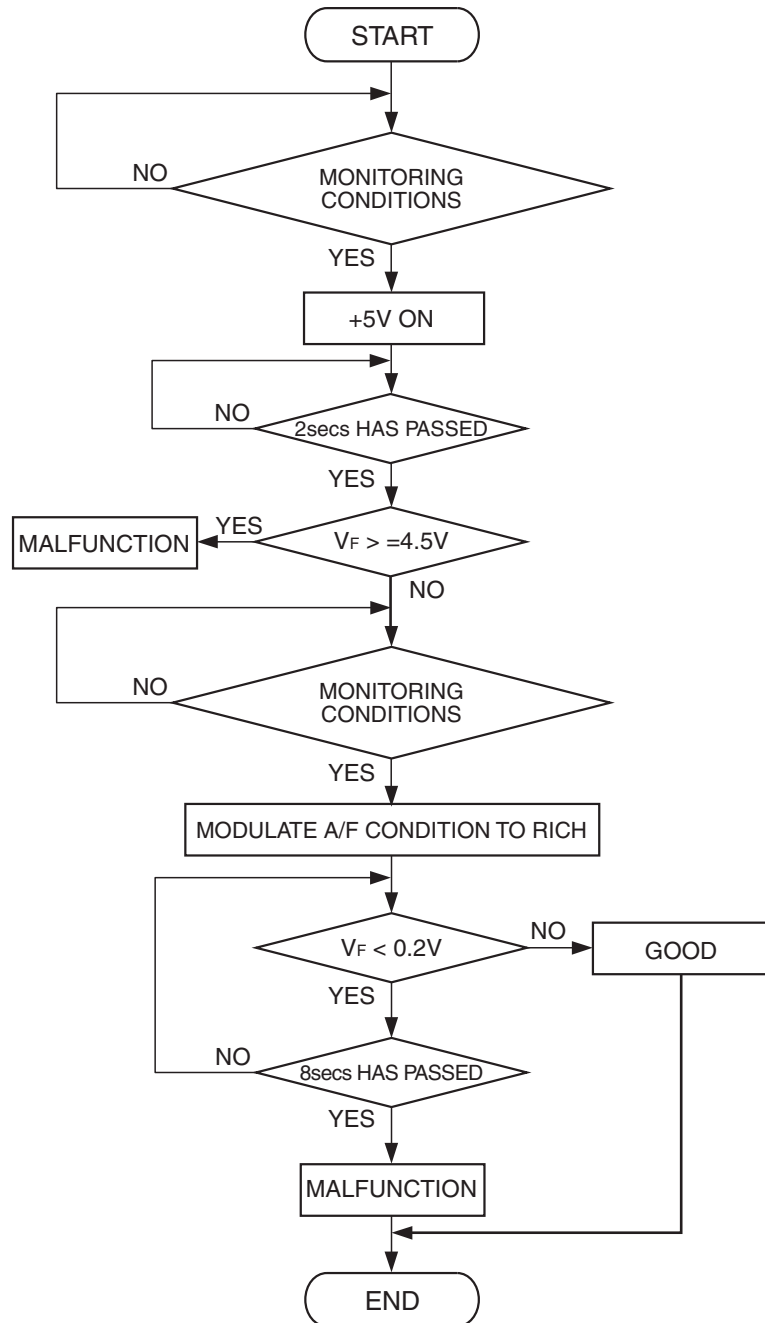
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelerator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK501058

Check Conditions

- 3 minutes or more have passed since the engine starting sequence was completed.
- Left bank 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.

Judgement Criterion

- Input voltage supplied to the PCM interface circuit is higher than 4.5 volts when 5 volts is applied to the left bank heated oxygen sensor (front) output line.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Left bank heated oxygen sensor (front) deteriorated.
- Open or shorted circuit in left bank heated oxygen sensor (front) output line, or harness damage.
- Open circuit in left bank heated oxygen sensor (front) ground line, or harness damage.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MB991316: Test Harness

STEP 1. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor Bank 2, Sensor 1 (left front).**⚠ CAUTION**

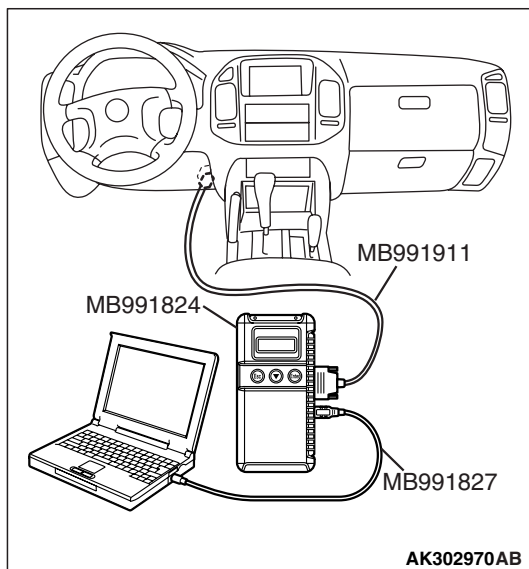
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor Bank 2, Sensor 1 (left front).
 - Warming up the engine. When the engine is revved, the output voltage should be 0.6 to 1.0 volt.
 - Warming 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?

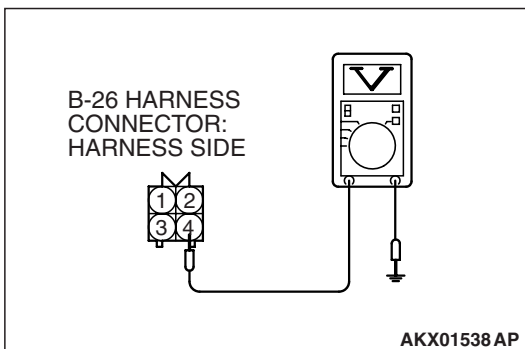
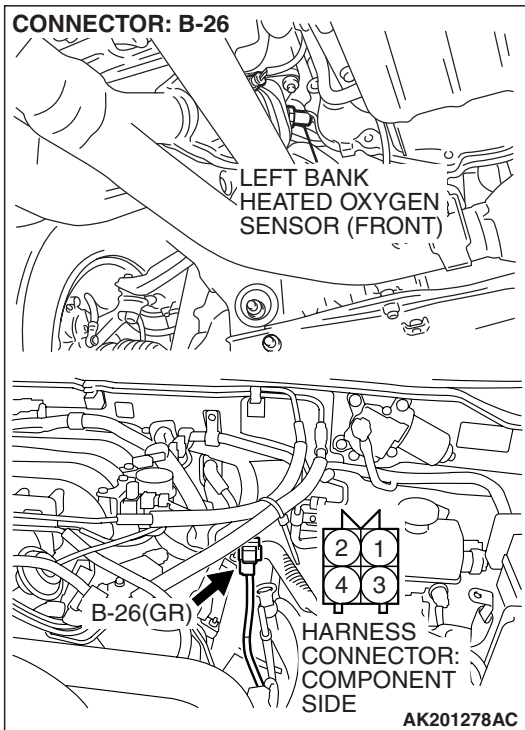
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.



STEP 2. Measure the sensor output voltage at left bank heated oxygen sensor (front) connector B-26 by backprobing

- (1) Do not disconnect the connector B-26.
- (2) Start the engine and run at idle.

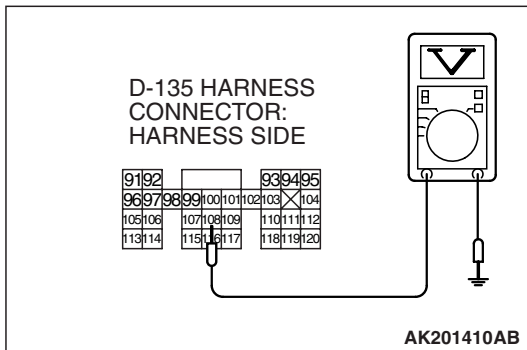
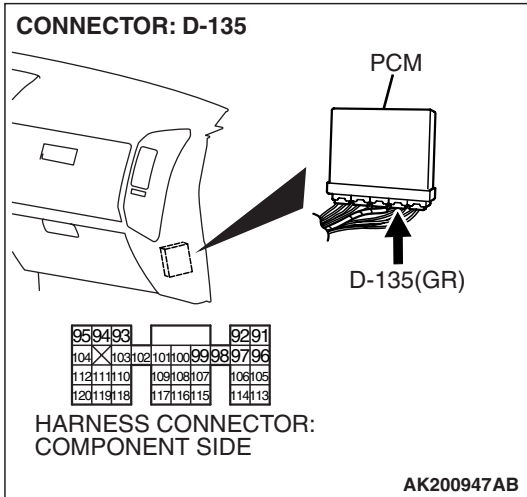


- (3) Measure the voltage between terminal No. 4 and ground by backprobing.
 - Warming up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the voltage normal?

YES : Go to Step 3.

NO : Go to Step 7.



STEP 3. Measure the sensor output voltage at PCM connector D-135 by backprobing.

- (1) Do not disconnect the connector D-135.
- (2) Start the engine and run at idle.

- (3) Measure the voltage between terminal No. 108 and ground by backprobing.
 - Warming 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 voltage normal?

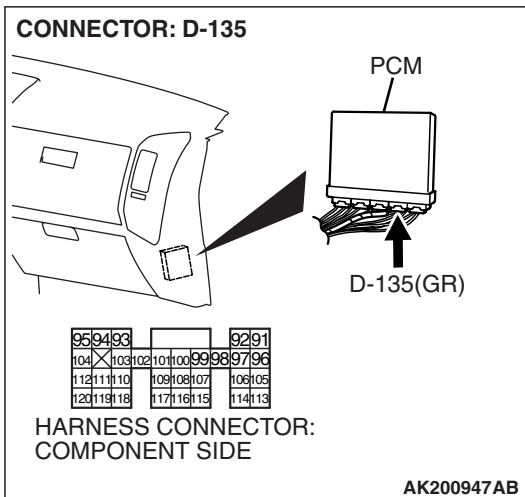
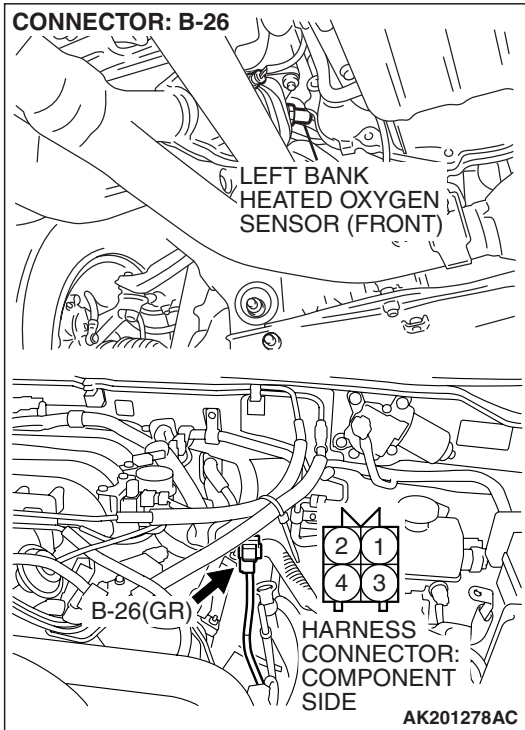
- YES :** Go to Step 4.
NO : Go to Step 6.

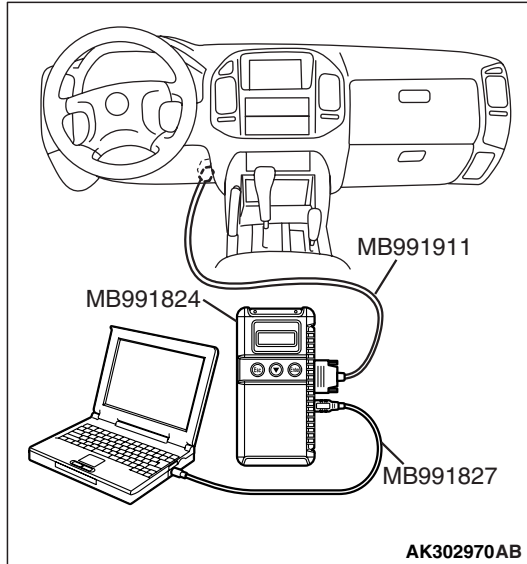
STEP 4. Check harness connector B-26 at left bank heated oxygen sensor (front) and harness connector D-135 at PCM for damage.

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 15.





STEP 5. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor Bank 2, Sensor 1 (left front).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor Bank 2, Sensor 1 (left front).
 - Warming up the engine. When the engine is revved, the output voltage should be 0.6 to 1.0 volt.
 - Warming 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.

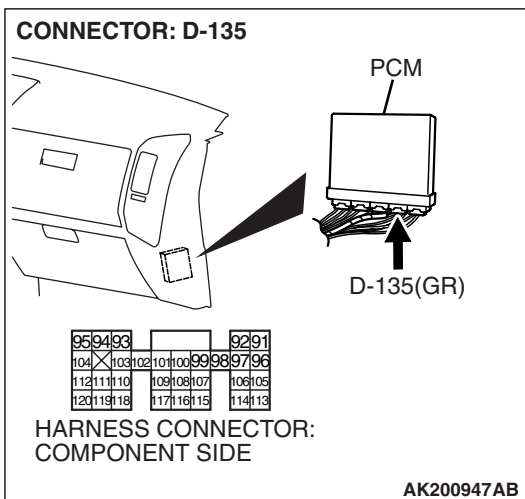
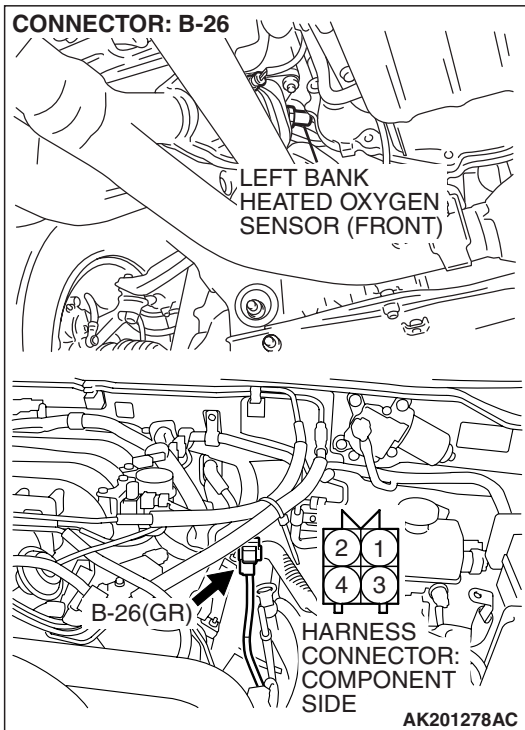
Q: Is the sensor operating properly?

- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).
- NO :** Replace the PCM. Then go to Step 15.

STEP 6. Check harness connector B-26 at left bank heated oxygen sensor (front) and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

- YES :** Repair harness wire between left bank heated oxygen sensor (front) connector B-26 (terminal No. 4) and PCM connector D-135 (terminal No. 108) 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.

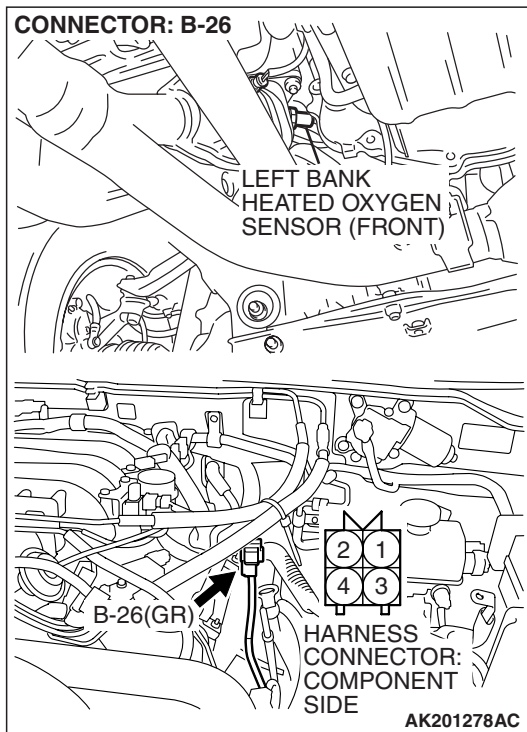


STEP 7. Check harness connector B-26 at left bank heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

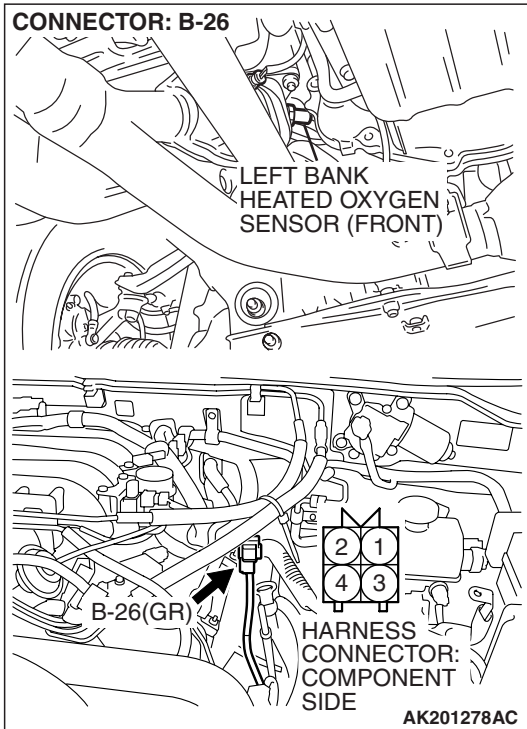
YES : Go to Step 8.

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



STEP 8. Check the continuity at left bank heated oxygen sensor (front) harness side connector B-26.

(1) Disconnect the connector B-26 and measure at the harness side.



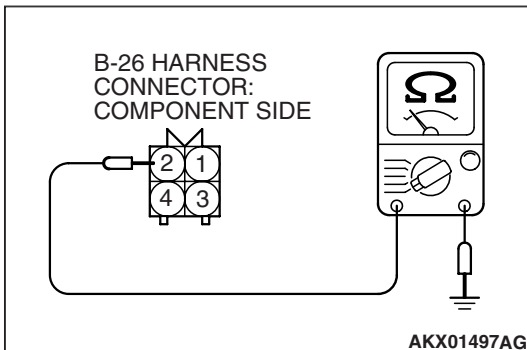
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.

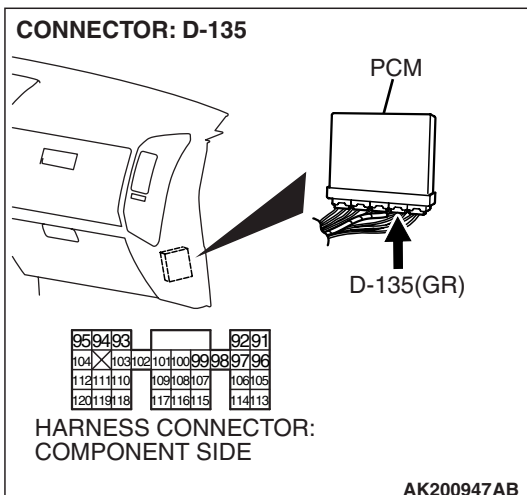


STEP 9. Check harness connector D-135 at PCM for damage.

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.

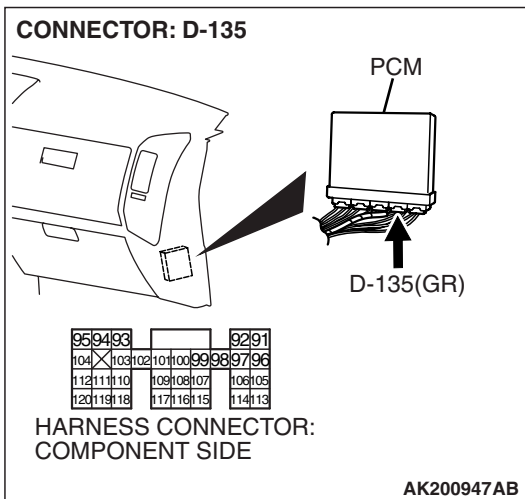
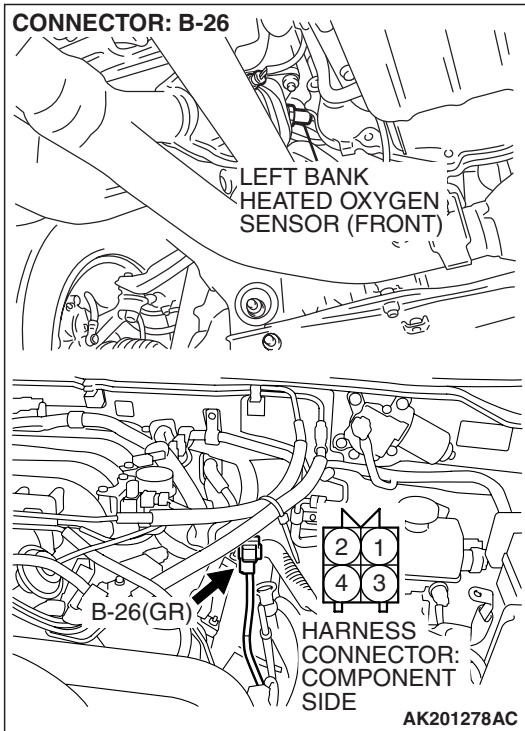


STEP 10. Check for open circuit and harness damage between left bank heated oxygen sensor (front) connector B-26 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 15.

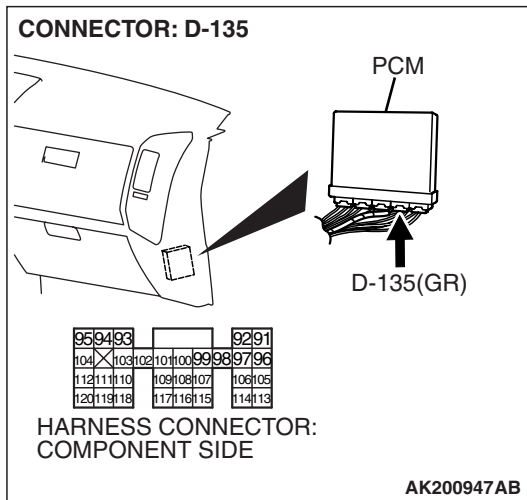


STEP 11. Check harness connector D-135 at PCM for damage.

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. Then go to Step 15.

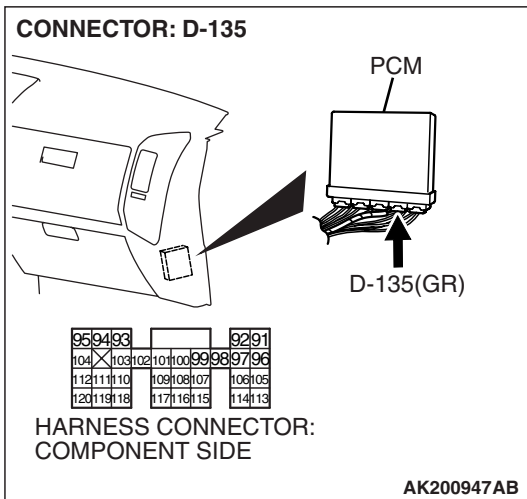
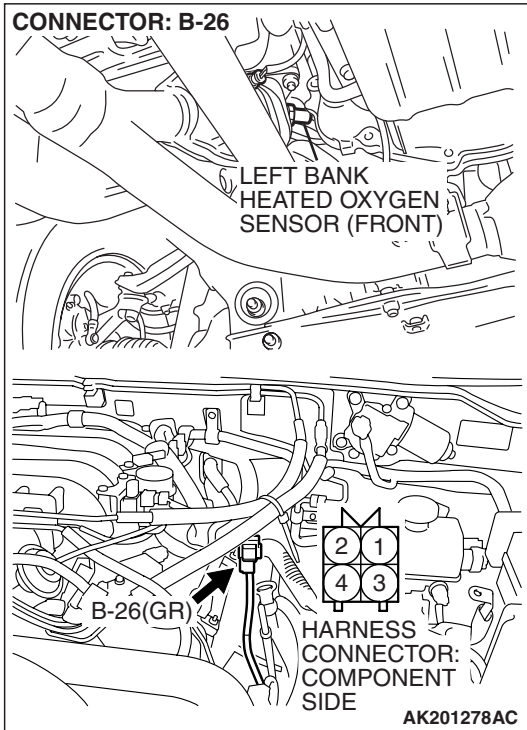


STEP 12. Check for harness damage between left bank heated oxygen sensor (front) connector B-26 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 15.

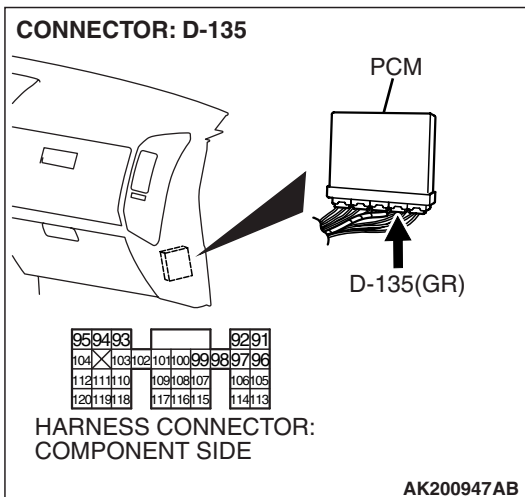
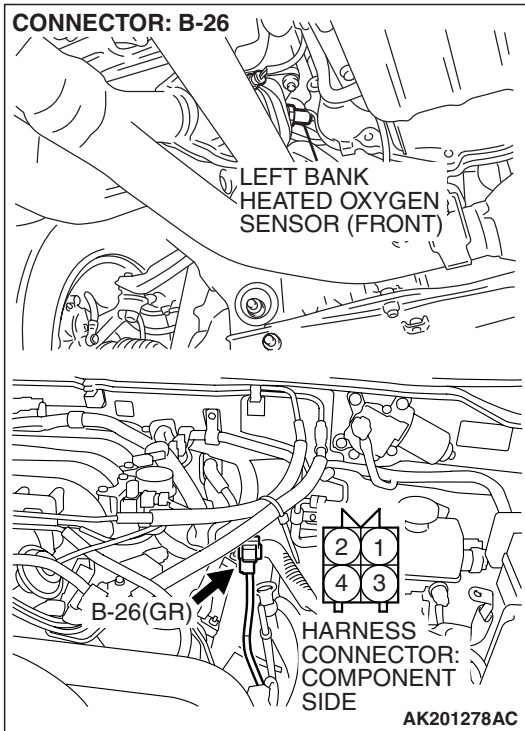


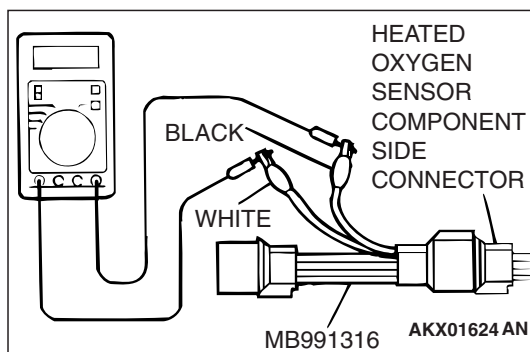
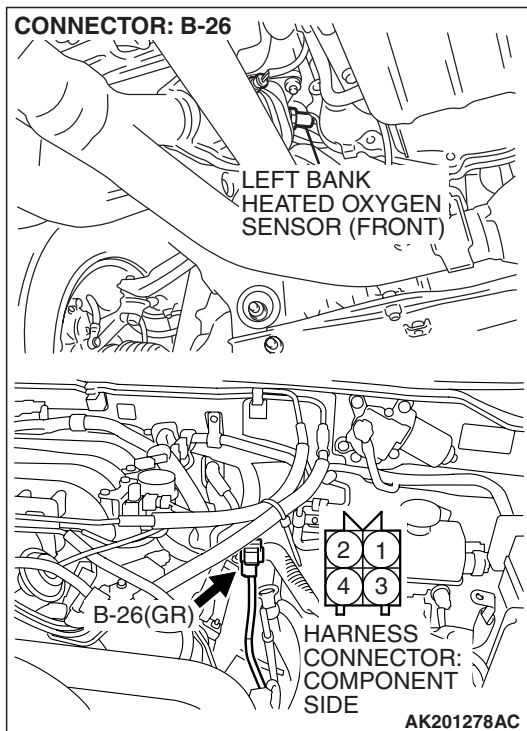
STEP 13. Check for short circuit to ground and harness damage between left bank heated oxygen sensor (front) connector B-26 (terminal No. 4) and PCM connector D-135 (terminal No. 108).

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 left bank heated oxygen sensor (front).**

- (1) Disconnect the left bank heated oxygen sensor (front) connector B-26 and connect test harness special tool MB991316 to the connector on the left bank heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the left bank heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the left bank heated oxygen sensor (front) heater.**

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 (red clip) and the terminal No. 3 (blue clip) of the heated oxygen sensor with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the voltage between 0.6 and 1.0 volt?

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

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

STEP 15. Test the OBD-II drive cycle.

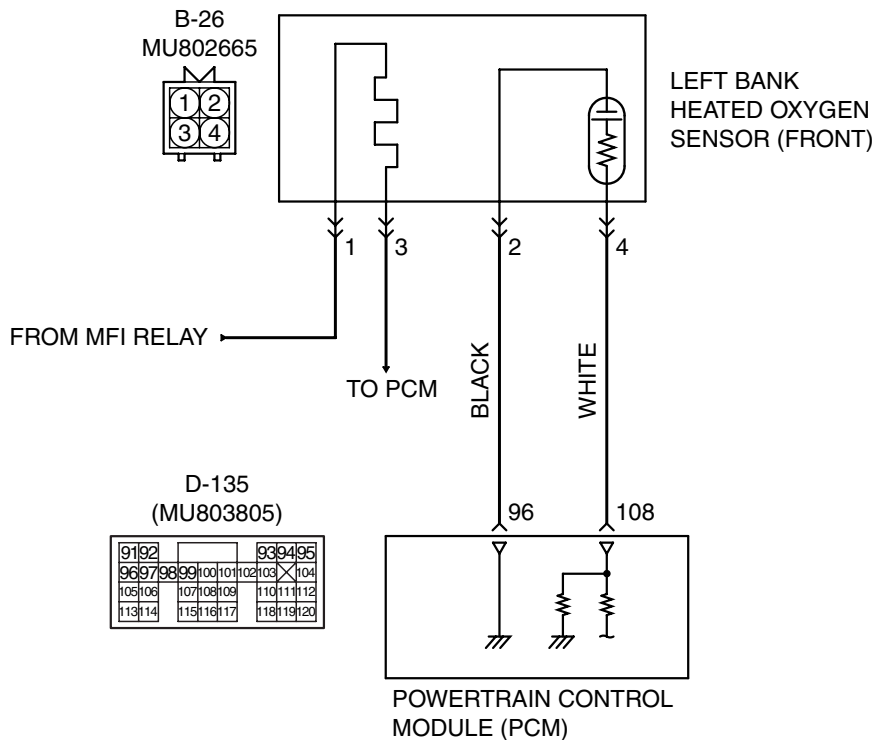
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0150 set?

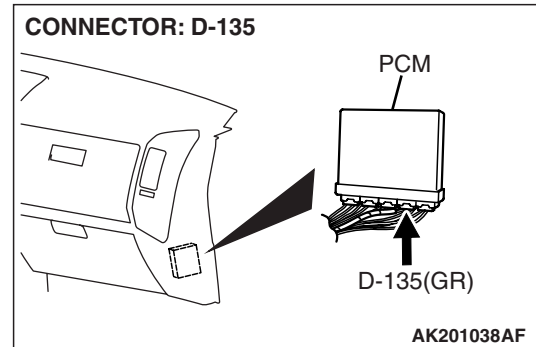
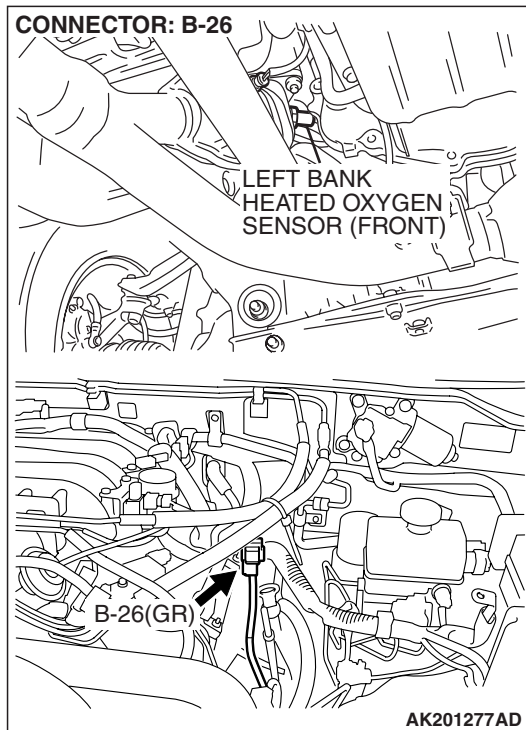
- YES :** Retry the troubleshooting.
NO : The inspection is complete.

DTC P0151: Heated Oxygen Sensor Circuit Low Voltage (bank 2, sensor 1)

Left Bank Heated Oxygen Sensor (front) Circuit



AK501061



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 108) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (front).
- Terminal No. 2 of the left bank heated oxygen sensor (front) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (front) output voltage stays low when air/fuel ratio is forced to be rich. The above procedure is repeated when oxygen sensor is inactive.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

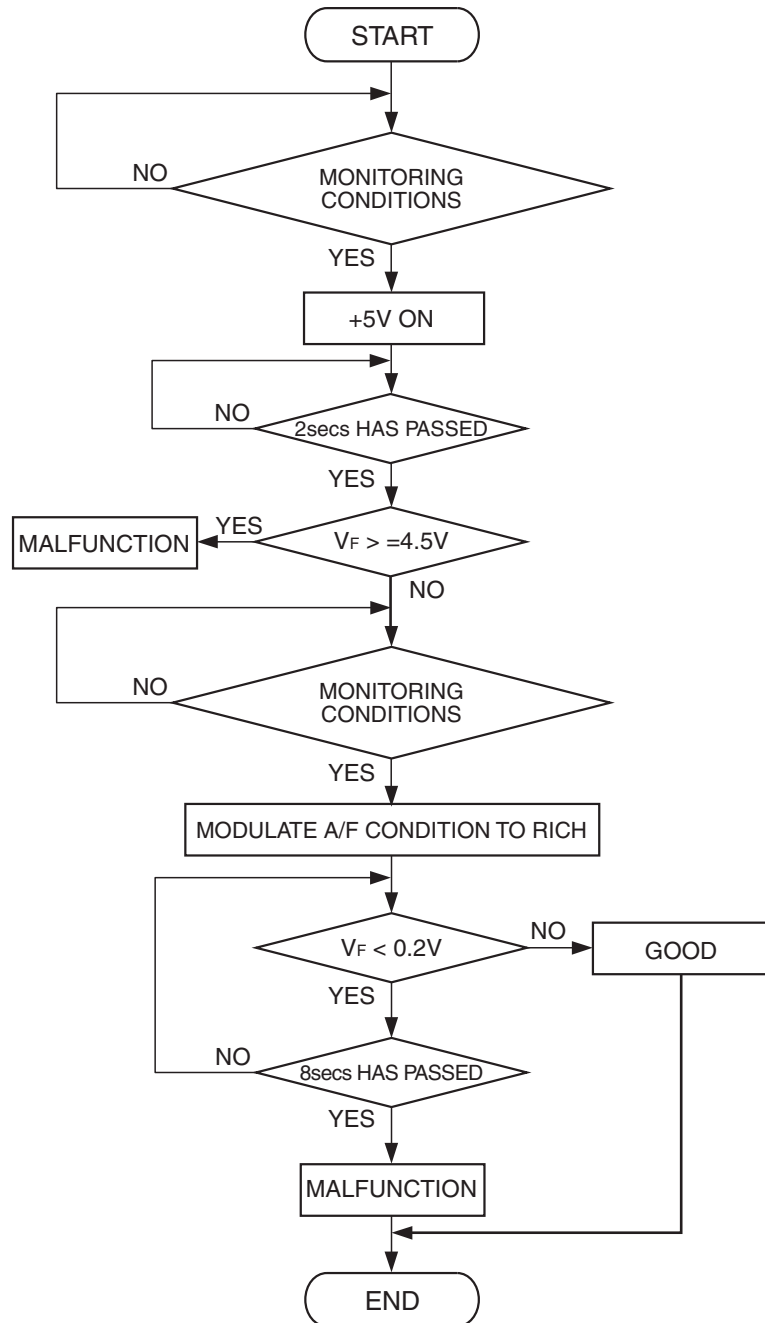
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelerator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK501058

Check Conditions

- After 2 seconds or more pass from the time when the monitor determines normally for detecting an open circuit.
- Left bank 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).
- Volume airflow sensor output frequency is higher than 100 Hz.
- At least 20 seconds have passed since fuel shut off control was canceled.

TSB Revision

Judgement Criterion

- Making the air/fuel ratio 15 percent richer for 8 seconds does not result in raising the heated oxygen sensor (front) output voltage beyond 0.2 volt.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Left bank heated oxygen sensor (front) failed.
- Short circuit in left bank heated oxygen sensor (front) output line.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MD991316: Test Harness

STEP 1. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor Bank 2, Sensor 1 (left front).

⚠ CAUTION

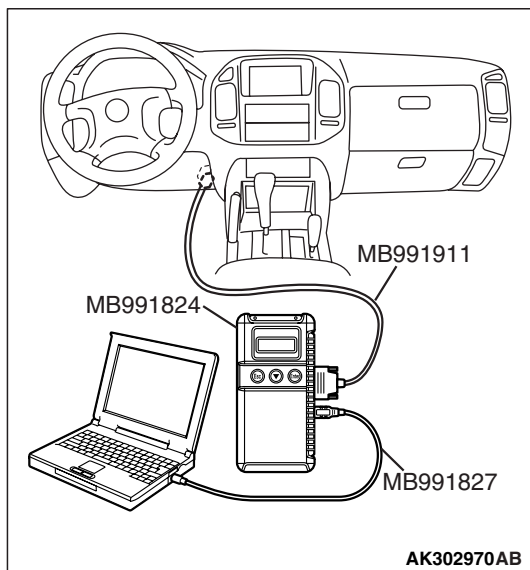
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor Bank 2, Sensor 1 (left 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.

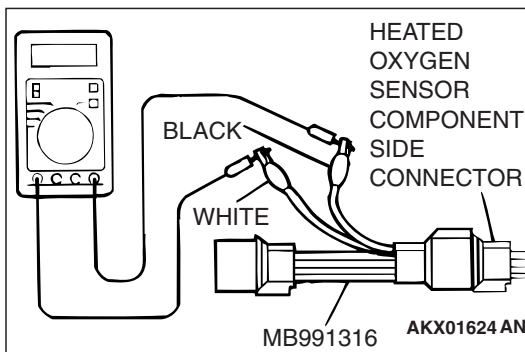
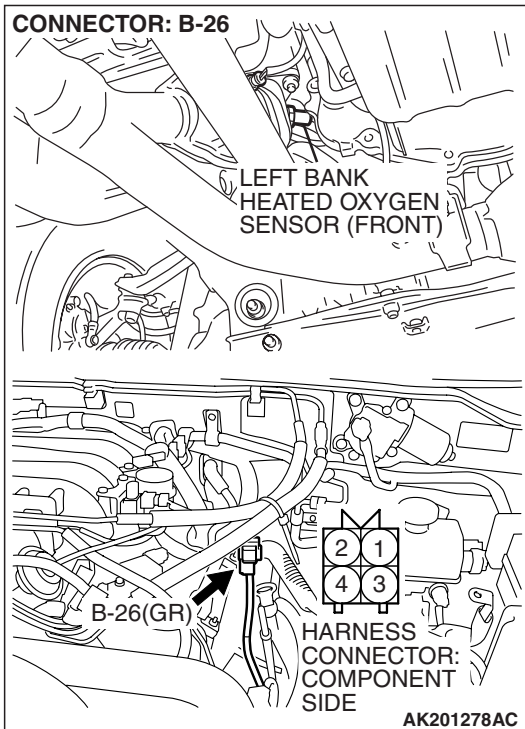
Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.



AK302970AB



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

- (1) Disconnect the left bank heated oxygen sensor (front) connector B-26 and connect test harness special tool MB991316 to the connector on the left bank heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the left bank heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 (red clip) and the terminal No. 3 (blue clip) of the heated oxygen sensor with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 3.

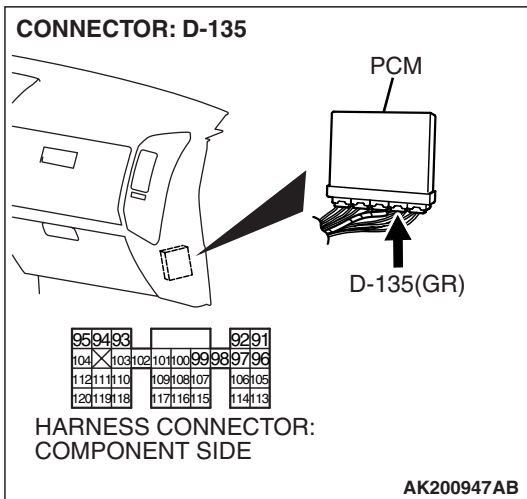
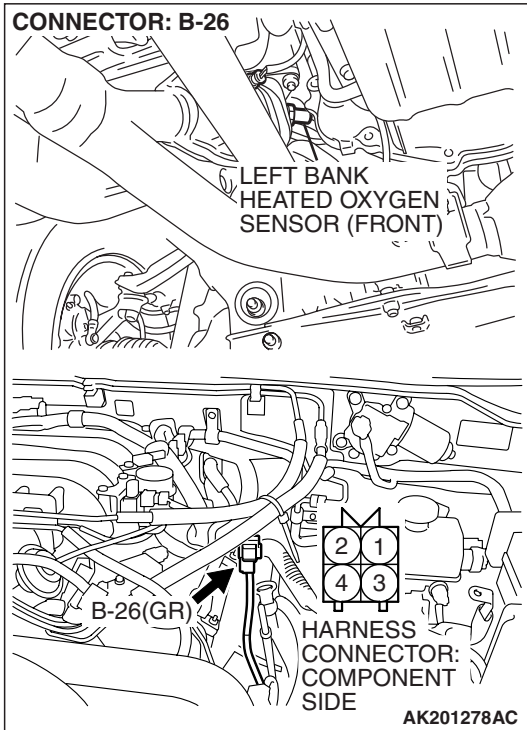
NO : Replace the left bank heated oxygen sensor (front).
Then go to Step 5.

STEP 3. Check harness connector B-26 at left bank heated oxygen sensor (front) and harness connector D-135 at PCM 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.

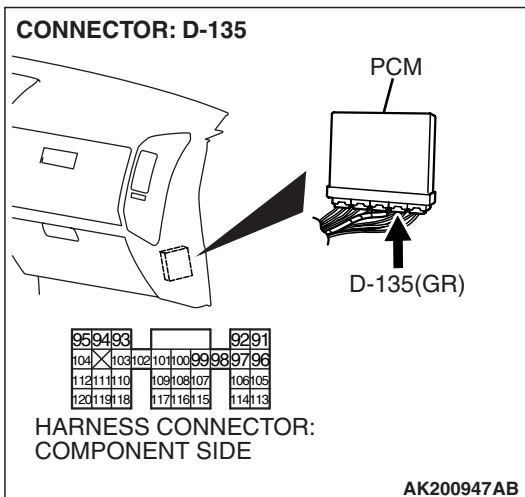
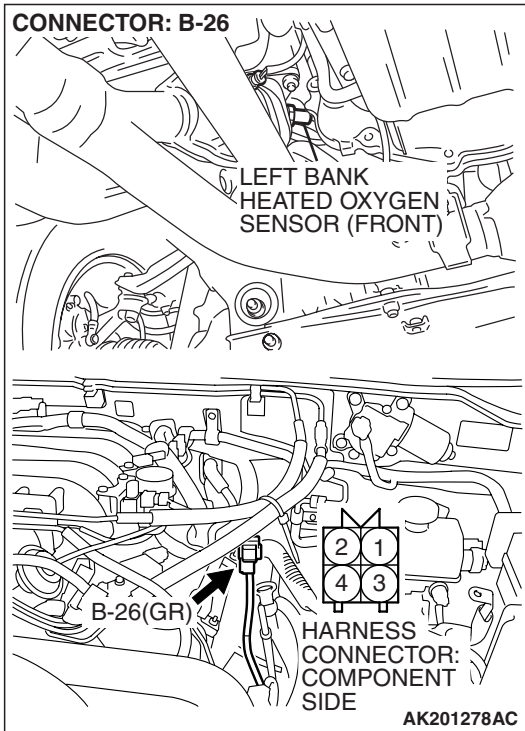


STEP 4. Check for short circuit to ground between left bank heated oxygen sensor (front) connector B-26 (terminal No. 4) and PCM connector D-135 (terminal No. 108).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 5.



STEP 5. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

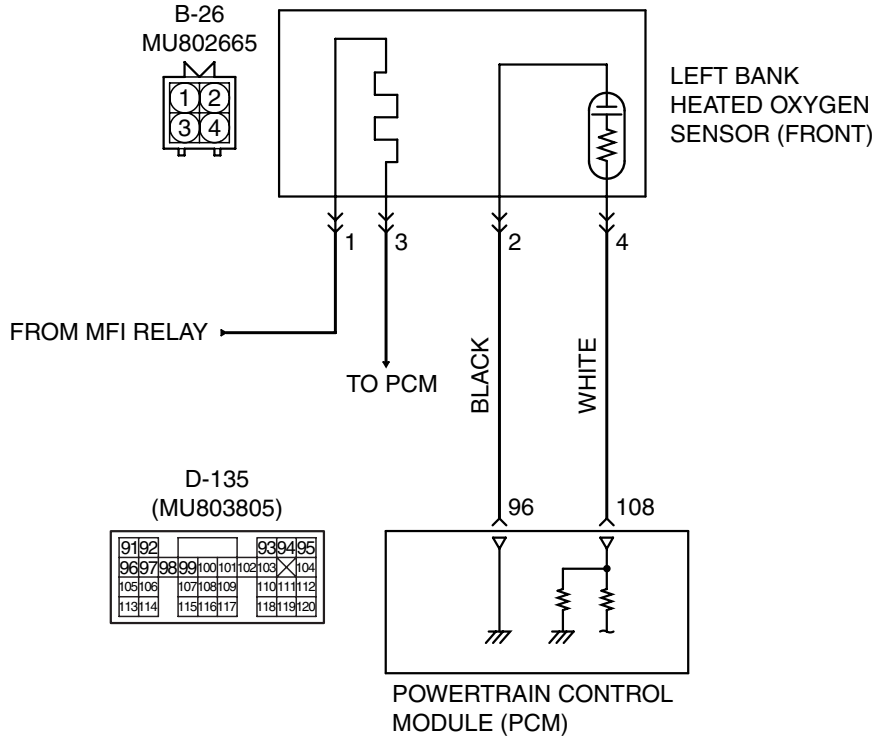
Q: Is DTC P0151 set?

YES : Retry the troubleshooting.

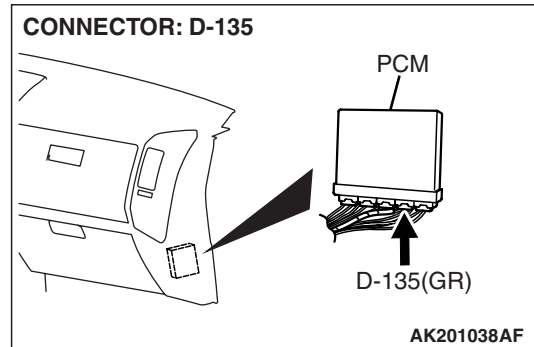
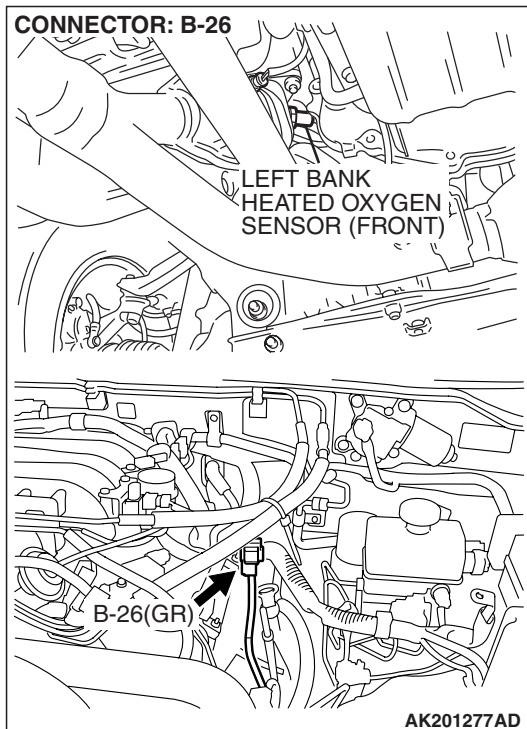
NO : The inspection is complete.

DTC P0152: Heated Oxygen Sensor Circuit High Voltage (bank 2, sensor 1)

Left Bank Heated Oxygen Sensor (front) Circuit



AK501061



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 108) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (front).
- Terminal No. 2 of the left bank heated oxygen sensor (front) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (front) output voltage is over specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

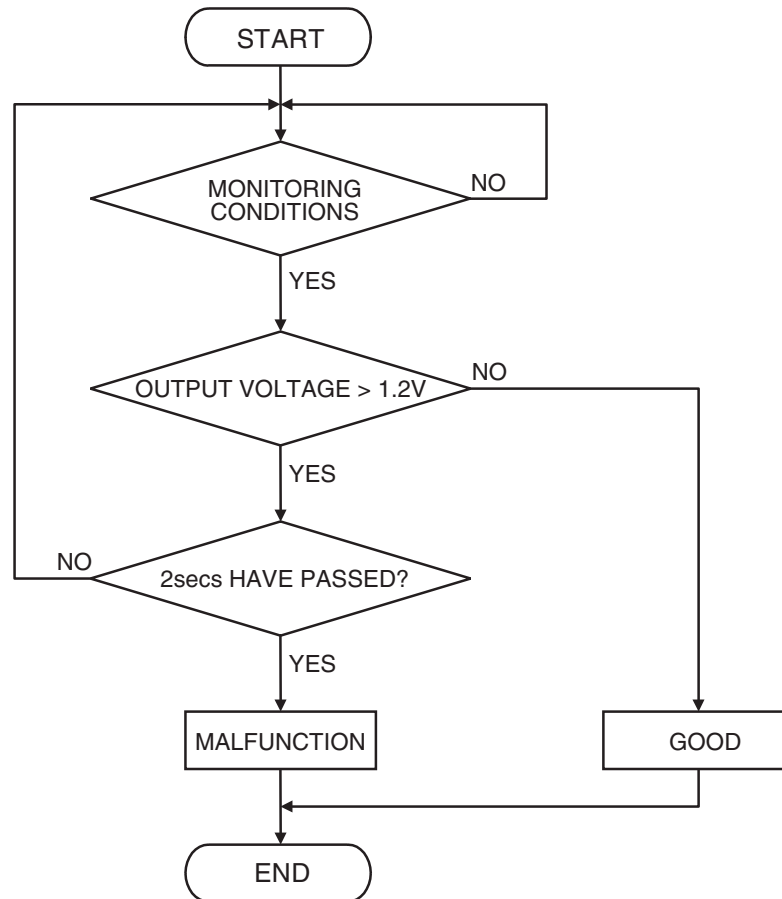
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelerator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302931

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-4](#).

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

- Short circuit in left bank heated oxygen sensor (front) output line.
- Connector damage.
- PCM failed.

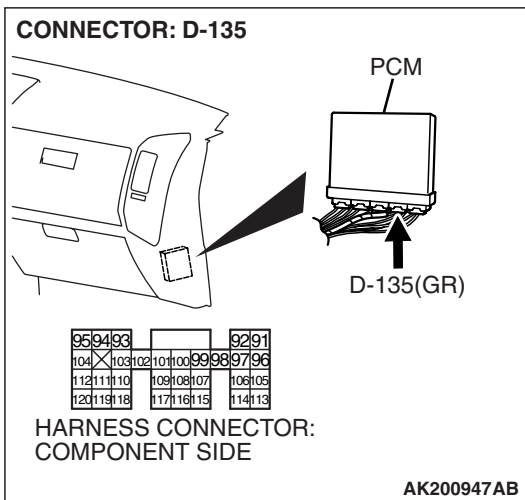
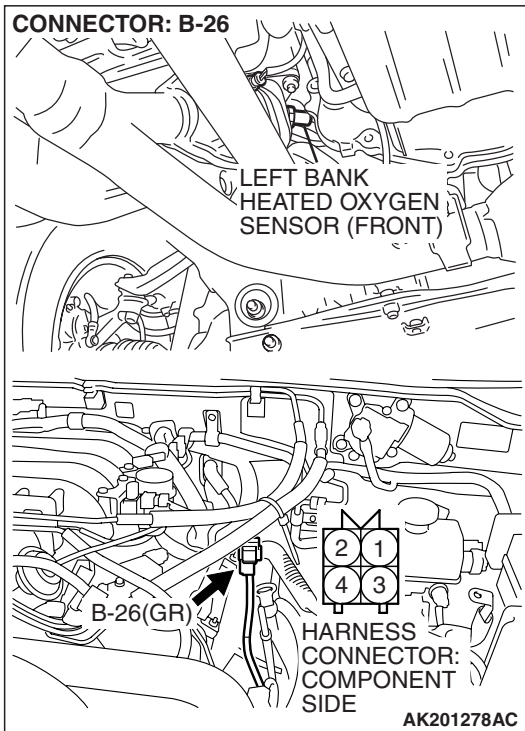
DIAGNOSIS

STEP 1. Check harness connector B-26 at left bank heated oxygen sensor (front) and harness connector D-135 at PCM 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.

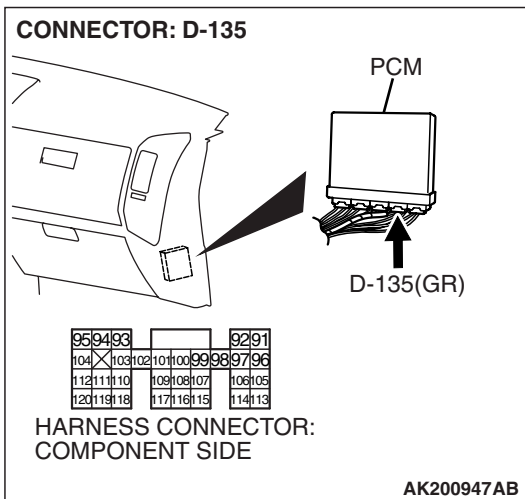
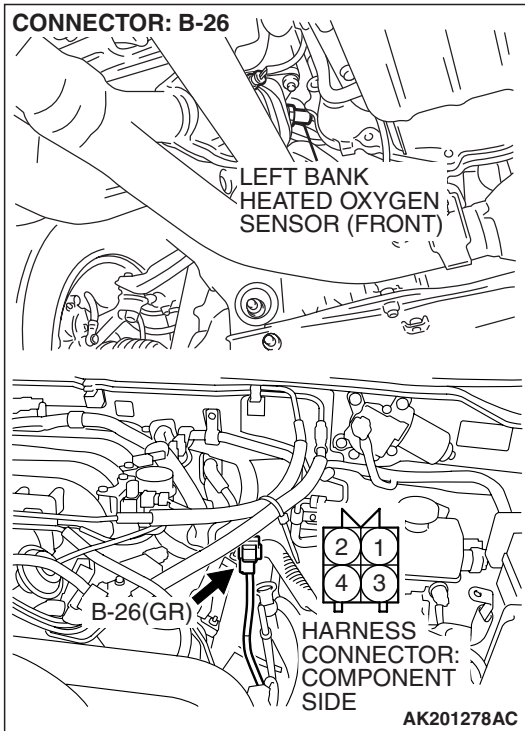


STEP 2. Check for short circuit to power supply between left bank heated oxygen sensor (front) connector B-26 (terminal No. 4) and PCM connector D-135 (terminal No. 108).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 3.



STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.

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

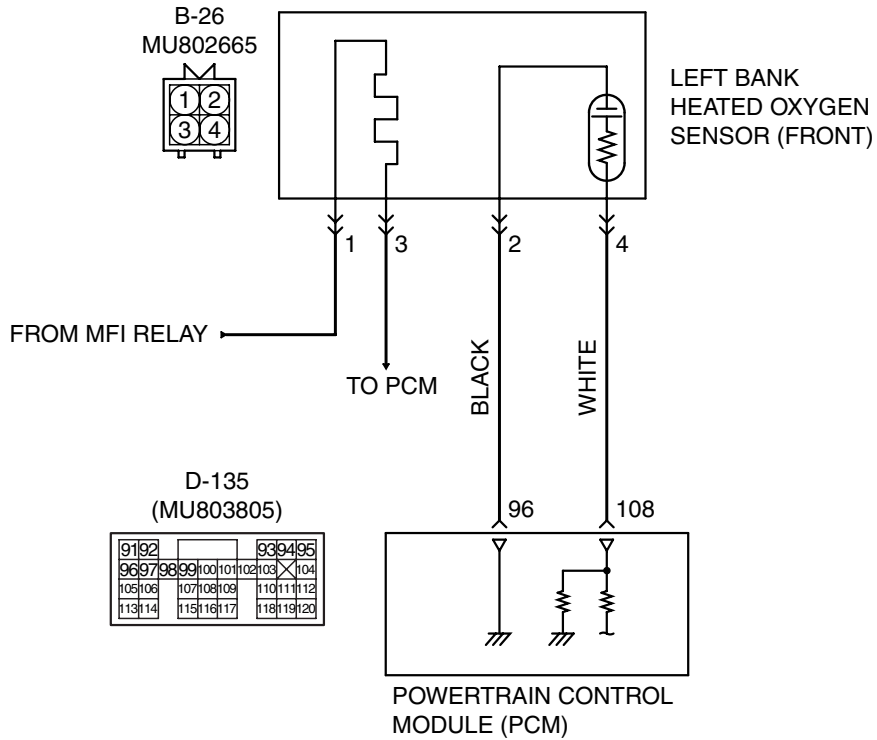
Q: Is DTC P0152 set?

YES : Retry the troubleshooting.

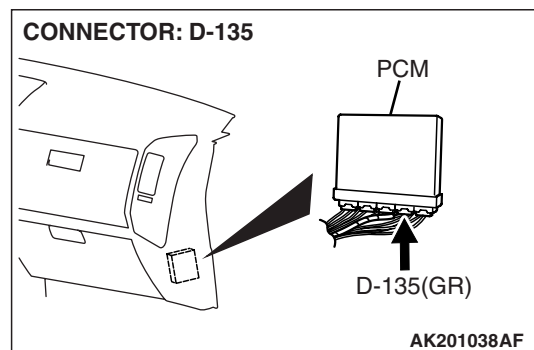
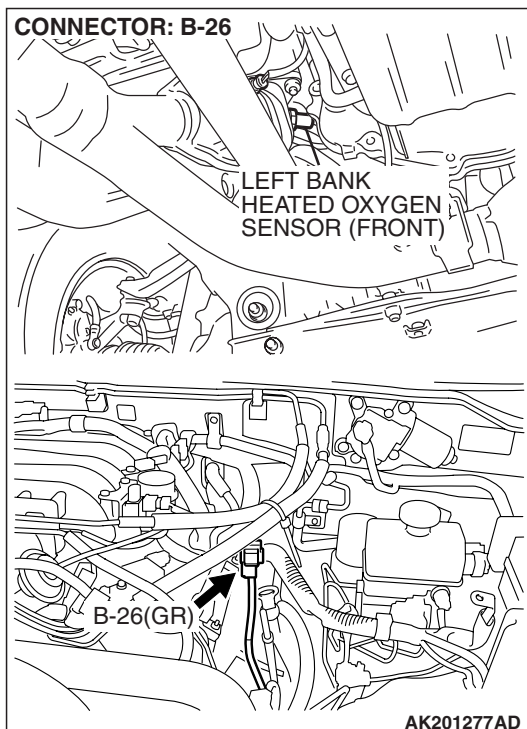
NO : The inspection is complete.

DTC P0153: Heated Oxygen Sensor Circuit Slow Response (bank 2, sensor 1)

Left Bank Heated Oxygen Sensor (front) Circuit



AK501061



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 108) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (front).
- Terminal No. 2 of the left bank heated oxygen sensor (front) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

- The left bank 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 PCM.
- When the left bank heated oxygen sensor (front) begins to deteriorate, the left bank heated oxygen sensor signal response becomes poor.
- The PCM forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the left bank heated oxygen sensor (front). In addition, the PCM also checks for an open circuit in the left bank heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (front) rich/lean switching frequency is under specified value.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

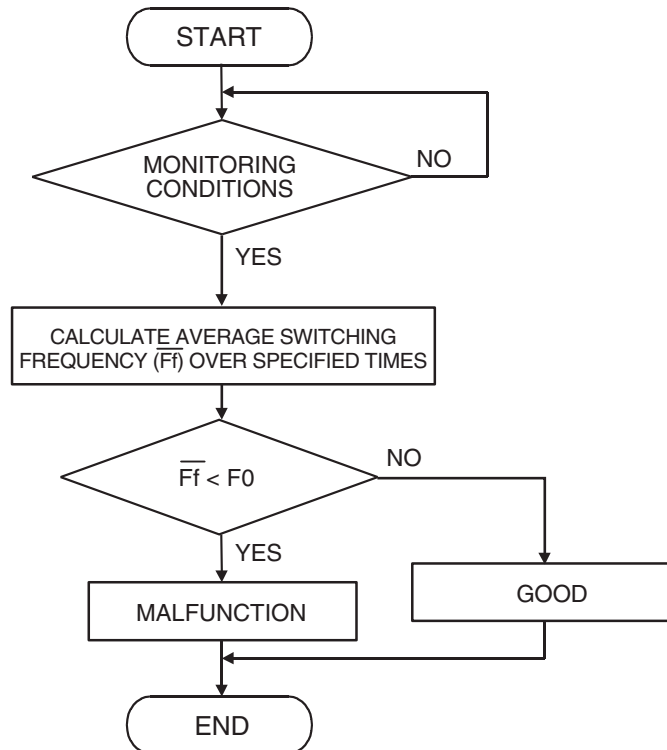
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelerator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



F0: THRESHOLD VALUE FOR AVERAGE SWITCHING FREQUENCY

AK400995

Check Conditions

- Engine coolant temperature is higher than 50°C (122°F).
- Engine speed is between 1,250 and 3,000 r/min.
- Volumetric efficiency is between 24 and 65 percent.
- Under the closed loop air/fuel control.
- The accelerator pedal is not closed.
- Short-term fuel trim is at between -30 and +25 percent.
- More than 3 seconds have elapsed after the above-mentioned conditions have been met.
- The PCM monitors for this condition for 7 cycles of 12 seconds each during the drive cycle.

Judgement Criterion

- The left bank heated oxygen sensor (front) sends "lean" and "rich" signals alternately 12 times or less for 12 seconds.

NOTE: If the sensor switching frequency is lower than the Judgment Criteria due to the MUT-III 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.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 1 [P.13A-4](#).

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

- Left bank heated oxygen sensor (front) deteriorated.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MD991316: Test Harness

STEP 1. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor Bank 2, Sensor 1 (left front).

⚠ CAUTION

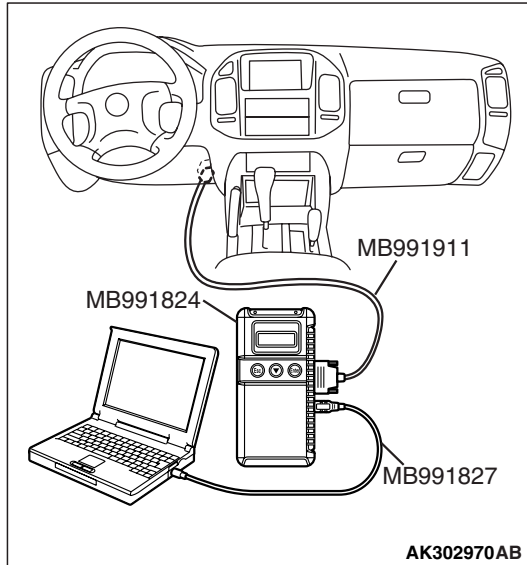
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

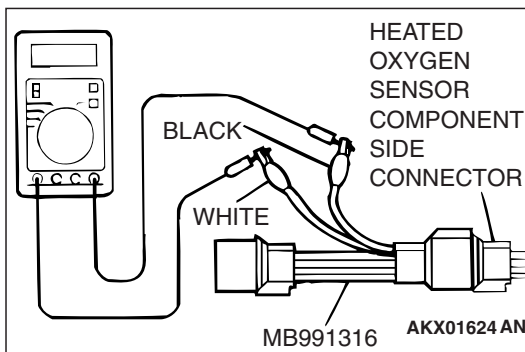
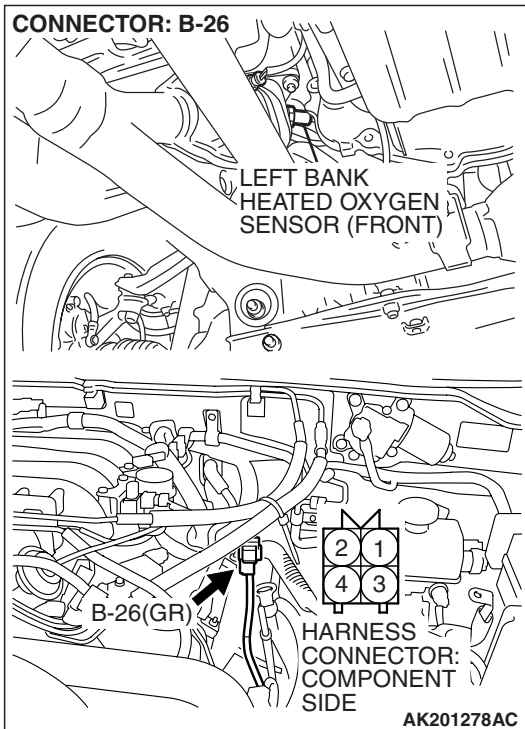
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor Bank 2, Sensor 1 (left front).
- (4) Warm up the engine, 2,500 r/min.
 - Output voltage repeats 0.4 volt or less 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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.





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

- (1) Disconnect the left bank heated oxygen sensor (front) connector B-26 and connect test harness special tool MB991316 to the connector on the left bank heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches temperature reaches 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the left bank heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 (red clip) and the terminal No. 3 (blue clip) of the heated oxygen sensor with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 3.

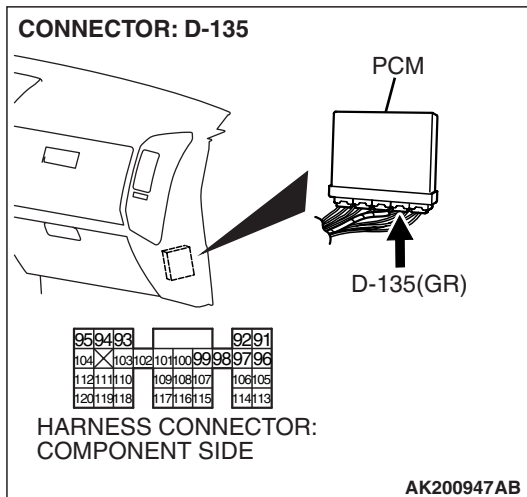
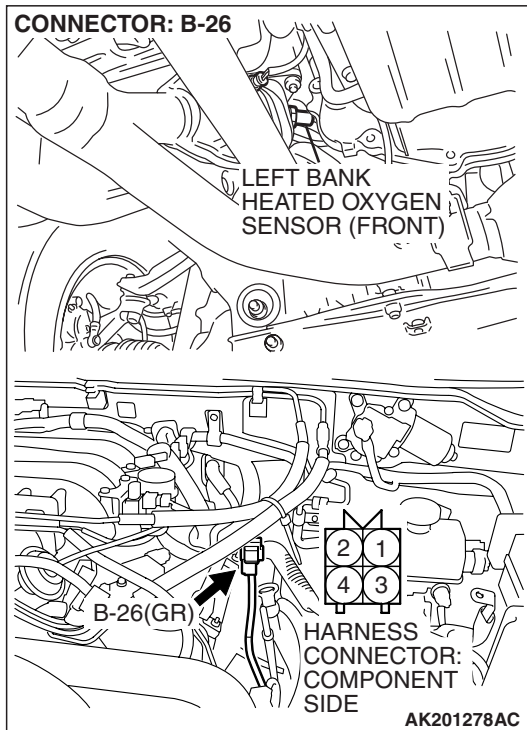
NO : Replace the left bank heated oxygen sensor (front).
Then go to Step 4.

STEP 3. Check harness connector B-26 at left bank heated oxygen sensor (front) and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Replace the PCM. 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. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 1 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0153 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0154: Heated Oxygen Sensor Circuit No Activity Detected (bank 2, sensor 1)

Heated Oxygen Sensor Circuit No Activity Detected (bank 2, sensor 1) Circuit

- Refer to DTC P0150 – Heated Oxygen Sensor Circuit (bank 2, sensor 1) [P.13A-305](#).
- Refer to DTC P0201 – P0206, Injector Circuit [P.13A-436](#).

CIRCUIT OPERATION

- Refer to DTC P0150 – Heated Oxygen Sensor Circuit (bank 2, sensor 1) [P.13A-328](#).
- Refer to, DTC P0201 – P0206, Injector Circuit [P.13A-436](#).

TECHNICAL DESCRIPTION

- The PCM effects air/fuel ratio feedback control in accordance with the signals from the left bank heated oxygen sensor (front).
- If the left bank heated oxygen sensor (front) has deteriorated, corrections will be made by the heated oxygen sensor (rear).
- DTC P0154 becomes stored in memory if a failure is detected in the above air/fuel ratio feedback control system.

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (front) output voltage does not cross 0.5 volt within specified period.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

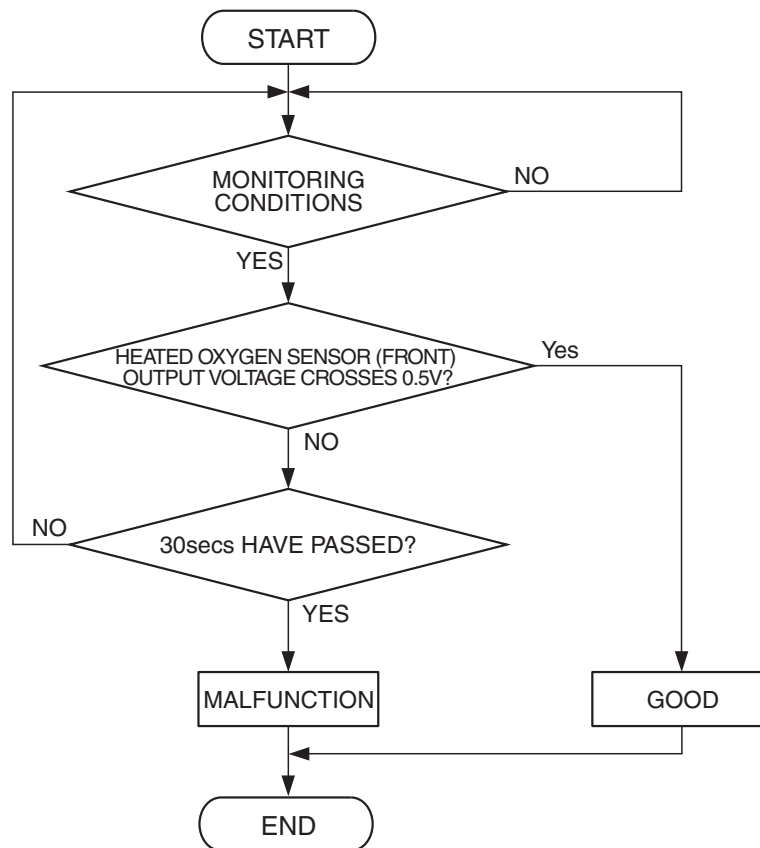
- Misfire monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302933

Check Conditions

- 20 seconds or more have passed since the engine starting sequence was completed.
- Engine coolant temperature is higher than 7°C (45° F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 30 percent.
- Throttle position sensor output voltage is lower than 4 volts.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Left bank heated oxygen sensor (front) deteriorated.
- Harness damage in left bank heated oxygen sensor (front) output line.
- Left bank heated oxygen sensor (rear) deteriorated.

NOTE: When the left bank 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 left bank heated oxygen sensor (rear).

If the left bank heated oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the left bank heated oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the left bank heated oxygen sensor (front) output voltage decreases, without intersecting with 0.5 volt. As a result, there is a possibility of DTC P0154 becoming registered.

- Open circuit in left bank injector.
- Harness damage in left bank injector circuit.
- Connector damage.
- PCM failed.
- Exhaust leak.
- Air drawn in from gaps in gasket, seals, etc.
- Incorrect fuel pressure.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MD991316: Test Harness

STEP 1. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).

CAUTION

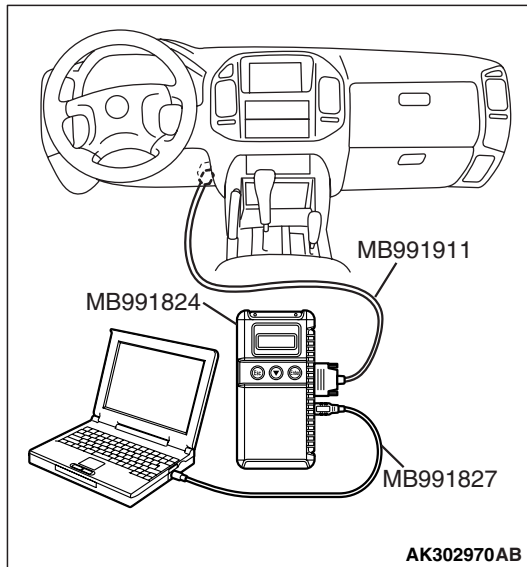
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

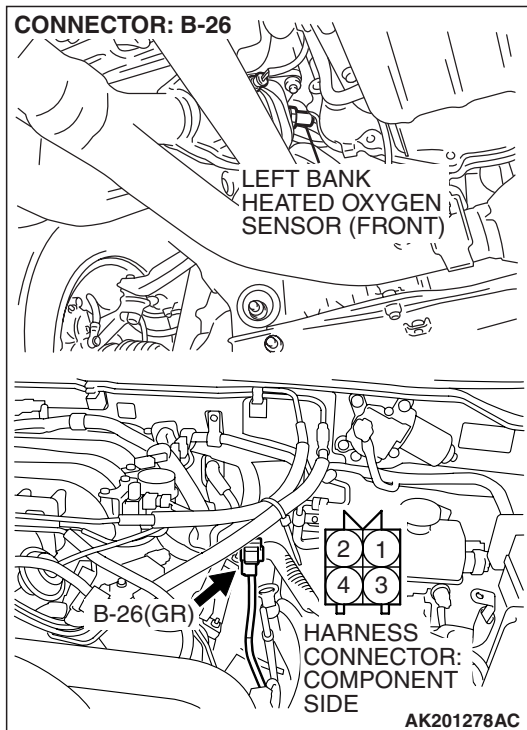
YES : Go to Step 2.

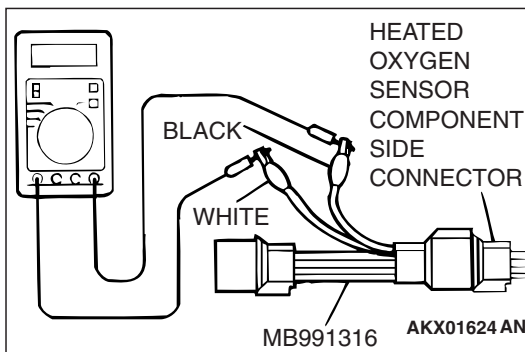
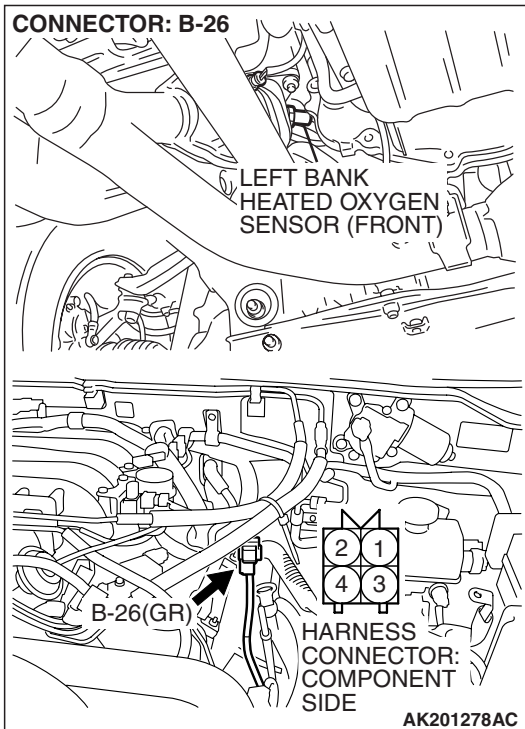
NO : Refer to DTC P0156 – Heated Oxygen Sensor Circuit (bank 2, sensor 2) [P.13A-349](#), DTC P0157 – Heated Oxygen Sensor Circuit Low Voltage (bank 2, sensor 2) [P.13A-365](#), DTC P0158-Heated Oxygen Sensor Circuit High Voltage (bank 2, sensor 2) [P.13A-372](#), DTC P0159 – Heated Oxygen Sensor Circuit Slow Response (bank 2, sensor 2) [P.13A-377](#), P160 – Heated Oxygen Sensor Circuit No Activity Detected (bank 2, sensor 2) [P.13A-381](#).



STEP 2. Check for exhaust leak.**Q: Are there any abnormalities?****YES :** Repair it. Then go to Step 14.**NO :** Go to Step 3.

STEP 3. Check for intake system vacuum leak.**Q: Are there any abnormalities?****YES :** Repair it. Then go to Step 14.**NO :** Go to Step 4.

STEP 4. Check harness connector B-26 at the left bank 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 14.



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

- (1) Disconnect the left bank heated oxygen sensor (front) connector B-26 and connect test harness special tool MB991316 to the connector on the left bank heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the left bank heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

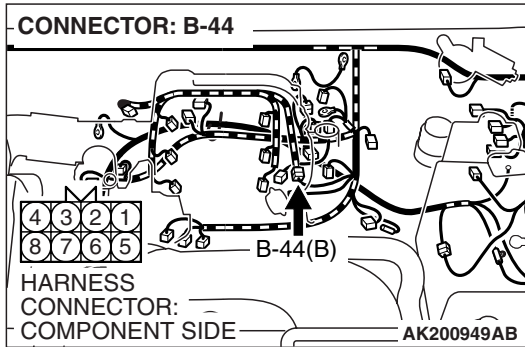
- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 (red clip) and the terminal No. 3 (blue clip) of the heated oxygen sensor with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 6.

NO : Replace the left bank heated oxygen sensor (front).
Then go to Step 14.

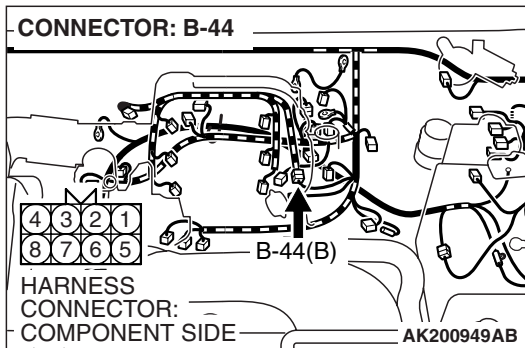


STEP 6. Check harness connector B-44 at intermediate connector for damage.

Q: Is the harness connector in good condition?

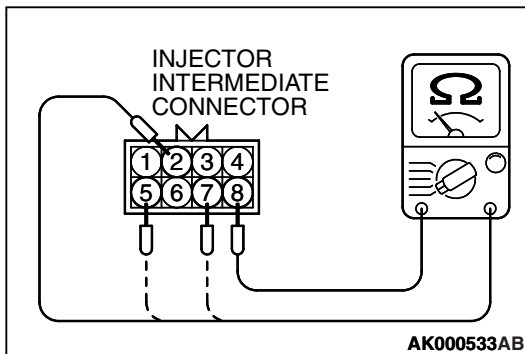
YES : Go to Step 7.

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



STEP 7. Check the left bank injector resistance at intermediate connector B-44.

(1) Disconnect the intermediate connector B-44.



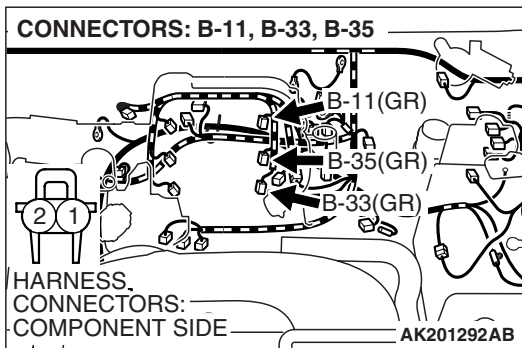
(2) Measure the resistance between each male connector side connector terminal.

- a. Measure the resistance between terminal No. 2 and No. 8 at No. 2 cylinder.
- b. Measure the resistance between terminal No. 7 and No. 8 at No. 4 cylinder.
- c. Measure the resistance between terminal No. 5 and No. 8 at No. 6 cylinder.
 - Resistance should be between 13 and 16 ohms [at 20°C (68°F)].

Q: Is the measured resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Go to Step 10.

NO : Go to Step 8.



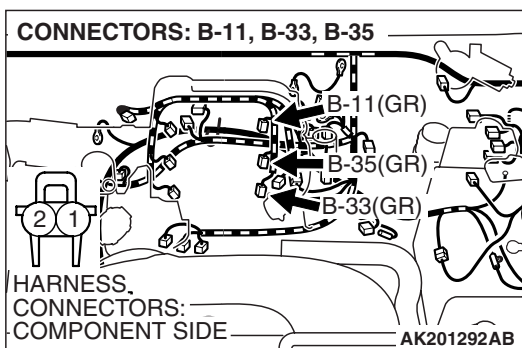
STEP 8. Check harness connector B-33, B-35, B-11 at left bank injector for damage.

- (1) Remove the intake manifold.
- (2) Check the left bank injector connector, which deviates from the standard value at Step 7.

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 the left bank injector.

- (1) Check the left bank injector connector, which deviates from the standard value at Step 7.

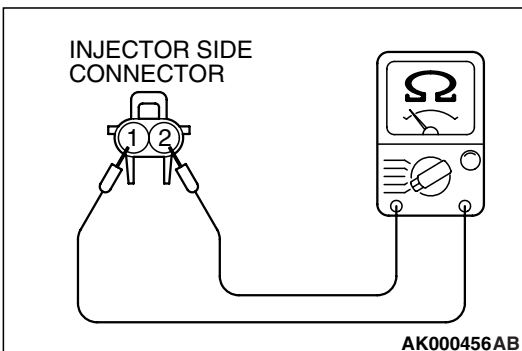
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 13 – 16 ohms [at 20°C (68°F)]

Q: Is the resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Repair harness wire between injector intermediate connector and left bank injector connector because of harness damage. Then go to Step 14.

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

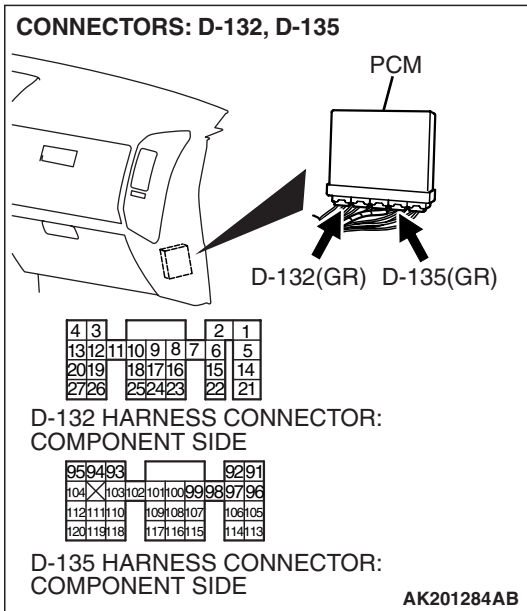


STEP 10. Check harness connector D-132, D-135 at PCM for damage.

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.

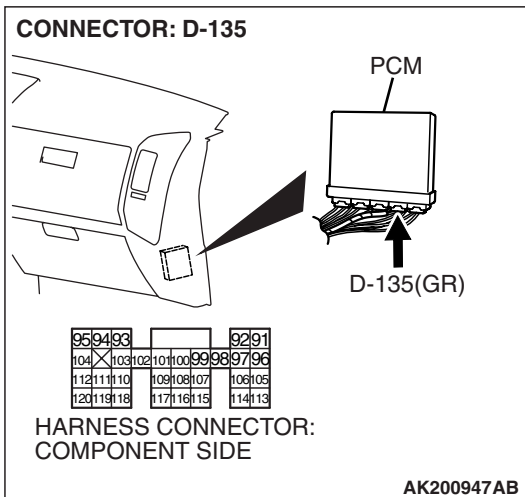
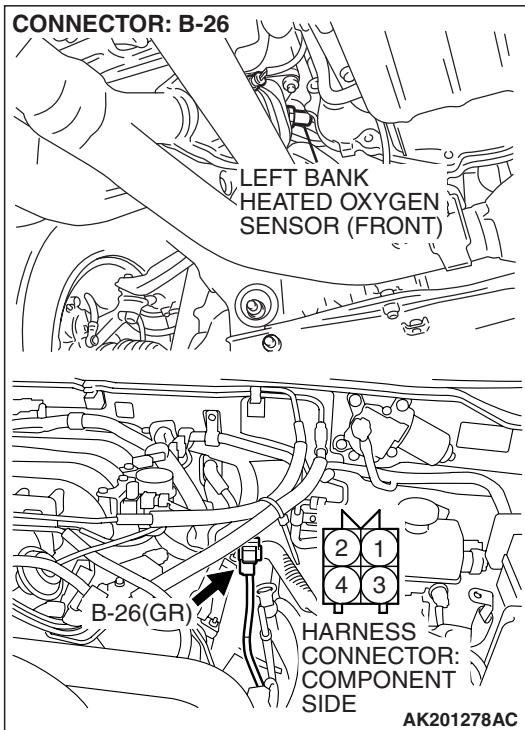


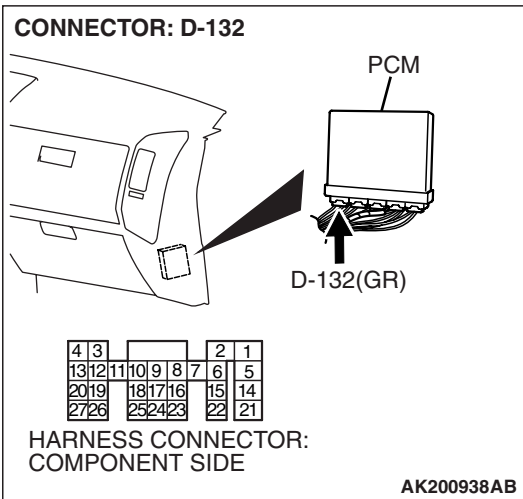
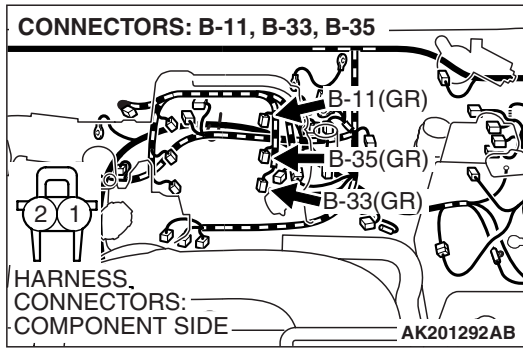
STEP 11. Check for harness damage between left bank heated oxygen sensor (front) connector B-26 (terminal No. 4) and PCM connector D-135 (terminal No. 108).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.





STEP 12. Check for harness damage between left bank injector connector and PCM connector.

- Check the harness wire between left bank injector connector B-33 (terminal No. 2) and PCM connector D-132 (terminal No. 5) at No. 2 cylinder.
- Check the harness wire between left bank injector connector B-35 (terminal No. 2) and PCM connector D-132 (terminal No. 21) at No. 4 cylinder.
- Check the harness wire between left bank injector connector B-11 (terminal No. 2) and PCM connector D-132 (terminal No. 6) at No. 6 cylinder.

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 fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-1048](#).

Q: Is the fuel pressure normal?

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

NO : Repair it. Then go to Step 14.

STEP 14. Test the OBD-II drive cycle.

- Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).
- Check the diagnostic trouble code (DTC).

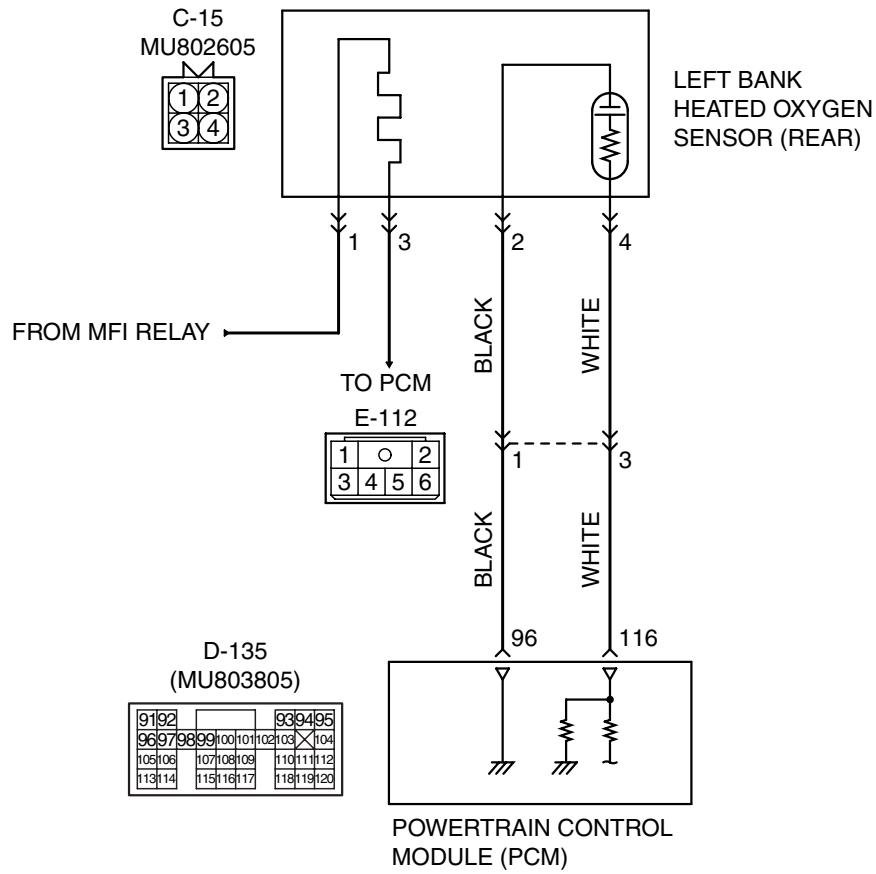
Q: Is DTC P0154 set?

YES : Retry the troubleshooting.

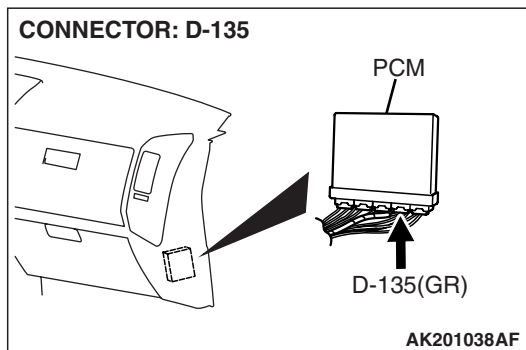
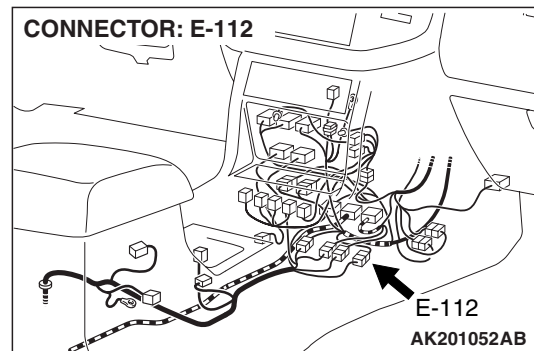
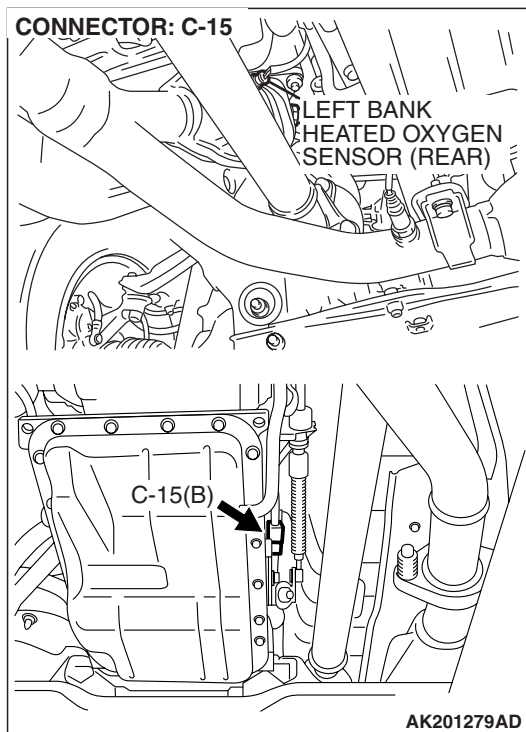
NO : The inspection is complete.

DTC P0156: Heated Oxygen Sensor Circuit (bank 2, sensor 2)

Left Bank Heated Oxygen Sensor (rear) Circuit



AK501062



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 116) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (rear).
- Terminal No. 2 of the left bank heated oxygen sensor (rear) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (rear) circuit is switched to 5 volts intentionally when oxygen sensor output is low, and detects the malfunction if the output voltage changes to equal or greater than 4.5 volts. The above procedure is repeated when oxygen sensor is inactive.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Check Conditions

- 3 minutes or more have passed since the engine starting sequence was completed.
- Left bank 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.

Judgement Criterion

- Input voltage supplied to the PCM interface circuit is higher than 4.5 volts when 5 volts is applied to the left bank heated oxygen sensor (rear) output line via a resistor.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Left bank heated oxygen sensor (rear) failed.
- Open or shorted circuit in left bank heated oxygen sensor (rear) output line, or harness damage.
- Open circuit in left bank heated oxygen sensor (rear) ground line, or harness damage.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- 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 MB991958, check data list item 59: Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).

CAUTION

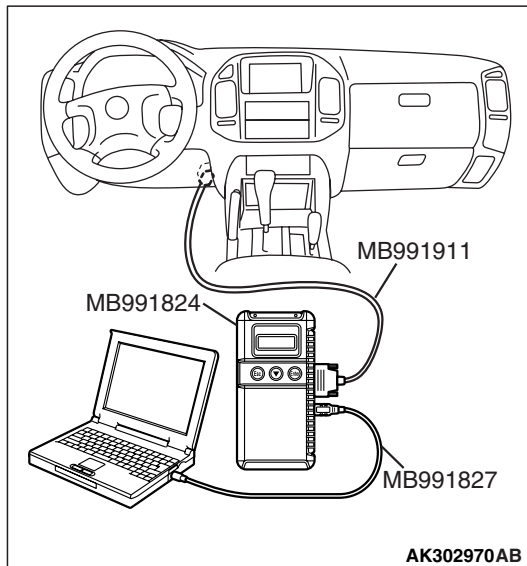
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

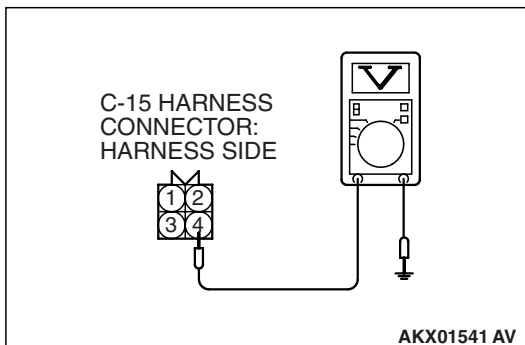
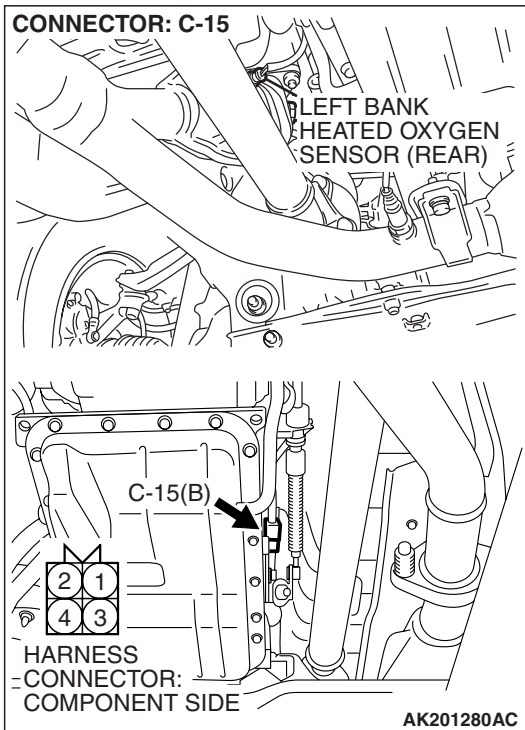
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.



STEP 2. Measure the sensor output voltage at left bank heated oxygen sensor (rear) connector C-15 by backprobing.

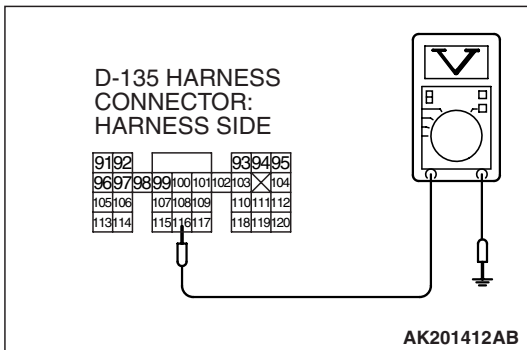
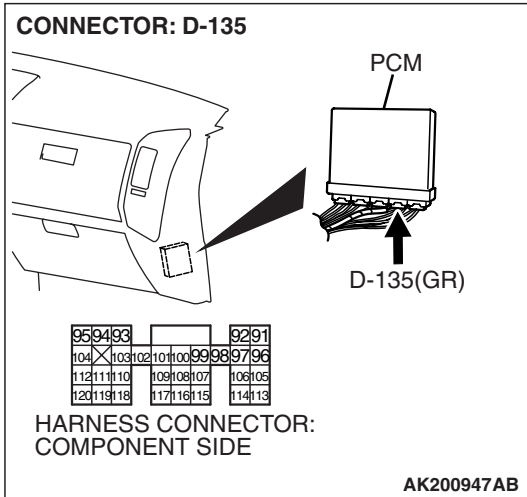
- (1) Do not disconnect the connector C-15.
- (2) Start the engine and run at idle.



- (3) Measure the voltage between terminal No. 4 and ground by backprobing.
 - Warming 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 voltage normal?

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



STEP 3. Measure the sensor output voltage at PCM connector D-135 by backprobing.

- (1) Do not disconnect the connector D-135.
- (2) Start the engine and run at idle.

- (3) Measure the voltage between terminal No. 116 and ground by backprobing.
 - Warming 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 voltage normal?

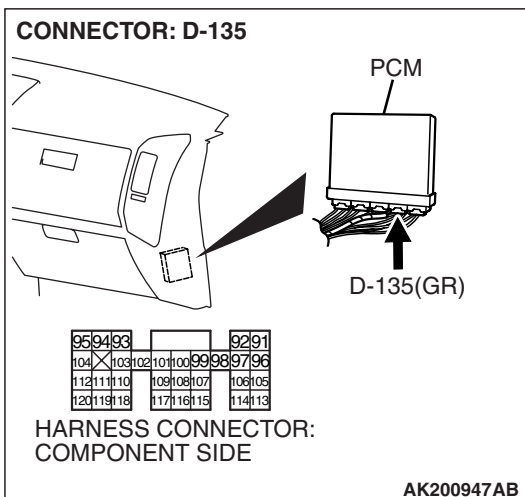
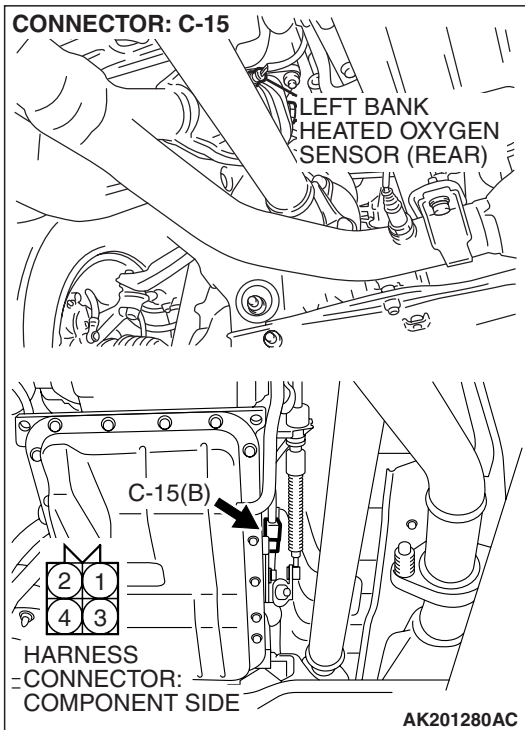
- YES :** Go to Step 4.
NO : Go to Step 6.

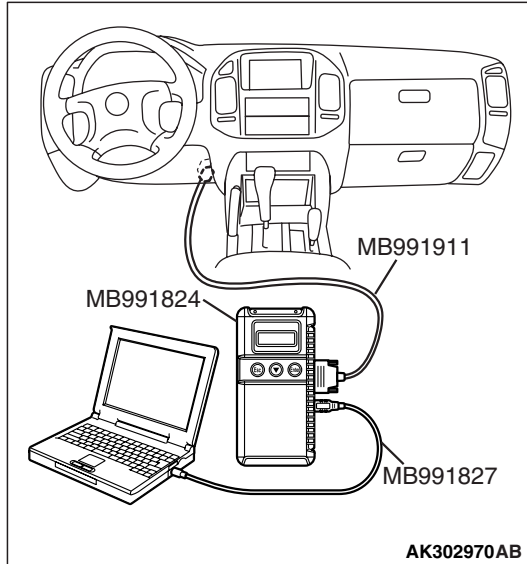
STEP 4. Check harness connector C-15 at left bank heated oxygen sensor (rear) and harness connector D-135 at PCM for damage.

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 15.





STEP 5. Using scan tool MB99158, check data list item 59: Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).

⚠ CAUTION

To prevent damage to scan tool MB99158, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB99158.

- (1) Connect scan tool MB99158 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB99158 to the data reading mode for item 59, Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

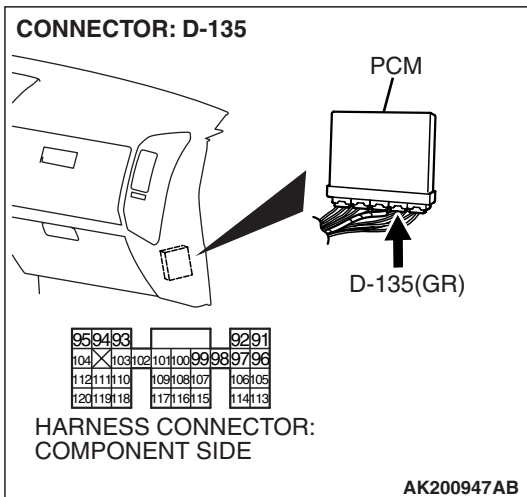
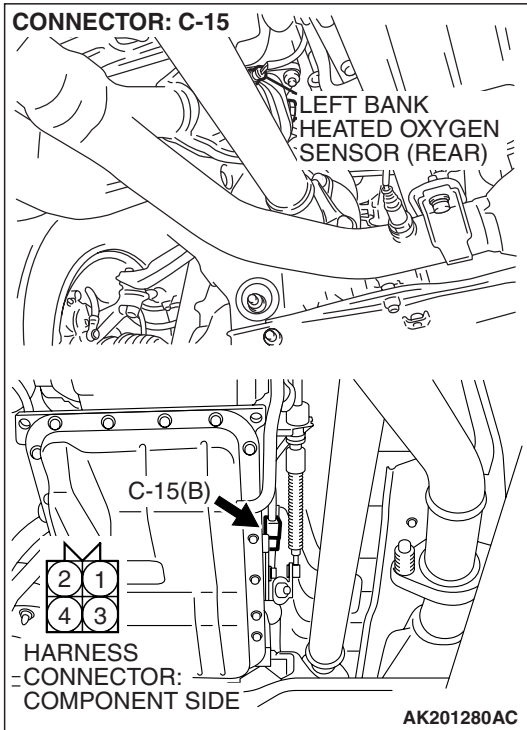
NO : Replace the PCM. Then go to Step 15.

STEP 6. Check harness connector C-15 at left bank heated oxygen sensor (rear) and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector E-112 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection. If intermediate connector E-112 is in good condition, repair harness wire between left bank heated oxygen sensor (rear) connector C-15 (terminal No. 4) and PCM connector D-135 (terminal No. 116) 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.

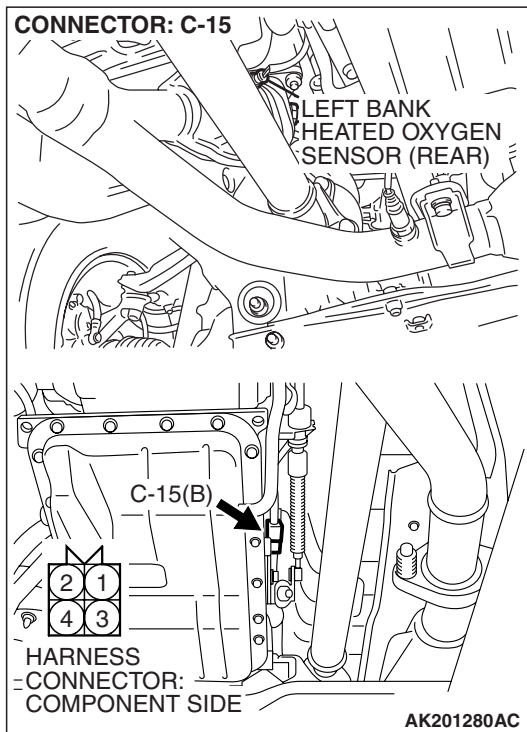


STEP 7. Check harness connector C-15 at left bank heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

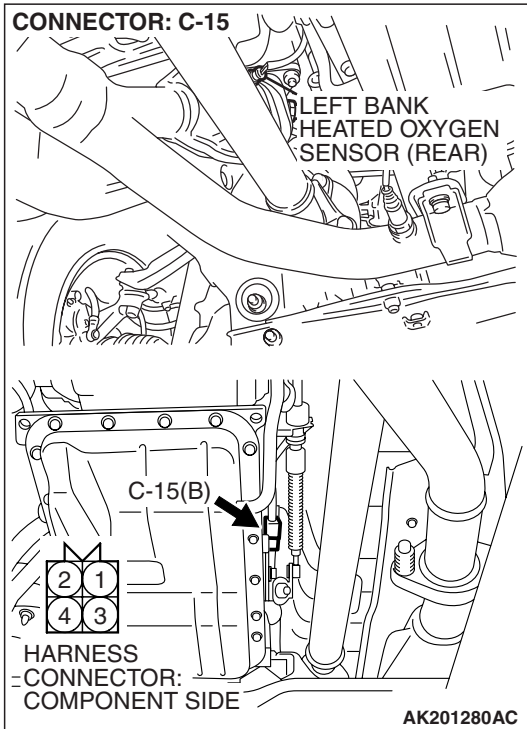
YES : Go to Step 8.

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



STEP 8. Check the continuity at left bank heated oxygen sensor (rear) harness side connector C-15.

- (1) Disconnect the connector C-15 and measure at the harness side.

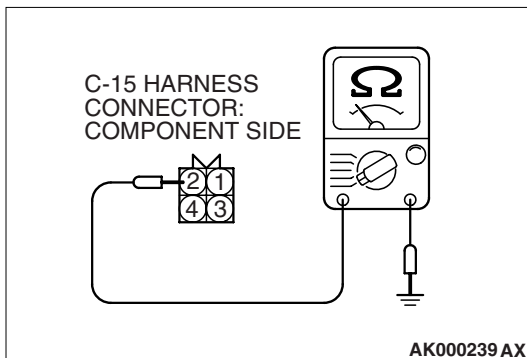


- (2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.

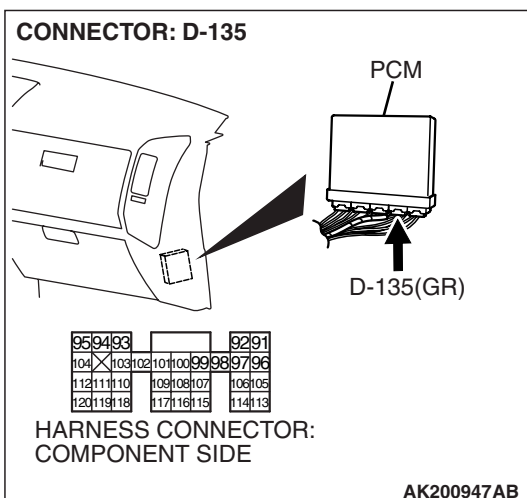


STEP 9. Check harness connector D-135 at PCM for damage.

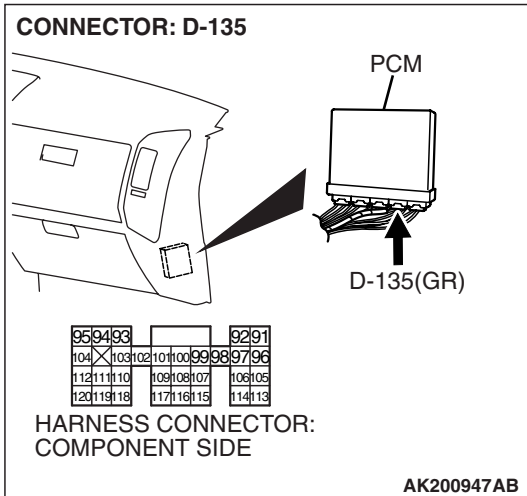
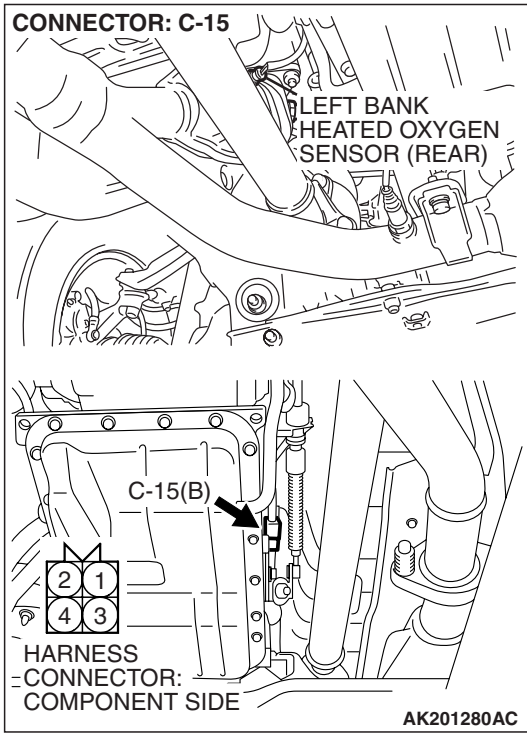
Q: Is the harness connector in good condition?

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 left bank heated oxygen sensor (rear) connector C-15 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

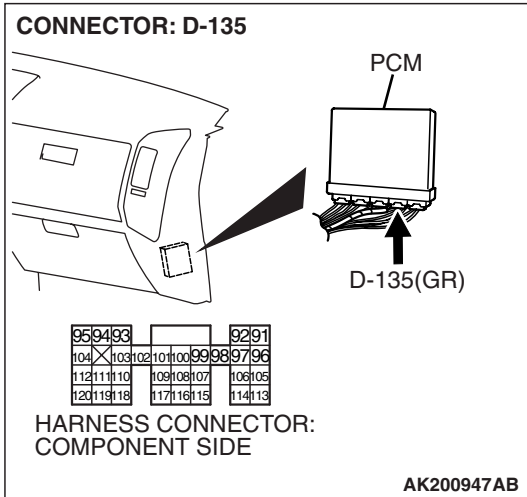


NOTE: Check harness after checking intermediate connector E-112. If intermediate connector E-112 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 15.



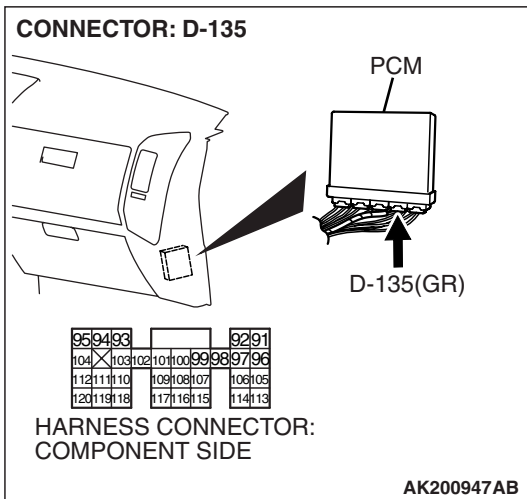
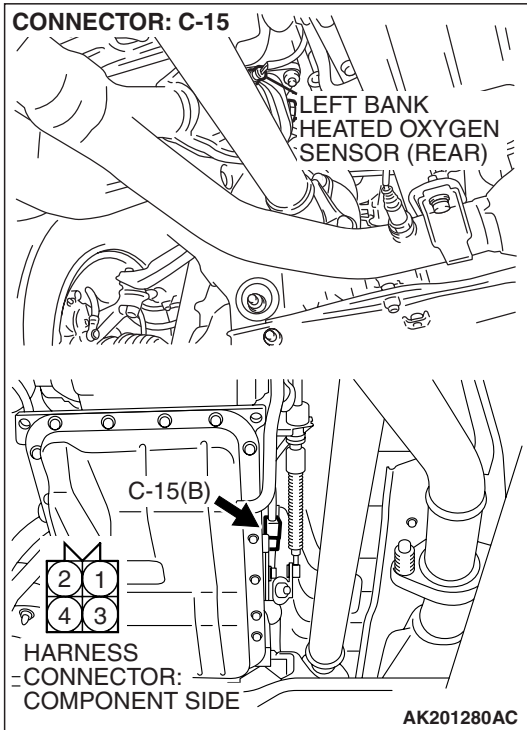
STEP 11. Check harness connector D-135 at PCM for damage.

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 left bank heated oxygen sensor (rear) connector C-15 (terminal No. 2) and PCM connector D-135 (terminal No. 96).



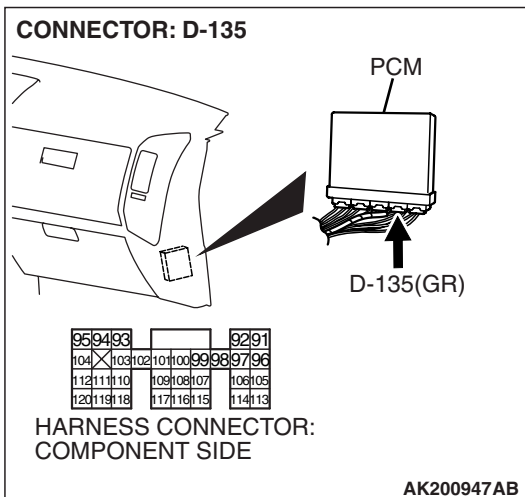
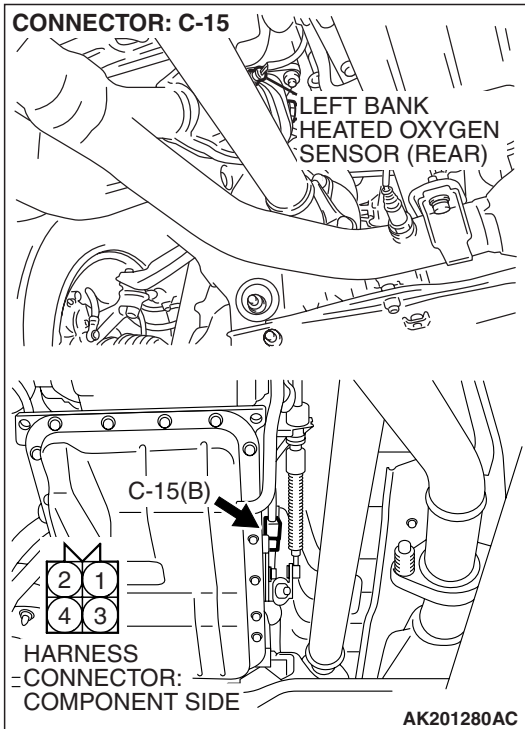
NOTE: Check harness after checking intermediate connector E-112. If intermediate connector E-112 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

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 left bank heated oxygen sensor (rear) connector C-15 (terminal No. 4) and PCM connector D-135 (terminal No. 116).

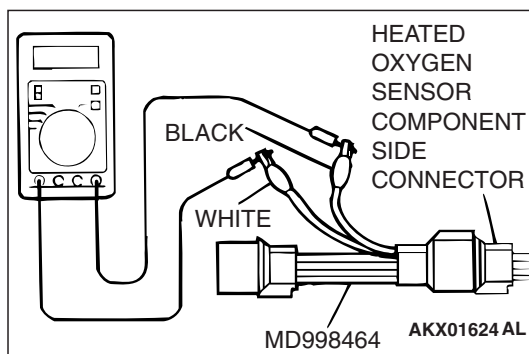
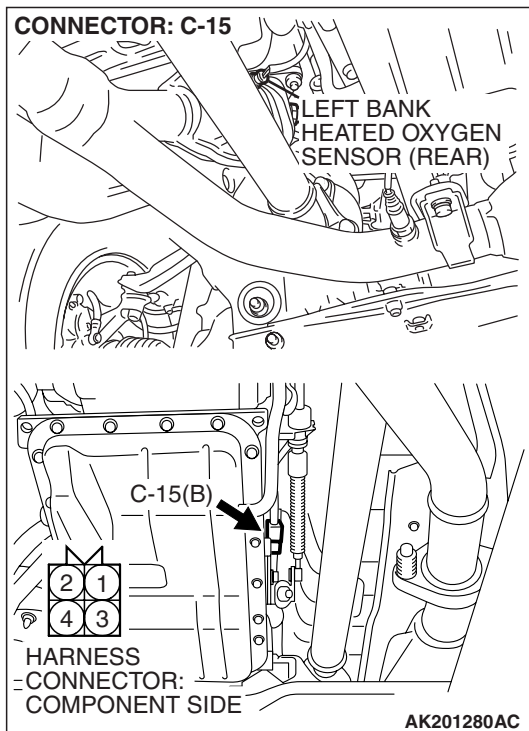


NOTE: Check harness after checking intermediate connector E-112. If intermediate connector E-112 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

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 left bank heated oxygen sensor (rear).**

- (1) Disconnect the left bank heated oxygen sensor (rear) connector C-15 and connect test harness special tool MD998464 to the connector on the left bank heated oxygen sensor (rear) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Drive at 50 km/h (31 mph) or more for 10 minutes.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip of special tool) and terminal No. 4 (white clip of special tool).
- (5) Measure the output voltage of heated oxygen sensor under the following driving.
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more

Standard value: 0.6 – 1.0 volt

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio.

Q: Is the voltage between 0.6 and 1.0 volt?

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

NO : Replace the left bank heated oxygen sensor (rear). Then go to Step 15.

STEP 15. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).
- (2) Check the diagnostic trouble code (DTC).

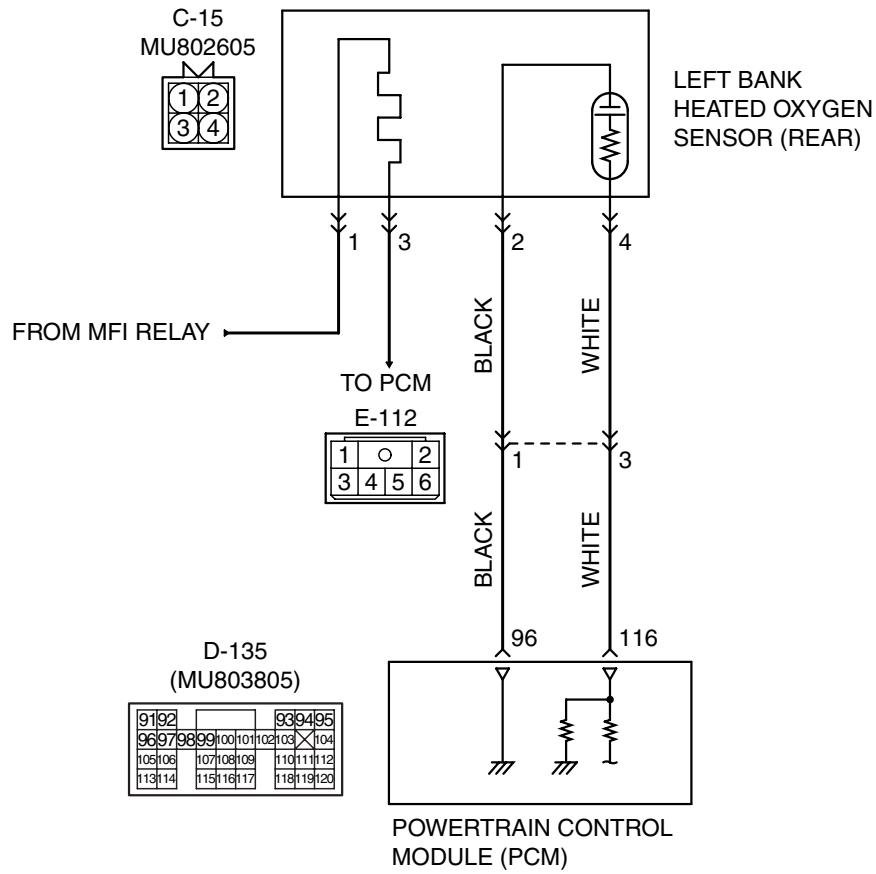
Q: Is DTC P0156 set?

YES : Retry the troubleshooting.

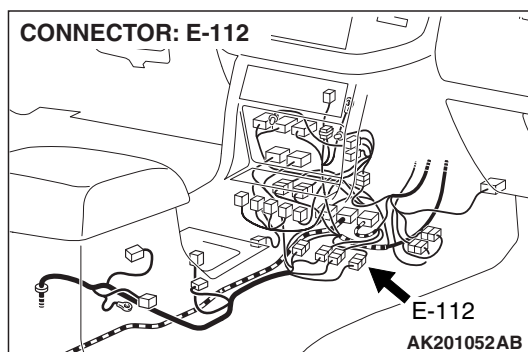
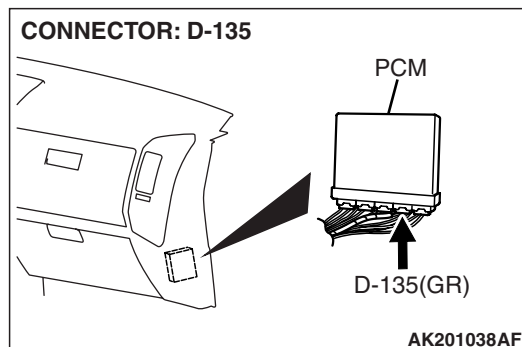
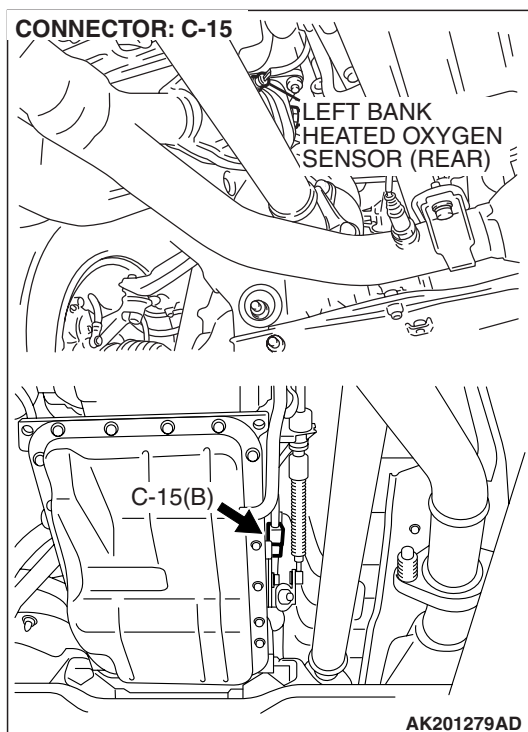
NO : The inspection is complete.

DTC P0157: Heated Oxygen Sensor Circuit Low Voltage (bank 2, sensor 2)

Left Bank Heated Oxygen Sensor (rear) Circuit



AK501062



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 116) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (rear).
- Terminal No. 2 of the left bank heated oxygen sensor (rear) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (rear) output voltage stays low when air/fuel ratio is forced to be rich.

The above procedure is repeated when oxygen sensor is inactive.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

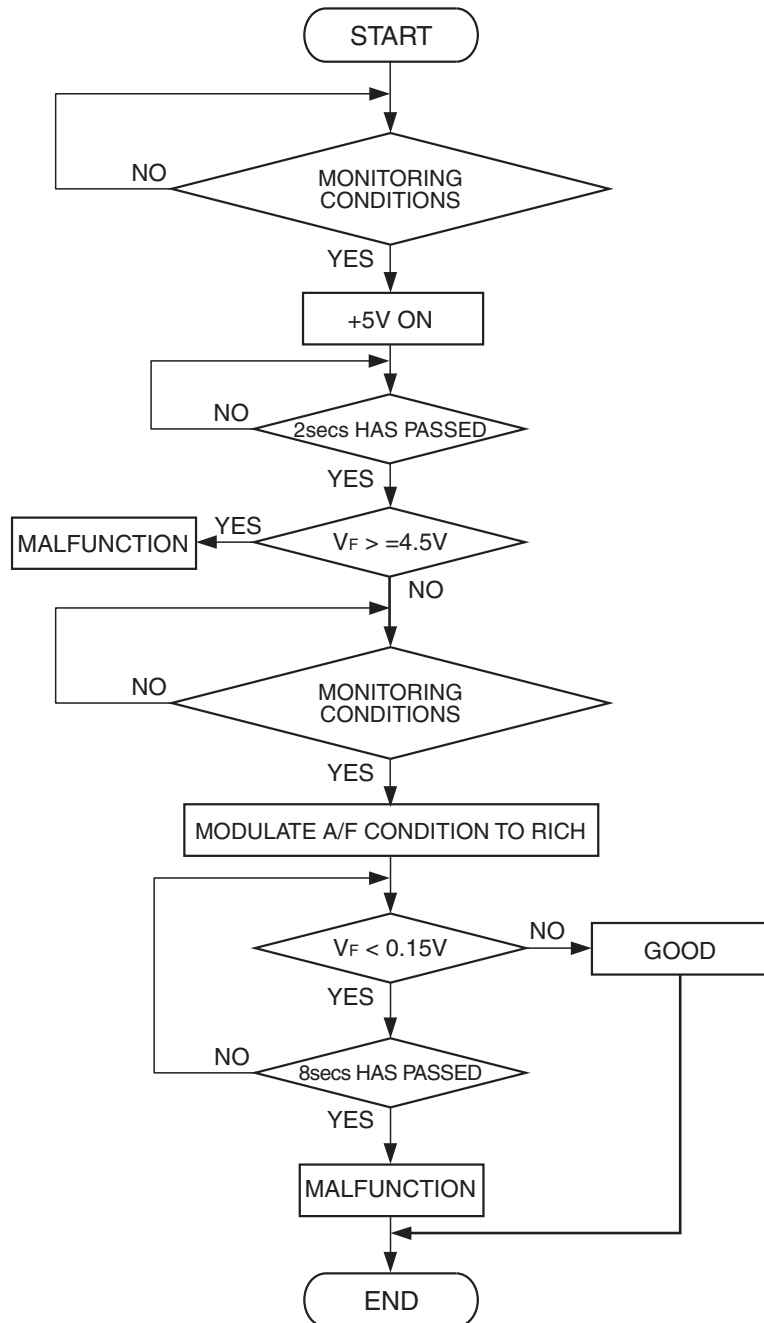
Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor

- Intake air temperature sensor
- Barometric pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

- After 2 seconds or more pass from the time when the monitor determines normally for detecting an open circuit.
- Left bank 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).
- Volume airflow sensor output frequency is higher than 100 Hz.
- At least 20 seconds have passed since fuel shut off control was canceled.

Judgement Criterion

- Making the air/fuel ratio 15 percent richer for 8 seconds does not result in raising the left bank heated oxygen sensor (rear) output voltage beyond 0.15 volt.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 [P.13A-4](#).

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

- Left bank heated oxygen sensor (rear) failed.
- Short circuit in left bank heated oxygen sensor (rear) output line.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MB998464: Test Harness Set

STEP 1. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).

⚠ CAUTION

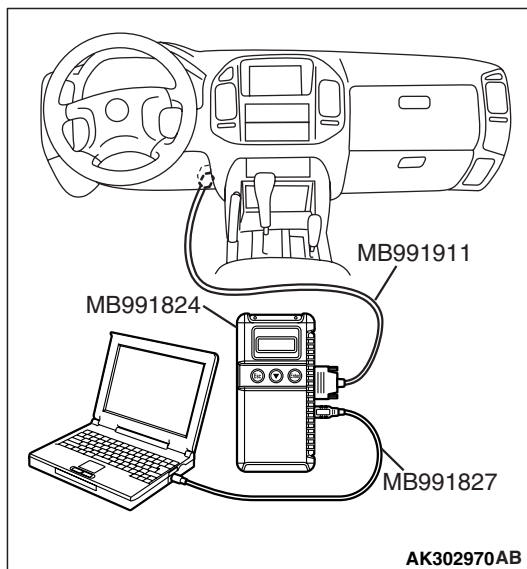
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

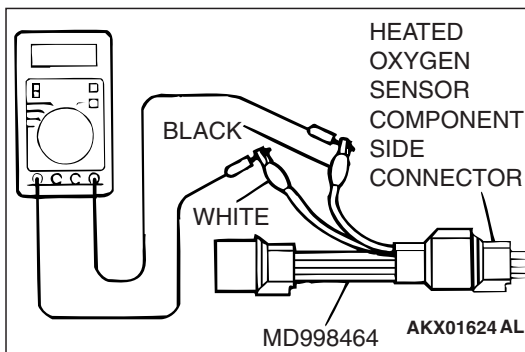
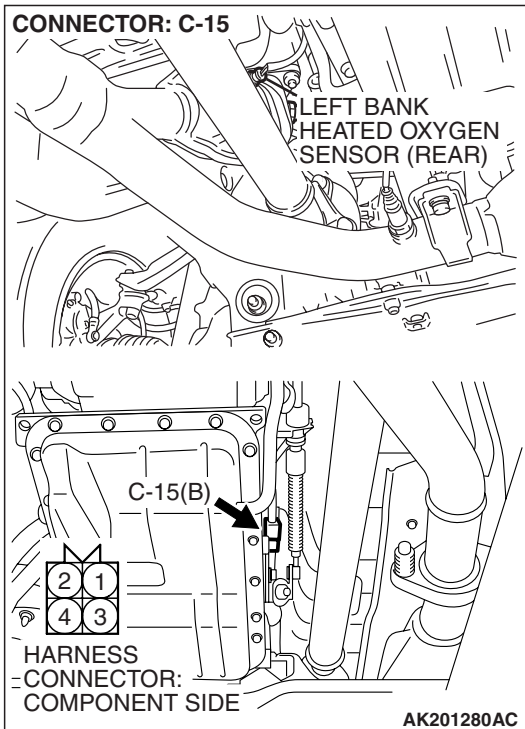
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (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 – How to Cope with Intermittent Malfunctions [P.00-13](#).

NO : Go to Step 2.





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

- (1) Disconnect the left bank heated oxygen sensor (rear) connector C-15 and connect test harness special tool MD998464 to the connector on the left bank heated oxygen sensor (rear) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Drive at 50 km/h (31 mph) or more for 10 minutes.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip of special tool) and terminal No. 4 (white clip of special tool).
- (5) Measure the output voltage of heated oxygen sensor under the following driving.
 - a. Transmission: "L" range
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more

Standard value: 0.6 – 1.0 volt

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio.

Q: Is the voltage between 0.6 and 1.0 volt?

YES : Go to Step 3.

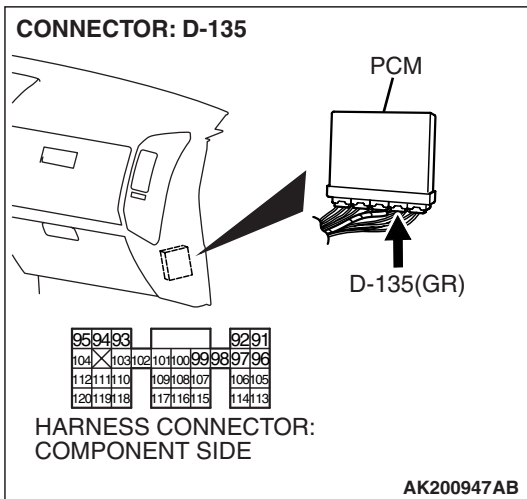
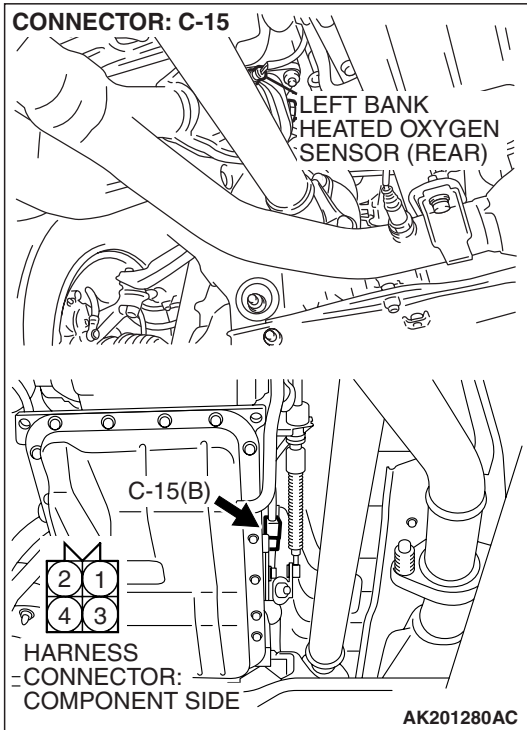
NO : Replace the left bank heated oxygen sensor (rear).
Then go to Step 5.

STEP 3. Check harness connector C-15 at left bank heated oxygen sensor (rear) and harness connector D-135 at PCM for damage.

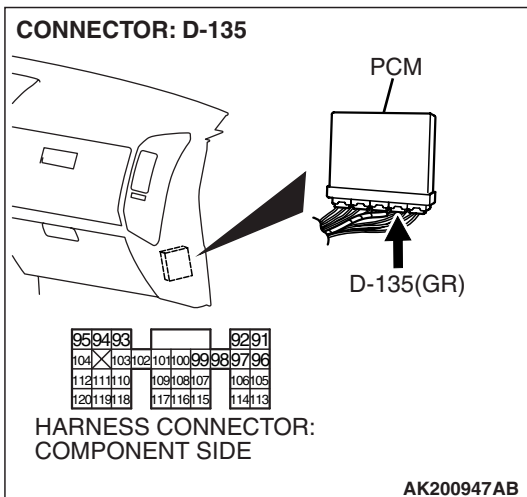
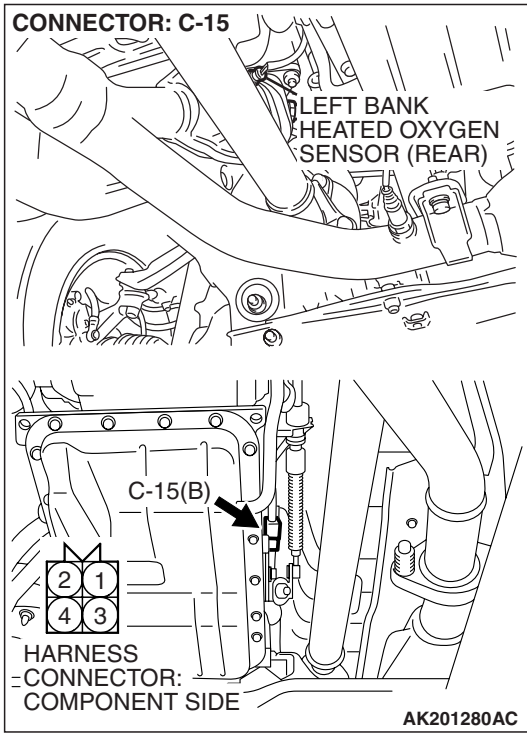
Q: Is the harness connector in good condition?

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 left bank heated oxygen sensor (rear) connector C-15 (terminal No. 4) and PCM connector D-135 (terminal No. 116).



NOTE: Check harness after checking intermediate connector E-112. IF intermediate connector is damaged, repair or replace it. Refer to Group 00E, Harness Connector Inspection P.00E-2.

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 5.

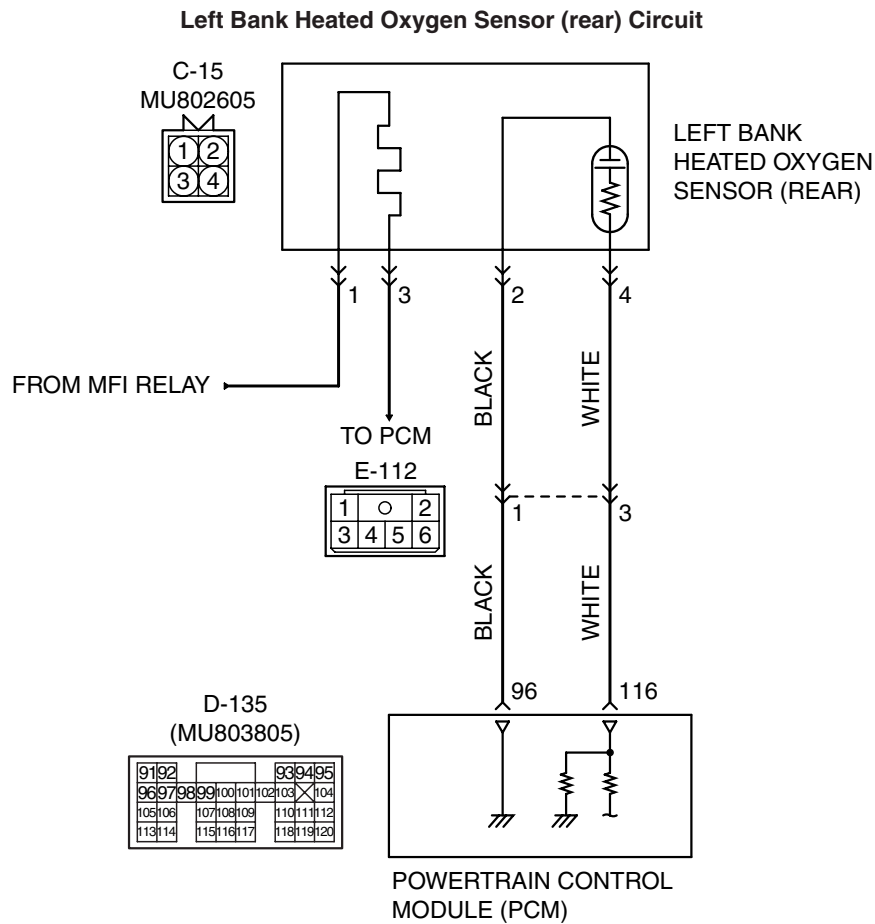
STEP 5. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 12 P.13A-4.
- (2) Check the diagnostic trouble code (DTC).

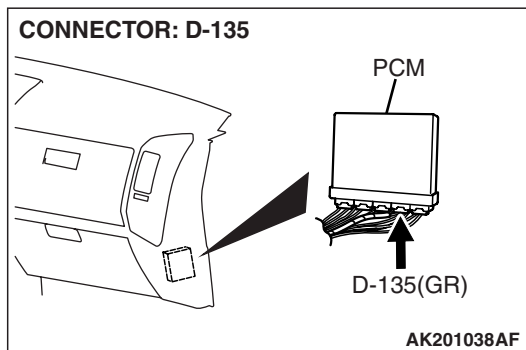
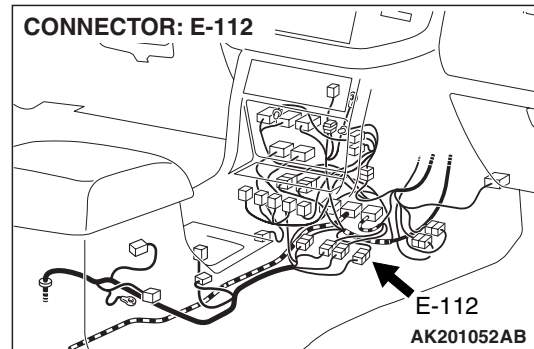
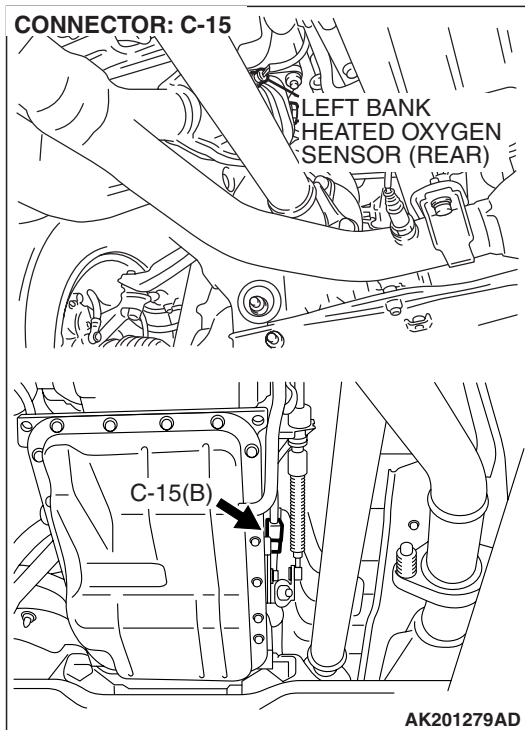
Q: Is DTC P0157 set?

- YES :** Retry the troubleshooting.
NO : The inspection is complete.

DTC P0158: Heated Oxygen Sensor Circuit High Voltage (bank 2, sensor 2)



AK501062



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 116) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (rear).
- Terminal No. 2 of the left bank heated oxygen sensor (rear) is grounded to the PCM (terminal No. 96).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (rear) output voltage is over specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

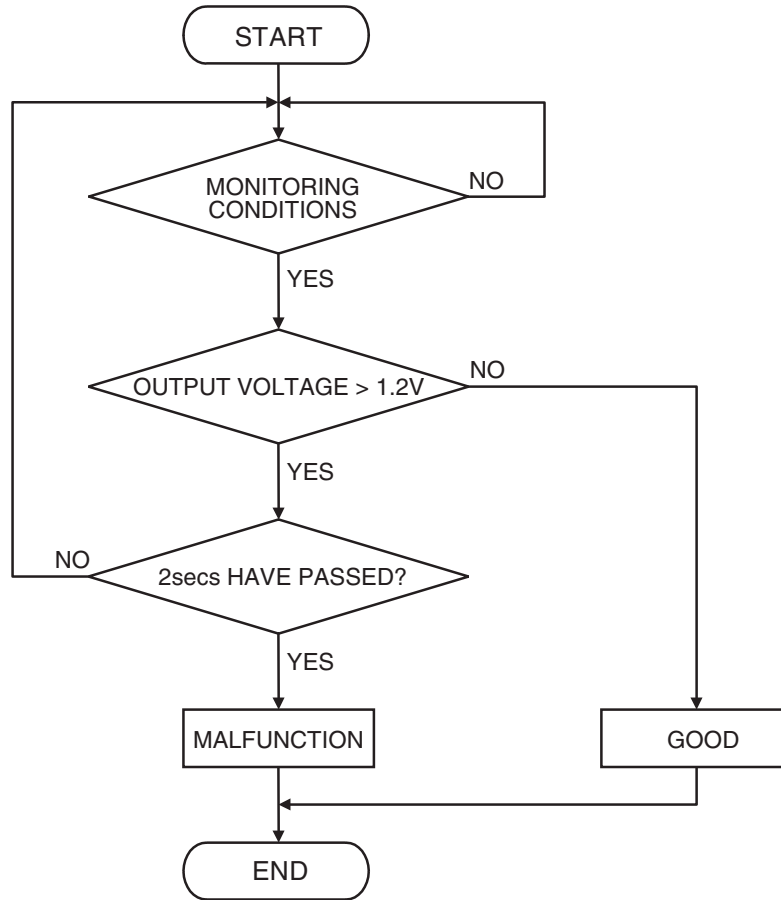
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302931

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-4](#).

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

- Short circuit in left bank heated oxygen sensor (rear) output line.
- Connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

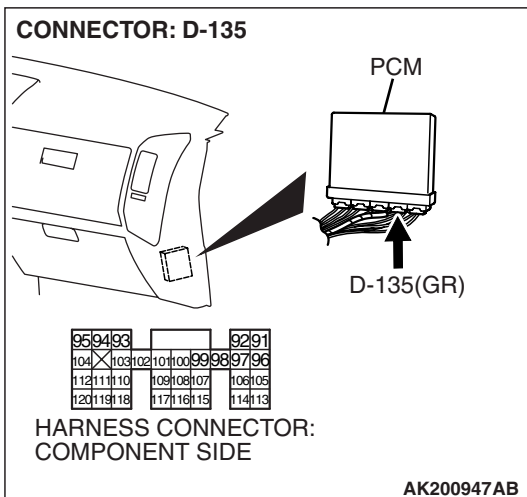
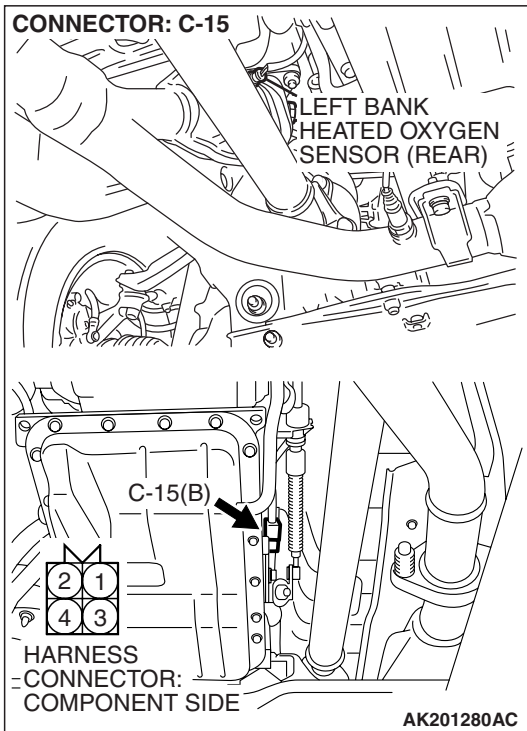
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Check harness connector C-15 at left bank heated oxygen sensor (rear) and harness connector D-135 at PCM for damage.

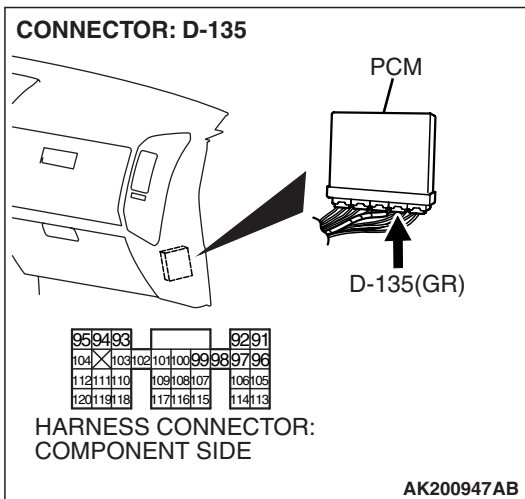
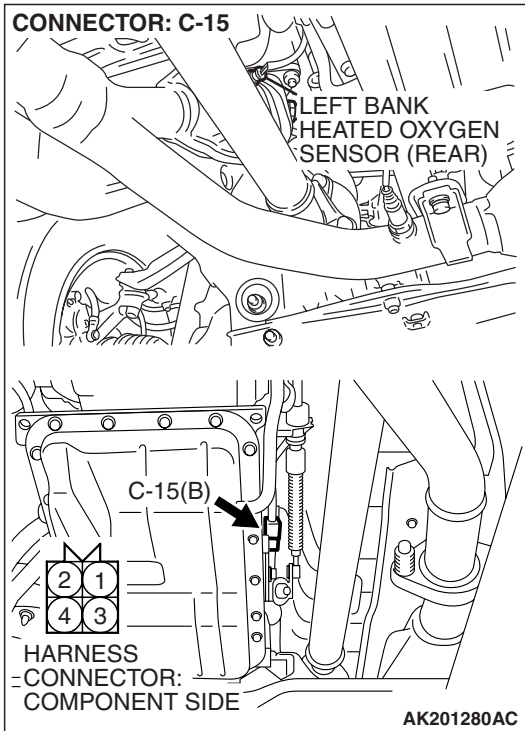
Q: Is the harness connector in good condition?

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 left bank heated oxygen sensor (rear) connector C-15 (terminal No. 4) and PCM connector D-135 (terminal No. 116).



NOTE: Check harness after checking intermediate connector E-112. If intermediate connector E-112 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 3.

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 3.

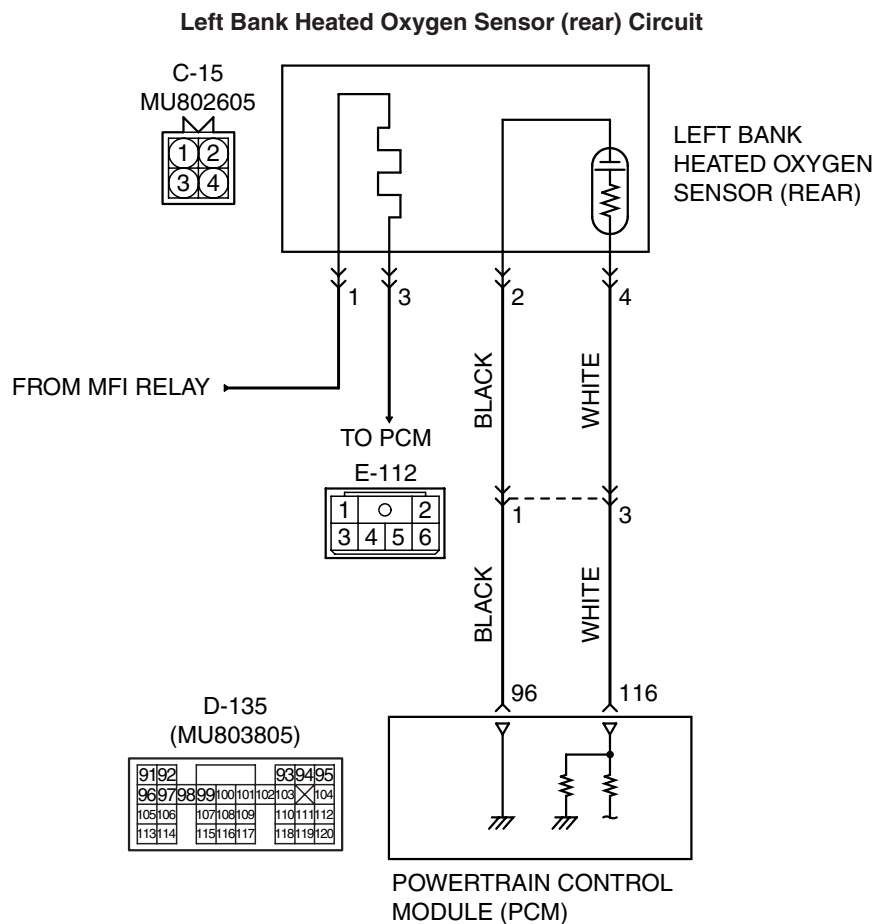
STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.
- (2) Check the diagnostic trouble code (DTC).

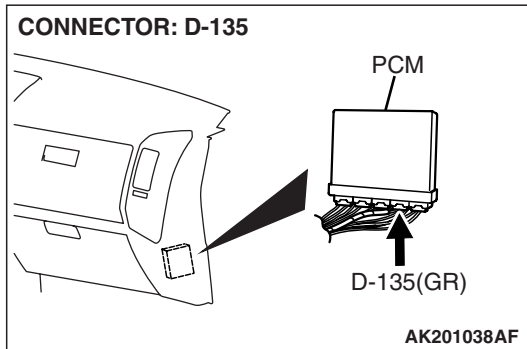
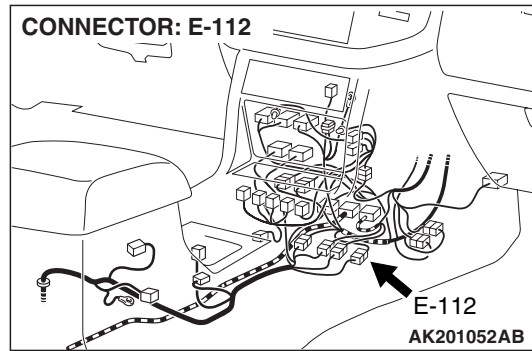
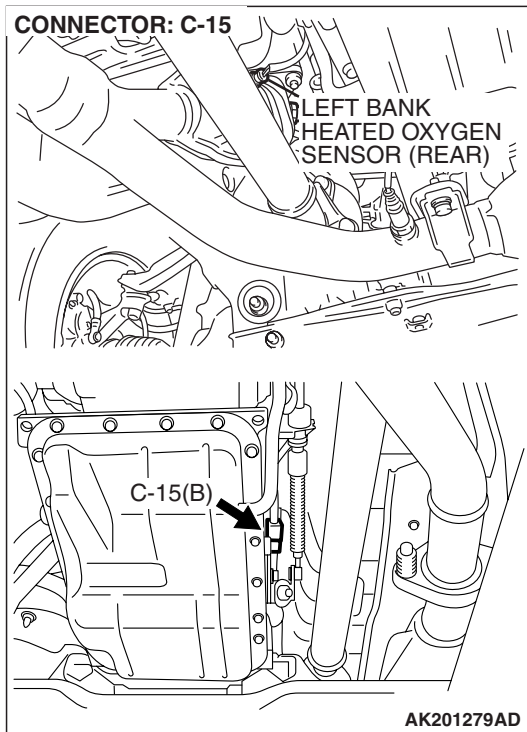
Q: Is DTC P0158 set?

- YES :** Retry the troubleshooting.
NO : The inspection is complete.

DTC P0159: Heated Oxygen Sensor Circuit Slow Response (bank 2, sensor 2)



AK501062



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 116) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (rear).
- Terminal No. 2 of the left bank heated oxygen sensor (rear) is grounded with the PCM (terminal No. 96).
- The PCM applies an offset voltage of 0.5 volt to terminal No. 2 of the left bank heated oxygen sensor (rear).

TECHNICAL DESCRIPTION

- The output signal of the heated left bank oxygen sensor (front) is compensated by the output signal of the left bank heated oxygen sensor (rear).

- The PCM checks for the left bank heated oxygen sensor (rear) output line.

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (rear) output voltage does not reach 0.2 volt after fuel cut operation.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

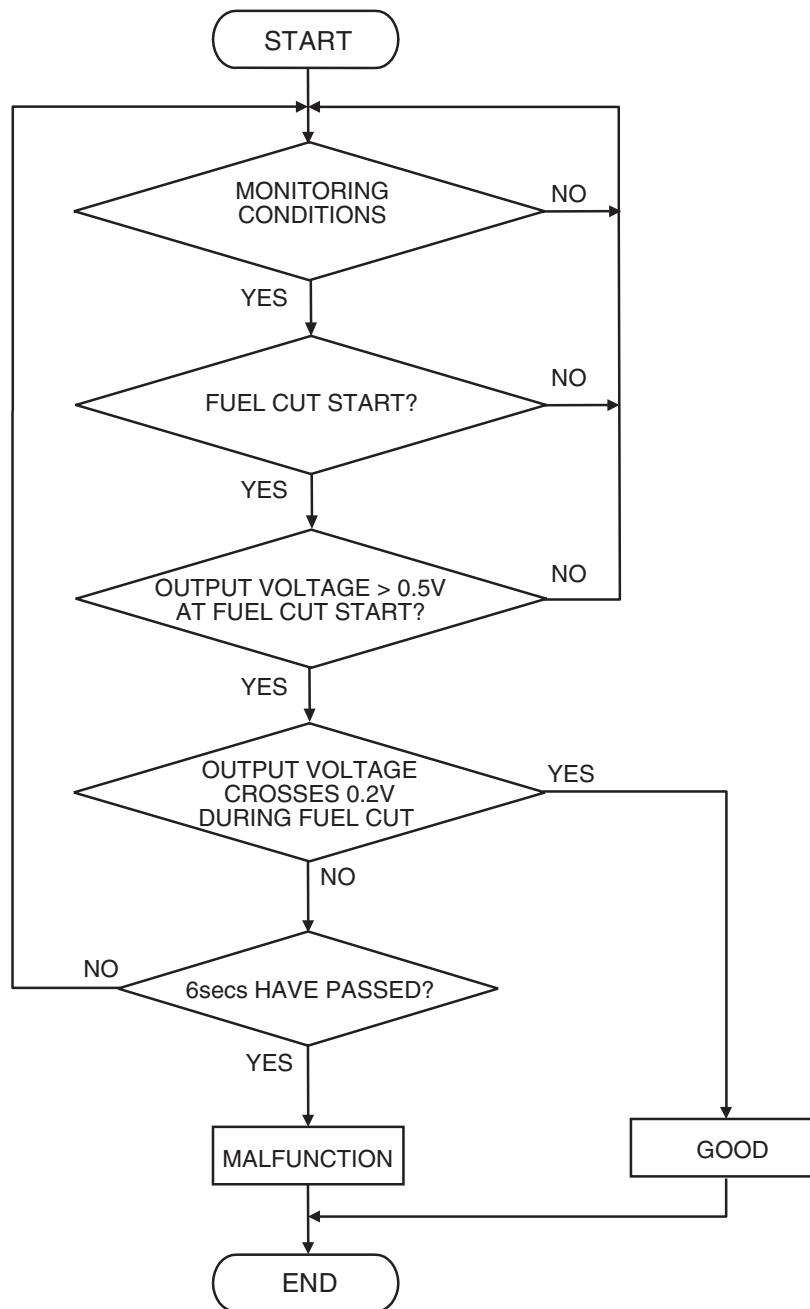
Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor

- Intake air temperature sensor
- Barometric pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



AK500043

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The left bank heated oxygen sensor (front) is active.
- The cumulative volume airflow sensor output is higher than 4,000 Hz.
- Fuel is being shut off.

Judgement Criterion

- Left bank heated oxygen sensor (rear) output voltage does not reach 0.2 volt for 6 seconds from fuel cut start.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-4](#).

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

- Left bank heated oxygen sensor (rear) deteriorated.
- Connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Replace the left bank heated oxygen sensor (rear).

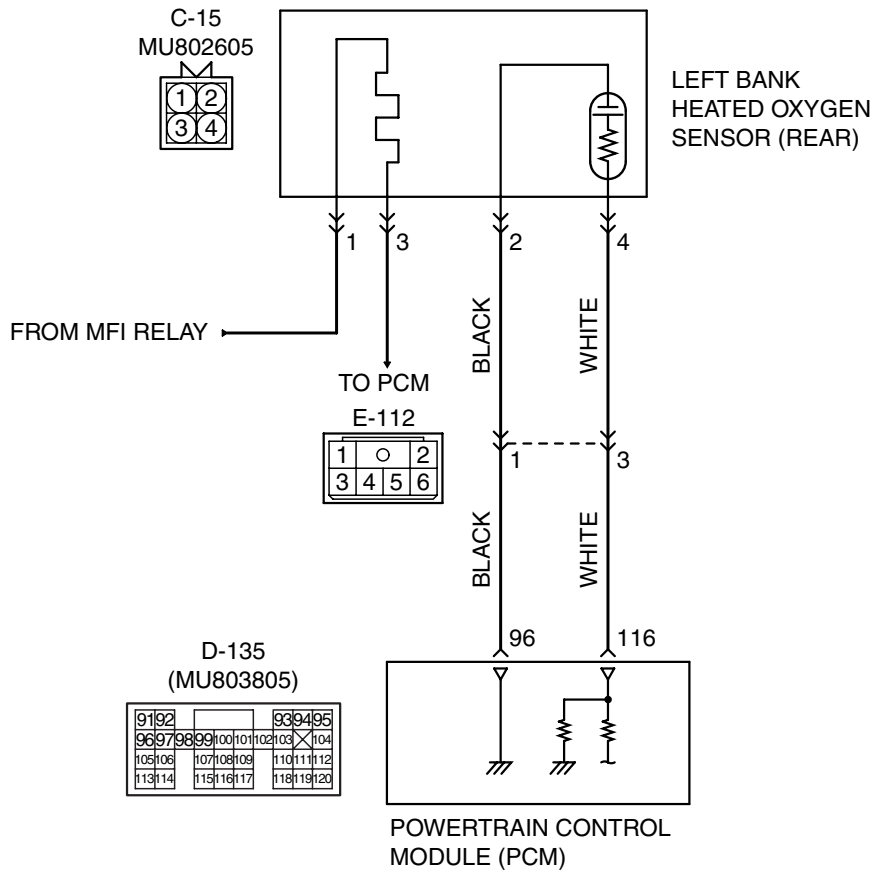
- (1) Replace the left bank heated oxygen sensor (rear).
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-4](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0159 set?

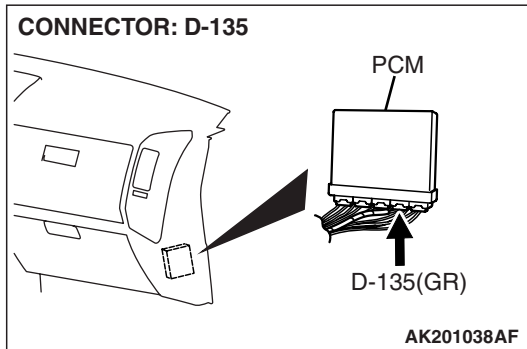
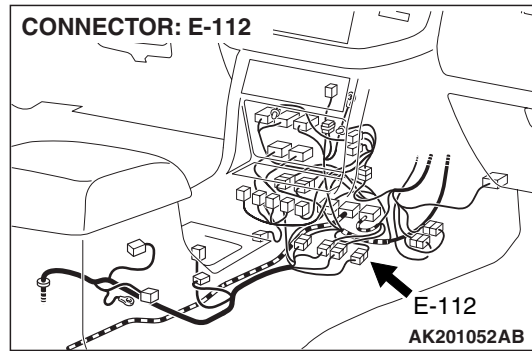
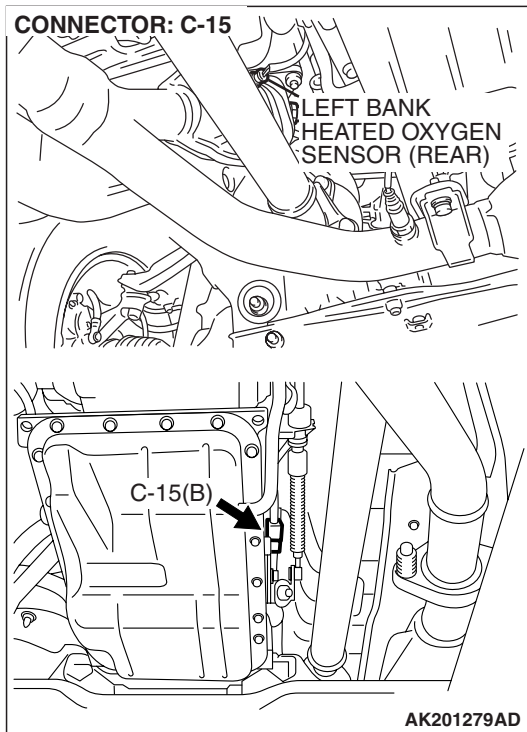
- YES** : Refer to, P156 – Heated Oxygen Sensor Circuit (bank 2, sensor 2) [P.13A-349](#), P0157 – Heated Oxygen Sensor Circuit Low Voltage (bank 2, sensor 2) [P.13A-365](#), DTC P0158 – Heated Oxygen Sensor Circuit High Voltage (bank 2, sensor 2) [P.13A-372](#).
- NO** : The inspection is complete.

DTC P0160: Heated Oxygen Sensor Circuit No Activity Detected (bank 2, sensor 2)

Left Bank Heated Oxygen Sensor (rear) Circuit



AK501062



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 116) from the output terminal (terminal No. 4) of the left bank heated oxygen sensor (rear).
- Terminal No. 2 of the left bank heated oxygen sensor (rear) is grounded with PCM (terminal No. 96).
- The PCM applies an offset voltage of 0.5 volt to terminal No. 2 of the left bank heated oxygen sensor (rear).

TECHNICAL DESCRIPTION

- The output signal of the heated left bank oxygen sensor (front) is compensated by the output signal of the left bank heated oxygen sensor (rear).
- The PCM checks for the left bank heated oxygen sensor (rear) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (rear) output voltage does not change during specified.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

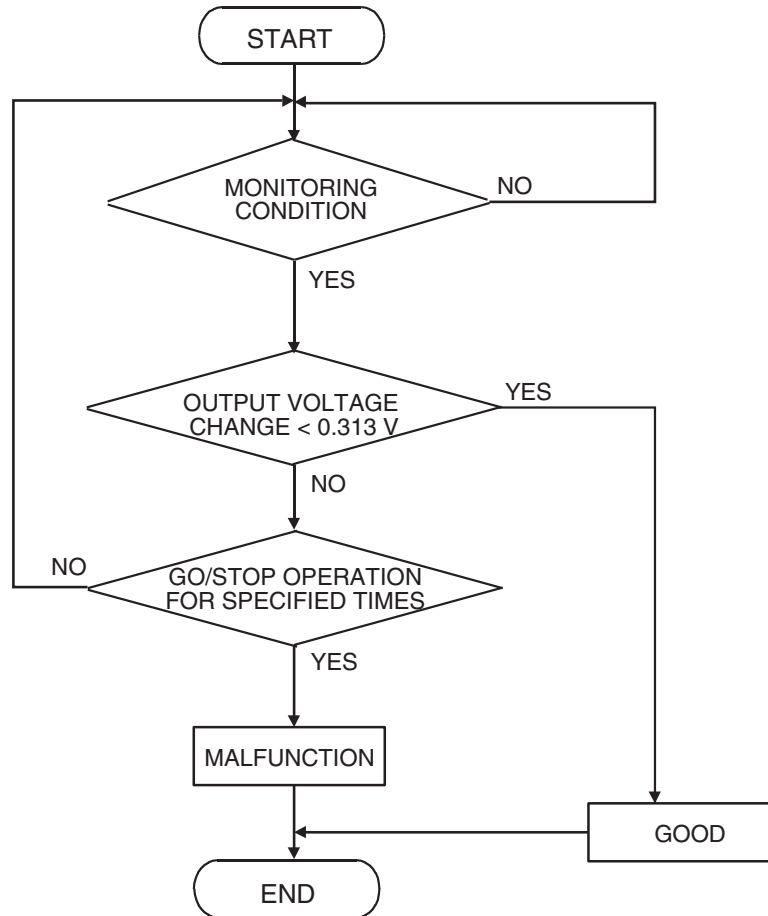
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302399

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The left bank heated oxygen sensor (front) is active.
- The cumulative volume airflow sensor output frequency for every 2 seconds is higher than 4,000 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 per cent.
- Vehicle speed is higher than 30 km/h (19 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 (1.0 mph).

Judgement Criterion

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

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 13 [P.13A-4](#).

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

- Left bank heated oxygen sensor (rear) deteriorated.
- Connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

STEP 1. Replace the left bank heated oxygen sensor (rear).

- (1) Replace the left bank heated oxygen sensor (rear).
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 13 [P.13A-4](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0160 set?

YES : Refer to, P0156 – Heated Oxygen Sensor Circuit (bank 2, sensor 2) [P.13A-349](#), P0157 – Heated Oxygen Sensor Circuit Low Voltage (bank 2, sensor 2) [P.13A-365](#), DTC P0158 – Heated Oxygen Sensor Circuit High Voltage (bank 2, sensor 2) [P.13A-372](#).

NO : The inspection is complete.

NEXT>>