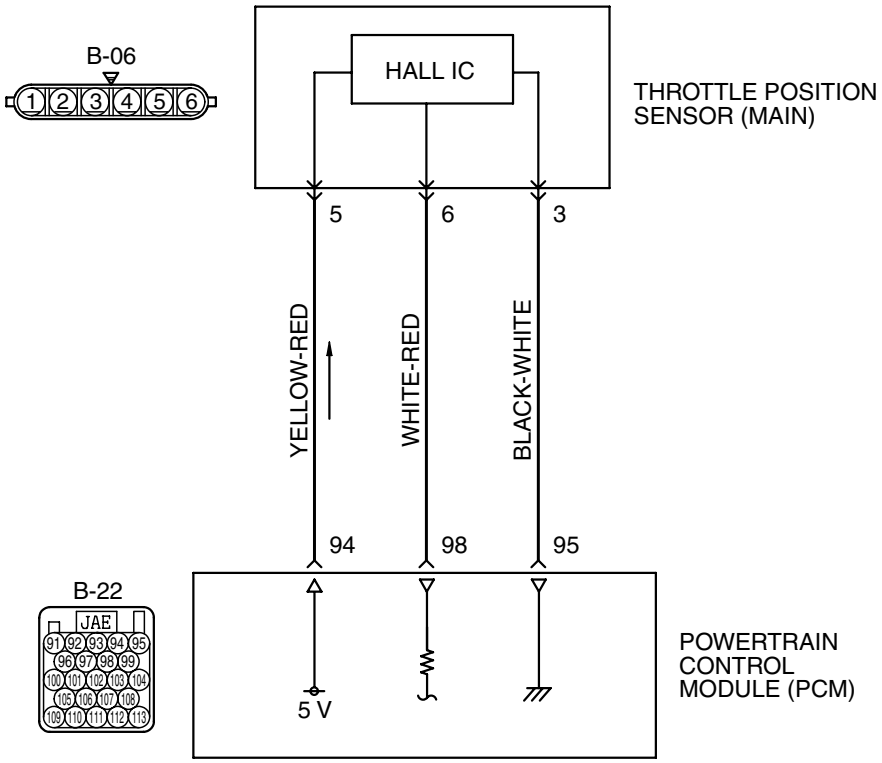
DTC P0122: Throttle Position Sensor (Main) Circuit Low Input

⚠ CAUTION
If DTC P0122 has been set, TCL related DTC U1120 is also set. After P0122 has been diagnosed, don't forget to erase DTC U1120.

Throttle Position Sensor (main) Circuit



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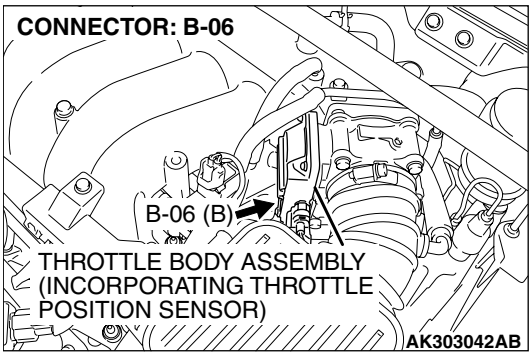
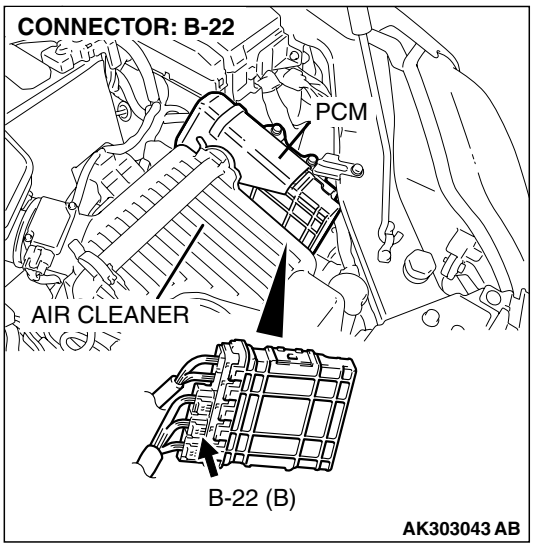




TSB Revision

CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the PCM (terminal No. 94).
  The ground terminal (terminal No. 3) is grounded with PCM (terminal No. 95).

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)

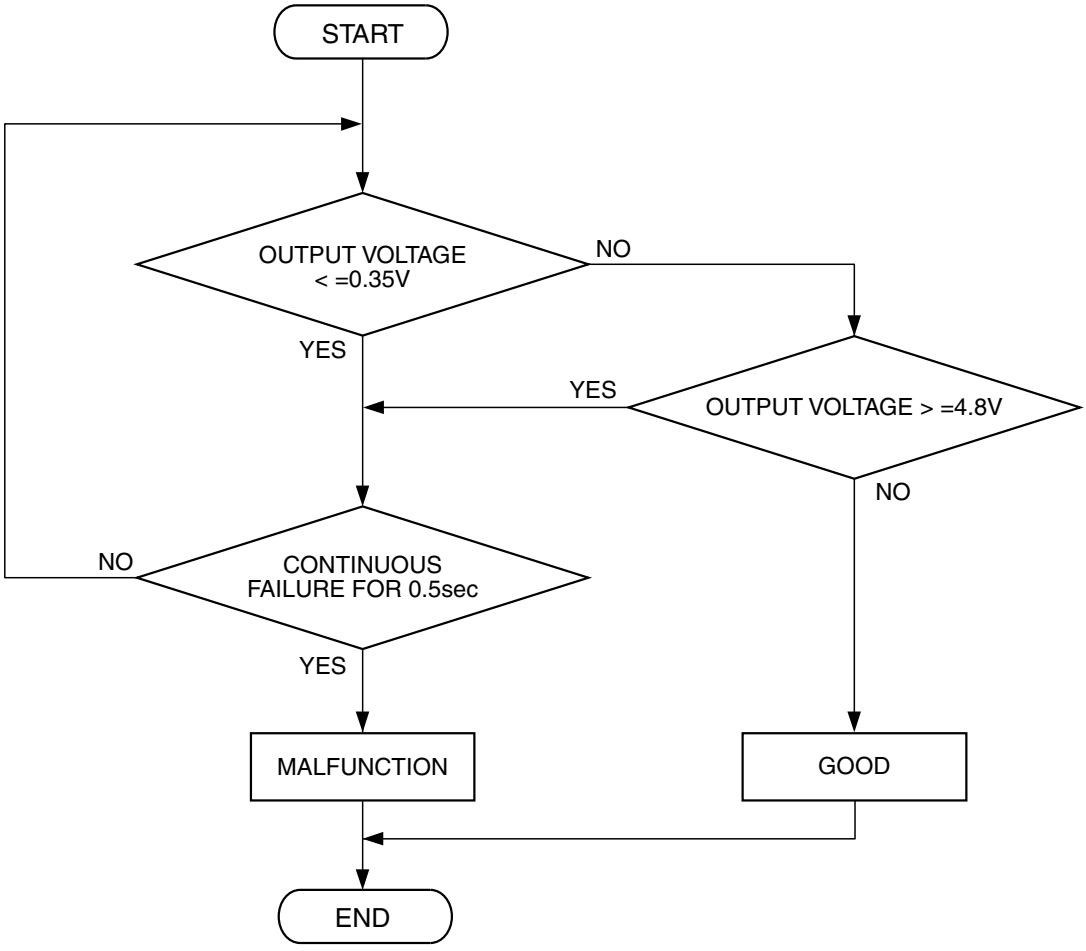
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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Check Condition
- Ignition switch is "ON" position.

Judgement Criteria
- 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.

TSB Revision

DIAGNOSIS

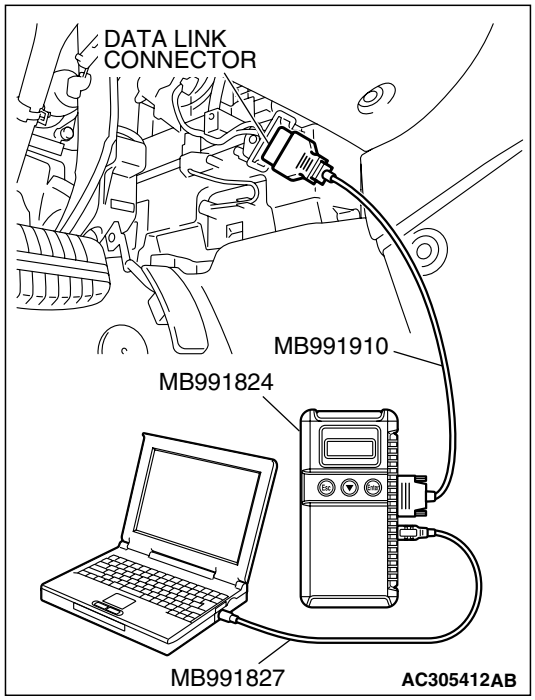
Required Special Tools:

- MB991958: Scan tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- 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.



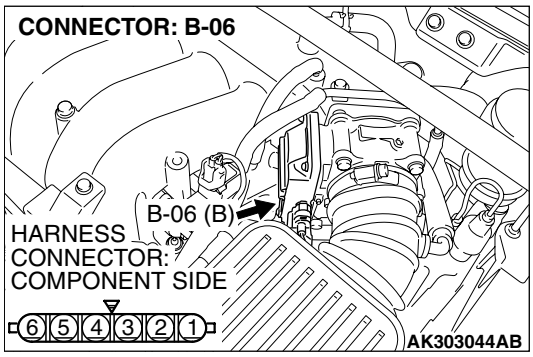
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Detach the intake air hose at the throttle body.
(4) Disconnect the connector of the throttle position sensor.
(5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
(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.00-14.

NO : Go to Step 2.

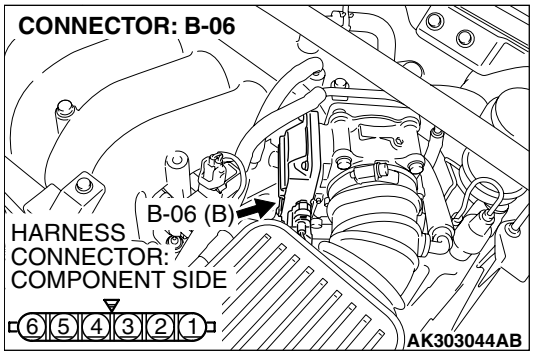
STEP 2. Check harness connector B-06 at throttle position sensor for damage.



Q: Is the harness connector in good condition?

YES : Go to Step 3.

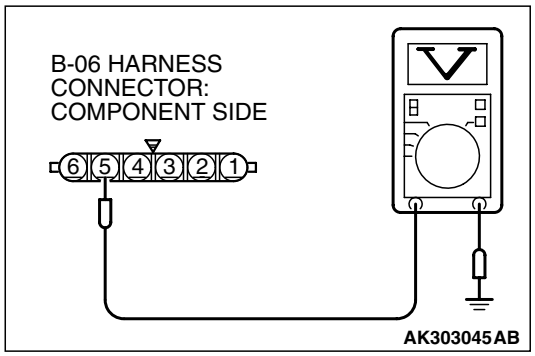
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.



STEP 3. Measure the sensor supply voltage at throttle position sensor harness side connector B-06.

(1) Disconnect the connector B-06 and measure at the harness side.

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



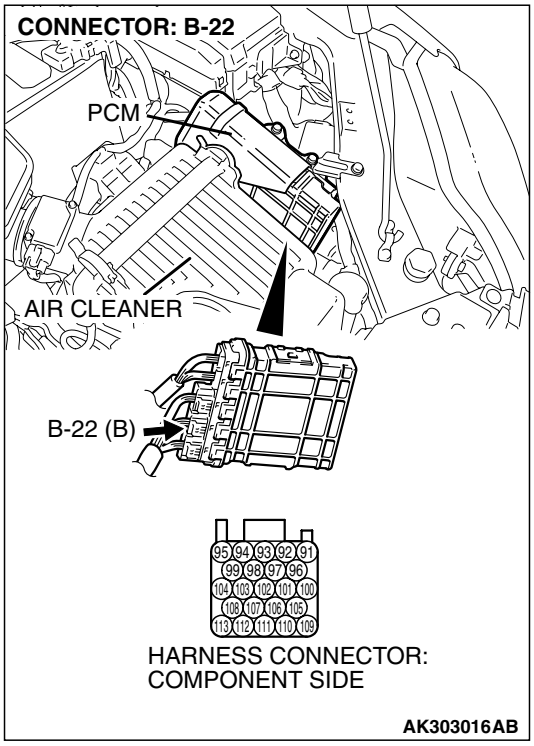
(3) Measure the voltage between terminal No. 5 and ground.
- Voltage should be between 4.9 and 5.1 volts.

(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.

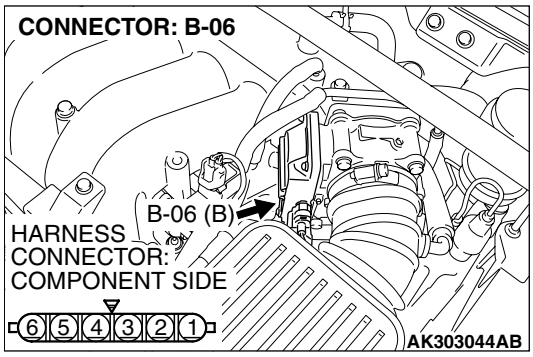


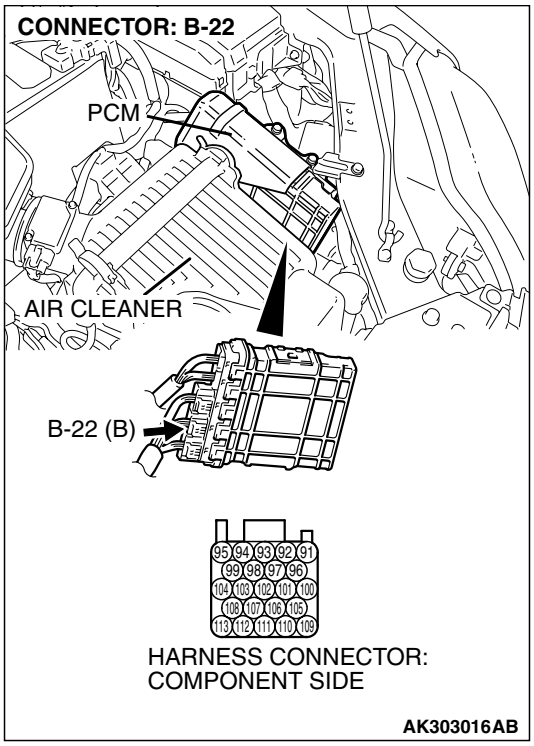
STEP 4. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

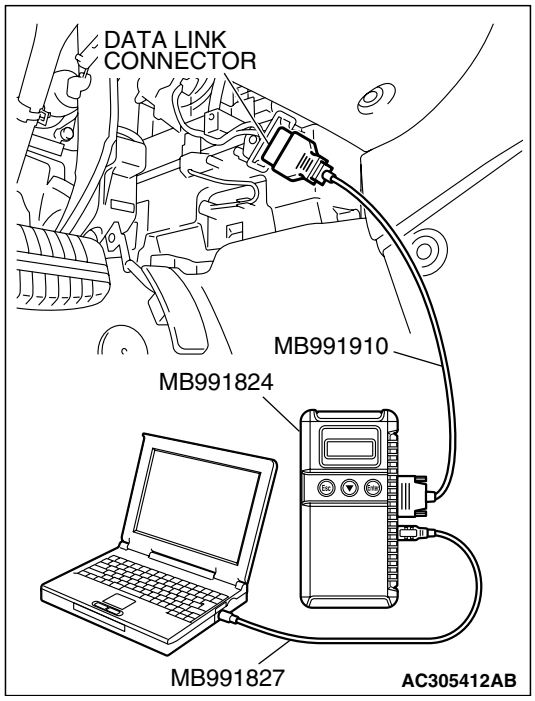
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.





STEP 5. Check for open circuit and short circuit to ground between throttle position sensor connector B-06 (terminal No. 5) and PCM connector B-22 (terminal No. 94).
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.

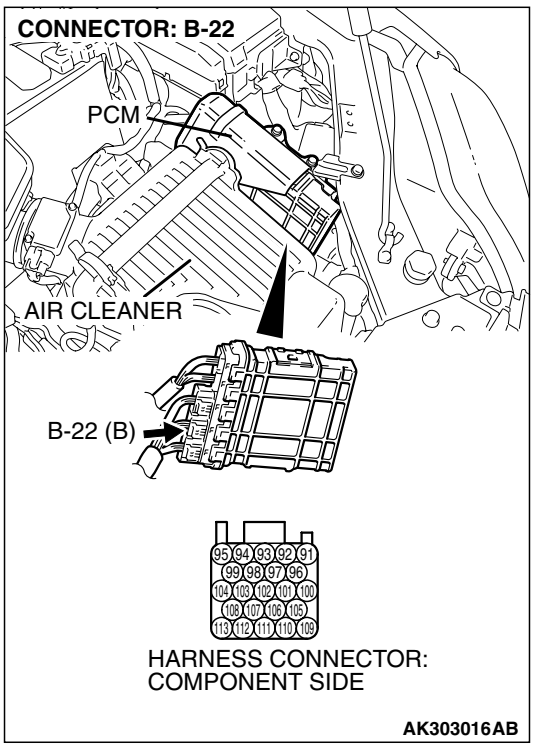
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Detach the intake air hose at the throttle body.
(4) Disconnect the connector of the throttle position sensor.
(5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
(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.00-14.

NO : Replace the PCM. Then go to Step 11.

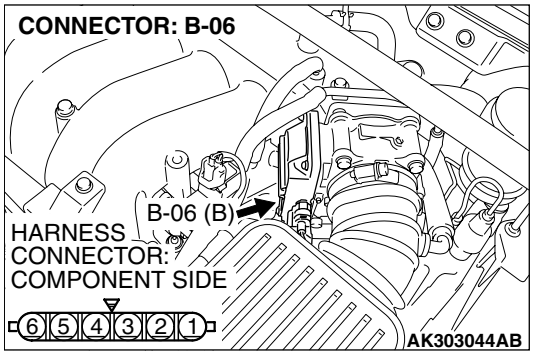


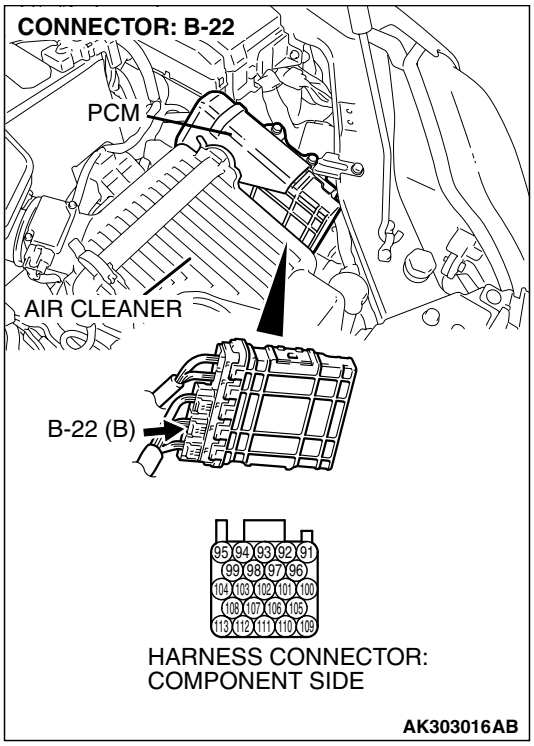
STEP 7. Check harness connector B-22 at PCM for damage.

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.





STEP 8. Check for harness damage between throttle position sensor connector B-06 (terminal No. 5) and PCM connector B-22 (terminal No. 94).

Q: Is the harness wire in good condition?

YES : Go to Step 9.

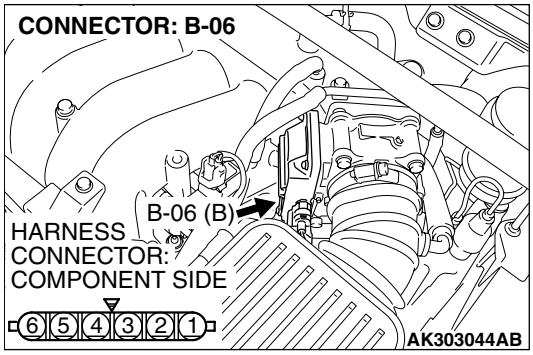
NO : Repair it. Then go to Step 11.

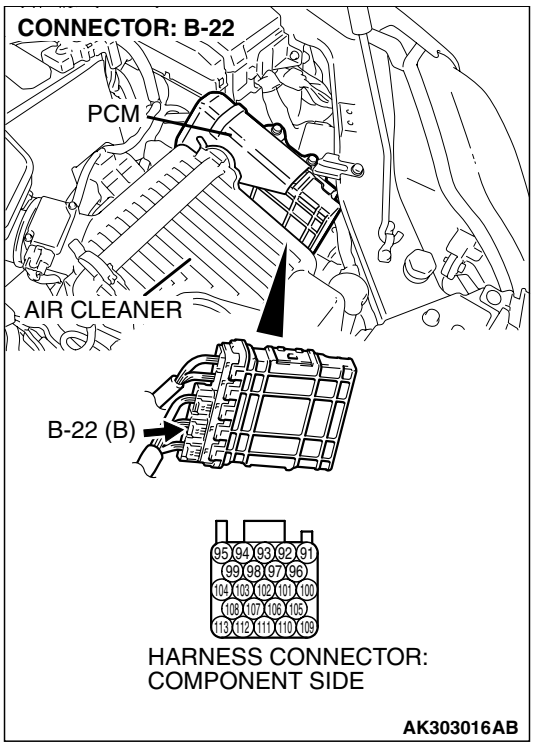
STEP 9. Check for open circuit, short circuit to ground and harness damage between throttle position sensor connector B-06 (terminal No. 6) and PCM connector B-22 (terminal No. 98).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 11.





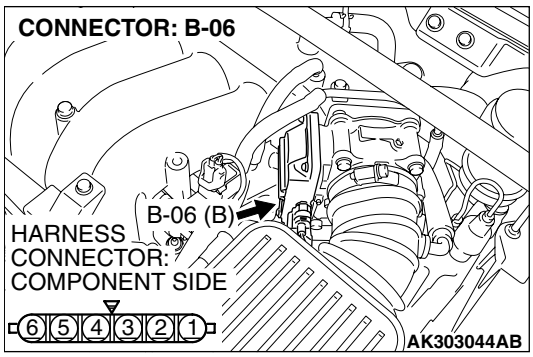
STEP 10. Replace the throttle body assembly.

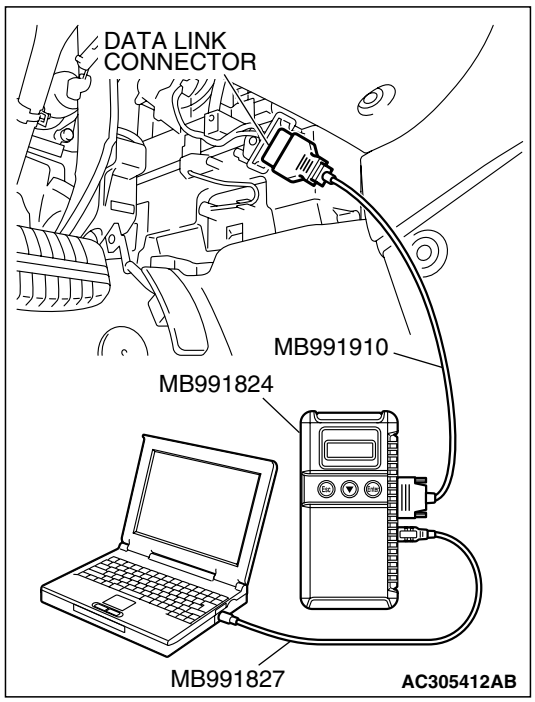
(1) Replace the throttle body assembly.
(2) Turn the ignition switch to the "ON" position.
(3) After the DTC has been deleted, read the DTC again.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0122 set?

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

NO : The inspection 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.

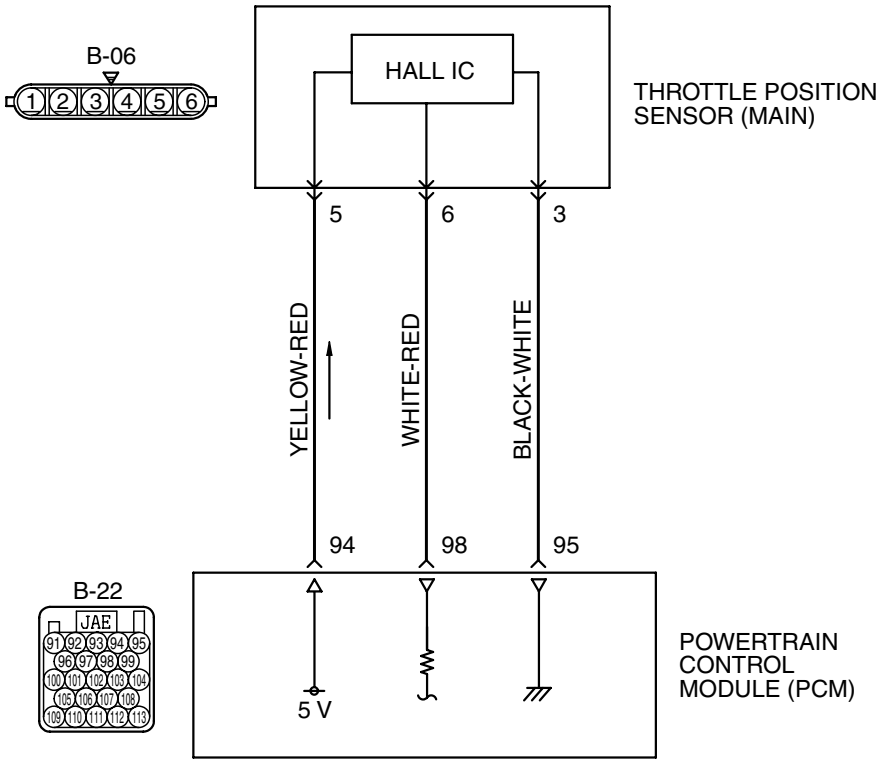
Q: Is DTC P0122 set?

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

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

⚠ CAUTION
If DTC P0123 has been set, TCL related DTC U1120 is also set. After P0123 has been diagnosed, don't forget to erase DTC U1120.

Throttle Position Sensor (main) Circuit



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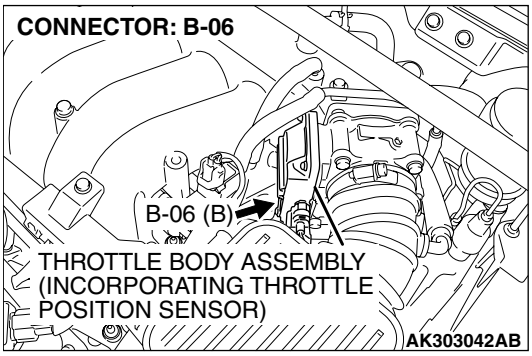
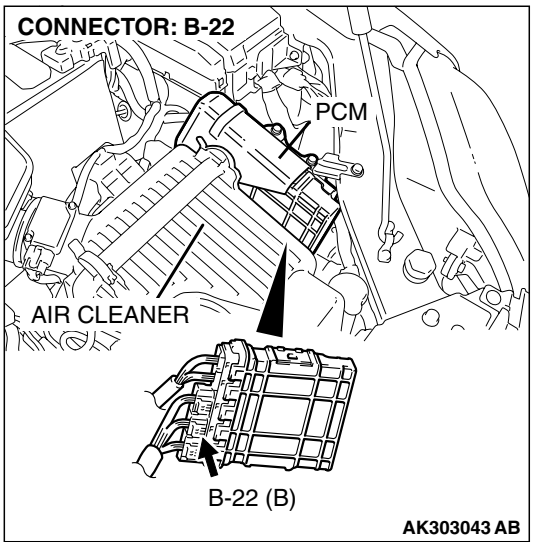




TSB Revision

CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the PCM (terminal No. 94).
  The ground terminal (terminal No. 3) is grounded with PCM (terminal No. 95).

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)

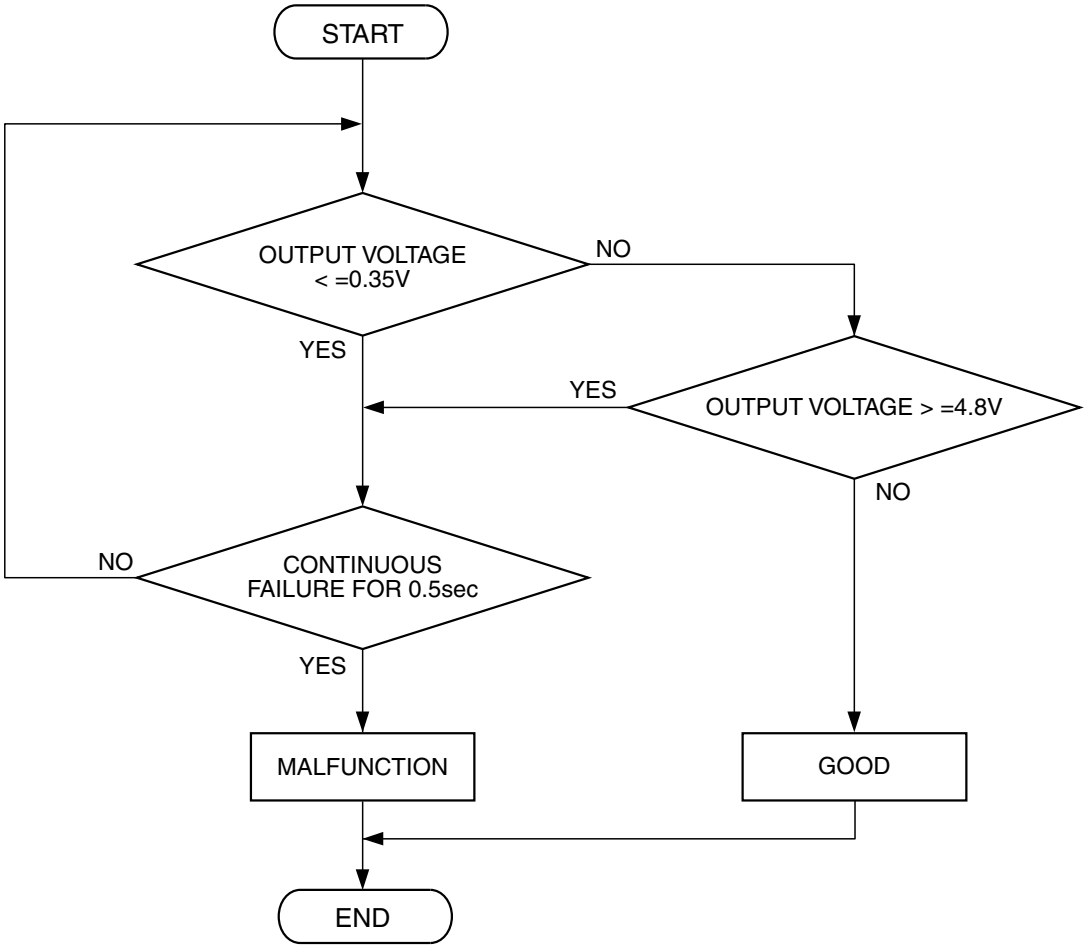
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions
- Ignition switch is "ON" position.

Judgement Criteria
- 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, or harness damage or connector damage.
- PCM failed.

OBD-II DRIVE CYCLE PATTERN
None.

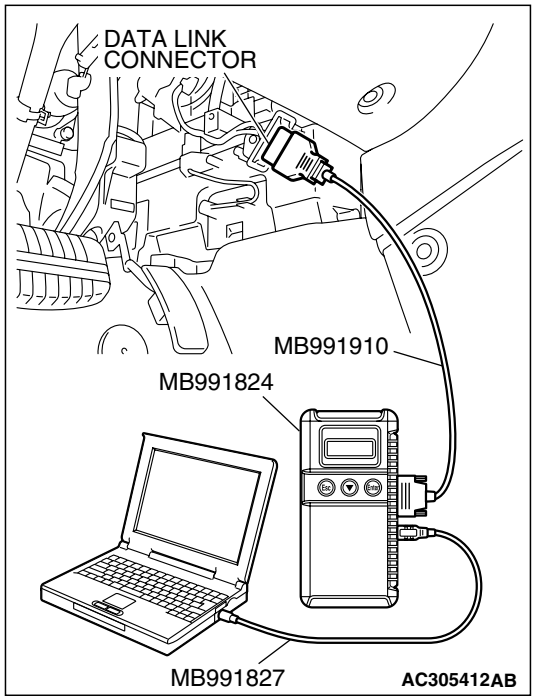
TSB Revision

DIAGNOSIS

Required Special Tools:

- MB991958: Scan tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- MB991658: Test Harness

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



⚠ CAUTION

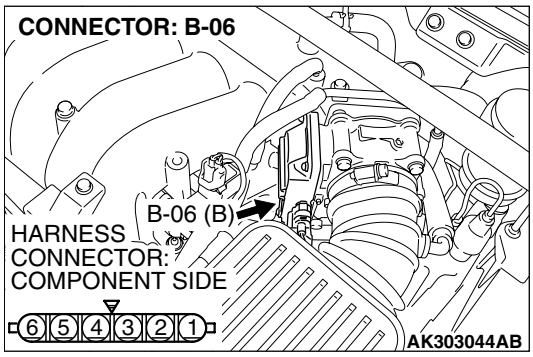
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK"(OFF) position before connecting or disconnecting scan tool MB991958.

(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. 3, No. 4, No. 5, and No. 6.
(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?

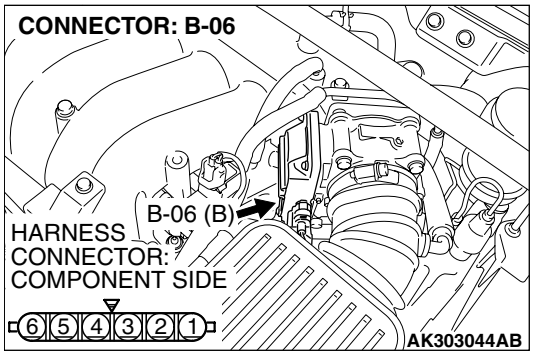
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.
NO : Go to Step 2.

STEP 2. Check harness connector B-06 at throttle position sensor for damage.



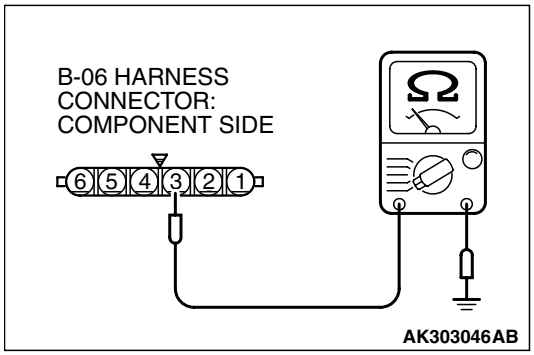
Q: Is the harness connector in good condition?

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-06.

(1) Disconnect the connector B-06 and measure at the harness side.

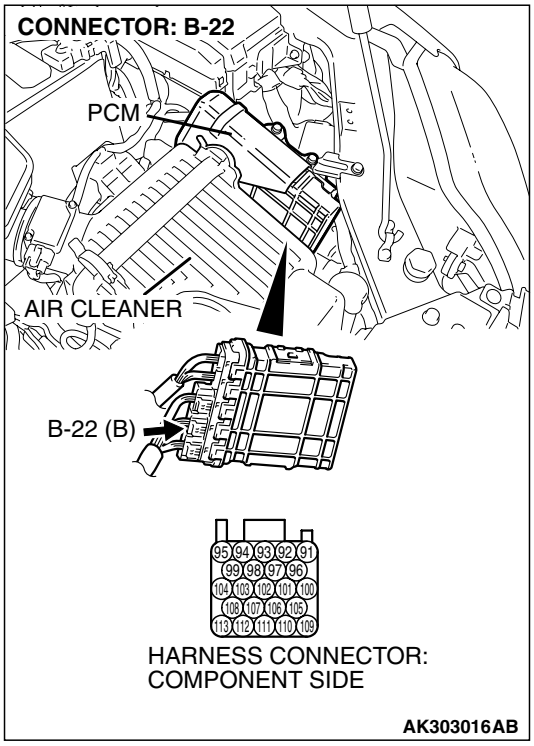


(2) Measure the continuity between terminal No. 3 and ground
- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 4.

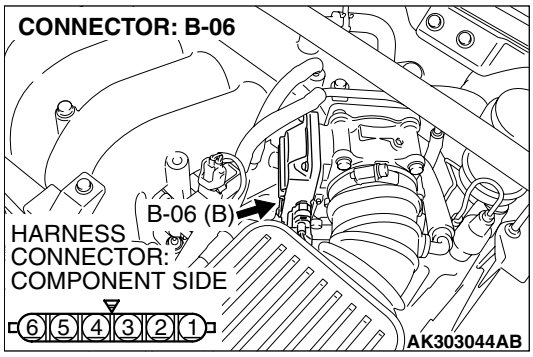


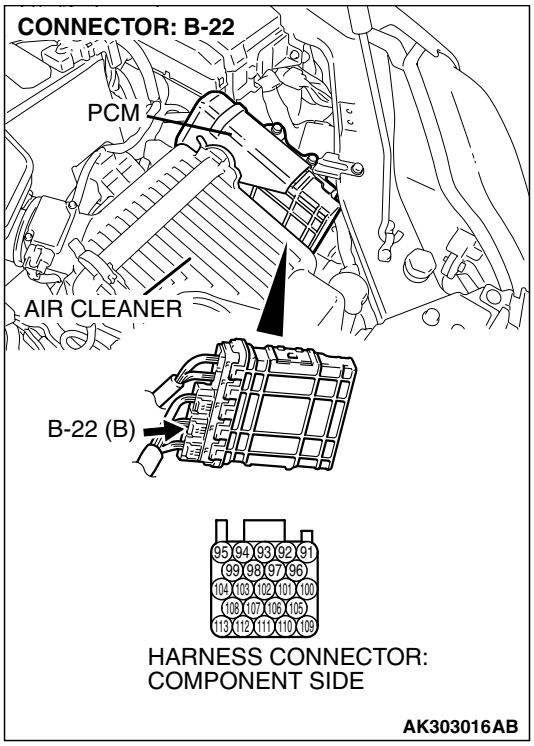
STEP 4. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

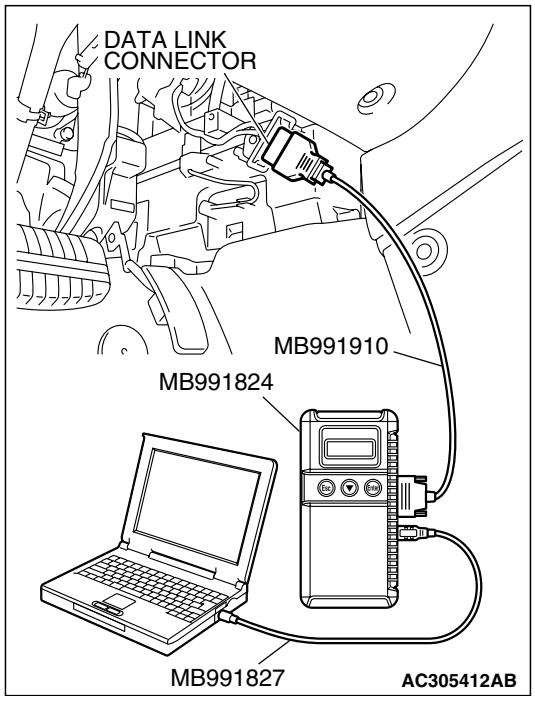
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.





STEP 5. Check for open circuit and harness damage between throttle position sensor connector B-06 (terminal No. 3) and PCM connector B-22 (terminal No. 95).
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.

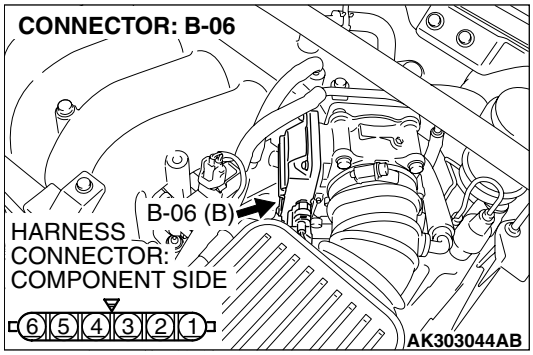
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Detach the intake air hose at the throttle body.
(4) Disconnect the connector of the throttle position sensor.
(5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
(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.00-14.

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



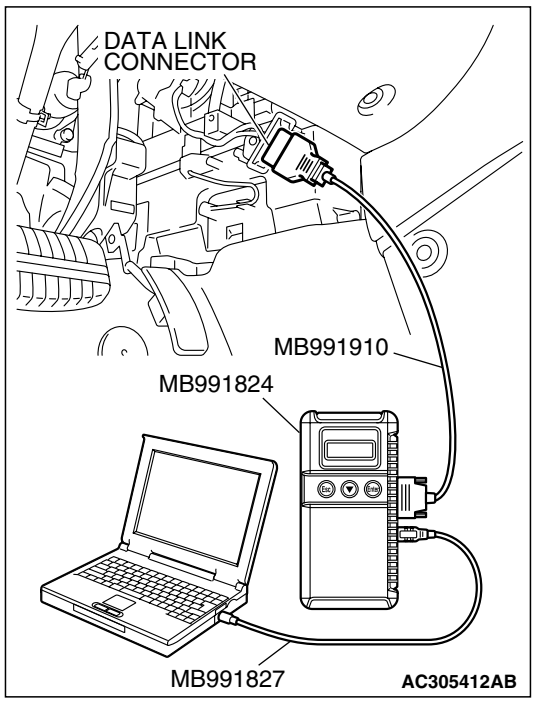
STEP 7. Replace the throttle body assembly.

(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.

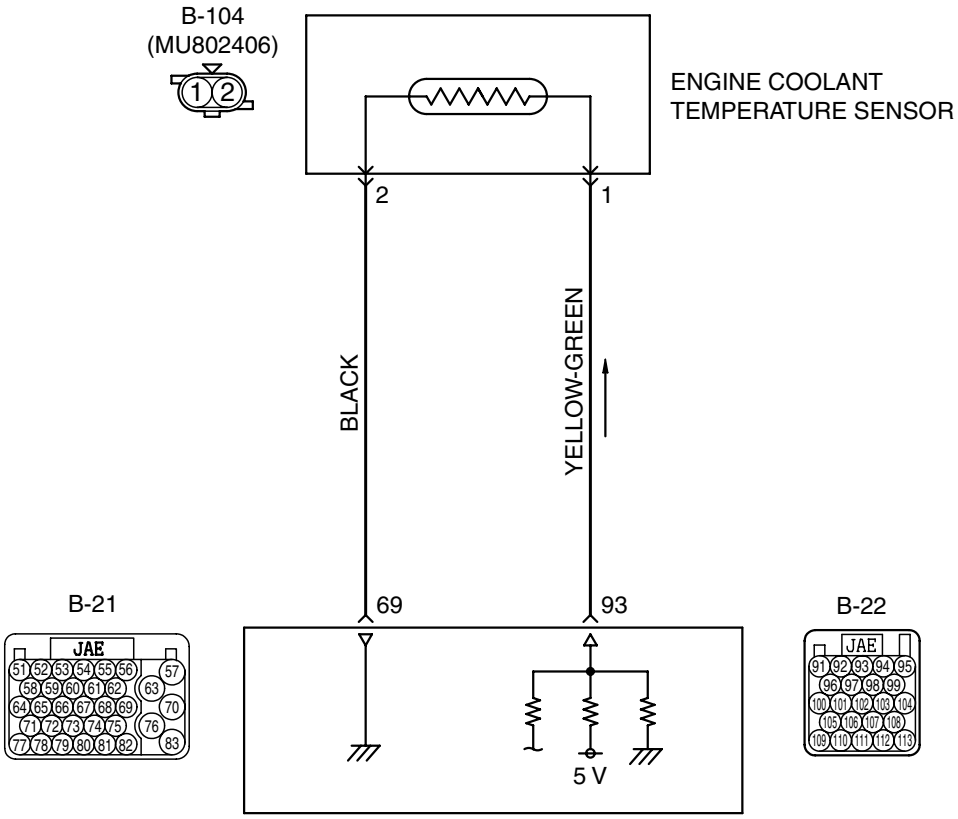
Q: Is DTC P0123 set?

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

DTC P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control

⚠ CAUTION
If DTC P0125 has been set, TCL related DTC U1120 is also set. After P0125 has been diagnosed, don't forget to erase DTC U1120.

Engine Coolant Temperature Sensor Circuit



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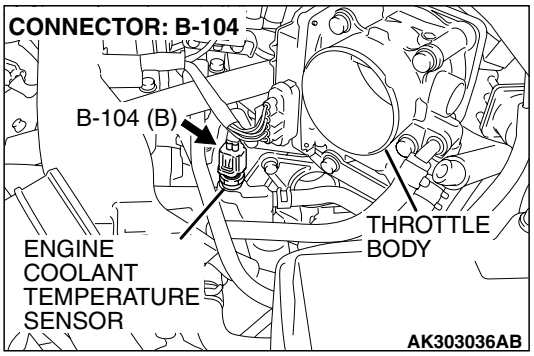
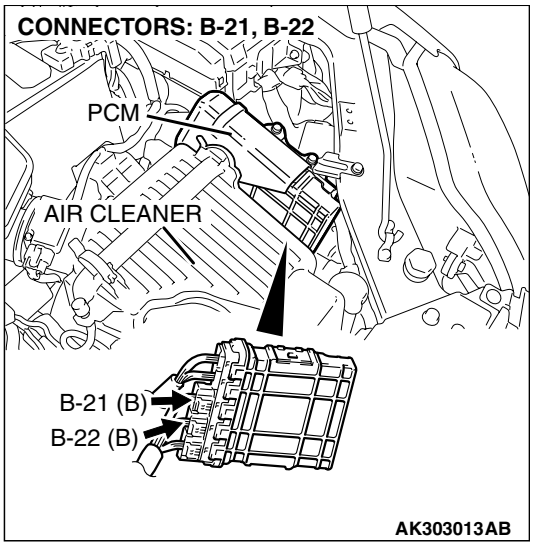


TSB Revision



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 93) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded with PCM (terminal No. 69).
- 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)

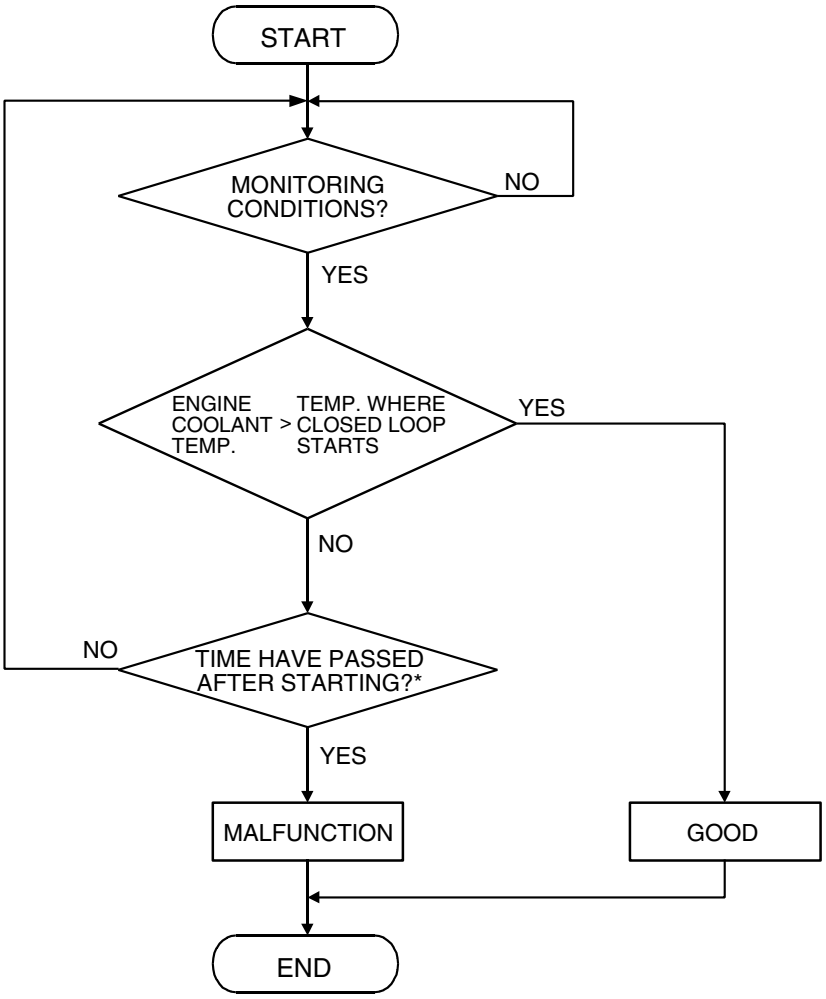
- Not applicable

Sensor (The sensor below is determined to be normal)

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

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

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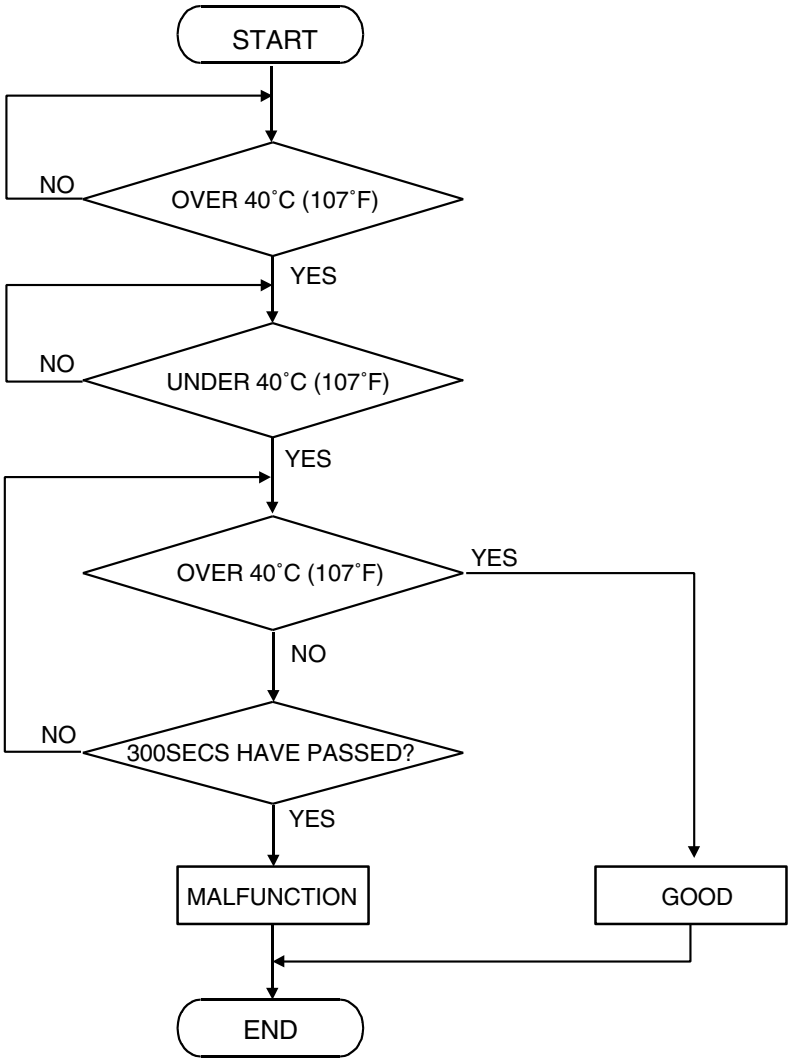
Check Conditions, Judgement Criteria

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

TSB Revision

DTC SET CONDITIONS <Range/Performance problem - drift>

Logic Flow Chart



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Check Conditions, Judgement Criteria

- 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.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.

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.

TSB Revision

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A

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.

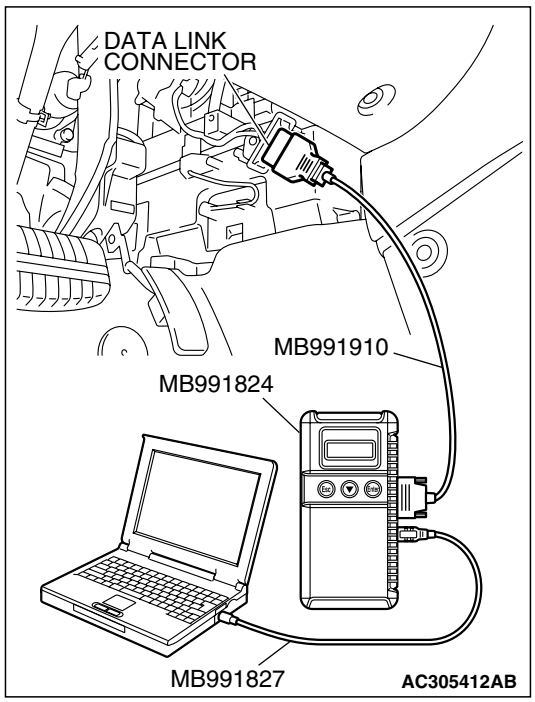
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately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

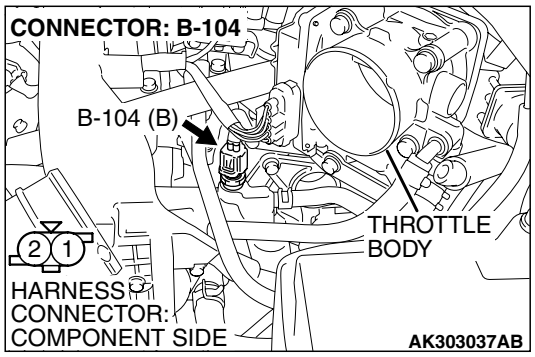
(4) Turn the ignition switch to the "LOCK" (OFF) position.

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.00-14.

NO : Go to Step 2.

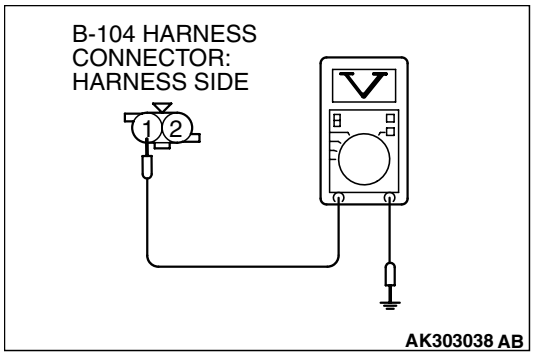




STEP 2. Measure the sensor output voltage at engine coolant temperature sensor connector B-104 by backprobing.

(1) Do not disconnect the connector B-104.

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



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

- When engine coolant temperature is –20°C (–4°F), voltage should be between 3.9 and 4.5 volts.
- When engine coolant temperature is 0°C (32°F), voltage should be between 3.2 and 3.8 volts.
- When engine coolant temperature is 20°C (68°F), voltage should be between 2.3 and 2.9 volts.
- When engine coolant temperature is 40°C (104°F), voltage should be between 1.3 and 1.9 volts.
- When engine coolant temperature is 60°C (140°F), voltage should be between 0.7 and 1.3 volts.
- When engine coolant temperature is 80°C (176°F), voltage should be between 0.3 and 0.9 volt.

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

Q: Is the measured voltage within the specified range?

YES : Go to Step 3.

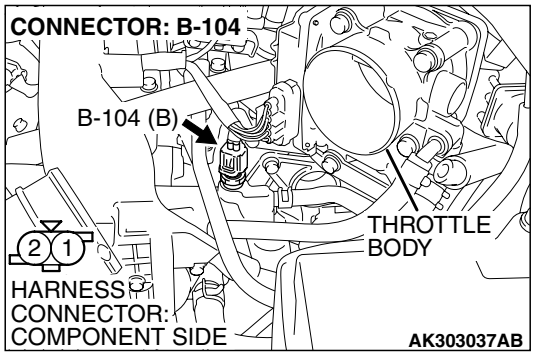
NO : Go to Step 5.

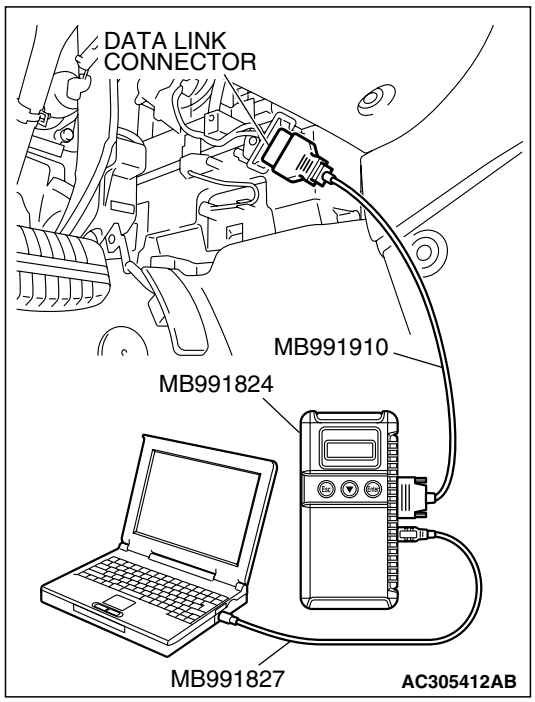
STEP 3. Check harness connector B-104 at the engine coolant temperature sensor for damage.

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.

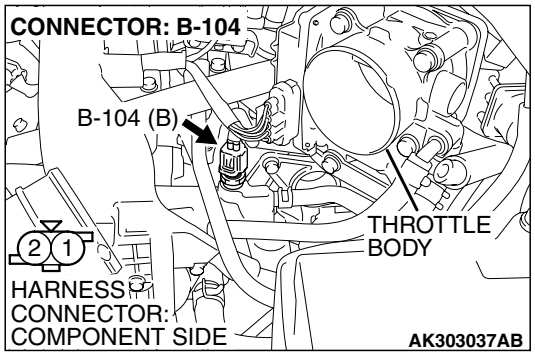
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
- The engine coolant temperature and temperature shown with the scan tool should approximately 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.00-14.

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

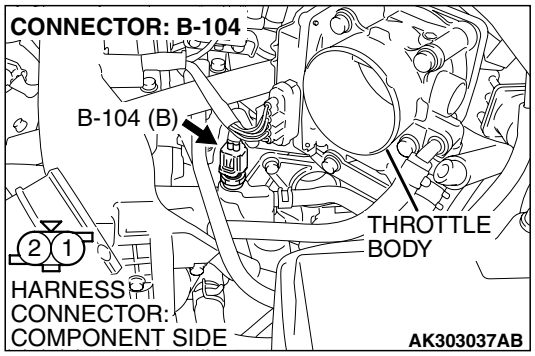


STEP 5. Check harness connector B-104 at engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

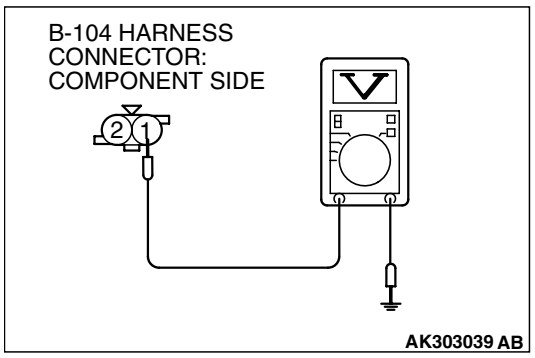
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.



STEP 6. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-104.

(1) Disconnect the connector B-104 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.

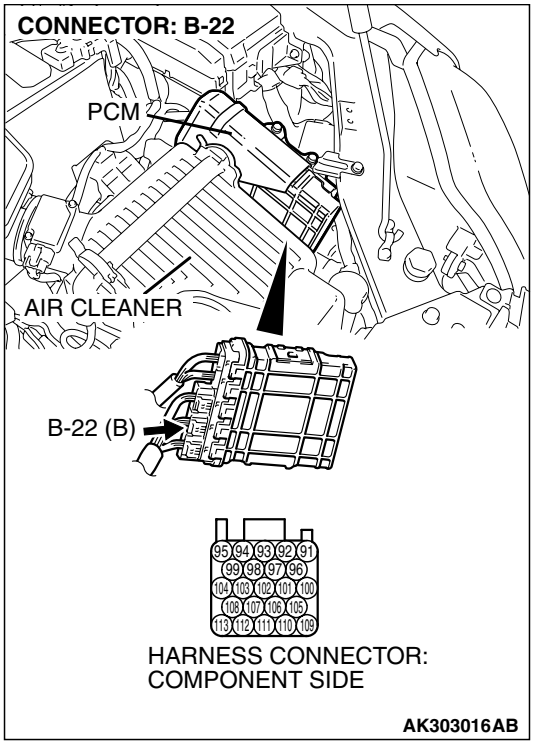
NO : Go to Step 7.

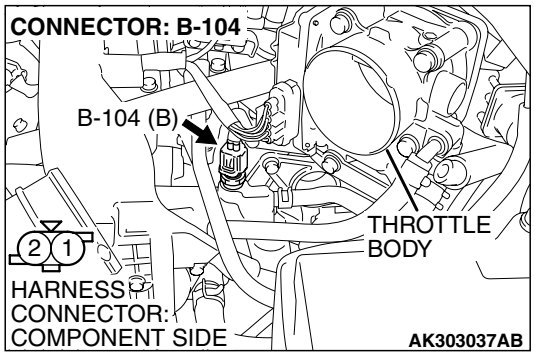
STEP 7. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

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

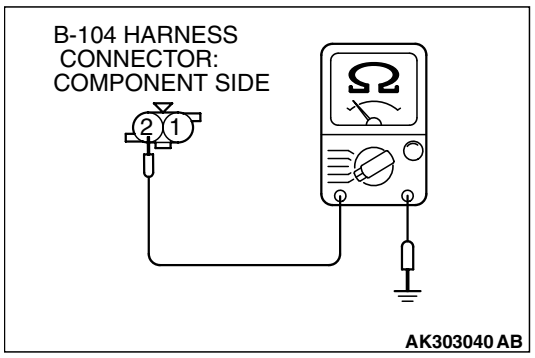
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.





STEP 8. Check the continuity at engine coolant temperature sensor harness side connector B-104.

(1) Disconnect the connector B-104 and measure at the harness side.



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

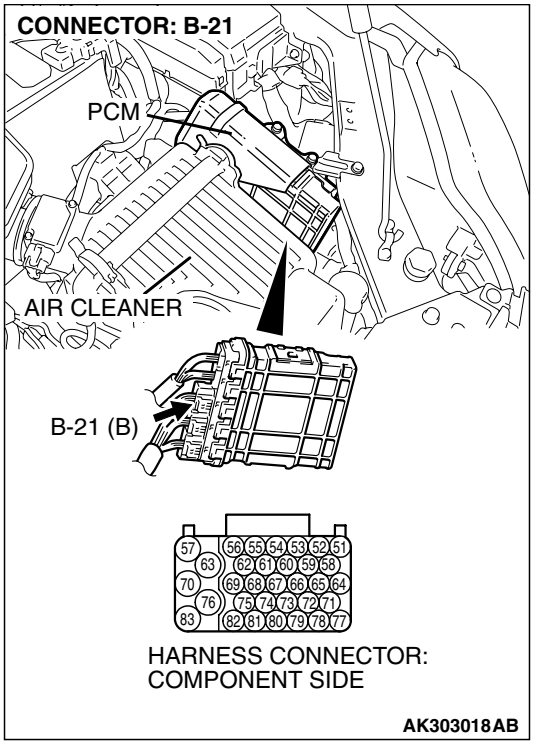
Q: Does continuity exist?

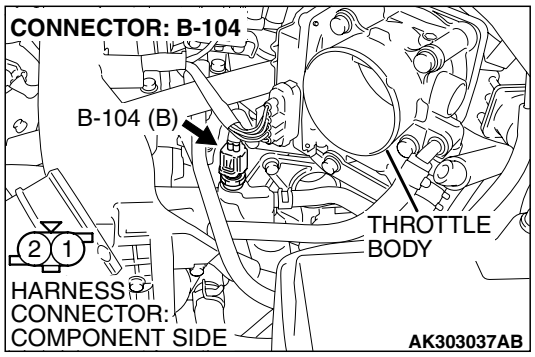
YES : Go to Step 11.
NO : Go to Step 9.

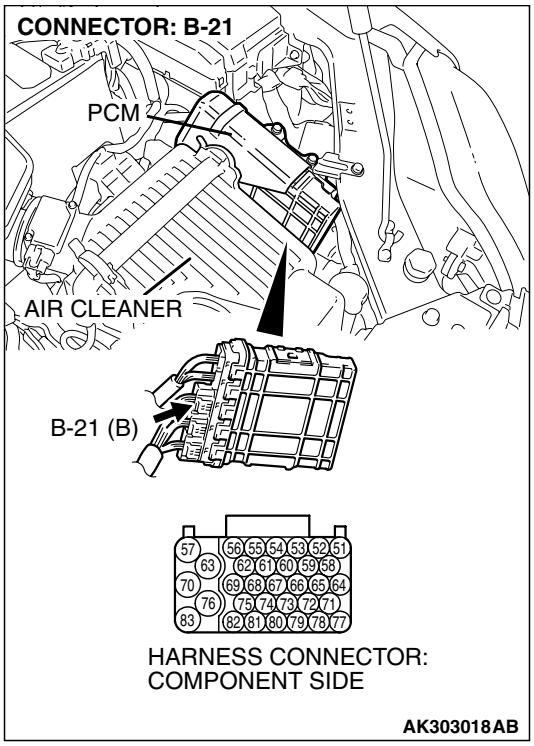
STEP 9. Check harness connector B-21 at PCM for damage.

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.

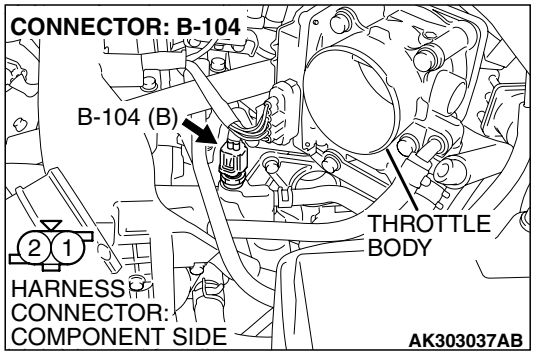






STEP 10. Check for harness damage between engine coolant temperature sensor connector B-104 (terminal No. 2) and PCM connector B-21 (terminal No. 69).
Q: Is the harness wire in good condition?

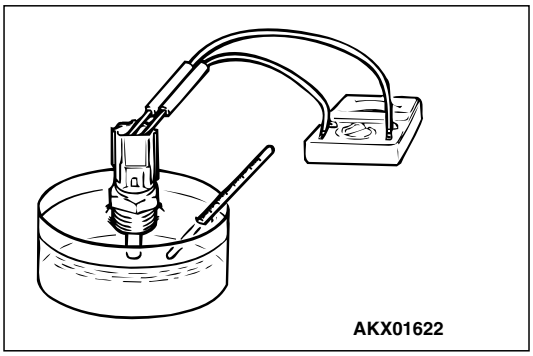
YES : Replace the PCM. Then go to Step 14.
NO : Repair it. Then go to Step 14.



STEP 11. Check the engine coolant temperature sensor.

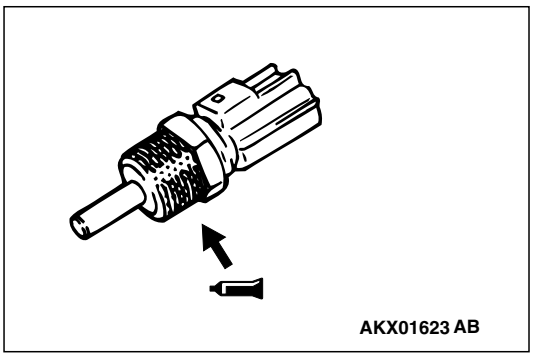
(1) Disconnect the engine coolant temperature sensor connector B-104.

(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.

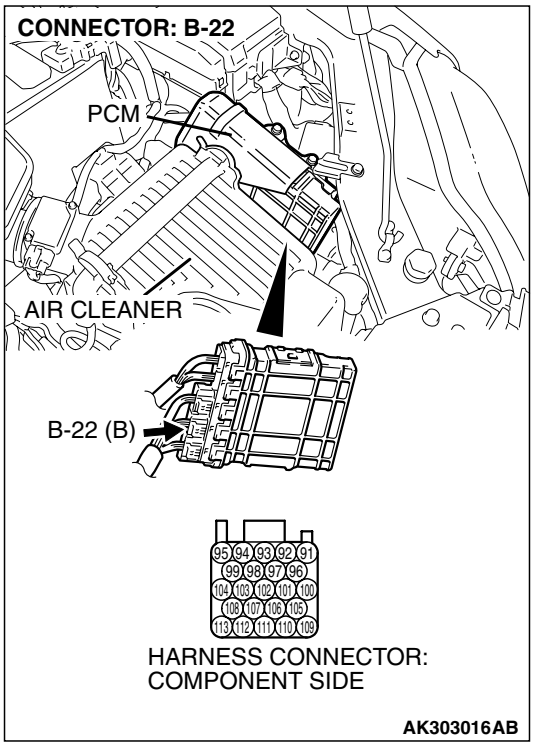
(5) Install the engine coolant temperature sensor, and tighten to the specified torque.

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

Q: Is the measured resistance at the standard value?

YES : Go to Step 12.

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

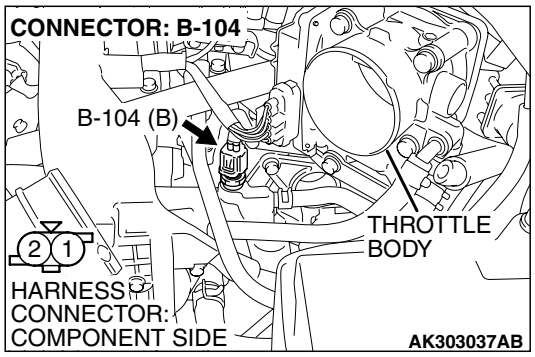


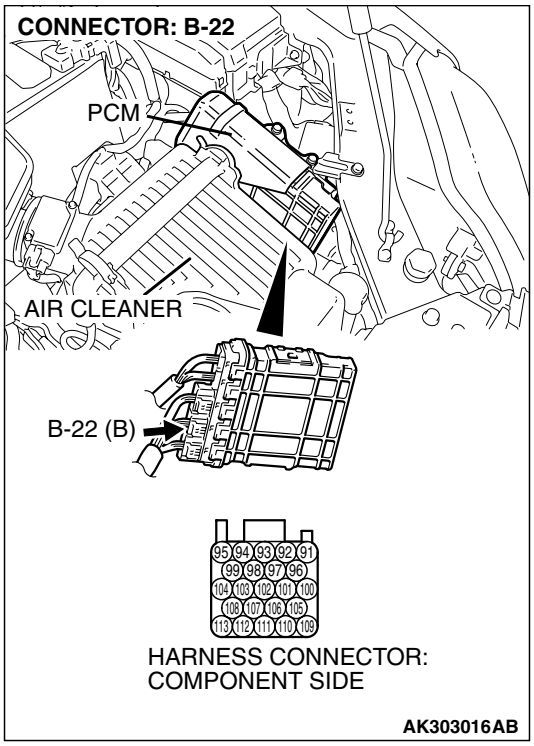
STEP 12. Check harness connector B-22 at PCM for damage.

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-104 (terminal No. 1) and PCM connector B-22 (terminal No. 93).

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 – Procedure 6 – Other Monitor P.13B-6.

(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)

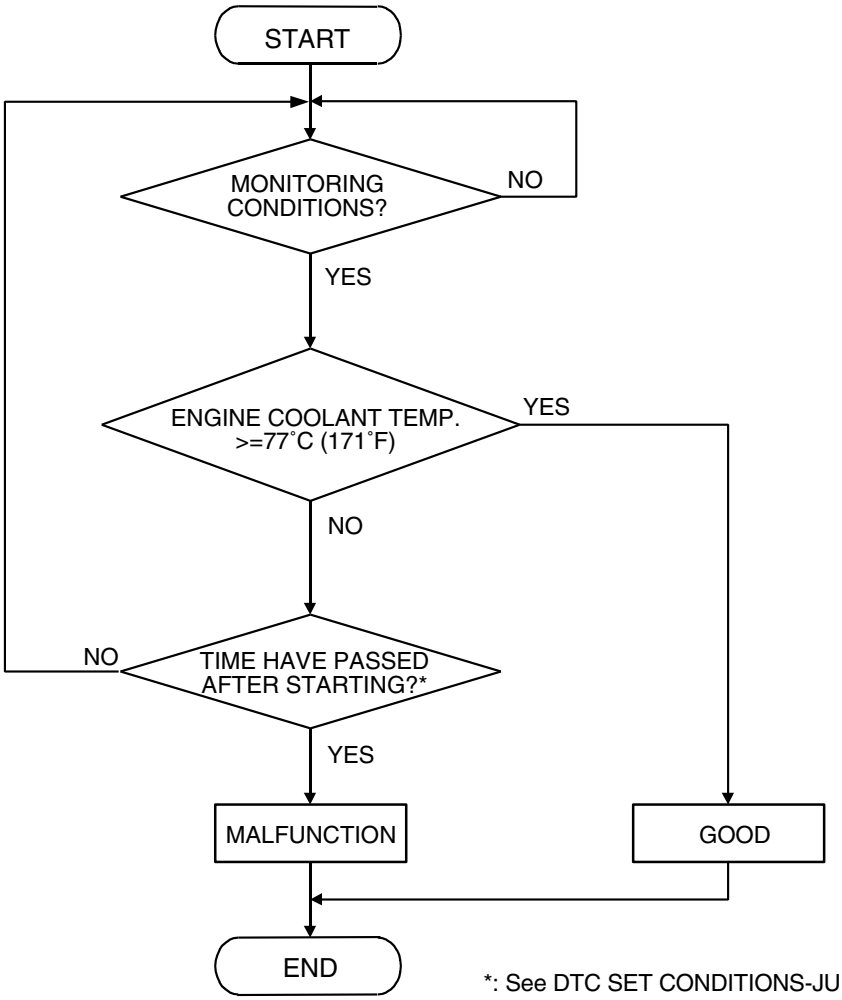
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



*: See DTC SET CONDITIONS-JUDGMENT CRITERIA

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TSB Revision

Check Conditions

- Engine coolant temperature is between –10°C (14°F) and 77°C (171°F) when the engine is started.
- The engine coolant temperature – intake air temperature is 5°C (9°F) or less when the engine is started.
- The intake air temperature when the engine is started – intake air temperature is 5°C (9°F) or less.
- The total time of the mass airflow sensor output whose state is below 15g/sec within 300seconds.

Judgment Criteria

- The time for the engine coolant temperature to rise to 77°C (171°F) takes longer than approximately 7 to 16 minutes.
- The PCM monitors for this condition once during the drive cycle.

OBD-II DRIVE CYCLE PATTERN

None.

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 Engine Cooling Diagnosis P.14-3.

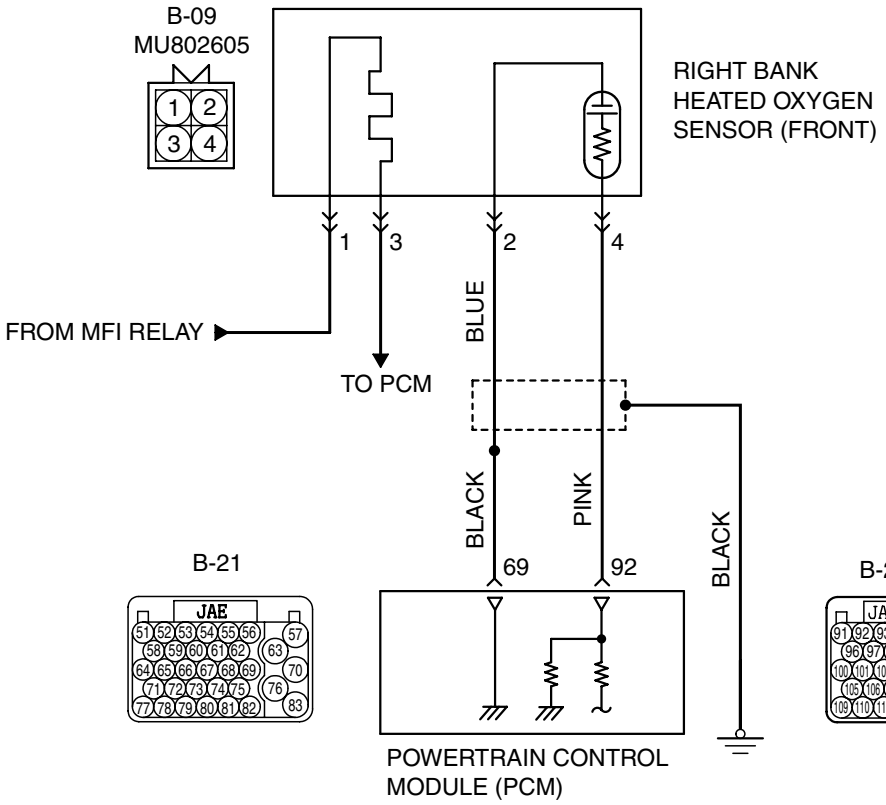
Q: Is the cooling system normal?

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

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

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

Right Bank Heated Oxygen Sensor (front) Circuit



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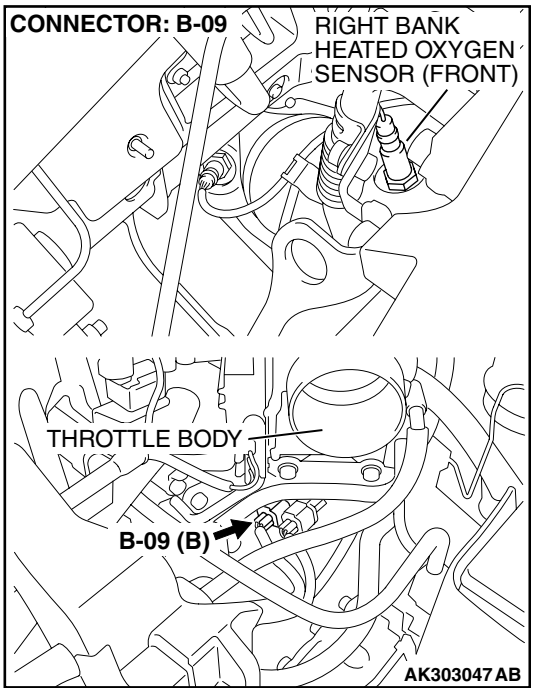
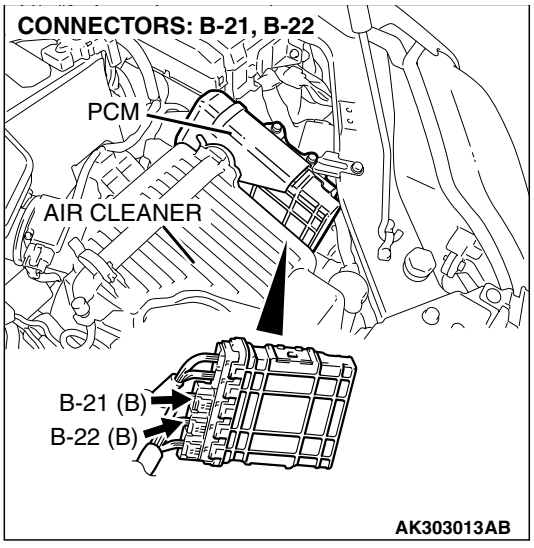




TSB Revision

CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 92) 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. 69).

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)

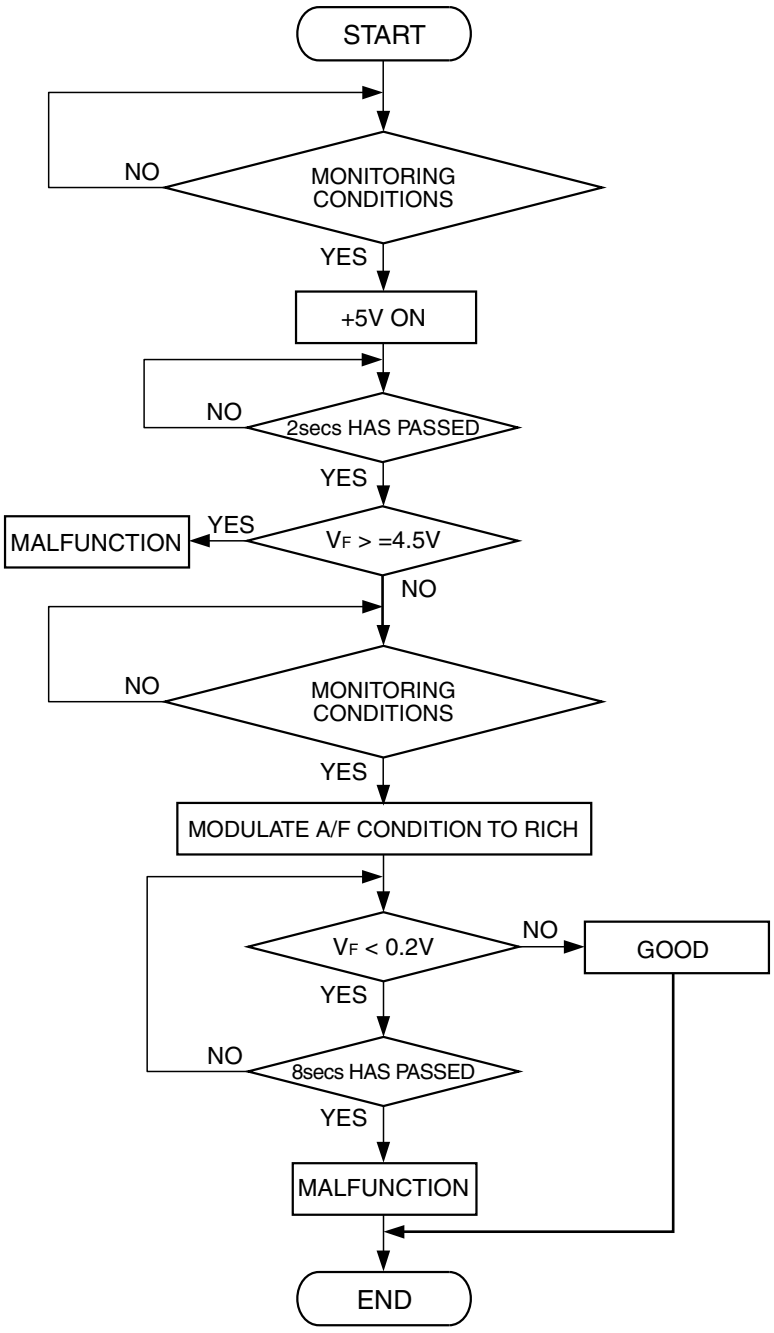
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Mass 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



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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.

TSB Revision

Judgment Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

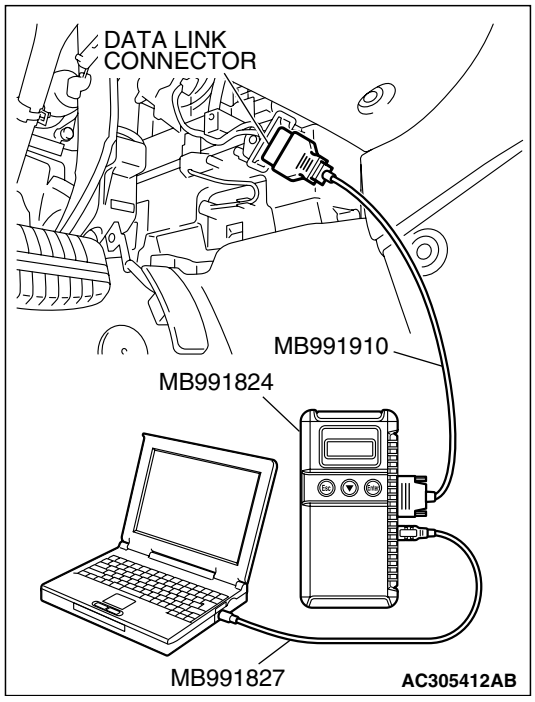
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Right bank heated oxygen sensor (front) failed.
- 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
  - MB991910: Main Harness A
- MD998464: Test Harness
- MB991923: Power Plant ECU Check 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.

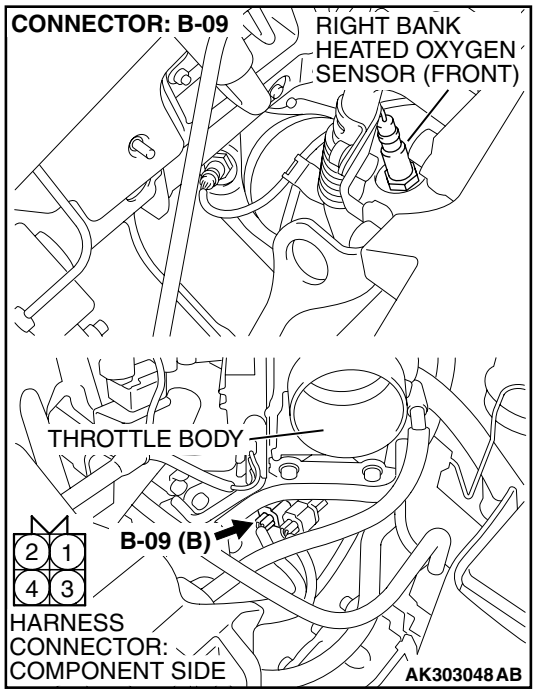
Q: Is the sensor operating properly?

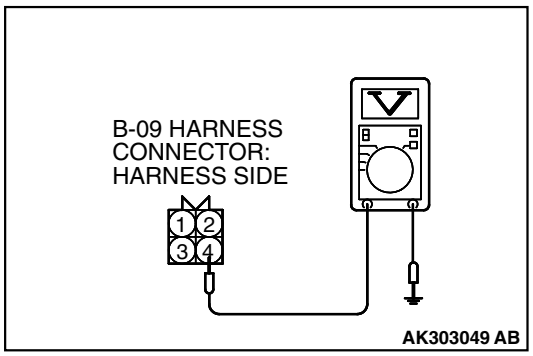
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at right bank heated oxygen sensor (front) connector B-09 by backprobing

(1) Do not disconnect the connector B-09.
(2) Start the engine and run at idle.



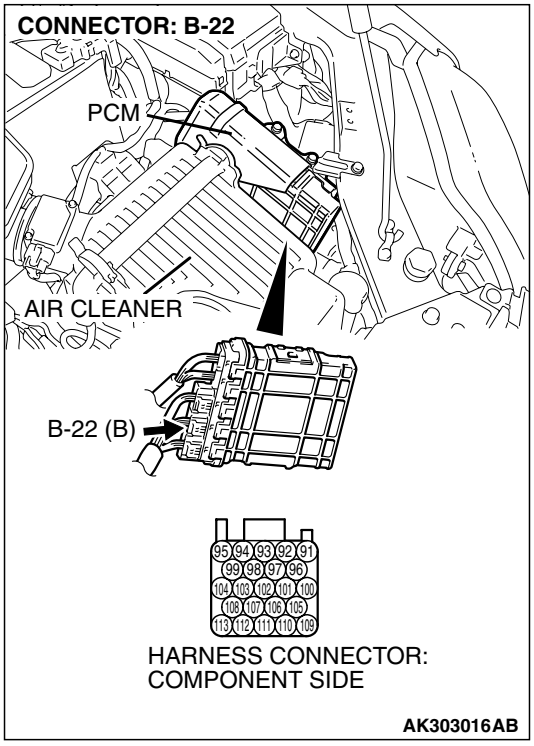


(3) Measure the voltage between terminal No. 4 and ground by backprobing.
- Warming up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.

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

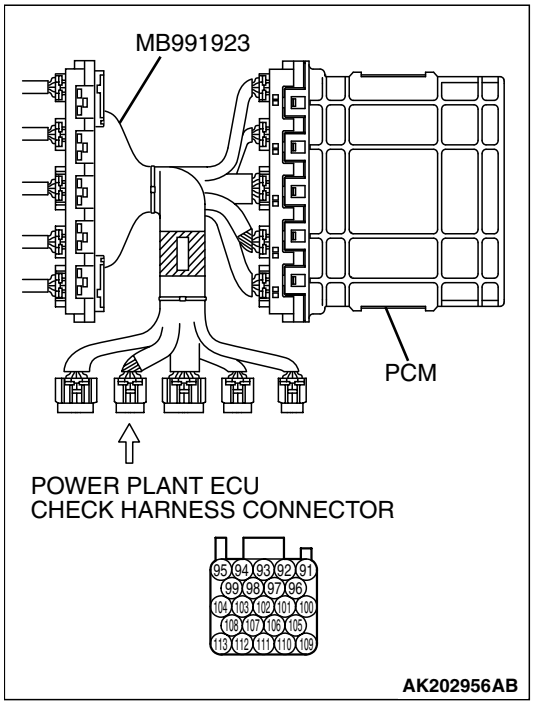
Q: Is the measured voltage within the specified range?

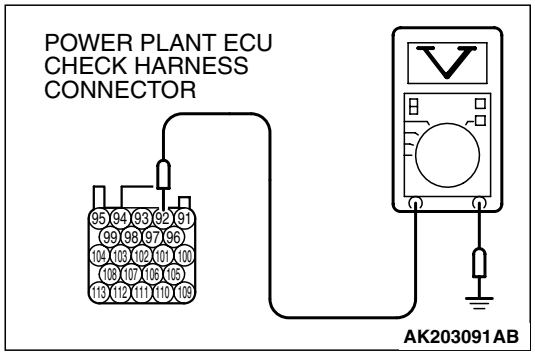
YES : Go to Step 3.
NO : Go to Step 7.



STEP 3. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect power plant ECU check harness special tool MB991923 between the separated connectors.
(2) Start the engine and run at idle.



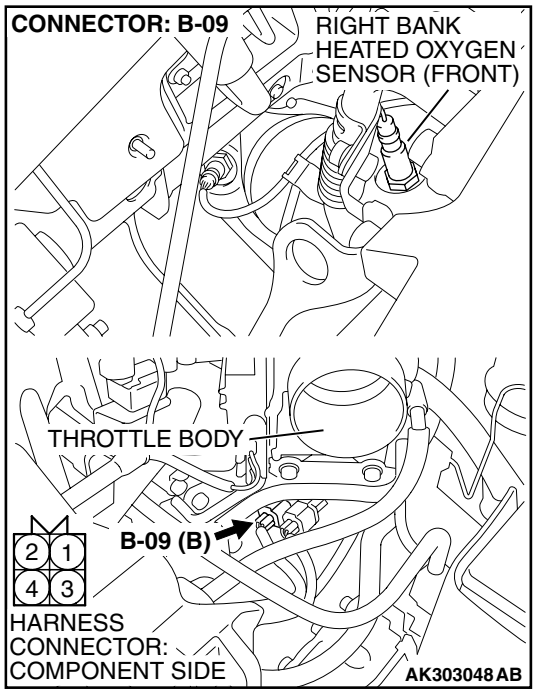


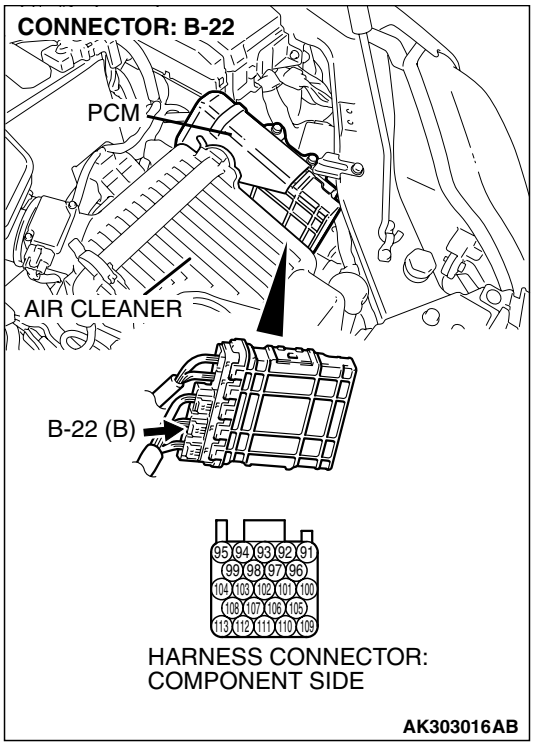
(3) Measure the voltage between terminal No. 92 and ground.
- Warming up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.

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

Q: Is the measured voltage within the specified range?

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



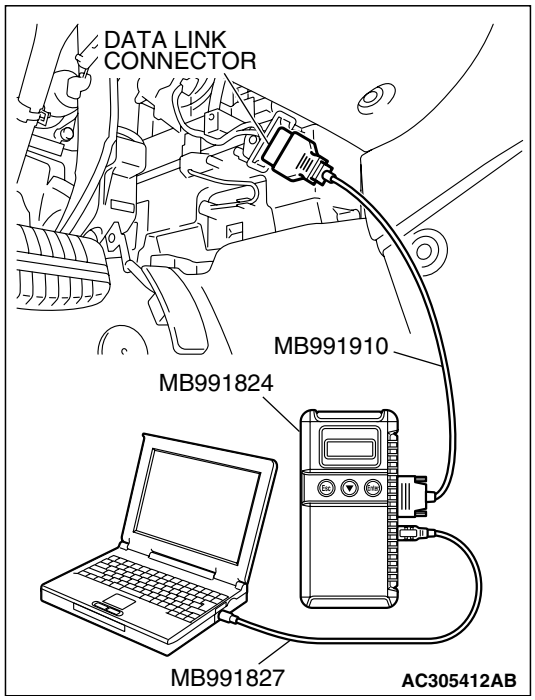


STEP 4. Check harness connector B-09 at right bank heated oxygen sensor (front) and harness connector B-22 at PCM for damage.

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.

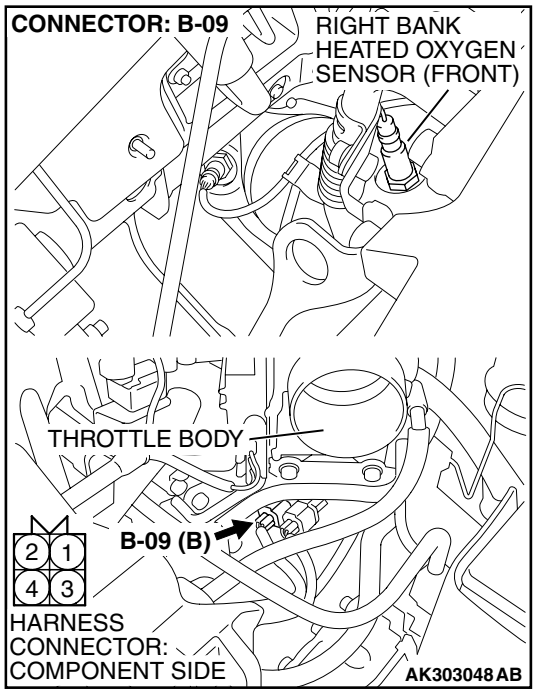
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 39, Heated Oxygen Sensor Bank 1, Sensor 1 (right front).
- Warming up the engine. When the engine is revved, the output voltage should be 0.6 to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

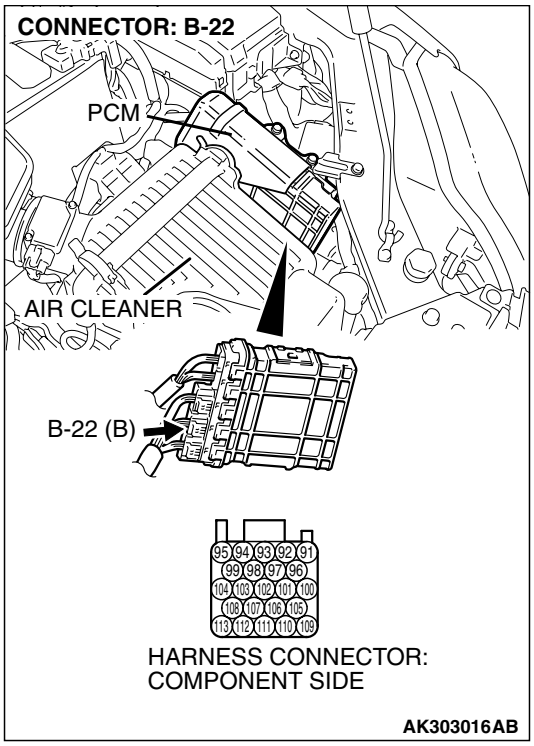
(4) Turn the ignition switch to the "LOCK" (OFF) position.

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.00-14.

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



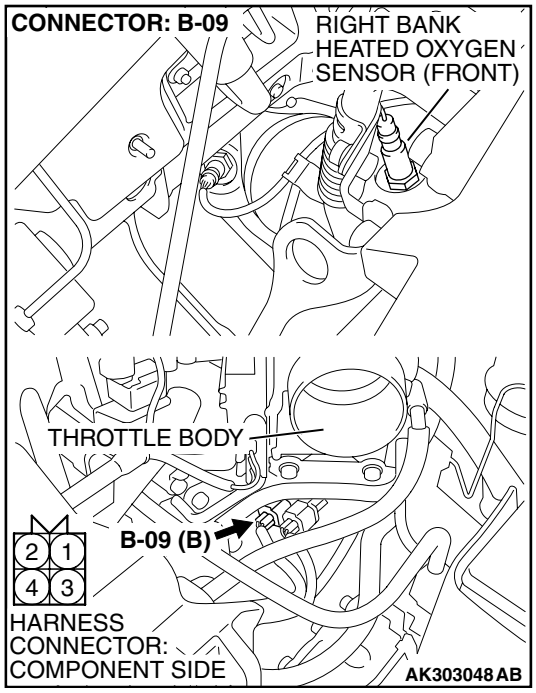


STEP 6. Check harness connector B-09 at right bank heated oxygen sensor (front) and harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

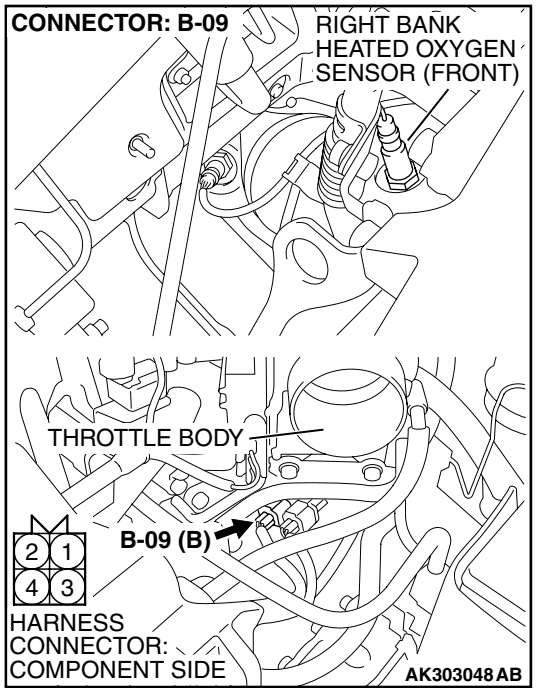
YES : Repair harness wire between right bank heated oxygen sensor (front) connector B-09 (terminal No. 4) and PCM connector B-22 (terminal No. 92) because of open circuit or harness damage. Then go to Step 15.

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



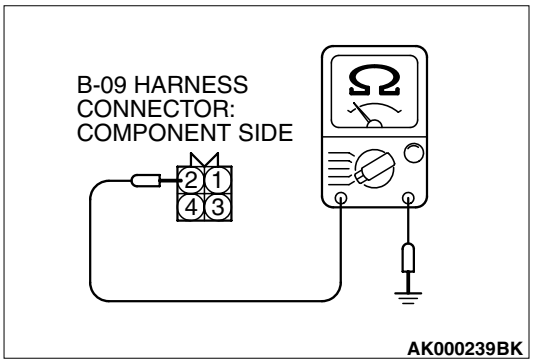
STEP 7. Check harness connector B-09 at right bank heated oxygen sensor (front) for damage.
Q: Is the harness connector in good condition?

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-09.

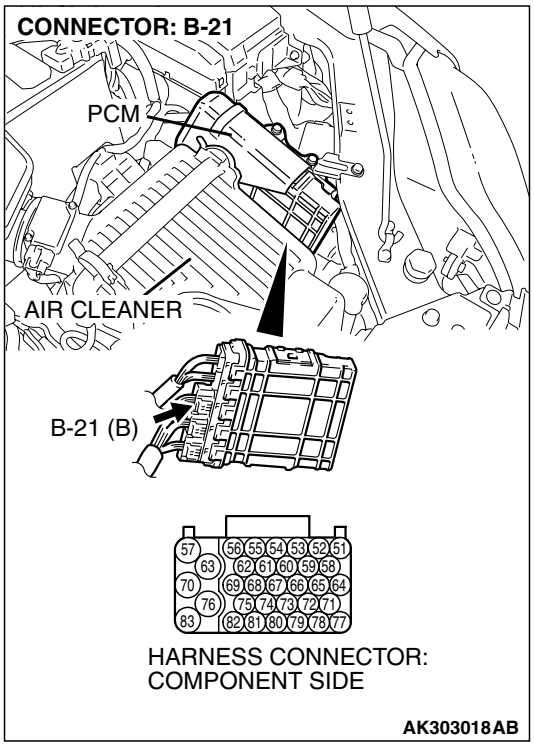
(1) Disconnect the connector B-09 and measure at the harness side.



(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.

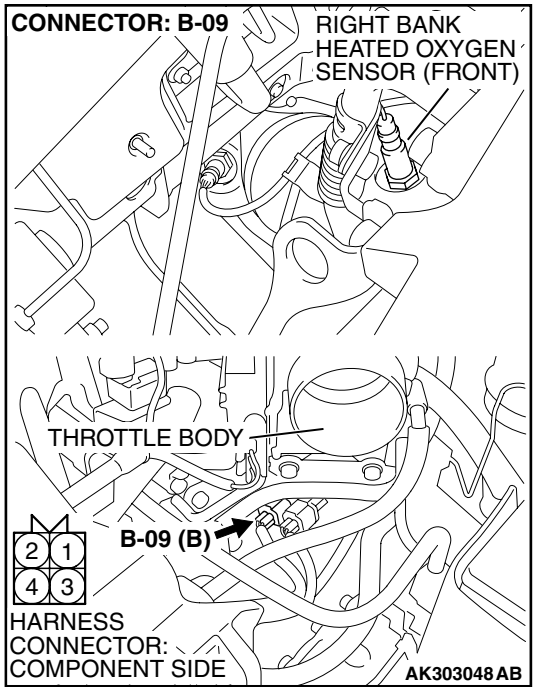


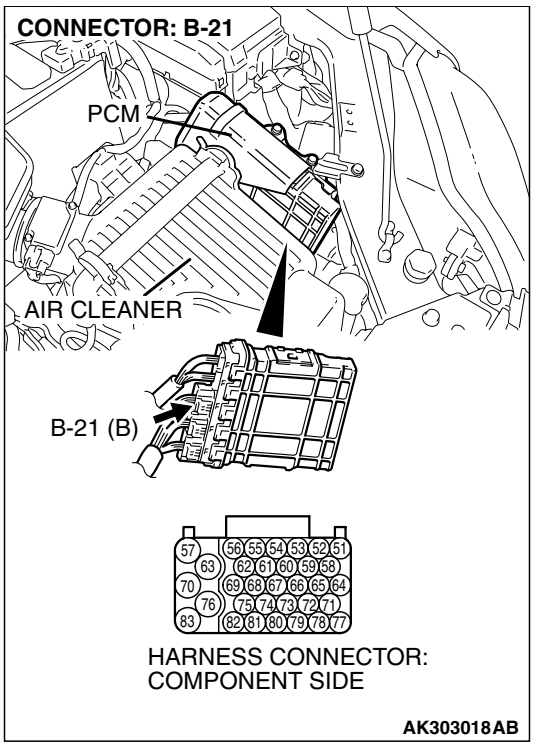
STEP 9. Check harness connector B-21 at PCM for damage.

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.



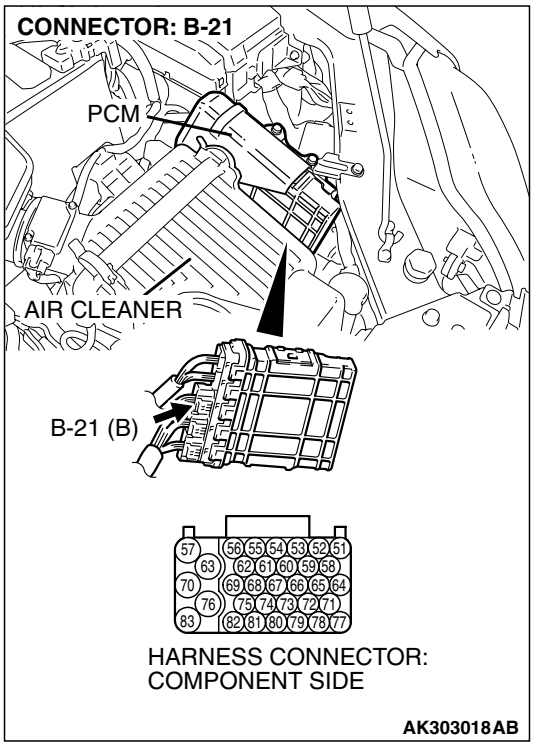


STEP 10. Check for open circuit and harness damage between right bank heated oxygen sensor (front) connector B-09 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

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.

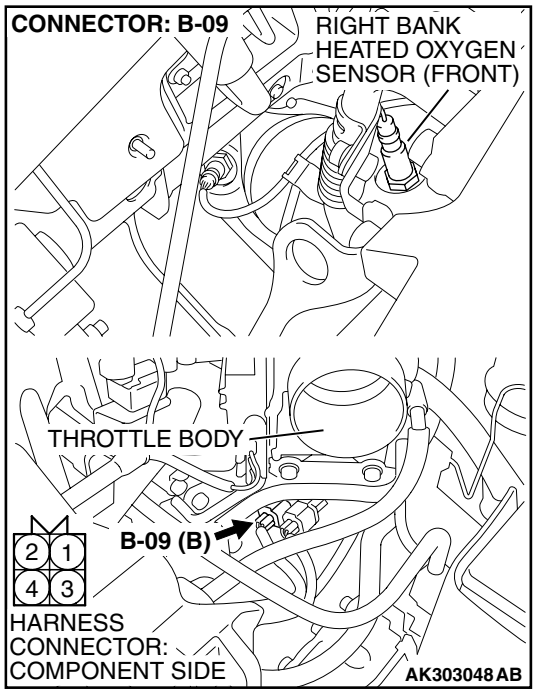


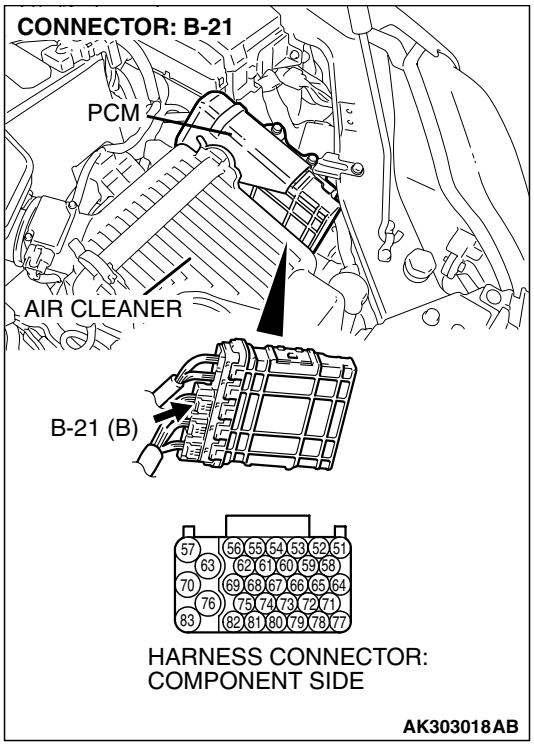
STEP 11. Check harness connector B-21 at PCM for damage.

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-09 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Go to Step 13.

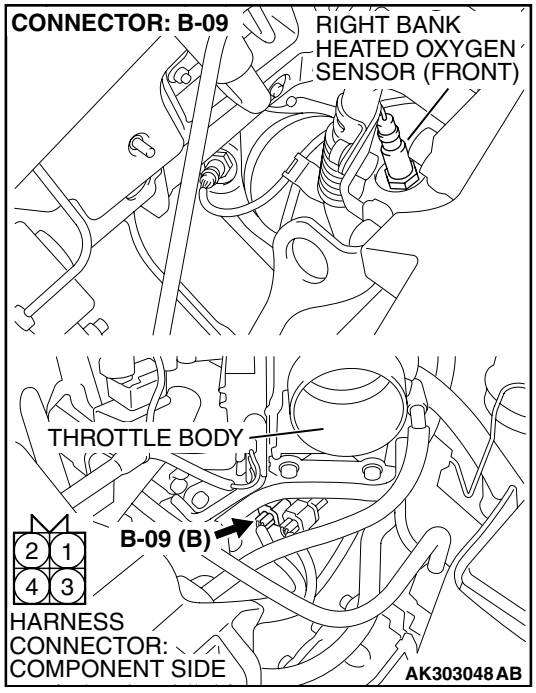
NO : Repair it. Then go to Step 15.

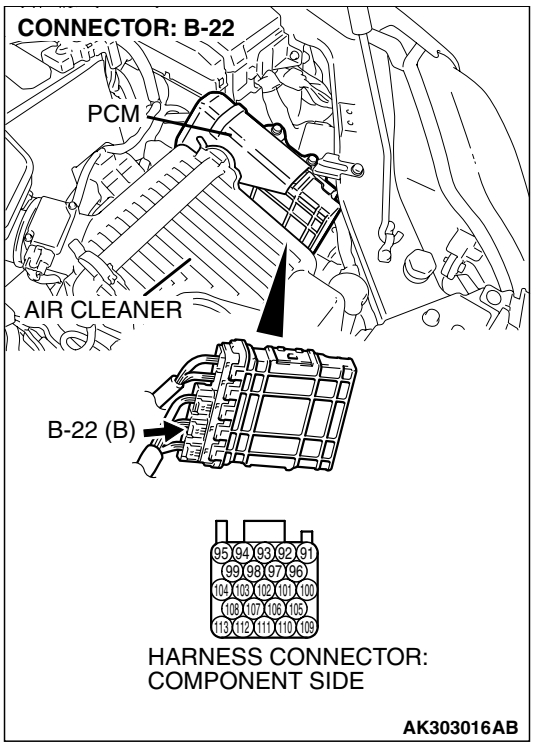
STEP 13. Check for short circuit to ground and harness damage between right bank heated oxygen sensor (front) connector B-09 (terminal No. 4) and PCM connector B-22 (terminal No. 92).

Q: Is the harness wire in good condition?

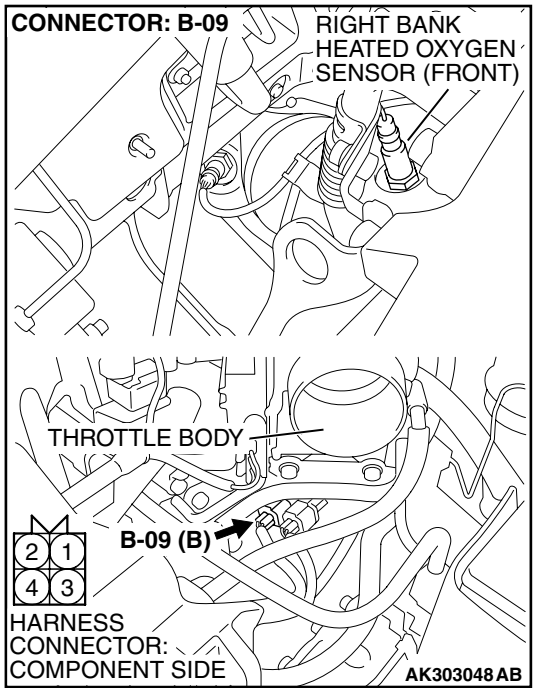
YES : Go to Step 14.

NO : Repair it. Then go to Step 15.

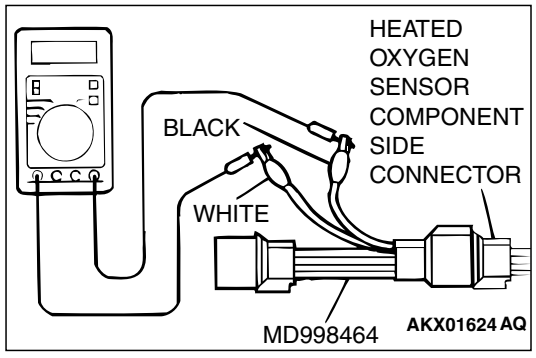




STEP 14. Check the right bank heated oxygen sensor (front).



(1) Disconnect the right bank heated oxygen sensor (front) connector B-09 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 – Procedure 6 – Other Monitor P.13B-6.

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

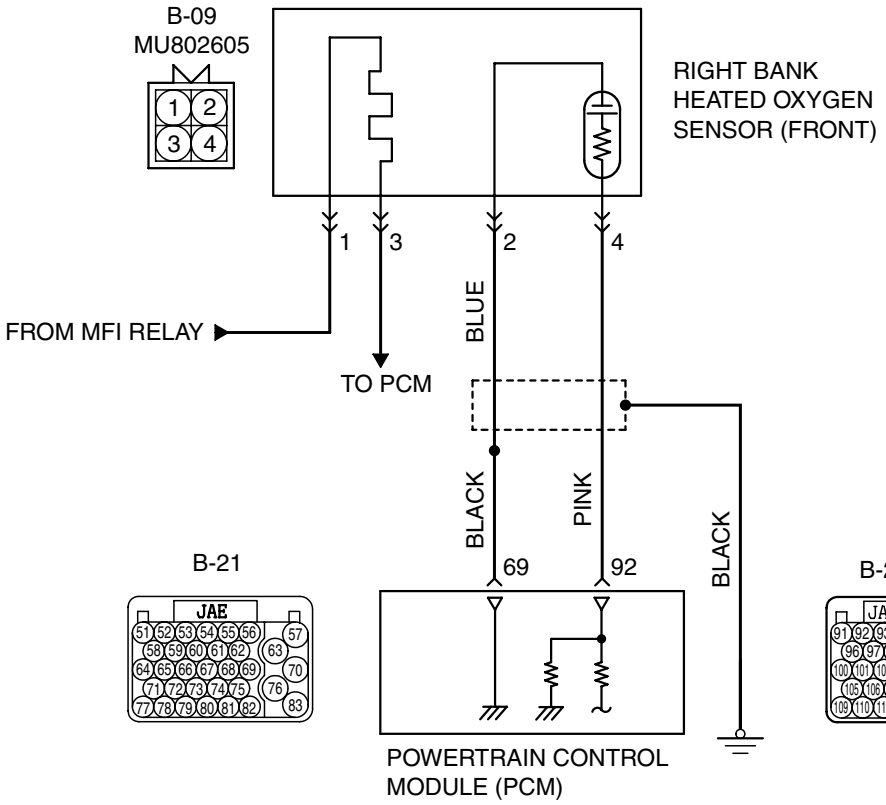
Q: Is DTC P0130 set?

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



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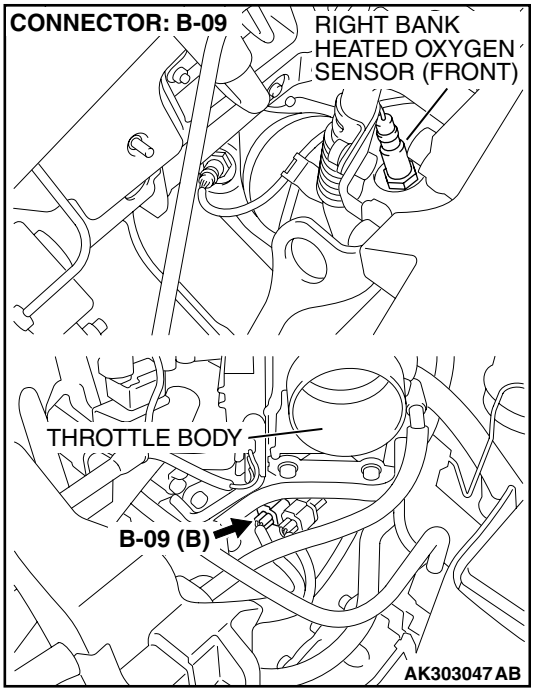
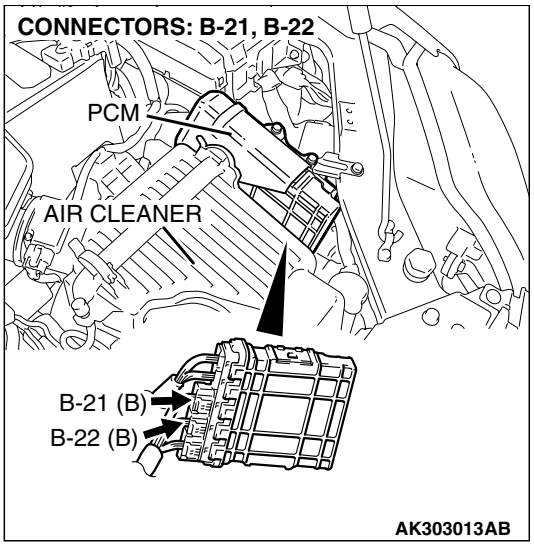




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 92) 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. 69).

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)

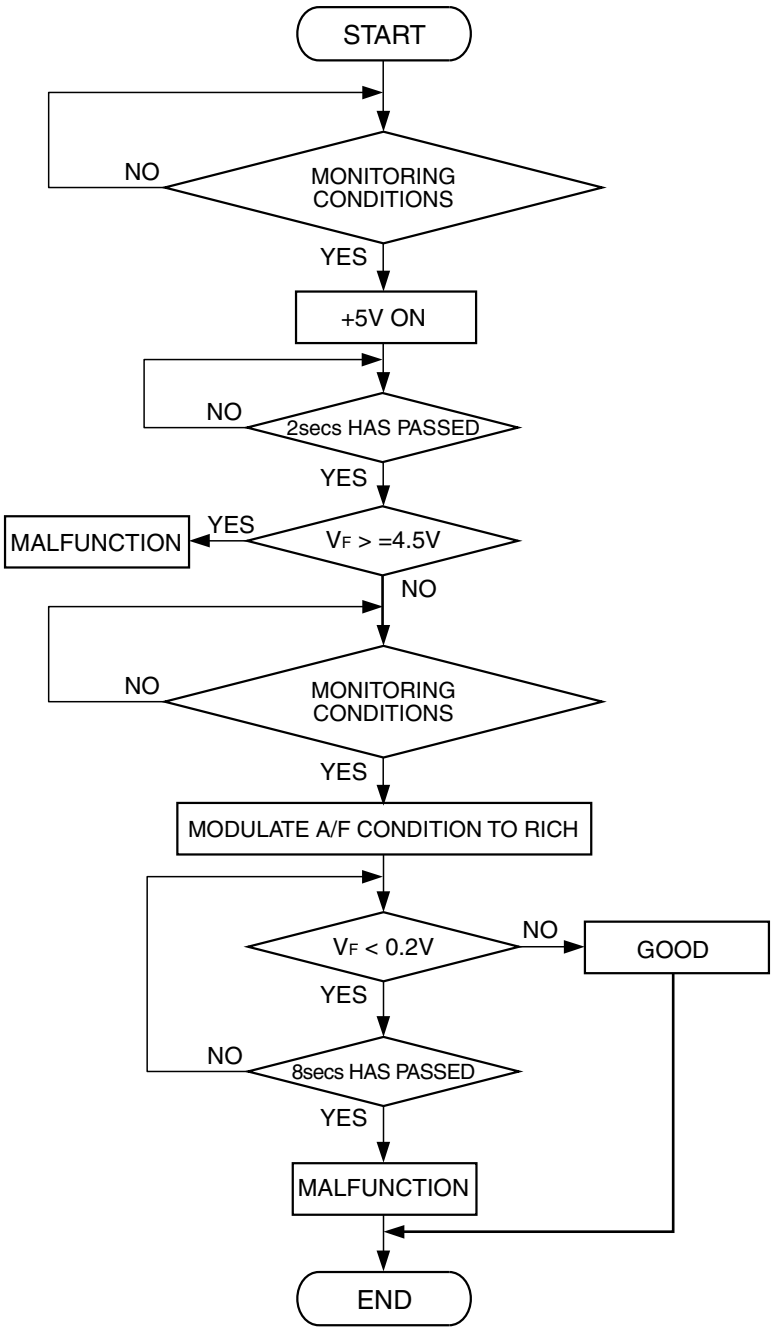
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Mass 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



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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).
- Mass airflow sensor output is 8 g/sec or more.

TSB Revision

- At least 20 seconds have passed since fuel shut off control was canceled.
- Monitoring time: 8 seconds.

Judgement Criteria

- 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.

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.

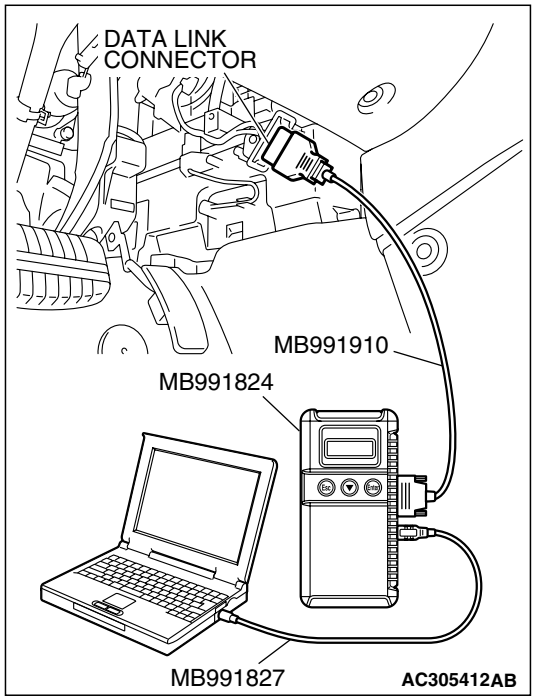
OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- 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.

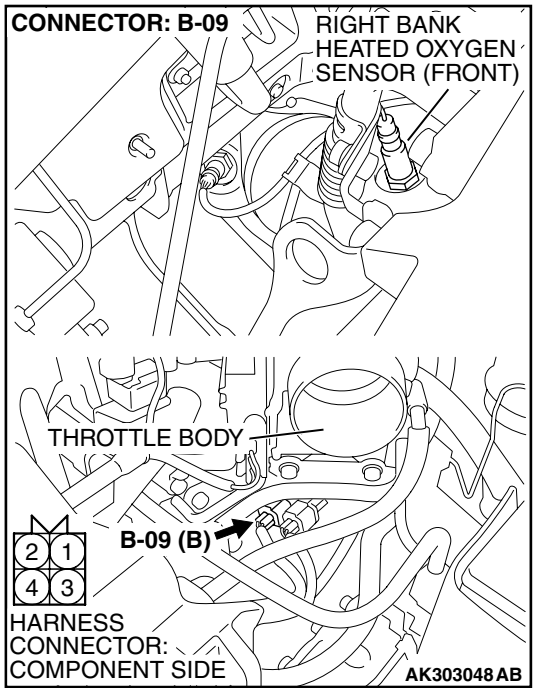
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 39, Heated Oxygen Sensor Bank 1, Sensor 1 (right front).
  - Warm up the engine. When the engine is revved, the output voltage should measure 0.6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

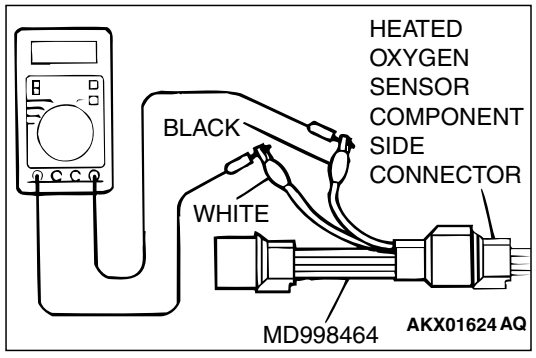
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

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-09 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

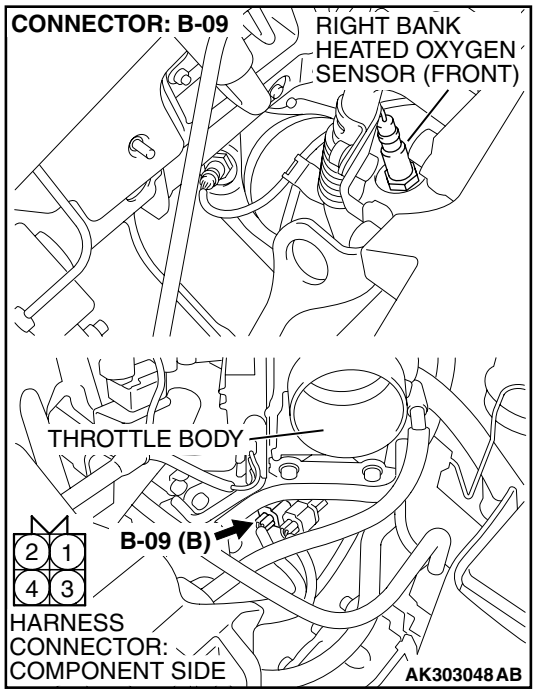
⚠ CAUTION

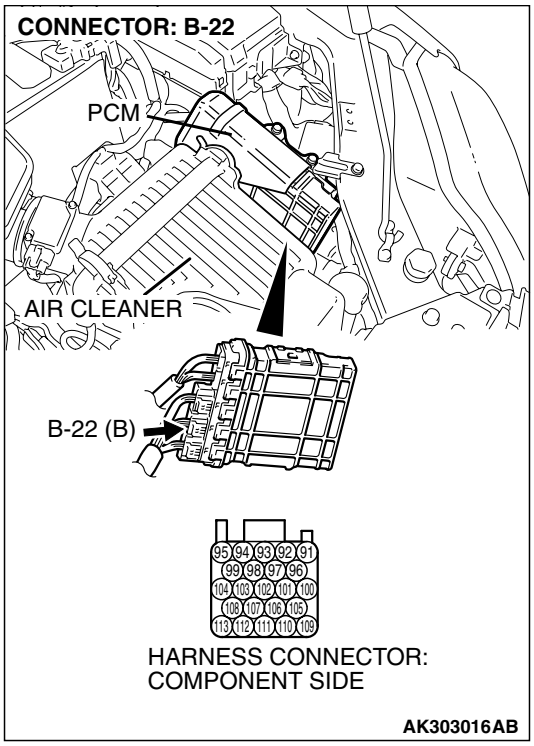
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.**

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.



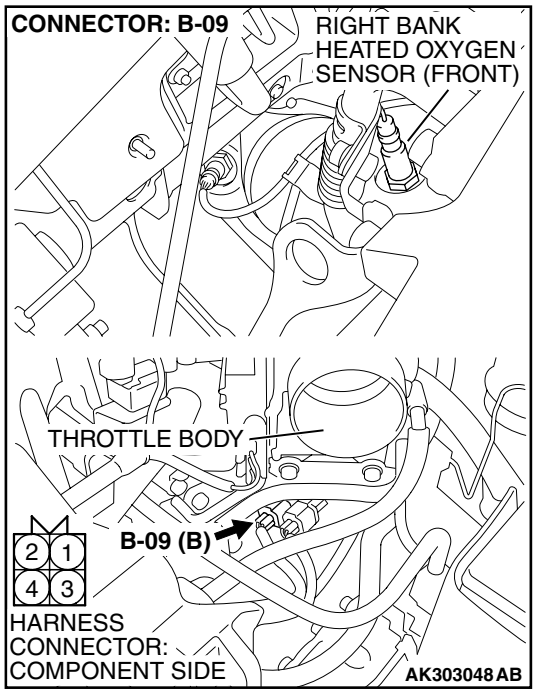


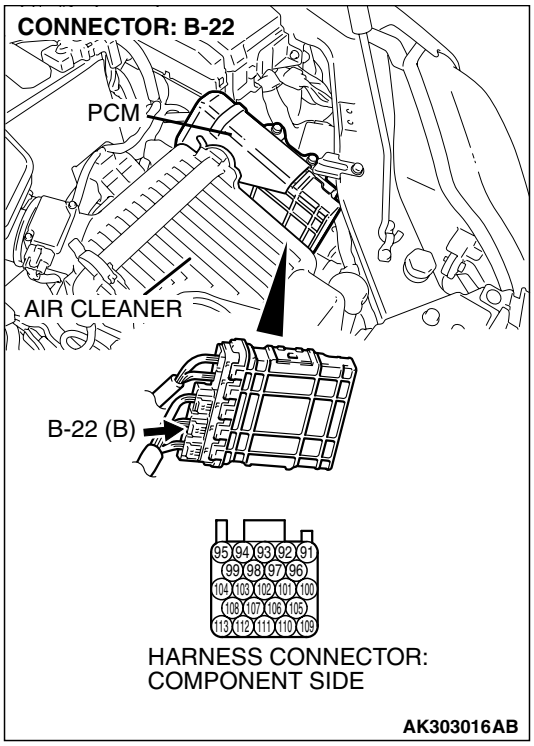
STEP 3. Check harness connector B-09 at right bank heated oxygen sensor (front) and connector B-22 at PCM for damage.

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-09 (terminal No. 4) and PCM connector B-22 (terminal No. 92).
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 – Procedure 6 – Other Monitor P.13B-6.

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

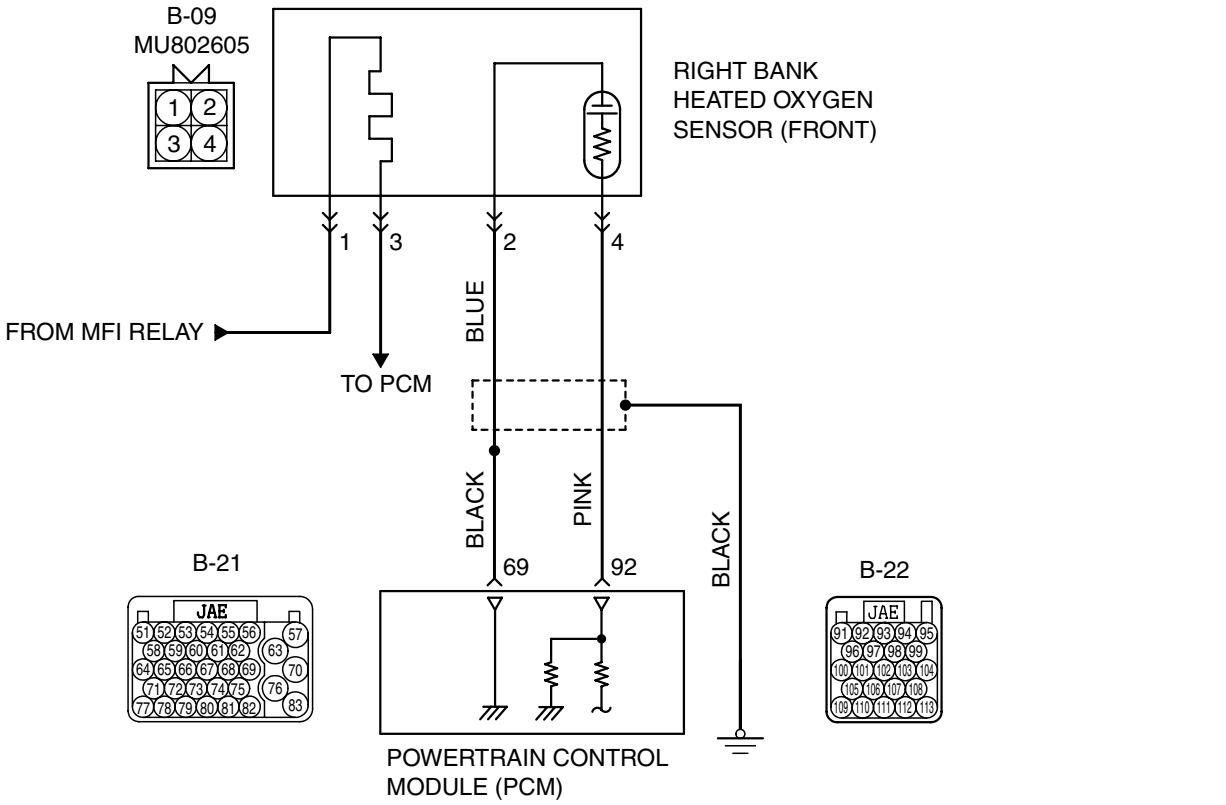
Q: Is DTC P0131 set?

YES : Retry the troubleshooting.

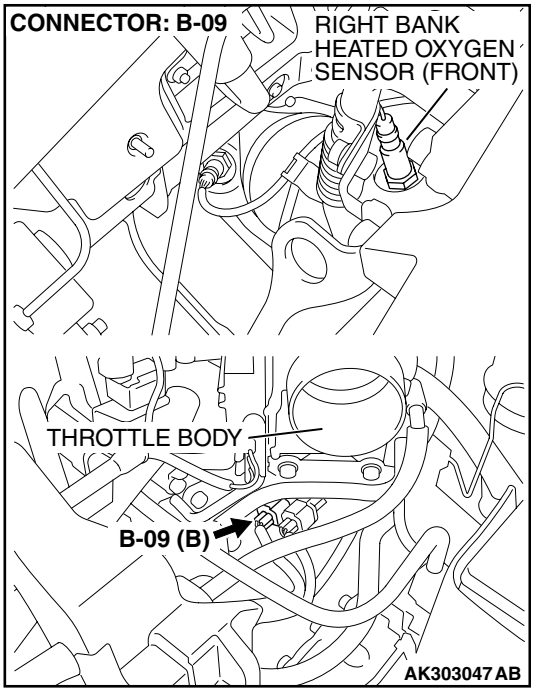
NO : The inspetion is complete.

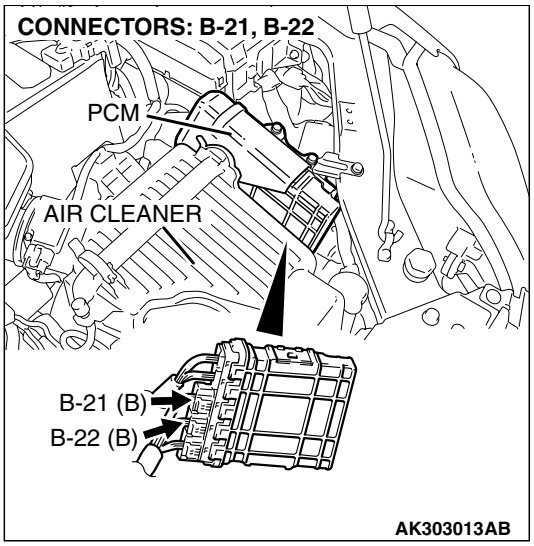
DTC P0132: Heated Oxygen Sensor Circuit High Voltage (bank 1, sensor 1)

Right Bank Heated Oxygen Sensor (front) Circuit



AK400900





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 92) 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. 69).

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)

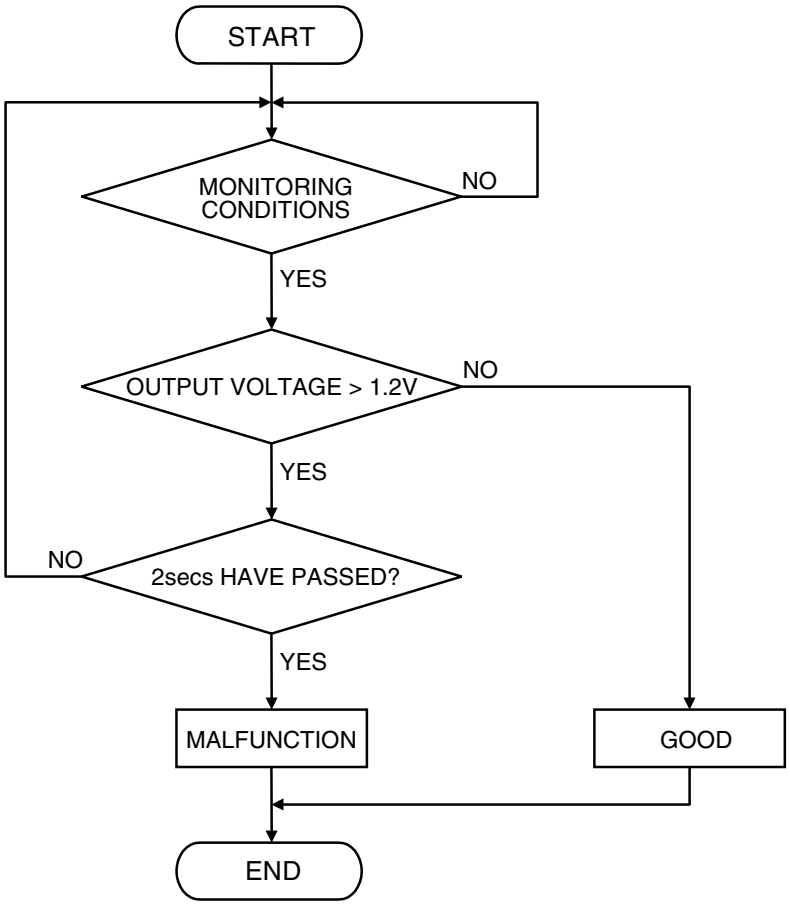
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Mass airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Throttle position sensor
- Accelarator pedal position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302396

Check Conditions

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

Judgment Criteria

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

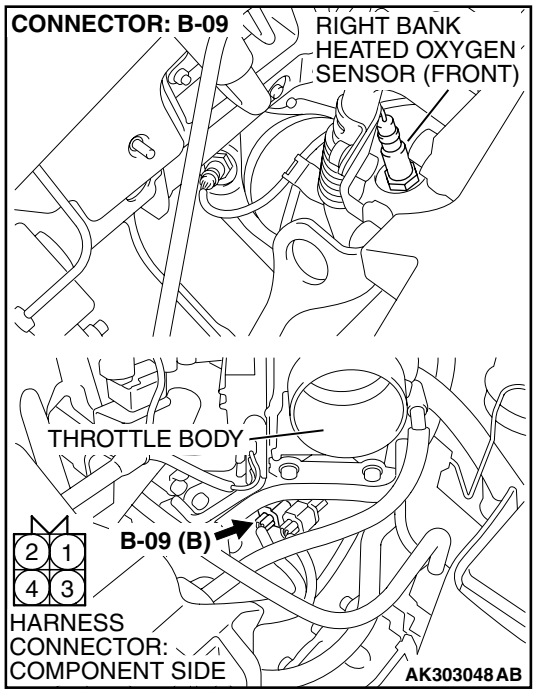
OBD-II DRIVE CYCLE PATTERN

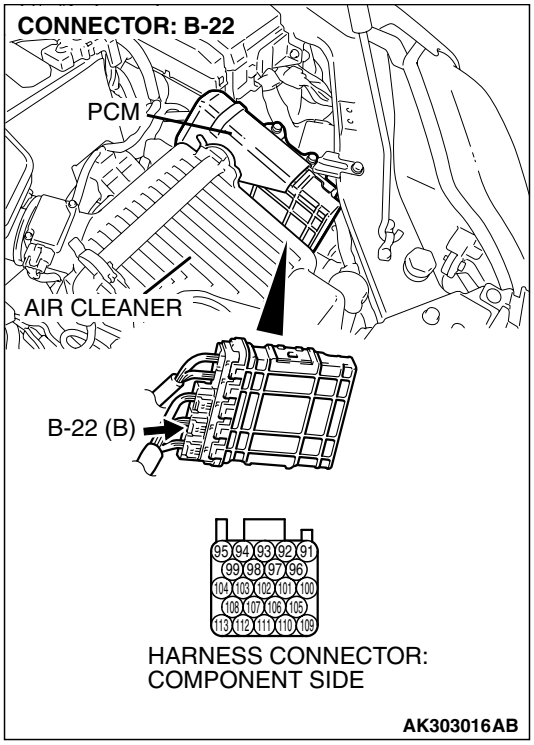
Refer to Diagnosis Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.

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



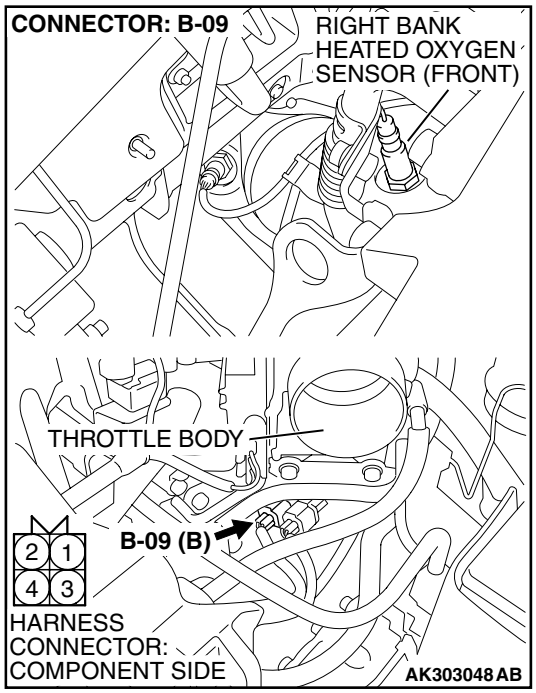


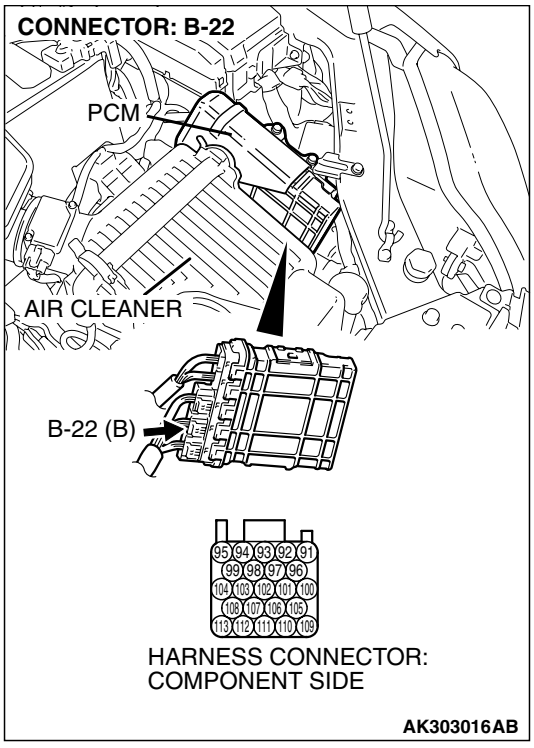
STEP 1. Check harness connector B-09 at right bank heated oxygen sensor (front) and harness connector B-22 at PCM for damage.

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-09 (terminal No. 4) and PCM connector B-22 (terminal No. 92).
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 – Procedure 6 – Other Monitor P.13B-6.

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

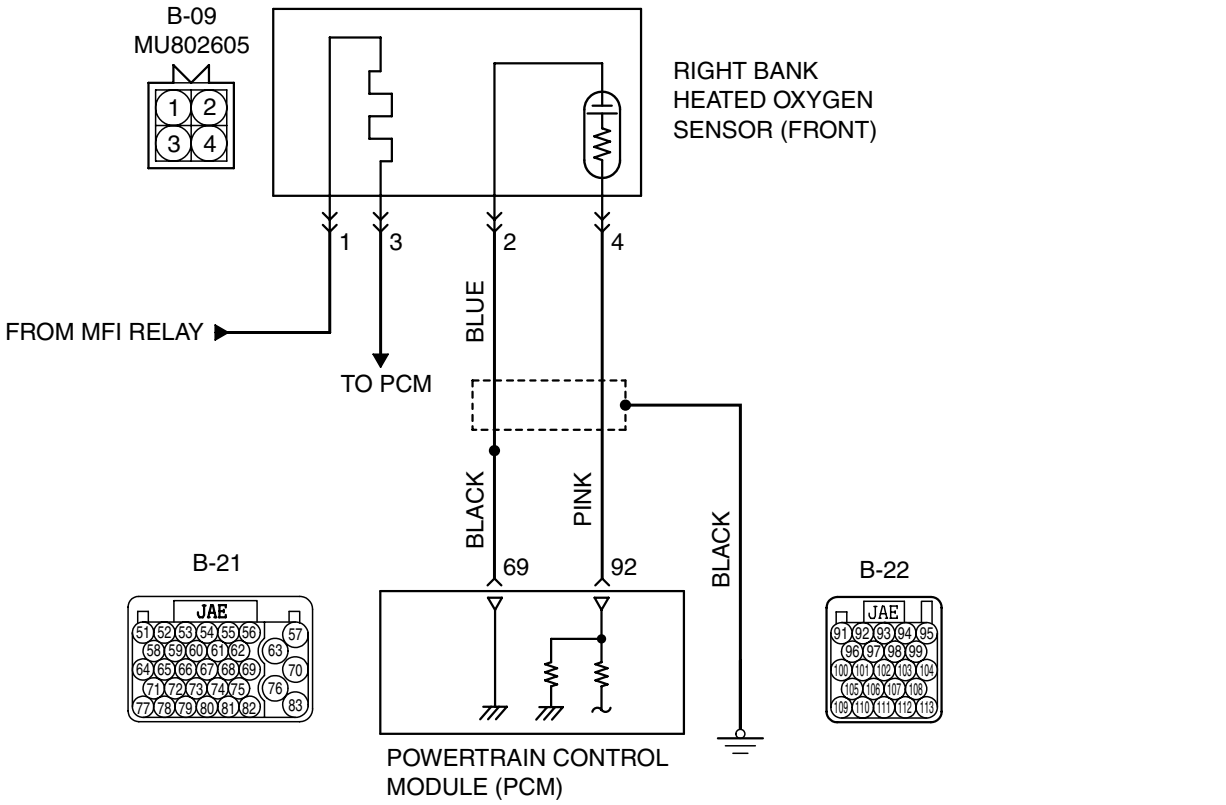
Q: Is DTC P0132 set?

YES : Retry the troubleshooting.

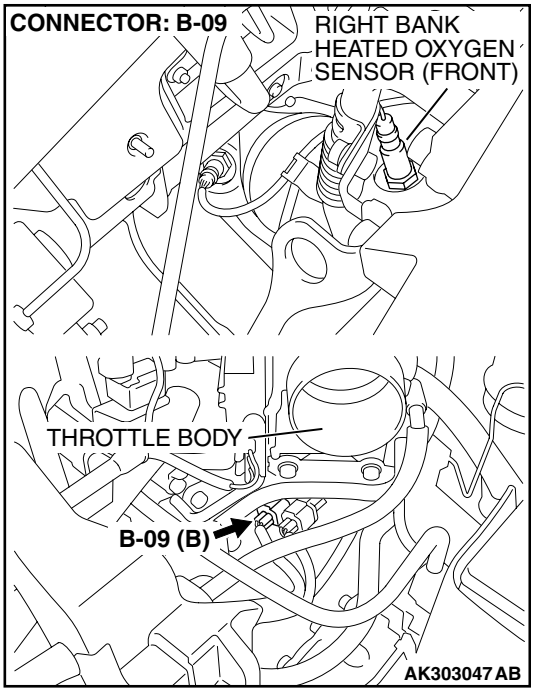
NO : The inspection is complete.

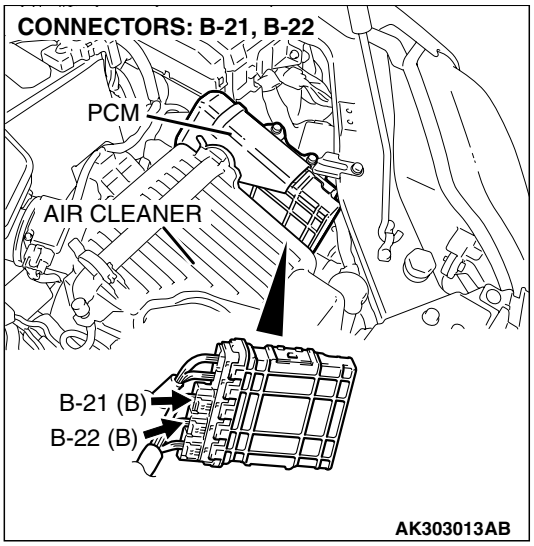
DTC P0133: Heated Oxygen Sensor Circuit Slow Response (bank 1, sensor 1)

Right Bank Heated Oxygen Sensor (front) Circuit



AK400900





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 92) 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. 69).

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)

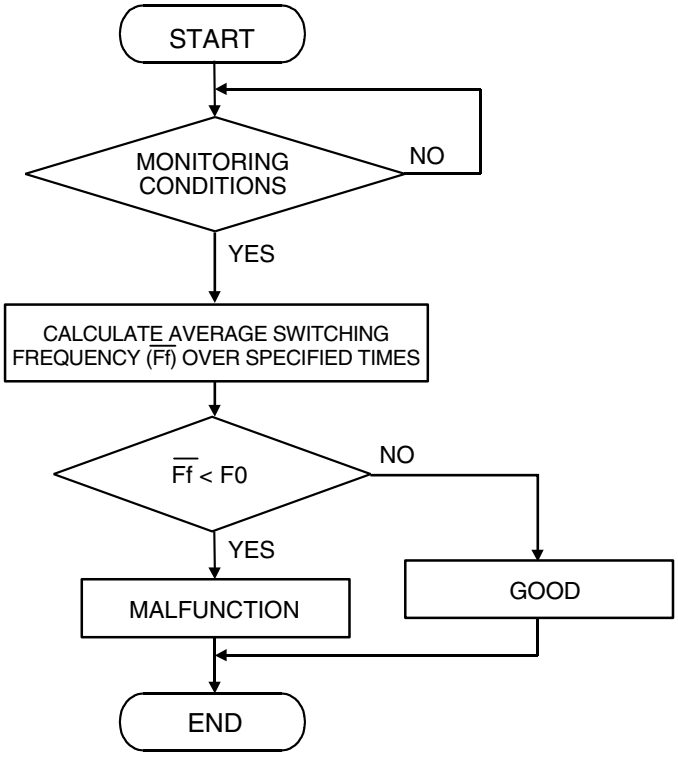
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Mass 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 SWITDHING FREQUENCY

AK302395

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 18 and 60 percent.
- Under the closed loop air/fuel control.
- The accelerator pedal is open.
- Short-term fuel trim is between –30 and +25 percent.
- More than 3 seconds have elapsed after the abovementioned conditions have been met.
- The PCM monitors for this condition for 5 cycles of 12 seconds each during the drive cycle.

Judgment Criteria

- The right bank heated oxygen sensor (front) sends "lean" and "rich" signals alternately 13 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 – Procedure 4 – Heated Oxygen Sensor Monitor P.13B-6.

TSB Revision

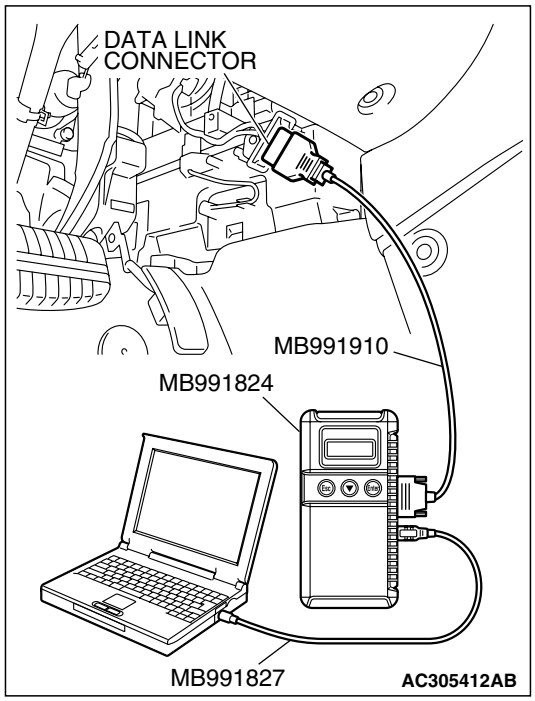
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Harness A
- 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.

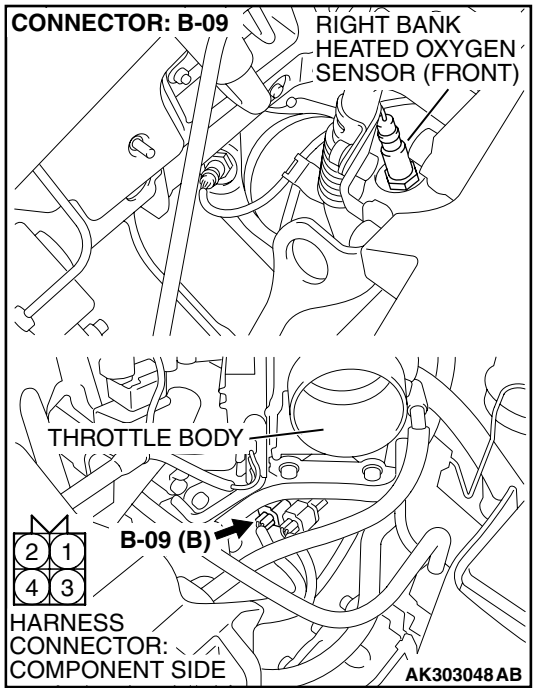
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 39, Heated Oxygen Sensor Bank 1, Sensor 1 (right front).
(4) Warm up the engine, 2,500 r/min.
  - Output voltage repeats 0.4 volt or less and 0.6 – 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?

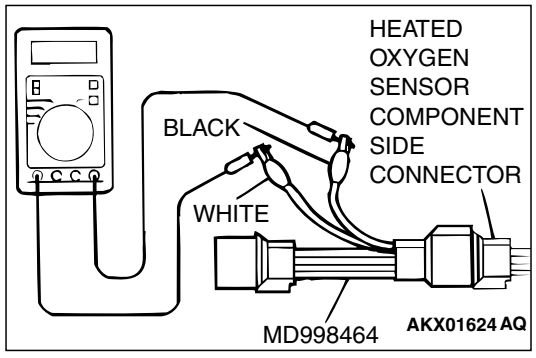
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

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-09 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

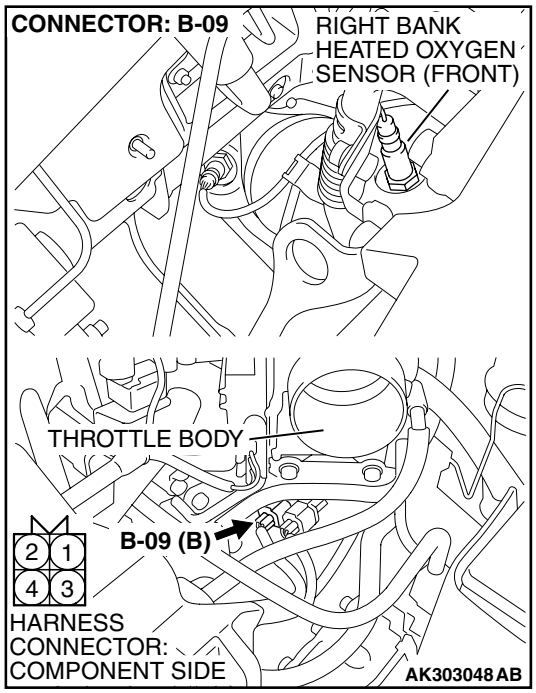
⚠ CAUTION

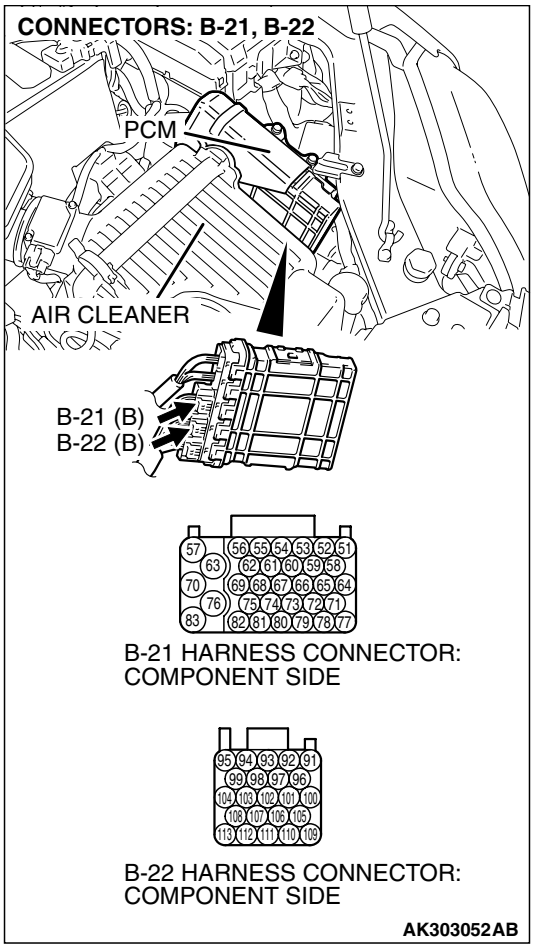
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.**

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-09 at right bank heated oxygen sensor (front) and harness connector B-21, B-22 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 – Procedure 4 – Heated Oxygen Sensor Monitor P.13B-6.
(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)

⚠ CAUTION
If DTC P0134 has been set, TCL related DTC U1120 is also set. After P0134 has been diagnosed, don't forget to erase DTC U1120.

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

- Refer to, DTC P0130 – Right Bank Heated Oxygen Sensor (Front) Circuit P.13B-195.
- Refer to, DTC P0201P.13B-481, P0203P.13B-504, P0205P.13B-527 – Injector Circuit.

CIRCUIT OPERATION

- Refer to, DTC P0132 – Right Bank Heated Oxygen Sensor (Front) Circuit P.13B-220.
- Refer to, DTC P0201P.13B-481, P0203P.13B-504, P0205P.13B-527 – Injector Circuit.

TECHNICAL DESCRIPTION

- The PCM effects air/fuel ratio feedback control in accordance with the signals from the right bank heater 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)

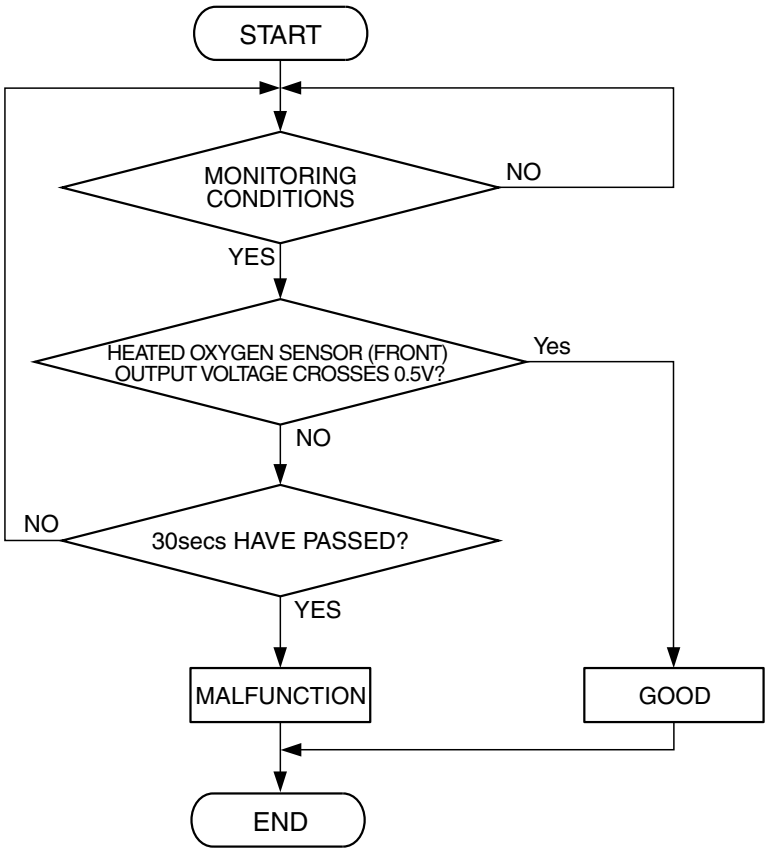
- Misfire monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK203999

Check Conditions

- 20 seconds or more have passed since the engine starting sequence was completed.
- Engine coolant temperature is higher than 50°C (122°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.

Judgment Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

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.

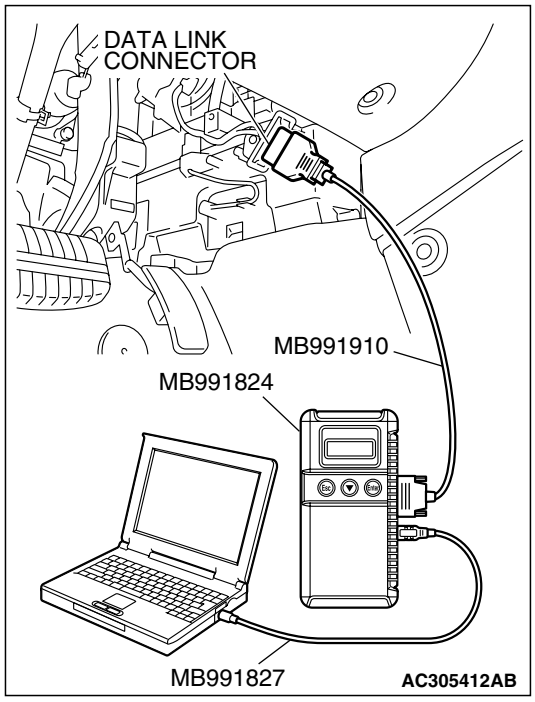
  NOTE: When the right bank heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor output voltage will deviate from the voltage when the sensor was new (normally 0.5 volt at stoichiometric ratio). This deviation will be corrected by the right bank heated oxygen sensor (rear).

  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
  - MB991910: Main Harness A
- 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).
  - 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 sensor operating properly?

YES : Go to Step 2.

NO : Refer to, DTC P0136 – Heated Oxygen Sensor Circuit (bank 1, sensor 2) DTC P.13B-255, P0137 – Heated Oxygen Sensor Circuit Low Voltage (bank 1, sensor 2) P.13B-273, DTC P0138 – Heated Oxygen Sensor Circuit High Voltage (bank 1, sensor 2) P.13B-280, DTC P0139 – Heated Oxygen Sensor Circuit Slow Response (bank 1, sensor 2) P.13B-285.

STEP 2. Check for exhaust leaks.

Q: Are there any abnormalities?

YES : Repair it. Then go to Step 13.
NO : Go to Step 3.

STEP 3. Check for intake system vacuum leak.

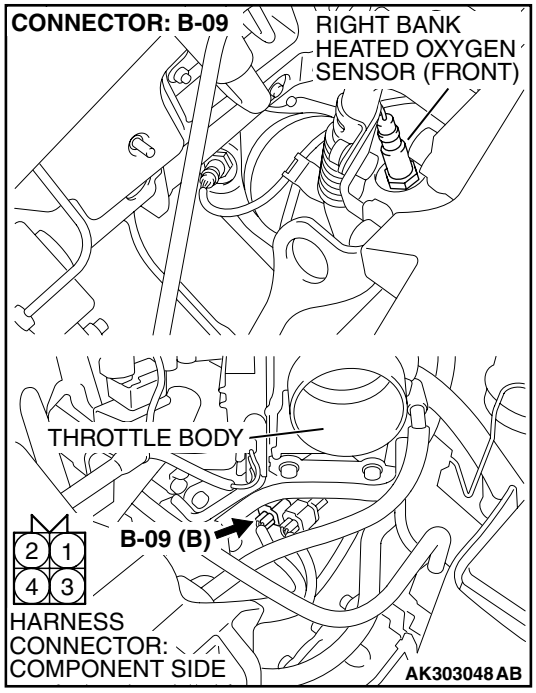
Q: Are there any abnormalities?

YES : Repair it. Then go to Step 13.
NO : Go to Step 4.

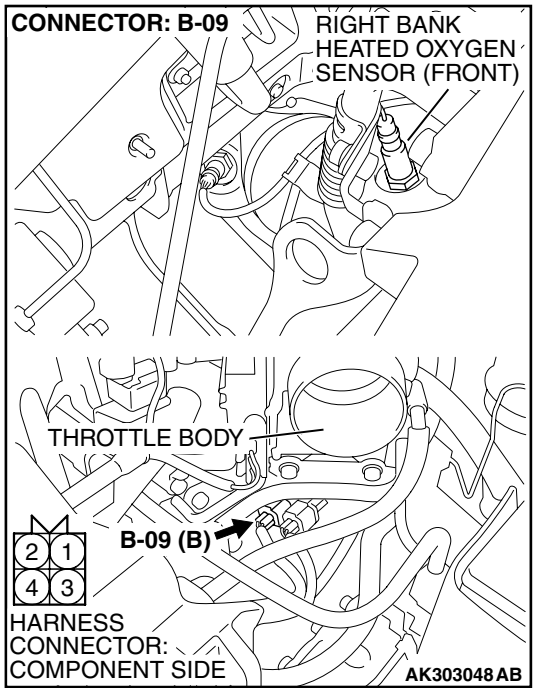
STEP 4. Check harness connector B-09 at the right bank heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

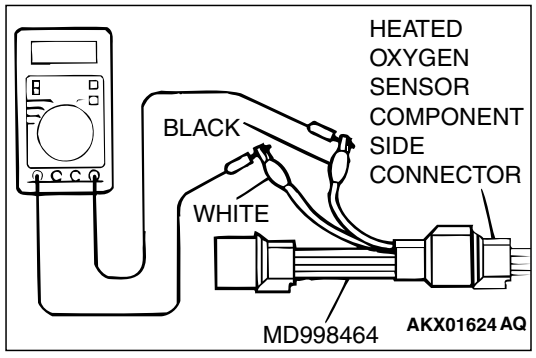
YES : Go to Step 5.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.



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



(1) Disconnect the right bank heated oxygen sensor (front) connector B-09 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

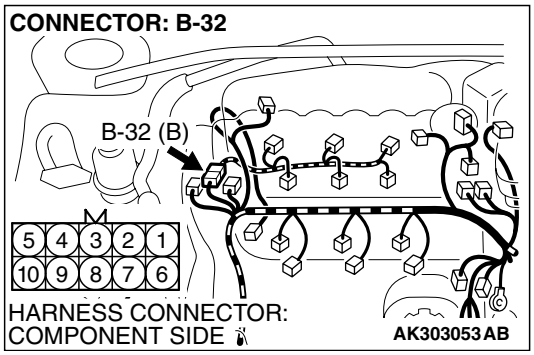
⚠ CAUTION

- **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 13.

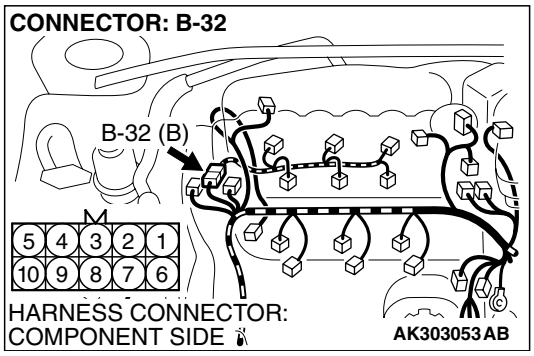


STEP 6. Check harness connector B-32 at intermediate connector for damage.

Q: Is the harness connector in good condition?

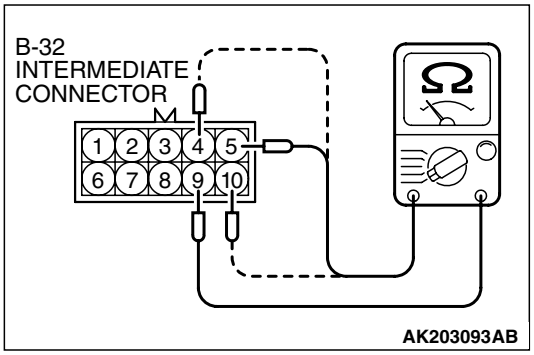
YES : Go to Step 7.

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



STEP 7. Measure the right bank injector resistance at intermediate connector B-32.

(1) Disconnect the intermediate connector B-32.



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

a. Measure the resistance between terminal No. 5 and No. 9 when measuring No. 1 cylinder.

b. Measure the resistance between terminal No. 9 and No. 10 when measuring No. 3 cylinder.

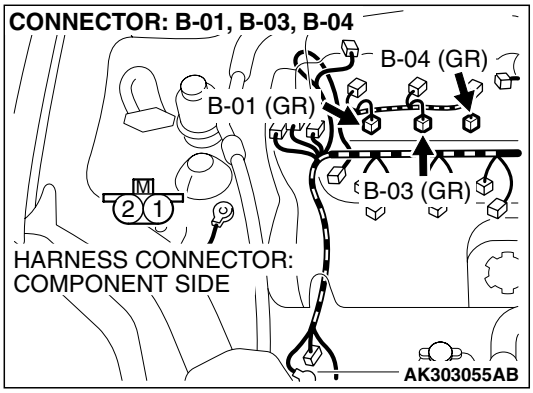
c. Measure the resistance between terminal No. 4 and No. 9 when measuring No. 5 cylinder.

- Resistance should be between 10.5 and 13.5 ohms [at 20°C (68° F)].

Q: Is the measured resistance between 10.5 and 13.5 ohms [at 20°C (68°F)]?

YES : Go to Step 10.

NO : Go to Step 8.



STEP 8. Check harness connector B-03, B-04, B-01 at right bank injector for damage.

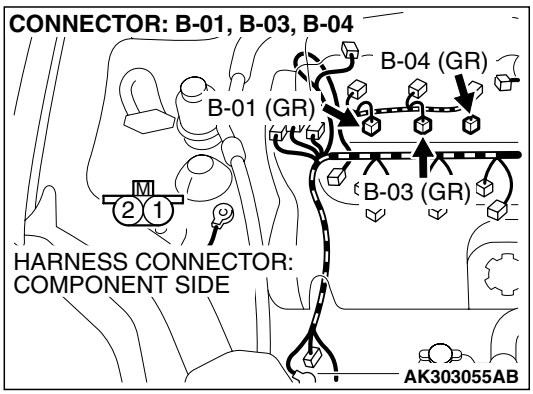
(1) Remove the intake manifold.

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

Q: Is the harness connector in good condition?

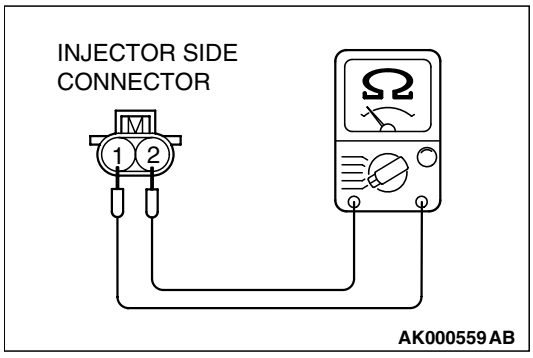
YES : Go to Step 9.

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



STEP 9. Check the right bank injector.

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



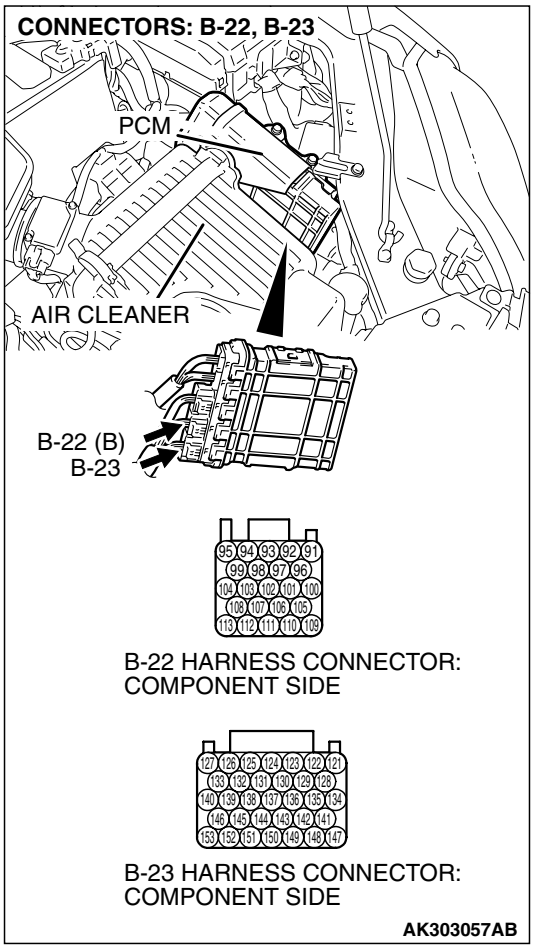
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 10.5 – 13.5 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 10.5 and 13.5 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 13.

NO : Replace the injector. Then go to Step 13.

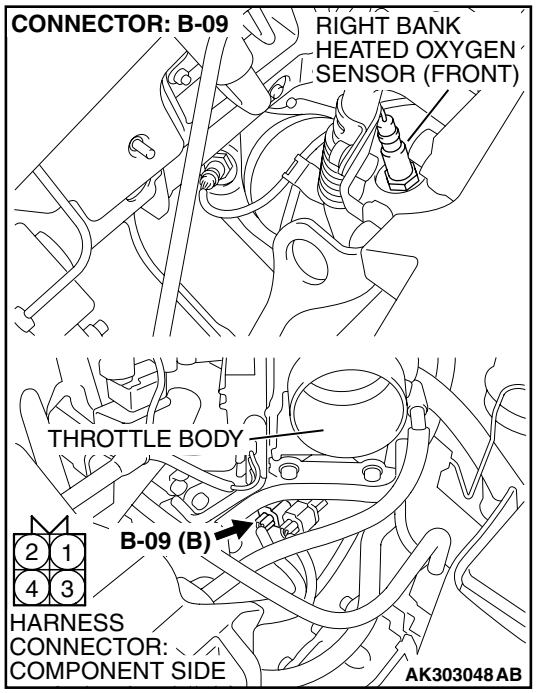


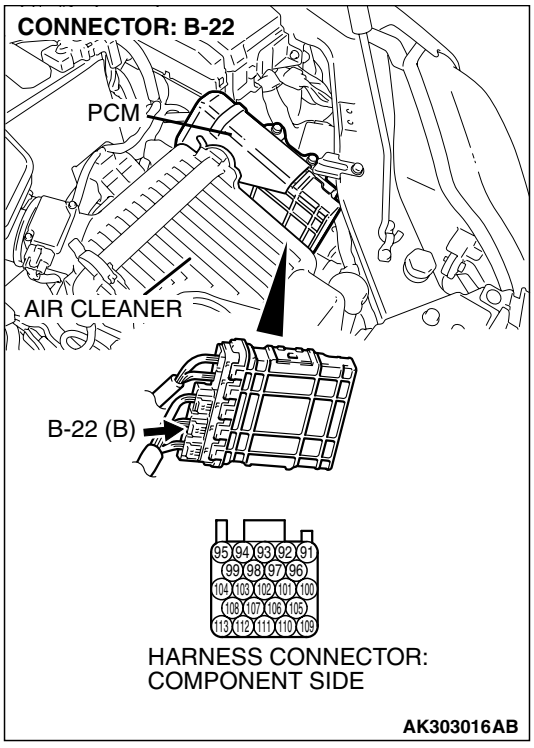
STEP 10. Check harness connector B-22, B-23 at PCM for damage.

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 13.



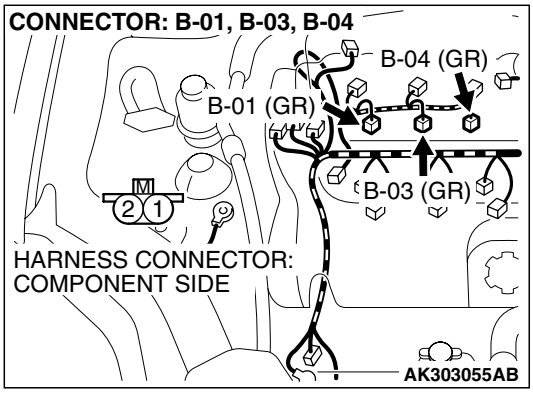


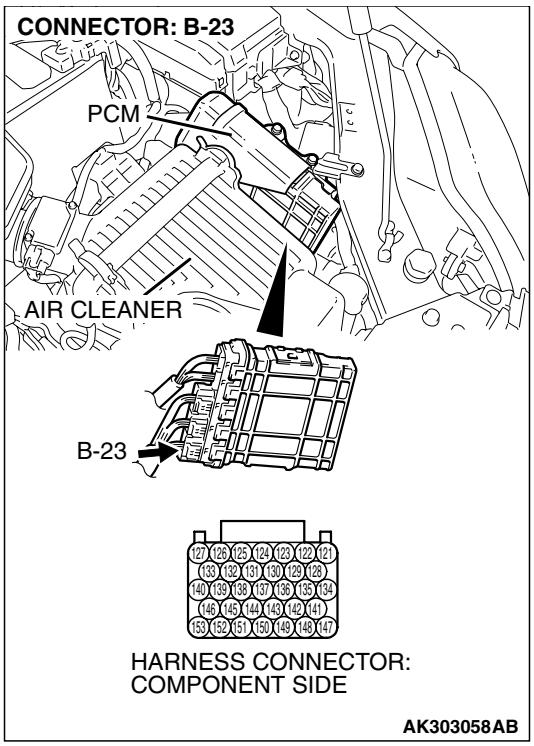
STEP 11. Check for harness damage between right bank heated oxygen sensor (front) connector B-09 (terminal No. 4) and PCM connector B-22 (terminal No. 92).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 13.





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

a. Check the harness wire between right bank injector connector B-01 (terminal No. 2) and PCM connector B-23 (terminal No. 153) when checking No. 1 cylinder.
b. Check the harness wire between right bank injector connector B-03 (terminal No. 2) and PCM connector B-23 (terminal No. 140) when checking No. 3 cylinder.
c. Check the harness wire between right bank injector connector B-04 (terminal No. 2) and PCM connector B-23 (terminal No. 133) when checking 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.13B-1179.

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.

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

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

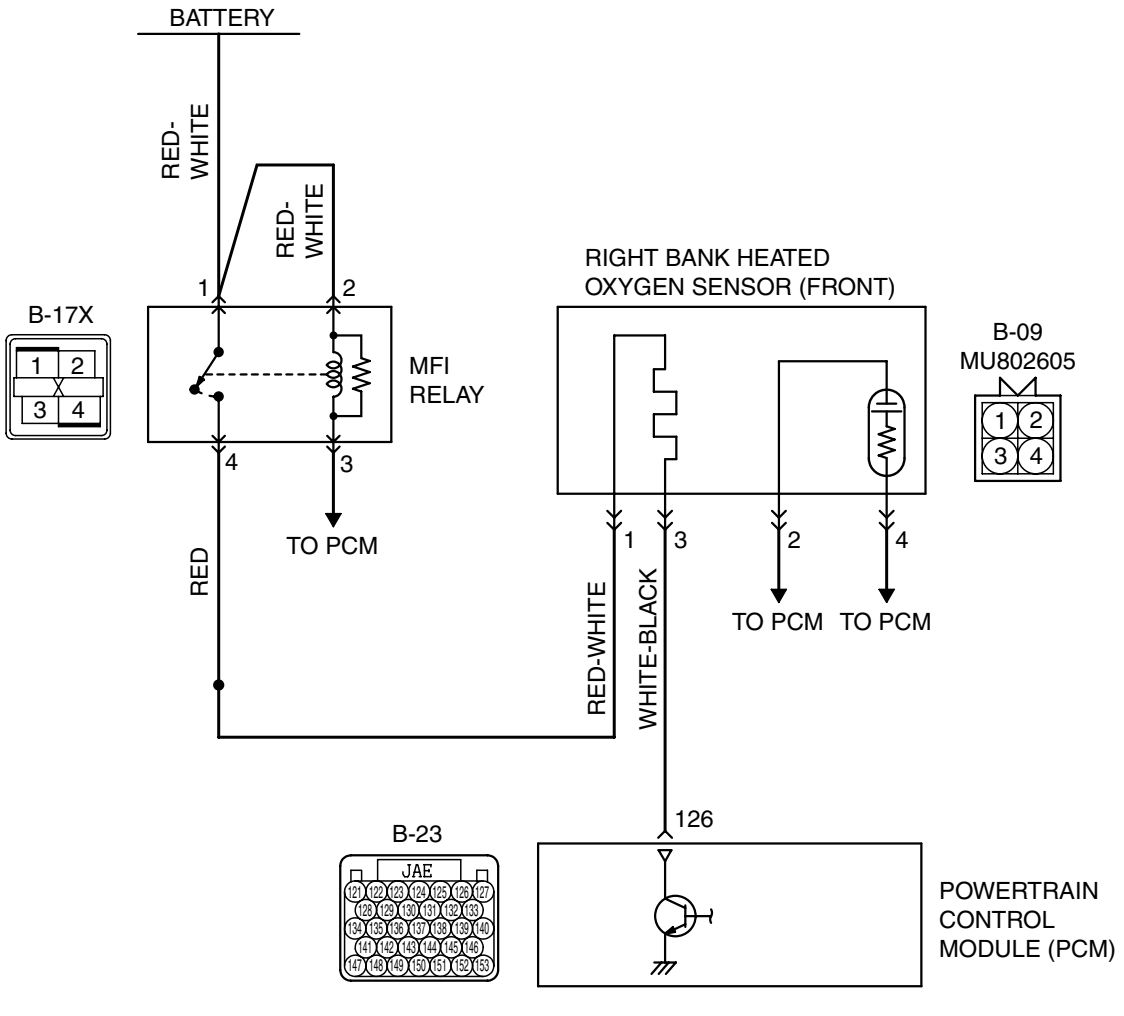
Q: Is DTC P0134 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0135: Heated Oxygen Sensor Heater Circuit (bank 1, sensor 1)

Right Bank Heated Oxygen Sensor (front) Heater Circuit



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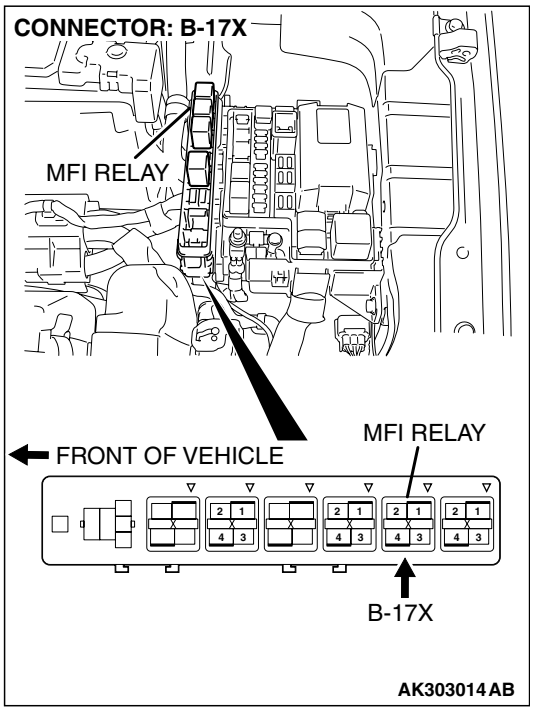

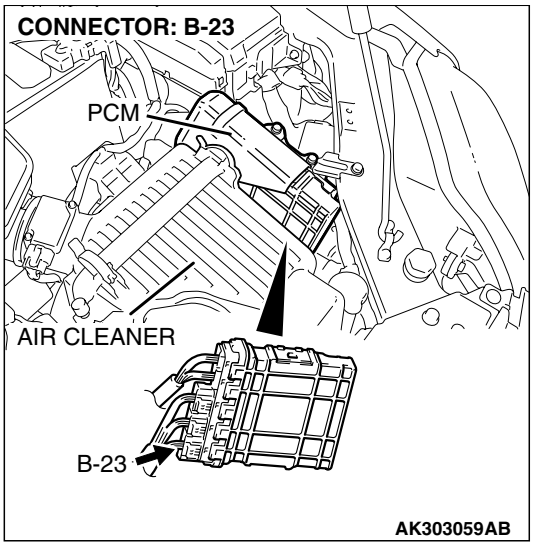

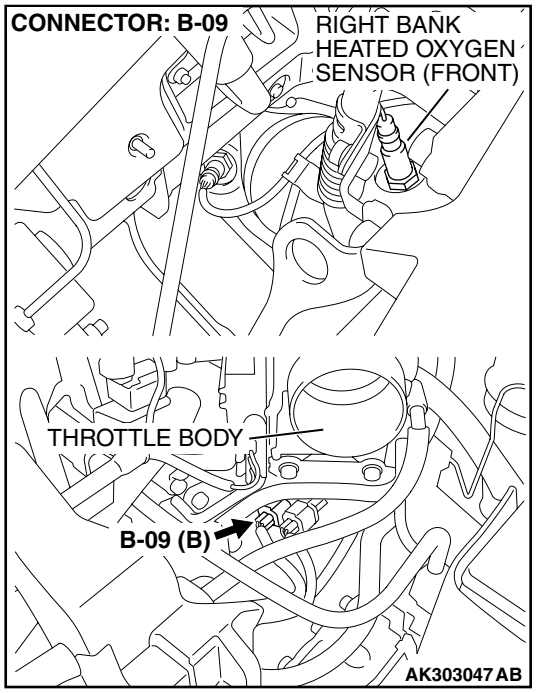

CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the right bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 126) controls continuity to the right bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor heater (front) current is out of specified range when engine coolant temperature is over 20°C (68°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)

- Engine coolant temperature sensor

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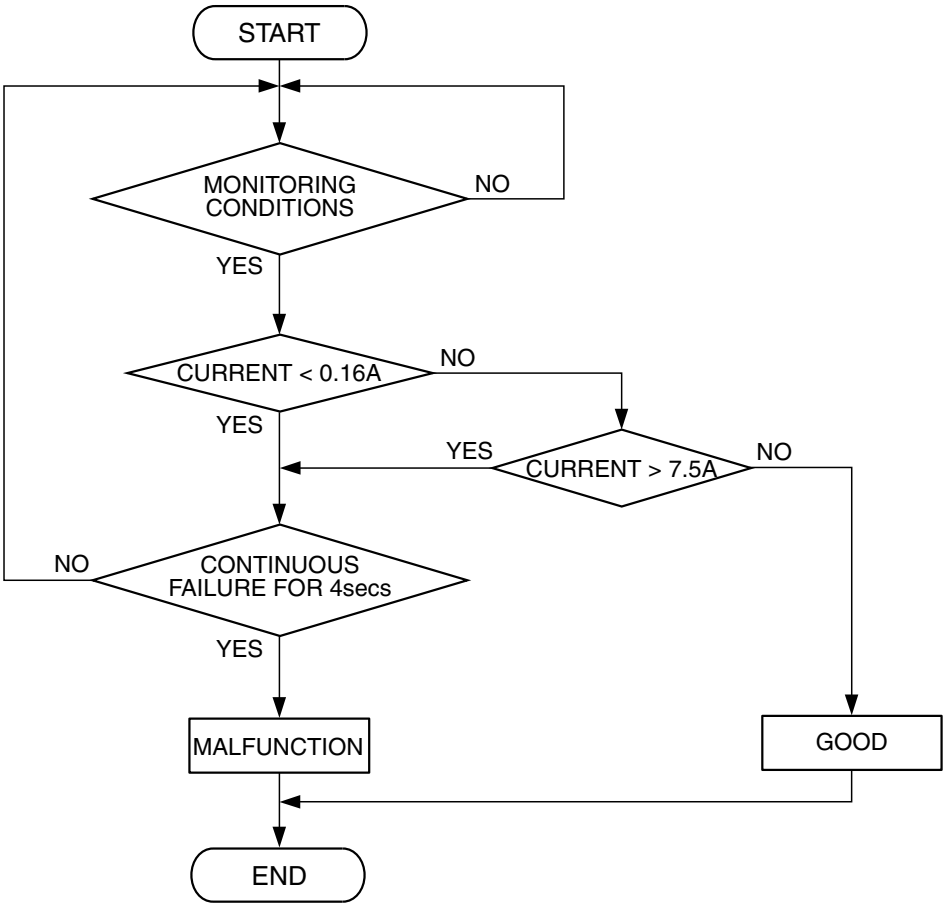
DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

- 60 seconds have elapsed from the start of the previous monitoring.
- Engine coolant temperature is higher than 20°C (68°F).
- While the right bank heated oxygen sensor (front) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgment Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.

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

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

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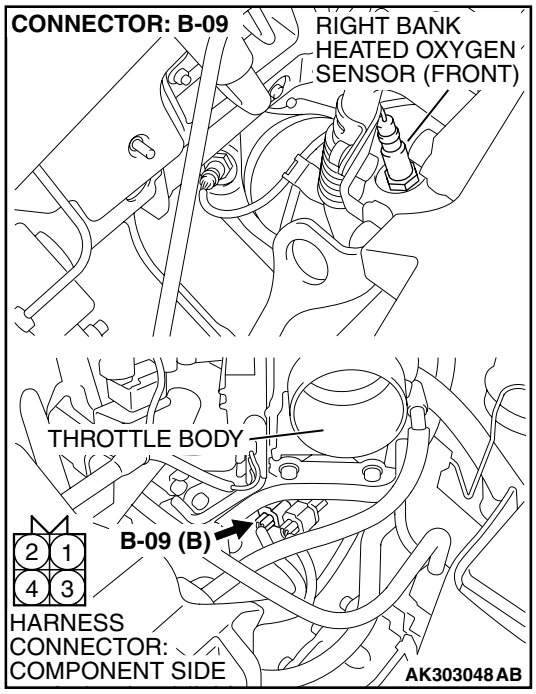
DIAGNOSIS

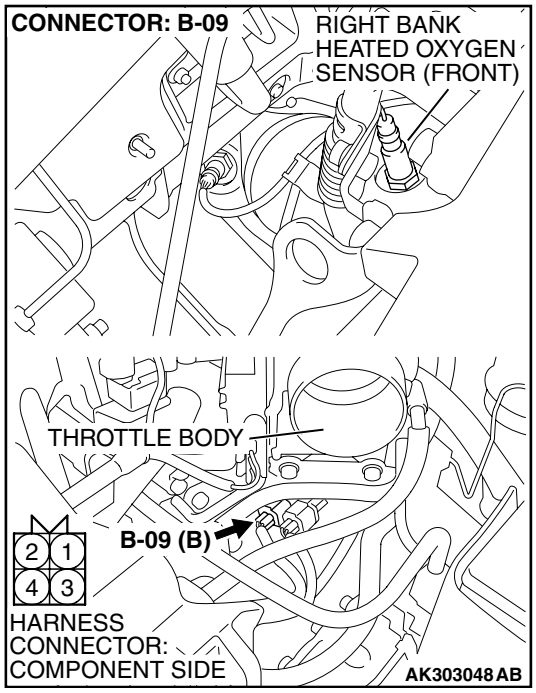
Required Special Tools:

- MD998464: Test Harness
- MB991923: Power Plant ECU Check Harness

STEP 1. Check harness connector B-09 at the right bank heated oxygen sensor (front) for damage.
Q: Is the harness connector in good condition?

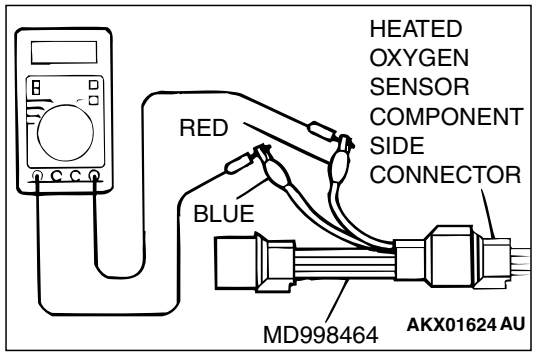
YES : Go to Step 2.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.





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

(1) Disconnect right bank heated oxygen sensor (front) connector B-09 and connect test harness special tool, MD998464, to the connector on the right bank heated oxygen (front) sensor side.



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

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

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

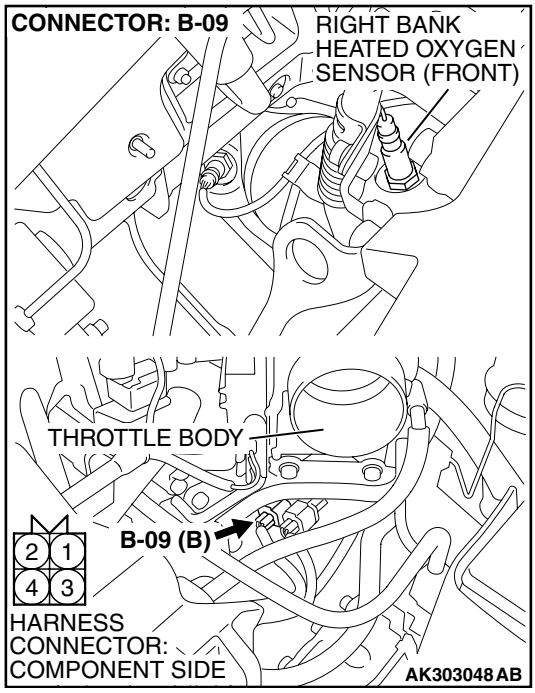
YES : Go to Step 3.

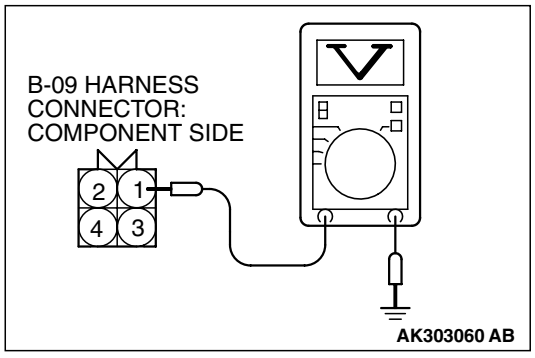
NO : Replace the right bank heated oxygen sensor (front). Then go to Step 12.

STEP 3. Measure the power supply voltage at right bank heated oxygen sensor (front) harness side connector B-09.

(1) Disconnect the connector B-09 and measure at the harness side.

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





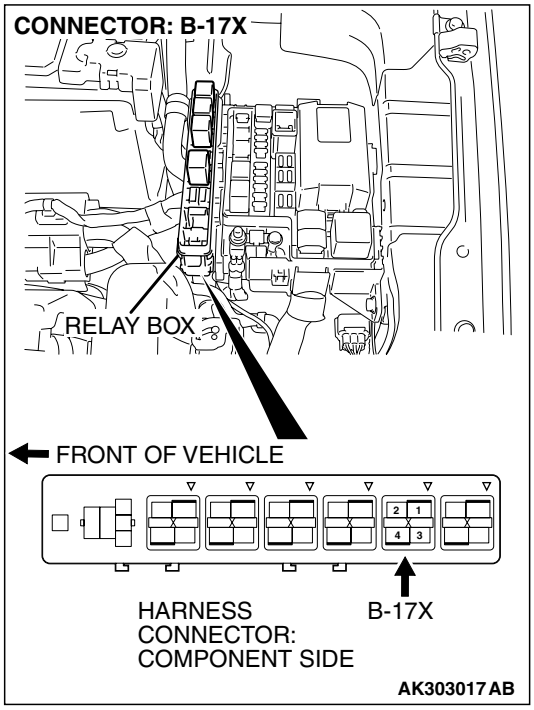
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

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

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

YES : Go to Step 5.

NO : Go to Step 4.

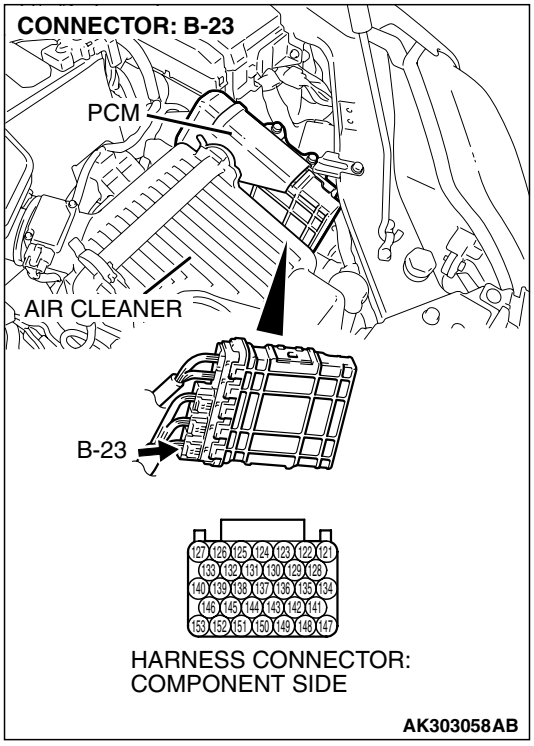


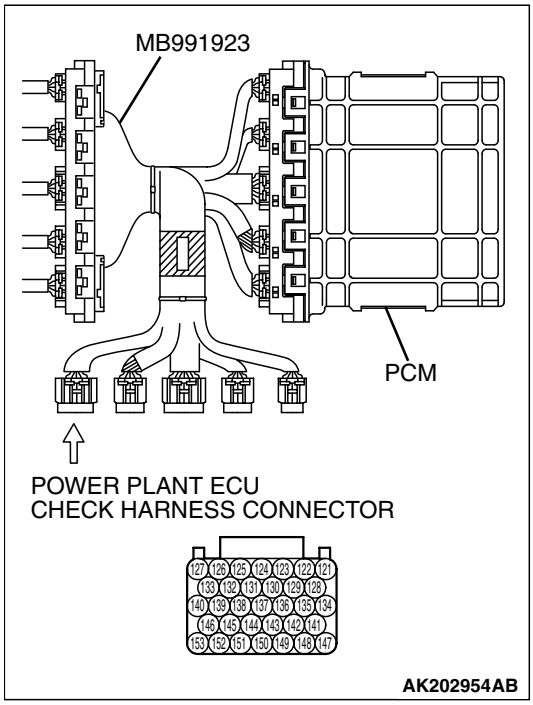
STEP 4. Check harness connector B-17X at the MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (front) connector B-09 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

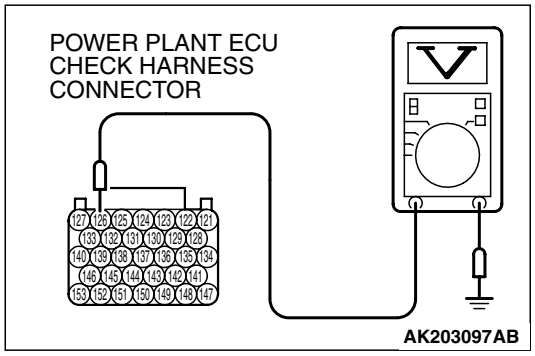




STEP 5. Measure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect power plant ECU check harness special tool MB991923 between the separated connectors.

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



(3) Measure the voltage between terminal No. 126 and ground.
- Voltage should be battery positive voltage.

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

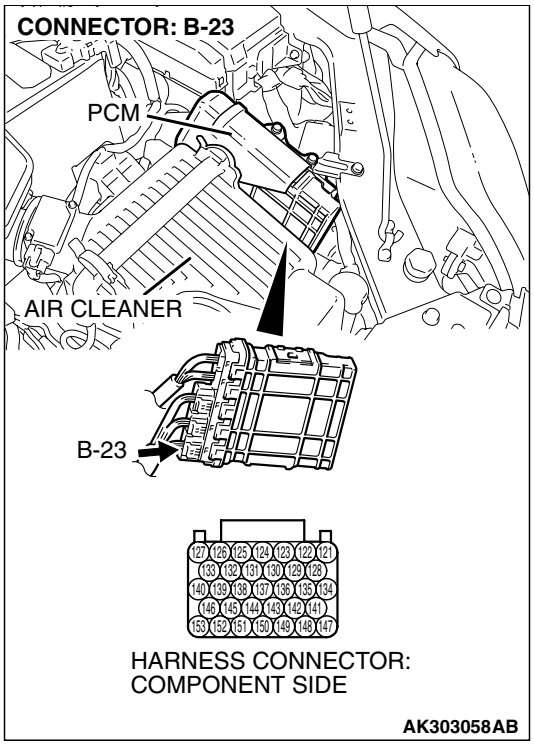
Q: Is battery positive voltage (approximately 12 volts) present?

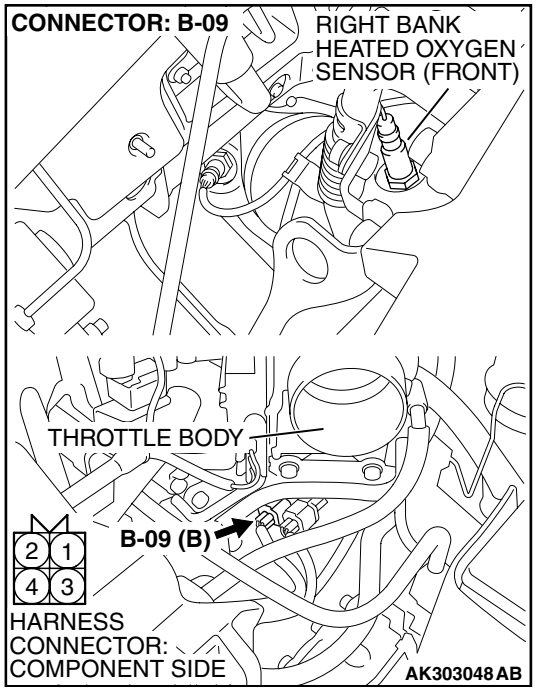
YES : Go to Step 8.
NO : Go to Step 6.

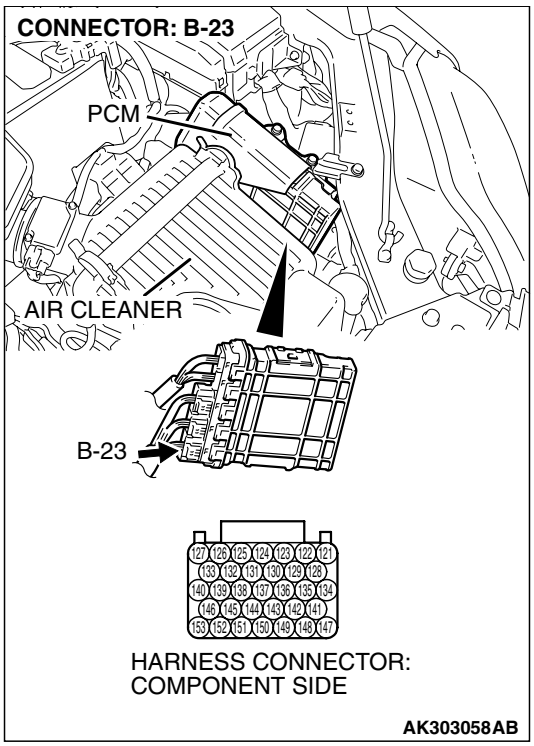
STEP 6. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

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





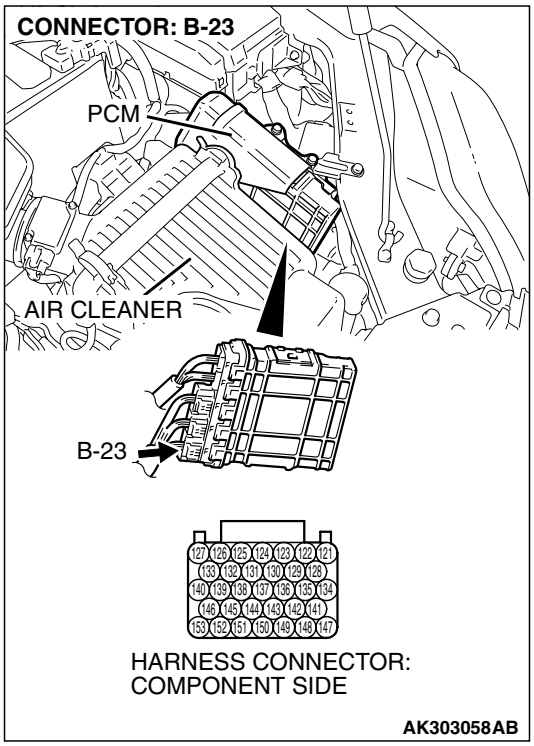


STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (front) connector B-09 (terminal No. 3) and PCM connector B-23 (terminal No. 126).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 12.

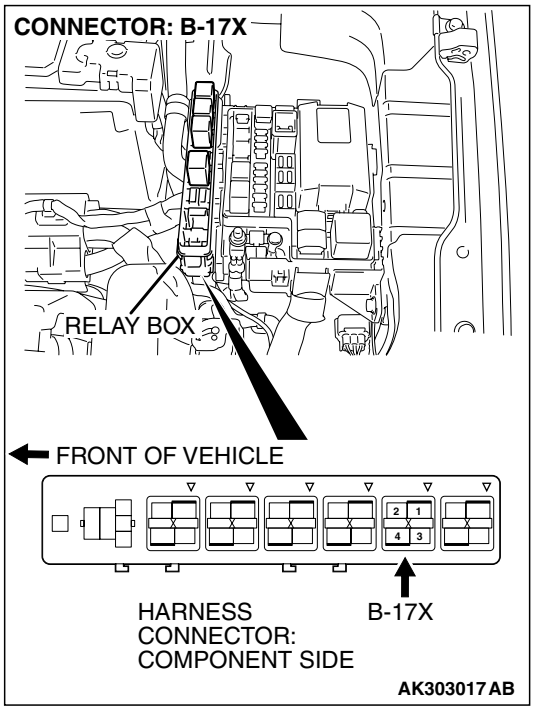


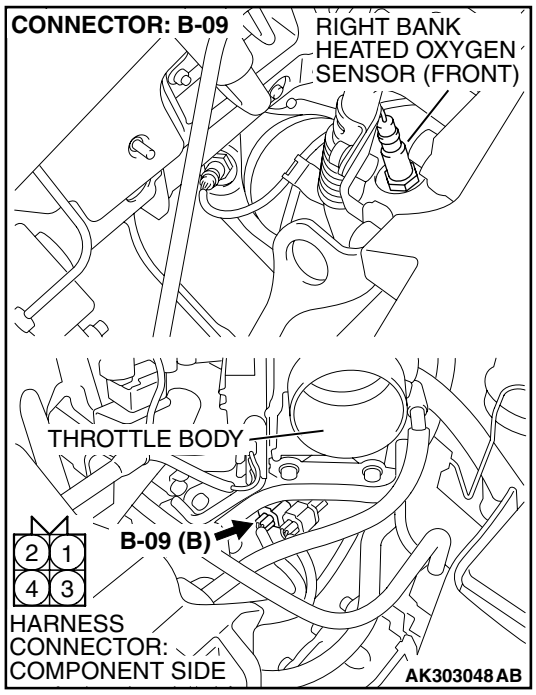
STEP 8. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

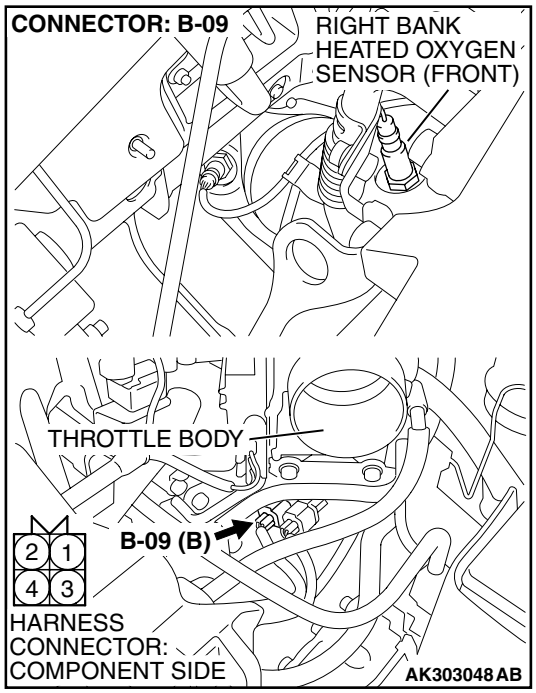
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

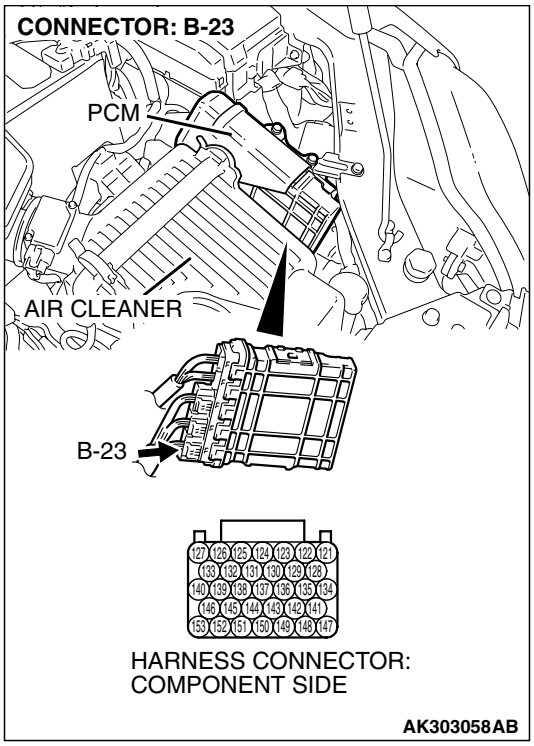




STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (front) connector B-09 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 10.
NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between right bank heated oxygen sensor (front) connector B-09 (terminal No. 3) and PCM connector B-23 (terminal No. 126).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

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

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

Q: Is DTC P0135 set?

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

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

STEP 12. 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 – Procedure 6 – Other Monitor P.13B-6.

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

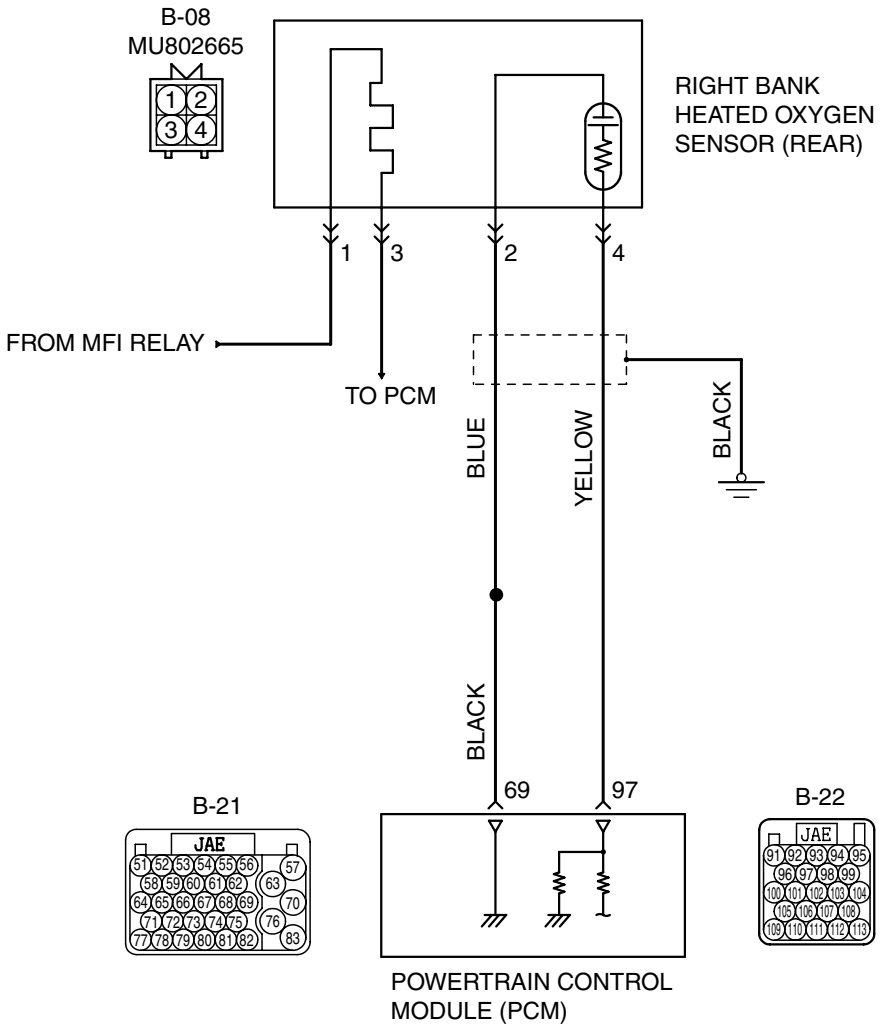
Q: Is DTC P0135 set?

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



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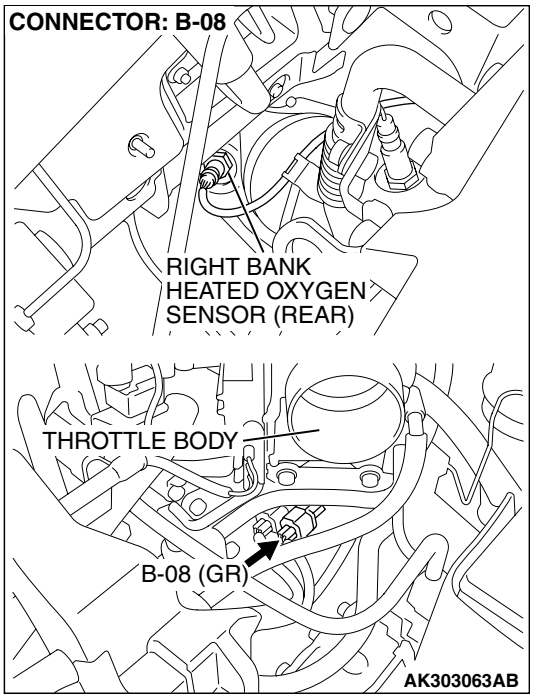
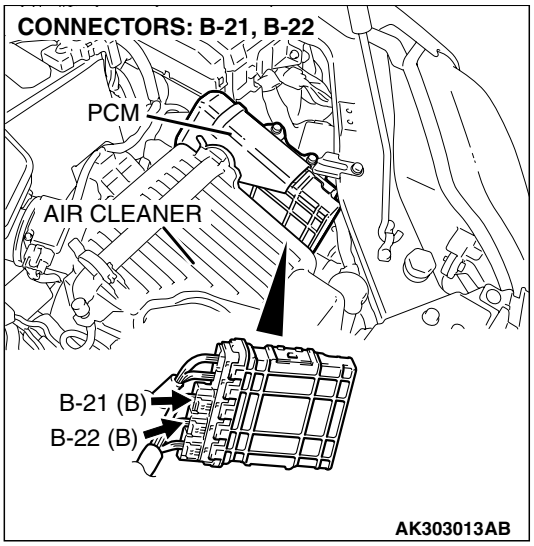




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 97) 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 PCM (terminal No. 69).

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)

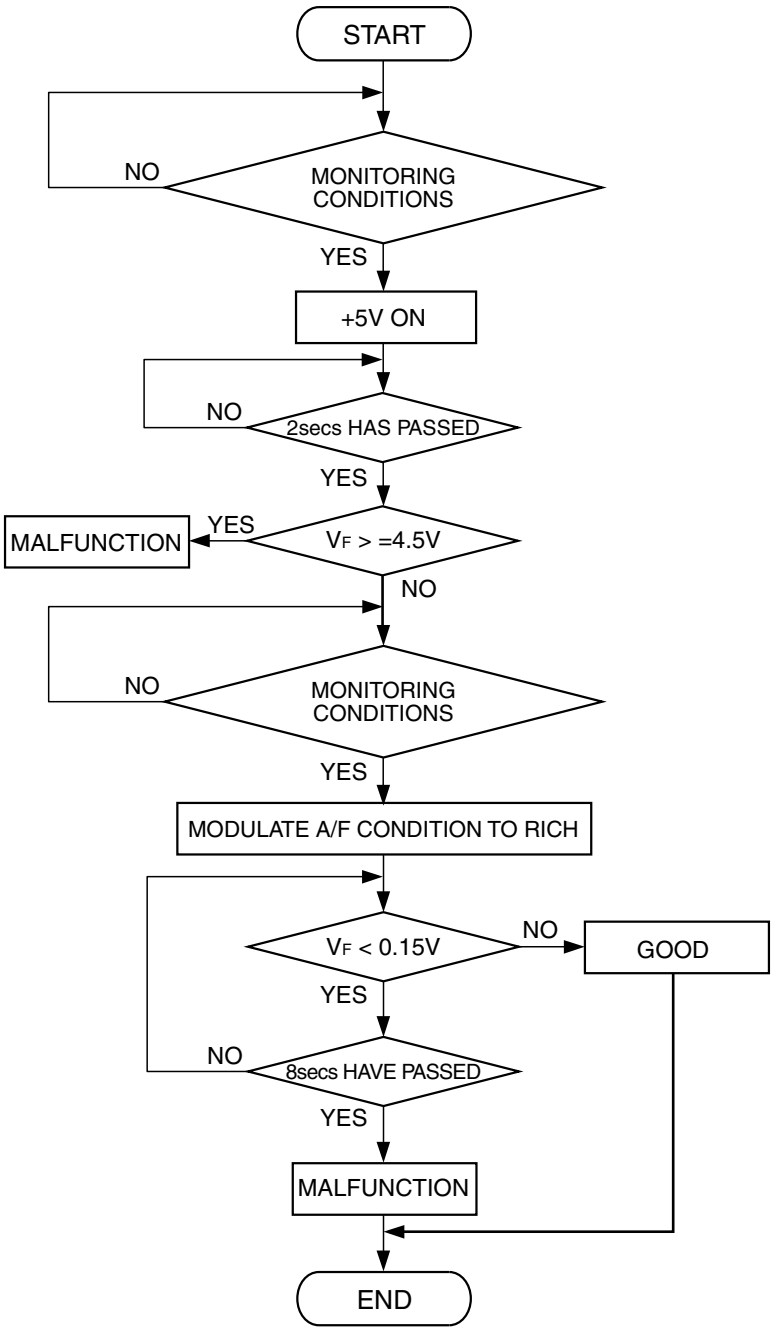
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



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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.

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Judgment Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

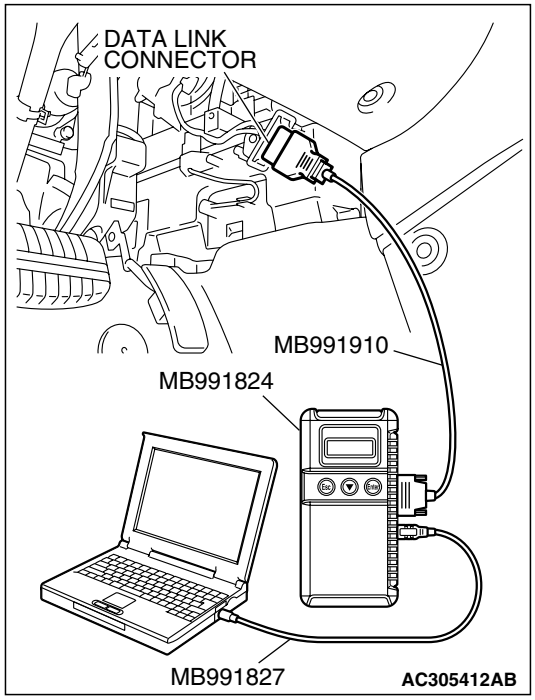
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Hamess A
- MB991316: Test Harness
- MB991923: Power Plant ECU Check 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).
  - 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.

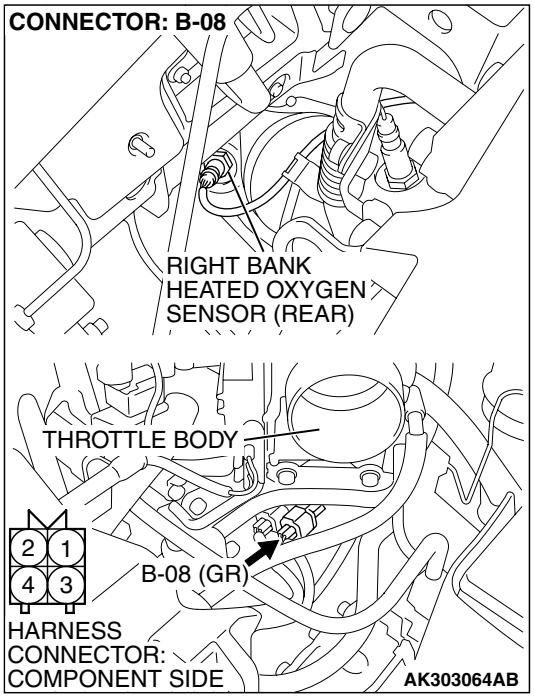
Q: Is the sensor operating properly?

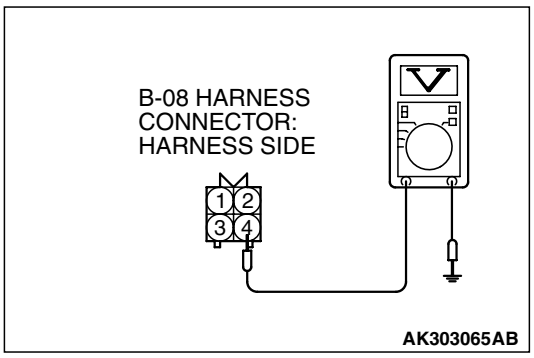
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at right bank heated oxygen sensor (rear) connector B-08 by backprobing

(1) Do not disconnect the connector B-08.
(2) Start the engine and run at idle.



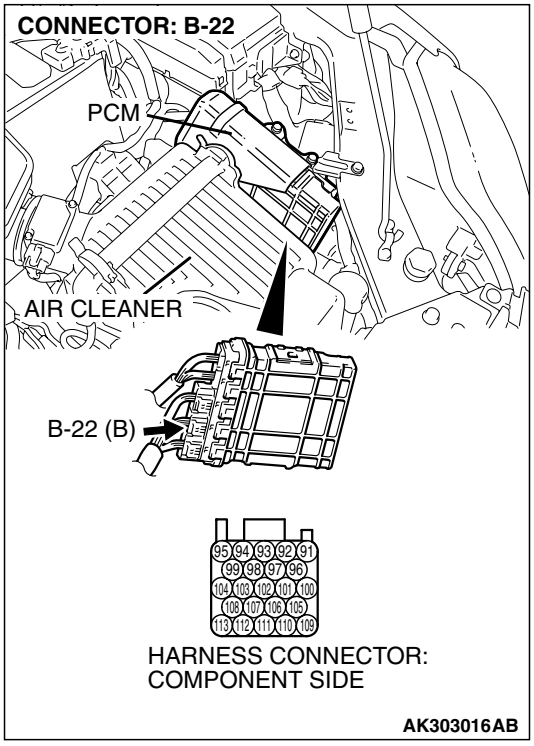


(3) Measure the voltage between terminal No. 4 and ground by backprobing.
- Warming up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

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

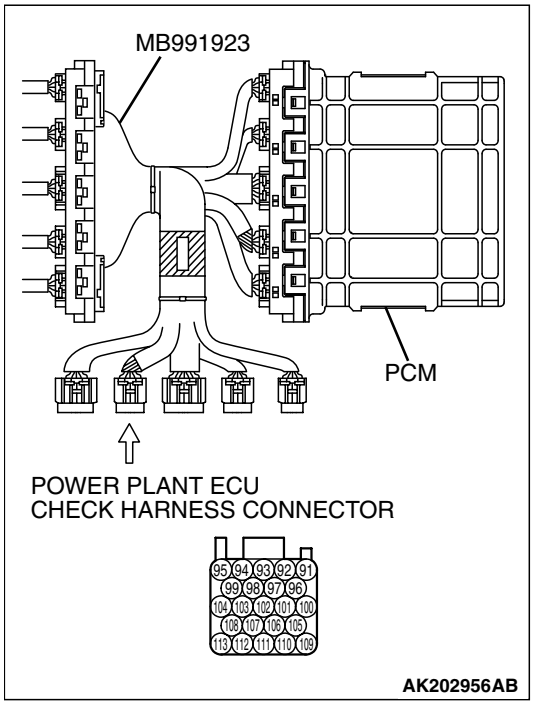
Q: Is the measured voltage within the specified range?

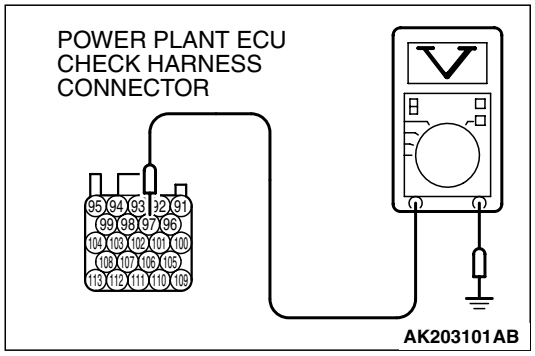
YES : Go to Step 3.
NO : Go to Step 7.



STEP 3. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect power plant ECU check harness special tool MB991923 between the separated connectors.
(2) Start the engine and run at idle.



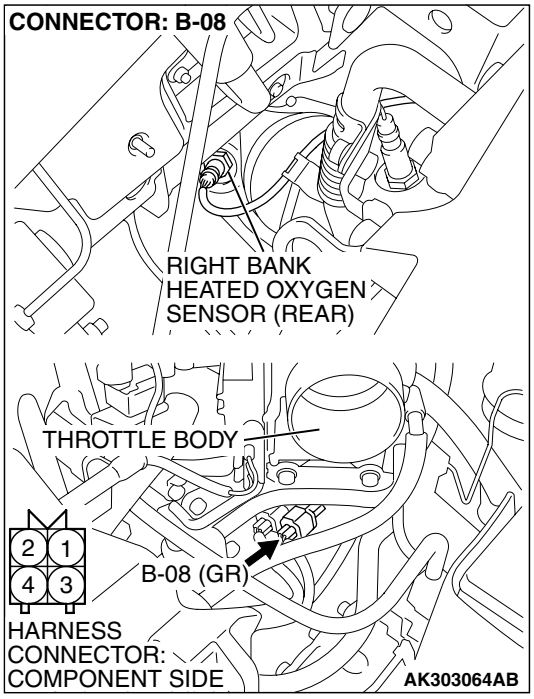


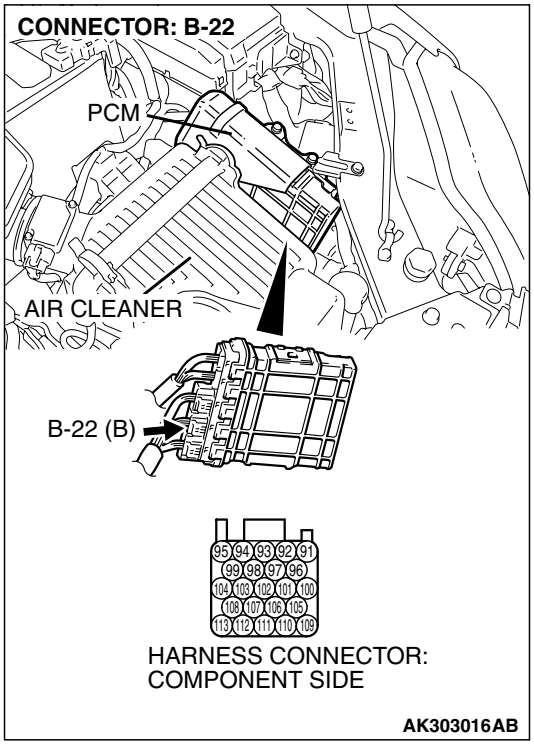
(3) Measure the voltage between terminal No. 97 and ground.
- Warming up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

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

Q: Is the measured voltage within the specified range?

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



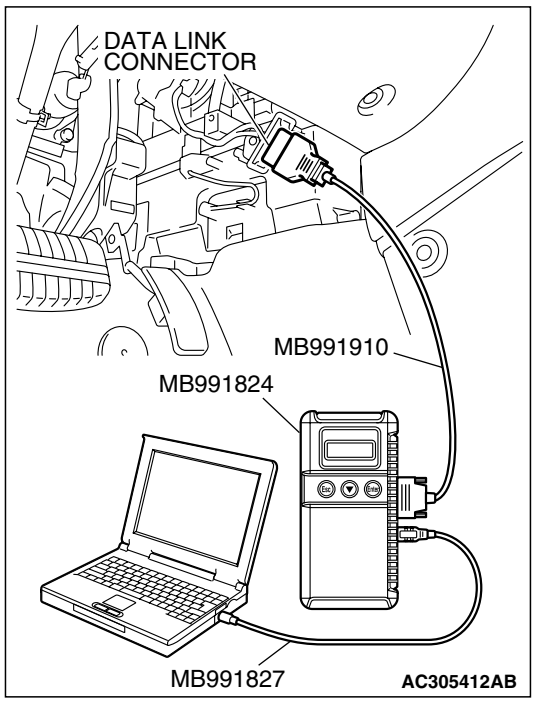


STEP 4. Check harness connector B-08 at right bank heated oxygen sensor (rear) and harness connector B-22 at PCM for damage.

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 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.

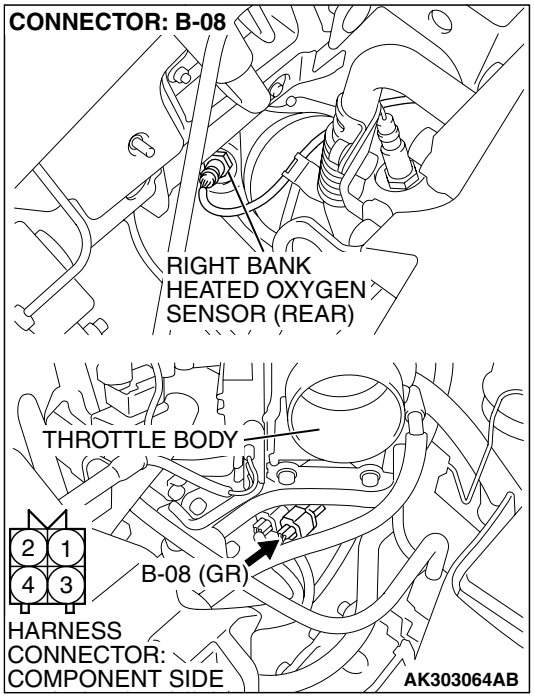
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 69, Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).
- Warming up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

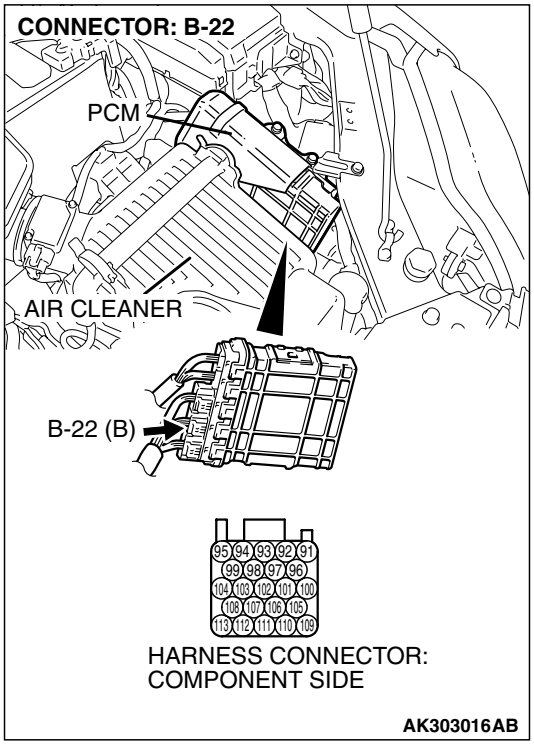
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the 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.00-14.

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



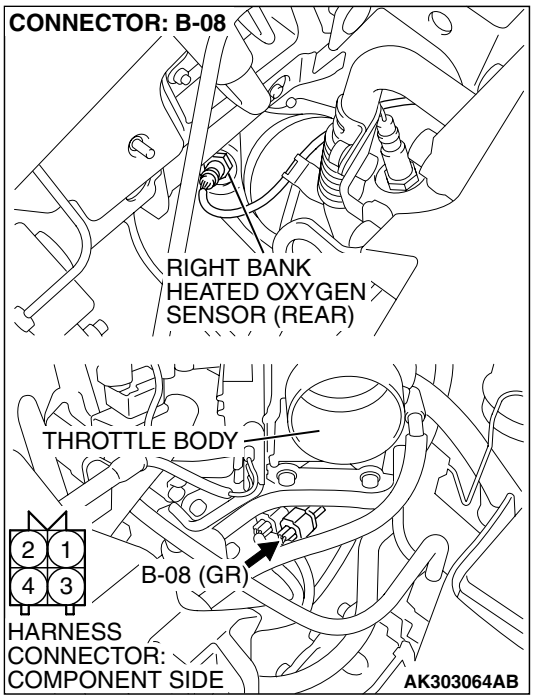


STEP 6. Check harness connector B-08 at right bank heated oxygen sensor (rear) and harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 4) and PCM connector B-22 (terminal No. 97) 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.

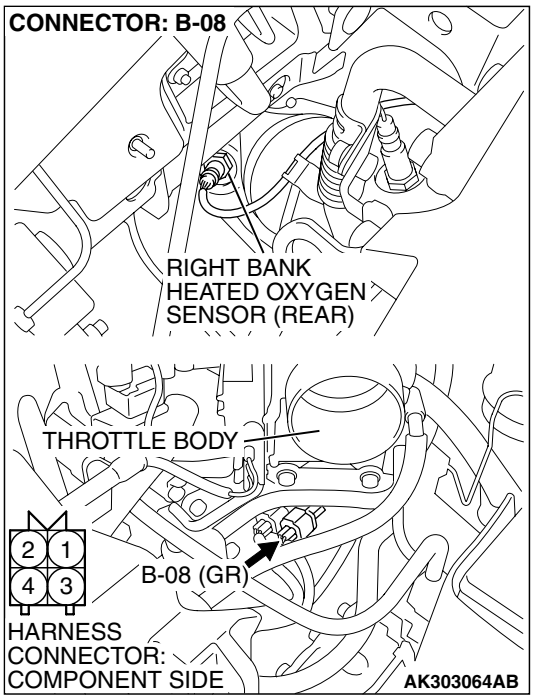


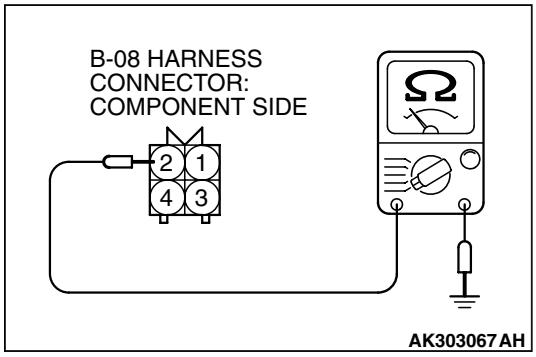
STEP 7. Check harness connector B-08 at right bank heated oxygen sensor (rear) for damage.
Q: Is the harness connector in good condition?

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 B-08.

(1) Disconnect the connector B-08 and measure at the harness side.

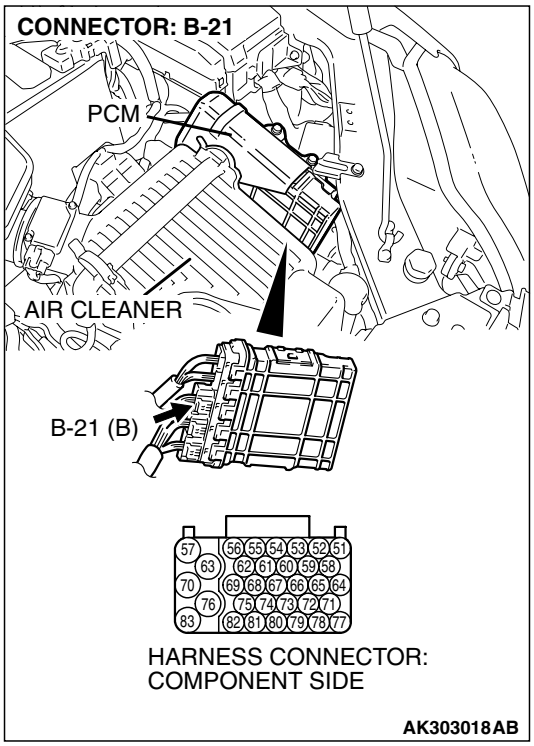




(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

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



STEP 9. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

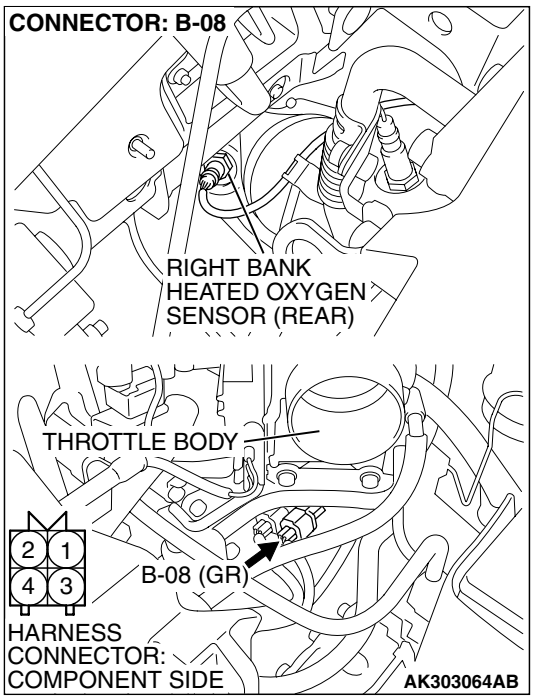
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 15.

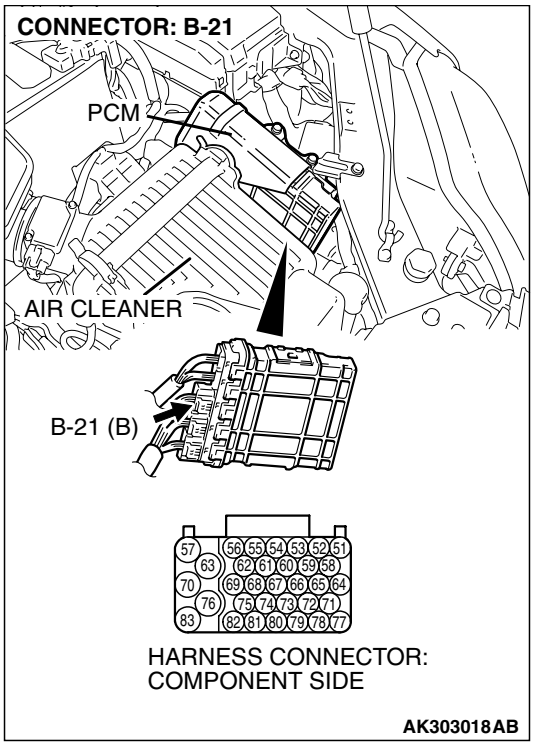
STEP 10. Check for open circuit and harness damage between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

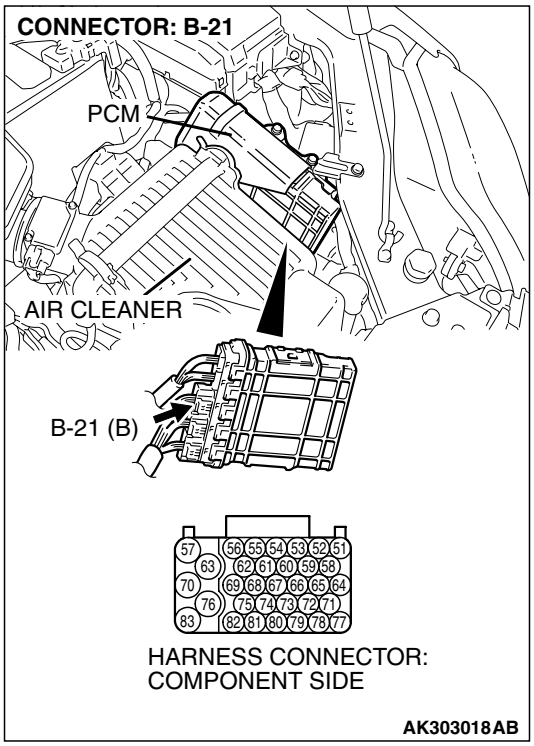
Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 15.





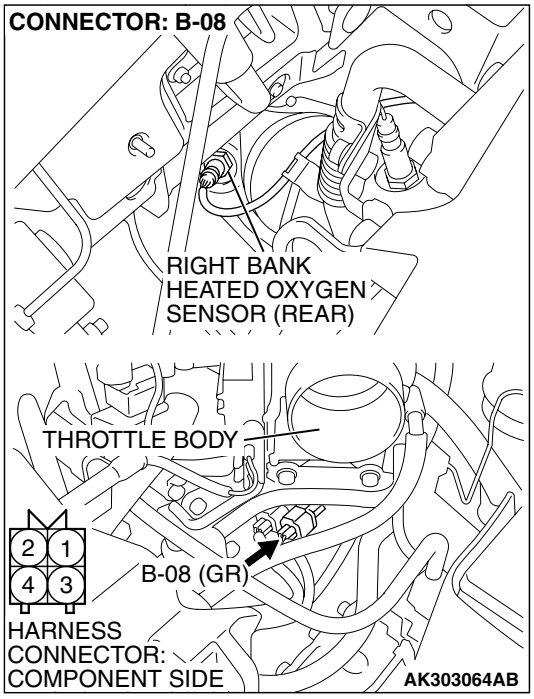


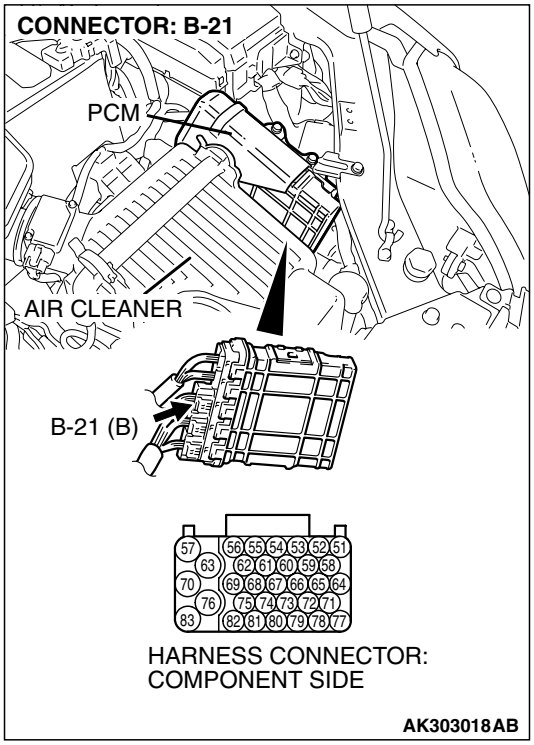
STEP 11. Check harness connector B-21 at PCM for damage.

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 B-08 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Go to Step 13.

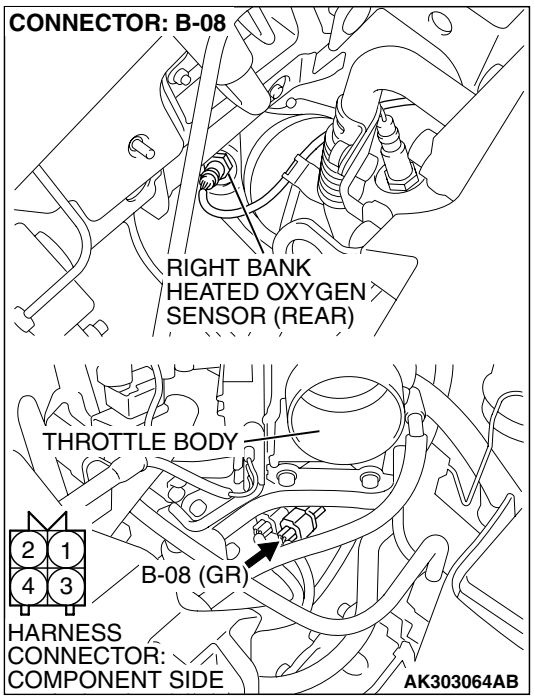
NO : Repair it. Then go to Step 15.

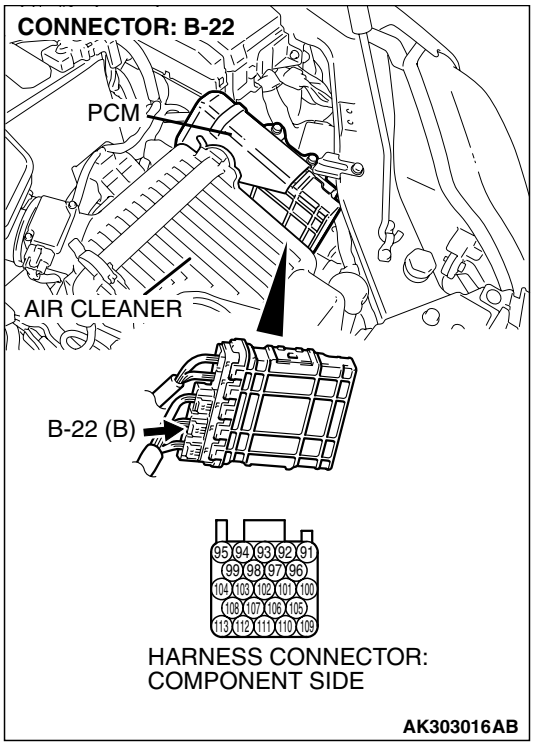
STEP 13. Check for short circuit to ground and harness damage between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 4) and PCM connector B-22 (terminal No. 97).

Q: Is the harness wire in good condition?

YES : Go to Step 14.

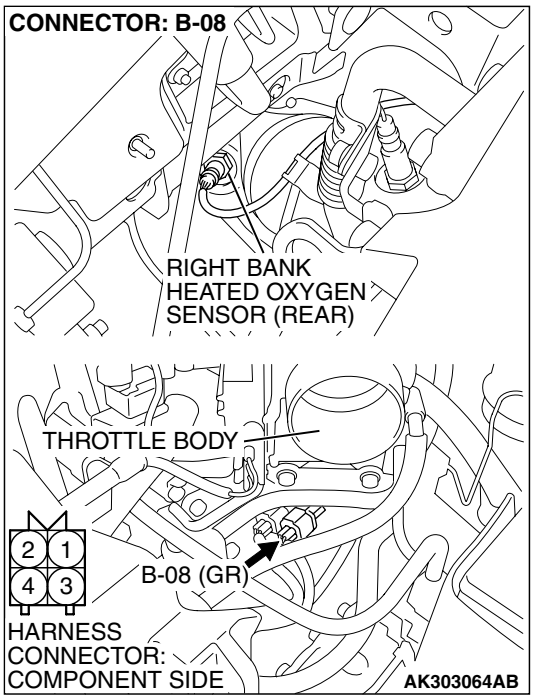
NO : Repair it. Then go to Step 15.

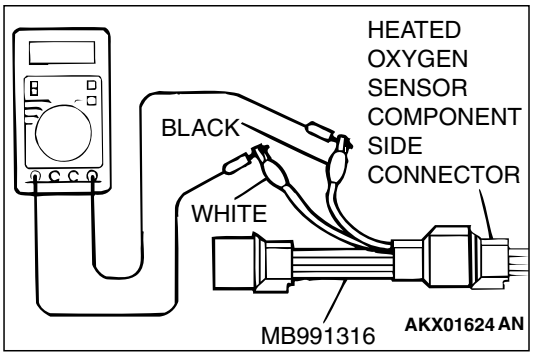




STEP 14. Check the right bank heated oxygen sensor (rear).

(1) Disconnect the right bank heated oxygen sensor (rear) connector B-08 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) 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 (rear) 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 (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 – Procedure 6 – Other Monitor P.13B-6.

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

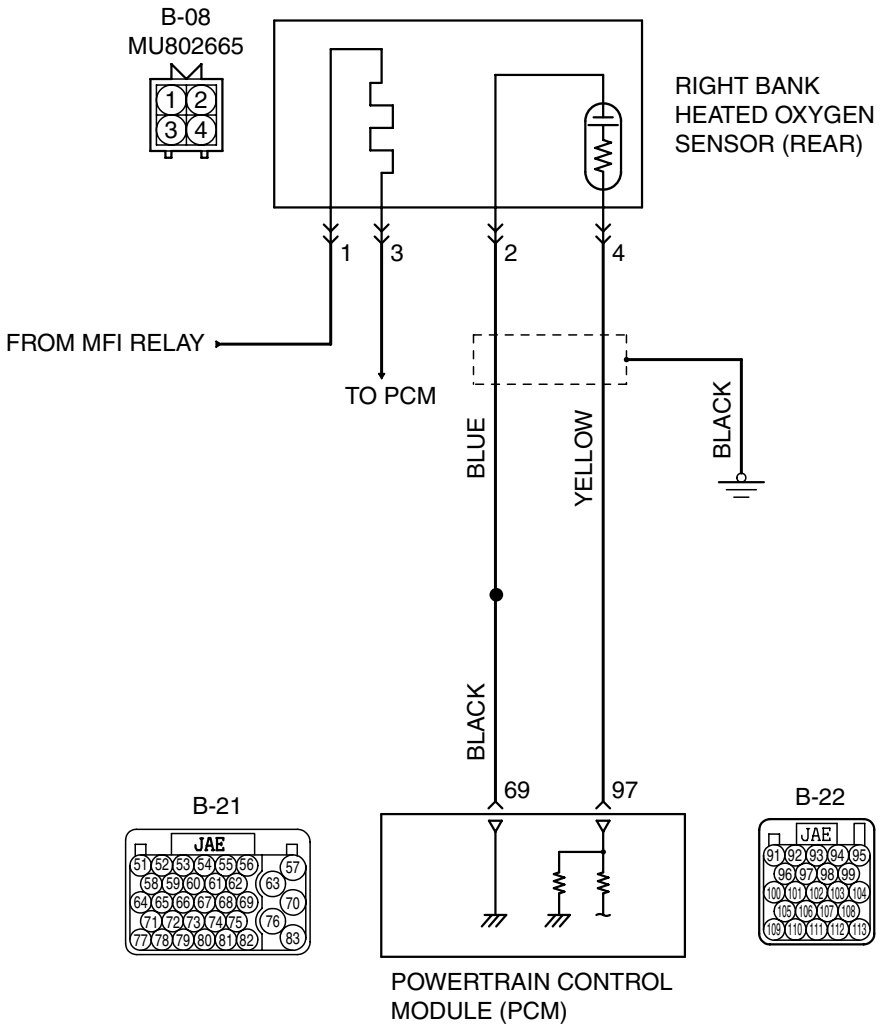
Q: Is DTC P0136 set?

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



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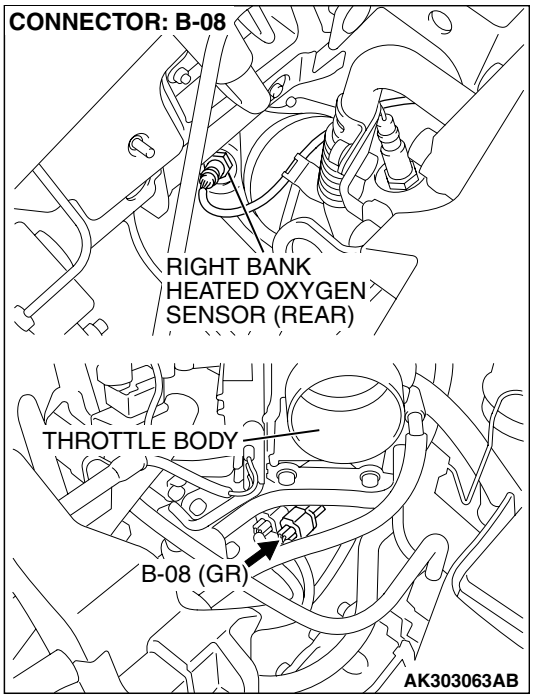
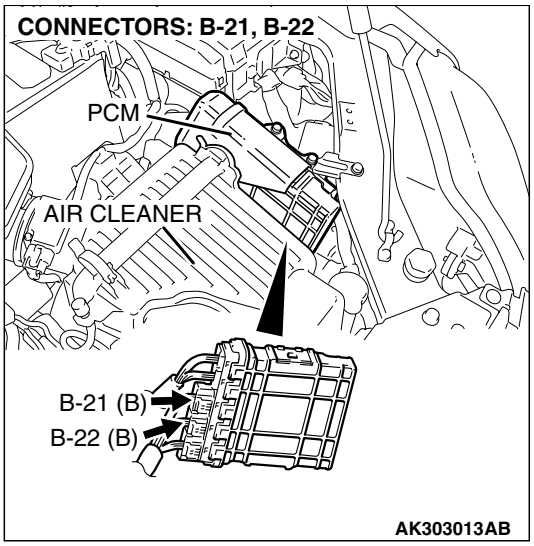




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 97) 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 PCM (terminal No. 69).

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)

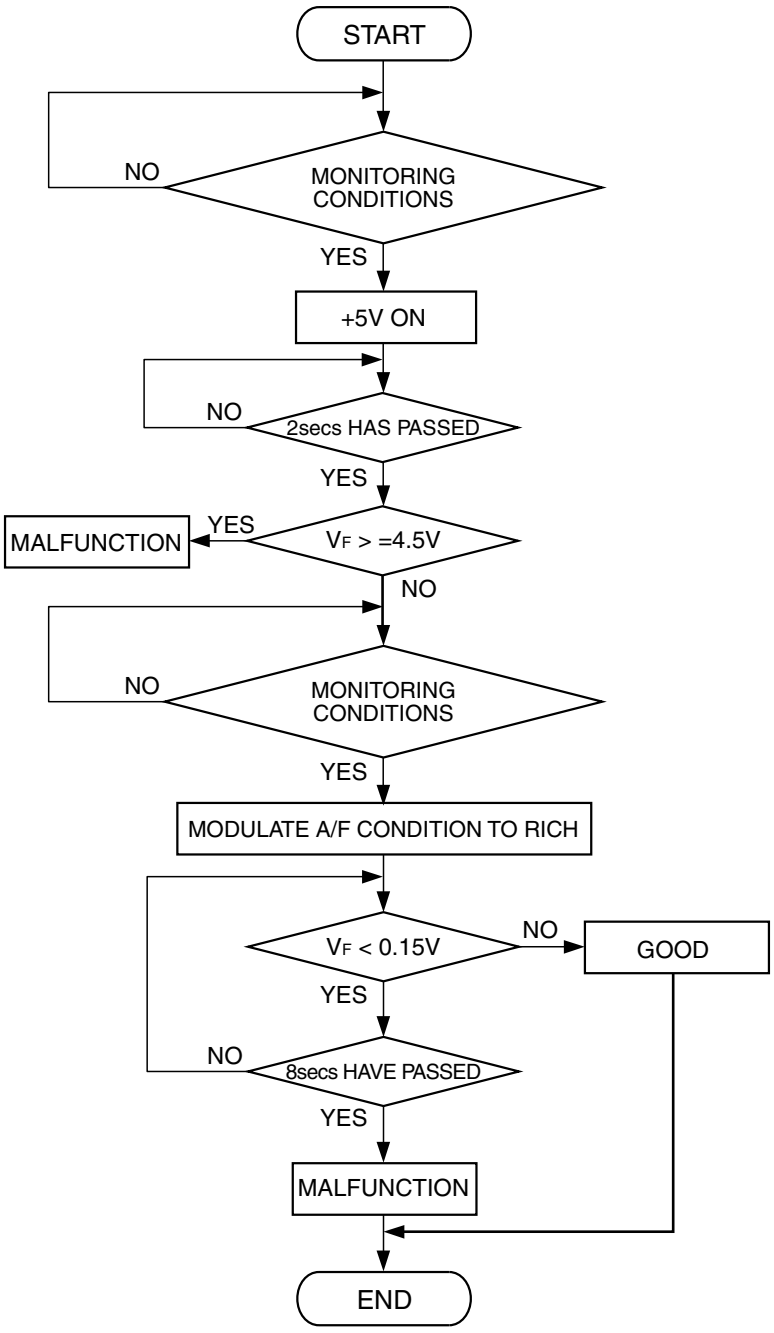
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



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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).
- Mass airflow sensor output is 8 g/sec or more.

TSB Revision

- At least 20 seconds have passed since fuel shut off control was canceled.
- Monitoring time: 8 seconds.

Judgement Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

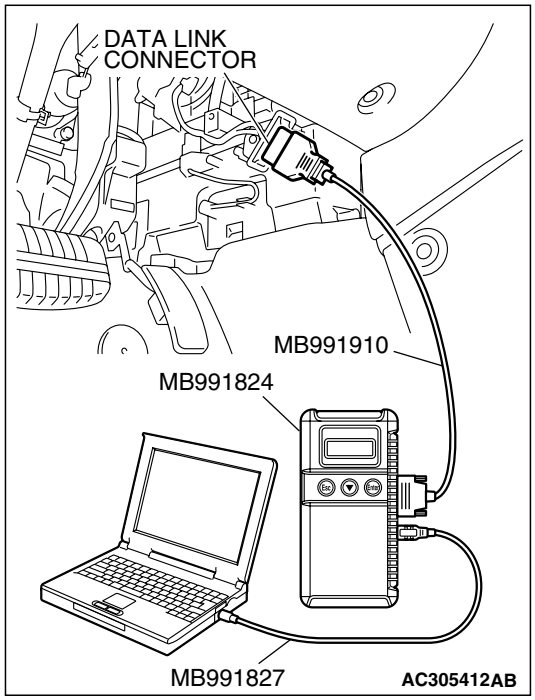
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Harness A
- MB991316: Test Harness



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

⚠ CAUTION

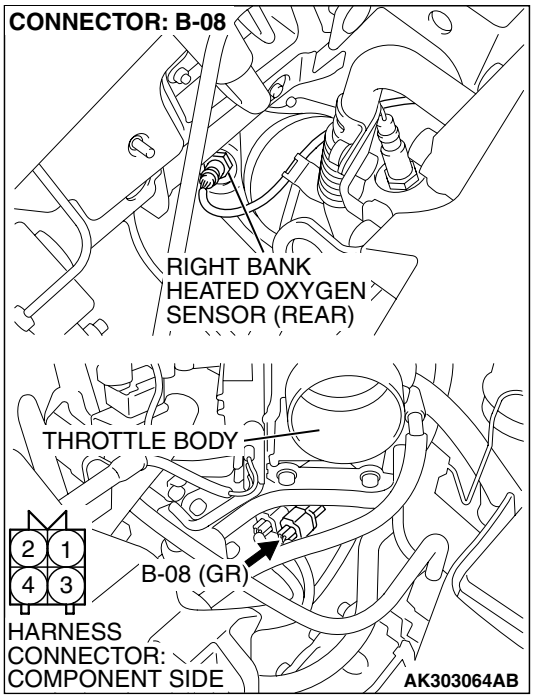
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(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).
  - 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 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.00-14.

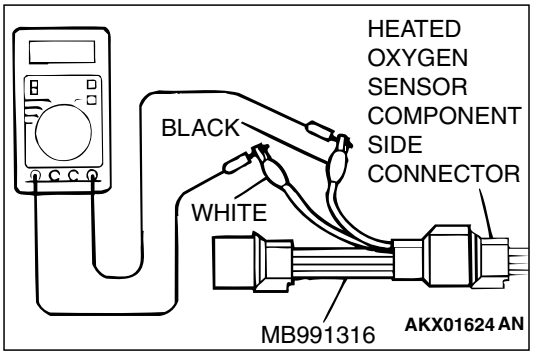
NO : Go to Step 2.



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

(1) Disconnect the right bank heated oxygen sensor (rear) connector B-08 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 temperture 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 (rear) output voltage.

Standard value: 0.6 – 1.0 volt

⚠ CAUTION

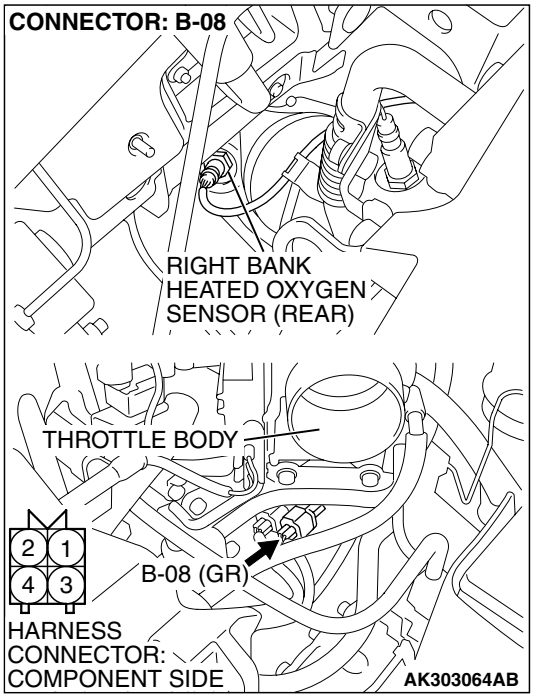
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.**

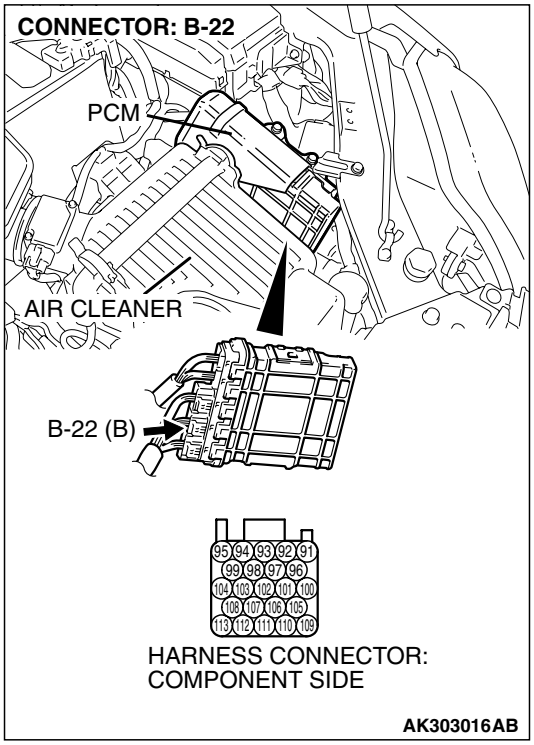
NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (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 measured 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 B-08 at right bank heated oxygen sensor (rear) and harness connector B-22 at PCM for damage.

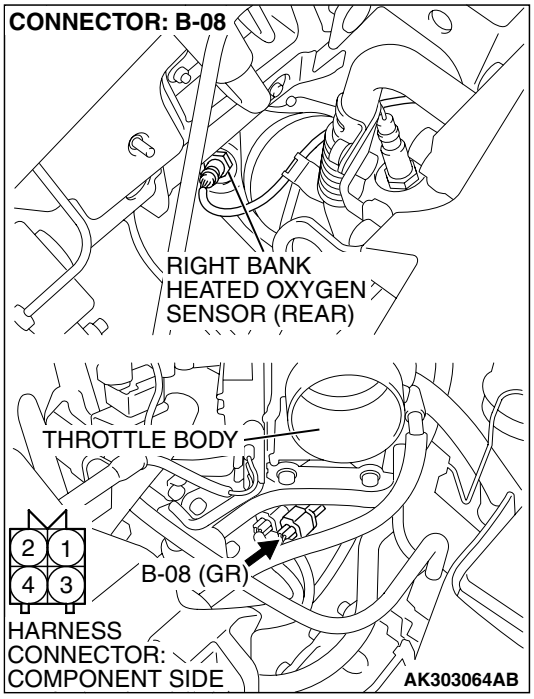
Q: Is the harness connector in good condition?

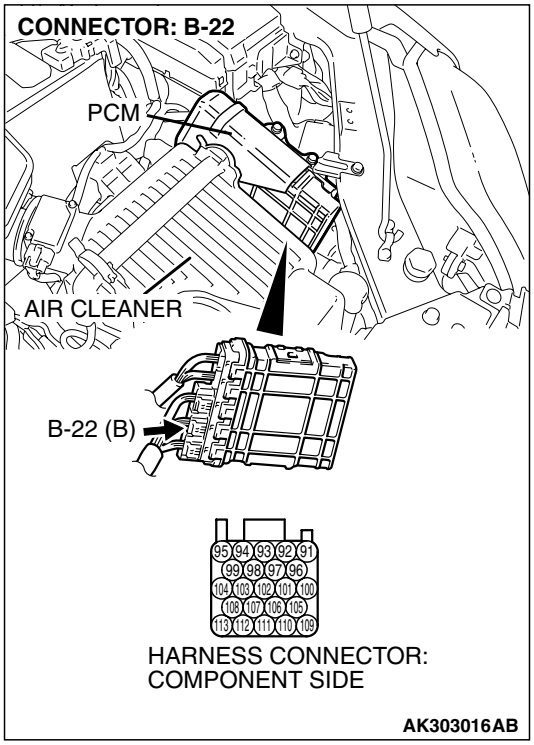
YES : Go to Step 4.

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 B-08 (terminal No. 4) and PCM connector B-22 (terminal No. 97).
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 – Procedure 6 – Other Monitor P.13B-6.

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

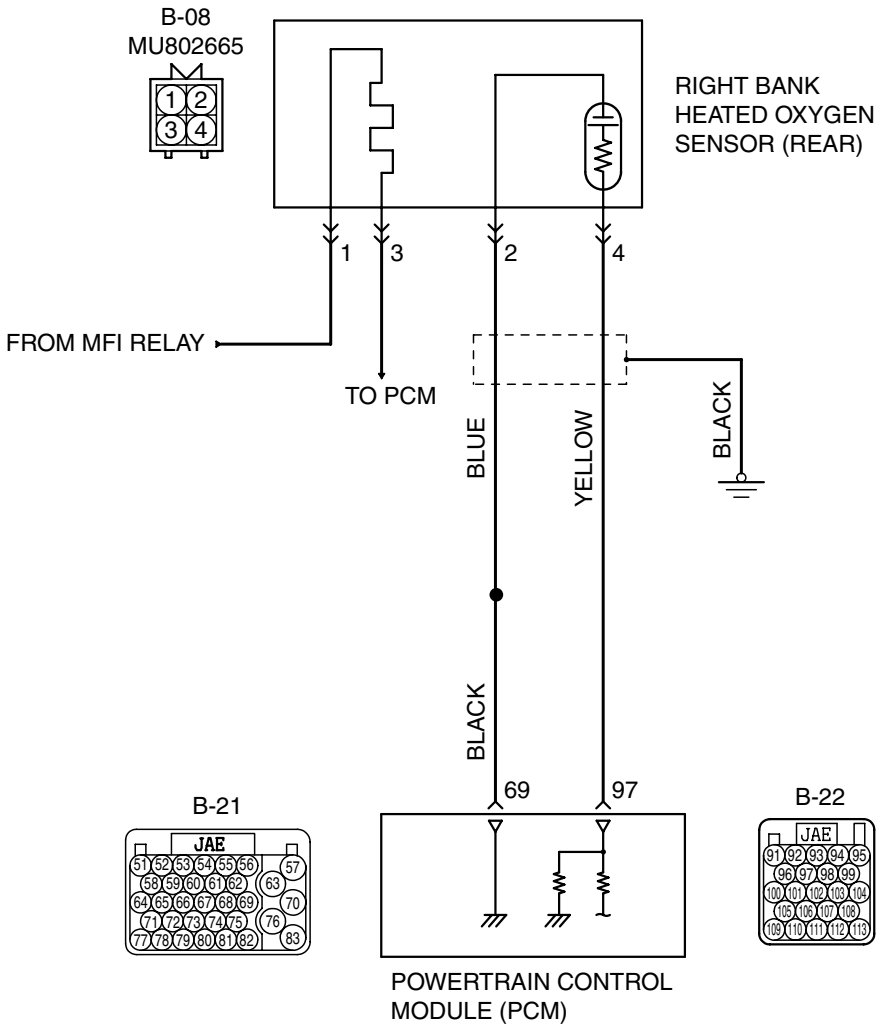
Q: Is DTC P0137 set?

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



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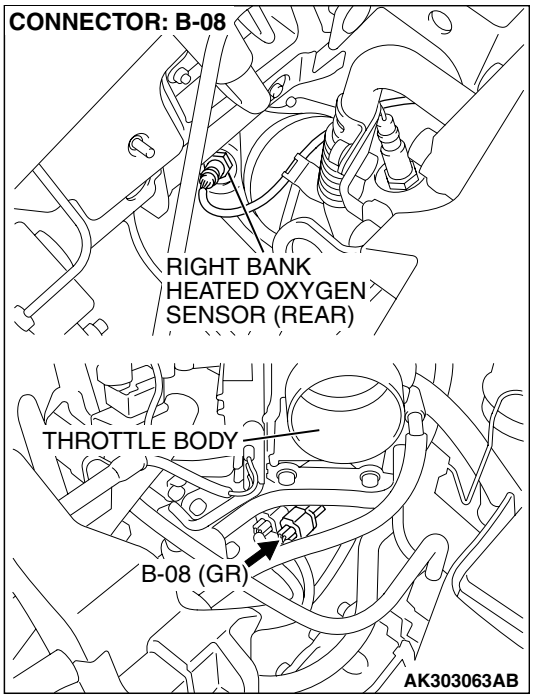
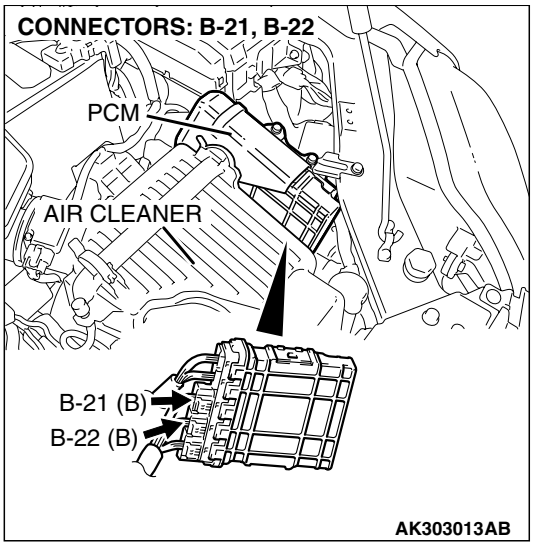




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 97) 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 PCM (terminal No. 69).

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)

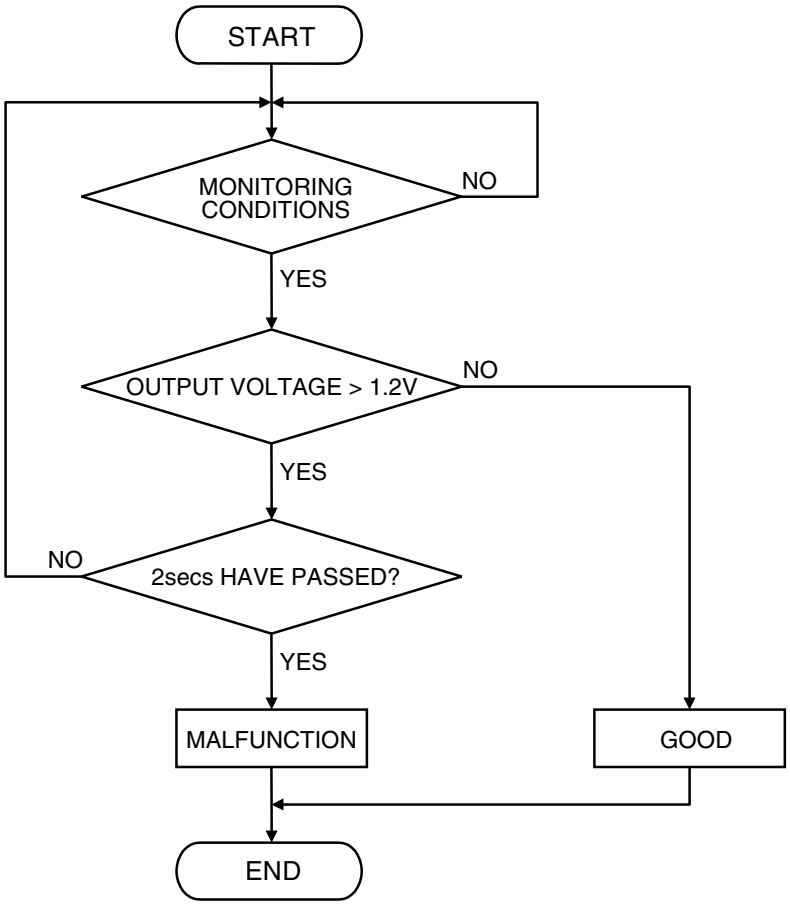
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK302396

Check Conditions

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

Judgment Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

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:

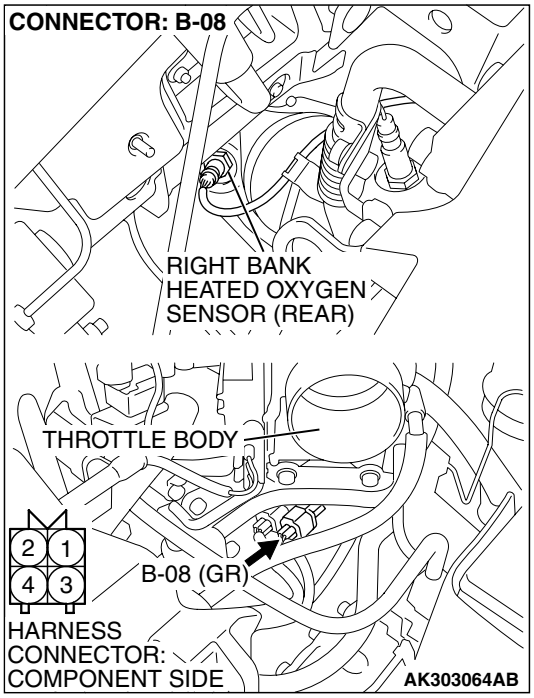
- MB991958: Scan tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A

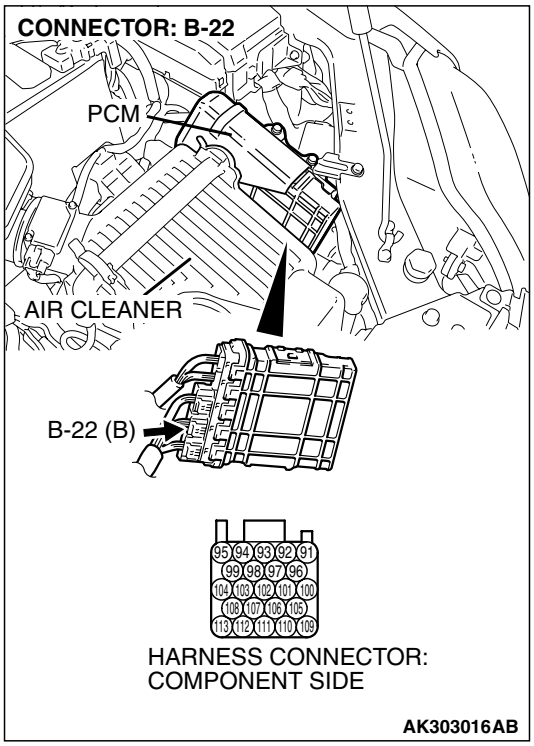
STEP 1. Check harness connector B-08 at right bank heated oxygen sensor (rear) and harness connector B-22 at PCM for damage.

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.





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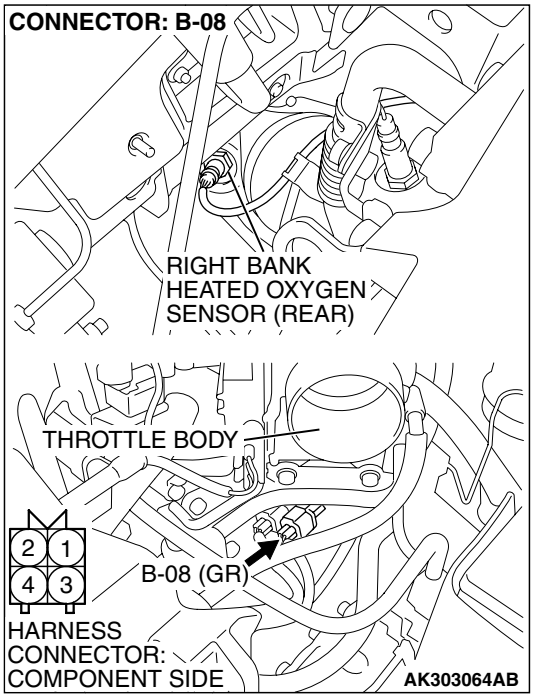
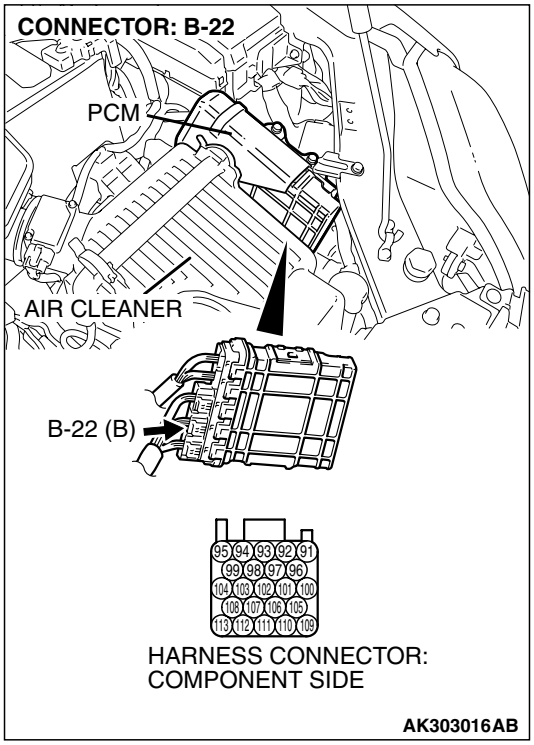




STEP 2. Check for short circuit to power supply between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 4) and PCM connector B-22 (terminal No. 97).
Q: Is the harness wire in good condition?

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 – Procedure 6 – Other Monitor P.13B-6.

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

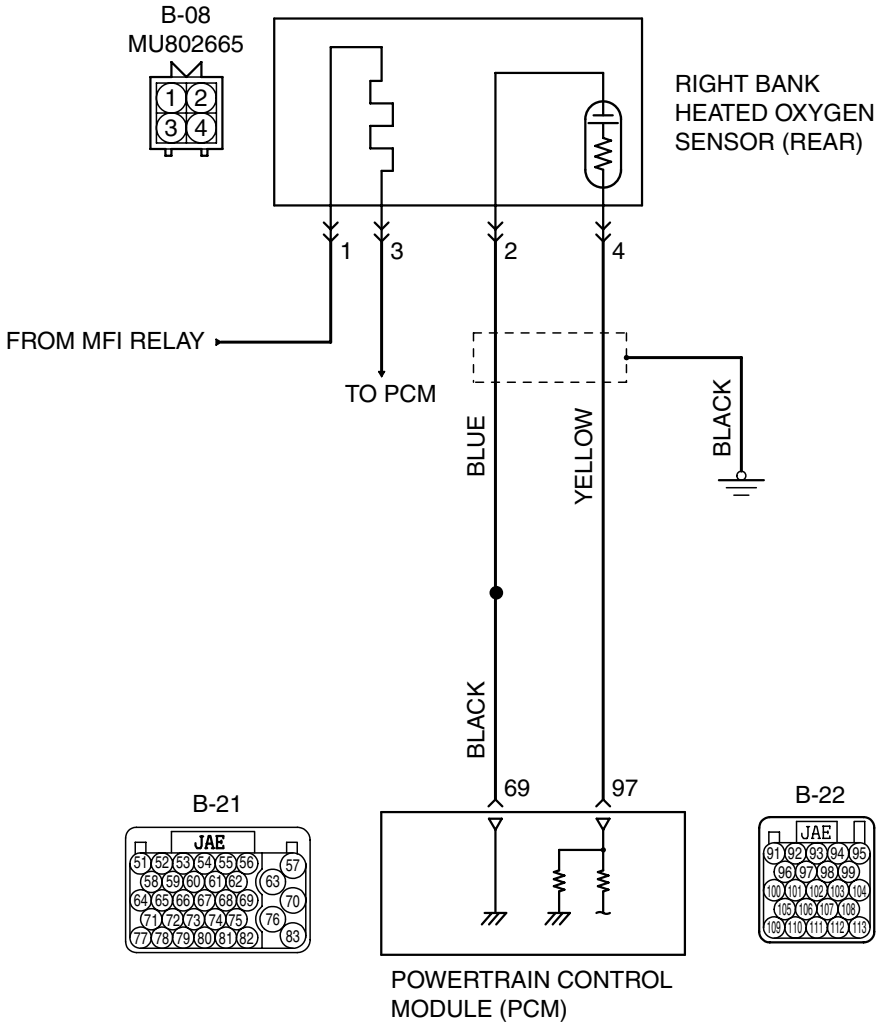
Q: Is DTC P0138 set?

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



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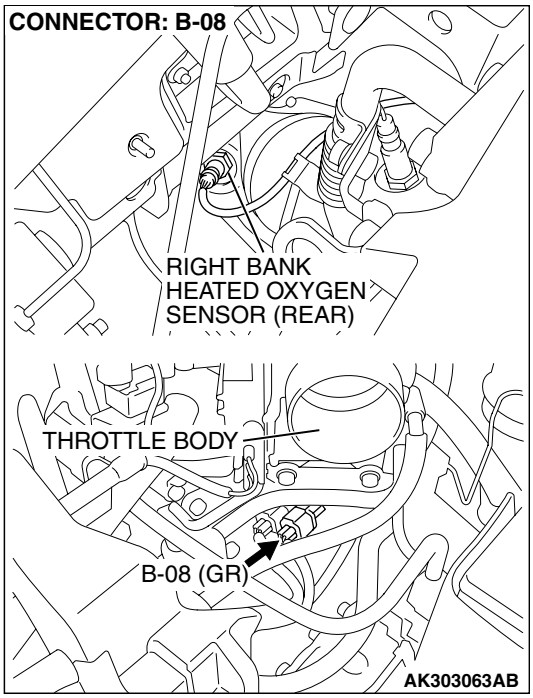
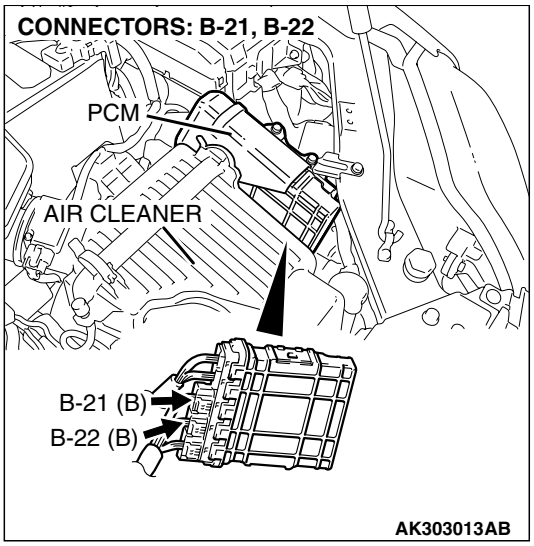




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 97) 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 PCM (terminal No. 69).

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 does not change during specified go/stop operations including fuel cut 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)

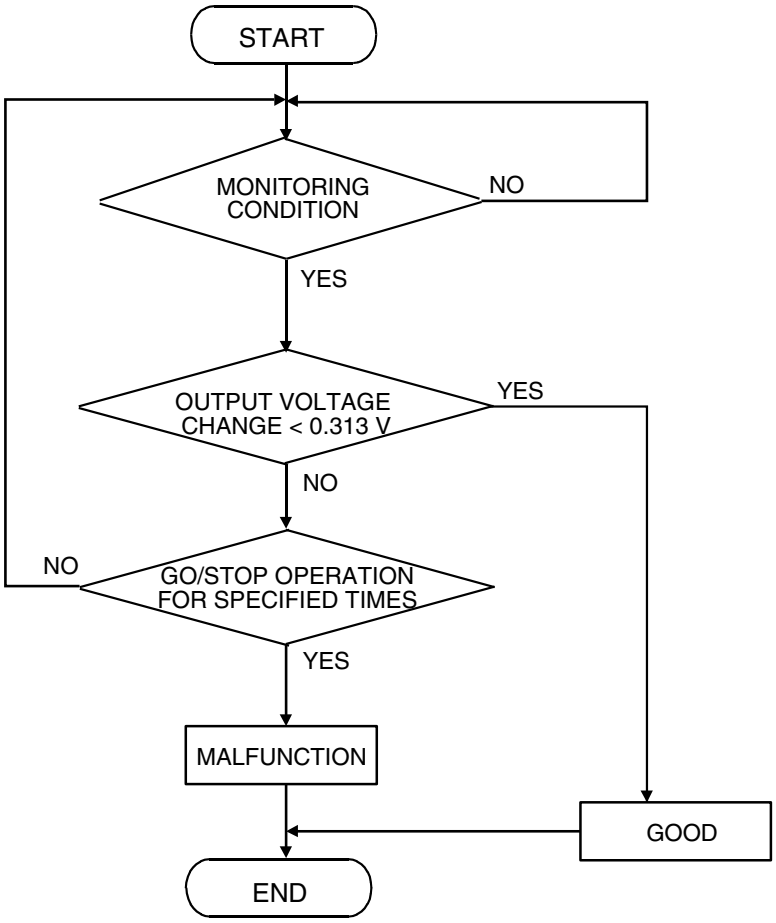
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

- Mass 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 mass airflow sensor output is higher than 1638 g.
- 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 Criteria

- 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 41 seconds.

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OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 4 – Heated Oxygen Sensor Monitor P.13B-6.

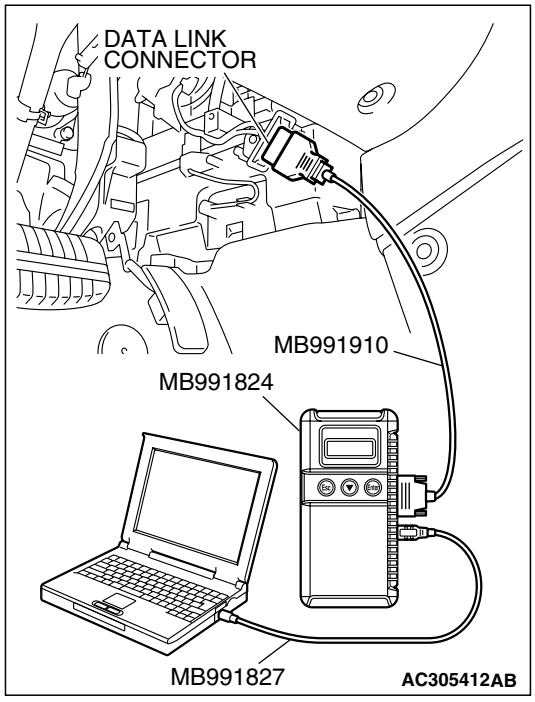
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Harness A
- 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.

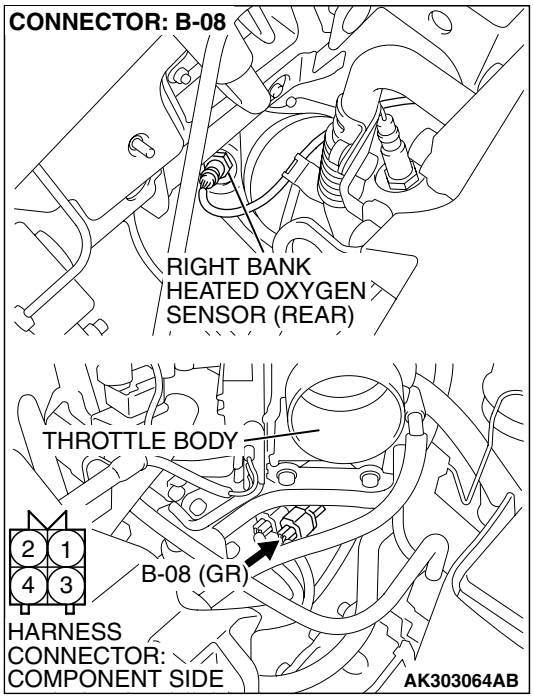
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 69, Heated Oxygen Sensor Bank 1, Sensor 2 (right rear).
(4) Warm up the engine.
- After increasing the output voltage 0.15 volt or more by the engine revving, finish it. Then confirm that the output voltage reduces to 0.15 volt or less within 3 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.00-14.

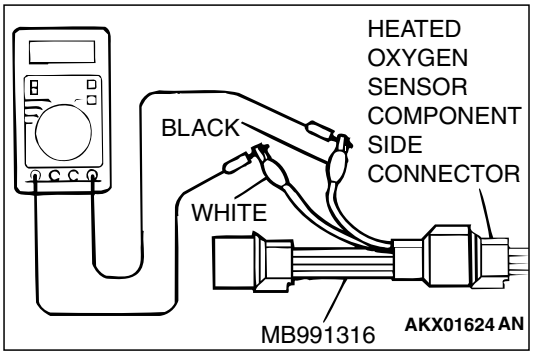
NO : Replace the heated oxygen sensor (rear). Then go to Step 2.



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

(1) Disconnect the right bank heated oxygen sensor (rear) connector B-08 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) 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 (rear) 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.

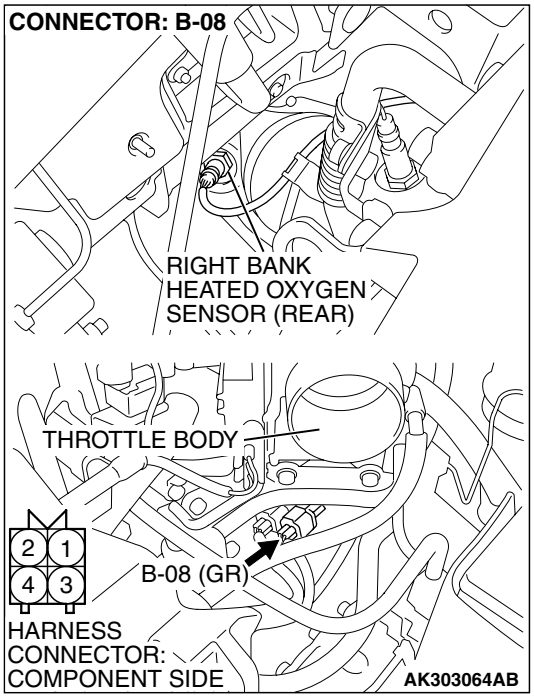
NO : Replace the right bank heated oxygen sensor (rear). Then go to Step 4.

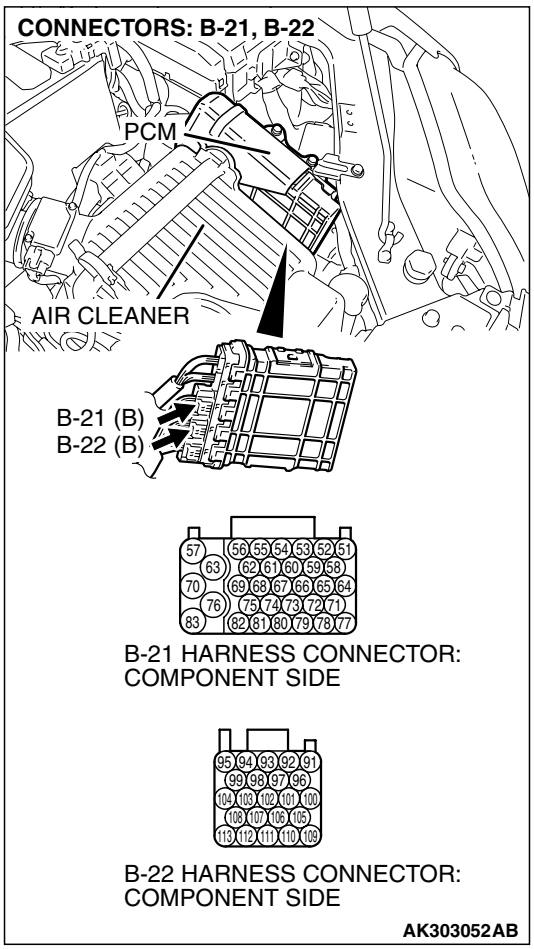
STEP 3. Check harness connector B-08 at right bank heated oxygen sensor (rear) and harness connector B-21, B-22 at PCM for damage.

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 – Procedure 4 – Heated Oxygen Sensor Monitor P.13B-6.

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

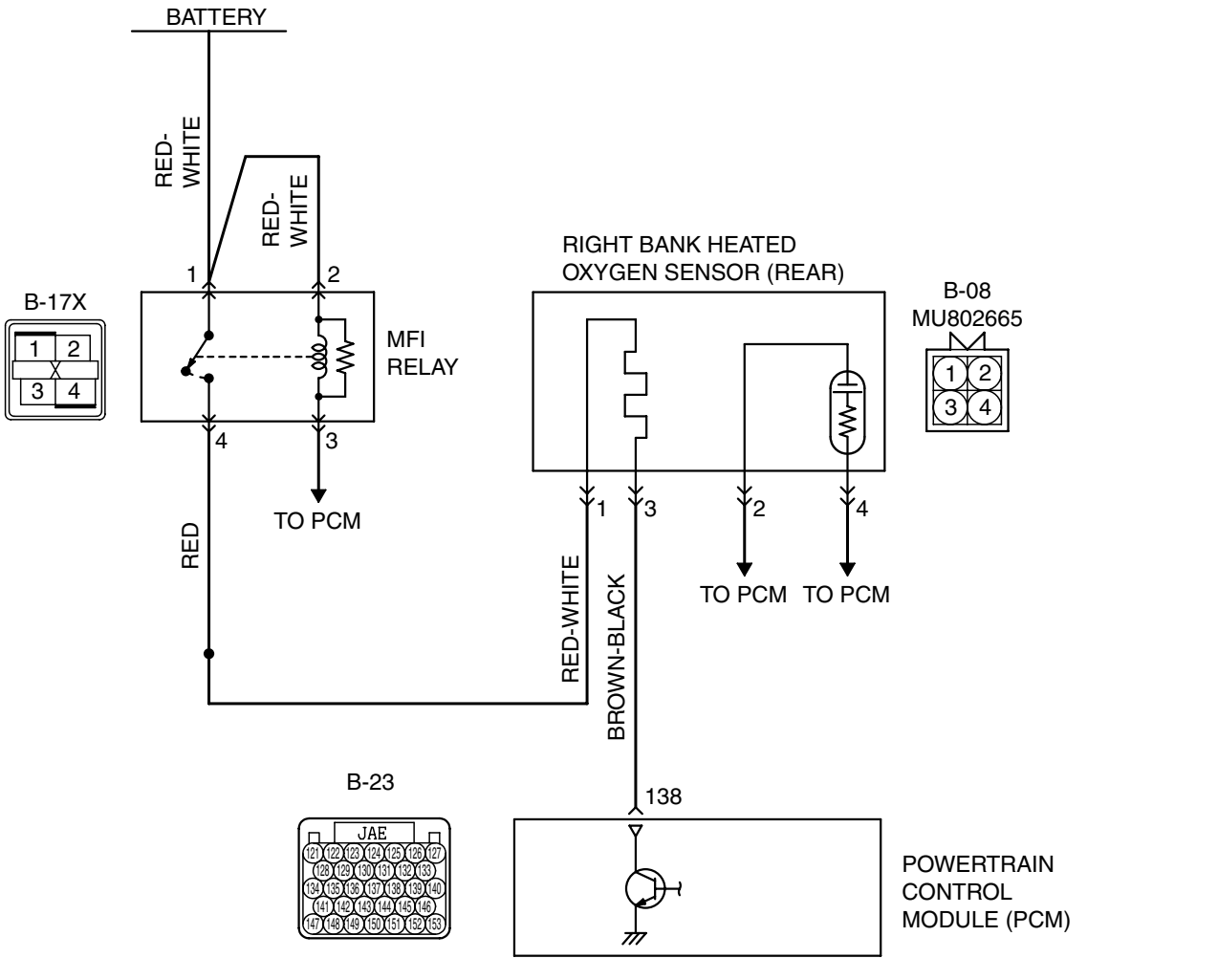
Q: Is DTC P0139 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0141: Heated Oxygen Sensor Heater Circuit (bank 1, sensor 2)

Right Bank Heated Oxygen Sensor (rear) Heater Circuit



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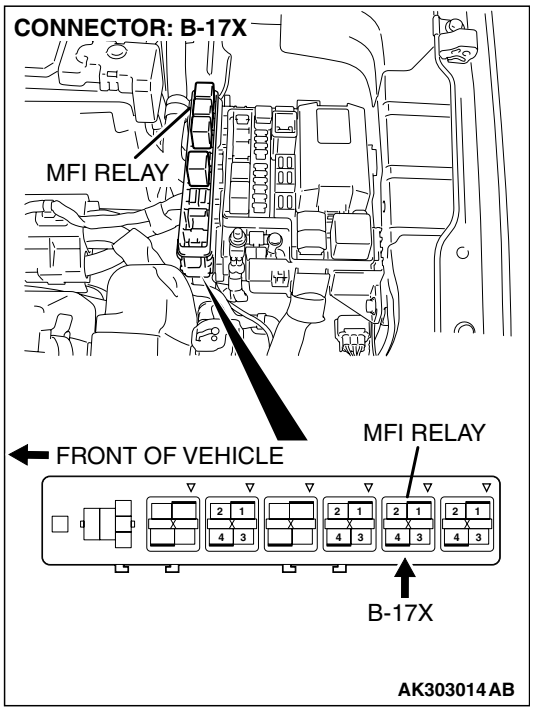

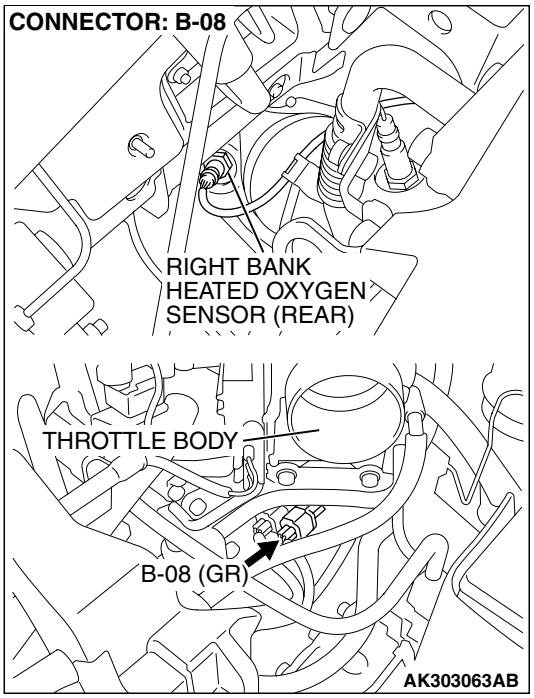

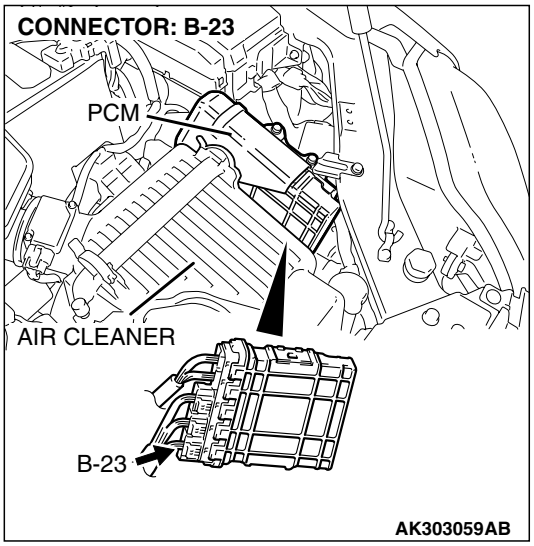

CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the right bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 138) controls continuity to the right bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor heater (rear) current is out of specified range when engine coolant temperature is over 20°C (68°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)

- Engine coolant temperature sensor

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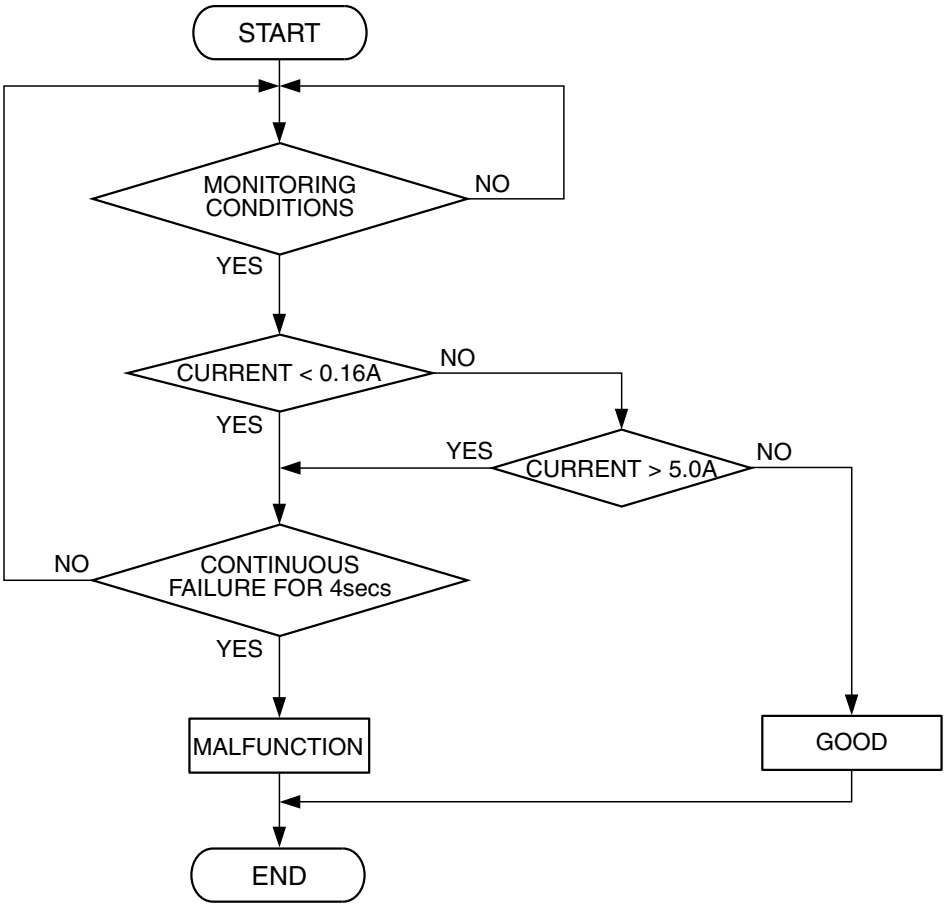
DTC SET CONDITIONS

Logic Flow Chart



AK302401

Check Conditions

- 60 seconds have elapsed from the start of the previous monitoring.
- Engine coolant temperature is higher than 20°C (68°F).
- While the right bank heated oxygen sensor (rear) heater is on.
- Battery positive voltage is at between 11 and 16.5 volts.

Judgment Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.

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

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

TSB Revision

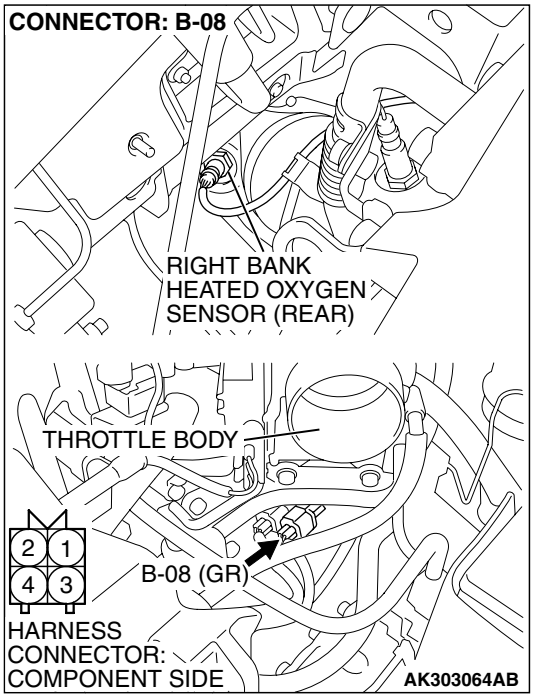
DIAGNOSIS

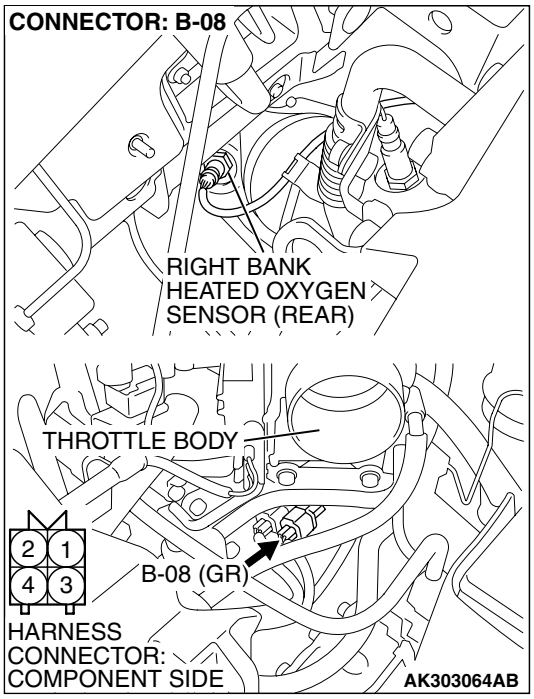
Required Special Tools:

- MB991316: Test Harness
- MB991923: Power Plant ECU Check Harness

STEP 1. Check harness connector B-08 at the right bank heated oxygen sensor (rear) for damage.
Q: Is the harness connector in good condition?

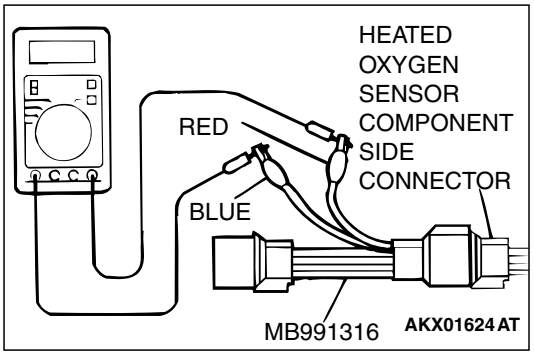
YES : Go to Step 2.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.





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

(1) Disconnect right bank heated oxygen sensor (rear) connector B-02 and connect test harness special tool, MB991316, to the connector on the right bank heated oxygen (rear) sensor side.



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

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

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

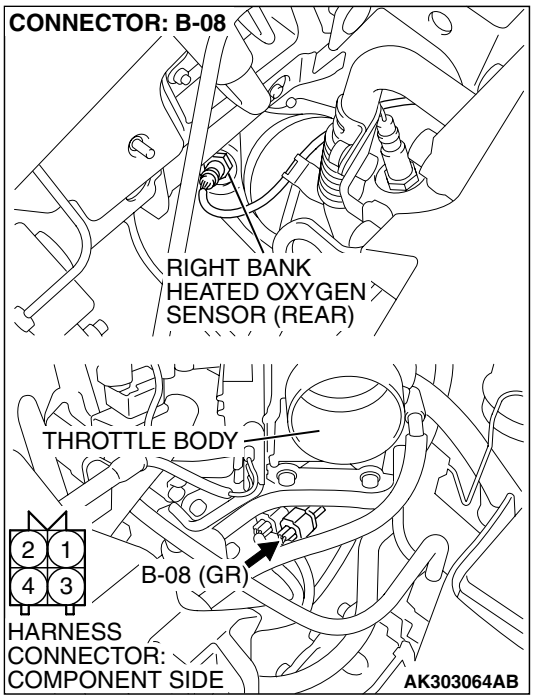
YES : Go to Step 3.

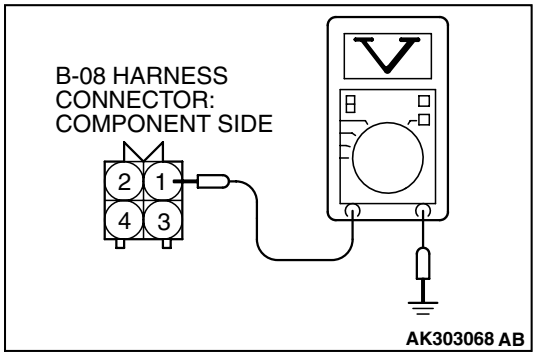
NO : Replace the right bank heated oxygen sensor (rear). Then go to Step 12.

STEP 3. Measure the power supply voltage at right bank heated oxygen sensor (rear) harness side connector B-08.

(1) Disconnect the connector B-08 and measure at the harness side.

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



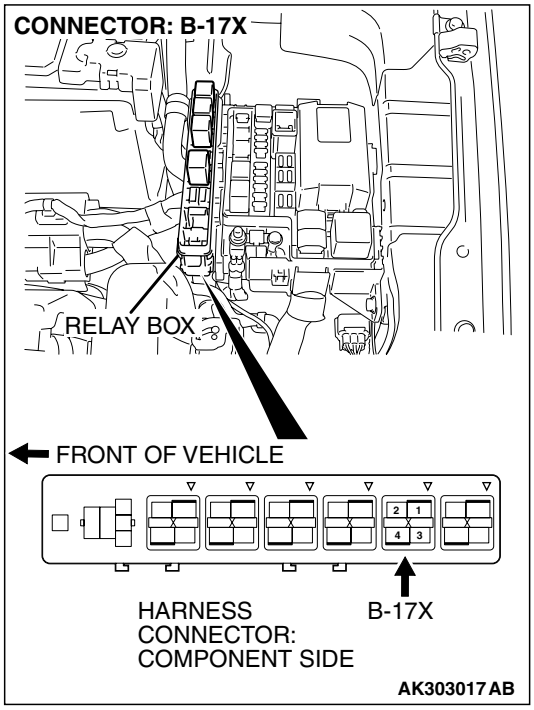


(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

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

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

YES : Go to Step 5.
NO : Go to Step 4.

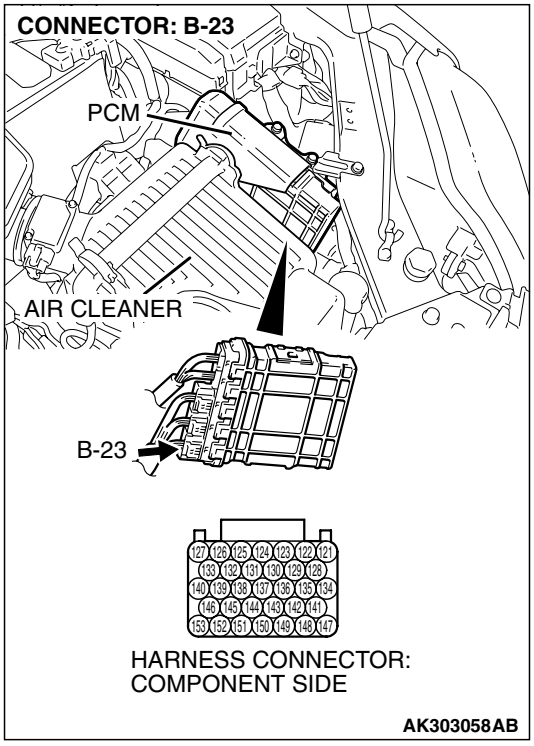


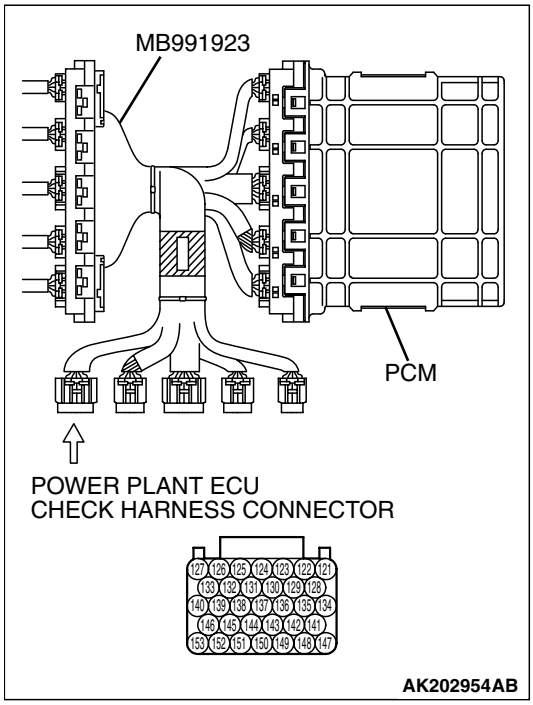
STEP 4. Check harness connector B-17X at the MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (rear) connector B-08 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

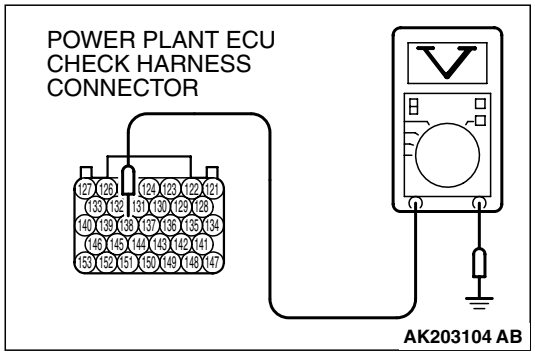




STEP 5. Measure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect power plant ECU check harness special tool MB991923 between the separated connectors.

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



(3) Measure the voltage between terminal No. 138 and ground.
- Voltage should be battery positive voltage.

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

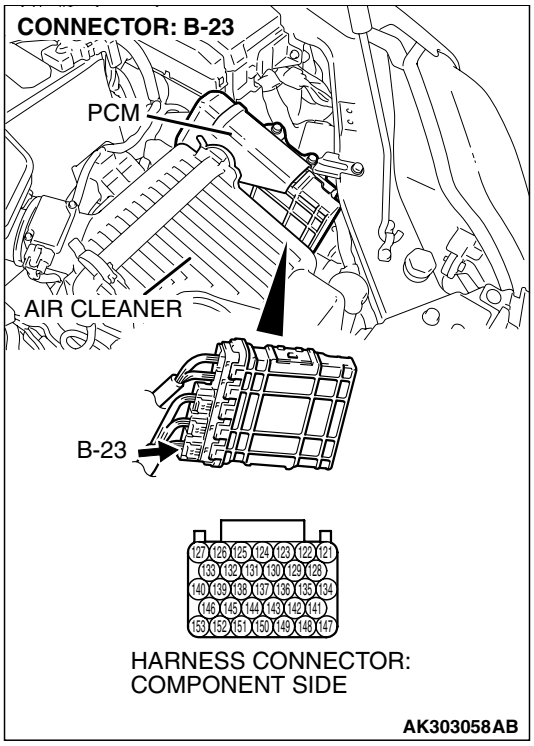
Q: Is battery positive voltage (approximately 12 volts) present?

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

STEP 6. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

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

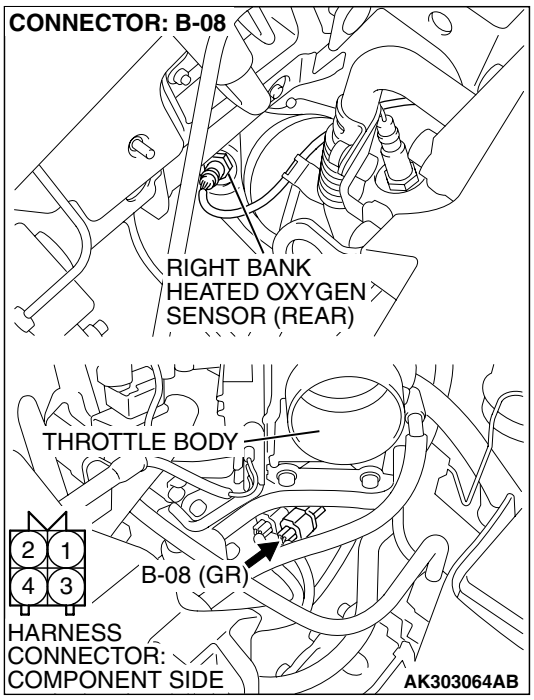


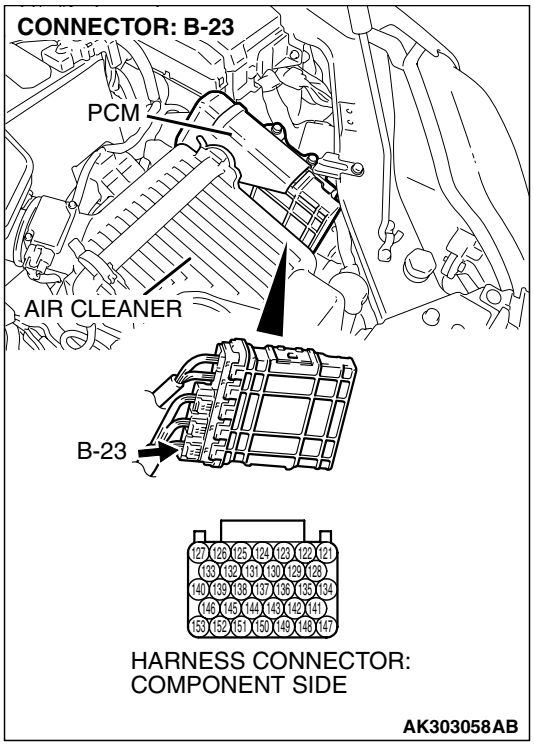
STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 3) and PCM connector B-23 (terminal No. 138).

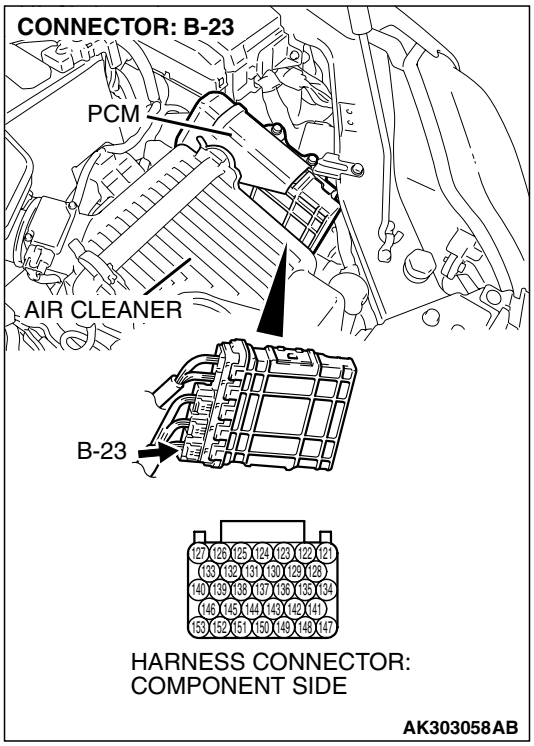
Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 12.





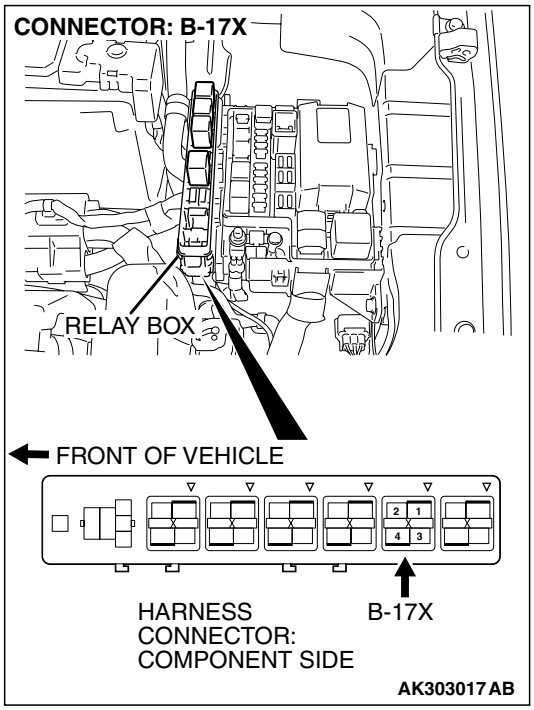


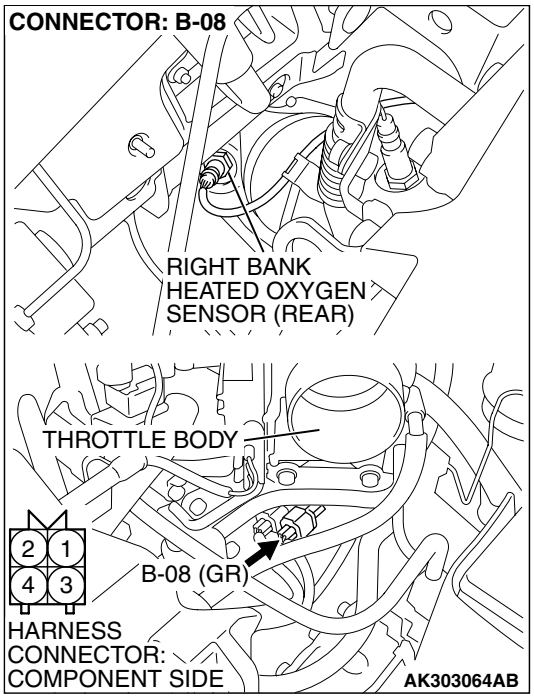
STEP 8. Check harness connector B-23 at PCM for damage.

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 12.



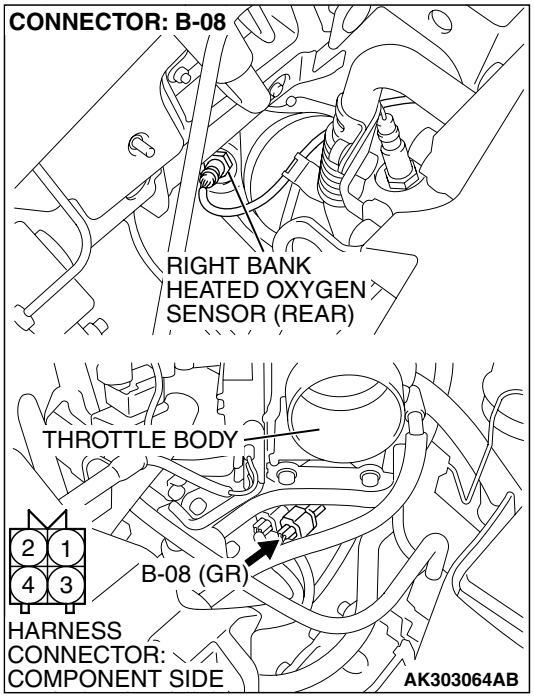


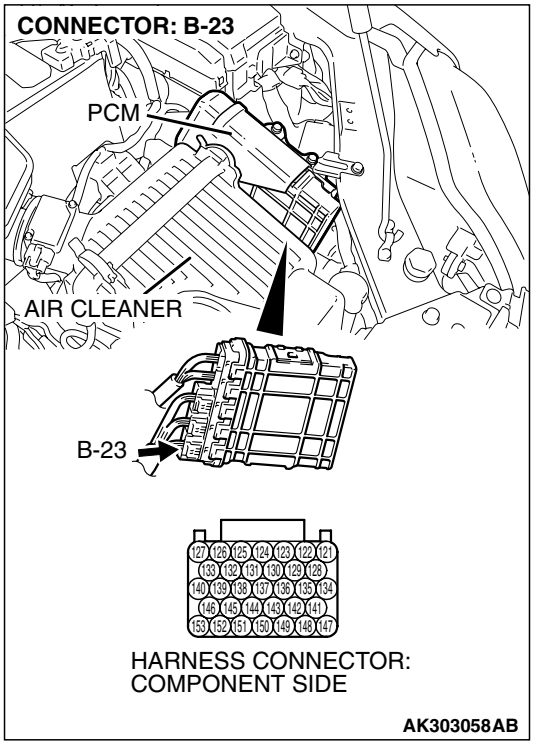
STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (rear) connector B-08 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 10.
NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 3) and PCM connector B-23 (terminal No. 138).
Q: Is the harness wire in good condition?

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





STEP 11. Check the trouble symptoms.

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

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

Q: Is DTC P0141 set?

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

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

STEP 12. 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 – Procedure 6 – Other Monitor P.13B-6.

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

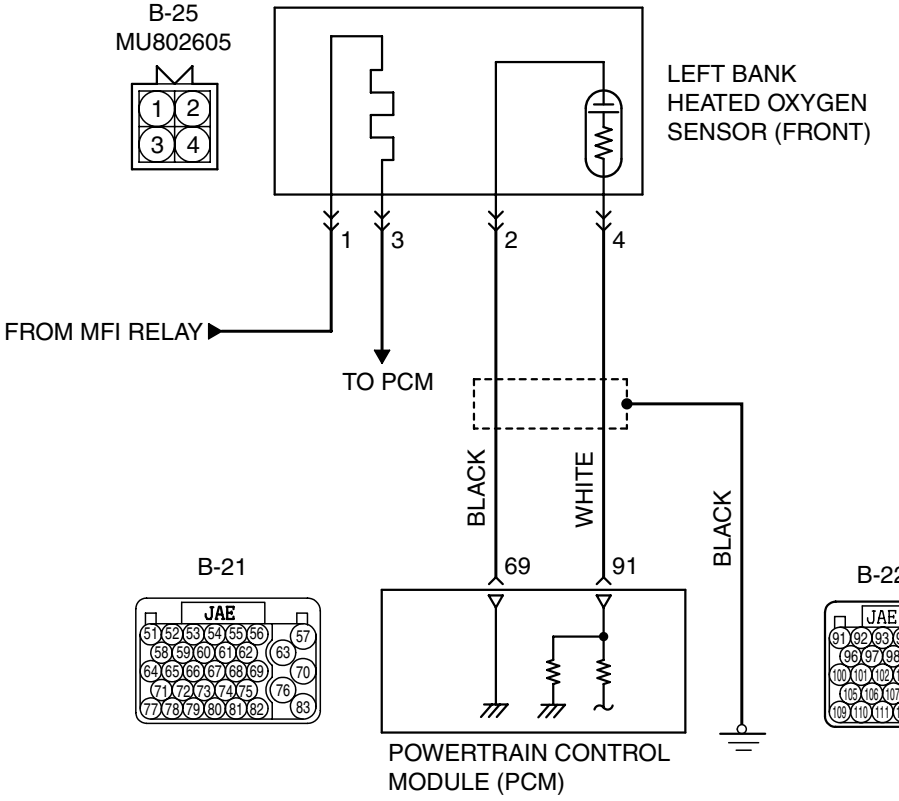
Q: Is DTC P0141 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

Left Bank Heated Oxygen Sensor (front) Circuit



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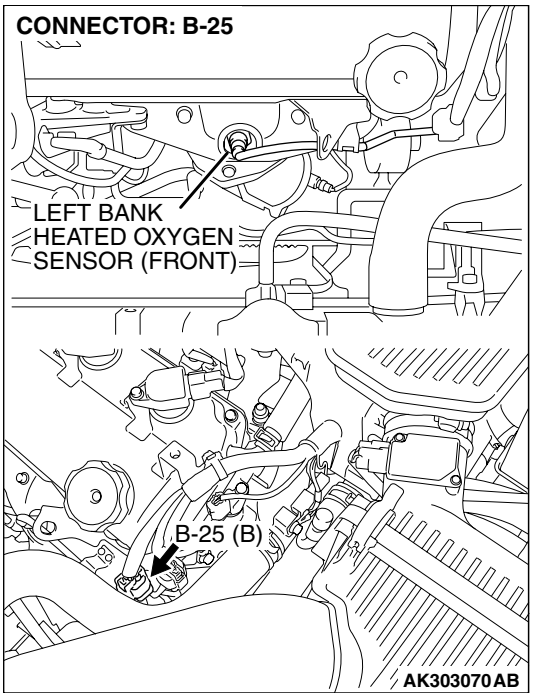
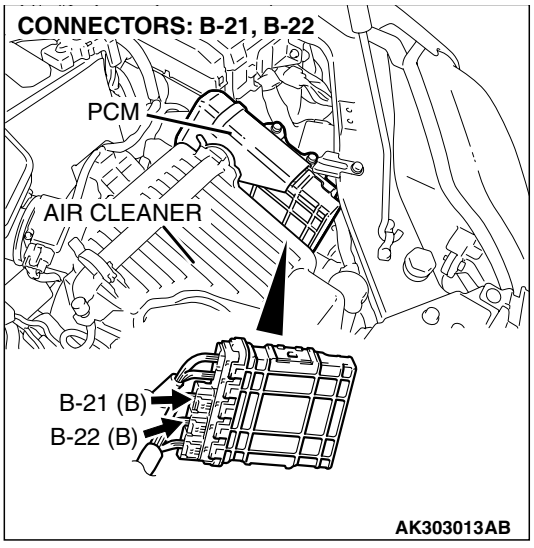




TSB Revision

CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 91) 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 with or PCM (terminal No. 69).

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 sends it to the PCM.
- When the left bank heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response deteriorates also.
- 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)

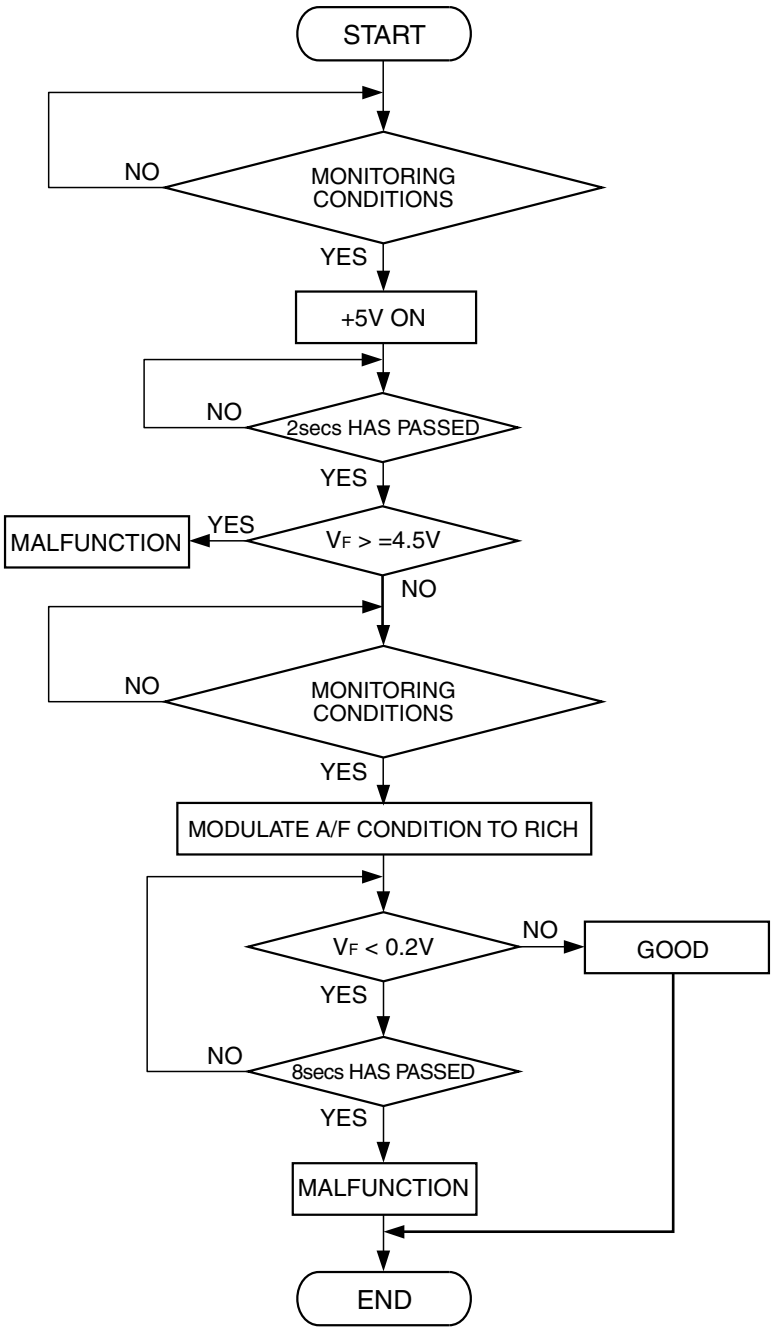
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Mass 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



AK401409

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.

TSB Revision

Judgment Criteria

- 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 – Procedure 6 – Other Monitor. P.13B-6

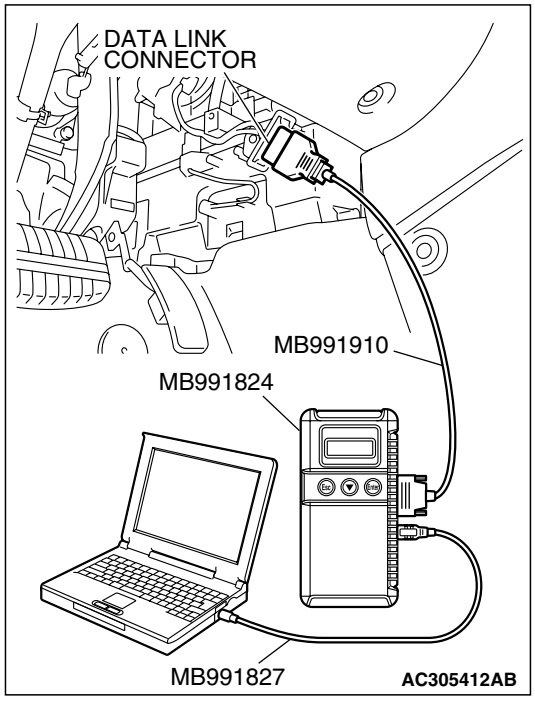
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Harness A
- MD998464: Test Harness
- MB991923: Power Plant ECU Check 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.

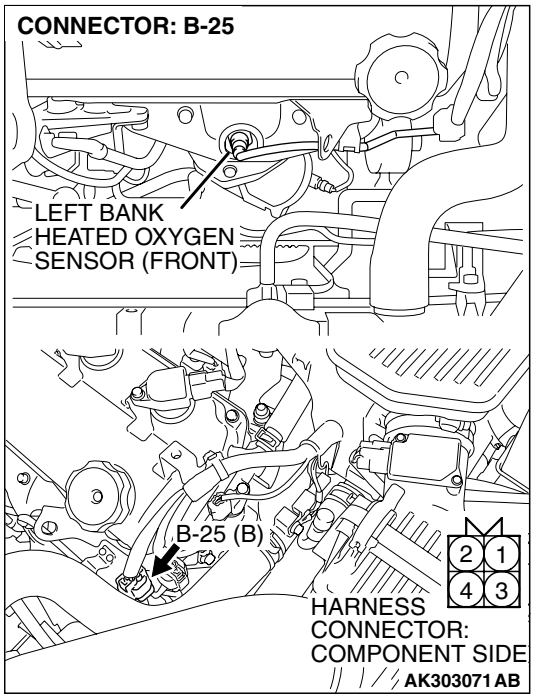
Q: Is the sensor operating properly?

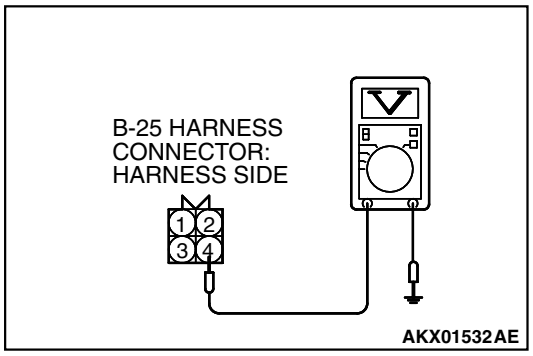
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at left bank heated oxygen sensor (front) connector B-25 by backprobing

(1) Do not disconnect the connector B-25.
(2) Start the engine and run at idle.



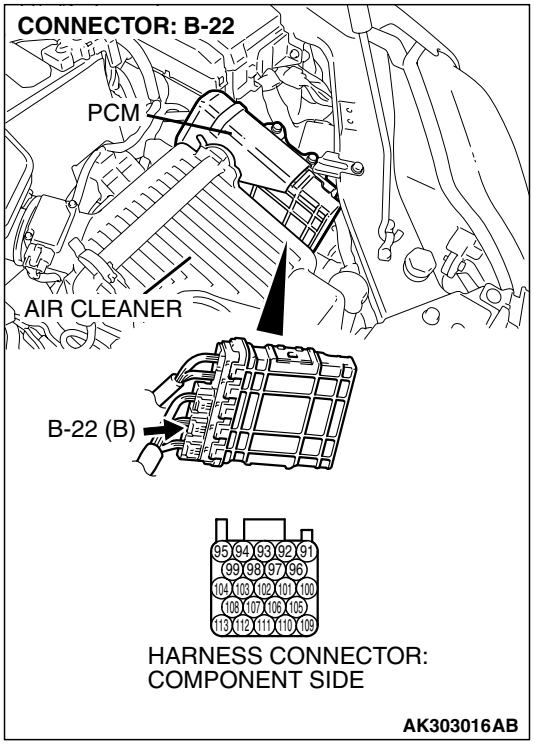


(3) Measure the voltage between terminal No. 4 and ground by backprobing.
- Warming up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.

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

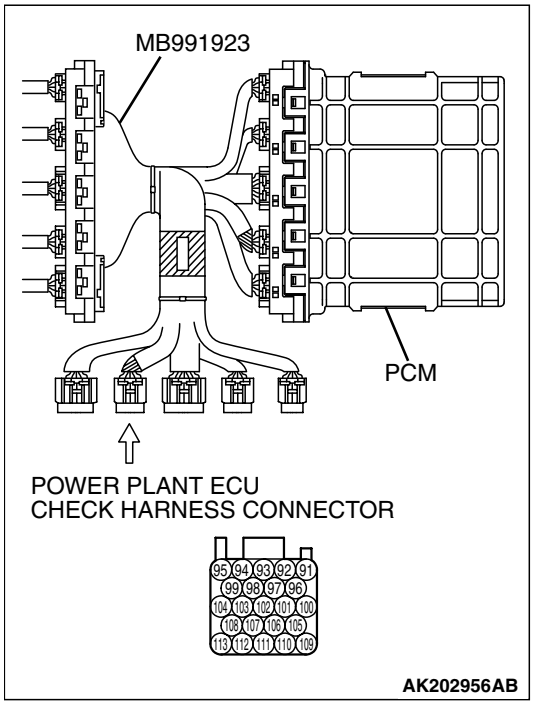
Q: Is the measured voltage within the specified range?

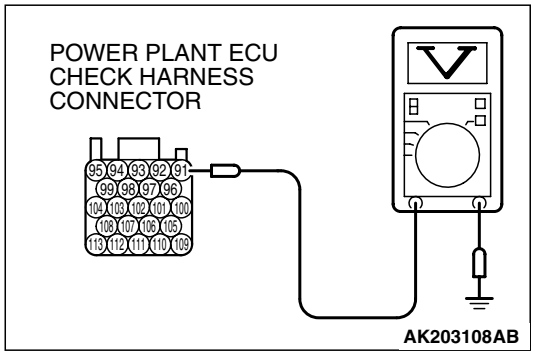
YES : Go to Step 3.
NO : Go to Step 7.



STEP 3. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect power plant ECU check harness special tool MB991923 between the separated connectors.
(2) Start the engine and run at idle.



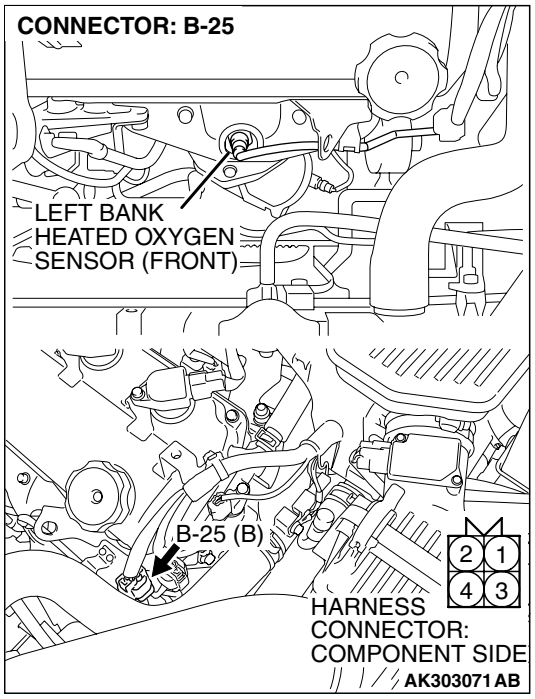


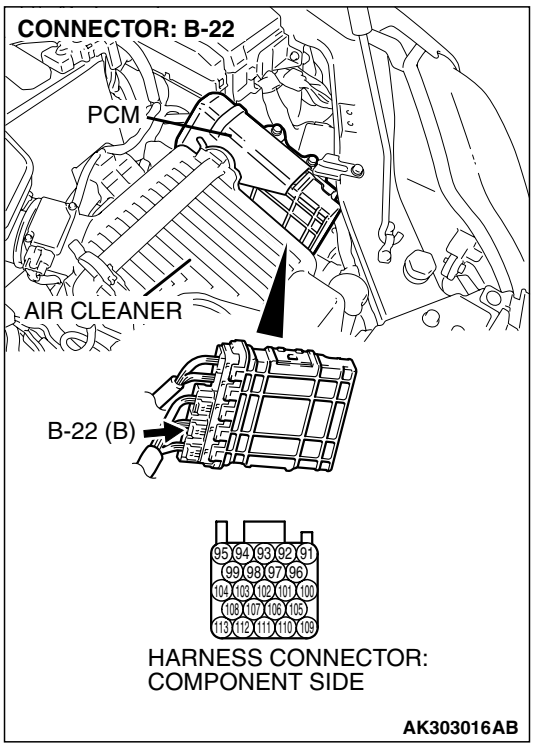
(3) Measure the voltage between terminal No. 91 and ground.
- Warming up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.

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

Q: Is the measured voltage within the specified range?

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



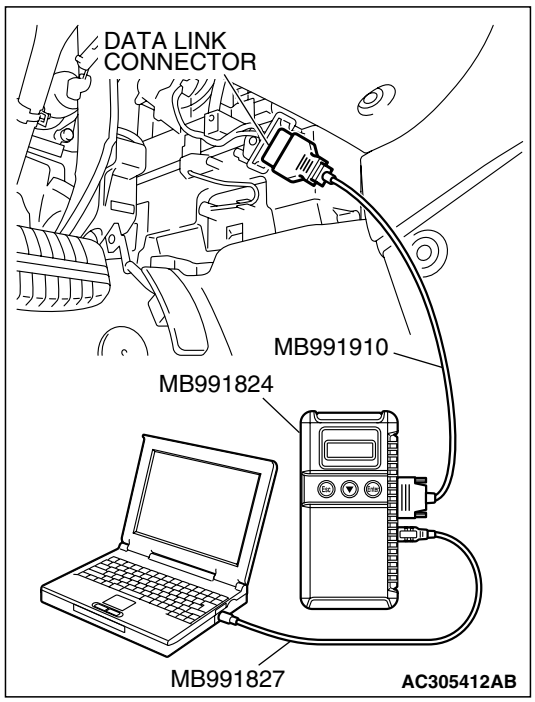


STEP 4. Check harness connector B-25 at left bank heated oxygen sensor (front) and harness connector B-22 at PCM for damage.

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.

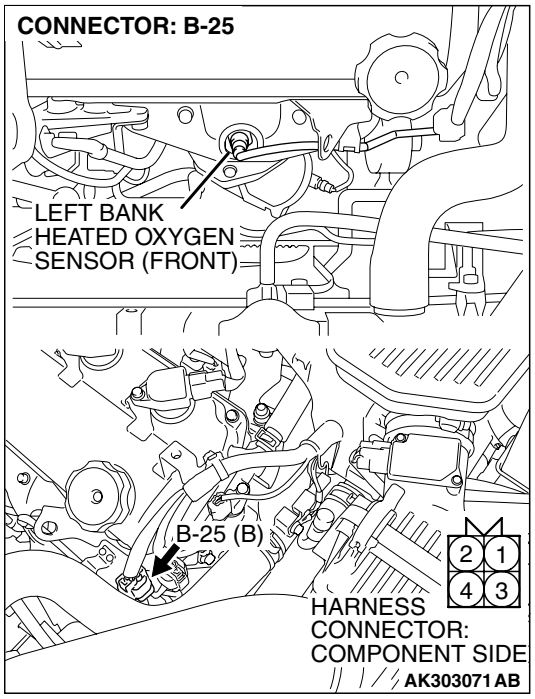
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor Bank 2, Sensor 1 (left front).
- Warming up the engine. When the engine is revved, the output voltage should be 0.6 to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

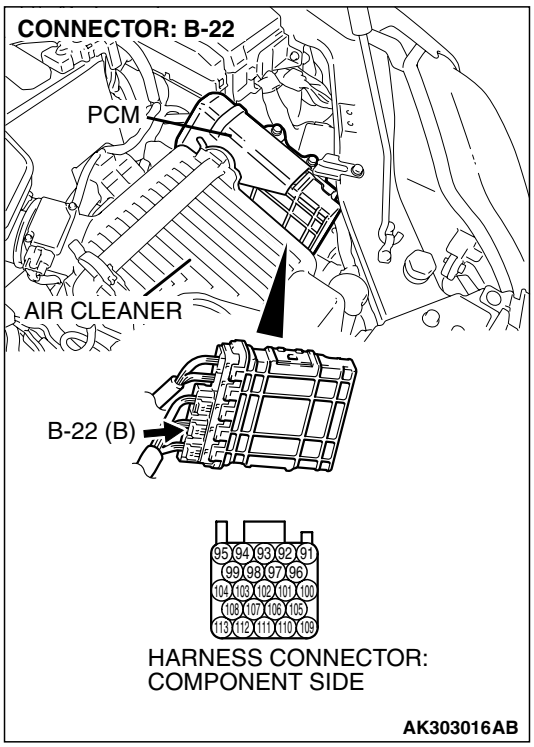
(4) Turn the ignition switch to the "LOCK" (OFF) position.

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.00-14.

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



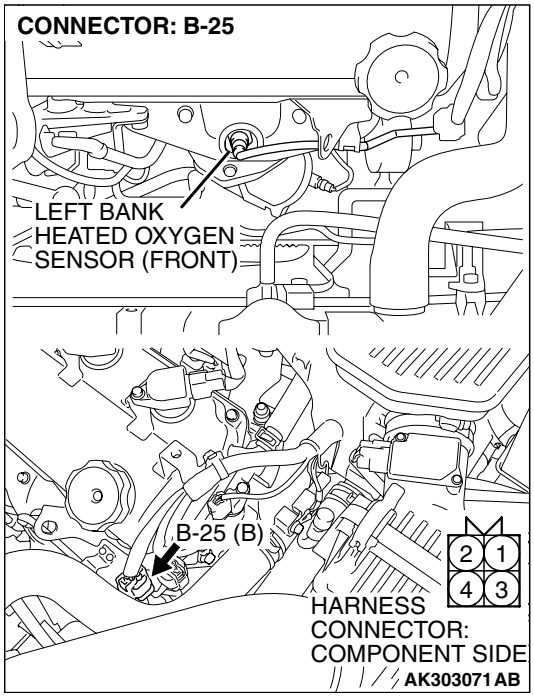


STEP 6. Check harness connector B-25 at left bank heated oxygen sensor (front) and harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between left bank heated oxygen sensor (front) connector B-25 (terminal No. 4) and PCM connector B-22 (terminal No. 91) 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.

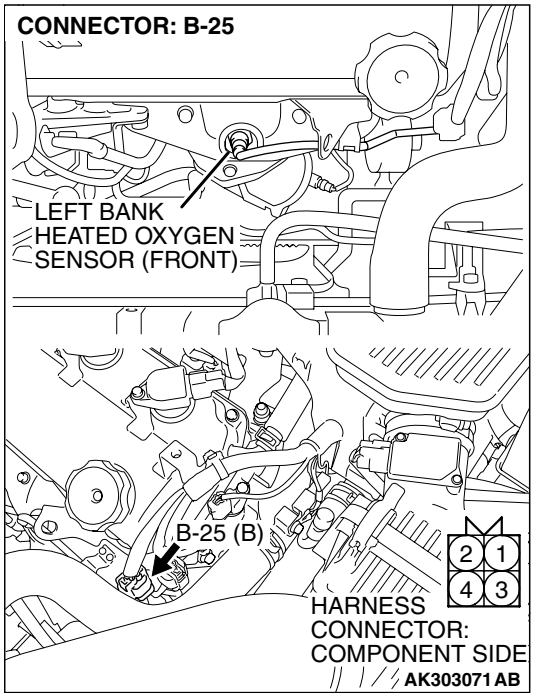


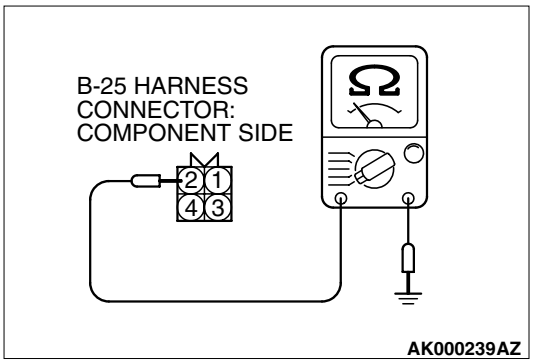
STEP 7. Check harness connector B-25 at left bank heated oxygen sensor (front) for damage.
Q: Is the harness connector in good condition?

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-25.

(1) Disconnect the connector B-25 and measure at the harness side.

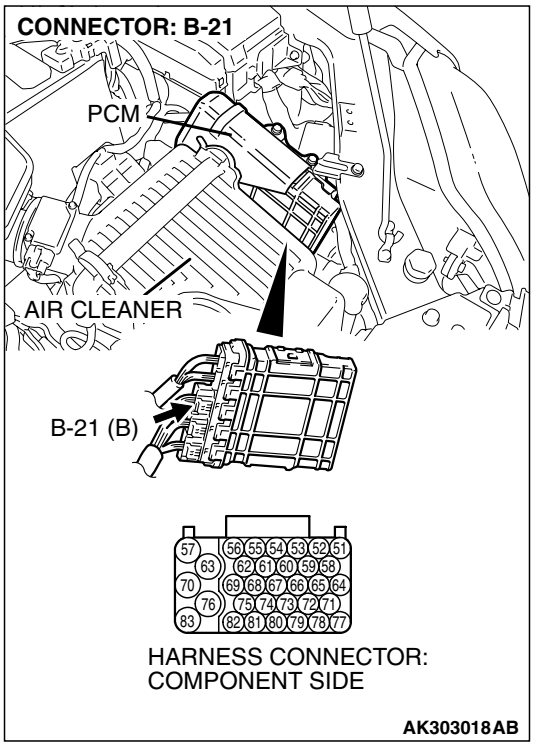




(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

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

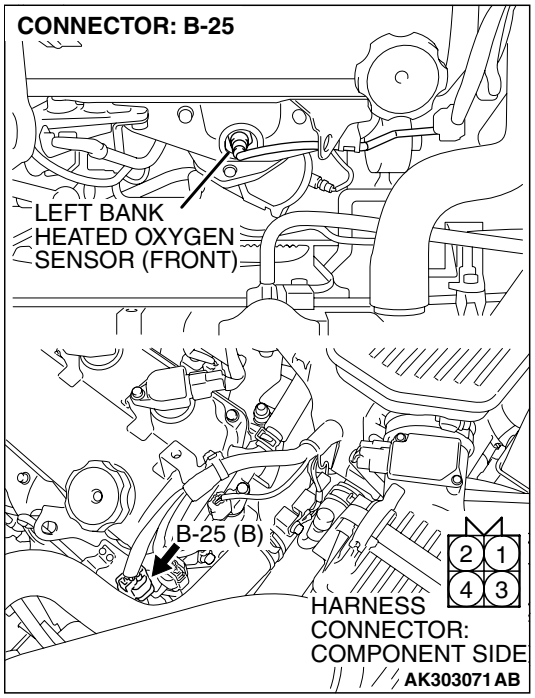


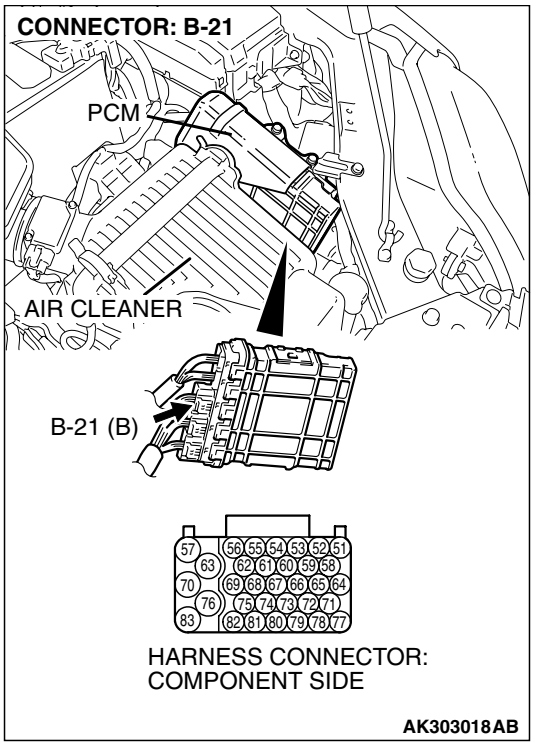
STEP 9. Check harness connector B-21 at PCM for damage.

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.



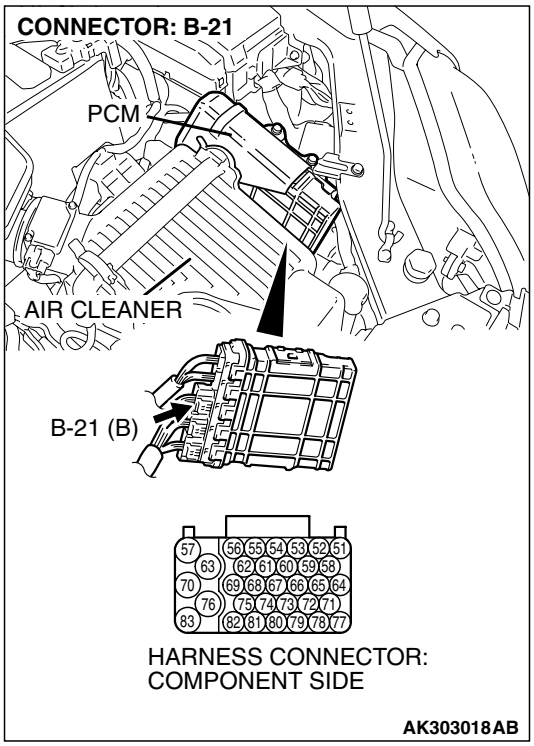


STEP 10. Check for open circuit and harness damage between left bank heated oxygen sensor (front) connector B-25 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

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.

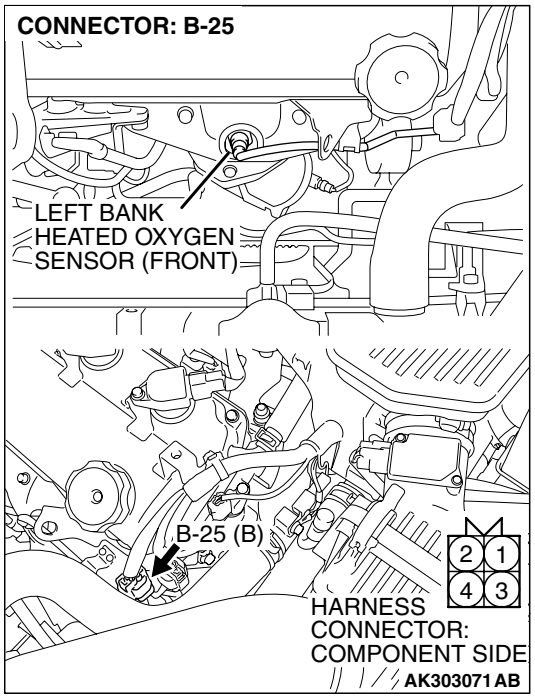


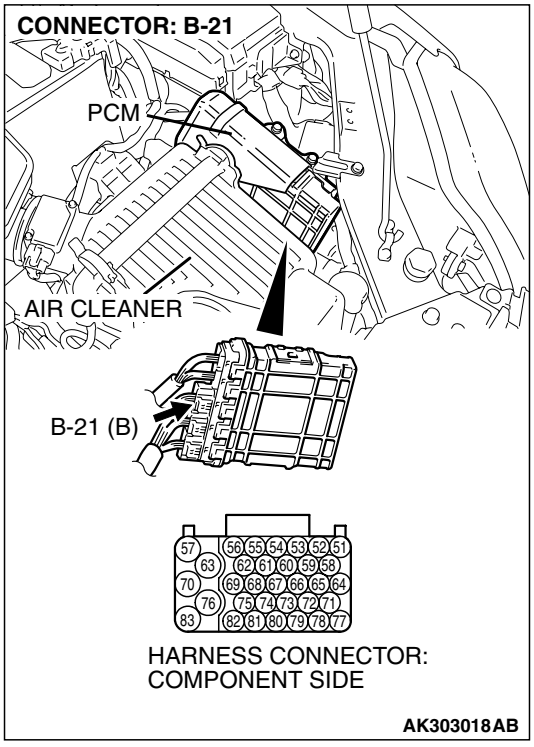
STEP 11. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 12.

NO : Repair or replace it. Then go to Step 15.





STEP 12. Check for harness damage between left bank heated oxygen sensor (front) connector B-25 (terminal No. 2) and PCM connector B-21 (terminal No. 69).
Q: Is the harness wire in good condition?

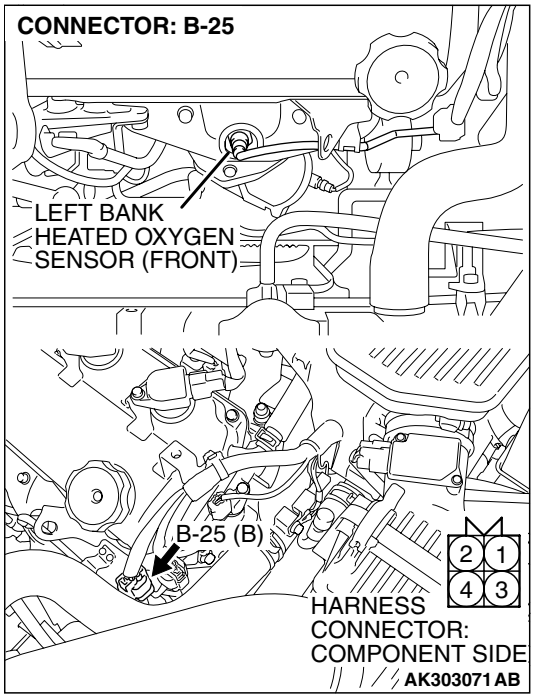
YES : Go to Step 13.
NO : Repair it. Then go to Step 15.

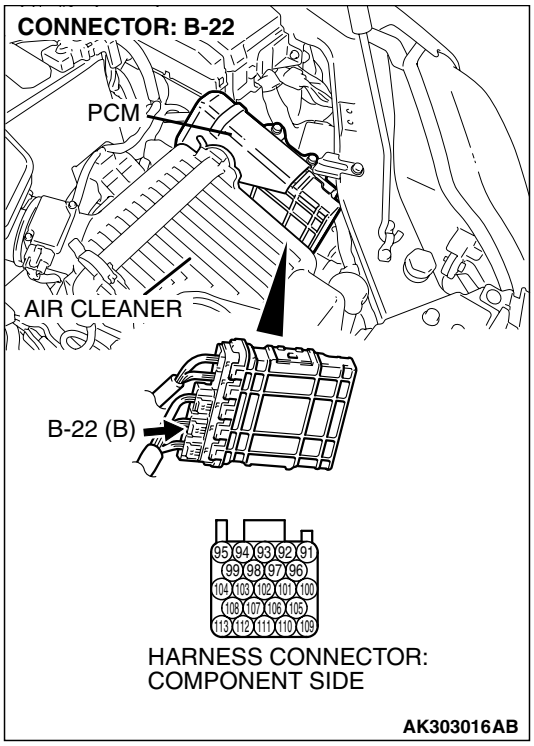
STEP 13. Check for short circuit to ground and harness damage between left bank heated oxygen sensor (front) connector B-25 (terminal No. 4) and PCM connector B-22 (terminal No. 91).

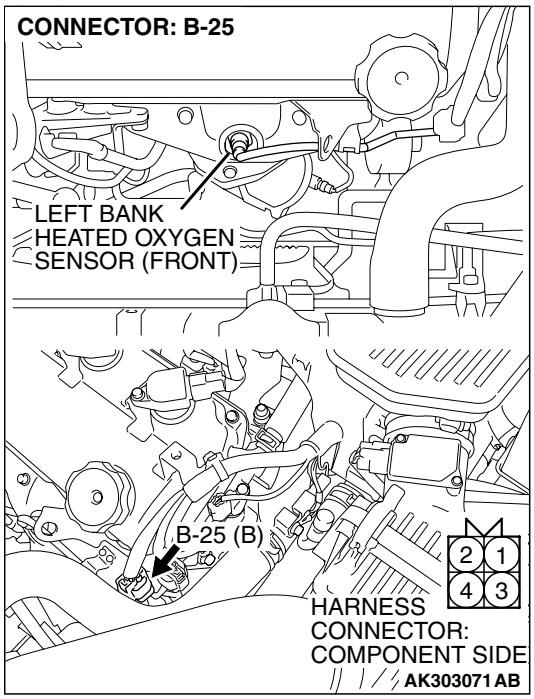
Q: Is the harness wire in good condition?

YES : Go to Step 14.

NO : Repair it. Then go to Step 15.



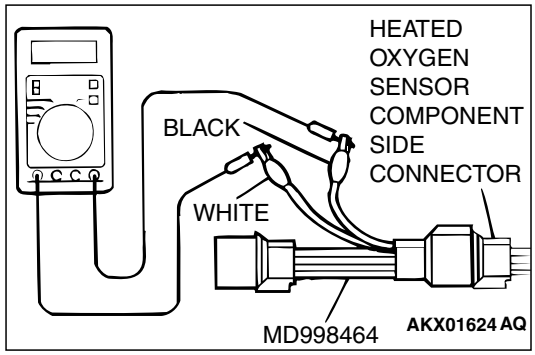




STEP 14. Check the left bank heated oxygen sensor (front).

(1) Disconnect the left bank heated oxygen sensor (front) connector B-25 and connect test harness special tool, MD998464, 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 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 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 – Procedure 6 – Other Monitor P.13B-6.

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

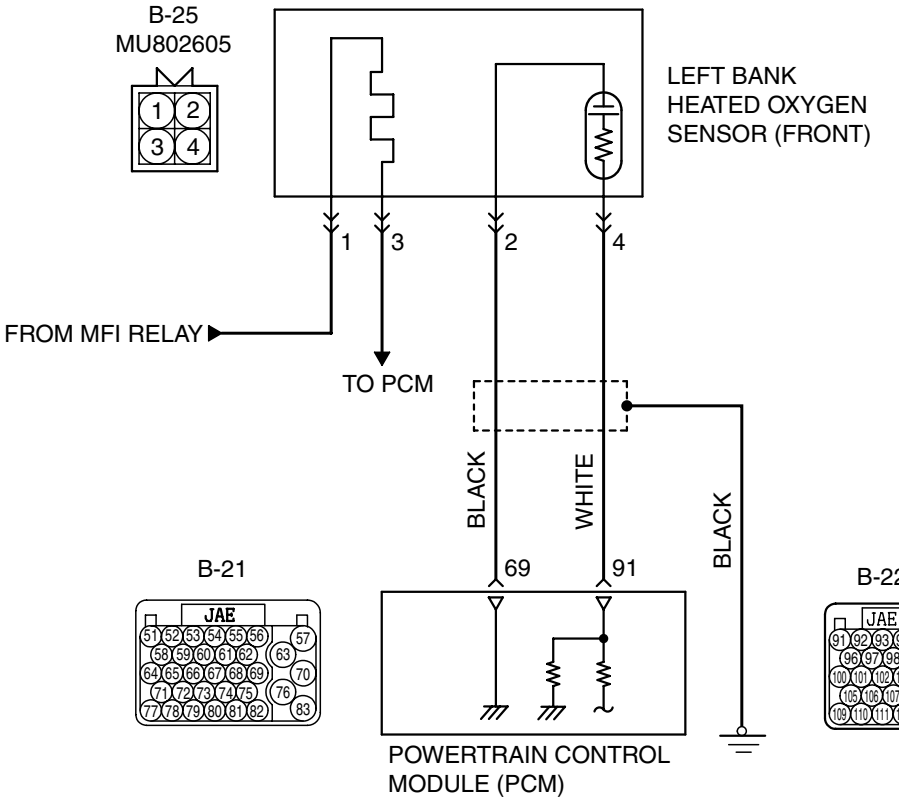
Q: Is DTC P0150 set?

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



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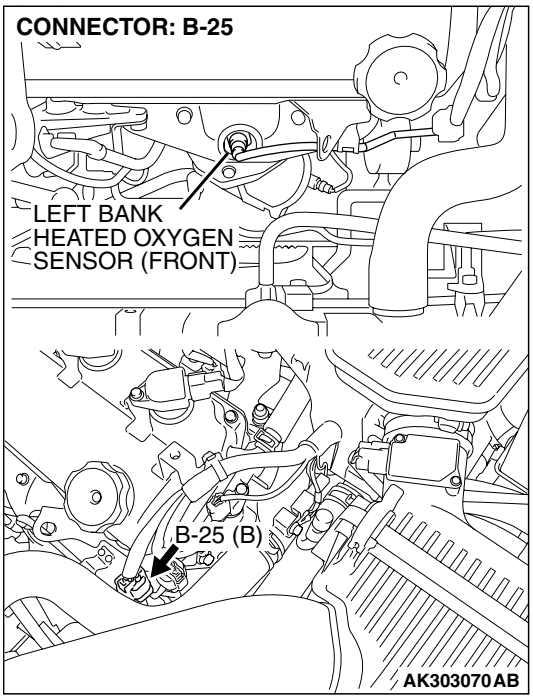
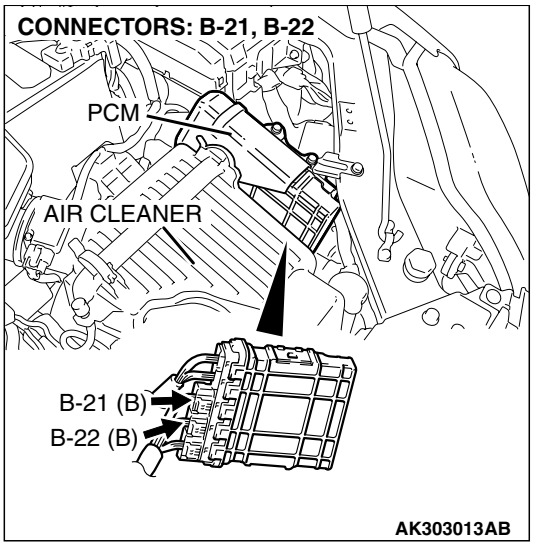




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 91) 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 with PCM (terminal No. 69).

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 input the resulting signal 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)

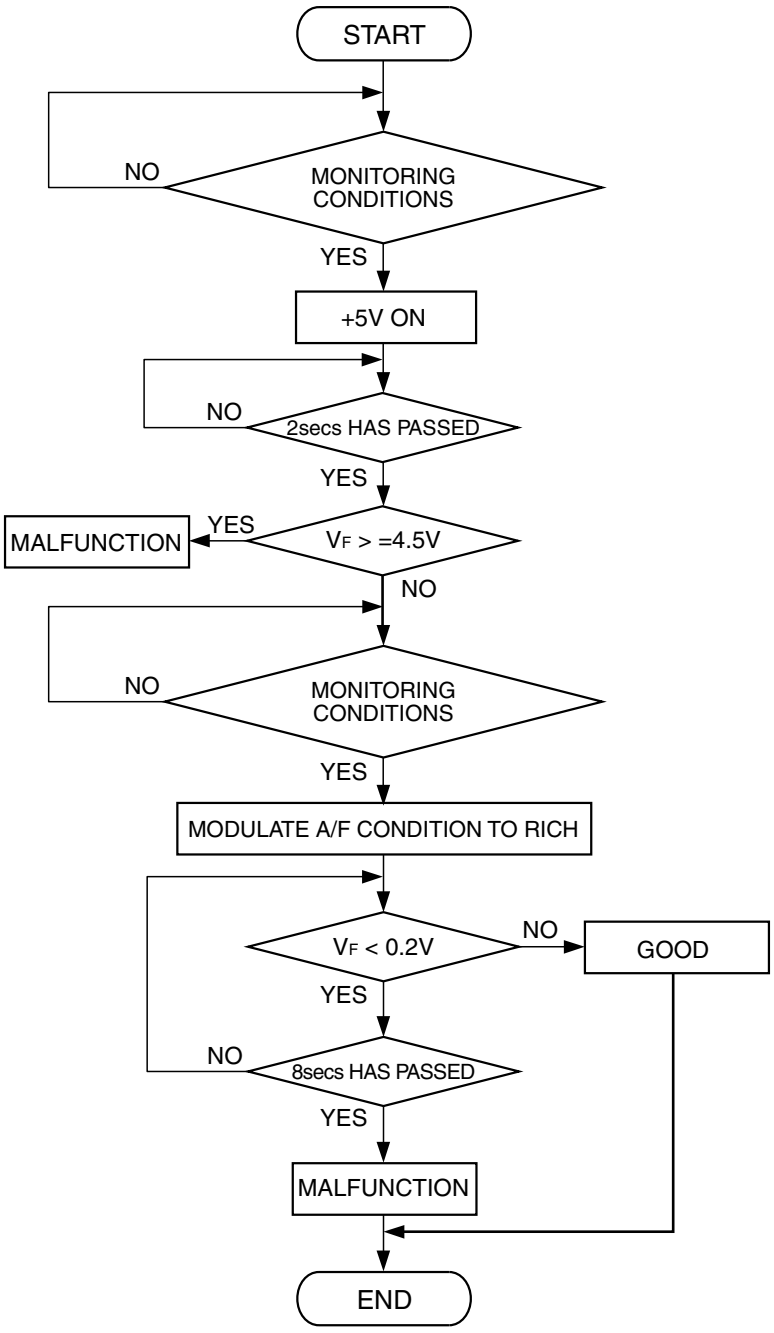
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Mass 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



AK401409

TSB Revision

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).
- Mass airflow sensor output is 8 g/sec or more.
- At least 20 seconds have passed since fuel shut off control was canceled.
- Monitoring time: 8 seconds.

Judgement Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

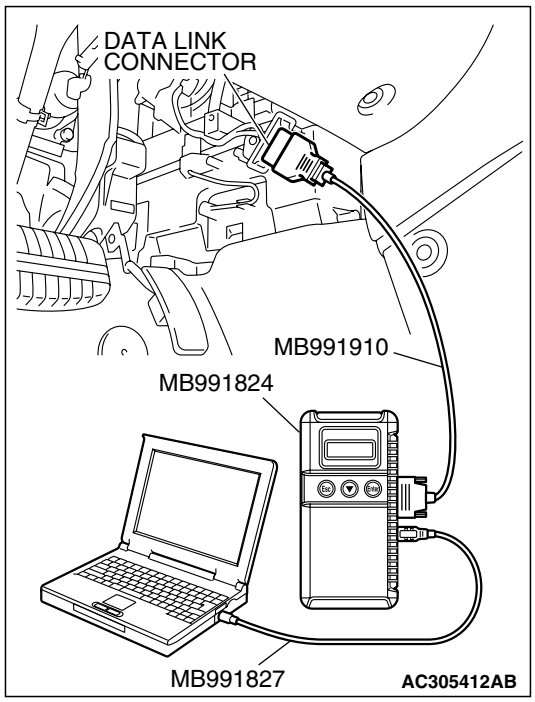
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Harness A
- MD998464: Test Harness



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

⚠ CAUTION

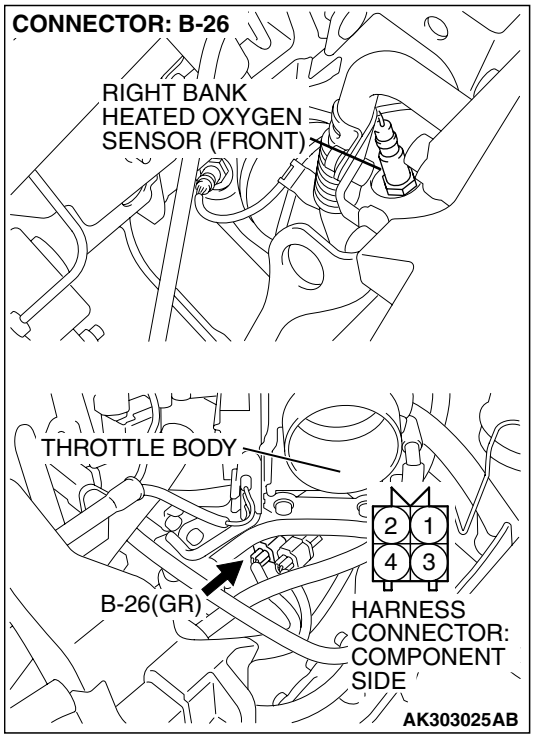
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(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.00-14.

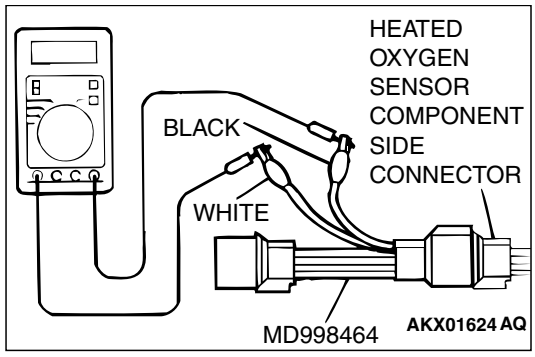
NO : Go to Step 2.



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

(1) Disconnect the left bank heated oxygen sensor (front) connector B-25 and connect test harness special tool, MD998464, 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

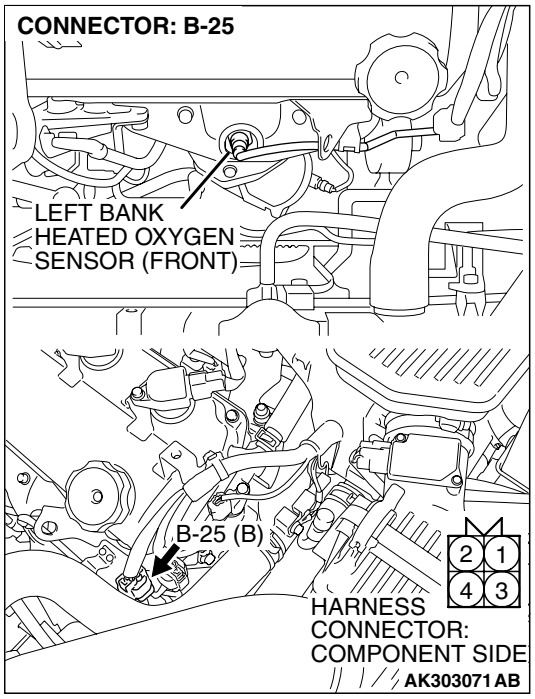
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.**

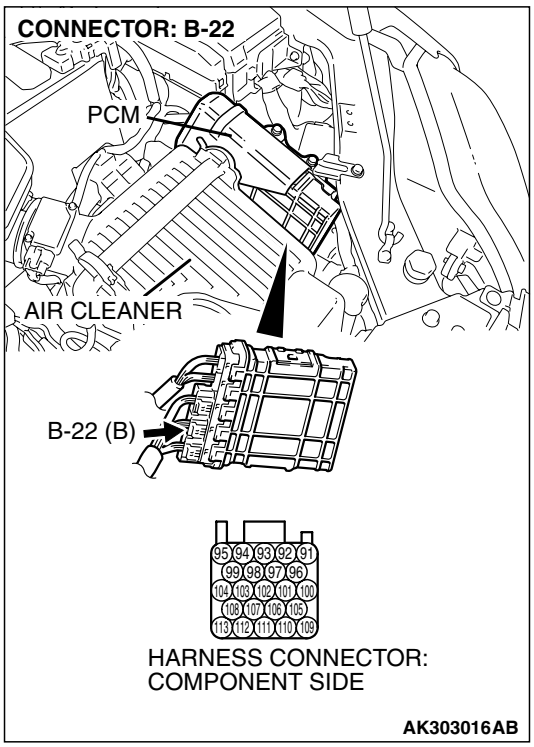
NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (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.



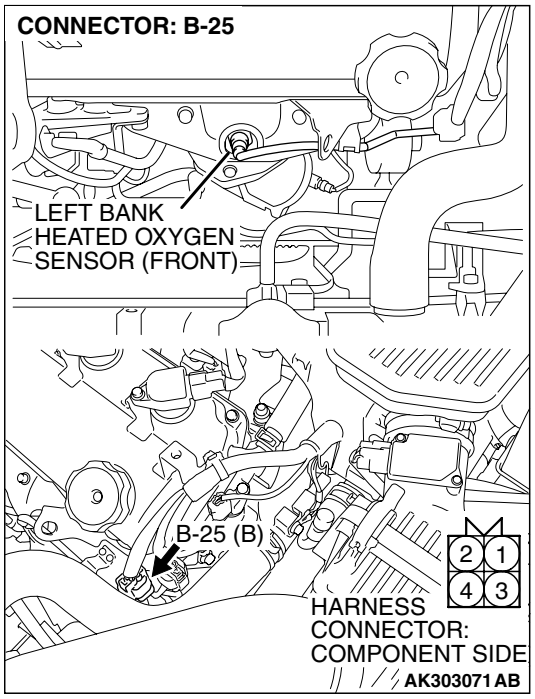


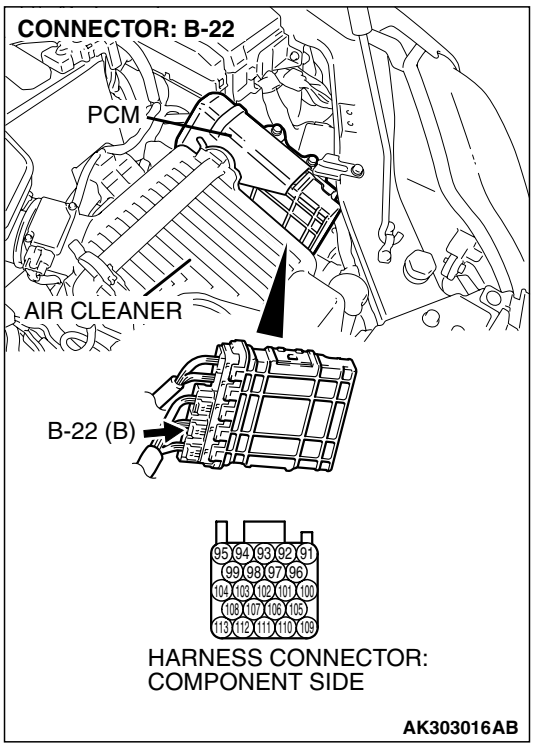
STEP 3. Check harness connector B-25 at left bank heated oxygen sensor (front) and harness connector B-22 at PCM for damage.

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-25 (terminal No. 4) and PCM connector B-22 (terminal No. 91).
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 – Procedure 6 – Other Monitor P.13B-6.

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

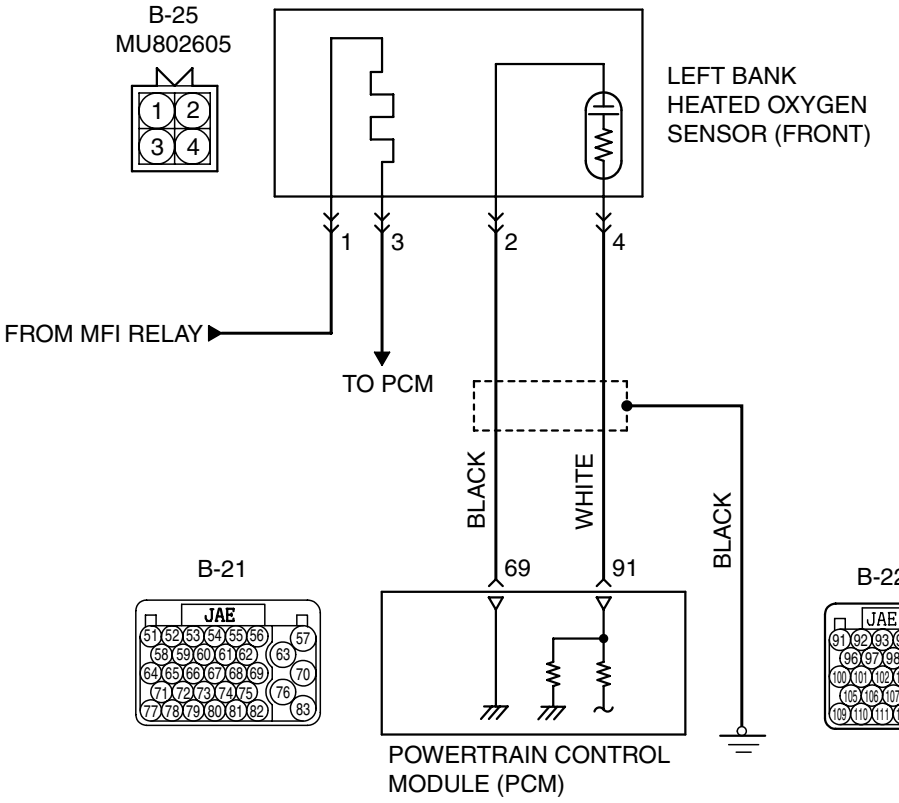
Q: Is DTC P0151 set?

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



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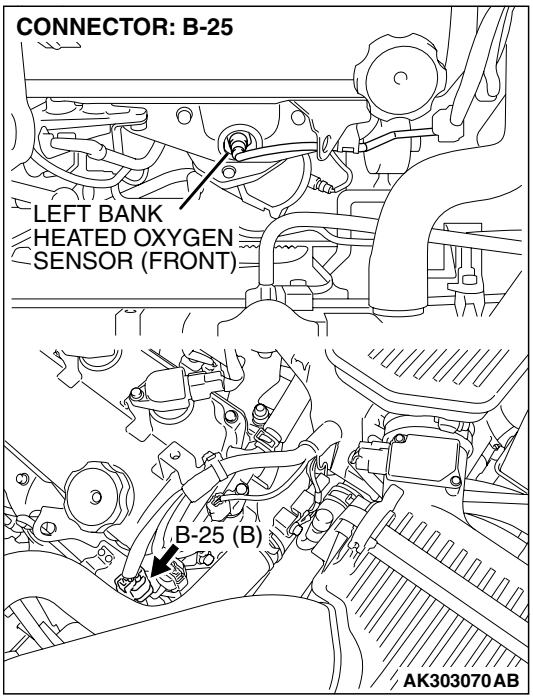
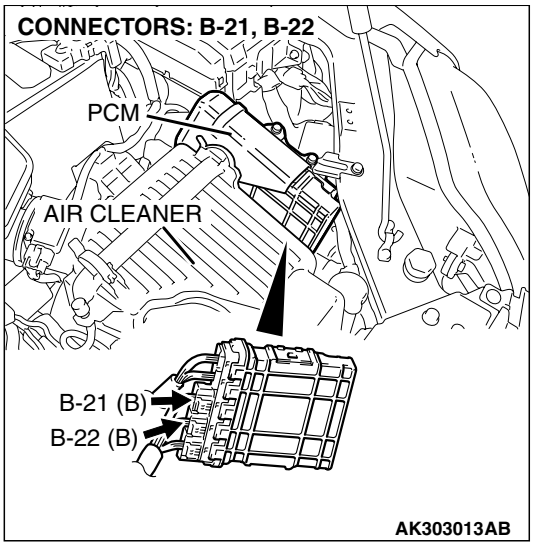




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 91) 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 with PCM (terminal No. 69).

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 input 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)

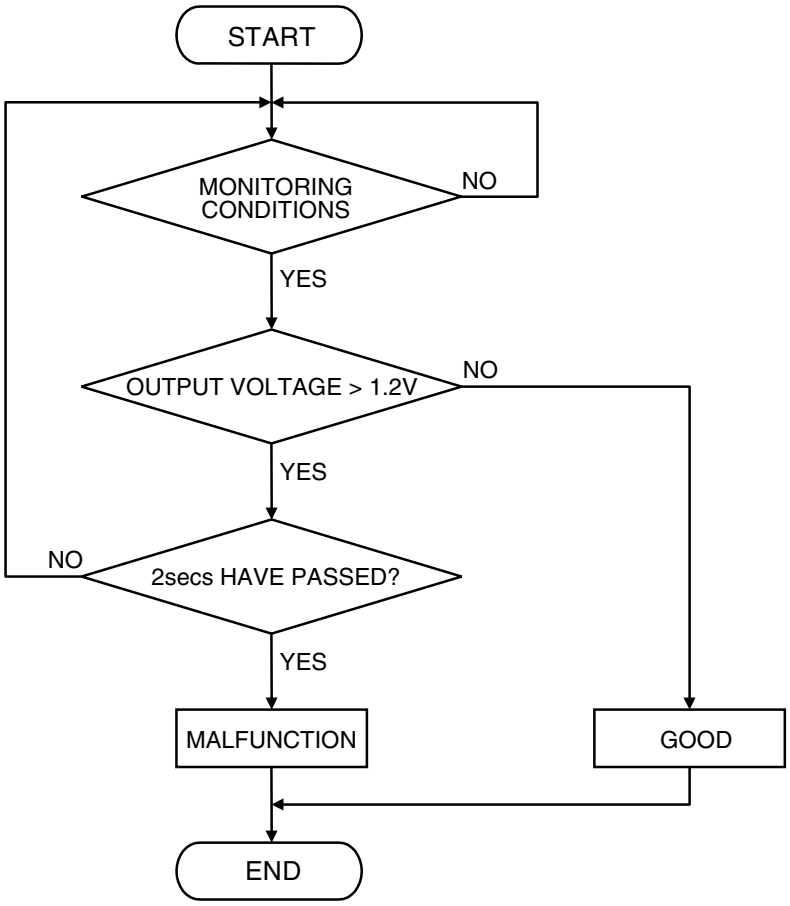
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Mass 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



AK302396

Check Conditions

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

Judgment Criteria

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

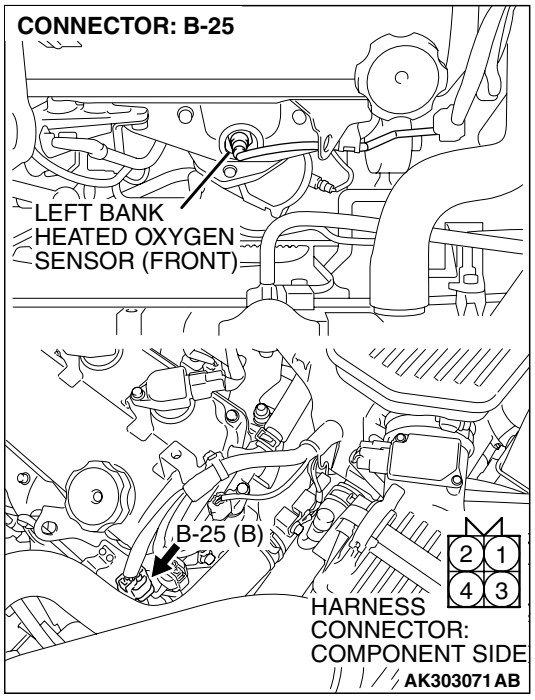
OBD-II DRIVE CYCLE PATTERN

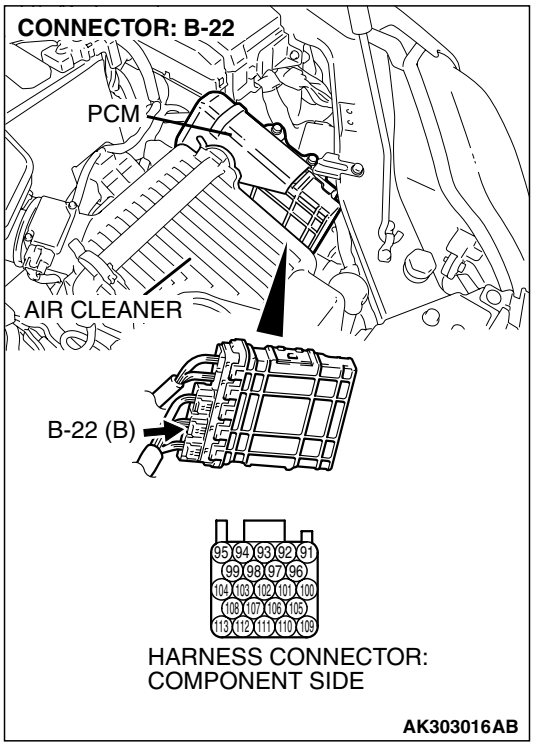
Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.

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



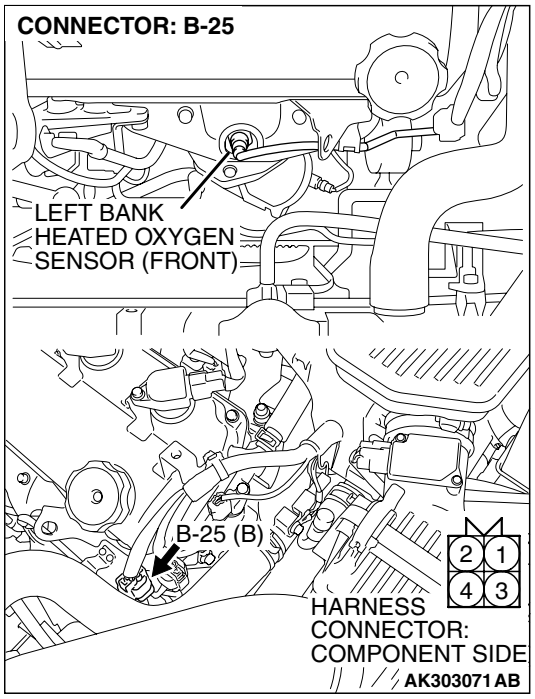


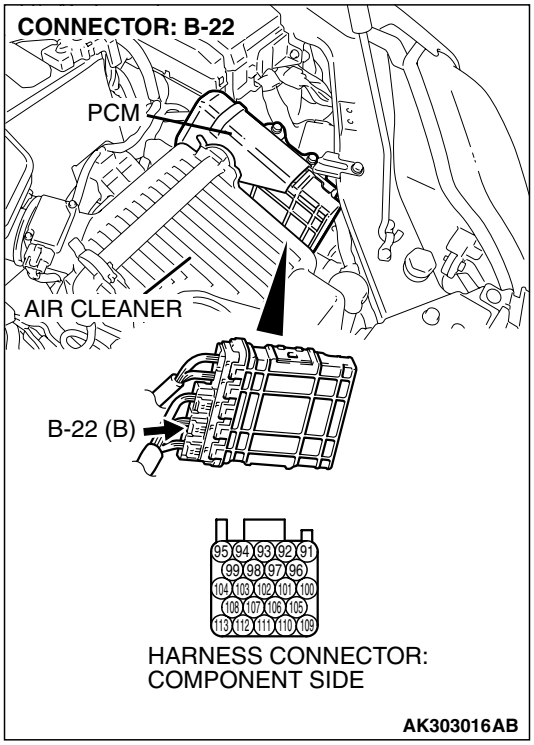
STEP 1. Check harness connector B-25 at left bank heated oxygen sensor (front) and harness connector B-22 at PCM for damage.

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-25 (terminal No. 4) and PCM connector B-22 (terminal No. 91).
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 – Procedure 6 – Other Monitor P.13B-6.

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

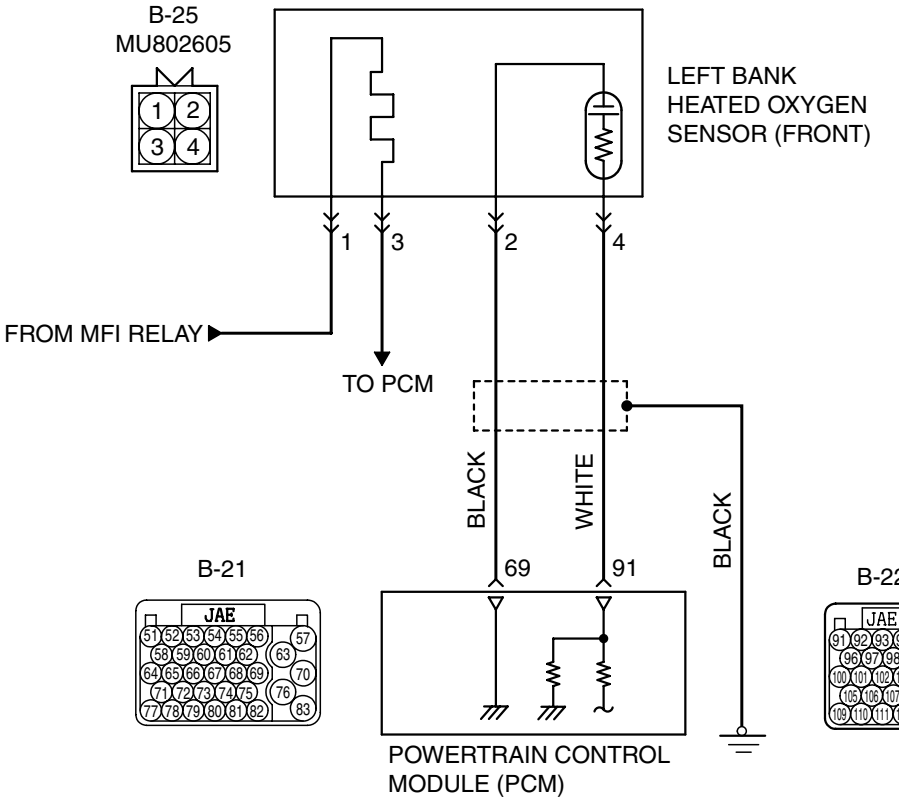
Q: Is DTC P0152 set?

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



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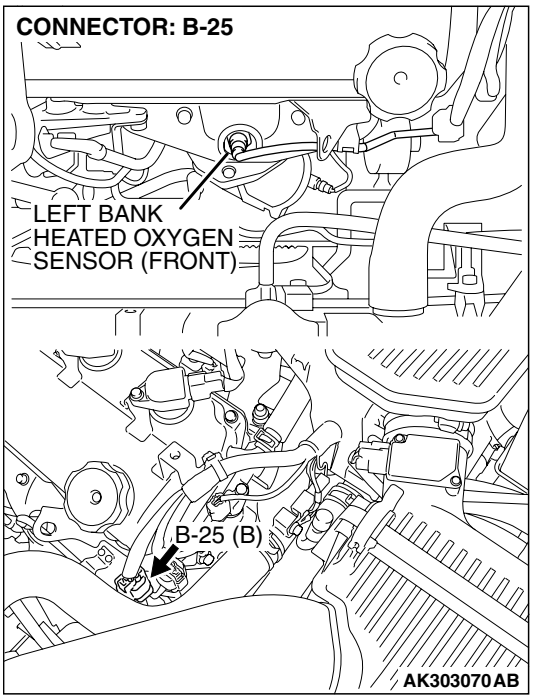
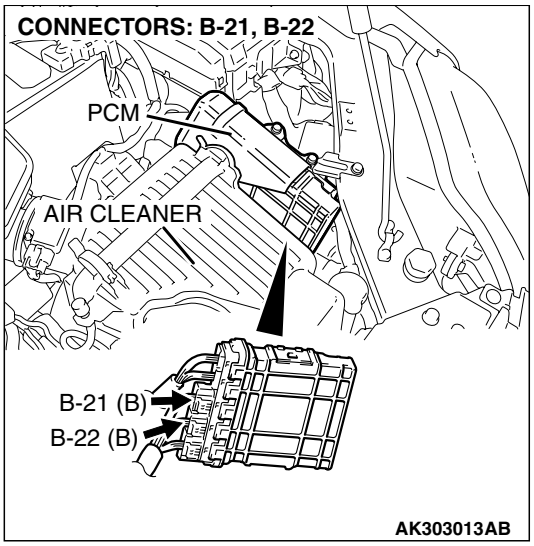




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 91) 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 with PCM (terminal No. 69).

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)

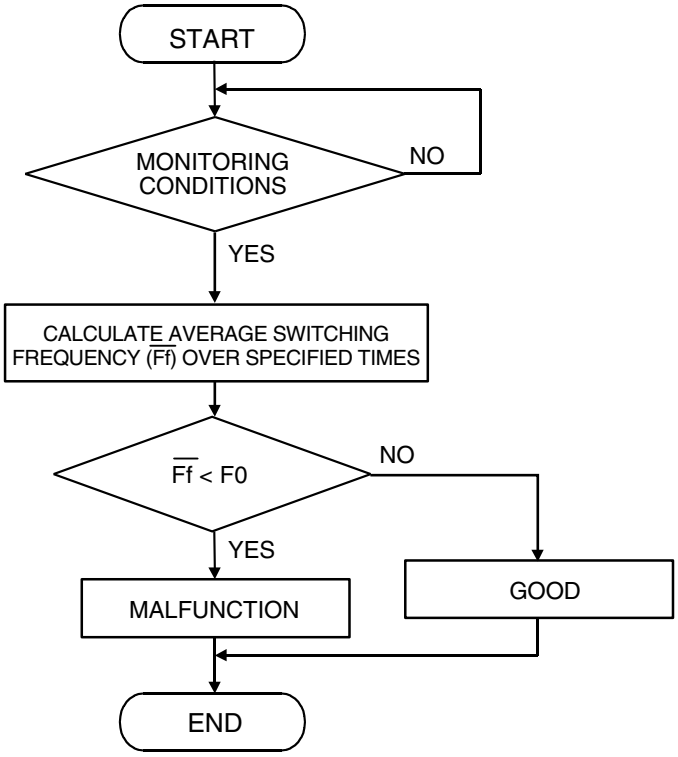
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Mass 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 SWITDHING FREQUENCY

AK302395

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 18 and 60 percent.
- Under the closed loop air/fuel control.
- The accelerator pedal open.
- Short-term fuel trim is at between –30 and +25 percent.
- More than 3 seconds have elapsed after the abovementioned conditions have been met.

Judgment Criteria

- The left bank heated oxygen sensor (front) sends "lean" and "rich" signals alternately 13 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 – Procedure 4 – Heated Oxygen Sensor Monitor P.13B-6.

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
  - MB991910: Main Harness A
- MD998464: Test Harness

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

⚠ CAUTION

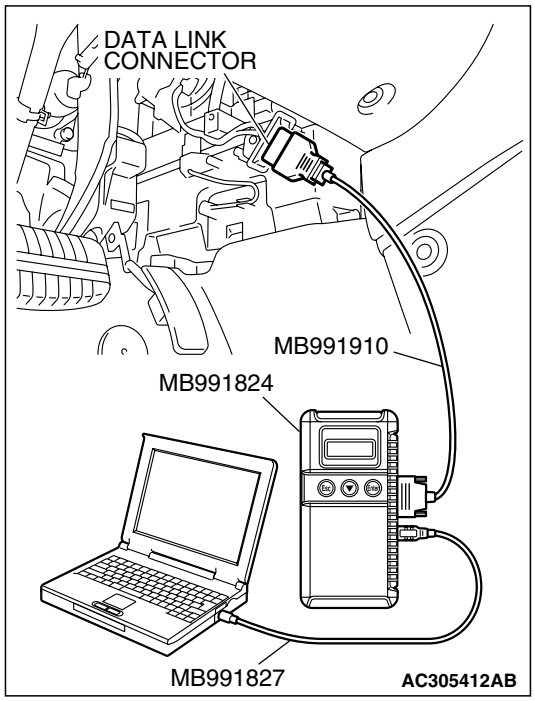
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

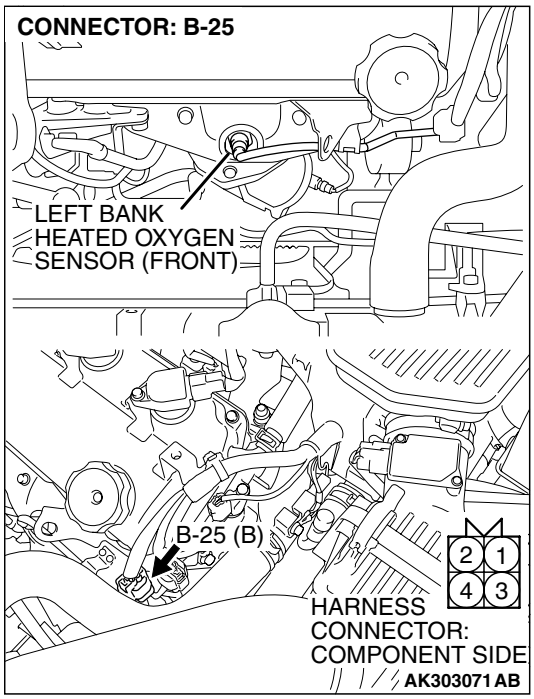
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor Bank 2, Sensor 1 (left front).
(4) Warm up the engine, 2,500 r/min.
  - Output voltage repeats 0.4 volt or less and 0.6 – 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.00-14.

NO : Go to Step 2.

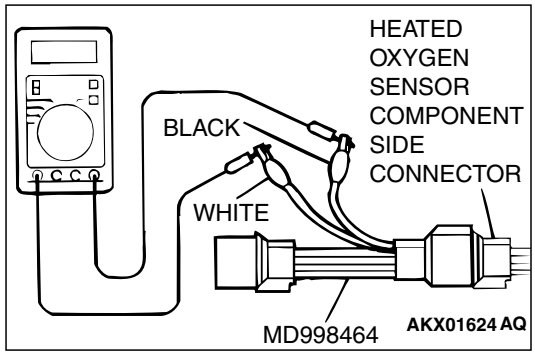




STEP 2. Check the left bank heated oxygen sensor (front).

(1) Disconnect the left bank heated oxygen sensor (front) connector B-25 and connect test harness special tool, MD998464, to the connector on the left bank heated oxygen sensor (front) side.

(2) Warm up the engine until engine coolant temperture 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

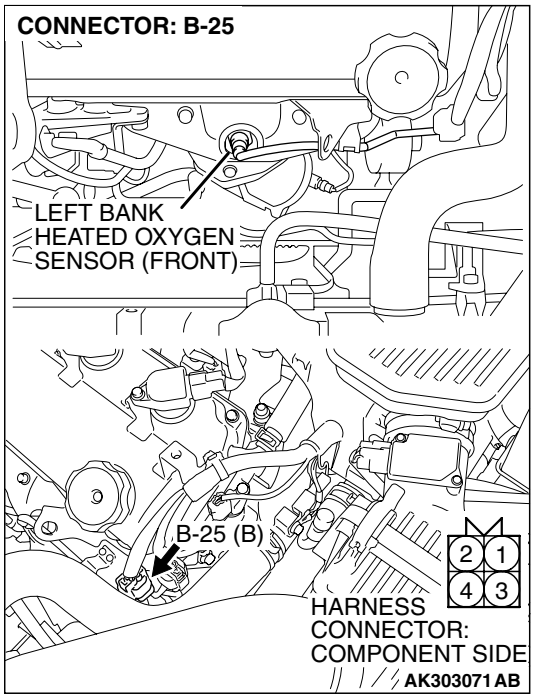
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.**

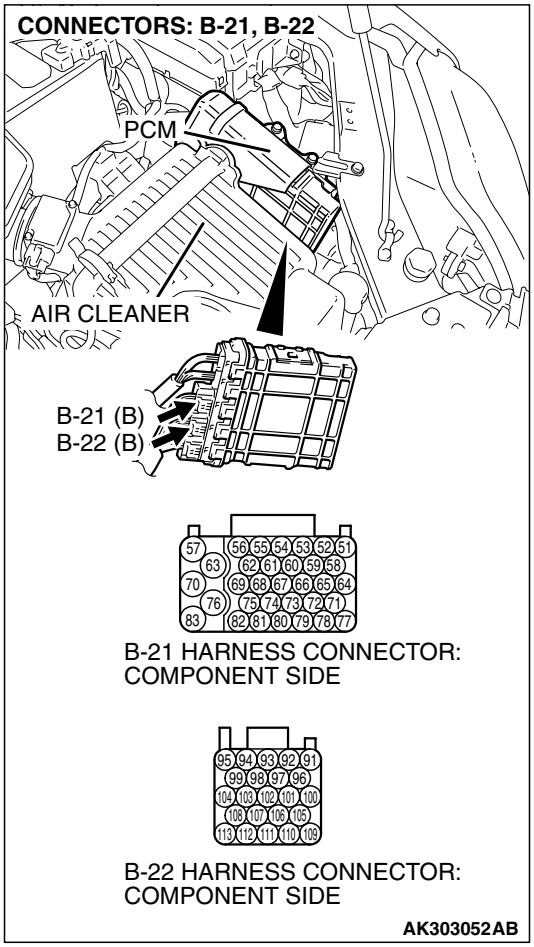
NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (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-25 at left bank heated oxygen sensor (front) and harness connector B-21, B-22 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 – Procedure 4 – Heated Oxygen Sensor Monitor P.13B-6.
(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)

⚠ CAUTION
If DTC P0154 has been set, TCL related DTC U1120 is also set. After P0154 has been diagnosed, don't forget to erase DTC U1120.

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

- Refer to, DTC P0150 – Left Bank Heated Oxygen Sensor (Front) Circuit P.13B-305.
- Refer to, DTC P0202P.13B-493, P0204P.13B-516, P0206P.13B-539 – Injector Circuit.

CIRCUIT OPERATION

- Refer to, DTC P0152 – Left Bank Heated Oxygen Sensor (Front) Circuit P.13B-330.
- Refer to, DTC P0202P.13B-493, P0204P.13B-516, P0206P.13B-539 – Injector Circuit.

TECHNICAL DESCRIPTION

- The PCM effects air/fuel ratio feedback control in accordance with the signals from the left bank heater 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)

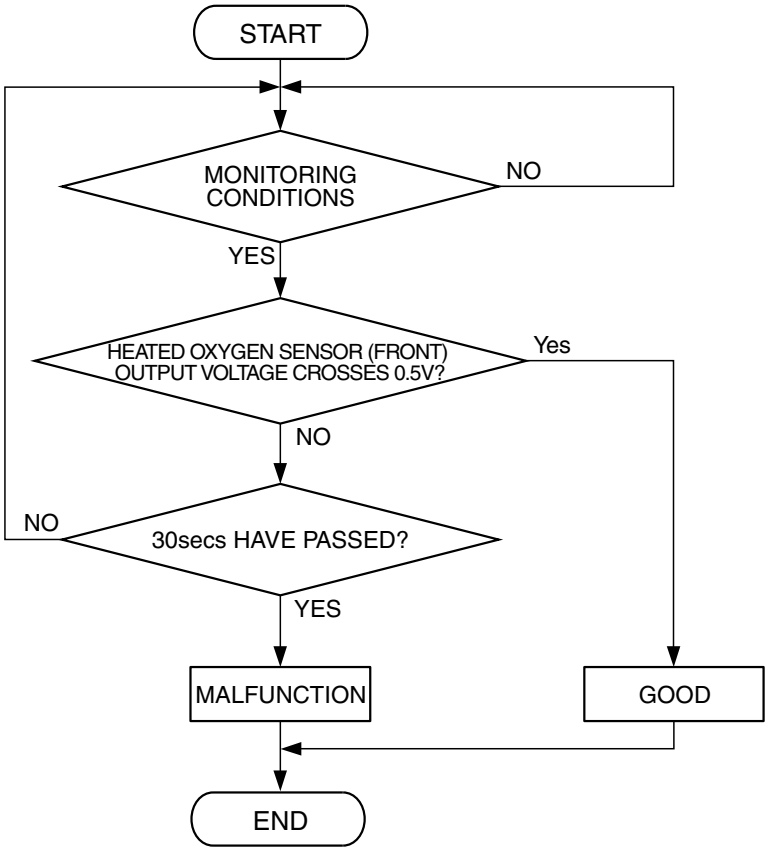
- Misfire monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK203999

Check Conditions

- 20 seconds or more have passed since the engine starting sequence was completed.
- Engine coolant temperature is higher than 50°C (122° 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.

Judgment Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

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.

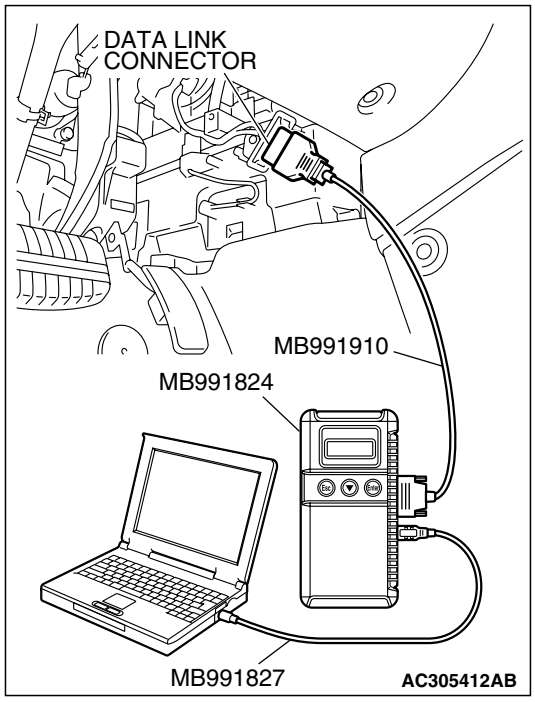
  NOTE: When the left bank heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor output voltage will deviate from the voltage when the sensor was new (normally 0.5 volt at stoichiometric ratio). This deviation will be corrected by the left bank heated oxygen sensor (rear).

  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
  - MB991910: Main Harness A
- 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).
  - 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 sensor operating properly?

YES : Go to Step 2.

NO : Refer to, DTC P0156 – Heated Oxygen Sensor Circuit (bank 2, sensor 2) P.13B-365, DTC P0157 – Heated Oxygen Sensor Circuit Low Voltage (bank 2, sensor 2) P.13B-382, DTC P0158-Heated Oxygen Sensor Circuit High Voltage (bank 2, sensor 2) P.13B-389, DTC P0159 – Heated Oxygen Sensor Circuit Slow Response (bank 2, sensor 2) P.13B-394.

STEP 2. Check for exhaust leak.

Q: Are there any abnormalities?

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

STEP 3. Check for intake system vacuum leak.

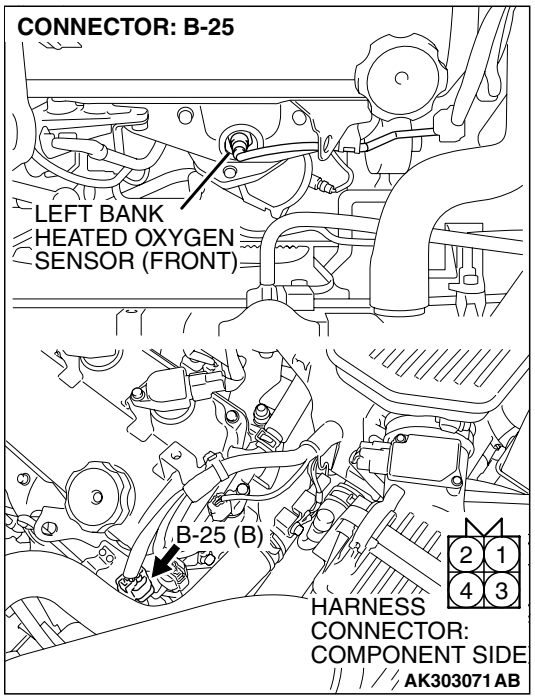
Q: Are there any abnormalities?

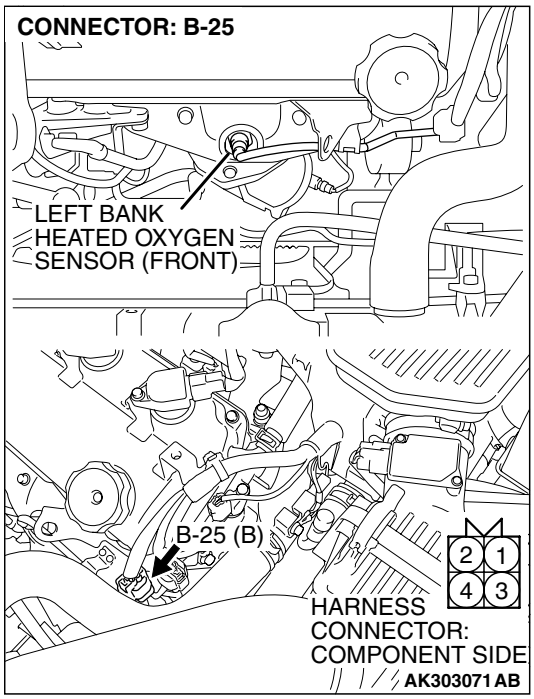
YES : Repair it. Then go to Step 12.
NO : Go to Step 4.

STEP 4. Check harness connector B-25 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 12.

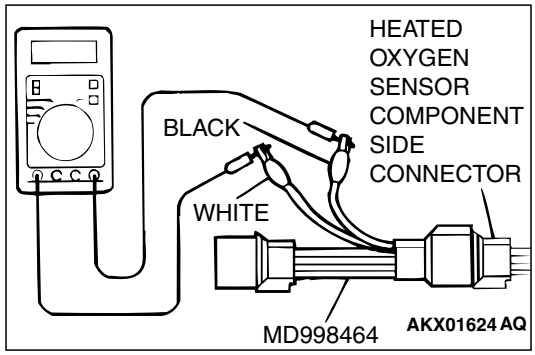




STEP 5. Check the left bank heated oxygen sensor (front).

(1) Disconnect the left bank heated oxygen sensor (front) connector B-25 and connect test harness special tool, MD998464 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

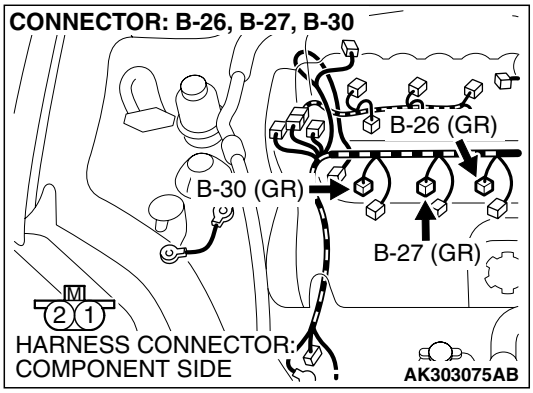
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.**

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 12.



STEP 6. Check harness connector B-27, B-26, B-30 at left bank injector for damage.

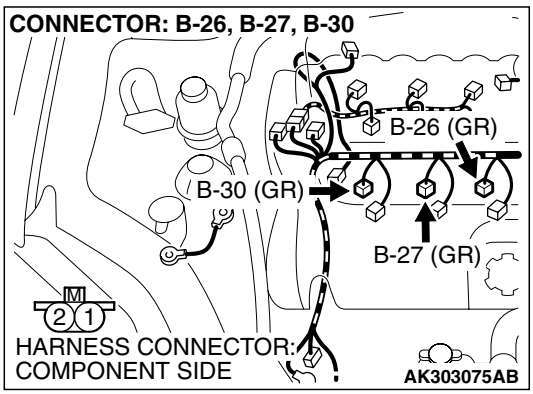
(1) Remove the intake manifold.

(2) Check the left bank injector connector for damage.

Q: Is the harness connector in good condition?

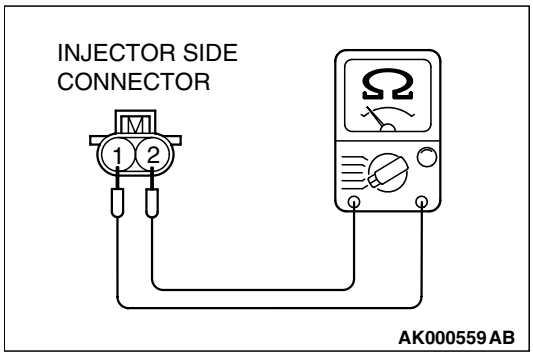
YES : Go to Step 7.

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



STEP 7. Check the left bank injector.

(1) Disconnect each left bank injector connector.



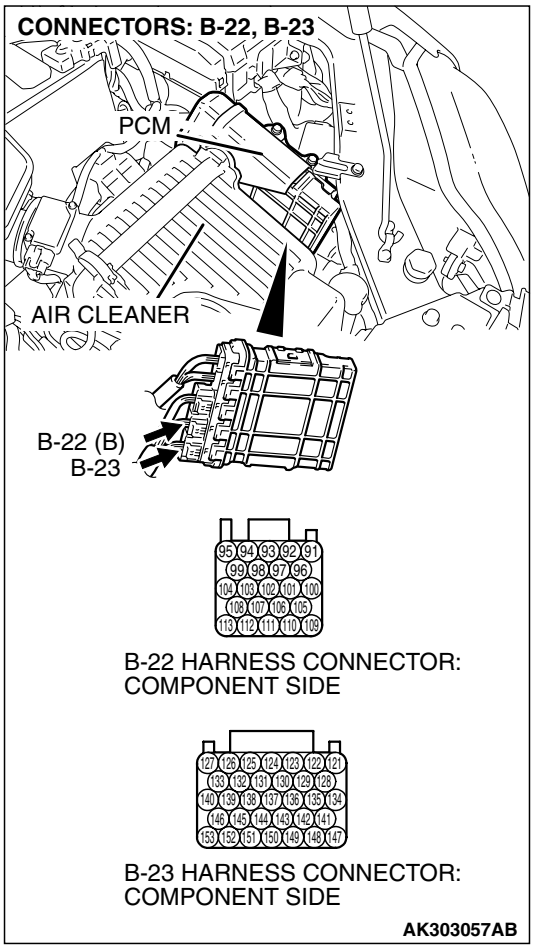
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 10.5 – 13.5 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 10.5 and 13.5 ohms [at 20°C (68°F)]?

YES : Go to Step 8.

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

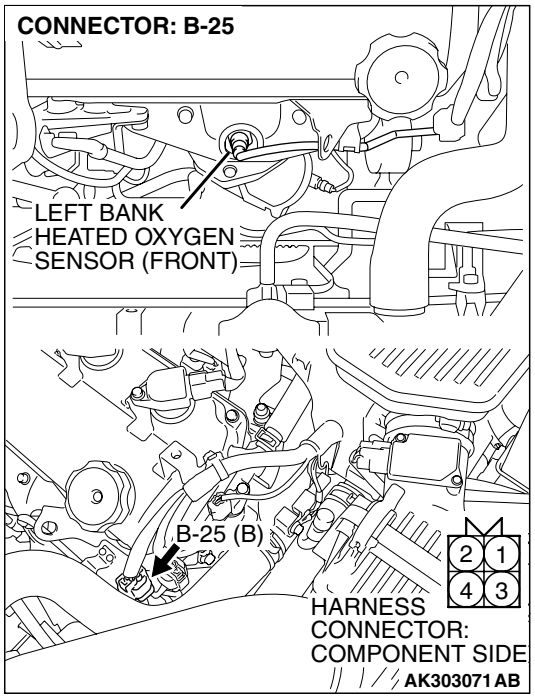


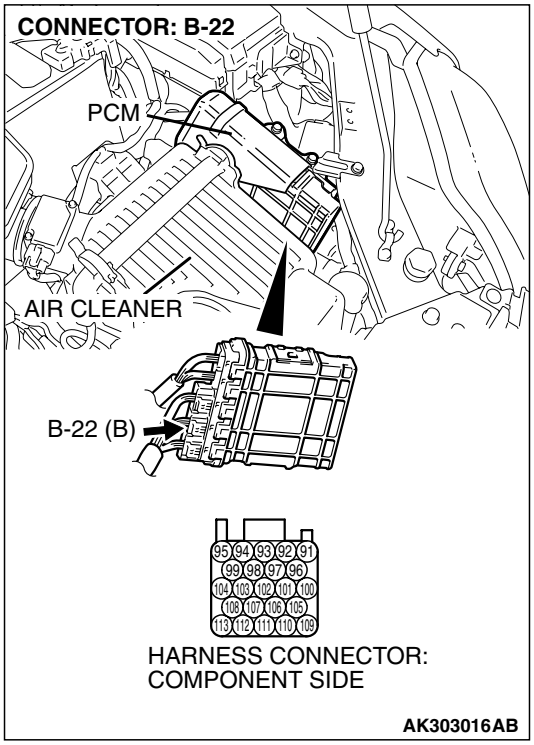
STEP 8. Check harness connector B-22, B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

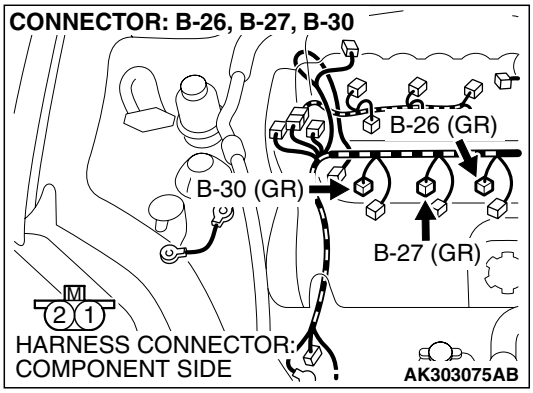
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

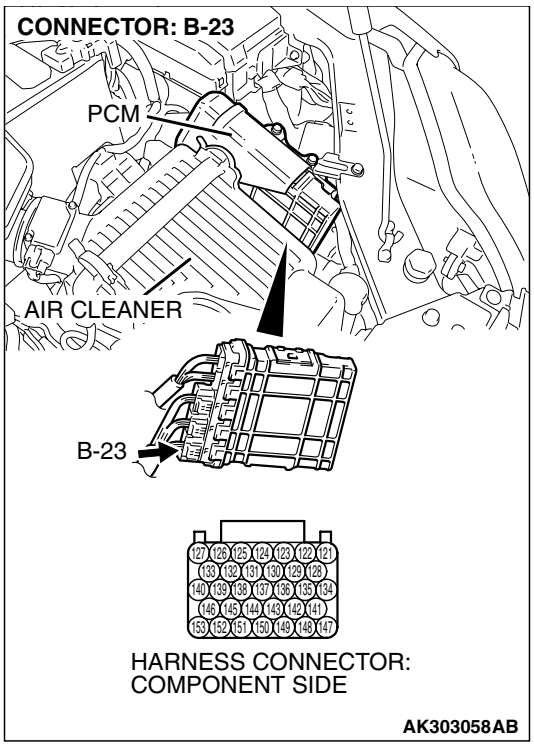




STEP 9. Check for harness damage between left bank heated oxygen sensor (front) connector B-25 (terminal No. 4) and PCM connector B-22 (terminal No. 91).
Q: Is the harness wire in good condition?

YES : Go to Step 10.
NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between left bank injector connector and PCM connector.

a. Check the harness wire between left bank injector connector B-30 (terminal No. 2) and PCM connector B-23 (terminal No. 146) at No. 2 cylinder.
b. Check the harness wire between left bank injector connector B-27 (terminal No. 2) and PCM connector B-23 (terminal No. 139) at No. 4 cylinder.
c. Check the harness wire between left bank injector connector B-26 (terminal No. 2) and PCM connector B-23 (terminal No. 127) at No. 6 cylinder.

Q: Is the harness wire in good condition?

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

STEP 11. Check the fuel pressure.
Refer to On-vehicle Service – Fuel Pressure Test P.13B-1179.

Q: Is the fuel pressure normal?

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

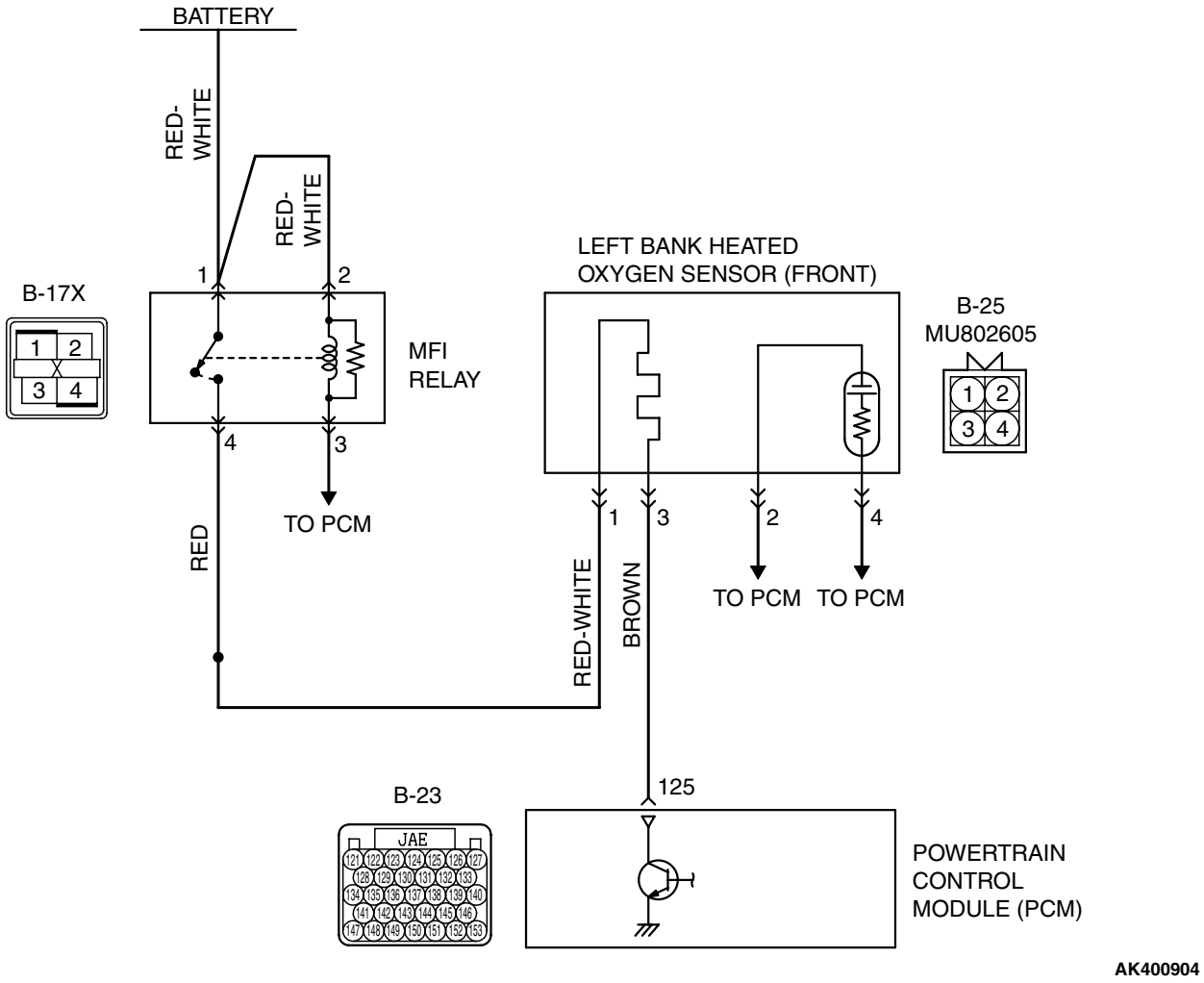
STEP 12. Test the OBD-II drive cycle.
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0154 set?

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

DTC P0155: Heated Oxygen Sensor Heater Circuit (bank 2, sensor 1)

Left Bank Heated Oxygen Sensor (front) Heater Circuit



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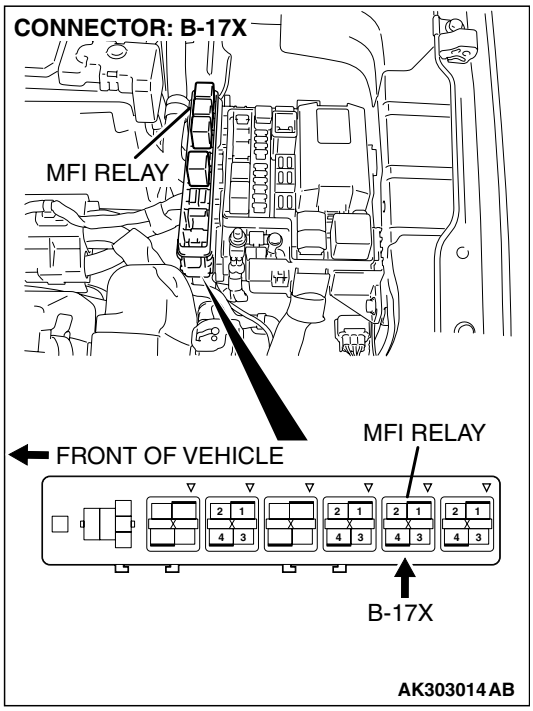
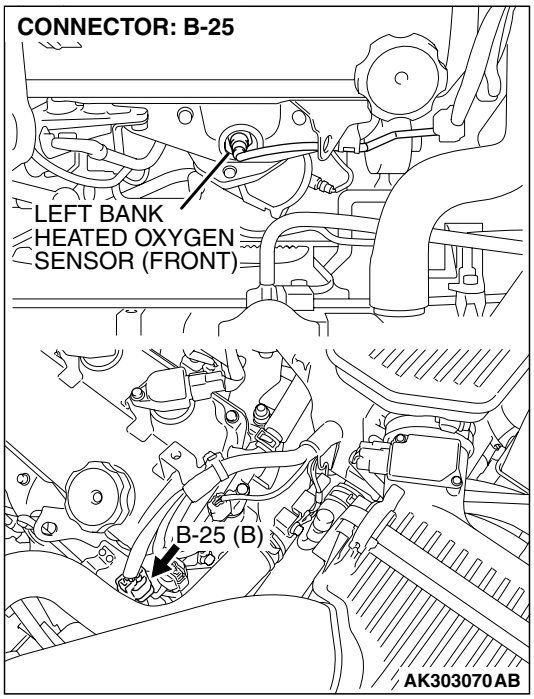
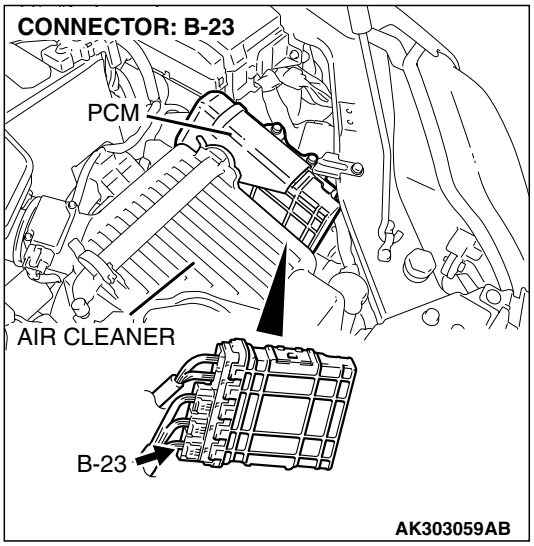






CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the left bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 125) controls continuity to the left bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor heater (front) current is out of specified range when engine coolant temperature is over 20°C (68°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

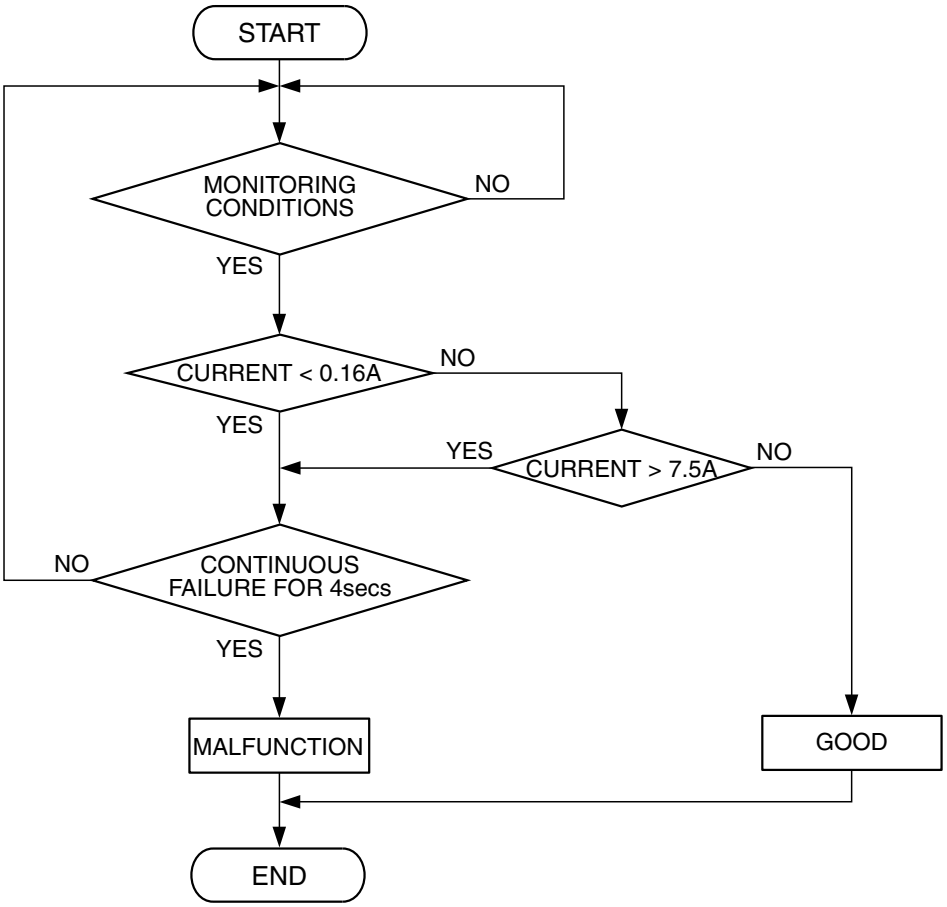
Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

TSB Revision

DTC SET CONDITIONS

Logic Flow Chart



AK302400

Check Conditions

- 60 seconds have elapsed from the start of the previous monitoring.
- Engine coolant temperature is higher than 20°C (68°F).
- While the left bank heated oxygen sensor (front) heater is on.
- Battery positive voltage is at between 11 and 16.5 volts.

Judgment Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.

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

- Open or shorted left bank heated oxygen sensor (front) heater circuit, or harness damage.
- Open circuit in left bank heated oxygen sensor (front) heater.
- Connector damage.
- PCM failed.

TSB Revision

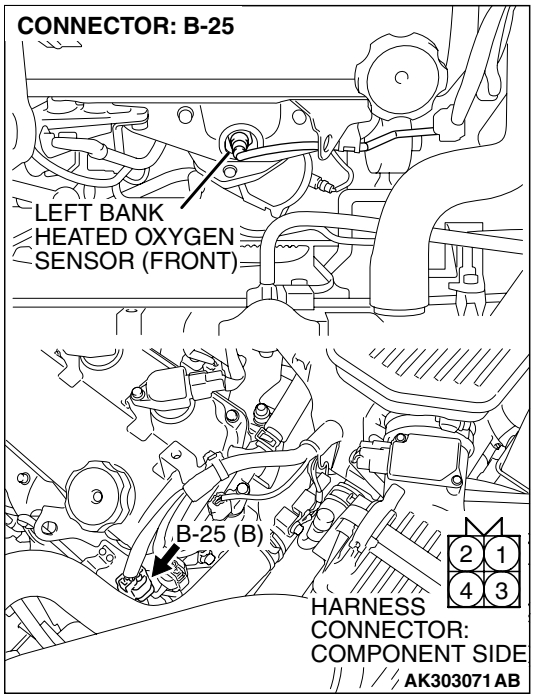
DIAGNOSIS

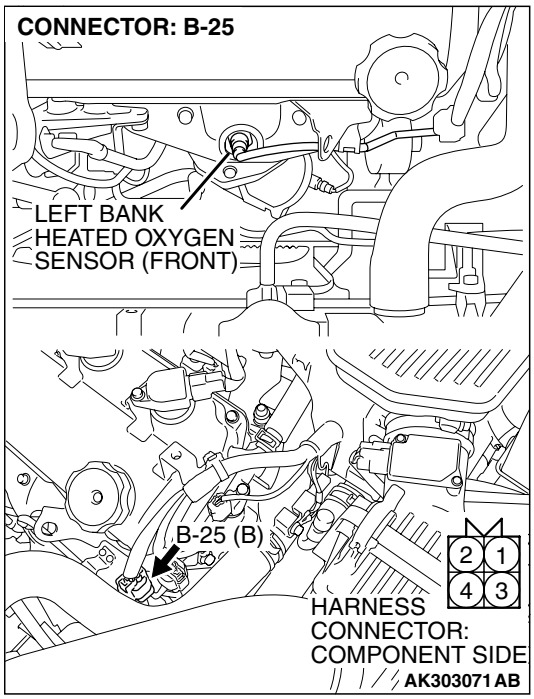
Required Special Tools:

- MD998464: Test Harness
- MB991923: Check Harness

STEP 1. Check harness connector B-25 at the left bank heated oxygen sensor (front) for damage.
Q: Is the harness connector in good condition?

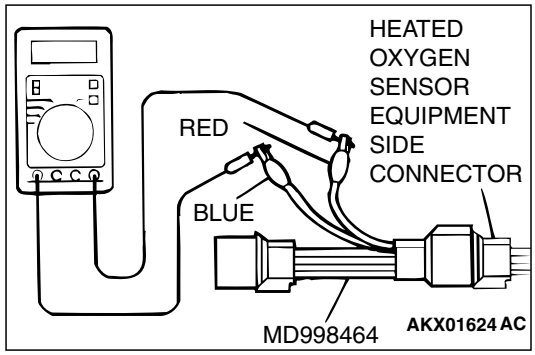
YES : Go to Step 2.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.





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

(1) Disconnect left bank heated oxygen sensor (front) connector B-25 and connect test harness special tool, MD998464, to the connector on the left bank heated oxygen (front) sensor side.



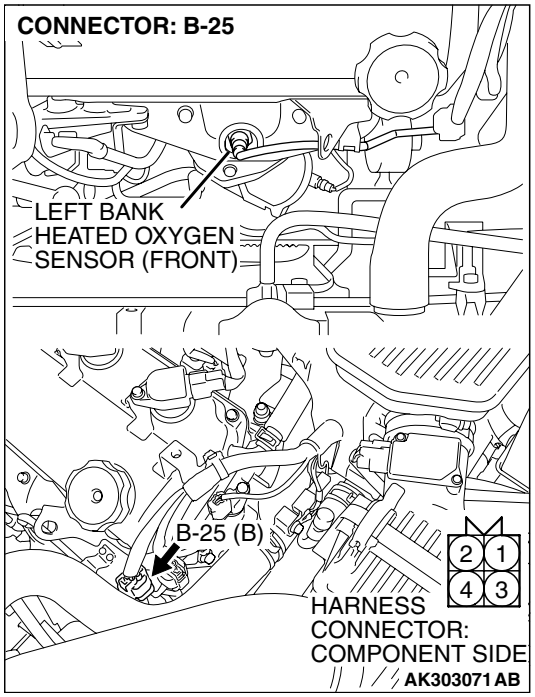
(2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

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

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

YES : Go to Step 3.

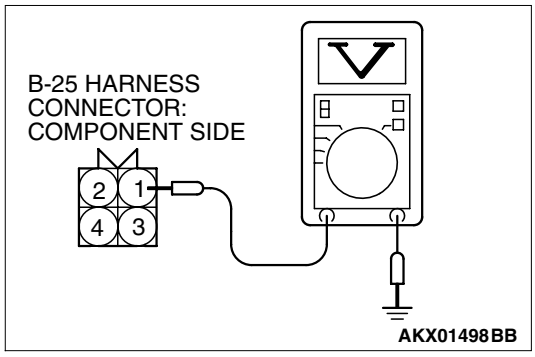
NO : Replace the left bank heated oxygen sensor (front). Then go to Step 12.



STEP 3. Measure the power supply voltage at left bank heated oxygen sensor (front) harness side connector B-25.

(1) Disconnect the connector B-25 and measure at the harness side.

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



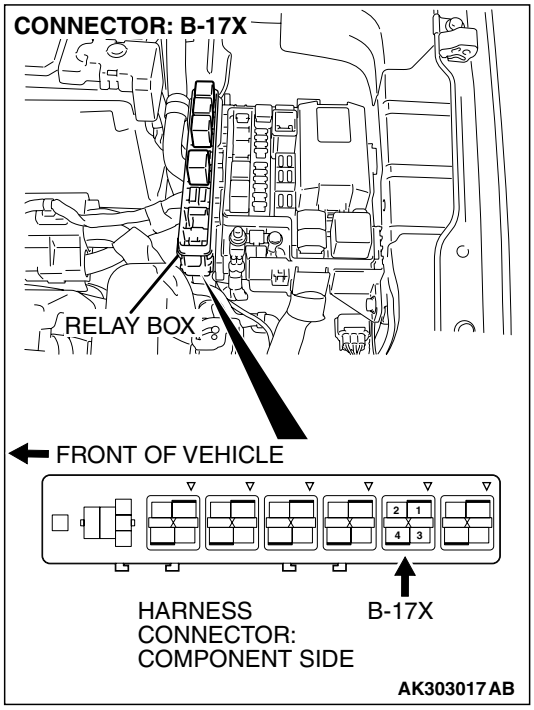
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

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

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

YES : Go to Step 5.

NO : Go to Step 4.

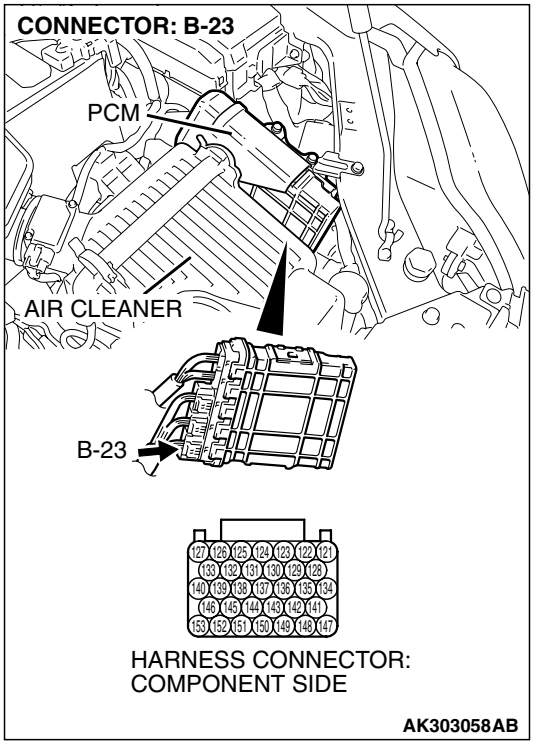


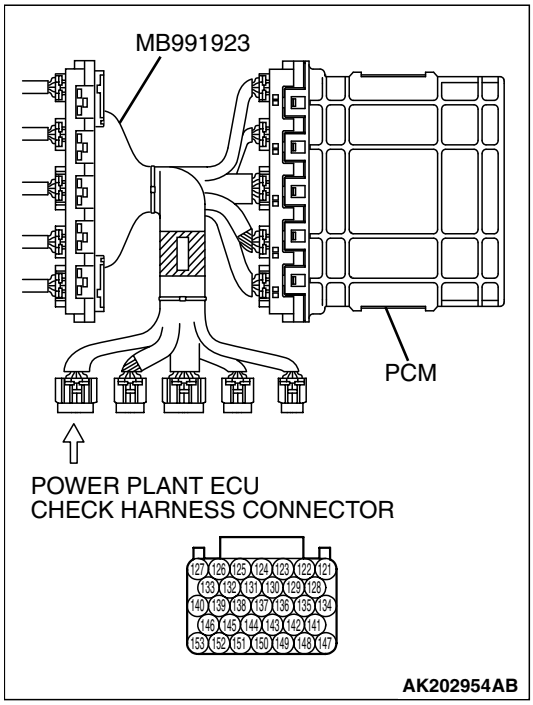
STEP 4. Check harness connector B-17X at the MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (front) connector B-25 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

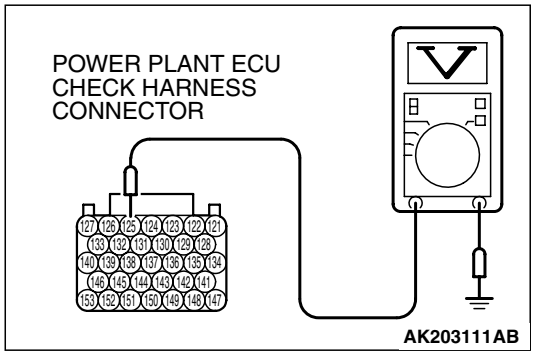




STEP 5. Meaure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect power plant ECU check harness special tool MB991923 between the separated connectors.

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



(3) Measure the voltage between terminal No. 125 and ground.
- Voltage should be battery positive voltage.

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

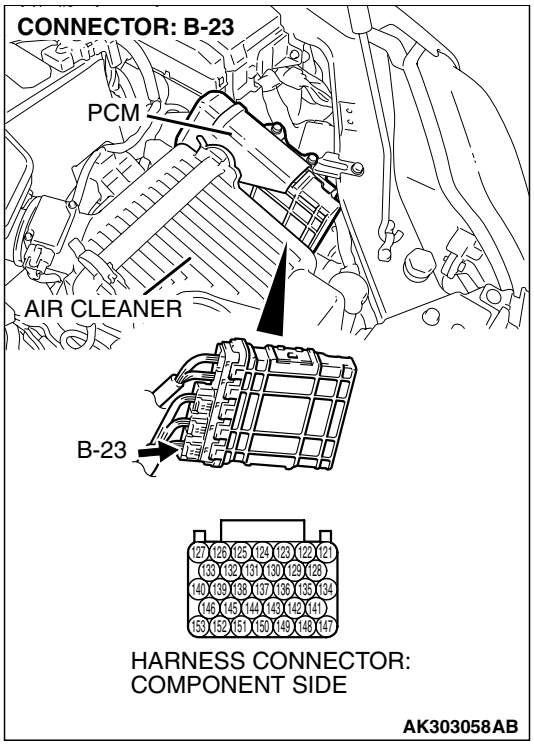
Q: Is battery positive voltage (approximately 12 volts) present?

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

STEP 6. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

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

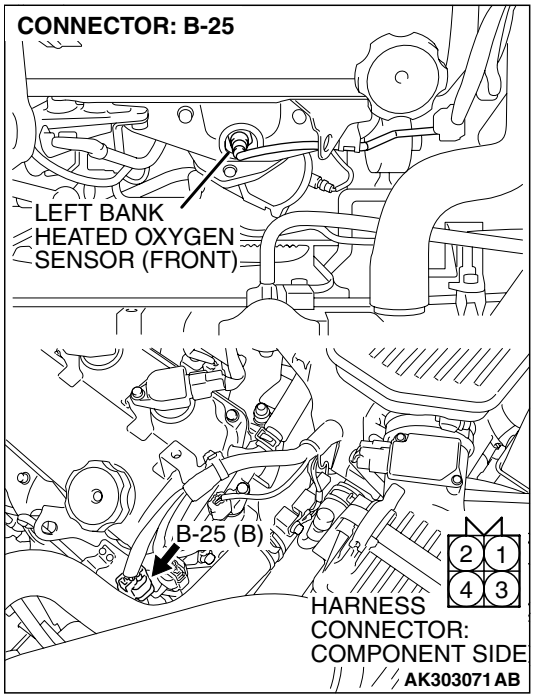


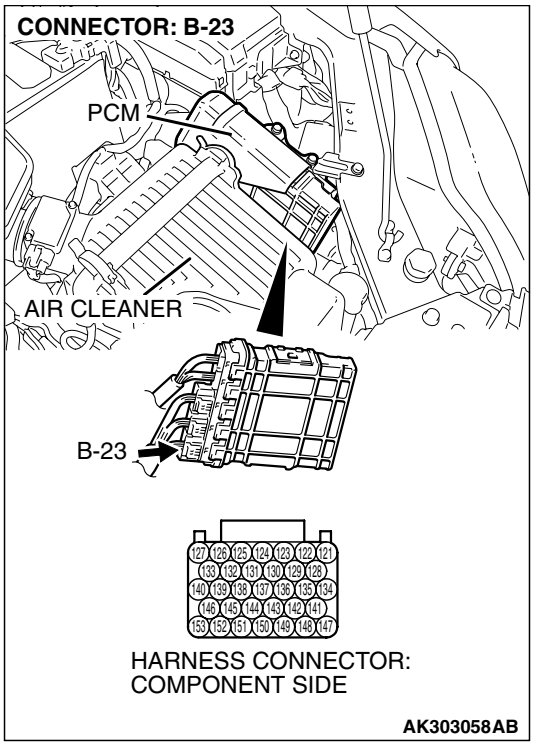
STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (front) connector B-25 (terminal No. 3) and PCM connector B-23 (terminal No. 125).

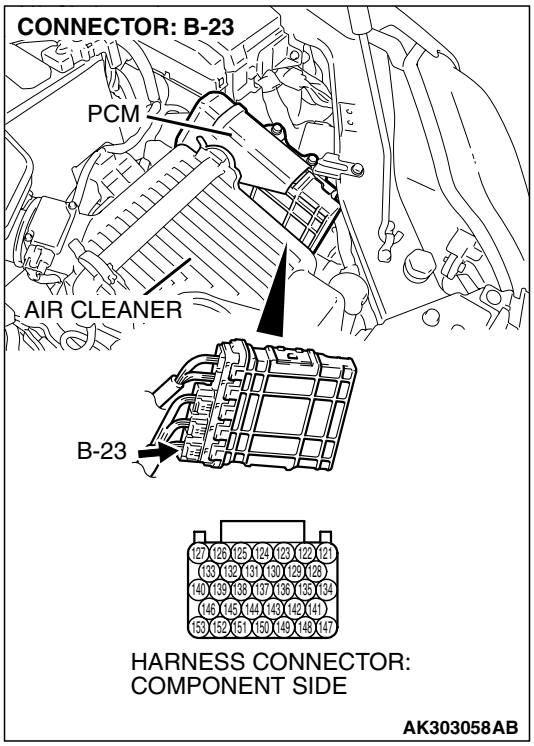
Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 12.





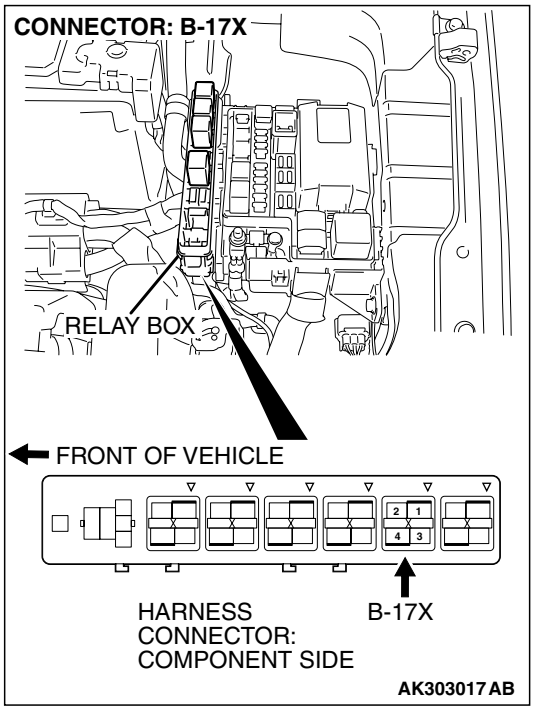


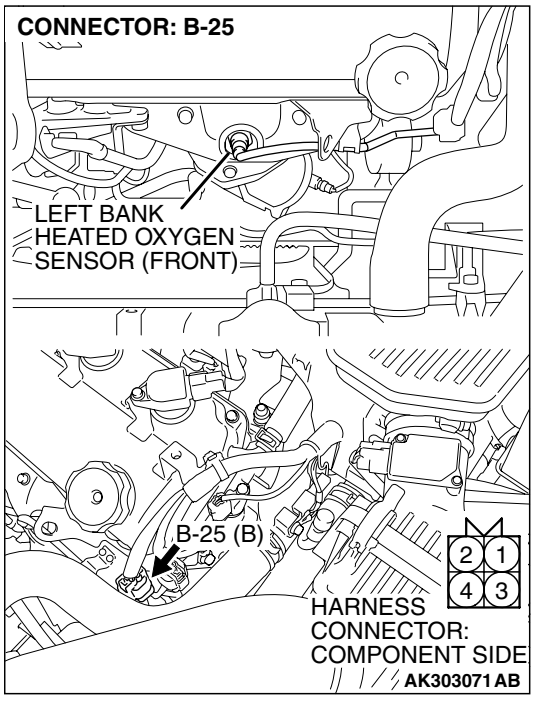
STEP 8. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

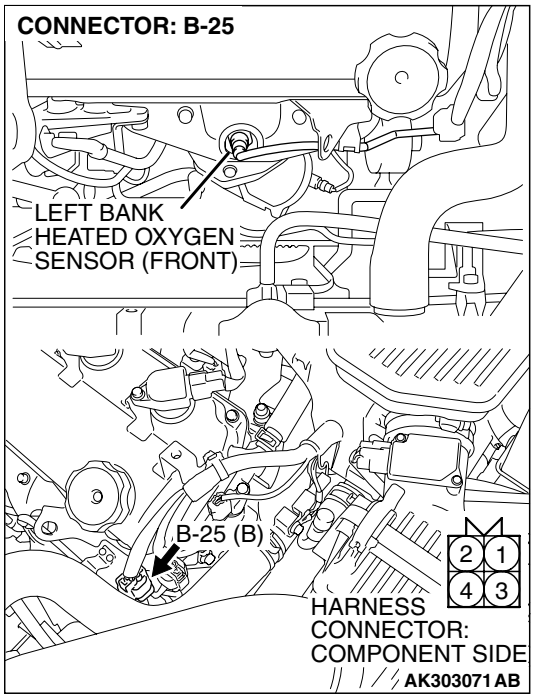
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

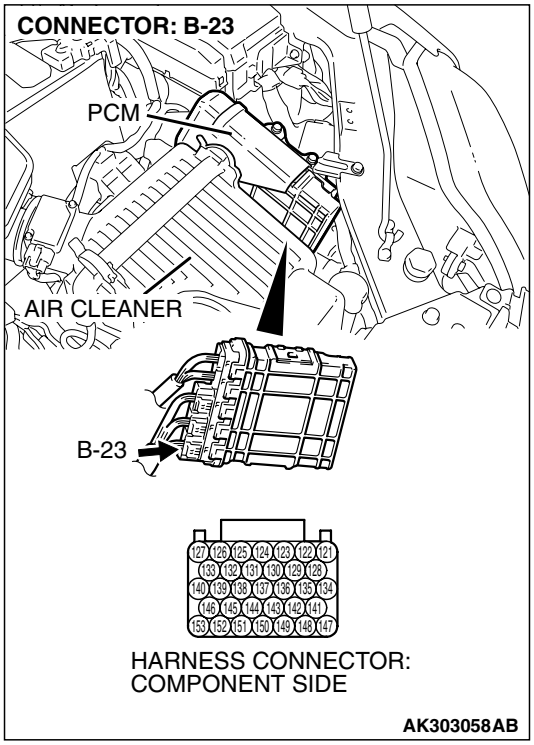




STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (front) connector B-25 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 10.
NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between left bank heated oxygen sensor (front) connector B-25 (terminal No. 3) and PCM connector B-23 (terminal No. 125).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

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

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

Q: Is DTC P0155 set?

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

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14 .

STEP 12. 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 – Procedure 6 – Other Monitor P.13B-6.

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

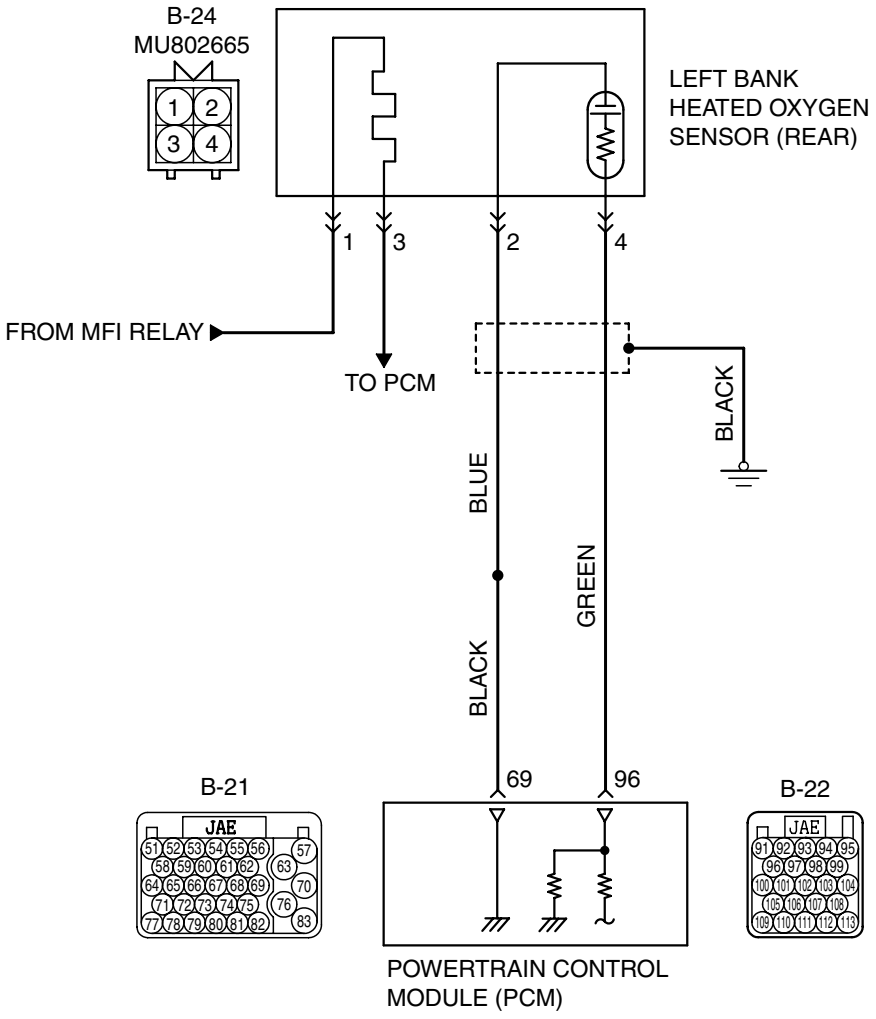
Q: Is DTC P0155 set?

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



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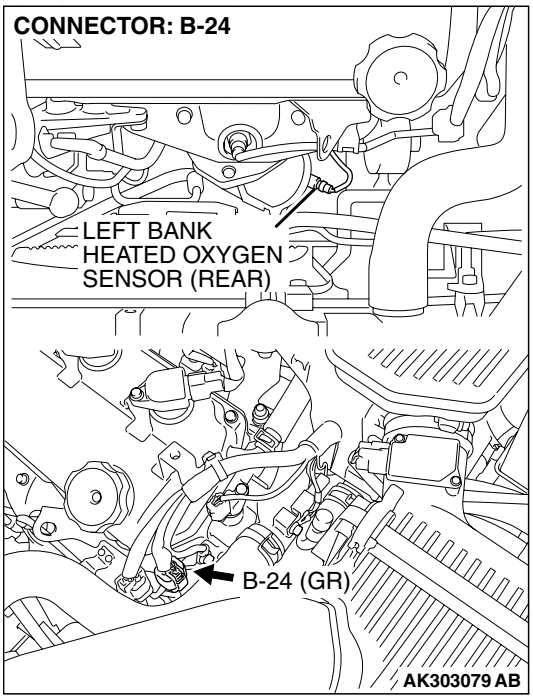
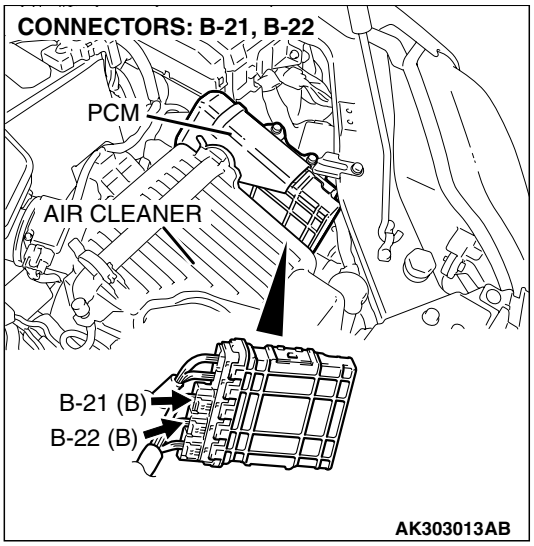




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 96) 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. 69).

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)

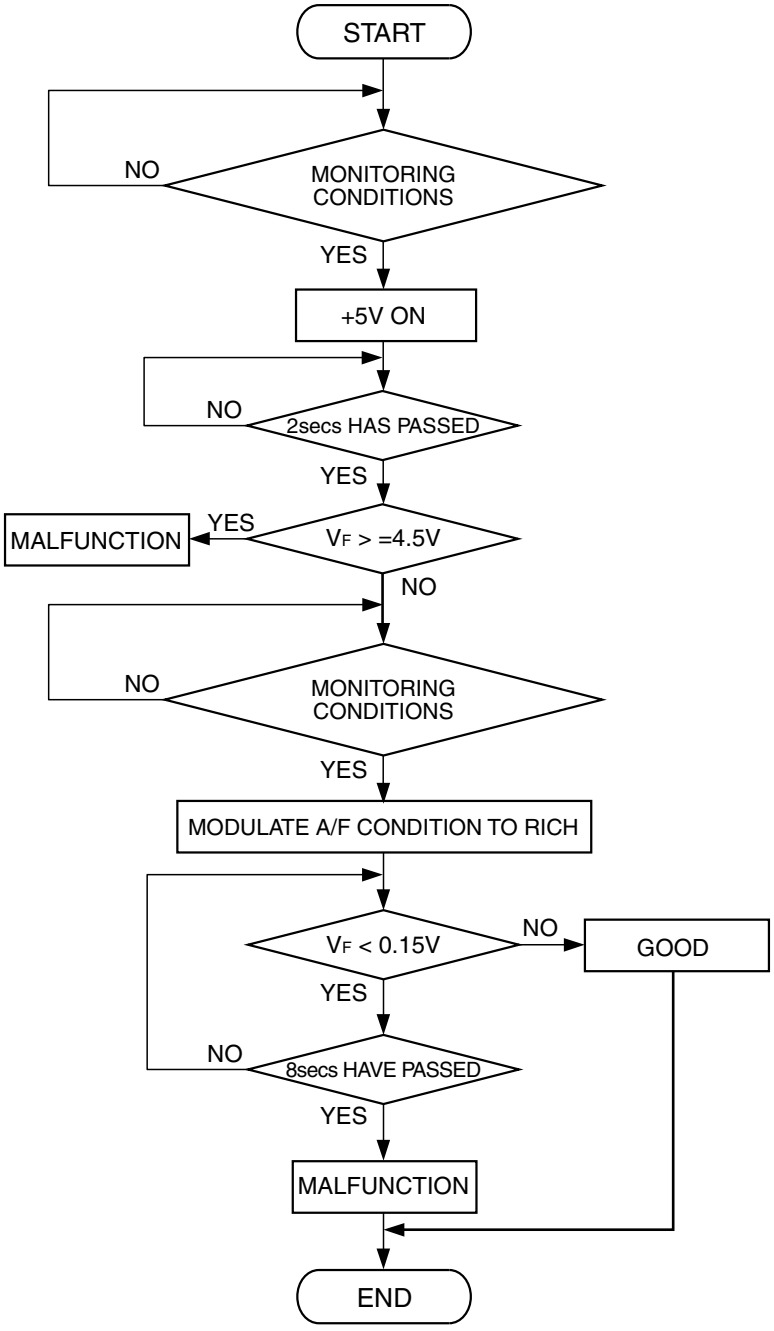
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



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TSB Revision

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.

Judgment Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

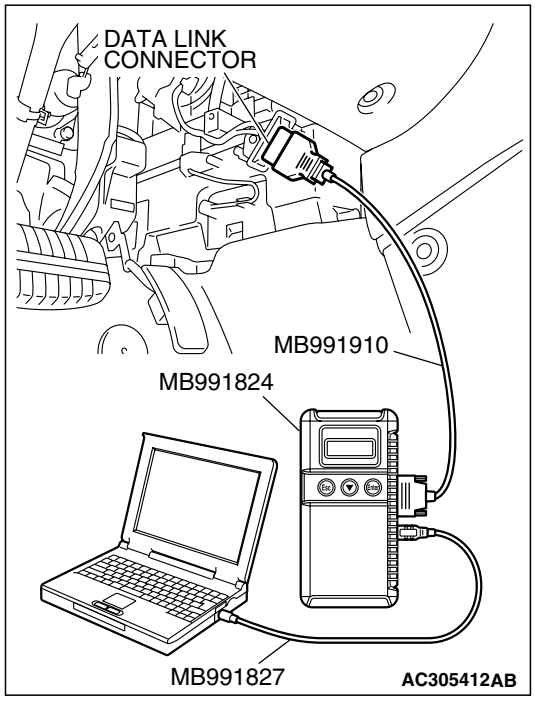
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Harness A
- MB991316: Test Harness
- MB991923: Power Plant ECU Check Harness



STEP 1. Using scan tool MB991958, check data list item 59: Left Bank 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).
  - 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.

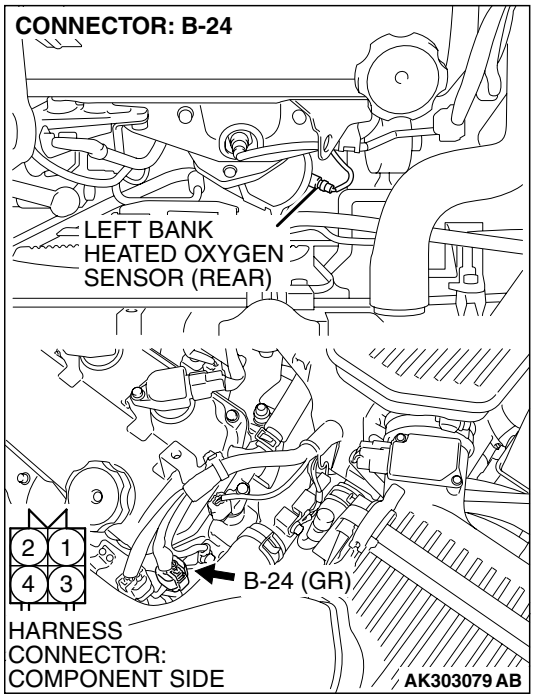
Q: Is the sensor operating properly?

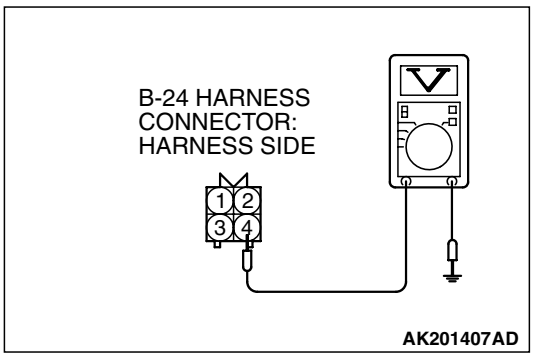
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at left bank heated oxygen sensor (rear) connector B-24 by backprobing.

(1) Do not disconnect the connector B-24.
(2) Start the engine and run at idle.



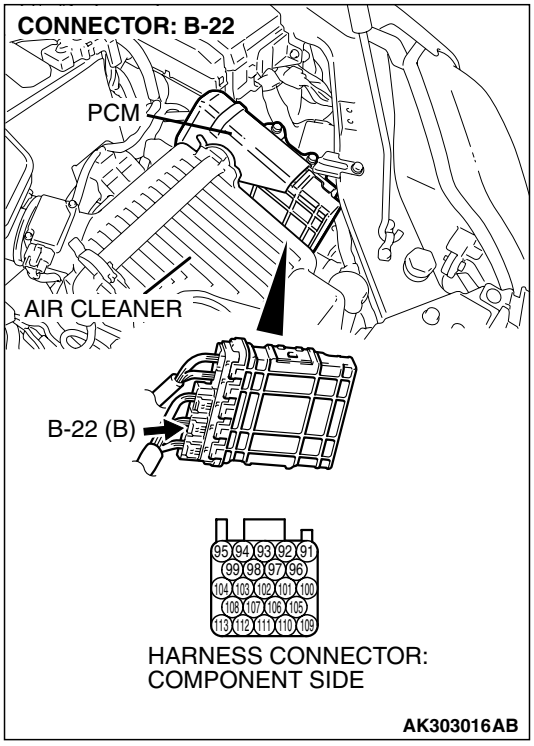


(3) Measure the voltage between terminal No. 4 and ground by backprobing.
- Warming up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

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

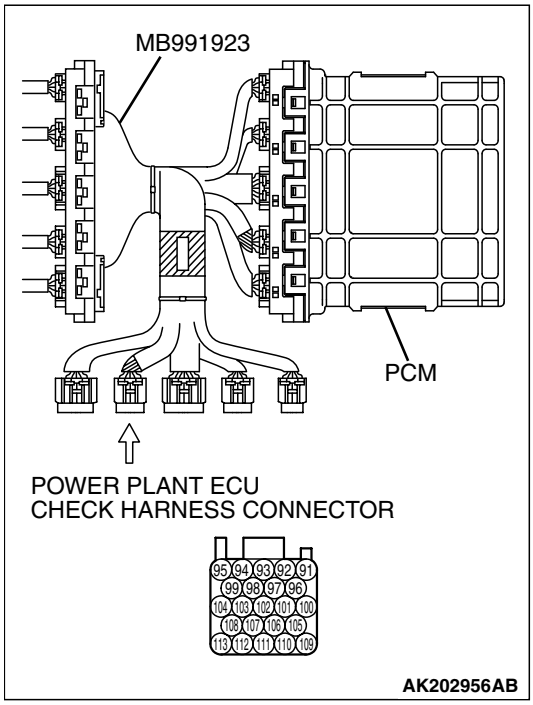
Q: Is the measured voltage within the specified range?

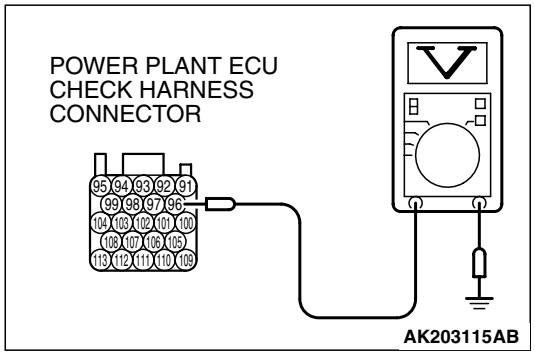
YES : Go to Step 3.
NO : Go to Step 7.



STEP 3. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect power plant ECU check harness special tool MB991923 between the separated connectors.
(2) Start the engine and run at idle.



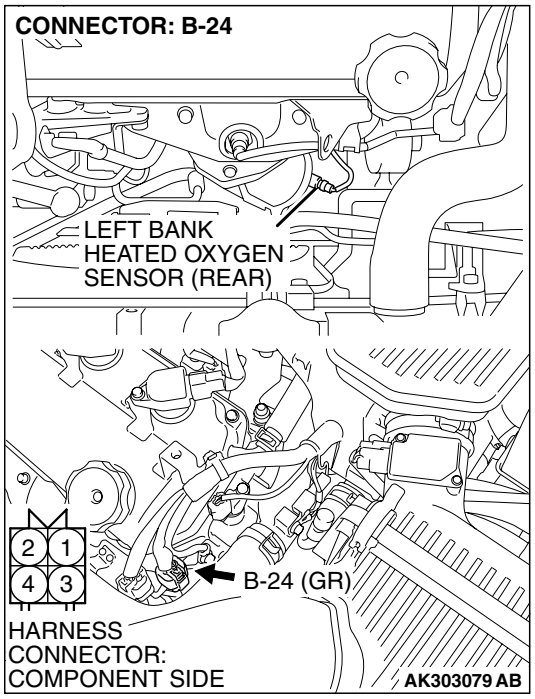


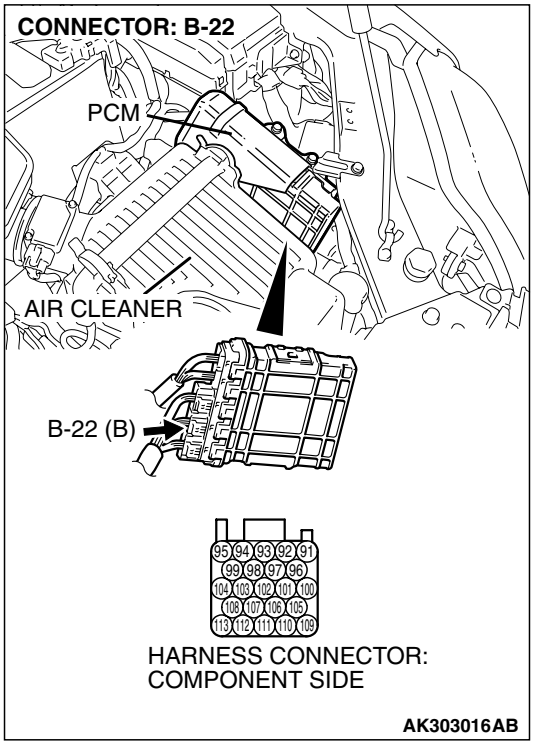
(3) Measure the voltage between terminal No. 96 and ground.
- Warming up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

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

Q: Is the measured voltage within the specified range?

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



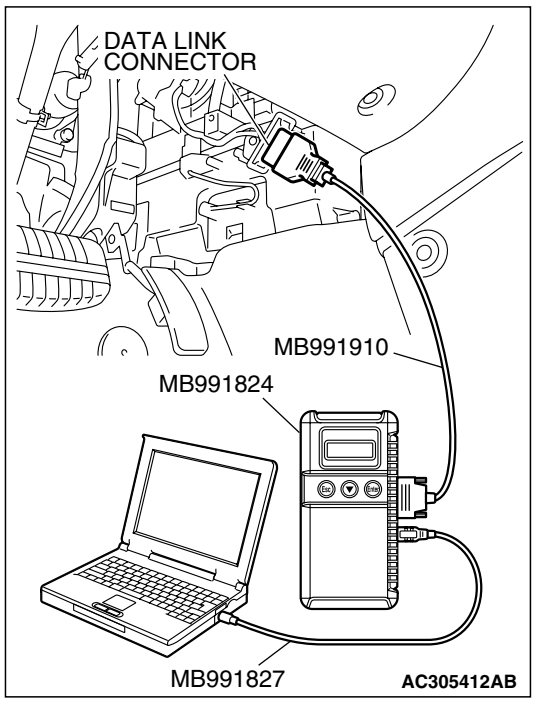


STEP 4. Check harness connector B-24 at left bank heated oxygen sensor (rear) and harness connector B-22 at PCM for damage.

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 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.

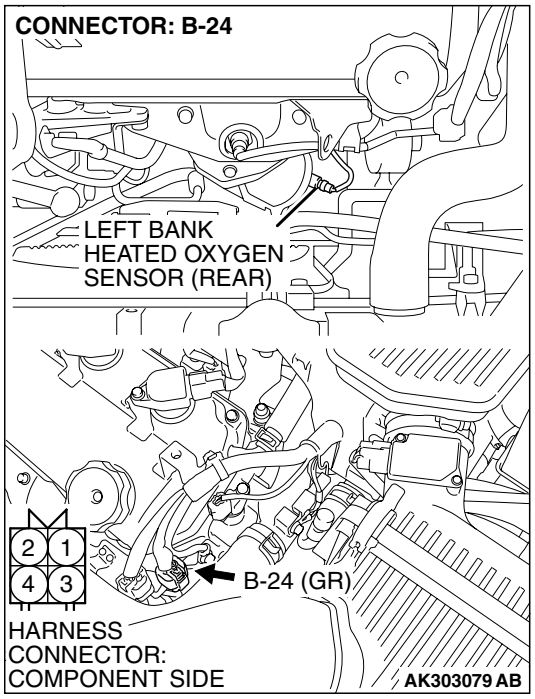
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor Bank 2, Sensor 2 (left rear).
- Warming up the engine. When the engine is revved, the output voltage should repeat 0 volt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

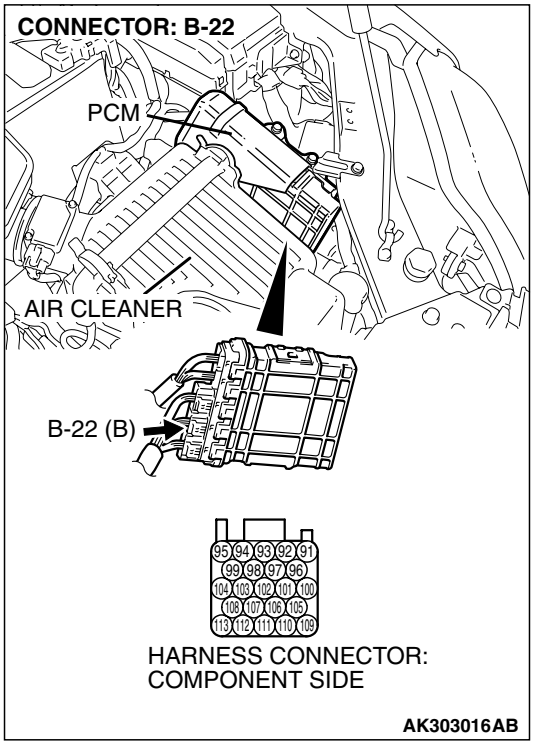
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the 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.00-14.

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



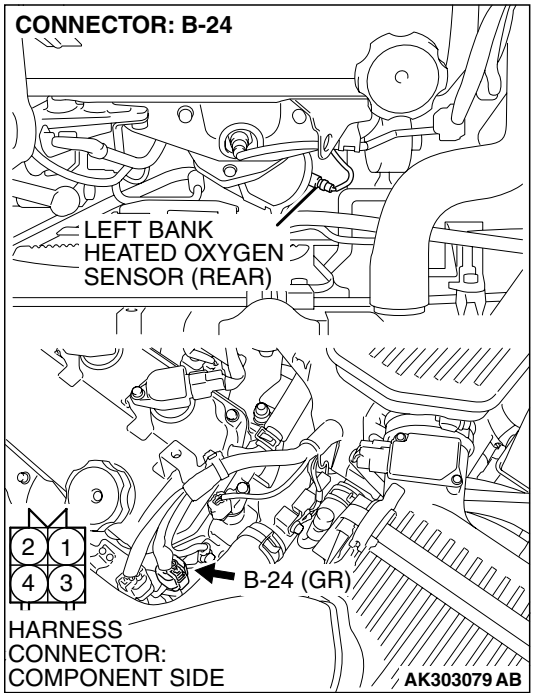


STEP 6. Check harness connector B-24 at left bank heated oxygen sensor (rear) and harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 4) and PCM connector B-22 (terminal No. 96) 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.

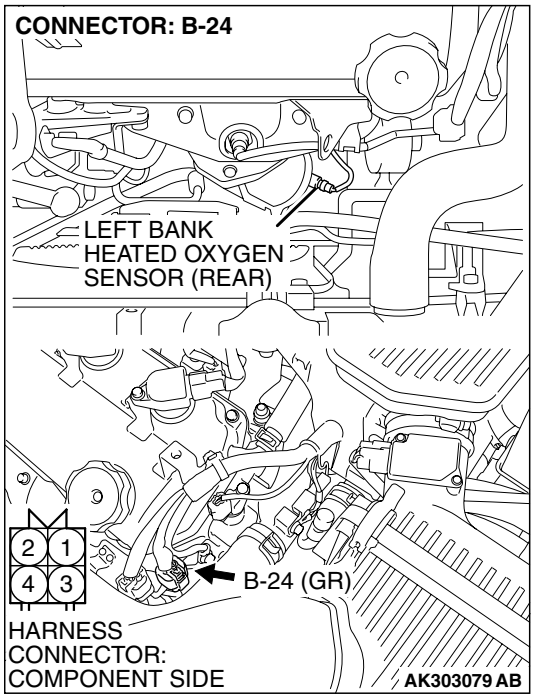


STEP 7. Check harness connector B-24 at left bank heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

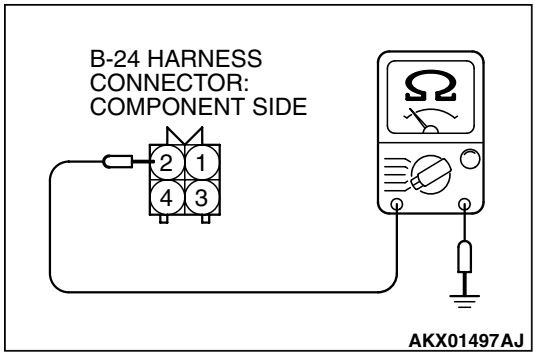
YES : Go to Step 8.

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 B-24.

(1) Disconnect the connector B-24 and measure at the harness side.



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

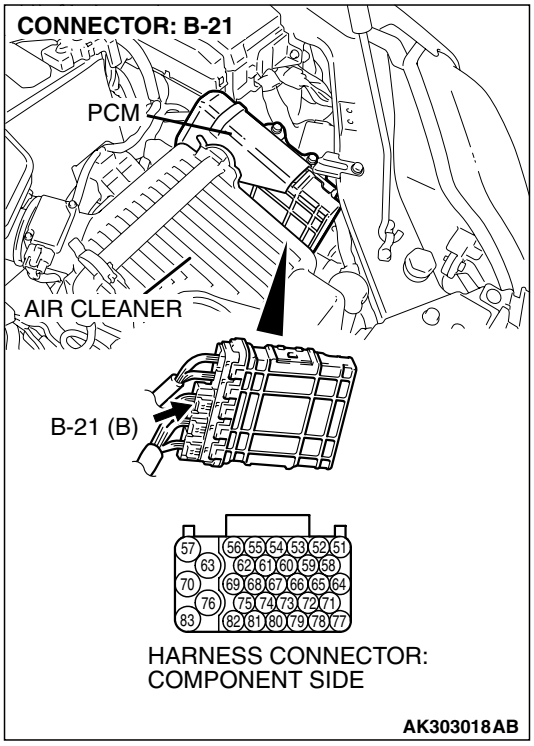
Q: Does continuity exist?

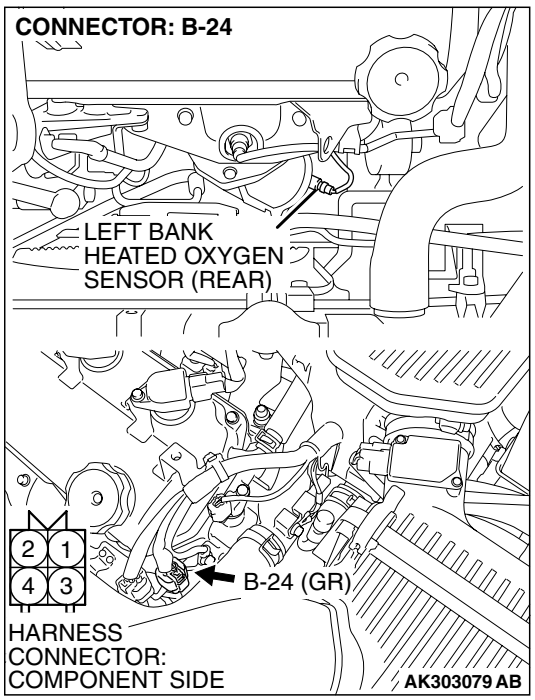
YES : Go to Step 11.
NO : Go to Step 9.

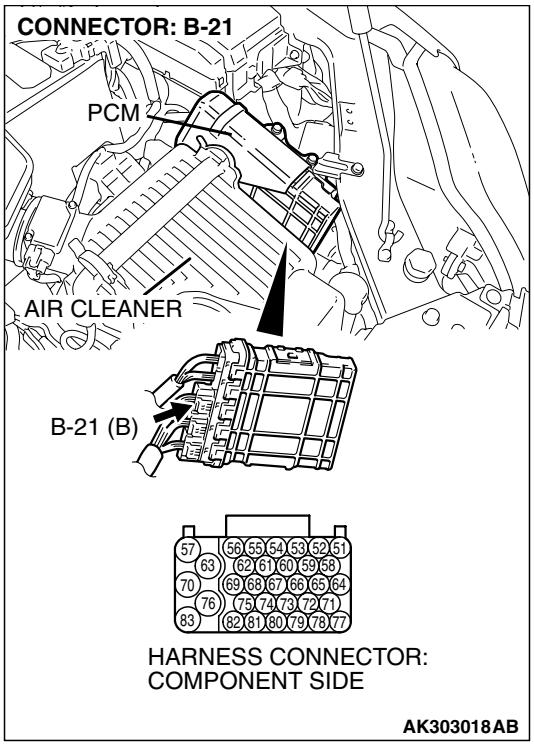
STEP 9. Check harness connector B-21 at PCM for damage.

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.





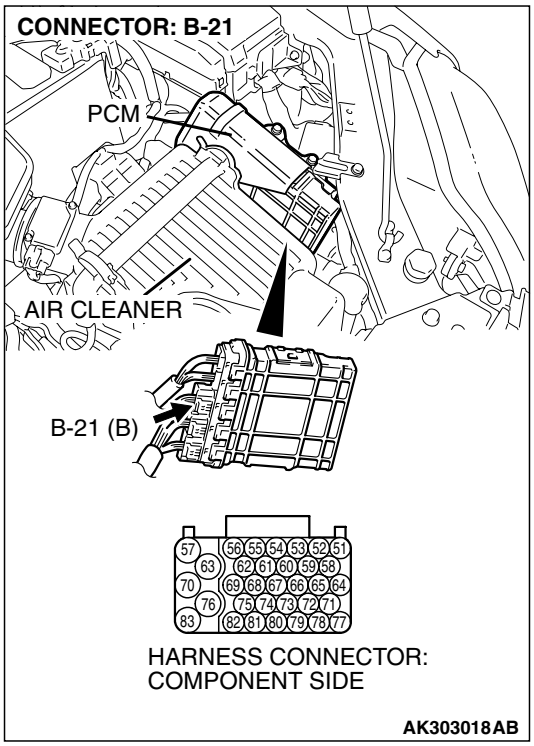


STEP 10. Check for open circuit and harness damage between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

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.

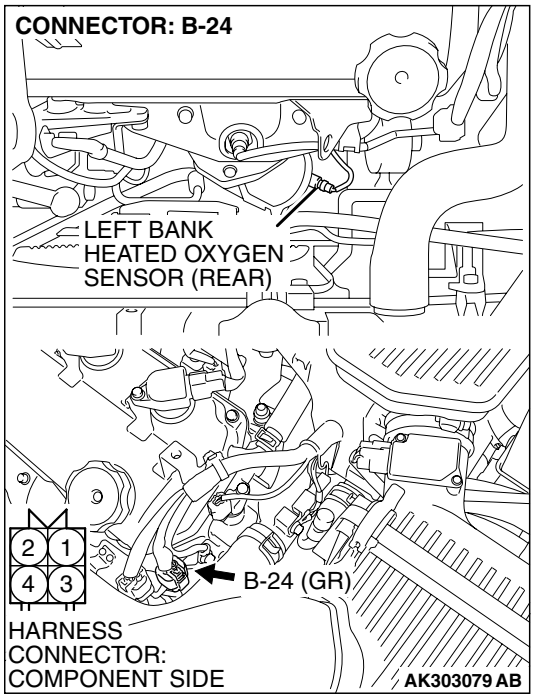


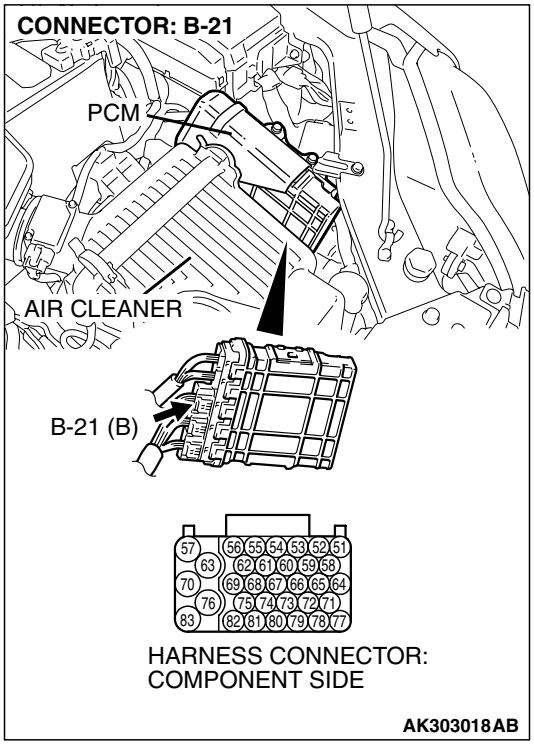
STEP 11. Check harness connector B-21 at PCM for damage.

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.



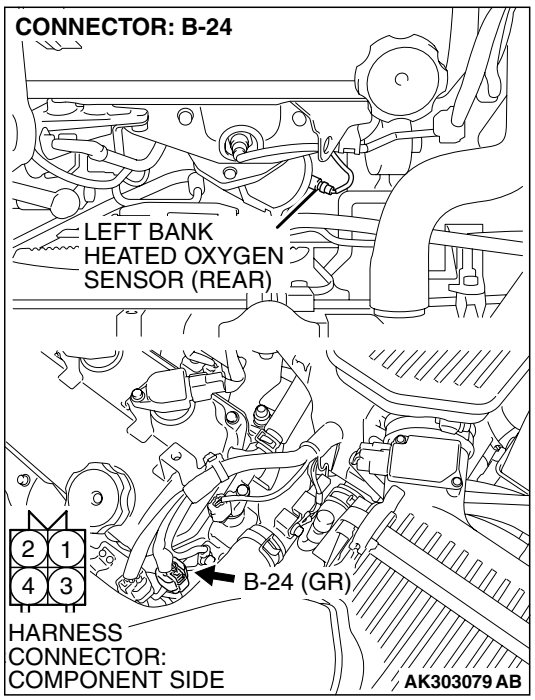


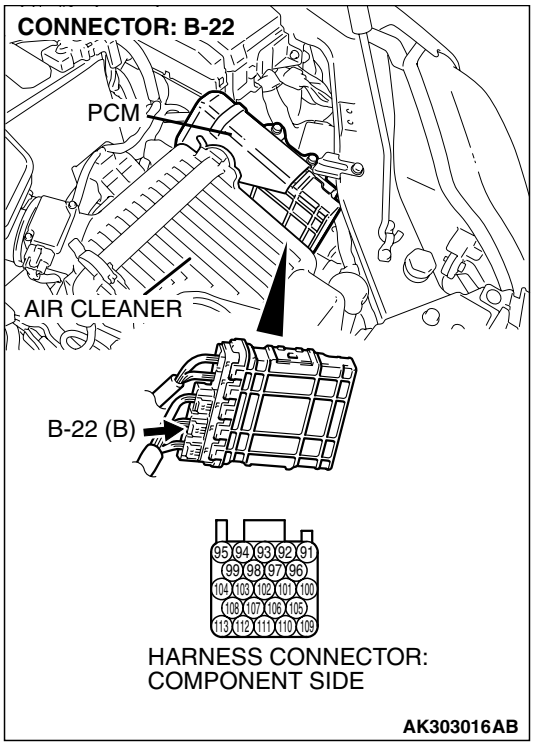
STEP 12. Check for harness damage between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 15.



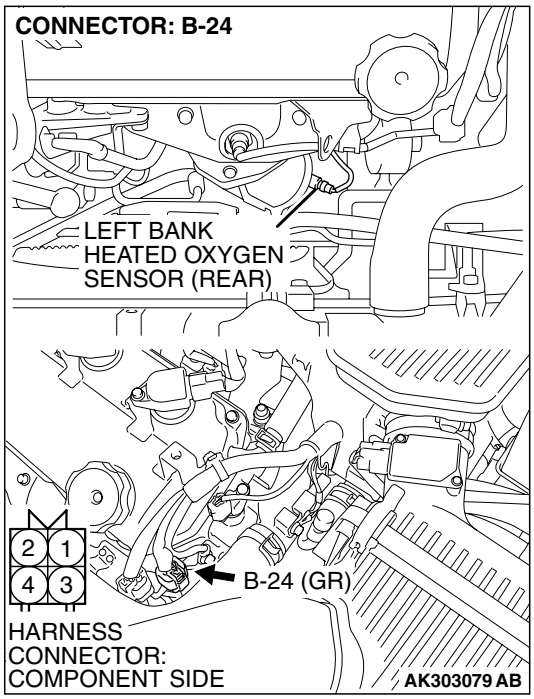


STEP 13. Check for short circuit to ground and harness damage between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 4) and PCM connector B-22 (terminal No. 96).

Q: Is the harness wire in good condition?

YES : Go to Step 14.

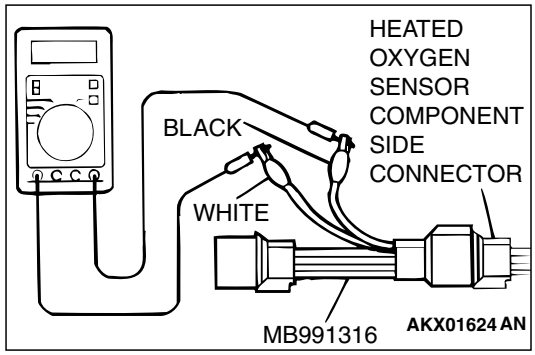
NO : Repair it. Then go to Step 15.



STEP 14. Check the left bank heated oxygen sensor (rear).

(1) Disconnect the left bank heated oxygen sensor (rear) connector B-24 and connect test harness special tool, MB991316, 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) 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 (rear) 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 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 – Procedure 6 – Other Monitor P.13B-6.

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

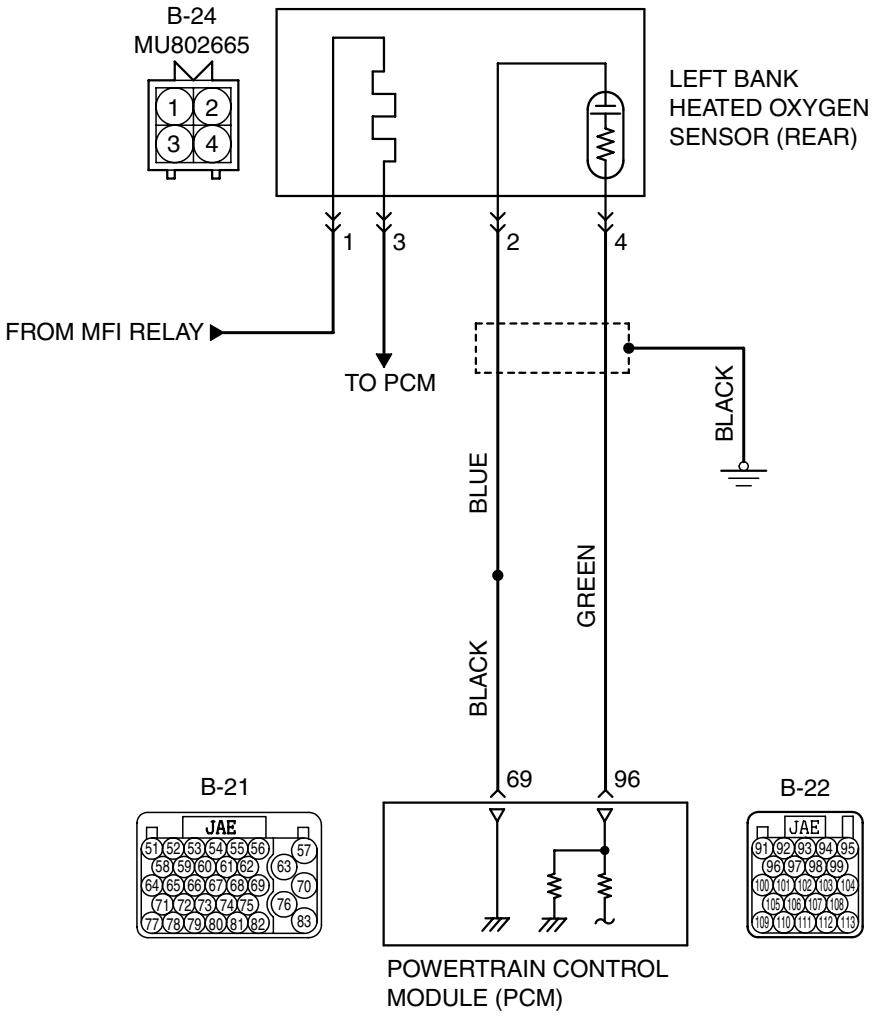
Q: Is DTC P0156 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

Left Bank Heated Oxygen Sensor (rear) Circuit



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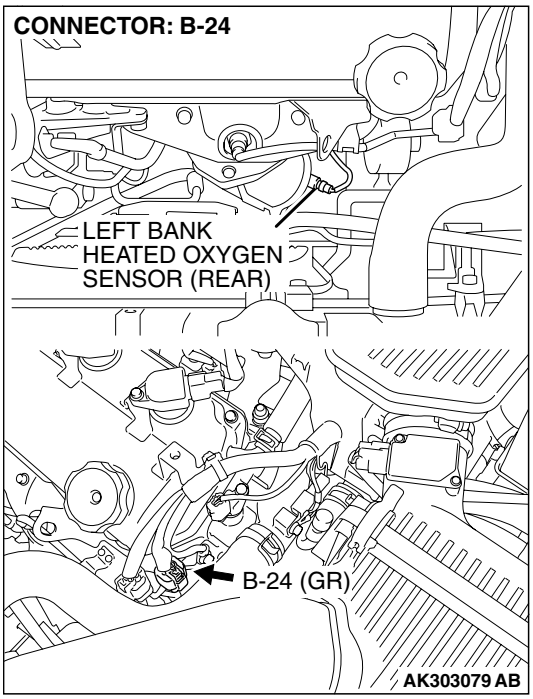
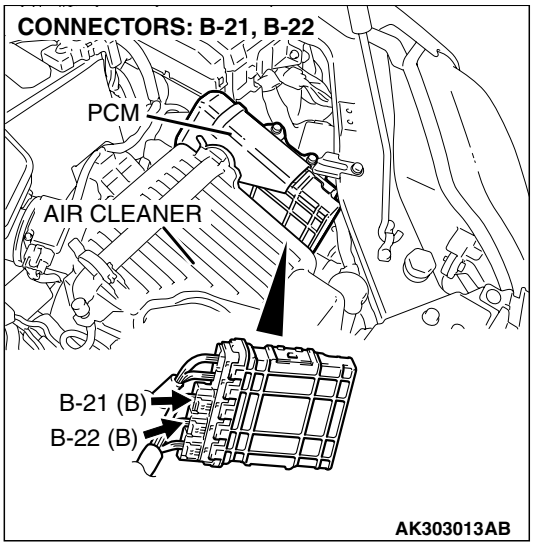




CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 96) 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. 69).

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)

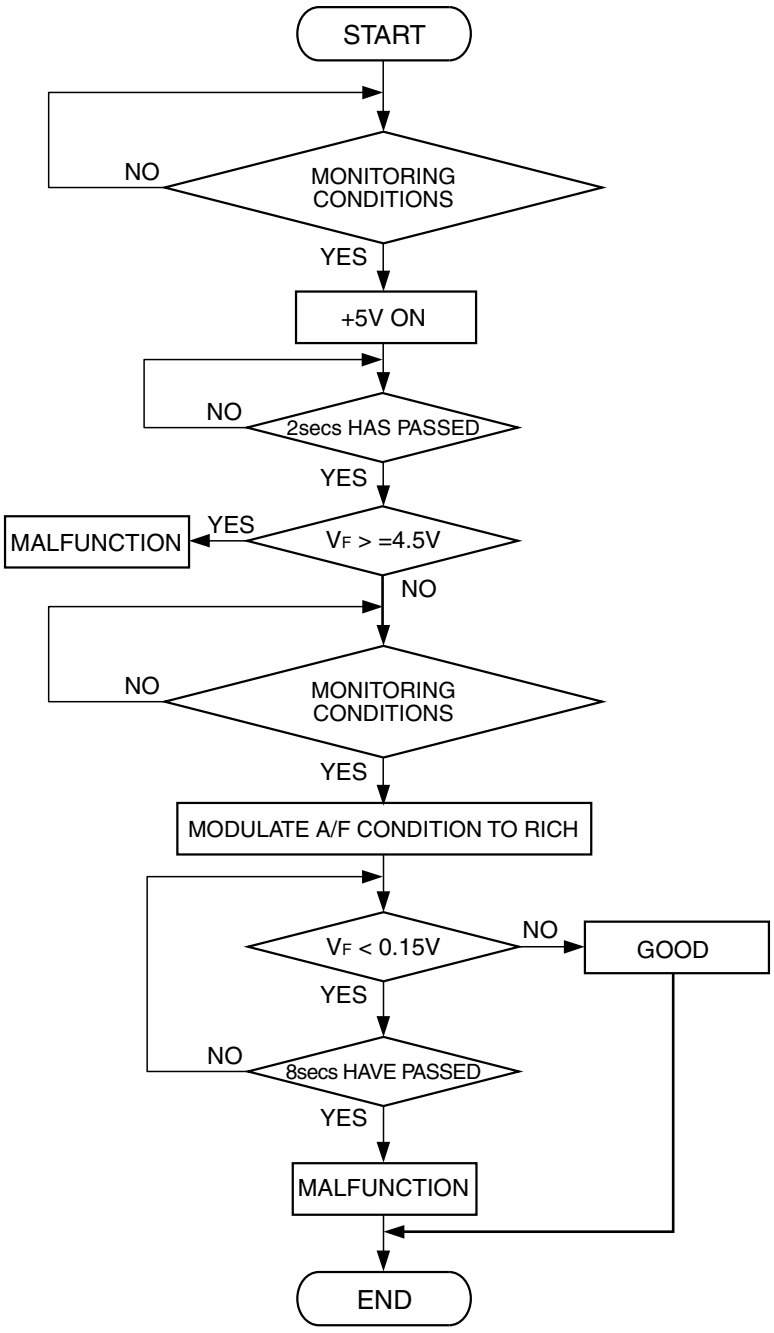
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK401414

TSB Revision

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).
- Mass airflow sensor output is 8 g/sec or more.
- At least 20 seconds have passed since fuel shut off control was canceled.
- Monitoring time: 8 seconds.

Judgement Criteria

- Making the air/fuel ratio 15 percent for 8 seconds richer 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 – Procedure 6 – Other Monitor P.13B-6.

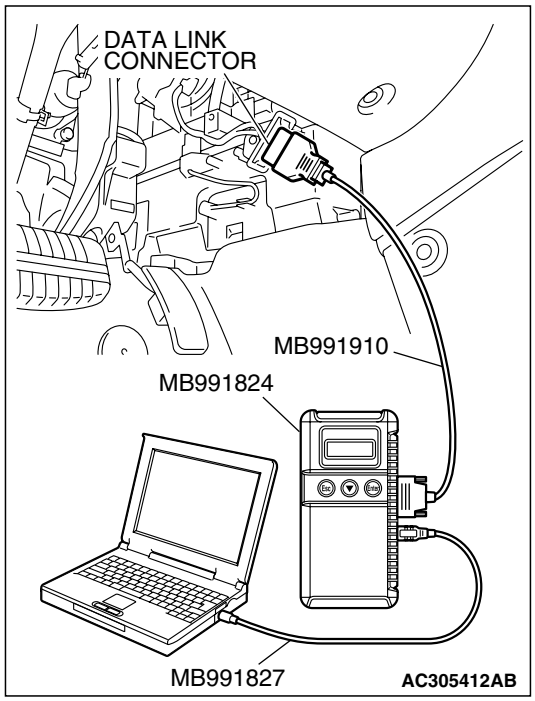
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Harness A
- MB991316: Test Harness



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

⚠ CAUTION

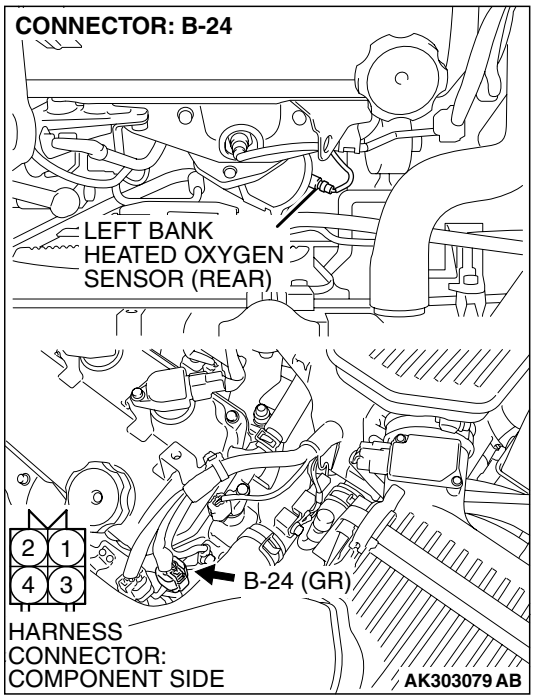
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(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).
  - 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 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.00-14.

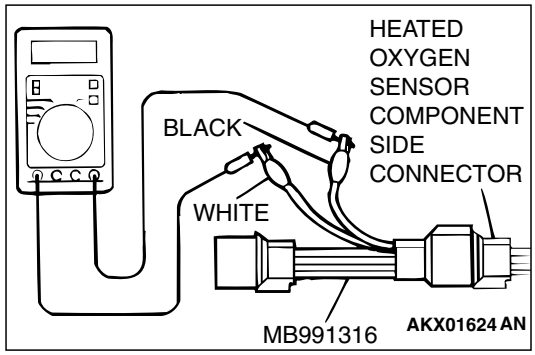
NO : Go to Step 2.



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

(1) Disconnect the left bank heated oxygen sensor (rear) connector B-24 and connect test harness special tool, MB991316, to the connector on the left bank heated oxygen sensor (rear) side.

(2) Warm up the engine until engine coolant temperture 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 heated oxygen sensor (rear) output voltage.

Standard value: 0.6 – 1.0 volt

⚠ CAUTION

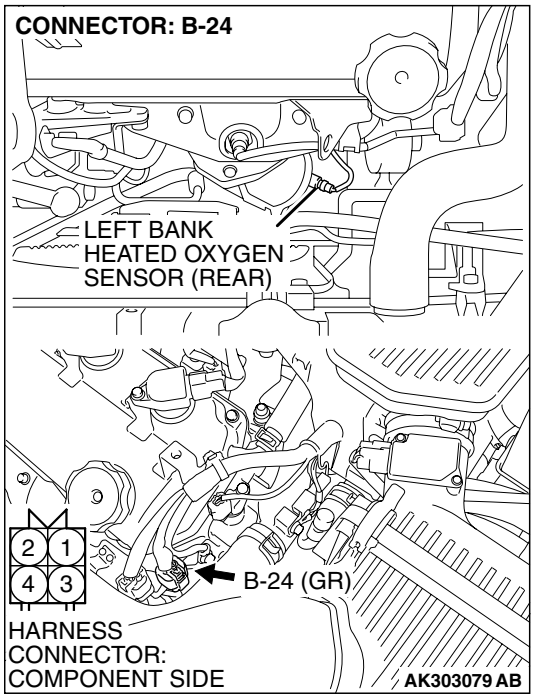
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.**

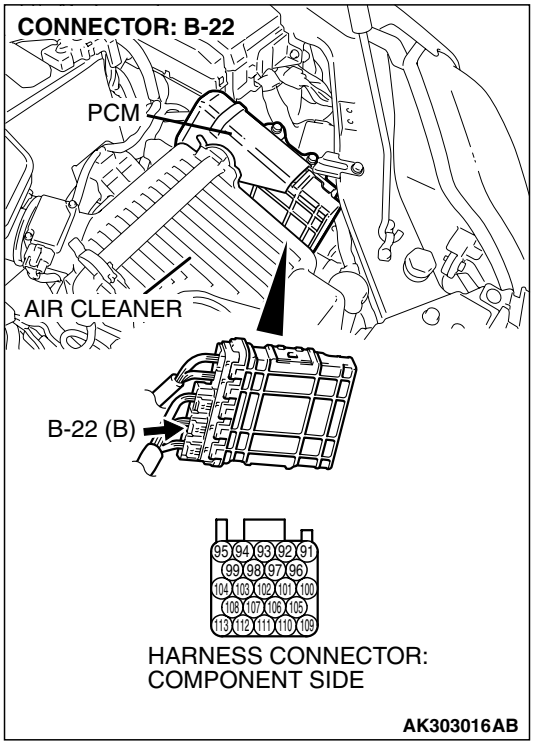
NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (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 (rear). Then go to Step 5.



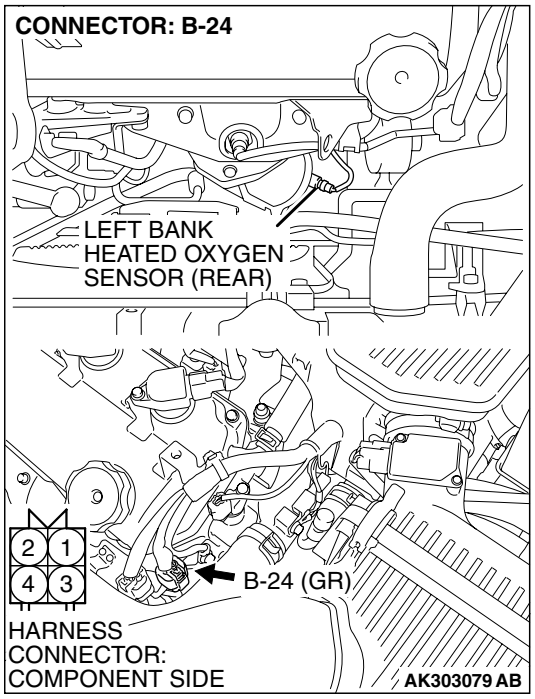


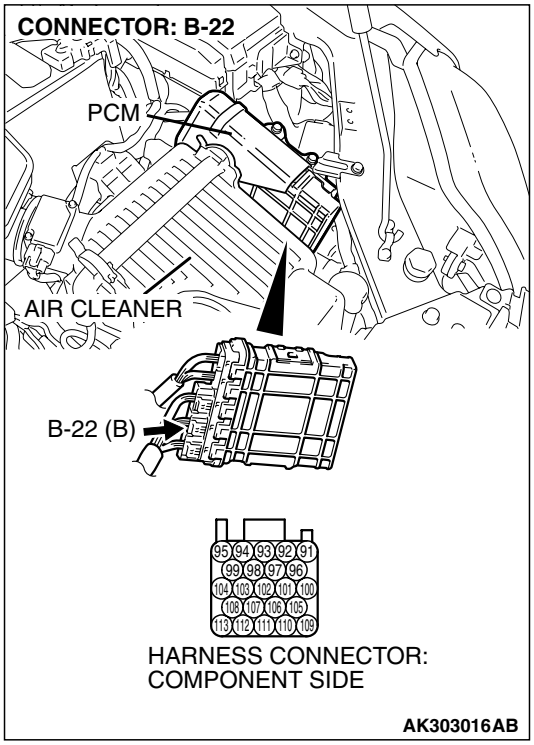
STEP 3. Check harness connector B-24 at left bank heated oxygen sensor (rear) and harness connector B-22 at PCM for damage.

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 B-24 (terminal No. 4) and PCM connector B-22 (terminal No. 96).
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 – Procedure 6 – Other Monitor P.13B-6.

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

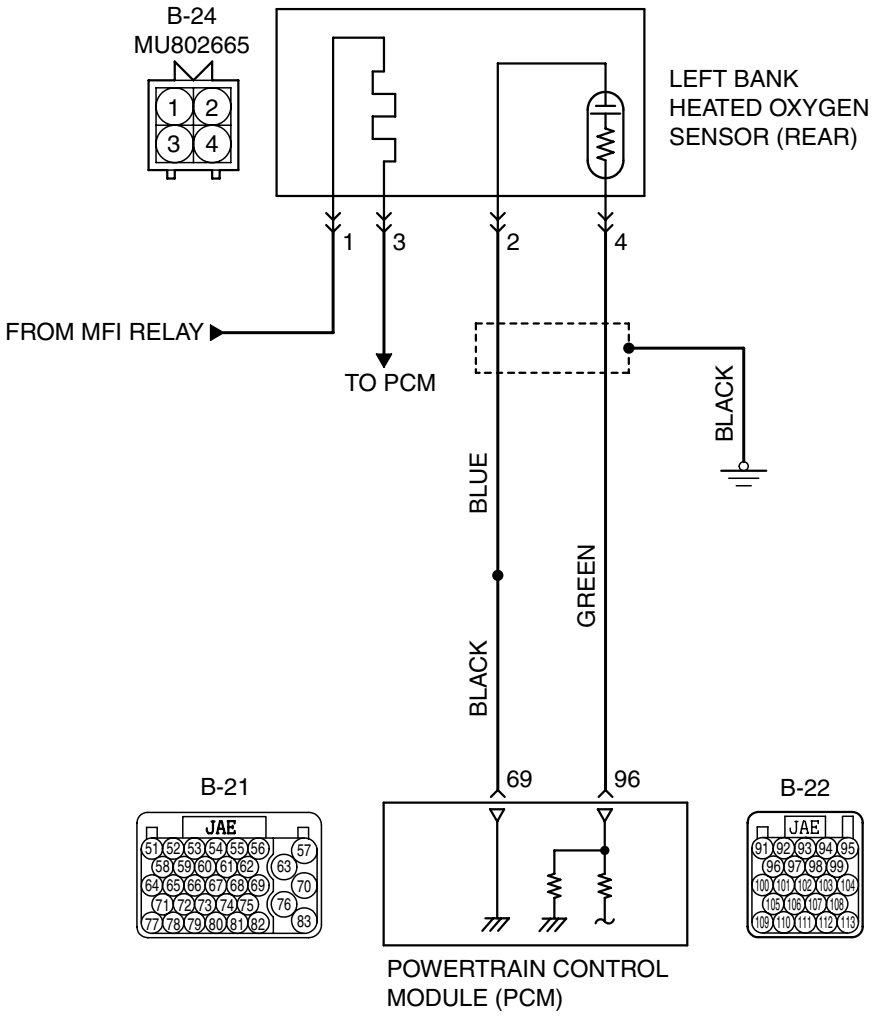
Q: Is DTC P0157 set?

YES : Retry the troubleshooting.

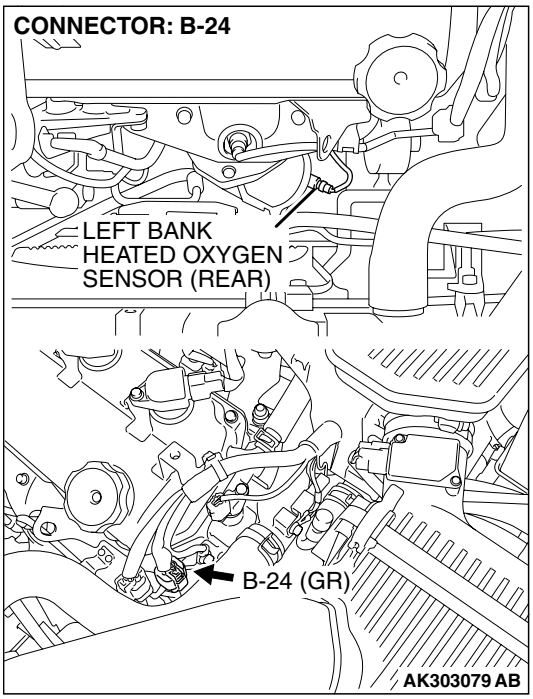
NO : The inspection is complete.

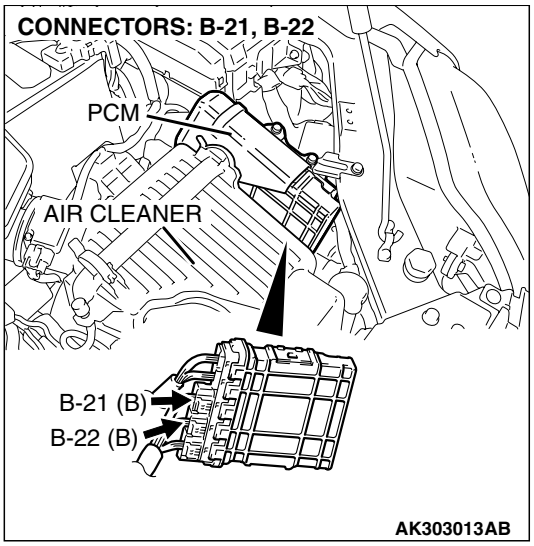
DTC P0158: Heated Oxygen Sensor Circuit High Voltage (bank 2, sensor 2)

Left Bank Heated Oxygen Sensor (rear) Circuit



AK400905





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 96) 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. 69).

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)

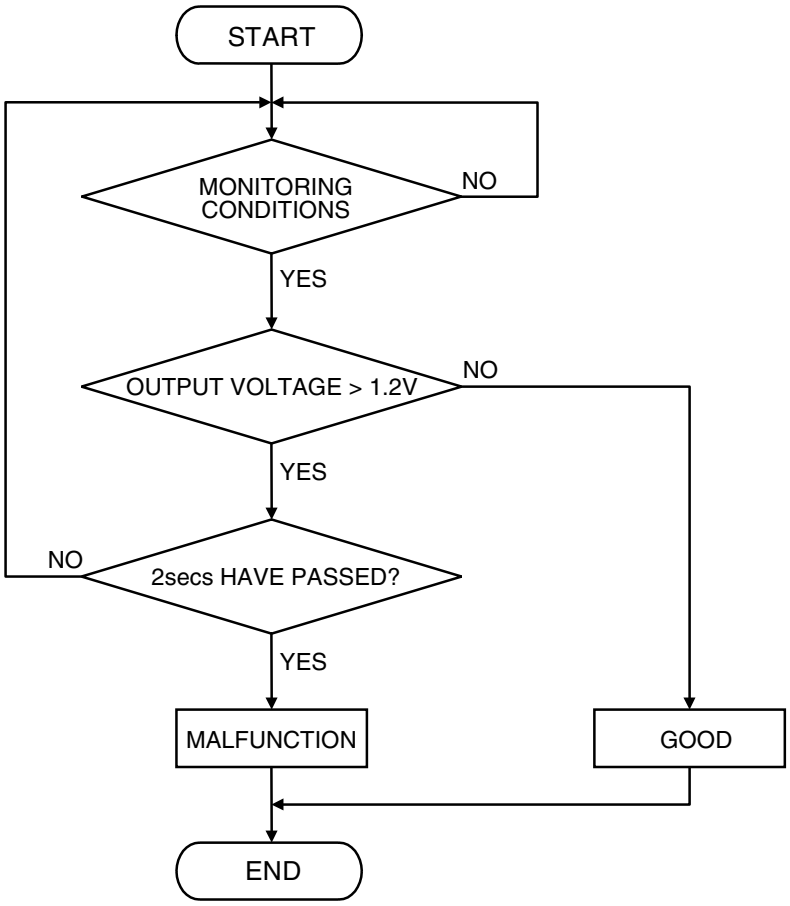
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK302396

Check Conditions

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

Judgment Criteria

- 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 – Procedure 6 – Other Monitor P.13B-6.

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:

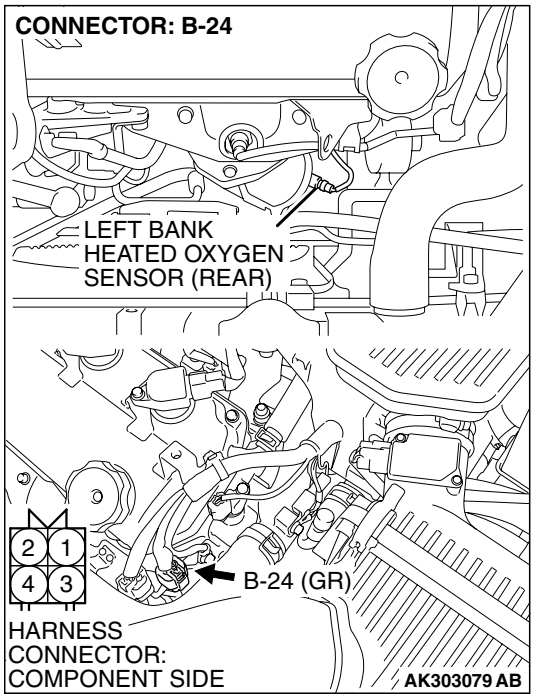
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A

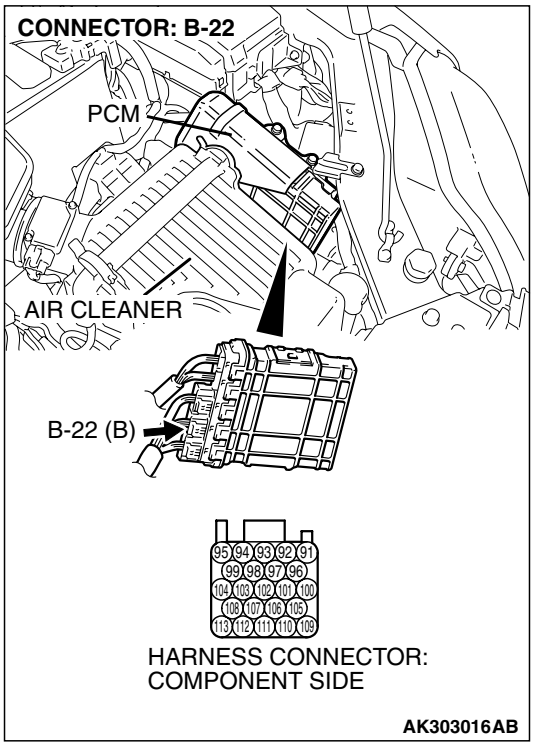
STEP 1. Check harness connector B-24 at left bank heated oxygen sensor (rear) and harness connector B-22 at PCM for damage.

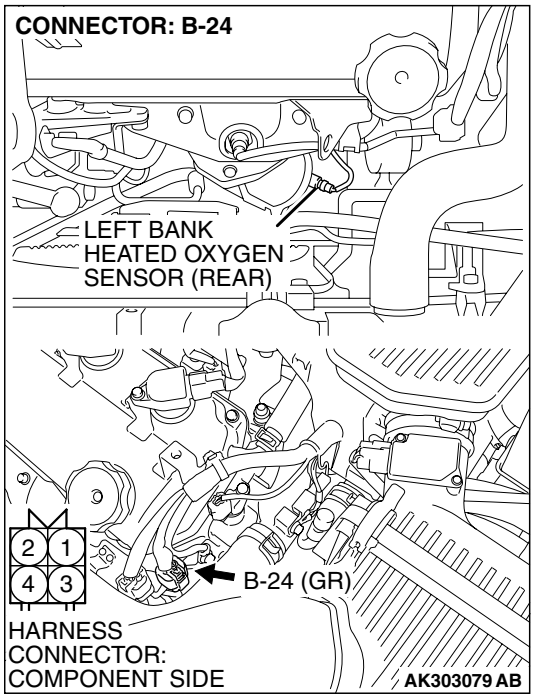
Q: Is the harness connector in good condition?

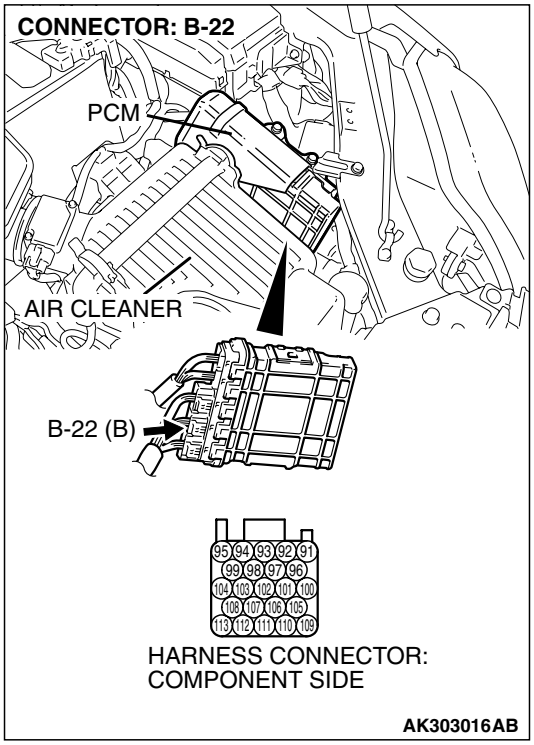
YES : Go to Step 2.

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 B-24 (terminal No. 4) and PCM connector B-22 (terminal No. 96).
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 – Procedure 6 – Other Monitor P.13B-6.

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

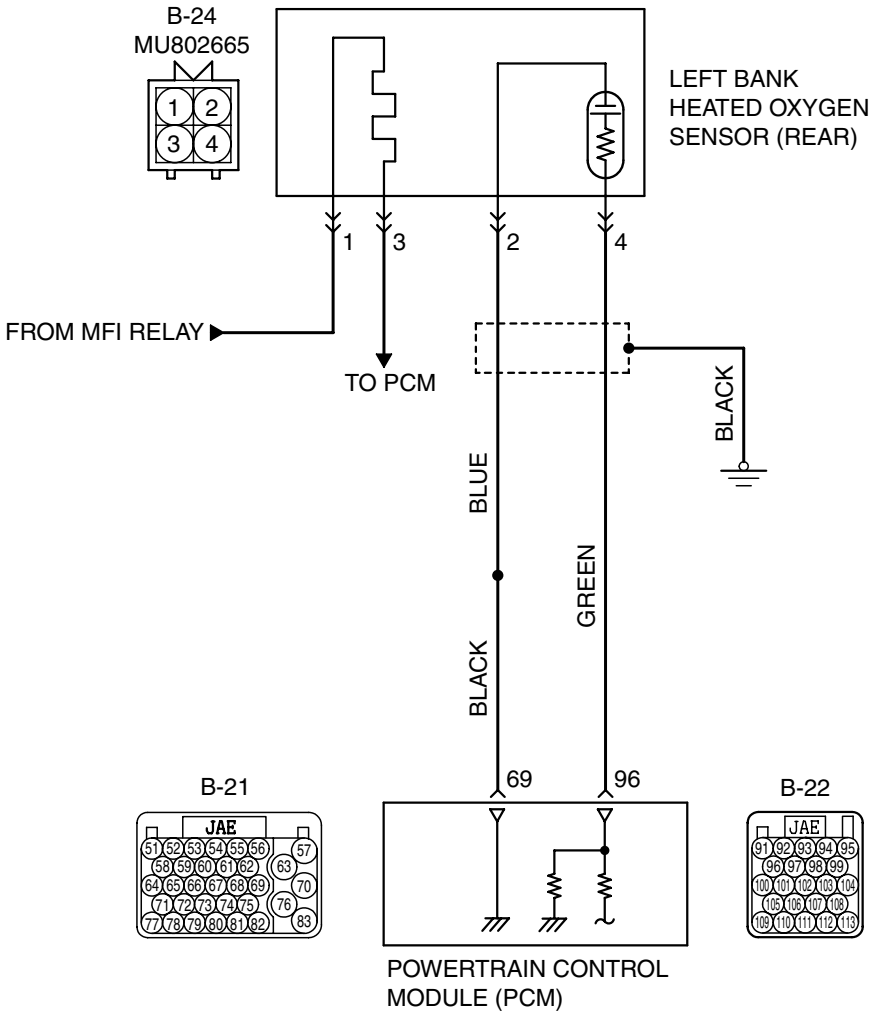
Q: Is DTC P0158 set?

YES : Retry the troubleshooting.

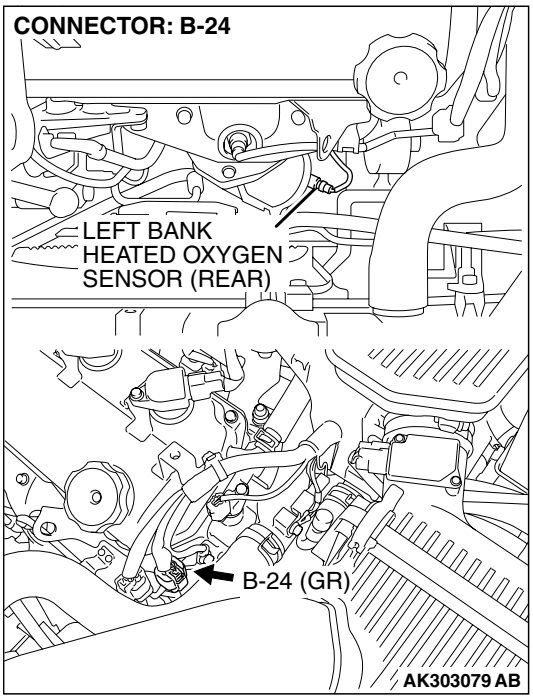
NO : The inspection is complete.

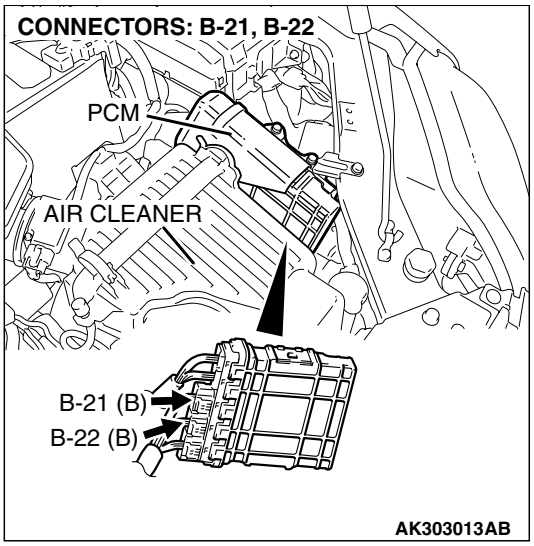
DTC P0159: Heated Oxygen Sensor Circuit Slow Response (bank 2, sensor 2)

Left Bank Heated Oxygen Sensor (rear) Circuit



AK400905





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the PCM (terminal No. 96) 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. 69) .

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 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 does not change during specified go/stop operations including fuel cut 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)

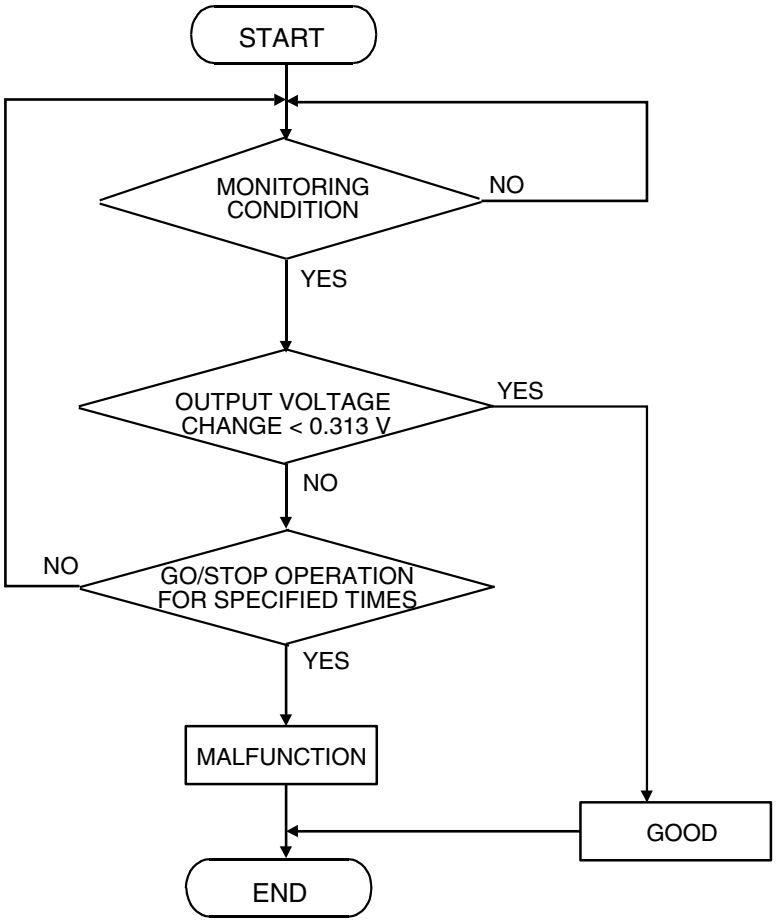
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

Sensor (The sensor below is determined to be normal)

- Mass 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 mass airflow sensor output is higher than 1,638 g.
- 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 Criteria

- 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 41 seconds.

TSB Revision

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 4 – Heated Oxygen Sensor Monitor P.13B-6.

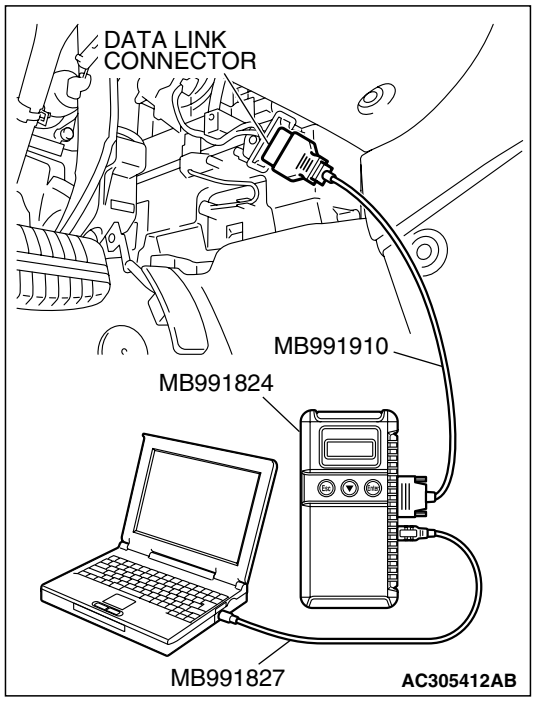
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991910: Main Harness A
- MB991316: Test Harness



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

⚠ CAUTION

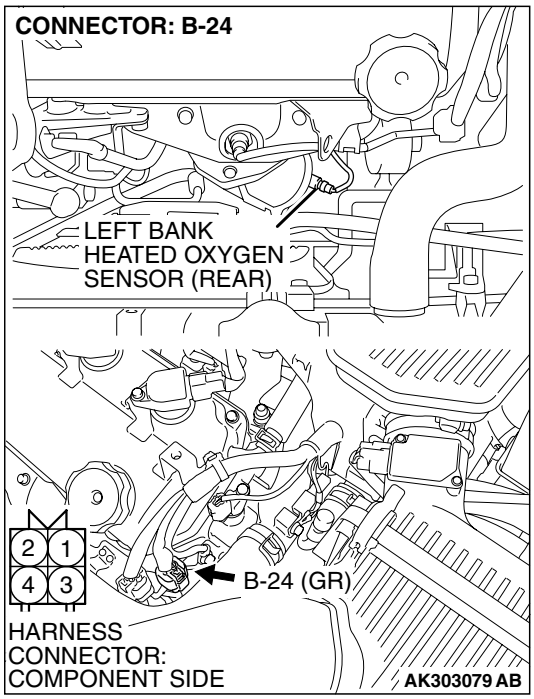
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(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).
(4) Warm up the engine.
  - After increasing the output voltage 0.15 volt or more by the engine revving, finish it. Then confirm that the output voltage reduces to 0.15 volt or less within 3 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.00-14.

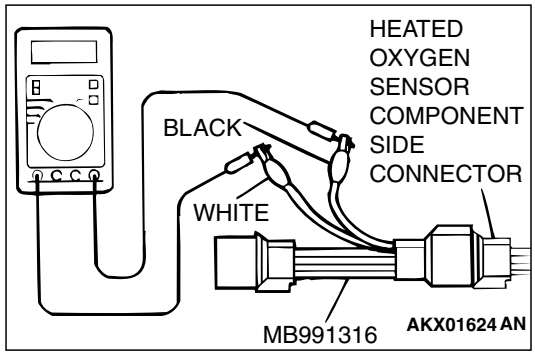
NO : Replace the heated oxygen sensor (rear). Then go to Step 2.



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

(1) Disconnect the left bank heated oxygen sensor (rear) connector B-24 and connect test harness special tool, MB991316, 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) 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 heated oxygen sensor (rear) output voltage.

Standard value: 0.6 – 1.0 volt

⚠ CAUTION

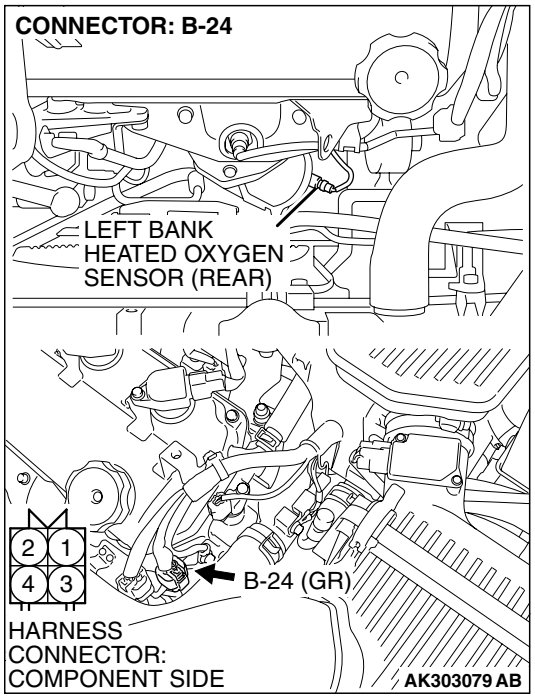
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor heater.**

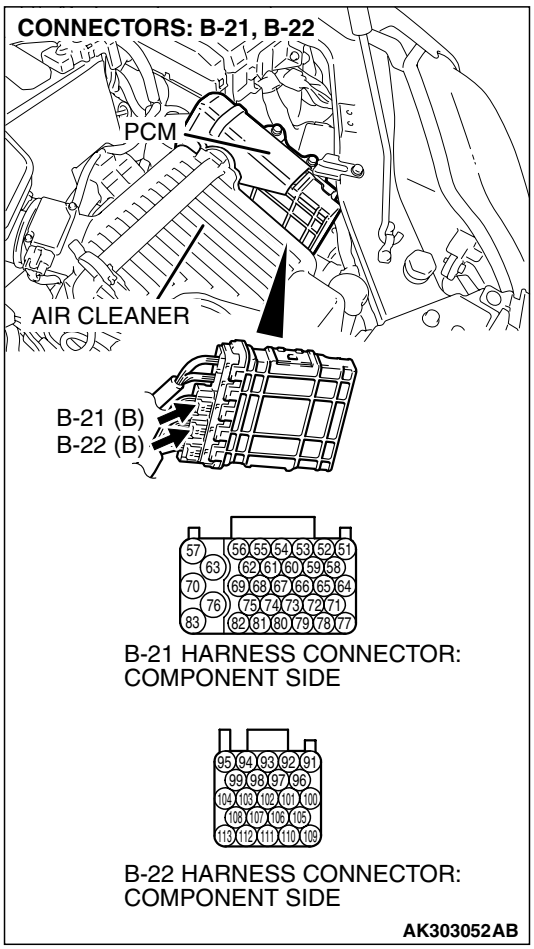
NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (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 (rear). Then go to Step 4.





STEP 3. Check harness connector B-24 at left bank heated oxygen sensor (rear) and harness connector B-21, B-22 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 – Procedure 4 – Heated Oxygen Sensor Monitor P.13B-6.

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

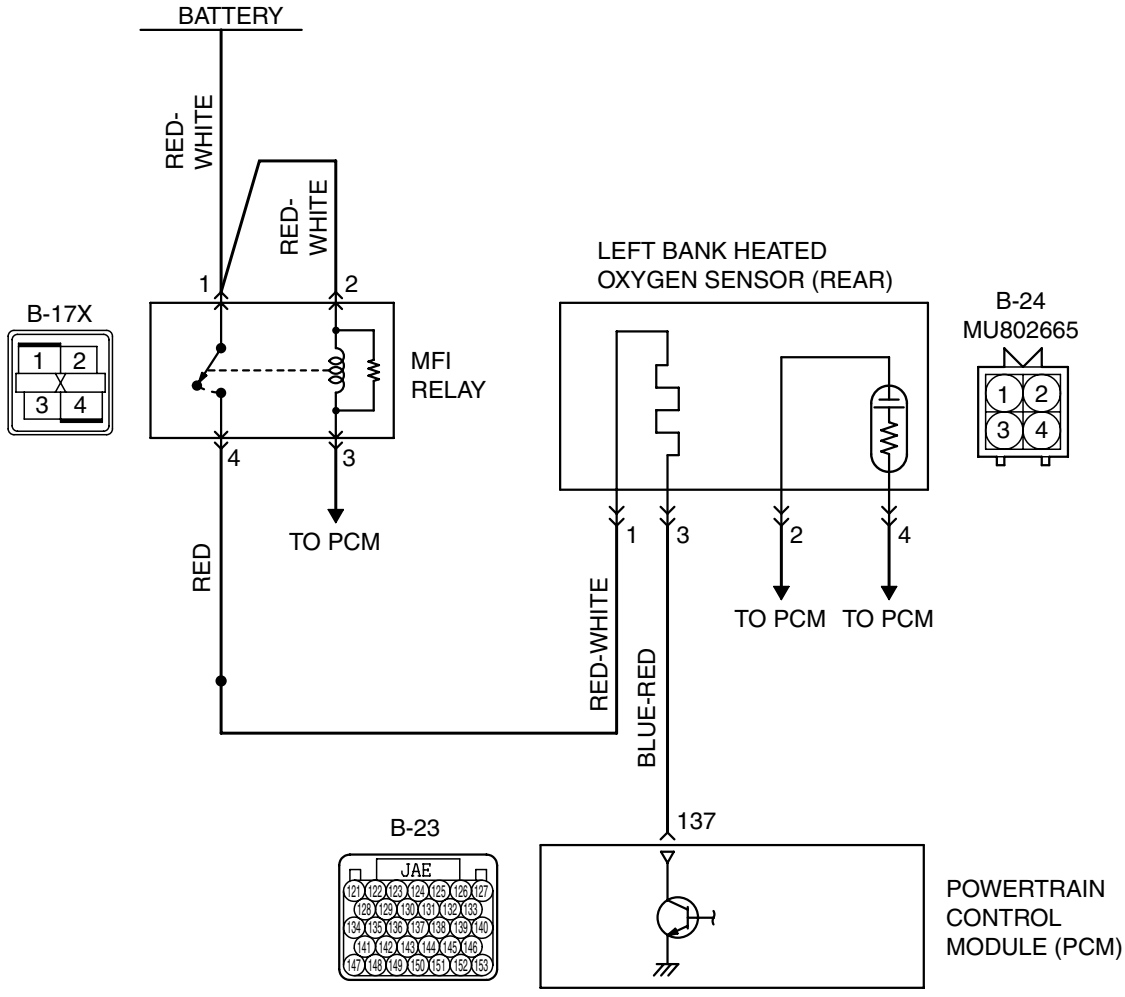
Q: Is DTC P0159 set?

YES : Retry the troubleshooting.

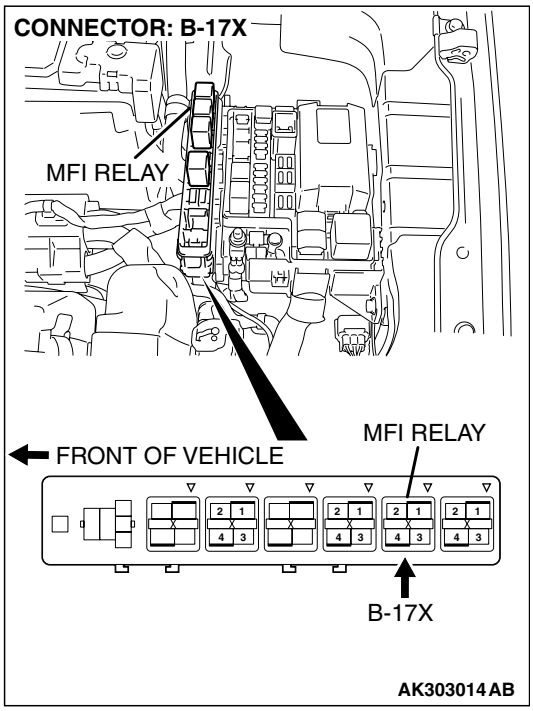
NO : The inspection is complete.

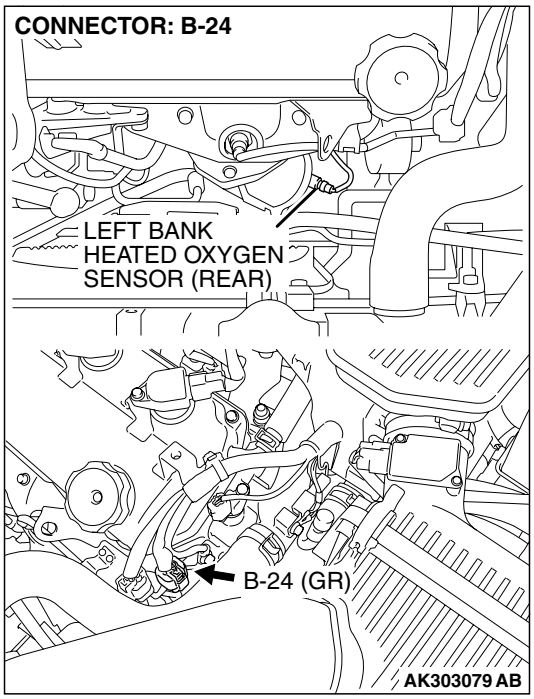
DTC P0161: Heated Oxygen Sensor Heater Circuit (bank 2, sensor 2)

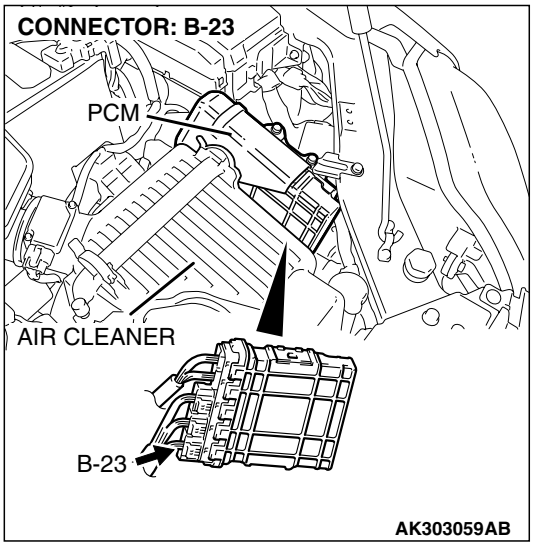
Left Bank Heated Oxygen Sensor (rear) Heater Circuit



AK400906







CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the left bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 137) controls continuity to the left bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

BACKGROUND

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor heater (rear) current is out of specified range when engine coolant temperature is over 20°C (68°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

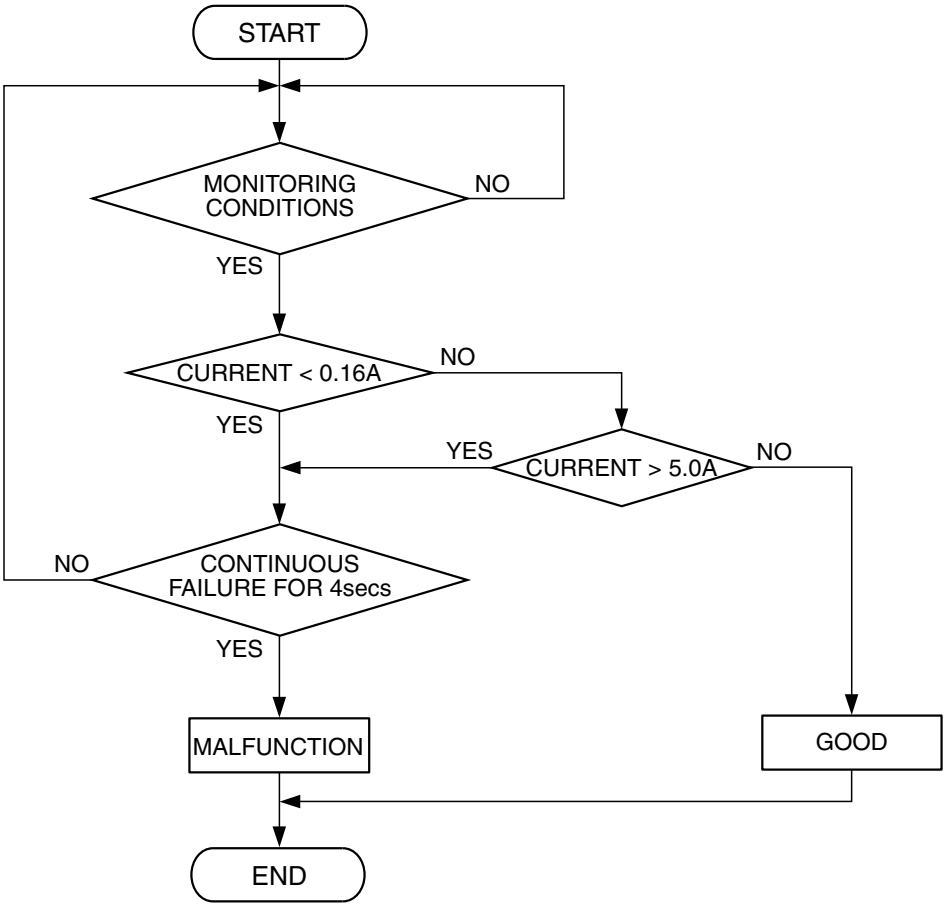
Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

TSB Revision

DTC SET CONDITIONS

Logic Flow Chart



AK302401

Check Conditions

- 60 seconds have elapsed from the start of the previous monitoring.
- Engine coolant temperature is higher than 20°C (68°F).
- While the left bank heated oxygen sensor (rear) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgment Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13B-6.

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

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

TSB Revision

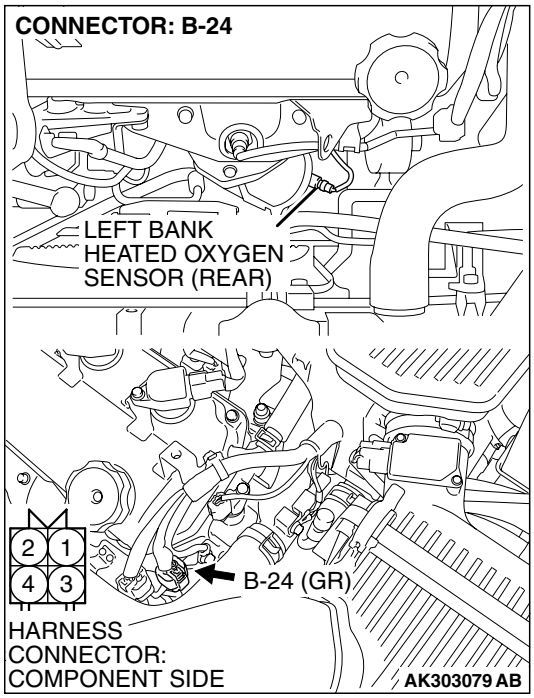
DIAGNOSIS

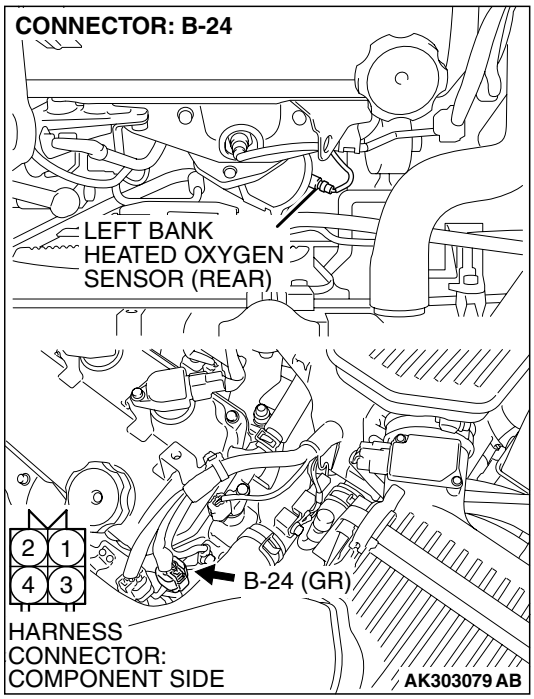
Required Special Tools:

- MB991316: Test Harness
- MB991923: Power Plant ECU Check Harness

STEP 1. Check harness connector B-24 at the left bank heated oxygen sensor (rear) for damage.
Q: Is the harness connector in good condition?

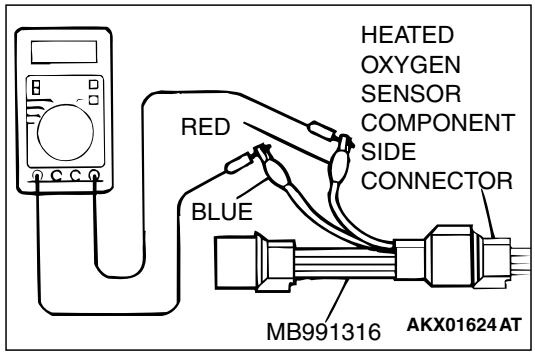
YES : Go to Step 2.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.





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

(1) Disconnect left bank heated oxygen sensor (rear) connector B-24 and connect test harness special tool, MB991316, to the connector on the left bank heated oxygen (rear) sensor side.



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

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

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

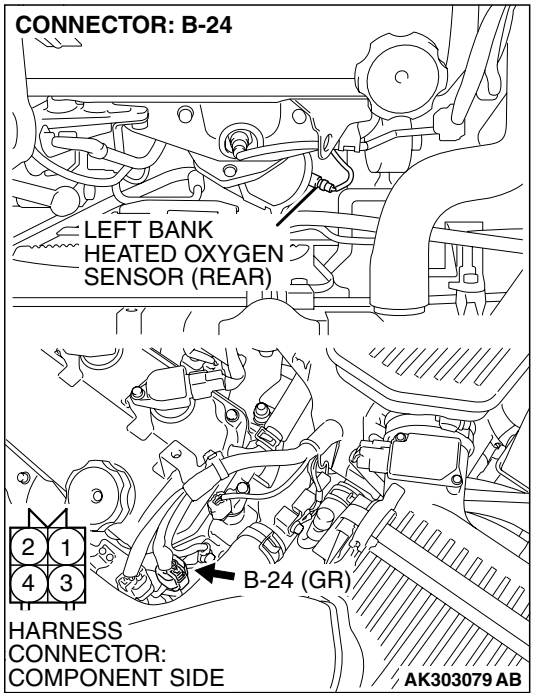
YES : Go to Step 3.

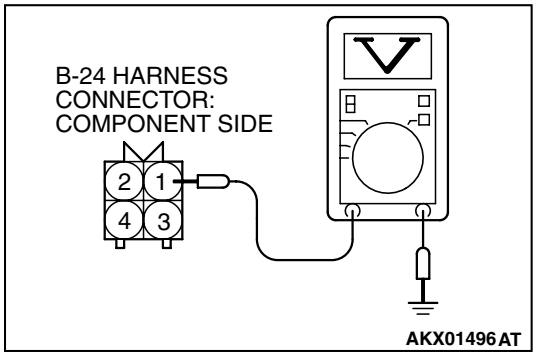
NO : Replace the left bank heated oxygen sensor (rear). Then go to Step 12.

STEP 3. Measure the power supply voltage at left bank heated oxygen sensor (rear) harness side connector B-24.

(1) Disconnect the connector B-24 and measure at the harness side.

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





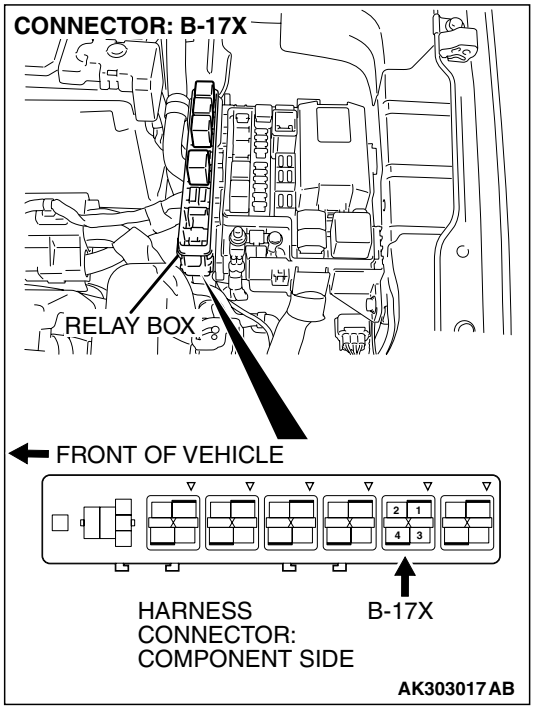
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

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

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

YES : Go to Step 5.

NO : Go to Step 4.

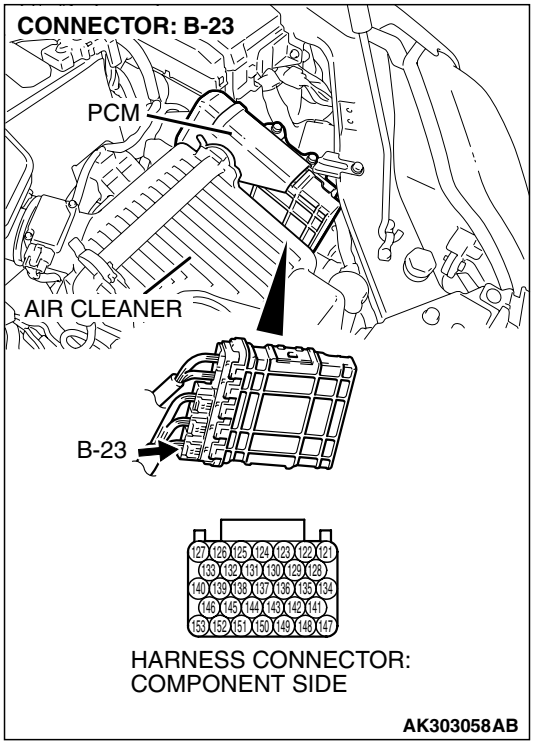


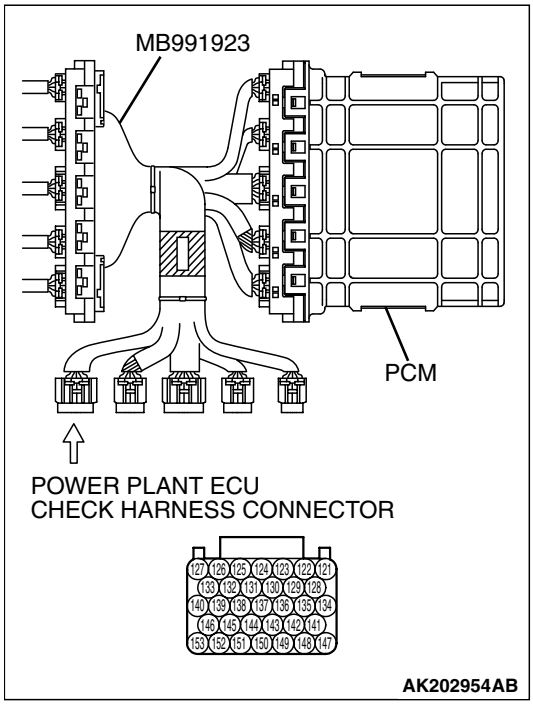
STEP 4. Check harness connector B-17X at the MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (rear) connector B-24 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

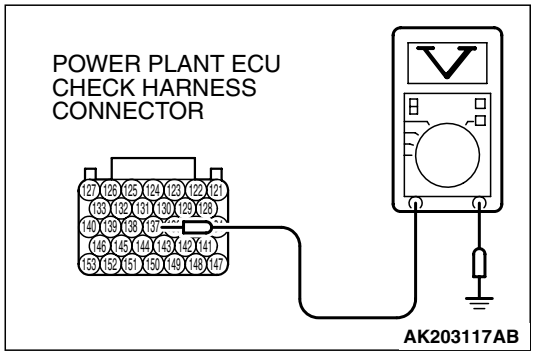




STEP 5. Measure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect power plant ECU check harness special tool MB991923 between the separated connectors.

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



(3) Measure the voltage between terminal No. 137 and ground.
- Voltage should be battery positive voltage.

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

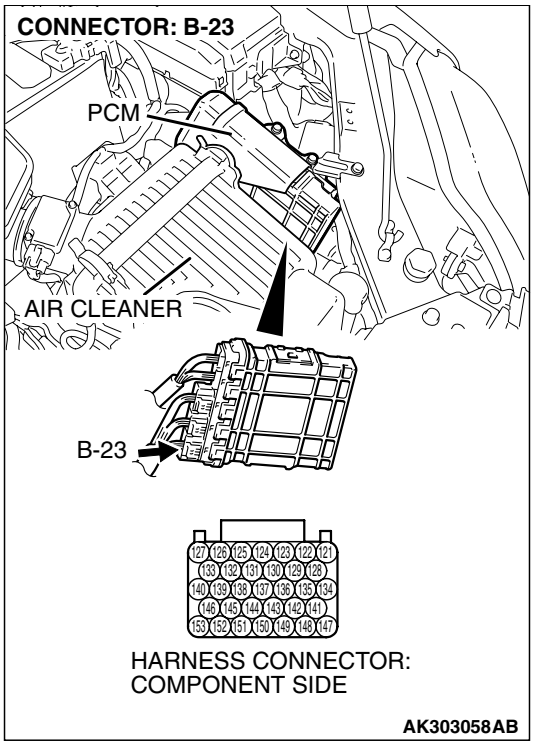
Q: Is battery positive voltage (approximately 12 volts) present?

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

STEP 6. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

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

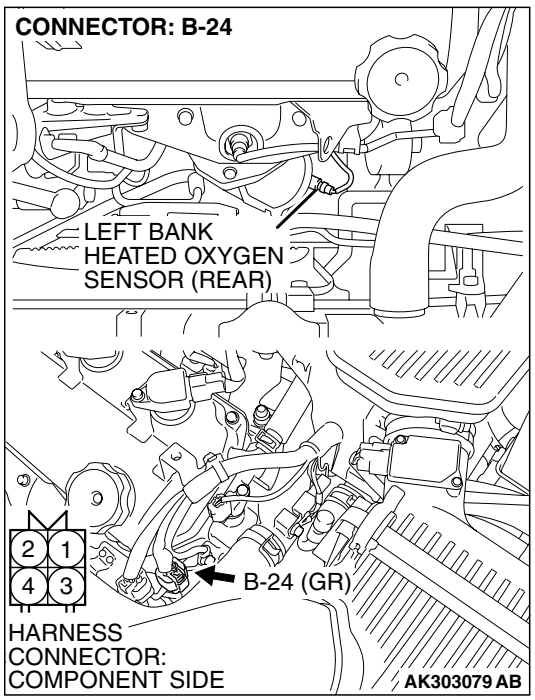


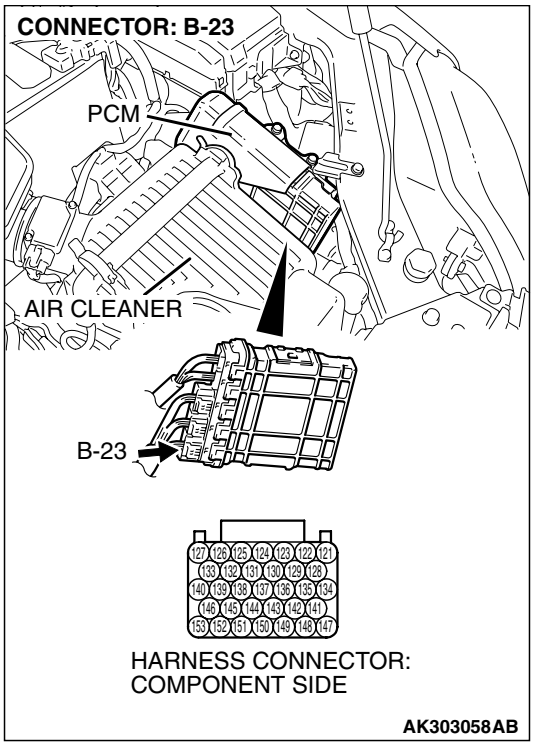
STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 3) and PCM connector B-23 (terminal No. 137).

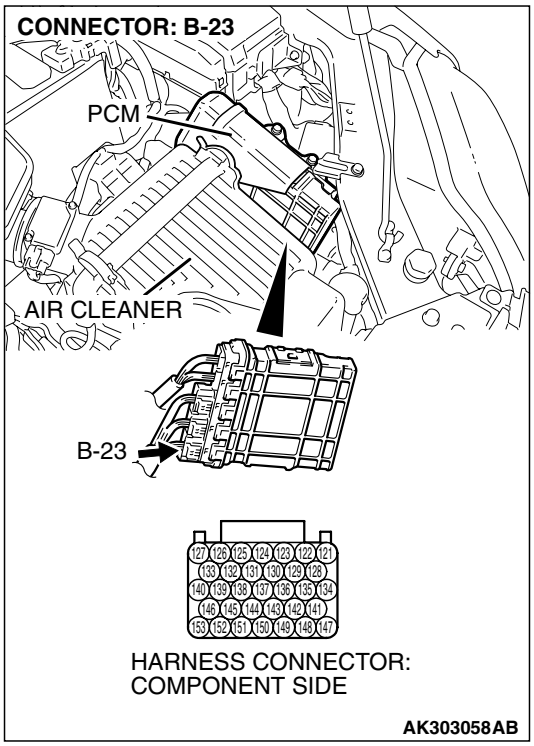
Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 12.





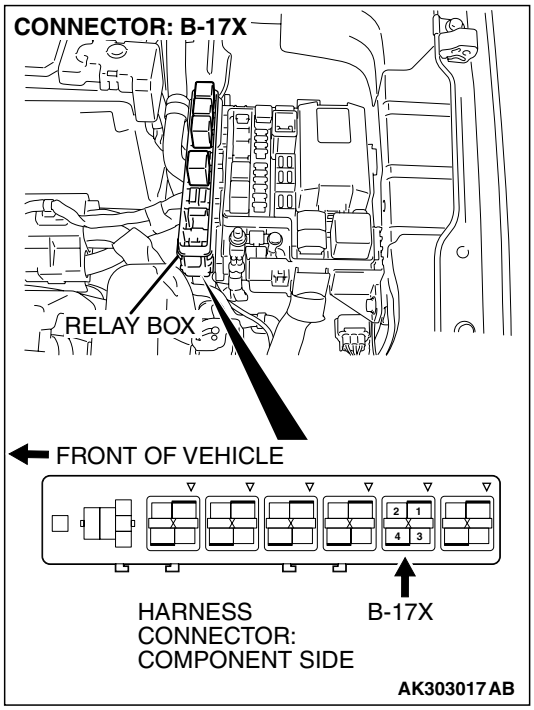


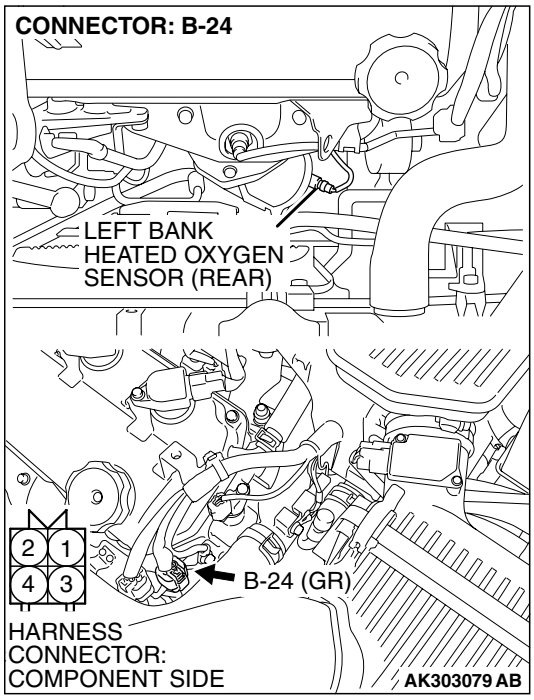
STEP 8. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

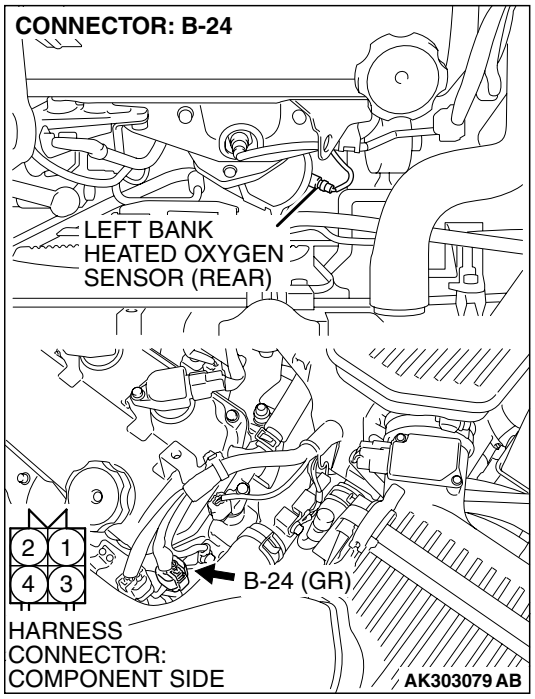
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

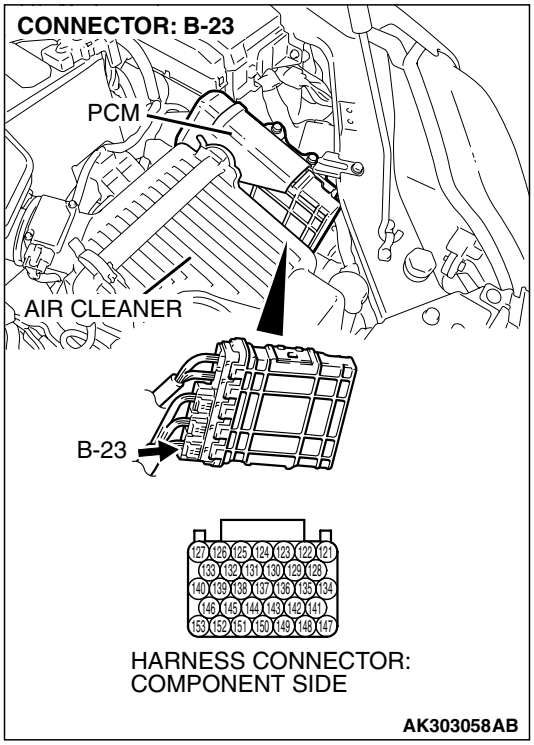




STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (rear) connector B-24 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 10.
NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 3) and PCM connector B-23 (terminal No. 137).
Q: Is the harness wire in good condition?

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

STEP 11. Check the trouble symptoms.

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

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

Q: Is DTC P0161 set?

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

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

STEP 12. 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 – Procedure 6 – Other Monitor P.13B-6.

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

Q: Is DTC P0161 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

NEXT>>