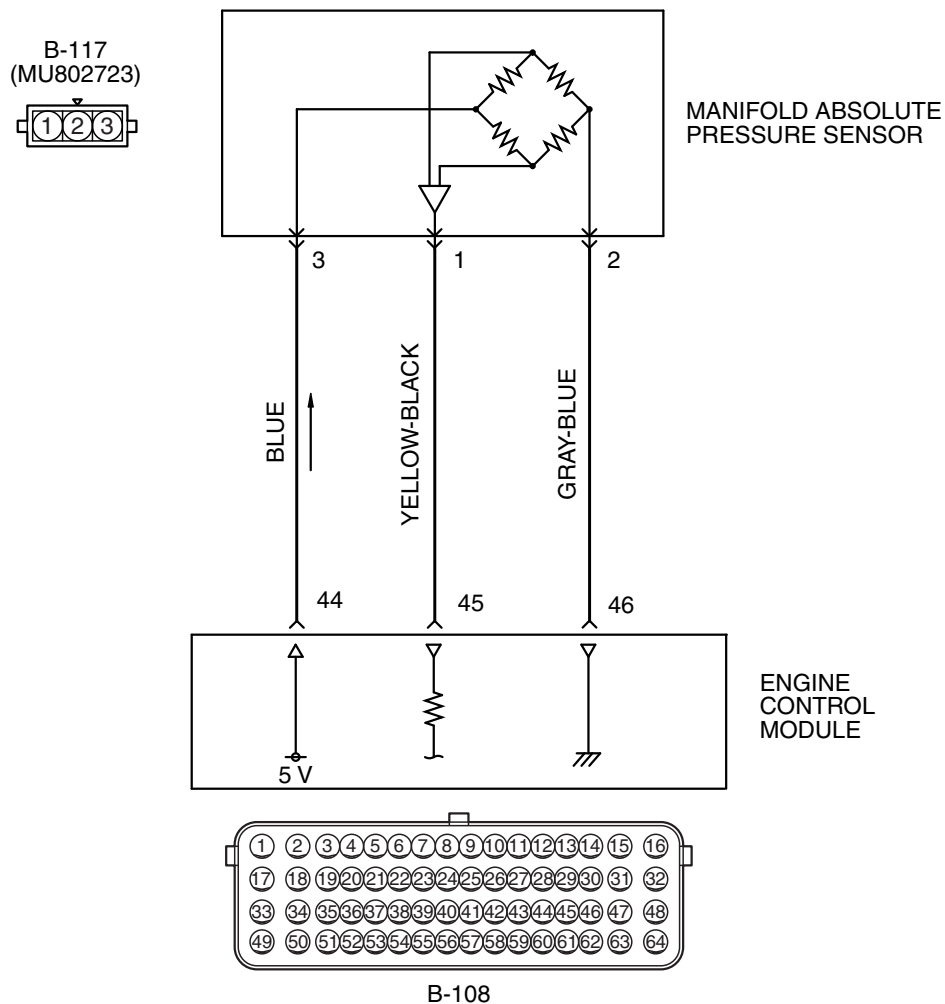
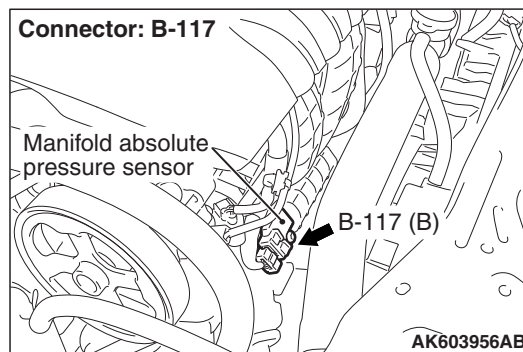
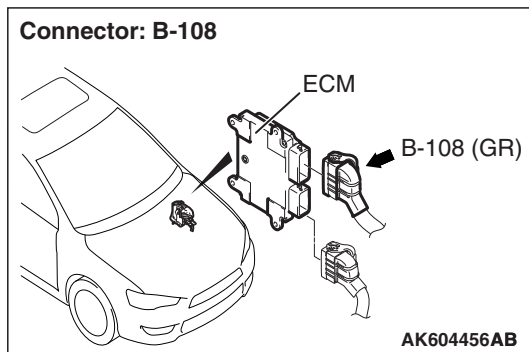


DTC P0106: Manifold Absolute Pressure Circuit Range/Performance Problem

MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT



AK604115 AD



CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the ECM (terminal No. 44). The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 46).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM (terminal No. 45) from the manifold absolute pressure sensor output terminal (terminal No. 1).

TECHNICAL DESCRIPTION

- The manifold absolute pressure sensor outputs a voltage which corresponds to the intake manifold pressure.
- The ECM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Compare load value with manifold absolute pressure sensor output voltage.

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)

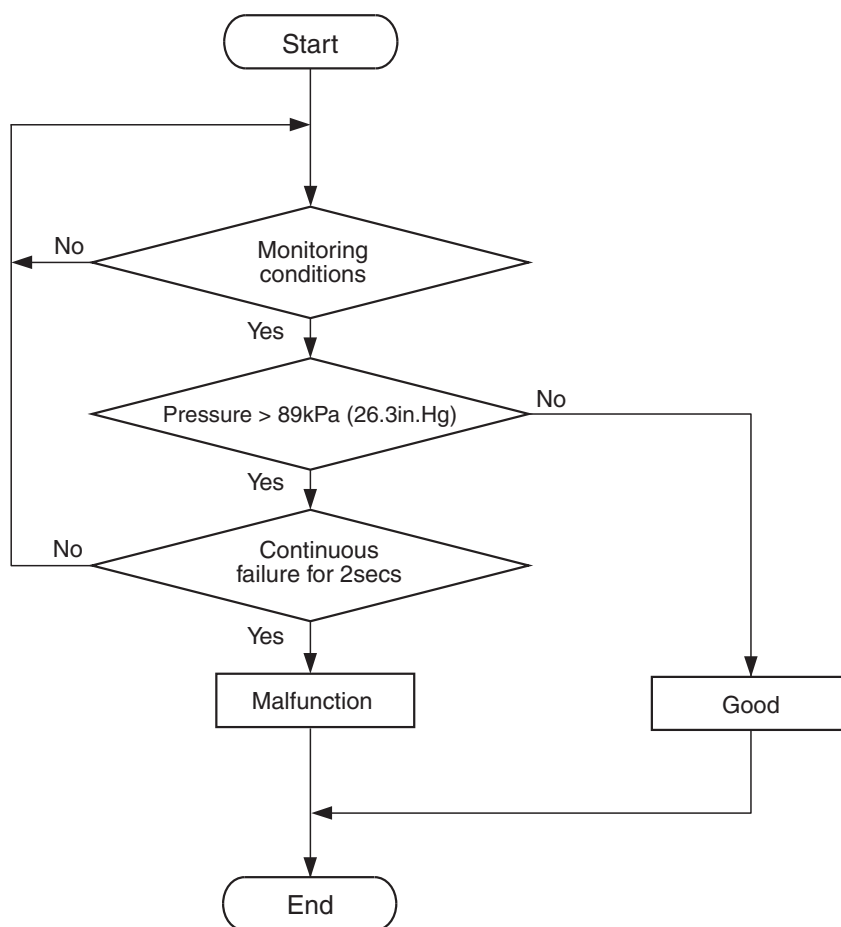
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS <Range/Performance problem – high input>

Logic Flow Chart



AK604311

Check Conditions

- 8 minutes or more have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is 0°C (32°F) or lower.
- Engine speed is between 500 r/min and 1,500 r/min.

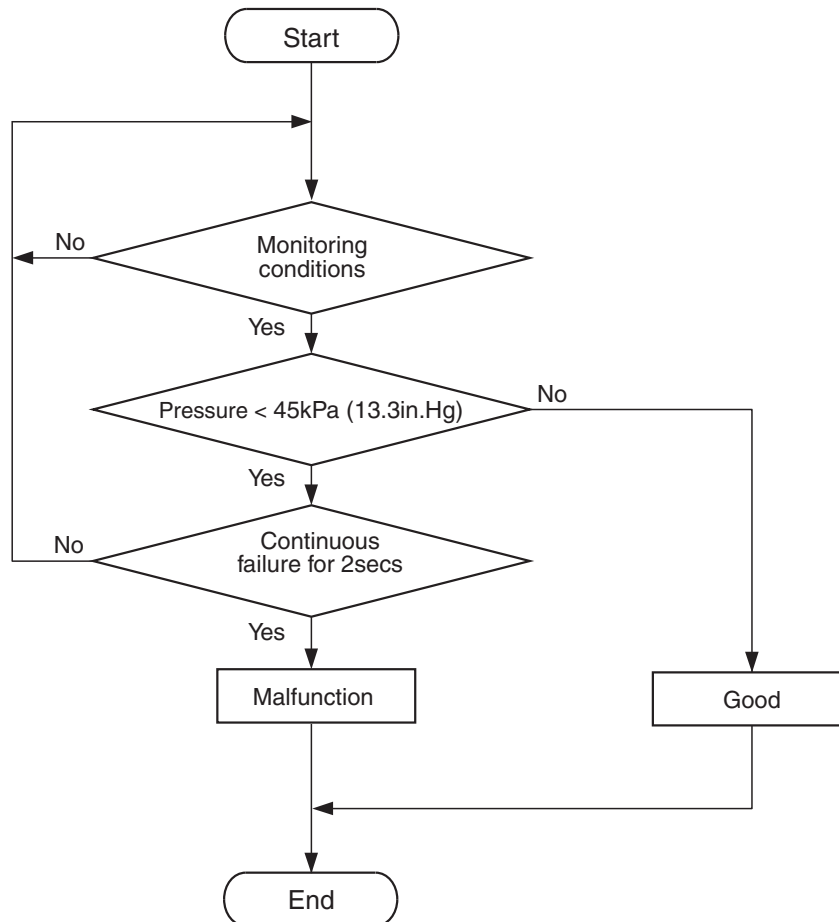
- Throttle position sensor output voltage is 0.8 volt or lower.

Judgement Criterion

- Manifold absolute pressure sensor output voltage has continued to be 3.5 volts [corresponding to a manifold absolute pressure of 89 kPa (26.3 in.Hg)] or higher for 2 seconds.

DTC SET CONDITIONS <Range/Performance problem – low input>

Logic Flow Chart



AK604312

Check Conditions

- 8 minutes or more have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is 0°C (32°F) or lower.
- Engine speed is 1,500 r/min or higher.
- Throttle position sensor output voltage is 3.5 volts or higher.

Judgement Criterion

- Manifold absolute pressure sensor output voltage has continued to be 1.8 volts [corresponding to a manifold absolute pressure of 45 kPa (13.3 in.Hg)] or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13A-12](#).

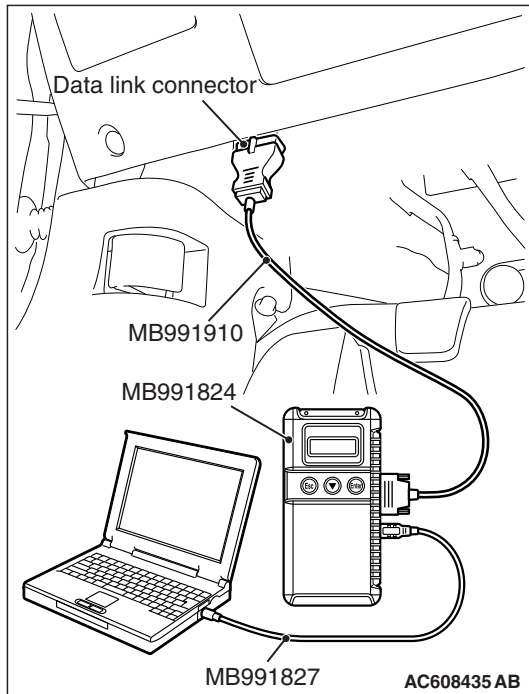
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Manifold absolute pressure sensor failed.
- Harness damage.
- Connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992110: Power Plant ECU Check Harness



STEP 1. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

⚠ CAUTION

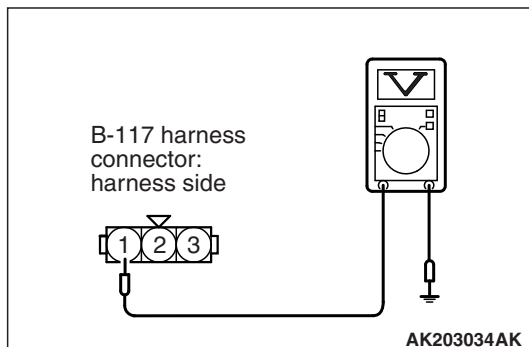
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine.
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (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.



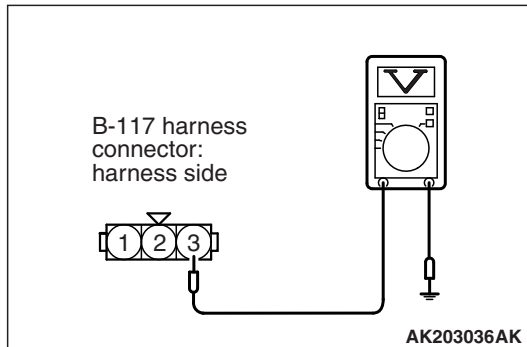
STEP 2. Measure the sensor output voltage at manifold absolute pressure sensor connector B-117 by backprobing.

- (1) Do not disconnect the connector B-117.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground by backprobing.
 - When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
 - When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
 - When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
 - When altitude is 1,800 m (5,906 feet), voltage should be between 3.0 and 3.4 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage normal?

YES : Go to Step 10.

NO : Go to Step 3.



STEP 3. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-117 by backprobing.

- (1) Do not disconnect the connector B-117.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 3 and ground by backprobing.
 - 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 6.

NO : Go to Step 4.

STEP 4. Check harness connector B-117 at the manifold absolute pressure sensor and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to step 5.

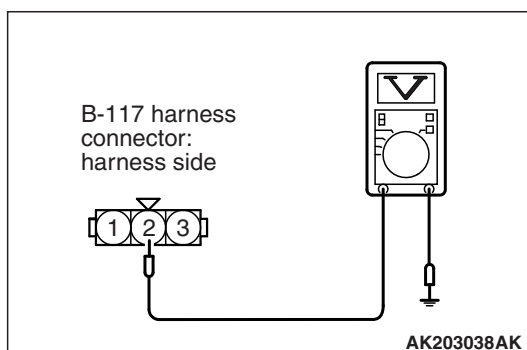
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 13.

STEP 5. Check for harness damage between manifold absolute pressure sensor connector B-117 (terminal No. 3) and ECM connector B-108 (terminal No. 44).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 13.



STEP 6. Measure the ground voltage at manifold absolute pressure sensor connector B-117 by backprobing.

- (1) Do not disconnect the connector B-117.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 2 and ground by backprobing.
 - Voltage should be 0.5 volt or less.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage 0.5 volt or less?

YES : Go to Step 9.

NO : Go to Step 7.

STEP 7. Check harness connector B-117 at the manifold absolute pressure sensor and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

STEP 8. Check for harness damage between manifold absolute pressure sensor connector B-117 (terminal No. 2) and ECM connector B-108 (terminal No. 46).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 13.

STEP 9. Check harness connector B-117 at manifold absolute pressure sensor for damage.

Q: Is the harness connector in good condition?

YES : Replace the manifold absolute pressure sensor. Then go to Step 13.

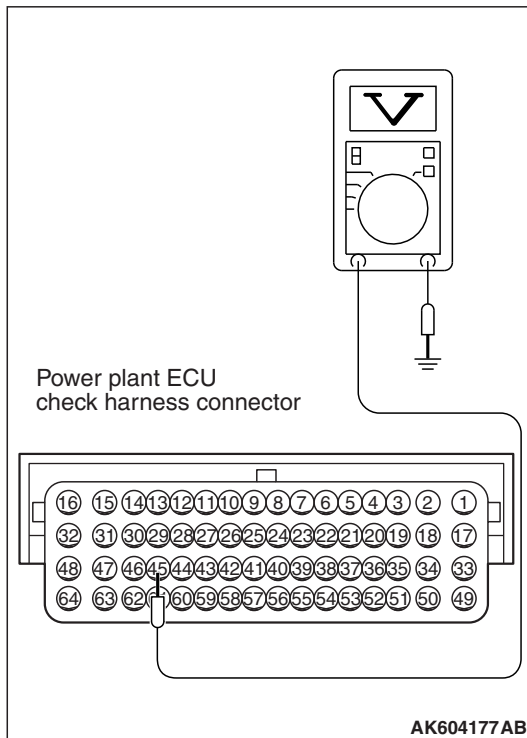
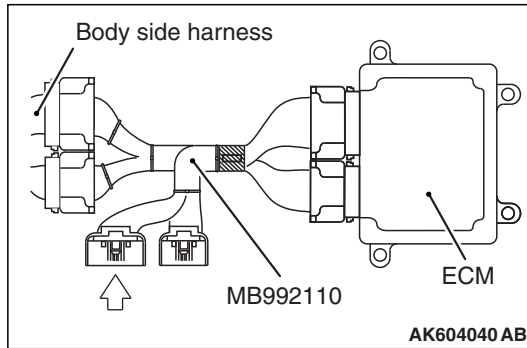
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 13.

STEP 10. Check harness connector B-117 at the manifold absolute pressure sensor and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 11.

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



STEP 11. Measure the sensor output voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.

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

(3) Measure the voltage between terminal No. 45 and ground.

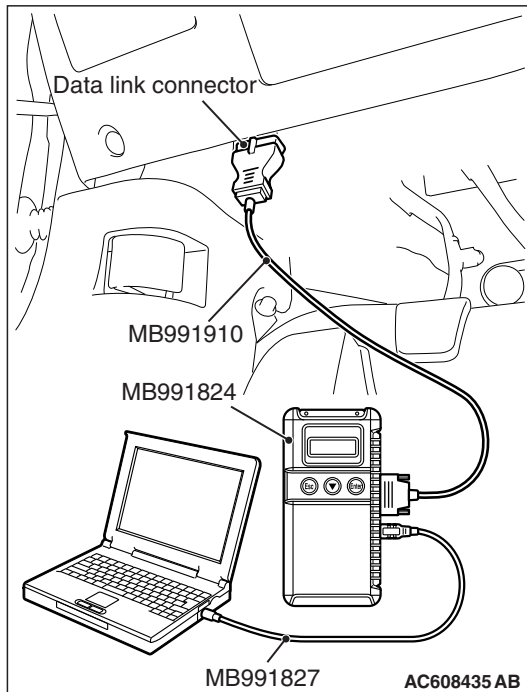
- When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
- When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
- When altitude is 1,800 m (5,906 feet), voltage should be between 3.0 and 3.4 volts.

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

Q: Is the measured voltage normal?

YES : Go to Step 12.

NO : Repair harness wire between manifold absolute pressure sensor connector B-117 (terminal No. 1) and ECM connector B-108 (terminal No. 45) because of harness damage. Then go to Step 13.



STEP 12. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine.
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 13.

STEP 13. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

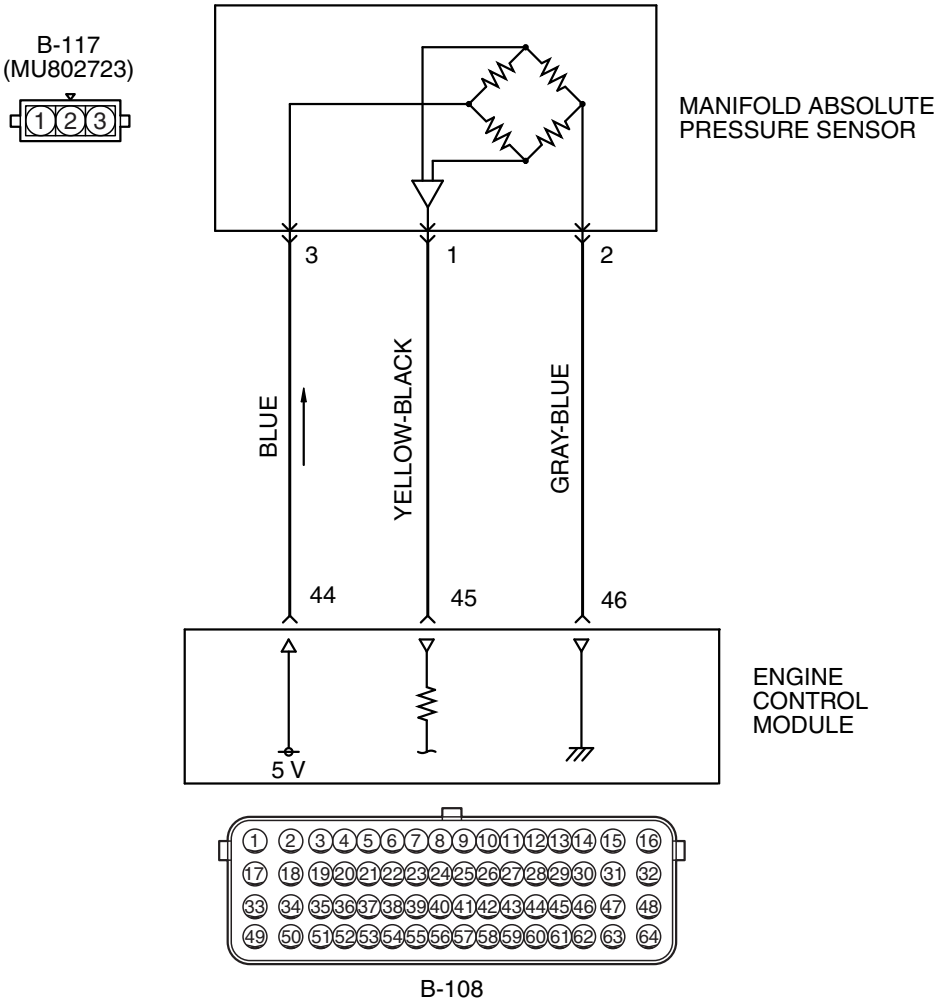
Q: Is DTC P0106 set?

YES : Retry the troubleshooting.

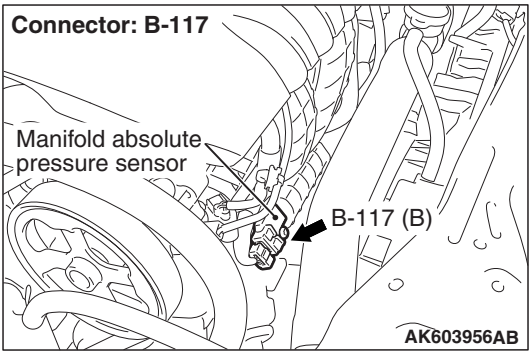
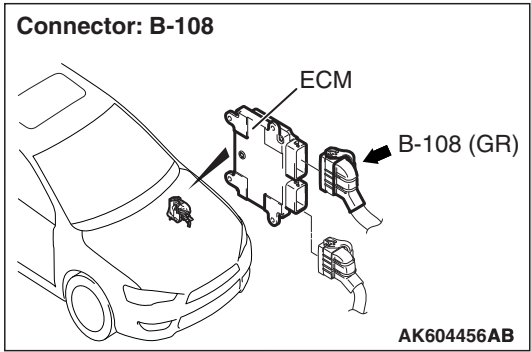
NO : The inspection is complete.

DTC P0107: Manifold Absolute Pressure Circuit Low Input

MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT



AK604115 AD



CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the ECM (terminal No. 44). The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 46).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM (terminal No. 45) from the manifold absolute pressure sensor output terminal (terminal No. 1).

TECHNICAL DESCRIPTION

- The manifold absolute pressure sensor outputs a voltage which corresponds to the intake manifold pressure.
- The ECM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Manifold absolute pressure sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

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

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

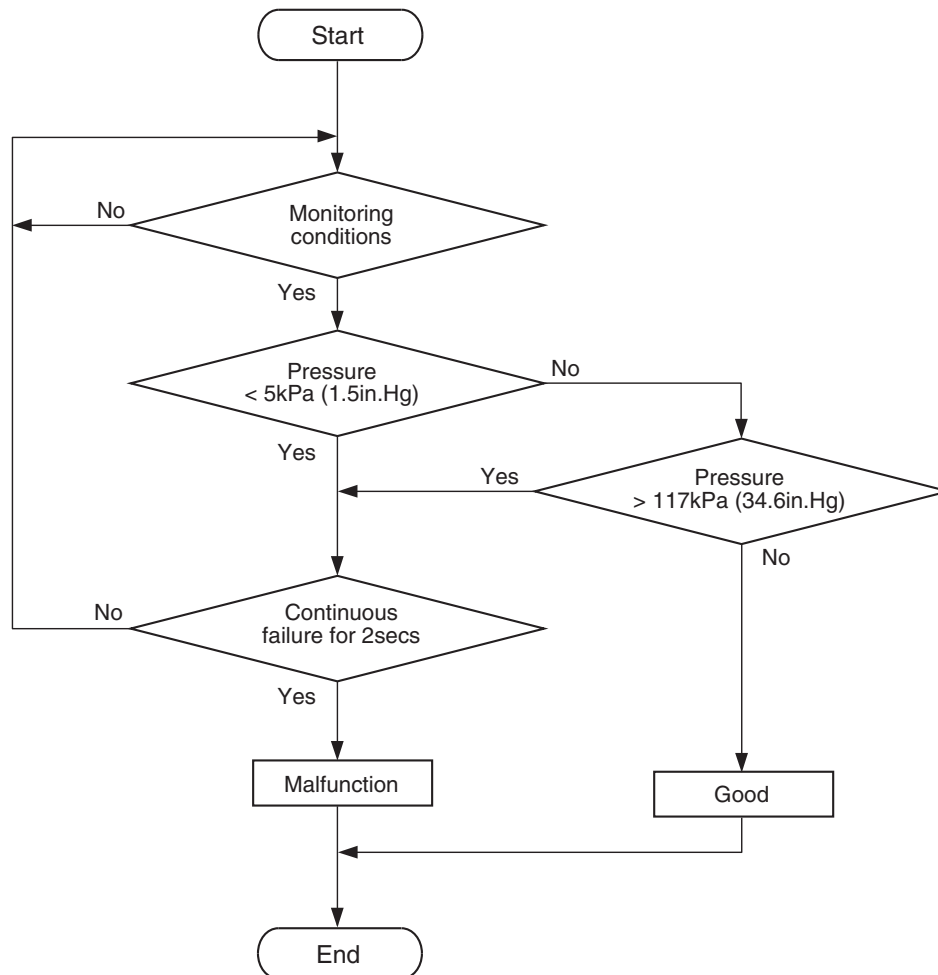
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK604313

Check Conditions

- 8 minutes or more have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is 0°C (32°F) or lower.
- Volumetric efficiency is higher than 20 percent.

Judgement Criterion

- Manifold absolute pressure sensor output voltage has continued to be 0.2 volt [corresponding to a manifold absolute pressure of 5 kPa (1.5 in.Hg)] or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13A-12](#).

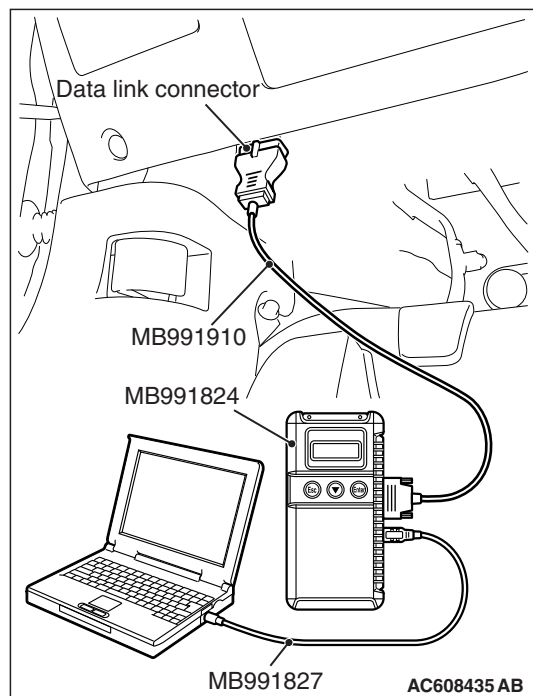
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Manifold absolute pressure sensor failed.
- Open or shorted manifold absolute pressure sensor circuit, harness damage or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992110: Power Plant ECU Check Harness



STEP 1. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure 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 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine.
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (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.

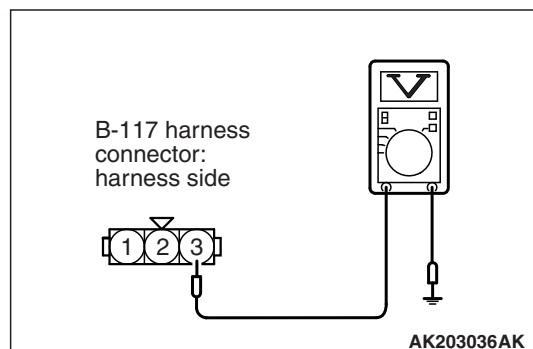
STEP 2. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-117 by backprobing.

- (1) Do not disconnect the connector B-117.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 3 and ground by backprobing.
 - 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 8.

NO : Go to Step 3.

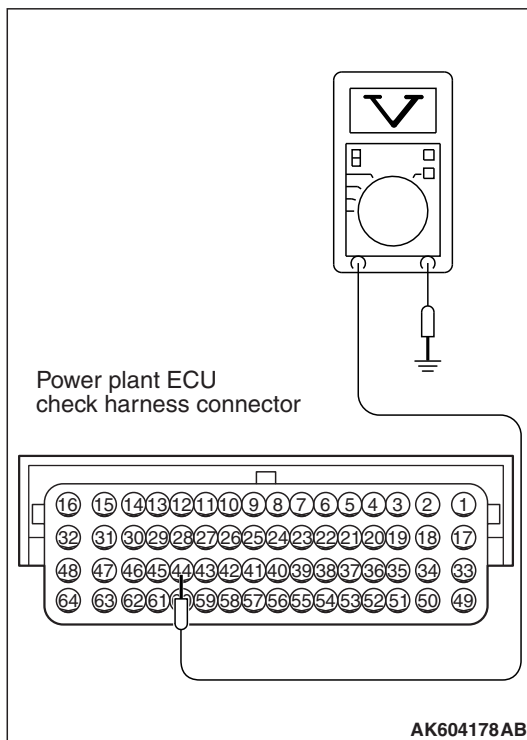
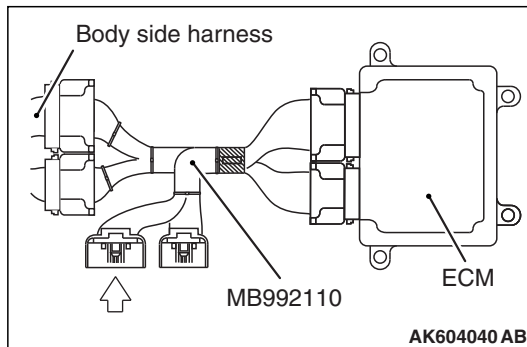


STEP 3. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

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



STEP 4. Measure the sensor supply voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.

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

(3) Measure the voltage between terminal No. 44 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 5.

STEP 5. Check harness connector B-117 at the manifold absolute pressure sensor for damage.

Q: Is the 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 12.

STEP 6. Check for short circuit to ground between manifold absolute pressure sensor connector B-117 (terminal No. 3) and ECM connector B-108 (terminal No. 44).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 7. Check harness connector B-117 at the manifold absolute pressure sensor for damage.

Q: Is the connector in good condition?

YES : Repair harness wire between manifold absolute pressure sensor connector B-117 (terminal No. 3) and ECM connector B-108 (terminal No. 44) because of open circuit. 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 8. Check harness connector B-117 at the manifold absolute pressure sensor and connector B-108 at ECM for damage.

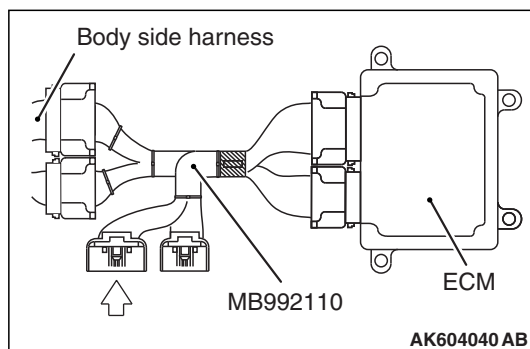
Q: Is the harness connector in good condition?

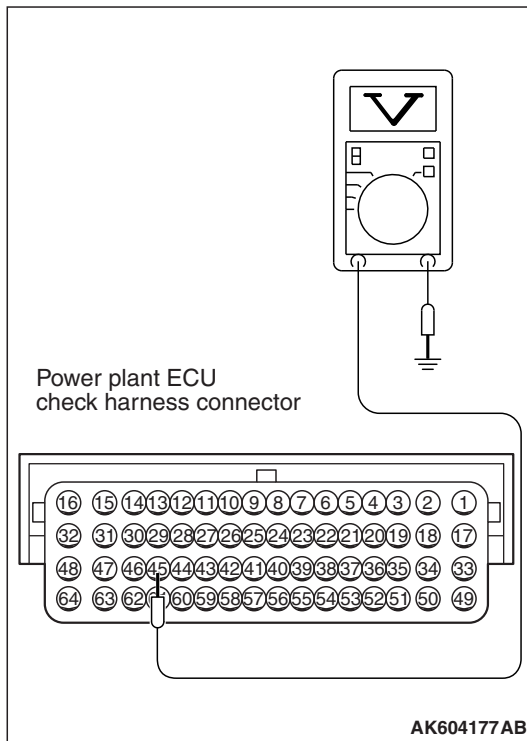
YES : Go to Step 9.

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

STEP 9. Measure the sensor output voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.





- (3) Measure the voltage between terminal No. 45 and ground.
- When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
 - When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
 - When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
 - When altitude is 1,800 m (5,906 feet), voltage should be between 3.0 and 3.4 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage normal?

YES : Go to Step 11.

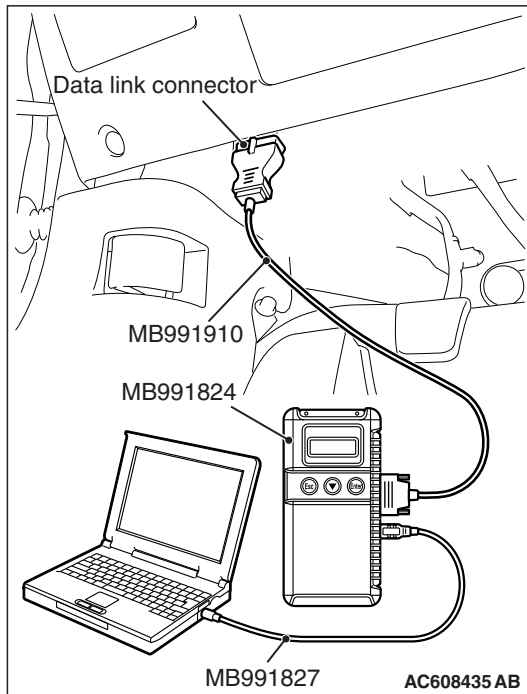
NO : Go to Step 10.

STEP 10. Check for open or short circuit to ground between manifold absolute pressure sensor connector B-117 (terminal No. 1) and ECM connector B-108 (terminal No. 45).

Q: Is the harness wire in good condition?

YES : Replace the manifold absolute pressure sensor. Then go to Step 12.

NO : Repair it. Then go to Step 12.



STEP 11. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine.
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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 – Pattern 7 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

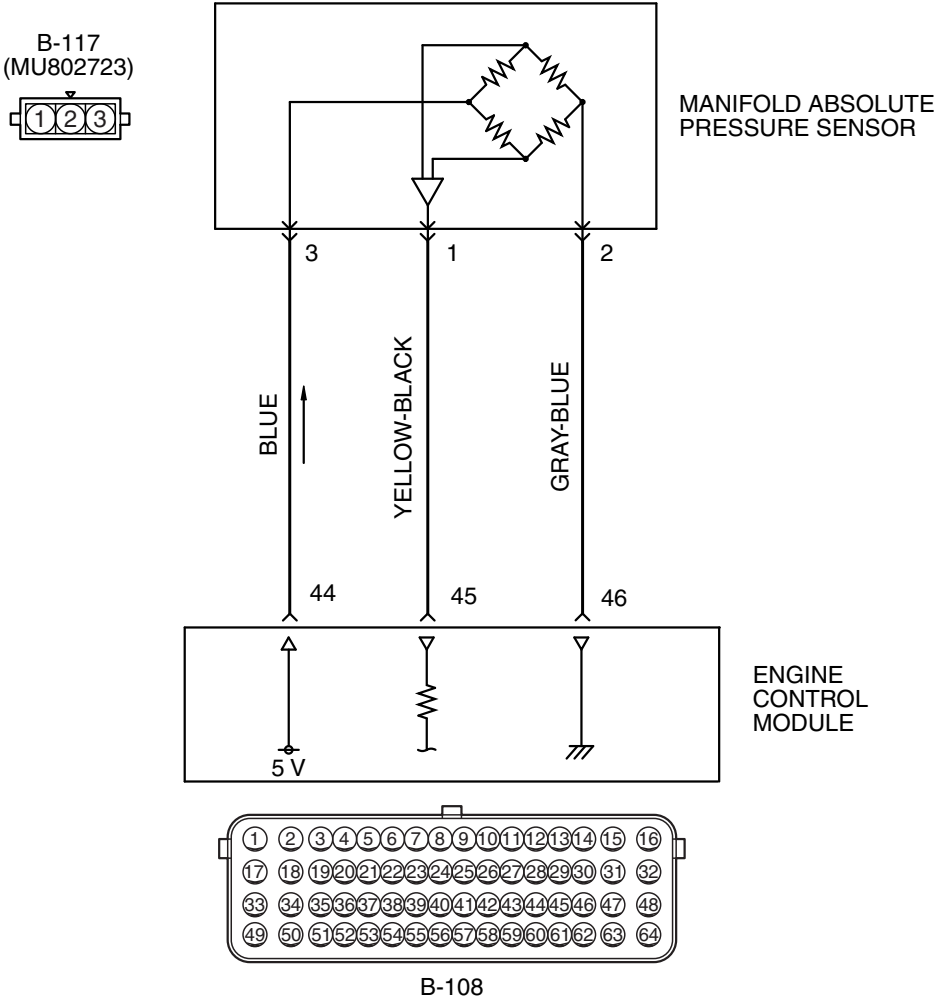
Q: Is DTC P0107 set?

YES : Retry the troubleshooting.

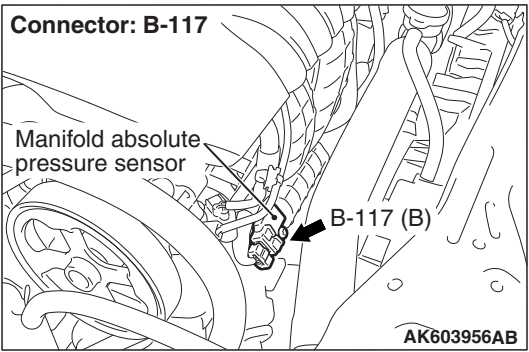
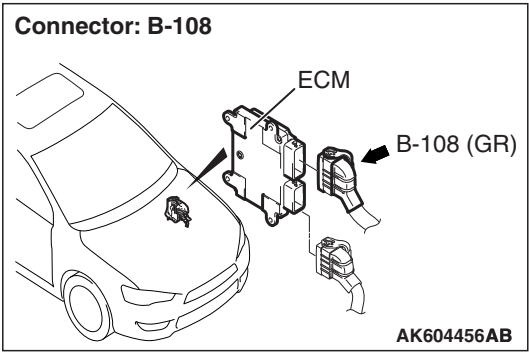
NO : The inspection is complete.

DTC P0108: Manifold Absolute Pressure Circuit High Input

MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT



AK604115 AD



CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from ECM (terminal No. 44). The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 46).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM (terminal No. 45) from the manifold absolute pressure sensor output terminal (terminal No. 1).

TECHNICAL DESCRIPTION

- The manifold absolute pressure sensor outputs a voltage which corresponds to the intake manifold pressure.
- The ECM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Manifold absolute pressure sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

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

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

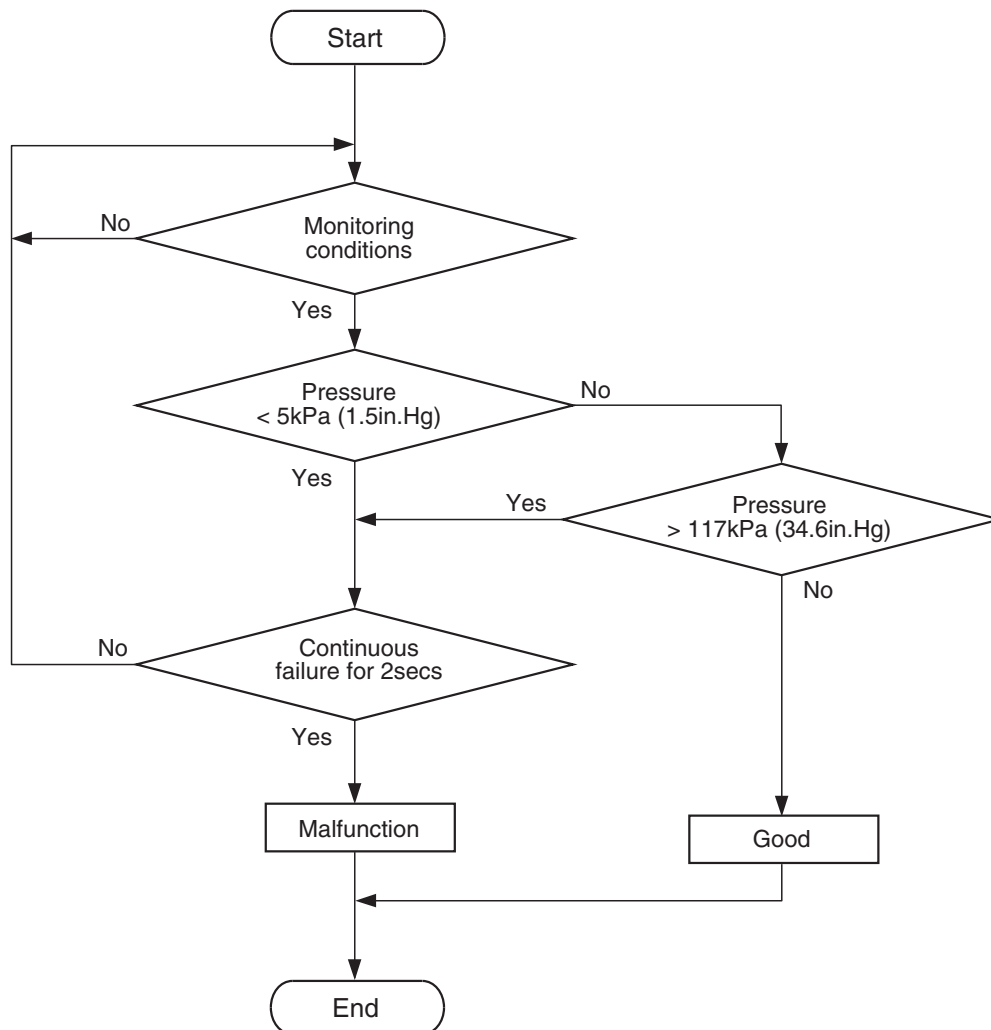
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK604313

Check Condition

- 8 minutes or more have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is 0°C (32°F) or lower.

Judgement Criterion

- Manifold absolute pressure sensor output voltage has continued to be 4.6 volts [corresponding to a manifold absolute pressure of 117 kPa (34.6 in.Hg)] or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

- Manifold absolute pressure sensor failed.
- Open manifold absolute pressure sensor circuit, or connector damage.
- ECM failed.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure 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 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine.
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (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.

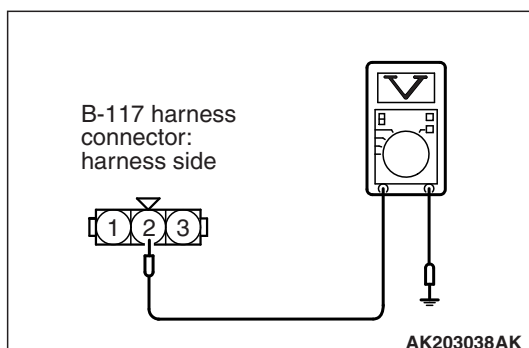
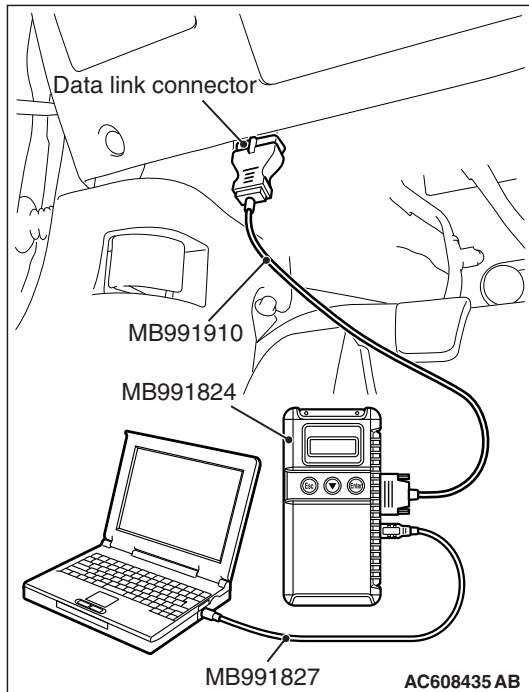
STEP 2. Measure the ground voltage at manifold absolute pressure sensor connector B-117 by backprobing.

- (1) Do not disconnect the connector B-117.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 2 and ground by backprobing.
 - Voltage should be 0.5 volt or less.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage 0.5 volt or less?

YES : Go to Step 6.

NO : Go to Step 3.



STEP 3. Check harness connector B-117 at the manifold absolute pressure sensor and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 7.

STEP 4. Check for open circuit between manifold absolute pressure sensor connector B-117 (terminal No. 2) and ECM connector B-108 (terminal No. 46).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 7.

STEP 5. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

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

(2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.

- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

(3) Start the engine.

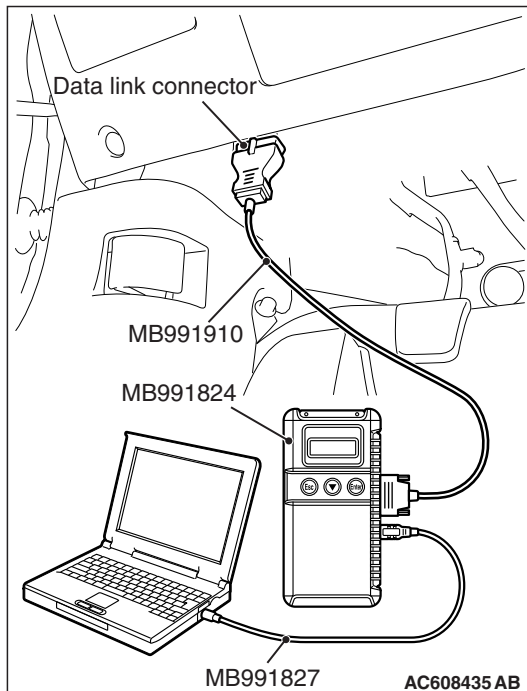
- When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
- When the engine is suddenly revved, manifold absolute pressure varies.

(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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 7.



STEP 6. Check harness connector B-117 at the manifold absolute pressure sensor and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Replace the manifold absolute pressure sensor. Then go to Step 7.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 7.

STEP 7. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

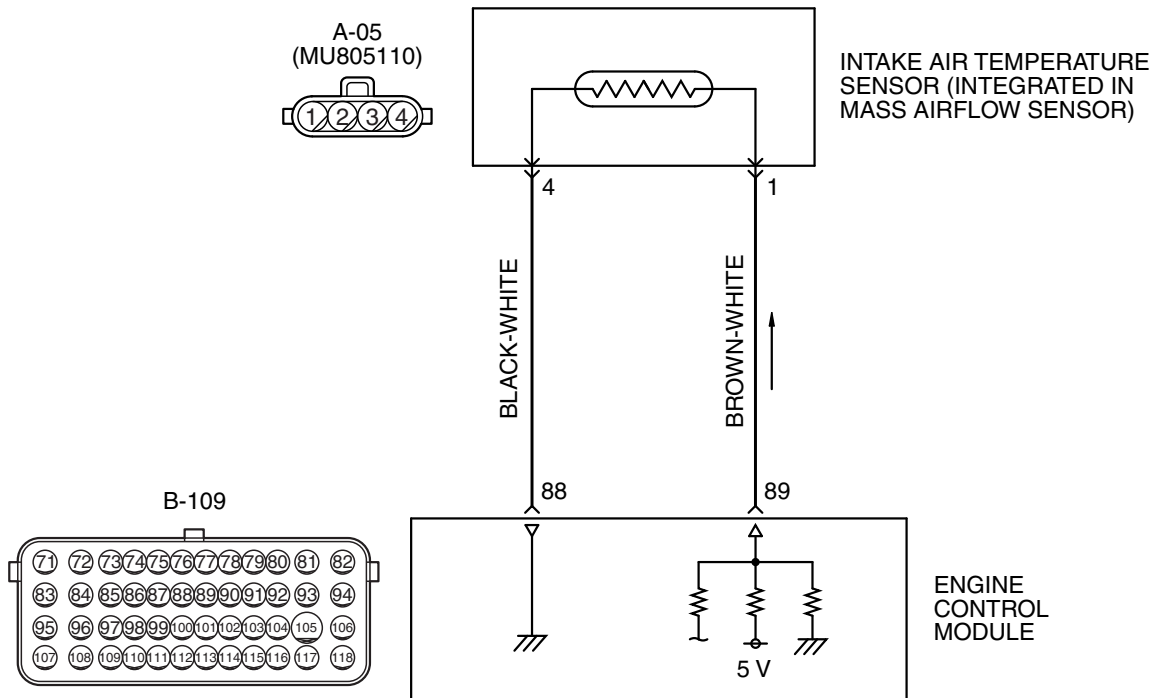
Q: Is DTC P0108 set?

YES : Retry the troubleshooting.

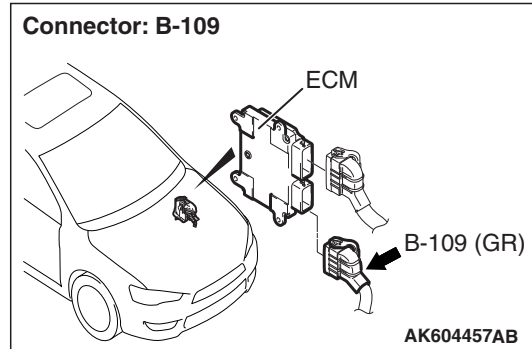
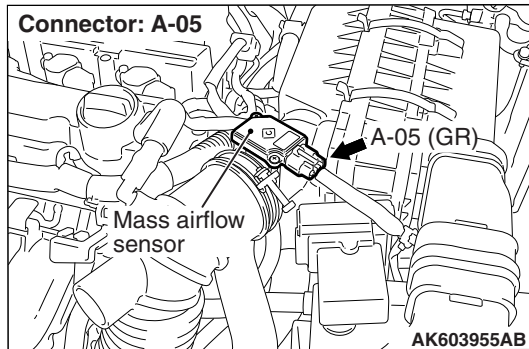
NO : The inspection is complete.

DTC P0111: Intake Air Temperature Circuit Range/Performance Problem

INTAKE AIR TEMPERATURE SENSOR CIRCUIT



AK603947AB



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 89) via the resistor in the ECM. The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 88).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

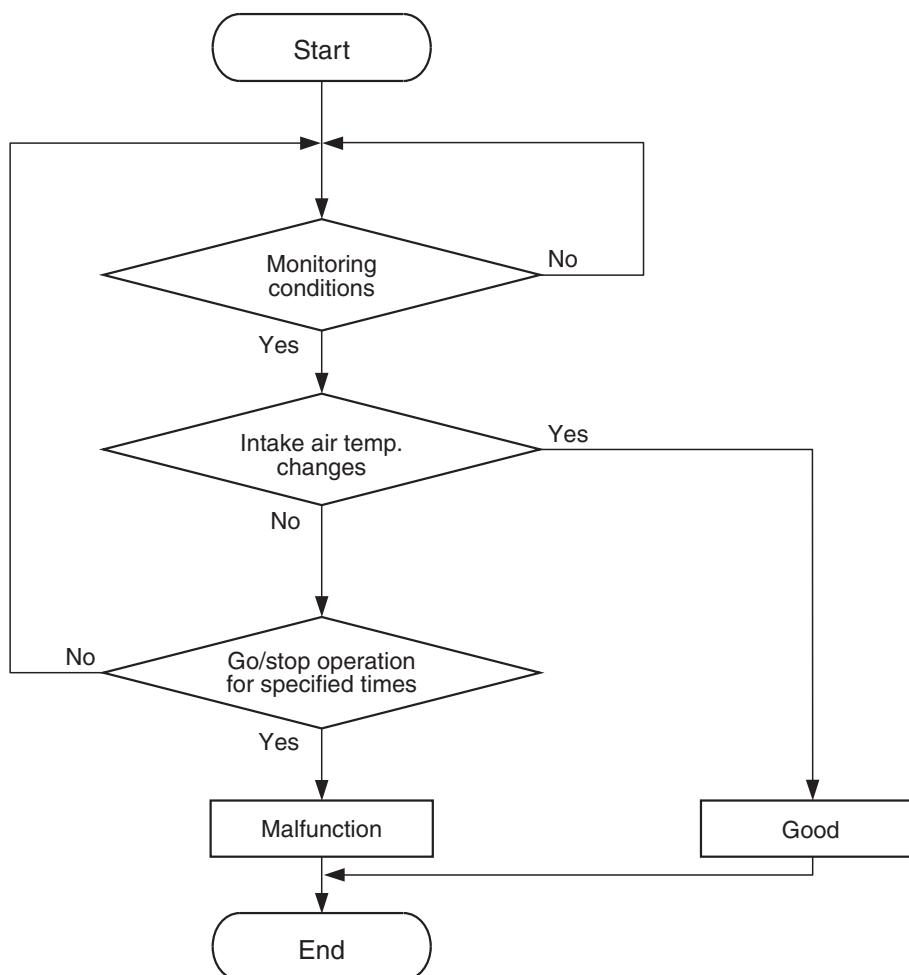
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



AK604314

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- Repeat 2 or more times: drive^{*1}, stop^{*2}.
 Drive^{*1}: vehicle speed higher than 50 km/h (31 mph) lasting a total of more than 60 seconds.
 Stop^{*2}: vehicle speed lower than 1.5 km/h (1.0 mph) lasting more than 30 seconds.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

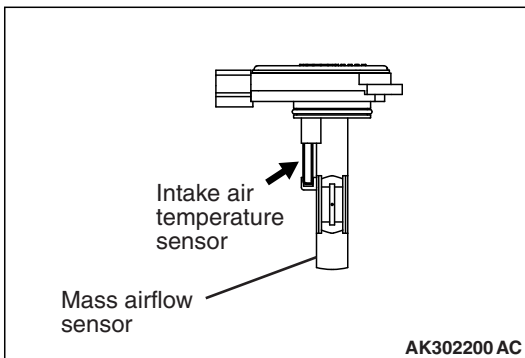
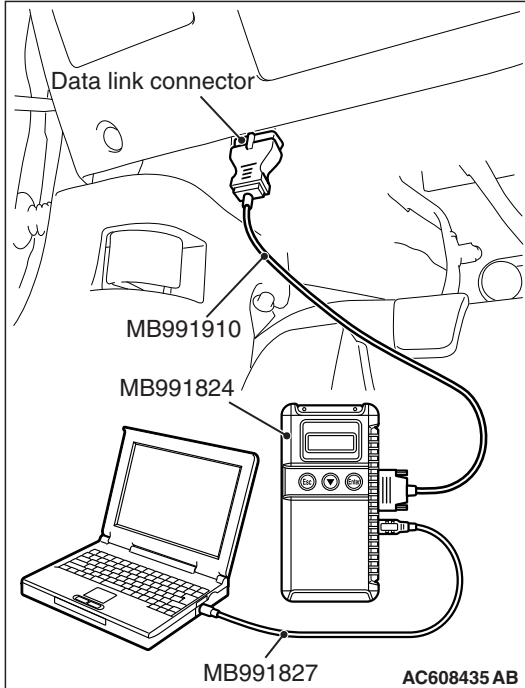
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A

STEP 1. Using scan tool MB991958, check data list item 5: Intake Air Temperature Sensor.

CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Remove the mass airflow sensor from the air intake hose.
- (3) Turn the ignition switch to the "ON" position.
- (4) Set scan tool MB991958 to the data reading mode for item 5, Intake Air Temperature Sensor.



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

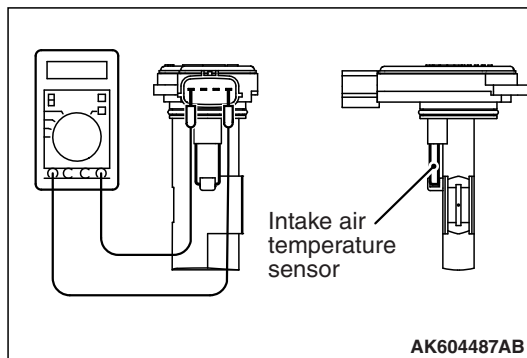
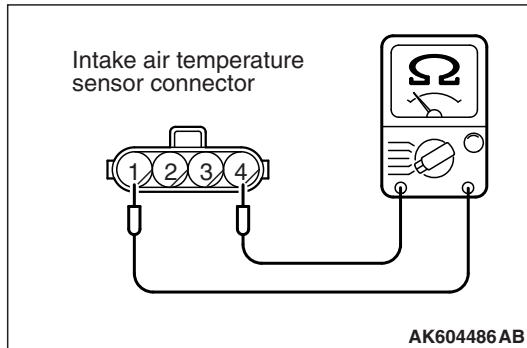
NOTE: Do not allow it to increase over 80 °C (176 °F).

- (6) Turn the ignition switch to the "LOCK" (OFF) position.
- (7) Attach the mass airflow sensor.

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 intake air temperature sensor.

- (1) Disconnect the intake air temperature sensor connector A-05.
- (2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.

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

Standard value:

13 – 17 kΩ	[at -20°C (-4°F)]
5.3 – 6.7 kΩ	[at 0°C (32°F)]
2.3 – 3.0 kΩ	[at 20°C (68°F)]
1.0 – 1.5 kΩ	[at 40°C (104°F)]
0.56 – 0.76 kΩ	[at 60°C (140°F)]
0.30 – 0.45 kΩ	[at 80°C (176°F)]

Q: Is the measured resistance at the standard value?

YES : Go to Step 3.

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

STEP 3. Check harness connector A-05 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

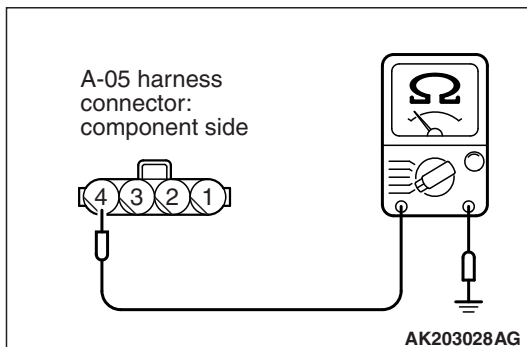
STEP 4. Check the continuity at intake air temperature sensor harness side connector A-05.

- (1) Disconnect the connector A-05 and measure at the harness side.
- (2) Check for the continuity between terminal No. 4 and ground.
 - Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 5.



STEP 5. Check harness connector B-109 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

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

STEP 6. Check for harness damage between intake air temperature sensor connector A-05 (terminal No. 4) and ECM connector B-109 (terminal No. 88).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 7. Check harness connector B-109 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

STEP 8. Check for harness damage between intake air temperature sensor connector A-05 (terminal No. 1) and ECM connector B-109 (terminal No. 89).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 9. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 [P.13A-12](#).

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

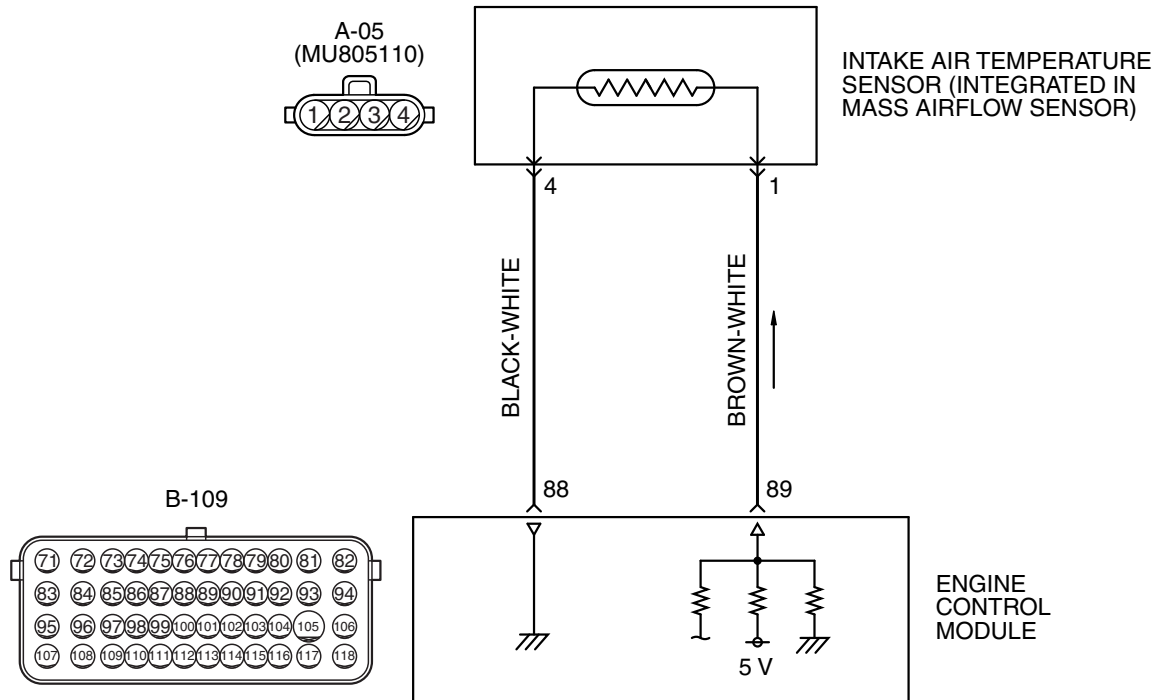
Q: Is DTC P0111 set?

YES : Retry the troubleshooting.

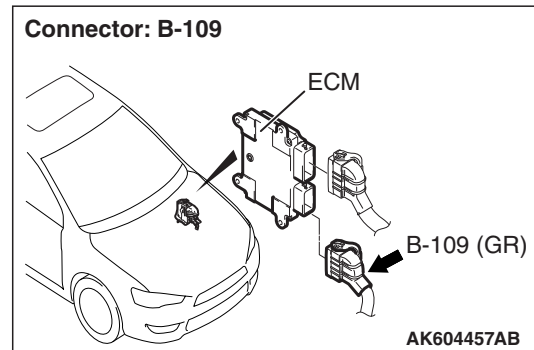
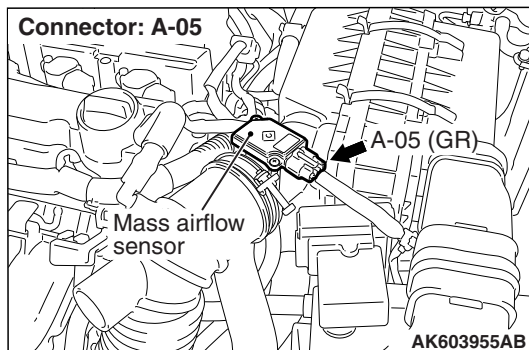
NO : The inspection is complete.

DTC P0112: Intake Air Temperature Circuit Low Input

INTAKE AIR TEMPERATURE SENSOR CIRCUIT



AK603947AB



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 89) via the resistor in the ECM. The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 88).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.

DESCRIPTIONS OF MONITOR METHODS

Intake air temperature sensor output voltage is out of

- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

specified range.

MONITOR EXECUTION

Continuous

Sensor (The sensor below is determined to be normal)

- Not applicable

MONITOR EXECUTION CONDITIONS

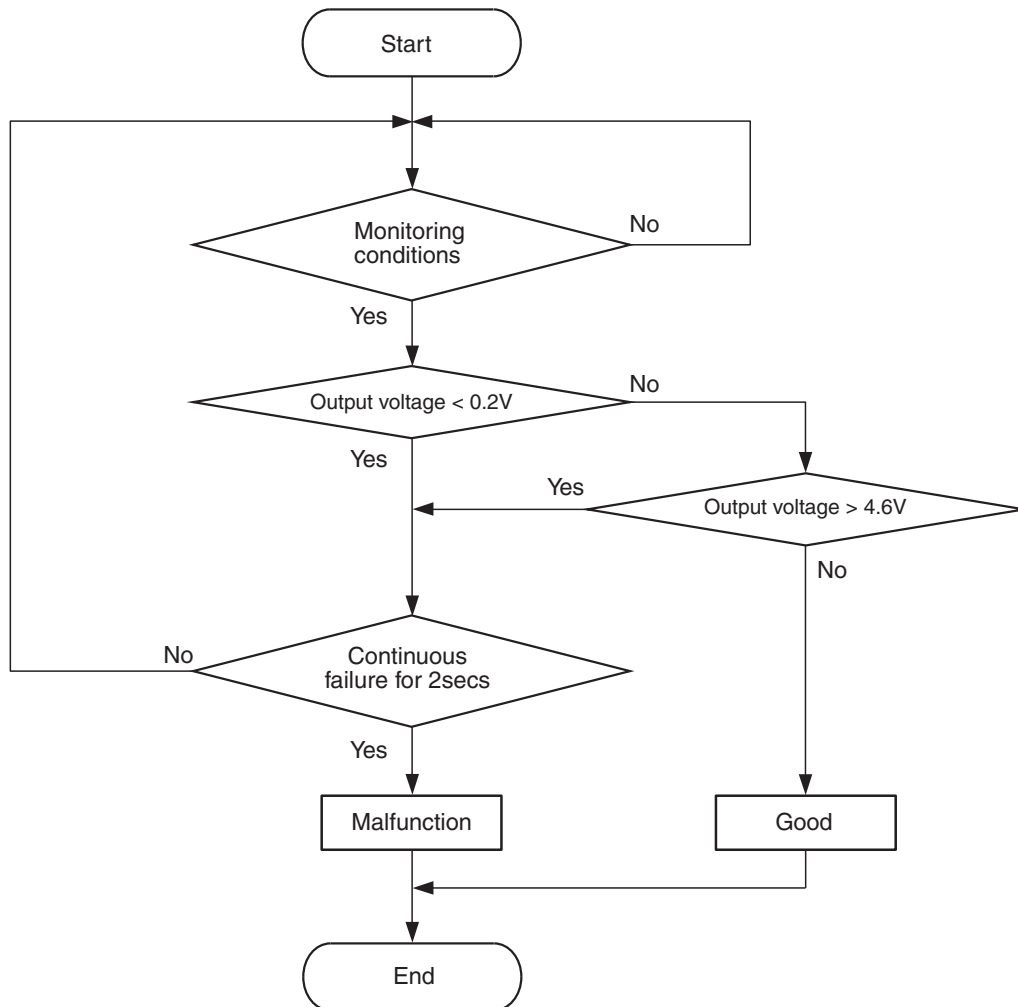
(Other monitor and Sensor)

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

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK604315

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –

Pattern 23 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 5: Intake Air Temperature Sensor.**⚠ CAUTION**

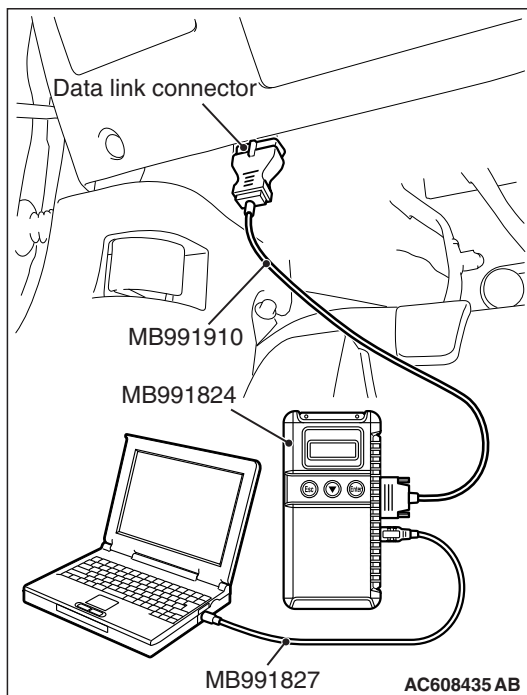
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 5, Intake Air Temperature Sensor.
 - The intake air temperature and temperature shown with the scan tool should approximately match.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

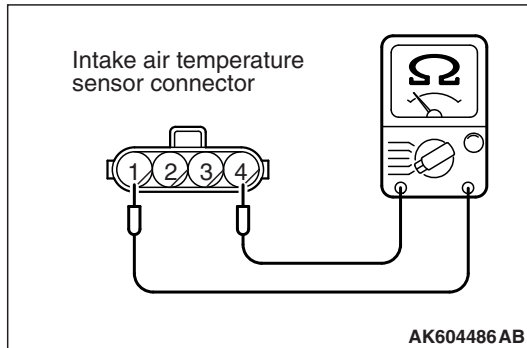
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

NO : Go to Step 2.

**STEP 2. Check harness connector A-05 at the intake air temperature sensor for damage.****Q: Is the harness connector in good condition?**

YES : Go to Step 3.

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



STEP 3. Check the intake air temperature sensor.

- (1) Disconnect the intake air temperature sensor connector A-05.
- (2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.
 - There should be continuity. (0.31 – 17 kΩ)

Q: Is the measured resistance between 0.31 and 17 kΩ?

YES : Go to Step 4.

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

STEP 4. Check for short circuit to ground between intake air temperature sensor connector A-05 (terminal No. 1) and ECM connector B-109 (terminal No. 89).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 6.

STEP 5. Check harness connector B-109 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 6.

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

STEP 6. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

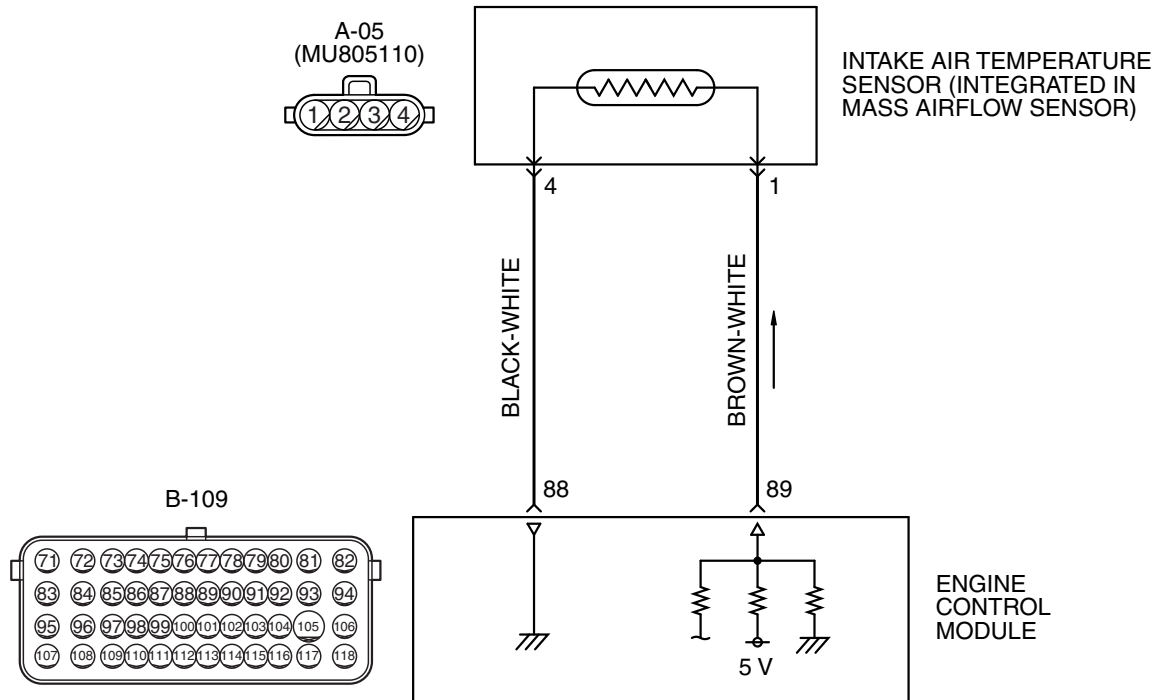
Q: Is DTC P0112 set?

YES : Retry the troubleshooting.

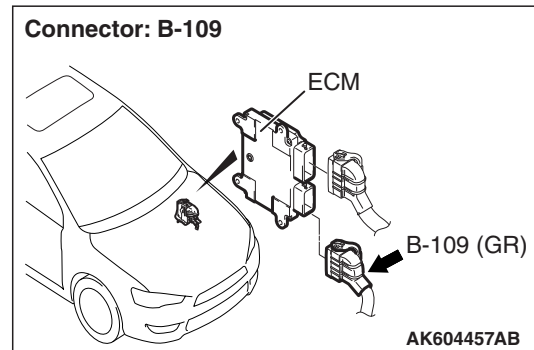
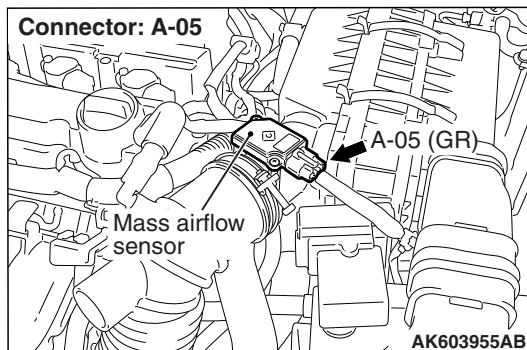
NO : The inspection is complete.

DTC P0113: Intake Air Temperature Circuit High Input

INTAKE AIR TEMPERATURE SENSOR CIRCUIT



AK603947AB



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 89) via the resistor in the ECM. The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 88).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.

DESCRIPTIONS OF MONITOR METHODS

Intake air temperature sensor output voltage is out of

- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

specified range.

MONITOR EXECUTION

Continuous

Sensor (The sensor below is determined to be normal)

- Not applicable

MONITOR EXECUTION CONDITIONS

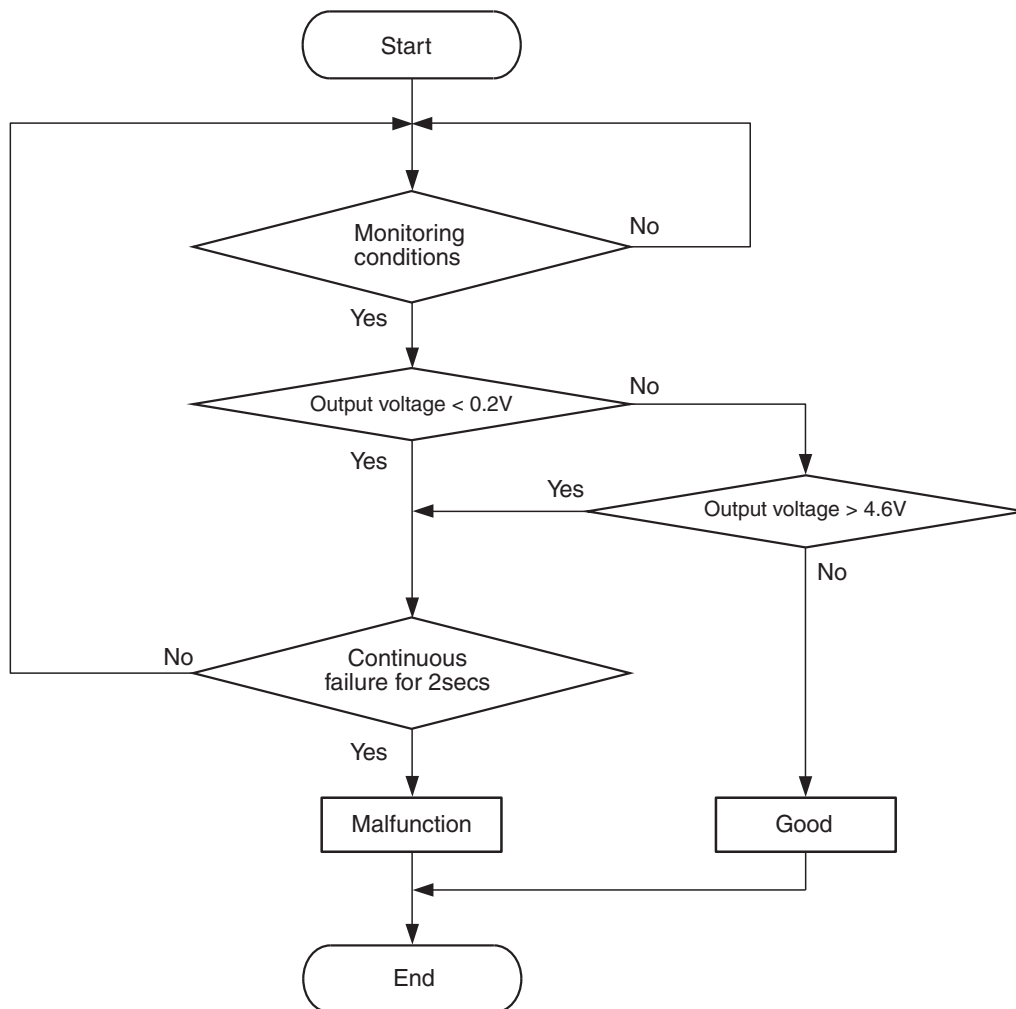
(Other monitor and Sensor)

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

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK604315

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –

Pattern 23 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992110: Power Plant ECU Check Harness

STEP 1. Using scan tool MB991958, check data list item 5: Intake Air Temperature Sensor.**⚠ CAUTION**

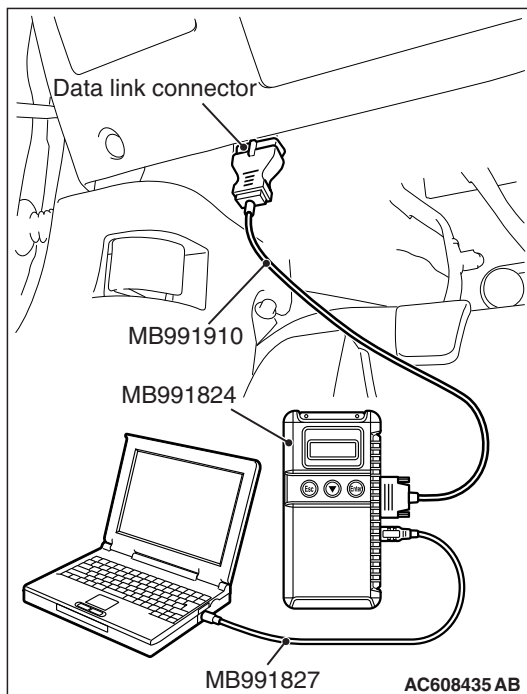
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 5, Intake Air Temperature Sensor.
 - The intake air temperature and temperature shown with the scan tool should approximately match.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

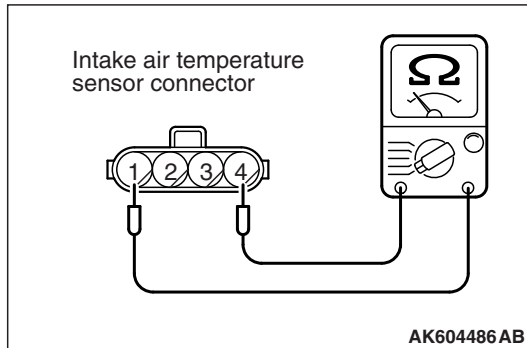
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

NO : Go to Step 2.

**STEP 2. Check harness connector A-05 at the intake air temperature sensor for damage.****Q: Is the harness connector in good condition?**

YES : Go to Step 3.

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



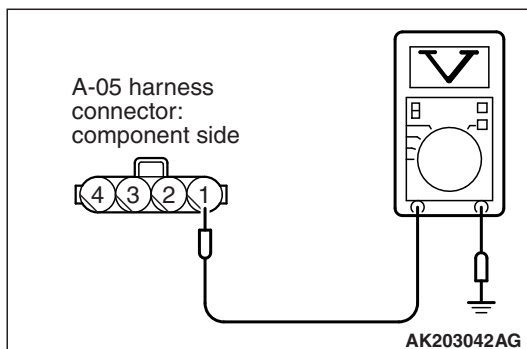
STEP 3. Check the intake air temperature sensor.

- (1) Disconnect the intake air temperature sensor connector A-05.
- (2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.
 - There should be continuity. (0.31 – 17 kΩ)

Q: Is the measured resistance between 0.31 and 17 kΩ?

YES : Go to Step 4.

NO : Replace the mass airflow sensor. Then go to Step 10.



STEP 4. Measure the sensor supply voltage at intake air temperature sensor harness side connector A-05.

- (1) Disconnect the connector A-05 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be between 4.5 and 4.9 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 7.

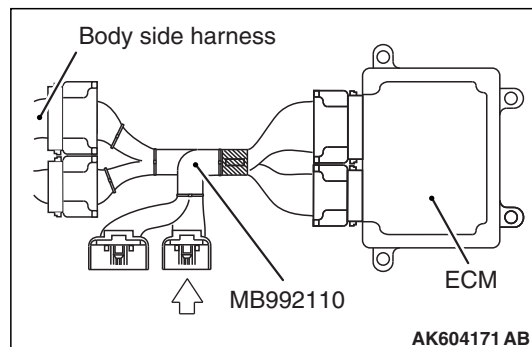
NO : Go to Step 5.

STEP 5. Check harness connector B-109 at ECM for damage.

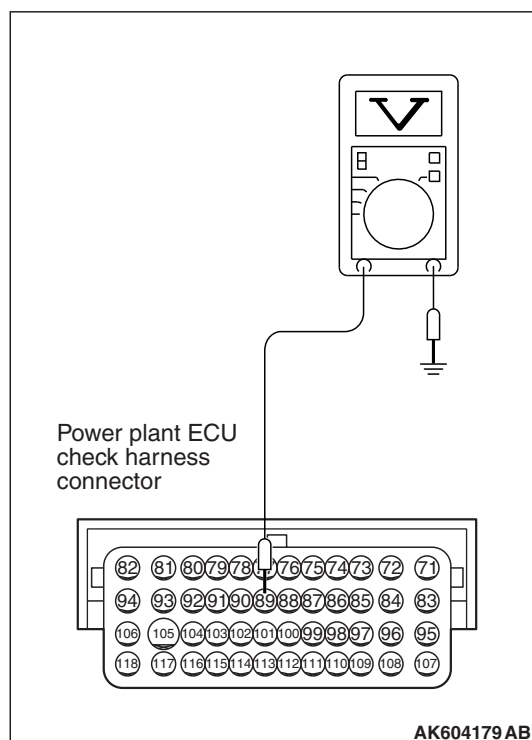
Q: Is the harness connector in good condition?

YES : Go to Step 6.

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



AK604171 AB



AK604179 AB

STEP 6. Measure the sensor supply voltage at ECM connector B-109 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Disconnect the intake air temperature sensor connector A-05.
- (3) Turn the ignition switch to the "ON" position.

- (4) Measure the voltage between terminal No. 89 and ground.
 - Voltage should be between 4.5 and 4.9 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Repair harness wire between intake air temperature sensor connector A-05 (terminal No. 1) and ECM connector B-109 (terminal No. 89) because of open circuit. Then go to Step 10.

NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

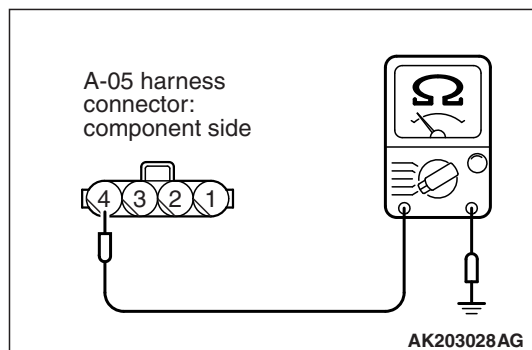
STEP 7. Check the continuity at intake air temperature sensor harness side connector A-05.

- (1) Disconnect the connector A-05 and measure at the harness side.
- (2) Check for the continuity between terminal No. 4 and ground.
 - Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

NO : Go to Step 8.



AK203028 AG

STEP 8. Check harness connector B-109 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

STEP 9. Check for open circuit between intake air temperature sensor connector A-05 (terminal No. 4) and ECM connector B-109 (terminal No. 88).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

NO : Repair it. Then go to Step 10.

STEP 10. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

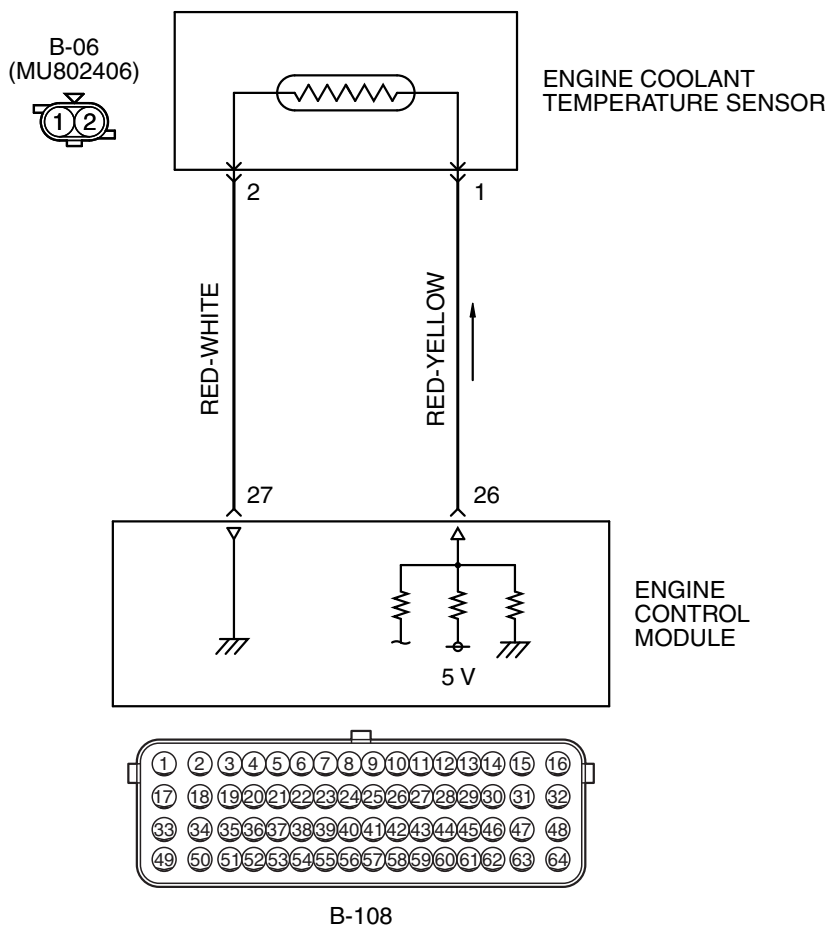
Q: Is DTC P0113 set?

YES : Retry the troubleshooting.

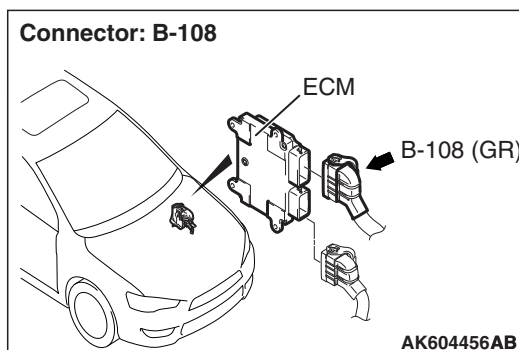
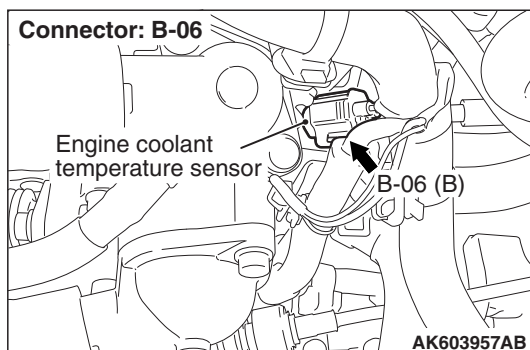
NO : The inspection is complete.

DTC P0116: Engine Coolant Temperature Circuit Range/Performance Problem

ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



AK603948 AF



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 26) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 27).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

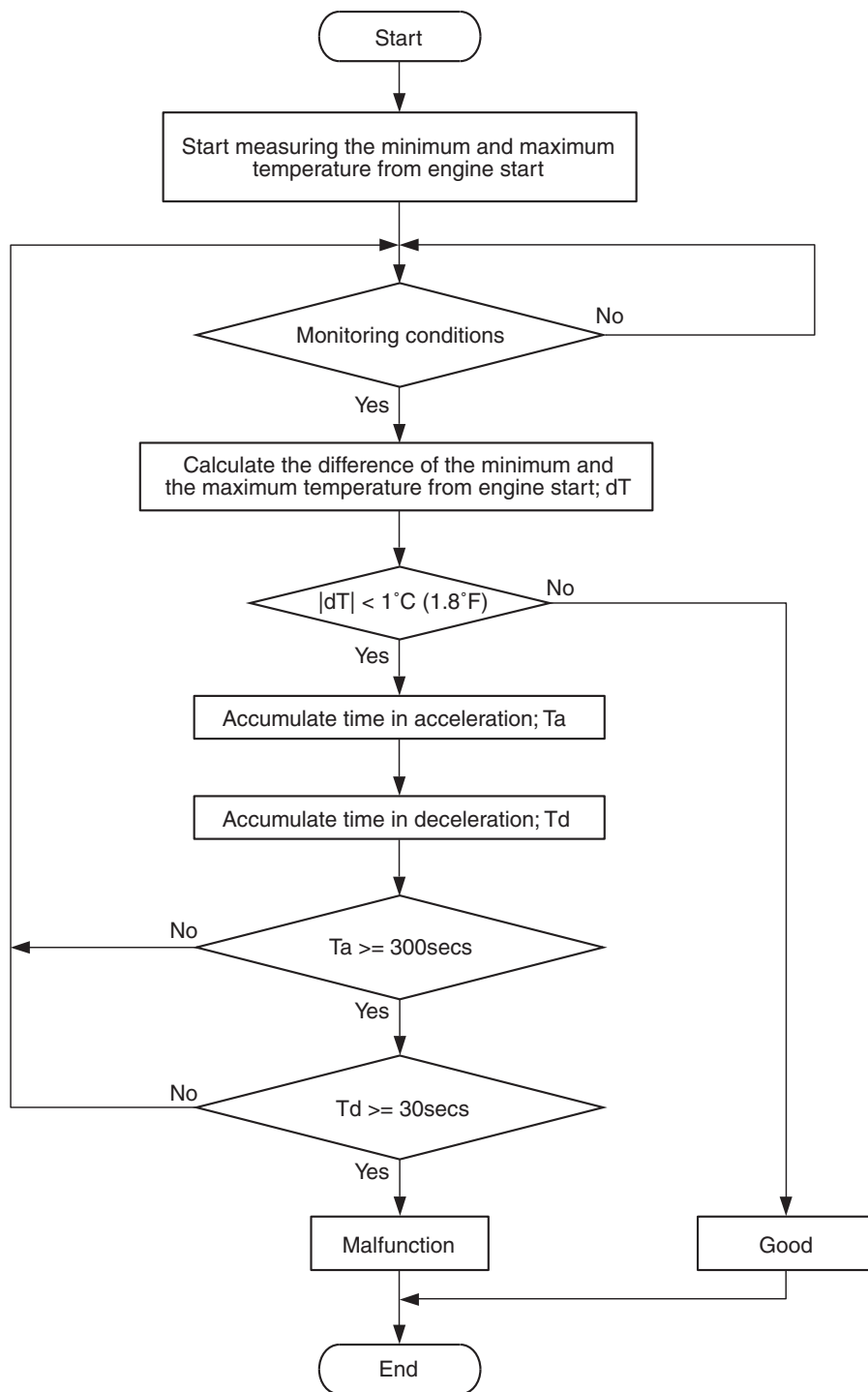
- Not applicable

Sensor (The sensor below is determined to be normal)

- Mass airflow sensor
- Intake air temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

- Engine coolant temperature was more than 0°C (32°F) when the engine started.
- The accumulation is more than 300 seconds during the acceleration having the mass airflow rate of 12 g/sec or more.
- The accumulation is more than 30 seconds during the deceleration having the mass airflow rate of 9 g/sec or less.

Judgement Criteria

- Engine coolant temperature fluctuates within 1°C (1.8°F) after 330 seconds have passed since the engine was started.
- However, time is not counted if any of the following conditions are met.

1. Intake air temperature is more than 60°C (140°F).
2. During fuel shut-off operation.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

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

STEP 1. Using scan tool MB991958, check data list item 6: Engine Coolant Temperature Sensor.

⚠ CAUTION

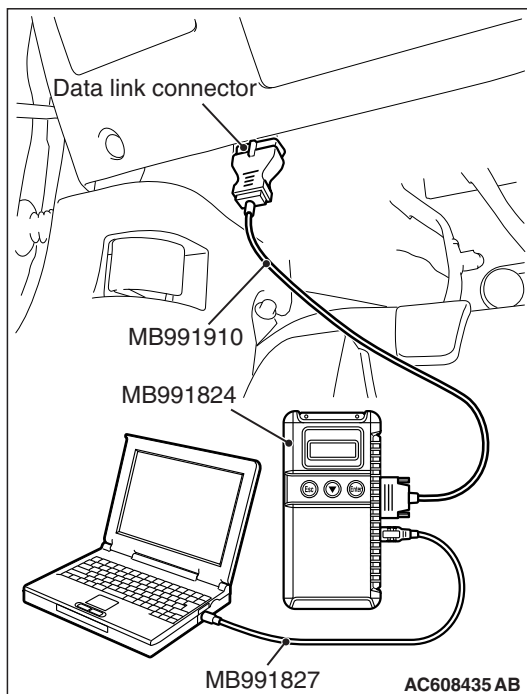
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 6, 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. Check the engine coolant temperature sensor.

Refer to Engine Coolant Temperature Sensor [P.13A-969](#)

Q: Is the engine coolant temperature sensor normal?

YES : Go to Step 3.

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

STEP 3. Check harness connector B-06 at the engine coolant temperature sensor for damage.**Q: Is the harness connector in good condition?**

YES : Go to Step 4.

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

STEP 4. Check the continuity at engine coolant temperature sensor harness side connector B-06.

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

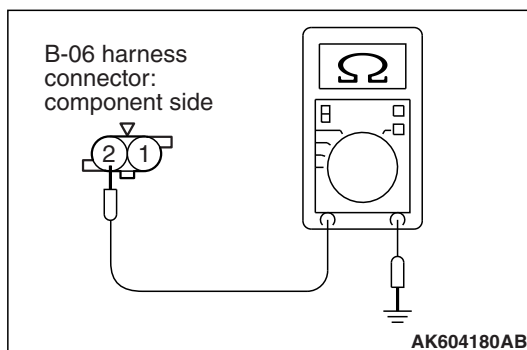
(2) Check for the continuity between terminal No. 2 and ground.

- Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 5.

**STEP 5. Check harness connector B-108 at ECM for damage.****Q: Is the harness connector in good condition?**

YES : Go to Step 6.

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

STEP 6. Check for harness damage between engine coolant temperature sensor connector B-06 (terminal No. 2) and ECM connector B-108 (terminal No. 27).**Q: Is the harness wire in good condition?**

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 7. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

STEP 8. Check for harness damage between engine coolant temperature sensor connector B-06 (terminal No. 1) and ECM connector B-108 (terminal No. 26).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 9. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 [P.13A-12](#).

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

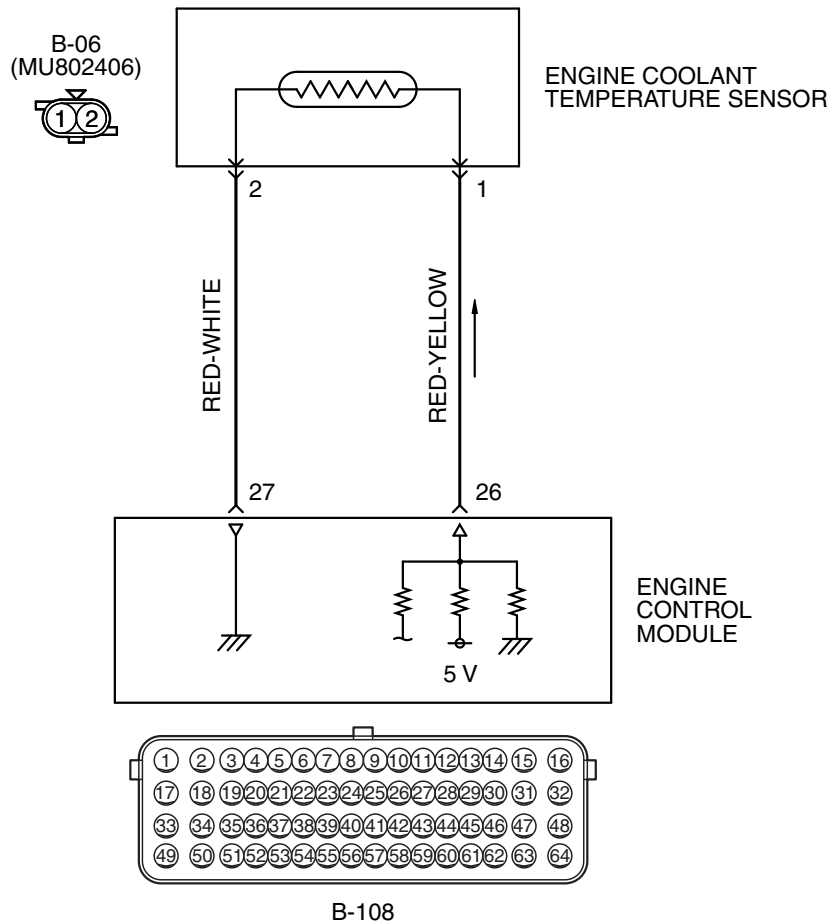
Q: Is DTC P0116 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

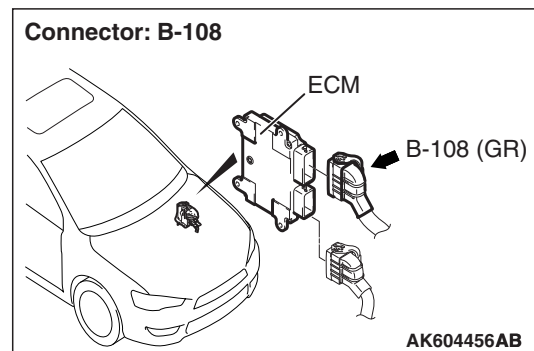
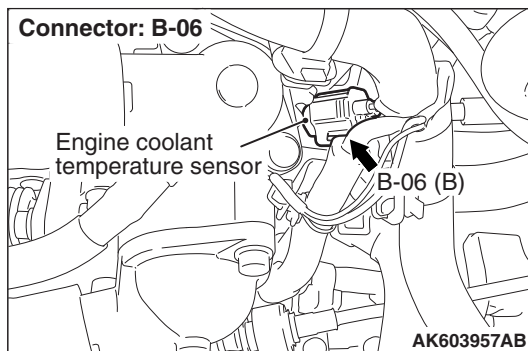
DTC P0117: Engine Coolant Temperature Circuit Low Input

ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



B-108

AK603948 AF



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 26) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 27).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

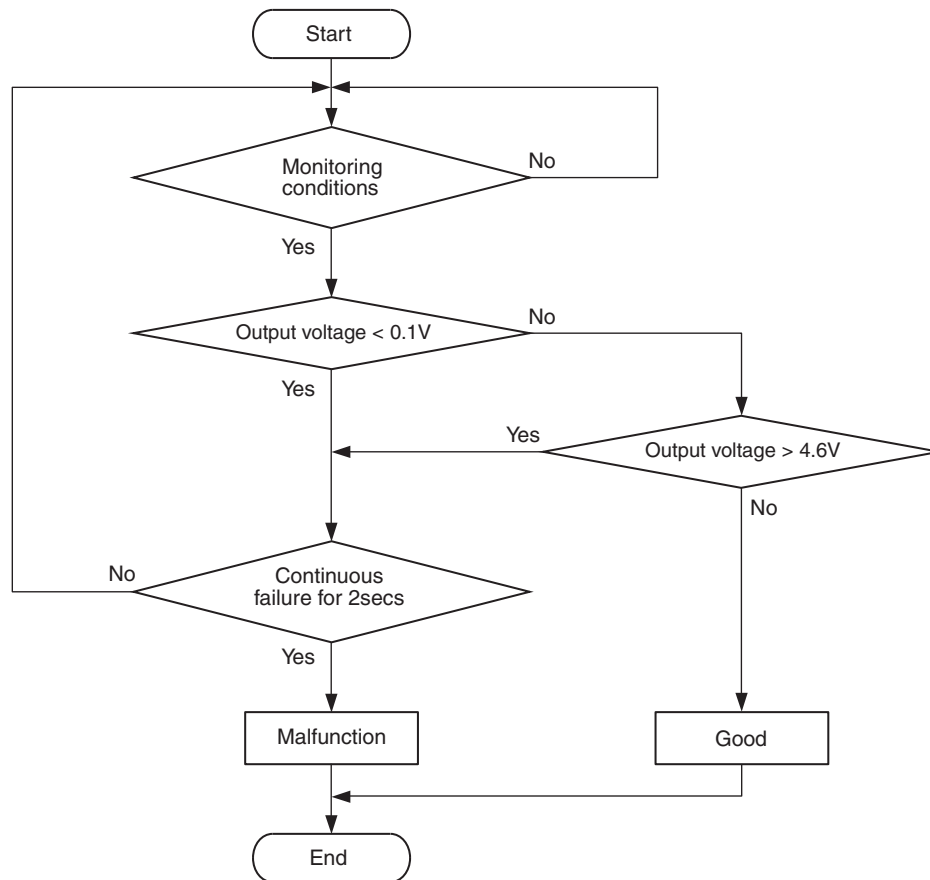
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK604317

Check Condition

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

Judgement Criterion

- Engine coolant temperature sensor output voltage has continued to be 0.1 volt or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –

Pattern 23 [P.13A-12.](#)

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

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

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 6: Engine Coolant Temperature Sensor.**⚠ CAUTION**

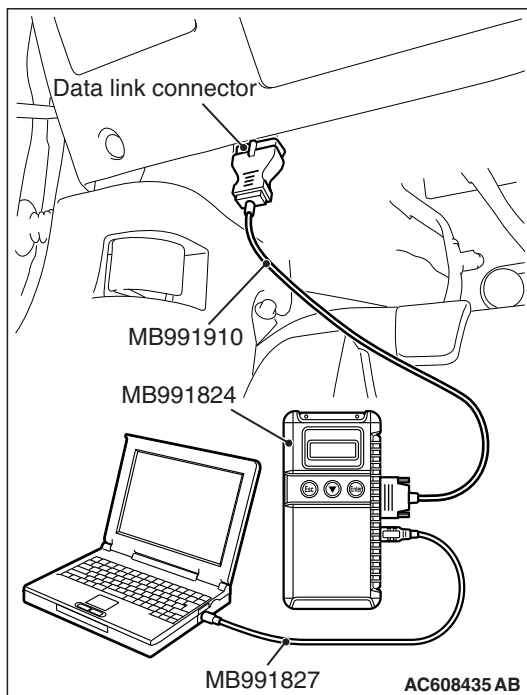
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 6, 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. Check harness connector B-06 at the engine coolant temperature sensor for damage.****Q: Is the harness connector in good condition?**

YES : Go to Step 3.

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

STEP 3. Check for short circuit to ground between engine coolant temperature sensor connector B-06 (terminal No. 1) and ECM connector B-108 (terminal No. 26).**Q: Is the harness wire in good condition?**

YES : Go to Step 4.

NO : Repair it. Then go to Step 6.

STEP 4. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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

STEP 5. Check the engine coolant temperature sensor.

Refer to Engine Coolant Temperature Sensor [P.13A-969](#)

Q: Is the engine coolant temperature sensor normal?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 6.

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

STEP 6. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

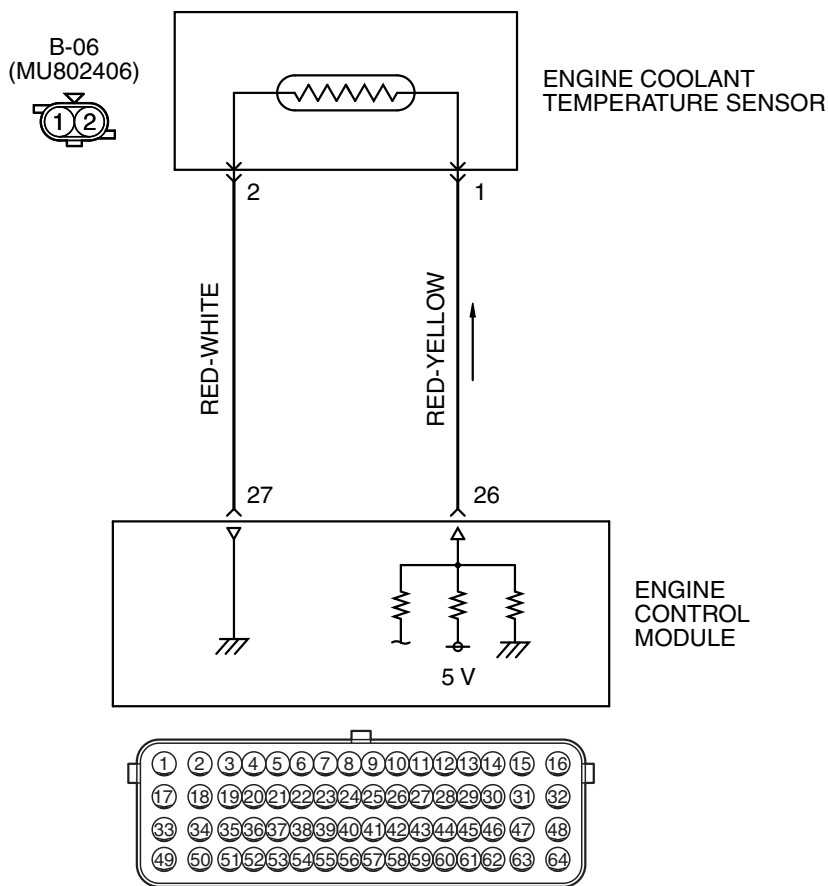
Q: Is DTC P0117 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

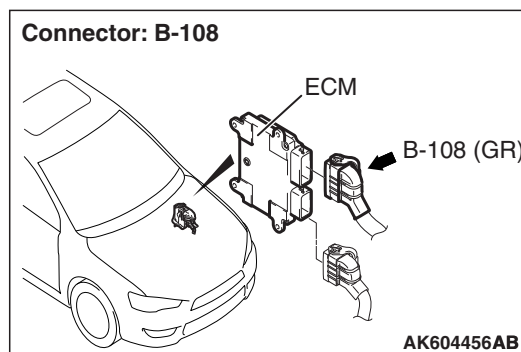
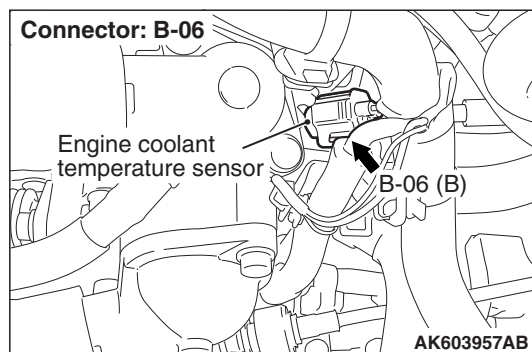
DTC P0118: Engine Coolant Temperature Circuit High Input

ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



B-108

AK603948 AF



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 26) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 27).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

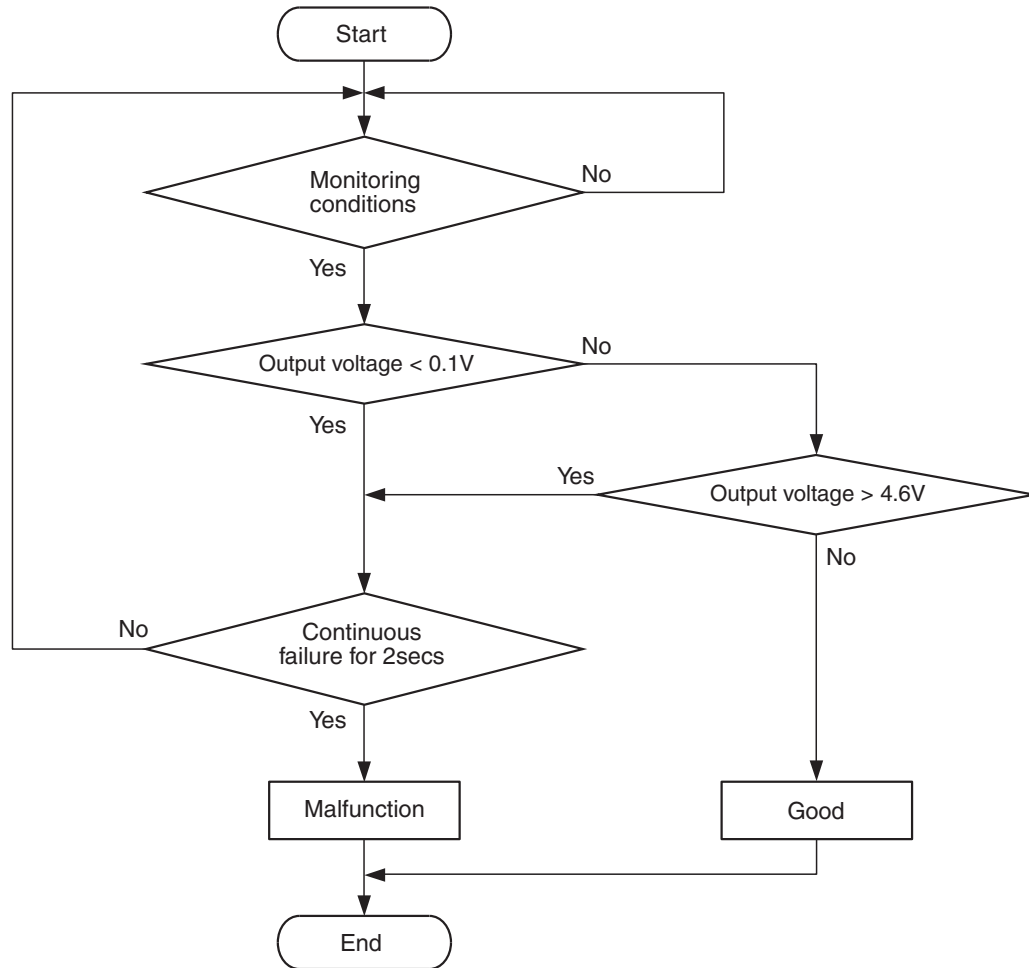
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK604317

Check Condition

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

Judgement Criterion

- Engine coolant temperature sensor output voltage has continued to be 4.6 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function—OBD-II Drive Cycle—Pattern 23 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992110: Power Plant ECU Check Harness

STEP 1. Using scan tool MB991958, check data list item 6: Engine Coolant Temperature Sensor.

⚠ CAUTION

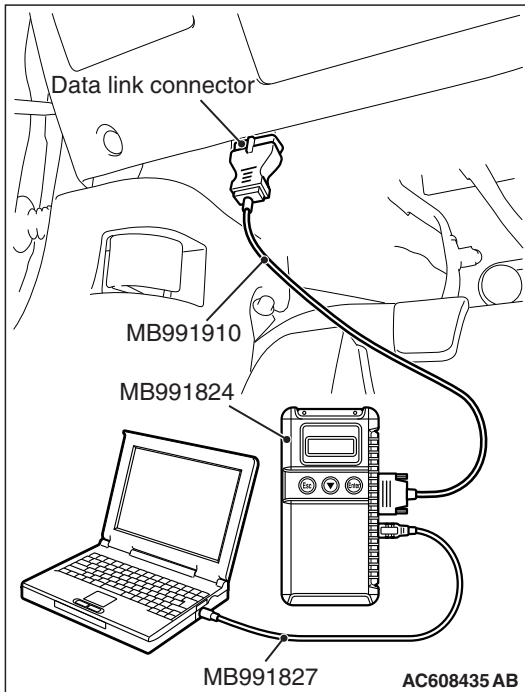
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 6, 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.

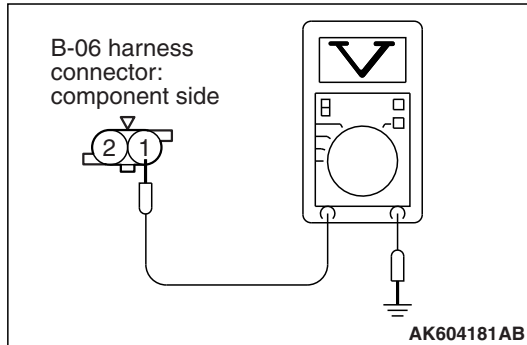


STEP 2. Check harness connector B-06 at the engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

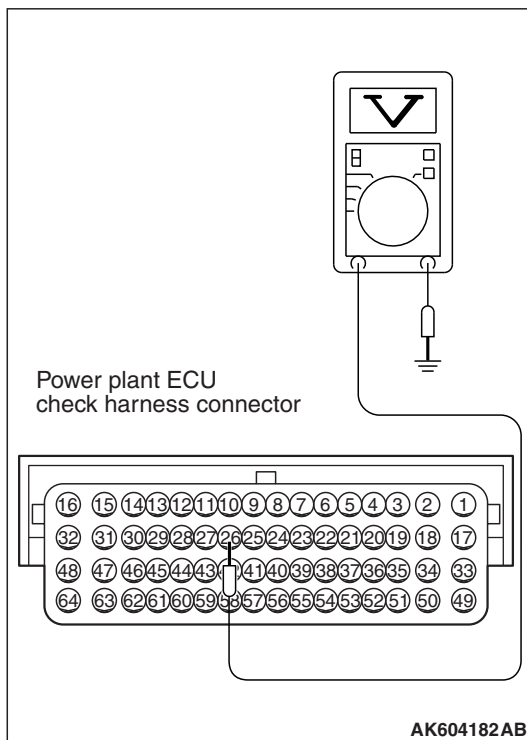
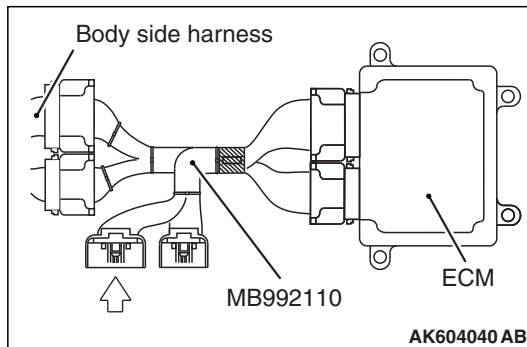
YES : Go to Step 3.

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

**STEP 3. Measure the sensor supply voltage at engine coolant temperature 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. 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 6.**NO :** Go to Step 4.**STEP 4. Check harness connector B-108 at ECM for damage.****Q: Is the harness connector in good condition?****YES :** Go to Step 5.**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.



STEP 5. Measure the sensor supply voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

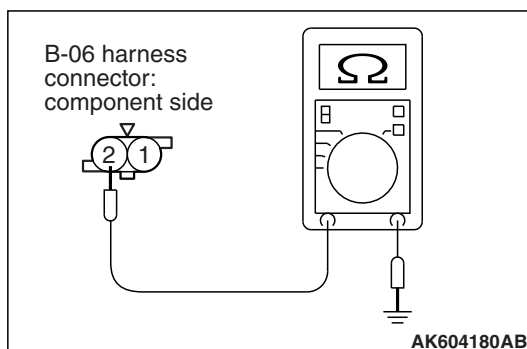
- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Disconnect the engine coolant temperature sensor connector B-06.
- (3) Turn the ignition switch to the "ON" position.

- (4) Measure the voltage between terminal No. 26 and ground.
 - Voltage should be between 4.5 and 4.9 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Repair harness wire between engine coolant temperature sensor connector B-06 (terminal No. 1) and ECM connector B-108 (terminal No. 26) because of open circuit. Then go to Step 10.

NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.



STEP 6. Check the continuity at engine coolant temperature sensor harness side connector B-06.

- (1) Disconnect the connector B-06 and measure at the harness side.
- (2) Check for the continuity between terminal No. 2 and ground.
 - Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 9.

NO : Go to Step 7.

STEP 7. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

STEP 8. Check for open circuit between engine coolant sensor connector B-06 (terminal No. 2) and ECM connector B-108 (terminal No. 27).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

NO : Repair it. Then go to Step 10.

STEP 9. Check the engine coolant temperature sensor.
Refer to Engine Coolant Temperature Sensor [P.13A-969](#)

Q: Is the engine coolant temperature sensor normal?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

NO : Replace the engine coolant temperature sensor. Then go to Step 10.

STEP 10. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

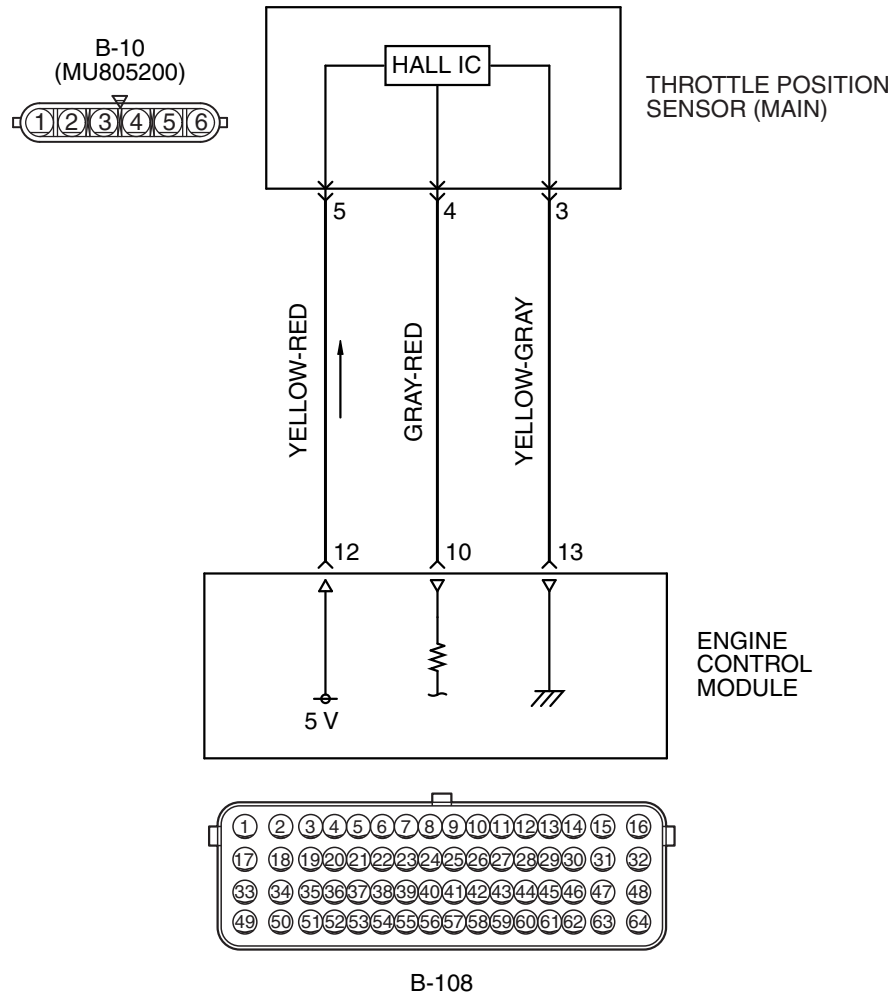
Q: Is DTC P0118 set?

YES : Retry the troubleshooting.

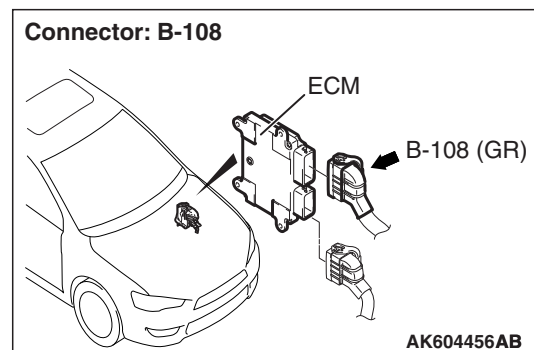
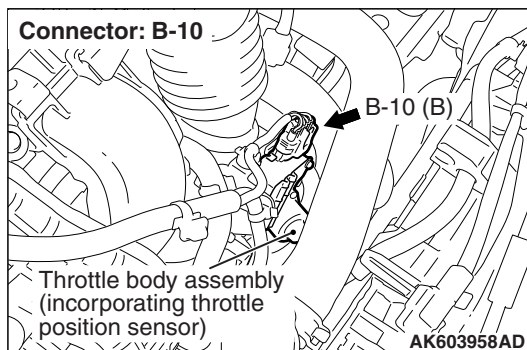
NO : The inspection is complete.

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

THROTTLE POSITION SENSOR (MAIN) CIRCUIT



AK603950 AE



CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the ECM (terminal No. 12).
- A voltage that is according to the throttle opening angle is sent to the ECM (terminal No. 10) from the throttle position sensor (main) output terminal (terminal No. 4).

- The ground terminal (terminal No. 3) is grounded with ECM (terminal No. 13).

TECHNICAL DESCRIPTION

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

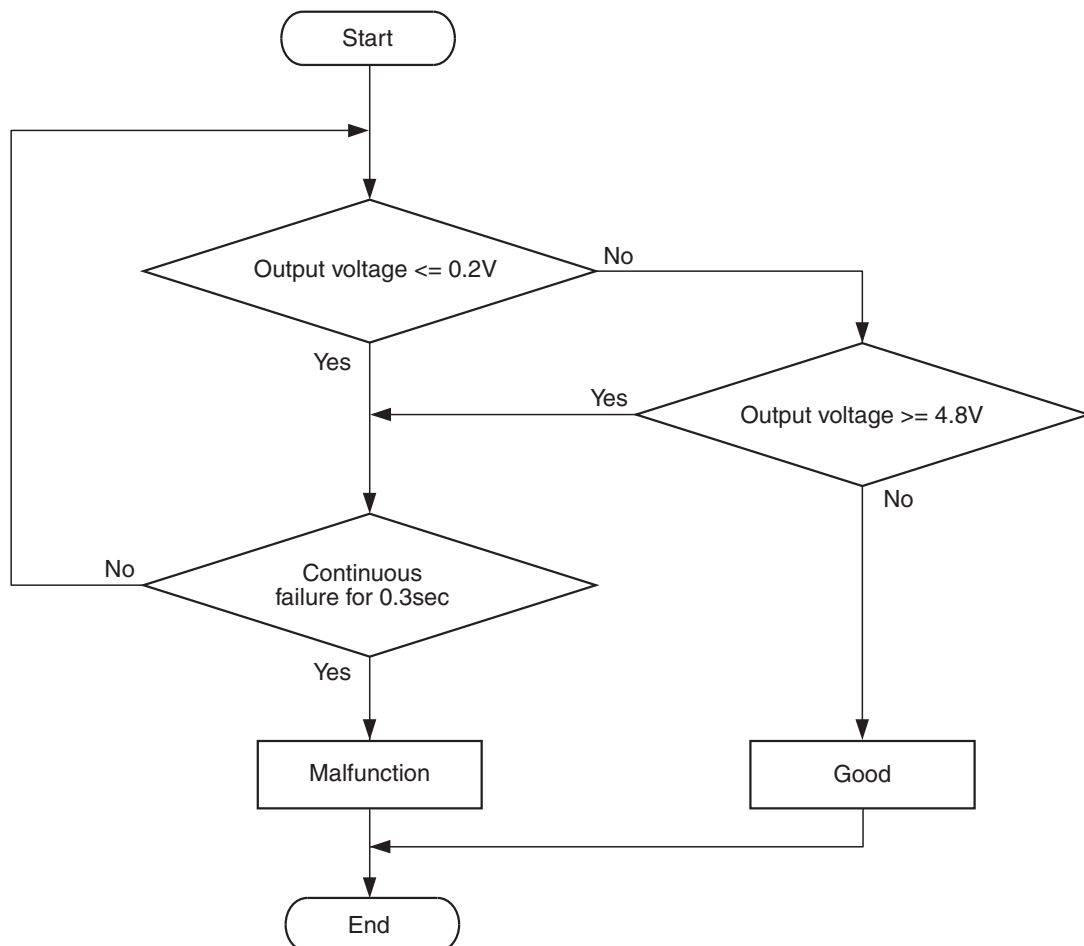
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



STEP 3. Check for harness damage between throttle position sensor connector B-10 (terminal No. 5) and ECM connector B-108 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 4.

NO : Repair it. Then go to Step 7.

STEP 4. Check for short circuit to ground and harness damage between throttle position sensor connector B-10 (terminal No. 4) and ECM connector B-108 (terminal No. 10).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 7.

STEP 5. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

- (1) Turn the ignition switch to the "ON" position.
- (2) Detach the intake air hose at the throttle body.
- (3) Disconnect the connector of the throttle position sensor.
- (4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (5) Set scan tool MB991958 to the data reading mode for item 13, 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.
- (6) 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 6.

STEP 6. 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 7.

NO : The inspection is complete.

STEP 7. Using scan tool MB991958, read the diagnostic trouble code (DTC).

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

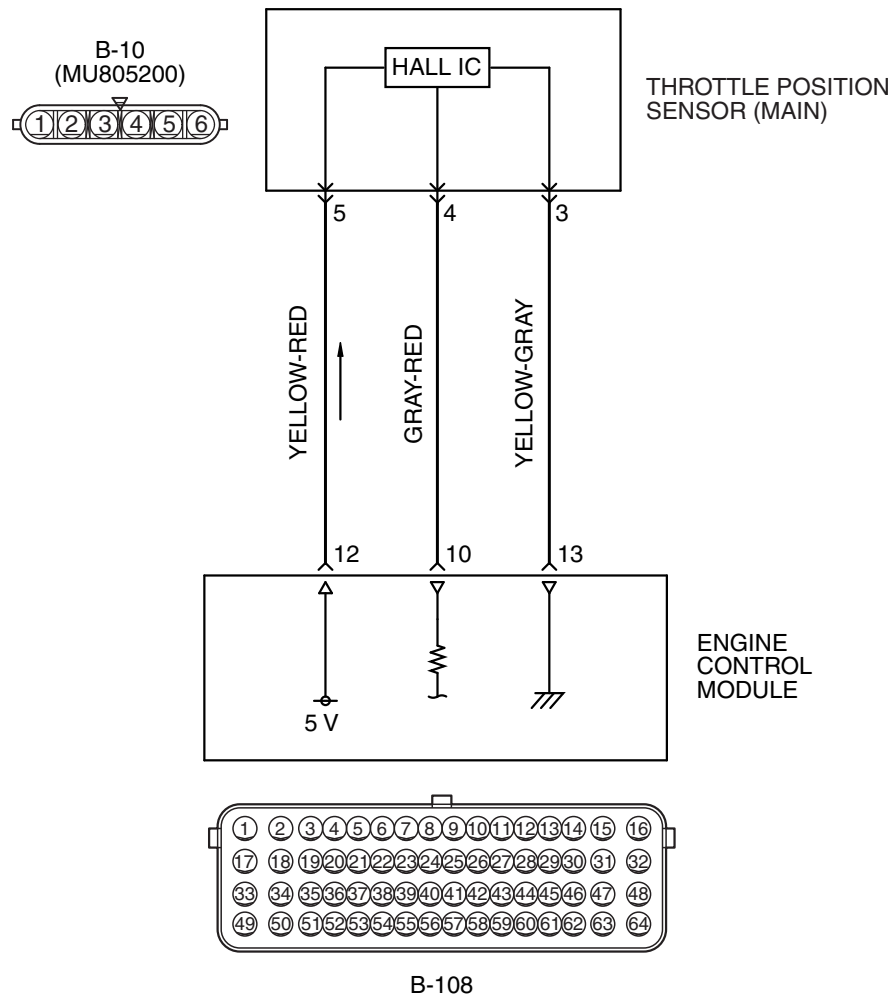
Q: Is DTC P0122 set?

YES : Retry the troubleshooting.

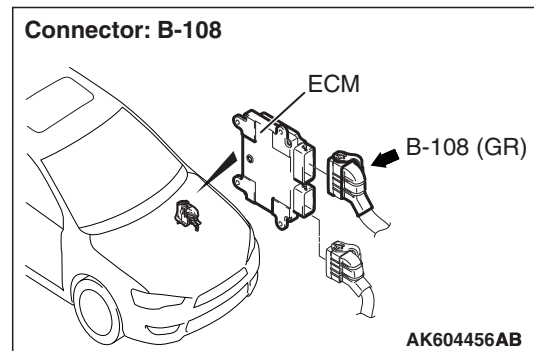
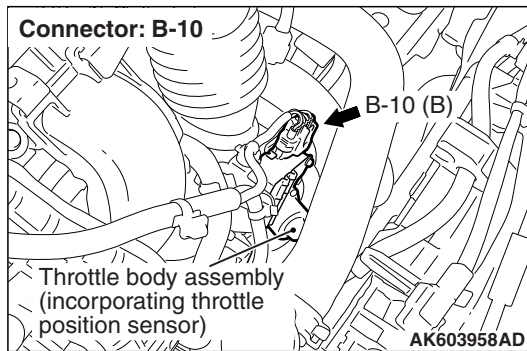
NO : The inspection is complete.

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

THROTTLE POSITION SENSOR (MAIN) CIRCUIT



AK603950 AE



CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the ECM (terminal No. 12).
- A voltage that is according to the throttle opening angle is sent to the ECM (terminal No. 10) from the throttle position sensor (main) output terminal (terminal No. 4)
- The ground terminal (terminal No. 3) is grounded with ECM (terminal No. 13).

TECHNICAL DESCRIPTION

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

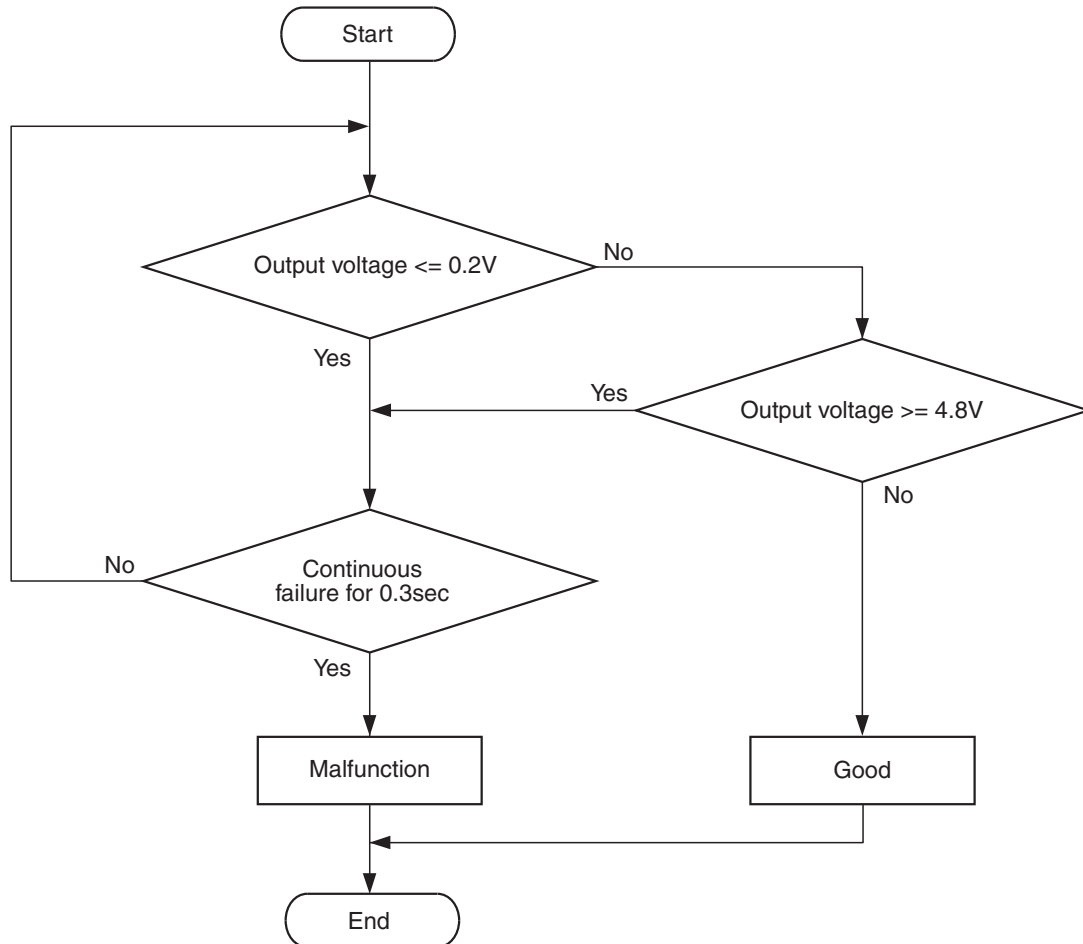
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK604318

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (main) output voltage should be 4.8 volts or more for 0.3 second.

OBD-II DRIVE CYCLE PATTERN

None.

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.
- ECM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan tool (M.U.T.-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 13: 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 13, 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](#).

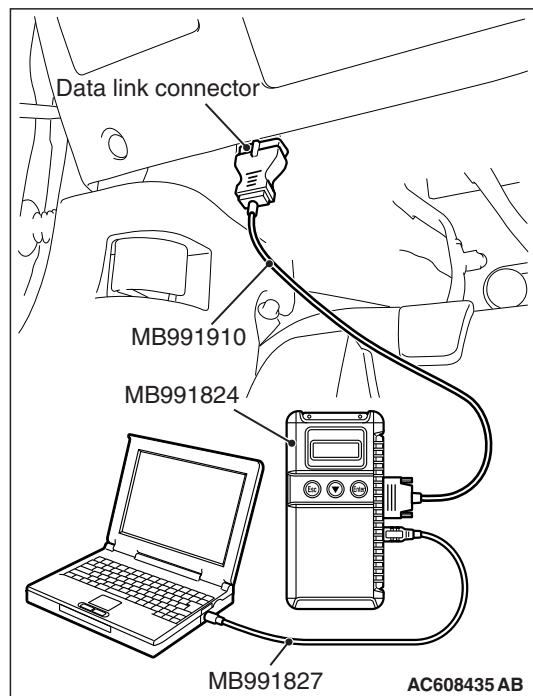
NO : Go to Step 2.

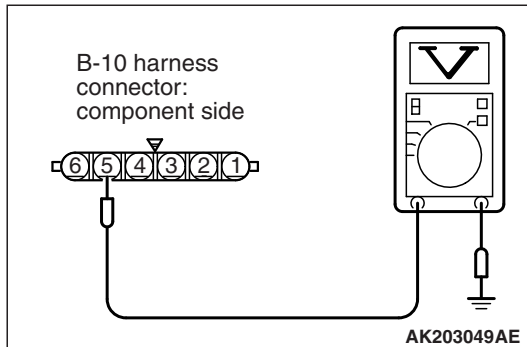
STEP 2. Check harness connector B-10 at throttle position sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

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





STEP 3. Measure the sensor supply voltage at throttle position sensor harness side connector B-10.

- (1) Disconnect the connector B-10 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 6.

NO : Go to Step 4.

STEP 4. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

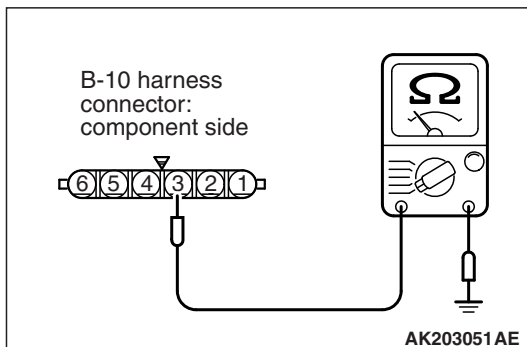
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

STEP 5. Check for open circuit and short circuit to ground between throttle position sensor connector B-10 (terminal No. 5) and ECM connector B-108 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 9.

NO : Repair it. Then go to Step 14.



STEP 6. Check the continuity at throttle position sensor harness side connector B-10.

- (1) Disconnect the connector B-10 and measure at the harness side.
- (2) Measure the continuity between terminal No. 3 and ground
 - Continuity ($2\ \Omega$ or less)

Q: Does continuity exist?

YES : Go to Step 10.

NO : Go to Step 7.

STEP 7. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

STEP 8. Check for open circuit and harness damage between throttle position sensor connector B-10 (terminal No. 3) and ECM connector B-108 (terminal No. 13).

Q: Is the harness wire in good condition?

YES : Go to Step 9.

NO : Repair it. Then go to Step 14.

STEP 9. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

- (1) Turn the ignition switch to the "ON" position.
- (2) Detach the intake air hose at the throttle body.
- (3) Disconnect the connector of the throttle position sensor.
- (4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (5) Set scan tool MB991958 to the data reading mode for item 13, 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.
- (6) 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

STEP 10. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 11.

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

STEP 11. Check for harness damage between throttle position sensor connector B-10 (terminal No. 5) and ECM connector B-108 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.

STEP 12. Check for open circuit, short circuit to ground and harness damage between throttle position sensor connector B-10 (terminal No. 4) and ECM connector B-108 (terminal No. 10).

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 14.

STEP 13. 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

NO : The inspection is complete.

STEP 14. Using scan tool MB991958, read the diagnostic trouble code (DTC).

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

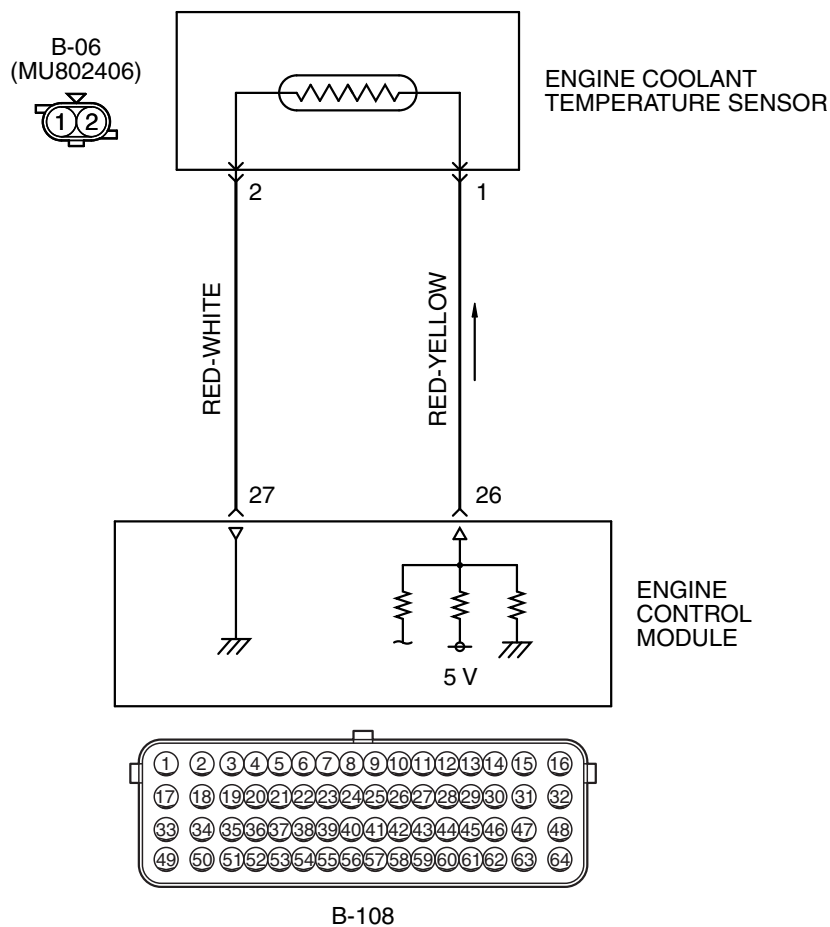
Q: Is DTC P0123 set?

YES : Retry the troubleshooting.

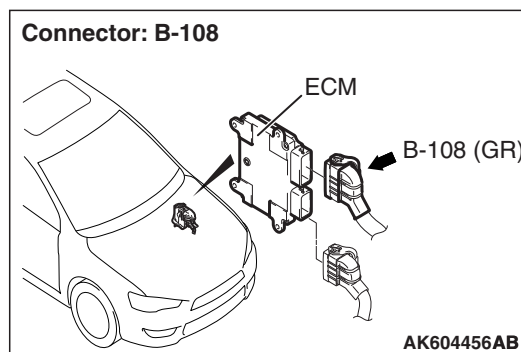
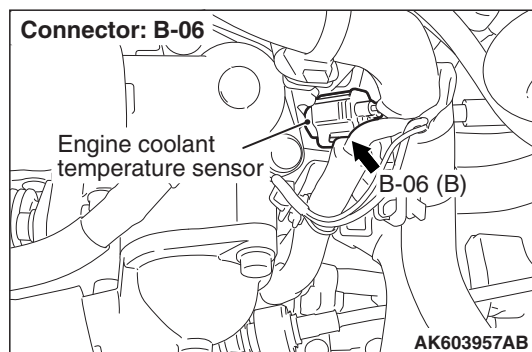
NO : The inspection is complete.

DTC P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control

ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



AK603948 AF



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 26) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 27).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

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 closed 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)

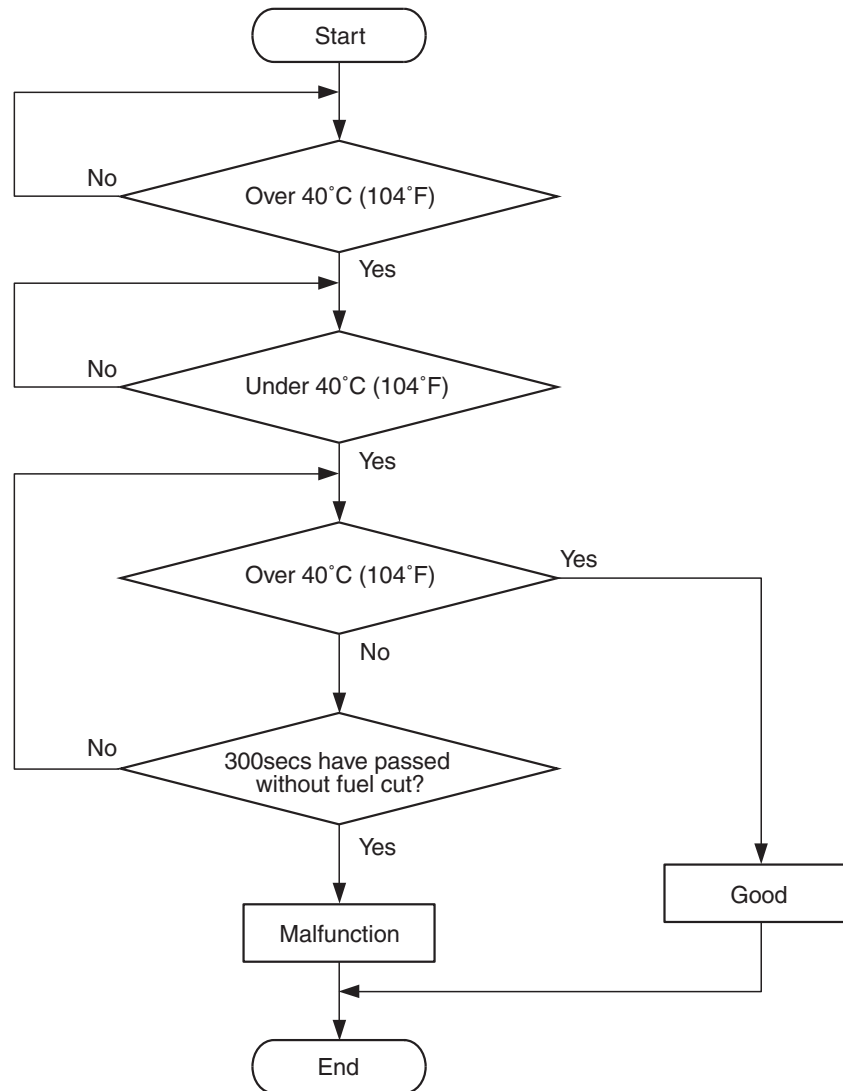
- Not applicable

Sensor (The sensor below is determined to be normal)

- Mass airflow sensor
- Intake air temperature sensor

DTC SET CONDITIONS <Range/Performance problem – drift>

Logic Flow Chart



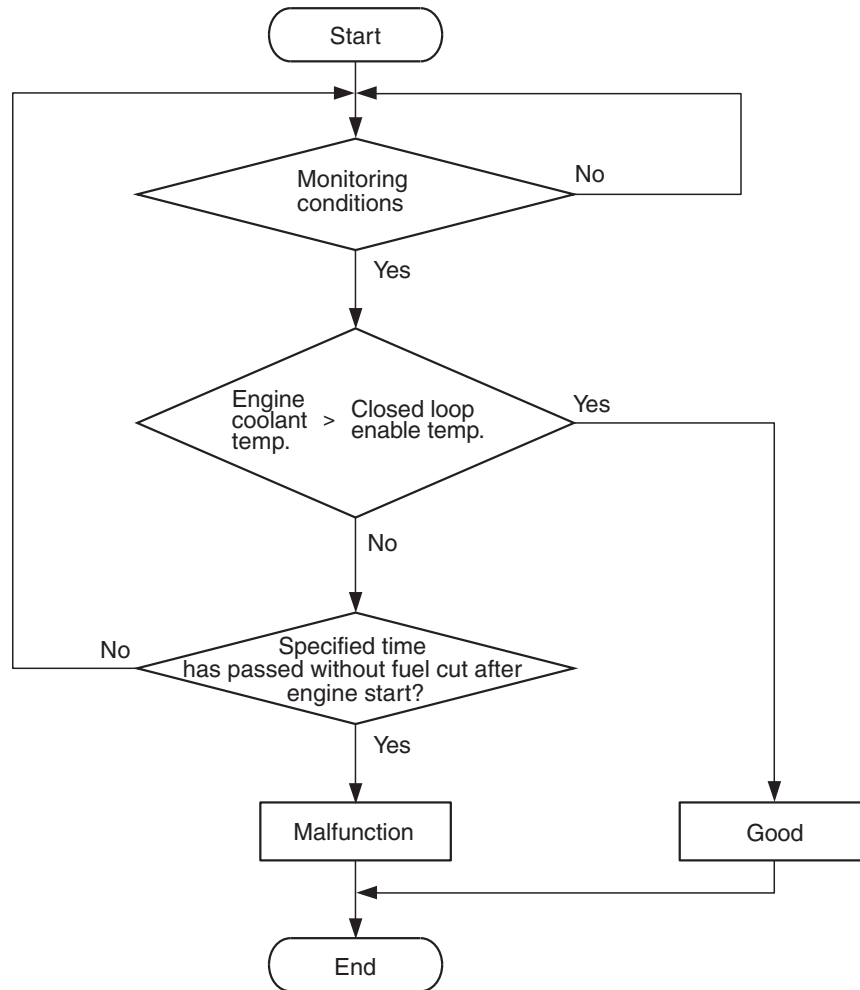
AK900355

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.
- However, time is not counted when fuel is shut off.

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

Logic Flow Chart



AK900354

Check Conditions, Judgement Criteria

- About 90 – 300 seconds have passed for the engine coolant temperature to rise to about 0°C (32°F) after starting sequence was completed.
- However, time is not counted when fuel is shut off.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 6: Engine Coolant Temperature Sensor.

⚠ CAUTION

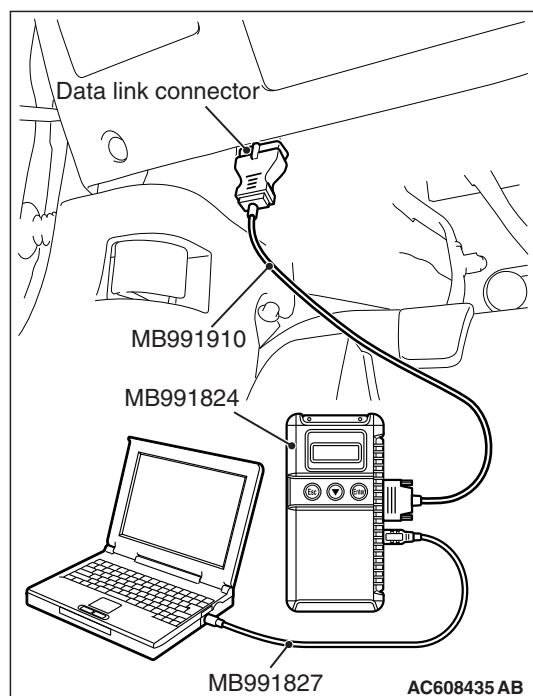
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

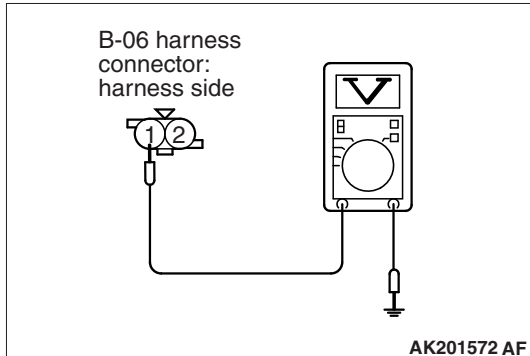
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 6, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately 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-06 by backprobing.

- (1) Do not disconnect the connector B-06.
- (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-06 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 6: Engine Coolant Temperature Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 6, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

STEP 5. Check harness connector B-06 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-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. 1 and ground.

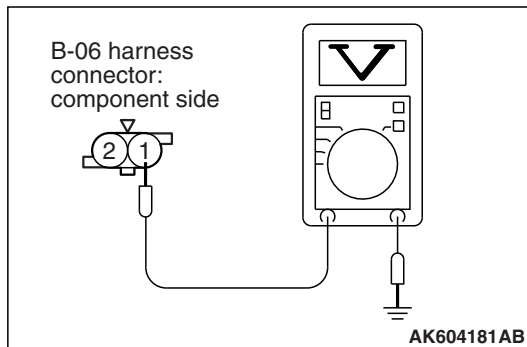
- Voltage should be between 4.5 and 4.9 volts.

(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-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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-06.

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

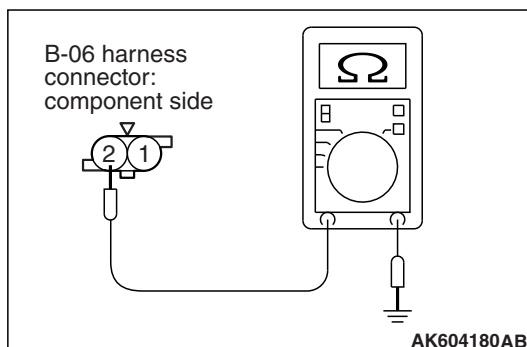
(2) Check for the continuity between terminal No. 2 and ground.

- Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.



STEP 9. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

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

STEP 10. Check for harness damage between engine coolant temperature sensor connector B-06 (terminal No. 2) and ECM connector B-108 (terminal No. 27).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

NO : Repair it. Then go to Step 14.

STEP 11. Check the engine coolant temperature sensor.
Refer to Engine Coolant Temperature Sensor [P.13A-969](#)

Q: Is the engine coolant temperature sensor normal?

YES : Go to Step 12.

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

STEP 12. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 13.

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

STEP 13. Check for harness damage between engine coolant temperature sensor connector B-06 (terminal No. 1) and ECM connector B-108 (terminal No. 26).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

NO : Repair it. Then go to Step 14.

STEP 14. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 [P.13A-12](#).
- (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 ECM checks the time for the cooling water temperature to reach the judgement 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)

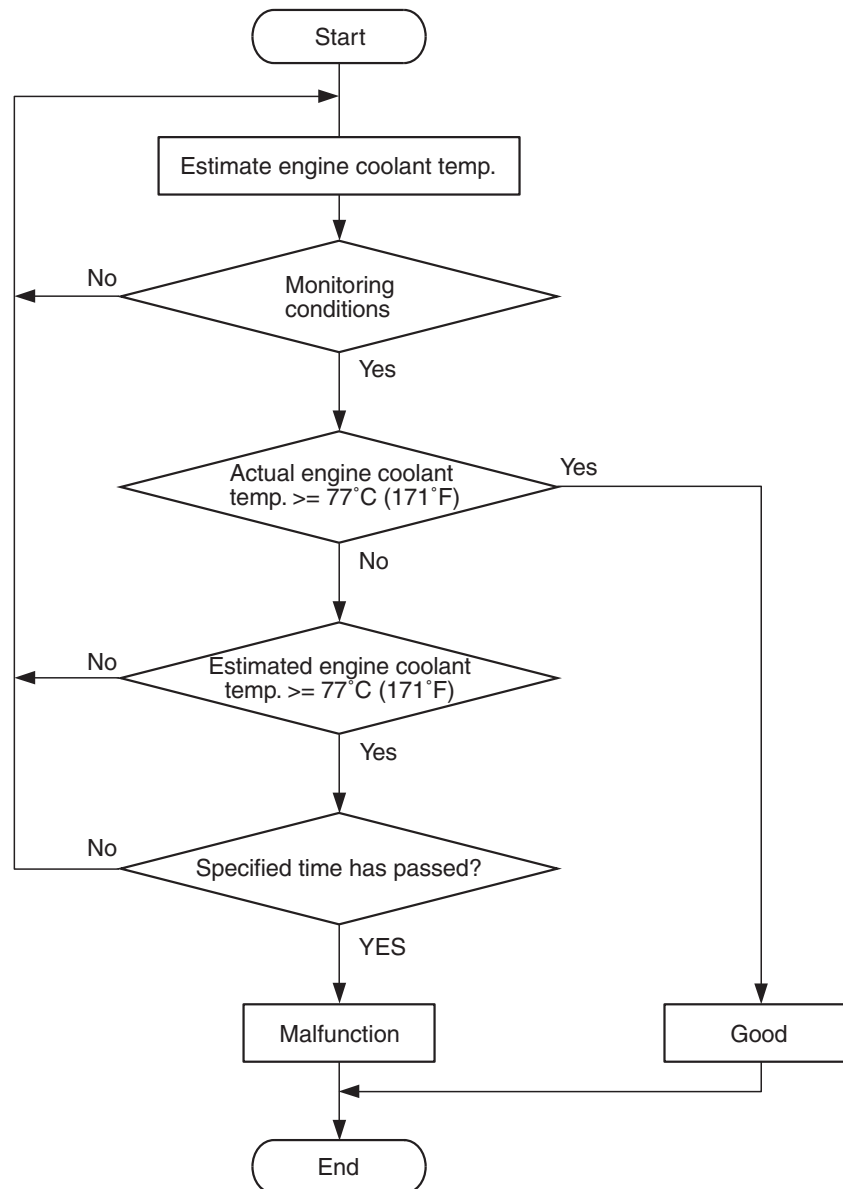
- Vehicle speed sensor monitor <M/T>

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



AK900356

Check Conditions

- Engine coolant temperature is between -10°C (14°F) and 60°C (140°F) when the engine is started.
- Intake air temperature is -10°C (14°F) or higher.
- The intake air temperature when the engine is started – intake air temperature is 10°C (18°F) or less.
- The total time when the amount of intake air is small is less than the specified time.

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

Judgement Criterion

- After the estimated engine coolant temperature rises above 77°C (171°F), the actual engine coolant temperature is less than 77°C (171°F) even though the specified time has passed.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 [P.13A-12](#).

- The engine cooling system is faulty.
- ECM failed.

DIAGNOSIS

STEP 1. Check the cooling system.

Refer to GROUP 14, Engine Cooling Diagnosis P.14-4.

Q: Is the cooling system normal?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 2.

NO : Repair it. Then go to Step 2.

STEP 2. Test the OBD-II drive cycle.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 P.13A-12.

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

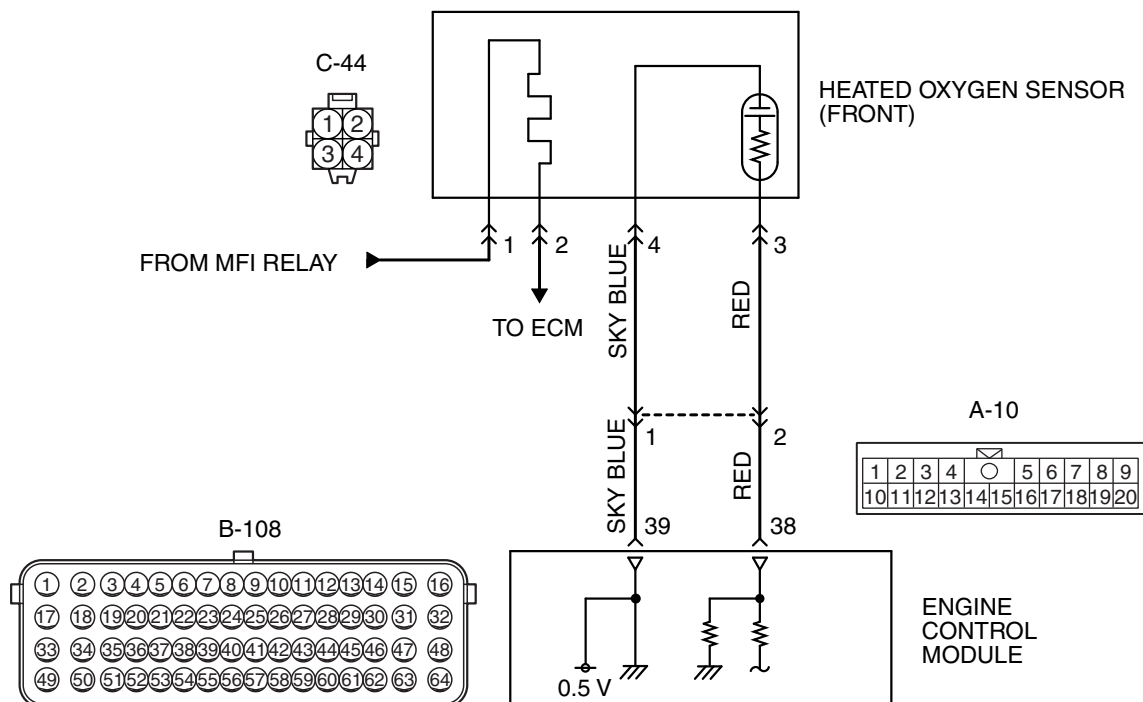
Q: Is DTC P0128 set?

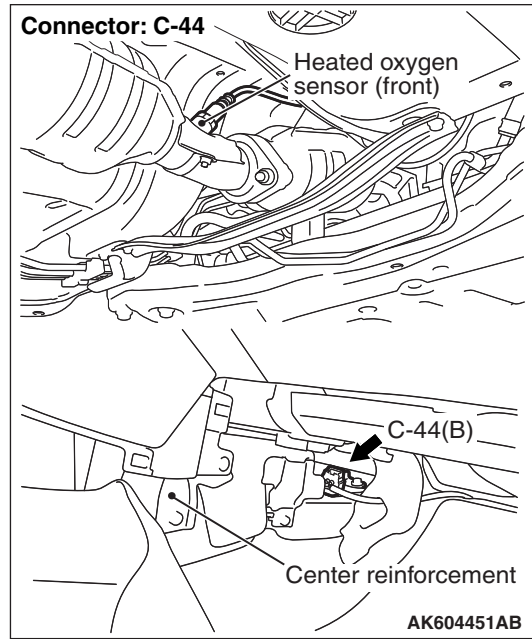
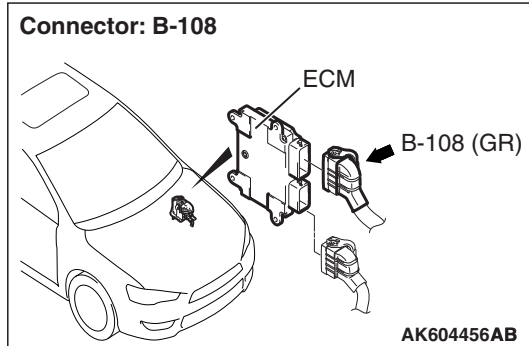
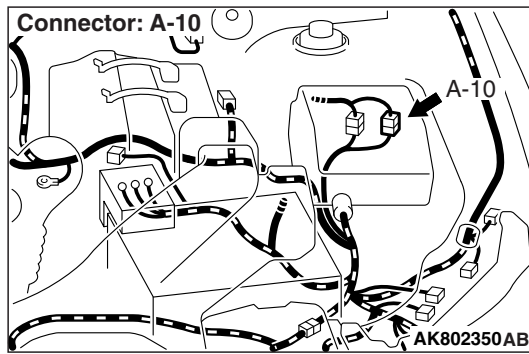
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0131: Heated Oxygen Sensor (front) Circuit Low Voltage <Except for California>

HEATED OXYGEN SENSOR (FRONT) CIRCUIT <EXCEPT FOR CALIFORNIA>





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 38) from the output terminal (terminal No. 3) of the heated oxygen sensor (front).
- Terminal No. 4 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 39).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (front).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM checks for the heated oxygen sensor (front) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (front) output voltage is under the 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)

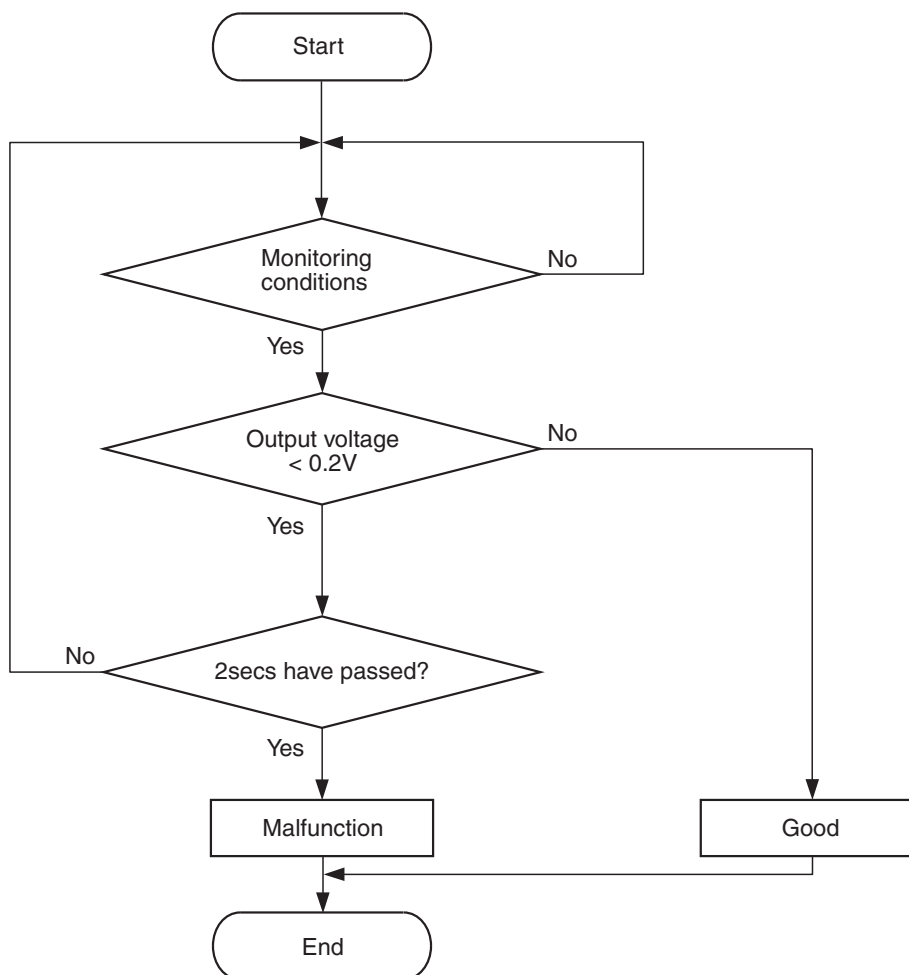
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

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



AK604321

Check Conditions

- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.
- Battery positive voltage is between 11 and 16.5 volts.
- More than 180 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Heated oxygen sensor (front) output voltage is lower than 0.2 volt for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991658: Test Harness
- MB992110: Power Plant ECU Check Harness

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

⚠ CAUTION

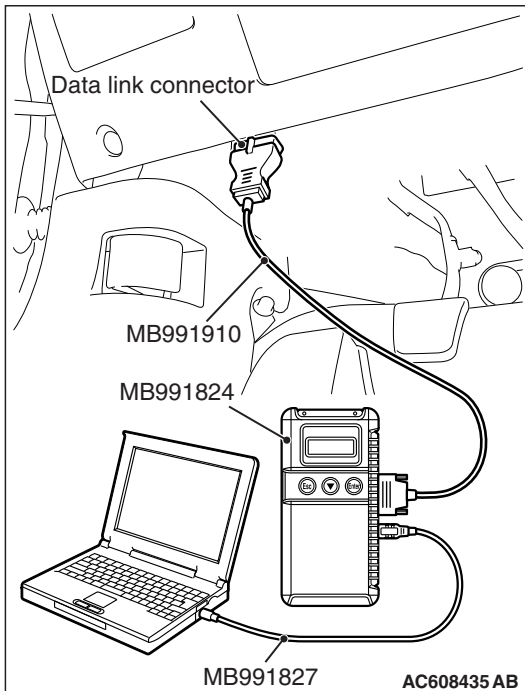
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 AC, Heated Oxygen Sensor (front).
 - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
 - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt or less 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.



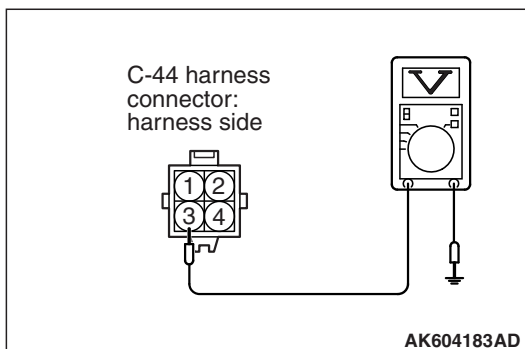
STEP 2. Measure the sensor output voltage at heated oxygen sensor (front) connector C-44 by backprobing

- (1) Do not disconnect the connector C-44.
- (2) Start the engine and run at idle.
- (3) Measure the voltage between terminal No. 3 and ground by backprobing.
 - Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0.4 volt or less 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 8.



STEP 3. Check harness connector B-108 at the ECM for damage.

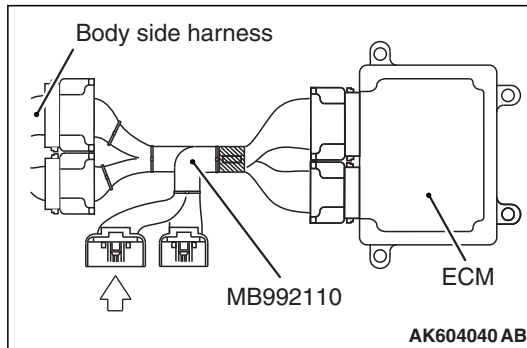
Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

STEP 4. Measure the sensor output voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Start the engine and run at idle.



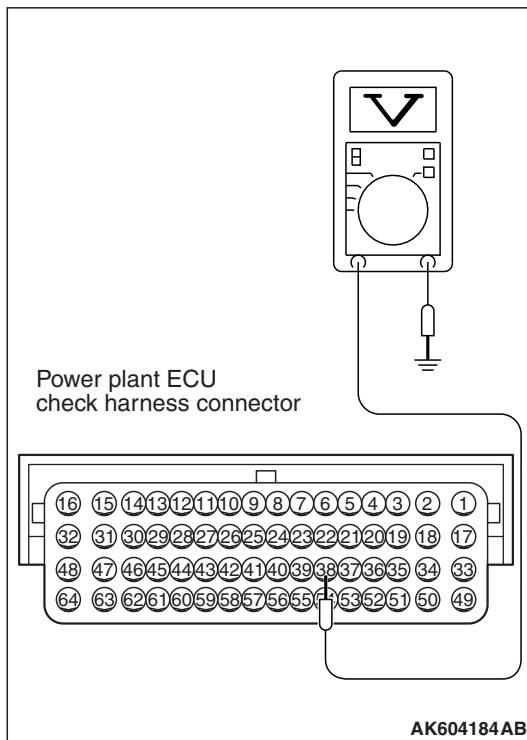
AK604040 AB

- (3) Measure the voltage between terminal No. 38 and ground.
 - Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0.4 volt or less 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 5.

NO : Go to Step 7.



AK604184 AB

STEP 5. Check harness connector C-44 at heated oxygen sensor (front) 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. Using scan tool MB991958, check data list item AC: Heated Oxygen Sensor (front).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item AC, Heated Oxygen Sensor (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 or less and 0.6 to 1.0 volt alternately.
- (3) 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

STEP 7. Check harness connector C-44 at heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector A-10 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between heated oxygen sensor (front) connector C-44 (terminal No. 3) and ECM connector B-108 (terminal No. 38) because of open circuit or harness damage. Then go to Step 14.

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

STEP 8. Check harness connector C-44 at heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

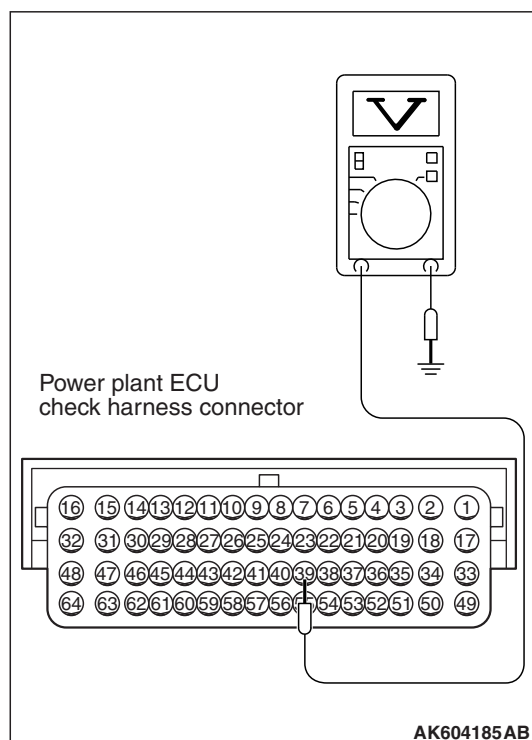
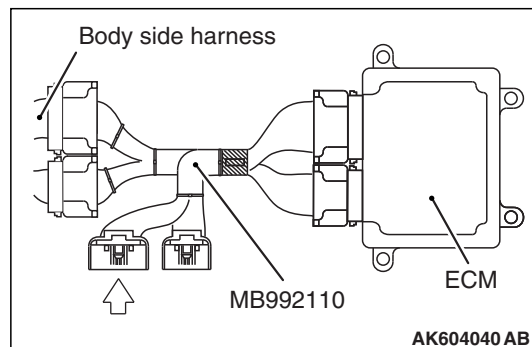
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

STEP 9. Check harness connector B-108 at the ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

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



STEP 10. Measure the sensor offset voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 39 and ground.
 - Voltage should be between 0.4 and 0.6 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 0.4 and 0.6 volts?

YES : Go to Step 11.

NO : Check harness connector A-10 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between headed oxygen sensor (front) connector C-44 (terminal No. 4) and ECM connector B-108 (terminal No. 39) because of open circuit or harness damage. Then go to Step 14.

STEP 11. Check for harness damage between heated oxygen sensor (front) connector C-44 (terminal No. 4) and ECM connector B-108 (terminal No. 39).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.

STEP 12. Check for short circuit to ground and harness damage between heated oxygen sensor (front) connector C-44 (terminal No. 3) and ECM connector B-108 (terminal No. 38).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 14.

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

- (1) Disconnect the heated oxygen sensor (front) connector C-44 and connect test harness special tool MB991658 to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Rev the engine for 5 minutes or more with the engine speed of 2,500 r/min.
- (4) Connect a digital voltage meter between terminal No. 3 and terminal No. 4.
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 V

⚠ CAUTION

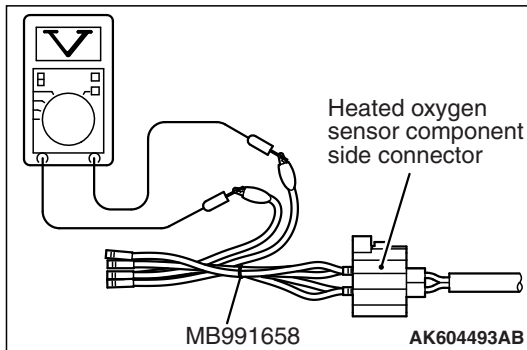
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater can be damaged if a voltage beyond 8 volts is applied to the heated oxygen sensor heater.**

NOTE: If the temperature of sensing area does not reach the high temperature [of approximately 400°C (752°F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 and the terminal No. 2 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?

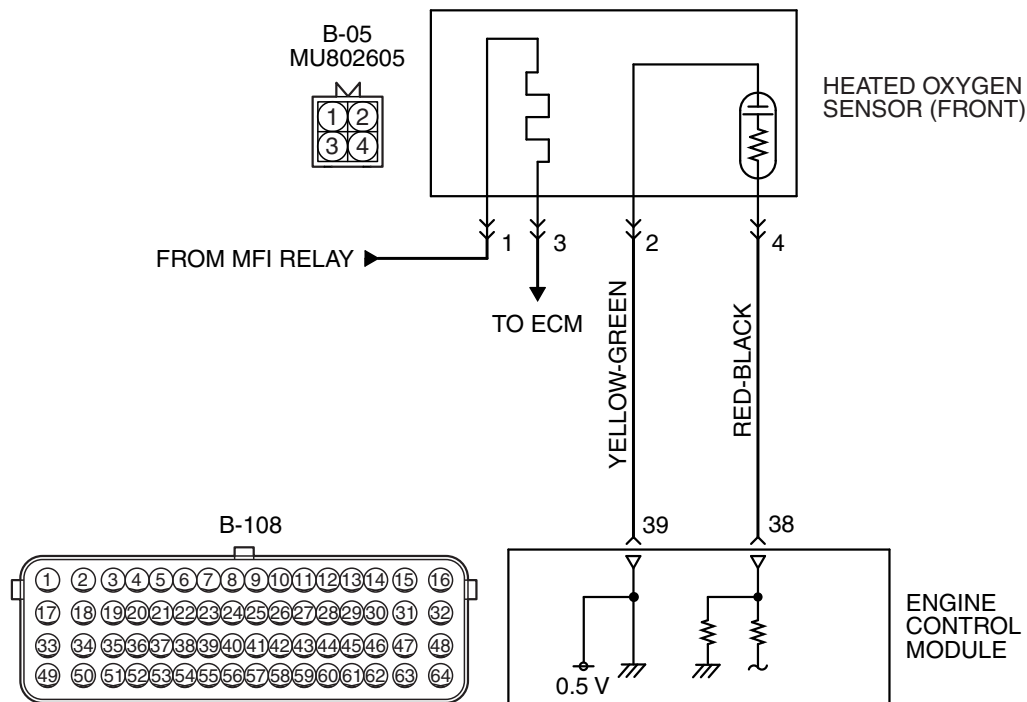
YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-11 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 14.

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

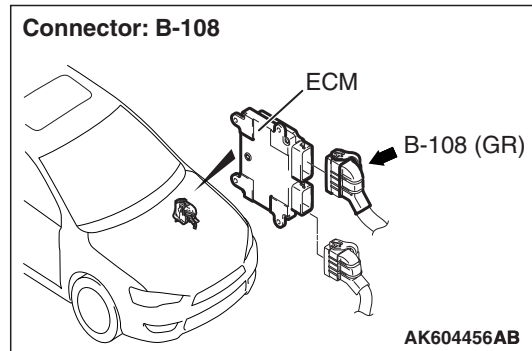
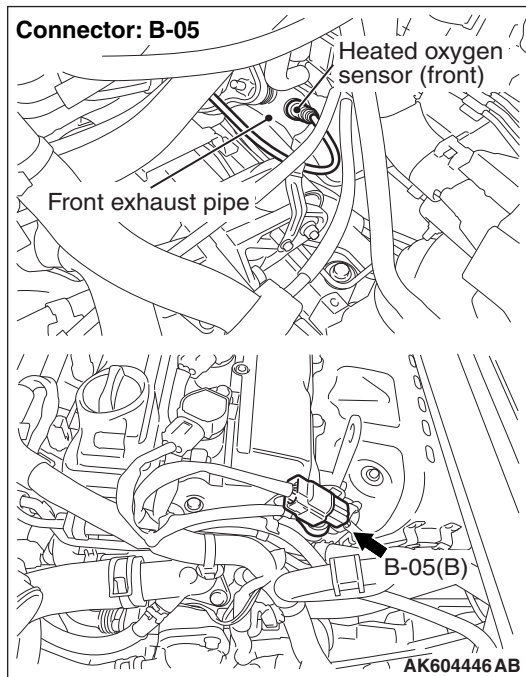


STEP 14. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0131 set?**YES** : Retry the troubleshooting.**NO** : The inspection is complete.**DTC P0131: Heated Oxygen Sensor (front) Circuit Low Voltage <California>****HEATED OXYGEN SENSOR (FRONT) CIRCUIT <CALIFORNIA>**

AK604238AC



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 38) from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 39).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 2 of the heated oxygen sensor (front).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM checks for the heated oxygen sensor (front) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (front) output voltage is under the 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)

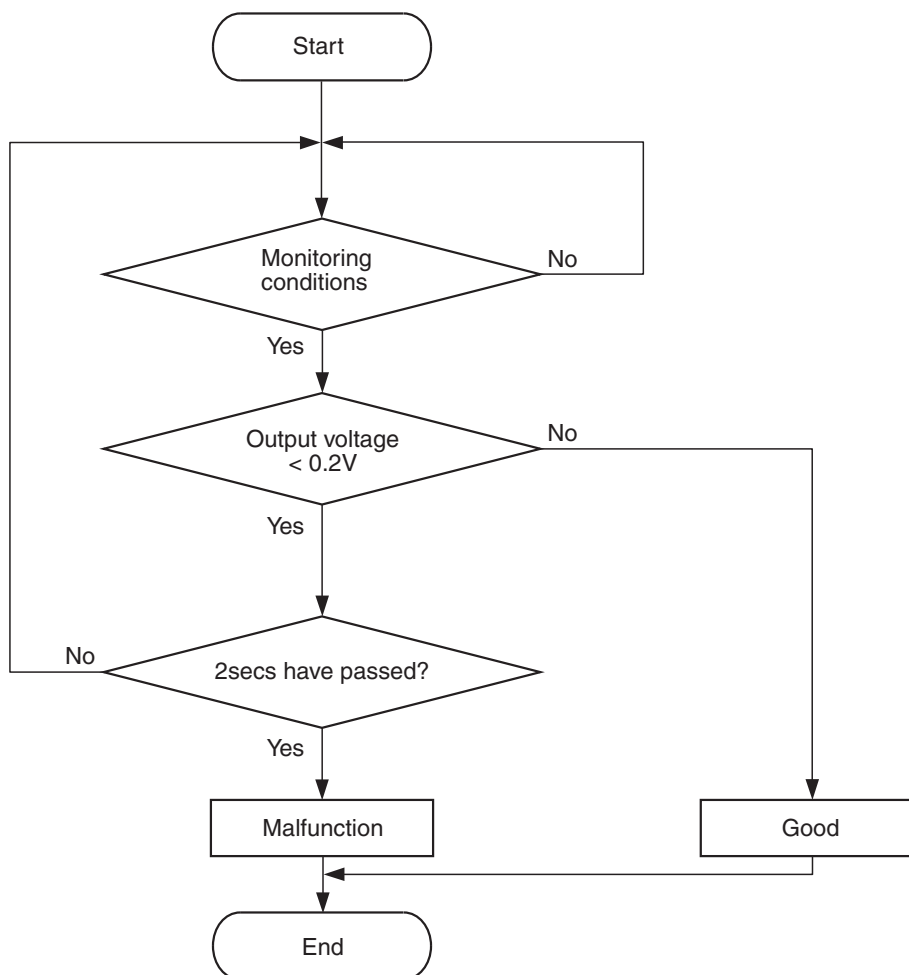
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

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



AK604321

Check Conditions

- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.
- Battery positive voltage is between 11 and 16.5 volts.
- More than 180 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Heated oxygen sensor (front) output voltage is lower than 0.2 volt for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MD998464: Test Harness
- MB992110: Power Plant ECU Check Harness

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

CAUTION

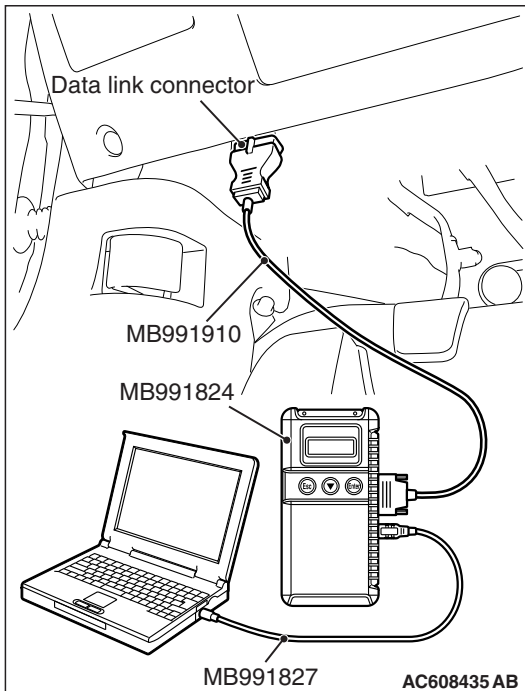
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 AC, Heated Oxygen Sensor (front).
 - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
 - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt or less 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.



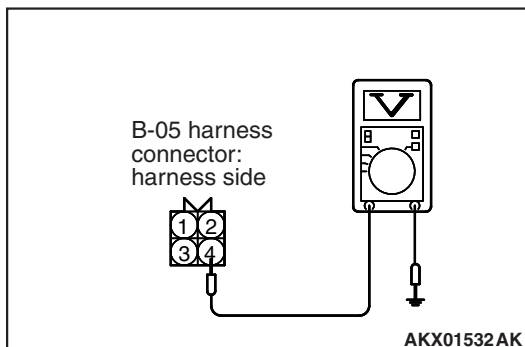
STEP 2. Measure the sensor output voltage at heated oxygen sensor (front) connector B-05 by backprobing

- (1) Do not disconnect the connector B-05.
- (2) Start the engine and run at idle.
- (3) Measure the voltage between terminal No. 4 and ground by backprobing.
 - Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0.4 volt or less 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 8.



STEP 3. Check harness connector B-108 at the ECM for damage.

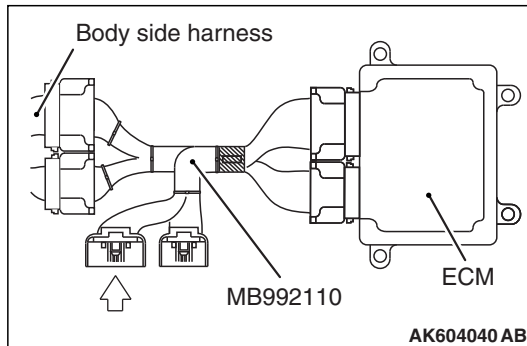
Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

STEP 4. Measure the sensor output voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Start the engine and run at idle.

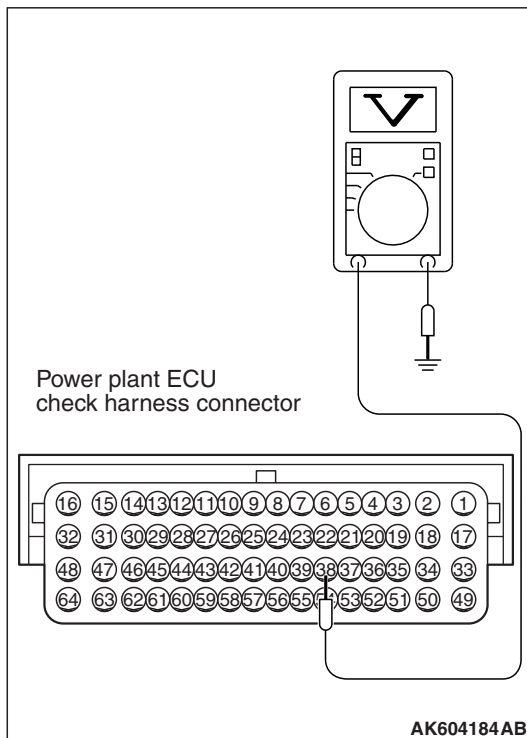


- (3) Measure the voltage between terminal No. 38 and ground.
 - Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0.4 volt or less and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage within the specified range?

YES : Go to Step 5.

NO : Go to Step 7.

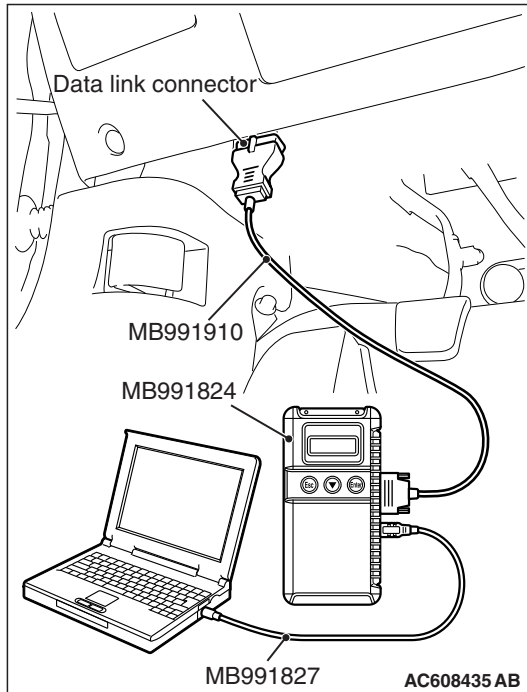


STEP 5. Check harness connector B-05 at heated oxygen sensor (front) for damage.

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. Using scan tool MB991958, check data list item AC: Heated Oxygen Sensor (front).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item AC, Heated Oxygen Sensor (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 or less and 0.6 to 1.0 volt alternately.
- (3) 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

STEP 7. Check harness connector B-05 at heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between heated oxygen sensor (front) connector B-05 (terminal No. 4) and ECM connector B-108 (terminal No. 38) because of open circuit or harness damage. Then go to Step 14.

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

STEP 8. Check harness connector B-05 at heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

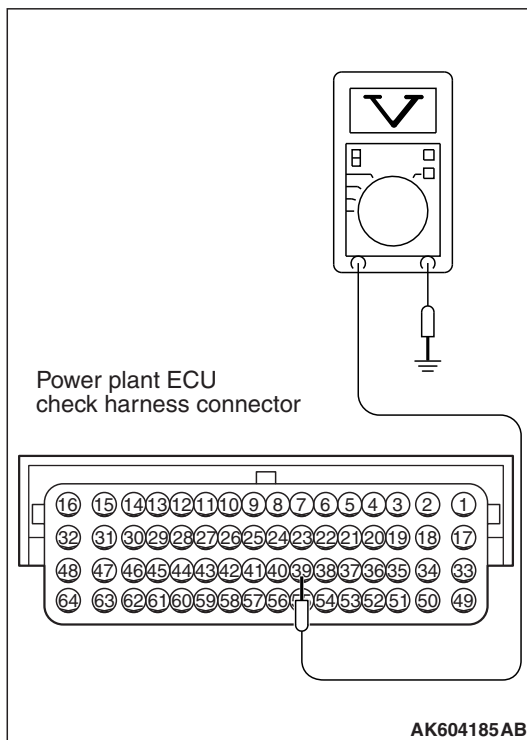
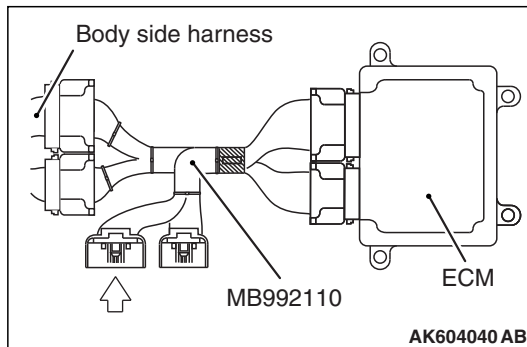
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

STEP 9. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

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



STEP 10. Measure the sensor offset voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 39 and ground.
 - Voltage should be between 0.4 and 0.6 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 0.4 and 0.6 volt?

YES : Go to Step 11.

NO : Repair harness wire between heated oxygen sensor (front) connector B-05 (terminal No. 2) and ECM connector B-108 (terminal No. 39) because of open circuit or harness damage. Then go to Step 14.

STEP 11. Check for harness damage between heated oxygen sensor (front) connector B-05 (terminal No. 2) and ECM connector B-108 (terminal No. 39).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

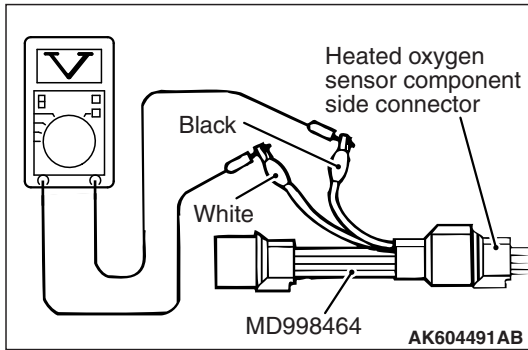
NO : Repair it. Then go to Step 14.

STEP 12. Check for short circuit to ground and harness damage between heated oxygen sensor (front) connector B-05 (terminal No. 4) and ECM connector B-108 (terminal No. 38).

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 14.



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

- (1) Disconnect the heated oxygen sensor (front) connector B-05 and connect test harness special tool MD998464 to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Rev the engine for 5 minutes or more with the engine speed of 2,500 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 (front) output voltage.

Standard value: 0.6 – 1.0 V

CAUTION

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

NOTE: If the temperature of sensing area does not reach the high temperature [of approximately 400 °C (752 °F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of 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 : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

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

STEP 14. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

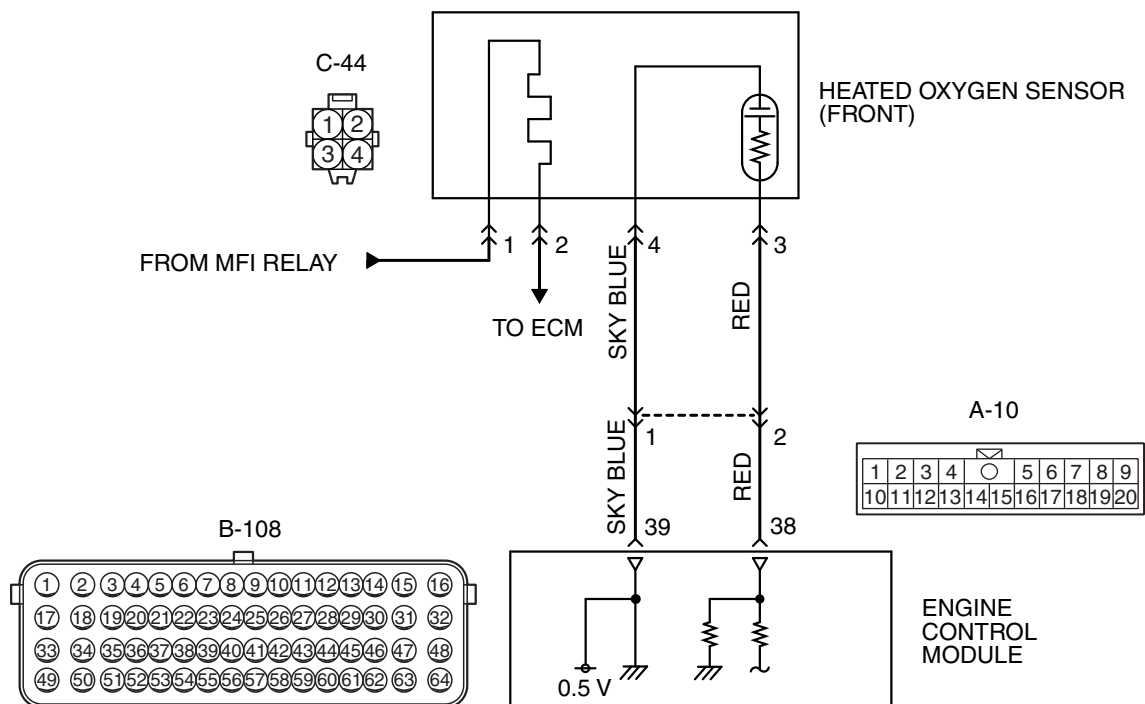
Q: Is DTC P0131 set?

YES : Retry the troubleshooting.

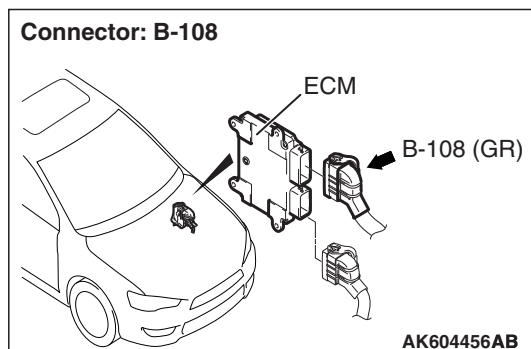
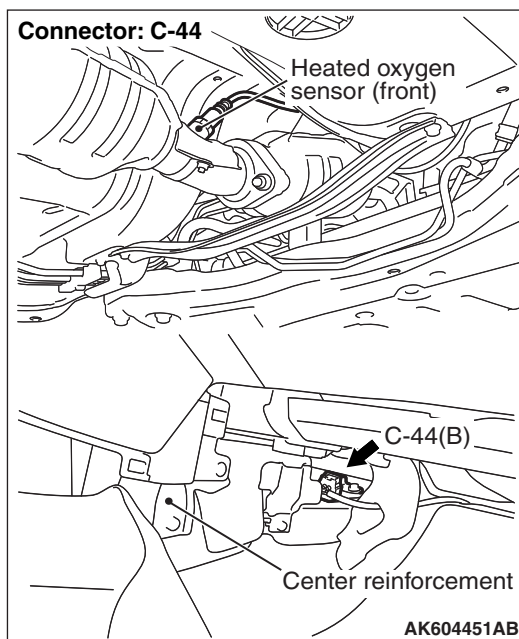
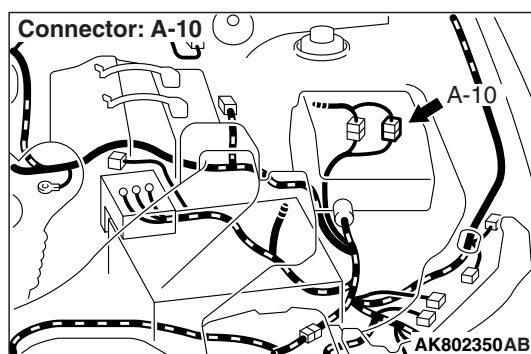
NO : The inspection is complete.

DTC P0132: Heated Oxygen Sensor (front) Circuit High Voltage <Except for California>

HEATED OXYGEN SENSOR (FRONT) CIRCUIT <EXCEPT FOR CALIFORNIA>



AK604239AC



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 38) from the output terminal (terminal No. 3) of the heated oxygen sensor (front).
- Terminal No. 4 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 39).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (front).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM checks for the heated oxygen sensor (front) output voltage.

DESCRIPTIONS OF MONITOR METHODS

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)

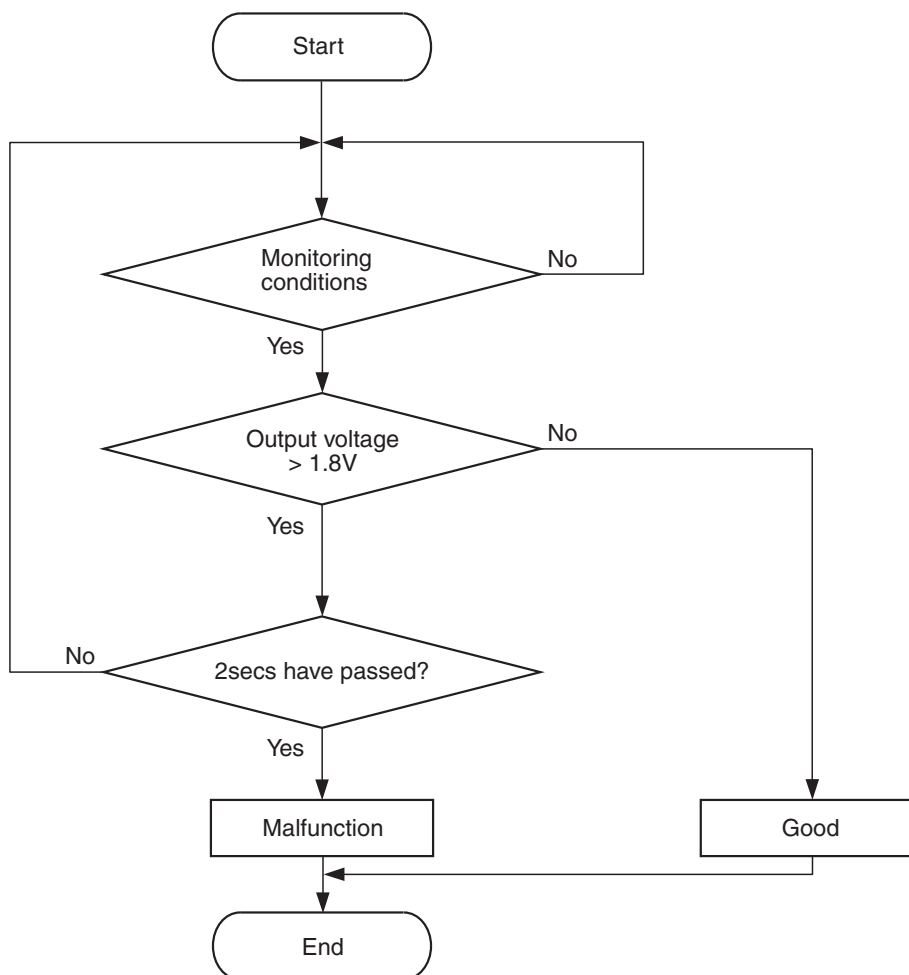
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

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 CONDITION

Logic Flow Chart



AK604322

Check Conditions

- 2 seconds or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.

Judgement Criterion

- Heated oxygen sensor (front) output voltage has continued to be 1.8 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnosis Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

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

DIAGNOSIS

STEP 1. Check harness connector C-44 at heated oxygen sensor (front) and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

STEP 2. Check for short circuit to power supply between heated oxygen sensor (front) connector C-44 (terminal No. 3) and ECM connector B-108 (terminal No. 38).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 3.

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

NO : Repair it. Then go to Step 3.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

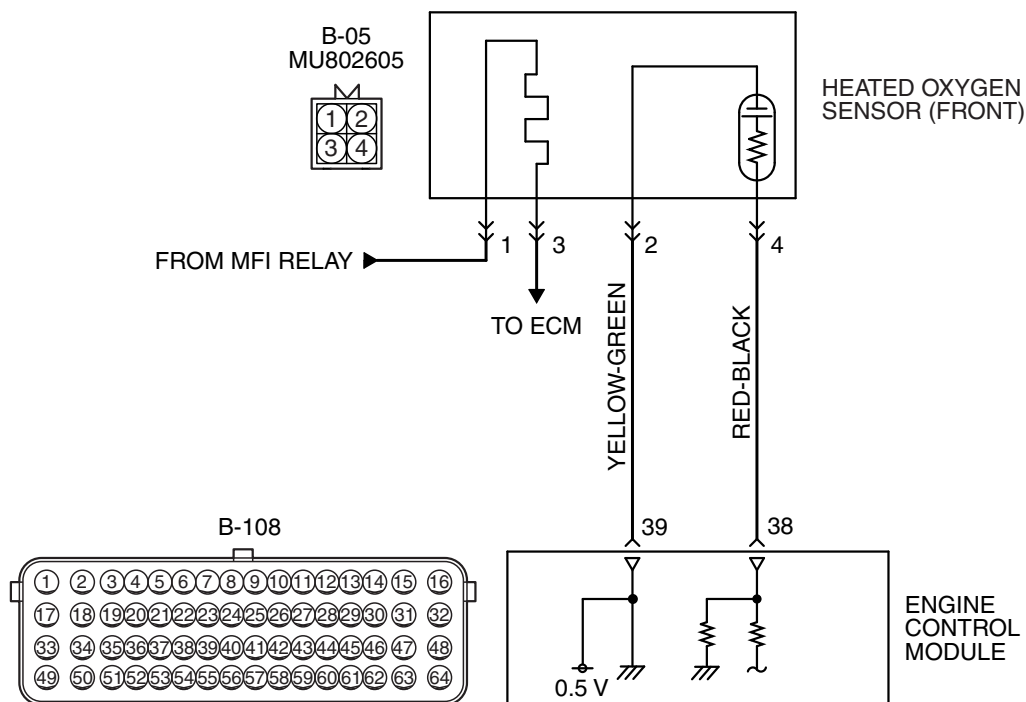
Q: Is DTC P0132 set?

YES : Retry the troubleshooting.

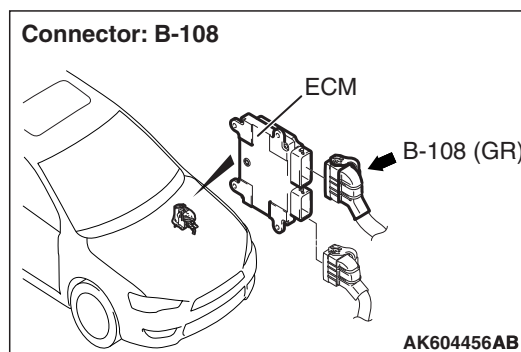
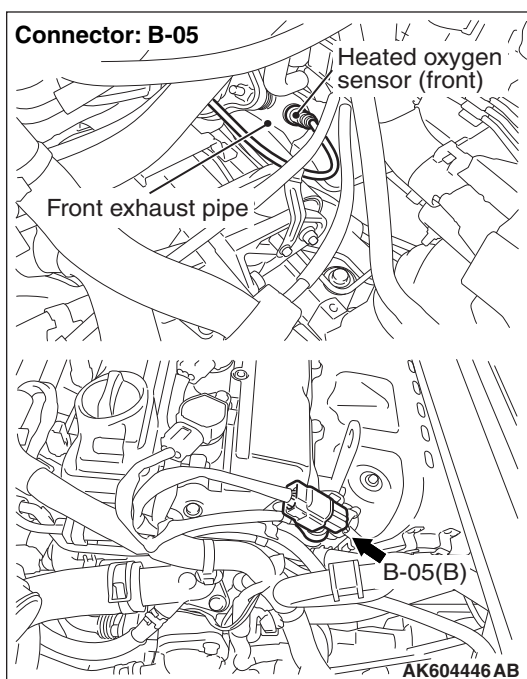
NO : The inspection is complete.

DTC P0132: Heated Oxygen Sensor (front) Circuit High Voltage <California>

HEATED OXYGEN SENSOR (FRONT) CIRCUIT <CALIFORNIA>



AK604238AC



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 38) from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 39).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 2 of the heated oxygen sensor (front).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM checks for the heated oxygen sensor (front) output voltage.

DESCRIPTIONS OF MONITOR METHODS

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)

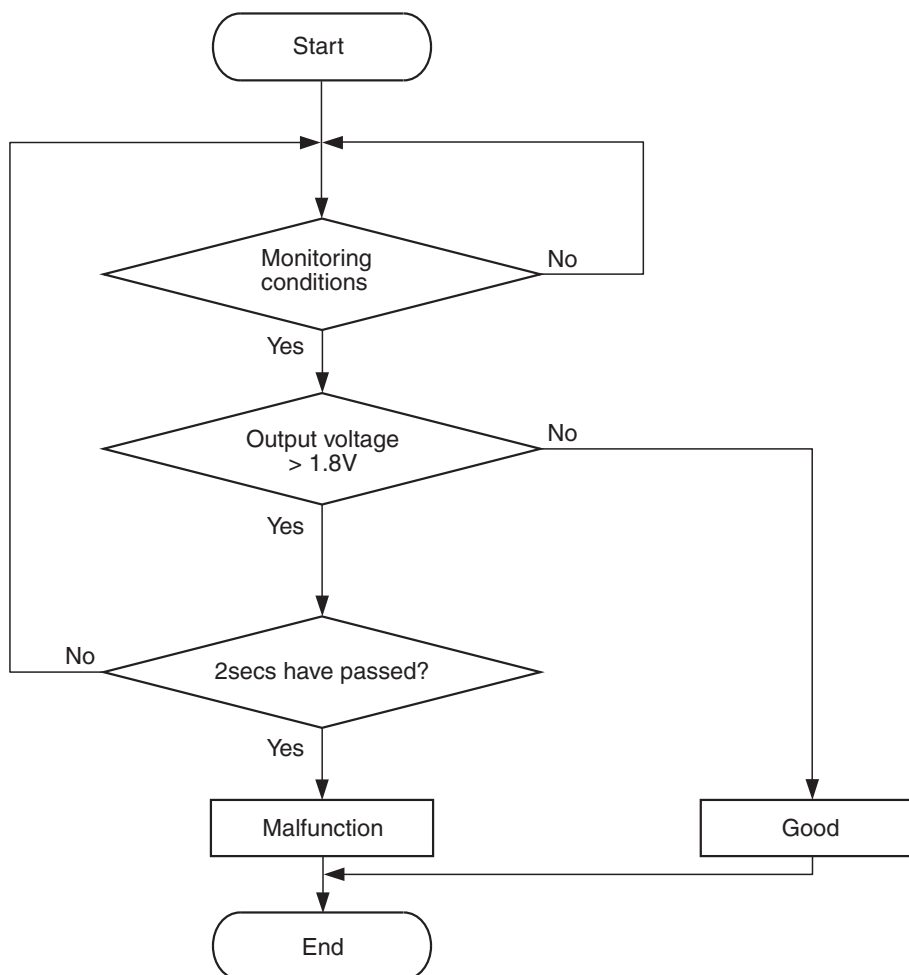
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

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 CONDITION

Logic Flow Chart



AK604322

Check Conditions

- 2 seconds or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.

Judgement Criterion

- Heated oxygen sensor (front) output voltage has continued to be 1.8 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnosis Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

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

DIAGNOSIS

STEP 1. Check harness connector B-05 at heated oxygen sensor (front) and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

STEP 2. Check for short circuit to power supply between heated oxygen sensor (front) connector B-05 (terminal No. 4) and ECM connector B-108 (terminal No. 38).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

NO : Repair it. Then go to Step 3.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

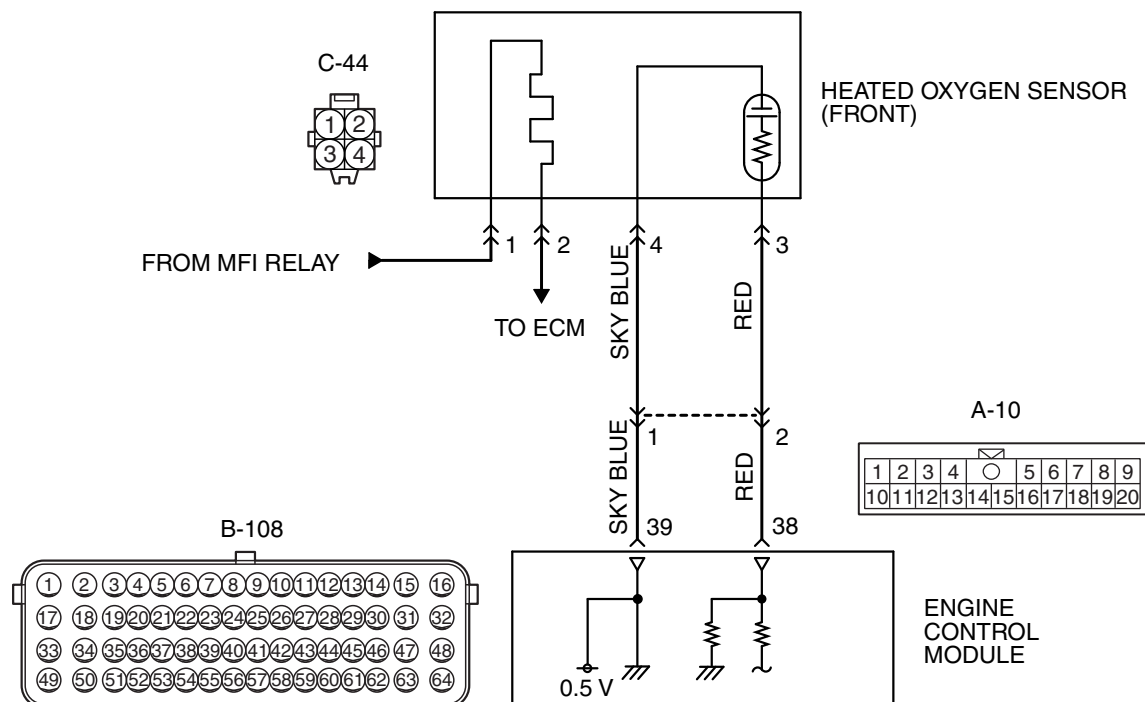
Q: Is DTC P0132 set?

YES : Retry the troubleshooting.

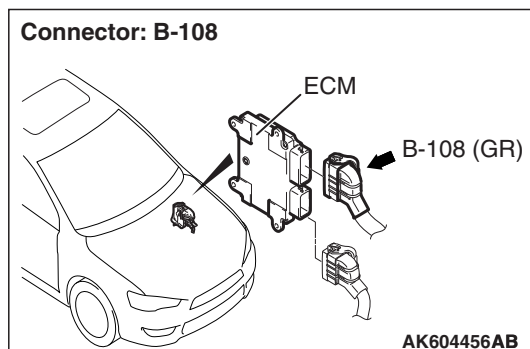
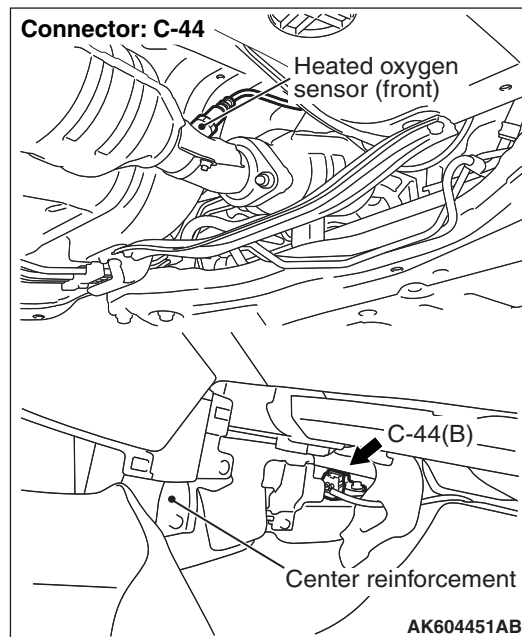
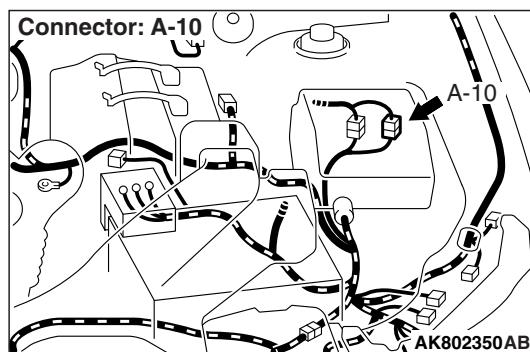
NO : The inspection is complete.

DTC P0133: Heated Oxygen Sensor (front) Circuit Slow Response <Except for California>

HEATED OXYGEN SENSOR (FRONT) CIRCUIT <EXCEPT FOR CALIFORNIA>



AK604239AC



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 38) from the output terminal (terminal No. 3) of the heated oxygen sensor (front).
- Terminal No. 4 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 39).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (front).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM checks for the heated oxygen sensor (front) rich/lean switching frequency.

DESCRIPTIONS OF MONITOR METHODS

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)

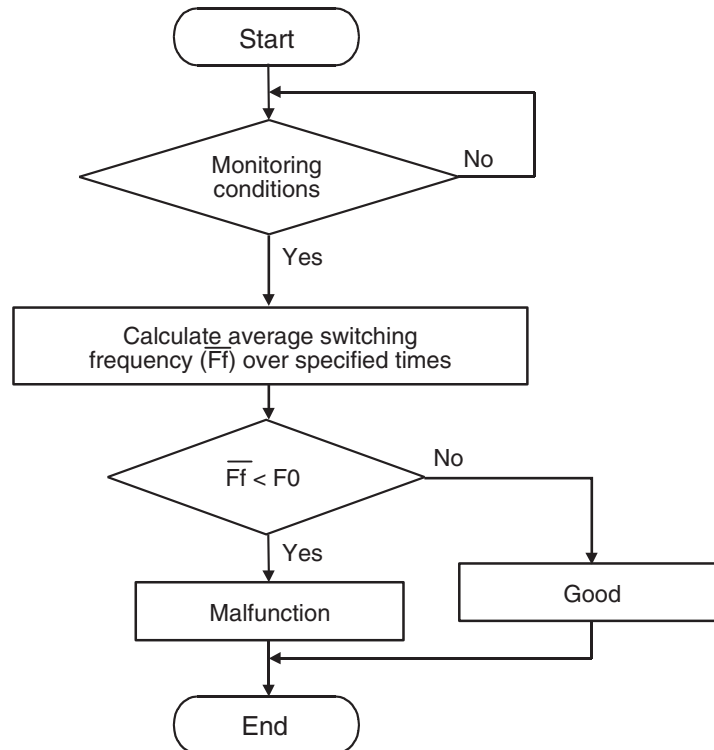
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

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 switching frequency

AK604323

Check Conditions

- Engine coolant temperature is higher than 60°C (140°F).
- Engine speed is between 1,500 and 3,500 r/min <M/T> or 1,375 and 3,000 r/min <CVT>.
- Volumetric efficiency is between 22 and 65 percent <M/T> or 25 and 65 percent <CVT>.
- Under the closed loop air/fuel control.
- The accelerator pedal is depressed.
- Short-term fuel trim is between -25 and +25 percent.
- More than 2 seconds have elapsed after the above mentioned conditions have been met.
- During the drive cycle, the ECM performs monitoring with the accumulated total time of 10 seconds, 5 times.

Judgement Criteria

- The average of the heated oxygen sensor (front) rich/lean switching frequency is less than 10 times for the accumulated time of 10 seconds.

- The heated oxygen sensor (front) rich/lean switching frequency is less than 16 times for the accumulated time of 10 seconds.

NOTE: If the sensor switching frequency is lower than the Judgement Criteria due to the M.U.T.-III OBD-II test Mode – HO2S Test Results, it is assumed that the heated oxygen sensor has deteriorated. If it is higher, it is assumed that the harness is damaged or has a short circuit.

If the heated oxygen sensor signal voltage has not changed even once (lean/rich) after the DTC was erased, the sensor switch time will display as 0 second.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 1 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-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 AC: Heated Oxygen Sensor (front).

⚠ CAUTION

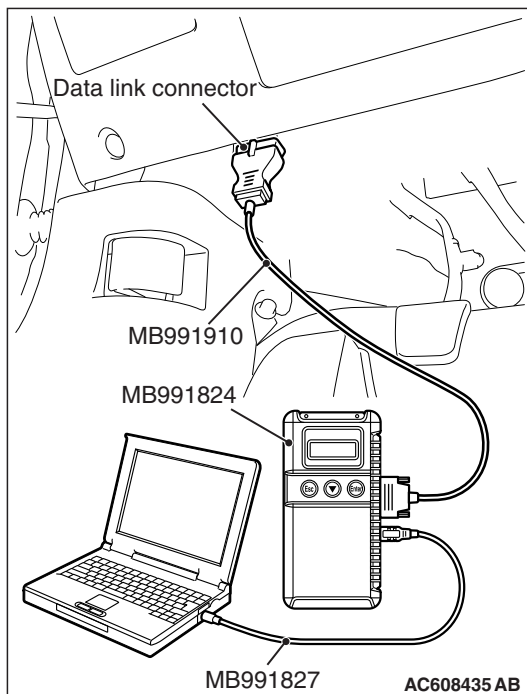
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

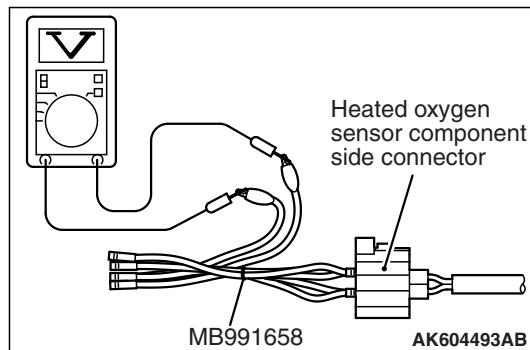
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item AC, Heated Oxygen Sensor (front).
- (4) Warm up the engine, 2,500 r/min.
 - Output voltage repeats 0.4 volt or less and 0.6 to 1.0 volt 8 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 heated oxygen sensor (front).**

- (1) Disconnect the heated oxygen sensor (front) connector C-44 and connect test harness special tool MB991658 to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Rev the engine for 5 minutes or more with the engine speed of 2,500 r/min.
- (4) Connect a digital voltage meter between terminal No. 3 and terminal No. 4.
- (5) Warm up the engine, 2,500 r/min
 - Output voltage repeats 0.4 volt or less and 0.6 to 1.0 volt 8 times or more within 10 seconds.

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 temperature of sensing area does not reach the high temperature [of approximately 400 °C (752 °F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 and the terminal No. 2 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 sensor operating properly?

YES : Go to Step 3.

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

STEP 3. Check harness connector C-44 at heated oxygen sensor (front) and harness connector B-108 at ECM for damage.**Q: Is the harness connector in good condition?**

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 4.

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

STEP 4. Test the OBD-II drive cycle.

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

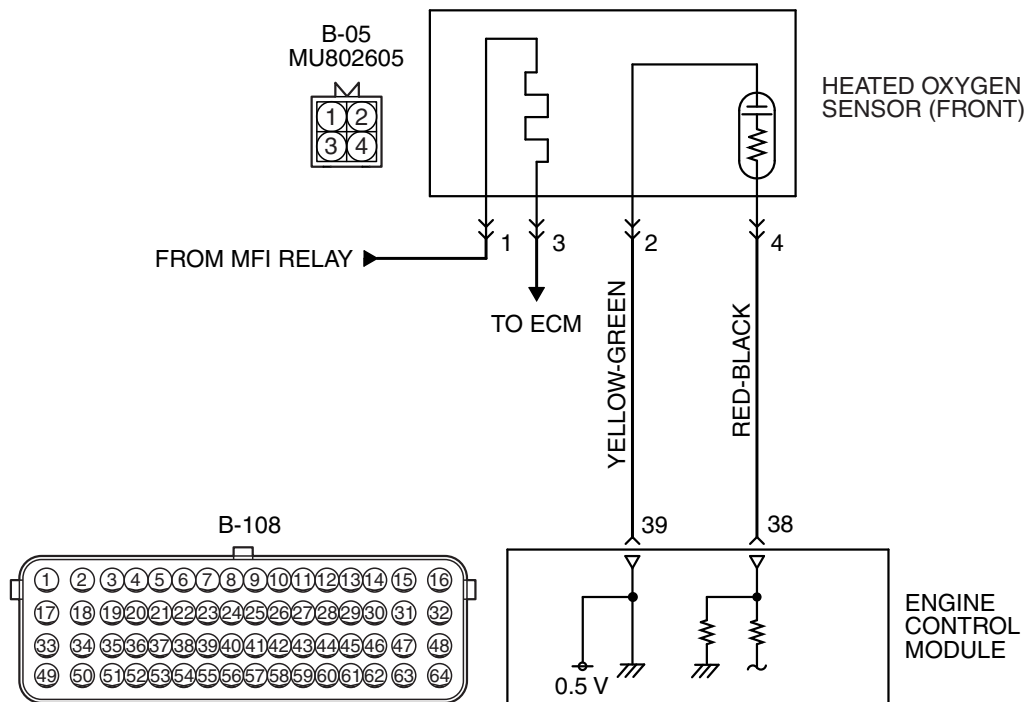
Q: Is DTC P0133 set?

YES : Retry the troubleshooting.

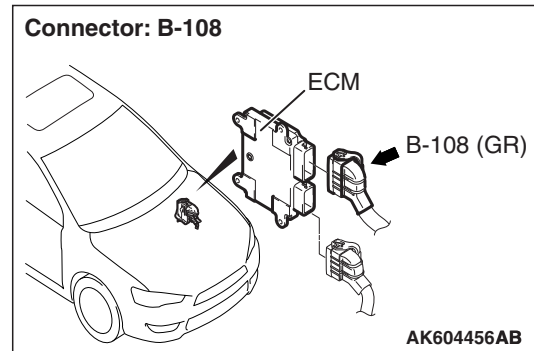
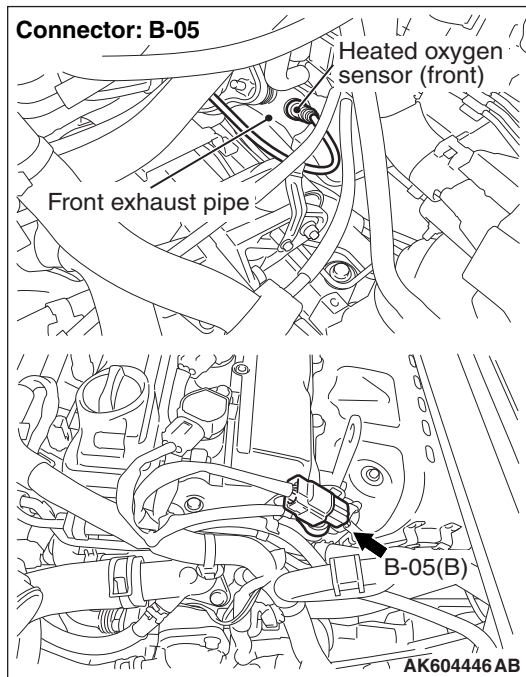
NO : The inspection is complete.

DTC P0133: Heated Oxygen Sensor (front) Circuit Slow Response <California>

HEATED OXYGEN SENSOR (FRONT) CIRCUIT <CALIFORNIA>



AK604238AC



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 38) from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 39).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 2 of the heated oxygen sensor (front).

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM checks for the heated oxygen sensor (front) rich/lean switching frequency.

DESCRIPTIONS OF MONITOR METHODS

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)

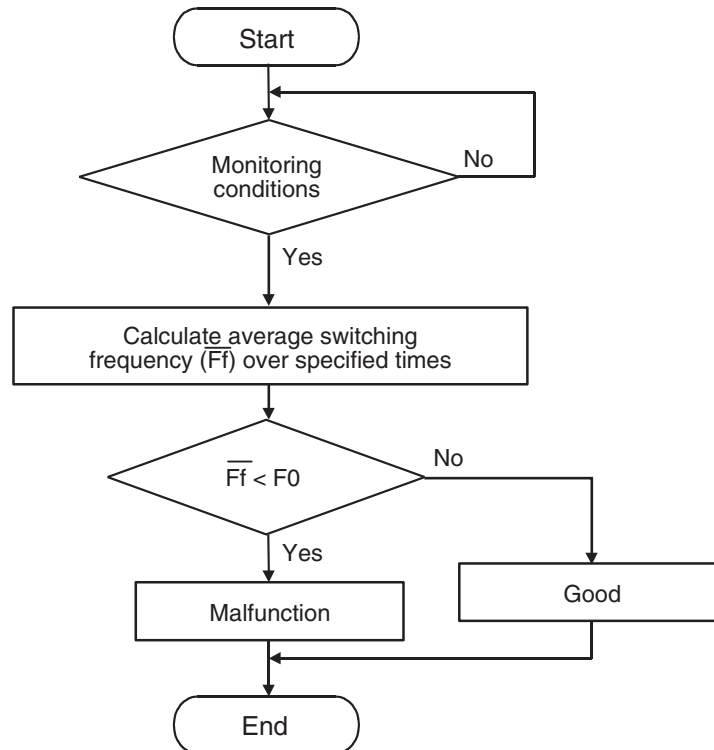
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

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 switching frequency

AK604323

Check Conditions

- Engine coolant temperature is higher than 60°C (140°F).
- Engine speed is between 1,500 and 3,500 r/min <M/T> or 1,375 and 3,000 r/min <CVT>.
- Volumetric efficiency is between 22 and 65 percent <M/T> or 25 and 65 percent <CVT>.
- Under the closed loop air/fuel control.
- The accelerator pedal is depressed.
- Short-term fuel trim is between -25 and +25 percent.
- More than 2 seconds have elapsed after the above mentioned conditions have been met.
- During the drive cycle, the ECM performs monitoring with the accumulated total time of 10 seconds, 5 times.

Judgement Criteria

- The average of the heated oxygen sensor (front) rich/lean switching frequency is less than 11 times <M/T> or 10 times <CVT> for the accumulated time of 10 seconds.
- The heated oxygen sensor (front) rich/lean switching frequency is less than 16 times for the accumulated time of 10 seconds.

NOTE: If the sensor switching frequency is lower than the Judgement Criteria due to the M.U.T.-III OBD-II test Mode – HO2S Test Results, it is assumed that the heated oxygen sensor has deteriorated. If it is higher, it is assumed that the harness is damaged or has a short circuit.

If the heated oxygen sensor signal voltage has not changed even once (lean/rich) after the DTC was erased, the sensor switch time will display as 0 second.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 1 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (M.U.T.-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 AC: Heated Oxygen Sensor (front).**⚠ CAUTION**

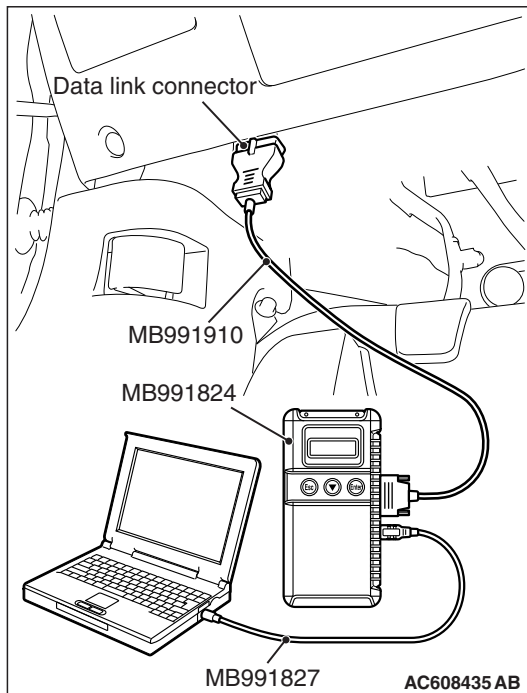
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

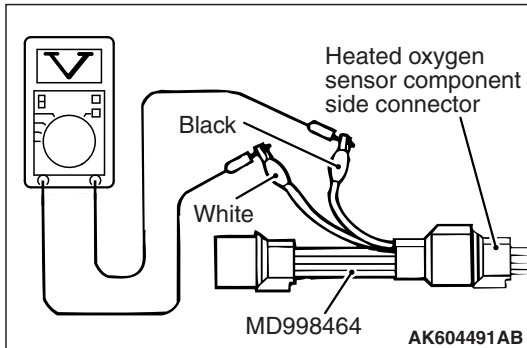
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item AC, Heated Oxygen Sensor (front).
- (4) Warm up the engine, 2,500 r/min.
 - Output voltage repeats 0.4 volt or less and 0.6 to 1.0 volt 8 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 heated oxygen sensor (front).

- (1) Disconnect the heated oxygen sensor (front) connector B-05 and connect test harness special tool MD998464 to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Rev the engine for 5 minutes or more with the engine speed of 2,500 r/min.
- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) Warm up the engine, 2,500 r/min
 - Output voltage repeats 0.4 volt or less and 0.6 to 1.0 volt 8 times or more within 10 seconds.

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 temperature of sensing area does not reach the high temperature [of approximately 400 °C (752 °F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of 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 sensor operating properly?

YES : Go to Step 3.

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

STEP 3. Check harness connector B-05 at heated oxygen sensor (front) and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 4.

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

STEP 4. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 1 [P.13A-12](#).
- (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 (front) No Activity Detected <Except for California>

Heated Oxygen Sensor (front) No Activity Detected Circuit

- Refer to DTC P0131 – Heated Oxygen Sensor (Front) Circuit Low Voltage <Except for California> [P.13A-242](#).
- Refer to DTC P0201 – Injector Circuit-cylinder 1 [P.13A-385](#).
- Refer to DTC P0202 – Injector Circuit-cylinder 2 [P.13A-395](#).
- Refer to DTC P0203 – Injector Circuit-cylinder 3 [P.13A-405](#).
- Refer to DTC P0204 – Injector Circuit-cylinder 4 [P.13A-415](#).

CIRCUIT OPERATION

- Refer to DTC P0131 – Heated Oxygen Sensor (Front) Circuit Low Voltage <Except for California> [P.13A-242](#).
- Refer to DTC P0201 – Injector Circuit-cylinder 1 [P.13A-385](#).
- Refer to DTC P0202 – Injector Circuit-cylinder 2 [P.13A-395](#).
- Refer to DTC P0203 – Injector Circuit-cylinder 3 [P.13A-405](#).
- Refer to DTC P0204 – Injector Circuit-cylinder 4 [P.13A-415](#).

TECHNICAL DESCRIPTION

- The ECM effects air/fuel ratio feedback control in accordance with the signals from the heated oxygen sensor (front).

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

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (front) output voltage does not cross lean/rich criteria (about 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)

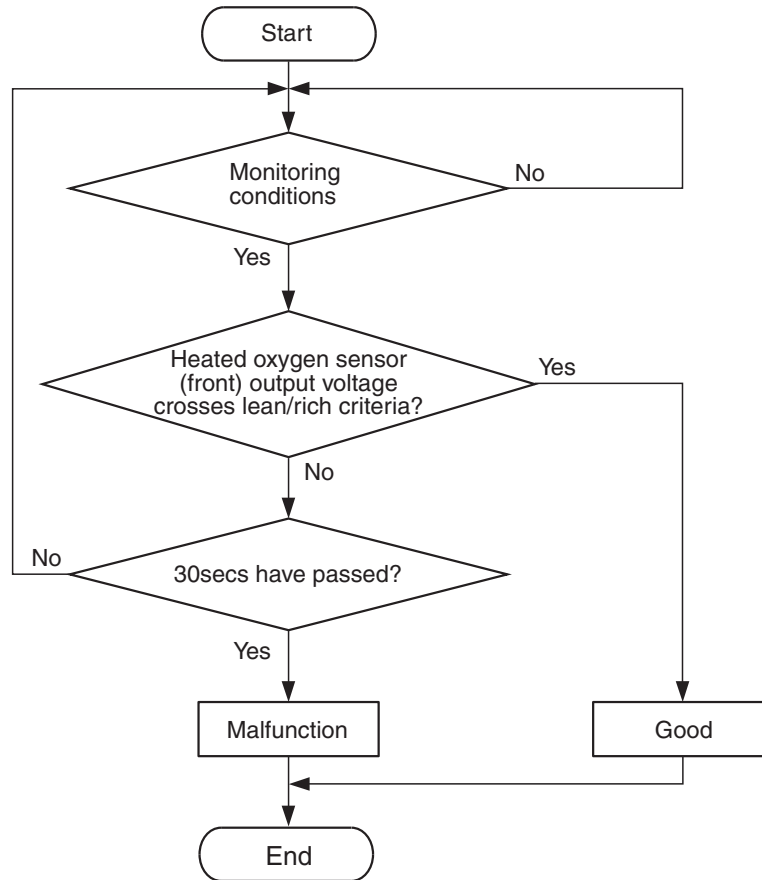
- Misfire monitor

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



AK704112

Check Conditions

- More than 120 seconds have passed since the engine starting sequence was completed.
- Engine coolant temperature is higher than 0°C (32°F).
- Engine speed is higher than 1,188 r/min.
- Volumetric efficiency is higher than 30 percent.
- Throttle position sensor output voltage is lower than 3.0 volts <M/T> or 3.2 volts <CVT>.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

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

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

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

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

If the heated oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the heated oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the heated oxygen sensor (front) output voltage decreases, without intersecting with 0.5 volt. As a result, there is a possibility of DTC P0134 becoming registered.

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

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-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 AD: Heated Oxygen Sensor (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 AD, Heated Oxygen Sensor (rear).
 - a. Transaxle: 2nd speed (CVT: "L" range).
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min
 - The output voltage should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 2.

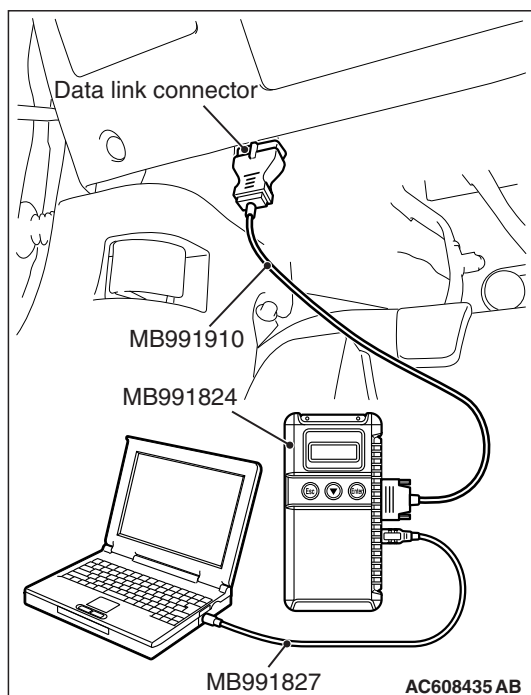
NO : Refer to DTC P0137 – Heated Oxygen Sensor (rear) Circuit Low Voltage <Except for California>

[P.13A-288](#), DTC P0138 – Heated Oxygen Sensor (rear) Circuit High Voltage <Except for California>

[P.13A-306](#), DTC P0139 – Heated Oxygen Sensor (rear) Circuit Slow Response <Except for California>

[P.13A-314](#), P0140 – Heated Oxygen Sensor (rear) Circuit No Activity Detected <Except for California>

[P.13A-324](#).



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 C-44 at the heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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

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

- (1) Disconnect the heated oxygen sensor (front) connector C-44 and connect test harness special tool MB991658 to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Rev the engine for 5 minutes or more with the engine speed of 2,500 r/min.
- (4) Connect a digital voltage meter between terminal No. 3 and terminal No. 4.
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 V

⚠ CAUTION

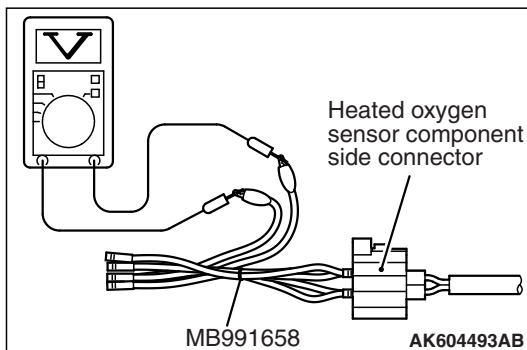
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater can be damaged if a voltage beyond 8 volts is applied to the heated oxygen sensor heater.**

NOTE: If the temperature of sensing area does not reach the high temperature [of approximately 400 °C (752 °F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 and the terminal No. 2 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 6.

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



STEP 6. Check harness connector B-101, B-102, B-103, and B-104 at injector for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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

STEP 7. Check the injectors.

(1) Disconnect each injector connector.

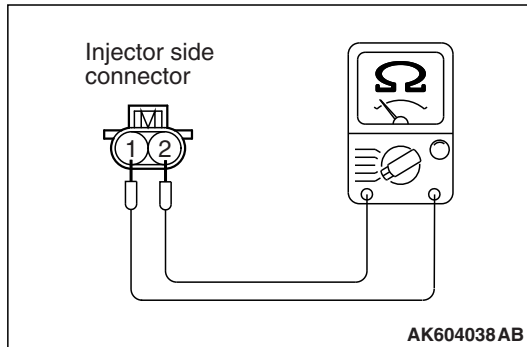
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

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

Q: Is the measured resistance between 10.5 and 13.5 Ω [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-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

STEP 9. Check for harness damage between heated oxygen sensor (front) connector C-44 (terminal No. 3) and ECM connector B-108 (terminal No. 38).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between injector connector and ECM connector.

- a. Check the harness wire between injector connector B-101 (terminal No. 2) and ECM connector B-108 (terminal No. 2) when checking No. 1 cylinder.
- b. Check the harness wire between injector connector B-102 (terminal No. 2) and ECM connector B-108 (terminal No. 3) when checking No. 2 cylinder.
- c. Check the harness wire between injector connector B-103 (terminal No. 2) and ECM connector B-108 (terminal No. 18) when checking No. 3 cylinder.
- d. Check the harness wire between injector connector B-104 (terminal No. 2) and ECM connector B-108 (terminal No. 19) when checking No. 4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-961](#).

Q: Is the fuel pressure normal?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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 – Pattern 12 [P.13A-12](#).

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

Q: Is DTC P0134 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0134: Heated Oxygen Sensor (front) No Activity Detected <California>**Heated Oxygen Sensor (front) No Activity Detected Circuit**

- Refer to DTC P0131 – Heated Oxygen Sensor (Front) Circuit Low Voltage <California> [P.13A-250](#).
- Refer to DTC P0201 – Injector Circuit-cylinder 1 [P.13A-385](#).
- Refer to DTC P0202 – Injector Circuit-cylinder 2 [P.13A-395](#).
- Refer to DTC P0203 – Injector Circuit-cylinder 3 [P.13A-405](#).
- Refer to DTC P0204 – Injector Circuit-cylinder 4 [P.13A-415](#).

CIRCUIT OPERATION

- Refer to DTC P0131 – Heated Oxygen Sensor (Front) Circuit Low Voltage <California> [P.13A-250](#).
- Refer to DTC P0201 – Injector Circuit-cylinder 1 [P.13A-385](#).
- Refer to DTC P0202 – Injector Circuit-cylinder 2 [P.13A-395](#).
- Refer to DTC P0203 – Injector Circuit-cylinder 3 [P.13A-405](#).
- Refer to DTC P0204 – Injector Circuit-cylinder 4 [P.13A-415](#).

TECHNICAL DESCRIPTION

- The ECM effects air/fuel ratio feedback control in accordance with the signals from the heated oxygen sensor (front).

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

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (front) output voltage does not cross lean/rich criteria (about 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)

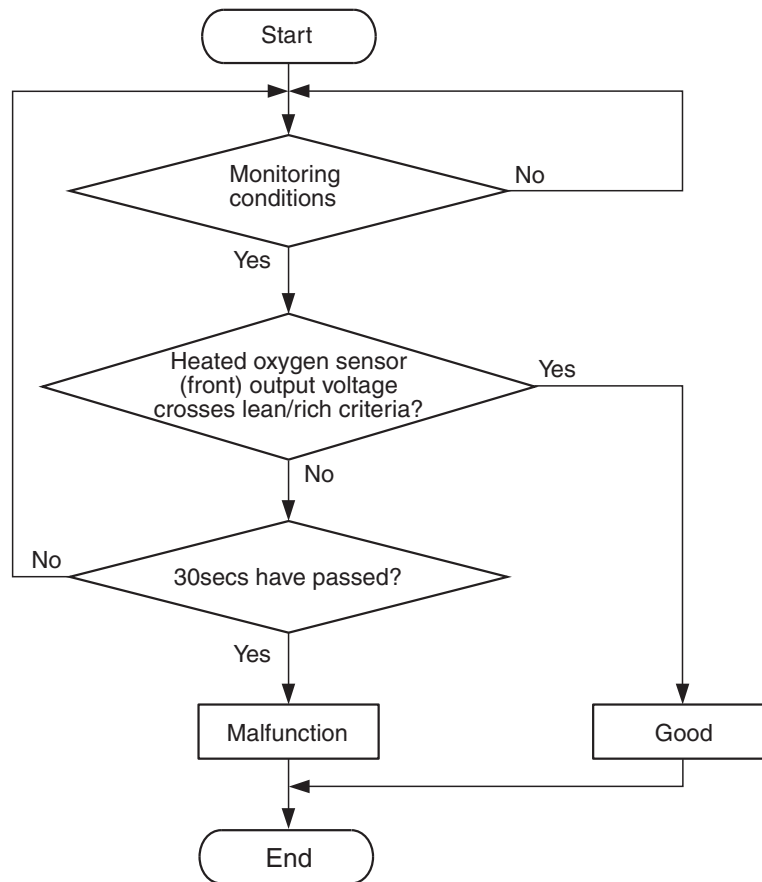
- Misfire monitor

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



AK704112

Check Conditions

- More than 120 seconds have passed since the engine starting sequence was completed.
- Engine coolant temperature is higher than 0°C (32°F).
- Engine speed is higher than 1,188 r/min.
- Volumetric efficiency is higher than 30 percent.
- Throttle position sensor output voltage is lower than 3.0 volts <M/T> or 3.2 volts <CVT>.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

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

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

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

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

If the heated oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the heated oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the heated oxygen sensor (front) output voltage decreases, without intersecting with 0.5 volt. As a result, there is a possibility of DTC P0134 becoming registered.

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

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-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 AD: Heated Oxygen Sensor (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 AD, Heated Oxygen Sensor (rear).
 - a. Transaxle: 2nd speed (CVT: "L" range).
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min
 - The output voltage should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 2.

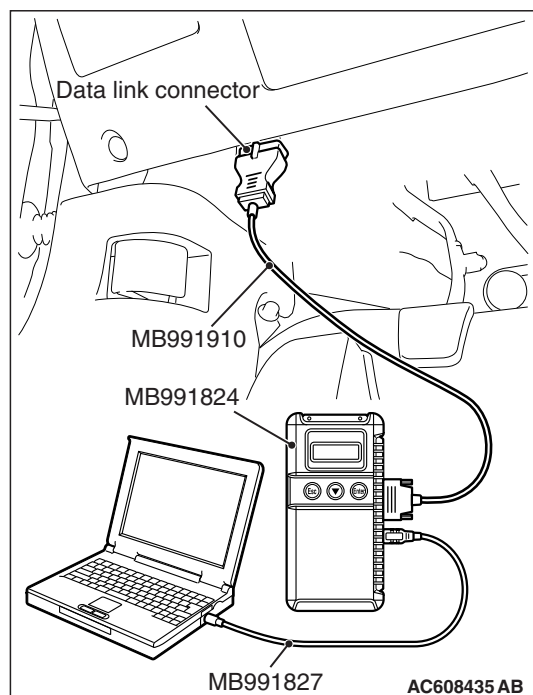
NO : Refer to DTC P0137 – Heated Oxygen Sensor (rear) Circuit Low Voltage <California> [P.13A-297](#), DTC P0138 – Heated Oxygen Sensor (rear) Circuit High Voltage <California> [P.13A-310](#), DTC P0139 – Heated Oxygen Sensor (rear) Circuit Slow Response <California> [P.13A-319](#), P0140 – Heated Oxygen Sensor (rear) Circuit No Activity Detected <California> [P.13A-328](#).

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-05 at the heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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

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

- (1) Disconnect the heated oxygen sensor (front) connector B-05 and connect test harness special tool MD998464 to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Rev the engine for 5 minutes or more with the engine speed of 2,500 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 (front) output voltage.

Standard value: 0.6 – 1.0 V

⚠ CAUTION

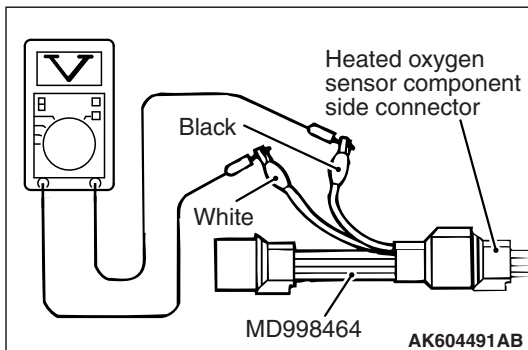
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater can be damaged if a voltage beyond 8 volts is applied to the heated oxygen sensor heater.**

NOTE: If the temperature of sensing area does not reach the high temperature [of approximately 400 °C (752 °F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of 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 6.

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



STEP 6. Check harness connector B-101, B-102, B-103 and B-104 at injector for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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

STEP 7. Check the injectors.

(1) Disconnect each injector connector.

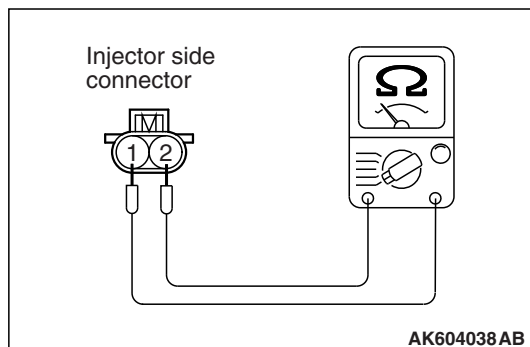
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

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

Q: Is the measured resistance between 10.5 and 13.5 Ω [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-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

STEP 9. Check for harness damage between heated oxygen sensor (front) connector B-05 (terminal No. 4) and ECM connector B-108 (terminal No. 38).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between injector connector and ECM connector.

- a. Check the harness wire between injector connector B-101 (terminal No. 2) and ECM connector B-108 (terminal No. 2) when checking No. 1 cylinder.
- b. Check the harness wire between injector connector B-102 (terminal No. 2) and ECM connector B-108 (terminal No. 3) when checking No. 2 cylinder.
- c. Check the harness wire between injector connector B-103 (terminal No. 2) and ECM connector B-108 (terminal No. 18) when checking No. 3 cylinder.
- d. Check the harness wire between injector connector B-104 (terminal No. 2) and ECM connector B-108 (terminal No. 19) when checking No. 4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-961](#).

Q: Is the fuel pressure normal?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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 – Pattern 12 [P.13A-12](#).

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

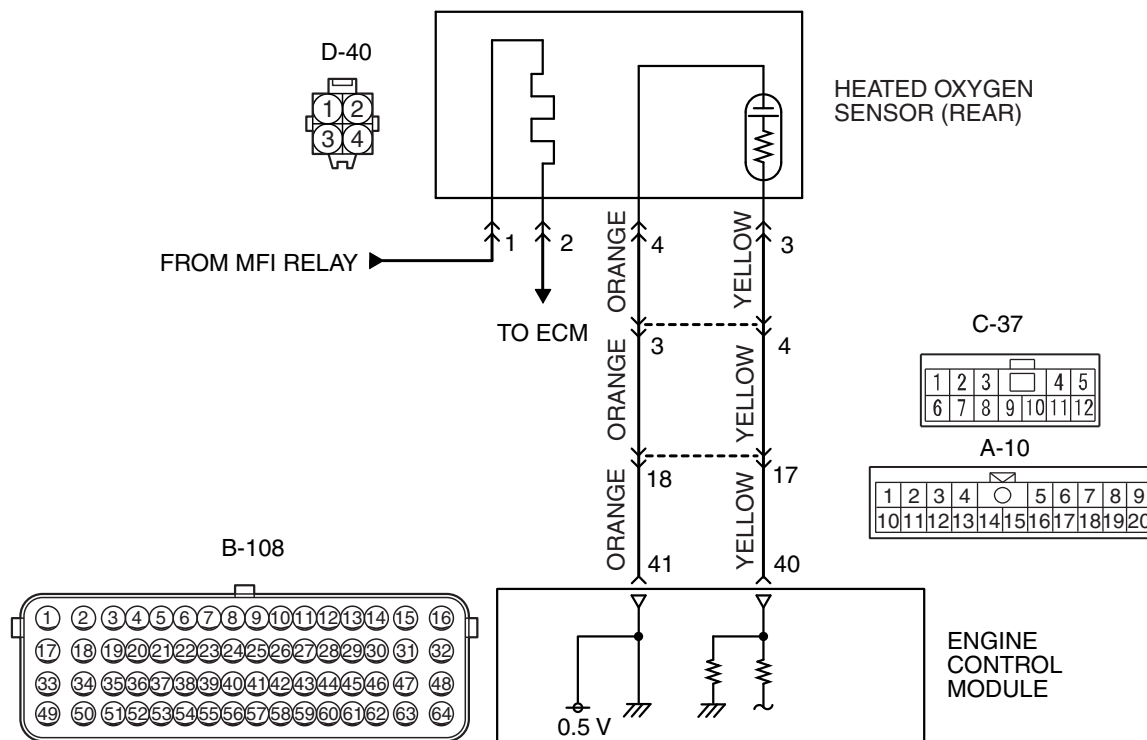
Q: Is DTC P0134 set?

YES : Retry the troubleshooting.

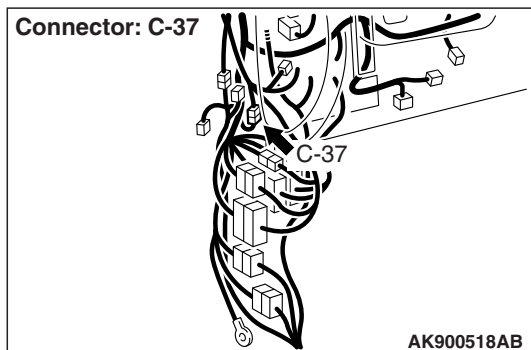
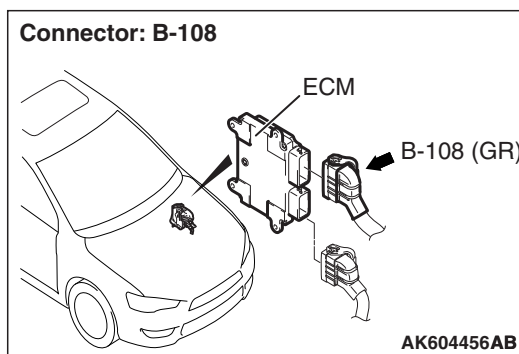
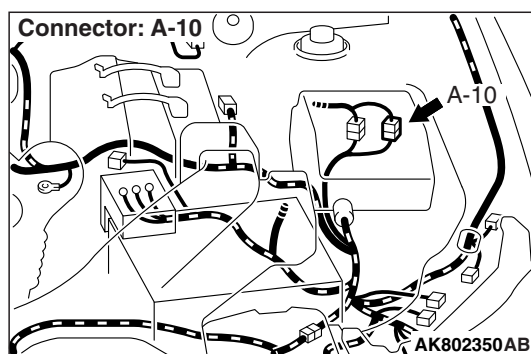
NO : The inspection is complete.

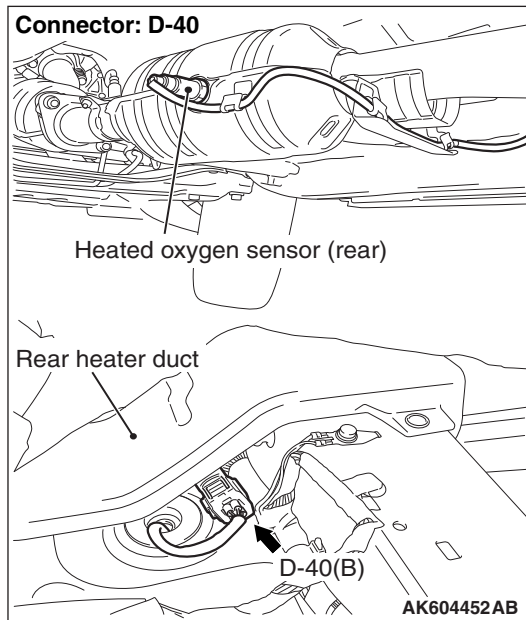
DTC P0137: Heated Oxygen Sensor (rear) Circuit Low Voltage <Except for California>

HEATED OXYGEN SENSOR (REAR) CIRCUIT <EXCEPT FOR CALIFORNIA>



AK603951AC





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 40) from the output terminal (terminal No. 3) of the heated oxygen sensor (rear).
- Terminal No. 4 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 41).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (rear).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (rear) output voltage is under the 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)

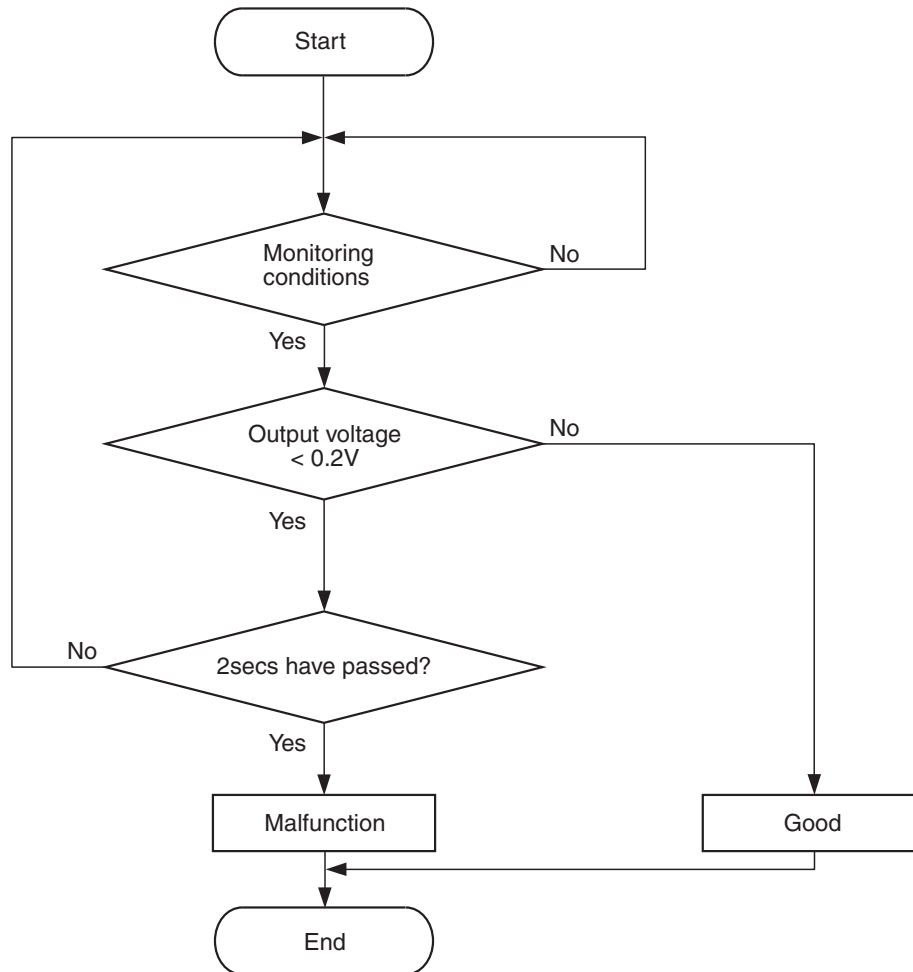
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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



AK604321

Check Conditions

- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.
- Battery positive voltage is between 11 and 16.5 volts.
- 3 minutes or more have passed since the engine starting sequence was completed.

Judgement Criterion

- Heated oxygen sensor (rear) output voltage is lower than 0.2 volt for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991658: Test Harness
- MB992110: Power Plant ECU Check Harness

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

⚠ CAUTION

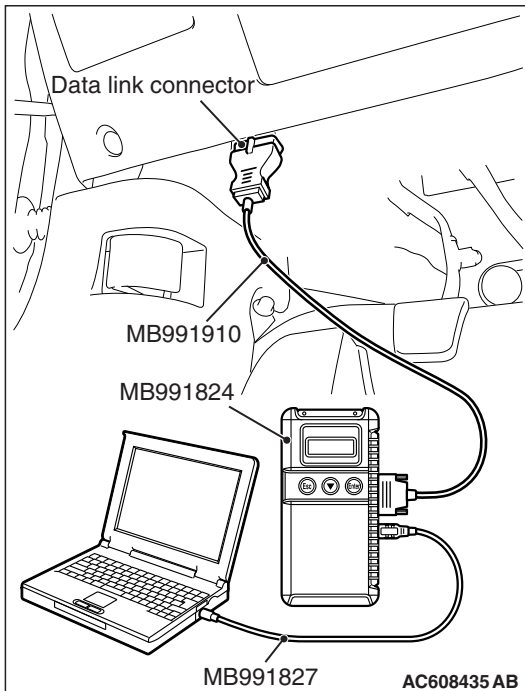
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 AD, Heated Oxygen Sensor (rear).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min
 - The output voltages should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.



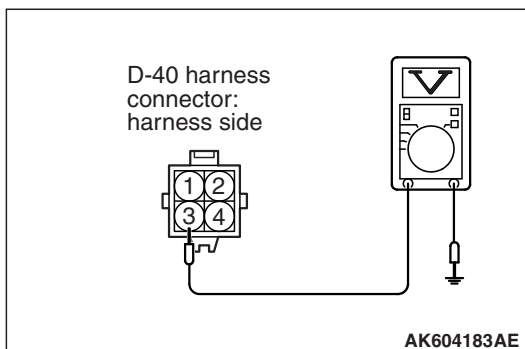
STEP 2. Measure the sensor output voltage at heated oxygen sensor (rear) connector D-40 by backprobing

- (1) Do not disconnect the connector D-40.
- (2) Start the engine and run at idle.
- (3) Measure the voltage between terminal No. 3 and ground by backprobing under the following driving.
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 1.0 and 1.5 volts.
- (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 8.



STEP 3. Check harness connector B-108 at ECM for damage.

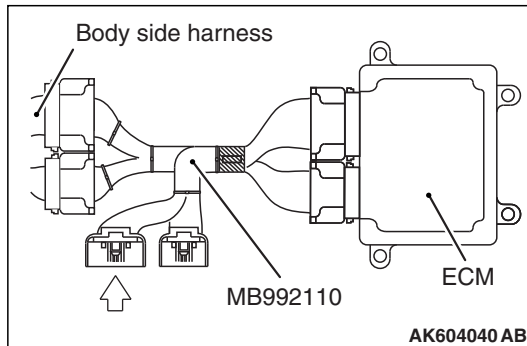
Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

STEP 4. Measure the sensor output voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Start the engine and run at idle.



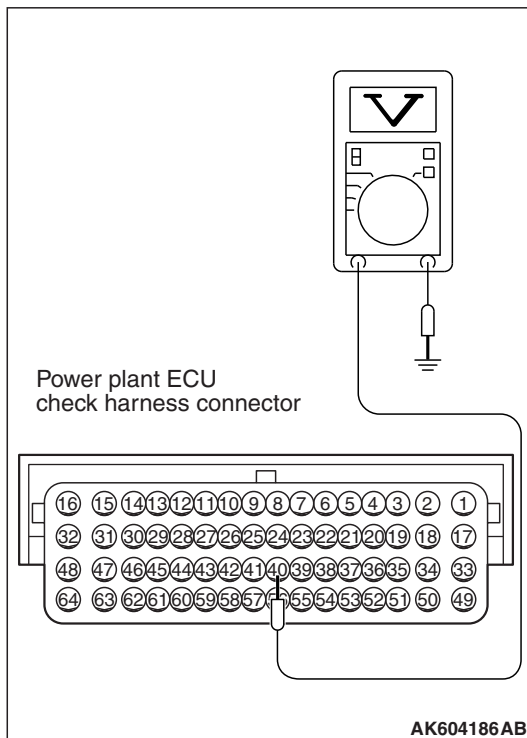
AK604040 AB

- (3) Measure the voltage between terminal No. 40 and ground under the following driving.
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 1.0 and 1.5 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 1.0 and 1.5 volts?

YES : Go to Step 5.

NO : Go to Step 7.



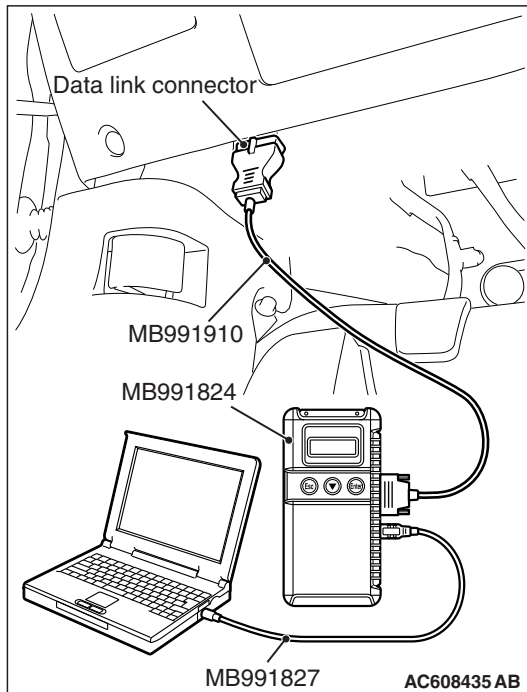
AK604186 AB

STEP 5. Check harness connector D-40 at heated oxygen sensor (rear) 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. Using scan tool MB99158, check data list item AD: Heated Oxygen Sensor (rear).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB99158 to the data reading mode for item AD, Heated Oxygen Sensor (rear).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (3) 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

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

Q: Is the harness connector in good condition?

- YES :** Check harness connector A-10 and C-37 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between heated oxygen sensor (rear) connector D-40 (terminal No. 3) and ECM connector B-108 (terminal No. 40) because of open circuit or harness damage. Then go to Step 14.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

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

Q: Is the harness connector in good condition?

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

STEP 9. Check harness connector B-108 at ECM for damage.

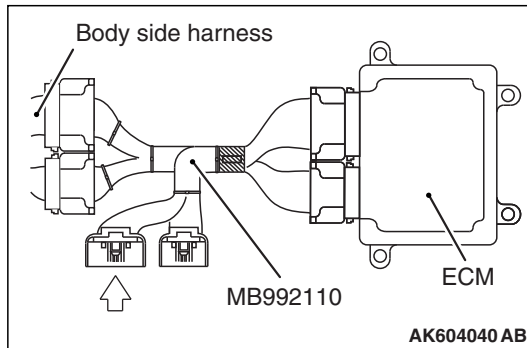
Q: Is the harness connector in good condition?

YES : Go to Step 10.

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

STEP 10. Measure the sensor offset voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

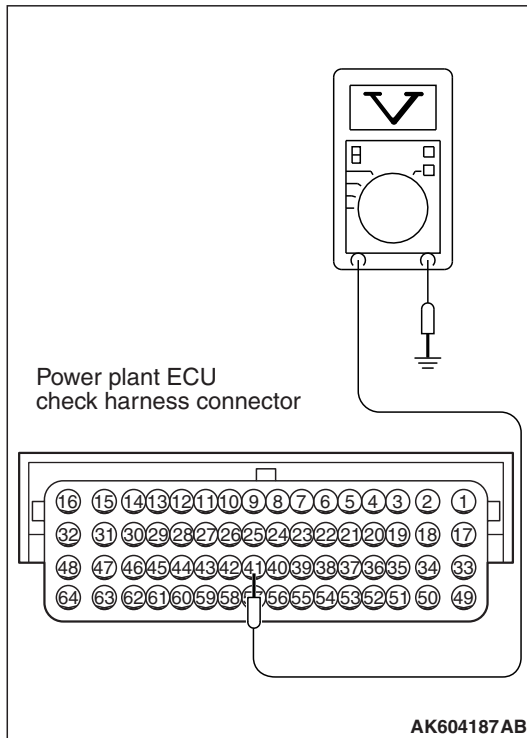


- (3) Measure the voltage between terminal No. 41 and ground.
 - Voltage should be between 0.4 and 0.6 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 0.4 and 0.6 volt?

YES : Go to Step 11.

NO : Check harness connector A-10 and C-37 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between headed oxygen sensor (rear) connector D-40 (terminal No. 4) and ECM connector B-108 (terminal No. 41) because of open circuit or harness damage. Then go to Step 14.



STEP 11. Check for harness damage between heated oxygen sensor (rear) connector D-40 (terminal No. 4) and ECM connector B-108 (terminal No. 41).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.

STEP 12. Check for short circuit to ground and harness damage between heated oxygen sensor (rear) connector D-40 (terminal No. 3) and ECM connector B-108 (terminal No. 40).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

Q: Is the harness wire in good condition?

YES : Go to Step 13.

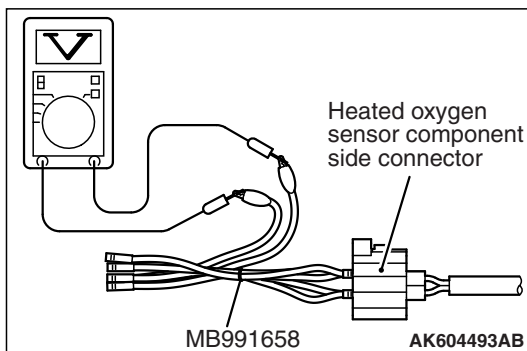
NO : Repair it. Then go to Step 14.

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

- (1) Disconnect the heated oxygen sensor (rear) connector D-40 and connect test harness special tool MB991658 to the connector on the heated oxygen sensor (rear) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Drive at 50 km/h (31mph) or more for 10 minutes.
- (4) Connect a digital voltage meter between terminal No. 3 and terminal No. 4.
- (5) Measure the output voltage of heated oxygen sensor under the following driving.
 - Transaxle: 2nd speed (CVT: "L" range)
 - Drive with wide open throttle
 - Engine: 3,500 r/min or more

Standard value: 0.6 – 1.0 V

NOTE: If the temperature of sensing area does not reach the high temperature [of approximately 400°C (752°F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.



NOTE: When the vehicle is driven with high loads, the temperature of the sensing area of the heated oxygen sensor is sufficiently high. Thus, it is not necessary to apply the voltage to the heater.

Q: Is the measured voltage between 0.6 and 1.0 volt?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

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

STEP 14. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).

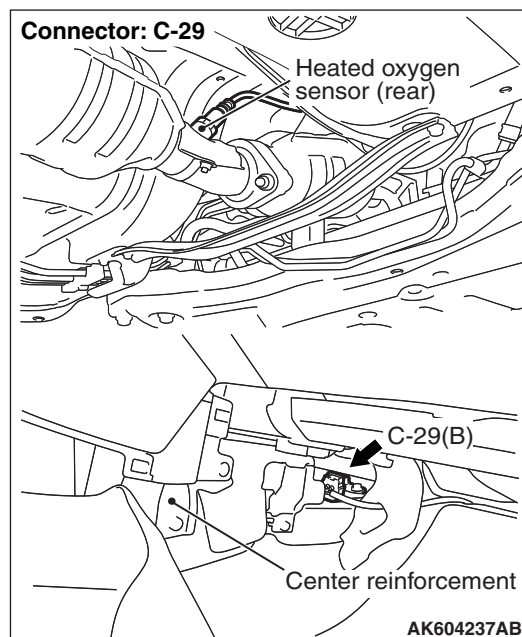
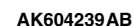
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0137 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

HEATED OXYGEN SENSOR (REAR) CIRCUIT <CALIFORNIA>



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 40) from the output terminal (terminal No. 3) of the heated oxygen sensor (rear).
- Terminal No. 4 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 41).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (rear).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (rear) output voltage is under the 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)

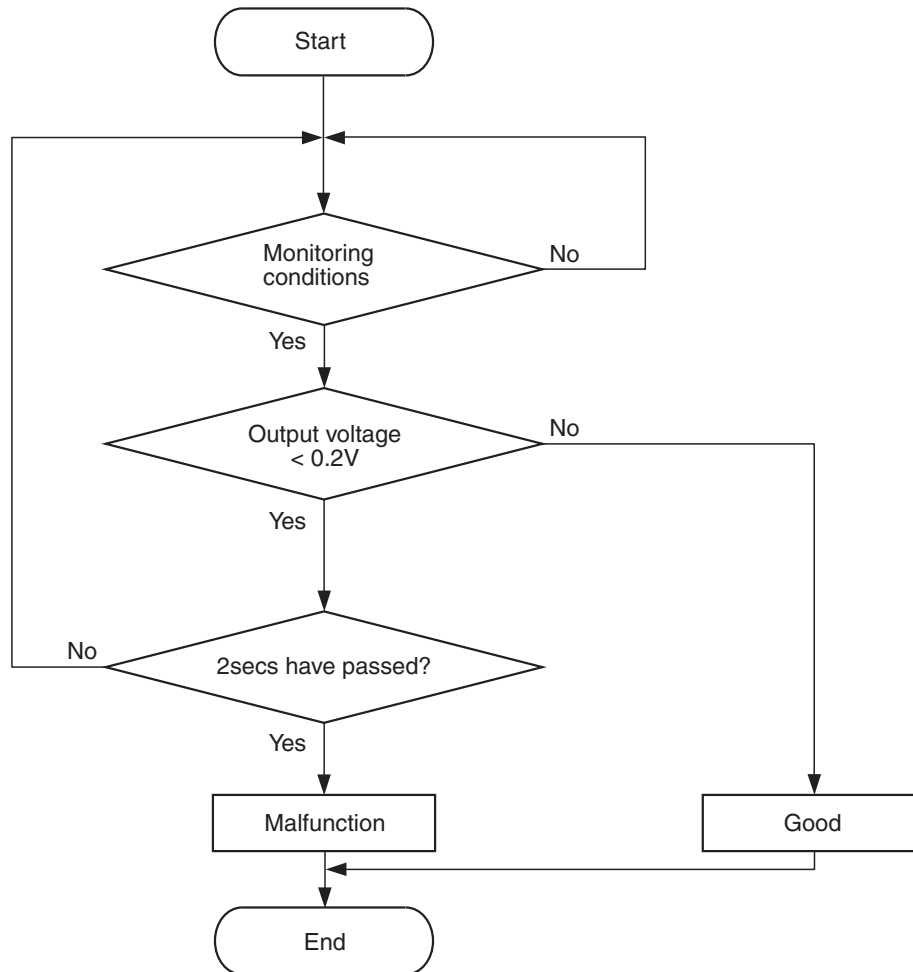
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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



AK604321

Check Conditions

- Heated oxygen sensor (rear) offset voltage is between 0.4 and 0.6 volt.
- Battery positive voltage is between 11 and 16.5 volts.
- 3 minutes or more have passed since the engine starting sequence was completed.

Judgement Criterion

- Heated oxygen sensor (rear) output voltage is lower than 0.2 volt for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991658: Test Harness
- MB992110: Power Plant ECU Check Harness

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

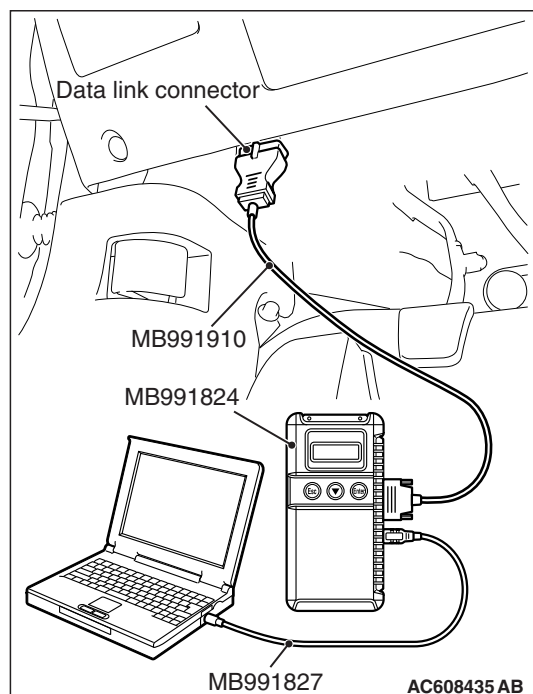
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 AD, Heated Oxygen Sensor (rear).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min
 - The output voltages should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

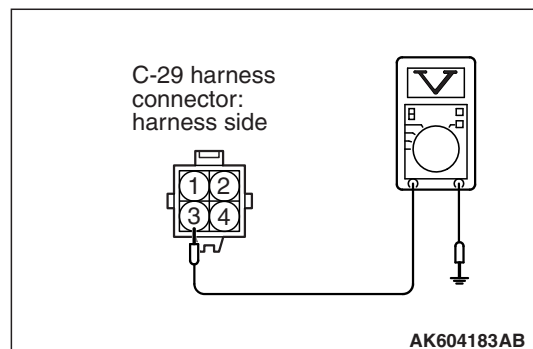
**STEP 2. Measure the sensor output voltage at heated oxygen sensor (rear) connector C-29 by backprobing**

- (1) Do not disconnect the connector C-29.
- (2) Start the engine and run at idle.
- (3) Measure the voltage between terminal No. 3 and ground by backprobing under the following driving.
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 1.0 and 1.5 volts.
- (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 8.



STEP 3. Check harness connector B-108 at ECM for damage.

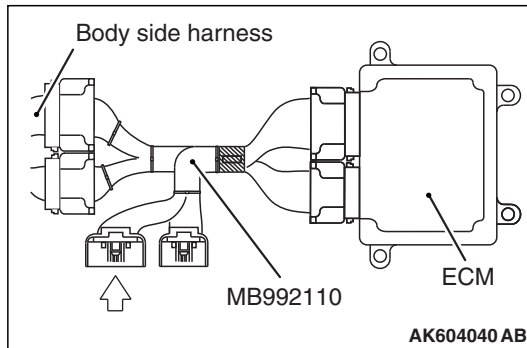
Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

STEP 4. Measure the sensor output voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Start the engine and run at idle.



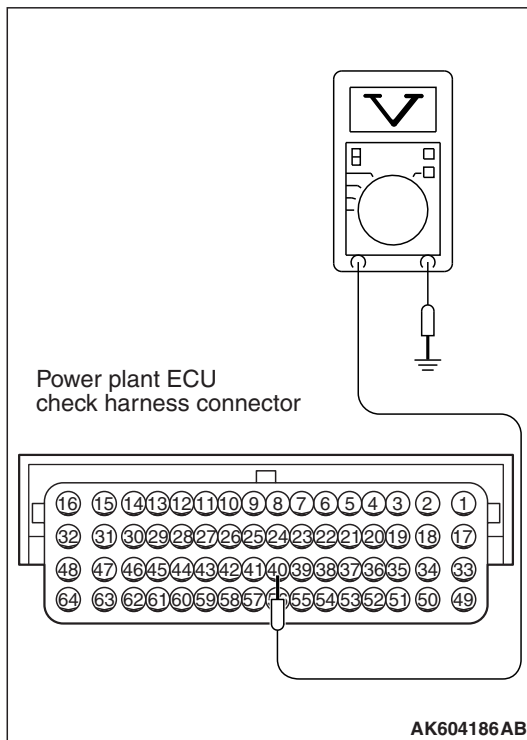
- (3) Measure the voltage between terminal No. 40 and ground under the following driving.
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 1.0 and 1.5 volts.

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

Q: Is the measured voltage between 1.0 and 1.5 volts?

YES : Go to Step 5.

NO : Go to Step 7.

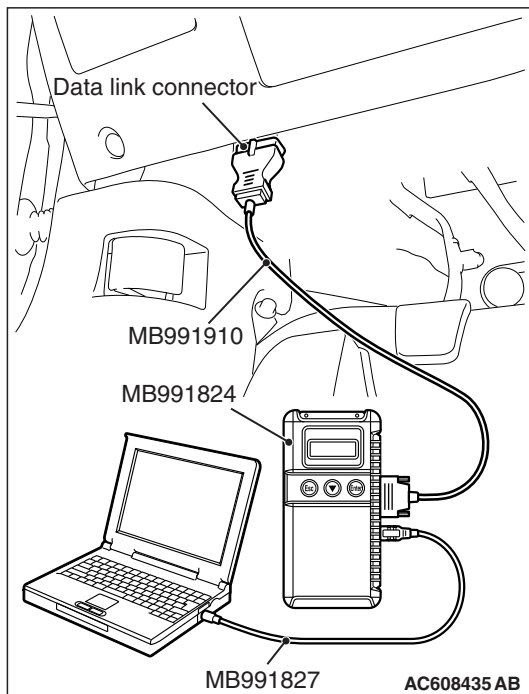


STEP 5. Check harness connector C-29 at heated oxygen sensor (rear) for damage.

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. Using scan tool MB99158, check data list item AD: Heated Oxygen Sensor (rear).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB99158 to the data reading mode for item AD, Heated Oxygen Sensor (rear).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (3) 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

STEP 7. Check harness connector C-29 at heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

- YES :** Check harness connector A-10 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between heated oxygen sensor (rear) connector C-29 (terminal No. 3) and ECM connector B-108 (terminal No. 40) because of open circuit or harness damage. Then go to Step 14.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

STEP 8. Check harness connector C-29 at heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

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

STEP 9. Check harness connector B-108 at ECM for damage.

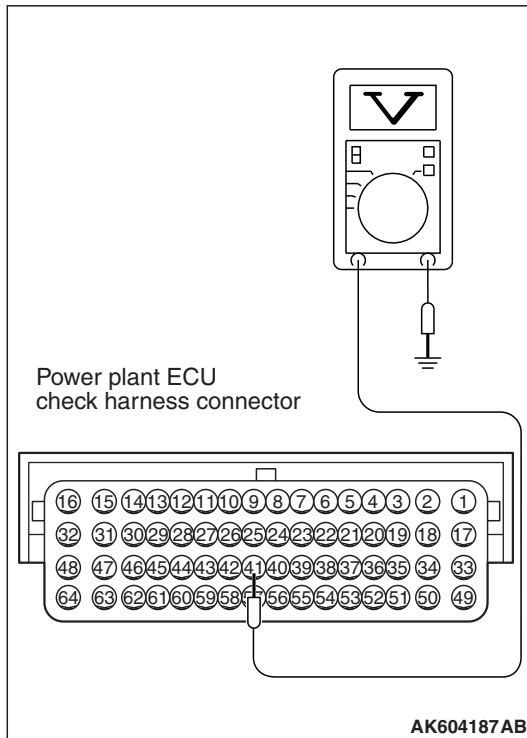
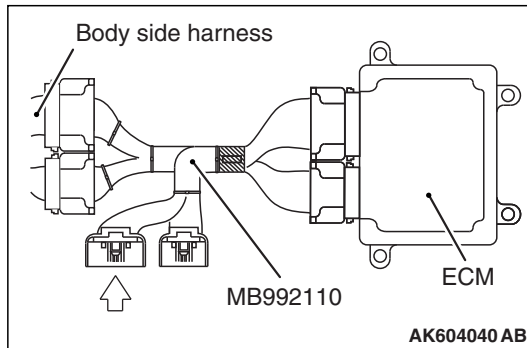
Q: Is the harness connector in good condition?

YES : Go to Step 10.

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

STEP 10. Measure the sensor offset voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



- (3) Measure the voltage between terminal No. 41 and ground.
 - Voltage should be between 0.4 and 0.6 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 0.4 and 0.6 volt?

YES : Go to Step 11.

NO : Check harness connector A-10 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between heated oxygen sensor (rear) connector C-29 (terminal No. 4) and ECM connector B-108 (terminal No. 41) because of open circuit or harness damage. Then go to Step 14.

STEP 11. Check for harness damage between heated oxygen sensor (rear) connector C-29 (terminal No. 4) and ECM connector B-108 (terminal No. 41).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.

STEP 12. Check for short circuit to ground and harness damage between heated oxygen sensor (rear) connector C-29 (terminal No. 3) and ECM connector B-108 (terminal No. 40).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

Q: Is the harness wire in good condition?

YES : Go to Step 13.

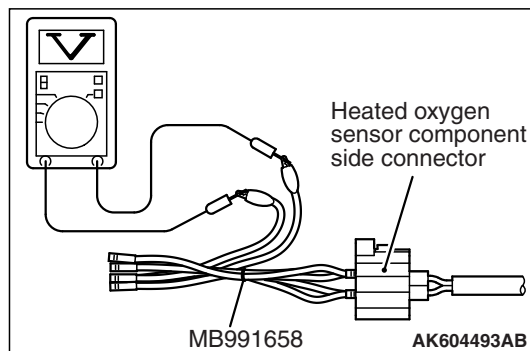
NO : Repair it. Then go to Step 14.

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

- (1) Disconnect the heated oxygen sensor (rear) connector C-29 and connect test harness special tool MB991658 to the connector on the heated oxygen sensor (rear) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Drive at 50 km/h (31mph) or more for 10 minutes.
- (4) Connect a digital voltage meter between terminal No. 3 and terminal No. 4.
- (5) Measure the output voltage of heated oxygen sensor under the following driving.
 - Transaxle: 2nd speed (CVT: "L" range)
 - Drive with wide open throttle
 - Engine: 3,500 r/min or more

Standard value: 0.6 – 1.0 V

NOTE: If the temperature of sensing area does not reach the high temperature [of approximately 400°C (752°F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.



NOTE: When the vehicle is driven with high loads, the temperature of the sensing area of the heated oxygen sensor is sufficiently high. Thus, it is not necessary to apply the voltage to the heater.

Q: Is the measured voltage between 0.6 and 1.0 volt?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

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

STEP 14. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).

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

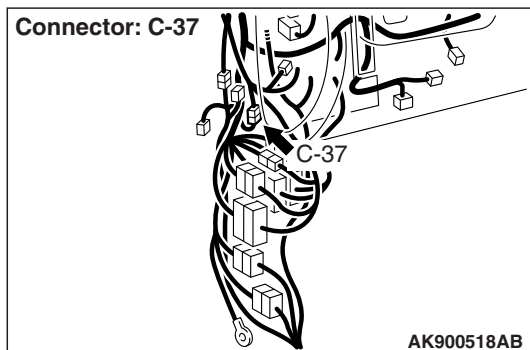
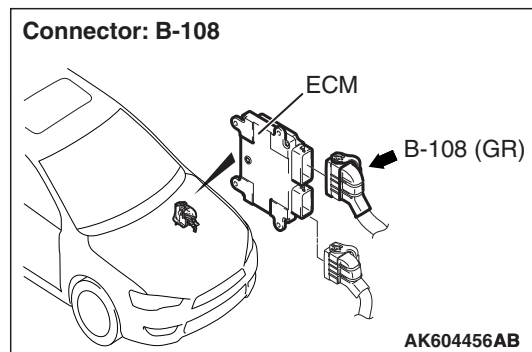
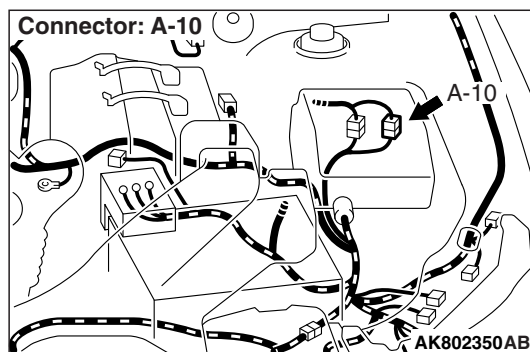
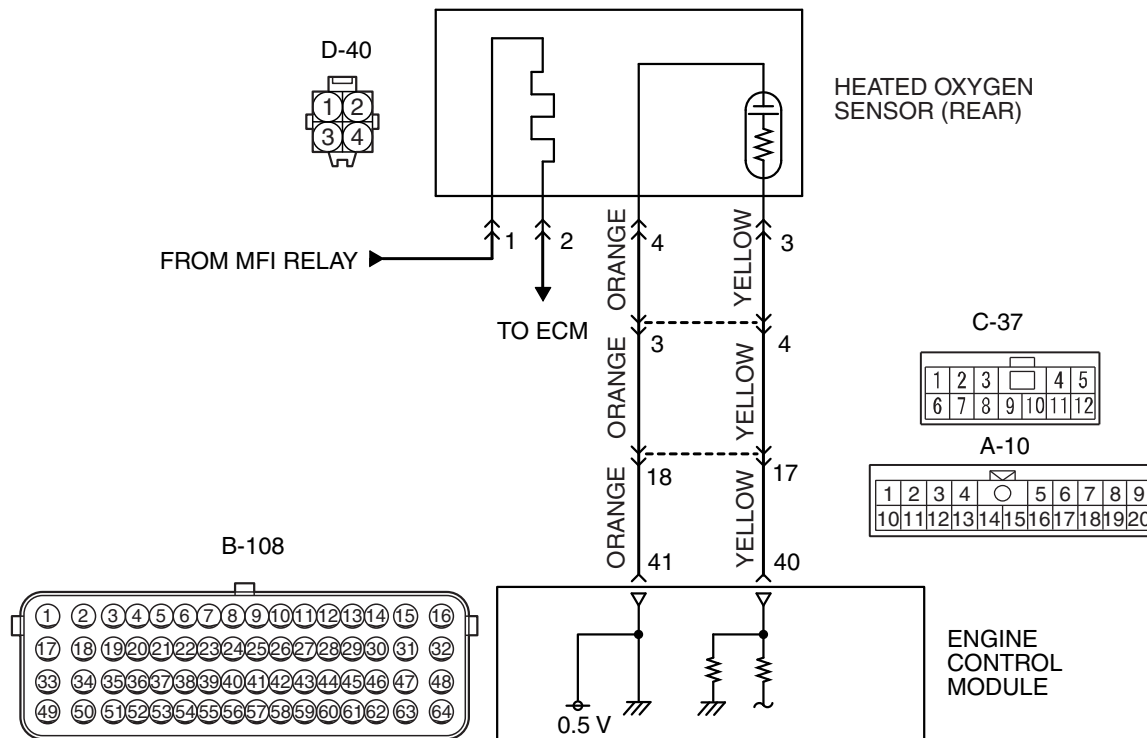
Q: Is DTC P0137 set?

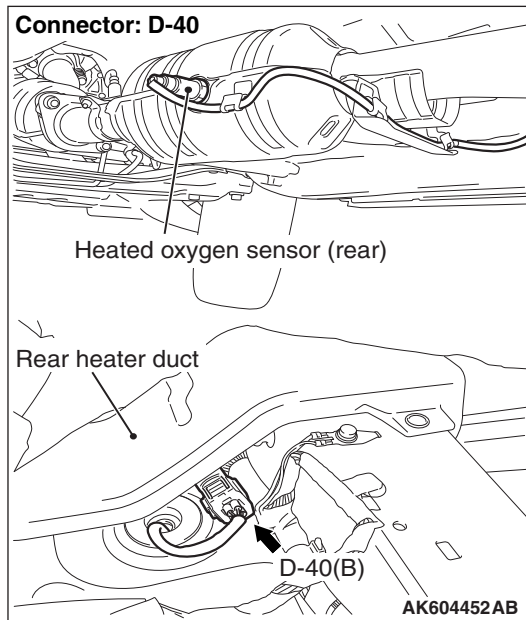
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0138: Heated Oxygen Sensor (rear) Circuit High Voltage <Except for California>

HEATED OXYGEN SENSOR (REAR) CIRCUIT <EXCEPT FOR CALIFORNIA>





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 40) from the output terminal (terminal No. 3) of the heated oxygen sensor (rear).
- Terminal No. 4 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 41).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (rear).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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)

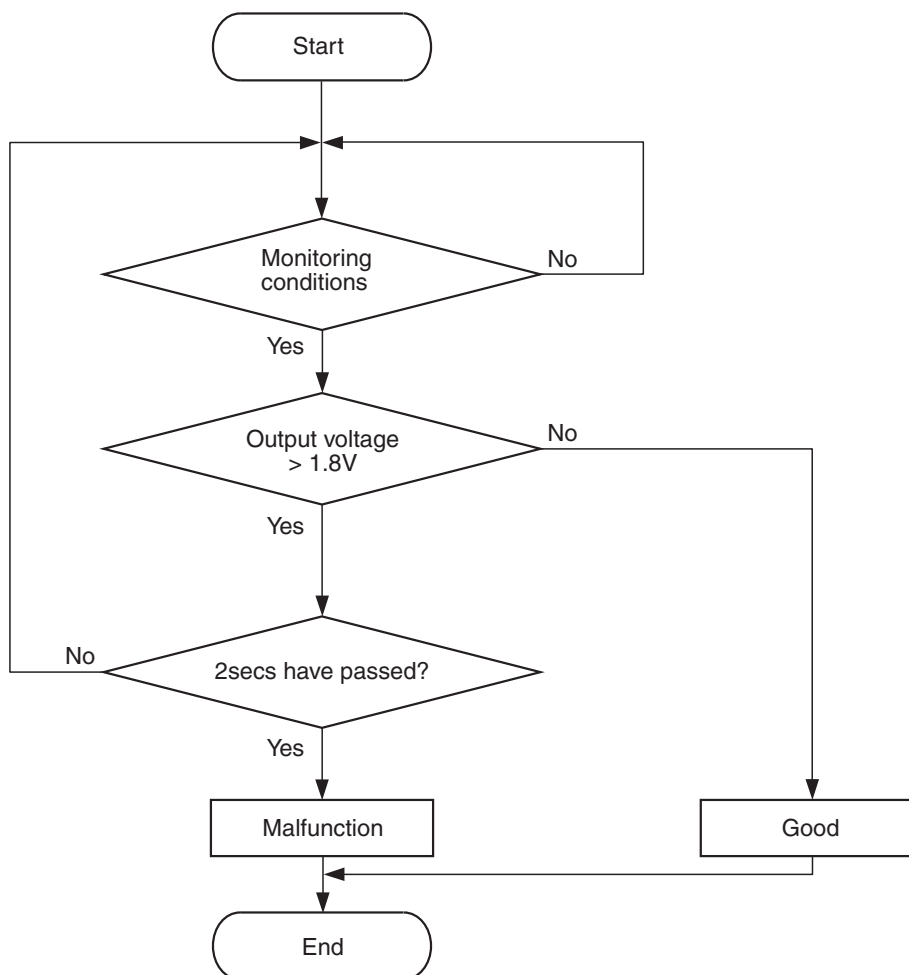
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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



AK604322

Check Conditions

- 2 seconds or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.

Judgement Criterion

- Heated oxygen sensor (rear) output voltage has continued to be 1.8 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

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

DIAGNOSIS

STEP 1. Check harness connector D-40 at heated oxygen sensor (rear) and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

STEP 2. Check for short circuit to power supply between heated oxygen sensor (rear) connector D-40 (terminal No. 3) and ECM connector B-108 (terminal No. 40).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 3.

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

NO : Repair it. Then go to Step 3.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

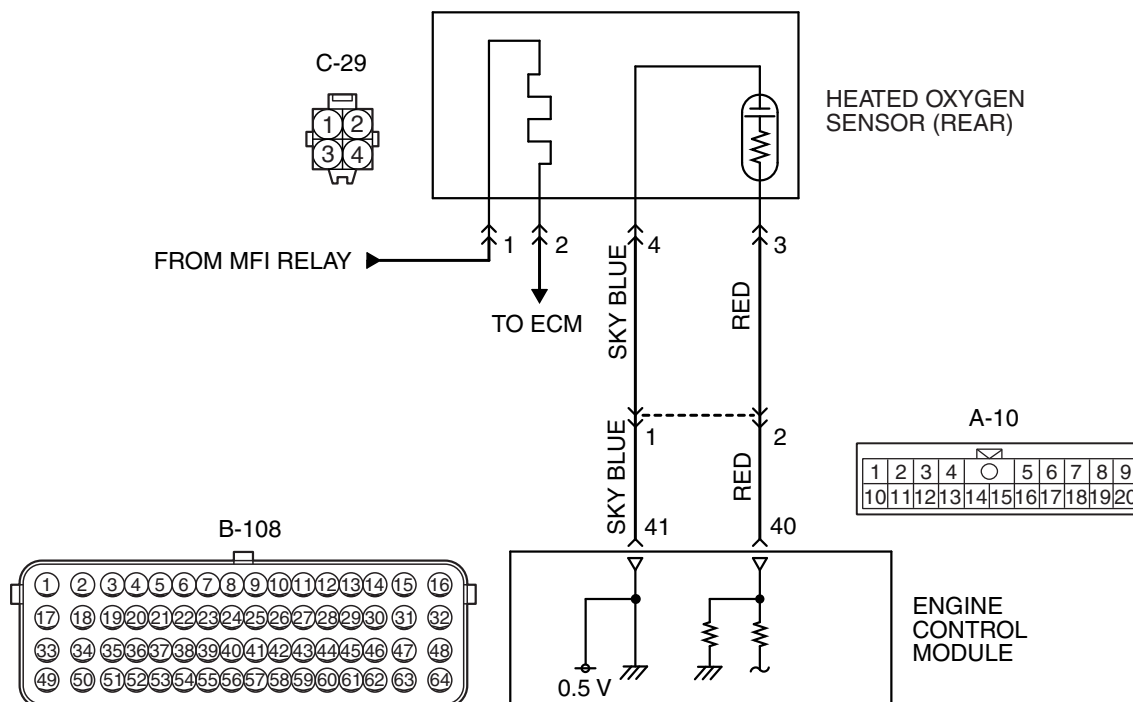
Q: Is DTC P0138 set?

YES : Retry the troubleshooting.

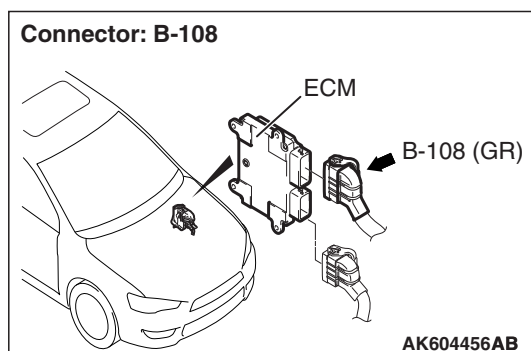
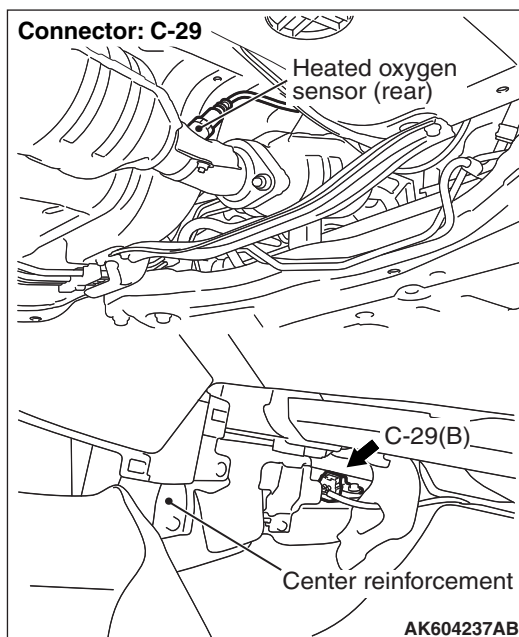
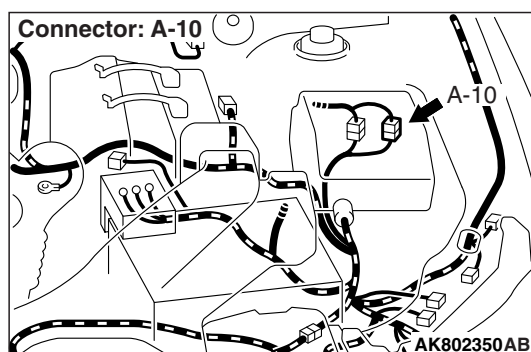
NO : The inspection is complete.

DTC P0138: Heated Oxygen Sensor (rear) Circuit High Voltage <California>

HEATED OXYGEN SENSOR (REAR) CIRCUIT <CALIFORNIA>



AK604239AB



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 40) from the output terminal (terminal No. 3) of the heated oxygen sensor (rear).
- Terminal No. 4 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 41).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (rear).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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)

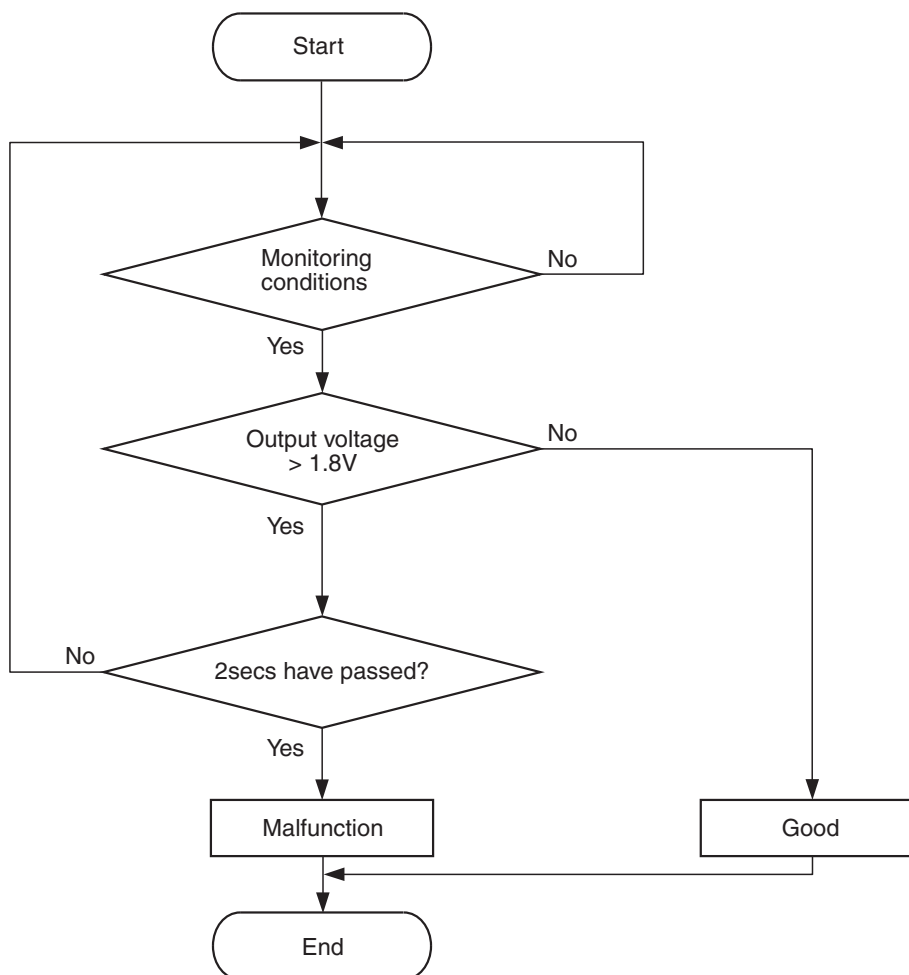
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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



AK604322

Check Conditions

- 2 seconds or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.

Judgement Criterion

- Heated oxygen sensor (rear) output voltage has continued to be 1.8 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

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

DIAGNOSIS

STEP 1. Check harness connector C-29 at heated oxygen sensor (rear) and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

STEP 2. Check for short circuit to power supply between heated oxygen sensor (rear) connector C-29 (terminal No. 3) and ECM connector B-108 (terminal No. 40).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 3.

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

NO : Repair it. Then go to Step 3.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

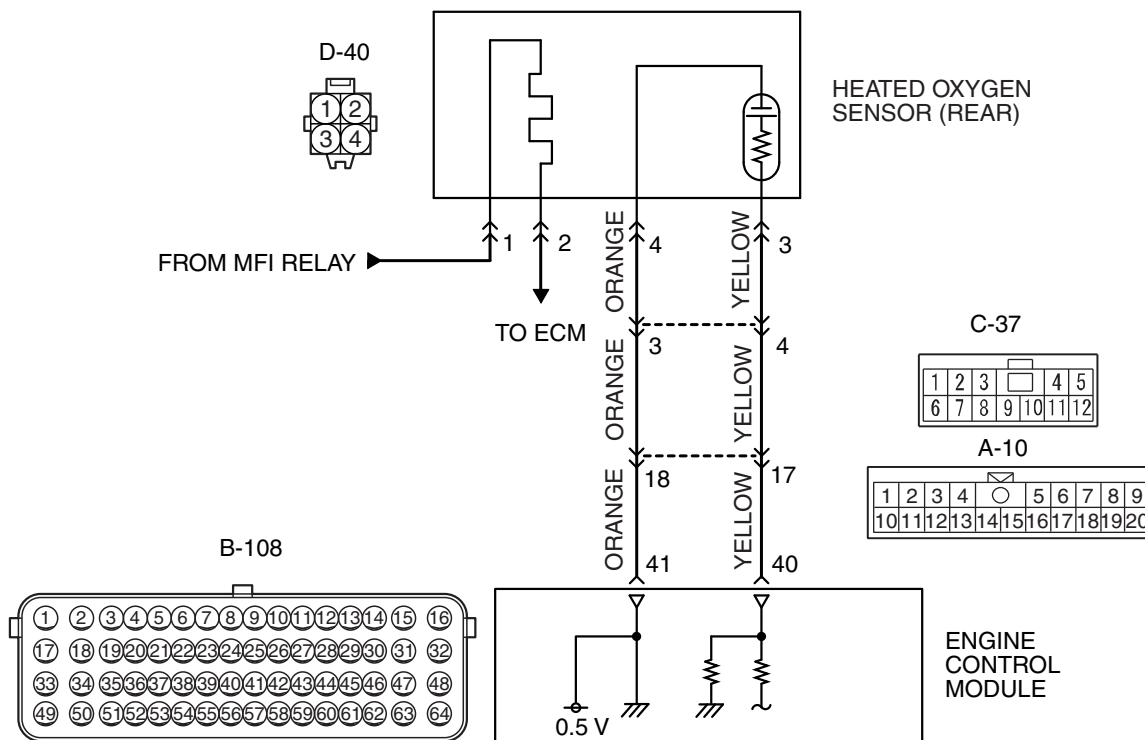
Q: Is DTC P0138 set?

YES : Retry the troubleshooting.

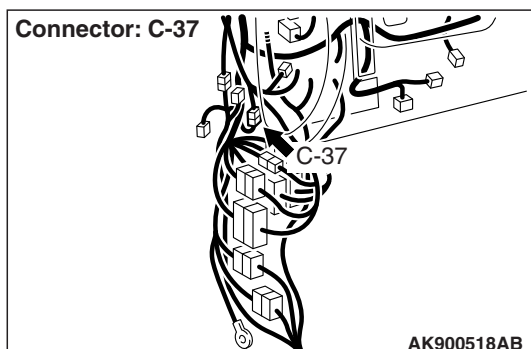
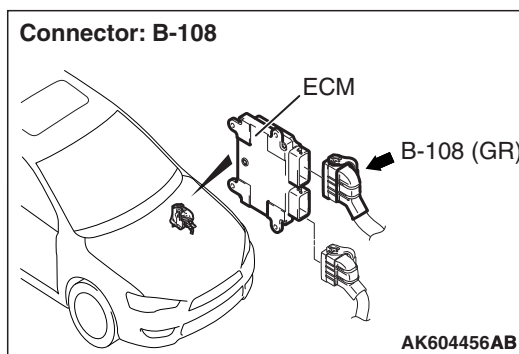
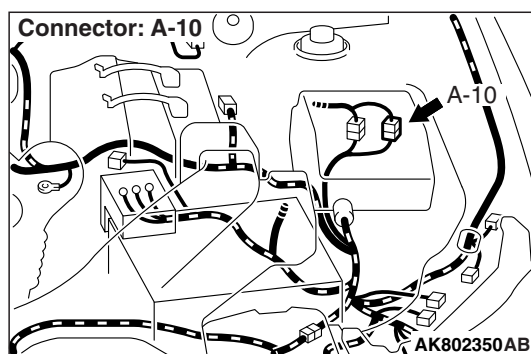
NO : The inspection is complete.

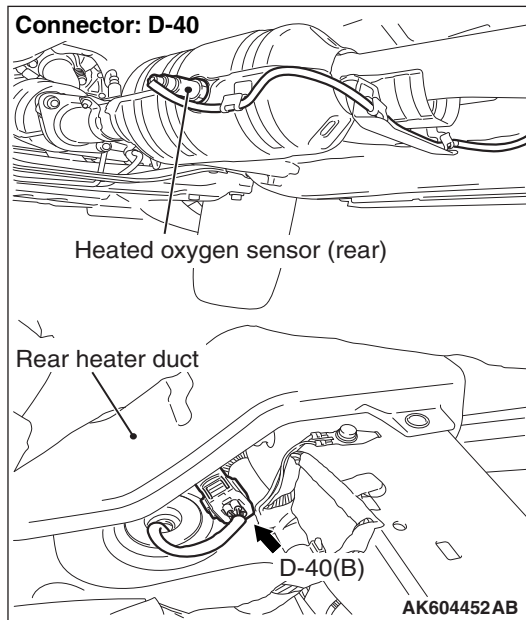
DTC P0139: Heated Oxygen Sensor (rear) Circuit Slow Response <Except for California>

HEATED OXYGEN SENSOR (REAR) CIRCUIT <EXCEPT FOR CALIFORNIA>



AK603951AC





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 40) from the output terminal (terminal No. 3) of the heated oxygen sensor (rear).
- Terminal No. 4 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 41).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (rear)

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

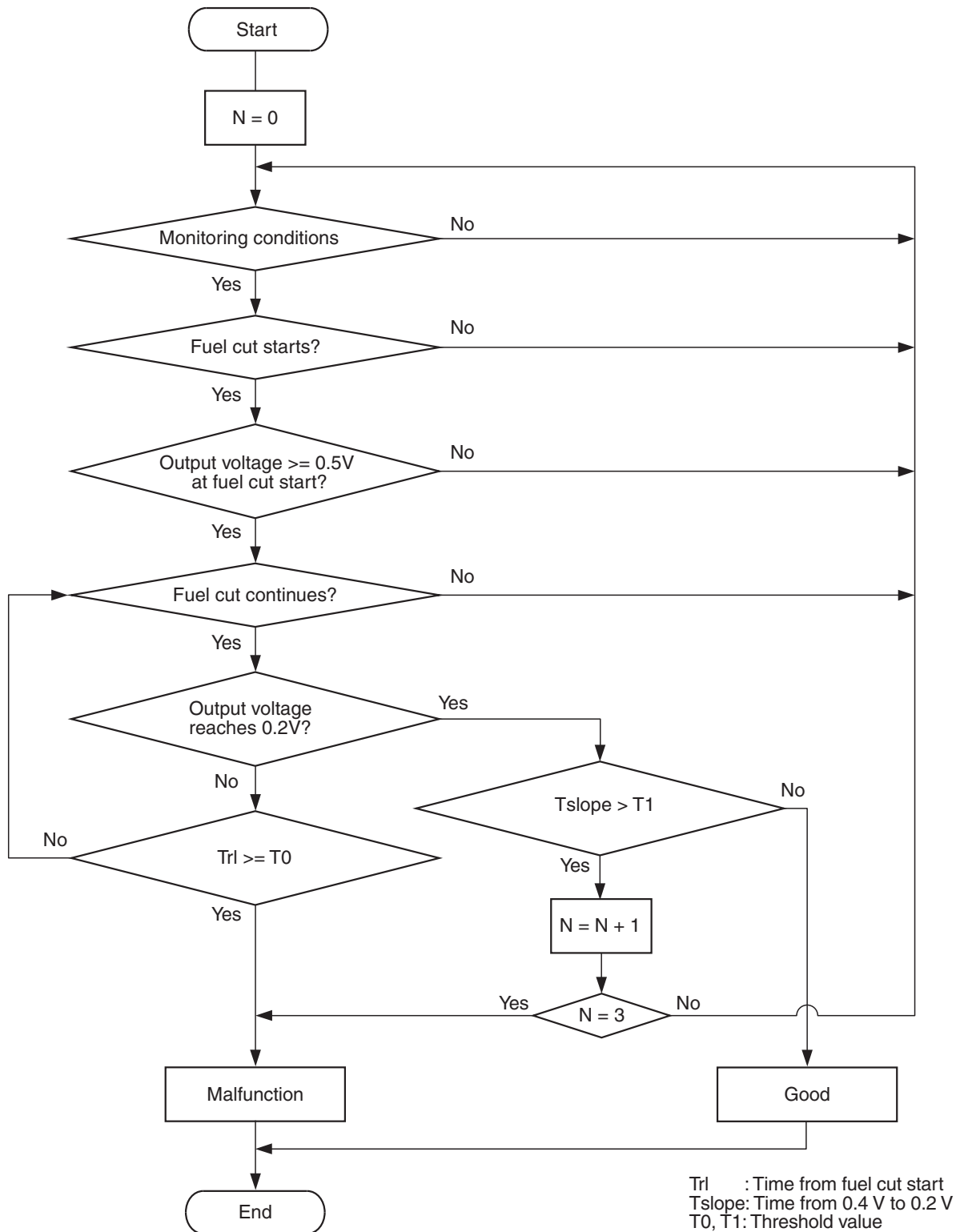
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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



Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 1,638 g.
- Fuel is being shut off.
- Heated oxygen sensor (rear) output voltage is higher than 0.5 volt when fuel cut is started.
- It has been taking more than 180 seconds since the drive signal of the heated oxygen sensor (rear) heater was turned on.
- Barometric pressure is higher than 76 kPa (22.4 in.Hg).

Judgement Criterion

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

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 1,638 g.
- Fuel is being shut off.
- The heated oxygen sensor (rear) output voltage is higher than 0.5 volt when fuel cut is started.

- It has been taking more than 180 seconds since the drive signal of the heated oxygen sensor (rear) heater was turned on.
- Barometric pressure is higher than 76 kPa (22.4 in.Hg).
- The ECM monitors for this condition for 3 cycles of 0.5 second each during drive cycles.

Judgement Criteria

- The heated oxygen sensor (rear) output voltage does not reach 0.2 volt for 0.5 second from 0.4 volt while fuel is being shut off.
- The ECM monitors for this condition once during the drive cycle.

NOTE: Monitoring stops after fuel has been shut off for more than 64 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 11 [P.13A-12](#).

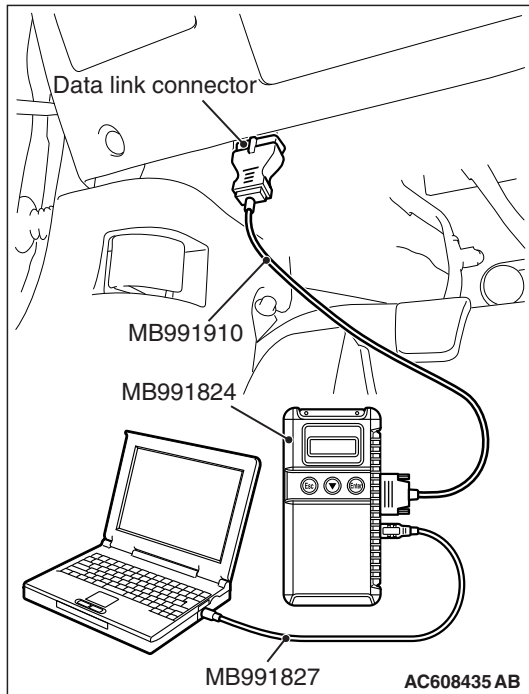
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

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

DIAGNOSIS

Required Special Tools:

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



STEP 1. Using scan tool MB991958, check data list item AD: Heated Oxygen Sensor (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 AD, Heated Oxygen Sensor (rear).
- (4) Warm up the engine.
 - After increasing the output voltage 0.5 volt or more by the engine revving, finish it. Then confirm that the output voltage reduces to 0.2 volt or less within 6 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. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 11 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0139 set?

YES : Refer to DTC P0137 – Heated Oxygen Sensor (rear) Circuit Low Voltage <Except for California> [P.13A-288](#), DTC P0138 – Heated Oxygen Sensor (rear) Circuit High Voltage <Except for California> [P.13A-306](#).

NO : The inspection is complete.

CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 40) from the output terminal (terminal No. 3) of the heated oxygen sensor (rear).
- Terminal No. 4 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 41).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (rear)

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

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

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

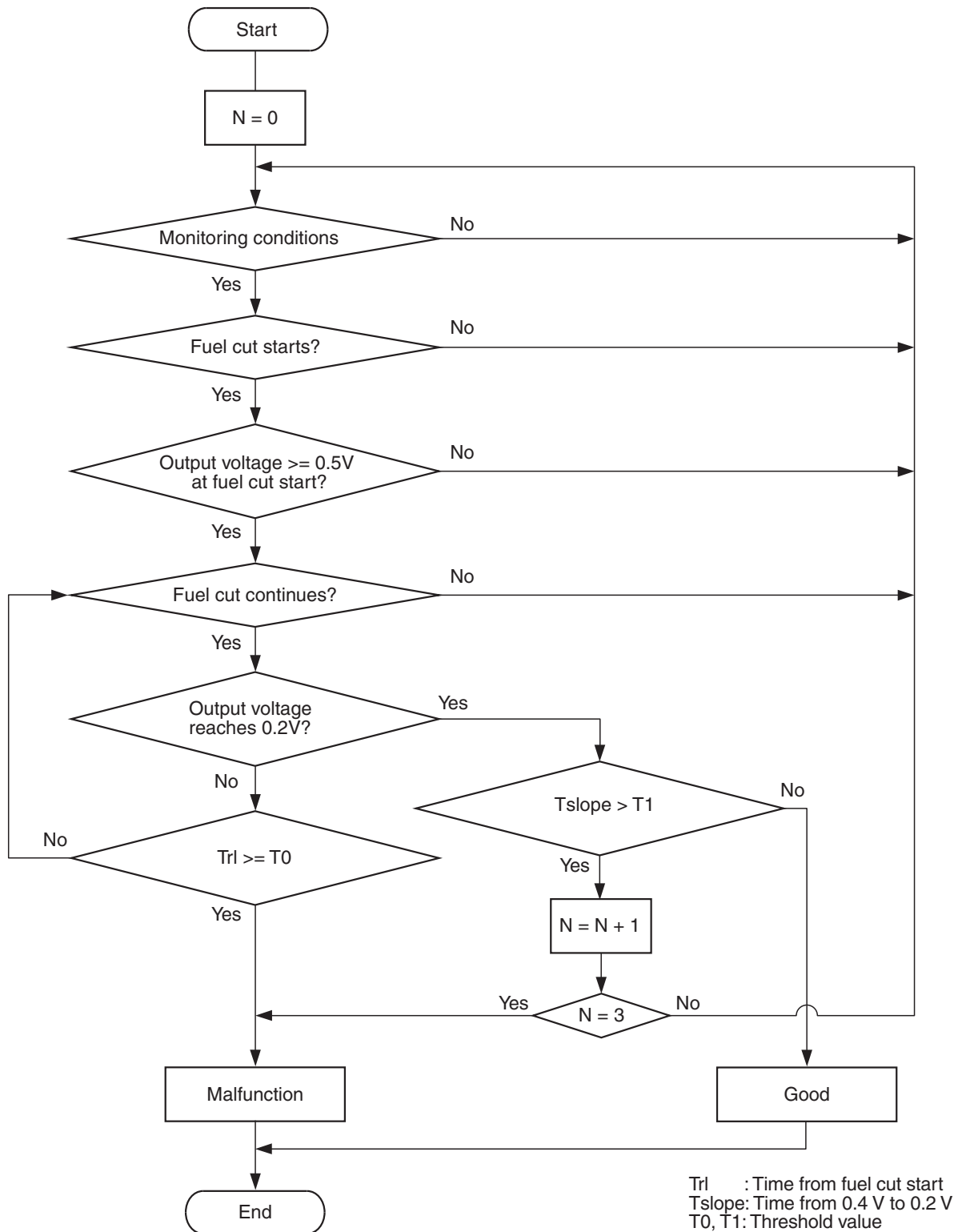
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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



AK900362

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 1,638 g.
- Fuel is being shut off.
- Heated oxygen sensor (rear) output voltage is higher than 0.5 volt when fuel cut is started.
- It has been taking more than 180 seconds since the drive signal of the heated oxygen sensor (rear) heater was turned on.
- Barometric pressure is higher than 76 kPa (22.4 in.Hg).

Judgement Criterion

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

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 1,638 g.
- Fuel is being shut off.
- The heated oxygen sensor (rear) output voltage is higher than 0.5 volt when fuel cut is started.

- It has been taking more than 180 seconds since the drive signal of the heated oxygen sensor (rear) heater was turned on.
- Barometric pressure is higher than 76 kPa (22.4 in.Hg).
- The ECM monitors for this condition for 3 cycles of 0.5 second each during drive cycles.

Judgement Criteria

- The heated oxygen sensor (rear) output voltage does not reach 0.2 volt for 0.5 second from 0.4 volt while fuel is being shut off.
- The ECM monitors for this condition once during the drive cycle.

NOTE: Monitoring stops after fuel has been shut off for more than 64 seconds.

OBD-II DRIVE CYCLE PATTERN

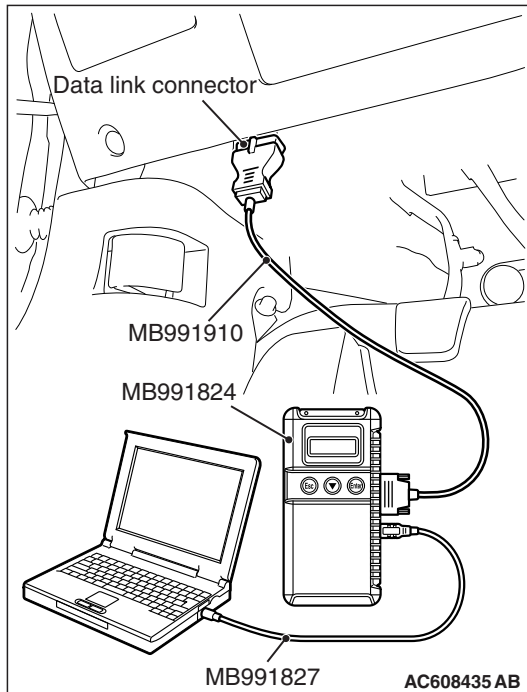
Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 11 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tools:**

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



STEP 1. Using scan tool MB991958, check data list item AD: Heated Oxygen Sensor (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 AD, Heated Oxygen Sensor (rear).
- (4) Warm up the engine.
 - After increasing the output voltage 0.5 volt or more by the engine revving, finish it. Then confirm that the output voltage reduces to 0.2 volt or less within 6 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. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 11 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

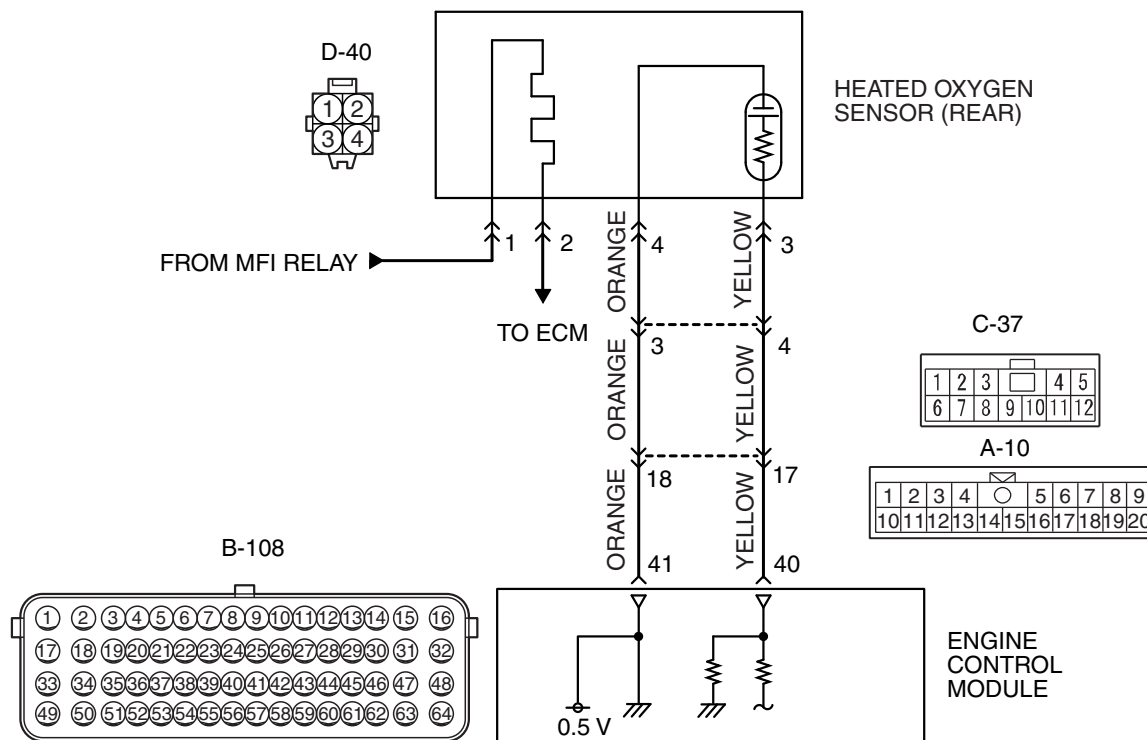
Q: Is DTC P0139 set?

YES : Refer to DTC P0137 – Heated Oxygen Sensor (rear) Circuit Low Voltage <California> [P.13A-297](#), DTC P0138 – Heated Oxygen Sensor (rear) Circuit High Voltage <California> [P.13A-310](#).

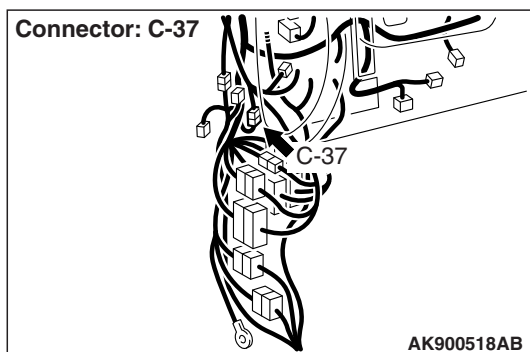
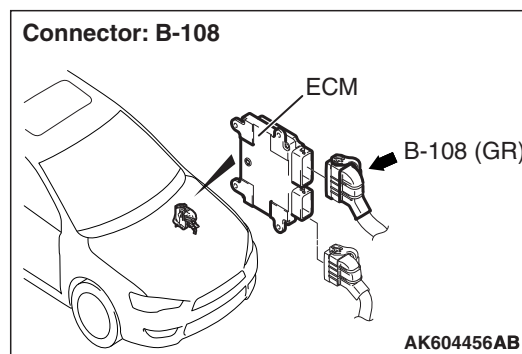
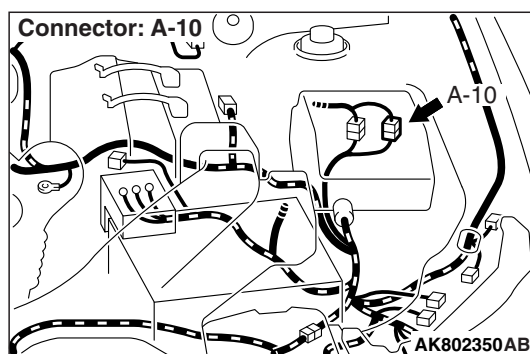
NO : The inspection is complete.

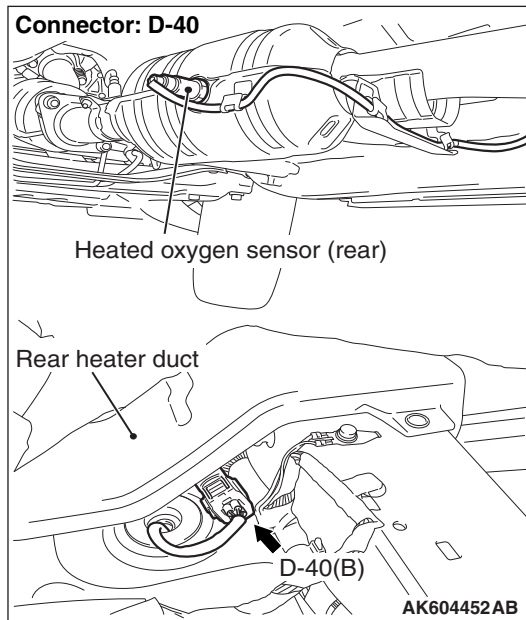
DTC P0140: Heated Oxygen Sensor (rear) Circuit No Activity Detected <Except for California>

HEATED OXYGEN SENSOR (REAR) CIRCUIT <EXCEPT FOR CALIFORNIA>



AK603951AC





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 40) from the output terminal (terminal No. 3) of the heated oxygen sensor (rear).
- Terminal No. 4 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 41).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (rear).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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)

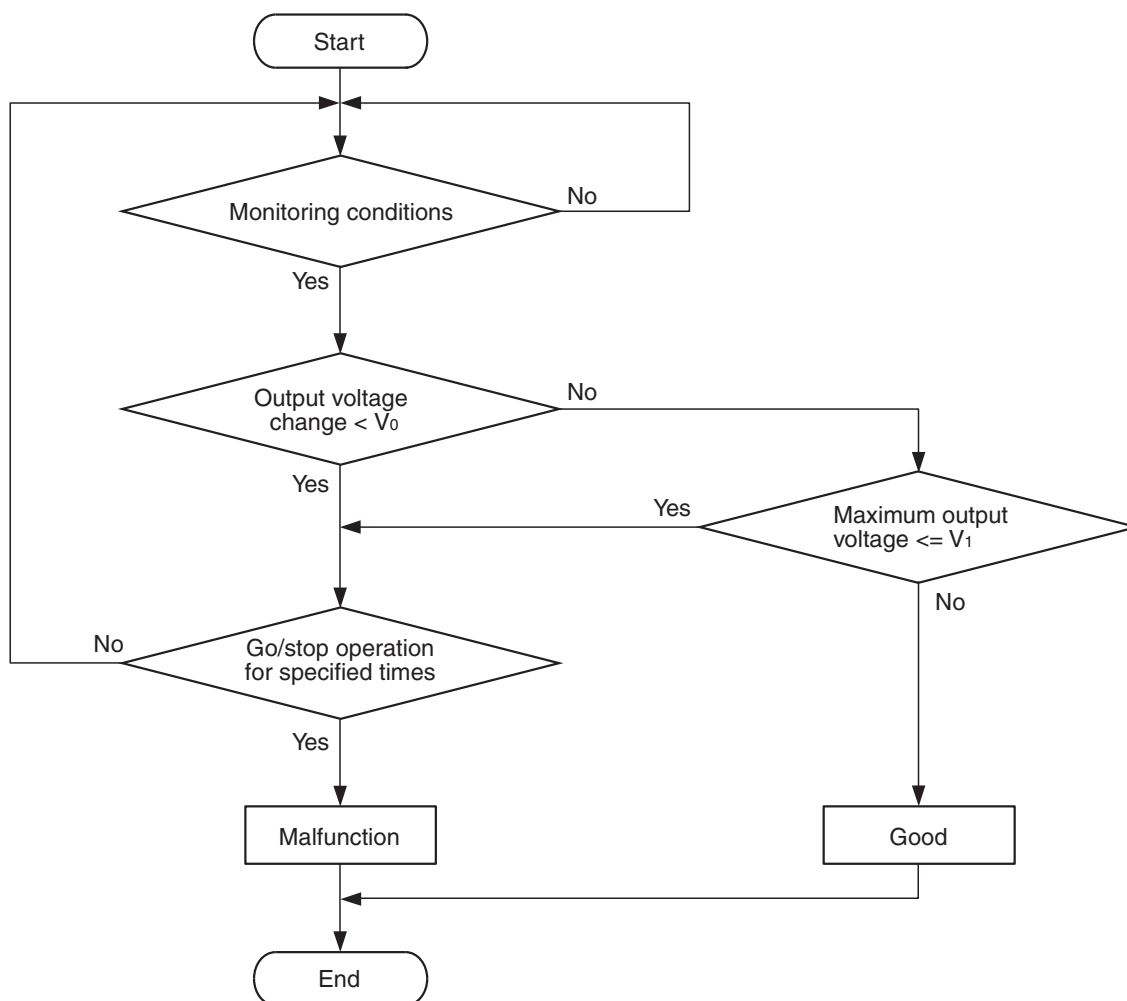
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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

V₀, V₁: Threshold valve

*: See DTC SET CONDITIONS-Judgment Criterion

AK800872

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 1,638 g.
- Repeat 1 or more times: drive^{*1}, stop^{*2}.

Drive^{*1}:

- Engine speed is higher than 1,500 r/min.
- Volumetric efficiency is higher than 40 per cent.

- Vehicle speed is higher than 30 km/h (19 mph).
- A total of more than 60 seconds have elapsed with the above mentioned conditions, and more than 3 seconds have elapsed with the fuel shut off.

Stop^{*2}:

- Vehicle speed is lower than 1.5 km/h (1 mph).

Judgement Criterion

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

or

- The maximum output voltage of the heated oxygen sensor (rear) is less than 0.508 volt.

NOTE: Monitoring stops after fuel has been shut off for more than 64 seconds.

OBD-II DRIVE CYCLE PATTERN

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

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

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

DIAGNOSIS

Required Special Tools:

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

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

CAUTION

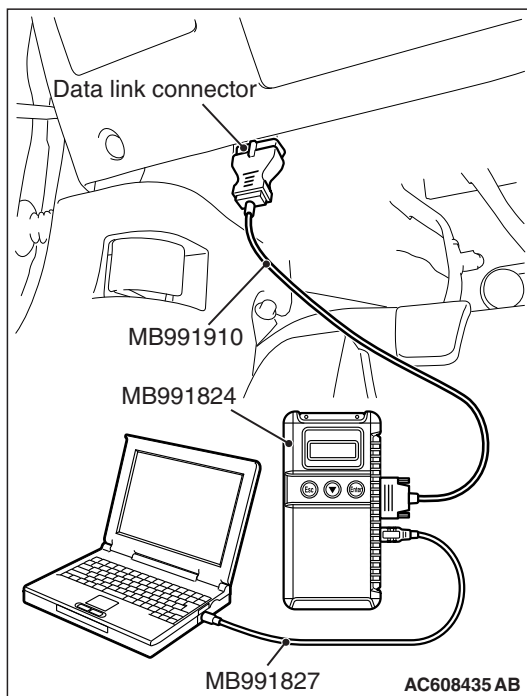
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 AD, Heated Oxygen Sensor (rear).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min
 - The output voltages should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

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



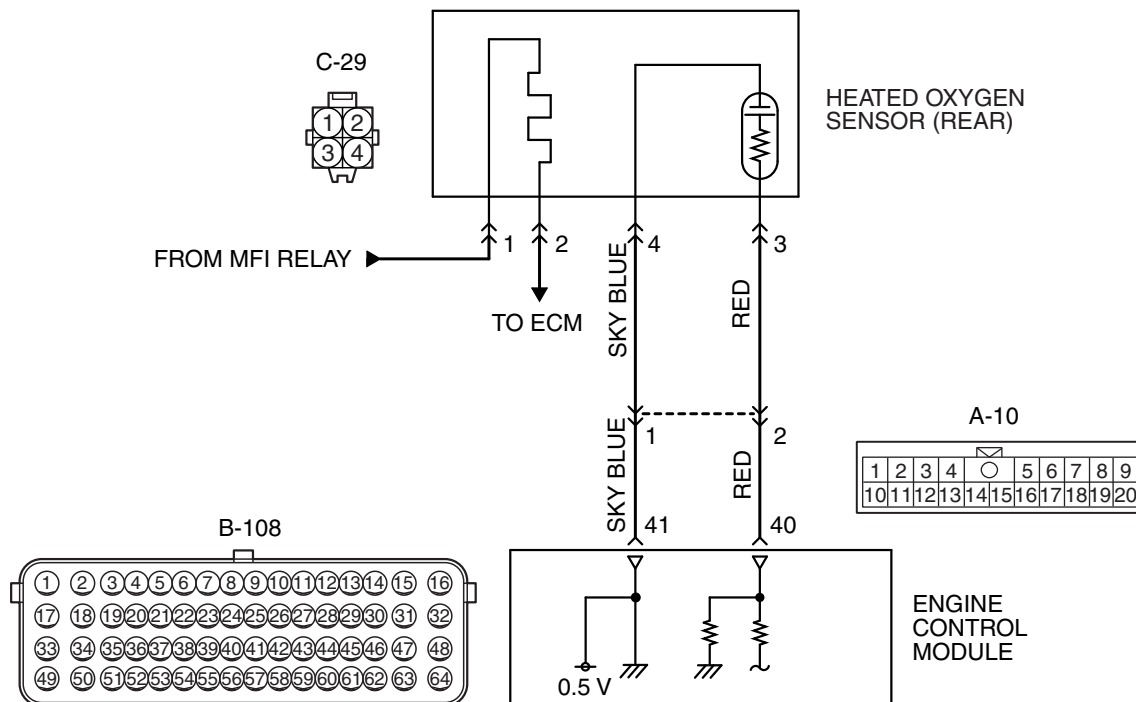
STEP 2. Test the OBD-II drive cycle.

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

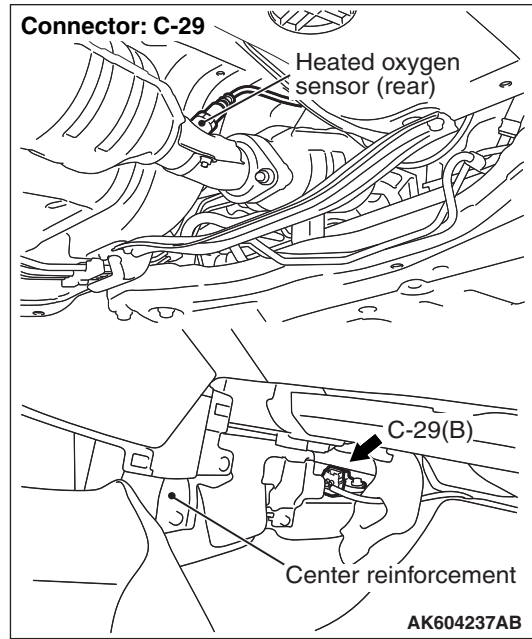
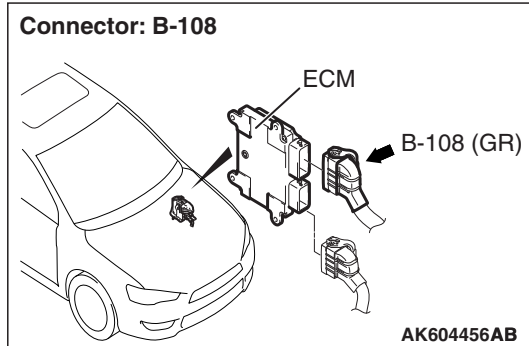
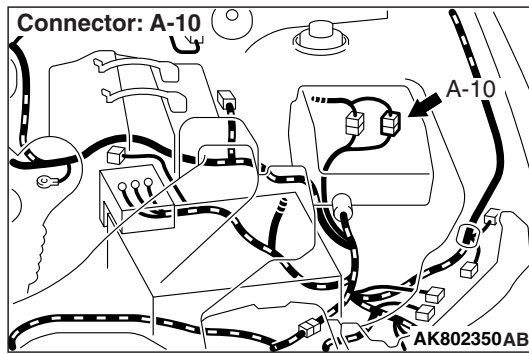
Q: Is DTC P0140 set?

YES : Refer to DTC P0137 – Heated Oxygen Sensor (rear) Circuit Low Voltage <Except for California> [P.13A-288](#), DTC P0138 – Heated Oxygen Sensor (rear) Circuit High Voltage <Except for California> [P.13A-306](#).

NO : The inspection is complete.

DTC P0140: Heated Oxygen Sensor (rear) Circuit No Activity Detected <California>**HEATED OXYGEN SENSOR (REAR) CIRCUIT <CALIFORNIA>**

AK604239AB



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 40) from the output terminal (terminal No. 3) of the heated oxygen sensor (rear).
- Terminal No. 4 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 41).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (rear).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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)

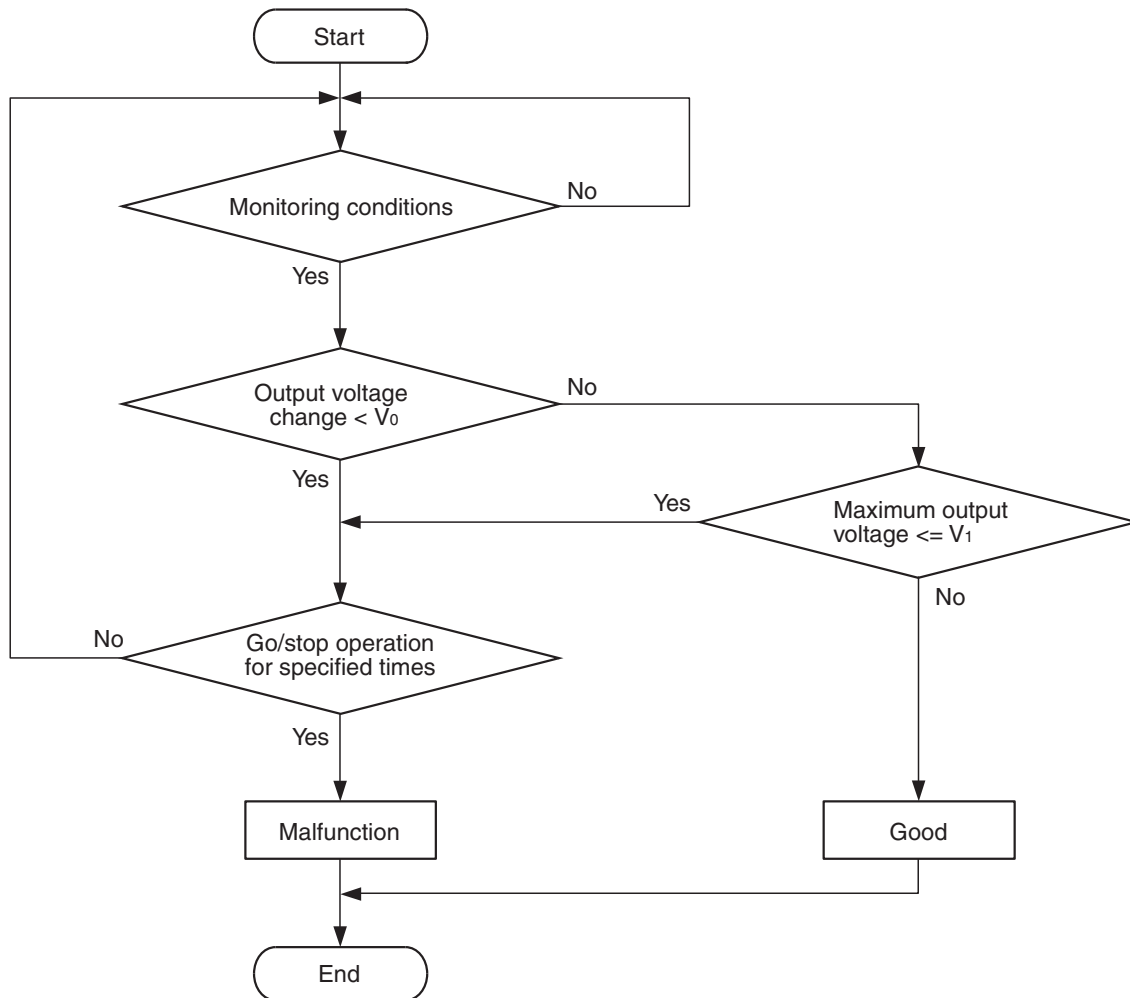
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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

V₀, V₁: Threshold value

*: See DTC SET CONDITIONS-Judgment Criterion

AK800872

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 1,638 g.
- Repeat 1 or more times: drive^{*1}, stop^{*2}.

Drive^{*1}:

- Engine speed is higher than 1,500 r/min.
- Volumetric efficiency is higher than 40 per cent.

- Vehicle speed is higher than 30 km/h (19 mph).
- A total of more than 60 seconds have elapsed with the above mentioned conditions, and more than 3 seconds have elapsed with the fuel shut off.

Stop^{*2}:

- Vehicle speed is lower than 1.5 km/h (1 mph).

Judgement Criterion

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

or

- The maximum output voltage of the heated oxygen sensor (rear) is less than 0.508 volt.

NOTE: Monitoring stops after fuel has been shut off for more than 64 seconds.

OBD-II DRIVE CYCLE PATTERN

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

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

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

DIAGNOSIS

Required Special Tools:

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

STEP 1. Using scan tool MB991958, check data list item AD: Heated Oxygen Sensor (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 AD, Heated Oxygen Sensor (rear).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min
 - The output voltages should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

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

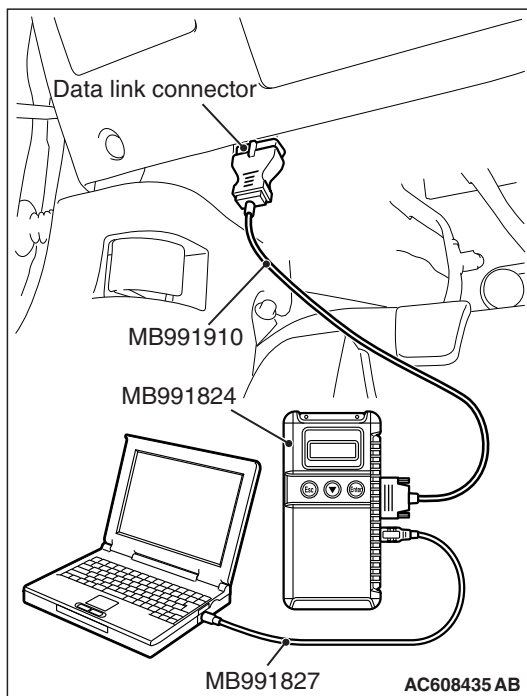
STEP 2. Test the OBD-II drive cycle.

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

Q: Is DTC P0140 set?

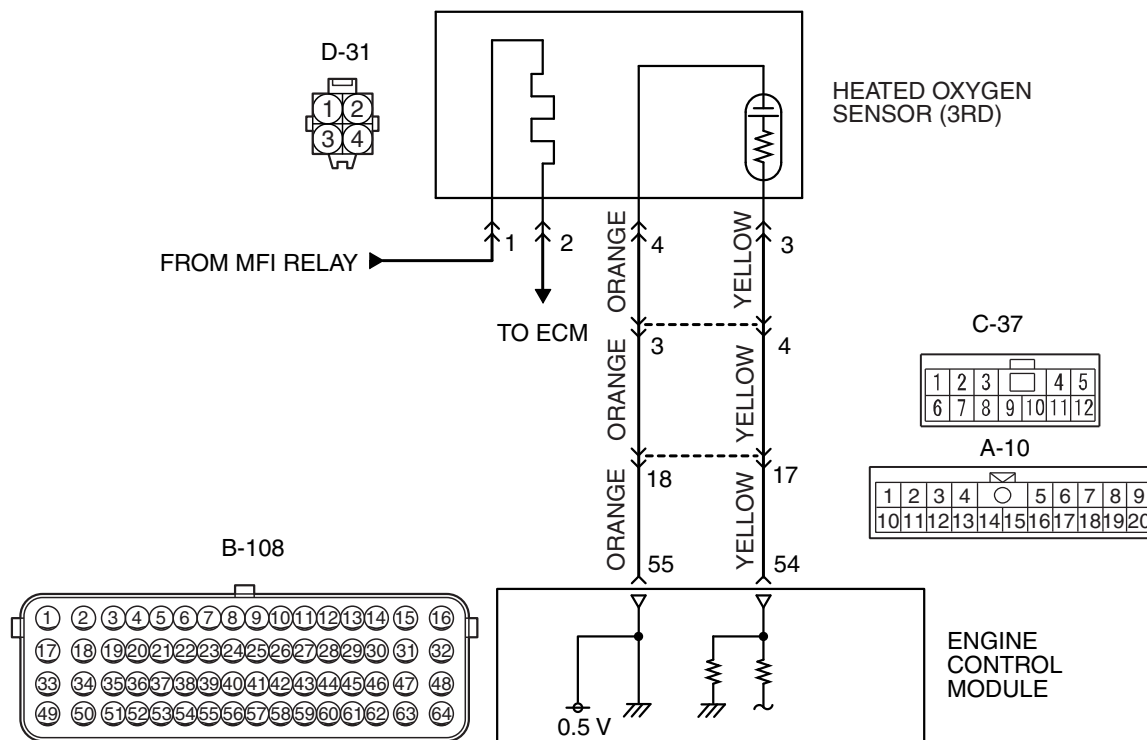
YES : Refer to DTC P0137 – Heated Oxygen Sensor (rear) Circuit Low Voltage <California> [P.13A-297](#), DTC P0138 – Heated Oxygen Sensor (rear) Circuit High Voltage <California> [P.13A-310](#).

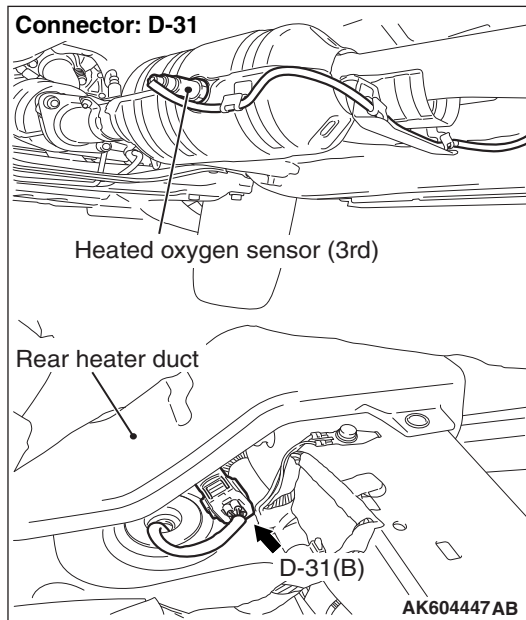
NO : The inspection is complete.



DTC P0143: Heated Oxygen Sensor (3rd) Circuit Low Voltage <California>

HEATED OXYGEN SENSOR (3RD) CIRCUIT <CALIFORNIA>





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 54) from the output terminal (terminal No. 3) of the heated oxygen sensor (3rd).
- Terminal No. 4 of the heated oxygen sensor (3rd) is grounded with ECM (terminal No. 55).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (3rd).

TECHNICAL DESCRIPTION

- The ECM checks for the heated oxygen sensor (3rd) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (3rd) output voltage is under the 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)

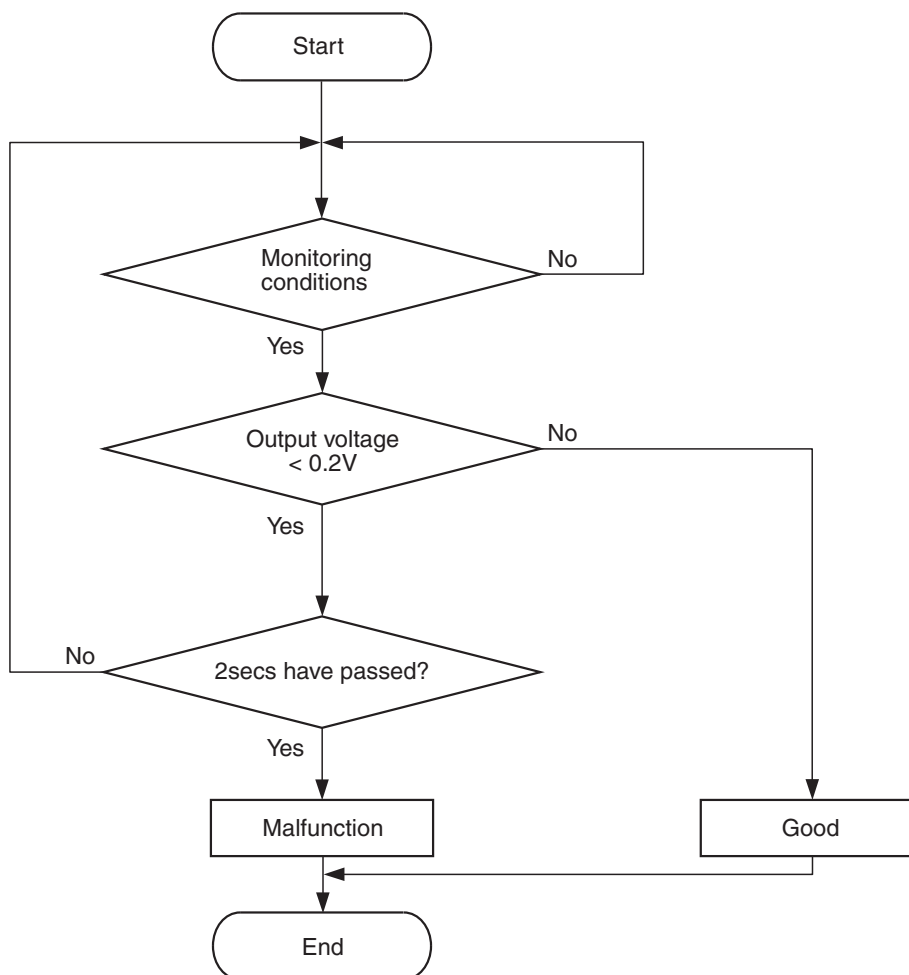
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor
- Heated oxygen sensor heater (3rd) monitor

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



AK604321

Check Conditions

- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.
- Battery positive voltage is between 11 and 16.5 volts.
- 3 minutes or more have passed since the engine starting sequence was completed.

Judgement Criterion

- Heated oxygen sensor (3rd) output voltage is lower than 0.2 volt for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).

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

- Heated oxygen sensor (3rd) failed.
- Open or shorted circuit in heated oxygen sensor (3rd) output line or harness damage.
- Open circuit in heated oxygen sensor (3rd) ground line or harness damage.
- Connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991658: Test Harness
- MB992110: Power Plant ECU Check Harness

STEP 1. Using scan tool MB991958, check data list item B1: Heated Oxygen Sensor (3rd).

⚠ CAUTION

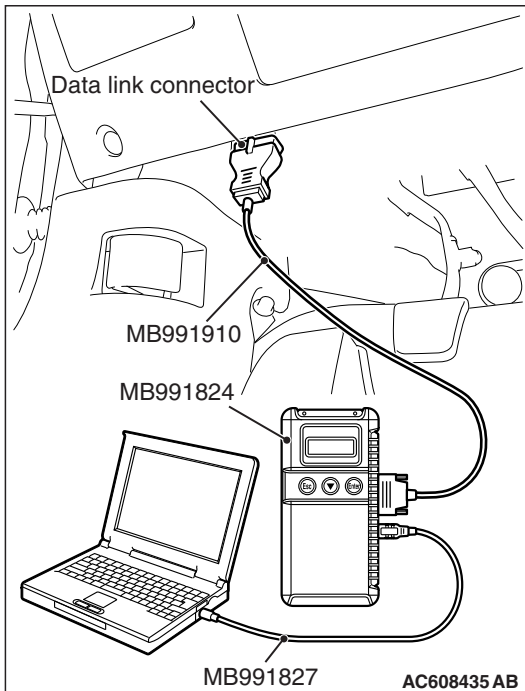
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 B1, Heated Oxygen Sensor (3rd).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min
 - The output voltages should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.



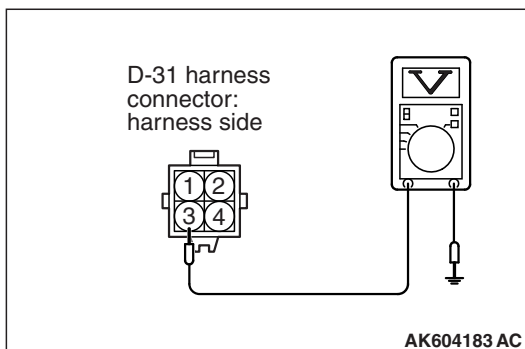
STEP 2. Measure the sensor output voltage at heated oxygen sensor (3rd) connector D-31 by backprobing

- (1) Do not disconnect the connector D-31.
- (2) Start the engine and run at idle.
- (3) Measure the voltage between terminal No. 3 and ground by backprobing under the following driving.
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 1.0 and 1.5 volts.
- (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 8.



STEP 3. Check harness connector B-108 at ECM for damage.

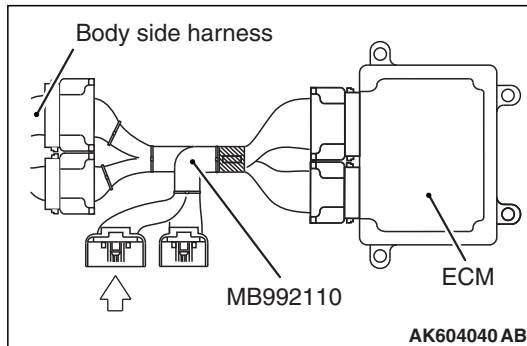
Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

STEP 4. Measure the sensor output voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Start the engine and run at idle.

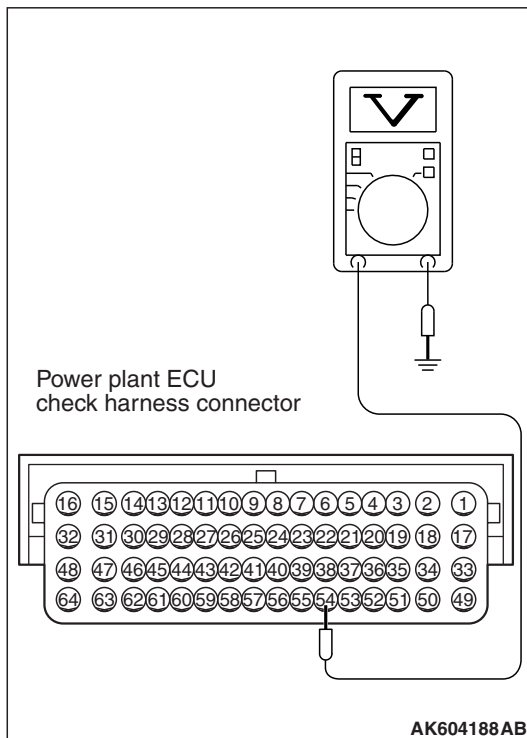


- (3) Measure the voltage between terminal No. 54 and ground under the following driving.
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 1.0 and 1.5 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 1.0 and 1.5 volts?

YES : Go to Step 5.

NO : Go to Step 7.

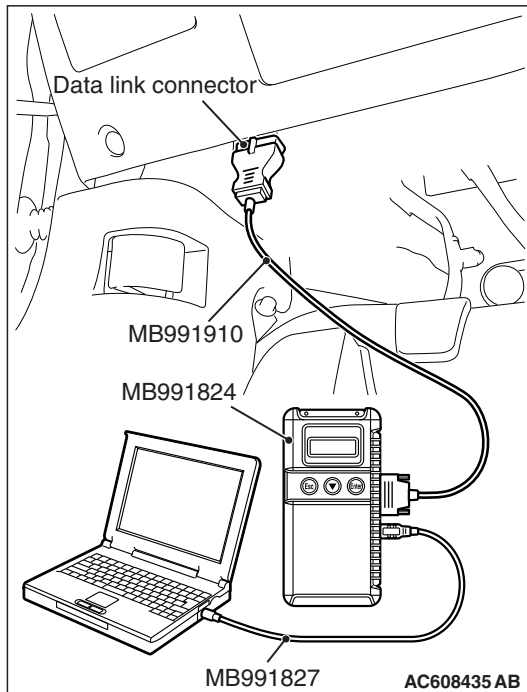


STEP 5. Check harness connector D-31 at heated oxygen sensor (3rd) for damage.

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. Using scan tool MB991958, check data list item B1: Heated Oxygen Sensor (3rd).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item B1, Heated Oxygen Sensor (3rd).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min or more
 - The output voltage should be between 0.6 and 1.0 volt.
- (3) 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 ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

STEP 7. Check harness connector D-31 at heated oxygen sensor (3rd) for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector A-10 and C-37 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between heated oxygen sensor (3rd) connector D-31 (terminal No. 3) and ECM connector B-108 (terminal No. 54) because of open circuit or harness damage. Then go to Step 14.

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

STEP 8. Check harness connector D-31 at heated oxygen sensor (3rd) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

STEP 9. Check harness connector B-108 at ECM for damage.

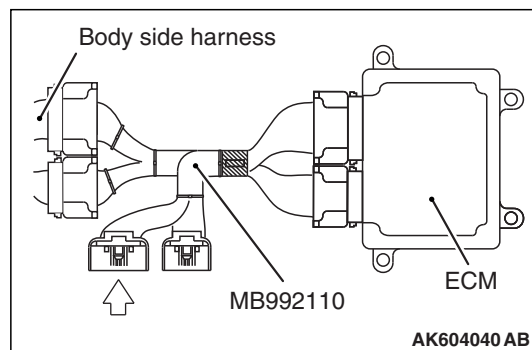
Q: Is the harness connector in good condition?

YES : Go to Step 10.

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

STEP 10. Measure the sensor offset voltage at ECM connector B-108 by using power plant ECU check harness special tool MB992110.

- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

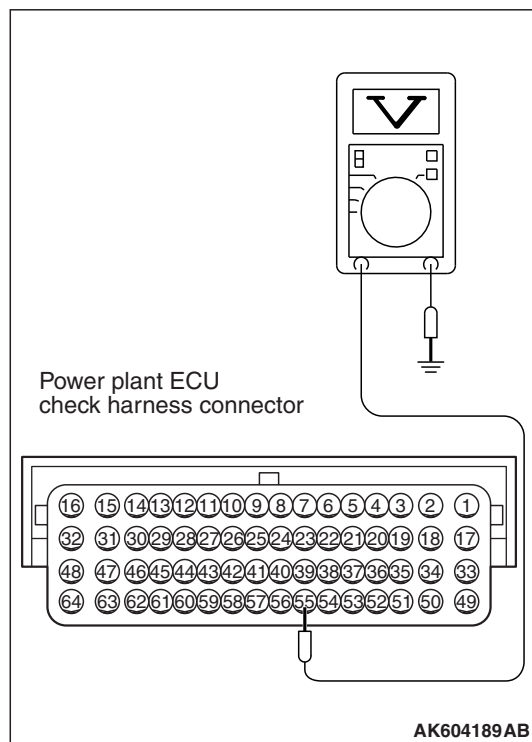


- (3) Measure the voltage between terminal No. 55 and ground.
 - Voltage should be between 0.4 and 0.6 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 0.4 and 0.6 volt?

YES : Go to Step 11.

NO : Check harness connector A-10 and C-37 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between headed oxygen sensor (3rd) connector D-31 (terminal No. 4) and ECM connector B-108 (terminal No. 55) because of open circuit or harness damage. Then go to Step 14.



STEP 11. Check for harness damage between heated oxygen sensor (3rd) connector D-31 (terminal No. 4) and ECM connector B-108 (terminal No. 55).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.

STEP 12. Check for short circuit to ground and harness damage between heated oxygen sensor (3rd) connector D-31 (terminal No. 3) and ECM connector B-108 (terminal No. 54).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

Q: Is the harness wire in good condition?

YES : Go to Step 13.

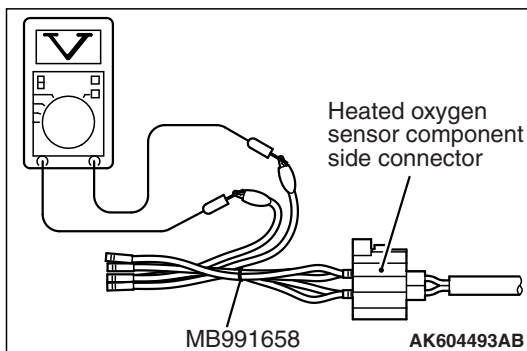
NO : Repair it. Then go to Step 14.

STEP 13. Check the heated oxygen sensor (3rd).

- (1) Disconnect the heated oxygen sensor (3rd) connector D-31 and connect test harness special tool MB991658 to the connector on the heated oxygen sensor (3rd) side.
- (2) Warm up the engine until engine coolant temperature reaches 80°C (176°F) or higher.
- (3) Drive at 50 km/h (31mph) or more for 10 minutes.
- (4) Connect a digital voltage meter between terminal No. 3 and terminal No. 4.
- (5) Measure the output voltage of heated oxygen sensor under the following driving.
 - Transaxle: 2nd speed (CVT: "L" range)
 - Drive with wide open throttle
 - Engine: 3,500 r/min or more

Standard value: 0.6 – 1.0 V

NOTE: If the temperature of sensing area does not reach the high temperature [of approximately 400°C (752°F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.



NOTE: When the vehicle is driven with high loads, the temperature of the sensing area of the heated oxygen sensor is sufficiently high. Thus, it is not necessary to apply the voltage to the heater.

Q: Is the measured voltage between 0.6 and 1.0 volt?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

NO : Replace the heated oxygen sensor (3rd). Then go to Step 14.

STEP 14. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 [P.13A-12](#).

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

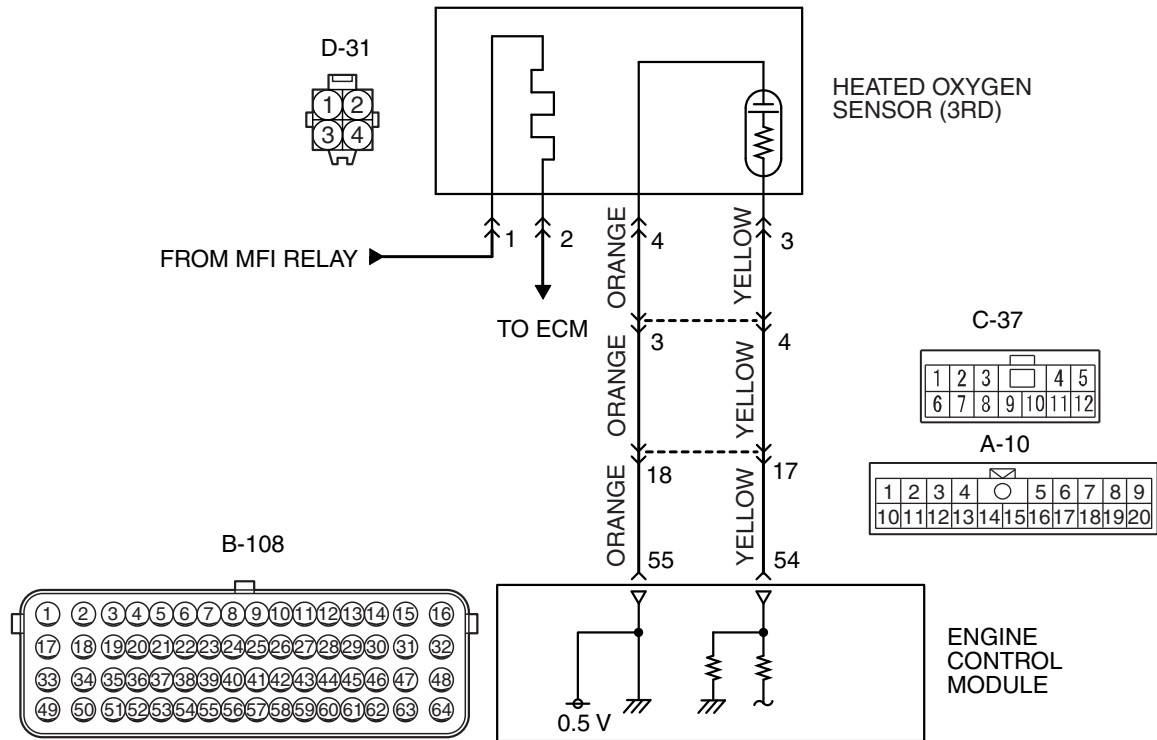
Q: Is DTC P0143 set?

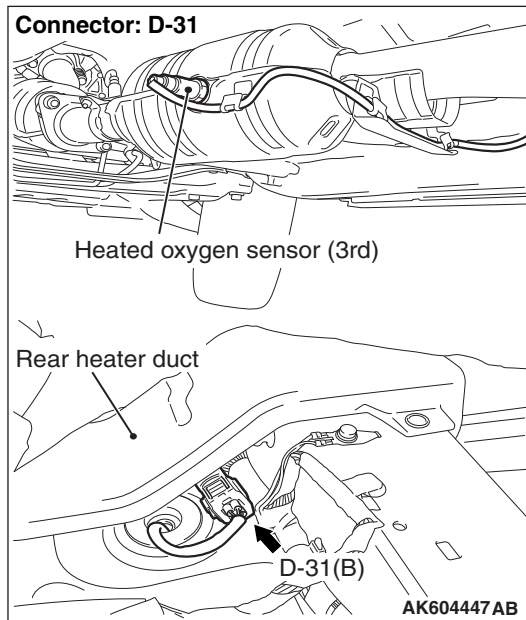
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0144: Heated Oxygen Sensor (3rd) Circuit High Voltage <California>

HEATED OXYGEN SENSOR (3RD) CIRCUIT <CALIFORNIA>





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 54) from the output terminal (terminal No. 3) of the heated oxygen sensor (3rd).
- Terminal No. 4 of the heated oxygen sensor (3rd) is grounded with ECM (terminal No. 55).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (3rd).

TECHNICAL DESCRIPTION

- The ECM checks for the heated oxygen sensor (3rd) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (3rd) 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)

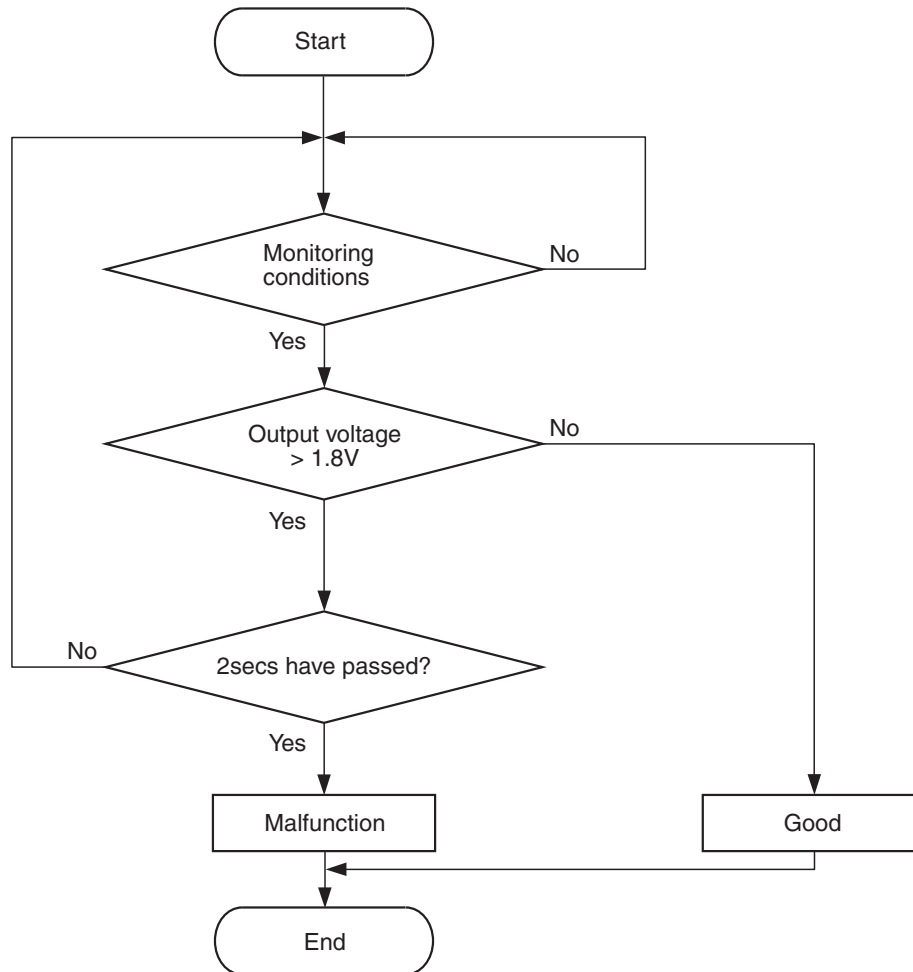
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor
- Heated oxygen sensor heater (3rd) monitor

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



AK604322

Check Conditions

- 2 seconds or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor offset voltage is between 0.4 and 0.6 volt.

Judgement Criterion

- Heated oxygen sensor (3rd) output voltage has continued to be 1.8 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

- Short circuit in heated oxygen sensor (3rd) output line.
- Connector damage.
- ECM failed.

DIAGNOSIS

STEP 1. Check harness connector D-31 at heated oxygen sensor (3rd) and harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

STEP 2. Check for short circuit to power supply between heated oxygen sensor (3rd) connector D-31 (terminal No. 3) and ECM connector B-108 (terminal No. 54).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 3.

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

NO : Repair it. Then go to Step 3.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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

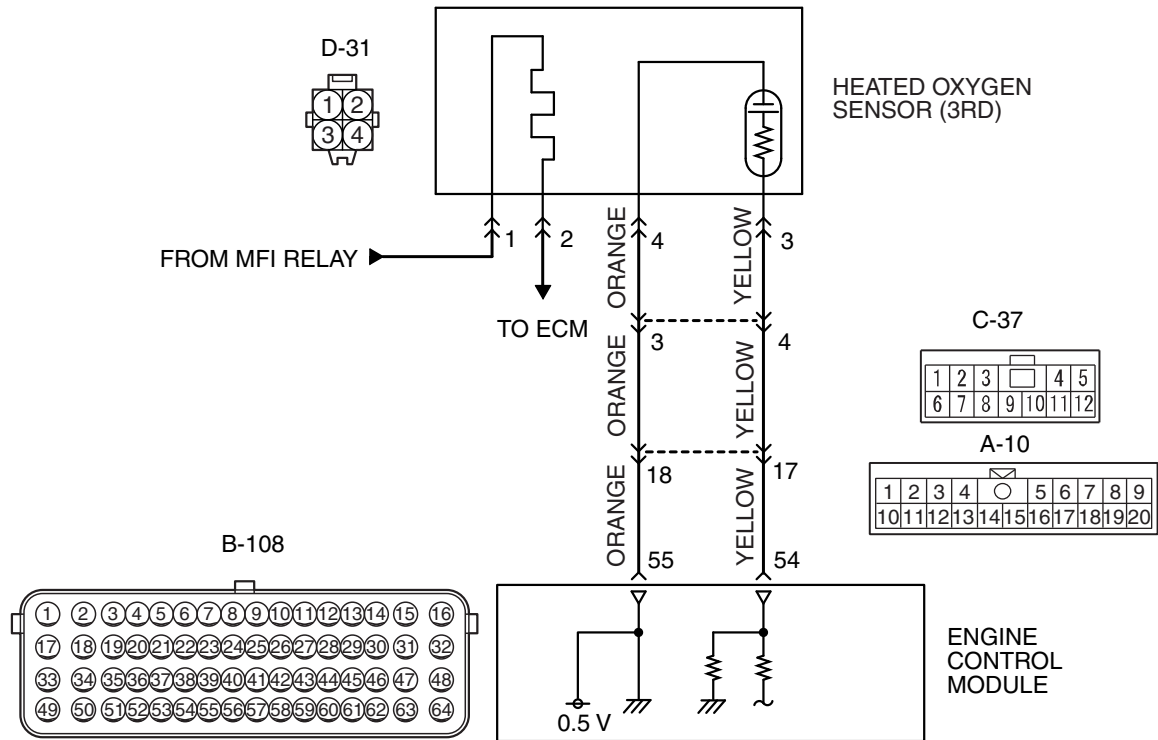
Q: Is DTC P0144 set?

YES : Retry the troubleshooting.

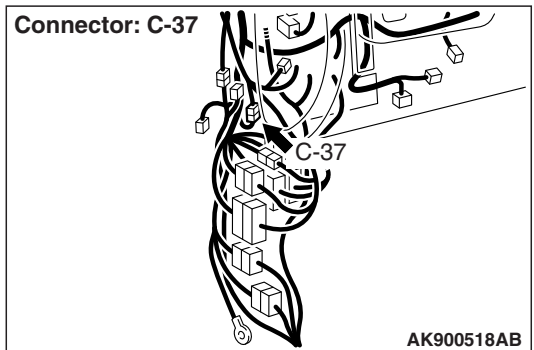
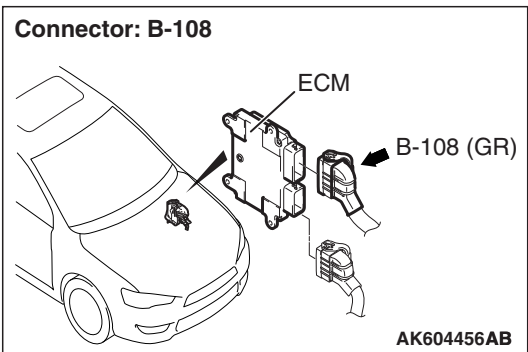
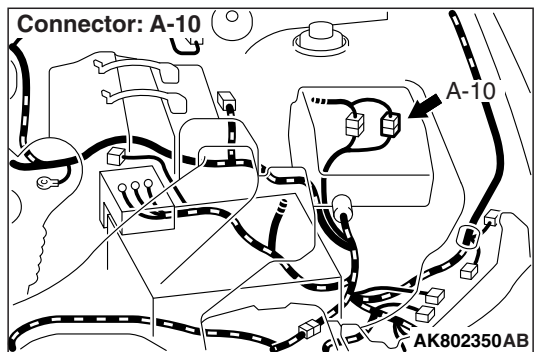
NO : The inspection is complete.

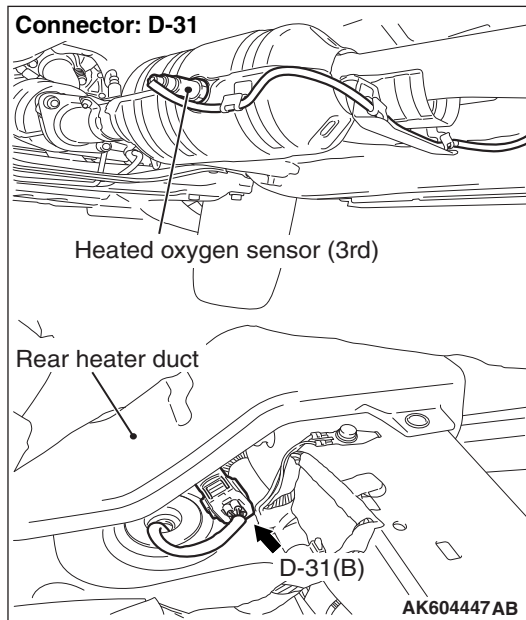
DTC P0145: Heated Oxygen Sensor (3rd) Circuit Slow Response <California>

HEATED OXYGEN SENSOR (3RD) CIRCUIT <CALIFORNIA>



AK603951AB





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 54) from the output terminal (terminal No. 3) of the heated oxygen sensor (3rd).
- Terminal No. 4 of the heated oxygen sensor (3rd) is grounded with ECM (terminal No. 55).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (3rd).

TECHNICAL DESCRIPTION

- The ECM checks for the heated oxygen sensor (3rd) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (3rd) output voltage does not reach 0.2 volt after fuel cut operation.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

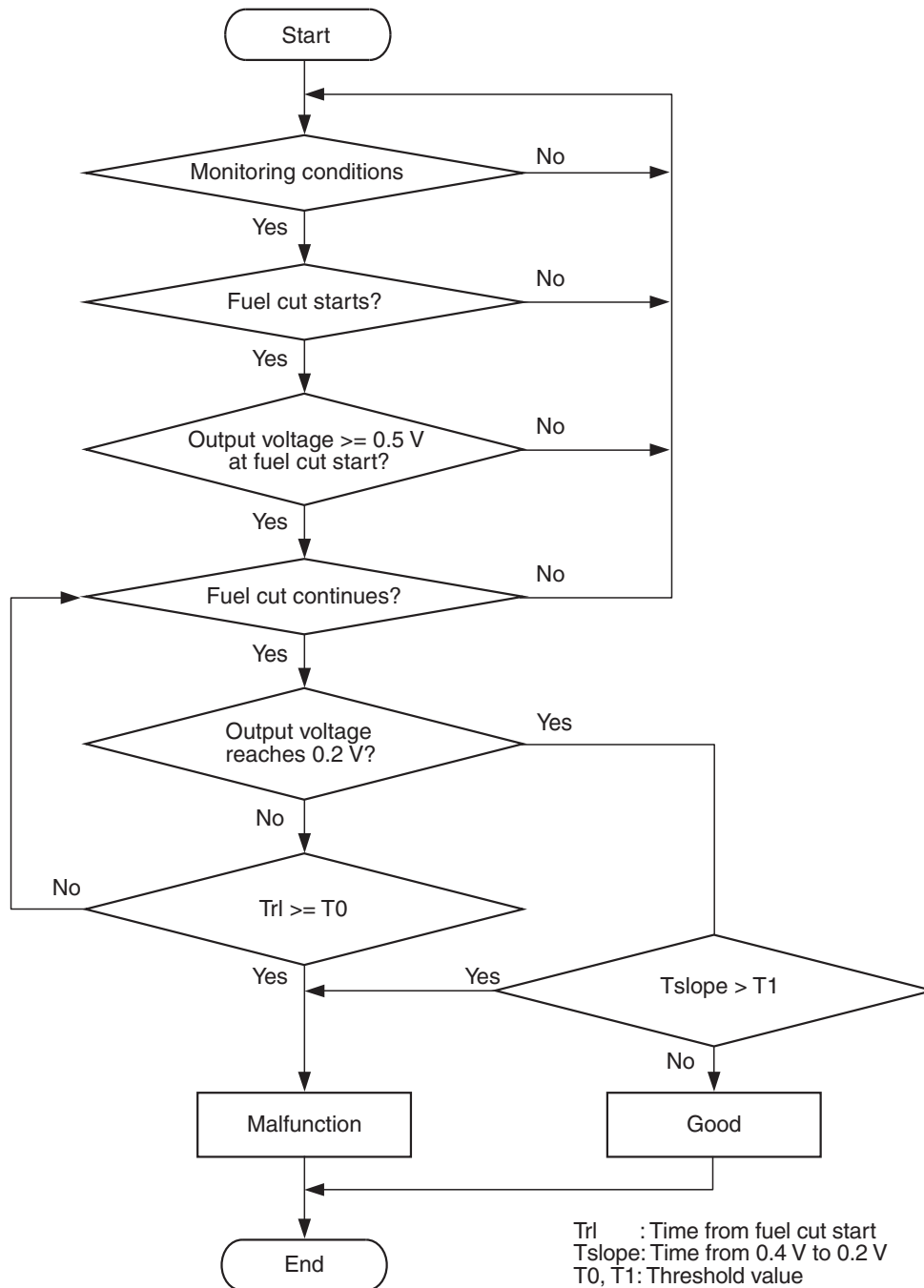
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor
- Heated oxygen sensor heater (3rd) monitor

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



AK800583

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 2,900 g.
- Fuel is being shut off.
- Heated oxygen sensor (3rd) output voltage is higher than 0.5 volt when fuel cut is started.

Judgement Criterion

- Heated oxygen sensor (3rd) output voltage does not reach 0.2 volt for 7 seconds from fuel cut start.
- or
- Heated oxygen sensor (3rd) output voltage does not reach 0.2 volt for 1 second from 0.4 volt while fuel is being shut off.

NOTE: Monitoring stops after fuel has been shut off for more than 64 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 11 [P.13A-12](#).

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

- Heated oxygen sensor (3rd) deteriorated.
- Connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

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

STEP 1. Using scan tool MB991958, check data list item B1: Heated Oxygen Sensor (3rd).

CAUTION

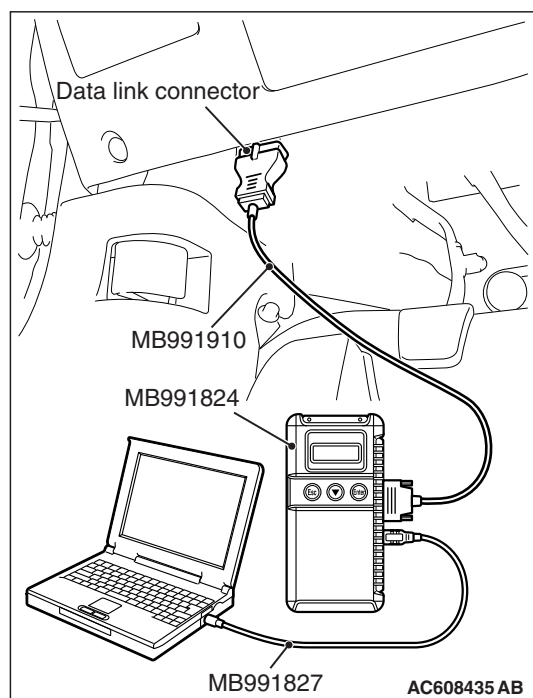
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 B1, Heated Oxygen Sensor (3rd).
- (4) Warm up the engine.
 - After increasing the output voltage 0.5 volt or more by the engine revving, finish it. Then confirm that the output voltage reduces to 0.2 volt or less within 7 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 (3rd). Then go to Step 2.



STEP 2. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 11 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

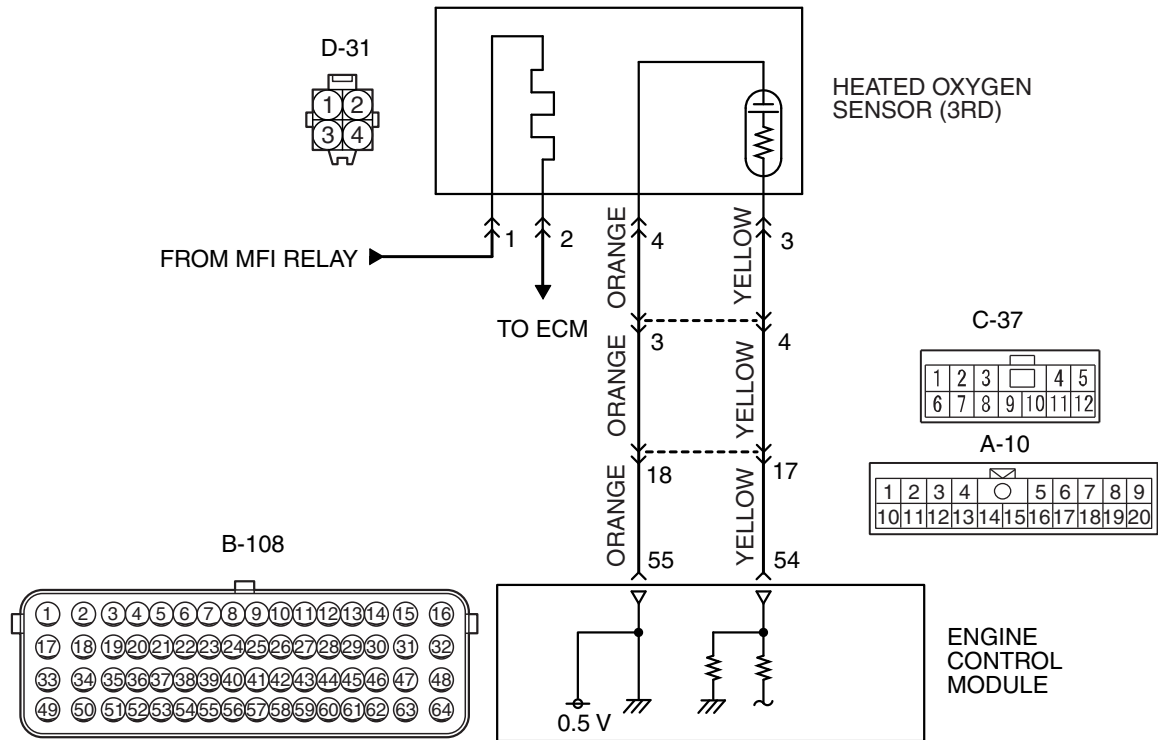
Q: Is DTC P0145 set?

YES : Refer to DTC P0143 – Heated Oxygen Sensor (3rd) Circuit Low Voltage [P.13A-332](#), DTC P0144 – Heated Oxygen Sensor (3rd) Circuit High Voltage [P.13A-341](#).

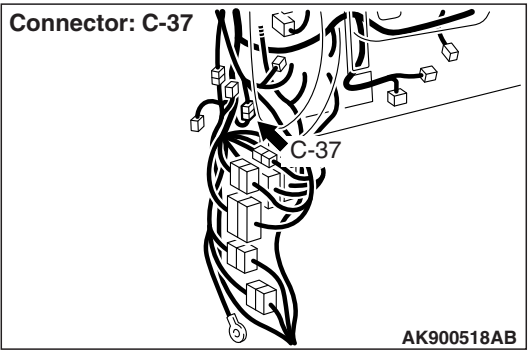
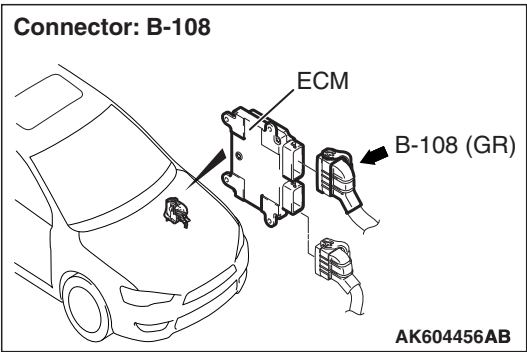
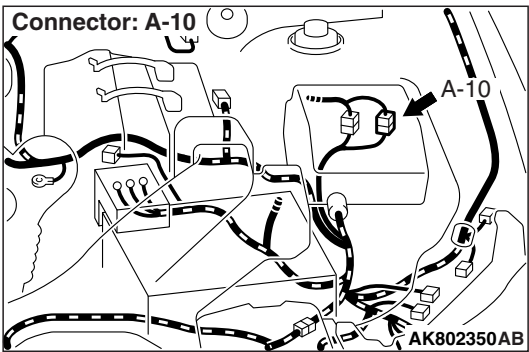
NO : The inspection is complete.

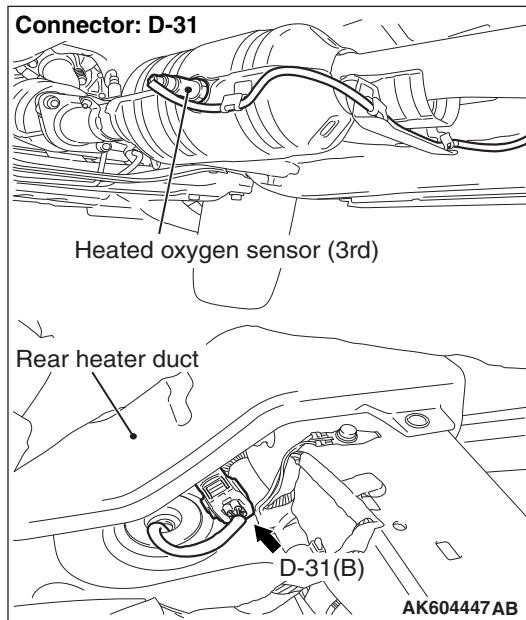
DTC P0146: Heated Oxygen Sensor (3rd) Circuit No Activity Detected <California>

HEATED OXYGEN SENSOR (3RD) CIRCUIT <CALIFORNIA>



AK603951AB





CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 54) from the output terminal (terminal No. 3) of the heated oxygen sensor (3rd).
- Terminal No. 4 of the heated oxygen sensor (3rd) is grounded with ECM (terminal No. 55).
- The ECM applies an offset voltage of 0.5 volt to terminal No. 4 of the heated oxygen sensor (3rd).

TECHNICAL DESCRIPTION

- The ECM checks for the heated oxygen sensor (3rd) output voltage.

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (3rd) 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)

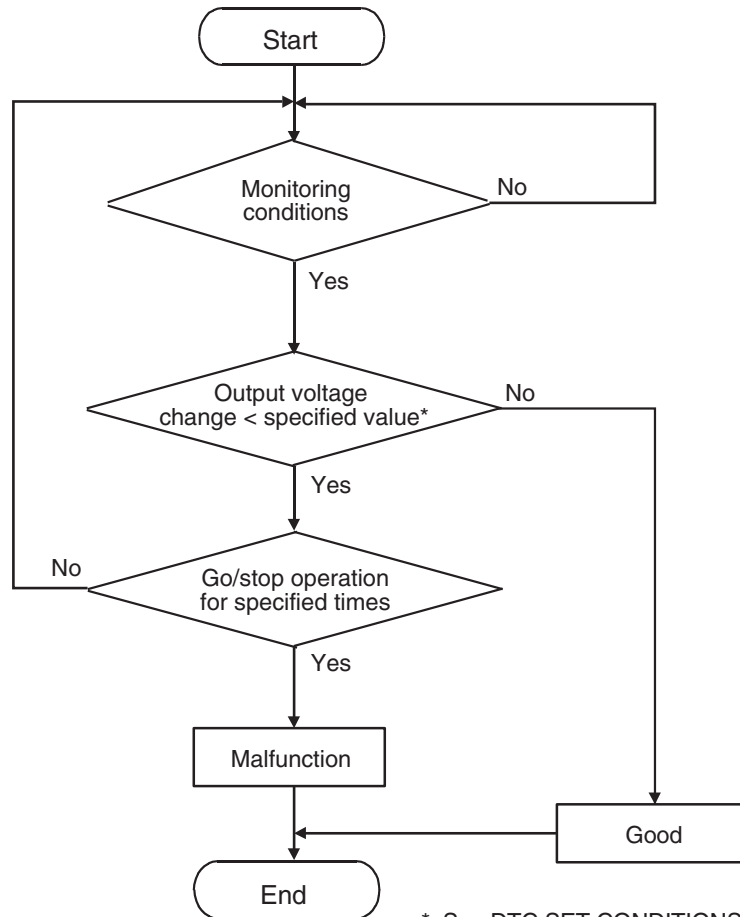
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor
- Heated oxygen sensor heater (3rd) monitor

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



*: See DTC SET CONDITIONS-Judgment Criterion

AK604327

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 2,900 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 per cent.
- Vehicle speed is higher than 30 km/h (19 mph).
- A total of more than 10 seconds have elapsed with the above mentioned conditions, and more than 3 seconds have elapsed with the fuel shut off.

Stop^{*2}:

- Vehicle speed is lower than 1.5 km/h (1 mph).

Judgement Criterion

- Change in the output voltage of the heated oxygen sensor (3rd) is lower than 0.098 volt.

NOTE: Monitoring stops after fuel has been shut off for more than 64 seconds.

OBD-II DRIVE CYCLE PATTERN

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

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

- Heated oxygen sensor (3rd) deteriorated.
- Connector damage.
- ECM failed.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item B1: Heated Oxygen Sensor (3rd).**⚠ CAUTION**

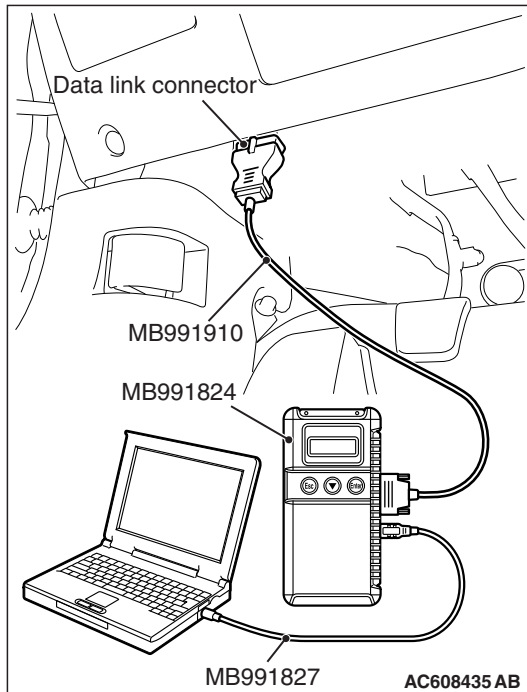
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 B1, Heated Oxygen Sensor (3rd).
 - a. Transaxle: 2nd speed (CVT: "L" range)
 - b. Drive with wide open throttle
 - c. Engine: 3,500 r/min
 - The output voltages should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Replace the heated oxygen sensor (3rd). Then go to Step 2.

**STEP 2. Test the OBD-II drive cycle.**

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

Q: Is DTC P0146 set?

YES : Refer to DTC P0143 – Heated Oxygen Sensor (3rd) Circuit Low Voltage [P.13A-332](#), DTC P0144 – Heated Oxygen Sensor (3rd) Circuit High Voltage [P.13A-341](#).

NO : The inspection is complete.

DTC P0171: System too Lean

Fuel Trim Circuit

- Refer to DTC P0201 – Injector Circuit-Cylinder 1 [P.13A-385](#), DTC P0202 – Injector Circuit-Cylinder 2 [P.13A-395](#), DTC P0203 – Injector Circuit-Cylinder 3 [P.13A-405](#), DTC P0204 – Injector Circuit-Cylinder 4 [P.13A-415](#).

CIRCUIT OPERATION

- Refer to DTC P0201 – Injector Circuit-Cylinder 1 [P.13A-385](#), DTC P0202 – Injector Circuit-Cylinder 2 [P.13A-395](#), DTC P0203 – Injector Circuit-Cylinder 3 [P.13A-405](#), DTC P0204 – Injector Circuit-Cylinder 4 [P.13A-415](#).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Air/fuel learning value (long time fuel trim) and air/fuel feedback integral value (short time fuel trim) are too lean.

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)

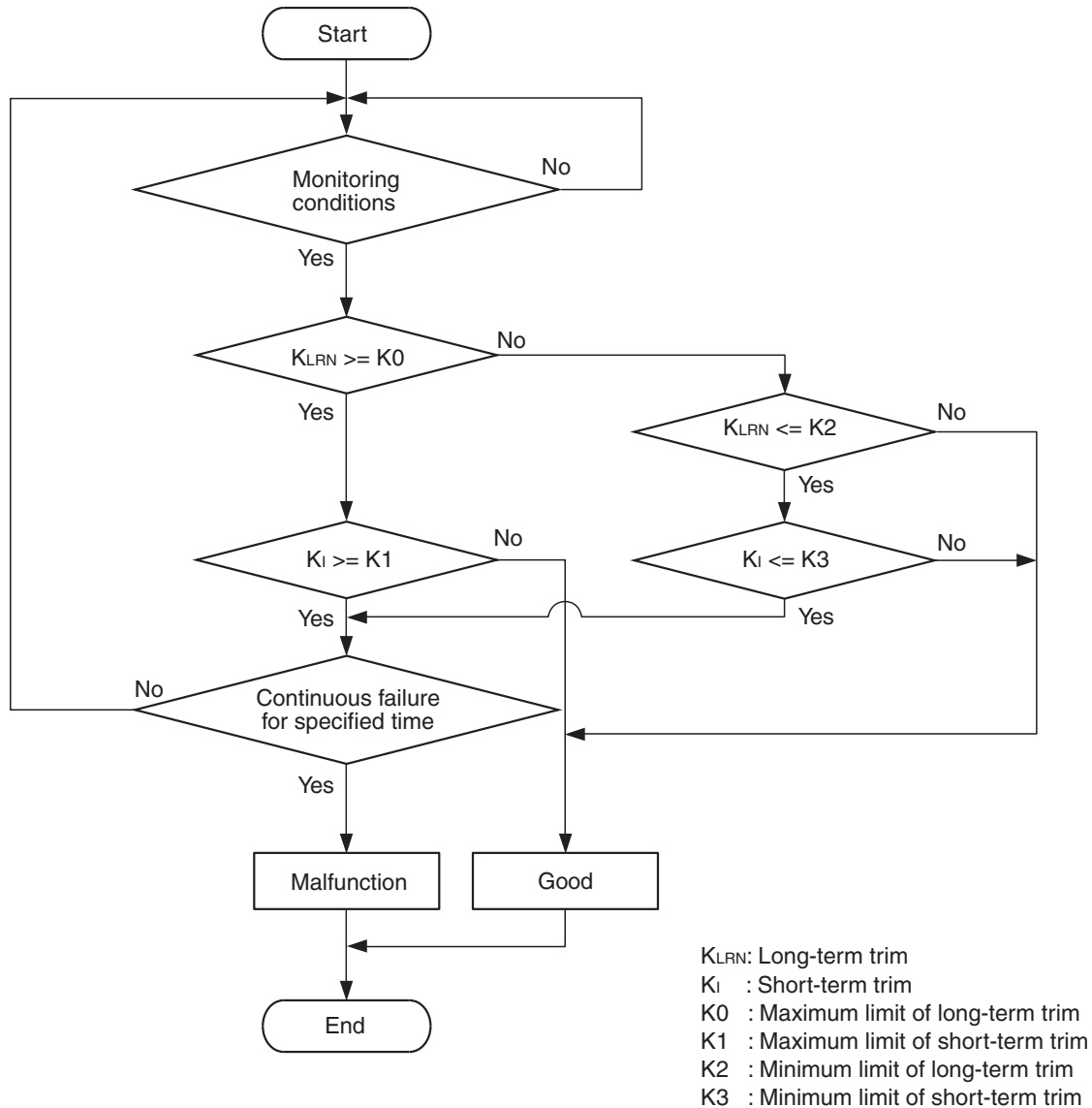
- Misfire monitor

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



AK703881

Check Conditions

- Engine coolant temperature is lower than 100°C (212°F) when the engine is started.
- Intake air temperature is lower than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76°C (169°F).
- Mass airflow sensor output is 10 g/sec <M/T> or 6 g/sec <CVT> or more.

Judgement Criterion

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

or

- Short-term fuel trim has continued to be higher than +7.0 percent <Except for California> or +5.5 percent <California> for 5 seconds.

Check Conditions

- Engine coolant temperature is lower than 100°C (212°F) when the engine is started.
- Intake air temperature is lower than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76°C (169°F).
- Mass airflow sensor output is 10 g/sec <M/T> or 6 g/sec <CVT> or less.

Judgement Criterion

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

or

- Short-term fuel trim has continued to be higher than +12.1 percent <Except for California> or +10.5 percent <California> for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than 100°C (212°F) when the engine is started.
- Intake air temperature is higher than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76°C (169°F).
- Mass airflow sensor output is 10 g/sec <M/T> or 6 g/sec <CVT> or more.

Judgement Criteria

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

or

- Short-term fuel trim has continued to be higher than +17.2 percent <Except for California> or +15.6 percent <California> for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than 100°C (212°F) when the engine is started.
- Intake air temperature is higher than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76°C (169°F).
- Mass airflow sensor output is 10 g/sec <M/T> or 6 g/sec <CVT> or less.

Judgement Criterion

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

or

- Short-term fuel trim has continued to be higher than +22.3 percent <Except for California> or +20.7 percent <California> for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- Under the closed loop air/fuel ratio control.

Judgement Criterion

- Long-term fuel trim has continued to be +12.5 percent for 2 seconds.

or

- Short-term fuel trim has continued to be +25.0 percent for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 21 [P.13A-12](#).

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

- Mass airflow sensor failed.
- Injector failed.
- Incorrect fuel pressure.
- Air drawn in from gaps in gasket, seals, etc.
- Engine coolant temperature sensor failed.
- Intake air temperature sensor failed.
- Barometric pressure sensor failed.
- Manifold absolute pressure sensor failed.
- Exhaust leak.
- Use of incorrect or contaminated fuel.
- Harness damage in injector circuit or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

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

STEP 1. Check for exhaust leak.

Q: Are there any abnormalities?

YES : Repair it. Then go to Step 14.

NO : Go to Step 2.

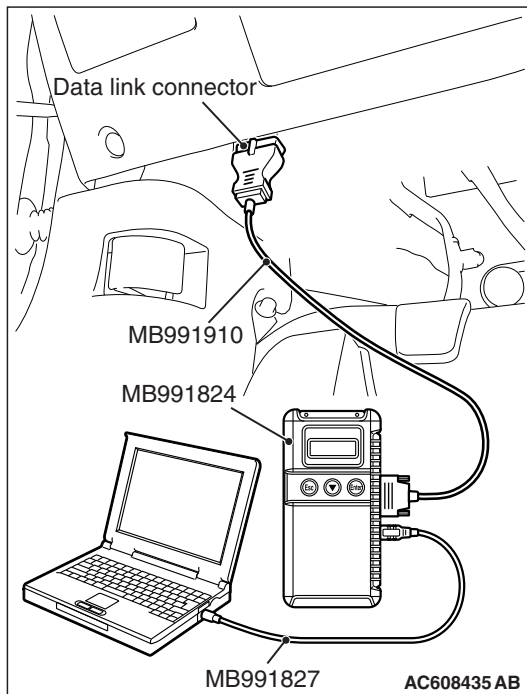
STEP 2. Check for intake system vacuum leak.**Q: Are there any abnormalities?****YES :** Repair it. Then go to Step 14.**NO :** Go to Step 3.**STEP 3. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.****⚠ CAUTION**

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) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - When idling, between 1,350 and 1,670 mV.
 - When 2,500 r/min, between 1,620 and 2,020 millivolts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?**YES :** Go to Step 4.

NO : Refer to DTC P0101 – Mass Airflow Circuit Range/Performance Problem [P.13A-147](#), DTC P0102 – Mass Airflow Circuit Low Input [P.13A-153](#), DTC P0103 – Mass Airflow Circuit High Input [P.13A-160](#).

**STEP 4. Using scan tool MB991958, check data list item 5: Intake Air Temperature Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 5, Intake Air Temperature Sensor.
 - The intake air temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?**YES :** Go to Step 5.

NO : Refer to DTC P0111 – Intake Air Temperature Circuit Range/Performance Problem [P.13A-188](#), DTC P0112 – Intake Air Temperature Circuit Low Input [P.13A-194](#), DTC P0113 – Intake Air Temperature Circuit High Input [P.13A-198](#).

**STEP 5. Using scan tool MB991958, check data list item 6:
Engine Coolant Temperature Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 6, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 6.

NO : Refer to DTC P0116 – Engine Coolant Temperature Circuit Range/Performance Problem [P.13A-204](#), DTC P0117 – Engine Coolant Temperature Circuit Low Input [P.13A-210](#), DTC P0118 – Engine Coolant Temperature Circuit High Input [P.13A-214](#).

**STEP 6. Using scan tool MB991958, check data list item 8:
Manifold Absolute Pressure Sensor.**

- (1) Turn the ignition switch the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine.
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 7.

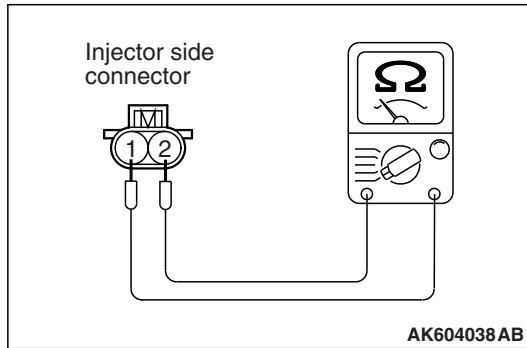
NO : Refer to DTC P0106 – Manifold Absolute Pressure Circuit Range/Performance Problem [P.13A-166](#), DTC P0107 – Manifold Absolute Pressure Circuit Low Input [P.13A-175](#), DTC P0108 – Manifold Absolute Pressure Circuit High Input [P.13A-183](#).

STEP 7. Check harness connector B-101, B-102, B-103 and B104 at injector for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

**STEP 8. Check the injector.**

- (1) Disconnect the injector connector B-101, B-102, B-103 and B-104.
- (2) Measure the resistance between each injector side connector terminal No. 1 and No. 2.

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

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

YES : Go to Step 9.

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

STEP 9. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

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

STEP 10. Check for harness damage between injector connector and ECM connector.

- a. Check the harness wire between injector connector B-101 (terminal No. 2) and ECM connector B-108 (terminal No. 2) at No. 1 cylinder injector.
- b. Check the harness wire between injector connector B-102 (terminal No. 2) and ECM connector B-108 (terminal No. 3) at No. 2 cylinder injector.
- c. Check the harness wire between injector connector B-103 (terminal No. 2) and ECM connector B-108 (terminal No. 18) at No. 3 cylinder injector.
- d. Check the harness wire between injector connector B-104 (terminal No. 2) and ECM connector B-108 (terminal No. 19) at No. 4 cylinder injector.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 14.

STEP 11. Check the fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-961](#).

Q: Is the fuel pressure normal?

YES : Go to Step 12.

NO : Repair it. Then go to Step 14.

STEP 12. Check for entry of foreign matter (water, kerosene, etc.) into fuel.

Q: Are there any abnormalities?

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

NO : Go to Step 13.

STEP 13. Replace the injector.

- (1) Replace the injector.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 21 [P.13A-12](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0171 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

NO : The inspection is complete.

STEP 14. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 21 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is the DTC P0171 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0172: System too Rich

Fuel Trim Circuit

- Refer to DTC P0201 – Injector Circuit-Cylinder 1 [P.13A-385](#), DTC P0202 – Injector Circuit-Cylinder 2 [P.13A-395](#), DTC P0203 – Injector Circuit-Cylinder 3 [P.13A-405](#), DTC P0204 – Injector Circuit-Cylinder 4 [P.13A-415](#).

CIRCUIT OPERATION

- Refer to DTC P0201 – Injector Circuit-Cylinder 1 [P.13A-385](#), DTC P0202 – Injector Circuit-Cylinder 2 [P.13A-395](#), DTC P0203 – Injector Circuit-Cylinder 3 [P.13A-405](#), DTC P0204 – Injector Circuit-Cylinder 4 [P.13A-415](#).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Air/fuel learning value (long time fuel trim) and air/fuel feedback integral value (short time fuel trim) are too rich.

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)

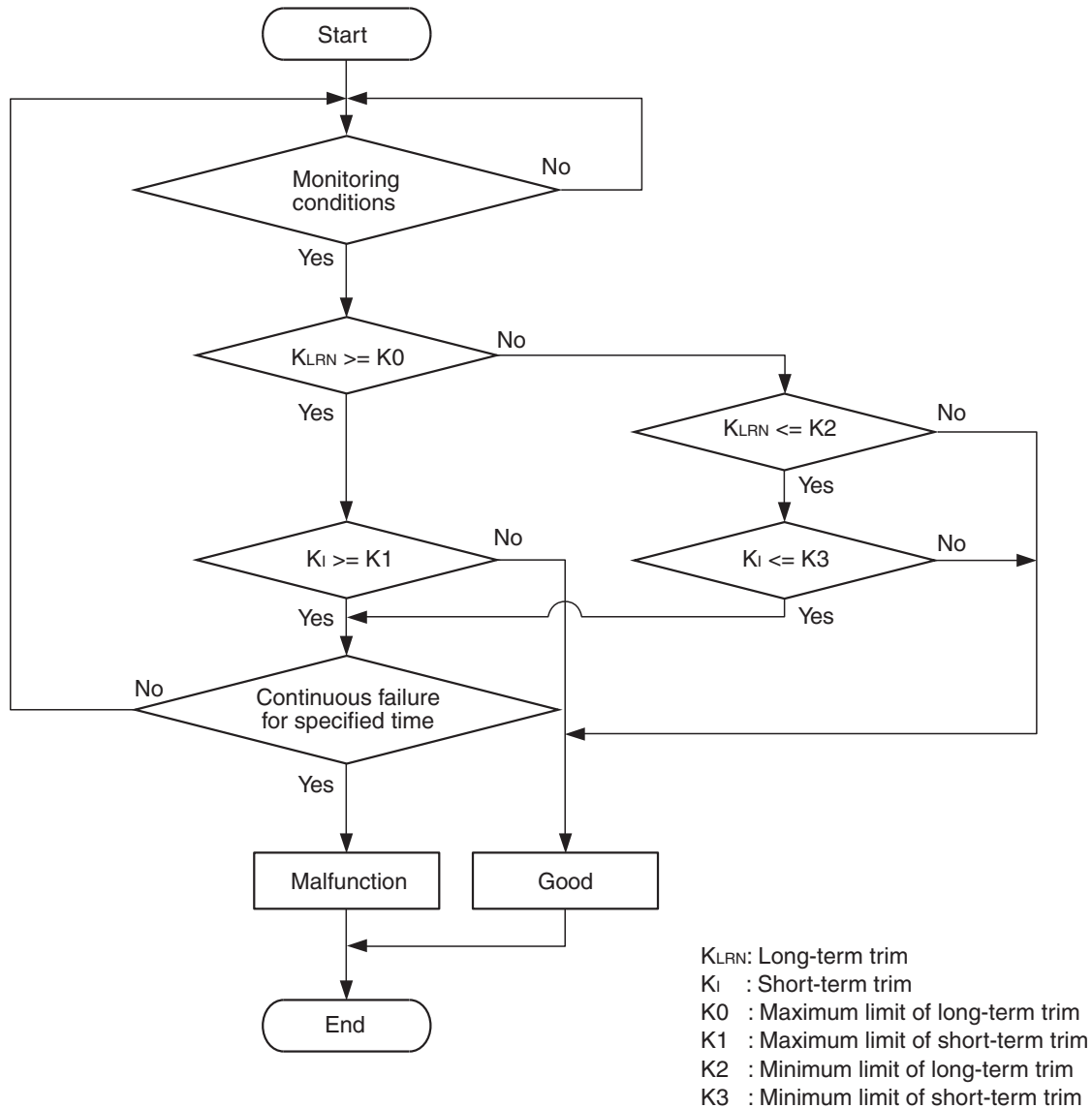
- Misfire monitor

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



AK703881

Check Conditions

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76°C (169°F).
- Mass airflow sensor output is 10 g/sec <M/T> or 6 g/sec <CVT> or more.

Judgement Criterion

- Long-term fuel trim has continued to be lower than –12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be lower than –10.2 percent <Except for California> or –5.5 percent <California> for 5 seconds.

Check Conditions

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76°C (169°F).
- Mass airflow sensor output is 10 g/sec <M/T> or 6 g/sec <CVT> or less.

Judgement Criterion

- Long-term fuel trim has continued to be lower than –12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be lower than -15.2 percent <Except for California> or -10.5 percent <California> for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- Under the closed loop air/fuel ratio control.

Judgement Criteria

- Long-term fuel trim has continued to be -12.5 percent for 2 seconds.

or

- Short-term fuel trim has continued to be -25.0 percent for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 21 [P.13A-12](#).

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

- Mass airflow sensor failed.
- Injector failed.
- Incorrect fuel pressure.
- Engine coolant temperature sensor failed.
- Intake air temperature sensor failed.
- Barometric pressure sensor failed.
- Manifold absolute pressure sensor failed.
- ECM failed.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.**⚠ CAUTION**

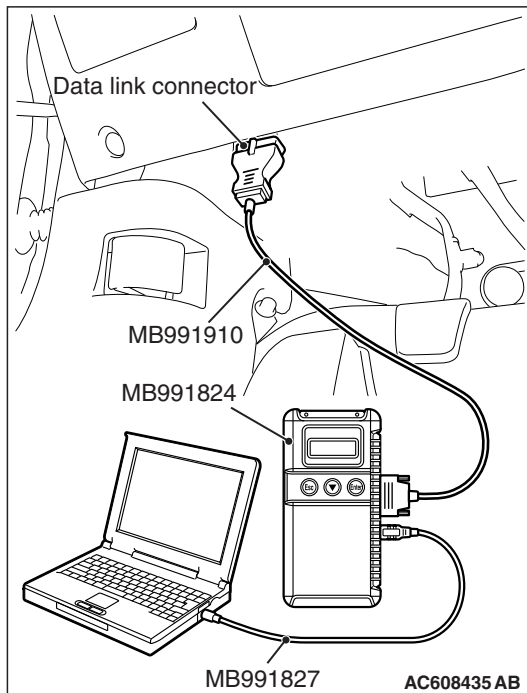
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - When idling, between 1,350 and 1,670 mV.
 - When 2,500 r/min, between 1,620 and 2,020 millivolts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : YES: Go to Step 2.

NO : Refer to DTC P0101 – Mass Airflow Circuit Range/Performance Problem [P.13A-147](#), DTC P0102 – Mass Airflow Circuit Low Input [P.13A-153](#), DTC P0103 – Mass Airflow Circuit High Input [P.13A-160](#).



**STEP 2. Using scan tool MB991958, check data list item 5:
Intake Air Temperature Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 5, Intake Air Temperature Sensor.
 - The intake air temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 3.

NO : Refer to DTC P0111 – Intake Air Temperature Circuit Range/Performance Problem [P.13A-188](#), DTC P0112 – Intake Air Temperature Circuit Low Input [P.13A-194](#), DTC P0113 – Intake Air Temperature Circuit High Input [P.13A-198](#).

**STEP 3. Using scan tool MB991958, check data list item 6:
Engine Coolant Temperature Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 6, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 4.

NO : Refer to DTC P0116 – Engine Coolant Temperature Circuit Range/Performance Problem [P.13A-204](#), DTC P0117 – Engine Coolant Temperature Circuit Low Input [P.13A-210](#), DTC P0118 – Engine Coolant Temperature Circuit High Input [P.13A-214](#).

STEP 4. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine.
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 5.

NO : Refer to DTC P0106 – Manifold Absolute Pressure Circuit Range/Performance Problem [P.13A-166](#), DTC P0107 – Manifold Absolute Pressure Circuit Low Input [P.13A-175](#), DTC P0108 – Manifold Absolute Pressure Circuit High Input [P.13A-183](#).

STEP 5. Check the injector.

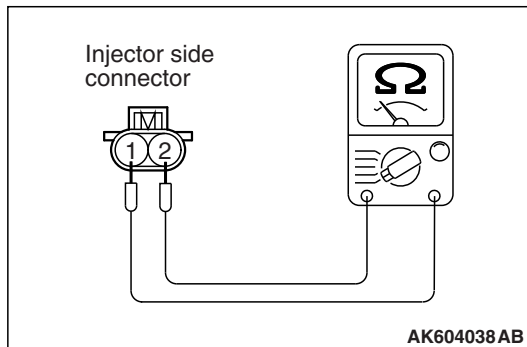
- (1) Disconnect the injector connector B-101, B-102, B-103 and B-104.
- (2) Measure the resistance between each injector side connector terminal No. 1 and No. 2.

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

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

YES : Go to Step 6.

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



STEP 6. Check the fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-961](#).

Q: Is the fuel pressure normal?

YES : Go to Step 7.

NO : Repair it. Then go to Step 8.

STEP 7. Replace the injector.

- (1) Replace the injector.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 21 [P.13A-12](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0172 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 8.

NO : The inspection is complete.

STEP 8. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 21 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0172 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.