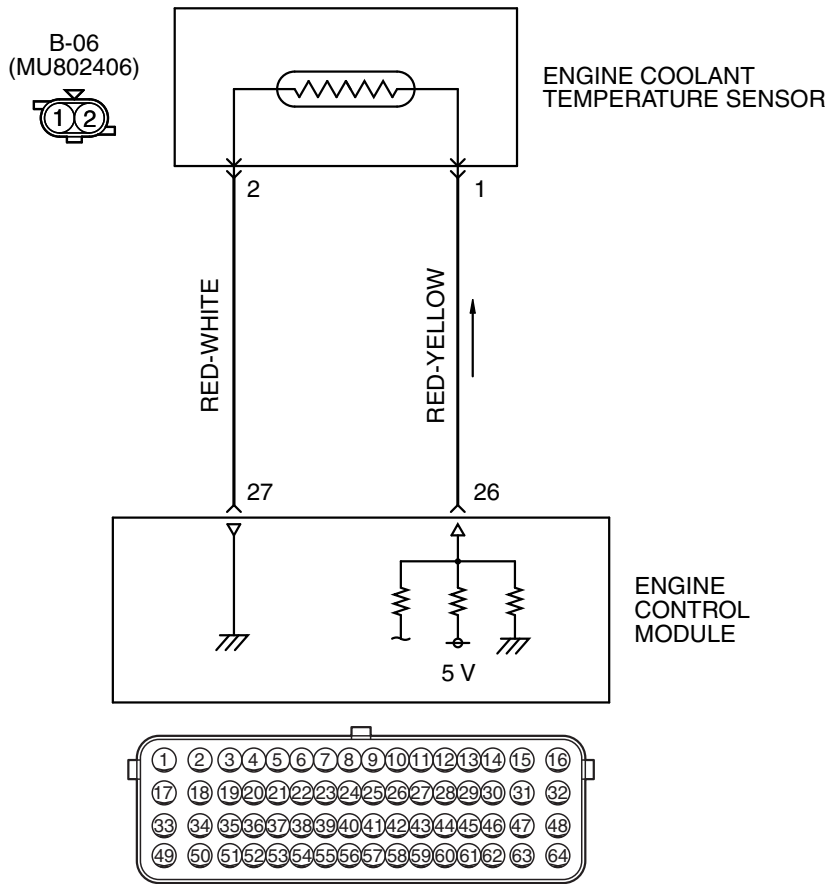
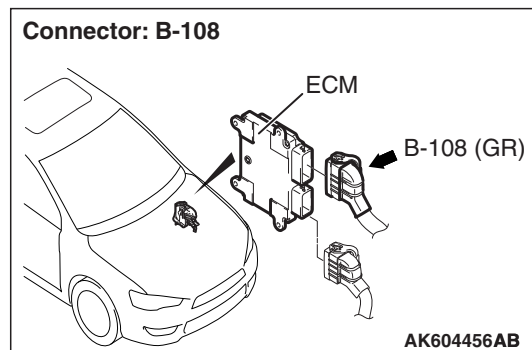
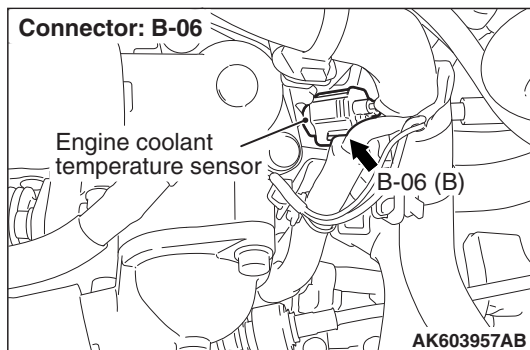


DTC P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control

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)**

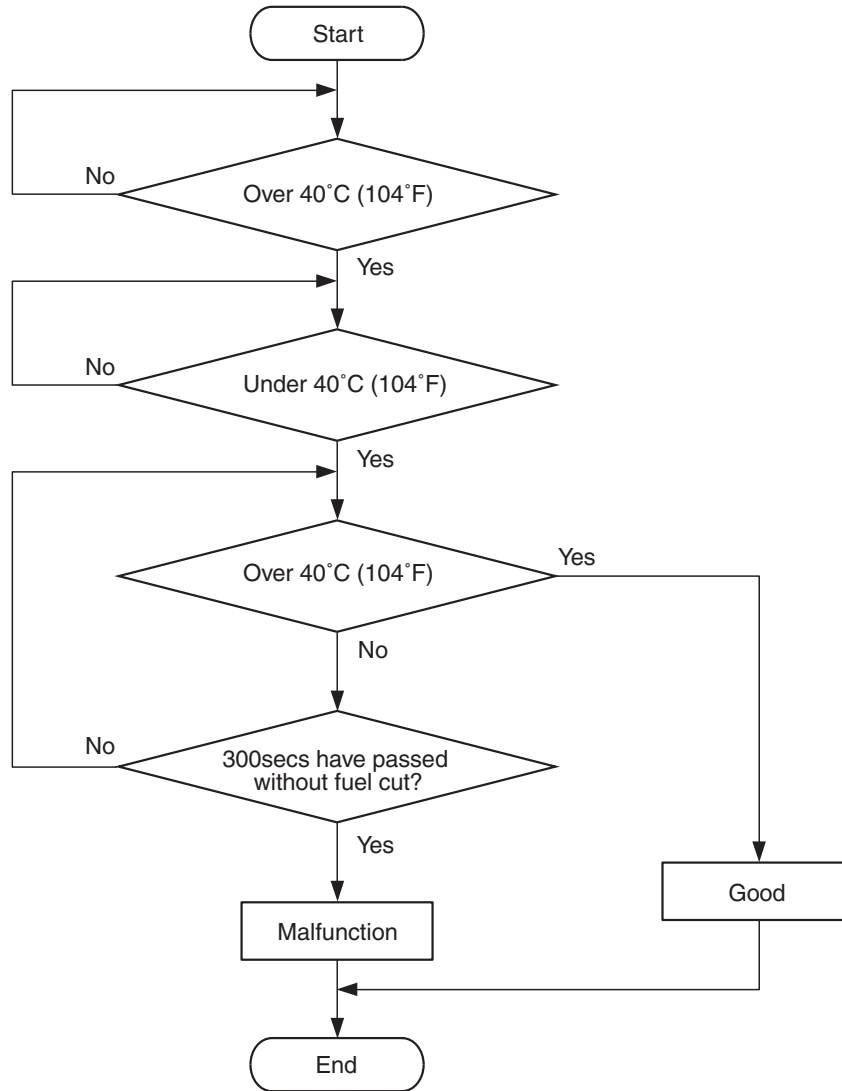
- Not applicable

**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

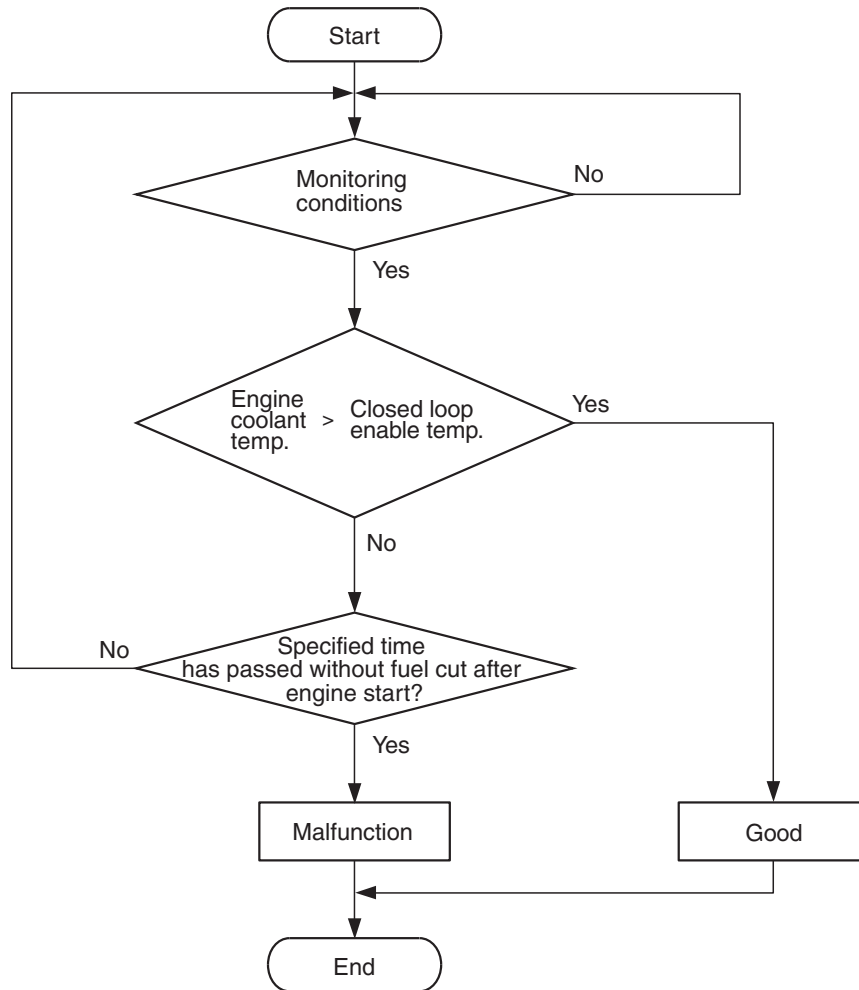
**Check Conditions, Judgement Criteria**

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

- Then the engine coolant temperature is less than 40° C (104° F) 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.

**FAIL-SAFE AND BACKUP FUNCTION**

- Control as if the engine coolant temperature is 80° C (176° F).

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 9 P.13B-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 Tool:**

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

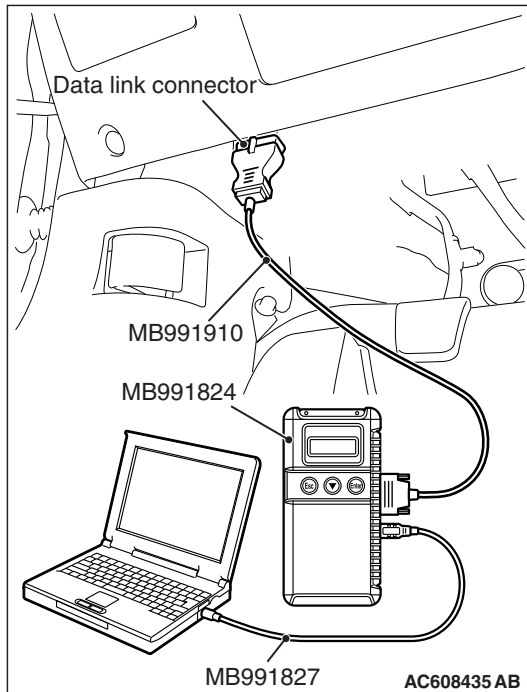
**STEP 1. Using scan tool MB991958, check data list item 6: Engine Coolant Temperature Sensor.****⚠ CAUTION**

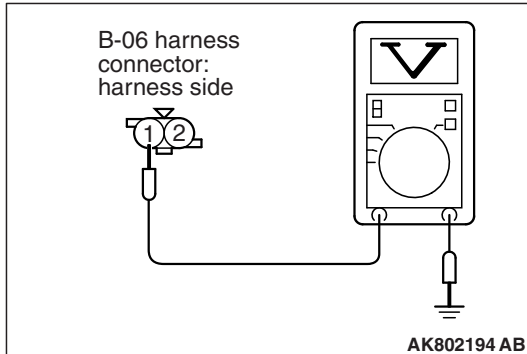
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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.00-13](#).
- 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 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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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.

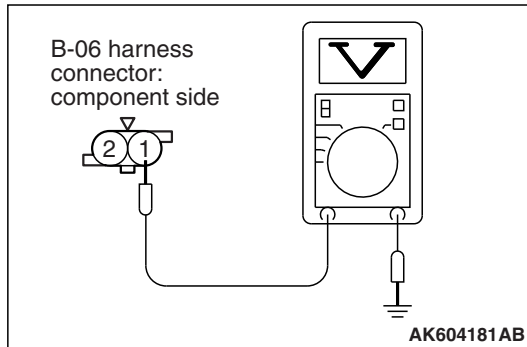
- Voltage should be between 4.5 and 4.9 volts.

(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 (Refer to, Removal and Installation [P.13B-1022](#)). 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.

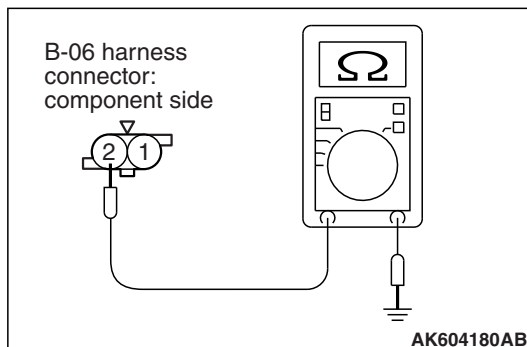
(2) Check for the continuity between terminal No. 2 and ground.

- Continuity (2 ohms 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 (Refer to, Removal and Installation [P.13B-1022](#)). 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 Check [P.13B-1005](#).

**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 (Refer to, Removal and Installation [P.13B-1022](#)). 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.13B-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)**

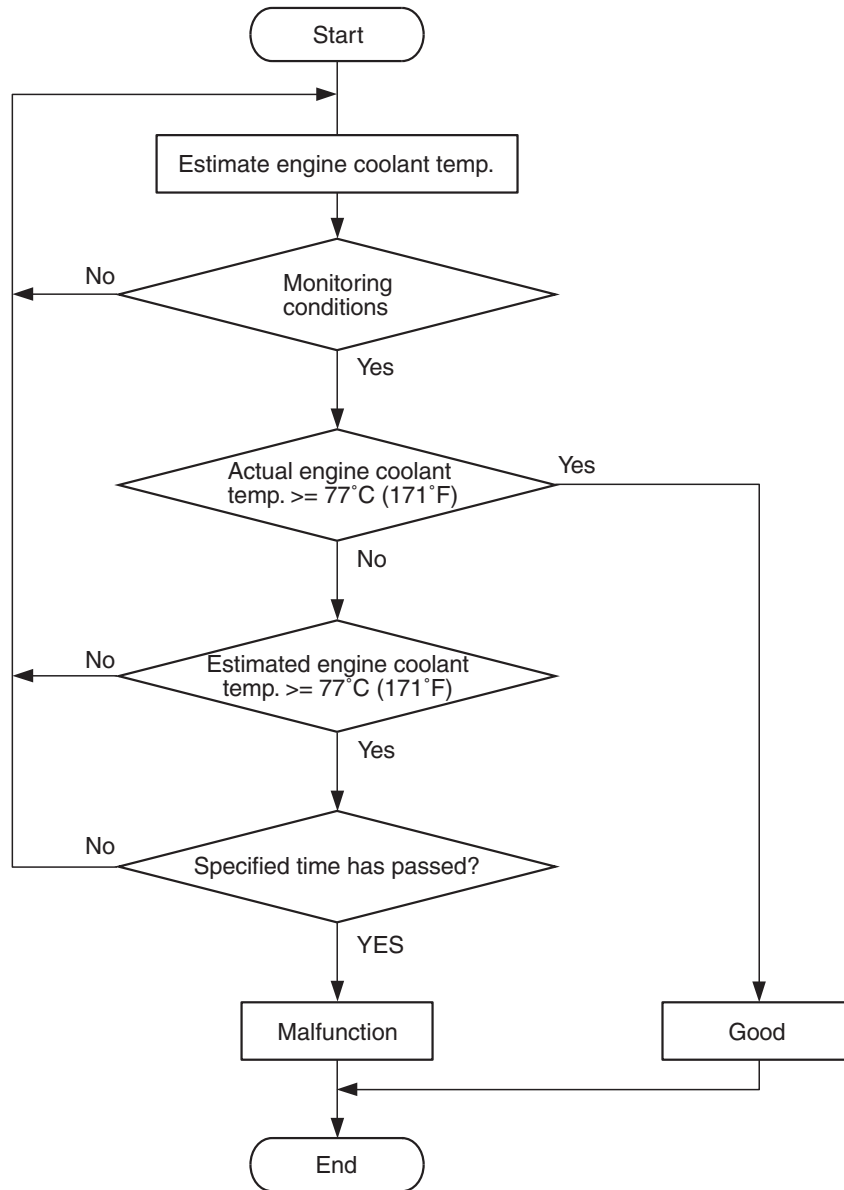
- Vehicle speed sensor monitor <M/T>

**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  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ) and  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ) when the engine is started.
- Intake air temperature is more than  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- The intake air temperature subtracted from the intake air temperature when the engine is started is less than  $10^{\circ}\text{C}$  ( $18^{\circ}\text{F}$ ).
- The total time when the amount of intake air is small is less than the specified time.

#### Judgement Criterion

- After the estimated engine coolant temperature rises above  $77^{\circ}\text{C}$  ( $171^{\circ}\text{F}$ ), the actual engine coolant temperature is less than  $77^{\circ}\text{C}$  ( $171^{\circ}\text{F}$ ) even though the specified time has passed.

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

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

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

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

**DIAGNOSIS****Required Special Tool:**

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

---

**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 (Refer to, Removal and Installation [P.13B-1022](#)). 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.13B-12](#).

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

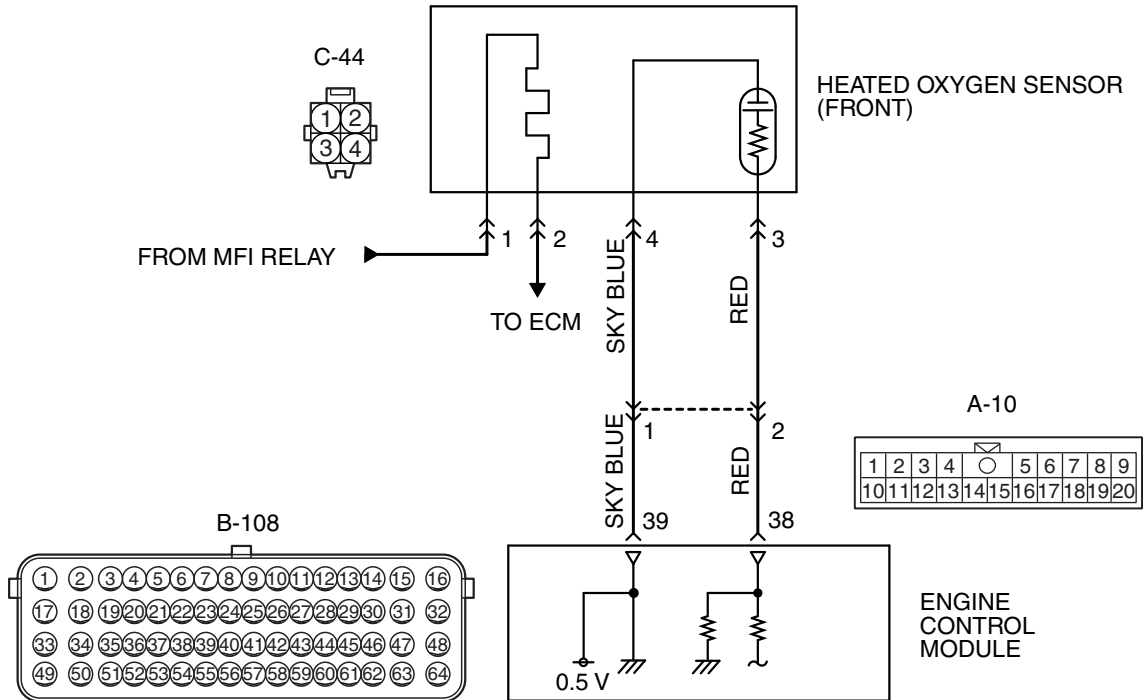
**Q: Is DTC P0128 set?**

**YES** : Retry the troubleshooting.

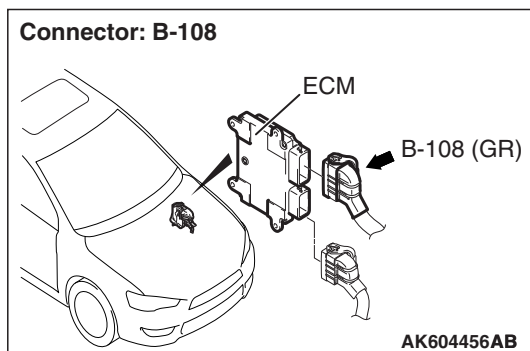
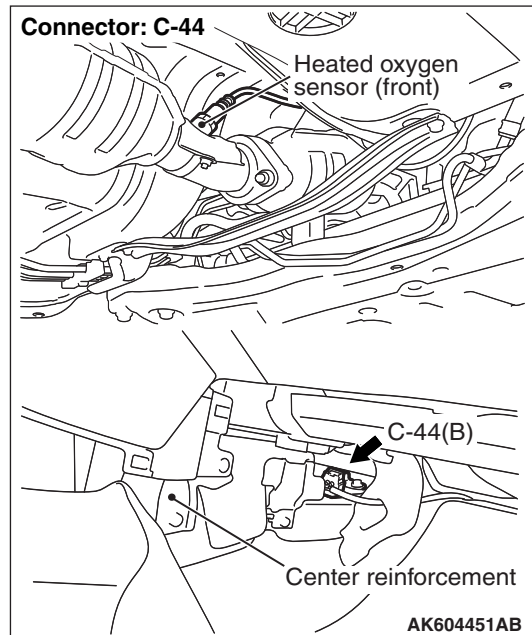
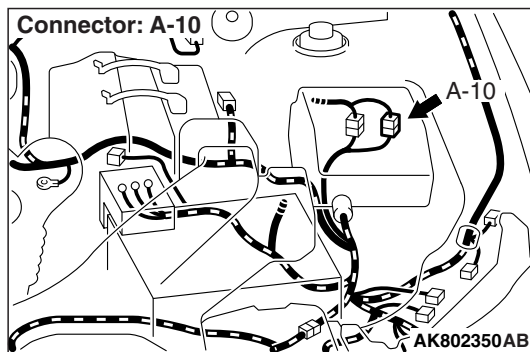
**NO** : The inspection is complete.

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

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



AK604239AF



**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)**

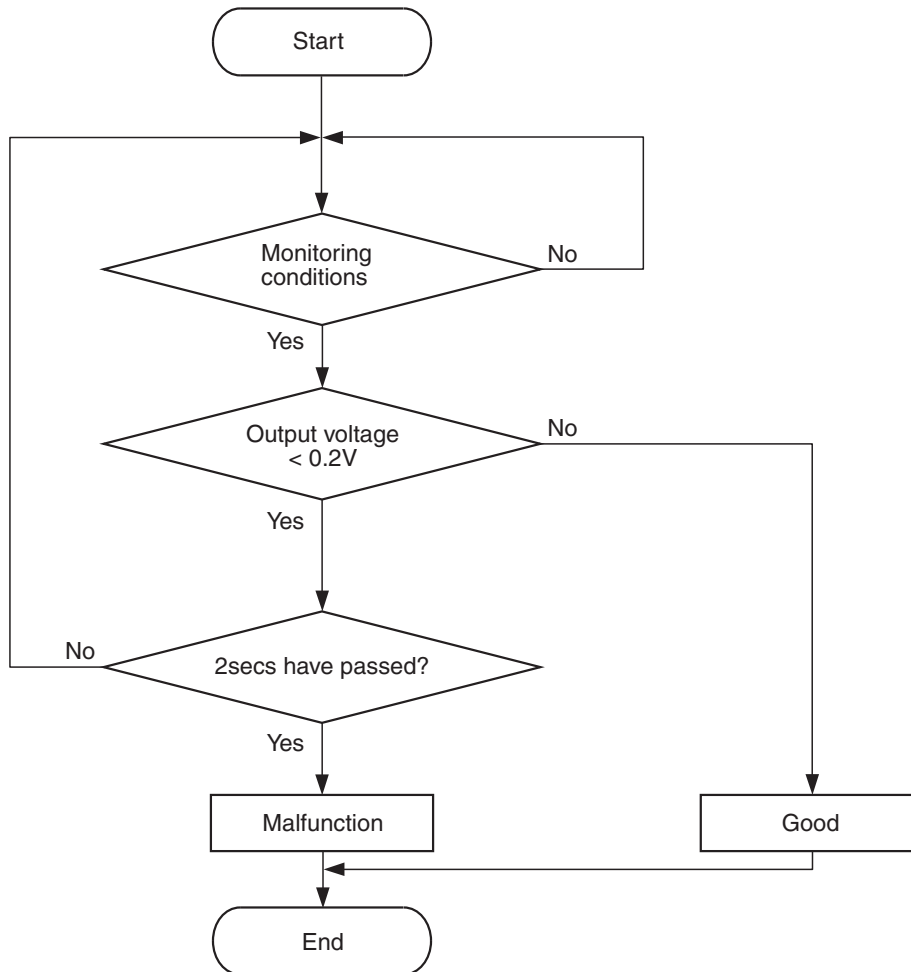
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

**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 less than 0.2 volt for 2 seconds.

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 22 [P.13B-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**

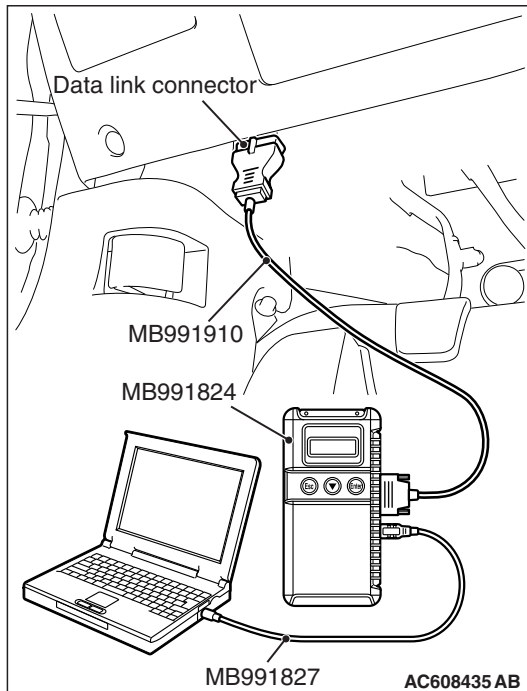
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 be 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.00-13.

**NO :** Go to Step 2.

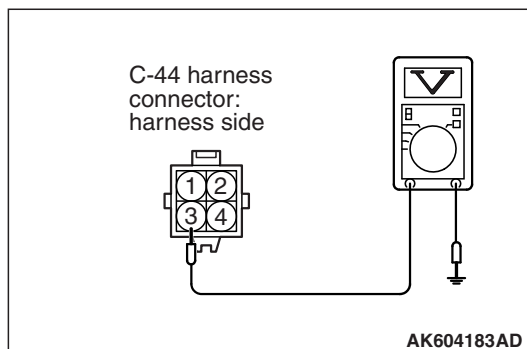
**STEP 2. Measure the sensor output voltage at heated oxygen sensor (front) connector C-44 by backprobing.**

- (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 0.9 volt or less and 1.1 to 1.5 volts 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 6.



**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.

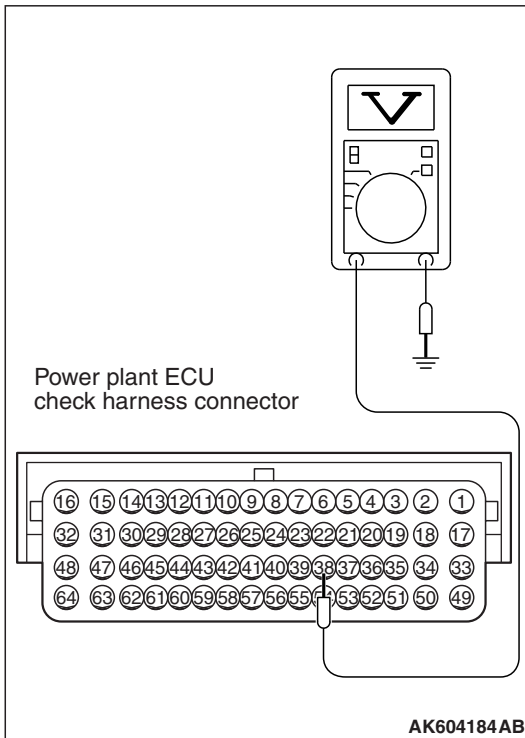
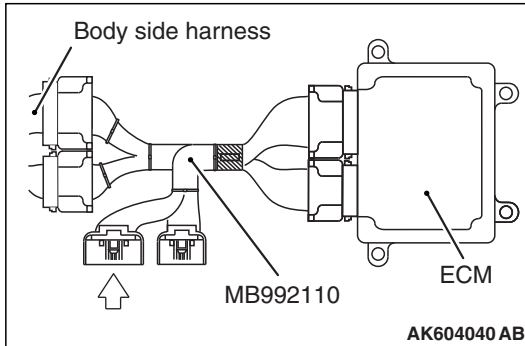
(3) Measure the voltage between terminal No. 38 and ground.  
 • Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0.9 volt or less and 1.1 to 1.5 volts alternately.

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

**Q: Is the measured voltage within the specified range?**

**YES :** Go to Step 13.

**NO :** Go to Step 5.





**STEP 5. 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 6. Check harness connector C-44 at heated oxygen sensor (front) for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 7.

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

**STEP 7. Measure the sensor offset voltage at heated oxygen sensor (front) harness side connector C-44.**

(1) Disconnect the connector C-44 and measure at the harness side.

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

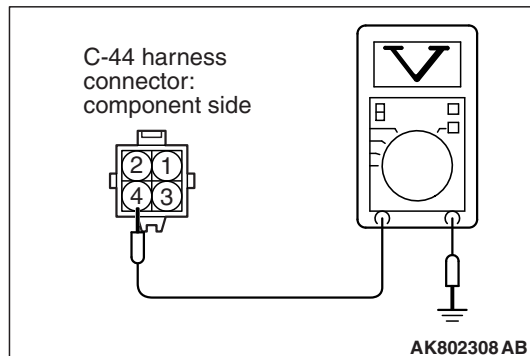
(3) Measure the voltage between terminal No. 4 and ground.  
• Voltage should be between 0.4 and 0.6 volt.

(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 9.

**NO :** Go to Step 8.



**STEP 8. Check harness connector B-108 at ECM 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. 4) and ECM connector B-108 (terminal No. 39) because of open circuit. 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 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 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 11.

**NO :** Repair it. Then go to Step 14.

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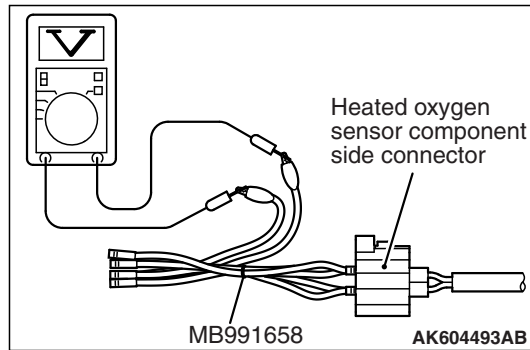
**STEP 11. Check for short circuit to ground between heated oxygen sensor (front) connector C-44 (terminal No. 3) and ECM connector B-108 (terminal No. 38).**

*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 12.

**NO :** Repair it. Then go to Step 14.

**STEP 12. 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 2,000 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 13.

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

---

**STEP 13. 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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

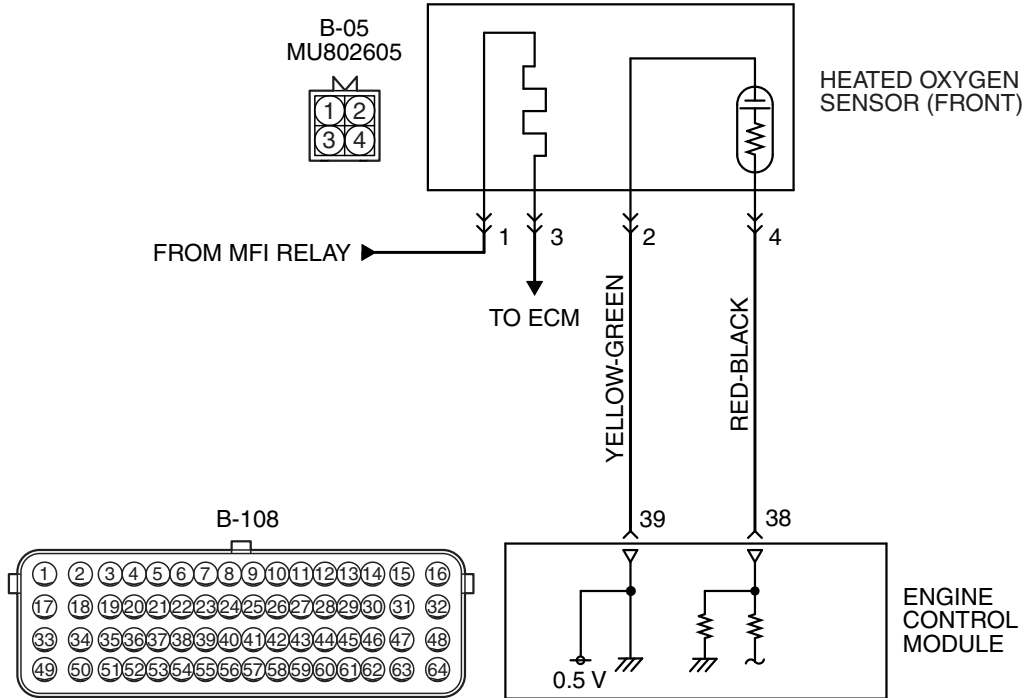
**Q: Is DTC P0131 set?**

**YES :** Retry the troubleshooting.

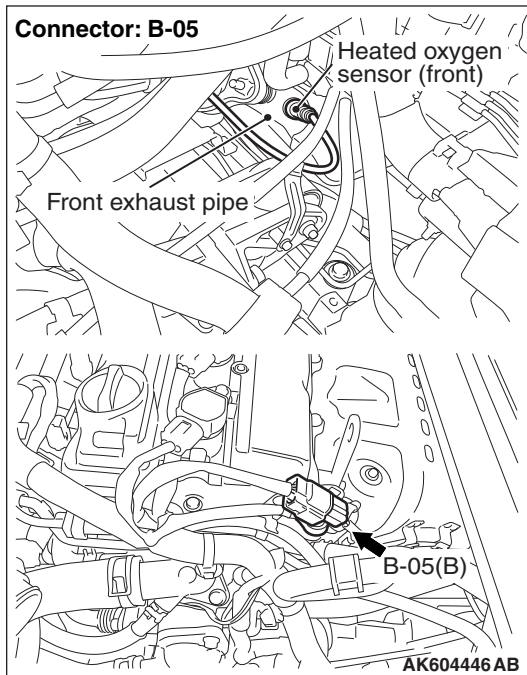
**NO :** The inspection is complete.

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

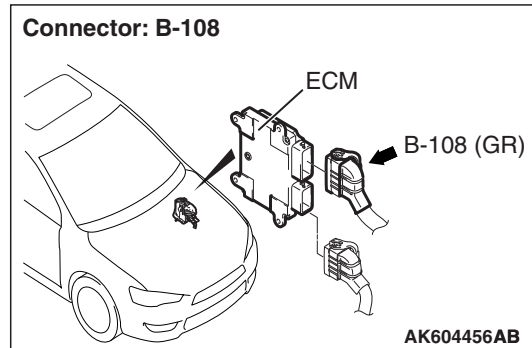
HEATED OXYGEN SENSOR (FRONT) CIRCUIT <VEHICLES FOR CALIFORNIA>



AK604238AD



AK604446 AB



AK604456 AB

## 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)**

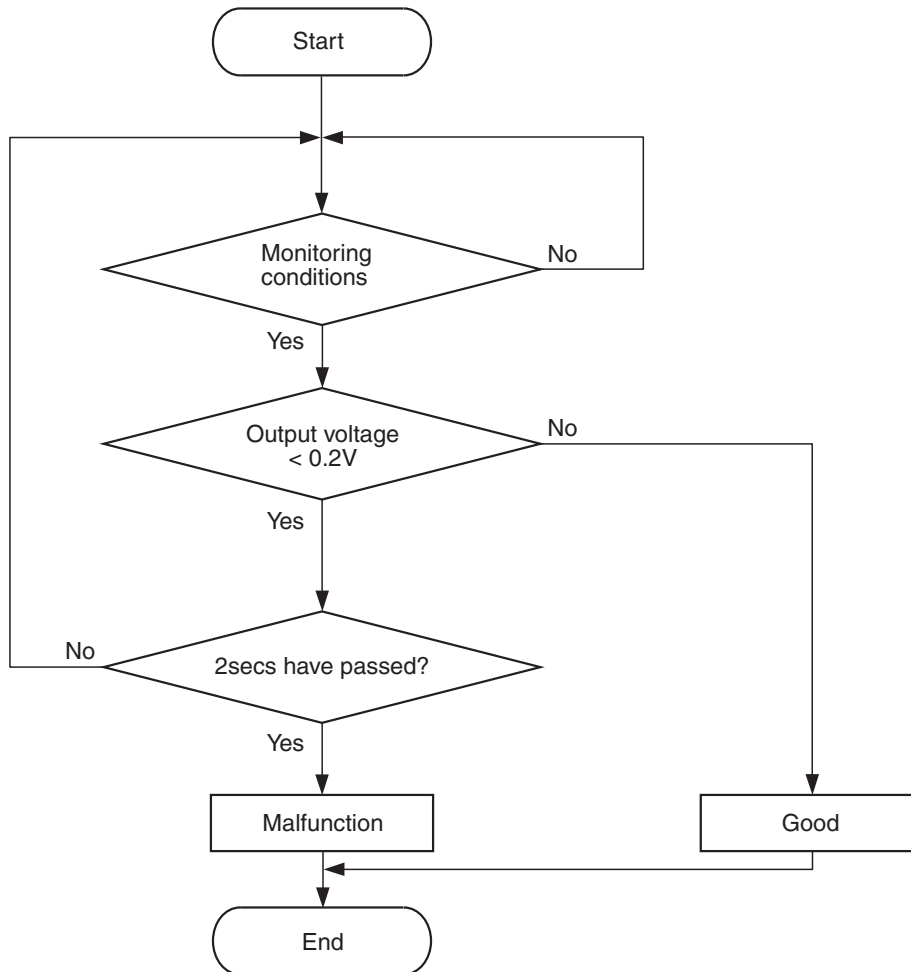
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

**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 less than 0.2 volt for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 22 [P.13B-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

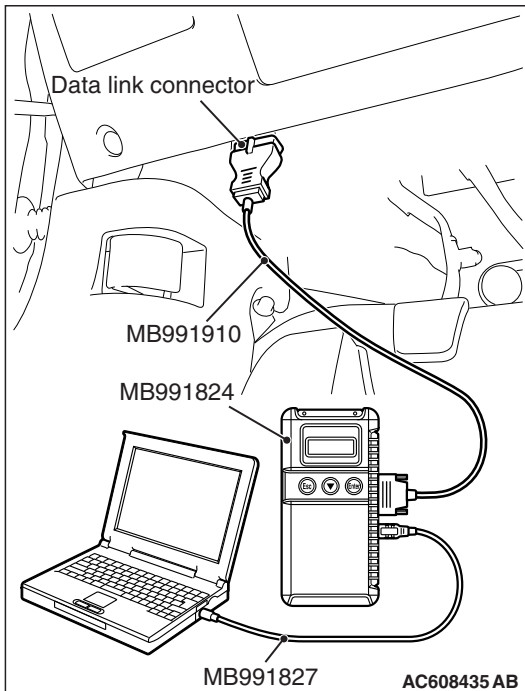
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 be 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.00-13.

**NO :** Go to Step 2.



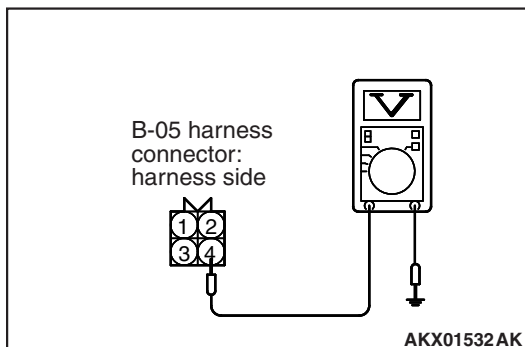
### STEP 2. Measure the sensor output voltage at heated oxygen sensor (front) connector B-05 by backprobing.

- (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 0.9 volt or less and 1.1 to 1.5 volts 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 6.





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

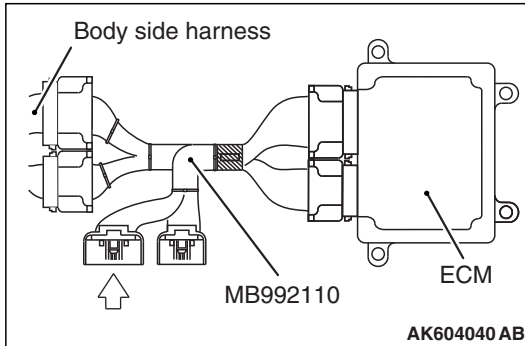
**Q: Is the harness connector in good condition?**

**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.

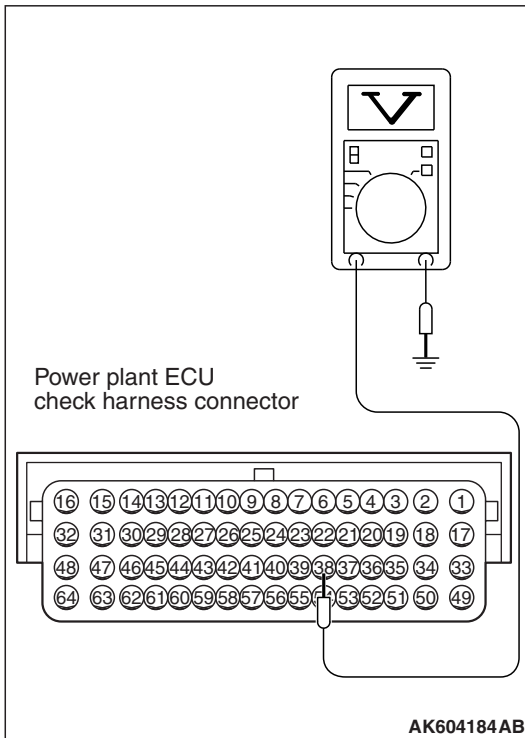


- (3) Measure the voltage between terminal No. 38 and ground.
  - Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0.9 volt or less and 1.1 to 1.5 volts alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the measured voltage within the specified range?**

**YES :** Go to Step 13.

**NO :** Go to Step 5.



---

**STEP 5. 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 6. Check harness connector B-05 at heated oxygen sensor (front) for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 7.

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

---

**STEP 7. Measure the sensor offset voltage at heated oxygen sensor (front) harness side connector B-05.**

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

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

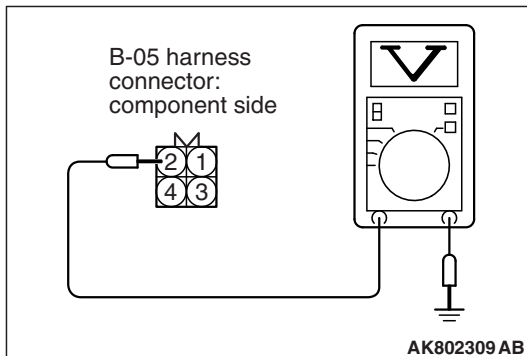
(3) Measure the voltage between terminal No. 2 and ground.  
• Voltage should be between 0.4 and 0.6 volt.

(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 9.

**NO :** Go to Step 8.



---

**STEP 8. Check harness connector B-108 at ECM for damage.**

**Q: Is the harness connector in good condition?**

**YES :** 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. 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 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 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 11.

**NO :** Repair it. Then go to Step 14.

**STEP 11. Check for short circuit to ground 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 12.

**NO :** Repair it. Then go to Step 14.

**STEP 12. 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 2,000 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**

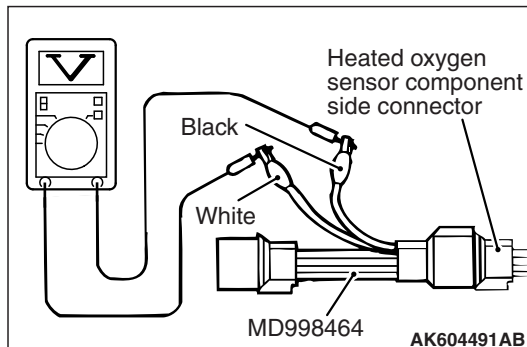
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater can be damaged if a voltage beyond 8 volts is applied to the heated oxygen sensor heater.**

*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 13.

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



---

**STEP 13. 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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

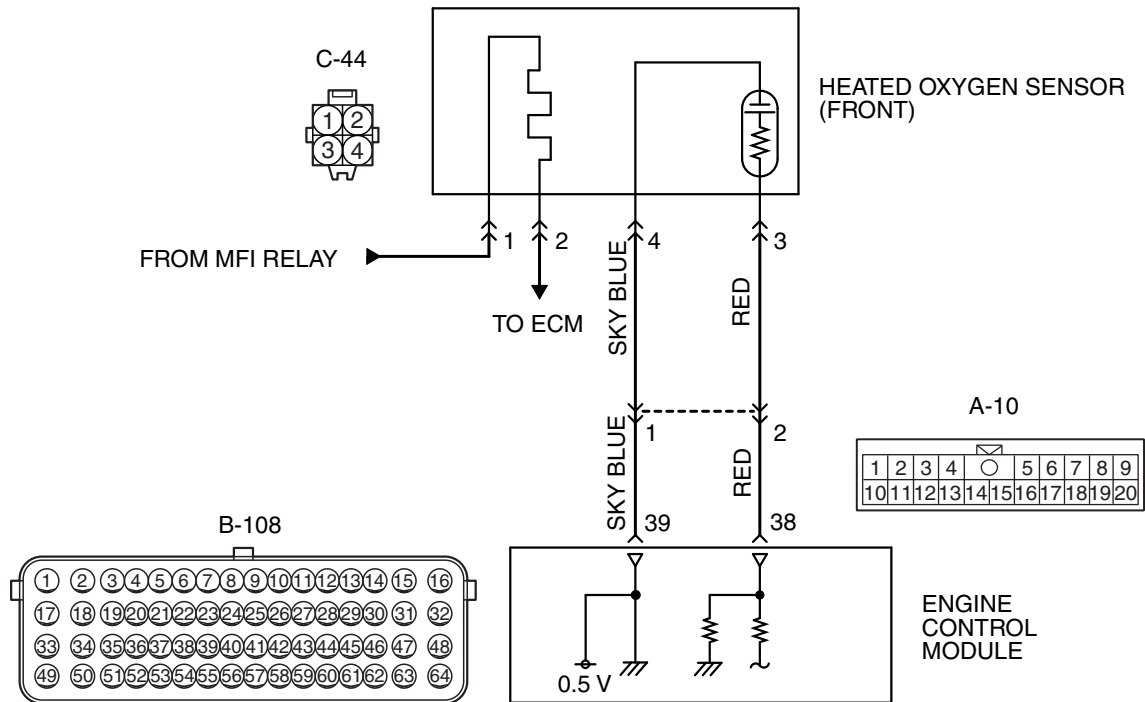
**Q: Is DTC P0131 set?**

**YES :** Retry the troubleshooting.

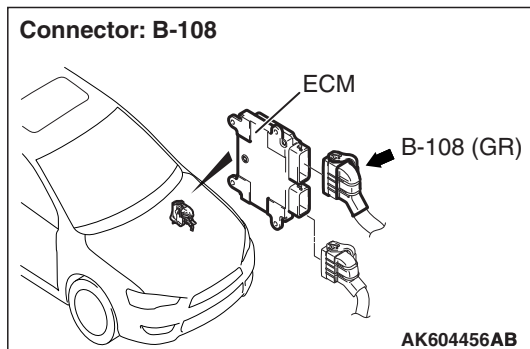
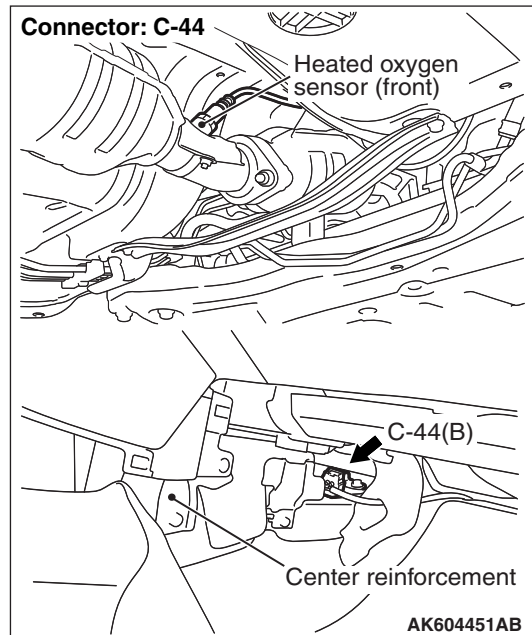
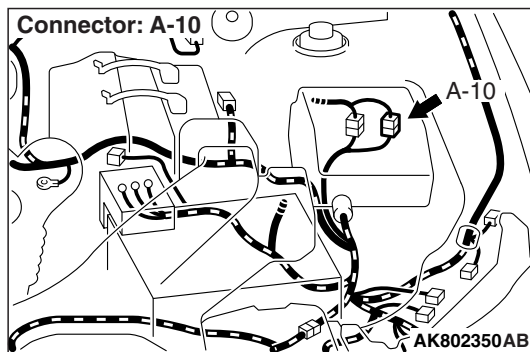
**NO :** The inspection is complete.

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

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



AK604239AF



## 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)**

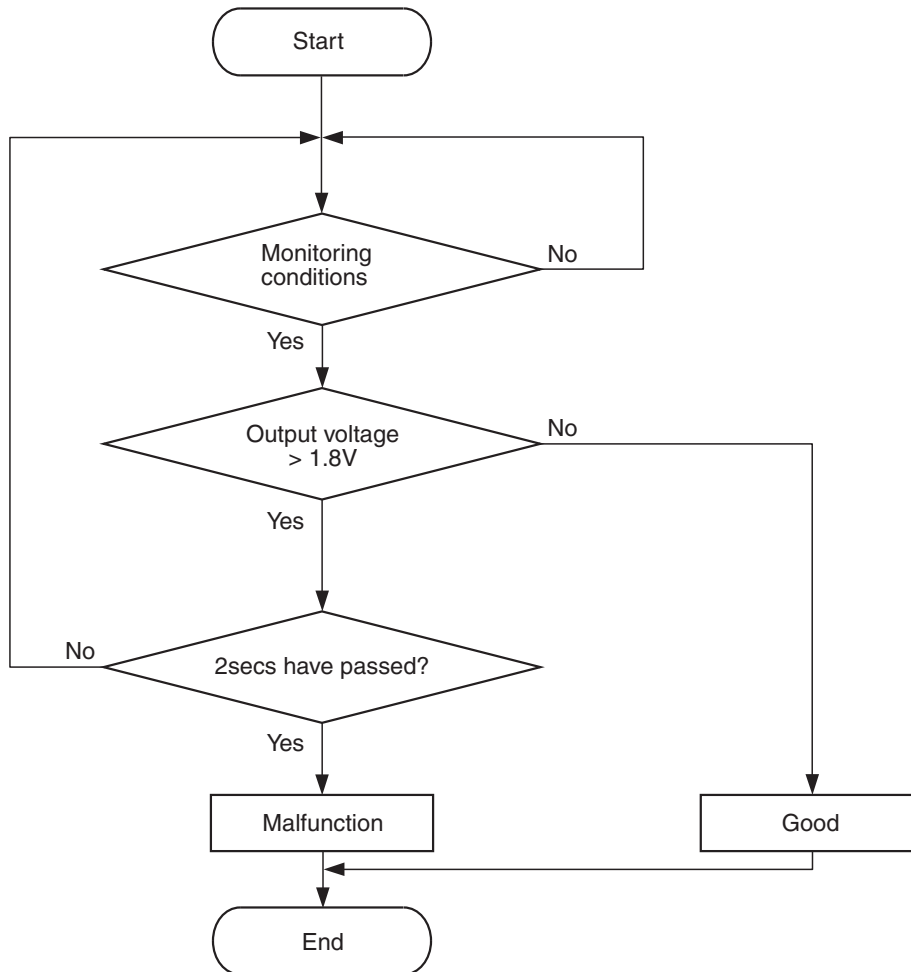
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

**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**

- More than 2 seconds 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 is more than 1.8 volts for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnosis Function –OBD-II Drive Cycle – Pattern 23 [P.13B-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

### Required Special Tool:

- 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 AC: Heated Oxygen Sensor (front).**

### ⚠ CAUTION

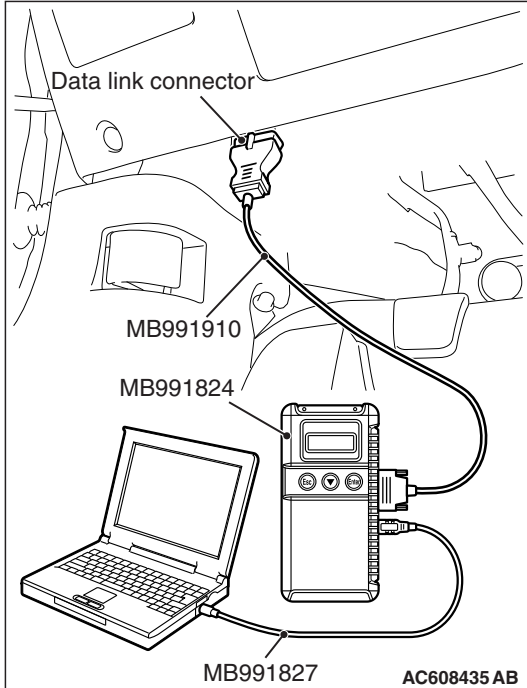
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 be 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.00-13.

**NO :** Go to Step 2.



**STEP 2. Check harness connector C-44 at heated oxygen sensor (front) and harness connector B-108 at ECM for damage.**

### Q: Are the harness connectors in good condition?

**YES :** Go to Step 3.

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

**STEP 3. 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 5.*

### Q: Is the harness wire in good condition?

**YES :** Go to Step 4.

**NO :** Repair it. Then go to Step 5.



**STEP 4. 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).
  - Warm up the engine. When the engine is revved, the output voltage should be 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.
- (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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

---

**STEP 5. Test the OBD-II drive cycle.**

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

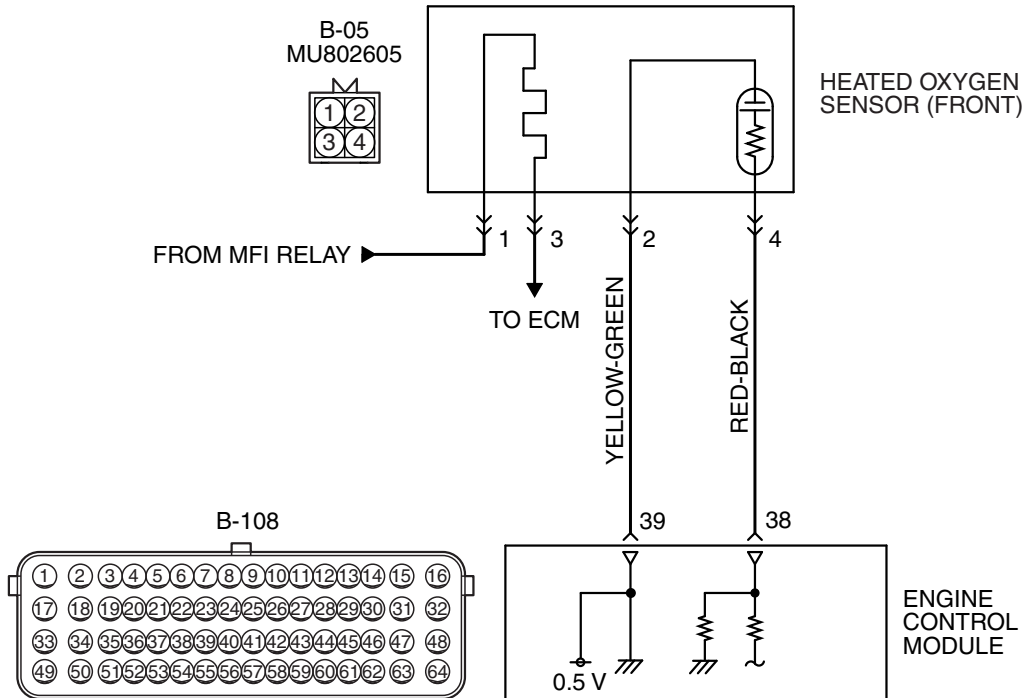
**Q: Is DTC P0132 set?**

**YES :** Retry the troubleshooting.

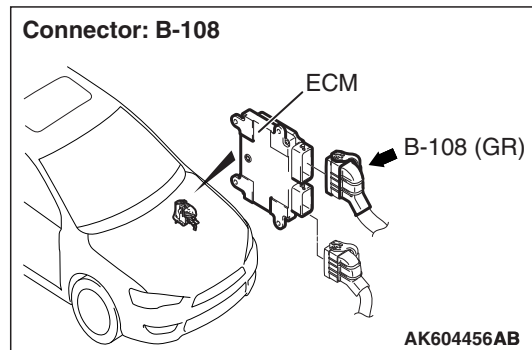
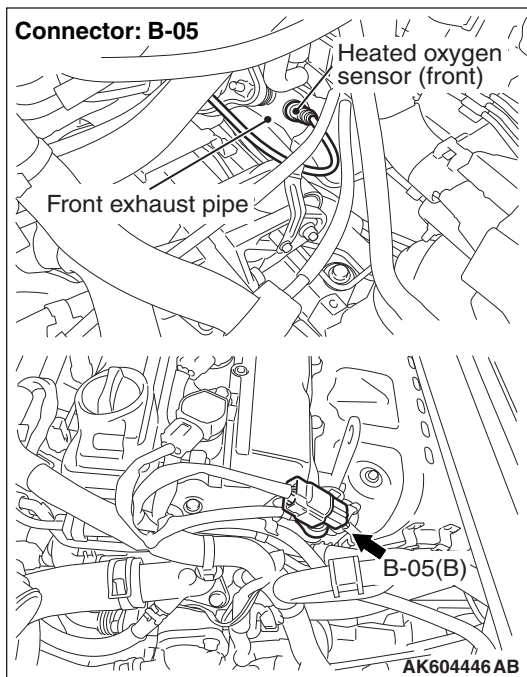
**NO :** The inspection is complete.

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

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



AK604238AD



**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)**

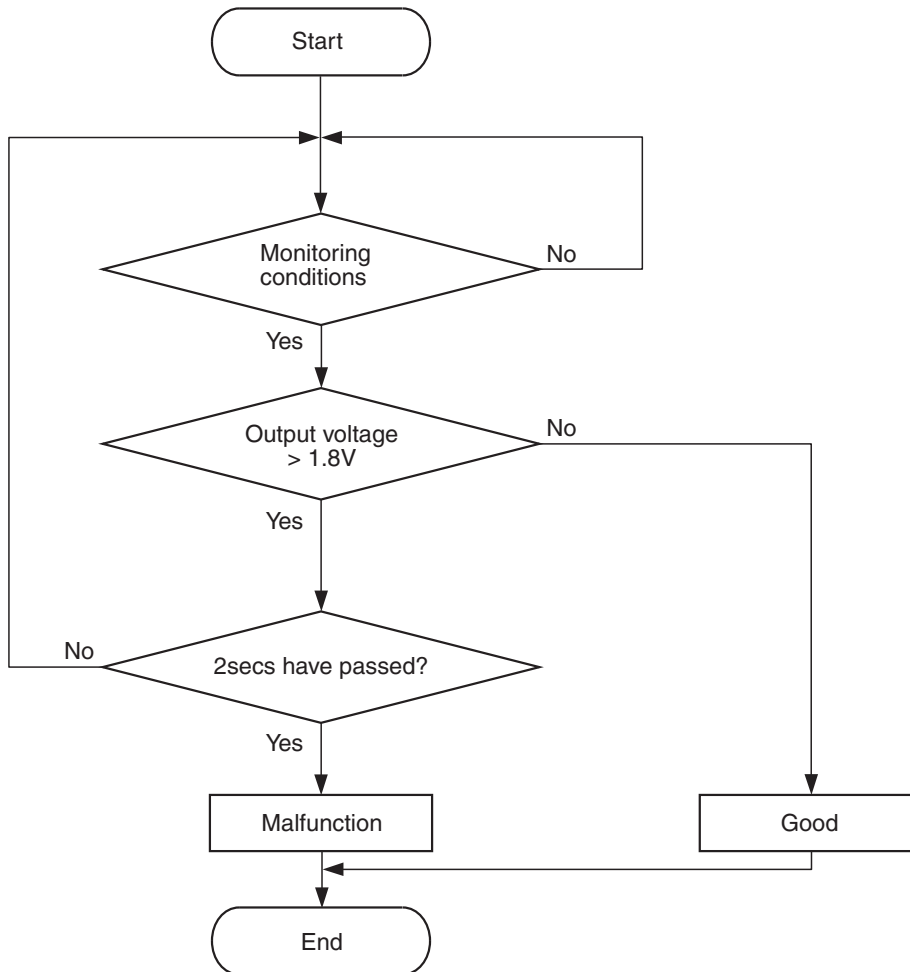
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

**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**

- More than 2 seconds 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 is more than 1.8 volts for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnosis Function –OBD-II Drive Cycle – Pattern 23 [P.13B-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

### Required Special Tool:

- 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 AC: Heated Oxygen Sensor (front).**

### **⚠ CAUTION**

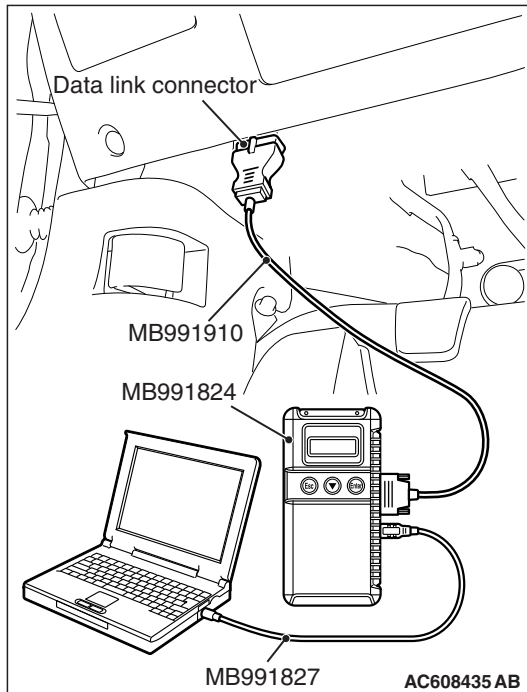
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 be 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.00-13](#).

**NO :** Go to Step 2.



**STEP 2. Check harness connector B-05 at heated oxygen sensor (front) and harness connector B-108 at ECM for damage.**

### **Q: Are the harness connectors in good condition?**

**YES :** Go to Step 3.

**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

**STEP 3. 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 :** Go to Step 4.

**NO :** Repair it. Then go to Step 5.

---

**STEP 4. 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).
  - Warm up the engine. When the engine is revved, the output voltage should be 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.
- (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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

---

**STEP 5. Test the OBD-II drive cycle.**

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

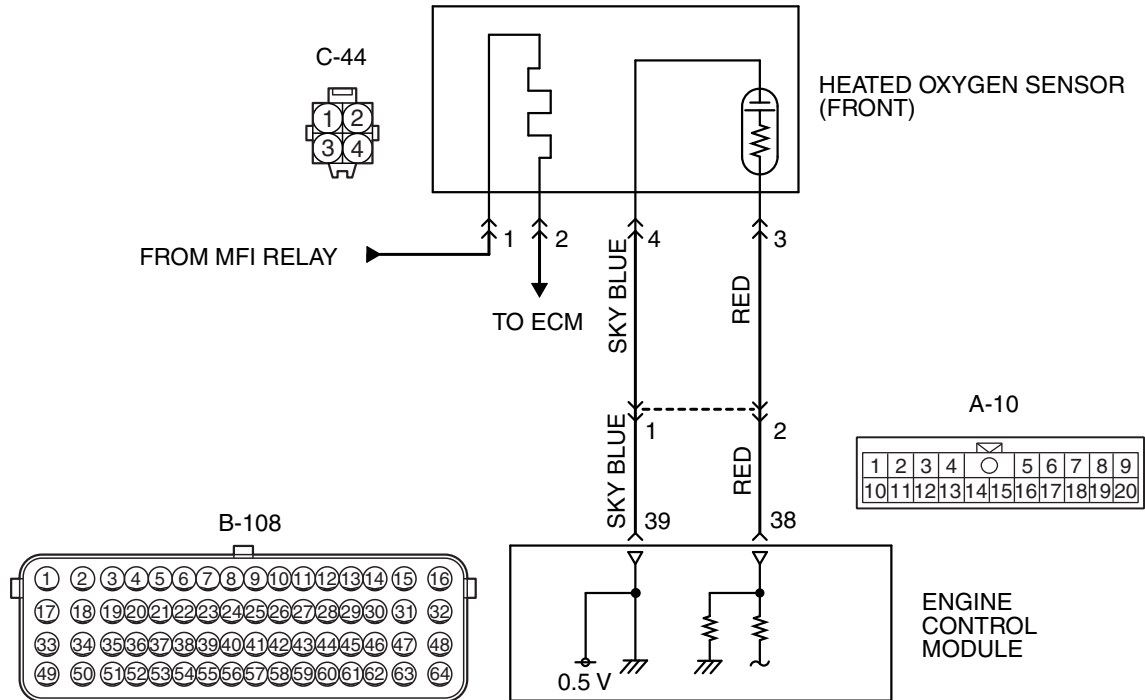
**Q: Is DTC P0132 set?**

**YES :** Retry the troubleshooting.

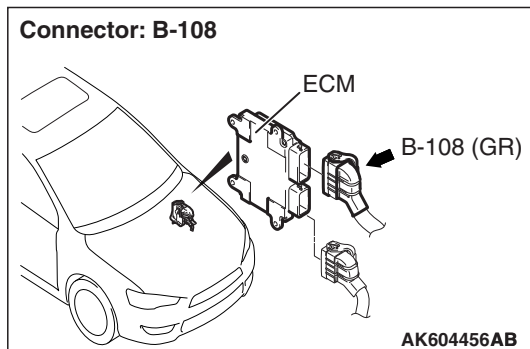
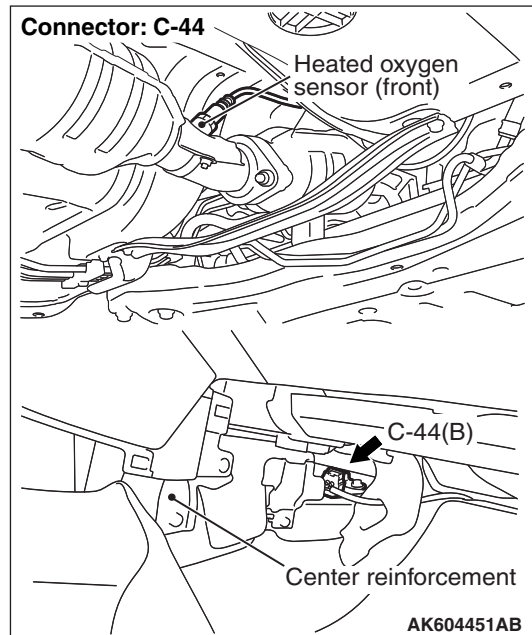
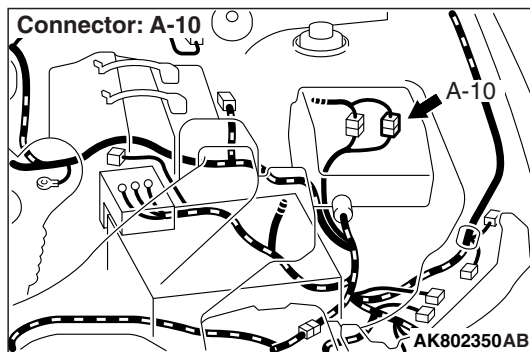
**NO :** The inspection is complete.

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

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



AK604239AF



## 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

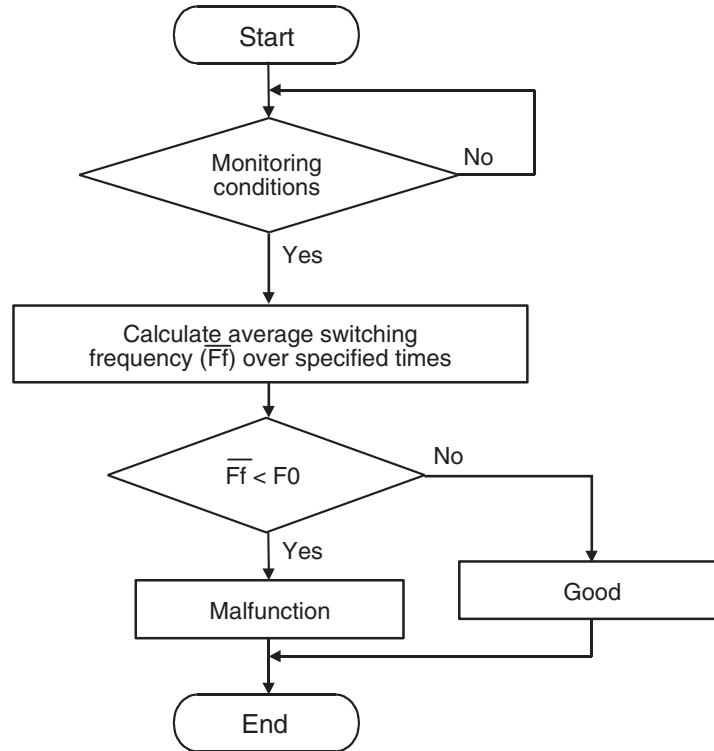
**Sensor (The sensor below is determined to be normal)**

- 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 more than 60° C (140° F).
- Engine speed is between 1,375 and 3,500 r/min <M/T> or 1,219 and 3,000 r/min <CVT>.
- Volumetric efficiency is between 18 and 65 percent <M/T> or 27.5 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 passed 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 8 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.*

**FAIL-SAFE AND BACKUP FUNCTION**

- None

## OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle –  
Pattern 1 [P.13B-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**

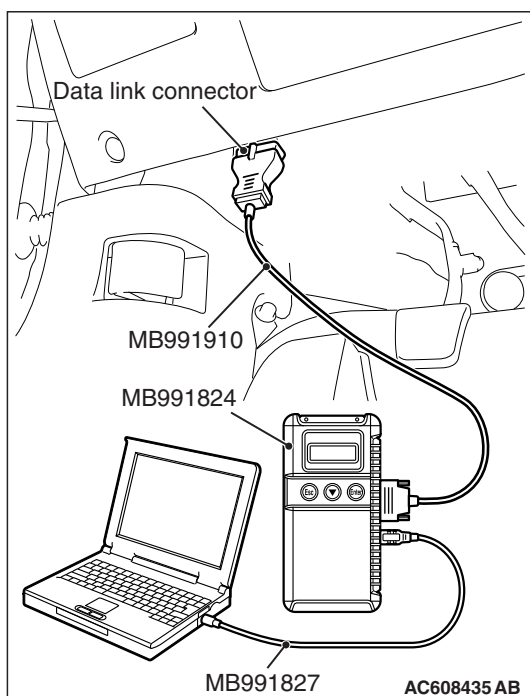
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

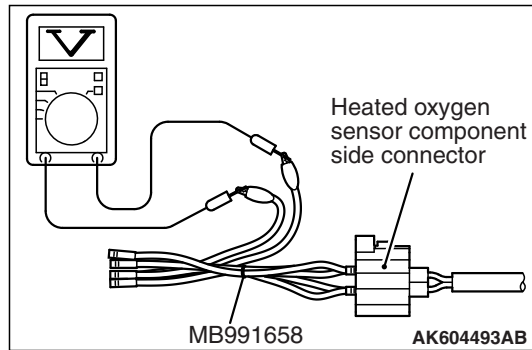
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item AC, Heated Oxygen Sensor (front).
- (4) Warm up the engine, 2,500 r/min.
  - Output voltage repeats 0.4 volt or less and 0.6 to 1.0 volt 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.00-13](#).

**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 2,000 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 5.

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

**YES :** Go to Step 4.

**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

---

**STEP 4. 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).
- (3) 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.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the sensor operating properly?**

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

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

---

**STEP 5. Test the OBD-II drive cycle.**

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

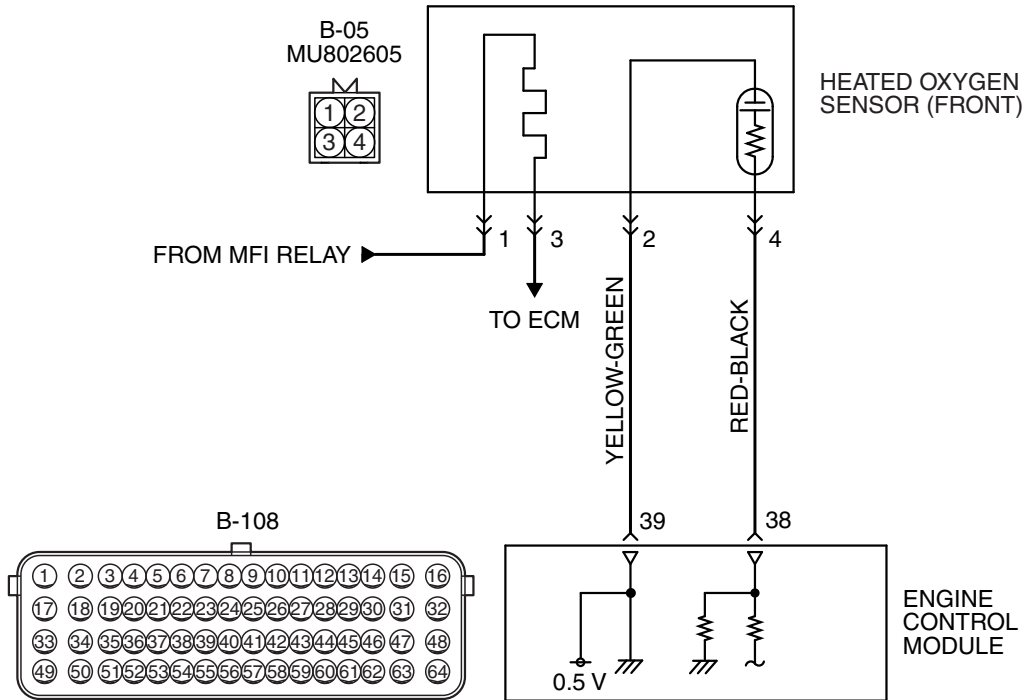
**Q: Is DTC P0133 set?**

**YES :** Retry the troubleshooting.

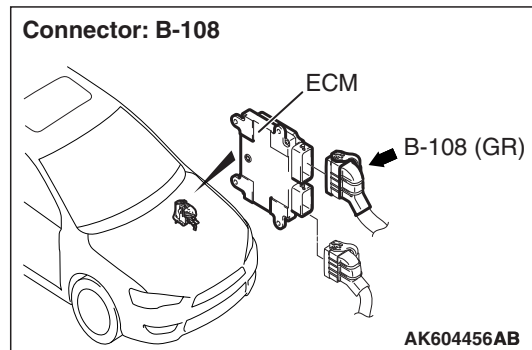
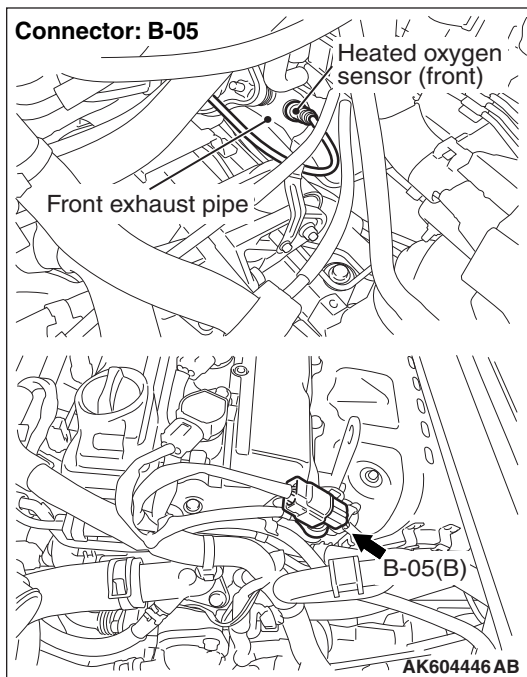
**NO :** The inspection is complete.

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

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



AK604238AD



## 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)**

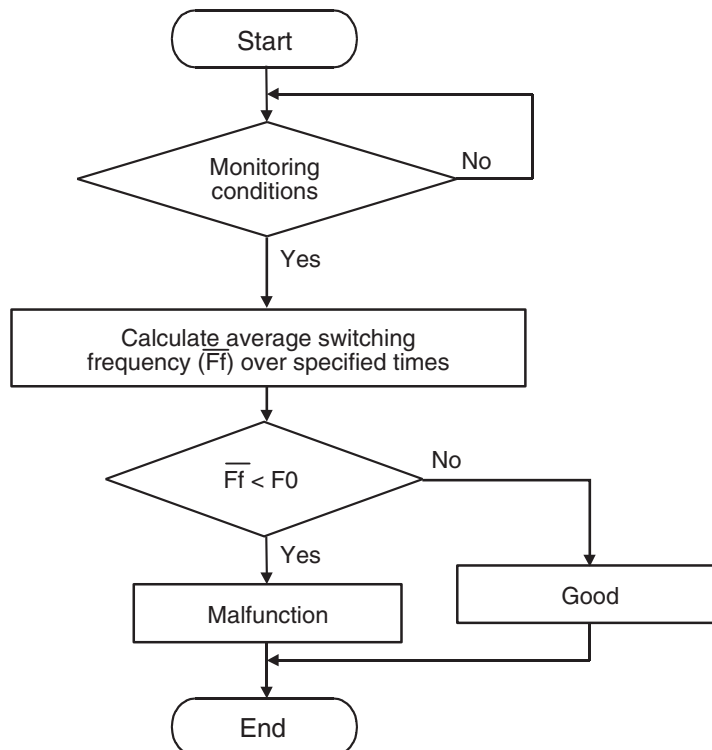
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor

**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 more than 60° C (140° F).
- Engine speed is between 1,375 and 3,500 r/min <M/T> or 1,219 and 3,000 r/min <CVT>.
- Volumetric efficiency is between 18 and 65 percent <M/T> or 27.5 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 passed 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 8 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.*

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 1 [P.13B-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**

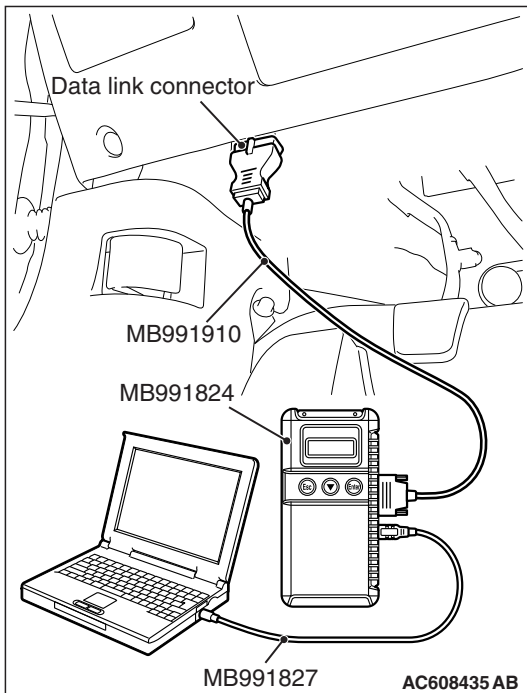
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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.

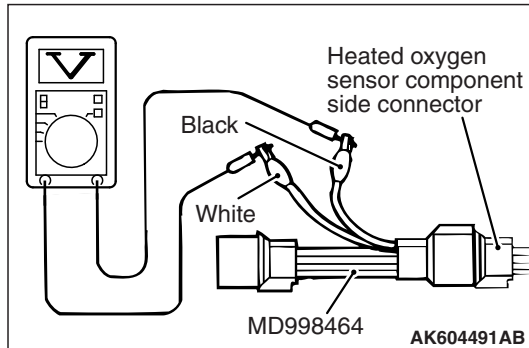
**Q: Is the sensor operating properly?**

**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.00-13](#).

**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 5.

**STEP 3. Check harness connector B-05 at heated oxygen sensor (front) and harness connector B-108 at ECM for damage.****Q: Are the harness connectors in good condition?**

**YES :** Go to Step 4.

**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

---

**STEP 4. 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).
- (3) 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.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the sensor operating properly?**

- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions [P.00-13](#).
- NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

---

**STEP 5. Test the OBD-II drive cycle.**

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

**Q: Is DTC P0133 set?**

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

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

**Heated Oxygen Sensor (front) No Activity Detected Circuit**

- Refer to DTC P0131 –Heated Oxygen Sensor (Front) Circuit Low Voltage <Except vehicles for California> [P.13B-249](#).
- Refer to DTC P0201 –Injector Circuit-cylinder 1 [P.13B-395](#).
- Refer to DTC P0202 –Injector Circuit-cylinder 2 [P.13B-404](#).
- Refer to DTC P0203 –Injector Circuit-cylinder 3 [P.13B-413](#).
- Refer to DTC P0204 –Injector Circuit-cylinder 4 [P.13B-422](#).

**CIRCUIT OPERATION**

- Refer to DTC P0131 –Heated Oxygen Sensor (Front) Circuit Low Voltage <Except vehicles for California> [P.13B-249](#).

- Refer to DTC P0201 –Injector Circuit-cylinder 1 [P.13B-395](#).
- Refer to DTC P0202 –Injector Circuit-cylinder 2 [P.13B-404](#).
- Refer to DTC P0203 –Injector Circuit-cylinder 3 [P.13B-413](#).
- Refer to DTC P0204 –Injector Circuit-cylinder 4 [P.13B-422](#).

**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)**

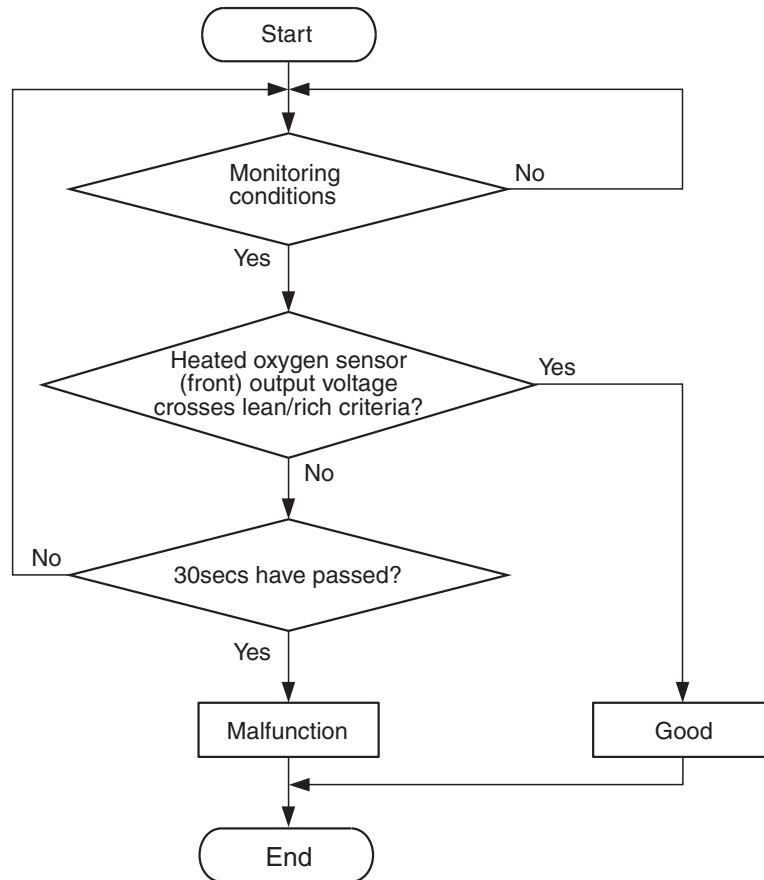
- Misfire monitor

**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 more than 0° C (32° F).

- Engine speed is more than 1,188 r/min.
- Volumetric efficiency is more than 30 percent.
- Throttle position sensor output voltage is less than 3.0 volts <M/T> or 3.8 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.

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 12 [P.13B-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).*

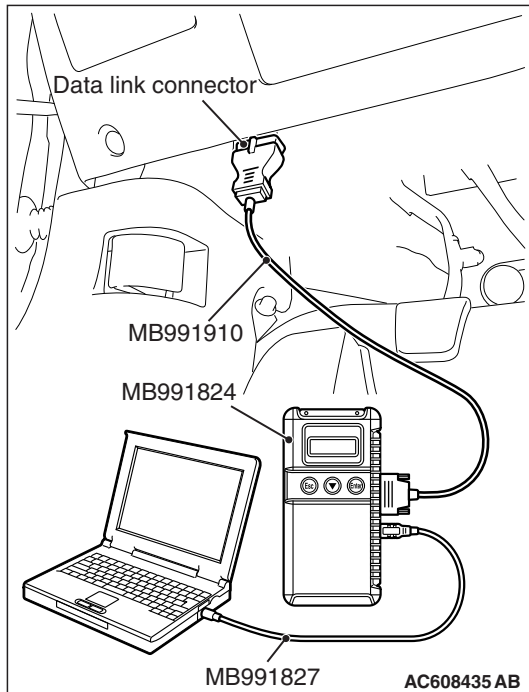
*If the heated oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the heated oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the heated oxygen sensor (front) output voltage decreases, without intersecting with 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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - The output voltage should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the sensor operating properly?**

**YES :** Go to Step 2.

**NO :** Refer to DTC P0137 –Heated Oxygen Sensor (rear) Circuit Low Voltage <Except vehicles for California> [P.13B-300](#), DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage <Except vehicles for California> [P.13B-316](#), DTC P0139 –Heated Oxygen Sensor (rear) Circuit Slow Response <Except vehicles for California> [P.13B-326](#), DTC P0140 – Heated Oxygen Sensor (rear) Circuit No Activity Detected <Except vehicles for California> [P.13B-336](#).

**STEP 2. Check for exhaust leak.**

**Q: Are there any abnormalities?**

**YES :** Repair it. Then go to Step 13.

**NO :** Go to Step 3.

**STEP 3. Check for intake system vacuum leak.**

**Q: Are there any abnormalities?**

**YES :** Repair it. Then go to Step 13.

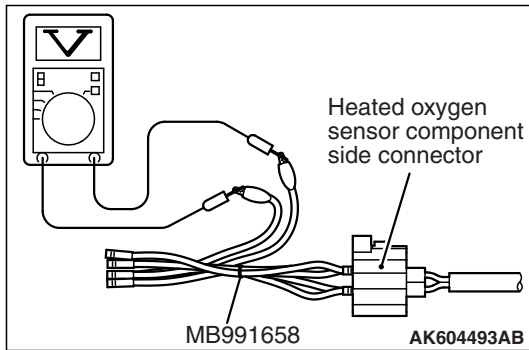
**NO :** Go to Step 4.

**STEP 4. Check harness connector C-44 at heated oxygen sensor (front) for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 5.

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



**STEP 5. Check the 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 2,000 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.

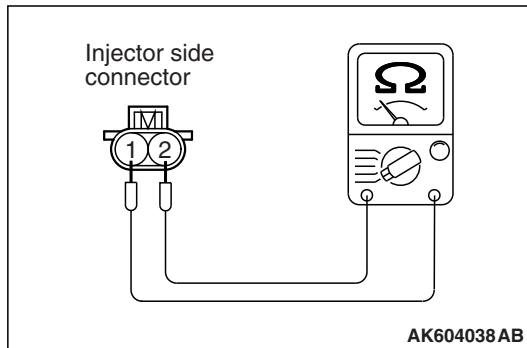
**NO :** Replace the heated oxygen sensor (front). Then go to Step 13.

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

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 7.

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

**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 13.

**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 13.

**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 13.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 10.

**NO :** Repair it. Then go to Step 13.

**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: Are the harness wires in good condition?**

**YES :** Go to Step 11.

**NO :** Repair them. Then go to Step 13.

---

**STEP 11. Check the fuel pressure.**

Refer to, Fuel Pressure Test [P.13B-997](#).

**Q: Is the fuel pressure normal?**

**YES** : Go to Step 12.

**NO** : Repair it. Then go to Step 13.

---

**STEP 12. Check the trouble symptoms.**

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

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

**Q: Is DTC P0134 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 13.

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

---

**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 12 [P.13B-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) Circuit No Activity Detected <Vehicles for California>**

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**Heated Oxygen Sensor (front) No Activity Detected Circuit**

- Refer to DTC P0131 –Heated Oxygen Sensor (front) Circuit Low Voltage <Vehicles for California> [P.13B-258](#).
- Refer to DTC P0201 –Injector Circuit-cylinder 1 [P.13B-395](#).
- Refer to DTC P0202 –Injector Circuit-cylinder 2 [P.13B-404](#).
- Refer to DTC P0203 –Injector Circuit-cylinder 3 [P.13B-413](#).
- Refer to DTC P0204 –Injector Circuit-cylinder 4 [P.13B-422](#).

**CIRCUIT OPERATION**

- Refer to DTC P0131 –Heated Oxygen Sensor (front) Circuit Low Voltage <Vehicles for California> [P.13B-258](#).

- Refer to DTC P0201 –Injector Circuit-cylinder 1 [P.13B-395](#).
- Refer to DTC P0202 –Injector Circuit-cylinder 2 [P.13B-404](#).
- Refer to DTC P0203 –Injector Circuit-cylinder 3 [P.13B-413](#).
- Refer to DTC P0204 –Injector Circuit-cylinder 4 [P.13B-422](#).

**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)**

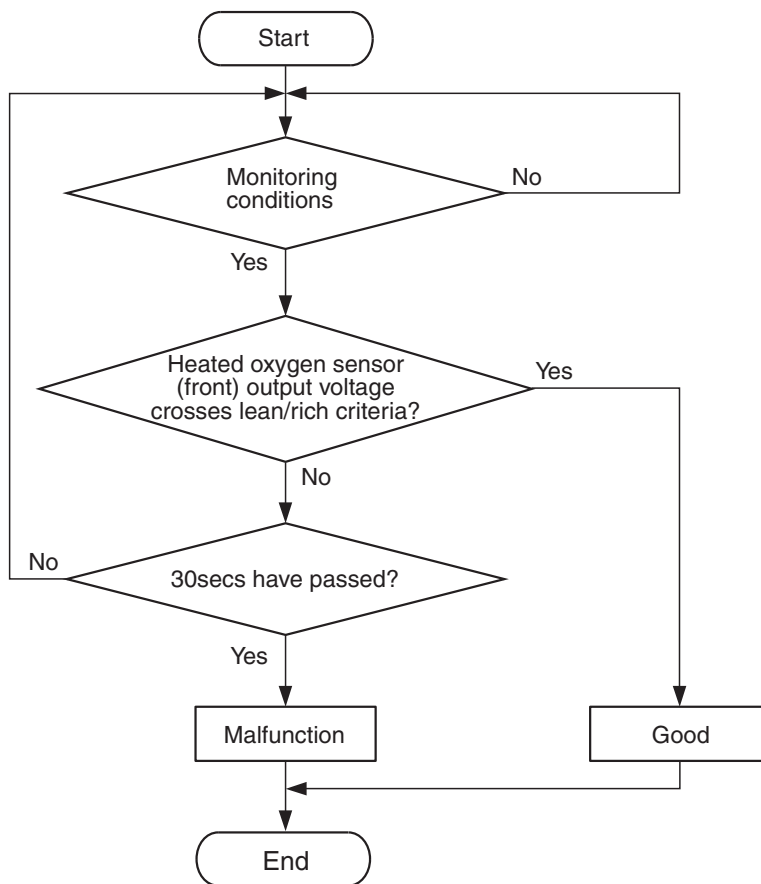
- Misfire monitor

**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 more than 0° C (32° F).

- Engine speed is more than 1,188 r/min.
- Volumetric efficiency is more than 30 percent.
- Throttle position sensor output voltage is less than 3.0 volts <M/T> or 3.8 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.

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 12 [P.13B-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).*

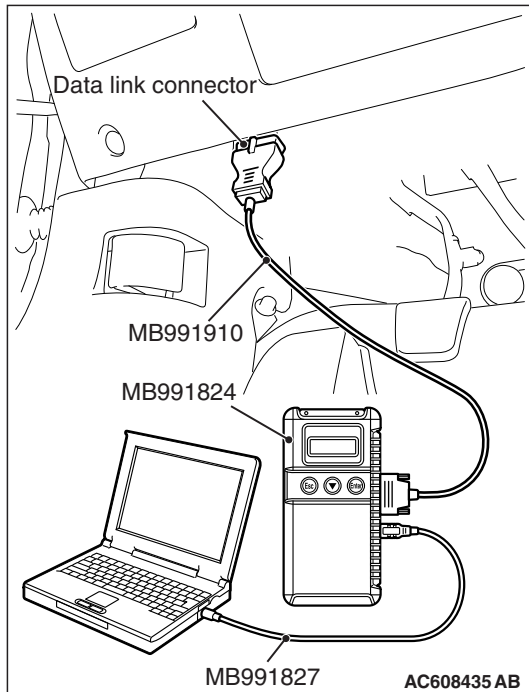
*If the heated oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the heated oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the heated oxygen sensor (front) output voltage decreases, without intersecting with 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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - The output voltage should be between 0.6 and 1.0 volt.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the sensor operating properly?**

**YES :** Go to Step 2.

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

[P.13B-308](#), DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage <Vehicles for California>

[P.13B-321](#), DTC P0139 –Heated Oxygen Sensor (rear) Circuit Slow Response <Vehicles for California>

[P.13B-331](#), DTC P0140 –Heated Oxygen Sensor (rear) Circuit No Activity Detected <Vehicles for California> [P.13B-340](#).

**STEP 2. Check for exhaust leak.**

**Q: Are there any abnormalities?**

**YES :** Repair it. Then go to Step 13.

**NO :** Go to Step 3.

**STEP 3. Check for intake system vacuum leak.**

**Q: Are there any abnormalities?**

**YES :** Repair it. Then go to Step 13.

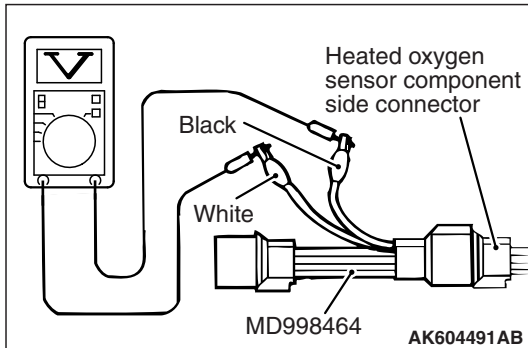
**NO :** Go to Step 4.

**STEP 4. Check harness connector B-05 at heated oxygen sensor (front) for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 5.

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



**STEP 5. Check the 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 2,000 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.

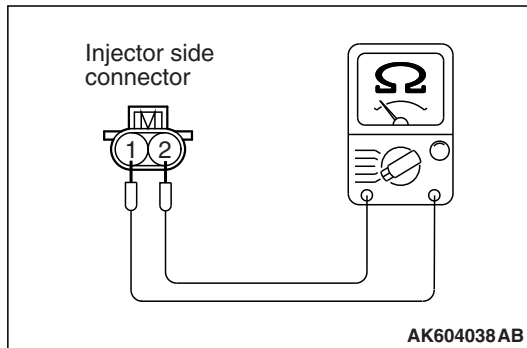
**NO :** Replace the heated oxygen sensor (front). Then go to Step 13.

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

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 7.

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

**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 13.

**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 13.

**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 13.

**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: Are the harness wires in good condition?**

**YES :** Go to Step 11.

**NO :** Repair them. Then go to Step 13.

---

**STEP 11. Check the fuel pressure.**

Refer to, Fuel Pressure Test [P.13B-997](#).

**Q: Is the fuel pressure normal?**

**YES** : Go to Step 12.

**NO** : Repair it. Then go to Step 13.

---

**STEP 12. Check the trouble symptoms.**

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

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

**Q: Is DTC P0134 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 13.

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

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**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 12 [P.13B-12](#).

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

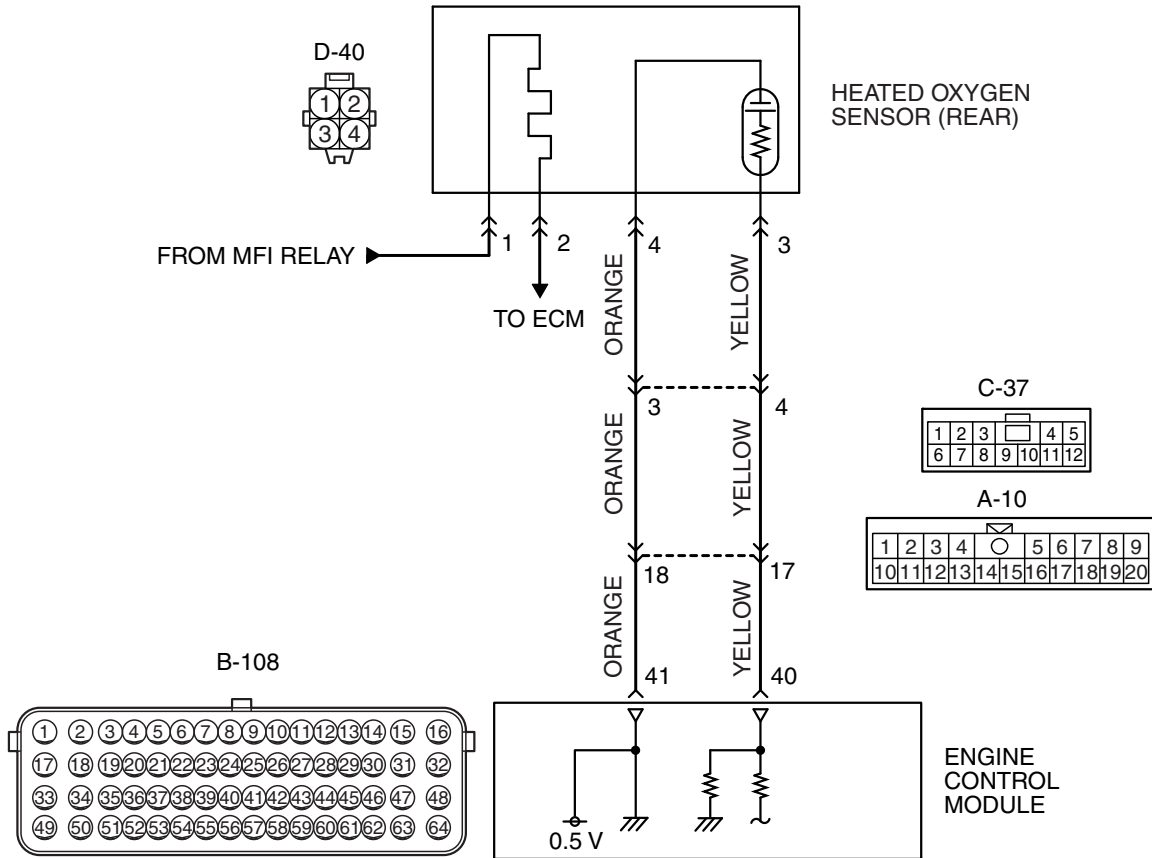
**Q: Is DTC P0134 set?**

**YES** : Retry the troubleshooting.

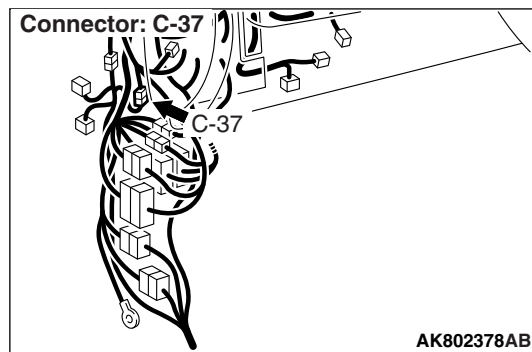
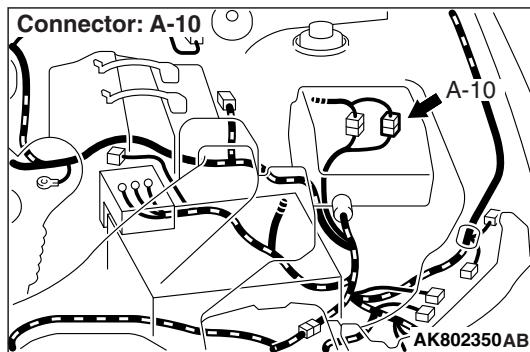
**NO** : The inspection is complete.

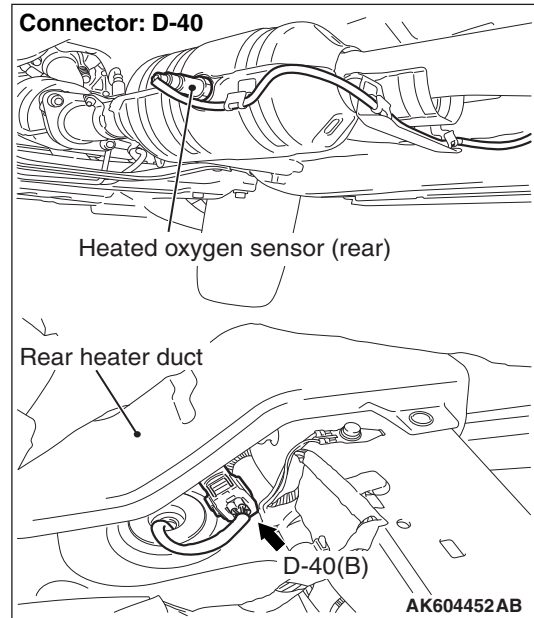
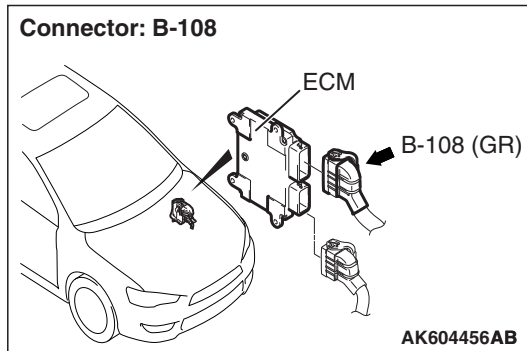
DTC P0137: Heated Oxygen Sensor (rear) Circuit Low Voltage <Except vehicles for California>

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



AK802011 AB





## 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

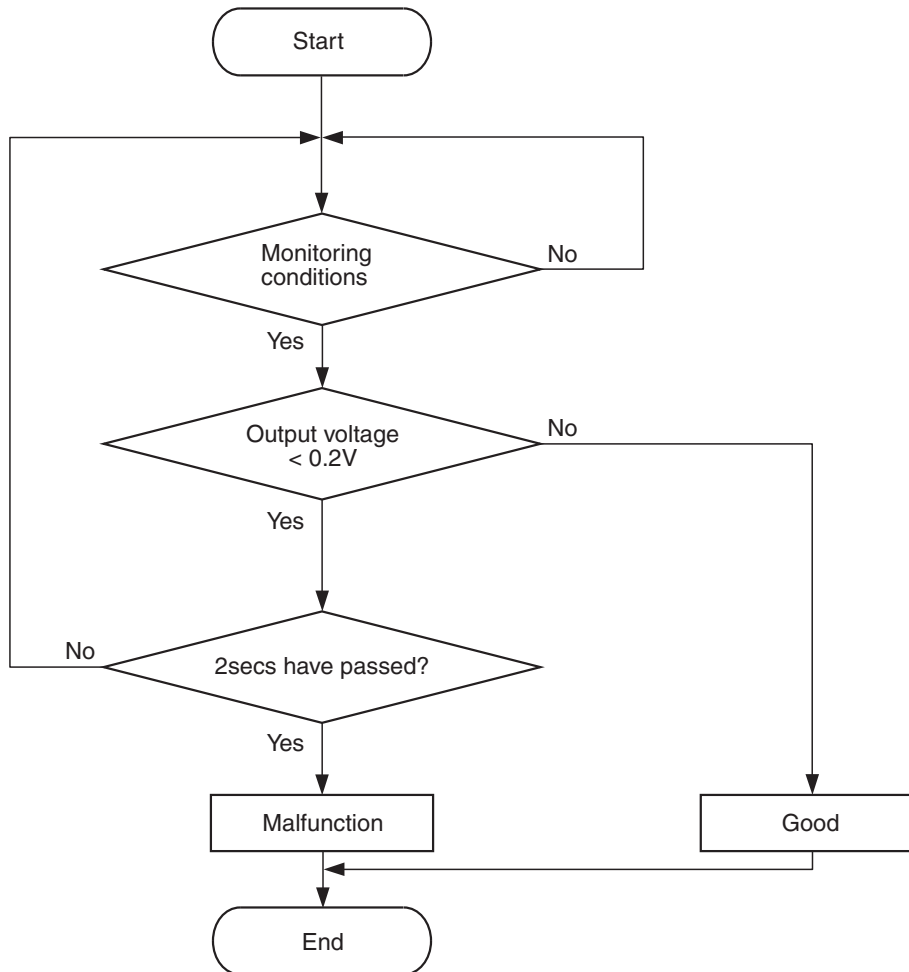
**Sensor (The sensor below is determined to be normal)**

- 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.
- More than 3 minutes have passed since the engine starting sequence was completed.

**Judgement Criterion**

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

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 22 [P.13B-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

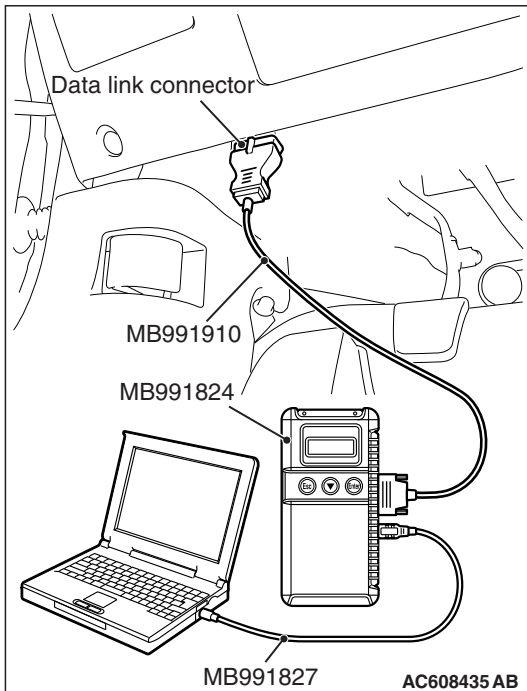
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13.

**NO** : Go to Step 2.



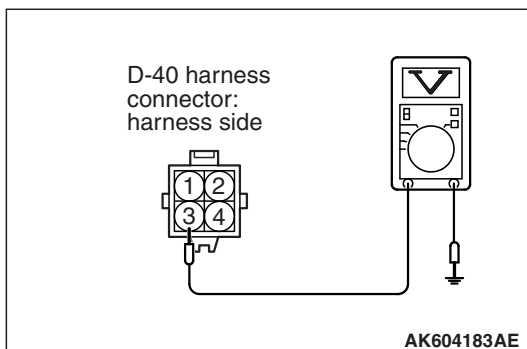
### STEP 2. Measure the sensor output voltage at heated oxygen sensor (rear) connector D-40 by backprobing.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - The output voltage should be between 1.1 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 6.



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

**Q: Is the harness connector in good condition?**

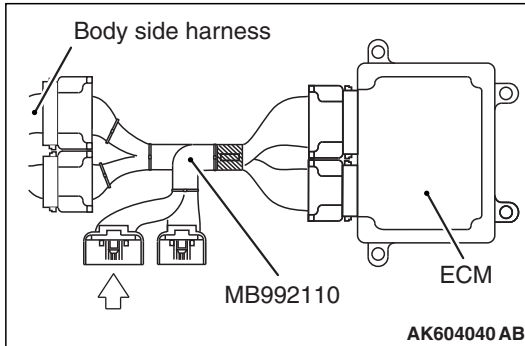
**YES :** Go to Step 4.

**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.

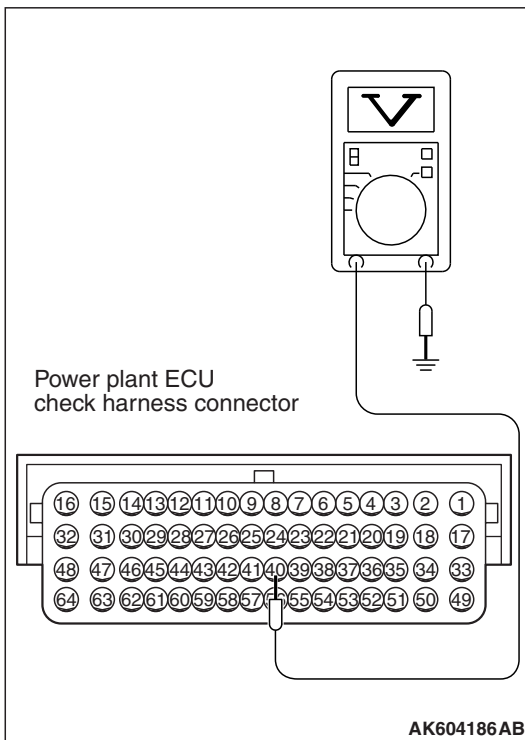
- a. Transaxle: 2nd speed
- b. Drive with wide open throttle
- c. Engine: 3,500 r/min or more
  - The output voltage should be between 1.1 and 1.5 volts.

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

**Q: Is the measured voltage between 1.1 and 1.5 volts?**

**YES :** Go to Step 13.

**NO :** Go to Step 5.



---

**STEP 5. 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 connectors for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connectors are 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 6. Check harness connector D-40 at heated oxygen sensor (rear) for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 7.

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

---

**STEP 7. Measure the sensor offset voltage at heated oxygen sensor (rear) harness side connector D-40.**

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

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

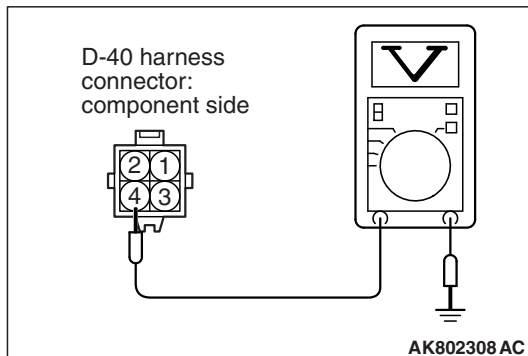
(3) Measure the voltage between terminal No. 4 and ground.  
• Voltage should be between 0.4 and 0.6 volt.

(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 9.

**NO :** Go to Step 8.



---

**STEP 8. Check harness connector B-108 at ECM for damage.**

**Q: Is the harness connector in good condition?**

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

*NOTE: Check harness after checking intermediate connectors A-10 and C-37. If intermediate connectors are damaged, repair or replace them. 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 11.

**NO :** Repair it. Then go to Step 14.

**STEP 11. Check for short circuit to ground 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 connectors A-10 and C-37. If intermediate connectors are damaged, repair or replace them. 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.

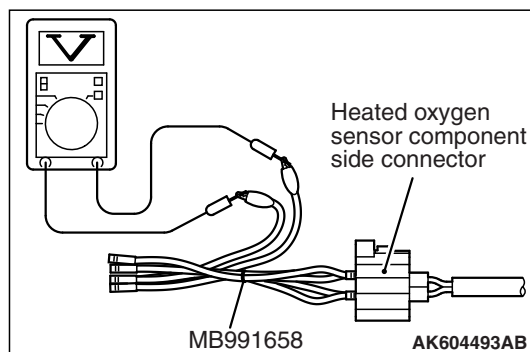
**NO :** Repair it. Then go to Step 14.

**STEP 12. Check 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
  - 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 :** Go to Step 13.

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

---

**STEP 13. Using scan tool MB991958, check data list item AD: Heated Oxygen Sensor (rear).**

(1) Start the engine and run at idle.

(2) Set scan tool MB991958 to the data reading mode for item AD, Heated Oxygen Sensor (rear).

a. Transaxle: 2nd speed

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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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.13B-12](#).

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

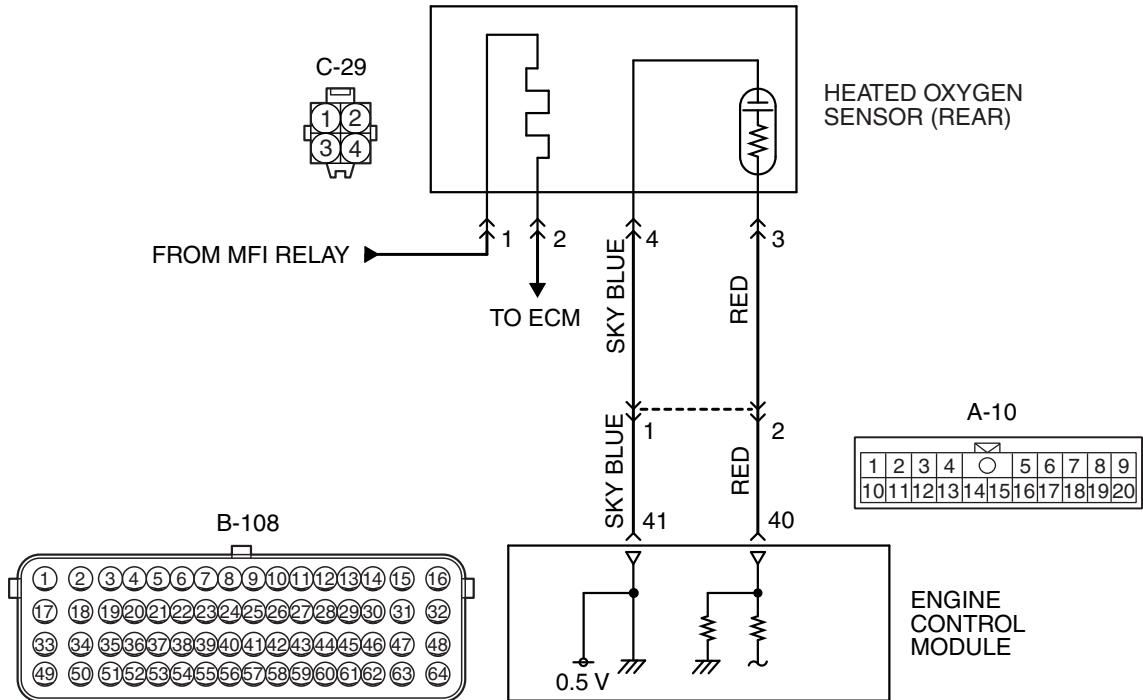
**Q: Is DTC P0137 set?**

**YES :** Retry the troubleshooting.

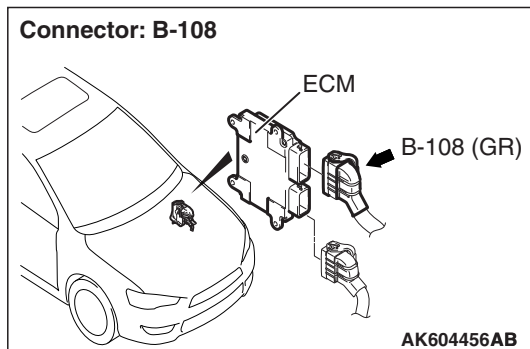
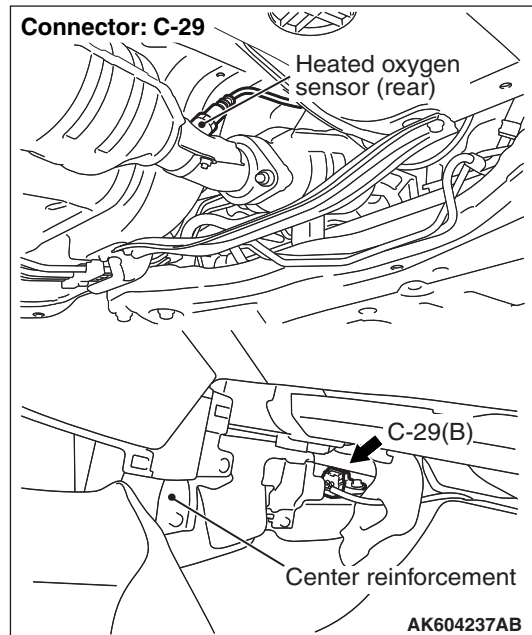
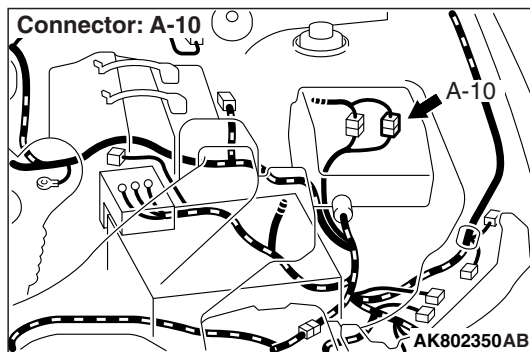
**NO :** The inspection is complete.

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

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



AK604239AG



## 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

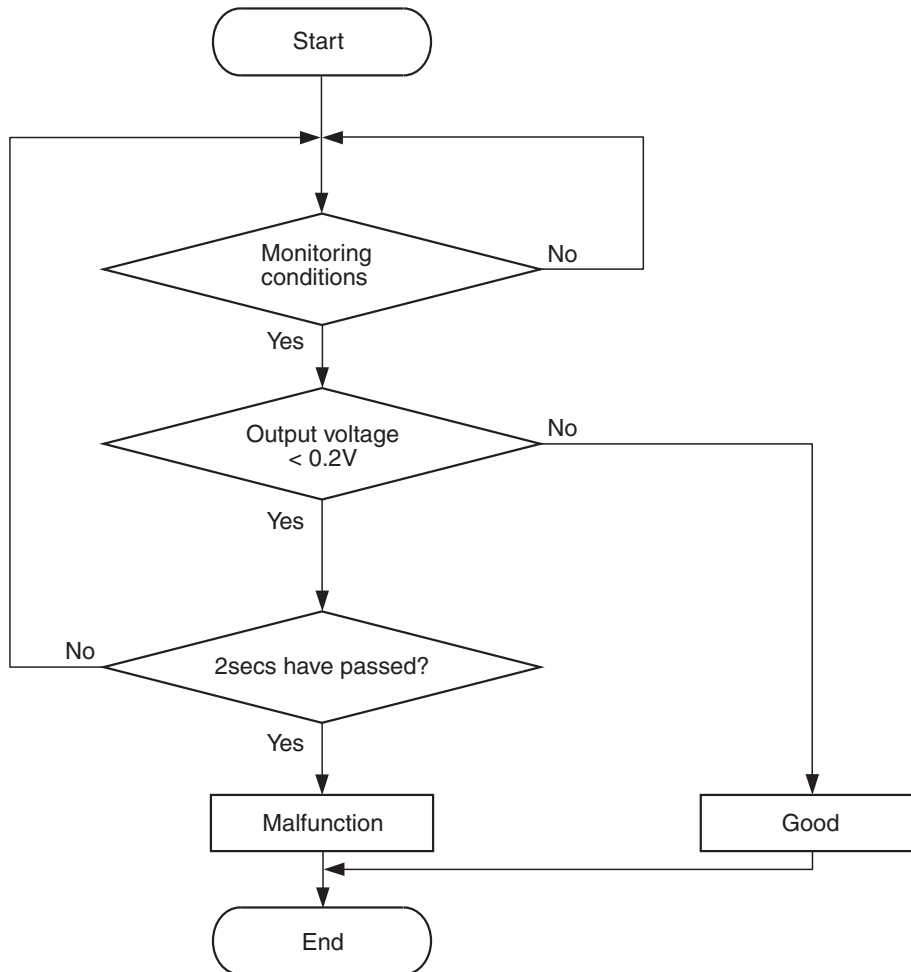
**Sensor (The sensor below is determined to be normal)**

- 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.
- More than 3 minutes have passed since the engine starting sequence was completed.

**Judgement Criterion**

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

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 22 [P.13B-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**

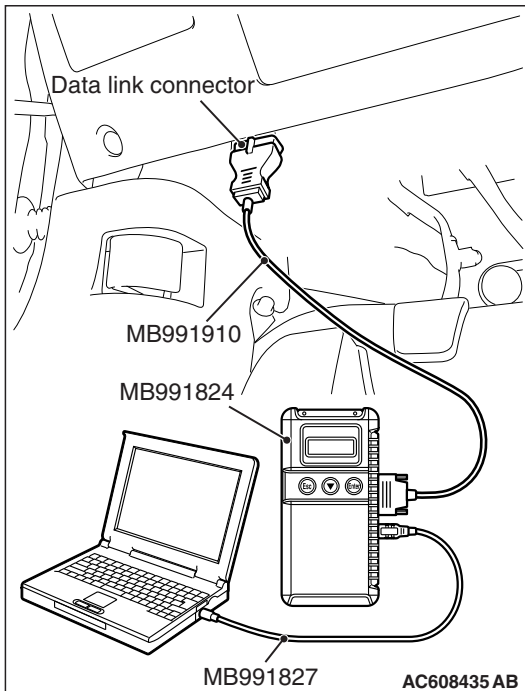
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13.

**NO** : Go to Step 2.



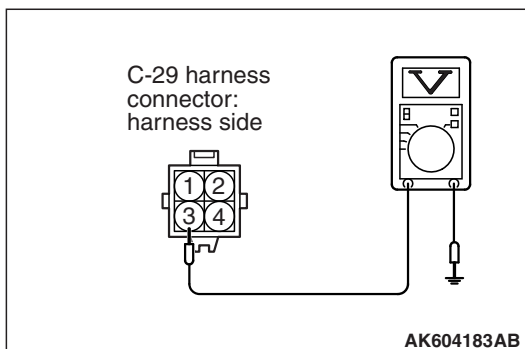
### STEP 2. Measure the sensor output voltage at heated oxygen sensor (rear) connector C-29 by backprobing.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - The output voltage should be between 1.1 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 6.



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

**Q: Is the harness connector in good condition?**

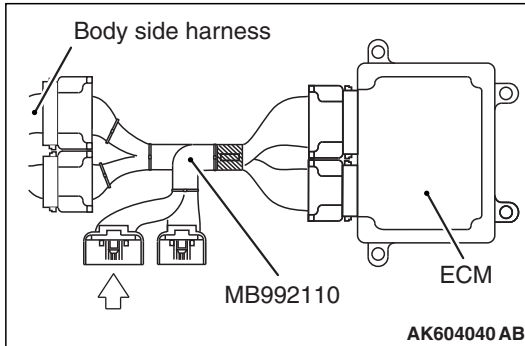
**YES :** Go to Step 4.

**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

b. Drive with wide open throttle

c. Engine: 3,500 r/min or more

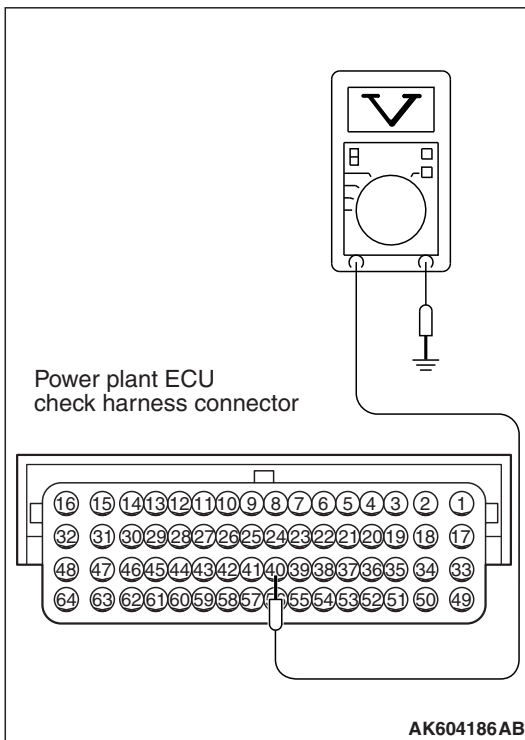
- The output voltage should be between 1.1 and 1.5 volts.

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

**Q: Is the measured voltage between 1.1 and 1.5 volts?**

**YES :** Go to Step 13.

**NO :** Go to Step 5.



---

**STEP 5. 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 6. Check harness connector C-29 at heated oxygen sensor (rear) for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 7.

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

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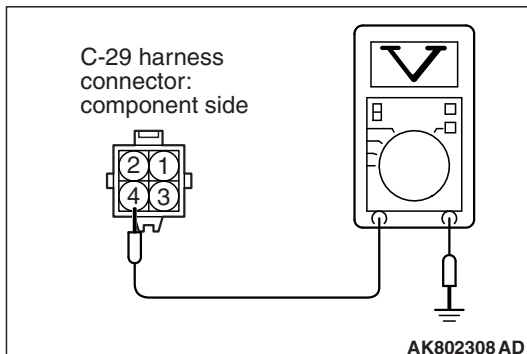
**STEP 7. Measure the sensor offset voltage at heated oxygen sensor (rear) harness side connector C-29.**

- (1) Disconnect the connector C-29 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 4 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 9.

**NO :** Go to Step 8.



---

**STEP 8. Check harness connector B-108 at ECM 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. 4) and ECM connector B-108 (terminal No. 41) because of open circuit. 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 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 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 11.

**NO :** Repair it. Then go to Step 14.

**STEP 11. Check for short circuit to ground 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 12.

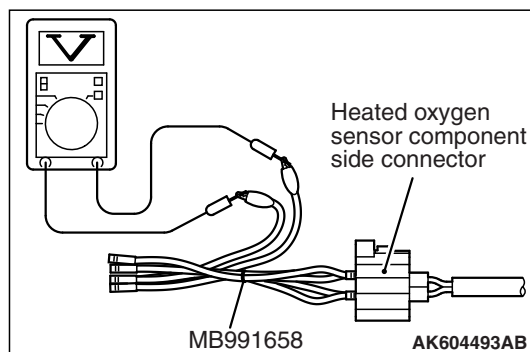
**NO :** Repair it. Then go to Step 14.

**STEP 12. 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
  - 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 :** Go to Step 13.

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

---

**STEP 13. Using scan tool MB991958, check data list item AD: Heated Oxygen Sensor (rear).**

(1) Start the engine and run at idle.

(2) Set scan tool MB991958 to the data reading mode for item AD, Heated Oxygen Sensor (rear).

a. Transaxle: 2nd speed

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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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.13B-12](#).

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

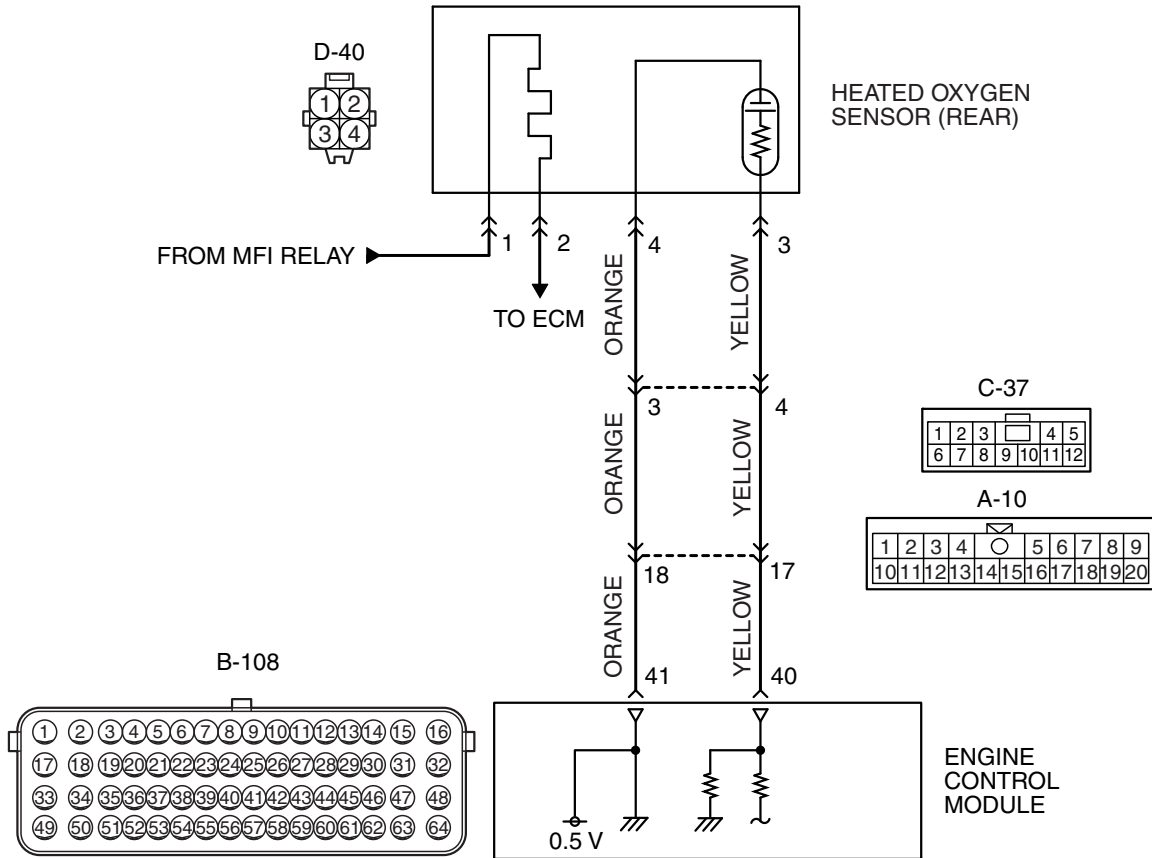
**Q: Is DTC P0137 set?**

**YES :** Retry the troubleshooting.

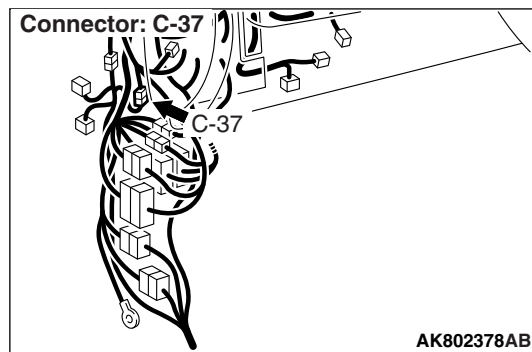
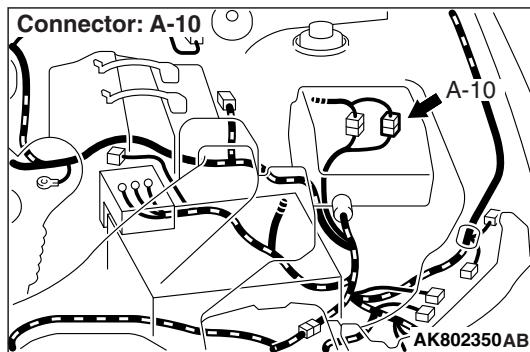
**NO :** The inspection is complete.

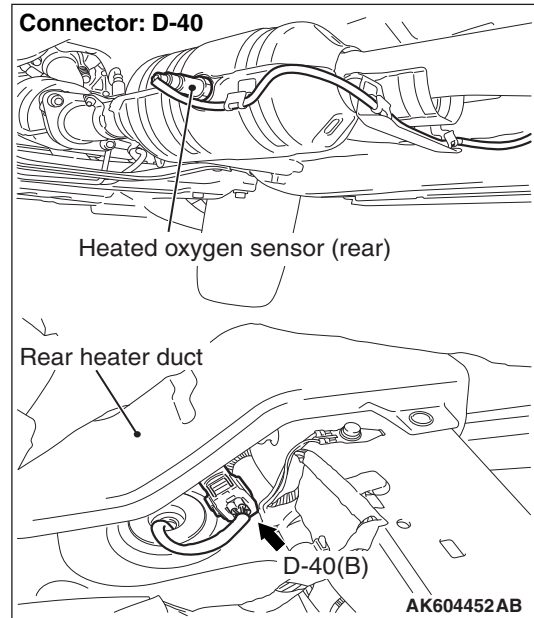
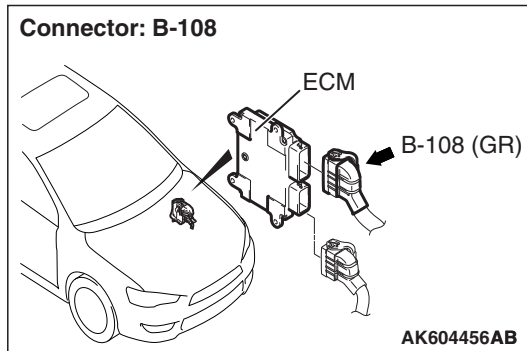
DTC P0138: Heated Oxygen Sensor (rear) Circuit High Voltage <Except vehicles for California>

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



AK802011 AB





## 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

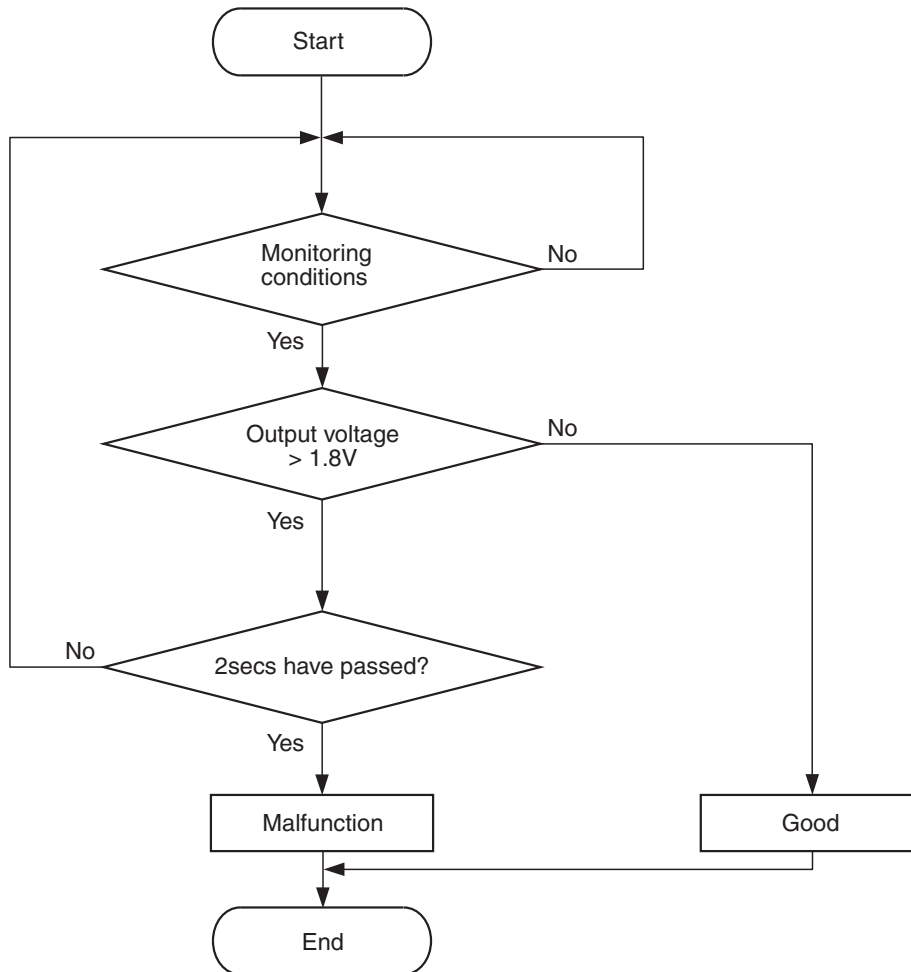
**Sensor (The sensor below is determined to be normal)**

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



DTC SET CONDITIONS

Logic Flow Chart



AK604322

**Check Conditions**

- More than 2 seconds 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 is more than 1.8 volts for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13B-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

### Required Special Tool:

- 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**

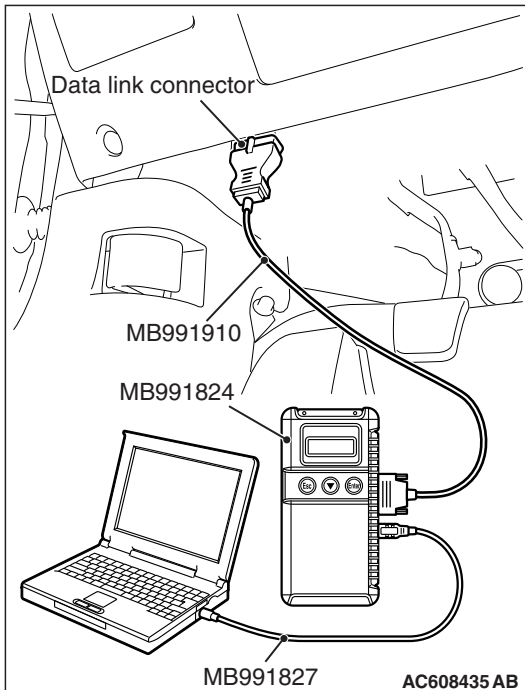
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13](#).

**NO :** Go to Step 2.



**STEP 2. Check harness connector D-40 at heated oxygen sensor (rear) and harness connector B-108 at ECM for damage.**

### **Q: Are the harness connectors in good condition?**

**YES :** Go to Step 3.

**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

**STEP 3. 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 connectors A-10 and C-37. If intermediate connectors are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.*

### **Q: Is the harness wire in good condition?**

**YES :** Go to Step 4.

**NO :** Repair it. Then go to Step 5.

**STEP 4. Using scan tool MB991958, check data list item****AD: Heated Oxygen Sensor (rear).**

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item AD, Heated Oxygen Sensor (rear).
  - a. Transaxle: 2nd speed
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - The output voltages 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.00-13](#).
- NO** : Replace the ECM (Refer to Removal and Installation [P.13B-1022](#)). Then go to Step 5.

---

**STEP 5. Test the OBD-II drive cycle.**

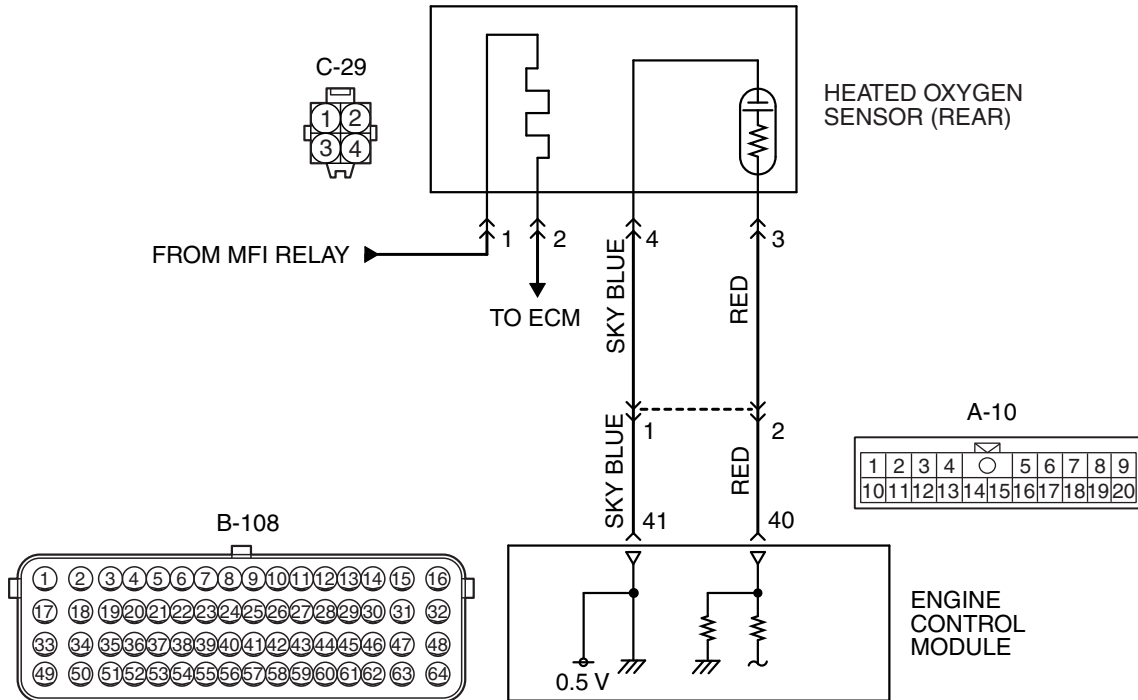
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0138 set?**

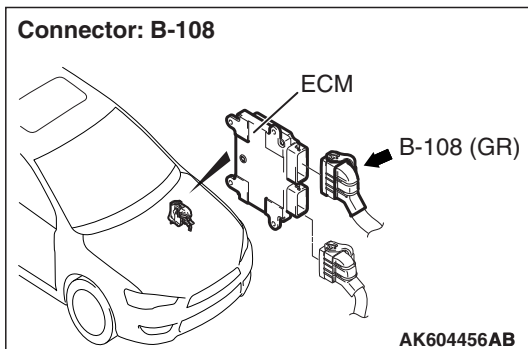
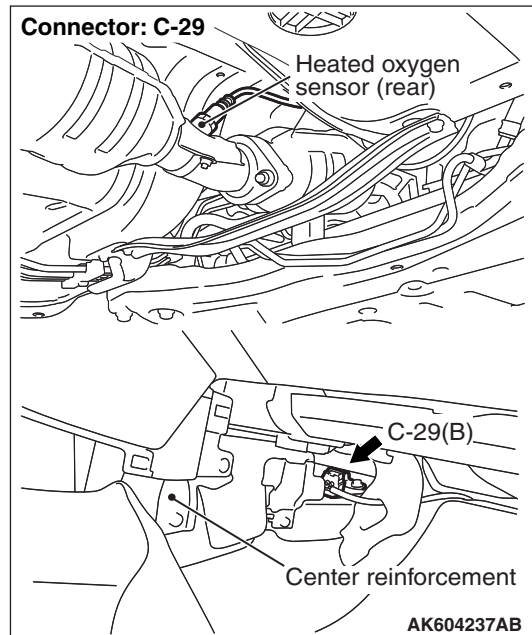
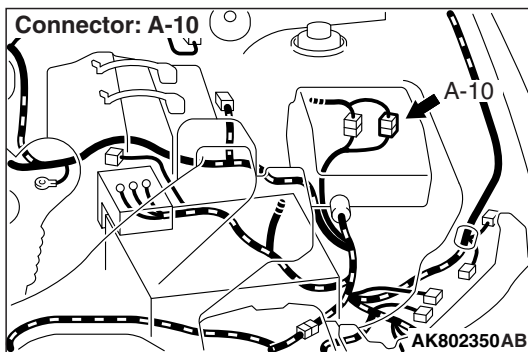
- YES** : Retry the troubleshooting.
- NO** : The inspection is complete.

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

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



AK604239AG



**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)**

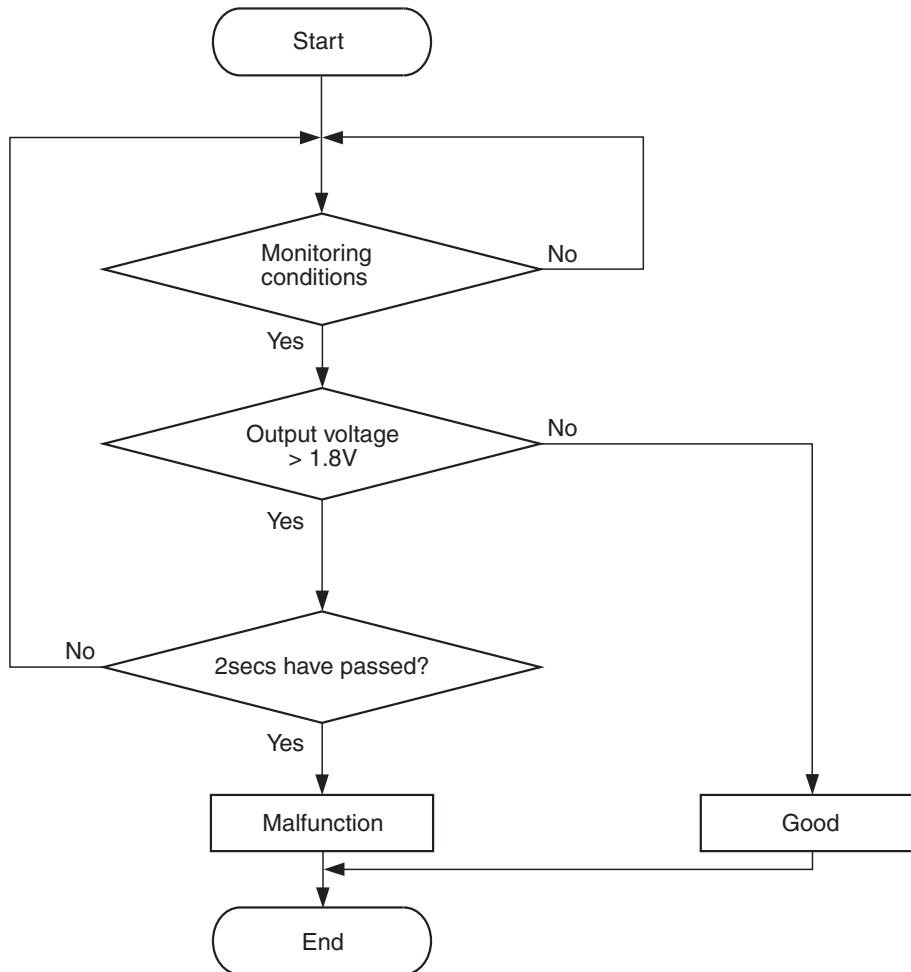
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

**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

- More than 2 seconds 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 is more than 1.8 volts for 2 seconds.

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13B-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

### Required Special Tool:

- 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**

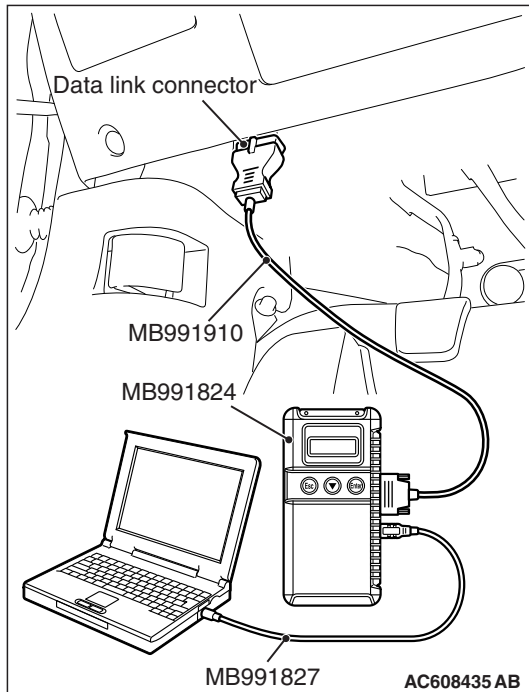
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13](#).

**NO :** Go to Step 2.



**STEP 2. Check harness connector C-29 at heated oxygen sensor (rear) and harness connector B-108 at ECM for damage.**

### **Q: Are the harness connectors in good condition?**

**YES :** Go to Step 3.

**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

**STEP 3. 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 5.*

### **Q: Is the harness wire in good condition?**

**YES :** Go to Step 4.

**NO :** Repair it. Then go to Step 5.

---

**STEP 4. Using scan tool MB991958, check data list item AD: Heated Oxygen Sensor (rear).**

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item AD, Heated Oxygen Sensor (rear).
  - a. Transaxle: 2nd speed
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - The output voltages 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.00-13](#).
- NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

---

**STEP 5. Test the OBD-II drive cycle.**

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

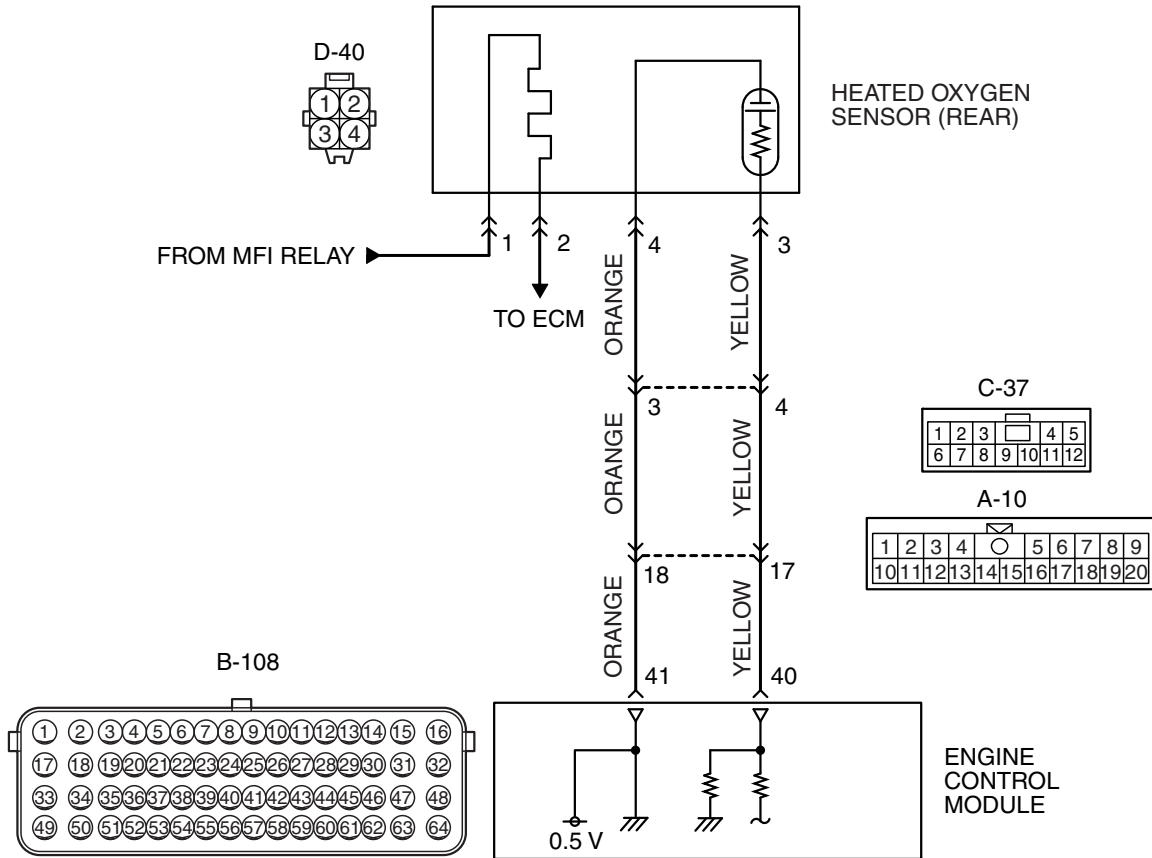
**Q: Is DTC P0138 set?**

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

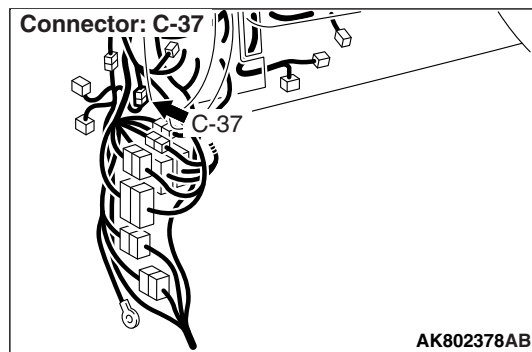
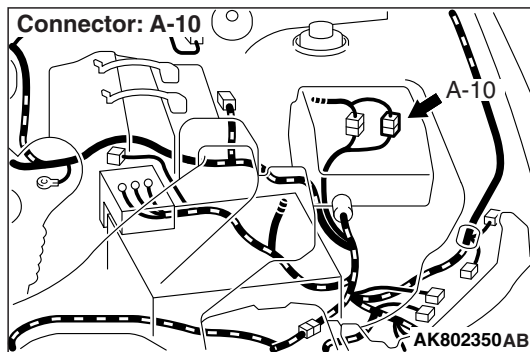


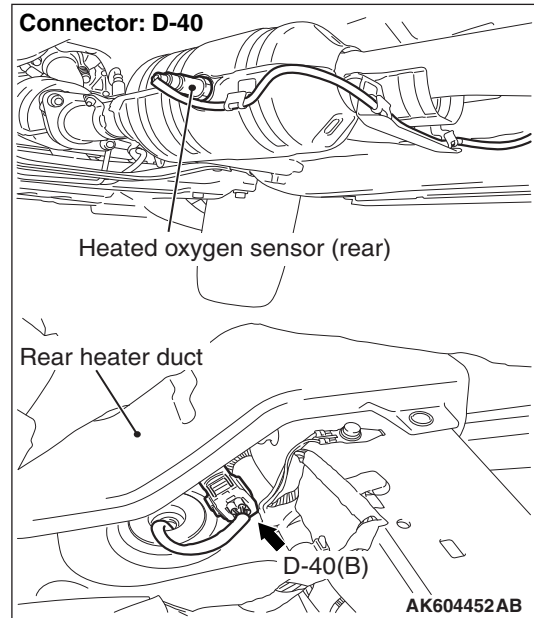
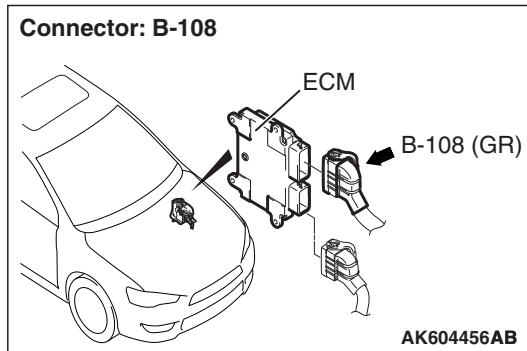
DTC P0139: Heated Oxygen Sensor (rear) Circuit Slow Response <Except vehicles for California>

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



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## 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)**

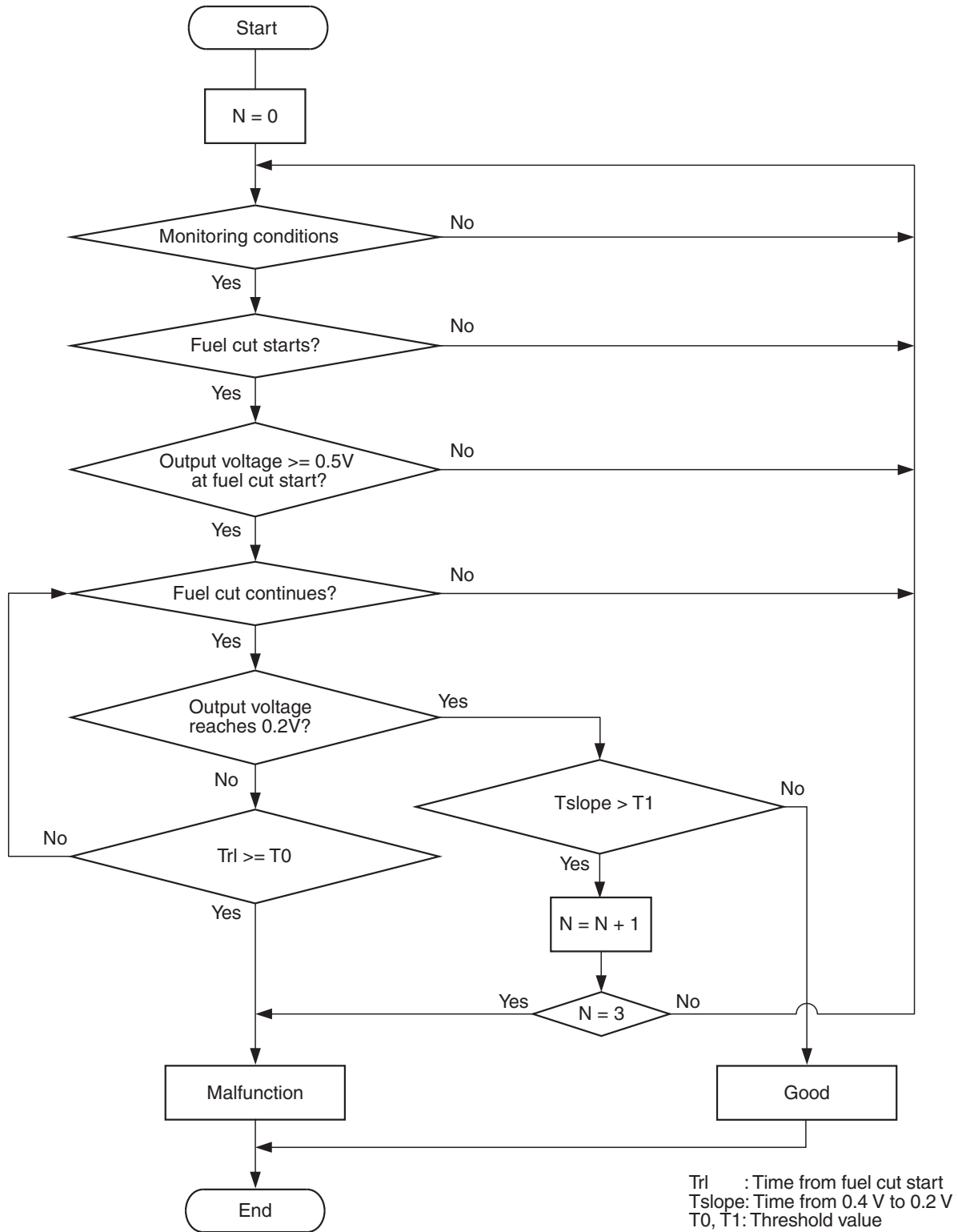
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

**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 more than 76° C (169° F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is more than 1,638 g <M/T> or 1,741 g <CVT>.
- Fuel is being shut off.
- Heated oxygen sensor (rear) output voltage is more 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 <M/T> or 1,741 g <CVT>.
- 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.*

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 11 [P.13B-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 Tool:**

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

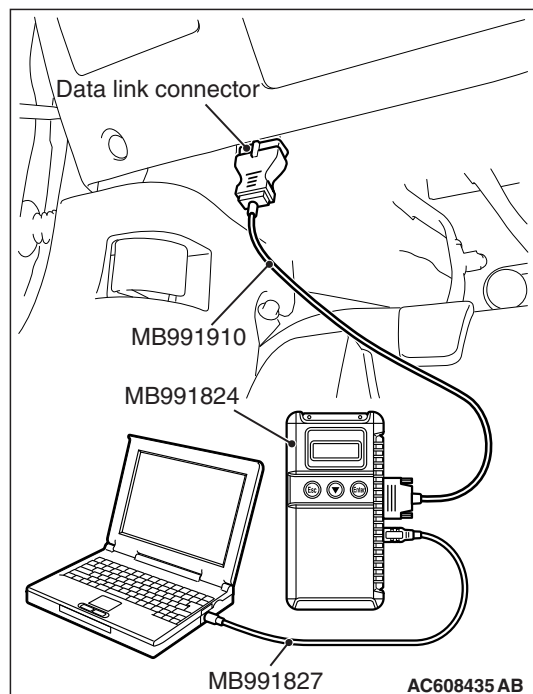
**STEP 1. Using scan tool MB991958, check data list item AD: Heated Oxygen Sensor (rear).****⚠ CAUTION**

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.00-13](#).
- NO** : Replace the heated oxygen sensor (rear). Then go to Step 2.

**STEP 2. Test the OBD-II drive cycle.**

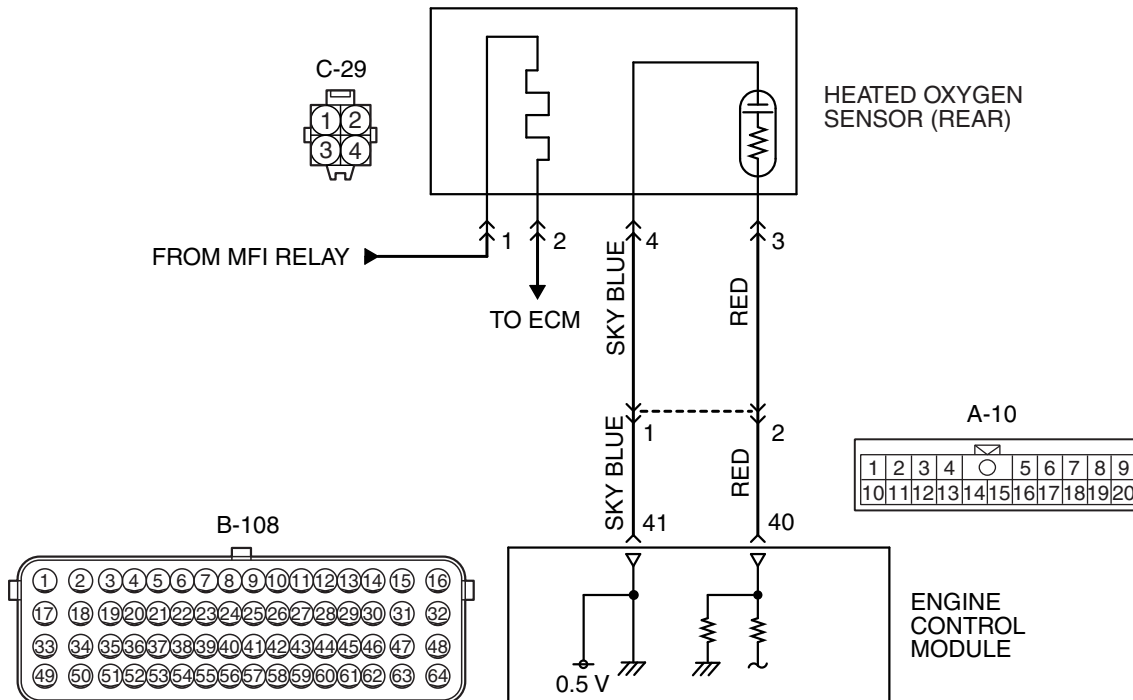
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 11 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0139 set?**

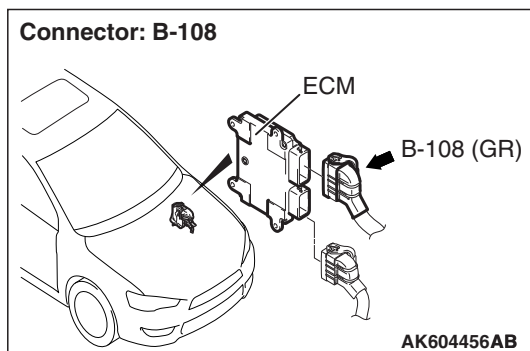
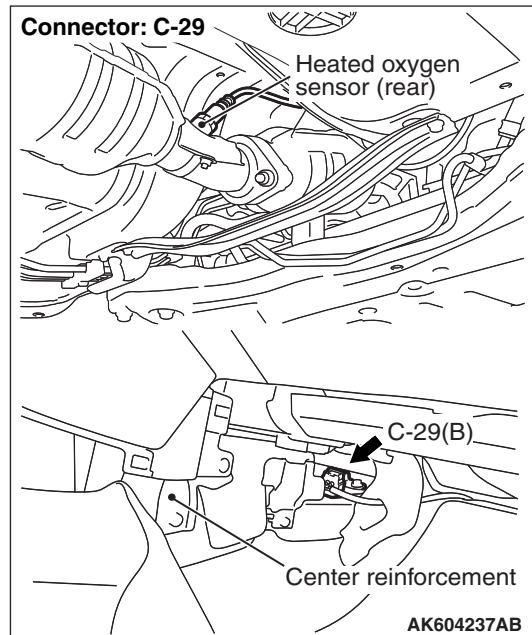
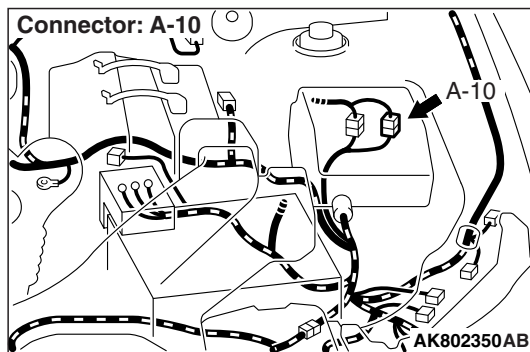
- YES** : Refer to DTC P0137 –Heated Oxygen Sensor (rear) Circuit Low Voltage <Except vehicles for California> [P.13B-300](#), DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage <Except vehicles for California> [P.13B-316](#).
- NO** : The inspection is complete.

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

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



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**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)**

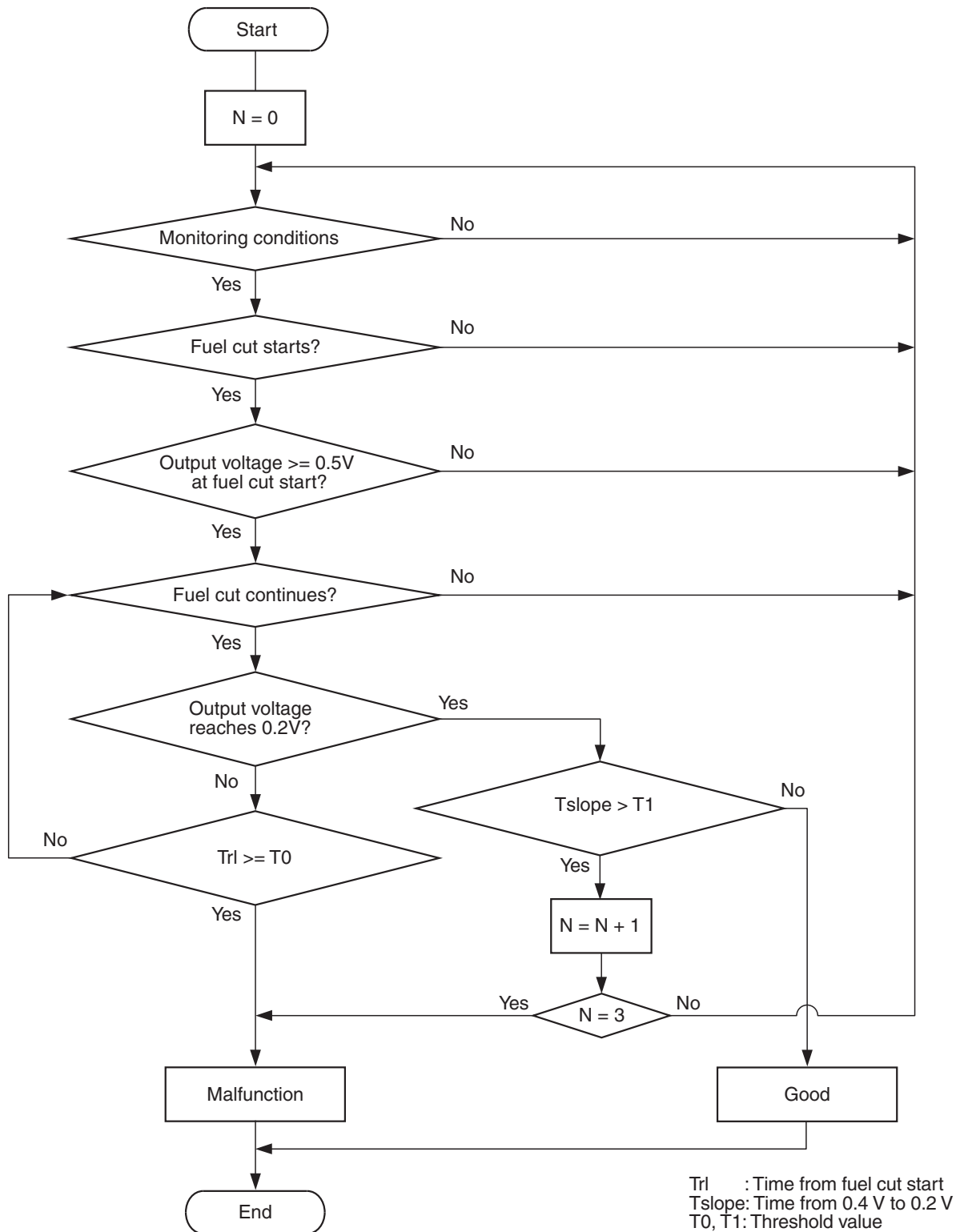
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

**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 more than 76° C (169° F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is more than 1,638 g <M/T> or 1,741 g <CVT>.
- Fuel is being shut off.
- Heated oxygen sensor (rear) output voltage is more 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 <M/T> or 1,741 g <CVT>.
- 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.*

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

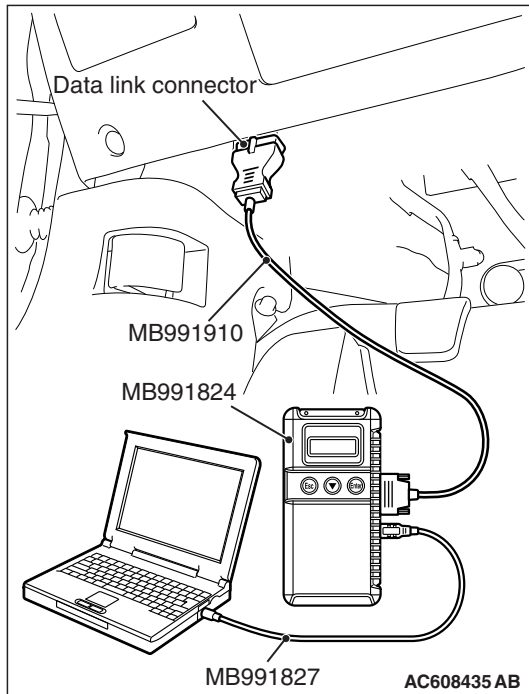
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 11 [P.13B-12](#).

**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 Tool:**

- 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.00-13](#).
- NO :** Replace the heated oxygen sensor (rear). Then go to Step 2.

**STEP 2. Test the OBD-II drive cycle.**

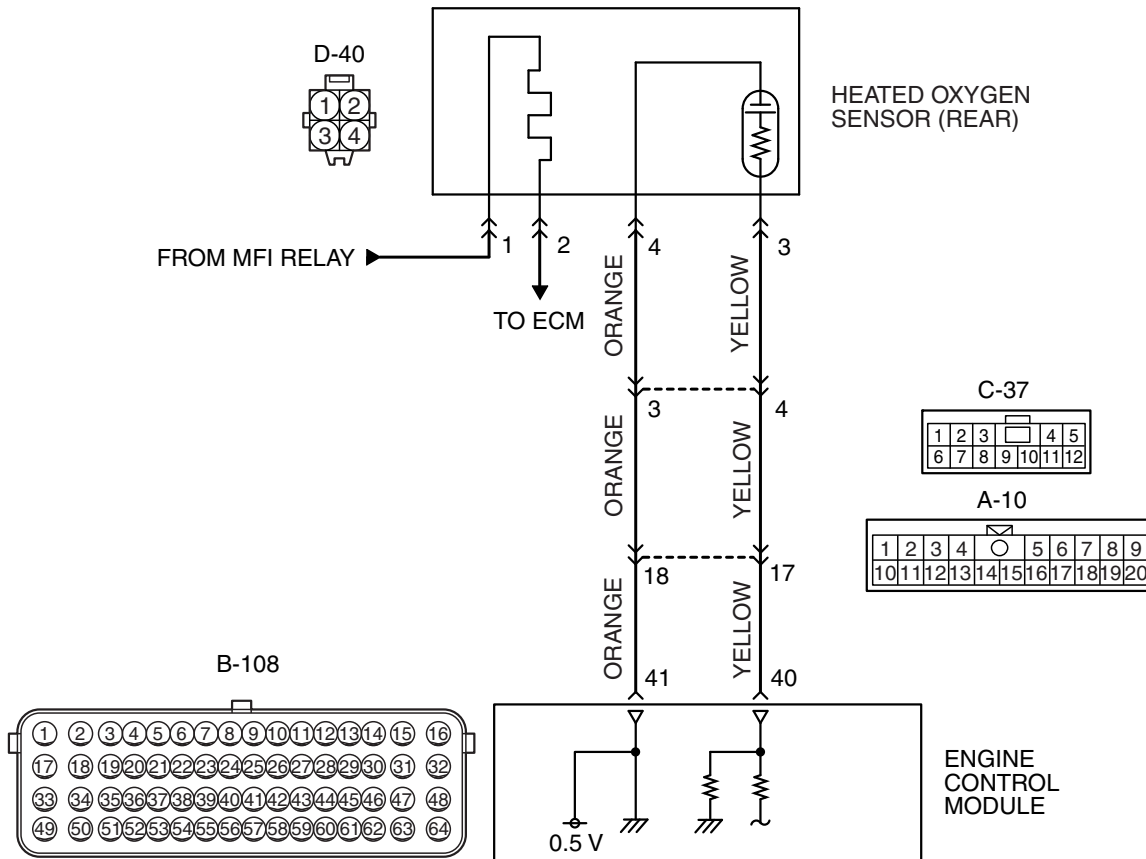
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 11 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0139 set?**

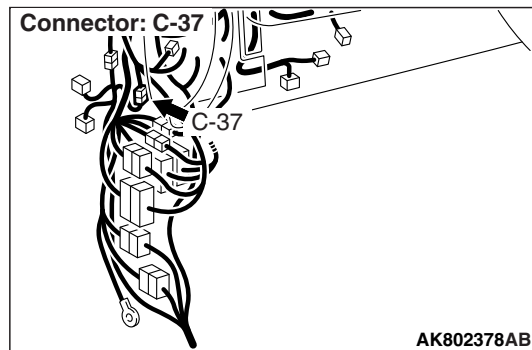
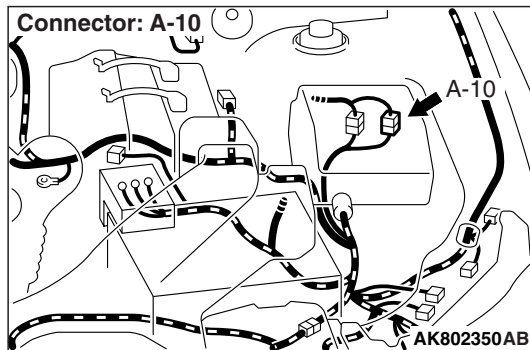
- YES :** Refer to DTC P0137 –Heated Oxygen Sensor (rear) Circuit Low Voltage <Vehicles for California> [P.13B-308](#), DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage <Vehicles for California> [P.13B-321](#).
- NO :** The inspection is complete.

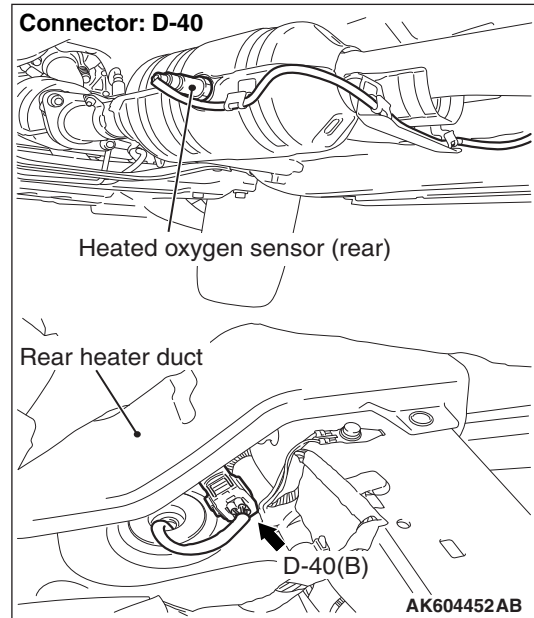
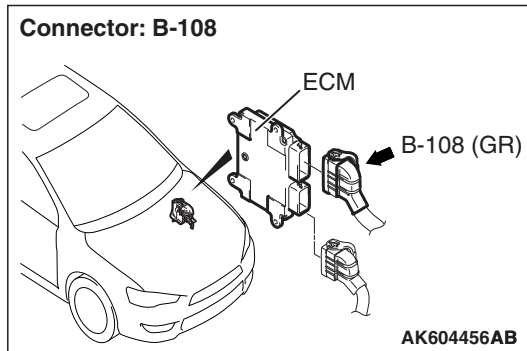
DTC P0140: Heated Oxygen Sensor (rear) Circuit No Activity Detected <Except vehicles for California>

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



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## 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)**

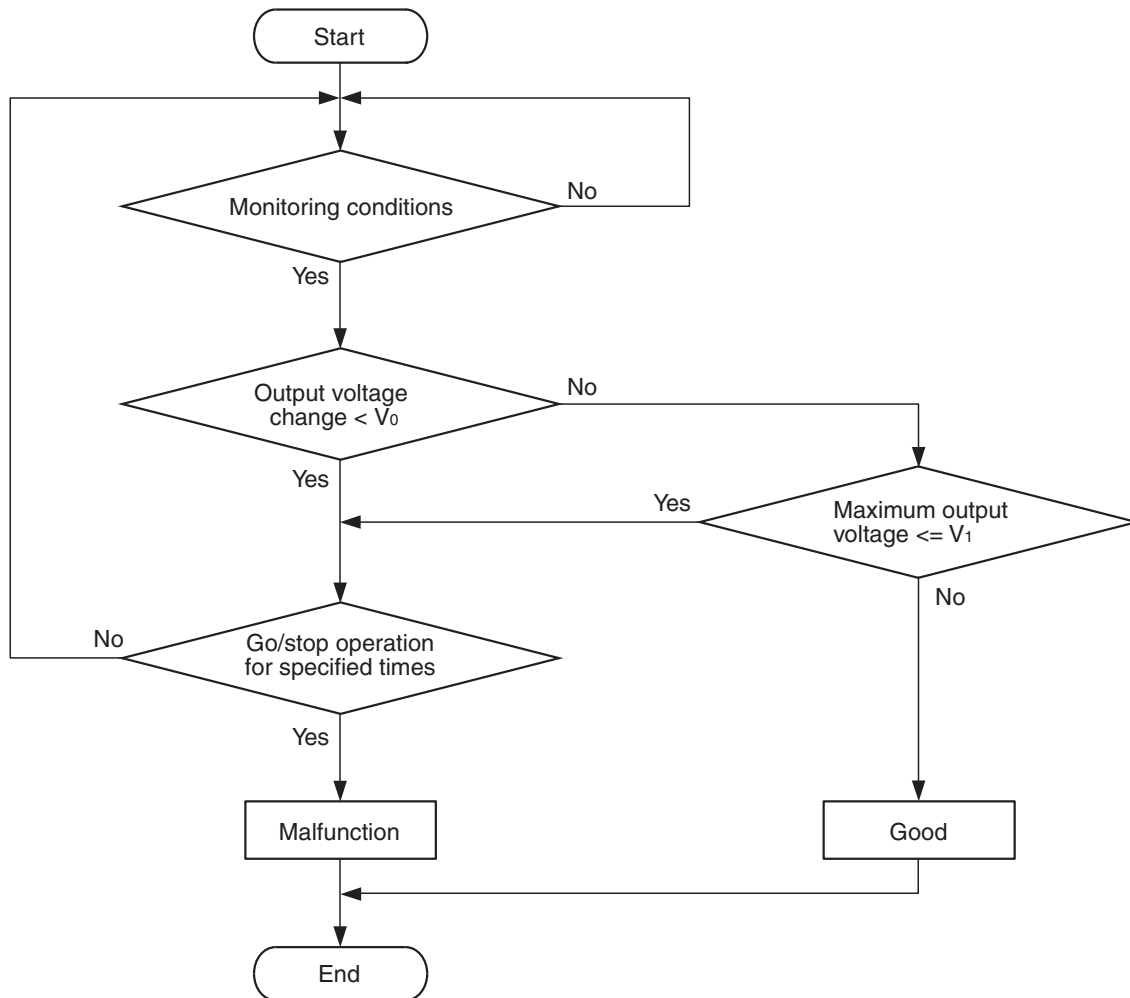
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

**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



$V_0$ ,  $V_1$ : Threshold valve

\*: See DTC SET CONDITIONS-Judgment Criterion

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### Check Conditions

- Engine coolant temperature is more than 76° C (169° F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is more than 1,638 g <M/T> or 1,741 g <CVT>.
- Repeat 1 time or more: drive<sup>\*1</sup>, stop<sup>\*2</sup>.

Drive<sup>\*1</sup>:

- Engine speed is more than 1,500 r/min.

Stop<sup>\*2</sup>:

- Volumetric efficiency is more than 40 percent.
- Vehicle speed is more than 30 km/h (19 mph).
- A total of more than 60 seconds have passed with the above mentioned conditions, and more than 3 seconds have passed with the fuel shut off.
- Vehicle speed is less than 1.5 km/h (1 mph).

### Judgement Criterion

- Change in the output voltage of the heated oxygen sensor (rear) is less 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.*

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 13 [P.13B-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 Tool:

- 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**

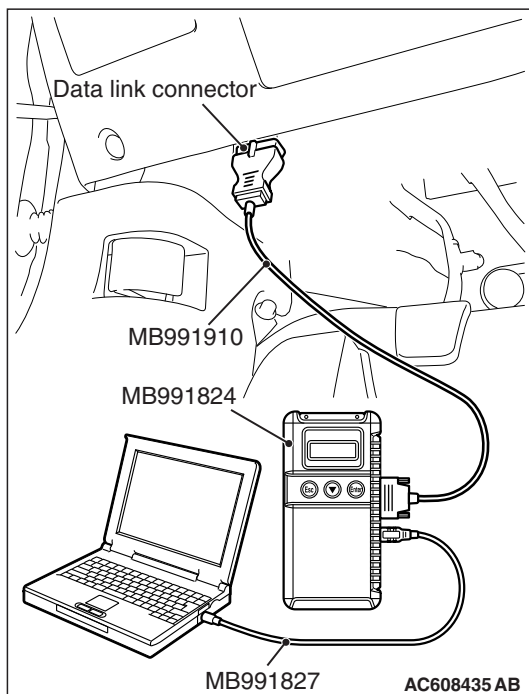
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13](#).

**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.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

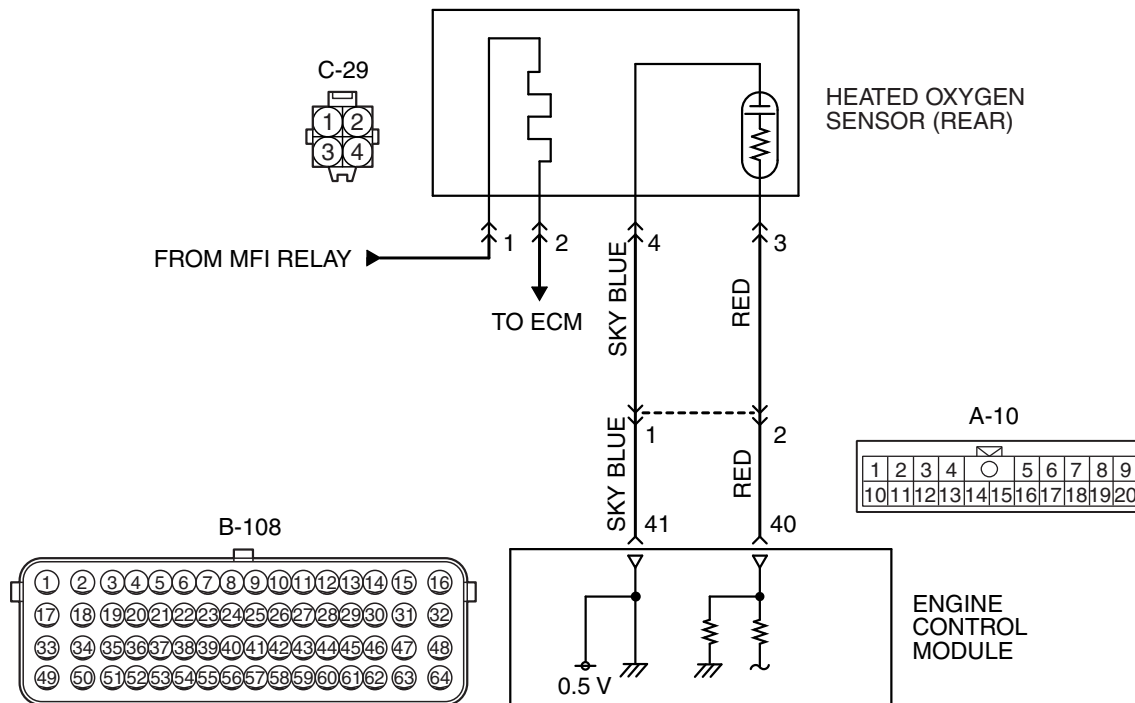
**Q: Is DTC P0140 set?**

**YES :** Refer to DTC P0137 –Heated Oxygen Sensor (rear) Circuit Low Voltage <Except vehicles for California> [P.13B-300](#), DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage <Except vehicles for California> [P.13B-321](#).

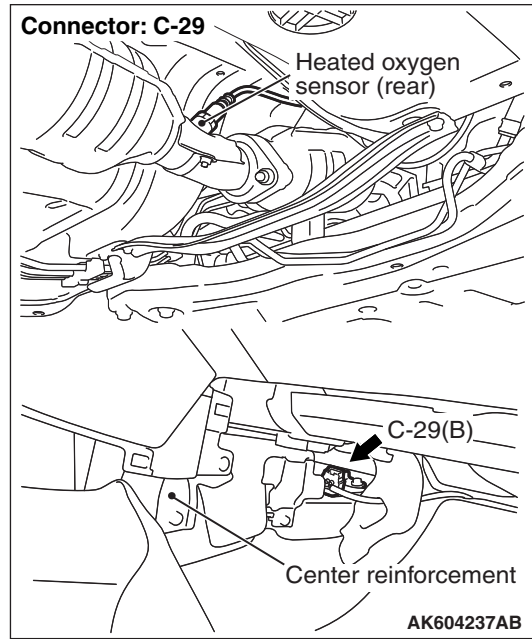
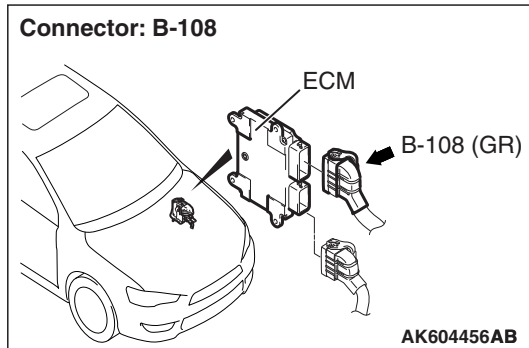
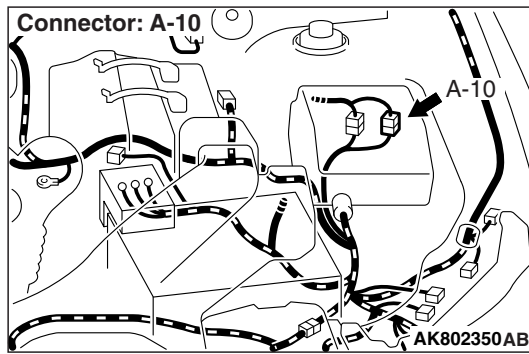
**NO :** The inspection is complete.

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

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



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## 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

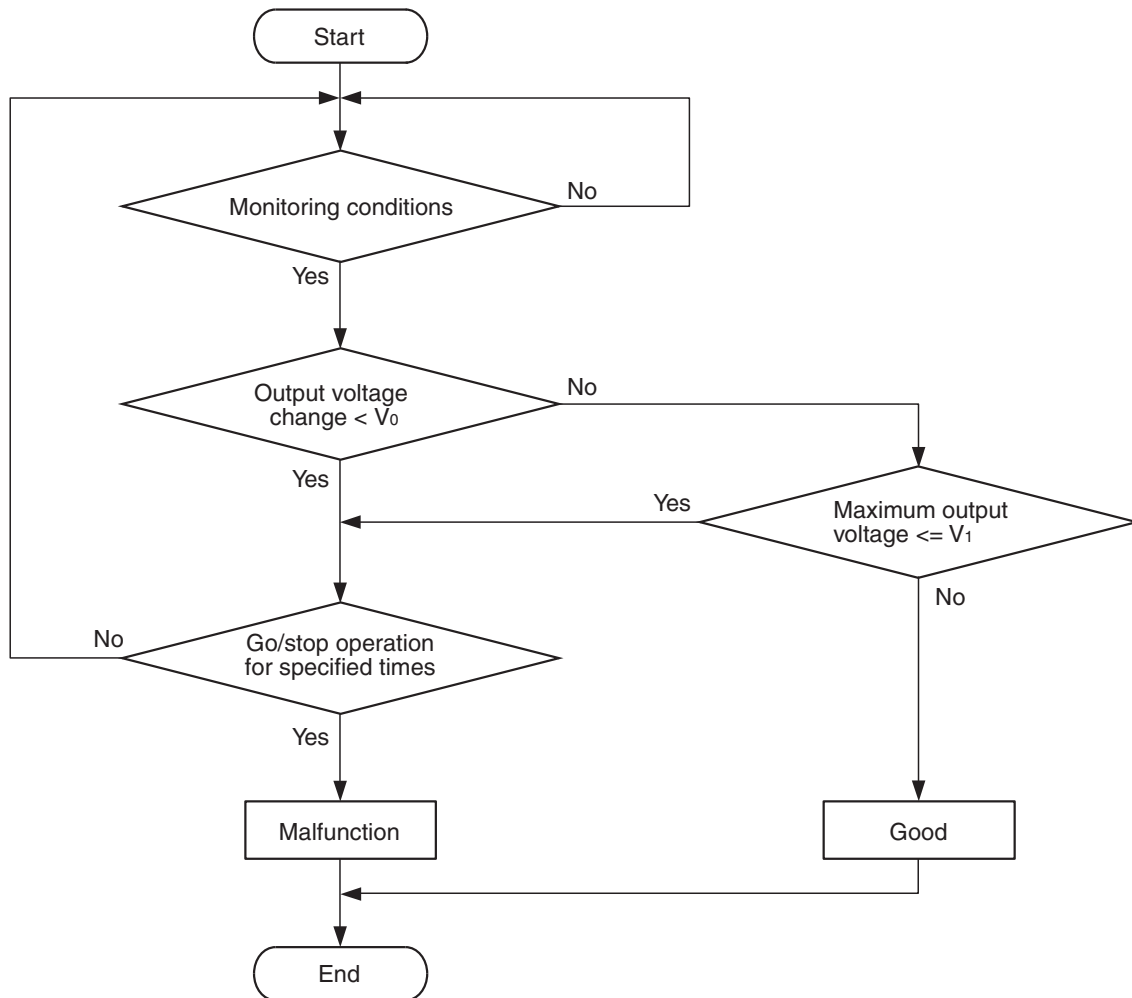
**Sensor (The sensor below is determined to be normal)**

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



DTC SET CONDITIONS

Logic Flow Chart



V<sub>0</sub>, V<sub>1</sub>: Threshold valve

\*: See DTC SET CONDITIONS-Judgment Criterion

AK800872

**Check Conditions**

- Engine coolant temperature is more than 76° C (169° F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is more than 1,638 g <M/T> or 1,741 g <CVT>.
- Repeat 1 time or more: drive<sup>\*1</sup>, stop<sup>\*2</sup>.

Drive<sup>\*1</sup>:

- Engine speed is more than 1,500 r/min.

Stop<sup>\*2</sup>:

- Volumetric efficiency is more than 40 percent.
- Vehicle speed is more than 30 km/h (19 mph).
- A total of more than 60 seconds have passed with the above mentioned conditions, and more than 3 seconds have passed with the fuel shut off.
- Vehicle speed is less than 1.5 km/h (1 mph).

### Judgement Criterion

- Change in the output voltage of the heated oxygen sensor (rear) is less 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.*

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 13 [P.13B-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 Tool:

- 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**

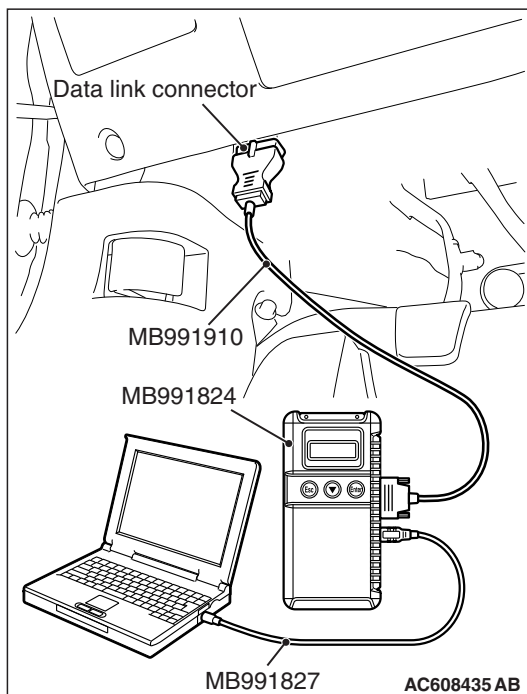
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13](#).

**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.13B-12.
- (2) Check the diagnostic trouble code (DTC).

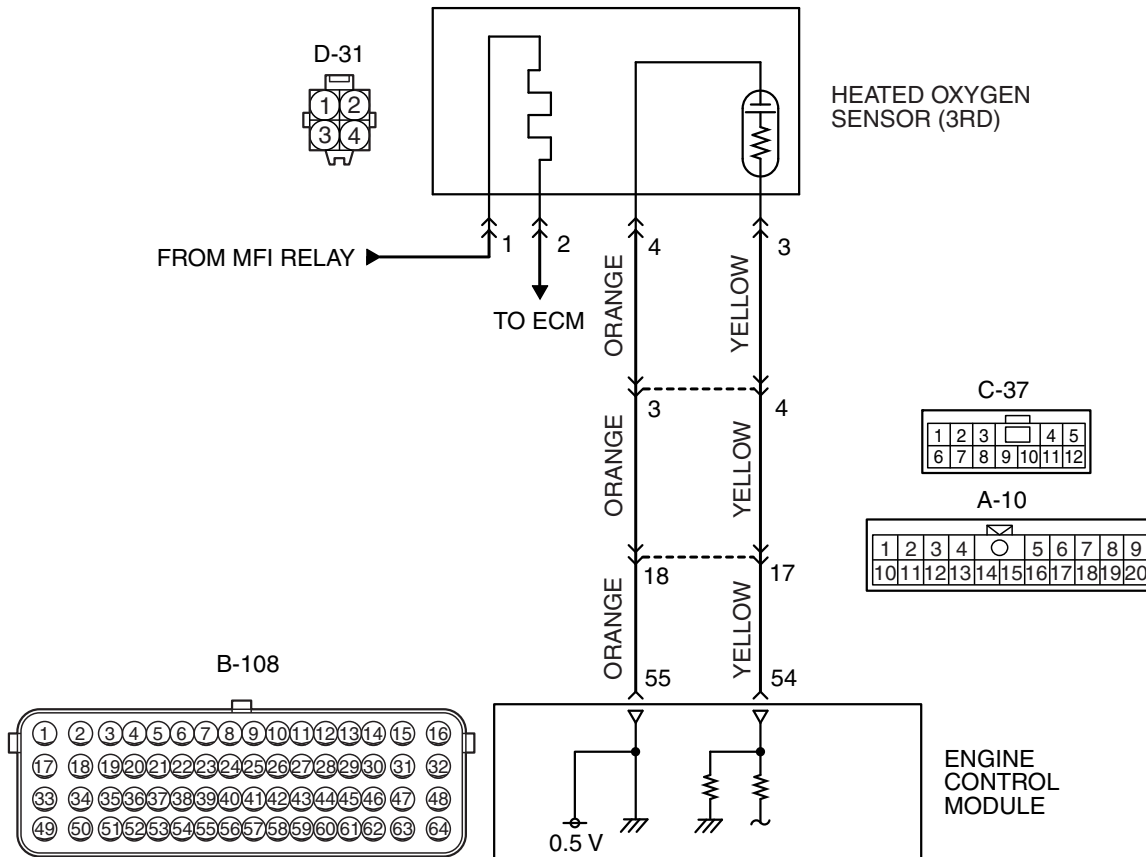
**Q: Is DTC P0140 set?**

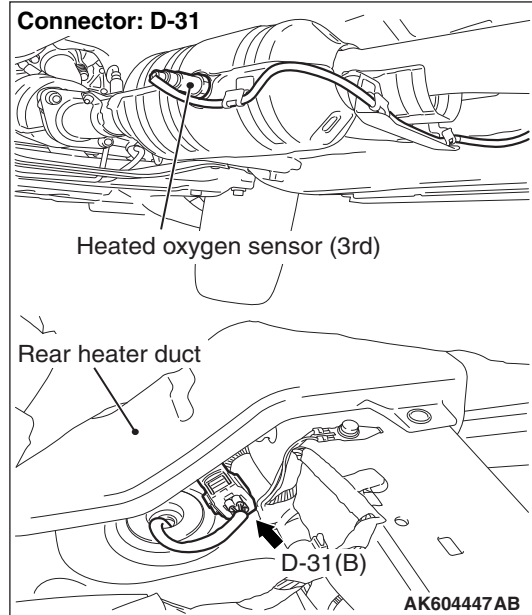
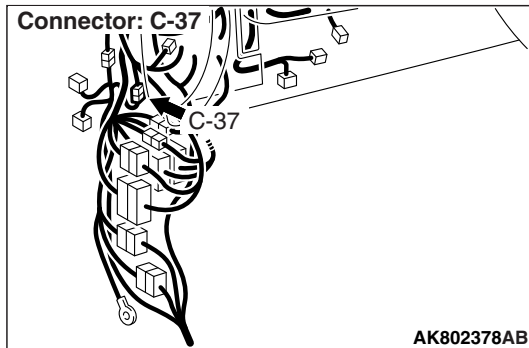
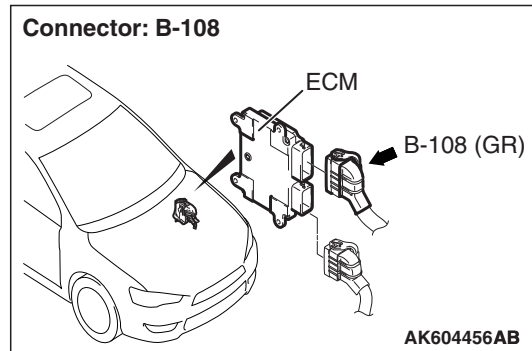
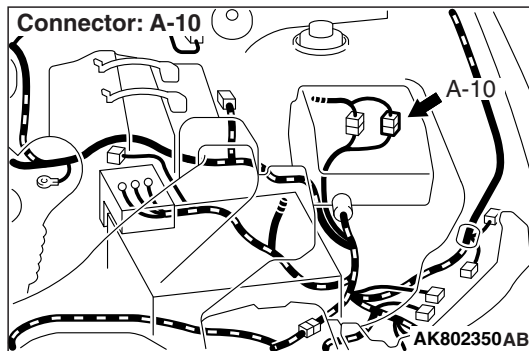
**YES :** Refer to DTC P0137 –Heated Oxygen Sensor (rear) Circuit Low Voltage <Vehicles for California> P.13B-308, DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage <Vehicles for California> P.13B-321.

**NO :** The inspection is complete.

**DTC P0143: Heated Oxygen Sensor (3rd) Circuit Low Voltage <Vehicles for California>**

**HEATED OXYGEN SENSOR (3RD) CIRCUIT < VEHICLES FOR 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)**

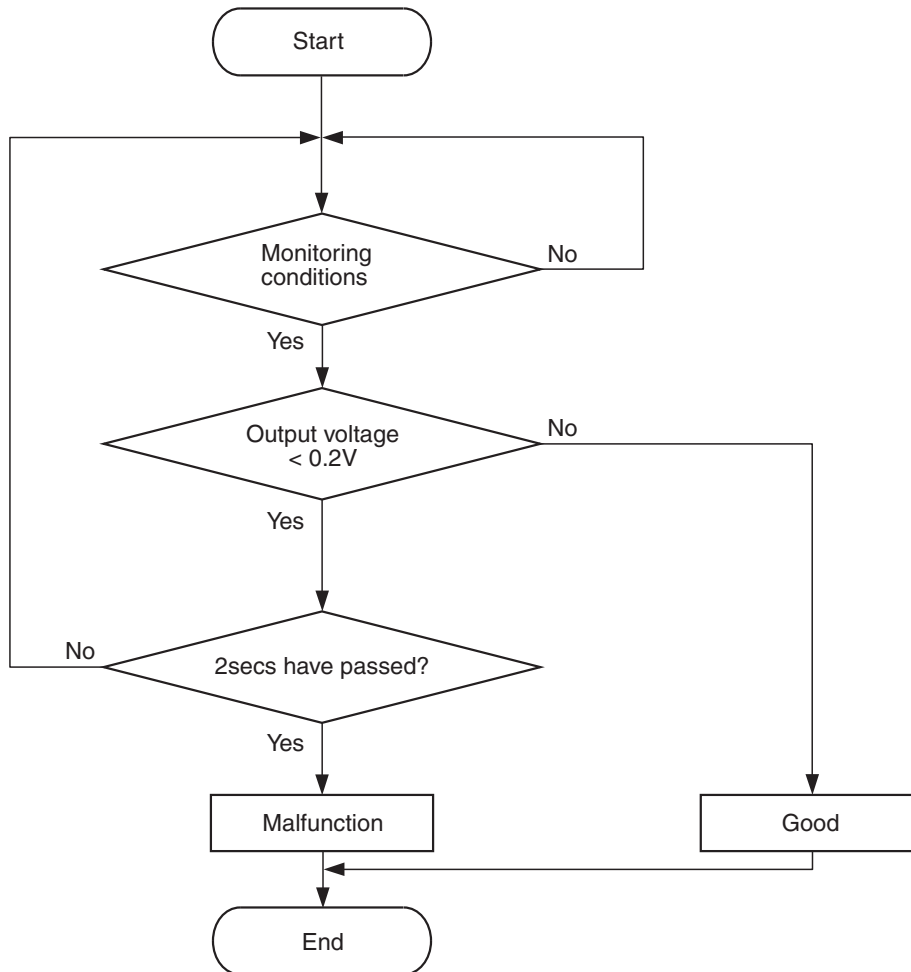
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor
- Heated oxygen sensor heater (3rd) monitor

**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.
- More than 3 minutes have passed since the engine starting sequence was completed.

**Judgement Criterion**

- Heated oxygen sensor (3rd) output voltage is less than 0.2 volt for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 22 [P.13B-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**

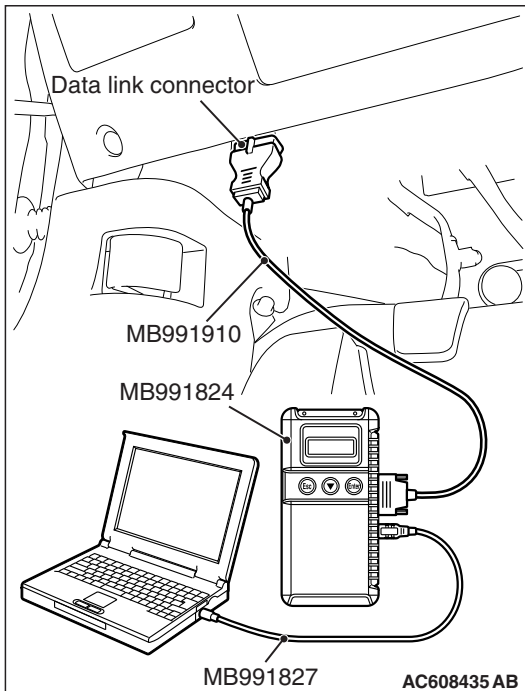
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13.

**NO** : Go to Step 2.



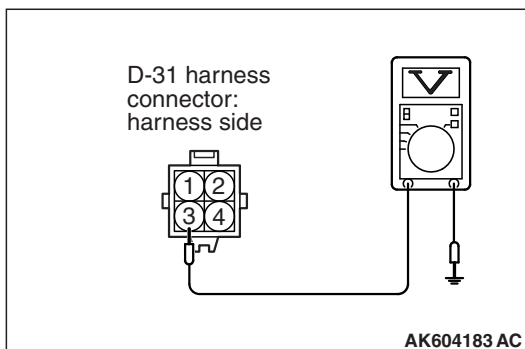
### STEP 2. Measure the sensor output voltage at heated oxygen sensor (3rd) connector D-31 by backprobing.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - The output voltage should be between 1.1 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 6.



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

**Q: Is the harness connector in good condition?**

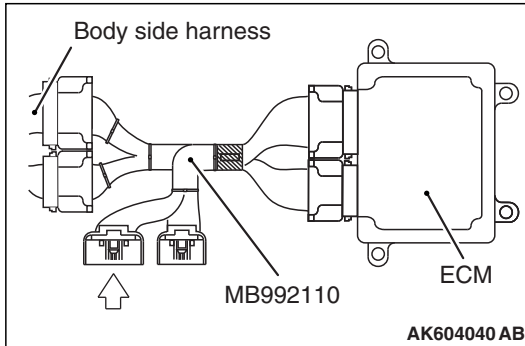
**YES :** Go to Step 4.

**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.

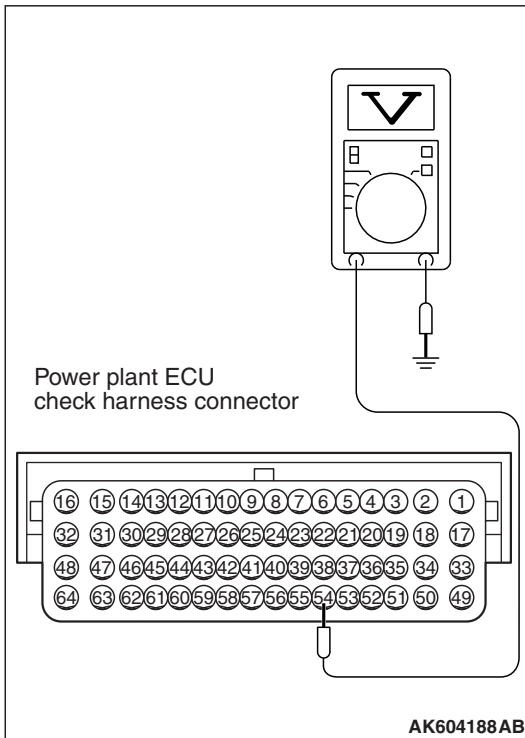
- a. Transaxle: 2nd speed
- b. Drive with wide open throttle
- c. Engine: 3,500 r/min or more
  - The output voltage should be between 1.1 and 1.5 volts.

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

**Q: Is the measured voltage between 1.1 and 1.5 volts?**

**YES :** Go to Step 13.

**NO :** Go to Step 5.



---

**STEP 5. 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 connectors for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connectors are 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 6. Check harness connector D-31 at heated oxygen sensor (3rd) for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 7.

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

---

**STEP 7. Measure the sensor offset voltage at heated oxygen sensor (3rd) harness side connector D-31.**

(1) Disconnect the connector D-31 and measure at the harness side.

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

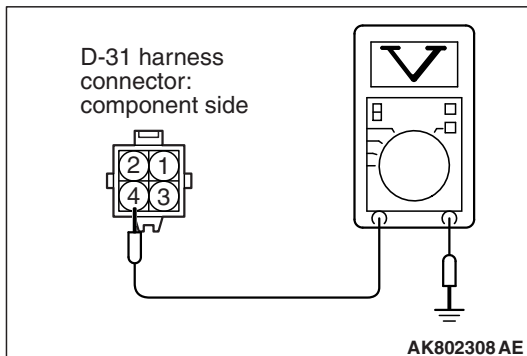
(3) Measure the voltage between terminal No. 4 and ground.  
• Voltage should be between 0.4 and 0.6 volt.

(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 9.

**NO :** Go to Step 8.



---

**STEP 8. Check harness connector B-108 at ECM for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Check harness connector A-10 and C-37 at intermediate connectors for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connectors are in good condition, repair harness wire between heated oxygen sensor (3rd) connector D-31 (terminal No. 4) and ECM connector B-108 (terminal No. 55) because of open circuit. 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 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 heated oxygen sensor (3rd) connector D-31 (terminal No. 4) and ECM connector B-108 (terminal No. 55).**

*NOTE: Check harness after checking intermediate connectors A-10 and C-37. If intermediate connectors are damaged, repair or replace them. 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 11.

**NO :** Repair it. Then go to Step 14.

**STEP 11. Check for short circuit to ground 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 connectors A-10 and C-37. If intermediate connectors are damaged, repair or replace them. 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.

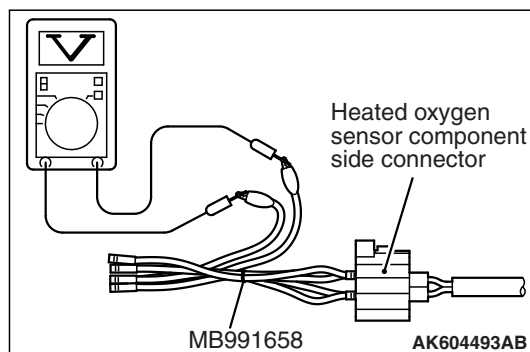
**NO :** Repair it. Then go to Step 14.

**STEP 12. Check 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
  - 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 :** Go to Step 13.

**NO :** Replace the heated oxygen sensor (3rd). Then go to Step 14.

---

**STEP 13. 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

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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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.13B-12](#).

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

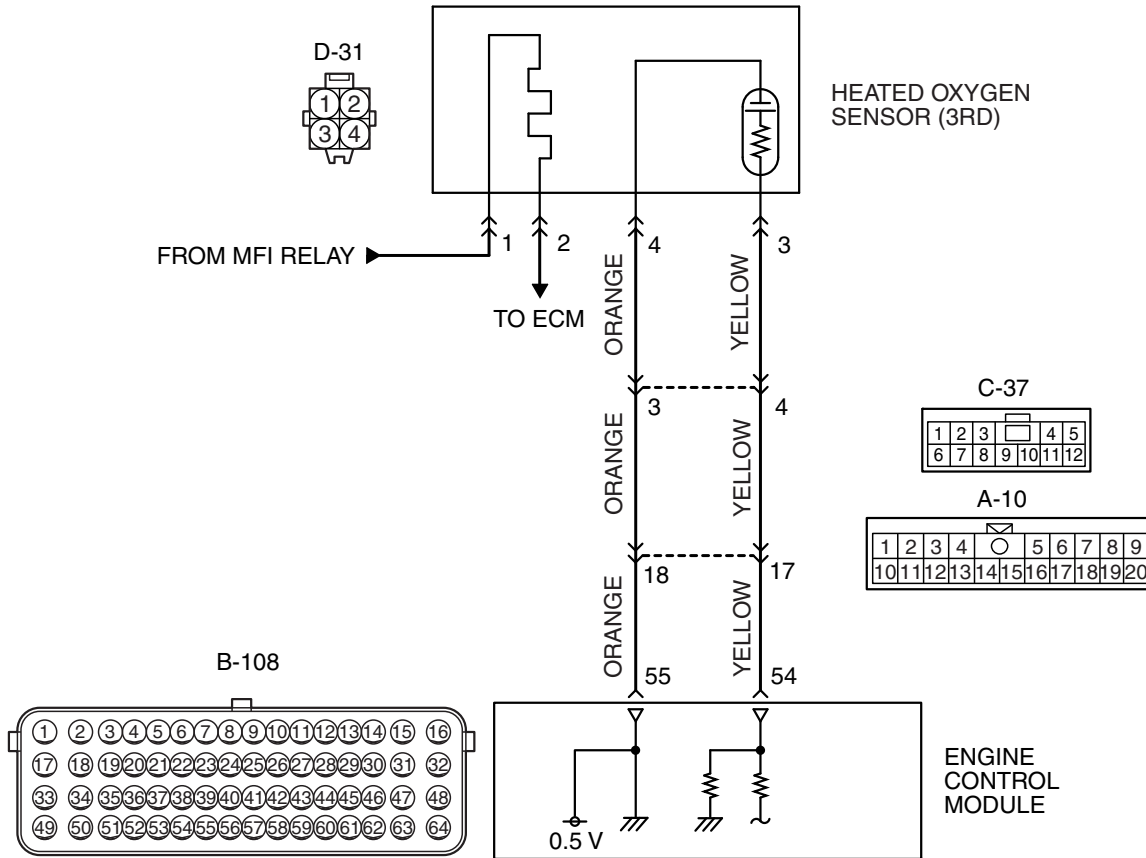
**Q: Is DTC P0143 set?**

**YES :** Retry the troubleshooting.

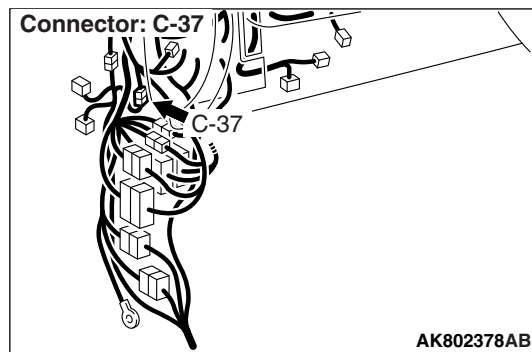
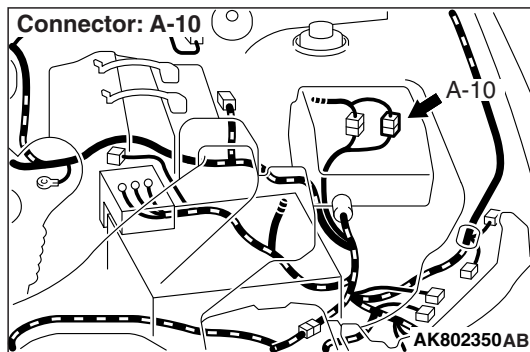
**NO :** The inspection is complete.

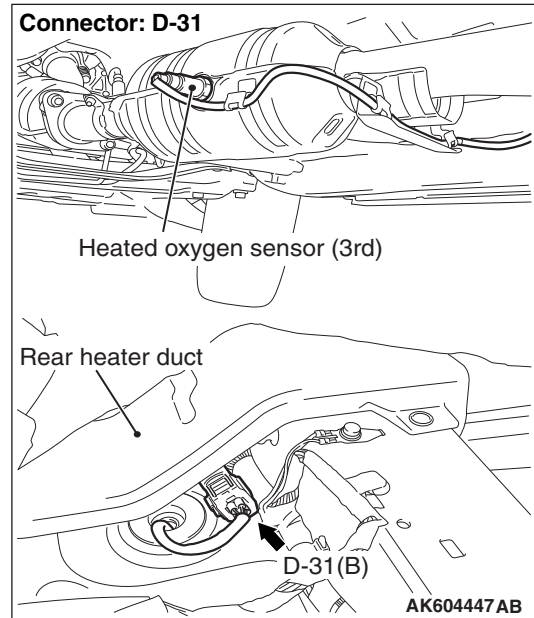
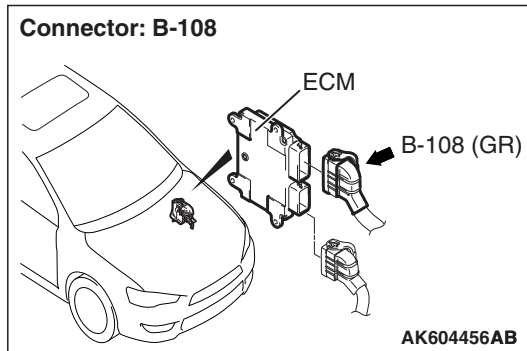
DTC P0144: Heated Oxygen Sensor (3rd) Circuit High Voltage <Vehicles for California>

HEATED OXYGEN SENSOR (3RD) CIRCUIT < VEHICLES FOR CALIFORNIA >



AK802011 AC





## 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)**

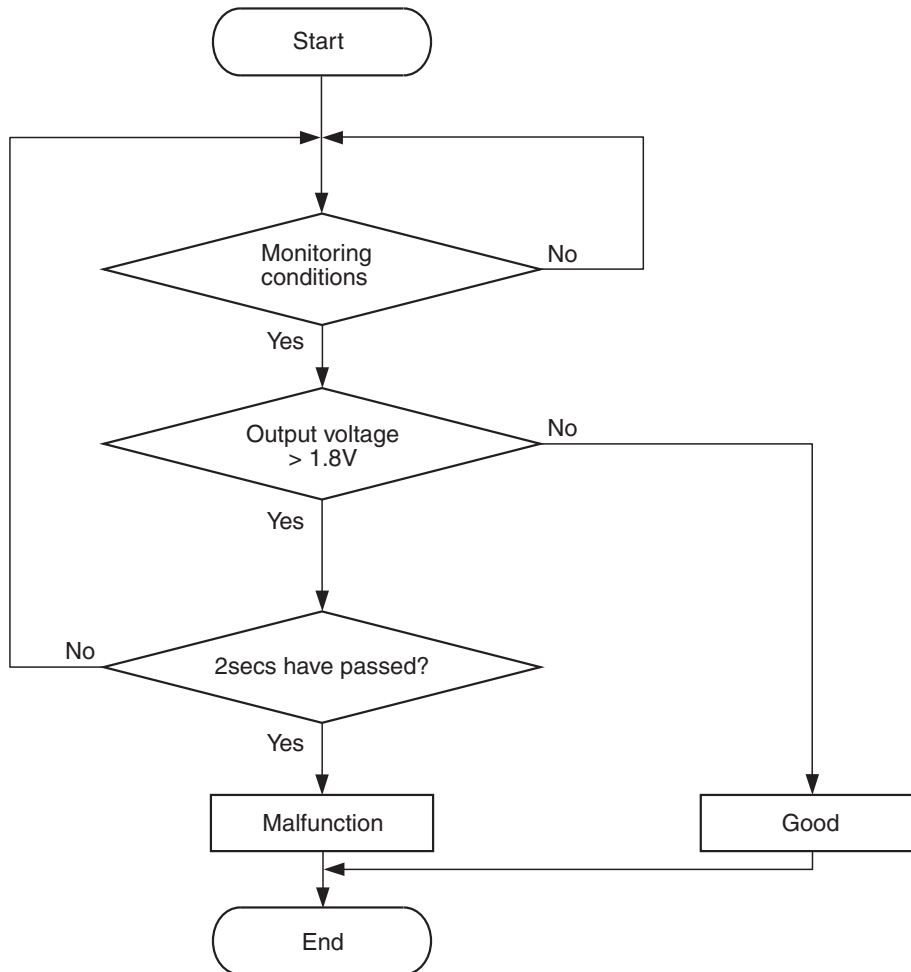
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor
- Heated oxygen sensor heater (3rd) monitor

**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**

- More than 2 seconds 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 is more than 1.8 volts for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13B-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

### Required Special Tool:

- 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

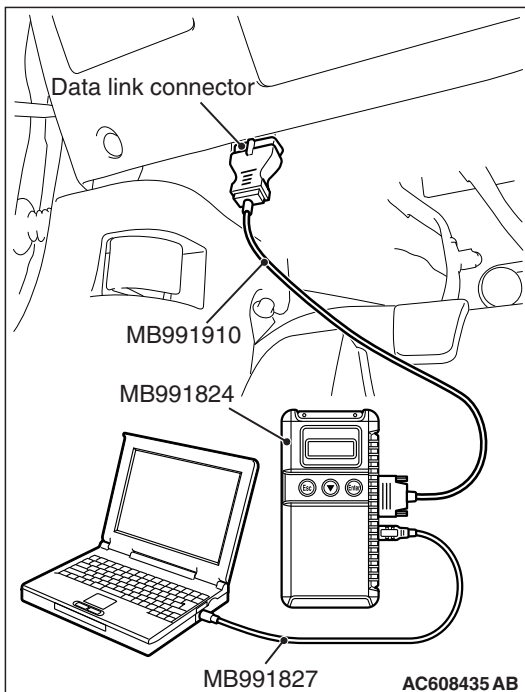
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13.

**NO :** Go to Step 2.



**STEP 2. Check harness connector D-31 at heated oxygen sensor (3rd) and harness connector B-108 at ECM for damage.**

### Q: Are the harness connectors in good condition?

**YES :** Go to Step 3.

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

**STEP 3. 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 connectors A-10 and C-37. If intermediate connectors are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 5.*

### Q: Is the harness wire in good condition?

**YES :** Go to Step 4.

**NO :** Repair it. Then go to Step 5.

**STEP 4. Using scan tool MB991958, check data list item****AD: Heated Oxygen Sensor (rear).**

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item AD, Heated Oxygen Sensor (rear).
  - a. Transaxle: 2nd speed
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - The output voltages 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.00-13](#).
- NO** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

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**STEP 5. Test the OBD-II drive cycle.**

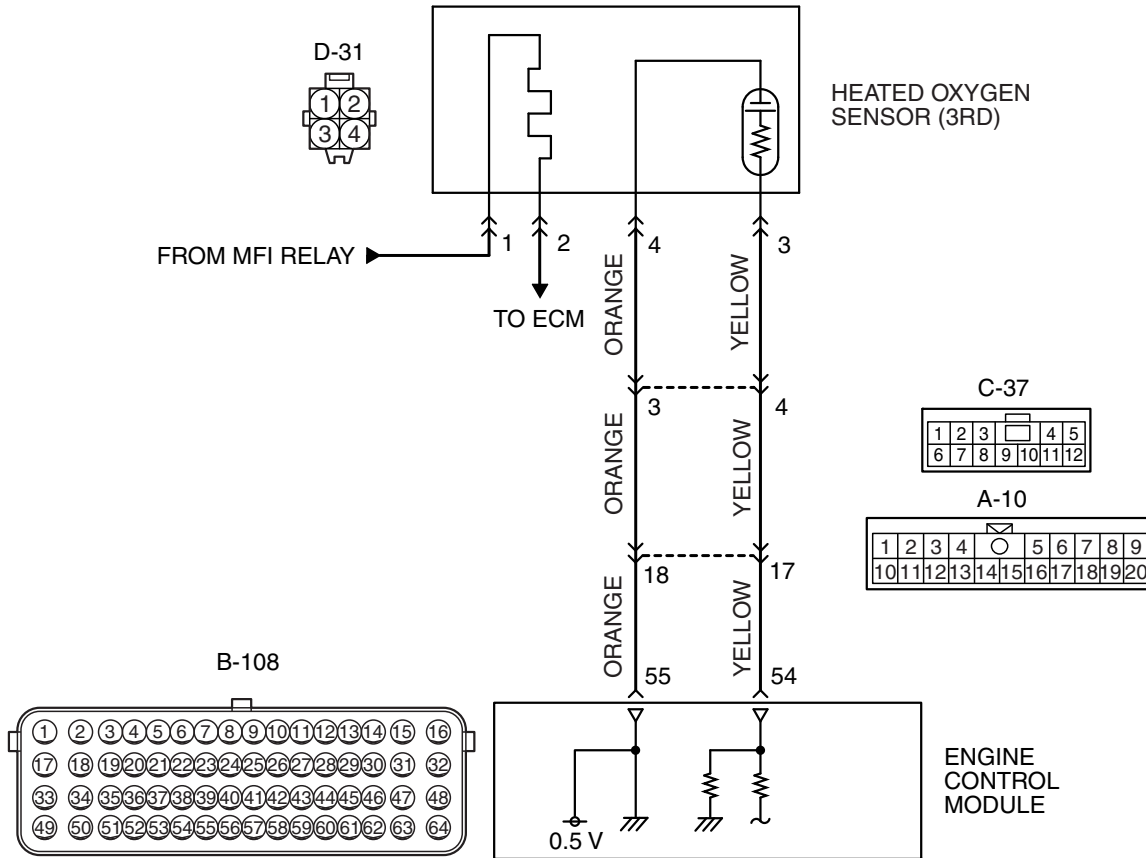
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0144 set?**

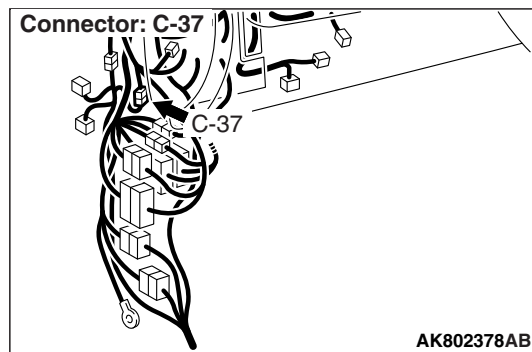
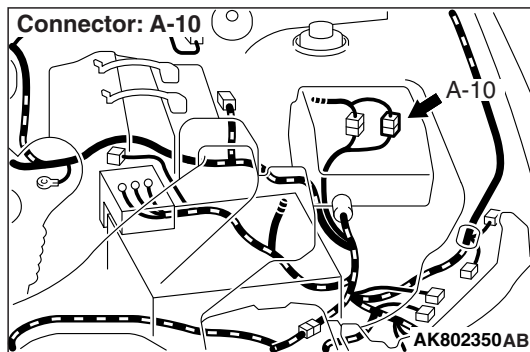
- YES** : Retry the troubleshooting.
- NO** : The inspection is complete.

DTC P0145: Heated Oxygen Sensor (3rd) Circuit Slow Response <Vehicles for California>

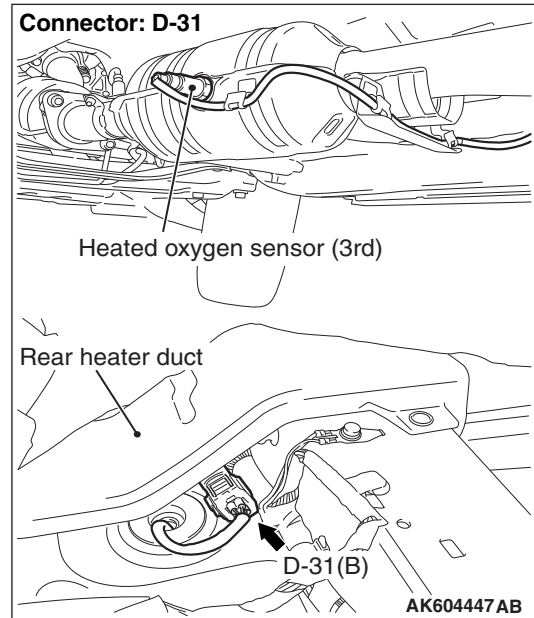
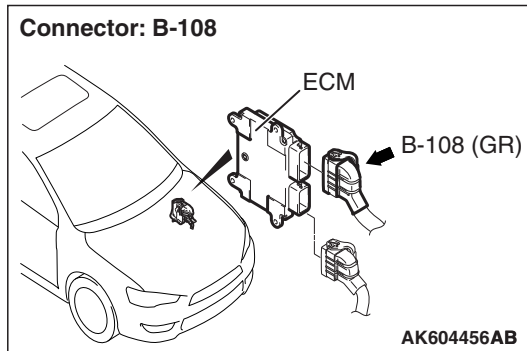
HEATED OXYGEN SENSOR (3RD) CIRCUIT < VEHICLES FOR CALIFORNIA >



AK802011 AC







## 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)**

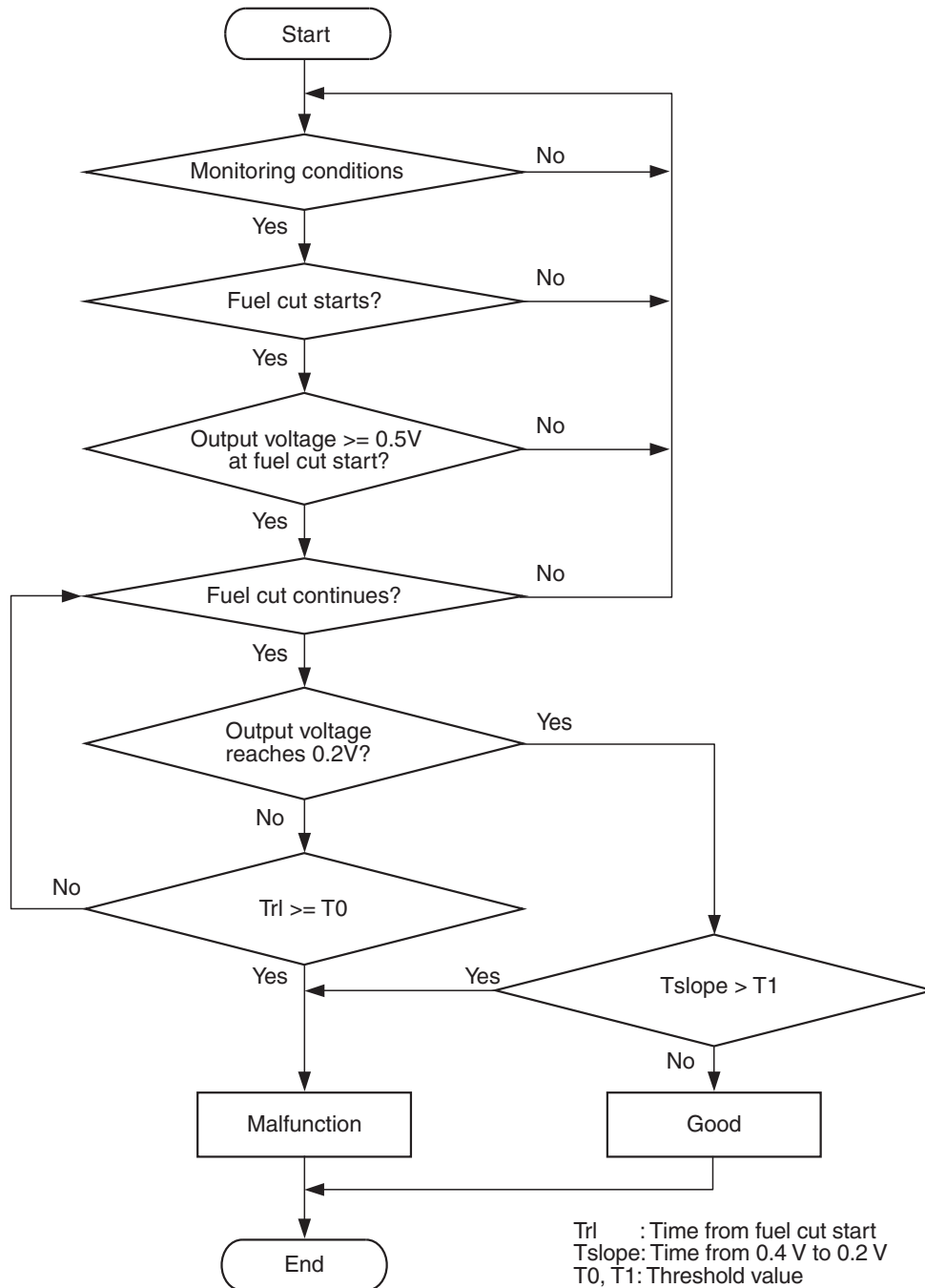
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor
- Heated oxygen sensor heater (3rd) monitor

**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



AK802132

**Check Conditions**

- Engine coolant temperature is more than 76° C (169° F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is more than 2,900 g.
- Fuel is being shut off.
- Heated oxygen sensor (3rd) output voltage is more 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.*

## FAIL-SAFE AND BACKUP FUNCTION

- None

## OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 11 [P.13B-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 Tool:

- 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.

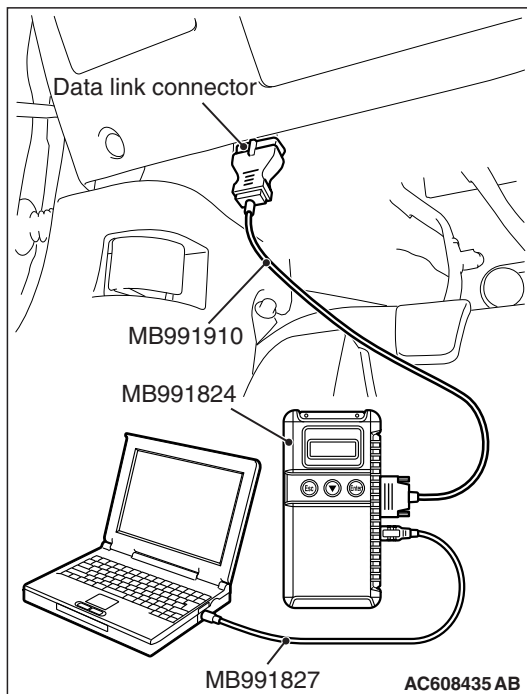
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item B1, Heated Oxygen Sensor (3rd).
- (4) Warm up the engine.
  - After increasing the output voltage 0.5 volt or more by the engine revving, 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.00-13](#).

**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.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

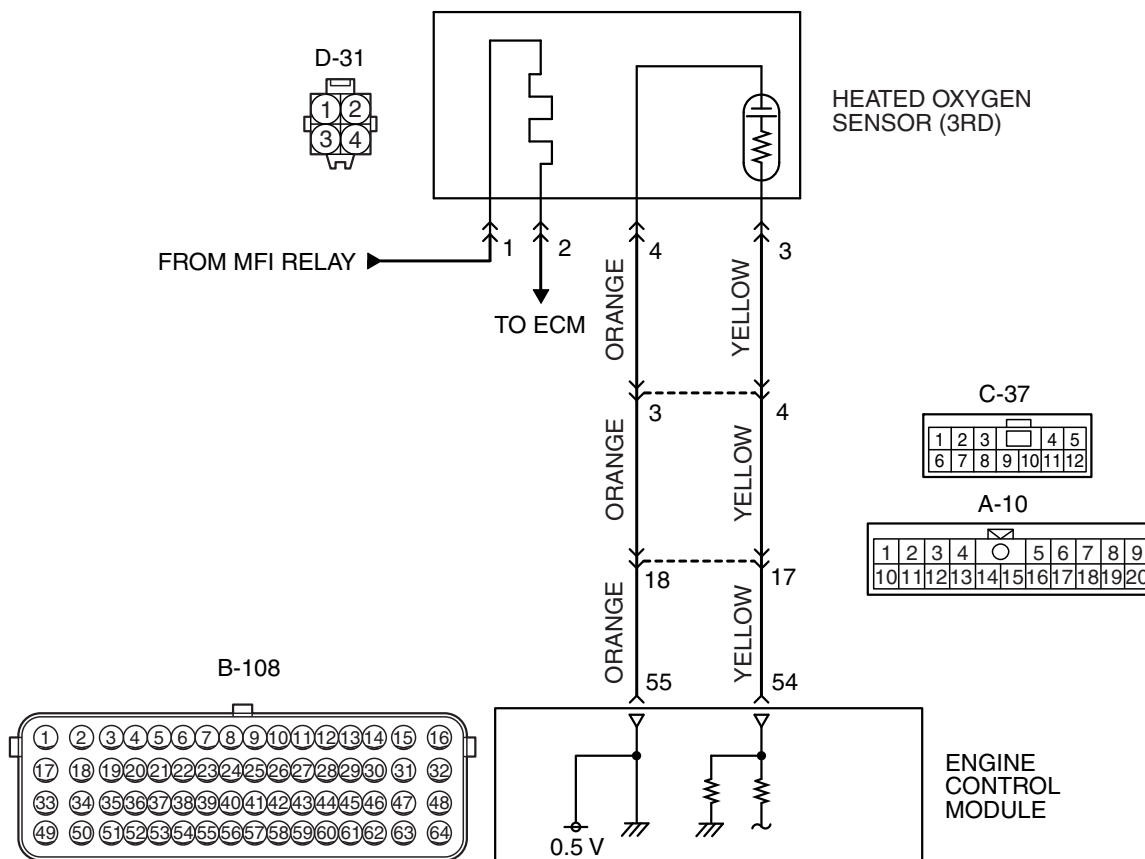
**Q: Is DTC P0145 set?**

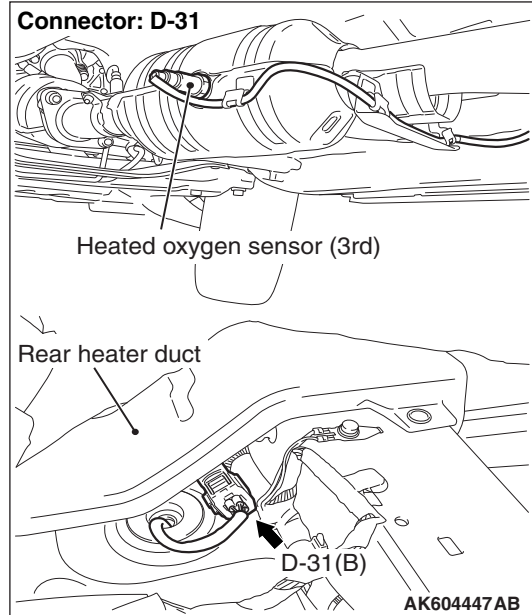
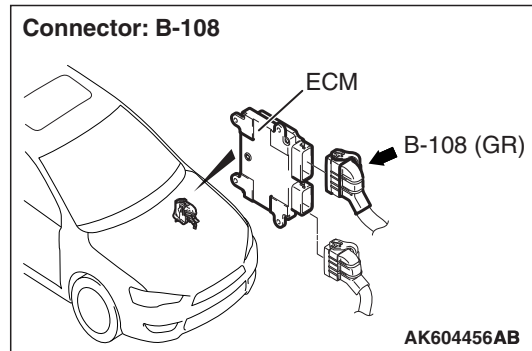
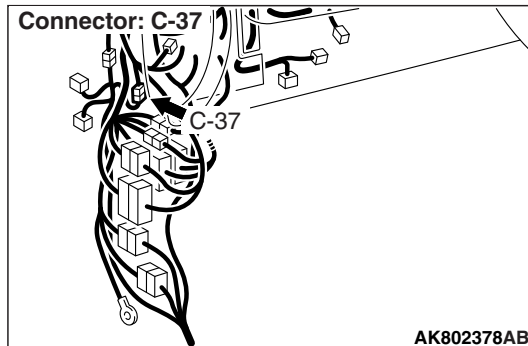
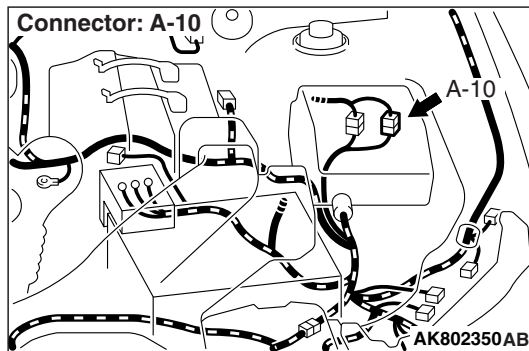
**YES :** Refer to DTC P0143 –Heated Oxygen Sensor (3rd) Circuit Low Voltage <Vehicles for California> [P.13B-344](#), DTC P0144 –Heated Oxygen Sensor (3rd) Circuit High Voltage <Vehicles for California> [P.13B-352](#).

**NO :** The inspection is complete.

**DTC P0146: Heated Oxygen Sensor (3rd) Circuit No Activity Detected <Vehicles for California>**

**HEATED OXYGEN SENSOR (3RD) CIRCUIT < VEHICLES FOR 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 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)**

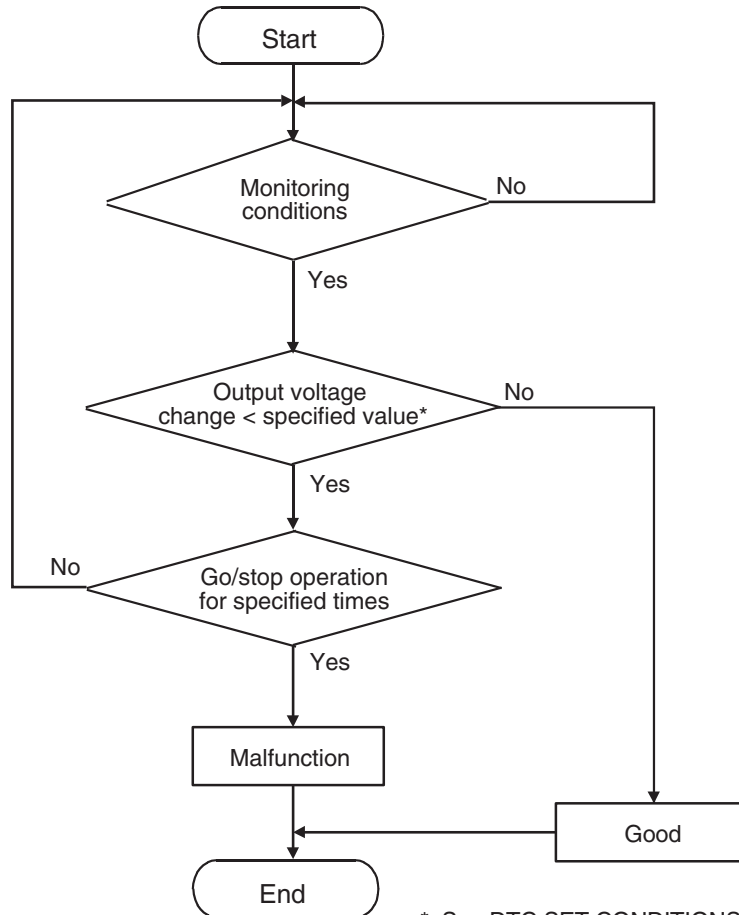
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor
- Heated oxygen sensor heater (3rd) monitor

**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 more than 76° C (169° F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is more than 2,900 g.
- Repeat 3 times or more: drive<sup>\*1</sup>, stop<sup>\*2</sup>.

#### Drive<sup>\*1</sup>:

- Engine speed is more than 1,500 r/min.
- Volumetric efficiency is more than 40 per cent.
- Vehicle speed is more than 30 km/h (19 mph).
- A total of more than 10 seconds have passed with the above mentioned conditions, and more than 3 seconds have passed with the fuel shut off.

#### Stop<sup>\*2</sup>:

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

#### Judgement Criterion

- Change in the output voltage of the heated oxygen sensor (3rd) is less than 0.098 volt.

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

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 13 P.13B-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 Tool:**

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

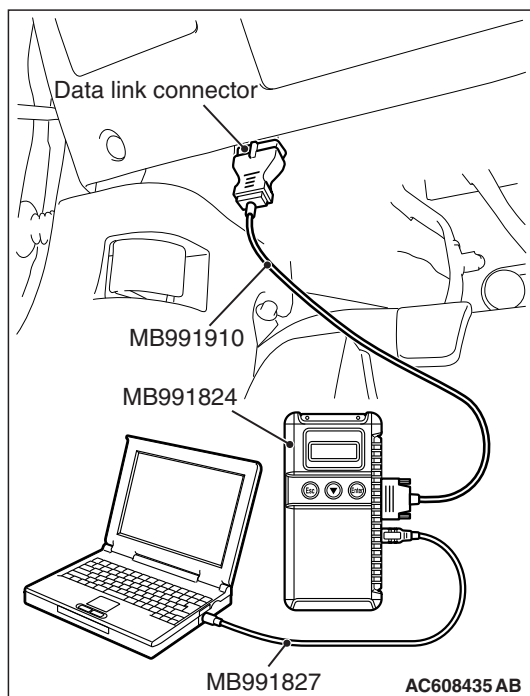
**STEP 1. Using scan tool MB991958, check data list item B1: Heated Oxygen Sensor (3rd).****⚠ CAUTION**

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
  - b. Drive with wide open throttle
  - c. Engine: 3,500 r/min or more
    - 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.00-13](#).
- 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.13B-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 <Vehicles for California> [P.13B-344](#), DTC P0144 –Heated Oxygen Sensor (3rd) Circuit High Voltage <Vehicles for California> [P.13B-352](#).
- NO** : The inspection is complete.

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**DTC P0171: System too Lean**

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**Fuel Trim Circuit**

- Refer to, DTC P0201 –Injector Circuit-Cylinder 1 [P.13B-395](#), DTC P0202 –Injector Circuit-Cylinder 2 [P.13B-404](#), DTC P0203 –Injector Circuit-Cylinder 3 [P.13B-413](#), DTC P0204 –Injector Circuit-Cylinder 4 [P.13B-422](#).

**CIRCUIT OPERATION**

- Refer to, DTC P0201 –Injector Circuit-Cylinder 1 [P.13B-395](#), DTC P0202 –Injector Circuit-Cylinder 2 [P.13B-404](#), DTC P0203 –Injector Circuit-Cylinder 3 [P.13B-413](#), DTC P0204 –Injector Circuit-Cylinder 4 [P.13B-422](#).

**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

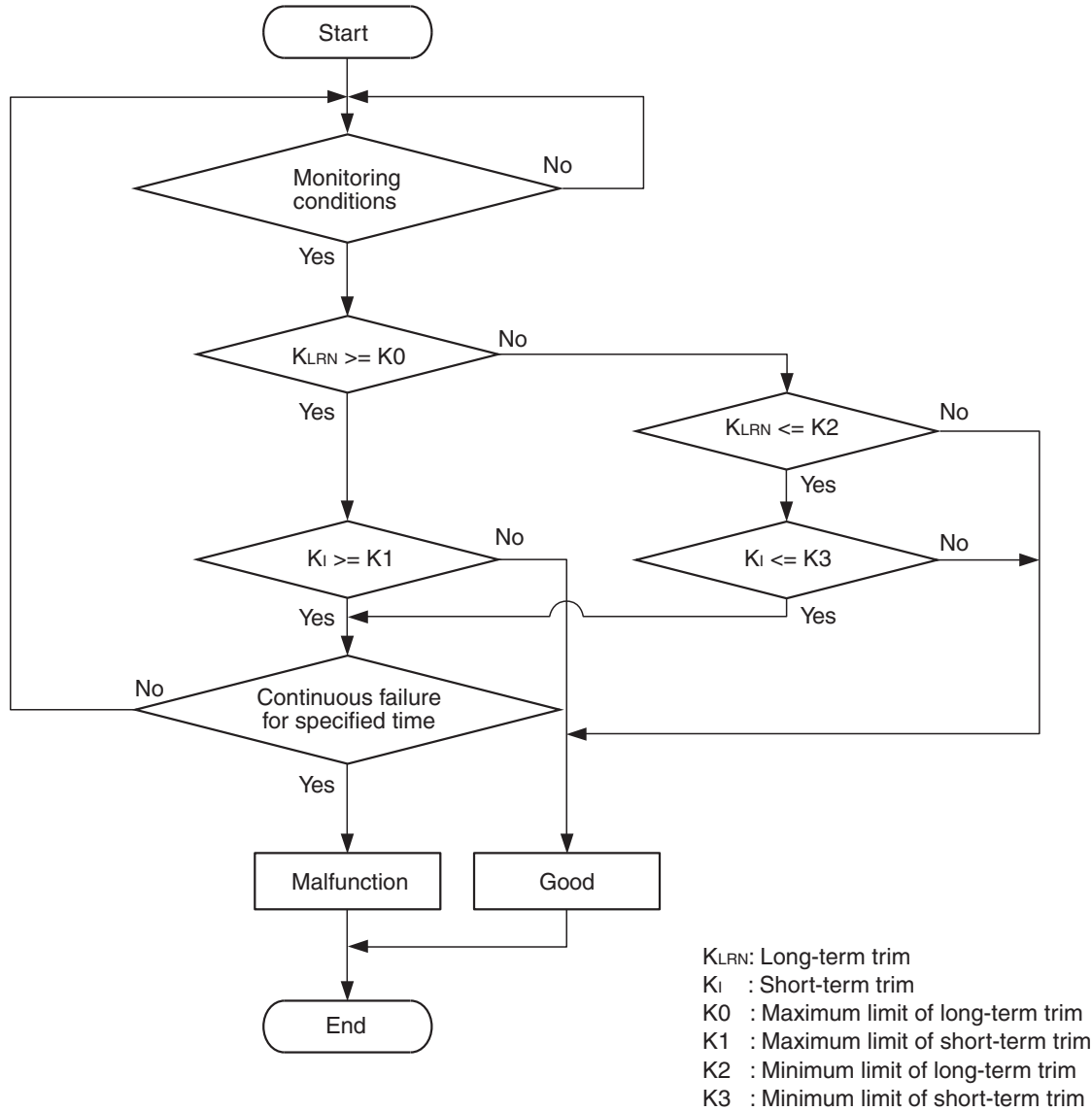
**Sensor (The sensor below is determined to be normal)**

- 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 less than 100° C (212° F) when the engine is started.
- Intake air temperature is less than 60° C (140° F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76° C (169° F).
- Mass airflow sensor output is more than 9 g/sec.

**Judgement Criterion**

- Long-term fuel trim is more than +12.5 percent for 5 seconds.

or

- Short-term fuel trim is more than +7.0 percent for 5 seconds <Except vehicles for California>.
- Short-term fuel trim is more than +5.5 percent for 5 seconds <Vehicles for California>.

**Check Conditions**

- Engine coolant temperature is less than 100° C (212° F) when the engine is started.
- Intake air temperature is less than 60° C (140° F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76° C (169° F).
- Mass airflow sensor output is less than 9 g/sec.

**Judgement Criterion**

- Long-term fuel trim is more than +12.5 percent for 5 seconds.

or

- Short-term fuel trim is more than +12.1 percent for 5 seconds <Except vehicles for California>.
- Short-term fuel trim is more than +10.5 percent for 5 seconds <Vehicles for California>.

**Check Conditions**

- Engine coolant temperature is more than 100° C (212° F) when the engine is started.
- Intake air temperature is more than 60° C (140° F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76° C (169° F).
- Mass airflow sensor output is more than 9 g/sec.

**Judgement Criterion**

- Long-term fuel trim is more than +12.5 percent for 5 seconds.

or

- Short-term fuel trim is more than +17.2 percent for 5 seconds <Except vehicles for California>.
- Short-term fuel trim is more than +15.6 percent for 5 seconds <Vehicles for California>.

**Check Conditions**

- Engine coolant temperature is more than 100° C (212° F) when the engine is started.
- Intake air temperature is more than 60° C (140° F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76° C (169° F).
- Mass airflow sensor output is less than 9 g/sec.

**Judgement Criterion**

- Long-term fuel trim is more than +12.5 percent for 5 seconds.

or

- Short-term fuel trim is more than +22.3 percent for 5 seconds <Except vehicles for California>.
- Short-term fuel trim is more than +20.7 percent for 5 seconds <Vehicles for California>.

**Check Conditions**

- Engine coolant temperature is more than 76° C (169° F).
- Under the closed loop air/fuel ratio control.

**Judgement Criterion**

- Long-term fuel trim is +12.5 percent for 2 seconds.

or

- Short-term fuel trim is +25.0 percent for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 21 [P.13B-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 Tool:**

- 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.**

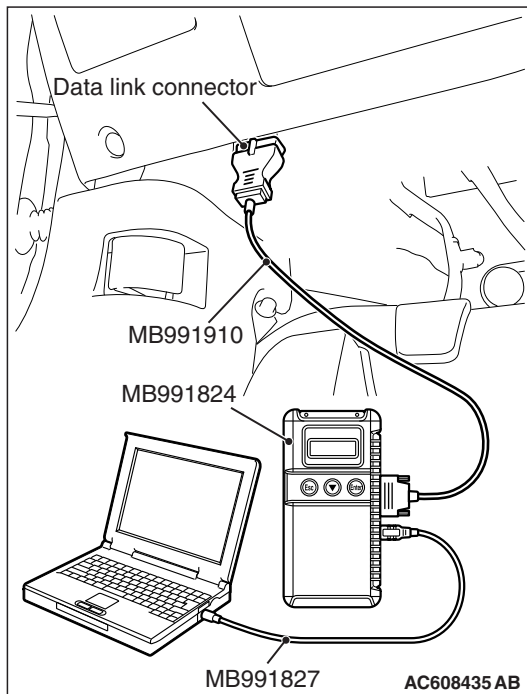
**Q: Are there any abnormalities?**

**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 millivolts.
  - 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.13B-152](#), DTC P0102 –Mass Airflow Circuit Low Input [P.13B-158](#), DTC P0103 –Mass Airflow Circuit High Input [P.13B-165](#).**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.13B-192](#), DTC P0112 –Intake Air Temperature Circuit Low Input [P.13B-198](#), DTC P0113 –Intake Air Temperature Circuit High Input [P.13B-202](#).

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**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.13B-209](#), DTC P0117 –Engine Coolant Temperature Circuit Low Input [P.13B-215](#), DTC P0118 –Engine Coolant Temperature Circuit High Input [P.13B-220](#).

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**STEP 6. 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.
  - Warm up 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.13B-170](#), DTC P0107 –Manifold Absolute Pressure Circuit Low Input [P.13B-179](#), DTC P0108 –Manifold Absolute Pressure Circuit High Input [P.13B-187](#).

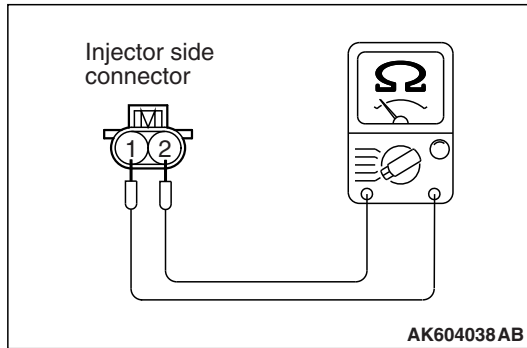
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**STEP 7. Check harness connector B-101, B-102, B-103 and B-104 at injector for damage.**

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 8.

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

**STEP 8. Check the injector.**

- (1) Disconnect the injector connectors B-101, B-102, B-103 and B104.
- (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 faulty 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: Are the harness wires in good condition?**

**YES :** Go to Step 11.

**NO :** Repair them. Then go to Step 14.

**STEP 11. Check the fuel pressure.**

Refer to, Fuel Pressure Test [P.13B-997](#).

**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, diesel fuel, 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.13B-12](#).
- (3) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0171 set?**

**YES :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 14.

**NO :** The inspection is complete.

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**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.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is the DTC P0171 set?**

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

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**DTC P0172: System too Rich**

**Fuel Trim Circuit**

- Refer to, DTC P0201 –Injector Circuit-Cylinder 1 [P.13B-395](#), DTC P0202 –Injector Circuit-Cylinder 2 [P.13B-404](#), DTC P0203 –Injector Circuit-Cylinder 3 [P.13B-413](#), DTC P0204 –Injector Circuit-Cylinder 4 [P.13B-422](#).

**CIRCUIT OPERATION**

- Refer to, DTC P0201 –Injector Circuit-Cylinder 1 [P.13B-395](#), DTC P0202 –Injector Circuit-Cylinder 2 [P.13B-404](#), DTC P0203 –Injector Circuit-Cylinder 3 [P.13B-413](#), DTC P0204 –Injector Circuit-Cylinder 4 [P.13B-422](#).

**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 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)**

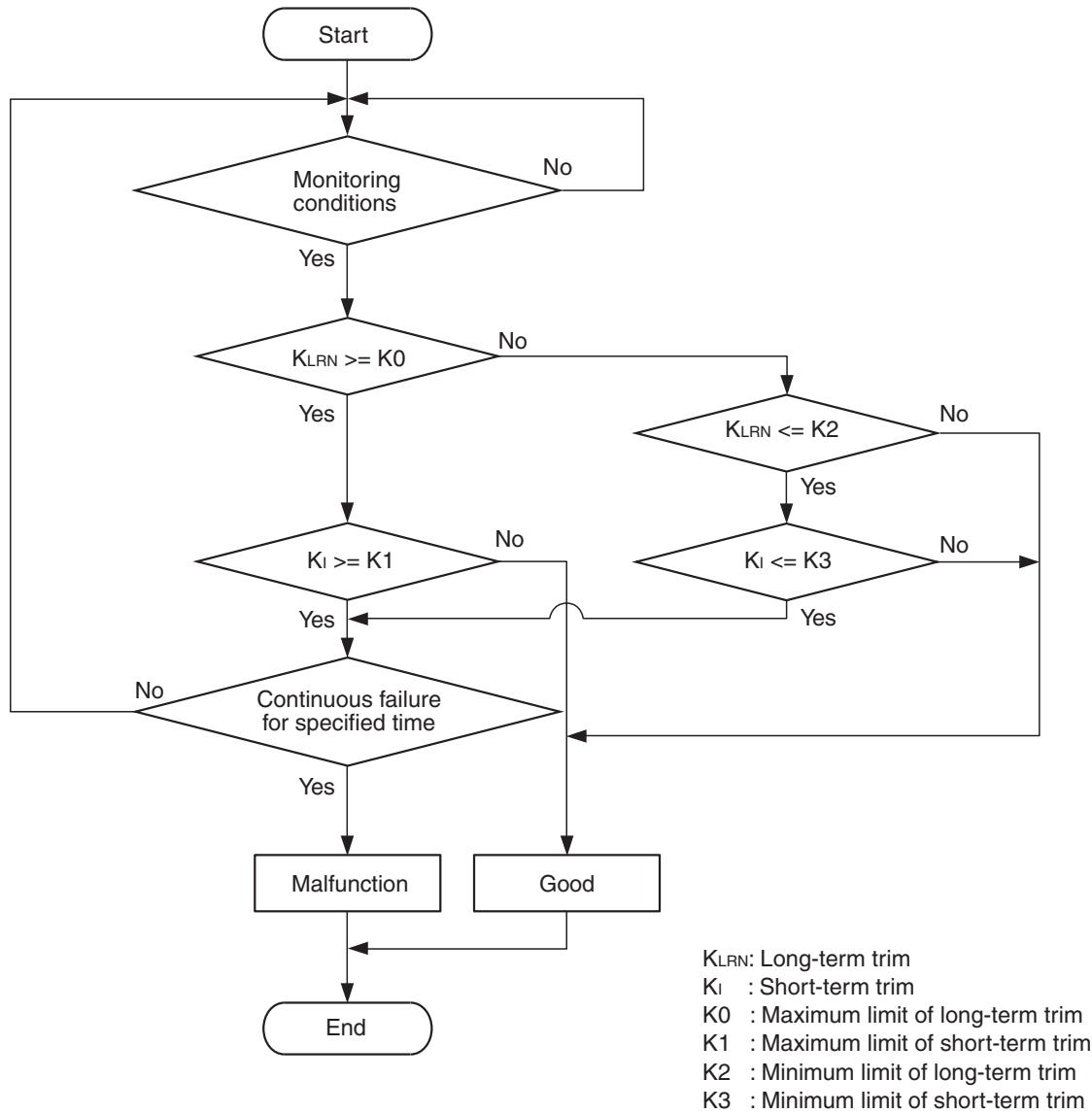
- Misfire monitor

**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 more than 76° C (169° F).
- Mass airflow sensor output is more than 9 g/sec.

**Judgement Criterion**

- Long-term fuel trim is less than -12.5 percent for 5 seconds.

or

- Short-term fuel trim is less than -10.2 percent for 5 seconds <Except vehicles for California>.

- Short-term fuel trim is less than -5.5 percent for 5 seconds <Vehicles for California>.

**Check Conditions**

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76° C (169° F).
- Mass airflow sensor output is less than 9 g/sec.

**Judgement Criterion**

- Long-term fuel trim is less than -12.5 percent for 5 seconds.

or

- Short-term fuel trim is less than -15.2 percent for 5 seconds <Except vehicles for California>.
- Short-term fuel trim is less than -10.5 percent for 5 seconds <Vehicles for California>.

#### Check Conditions

- Engine coolant temperature is more than 76° C (169° F).
- Under the closed loop air/fuel ratio control.

#### Judgement Criterion

- Long-term fuel trim is -12.5 percent for 2 seconds.

or

- Short-term fuel trim is -25.0 percent for 2 seconds.

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 21 [P.13B-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 Tool:

- 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

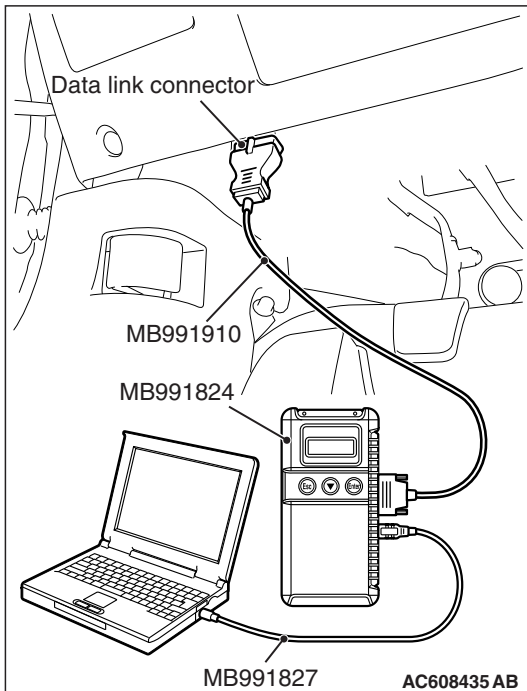
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 millivolts.
  - 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 2.

**NO** : Refer to, DTC P0101 –Mass Airflow Circuit Range/Performance Problem [P.13B-152](#), DTC P0102 –Mass Airflow Circuit Low Input [P.13B-158](#), DTC P0103 –Mass Airflow Circuit High Input [P.13B-165](#).





**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.13B-192](#), DTC P0112 –Intake Air Temperature Circuit Low Input [P.13B-198](#), DTC P0113 –Intake Air Temperature Circuit High Input [P.13B-202](#).

**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.13B-209](#), DTC P0117 –Engine Coolant Temperature Circuit Low Input [P.13B-215](#), DTC P0118 –Engine Coolant Temperature Circuit High Input [P.13B-220](#).

---

**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.
  - Warm up 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.13B-170](#), DTC P0107 –Manifold Absolute Pressure Circuit Low Input [P.13B-179](#), DTC P0108 –Manifold Absolute Pressure Circuit High Input [P.13B-187](#).

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**STEP 5. Check the injector.**

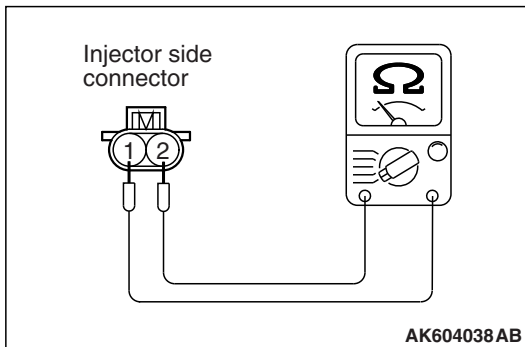
- (1) Disconnect the injector connectors B-101, B-102, B-103 and B-104.
- (2) Measure the resistance between each injector side connector terminal No. 1 and No. 2.

**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 faulty injector. Then go to Step 8.



---

**STEP 6. Check the fuel pressure.**

Refer to, Fuel Pressure Test [P.13B-997](#).

**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.13B-12](#).
- (3) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0172 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

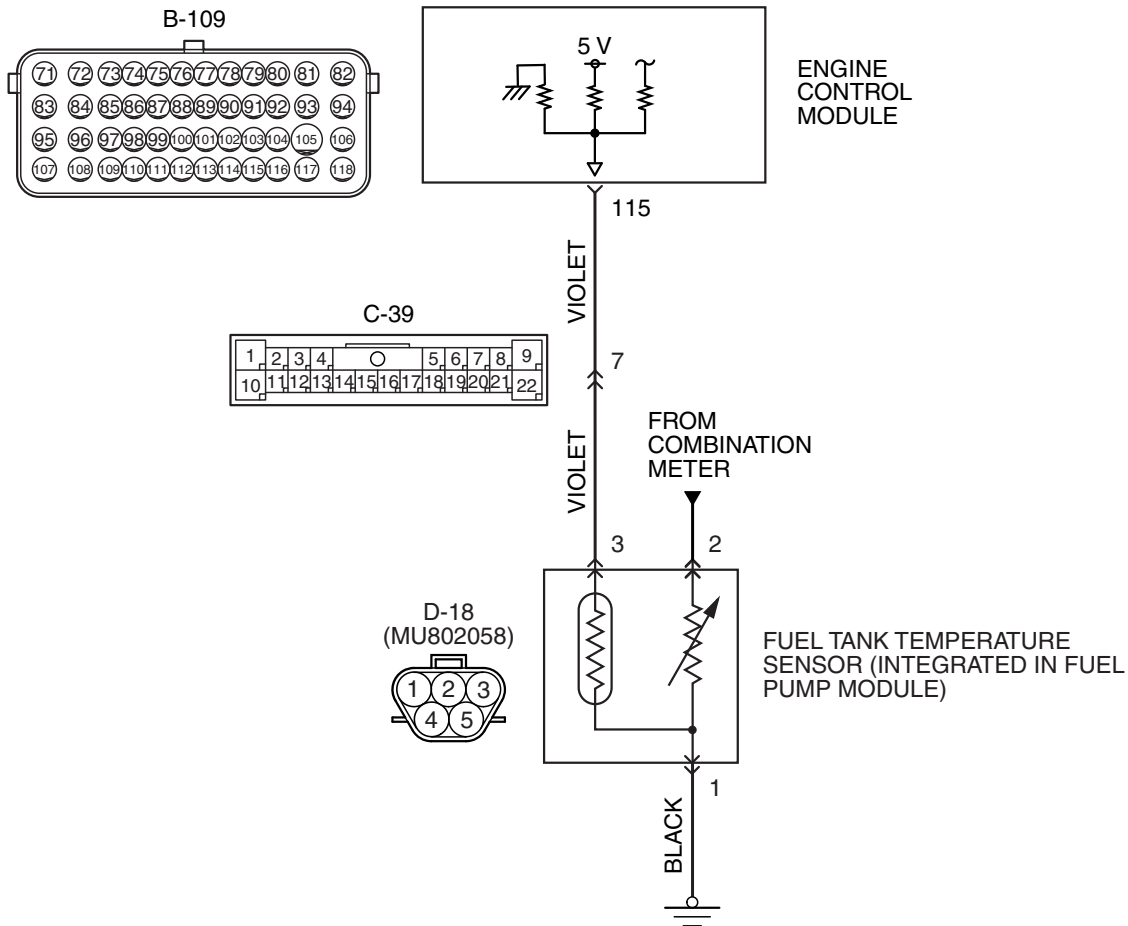
**Q: Is DTC P0172 set?**

**YES** : Retry the troubleshooting.

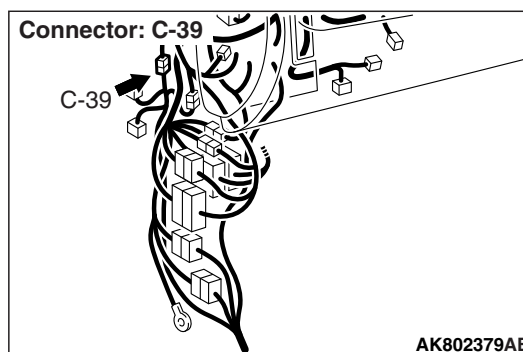
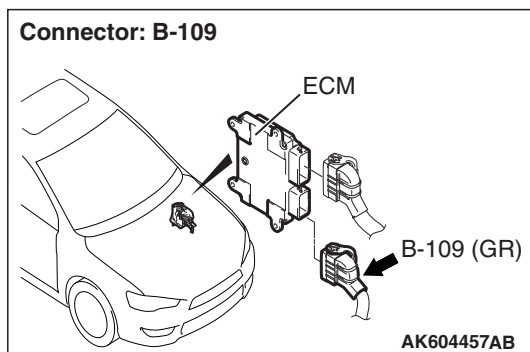
**NO** : The inspection is complete.

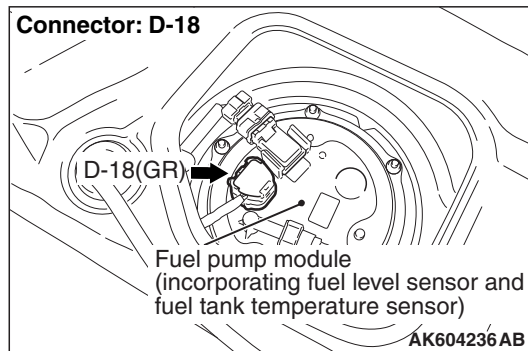
DTC P0181: Fuel Tank Temperature Sensor Circuit Range/Performance

FUEL TANK TEMPERATURE SENSOR CIRCUIT



AK604240AD





## CIRCUIT OPERATION

- 5-volt voltage is applied to the fuel tank temperature sensor output terminal (terminal No. 3) from the ECM (terminal No. 115) via the resistor in the ECM.
- The fuel tank temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases. The ground terminal (terminal No. 1) is grounded to the vehicle body.

## TECHNICAL DESCRIPTION

- The fuel tank temperature sensor converts the fuel tank temperature to a voltage.
- The ECM detects the fuel tank temperature with this output voltage.

## DESCRIPTIONS OF MONITOR METHODS

Fuel tank temperature at engine start is higher than engine coolant temperature at engine start by specified value when engine is cold start condition.

## 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)**

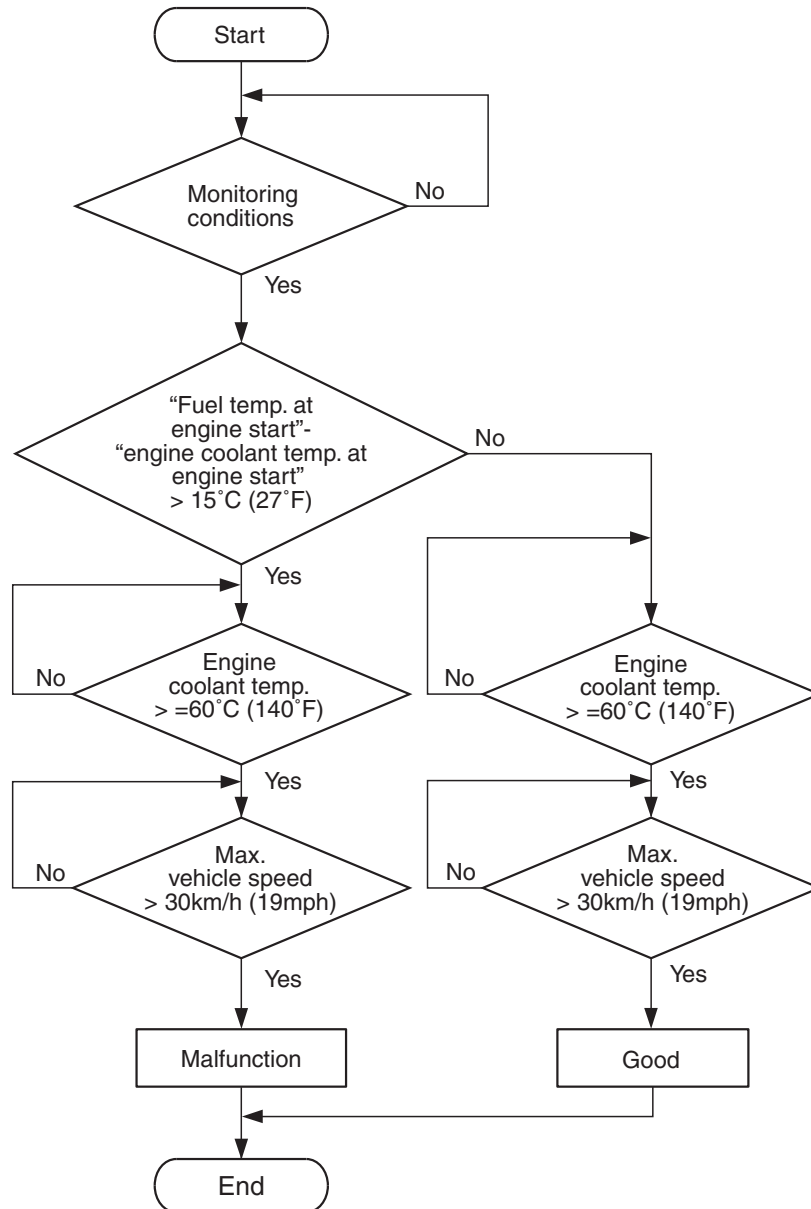
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Engine coolant temperature sensor
- Intake air temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



AK700114

**Check Conditions**

- When the engine is started, the intake air temperature subtracted from the engine coolant temperature is less than 5° C (9° F).
- The engine coolant temperature is between -10° C (14° F) and 36° C (97° F) when the engine is started.

- The engine coolant temperature is more than 60° C (140° F).
- Maximum vehicle speed is more than 30 km/h (19 mph) after the engine starting sequence was completed.

**Judgement Criterion**

- When the engine is started, the engine coolant temperature subtracted from the fuel tank temperature is more than 15° C (27° F).

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 14 P.13B-12.

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

- Fuel tank temperature sensor failed.

- Fuel tank temperature sensor circuit harness damage or connector damage.
- ECM failed.

*NOTE: A diagnostic trouble code (DTC) could be output if the engine and the radiator have been flushed repeatedly when the engine coolant temperature was high (or the fuel tank temperature was high). Because this is not a failure, the DTC must be erased.*

*Make sure to test drive the vehicle in accordance with the OBD-II drive cycle pattern in order to verify that a DTC will not be output.*

**DIAGNOSIS****Required Special Tool:**

- 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 53: Fuel Tank Temperature Sensor.****⚠ CAUTION**

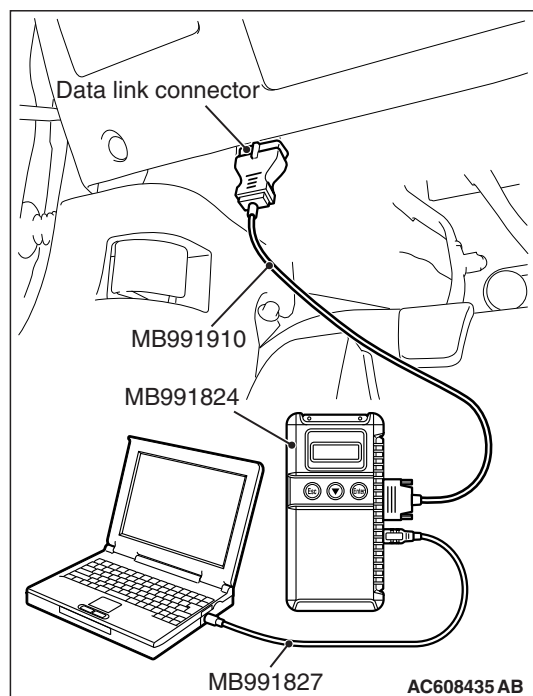
**To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.**

- (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 53, Fuel Tank Temperature Sensor.
  - Approximately the same as the ambient air temperature when the engine is cooled.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the sensor operating properly?**

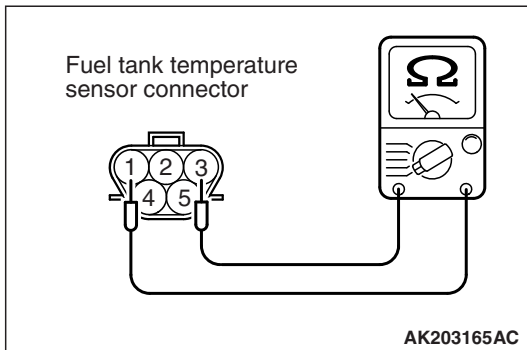
**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions P.00-13.

**NO :** Go to Step 2.

**STEP 2. Check harness connector D-18 at fuel pump module for damage.****Q: Is the harness connector in good condition?**

**YES :** Go to Step 3.

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



**STEP 3. Check the fuel tank temperature sensor.**

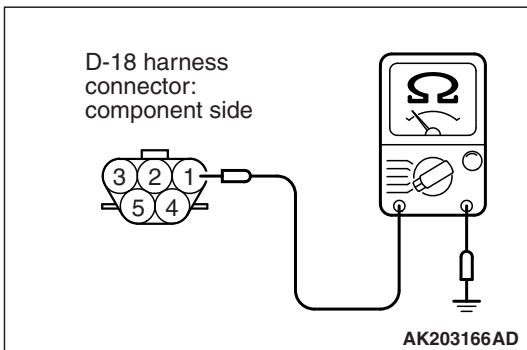
- (1) Disconnect the fuel pump module connector D-18.
- (2) Measure the resistance between terminal No. 1 and No. 3 of the fuel pump module.

**Standard value: 0.5 –12.0 k $\Omega$**

**Q: Is the measured resistance between 0.5 and 12.0 k $\Omega$ ?**

**YES :** Go to Step 4.

**NO :** Replace the fuel pump module. Then go to Step 8.



**STEP 4. Check the continuity at fuel pump module harness side connector D-18.**

- (1) Disconnect the connector D-18 and measure at the harness side.
- (2) Check for the continuity between terminal No. 1 and ground.
  - Continuity (2 ohms or less)

**Q: Does continuity exist?**

**YES :** Go to Step 5.

**NO :** Repair harness wire between fuel pump module connector D-18 (terminal No. 1) and ground because of harness damage. Then go to Step 8.

**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 8.

**STEP 6. Check for harness damage between fuel pump module connector D-18 (terminal No. 3) and ECM connector B-109 (terminal No. 115).**

*NOTE: Check harness after checking intermediate connector C-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 8.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 7.

**NO :** Repair it. Then go to Step 8.



**STEP 7. Using scan tool MB991958, check data list item 53:  
Fuel Tank Temperature Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 53, Fuel Tank Temperature Sensor.
  - Approximately the same as the ambient air temperature when the engine is cooled.
- (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.00-13](#).
- NO** : Replace the ECM (Refer to, Removal and Installation  
[P.13B-1022](#)). Then go to Step 8.

---

**STEP 8. Test the OBD-II drive cycle.**

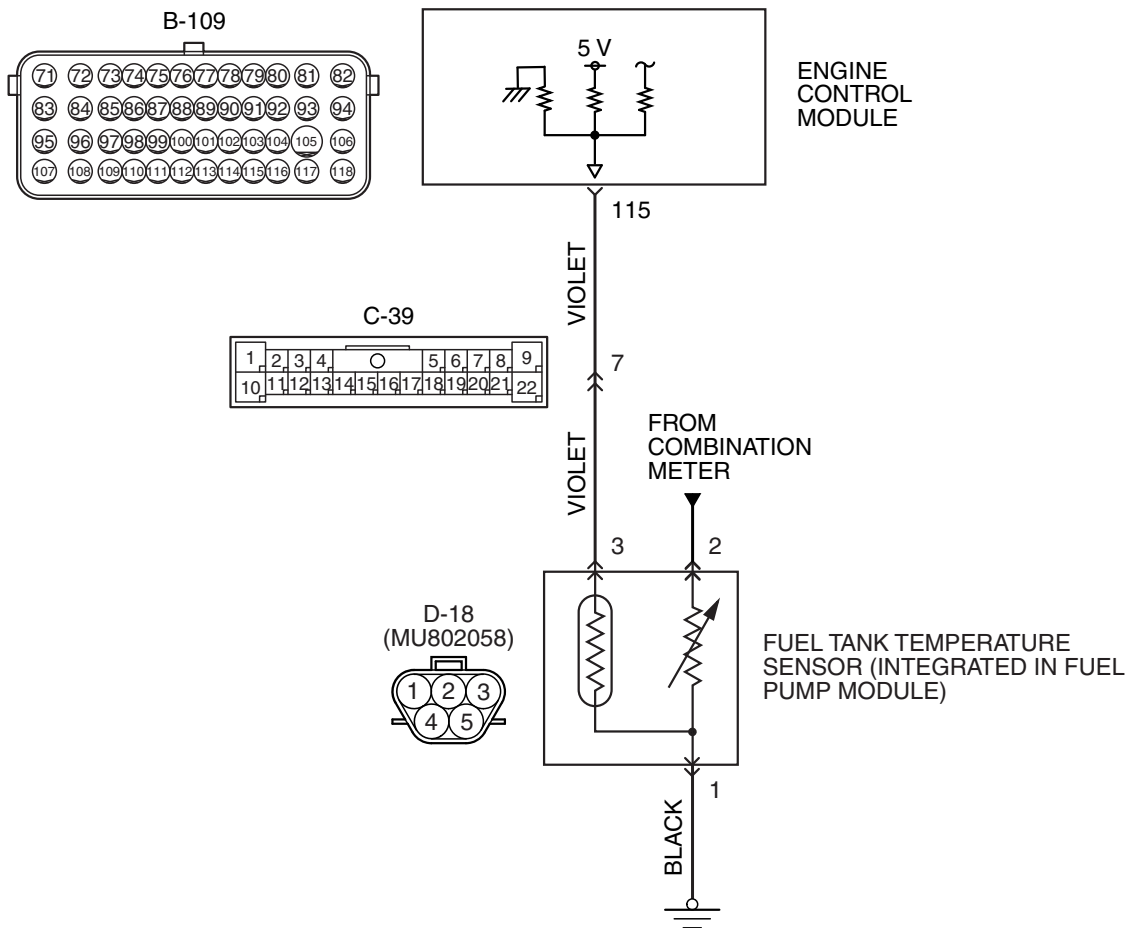
- (1) Carry out a test drive with the drive cycle pattern. Refer to  
Diagnostic Function –OBD-II Drive Cycle –Pattern 14  
[P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0181 set?**

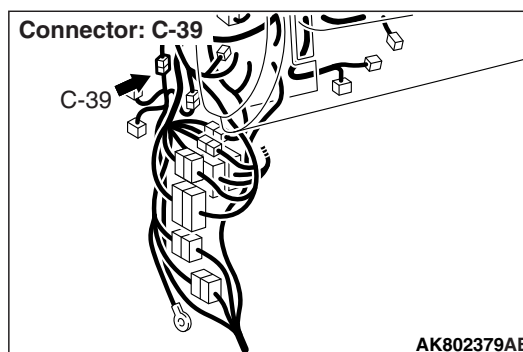
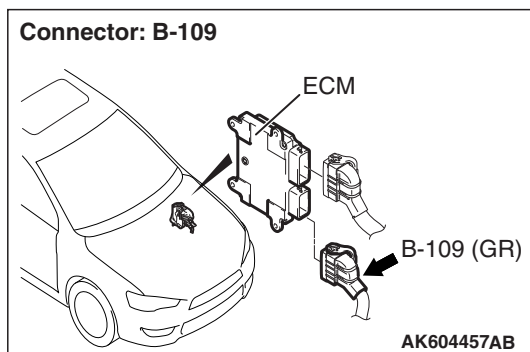
- YES** : Retry the troubleshooting.
- NO** : The inspection is complete.

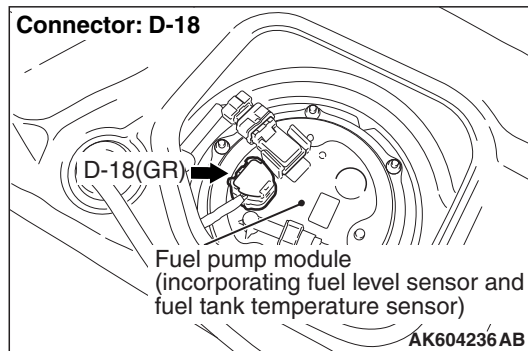
DTC P0182: Fuel Tank Temperature Sensor Circuit Low Input

FUEL TANK TEMPERATURE SENSOR CIRCUIT



AK604240AD





## CIRCUIT OPERATION

- 5-volt voltage is applied to the fuel tank temperature sensor output terminal (terminal No. 3) from the ECM (terminal No. 115) via the resistor in the ECM.
- The fuel tank temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases. The ground terminal (terminal No. 1) is grounded to the vehicle body.

## TECHNICAL DESCRIPTION

- The fuel tank temperature sensor converts the fuel tank temperature to a voltage.
- The ECM detects the fuel tank temperature with this output voltage.

## DESCRIPTIONS OF MONITOR METHODS

Fuel tank 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)**

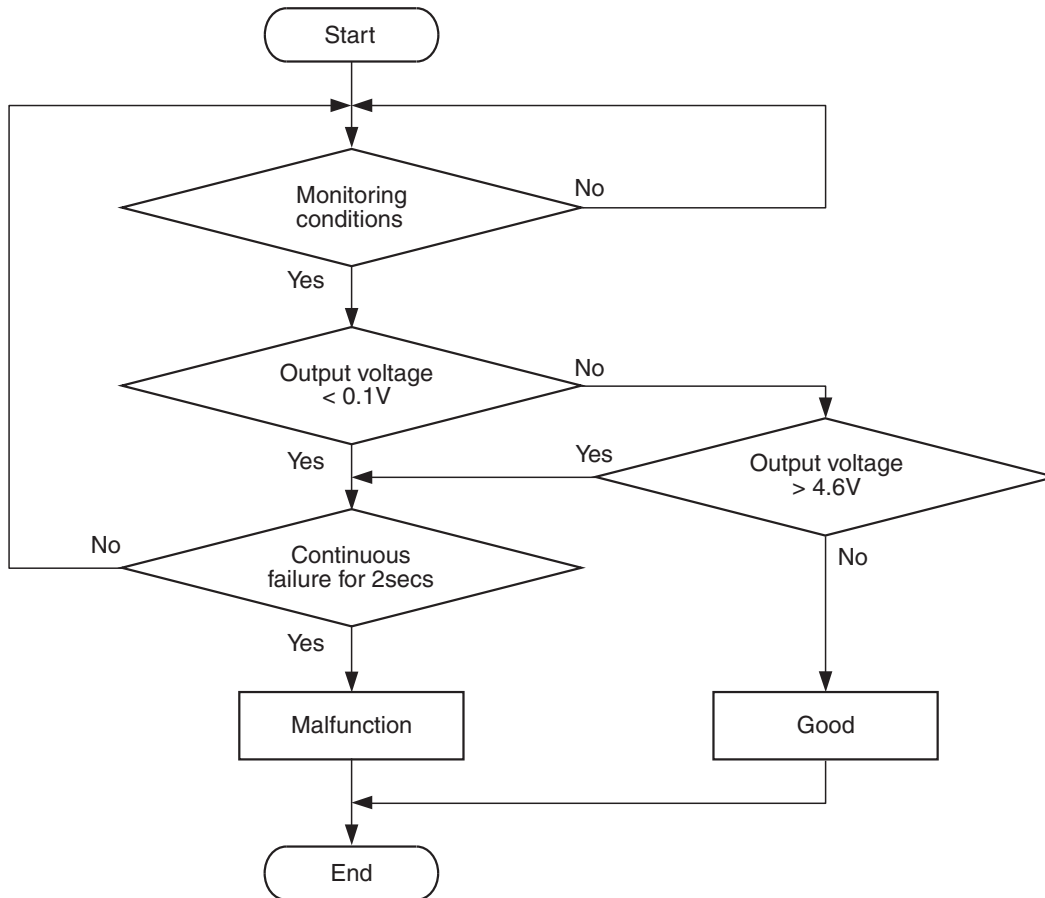
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Not applicable

## DTC SET CONDITIONS

### Logic Flow Chart



AK700478

#### Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

#### Judgement Criterion

- Fuel tank temperature sensor output voltage is less than 0.1 volt for 2 seconds.

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

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

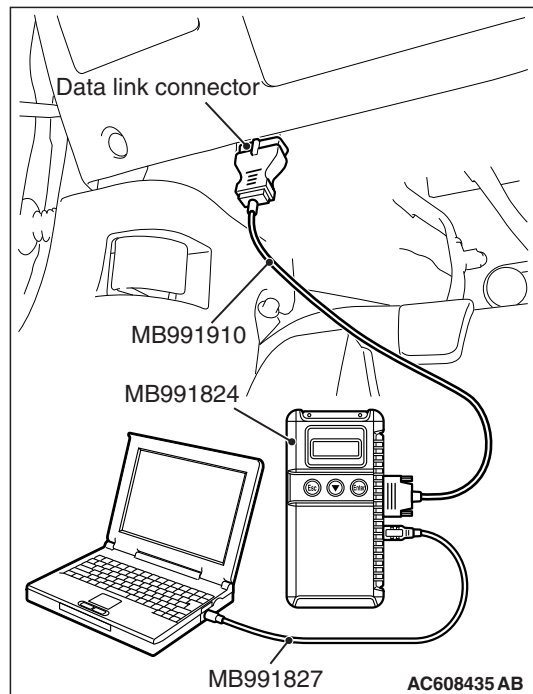
#### TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Fuel tank temperature sensor failed.
- Shorted fuel tank temperature sensor circuit or connector damage.
- ECM failed.

#### DIAGNOSIS

##### Required Special Tool:

- 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 53: Fuel Tank 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 53, Fuel Tank Temperature Sensor.
  - Approximately the same as the ambient air temperature when the engine is cooled.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the sensor operating properly?**

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

**NO :** Go to Step 2.

**STEP 2. Check harness connector D-18 at fuel pump module 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 7.

**STEP 3. Check the fuel tank temperature sensor.**

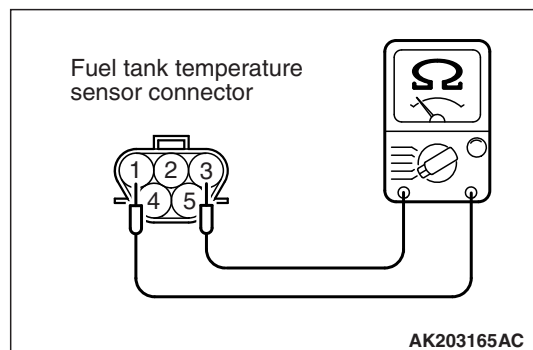
- (1) Disconnect the fuel pump module connector D-18.
- (2) Measure the resistance between terminal No. 1 and No. 3 of the fuel pump module.

**Standard value: 0.5 –12.0 kΩ**

**Q: Is the measured resistance between 0.5 and 12.0 kΩ?**

**YES :** Go to Step 4.

**NO :** Replace the fuel pump module. Then go to Step 7.



**STEP 4. Check harness connector B-109 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 7.

---

**STEP 5. Check for short circuit to ground between fuel pump module connector D-18 (terminal No. 3) and ECM connector B-109 (terminal No. 115).**

*NOTE: Check harness after checking intermediate connector C-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 7.*

**Q: Is the harness wire in good condition?**

**YES** : Go to Step 6.

**NO** : Repair it. Then go to Step 7.

---

**STEP 6. Using scan tool MB991958, check data list item 53: Fuel Tank Temperature Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 53, Fuel Tank Temperature Sensor.
  - Approximately the same as the ambient air temperature when the engine is cooled.
- (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.00-13.

**NO** : Replace the ECM (Refer to, Removal and Installation P.13B-1022). 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.13B-12.
- (2) Check the diagnostic trouble code (DTC).

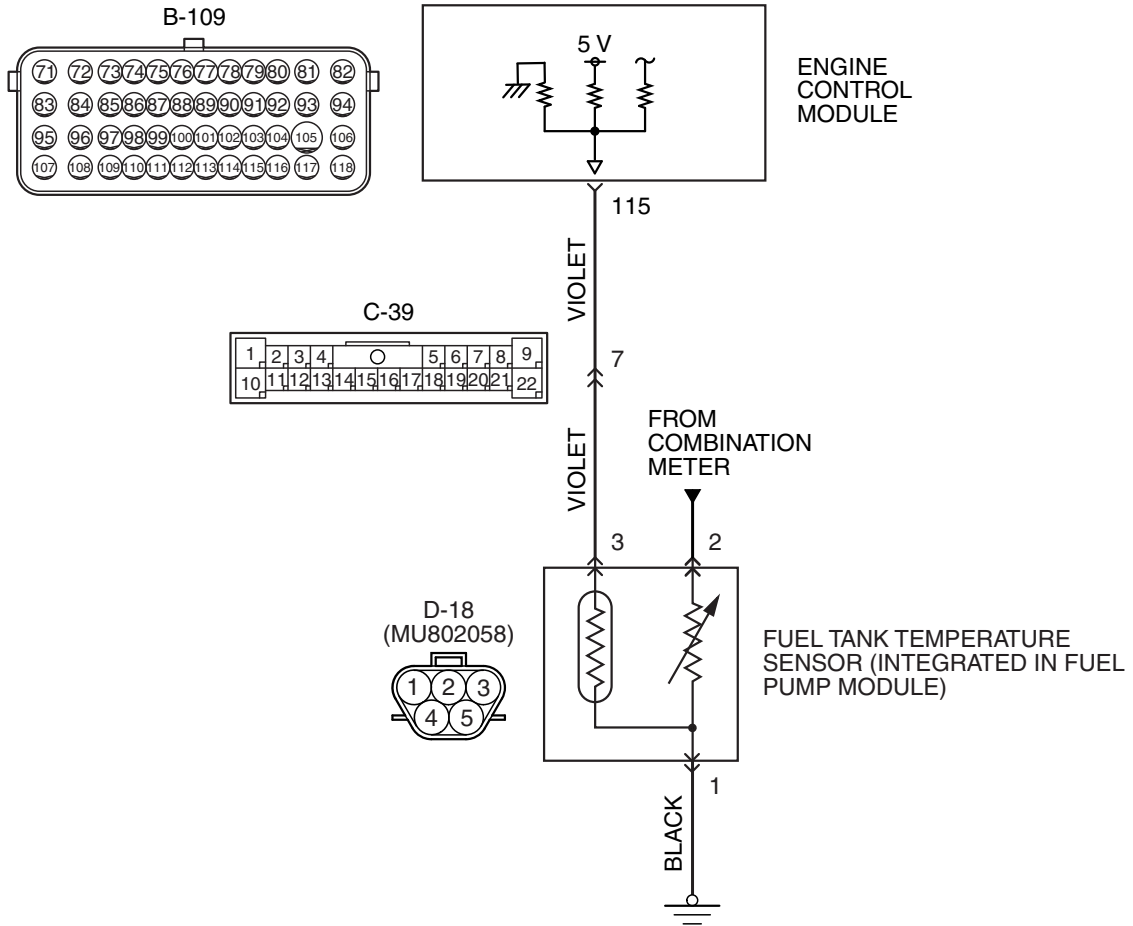
**Q: Is DTC P0182 set?**

**YES** : Retry the troubleshooting.

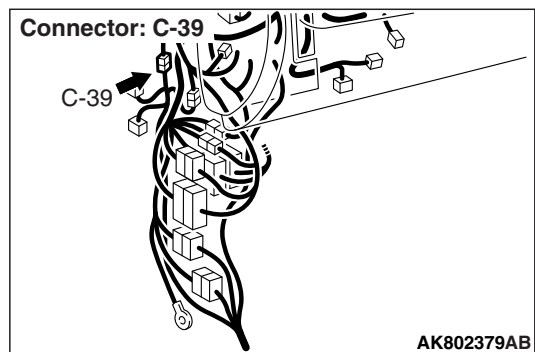
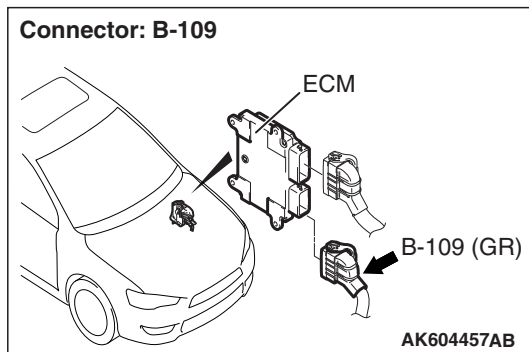
**NO** : The inspection is complete.

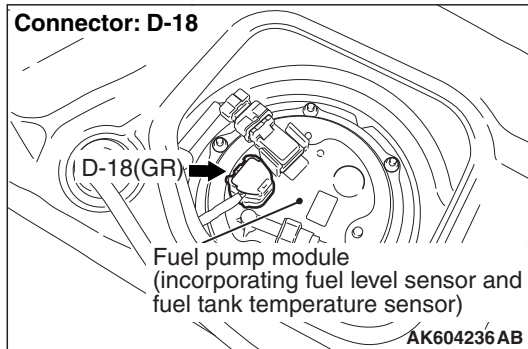
DTC P0183: Fuel Tank Temperature Sensor Circuit High Input

FUEL TANK TEMPERATURE SENSOR CIRCUIT



AK604240AD





## CIRCUIT OPERATION

- 5-volt voltage is applied to the fuel tank temperature sensor output terminal (terminal No. 3) from the ECM (terminal No. 115) via the resistor in the ECM.
- The fuel tank temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases. The ground terminal (terminal No. 1) is grounded to the vehicle body.

## TECHNICAL DESCRIPTION

- The fuel tank temperature sensor converts the fuel tank temperature to a voltage.
- The ECM detects the fuel tank temperature with this output voltage.

## DESCRIPTIONS OF MONITOR METHODS

Fuel tank 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

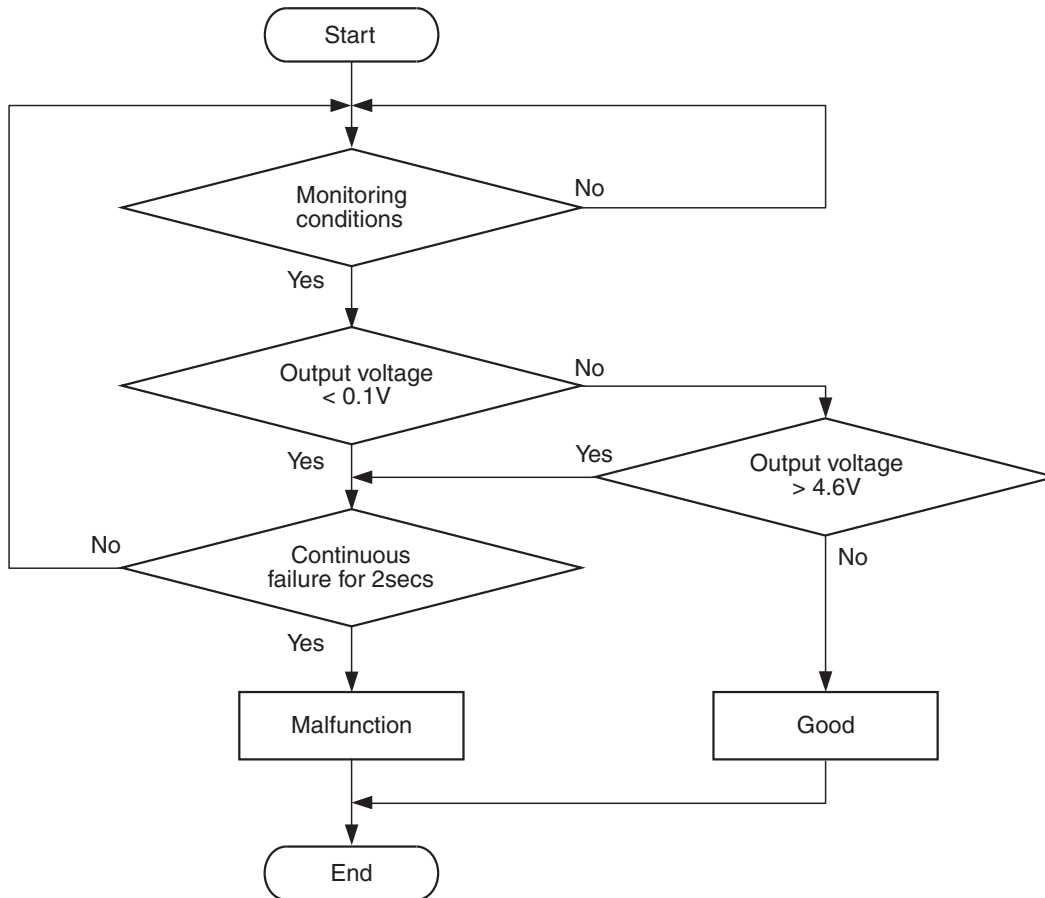
**Sensor (The sensor below is determined to be normal)**

- Not applicable



## DTC SET CONDITIONS

## Logic Flow Chart



AK700478

**Check Condition**

- More than 2 seconds have passed since the engine starting sequence was completed.

**Judgement Criterion**

- Fuel tank temperature sensor output voltage is more than 4.6 volts for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

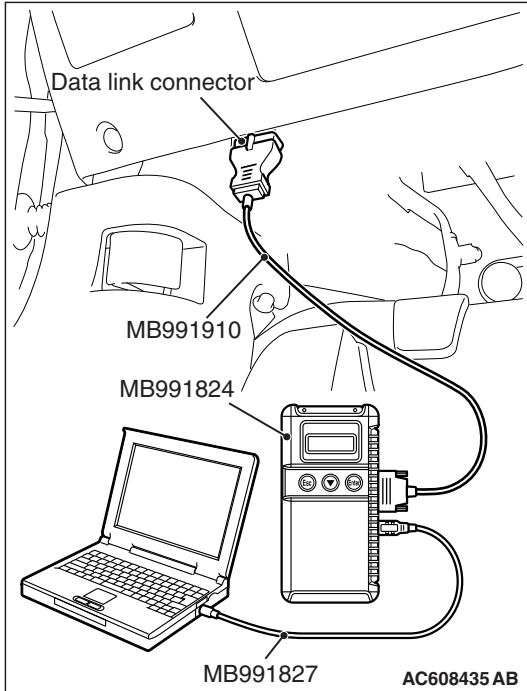
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13B-12](#).

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

- Fuel tank temperature sensor failed.
- Open fuel tank temperature 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 53: Fuel Tank 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 53, Fuel Tank Temperature Sensor.
  - Approximately the same as the ambient air temperature when the engine is cooled.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the sensor operating properly?**

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

**NO :** Go to Step 2.

**STEP 2. Check harness connector D-18 at fuel pump module 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 9.

**STEP 3. Check the fuel tank temperature sensor.**

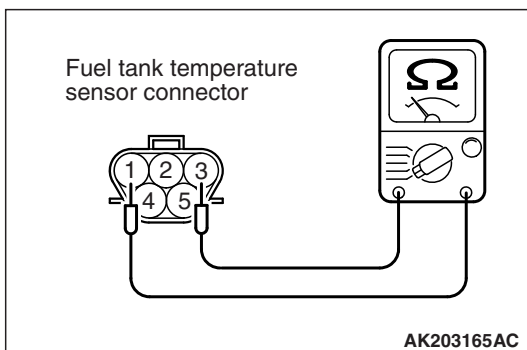
- (1) Disconnect the fuel pump module connector D-18.
- (2) Measure the resistance between terminal No. 1 and No. 3 of the fuel pump module.

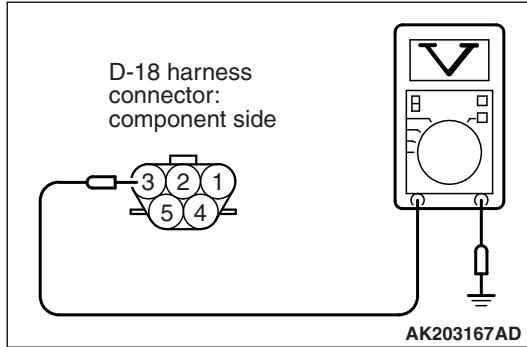
**Standard value: 0.5 –12.0 kΩ**

**Q: Is the measured resistance between 0.5 and 12.0 kΩ?**

**YES :** Go to Step 4.

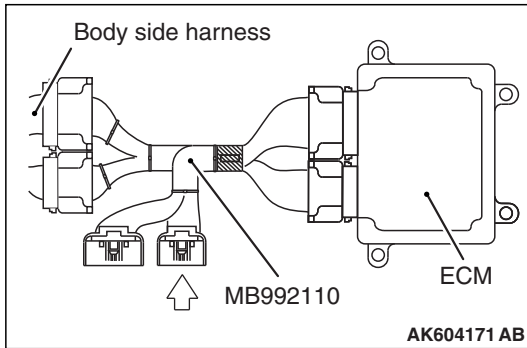
**NO :** Replace the fuel pump module. Then go to Step 9.



**STEP 4. Measure the sensor supply voltage at fuel pump module harness side connector D-18.**

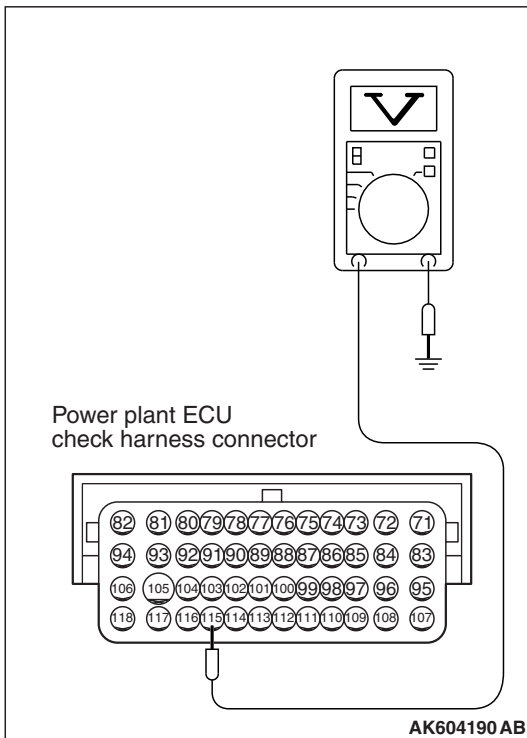
- (1) Disconnect the connector D-18 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 3 and ground.
  - Voltage should be between 4.5 and 4.9 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**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 9.



**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 fuel pump module connector D-18.
- (3) Turn the ignition switch to the "ON" position.

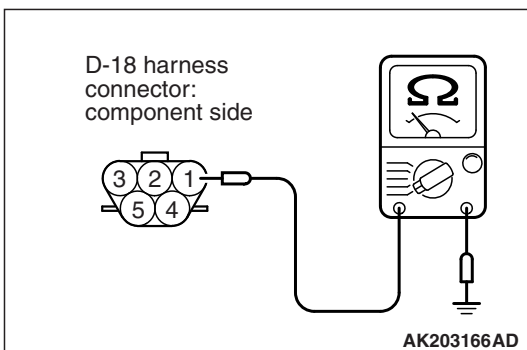


- (4) Measure the voltage between terminal No. 115 and ground.
  - Voltage should be between 4.5 and 4.9 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Check harness connector C-39 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 fuel pump module connector D-18 (terminal No. 3) and ECM connector B-109 (terminal No. 115) because of open circuit. Then go to Step 9.

**NO :** Go to Step 8.



**STEP 7. Check the continuity at fuel pump module harness side connector D-18.**

- (1) Disconnect the connector D-18 and measure at the harness side.
- (2) Check for the continuity between terminal No. 1 and ground.
  - Continuity (2 ohms or less)

**Q: Does continuity exist?**

**YES :** Go to Step 8.

**NO :** Repair harness wire between fuel pump module connector D-18 (terminal No. 1) and ground because of open circuit. Then go to Step 9.

**STEP 8. Using scan tool MB991958, check data list item 53:  
Fuel Tank Temperature Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 53, Fuel Tank Temperature Sensor.
  - Approximately the same as the ambient air temperature when the engine is cooled.
- (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.00-13](#).
- NO** : Replace the ECM (Refer to, Removal and Installation  
[P.13B-1022](#)). Then go to Step 9.

---

**STEP 9. Test the OBD-II drive cycle.**

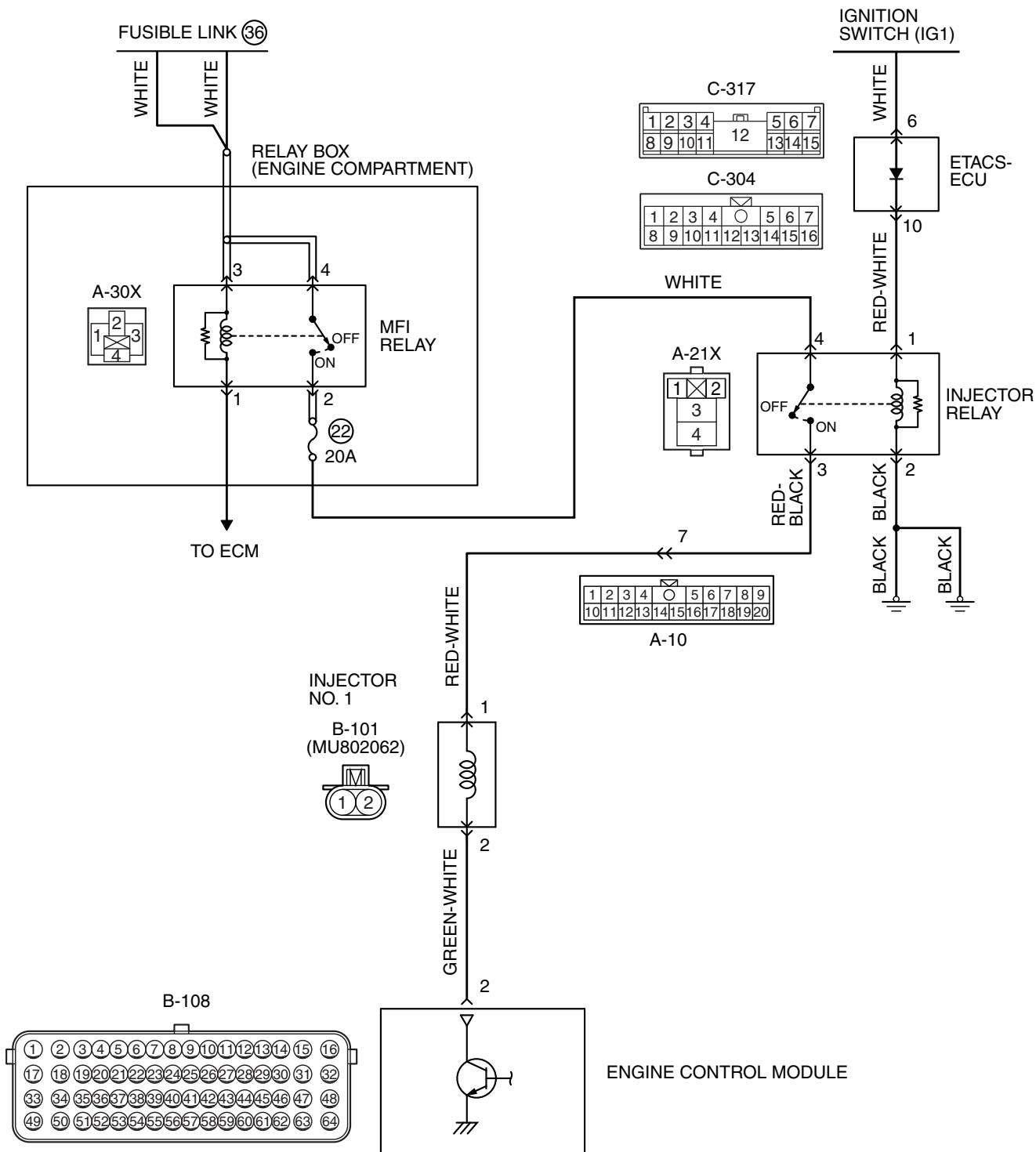
- (1) Carry out a test drive with the drive cycle pattern. Refer to  
Diagnostic Function –OBD-II Drive Cycle –Pattern 23  
[P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0183 set?**

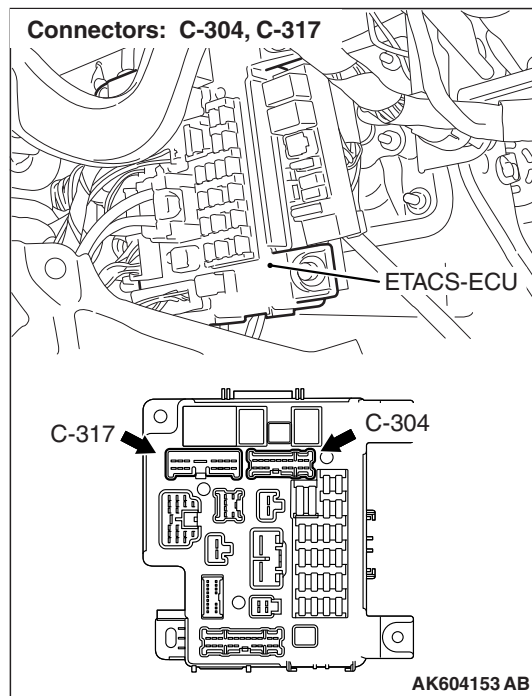
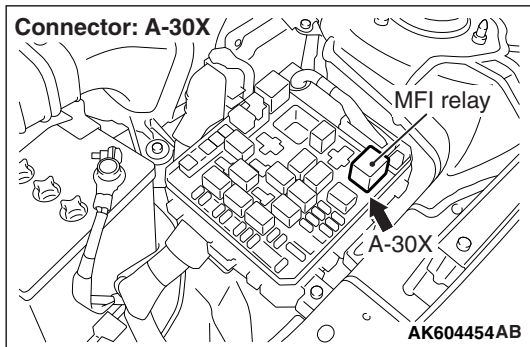
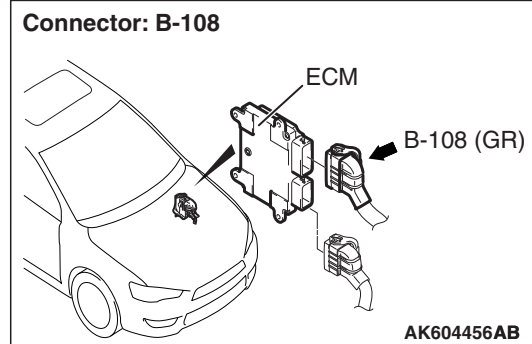
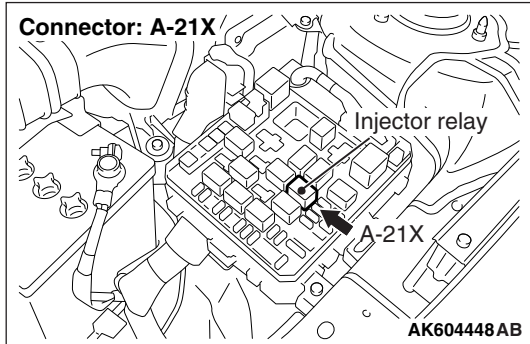
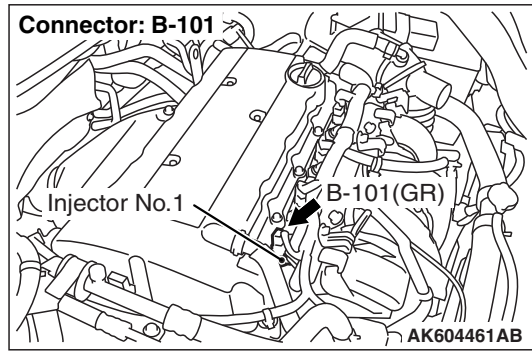
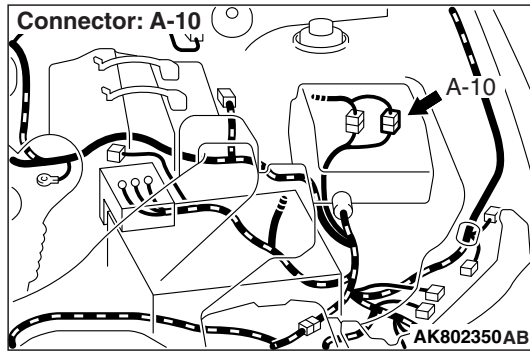
- YES** : Retry the troubleshooting.
- NO** : The inspection is complete.

DTC P0201: Injector Circuit-Cylinder 1

INJECTOR CIRCUIT-CYLINDER 1



AK604241AC



**CIRCUIT OPERATION**

- The injector power is supplied from the injector relay (terminal No. 3).
- The ECM controls the injector by turning the power transistor in the ECM "ON" and "OFF".

**TECHNICAL DESCRIPTION**

- The amount of fuel injected by the injector is controlled by the amount of continuity time the coil is grounded by the ECM.

**DESCRIPTIONS OF MONITOR METHODS**

The ECM detects open circuit and short malfunction.

**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)

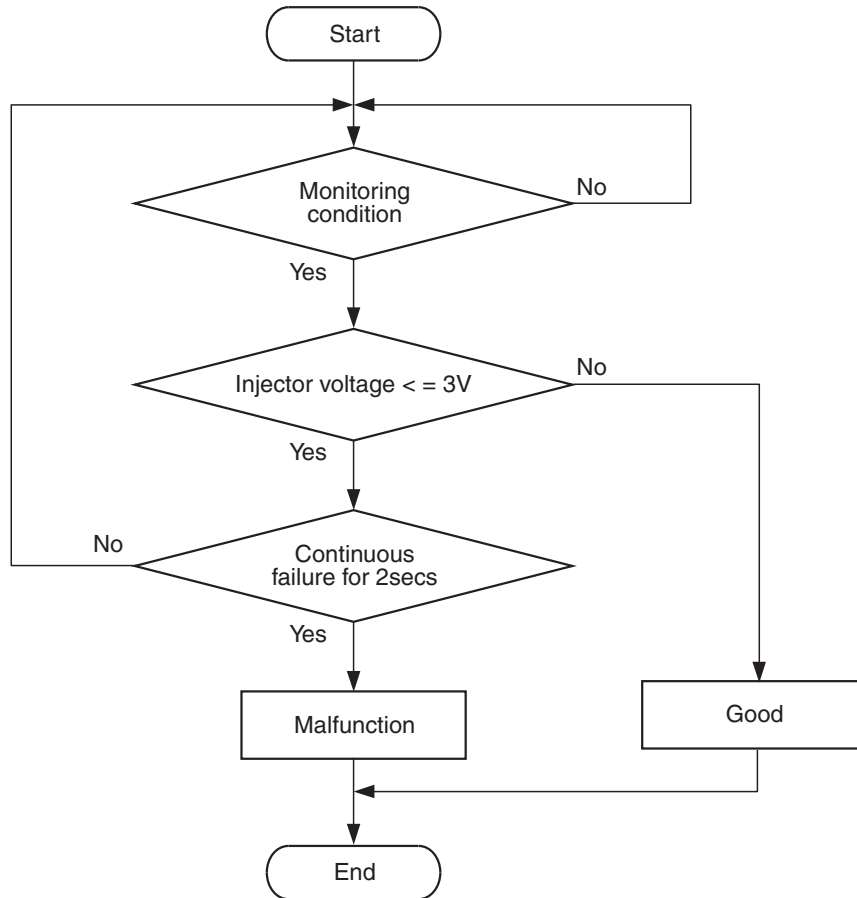
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

**DTC SET CONDITIONS <Circuit continuity –open circuit and shorted low>**

**Logic Flow Chart**



AK700479

**Check Condition**

- Engine is running.

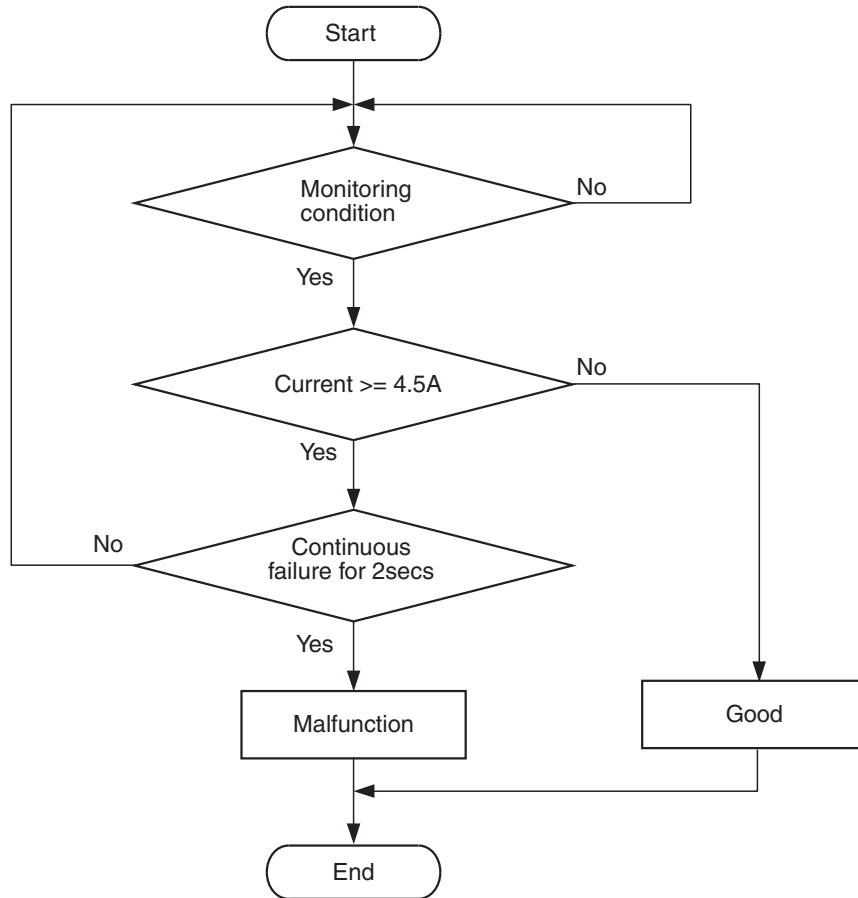
**Judgement Criterion**

- The supply voltage is less than 3 volts without the injector driving for 2 seconds.



**DTC SET CONDITIONS <Circuit continuity –shorted high>**

**Logic Flow Chart**



AK604332

**Check Condition**

- Engine is running.

**Judgement Criterion**

- The coil current is more than 4.5 amperes with the injector driving for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

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

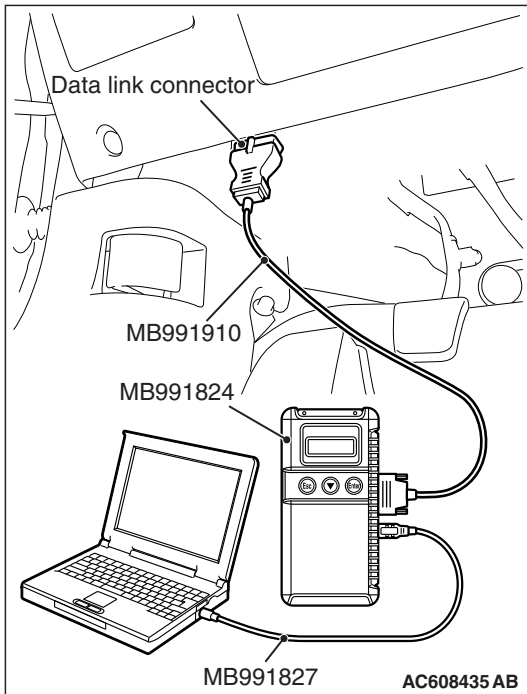
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

- No. 1 cylinder injector failed.
- Open or shorted No. 1 cylinder injector 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
- MB992110: Power Plant ECU Check Harness



**STEP 1. Using scan tool MB991958, check actuator test item 1: Injectors.**

**⚠ 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) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
- (4) Set scan tool MB991958 to the actuator testing mode for item 1 Injectors.
  - The idle should become slightly rougher.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the actuator operating properly?**

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

**NO :** Go to Step 2.

**STEP 2. Check harness connector B-101 at No. 1 cylinder injector 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 13.

**STEP 3. Check the No. 1 cylinder injector.**

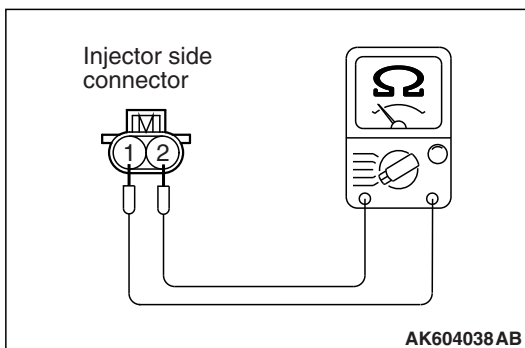
- (1) Disconnect the No. 1 cylinder injector connector B-101.
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

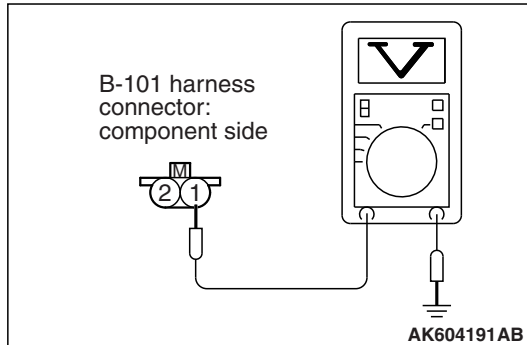
**Standard value: 10.5 –13.5 Ω [at 20° C (68° F)]**

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

**YES :** Go to Step 4.

**NO :** Replace the No. 1 cylinder injector. Then go to Step 13.



**STEP 4. Measure the power supply voltage at No. 1 cylinder injector harness side connector B-101.**

- (1) Disconnect the connector B-101 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 7.

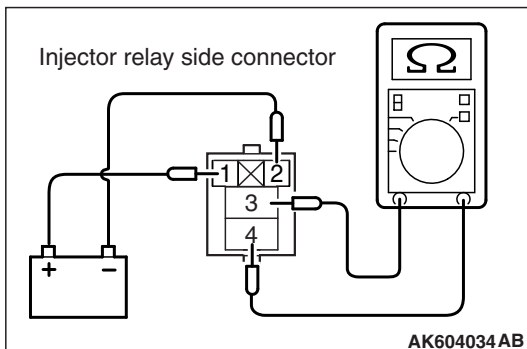
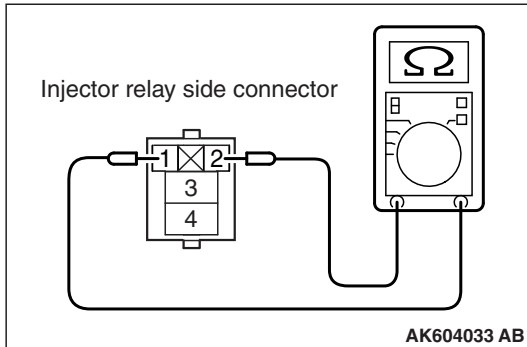
**NO :** Go to Step 5.

**STEP 5. Check harness connector A-21X at injector relay 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 13.



**STEP 6. Check the injector relay.**

- (1) Remove the injector relay.
- (2) Check for continuity between the injector relay terminal No. 1 and No. 2.
  - There should be continuity.

- (3) Use jumper wires to connect injector relay terminal No. 1 to the positive battery terminal and terminal No. 2 to the negative battery terminal.
- (4) Check for continuity between the injector relay terminal No. 3 and No. 4 while connecting and disconnecting the jumper wire at the negative battery terminal.
  - Continuity (2 ohms or less). <Negative battery terminal connected>
  - Should be open loop. <Negative battery terminal disconnected>
- (5) Install the injector relay.

**Q: Is the measured resistance normal?**

**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 injector relay connector A-21X (terminal No. 3) and No. 1 cylinder injector connector B-101 (terminal No. 1) because of open circuit. Then go to Step 13.

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

**STEP 7. Check harness connector A-30X at MFI relay and harness connector A-21X at injector relay for damage.**

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 8.

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

**STEP 8. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and injector relay connector A-21X (terminal No. 4).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 9.

**NO :** Repair it. Then go to Step 13.

---

**STEP 9. Check for harness damage between injector relay connector A-21X (terminal No. 3) and No. 1 cylinder injector connector B-101 (terminal No. 1).**

*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 13.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 10.

**NO :** Repair it. Then go to Step 13.

---

**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 13.

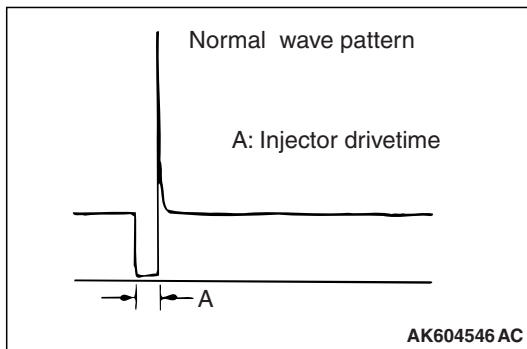
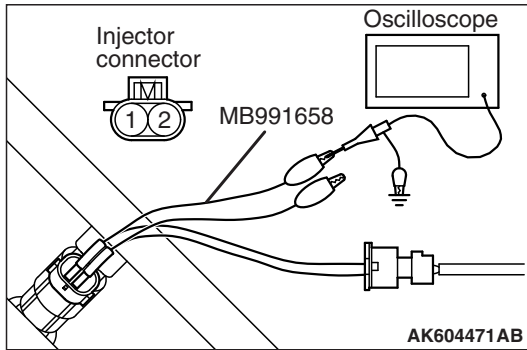
---

**STEP 11. Check for open circuit, short circuit to ground and harness damage between No. 1 cylinder injector connector B-101 (terminal No. 2) and ECM connector B-108 (terminal No. 2).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 12.

**NO :** Repair it. Then go to Step 13.



**STEP 12. Using the oscilloscope, check the No. 1 cylinder injector.**

(1) Disconnect the No. 1 cylinder injector connector B-101 and connect the test harness special tool MB991658 between the separated connectors. (All terminals should be connected.)

(2) Connect the oscilloscope probe to the injector side connector terminal No. 2.

*NOTE: When checking with the ECM side connector, disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 2.*

(3) Start the engine and run at idle.

(4) Check the wave pattern.

- The wave pattern should show a normal pattern similar to the illustration.

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

**Q: Is the wave pattern normal?**

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

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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 23 [P.13B-12](#).

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

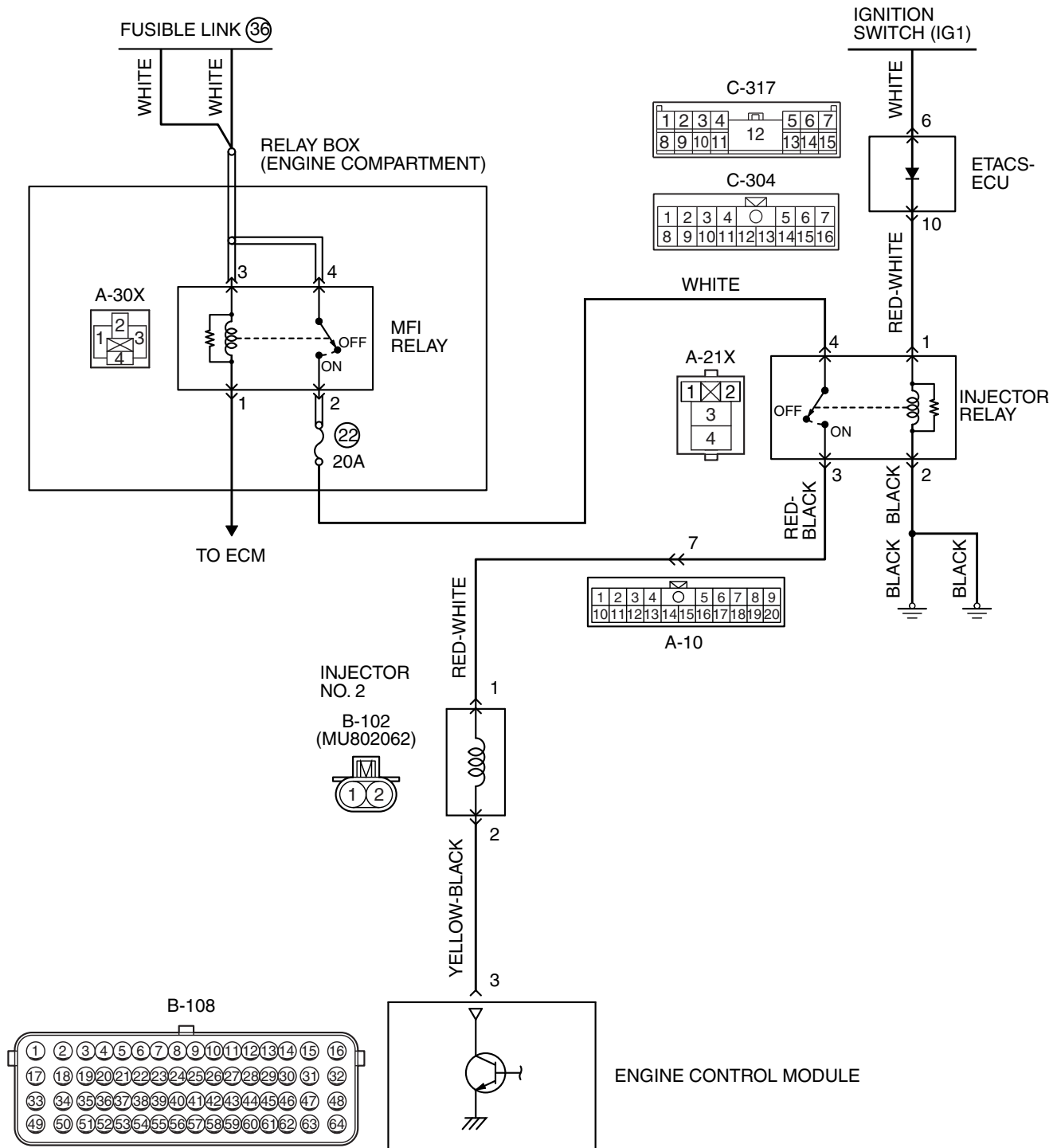
**Q: Is DTC P0201 set?**

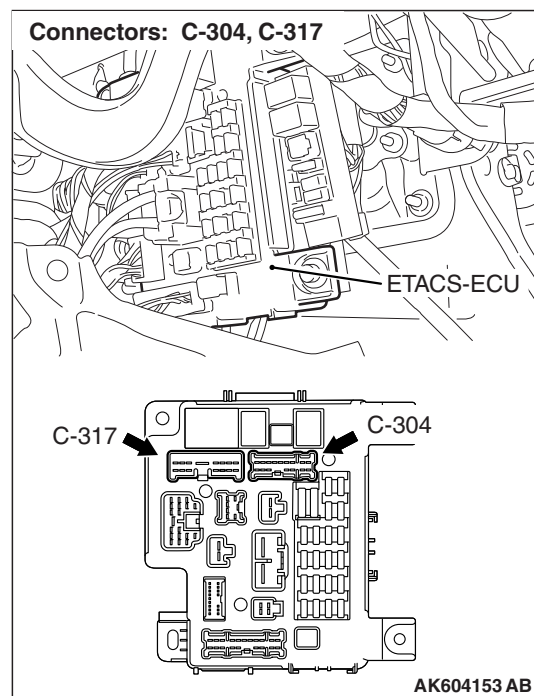
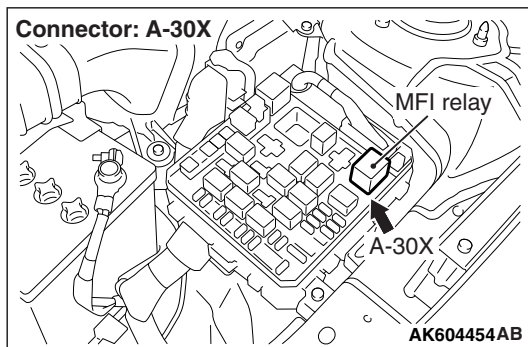
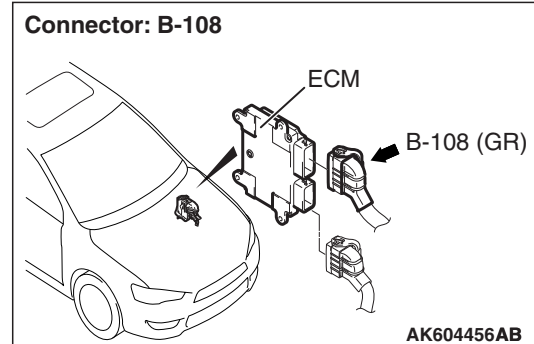
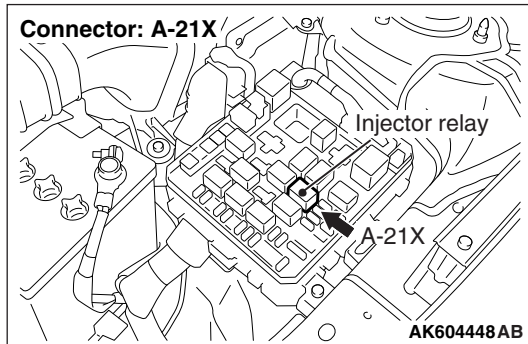
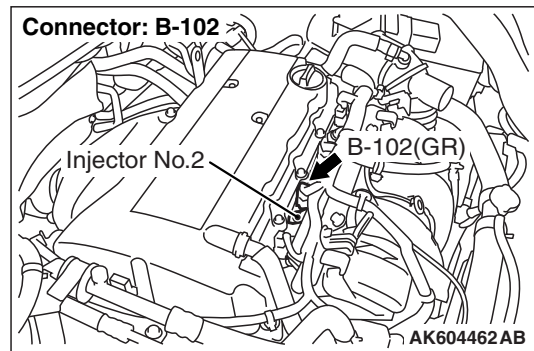
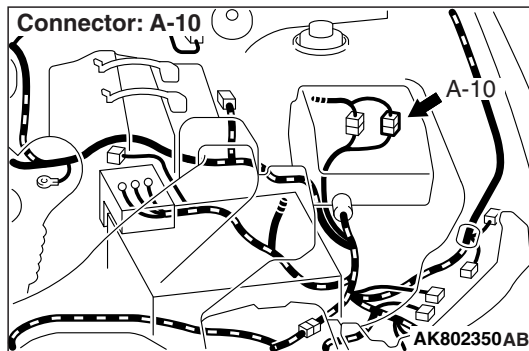
**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

DTC P0202: Injector Circuit-Cylinder 2

INJECTOR CIRCUIT-CYLINDER 2





## CIRCUIT OPERATION

- The injector power is supplied from the injector relay (terminal No. 3).
- The ECM controls the injector by turning the power transistor in the ECM "ON" and "OFF".

## TECHNICAL DESCRIPTION

- The amount of fuel injected by the injector is controlled by the amount of continuity time the coil is grounded by the ECM.

## DESCRIPTIONS OF MONITOR METHODS

The ECM detects open circuit and short malfunction.

## 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)

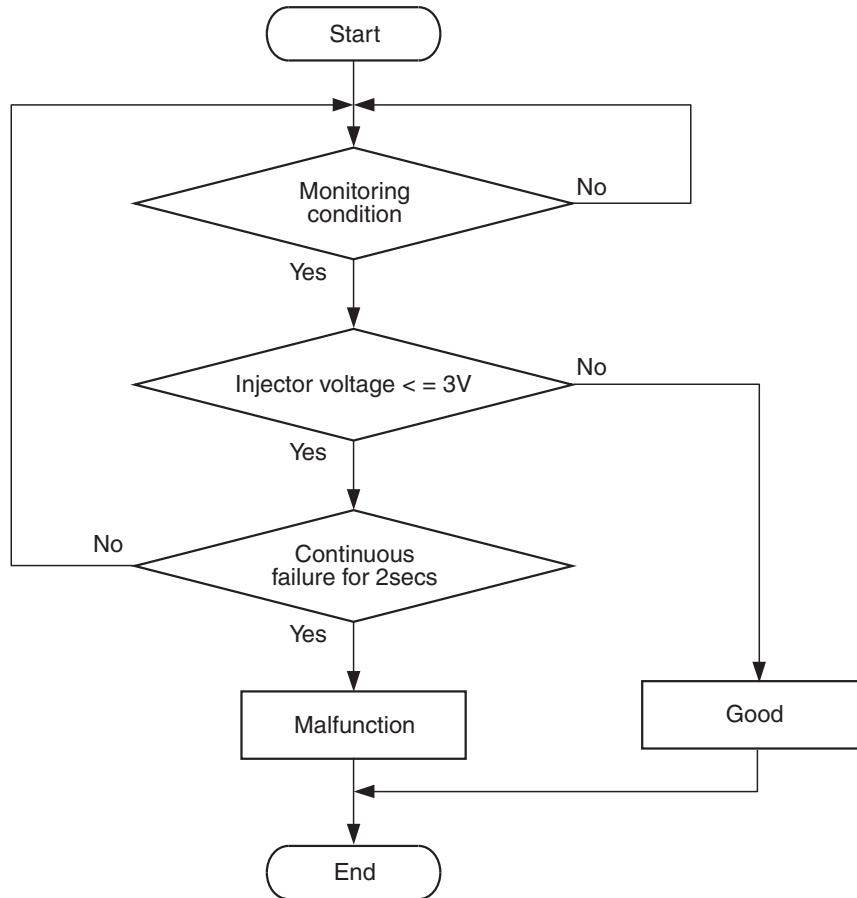
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

**DTC SET CONDITIONS <Circuit continuity –open circuit and shorted low>**

**Logic Flow Chart**



AK700479

**Check Condition**

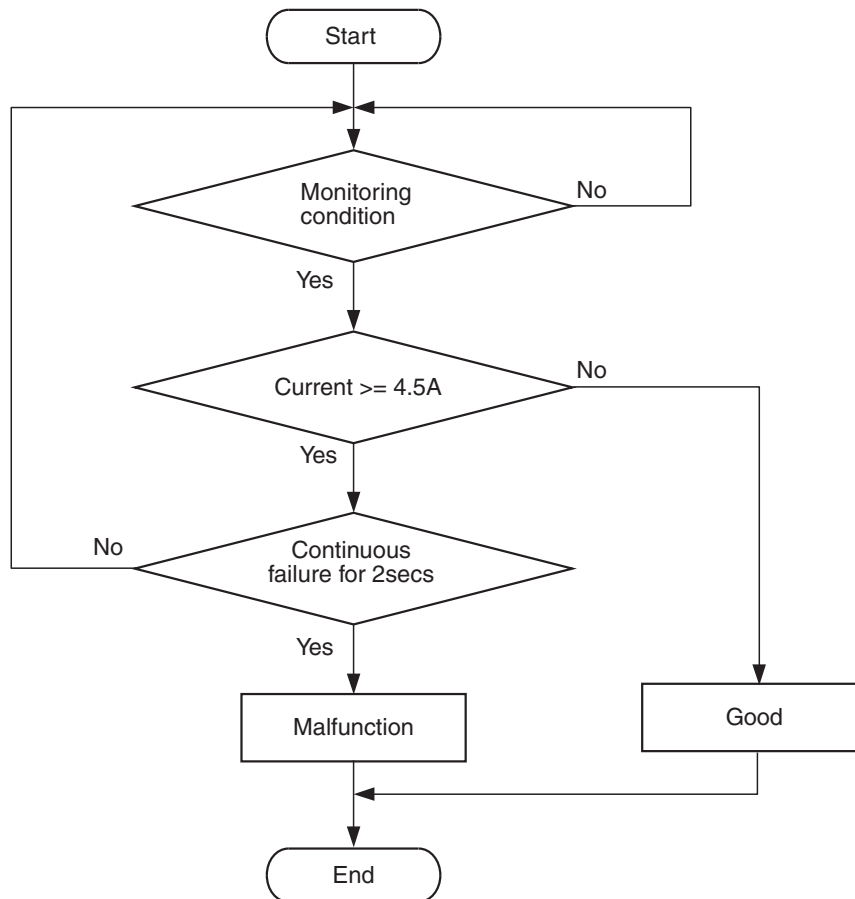
- Engine is running.

**Judgement Criterion**

- The supply voltage is less than 3 volts without the injector driving for 2 seconds.

**DTC SET CONDITIONS <Circuit continuity –shorted high>**

**Logic Flow Chart**



AK604332

**Check Condition**

- Engine is running.

**Judgement Criterion**

- The coil current is more than 4.5 amperes with the injector driving for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

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

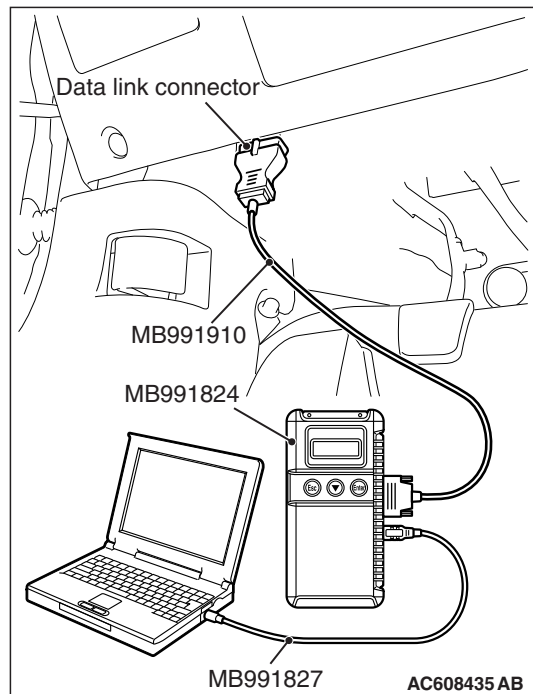
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

- No. 2 cylinder injector failed.
- Open or shorted No. 2 cylinder injector 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
- MB992110: Power Plant ECU Check Harness



**STEP 1. Using scan tool MB991958, check actuator test item 1: Injectors.**

**⚠ 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) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
- (4) Set scan tool MB991958 to the actuator testing mode for item 1 Injectors.
  - The idle should become slightly rougher.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the actuator operating properly?**

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

**NO :** Go to Step 2.

**STEP 2. Check harness connector B-102 at No. 2 cylinder injector 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 13.

**STEP 3. Check the No. 2 cylinder injector.**

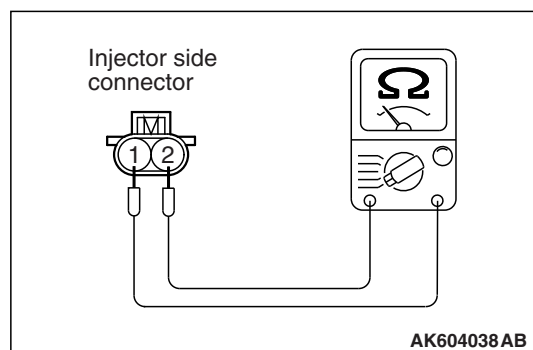
- (1) Disconnect the No. 2 cylinder injector connector B-102.
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

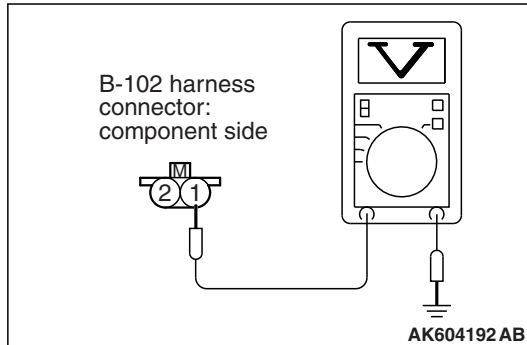
**Standard value: 10.5 –13.5 Ω [at 20° C (68° F)]**

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

**YES :** Go to Step 4.

**NO :** Replace the No. 2 cylinder injector. Then go to Step 13.





**STEP 4. Measure the power supply voltage at No. 2 cylinder injector harness side connector B-102.**

- (1) Disconnect the connector B-102 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 7.

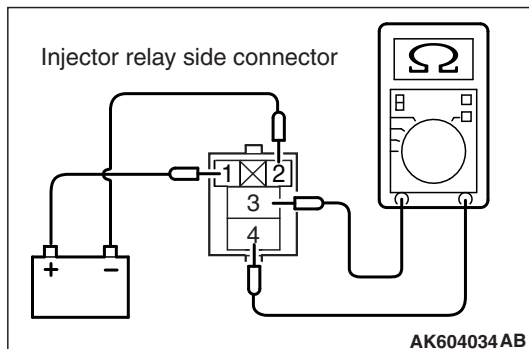
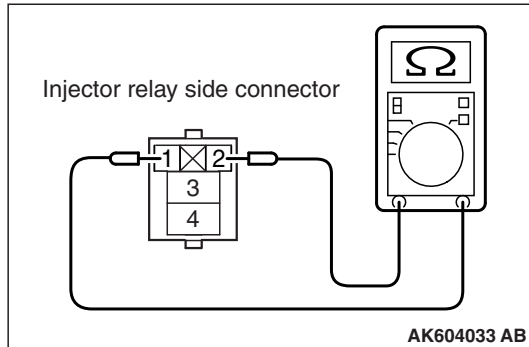
**NO :** Go to Step 5.

**STEP 5. Check harness connector A-21X at injector relay 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 13.

**STEP 6. Check the injector relay.**

- (1) Remove the injector relay.
- (2) Check for continuity between the injector relay terminal No. 1 and No. 2.
  - There should be continuity.

- (3) Use jumper wires to connect injector relay terminal No. 1 to the positive battery terminal and terminal No. 2 to the negative battery terminal.
- (4) Check for continuity between the injector relay terminal No. 3 and No. 4 while connecting and disconnecting the jumper wire at the negative battery terminal.
  - Continuity (2 ohms or less). <Negative battery terminal connected>
  - Should be open loop. <Negative battery terminal disconnected>
- (5) Install the injector relay.

**Q: Is the measured resistance normal?**

**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 injector relay connector A-21X (terminal No. 3) and No. 2 cylinder injector connector B-102 (terminal No. 1) because of open circuit. Then go to Step 13.

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

**STEP 7. Check harness connector A-30X at MFI relay and harness connector A-21X at injector relay for damage.****Q: Are the harness connectors in good condition?**

**YES :** Go to Step 8.

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

**STEP 8. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and injector relay connector A-21X (terminal No. 4).****Q: Is the harness wire in good condition?**

**YES :** Go to Step 9.

**NO :** Repair it. Then go to Step 13.

---

**STEP 9. Check for harness damage between injector relay connector A-21X (terminal No. 3) and No. 2 cylinder injector connector B-102 (terminal No. 1).**

*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 13.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 10.

**NO :** Repair it. Then go to Step 13.

---

**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 13.

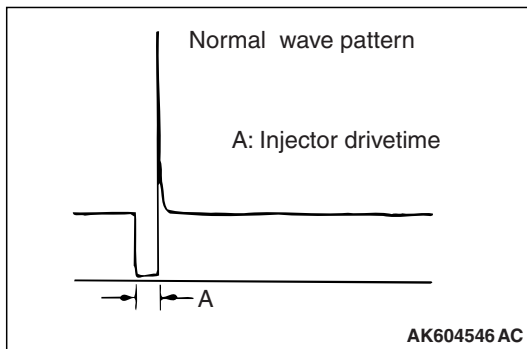
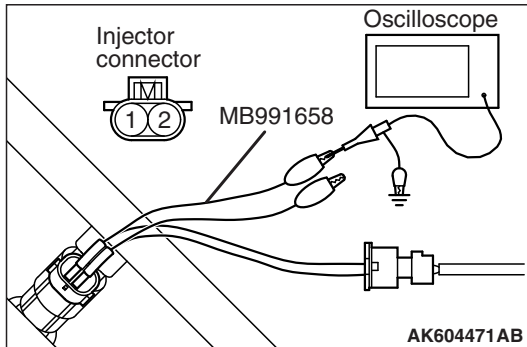
---

**STEP 11. Check for open circuit, short circuit to ground and harness damage between No. 2 cylinder injector connector B-102 (terminal No. 2) and ECM connector B-108 (terminal No. 3).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 12.

**NO :** Repair it. Then go to Step 13.

**STEP 12. Using the oscilloscope, check the No. 2 cylinder injector.**

(1) Disconnect the No. 2 cylinder injector connector B-102 and connect the test harness special tool MB991658 between the separated connectors. (All terminals should be connected.)

(2) Connect the oscilloscope probe to the injector side connector terminal No. 2.

*NOTE: When checking with the ECM side connector, disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 3.*

(3) Start the engine and run at idle.

(4) Check the wave pattern.

- The wave pattern should show a normal pattern similar to the illustration.

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

**Q: Is the wave pattern normal?**

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

**NO :** Replace the ECM (Refer to, Removal and Installation P.13B-1022). 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 23 P.13B-12.

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

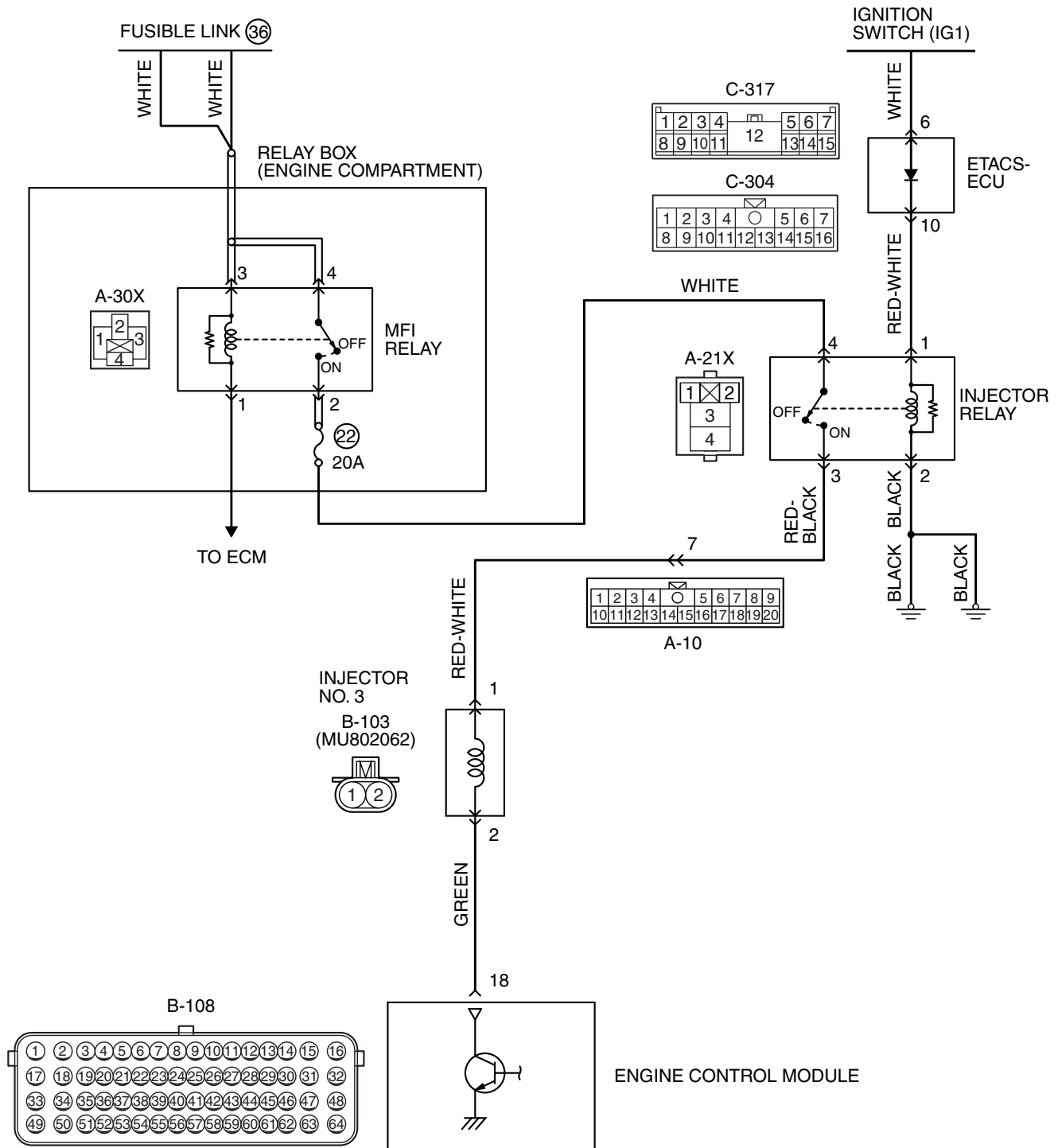
**Q: Is DTC P0202 set?**

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

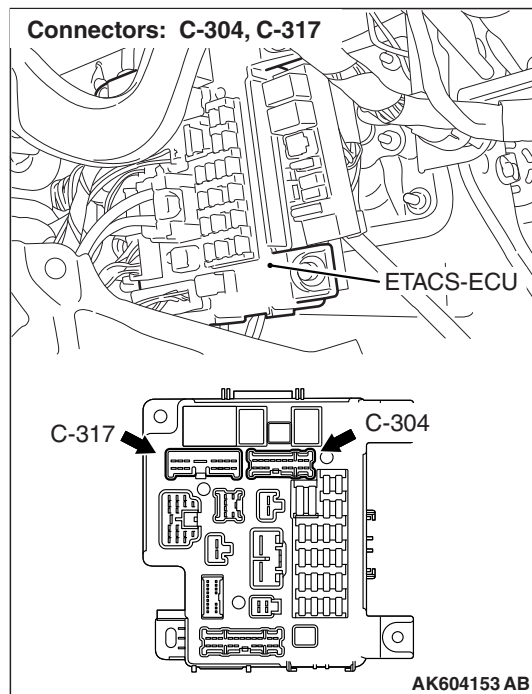
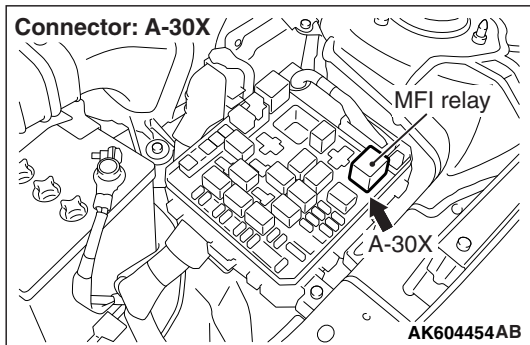
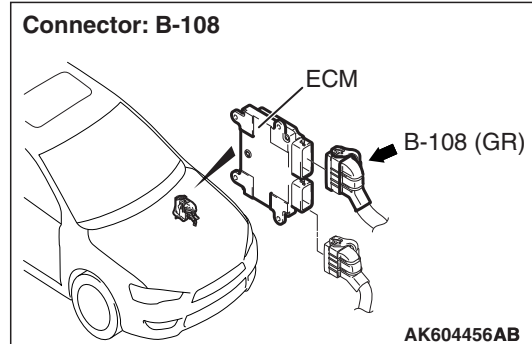
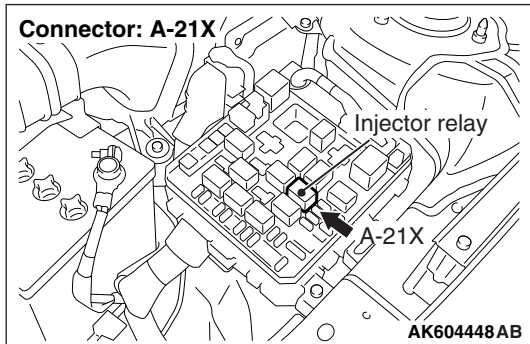
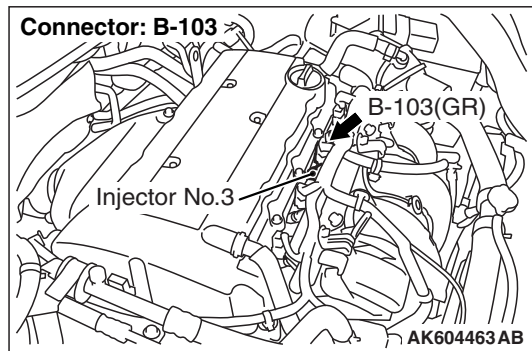
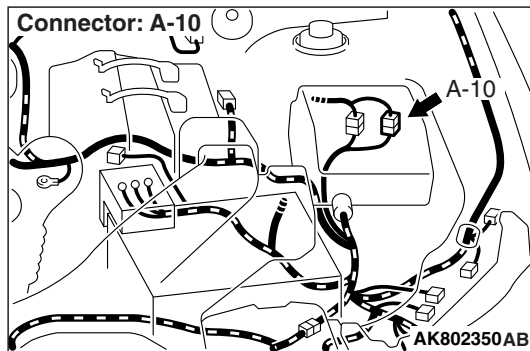
DTC P0203: Injector Circuit-Cylinder 3

INJECTOR CIRCUIT-CYLINDER 3



AK604242AC





**CIRCUIT OPERATION**

- The injector power is supplied from the injector relay (terminal No. 3).
- The ECM controls the injector by turning the power transistor in the ECM "ON" and "OFF".

**TECHNICAL DESCRIPTION**

- The amount of fuel injected by the injector is controlled by the amount of continuity time the coil is grounded by the ECM.

**DESCRIPTIONS OF MONITOR METHODS**

The ECM detects open circuit and short malfunction.

**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)

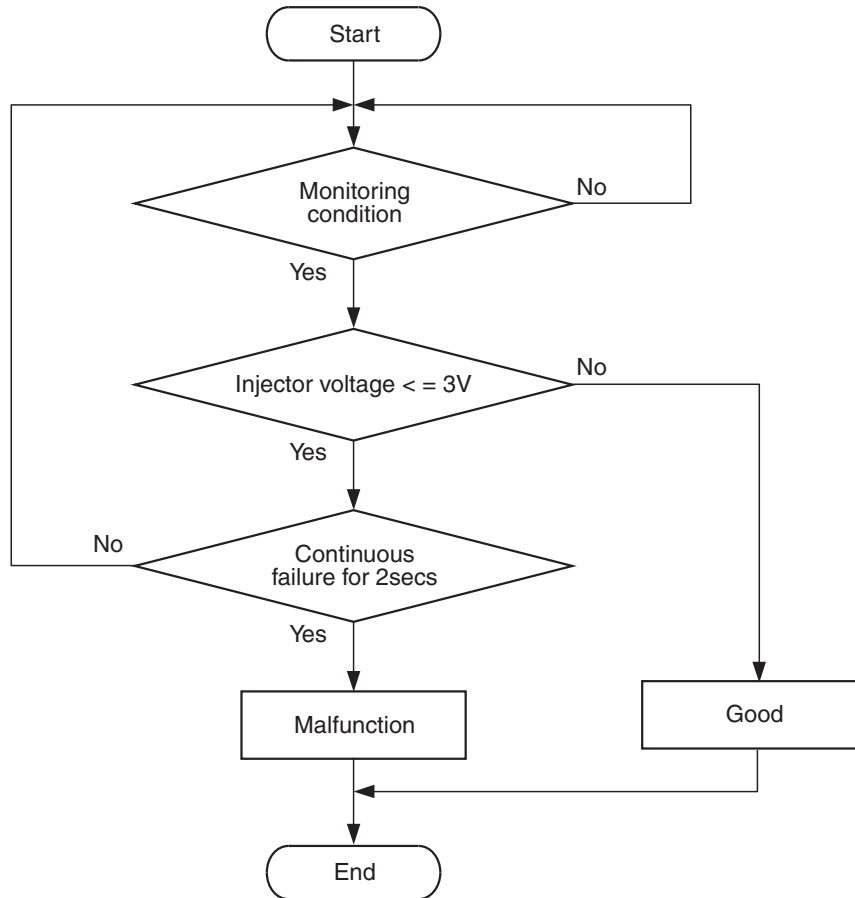
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

**DTC SET CONDITIONS <Circuit continuity –open circuit and shorted low>**

**Logic Flow Chart**



AK700479

**Check Condition**

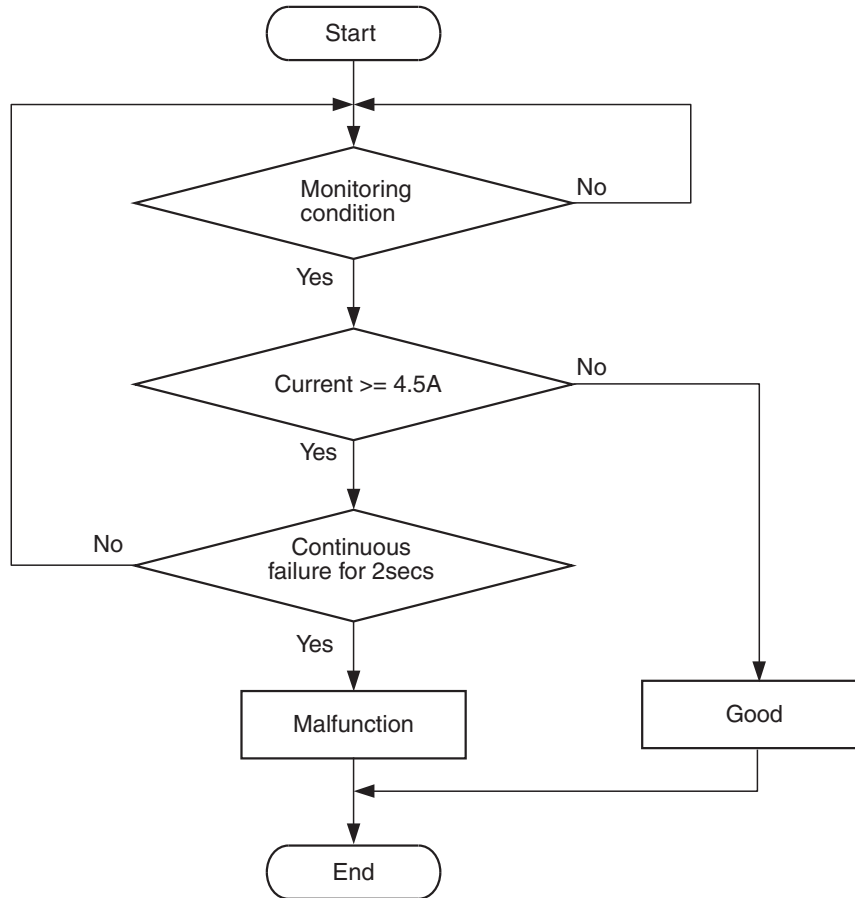
- Engine is running.

**Judgement Criterion**

- The supply voltage is less than 3 volts without the injector driving for 2 seconds.

**DTC SET CONDITIONS <Circuit continuity –shorted high>**

**Logic Flow Chart**



AK604332

**Check Condition**

- Engine is running.

**Judgement Criterion**

- The coil current is more than 4.5 amperes with the injector driving for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

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

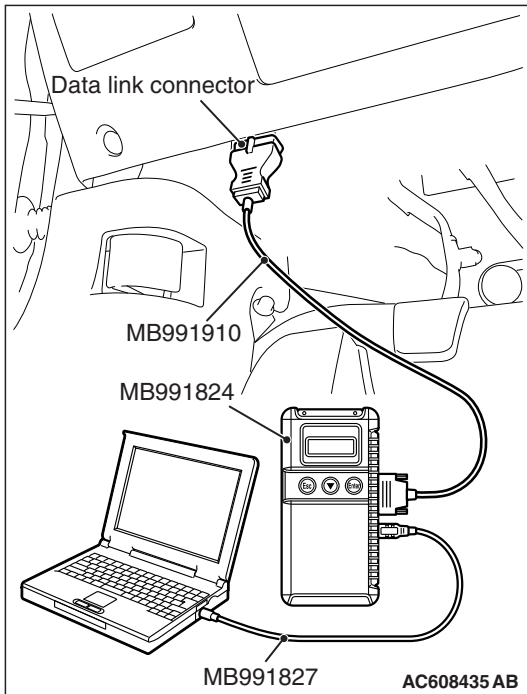
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

- No. 3 cylinder injector failed.
- Open or shorted No. 3 cylinder injector 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
- MB992110: Power Plant ECU Check Harness



**STEP 1. Using scan tool MB991958, check actuator test item 1: Injectors.**

**⚠ 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) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
- (4) Set scan tool MB991958 to the actuator testing mode for item 1 Injectors.
  - The idle should become slightly rougher.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the actuator operating properly?**

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

**STEP 2. Check harness connector B-103 at No. 3 cylinder injector 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 13.

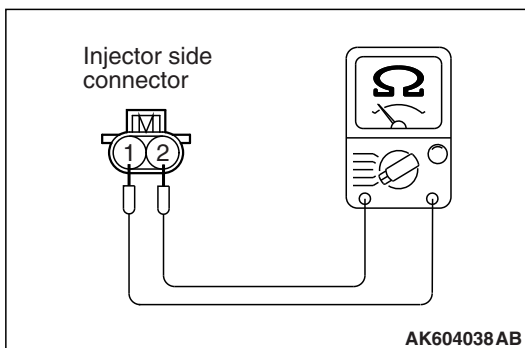
**STEP 3. Check the No. 3 cylinder injector.**

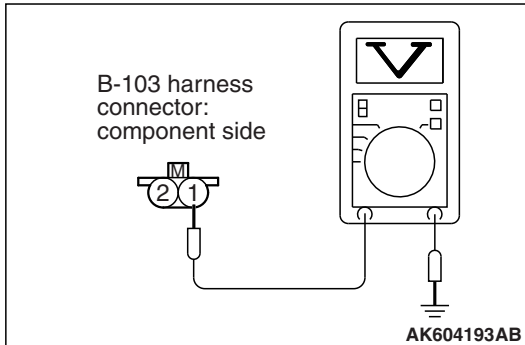
- (1) Disconnect the No. 3 cylinder injector connector B-103.
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

**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 4.
- NO :** Replace the No. 3 cylinder injector. Then go to Step 13.



**STEP 4. Measure the power supply voltage at No. 3 cylinder injector harness side connector B-103.**

- (1) Disconnect the connector B-103 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 7.

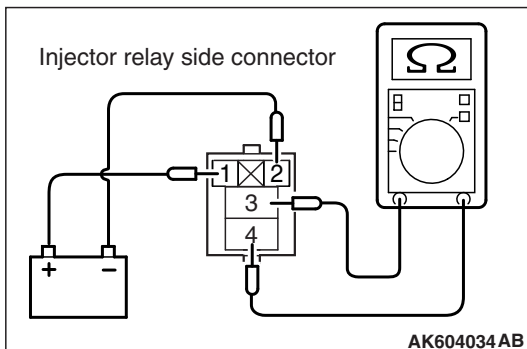
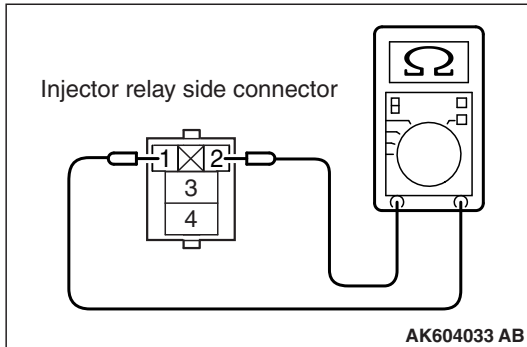
**NO :** Go to Step 5.

**STEP 5. Check harness connector A-21X at injector relay 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 13.



**STEP 6. Check the injector relay.**

- (1) Remove the injector relay.
- (2) Check for continuity between the injector relay terminal No. 1 and No. 2.
  - There should be continuity.

- (3) Use jumper wires to connect injector relay terminal No. 1 to the positive battery terminal and terminal No. 2 to the negative battery terminal.
- (4) Check for continuity between the injector relay terminal No. 3 and No. 4 while connecting and disconnecting the jumper wire at the negative battery terminal.
  - Continuity (2 ohms or less). <Negative battery terminal connected>
  - Should be open loop. <Negative battery terminal disconnected>
- (5) Install the injector relay.

**Q: Is the measured resistance normal?**

**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 injector relay connector A-21X (terminal No. 3) and No. 3 cylinder injector connector B-103 (terminal No. 1) because of open circuit. Then go to Step 13.

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

**STEP 7. Check harness connector A-30X at MFI relay and harness connector A-21X at injector relay for damage.**

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 8.

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

**STEP 8. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and injector relay connector A-21X (terminal No. 4).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 9.

**NO :** Repair it. Then go to Step 13.

---

**STEP 9. Check for harness damage between injector relay connector A-21X (terminal No. 3) and No. 3 cylinder injector connector B-103 (terminal No. 1).**

*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 13.*

**Q: Is the harness wire in good condition?**

**YES** : Go to Step 10.

**NO** : Repair it. Then go to Step 13.

---

**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 13.

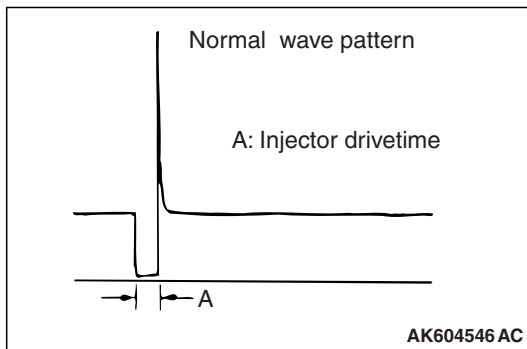
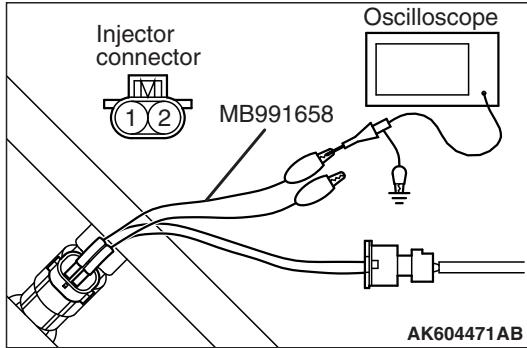
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**STEP 11. Check for open circuit, short circuit to ground and harness damage between No. 3 cylinder injector connector B-103 (terminal No. 2) and ECM connector B-108 (terminal No. 18).**

**Q: Is the harness wire in good condition?**

**YES** : Go to Step 12.

**NO** : Repair it. Then go to Step 13.



**STEP 12. Using the oscilloscope, check the No. 3 cylinder injector.**

- (1) Disconnect the No. 3 cylinder injector connector B-103 and connect the test harness special tool MB991658 between the separated connectors. (All terminals should be connected.)
- (2) Connect the oscilloscope probe to the injector side connector terminal No. 2.

*NOTE: When checking with the ECM side connector, disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 18.*

- (3) Start the engine and run at idle.

- (4) Check the wave pattern.

- The wave pattern should show a normal pattern similar to the illustration.

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

**Q: Is the wave pattern normal?**

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

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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 23 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0203 set?**

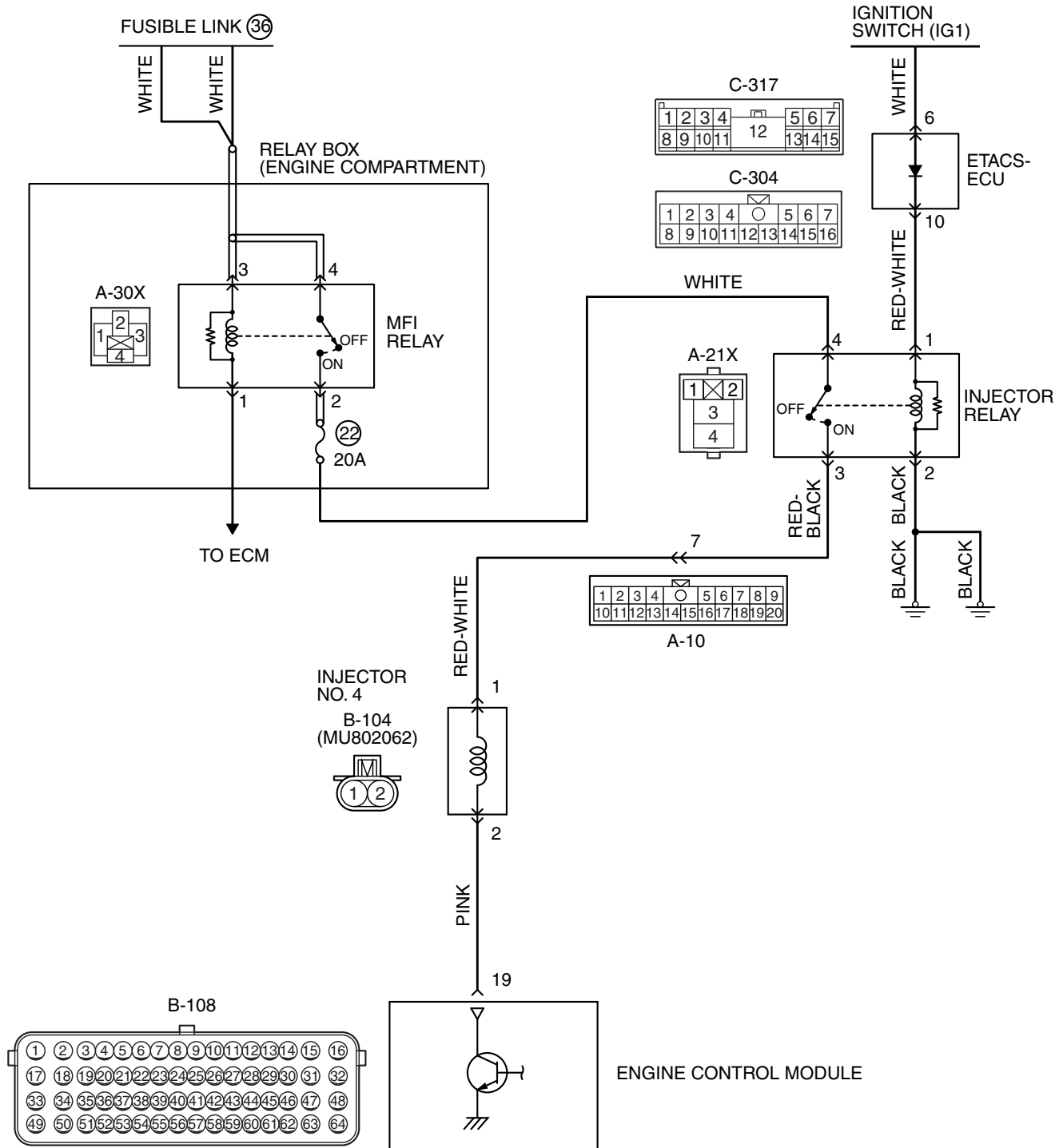
**YES :** Retry the troubleshooting.

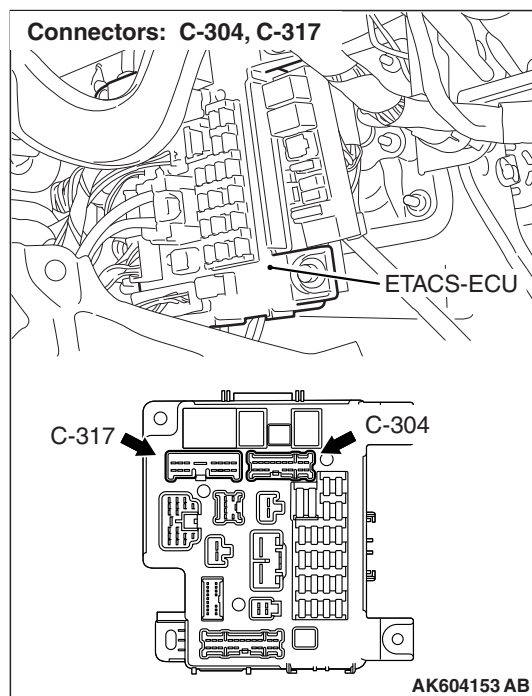
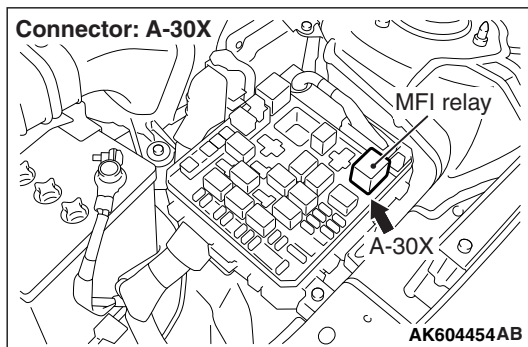
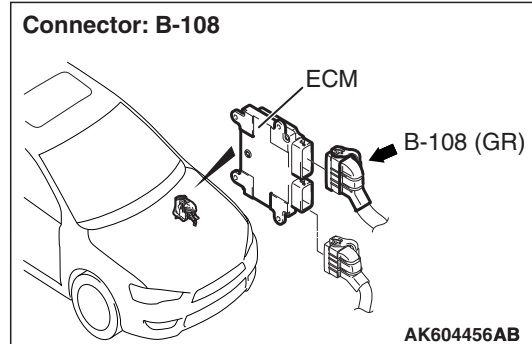
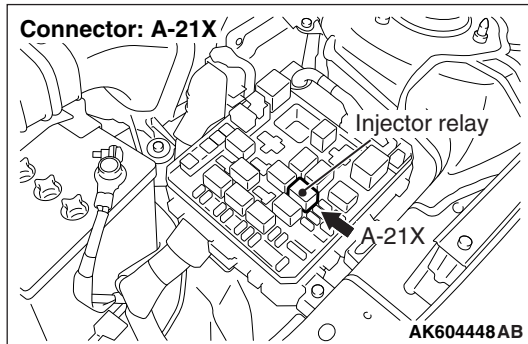
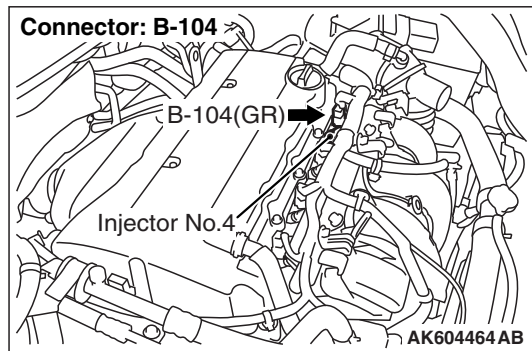
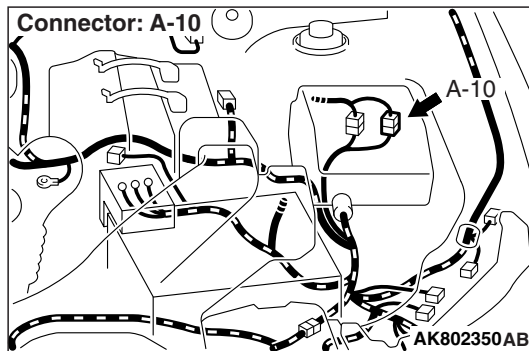
**NO :** The inspection is complete.



DTC P0204: Injector Circuit-Cylinder 4

INJECTOR CIRCUIT-CYLINDER 4





## CIRCUIT OPERATION

- The injector power is supplied from the injector relay (terminal No. 3).
- The ECM controls the injector by turning the power transistor in the ECM "ON" and "OFF".

## TECHNICAL DESCRIPTION

- The amount of fuel injected by the injector is controlled by the amount of continuity time the coil is grounded by the ECM.

## DESCRIPTIONS OF MONITOR METHODS

The ECM detects open circuit and short malfunction.

## 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)

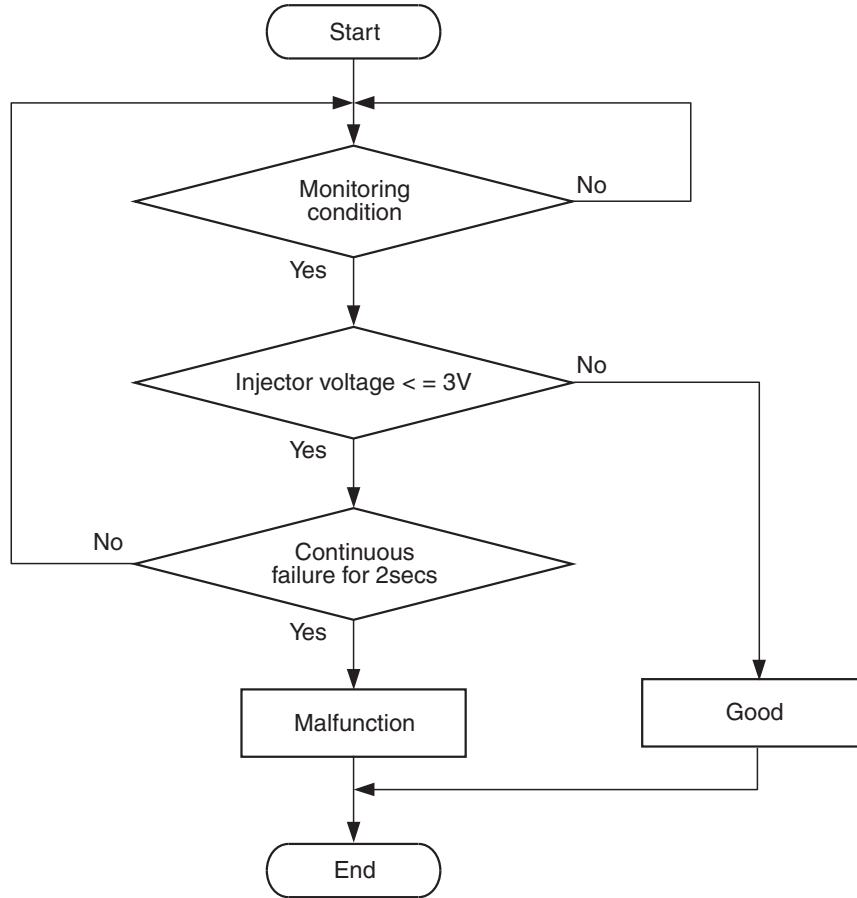
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

**DTC SET CONDITIONS <Circuit continuity –open circuit and shorted low>**

**Logic Flow Chart**



AK700479

**Check Condition**

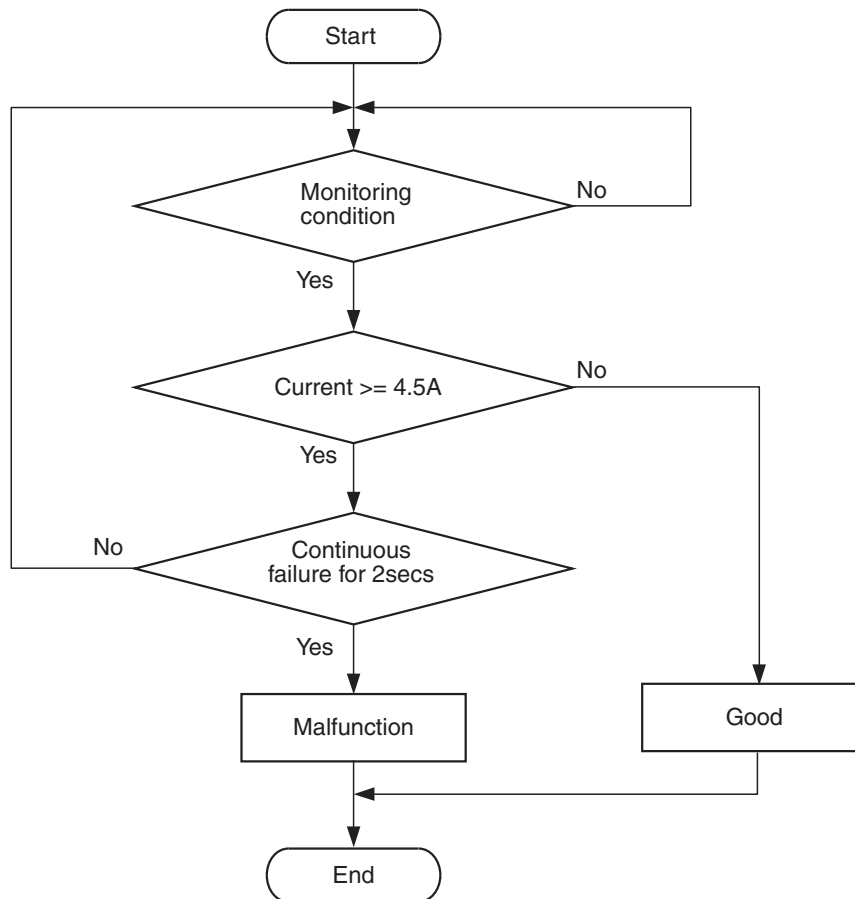
- Engine is running.

**Judgement Criterion**

- The supply voltage is less than 3 volts without the injector driving for 2 seconds.

**DTC SET CONDITIONS <Circuit continuity –shorted high>**

**Logic Flow Chart**



AK604332

**Check Condition**

- Engine is running.

**Judgement Criterion**

- The coil current is more than 4.5 amperes with the injector driving for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

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

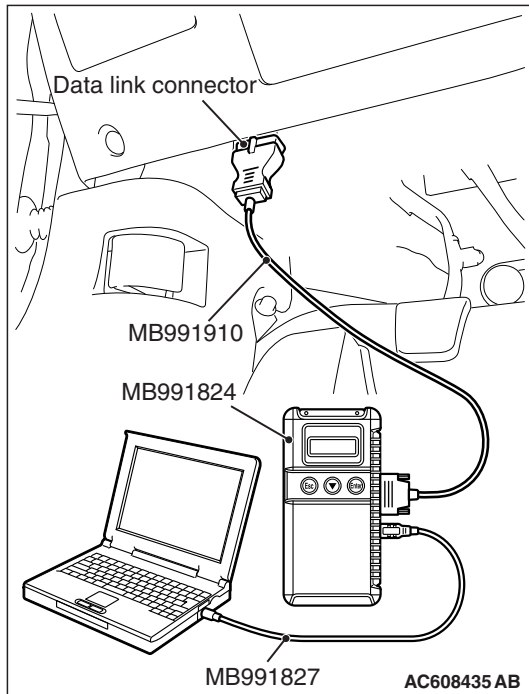
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

- No. 4 cylinder injector failed.
- Open or shorted No. 4 cylinder injector 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
- MB992110: Power Plant ECU Check Harness



**STEP 1. Using scan tool MB991958, check actuator test item 1: Injectors.**

**⚠ 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) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
- (4) Set scan tool MB991958 to the actuator testing mode for item 1 Injectors.
  - The idle should become slightly rougher.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the actuator operating properly?**

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

**NO :** Go to Step 2.

**STEP 2. Check harness connector B-104 at No. 4 cylinder injector 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 13.

**STEP 3. Check the No. 4 cylinder injector.**

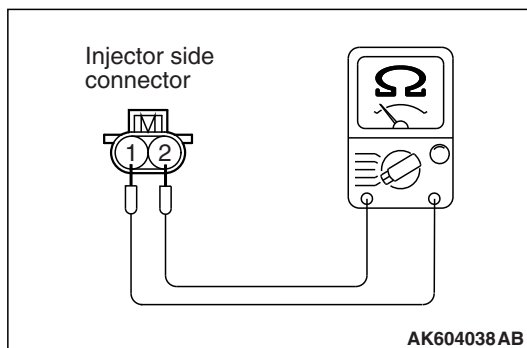
- (1) Disconnect the No. 4 cylinder injector connector B-104.
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

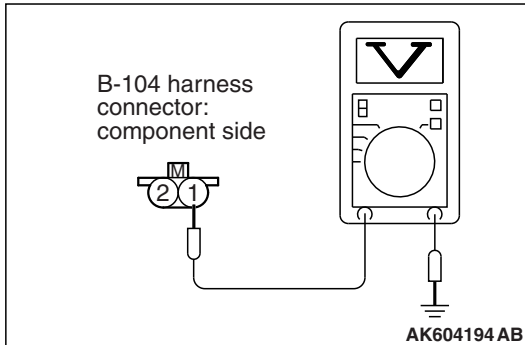
**Standard value: 10.5 –13.5 Ω [at 20° C (68° F)]**

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

**YES :** Go to Step 4.

**NO :** Replace the No. 4 cylinder injector. Then go to Step 13.





**STEP 4. Measure the power supply voltage at No. 4 cylinder injector harness side connector B-104.**

- (1) Disconnect the connector B-104 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 7.

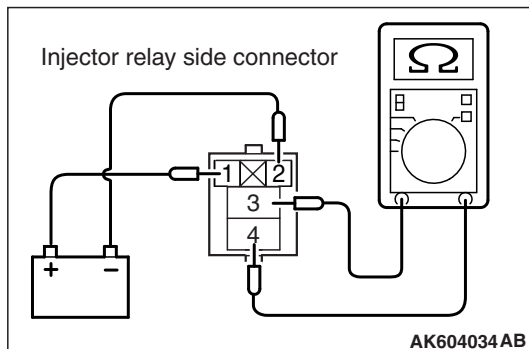
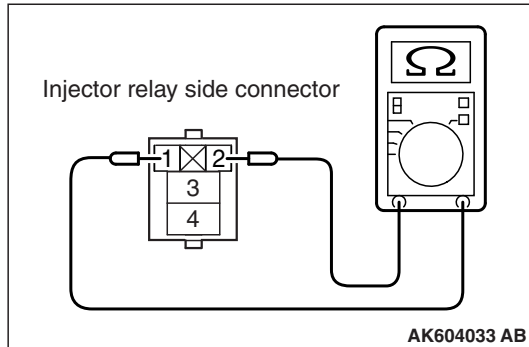
**NO :** Go to Step 5.

**STEP 5. Check harness connector A-21X at injector relay 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 13.

**STEP 6. Check the injector relay.**

- (1) Remove the injector relay.
- (2) Check for continuity between the injector relay terminal No. 1 and No. 2.
  - There should be continuity.

- (3) Use jumper wires to connect injector relay terminal No. 1 to the positive battery terminal and terminal No. 2 to the negative battery terminal.
- (4) Check for continuity between the injector relay terminal No. 3 and No. 4 while connecting and disconnecting the jumper wire at the negative battery terminal.
  - Continuity (2 ohms or less). <Negative battery terminal connected>
  - Should be open loop. <Negative battery terminal disconnected>
- (5) Install the injector relay.

**Q: Is the measured resistance normal?**

**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 injector relay connector A-21X (terminal No. 3) and No. 4 cylinder injector connector B-104 (terminal No. 1) because of open circuit. Then go to Step 13.

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

**STEP 7. Check harness connector A-30X at MFI relay and harness connector A-21X at injector relay for damage.****Q: Are the harness connectors in good condition?**

**YES :** Go to Step 8.

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

**STEP 8. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and injector relay connector A-21X (terminal No. 4).****Q: Is the harness wire in good condition?**

**YES :** Go to Step 9.

**NO :** Repair it. Then go to Step 13.

---

**STEP 9. Check for harness damage between injector relay connector A-21X (terminal No. 3) and No. 4 cylinder injector connector B-104 (terminal No. 1).**

*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 13.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 10.

**NO :** Repair it. Then go to Step 13.

---

**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 13.

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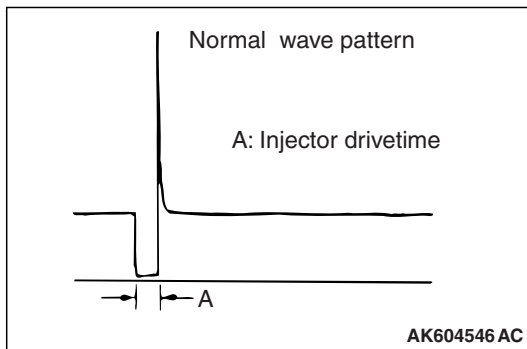
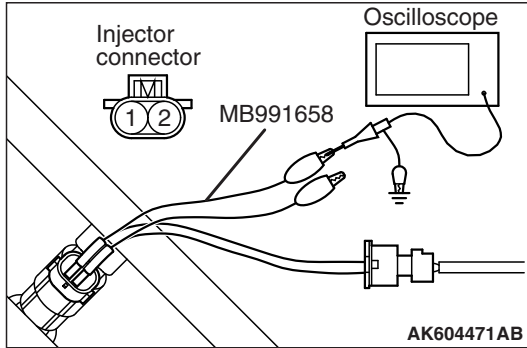
**STEP 11. Check for open circuit, short circuit to ground and harness damage between No. 4 cylinder injector connector B-104 (terminal No. 2) and ECM connector B-108 (terminal No. 19).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 12.

**NO :** Repair it. Then go to Step 13.





### STEP 12. Using the oscilloscope, check the No. 4 cylinder injector.

(1) Disconnect the No. 4 cylinder injector connector B-104 and connect the test harness special tool MB991658 between the separated connectors. (All terminals should be connected.)

(2) Connect the oscilloscope probe to the injector side connector terminal No. 2.

*NOTE: When checking with the ECM side connector, disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 19.*

(3) Start the engine and run at idle.

(4) Check the wave pattern.

- The wave pattern should show a normal pattern similar to the illustration.

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

#### Q: Is the wave pattern normal?

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

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). 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 23 [P.13B-12](#).

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

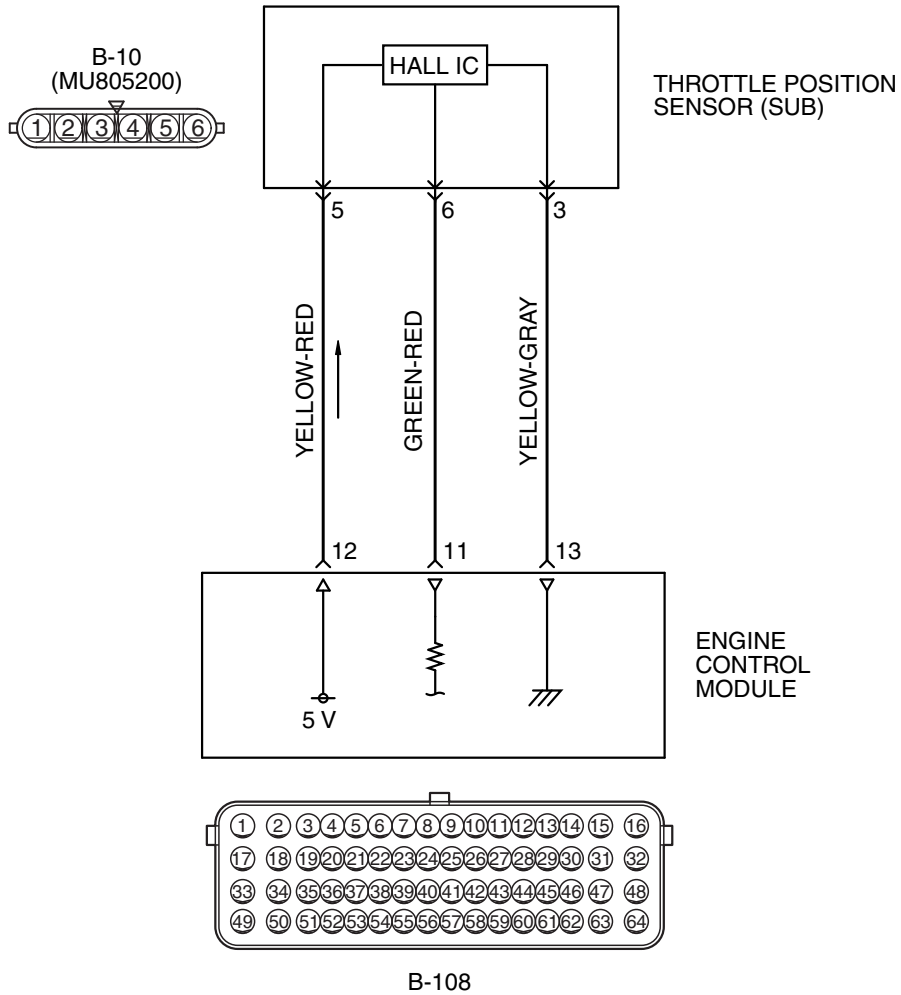
#### Q: Is DTC P0204 set?

**YES :** Retry the troubleshooting.

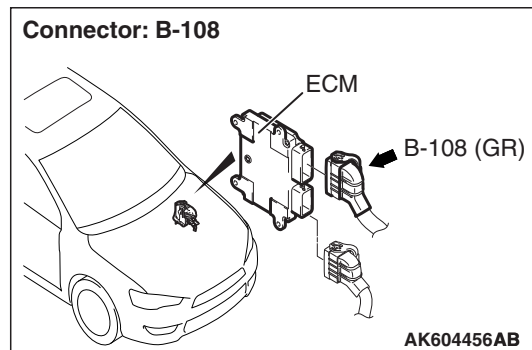
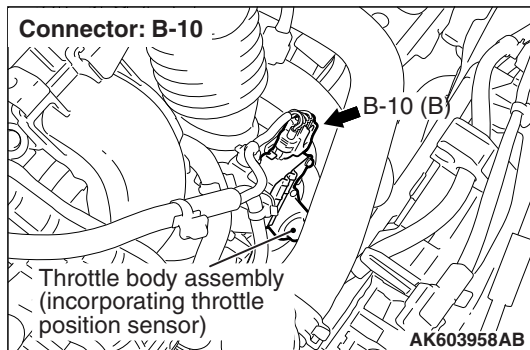
**NO :** The inspection is complete.

DTC P0222: Throttle Position Sensor (sub) Circuit Low Input

THROTTLE POSITION SENSOR (SUB) CIRCUIT



AK604243 AF



CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (sub) power terminal (terminal No. 5) from the throttle position sensor (sub) output terminal (terminal No. 6).
- A voltage that is according to the throttle opening angle is sent to the ECM (terminal No. 11) from the throttle position sensor (sub) output terminal (terminal No. 6).

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

**TECHNICAL DESCRIPTION**

- The throttle position sensor (sub) 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 (sub) output voltage is out of specified range.

**MONITOR EXECUTION**

Continuous

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

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

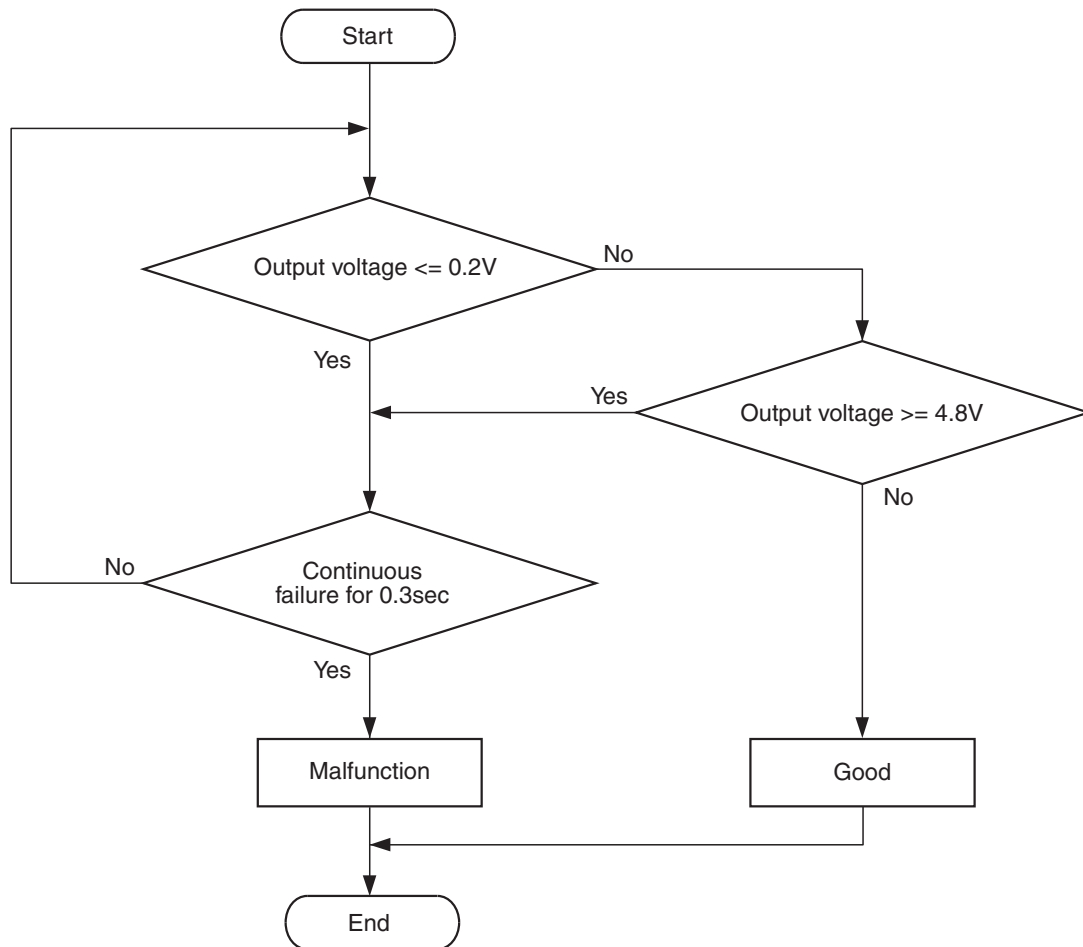
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Not applicable

**DTC SET CONDITIONS**

**Logic Flow Chart**



### Check Condition

- Ignition switch is "ON" position.

### Judgement Criterion

- Throttle position sensor (sub) output voltage is less than 0.2 volt for 0.3 second.

### FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (main) fails.

### 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 (sub) 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 15: Throttle Position Sensor (sub).

#### **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) Detach the intake air hose at the throttle body.
- (3) Disconnect the connector of the electronic-controlled throttle valve.
- (4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (5) Turn the ignition switch to the "ON" position.
- (6) Set scan tool MB991958 to the data reading mode for item 15, Throttle Position Sensor (sub).
  - Output voltage should be 4,000 millivolts or more when the throttle valve is fully closed with your finger.
  - Output voltage should be 1,000 millivolts or less when the throttle valve is fully open with your finger.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

#### Q: Is the sensor operating properly?

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

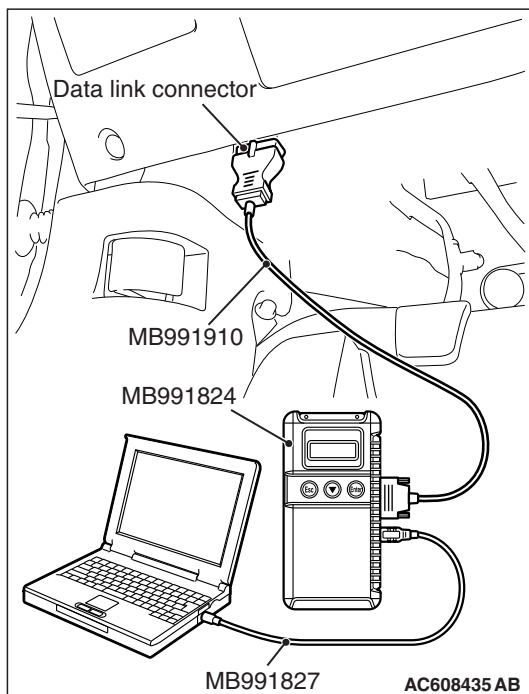
**NO** : Go to Step 2.

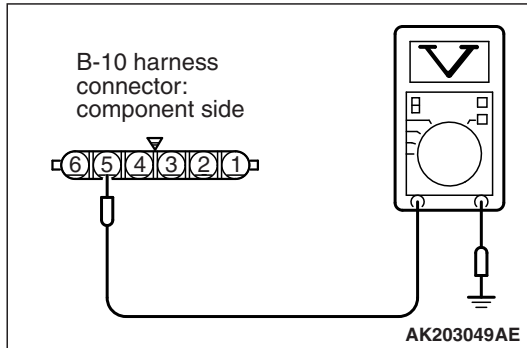
#### STEP 2. Check harness connector B-10 at electronic-controlled throttle valve for damage.

#### Q: Is the harness connector in good condition?

**YES** : Go to Step 3.

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






---

**STEP 3. Measure the sensor supply voltage at electronic-controlled throttle valve 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 7.

**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 11.

---

**STEP 5. Check for open circuit and short circuit to ground between electronic-controlled throttle valve 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 6.

**NO :** Repair it. Then go to Step 11.

---

**STEP 6. Using scan tool MB991958, check data list item 15: Throttle Position Sensor (sub).**

- (1) Detach the intake air hose at the throttle body.
- (2) Disconnect the connector of the electronic-controlled throttle valve.
- (3) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (4) Turn the ignition switch to the "ON" position.
- (5) Set scan tool MB991958 to the data reading mode for item 15, Throttle Position Sensor (sub).
  - Output voltage should be 4,000 millivolts or more when the throttle valve is fully closed with your finger.
  - Output voltage should be 1,000 millivolts or less 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.00-13](#).
- NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 11.

---

**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 11.

---

**STEP 8. Check for harness damage between electronic-controlled throttle valve 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 11.

---

**STEP 9. Check for open circuit, short circuit to ground and harness damage between electronic-controlled throttle valve connector B-10 (terminal No. 6) and ECM connector B-108 (terminal No. 11).**

**Q: Is the harness wire in good condition?**

- YES :** Go to Step 10.
- NO :** Repair it. Then go to Step 11.

**STEP 10. Replace the throttle body assembly.**

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

**Q: Is DTC P0222 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 11.

**NO** : The inspection is complete.

---

**STEP 11. 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.

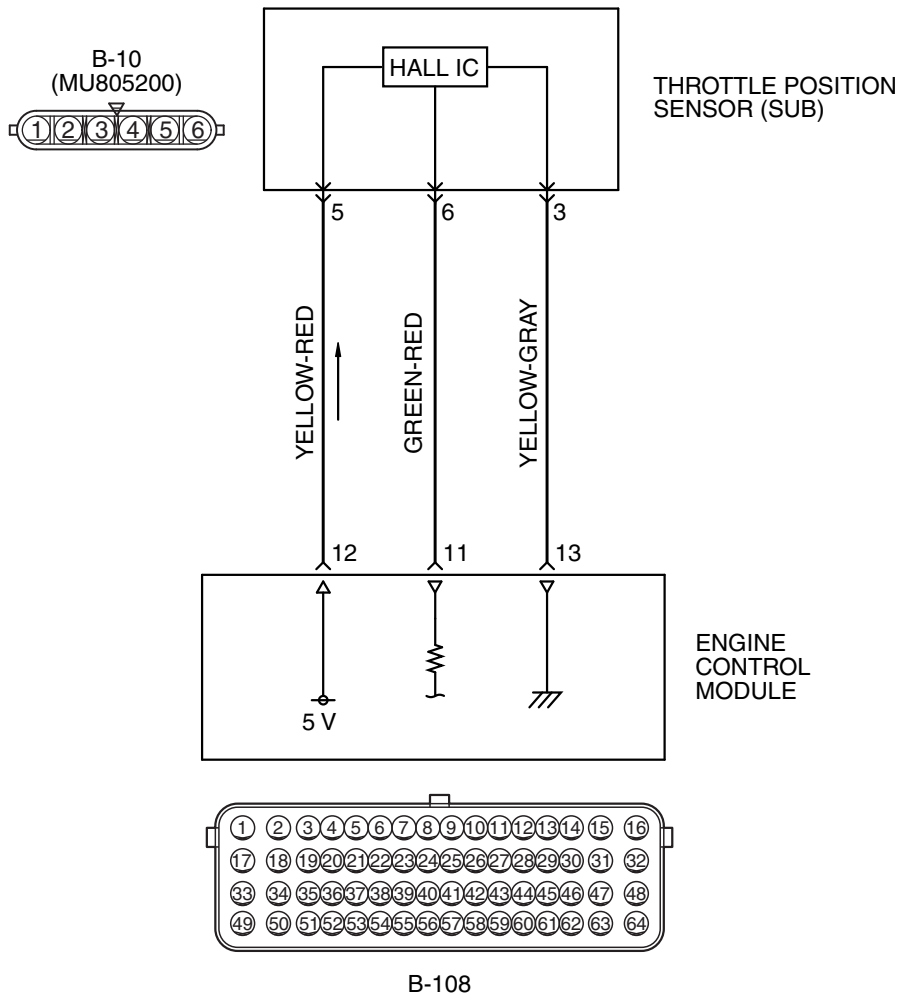
**Q: Is DTC P0222 set?**

**YES** : Retry the troubleshooting.

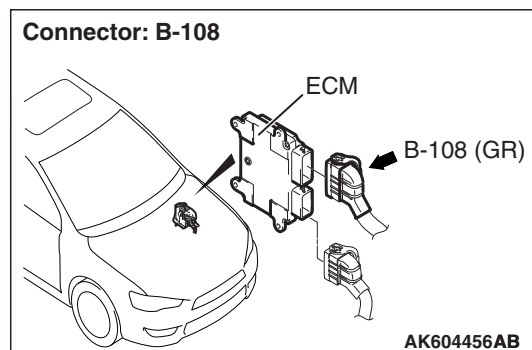
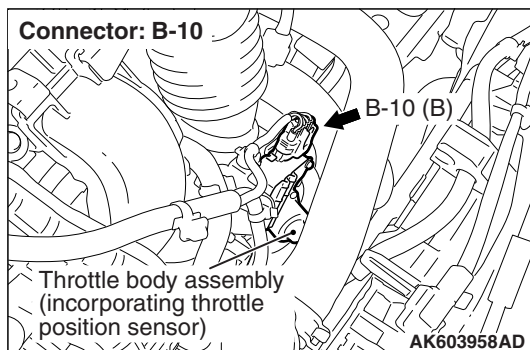
**NO** : The inspection is complete.

DTC P0223: Throttle Position Sensor (sub) Circuit High Input

THROTTLE POSITION SENSOR (SUB) CIRCUIT



AK604243 AF



CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (sub) power terminal (terminal No. 5) from the throttle position sensor (sub) output terminal (terminal No. 6).
- A voltage that is according to the throttle opening angle is sent to the ECM (terminal No. 11) from the throttle position sensor (sub) output terminal (terminal No. 6).



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

**TECHNICAL DESCRIPTION**

- The throttle position sensor (sub) 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 (sub) output voltage is out of specified range.

**MONITOR EXECUTION**

Continuous

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

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

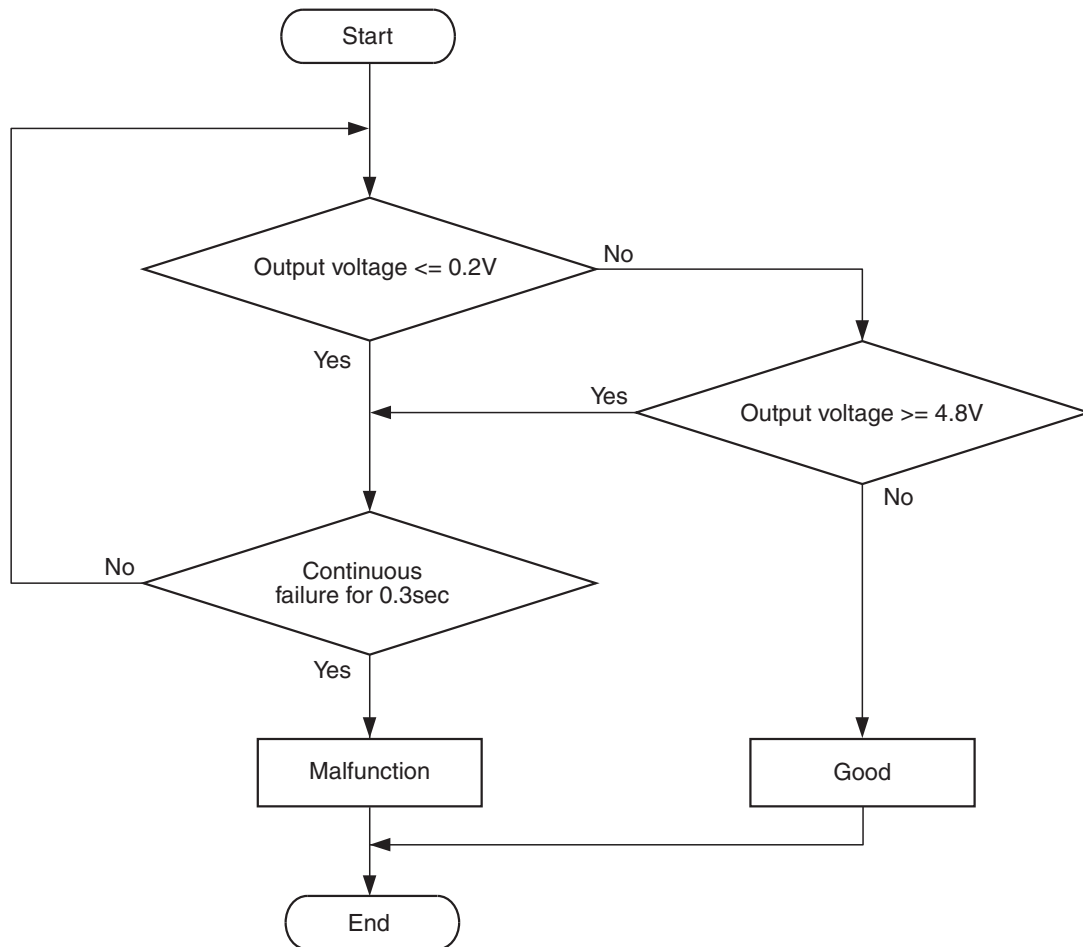
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Not applicable

**DTC SET CONDITIONS**

**Logic Flow Chart**



### Check Condition

- Ignition switch is "ON" position.

### Judgement Criterion

- Throttle position sensor (sub) output voltage is more than 4.8 volts for 0.3 second.

### FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (main) fails.

### OBD-II DRIVE CYCLE PATTERN

None.

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

- Throttle position sensor failed.
- Open throttle position sensor (sub) 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 15: Throttle Position Sensor (sub).

#### ⚠ 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) Detach the intake air hose at the throttle body.
- (3) Disconnect the connector of the electronic-controlled throttle valve.
- (4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (5) Turn the ignition switch to the "ON" position.
- (6) Set scan tool MB991958 to the data reading mode for item 15, Throttle Position Sensor (sub).
  - Output voltage should be 4,000 millivolts or more when the throttle valve is fully closed with your finger.
  - Output voltage should be 1,000 millivolts or less when the throttle valve is fully open with your finger.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

#### Q: Is the sensor operating properly?

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

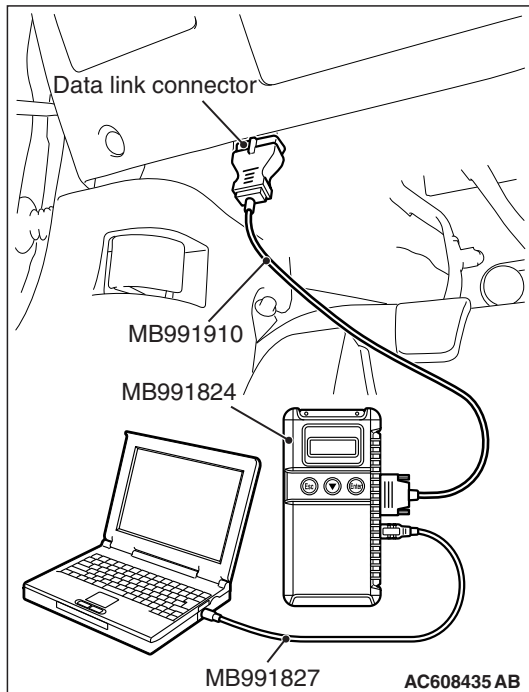
**NO** : Go to Step 2.

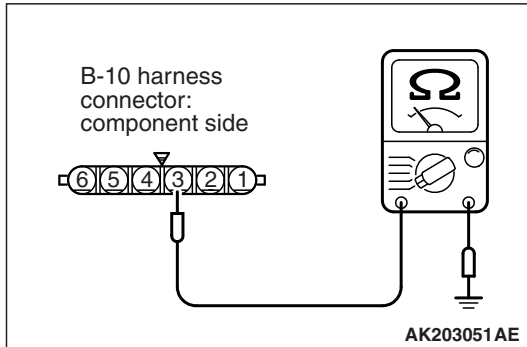
#### STEP 2. Check harness connector B-10 at electronic-controlled throttle valve for damage.

#### Q: Is the harness connector in good condition?

**YES** : Go to Step 3.

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






---

**STEP 3. Check the continuity at electronic-controlled throttle valve harness side connector B-10.**

- (1) Disconnect the connector B-10 and measure at the harness side.
- (2) Check for the continuity between terminal No. 3 and ground.
  - Continuity (2 ohms or less)

**Q: Does continuity exist?****YES** : Go to Step 7.**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 8.

---

**STEP 5. Check for open circuit and harness damage between electronic-controlled throttle valve 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 6.**NO** : Repair it. Then go to Step 8.

---

**STEP 6. Using scan tool MB991958, check data list item 15: Throttle Position Sensor (sub).**

- (1) Detach the intake air hose at the throttle body.
- (2) Disconnect the connector of the electronic-controlled throttle valve.
- (3) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (4) Turn the ignition switch to the "ON" position.
- (5) Set scan tool MB991958 to the data reading mode for item 15, Throttle Position Sensor (sub).
  - Output voltage should be 4,000 millivolts or more when the throttle valve is fully closed with your finger.
  - Output voltage should be 1,000 millivolts or less 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.00-13](#).

**NO :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 8.

---

**STEP 7. Replace the throttle body assembly.**

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

**Q: Is DTC P0223 set?**

**YES :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 8.

**NO :** The inspection is complete.

---

**STEP 8. 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 P0223 set?**

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

**DTC P0300: Random/Multiple Cylinder Misfire Detected**

---

**TECHNICAL DESCRIPTION**

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The ECM checks for such changes in engine speed.

**DESCRIPTIONS OF MONITOR METHODS**

Monitor angular acceleration of crankshaft and detect malfunction when negative variation of the angular acceleration is large.

**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)**

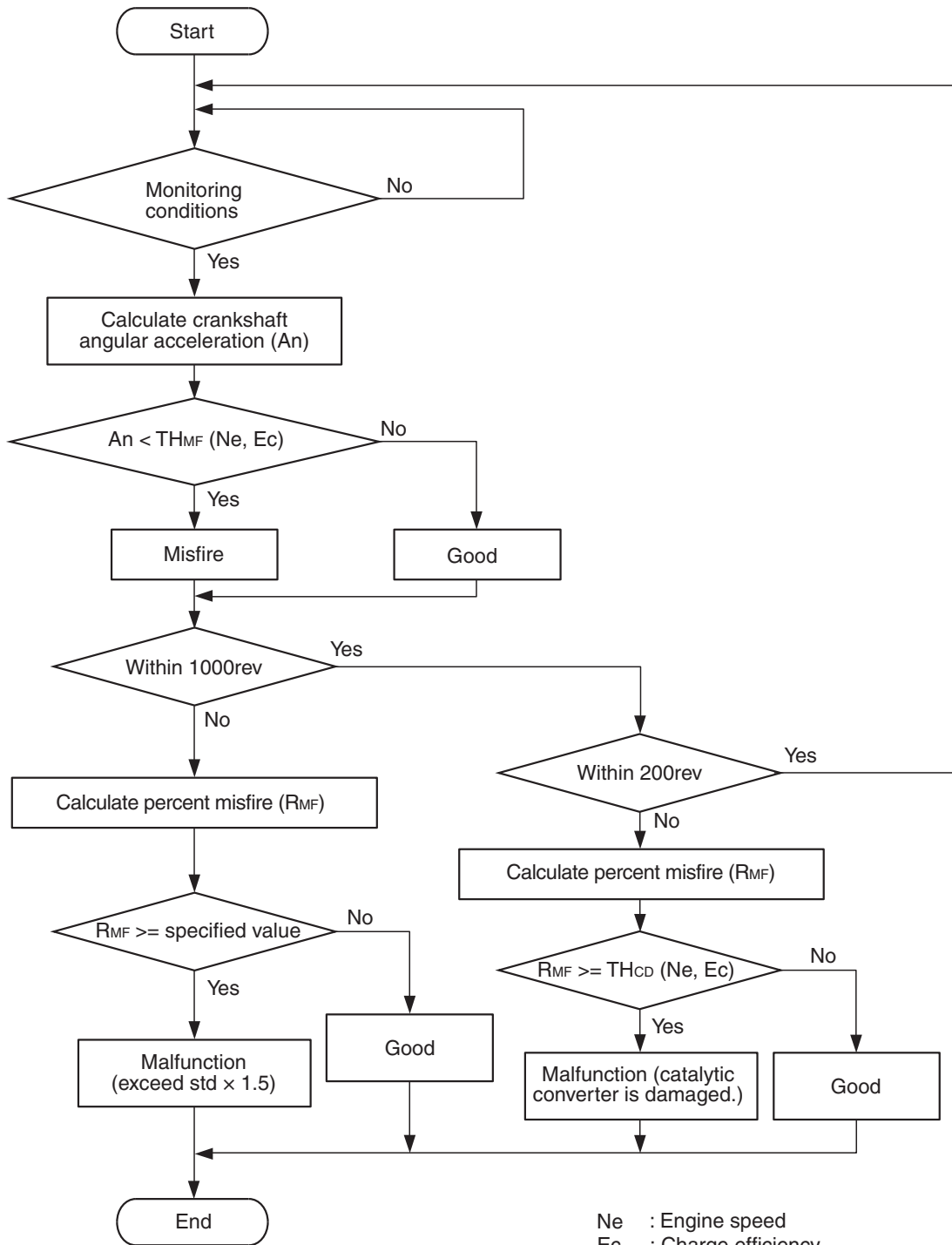
- Not applicable

**Sensor (The sensor below is determined to be normal)**

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

DTC SET CONDITIONS

Logic Flow Chart



Ne : Engine speed  
 Ec : Charge efficiency  
 TH<sub>MF</sub> : Threshold value for misfire  
 TH<sub>CD</sub> : Threshold value for catalyst damage

**Check Conditions**

- Engine speed is between 438 and 6,594 r/min.
- Engine coolant temperature is more than -10° C (14° F).
- Barometric pressure is more than 76 kPa (22.4 in.Hg).
- The engine load is with in the positive torque load.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding rough road driving <M/T> sudden acceleration/deceleration and fuel shut-off operation.

**Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection)**

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000° C (1,832° F)].

or

- Misfire has occurred in 1.5 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard) <Except vehicles for California>.

- Misfire has occurred in 1.4 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard) <Vehicles for California>.

**FAIL-SAFE AND BACKUP FUNCTION**

- The supply of fuel to the misfiring cylinder can possibly be cut.

**OBD-II DRIVE CYCLE PATTERN**

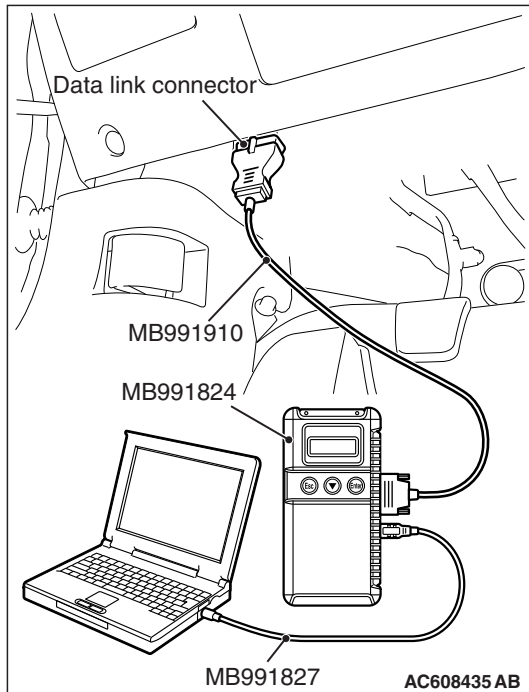
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 15 [P.13B-12](#).

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

- Ignition system related part(s) failed.
- Poor crankshaft position sensor.
- Incorrect air/fuel ratio.
- Low compression pressure.
- Skipping of timing chain teeth.
- EGR system and EGR valve failed.
- ECM failed.

**DIAGNOSIS****Required Special Tool:**

- 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 2: Crankshaft Position 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 2, Crankshaft Position Sensor.
  - The tachometer and engine speed indicated on the scan tool should match.
- (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 P0335 –Crankshaft Position Sensor Circuit [P.13B-470](#).

**STEP 2. Using scan tool MB991958, check data list item 26: Long-Term Fuel Trim.**

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item 26, Long-Term Fuel Trim.
  - The fuel trim should be between -12.5 and +12.5 percent when the engine is 2,500 r/min (during closed loop) after the engine is warmed.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the specification normal?**

**YES :** Go to Step 3.

**NO :** Refer to, DTC P0171 –System too Lean [P.13B-365](#), DTC P0172 –System too Rich [P.13B-371](#).

**STEP 3. Using scan tool MB991958, check data list item 28: Short-Term Fuel Trim.**

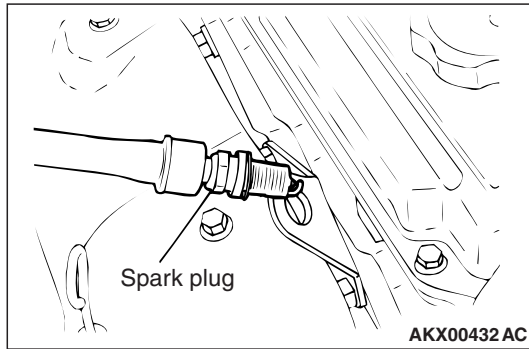
- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item 28, Short-Term Fuel Trim.
  - The fuel trim should be between -7.4 and +7.4 percent when the engine is 2,500 r/min (during closed loop) after the engine is warmed.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the specification normal?**

**YES :** Go to Step 4.

**NO :** Refer to, DTC P0171 –System too Lean [P.13B-365](#), DTC P0172 –System too Rich [P.13B-371](#).



**STEP 4. Visual check of ignition spark.**

- (1) Remove the spark plug and install it to the ignition coil.
- (2) Connect the ignition coil connector.
- (3) Disconnect all injector connector.
- (4) At the engine start, check each spark plug produces a spark.

**Q: Did it spark?****YES** : Go to Step 6.**NO** : Go to Step 5.**STEP 5. Check the spark plugs.**

Refer to GROUP 16, Ignition System –On-vehicle Service – Spark Plug Check And Cleaning [P.16-48](#).

**Q: Is the spark plug normal?****YES** : Refer to, Symptom Procedures 27 –Ignition Circuit System [P.13B-932](#).**NO** : Replace the faulty spark plug. Then go to Step 8.**STEP 6. Check the following items.**

- (1) Check the following items, and repair or replace the defective component.
  - a. Check for skipped timing chain teeth.
  - b. Check compression.
  - c. EGR valve failed.

**Q: Are there any abnormalities?****YES** : Repair or replace it. Then go to Step 8.**NO** : Go to Step 7.**STEP 7. Check the trouble symptoms.**

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0300 set?****YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 8.**NO** : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions [P.00-13](#).

---

**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 15 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0300 set?**

**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

---

**DTC P0301: Cylinder 1 Misfire Detected**

---

**TECHNICAL DESCRIPTION**

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The ECM checks for such changes in engine speed.

**DESCRIPTIONS OF MONITOR METHODS**

Monitor angular acceleration of crankshaft and detect malfunction when negative variation of the angular acceleration is large.

**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)**

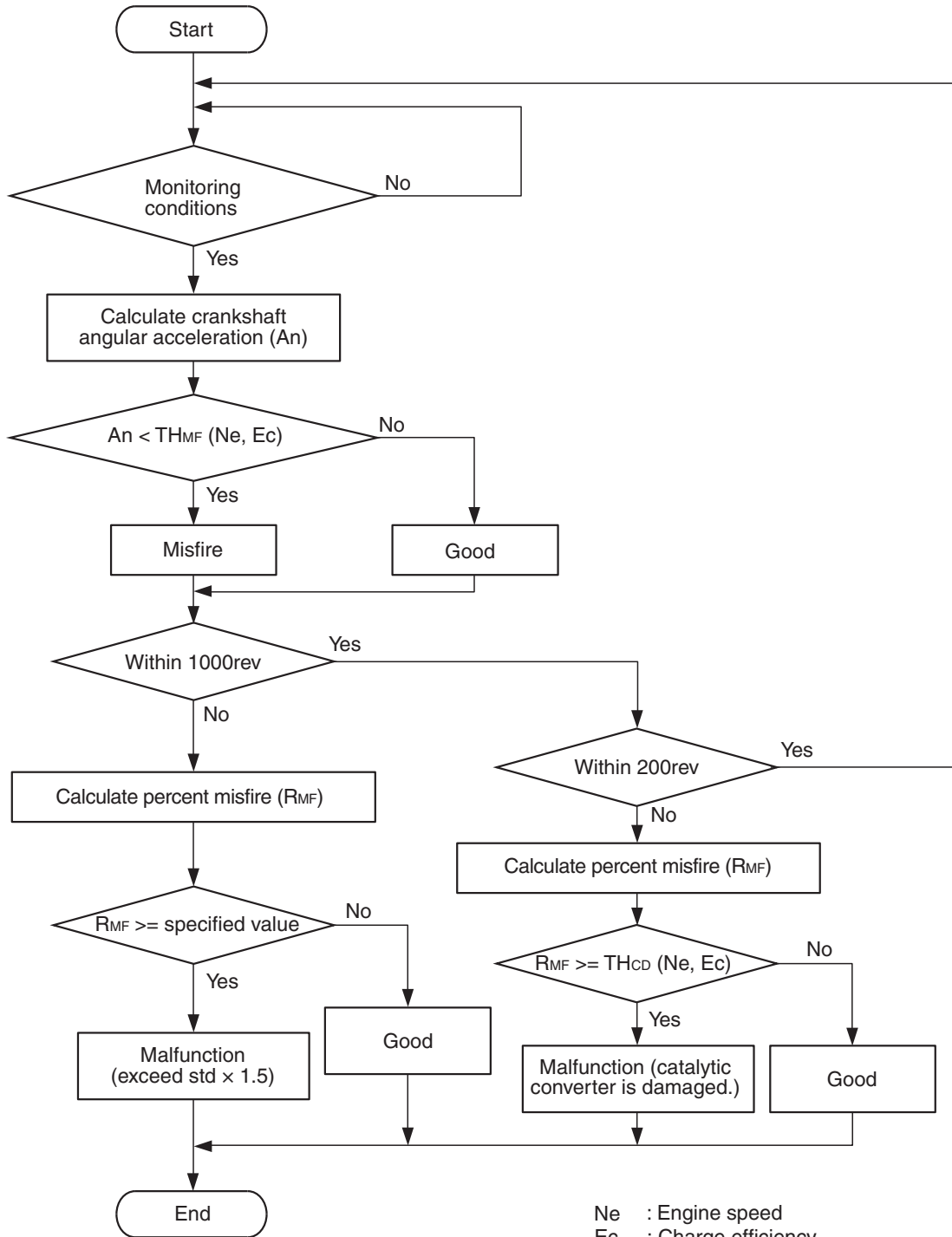
- Not applicable

**Sensor (The sensor below is determined to be normal)**

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

DTC SET CONDITIONS

Logic Flow Chart



Ne : Engine speed  
Ec : Charge efficiency  
TH<sub>MF</sub> : Threshold value for misfire  
TH<sub>CD</sub> : Threshold value for catalyst damage

### Check Conditions

- Engine speed is between 438 and 6,594 r/min.
- Engine coolant temperature is more than -10° C (14° F).
- Barometric pressure is more than 76 kPa (22.4 in.Hg).
- The engine load is with in the positive torque load.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding rough road driving <M/T> sudden acceleration/deceleration and fuel shut-off operation.

### Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection)

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000° C (1,832° F)].

or

- Misfire has occurred in 1.5 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard). <Except vehicles for California>.
- Misfire has occurred in 1.4 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard) <Vehicles for California>.

### FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 15 [P.13B-12](#).

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

- Ignition system related part(s) failed.
- Low compression pressure.
- ECM failed.

### DIAGNOSIS

#### Required Special Tool:

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

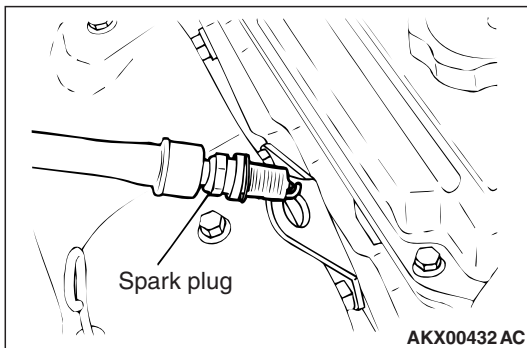
#### STEP 1. Visual check on ignition spark of No. 1 cylinder.

- (1) Remove the spark plug and install it to the ignition coil.
- (2) Connect the ignition coil connector.
- (3) Disconnect all injector connector.
- (4) At the engine start, check spark plug produces a spark.

#### Q: Did it spark?

**YES** : Go to Step 3.

**NO** : Go to Step 2.



**STEP 2. Check the No. 1 cylinder spark plug.**

Refer to GROUP 16, Ignition System –On-vehicle Service – Spark Plug Check And Cleaning [P.16-48](#).

**Q: Is the spark plug normal?**

**YES** : Refer to, Symptom Procedures 27 –Ignition Circuit System [P.13B-932](#).

**NO** : Replace the No. 1 cylinder spark plug. Then go to Step 5.

---

**STEP 3. Check the compression.**

Refer to GROUP 11C, On-vehicle Service –Compression Pressure Check [P.11C-16](#).

**Q: Are there any abnormalities?**

**YES** : Repair it. Then go to Step 5.

**NO** : Go to Step 4.

---

**STEP 4. Check the trouble symptoms.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).

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

**Q: Is DTC P0301 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

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

---

**STEP 5. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).

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

**Q: Is DTC P0301 set?**

**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

---

**DTC P0302: Cylinder 2 Misfire Detected**

---

**TECHNICAL DESCRIPTION**

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The ECM checks for such changes in engine speed.

**DESCRIPTIONS OF MONITOR METHODS**

Monitor angular acceleration of crankshaft and detect malfunction when negative variation of the angular acceleration is large.

**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)**

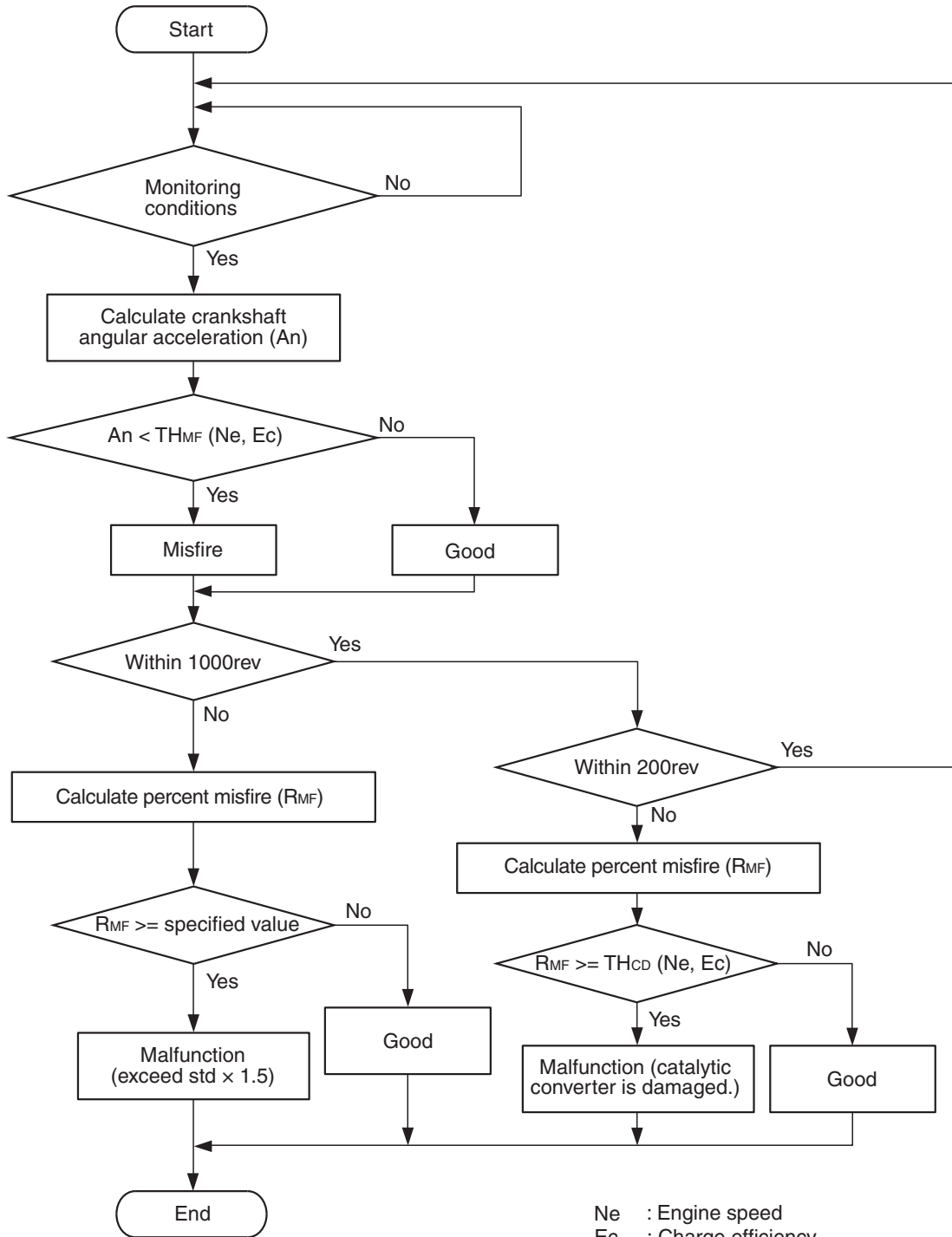
- Not applicable

**Sensor (The sensor below is determined to be normal)**

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

DTC SET CONDITIONS

Logic Flow Chart



Ne : Engine speed  
Ec : Charge efficiency  
TH<sub>MF</sub> : Threshold value for misfire  
TH<sub>CD</sub> : Threshold value for catalyst damage

### Check Conditions

- Engine speed is between 438 and 6,594 r/min.
- Engine coolant temperature is more than -10° C (14° F).
- Barometric pressure is more than 76 kPa (22.4 in.Hg).
- The engine load is with in the positive torque load.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding rough road driving <M/T> sudden acceleration/deceleration and fuel shut-off operation.

### Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection)

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000° C (1,832° F)].

or

- Misfire has occurred in 1.5 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard). <Except vehicles for California>.
- Misfire has occurred in 1.4 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard) <Vehicles for California>.

### FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 15 [P.13B-12](#).

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

- Ignition system related part(s) failed.
- Low compression pressure.
- ECM failed.

### DIAGNOSIS

#### Required Special Tool:

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

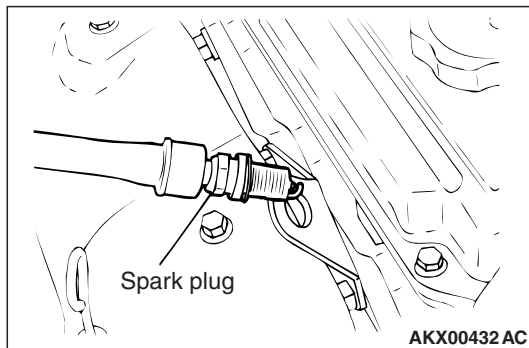
#### STEP 1. Visual check on ignition spark of No. 2 cylinder.

- (1) Remove the spark plug and install it to the ignition coil.
- (2) Connect the ignition coil connector.
- (3) Disconnect all injector connector.
- (4) At the engine start, check spark plug produces a spark.

#### Q: Did it spark?

**YES** : Go to Step 3.

**NO** : Go to Step 2.





**STEP 2. Check the No. 2 cylinder spark plug.**

Refer to GROUP 16, Ignition System –On-vehicle Service – Spark Plug Check And Cleaning [P.16-48](#).

**Q: Is the spark plug normal?**

**YES** : Refer to, Symptom Procedures 27 –Ignition Circuit System [P.13B-932](#).

**NO** : Replace the No. 2 cylinder spark plug. Then go to Step 5.

---

**STEP 3. Check the compression.**

Refer to GROUP 11C, On-vehicle Service –Compression Pressure Check [P.11C-16](#).

**Q: Are there any abnormalities?**

**YES** : Repair it. Then go to Step 5.

**NO** : Go to Step 4.

---

**STEP 4. Check the trouble symptoms.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).

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

**Q: Is DTC P0302 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

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

---

**STEP 5. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).

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

**Q: Is DTC P0302 set?**

**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

---

**DTC P0303: Cylinder 3 Misfire Detected**

---

**TECHNICAL DESCRIPTION**

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The ECM checks for such changes in engine speed.

**DESCRIPTIONS OF MONITOR METHODS**

Monitor angular acceleration of crankshaft and detect malfunction when negative variation of the angular acceleration is large.

**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)**

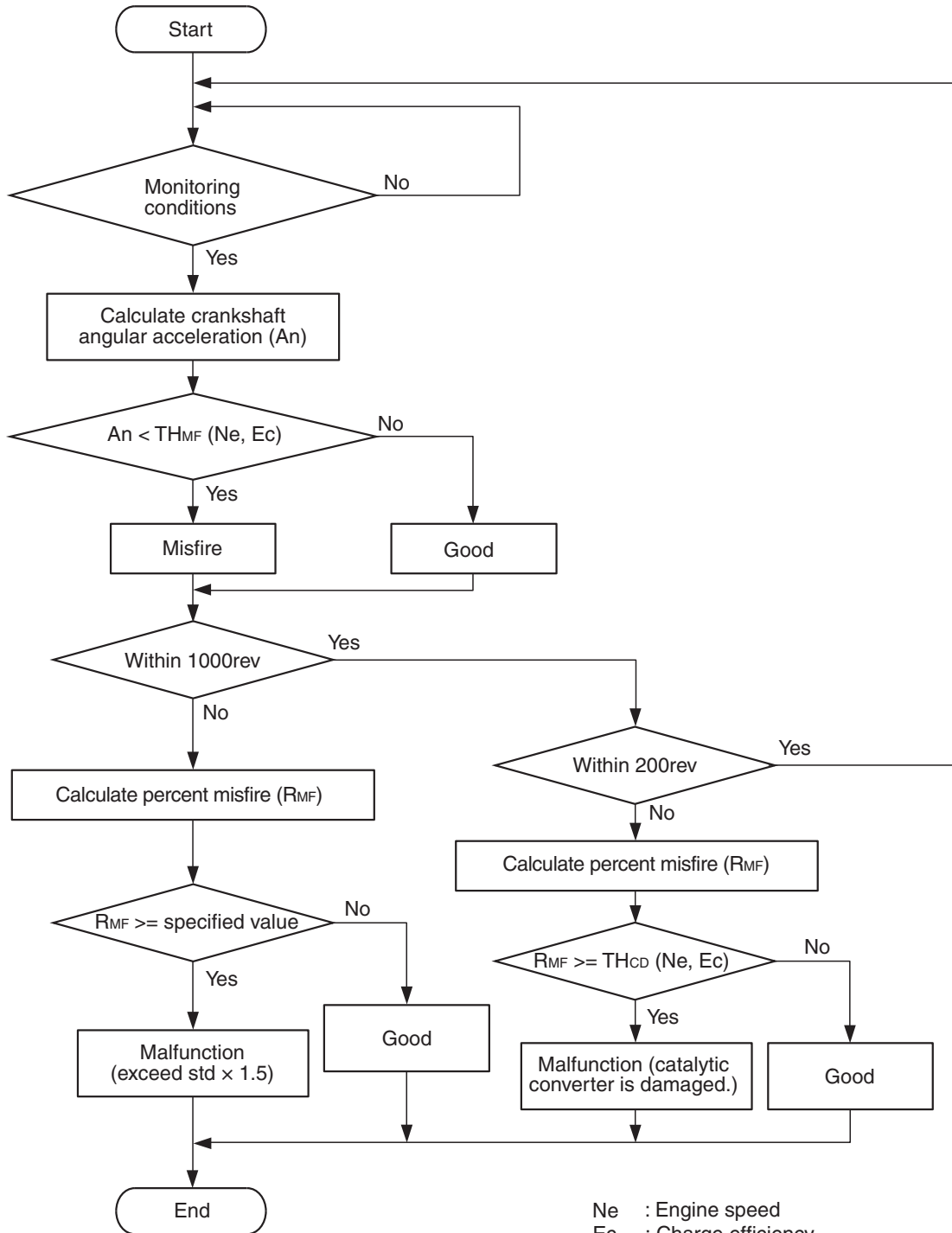
- Not applicable

**Sensor (The sensor below is determined to be normal)**

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

DTC SET CONDITIONS

Logic Flow Chart



Ne : Engine speed  
Ec : Charge efficiency  
TH<sub>MF</sub> : Threshold value for misfire  
TH<sub>CD</sub> : Threshold value for catalyst damage

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Check Conditions

- Engine speed is between 438 and 6,594 r/min.

- Engine coolant temperature is more than -10° C (14° F).

- Barometric pressure is more than 76 kPa (22.4 in.Hg).
- The engine load is within the positive torque load.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding rough road driving <M/T> sudden acceleration/deceleration and fuel shut-off operation.

**Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection)**

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000°C (1,832°F)].

or

- Misfire has occurred in 1.5 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard). <Except vehicles for California>.

- Misfire has occurred in 1.4 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard) <Vehicles for California>.

**FAIL-SAFE AND BACKUP FUNCTION**

- The supply of fuel to the misfiring cylinder can possibly be cut.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 15 [P.13B-12](#).

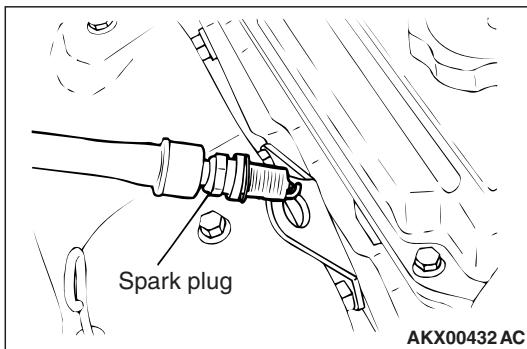
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

- Ignition system related part(s) failed.
- Low compression pressure.
- ECM failed.

**DIAGNOSIS**

**Required Special Tool:**

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



**STEP 1. Visual check on ignition spark of No. 3 cylinder.**

- (1) Remove the spark plug and install it to the ignition coil.
- (2) Connect the ignition coil connector.
- (3) Disconnect all injector connector.
- (4) At the engine start, check spark plug produces a spark.

**Q: Did it spark?**

- YES** : Go to Step 3.  
**NO** : Go to Step 2.

**STEP 2. Check the No. 3 cylinder spark plug.**

Refer to GROUP 16, Ignition System –On-vehicle Service – Spark Plug Check And Cleaning [P.16-48](#).

**Q: Is the spark plug normal?**

- YES** : Refer to, Symptom Procedures 27 –Ignition Circuit System [P.13B-932](#).  
**NO** : Replace the No. 3 cylinder spark plug. Then go to Step 5.

**STEP 3. Check the compression.**

Refer to GROUP 11C, On-vehicle Service –Compression Pressure Check [P.11C-16](#).

**Q: Are there any abnormalities?**

**YES** : Repair it. Then go to Step 5.

**NO** : Go to Step 4.

**STEP 4. Check the trouble symptoms.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).

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

**Q: Is DTC P0303 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

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

**STEP 5. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).

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

**Q: Is DTC P0303 set?**

**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

**DTC P0304: Cylinder 4 Misfire Detected****TECHNICAL DESCRIPTION**

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The ECM checks for such changes in engine speed.

**DESCRIPTIONS OF MONITOR METHODS**

Monitor angular acceleration of crankshaft and detect malfunction when negative variation of the angular acceleration is large.

**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)**

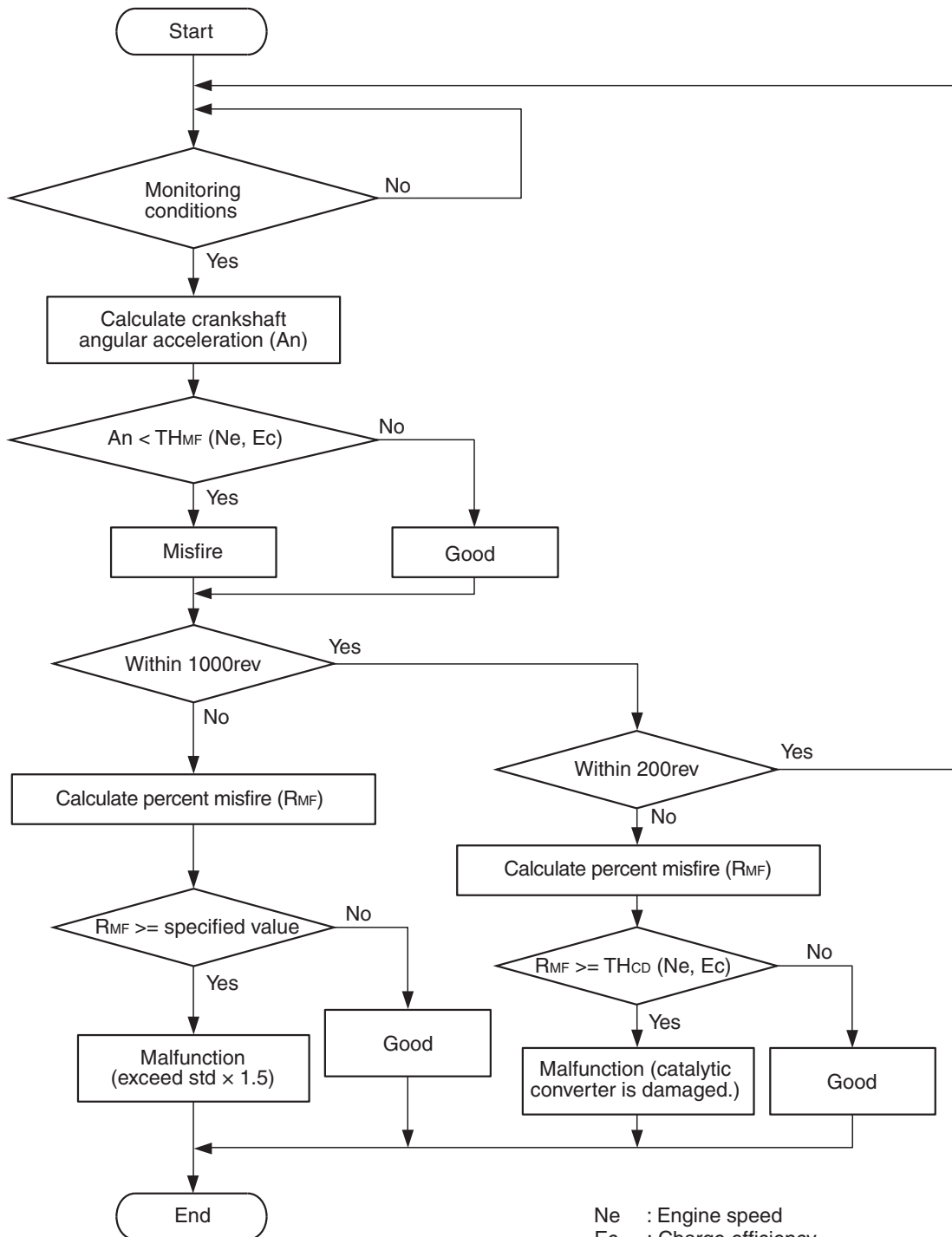
- Not applicable

**Sensor (The sensor below is determined to be normal)**

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

DTC SET CONDITIONS

Logic Flow Chart



Ne : Engine speed  
Ec : Charge efficiency  
TH<sub>MF</sub> : Threshold value for misfire  
TH<sub>CD</sub> : Threshold value for catalyst damage

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Check Conditions

- Engine speed is between 438 and 6,594 r/min.
- Engine coolant temperature is more than -10° C (14° F).

- Barometric pressure is more than 76 kPa (22.4 in.Hg).
- The engine load is within the positive torque load.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding rough road driving <M/T> sudden acceleration/deceleration and fuel shut-off operation.

**Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection)**

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is more than 1,000°C (1,832°F)].

or

- Misfire has occurred in 1.5 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard). <Except vehicles for California>.

- Misfire has occurred in 1.4 percent <M/T> or 1.8 percent <CVT> or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard) <Vehicles for California>.

**FAIL-SAFE AND BACKUP FUNCTION**

- The supply of fuel to the misfiring cylinder can possibly be cut.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 15 [P.13B-12](#).

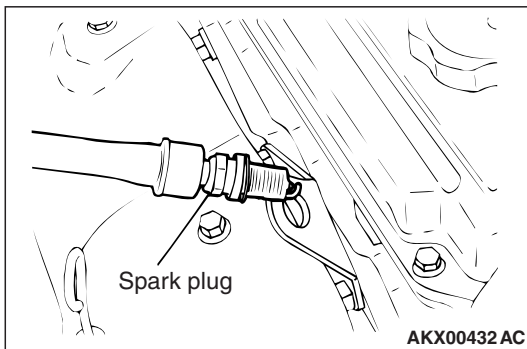
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

- Ignition system related part(s) failed.
- Low compression pressure.
- ECM failed.

**DIAGNOSIS**

**Required Special Tool:**

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



**STEP 1. Visual check on ignition spark of No. 4 cylinder.**

- (1) Remove the spark plug and install it to the ignition coil.
- (2) Connect the ignition coil connector.
- (3) Disconnect all injector connector.
- (4) At the engine start, check spark plug produces spark.

**Q: Did it spark?**

- YES** : Go to Step 3.  
**NO** : Go to Step 2.

**STEP 2. Check the No. 4 cylinder spark plug.**

Refer to GROUP 16, Ignition System –On-vehicle Service – Spark Plug Check And Cleaning [P.16-48](#).

**Q: Is the spark plug normal?**

- YES** : Refer to, Symptom Procedures 27 –Ignition Circuit System [P.13B-932](#).  
**NO** : Replace the No. 4 cylinder spark plug. Then go to Step 5.

---

**STEP 3. Check the compression.**

Refer to GROUP 11C, On-vehicle Service –Compression Pressure Check [P.11C-16](#).

**Q: Are there any abnormalities?**

**YES** : Repair it. Then go to Step 5.

**NO** : Go to Step 4.

---

**STEP 4. Check the trouble symptoms.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).

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

**Q: Is DTC P0304 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

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

---

**STEP 5. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 [P.13B-12](#).

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

**Q: Is DTC P0304 set?**

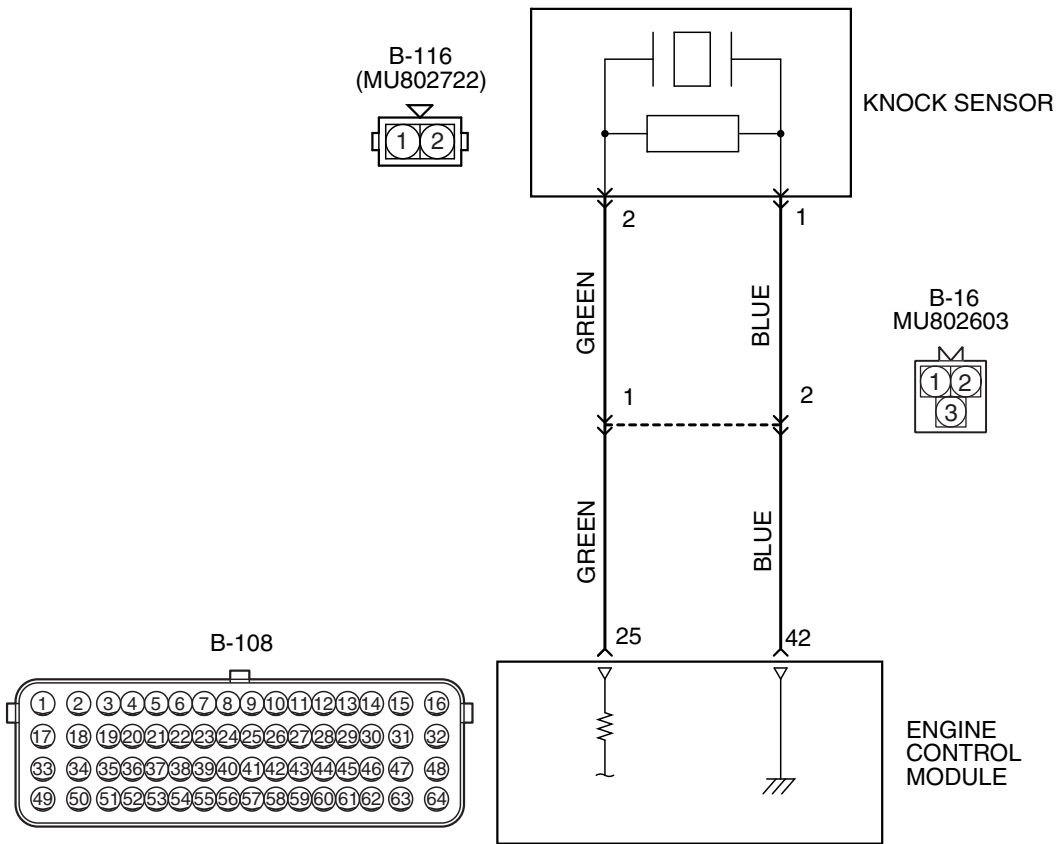
**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

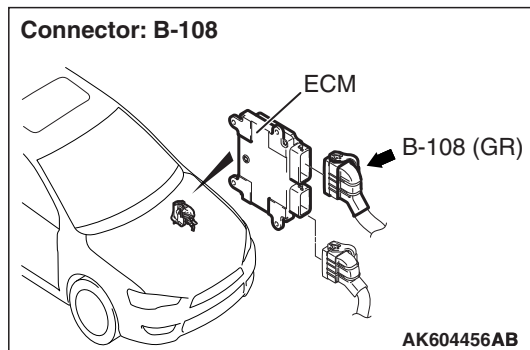
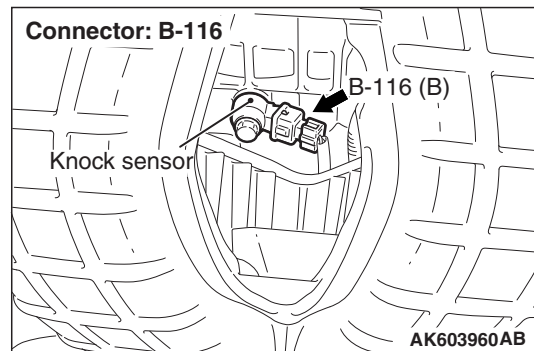
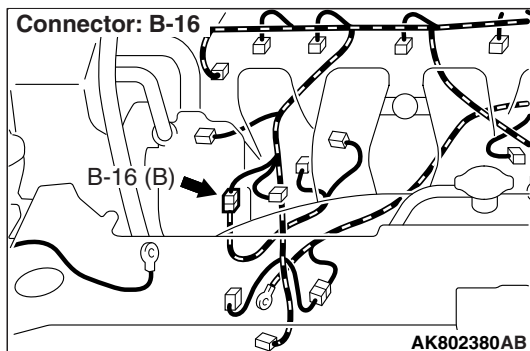


DTC P0327: Knock Sensor Circuit Low

KNOCK SENSOR CIRCUIT



AK604244 AC



## CIRCUIT OPERATION

- The knock sensor (terminal No. 2) sends a signal voltage to the ECM (terminal No. 25).
- The ground terminal (terminal No. 1) is grounded with ECM (terminal No. 42).

## TECHNICAL DESCRIPTION

- The knock sensor converts the vibration of the cylinder block into a voltage and outputs it.
- The ECM checks whether the voltage is within a specified range.

## DESCRIPTIONS OF MONITOR METHODS

Knock sensor output voltage is out of specified range.

## MONITOR EXECUTION

Continuous

## MONITOR EXECUTIONS (Other monitor and Sensor)

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

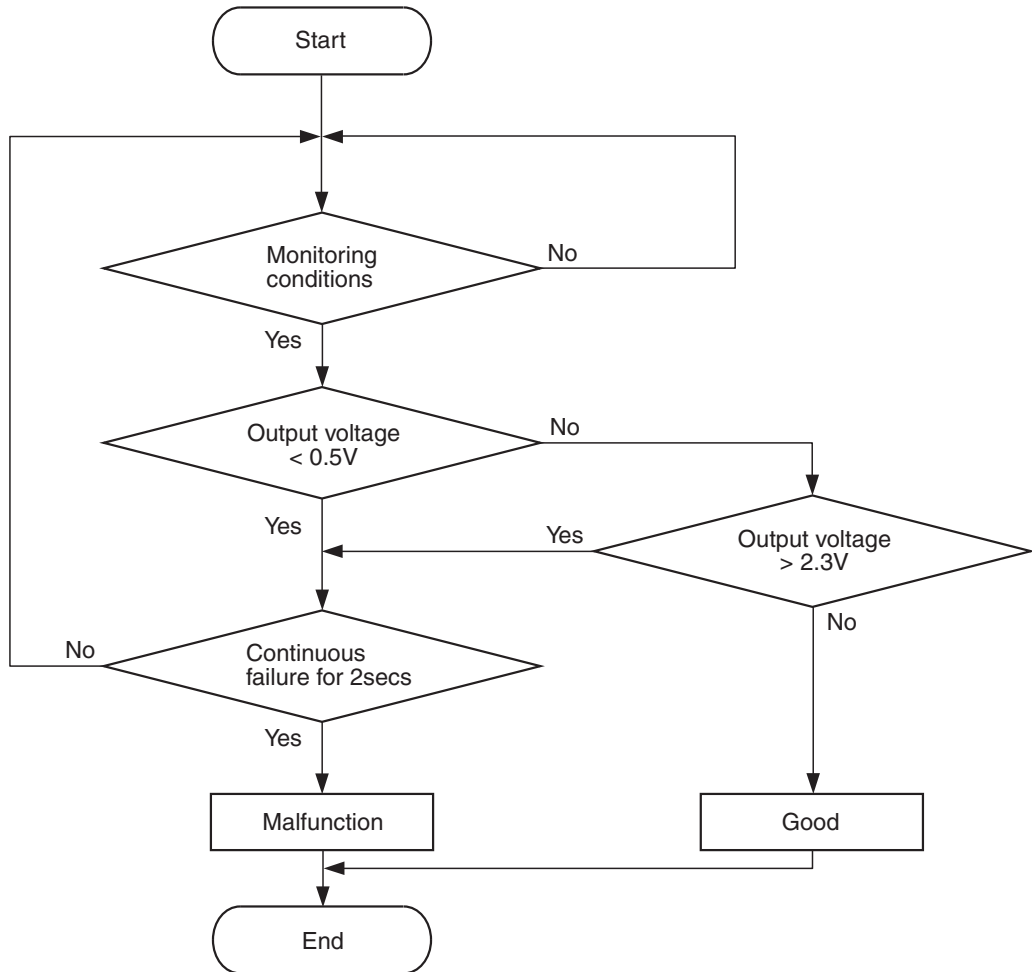
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Not applicable

## DTC SET CONDITIONS

## Logic Flow Chart



AK704271

**Check Condition**

- More than 2 seconds have passed since the engine starting sequence was completed.

**Judgement Criterion**

- Knock sensor output voltage is less than 0.5 volt for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- Fix the ignition timing with an allowance against knock.

**OBD-II DRIVE CYCLE PATTERN**

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

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

- Knock sensor failed.
- Open or shorted knock sensor circuit, harness damage or connector damage.
- ECM failed.

---

## DIAGNOSIS

### Required Special Tool:

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

---

**STEP 1. Check harness connector B-116 at knock sensor and harness connector B-108 at ECM for damage.**

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 2.

**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

---

**STEP 2. Check for open circuit and harness damage between knock sensor connector B-116 (terminal No. 1) and ECM connector B-108 (terminal No. 42).**

*NOTE: Check harness after checking intermediate connector B-16. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 3.

**NO :** Repair it. Then go to Step 5.

---

**STEP 3. Check for open circuit, short circuit to ground and harness damage between knock sensor connector B-116 (terminal No. 2) and ECM connector B-108 (terminal No. 25).**

*NOTE: Check harness after checking intermediate connector B-16. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 4.

**NO :** Repair it. Then go to Step 5.

---

**STEP 4. Replace the knock sensor.**

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

**Q: Is DTC P0327 set?**

**YES :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

**NO :** The inspection is complete.

**STEP 5. Test the OBD-II drive cycle.**

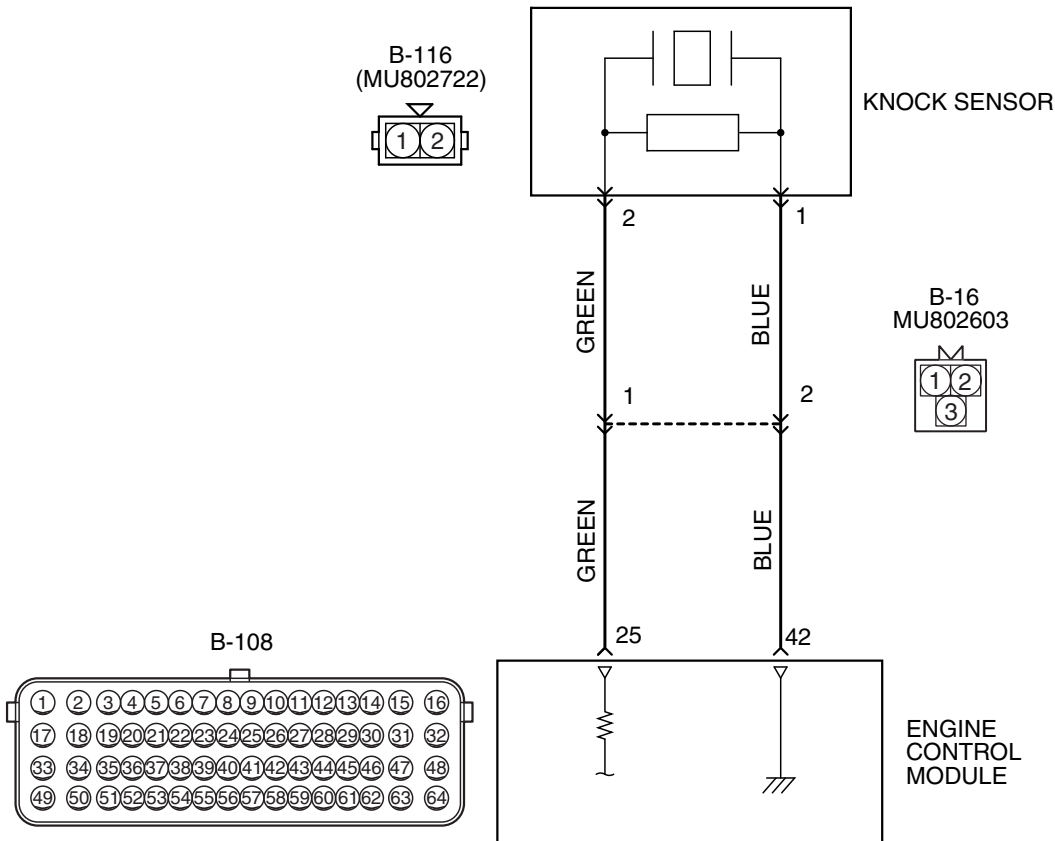
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 P.13B-12.
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0327 set?**

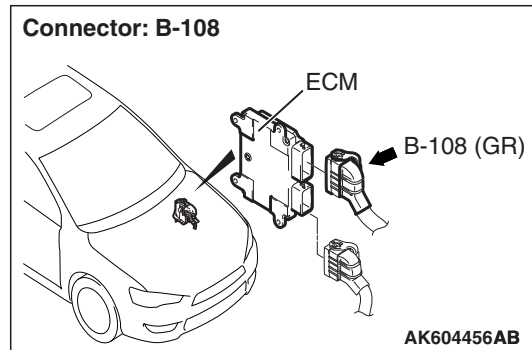
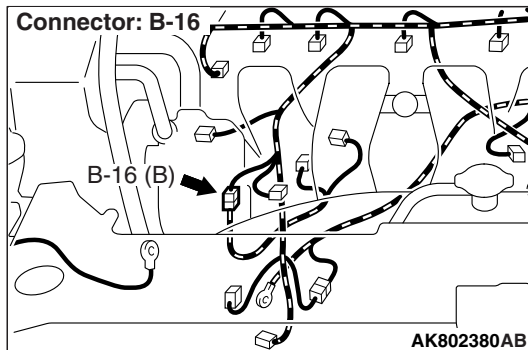
- YES :** Retry the troubleshooting.
- NO :** The inspection is complete.

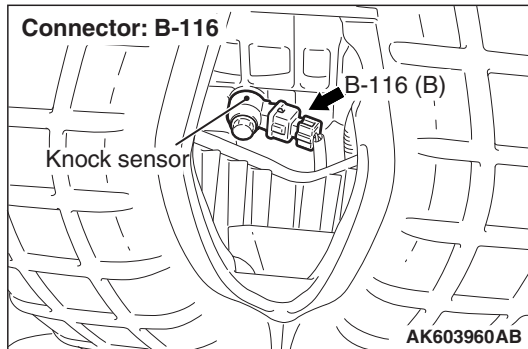
**DTC P0328: Knock Sensor Circuit High**

**KNOCK SENSOR CIRCUIT**



AK604244 AC





## CIRCUIT OPERATION

- The knock sensor (terminal No. 2) sends a signal voltage to the ECM (terminal No. 25).
- The ground terminal (terminal No. 1) is grounded with ECM (terminal No. 42).

## TECHNICAL DESCRIPTION

- The knock sensor converts the vibration of the cylinder block into a voltage and outputs it.
- The ECM checks whether the voltage is within a specified range.

## DESCRIPTIONS OF MONITOR METHODS

Knock sensor output voltage is out of specified range.

## MONITOR EXECUTION

Continuous

## MONITOR EXECUTIONS (Other monitor and Sensor)

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

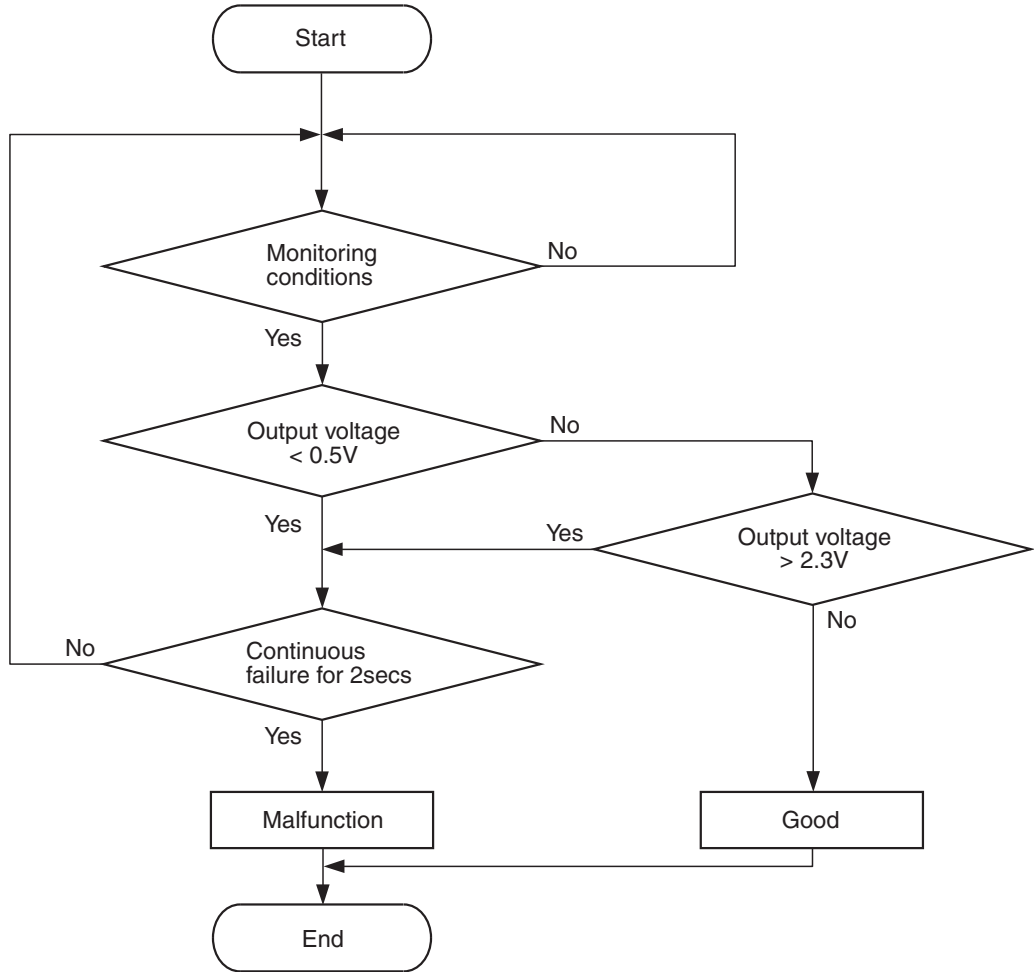
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK704271

**Check Condition**

- More than 2 seconds have passed since the engine starting sequence was completed.

**Judgement Criterion**

- Knock sensor output voltage is more than 2.3 volts for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- Fix the ignition timing with an allowance against knock.

**OBD-II DRIVE CYCLE PATTERN**

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

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

- Shorted knock sensor circuit or connector damage.
- ECM failed.

---

## DIAGNOSIS

### Required Special Tool:

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

---

**STEP 1. Check harness connector B-116 at knock sensor and harness connector B-108 at ECM for damage.**

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 2.

**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

---

**STEP 2. Check for short circuit to power supply between knock sensor connector B-116 (terminal No. 2) and ECM connector B-108 (terminal No. 25).**

*NOTE: Check harness after checking intermediate connector B-16. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 3.

**NO :** Repair it. Then go to Step 5.

---

**STEP 3. Check for short circuit to power supply between knock sensor connector B-116 (terminal No. 1) and ECM connector B-108 (terminal No. 42).**

*NOTE: Check harness after checking intermediate connector B-16. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.*

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 4.

**NO :** Repair it. Then go to Step 5.

---

**STEP 4. Check the trouble symptoms.**

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

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

**Q: Is DTC P0328 set?**

**YES :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 5.

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



**STEP 5. Test the OBD-II drive cycle.**

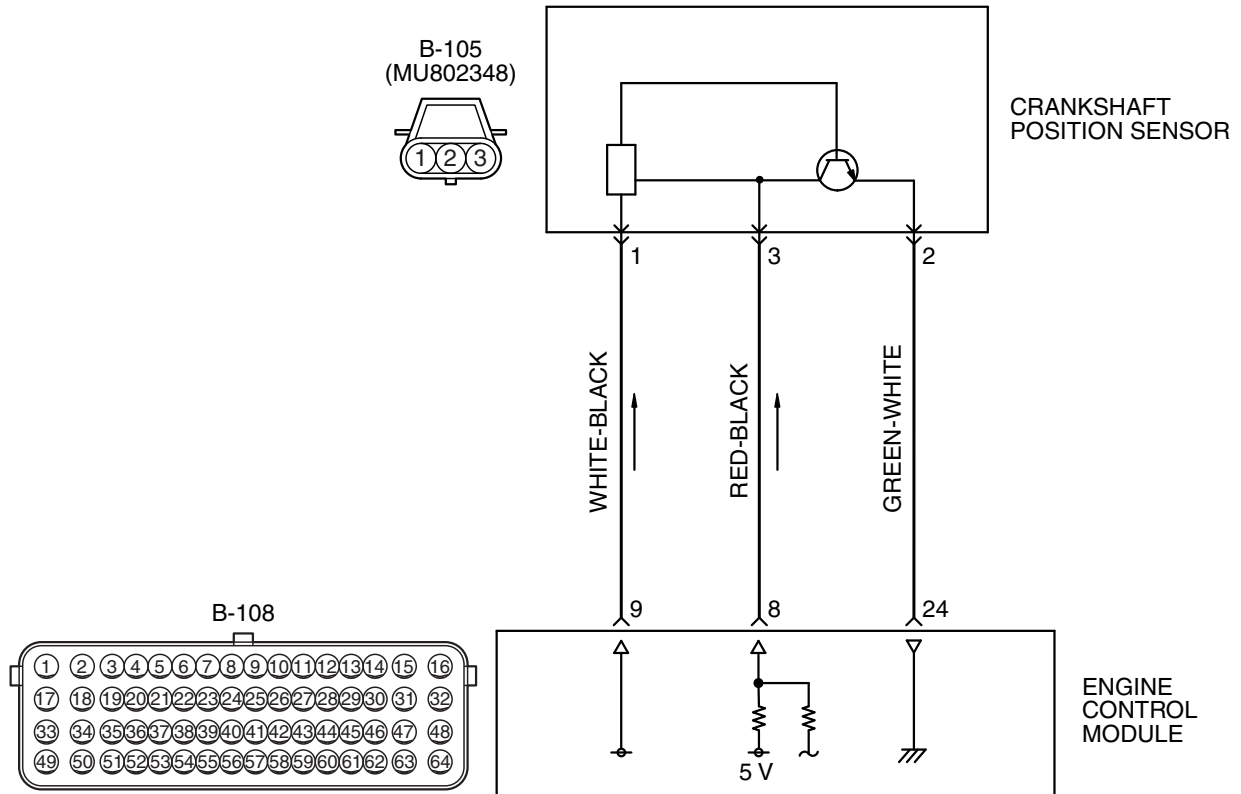
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 P.13B-12.
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0328 set?**

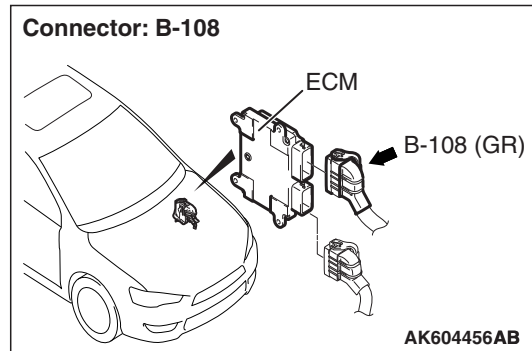
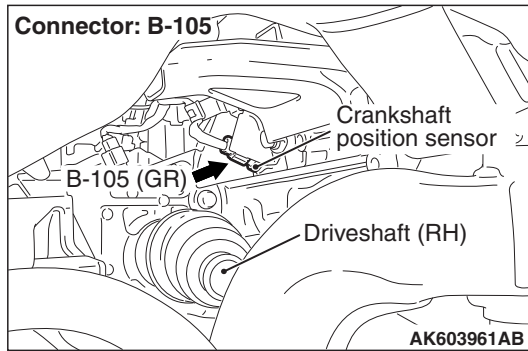
- YES :** Retry the troubleshooting.
- NO :** The inspection is complete.

**DTC P0335: Crankshaft Position Sensor Circuit**

**CRANKSHAFT POSITION SENSOR CIRCUIT**



AK604245AF



## CIRCUIT OPERATION

- The crankshaft position sensor power is supplied from the ECM (terminal No. 9).
- Terminal No. 2 of the crankshaft position sensor is grounded with ECM (terminal No. 24).
- A 5-volt voltage is applied on the crankshaft position sensor output terminal (terminal No. 3) from the ECM (terminal No. 8). The crankshaft position sensor generates a pulse signal when the output terminal is opened and grounded.

## TECHNICAL DESCRIPTION

- The crankshaft position sensor detects the crank angle (position) of each cylinder, and converts that data to pulse signals, then which are input to the ECM.
- When the engine is running, the crankshaft position sensor outputs a pulse signal.
- The ECM checks whether pulse signal is input while the engine is cranking.

## DESCRIPTIONS OF MONITOR METHODS

- Crankshaft position sensor signal does not change.
- Crankshaft position sensor signal is not normal pattern.

## 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)**

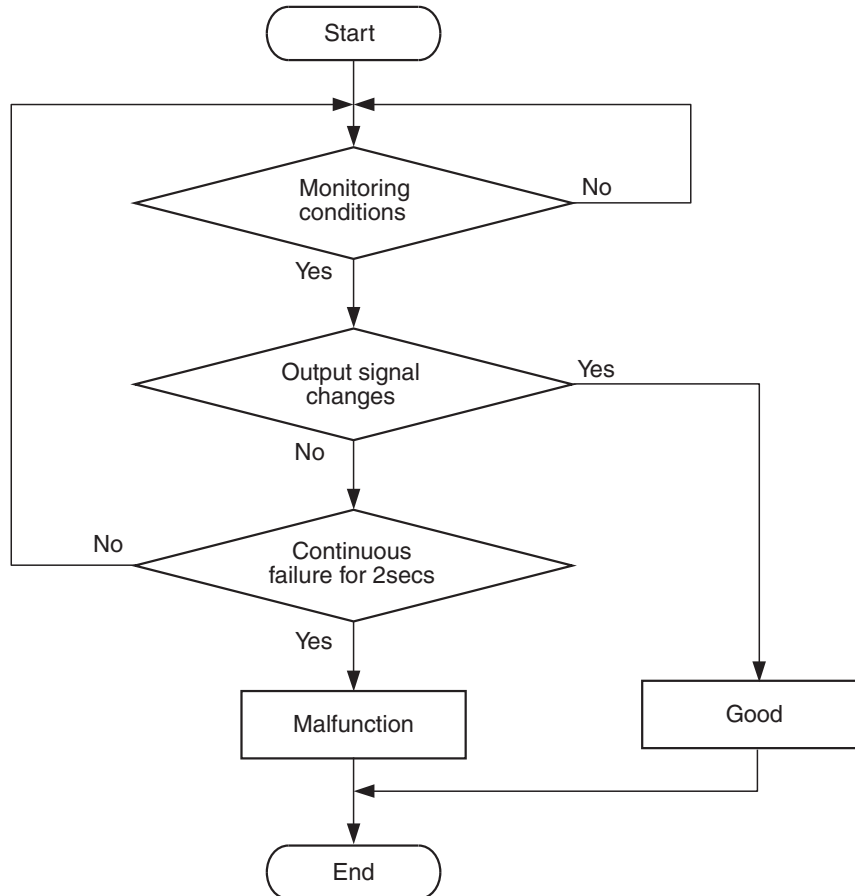
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Not applicable

## DTC SET CONDITIONS &lt;Circuit continuity&gt;

## Logic Flow Chart



AK604334

**Check Condition**

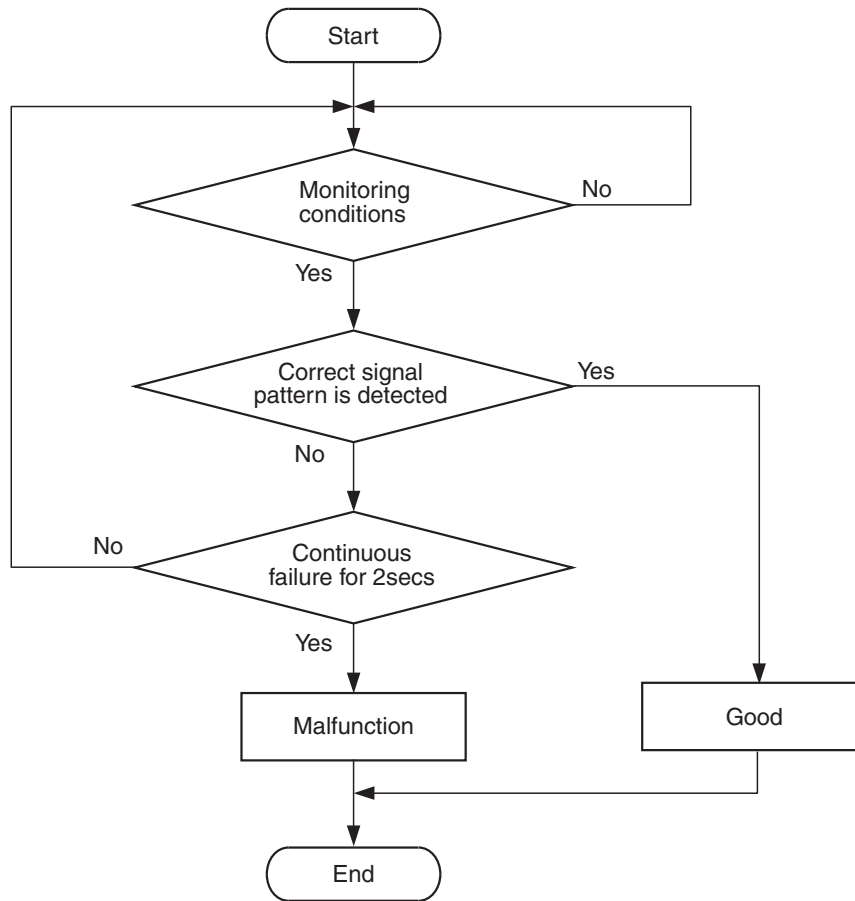
- Engine is being cranked.
- or
- Engine speed is more than 500 r/min excluding during cranking.

**Judgement Criterion**

- Crankshaft position sensor output voltage does not change (no pulse signal is input) for 2 seconds.

**DTC SET CONDITIONS <Range/Performance problem –alignment>**

**Logic Flow Chart**



AK705067

**Check Condition**

- Engine is being cranked.
- or
- Engine speed is more than 500 r/min excluding during cranking.

**Judgement Criterion**

- Normal signal pattern is not inputted for cylinder identification from the crankshaft position sensor signal and camshaft position sensor signal for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 P.13B-12.

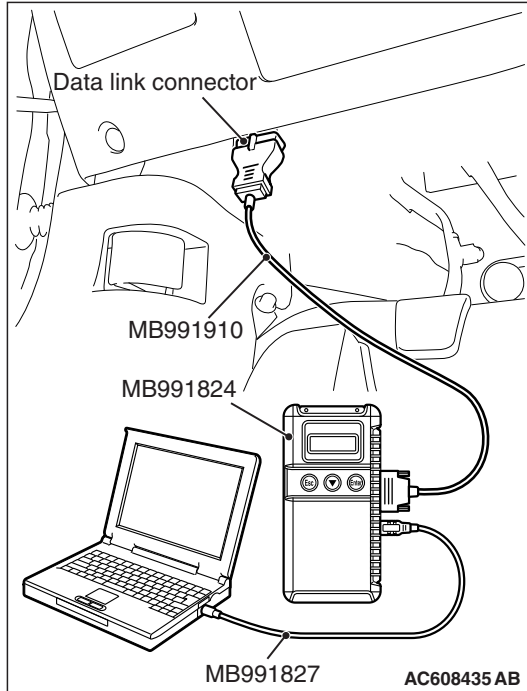
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

- Crankshaft position sensor failed.
- Open or shorted crankshaft position sensor circuit, harness damage or connector damage.
- Crankshaft position sensing ring 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
- MB991709: Test Harness
- MB992110: Power Plant ECU Check Harness



**STEP 1. Using scan tool MB991958, check data list item 2: Crankshaft Position 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 2, Crankshaft Position Sensor.
  - The tachometer and engine speed indicated on the scan tool should match.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

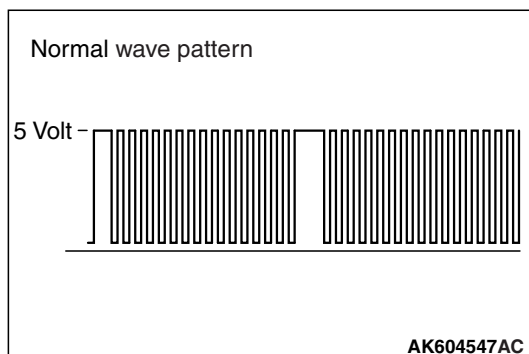
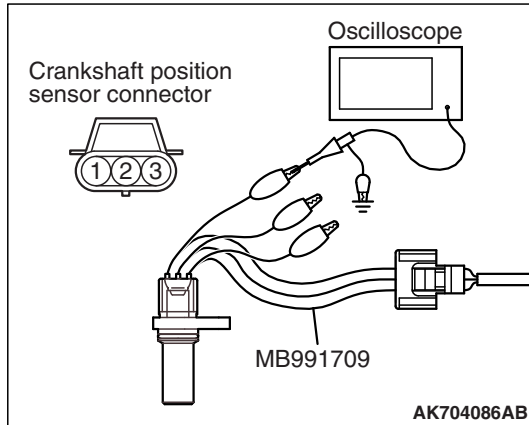
**Q: Is the sensor operating properly?**

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

Refer to GROUP 00, How to Use

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

**NO :** Go to Step 2.



**STEP 2. Using the oscilloscope, check the crankshaft position sensor.**

(1) Disconnect the crankshaft position sensor connector B-105 and connect the test harness special tool MB991709 between the separated connectors. (All terminals should be connected.)

(2) Connect the oscilloscope probe to terminal No. 3 of the crankshaft position sensor connector.

*NOTE: When checking with the ECM side connector, disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 8.*

(3) Start the engine and run at idle.

(4) Check the wave pattern.

- The wave pattern should show a pattern similar to the illustration.

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

**Q: Is the wave pattern normal?**

**YES :** Go to Step 3.

**NO :** Go to Step 4.

**STEP 3. Check harness connector B-105 at crankshaft position sensor and harness connector B-108 at ECM for damage.**

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 19.

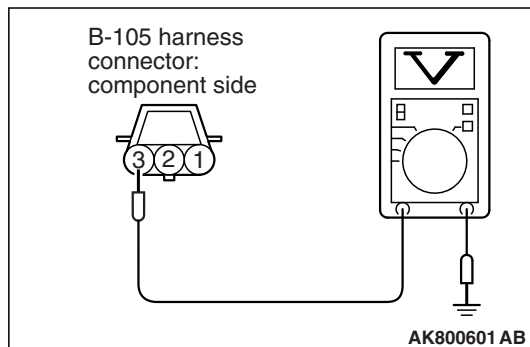
**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 4. Check harness connector B-105 at crankshaft position sensor for damage.**

**Q: Is the harness connector in good condition?**

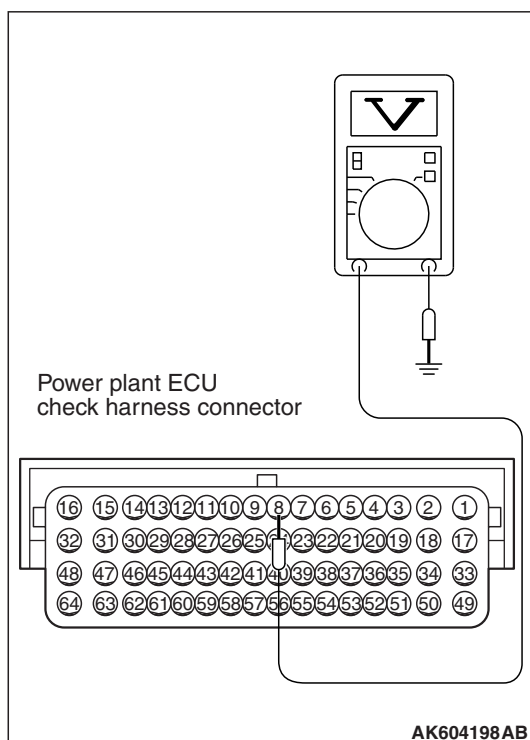
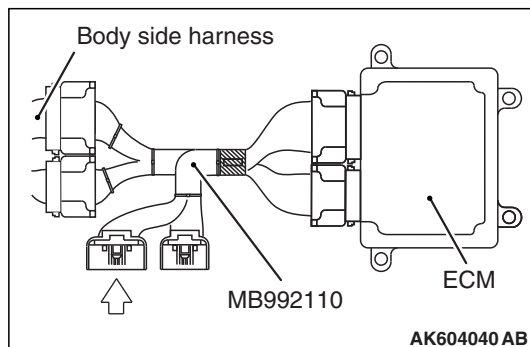
**YES :** Go to Step 5.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 5. Measure the sensor supply voltage at crankshaft position sensor harness side connector B-105.**

- (1) Disconnect the connector B-105 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 3 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 9.**NO :** Go to Step 6.**STEP 6. Check harness connector B-108 at ECM 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 20.



**STEP 7. 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 crankshaft position sensor connector B-105.
- (3) Turn the ignition switch to the "ON" position.

- (4) Measure the voltage between terminal No. 8 and ground.
  - Voltage should be between 4.9 and 5.1 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Repair harness wire between crankshaft position sensor connector B-105 (terminal No. 3) and ECM connector B-108 (terminal No. 8) because of open circuit. Then go to Step 20.

**NO :** Go to Step 8.

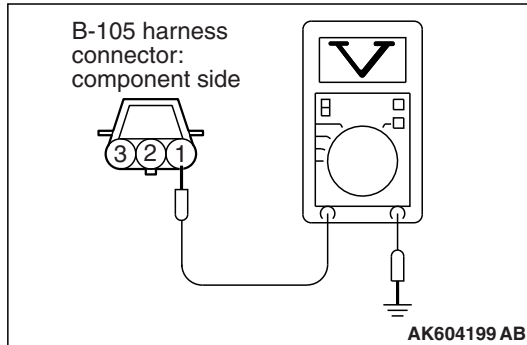
**STEP 8. Check for short circuit to ground between crankshaft position sensor connector B-105 (terminal No. 3) and ECM connector B-108 (terminal No. 8).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 19.

**NO :** Repair it. Then go to Step 20.



**STEP 9. Measure the sensor supply voltage at crankshaft position sensor harness side connector B-105.**

- (1) Disconnect the connector B-105 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 12.

**NO :** Go to Step 10.

**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 20.

**STEP 11. Check for open circuit and short circuit to ground between crankshaft position sensor connector B-105 (terminal No. 1) and ECM connector B-108 (terminal No. 9).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 19.

**NO :** Repair it. Then go to Step 20.

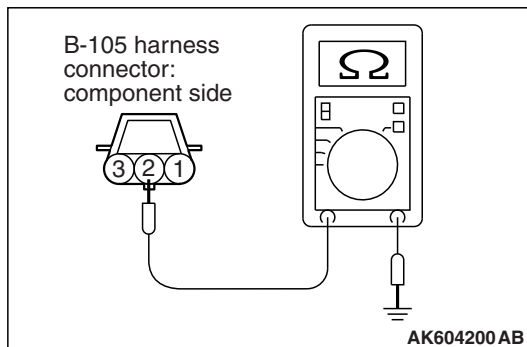
**STEP 12. Check the continuity at crankshaft position sensor harness side connector B-105.**

- (1) Disconnect the connector B-105 and measure at the harness side.
- (2) Check for the continuity between terminal No. 2 and ground.
  - Continuity (2 ohms or less)

**Q: Does continuity exist?**

**YES :** Go to Step 15.

**NO :** Go to Step 13.



---

**STEP 13. Check harness connector B-108 at ECM for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 14.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 14. Check for open circuit and harness damage between crankshaft position sensor connector B-105 (terminal No. 2) and ECM connector B-108 (terminal No. 24).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 19.

**NO :** Repair it. Then go to Step 20.

---

**STEP 15. Check harness connector B-108 at ECM for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 16.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 16. Check for harness damage between ECM connector B-108 (terminal No. 9) and crankshaft position sensor connector B-105 (terminal No. 1).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 20.

---

**STEP 17. Check for harness damage between crankshaft position sensor connector B-105 (terminal No. 3) and ECM connector B-108 (terminal No. 8).**

**Q: Is the harness wire in good condition?**

**YES :** Replace the crankshaft position sensor. Then go to Step 18.

**NO :** Repair it. Then go to Step 20.

---

**STEP 18. Check the trouble symptoms.**

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

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

**Q: Is DTC P0335 set?**

**YES :** Replace the crankshaft sensing ring. Then go to Step 20.

**NO :** The inspection is complete.

**STEP 19. Using scan tool MB991958, check data list item 2: Crankshaft Position Sensor.**

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item 2, Crankshaft Position Sensor.
  - The tachometer and engine speed indicated on the scan tool should 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.00-13](#).
- NO** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 20.

---

**STEP 20. Test the OBD-II drive cycle.**

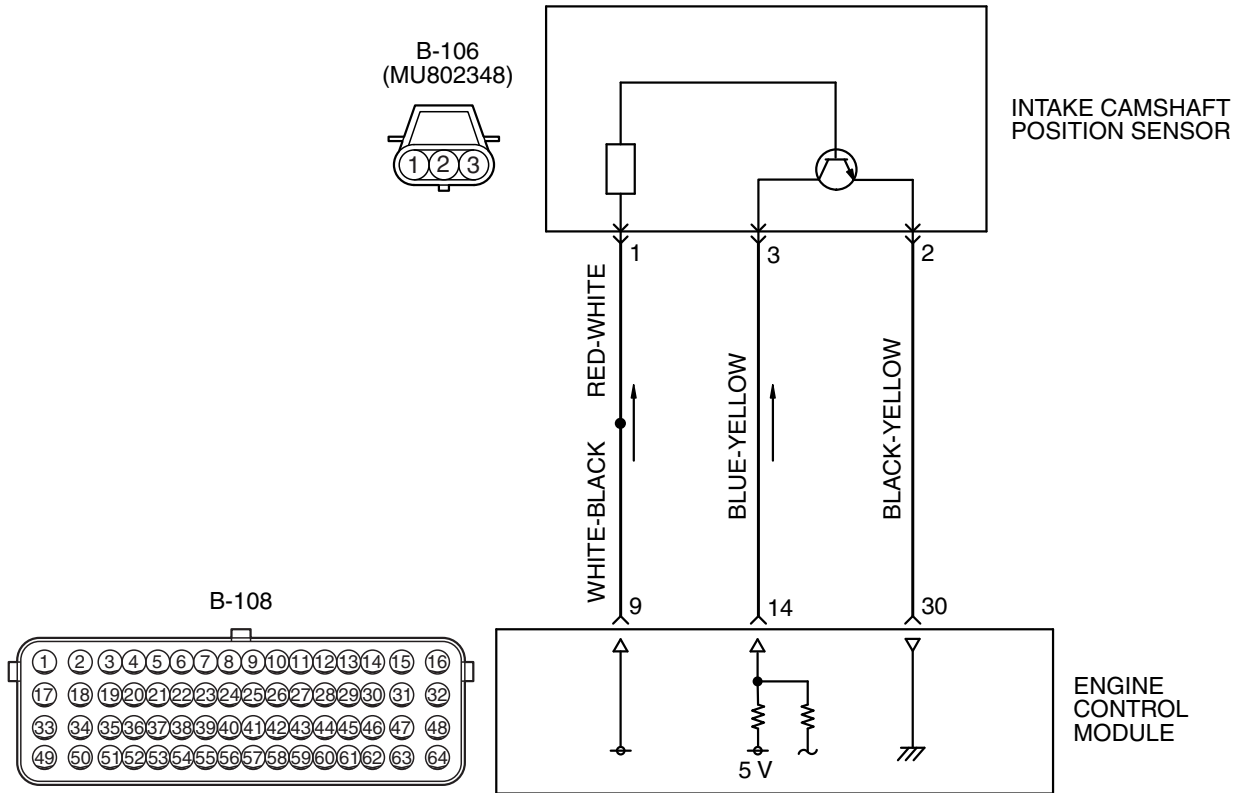
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0335 set?**

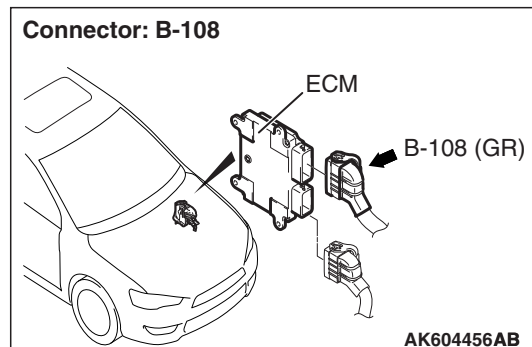
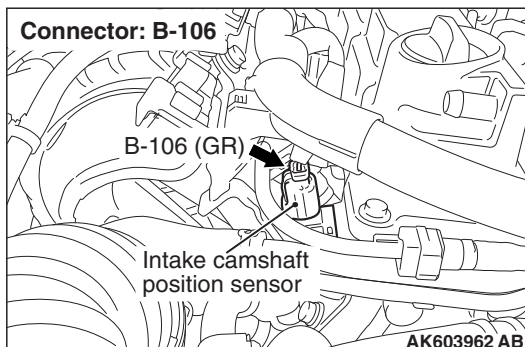
- YES** : Retry the troubleshooting.
- NO** : The inspection is complete.

DTC P0340: Intake Camshaft Position Sensor Circuit

INTAKE CAMSHAFT POSITION SENSOR CIRCUIT



AK705047AC



**CIRCUIT OPERATION**

- The intake camshaft position sensor power is supplied from the ECM (terminal No. 9).
- Terminal No. 2 of the intake camshaft position sensor is grounded with ECM (terminal No. 30).

- A 5-volt voltage is applied on the intake camshaft position sensor output terminal (terminal No. 3) from the ECM (terminal No. 14). The intake camshaft position sensor generates a pulse signal when the output terminal is opened and grounded.

**TECHNICAL DESCRIPTION**

- The intake camshaft position sensor detects the position of the intake camshaft and inputs the pulse signal to the ECM.
- In response to the intake camshaft position sensor signal and the crankshaft sensor signal, the ECM detects the compression top dead center of the No. 1 cylinder.
- Also, in response to the intake camshaft position sensor signal, the ECM controls variable valve timing (V.V.T.).

**DESCRIPTIONS OF MONITOR METHODS**

- Intake camshaft position sensor signal does not change.

- Intake camshaft position sensor signal is not normal pattern.

**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)**

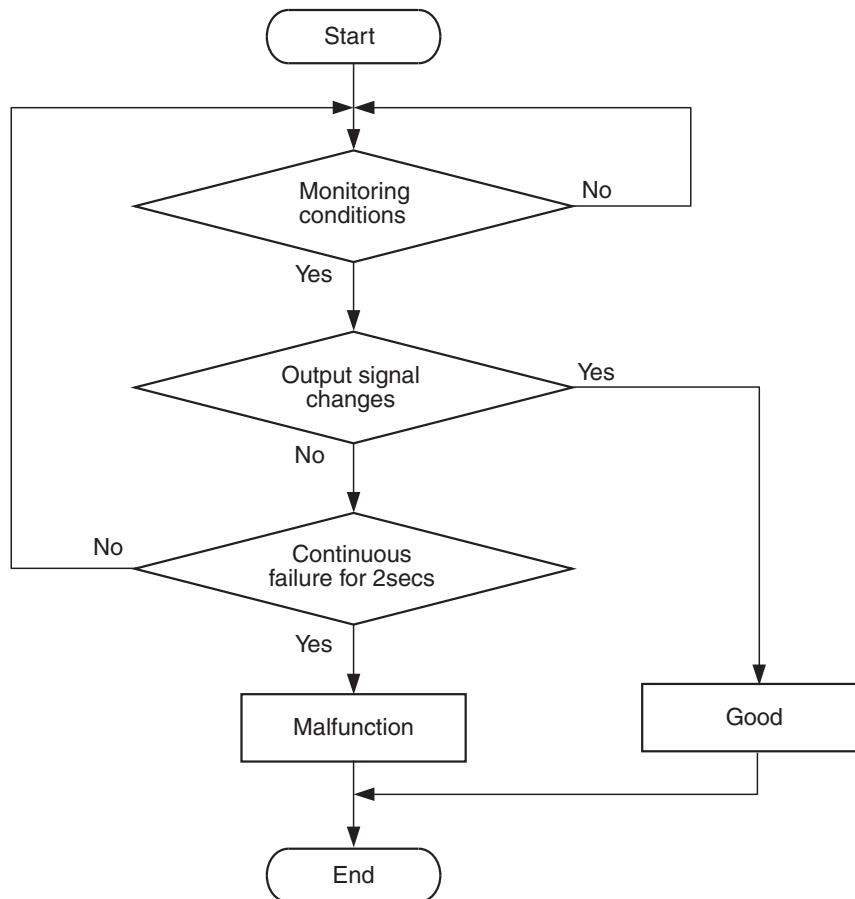
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Not applicable

**DTC SET CONDITIONS <Circuit continuity>**

**Logic Flow Chart**



AK604334

**Check Condition**

- Engine is being cranked.
- or

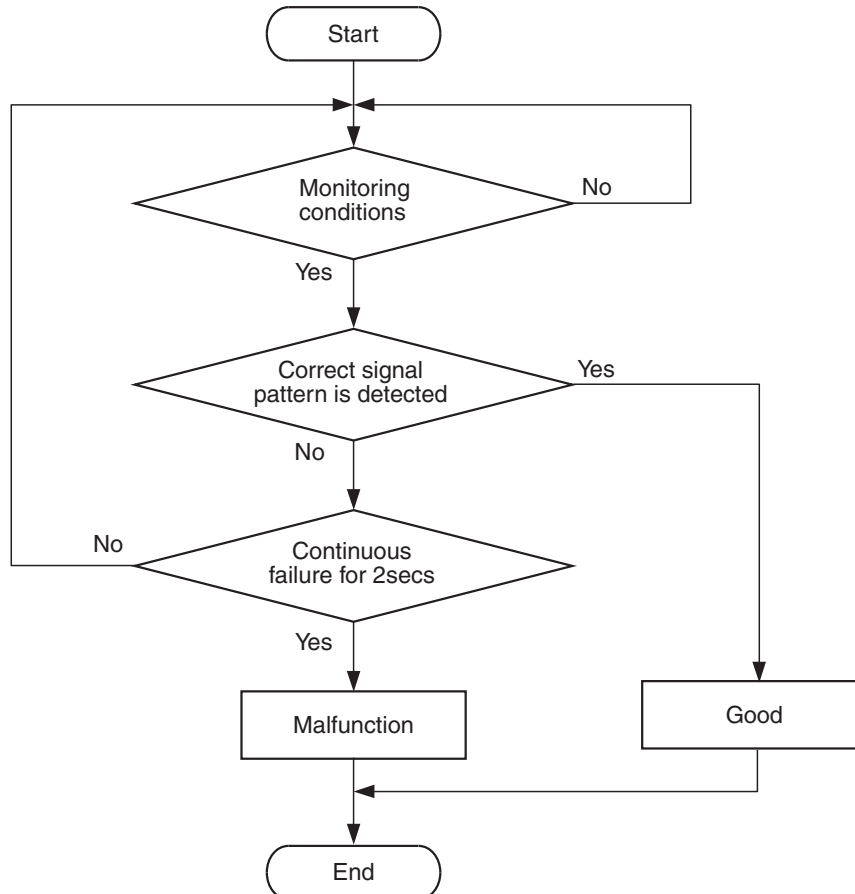
- Engine speed is more than 500 r/min excluding during cranking.

**Judgement Criterion**

- Intake camshaft position sensor output voltage does not change (no pulse signal is input) for 2 seconds.

**DTC SET CONDITIONS <Range/Performance problem –alignment>**

**Logic Flow Chart**



AK705067

**Check Condition**

- Engine is being cranked.
- or
- Engine speed is more than 500 r/min excluding during cranking.

**Judgement Criterion**

- Normal signal pattern is not inputted for cylinder identification from the crankshaft position sensor signal and intake camshaft position sensor signal for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- Engine runs in learned pattern until engine stops.
- Does not control variable valve timing (V.V.T.).

**OBD-II DRIVE CYCLE PATTERN**

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

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

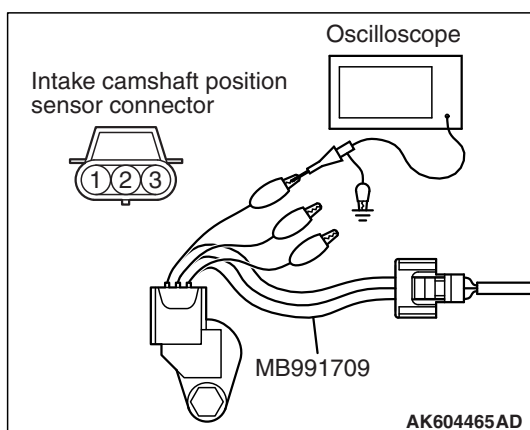
- Intake camshaft position sensor failed.
- Open or shorted intake camshaft position sensor circuit, harness damage or connector damage.
- Intake camshaft failed.
- ECM failed.

**DIAGNOSIS****Required Special Tools:**

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- MB991709: Test Harness
- MB992110: Power Plant ECU Check Harness

**STEP 1. Using the oscilloscope, check the intake camshaft position sensor.**

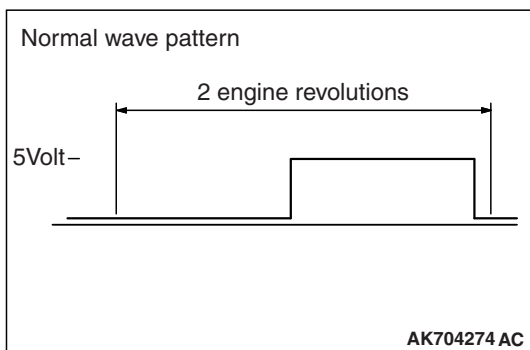
- (1) Disconnect the intake camshaft position sensor connector B-106, and connect test harness special tool MB991709 between the separated connectors. (All terminals should be connected.)



- (2) Connect the oscilloscope probe to the intake camshaft position sensor side connector terminal No. 3.

*NOTE: When checking with the ECM side connector, disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 14.*

- (3) Start the engine and run at idle.



- (4) Check the wave pattern.

- The wave pattern should show a pattern similar to the illustration.

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

**Q: Is the wave pattern normal?**

**YES** : Go to Step 2.

**NO** : Go to Step 3.

**STEP 2. Check harness connector B-106 at intake camshaft position sensor and harness connector B-108 at ECM for damage.****Q: Are the harness connectors in good condition?**

**YES** : Go to Step 18.

**NO** : Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 19.

---

**STEP 3. Check harness connector B-106 at intake camshaft position 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 19.

---

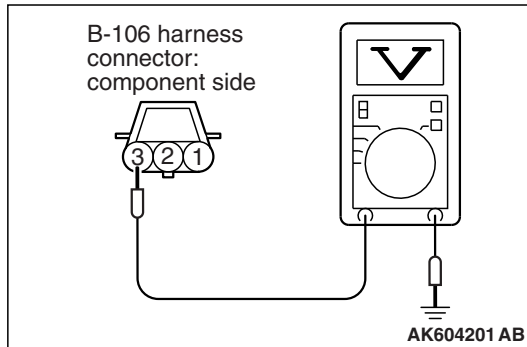
**STEP 4. Measure the sensor supply voltage at intake camshaft position sensor harness side connector B-106.**

- (1) Disconnect the connector B-106 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 3 and ground.
  - Voltage should 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 5.



---

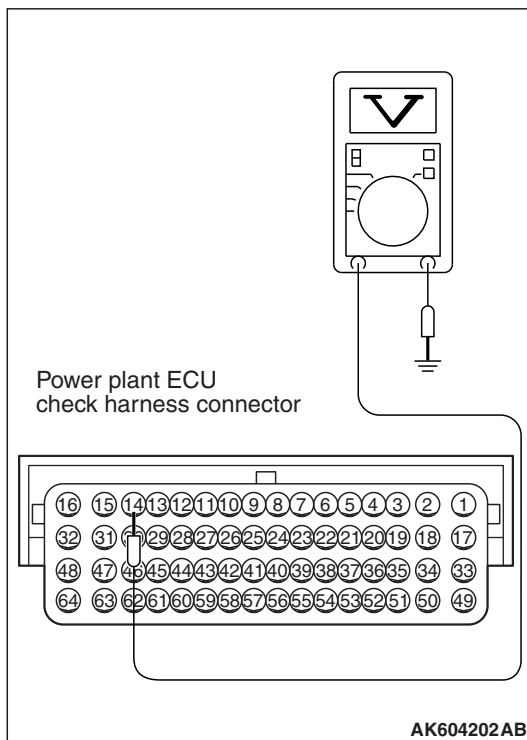
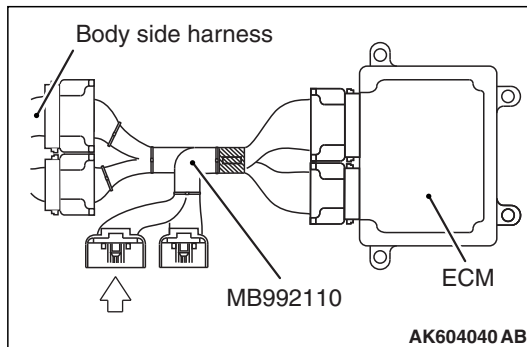
**STEP 5. Check harness connector B-108 at ECM for damage.**

**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 19.





**STEP 6. 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 intake camshaft position sensor connector B-106.
- (3) Turn the ignition switch to the "ON" position.

- (4) Measure the voltage between terminal No. 14 and ground.
  - Voltage should be between 4.9 and 5.1 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Repair harness wire between intake camshaft position sensor connector B-106 (terminal No. 3) and ECM connector B-108 (terminal No. 14) because of open circuit. Then go to Step 19.

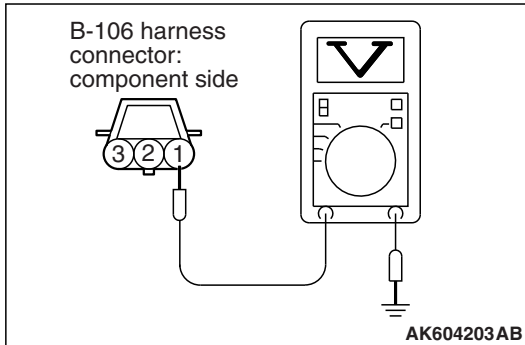
**NO :** Go to Step 7.

**STEP 7. Check for short circuit to ground between intake camshaft position sensor connector B-106 (terminal No. 3) and ECM connector B-108 (terminal No. 14).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 18.

**NO :** Repair it. Then go to Step 19.



**STEP 8. Measure the sensor supply voltage at intake camshaft position sensor harness side connector B-106.**

- (1) Disconnect the connector B-106 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 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.

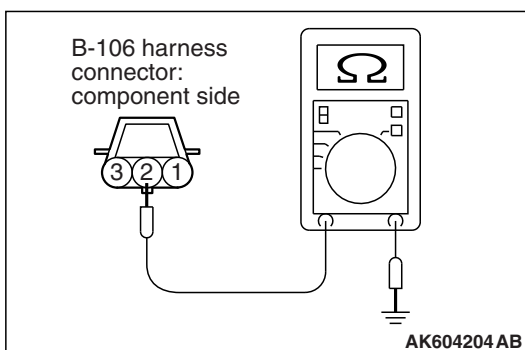
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 19.

**STEP 10. Check for open circuit and short circuit to ground between intake camshaft position sensor connector B-106 (terminal No. 1) and ECM connector B-108 (terminal No. 9).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 18.

**NO :** Repair it. Then go to Step 19.



**STEP 11. Check the continuity at intake camshaft position sensor harness side connector B-106.**

- (1) Disconnect the connector B-106 and measure at the harness side.
- (2) Check for the continuity between terminal No. 2 and ground.
  - Continuity (2 ohms or less).

**Q: Does continuity exist?**

**YES :** Go to Step 14.

**NO :** Go to Step 12.

---

**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 19.

---

**STEP 13. Check for open circuit and harness damage between intake camshaft position sensor connector B-106 (terminal No. 2) and ECM connector B-108 (terminal No. 30).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 18.

**NO :** Repair it. Then go to Step 19.

---

**STEP 14. Check harness connector B-108 at ECM for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 15.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 19.

---

**STEP 15. Check for harness damage between ECM connector B-108 (terminal No. 9) and intake camshaft position sensor connector B-106 (terminal No. 1).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 16.

**NO :** Repair it. Then go to Step 19.

---

**STEP 16. Check for harness damage between intake camshaft position sensor connector B-106 (terminal No. 3) and ECM connector B-108 (terminal No. 14).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 19.

---

**STEP 17. Check the intake camshaft position sensing portion.**

**Q: Is the intake camshaft position sensing portion in good condition?**

**YES :** Replace the intake camshaft position sensor. Then go to Step 19.

**NO :** Replace the intake camshaft. Then go to Step 19.

---

---

**STEP 18. Check the trouble symptoms.**

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

**Q: Is DTC P0340 set?**

**YES :** Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 19.

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

---

**STEP 19. 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.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

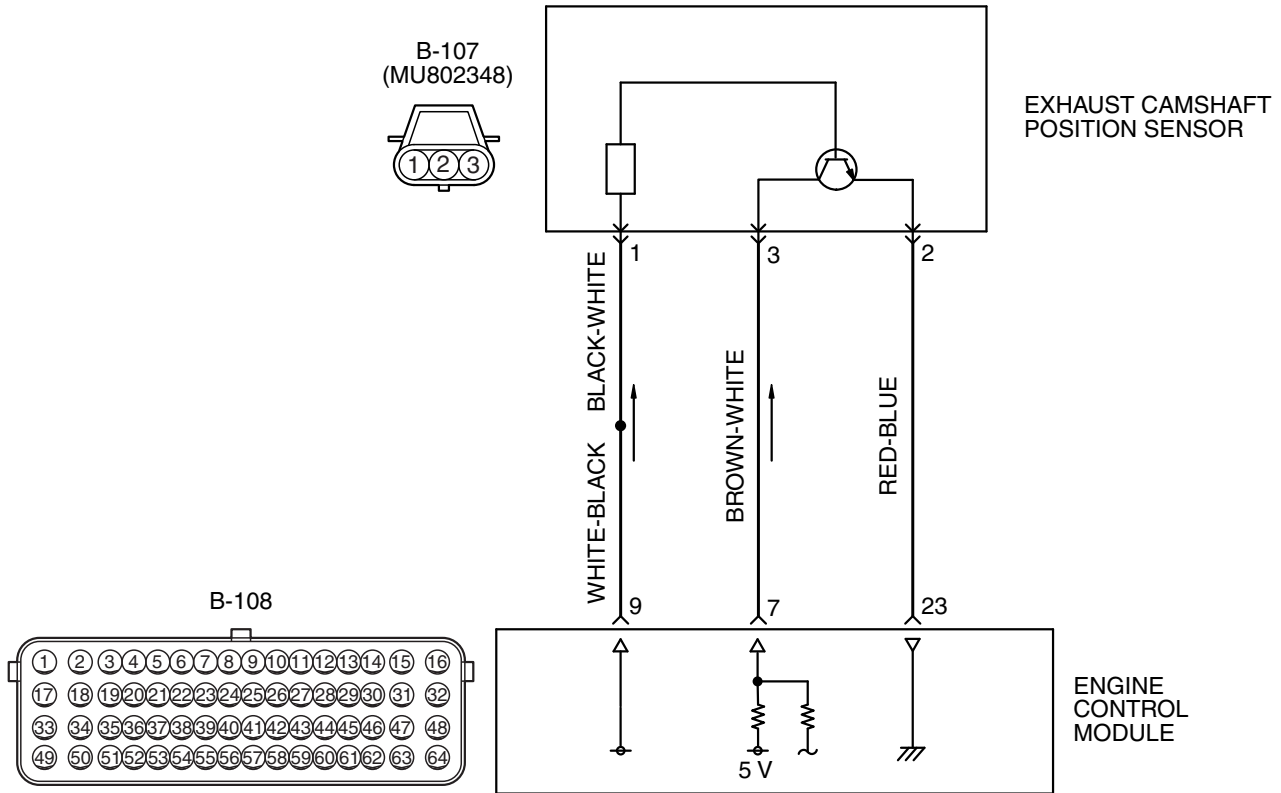
**Q: Is DTC P0340 set?**

**YES :** Retry the troubleshooting.

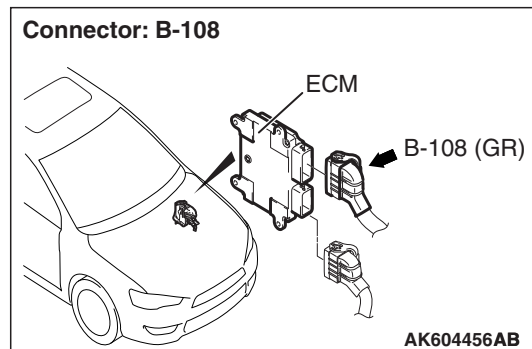
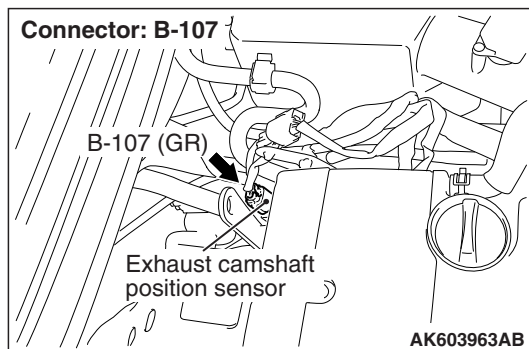
**NO :** The inspection is complete.

DTC P0365: Exhaust Camshaft Position Sensor Circuit

EXHAUST CAMSHAFT POSITION SENSOR CIRCUIT



AK705048 AC



CIRCUIT OPERATION

- The exhaust camshaft position sensor power is supplied from the ECM (terminal No. 9).
- Terminal No. 2 of the exhaust camshaft position sensor is grounded with ECM (terminal No. 23).
- A 5-volt voltage is applied on the exhaust camshaft position sensor output terminal (terminal No. 3) from the ECM (terminal No. 7). The exhaust camshaft position sensor generates a pulse signal when the output terminal is opened and grounded.

**TECHNICAL DESCRIPTION**

- The exhaust camshaft position sensor detects the position of the exhaust camshaft and inputs the pulse signal to the ECM.
- In response to the exhaust camshaft position sensor signal, the ECM controls variable valve timing (V.V.T.).

**DESCRIPTIONS OF MONITOR METHODS**

- Exhaust camshaft position sensor signal does not change.
- Exhaust camshaft position sensor signal is not normal pattern.

**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)**

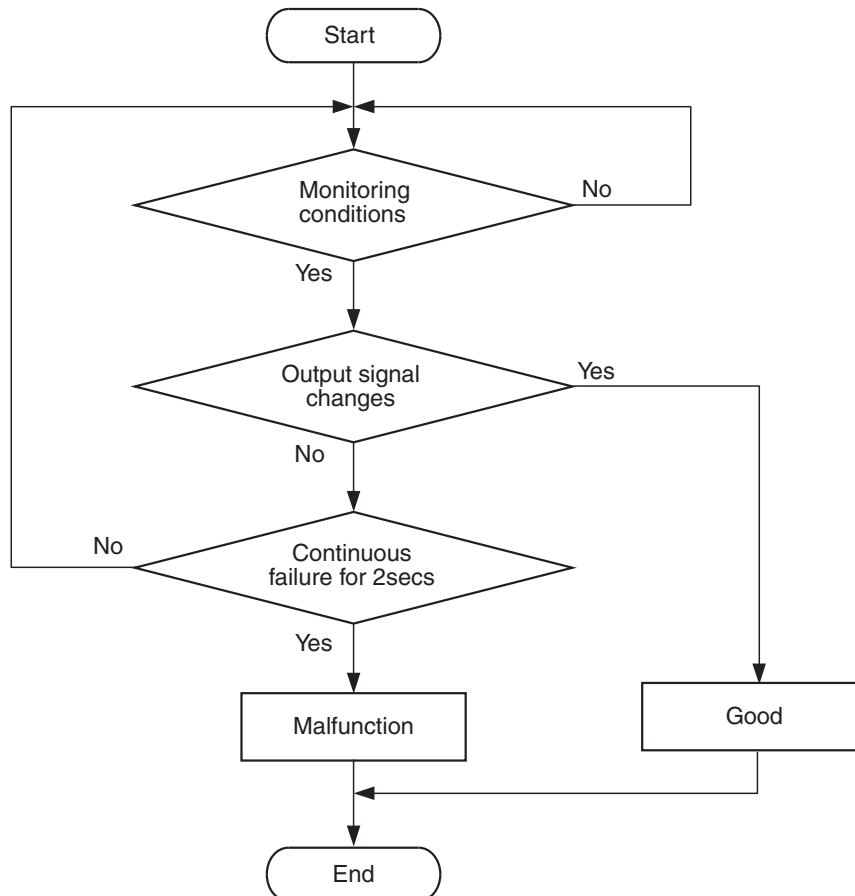
- Not applicable

**Sensor (The sensor below is determined to be normal)**

- Not applicable

**DTC SET CONDITIONS <Circuit continuity>**

**Logic Flow Chart**



AK604334

**Check Condition**

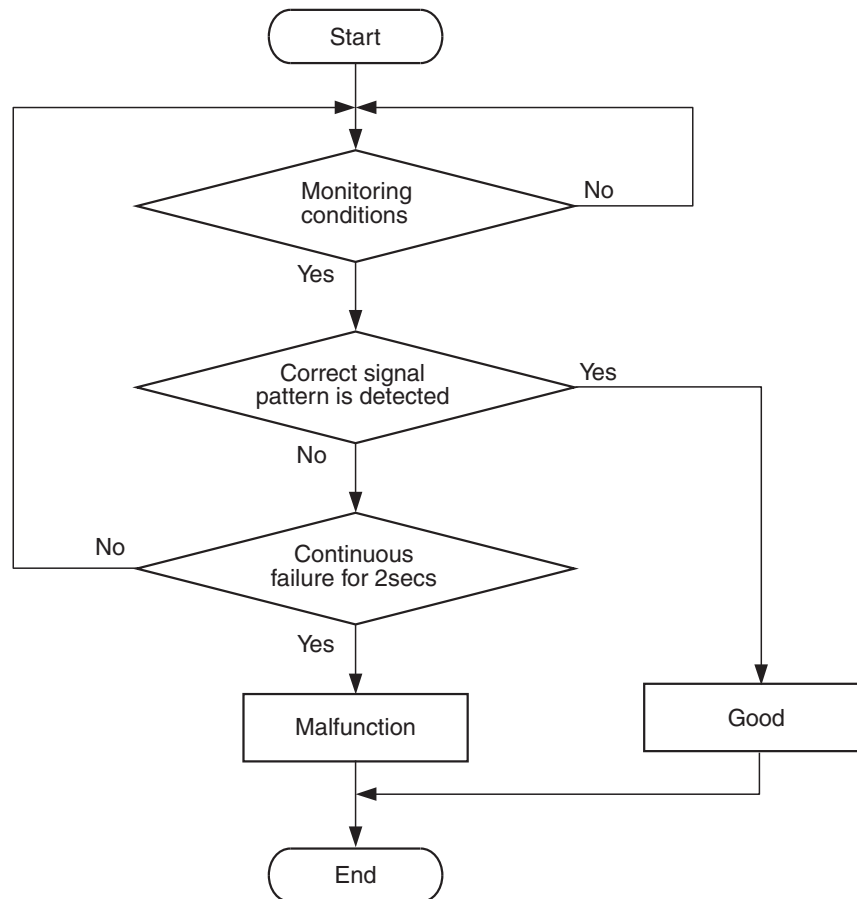
- Engine is being cranked.
- or
- Engine speed is more than 500 r/min excluding during cranking.

**Judgement Criterion**

- Exhaust camshaft position sensor output voltage does not change (no pulse signal is input) for 2 seconds.

## DTC SET CONDITIONS &lt;Range/Performance problem –alignment&gt;

## Logic Flow Chart



AK705067

**Check Condition**

- Engine is being cranked.
- or
- Engine speed is more than 500 r/min excluding during cranking.

**Judgement Criterion**

- Normal signal pattern is not inputted from the crankshaft position sensor signal and exhaust camshaft position sensor signal for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- Does not control variable valve timing (V.V.T.).

**OBD-II DRIVE CYCLE PATTERN**

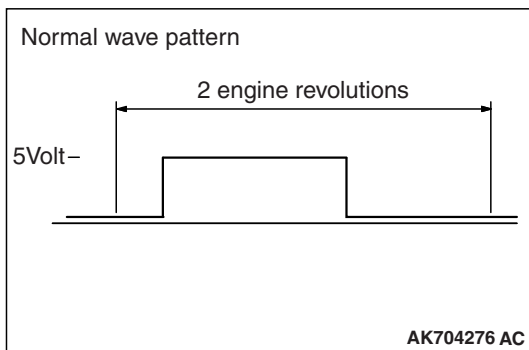
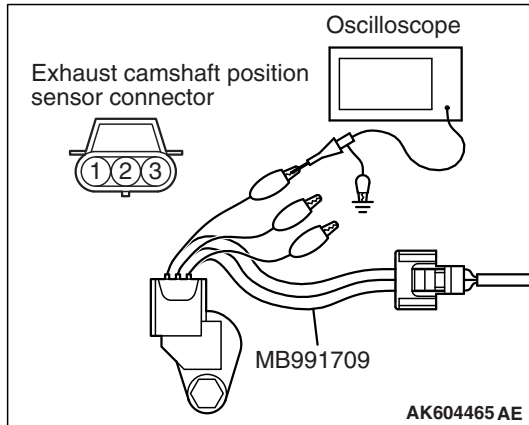
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13B-12](#).

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

- Exhaust camshaft position sensor failed.
- Open or shorted exhaust camshaft position sensor circuit, harness damage or connector damage.
- Exhaust camshaft 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
- MB991709: Test Harness
- MB992110: Power Plant ECU Check Harness



**STEP 1. Using the oscilloscope, check the exhaust camshaft position sensor.**

(1) Disconnect the exhaust camshaft position sensor connector B-107, and connect test harness special tool MB991709 between the separated connectors. (All terminals should be connected.)

(2) Connect the oscilloscope probe to the exhaust camshaft position sensor side connector terminal No. 3.

*NOTE: When checking with the ECM side connector, disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 7.*

(3) Start the engine and run at idle.

(4) Check the wave pattern.

- The wave pattern should show a pattern similar to the illustration.

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

**Q: Is the wave pattern normal?**

**YES :** Go to Step 2.

**NO :** Go to Step 3.

**STEP 2. Check harness connector B-107 at exhaust camshaft position sensor and harness connector B-108 at ECM for damage.**

**Q: Are the harness connectors in good condition?**

**YES :** Go to Step 18.

**NO :** Repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 19.

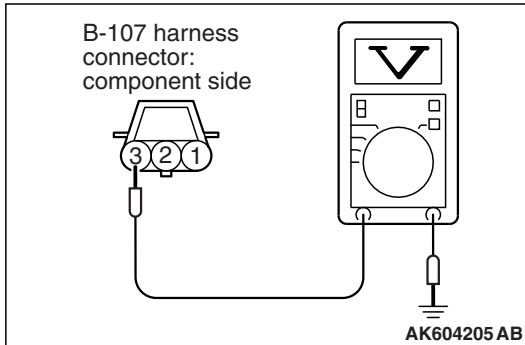
**STEP 3. Check harness connector B-107 at exhaust camshaft position sensor for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 4.

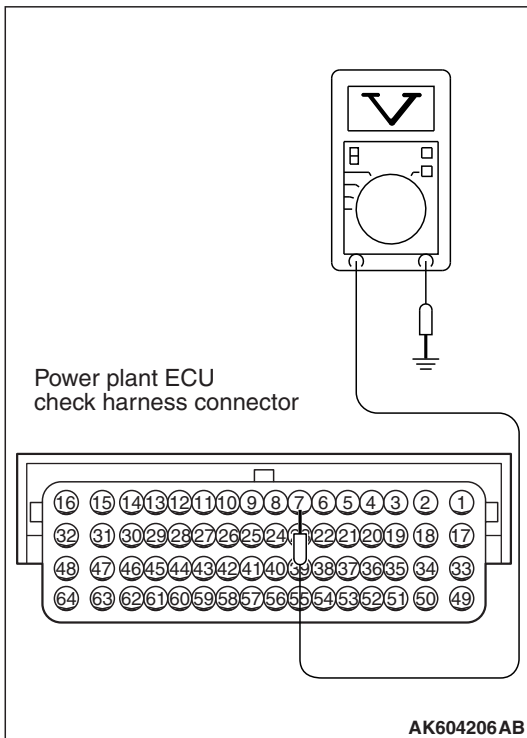
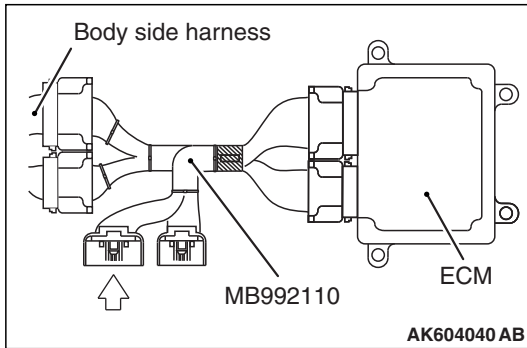
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 19.



**STEP 4. Measure the sensor supply voltage at exhaust camshaft position sensor harness side connector B-107.**

- (1) Disconnect the connector B-107 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 3 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 8.**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 19.



**STEP 6. 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 exhaust camshaft position sensor connector B-107.
- (3) Turn the ignition switch to the "ON" position.

- (4) Measure the voltage between terminal No. 7 and ground.
  - Voltage should be between 4.9 and 5.1 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Repair harness wire between exhaust camshaft position sensor connector B-107 (terminal No. 3) and ECM connector B-108 (terminal No. 7) because of open circuit. Then go to Step 19.

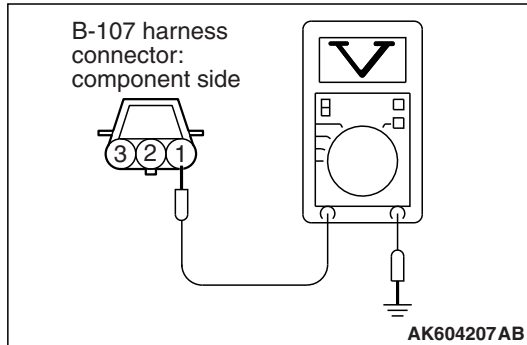
**NO :** Go to Step 7.

**STEP 7. Check for short circuit to ground between exhaust camshaft position sensor connector B-107 (terminal No. 3) and ECM connector B-108 (terminal No. 7).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 18.

**NO :** Repair it. Then go to Step 19.



**STEP 8. Measure the sensor supply voltage at exhaust camshaft position sensor harness side connector B-107.**

- (1) Disconnect the connector B-107 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 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 19.

**STEP 10. Check for open circuit and short circuit to ground between exhaust camshaft position sensor connector B-107 (terminal No. 1) and ECM connector B-108 (terminal No. 9).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 18.

**NO :** Repair it. Then go to Step 19.

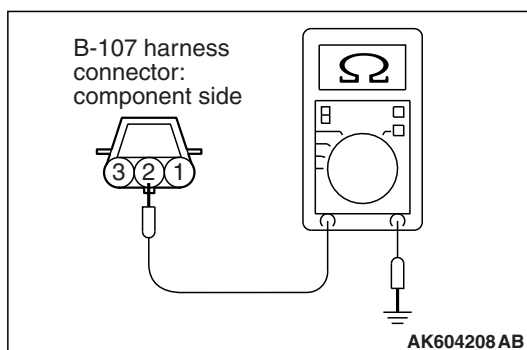
**STEP 11. Check the continuity at exhaust camshaft position sensor harness side connector B-107.**

- (1) Disconnect the connector B-107 and measure at the harness side.
- (2) Check for the continuity between terminal No. 2 and ground.
  - Continuity (2 ohms or less).

**Q: Does continuity exist?**

**YES :** Go to Step 14.

**NO :** Go to Step 12.



---

**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 19.

---

**STEP 13. Check for open circuit and harness damage between exhaust camshaft position sensor connector B-107 (terminal No. 2) and ECM connector B-108 (terminal No. 23).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 18.

**NO :** Repair it. Then go to Step 19.

---

**STEP 14. Check harness connector B-108 at ECM for damage.**

**Q: Is the harness connector in good condition?**

**YES :** Go to Step 15.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 19.

---

**STEP 15. Check for harness damage between ECM connector B-108 (terminal No. 9) and exhaust camshaft position sensor connector B-107 (terminal No. 1).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 16.

**NO :** Repair it. Then go to Step 19.

---

**STEP 16. Check for harness damage between exhaust camshaft position sensor connector B-107 (terminal No. 3) and ECM connector B-108 (terminal No. 7).**

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 19.

---

**STEP 17. Check the exhaust camshaft position sensing portion.**

**Q: Is the exhaust camshaft position sensing portion in good condition?**

**YES :** Replace the exhaust camshaft position sensor. Then go to Step 19.

**NO :** Replace the exhaust camshaft. Then go to Step 19.

**STEP 18. Check the trouble symptoms.**

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

**Q: Is DTC P0365 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 19.

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

---

**STEP 19. 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.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0365 set?**

**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

---

**DTC P0401: Exhaust Gas Recirculation Flow Insufficient Detected****TECHNICAL DESCRIPTION**

- When the EGR valve (stepper motor) is actuated from the fully closed position toward the open position while the engine is running, EGR gas flows.
- The ECM checks how the EGR gas flow signal changes.

**DESCRIPTIONS OF MONITOR METHODS**

Small manifold pressure change during exhaust gas recirculation (EGR) operation from closed to open.

**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)**

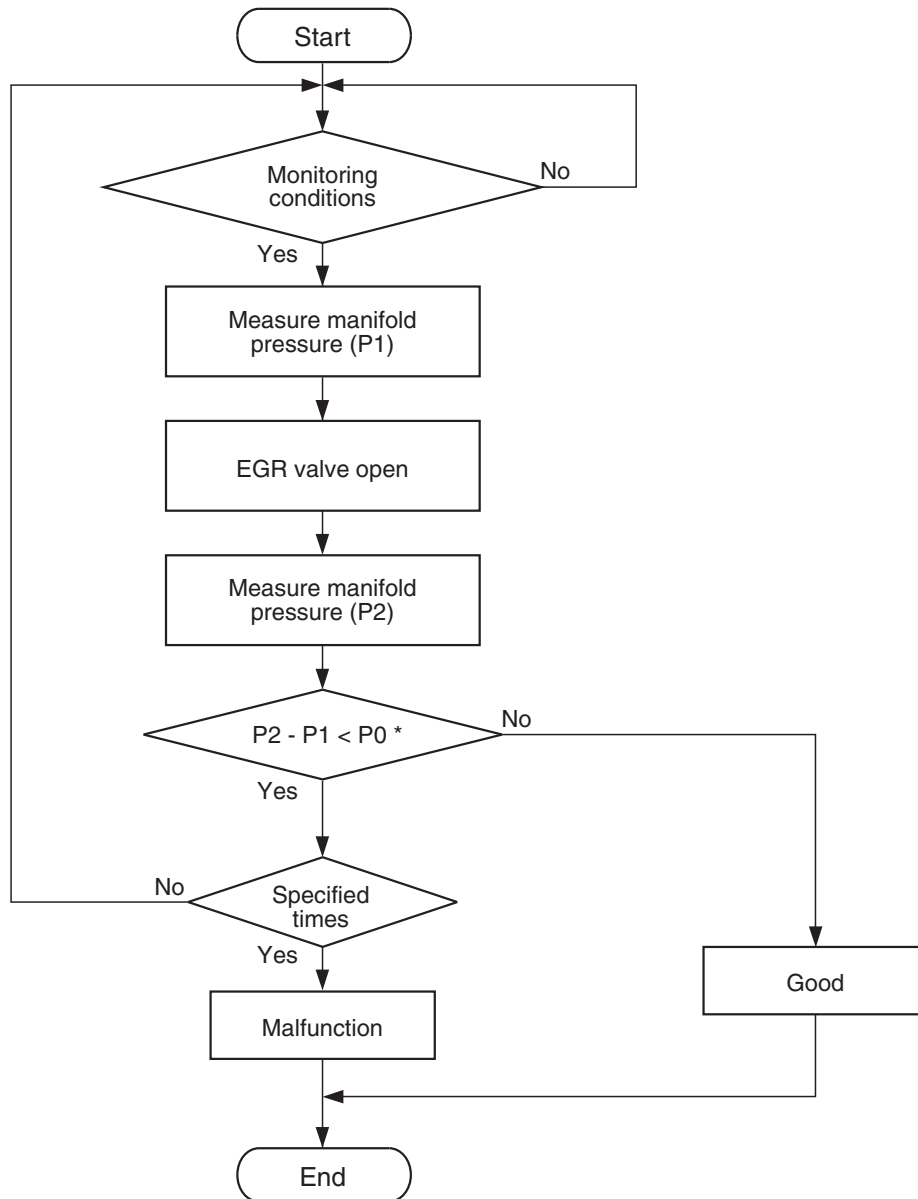
- Exhaust gas recirculation (EGR) stepper motor monitor

**Sensor (The sensor below is determined to be normal)**

- Mass airflow sensor
- Engine coolant temperature sensor
- Intake air temperature sensor
- Barometric pressure sensor
- Accelerator pedal position sensor
- Manifold absolute pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



\* P0 : Threshold value

AK604336

**Check Conditions**

- At least 20 seconds have passed since the last monitor was complete.
- Engine coolant temperature is more than 76° C (169° F).
- Engine speed is between 1,188 and 2,500 r/min <M/T> or 1,125 and 2,500 r/min <CVT>.
- Intake air temperature is more than -10° C (14° F).
- Barometric pressure is more than 76 kPa (22.4 in.Hg).
- Fuel is being shut off.
- Vehicle speed is more than 30 km/h (19 mph).
- At least 90 seconds have passed since manifold absolute pressure sensor output voltage fluctuated more than 1.5 volts.
- Battery positive voltage is more than 10.3 volts.
- Accelerator pedal is not depressed.
- Volumetric efficiency is less than 24 percent.
- The ECM monitors for this condition for 3 cycles of 1.8 seconds each during the drive cycle.

**Judgement Criterion**

- When the EGR valve opens to the prescribed opening, the intake manifold pressure fluctuation width is less than 2.5 kPa (0.74 in.Hg).

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 3 [P.13B-12](#).

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

- Contaminated EGR valve and EGR passage.
- ECM failed.

**DIAGNOSIS****Required Special Tool:**

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

**STEP 1. Check the EGR system**

Refer to GROUP 17, Emission Control –Exhaust Gas Recirculation (EGR) System <2.4L ENGINE> –General Information [P.17-102](#).

**Q: Are there any abnormalities?**

**YES** : Repair it. Then go to Step 4.

**NO** : Go to Step 2.

**STEP 2. Check the EGR valve contamination and the EGR passage contamination.****Q: Are the EGR valve and the EGR passage clogged?**

**YES** : Repair the EGR valve and the EGR passage contamination. Then go to Step 4.

**NO** : Go to Step 3.

**STEP 3. Check the trouble symptoms.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 3 [P.13B-12](#).

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

**Q: Is DTC P0401 set?**

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)). Then go to Step 4.

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

---

**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 3 [P.13B-12](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0401 set?**

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

---

**DTC P0420: Warm Up Catalyst Efficiency Below Threshold <Except vehicles for California>**

---

**TECHNICAL DESCRIPTION**

- The signal from the heated oxygen sensor (rear) differs from the heated oxygen sensor (front), because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the heated oxygen sensor (front) becomes similar to the heated oxygen sensor (rear).
- The ECM compares the output of the heated oxygen sensor (front and rear) signals.

**DESCRIPTIONS OF MONITOR METHODS**

Heated oxygen sensor (front and rear) rich/lean switching frequencies are nearly equal.

**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 (rear) 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
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system monitor
- Air/fuel ratio feedback monitor

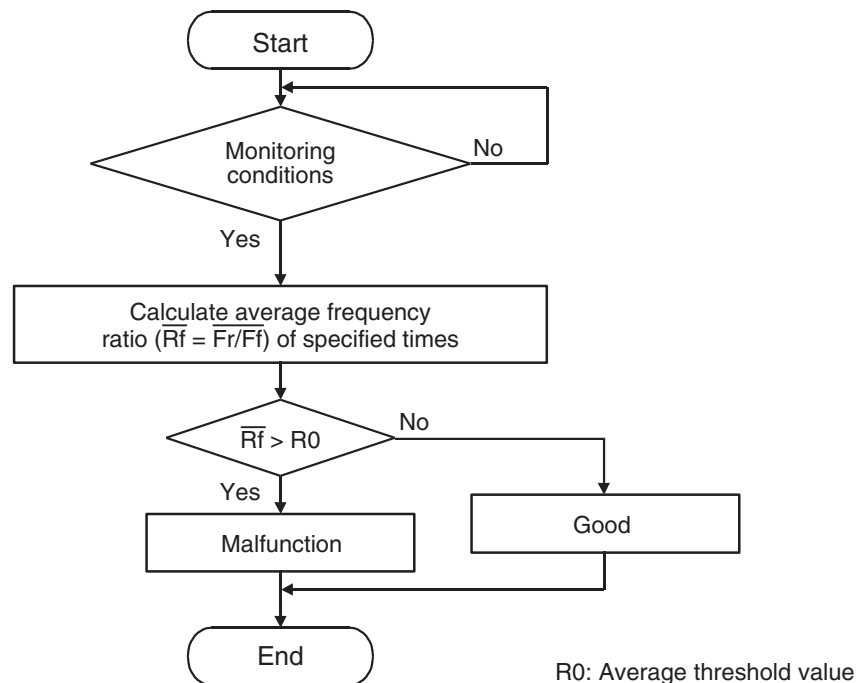
**Sensor (The sensor below is determined to be normal)**

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



## DTC SET CONDITIONS

## Logic Flow Chart



AK604337

**Check Conditions**

- Engine speed is less than 3,500 r/min <M/T> or 3,000 r/min <CVT>.
- Accelerator pedal is depressed.
- Mass airflow rate is between 10 and 45 g/sec.
- More than 3 seconds have passed after the above-mentioned three conditions have been met.
- Intake air temperature is more than  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- Barometric pressure is more than 76 kPa (22.4 in.Hg).
- Under the closed loop air/fuel ratio control.
- Vehicle speed is more than 1.5 km/h (1.0 mph).
- The ECM monitors the maximum 4 times <M/T> or 3 times <CVT> per drive cycle under these conditions.
- Short-term fuel trim is between  $-25$  percent and  $+25$  percent.
- The cumulative mass airflow is more than 1,638 g <M/T> or 1,741 g <CVT>.

**Judgement Criterion**

- When the monitoring for 10 seconds is carried out 5 times, the frequency ratio of rear and front signals is more than the specified value.

*NOTE: The specified value varies depending on the average air flow rate.*

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

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

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

- Catalytic converter deteriorated.
- Heated oxygen sensor failed.
- Exhaust leak.
- ECM failed.

## DIAGNOSIS

### Required Special Tool:

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

---

### STEP 1. Replace the catalytic converter.

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

### Q: Is DTC P0420 set?

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)).

**NO** : The inspection is complete.

---

## DTC P0421: Warm Up Catalyst Efficiency Below Threshold <Vehicles for California>

---

### TECHNICAL DESCRIPTION

- The signal from the heated oxygen sensor (rear) differs from the heated oxygen sensor (front), because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the heated oxygen sensor (front) becomes similar to the heated oxygen sensor (rear).
- The ECM compares the output of the heated oxygen sensor (front and rear) signals.

### DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (front and rear) rich/lean switching frequencies are nearly equal.

### 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

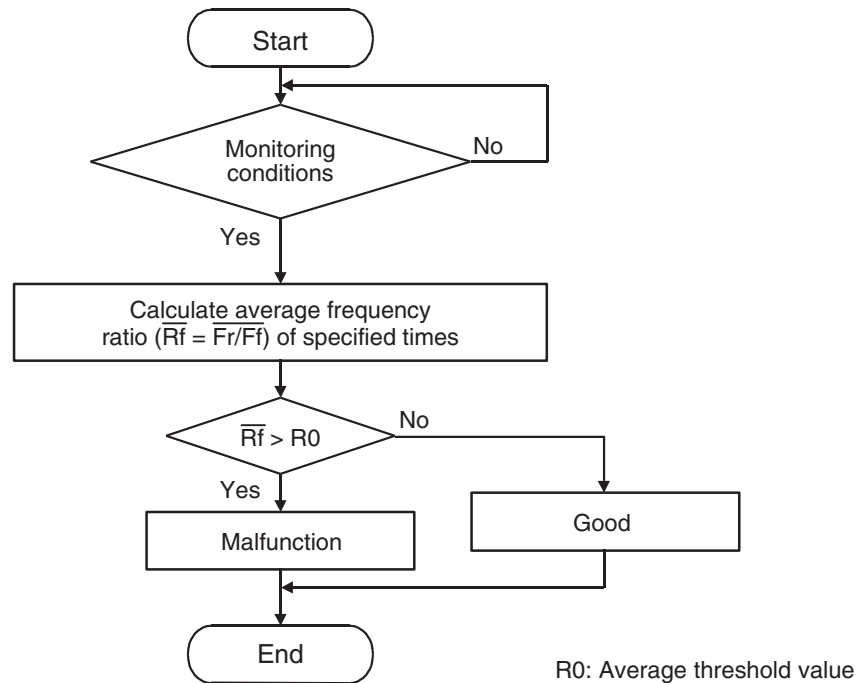
- Heated oxygen sensor (rear) monitor
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Heated oxygen sensor inactive (front) monitor
- Heated oxygen sensor offset voltage monitor
- Misfire monitor
- Fuel system monitor
- Heated oxygen sensor (rear) feedback control system 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
- Throttle position sensor
- Accelerator pedal position sensor

## DTC SET CONDITIONS

## Logic Flow Chart



AK604337

**Check Conditions**

- Engine speed is less than 3,500 r/min <M/T> or 3,000 r/min <CVT>.
- Accelerator pedal is depressed.
- Mass airflow rate is between 10 and 45 g/sec.
- More than 3 seconds have passed after the above-mentioned three conditions have been met.
- Intake air temperature is more than  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- Barometric pressure is more than 76 kPa (22.4 in.Hg).
- Under the closed loop air/fuel ratio control.
- Vehicle speed is more than 1.5 km/h (1.0 mph).
- The ECM monitors the maximum 4 times <M/T> or 3 times <CVT> per drive cycle under these conditions.
- Short-term fuel trim is between  $-25$  percent and  $+25$  percent.
- The cumulative mass airflow is more than 1,638 g <M/T> or 1,741 g <CVT>.

**Judgement Criterion**

- When the monitoring for 10 seconds is carried out 5 times, the frequency ratio of rear and front signals is more than the specified value.  
*NOTE: The specified value varies depending on the average air flow rate.*

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

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

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

- Catalytic converter deteriorated.
- Heated oxygen sensor failed.
- Exhaust leak.
- ECM failed.

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## DIAGNOSIS

### Required Special Tool:

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

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### STEP 1. Replace the catalytic converter.

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

### Q: Is DTC P0421 set?

**YES** : Replace the ECM (Refer to, Removal and Installation [P.13B-1022](#)).

**NO** : The inspection is complete.