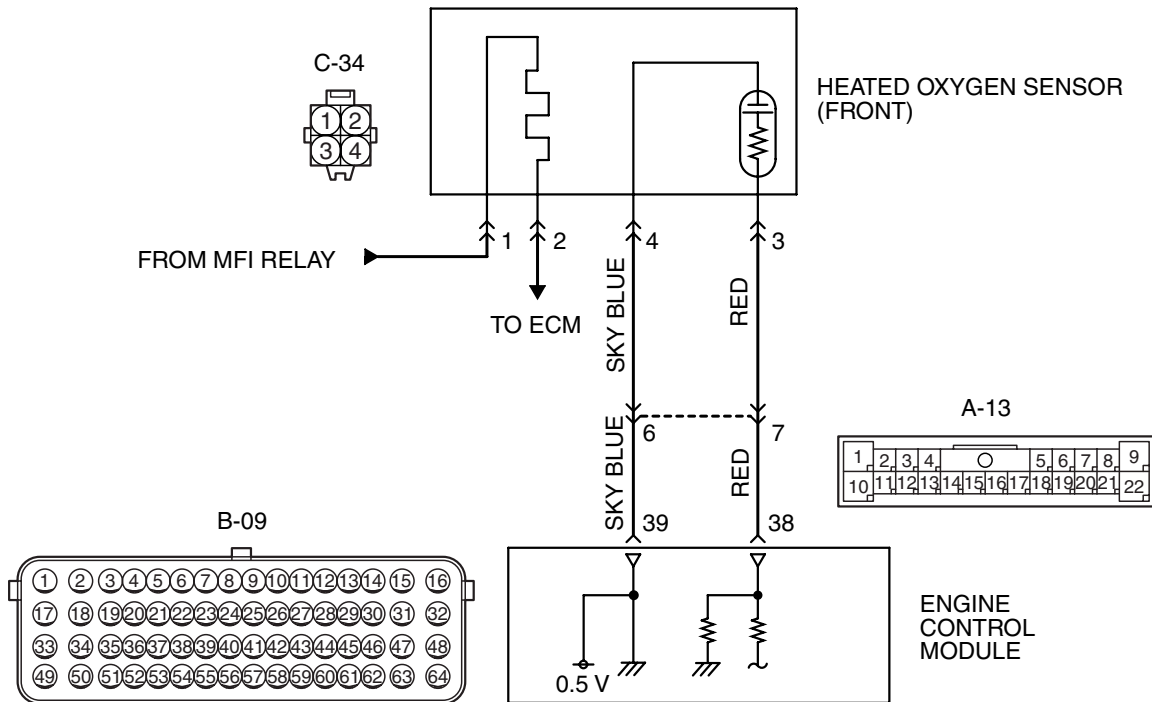
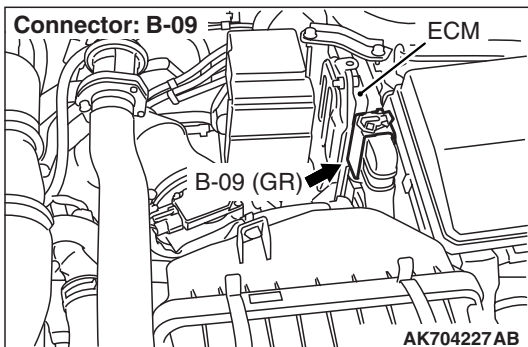
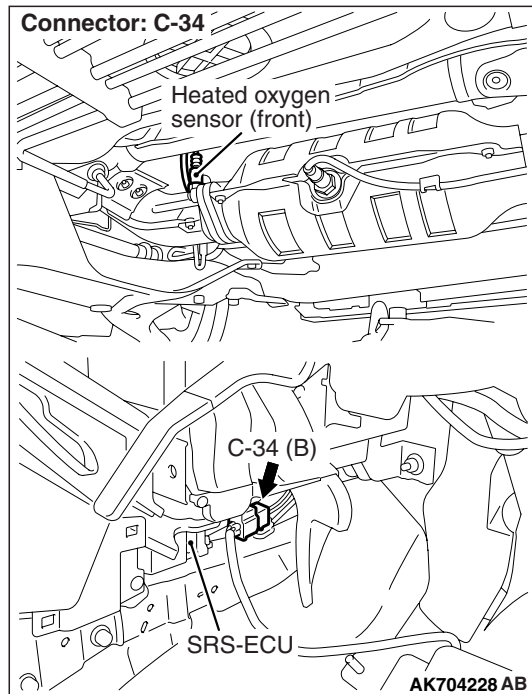
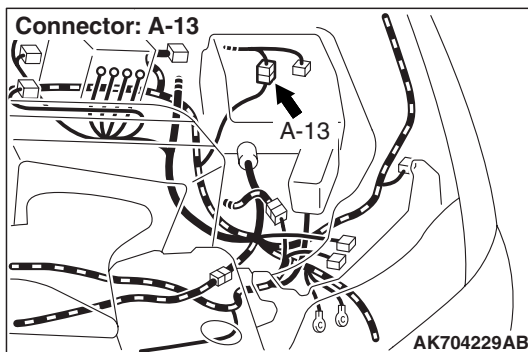


DTC P0131: Heated Oxygen Sensor (front) Circuit Low Voltage

HEATED OXYGEN SENSOR (FRONT) CIRCUIT



AK704249AB



**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)**

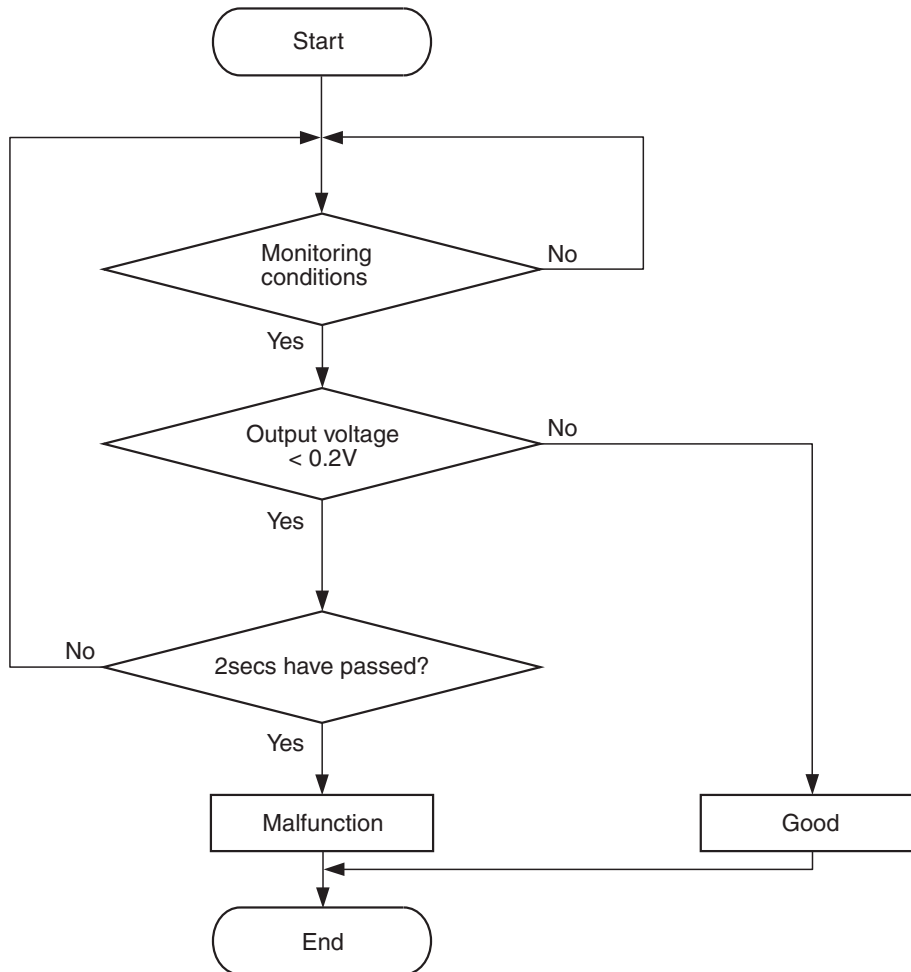
- Heated oxygen sensor (front) heater monitor
- Misfire monitor
- Fuel system monitor

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

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

## DTC SET CONDITIONS

### Logic Flow Chart



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 60 seconds have passed since the engine starting sequence was completed.

#### Judgement Criterion

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

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 22 [P.13A-9](#).

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

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

**DIAGNOSIS****Required Special Tools:**

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

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

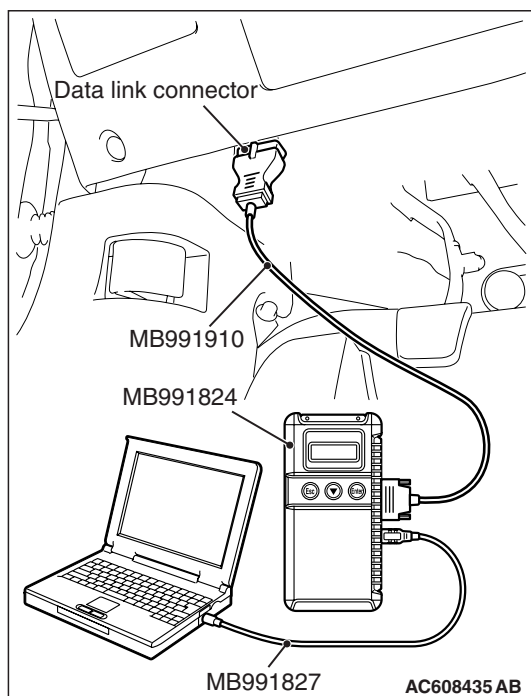
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

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

**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions P.00-15.

**NO :** Go to Step 2.

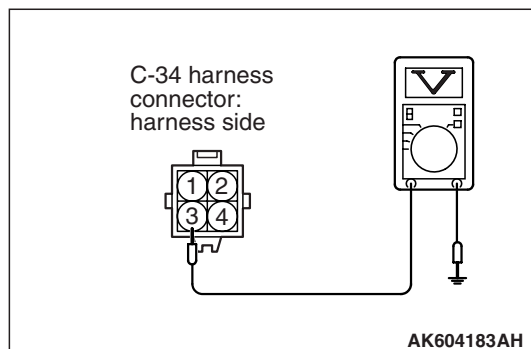
**STEP 2. Measure the sensor output voltage at heated oxygen sensor (front) connector C-34 by backprobing**

- (1) Do not disconnect the connector C-34.
- (2) Start the engine and run at idle.
- (3) Measure the voltage between terminal No. 3 and ground by backprobing.
  - Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0.4 volt or less and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 3.

**NO :** Go to Step 8.



**STEP 3. Check harness connector B-09 at the ECM for damage.**

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

**YES :** Go to Step 4.

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

**STEP 4. Measure the sensor output voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

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

(2) Start the engine and run at idle.

(3) Measure the voltage between terminal No. 38 and ground.

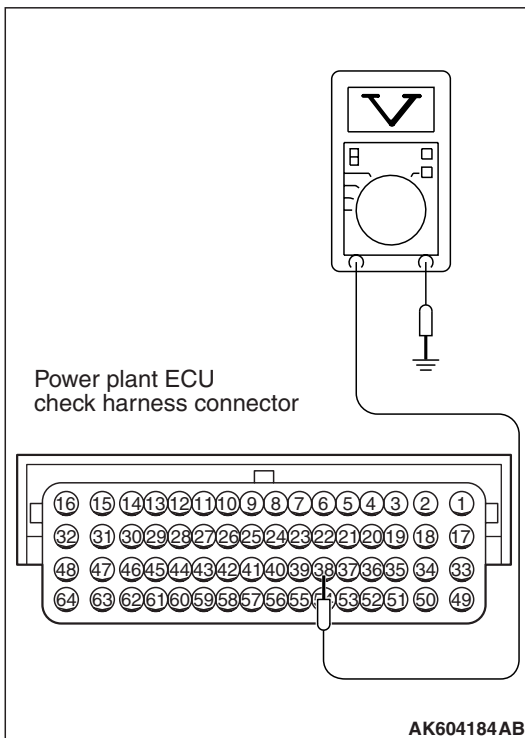
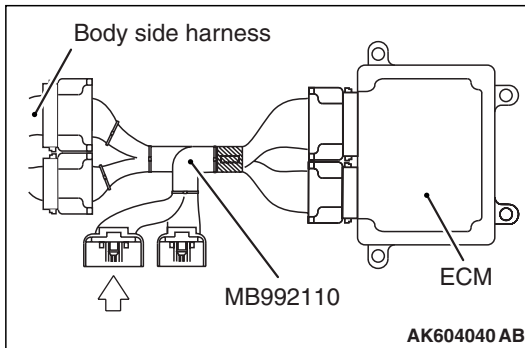
- Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0.4 volt or less and 0.6 to 1.0 volt alternately.

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

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

**YES :** Go to Step 5.

**NO :** Go to Step 7.



**STEP 5. Check harness connector C-34 at heated oxygen sensor (front) for damage.**

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

**YES :** Go to Step 6.

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

**STEP 6. Using scan tool MB991958, check data list item AC: Heated Oxygen Sensor (front).**

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

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

- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions [P.00-15](#).
- NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

---

**STEP 7. Check harness connector C-34 at heated oxygen sensor (front) for damage.****Q: Is the harness connector in good condition?**

- YES :** Check harness connector A-13 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-34 (terminal No. 3) and ECM connector B-09 (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.

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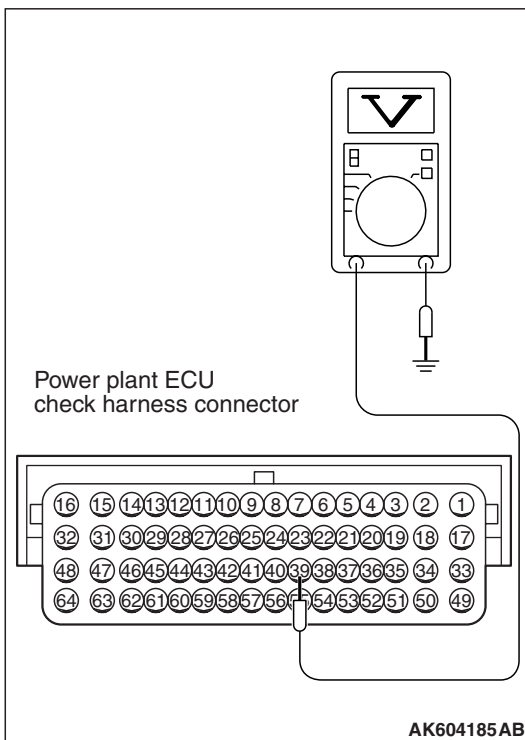
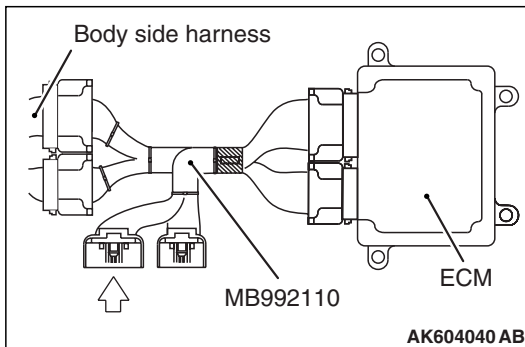
**STEP 8. Check harness connector C-34 at heated oxygen sensor (front) for damage.****Q: Is the harness connector in good condition?**

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

---

**STEP 9. Check harness connector B-09 at the ECM for damage.****Q: Is the harness connector in good condition?**

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



**STEP 10. Measure the sensor offset voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

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

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

(3) Measure the voltage between terminal No. 39 and ground.

- Voltage should be between 0.4 and 0.6 volt.

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

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

**YES :** Go to Step 11.

**NO :** Check harness connector A-13 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between headed oxygen sensor (front) connector C-34 (terminal No. 4) and ECM connector B-09 (terminal No. 39) because of open circuit or harness damage. Then go to Step 14.

**STEP 11. Check for harness damage between heated oxygen sensor (front) connector C-34 (terminal No. 4) and ECM connector B-09 (terminal No. 39).**

*NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.*

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

**YES :** Go to Step 12.

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

**STEP 12. Check for short circuit to ground and harness damage between heated oxygen sensor (front) connector C-34 (terminal No. 3) and ECM connector B-09 (terminal No. 38).**

*NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.*

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

**YES :** Go to Step 13.

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

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

- (1) Disconnect the heated oxygen sensor (front) connector C-34 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**

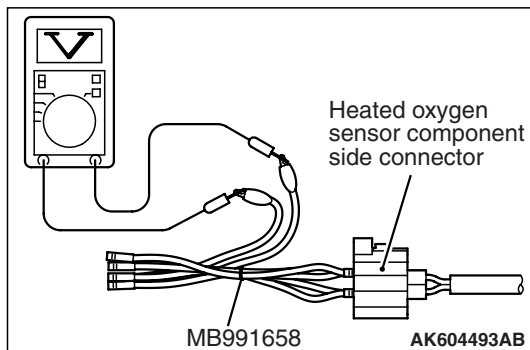
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater can be damaged if a voltage beyond 8 volts is applied to the heated oxygen sensor heater.**

*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 :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 14.

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





**STEP 14. Test the OBD-II drive cycle.**

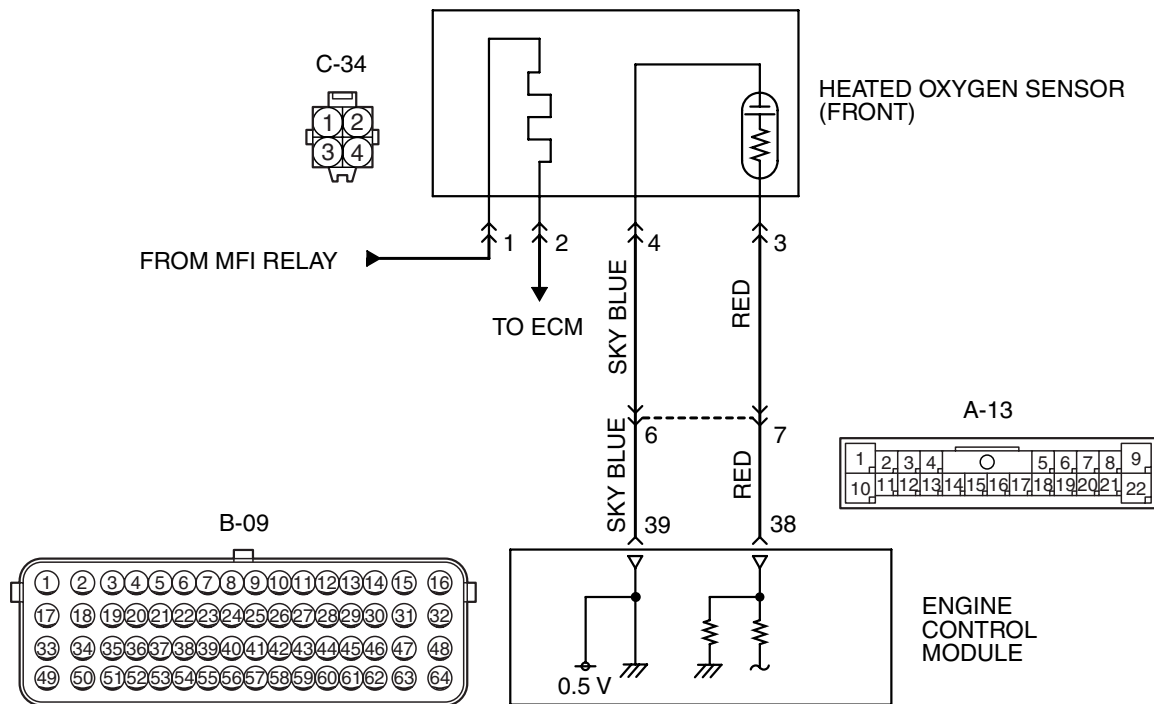
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 22 P.13A-9.
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0131 set?**

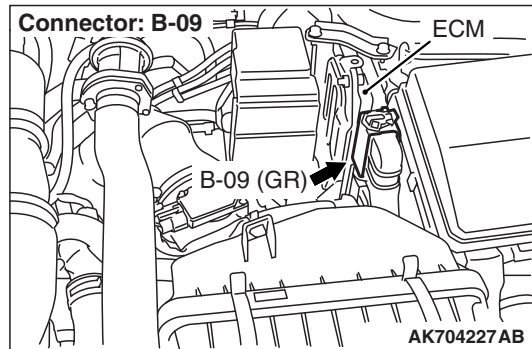
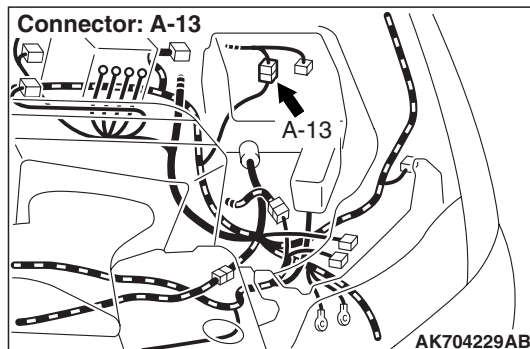
- YES :** Retry the troubleshooting.  
**NO :** The inspection is complete.

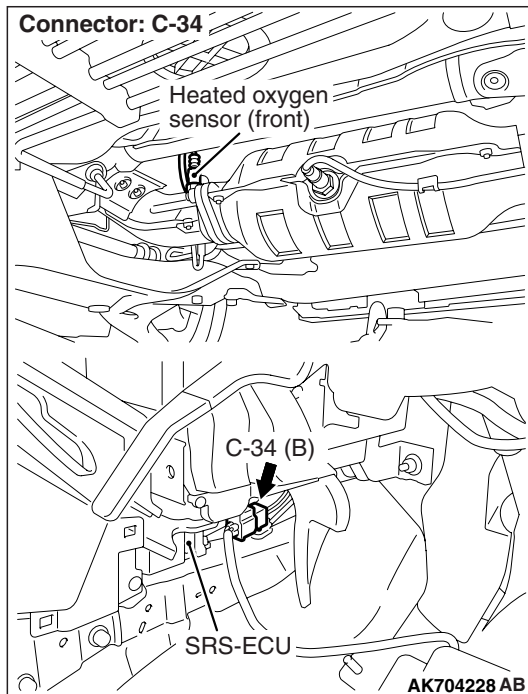
**DTC P0132: Heated Oxygen Sensor (front) Circuit High Voltage**

**HEATED OXYGEN SENSOR (FRONT) CIRCUIT**



AK704249AB





## 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)**

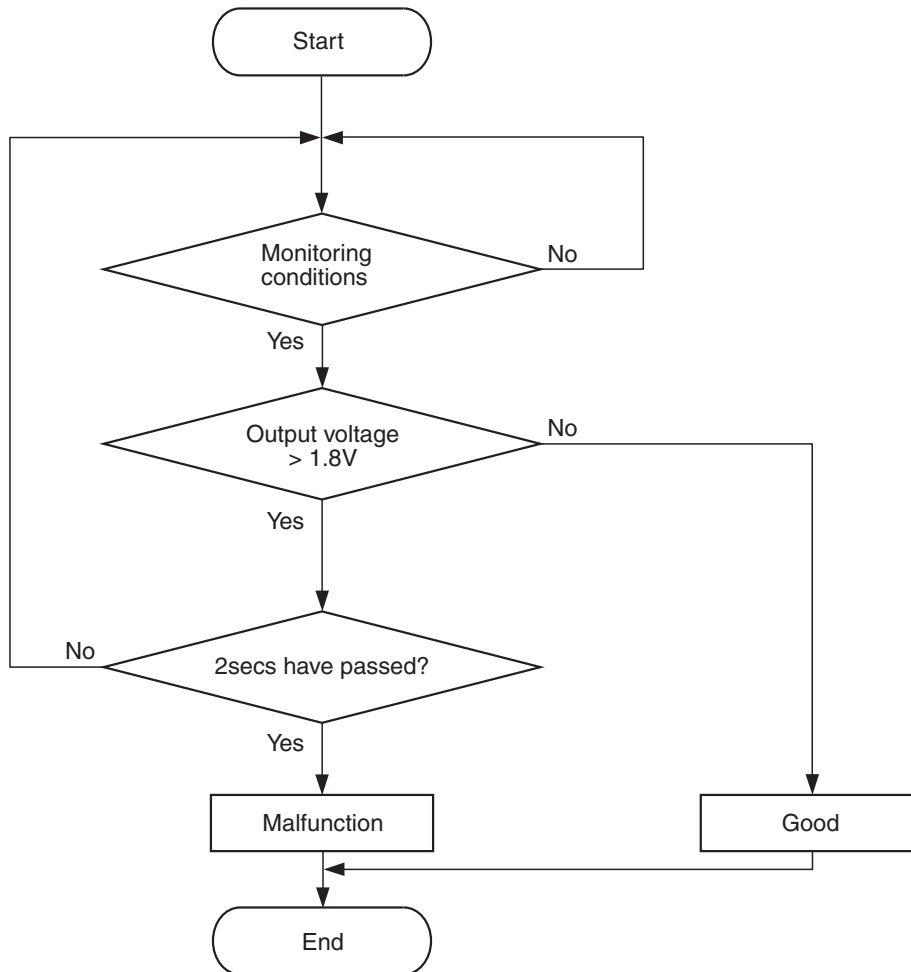
- Heated oxygen sensor (front) heater monitor
- Misfire monitor
- Fuel system monitor

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

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

**DTC SET CONDITION**

**Logic Flow Chart**



AK604322

**Check Conditions**

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

**Judgement Criterion**

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

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnosis Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

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

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

**DIAGNOSIS**

---

**STEP 1. Check harness connector C-34 at heated oxygen sensor (front) and harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 2.

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

---

**STEP 2. Check for short circuit to power supply between heated oxygen sensor (front) connector C-34 (terminal No. 3) and ECM connector B-09 (terminal No. 38).**

*NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 3.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

**NO :** Repair it. Then go to Step 3.

---

**STEP 3. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13A-9](#).

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

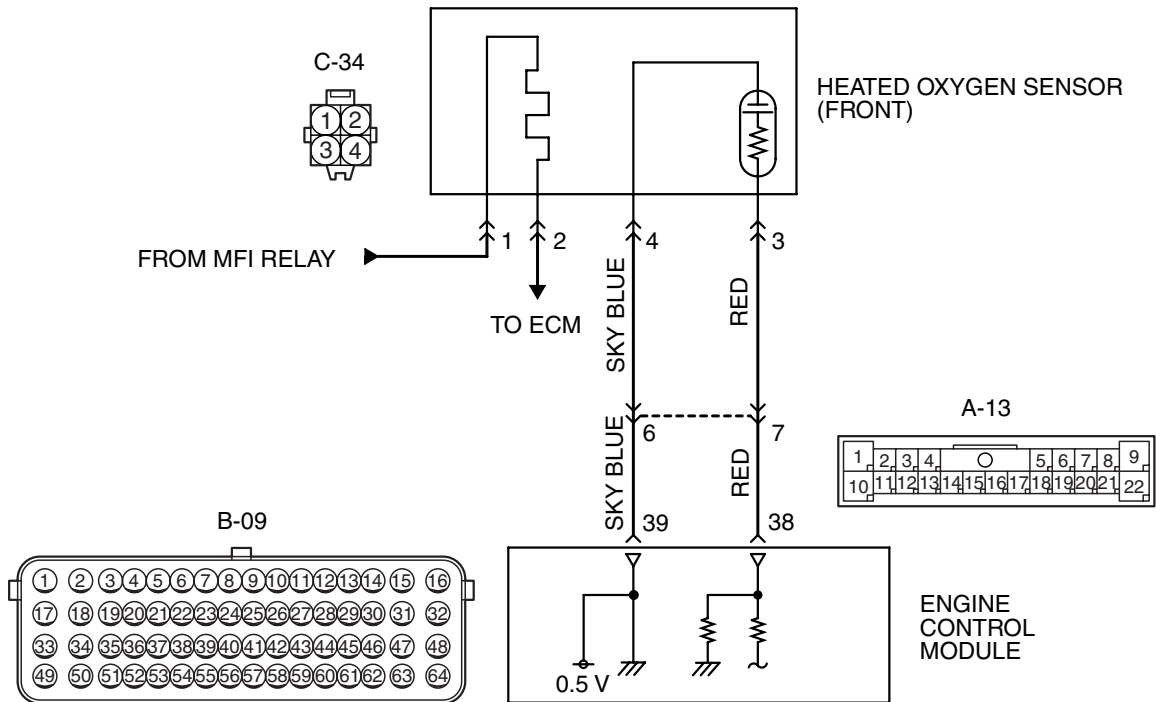
**Q: Is DTC P0132 set?**

**YES :** Retry the troubleshooting.

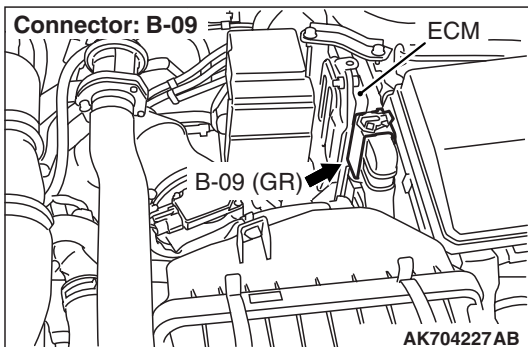
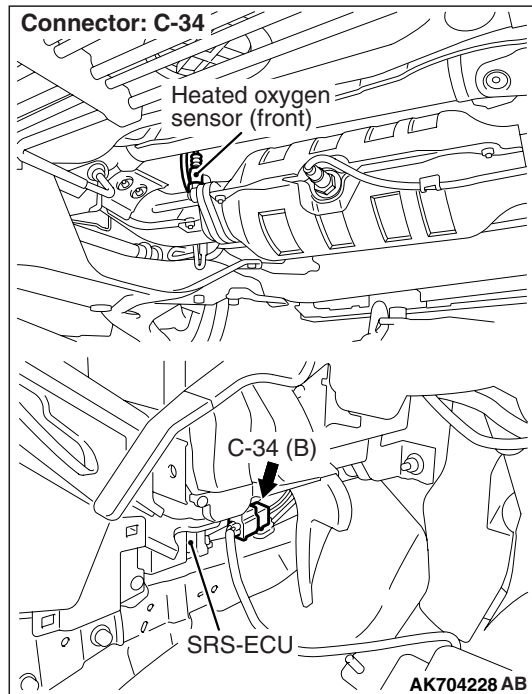
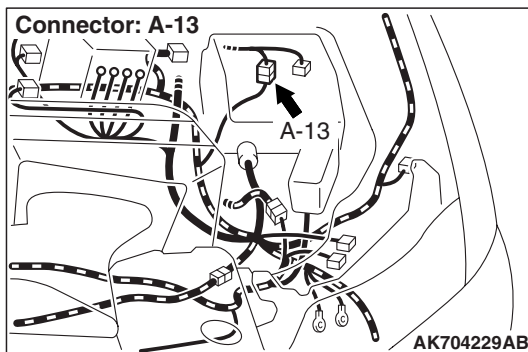
**NO :** The inspection is complete.

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

HEATED OXYGEN SENSOR (FRONT) CIRCUIT



AK704249AB



**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)**

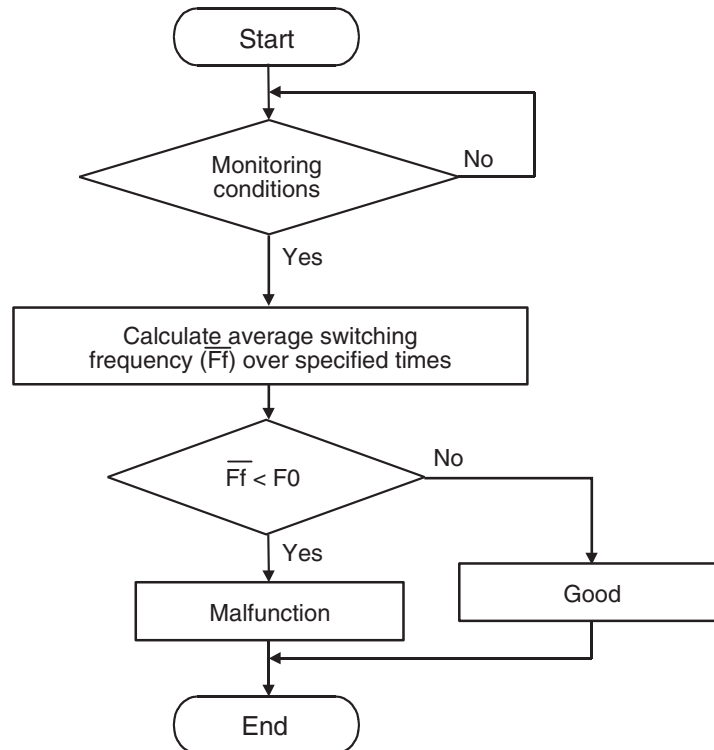
- Heated oxygen sensor (front) heater monitor
- Misfire monitor
- Fuel system monitor

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

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

## DTC SET CONDITIONS

### Logic Flow Chart



F0: Threshold value for average switching frequency

AK604323

#### Check Conditions

- Engine coolant temperature is higher than 60° C (140° F).
- Engine speed is between 1,406 and 3,500 r/min.
- Volumetric efficiency is between 20 and 65 per cent.
- Under the closed loop air/fuel control.
- The accelerator pedal is open.
- Short-term fuel trim is between -20 and +17 per cent.
- More than 3.5 seconds have elapsed after the above mentioned conditions have been met.
- The ECM monitors for this condition for 5 cycles of 10 seconds each during the drive cycle.

#### Judgement Criterion

- The average of the heated oxygen sensor (front) rich/lean switching frequency is less than 9 times <M/T> or 8 times <TC-SST> per 10 seconds.

or

- The heated oxygen sensor (front) rich/lean switching frequency is less than 20 times <M/T> or 16 times <TC-SST> per 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.13A-9](#).

**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**

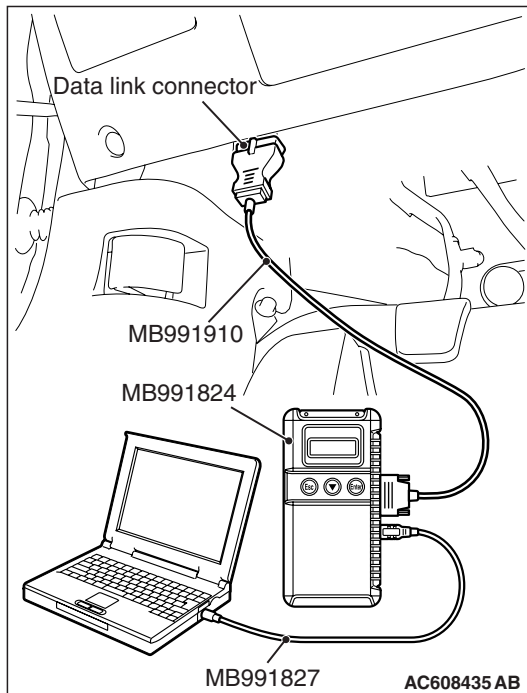
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 9 times <M/T> or 8 times <TC-SST> or more within 10 seconds.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

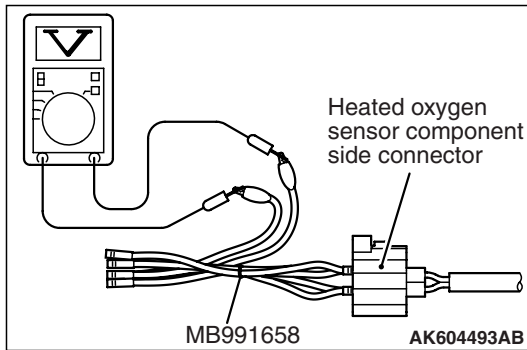
**Q: Is the sensor operating properly?**

**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.00-15](#).

**NO** : Go to Step 2.







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

- (1) Disconnect the heated oxygen sensor (front) connector C-34 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 9 times <M/T> or 8 times <TC-SST> 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 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 sensor operating properly?**

**YES :** Go to Step 3.

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

**STEP 3. Check harness connector C-34 at heated oxygen sensor (front) and harness connector B-09 at ECM for damage.**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 4.

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

**STEP 4. Test the OBD-II drive cycle.**

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

**Q: Is DTC P0133 set?****YES** : Retry the troubleshooting.**NO** : The inspection is complete.**DTC P0134: Heated Oxygen Sensor (front) Circuit No Activity Detected****Heated Oxygen Sensor (front) No Activity Detected Circuit**

- Refer to DTC P0131 –Heated Oxygen Sensor (Front) Circuit Low Voltage [P.13A-203](#).
- Refer to DTC P0201 –Injector Circuit-cylinder 1 [P.13A-277](#).
- Refer to DTC P0202 –Injector Circuit-cylinder 2 [P.13A-287](#).
- Refer to DTC P0203 –Injector Circuit-cylinder 3 [P.13A-297](#).
- Refer to DTC P0204 –Injector Circuit-cylinder 4 [P.13A-307](#).

**CIRCUIT OPERATION**

- Refer to DTC P0131 –Heated Oxygen Sensor (Front) Circuit Low Voltage [P.13A-203](#).
- Refer to DTC P0201 –Injector Circuit-cylinder 1 [P.13A-277](#).
- Refer to DTC P0202 –Injector Circuit-cylinder 2 [P.13A-287](#).
- Refer to DTC P0203 –Injector Circuit-cylinder 3 [P.13A-297](#).
- Refer to DTC P0204 –Injector Circuit-cylinder 4 [P.13A-307](#).

**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)**

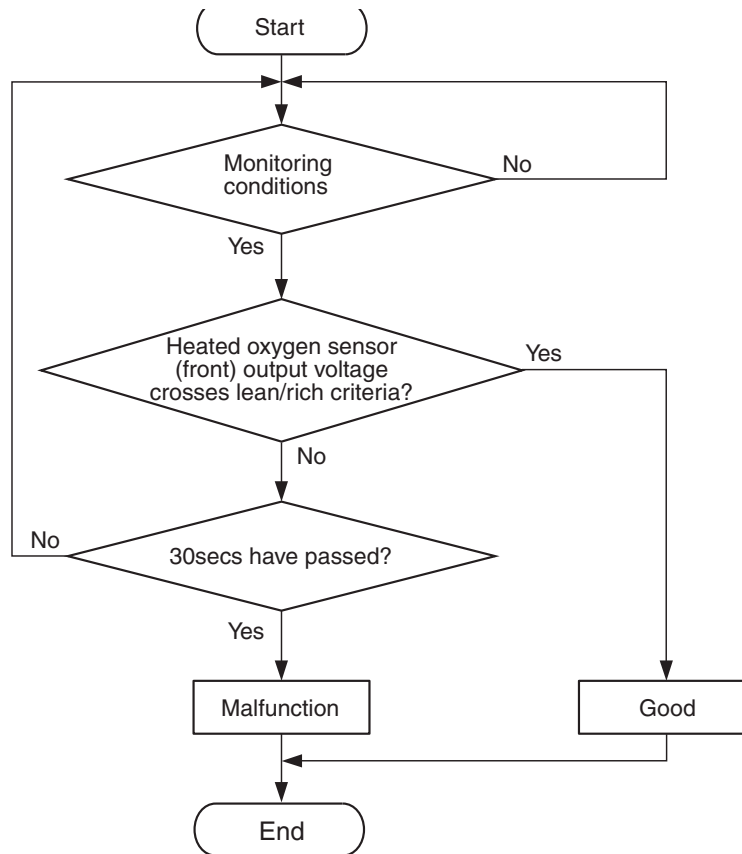
- Misfire monitor

**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

- 20 seconds or more have passed since the engine starting sequence was completed.
- Engine coolant temperature is higher than 7° C (45° F).
- Engine speed is higher than 1,188 r/min.
- Volumetric efficiency is higher than 30 percent.
- Throttle position sensor output voltage is lower than 4 volts.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

#### Judgement Criterion

- 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 11 [P.13A-9](#).

**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**

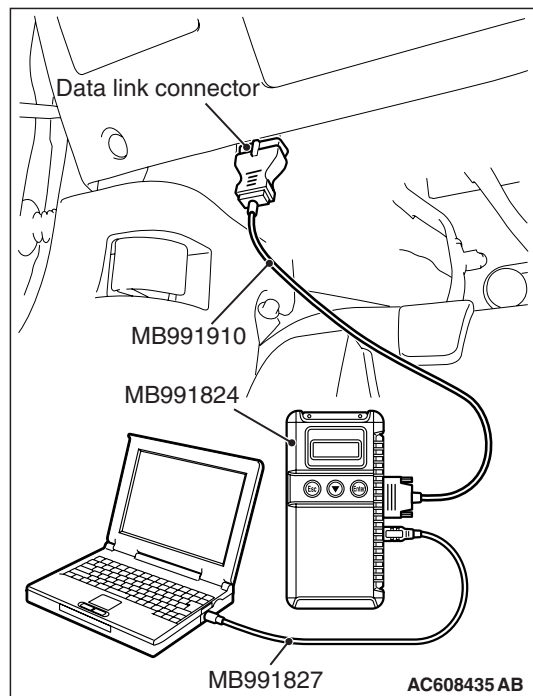
**To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.**

- (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
    - 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 [P.13A-226](#), DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage [P.13A-234](#), DTC P0139 –Heated Oxygen Sensor (rear) Circuit Slow Response [P.13A-238](#), P0140 – Heated Oxygen Sensor (rear) Circuit No Activity Detected [P.13A-242](#).



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

**Q: Are there any abnormalities?**

**YES :** Repair it. Then go to Step 12.

**NO :** Go to Step 3.

---

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

**Q: Are there any abnormalities?**

**YES :** Repair it. Then go to Step 12.

**NO :** Go to Step 4.

---

**STEP 4. Check harness connector C-34 at the heated oxygen sensor (front) for damage.**

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

**YES :** Go to Step 5.

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

---

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

- (1) Disconnect the heated oxygen sensor (front) connector C-34 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**

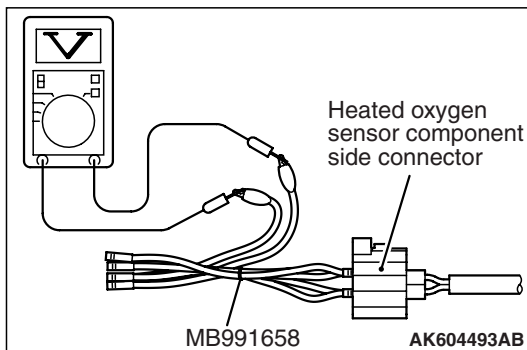
- **Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.**
- **Be careful the heater can be damaged if a voltage beyond 8 volts is applied to the heated oxygen sensor heater.**

*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 12.



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

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

**YES :** Go to Step 7.

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

**STEP 7. Check the injectors.**

(1) Disconnect each injector connector.

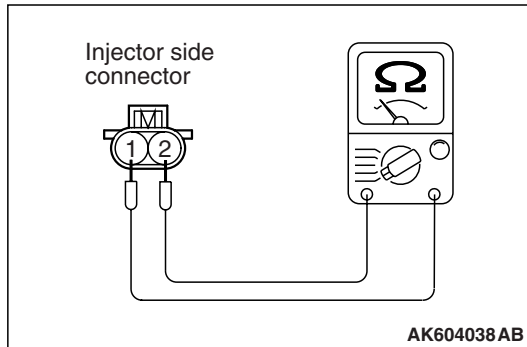
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

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

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

**YES :** Go to Step 8.

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



**STEP 8. Check harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 9.

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

**STEP 9. Check for harness damage between heated oxygen sensor (front) connector C-34 (terminal No. 3) and ECM connector B-09 (terminal No. 38).**

*NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.*

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

**YES :** Go to Step 10.

**NO :** Repair it. Then go to Step 12.

---

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

- a. Check the harness wire between injector connector B-101 (terminal No. 2) and ECM connector B-09 (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-09 (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-09 (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-09 (terminal No. 19) when checking No. 4 cylinder.

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

**YES** : Go to Step 11.

**NO** : Repair it. Then go to Step 12.

---

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

Refer to On-vehicle Service –Fuel Pressure Test [P.13A-897](#).

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

**YES** : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

**NO** : Repair it. Then go to Step 12.

---

**STEP 12. Test the OBD-II drive cycle.**

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 11 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

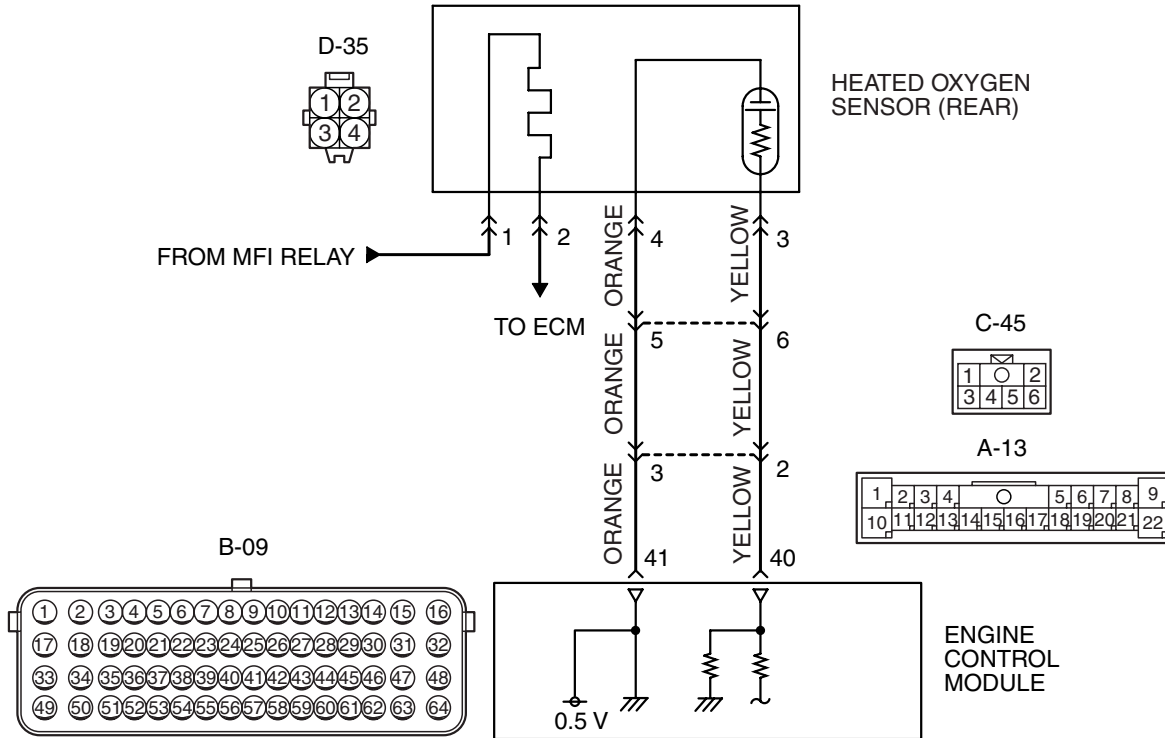
**Q: Is DTC P0134 set?**

**YES** : Retry the troubleshooting.

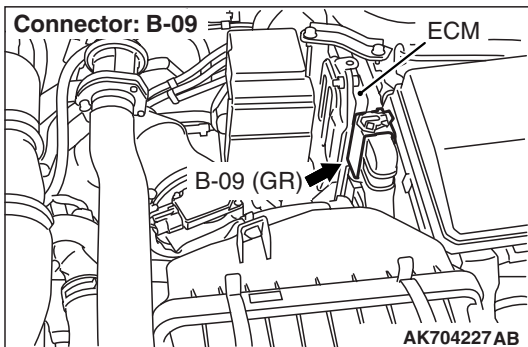
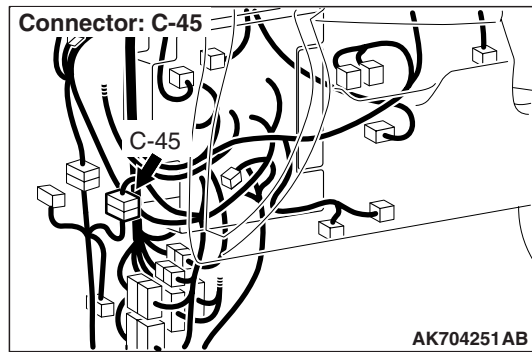
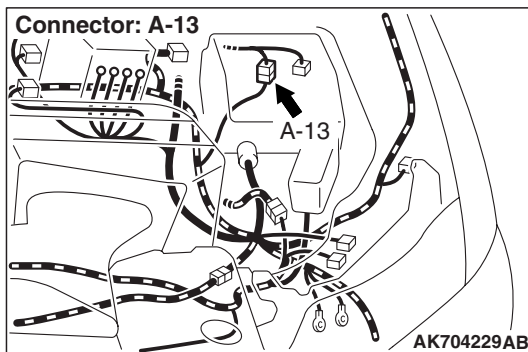
**NO** : The inspection is complete.

DTC P0137: Heated Oxygen Sensor (rear) Circuit Low Voltage

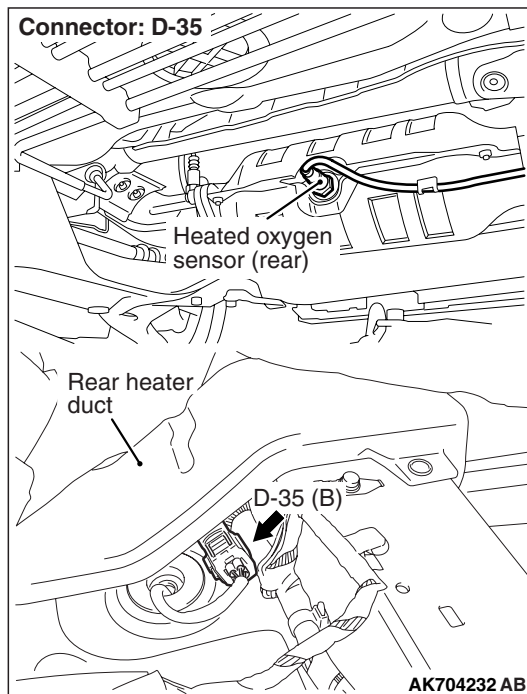
HEATED OXYGEN SENSOR (REAR) CIRCUIT



AK704250AB







## 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)**

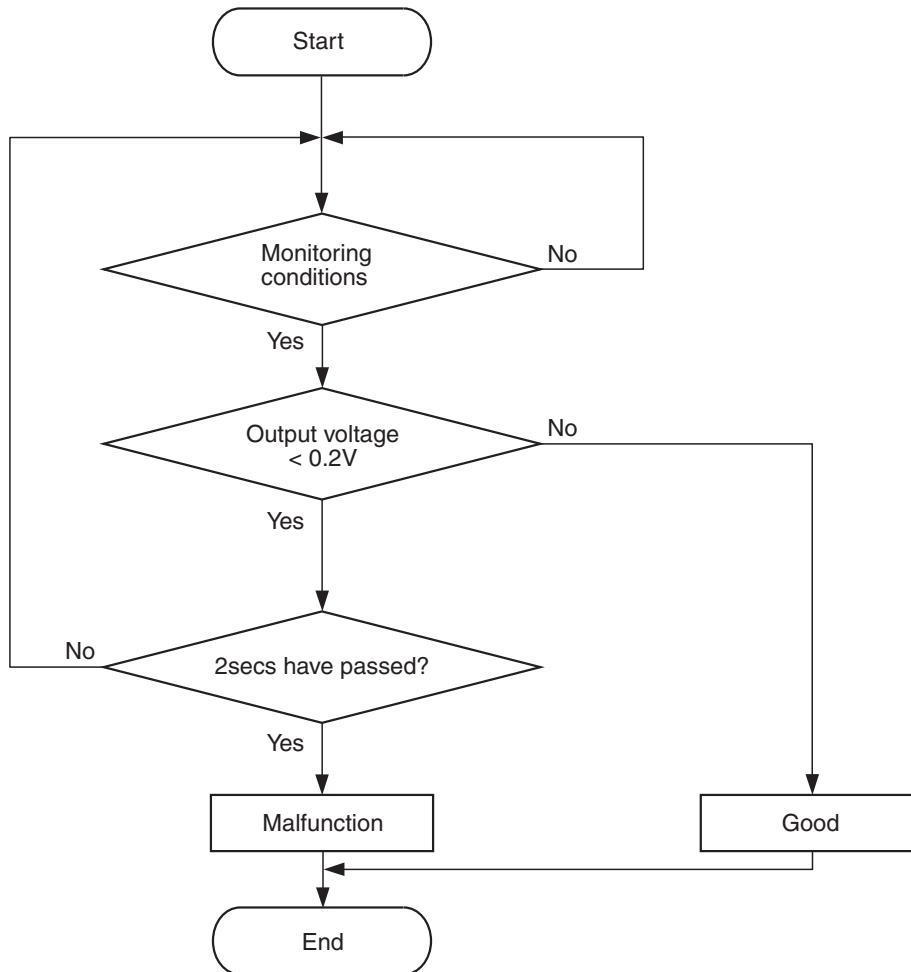
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor (front) heater monitor
- Heated oxygen sensor (rear) heater monitor
- Heated oxygen sensor (front) inactive monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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

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

DTC SET CONDITIONS

Logic Flow Chart



AK604321

**Check Conditions**

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

**Judgement Criterion**

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

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 22 [P.13A-9](#).

**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**

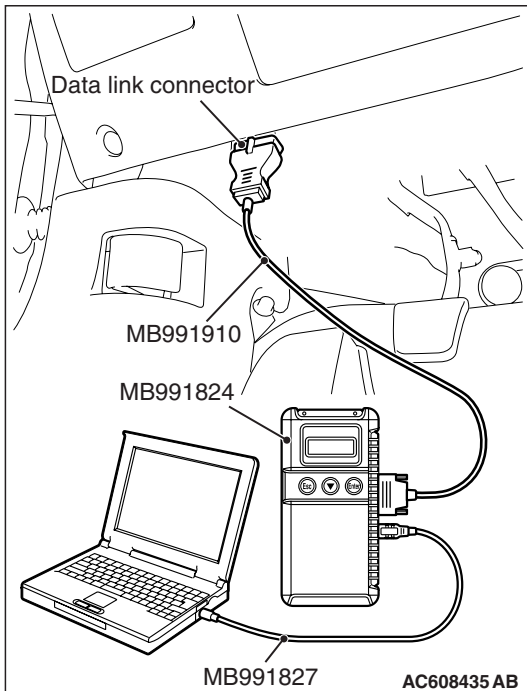
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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
    - 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.00-15.

**NO** : Go to Step 2.



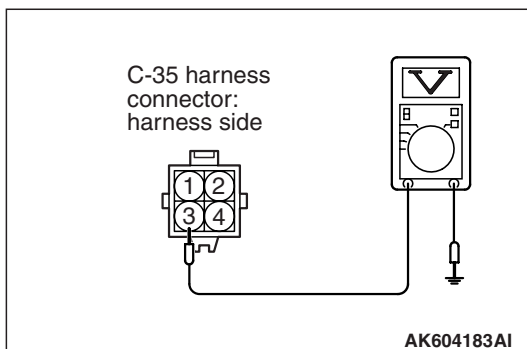
### STEP 2. Measure the sensor output voltage at heated oxygen sensor (rear) connector D-35 by backprobing

- (1) Do not disconnect the connector D-35.
- (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 1.0 and 1.5 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES** : Go to Step 3.

**NO** : Go to Step 8.



**STEP 3. Check harness connector B-09 at ECM for damage.**

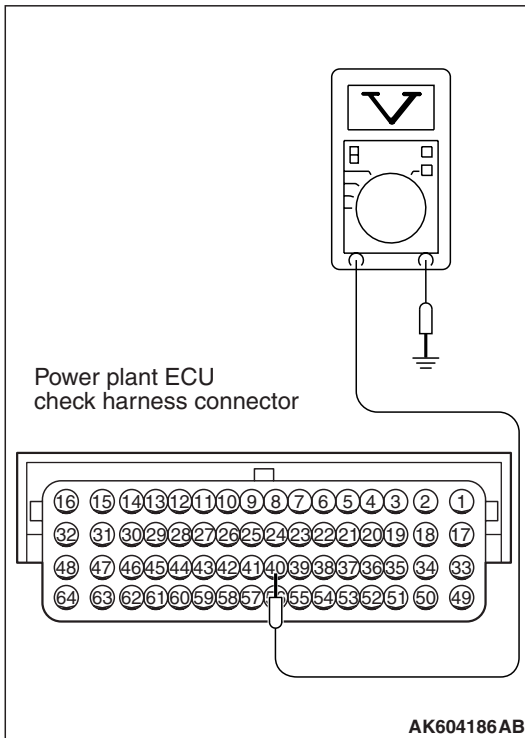
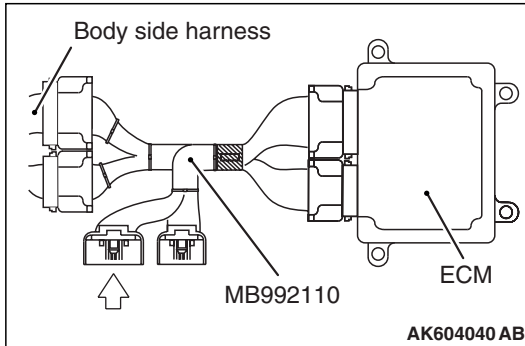
**Q: Is the harness connector in good condition?**

**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-09 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 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 1.0 and 1.5 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 5.

**NO :** Go to Step 7.

**STEP 5. Check harness connector D-35 at heated oxygen sensor (rear) for damage.**

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

**YES :** Go to Step 6.

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

---

**STEP 6. Using scan tool 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.00-15](#).

**NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

---

**STEP 7. Check harness connector D-35 at heated oxygen sensor (rear) for damage.**

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

**YES :** Check harness connectors A-13 and C-45 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-35 (terminal No. 3) and ECM connector B-09 (terminal No. 40) because of open circuit or harness damage. Then go to Step 14.

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

---

**STEP 8. Check harness connector D-35 at heated oxygen sensor (rear) for damage.**

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

**YES :** Go to Step 9.

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

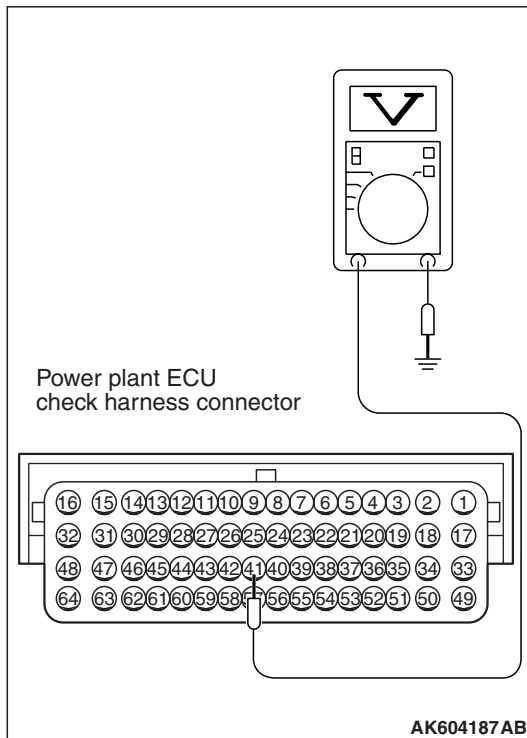
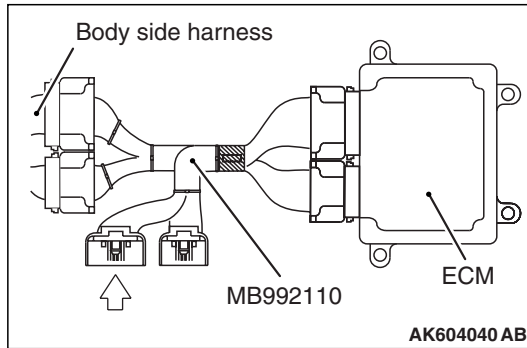
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**STEP 9. Check harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 10.

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



**STEP 10. Measure the sensor offset voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

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

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

(3) Measure the voltage between terminal No. 41 and ground.

- Voltage should be between 0.4 and 0.6 volt.

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

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

**YES :** Go to Step 11.

**NO :** Check harness connectors A-13 and C-45 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 headed oxygen sensor (rear) connector D-35 (terminal No. 4) and ECM connector B-09 (terminal No. 41) because of open circuit or harness damage. Then go to Step 14.

**STEP 11. Check for harness damage between heated oxygen sensor (rear) connector D-35 (terminal No. 4) and ECM connector B-09 (terminal No. 41).**

*NOTE: Check harness after checking intermediate connectors A-13 and C-45. 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 for short circuit to ground and harness damage between heated oxygen sensor (rear) connector D-35 (terminal No. 3) and ECM connector B-09 (terminal No. 40).**

*NOTE: Check harness after checking intermediate connectors A-13 and C-45. 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 13.

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

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

- (1) Disconnect the heated oxygen sensor (rear) connector D-35 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**

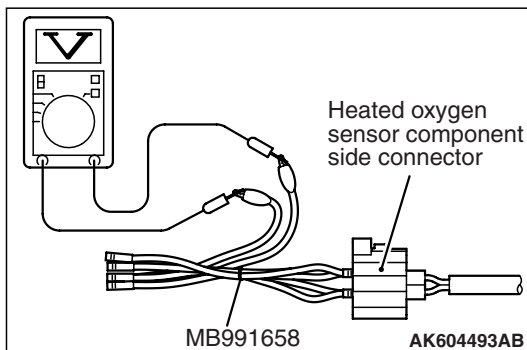
*NOTE: If the temperature of sensing area does not reach the high temperature [of approximately 400° C (752° F) or more] even though the heated oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air/fuel ratio.*

*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 :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 14.

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



**STEP 14. Test the OBD-II drive cycle.**

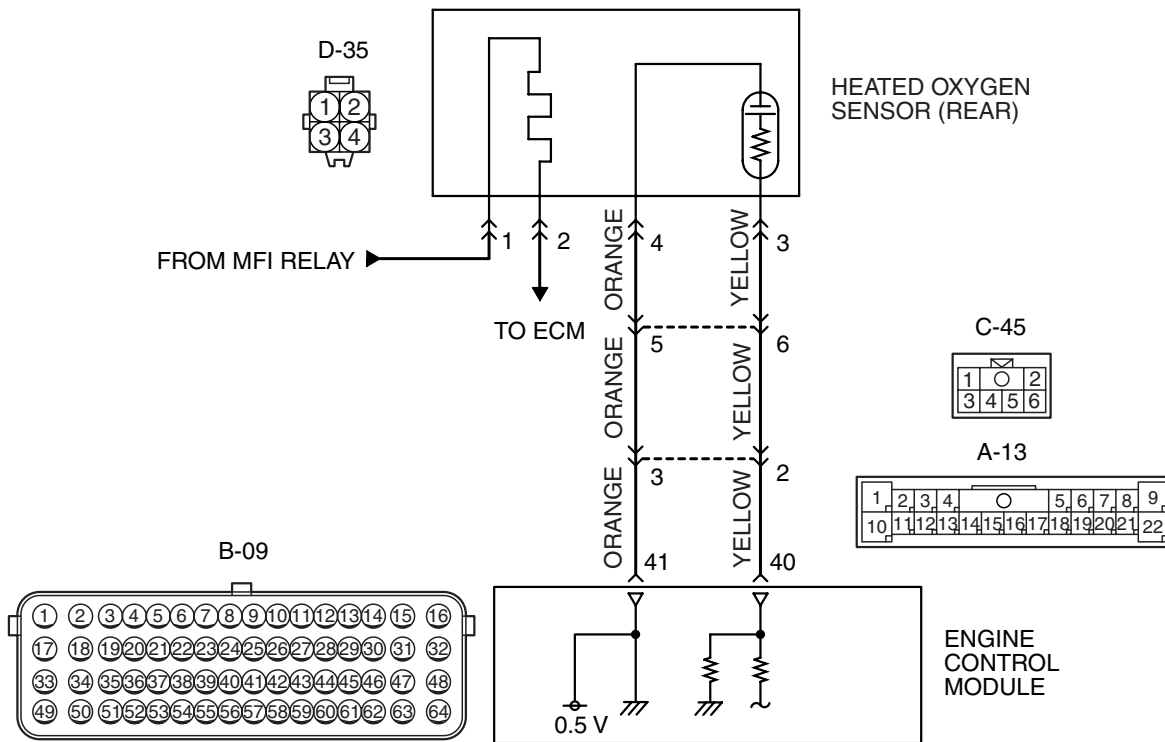
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 22 P.13A-9.
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0137 set?**

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

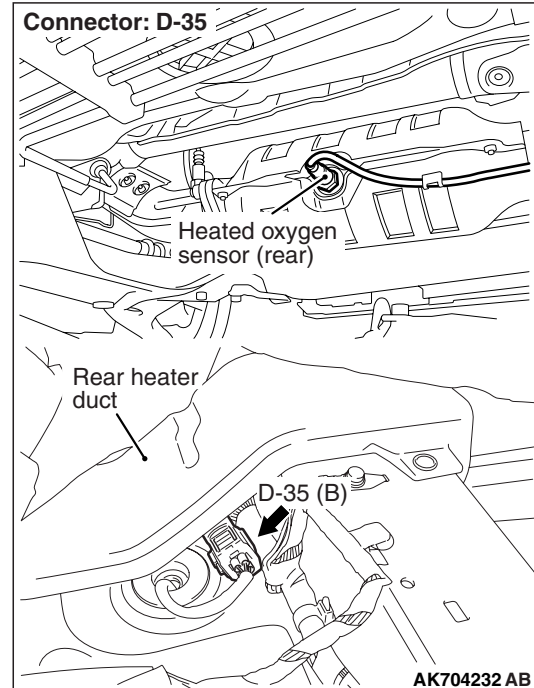
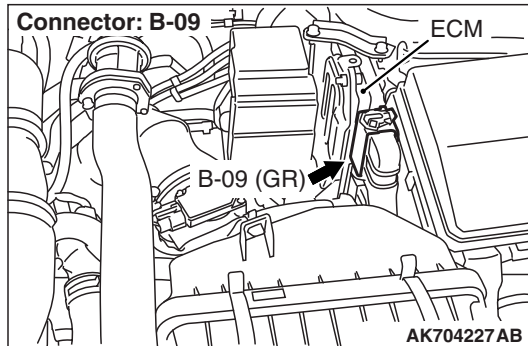
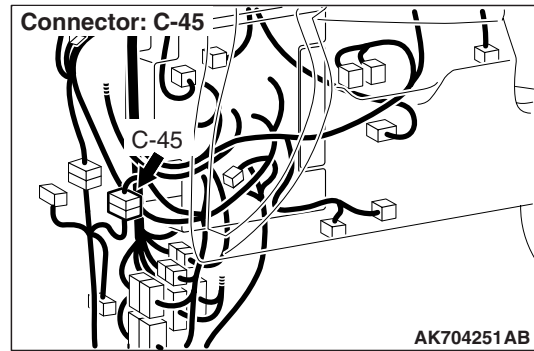
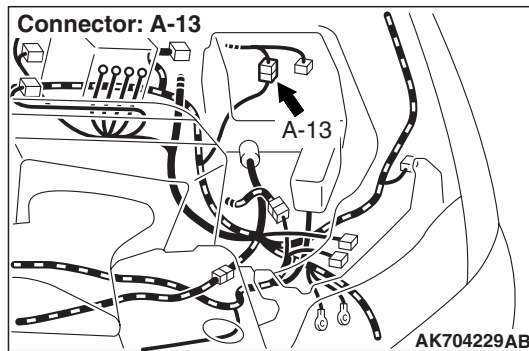
**DTC P0138: Heated Oxygen Sensor (rear) Circuit High Voltage**

HEATED OXYGEN SENSOR (REAR) CIRCUIT



AK704250AB





## 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)**

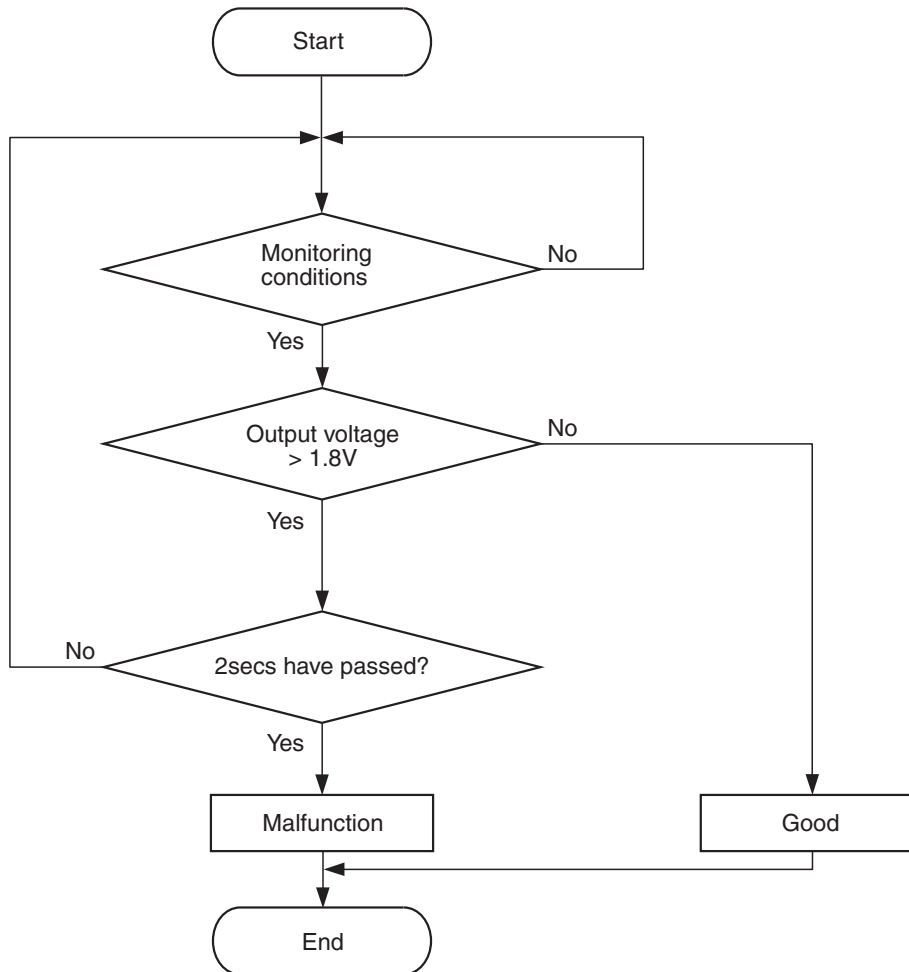
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor (front) heater monitor
- Heated oxygen sensor (rear) heater monitor
- Heated oxygen sensor (front) inactive monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

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

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

## DTC SET CONDITIONS

## Logic Flow Chart



AK604322

**Check Conditions**

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

**Judgement Criterion**

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

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

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

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

---

## DIAGNOSIS

---

**STEP 1. Check harness connector D-35 at heated oxygen sensor (rear) and harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 2.

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

---

**STEP 2. Check for short circuit to power supply between heated oxygen sensor (rear) connector D-35 (terminal No. 3) and ECM connector B-09 (terminal No. 40).**

*NOTE: Check harness after checking intermediate connectors A-13 and C-45. If intermediate connectors are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 3.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

**NO :** Repair it. Then go to Step 3.

---

**STEP 3. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13A-9](#).

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

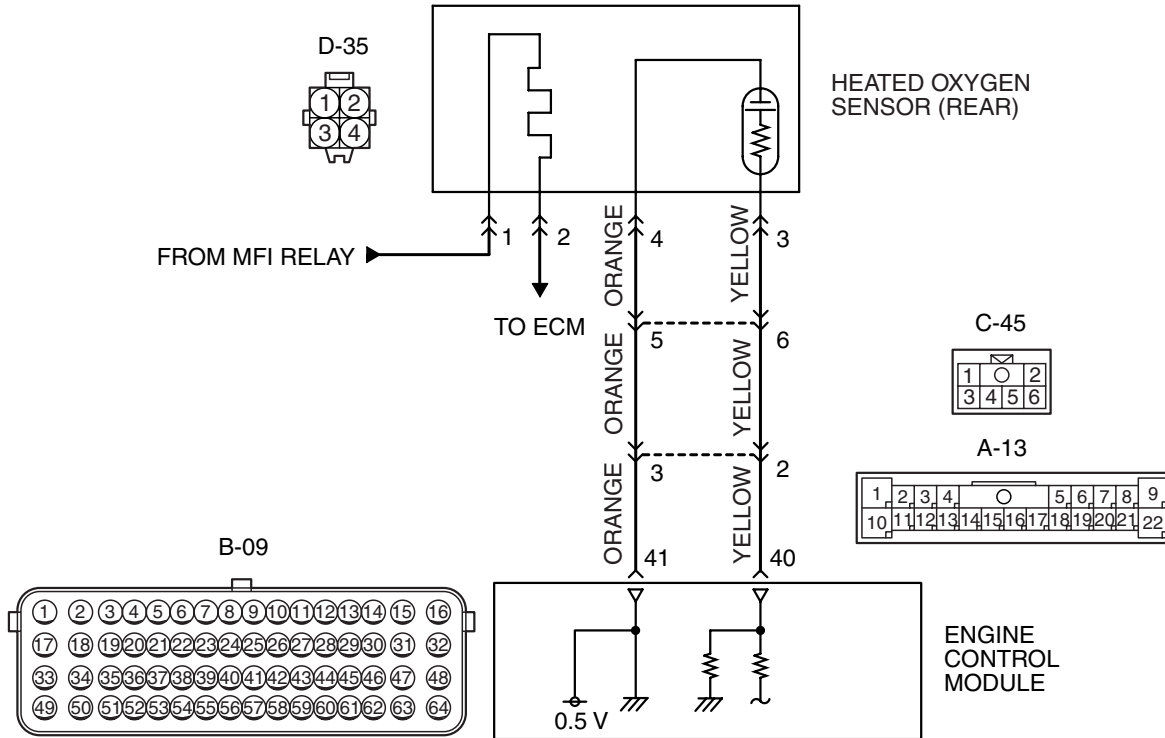
**Q: Is DTC P0138 set?**

**YES :** Retry the troubleshooting.

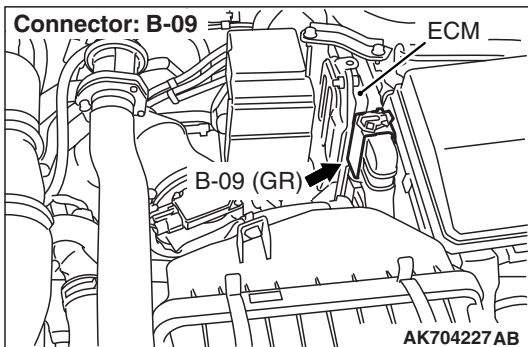
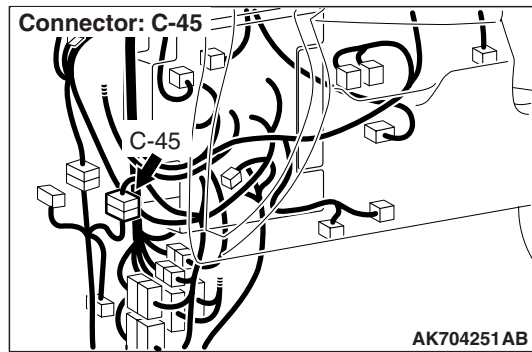
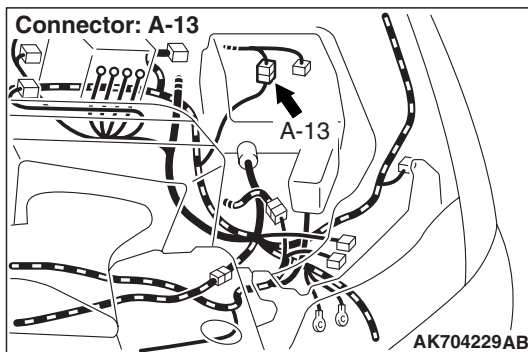
**NO :** The inspection is complete.

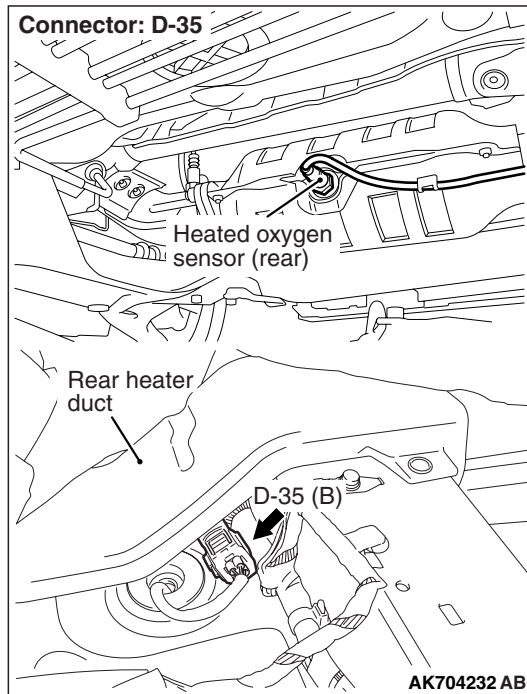
DTC P0139: Heated Oxygen Sensor (rear) Circuit Slow Response

HEATED OXYGEN SENSOR (REAR) CIRCUIT



AK704250AB





## 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)**

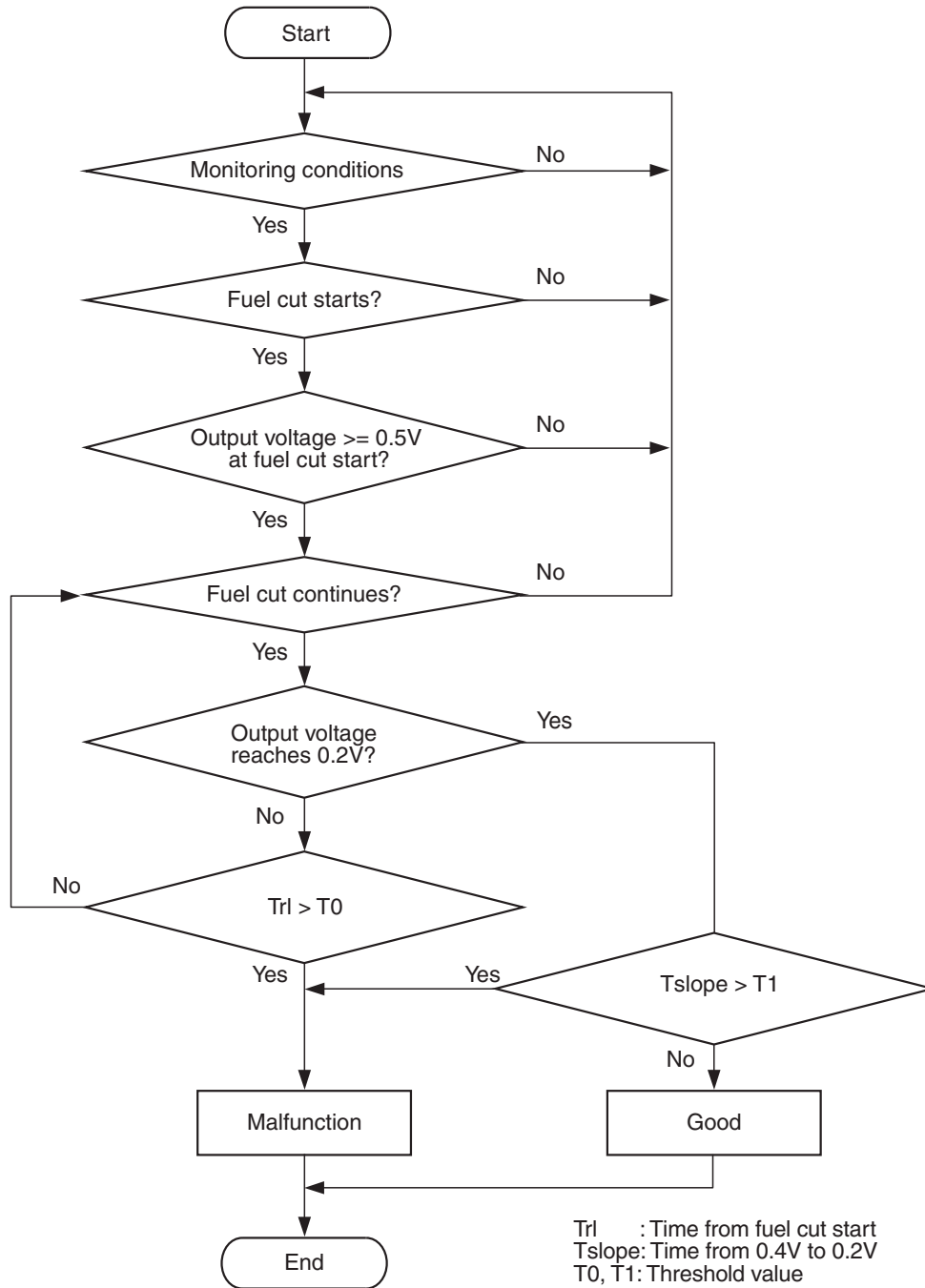
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor (front) heater monitor
- Heated oxygen sensor (rear) heater monitor
- Heated oxygen sensor (front) inactive monitor
- Heated oxygen sensor offset voltage monitor
- Air/fuel ratio feedback monitor

**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



AK604326

**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 1,638 g or higher.
- Fuel is being shut off.
- Heated oxygen sensor (rear) output voltage is 0.5 volt or higher when fuel cut is started.

**Judgement Criterion**

- Heated oxygen sensor (rear) output voltage does not reach 0.2 volt for 6 seconds from fuel cut start.
- or
- Heated oxygen sensor (rear) 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 64 seconds or more.*

## FAIL-SAFE AND BACKUP FUNCTION

- None

## OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle –  
Pattern 10 [P.13A-9](#).

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

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

## DIAGNOSIS

### Required Special Tools:

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

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

### **⚠ CAUTION**

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

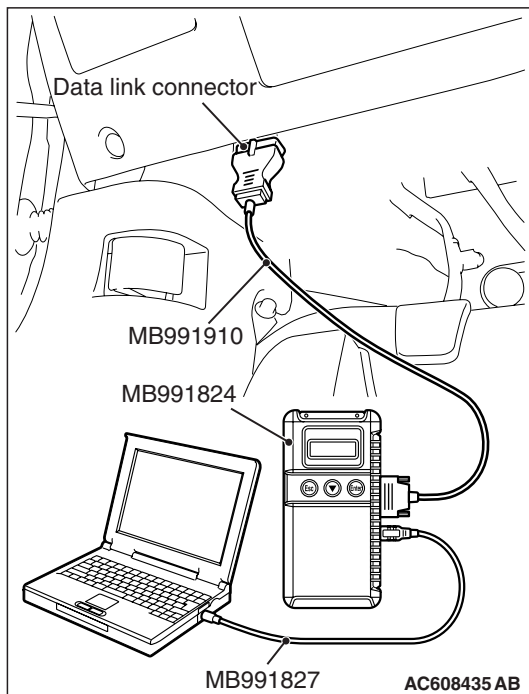
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item AD, Heated Oxygen Sensor (rear).
- (4) Warm up the engine.
  - After increasing the output voltage 0.5 volt or more by the engine revving, finish it. Then confirm that the output voltage reduces to 0.2 volt or less within 6 seconds.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use

Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions [P.00-15](#).

**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 10 P.13A-9.
- (2) Check the diagnostic trouble code (DTC).

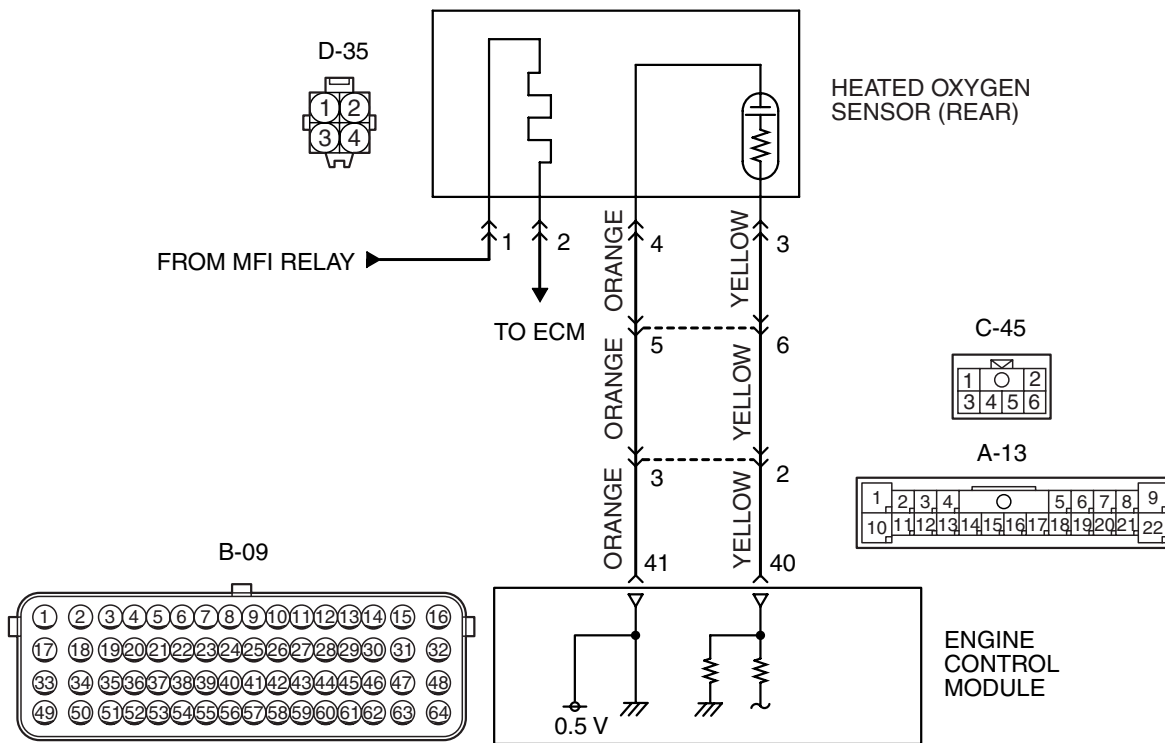
**Q: Is DTC P0139 set?**

**YES :** Refer to DTC P0137 –Heated Oxygen Sensor (rear) Circuit Low Voltage P.13A-226, DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage P.13A-234.

**NO :** The inspection is complete.

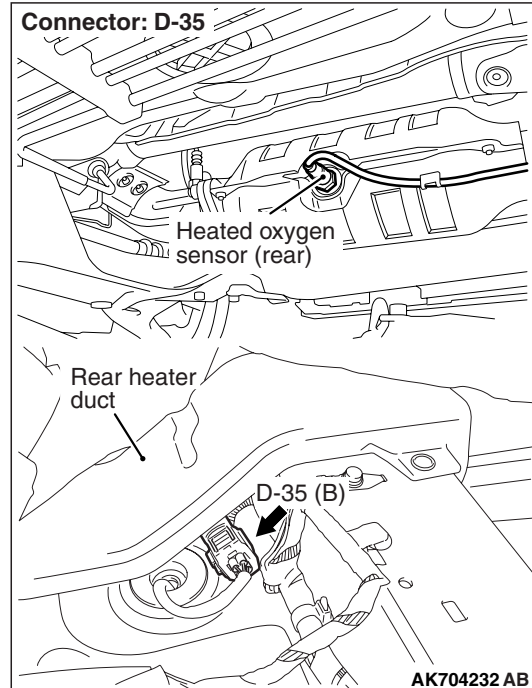
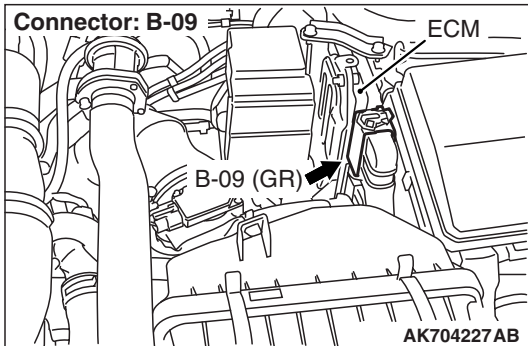
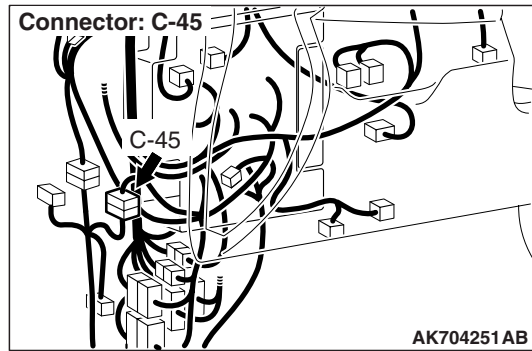
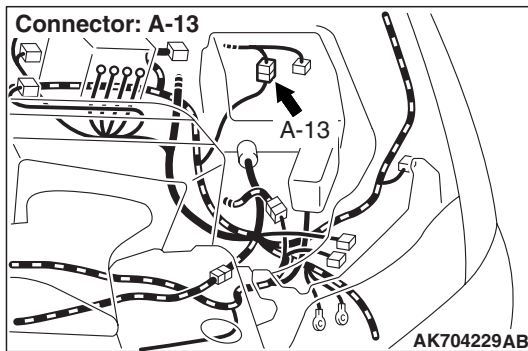
**DTC P0140: Heated Oxygen Sensor (rear) Circuit No Activity Detected**

**HEATED OXYGEN SENSOR (REAR) CIRCUIT**



AK704250AB





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

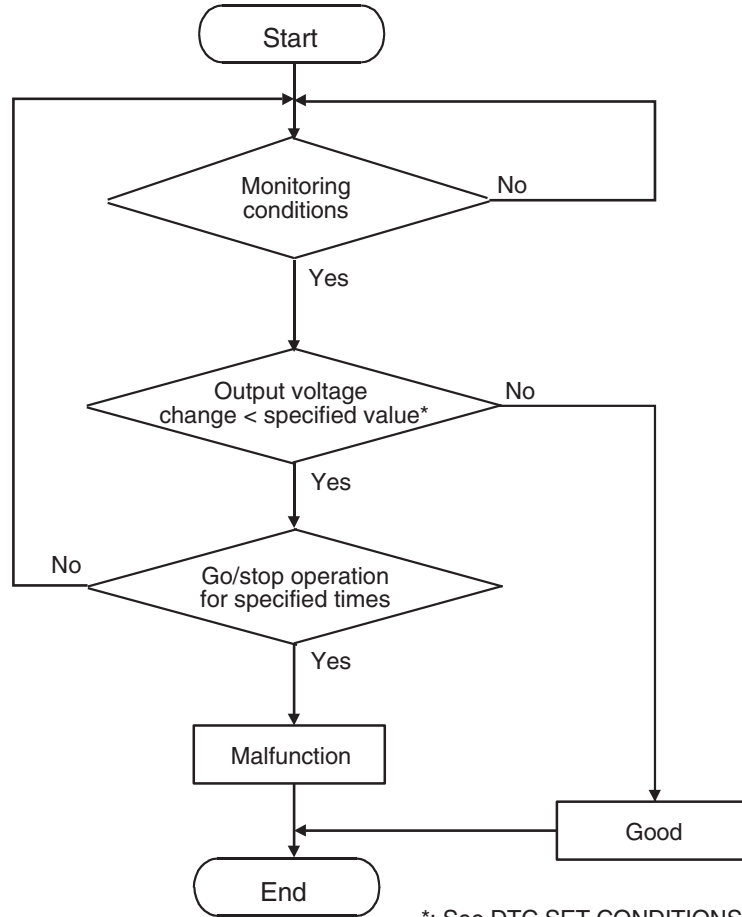
Sensor (The sensor below is determined to be normal)

- Mass airflow sensor
- Engine coolant temperature sensor

- Intake air temperature sensor
- Barometric pressure sensor

**DTC SET CONDITIONS**

**Logic Flow Chart**



\*: See DTC SET CONDITIONS-Judgment Criterion

AK604327

**Check Conditions**

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

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

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

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

- Volumetric efficiency is higher than 40 per cent.
- Vehicle speed is higher than 30 km/h (19 mph).
- A total of more than 30 seconds have elapsed with the above mentioned conditions, and more than 2 seconds have elapsed with the fuel shut off.
- Vehicle speed is lower than 1.5 km/h (1 mph).

### Judgement Criterion

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

or

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

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

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

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

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

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

### DIAGNOSIS

#### Required Special Tools:

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

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

#### **CAUTION**

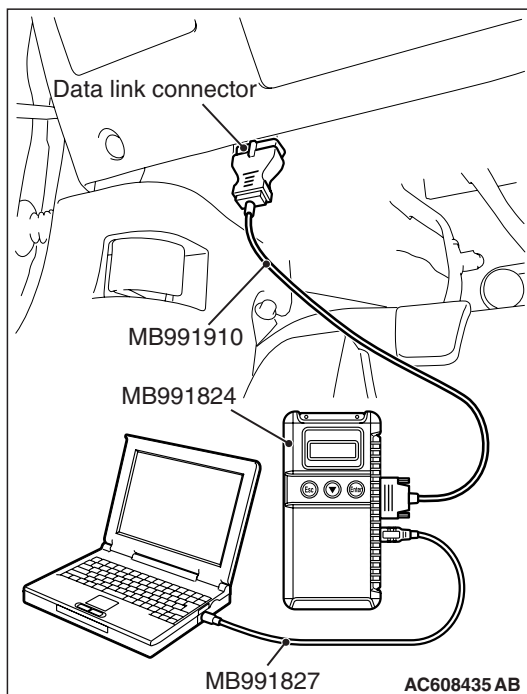
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

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

**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions [P.00-15](#).

**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 12 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0140 set?**

**YES :** Refer to DTC P0137 –Heated Oxygen Sensor (rear) Circuit Low Voltage [P.13A-226](#), DTC P0138 –Heated Oxygen Sensor (rear) Circuit High Voltage [P.13A-234](#).

**NO :** The inspection is complete.

**DTC P0171: System too Lean****Fuel Trim Circuit**

- Refer to DTC P0201 –Injector Circuit-Cylinder 1 [P.13A-277](#), DTC P0202 –Injector Circuit-Cylinder 2 [P.13A-287](#), DTC P0203 –Injector Circuit-Cylinder 3 [P.13A-297](#), DTC P0204 –Injector Circuit-Cylinder 4 [P.13A-307](#).

**CIRCUIT OPERATION**

- Refer to DTC P0201 –Injector Circuit-Cylinder 1 [P.13A-277](#), DTC P0202 –Injector Circuit-Cylinder 2 [P.13A-287](#), DTC P0203 –Injector Circuit-Cylinder 3 [P.13A-297](#), DTC P0204 –Injector Circuit-Cylinder 4 [P.13A-307](#).

**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)**

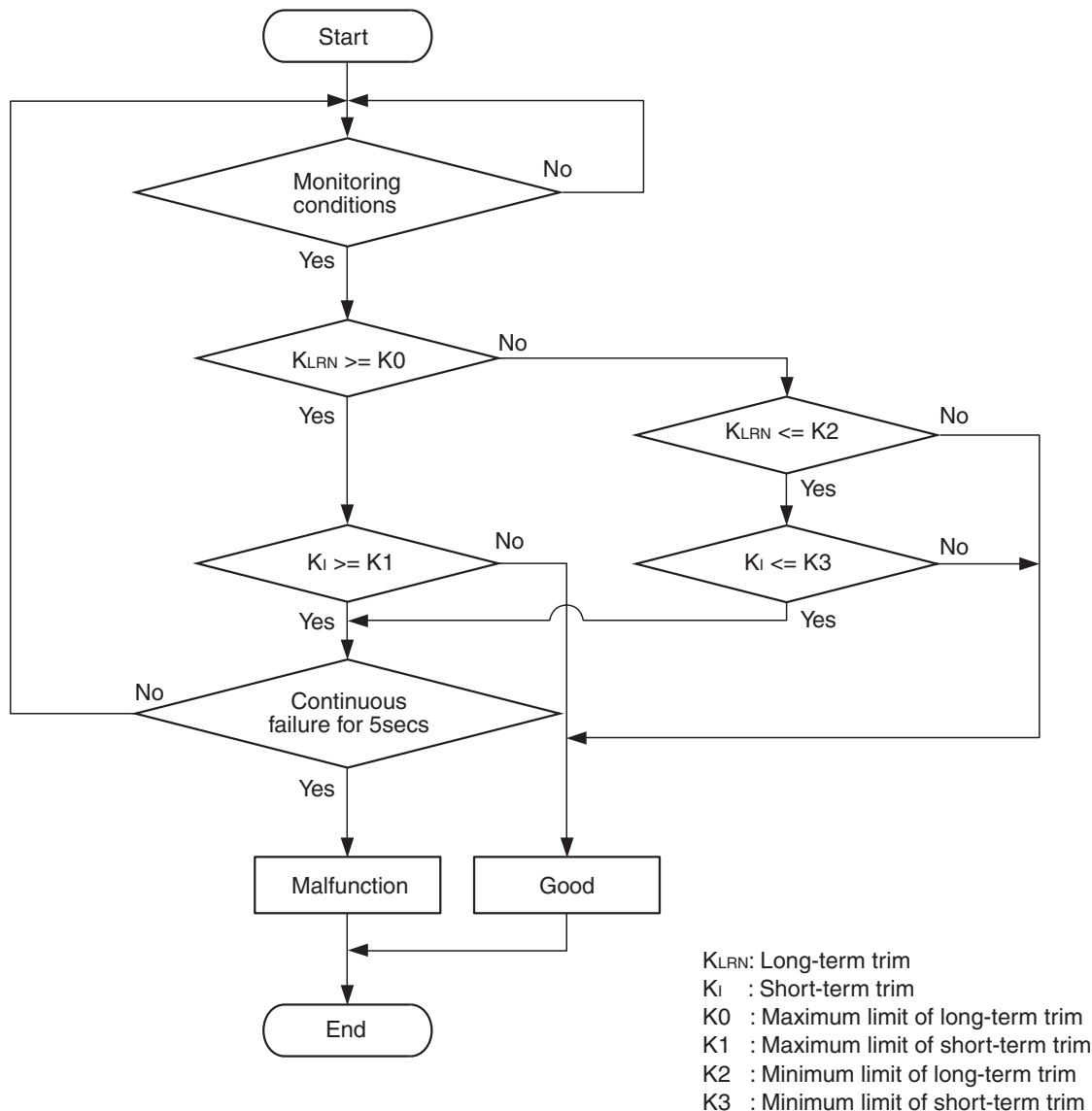
- Misfire monitor

**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



AK604328

**Check Conditions**

- Engine coolant temperature is lower than 100° C (212° F) when the engine is started.
- Intake air temperature is lower than 60° C (140° F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76° C (169° F).
- Mass airflow sensor output is 13 g/sec or more.

**Judgement Criterion**

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

or

- Short-term fuel trim has continued to be +7.0 percent or higher for 5 seconds.

**Check Conditions**

- Engine coolant temperature is lower than 100° C (212° F) when the engine is started.
- Intake air temperature is lower than 60° C (140° F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76° C (169° F).
- Mass airflow sensor output is less than 13 g/sec.

**Judgement Criterion**

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

or

- Short-term fuel trim has continued to be +12.1 percent or higher for 5 seconds.

**Check Conditions**

- Engine coolant temperature is higher than 100° C (212° F) when the engine is started.
- Intake air temperature is higher than 60° C (140° F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76° C (169° F).
- Mass airflow sensor output is 13 g/sec or more.

**Judgement Criteria**

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

or

- Short-term fuel trim has continued to be +17.2 percent or higher for 5 seconds.

**Check Conditions**

- Engine coolant temperature is higher than 100° C (212° F) when the engine is started.
- Intake air temperature is higher than 60° C (140° F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76° C (169° F).
- Mass airflow sensor output is less than 13 g/sec.

**Judgement Criterion**

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

or

- Short-term fuel trim has continued to be +22.3 percent or higher for 5 seconds.

**Check Conditions**

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

**Judgement Criterion**

- Long-term fuel trim has continued to be +12.5 percent for 2 seconds.

or

- Short-term fuel trim has continued to be +25.0 percent for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 21 [P.13A-9](#).

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

- Mass airflow sensor failed.
- Injector failed.
- Incorrect fuel pressure.
- Air drawn in from gaps in gasket, seals, etc.
- Engine coolant temperature sensor failed.
- Intake air temperature sensor failed.
- Barometric pressure sensor failed.
- Manifold absolute pressure sensor failed.
- Exhaust leak.
- Use of incorrect or contaminated fuel.
- Harness damage in injector circuit or connector damage.
- ECM failed.

**DIAGNOSIS****Required Special Tools:**

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

**STEP 1. Check for exhaust leak.****Q: Are there any abnormalities?**

**YES** : Repair it. Then go to Step 14.

**NO** : Go to Step 2.

**STEP 2. Check for intake system vacuum leak.**

**Q: Are there any abnormalities?**

**YES :** Repair it. Then go to Step 14.

**NO :** Go to Step 3.

**STEP 3. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.**

**⚠ CAUTION**

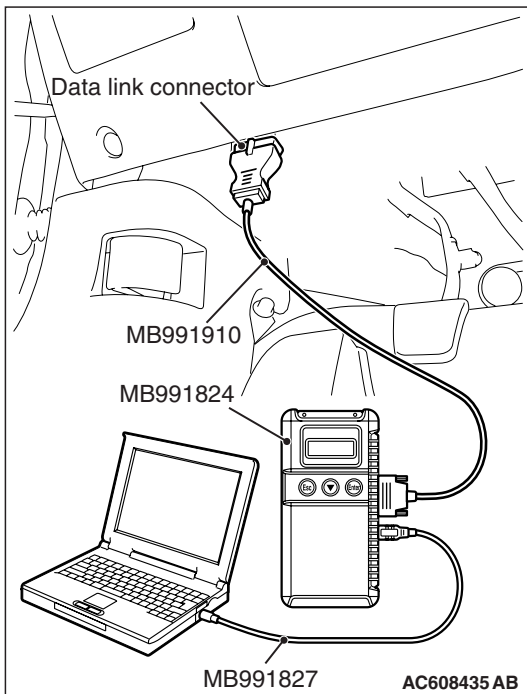
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
  - When idling, between 1,300 and 1,650 millivolts.
  - When 2,500 r/min, between 1,620 and 2,100 millivolts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 4.

**NO :** Refer to DTC P0101 –Mass Airflow Circuit Range/Performance Problem [P.13A-107](#), DTC P0102 –Mass Airflow Circuit Low Input [P.13A-113](#), DTC P0103 –Mass Airflow Circuit High Input [P.13A-120](#).



**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 (sensor 1) [P.13A-147](#), DTC P0112 –Intake Air Temperature Circuit Low Input (sensor 1) [P.13A-153](#), DTC P0113 –Intake Air Temperature Circuit High Input (sensor 1) [P.13A-157](#).

**STEP 5. Using scan tool MB991958, check data list item 6: Engine Coolant Temperature Sensor.**

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

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

**YES :** Go to Step 6.

**NO :** Refer to DTC P0116 –Engine Coolant Temperature Circuit Range/Performance Problem [P.13A-163](#), DTC P0117 –Engine Coolant Temperature Circuit Low Input [P.13A-169](#), DTC P0118 –Engine Coolant Temperature Circuit High Input [P.13A-174](#).

**STEP 6. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.**

- (1) Turn the ignition switch the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
  - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
  - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine.
  - When the engine is idling, 31 –45 kPa (9.1 –13.3 in.Hg).
  - When the engine is suddenly revved, manifold absolute pressure varies.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 7.

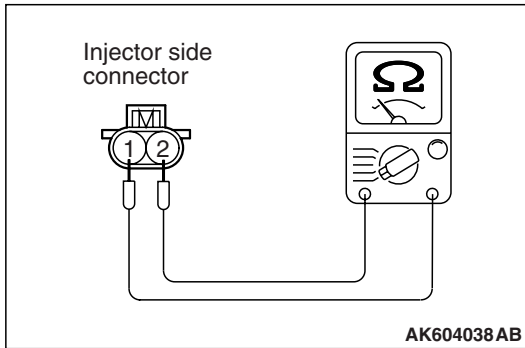
**NO :** Refer to DTC P0106 –Manifold Absolute Pressure Circuit Range/Performance Problem [P.13A-125](#), DTC P0107 –Manifold Absolute Pressure Circuit Low Input [P.13A-134](#), DTC P0108 –Manifold Absolute Pressure Circuit High Input [P.13A-142](#).

**STEP 7. Check harness connector B-101, B-102, B-103 and B-104 at injector for damage.****Q: Is the harness connector in good condition?**

**YES :** Go to Step 8.

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





**STEP 8. Check the injector.**

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

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

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

**YES :** Go to Step 9.

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

**STEP 9. Check harness connector B-09 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-09 (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-09 (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-09 (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-09 (terminal No. 19) at No. 4 cylinder injector.

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

**YES :** Go to Step 11.

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

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

Refer to On-vehicle Service –Fuel Pressure Test [P.13A-897](#).

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

**YES :** Go to Step 12.

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

**STEP 12. Check for entry of foreign matter (water, kerosene, etc.) into fuel.**

**Q: Are there any abnormalities?**

**YES :** Replace the fuel. Then go to Step 14.

**NO :** Go to Step 13.

**STEP 13. Replace the injector.**

- (1) Replace the injector.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 21 [P.13A-9](#).
- (3) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0171 set?**

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14.

**NO :** The inspection is complete.

**STEP 14. Test the OBD-II drive cycle.**

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 21 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

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

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

**DTC P0172: System too Rich****Fuel Trim Circuit**

- Refer to DTC P0201 –Injector Circuit-Cylinder 1 [P.13A-277](#), DTC P0202 –Injector Circuit-Cylinder 2 [P.13A-287](#), DTC P0203 –Injector Circuit-Cylinder 3 [P.13A-297](#), DTC P0204 –Injector Circuit-Cylinder 4 [P.13A-307](#).

**CIRCUIT OPERATION**

- Refer to DTC P0201 –Injector Circuit-Cylinder 1 [P.13A-277](#), DTC P0202 –Injector Circuit-Cylinder 2 [P.13A-287](#), DTC P0203 –Injector Circuit-Cylinder 3 [P.13A-297](#), DTC P0204 –Injector Circuit-Cylinder 4 [P.13A-307](#).

**TECHNICAL DESCRIPTION**

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

**DESCRIPTIONS OF MONITOR METHODS**

Air/fuel learning value (long time fuel trim) and air/fuel feedback integral value (short time fuel trim) are too rich.

**MONITOR EXECUTION**

Continuous

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

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

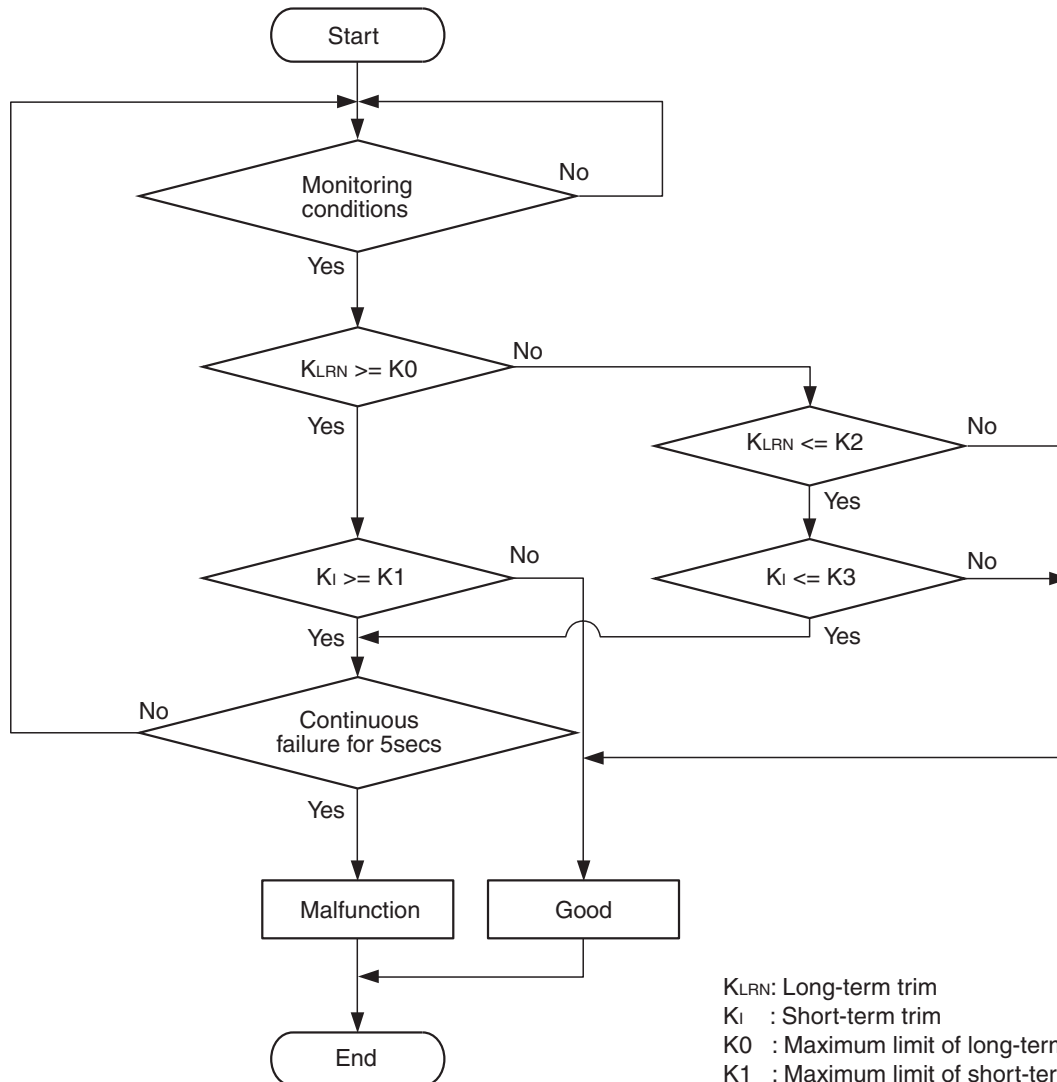
- Misfire monitor

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

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

DTC SET CONDITIONS

Logic Flow Chart



KLRN: Long-term trim  
 Ki : Short-term trim  
 K0 : Maximum limit of long-term trim  
 K1 : Maximum limit of short-term trim  
 K2 : Minimum limit of long-term trim  
 K3 : Minimum limit of short-term trim

AK604328

**Check Conditions**

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76° C (169° F).
- Mass airflow sensor output is 13 g/sec or more.

**Judgement Criterion**

- Long-term fuel trim has continued to be -12.5 percent or lower for 5 seconds.
- or
- Short-term fuel trim has continued to be -10.2 percent or lower for 5 seconds.

**Check Conditions**

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 76° C (169° F).
- Mass airflow sensor output is less than 13 g/sec.

**Judgement Criterion**

- Long-term fuel trim has continued to be -12.5 percent or lower for 5 seconds.
- or
- Short-term fuel trim has continued to be -15.2 percent or lower for 5 seconds.

**Check Conditions**

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

**Judgement Criteria**

- Long-term fuel trim has continued to be -12.5 percent for 2 seconds.

or

- Short-term fuel trim has continued to be -25.0 percent for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 21 [P.13A-9](#).

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

- Mass airflow sensor failed.
- Injector failed.
- Incorrect fuel pressure.
- Engine coolant temperature sensor failed.
- Intake air temperature sensor failed.
- Barometric pressure sensor failed.
- Manifold absolute pressure sensor failed.
- ECM failed.

**DIAGNOSIS****Required Special Tools:**

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

**STEP 1. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.****⚠ CAUTION**

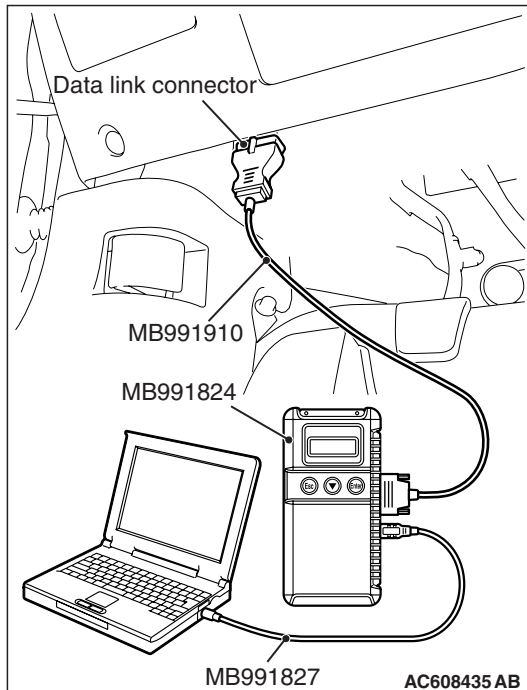
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
  - When idling, between 1,300 and 1,650 millivolts.
  - When 2,500 r/min, between 1,620 and 2,100 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 (sensor 1) [P.13A-107](#), DTC P0102 –Mass Airflow Circuit Low Input (sensor 1) [P.13A-113](#), DTC P0103 –Mass Airflow Circuit High Input (sensor 1) [P.13A-120](#).



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**STEP 2. Using scan tool MB991958, check data list item 5:  
Intake Air Temperature Sensor.**

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

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

**YES :** Go to Step 3.

**NO :** Refer to DTC P0111 –Intake Air Temperature Circuit Range/Performance Problem [P.13A-147](#), DTC P0112 –Intake Air Temperature Circuit Low Input [P.13A-153](#), DTC P0113 –Intake Air Temperature Circuit High Input [P.13A-157](#).

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**STEP 3. Using scan tool MB991958, check data list item 6:  
Engine Coolant Temperature Sensor.**

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

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

**YES :** Go to Step 4.

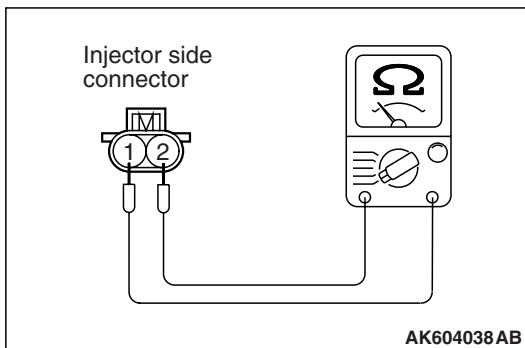
**NO :** Refer to DTC P0116 –Engine Coolant Temperature Circuit Range/Performance Problem [P.13A-163](#), DTC P0117 –Engine Coolant Temperature Circuit Low Input [P.13A-169](#), DTC P0118 –Engine Coolant Temperature Circuit High Input [P.13A-174](#).

**STEP 4. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
  - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
  - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine.
  - When the engine is idling, 31 –45 kPa (9.1 –13.3 in.Hg).
  - When the engine is suddenly revved, manifold absolute pressure varies.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the sensor operating properly?****YES** : Go to Step 5.**NO** : Refer to DTC P0106 –Manifold Absolute Pressure Circuit Range/Performance Problem [P.13A-125](#), DTC P0107 –Manifold Absolute Pressure Circuit Low Input [P.13A-134](#), DTC P0108 –Manifold Absolute Pressure Circuit High Input [P.13A-142](#).**STEP 5. Check the injector.**

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

**Standard value: 10.5 –13.5  $\Omega$  [at 20° C (68° F)]****Q: Is the measured resistance between 10.5 and 13.5  $\Omega$  [at 20° C (68° F)]?****YES** : Go to Step 6.**NO** : Replace the injector. Then go to Step 8.**STEP 6. Check the fuel pressure.**Refer to On-vehicle Service –Fuel Pressure Test [P.13A-897](#).**Q: Is the fuel pressure normal?****YES** : Go to Step 7.**NO** : Repair it. Then go to Step 8.

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**STEP 7. Replace the injector.**

- (1) Replace the injector.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 21 [P.13A-9](#).
- (3) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0172 set?**

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 8.

**NO :** The inspection is complete.

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

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 21 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

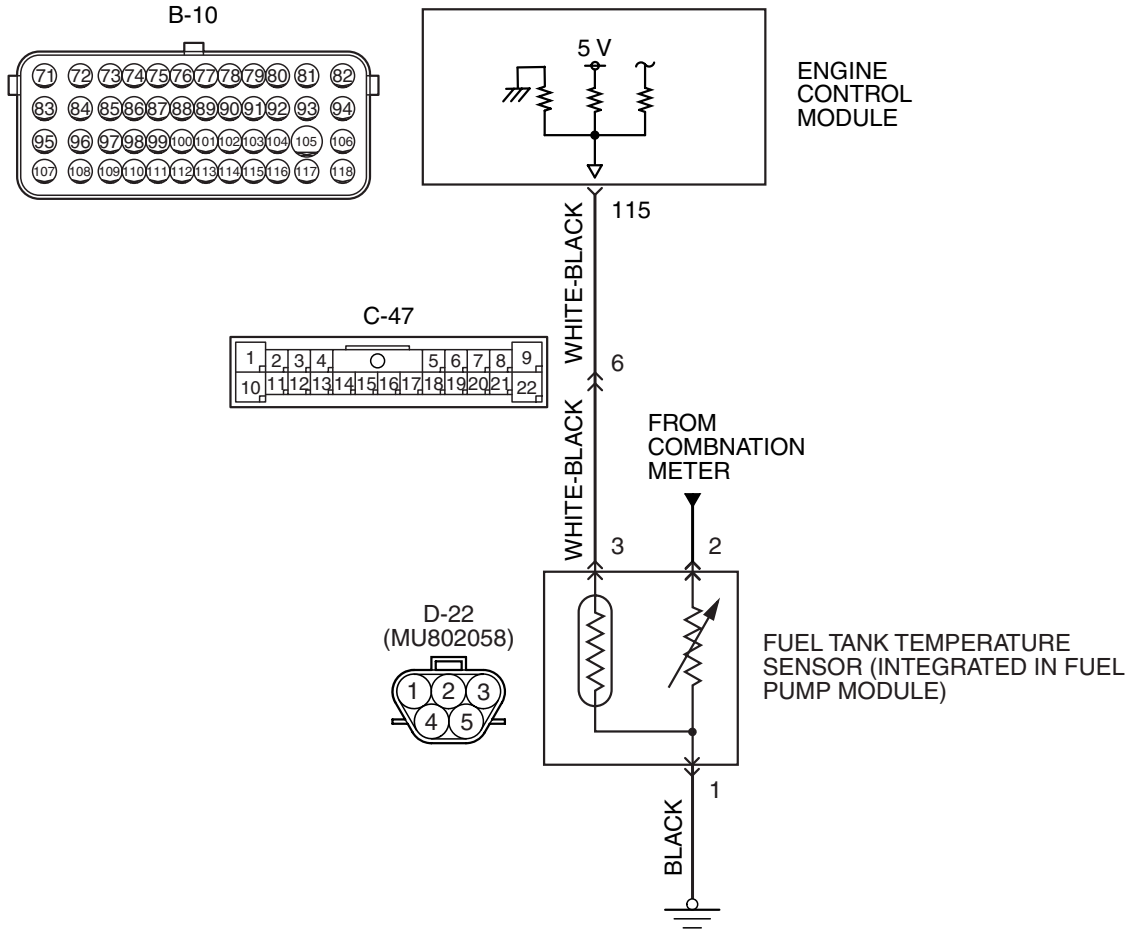
**Q: Is DTC P0172 set?**

**YES :** Retry the troubleshooting.

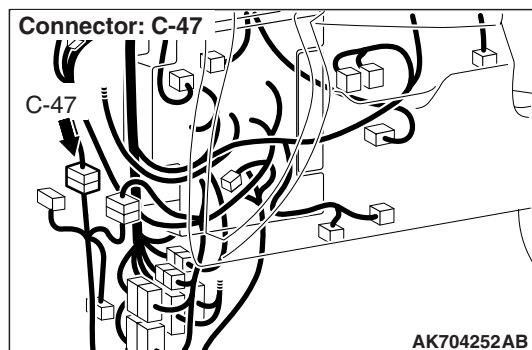
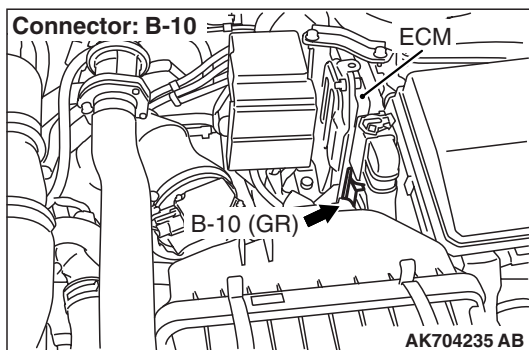
**NO :** The inspection is complete.

DTC P0181: Fuel Tank Temperature Sensor Circuit Range/Performance

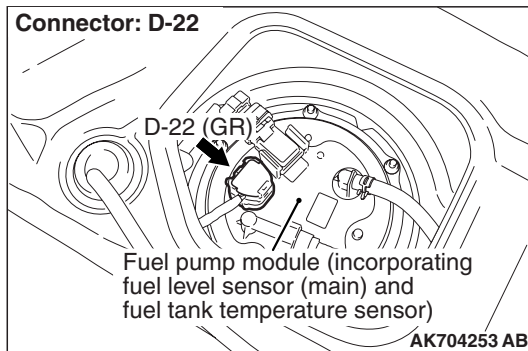
FUEL TANK TEMPERATURE SENSOR CIRCUIT



AK604240AC







## 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)**

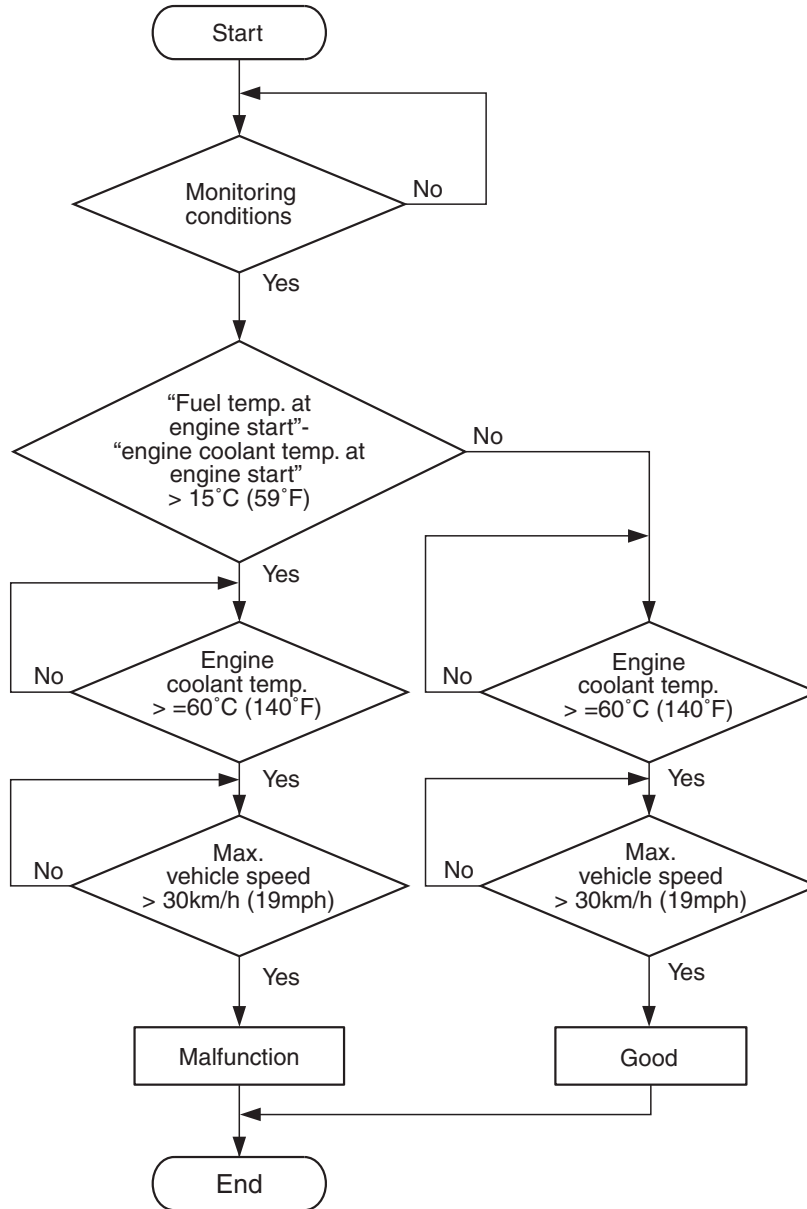
- Not applicable

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

- Engine coolant temperature sensor
- Intake air temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



AK604329

**Check Conditions**

- The engine coolant temperature –intake air temperature is 5° C (9° F) or less when the engine is started.
- 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 60° C (140° F) or higher.
- Maximum vehicle speed is higher than 30 km/h (19 mph) after the engine starting sequence has been completed.

**Judgement Criterion**

- The fuel tank temperature –engine coolant temperature is 15° C (27° F) or more when the engine is started.

## FAIL-SAFE AND BACKUP FUNCTION

- None

## OBD-II DRIVE CYCLE PATTERN

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

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

- Fuel tank temperature sensor failed.

- Open or shorted 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 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**

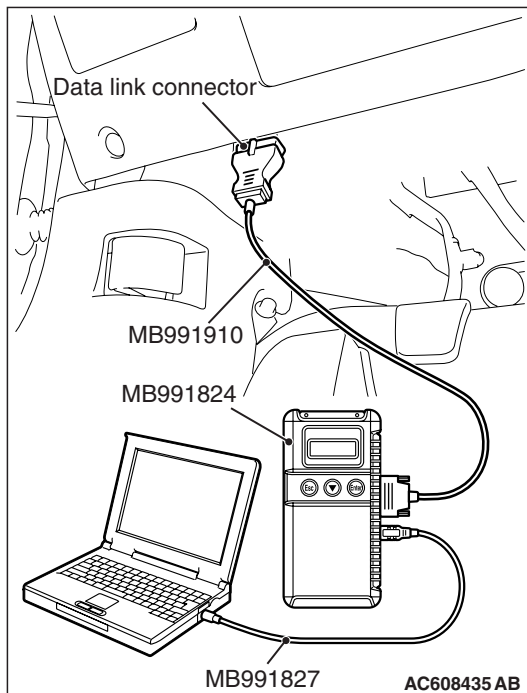
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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.00-15](#).

**NO** : Go to Step 2.

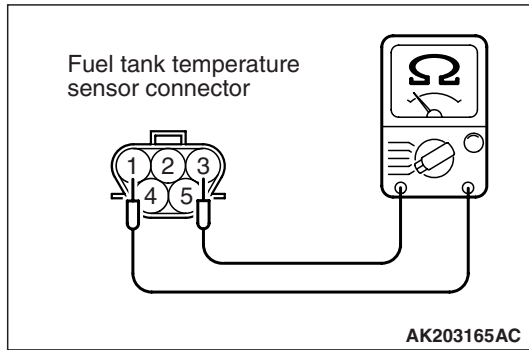


### STEP 2. Check harness connector D-22 at the fuel tank temperature sensor for damage.

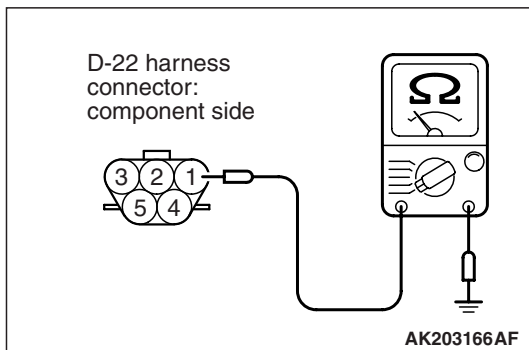
#### Q: Is the harness connector in good condition?

**YES** : Go to Step 3.

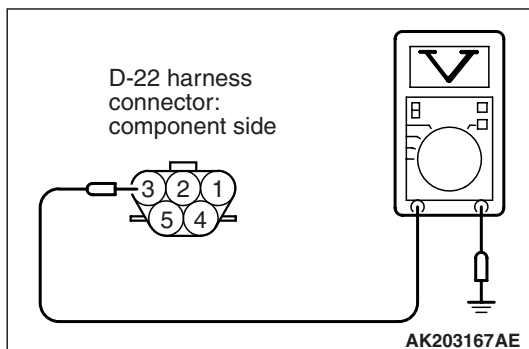
**NO** : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

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

- (1) Disconnect the fuel tank temperature sensor connector D-22.
- (2) Measure the resistance between terminal No. 1 and No. 3 of the fuel tank temperature sensor.

**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 tank temperature sensor. Then go to Step 11.**STEP 4. Check the continuity at fuel tank temperature sensor harness side connector D-22.**

- (1) Disconnect the connector D-22 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 tank temperature sensor connector D-22 (terminal No. 1) and ground because of open circuit or harness damage. Then go to Step 11.**STEP 5. Measure the sensor supply voltage at fuel tank temperature sensor harness side connector D-22.**

- (1) Disconnect the connector D-22 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 9.**NO :** Go to Step 6.

**STEP 6. Check harness connector B-10 at ECM for damage.**

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

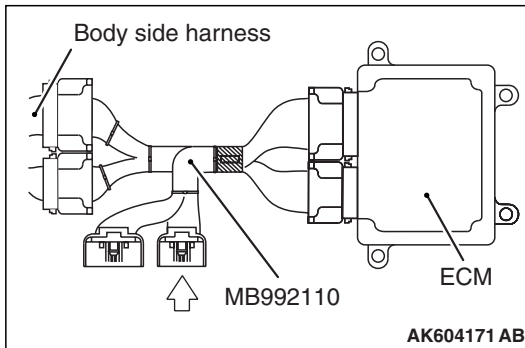
**YES :** Go to Step 7.

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

**STEP 7. Measure the sensor supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.**

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

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



(3) Measure the voltage between terminal No. 115 and ground.

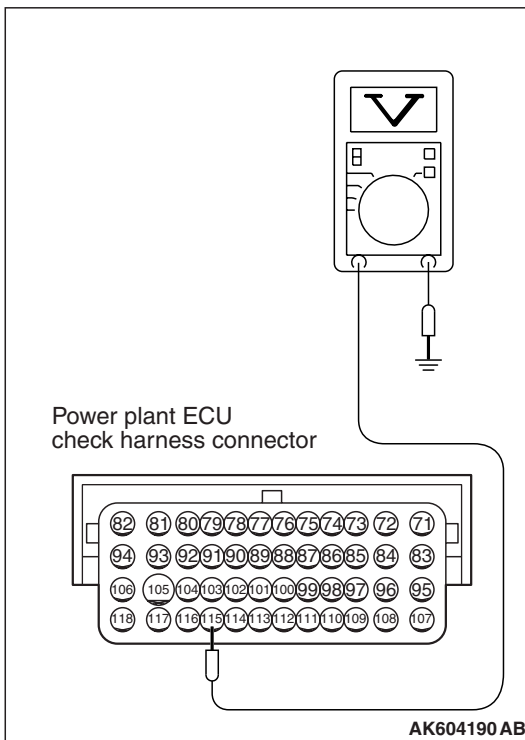
- When fuel tank temperature is 0° C (32° F), voltage should be between 2.7 and 3.1 volts.
- When fuel tank temperature is 20° C (68° F), voltage should be between 2.1 and 2.5 volts.
- When fuel tank temperature is 40° C (104° F), voltage should be between 1.6 and 2.0 volts.
- When fuel tank temperature is 80° C (176° F), voltage should be between 0.8 and 1.2 volts.

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

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

**YES :** Check harness connector C-47 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 tank temperature sensor connector D-22 (terminal No. 3) and ECM connector B-10 (terminal No. 115) because of open circuit. Then go to Step 11.

**NO :** Go to Step 8.



**STEP 8. Check for short circuit to ground between fuel tank temperature sensor connector D-22 (terminal No. 3) and ECM connector B-10 (terminal No. 115).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 11.

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

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**STEP 9. Check harness connector B-10 at ECM for damage.**

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

**YES :** Go to Step 10.

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

---

**STEP 10. Check for harness damage between fuel tank temperature sensor connector D-22 (terminal No. 3) and ECM connector B-10 (terminal No. 115).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 11.

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

---

**STEP 11. Test the OBD-II drive cycle.**

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

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

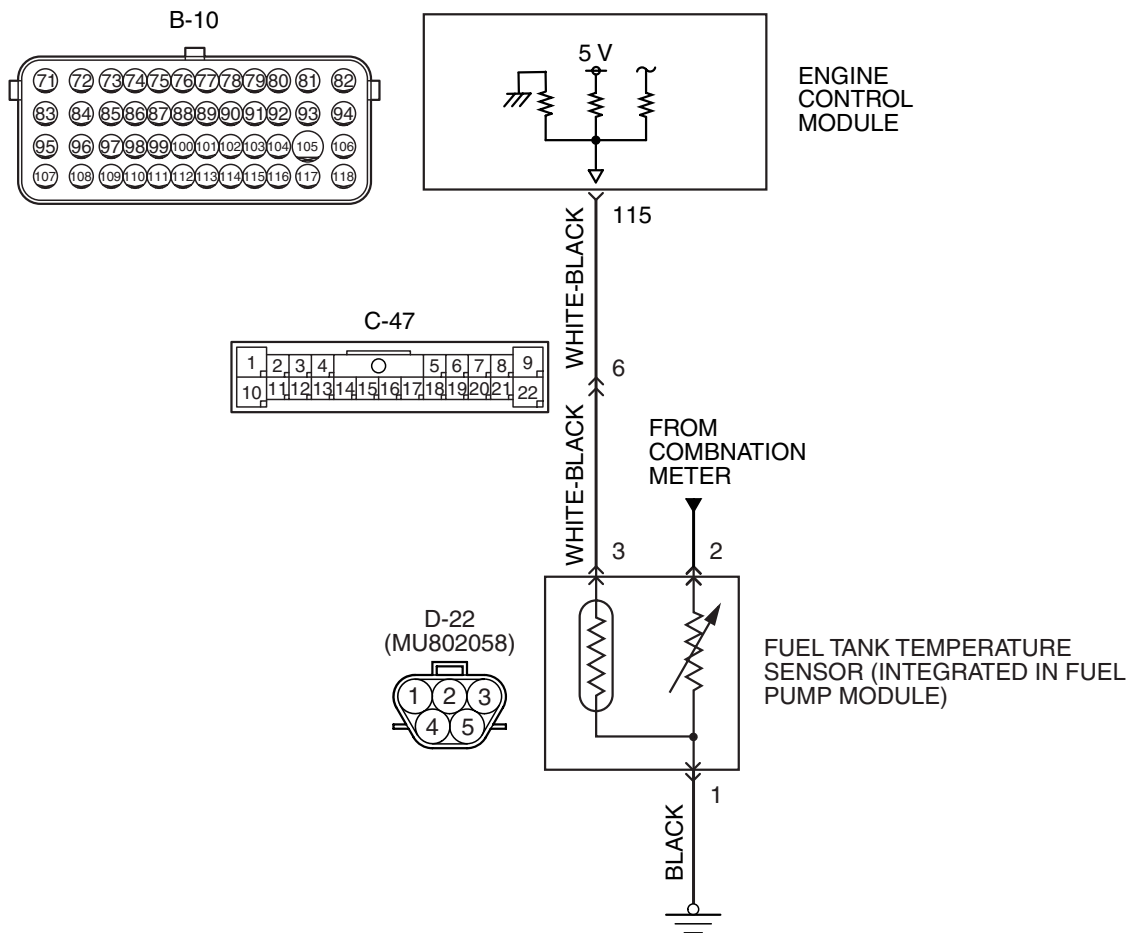
**Q: Is DTC P0181 set?**

**YES :** Retry the troubleshooting.

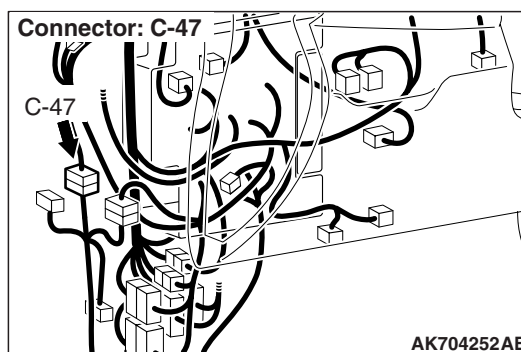
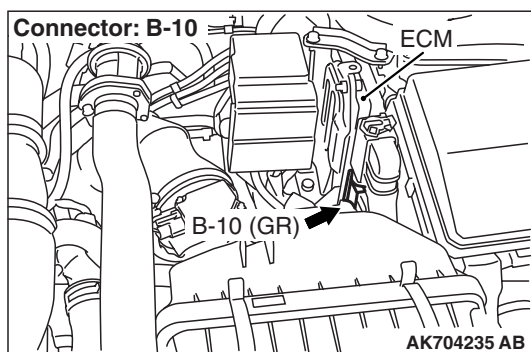
**NO :** The inspection is complete.

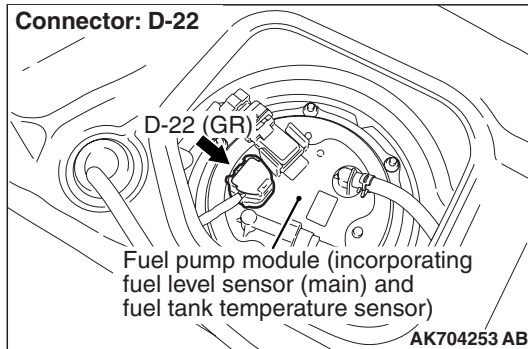
DTC P0182: Fuel Tank Temperature Sensor Circuit Low Input

FUEL TANK TEMPERATURE SENSOR CIRCUIT



AK604240AC





## 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

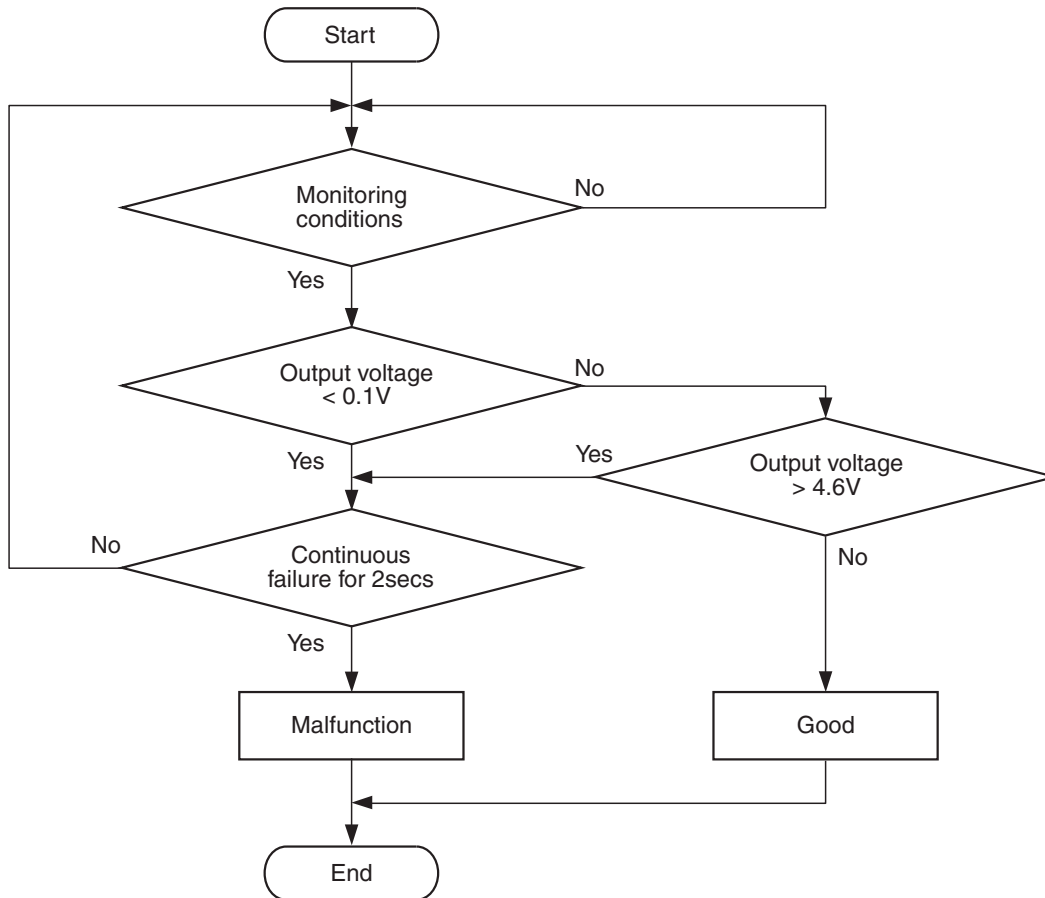
**Sensor (The sensor below is determined to be normal)**

- Not applicable



**DTC SET CONDITIONS**

**Logic Flow Chart**



AK700478

**Check Condition**

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

**Judgement Criterion**

- Sensor output voltage has continued to be 0.1 volt or lower 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.13A-9](#).

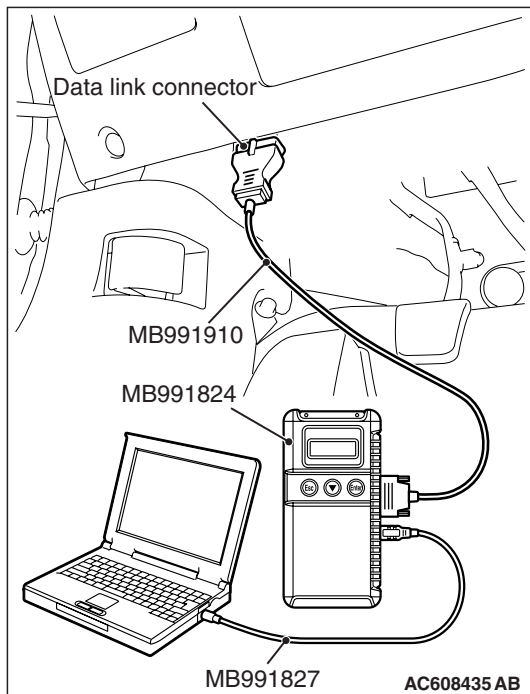
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

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

**DIAGNOSIS**

**Required Special Tools:**

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



**STEP 1. Using scan tool MB991958, check data list item 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.00-15.

**NO :** Go to Step 2.

**STEP 2. Check harness connector D-22 at the fuel tank temperature sensor for damage.**

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

**YES :** Go to Step 3.

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

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

- (1) Disconnect the fuel tank temperature sensor connector D-22.
- (2) Measure the resistance between terminal No. 1 and No. 3 of the fuel tank temperature sensor.

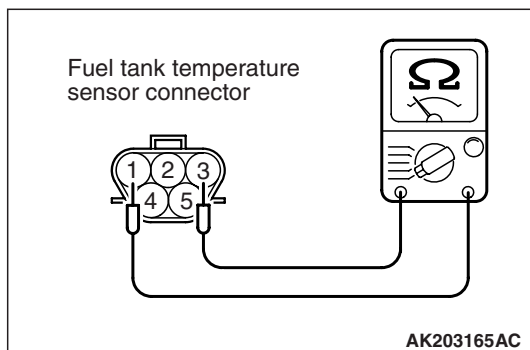
**Standard value:**

**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 tank temperature sensor. Then go to Step 6.



---

**STEP 4. Check harness connector B-10 at ECM for damage.**

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

**YES :** Go to Step 5.

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

---

**STEP 5. Check for short circuit to ground between fuel tank temperature sensor connector D-22 (terminal No. 3) and ECM connector B-10 (terminal No. 115).**

*NOTE: Check harness after checking intermediate connector C-47. If the intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 6.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 6.

**NO :** Repair it. Then go to Step 6.

---

**STEP 6. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13A-9](#).

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

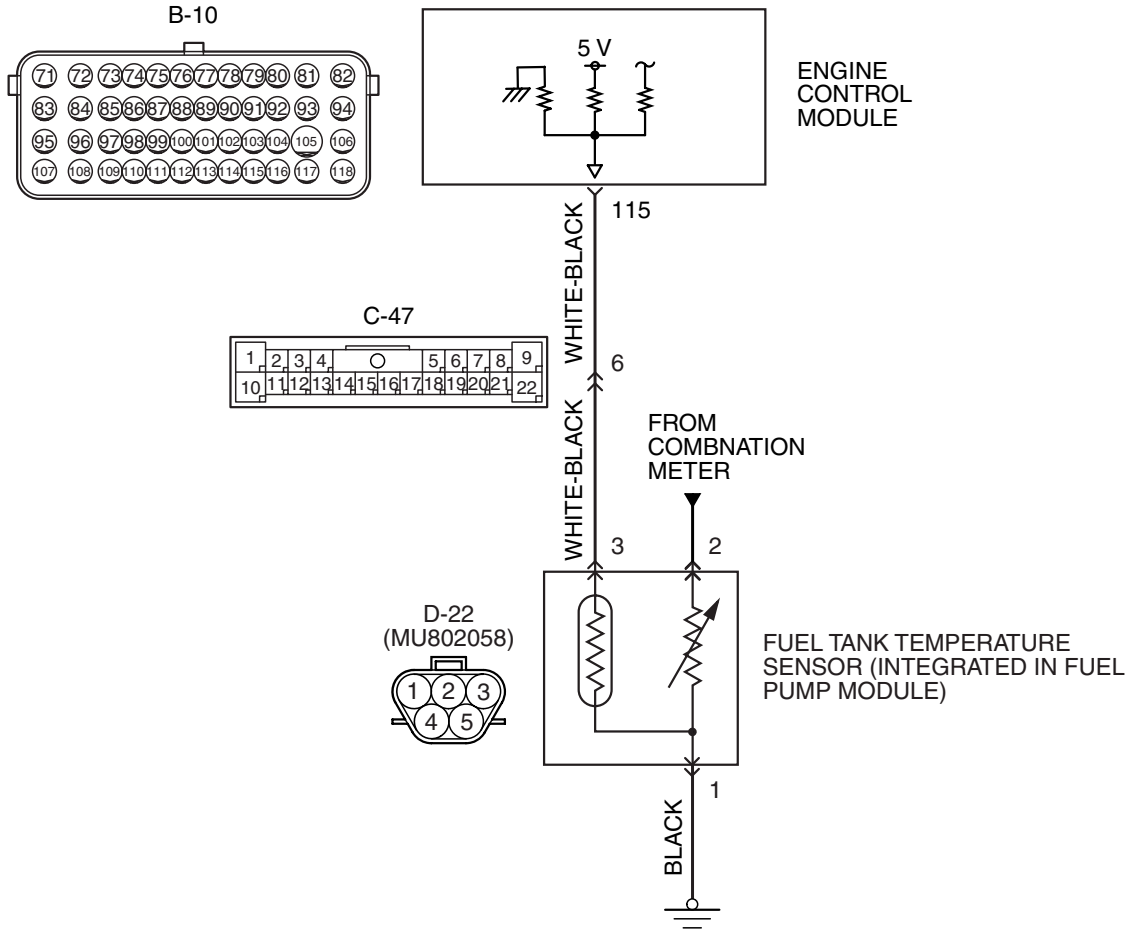
**Q: Is DTC P0182 set?**

**YES :** Retry the troubleshooting.

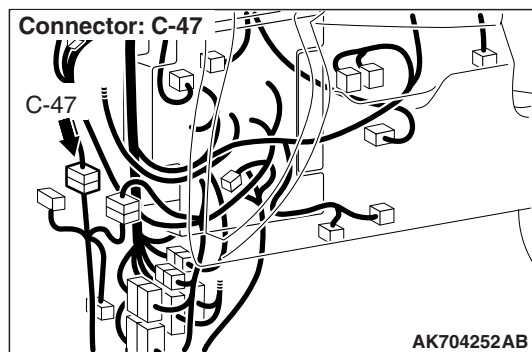
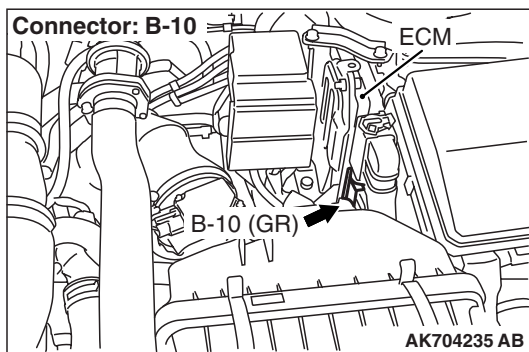
**NO :** The inspection is complete.

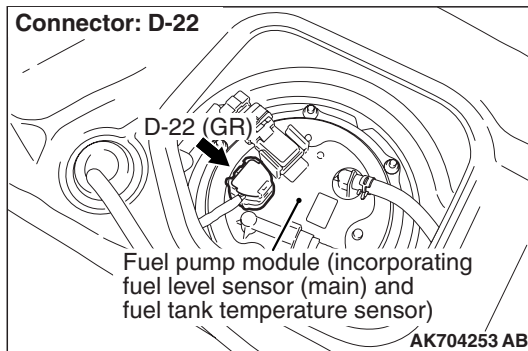
DTC P0183: Fuel Tank Temperature Sensor Circuit High Input

FUEL TANK TEMPERATURE SENSOR CIRCUIT



AK604240AC





## 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)**

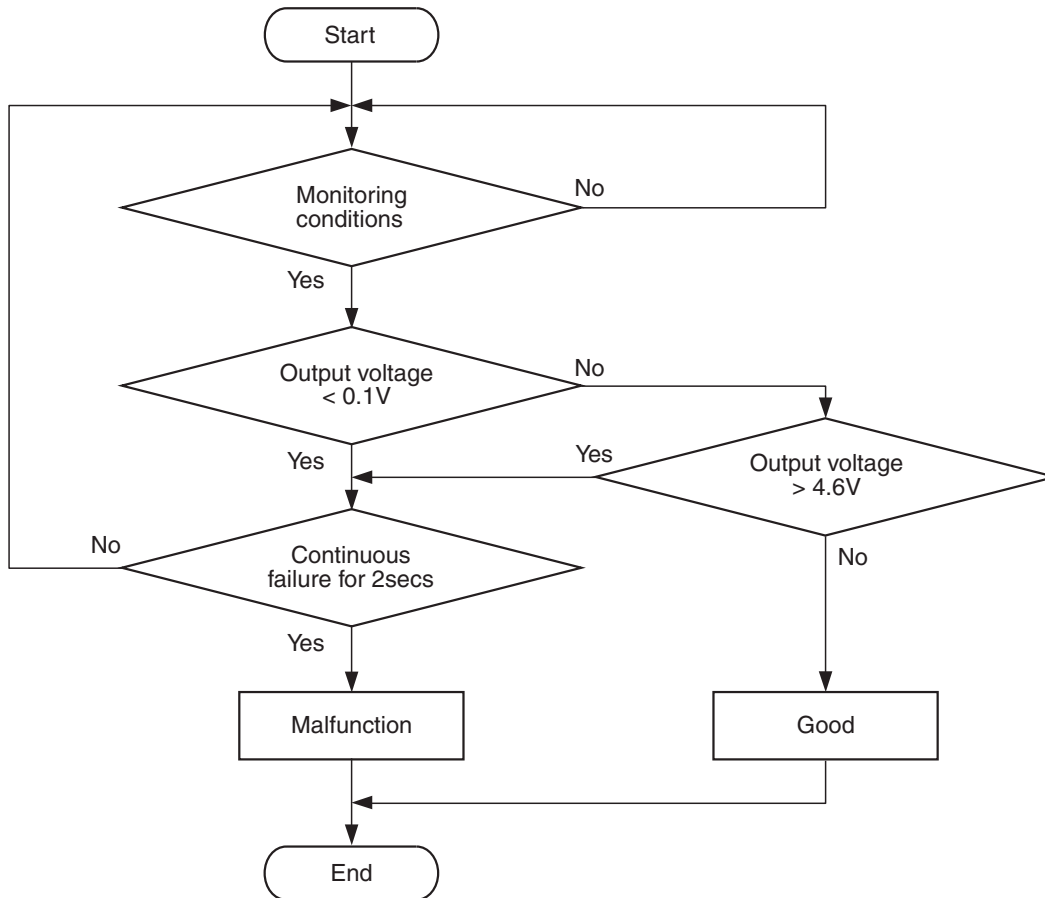
- Not applicable

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

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK700478

**Check Condition**

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

**Judgement Criterion**

- Sensor output voltage has continued to be 4.6 volts or higher 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.13A-9](#).

**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**

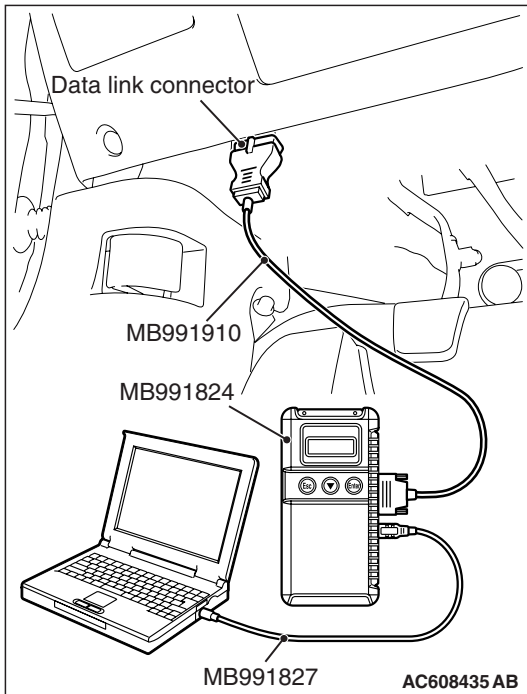
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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.00-15.

**NO :** Go to Step 2.



**STEP 2. Check harness connector D-22 at the fuel tank temperature sensor for damage.**

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

**YES :** Go to Step 3.

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

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

- (1) Disconnect the fuel tank temperature sensor connector D-22.
- (2) Measure the resistance between terminal No. 1 and No. 3 of the fuel tank temperature sensor.

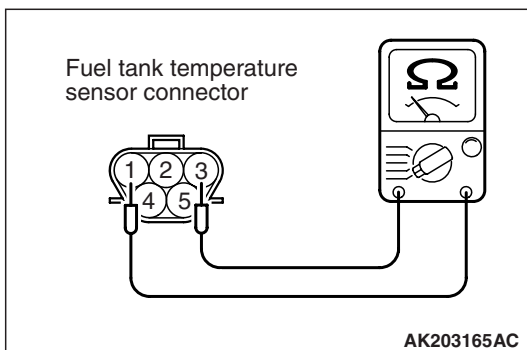
**Standard value:**

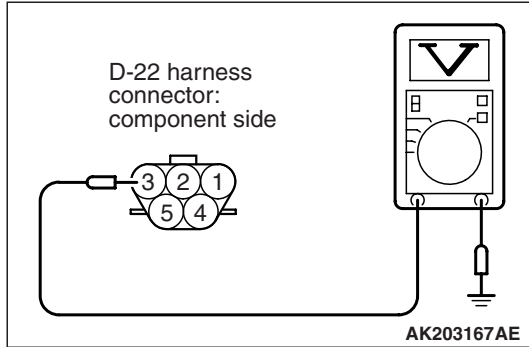
**0.5 –12.0 kΩ**

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

**YES :** Go to Step 4.

**NO :** Replace the fuel tank temperature sensor. Then go to Step 10.

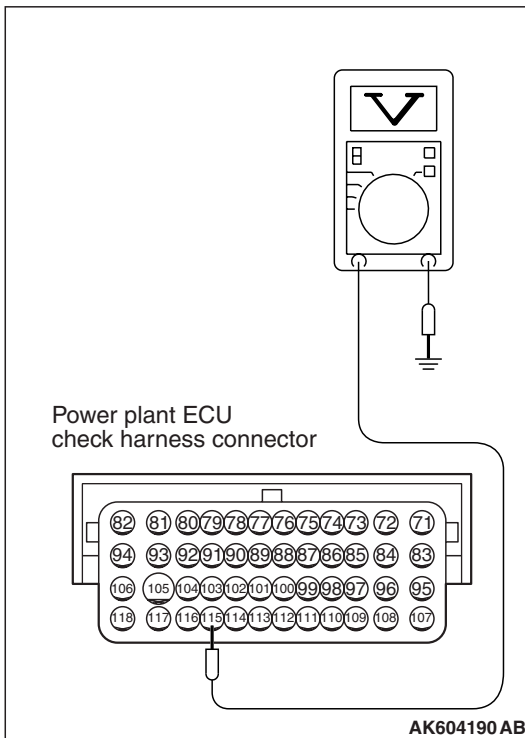
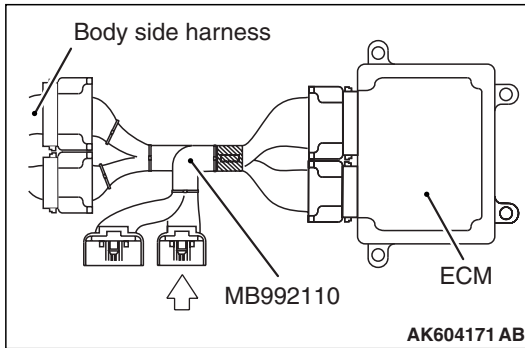


**STEP 4. Check the sensor supply voltage at fuel tank temperature sensor harness side connector D-22.**

- (1) Disconnect the connector D-22 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-10 at ECM for damage.****Q: Is the harness connector in good condition?****YES :** Go to Step 6.**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.





**STEP 6. Check the sensor supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.**

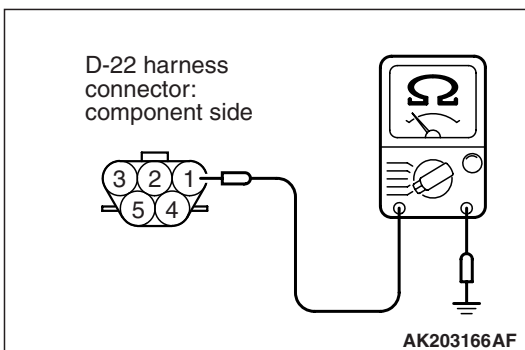
- (1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
- (2) Disconnect the fuel tank temperature sensor connector D-22.
- (3) Turn the ignition switch to the "ON" position.

- (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-47 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If the intermediate connector is in good condition, repair the harness wire between fuel tank temperature sensor connector D-22 (terminal No. 3) and ECM connector B-10 (terminal No. 115) because of open circuit. Then go to Step 10.

**NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.



**STEP 7. Check the continuity at fuel tank temperature sensor harness side connector D-22.**

- (1) Disconnect the connector D-22 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 tank temperature sensor connector D-22 (terminal No. 1) and ground because of open circuit or harness damage. Then go to Step 10.

---

**STEP 8. Check harness connector B-10 at ECM for damage.**

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

**YES :** Go to Step 9.

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

---

**STEP 9. Check for harness damage between fuel tank temperature sensor connector D-22 (terminal No. 3) and ECM connector B-10 (terminal No. 115).**

*NOTE: Check harness after checking intermediate connector C-47. If the intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

**NO :** Repair it. Then go to Step 10.

---

**STEP 10. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13A-9](#).

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

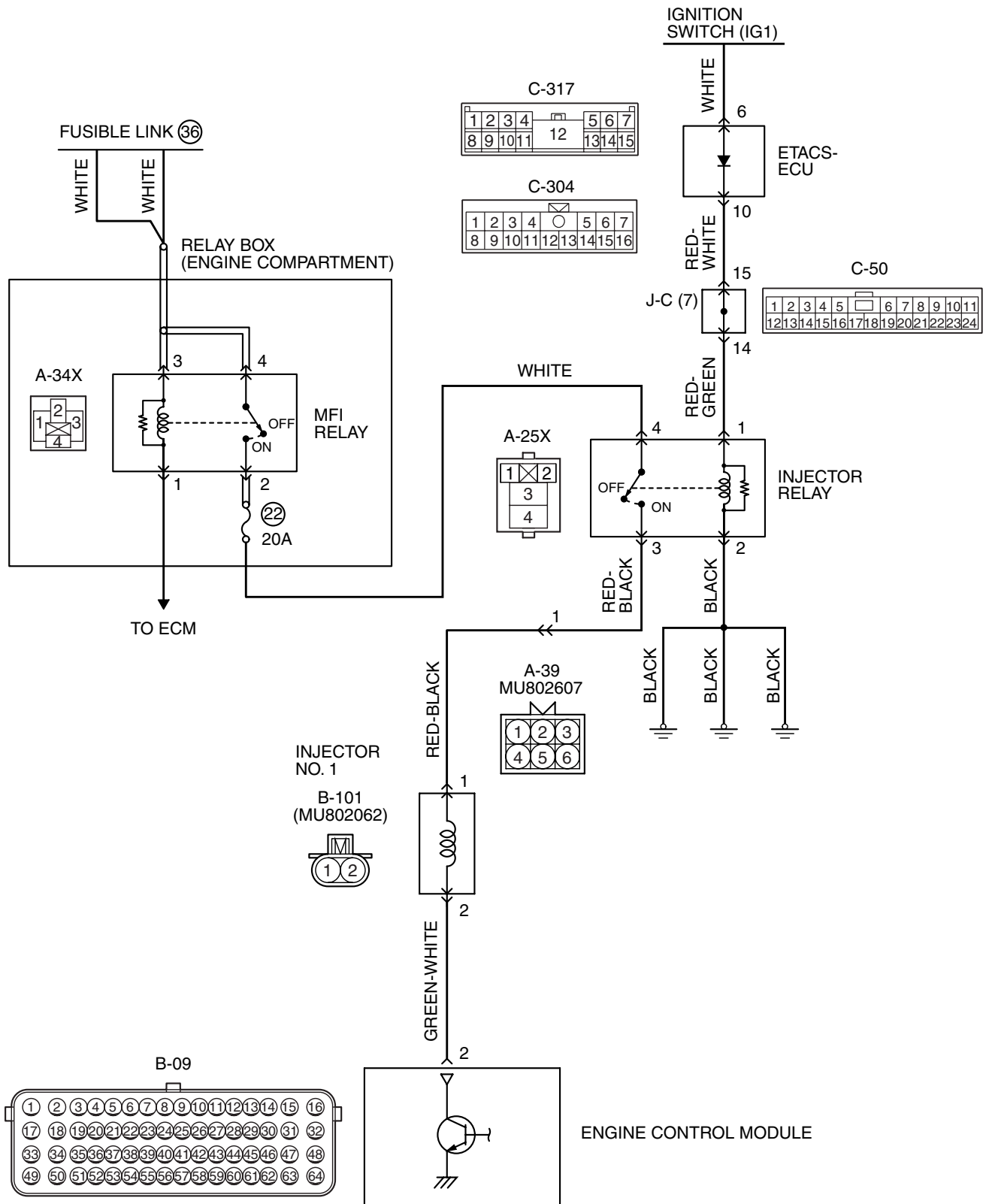
**Q: Is DTC P0183 set?**

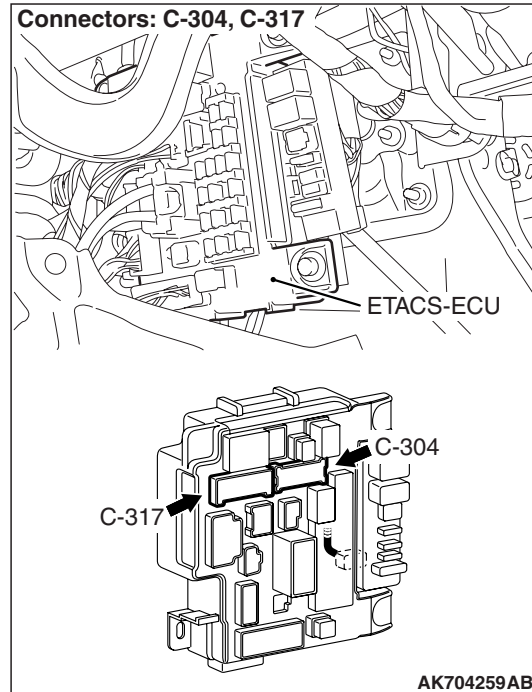
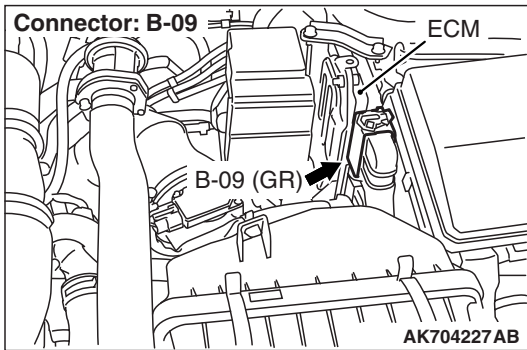
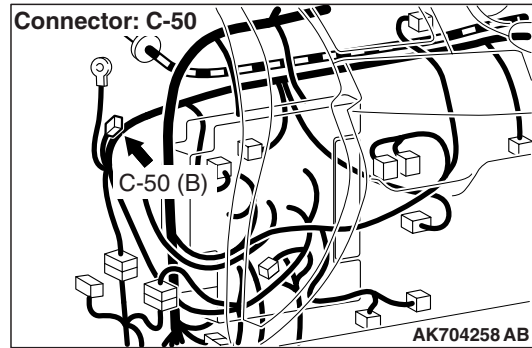
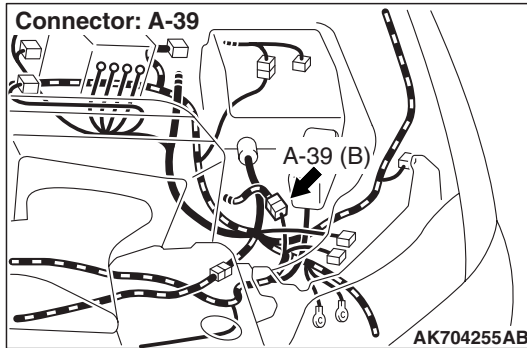
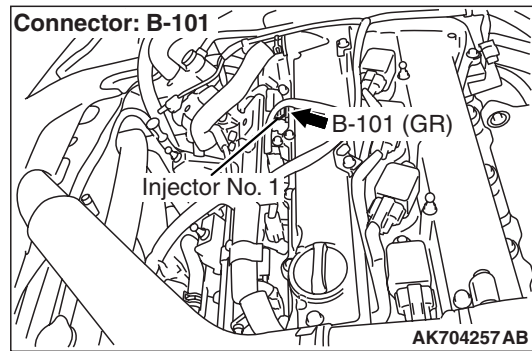
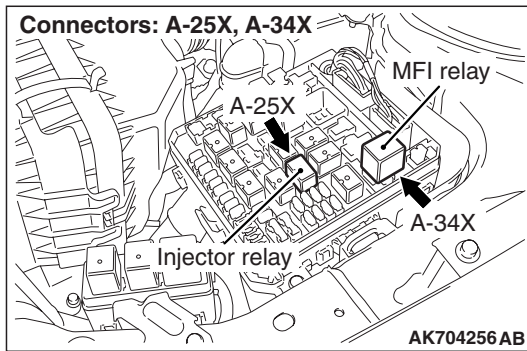
**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

DTC P0201: Injector Circuit-Cylinder 1

INJECTOR CIRCUIT-CYLINDER 1





**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".

**DESCRIPTIONS OF MONITOR METHODS**

The ECM detects open circuit and short malfunction.

**MONITOR EXECUTION**

Continuous

**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.

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

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

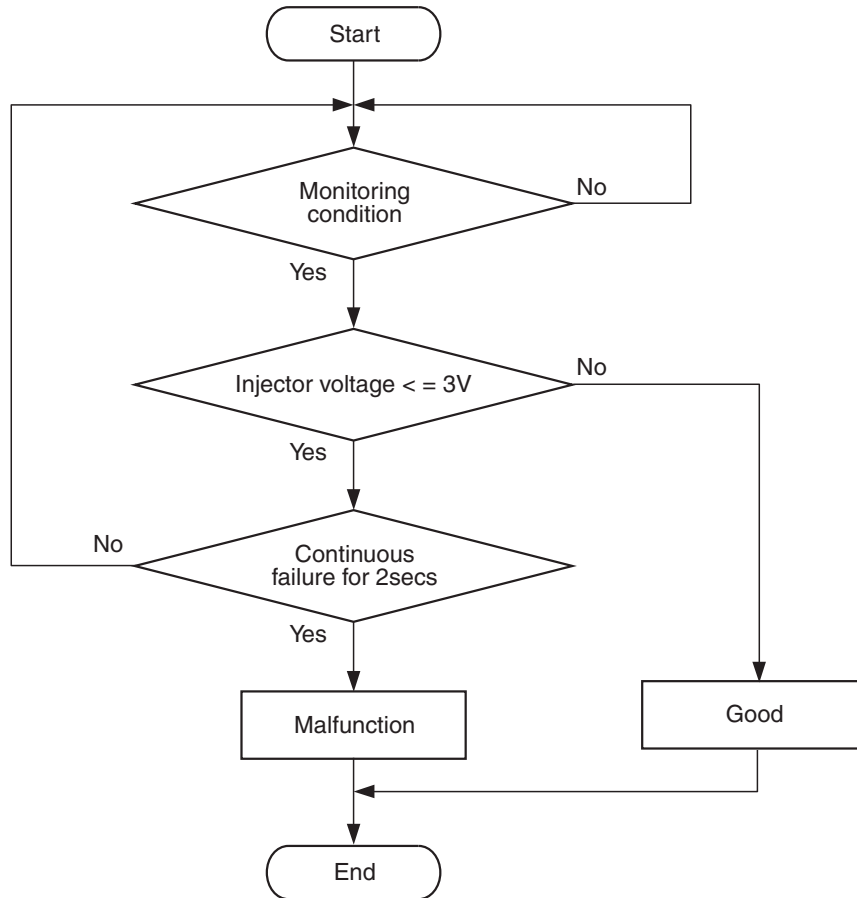
- Not applicable

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**

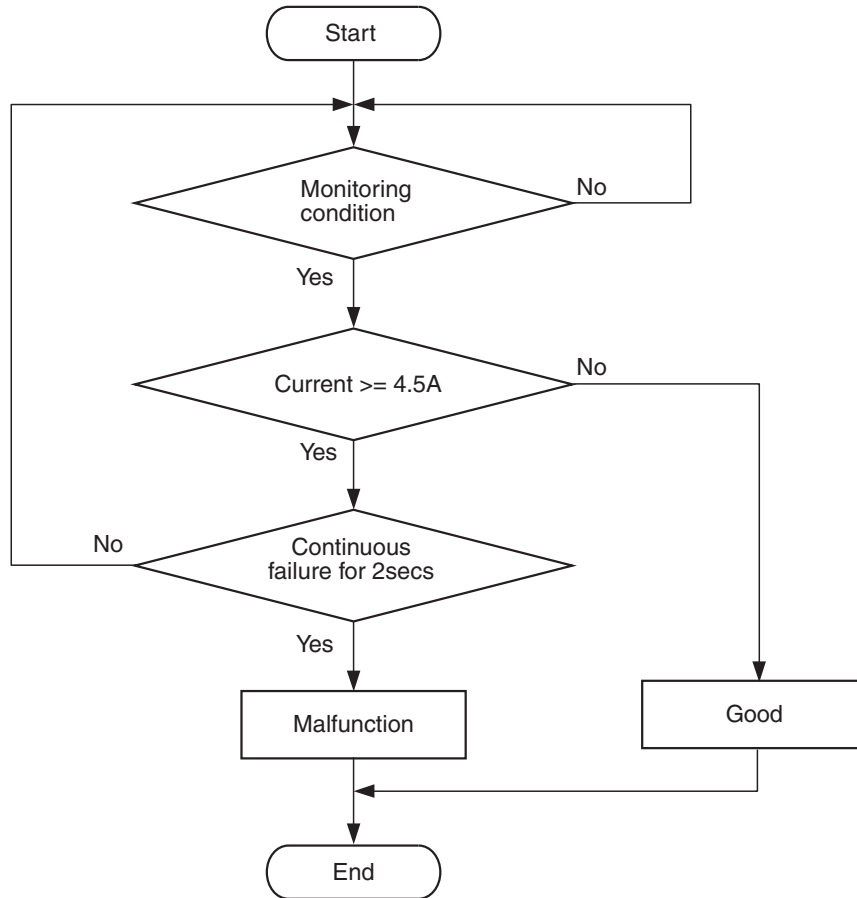
- Engine is running.

**Judgement Criterion**

- The supply voltage is 3 volts or less 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 4.5 ampere or more 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.13A-9](#).

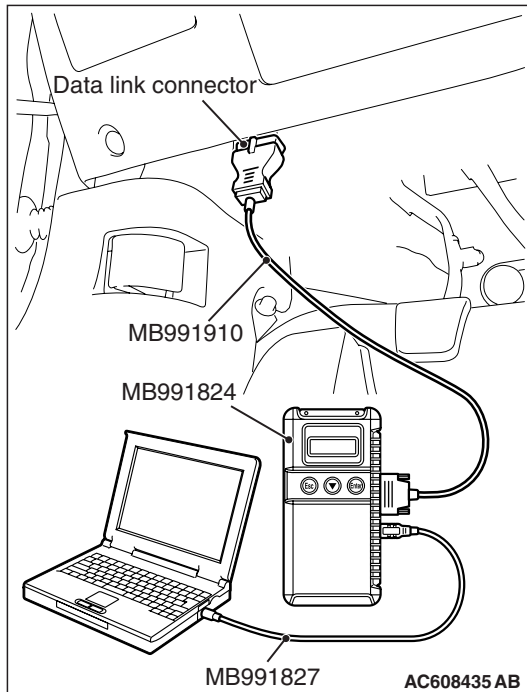
**TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)**

- 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) Set scan tool MB991958 to the actuator testing mode for item 1, Injectors.
- (4) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
  - 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.00-15.

**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 20.

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

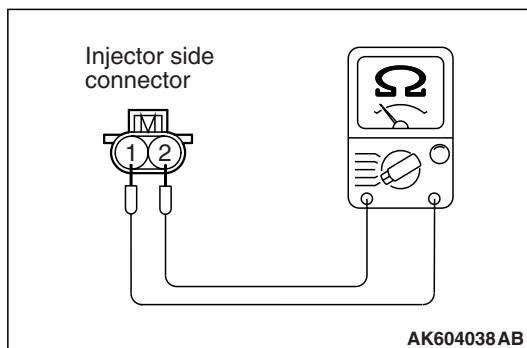
- (1) Disconnect the No. 1 cylinder injector connector B-101.
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

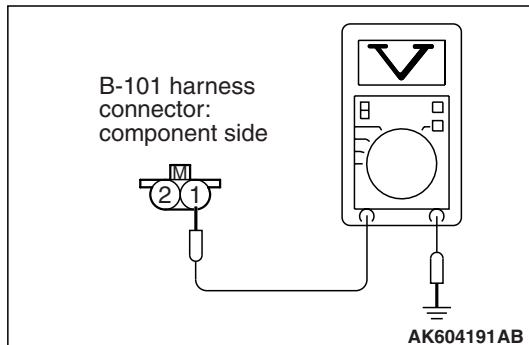
**Standard value: 10.5 –13.5 Ω [at 20° C (68° F)]**

**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 20.





**STEP 4. Measure the power supply voltage at No. 1 cylinder injector connector.**

- (1) Disconnect 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 14.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-25X at injector relay for damage.**

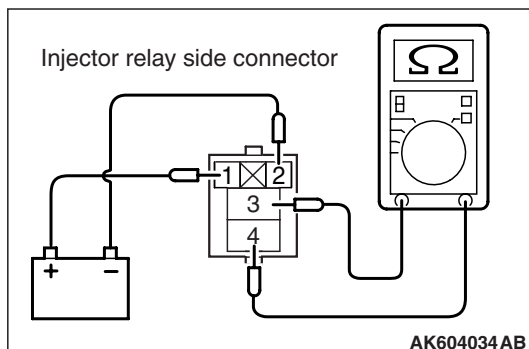
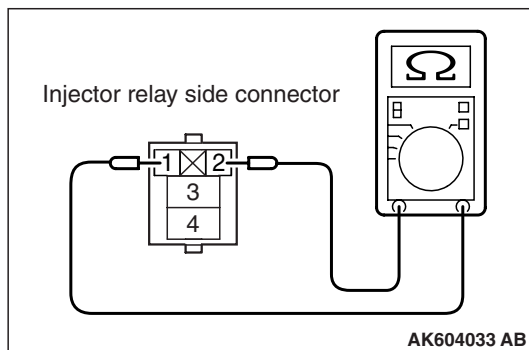
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 6.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**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.



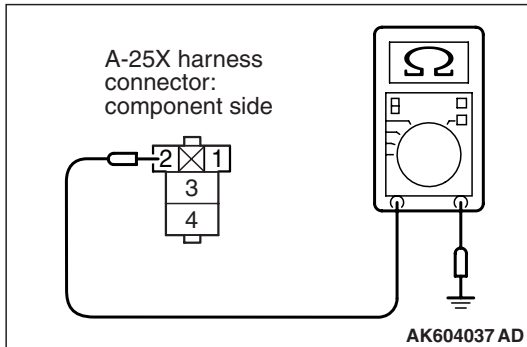
- (3) Use jumper wires to connect injector relay terminal No. 1 to the positive battery terminal and terminal No. 2 to the negative battery terminal.
- (4) Check for continuity between the injector relay terminal No. 3 and No. 4 while connecting and disconnecting the jumper wire at the negative battery 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 :** Go to Step 7.

**NO :** Replace the injector relay. Then go to Step 20.





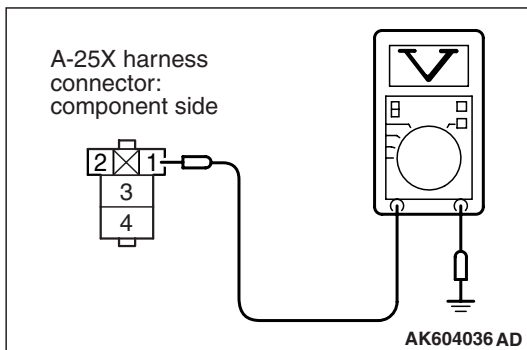
**STEP 7. Check for continuity at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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 8.

**NO :** Repair harness wire between injector relay connector A-25X (terminal No. 2) and ground because of open circuit or harness damage. Then go to Step 20.



**STEP 8. Measure the power supply voltage at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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.

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

**YES :** Go to Step 10.

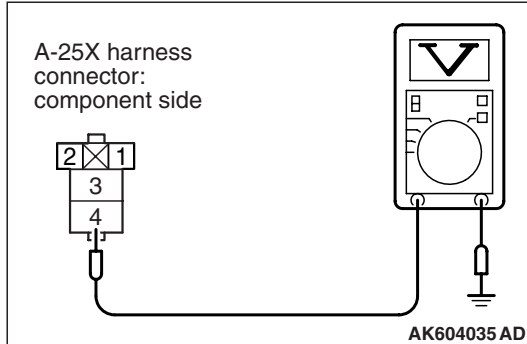
**NO :** Go to Step 9.

**STEP 9. Check harness connector C-304 at ETACS-ECU for damage.**

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

**YES :** Check harness connector C-50 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-25X (terminal No. 1) and ETACS-ECU connector C-304 (terminal No. 10) because of open circuit or short circuit to ground. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.




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**STEP 10. Measure the power supply voltage at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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 battery positive voltage.

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

**YES :** Go to Step 12.

**NO :** Go to Step 11.

---

**STEP 11. Check harness connector A-34X at MFI relay for damage.**
**Q: Is the harness connector in good condition?**

**YES :** Repair harness wire between MFI relay connector A-34X (terminal No. 2) and injector relay connector A-25X (terminal No. 4) because of open circuit or short circuit to ground. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 12. Check for open circuit or short circuit to ground between injector relay connector A-25X (terminal No. 3) and No. 1 cylinder injector connector B-101 (terminal No. 1).**

*NOTE: Check harness connector after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20 .*

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

**YES :** Go to Step 13.

**NO :** Repair it. Then go to Step 20.

---

**STEP 13. Check harness connector C-304 at ETACS-ECU for damage.**

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

**YES :** Check harness connector C-50 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-25X (terminal No. 1) and ETACS-ECU connector C-304 (terminal No. 10) because of harness damage. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 14. Check harness connector A-34X at MFI relay 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 20.

---

**STEP 15. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and injector relay connector A-25X (terminal No. 4).**

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

**YES :** Go to Step 16.

**NO :** Repair it. Then go to Step 20.

---

**STEP 16. Check for harness damage between injector relay connector A-25X (terminal No. 3) and No. 1 cylinder injector connector B-101 (terminal No. 1).**

*NOTE: Check harness after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20 .*

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

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 20.

---

**STEP 17. Check harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 18.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 18. Check for open circuit and short circuit to ground and harness damage between No. 1 cylinder injector connector B-101 (terminal No. 2) and ECM connector B-09 (terminal No. 2).**

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

**YES** : Go to Step 19.

**NO** : Repair it. Then go to Step 20.

**STEP 19. 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 measuring with the ECM side connector, disconnect all ECM connectors. Connect the 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) Measure the waveform.

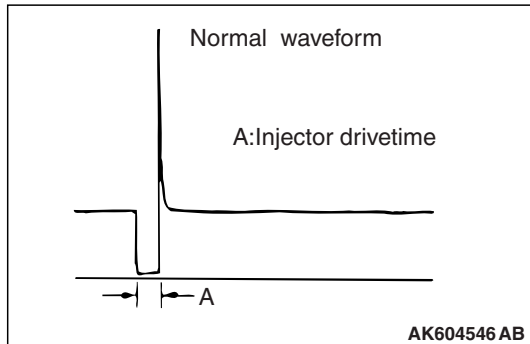
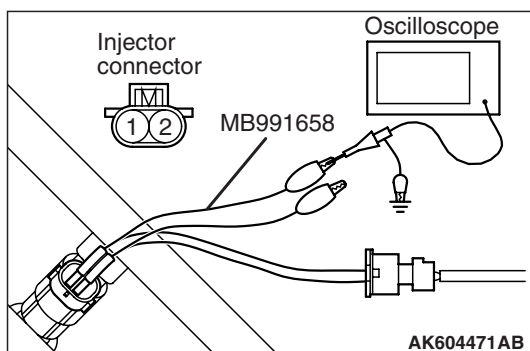
- The waveform should show a normal pattern similar to the illustration.

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

**Q: Is the waveform 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.00-15](#).

**NO** : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.13A-9](#).

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

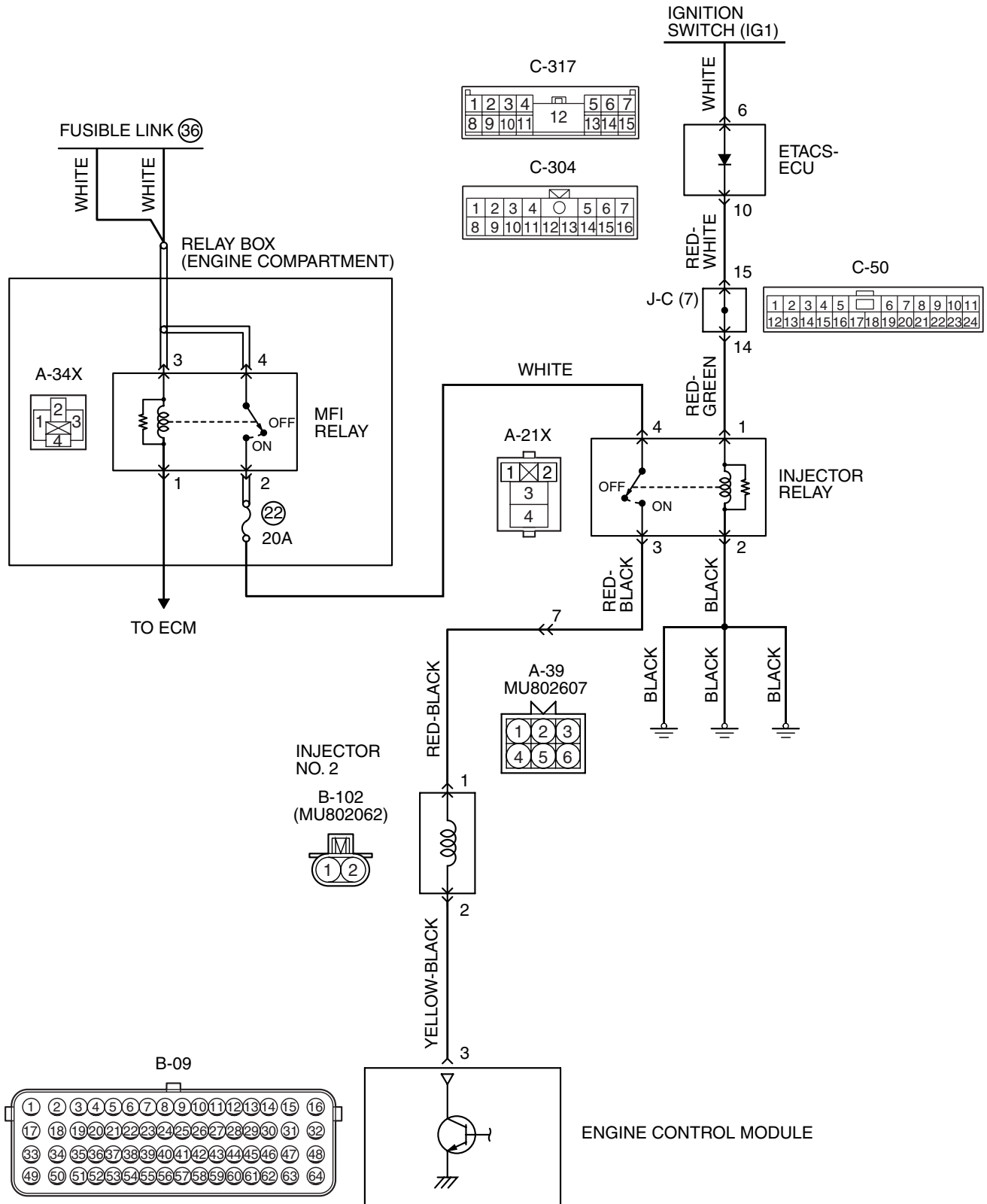
**Q: Is DTC P0201 set?**

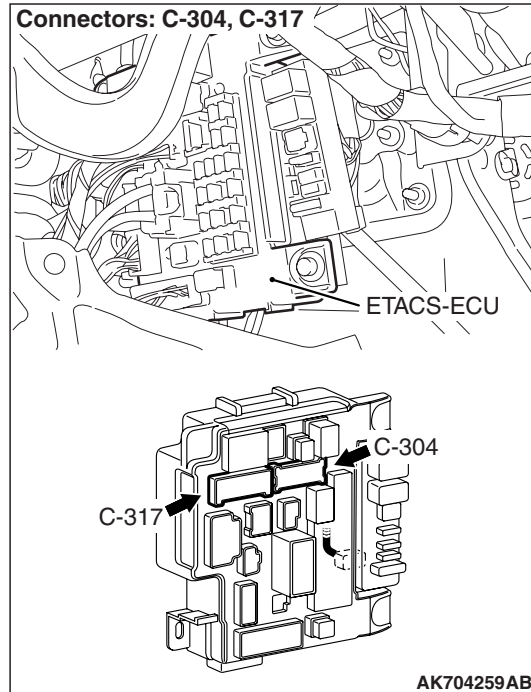
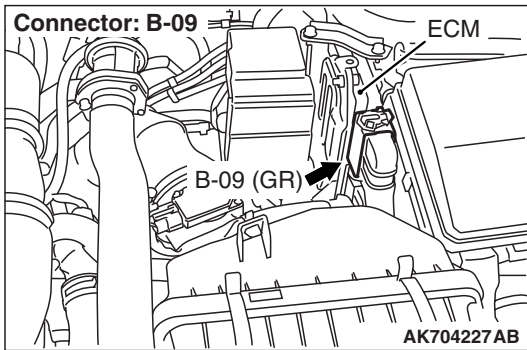
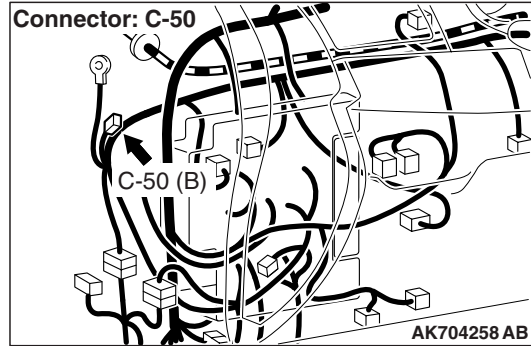
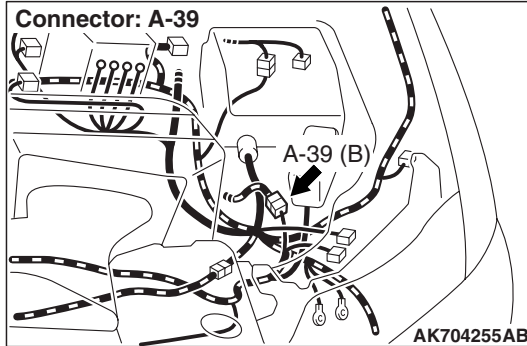
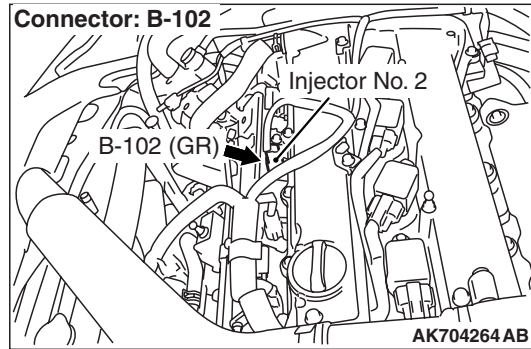
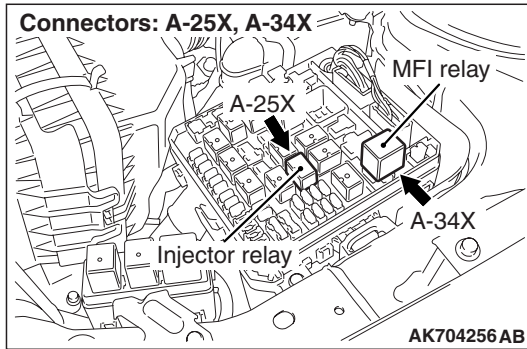
**YES** : Retry the troubleshooting.

**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)

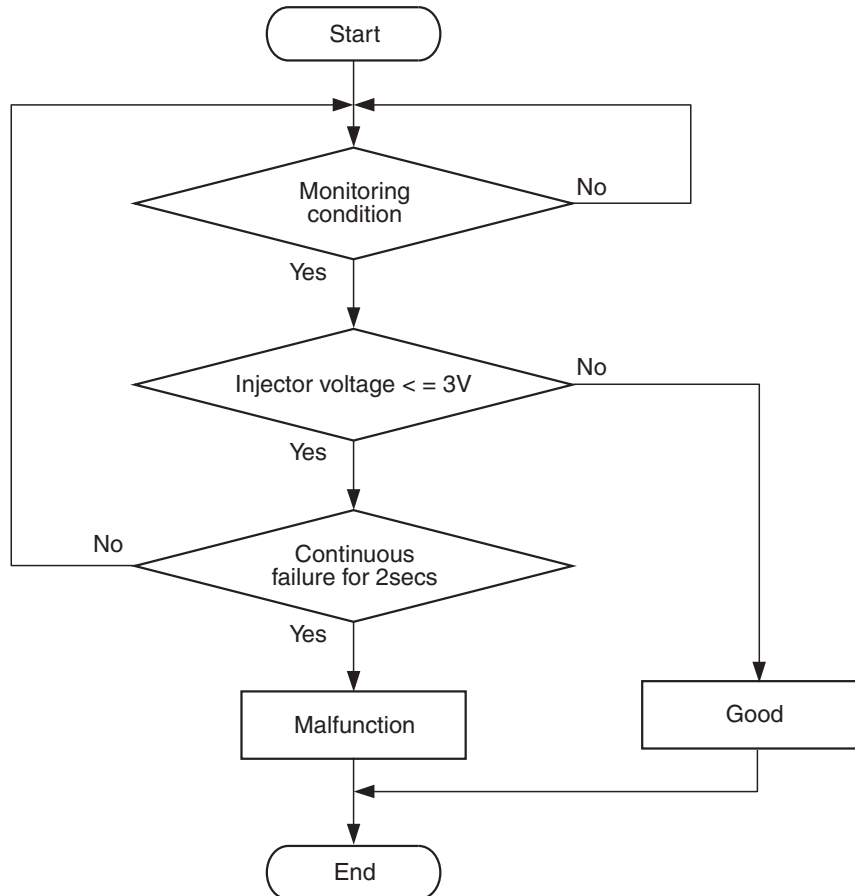
- Not applicable

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**

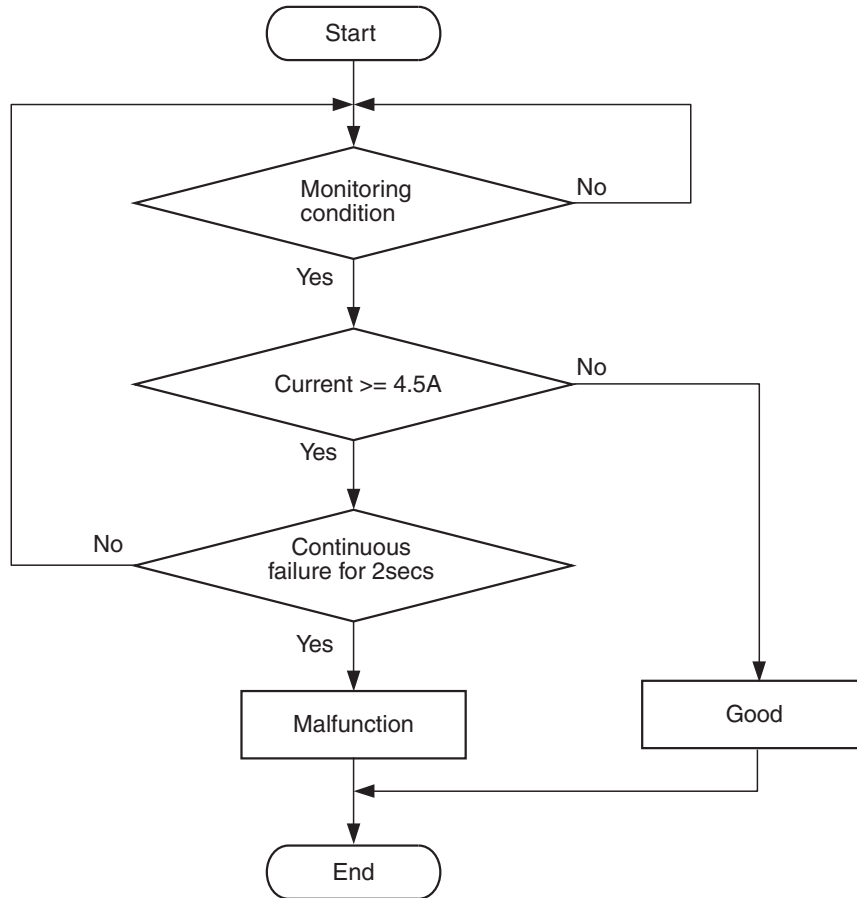
- Engine is running.

**Judgement Criterion**

- The supply voltage is 3 volts or less 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 4.5 ampere or more 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.13A-9](#).

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

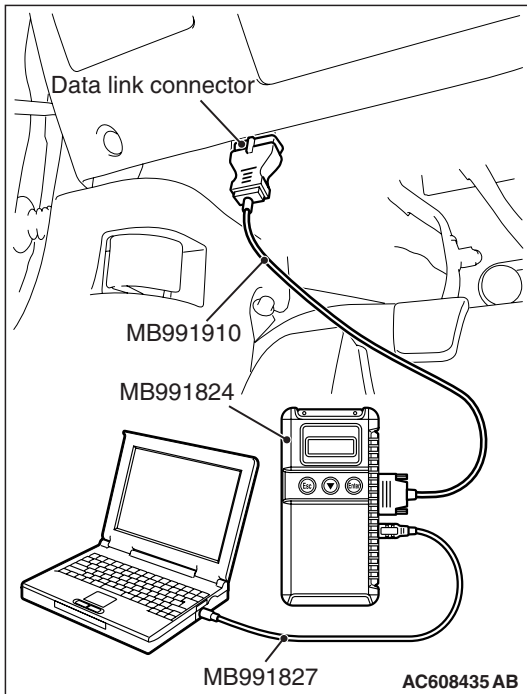
- No. 2 cylinder injector failed.
- Open or shorted No. 2 cylinder injector circuit, harness damage or connector damage.
- ECM failed.

**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) Set scan tool MB991958 to the actuator testing mode for item 1, Injectors.
- (4) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
  - 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.00-15.

**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 20.

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

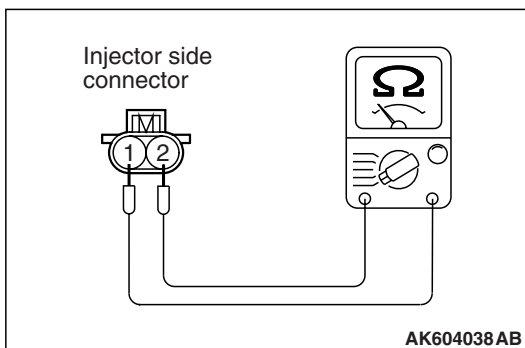
- (1) Disconnect the No. 2 cylinder injector connector B-102.
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

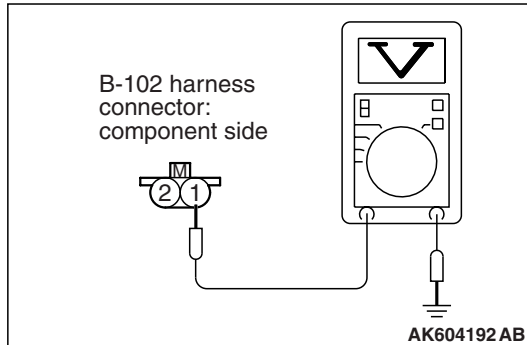
**Standard value: 10.5 –13.5 Ω [at 20° C (68° F)]**

**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 20.





**STEP 4. Measure the power supply voltage at No. 2 cylinder injector connector.**

- (1) Disconnect 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 14.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-25X at injector relay for damage.**

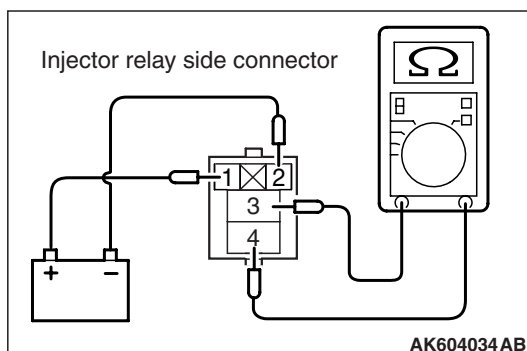
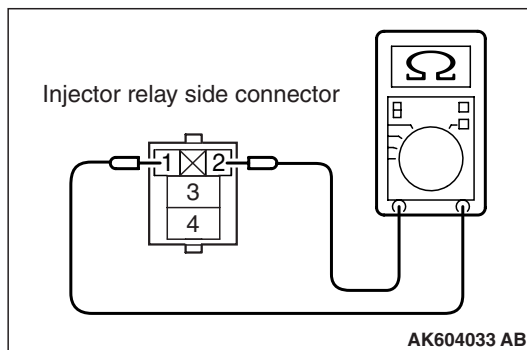
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 6.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**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.

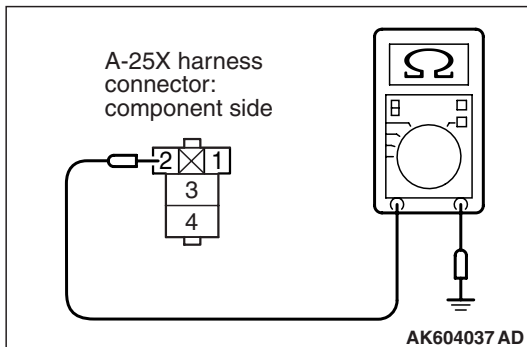


- (3) Use jumper wires to connect injector relay terminal No. 1 to the positive battery terminal and terminal No. 2 to the negative battery terminal.
- (4) Check for continuity between the injector relay terminal No. 3 and No. 4 while connecting and disconnecting the jumper wire at the negative battery 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 :** Go to Step 7.

**NO :** Replace the injector relay. Then go to Step 20.



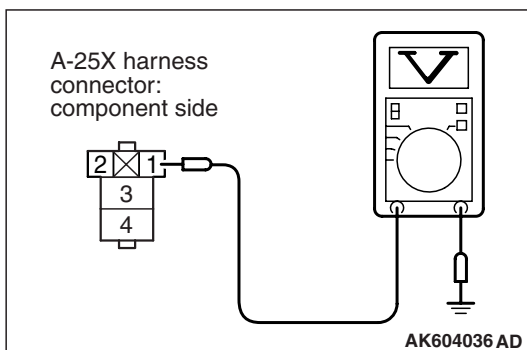
**STEP 7. Check for continuity at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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 8.

**NO :** Repair harness wire between injector relay connector A-25X (terminal No. 2) and ground because of open circuit or harness damage. Then go to Step 20.



**STEP 8. Measure the power supply voltage at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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.

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

**YES :** Go to Step 10.

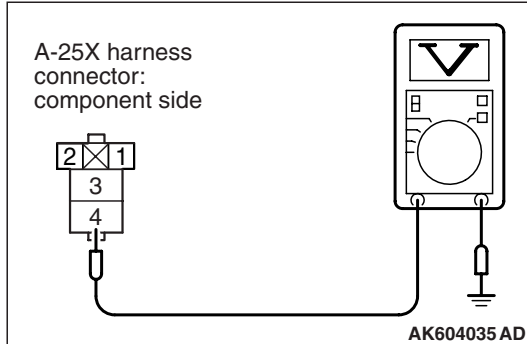
**NO :** Go to Step 9.

**STEP 9. Check harness connector C-304 at ETACS-ECU for damage.**

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

**YES :** Check harness connector C-50 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-25X (terminal No. 1) and ETACS-ECU connector C-304 (terminal No. 10) because of open circuit or short circuit to ground. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 20.




---

**STEP 10. Measure the power supply voltage at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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 battery positive voltage.

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

**YES :** Go to Step 12.

**NO :** Go to Step 11.

---

**STEP 11. Check harness connector A-34X at MFI relay for damage.**
**Q: Is the harness connector in good condition?**

**YES :** Repair harness wire between MFI relay connector A-34X (terminal No. 2) and injector relay connector A-25X (terminal No. 4) because of open circuit or short circuit to ground. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 12. Check for open circuit or short circuit to ground between injector relay connector A-25X (terminal No. 3) and No. 2 cylinder injector connector B-102 (terminal No. 1).**

*NOTE: Check harness after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20 .*

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

**YES :** Go to Step 13.

**NO :** Repair it. Then go to Step 20.

---

**STEP 13. Check harness connector C-304 at ETACS-ECU for damage.**

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

**YES :** Check harness connector C-50 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-25X (terminal No. 1) and ETACS-ECU connector C-304 (terminal No. 10) because of harness damage. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 14. Check harness connector A-34X at MFI relay 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 20.

---

**STEP 15. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and injector relay connector A-25X (terminal No. 4).**

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

**YES :** Go to Step 16.

**NO :** Repair it. Then go to Step 20.

---

**STEP 16. Check for harness damage between injector relay connector A-25X (terminal No. 3) and No. 2 cylinder injector connector B-102 (terminal No. 1).**

*NOTE: Check harness after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20 .*

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

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 20.

---

**STEP 17. Check harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 18.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 18. Check for open circuit and short circuit to ground and harness damage between No. 2 cylinder injector connector B-102 (terminal No. 2) and ECM connector B-09 (terminal No. 3).**

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

**YES :** Go to Step 19.

**NO :** Repair it. Then go to Step 20.

**STEP 19. 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 measuring with the ECM side connector, disconnect all ECM connectors. Connect the 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) Measure the waveform.

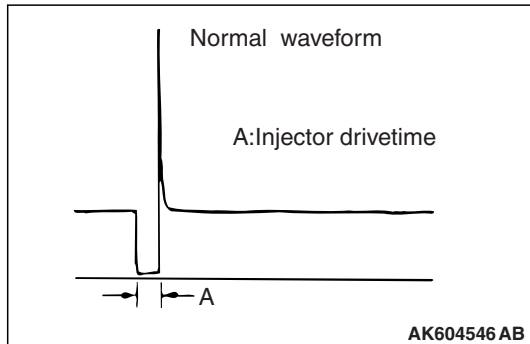
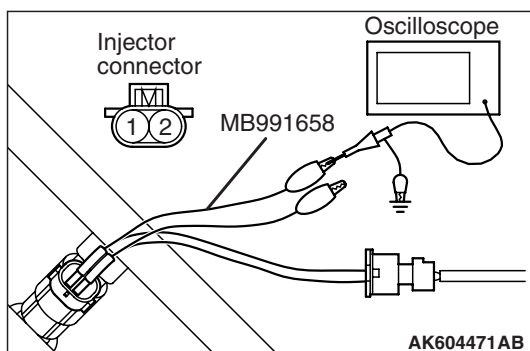
- The waveform should show a normal pattern similar to the illustration.

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

**Q: Is the waveform 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.00-15.

**NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. 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.13A-9.

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

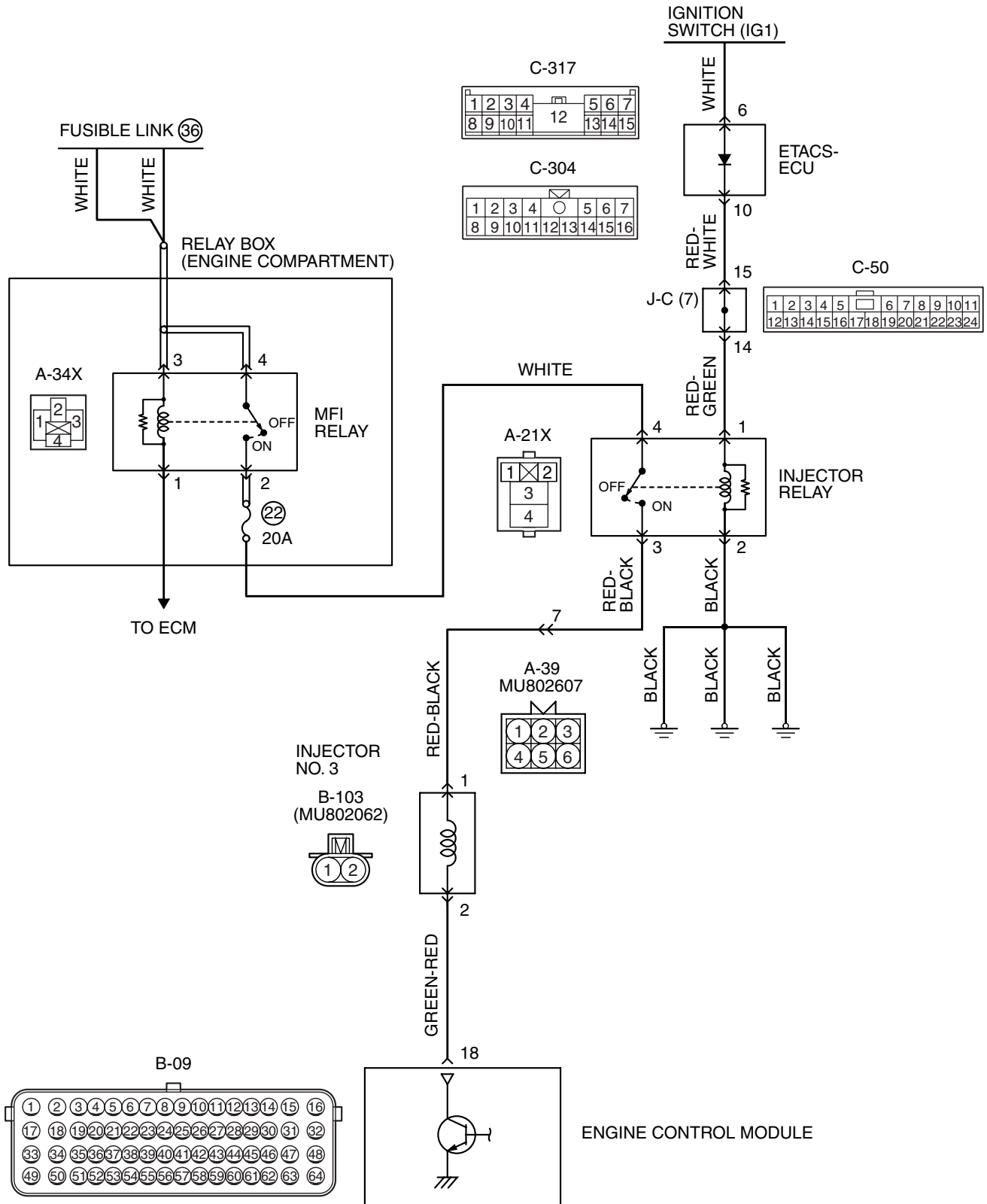
**Q: Is DTC P0202 set?**

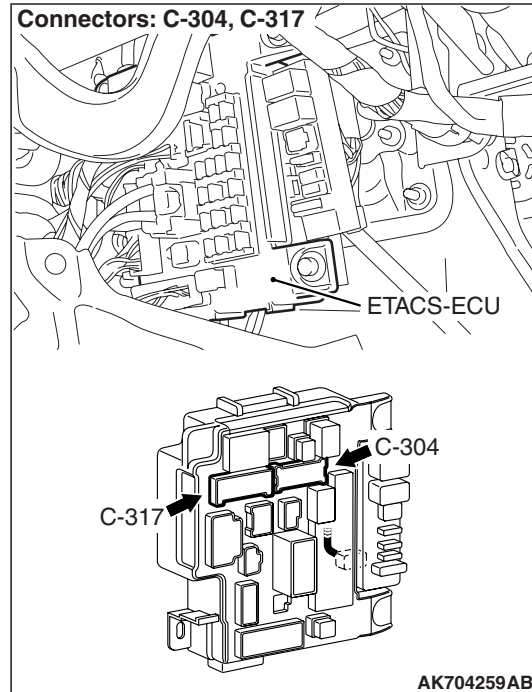
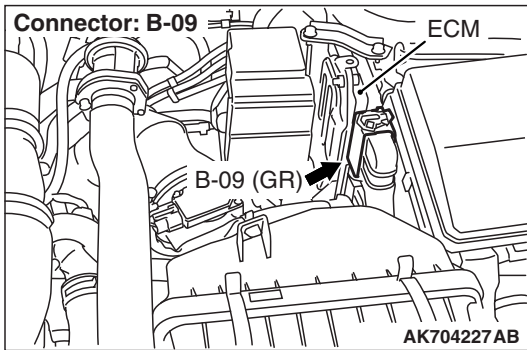
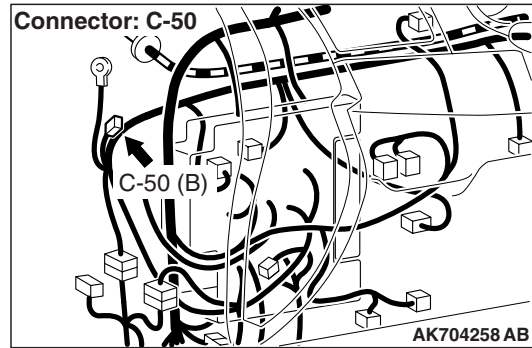
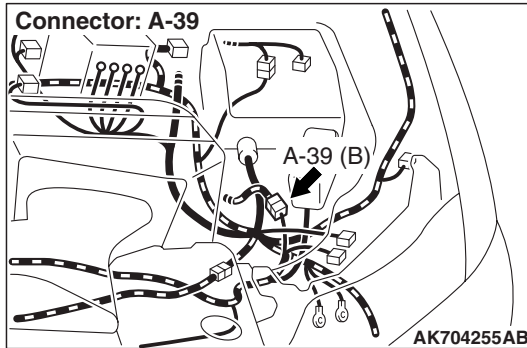
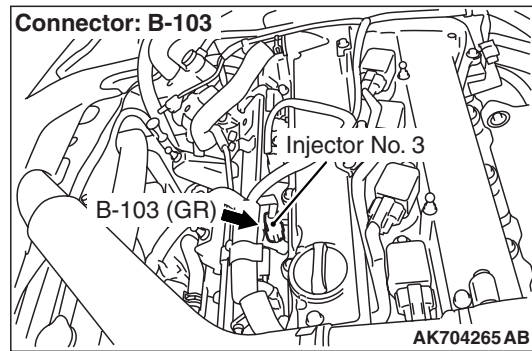
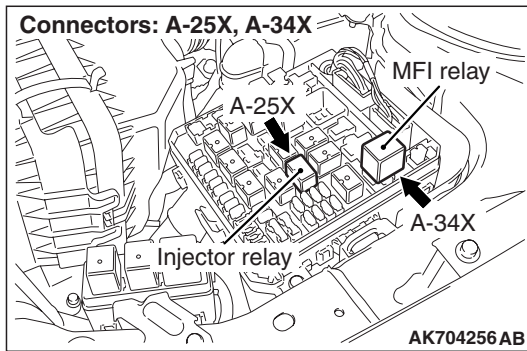
**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

DTC P0203: Injector Circuit-Cylinder 3

INJECTOR CIRCUIT-CYLINDER 3





**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)

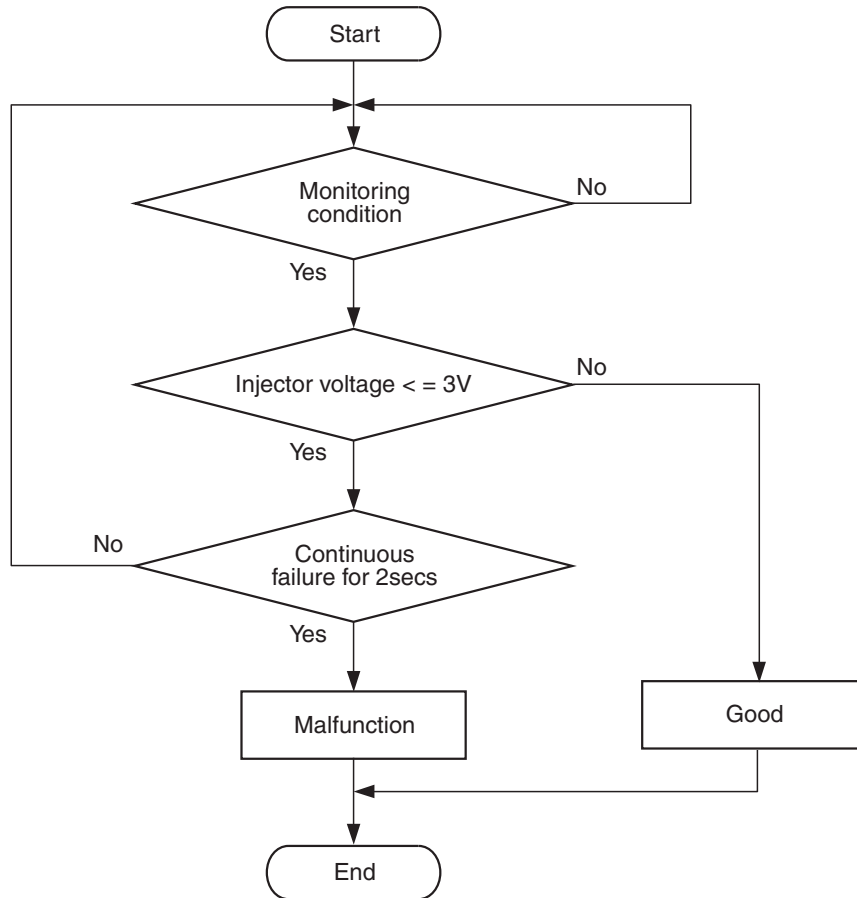
- Not applicable

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**

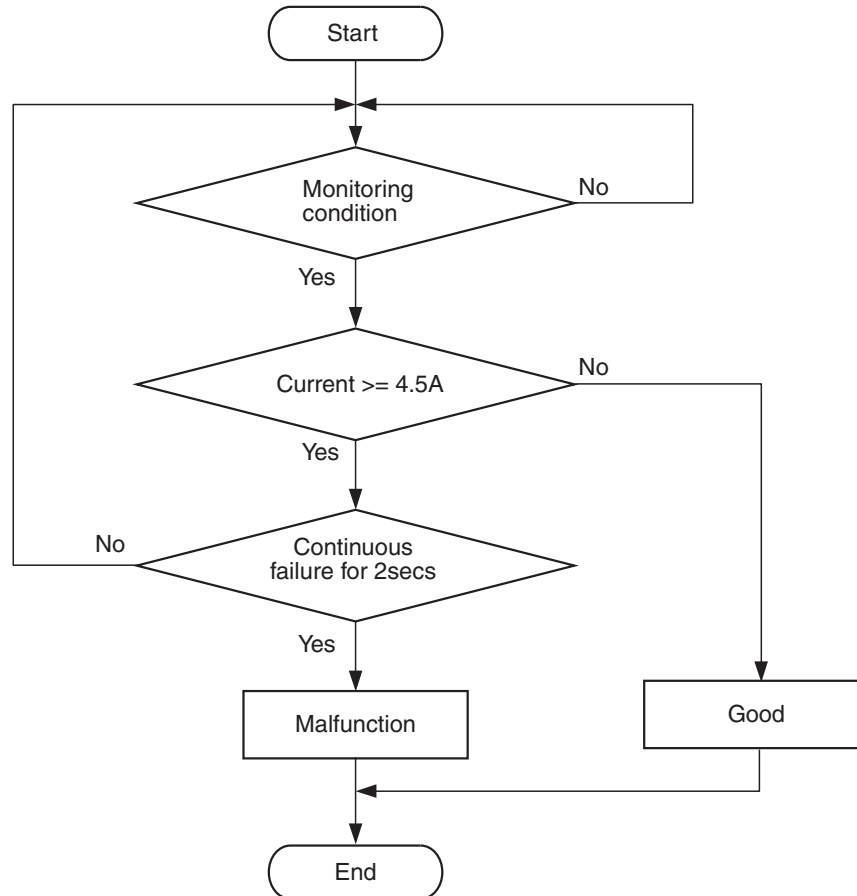
- Engine is running.

**Judgement Criterion**

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

## DTC SET CONDITIONS &lt;Circuit continuity –shorted high&gt;

## Logic Flow Chart



AK604332

**Check Condition**

- Engine is running.

**Judgement Criterion**

- The coil current is 4.5 ampere or more with the injector driving for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

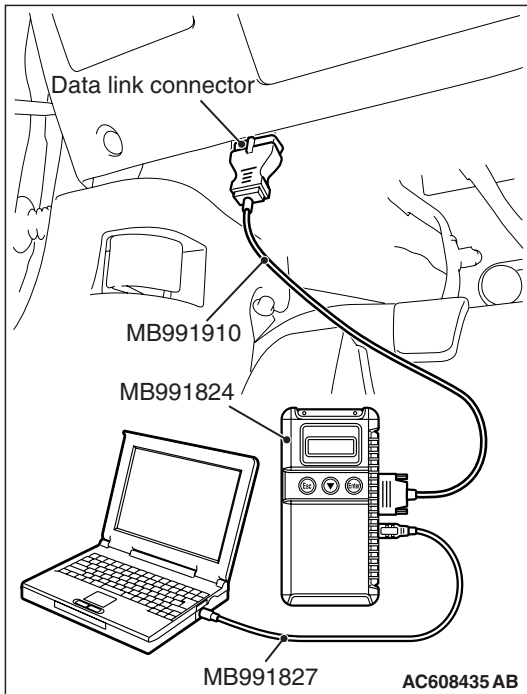
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

**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) Set scan tool MB991958 to the actuator testing mode for item 1, Injectors.
- (4) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
  - 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.00-15.

**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 20.

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

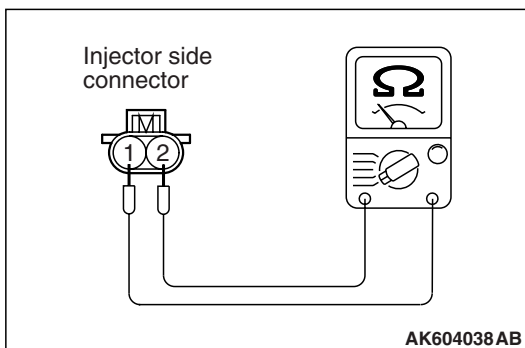
- (1) Disconnect the No. 3 cylinder injector connector B-103.
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

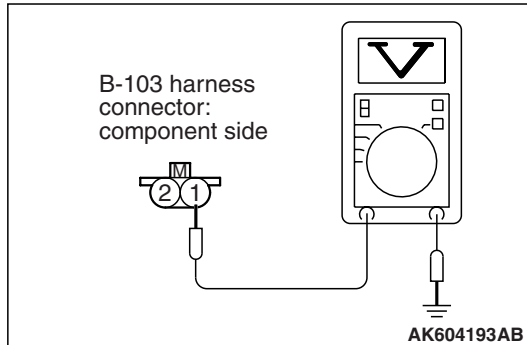
**Standard value: 10.5 –13.5 Ω [at 20° C (68° F)]**

**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 20.





**STEP 4. Measure the power supply voltage at No. 3 cylinder injector connector.**

- (1) Disconnect 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 14.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-25X at injector relay for damage.**

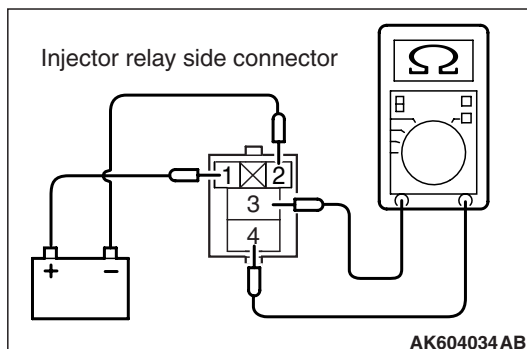
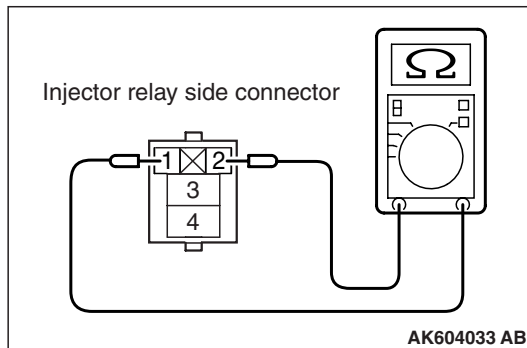
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 6.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**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.

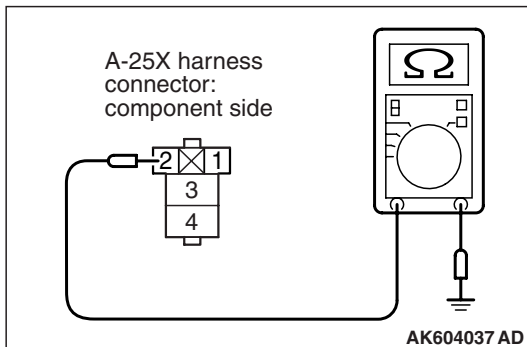


- (3) Use jumper wires to connect injector relay terminal No. 1 to the positive battery terminal and terminal No. 2 to the negative battery terminal.
- (4) Check for continuity between the injector relay terminal No. 3 and No. 4 while connecting and disconnecting the jumper wire at the negative battery 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 :** Go to Step 7.

**NO :** Replace the injector relay. Then go to Step 20.



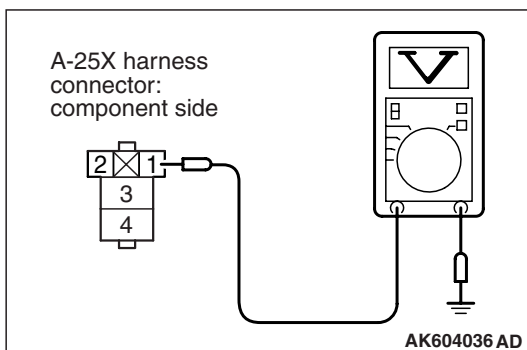
**STEP 7. Check for continuity at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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 8.

**NO :** Repair harness wire between injector relay connector A-25X (terminal No. 2) and ground because of open circuit or harness damage. Then go to Step 20.



**STEP 8. Measure the power supply voltage at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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.

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

**YES :** Go to Step 10.

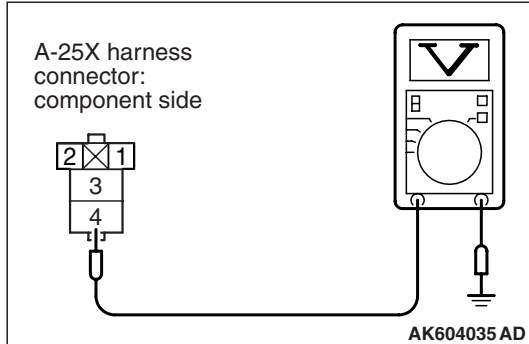
**NO :** Go to Step 9.

**STEP 9. Check harness connector C-304 at ETACS-ECU for damage.**

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

**YES :** Check harness connector C-50 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-25X (terminal No. 1) and ETACS-ECU connector C-304 (terminal No. 10) because of open circuit or short circuit to ground. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.




---

**STEP 10. Measure the power supply voltage at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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 battery positive voltage.

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

**YES :** Go to Step 12.

**NO :** Go to Step 11.

---

**STEP 11. Check harness connector A-34X at MFI relay for damage.**

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

**YES :** Repair harness wire between MFI relay connector A-34X (terminal No. 2) and injector relay connector A-25X (terminal No. 4) because of open circuit or short circuit to ground. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 12. Check for open circuit or short circuit to ground between injector relay connector A-25X (terminal No. 3) and No. 3 cylinder injector connector B-103 (terminal No. 1).**

*NOTE: Check harness after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20 .*

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

**YES :** Go to Step 13.

**NO :** Repair it. Then go to Step 20.

---

**STEP 13. Check harness connector C-304 at ETACS-ECU for damage.**

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

**YES :** Check harness connector C-50 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-25X (terminal No. 1) and ETACS-ECU connector C-304 (terminal No. 10) because of harness damage. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 14. Check harness connector A-34X at MFI relay 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 20.

---

**STEP 15. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and injector relay connector A-25X (terminal No. 4).**

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

**YES :** Go to Step 16.

**NO :** Repair it. Then go to Step 20.

---

**STEP 16. Check for harness damage between injector relay connector A-25X (terminal No. 3) and No. 3 cylinder injector connector B-103 (terminal No. 1).**

*NOTE: Check harness after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20 .*

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

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 20.

---

**STEP 17. Check harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 18.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 18. Check for open circuit and short circuit to ground and harness damage between No. 3 cylinder injector connector B-103 (terminal No. 2) and ECM connector B-09 (terminal No. 18).**

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

**YES :** Go to Step 19.

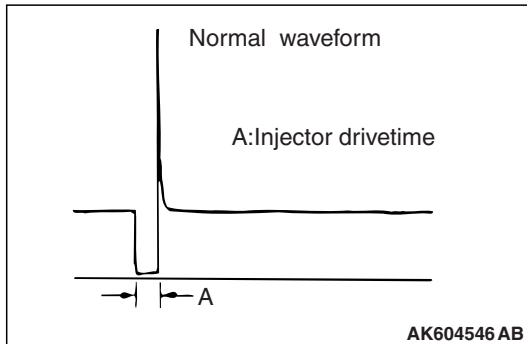
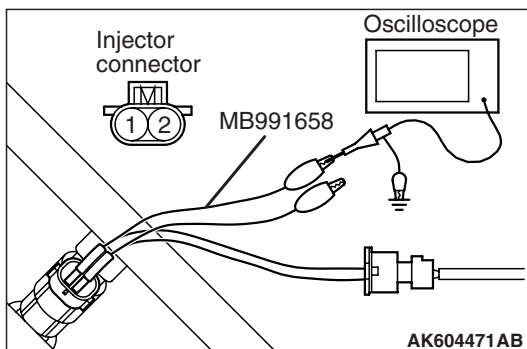
**NO :** Repair it. Then go to Step 20.

**STEP 19. 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 measuring with the ECM side connector, disconnect all ECM connectors. Connect the 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) Measure the waveform.
  - The waveform should show a normal pattern similar to the illustration.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the waveform 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.00-15.

**NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. 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.13A-9.
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0203 set?**

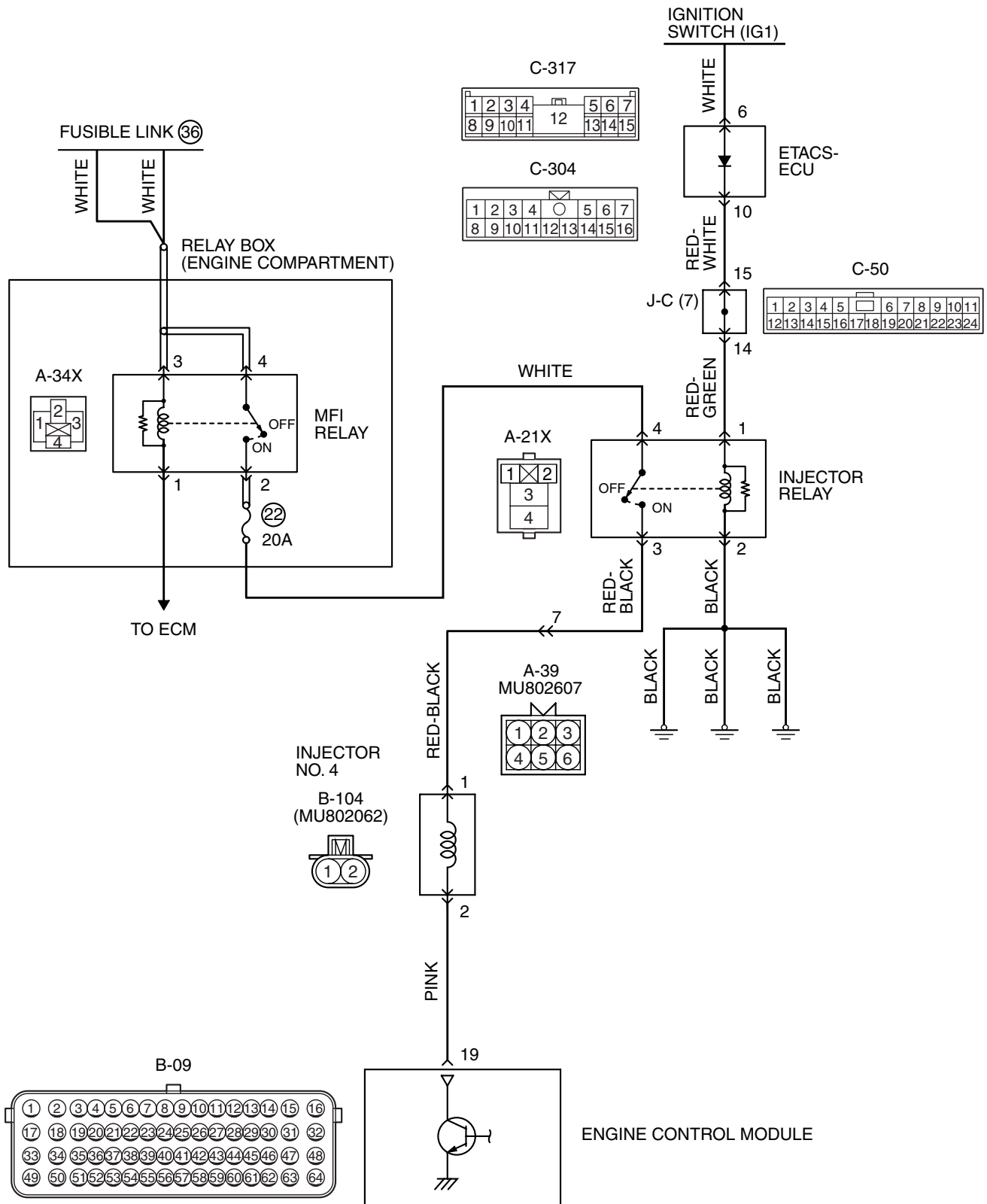
**YES :** Retry the troubleshooting.

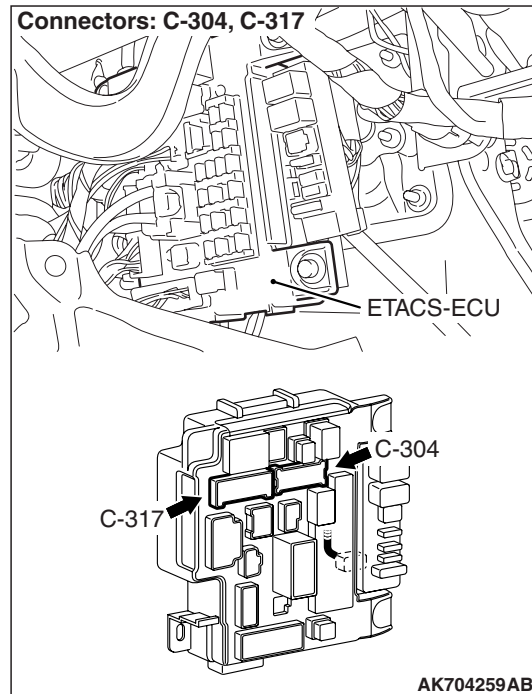
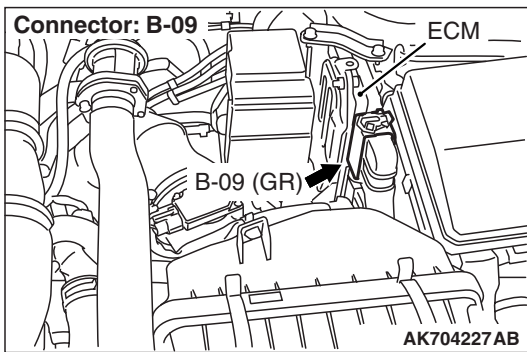
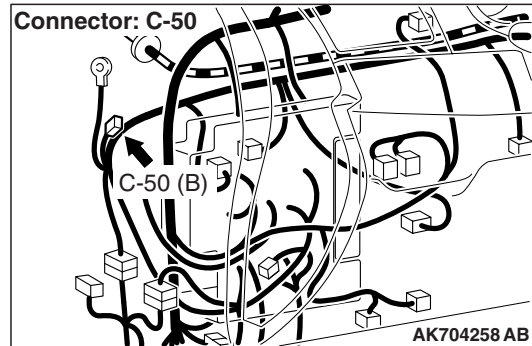
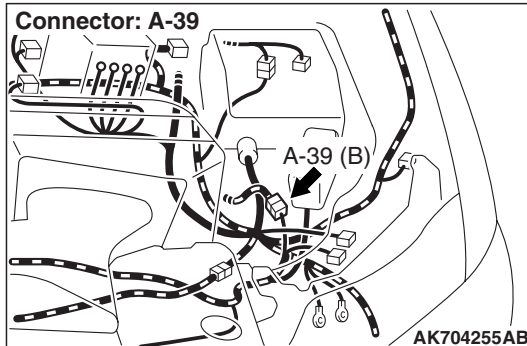
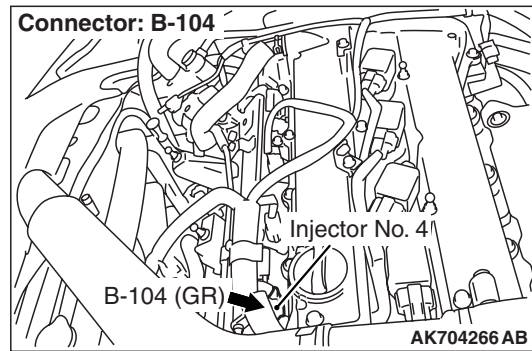
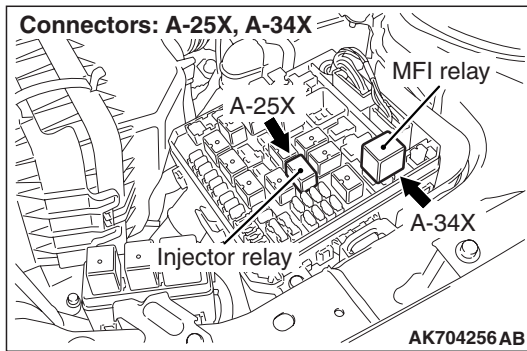
**NO :** The inspection is complete.



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)

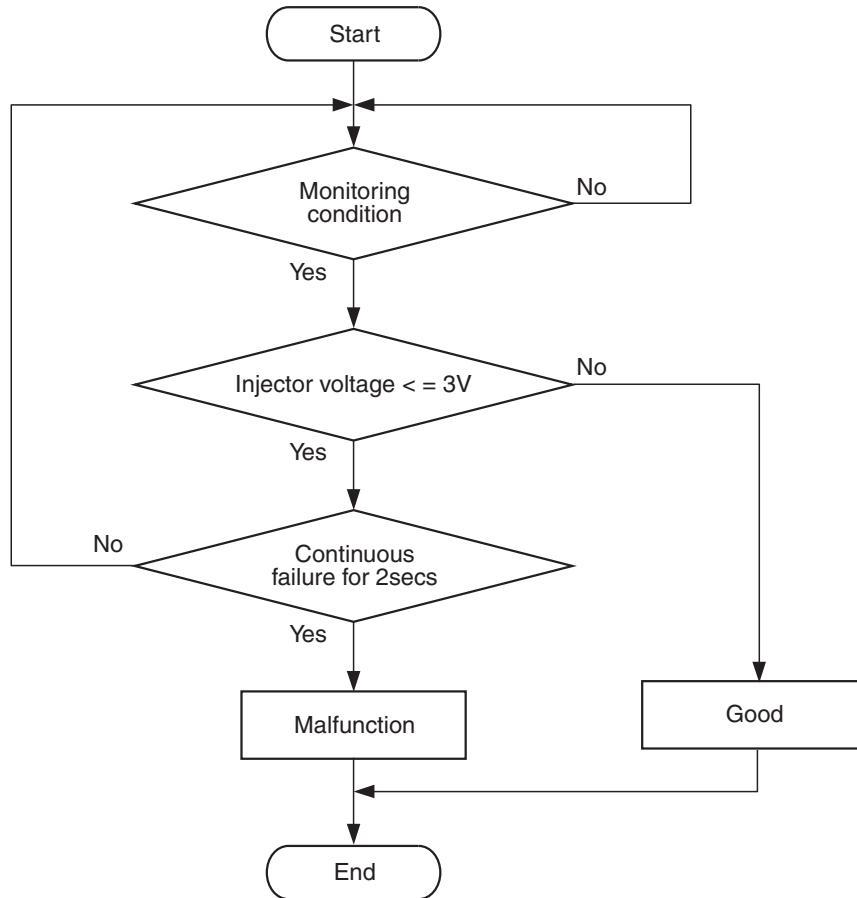
- Not applicable

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**

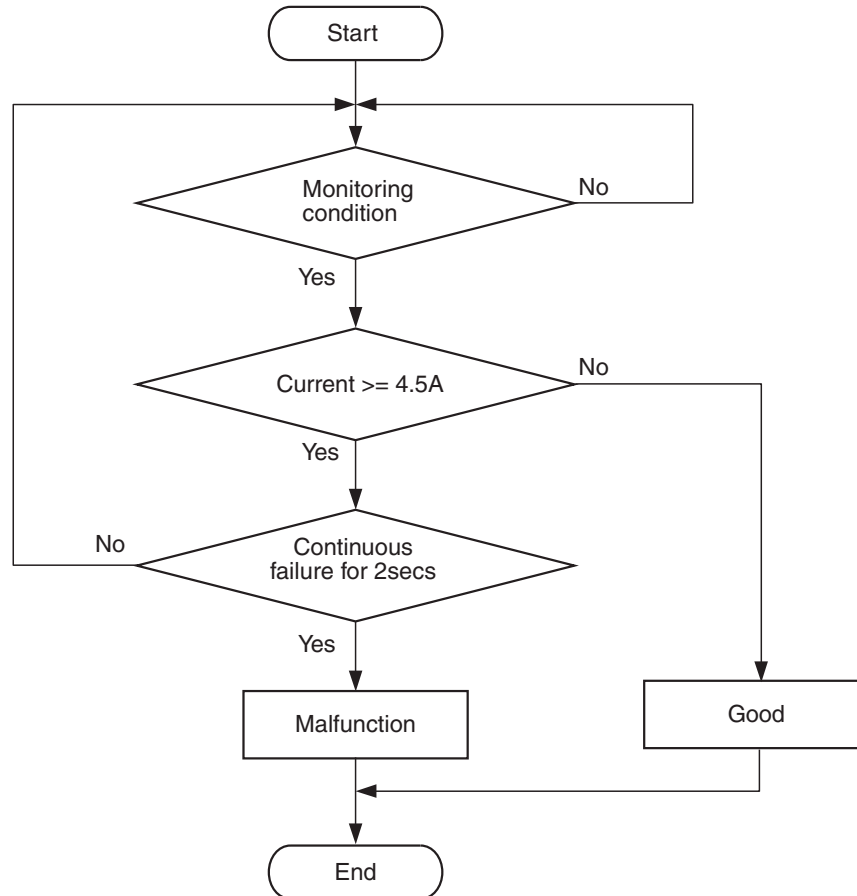
- Engine is running.

**Judgement Criterion**

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

## DTC SET CONDITIONS &lt;Circuit continuity –shorted high&gt;

## Logic Flow Chart



AK604332

**Check Condition**

- Engine is running.

**Judgement Criterion**

- The coil current is 4.5 ampere or more with the injector driving for 2 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

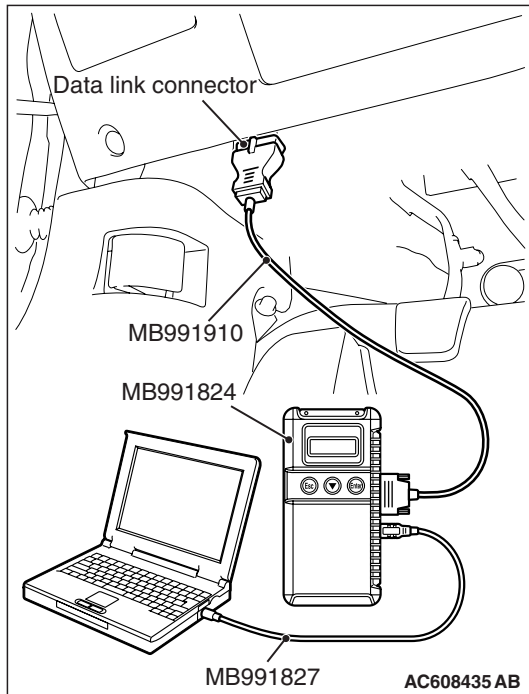
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

**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) Set scan tool MB991958 to the actuator testing mode for item 1, Injectors.
- (4) Warm up the engine to normal operating temperature: 80° C to 95° C (176° F to 203° F).
  - 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.00-15.

**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 20.

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

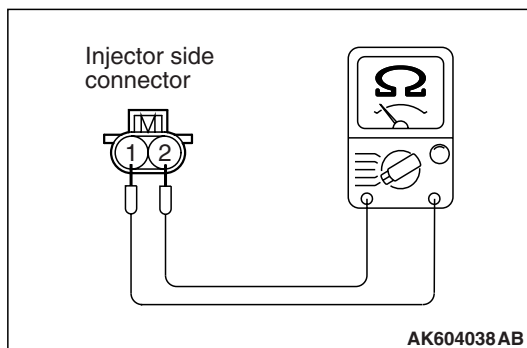
- (1) Disconnect the No. 4 cylinder injector connector B-104.
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

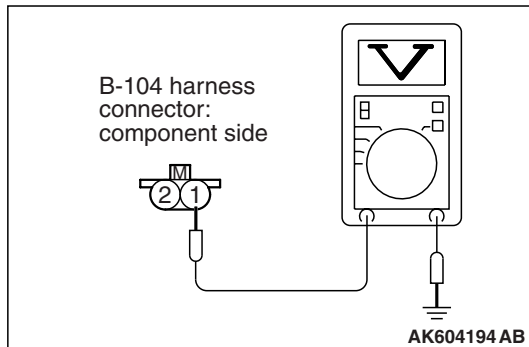
**Standard value: 10.5 –13.5 Ω [at 20° C (68° F)]**

**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 20.





**STEP 4. Measure the power supply voltage at No. 4 cylinder injector connector.**

- (1) Disconnect 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 14.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-25X at injector relay for damage.**

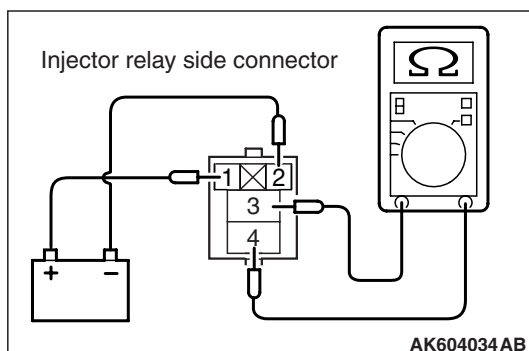
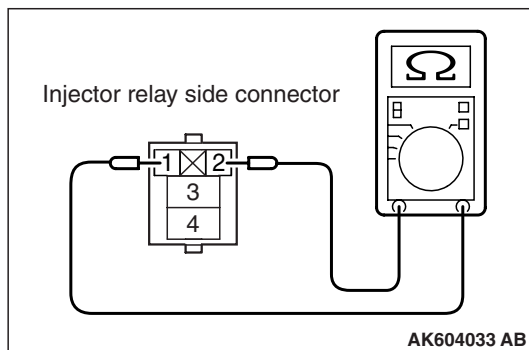
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 6.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**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.

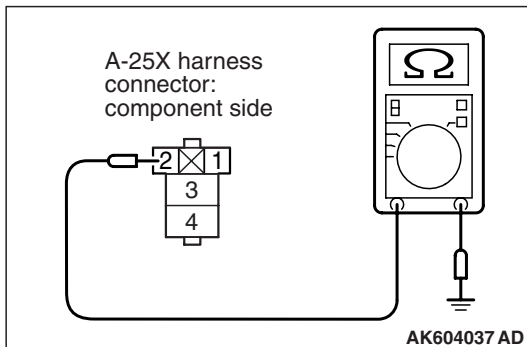


- (3) Use jumper wires to connect injector relay terminal No. 1 to the positive battery terminal and terminal No. 2 to the negative battery terminal.
- (4) Check for continuity between the injector relay terminal No. 3 and No. 4 while connecting and disconnecting the jumper wire at the negative battery 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 :** Go to Step 7.

**NO :** Replace the injector relay. Then go to Step 20.



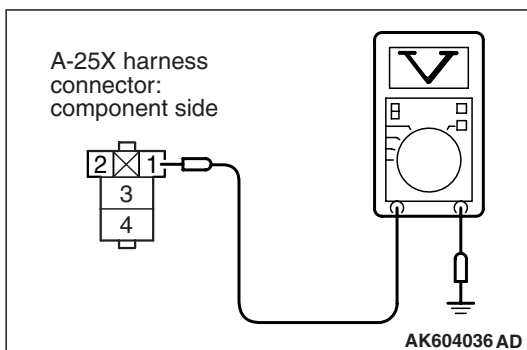
**STEP 7. Check for continuity at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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 8.

**NO :** Repair harness wire between injector relay connector A-25X (terminal No. 2) and ground because of open circuit or harness damage. Then go to Step 20.



**STEP 8. Measure the power supply voltage at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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.

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

**YES :** Go to Step 10.

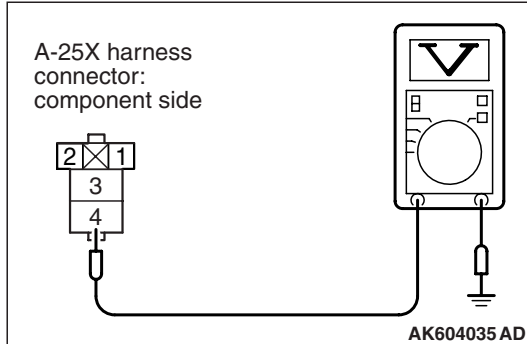
**NO :** Go to Step 9.

**STEP 9. Check harness connector C-304 at ETACS-ECU for damage.**

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

**YES :** Check harness connector C-50 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-25X (terminal No. 1) and ETACS-ECU connector C-304 (terminal No. 10) because of open circuit or short circuit to ground. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.




---

**STEP 10. Measure the power supply voltage at injector relay harness side connector A-25X.**

- (1) Disconnect the connector A-25X 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 battery positive voltage.

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

**YES :** Go to Step 12.

**NO :** Go to Step 11.

---

**STEP 11. Check harness connector A-34X at MFI relay for damage.**
**Q: Is the harness connector in good condition?**

**YES :** Repair harness wire between MFI relay connector A-34X (terminal No. 2) and injector relay connector A-25X (terminal No. 4) because of open circuit or short circuit to ground. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 12. Check for open circuit or short circuit to ground between injector relay connector A-25X (terminal No. 3) and No. 4 cylinder injector connector B-104 (terminal No. 1).**

*NOTE: Check harness after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20 .*

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

**YES :** Go to Step 13.

**NO :** Repair it. Then go to Step 20.



---

**STEP 13. Check harness connector C-304 at ETACS-ECU for damage.**

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

**YES :** Check harness connector C-50 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-25X (terminal No. 1) and ETACS-ECU connector C-304 (terminal No. 10) because of harness damage. Then go to Step 20.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 14. Check harness connector A-34X at MFI relay 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 20.

---

**STEP 15. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and injector relay connector A-25X (terminal No. 4).**

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

**YES :** Go to Step 16.

**NO :** Repair it. Then go to Step 20.

---

**STEP 16. Check for harness damage between injector relay connector A-25X (terminal No. 3) and No. 4 cylinder injector connector B-104 (terminal No. 1).**

*NOTE: Check harness after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20 .*

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

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 20.

---

**STEP 17. Check harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 18.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 18. Check for open circuit and short circuit to ground and harness damage between No. 4 cylinder injector connector B-104 (terminal No. 2) and ECM connector B-09 (terminal No. 19).**

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

**YES :** Go to Step 19.

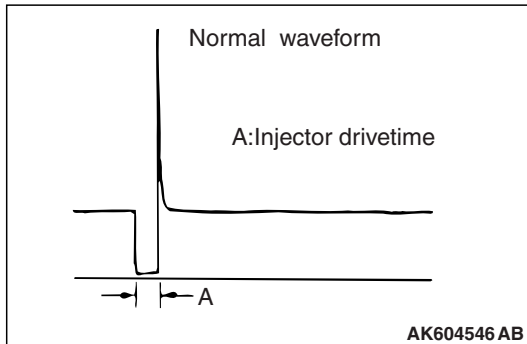
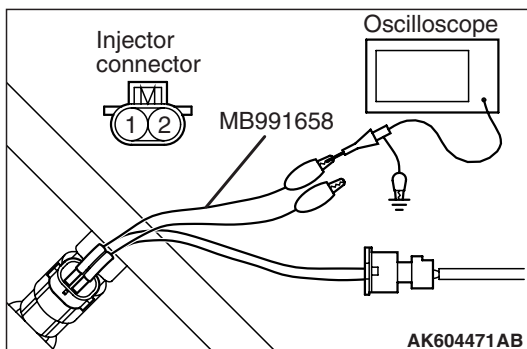
**NO :** Repair it. Then go to Step 20.

**STEP 19. 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 measuring with the ECM side connector, disconnect all ECM connectors. Connect the 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) Measure the waveform.
  - The waveform should show a normal pattern similar to the illustration.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the waveform 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.00-15.

**NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. 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.13A-9.
- (2) Check the diagnostic trouble code (DTC).

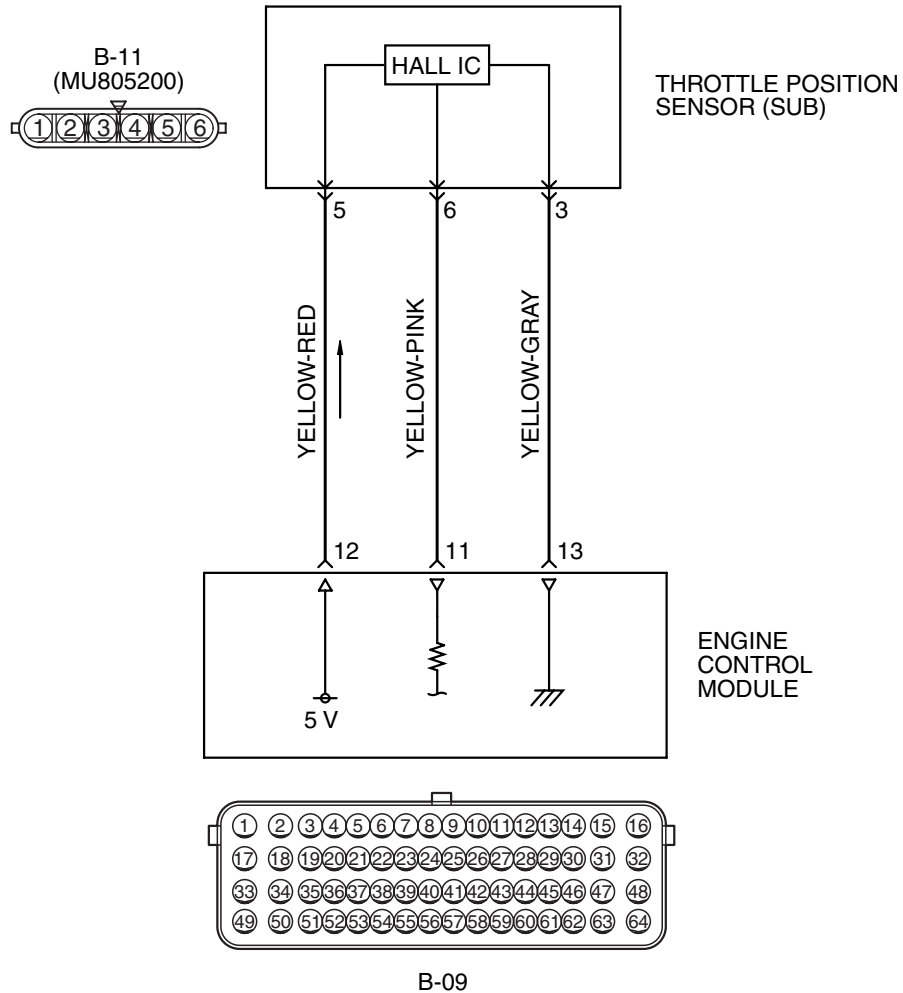
**Q: Is DTC P0204 set?**

**YES :** Retry the troubleshooting.

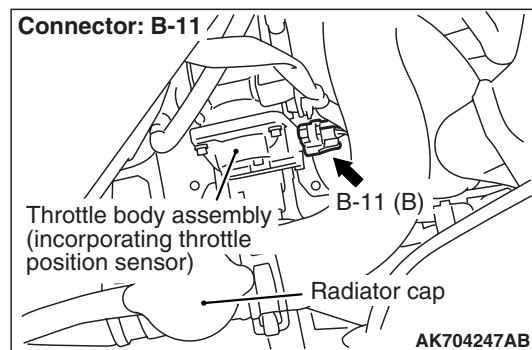
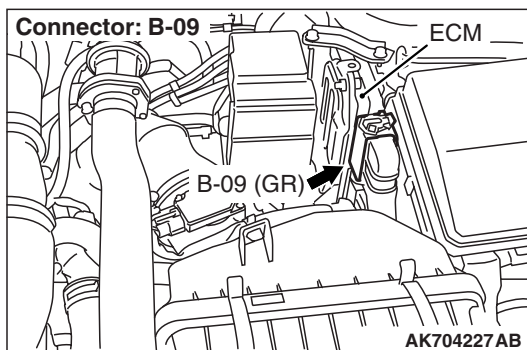
**NO :** The inspection is complete.

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

THROTTLE POSITION SENSOR (SUB) CIRCUIT



AK604243 AD



**CIRCUIT OPERATION**

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

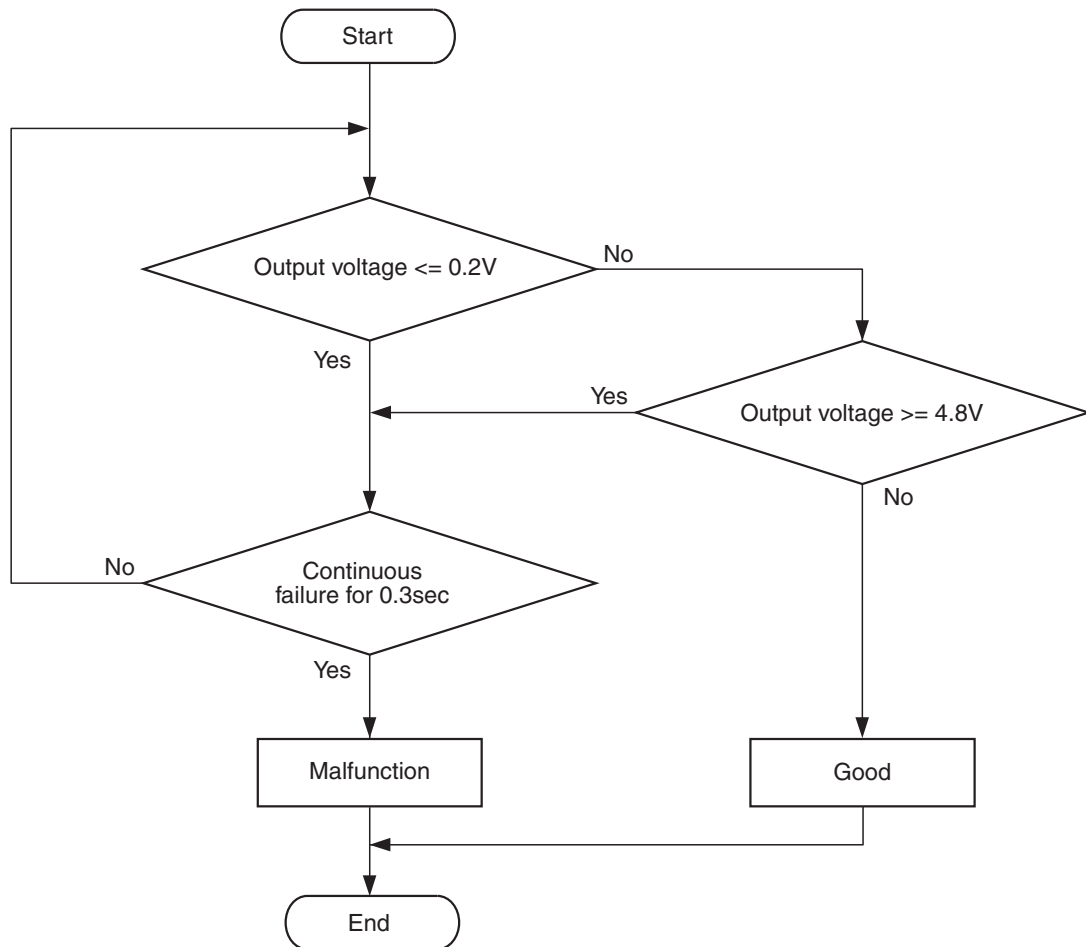
- Not applicable

**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 should be 0.2 volt or less 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) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (6) Set scan tool MB991958 to the data reading mode for item 15, Throttle Position Sensor (sub).
  - Output voltage should be 4.0 volts or more when the throttle valve is fully closed with your finger.
  - Output voltage should be 1.0 volt 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.00-15.

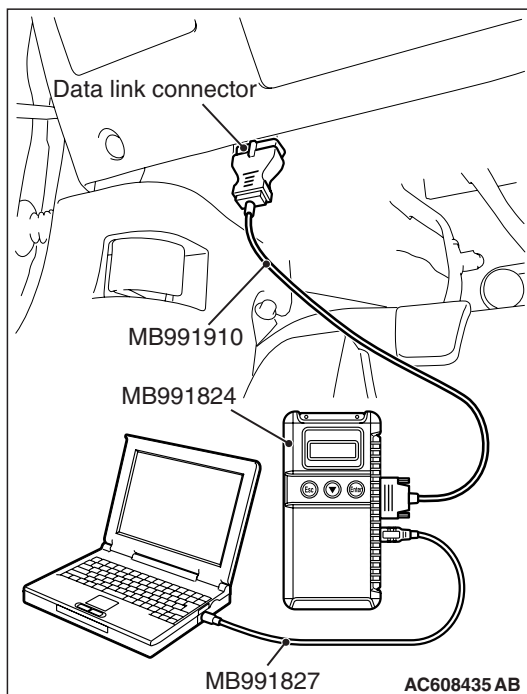
**NO** : Go to Step 2.

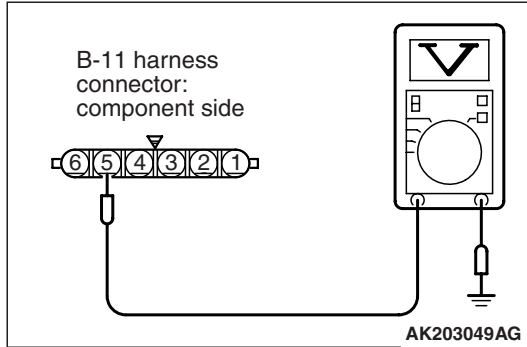
#### STEP 2. Check harness connector B-11 at throttle position sensor for damage.

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

**YES** : Go to Step 3.

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






---

**STEP 3. Measure the sensor supply voltage at throttle position sensor harness side connector B-11.**

- (1) Disconnect the connector B-11 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-09 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 throttle position sensor connector B-11 (terminal No. 5) and ECM connector B-09 (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) Turn the ignition switch to the "ON" position.
- (2) Detach the intake air hose at the throttle body.
- (3) Disconnect the connector of the throttle position sensor.
- (4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (5) Set scan tool MB991958 to the data reading mode for item 15, Throttle Position Sensor (sub).
  - Output voltage should be 4.0 volts or more when the throttle valve is fully closed with your finger.
  - Output voltage should be 1.0 volt 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.00-15](#).
- NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 11.

---

**STEP 7. Check harness connector B-09 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 throttle position sensor connector B-11 (terminal No. 5) and ECM connector B-09 (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 throttle position sensor connector B-11 (terminal No. 6) and ECM connector B-09 (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. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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?**

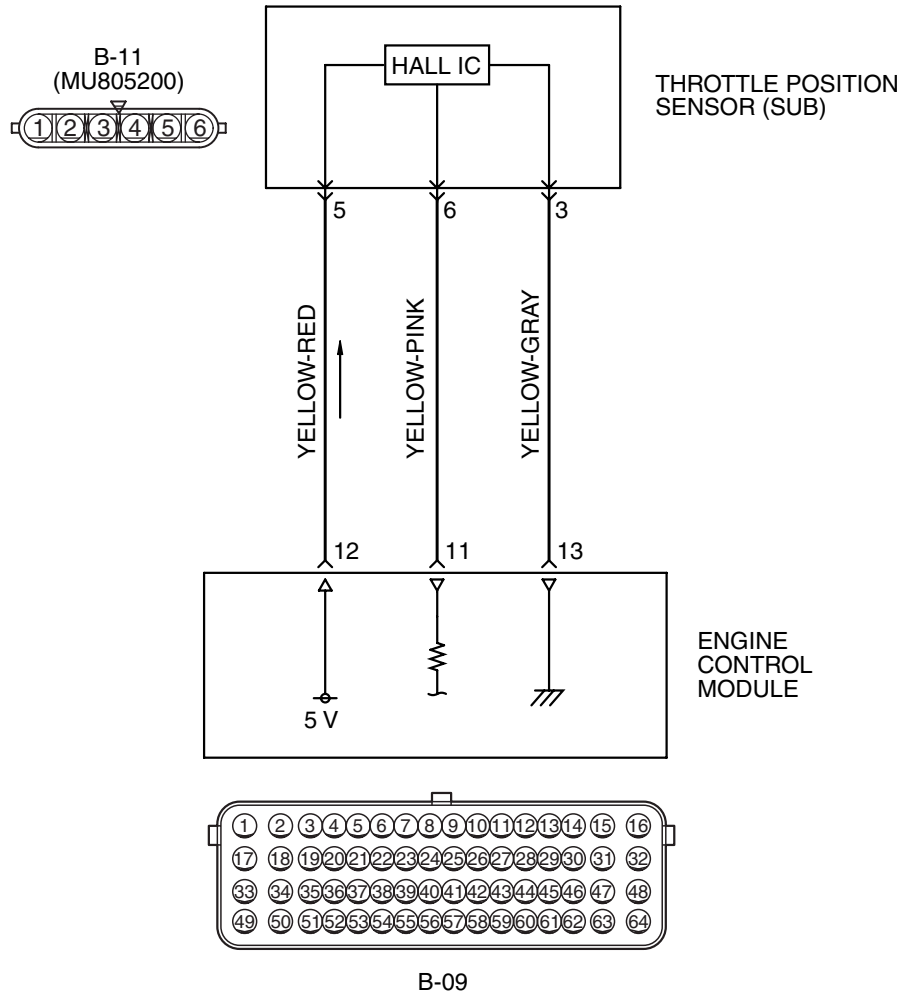
**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

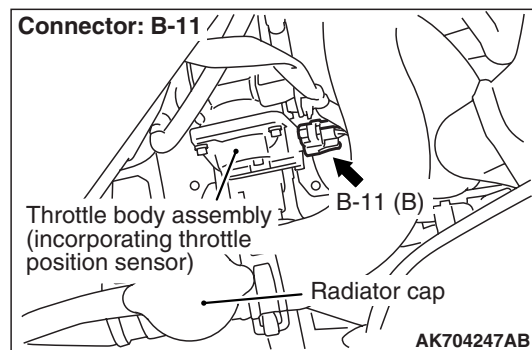
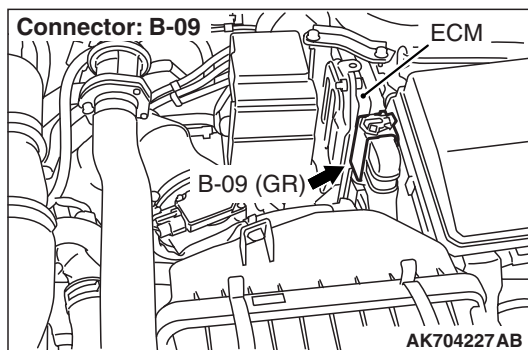


DTC P0223: Throttle Position Sensor (sub) Circuit High Input

THROTTLE POSITION SENSOR (SUB) CIRCUIT



AK604243 AD



CIRCUIT OPERATION

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

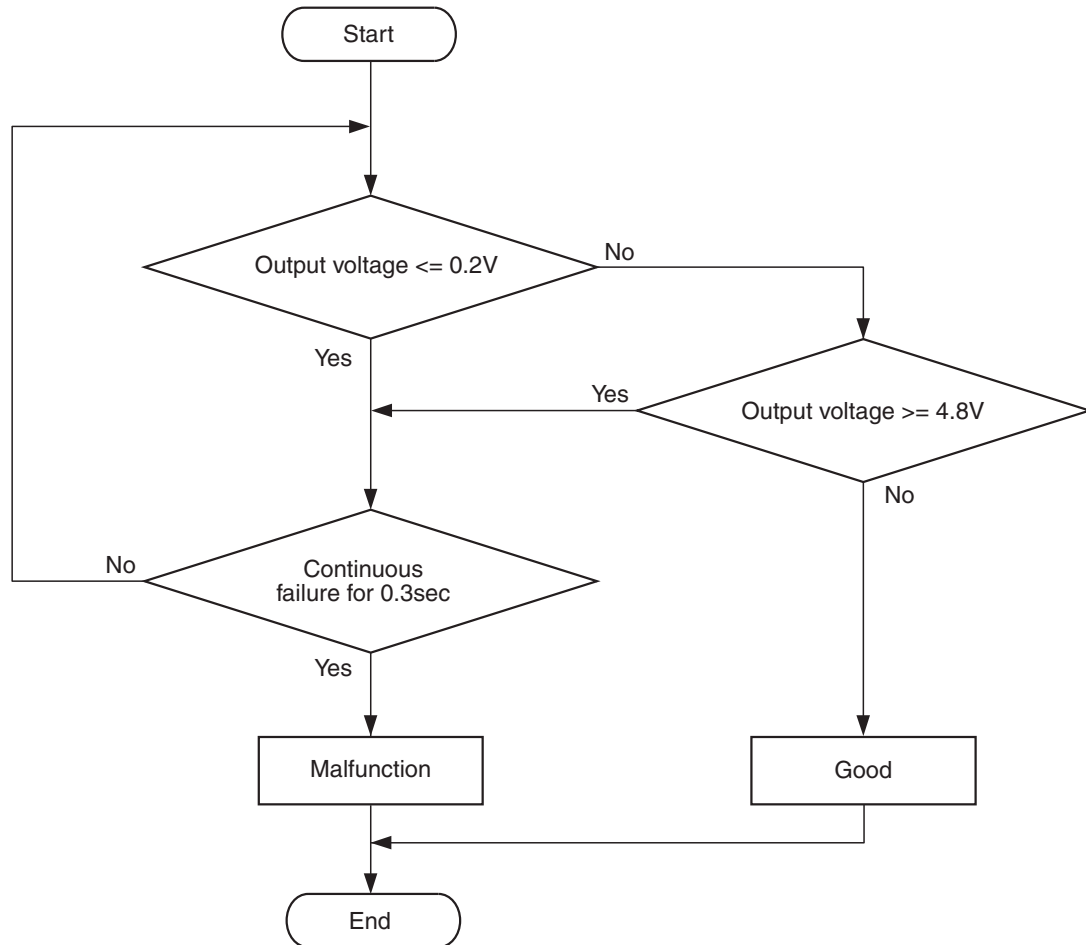
- Not applicable

**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 should be 4.8 volts or more 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) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (6) Set scan tool MB991958 to the data reading mode for item 15, Throttle Position Sensor (sub).
  - Output voltage should be 4.0 volts or more when the throttle valve is fully closed with your finger.
  - Output voltage should be 1.0 volt 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.00-15.

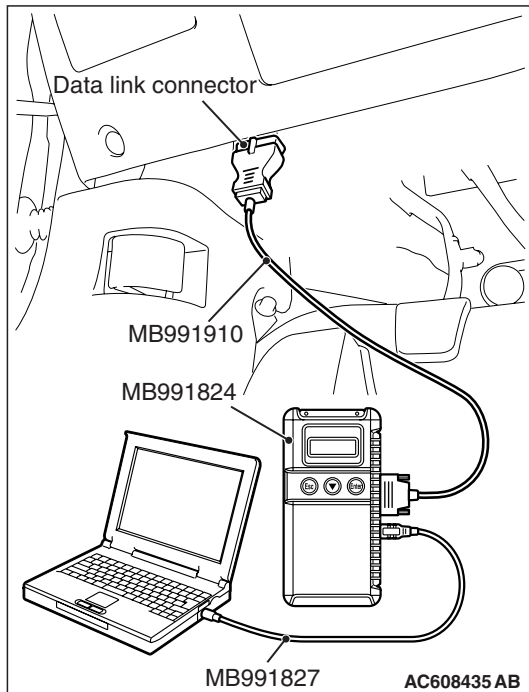
**NO :** Go to Step 2.

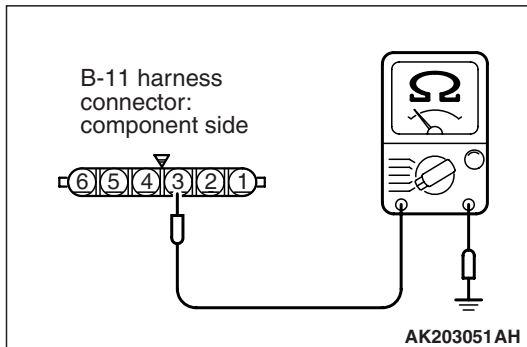
**STEP 2. Check harness connector B-11 at throttle position sensor for damage.**

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

**YES :** Go to Step 3.

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






---

**STEP 3. Check the continuity at throttle position sensor harness side connector B-11.**

- (1) Disconnect the connector B-11 and measure at the harness side.
- (2) Measure 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-09 at ECM for damage.**
**Q: Is the harness connector in good condition?****YES** : Go to Step 5.**NO** : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 8.

---

**STEP 5. Check for open circuit and harness damage between throttle position sensor connector B-11 (terminal No. 3) and ECM connector B-09 (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) Turn the ignition switch to the "ON" position.
- (2) Detach the intake air hose at the throttle body.
- (3) Disconnect the connector of the throttle position sensor.
- (4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (5) Set scan tool MB991958 to the data reading mode for item 15, Throttle Position Sensor (sub).
  - Output voltage should be 4.0 volts or more when the throttle valve is fully closed with your finger.
  - Output voltage should be 1.0 volt 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.00-15](#).

**NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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 P0234: Turbocharger Wastegate System Malfunction**

**TECHNICAL DESCRIPTION**

- The ECM checks that the engine is not overcharged by always monitoring intake air volume.
- The ECM protects the engine by shutting off fuel when an overcharged condition is detected.

**DESCRIPTIONS OF MONITOR METHODS**

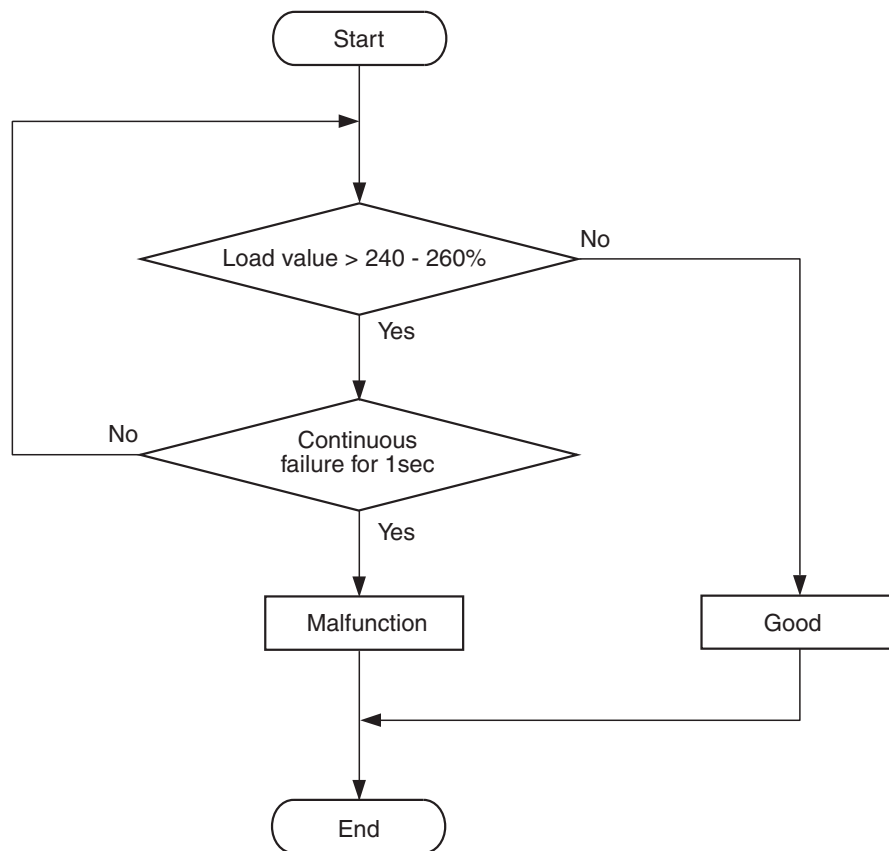
It detects overcharging failure by monitoring intake air volume.

**MONITOR EXECUTION**

Continuous

**DTC SET CONDITIONS**

**Logic Flow Chart**



AK704404

**Check Condition, Judgement Criterion**

- Volumetric efficiency is higher than 240 –260 per-cent.

**FAIL-SAFE AND BACKUP FUNCTION**

- Fuel is cut in abnormal engine overboost condition.

## OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle –  
Pattern 17.

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

- Turbocharger wastegate actuator failed.
- Charging pressure control system failed.
- ECM failed.

## DIAGNOSIS

---

### STEP 1. Check the intake charge pressure.

Refer to GROUP 15, On-vehicle Service –Intake Charge Pressure Check [P.15-5](#).

#### Q: Are there any abnormalities?

**YES** : Repair or replace it. Then go to Step 3.

**NO** : Go to Step 2.

---

### STEP 2. Check the charge pressure control system.

Refer to GROUP 15, On-vehicle Service –Intake Charge Pressure Control System Check [P.15-7](#).

#### Q: Are there any abnormalities?

**YES** : Repair or replace it. Then go to Step 3.

**NO** : Go to Step 3.

---

### STEP 3. 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 17 [P.13A-9](#).

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

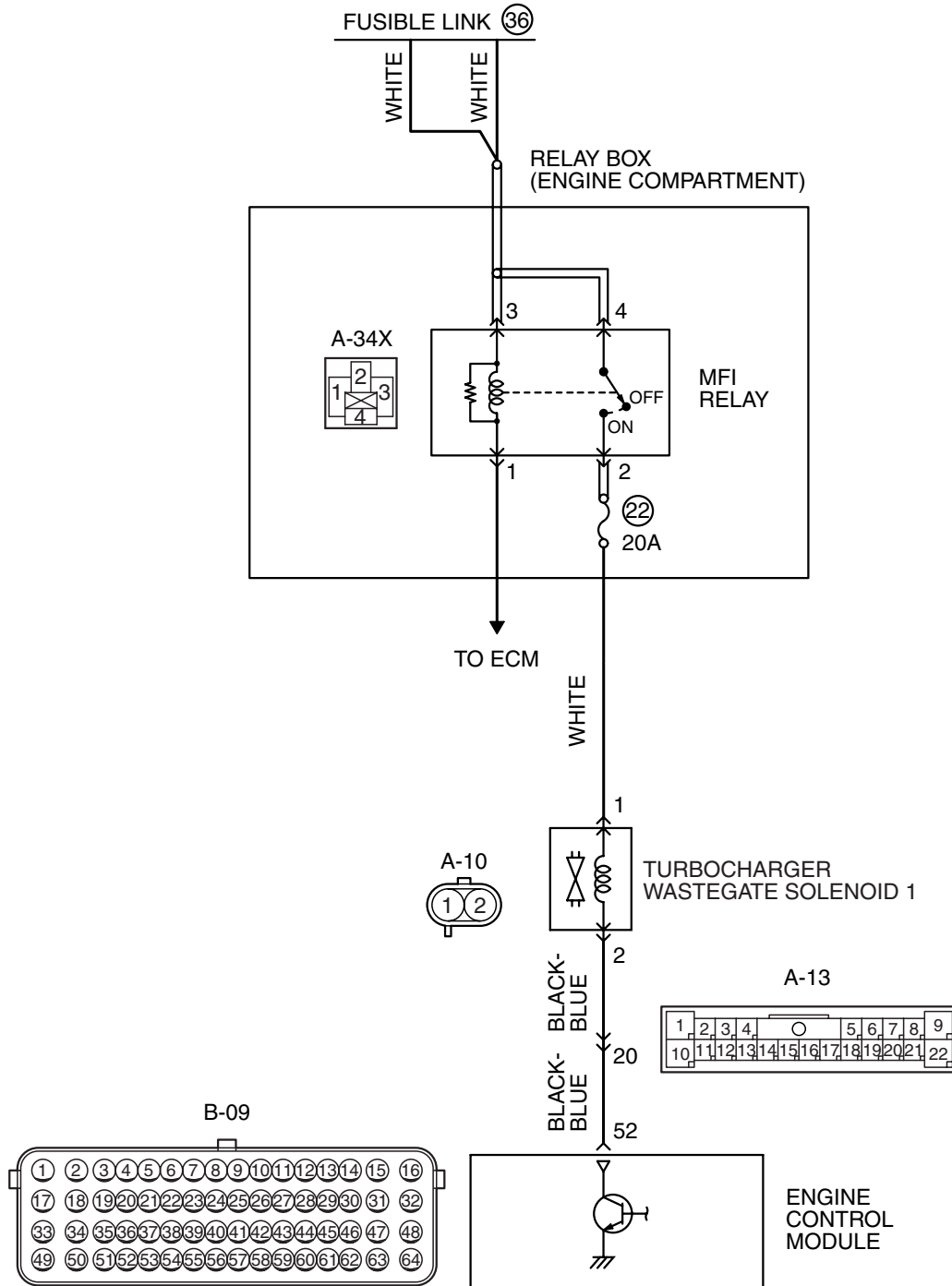
#### Q: Is the DTC P0234 set?

**YES** : Retry the troubleshooting.

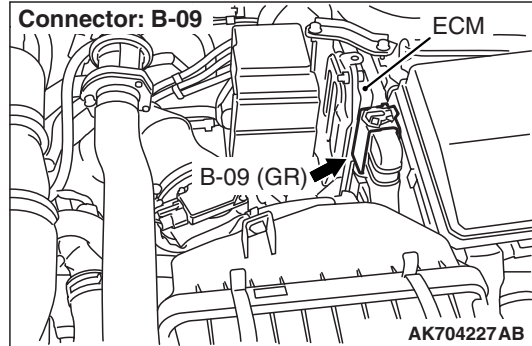
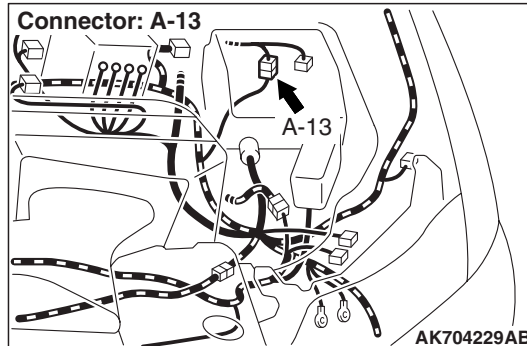
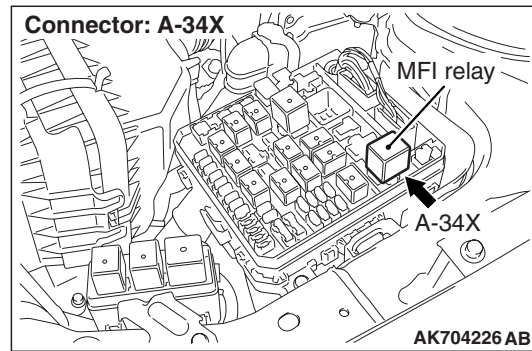
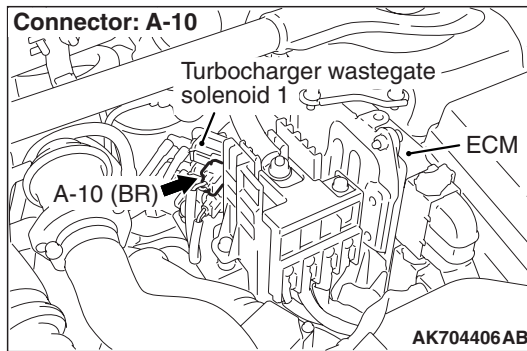
**NO** : The inspection is complete.

DTC P0243: Turbocharger Wastegate Solenoid 1 Circuit

TURBOCHARGER WASTEGATE SOLENOID 1 CIRCUIT







## CIRCUIT OPERATION

- The turbocharger wastegate solenoid 1 power is supplied from the MFI relay (terminal No. 2).
- The ECM controls ground the turbocharger wastegate solenoid 1 by turning the power transistor in the ECM "ON" and "OFF".

## TECHNICAL DESCRIPTION

- To judge if there is open circuit in the turbocharger wastegate solenoid 1 drive circuit, the ECM measures the surge voltage of the turbocharger wastegate solenoid 1 coil.
- The ECM drives the turbocharger wastegate solenoid 1. After the solenoid is turned off, the ECM will check if the solenoid coil produces a surge voltage of 2 volts or more.

## DESCRIPTIONS OF MONITOR METHODS

If a surge current is not generated in the coil after the turbocharger wastegate solenoid 1 has been actuated, an open circuit is determined to have occurred.

## 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)**

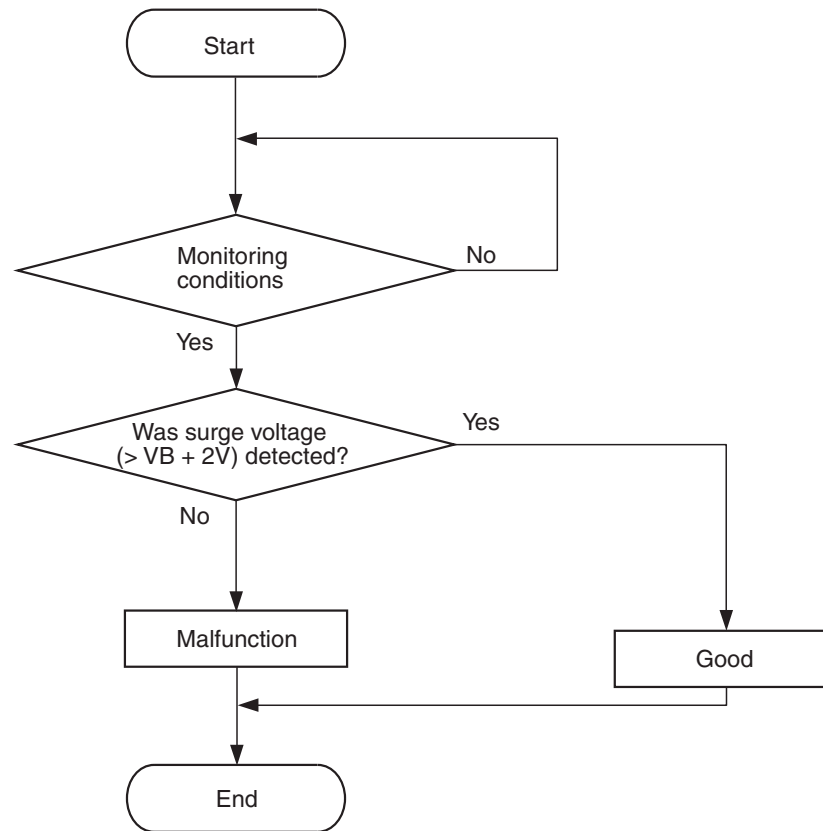
- Not applicable

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

- Not applicable

## DTC SET CONDITIONS

## Logic Flow Chart



AK604339

**Check Conditions**

- Engine is being cranked.
- Battery positive voltage is between 10 and 16.5 volts.

**Judgement Criteria**

- The turbocharger wastegate solenoid 1 coil surge voltage (battery positive voltage + 2 volts) is not detected for 0.2 second.
- The ECM monitors for this condition once during the drive cycle.

**Check Conditions**

- Battery positive voltage is between 10 and 16.5 volts.
- ON duty cycle of the turbocharger wastegate solenoid 1 is between 10 and 90 percent.
- 1 second or more has elapsed after the above mentioned conditions have been met.

**Judgement Criterion**

- The turbocharger wastegate solenoid 1 coil surge voltage (battery positive voltage + 2 volts) is not detected for 1 second after the turbocharger wastegate solenoid 1 is turned off.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

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

- Turbocharger wastegate solenoid 1 failed.
- Open or shorted turbocharger wastegate solenoid 1 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 actuator test item 20: Turbocharger Wastegate Solenoid.

#### **⚠ CAUTION**

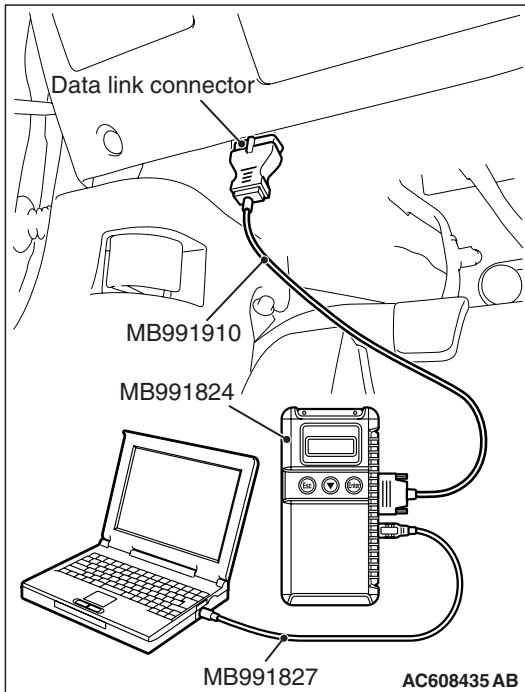
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 actuator test mode for item 20, Turbocharger wastegate solenoid.
  - An operation sound should be heard and vibration should be felt when the turbocharger wastegate solenoid 1 is operated.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

#### **Q: Is the solenoid operating properly?**

**YES** : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How Cope with Intermittent Malfunctions P.00-15.

**NO** : Go to Step 2.



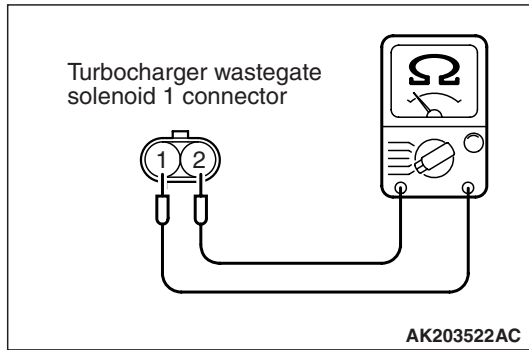
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### STEP 2. Check harness connector A-10 at the turbocharger wastegate solenoid 1 for damage.

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

**YES** : Go to Step 3.

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

**STEP 3. Check the turbocharger wastegate solenoid 1.**

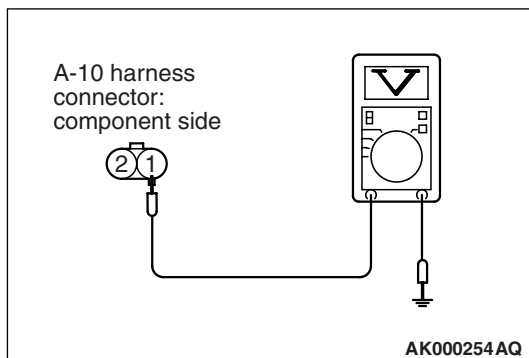
- (1) Disconnect the turbocharger wastegate solenoid 1 connector A-10.
- (2) Measure the resistance between turbocharger wastegate solenoid 1 side connector terminal No. 1 and No. 2.

**Standard value: 29 –35  $\Omega$  [at 20° C (68° F)]**

**Q: Is the measured resistance between 29 and 35  $\Omega$  [at 20° C (68° F)]?**

**YES :** Go to Step 4.

**NO :** Replace the turbocharger wastegate solenoid 1. Then go to Step 10.

**STEP 4. Measure the power supply voltage at turbocharger wastegate solenoid 1 harness side connector A-10.**

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

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-34X at MFI relay for damage.**

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

**YES :** Repair harness wire between MFI relay connector A-34X (terminal No. 2) and turbocharger wastegate solenoid 1 connector A-10 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 10.

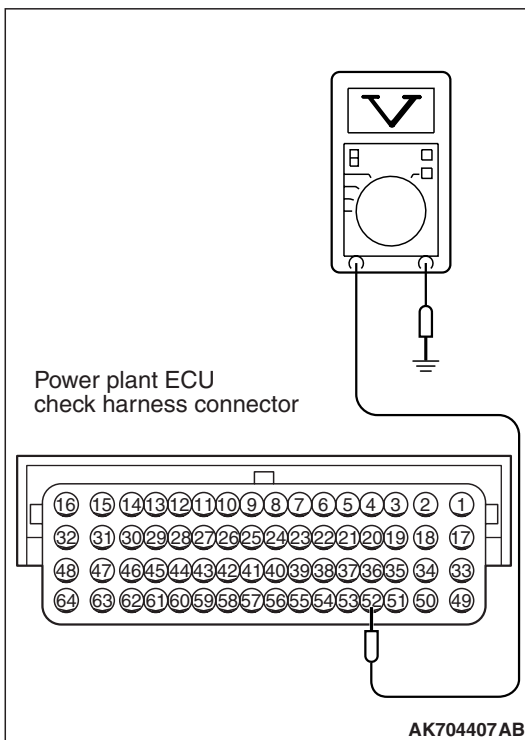
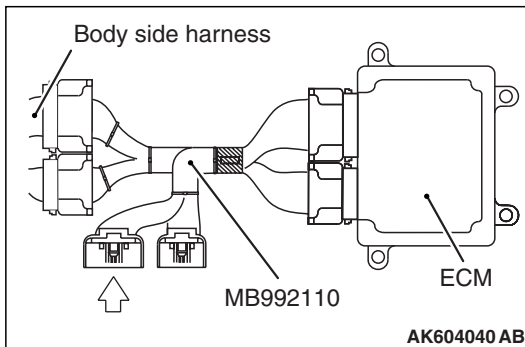
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.

**STEP 6. Check harness connector B-09 at the 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 10.



**STEP 7. Measure the power supply voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

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

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

(3) Measure the voltage between terminal No. 52 and ground.

- Voltage should be battery positive voltage.

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

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

**YES :** Go to Step 8.

**NO :** Check harness connector A-13 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 turbocharger wastegate solenoid 1 connector A-10 (terminal No. 2) and ECM connector B-09 (terminal No. 52) because of open circuit or short circuit to ground. Then go to Step 10.

**STEP 8. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and turbocharger wastegate solenoid 1 connector A-10 (terminal No. 1).**

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

**YES :** Go to Step 9.

**NO :** Repair it. Then go to Step 10.

**STEP 9. Check for harness damage between turbocharger wastegate solenoid 1 connector A-10 (terminal No. 2) and ECM connector B-09 (terminal No. 52).**

*NOTE: Check harness connector after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 10.

**NO :** Repair it. Then go to Step 10.

---

**STEP 10. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 P.13A-9.

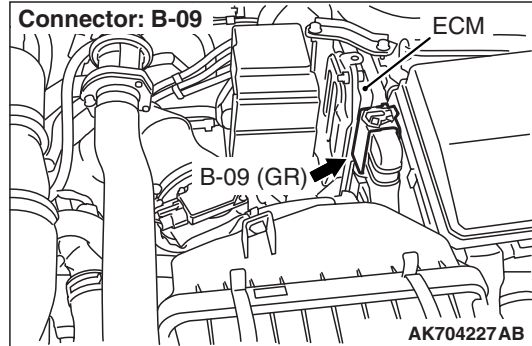
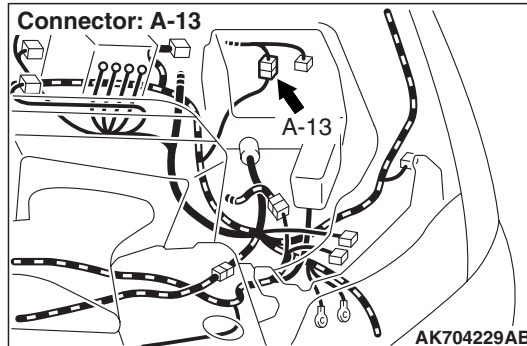
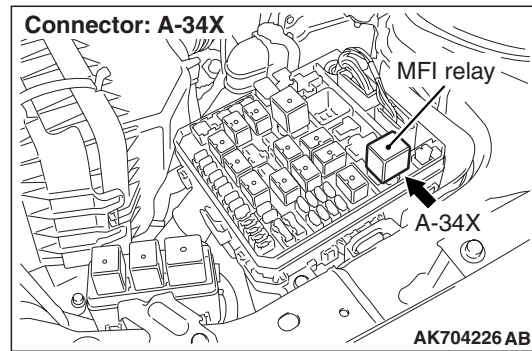
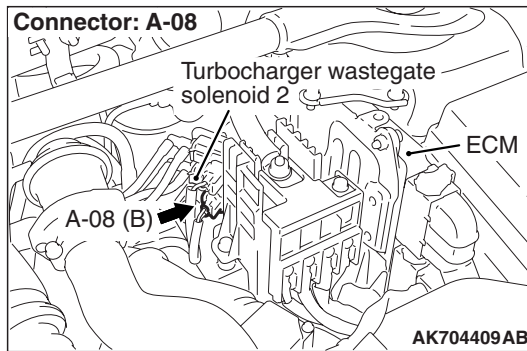
(2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0243 set?**

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.





## CIRCUIT OPERATION

- The turbocharger wastegate solenoid 2 power is supplied from the MFI relay (terminal No. 2).
- The ECM controls ground the turbocharger wastegate solenoid 2 by turning the power transistor in the ECM "ON" and "OFF".

## TECHNICAL DESCRIPTION

- To judge if there is open circuit in the turbocharger wastegate solenoid 2 drive circuit, the ECM measures the surge voltage of the turbocharger wastegate solenoid 2 coil.
- The ECM drives the turbocharger wastegate solenoid 2. After the solenoid is turned off, the ECM will check if the solenoid coil produces a surge voltage of 2 volts or more.

## DESCRIPTIONS OF MONITOR METHODS

If a surge current is not generated in the coil after the turbocharger wastegate solenoid 2 has been actuated, an open circuit is determined to have occurred.

## 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

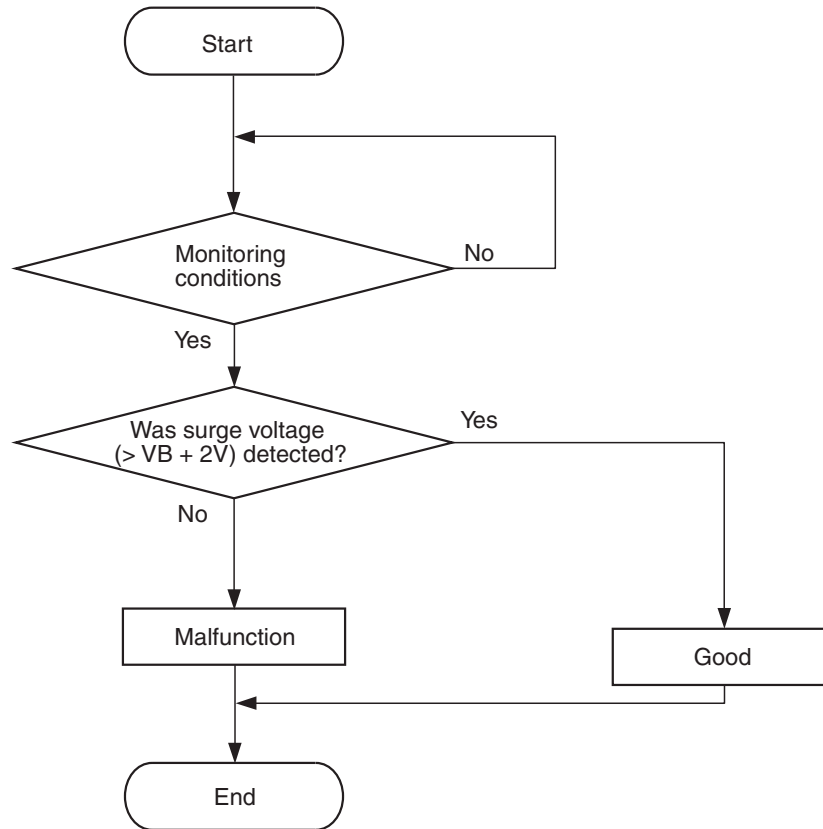
**Sensor (The sensor below is determined to be normal)**

- Not applicable



## DTC SET CONDITIONS

### Logic Flow Chart



AK604339

#### Check Conditions

- Engine is being cranked.
- Battery positive voltage is between 10 and 16.5 volts.

#### Judgement Criteria

- The turbocharger wastegate solenoid 2 coil surge voltage (battery positive voltage + 2 volts) is not detected for 0.2 second.
- The ECM monitors for this condition once during the drive cycle.

#### Check Conditions

- Battery positive voltage is between 10 and 16.5 volts.
- ON duty cycle of the turbocharger wastegate solenoid 2 is between 10 and 90 percent.
- 1 second or more has elapsed after the above mentioned conditions have been met.

#### Judgement Criterion

- The turbocharger wastegate solenoid 2 coil surge voltage (battery positive voltage + 2 volts) is not detected for 1 second after the turbocharger wastegate solenoid 2 is turned off.

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

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

- Turbocharger wastegate solenoid 2 failed.
- Open or shorted turbocharger wastegate solenoid 2 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 actuator test item 20: Turbocharger Wastegate Solenoid.****⚠ CAUTION**

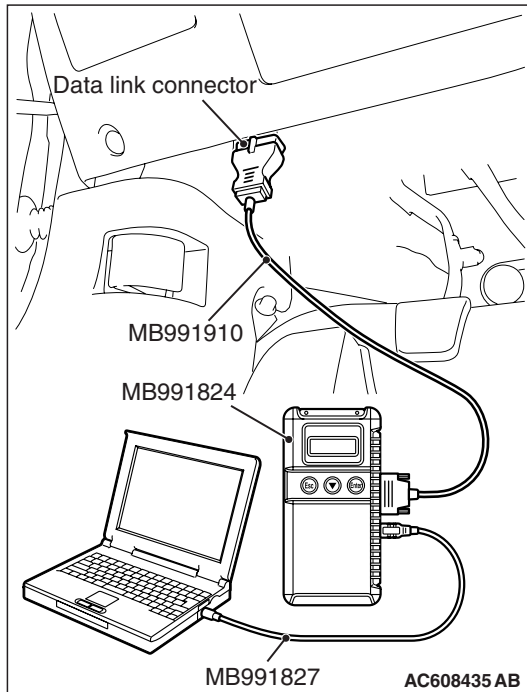
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 actuator test mode for item 20, Turbocharger wastegate solenoid.
  - An operation sound should be heard and vibration should be felt when the turbocharger wastegate solenoid 2 is operated.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

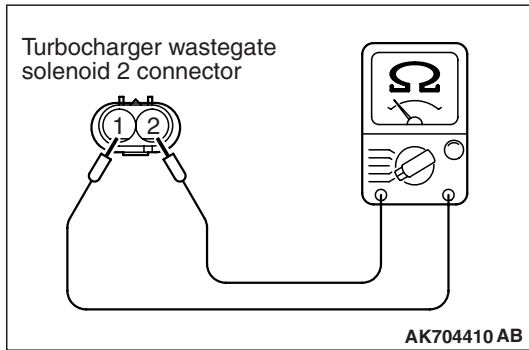
**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How Cope with Intermittent Malfunctions P.00-15.

**NO :** Go to Step 2.

**STEP 2. Check harness connector A-08 at the turbocharger wastegate solenoid 2 for damage.****Q: Is the harness connector in good condition?**

**YES :** Go to Step 3.

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



**STEP 3. Check the turbocharger wastegate solenoid 2.**

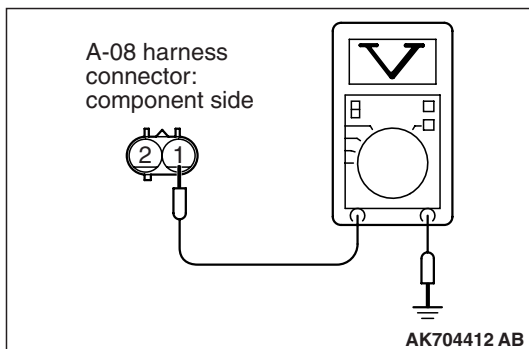
- (1) Disconnect the turbocharger wastegate solenoid 2 connector A-08.
- (2) Measure the resistance between turbocharger wastegate solenoid 2 side connector terminal No. 1 and No. 2.

**Standard value: 29 –35  $\Omega$  [at 20° C (68° F)]**

**Q: Is the measured resistance between 29 and 35  $\Omega$  [at 20° C (68° F)]?**

**YES :** Go to Step 4.

**NO :** Replace the turbocharger wastegate solenoid 2. Then go to Step 10.



**STEP 4. Measure the power supply voltage at turbocharger wastegate solenoid 2 harness side connector A-08.**

- (1) Disconnect the connector A-08 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 6.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-34X at MFI relay for damage.**

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

**YES :** Repair harness wire between MFI relay connector A-34X (terminal No. 2) and turbocharger wastegate solenoid 2 connector A-08 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 10.

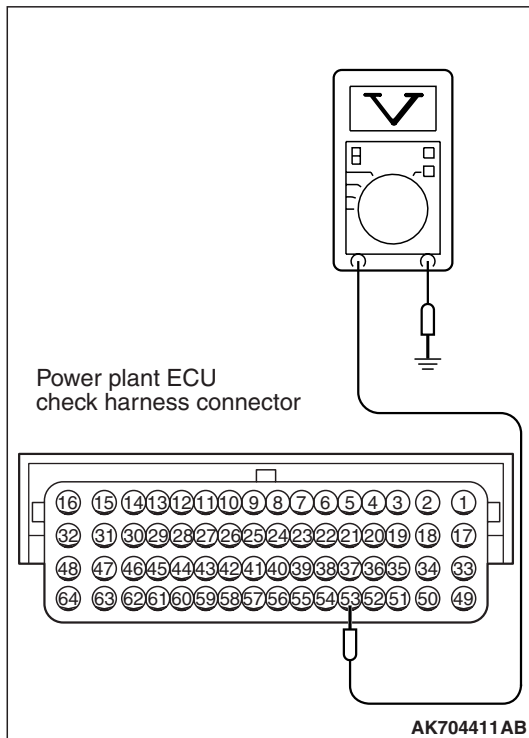
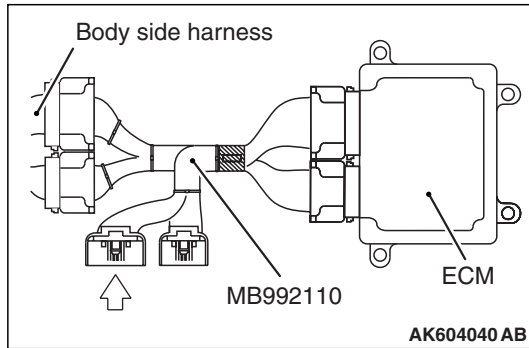
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.

**STEP 6. Check harness connector B-09 at the 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 10.



**STEP 7. Measure the power supply voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

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

- (3) Measure the voltage between terminal No. 53 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

- YES :** Go to Step 8.
- NO :** Check harness connector A-13 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 turbocharger wastegate solenoid 2 connector A-08 (terminal No. 2) and ECM connector B-09 (terminal No. 53) because of open circuit or short circuit to ground. Then go to Step 10.

**STEP 8. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and turbocharger wastegate solenoid 2 connector A-08 (terminal No. 1).**

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

- YES :** Go to Step 9.
- NO :** Repair it. Then go to Step 10.

---

**STEP 9. Check for harness damage between turbocharger wastegate solenoid 2 connector A-08 (terminal No. 2) and ECM connector B-09 (terminal No. 53).**

*NOTE: Check harness connector after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 10.

**NO :** Repair it. Then go to Step 10.

---

**STEP 10. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 P.13A-9.

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

**Q: Is DTC P0247 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)**

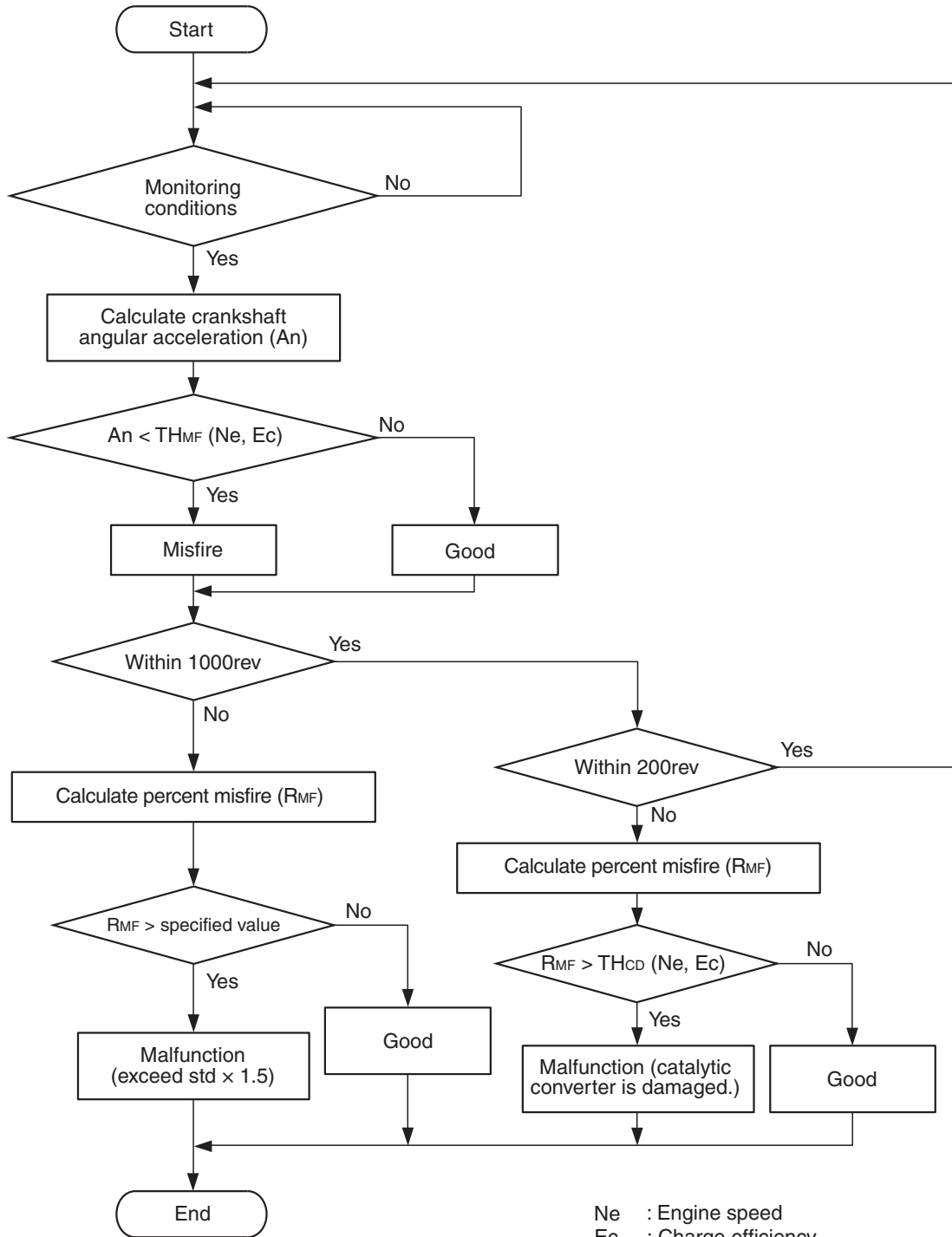
- Not applicable

**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  
THMF : Threshold value for misfire  
THCD : Threshold value for catalyst damage

### Check Conditions

- Engine speed is between 438 and 7,000 r/min.
- Engine coolant temperature is higher than -10°C (14°F).
- Barometric pressure is higher 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 Criteria (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 higher than 1,000°C (1,832°F)].

or

- Misfire has occurred in 2.0 percent or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard).

### 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 14 [P.13A-9](#).

### 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 belt teeth.
- ECM failed.

### DIAGNOSIS

#### Required Special Tools:

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

#### STEP 1. Using scan tool MB991958, check data list item 2: Crankshaft Position Sensor.

#### **⚠ CAUTION**

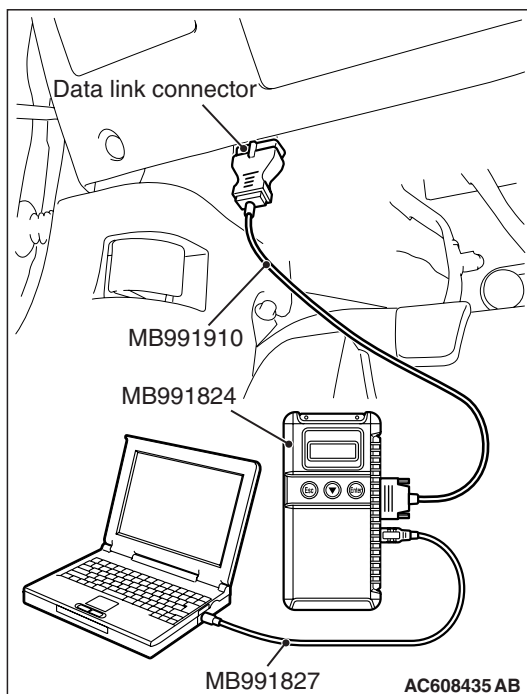
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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.13A-367](#).



---

**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.13A-246](#),  
DTC P0172 –System too Rich [P.13A-252](#).

---

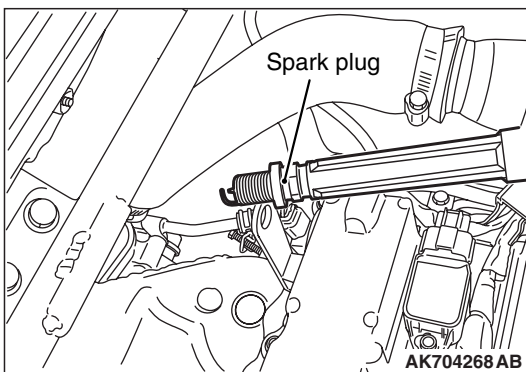
**STEP 3. Using scan tool MB991958, check data list item 28: Short-Term Fuel Trim.**

- (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 -25 and +25 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.13A-246](#),  
DTC P0172 –System too Rich [P.13A-252](#).




---

**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) Remove 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.16-37](#)

**Q: Is the spark plug normal?**

**YES :** Refer to Symptom Procedures 26 –Ignition Circuit System [P.13A-842](#).

**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.

**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 14 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0300 set?**

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-15](#).

---

**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.13A-9](#).
- (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)**

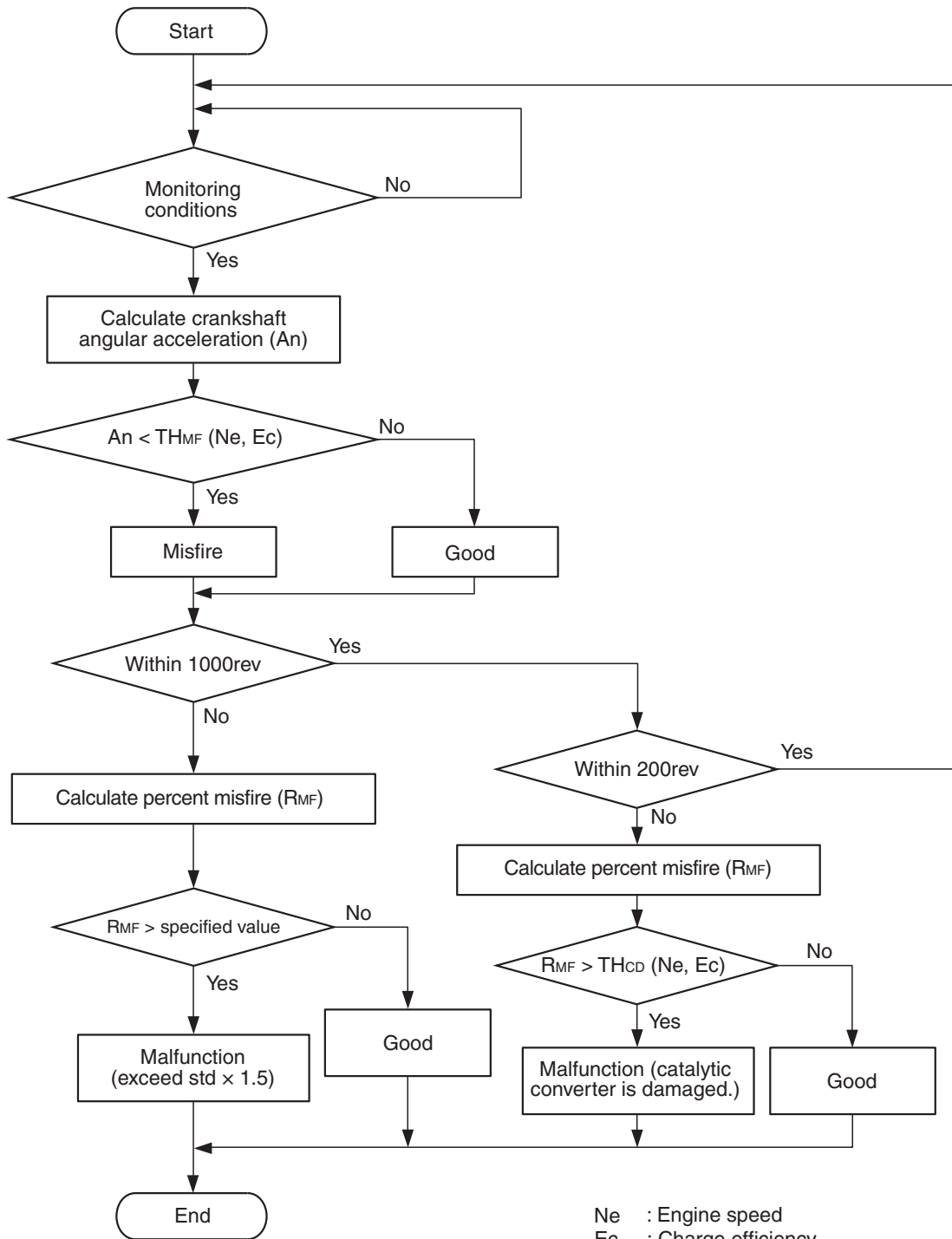
- Not applicable

**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 7,000 r/min.
- Engine coolant temperature is higher than -10° C (14° F).
- Barometric pressure is higher 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 Criteria (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 higher than 1,000° C (1,832° F)].

or

- Misfire has occurred in 2.0 percent or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard).

**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 14 [P.13A-9](#).

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

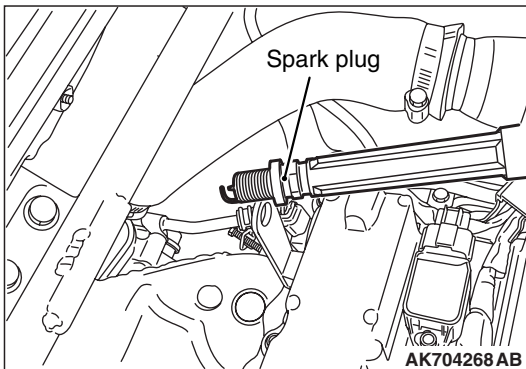
- Ignition system related part(s) failed.
- Low compression pressure.
- ECM failed.

**DIAGNOSIS****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) Remove 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.16-37](#).

**Q: Is the spark plug normal?**

- YES** : Refer to, Symptom Procedures 26 –Ignition Circuit System [P.13A-842](#).  
**NO** : Replace the No. 1 cylinder spark plug. Then go to Step 5.

**STEP 3. Check the compression.**

Refer to GROUP 11A, On-vehicle Service –Compression Pressure Check [P.11A-15](#).

**Q: Are there any abnormalities?**

- YES** : Repair or replace 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 14 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0301 set?**

- YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-15](#).

---

**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 14 [P.13A-9](#).
- (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)**

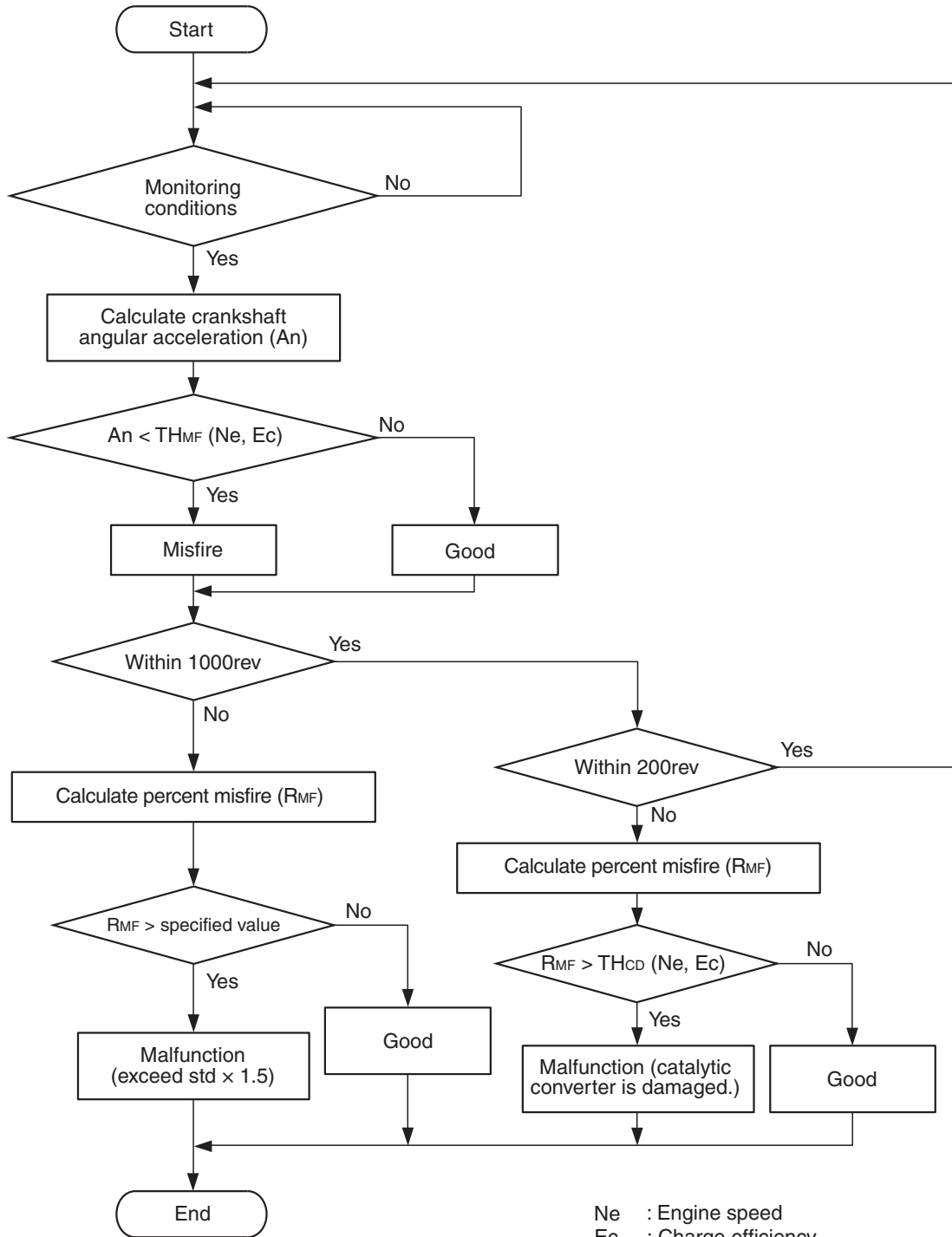
- Not applicable

**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 7,000 r/min.
- Engine coolant temperature is higher than -10° C (14° F).
- Barometric pressure is higher 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 Criteria (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 higher than 1,000° C (1,832° F)].

or

- Misfire has occurred in 2.0 percent or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard).

### 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 14 [P.13A-9](#).

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

- Ignition system related part(s) failed.
- Low compression pressure.
- ECM failed.

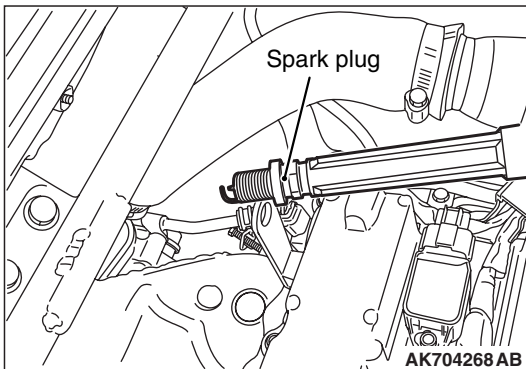
## DIAGNOSIS

### 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) Remove 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.16-37](#).

#### Q: Is the spark plug normal?

- YES** : Refer to, Symptom Procedures 26 –Ignition Circuit System [P.13A-842](#).  
**NO** : Replace the No. 2 cylinder spark plug. Then go to Step 5.

### STEP 3. Check the compression.

Refer to GROUP 11A, On-vehicle Service –Compression Pressure Check [P.11A-15](#).

#### Q: Are there any abnormalities?

- YES** : Repair or replace 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 14 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0302 set?**

- YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-15](#).

**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 14 [P.13A-9](#).
- (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

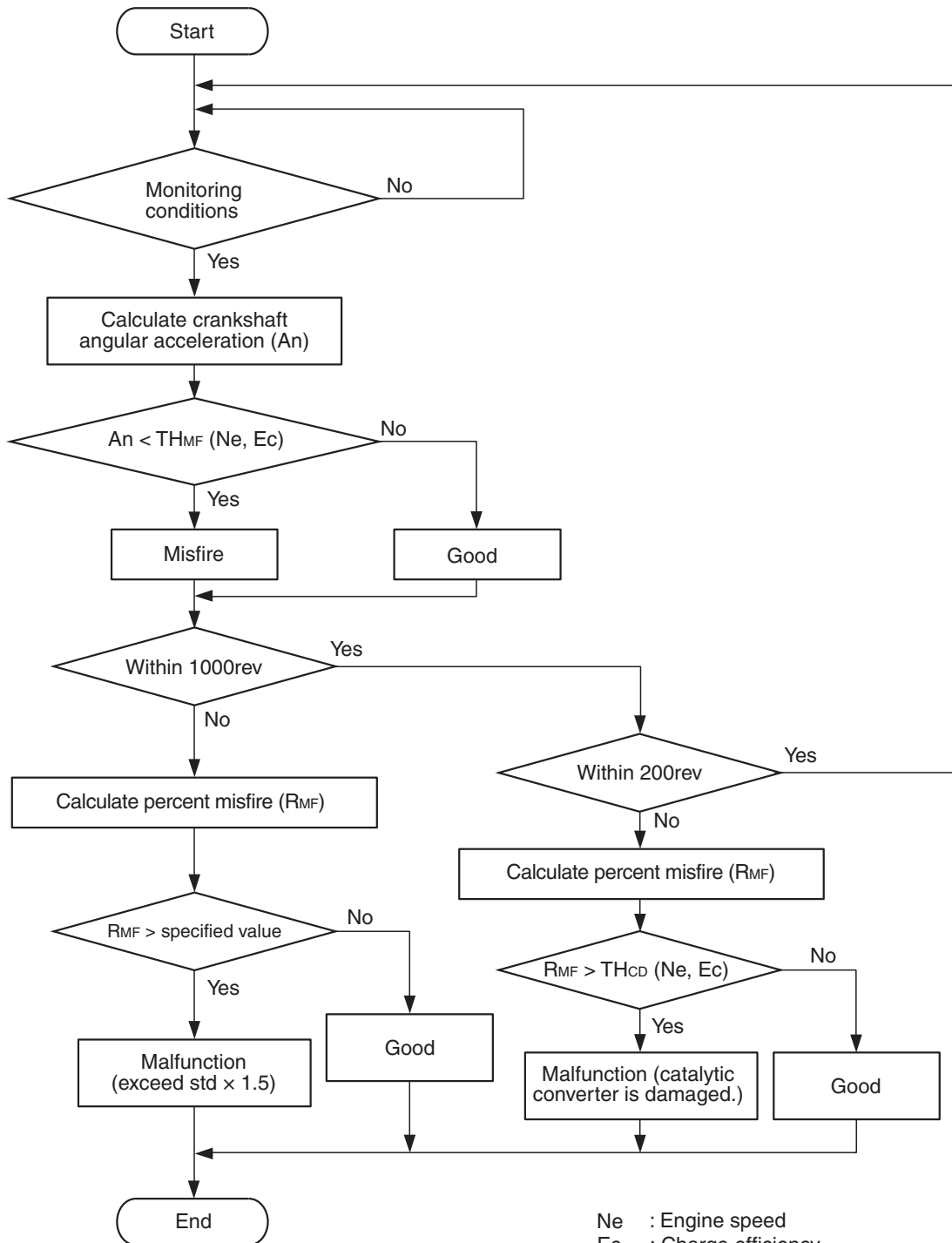
**Sensor (The sensor below is determined to be normal)**

- 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

**Check Conditions**

- Engine speed is between 438 and 7,000 r/min.
- Engine coolant temperature is higher than -10° C (14° F).
- Barometric pressure is higher 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 Criteria (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 higher than 1,000° C (1,832° F)].

or

- Misfire has occurred in 2.0 percent or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard).

**FAIL-SAFE AND BACKUP FUNCTION**

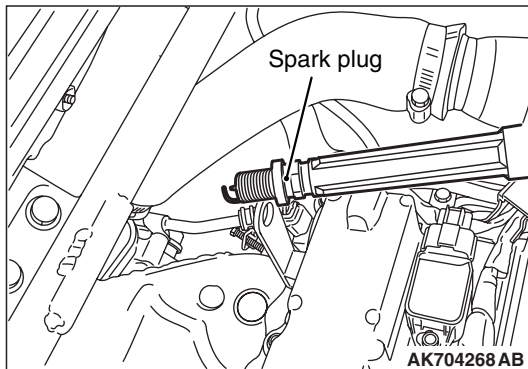
- The supply of fuel to the misfiring cylinder can possibly be cut.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 14 [P.13A-9](#).

**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****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) Remove 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.16-37](#).

**Q: Is the spark plug normal?**

- YES** : Refer to, Symptom Procedures 26 –Ignition Circuit System [P.13A-842](#).  
**NO** : Replace the No. 3 cylinder spark plug. Then go to Step 5.

**STEP 3. Check the compression.**

Refer to GROUP 11A, On-vehicle Service –Compression Pressure Check [P.11A-15](#).

**Q: Are there any abnormalities?**

- YES** : Repair or replace 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 14 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0303 set?**

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-15](#).

---

**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 14 [P.13A-9](#).
- (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)**

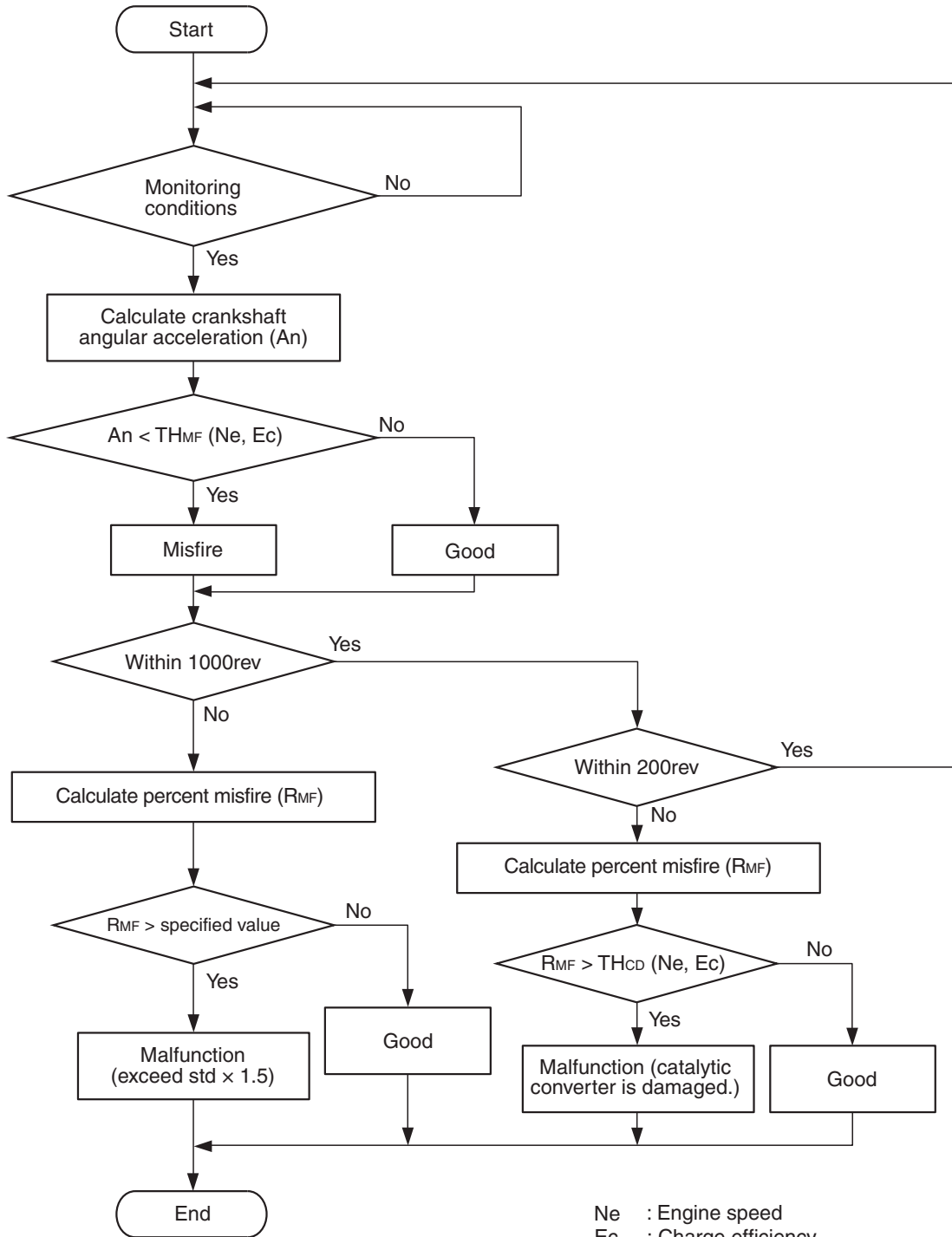
- Not applicable

**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

### Check Conditions

- Engine speed is between 438 and 7,000 r/min.
- Engine coolant temperature is higher than  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- Barometric pressure is higher 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 Criteria (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 higher than  $1,000^{\circ}\text{C}$  ( $1,832^{\circ}\text{F}$ )].

or

- Misfire has occurred in 2.0 percent or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard).

### FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

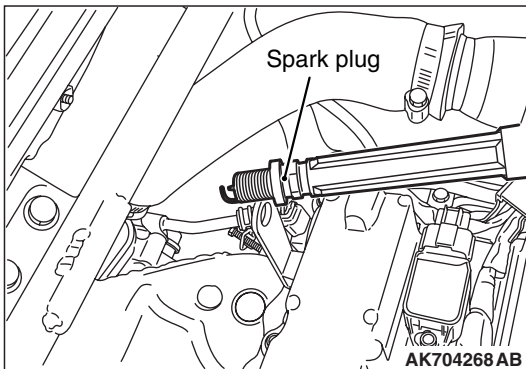
### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 14 [P.13A-9](#).

### 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



### 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) Remove 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.16-37](#).

#### Q: Is the spark plug normal?

- YES** : Refer to, Symptom Procedures 26 –Ignition Circuit System [P.13A-842](#).
- NO** : Replace the No. 4 cylinder spark plug. Then go to Step 5.

### STEP 3. Check the compression.

Refer to GROUP 11A, On-vehicle Service –Compression Pressure Check [P.11A-15](#).

#### Q: Are there any abnormalities?

- YES** : Repair or replace 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 14 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0304 set?**

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-15](#).

---

**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 14 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

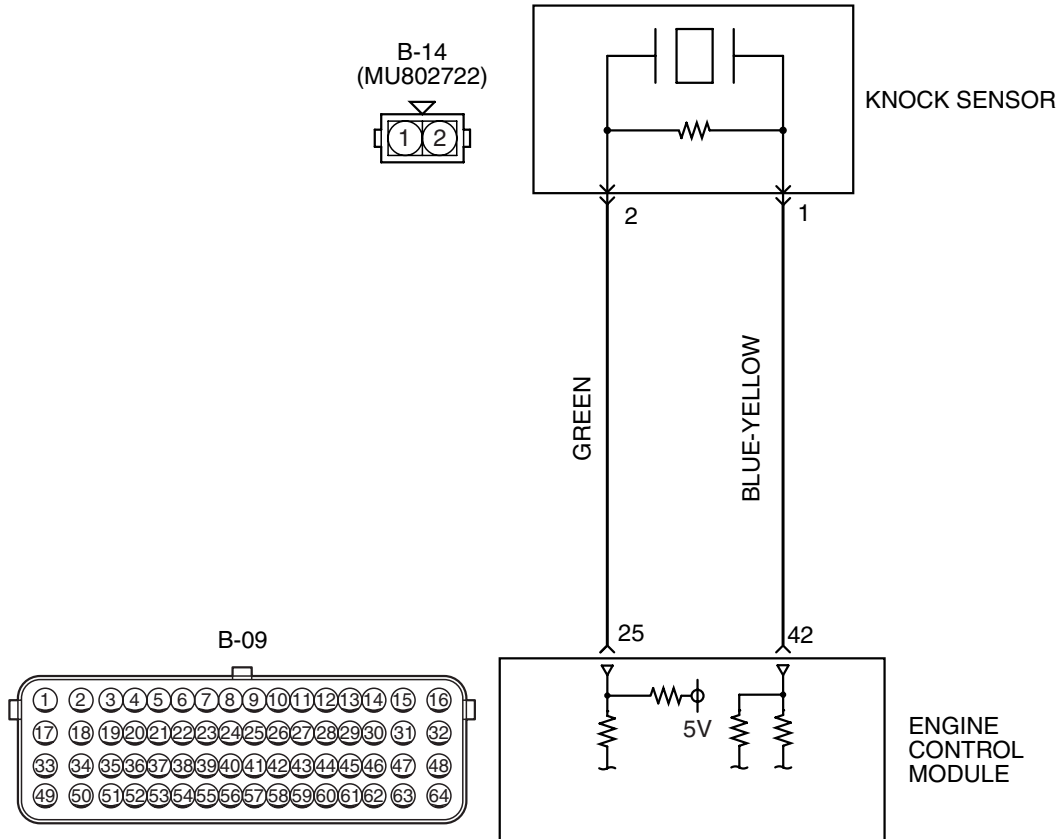
**Q: Is DTC P0304 set?**

**YES :** Retry the troubleshooting.

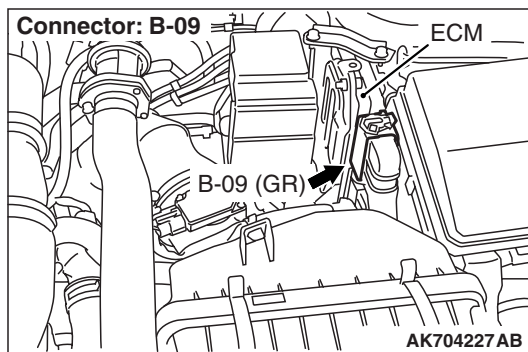
**NO :** The inspection is complete.

DTC P0327: Knock Sensor Circuit Low

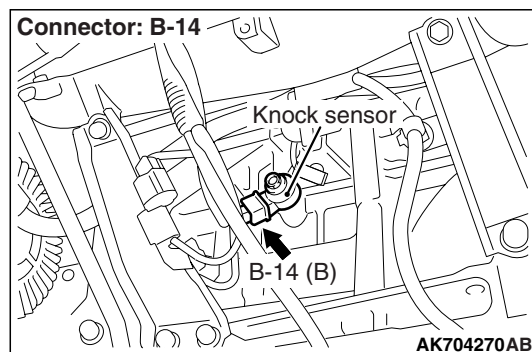
KNOCK SENSOR CIRCUIT



AK704757 AB



AK704227 AB



AK704270 AB

**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).

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

**TECHNICAL DESCRIPTION**

- The knock sensor converts the vibration of the cylinder block into a voltage and outputs it.

**DESCRIPTIONS OF MONITOR METHODS**

Knock 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)

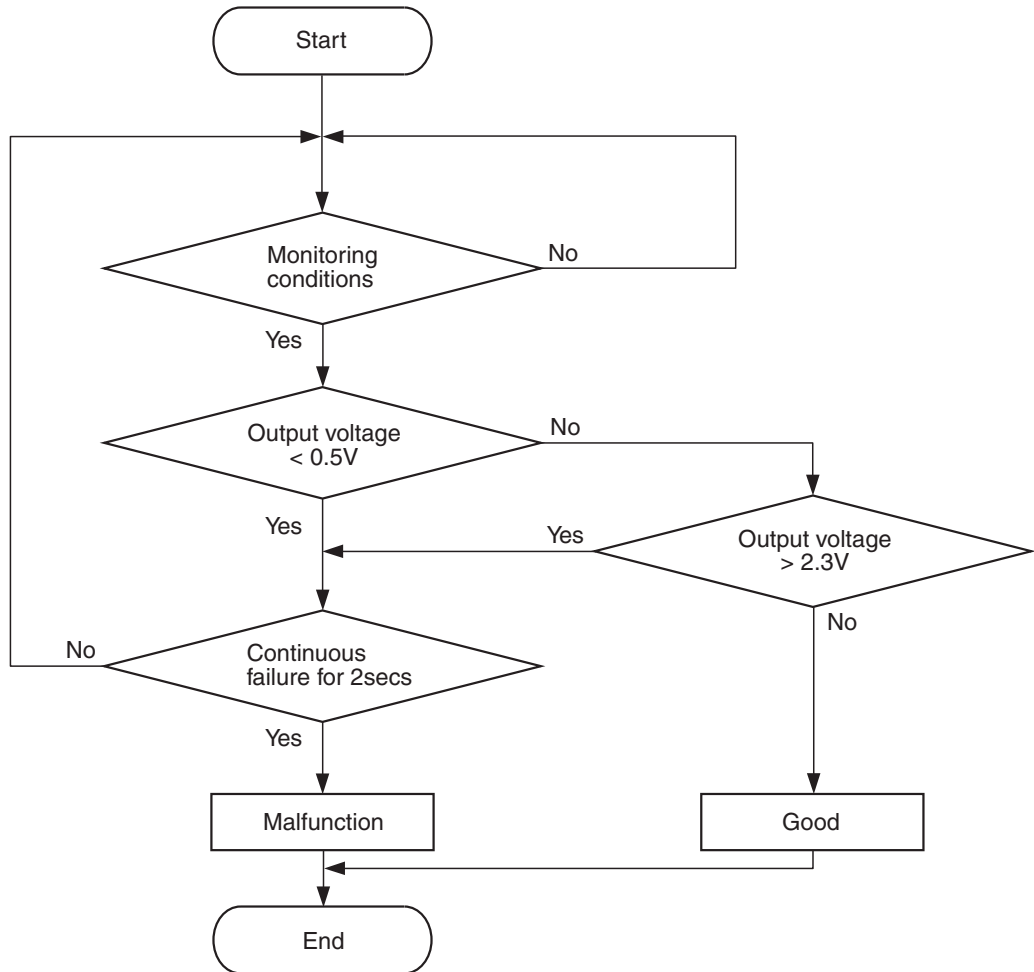
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

**DTC SET CONDITIONS**

**Logic Flow Chart**



AK704271

**Check Condition**

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

**Judgement Criterion**

- Knock sensor output voltage has continued to be lower 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.13A-9](#).

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

- Knock sensor failed.
- Open or shorted knock sensor circuit or connector damage.
- ECM failed.



---

## DIAGNOSIS

---

**STEP 1. Check harness connector B-14 at the knock sensor and harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 2.

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

---

**STEP 2. Check for open circuit between knock sensor connector B-14 (terminal No. 1) and ECM connector B-09 (terminal No. 42).**

**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 and short circuit to ground between knock sensor connector B-14 (terminal No. 2) and ECM connector B-09 (terminal No. 25).**

**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) 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 P0327 set?**

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis –ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, Diagnosis –ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 5.

**NO :** Replace the knock sensor. 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.13A-9](#).

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

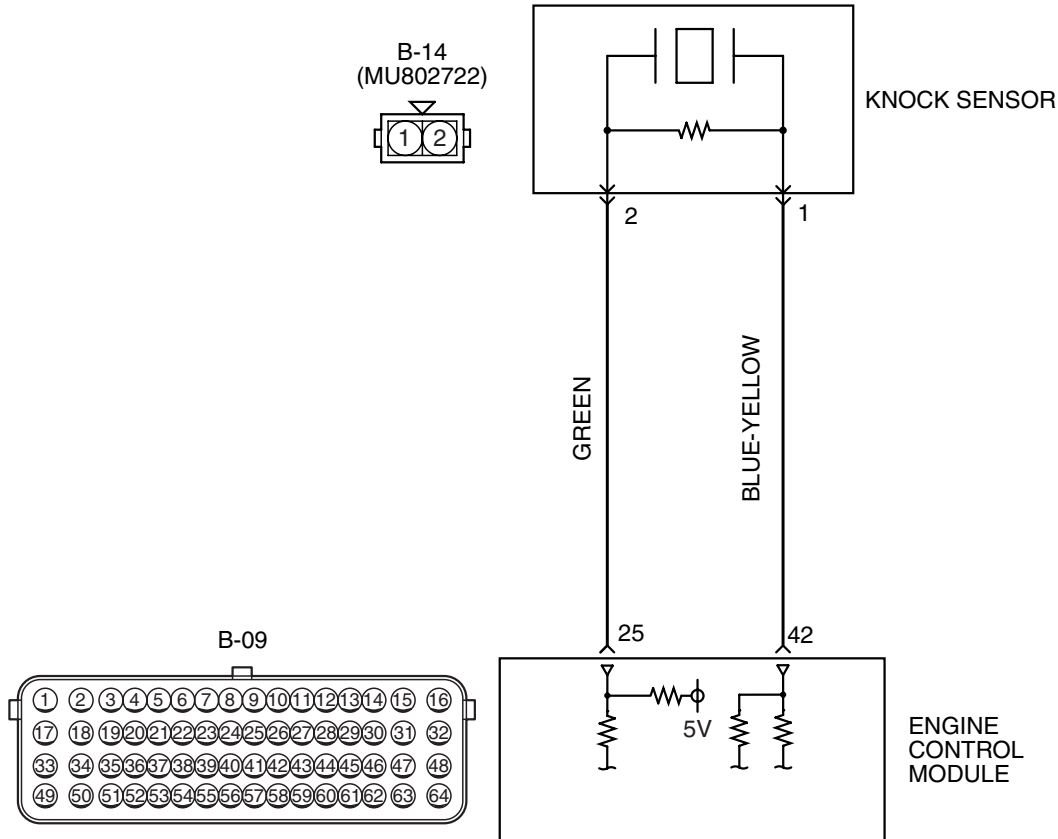
**Q: Is DTC P0327 set?**

**YES :** Retry the troubleshooting.

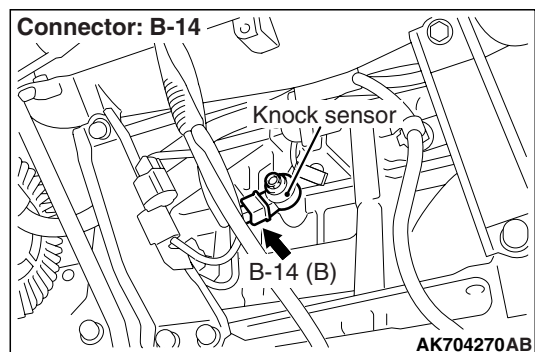
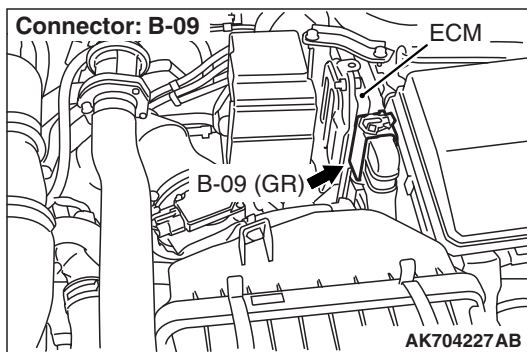
**NO :** The inspection is complete.

DTC P0328: Knock Sensor Circuit High

KNOCK SENSOR CIRCUIT



AK704757 AB



**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).

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

**TECHNICAL DESCRIPTION**

- The knock sensor converts the vibration of the cylinder block into a voltage and outputs it.

**DESCRIPTIONS OF MONITOR METHODS**

Knock 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)

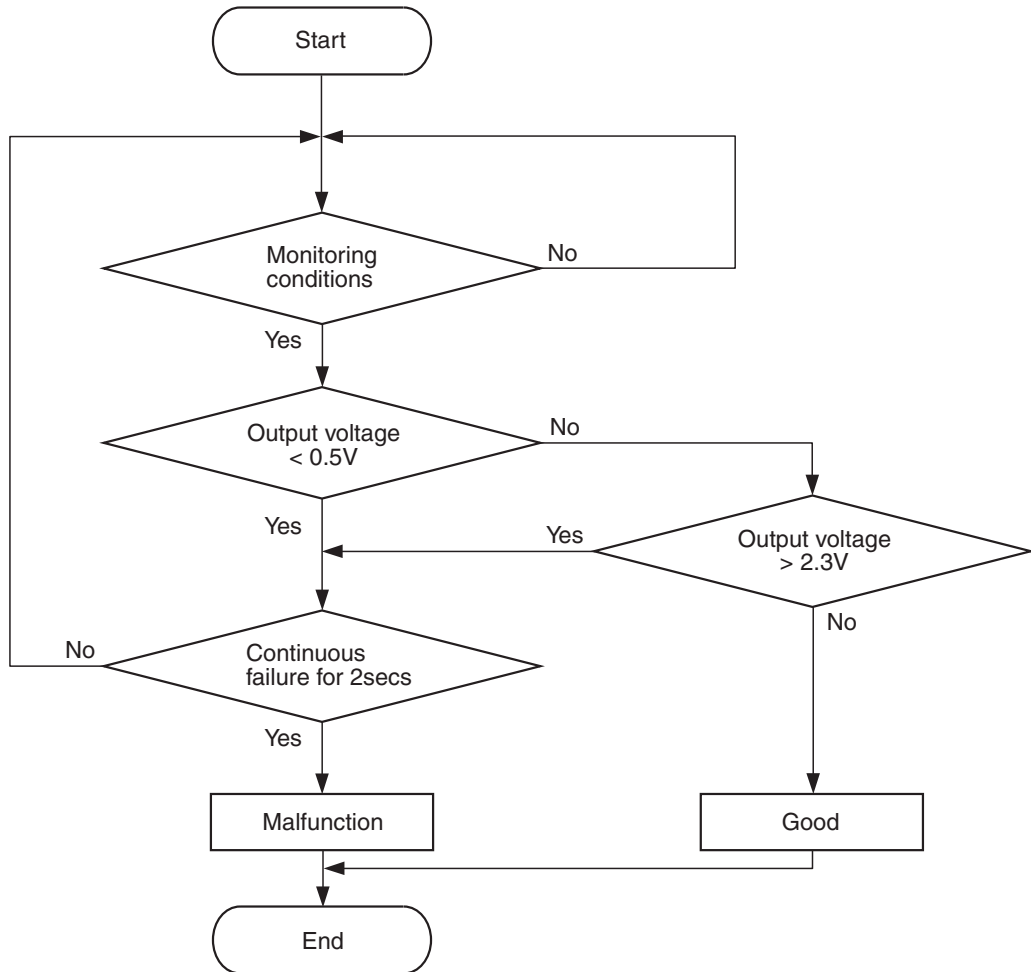
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

**DTC SET CONDITIONS**

**Logic Flow Chart**



AK704271

**Check Condition**

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

**Judgement Criterion**

- Knock sensor output voltage has continued to be higher than 2.25 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.13A-9](#).

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

- Shorted knock sensor circuit or connector damage.
- ECM failed.

**DIAGNOSIS**

---

**STEP 1. Check harness connector B-14 at the knock sensor and harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 2.

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

---

**STEP 2. Check for short circuit to power supply between knock sensor connector B-14 (terminal No. 2) and ECM connector B-09 (terminal No. 25).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis –ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, Diagnosis –ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

**NO :** Repair it. Then go to Step 3.

---

**STEP 3. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13A-9](#).

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

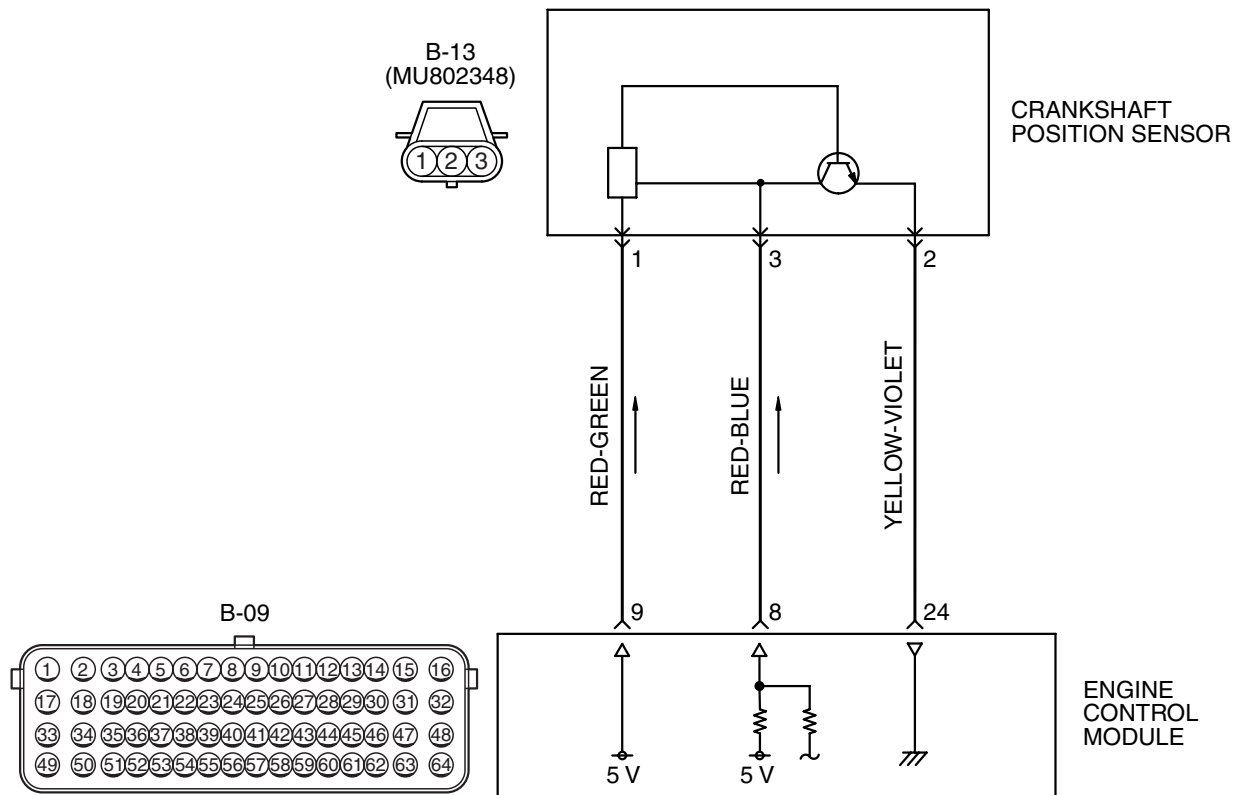
**Q: Is DTC P0328 set?**

**YES :** Retry the troubleshooting.

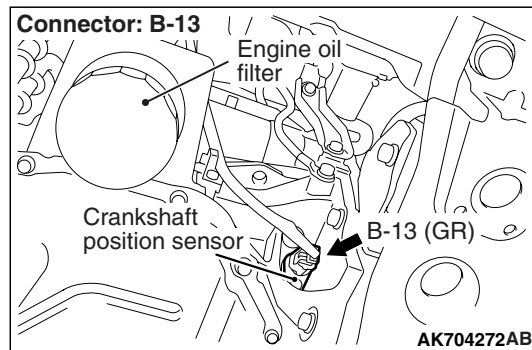
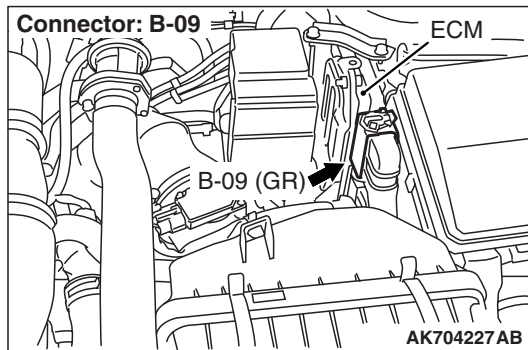
**NO :** The inspection is complete.

DTC P0335: Crankshaft Position Sensor Circuit

CRANKSHAFT POSITION SENSOR CIRCUIT



AK604245 AD



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**

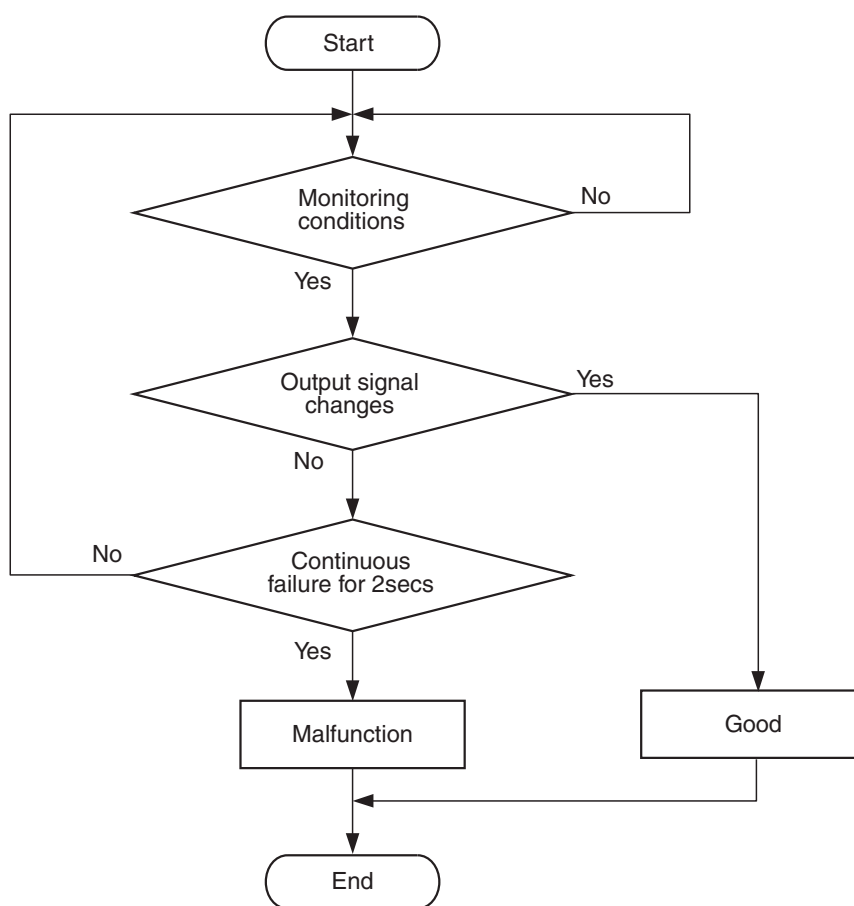
- The crankshaft position sensor detects the crank angle (position) of each cylinder, and converts that data to pulse signals, then which are input to the ECM.
- When the engine is running, the crankshaft position sensor outputs a pulse signal.
- The ECM checks whether pulse signal is input while the engine is cranking.

**DESCRIPTIONS OF MONITOR METHODS**

- Crankshaft position sensor signal does not change.
- Crankshaft position sensor signal is not normal pattern.

**DTC SET CONDITIONS <Circuit continuity>**

**Logic Flow Chart**



AK604334

**Check Condition**

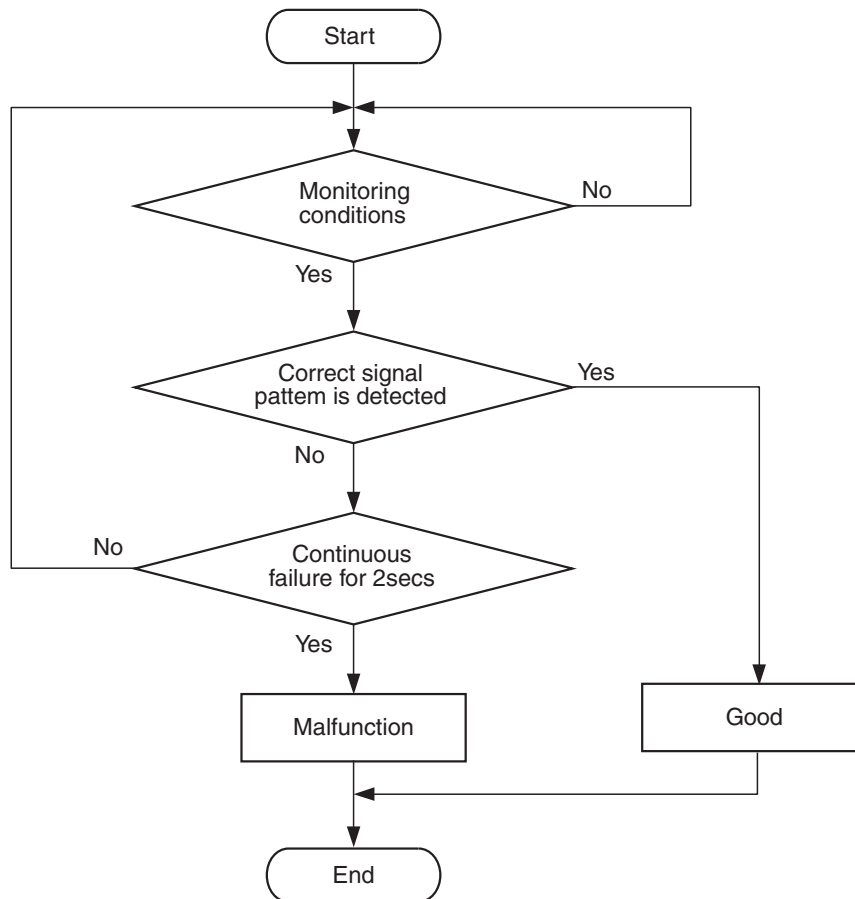
- Engine is being cranked.
- or
- Engine speed is higher than 500 r/min excluding during cranking.

**Judgement Criterion**

- Crankshaft position sensor output voltage has not changed (no pulse signal is input) for 2 seconds.

**DTC SET CONDITIONS <Range/Performance problem –alignment>**

**Logic Flow Chart**



AK604335

**Check Condition**

- Engine is being cranked.
- or
- Engine speed is higher than 500 r/min excluding during cranking.

**Judgement Criterion**

- Normal signal pattern has not been input 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.13A-9](#).

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

- Crankshaft position sensor failed.
- Open or shorted crankshaft position sensor circuit, or 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**

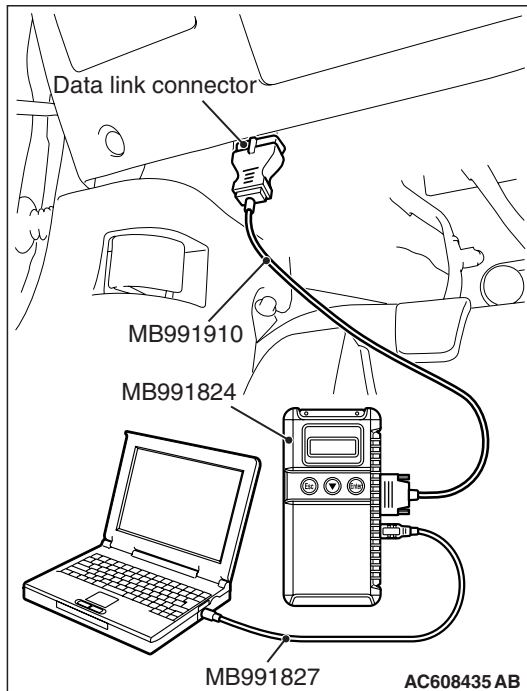
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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.

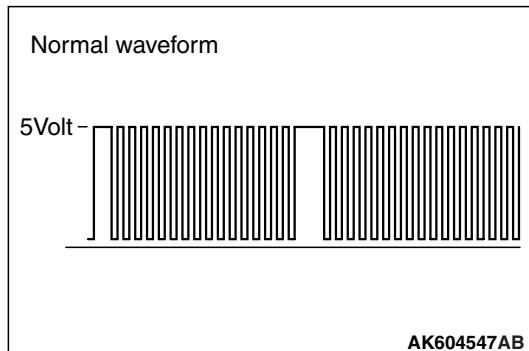
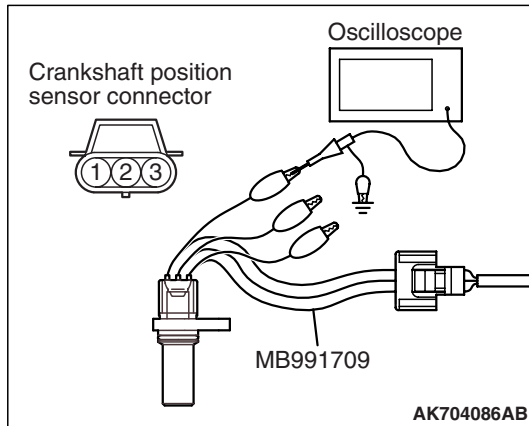
#### **Q: Is the sensor operating properly?**

**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.00-15](#).

**NO :** Go to Step 2.







**STEP 2. Using the oscilloscope, check the crankshaft position sensor.**

(1) Disconnect the crankshaft position sensor connector B-13 and connect the test harness special tool (MB991709) between the separated connectors.

(2) Connect the oscilloscope probe to terminal No. 3 of the crankshaft position sensor connector.

*NOTE: When measuring with the ECM side connector, disconnect all ECM connectors. Connect the 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 waveform.

- The waveform should show a pattern similar to the illustration.

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

**Q: Is the waveform normal?**

**YES :** Go to Step 3.

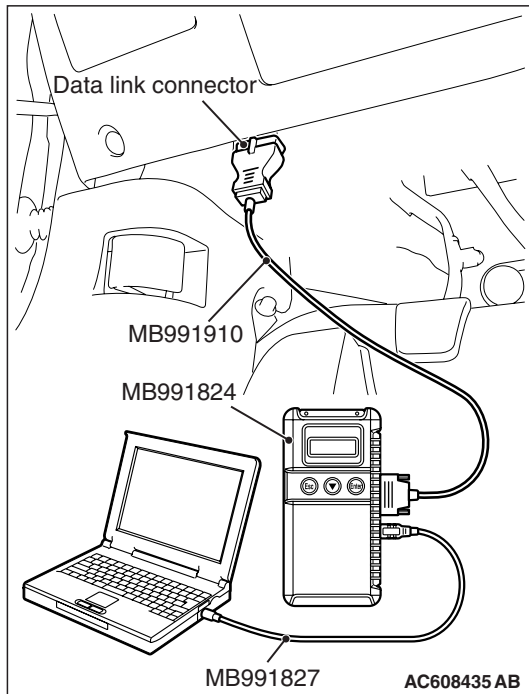
**NO :** Go to Step 5.

**STEP 3. Check harness connector B-13 at the crankshaft position sensor and harness connector B-09 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 20.



**STEP 4. Using scan tool MB991958, check data list item 2: Crankshaft Position Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (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.00-15](#).
- NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 20.

**STEP 5. Check harness connector B-13 at the crankshaft position sensor for damage.**

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

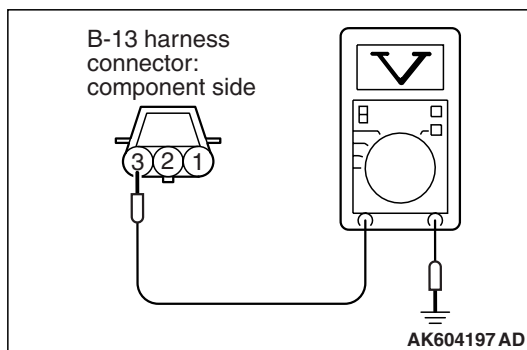
- YES :** Go to Step 6.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 6. Measure the sensor supply voltage at crankshaft position sensor harness side connector B-13.**

- (1) Disconnect the connector B-13 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 10.
- NO :** Go to Step 7.



**STEP 7. Check harness connector B-09 at ECM for damage.**

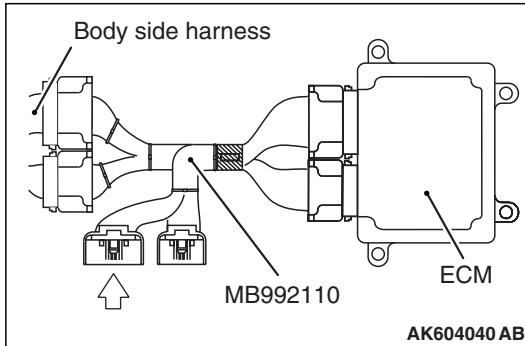
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 8.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 8. Measure the sensor supply voltage at ECM connector B-09 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-13.
- (3) Turn the ignition switch to the "ON" position.

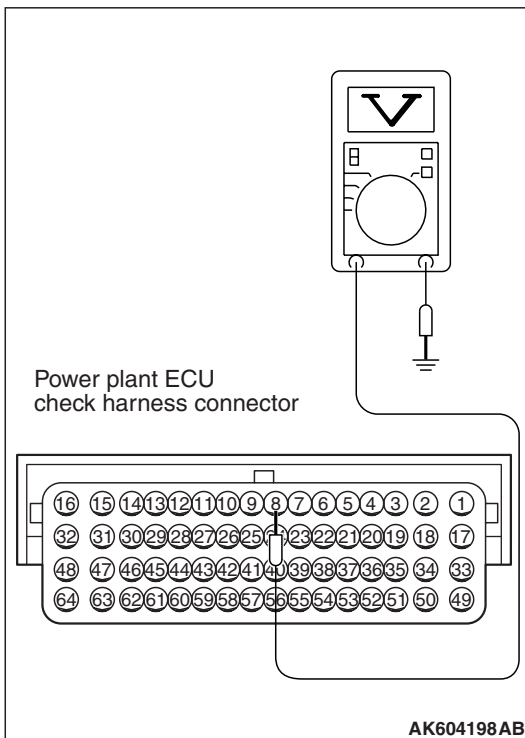


- (4) Measure the voltage between terminal No. 8 and ground.
  - Voltage should be between 4.9 and 5.1 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Repair harness wire between crankshaft position sensor connector B-13 (terminal No. 3) and ECM connector B-09 (terminal No. 8) because of open circuit. Then go to Step 20.

**NO :** Go to Step 9.



**STEP 9. Check for short circuit to ground between crankshaft position sensor connector B-13 (terminal No. 3) and ECM connector B-09 (terminal No. 8).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 20.

**NO :** Repair it. Then go to Step 20.

**STEP 10. Measure the power supply voltage at crankshaft position sensor harness side connector B-13.**

(1) Disconnect the connector B-13 and measure at the harness side.

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

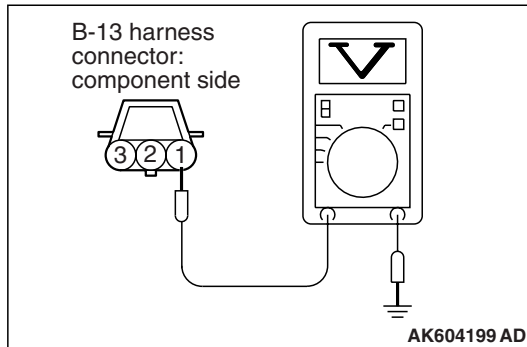
(3) Measure the voltage between terminal No. 1 and ground.  
 • Voltage should be between 4.9 and 5.1 volts.

(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 13.

**NO :** Go to Step 11.



**STEP 11. Check harness connector B-09 at ECM for damage.**

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

**YES :** Go to Step 12.

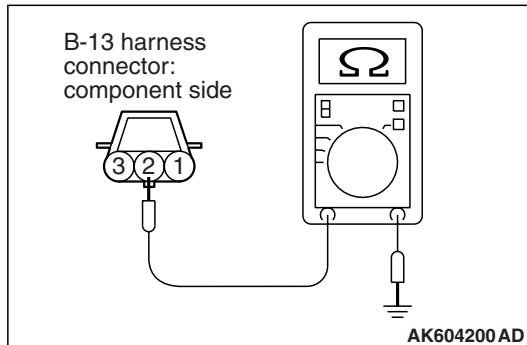
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

**STEP 12. Check for open circuit and short circuit to ground between crankshaft position sensor connector B-13 (terminal No. 1) and ECM connector B-09 (terminal No. 9).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 20.

**NO :** Repair it. Then go to Step 20.



---

**STEP 13. Check the continuity at crankshaft position sensor harness side connector B-13.**

- (1) Disconnect the connector B-13 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 16.  
**NO :** Go to Step 14.

---

**STEP 14. Check harness connector B-09 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 20.

---

**STEP 15. Check for open circuit and harness damage between crankshaft position sensor connector B-13 (terminal No. 2) and ECM connector B-09 (terminal No. 24).**

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

- YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 20.  
**NO :** Repair it. Then go to Step 20.

---

**STEP 16. Check harness connector B-09 at ECM for damage.**

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

- YES :** Go to Step 17.  
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

---

**STEP 17. Check for harness damage between ECM connector B-09 (terminal No. 9) and crankshaft position sensor connector B-13 (terminal No. 1).**

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

- YES :** Go to Step 18.  
**NO :** Repair it. Then go to Step 20.

---

**STEP 18. Check for harness damage between crankshaft position sensor connector B-13 (terminal No. 3) and ECM connector B-09 (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 19. Check the crankshaft position sensing ring.**

**Q: Is the crankshaft position sensing ring in good condition?**

**YES** : Replace the crankshaft position sensor. Then go to Step 20.

**NO** : Replace the crankshaft sensing ring. 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.13A-9](#).

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

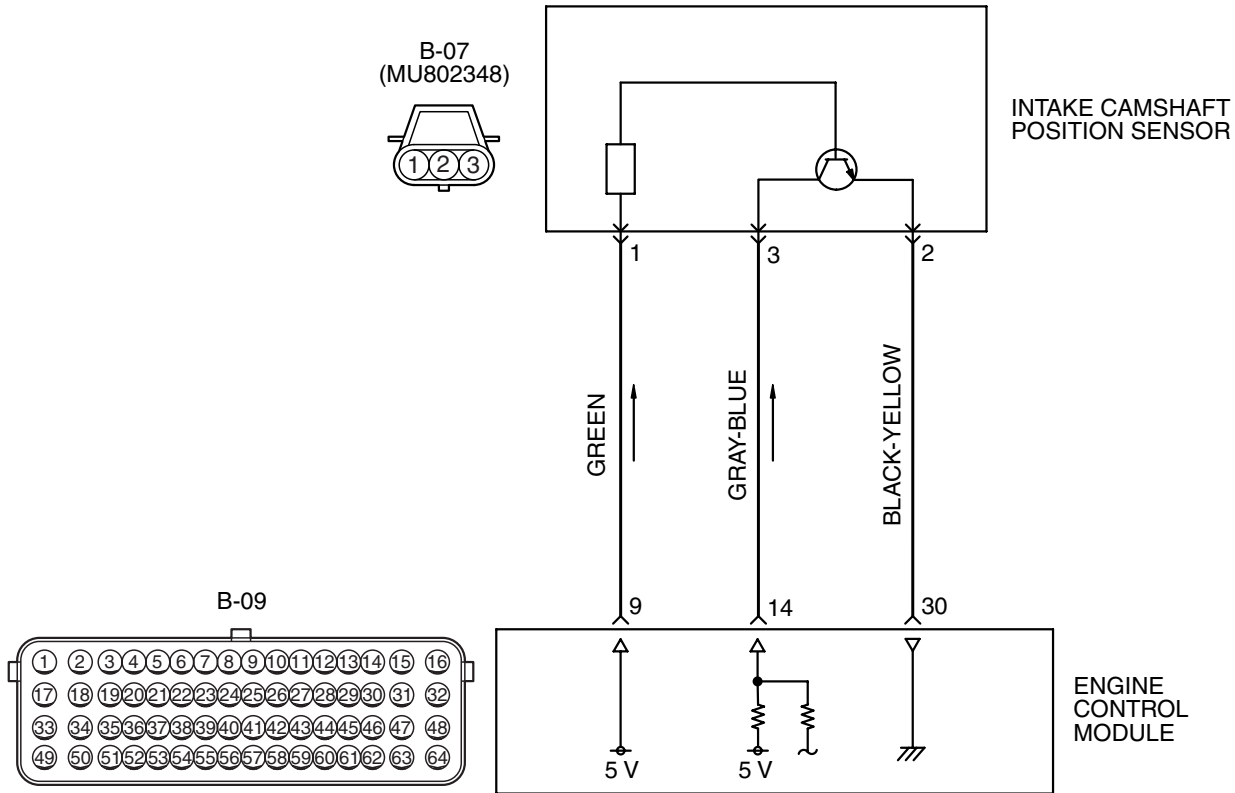
**Q: Is DTC P0335 set?**

**YES** : Retry the troubleshooting.

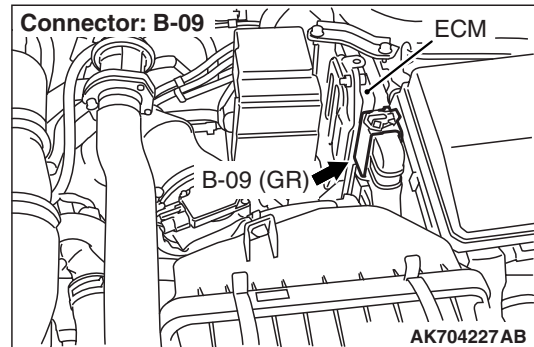
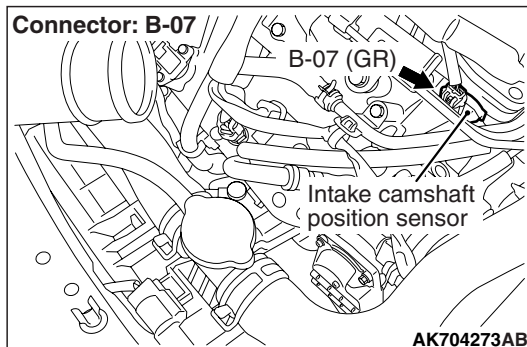
**NO** : The inspection is complete.

DTC P0340: Intake Camshaft Position Sensor Circuit

INTAKE CAMSHAFT POSITION SENSOR CIRCUIT



AK604246AD



**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**

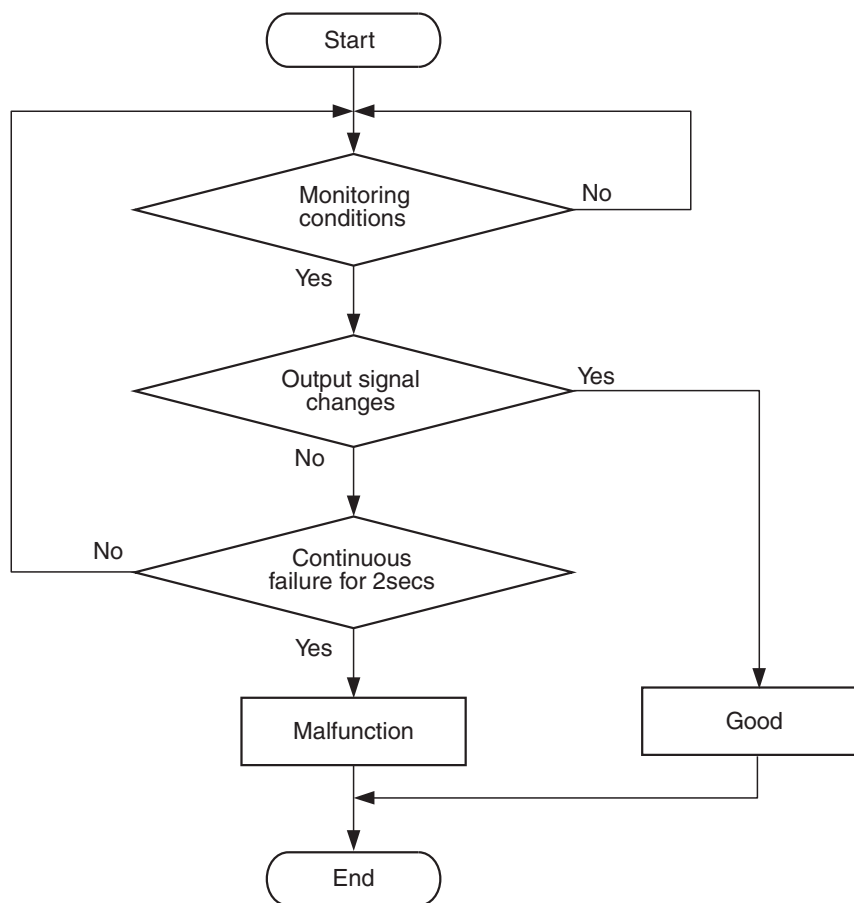
- The intake camshaft position sensor functions to detect the top dead center position of the number 1 cylinder and to convert that data to pulse signals that are input to the ECM.
- When the engine is running, the intake camshaft position sensor outputs a pulse signal.
- The ECM checks whether pulse signal is input while the engine is cranking.

**DESCRIPTIONS OF MONITOR METHODS**

- Intake camshaft position sensor signal does not change.
- Intake camshaft position sensor signal is not normal pattern.

**DTC SET CONDITIONS <Circuit continuity>**

**Logic Flow Chart**



AK604334

**Check Condition**

- Engine is being cranked.
- or
- Engine speed is higher than 500 r/min excluding during cranking.

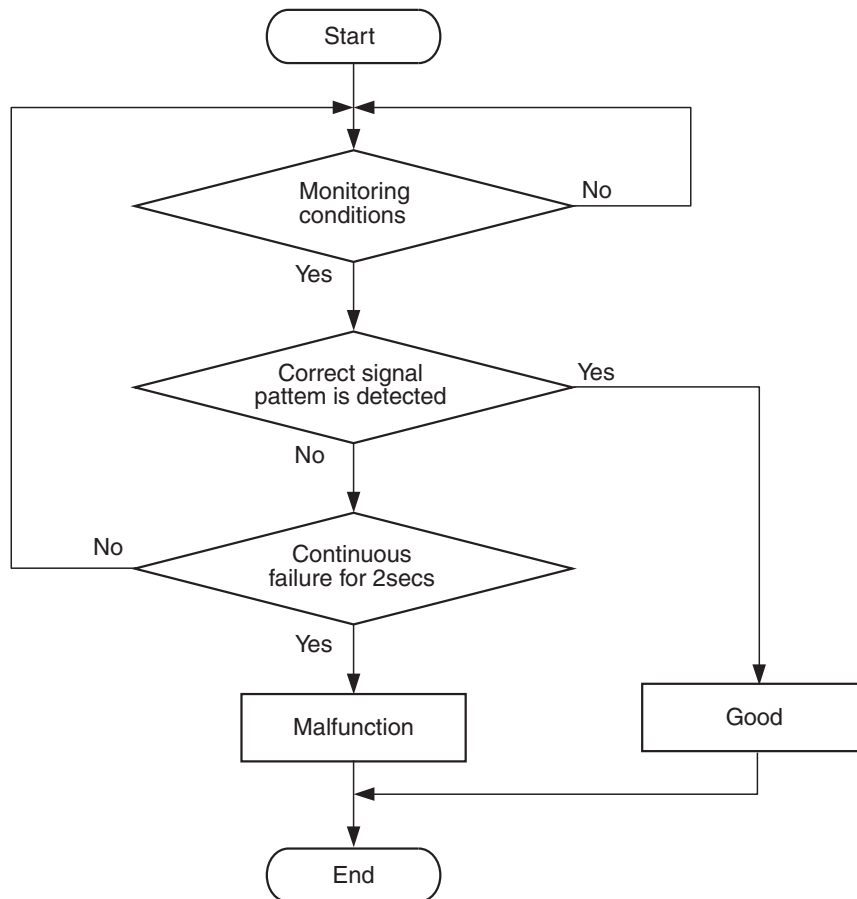
**Judgement Criterion**

- Intake camshaft position sensor output voltage has not changed (no pulse signal is input) for 2 seconds.



**DTC SET CONDITIONS <Range/Performance problem –alignment>**

**Logic Flow Chart**



AK604335

**Check Condition**

- Engine is being cranked.
- or
- Engine speed is higher than 500 r/min excluding during cranking.

**Judgement Criterion**

- Normal signal pattern has not been input 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.13A-9](#).

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

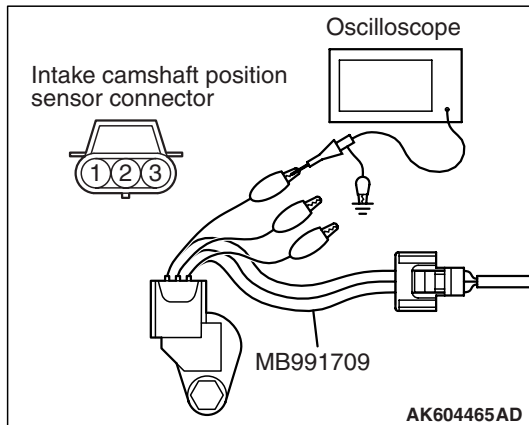
- Intake camshaft position sensor failed.
- Open or shorted intake camshaft position sensor circuit, or harness damage, or connector damage.
- Intake camshaft failed.
- ECM failed.

**DIAGNOSIS****Required Special Tools:**

- 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-07, 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 measuring with the ECM side connector, disconnect all ECM connectors. Connect the 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 waveform.

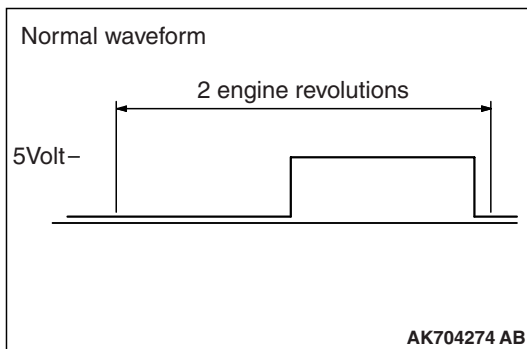
- The waveform should show a pattern similar to the illustration.

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

**Q: Is the waveform normal?**

**YES :** Go to Step 2.

**NO :** Go to Step 4.

**STEP 2. Check harness connector B-07 at intake camshaft position sensor and harness connector B-09 at ECM 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 19.

---

**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 23 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0340 set?**

- YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-15](#).

---

**STEP 4. Check harness connector B-07 at intake camshaft 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 19.

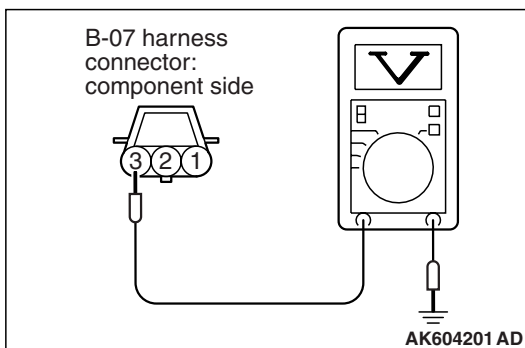
---

**STEP 5. Measure the sensor supply voltage at intake camshaft position sensor connector B-07.**

- (1) Disconnect the connector B-07 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.

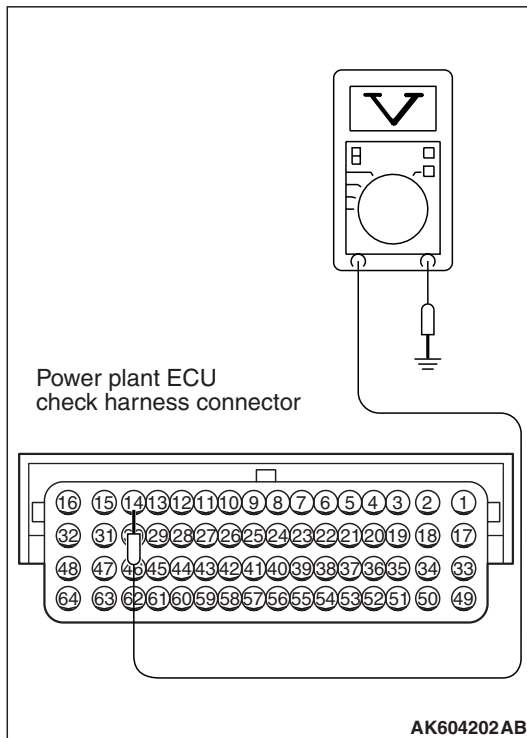
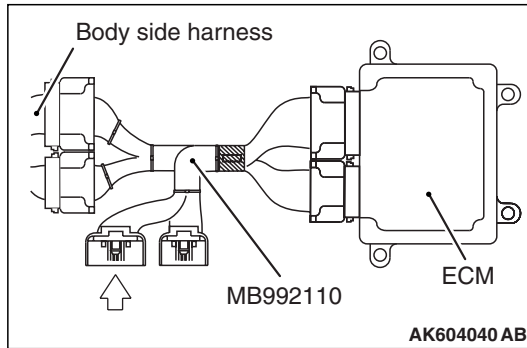


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**STEP 6. Check harness connector B-09 at ECM for damage.**

**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 19.



**STEP 7. Measure the sensor supply voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

- (1) Disconnect the 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-07.
- (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-07 (terminal No. 3) and ECM connector B-09 (terminal No. 14) because of open circuit. Then go to Step 19.

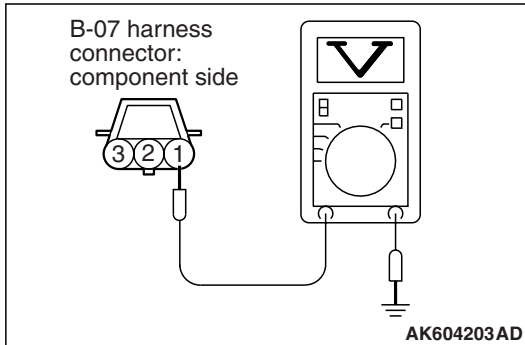
**NO :** Go to Step 8.

**STEP 8. Check for short circuit to ground between intake camshaft position sensor connector B-07 (terminal No. 3) and ECM connector B-09 (terminal No. 14).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 19.

**NO :** Repair it. Then go to Step 19.



**STEP 9. Measure the power supply voltage at intake camshaft position sensor connector B-07.**

- (1) Disconnect the connector B-07 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 4.9 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 12.

**NO :** Go to Step 10.

**STEP 10. Check harness connector B-09 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 19.

**STEP 11. Check for open circuit and short circuit to ground between intake camshaft position sensor connector B-07 (terminal No. 1) and ECM connector B-09 (terminal No. 9).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 19.

**NO :** Repair it. Then go to Step 19.

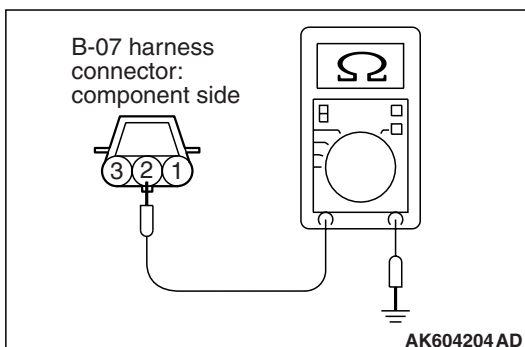
**STEP 12. Check the continuity at intake camshaft position sensor connector B-07.**

- (1) Disconnect the connector B-07 and measure at the harness side.
- (2) Check for the continuity between terminal No. 2 and ground.
  - 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-09 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 19.

---

**STEP 14. Check for open circuit and harness damage between intake camshaft position sensor connector B-07 (terminal No. 2) and ECM connector B-09 (terminal No. 30).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 19.

**NO :** Repair it. Then go to Step 19.

---

**STEP 15. Check harness connector B-09 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 19.

---

**STEP 16. Check for harness damage between ECM connector B-09 (terminal No. 9) and intake camshaft position sensor connector B-07 (terminal No. 1).**

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

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 19.

---

**STEP 17. Check for harness damage between intake camshaft position sensor connector B-07 (terminal No. 3) and ECM connector B-09 (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 18. 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 19. Test the OBD-II drive cycle.**

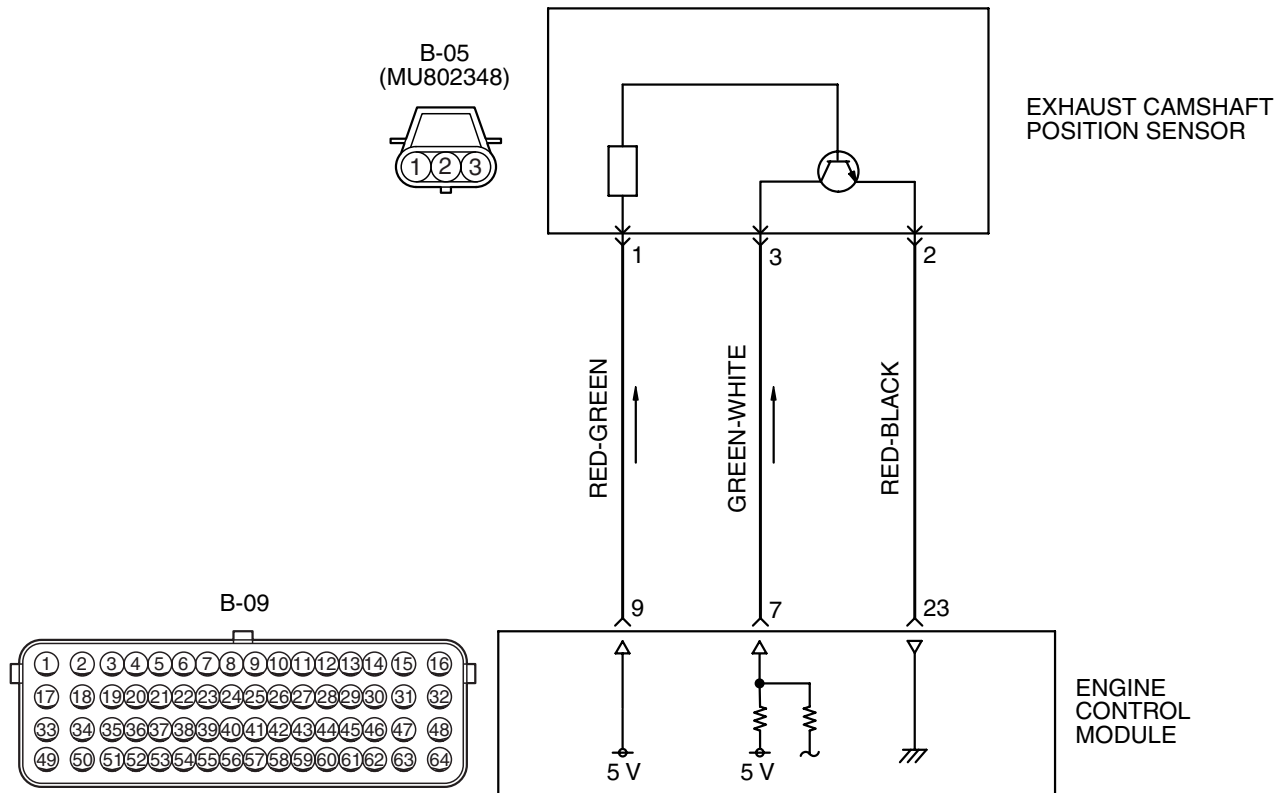
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 P.13A-9.
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0340 set?**

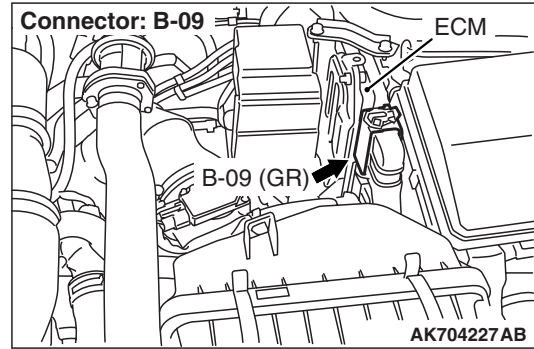
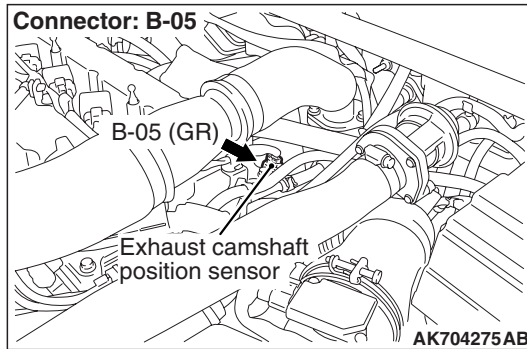
- YES :** Retry the troubleshooting.  
**NO :** The inspection is complete.

**DTC P0365: Exhaust Camshaft Position Sensor Circuit**

**EXHAUST CAMSHAFT POSITION SENSOR CIRCUIT**



AK604247AD



## 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 functions to detect the top dead center position of the number 1 cylinder and to convert that data to pulse signals that are input to the ECM.
- When the engine is running, the exhaust camshaft position sensor outputs a pulse signal.
- The ECM checks whether pulse signal is input while the engine is cranking.

## 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

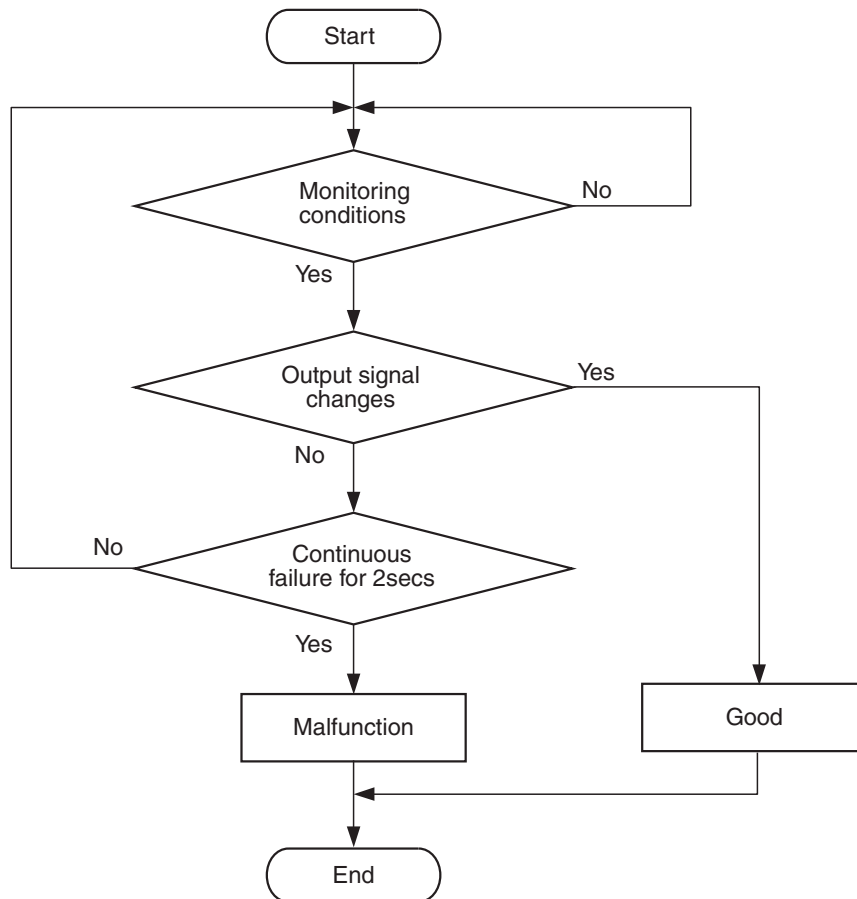
**Sensor (The sensor below is determined to be normal)**

- Not applicable



DTC SET CONDITIONS <Circuit continuity>

Logic Flow Chart



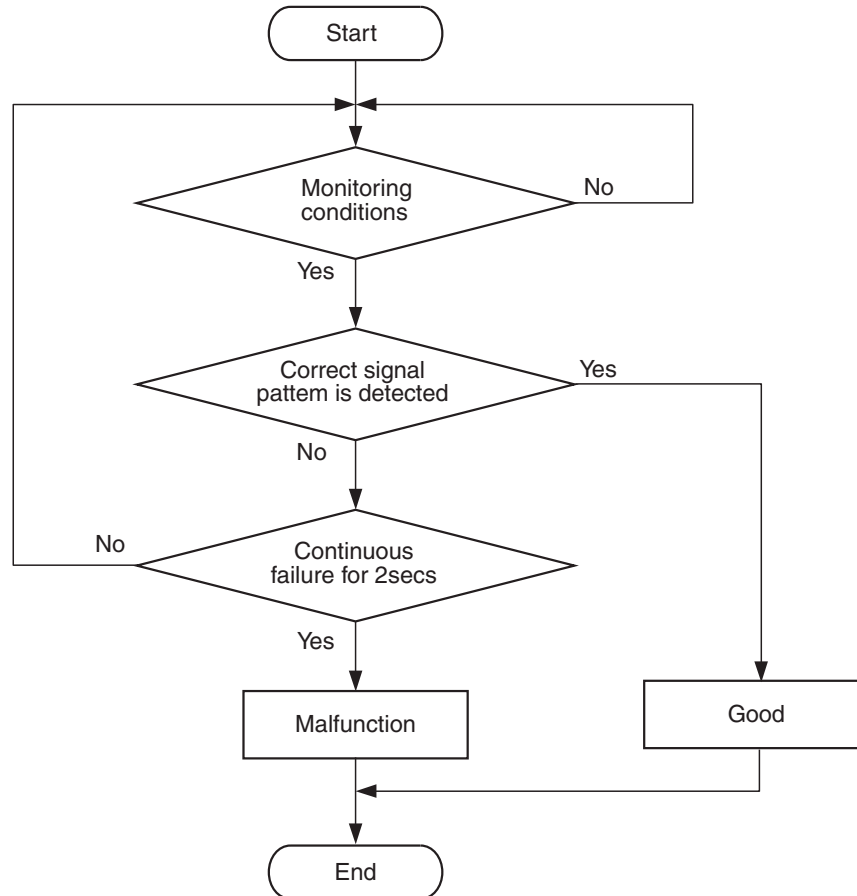
AK604334

**Check Condition**

- Engine is being cranked.
- or
- Engine speed is higher than 500 r/min excluding during cranking.

**Judgement Criterion**

- Exhaust camshaft position sensor output voltage has not changed (no pulse signal is input) for 2 seconds.

**DTC SET CONDITIONS <Range/Performance problem –alignment>****Logic Flow Chart**

AK604335

**Check Condition**

- Engine is being cranked.
- or
- Engine speed is higher than 500 r/min excluding during cranking.

**Judgement Criterion**

- Normal signal pattern has not been input for cylinder identification 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.13A-9](#).

**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, or harness damage, or connector damage.
- Exhaust camshaft failed.
- ECM failed.

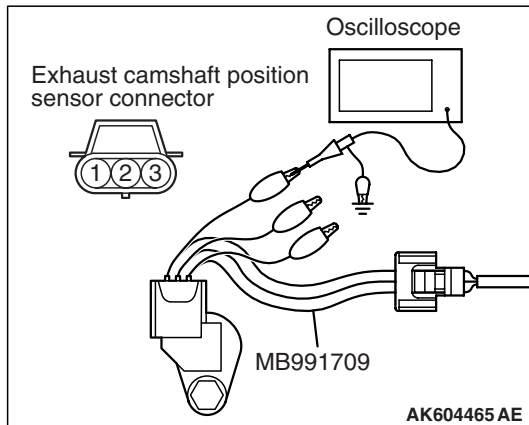
## DIAGNOSIS

### Required Special Tools:

- 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-05, 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 measuring with the ECM side connector, disconnect all ECM connectors. Connect the 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 waveform.

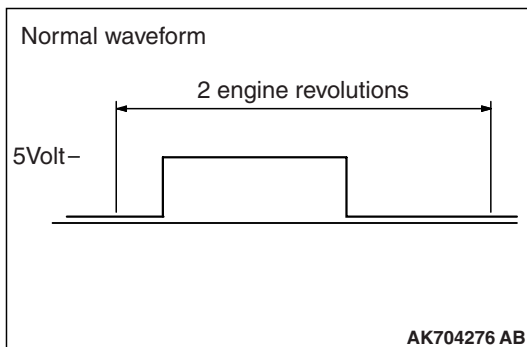
- The waveform should show a pattern similar to the illustration.

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

### Q: Is the waveform normal?

**YES** : Go to Step 2.

**NO** : Go to Step 4.



### STEP 2. Check harness connector B-05 at exhaust camshaft position sensor and harness connector B-09 at ECM 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 19.

**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 23 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0365 set?**

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-15](#).

**STEP 4. Check harness connector B-05 at exhaust camshaft 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 19.

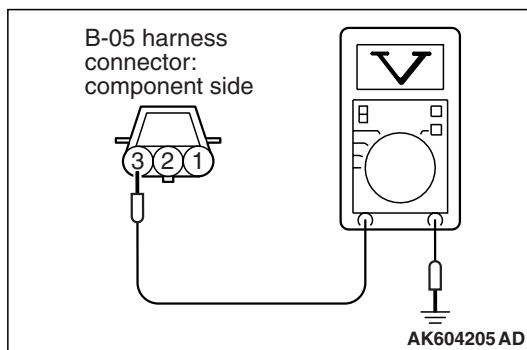
**STEP 5. Measure the sensor supply voltage at exhaust camshaft position sensor connector B-05.**

- (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. 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?**

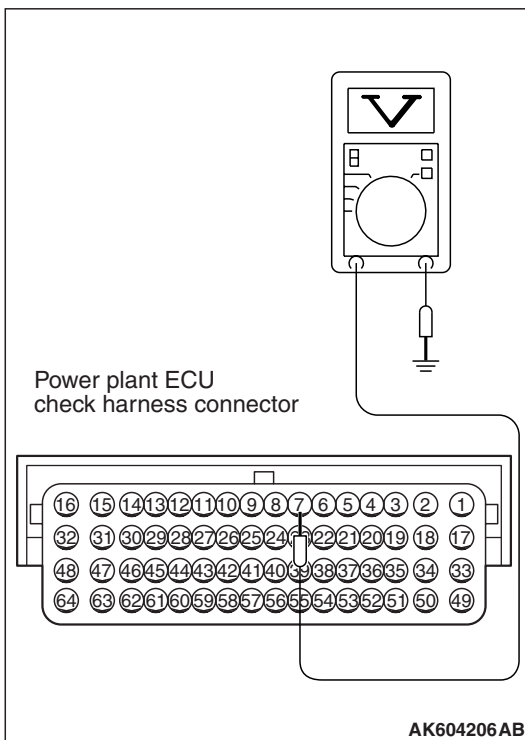
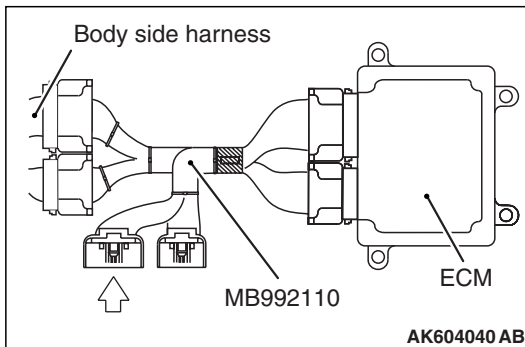
**YES :** Go to Step 9.

**NO :** Go to Step 6.

**STEP 6. Check harness connector B-09 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 19.



**STEP 7. Measure the sensor supply voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

- (1) Disconnect the 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-05.
- (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-05 (terminal No. 3) and ECM connector B-09 (terminal No. 7) because of open circuit. Then go to Step 19.

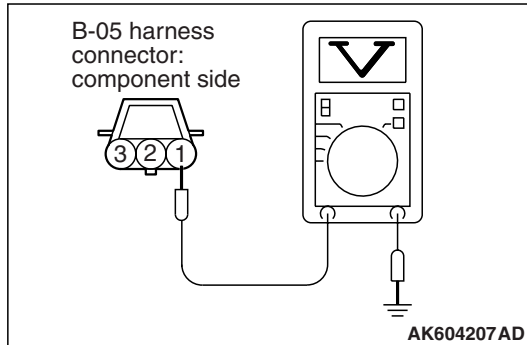
**NO :** Go to Step 8.

**STEP 8. Check for short circuit to ground between exhaust camshaft position sensor connector B-05 (terminal No. 3) and ECM connector B-09 (terminal No. 7).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 19.

**NO :** Repair it. Then go to Step 19.

**STEP 9. Measure the power supply voltage at exhaust camshaft position sensor 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. 1 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 12.

**NO :** Go to Step 10.

**STEP 10. Check harness connector B-09 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 19.

**STEP 11. Check for open circuit and short circuit to ground between exhaust camshaft position sensor connector B-05 (terminal No. 1) and ECM connector B-09 (terminal No. 9).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 19.

**NO :** Repair it. Then go to Step 19.

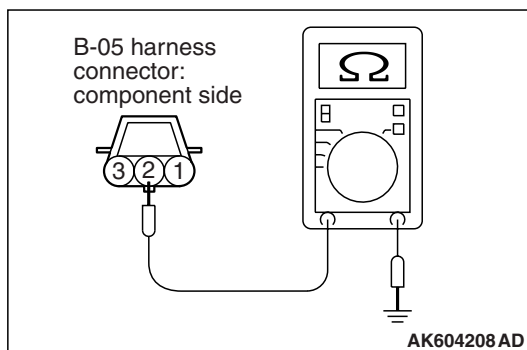
**STEP 12. Check the continuity at exhaust camshaft position sensor connector B-05.**

- (1) Disconnect the connector B-05 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-09 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 19.

---

**STEP 14. Check for open circuit and harness damage between exhaust camshaft position sensor connector B-05 (terminal No. 2) and ECM connector B-09 (terminal No. 23).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 19.

**NO :** Repair it. Then go to Step 19.

---

**STEP 15. Check harness connector B-09 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 19.

---

**STEP 16. Check for harness damage between ECM connector B-09 (terminal No. 9) and exhaust camshaft position sensor connector B-05 (terminal No. 1).**

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

**YES :** Go to Step 17.

**NO :** Repair it. Then go to Step 19.

---

**STEP 17. Check for harness damage between exhaust camshaft position sensor connector B-05 (terminal No. 3) and ECM connector B-09 (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 18. 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 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.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0365 set?**

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

**DTC P0420: Warm Up Catalyst Efficiency Below Threshold****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 (front) heater monitor
- Heated oxygen sensor (rear) heater monitor
- Heated oxygen sensor (front) inactive monitor
- Heated oxygen sensor offset voltage monitor
- Misfire monitor
- Fuel system monitor
- Air/fuel ratio feedback monitor

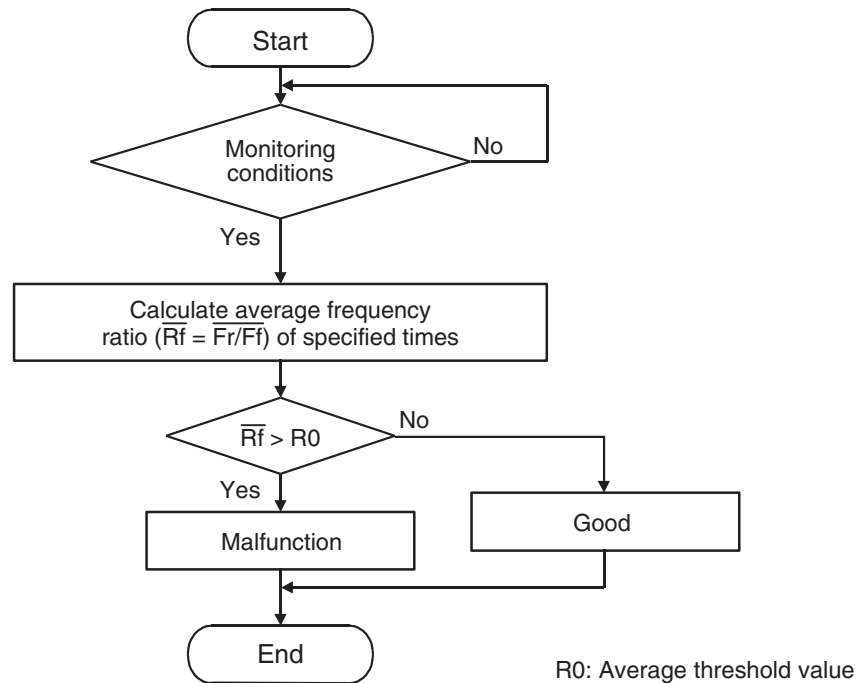
**Sensor (The sensor below is determined to be normal)**

- 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 3,500 r/min or lower.
- Accelerator pedal is open.
- Mass airflow is between 13 and 45 g/sec.
- More than 3 seconds have elapsed after the above-mentioned three conditions have been met.
- Intake air temperature is higher than -10° C (14° F).
- Barometric pressure is higher than 76 kPa (22.4 in.Hg).
- Under the closed loop air/fuel ratio control.
- Vehicle speed is 1.5 km/h (1.0 mph) or more.
- The ECM monitors the maximum 5 times per drive cycle under these conditions.
- Short-term fuel trim is higher than -20 percent and lower than +17 percent.
- The cumulative mass airflow is higher than 1,638 g.

#### Judgement Criterion

- When the monitoring for 10 seconds is carried out 5 times, the frequency ratio of rear and front signals is the specified value or more.

*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 3 [P.13A-9](#).

#### 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 Tools:

- 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.

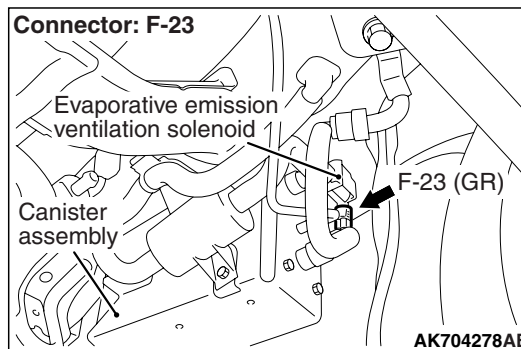
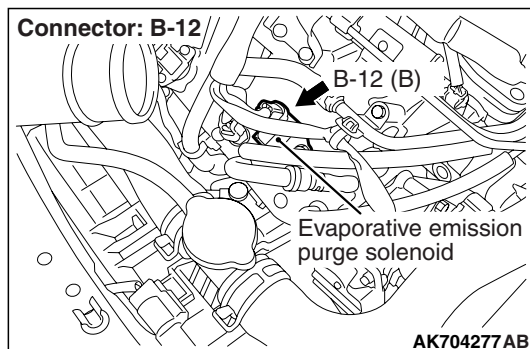
- (1) Replace the catalytic converter.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 3 [P.13A-9](#).
- (3) Check the diagnostic trouble code (DTC).

### Q: Is DTC P0420 set?

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

**NO** : The inspection is complete.

## DTC P0441: Evaporative Emission Control System Incorrect Purge Flow



### TECHNICAL DESCRIPTION

- ECM detects a stuck open condition of evaporative emission purge solenoid and a stuck closed condition of evaporative emission ventilation solenoid by pressure change in fuel tank.
- Stuck open evaporative emission purge solenoid is judged through monitoring leak of evaporative emission system.
- Stuck closed evaporative emission ventilation solenoid is judged after 20 seconds from end of monitoring leak of evaporative emission system, or of usual operation of evaporative emission purge solenoid from ON to OFF.

### DESCRIPTIONS OF MONITOR METHODS

Fuel tank pressure decreases largely during purge-cut.

### 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)**

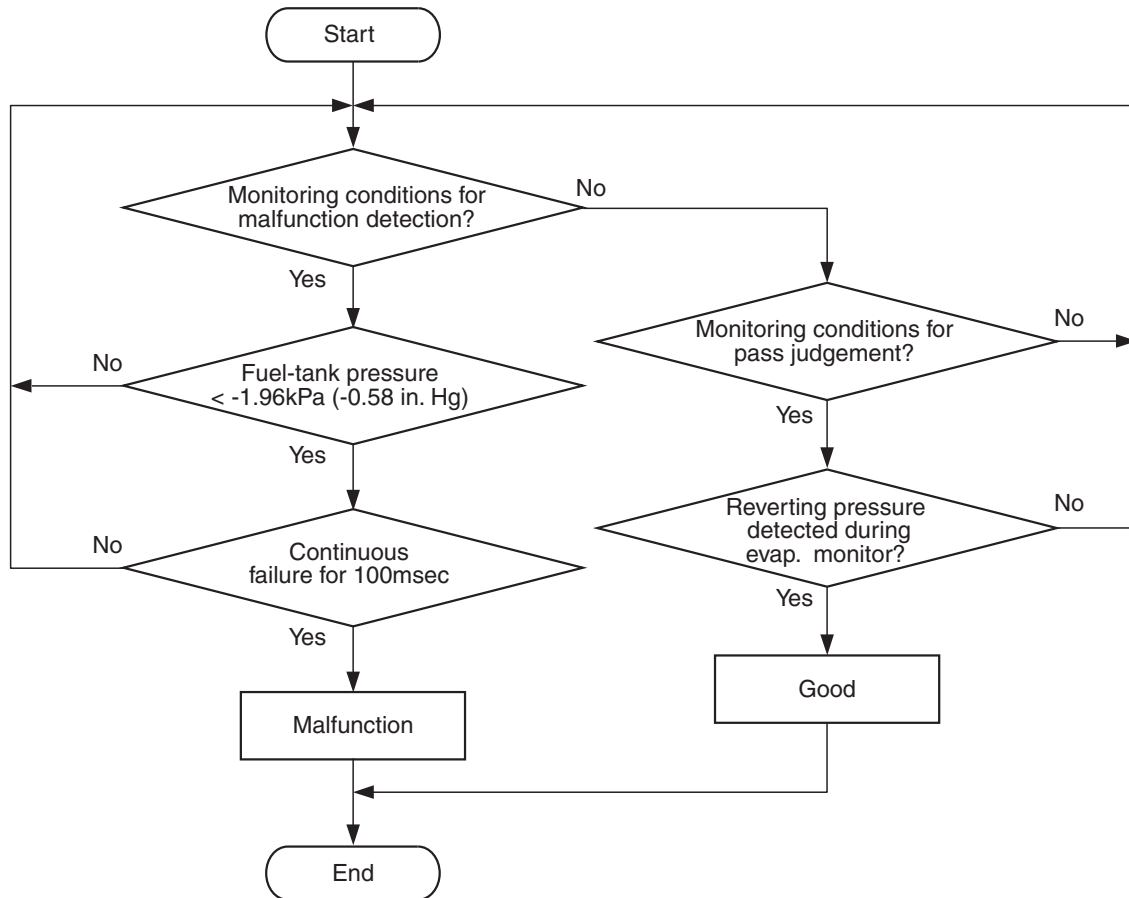
- Fuel tank differential pressure sensor monitor

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

- Not applicable

**DTC SET CONDITIONS**

**Logic Flow Chart**



AK604338

**Check Conditions**

- Engine is running.
- ON duty cycle of the evaporative emission purge solenoid is 0 percent.
- 20 seconds have elapsed since the duty cycle of the evaporative emission purge solenoid has turned to 0 percent.

**Judgement Criterion**

- The pressure in the fuel tank is -1.96 kPa (-0.58 in.Hg) or less for 0.1 second.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

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

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

- Evaporative emission purge solenoid failed.
- Evaporative emission ventilation solenoid failed.
- Fuel tank differential pressure sensor circuit related part(s) failed.

**DIAGNOSIS****Required Special Tools:**

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

**STEP 1. Using scan tool MB991958, read the diagnostic trouble code (DTC).**

**⚠ CAUTION**

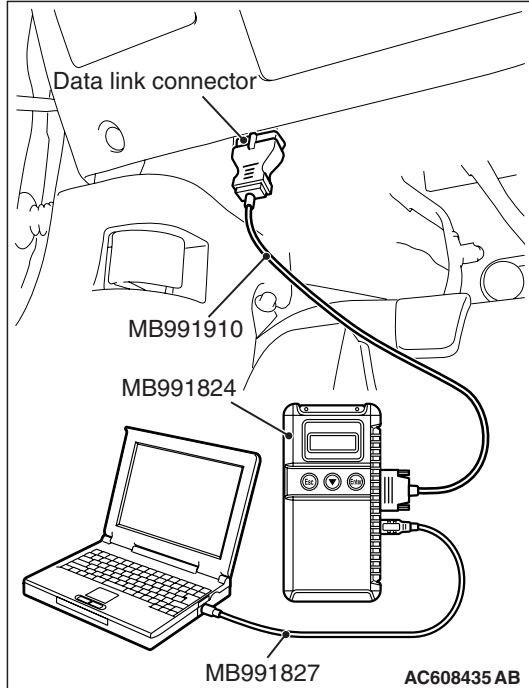
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Read the DTC.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC P0451 set?**

**YES** : Refer to DTC P0451 –Fuel Tank Differential Pressure Circuit Range/Performance Problem [P.13A-485](#).

**NO** : Go to Step 2.



**STEP 2. Using scan tool MB991958, check data list item 52: Fuel Tank Differential Pressure Sensor.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Remove the fuel cap.
- (3) Set scan tool MB991958 to the data reading mode for item 52, Fuel Tank Differential Pressure Sensor.
  - The fuel tank differential pressures should be 1,500 and 3,500 millivolts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the fuel tank pressure between 1,500 and 3,500 millivolts?**

**YES** : Go to Step 3.

**NO** : Refer to DTC P0451 –Fuel Tank Differential Pressure Circuit Range/Performance Problem [P.13A-485](#).

---

**STEP 3. Using scan tool MB991958, check actuator test item 10: Evaporative Emission Purge Solenoid.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the actuator test mode for item 10, Evaporative emission purge solenoid.
  - An operation sound should be heard and vibration should be felt when the evaporative emission purge solenoid is operated.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 4.

**NO :** Replace the evaporative emission purge solenoid.  
Then go to Step 5.

---

**STEP 4. Using scan tool MB991958, check actuator test item 15: Evaporative Emission Ventilation Solenoid.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the actuator test mode for item 15, Evaporative emission ventilation solenoid.
  - An operation sound should be heard and vibration should be felt when the evaporative emission ventilation solenoid is operated.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Repair or replace the vent hose and air filter. Then go to Step 5.

**NO :** Replace the evaporative emission ventilation solenoid. Then go to Step 5.

---

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

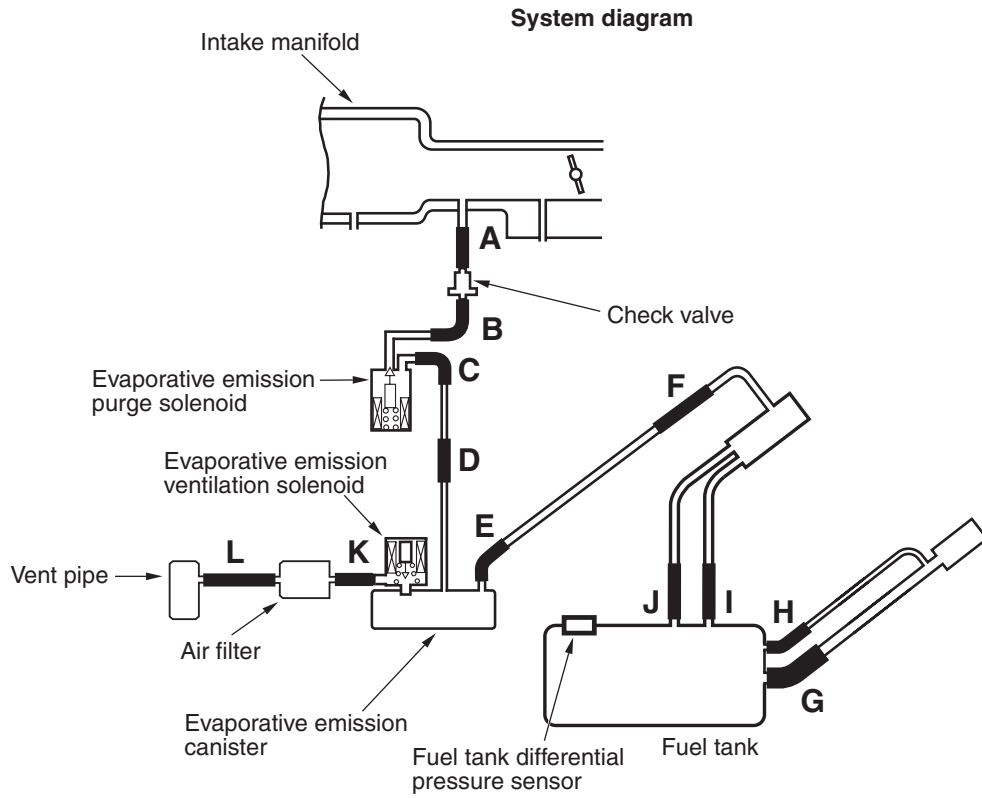
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 4 [P.13A-9](#).
- (2) Read the diagnostic trouble code.

**Q: Is DTC P0441 set?**

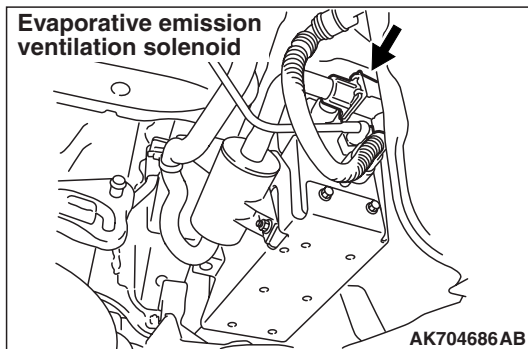
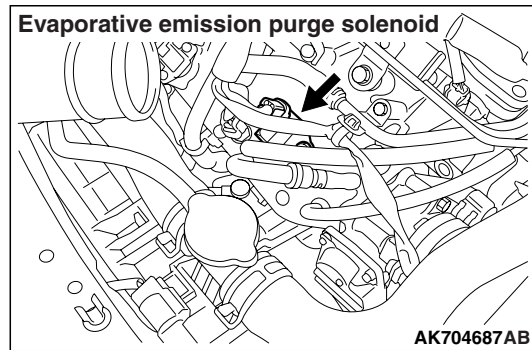
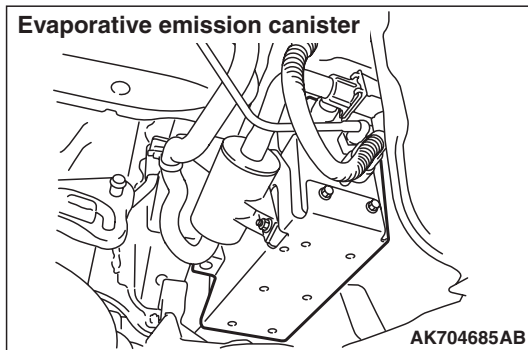
**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

DTC P0442: Evaporative Emission System Leak Detected (Small Leak)



AK704684AB



## TECHNICAL DESCRIPTION

- The ECM monitors the Evaporative Emission (EVAP) System pressure.
- The ECM controls the evaporative emission ventilation solenoid. It closes the evaporative emission ventilation solenoid to seal the evaporative emission canister side of the system.
- The evaporative emission purge solenoid is opened to allow manifold vacuum to create low pressure (vacuum) in the EVAP system.
- When the EVAP system develops a vacuum of 2 kPa (0.29 psi), the evaporative emission purge solenoid is closed and the fuel system vacuum is maintained at 2 kPa (0.29 psi).
- The ECM determines whether there is a leak in the EVAP system by monitoring the vacuum inside the fuel tank.
- The test is stopped when fuel vapor pressure exceeds predetermined limits.

## DESCRIPTIONS OF MONITOR METHODS

Measure reverting pressure after depressurizing by intake manifold negative pressure and detect malfunction if reverting pressure rises largely.

## 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)**

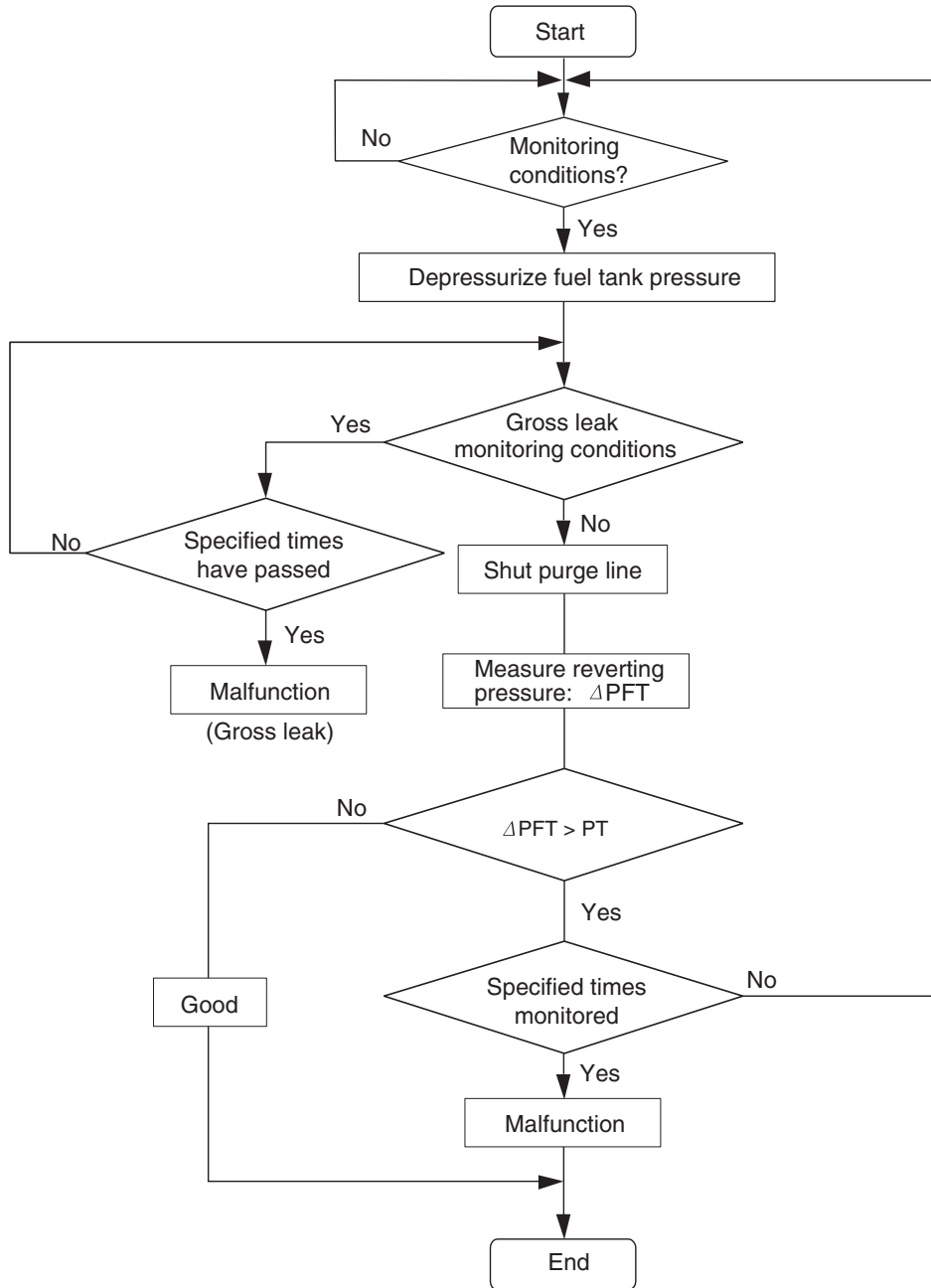
- Evaporative emission purge solenoid monitor
- Evaporative emission purge system monitor
- Fuel tank differential pressure sensor monitor
- Evaporative emission ventilation solenoid monitor
- Fuel level sensor monitor
- Fuel tank temperature sensor monitor

**Sensor (The sensors below are determined to be normal)**

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

DTC SET CONDITIONS

Logic Flow Chart (Monitor Sequence)



AK604523AB

**Check Conditions**

Remaining fuel amount is 15 –40 percent of capacity.

**Conditions A: At Start up**

- Intake air temperature is 36° C (97° F) or less when the engine is started.
- The engine coolant temperature is 36 ° C (97 ° F) or less when the engine is started.

**Conditions B: For Test to Run**

- The fuel temperature is less than 36 ° C (97 ° F), and less than 13 minutes have elapsed since the engine was started.
- Engine coolant temperature is greater than 60° C (140° F)
- Power steering switch: "OFF"
- Barometric pressure is greater than 76 kPa (11 psi).



- Fuel tank differential pressure sensor output voltage is 1 to 4 volts.
- Vehicle speed is greater than 20 km/h (12.4 mph).

#### Conditions C: For Test to Stop

- Intake air temperature is greater than  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- When the evaporative emission purge solenoid and evaporative emission ventilation solenoid are closed, the pressure in the fuel tank is less than 451 Pa (0.065 psi).
- The pressure fluctuation is less than 647 Pa (0.094 psi).
- 10 seconds have elapsed since the start of the previous monitoring.
- Monitoring time: 75 –125 seconds.

#### Judgement Criteria

- Internal pressure of the fuel tank has changed more than 1,010 Pa (0.147 psi) in 20 seconds after the tank and vapor line were closed.

*NOTE: The monitoring time (75 –125 seconds) depends on the fuel level and the temperature in the fuel tank.*

*The next monitoring occurs at least 10 seconds later.*

#### Check Conditions

Remaining fuel amount is 40 –85 percent of capacity.

#### Conditions A: At Start up

- Intake air temperature is less than  $36^{\circ}\text{C}$  ( $97^{\circ}\text{F}$ ) when the engine is started.
- The engine coolant temperature is less than  $36^{\circ}\text{C}$  ( $97^{\circ}\text{F}$ ) when the engine is started.

#### Conditions B: For Test to Run

- The fuel temperature is less than  $36^{\circ}\text{C}$  ( $97^{\circ}\text{F}$ ).
- Barometric pressure is greater than 76 kPa (11 psi).
- Fuel tank differential pressure sensor output voltage is 1 to 4 volts.

#### Conditions C: For Test to Stop

- Intake air temperature is greater than  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ).
- Engine coolant temperature is greater than  $20^{\circ}\text{C}$  ( $68^{\circ}\text{F}$ ).
- When the evaporative emission purge solenoid and evaporative emission ventilation solenoid are closed, the pressure in the fuel tank is less than 324 Pa (0.047 psi).
- 10 seconds have elapsed since the start of the previous monitoring.
- Monitoring time: 10 –14 minutes.

#### Judgement Criteria

- Internal pressure of the fuel tank has changed more than 1,922 Pa (0.279 psi) in 128 seconds after the tank and vapor line were closed.

*NOTE: The monitoring time (10 –14 minutes) depends on the fuel level and the temperature in the fuel tank.*

*The next monitoring occurs at least 10 seconds later.*

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

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

#### TROUBLESHOOTING HINTS (THE MOST LIKELY CAUSES FOR THIS CODE TO BE SET ARE:)

- Loose fuel cap.
- Fuel cap relief pressure is incorrect.
- Evaporative emission canister seal is leaking.
- Fuel tank, purge line or vapor line seal is leaking.
- Evaporative emission ventilation solenoid does not seal.

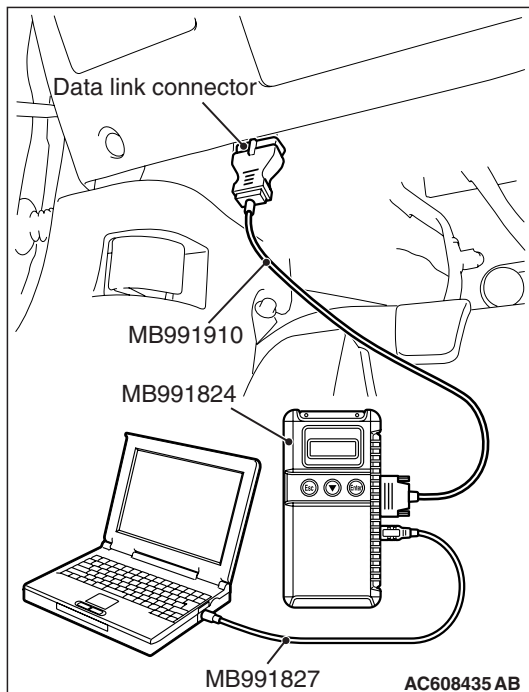
**DIAGNOSIS****Required Special Tools:**

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

**STEP 1. Using scan tool MB991958, check the evaporative emission system monitor test.****⚠ 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.
- During this test, the ECM will automatically increase the engine speed to 1,600 r/min or greater. Check that the transaxle is set to "P" position.

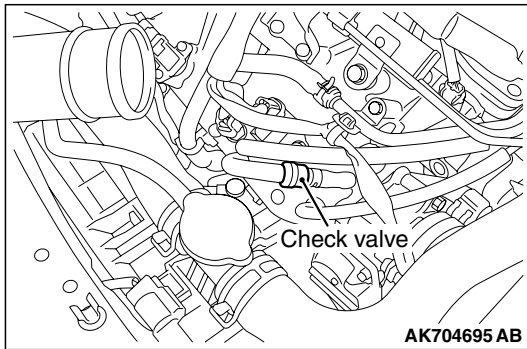
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Erase the DTCs using scan tool MB991958.
- (4) Check that the fuel cap is securely closed (Tighten until three clicks are heard).
- (5) Start the engine.
- (6) Select "Special Function"
- (7) Select "Evap Leak Monitor"
- (8) During this test, keep the accelerator pedal at the idle position.
- (9) Keep the engine speed and engine load within the specified range. When the monitor test starts, the "In Progress" item on scan tool MB991958 will change from "NO" to "YES".
- (10) Turn the ignition switch to the "LOCK" (OFF) position, and disconnect scan tool MB991958.

**Q: Is "Evap Leak Mon. Completed. Test Failed and DTCs Set" displayed on scan tool MB991958?**

**YES :** A malfunction has been detected during the monitor test. Refer to the Diagnostic Trouble Code Chart and diagnose any other DTCs that are set [P.13A-44](#). If no other DTC's have been set, go to Step 2 .

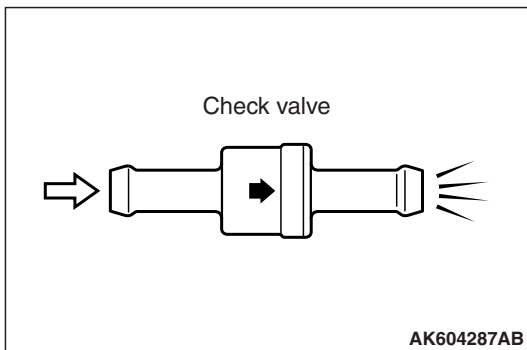
**NO <"Evap Leak Mon. Completed. Test Passed" is displayed on scan tool MB991958.> :** The evaporative emission system is working properly at this time. Explain to the customer that an improperly tightened fuel cap can cause the MIL to illuminate. Return the vehicle to the customer.

**NO <"Evap Leak Mon. Discontinued. Retest again from the first" is displayed on scan tool MB991958.> :** The EVAP monitor has been interrupted during the test. Turn the ignition switch to the "LOCK" (OFF) position once, and repeat the monitoring.



**STEP 2. Test check valve.**

(1) Check valve is a one-way check valve.

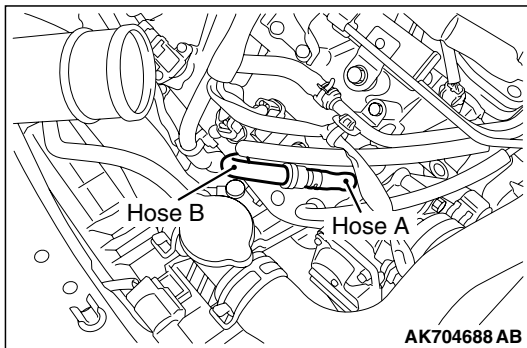


(2) Check valve should allow air to flow in only one direction.

**Q: Does check valve allow air to pass in one direction only?**

**YES :** Go to Step 3 .

**NO :** Replace check valve. Then go to Step 14 .



**STEP 3. Check for leaks in evaporative emission hoses A and B.**

Use a hand vacuum pump to test each hose A and B.

**Q: Do the hoses hold vacuum?**

**YES :** Go to Step 4 .

**NO :** Replace any damaged hose. Then go to Step 14 .

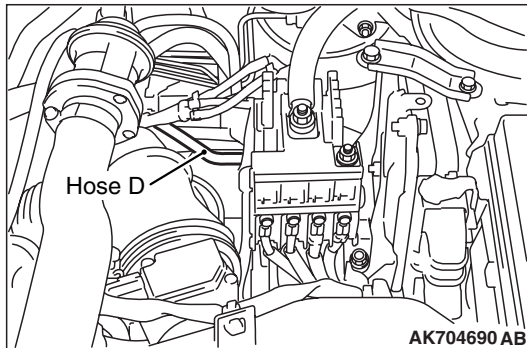
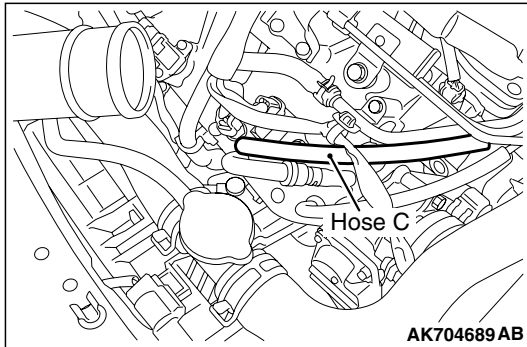
**STEP 4. Check the evaporative emission purge solenoid for leaks.**

Refer to GROUP 17, Emission Control –Evaporative Emission Control System –Evaporative Emission Purge Solenoid Check [P.17-77](#).

**Q: Is the evaporative emission purge solenoid operating properly?**

**YES :** Go to Step 5 .

**NO :** Replace the evaporative emission purge solenoid. Then go to Step 14 .



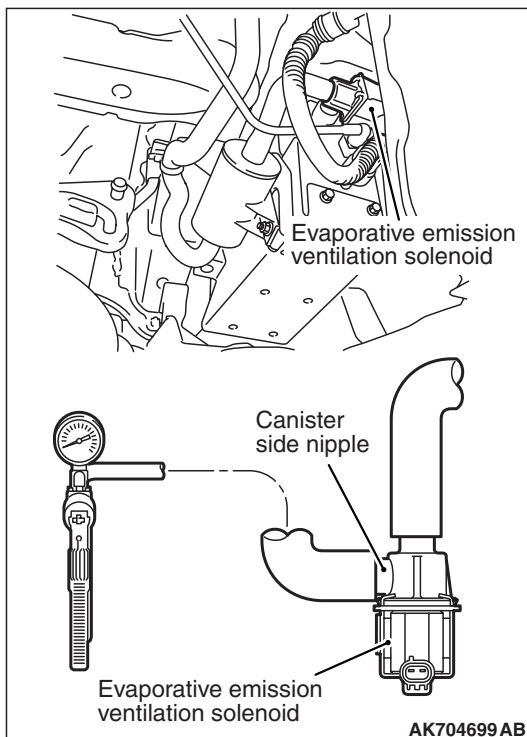
**STEP 5. Check for leaks in evaporative emission hoses C and D.**

Use a hand vacuum pump to test each hose C and D.

**Q: Do the hoses hold vacuum?**

**YES** : Go to Step 6 .

**NO** : Replace any damaged hose. Then go to Step 14 .



**STEP 6. Using scan tool MB991958, check actuator test item 15: Evaporative emission ventilation solenoid.**

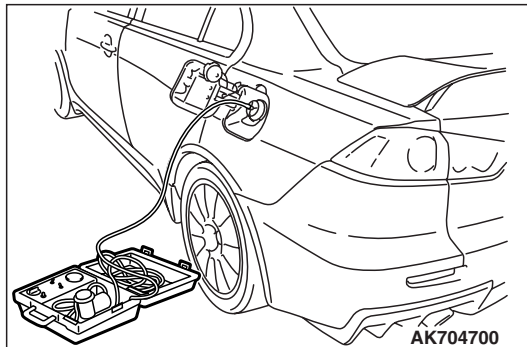
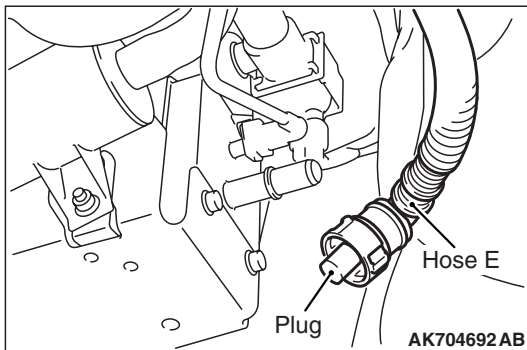
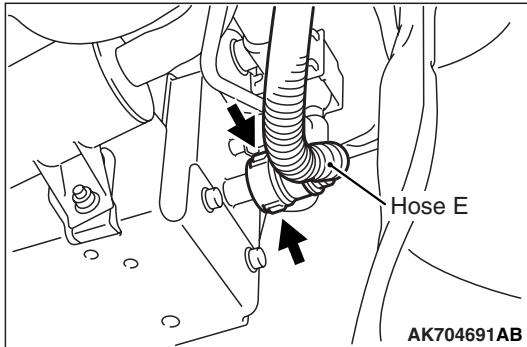
- (1) Remove the canister cover.
- (2) Remove the evaporative emission ventilation solenoid. Do not disconnect the connector.
- (3) Connect the hose of the hand vacuum pump to the canister side nipple of the evaporative emission ventilation solenoid.
- (4) Turn the ignition switch to the "ON" position.
- (5) Set scan tool MB991958 to actuator test mode.
  - Item 15: Evaporative Emission Ventilation Solenoid.
    - While the evaporative emission ventilation solenoid is energized, operate the hand vacuum pump and confirm that the solenoid holds vacuum.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.
- (7) Disconnect the hand vacuum pump, and reinstall the evaporative emission ventilation solenoid.
- (8) Reinstall the canister cover.

**Q: Did the evaporative emission ventilation solenoid hold vacuum?**

**YES** : Go to Step 7 .

**NO** : Replace the evaporative emission ventilation solenoid. Then go to Step 14 .

**STEP 7. Perform the pressure test on the evaporative emission system.**



(1) Disconnect hose E from the canister while holding the release buttons indicated in the illustration pressed by fingers.

(2) Plug the disconnected end of hose E.

(3) Confirm that the evaporative emission system pressure pump (Miller number 6872A) is operating properly. Perform the self-test as described in the pump manufacturer's instructions.

(4) Remove the fuel cap.

(5) Connect the evaporative emission system pressure pump (Miller number 6872A) to the fuel tank filler tube by using fuel tank adapter (MLR-8382).

(6) Pressure test the system to determine whether any leaks are present.

*NOTE: The "Pressure test" in this procedure refers to the I/M240 Simulation Test. The eight steps of this test are described in the manufacturer's instructions for the evaporative emission system pressure pump, Miller number 6872A.*

(7) Remove the evaporative emission system pressure pump (Miller number 6872A) and the fuel tank adapter (MLR-8382), and reinstall the fuel cap.

(8) Connect hose E to the evaporative emission canister.

**Q: Is the evaporative emission system line free of leaks?**

**YES :** Go to Step 12 .

**NO :** Go to Step 8 .

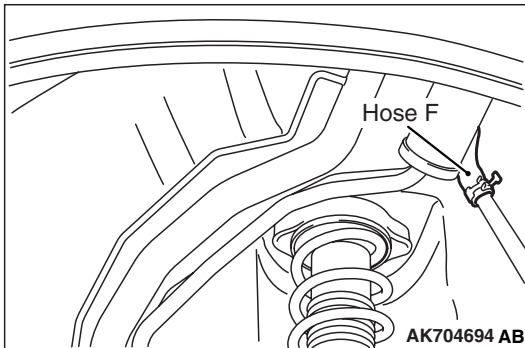
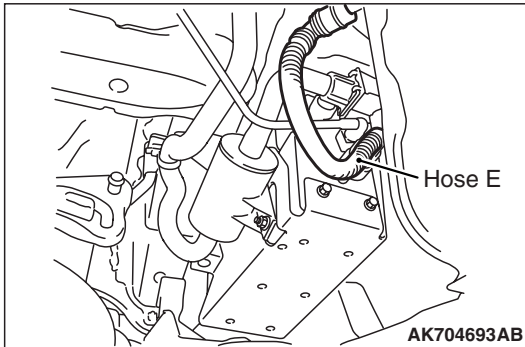
**STEP 8. Check for leaks in evaporative emission hoses E and F.**

Use a hand vacuum pump to test each hose E and F.

**Q: Do the hoses hold vacuum?**

**YES** : Go to Step 9 .

**NO** : Replace any damaged hose. Then go to Step 14 .

**STEP 9. Check for leaks in evaporative emission hoses G and H.**

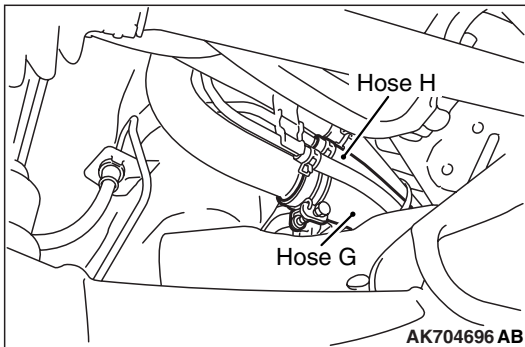
(1) Remove the fuel tank assembly.

(2) Use a hand vacuum pump to test each hose G and H.

**Q: Do the hoses hold vacuum?**

**YES** : Go to Step 10.

**NO** : Replace any damaged hose and reinstall the fuel tank assembly. Then go to Step 14 .

**STEP 10. Check for leaks in evaporative emission hoses I and J.**

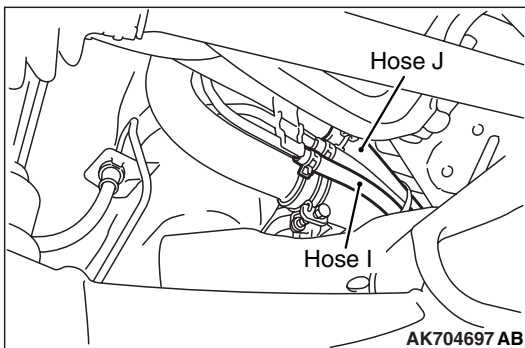
(1) Remove the fuel tank assembly.

(2) Use a hand vacuum pump to test each hose I and J.

**Q: Do the hoses hold vacuum?**

**YES** : Go to Step 11 .

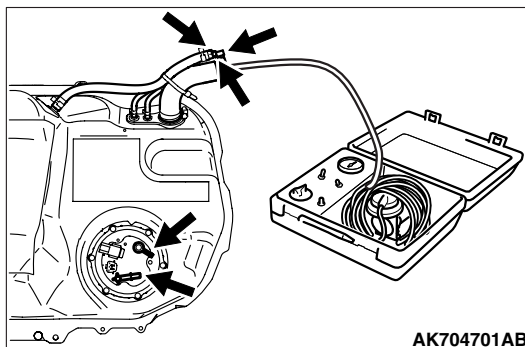
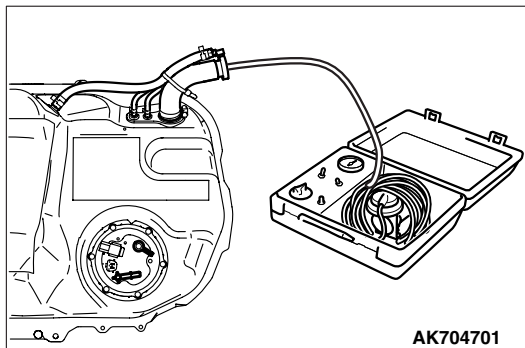
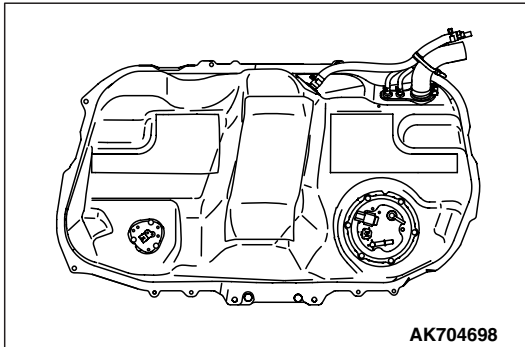
**NO** : Replace any damaged hose and reinstall the fuel tank assembly. Then go to Step 14 .



**STEP 11. Check for leaks in the fuel tank.**

- (1) Visually check for cracks or other leaks in the fuel tank.

*NOTE: Carefully check the fuel pump module and the fuel tank differential pressure sensor installation in the fuel tank.*



- (2) Connect the evaporative emission system pressure pump (Miller number 6872A) to the fuel filler hose.

- (3) Plug the hose and the nipple shown in the illustration.

*NOTE: If these items are not securely plugged now, the fuel could leak in the next step.*

- (4) Pressurize the fuel tank with the evaporative emission system pressure pump.  
(5) In the pressurized state, check for leaks by applying a soapy water solution to each section and look for bubbles.

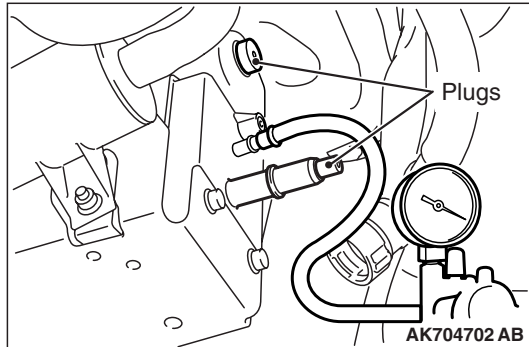
**Q: Are any leaks found?**

**YES <When there is a leak from the attachment points of the fuel pump module, fuel tank differential pressure sensor, fuel level sensor or leveling valve.> :**

Reassemble the leaked parts and check again that there are no leaks. Then reinstall the fuel tank. Then go to Step 14 .

**YES <When there is a leak from the fuel tank.> :** Replace the fuel tank. Then go to Step 14 .

**NO :** When there is no leak, reinstall the fuel tank. Then go to Step 13 .




---

**STEP 12. Check the evaporative emission canister for vacuum leaks.**

- (1) Connect a hand vacuum pump to the evaporative emission canister and plug the other nipples.
- (2) Apply a pressure on the hand vacuum pump, and confirm that air is maintained.
- (3) Disconnect the hand vacuum pump and remove the plugs.

**Q: Is the evaporative emission canister in good condition?**

**YES :** Go to Step 13 .

**NO :** Replace the evaporative emission canister. Then go to Step 14 .

---

**STEP 13. Using scan tool MB991958, check the evaporative emission system monitor test.**
**⚠ CAUTION**

- During this test, the ECM automatically increases the engine speed to 1,600 r/min or greater. Check that the transaxle is set to "P" position.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTCs using scan tool MB991958.
- (3) Check that the fuel cap is securely closed (Tighten until three clicks are heard).
- (4) Start the engine.
- (5) Select "Special Function"
- (6) Select "Evap Leak Monitor"
- (7) During the test, keep the accelerator pedal at the idle position.
- (8) Keep the engine speed and engine load within the specified range. When the monitor test starts, the "In Progress" item on scan tool MB991958 will change from "NO" to "YES".
- (9) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is "Evap Leak Mon. Completed. Test Failed and DTCs Set" displayed on scan tool MB991958?**

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Code Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 14 .

**NO <"Evap Leak Mon. Completed. Test Passed" is displayed on scan tool MB991958.> :** The evaporative emission system is working properly at this time. Go to Step 14 .

**NO <"Evap Leak Mon. Discontinued. Retest again from the first" is displayed on scan tool MB991958.> :** The EVAP monitor has been interrupted during the test. Turn the ignition switch to the "LOCK" (OFF) position once, and repeat the monitoring.



**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 4 [P.13A-9](#).
- (2) Check the diagnostic trouble code (DTC).

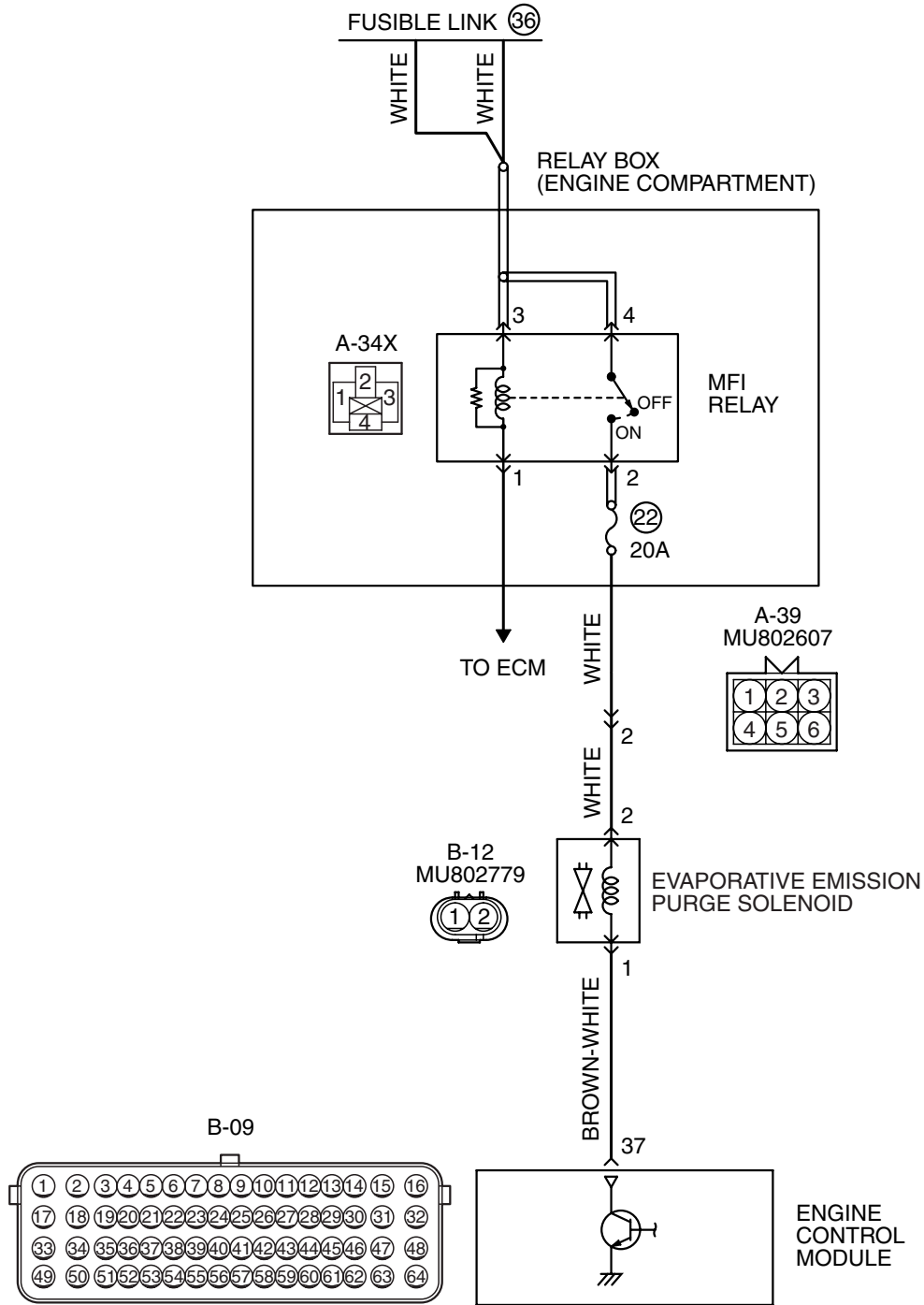
**Q: Is DTC P0442 set?**

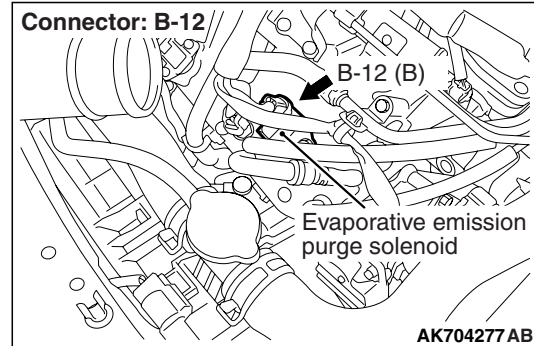
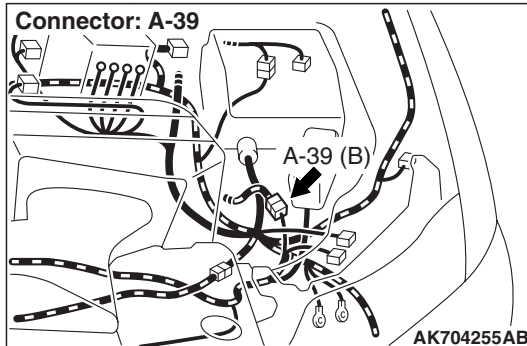
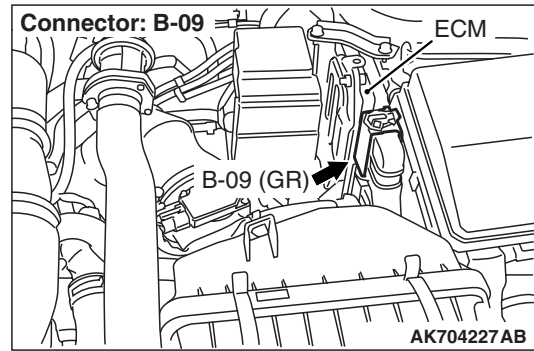
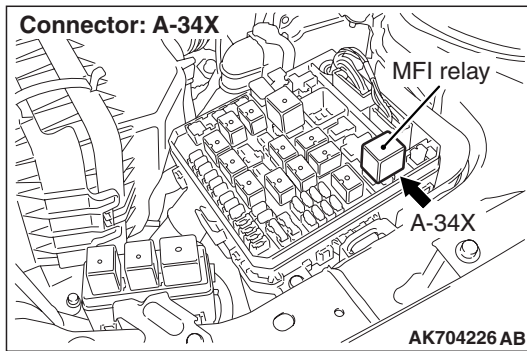
**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

DTC P0443: Evaporative Emission Purge Solenoid Circuit

EVAPORATIVE EMISSION PURGE SOLENOID CIRCUIT





## CIRCUIT OPERATION

- The evaporative emission purge solenoid power is supplied from the MFI relay (terminal No. 2).
- The ECM controls ground evaporative emission purge solenoid by turning the power transistor in the ECM "ON" and "OFF".

## TECHNICAL DESCRIPTION

- To judge if there is open circuit in the evaporative emission purge solenoid drive circuit, the ECM measures the surge voltage of the evaporative emission purge solenoid coil.

## DESCRIPTIONS OF MONITOR METHODS

Off-surge does not occur after solenoid is operated from on to off.

## 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)**

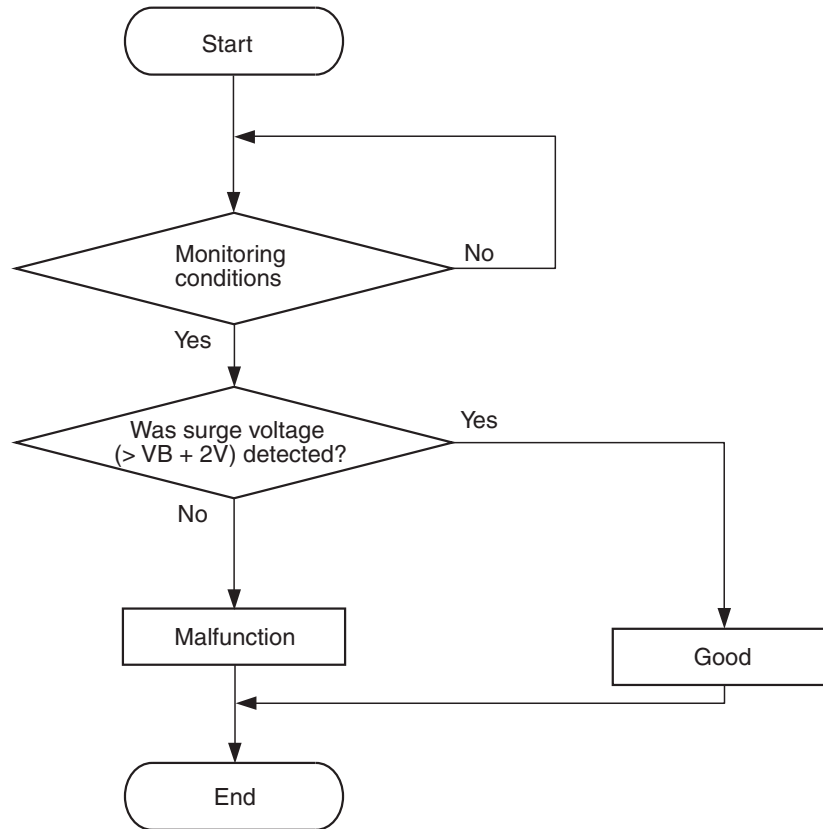
- Not applicable

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

- Not applicable

## DTC SET CONDITIONS

## Logic Flow Chart



AK604339

**Check Conditions**

- Engine is being cranked.
- Battery positive voltage is between 10 and 16.5 volts.

**Judgement Criteria**

- The evaporative emission purge solenoid coil surge voltage (battery positive voltage + 2 volts) is not detected for 0.2 second.
- The ECM monitors for this condition once during the drive cycle.

**Check Conditions**

- Battery positive voltage is between 10 and 16.5 volts.
- ON duty cycle of the evaporative emission purge solenoid is between 10 and 90 percent.
- Evaporative emission ventilation solenoid is off.
- 1 second or more has elapsed after the above mentioned conditions have been met.

**Judgement Criterion**

- The evaporative emission purge solenoid coil surge voltage (battery positive voltage + 2 volts) is not detected for 1 second after the evaporative emission purge solenoid is turned off.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

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

- Evaporative emission purge solenoid failed.
- Open or shorted evaporative emission purge solenoid 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 actuator test item 10: Evaporative Emission Purge Solenoid.**

### **⚠ CAUTION**

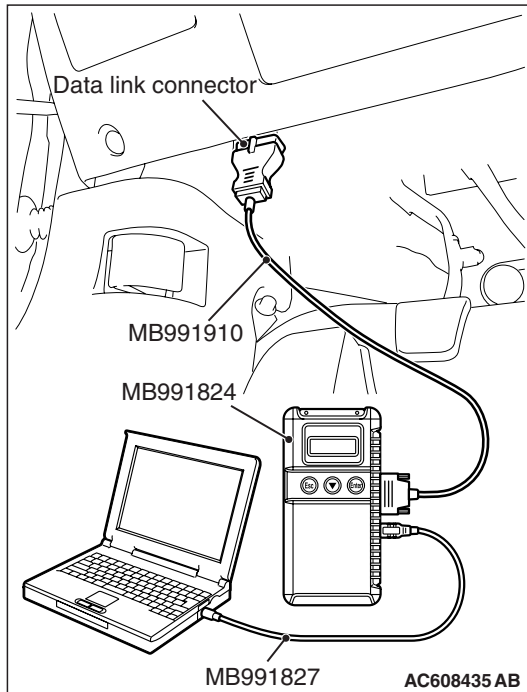
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 actuator test mode for item 10, Evaporative emission purge solenoid.
  - An operation sound should be heard and vibration should be felt when the evaporative emission purge solenoid is operated.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

### **Q: Is the solenoid operating properly?**

**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How Cope with Intermittent Malfunctions [P.00-15](#).

**NO :** Go to Step 2.

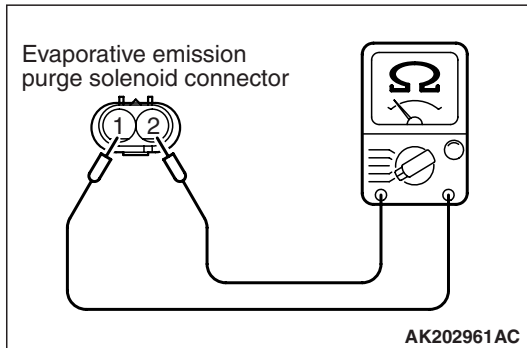


**STEP 2. Check harness connector B-12 at the evaporative emission purge solenoid for damage.**

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

**YES :** Go to Step 3.

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

**STEP 3. Check the evaporative emission purge solenoid.**

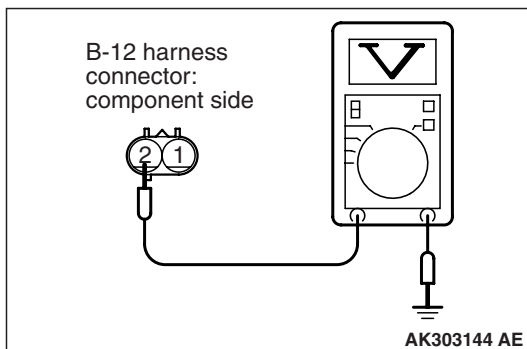
- (1) Disconnect the evaporative emission purge solenoid connector B-12.
- (2) Measure the resistance between evaporative emission purge solenoid side connector terminal No. 1 and No. 2.

**Standard value: 22 –26  $\Omega$  [at 20° C (68° F)]**

**Q: Is the measured resistance between 22 and 26  $\Omega$  [at 20° C (68° F)]?**

**YES :** Go to Step 4.

**NO :** Replace the evaporative emission purge solenoid. Then go to Step 10.

**STEP 4. Measure the power supply voltage at evaporative emission purge solenoid harness side connector B-12.**

- (1) Disconnect the connector B-12 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 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 6.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-34X at MFI relay for damage.**

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

**YES :** Check harness connector A-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 MFI relay connector A-34X (terminal No. 2) and evaporative emission purge solenoid connector B-12 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

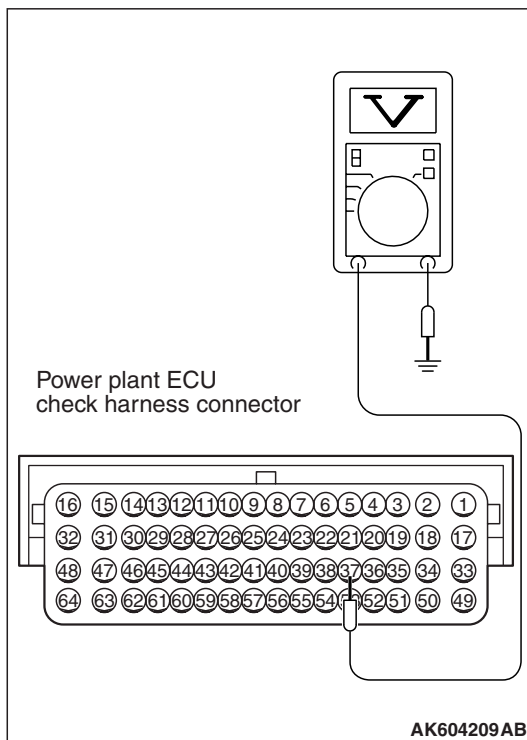
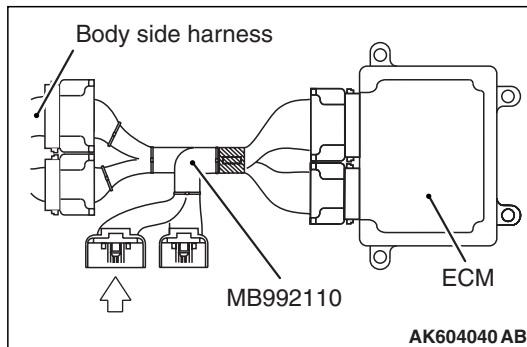
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

**STEP 6. Check harness connector B-09 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 10.



**STEP 7. Measure the power supply voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

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

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

(3) Measure the voltage between terminal No. 37 and ground.

- Voltage should be battery positive voltage.

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

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

**YES :** Go to Step 8.

**NO :** Repair harness wire between evaporative emission purge solenoid connector B-12 (terminal No. 1) and ECM connector B-09 (terminal No. 37) because of open circuit or short circuit to ground. Then go to Step 10.

**STEP 8. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and evaporative emission purge solenoid connector B-12 (terminal No. 2).**

*NOTE: Check harness connector after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.*

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

**YES :** Go to Step 9.

**NO :** Repair it. Then go to Step 10.

**STEP 9. Check for harness damage between evaporative emission purge solenoid connector B-12 (terminal No. 1) and ECM connector B-09 (terminal No. 37).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

**NO :** Repair it. Then go to Step 10.

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**STEP 10. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13A-9](#).

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

**Q: Is DTC P0443 set?**

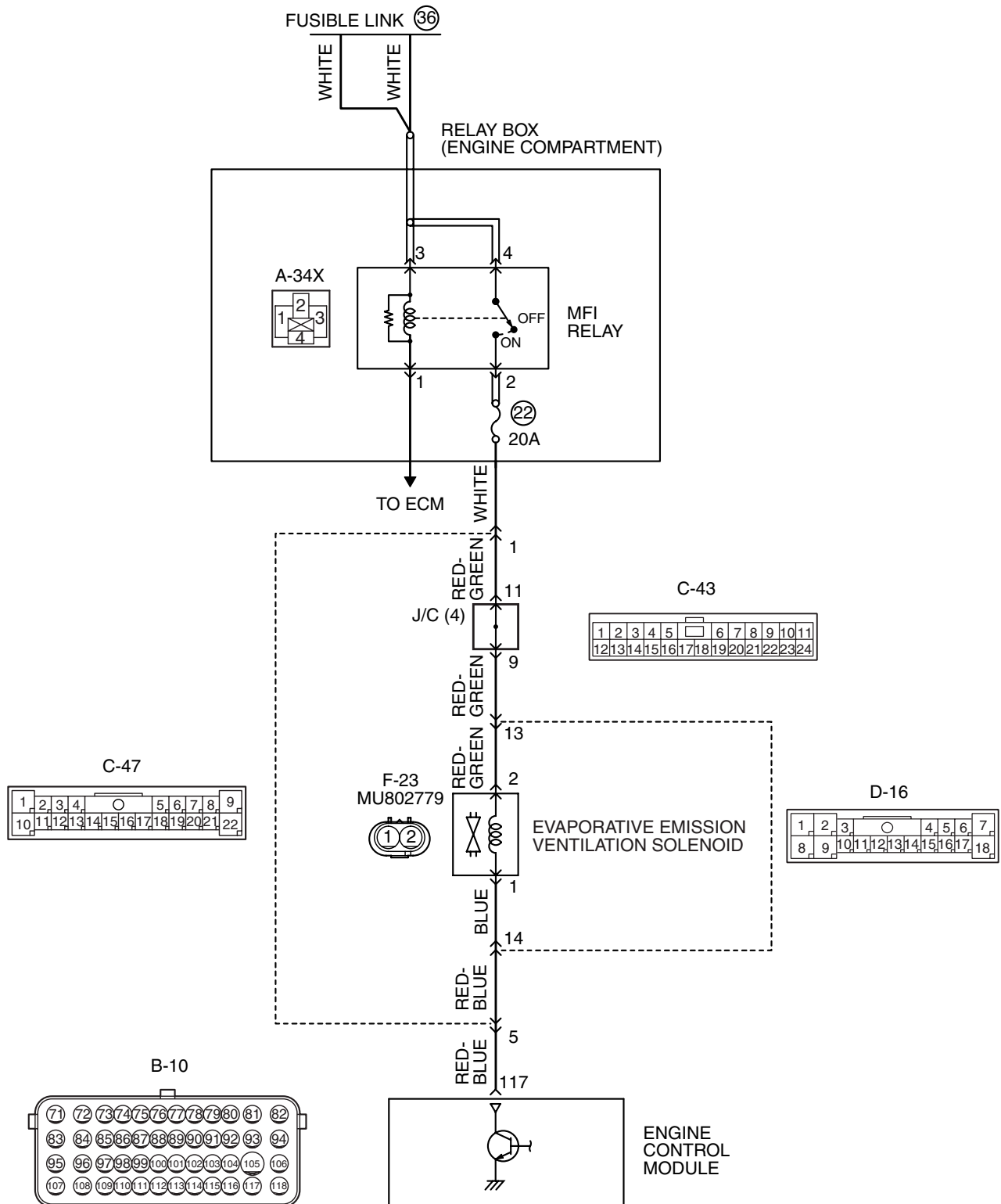
**YES :** Retry the troubleshooting.

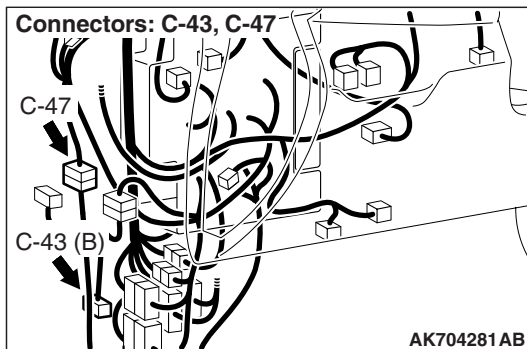
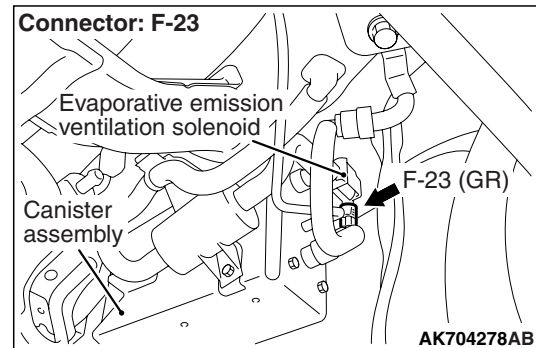
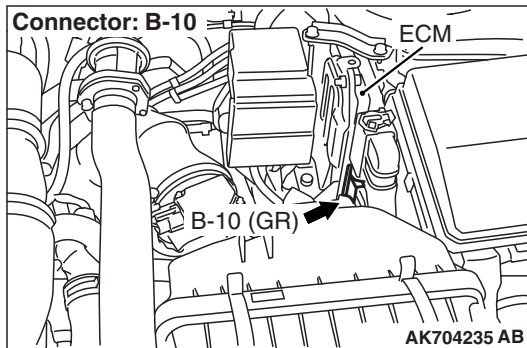
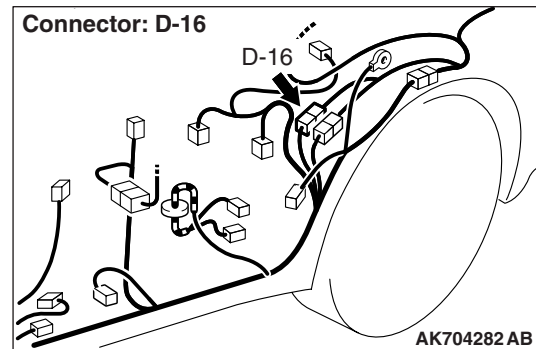
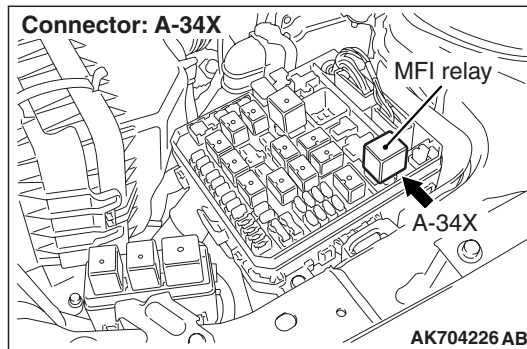
**NO :** The inspection is complete.



DTC P0446: Evaporative Emission Ventilation Solenoid Circuit

EVAPORATIVE EMISSION VENTILATION SOLENOID CIRCUIT





## CIRCUIT OPERATION

- The evaporative emission ventilation solenoid power is supplied from the MFI relay (terminal No. 2).
- The ECM controls the evaporative emission ventilation solenoid ground by turning the power transistor in the ECM ON and OFF.

## TECHNICAL DESCRIPTION

- To judge if there is open circuit in the evaporative emission ventilation solenoid drive circuit, ECM measures the surge voltage of the evaporative emission ventilation solenoid coil.
- The ECM drives the evaporative emission ventilation solenoid. After the solenoid is turned off, the ECM will check if the solenoid coil produces a surge voltage (battery positive voltage + 2 volts).

## DESCRIPTIONS OF MONITOR METHODS

Off-surge does not occur after solenoid is operated on to off.

## 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)**

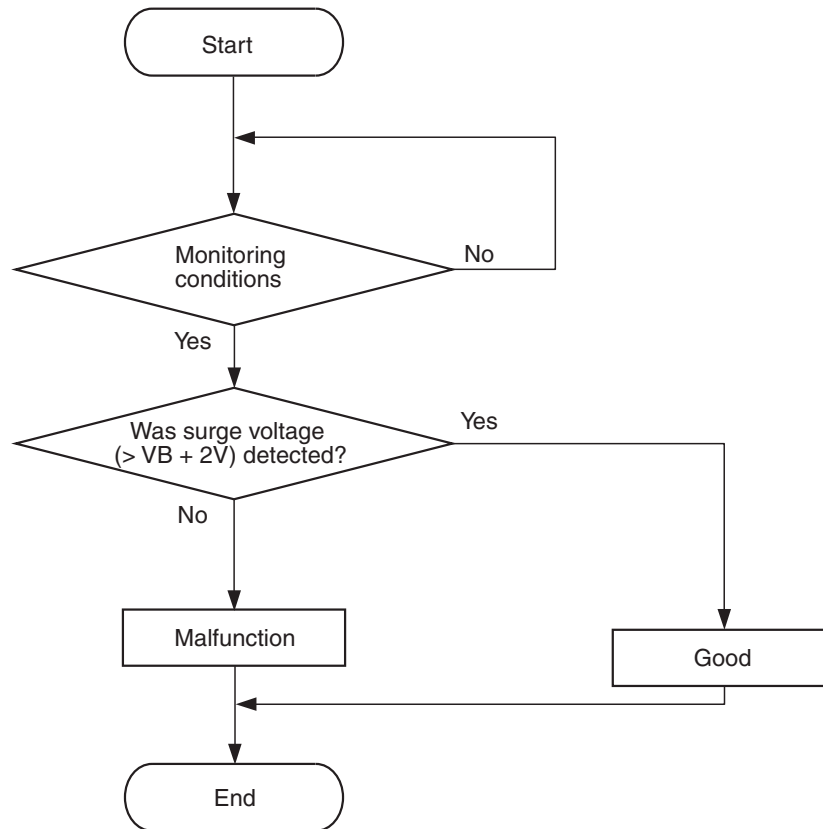
- Not applicable

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

- Not applicable

## DTC SET CONDITIONS

### Logic Flow Chart



AK604339

#### Check Conditions

- Engine is being cranked.
- Battery positive voltage is between 10 and 16.5 volts.

#### Judgement Criteria

- The evaporative emission ventilation solenoid coil surge voltage (battery positive voltage + 2 volts) is not detected for 0.2 second.
- The ECM monitors for this condition once during the drive cycle.

#### Check Conditions

- Battery positive voltage is between 10 and 16.5 volts.
- ON duty cycle of the evaporative emission purge solenoid is 0 percent.
- Evaporative emission ventilation solenoid is ON.
- 1 second or more has elapsed after the above mentioned conditions have been met.

#### Judgement Criterion

- The evaporative emission ventilation solenoid coil surge voltage (battery positive voltage + 2 volts) is not detected for 1 second after the evaporative emission ventilation solenoid is turned OFF.

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

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

- Evaporative emission ventilation solenoid failed.
- Open or shorted evaporative emission ventilation solenoid 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

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### STEP 1. Using scan tool MB991958, check actuator test item 15: Evaporative Emission Ventilation Solenoid.

#### **⚠ CAUTION**

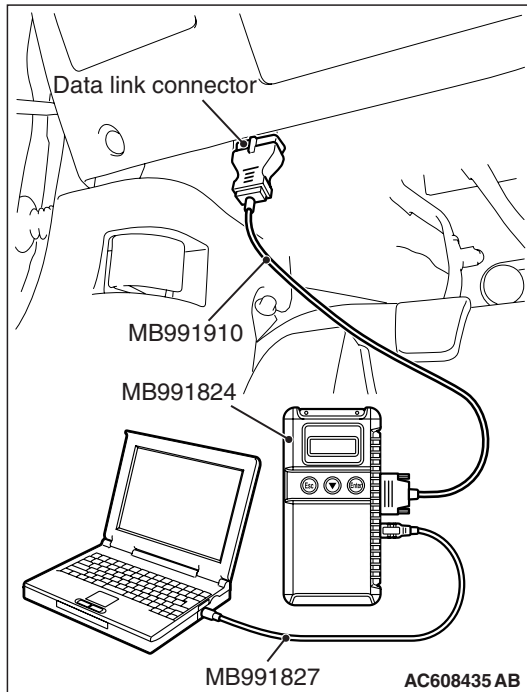
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 actuator test mode for item 15, Evaporative emission ventilation solenoid.
  - An operation sound should be heard and vibration should be felt when the evaporative emission ventilation solenoid is operated.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

#### **Q: Is the solenoid 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.00-15](#).

**NO** : Go to Step 2.



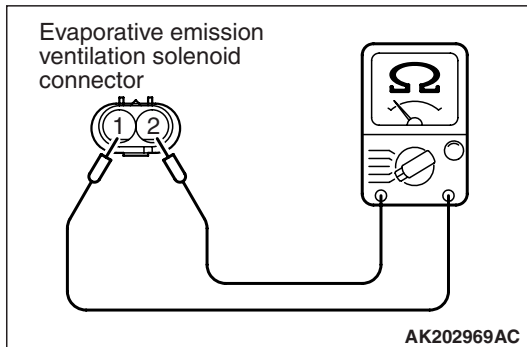

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### STEP 2. Check harness connector F-23 at the evaporative emission ventilation solenoid for damage.

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

**YES** : Go to Step 3.

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



**STEP 3. Check the evaporative emission ventilation solenoid.**

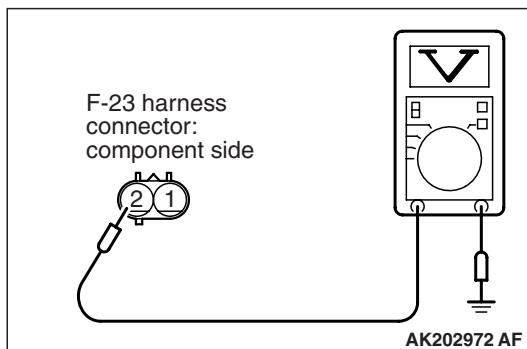
- (1) Disconnect the evaporative emission ventilation solenoid connector F-23.
- (2) Measure the resistance between evaporative emission ventilation solenoid side connector terminal No. 1 and No. 2.

**Standard value: 17 –21  $\Omega$  [at 20° C (68° F)]**

**Q: Is the measured resistance between 17 and 21  $\Omega$  [at 20° C (68° F)]?**

**YES :** Go to Step 4.

**NO :** Replace it. Then go to Step 10.



**STEP 4. Measure the power supply voltage at evaporative emission ventilation solenoid harness side connector F-23.**

- (1) Disconnect the connector F-23 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 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 6.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-34X at MFI relay for damage.**

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

**YES :** Check harness connectors C-43, C-47 and D-16 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 MFI relay connector A-34X (terminal No. 2) and evaporative emission ventilation solenoid connector F-23 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

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

**STEP 6. Check harness connector B-10 at ECM for damage.**

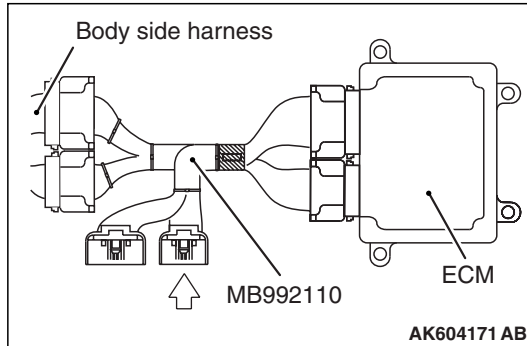
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 7.

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

**STEP 7. Measure the power supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.**

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

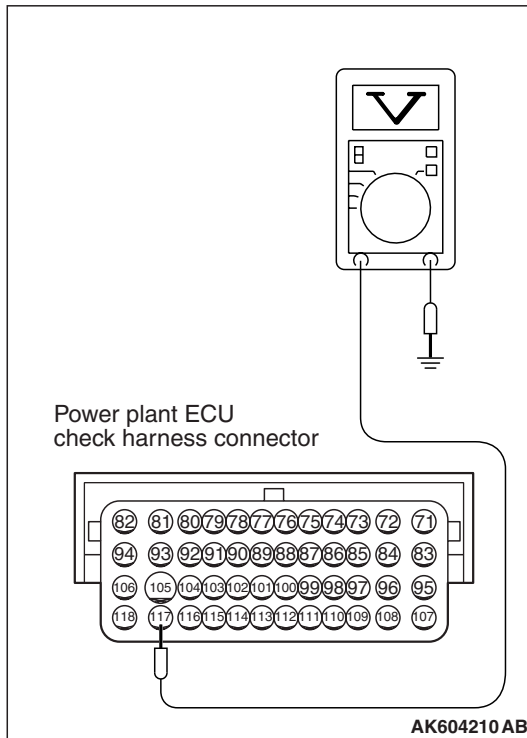


- (3) Measure the voltage between terminal No. 117 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 8.

**NO :** Check harness connectors C-47 and D-16 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 evaporative emission ventilation solenoid connector F-23 (terminal No. 1) and ECM connector B-10 (terminal No. 117) because of open circuit or short circuit to ground. Then go to Step 10.



---

**STEP 8. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and evaporative emission ventilation solenoid connector F-23 (terminal No. 2).**

*NOTE: Check harness after checking intermediate connectors C-43, C-47 and D-16. If intermediate connectors are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.*

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

**YES** : Go to Step 9.

**NO** : Repair it. Then go to Step 10.

---

**STEP 9. Check for harness damage between evaporative emission ventilation solenoid connector F-23 (terminal No. 1) and ECM connector B-10 (terminal No. 117).**

*NOTE: Check harness after checking intermediate connectors C-47 and D-16. If intermediate connectors are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.*

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

**YES** : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 10.

**NO** : Repair it. Then go to Step 10.

---

**STEP 10. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 P.13A-9.

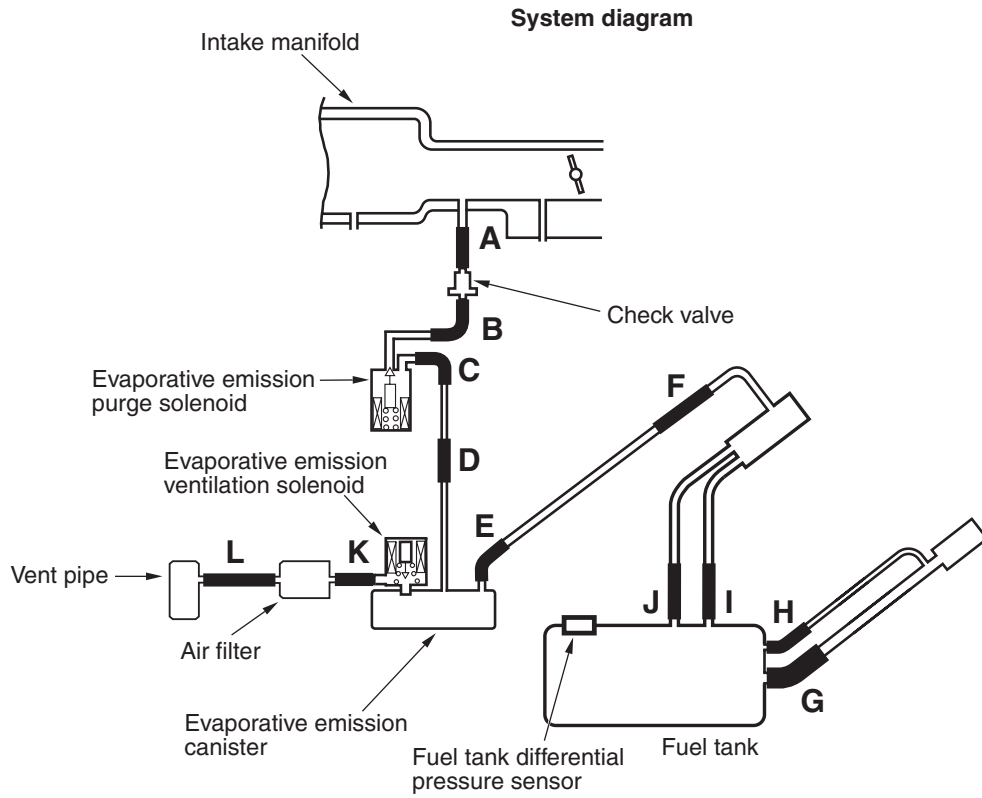
(2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0446 set?**

**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

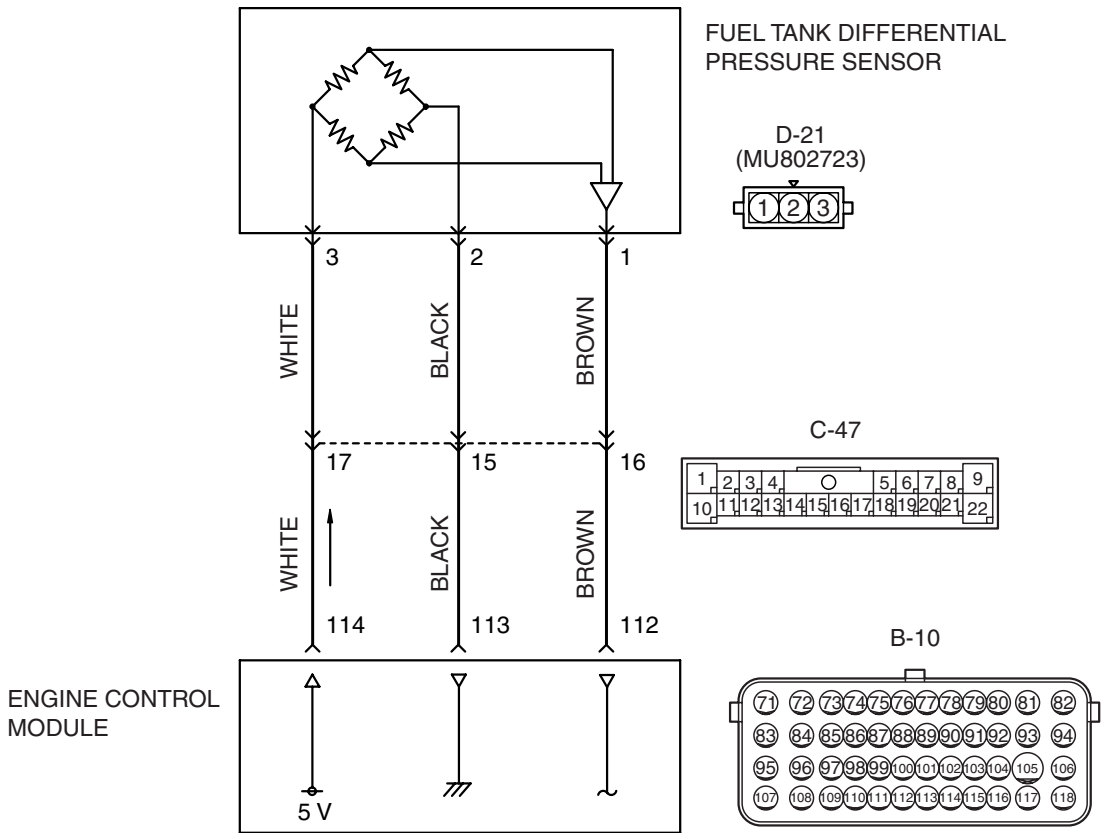
DTC P0450: Fuel Tank Differential Pressure Sensor Malfunction



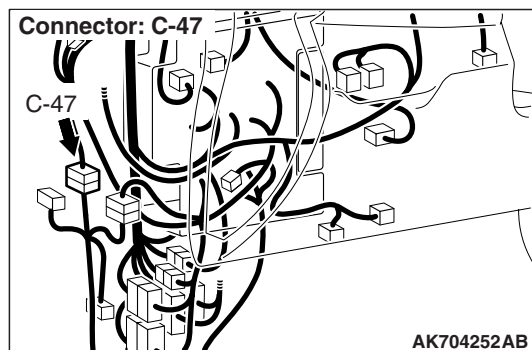
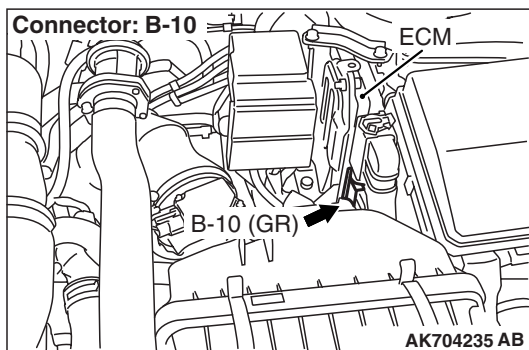
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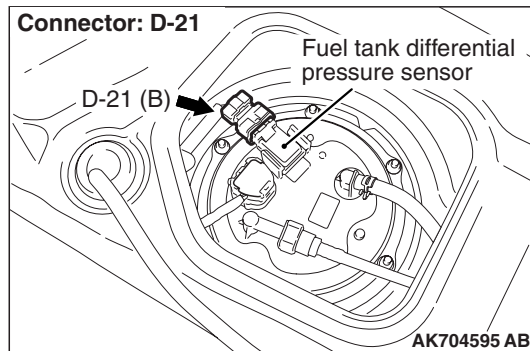


FUEL TANK DIFFERENTIAL PRESSURE SENSOR CIRCUIT



AK604513 AE





## CIRCUIT OPERATION

- The ECM (terminal No. 114) supplies a 5 volts reference signal to the fuel tank differential pressure sensor (terminal No. 3). The fuel tank differential pressure sensor (terminal No. 2) is grounded through the ECM (terminal No. 113).
- The fuel tank differential pressure sensor (terminal No. 1) returns a voltage signal to the ECM (terminal No. 112) that is proportional to the pressure in the fuel tank.

## TECHNICAL DESCRIPTION

- The ECM monitors the fuel tank differential pressure sensor output voltage.
- The ECM determines whether the fuel tank differential pressure sensor signal voltage is within normal operating parameters.

## DESCRIPTIONS OF MONITOR METHODS

Compare evaporative emission purge solenoid status with fuel tank differential pressure sensor output voltage.

## MONITOR EXECUTION

Continuous

## MONITOR EXECUTION CONDITIONS (OTHER MONITOR AND SENSOR)

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

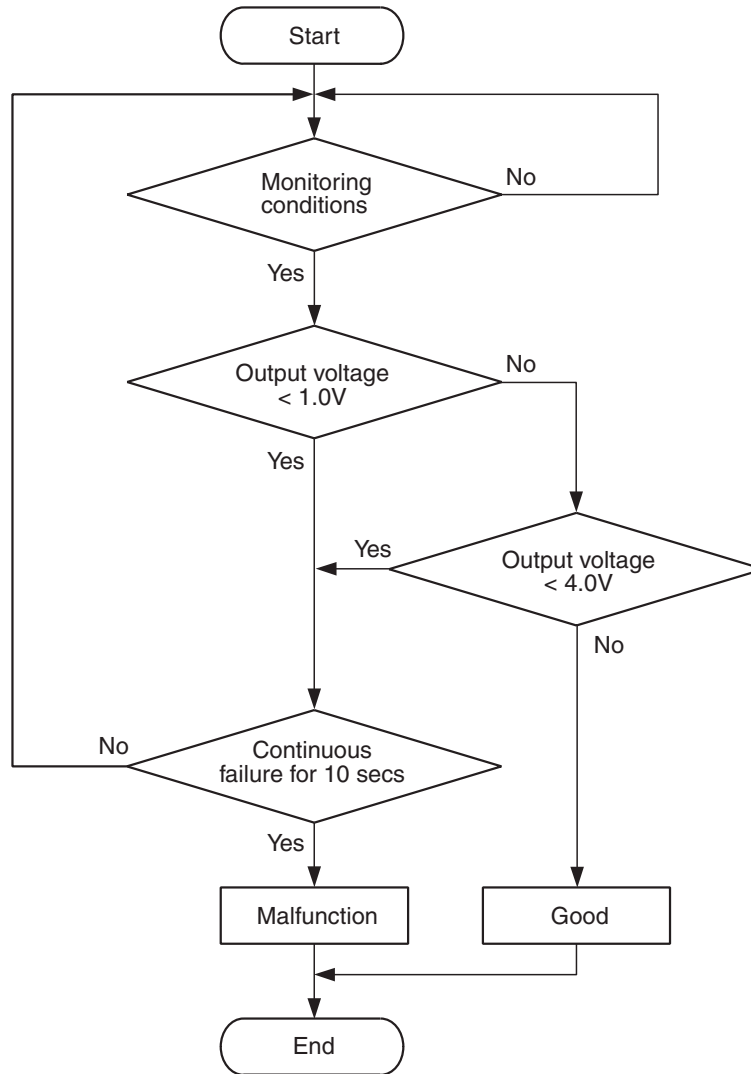
- Evaporative emission purge solenoid monitor
- Evaporative emission ventilation solenoid monitor
- Fuel tank temperature sensor monitor
- Fuel level sensor monitor

**Sensor (The sensors below are determined to be normal)**

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

## DTC SET CONDITIONS

### Logic Flow Chart (Monitor Sequence)



AK704741

### Check Conditions

- Intake air temperature is greater than 5° C (41° F).
- Engine speed is 1,594 r/min or greater.
- Volumetric efficiency is between 20 and 80 percent.

### Judgement Criteria

- When the evaporative emission purge solenoid is off, the fuel differential pressure sensor output voltage remains 1.0 volt or less for ten seconds.

### Check Conditions

- Intake air temperature is between 5° C (41° F) and 45° C (113° F) or greater.
- Engine speed is 1,594 r/min or greater.

- Volumetric efficiency is between 20 and 80 percent.

### Judgement Criteria

- When the evaporative emission purge solenoid valve is fully operational (100 percent ratio), the fuel differential pressure sensor output voltage remains at 4.0 volts or greater for ten seconds.

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

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

### TROUBLESHOOTING HINTS (THE MOST LIKELY CAUSES FOR THIS CODE TO BE SET ARE:)

- Fuel tank differential pressure sensor failed.
- Fuel tank differential pressure sensor circuit harness damage, or connector damage.
- ECM failed.

### DIAGNOSIS

#### Required Special Tools:

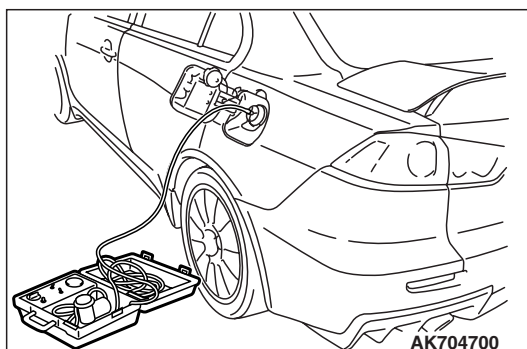
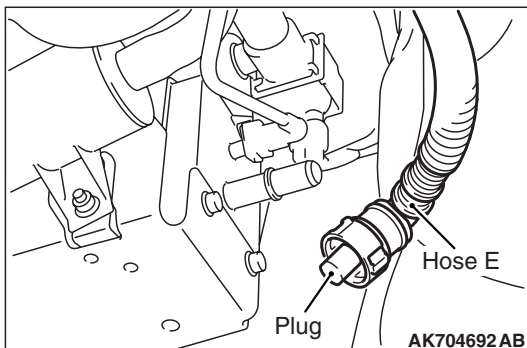
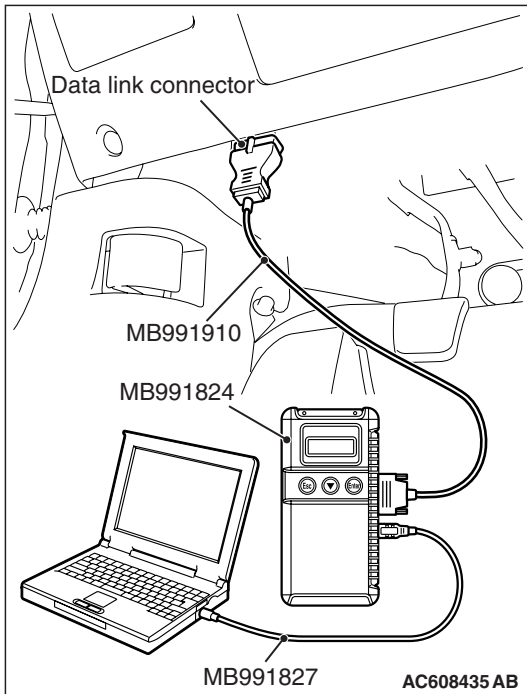
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: M.U.T.-III USB Cable
  - MB991910: M.U.T.-III Main Harness A

**STEP 1. Using scan tool MB991958, check data list item 52: Fuel Tank Differential Pressure Sensor.**

**⚠ CAUTION**

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

(1) Connect scan tool MB991958 to the data link connector.



- (2) Plug the disconnected end of hose E.
- (3) Turn the ignition switch to the "ON" position.
- (4) Remove the fuel cap.
- (5) Set scan tool MB991958 to the data reading mode for item 52, Fuel Tank Differential Pressure Sensor.
  - Output voltage should be between 1,500 to 3,500 mV.

- (6) Connect the evaporative emission system pressure pump (Miller number 6872A) to the fuel tank filler tube by using fuel tank adapter (MLR-8382) and pressurize the fuel tank.
  - The fuel tank pressure reading should increase.
- (7) Turn the ignition switch to the "LOCK" (OFF) position. Then disconnect scan tool MB991958.
- (8) Remove the evaporative emission system pressure pump (Miller number 6872A) and the fuel tank adapter (MLR-8382), and reinstall the fuel cap.
- (9) Connect hose E to the evaporative emission canister.

**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.00-15.

**NO :** Go to Step 2 .

**STEP 2. Check harness connector D-21 at fuel tank differential pressure sensor for damage.**

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

**YES :** Go to Step 3 .

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

**STEP 3. Measure the sensor supply voltage at fuel tank differential pressure sensor connector D-21 by backprobing.**

(1) Do not disconnect the connector D-21.

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

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

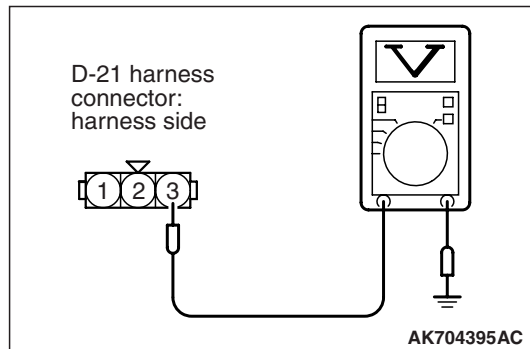
- Voltage should be between 4.9 and 5.1 volts.

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

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

**YES :** Go to Step 6 .

**NO :** Go to Step 4 .



**STEP 4. Check harness connector B-10 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 12 .

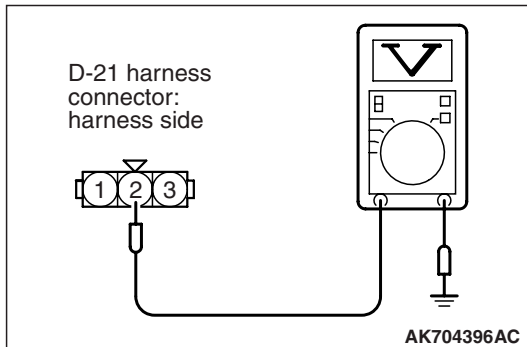
**STEP 5. Check for harness damage between fuel tank differential pressure sensor connector D-21 (terminal No. 3) and ECM connector B-10 (terminal No. 114).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12 .*

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

**YES :** Go to Step 11 .

**NO :** Repair it. Then go to Step 12 .



**STEP 6. Measure the ground voltage at fuel tank differential pressure sensor connector D-21 by backprobing.**

- (1) Do not disconnect the connector D-21.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 2 and ground by backprobing.
  - Voltage should be 0.5 volt or less.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the measured voltage 0.5 volt or less?**

**YES :** Go to Step 9 .

**NO :** Go to Step 7 .

**STEP 7. Check harness connector B-10 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 12 .

**STEP 8. Check for harness damage between fuel tank differential pressure sensor connector D-21 (terminal No. 2) and ECM connector B-10 (terminal No. 113).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12 .*

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

**YES :** Go to Step 11 .

**NO :** Repair it. Then go to Step 12 .

**STEP 9. Check harness connector B-10 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 12 .

**STEP 10. Check for harness damage between fuel tank differential pressure sensor connector D-21 (terminal No. 1) and ECM connector B-10 (terminal No. 112).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12 .*

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

**YES** : Go to Step 11 .

**NO** : Repair it. Then go to Step 12 .

---

**STEP 11. Replace the fuel tank differential pressure sensor.**

- (1) Replace the fuel tank differential pressure sensor.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 4 P.13A-9.
- (3) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0450 set?**

**YES** : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis –ID Code Registration Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, Diagnosis –ID Code Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 12 .

**NO** : The inspection is complete.

---

**STEP 12. Test the OBD-II drive cycle.**

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

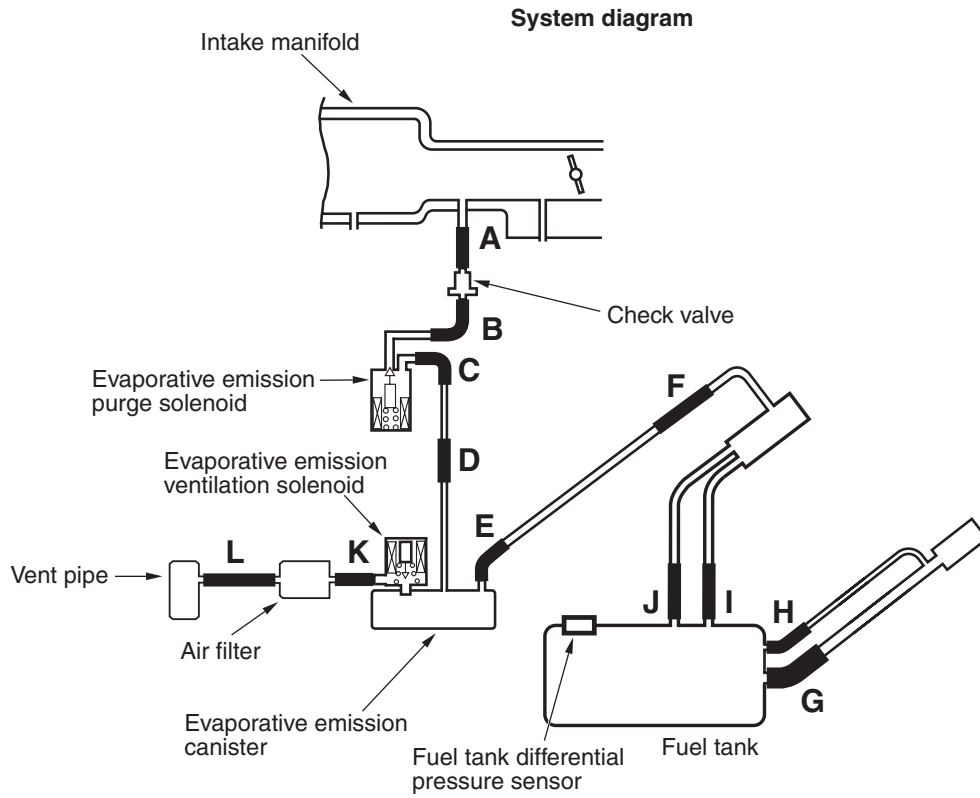
**Q: Is DTC P0450 set?**

**YES** : Repeat the troubleshooting.

**NO** : The inspection is complete.

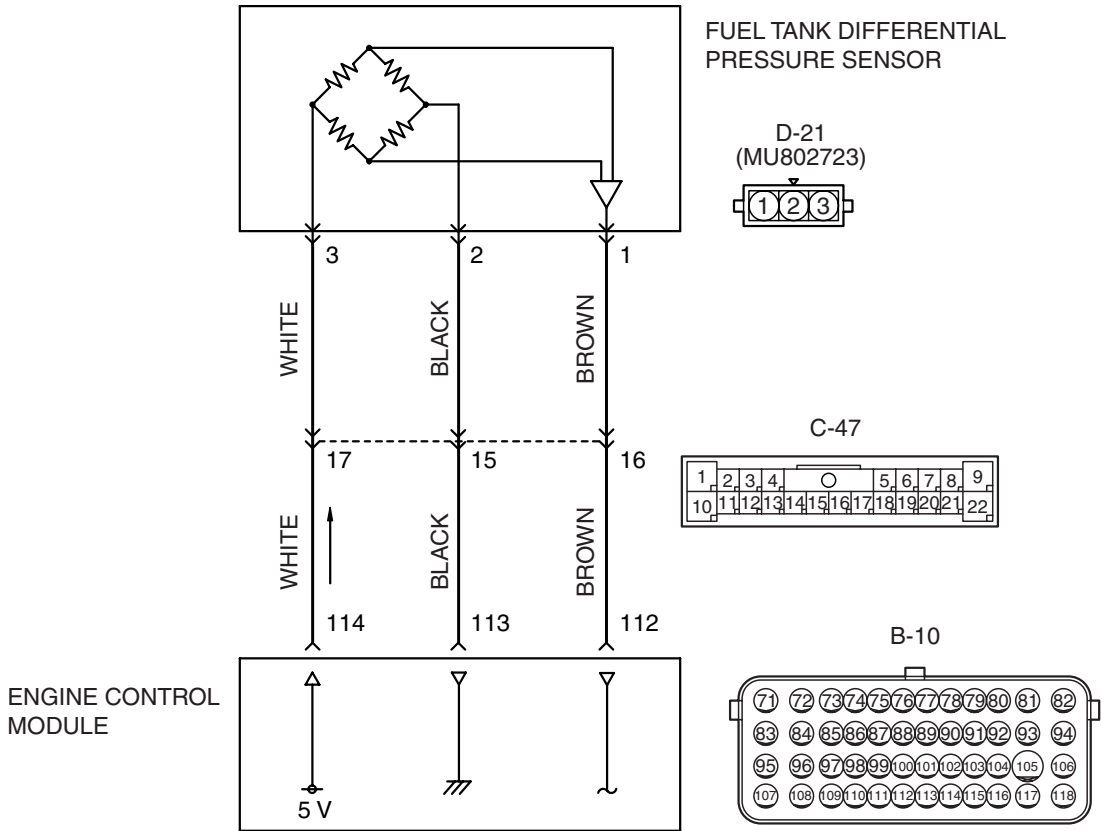


DTC P0451: Fuel Tank Differential Pressure Circuit Range/Performance Problem

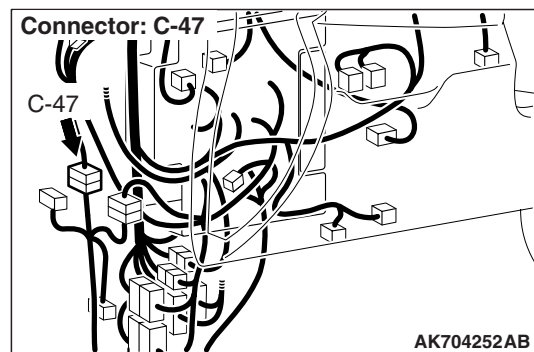
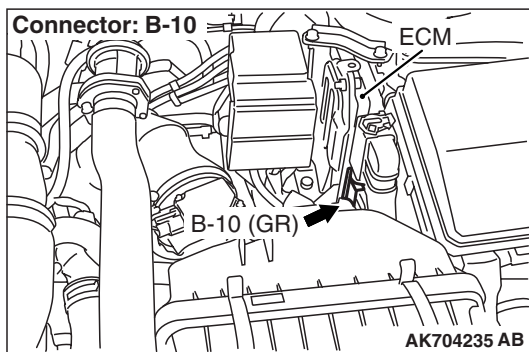


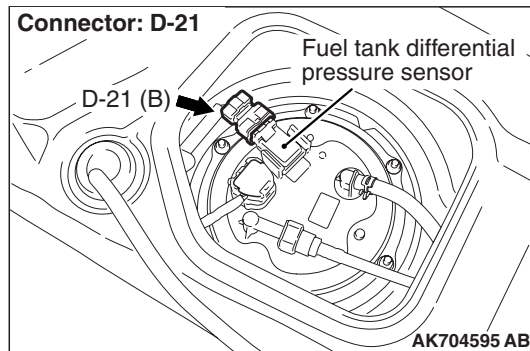
AK704684AB

FUEL TANK DIFFERENTIAL PRESSURE SENSOR CIRCUIT



AK604513 AE





## CIRCUIT OPERATION

- The ECM (terminal No. 114) supplies a 5 volts reference signal to the fuel tank differential pressure sensor (terminal No. 3). The fuel tank differential pressure sensor (terminal No. 2) is grounded through the ECM (terminal No. 113).
- The fuel tank differential pressure sensor (terminal No. 1) returns a voltage signal to the ECM (terminal No. 112) that is proportional to the pressure in the fuel tank.

## TECHNICAL DESCRIPTION

- The ECM monitors the fuel tank differential pressure sensor signal voltage.
- The ECM determines whether the fuel tank differential pressure sensor signal voltage is within normal operating parameters.

## DESCRIPTIONS OF MONITOR METHODS

Detect malfunction if change of fuel tank differential pressure sensor output voltage during idling stays large during specified go/stop operations.

## 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)**

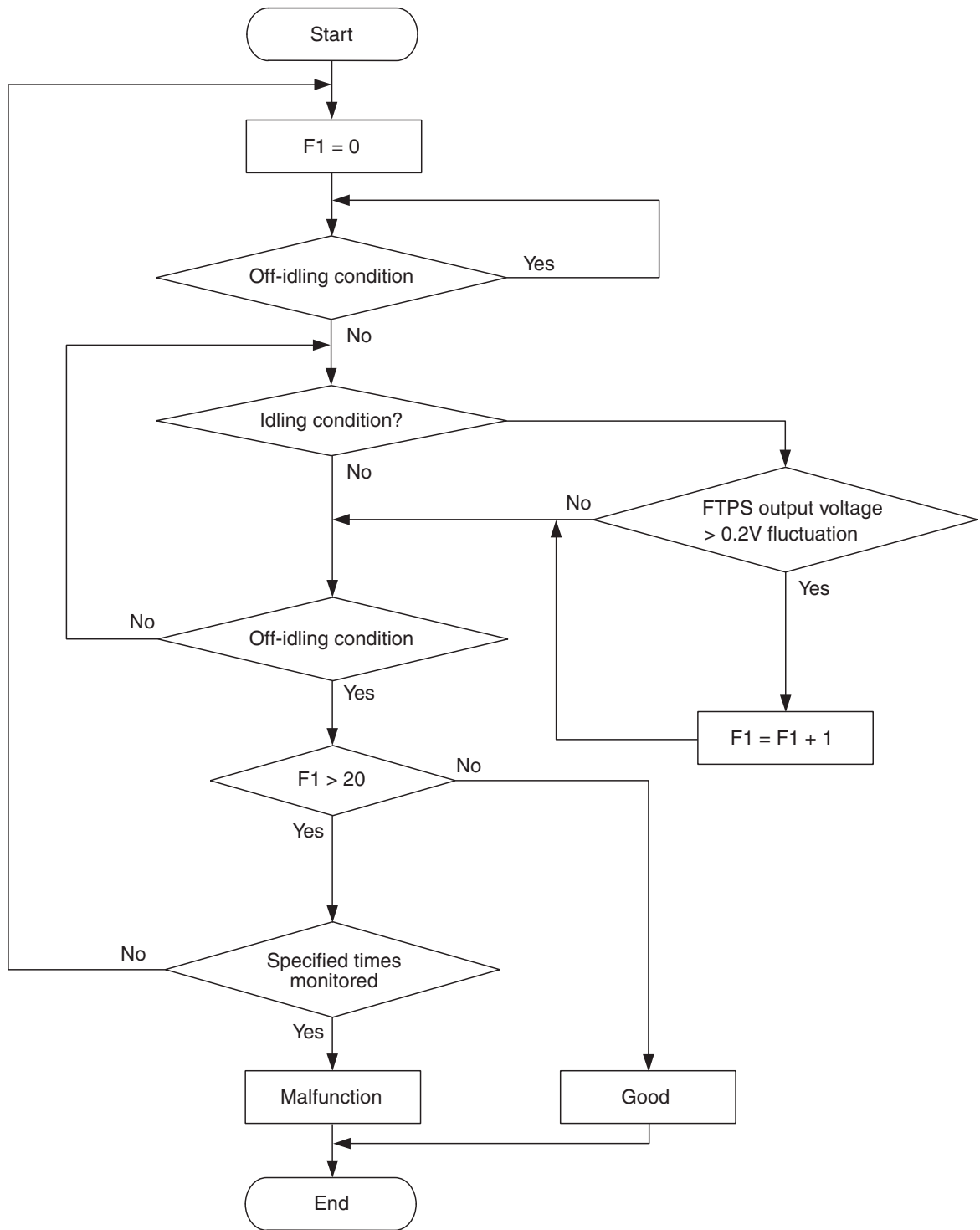
- Evaporative emission purge solenoid monitor
- Evaporative emission ventilation solenoid monitor
- Fuel tank temperature sensor monitor
- Fuel level sensor monitor

**Sensor (The sensors below are determined to be normal)**

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

DTC SET CONDITIONS

Logic Flow Chart (Monitor Sequence)



AK704744

Check Conditions

- Throttle valve is closed.

- Vehicle speed is 1.5 km/h (0.93 mph) or less.

### Judgement Criteria

- If the voltage signal from the fuel tank differential pressure sensor changes by 0.2 volt or more, DTC P0451 will set. The code may also set if a sudden pressure fluctuation occurs twenty times while the engine is idling, and then four consecutive times during normal driving.

*NOTE: If the number of sudden pressure fluctuations does not reach twenty during any one period of engine idling, or if the ignition switch is turned OFF, the counter will reset to zero.*

*NOTE: The conditions for deviating from idling operation are as follows:*

- *Vehicle speed is 50 km/h (31 mph) or greater.*

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 15 [P.13A-9](#).

### TROUBLESHOOTING HINTS (THE MOST LIKELY CAUSES FOR THIS CODE TO BE SET ARE:)

- Fuel tank differential pressure sensor failed.
- Fuel tank differential pressure sensor circuit harness damage, or connector damage.
- ECM failed.

### DIAGNOSIS

#### Required Special Tools:

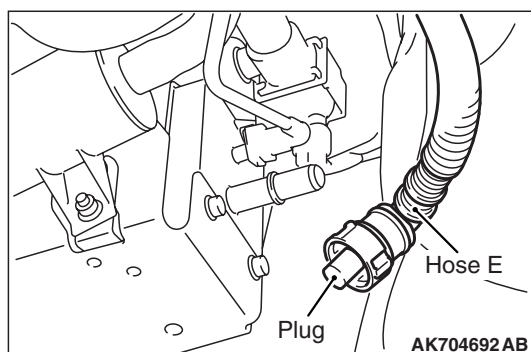
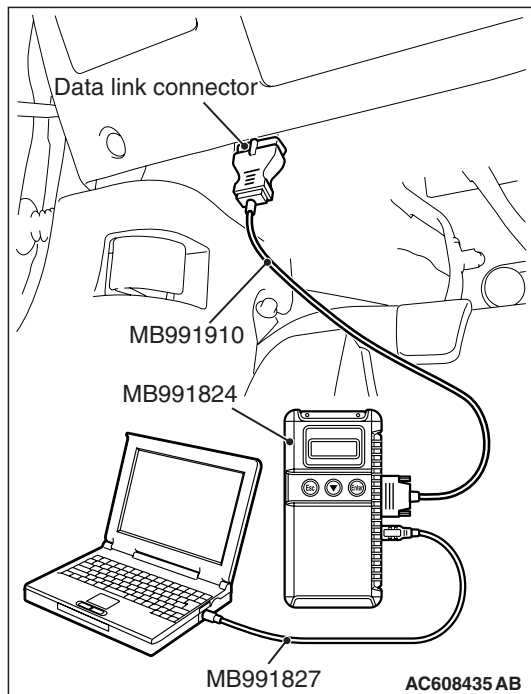
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: M.U.T.-III USB Cable
  - MB991910: M.U.T.-III Main Harness A

**STEP 1. Using scan tool MB991958, check data list item 52: Fuel Tank Differential Pressure Sensor.**

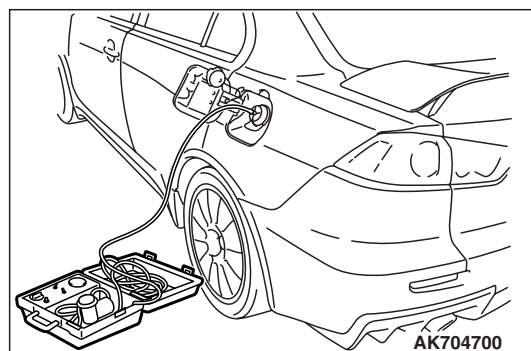
**⚠ CAUTION**

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

(1) Connect scan tool MB991958 to the data link connector.



- (2) Plug the disconnected end of hose E.
- (3) Turn the ignition switch to the "ON" position.
- (4) Remove the fuel cap.
- (5) Set scan tool MB991958 to the data reading mode for item 52, Fuel Tank Differential Pressure Sensor.
  - Output voltage should be between 1,500 to 3,500 mV.



- (6) Connect the evaporative emission system pressure pump (Miller number 6872A) to the fuel tank filler tube by using fuel tank adapter (MLR-8382) and pressurize the fuel tank.
  - The fuel tank pressure reading should increase.
- (7) Turn the ignition switch to the "LOCK" (OFF) position. Then disconnect scan tool MB991958.
- (8) Remove the evaporative emission system pressure pump (Miller number 6872A) and the fuel tank adapter (MLR-8382), and reinstall the fuel cap.
- (9) Connect hose E to the evaporative emission canister.

**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.00-15](#).

**NO :** Go to Step 2 .

---

**STEP 2. Check harness connector D-21 at fuel tank differential pressure sensor for damage.**

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

**YES :** Go to Step 3 .

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

---

**STEP 3. Measure the sensor supply voltage at fuel tank differential pressure sensor connector D-21 by backprobing.**

(1) Do not disconnect the connector D-21.

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

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

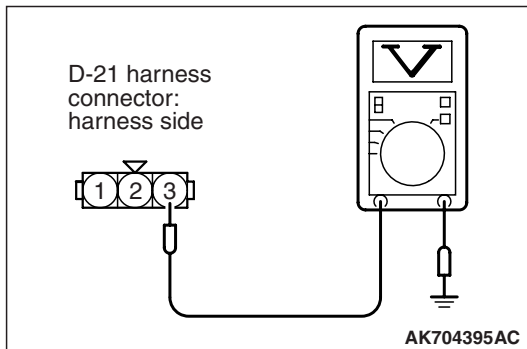
- Voltage should be between 4.9 and 5.1 volts.

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

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

**YES :** Go to Step 6 .

**NO :** Go to Step 4 .



---

**STEP 4. Check harness connector B-10 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 12 .

---

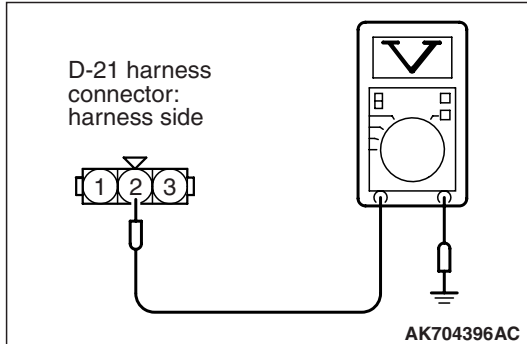
**STEP 5. Check for harness damage between fuel tank differential pressure sensor connector D-21 (terminal No. 3) and ECM connector B-10 (terminal No. 114).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12 .*

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

**YES :** Go to Step 11 .

**NO :** Repair it. Then go to Step 12 .




---

**STEP 6. Measure the ground voltage at fuel tank differential pressure sensor connector D-21 by backprobing.**

- (1) Do not disconnect the connector D-21.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 2 and ground by backprobing.
  - Voltage should be 0.5 volt or less.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the measured voltage 0.5 volt or less?**

**YES :** Go to Step 9 .

**NO :** Go to Step 7 .

---

**STEP 7. Check harness connector B-10 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 12 .

---

**STEP 8. Check for harness damage between fuel tank differential pressure sensor connector D-21 (terminal No. 2) and ECM connector B-10 (terminal No. 113).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12 .*

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

**YES :** Go to Step 11 .

**NO :** Repair it. Then go to Step 12 .

---

**STEP 9. Check harness connector B-10 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 12 .



---

**STEP 10. Check for harness damage between fuel tank differential pressure sensor connector D-21 (terminal No. 1) and ECM connector B-10 (terminal No. 112).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12 .*

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

**YES** : Go to Step 11 .

**NO** : Repair it. Then go to Step 12 .

---

**STEP 11. Replace the fuel tank differential pressure sensor.**

- (1) Replace the fuel tank differential pressure sensor.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 P.13A-9.
- (3) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0451 set?**

**YES** : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis –ID Code Registration Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, Diagnosis –ID Code Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 12 .

**NO** : The inspection is complete.

---

**STEP 12. Test the OBD-II drive cycle.**

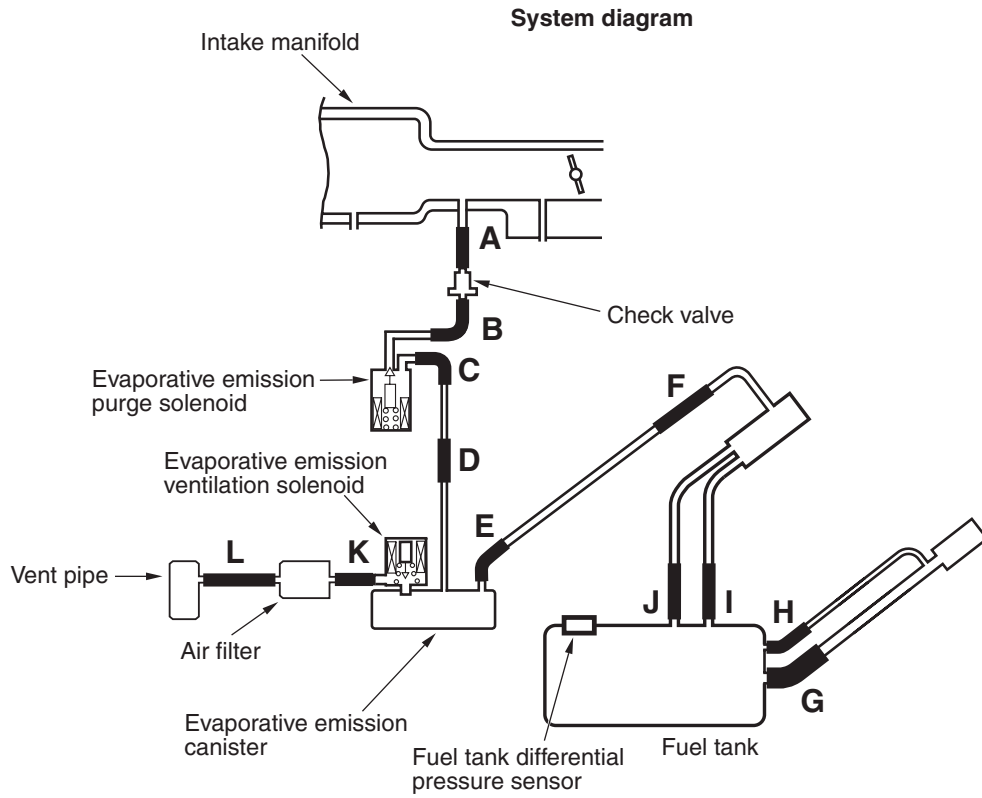
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 15 P.13A-9.
- (2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0451 set?**

**YES** : Repeat the troubleshooting.

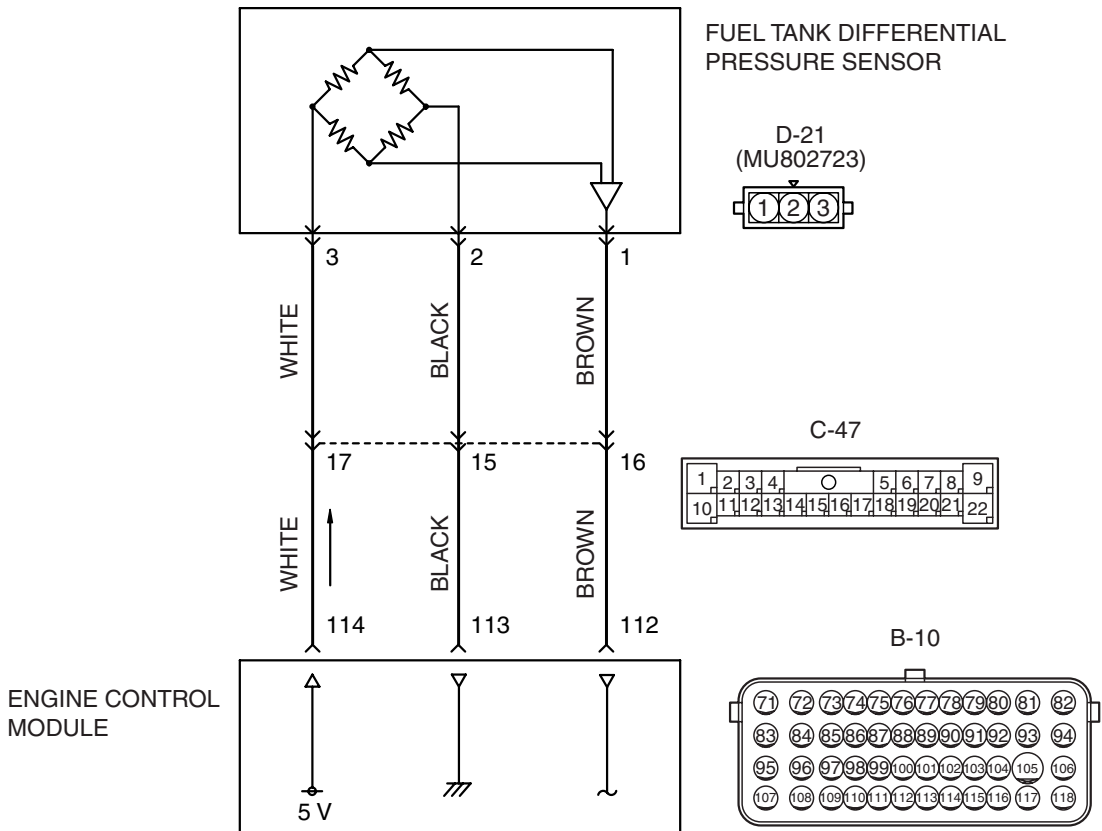
**NO** : The inspection is complete.

DTC P0452: Fuel Tank Differential Pressure Circuit Low Input

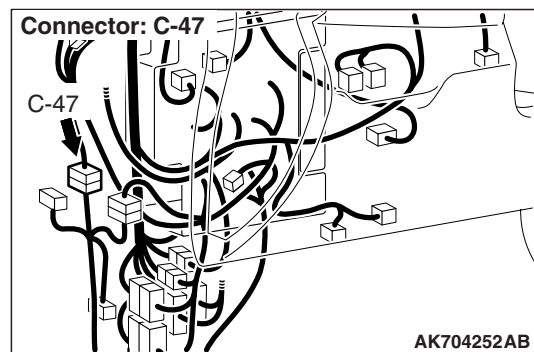
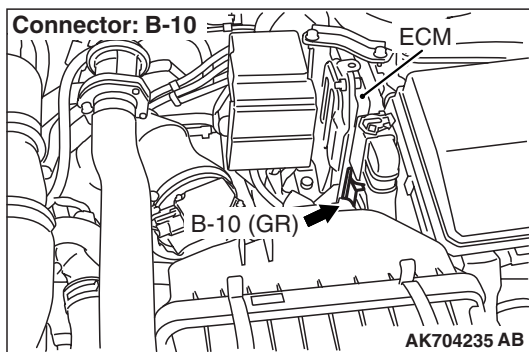


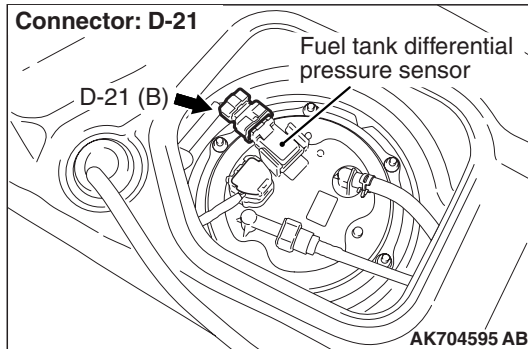
AK704684AB

FUEL TANK DIFFERENTIAL PRESSURE SENSOR CIRCUIT



AK604513 AE





## CIRCUIT OPERATION

- The ECM (terminal No. 114) supplies a 5 volts reference signal to the fuel tank differential pressure sensor (terminal No. 3). The fuel tank differential pressure sensor (terminal No. 2) is grounded through the ECM (terminal No. 113).
- The fuel tank differential pressure sensor (terminal No. 1) returns a voltage signal to the ECM (terminal No. 112) that is proportional to the pressure in the fuel tank.

## TECHNICAL DESCRIPTION

- The ECM monitors the fuel tank differential pressure sensor output voltage.
- The ECM determines whether the fuel tank differential pressure sensor signal voltage is within normal operating parameters.

## DESCRIPTIONS OF MONITOR METHODS

Fuel tank differential pressure sensor output voltage is out of specified range.

## MONITOR EXECUTION

Continuous

## MONITOR EXECUTION CONDITIONS (OTHER MONITOR AND SENSOR)

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

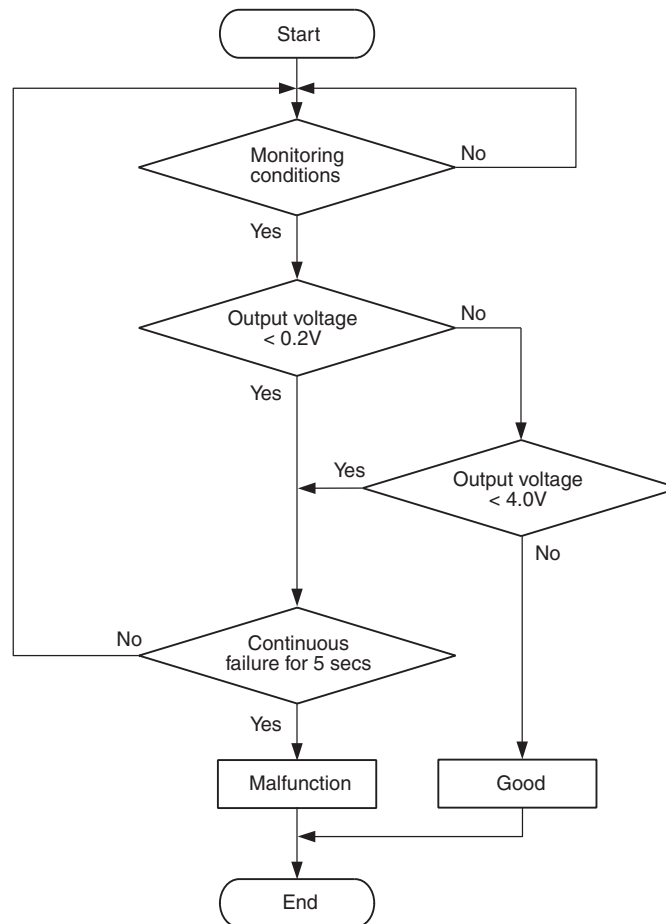
- Evaporative emission purge solenoid monitor
- Evaporative emission ventilation solenoid monitor
- Fuel tank temperature sensor monitor
- Fuel level sensor monitor

**Sensor (The sensors below are determined to be normal)**

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

## DTC SET CONDITIONS

### Logic Flow Chart (Monitor Sequence)



AK704742

### Check Conditions

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

### Judgement Criteria

- The fuel tank differential pressure sensor output voltage remains 0.2 volt or less for 5 seconds.

### FAIL-SAFE AND BACKUP FUNCTION

- None

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

### TROUBLESHOOTING HINTS (THE MOST LIKELY CAUSES FOR THIS CODE TO BE SET ARE:)

- Fuel tank differential pressure sensor failed.
- Open or shorted fuel tank differential pressure sensor circuit, connector damage.
- ECM failed.

### DIAGNOSIS

#### Required Special Tools:

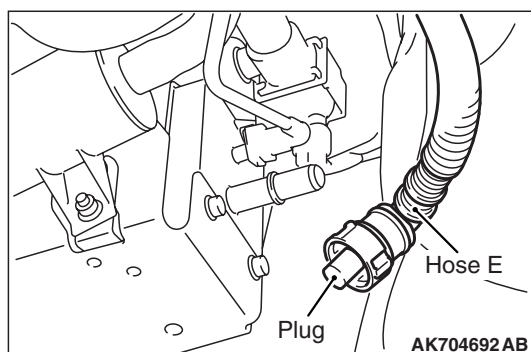
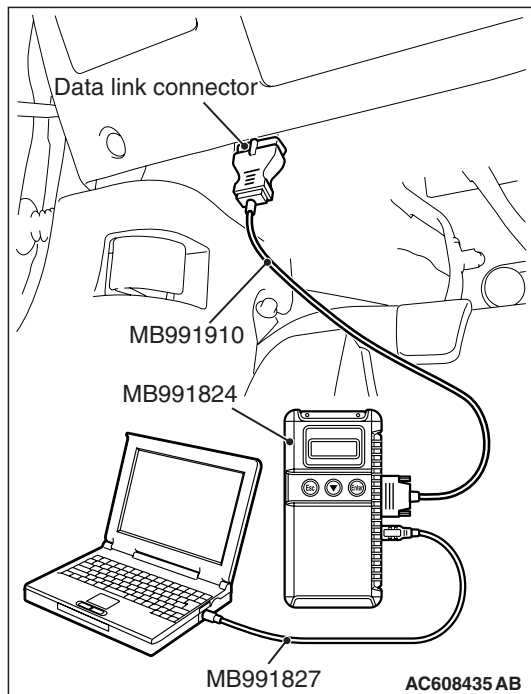
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: M.U.T.-III USB Cable
  - MB991910: M.U.T.-III Main Harness A
- MB992110: Power Plant ECU Check Harness

**STEP 1. Using scan tool MB991958, check data list item 52: Fuel Tank Differential Pressure Sensor.**

**⚠ CAUTION**

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

(1) Connect scan tool MB991958 to the data link connector.



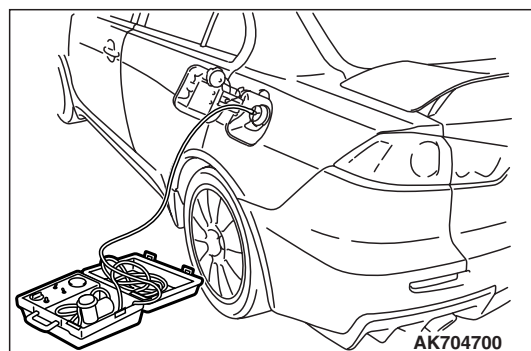
(2) Disconnect hose E from the evaporative emission canister, and plug the hose.

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

(4) Remove the fuel cap.

(5) Set scan tool MB991958 to the data reading mode for item 52, Fuel Tank Differential Pressure Sensor.

- Output voltage should be between 1,500 to 3,500 mV.



(6) Connect the evaporative emission system pressure pump (Miller number 6872A) to the fuel tank filler tube by using fuel tank adapter (MLR-8382) and pressurize the fuel tank.

- The fuel tank pressure reading should increase.

(7) Turn the ignition switch to the "LOCK" (OFF) position. Then disconnect scan tool MB991958.

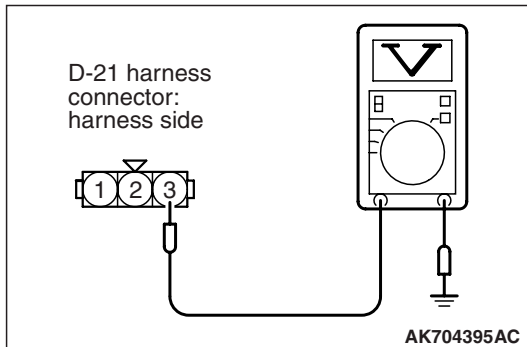
(8) Remove the evaporative emission system pressure pump (Miller number 6872A) and the fuel tank adapter (MLR-8382), and reinstall the fuel cap.

(9) Connect hose E to the evaporative emission canister.

**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.00-15.

**NO :** Go to Step 2 .



**STEP 2. Measure the sensor supply voltage at fuel tank differential pressure sensor connector D-21 by backprobing.**

- (1) Do not disconnect the connector D-21.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 3 and ground by backprobing.
  - Voltage should be between 4.9 and 5.1 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 8 .

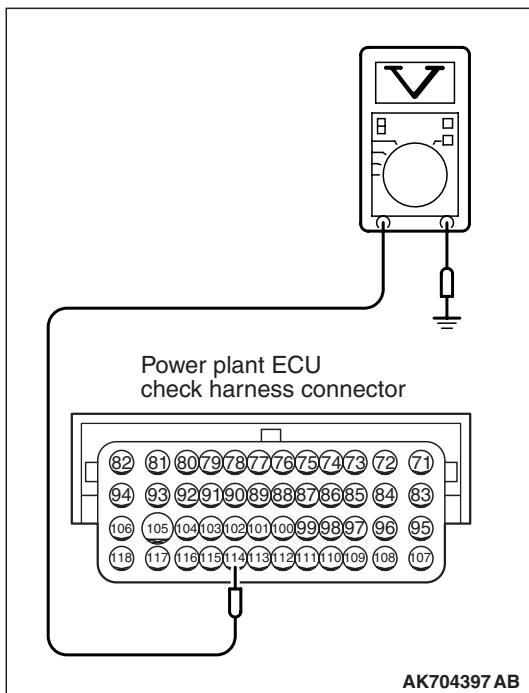
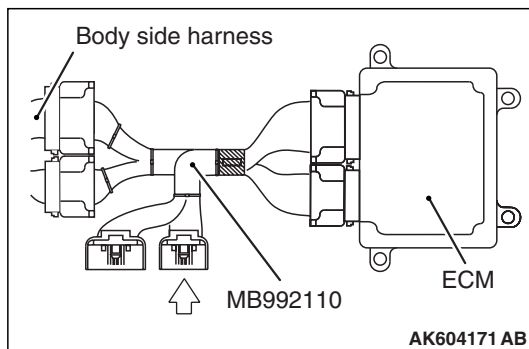
**NO :** Go to Step 3 .

**STEP 3. Check harness connector B-10 at ECM for damage.**

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

**YES :** Go to Step 4 .

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



**STEP 4. Measure the sensor supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.**

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

- (3) Measure the voltage between terminal No. 114 and ground.
  - Voltage should be between 4.9 and 5.1 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 7 .

**NO :** Go to Step 5 .

**STEP 5. Check harness connector D-21 at the fuel tank differential pressure 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 12 .

**STEP 6. Check for short circuit to ground between fuel tank differential pressure sensor connector D-21 (terminal No. 3) and ECM connector B-10 (terminal No. 114).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.*

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

**YES :** Go to Step 11 .

**NO :** Repair it. Then go to Step 12 .



---

**STEP 7. Check harness connector D-21 at the fuel tank differential pressure sensor for damage.**

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

**YES :** Check harness connector C-47 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 tank differential pressure sensor connector D-21 (terminal No. 3) and ECM connector B-10 (terminal No. 114) because of open circuit. Then go to Step 12 .

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

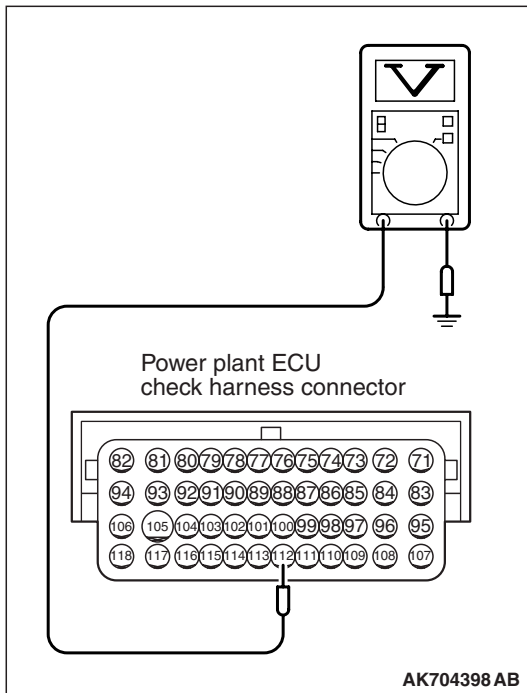
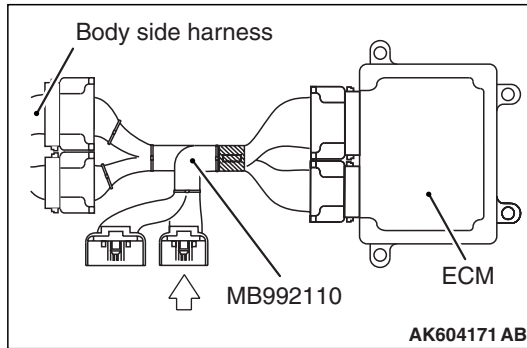
---

**STEP 8. Check harness connector D-21 at the fuel tank differential pressure sensor and connector B-10 at ECM for damage.**

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

**YES :** Go to Step 9 .

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



**STEP 9. Measure the sensor output voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.**

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

- (4) Measure the voltage between terminal No. 112 and ground.
  - Voltage should be between 1.5 and 3.5 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

- YES :** Go to Step 11 .
- NO :** Go to Step 10 .

**STEP 10. Check for open circuit and short circuit to ground between fuel tank differential pressure sensor connector D-21 (terminal No. 1) and ECM connector B-10 (terminal No. 112).**

*NOTE: Check harness after checking intermediate connector C-47. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.*

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

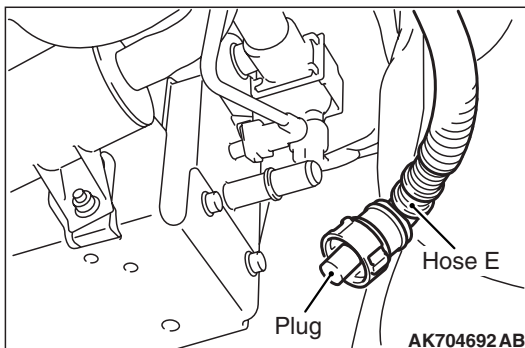
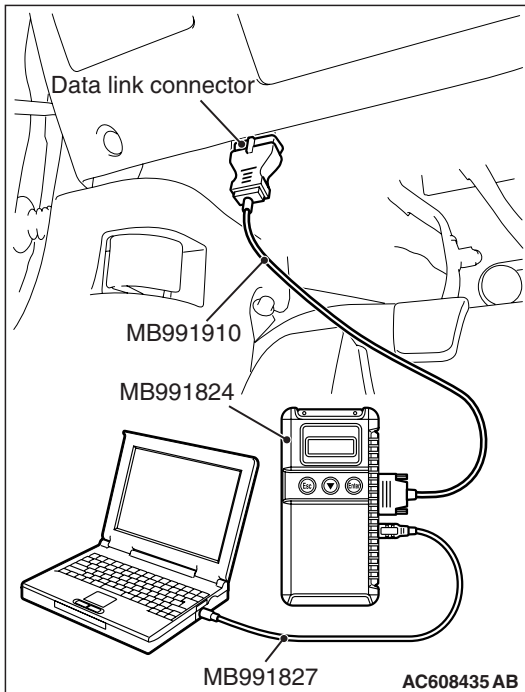
- YES :** Replace the fuel tank differential pressure sensor. Then go to Step 12 .
- NO :** Repair it. Then go to Step 12 .

**STEP 11. Using scan tool MB991958, check data list item 52: Fuel Tank Differential Pressure Sensor.**

**⚠ CAUTION**

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

(1) Connect scan tool MB991958 to the data link connector.



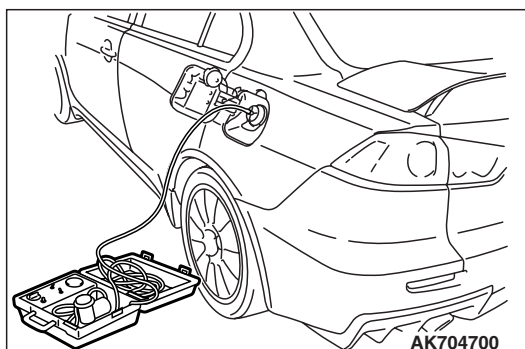
(2) Disconnect hose E from the evaporative emission canister, and plug the hose.

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

(4) Remove the fuel cap.

(5) Set scan tool MB991958 to the data reading mode for item 52, Fuel Tank Differential Pressure Sensor.

- Output voltage should be between 1,500 to 3,500 mV.



(6) Connect the evaporative emission system pressure pump (Miller number 6872A) to the fuel tank filler tube by using fuel tank adapter (MLR-8382) and pressurize the fuel tank.

- The fuel tank pressure reading should increase.

(7) Turn the ignition switch to the "LOCK" (OFF) position. Then disconnect scan tool MB991958.

(8) Remove the evaporative emission system pressure pump (Miller number 6872A) and the fuel tank adapter (MLR-8382), and reinstall the fuel cap.

(9) Connect hose E to the evaporative emission canister.

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

**YES** : It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Intermittent Malfunctions [P.00-15](#).

**NO** : Replace the ECM. When the ECM is replaced,  
register the ID code. Refer to GROUP 42B, Diagnosis  
–ID Code Registration Judgment Table <Vehicles with  
KOS> [P.42B-12](#) or GROUP 42C, Diagnosis –ID Code  
Registration Judgment Table <Vehicles with WCM>  
[P.42C-9](#). Then go to Step 12 .

---

**STEP 12. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to  
Diagnostic Function –OBD-II Drive Cycle –Pattern 23  
[P.13A-9](#).

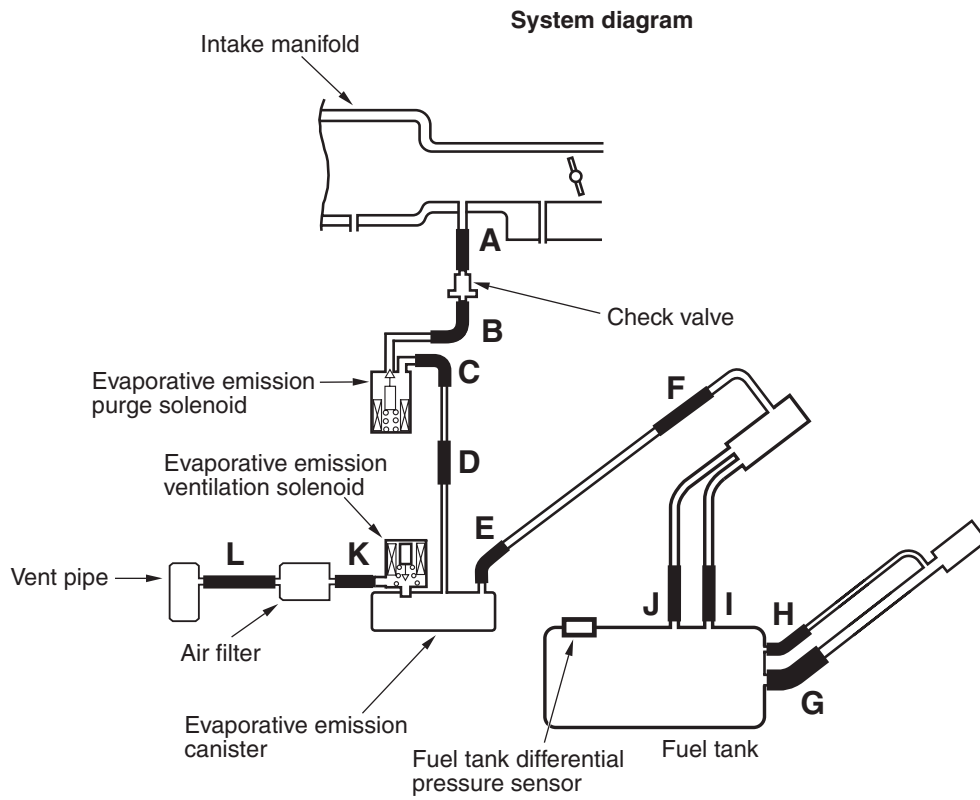
(2) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0452 set?**

**YES** : Retry the troubleshooting.

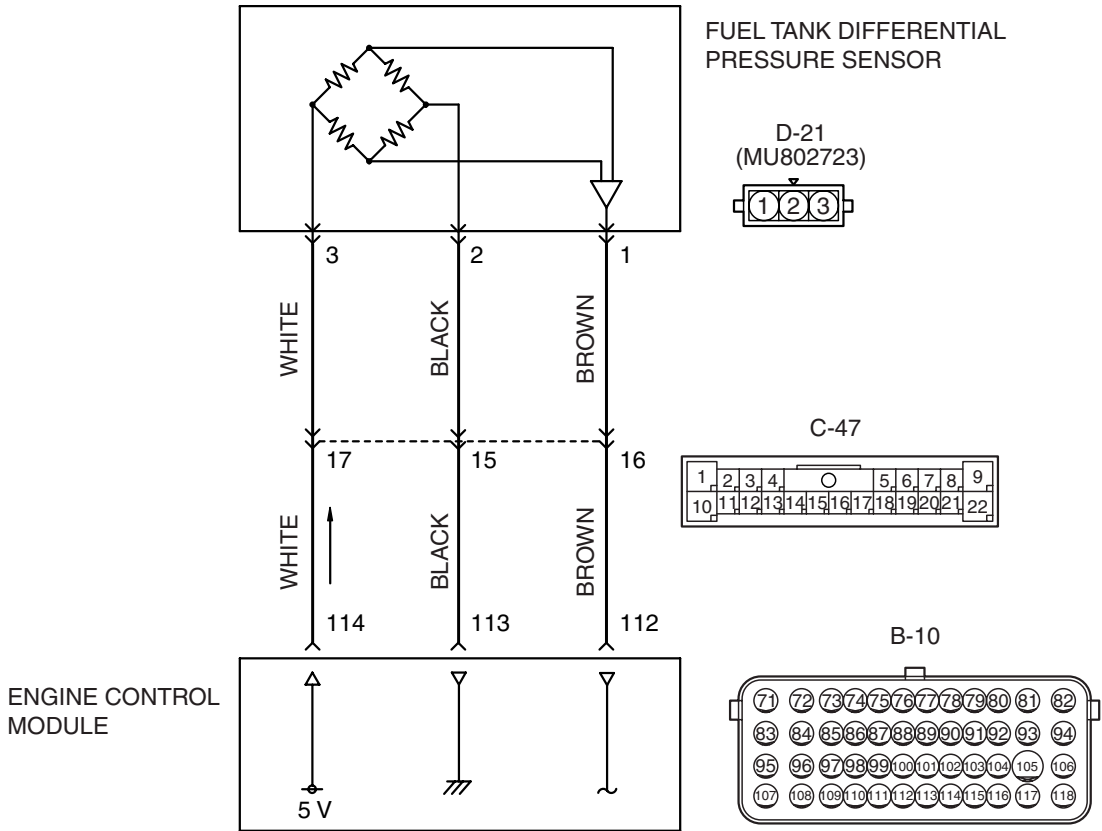
**NO** : The inspection is complete.

DTC P0453: Fuel Tank Differential Pressure Circuit High Input

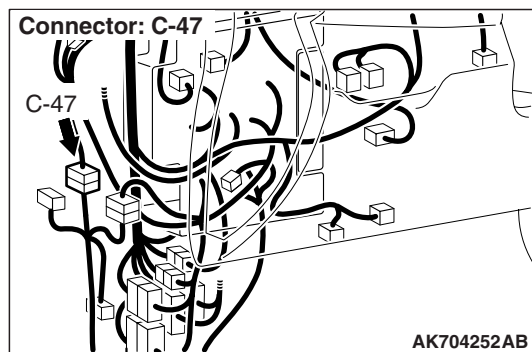
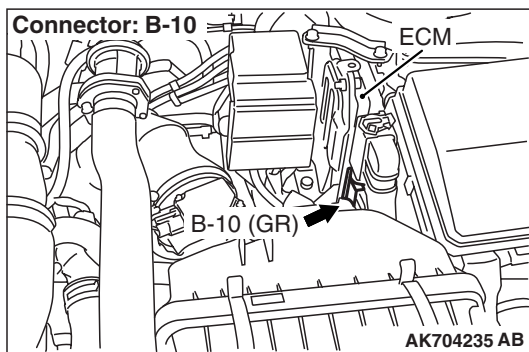


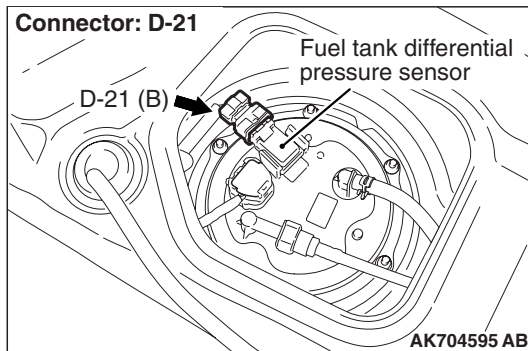
AK704684AB

FUEL TANK DIFFERENTIAL PRESSURE SENSOR CIRCUIT



AK604513 AE





## CIRCUIT OPERATION

- The ECM (terminal No. 114) supplies a 5 volts reference voltage to the fuel tank differential pressure sensor (terminal No. 3). The ECM (terminal No. 113) supplies a ground to the fuel tank differential pressure sensor (terminal No. 2).
- The ECM (terminal No. 112) receives a voltage signal proportional to the pressure in the fuel tank from the fuel tank differential pressure sensor (terminal No. 1).

## TECHNICAL DESCRIPTION

- To determine whether the fuel tank differential pressure sensor is defective, the ECM monitors the fuel tank differential pressure sensor output voltage.
- The ECM judges if the fuel tank differential pressure sensor output voltage is normal.

*NOTE: In rare cases, this DTC may be also set under some fuel and driving conditions regardless of the fuel pressure sensor output voltage when the fuel system is clogged.*

## DESCRIPTIONS OF MONITOR METHODS

Fuel tank differential pressure sensor output voltage is out of specified range.

## MONITOR EXECUTION

Continuous

## MONITOR EXECUTION CONDITIONS (OTHER MONITOR AND SENSOR)

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

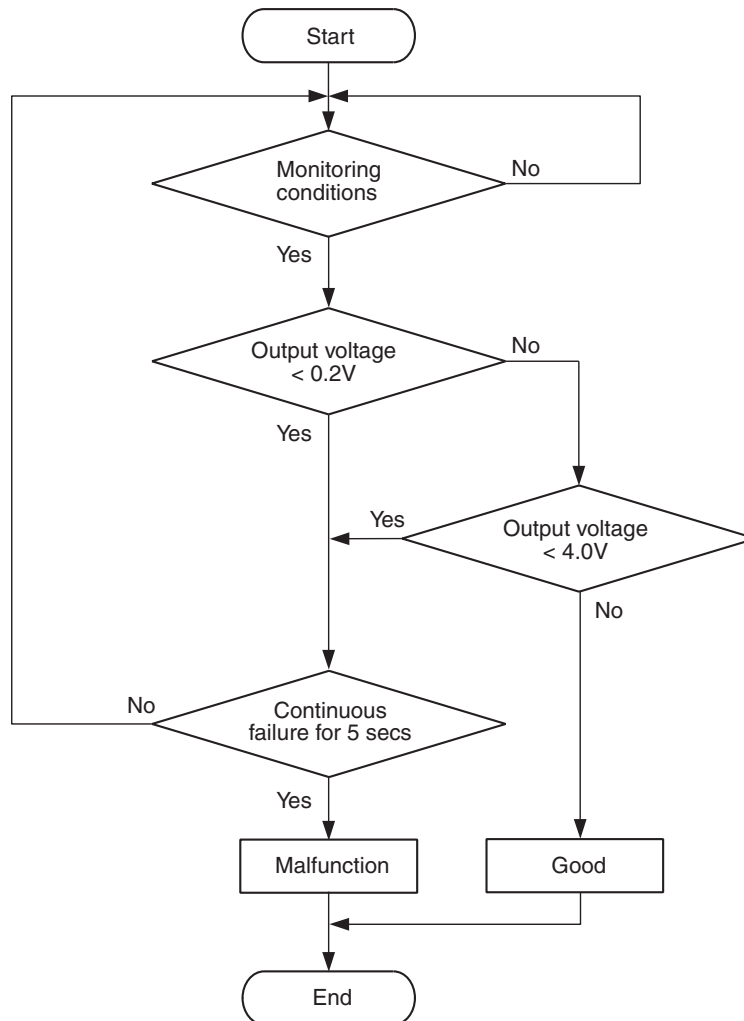
- Evaporative emission purge solenoid monitor
- Evaporative emission ventilation solenoid monitor
- Fuel tank temperature sensor monitor
- Fuel level sensor monitor

**Sensor (The sensors below are determined to be normal)**

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

DTC SET CONDITIONS

Logic Flow Chart (Monitor Sequence)



AK704742

**Check Conditions**

- 2 seconds or more have passed since the starting sequence was completed.
- The fuel temperature is 36° C (97° F) or less.
- Remaining fuel level is 85 percent or less when the engine is started.

**Judgement Criteria**

- The fuel tank differential pressure sensor output voltage remains 4.8 volts or greater for 5 seconds.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

**TROUBLESHOOTING HINTS (THE MOST LIKELY CAUSES FOR THIS CODE TO BE SET ARE:)**

- Fuel tank differential pressure sensor failed.
- Open fuel tank differential pressure sensor circuit, or connector damage.
- ECM failed.



## DIAGNOSIS

### Required Special Tools:

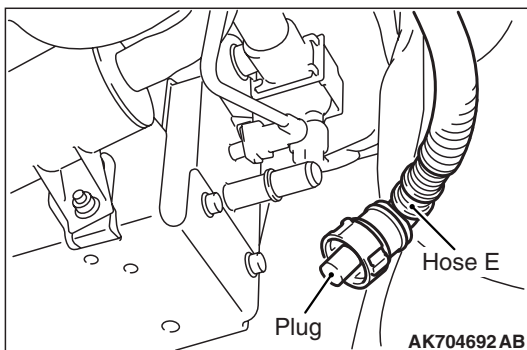
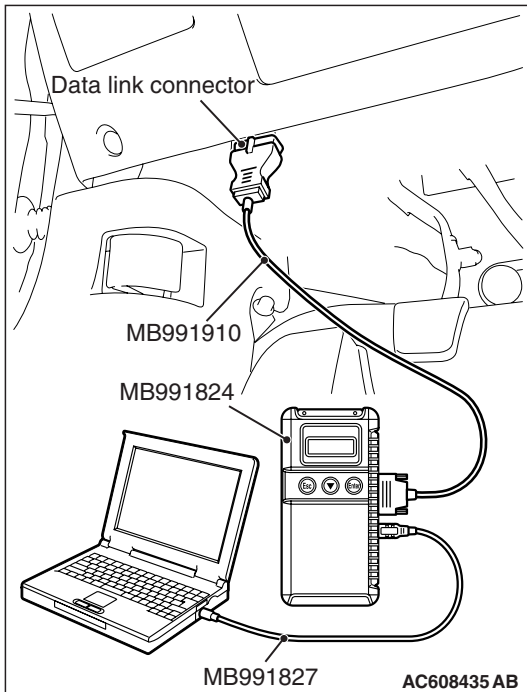
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: M.U.T.-III USB Cable
  - MB991910: M.U.T.-III Main Harness A

**STEP 1. Using scan tool MB991958, check data list item 52: Fuel Tank Differential Pressure Sensor.**

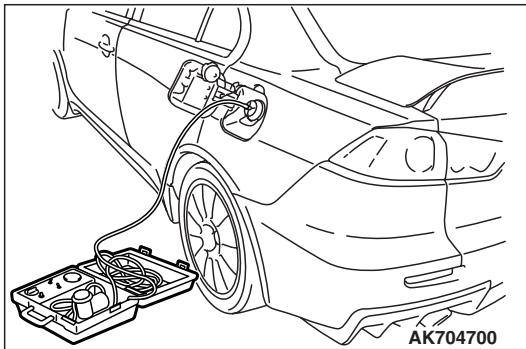
### **CAUTION**

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

(1) Connect scan tool MB991958 to the data link connector.



- (2) Disconnect hose E from the evaporative emission canister, and plug the hose.
- (3) Turn the ignition switch to the "ON" position.
- (4) Remove the fuel cap.
- (5) Set scan tool MB991958 to the data reading mode for item 52, Fuel Tank Differential Pressure Sensor.
  - Output voltage should be between 1,500 to 3,500 mV.



- (6) Connect the evaporative emission system pressure pump (Miller number 6872A) to the fuel tank filler tube by using fuel tank adapter (MLR-8382) and pressurize the fuel tank.
  - The fuel tank pressure reading should increase.
- (7) Turn the ignition switch to the "LOCK" (OFF) position. Then disconnect scan tool MB991958.
- (8) Remove the evaporative emission system pressure pump (Miller number 6872A) and the fuel tank adapter (MLR-8382), and reinstall the fuel cap.
- (9) Connect hose E to the evaporative emission canister.

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

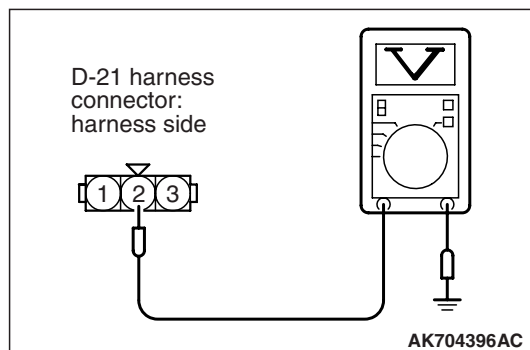
- YES :** It can be assumed that this malfunction is intermittent. (Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions [P.00-15](#)).
- NO :** Go to Step 2 .

**STEP 2. Measure the ground voltage at fuel tank differential pressure sensor connector D-21 by backprobing.**

- (1) Do not disconnect the connector D-21.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 2 and ground by backprobing.
  - Voltage should be 0.5 volt or less.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the measured voltage 0.5 volt or less?**

- YES :** Go to Step 6 .
- NO :** Go to Step 3 .



**STEP 3. Check harness connector D-21 at the fuel tank differential pressure sensor and harness connector B-10 at ECM for damage.**

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

- YES :** Go to Step 4 .
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 7 .

**STEP 4. Check for open circuit between fuel tank differential pressure sensor connector D-21 (terminal No. 2) and ECM connector B-10 (terminal No. 113).**

*NOTE: Check harness after checking intermediate connector C-47. 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?**

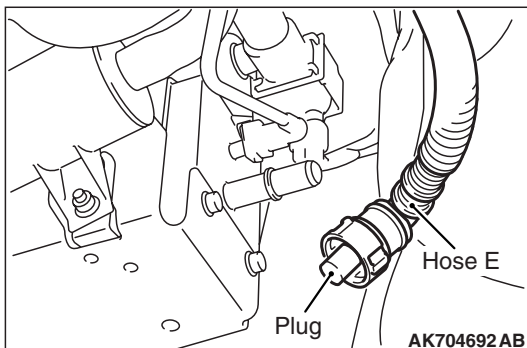
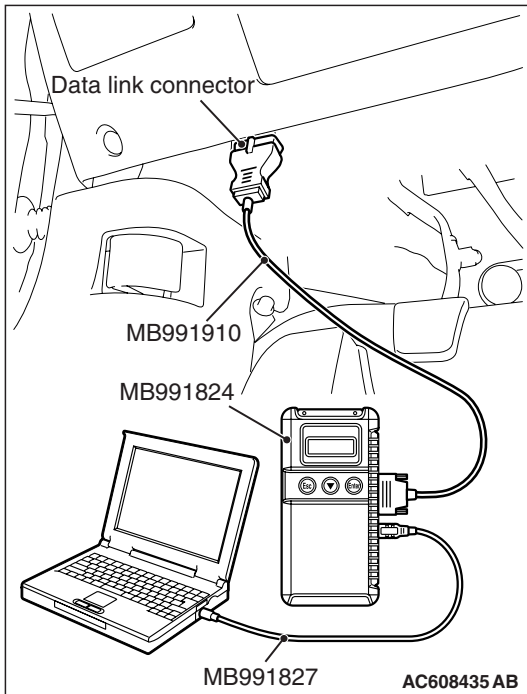
- YES :** Go to Step 5 .
- NO :** Repair it. Then go to Step 7 .

**STEP 5. Using scan tool MB991958, check data list item 52: Fuel Tank Differential Pressure Sensor.**

**⚠ CAUTION**

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

(1) Connect scan tool MB991958 to the data link connector.



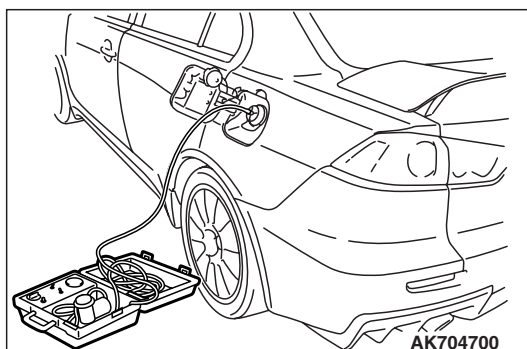
(2) Disconnect hose E from the evaporative emission canister, and plug the hose.

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

(4) Remove the fuel cap.

(5) Set scan tool MB991958 to the data reading mode for item 52, Fuel Tank Differential Pressure Sensor.

- Output voltage should be between 1,500 to 3,500 mV.



(6) Connect the evaporative emission system pressure pump (Miller number 6872A) to the fuel tank filler tube by using fuel tank adapter (MLR-8382) and pressurize the fuel tank.

- The fuel tank pressure reading should increase.

(7) Turn the ignition switch to the "LOCK" (OFF) position. Then disconnect scan tool MB991958.

(8) Remove the evaporative emission system pressure pump (Miller number 6872A) and the fuel tank adapter (MLR-8382), and reinstall the fuel cap.

(9) Connect hose E to the evaporative emission canister.

**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.00-15.

**NO :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis

–ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, Diagnosis –ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 7 .

---

**STEP 6. Check harness connector D-21 at the fuel tank differential pressure sensor and harness connector B-10 at ECM for damage.**

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

**YES** : Replace the fuel tank differential pressure sensor.  
Then go to Step 7 .

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

---

**STEP 7. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13A-9](#).

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

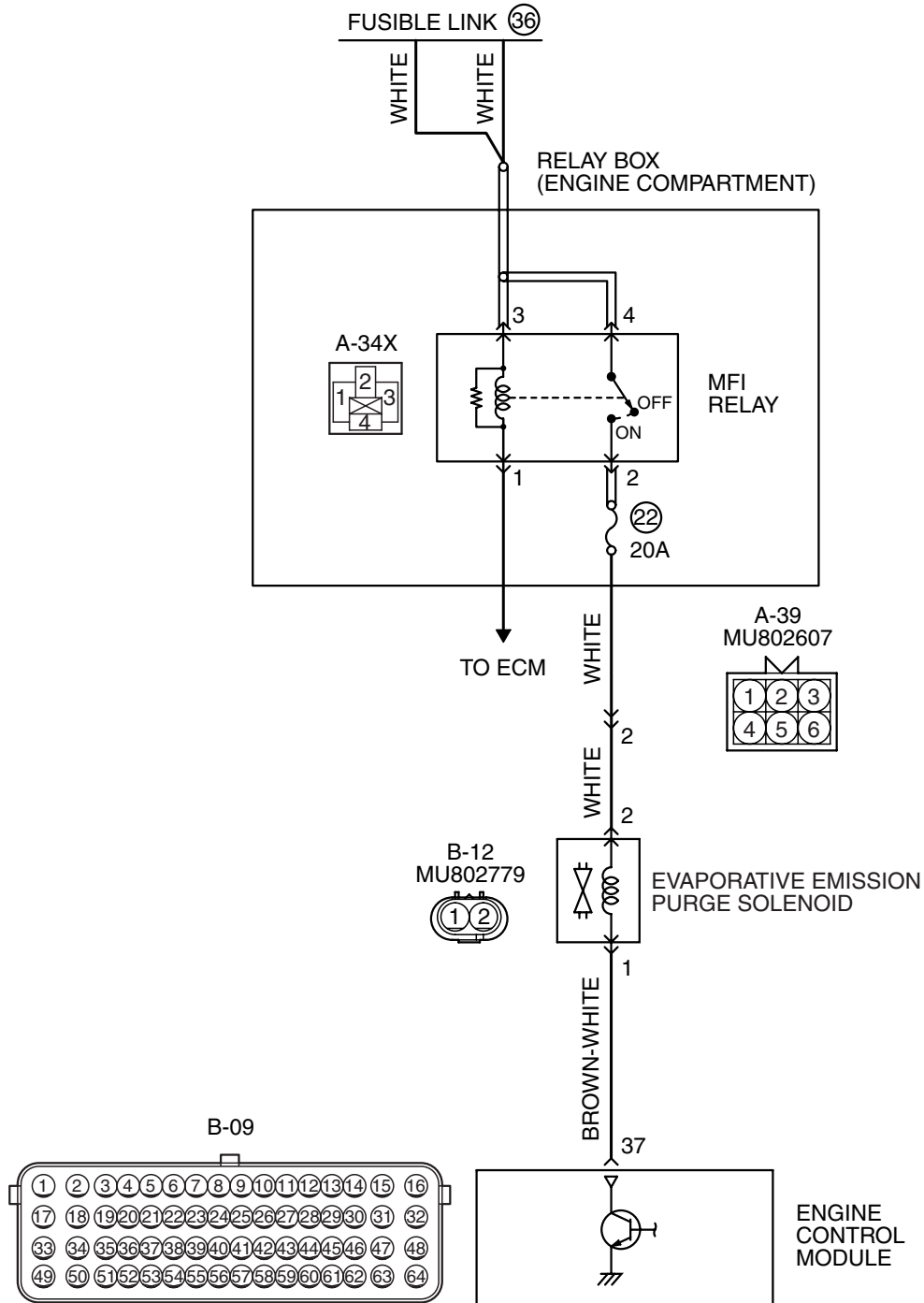
**Q: Is DTC P0453 set?**

**YES** : Retry the troubleshooting.

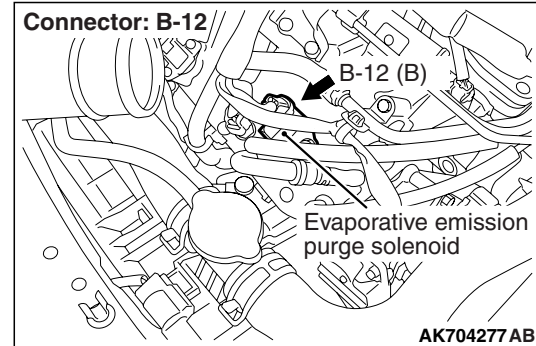
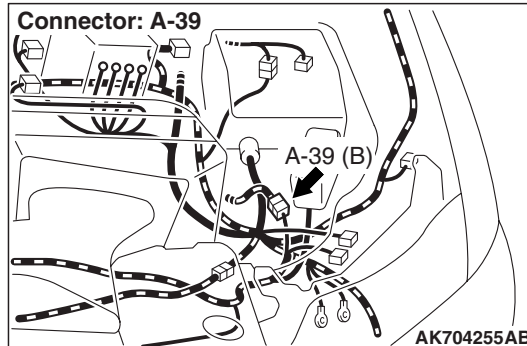
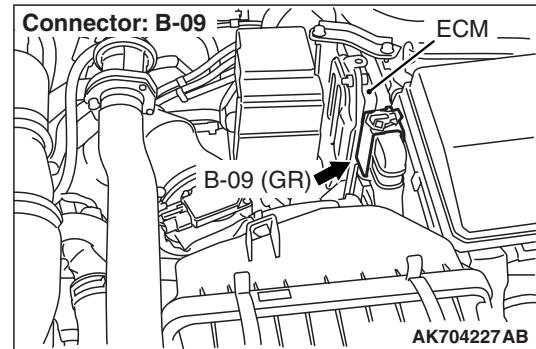
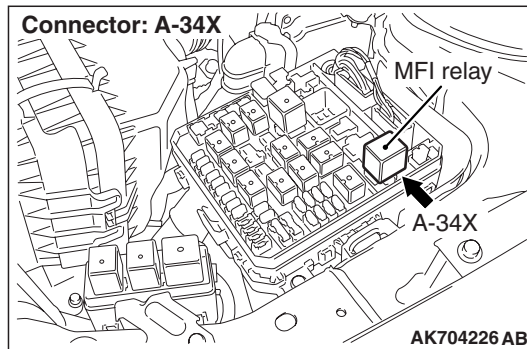
**NO** : The inspection is complete.

DTC P0443: Evaporative Emission Purge Solenoid Circuit

EVAPORATIVE EMISSION PURGE SOLENOID CIRCUIT



AK704279 AB



## CIRCUIT OPERATION

- The evaporative emission purge solenoid power is supplied from the MFI relay (terminal No. 2).
- The ECM controls ground evaporative emission purge solenoid by turning the power transistor in the ECM "ON" and "OFF".

## TECHNICAL DESCRIPTION

- To judge if there is open circuit in the evaporative emission purge solenoid drive circuit, the ECM measures the surge voltage of the evaporative emission purge solenoid coil.

## DESCRIPTIONS OF MONITOR METHODS

Off-surge does not occur after solenoid is operated from on to off.

## 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)**

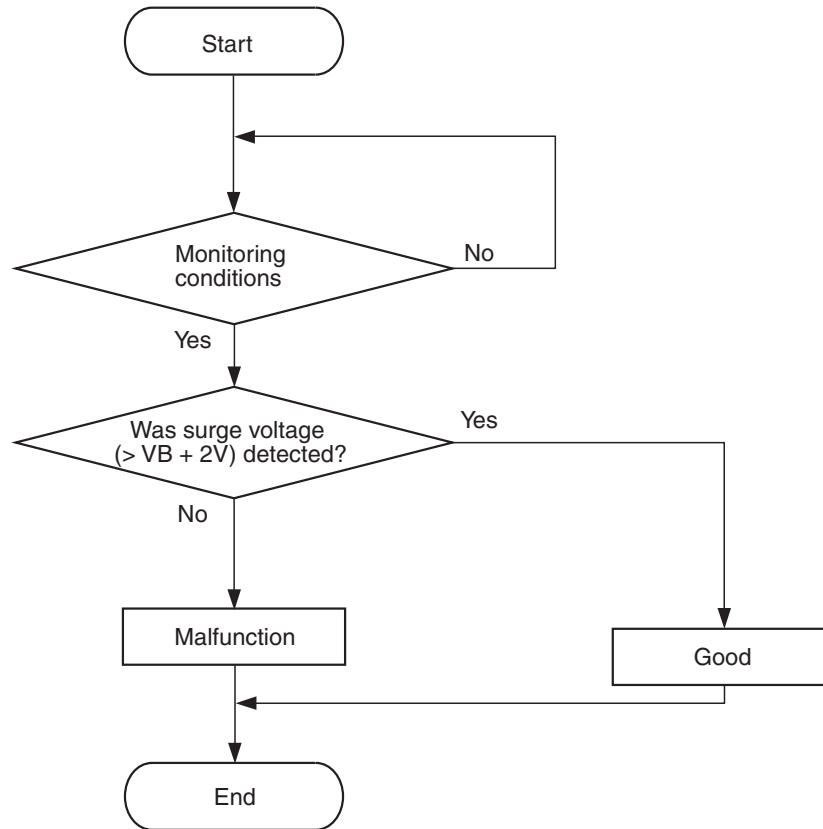
- Not applicable

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

- Not applicable

## DTC SET CONDITIONS

### Logic Flow Chart



AK604339

#### Check Conditions

- Engine is being cranked.
- Battery positive voltage is between 10 and 16.5 volts.

#### Judgement Criteria

- The evaporative emission purge solenoid coil surge voltage (battery positive voltage + 2 volts) is not detected for 0.2 second.
- The ECM monitors for this condition once during the drive cycle.

#### Check Conditions

- Battery positive voltage is between 10 and 16.5 volts.
- ON duty cycle of the evaporative emission purge solenoid is between 10 and 90 percent.
- Evaporative emission ventilation solenoid is off.
- 1 second or more has elapsed after the above mentioned conditions have been met.

#### Judgement Criterion

- The evaporative emission purge solenoid coil surge voltage (battery positive voltage + 2 volts) is not detected for 1 second after the evaporative emission purge solenoid is turned off.

#### FAIL-SAFE AND BACKUP FUNCTION

- None

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

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

- Evaporative emission purge solenoid failed.
- Open or shorted evaporative emission purge solenoid 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 actuator test item 10: Evaporative Emission Purge Solenoid.****⚠ CAUTION**

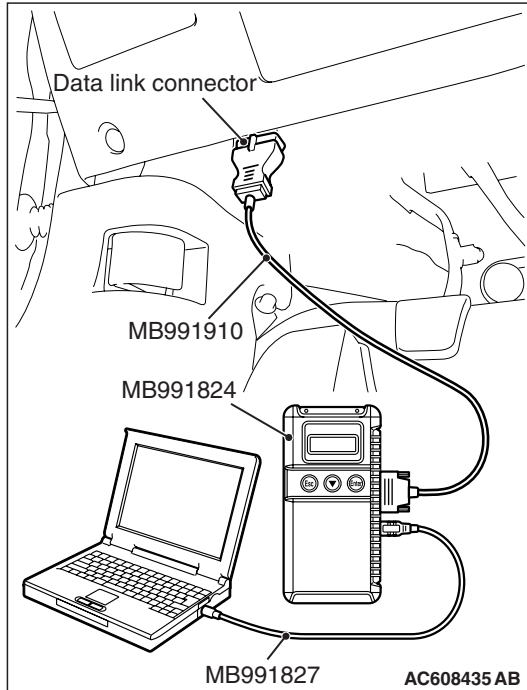
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 actuator test mode for item 10, Evaporative emission purge solenoid.
  - An operation sound should be heard and vibration should be felt when the evaporative emission purge solenoid is operated.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES** : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How Cope with Intermittent Malfunctions P.00-15.

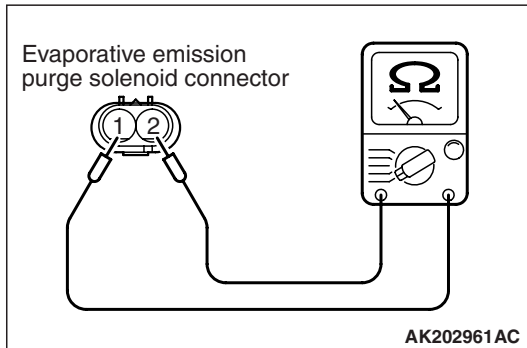
**NO** : Go to Step 2.

**STEP 2. Check harness connector B-12 at the evaporative emission purge solenoid for damage.****Q: Is the harness connector in good condition?**

**YES** : Go to Step 3.

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





**STEP 3. Check the evaporative emission purge solenoid.**

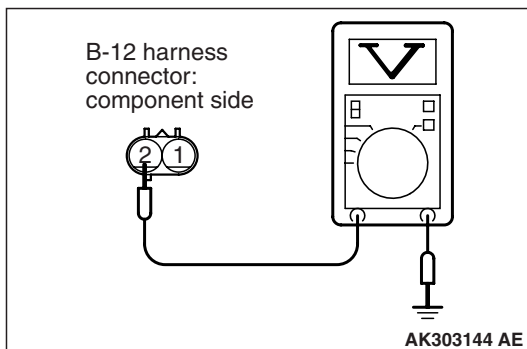
- (1) Disconnect the evaporative emission purge solenoid connector B-12.
- (2) Measure the resistance between evaporative emission purge solenoid side connector terminal No. 1 and No. 2.

**Standard value: 22 –26  $\Omega$  [at 20° C (68° F)]**

**Q: Is the measured resistance between 22 and 26  $\Omega$  [at 20° C (68° F)]?**

**YES :** Go to Step 4.

**NO :** Replace the evaporative emission purge solenoid. Then go to Step 10.



**STEP 4. Measure the power supply voltage at evaporative emission purge solenoid harness side connector B-12.**

- (1) Disconnect the connector B-12 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 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 6.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-34X at MFI relay for damage.**

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

**YES :** Check harness connector A-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 MFI relay connector A-34X (terminal No. 2) and evaporative emission purge solenoid connector B-12 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

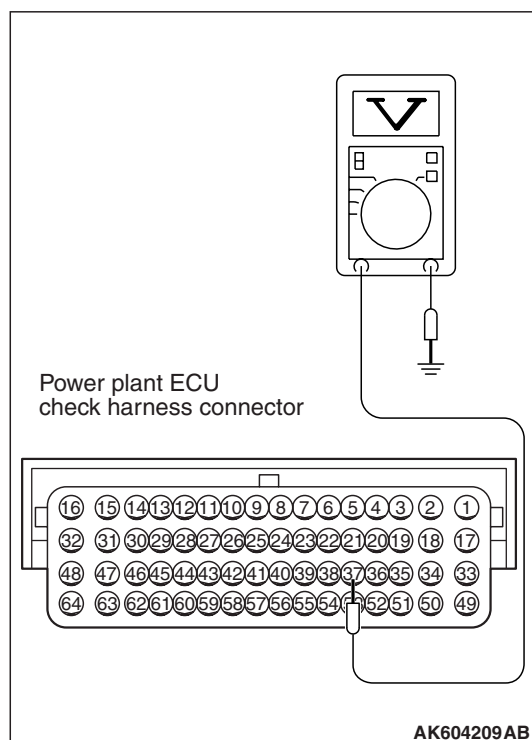
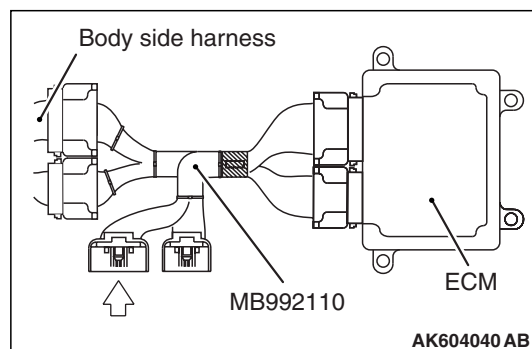
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

**STEP 6. Check harness connector B-09 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 10.



**STEP 7. Measure the power supply voltage at ECM connector B-09 by using power plant ECU check harness special tool MB992110.**

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

- (3) Measure the voltage between terminal No. 37 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 8.

**NO :** Repair harness wire between evaporative emission purge solenoid connector B-12 (terminal No. 1) and ECM connector B-09 (terminal No. 37) because of open circuit or short circuit to ground. Then go to Step 10.

**STEP 8. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and evaporative emission purge solenoid connector B-12 (terminal No. 2).**

*NOTE: Check harness connector after checking intermediate connector A-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.*

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

**YES :** Go to Step 9.

**NO :** Repair it. Then go to Step 10.

---

**STEP 9. Check for harness damage between evaporative emission purge solenoid connector B-12 (terminal No. 1) and ECM connector B-09 (terminal No. 37).**

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-12](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

**NO :** Repair it. Then go to Step 10.

---

**STEP 10. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 [P.13A-9](#).

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

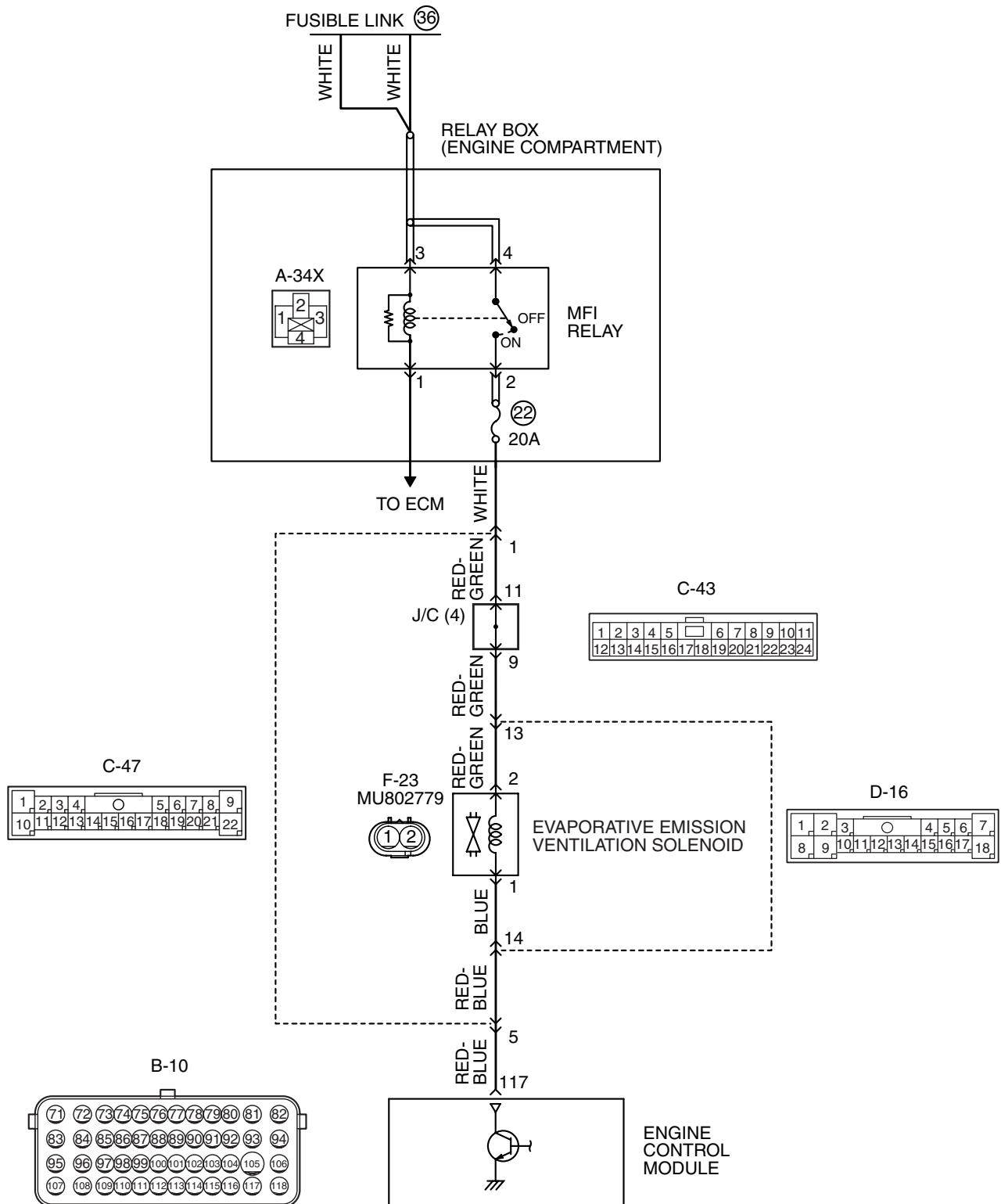
**Q: Is DTC P0443 set?**

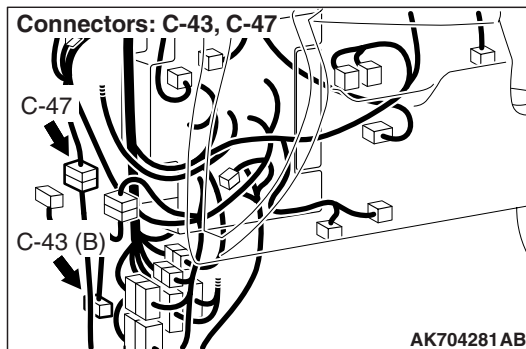
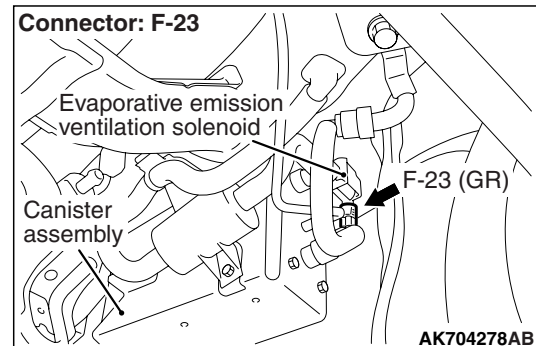
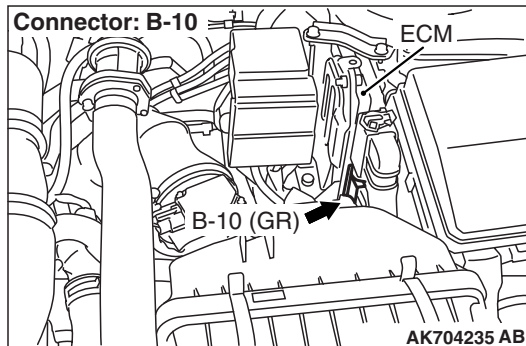
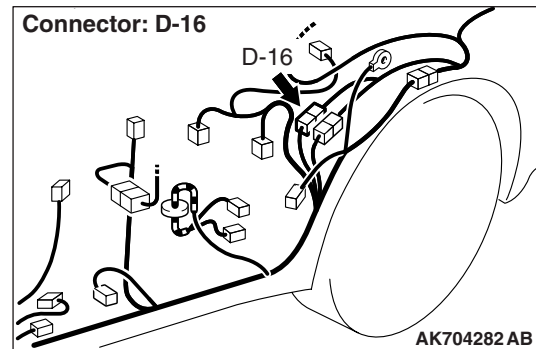
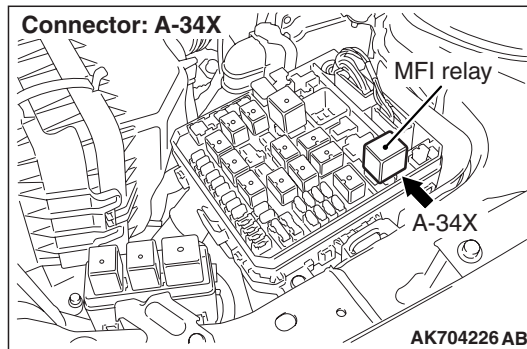
**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

DTC P0446: Evaporative Emission Ventilation Solenoid Circuit

EVAPORATIVE EMISSION VENTILATION SOLENOID CIRCUIT





## CIRCUIT OPERATION

- The evaporative emission ventilation solenoid power is supplied from the MFI relay (terminal No. 2).
- The ECM controls the evaporative emission ventilation solenoid ground by turning the power transistor in the ECM ON and OFF.

## TECHNICAL DESCRIPTION

- To judge if there is open circuit in the evaporative emission ventilation solenoid drive circuit, ECM measures the surge voltage of the evaporative emission ventilation solenoid coil.
- The ECM drives the evaporative emission ventilation solenoid. After the solenoid is turned off, the ECM will check if the solenoid coil produces a surge voltage (battery positive voltage + 2 volts).

## DESCRIPTIONS OF MONITOR METHODS

Off-surge does not occur after solenoid is operated on to off.

## 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)**

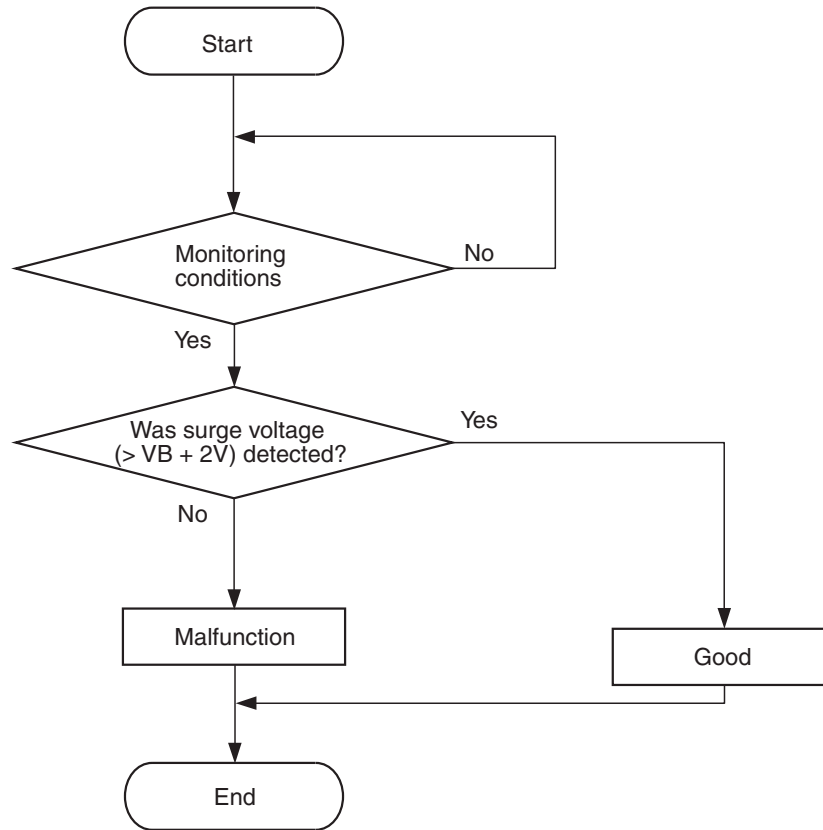
- Not applicable

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

- Not applicable

## DTC SET CONDITIONS

## Logic Flow Chart



AK604339

**Check Conditions**

- Engine is being cranked.
- Battery positive voltage is between 10 and 16.5 volts.

**Judgement Criteria**

- The evaporative emission ventilation solenoid coil surge voltage (battery positive voltage + 2 volts) is not detected for 0.2 second.
- The ECM monitors for this condition once during the drive cycle.

**Check Conditions**

- Battery positive voltage is between 10 and 16.5 volts.
- ON duty cycle of the evaporative emission purge solenoid is 0 percent.
- Evaporative emission ventilation solenoid is ON.
- 1 second or more has elapsed after the above mentioned conditions have been met.

**Judgement Criterion**

- The evaporative emission ventilation solenoid coil surge voltage (battery positive voltage + 2 volts) is not detected for 1 second after the evaporative emission ventilation solenoid is turned OFF.

**FAIL-SAFE AND BACKUP FUNCTION**

- None

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 23 [P.13A-9](#).

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

- Evaporative emission ventilation solenoid failed.
- Open or shorted evaporative emission ventilation solenoid 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 actuator test item 15: Evaporative Emission Ventilation Solenoid.

#### **⚠ CAUTION**

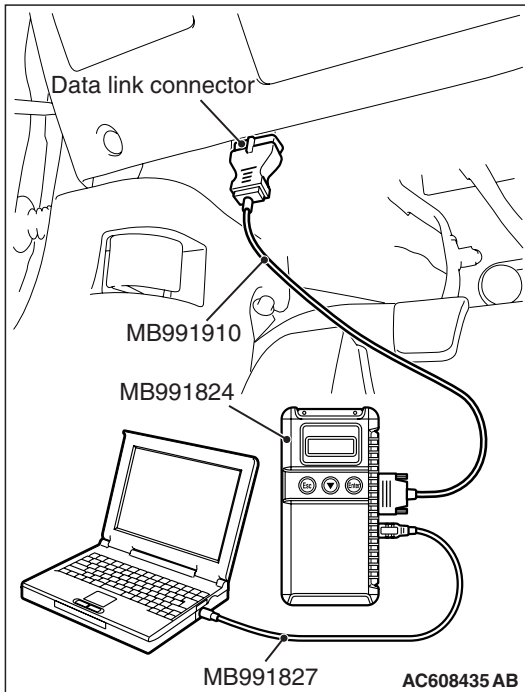
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 actuator test mode for item 15, Evaporative emission ventilation solenoid.
  - An operation sound should be heard and vibration should be felt when the evaporative emission ventilation solenoid is operated.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

#### **Q: Is the solenoid 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.00-15](#).

**NO** : Go to Step 2.



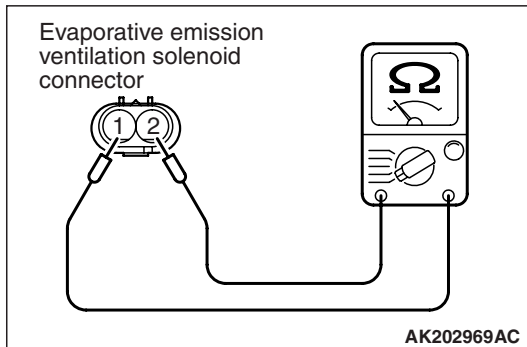
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### STEP 2. Check harness connector F-23 at the evaporative emission ventilation solenoid for damage.

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

**YES** : Go to Step 3.

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



**STEP 3. Check the evaporative emission ventilation solenoid.**

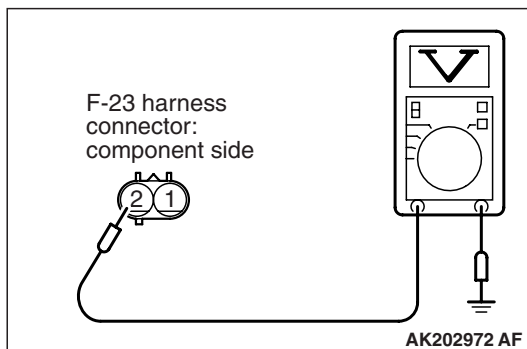
- (1) Disconnect the evaporative emission ventilation solenoid connector F-23.
- (2) Measure the resistance between evaporative emission ventilation solenoid side connector terminal No. 1 and No. 2.

**Standard value: 17 –21 Ω [at 20° C (68° F)]**

**Q: Is the measured resistance between 17 and 21 Ω [at 20° C (68° F)]?**

**YES :** Go to Step 4.

**NO :** Replace it. Then go to Step 10.



**STEP 4. Measure the power supply voltage at evaporative emission ventilation solenoid harness side connector F-23.**

- (1) Disconnect the connector F-23 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 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 6.

**NO :** Go to Step 5.

**STEP 5. Check harness connector A-34X at MFI relay for damage.**

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

**YES :** Check harness connectors C-43, C-47 and D-16 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 MFI relay connector A-34X (terminal No. 2) and evaporative emission ventilation solenoid connector F-23 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

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



**STEP 6. Check harness connector B-10 at ECM for damage.**

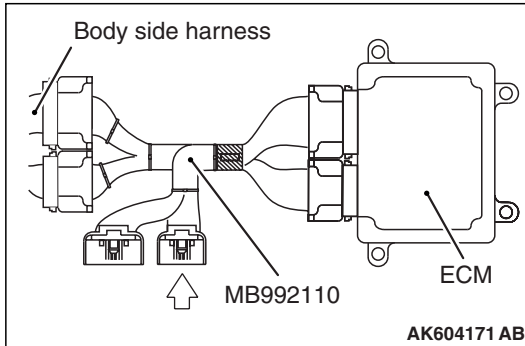
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 7.

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

**STEP 7. Measure the power supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.**

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

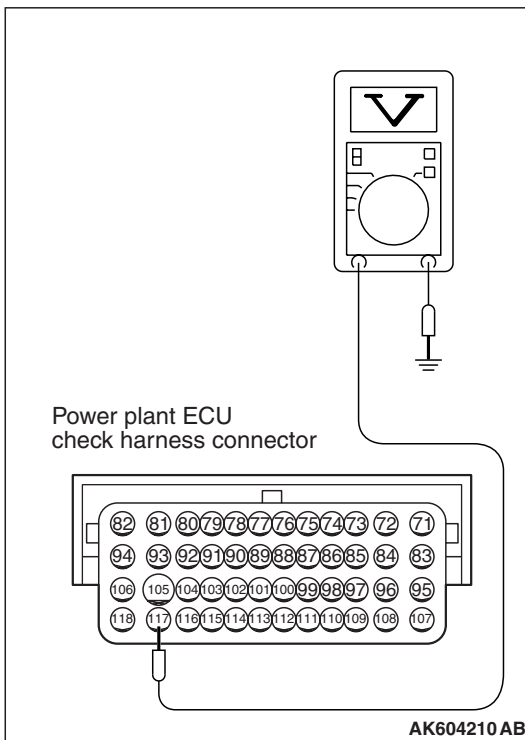


- (3) Measure the voltage between terminal No. 117 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 8.

**NO :** Check harness connectors C-47 and D-16 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 evaporative emission ventilation solenoid connector F-23 (terminal No. 1) and ECM connector B-10 (terminal No. 117) because of open circuit or short circuit to ground. Then go to Step 10.



---

**STEP 8. Check for harness damage between MFI relay connector A-34X (terminal No. 2) and evaporative emission ventilation solenoid connector F-23 (terminal No. 2).**

*NOTE: Check harness after checking intermediate connectors C-43, C-47 and D-16. If intermediate connectors are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.*

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

**YES :** Go to Step 9.

**NO :** Repair it. Then go to Step 10.

---

**STEP 9. Check for harness damage between evaporative emission ventilation solenoid connector F-23 (terminal No. 1) and ECM connector B-10 (terminal No. 117).**

*NOTE: Check harness after checking intermediate connectors C-47 and D-16. If intermediate connectors are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.*

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

**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, ID Code Registration Necessity Judgment Table <Vehicles with KOS> P.42B-12 or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-9. Then go to Step 10.

**NO :** Repair it. Then go to Step 10.

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**STEP 10. Test the OBD-II drive cycle.**

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 23 P.13A-9.

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

**Q: Is DTC P0446 set?**

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.