

## GROUP 13B

# MULTIPOINT FUEL INJECTION (MFI) <2.4L ENGINE>

## CONTENTS

|                                                                                                    |                |                                                                                                              |         |
|----------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------|---------|
| <b>GENERAL DESCRIPTION.....</b>                                                                    | <b>13B-3</b>   | ADJUSTMENT .....                                                                                             | 13B-901 |
| <b>MULTIPOINT FUEL INJECTION (MFI)<br/>DIAGNOSIS .....</b>                                         | <b>13B-6</b>   | FUEL PRESSURE TEST .....                                                                                     | 13B-903 |
| TROUBLESHOOTING STRATEGY .....                                                                     | 13B-6          | FUEL PUMP CONNECTOR DISCONNECTION<br>(HOW TO REDUCE PRESSURIZED FUEL<br>LINES).....                          | 13B-906 |
| DIAGNOSTIC FUNCTION .....                                                                          | 13B-6          | FUEL PUMP OPERATION CHECK .....                                                                              | 13B-906 |
| FAIL-SAFE FUNCTION REFERENCE<br>TABLE.....                                                         | 13B-29         | MULTIPOINT FUEL INJECTION (MFI) RELAY AND<br>THROTTLE ACTUATOR CONTROL MOTOR<br>RELAY CONTINUITY CHECK ..... | 13B-907 |
| DIAGNOSTIC TROUBLE CODE CHART..                                                                    | 13B-31         | FUEL PUMP RELAY CONTINUITY CHECK                                                                             | 13B-907 |
| SYMPTOM CHART.....                                                                                 | 13B-35         | INTAKE AIR TEMPERATURE SENSOR<br>CHECK .....                                                                 | 13B-908 |
| DIAGNOSTIC TROUBLE CODE<br>PROCEDURES.....                                                         | 13B-38         | ENGINE COOLANT TEMPERATURE SENSOR<br>CHECK .....                                                             | 13B-908 |
| SYMPTOM PROCEDURES .....                                                                           | 13B-727        | ACCELERATOR PEDAL POSITION SENSOR<br>CHECK .....                                                             | 13B-909 |
| DATA LIST REFERENCE TABLE .....                                                                    | 13B-864        | ACCELERATOR PEDAL POSITION SWITCH<br>CHECK .....                                                             | 13B-910 |
| ACTUATOR TEST REFERENCE TABLE..                                                                    | 13B-876        | HEATED OXYGEN SENSOR CHECK ....                                                                              | 13B-910 |
| CHECK AT THE ENGINE CONTROL MODULE<br>(ECM) <M/T> OR POWERTRAIN CONTROL<br>MODULE (PCM) <A/T>..... | 13B-877        | INJECTOR CHECK.....                                                                                          | 13B-913 |
| INSPECTION PROCEDURE USING AN<br>OSCILLOSCOPE .....                                                | 13B-885        | THROTTLE ACTUATOR CONTROL MOTOR<br>CHECK .....                                                               | 13B-913 |
| <b>SPECIAL TOOLS.....</b>                                                                          | <b>13B-894</b> | ENGINE OIL CONTROL VALVE CHECK..                                                                             | 13B-914 |
| <b>ON-VEHICLE SERVICE.....</b>                                                                     | <b>13B-896</b> | EVAPORATIVE EMISSION PURGE SOLENOID<br>CHECK .....                                                           | 13B-914 |
| COMPONENT LOCATION .....                                                                           | 13B-896        | EVAPORATIVE EMISSION VENTILATION<br>SOLENOID CHECK .....                                                     | 13B-914 |
| THROTTLE BODY (THROTTLE VALVE AREA)<br>CLEANING .....                                              | 13B-901        | EGR VALVE CHECK.....                                                                                         | 13B-914 |
| ACCELERATOR PEDAL POSITION SWITCH AND<br>ACCELERATOR PEDAL POSITION SENSOR (APS)                   |                |                                                                                                              |         |

Continued on next page

|                                      |                |                                |                |
|--------------------------------------|----------------|--------------------------------|----------------|
| <b>INJECTOR</b> .....                | <b>13B-915</b> | <b>(PCM)</b> .....             | <b>13A-926</b> |
| REMOVAL AND INSTALLATION .....       | 13B-915        | REMOVAL AND INSTALLATION ..... | 13B-919        |
| <b>THROTTLE BODY ASSEMBLY</b> ...    | <b>13B-917</b> | <b>SPECIFICATIONS</b> .....    | <b>13B-920</b> |
| REMOVAL AND INSTALLATION .....       | 13B-917        | FASTENER TIGHTENING            |                |
|                                      |                | SPECIFICATIONS .....           | 13B-920        |
|                                      |                | GENERAL SPECIFICATION(S) ..... | 13B-920        |
|                                      |                | SERVICE SPECIFICATIONS .....   | 13B-921        |
|                                      |                | SEALANT AND ADHESIVE .....     | 13B-921        |
| <b>ENGINE CONTROL MODULE (ECM)</b>   |                |                                |                |
| <b>AND POWERTRAIN CONTROL MODULE</b> |                |                                |                |

## GENERAL DESCRIPTION

M1131000101135

The Multiport Fuel Injection System consists of sensors, actuators and the engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T>. The sensors detect the engine condition. The ECM <M/T> or PCM <A/T> controls the system based on signals from these sensors. The actuators work under the control of the ECM <M/T> or PCM <A/T>. The ECM <M/T> or PCM <A/T> carries out activities such as fuel injection control, throttle valve opening control, idle air control, and ignition timing control. In addition, the ECM <M/T> or PCM <A/T> has several diagnostic test modes which simplify troubleshooting when a problem develops.

### FUEL INJECTION CONTROL

The ECM <M/T> or PCM <A/T> controls injector drive times and injection timing to supply the optimum air/fuel mixture to the engine according to the continually-changing engine operation conditions. A single injector is mounted at the intake port of each cylinder. The fuel pump supplies pressurized fuel from the fuel tank to the fuel injectors. The fuel pressure regulator controls the fuel pressure. Thus, the regulated fuel is distributed to each injector. Fuel is normally injected for each cylinder every two rotations of the crankshaft. The firing order is 1-3-4-2. Each cylinder has a dedicated fuel injector. This is called "multiport". The ECM <M/T> or PCM <A/T> provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or running under high load conditions. Thus, engine performance is maintained. In addition, when the engine is under normal operating temperature after warming-up, the ECM <M/T> or PCM <A/T> controls the air/fuel mixture according to the heated oxygen sensor signal. This control is a "closed-loop" control. The closed-loop control achieves the theoretical air/fuel mixture ratio where the catalytic converter can obtain the maximum cleaning performance.

### THROTTLE VALVE OPENING CONTROL

This system electrically controls the opening of the throttle valve. The ECM <M/T> or PCM <A/T> detects the amount of travel of the accelerator pedal via the accelerator pedal position sensor, and controls the actuation of the throttle actuator control motor, which is mounted on the throttle body, in order to attain the target throttle valve opening that has been predetermined in accordance with driving conditions.

### IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that passes through the throttle valve in accordance with changes in idling conditions and engine load during idling.

The ECM <M/T> or PCM <A/T> drives the throttle actuator control motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and A/C and other electrical load. In addition, when the air conditioning switch is turned off and on while the engine is idling, the throttle actuator control motor adjusts the throttle valve passes through air amount according to the engine load conditions to avoid fluctuations in the engine speed.

### IGNITION TIMING CONTROL

The ignition power transistor located in the ignition primary circuit turns on and off to control primary current flow to the ignition coil. This maintains ignition timing at an optimum level regardless of various engine operating conditions. The ECM <M/T> or PCM <A/T> determines the ignition timing according to engine speed, intake air volume, engine coolant temperature, and atmospheric pressure.

### DIAGNOSTIC TEST MODE

- When a fault is detected in any of the sensors or actuators related to emission control, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates to warn the driver.
- When a fault is detected in one of the sensors or actuators, a diagnostic trouble code corresponding to the fault is stored in the ECM <M/T> or PCM <A/T>.
- The RAM data inside the ECM <M/T> or PCM <A/T> that is related to the sensors and actuators can be read with the scan tool. In addition, the actuators can be controlled by the scan tool MB991958 (MUT-III sub assembly) under certain circumstances.

**OTHER CONTROL FUNCTIONS****Fuel Pump Control**

- Turns on the fuel pump relay so that current is supplied to the fuel pump while the engine is cranking or running.

**A/C Compressor Clutch Relay Control**

- Turns on and off the air conditioning compressor clutch.

**Engine Oil Control Valve Control**

- The ECM <M/T> or PCM <A/T> effects duty cycle control on the engine oil control valve, in accordance with the engine speed. This regulates the supply of engine oil to the intake rocker shaft, which switches the cams.

**Fan Relay Control**

- The radiator fan and condenser fan speeds are controlled in response to the engine coolant temperature and vehicle speed.

**Generator Output Current Control**

- Prevents generator output current from increasing suddenly and idle speed from dropping at times such as when the headlights are turned on.

**Evaporative Emission Purge Control**

- (Refer to GROUP 17, Emission Control System – Evaporative Emission System – General Information. [P.17-213](#))

**EGR Control**

- (Refer to GROUP 17, Emission Control System – Exhaust Gas Recirculation (EGR) System – General Information. [P.17-220](#))

## MULTIPOINT FUEL INJECTION (MFI) SYSTEM DIAGRAM

### SENSE

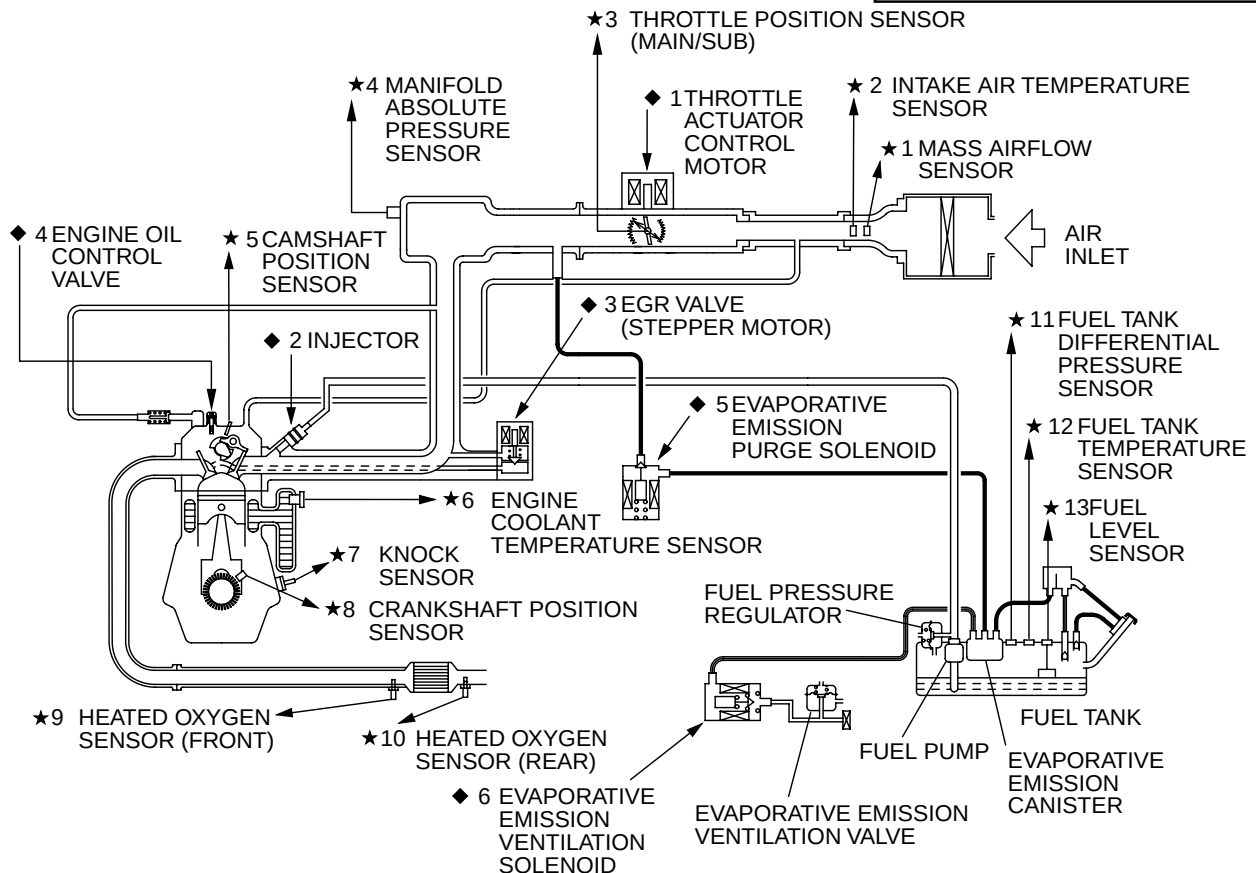
- ★1 MASS AIRFLOW SENSOR
  - ★2 INTAKE AIR TEMPERATURE SENSOR
  - ★3 THROTTLE POSITION SENSOR (MAIN/SUB)
  - ★4 MANIFOLD ABSOLUTE PRESSURE SENSOR
  - ★5 CAMSHAFT POSITION SENSOR
  - ★6 ENGINE COOLANT TEMPERATURE SENSOR
  - ★7 KNOCK SENSOR
  - ★8 CRANKSHAFT POSITION SENSOR
  - ★9 HEATED OXYGEN SENSOR (FRONT)
  - ★10 HEATED OXYGEN SENSOR (REAR)
  - ★11 FUEL TANK DIFFERENTIAL PRESSURE SENSOR
  - ★12 FUEL TANK TEMPERATURE SENSOR
  - ★13 FUEL LEVEL SENSOR
- 
- ACCELERATOR PEDAL POSITION SENSOR (MAIN/SUB)
  - ACCELERATOR PEDAL POSITION SWITCH
  - ENGINE OIL PRESSURE SWITCH
  - A/C SWITCH
  - A/C LOAD SIGNAL
  - OUTPUT SHAFT SPEED SENSOR
  - TRANSMISSION RANGE SWITCH
  - GENERATOR FR TERMINAL
  - IGNITION SWITCH - IG
  - IGNITION SWITCH - ST
  - POWER SUPPLY

### DECIDE

ECM <MT> OR  
PCM <AT>  
(WITH  
BAROMETRIC  
PRESSURE  
SENSOR)

### ACT

- ◆1 THROTTLE ACTUATOR CONTROL MOTOR
  - ◆2 INJECTOR
  - ◆3 EGR VALVE (STEPPER MOTOR)
  - ◆4 ENGINE OIL CONTROL VALVE
  - ◆5 EVAPORATIVE EMISSION PURGE SOLENOID
  - ◆6 EVAPORATIVE EMISSION VENTILATION SOLENOID
- 
- IGNITION COIL, IGNITION POWER TRANSISTER
  - MULTIPOINT FUEL INJECTION (MFI) RELAY
  - FUEL PUMP RELAY
  - THROTTLE ACTUATOR CONTROL MOTOR RELAY
  - GENERATOR G TERMINAL
  - HEATED OXYGEN SENSOR HEATER
  - FAN CONTROL MODULE (RADIATOR, A/C CONDENSER)
  - A/C COMPRESSOR CLUTCH RELAY
  - MALFUNCTION INDICATOR LAMP (SERVICE ENGINE SOON OR CHECK ENGINE LAMP)
  - DIAGNOSTIC OUTPUT



AK300210AD

**NOTE:** For the vacuum hose routing, refer to GROUP 17, Vacuum Hoses [P.17-206](#).

# MULTIPOINT FUEL INJECTION (MFI) DIAGNOSIS

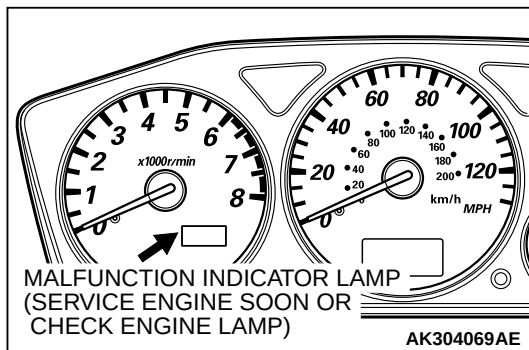
## TROUBLESHOOTING STRATEGY

M1131150000621

**NOTE:** If a DTC is erased, its "freeze frame" data will be also erased and the system readiness test status will be reset. Store the "freeze frame" data before erasing the DTC.

Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure to have exhausted most of the possible ways to find an MFI fault.

1. Gather as much information as possible about the complaint from the customer.
2. Verify that the condition described by the customer exists.
3. Check the vehicle for any MFI Diagnostic Trouble Code (DTC).
4. If you cannot verify the condition and there are no DTCs, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to cope with Intermittent Malfunction [P.00-6](#).
5. If you can verify the condition but there are no DTCs, or the system cannot communicate with the scan tool, refer to the trouble symptom classification table.
6. If there is a DTC, record the number of the code, then erase the code from the memory using the scan tool.
7. Reconfirm the malfunction symptom and carry out a test drive with the drive cycle pattern.
8. If DTC is set again, carry out an inspection with appropriate diagnostic trouble code procedures.
9. If DTC is not set again, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to cope with Intermittent Malfunction [P.00-6](#).
10. After repairs are completed, conduct a road test duplicating the complaint set conditions to confirm the malfunction has been corrected.



## DIAGNOSTIC FUNCTION

M1131155500289

### MALFUNCTION INDICATOR LAMP (SERVICE ENGINE SOON OR CHECK ENGINE LAMP)

Among the on-board diagnostic items, a Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates to notify the driver of an emission control malfunction. However, when an irregular signal returns to normal and the engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> judges that it has returned to normal, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is switched off.

Immediately after the ignition switch is turned on, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is lit for 20 seconds to indicate that the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) operates normally.

**Items Indicated by the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp)**

| <b>DTC</b> | <b>ITEM</b>                                                                            |
|------------|----------------------------------------------------------------------------------------|
| –          | Engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> malfunction |
| P0101*     | Mass airflow circuit range/performance problem                                         |
| P0102*     | Mass airflow circuit low input                                                         |
| P0103*     | Mass airflow circuit high input                                                        |
| P0106      | Manifold absolute pressure circuit range/performance problem                           |
| P0107      | Manifold absolute pressure circuit low input                                           |
| P0108      | Manifold absolute pressure circuit high input                                          |
| P0111*     | Intake air temperature circuit range/performance problem                               |
| P0112*     | Intake air temperature circuit low input                                               |
| P0113*     | Intake air temperature circuit high input                                              |
| P0116*     | Engine coolant temperature circuit range/performance problem                           |
| P0117*     | Engine coolant temperature circuit low input                                           |
| P0118*     | Engine coolant temperature circuit high input                                          |
| P0122*     | Throttle position sensor (main) circuit low input                                      |
| P0123*     | Throttle position sensor (main) circuit high input                                     |
| P0125*     | Insufficient coolant temperature for closed loop fuel control                          |
| P0128      | Coolant thermostat (Coolant temperature below thermostat regulating temperature)       |
| P0130      | Heated oxygen sensor circuit (sensor 1)                                                |
| P0131      | Heated oxygen sensor circuit low voltage (sensor 1)                                    |
| P0132      | Heated oxygen sensor circuit high voltage (sensor 1)                                   |
| P0133      | Heated oxygen sensor circuit slow response (sensor 1)                                  |
| P0134*     | Heated oxygen sensor circuit no activity detected (sensor 1)                           |
| P0135      | Heated oxygen sensor heater circuit (sensor 1)                                         |
| P0136      | Heated oxygen sensor circuit (sensor 2)                                                |
| P0137      | Heated oxygen sensor circuit low voltage (sensor 2)                                    |
| P0138      | Heated oxygen sensor circuit high voltage (sensor 2)                                   |
| P0139      | Heated oxygen sensor circuit slow response (sensor 2)                                  |
| P0141      | Heated oxygen sensor heater circuit (sensor 2)                                         |
| P0171      | System too lean                                                                        |
| P0172      | System too rich                                                                        |
| P0181      | Fuel tank temperature sensor circuit range/performance                                 |
| P0182      | Fuel tank temperature sensor circuit low input                                         |
| P0183      | Fuel tank temperature sensor circuit high input                                        |
| P0201      | Injector circuit-cylinder 1                                                            |
| P0202      | Injector circuit-cylinder 2                                                            |
| P0203      | Injector circuit-cylinder 3                                                            |
| P0204      | Injector circuit-cylinder 4                                                            |
| P0222*     | Throttle position sensor (sub) circuit low input                                       |

| <b>DTC</b> | <b>ITEM</b>                                                                   |
|------------|-------------------------------------------------------------------------------|
| P0223*     | Throttle position sensor (sub) circuit high input                             |
| P0300      | Random/multiple cylinder misfire detected                                     |
| P0301      | Cylinder 1 misfire detected                                                   |
| P0302      | Cylinder 2 misfire detected                                                   |
| P0303      | Cylinder 3 misfire detected                                                   |
| P0304      | Cylinder 4 misfire detected                                                   |
| P0335*     | Crankshaft position sensor circuit                                            |
| P0340*     | Camshaft position sensor circuit                                              |
| P0401      | Exhaust gas recirculation flow insufficient detected                          |
| P0403      | Exhaust gas recirculation control circuit                                     |
| P0420      | Catalyst efficiency below threshold                                           |
| P0441      | Evaporative emission control system incorrect purge flow                      |
| P0442      | Evaporative emission control system leak detected (Small leak)                |
| P0443      | Evaporative emission control system purge control valve circuit               |
| P0446      | Evaporative emission control system vent control circuit                      |
| P0451      | Evaporative emission control system pressure sensor range/performance         |
| P0452      | Evaporative emission control system pressure sensor low input                 |
| P0453      | Evaporative emission control system pressure sensor high input                |
| P0455      | Evaporative emission control system leak detected (Gross leak)                |
| P0456      | Evaporative emission control system leak detected (Very small leak)           |
| P0461      | Fuel level sensor circuit range/performance                                   |
| P0500      | Vehicle speed sensor malfunction <M/T>                                        |
| P0506      | Idle control system RPM lower than expected                                   |
| P0507      | Idle control system RPM higher than expected                                  |
| P0551      | Power steering pressure switch circuit range/performance                      |
| P0554      | Power steering pressure switch circuit intermittent                           |
| P0606*     | Engine control module or powertrain control module main processor malfunction |
| P0638*     | Throttle actuator control motor circuit range/performance problem             |
| P0642*     | Throttle position sensor power supply                                         |
| P0657*     | Throttle actuator control motor relay circuit malfunction                     |
| P0705      | Transmission range sensor circuit malfunction (RPNDL input)                   |
| P0712*     | Transmission fluid temperature sensor circuit low input                       |
| P0713*     | Transmission fluid temperature sensor circuit high input                      |
| P0715*     | Input/turbine speed sensor circuit                                            |
| P0720*     | Output speed sensor circuit                                                   |
| P0731*     | Gear 1 incorrect ratio                                                        |
| P0732*     | Gear 2 incorrect ratio                                                        |
| P0733*     | Gear 3 incorrect ratio                                                        |
| P0734*     | Gear 4 incorrect ratio                                                        |
| P0736*     | Gear R incorrect ratio                                                        |

| <b>DTC</b> | <b>ITEM</b>                                                                                       |
|------------|---------------------------------------------------------------------------------------------------|
| P0741      | Torque converter clutch circuit performance or stuck off                                          |
| P0742      | Torque converter clutch circuit stuck on                                                          |
| P0743*     | Torque converter clutch circuit electrical                                                        |
| P0753*     | Shift solenoid "A" electrical                                                                     |
| P0758*     | Shift solenoid "B" electrical                                                                     |
| P0763*     | Shift solenoid "C" electrical                                                                     |
| P0768*     | Shift solenoid "D" electrical                                                                     |
| P1020      | Mitsubishi innovative valve timing and lift electronic control system (MIVEC) performance problem |
| P1021      | Engine oil control valve circuit                                                                  |
| P1602      | Communication malfunction (between ECM <M/T> or PCM <A/T> main processor and system LSI)          |
| P1603*     | Battery backup line malfunction                                                                   |
| P1751*     | A/T control relay malfunction                                                                     |
| P2100*     | Throttle actuator control motor circuit (open)                                                    |
| P2101*     | Throttle actuator control motor magneto malfunction                                               |
| P2102*     | Throttle actuator control motor circuit (shorted low)                                             |
| P2103*     | Throttle actuator control motor circuit (shorted high)                                            |
| P2121*     | Accelerator pedal position sensor (main) circuit range/performance problem                        |
| P2122*     | Accelerator pedal position sensor (main) circuit low input                                        |
| P2123*     | Accelerator pedal position sensor (main) circuit high input                                       |
| P2126*     | Accelerator pedal position sensor (sub) circuit range/performance problem                         |
| P2127*     | Accelerator pedal position sensor (sub) circuit low input                                         |
| P2128*     | Accelerator pedal position sensor (sub) circuit high input                                        |
| P2135*     | Throttle position sensor (main and sub) range/performance problem                                 |
| P2138*     | Accelerator pedal position sensor (main and sub) range/performance problem                        |
| P2173*     | Abnormal intake air amount                                                                        |
| P2227*     | Barometric pressure circuit range/performance problem                                             |
| P2228*     | Barometric pressure circuit low input                                                             |
| P2229*     | Barometric pressure circuit high input                                                            |

*NOTE: If the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates because of a malfunction of the engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T>, transmission between scan tool and the ECM <M/T> or PCM <A/T> is impossible. In this case, the diagnostic trouble code (DTC) cannot be read.*

*NOTE: After the ECM <M/T> or PCM <A/T> has detected a malfunction, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "\*" in the DTC NO column, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates on the first detection of the malfunction.*

*NOTE: After the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates, it will be switched off under the following conditions.*

- When the ECM <M/T> or PCM <A/T> monitored the powertrain malfunction three times\* it met set condition requirements, it detected no malfunction. \*: In this case, "one time" indicates from engine start to next engine start.
- For misfiring or a fuel trim malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.

**NOTE:** Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

## HOW TO CONNECT THE SCAN TOOL (MUT-III)

### Required Special Tools:

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

### **⚠ CAUTION**

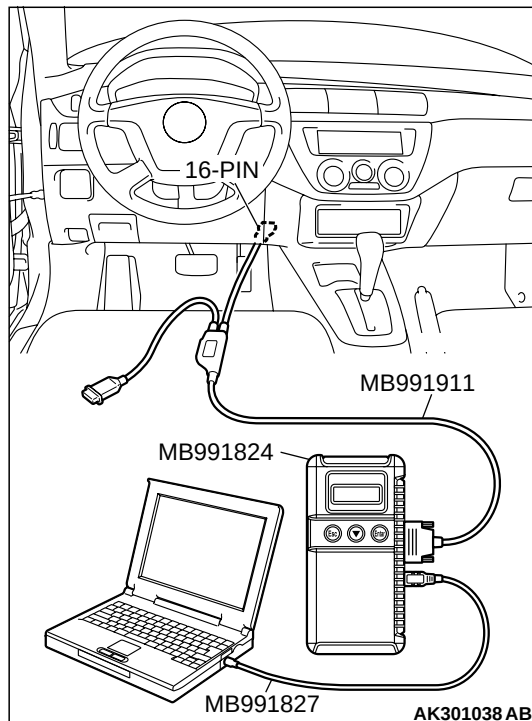
**To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.**

1. Ensure that the ignition switch is at the "LOCK" (OFF) position.
2. Start up the personal computer.
3. Connect special tool MB991827 to special tool MB991824 and the personal computer.
4. Connect special tool MB991911 to special tool MB991824.
5. Connect special tool MB991911 to the data link connector.
6. Turn the power switch of special tool MB991824 to the "ON" position.

**NOTE:** When the special tool MB991824 is energized, special tool MB991824 indicator light will be illuminated in a green color.

7. Start the MUT-III system on the personal computer.

**NOTE:** Disconnecting the scan tool MB991958 is the reverse of the connecting sequence, making sure that the ignition switch is at the "LOCK" (OFF) position.



## HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODES.

### Required Special Tools:

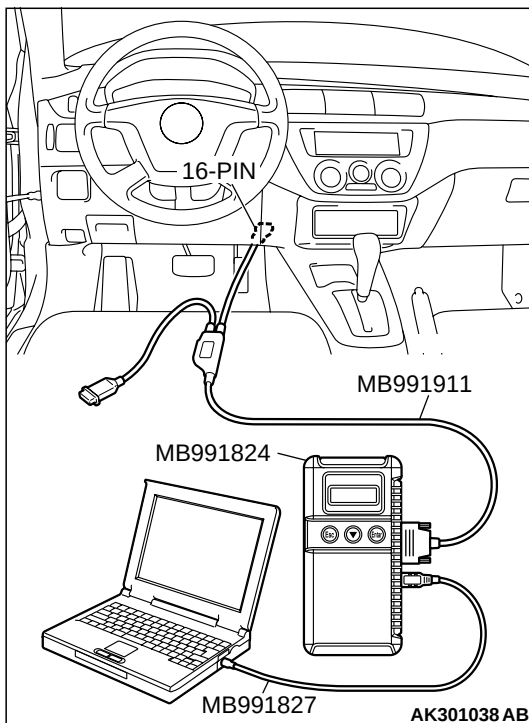
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B

### 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.

*NOTE: If the battery voltage is low, diagnostic trouble codes will not be set. Check the battery if scan tool MB991958 does not display.*

1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "MFI" from the "POWER TRAIN" tab.
6. Select "MITSUBISHI."
7. Select "Diagnostic Trouble Code".
8. If a DTC is set, it is shown.
9. Choose "Erase DTCs" to erase the DTC.



## HOW TO READ DATA LIST

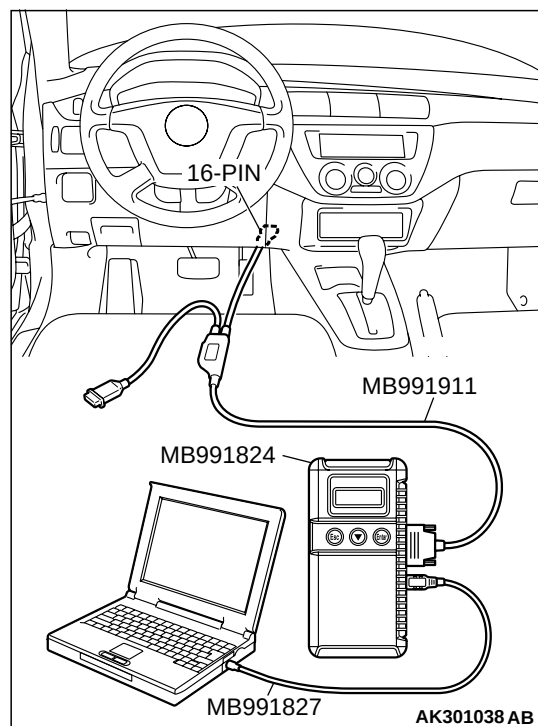
### Required Special Tools:

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

**⚠ 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. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "MFI" from the "POWER TRAIN" tab.
6. Select "MITSUBISHI."
7. Select "Data List."
8. Choose an appropriate item and select the "OK" button.

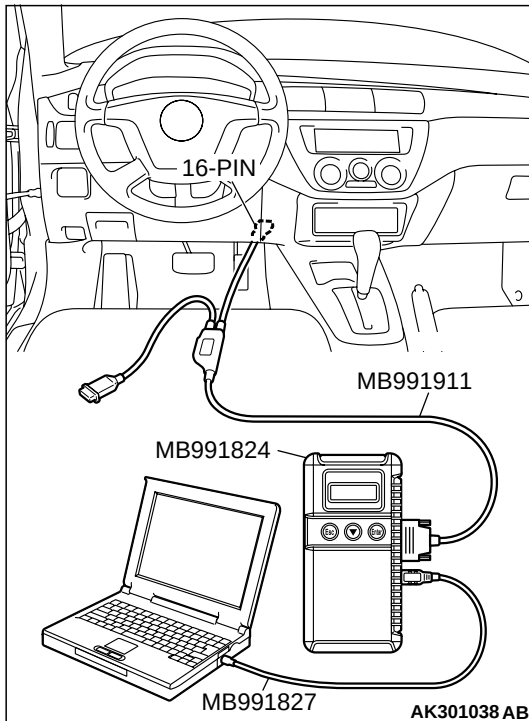
**HOW TO PERFORM ACTUATOR TEST****Required Special Tools:**

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

**⚠ 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. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "MFI" from the "POWER TRAIN" tab.
6. Select "MITSUBISHI."
7. Select "Actuator Test."
8. Choose an appropriate item and select the "OK" button.



**PROVISIONAL DTCs [MUT-III OBD-II Test Mode - Results (Mode 7)]**

The scan tool MB991958 (MUT-III sub assembly) will display the Provisional DTCs reported by ECM <M/T> or PCM <A/T> if the ECM <M/T> or PCM <A/T> detects some malfunction for "Misfire", "Fuel System" and "Comprehensive" monitoring during a single driving cycle. The intended use of this data is to assist the technician after a vehicle repair, and after clearing diagnostic information, by reporting test result after a single driving cycle. Note that the test results reported by this mode do not necessarily indicate a faulty component/system. If test results indicate a failure after additional (consecutive) driving, then the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) will be illuminated and a DTC will be set.

**MODE 6 REFERENCE TABLE**

The engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> monitors the condition of emission control system.

By selecting MODE 6 using scan tool, Test Result and Limit Value (minimum) \*1 or (maximum) \*2 about the main items of emission control system which ECM <M/T> or PCM <A/T> monitors can be confirmed. The value at the last monitoring is output by ECM <M/T> or PCM <A/T> as a test result.

| TEST ID | MONITORING ITEM                       | SIMPLE TECHNICAL DESCRIPTION                                                                                                                                                                                                                                                          | INDICATION OF SCAN TOOL                                                       | CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL |
|---------|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------|
| 01      | Catalyst monitor                      | ECM <M/T> or PCM <A/T> monitors the deterioration of catalyst by the output frequency ratio between heated oxygen sensor (front) and heated oxygen sensor (rear).                                                                                                                     | Catalyst Frequency Ratio<br>Test Result and Limit Value (max.)                | × 0.0039                                          |
| 03      | EGR monitor                           | ECM <M/T> or PCM <A/T> monitors the operation of EGR system by the pressure difference of intake manifold between before and after introduction of EGR using the manifold absolute pressure sensor.                                                                                   | EGR Monitor Pressure Value<br>Test Result and Limit Value (min.) kPa          | × 0.43 kPa                                        |
| 06      | Evaporation leak monitor (Small leak) | After ECM <M/T> or PCM <A/T> vacuumizes the fuel tank and the fuel line and then the specified time is passed, ECM <M/T> or PCM <A/T> monitors the leak of fuel evaporation gas through the fuel tank differential pressure sensor to check the reduction of vacuum in the fuel tank. | EVAP Leak Mon. 1 mm Pressure Value<br>Test Result and Limit Value (max.) kPa  | × 0.032 kPa                                       |
| 07      | Evaporation leak monitor (Gross leak) | ECM <M/T> or PCM <A/T> monitors the leak of fuel evaporation gas by checking whether the pressure can be reduced (the amount of pressure reduction) using the fuel tank differential pressure sensor after sealing the fuel tank and the fuel line.                                   | EVAP Leak Mon. Gross Pressure Value<br>Test Result and Limit Value (min.) kPa | × 0.032 kPa                                       |

| TEST ID | MONITORING ITEM                                    | SIMPLE TECHNICAL DESCRIPTION                                                                                                                                                                                                                                                          | INDICATION OF SCAN TOOL                                                          | CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL |
|---------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------|
| 08      | Evaporation leak monitor (Very small leak)         | After ECM <M/T> or PCM <A/T> vacuumizes the fuel tank and the fuel line and then the specified time is passed, ECM <M/T> or PCM <A/T> monitors the leak of fuel evaporation gas through the fuel tank differential pressure sensor to check the reduction of vacuum in the fuel tank. | EVAP Leak Mon. 0.5 mm Pressure Value<br>Test Result and Limit Value (max.) kPa   | × 0.032 kPa                                       |
| 09      | Heated oxygen sensor monitor (Rich/Lean Switching) | ECM <M/T> or PCM <A/T> monitors the deteriorated condition of the heated oxygen sensor (front) by checking the lean/rich switching frequency of the heated oxygen sensor (front).                                                                                                     | HO2S B1 SENSOR 1 Rich/Lean Switching Count<br>Test Result and Limit Value (min.) | ×1 time                                           |
| 0B      | Heated oxygen sensor monitor (Voltage)             | ECM <M/T> or PCM <A/T> checks the output voltage of the heated oxygen sensor (rear) in order to monitor whether the heated oxygen sensor (rear) output is stuck.                                                                                                                      | HO2S B1 SENSOR2 Change in Volt<br>Test Result and Limit Value (min.)             | × 19.5mV                                          |

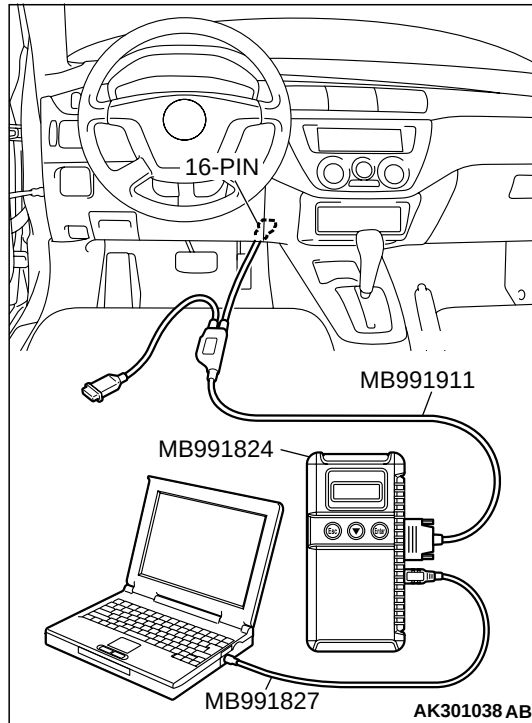
**NOTE: \*1 : Minimum value: The test fails if test value is less than this value.**

**NOTE: \*2 : Maximum value: The test fails if test value is greater than this value.**

### **DIAGNOSTIC BY DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY)**

**Required Special Tools:**

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

**⚠ 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.

*NOTE: When mode II is selected with MB991958, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) will light when the engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> first detects the trouble (Note that this is only for emission-related trouble). At the same time, the relevant diagnostic trouble codes will be registered. In respect to the comprehensive component electrical faults (opens/shorts), the time for the diagnostic trouble code to be registered after the fault occurrence is four seconds → one second. Therefore, the confirmation of the trouble symptom and the confirmation after completing repairs can be reduced. To return to the normal mode I after mode II has been selected once, the ignition switch must be turned "OFF" once or mode I must be reselected with MB991958. The diagnostic trouble code, system system readiness test status and freeze frame data, etc., will be erased when mode I is returned to, so record these before returning to mode I.*

1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Change the diagnostic test mode of the powertrain control module to DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY).
4. Road test the vehicle.
5. Read the diagnostic trouble code and repair the malfunctioning part.
6. Turn the ignition switch to the "LOCK" (OFF) position.
7. Disconnect scan tool MB991958 from the data link connector.

## ON-BOARD DIAGNOSTICS

The engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> monitors the input/output signals (some signals all the time and others under specified conditions) of the ECM <M/T> or PCM <A/T>. When a malfunction continues for a specified time or longer after the irregular signal is initially monitored, the ECM <M/T> or PCM <A/T> judges that a malfunction has occurred. After the ECM <M/T> or PCM <A/T> first detects a malfunction, a diagnostic trouble code is recorded when the engine is restarted and the same malfunction is re-detected. However, for items marked with a "\*", a diagnostic trouble code is recorded on the first detection of the malfunction. There are 108 diagnostic items. The diagnostic results can be read out with a scan tool. Since memorization of the diagnostic trouble codes is backed up directly by the battery, the diagnostic results are memorized even if the ignition key is turned off. The diagnostic trouble codes will, however, be erased when the battery terminal or the ECM <M/T> or PCM <A/T> connector is disconnected. In addition, the diagnostic trouble code can also be erased by turning the ignition switch to the "ON" position and sending the diagnostic trouble code erase signal from scan tool MB991958 to the ECM <M/T> or PCM <A/T>.

*NOTE: If the sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code is memorized. In this case, send the diagnostic trouble code erase signal to the ECM <M/T> or PCM <A/T> in order to erase the diagnostic memory. The 108 diagnostic items are all indicated sequentially from the smallest code number. The ECM <M/T> or PCM <A/T> records the engine operating condition when the diagnostic trouble code is set. This data is called "Freeze-frame" data. This data can be read by using the scan tool, and can then be used in simulation tests for troubleshooting. Data items are as follows:*

*NOTE: If the ECM <M/T> or PCM <A/T> detects multiple malfunctions, the ECM <M/T> or PCM <A/T> stores the "Freeze - frame" data for only the first item that was detected. However, if the ECM <M/T> or PCM <A/T> detects a misfire or a fuel system malfunction, the ECM <M/T> or PCM <A/T> stores the data by giving priority to the misfire or fuel system malfunction, regardless of the order in which the malfunction was detected.*

*NOTE: As for diagnostic trouble code P1603, "freeze frame" data is not memorized.*

| SCAN TOOL DISPLAY | ITEM NO. | DATA ITEM                                    | UNIT or STATE                                                                                                                                                                                             |
|-------------------|----------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ECT SENSOR        | 21       | Engine coolant temperature sensor            | °C or °F                                                                                                                                                                                                  |
| ENGINE LOAD       | 87       | Calculated load value                        | %                                                                                                                                                                                                         |
| ENGINE SPEED      | 22       | Crankshaft position sensor                   | r/min                                                                                                                                                                                                     |
| IAT SENSOR        | 13       | Intake air temperature sensor                | °C or °F                                                                                                                                                                                                  |
| IG. TIMING ADV    | 44       | Ignition coils and ignition power transistor | deg                                                                                                                                                                                                       |
| LONG TRIM B1      | 81       | Long-term fuel trim                          | %                                                                                                                                                                                                         |
| MAP/MDP SNSR.     | 32       | Manifold absolute pressure sensor            | kPa or in.Hg                                                                                                                                                                                              |
| SHORT TRIM B1     | 82       | Short-term fuel trim                         | %                                                                                                                                                                                                         |
| SYS. STATUS B1    | 88       | Fuel system status                           | <ul style="list-style-type: none"> <li>• Open loop</li> <li>• Closed loop</li> <li>• Open loop-drive condition</li> <li>• Open loop-DTC set</li> <li>• Closed loop-O<sub>2</sub> (rear) failed</li> </ul> |
| TP SENSOR         | 8A       | Throttle position sensor (main)              | %                                                                                                                                                                                                         |
| VAF/MAF SNSR.     | 12       | Mass airflow sensor                          | gm/s                                                                                                                                                                                                      |
| VSS               | 24       | Vehicle speed signal                         | km/h or mph                                                                                                                                                                                               |

**OBD- II DRIVE CYCLE**

All kinds of diagnostic trouble codes (DTCs) can be monitored by carrying out a short drive according to the following six drive cycle pattern. In other words, doing such a drive regenerates any kind of trouble which involves illuminating the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) and verifies the repair procedure has eliminated the trouble (the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is no longer illuminated).

**⚠ CAUTION**

**Two technicians should always be in the vehicle when carrying out a test drive.**

*NOTE: Check that the diagnosis trouble code (DTC) is not output before driving the OBD-II drive cycle. Erase the DTC if it has been output.*

**DRIVE CYCLE PATTERN LIST**

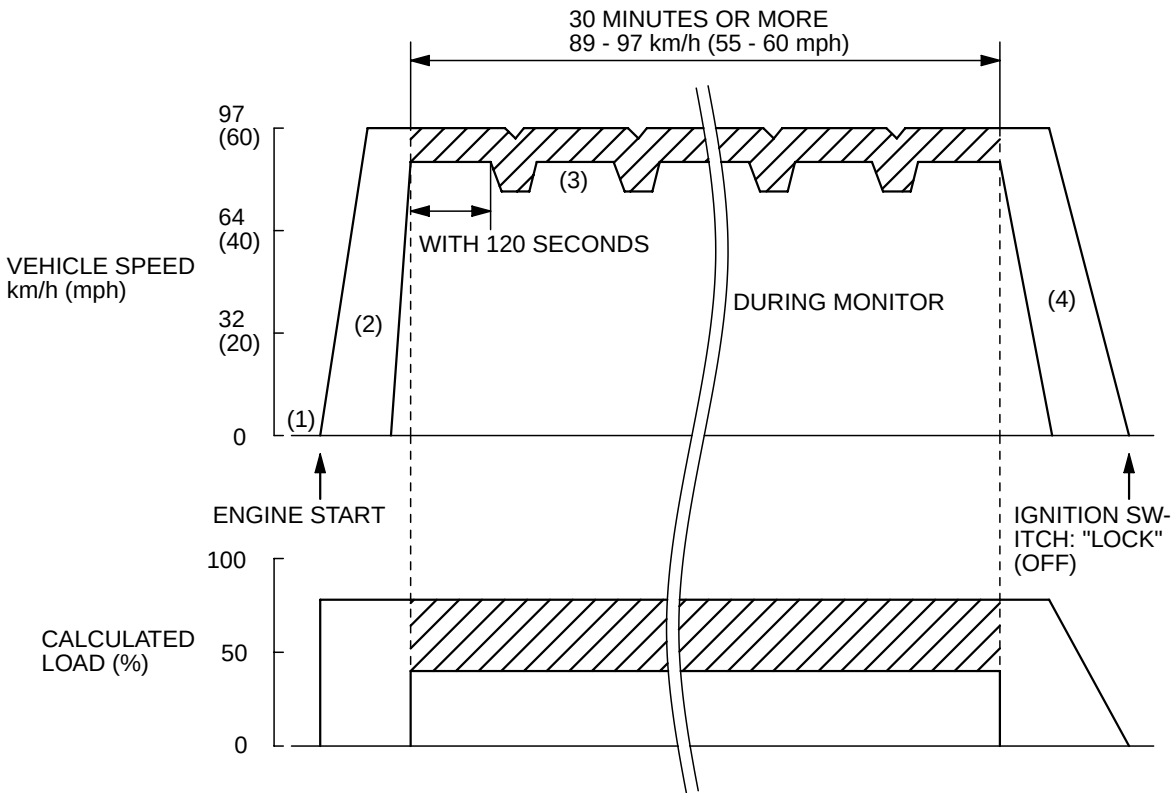
| PROCEDURE | MONITOR ITEM                                   |                                 | DIAGNOSTIC TROUBLE CODE (DTC)                                                                                                       |
|-----------|------------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1         | Evaporative emission system leak monitor       |                                 | P0441, P0442, P0451, P0452, P0453, P0455, P0456                                                                                     |
| 2         | Fuel trim monitor                              |                                 | P0171, P0172                                                                                                                        |
| 3         | Catalytic converter monitor                    |                                 | P0420                                                                                                                               |
| 4         | Heated oxygen sensor monitor                   |                                 | P0133, P0139                                                                                                                        |
| 5         | Exhaust gas recirculation (EGR) system monitor |                                 | P0401                                                                                                                               |
| 6         | Other monitor                                  | Main components                 | P0106, P0107, P0108, P0134, P0300, P0301, P0302, P0303, P0304, P0506, P0507                                                         |
|           |                                                | Sensors and switches            | P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0181, P0182, P0183, P0335, P0340, P0461, P2227, P2228, P2229 |
|           |                                                | Wire breakage and short circuit | P0130, P0131, P0132, P0135, P0136, P0137, P0138, P0141, P0201, P0202, P0203, P0204, P0403, P0443, P0446                             |

**PROCEDURE 1**

| <b>EVAPORATIVE EMISSION SYSTEM LEAK MONITOR</b> |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DTC                                             | P0441, P0442, P0451, P0452, P0453, P0455, P0456                                                                                                                                                                                                                                                                                                                                                                     |
| Drive cycle pattern                             | <p>This monitor [from start to ignition switch to the "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 8 minutes. You must complete this drive twice.</p> <p><i>NOTE: Vehicle speed and throttle opening angle should be within the shaded range.</i></p> <div data-bbox="336 617 1424 1337"> </div> <p align="right"><b>AKX01345 AB</b></p> |
| Inspection conditions                           | <ul style="list-style-type: none"> <li>• Engine coolant temperature: 45°C (113°F) or less (The engine is stopped before the test drive is started)</li> <li>• Atmospheric temperature: 5 – 45°C (41 – 113°F)</li> <li>• Condition of A/T: Selector lever D range</li> </ul>                                                                                                                                         |

| EVAPORATIVE EMISSION SYSTEM LEAK MONITOR |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test procedure                           | <ol style="list-style-type: none"> <li>1. Engine: start</li> <li>2. Accelerate until the vehicle speed is 89 – 97 km/h (55 – 60 mph).</li> <li>3. Travel for 200 seconds or more while keeping the vehicle speed at 89 – 97 km/h (55 – 60 mph).</li> <li>4. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 89 – 97 km/h (55 – 60 mph) and travel for 150 seconds or more. (During monitor)</li> <li>5. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position.</li> <li>6. Confirm that the diagnostic trouble code (DTC) is not output.</li> <li>7. If DTC P0441 is output, refer to DTC P0441 – Evaporative Emission Control System Incorrect Purge Flow <a href="#">P.13B-377</a>.<br/>           If DTC P0442 is output, refer to DTC P0442 – Evaporative Emission Control System Leak Detected (Small Leak) <a href="#">P.13B-381</a>.<br/>           If DTC P0451 is output, refer to DTC P0451 – Evaporative Emission Control System Pressure Sensor Range/performance <a href="#">P.13B-414</a>.<br/>           If DTC P0452 is output, refer to DTC P0452 – Evaporative Emission Control System Pressure Sensor Low Input <a href="#">P.13B-444</a>.<br/>           If DTC P0453 is output, refer to DTC P0453 – Evaporative Emission Control System Pressure Sensor High Input <a href="#">P.13B-473</a>.<br/>           If DTC P0455 is output, refer to DTC P0455 – Evaporative Emission Control System Leak Detected (Gross Leak) <a href="#">P.13B-502</a>.<br/>           If DTC P0456 is output, refer to DTC P0456 – Evaporative Emission Control System Leak Detected (Very Small Leak) <a href="#">P.13B-520</a>.</li> </ol> |

**PROCEDURE 2**

| <b>FUEL TRIM MONITOR</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DTC                      | P0171, P0172                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Drive cycle pattern      | <p>This monitor [from start to ignition switch to the "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 35 minutes. You must complete this drive twice.</p> <p><i>NOTE: Vehicle speed and throttle opening angle should be within the shaded range.</i></p>  <p align="right">AKX01346 AB</p>                                                                                                                                                                                                                                                                                                       |
| Inspection conditions    | <ul style="list-style-type: none"> <li>• Engine coolant temperature: 80 – 97°C (176 – 207°F)</li> <li>• Atmospheric temperature: –10 to 60°C (14 – 140°F)</li> <li>• Condition of A/T: Selector lever D range</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Test procedure           | <ol style="list-style-type: none"> <li>1. Engine: start</li> <li>2. Accelerate until the vehicle speed is 89 – 97 km/h (55 – 60 mph).</li> <li>3. Travel for 30 minutes or more while keeping the vehicle speed at 89 – 97 km/h (55 – 60 mph). Carry out one gradual deceleration/acceleration returning to 89 – 97 km/h (55 – 60 mph) within 120 seconds. (During monitor)</li> <li>4. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position.</li> <li>5. Confirm that the diagnostic trouble code (DTC) is not output.<br/>If DTC P0171 is output, refer to DTC P0171 – System too lean <a href="#">P.13B-255</a>.<br/>If DTC P0172 is output, refer to DTC P0172 – System too rich <a href="#">P.13B-264</a>.</li> </ol> |

## PROCEDURE 3

## CATALYTIC CONVERTER MONITOR

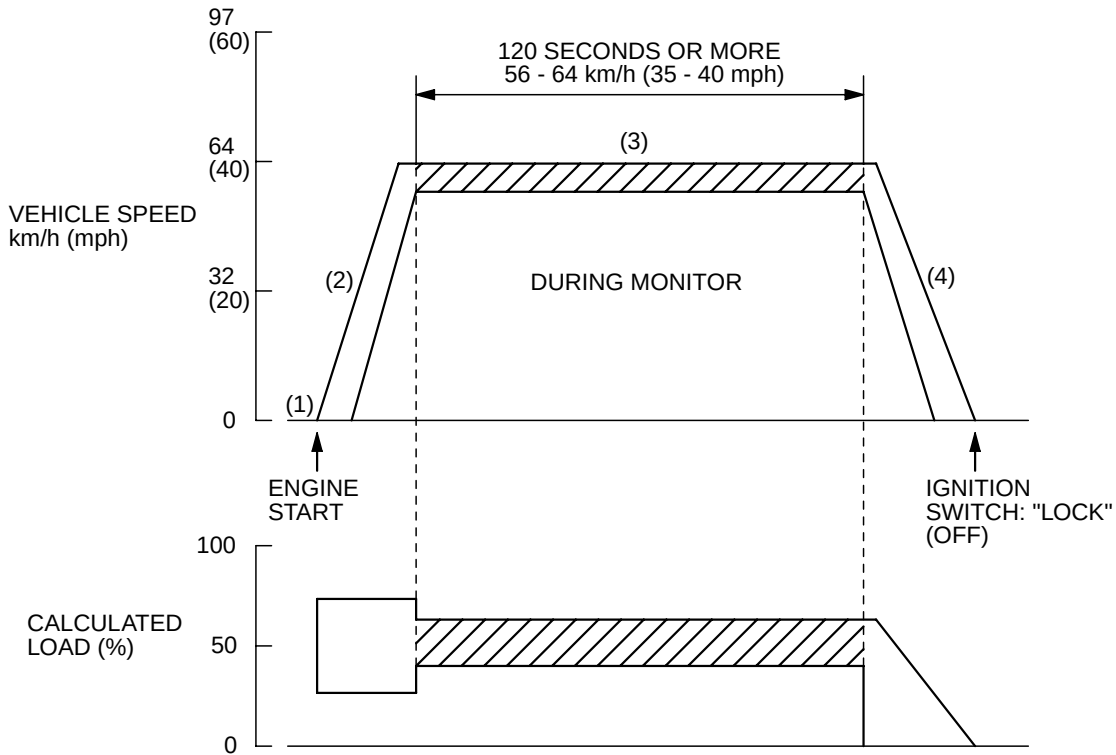
|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DTC                   | P0420                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Drive cycle pattern   | <p>This monitor [from start to ignition switch to the "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 20 minutes. You must complete this drive twice.</p> <p><i>NOTE: Vehicle speed and throttle opening angle should be within the shaded range.</i></p> <p>VEHICLE SPEED<br/>km/h (mph)</p> <p>97 (60)<br/>64 (40)<br/>32 (20)<br/>0</p> <p>300 SECONDS OR MORE<br/>72 - 97 km/h (45 - 60 mph)</p> <p>90 SECONDS OR MORE<br/>56 - 64 km/h (35 - 40 mph)</p> <p>(1) (2) (3) (4) (5) (6) (7)</p> <p>ENGINE START</p> <p>PREPARATION PERIOD</p> <p>1 ST MON-ITOR</p> <p>2 ND MON-ITOR</p> <p>6 TH MON-ITOR</p> <p>IGNITION SWITCH: "LOCK" (OFF)</p> <p>CALCULATED LOAD (%)</p> <p>100<br/>50<br/>0</p> <p>FULL DECEL-ERATION</p> <p>FULL DECEL-ERATION</p> <p>FULL DECEL-ERATION</p> <p>AKX01347 AB</p> |
| Inspection conditions | <ul style="list-style-type: none"> <li>Atmospheric temperature: <math>-10^{\circ}\text{C}</math> (<math>14^{\circ}\text{F}</math>) or more</li> <li>A/C switch: OFF</li> <li>Condition of A/T: Selector lever D range</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**CATALYTIC CONVERTER MONITOR**

Test  
procedure

1. Engine: start
2. Accelerate until the vehicle speed is 72 km/h (45 mph).
3. Travel for 300 seconds or more while keeping the vehicle speed at 72 – 97 km/h (45 – 60 mph).
4. Decelerate until the vehicle speed is within 56 – 64 km/h (35 – 40 mph).
5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 56 – 64 km/h (35 – 40 mph) and travel for 90 seconds or more. (During monitor)
6. Fully close the throttle and decelerate, and keep the deceleration state for 10 seconds. Then, quickly accelerate until the vehicle speed reaches 56 – 64 km/h (35 – 40 mph). Then, repeat steps 5 and 6, and complete six monitor sessions.
7. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position.
8. Confirm that the diagnostic trouble code (DTC) is not output.
9. If DTC P0420 is output, refer to DTC P0420 – Catalyst Efficiency Below Threshold  
[P.13B-372](#).

## PROCEDURE 4

| HEATED OXYGEN SENSOR MONITOR |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DTC                          | P0133, P0139                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Drive cycle pattern          | <p>This monitor [from start to ignition switch to the "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 5 minutes. You must complete this drive twice.</p> <p><i>NOTE: Vehicle speed and throttle opening angle should be within the shaded range.</i></p>  <p style="text-align: right;">AKX01348 AB</p>                                                                                                                                                                                                                                                                                                                            |
| Inspection conditions        | <ul style="list-style-type: none"> <li>• Engine coolant temperature: 80°C (176°F) or more</li> <li>• Atmospheric temperature: -10°C (14°F) or more</li> <li>• Condition of A/T: Selector lever D range</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Test procedure               | <ol style="list-style-type: none"> <li>1. Engine: start</li> <li>2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph).</li> <li>3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 56 – 64 km/h (35 – 40 mph) and travel for 120 seconds or more. (During monitor)</li> <li>4. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position.</li> <li>5. Confirm that the diagnostic trouble code (DTC) is not output.</li> <li>6. If DTC P0133 is output, refer to DTC P0133 – Heated oxygen Sensor Circuit Slow Response (Sensor 1) <a href="#">P.13B-192</a>.<br/>If DTC P0139 is output, refer to DTC P0139 – Heated oxygen Sensor Circuit Slow Response (Sensor 2) <a href="#">P.13B-240</a>.</li> </ol> |

**PROCEDURE 5**

| <b>EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITOR</b> |                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DTC                                                   | P0401                                                                                                                                                                                                                                                                                                                                                                     |
| Drive cycle pattern                                   | <p>This monitor [from start to ignition switch to the "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 10 minutes. You must complete this drive twice.</p> <p><i>NOTE: Vehicle speed and throttle opening angle should be within the shaded range.</i></p> <p align="right"><b>AKX01349 AB</b></p> |
| Inspection conditions                                 | <ul style="list-style-type: none"> <li>• Engine coolant temperature: 80°C (176°F) or more</li> <li>• Atmospheric temperature: 5°C (41°F) or more</li> <li>• A/C switch: OFF</li> <li>• Condition of A/T: Selector lever D range</li> </ul>                                                                                                                                |

**EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITOR****Test  
procedure**

1. Engine: start
2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph).
3. Travel for 20 seconds or more while keeping the vehicle speed at 56 – 64 km/h (35 – 40 mph).
4. Fully close the throttle from an engine speed of 2,000 – 3,000 r/min, and while keeping the clutch engaged, decelerate to approximately 900 r/min without applying the brakes. Do not steer the handle or turn the light ON/OFF during this time. (During monitor)
5. Accelerate until the vehicle speed reaches 56 – 64 km/h (35 – 40 mph), and travel for 20 seconds or more. Then, repeat steps 4 and 5 and complete 8 monitor sessions.
6. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position.
7. Confirm that the diagnostic trouble code (DTC) is not output.
8. If DTC P0401 is output, refer to DTC P0401 – Exhaust Gas Recirculation Flow Insufficient detected [P.13B-359](#).

**PROCEDURE 6**

| <b>OTHER MONITOR (Main components, sensors and switches, wire breakage and short circuit)</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DTC                                                                                           | <ul style="list-style-type: none"> <li>• Main components: P0106, P0107, P0108, P0134, P0300, P0301, P0302, P0303, P0304, P0506, P0507</li> <li>• Sensors and switches: P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0181, P0182, P0183, P0335, P0340, P0461, P2227, P2228, P2229</li> <li>• Wire breakage and short circuit: P0130, P0131, P0132, P0135, P0136, P0137, P0138, P0141, P0201, P0202, P0203, P0204, P0403, P0443, P0446</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Drive cycle pattern                                                                           | <p>This monitor [from start to ignition switch to the "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 10 minutes. You must complete this drive twice.</p> <p><i>NOTE: Drive according to the graph below.</i></p> <div data-bbox="324 756 1494 1470"> <p>The graph consists of two vertically aligned plots sharing a common time axis.</p> <p><b>Top Plot: VEHICLE SPEED</b><br/> Y-axis: 0, 32 (20), 64 (40) km/h (mph).<br/> - (1) starts at 0 speed at 'ENGINE START'.<br/> - (2) ramps up to 32 km/h (20 mph).<br/> - (3) maintains 32 km/h (20 mph) for '300 SECONDS OR MORE' at '56 - 64 km/h (35 - 40 mph)'.<br/> - (4) ramps down to 0 speed.<br/> - After (4), speed remains at 0 for 'ENGINE: IDLING TRANSMISSION: NEUTRAL 300 SECONDS'.<br/> - The cycle ends at 'IGNITION SWITCH: "LOCK" (OFF)'.</p> <p><b>Bottom Plot: CALCULATED LOAD (%)</b><br/> Y-axis: 0, 50, 100.<br/> - Load is 0% during (1).<br/> - Load jumps to 100% at the start of (2).<br/> - Load drops to 50% at the start of (3).<br/> - Load returns to 0% at the end of (4).</p> </div> |
| Inspection conditions                                                                         | <ul style="list-style-type: none"> <li>• Engine coolant temperature: 80°C (176°F) or more</li> <li>• Atmospheric temperature: 5°C (41°F) or more</li> <li>• Condition of A/T: Selector lever D range</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

AKX01350 AB

**OTHER MONITOR (Main components, sensors and switches, wire breakage and short circuit)**

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test procedure | <ol style="list-style-type: none"> <li>1. Engine: start</li> <li>2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph), and travel for 300 seconds or more.</li> <li>3. Return the vehicle to the shop.</li> <li>4. After stopping the vehicle, continue idling for 300 seconds, and then turn the ignition switch to the "LOCK" (OFF) position. Moreover, the vehicle should be set to the following conditions for idling.<br/><i>NOTE: Vehicles for Canada, the headlight, taillight, etc. remain lit even when the lighting switch is in "OFF" position but this is no problem for checks.</i> <ul style="list-style-type: none"> <li>• A/C switch: OFF</li> <li>• Lights and all accessories: OFF</li> <li>• Transaxle: Neutral</li> <li>• Steering wheel: Straightforward position</li> </ul> </li> <li>5. Confirm that the diagnostic trouble code (DTC) is not output.</li> <li>6. If a DTC is displayed, refer to Diagnostic Trouble Code Chart <a href="#">P.13B-31</a>.</li> </ol> |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**SYSTEM READINESS TEST STATUS****PURPOSE**

The Readiness function (also referred as I/M Readiness or I/M Flags) indicates if a full diagnostic check has been "Completed" (is "Ready") for each non-continuous monitor. Enhanced I/M State Emission Programs will use the Readiness status (Codes) to see if the vehicle is ready for OBD-II testing. "Incomplete" (Not Ready) codes will be one of the triggers for I/M failure.

**OVERVIEW**

The engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> monitors the following main diagnosis items and records whether the evaluation was completed or is incomplete. The Readiness codes were established for the I/M programs, thereby confirming that the vehicle was not tampered with by erasing the diagnostic trouble code(s) (DTC's) before I/M testing. The Readiness and DTC codes can be reset by disconnecting the battery or by erasing the codes with a scan tool. For this reason all Readiness codes must read "Complete" before I/M testing.

When the monitors run and complete, the scan tool MB991958 will record the Readiness Code as "Complete" (General Scan Tools record as "Ready"). If the monitor did not run completely, the system then reads as "Incomplete" (General Scan Tools record as "Not Ready"). When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, Readiness Code will set as "Complete" on the first drive cycle. If during the first drive cycle a fault is detected then, a second drive is required before the Readiness Code will "Complete". If the fault is still there, then a DTC will set.

- Catalyst: P0420
- Evaporative system: P0441, P0442, P0455, P0456
- Heated oxygen sensor: P0130, P0131, P0132, P0133, P0134, P0136, P0137, P0138, P0139
- Heated oxygen sensor heater: P0135, P0141
- EGR system: P0401

After the Readiness is "Complete", the technician is assured that any DTC's associated with that monitor will be displayed if the system has a problem. That is why some State's I/M programs require the Readiness Code as "Complete" before they check for DTC's.

*NOTE: After a repair is made for a DTC the technician should drive the OBD-II drive cycle checking that the scan tool MB991958 records all Readiness as "Complete".*

## FAIL-SAFE FUNCTION REFERENCE TABLE

M1131153000396

When the main sensor malfunctions are detected by the diagnostic test mode, the vehicle is controlled by means of the following defaults.

| <b>MALFUNCTION ITEM</b>                  | <b>CONTROL CONTENTS DURING MALFUNCTION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mass airflow sensor                      | <ul style="list-style-type: none"> <li>• Uses the throttle position sensor signal and engine speed signal (crankshaft position sensor signal) for basic injector drive time and basic ignition timing from the pre-set mapping.</li> </ul>                                                                                                                                                                                                                                                                                                                                        |
| Intake air temperature sensor            | Controls as if the intake air temperature is 25°C (77°F).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Engine coolant temperature sensor        | Controls as if the engine coolant temperature is 80°C (176°F). (This control will be continued until the ignition switch is turned to the "LOCK" (OFF) position even though the sensor signal returns to normal.)                                                                                                                                                                                                                                                                                                                                                                 |
| Camshaft position sensor                 | Injects fuel into the cylinders in the order 1-3-4-2 with irregular timing. (After the ignition switch is turned to the "ON" position, the No. 1 cylinder top dead center is not detected at all.)                                                                                                                                                                                                                                                                                                                                                                                |
| Barometric pressure sensor               | Controls as if the barometric pressure is 101 kPa (30 in.Hg).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Knock sensor                             | Switches the ignition timing from ignition timing for high octane to ignition timing for standard octane fuel.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Heated oxygen sensor <front>             | Air/fuel ratio closed loop control is not performed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Heated oxygen sensor <rear>              | Performs the closed loop control of the air/fuel ratio by using only the signal of the heated oxygen sensor (front) installed on the front side of the catalytic converter.                                                                                                                                                                                                                                                                                                                                                                                                       |
| Generator FR terminal                    | No generator output suppression control is performed for the electrical load (to be operated as an ordinary generator).                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Misfire detection                        | The ECM <M/T> or PCM <A/T> stops supplying fuel to the cylinder with the highest misfiring rate if a misfiring that could damage the catalytic converter is detected.                                                                                                                                                                                                                                                                                                                                                                                                             |
| Accelerator pedal position sensor (main) | <ul style="list-style-type: none"> <li>• Detects the amount of the accelerator pedal travel through the use of the accelerator pedal position sensor (sub) signal, but rendering it only as being approximately one-half the normal opening angle.</li> <li>• Prohibits the operation of the auto-cruise control.</li> <li>• Cuts off fuel when the engine speed exceeds 3,000 r/min.</li> <li>• Suppresses the engine output by stopping the electronically controlled throttle valve system if the accelerator pedal position sensor (sub) is also malfunctioning.</li> </ul>   |
| Accelerator pedal position sensor (sub)  | <ul style="list-style-type: none"> <li>• Detects the amount of the accelerator pedal travel through the use of the accelerator pedal position sensor (main) signal, but rendering it only as being approximately one-half the normal opening angle.</li> <li>• Prohibits the operation of the auto-cruise control.</li> <li>• Cuts off fuel when the engine speed exceeds 3,000 r/min.</li> <li>• Suppresses the engine output by stopping the electronically controlled throttle valve system if the accelerator pedal position sensor (main) is also malfunctioning.</li> </ul> |

| <b>MALFUNCTION ITEM</b>                                                                                                        | <b>CONTROL CONTENTS DURING MALFUNCTION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Throttle position sensor (main)                                                                                                | <ul style="list-style-type: none"> <li>Controls the throttle valve position through the use of the throttle position sensor (sub) signal.</li> <li>Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle.</li> <li>Prohibits the operation of the engine speed feedback control.</li> <li>Prohibits the operation of the auto-cruise control.</li> <li>Cuts off fuel when the engine speed exceeds 3,000 r/min.</li> <li>Suppresses the engine output by stopping the electronically controlled throttle valve system if the throttle position sensor (sub) is also malfunctioning.</li> </ul> |
| Throttle position sensor (sub)                                                                                                 | <ul style="list-style-type: none"> <li>Controls the throttle valve position through the use of the throttle position sensor (main) signal.</li> <li>Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle.</li> <li>Prohibits the operation of the auto-cruise control.</li> <li>Cuts off fuel when the engine speed exceeds 3,000 r/min.</li> <li>Prohibits the idle speed control from learning.</li> <li>Suppresses the engine output by stopping the electronically controlled throttle valve system if the throttle position sensor (main) is also malfunctioning.</li> </ul>             |
| Throttle valve position feedback                                                                                               | <ul style="list-style-type: none"> <li>Suppresses the engine output by stopping the electronically controlled throttle valve system.</li> <li>Prohibits the operation of the auto-cruise control.</li> <li>Prohibits the operation of the engine speed feedback control.</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
| Throttle actuator control motor                                                                                                | <ul style="list-style-type: none"> <li>Suppresses the engine output by stopping the electronically controlled throttle valve system.</li> <li>Prohibits the operation of the auto-cruise control.</li> <li>Prohibits the operation of the engine speed feedback control.</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
| Engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> main processor                                      | <ul style="list-style-type: none"> <li>Suppresses the engine output by stopping the electronically controlled throttle valve system.</li> <li>Prohibits the operation of the auto-cruise control.</li> <li>Prohibits the operation of the engine speed feedback control.</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
| Communication between engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> main processor and system LSI | <ul style="list-style-type: none"> <li>Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle.</li> <li>Prohibits the operation of the auto-cruise control.</li> <li>Prohibits the operation of the engine speed feedback control.</li> <li>Cuts off fuel when the engine speed exceeds 3,000 r/min.</li> </ul>                                                                                                                                                                                                                                                                                 |
| Intake air monitor                                                                                                             | <ul style="list-style-type: none"> <li>Suppresses the engine output by stopping the electronically controlled throttle valve system.</li> <li>Prohibits the operation of the auto-cruise control.</li> <li>Prohibits the operation of engine speed feedback.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                          |
| Switching to high-speed cam in mitsubishi innovative valve timing and lift electronic control                                  | <ul style="list-style-type: none"> <li>Do not switch to high-speed cam.</li> <li>Cut off fuel when the engine speed exceeds 5,000 r/min.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**DIAGNOSTIC TROUBLE CODE CHART**

M1131151000840

| <b>DTC CODE</b> | <b>DIAGNOSTIC ITEMS</b>                                                          | <b>REFERENCE PAGE</b>     |
|-----------------|----------------------------------------------------------------------------------|---------------------------|
| P0101*          | Mass airflow circuit range/performance problem                                   | <a href="#">P.13B-38</a>  |
| P0102*          | Mass airflow circuit low input                                                   | <a href="#">P.13B-46</a>  |
| P0103*          | Mass airflow circuit high input                                                  | <a href="#">P.13B-54</a>  |
| P0106           | Manifold absolute pressure circuit range/performance problem                     | <a href="#">P.13B-61</a>  |
| P0107           | Manifold absolute pressure circuit low input                                     | <a href="#">P.13B-71</a>  |
| P0108           | Manifold absolute pressure circuit high input                                    | <a href="#">P.13B-85</a>  |
| P0111*          | Intake air temperature circuit range/performance problem                         | <a href="#">P.13B-96</a>  |
| P0112*          | Intake air temperature circuit low input                                         | <a href="#">P.13B-103</a> |
| P0113*          | Intake air temperature circuit high input                                        | <a href="#">P.13B-108</a> |
| P0116*          | Engine coolant temperature circuit range/performance problem                     | <a href="#">P.13B-115</a> |
| P0117*          | Engine coolant temperature circuit low input                                     | <a href="#">P.13B-123</a> |
| P0118*          | Engine coolant temperature circuit high input                                    | <a href="#">P.13B-128</a> |
| P0122*          | Throttle position sensor (main) circuit low input                                | <a href="#">P.13B-136</a> |
| P0123*          | Throttle position sensor (main) circuit high input                               | <a href="#">P.13B-145</a> |
| P0125*          | Insufficient coolant temperature for closed loop fuel control                    | <a href="#">P.13B-153</a> |
| P0128           | Coolant thermostat (coolant temperature below thermostat regulating temperature) | <a href="#">P.13B-165</a> |
| P0130           | Heated oxygen sensor circuit (sensor 1)                                          | <a href="#">P.13B-167</a> |
| P0131           | Heated oxygen sensor circuit low voltage (sensor 1)                              | <a href="#">P.13B-179</a> |
| P0132           | Heated oxygen sensor circuit high voltage (sensor 1)                             | <a href="#">P.13B-187</a> |
| P0133           | Heated oxygen sensor circuit slow response (sensor 1)                            | <a href="#">P.13B-192</a> |
| P0134*          | Heated oxygen sensor circuit no activity detected (sensor 1)                     | <a href="#">P.13B-196</a> |
| P0135           | Heated oxygen sensor heater circuit (sensor 1)                                   | <a href="#">P.13B-205</a> |
| P0136           | Heated oxygen sensor circuit (sensor 2)                                          | <a href="#">P.13B-216</a> |
| P0137           | Heated oxygen sensor circuit low voltage (sensor 2)                              | <a href="#">P.13B-227</a> |
| P0138           | Heated oxygen sensor circuit high voltage (sensor 2)                             | <a href="#">P.13B-235</a> |
| P0139           | Heated oxygen sensor circuit slow response (sensor 2)                            | <a href="#">P.13B-240</a> |
| P0141           | Heated oxygen sensor heater circuit (sensor 2)                                   | <a href="#">P.13B-244</a> |
| P0171           | System too lean                                                                  | <a href="#">P.13B-255</a> |
| P0172           | System too rich                                                                  | <a href="#">P.13B-264</a> |
| P0181           | Fuel tank temperature sensor circuit range/performance                           | <a href="#">P.13B-270</a> |
| P0182           | Fuel tank temperature sensor circuit low input                                   | <a href="#">P.13B-277</a> |
| P0183           | Fuel tank temperature sensor circuit high input                                  | <a href="#">P.13B-283</a> |
| P0201           | Injector circuit-cylinder 1                                                      | <a href="#">P.13B-291</a> |
| P0202           | Injector circuit-cylinder 2                                                      | <a href="#">P.13B-291</a> |

| DTC CODE | DIAGNOSTIC ITEMS                                                              | REFERENCE PAGE |
|----------|-------------------------------------------------------------------------------|----------------|
| P0203    | Injector circuit-cylinder 3                                                   | P.13B-291      |
| P0204    | Injector circuit-cylinder 4                                                   | P.13B-291      |
| P0222*   | Throttle position sensor (sub) circuit low input                              | P.13B-299      |
| P0223*   | Throttle position sensor (sub) circuit high input                             | P.13B-307      |
| P0300    | Random/multiple cylinder misfire detected                                     | P.13B-315      |
| P0301    | Cylinder 1 misfire detected                                                   | P.13B-320      |
| P0302    | Cylinder 2 misfire detected                                                   | P.13B-320      |
| P0303    | Cylinder 3 misfire detected                                                   | P.13B-320      |
| P0304    | Cylinder 4 misfire detected                                                   | P.13B-320      |
| P0325    | Knock sensor circuit                                                          | P.13B-324      |
| P0335*   | Crankshaft position sensor circuit                                            | P.13B-330      |
| P0340*   | Camshaft position sensor circuit                                              | P.13B-346      |
| P0401    | Exhaust gas recirculation flow insufficient detected                          | P.13B-359      |
| P0403    | Exhaust gas recirculation control circuit                                     | P.13B-363      |
| P0420    | Catalyst efficiency below threshold                                           | P.13B-372      |
| P0441    | Evaporative emission control system incorrect purge flow                      | P.13B-377      |
| P0442    | Evaporative emission control system leak detected (Small leak)                | P.13B-381      |
| P0443    | Evaporative emission control system purge control valve circuit               | P.13B-395      |
| P0446    | Evaporative emission control system vent control circuit                      | P.13B-404      |
| P0451    | Evaporative emission control system pressure sensor range/performance         | P.13B-414      |
| P0452    | Evaporative emission control system pressure sensor low input                 | P.13B-444      |
| P0453    | Evaporative emission control system pressure sensor high input                | P.13B-473      |
| P0455    | Evaporative emission control system leak detected (Gross leak)                | P.13B-502      |
| P0456    | Evaporative emission control system leak detected (Very small leak)           | P.13B-520      |
| P0461    | Fuel level sensor circuit range/performance                                   | P.13B-534      |
| P0500    | Vehicle speed sensor malfunction <M/T>                                        | P.13B-540      |
| P0506    | Idle control system RPM lower than expected                                   | P.13B-552      |
| P0507    | Idle control system RPM higher than expected                                  | P.13B-555      |
| P0551    | Power steering pressure switch circuit range/performance                      | P.13B-558      |
| P0554    | Power steering pressure switch circuit intermittent                           | P.13B-569      |
| P0606*   | Engine control module or powertrain control module main processor malfunction | P.13B-576      |
| P0622    | Generator FR terminal circuit malfunction                                     | P.13B-578      |
| P0638*   | Throttle actuator control motor circuit range/performance problem             | P.13B-586      |
| P0642*   | Throttle position sensor power supply                                         | P.13B-592      |
| P0657*   | Throttle actuator control motor relay circuit malfunction                     | P.13B-594      |

| <b>DTC CODE</b> | <b>DIAGNOSTIC ITEMS</b>                                                                           |                                                                                                                                                                                                       | <b>REFERENCE PAGE</b> |
|-----------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| P0705           | Transmission range sensor circuit malfunction (PRNDL input)                                       | <ul style="list-style-type: none"> <li>• A/T DTC No. 27 (Park/Neutral position switch system: Open circuit)</li> <li>• A/T DTC No. 28 (Park/Neutral position switch system: Short circuit)</li> </ul> | P.23B-38              |
| P0712*          | Transmission fluid temperature sensor circuit low input                                           | <ul style="list-style-type: none"> <li>• A/T DTC No. 16 (Oil temperature sensor system: Short circuit)</li> </ul>                                                                                     | P.23B-38              |
| P0713*          | Transmission fluid temperature sensor circuit high input                                          | <ul style="list-style-type: none"> <li>• A/T DTC No. 15 (Oil temperature sensor system: Open circuit)</li> </ul>                                                                                      | P.23B-38              |
| P0715*          | Input/turbine speed sensor circuit                                                                | <ul style="list-style-type: none"> <li>• A/T DTC No. 22 (Input shaft speed sensor system: Short circuit/Open circuit)</li> </ul>                                                                      | P.23B-38              |
| P0720*          | Output speed sensor circuit                                                                       | <ul style="list-style-type: none"> <li>• A/T DTC No. 23 (Output shaft speed sensor system: Short circuit/Open circuit)</li> </ul>                                                                     | P.23B-38              |
| P0731*          | Gear 1 incorrect ratio                                                                            | <ul style="list-style-type: none"> <li>• A/T DTC No. 41 (1st gear incorrect ratio)</li> </ul>                                                                                                         | P.23B-38              |
| P0732*          | Gear 2 incorrect ratio                                                                            | <ul style="list-style-type: none"> <li>• A/T DTC No. 42 (2nd gear incorrect ratio)</li> </ul>                                                                                                         | P.23B-38              |
| P0733*          | Gear 3 incorrect ratio                                                                            | <ul style="list-style-type: none"> <li>• A/T DTC No. 43 (3rd gear incorrect ratio)</li> </ul>                                                                                                         | P.23B-38              |
| P0734*          | Gear 4 incorrect ratio                                                                            | <ul style="list-style-type: none"> <li>• A/T DTC No. 44 (4th gear incorrect ratio)</li> </ul>                                                                                                         | P.23B-38              |
| P0736*          | Gear R incorrect ratio                                                                            | <ul style="list-style-type: none"> <li>• A/T DTC No. 46 (Reverse gear incorrect ratio)</li> </ul>                                                                                                     | P.23B-38              |
| P0741           | Torque converter clutch circuit performance or stuck off                                          | <ul style="list-style-type: none"> <li>• A/T DTC No. 52 (Torque converter clutch solenoid system: Defective system)</li> </ul>                                                                        | P.23B-38              |
| P0742           | Torque converter clutch circuit stuck on                                                          | <ul style="list-style-type: none"> <li>• A/T DTC No. 53 (Torque converter clutch solenoid system: Lock-up stuck on)</li> </ul>                                                                        | P.23B-38              |
| P0743*          | Torque converter clutch circuit electrical                                                        | <ul style="list-style-type: none"> <li>• A/T DTC No. 36 (Torque converter clutch solenoid system: Short circuit/Open circuit)</li> </ul>                                                              | P.23B-38              |
| P0753*          | Shift solenoid "A" electrical                                                                     | <ul style="list-style-type: none"> <li>• A/T DTC No. 31 (Low and reverse solenoid valve system: Short circuit/Open circuit)</li> </ul>                                                                | P.23B-38              |
| P0758*          | Shift solenoid "B" electrical                                                                     | <ul style="list-style-type: none"> <li>• A/T DTC No. 32 (Underdrive solenoid valve system: Short circuit/Open circuit)</li> </ul>                                                                     | P.23B-38              |
| P0763*          | Shift solenoid "C" electrical                                                                     | <ul style="list-style-type: none"> <li>• A/T DTC No. 33 (Second solenoid valve system: Short circuit/Open circuit)</li> </ul>                                                                         | P.23B-38              |
| P0768*          | Shift solenoid "D" electrical                                                                     | <ul style="list-style-type: none"> <li>• A/T DTC No. 34 (Overdrive solenoid valve system: Short circuit/Open circuit)</li> </ul>                                                                      | P.23B-38              |
| P1020           | Mitsubishi innovative valve timing and lift electronic control system (MIVEC) performance problem |                                                                                                                                                                                                       | P.13B-605             |
| P1021           | Engine oil control valve circuit                                                                  |                                                                                                                                                                                                       | P.13B-611             |
| P1602*          | Communication malfunction (between ECM <M/T> or PCM <A/T> main processor and system LSI)          |                                                                                                                                                                                                       | P.13B-619             |
| P1603*          | Battery backup line malfunction                                                                   |                                                                                                                                                                                                       | P.13B-621             |
| P1751*          | A/T control relay malfunction                                                                     | <ul style="list-style-type: none"> <li>• A/T DTC No. 54 (A/T control relay system: Short circuit to ground /open circuit)</li> </ul>                                                                  | P.23B-38              |
| P2100*          | Throttle actuator control motor circuit (open)                                                    |                                                                                                                                                                                                       | P.13B-627             |

| DTC CODE | DIAGNOSTIC ITEMS                                                           | REFERENCE PAGE |
|----------|----------------------------------------------------------------------------|----------------|
| P2101*   | Throttle actuator control motor magneto malfunction                        | P.13B-634      |
| P2102*   | Throttle actuator control motor circuit (shorted low)                      | P.13B-640      |
| P2103*   | Throttle actuator control motor circuit (shorted high)                     | P.13B-646      |
| P2121*   | Accelerator pedal position sensor (main) circuit range/performance problem | P.13B-652      |
| P2122*   | Accelerator pedal position sensor (main) circuit low input                 | P.13B-661      |
| P2123*   | Accelerator pedal position sensor (main) circuit high input                | P.13B-670      |
| P2126*   | Accelerator pedal position sensor (sub) circuit range/performance problem  | P.13B-677      |
| P2127*   | Accelerator pedal position sensor (sub) circuit low input                  | P.13B-686      |
| P2128*   | Accelerator pedal position sensor (sub) circuit high input                 | P.13B-695      |
| P2135*   | Throttle position sensor (main and sub) range/performance problem          | P.13B-702      |
| P2138*   | Accelerator pedal position sensor (main and sub) range/performance problem | P.13B-707      |
| P2173*   | Abnormal intake air amount                                                 | P.13B-718      |
| P2227*   | Barometric pressure circuit range/performance problem                      | P.13B-721      |
| P2228*   | Barometric pressure circuit low input                                      | P.13B-723      |
| P2229*   | Barometric pressure circuit high input                                     | P.13B-725      |

**NOTE:** Do not replace the engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> until a through terminal check reveals there are no short/open circuits.

**NOTE:** Check that the ECM <M/T> or PCM <A/T> ground circuit is normal before checking for the cause of the problem.

**NOTE:** After the ECM <M/T> or PCM <A/T> detects a malfunction, a diagnostic trouble code is recorded the next time the engine is started and the same malfunction is re-detected. However, for items marked with a "\*", the diagnostic trouble code is recorded on the first detection of the malfunction.

**NOTE:** Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

## SYMPTOM CHART

M1131151500782

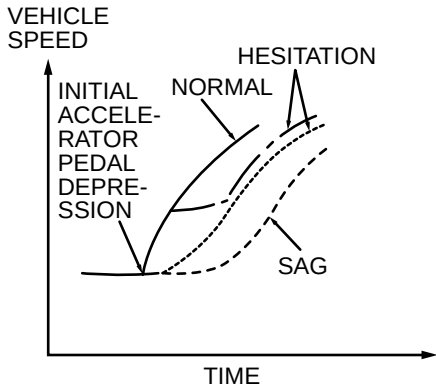
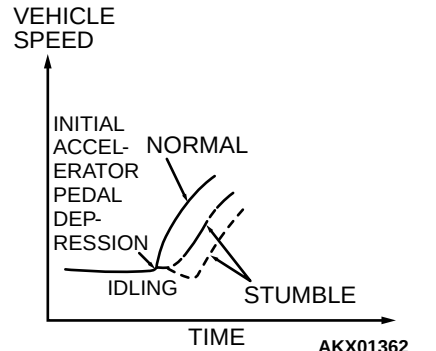
*NOTE: Check that the engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> ground circuit is normal before checking for the cause of the problem.*

| SYMPTOMS                                                                                |                                                                                                                                                              | INSPECTION<br>PROCEDURE | REFERENCE<br>PAGE         |
|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------|
| Communication with scan tool is impossible                                              | Communication with all systems is not possible                                                                                                               | 1                       | <a href="#">P.13B-727</a> |
|                                                                                         | Communication with ECM <M/T> or PCM <A/T> only is not possible                                                                                               | 2                       | <a href="#">P.13B-730</a> |
| Malfunction indicator lamp (SERVICE ENGINE SOON or check engine lamp) and related parts | The malfunction indicator lamp (SERVICE ENGINE SOON or check engine lamp) does not illuminate right after the ignition switch is turned to the "ON" position | 3                       | <a href="#">P.13B-733</a> |
|                                                                                         | The malfunction indicator lamp (SERVICE ENGINE SOON or check engine lamp) remains illuminated and never goes out                                             | 4                       | <a href="#">P.13B-738</a> |
| Starting                                                                                | Cranks, won't start                                                                                                                                          | 5                       | <a href="#">P.13B-742</a> |
|                                                                                         | Starts up and dies                                                                                                                                           | 6                       | <a href="#">P.13B-747</a> |
|                                                                                         | Hard starting                                                                                                                                                | 7                       | <a href="#">P.13B-751</a> |
| Idling stability (improper idling)                                                      | Unstable idle (rough idle, hunting)                                                                                                                          | 8                       | <a href="#">P.13B-755</a> |
|                                                                                         | Idle speed is high (improper idle speed)                                                                                                                     | 9                       | <a href="#">P.13B-759</a> |
|                                                                                         | Idle speed is low (improper idle speed)                                                                                                                      | 10                      | <a href="#">P.13B-761</a> |
| Idling stability (engine stalls)                                                        | When the engine is cold, it stalls at idle (die out)                                                                                                         | 11                      | <a href="#">P.13B-763</a> |
|                                                                                         | When the engine is hot, it stalls at idle (die out)                                                                                                          | 12                      | <a href="#">P.13B-766</a> |
|                                                                                         | The engine stalls when accelerating (pass out)                                                                                                               | 13                      | <a href="#">P.13B-770</a> |
|                                                                                         | The engine stalls when decelerating                                                                                                                          | 14                      | <a href="#">P.13B-771</a> |
| Driving                                                                                 | Hesitation, sag or stumble                                                                                                                                   | 15                      | <a href="#">P.13B-773</a> |
|                                                                                         | Acceleration shock                                                                                                                                           | 16                      | <a href="#">P.13B-777</a> |
|                                                                                         | Deceleration shock                                                                                                                                           | 17                      | <a href="#">P.13B-778</a> |
|                                                                                         | Poor acceleration                                                                                                                                            | 18                      | <a href="#">P.13B-779</a> |
|                                                                                         | Surge                                                                                                                                                        | 19                      | <a href="#">P.13B-783</a> |
|                                                                                         | Knocking                                                                                                                                                     | 20                      | <a href="#">P.13B-787</a> |
| Dieseling (Run-on)                                                                      |                                                                                                                                                              | 21                      | <a href="#">P.13B-789</a> |
| Too high CO and HC concentration when idling                                            |                                                                                                                                                              | 22                      | <a href="#">P.13B-789</a> |
| IM240 test failure                                                                      | Transient, mass emission tailpipe test failure                                                                                                               | 23                      | <a href="#">P.13B-792</a> |
|                                                                                         | Purge flow test of the evaporative emission canister failure                                                                                                 | 24                      | <a href="#">P.13B-797</a> |
|                                                                                         | Pressure test of the evaporative system failure                                                                                                              | 25                      | <a href="#">P.13B-798</a> |
| Generator output voltage is low (approximately 12.3 volts)                              |                                                                                                                                                              | 26                      | <a href="#">P.13B-799</a> |
| Improper idle speed when the A/C is on (A/C load signal)                                |                                                                                                                                                              | 27                      | <a href="#">P.13B-803</a> |
| Fans (radiator fan, A/C condenser fan) are inoperative                                  |                                                                                                                                                              | 28                      | <a href="#">P.13B-806</a> |

| SYMPTOMS                                                             | INSPECTION<br>PROCEDURE | REFERENCE<br>PAGE         |
|----------------------------------------------------------------------|-------------------------|---------------------------|
| Power supply system and ignition switch-IG system                    | 29                      | <a href="#">P.13B-810</a> |
| Fuel pump system                                                     | 30                      | <a href="#">P.13B-820</a> |
| Ignition switch-ST system <M/T>                                      | 31                      | <a href="#">P.13B-833</a> |
| Ignition switch-ST system and transmission range switch system <A/T> | 32                      | <a href="#">P.13B-840</a> |
| Ignition circuit system                                              | 33                      | <a href="#">P.13B-845</a> |
| A/C system                                                           | 34                      | <a href="#">P.13B-853</a> |
| Accelerator pedal position switch circuit system                     | 35                      | <a href="#">P.13B-857</a> |

**PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)**

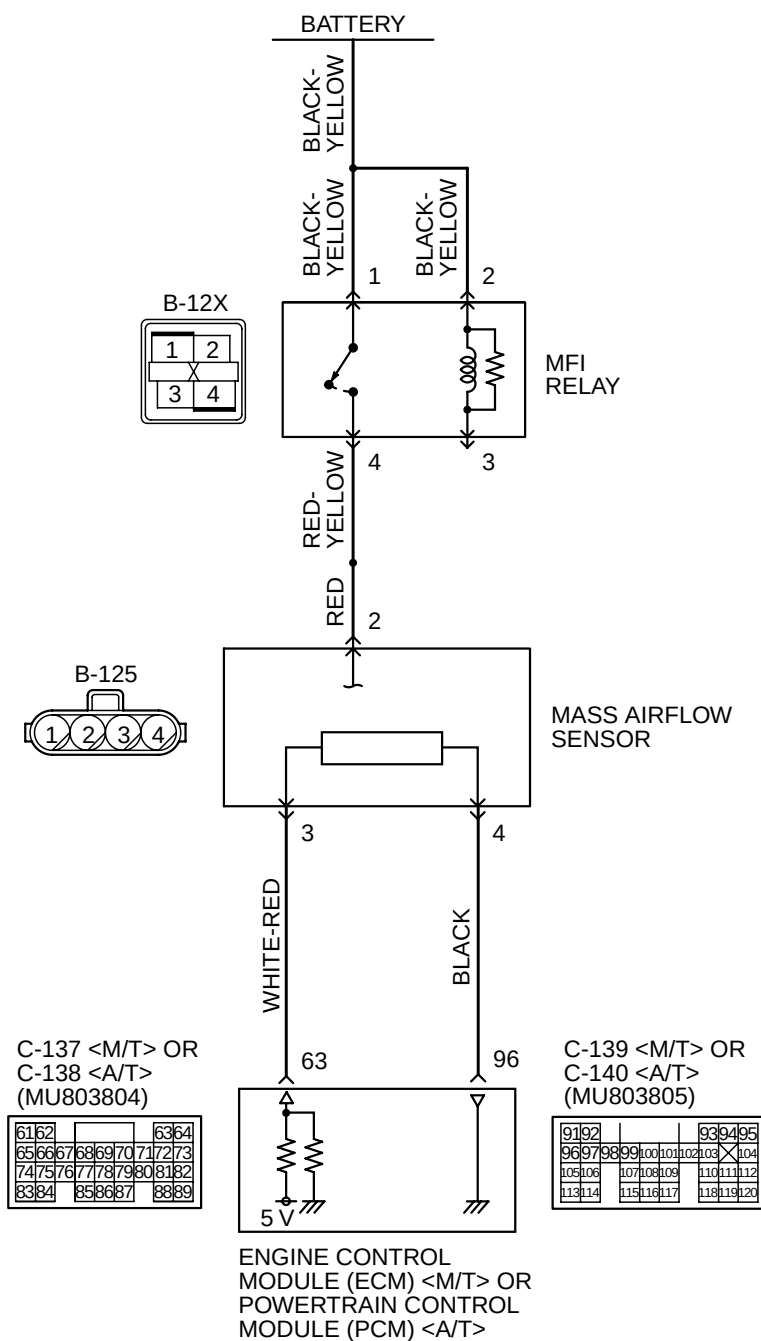
| ITEMS            |                         | SYMPTOM                                                                                                                                                     |
|------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| At starting      | Won't start             | The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.                                       |
|                  | Starts up and dies      | The engine starts, but then the engine soon stalls.                                                                                                         |
|                  | Hard starting           | Engine starts after cranking a while.                                                                                                                       |
| Idling stability | Hunting                 | Engine speed doesn't remain constant; changes at idle.                                                                                                      |
|                  | Rough idle              | Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. |
|                  | Incorrect idle speed    | The engine doesn't idle at the correct speed.                                                                                                               |
|                  | Engine stall (die out)  | The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not.                                    |
|                  | Engine stall (pass out) | The engine stalls when the accelerator pedal is depressed.                                                                                                  |

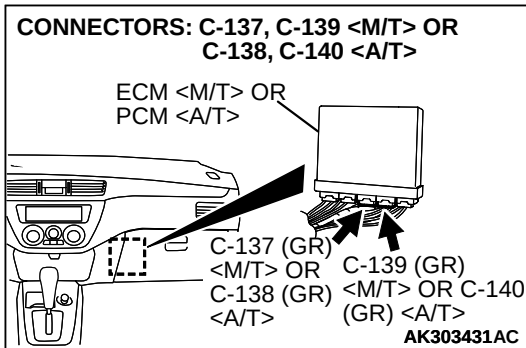
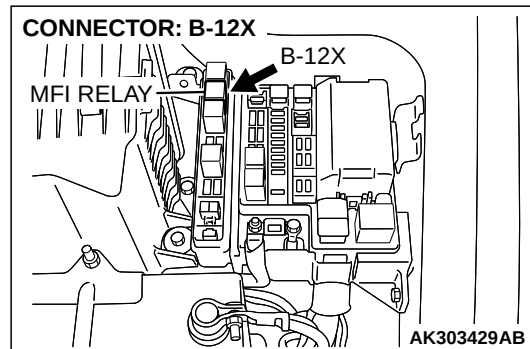
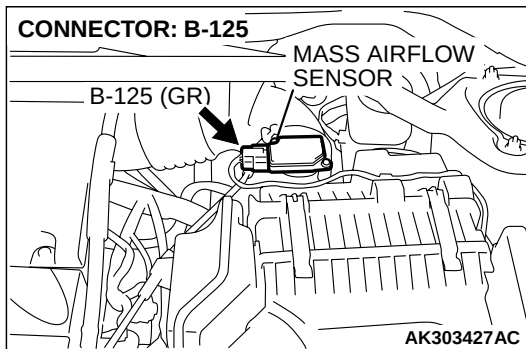
| ITEMS      |                    | SYMPTOM                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| At driving | Hesitation Sag     | <p>"Hesitation" is the delay in response of the vehicle speed (engine speed). This occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag".</p>  <p align="right">AKX01361AB</p> |
|            | Poor acceleration  | <p>Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth. Also the inability to reach maximum speed.</p>                                                                                                                                                                                                                                                    |
|            | Stumble            | <p>Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration.</p>  <p align="right">AKX01362</p>                                                                                                                                                                                                                     |
|            | Shock              | <p>The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.</p>                                                                                                                                                                                                                                                                                                                                     |
|            | Surge              | <p>This is slight acceleration and deceleration feel usually felt during steady, light throttle cruise. Most notable under light loads.</p>                                                                                                                                                                                                                                                                                                        |
|            | Knocking           | <p>A sharp sound during driving, which sounds like a hammer striking the cylinder walls. It makes poor driveability</p>                                                                                                                                                                                                                                                                                                                            |
| At stopped | Dieseling (run on) | <p>The condition in which the engine continues to run after the ignition switch is turned to the "LOCK" (OFF) position. Also called "dieseling".</p>                                                                                                                                                                                                                                                                                               |

## DIAGNOSTIC TROUBLE CODE PROCEDURES

## DTC P0101: Mass Airflow Circuit Range/Performance Problem

Mass Airflow Sensor Circuit





### CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 4), and the ground is provided on the ECM <M/T> or PCM <A/T> (terminal No. 96).
- A voltage that is according to the mass airflow rate is sent to the ECM <M/T> or PCM <A/T> (terminal No. 63) from the mass airflow sensor output terminal (terminal No. 3).

### TECHNICAL DESCRIPTION

- While the engine is running, the mass airflow sensor outputs voltage which corresponds to the mass airflow rate.
- The ECM <M/T> or PCM <A/T> checks whether the voltage output by the mass airflow sensor while the engine is running is within a specified range.

### DESCRIPTIONS OF MONITOR METHODS

Compare load value with mass airflow sensor output voltage.

### MONITOR EXECUTION

Continuous

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

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

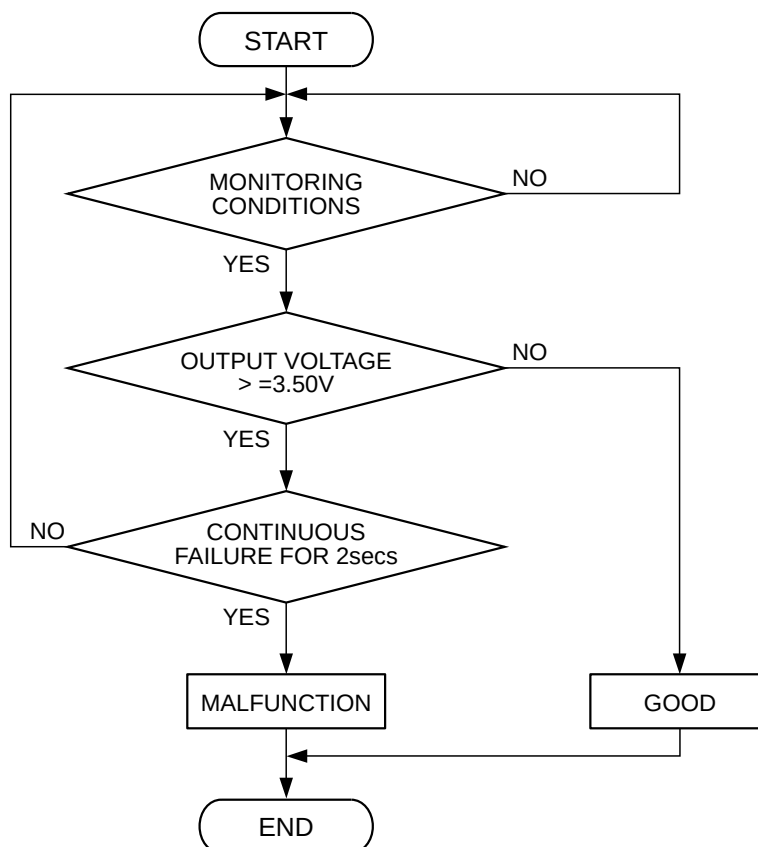
- Not applicable

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

- Throttle position sensor

## DTC SET CONDITIONS &lt;Range/Performance problem – high input&gt;

## Logic Flow Chart



AK302006

**Check Conditions**

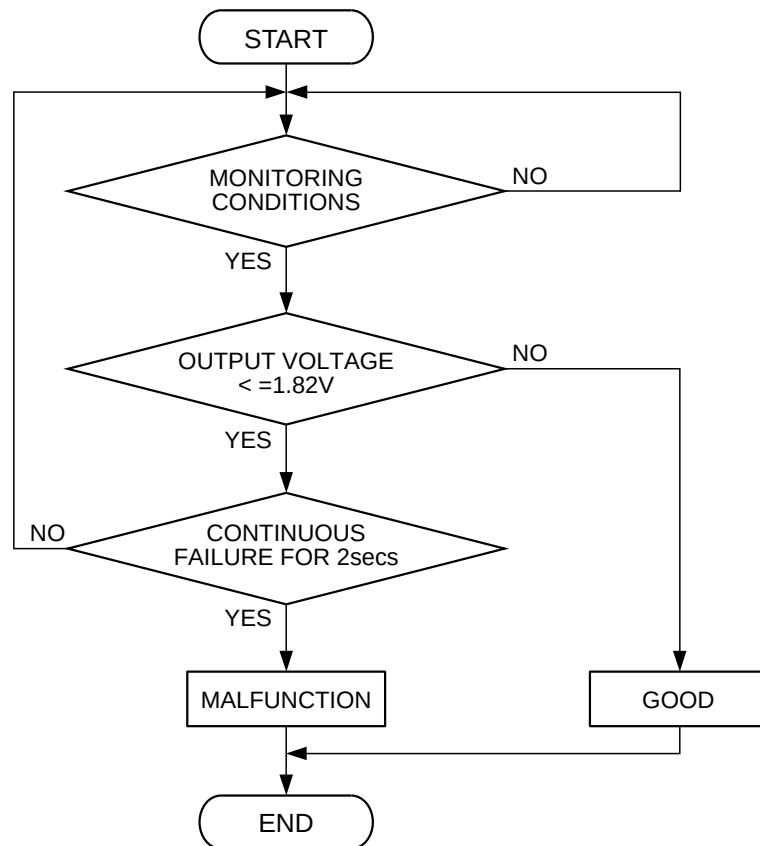
- Throttle position sensor output voltage is 1.0 volt or lower.

**Judgement Criteria**

- Mass airflow sensor output voltage has continued to be 3.5 volts or higher for 2 seconds.

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

Logic Flow Chart



AK302007

**Check Conditions**

- Throttle position sensor output voltage is 1.5 volts or higher.

**Judgement Criteria**

- Mass airflow sensor output voltage has continued to be 1.82 volts or lower for 2 seconds.

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

- Mass airflow sensor failed.
- Mass airflow sensor circuit harness damage, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

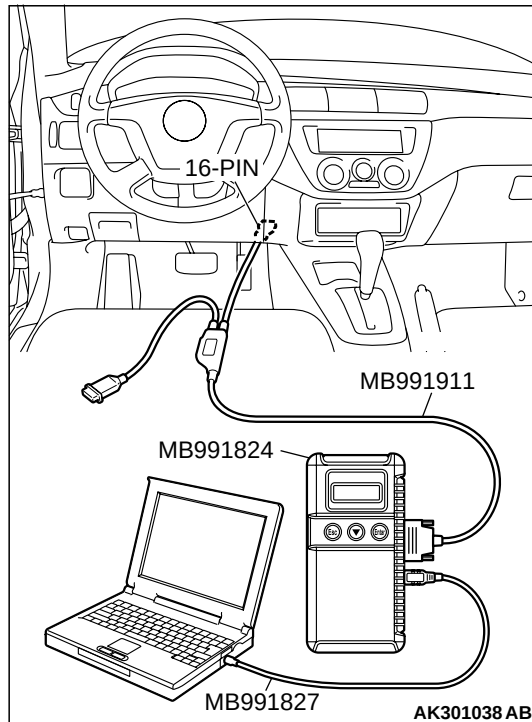
**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle –  
Procedure 6 – Other Monitor [P.13B-6](#).

**DIAGNOSIS**

**Required Special Tools:**

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



**STEP 1. Using scan tool MB991958, check data list item 12: Mass Airflow Sensor.**

**⚠ CAUTION**

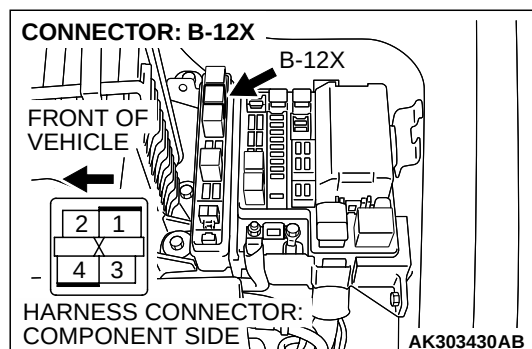
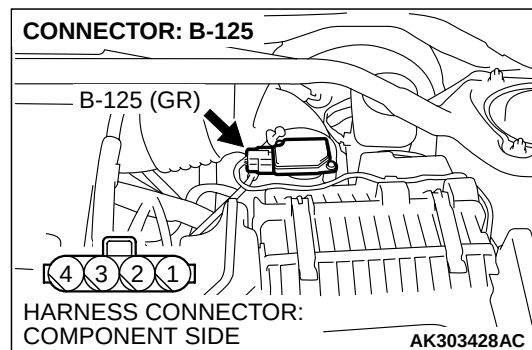
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 12, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 85°C to 95°C (185°F to 203°F).
  - The standard value during idling should be between 2.0 and 6.0 g/sec.
  - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
- (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 [P.00-6](#).

**NO :** Go to Step 2.



**STEP 2. Check harness connector B-125 at mass airflow sensor and harness connector B-12X at MFI relay for damage.**

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

**YES :** Go to Step 3.

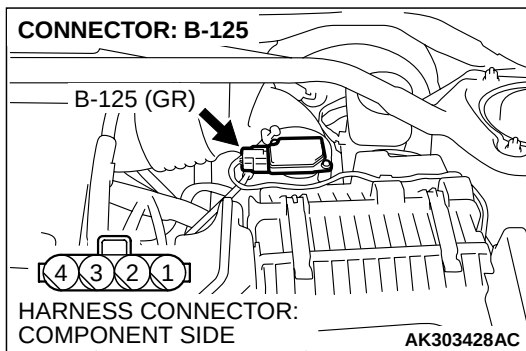
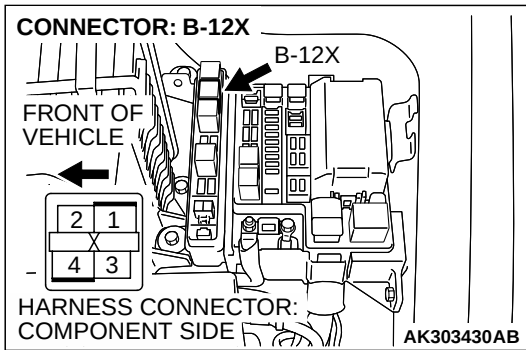
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 9.

**STEP 3. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and mass airflow sensor connector B-125 (terminal No. 2).**

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

**YES :** Go to Step 4.

**NO :** Repair it. Then go to Step 9.

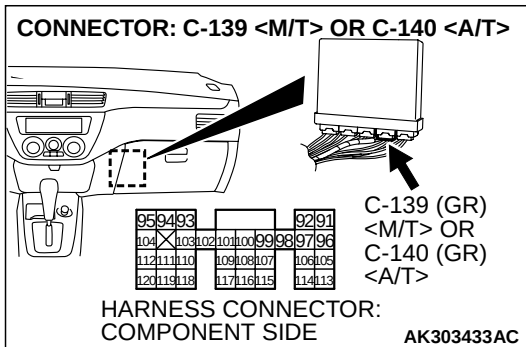


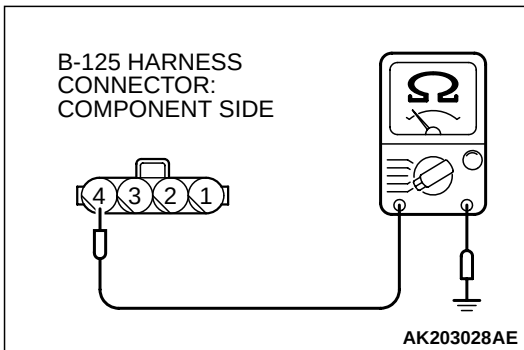
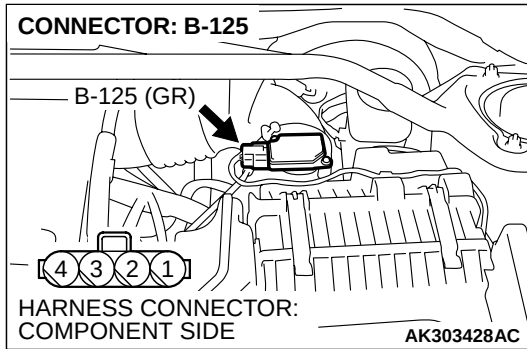
**STEP 4. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

**Q: Is the 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 9.





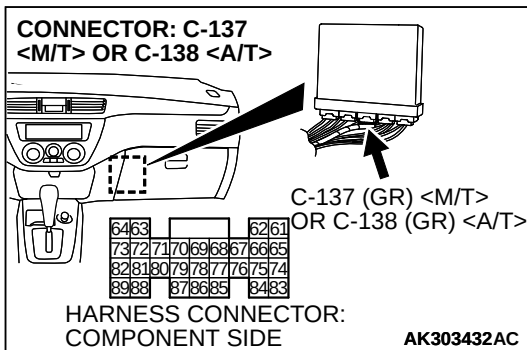
**STEP 5. Check the continuity at mass airflow sensor harness side connector B-125.**

- (1) Disconnect the connector B-125 and measure at the harness side.
- (2) Check for the continuity between terminal No. 4 and ground.
  - Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Go to Step 6.

**NO :** Check harness wire between mass airflow sensor connector B-125 (terminal No. 4) and ECM connector C-139 <M/T> or PCM connector C-140 (terminal No. 96) because of harness damage. Then go to Step 9.



**STEP 6. Check harness connector C-137 at ECM <M/T> or C-138 at PCM <A/T> for damage.**

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

**YES :** Go to Step 7.

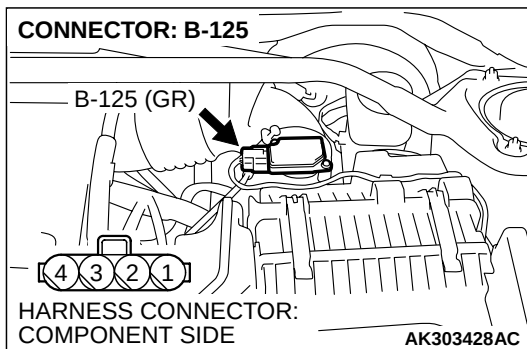
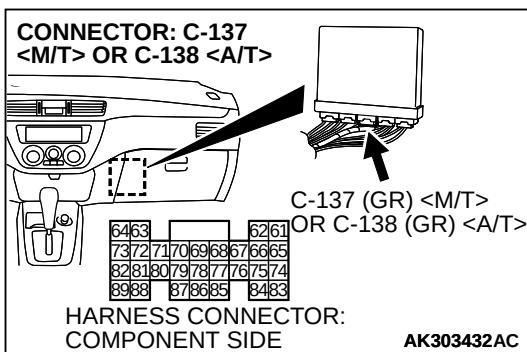
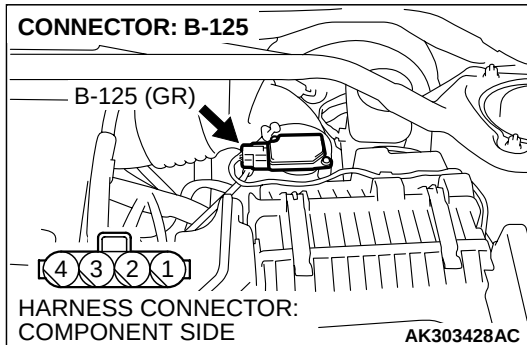
**NO :** Repair it. Then go to Step 9.

**STEP 7. Check for harness damage between mass airflow sensor connector B-125 (terminal No. 3) and ECM <M/T> connector C-137 or PCM <A/T> connector C-138 (terminal No. 63).**

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

**YES :** Go to Step 8.

**NO :** Repair it. Then go to Step 9.



**STEP 8. Replace the mass airflow sensor.**

- (1) Replace the mass airflow sensor.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).
- (3) Check the diagnostic trouble code (DTC).

**Q: Is DTC P0101 set?**

**YES :** Replace the ECM or PCM. Then go to Step 9.

**NO :** The inspection is complete.

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

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

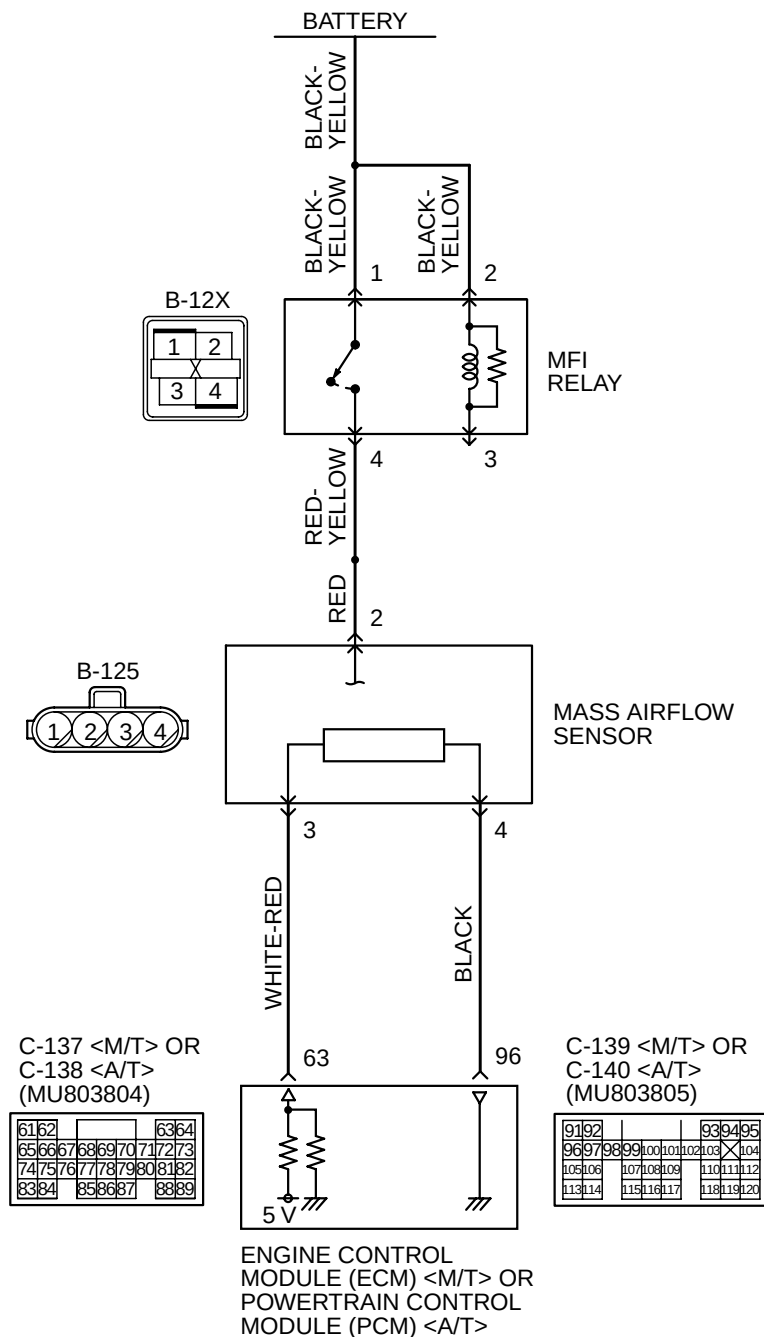
**Q: Is DTC P0101 set?**

**YES :** Retry the troubleshooting.

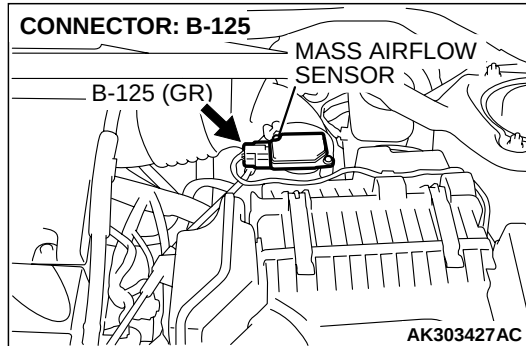
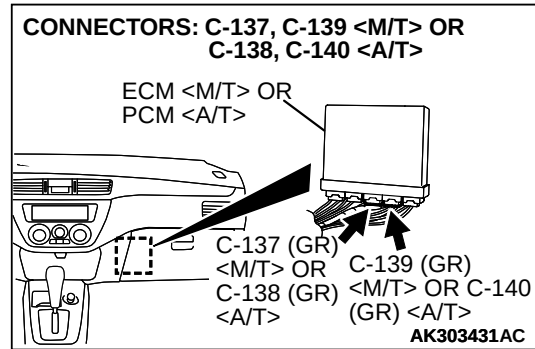
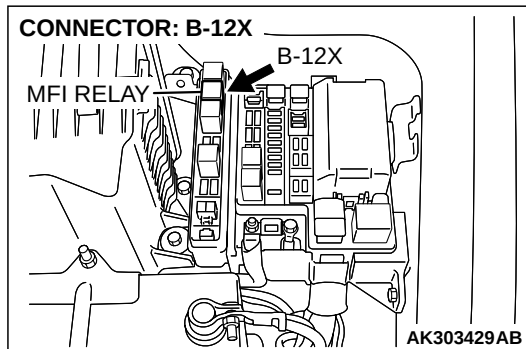
**NO :** The inspection is complete.

## DTC P0102: Mass Airflow Circuit Low Input

Mass Airflow Sensor Circuit



AK303979



### **CIRCUIT OPERATION**

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 4), and the ground is provided on the ECM <M/T> or PCM <A/T> (terminal No. 96).
- A voltage that is according to the mass airflow rate is sent to the ECM <M/T> or PCM <A/T> (terminal No. 63) from the mass airflow sensor output terminal (terminal No. 3).

### **TECHNICAL DESCRIPTION**

- While the engine is running, the mass airflow sensor outputs voltage which corresponds to the mass airflow rate.
- The ECM <M/T> or PCM <A/T> checks whether the voltage output by the mass airflow sensor while the engine is running is within a specified range.

### **DESCRIPTIONS OF MONITOR METHODS**

Mass airflow 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)**

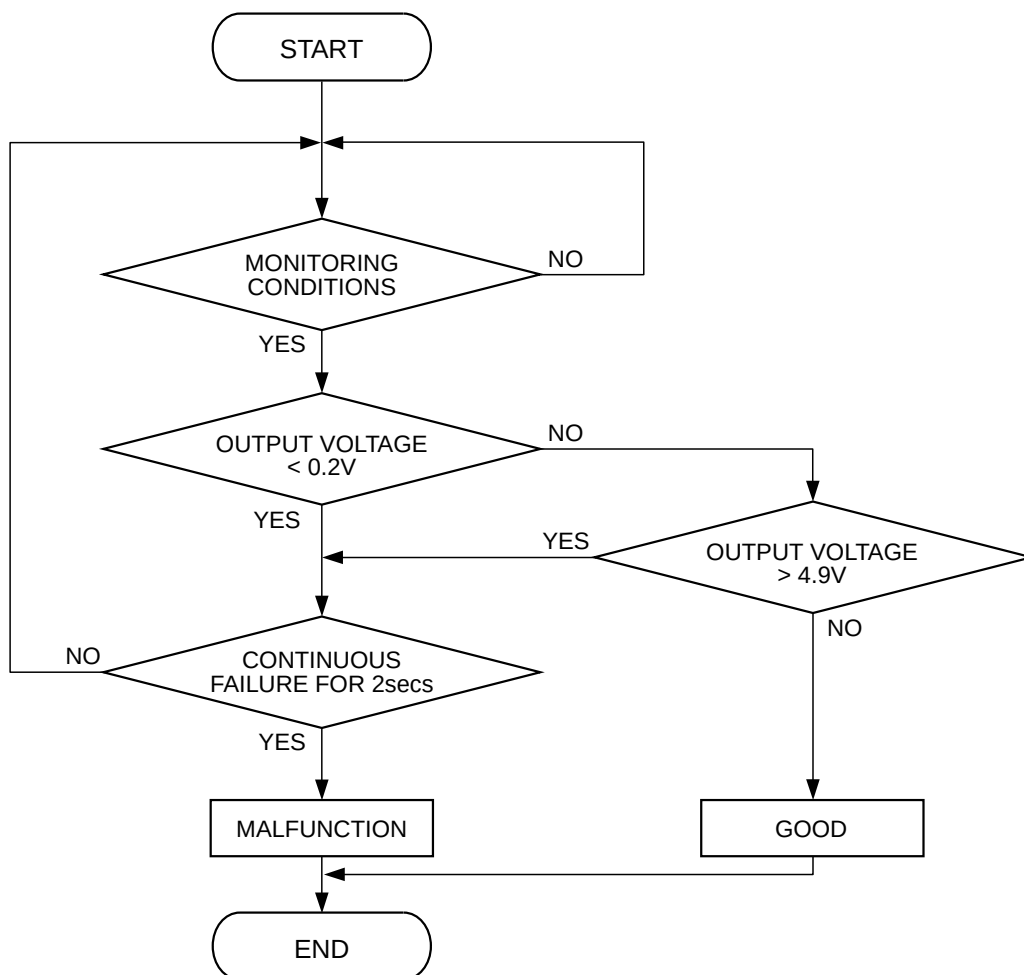
- Not applicable

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

- Not applicable

## DTC SET CONDITIONS

## Logic Flow Chart



AK302008

**Check Conditions**

- 3 seconds or more have passed since the ignition switch was turned to "ON" position.

**Judgement Criteria**

- Mass airflow sensor output voltage has continued to be lower than 0.2 volt for 2 seconds.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Mass airflow sensor failed.
- Open or shorted mass airflow sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

### STEP 1. Using scan tool MB991958, check data list item 12: Mass Airflow Sensor.

#### ⚠ CAUTION

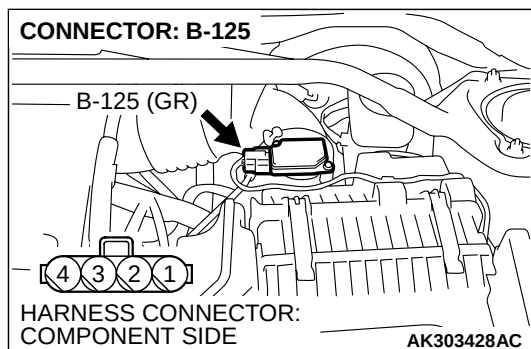
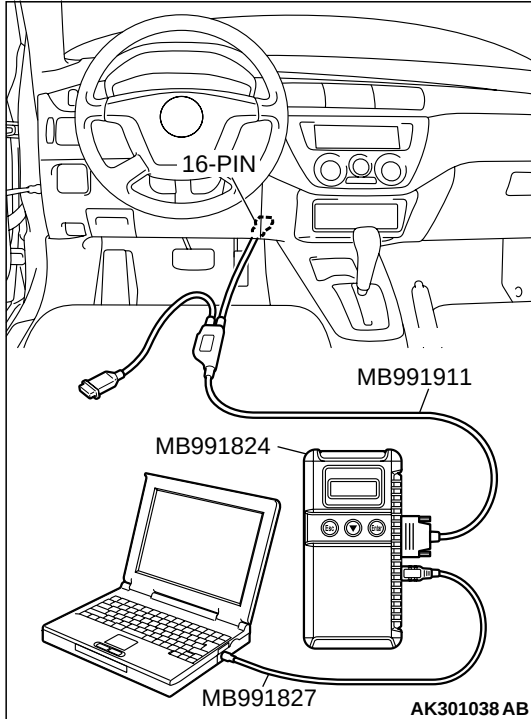
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 12, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 85°C to 95°C (185°F to 203°F).
  - The standard value during idling should be between 2.0 and 6.0 g/sec.
  - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
- (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 [P.00-6](#).

**NO** : Go to Step 2.

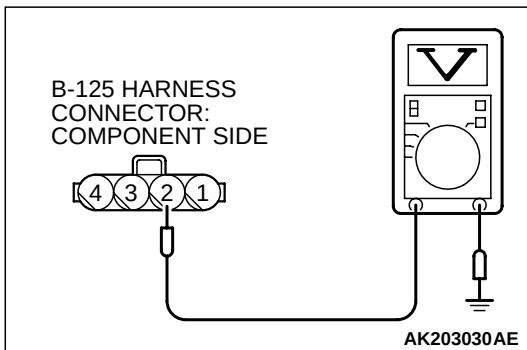
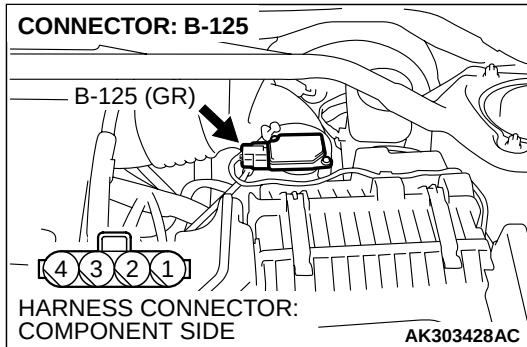


### STEP 2. Check harness connector B-125 at mass airflow sensor for damage.

#### Q: Is the 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.



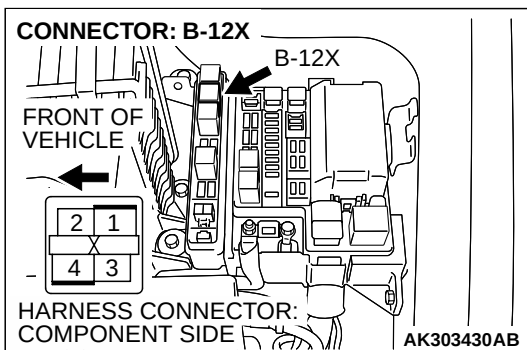
**STEP 3. Measure the power supply voltage at mass airflow sensor harness side connector B-125.**

- (1) Disconnect the connector B-125 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 5.

**NO :** Go to Step 4.

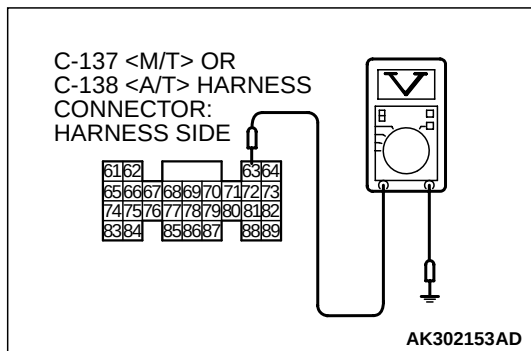
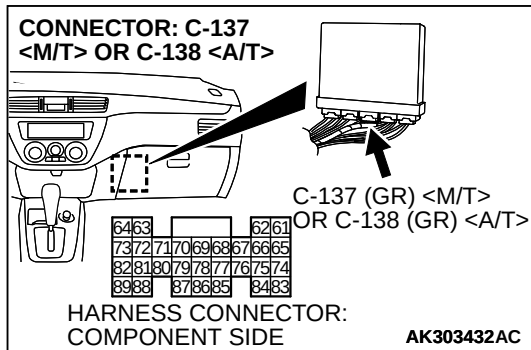


**STEP 4. Check harness connector B-12X at MFI relay for damage.**

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

**YES :** Repair harness wire between MFI relay connector B-12X (terminal No. 4) and mass airflow sensor connector B-125 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 11.

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



**STEP 5. Measure the sensor output voltage at ECM connector C-137 <M/T> or PCM connector C-138 <A/T> by backprobing.**

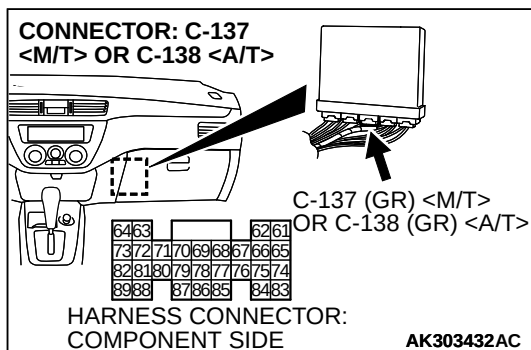
- (1) Do not disconnect the connector C-137 <M/T> or C-138 <A/T>.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 63 and ground by backprobing.
  - When the engine is revved, voltage should be increase in response to revving.

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

**YES :** Go to Step 9.

**NO :** Go to Step 6.



**STEP 6. Check harness connector C-137 at ECM <M/T> or C-138 at PCM <A/T> for damage.**

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

**YES :** Go to Step 7.

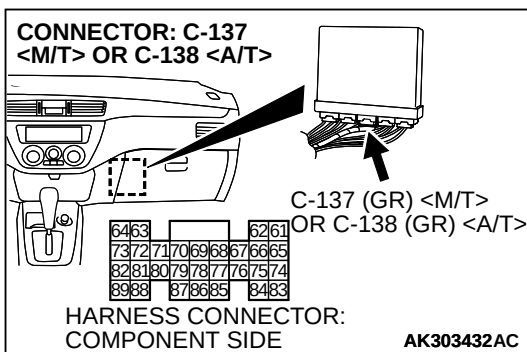
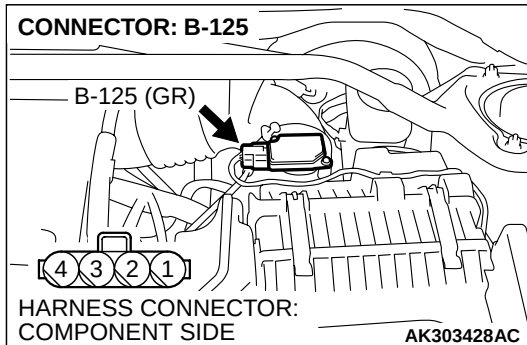
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

**STEP 7. Check for open circuit or short circuit to ground between mass airflow sensor connector B-125 (terminal No. 3) and ECM connector C-137 <M/T> or PCM connector C-138 <A/T> (terminal No. 63).**

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

**YES :** Replace the mass airflow sensor. Then go to Step 8.

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



**STEP 8. Replace the mass airflow sensor.**

(1) Replace the mass airflow sensor.

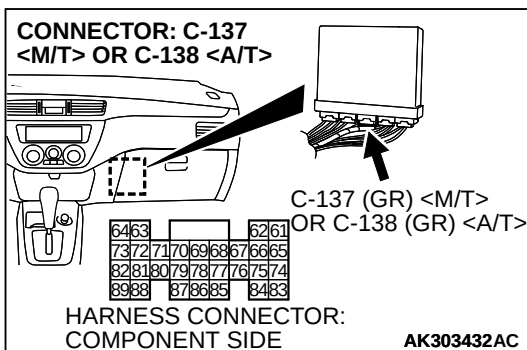
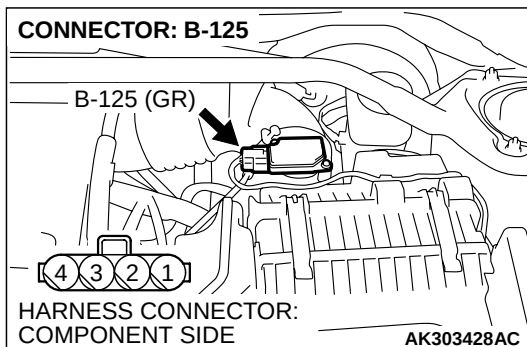
(2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

**Q: Is DTC P0102 set?**

**YES :** Replace the ECM or PCM. Then go to Step 11.

**NO :** The inspection is complete.

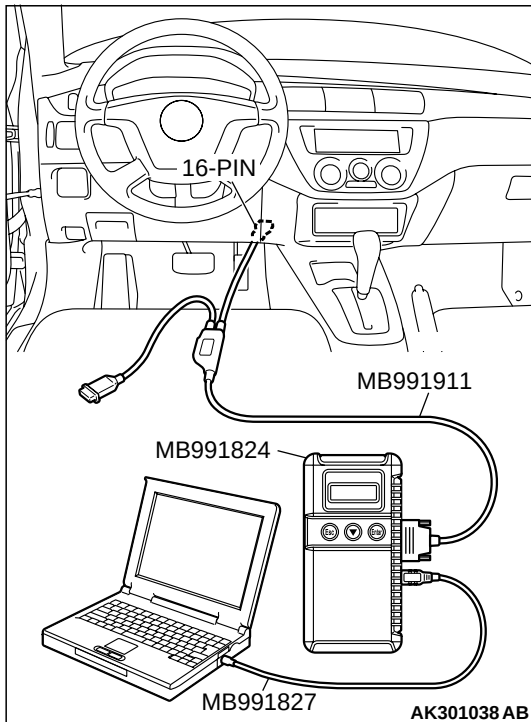


**STEP 9. Check harness connector C-137 at ECM <M/T> or C-138 at PCM <A/T> for damage.**

**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 10.



**STEP 10. Using scan tool MB991958, check data list item 12: 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 12, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 85°C to 95°C (185°F to 203°F).
  - The standard value during idling should be between 2.0 and 6.0 g/sec.
  - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
- (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 [P.00-6](#).

**NO :** Replace the ECM or PCM. 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 – Procedure 6 – Other Monitor [P.13B-6](#).
- (2) Check the diagnostic trouble code (DTC).

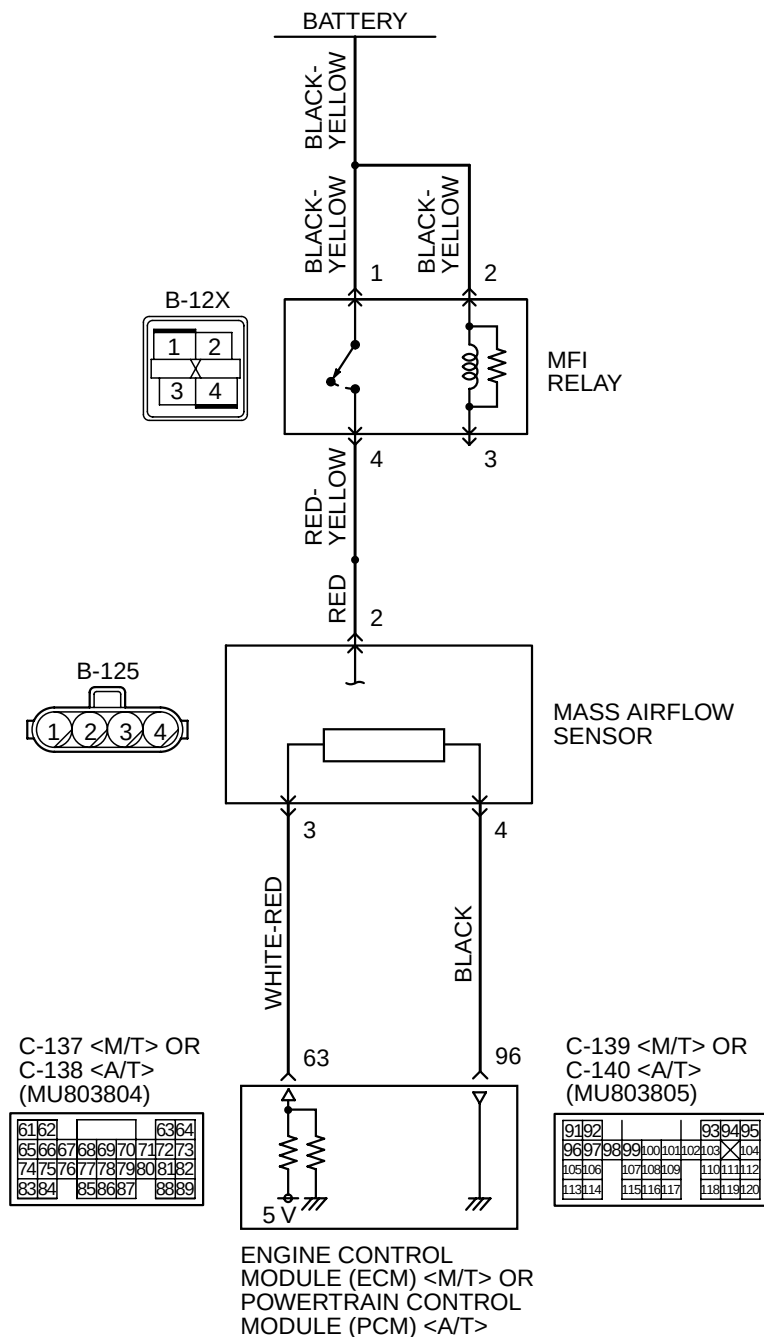
**Q: Is DTC P0102 set?**

**YES :** Retry the troubleshooting.

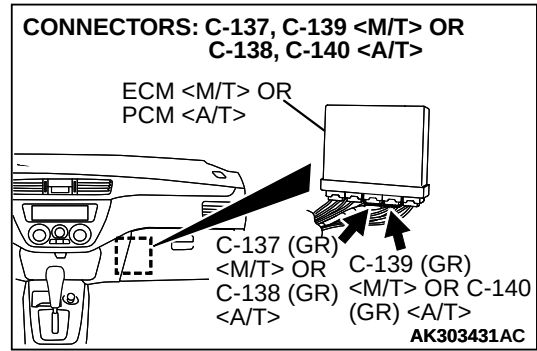
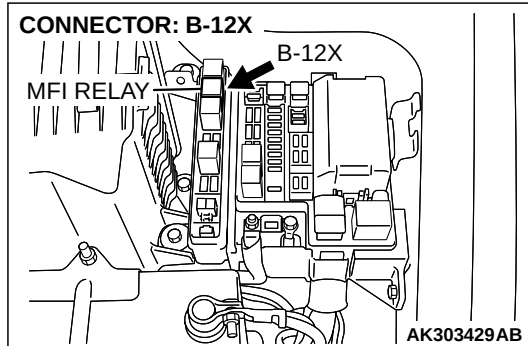
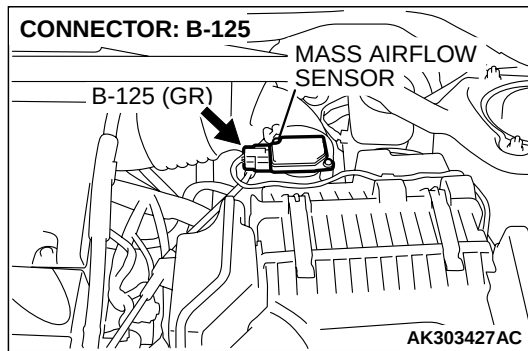
**NO :** The inspection is complete.

## DTC P0103: Mass Airflow Circuit High Input

Mass Airflow Sensor Circuit



AK303979



### CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 4), and the ground is provided on the ECM <M/T> or PCM <A/T> (terminal No. 96).
- A voltage that is according to the mass airflow rate is sent to the ECM <M/T> or PCM <A/T> (terminal No. 63) from the mass airflow sensor output terminal (terminal No. 3).

### TECHNICAL DESCRIPTION

- While the engine is running, the mass airflow sensor outputs voltage which corresponds to the mass airflow rate.
- The ECM <M/T> or PCM <A/T> checks whether the voltage output by the mass airflow sensor while the engine is running is within a specified range.

### DESCRIPTIONS OF MONITOR METHODS

Mass airflow 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)**

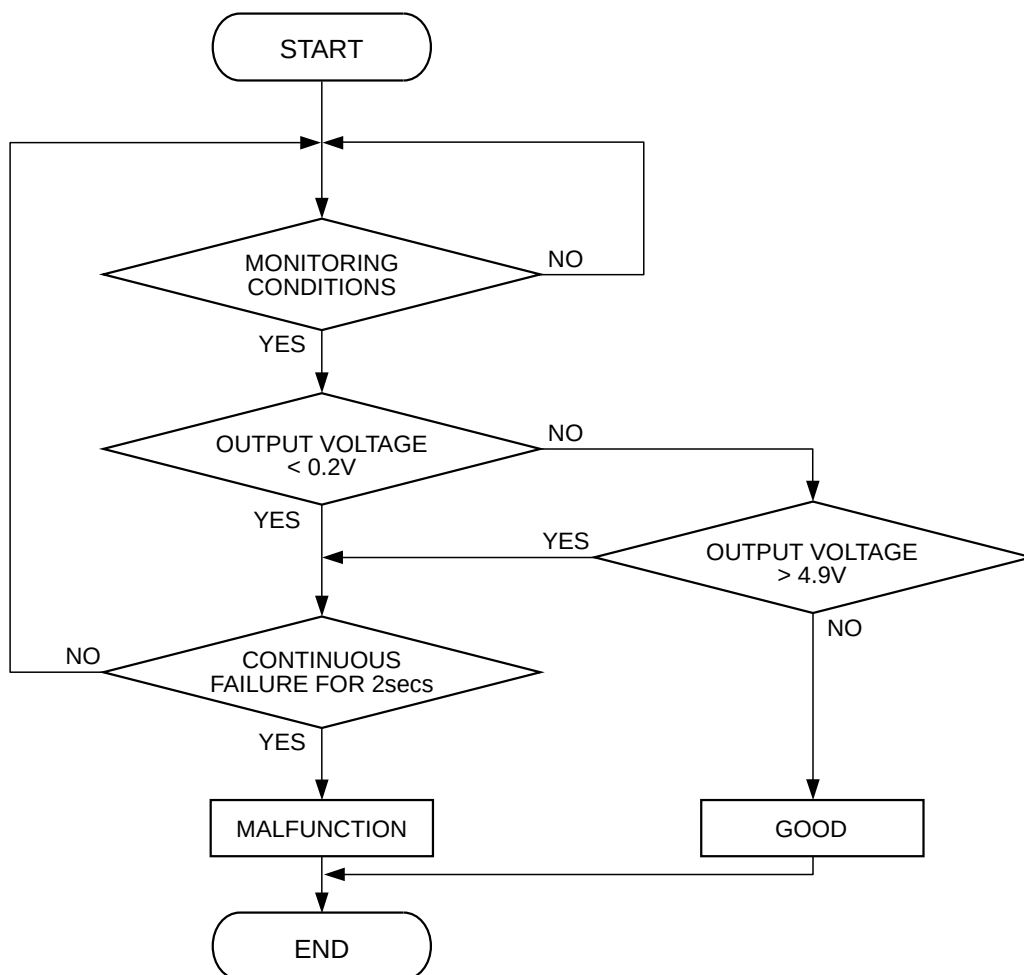
- Not applicable

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

- Not applicable

## DTC SET CONDITIONS

## Logic Flow Chart



AK302008

**Check Conditions**

- 3 seconds or more have passed since the ignition switch was turned to "ON" position.

**Judgement Criteria**

- Mass airflow sensor output voltage has continued to be higher than 4.9 volts for 2 seconds.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Mass airflow sensor failed.
- Open mass airflow sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tool:

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

### STEP 1. Using scan tool MB991958, check data list item 12: Mass Airflow Sensor.

#### ⚠ CAUTION

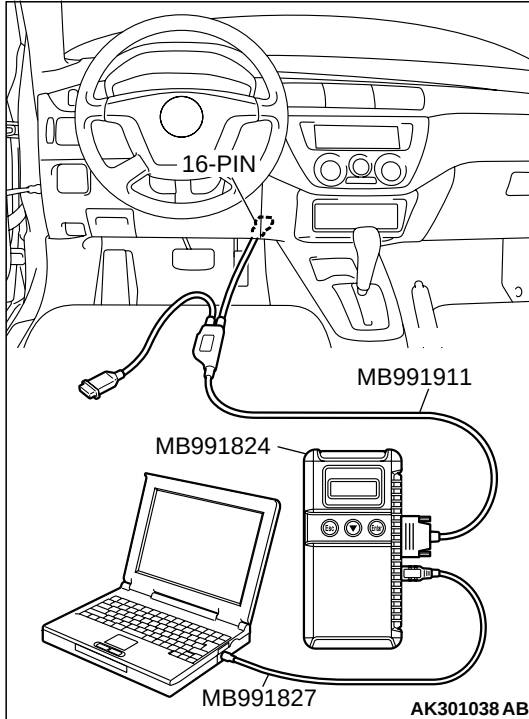
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 12, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 85°C to 95°C (185°F to 203°F).
  - The standard value during idling should be between 2.0 and 6.0 g/sec.
  - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
- (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 [P.00-6](#).

**NO** : Go to Step 2.

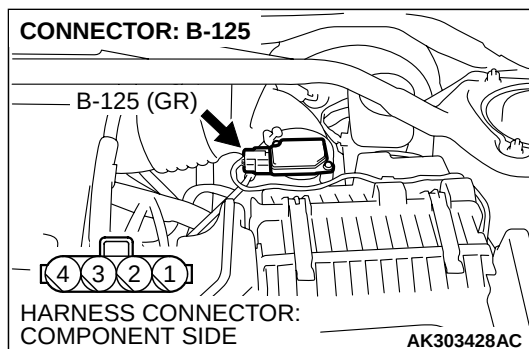


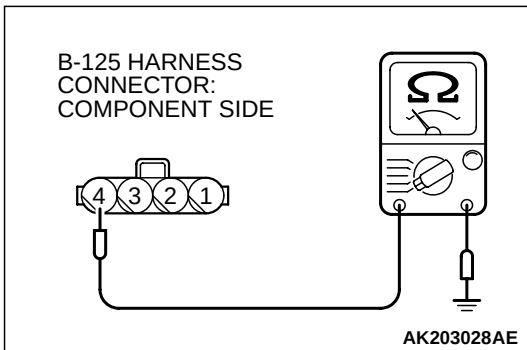
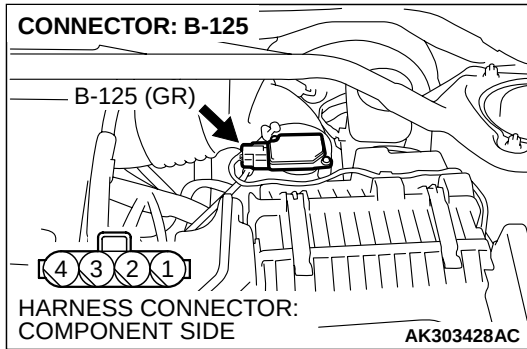
### STEP 2. Check harness connector B-125 at mass airflow sensor for damage.

#### Q: Is the 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.





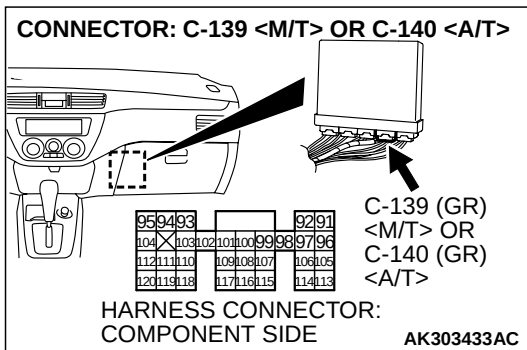
**STEP 3. Check the continuity at mass airflow sensor harness side connector B-125.**

- (1) Disconnect the connector B-125 and measure at the harness side.
- (2) Check for the continuity between terminal No. 4 and ground.
  - Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Go to Step 7.

**NO :** Go to Step 4.



**STEP 4. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 5.

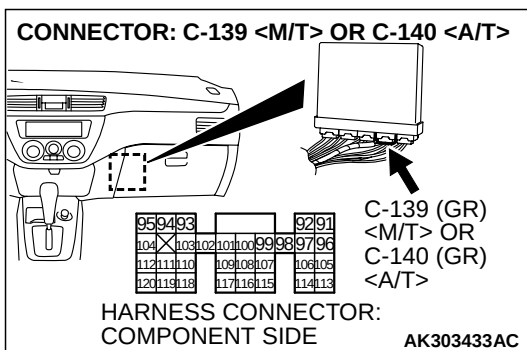
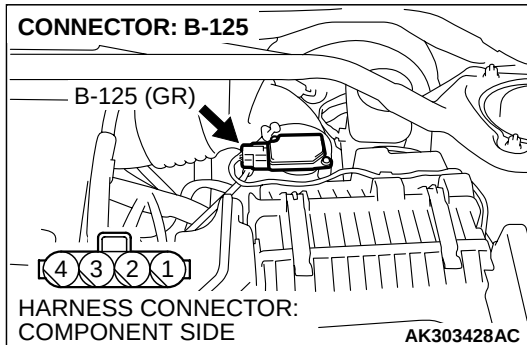
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 8.

**STEP 5. Check for open circuit between mass airflow sensor connector B-125 (terminal No. 4) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

**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 12: Mass Airflow Sensor.**

**⚠ CAUTION**

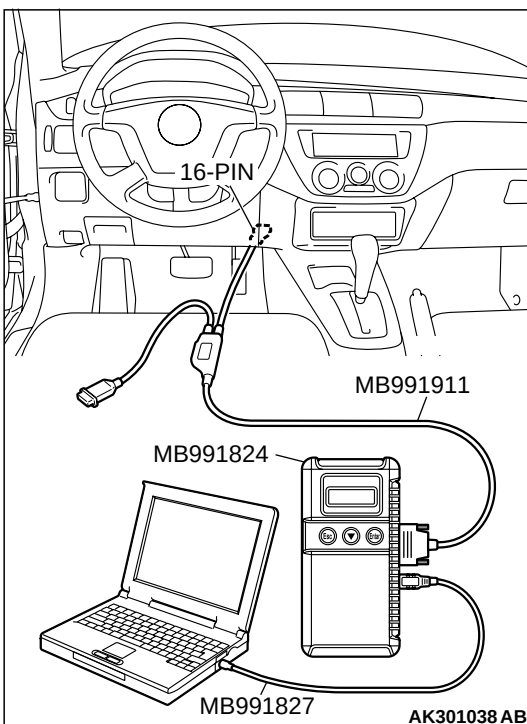
**To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.**

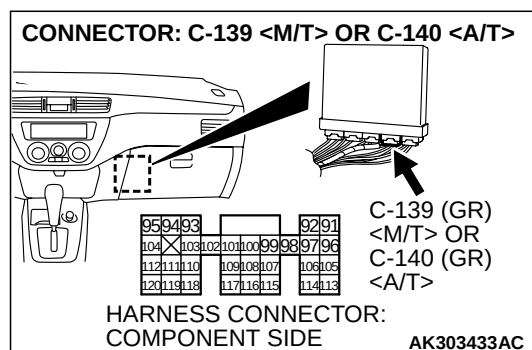
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 12, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 85°C to 95°C (185°F to 203°F).
  - The standard value during idling should be between 2.0 and 6.0 g/sec.
  - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
- (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 [P.00-6](#).

**NO :** Replace the ECM or PCM. Then go to Step 8.





**STEP 7. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Replace the mass airflow sensor. Then go to Step 8.

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

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

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

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

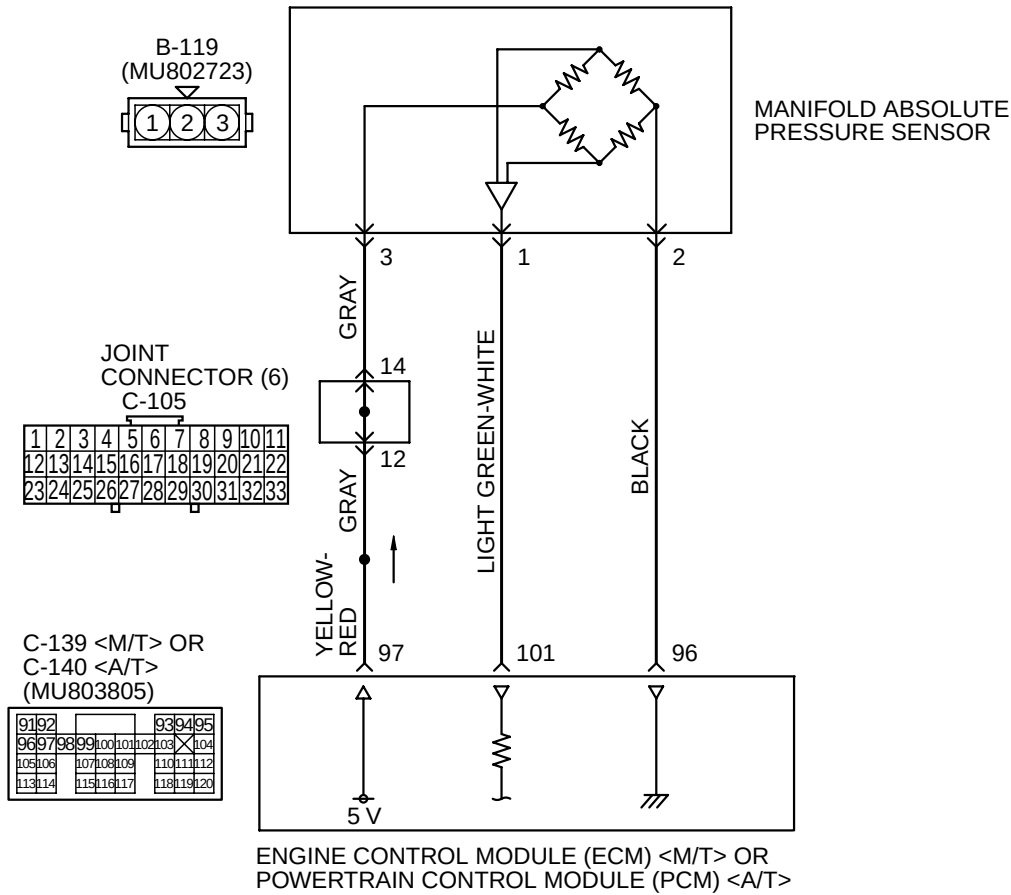
**Q: Is DTC P0103 set?**

**YES :** Retry the troubleshooting.

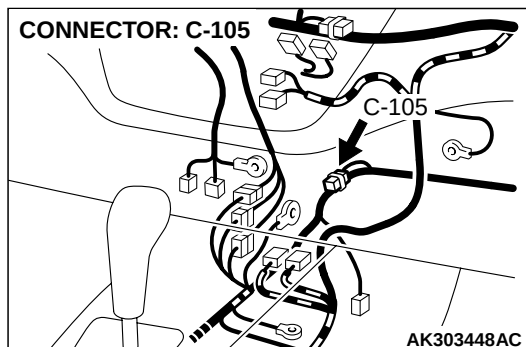
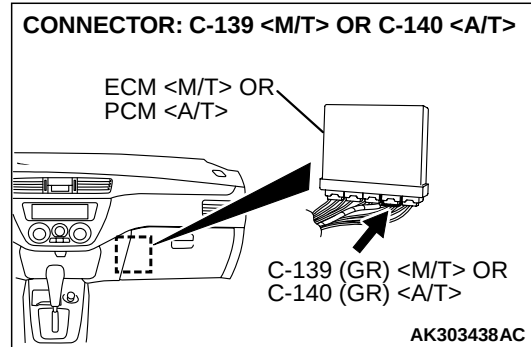
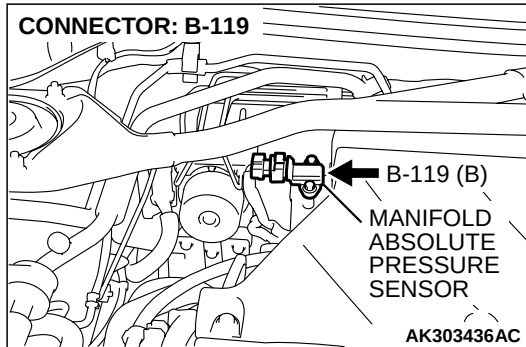
**NO :** The inspection is complete.

DTC P0106: Manifold Absolute Pressure Circuit Range/Performance Problem

Manifold Absolute Pressure Sensor Circuit



AK303980



**CIRCUIT OPERATION**

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the ECM <M/T> or PCM <A/T> (terminal No. 97). The ground terminal (terminal No. 2) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM <M/T> or PCM <A/T> (terminal No. 101) from the manifold absolute pressure sensor output terminal (terminal No. 1).

**TECHNICAL DESCRIPTION**

- The manifold absolute pressure sensor outputs a voltage which corresponds to the intake manifold pressure.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

Compare load value with manifold absolute pressure sensor output voltage.

**MONITOR EXECUTION**

Continuous

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

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

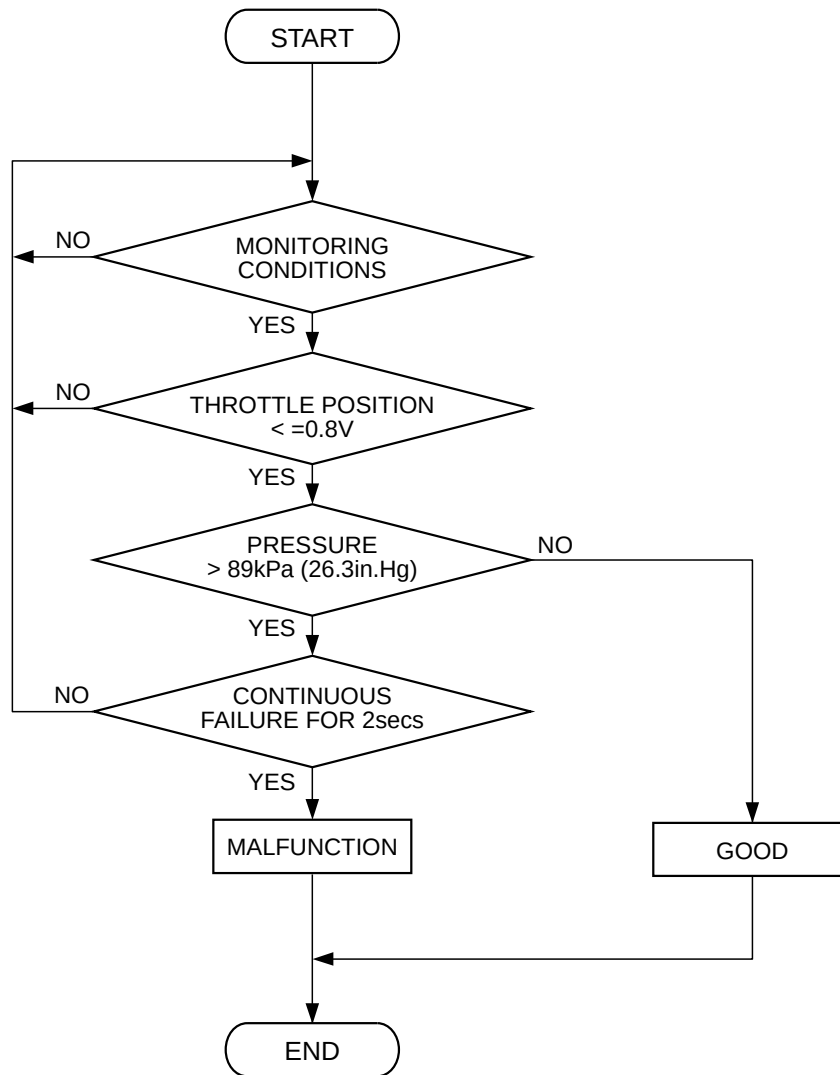
- Not applicable

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

- Engine coolant temperature sensor
- Throttle position sensor

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

Logic Flow Chart



AK302009

**Check Conditions**

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

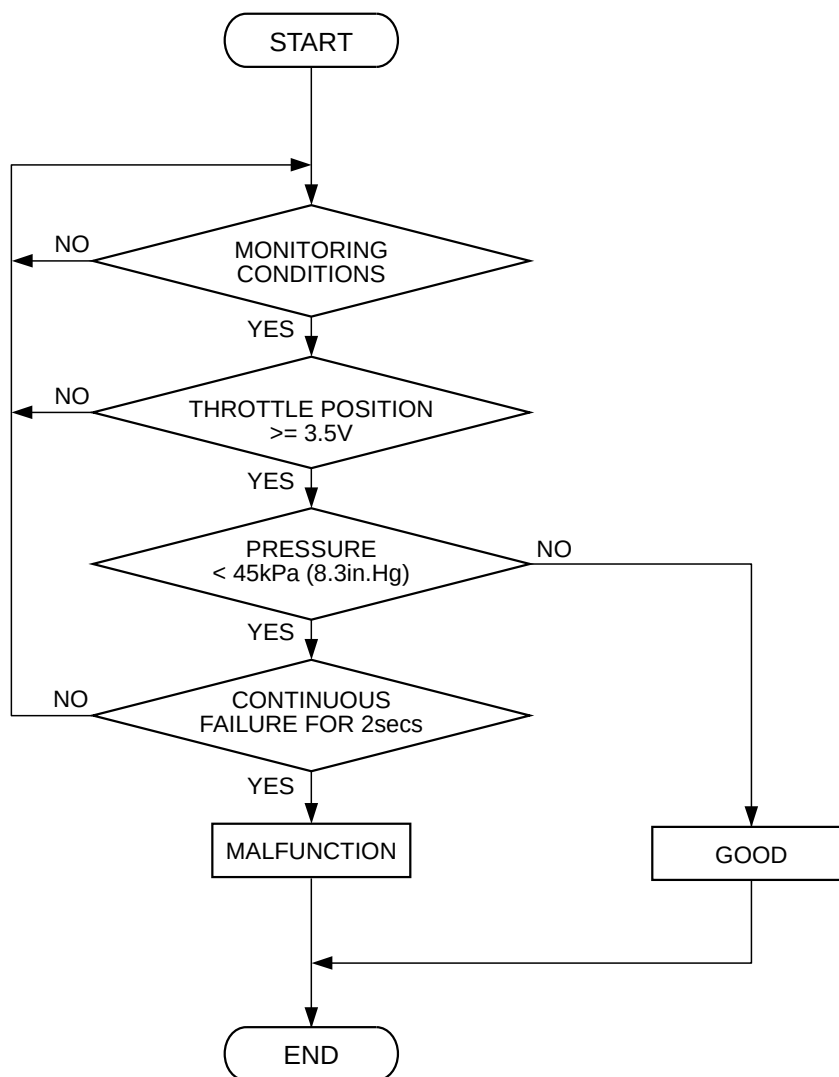
- Throttle position sensor output voltage is 0.8 volt or lower.

**Judgement Criteria**

- Manifold Absolute pressure is 89 kPa (26.3 in.Hg) or higher for 2 seconds.

## DTC SET CONDITIONS &lt;Range/Performance problem – low input&gt;

## Logic Flow Chart



AK302010

**Check Conditions**

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

**Judgement Criteria**

- Manifold absolute pressure is 45 kPa (8.3 in.Hg) or lower for 2 seconds.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Manifold absolute pressure sensor failed.
- Harness damage.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

### STEP 1. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.

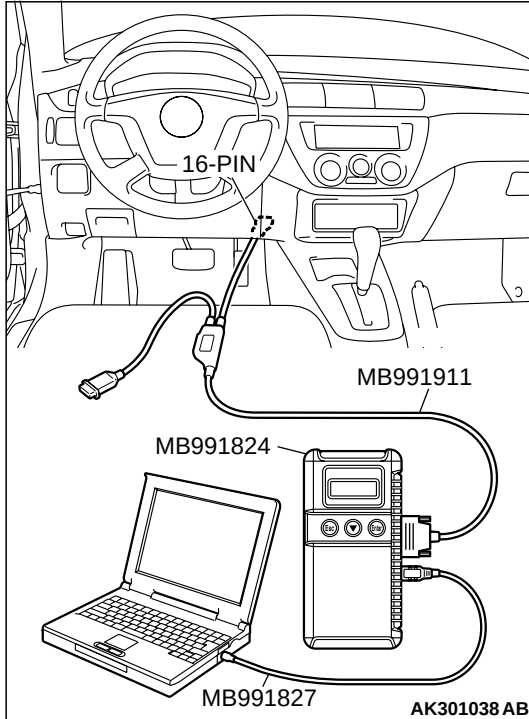
#### **⚠ CAUTION**

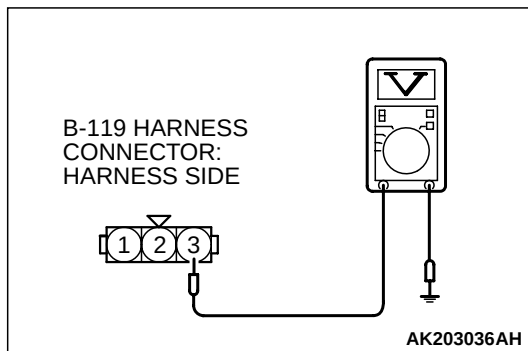
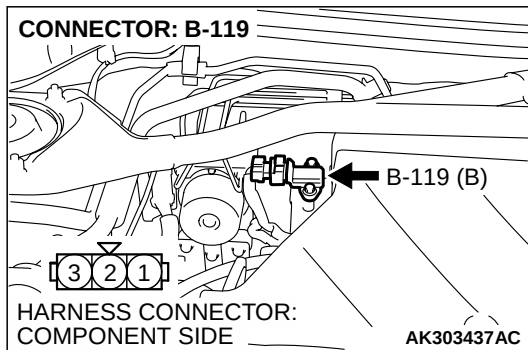
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
  - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
  - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine.
  - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
  - When the engine is suddenly revved, manifold absolute pressure increases.
- (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 [P.00-6](#).
- NO** : Go to Step 2.





**STEP 2. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-119 by backprobing.**

- (1) Do not disconnect the connector B-119.
- (2) Turn the ignition switch to the "ON" position.

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

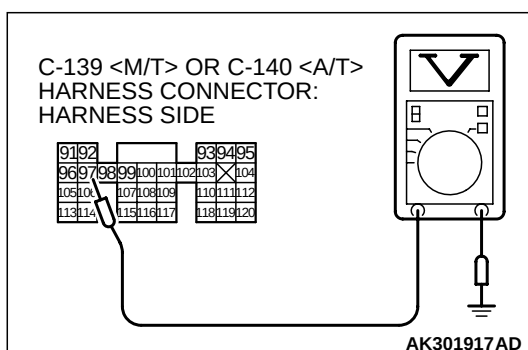
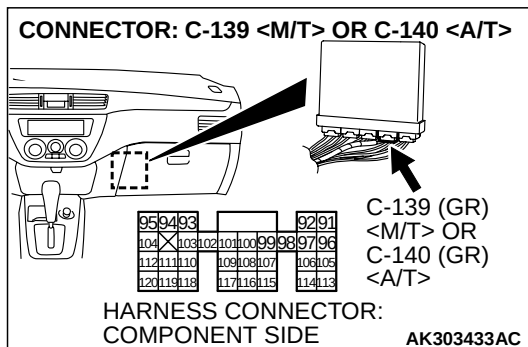
- Voltage should be between 4.8 and 5.2 volts.

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

**Q: Is the measured voltage between 4.8 and 5.2 volts?**

**YES :** Go to Step 6.

**NO :** Go to Step 3.



**STEP 3. Measure the sensor supply voltage at ECM connector C-139 <M/T> or PCM connector C-140 <A/T> by backprobing.**

- (1) Do not disconnect the connector C-139 <M/T> or C-140 <A/T>.

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

- (3) Measure the voltage between terminal No. 97 and ground by backprobing.

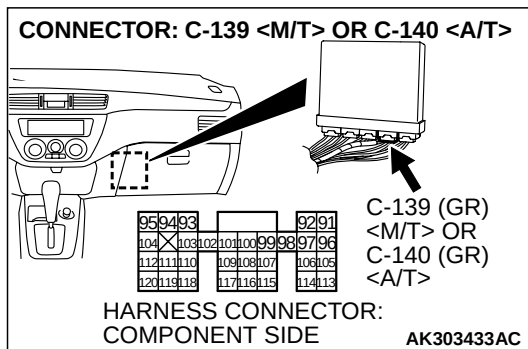
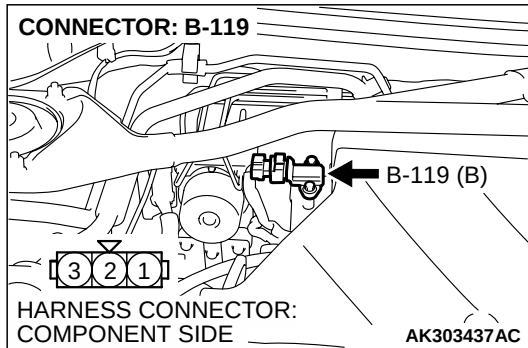
- Voltage should be between 4.8 and 5.2 volts.

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

**Q: Is the measured voltage between 4.8 and 5.2 volts?**

**YES :** Go to Step 4.

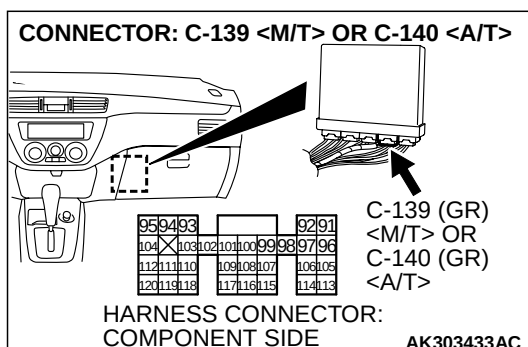
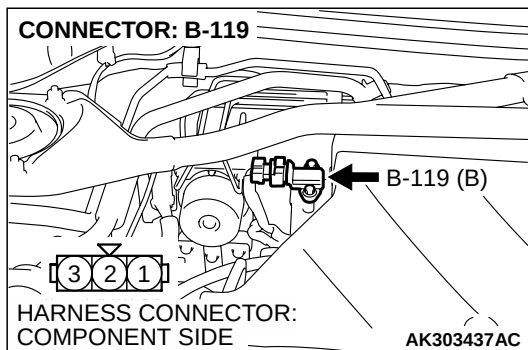
**NO :** Go to Step 5.



**STEP 4. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

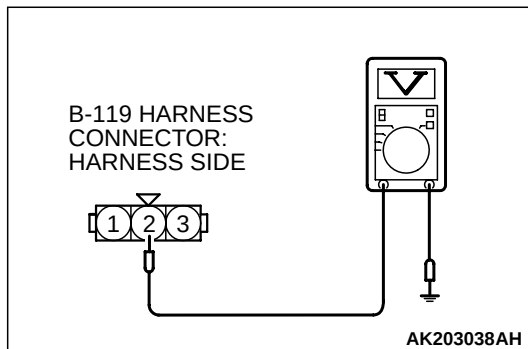
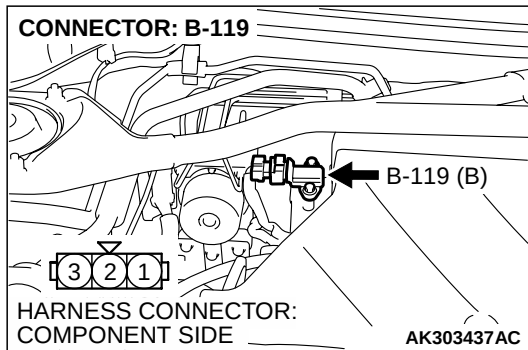
- YES :** Check harness connector C-105 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between manifold absolute pressure sensor connector B-119 (terminal No. 3) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 97) because of open circuit or harness damage. Then go to Step 12.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



**STEP 5. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

- YES :** Replace the ECM or PCM. 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 6. Measure the ground voltage at manifold absolute pressure sensor connector B-119 by backprobing.**

- (1) Do not disconnect the connector B-119.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 2 and ground by backprobing.

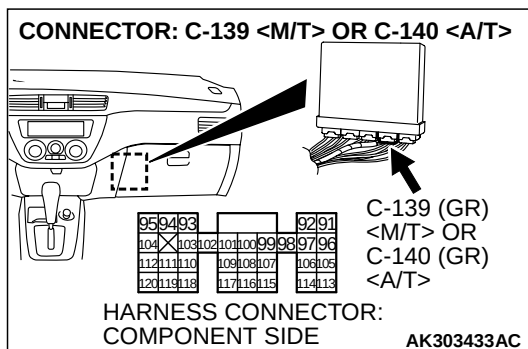
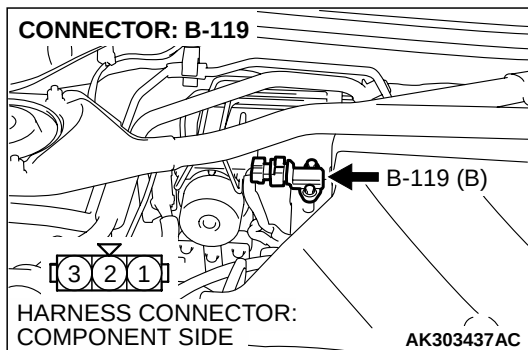
- Voltage should be 0.5 volt or less.

- (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-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 8.

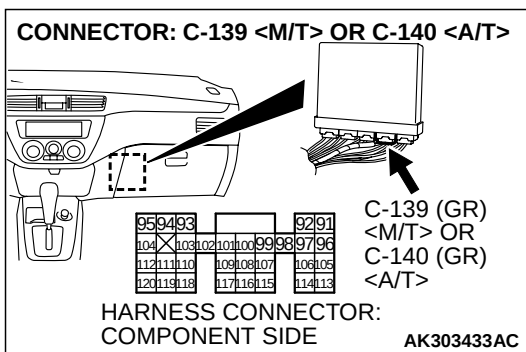
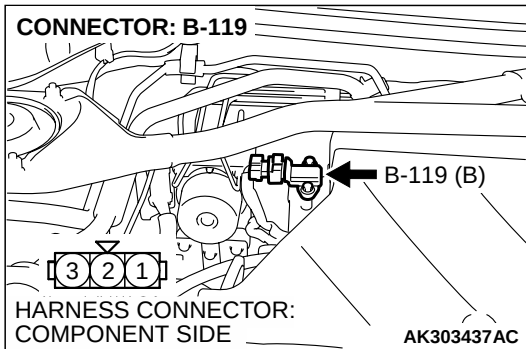
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

**STEP 8. Check for harness damage between manifold absolute pressure sensor connector B-119 (terminal No. 2) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

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

**YES :** Replace the ECM or PCM. Then go to Step 12.

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

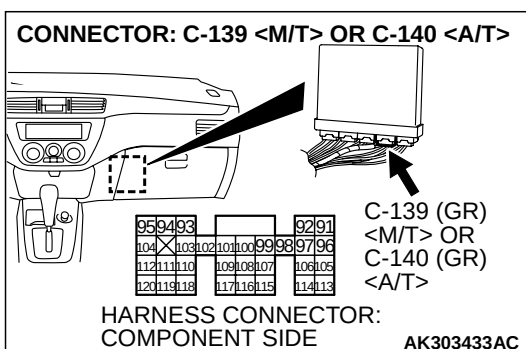
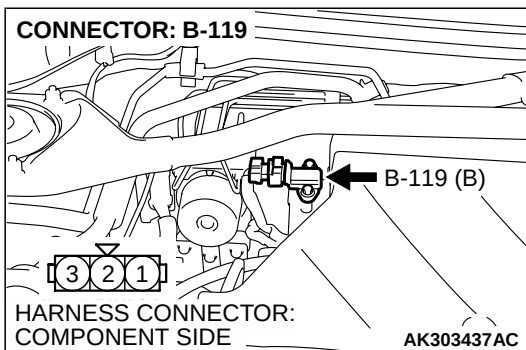


**STEP 9. Check harness connector B-119 at manifold absolute pressure sensor for damage.**

**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.

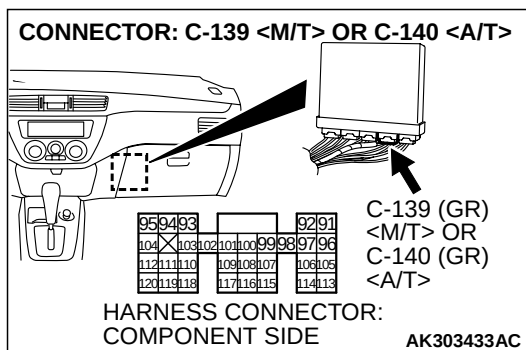
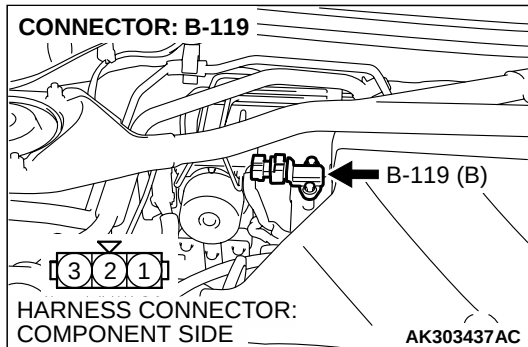


**STEP 10. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

**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 12.



**STEP 11. Check for short circuit to ground and harness damage between manifold absolute pressure sensor connector B-119 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 101).**  
**Q: Is the harness wire in good condition?**

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

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

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

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

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

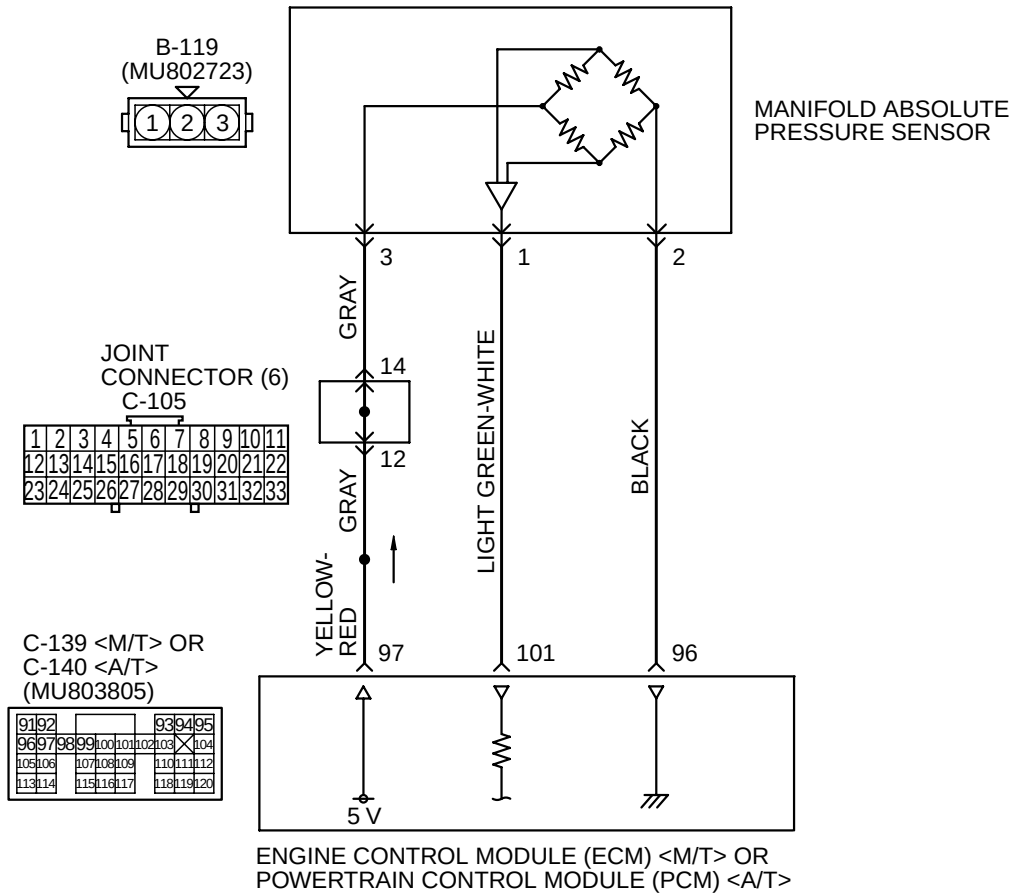
**Q: Is DTC P0106 set?**

**YES :** Retry the troubleshooting.

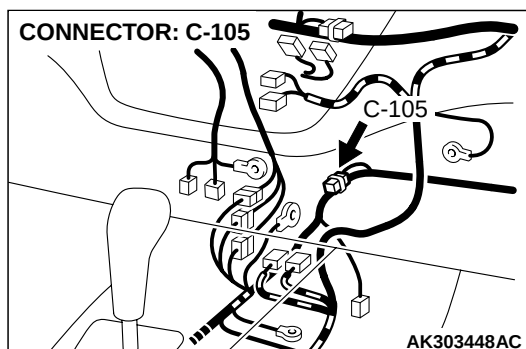
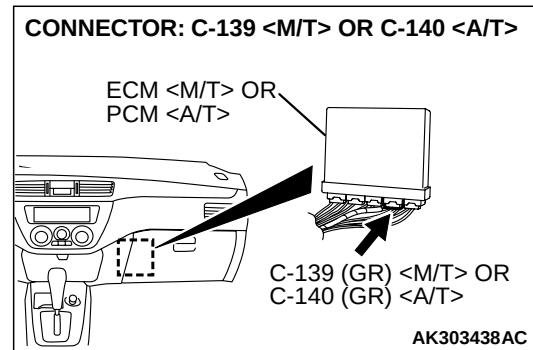
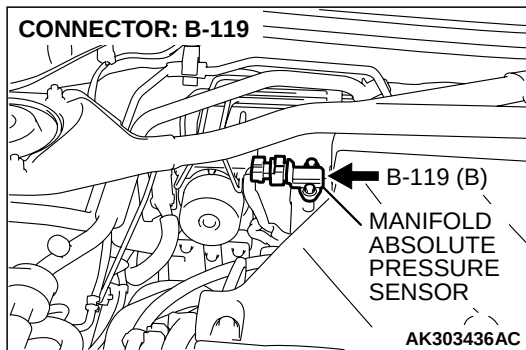
**NO :** The inspection is complete.

DTC P0107: Manifold Absolute Pressure Circuit Low Input

Manifold Absolute Pressure Sensor Circuit



AK303980



**CIRCUIT OPERATION**

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the ECM <M/T> or PCM <A/T> (terminal No. 97). The ground terminal (terminal No. 2) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM <M/T> or PCM <A/T> (terminal No. 101) from the manifold absolute pressure sensor output terminal (terminal No. 1).

**TECHNICAL DESCRIPTION**

- The manifold absolute pressure sensor outputs a voltage which corresponds to the intake manifold pressure.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

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

**MONITOR EXECUTION**

Continuous

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

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

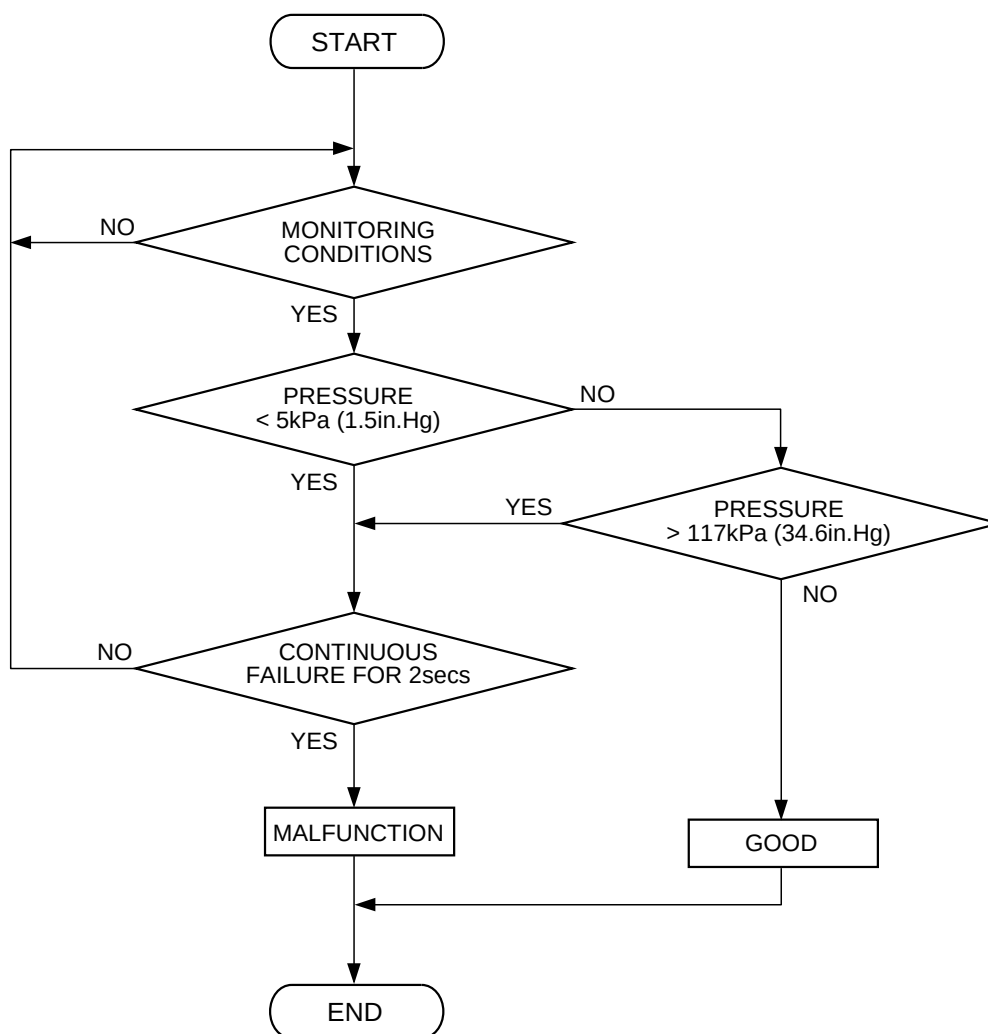
- Not applicable

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

- Engine coolant temperature sensor
- Throttle position sensor

## DTC SET CONDITIONS

### Logic Flow Chart



AK302011

#### Check Conditions

- 8 minutes or more have passed since the starting sequence was completed, when the engine coolant temperature at engine start is 0°C (32°F) or lower.
- Throttle position sensor output voltage is 1.25 volts or higher.

#### Judgement Criteria

- Manifold Absolute pressure is 5 kPa (1.5 in.Hg) or lower for 2 seconds.

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Manifold absolute pressure sensor failed.
- Open or shorted manifold absolute pressure sensor circuit, harness damage or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

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

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

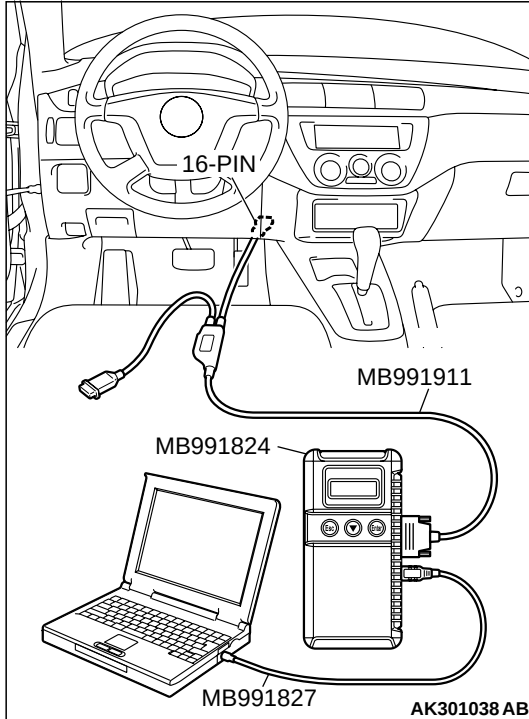
**STEP 1. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.****⚠ CAUTION**

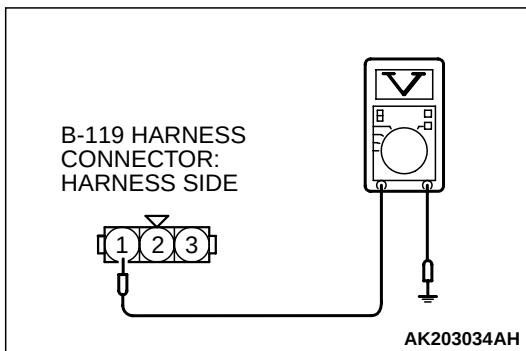
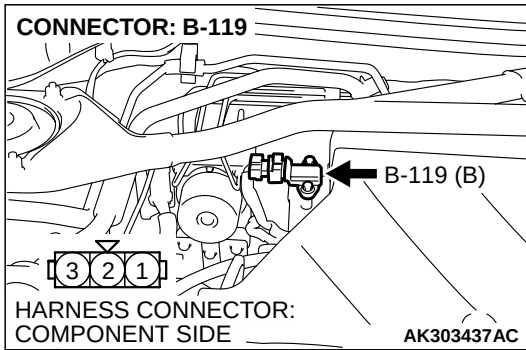
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 95, Manifold absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
  - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
  - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine.
  - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
  - When the engine is suddenly revved, manifold absolute pressure increases.
- (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 [P.00-6](#).
- NO :** Go to Step 2.





**STEP 2. Measure the sensor output voltage at Manifold absolute pressure sensor connector B-119 by backprobing.**

- (1) Do not disconnect the connector B-119.
- (2) Turn the ignition switch to the "ON" position.

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

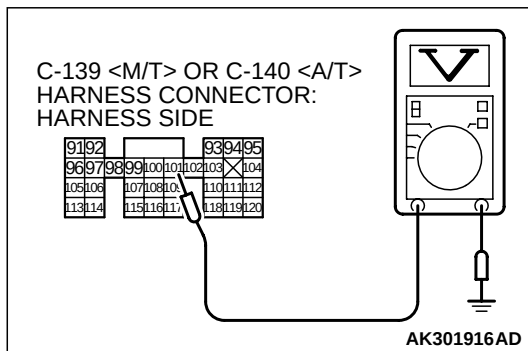
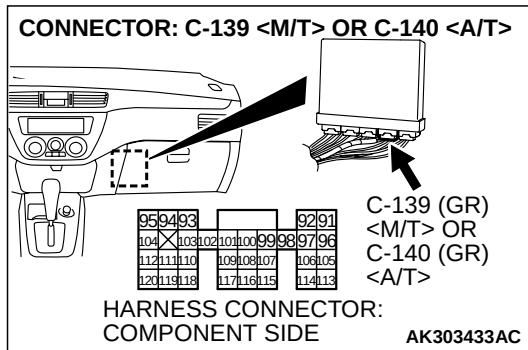
- When altitude is 0 m (0 foot), voltage should be 3.7 and 4.3 volts.
- When altitude is 600 m (1,969 feet), voltage should be 3.4 and 4.0 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be 3.2 and 3.8 volts.
- When altitude is 1,800 m (5,906 feet), voltage should be 2.9 and 3.5 volts.

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

**Q: Is the voltage normal?**

**YES :** Go to Step 3.

**NO :** Go to Step 7.



**STEP 3. Measure the sensor output voltage at ECM connector C-139 <M/T> or PCM connector C-140 <A/T> by backprobing.**

- (1) Do not disconnect the connector C-139 <M/T> or C-140 <A/T>.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 101 and ground by backprobing.
  - When altitude is 0 m (0 foot), voltage should be 3.7 and 4.3 volts.
  - When altitude is 600 m (1,969 feet), voltage should be 3.4 and 4.0 volts.
  - When altitude is 1,200 m (3,937 feet), voltage should be 3.2 and 3.8 volts.
  - When altitude is 1,800 m (5,906 feet), voltage should be 2.9 and 3.5 volts.

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

**Q: Is the voltage normal?**

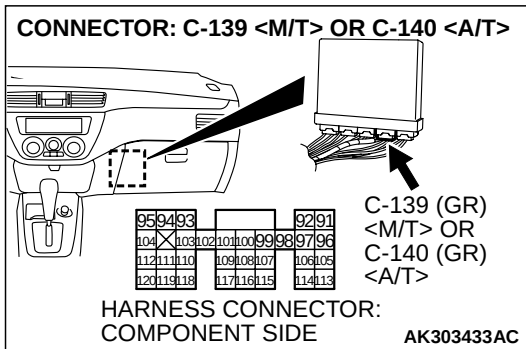
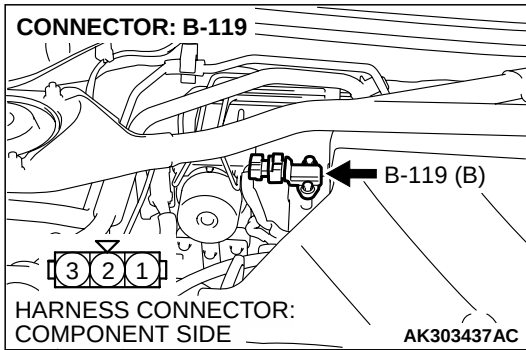
- YES :** Go to Step 4.  
**NO :** Go to Step 6.

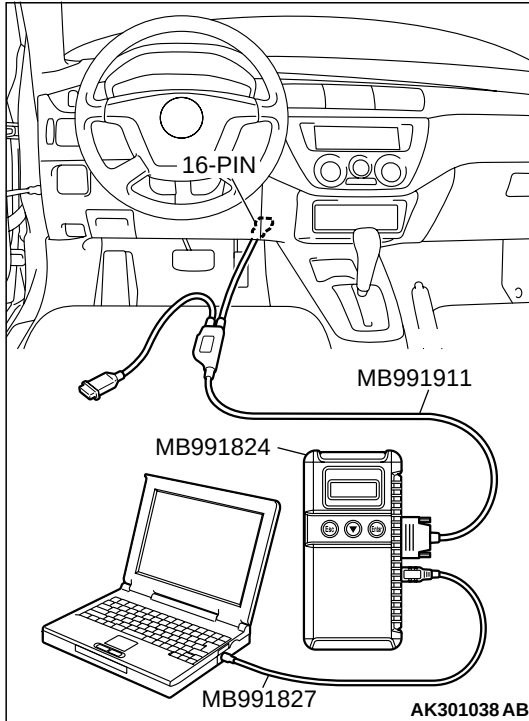
**STEP 4. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

**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 18.





**STEP 5. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.**

**⚠ CAUTION**

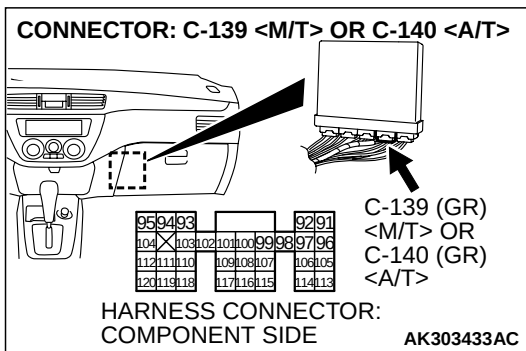
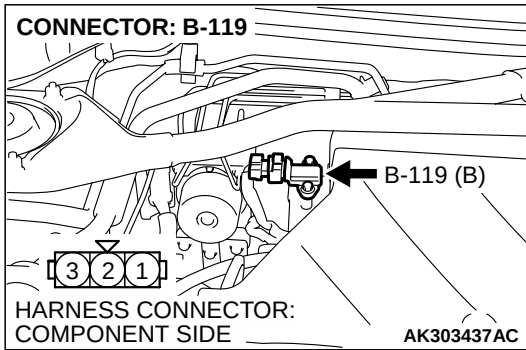
**To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.**

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
  - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
  - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine.
  - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
  - When the engine is suddenly revved, manifold absolute pressure increases.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

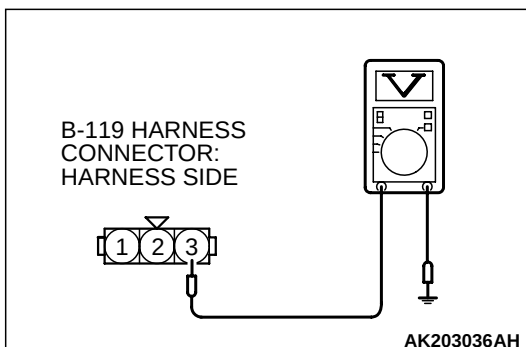
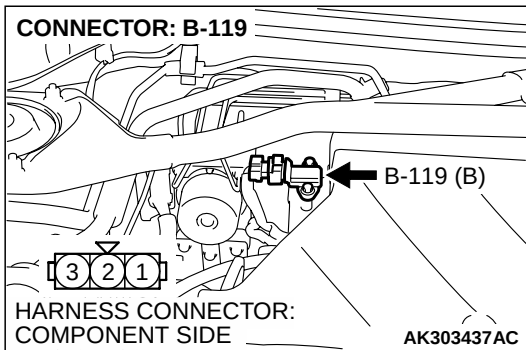
**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Replace the ECM or PCM. Then go to Step 18.



**STEP 6. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> at PCM for damage.**  
**Q: Is the harness connector in good condition?**

- YES :** Repair harness wire between manifold absolute pressure sensor connector B-119 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 101) because of open circuit or harness damage. Then go to Step 18.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 18.



**STEP 7. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-119 by backprobing.**

- (1) Do not disconnect the connector B-119.
- (2) Turn the ignition switch to the "ON" position.

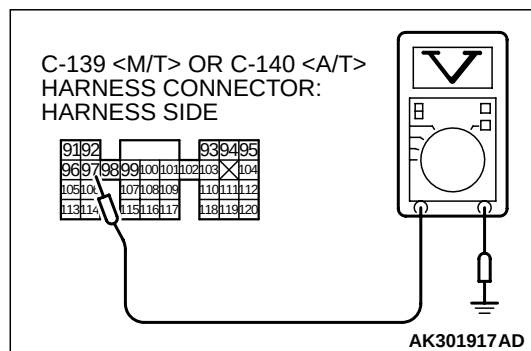
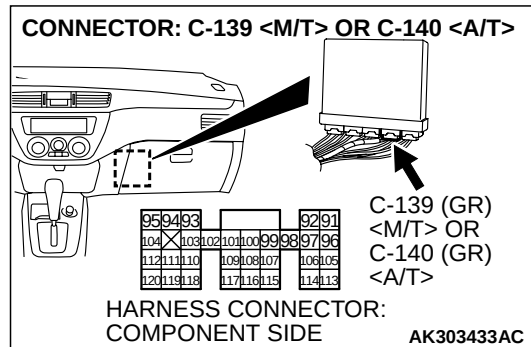
- (3) Measure the voltage between terminal No. 3 and ground by backprobing.

- Voltage should be between 4.8 and 5.2 volts.

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

**Q: Is the measured voltage between 4.8 and 5.2 volts?**

- YES :** Go to Step 12.
- NO :** Go to Step 8.



**STEP 8. Measure the sensor supply voltage at ECM connector C-139 <M/T> or PCM connector C-140 <A/T> by backprobing.**

- (1) Do not disconnect the connector C-139 <M/T> or C-140 <A/T>.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 97 and ground by backprobing.

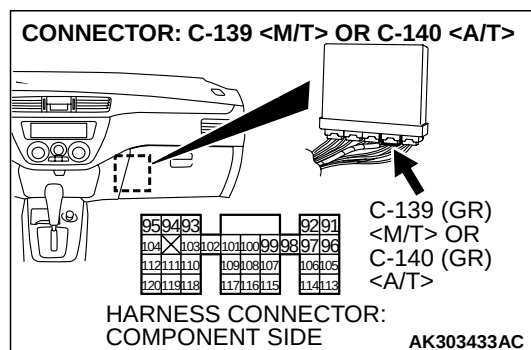
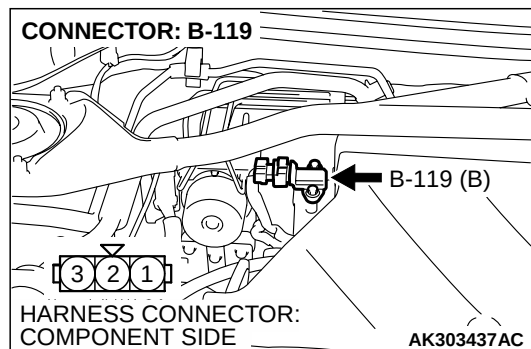
- Voltage should be between 4.8 and 5.2 volts.

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

**Q: Is the measured voltage between 4.8 and 5.2 volts?**

**YES :** Go to Step 9.

**NO :** Go to Step 10.



**STEP 9. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Check harness connector C-105 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 manifold absolute pressure sensor connector B-119 (terminal No. 3) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 97) because of open circuit or harness damage. Then go to Step 18.

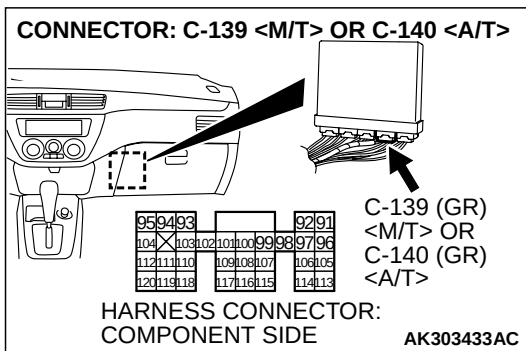
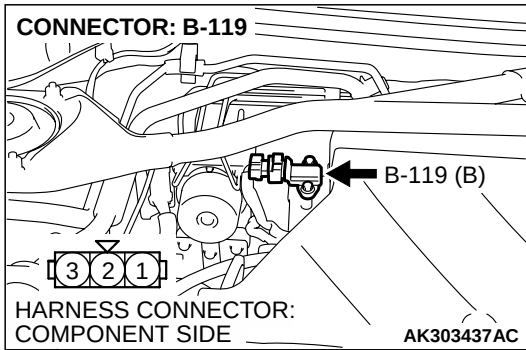
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 18.

**STEP 10. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

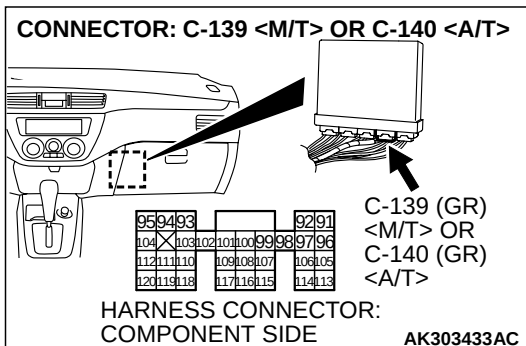
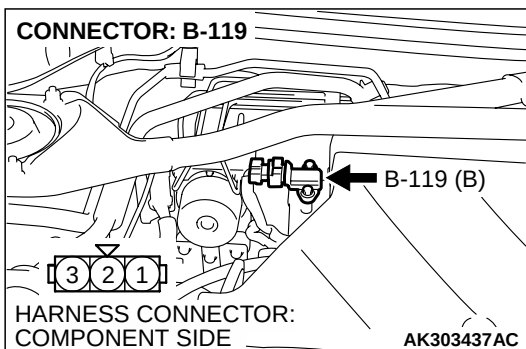
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 11.

**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 18.



**STEP 11. Check for short circuit to ground between manifold absolute pressure sensor connector B-119 (terminal No. 3) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 97).**



*NOTE: Check harness after checking intermediate connector C-105. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 18.*

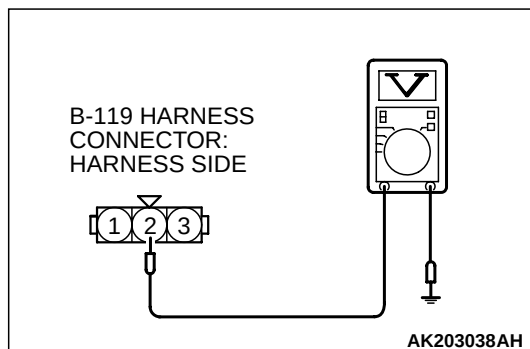
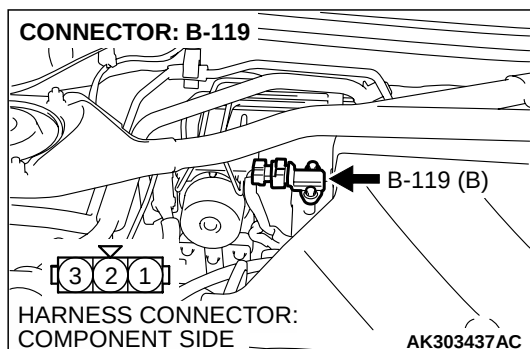
**Q: Is the harness wire in good condition?**

**YES :** Replace the ECM or PCM. Then go to Step 18.

**NO :** Repair it. Then go to Step 18.

**STEP 12. Measure the ground voltage at manifold absolute pressure sensor connector B-119 by backprobing.**

- (1) Do not disconnect the connector B-119.
- (2) Turn the ignition switch to the "ON" position.



- (3) Measure the voltage between terminal No. 2 and ground by backprobing.

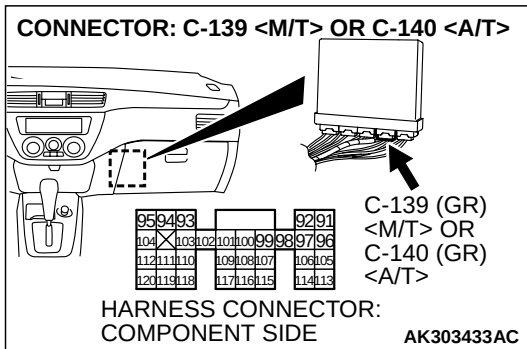
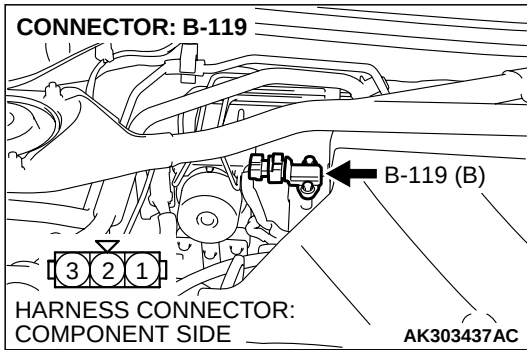
- Voltage should be 0.5 volt or less.

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

**Q: Is the measured voltage 0.5 volt or less?**

**YES :** Go to Step 15.

**NO :** Go to Step 13.

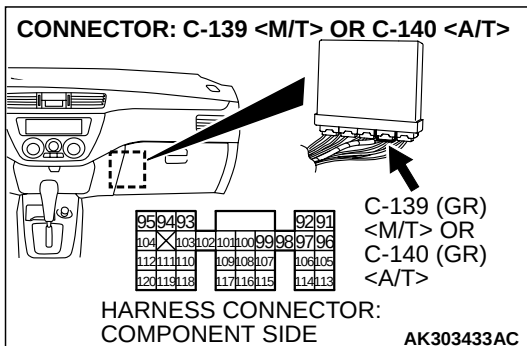
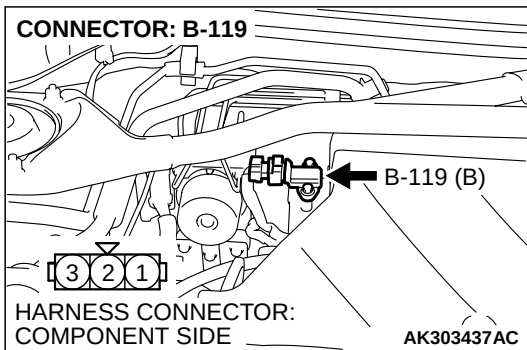


**STEP 13. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

**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 18.

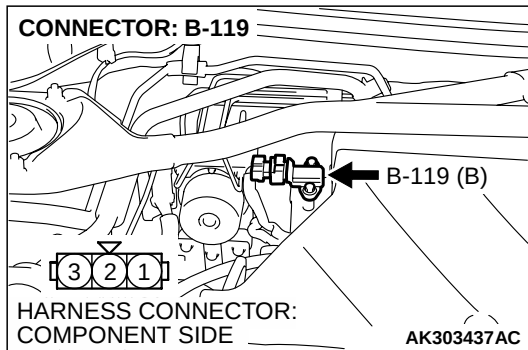


**STEP 14. Check for harness damage between manifold absolute pressure sensor connector B-119 (terminal No. 2) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

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

**YES :** Replace the ECM or PCM. Then go to Step 18.

**NO :** Repair it. Then go to Step 18.

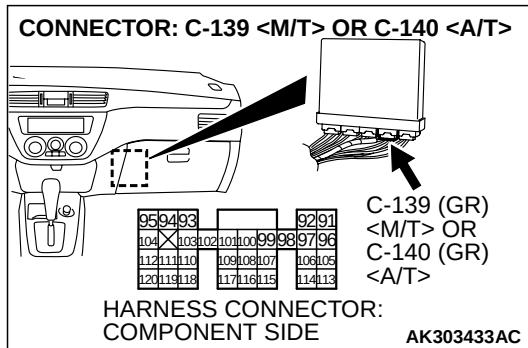


**STEP 15. Check harness connector B-119 at manifold absolute pressure sensor for damage.**

**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 18.

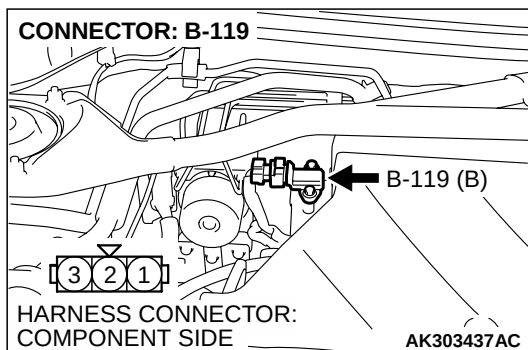


**STEP 16. Check harness connector C-139 at ECM <M/T> or C-140 at PCM for damage.**

**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 18.

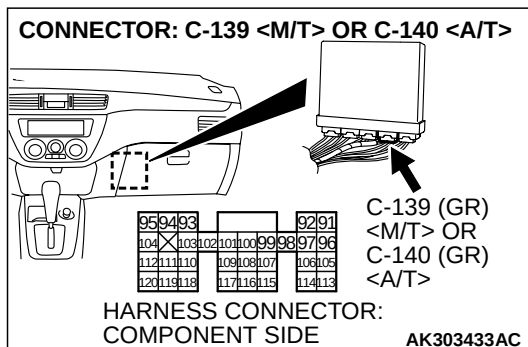


**STEP 17. Check for short circuit to ground and harness damage between manifold absolute pressure sensor connector B-119 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 (terminal No. 101).**

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

**YES :** Replace the manifold absolute pressure sensor. Then go to Step 18.

**NO :** Repair it. Then go to Step 18.



**STEP 18. Test the OBD-II drive cycle.**

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

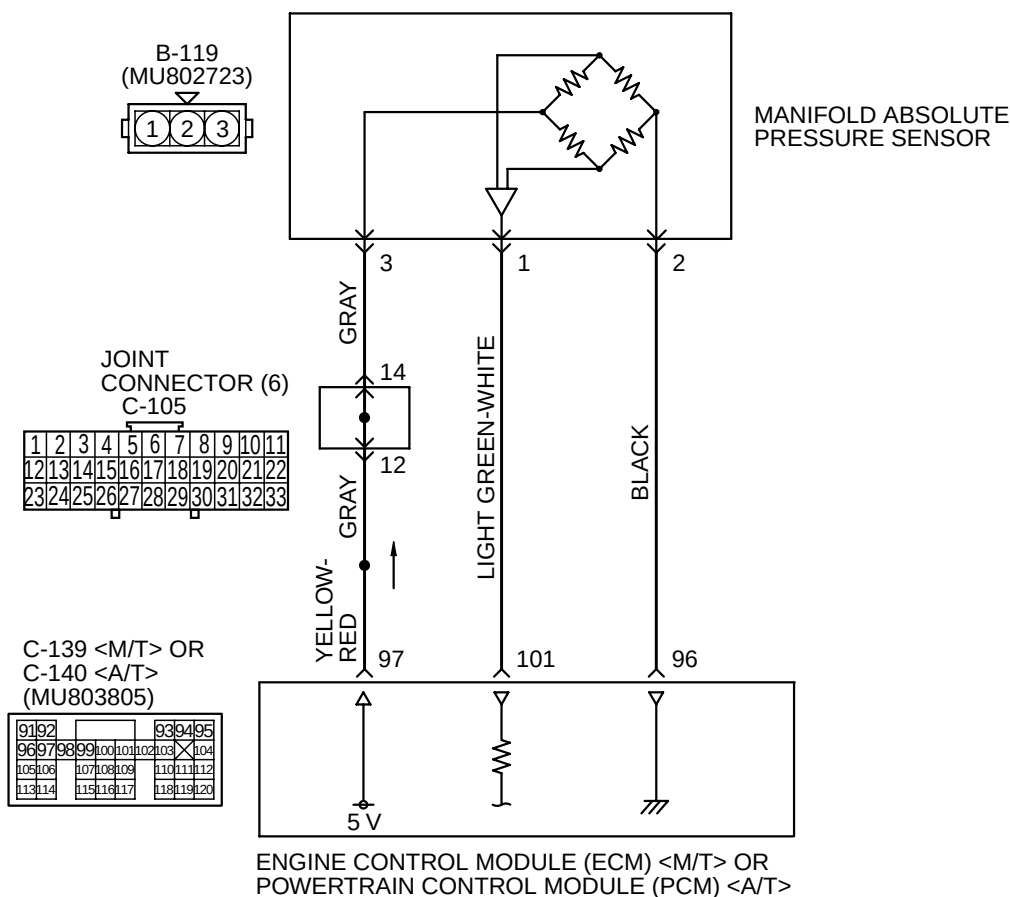
**Q: Is DTC P0107 set?**

**YES :** Retry the troubleshooting.

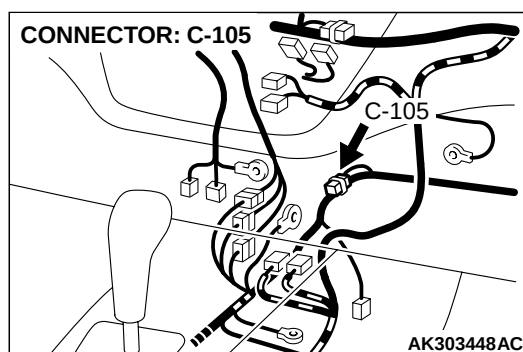
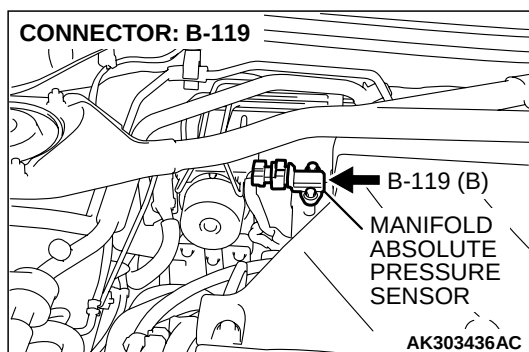
**NO :** The inspection is complete.

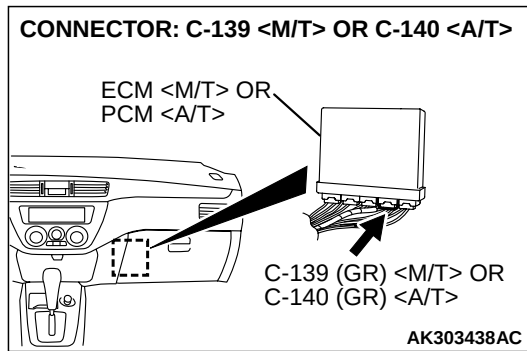
**DTC P0108: Manifold Absolute Pressure Circuit High Input**

**Manifold Absolute Pressure Sensor Circuit**



AK303980



**CIRCUIT OPERATION**

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from ECM <M/T> or PCM <A/T> (terminal No. 97). The ground terminal (terminal No. 2) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM <M/T> or PCM <A/T> (terminal No. 101) from the manifold absolute pressure sensor output terminal (terminal No. 1).

**TECHNICAL DESCRIPTION**

- The manifold absolute pressure sensor outputs a voltage which corresponds to the intake manifold pressure.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

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

**MONITOR EXECUTION**

Continuous

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

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

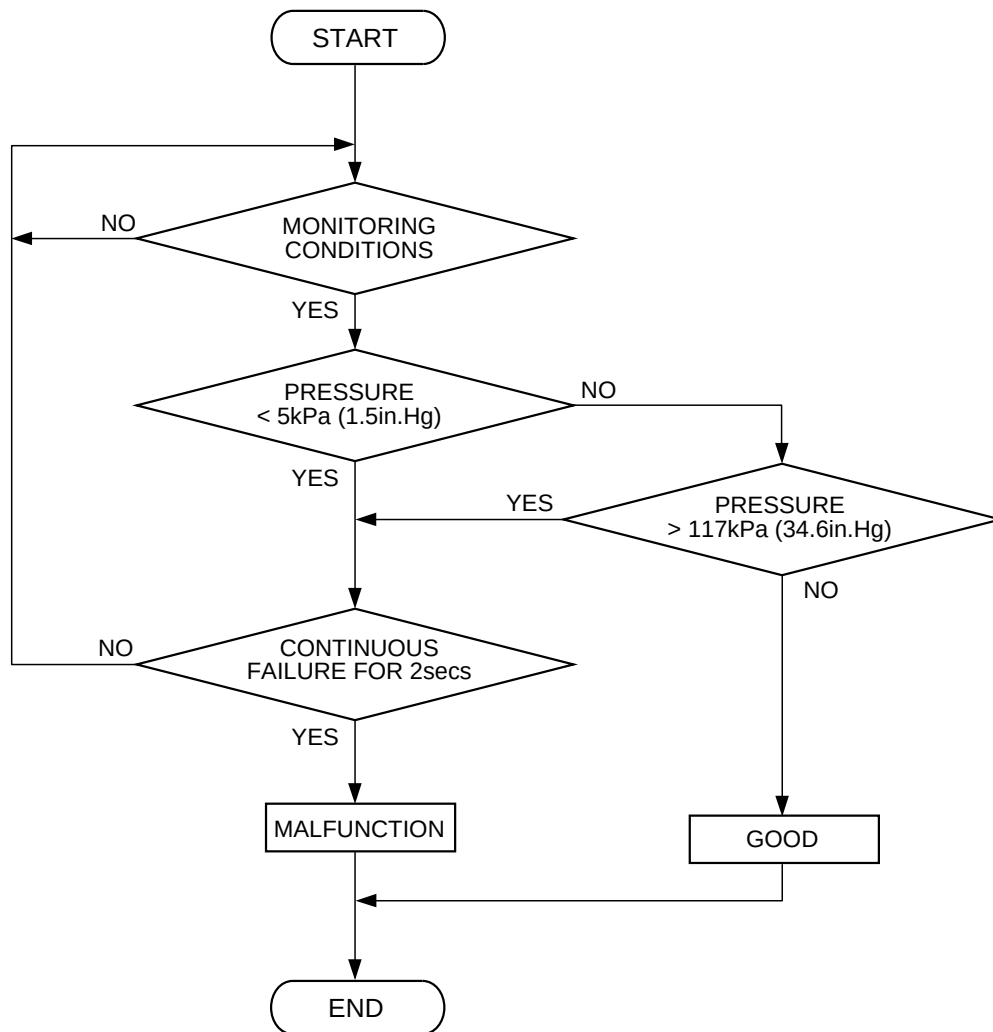
- Not applicable

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

- Engine coolant temperature sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302011

**Check Conditions**

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

**Judgement Criteria**

- Manifold absolute pressure is higher than 117 kPa (34.6 in.Hg) for 2 seconds.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Manifold Absolute pressure sensor failed.
- Open manifold absolute pressure sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

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

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

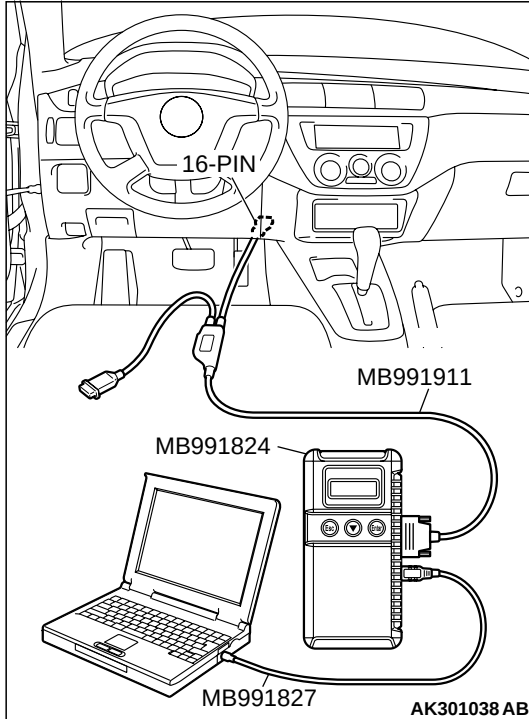
**STEP 1. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.****⚠ CAUTION**

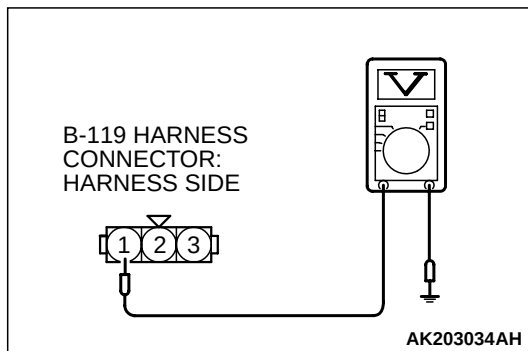
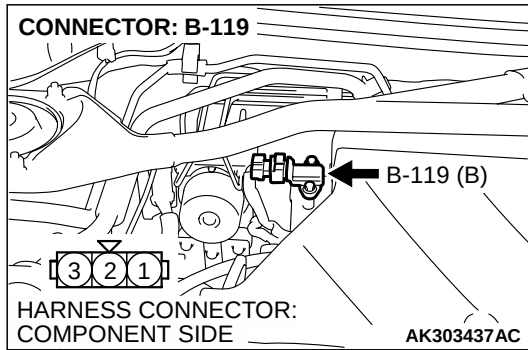
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
  - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
  - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine.
  - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
  - When the engine is suddenly revved, manifold absolute pressure increases.
- (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 [P.00-6](#).
- NO :** Go to Step 2.





**STEP 2. Measure the sensor output voltage at manifold absolute pressure sensor connector B-119 by backprobing.**

- (1) Do not disconnect the connector B-119.
- (2) Turn the ignition switch to the "ON" position.

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

- When altitude is 0 m (0 foot), voltage should be 3.7 and 4.3 volts.
- When altitude is 600 m (1,969 feet), voltage should be 3.4 and 4.0 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be 3.2 and 3.8 volts.
- When altitude is 1,800 m (5,906 feet), voltage should be 2.9 and 3.5 volts.

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

**Q: Is the voltage normal?**

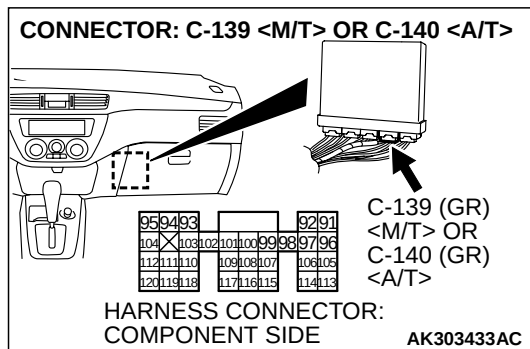
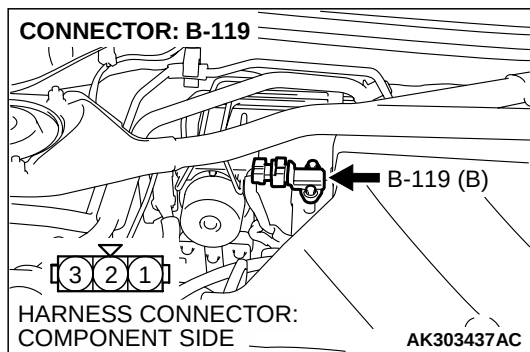
- YES :** Go to Step 3.
- NO :** Go to Step 5.

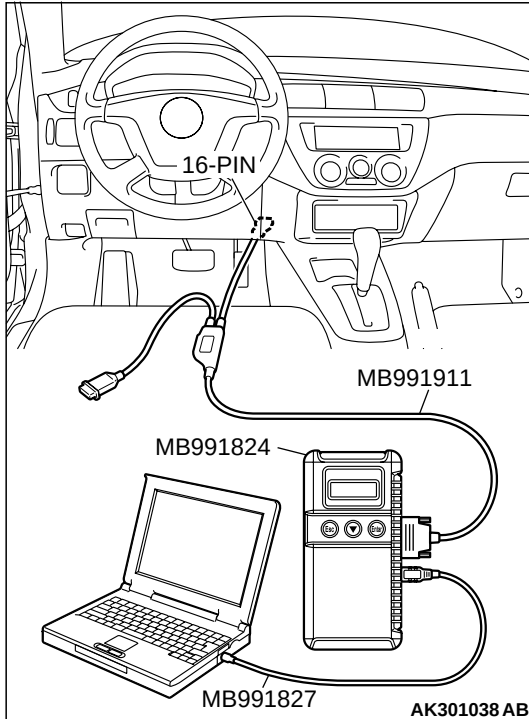
**STEP 3. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

**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. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.**

**⚠ CAUTION**

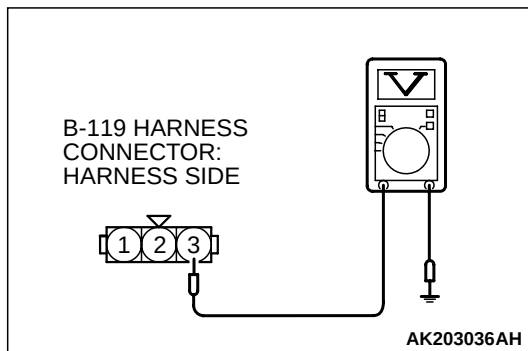
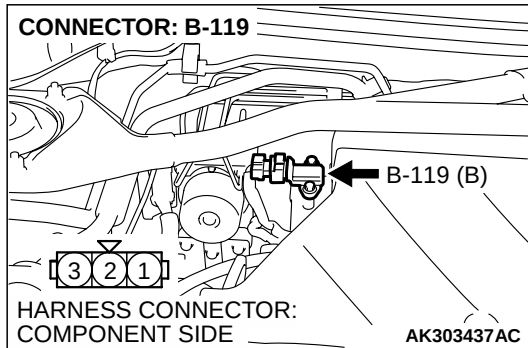
**To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.**

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
  - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
  - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine.
  - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
  - When the engine is suddenly revved, manifold absolute pressure increases.
- (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 [P.00-6](#).

**NO :** Replace the ECM or PCM. Then go to Step 12.



**STEP 5. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-119 by backprobing.**

- (1) Do not disconnect the connector B-119.
- (2) Turn the ignition switch to the "ON" position.

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

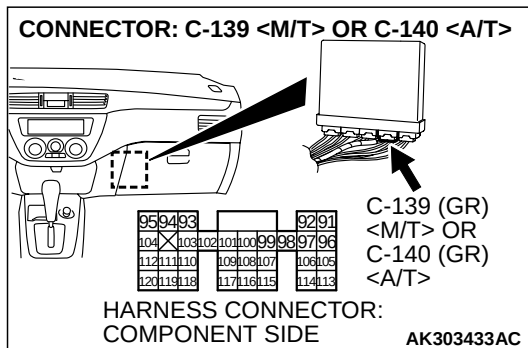
- Voltage should be between 4.8 and 5.2 volts.

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

**Q: Is the measured voltage between 4.8 and 5.2 volts?**

**YES :** Go to Step 7.

**NO :** Go to Step 6.

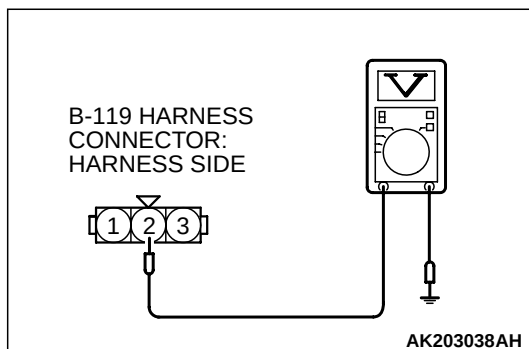
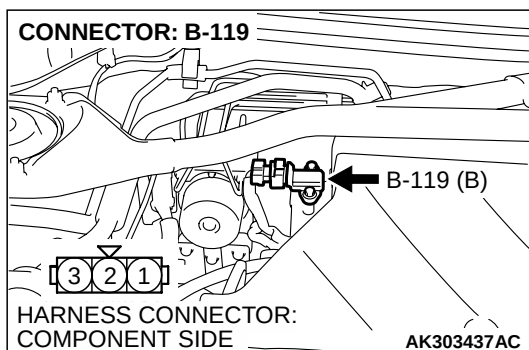


**STEP 6. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Replace the ECM or PCM. 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 7. Measure the ground voltage at manifold absolute pressure sensor connector B-119 by backprobing.**

- (1) Do not disconnect the connector B-119.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 2 and ground by backprobing.

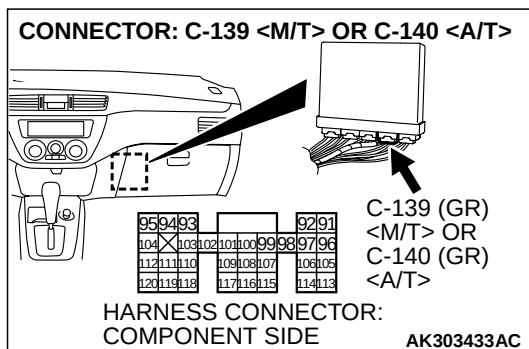
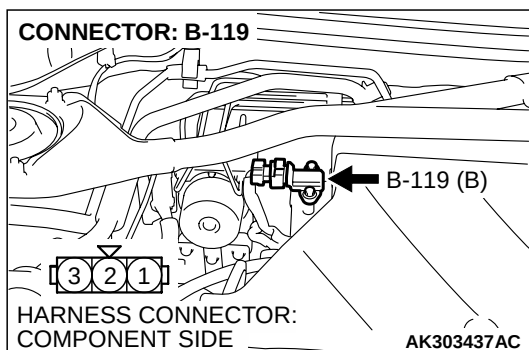
- Voltage should be 0.5 volt or less.

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

**Q: Is the measured voltage 0.5 volt or less?**

**YES :** Go to Step 10.

**NO :** Go to Step 8.



**STEP 8. Check harness connector B-119 at the manifold absolute pressure sensor and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 9.

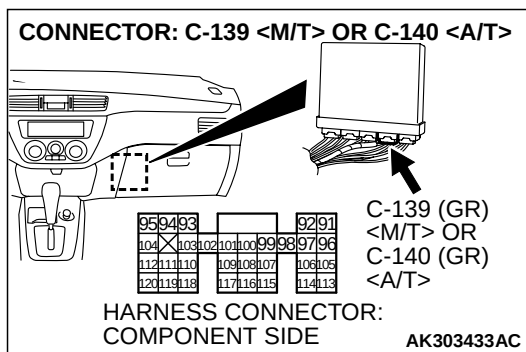
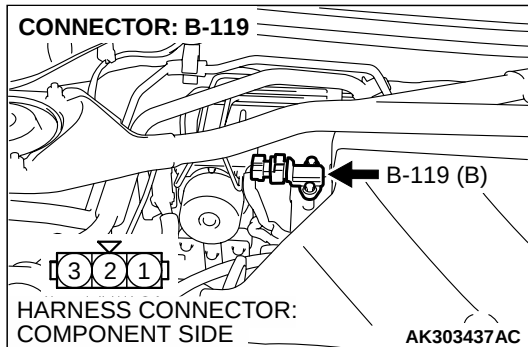
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

**STEP 9. Check for open circuit between manifold absolute pressure sensor connector B-119 (terminal No. 2) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

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

**YES :** Replace the ECM or PCM. Then go to Step 12.

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

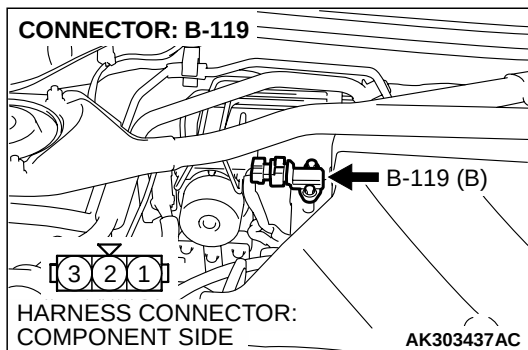


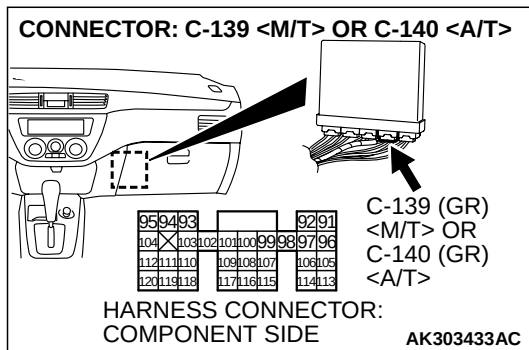
**STEP 10. Check harness connector B-119 at manifold absolute pressure sensor for damage.**

**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 12.





**STEP 11. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Replace the manifold absolute pressure sensor. 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 12. Test the OBD-II drive cycle.**

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

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

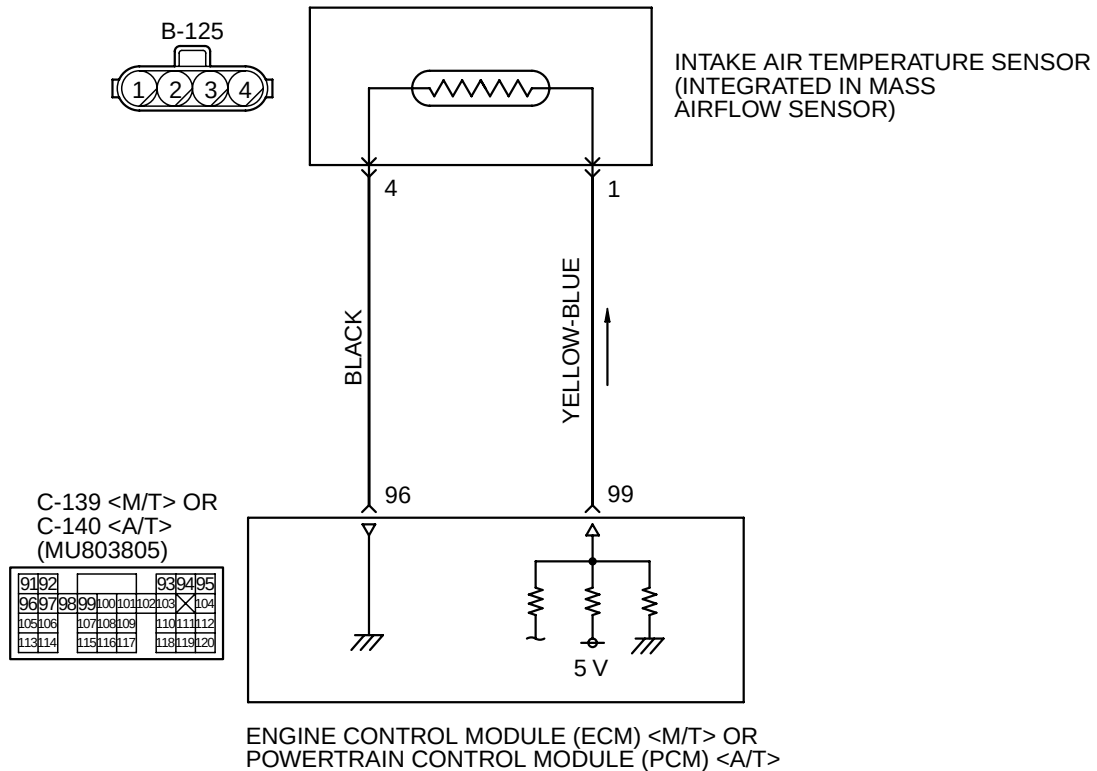
**Q: Is DTC P0108 set?**

**YES :** Retry the troubleshooting.

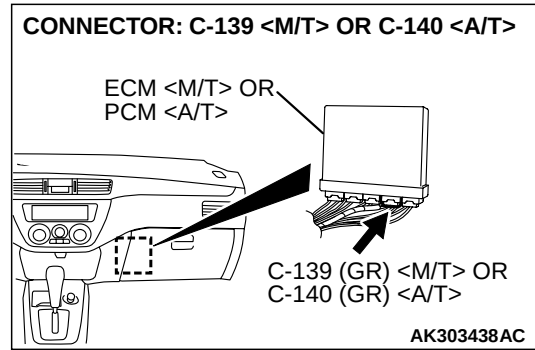
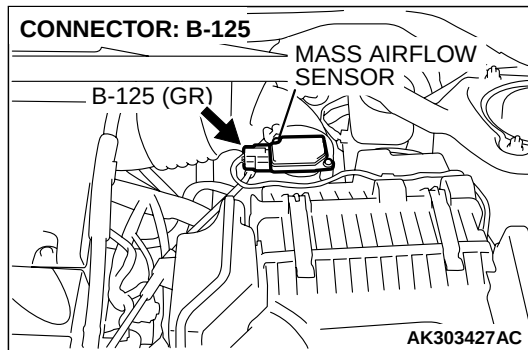
**NO :** The inspection is complete.

## DTC P0111: Intake Air Temperature Circuit Range/Performance Problem

Intake Air Temperature Sensor Circuit



AK303981



## CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM <M/T> or PCM <A/T> (terminal No. 99) via the resistor in the ECM <M/T> or PCM <A/T>. The ground terminal (terminal No. 4) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

**TECHNICAL DESCRIPTION**

- The intake air temperature sensor converts the intake air temperature to a voltage.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

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

**MONITOR EXECUTION**

Continuous

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

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

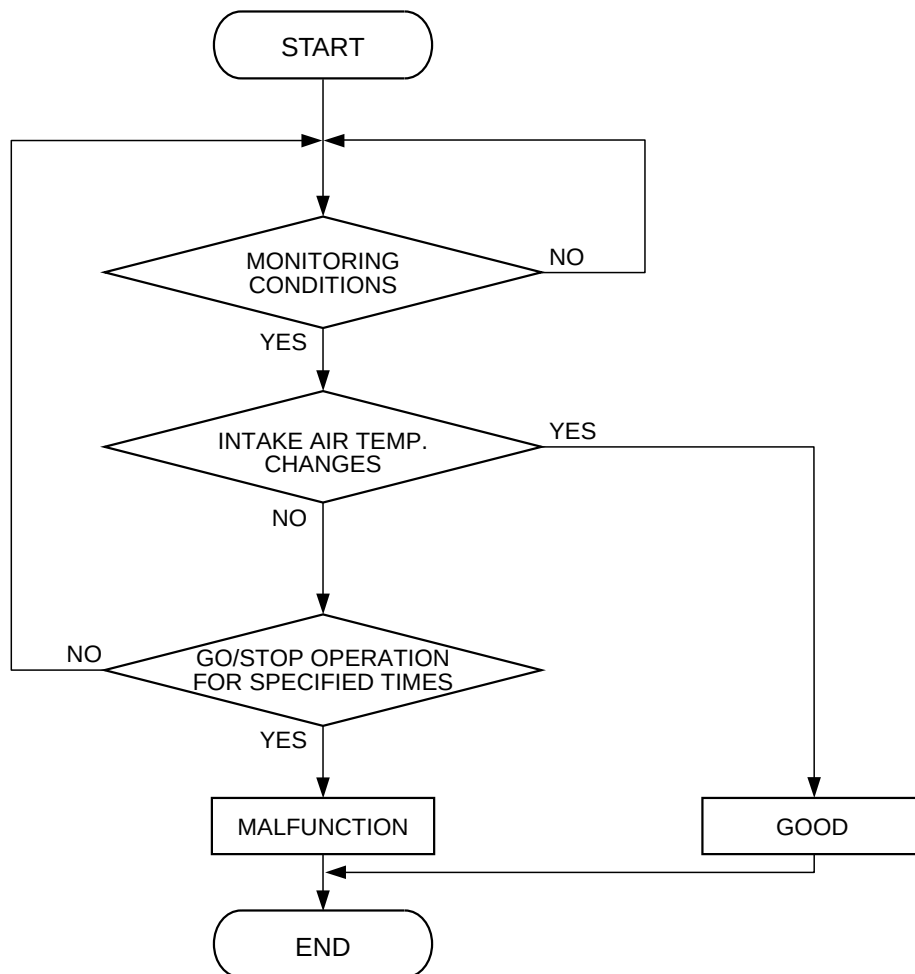
- Not applicable

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

- Not applicable

**DTC SET CONDITIONS**

**Logic Flow Chart**



AK302012

**Check Conditions**

- Engine coolant temperature is higher than 76°C (169°F).
- Repeat 5 or more times: drive<sup>\*1</sup>, stop<sup>\*2</sup>.

Drive<sup>\*1</sup>: vehicle speed higher than 50 km/h (31 mph) lasting a total of more than 60 seconds.

Stop<sup>\*2</sup>: vehicle speed lower than 1.5 km/h (1 mph) lasting more than 30 seconds.

**Judgement Criteria**

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

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle –  
Procedure 6 – Other Monitor [P.13B-6](#).

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

- Intake air temperature sensor failed.
- Open or shorted intake air temperature sensor circuit, harness damage, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

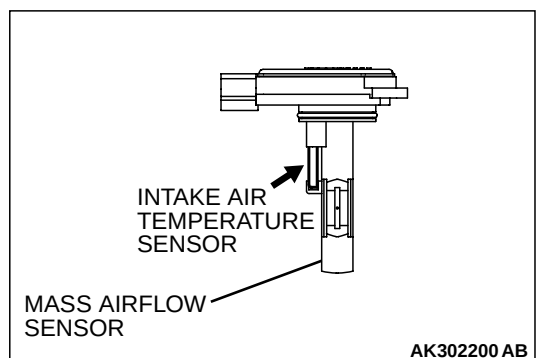
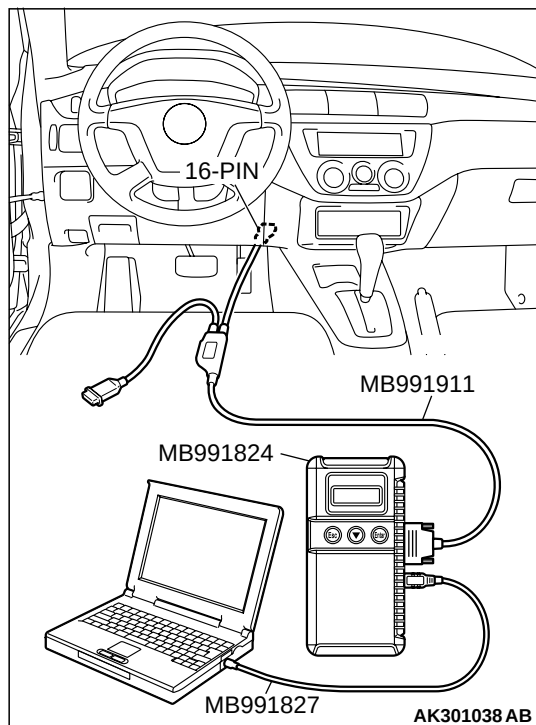
**DIAGNOSIS****Required Special Tools:**

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

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

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Remove the mass airflow sensor from the air intake hose.
- (3) Turn the ignition switch to the "ON" position.
- (4) Set scan tool MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.



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

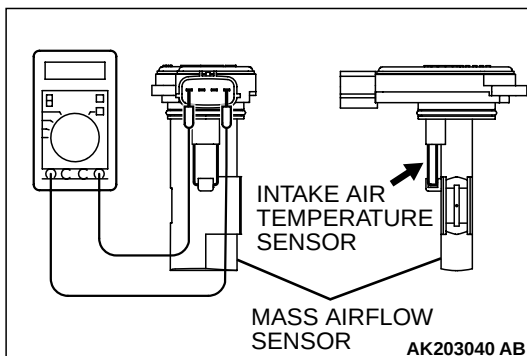
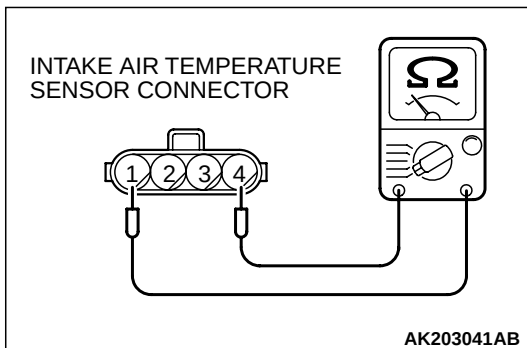
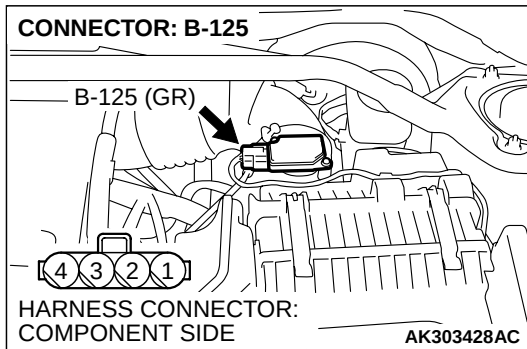
*NOTE: Do not allow it to increase over 80°C (176°F).*

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

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

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Go to Step 2.



**STEP 2. Check the intake air temperature sensor.**

(1) Disconnect the intake air temperature sensor connector B-125.

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

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

**Standard value:**

13 – 17 k $\Omega$  [at –20°C (–4°F)]

5.3 – 6.7 k $\Omega$  [at 0°C (32°F)]

2.3 – 3.0 k $\Omega$  [at 20°C (68°F)]

1.0 – 1.5 k $\Omega$  [at 40°C (104°F)]

0.56 – 0.76 k $\Omega$  [at 60°C (140°F)]

0.30 – 0.45 k $\Omega$  [at 80°C (176°F)]

**Q: Is the resistance at the standard value?**

**YES** : Go to Step 3.

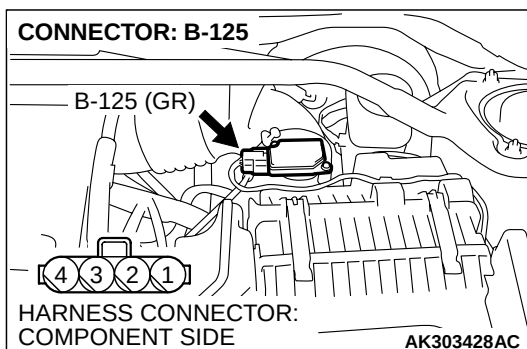
**NO** : Replace the mass airflow sensor. Then go to Step 9.

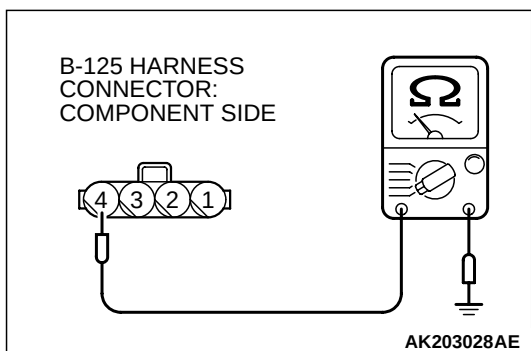
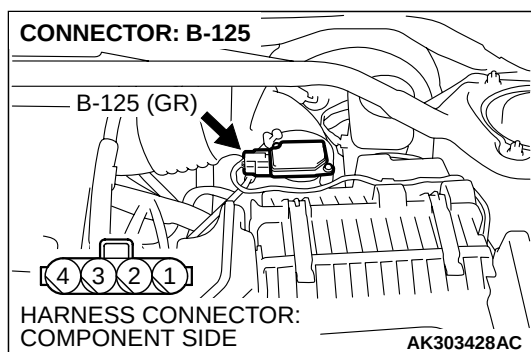
**STEP 3. Check harness connector B-125 at the intake air temperature sensor for damage.**

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

**YES** : Go to Step 4.

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





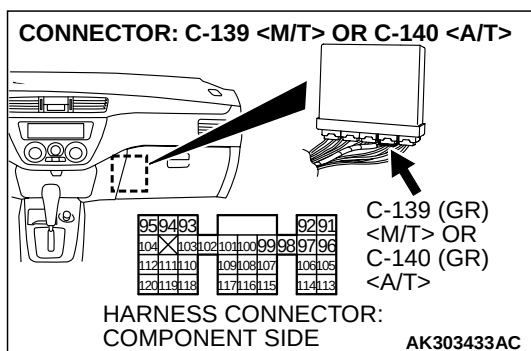
**STEP 4. Check for continuity at intake air temperature sensor harness side connector B-125.**

- (1) Disconnect the connector B-125 and measure at the harness side.
- (2) Check for the continuity between terminal No. 4 and ground.
  - Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Go to Step 7.

**NO :** Go to Step 5.



**STEP 5. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 6.

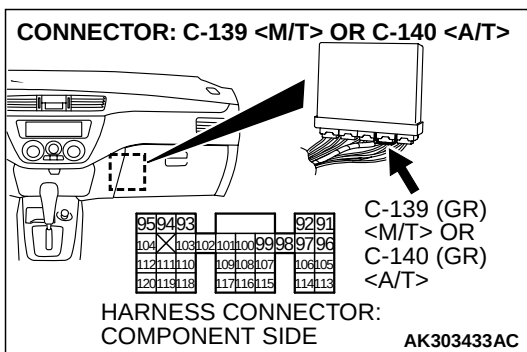
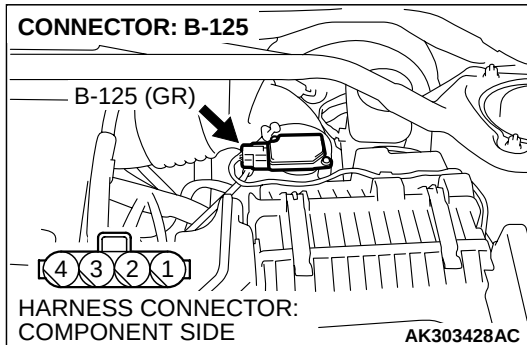
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 9.

**STEP 6. Check for open circuit and harness damage between intake air temperature sensor connector B-125 (terminal No. 4) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

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

**YES :** Replace the ECM or PCM. Then go to Step 9.

**NO :** Repair it. Then go to Step 9.

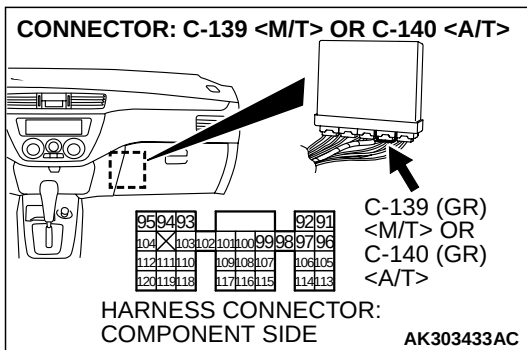


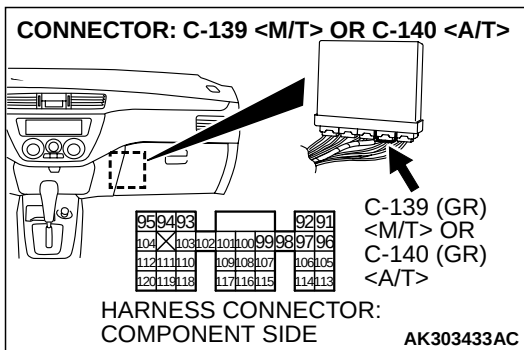
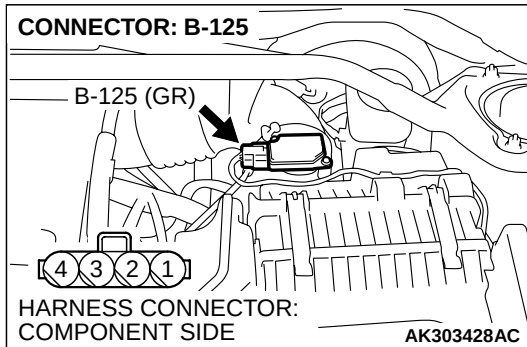
**STEP 7. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 8.

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





**STEP 8. Check for open circuit and harness damage between intake air temperature sensor connector B-125 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 99).**

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

**YES :** Replace the ECM or PCM. Then go to Step 9.

**NO :** Repair it. Then go to Step 9.

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

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

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

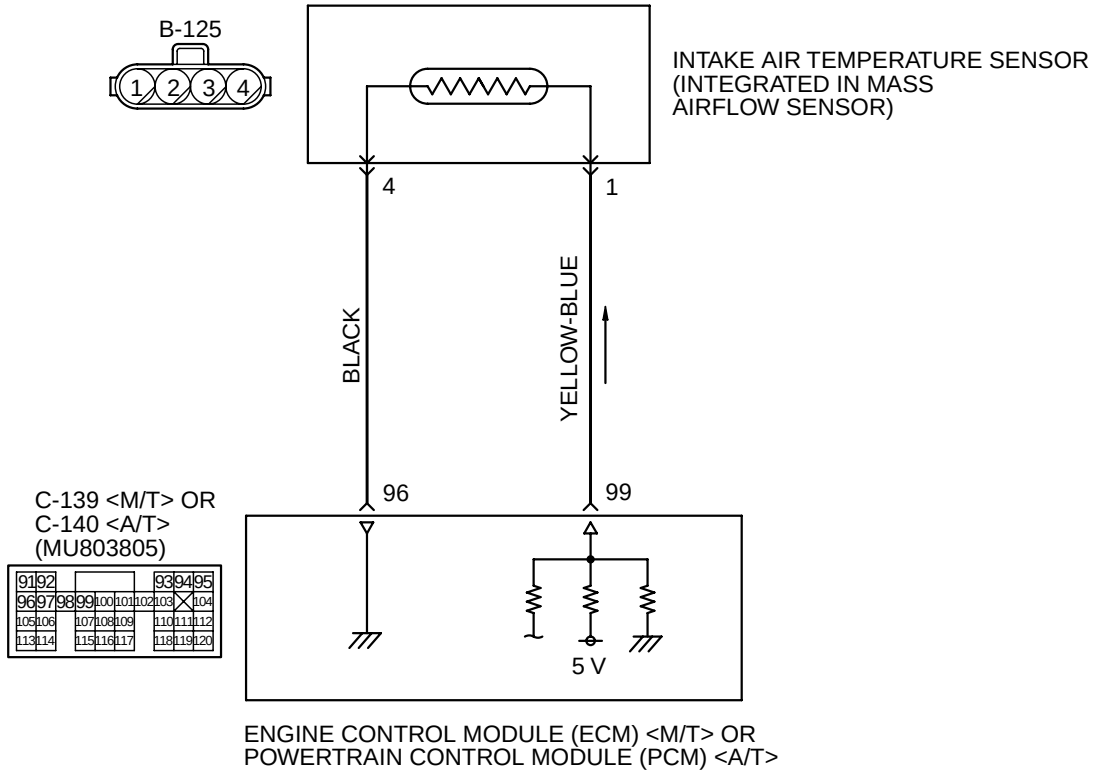
**Q: Is DTC P0111 set?**

**YES :** Retry the troubleshooting.

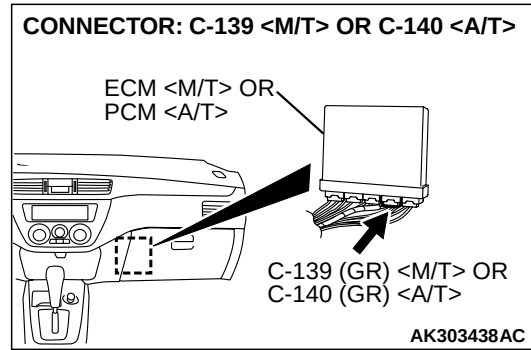
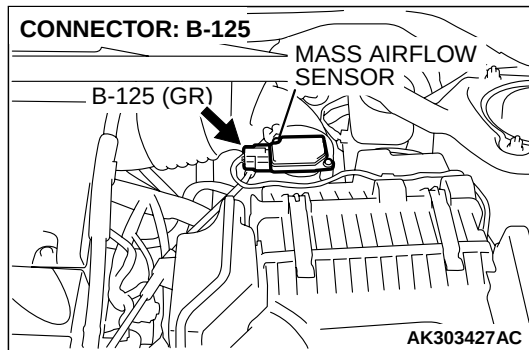
**NO :** The inspection is complete.

DTC P0112: Intake air temperature Circuit Low Input

Intake Air Temperature Sensor Circuit



AK303981



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM <M/T> or PCM <A/T> (terminal No. 99) via the resistor in the ECM <M/T> or PCM <A/T>. The ground terminal (terminal No. 4) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

**TECHNICAL DESCRIPTION**

- The intake air temperature sensor converts the intake air temperature to a voltage.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

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

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

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

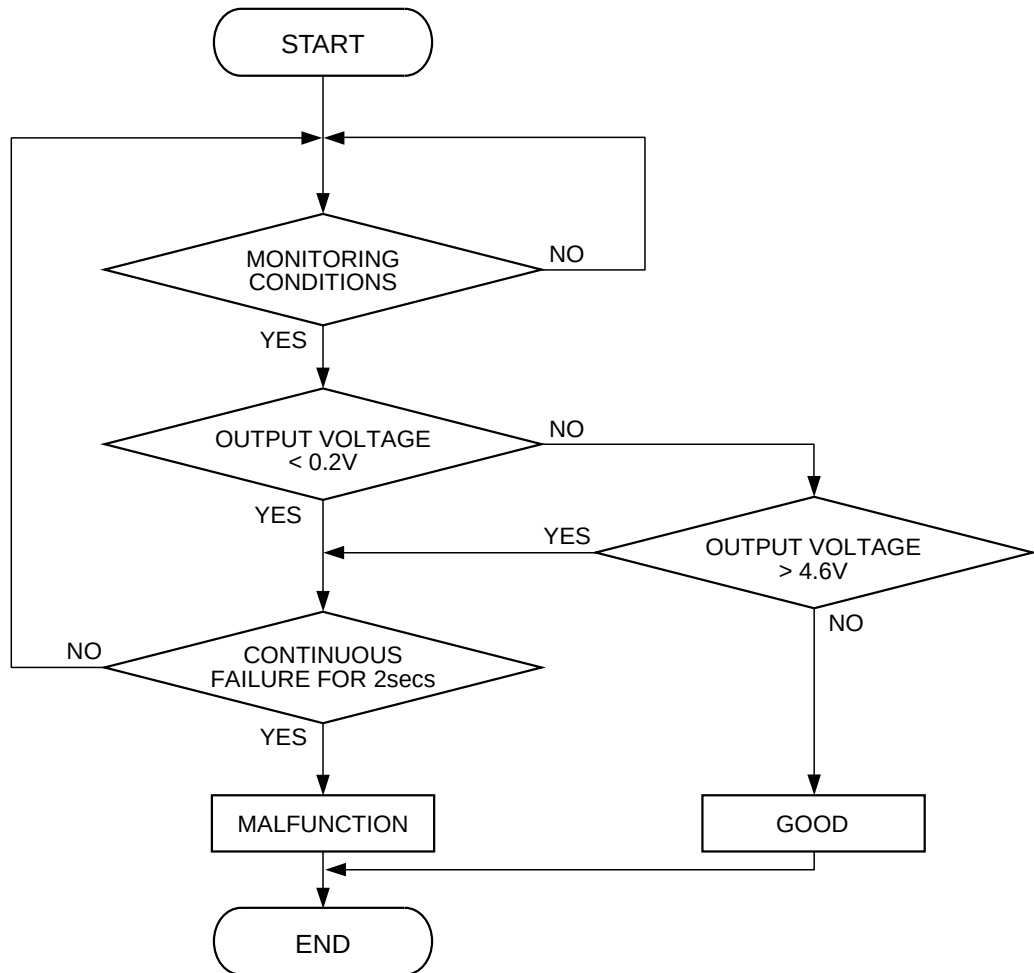
- Not applicable

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

- Not applicable

**MONITOR EXECUTION**

Continuous

**DTC SET CONDITIONS****Logic Flow Chart**

AK302013

### Check Conditions

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

### Judgement Criteria

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

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Intake air temperature sensor failed.
- Shorted intake air temperature sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

#### **⚠ CAUTION**

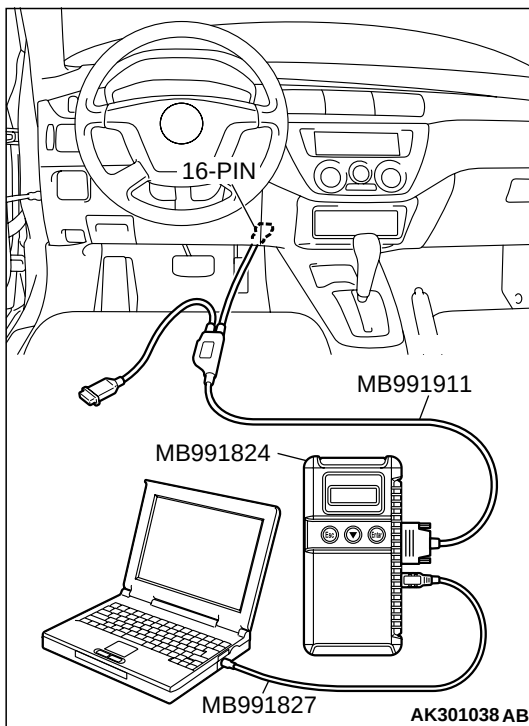
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

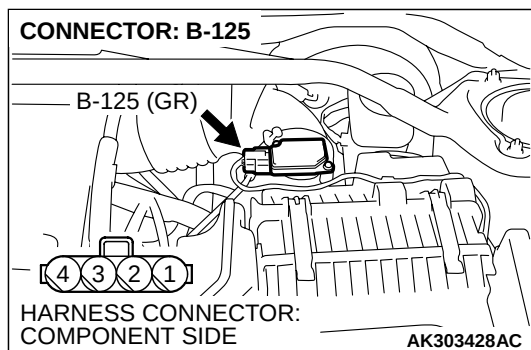
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
  - The intake air temperature and temperature shown with the scan tool should approximately match.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

### Q: Is the sensor operating properly?

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Go to Step 2.



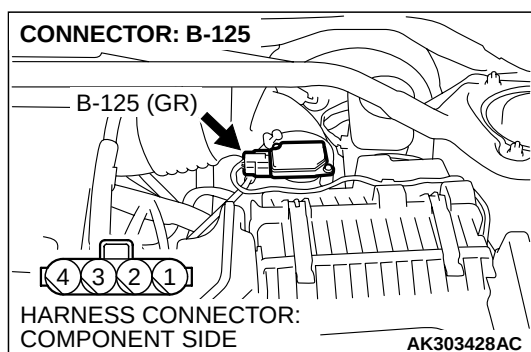


**STEP 2. Check harness connector B-125 at the intake air temperature sensor for damage.**

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

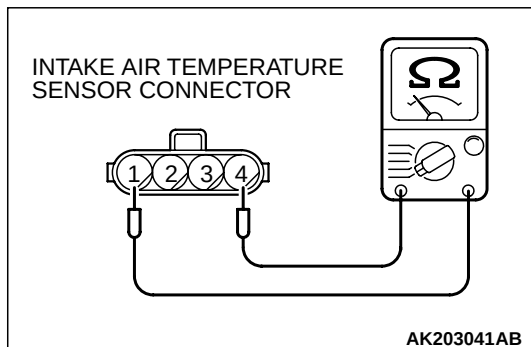
**YES :** Go to Step 3.

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



**STEP 3. Check the intake air temperature sensor.**

(1) Disconnect the intake air temperature sensor connector B-125.



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

- There should be continuity. (0.30 – 20 kΩ)

**Q: Is the measured resistance between 0.30 and 20 kΩ?**

**YES :** Go to Step 4.

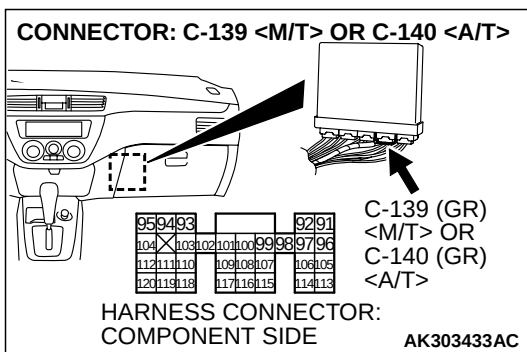
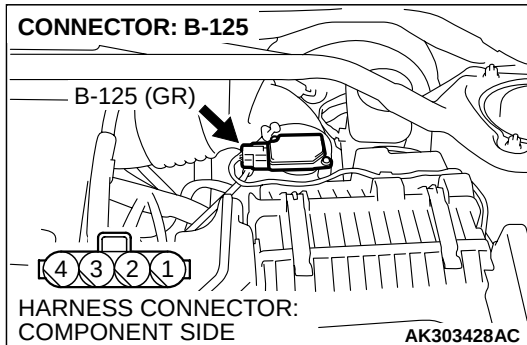
**NO :** Replace the mass airflow sensor. Then go to Step 6.

**STEP 4. Check for short circuit to ground between intake air temperature sensor connector B-125 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 99).**

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

**YES :** Go to Step 5.

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

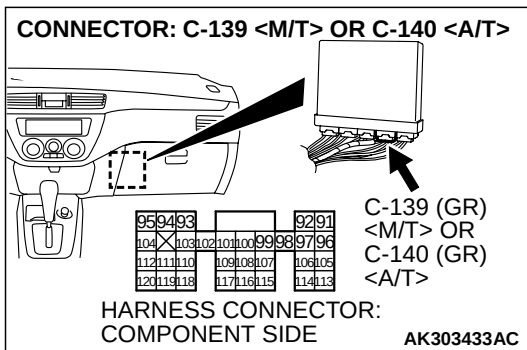


**STEP 5. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Replace the ECM or PCM. Then go to Step 6.

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



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

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

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

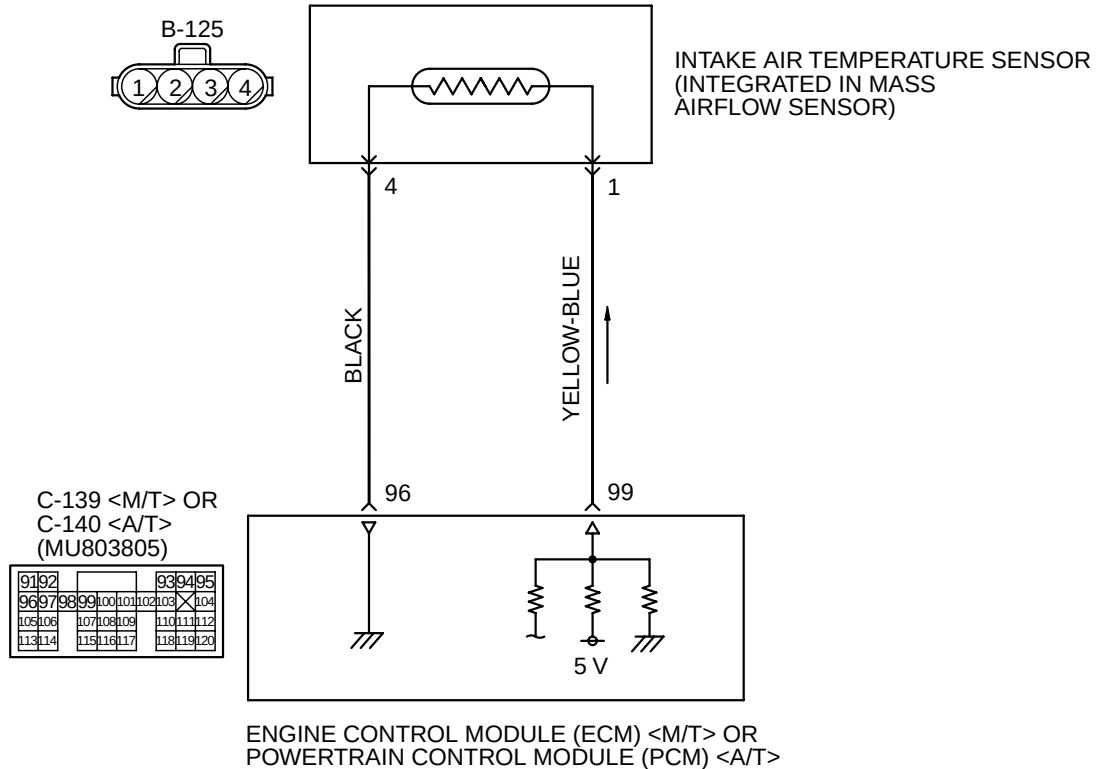
**Q: Is DTC P0112 set?**

**YES :** Retry the troubleshooting.

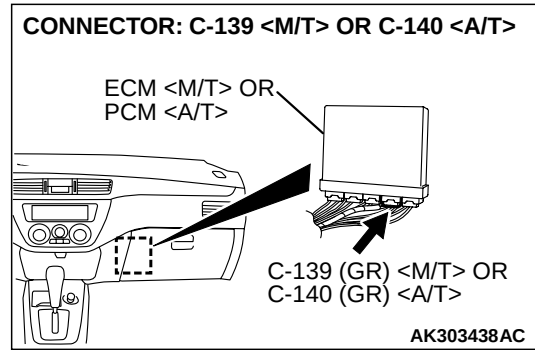
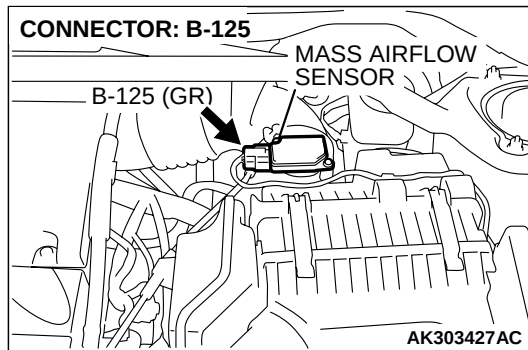
**NO :** The inspection is complete.

## DTC P0113: Intake air temperature Circuit High Input

Intake Air Temperature Sensor Circuit



AK303981



## CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM <M/T> or PCM <A/T> (terminal No. 99) via the resistor in the ECM <M/T> or PCM <A/T>. The ground terminal (terminal No. 4) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

### TECHNICAL DESCRIPTION

- The intake air temperature sensor converts the intake air temperature to a voltage.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

### DESCRIPTIONS OF MONITOR METHODS

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

### MONITOR EXECUTION 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)**

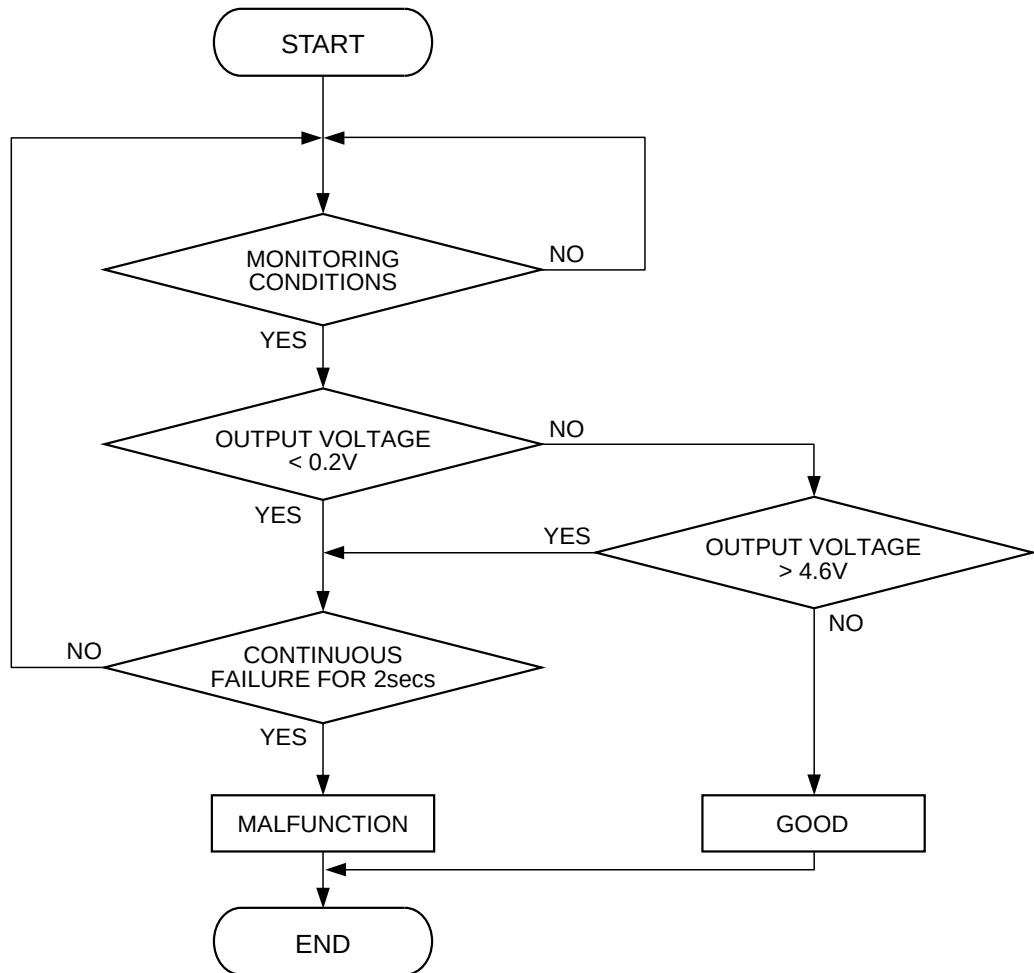
- Not applicable

### MONITOR EXECUTION

Continuous

### DTC SET CONDITIONS

### Logic Flow Chart



AK302013

**Check Conditions**

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

**Judgement Criteria**

- Intake air temperature sensor output voltage has continued to be 4.6 volts or higher [corresponding to an air intake temperature of  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) or lower] for 2 seconds.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Intake air temperature sensor failed.
- Open intake air temperature sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

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

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

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

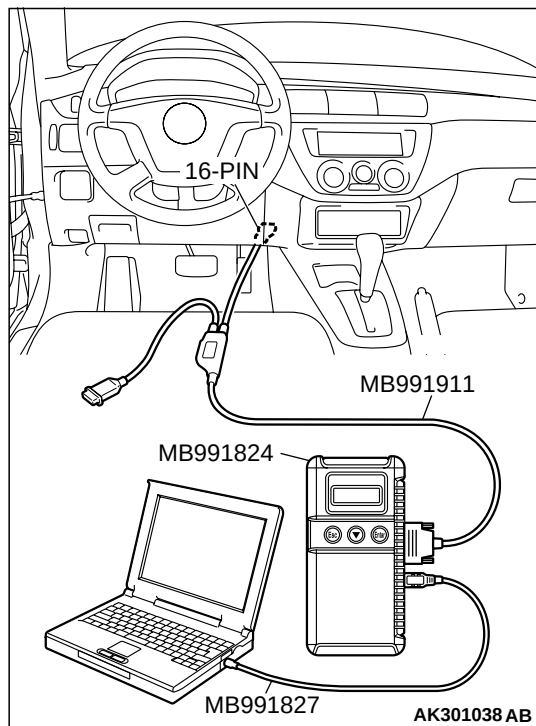
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

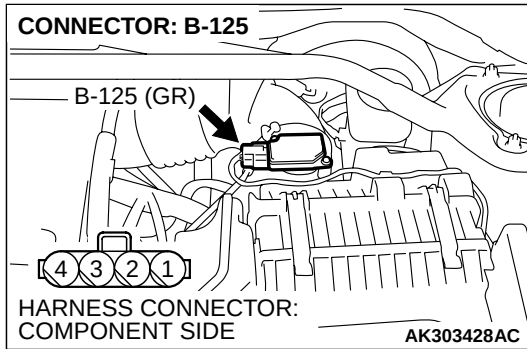
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
  - The intake air temperature and temperature shown with the scan tool should approximately match.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Go to Step 2.



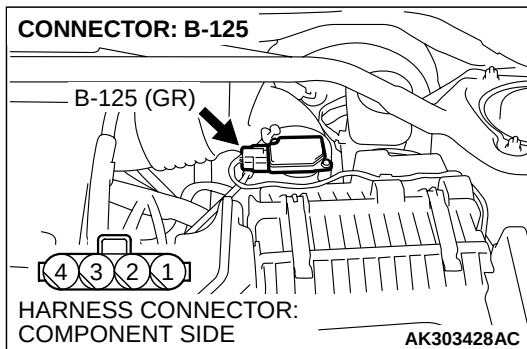


**STEP 2. Check harness connector B-125 at the intake air temperature sensor for damage.**

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

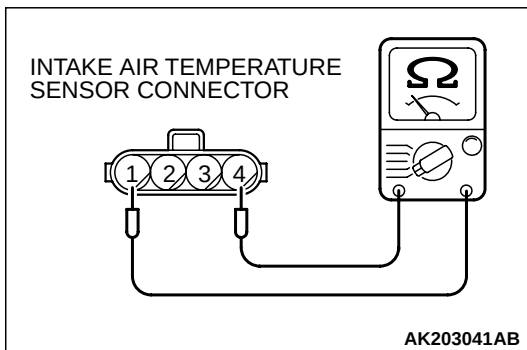
**YES :** Go to Step 3.

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



**STEP 3. Check the intake air temperature sensor.**

(1) Disconnect the intake air temperature sensor connector B-125.



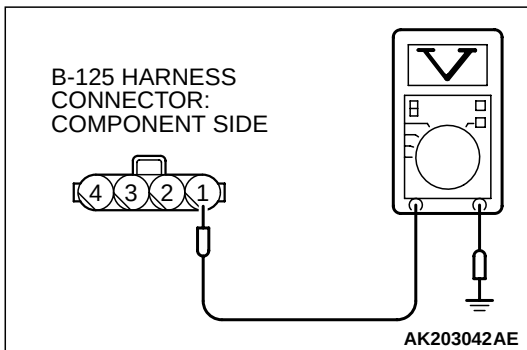
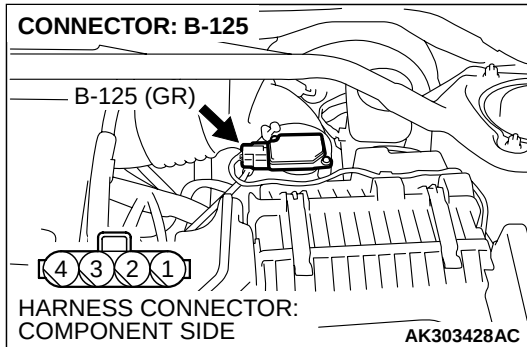
(2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.

- There should be continuity. (0.30 – 20 k $\Omega$ )

**Q: Is the measured resistance between 0.30 and 20 k $\Omega$ ?**

**YES :** Go to Step 4.

**NO :** Replace the mass airflow sensor. Then go to Step 11.



**STEP 4. Measure the sensor supply voltage at intake air temperature sensor harness side connector B-125.**

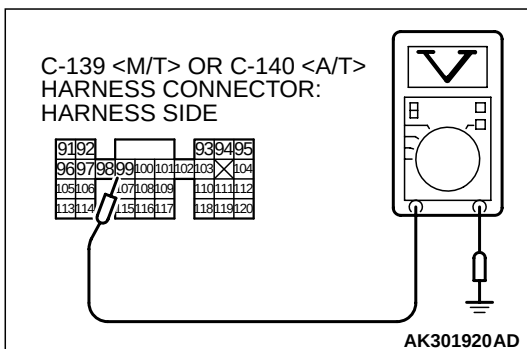
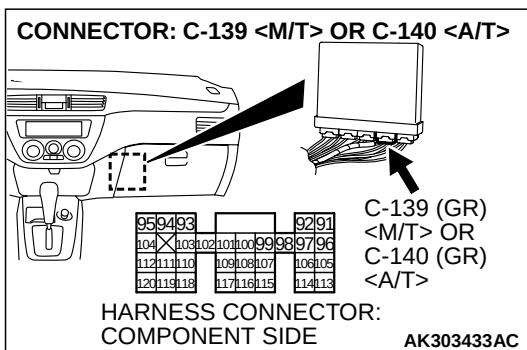
- (1) Disconnect the connector B-125 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should measure between 4.5 and 4.9 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 8.

**NO :** Go to Step 5.



**STEP 5. Measure the sensor supply voltage at ECM connector C-139 <M/T> or PCM connector C-140 <A/T> by backprobing.**

- (1) Do not disconnect the ECM connector C-139 <M/T> or PCM connector C-140 <A/T>.
- (2) Disconnect the intake air temperature sensor connector B-125.
- (3) Turn the ignition switch to the "ON" position.

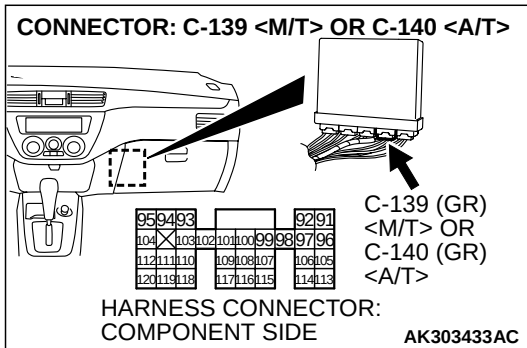
- (4) Measure the voltage between terminal No. 99 and ground by backprobing.
  - Voltage should measure between 4.5 and 4.9 volts.

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

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

**YES :** Go to Step 6.

**NO :** Go to Step 7.

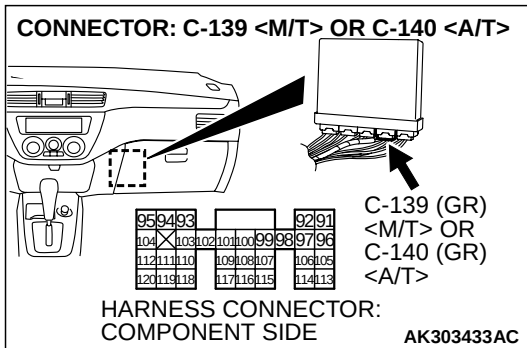


**STEP 6. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Repair harness wire between intake air temperature sensor connector B-125 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 99) because of open circuit. Then go to Step 11.

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

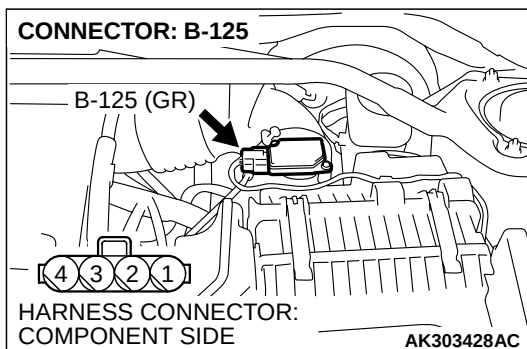


**STEP 7. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

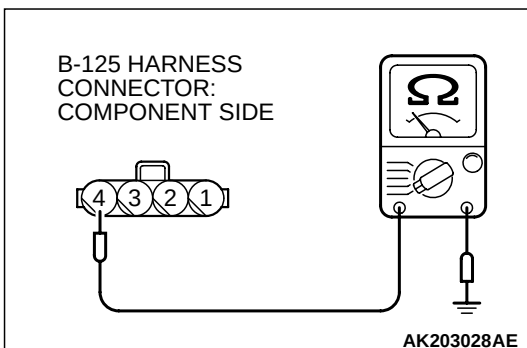
**YES :** Replace the ECM or PCM. Then go to Step 11.

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



**STEP 8. Check the continuity at intake air temperature sensor harness side connector B-125.**

(1) Disconnect the connector B-125 and measure at the harness side.



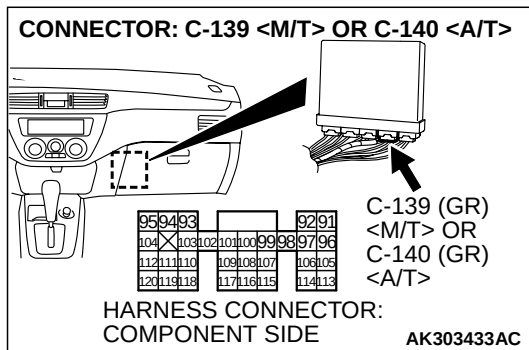
(2) Check for the continuity between terminal No. 4 and ground.

- Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Replace the ECM or PCM. Then go to Step 11.

**NO :** Go to Step 9.

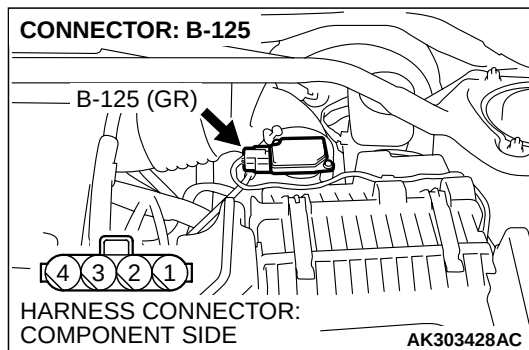


**STEP 9. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 10.

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

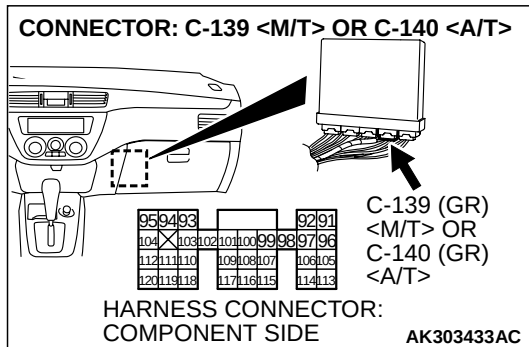


**STEP 10. Check for open circuit between intake air temperature sensor connector B-125 (terminal No. 4) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

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

**YES :** Replace the ECM or PCM. Then go to Step 11.

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



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

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

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

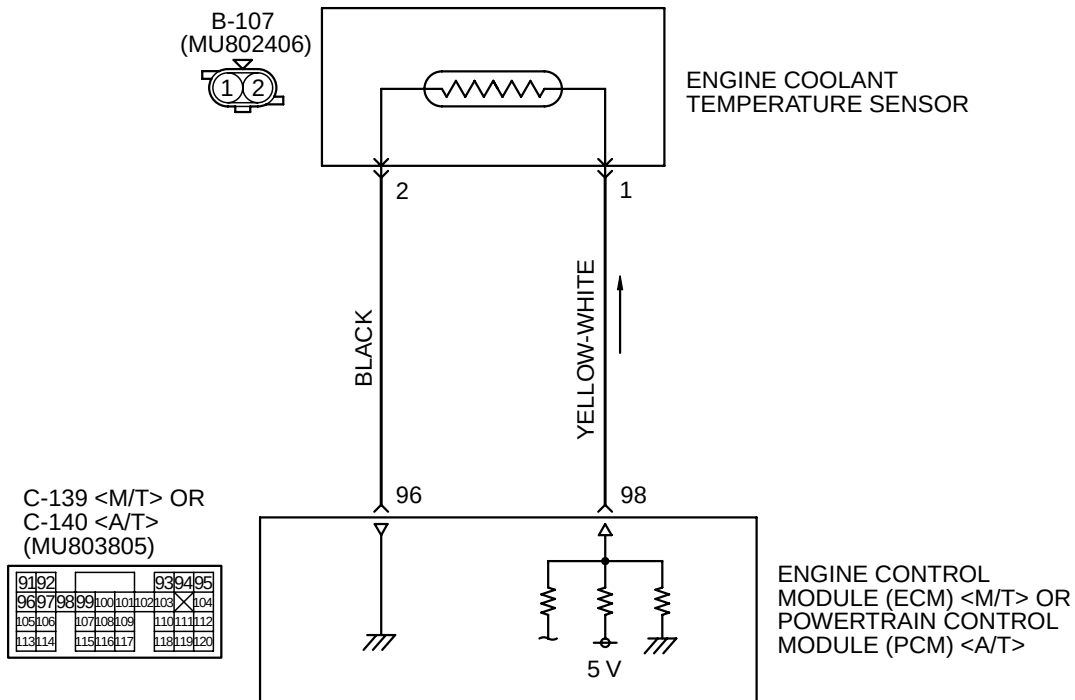
**Q: Is DTC P0113 set?**

**YES :** Retry the troubleshooting.

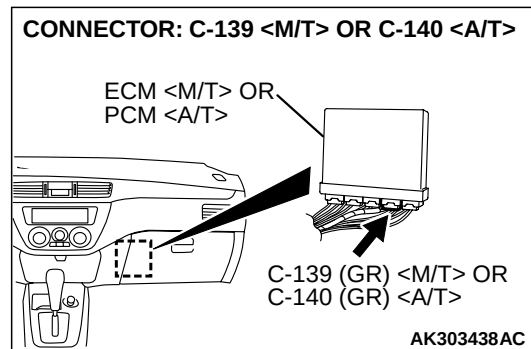
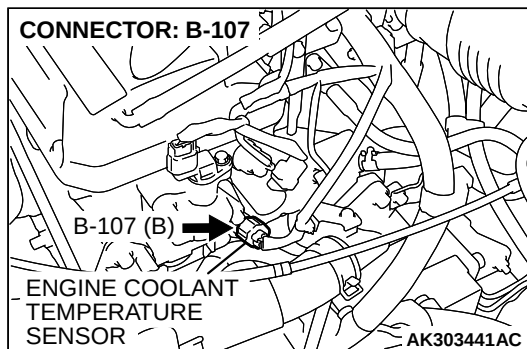
**NO :** The inspection is complete.

DTC P0116: Engine Coolant Temperature Circuit Range/Performance Problem

Engine Coolant Temperature Sensor Circuit



AK303982



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM <M/T> or PCM <A/T> (terminal No. 98) via the resistor in the ECM <M/T> or PCM <A/T>. The ground terminal (terminal No. 2) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

**TECHNICAL DESCRIPTION**

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

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

**MONITOR EXECUTION**

Once per driving cycle

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

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

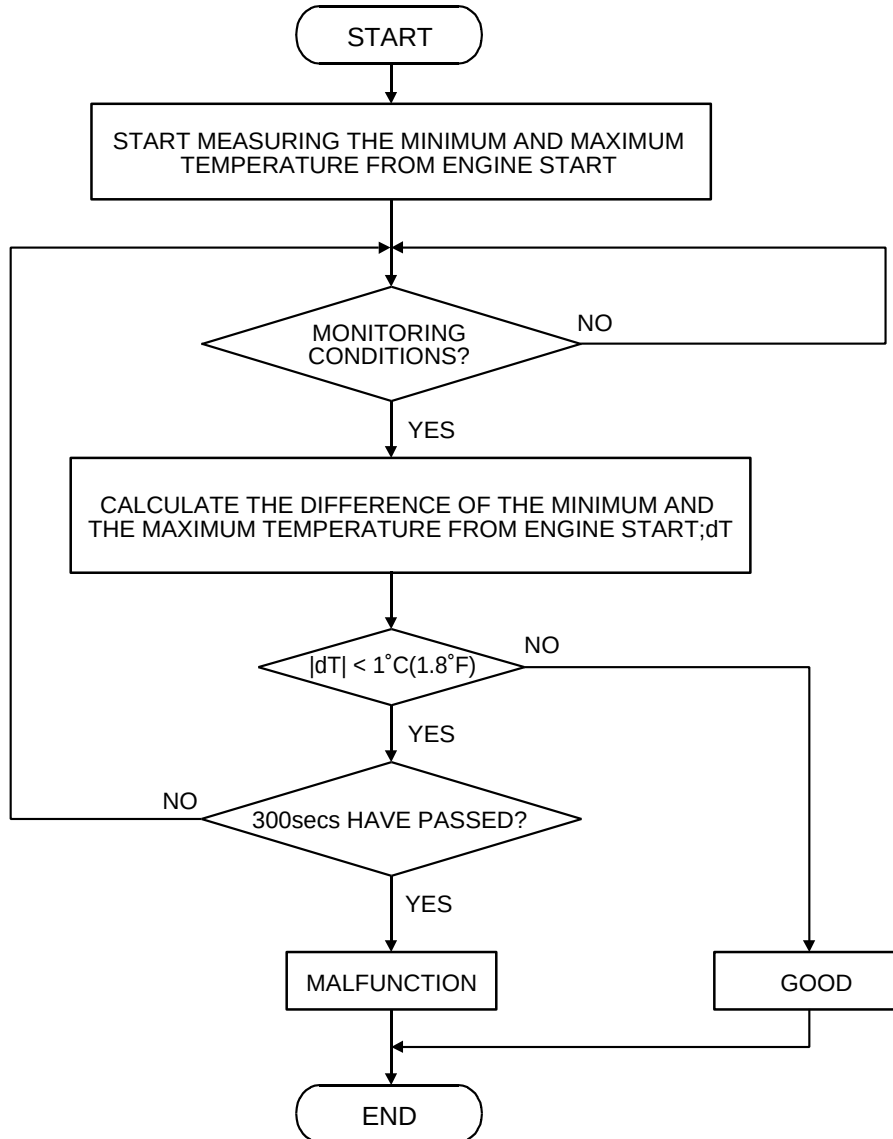
- Not applicable

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

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

DTC SET CONDITIONS

Logic Flow Chart



AK302014

**Check Conditions**

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

**Judgement Criteria**

- Engine coolant temperature fluctuates within 1°C (1.8°F) after 5 minutes have passed since the engine was started.
- However, time is not counted if any of the following conditions are met.

1. Intake air temperature is 60°C (140°F) or more.
2. Mass airflow sensor output is 10 g/sec or less.
3. During fuel shut-off operation.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function–OBD-II Drive Cycle–Procedure 6–Other Monitor [P.13B-6](#).

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

- Engine coolant temperature sensor failed.

- Harness damage or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

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

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

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

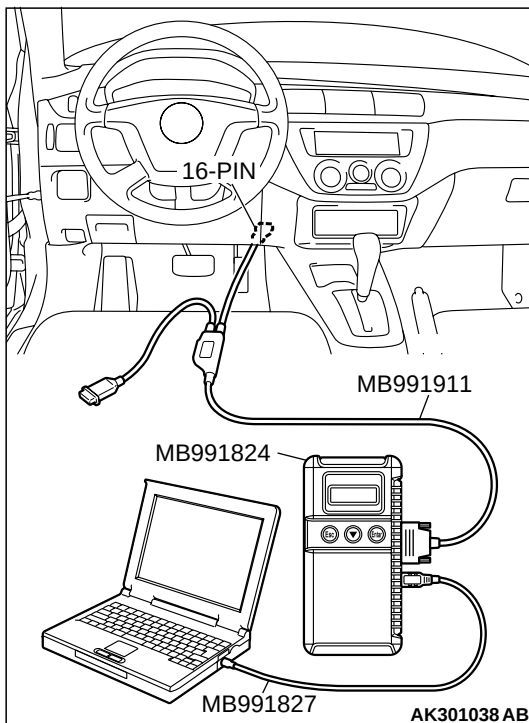
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

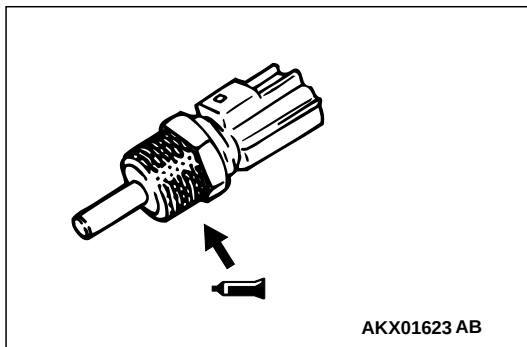
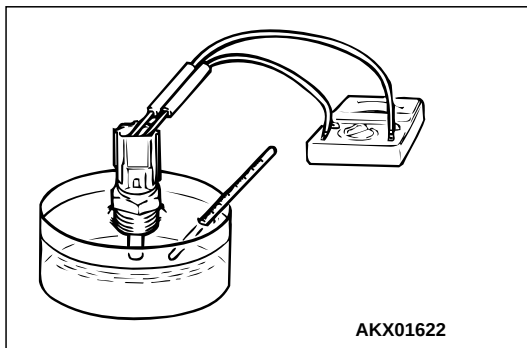
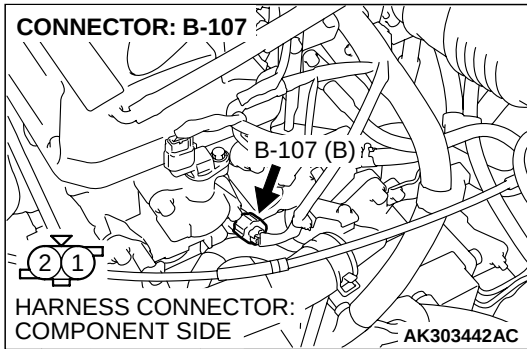
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately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

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

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Go to Step 2.





**STEP 2. Check the engine coolant temperature sensor.**

- (1) Disconnect the engine coolant temperature sensor connector B-107.
- (2) Remove the engine coolant temperature sensor.

- (3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, measure resistance.

**Standard value:**

|                                  |
|----------------------------------|
| 14 – 17 kΩ [at –20°C (–4°F)]     |
| 5.1 – 6.5 kΩ [at 0°C (32°F)]     |
| 2.1 – 2.7 kΩ [at 20°C (68°F)]    |
| 0.9 – 1.3 kΩ [at 40°C (104°F)]   |
| 0.48 – 0.68 kΩ [at 60°C (140°F)] |
| 0.26 – 0.36 kΩ [at 80°C (176°F)] |

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

**Tightening torque: 30 ± 9 N·m (22 ± 7 ft-lb)**

**Q: Is the resistance at the standard value?**

**YES :** Go to Step 3.

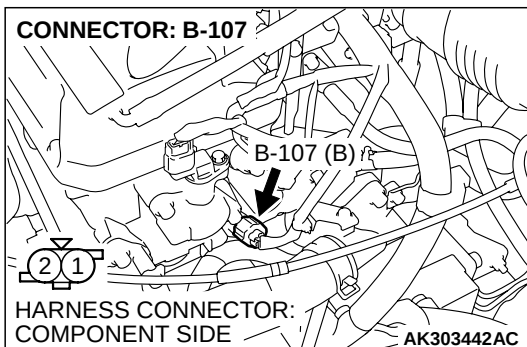
**NO :** Replace the engine coolant temperature sensor. Then go to Step 9.

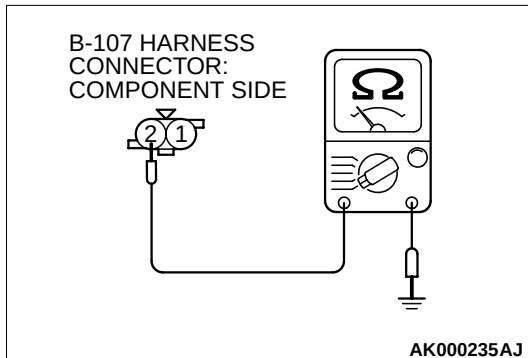
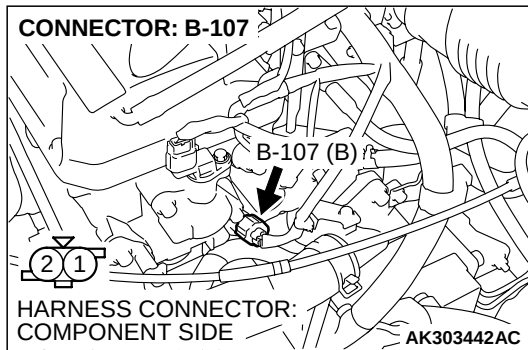
**STEP 3. Check harness connector B-107 at the engine coolant temperature sensor for damage.**

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

**YES :** Go to Step 4.

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





**STEP 4. Check the continuity at engine coolant temperature sensor harness side connector B-107.**

(1) Disconnect the connector B-107 and measure at the harness side.

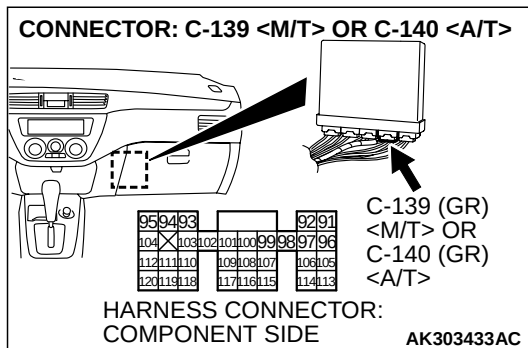
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Go to Step 7.

**NO :** Go to Step 5.



**STEP 5. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 6.

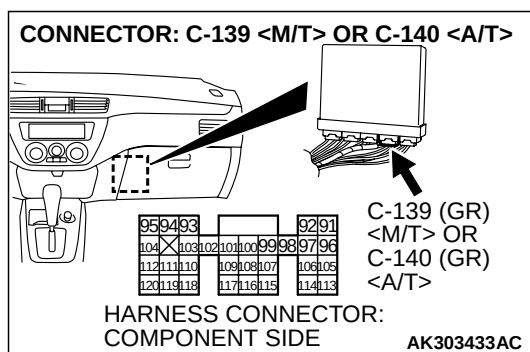
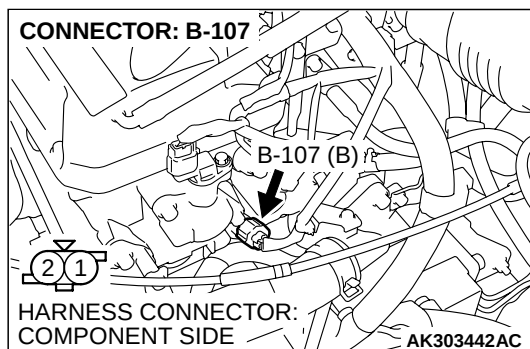
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 9.

**STEP 6. Check for harness damage between engine coolant temperature sensor connector B-107 (terminal No. 2) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

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

**YES :** Replace the ECM or PCM. Then go to Step 9.

**NO :** Repair it. Then go to Step 9.

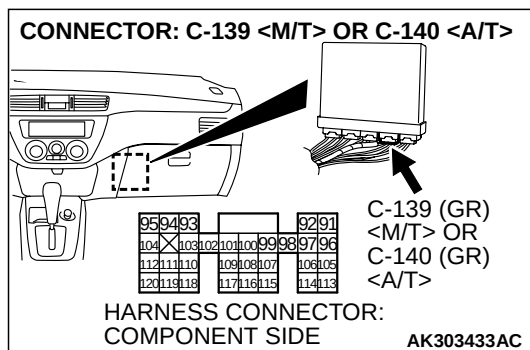


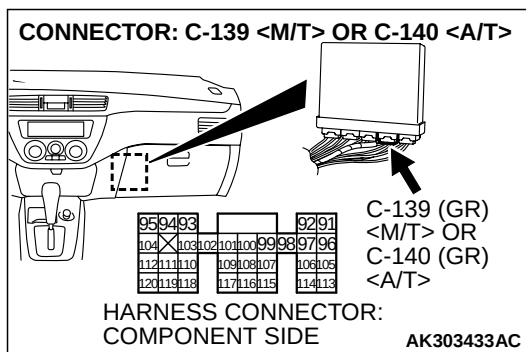
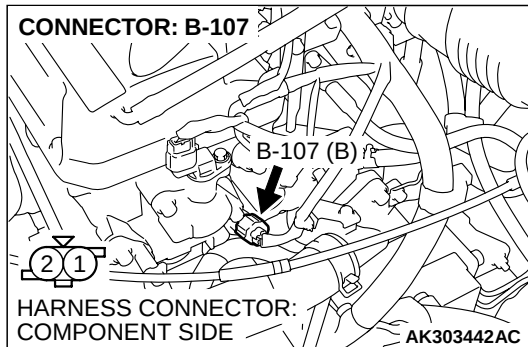
**STEP 7. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 8.

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





**STEP 8. Check for harness damage between engine coolant temperature sensor connector B-107 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 98).**

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

**YES :** Replace the ECM or PCM. Then go to Step 9.

**NO :** Repair it. Then go to Step 9.

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

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

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

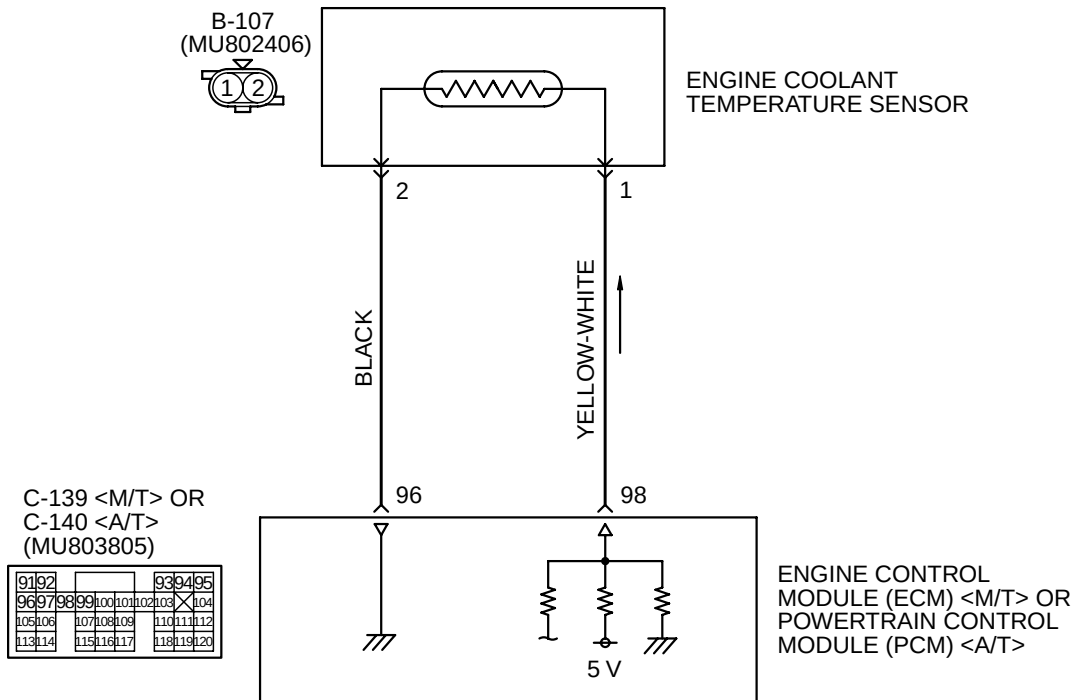
**Q: Is DTC P0116 set?**

**YES :** Retry the troubleshooting.

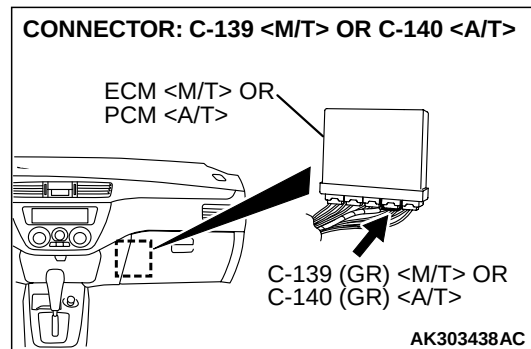
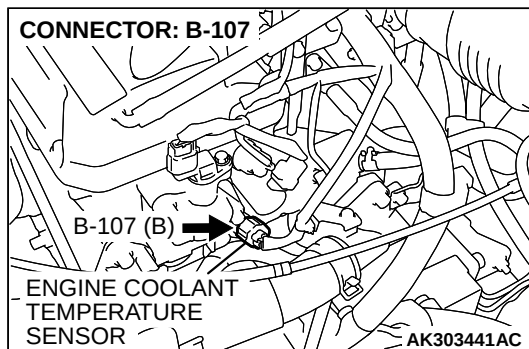
**NO :** The inspection is complete.

DTC P0117: Engine Coolant Temperature Circuit Low Input

Engine Coolant Temperature Sensor Circuit



AK303982



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM <M/T> or PCM <A/T> (terminal No. 98) via the resistor in the ECM <M/T> or PCM <A/T>. The ground terminal (terminal No. 2) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

**TECHNICAL DESCRIPTION**

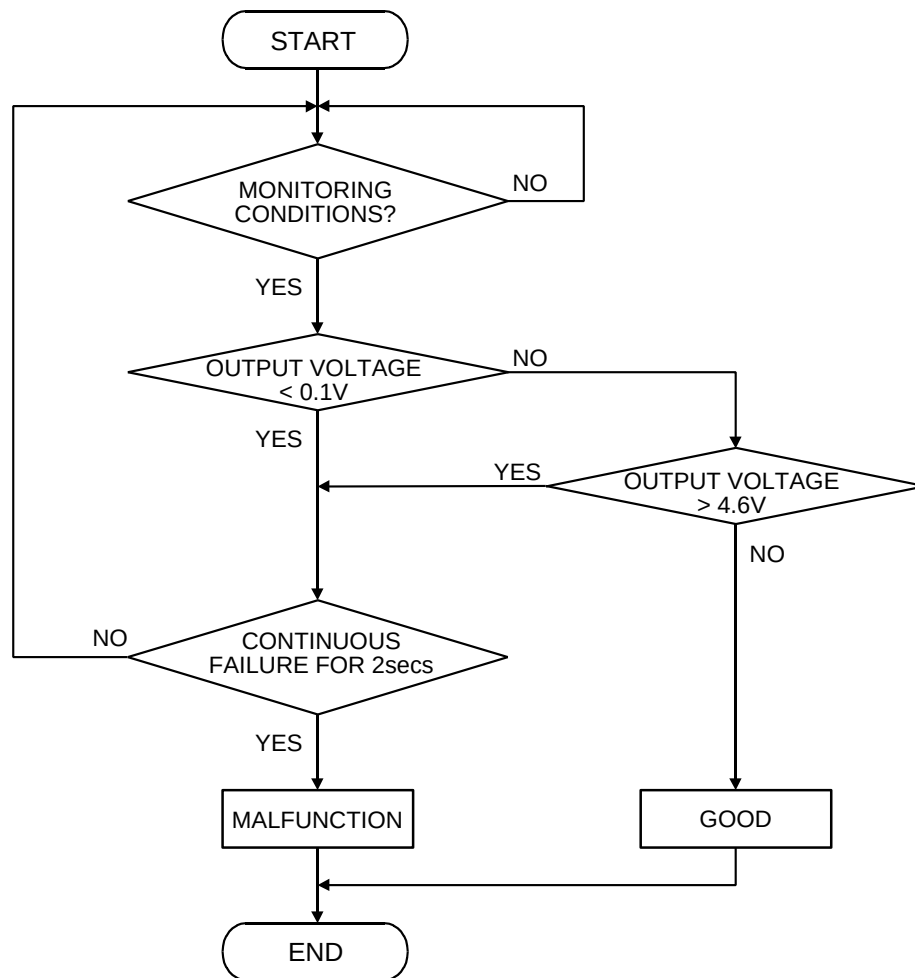
- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

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

**MONITOR EXECUTION**

Continuous

**DTC SET CONDITIONS****Logic Flow Chart**

AK302015

### Check Conditions

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

### Judgement Criteria

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

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Engine coolant temperature sensor failed.
- Shorted engine coolant temperature sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

#### **⚠ CAUTION**

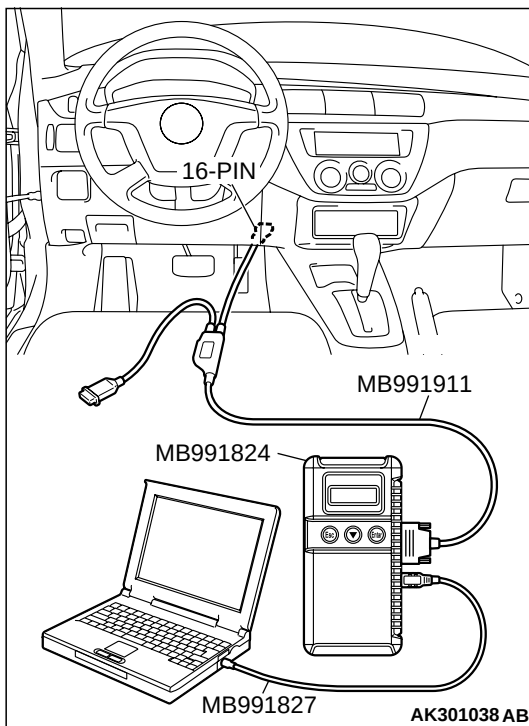
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

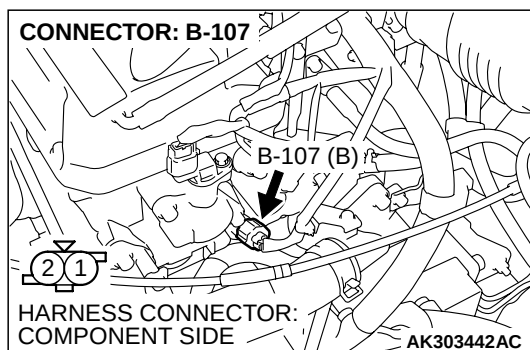
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately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

### Q: Is the sensor operating properly?

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Go to Step 2.



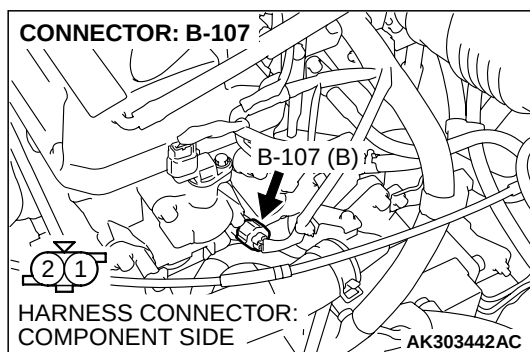


**STEP 2. Check harness connector B-107 at the engine coolant temperature sensor for damage.**

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

**YES :** Go to Step 3.

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

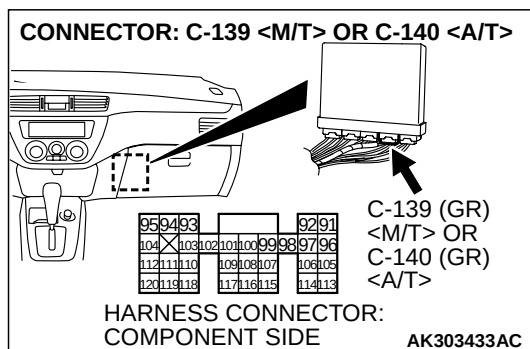


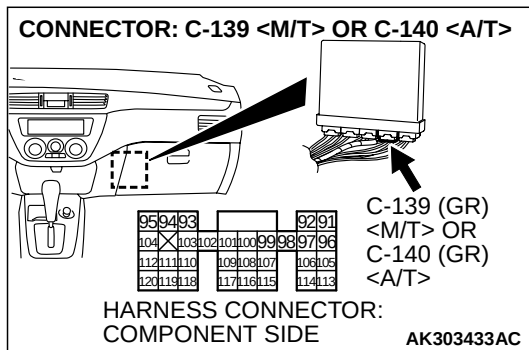
**STEP 3. Check for short circuit to ground between engine coolant temperature sensor connector B-107 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 98).**

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

**YES :** Go to Step 4.

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



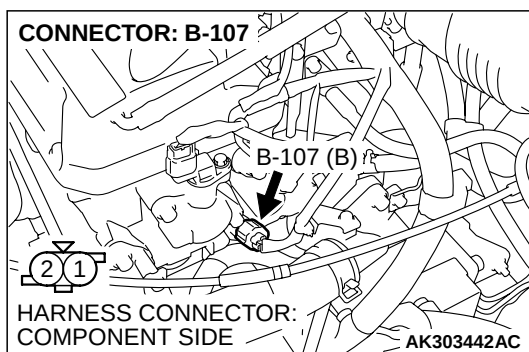


**STEP 4. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 5.

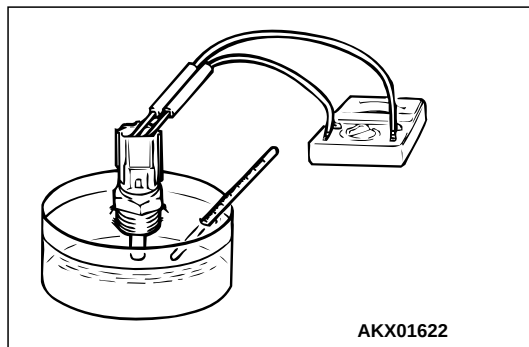
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 6.



**STEP 5. Check the engine coolant temperature sensor.**

(1) Disconnect the engine coolant temperature sensor connector B-107.

(2) Remove the engine coolant temperature sensor.



(3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, measure resistance.

**Standard value:**

14 – 17 kΩ [at –20°C (–4°F)]

5.1 – 6.5 kΩ [at 0°C (32°F)]

2.1 – 2.7 kΩ [at 20°C (68°F)]

0.9 – 1.3 kΩ [at 40°C (104°F)]

0.48 – 0.68 kΩ [at 60°C (140°F)]

0.26 – 0.36 kΩ [at 80°C (176°F)]

(4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.

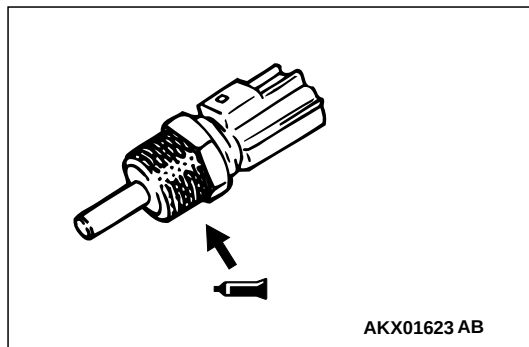
(5) Install the engine coolant temperature sensor, and tighten to the specified torque.

**Tightening torque: 30 ± 9 N·m (22 ± 7 ft-lb)**

**Q: Is the resistance at the standard value?**

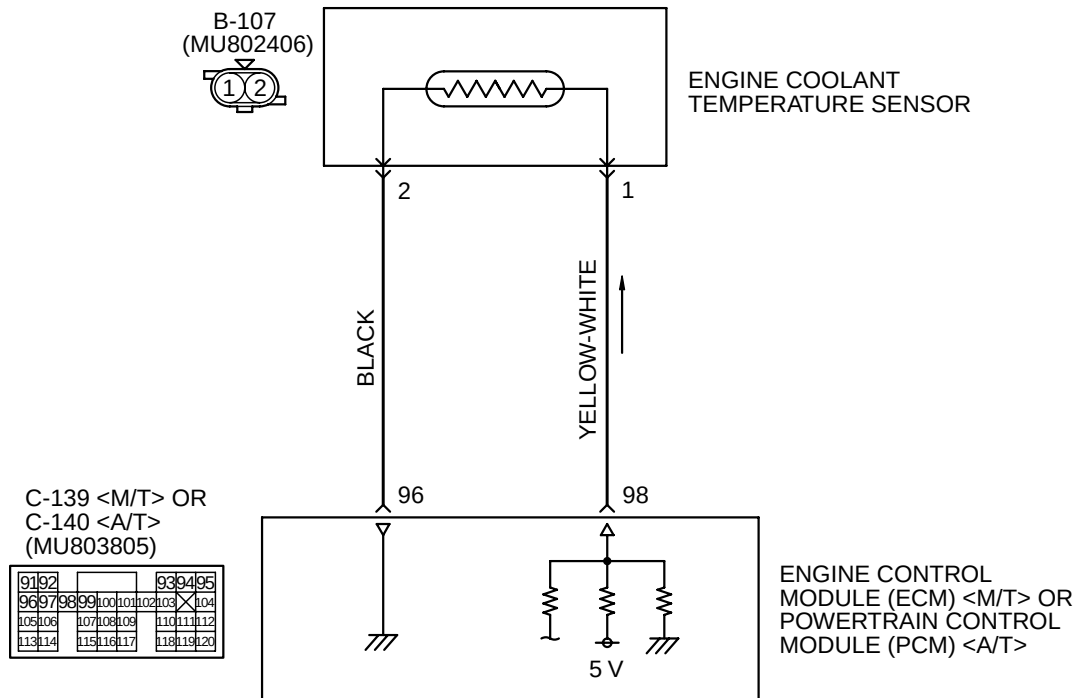
**YES :** Replace the ECM or PCM. Then go to Step 6.

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

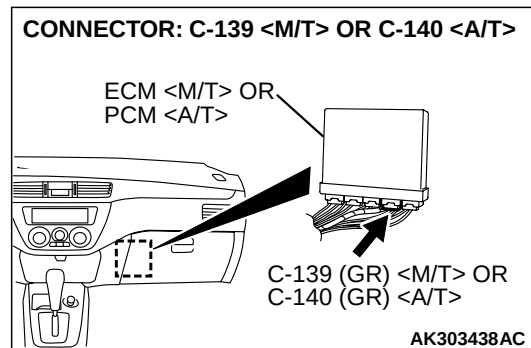
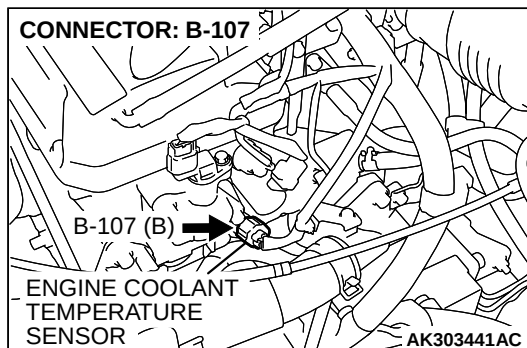


**STEP 6. Test the OBD-II drive cycle.**

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

**Q: Is DTC P0117 set?****YES** : Retry the troubleshooting.**NO** : The inspection is complete.**DTC P0118: Engine Coolant Temperature Circuit High Input****Engine Coolant Temperature Sensor Circuit**

AK303982



### CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM <M/T> or PCM <A/T> (terminal No. 98) via the resistor in the ECM <M/T> or PCM <A/T>. The ground terminal (terminal No. 2) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

### TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

### DESCRIPTIONS OF MONITOR METHODS

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

### MONITOR EXECUTION

Continuous

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

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

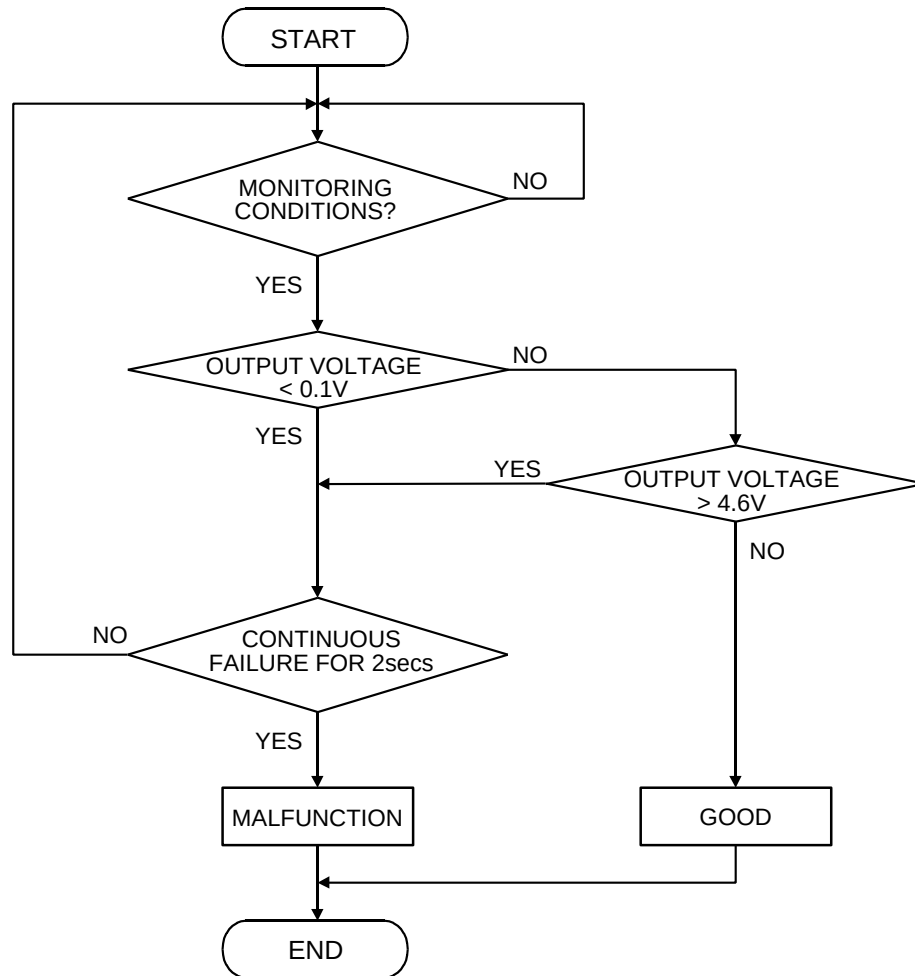
- Not applicable

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

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

## DTC SET CONDITIONS

## Logic Flow Chart



AK302015

**Check Conditions**

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

**Judgement Criteria**

- Engine coolant temperature sensor output voltage has continued to be 4.6 volts or higher [corresponding to coolant temperature of  $-45^{\circ}\text{C}$  ( $-49^{\circ}\text{F}$ ) or lower] for 2 seconds.

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function—OBD-II Drive Cycle—Procedure 6—Other Monitor [P.13B-6](#).

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

- Engine coolant temperature sensor failed.
- Open engine coolant temperature sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

#### ⚠ CAUTION

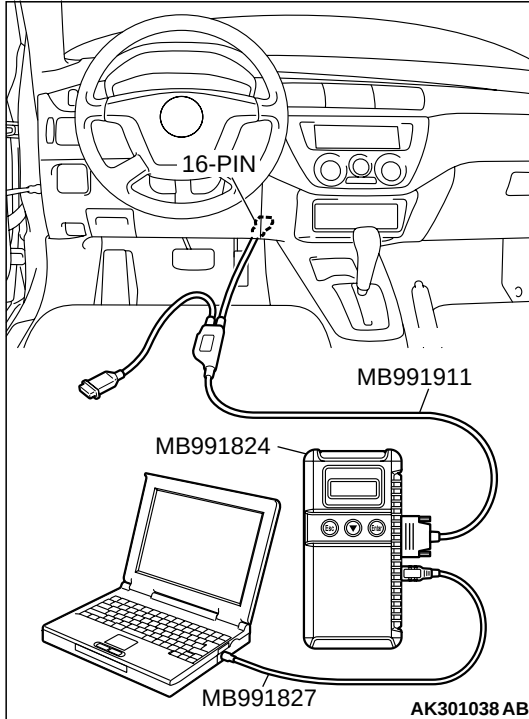
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

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

**YES** : It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**NO** : Go to Step 2.

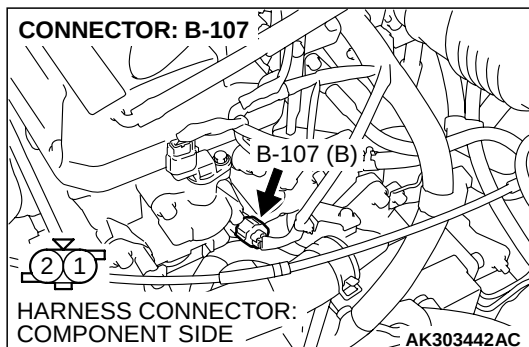


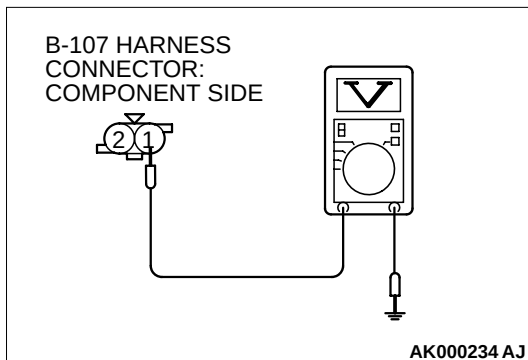
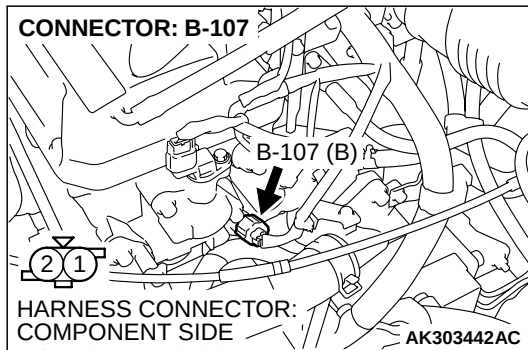
### STEP 2. Check harness connector B-107 at the engine coolant temperature sensor for damage.

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

**YES** : Go to Step 3.

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





**STEP 3. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-107.**

(1) Disconnect the connector B-107 and measure at the harness side.

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

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

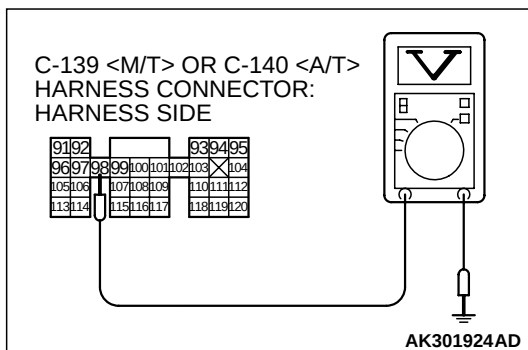
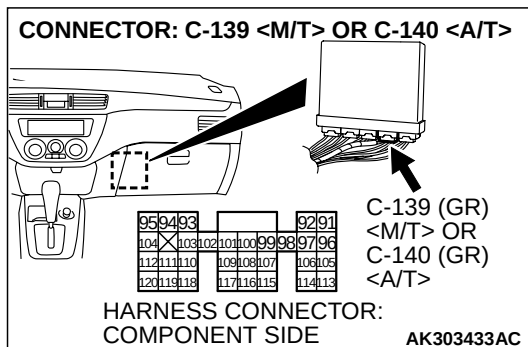
- Voltage should be between 4.5 and 4.9 volts.

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

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

**YES :** Go to Step 7.

**NO :** Go to Step 4.



**STEP 4. Measure the sensor supply voltage at ECM connector C-139 <M/T> or PCM connector C-140 <A/T> by backprobing.**

(1) Do not disconnect the ECM connector C-139 <M/T> or PCM connector C-140 <A/T>.

(2) Disconnect the engine coolant temperature sensor connector B-107.

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

(4) Measure the voltage between terminal No. 98 and ground by backprobing.

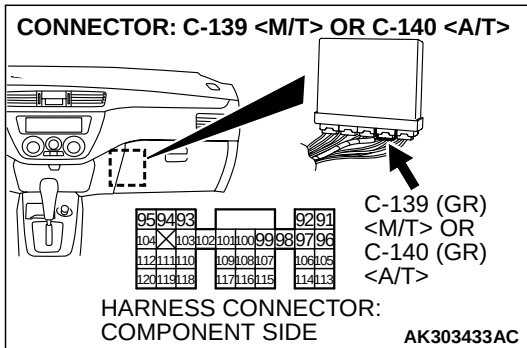
- Voltage should be between 4.5 and 4.9 volts.

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

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

**YES :** Go to Step 5.

**NO :** Go to Step 6.

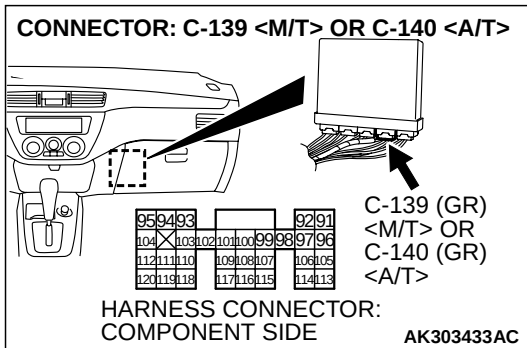


**STEP 5. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Repair harness wire between engine coolant temperature sensor connector B-107 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 98) because of open circuit. Then go to Step 11.

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

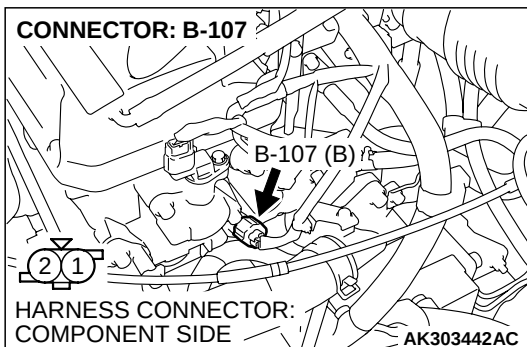


**STEP 6. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

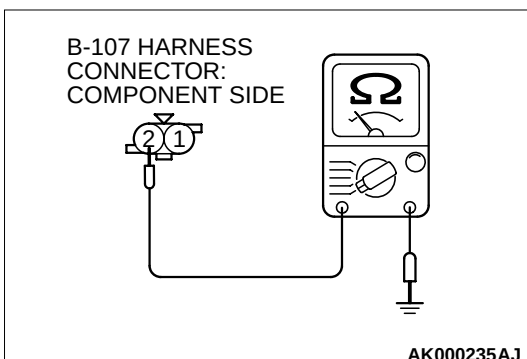
**YES :** Replace the ECM or PCM. Then go to Step 11.

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



**STEP 7. Check the continuity at engine coolant temperature sensor harness side connector B-107.**

(1) Disconnect the connector B-107 and measure at the harness side.



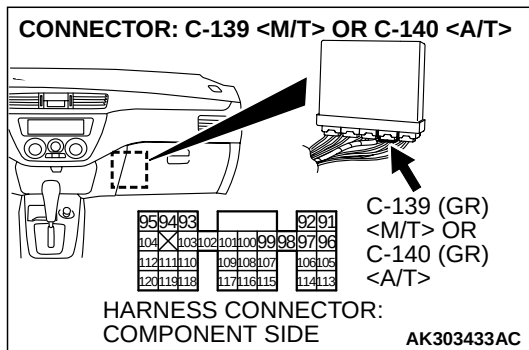
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Go to Step 10.

**NO :** Go to Step 8.

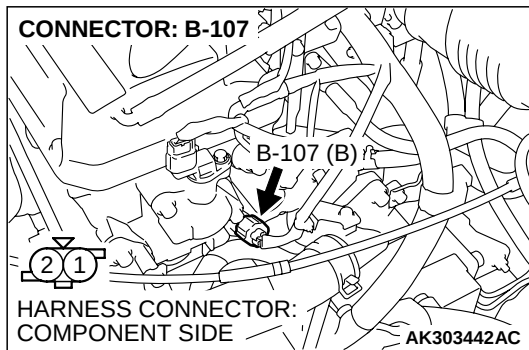


**STEP 8. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 9.

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

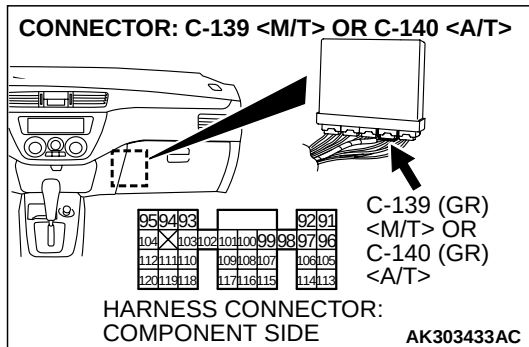


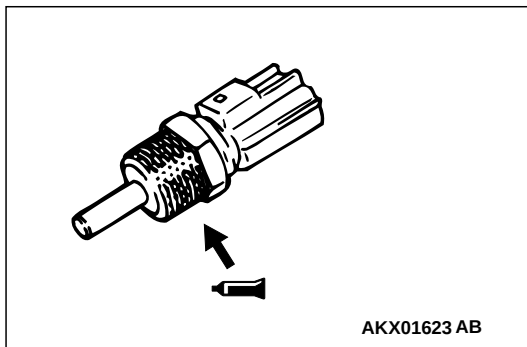
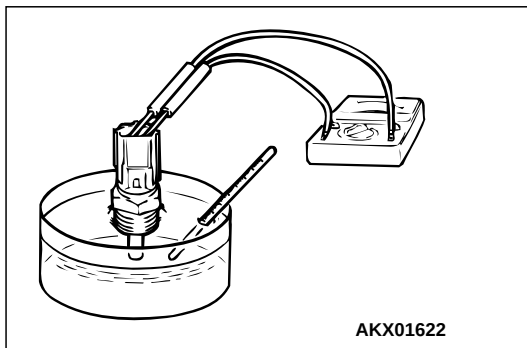
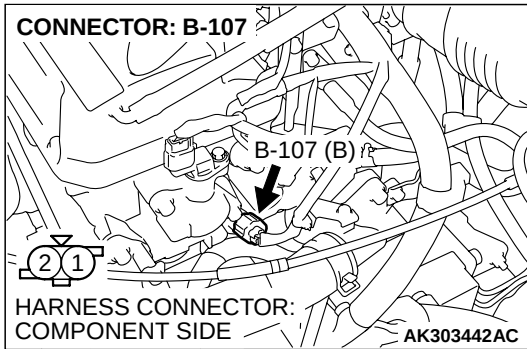
**STEP 9. Check for open circuit between engine coolant sensor connector B-107 (terminal No. 2) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

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

**YES :** Replace the ECM or PCM. Then go to Step 11.

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





**STEP 10. Check the engine coolant temperature sensor.**

- (1) Disconnect the engine coolant temperature sensor connector B-107.
- (2) Remove the engine coolant temperature sensor.

- (3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

**Standard value:**

|                                          |
|------------------------------------------|
| 14 – 17 k $\Omega$ [at –20°C (–4°F)]     |
| 5.1 – 6.5 k $\Omega$ [at 0°C (32°F)]     |
| 2.1 – 2.7 k $\Omega$ [at 20°C (68°F)]    |
| 0.9 – 1.3 k $\Omega$ [at 40°C (104°F)]   |
| 0.48 – 0.68 k $\Omega$ [at 60°C (140°F)] |
| 0.26 – 0.36 k $\Omega$ [at 80°C (176°F)] |

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

**Tightening torque: 30 ± 9 N·m (22 ± 7 ft-lb)**

**Q: Is the resistance at the standard value?**

**YES :** Replace the ECM or PCM. Then go to Step 11.

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

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

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

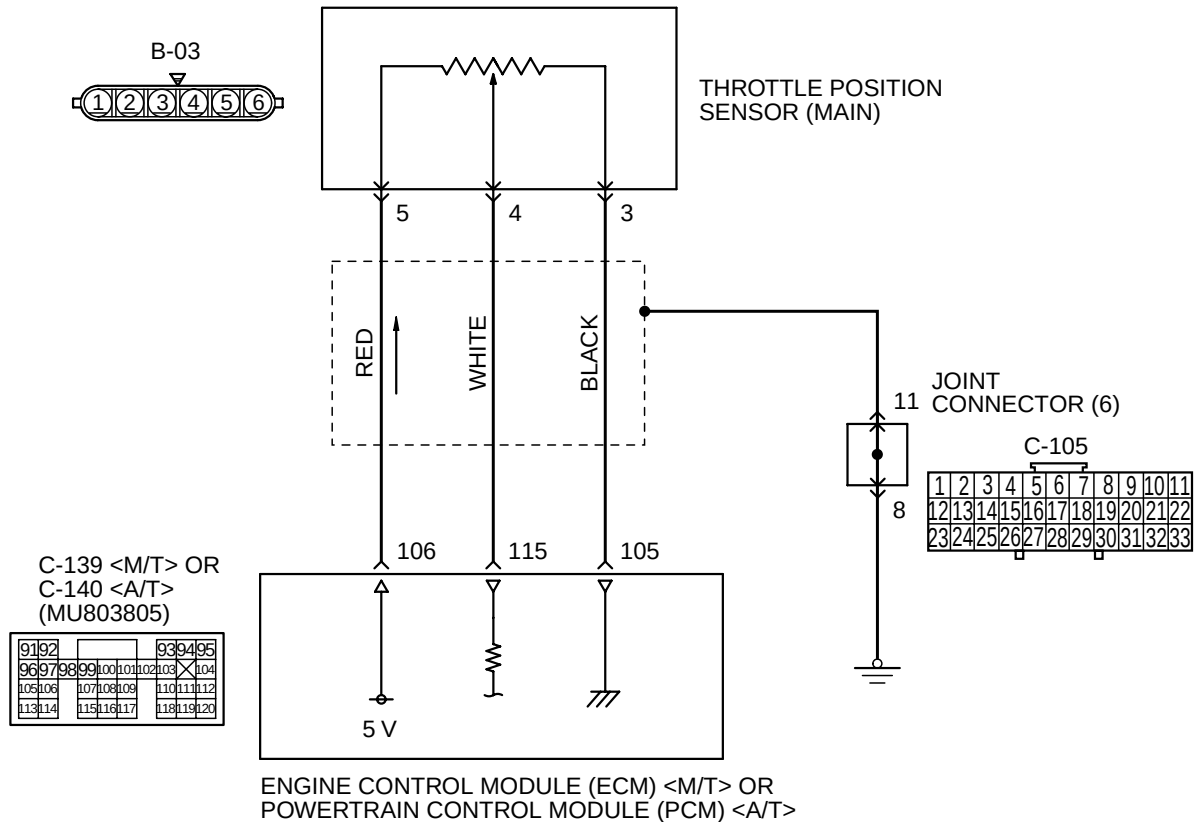
**Q: Is DTC P0118 set?**

**YES :** Retry the troubleshooting.

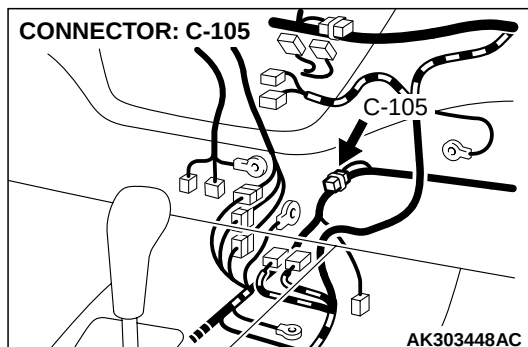
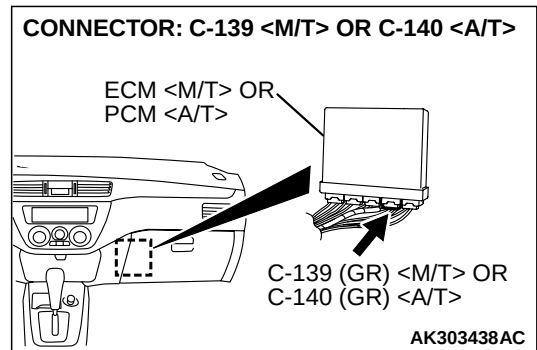
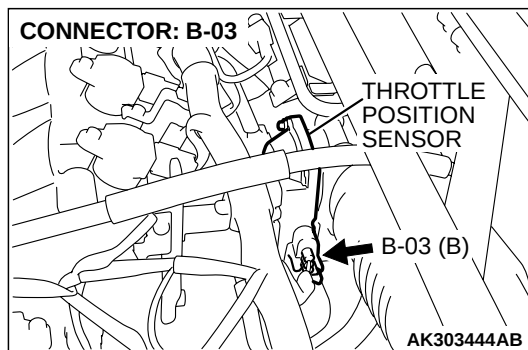
**NO :** The inspection is complete.

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

Throttle Position Sensor (main) Circuit



AK303983



### CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the ECM <M/T> or PCM <A/T> (terminal No. 106).  
The ground terminal (terminal No. 3) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 105).
- When the throttle valve shaft is turned from the idle position to the fully opened position, the resistance between the throttle position sensor (main) output terminal (terminal No. 4) and ground terminal will increase according to the rotation.

### TECHNICAL DESCRIPTION

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

- The ECM <M/T> or PCM <A/T> checks whether the voltage is within a specified range.

### DESCRIPTIONS OF MONITOR METHODS

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

### MONITOR EXECUTION

Continuous

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

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

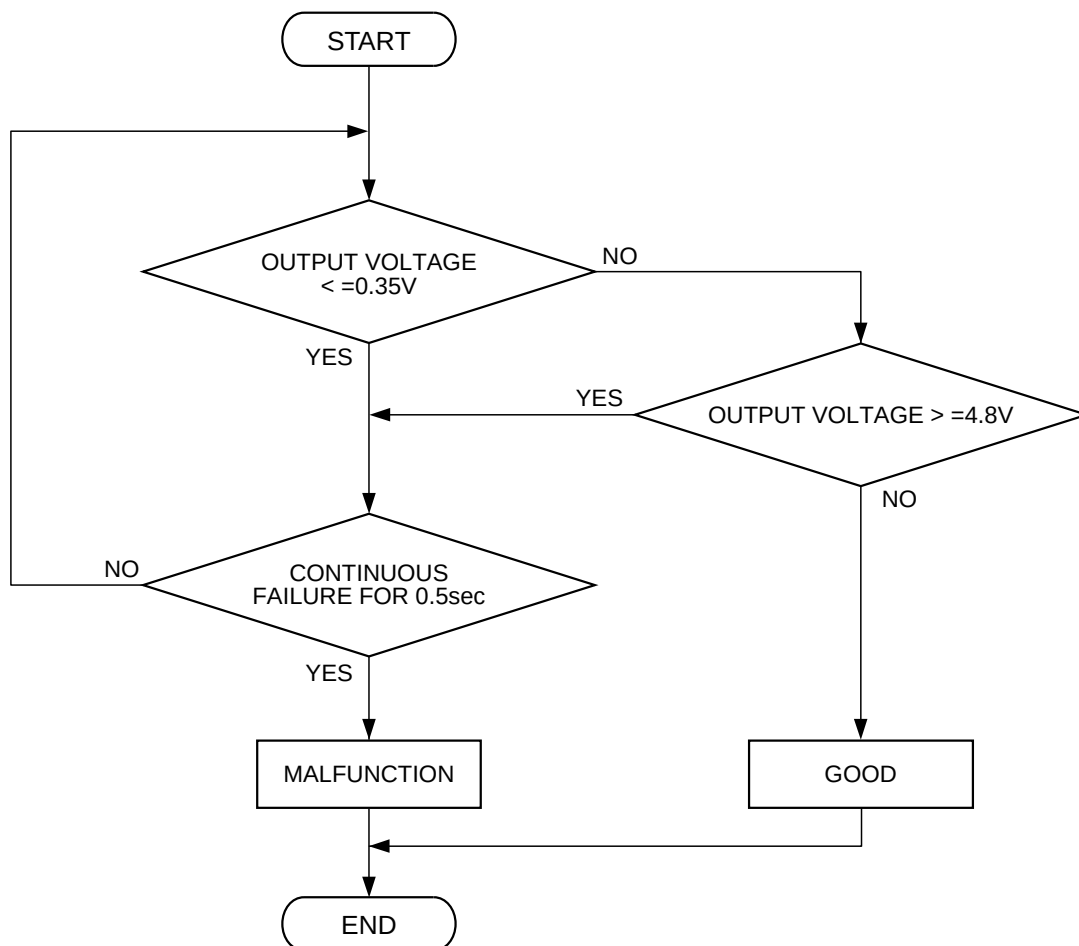
- Not applicable

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

- Not applicable

## DTC SET CONDITIONS

## Logic Flow Chart



AK302016

**Check Condition**

- Ignition switch "ON" position.

**Judgement Criteria**

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

**OBD-II DRIVE CYCLE PATTERN**

None.

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

- Throttle position sensor failed.
- Open or shorted throttle position sensor (main) circuit, harness damage, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

#### ⚠ CAUTION

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

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

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

**YES** : It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

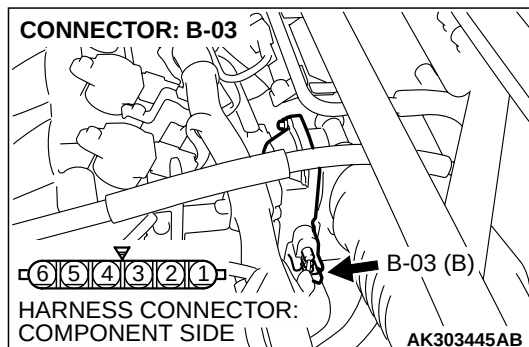
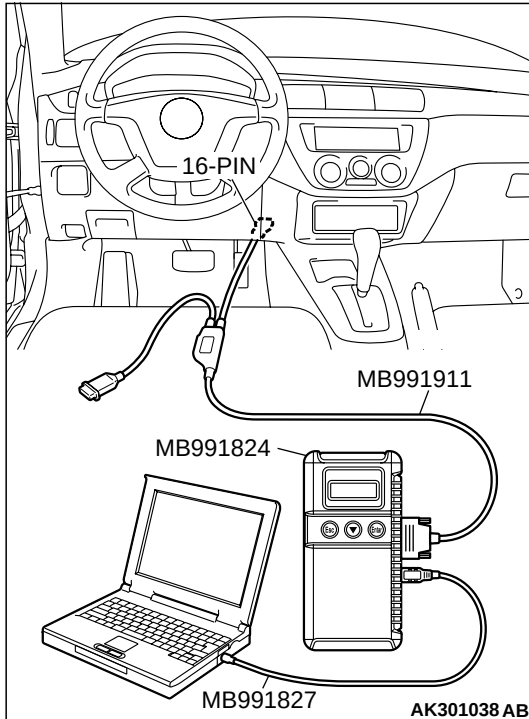
**NO** : Go to Step 2.

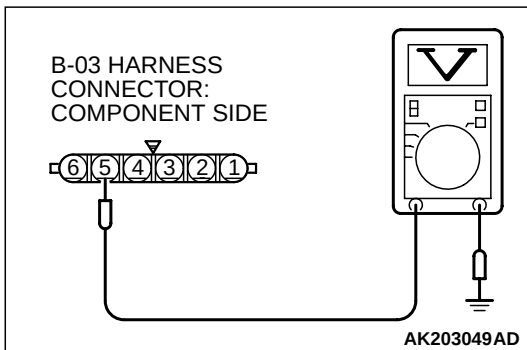
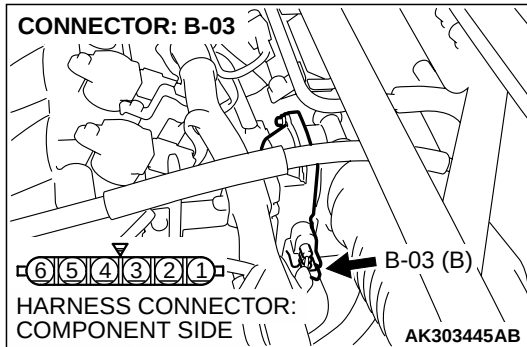
### STEP 2. Check harness connector B-03 at throttle position sensor for damage.

#### 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-03.**

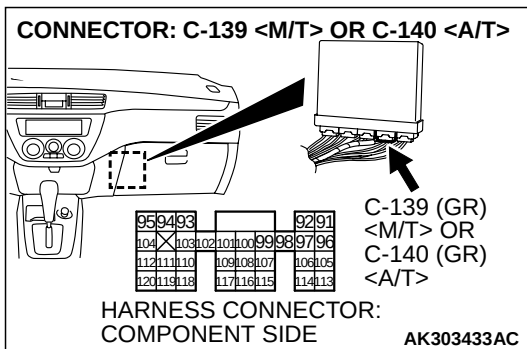
- (1) Disconnect the connector B-03 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 5 and ground.
  - Voltage should be between 4.8 and 5.2 volts.
- (4) Turn the ignition switch to the "LOCK"(OFF) position.

**Q: Is the measured voltage between 4.8 and 5.2 volts?**

**YES :** Go to Step 7.

**NO :** Go to Step 4.



**STEP 4. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 5.

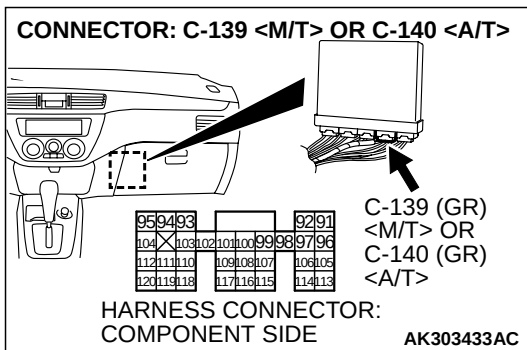
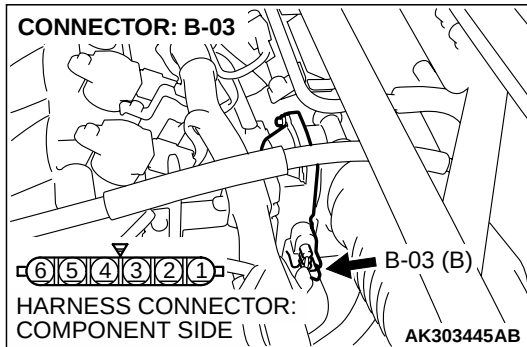
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

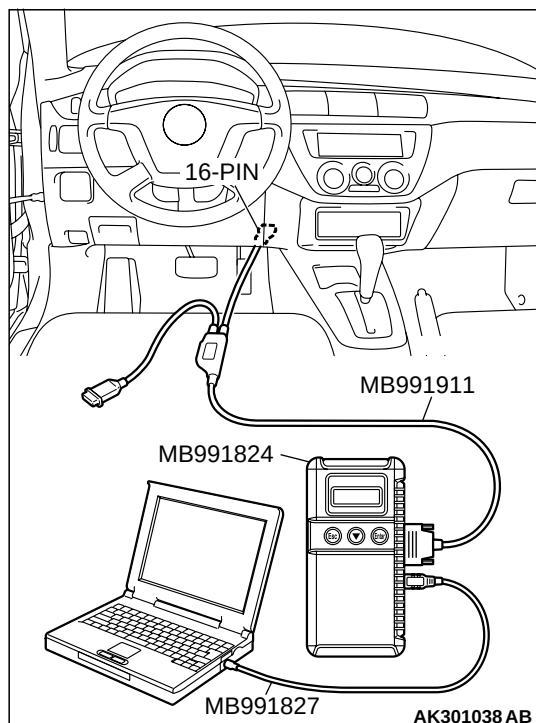
**STEP 5.** Check for open circuit and short circuit to ground between throttle position sensor connector B-03 (terminal No. 5) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 106).

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

**YES :** Go to Step 6.

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





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

**⚠ CAUTION**

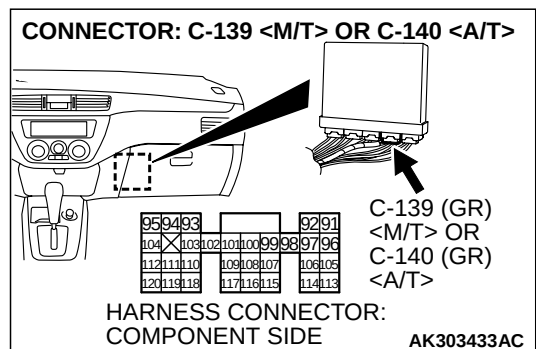
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK"(OFF) position before connecting or disconnecting scan tool MB991958.

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

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

**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Replace the ECM or PCM. Then go to Step 11.



**STEP 7. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 8.

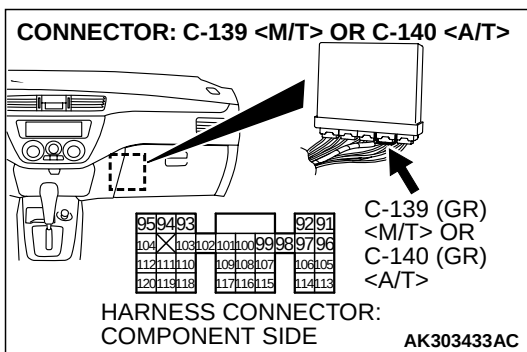
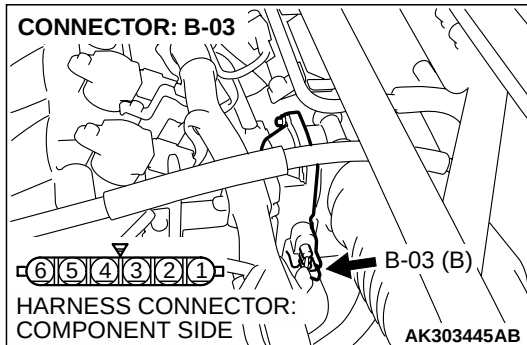
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

**STEP 8. Check for harness damage between throttle position sensor connector B-03 (terminal No. 5) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 106).**

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

**YES :** Go to Step 9.

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

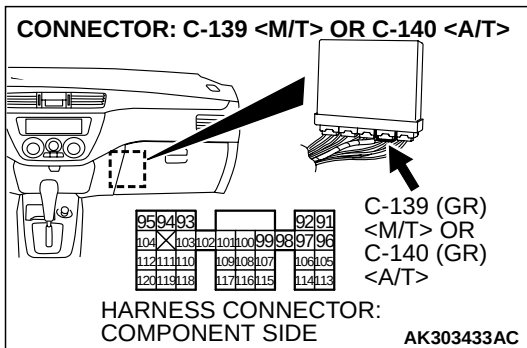
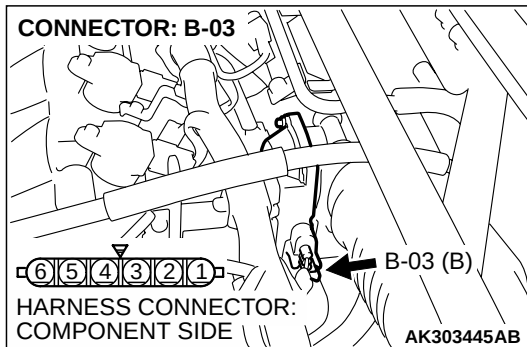


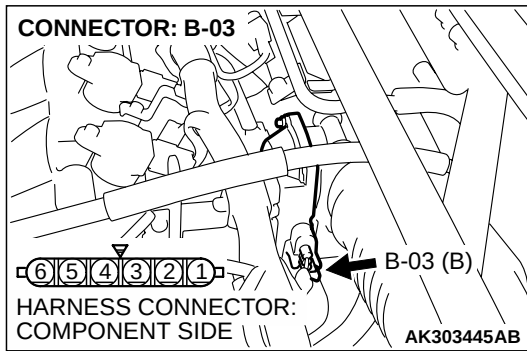
**STEP 9. Check for open circuit, short circuit to ground and harness damage between throttle position sensor connector B-03 (terminal No. 4) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 115).**

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

**YES :** Go to Step 10.

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



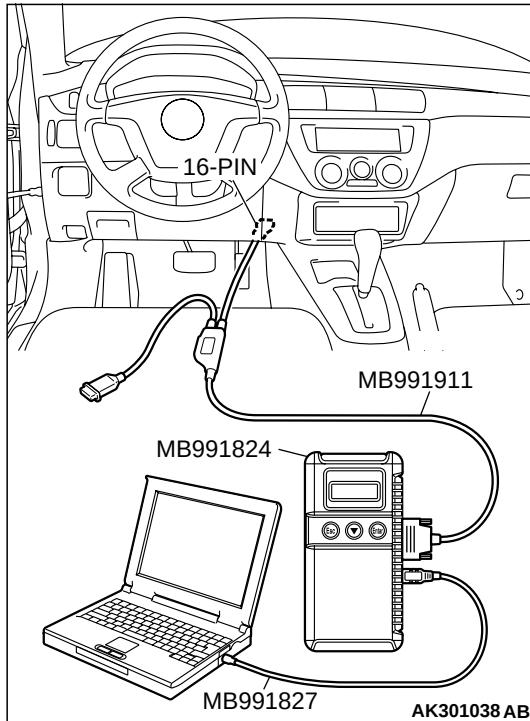
**STEP10. Replace the throttle body assembly.**

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

**Q: Is DTC P0122 set?**

**YES** : Replace the ECM or PCM. Then go to Step 11.

**NO** : The inspection is complete.

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

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

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

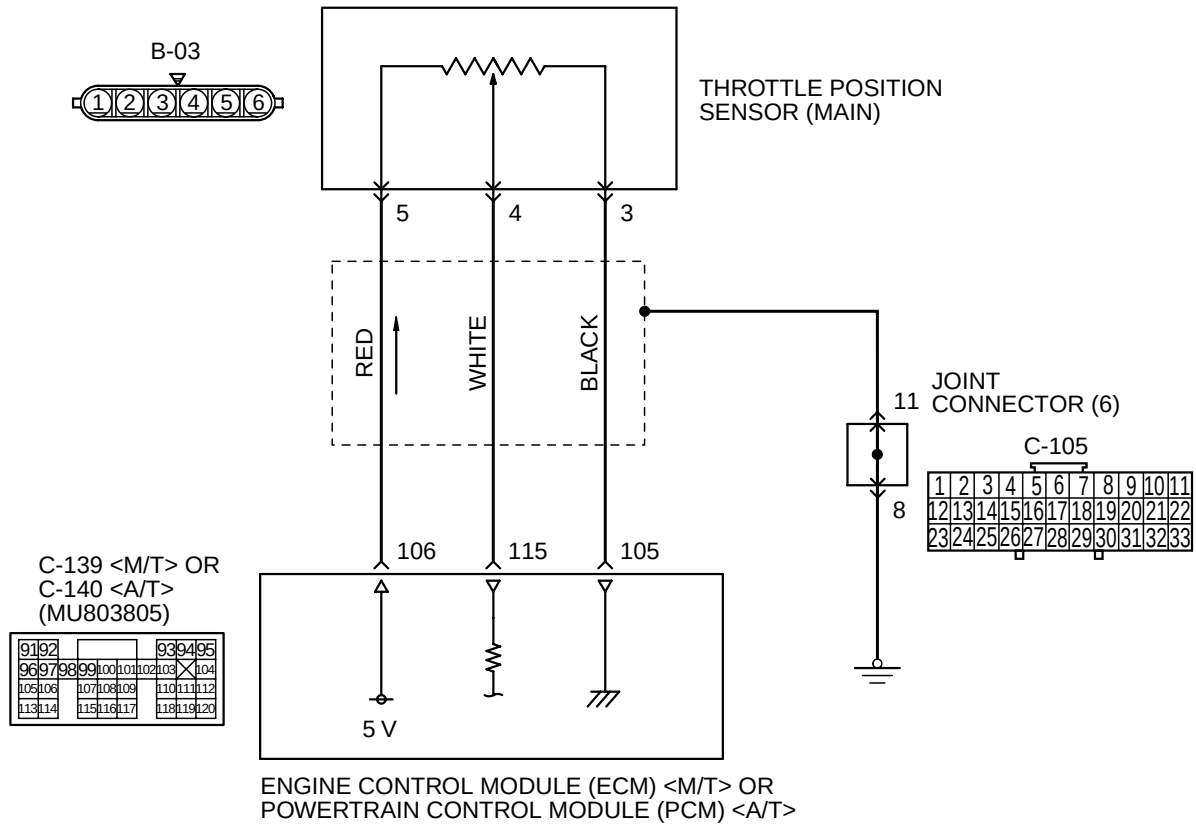
**Q: Is DTC P0122 set?**

**YES** : Retry the troubleshooting.

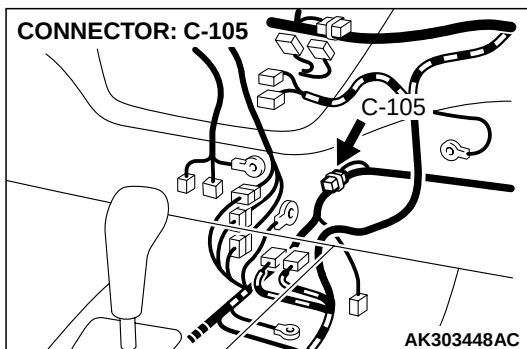
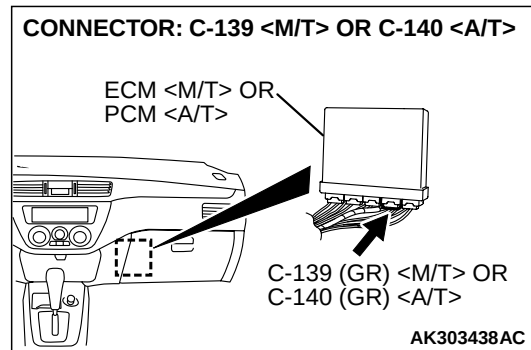
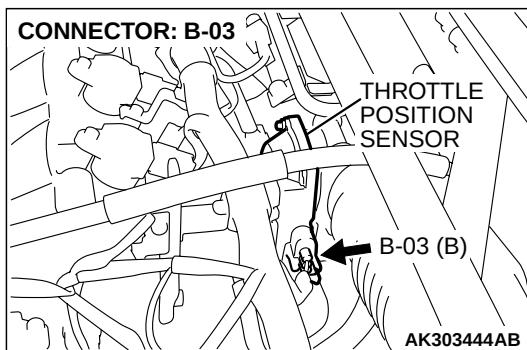
**NO** : The inspection is complete.

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

Throttle Position Sensor (main) Circuit



AK303983



**CIRCUIT OPERATION**

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the ECM <M/T> or PCM <A/T> (terminal No. 106).  
The ground terminal (terminal No. 3) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 105).
- When the throttle valve shaft is turned from the idle position to the fully opened position, the resistance between the throttle position sensor (main) output terminal (terminal No. 4) and ground terminal will increase according to the rotation.

**TECHNICAL DESCRIPTION**

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

- The ECM <M/T> or PCM <A/T> checks whether the voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

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

**MONITOR EXECUTION**

Continuous

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

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

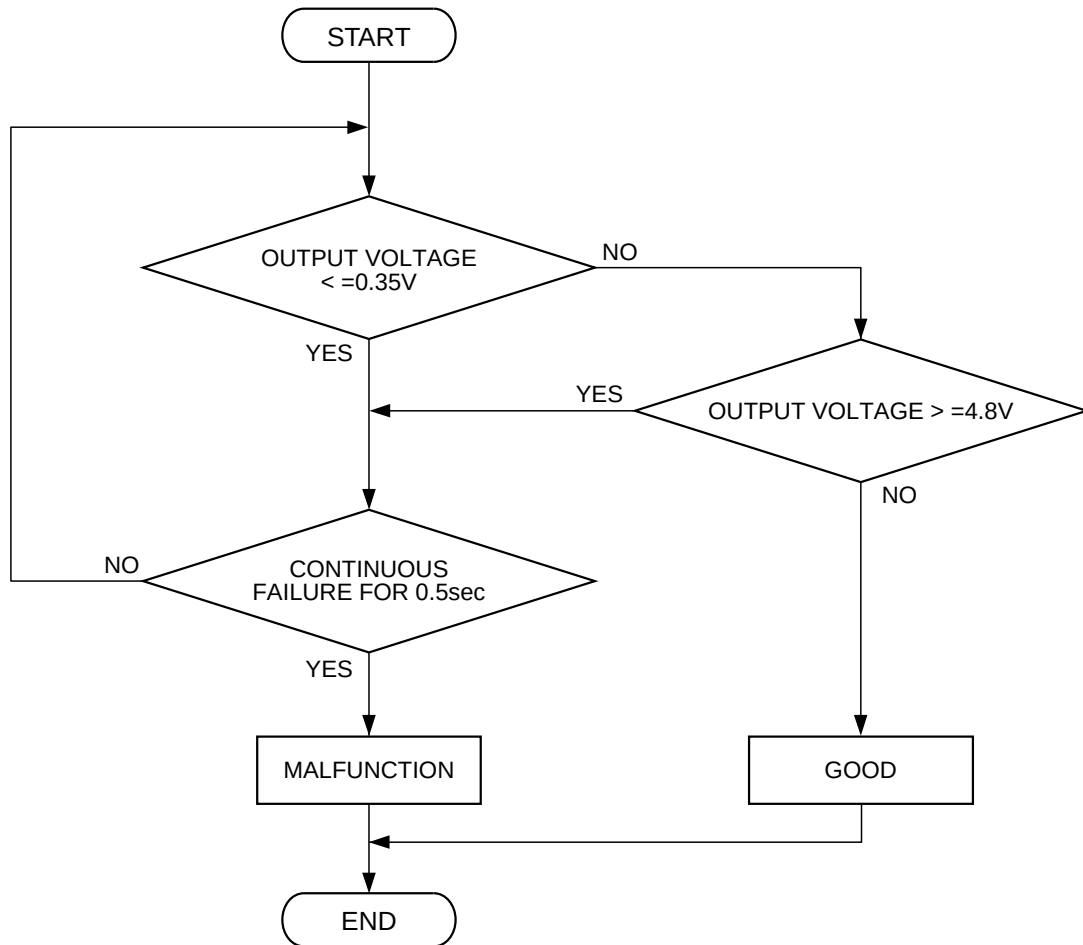
- Not applicable

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

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302016

**Check Conditions**

- Ignition switch "ON" position.

**Judgement Criteria**

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

**OBD-II DRIVE CYCLE PATTERN**

None.

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

- Throttle position sensor failed.
- Open throttle position sensor (main) circuit, harness damage, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

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

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

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

**⚠ CAUTION**

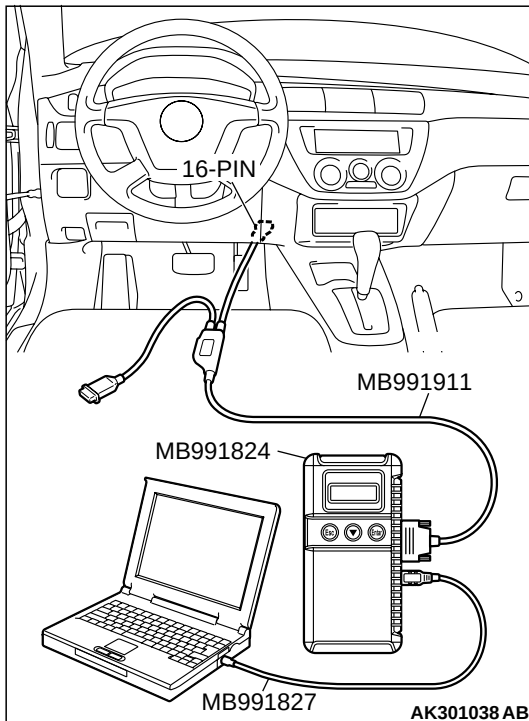
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK"(OFF) position before connecting or disconnecting scan tool MB991958.

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

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

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Go to Step 2.

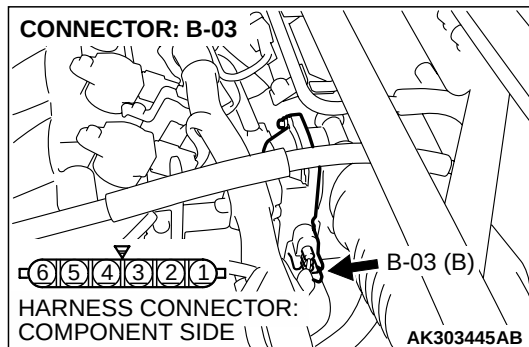


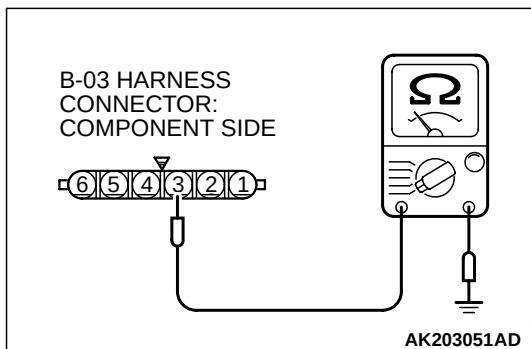
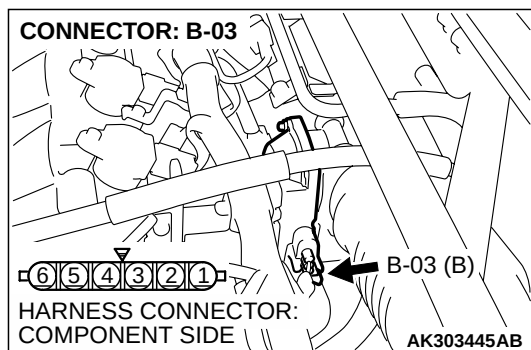
**STEP 2. Check harness connector B-03 at throttle position sensor for damage.**

**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-03.**

(1) Disconnect the connector B-03 and measure at the harness side.

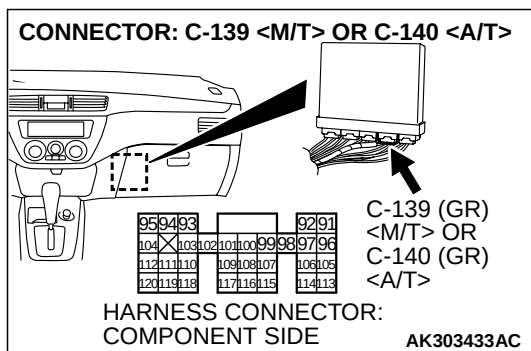
(2) Measure the continuity between terminal No. 3 and ground

- Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Go to Step 7.

**NO :** Go to Step 4.



**STEP 4. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 5.

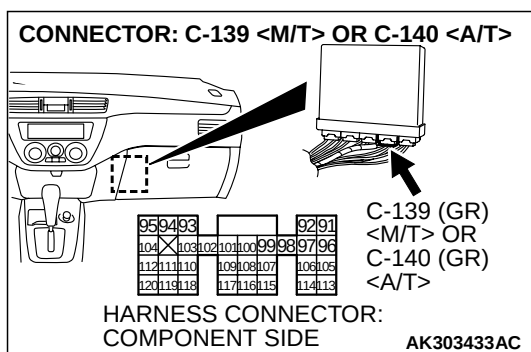
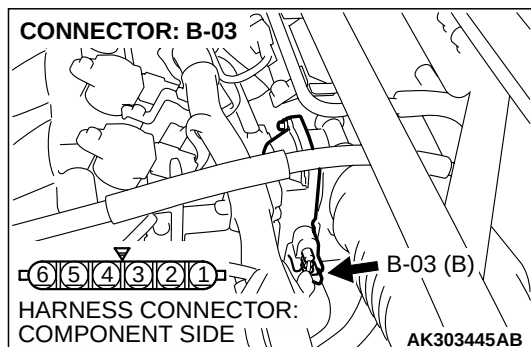
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 8.

**STEP 5. Check for open circuit and harness damage between throttle position sensor connector B-03 (terminal No. 3) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 105).**

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

**YES :** Go to Step 6.

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



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

**⚠ CAUTION**

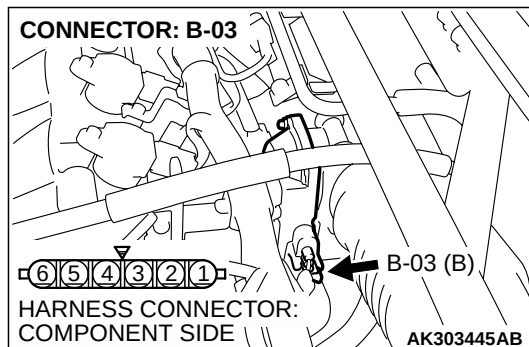
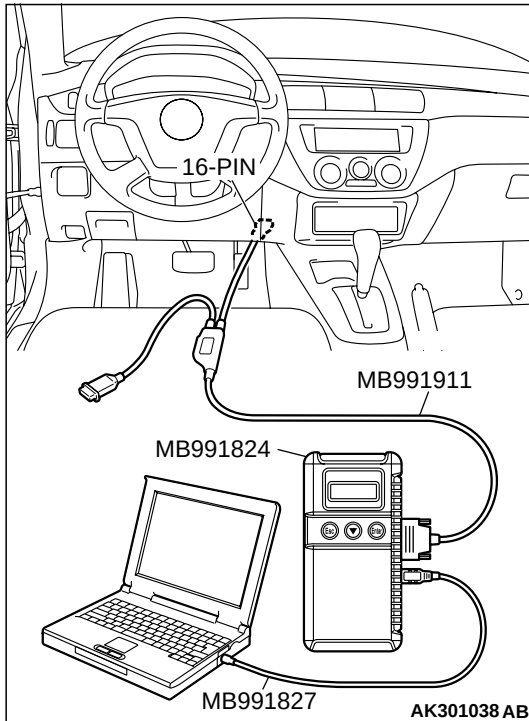
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK"(OFF) position before connecting or disconnecting scan tool MB991958.

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

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

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Replace the ECM or PCM. Then go to Step 8.



**STEP 7. Replace the throttle body assembly.**

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

**Q: Is DTC P0123 set?**

**YES :** Replace the ECM or PCM. Then go to Step 8.

**NO :** The inspection is complete.

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

**⚠ CAUTION**

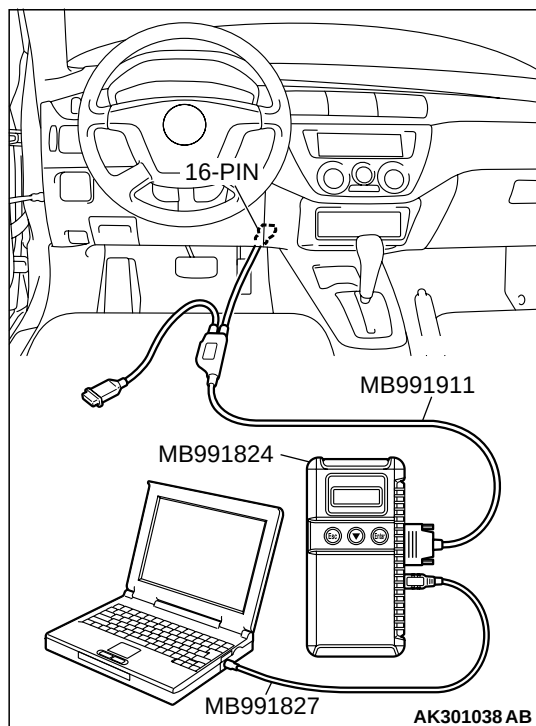
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK"(OFF) position before connecting or disconnecting scan tool MB991958.

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

**Q: Is DTC P0123 set?**

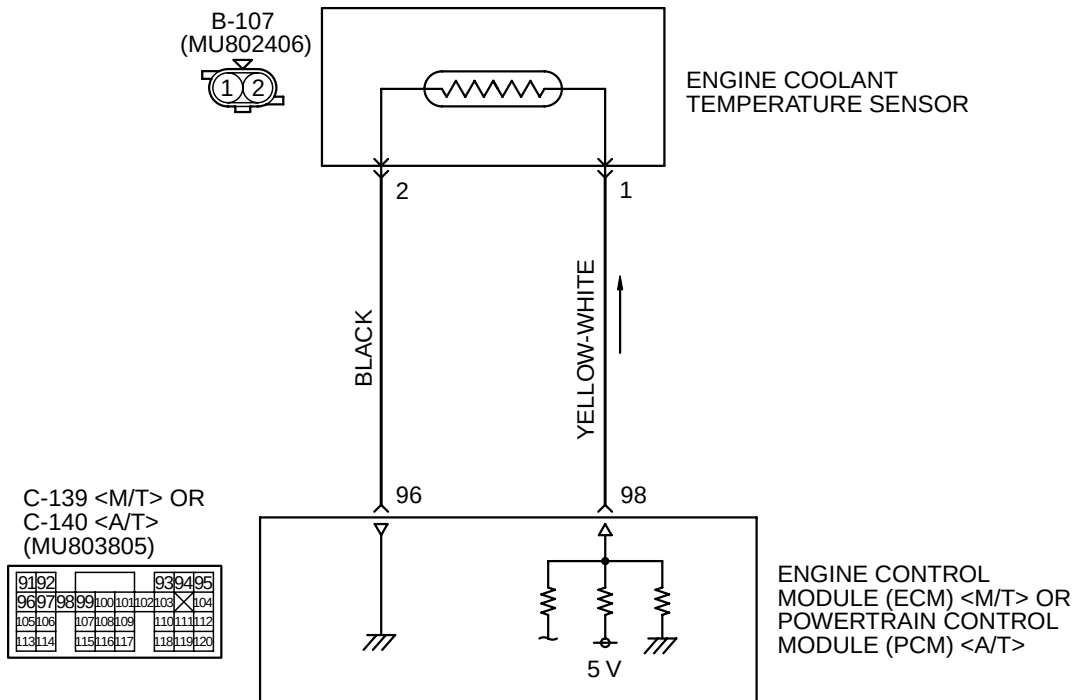
**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

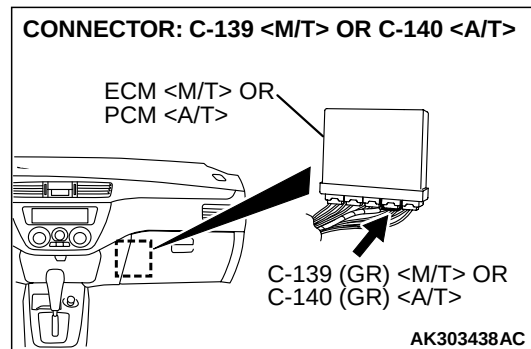
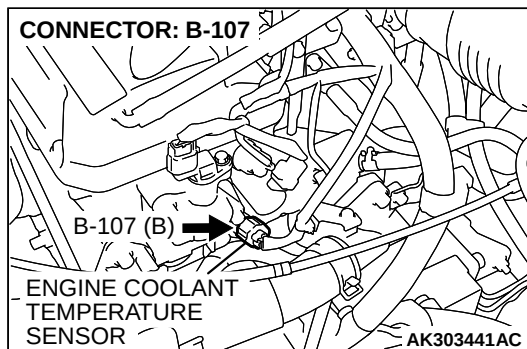


DTC P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control

Engine Coolant Temperature Sensor Circuit



AK303982



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM <M/T> or PCM <A/T> (terminal No. 98) via the resistor in the ECM <M/T> or PCM <A/T>. The ground terminal (terminal No. 2) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

**TECHNICAL DESCRIPTION**

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM <M/T> or PCM <A/T> checks whether this voltage is within a specified range.

**DESCRIPTIONS OF MONITOR METHODS**

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

**MONITOR EXECUTION**

Continuous

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

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

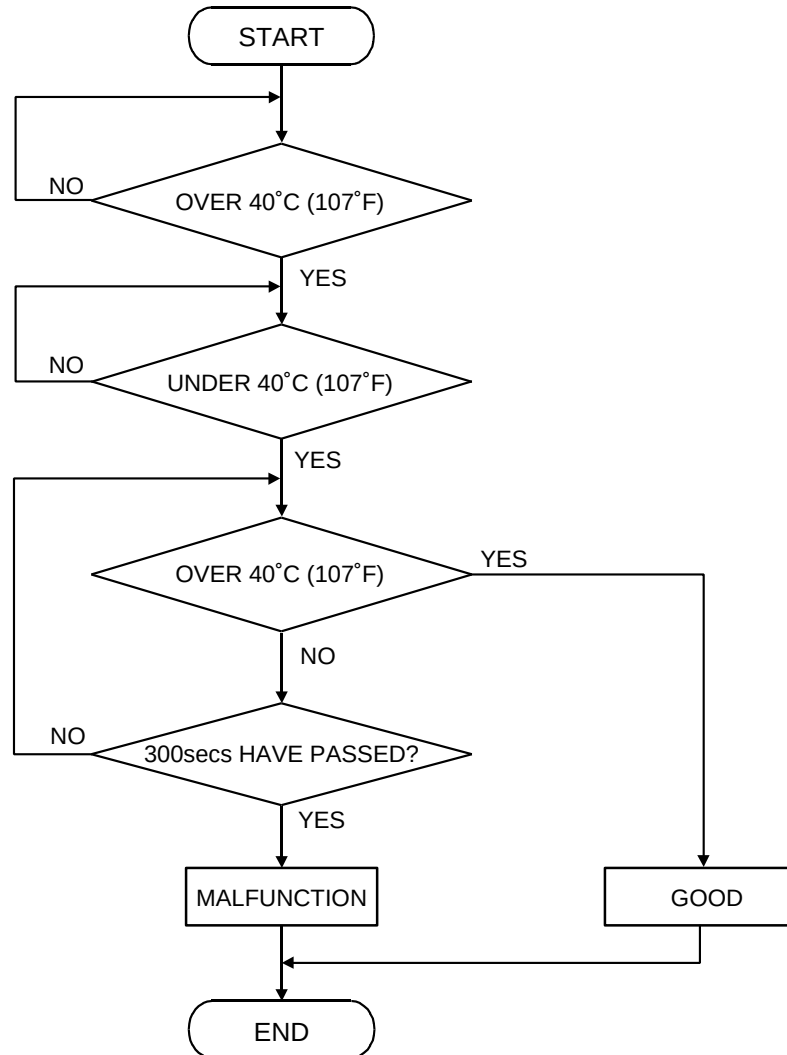
- Not applicable

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

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

DTC SET CONDITIONS <Range/Performance problem – drift>

Logic Flow Chart



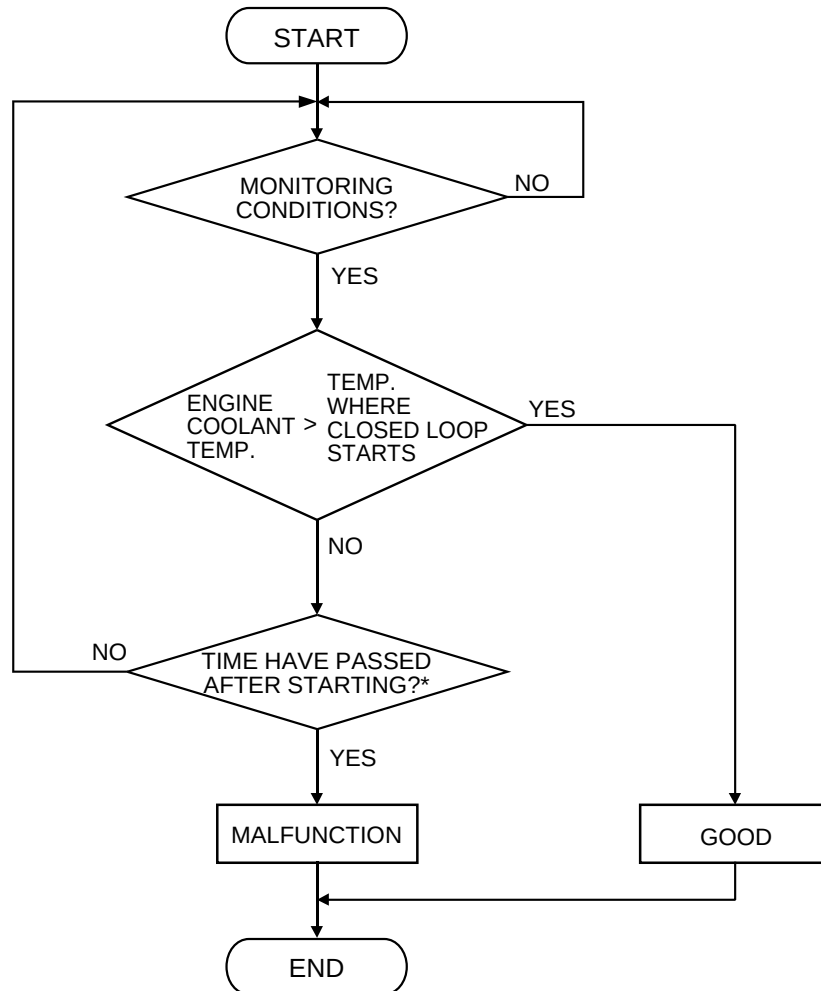
AK302017

**Check Conditions, Judgement Criteria**

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

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

## Logic Flow Chart



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

AK302018

### Check Conditions, Judgement Criteria

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

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –  
Procedure 6 – Other Monitor [P.13B-6](#).

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

- Engine coolant temperature sensor failed.
- Harness damage in engine coolant temperature sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

### **⚠ CAUTION**

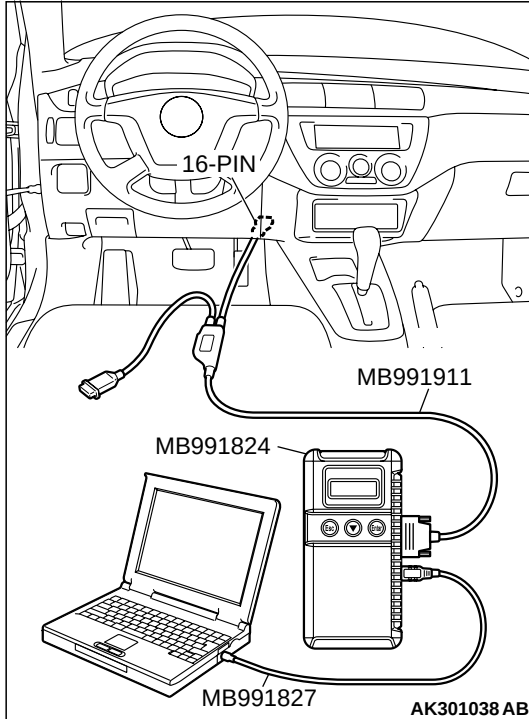
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

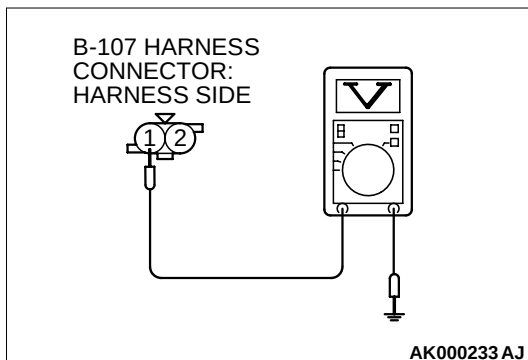
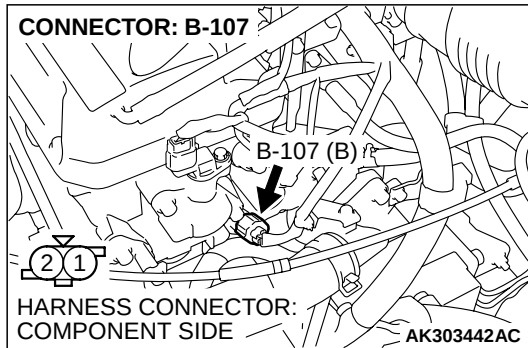
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately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

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

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Go to Step 2.





**STEP 2. Measure the sensor output voltage at engine coolant temperature sensor connector B-107 by backprobing.**

- (1) Do not disconnect the connector B-107.
- (2) Turn the ignition switch to the "ON" position.

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

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

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

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

**YES :** Go to Step 3.

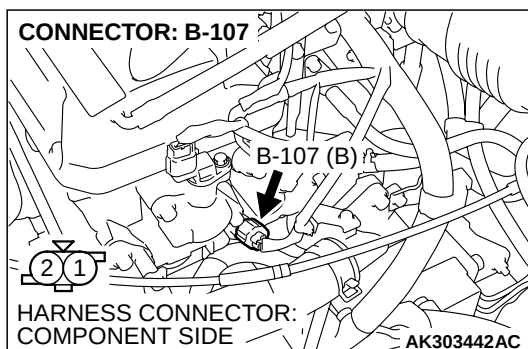
**NO :** Go to Step 5.

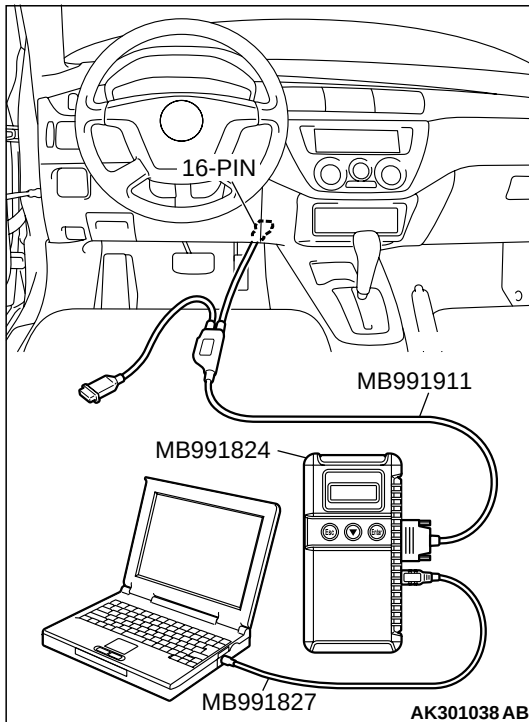
**STEP 3. Check harness connector B-107 at the engine coolant temperature sensor for damage.**

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

**YES :** Go to Step 4.

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





**STEP 4. Using scan tool MB991958, check data list item 21: Engine Coolant Temperature Sensor.**

**⚠ CAUTION**

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.

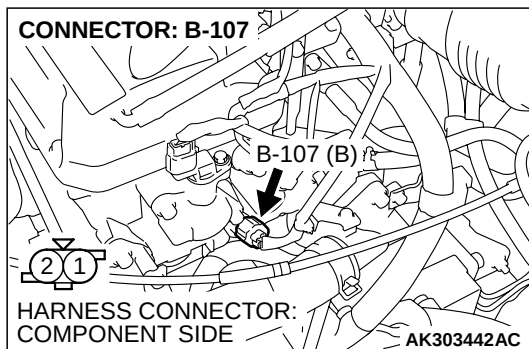
- The engine coolant temperature and temperature shown with the scan tool should approximately match.

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

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

**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Replace the ECM or PCM. Then go to Step 14.

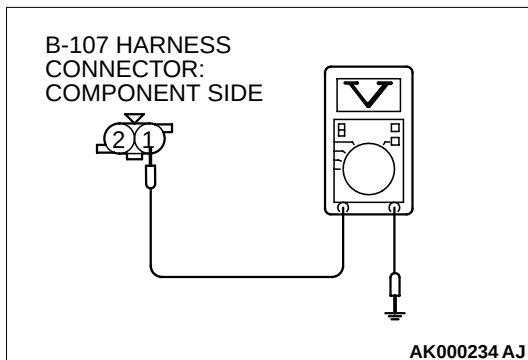
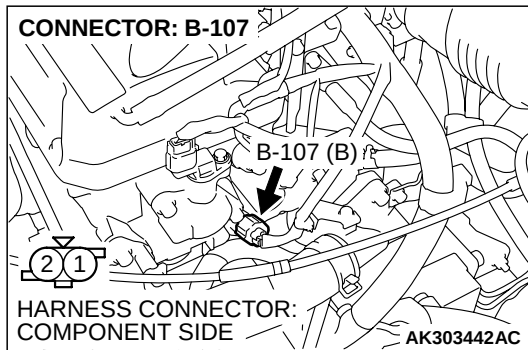


**STEP 5. Check harness connector B-107 at engine coolant temperature sensor for damage.**

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

**YES :** Go to Step 6.

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



**STEP 6. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-107.**

(1) Disconnect the connector B-107 and measure at the harness side.

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

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

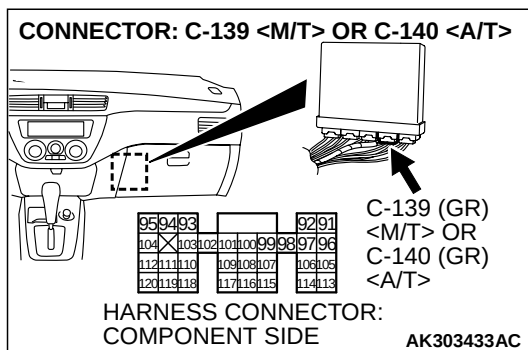
- Voltage should measure between 4.5 and 4.9 volts.

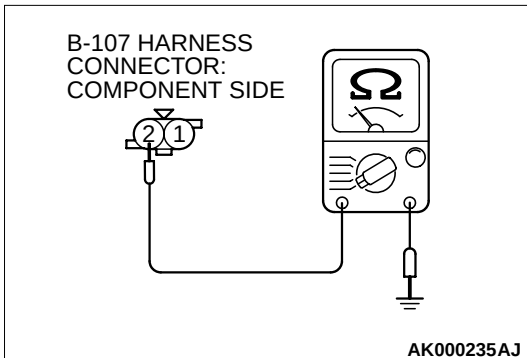
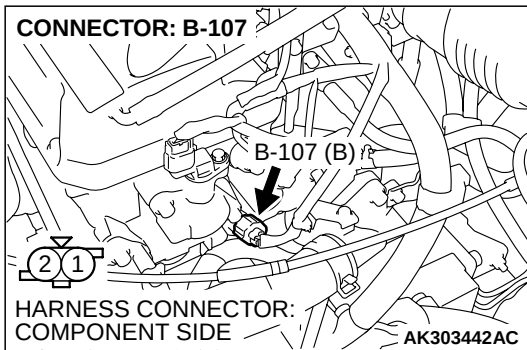
(4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 8.

**NO :** Go to Step 7.





**STEP 8. Check the continuity at engine coolant temperature sensor harness side connector B-107.**

(1) Disconnect the connector B-107 and measure at the harness side.

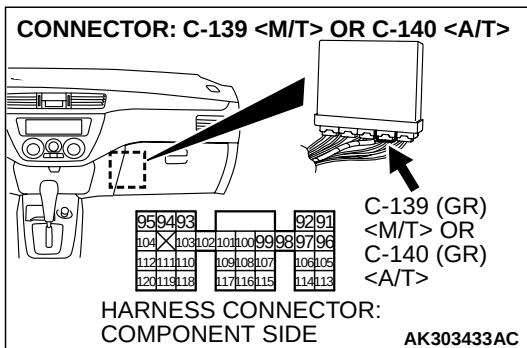
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Go to Step 11.

**NO :** Go to Step 9.



**STEP 9. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 10.

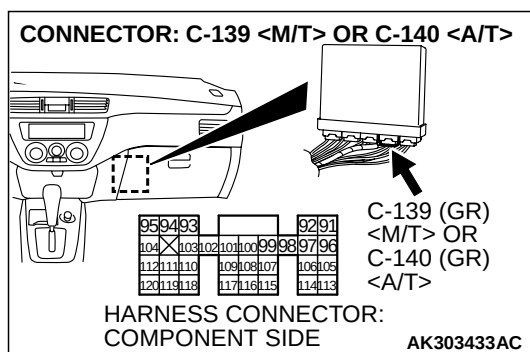
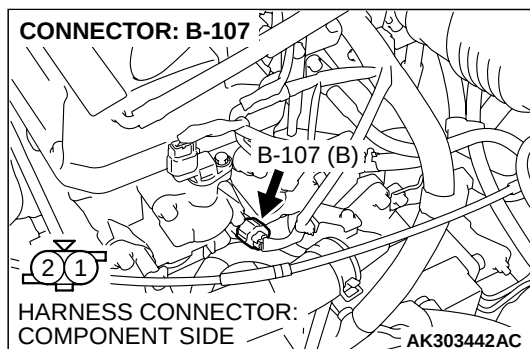
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

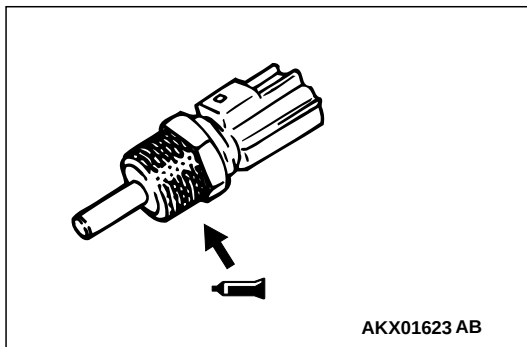
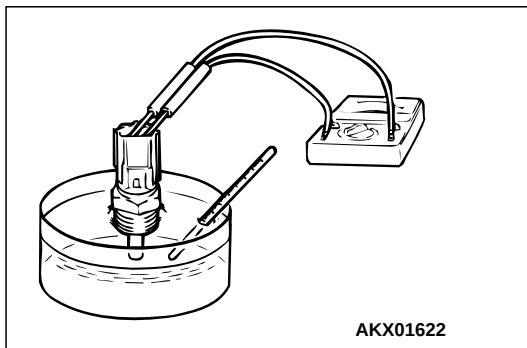
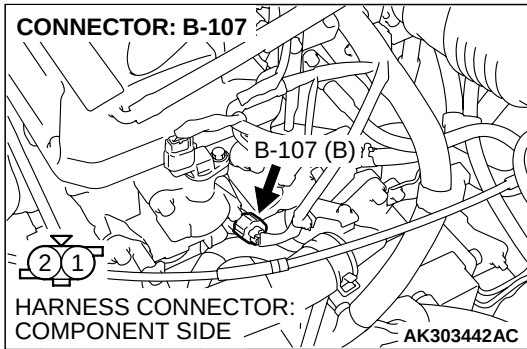
**STEP 10. Check for harness damage between engine coolant temperature sensor connector B-107 (terminal No. 2) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).**

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

**YES :** Replace the ECM or PCM. Then go to Step 14.

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





**STEP 11. Check the engine coolant temperature sensor.**

- (1) Disconnect the engine coolant temperature sensor connector B-107.
- (2) Remove the engine coolant temperature sensor.

- (3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, measure resistance.

**Standard value:**

- 14 – 17 kΩ [at –20°C (–4°F)]
- 5.1 – 6.5 kΩ [at 0°C (32°F)]
- 2.1 – 2.7 kΩ [at 20°C (68°F)]
- 0.9 – 1.3 kΩ [at 40°C (104°F)]
- 0.48 – 0.68 kΩ [at 60°C (140°F)]
- 0.26 – 0.36 kΩ [at 80°C (176°F)]

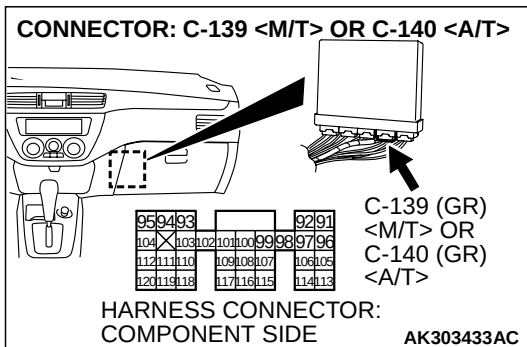
- (4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.
- (5) Install the engine coolant temperature sensor, and tighten to the specified torque.

**Tightening torque: 30 ± 9 N·m (22 ± 7 ft-lb)**

**Q: Is the resistance at the standard value?**

**YES :** Go to Step 12.

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

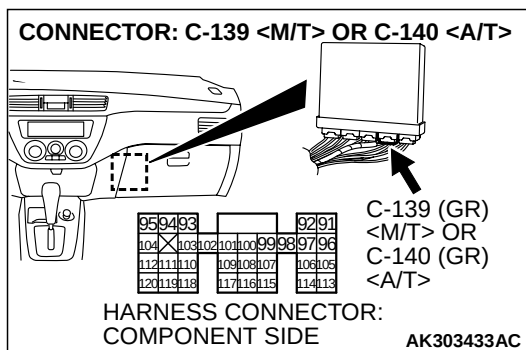
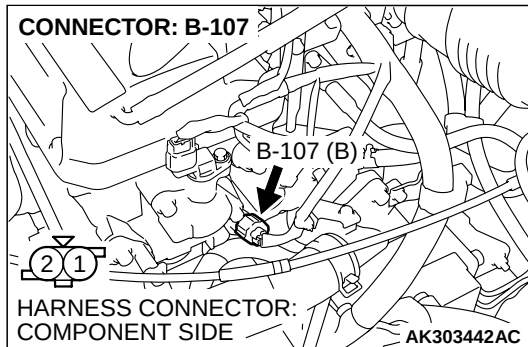


**STEP 12. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 13.

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



**STEP 13. Check for harness damage between engine coolant temperature sensor connector B-107 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 98).**

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

**YES :** Replace the ECM or PCM. Then go to Step 14.

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

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

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

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

**Q: Is DTC P0125 set?**

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

---

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

---

**TECHNICAL DESCRIPTION**

- The ECM <M/T> or PCM <A/T> checks the time for the cooling water temperature to reach the judgment temperature.

**DESCRIPTIONS OF MONITOR METHODS**

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

**MONITOR EXECUTION**

Once per driving cycle

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

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

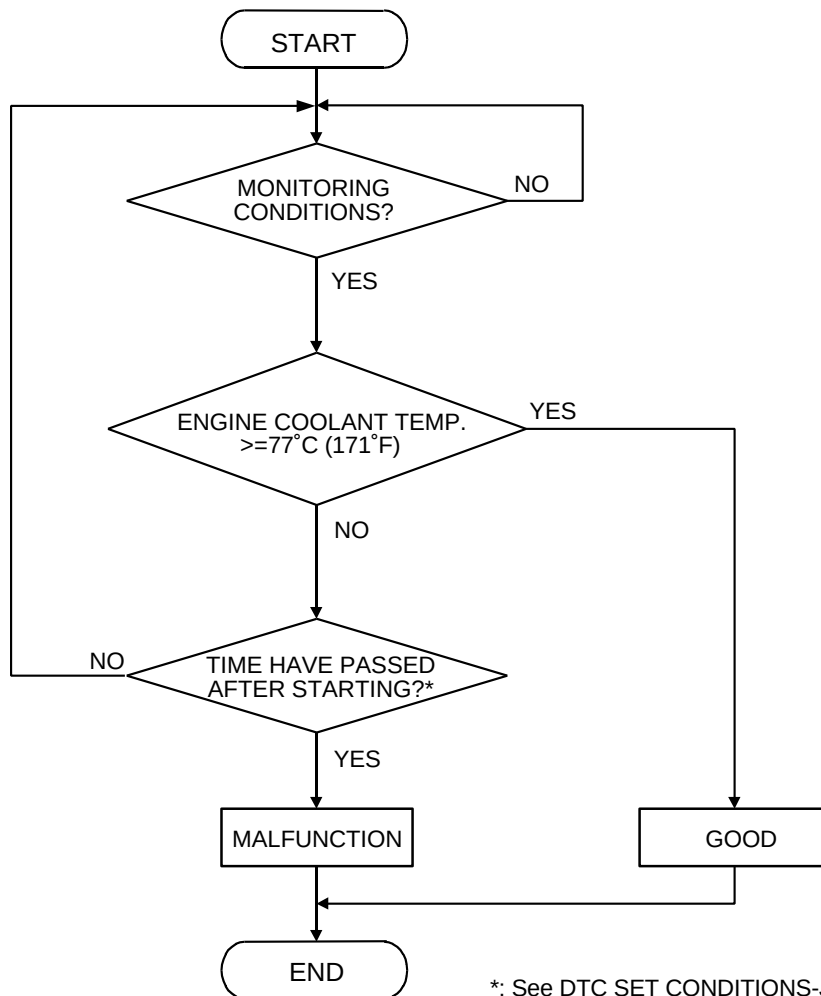
- Not applicable

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

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

## DTC SET CONDITIONS

## Logic Flow Chart



\*: See DTC SET CONDITIONS-JUDGMENT CRITERIA

AK302024

**Check Conditions**

- Engine coolant temperature is between  $-10^{\circ}\text{C}$  ( $14^{\circ}\text{F}$ ) and  $77^{\circ}\text{C}$  ( $171^{\circ}\text{F}$ ) when the engine is started.
- The engine coolant temperature – intake air temperature is  $5^{\circ}\text{C}$  ( $9^{\circ}\text{F}$ ) or less when the engine is started.
- The intake air temperature when the engine is started – intake air temperature is  $5^{\circ}\text{C}$  ( $9^{\circ}\text{F}$ ) or less.
- The total time of the mass airflow sensor output whose state is below 12 g/sec within 300 seconds.

**Judgment Criteria**

- The time for the engine coolant temperature to rise to  $77^{\circ}\text{C}$  ( $171^{\circ}\text{F}$ ) takes longer than approximately 11 to 12 minutes.

**OBD-II DRIVE CYCLE PATTERN**

None.

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

- The thermostat is faulty.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### STEP 1. Check the cooling system.

Refer to GROUP 14, Engine Cooling Diagnosis [P.14-4](#).

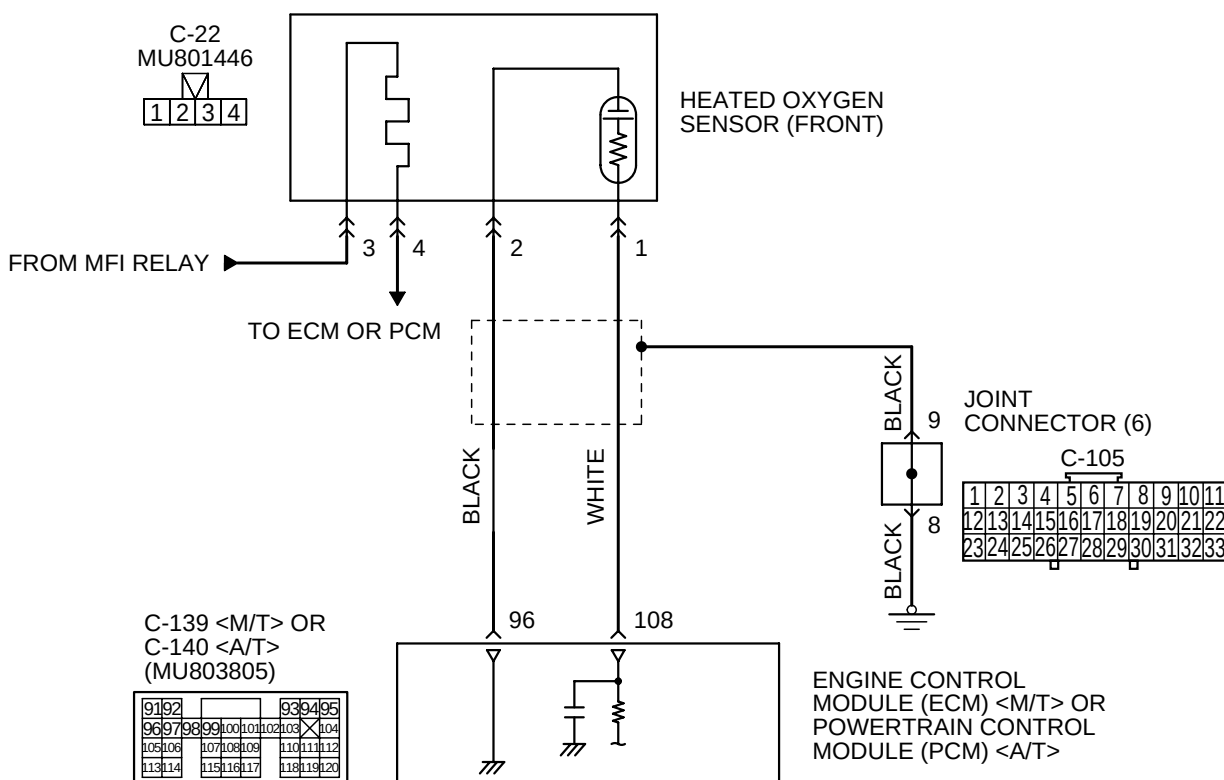
#### Q: Is the cooling system normal?

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

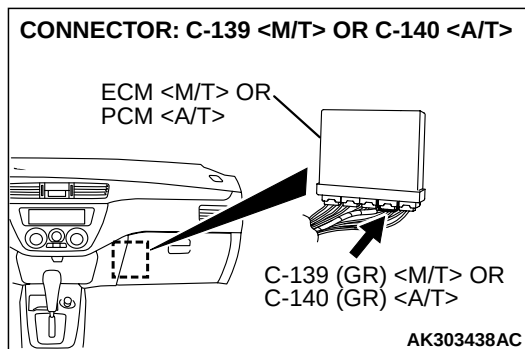
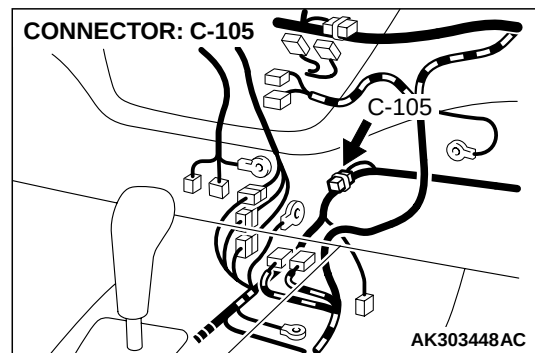
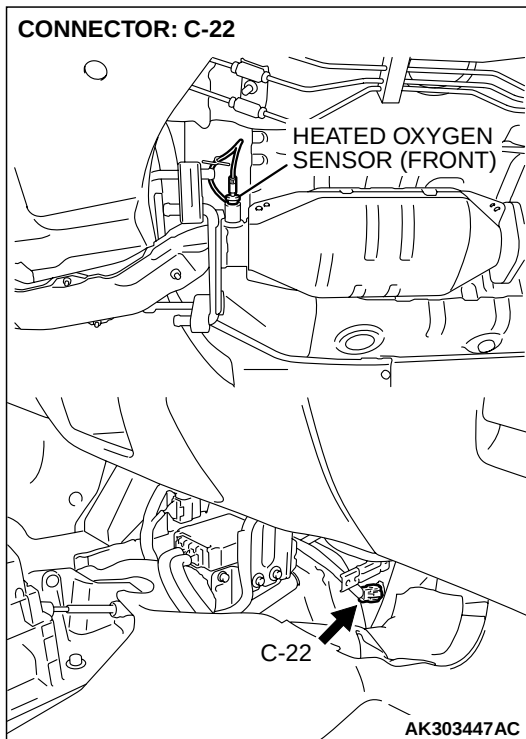
**NO** : Repair it. Then check that the DTC P0128 does not reset.

### DTC P0130: Heated Oxygen Sensor Circuit (sensor 1)

Heated Oxygen Sensor (front) Circuit



AK303984



### CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM <M/T> or PCM <A/T> (terminal No. 108) from the output terminal (terminal No. 1) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).

### 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 <M/T> or PCM <A/T>.

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

### DESCRIPTIONS OF MONITOR METHODS

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

**MONITOR EXECUTION**

Continuous

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

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

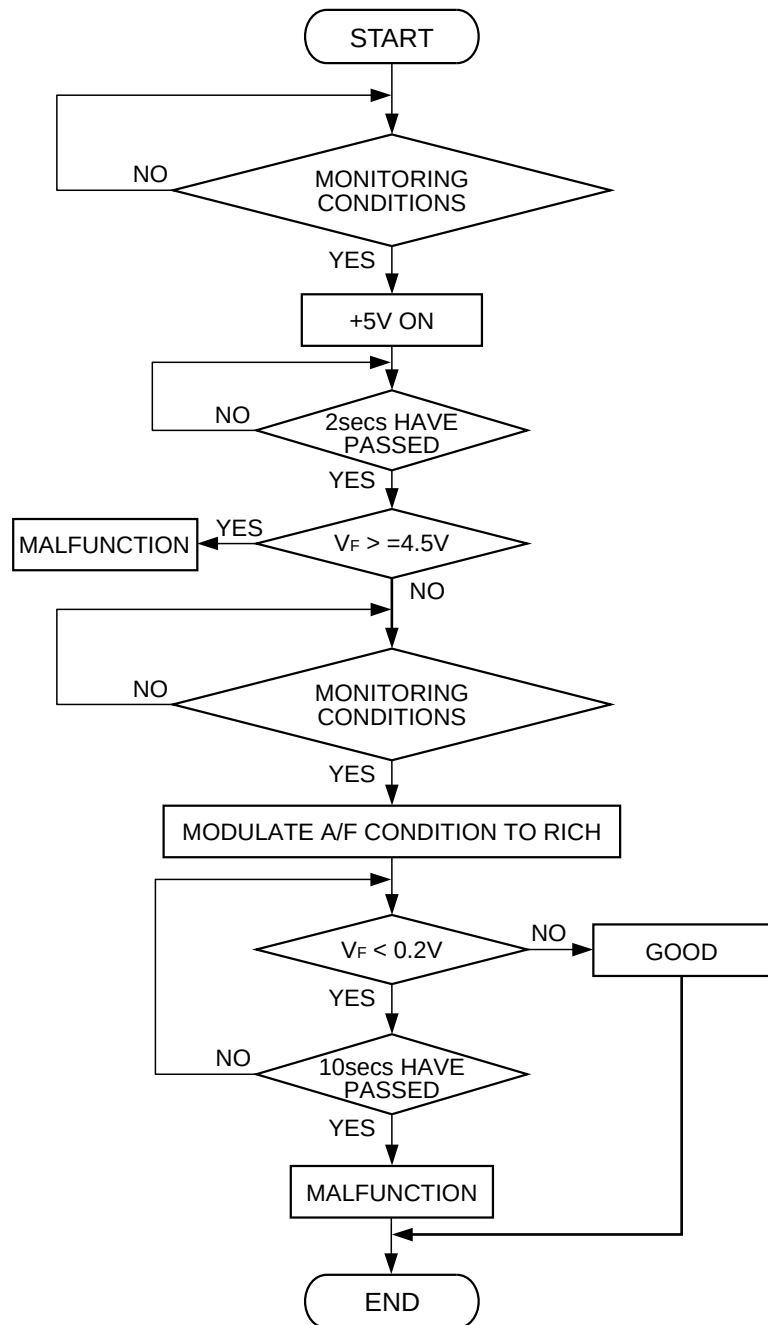
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

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

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

## DTC SET CONDITIONS

## Logic Flow Chart



AK302019

**Check Conditions**

- 3 minutes or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor (front) signal voltage has continued to be 0.2 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Monitoring time: 7 seconds.

### Judgment Criteria

- Input voltage supplied to the ECM <M/T> or PCM <A/T> interface circuit is higher than 4.5 volts when 5 volts is applied to the heated oxygen sensor (front) output line via a resistor.

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Heated oxygen sensor (front) failed.
- Open circuit in heated oxygen sensor (front) output line or connector damage.
- Open circuit in heated oxygen sensor (front) ground line or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

#### CAUTION

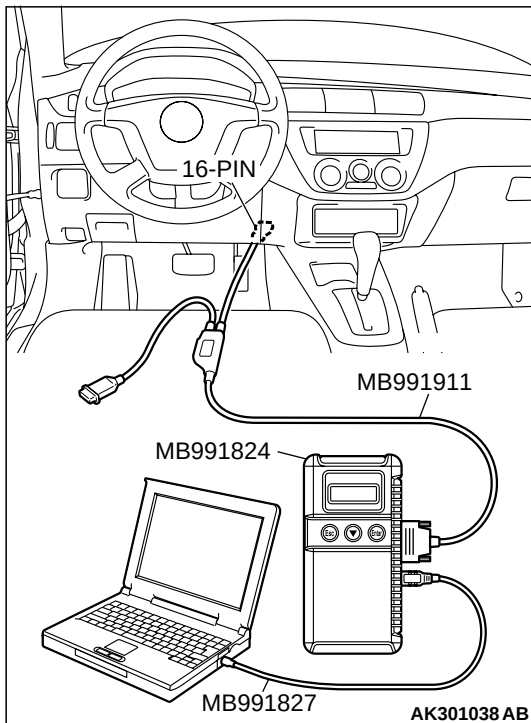
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

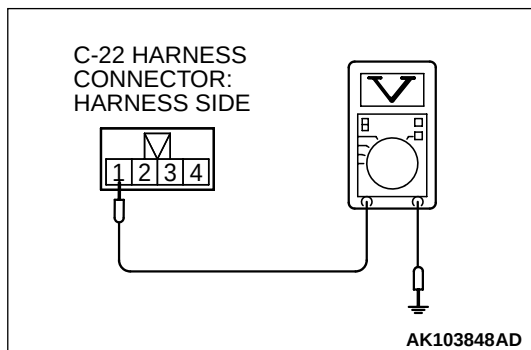
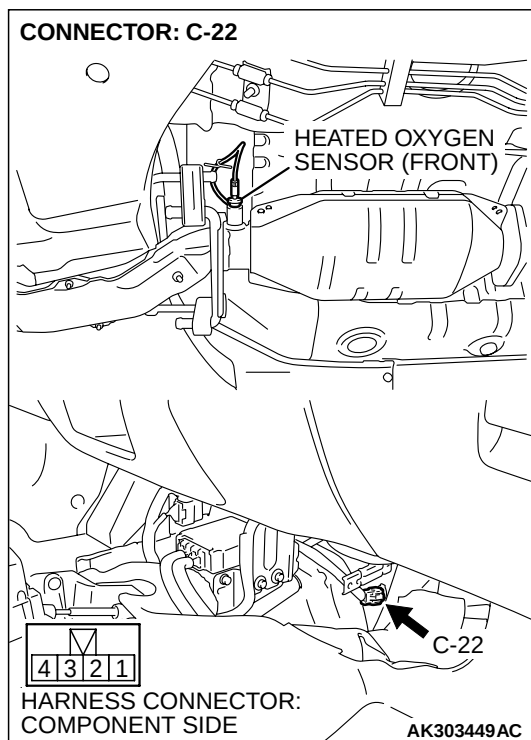
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
  - Warm up the engine. When the engine is revved, the output voltage should be 0.6 to 1.0 volt.
  - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt 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 [P.00-6](#).

**NO :** Go to Step 2.





**STEP 2. Measure the sensor output voltage at heated oxygen sensor (front) connector C-22 by backprobing.**

- (1) Do not disconnect the connector C-22.
- (2) Start the engine and run at idle.

- (3) Measure the voltage between terminal No. 1 and ground by backprobing.
  - Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 3.

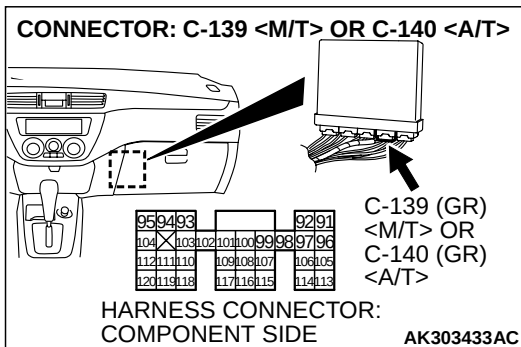
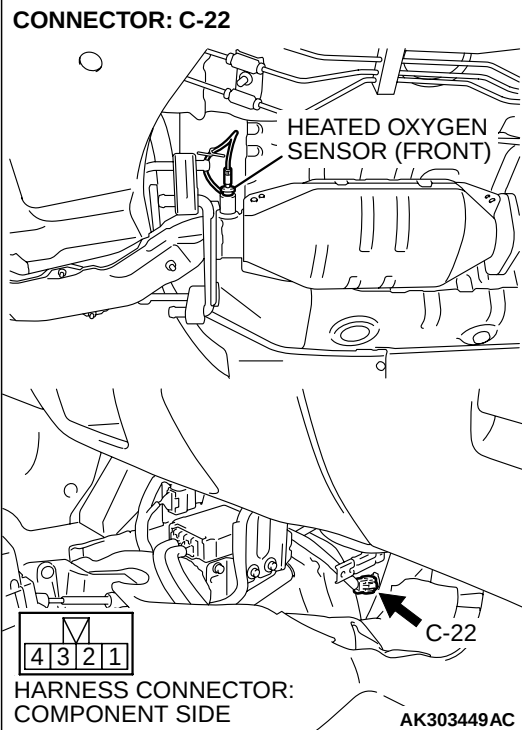
**NO :** Go to Step 6.

**STEP 3.** Check harness connector C-22 at heated oxygen sensor (front) and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> 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 11.

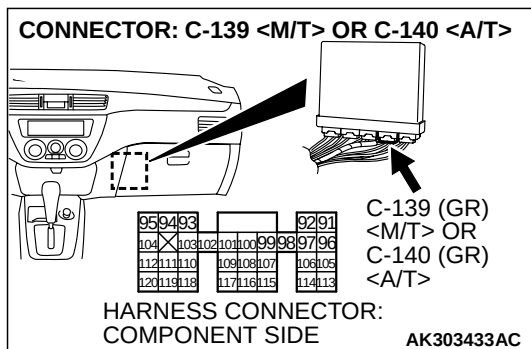
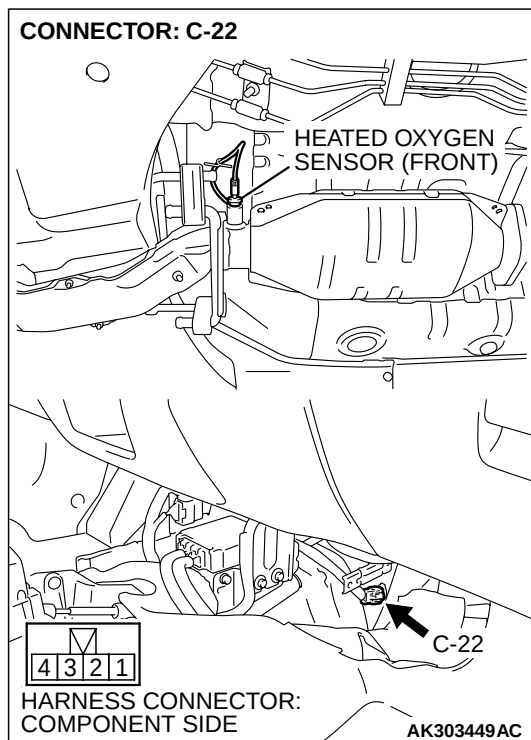


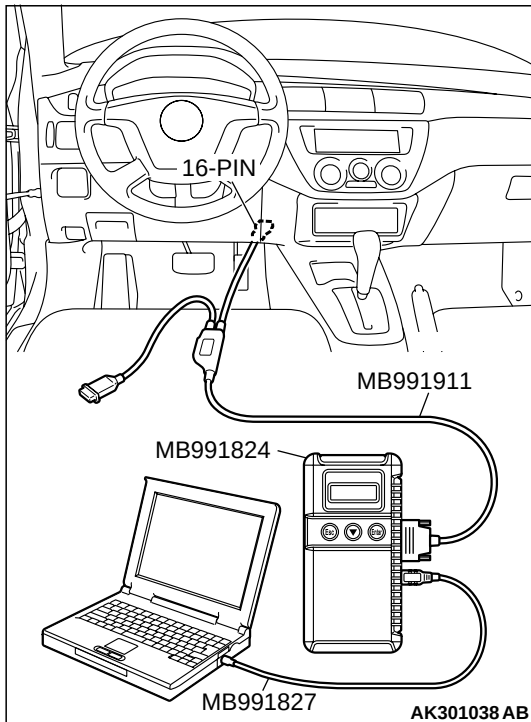
**STEP 4.** Check for open circuit to ground between heated oxygen sensor (front) connector C-22 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 108).

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

**YES :** Go to Step 5.

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





**STEP 5. Using scan tool MB991958, check data list item 11: 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.

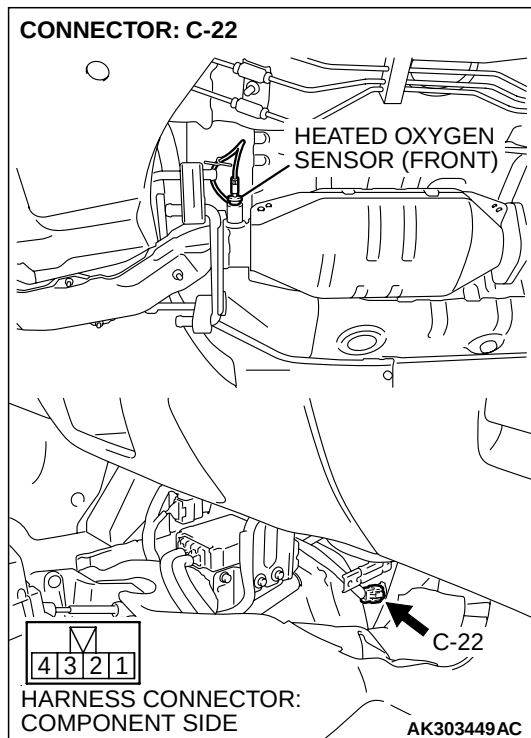
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
  - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
  - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt 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 [P.00-6](#).

**NO :** Replace the ECM or PCM. Then go to Step 11.

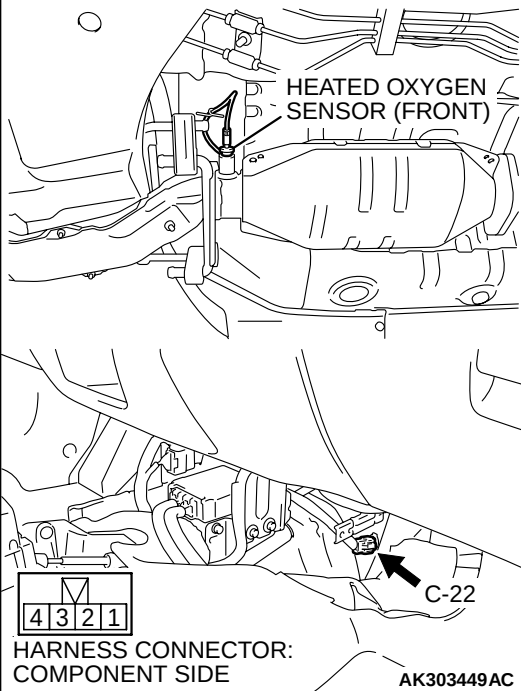
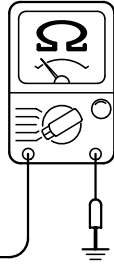
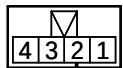


**STEP 6. Check harness connector C-22 at heated oxygen sensor (front) for damage.**

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

**YES :** Go to Step 7.

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

**CONNECTOR: C-22****C-22 HARNESS CONNECTOR: COMPONENT SIDE**

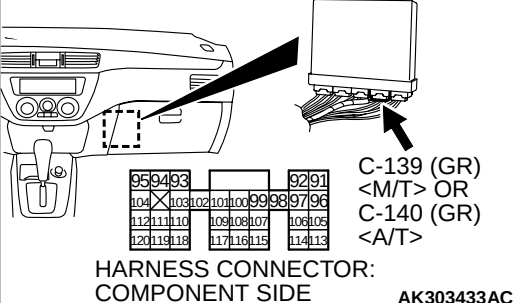
AK103849AD

**STEP 7. Check the continuity at heated oxygen sensor (front) harness side connector C-22.**

(1) Disconnect the connector C-22 and measure at the harness side.

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

- Should be less than 2 ohms.

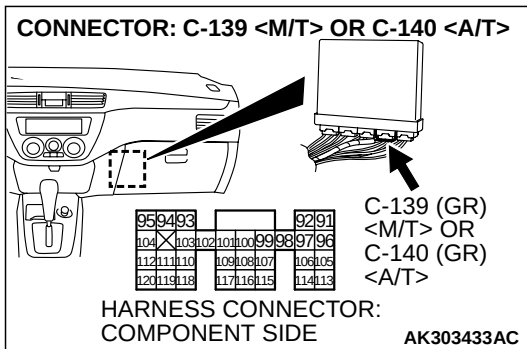
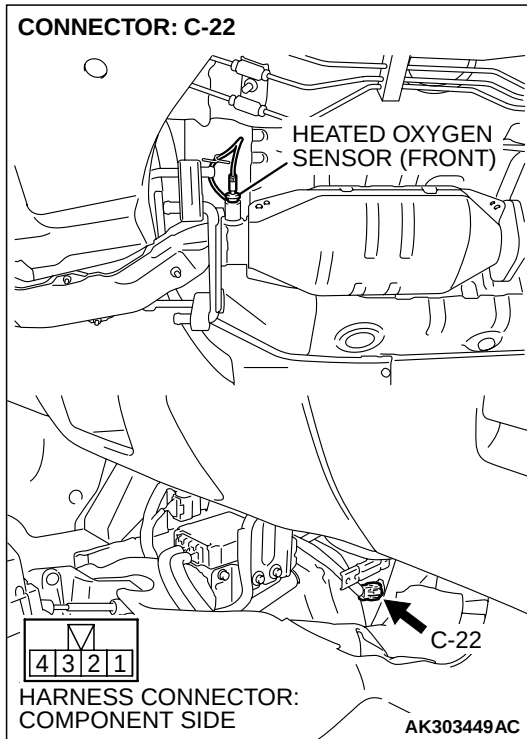
**Q: Does continuity exist?****YES :** Go to Step 10.**NO :** Go to Step 8.**CONNECTOR: C-139 <M/T> OR C-140 <A/T>****STEP 8. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.****Q: Is the harness connector in good condition?****YES :** Go to Step 9.**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

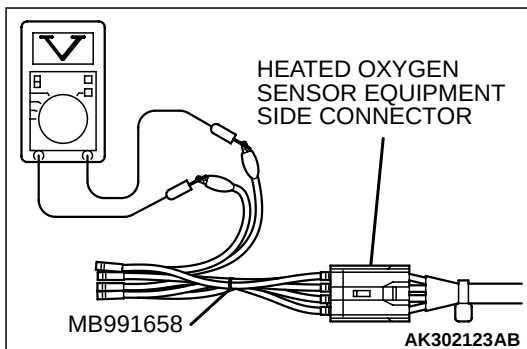
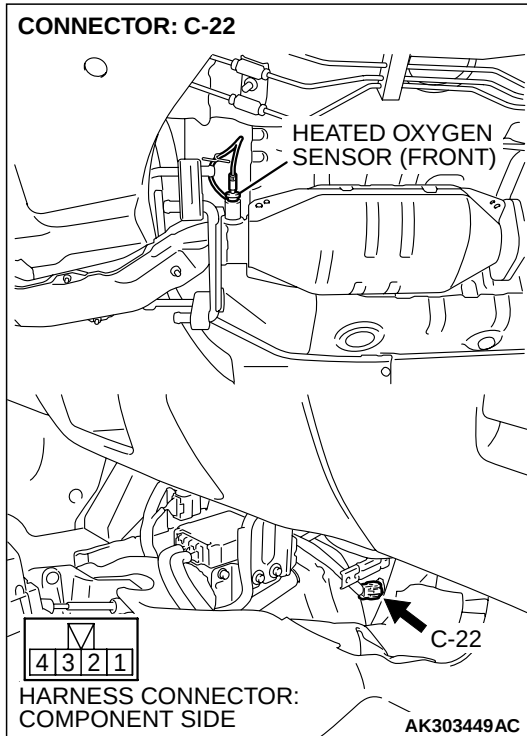
**STEP 9.** Check for open circuit between heated oxygen sensor (front) connector C-22 (terminal No. 2) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).

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

**YES :** Replace the ECM or PCM. Then go to Step 11.

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



**STEP 10. Check the heated oxygen sensor (front).**

- (1) Disconnect the heated oxygen sensor (front) connector C-22 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) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 1 and terminal No. 2.
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

**Standard value: 0.6 – 1.0 volt**

**⚠ CAUTION**

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

*NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (front) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 3 and the terminal No. 4 of the heated oxygen sensor (front) 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 or PCM. Then go to Step 11.

**NO :** Replace the heated oxygen sensor (front). 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 – Procedure 6 – Other Monitor [P.13B-6](#).
- (2) Check the diagnostic trouble code (DTC).

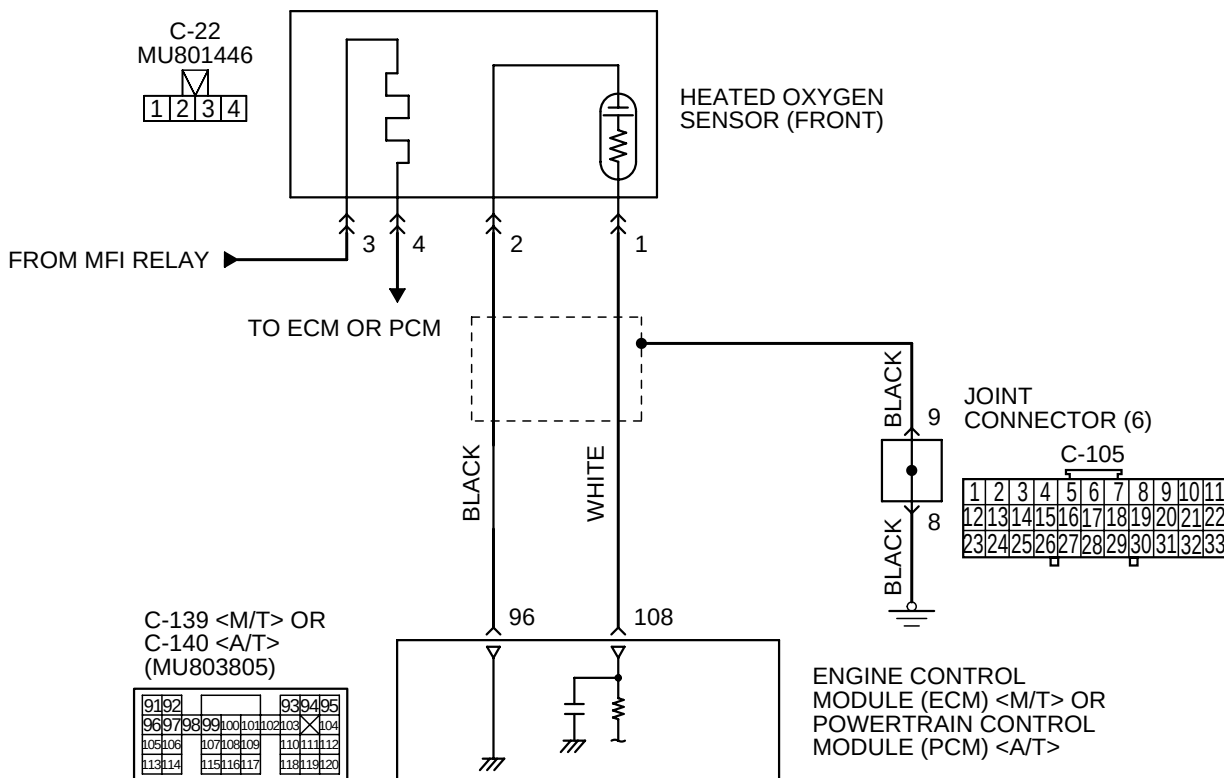
**Q: Is DTC P0130 set?**

**YES :** Retry the troubleshooting.

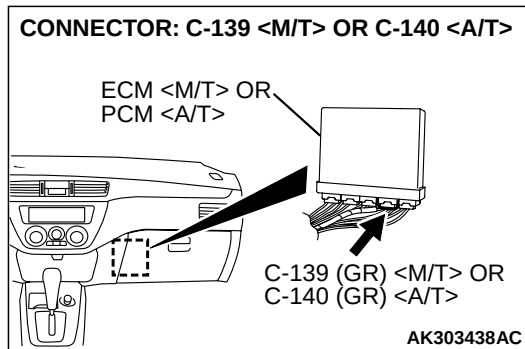
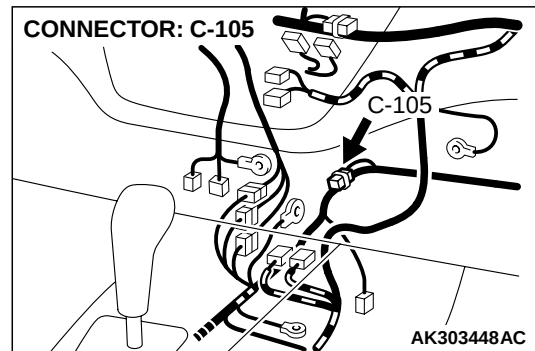
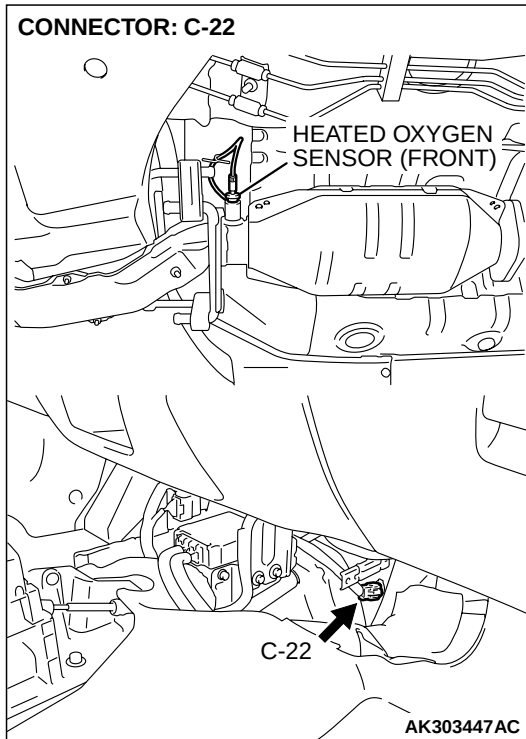
**NO :** The inspection is complete.

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

**Heated Oxygen Sensor (front) Circuit**



AK303984



### CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM <M/T> or PCM <A/T> (terminal No. 108) from the output terminal (terminal No. 1) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).

### 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 <M/T> or PCM <A/T>.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.

- The ECM <M/T> or PCM <A/T> forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM <M/T> or PCM <A/T> also checks for an open circuit in the heated oxygen sensor (front) output line.

### DESCRIPTIONS OF MONITOR METHODS

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

### MONITOR EXECUTION

Continuous

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

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

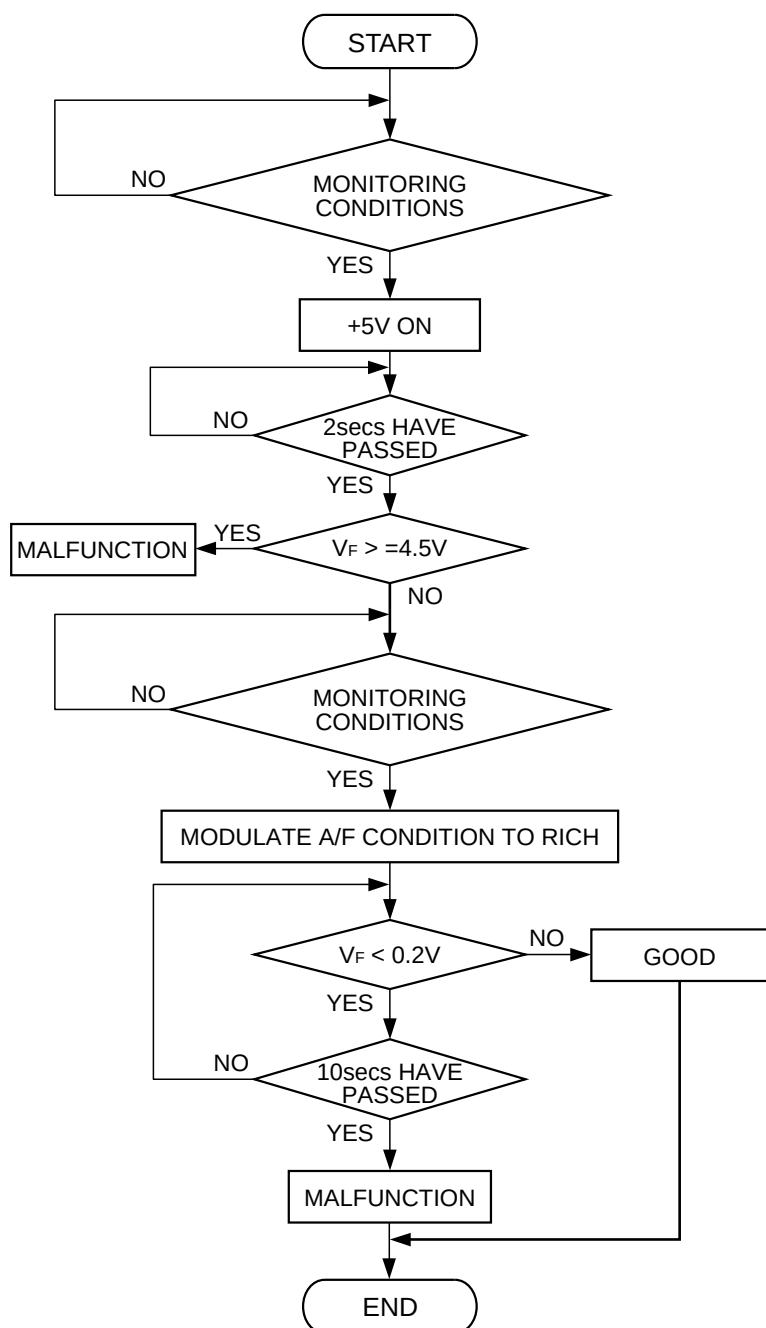
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

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

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

## DTC SET CONDITIONS

## Logic Flow Chart



AK302019

**Check Conditions**

- 3 minutes or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor (front) signal voltage has continued to be 0.2 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Mass airflow sensor output is 8 g/sec or more.
- At least 20 seconds have passed since fuel shut off control was canceled.
- Monitoring time: 10 seconds.

### Judgement Criteria

- Making the air/fuel ratio 15 percent richer for 10 seconds does not result in raising the heated oxygen sensor (front) output voltage beyond 0.2 volt.

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –  
Procedure 6 – Other Monitor [P.13B-6](#).

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

- Heated oxygen sensor (front) failed.
- Short circuit in heated oxygen sensor (front) output line.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

#### **⚠ CAUTION**

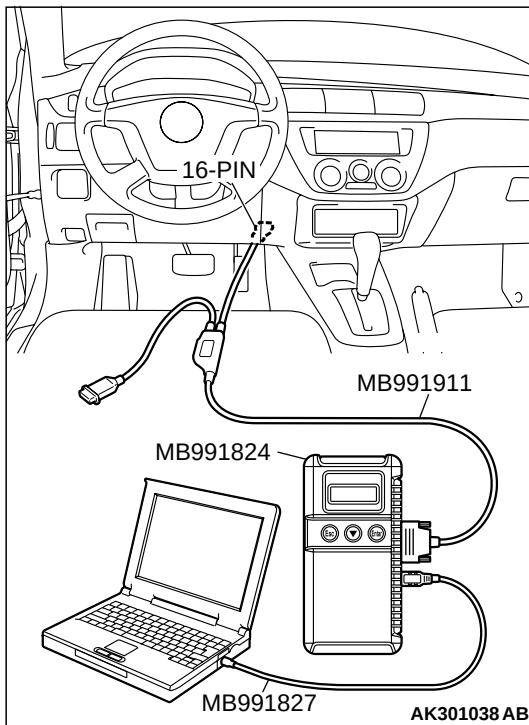
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

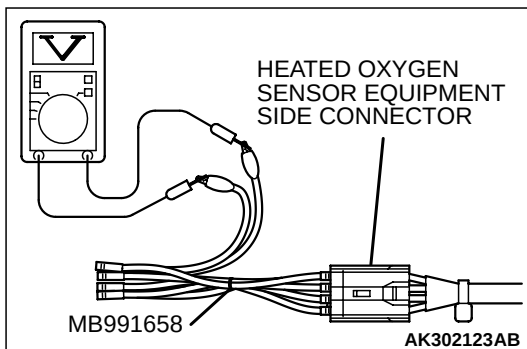
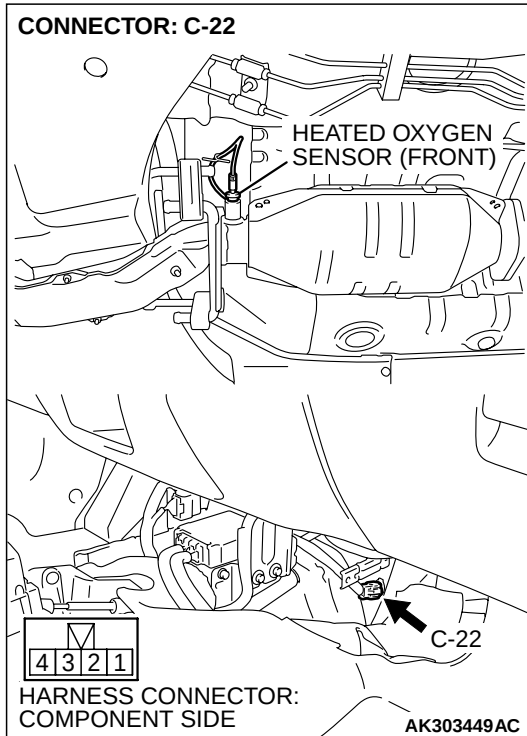
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
  - Warm up the engine. When the engine is revved, the output voltage should be 0.6 to 1.0 volt.
  - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt 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 [P.00-6](#).

**NO** : Go to Step 2.



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

- (1) Disconnect the heated oxygen sensor (front) connector C-22 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) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 1 and terminal No. 2.
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

**Standard value: 0.6 – 1.0 volt**

**CAUTION**

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

*NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (front) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 3 and the terminal No. 4 of the heated oxygen sensor (front) with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.*

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

**YES :** Go to Step 3.

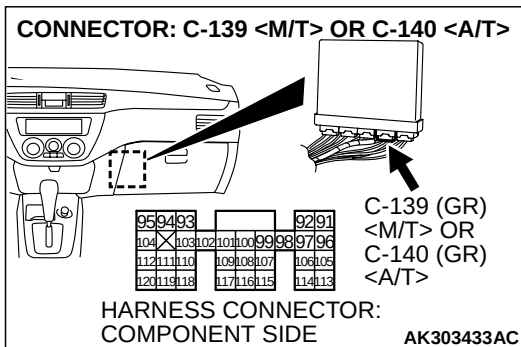
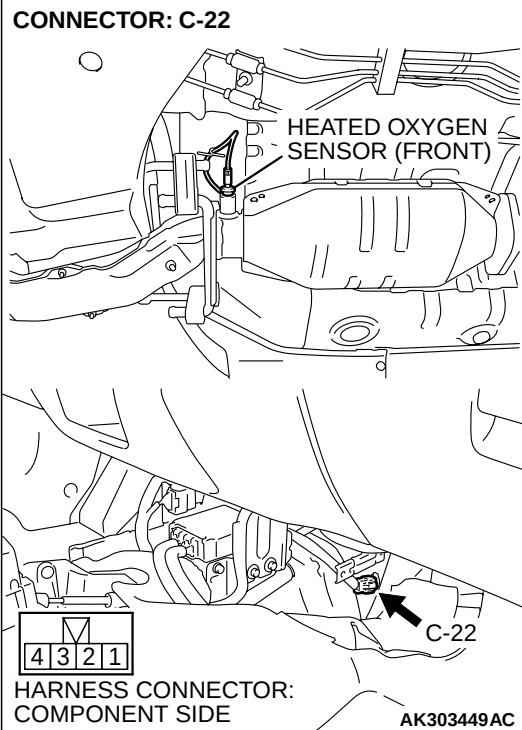
**NO :** Replace the heated oxygen sensor (front). Then go to Step 5.

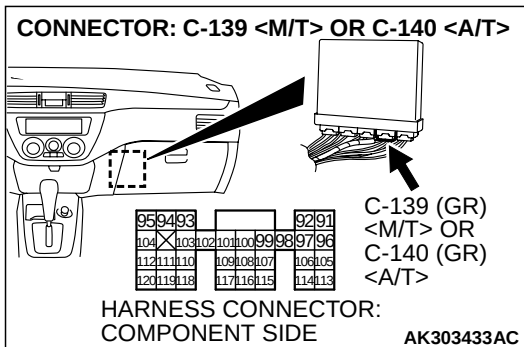
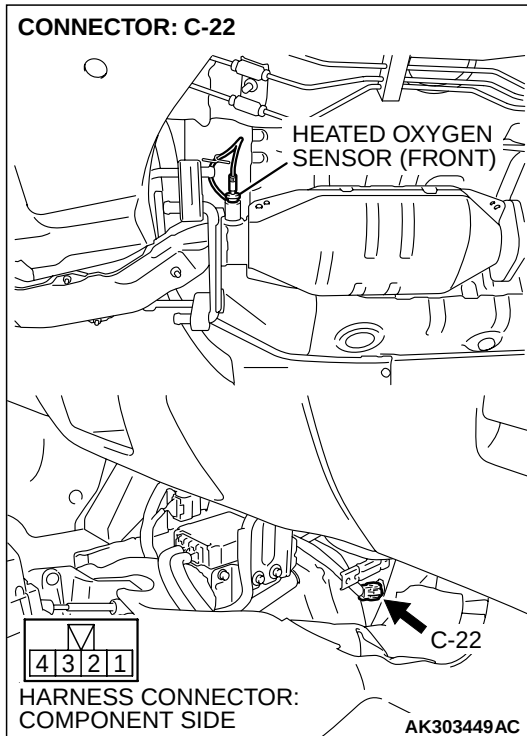
**STEP 3.** Check harness connector C-22 at heated oxygen sensor (front) and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.

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

**YES :** Go to Step 4.

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





**STEP 4. Check for short circuit to ground between heated oxygen sensor (front) connector C-22 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 108).**

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

**YES :** Replace the ECM or PCM. Then go to Step 5.

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

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

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

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

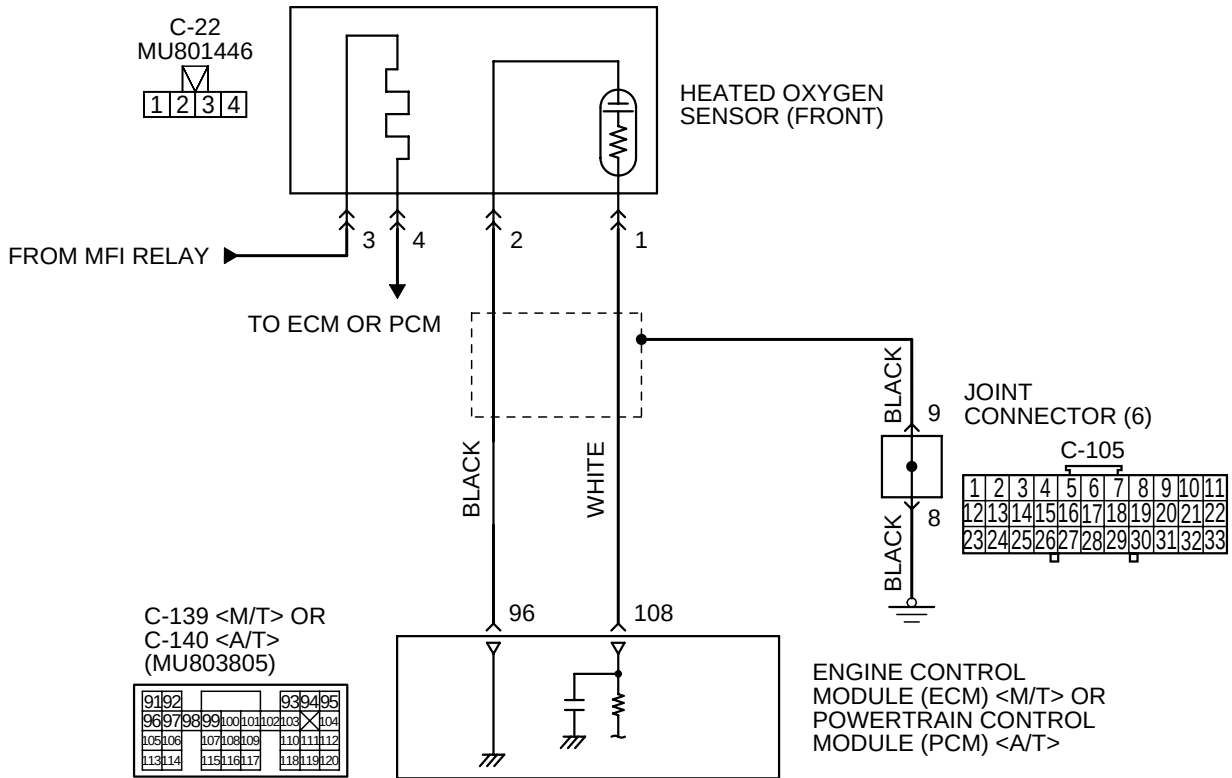
**Q: Is DTC P0131 set?**

**YES :** Retry the troubleshooting.

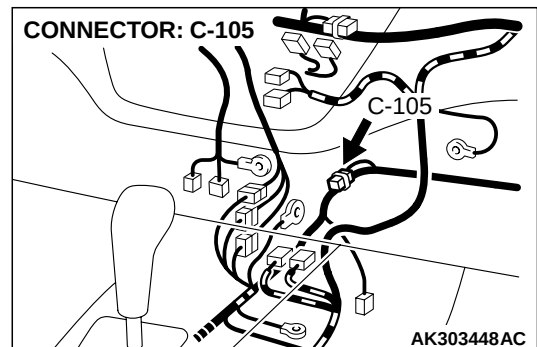
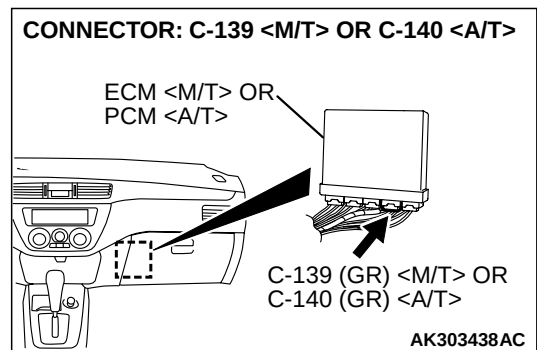
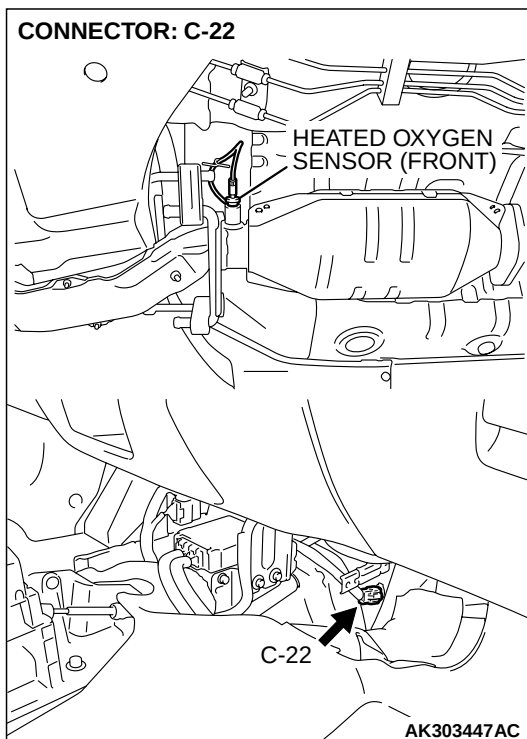
**NO :** The inspection is complete.

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

**Heated Oxygen Sensor (front) Circuit**



AK303984



**CIRCUIT OPERATION**

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM <M/T> or PCM <A/T> (terminal No. 108) from the output terminal (terminal No. 1) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).

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

**DESCRIPTIONS OF MONITOR METHODS**

Heated oxygen sensor (front) output voltage is over specified range.

**MONITOR EXECUTION**

Continuous

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

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

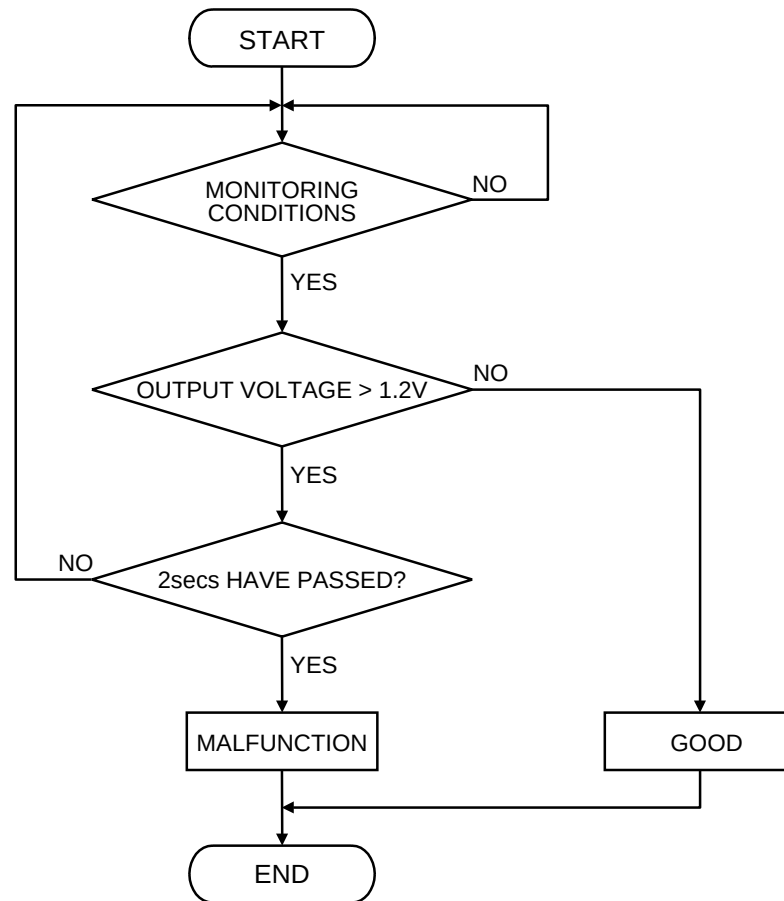
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

**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



AK302020

**Check Conditions**

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

**Judgment Criteria**

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

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnosis Function – OBD-II Drive Cycle –  
Procedure 6 – Other Monitor [P.13B-6](#).

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

- Short circuit in heated oxygen sensor (front) output line.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

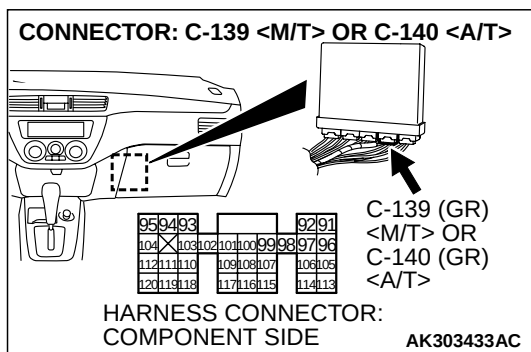
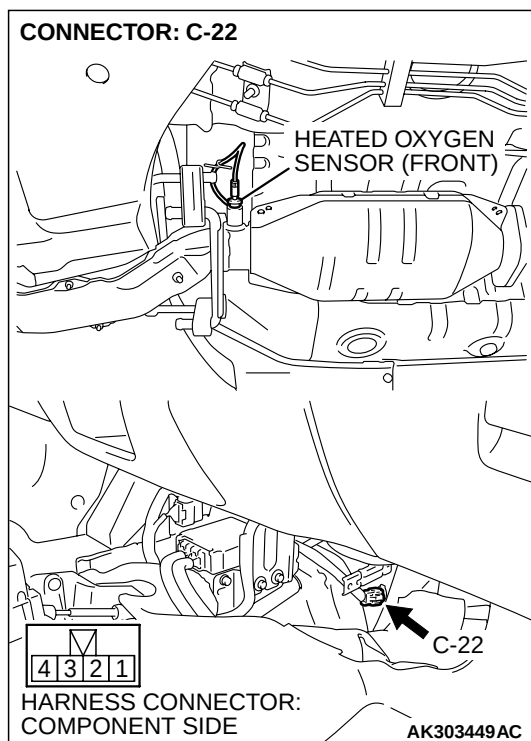
## DIAGNOSIS

**STEP 1.** Check harness connector C-22 at heated oxygen sensor (front) and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> 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.

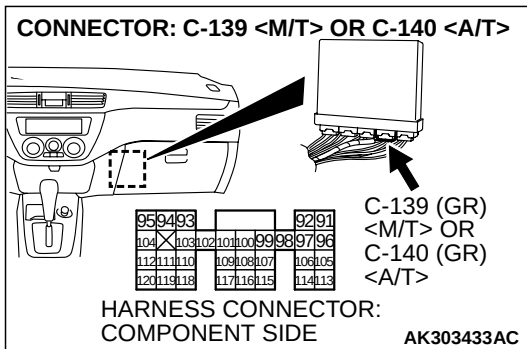
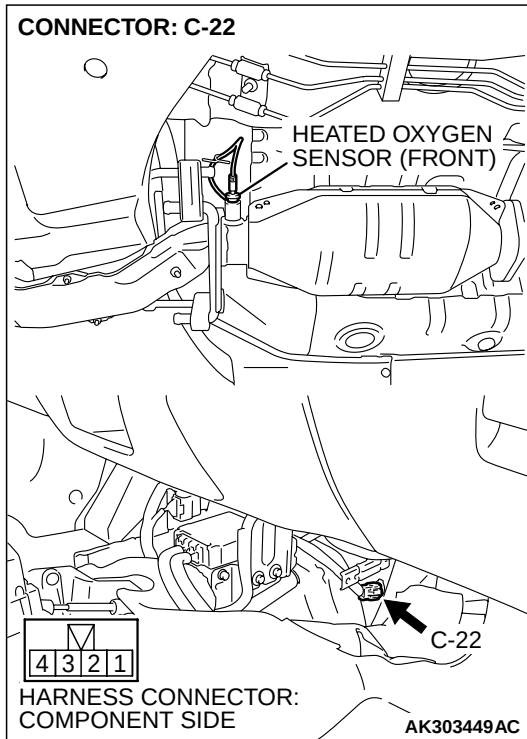


**STEP 2. Check for short circuit to power supply between heated oxygen sensor (front) connector C-22 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 108).**

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

**YES :** Replace the ECM or PCM. Then go to Step 3.

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



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

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

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

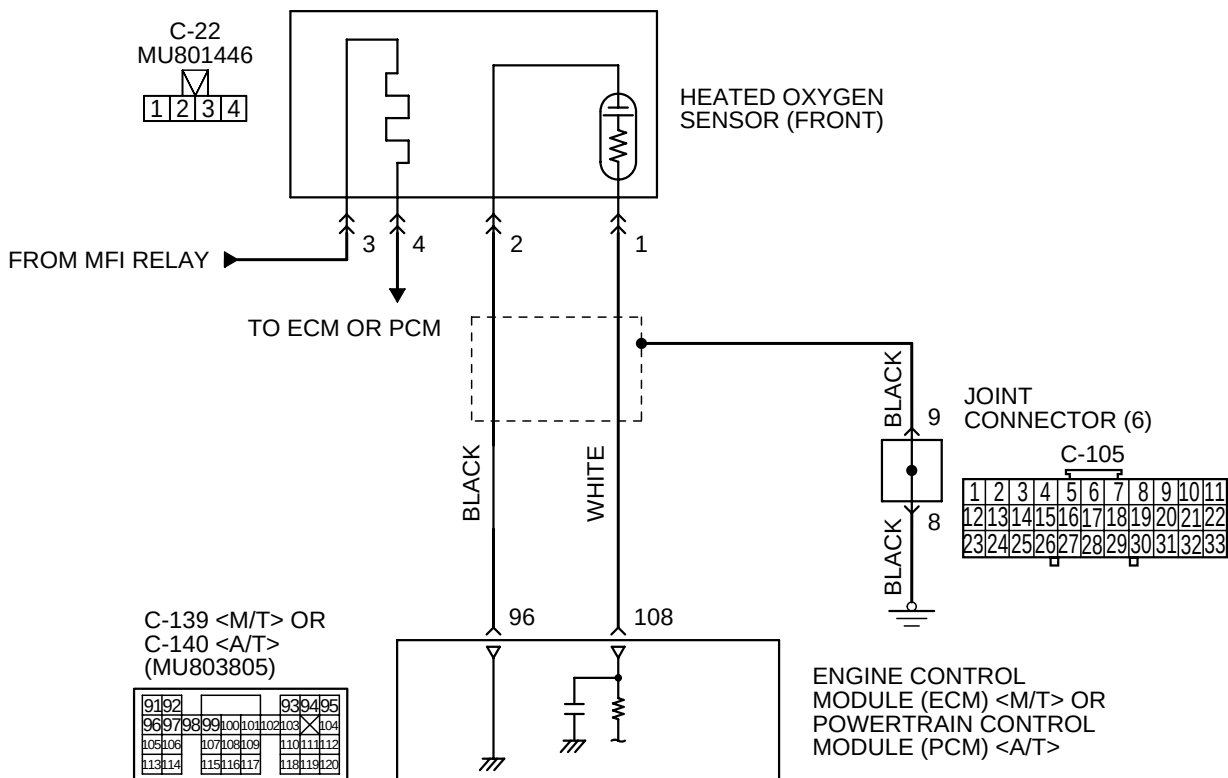
**Q: Is DTC P0132 set?**

**YES :** Retry the troubleshooting.

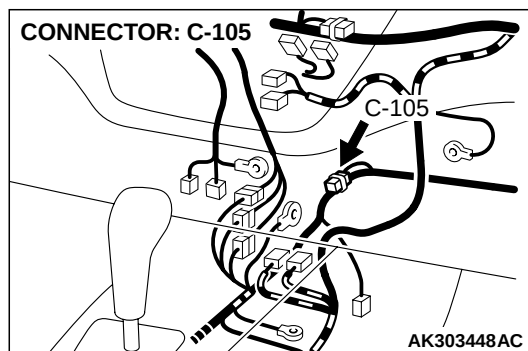
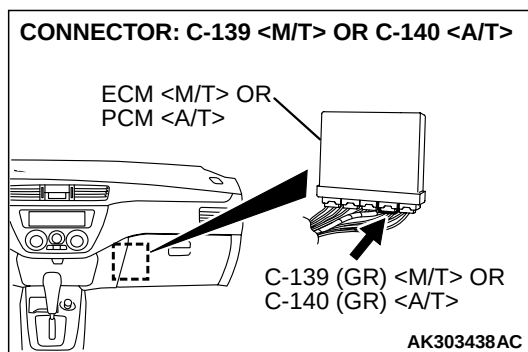
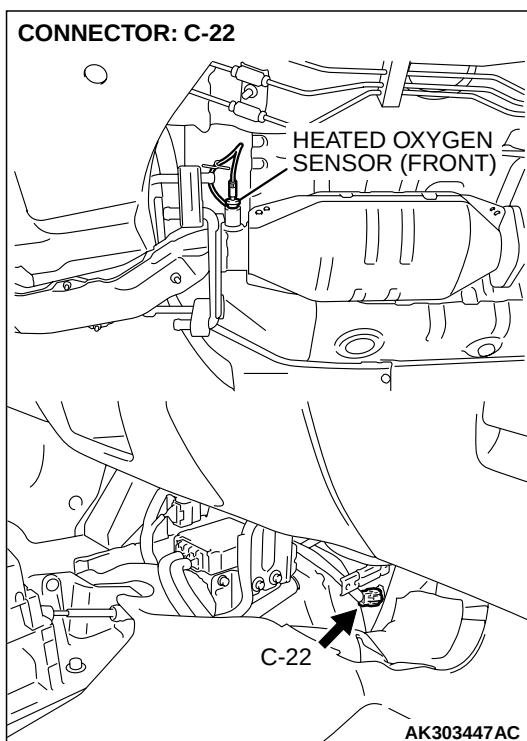
**NO :** The inspection is complete.

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

## Heated Oxygen Sensor (front) Circuit



AK303984



### CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM <M/T> or PCM <A/T> (terminal No. 108) from the output terminal (terminal No. 1) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).

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

### DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (front) rich/lean switching frequency is under specified value.

### MONITOR EXECUTION

Continuous

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

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

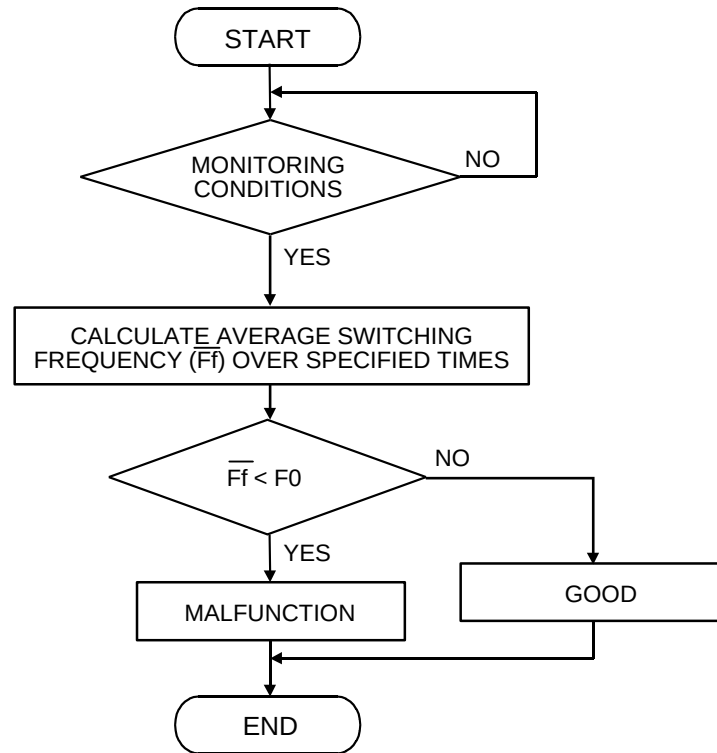
- Heated oxygen sensor heater (front) monitor
- Misfire monitor
- Fuel system monitor

**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

AK302021

## Check Conditions

- Engine coolant temperature is higher than 60°C (140°F).
- Engine speed is between 1,200 and 3,000 r/min.
- Volumetric efficiency is at between 30 and 60 percent.
- Under the closed loop air/fuel control.
- The accelerator pedal is open.
- Short-term fuel trim is higher than -25 percent and lower than +25 percent.
- More than 2 seconds have elapsed after the abovementioned conditions have been met.
- The ECM <M/T> or PCM <A/T> monitors for this condition for 7 cycles of 10 seconds each during the drive cycle.

## Judgment Criteria

- The heated oxygen sensor (front) sends "lean" and "rich" signals alternately 9 times or less for 10 seconds.

*NOTE: If the sensor switching frequency is lower than the Judgment Criteria due to the scan tool MB991958 OBD-II test Mode – H02S Test Results, it is assumed that the heated oxygen sensor has deteriorated. If it is short, it is assumed that the harness is damaged or has a short circuit.*

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

## OBD-II DRIVE CYCLE PATTERN

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

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

- Heated oxygen sensor (front) deteriorated.

## DIAGNOSIS

### Required Special Tools:

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

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

#### CAUTION

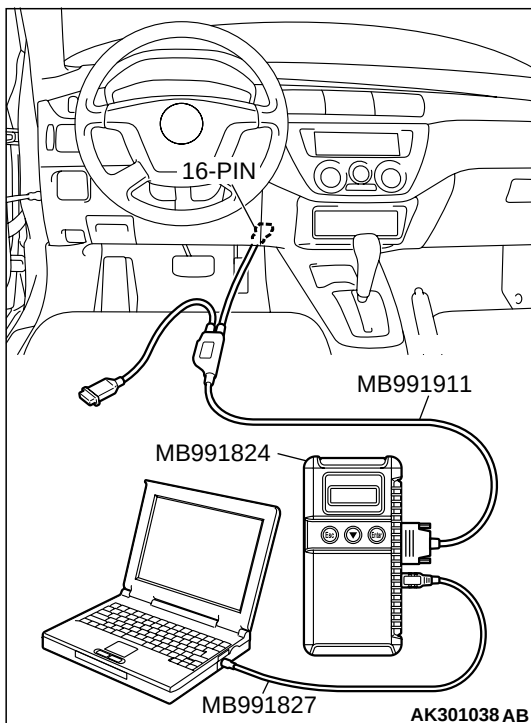
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 11, Heated Oxygen Sensor (front).
- (4) Warm up the engine, 2,500 r/min.
  - Output voltage repeats 0.4 volt or less and 0.6 – 1.0 volt 10 times or more within 10 seconds.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES** : It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**NO** : Replace the heated oxygen sensor (front). 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 – Procedure 4 – Heated Oxygen Sensor Monitor [P.13B-6](#).
- (2) Check the diagnostic trouble code (DTC).

#### Q: Is DTC P0133 set?

**YES** : Retry the troubleshooting.

**NO** : The inspection is complete.

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

---

**HEATED OXYGEN SENSOR CIRCUIT NO  
ACTIVITY DETECTED (SENSOR 1) CIRCUIT**

- Refer to, DTC P0130 Heated Oxygen Sensor Circuit (sensor1) [P.13B-167](#).
- Refer to, DTC P0201, P0202, P0203, P0204 – Injector Circuit [P.13B-291](#).

**CIRCUIT OPERATION**

- Refer to, DTC P0130 Heated Oxygen Sensor Circuit (sensor1) [P.13B-167](#).
- Refer to, DTC P0201, P0202, P0203, P0204 – Injector Circuit [P.13B-291](#).

**TECHNICAL DESCRIPTION**

- The ECM <M/T> or PCM <A/T> 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 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)**

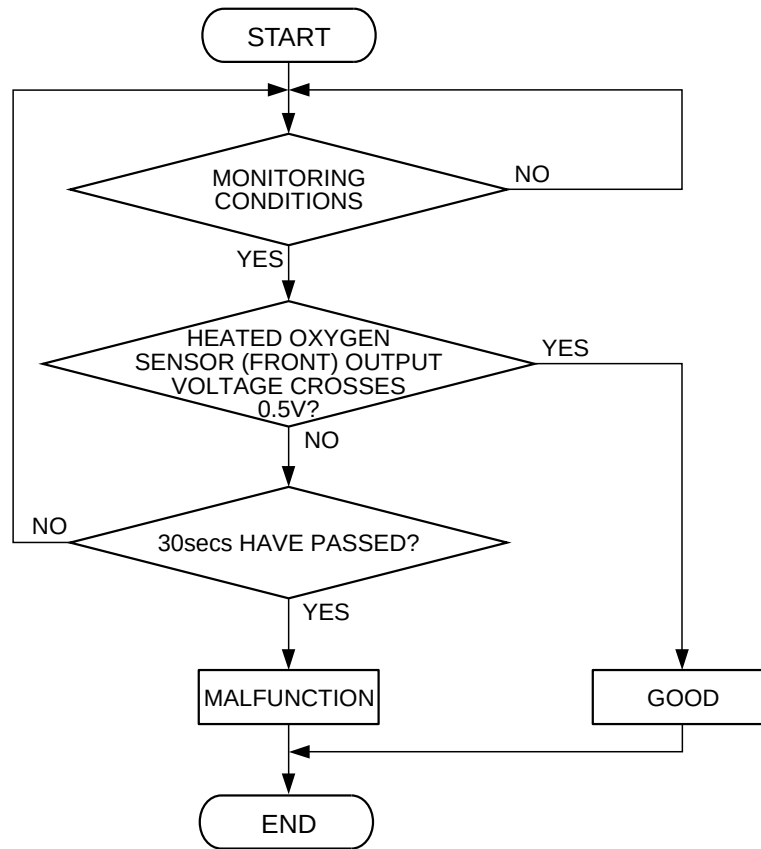
- Misfire monitor

**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



AK302022

**Check Conditions**

- 20 seconds or more have passed since the engine starting sequence was completed.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is between 30 and 80 percent.
- Throttle position sensor output voltage is lower than 4.3 volts.

- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

**Judgment Criteria**

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

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- 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 the injector.
- Harness damage in injector circuit.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>
- Exhaust leak.
- Air drawn in from gaps in gasket, seals, etc.
- Incorrect fuel pressure.

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

- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991911: Main Harness B
- M991658: Test Harness

**STEP 1. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor (rear).****⚠ CAUTION**

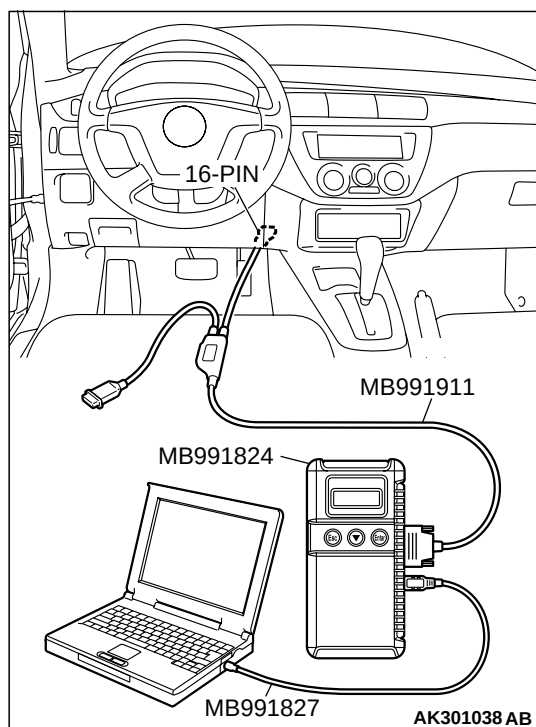
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 59, Heated Oxygen Sensor (rear).
  - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 2.

**NO :** Refer to, DTC P0136 – Heated Oxygen Sensor Circuit (sensor 2) [P.13B-216](#), DTC P0137 – Heated Oxygen Sensor Circuit Low Voltage (sensor 2) [P.13B-227](#), DTC P0138 – Heated Oxygen Sensor Circuit High Voltage (sensor 2) [P.13B-235](#), DTC P0139 – Heated Oxygen Sensor Circuit Slow Response (sensor 2) [P.13B-240](#).



---

**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.

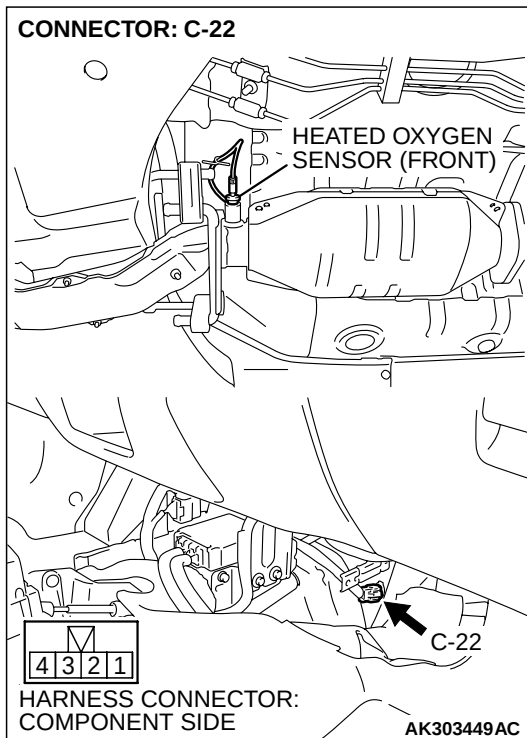
---

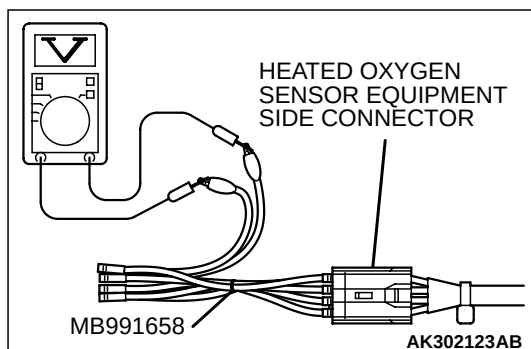
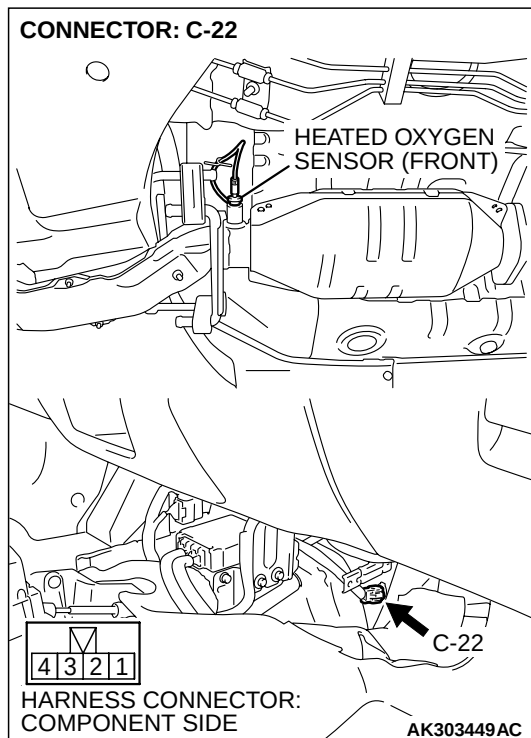
**STEP 4. Check harness connector C-22 at the heated oxygen sensor (front) for damage.**

**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-22 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) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 1 and terminal No. 2.
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

**Standard value: 0.6 – 1.0 volt**

**⚠ CAUTION**

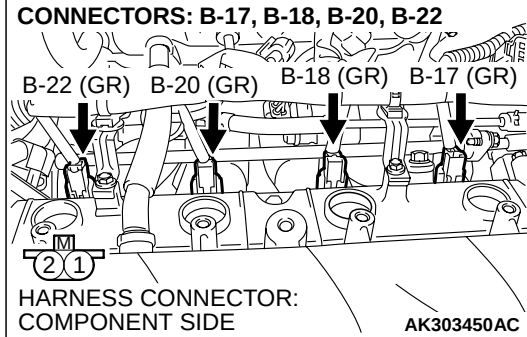
- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (front).
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor (front) heater.

*NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (front) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 3 and the terminal No. 4 of the heated oxygen sensor (front) 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.

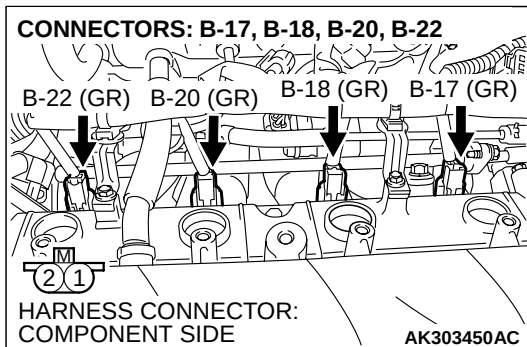


**STEP 6. Check harness connector B-17, B-18, B-20, B-22 at injector for damage.**

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

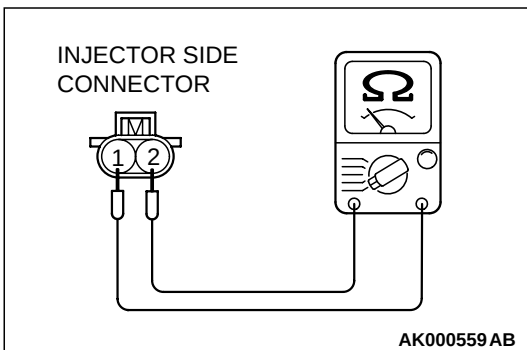
**YES :** Go to Step 7.

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



**STEP 7. Check the injector.**

(1) Disconnect each injector connector.



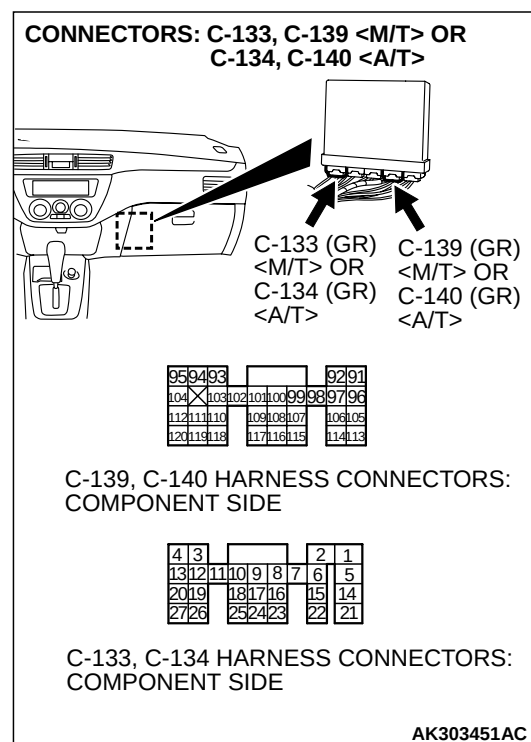
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

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

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

**YES :** Go to Step 8.

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



**STEP 8. Check harness connector C-133, C-139 at ECM <M/T> or C-134, C-140 at PCM <A/T> for damage.**  
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 9.

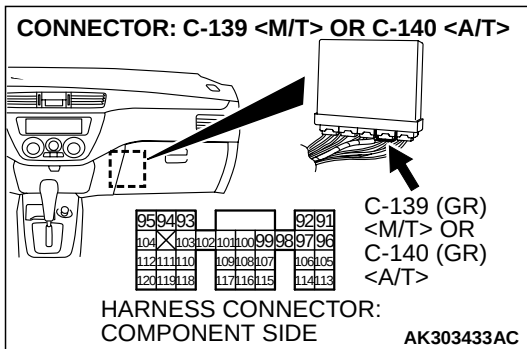
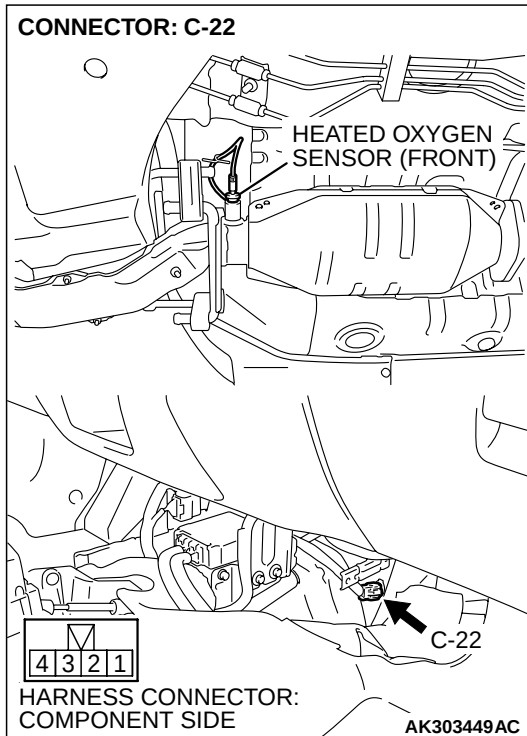
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

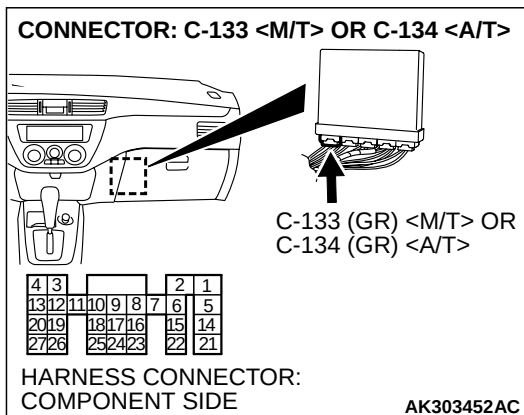
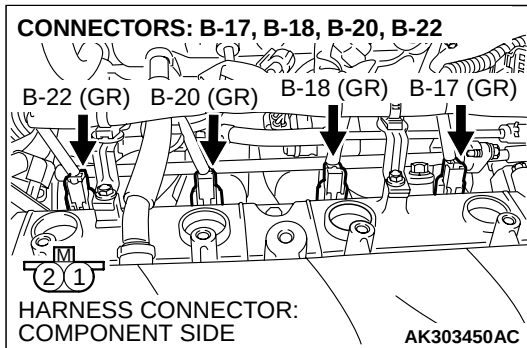
**STEP 9.** Check for harness damage between heated oxygen sensor (front) connector C-22 (terminal No. 1) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 108).

**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 B-17, B-18, B-20, B-22 and ECM connector C-133 <M/T> or PCM connector C-134 <A/T>.**

- Check the harness wire between injector connector B-22 (terminal No. 2) and ECM connector C-133 <M/T> or PCM connector C-134 <A/T> (terminal No. 1) at No. 1 cylinder.
- Check the harness wire between injector connector B-20 (terminal No. 2) and ECM connector C-133 <M/T> or PCM connector C-134 <A/T> (terminal No. 5) at No. 2 cylinder.
- Check the harness wire between injector connector B-18 (terminal No. 2) and ECM connector C-133 <M/T> or PCM connector C-134 <A/T> (terminal No. 14) at No. 3 cylinder.
- Check the harness wire between injector connector B-17 (terminal No. 2) and ECM connector C-133 <M/T> or PCM connector C-134 <A/T> (terminal No. 21) at 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.13B-903](#).

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

**YES :** Replace the ECM or PCM. Then go to Step 12.

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

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

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

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

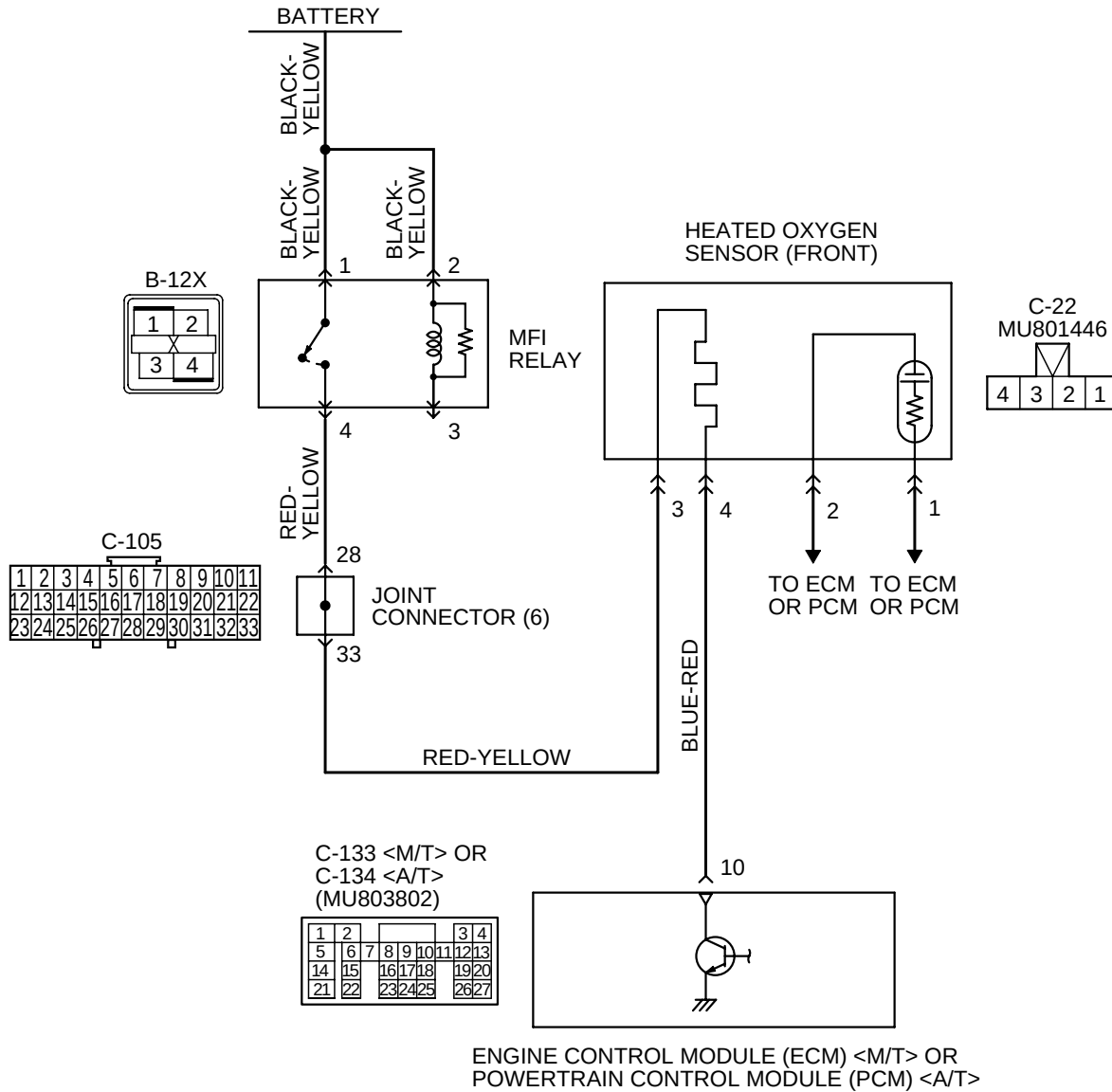
**Q: Is DTC P0134 set?**

**YES :** Retry the troubleshooting.

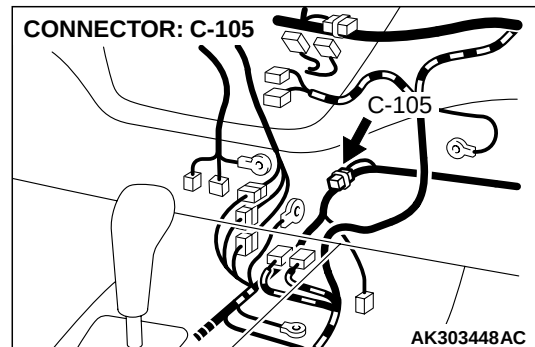
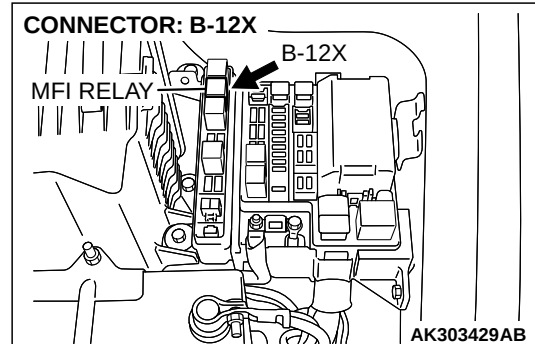
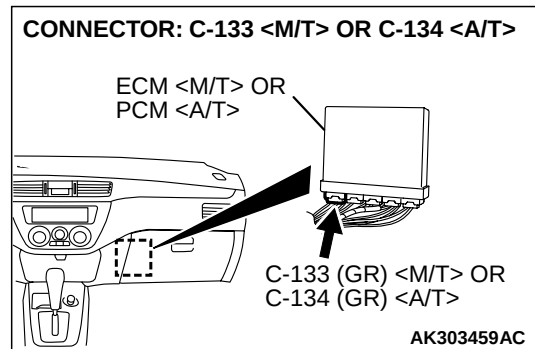
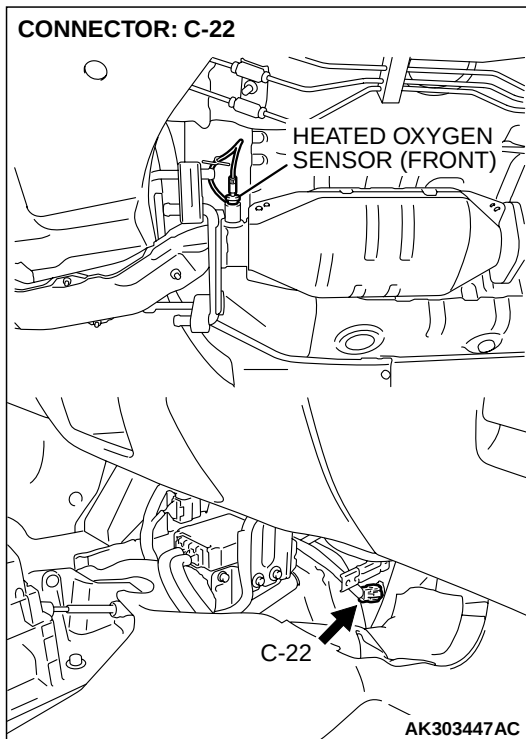
**NO :** The inspection is complete.

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

Heated Oxygen Sensor (front) Heater Circuit



AK303985



### CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the heated oxygen sensor (front) heater.
- The ECM <M/T> or PCM <A/T> (terminal No. 10) controls continuity to the heated oxygen sensor (front) heater by turning the power transistor in the ECM <M/T> or PCM <A/T> "ON" and "OFF".

### TECHNICAL DESCRIPTION

- The ECM <M/T> or PCM <A/T> checks whether the heater current is within a specified range when the heater is energized.

### DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor heater (front) current is out of specified range when engine coolant temperature is over 20°C (68°F).

### MONITOR EXECUTION

Continuous

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

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

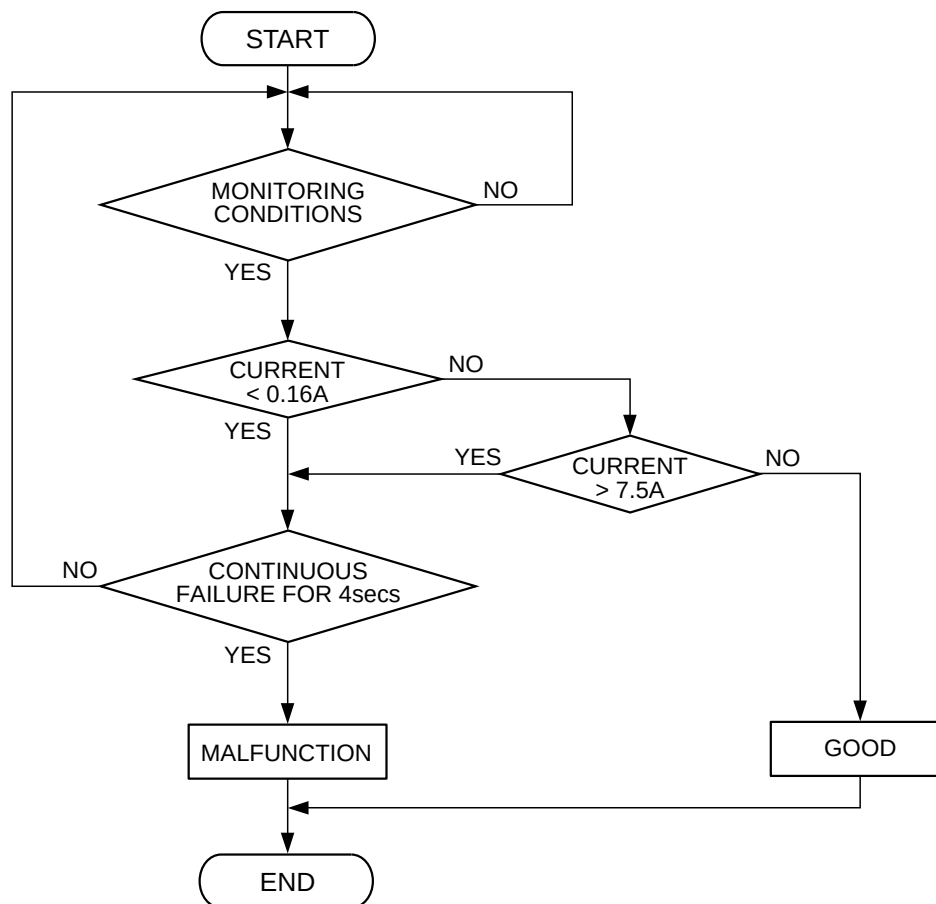
- Not applicable

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

- Engine coolant temperature sensor

## DTC SET CONDITIONS

### Logic Flow Chart



AK302023

#### Check Conditions

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

#### Judgment Criteria

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

#### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Open or shorted heated oxygen sensor (front) heater circuit, harness damage or connector damage.
- Open circuit in heated oxygen sensor (front) heater.
- ECM failed. <M/T>
- PCM failed. <A/T>

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

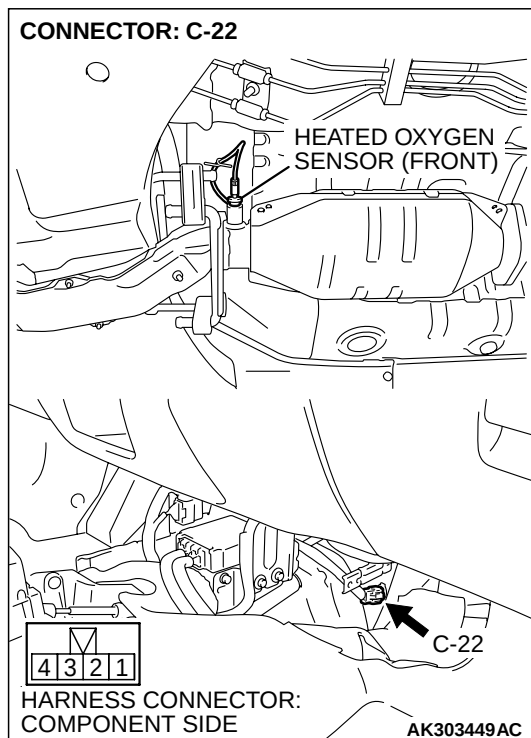
- MB991658: Test Harness

**STEP 1. Check harness connector C-22 at the heated oxygen sensor (front) for damage.**

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

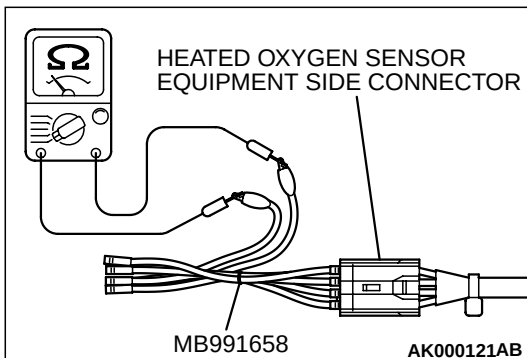
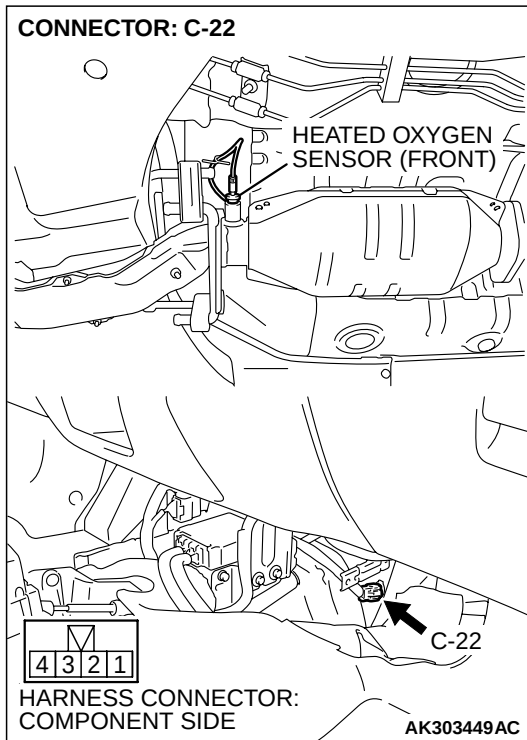
**YES :** Go to Step 2.

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



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

- (1) Disconnect heated oxygen sensor (front) connector C-22 and connect test harness special tool, MB991658, to the connector on the heated oxygen (front) sensor side.



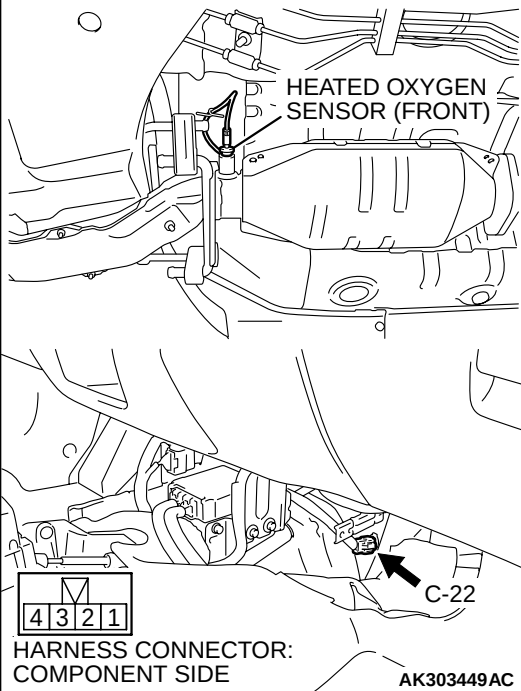
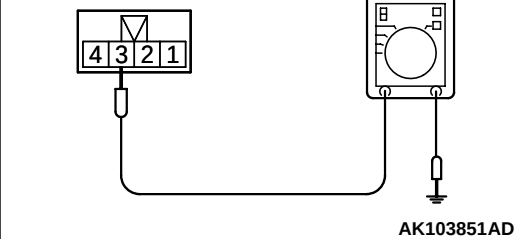
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

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

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

**YES :** Go to Step 3.

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

**CONNECTOR: C-22****C-22 HARNESS CONNECTOR: COMPONENT SIDE****STEP 3. Measure the power supply voltage at heated oxygen sensor (front) harness side connector C-22.**

- (1) Disconnect the connector C-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 battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 5.

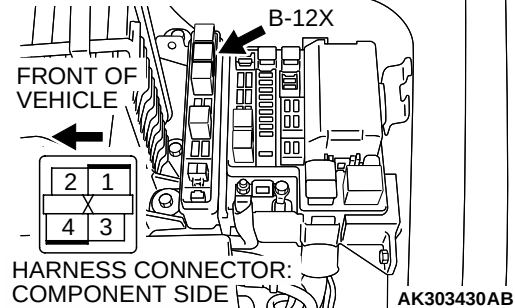
**NO :** Go to Step 4.

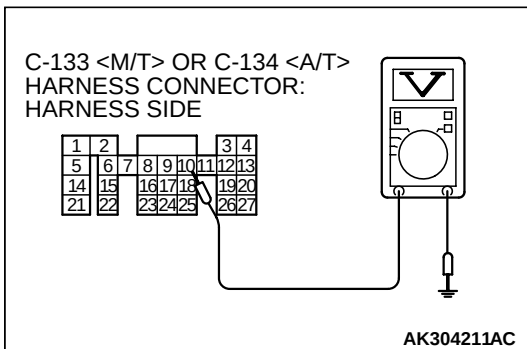
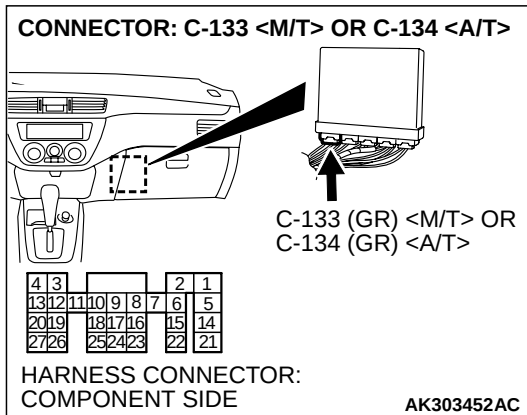
**STEP 4. Check harness connector B-12X at the MFI relay for damage.**

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

**YES :** Check harness connector C-105 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 B-12X (terminal No. 4) and heated oxygen sensor (front) connector C-22 (terminal No. 3) because of open circuit or short circuit to ground. Then go to Step 12.

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

**CONNECTOR: B-12X**



**STEP 5. Measure the power supply voltage at ECM harness side connector C-133 <M/T> or PCM harness side connector C-134 <A/T> by backprobing.**

- (1) Do not disconnect the connector C-133 <M/T> or C-134 <A/T>.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 10 and ground by backprobing.

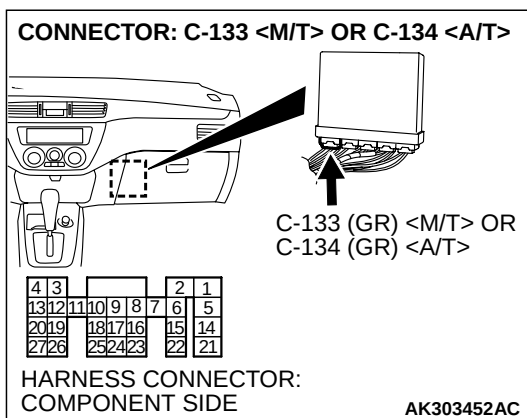
- Voltage should be battery positive voltage.

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

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

**YES :** Go to Step 8.

**NO :** Go to Step 6.



**STEP 6. Check harness connector C-133 at ECM <M/T> or C-134 at PCM <A/T> for damage.**

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

**YES :** Go to Step 7.

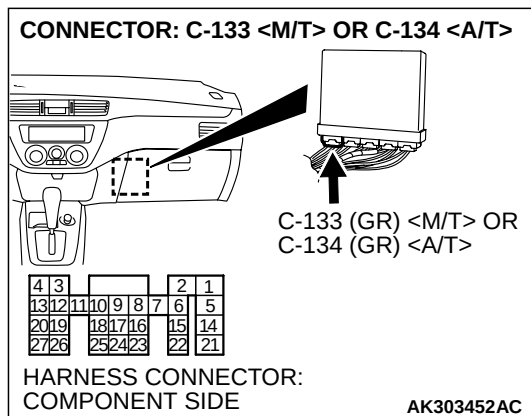
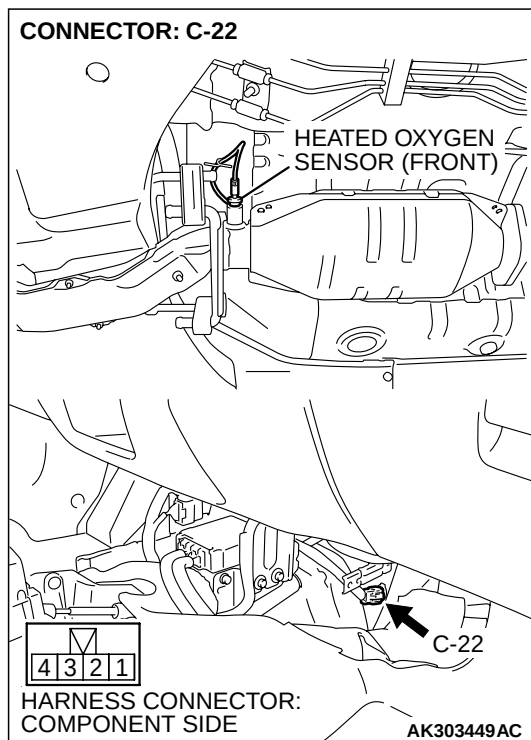
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

**STEP 7.** Check for open circuit or short circuit to ground between heated oxygen sensor (front) connector C-22 (terminal No. 4) and ECM connector C-133 <M/T> or PCM connector C-134 <A/T> (terminal No. 10).

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

**YES :** Replace the ECM or PCM. Then go to Step 12.

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

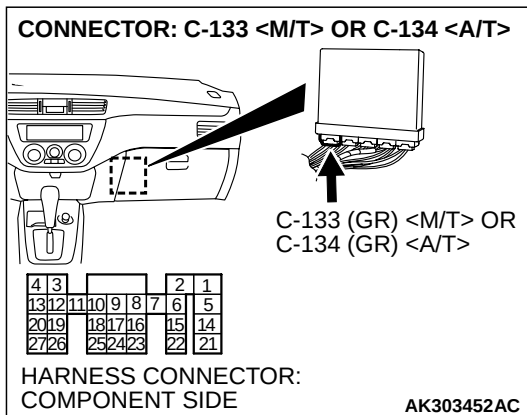


**STEP 8. Check harness connector C-133 at ECM <M/T> or C-134 at PCM <A/T> for damage.**

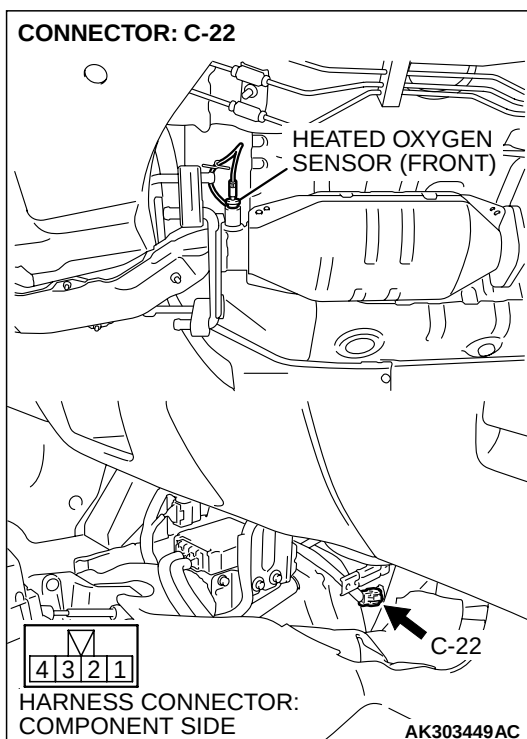
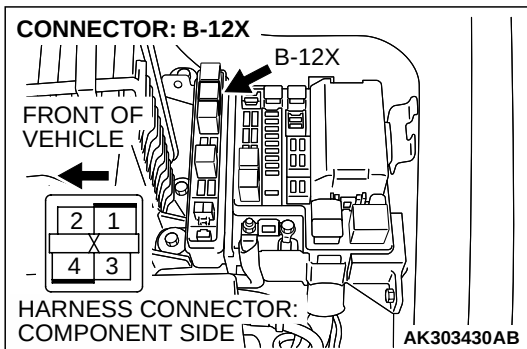
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 9.

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



**STEP 9. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (front) connector C-22 (terminal No. 3).**



*NOTE: Check harness after checking intermediate connector C-105. 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.

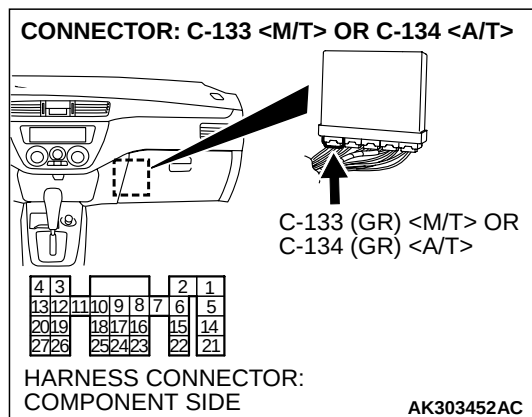
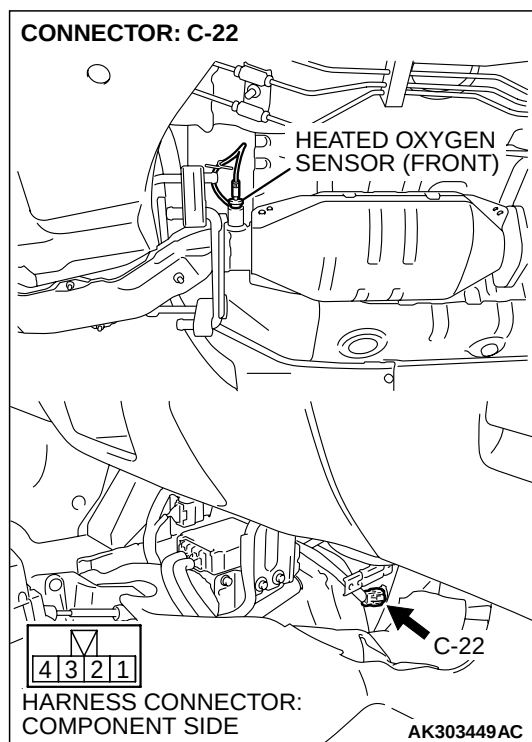
**NO :** Repair it. Then go to Step 12.

**STEP 10. Check for harness damage between heated oxygen sensor (front) connector C-22 (terminal No. 4) and ECM connector C-133 <M/T> or PCM connector C-134 <A/T> (terminal No. 10).**

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

**YES :** Go to Step 11.

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



---

**STEP 11. Check the trouble symptoms.**

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

**Q: Is DTC P0135 set?**

**YES :** Replace the ECM or PCM. Then go to Step 12.

**NO :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

---

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

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

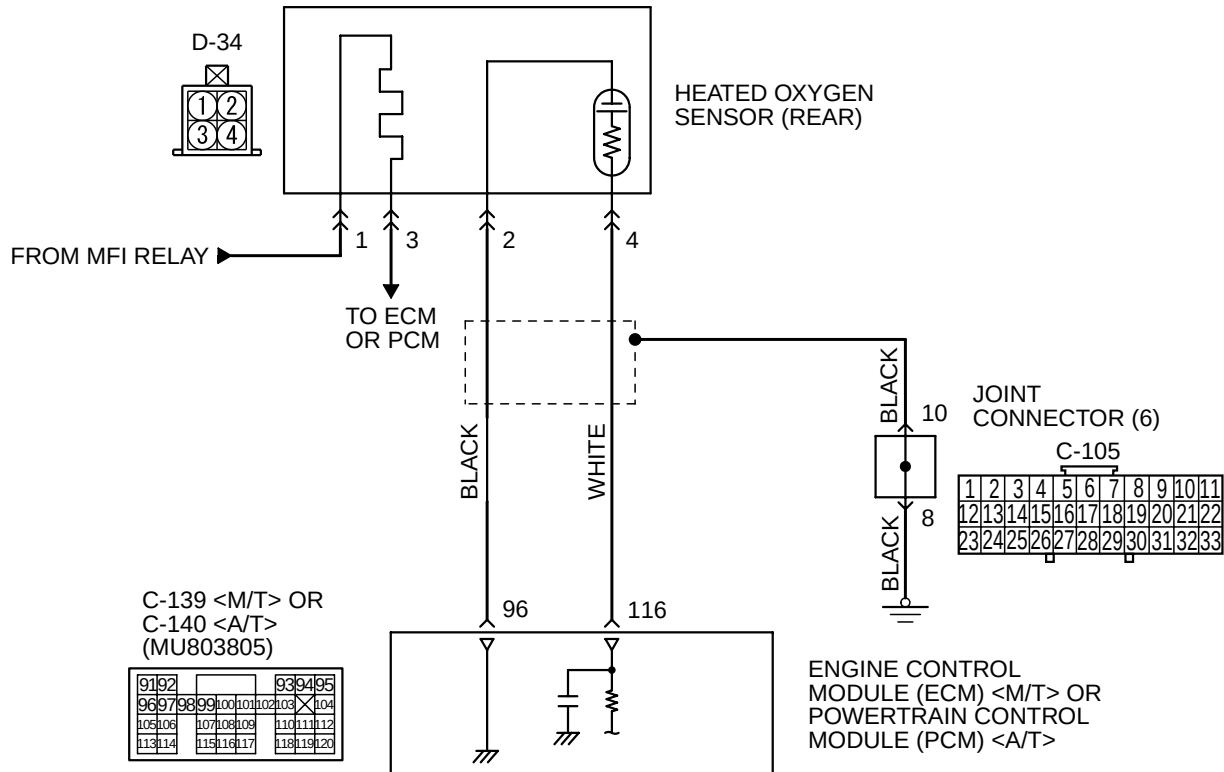
**Q: Is DTC P0135 set?**

**YES :** Retry the troubleshooting.

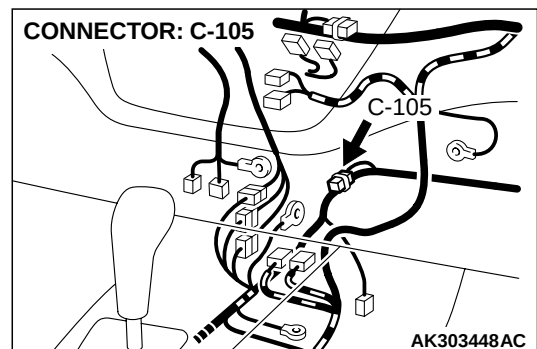
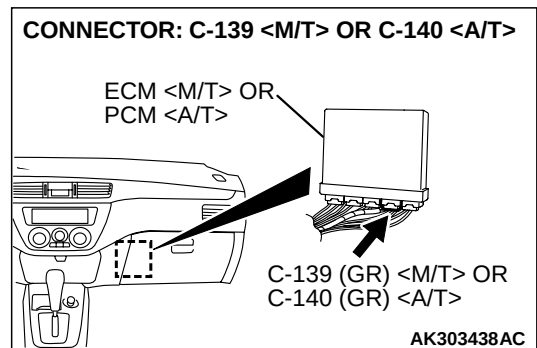
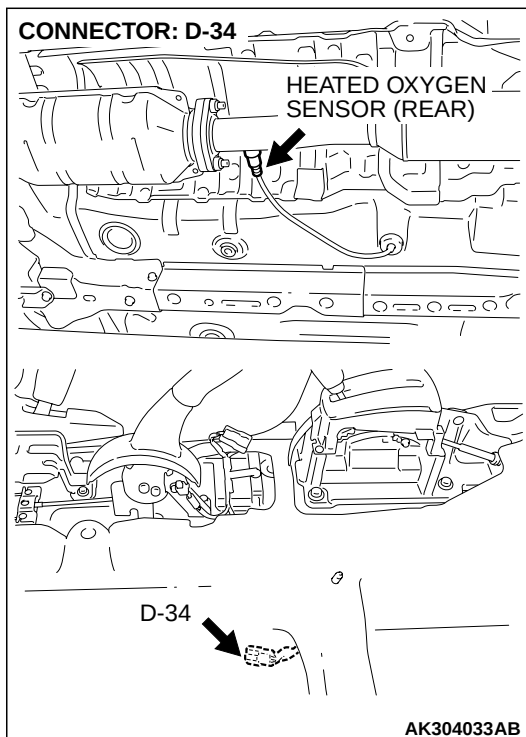
**NO :** The inspection is complete.

## DTC P0136: Heated Oxygen Sensor Circuit (sensor 2)

## Heated Oxygen Sensor (rear) Circuit



AK303986



### CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM <M/T> or PCM <A/T> (terminal No. 116) from the output terminal (terminal No. 4) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).

### 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 <M/T> or PCM <A/T> checks for an open circuit in the heated oxygen sensor (rear) output line.

### DESCRIPTIONS OF MONITOR METHODS

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

### MONITOR EXECUTION

Continuous

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

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

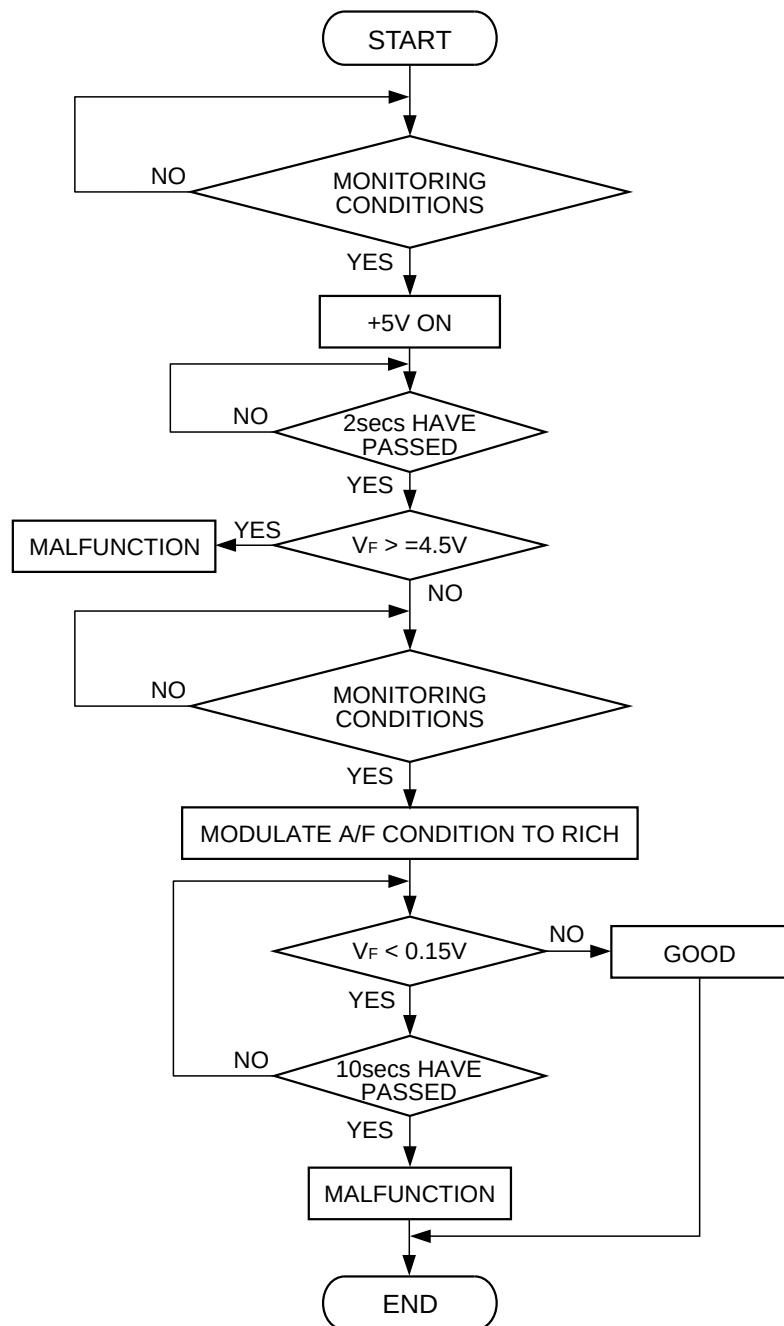
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

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

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

## DTC SET CONDITIONS

## Logic Flow Chart



AK302025

**Check Conditions**

- 3 minutes or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor (rear) signal voltage has continued to be 0.15 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Monitoring time: 7 seconds.

### Judgment Criteria

- Input voltage supplied to the ECM <M/T> or PCM <A/T> interface circuit is higher than 4.5 volts when 5 volts is applied to the heated oxygen sensor (rear) output line via a resistor.

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Heated oxygen sensor (rear) failed.
- Open circuit in heated oxygen sensor (rear) output line or connector damage.
- Open circuit in heated oxygen sensor (rear) ground line or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

#### CAUTION

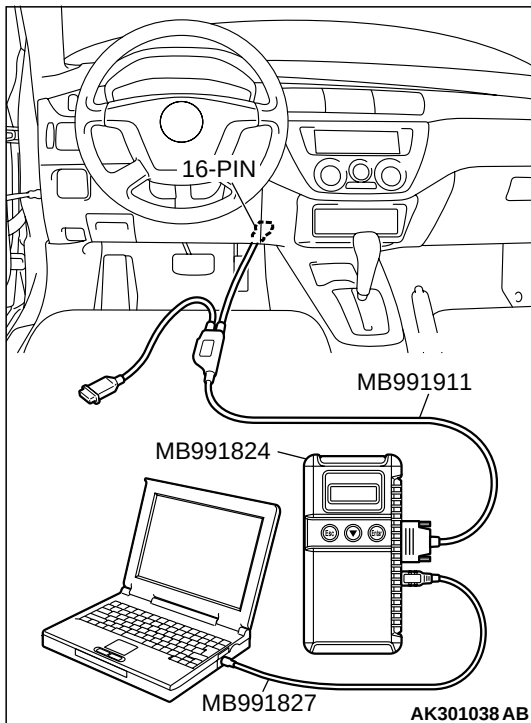
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

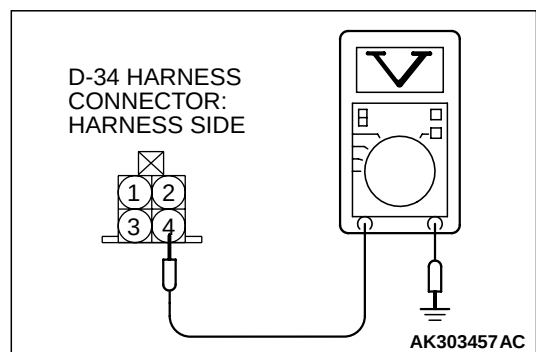
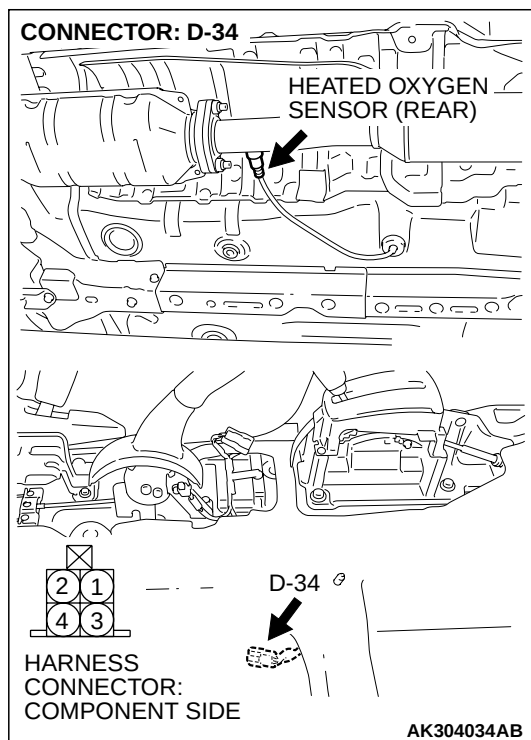
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
  - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

### Q: Is the sensor operating properly?

**YES** : It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

**NO** : Go to Step 2.





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

- (1) Do not disconnect the connector D-34.
- (2) Start the engine and run at idle.

- (3) Measure the voltage between terminal No. 4 and ground by backprobing.
  - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 3.

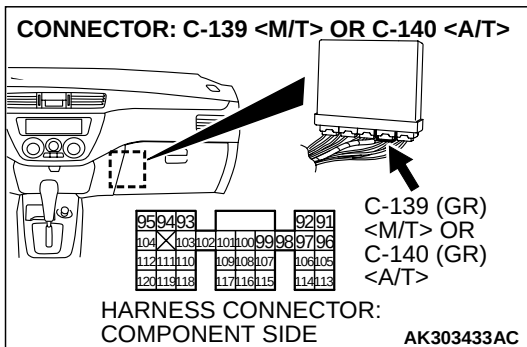
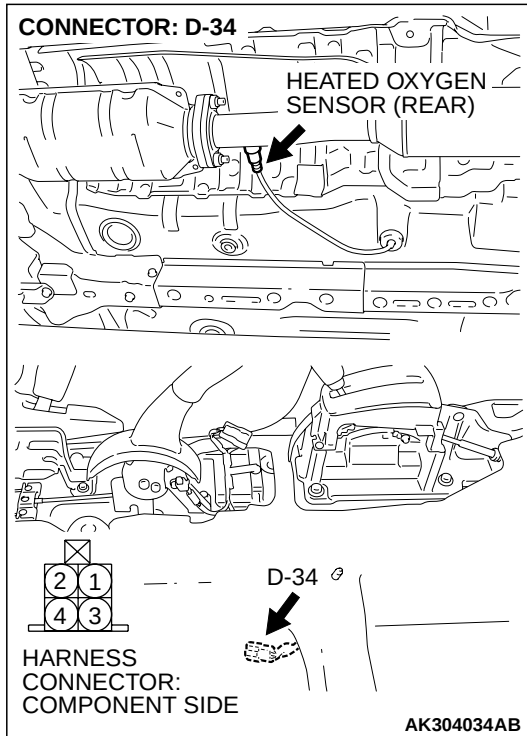
**NO :** Go to Step 6.

**STEP 3. Check harness connector D-34 at heated oxygen sensor (rear) and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> 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 11.

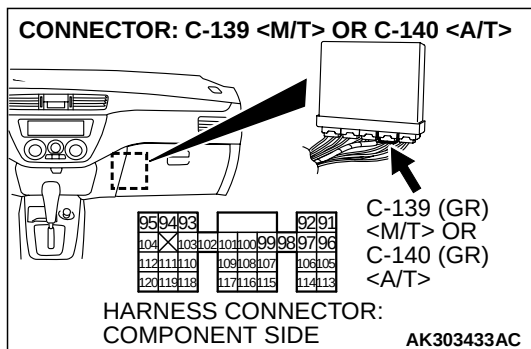
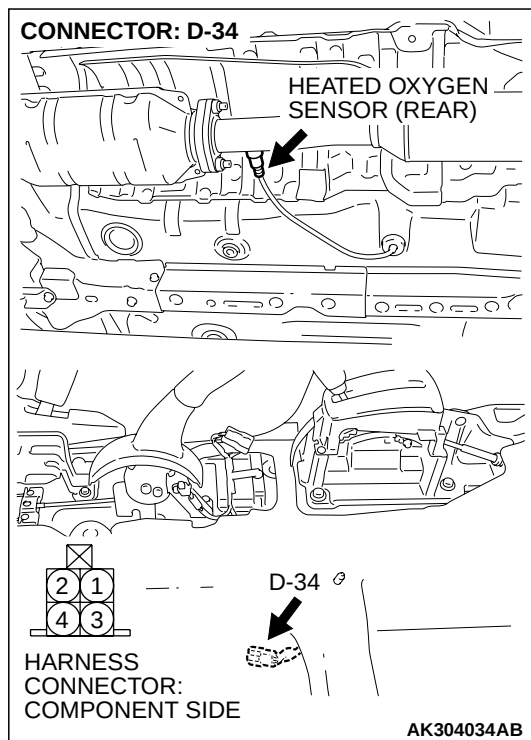


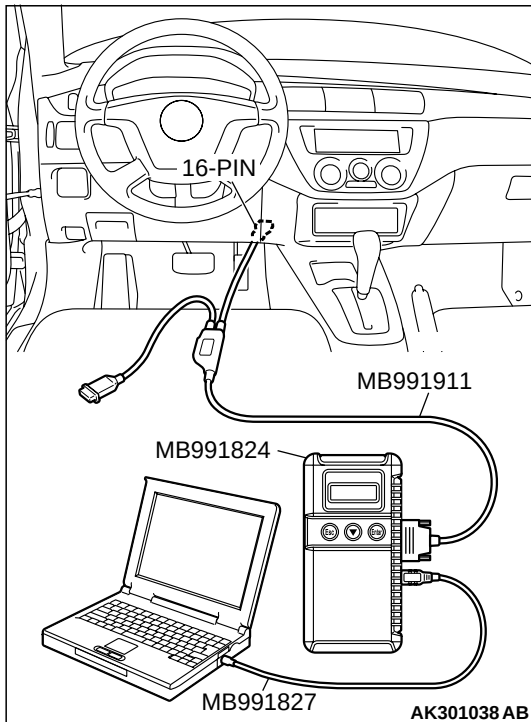
**STEP 4.** Check for open circuit between heated oxygen sensor (rear) connector D-34 (terminal No. 4) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 116).

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

**YES :** Go to Step 5.

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





**STEP 5. Using scan tool MB991958, check data list item 59: 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.

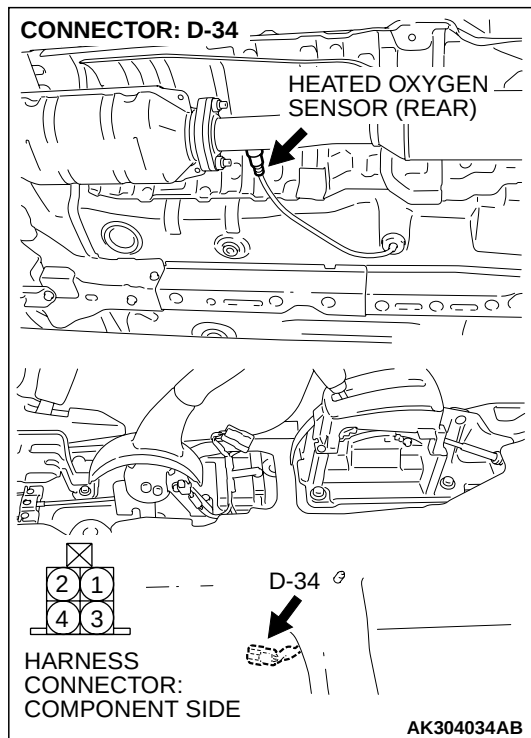
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
  - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

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

Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Replace the ECM or PCM. Then go to Step 11.

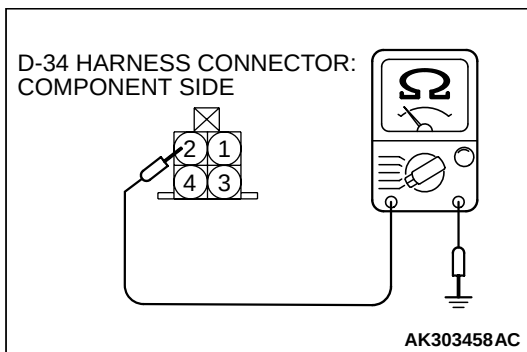
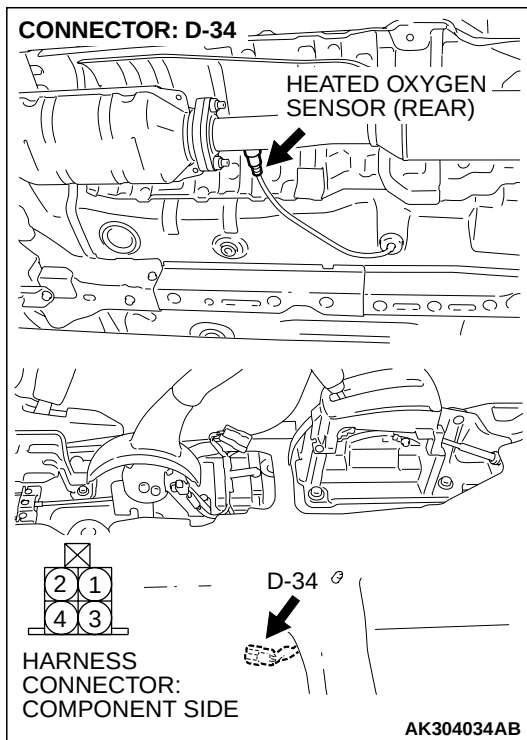


**STEP 6. Check harness connector D-34 at heated oxygen sensor (rear) for damage.**

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

**YES :** Go to Step 7.

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



**STEP 7. Check the continuity at heated oxygen sensor (rear) harness side connector D-34.**

(1) Disconnect the connector D-34 and measure at the harness side.

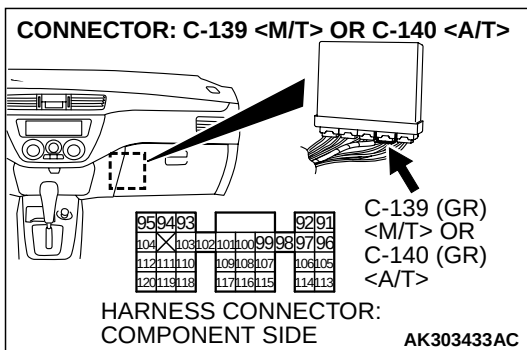
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

**Q: Does continuity exist?**

**YES :** Go to Step 10.

**NO :** Go to Step 8.



**STEP 8. Check harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 9.

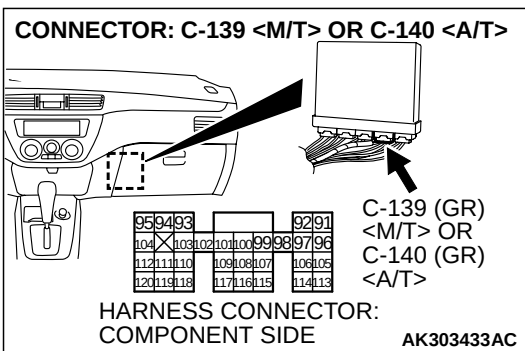
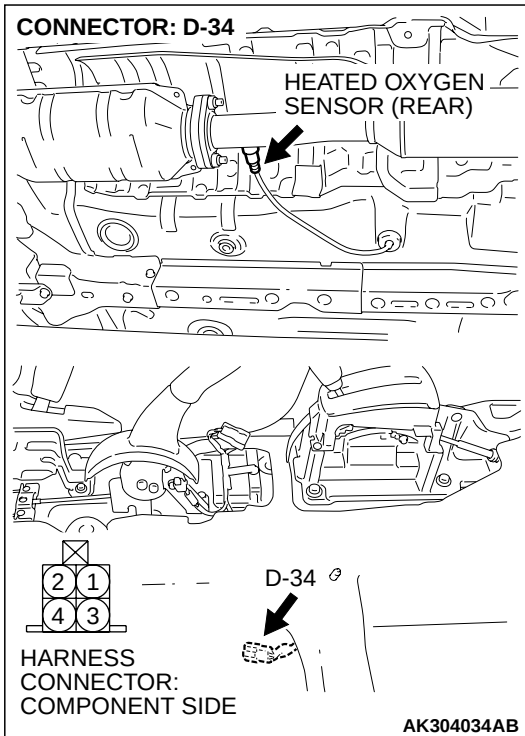
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

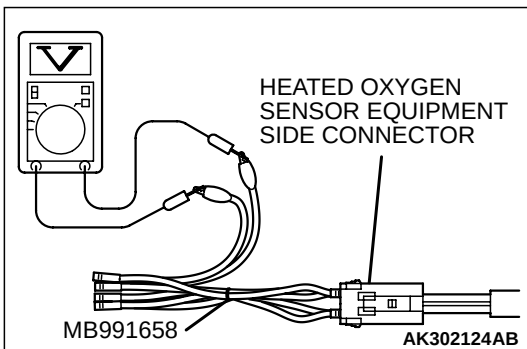
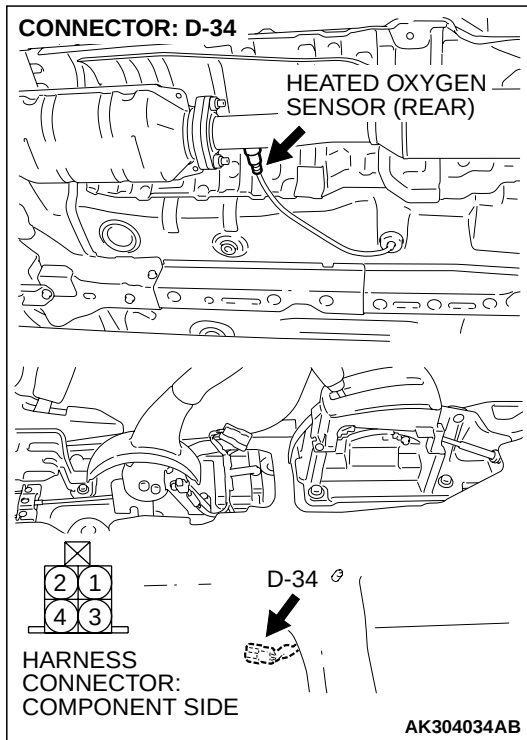
**STEP 9.** Check for open circuit between heated oxygen sensor (rear) connector D-34 (terminal No. 2) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 96).

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

**YES :** Replace the ECM or PCM. Then go to Step 11.

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



**STEP 10. Check the heated oxygen sensor (rear).**

- (1) Disconnect the heated oxygen sensor (rear) connector D-34 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) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

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

**Standard value: 0.6 – 1.0 volt**

**CAUTION**

- Be very careful when connecting the jumper wire; incorrect connection can damage the heated oxygen sensor (rear).
- Be careful the heater is broken when voltage of beyond 12 volts is applied to the heated oxygen sensor (rear) heater.

*NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (rear) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 and the terminal No. 3 of the heated oxygen sensor (rear) with the positive terminal and the negative terminal of 12 volts power supply respectively, then check again.*

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

**YES :** Replace the ECM or PCM. Then go to Step 11.

**NO :** Replace the heated oxygen sensor (rear). 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 – Procedure 6 – Other Monitor [P.13B-6](#).
- (2) Check the diagnostic trouble code (DTC).

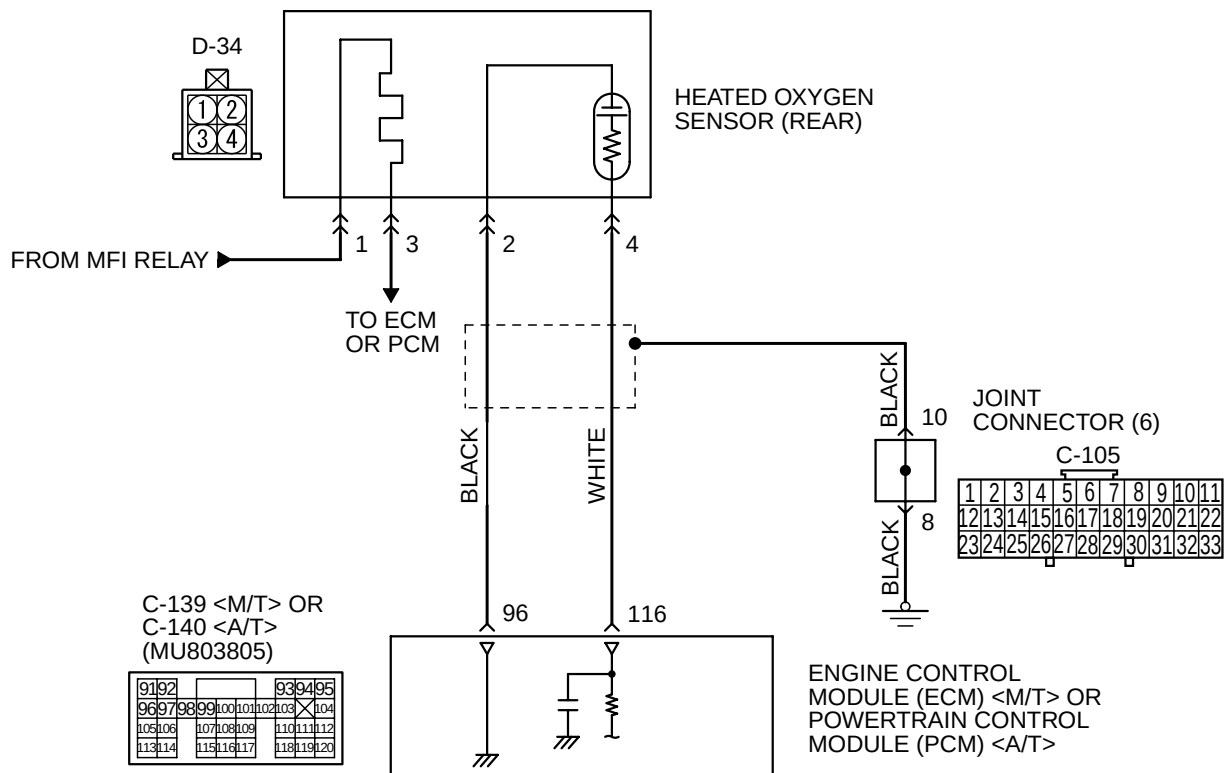
**Q: Is DTC P0136 set?**

**YES :** Retry the troubleshooting.

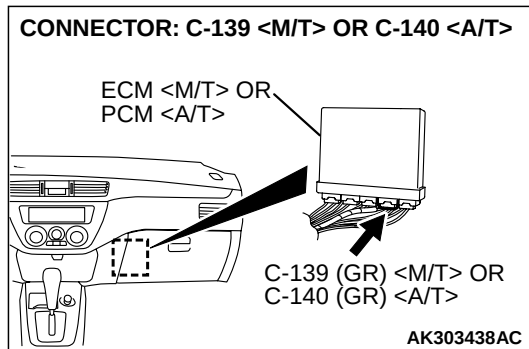
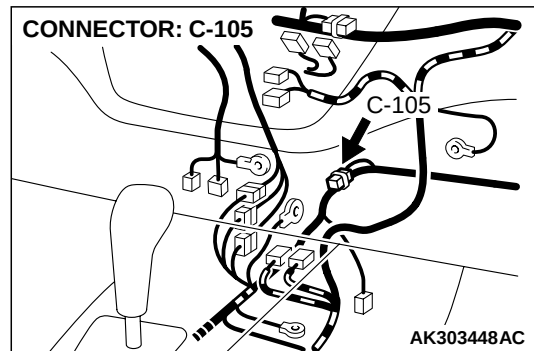
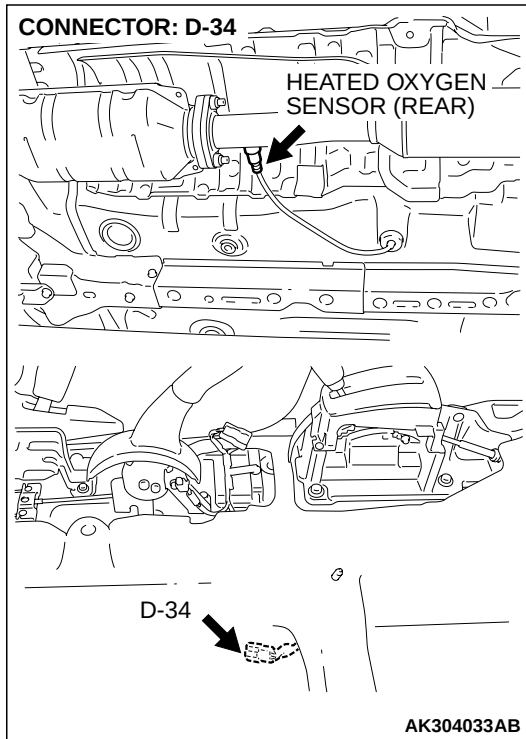
**NO :** The inspection is complete.

**DTC P0137: Heated Oxygen Sensor Circuit Low Voltage (sensor 2)**

**Heated Oxygen Sensor (rear) Circuit**



AK303986



### CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM <M/T> or PCM <A/T> (terminal No. 116) from the output terminal (terminal No. 4) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).

### 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 <M/T> or PCM <A/T> checks for an open circuit in the heated oxygen sensor (rear) output line.

### DESCRIPTIONS OF MONITOR METHODS

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

### MONITOR EXECUTION

Continuous

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

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

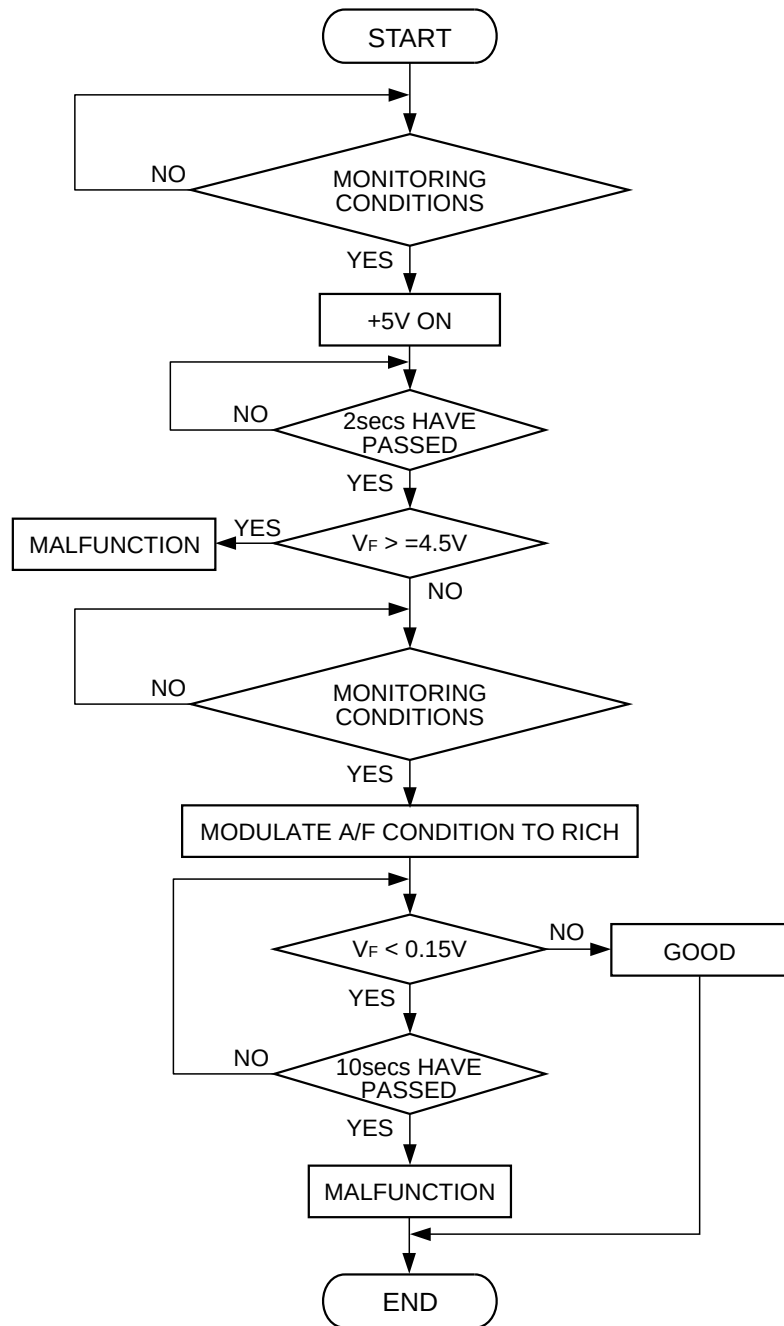
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

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

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

## DTC SET CONDITIONS

## Logic Flow Chart



AK302025

**Check Conditions**

- 3 minutes or more have passed since the engine starting sequence was completed.
- Heated oxygen sensor (rear) signal voltage has continued to be 0.15 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Mass airflow sensor output is 13 g/sec or more.
- At least 20 seconds have passed since fuel shut off control was canceled.
- Monitoring time: 10 seconds.

### Judgement Criteria

- Making the air/fuel ratio 15 percent richer for 10 seconds does not result in raising the heated oxygen sensor (rear) output voltage beyond 0.15 volt.

### OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –  
Procedure 6 – Other Monitor [P.13B-6](#).

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

- Heated oxygen sensor (rear) failed.
- Short circuit in heated oxygen sensor (rear) output line.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tools:

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

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

#### CAUTION

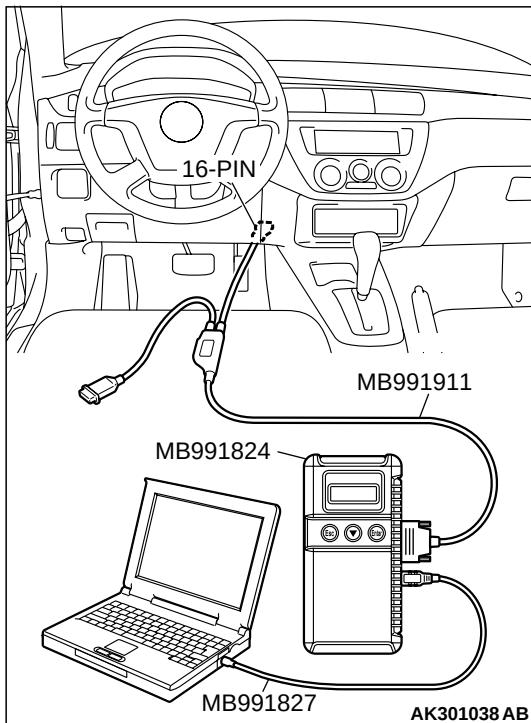
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

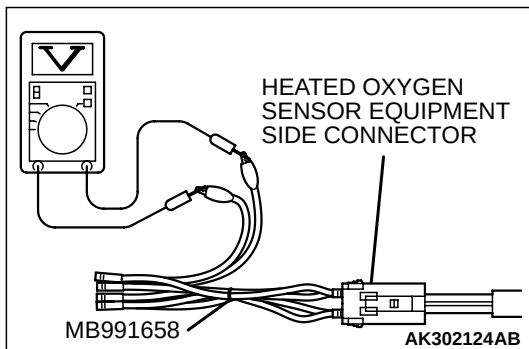
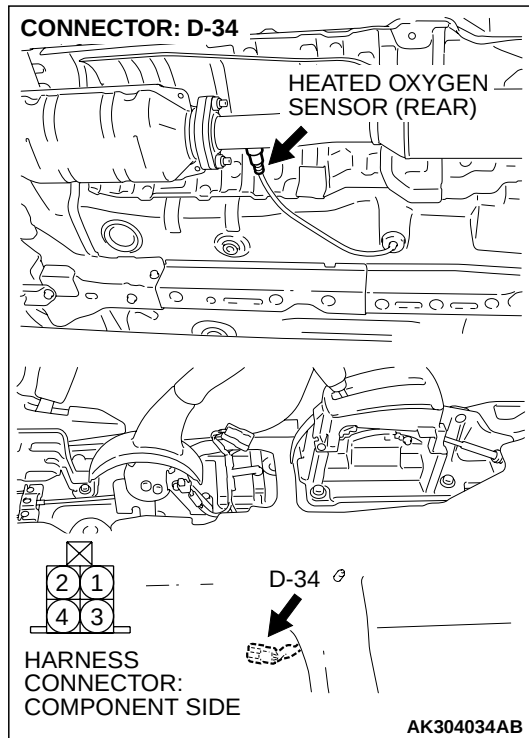
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
  - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

### Q: Is the sensor operating properly?

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**NO :** Go to Step 2.



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

- (1) Disconnect the heated oxygen sensor (rear) connector D-34 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) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

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

**Standard value: 0.6 – 1.0 volt**

**CAUTION**

- Be very careful when connecting the jumper wire; incorrect connection can damage the heated oxygen sensor (rear).
- Be careful the heater is broken when voltage of beyond 12 volts is applied to the heated oxygen sensor (rear) heater.

*NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (rear) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 and the terminal No. 3 of the heated oxygen sensor (rear) with the positive terminal and the negative terminal of 12 volts power supply respectively, then check again.*

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

**YES :** Go to Step 3.

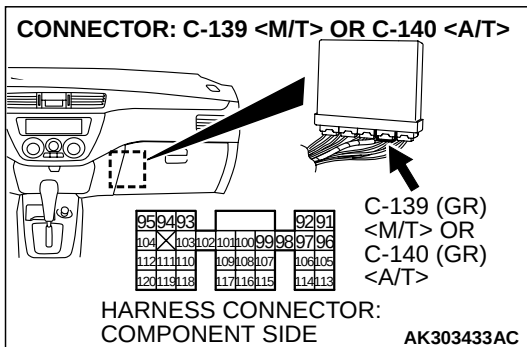
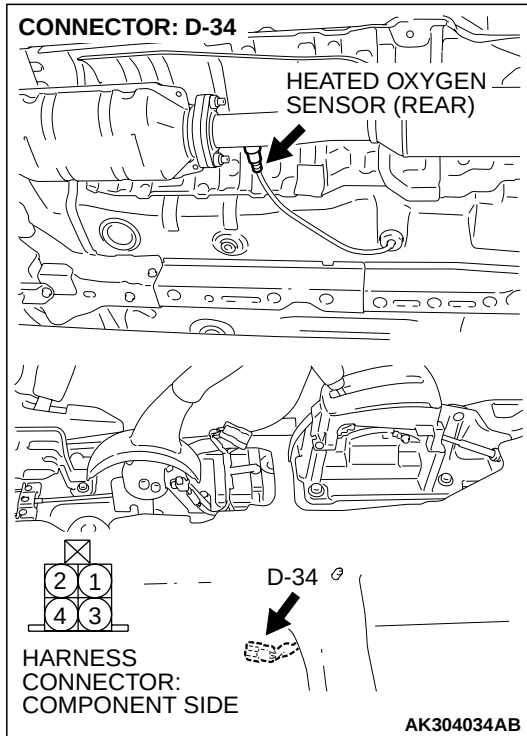
**NO :** Replace the heated oxygen sensor (rear). Then go to Step 5.

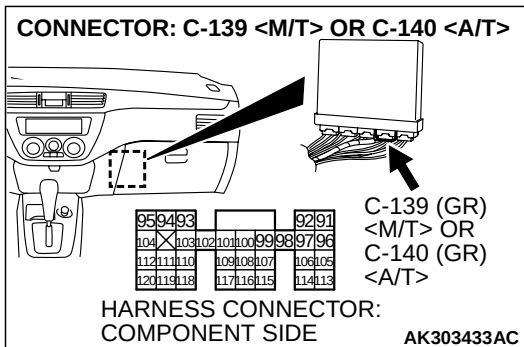
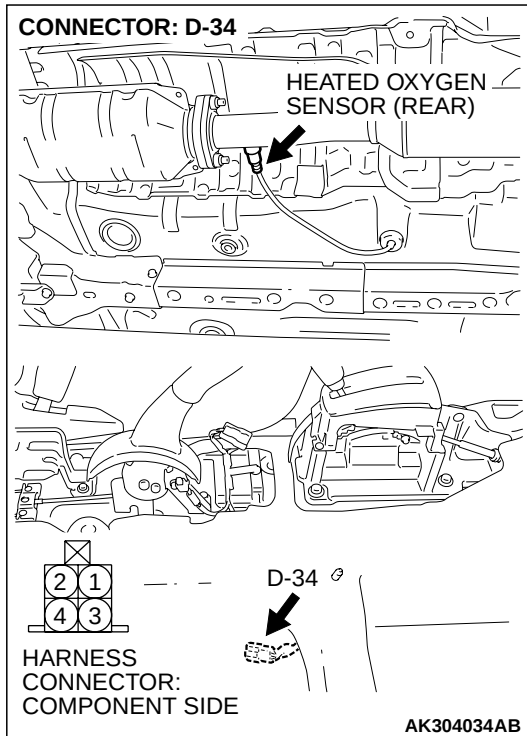
**STEP 3. Check harness connector D-34 at heated oxygen sensor (rear) and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> for damage.**

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

**YES :** Go to Step 4.

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





**STEP 4. Check for short circuit to ground between heated oxygen sensor (rear) connector D-34 (terminal No. 4) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 116).**

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

**YES :** Replace the ECM or PCM. Then go to Step 5.

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

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

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

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

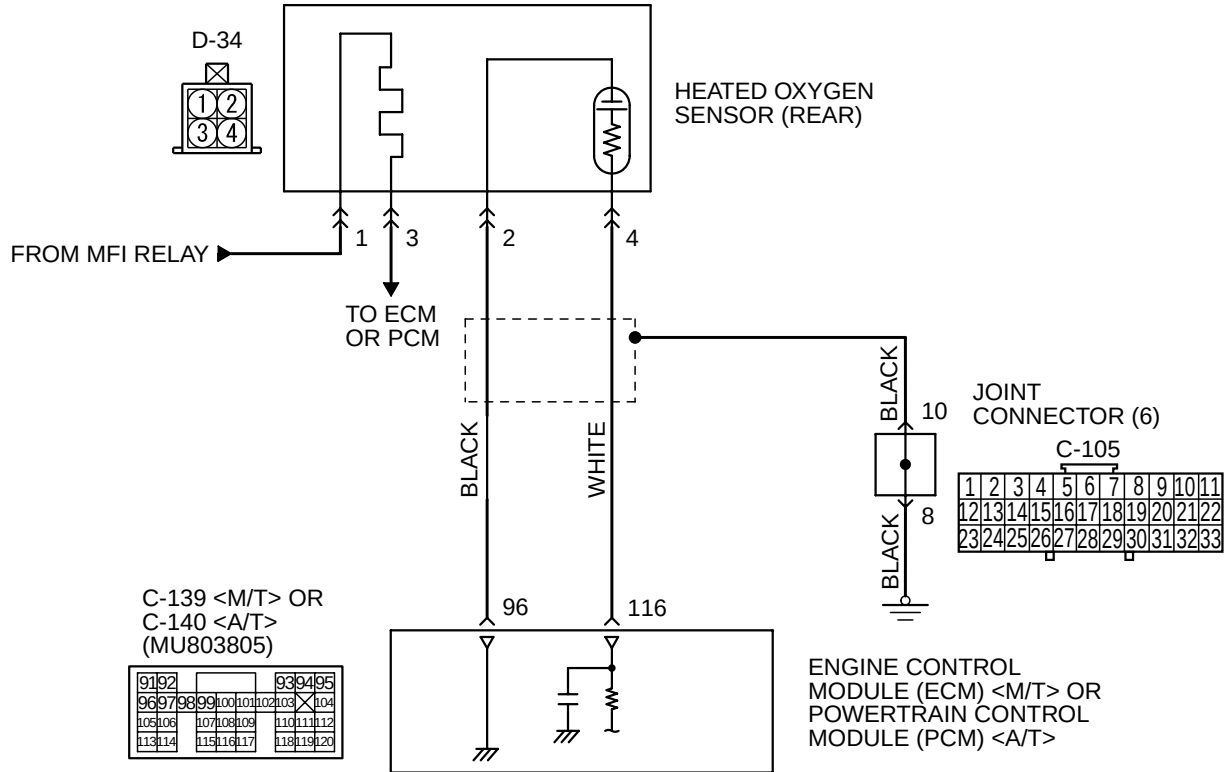
**Q: Is DTC P0137 set?**

**YES :** Retry the troubleshooting.

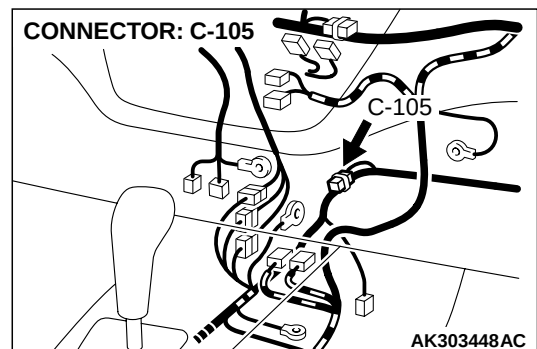
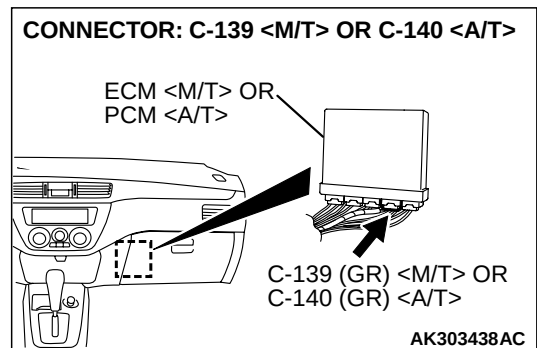
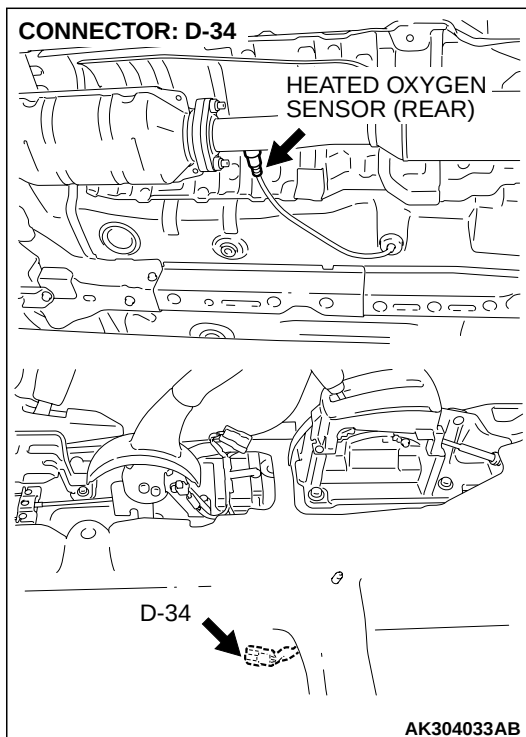
**NO :** The inspection is complete.

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

Heated Oxygen Sensor (rear) Circuit



AK303986



**CIRCUIT OPERATION**

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM <M/T> or PCM <A/T> (terminal No. 116) from the output terminal (terminal No. 4) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).

**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 <M/T> or PCM <A/T> checks for an open circuit in the heated oxygen sensor (rear) output line.

**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)**

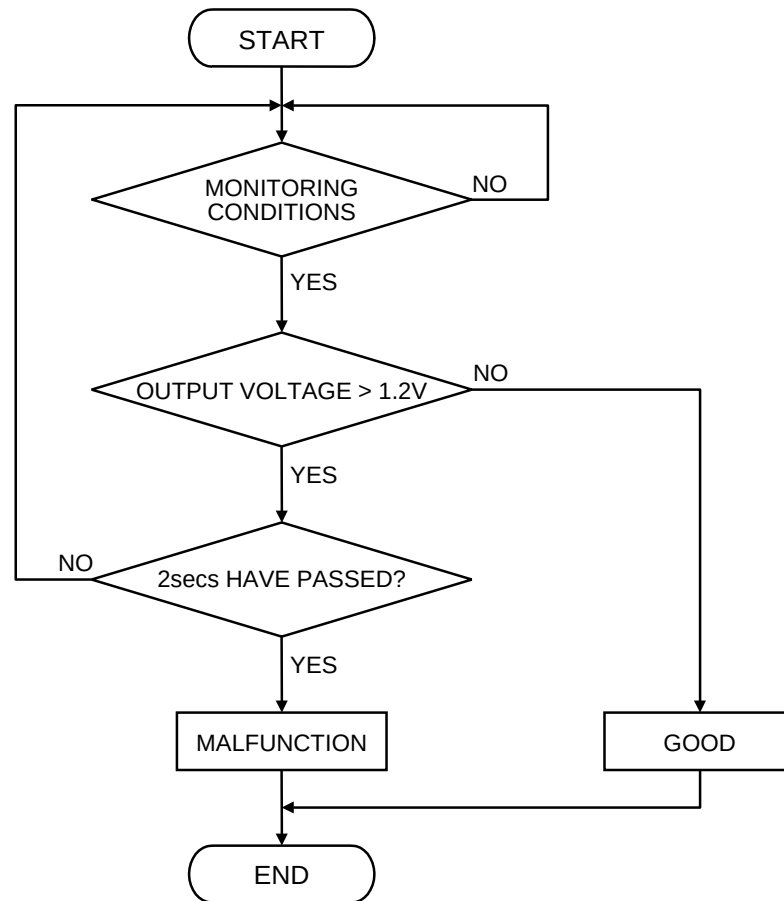
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

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

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

DTC SET CONDITIONS

Logic Flow Chart



AK302026

**Check Conditions**

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

**Judgment Criteria**

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

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Short circuit in heated oxygen sensor (rear) output line.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

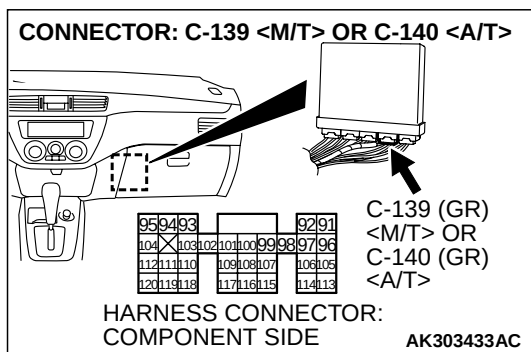
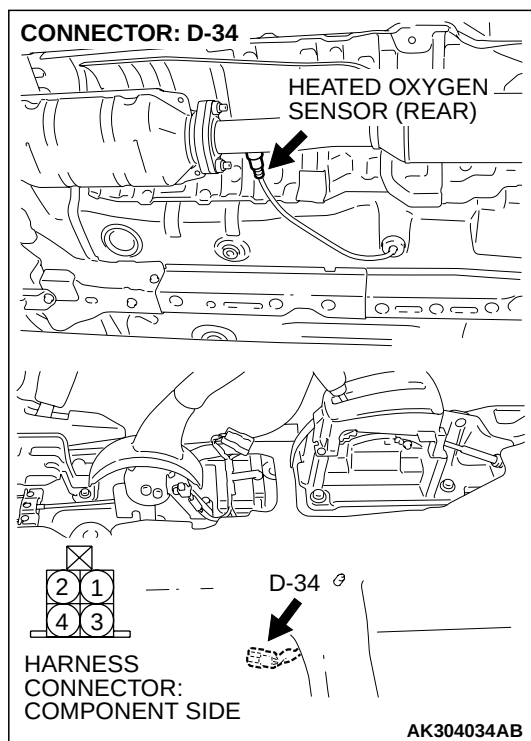
## DIAGNOSIS

**STEP 1.** Check harness connector D-34 at heated oxygen sensor (rear) and harness connector C-139 at ECM <M/T> or C-140 at PCM <A/T> 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.

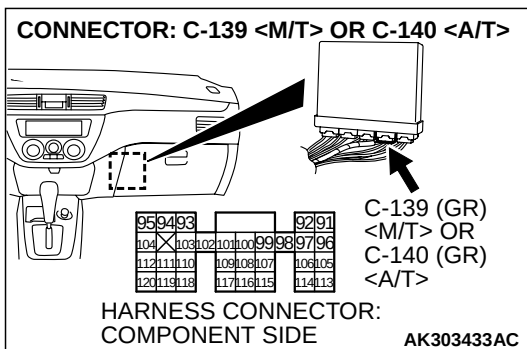
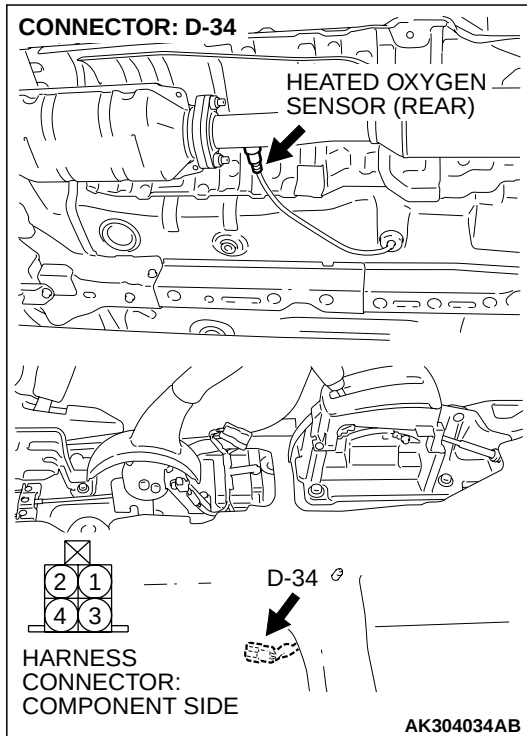


**STEP 2. Check for short circuit to power supply between heated oxygen sensor (rear) connector D-34 (terminal No. 4) and ECM connector C-139 <M/T> or PCM connector C-140 <A/T> (terminal No. 116).**

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

**YES :** Replace the ECM or PCM. Then go to Step 3.

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



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

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

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

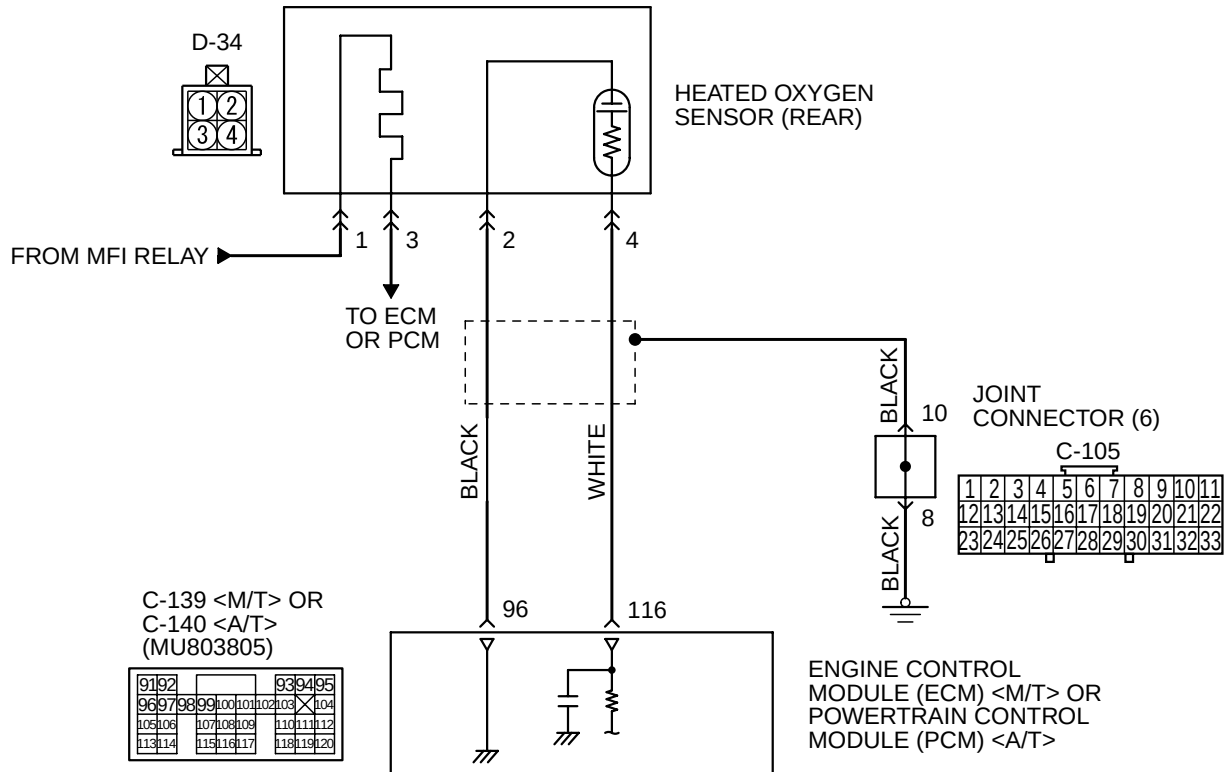
**Q: Is DTC P0138 set?**

**YES :** Retry the troubleshooting.

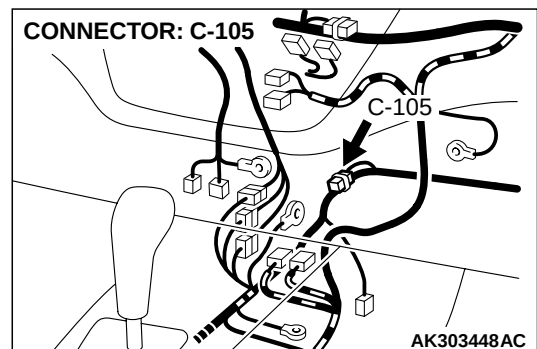
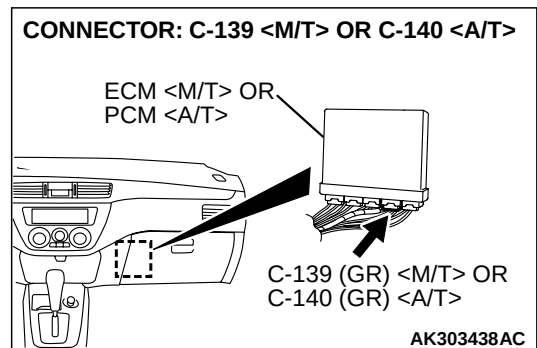
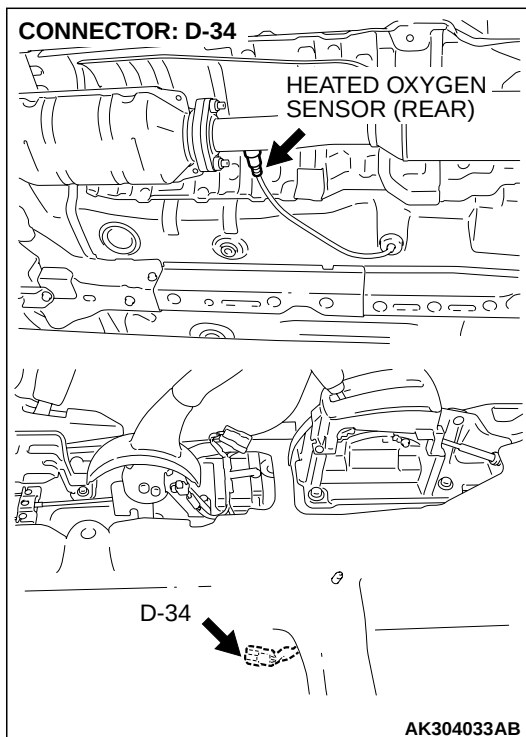
**NO :** The inspection is complete.

## DTC P0139: Heated Oxygen Sensor Circuit Slow Response (sensor 2)

## Heated Oxygen Sensor (rear) Circuit



AK303986



### CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM <M/T> or PCM <A/T> (terminal No. 116) from the output terminal (terminal No. 4) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM <M/T> or PCM <A/T> (terminal No. 96).

### 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 <M/T> or PCM <A/T> checks for an open circuit in the heated oxygen sensor (rear) output line.

### 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)**

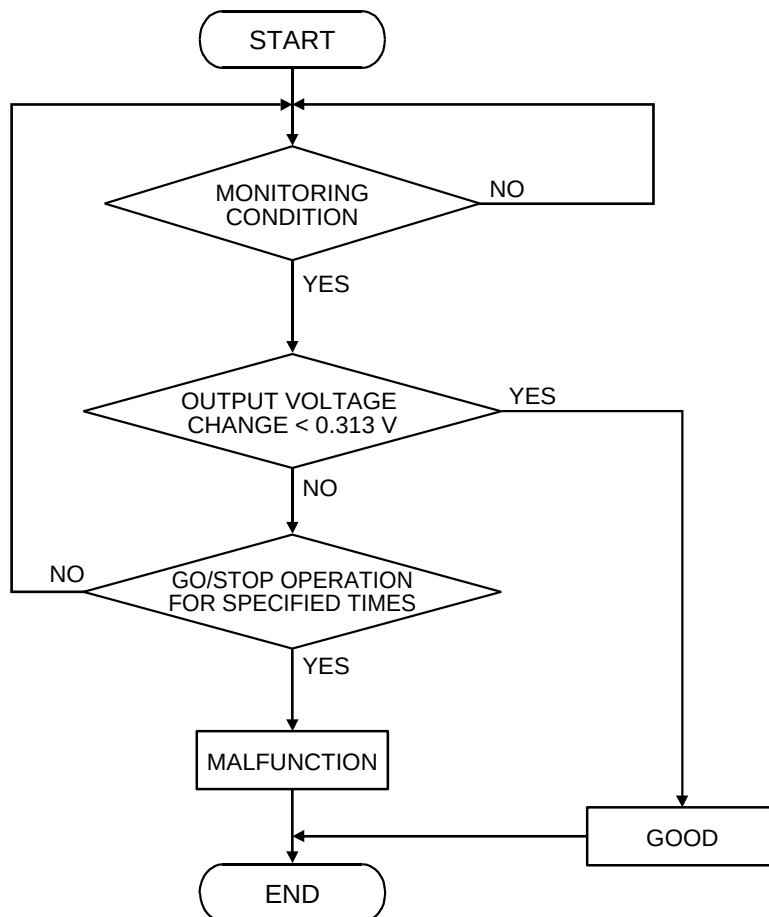
- Heated oxygen sensor heater (front) monitor
- Heated oxygen sensor heater (rear) monitor
- Air/fuel ratio feedback monitor

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

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

## DTC SET CONDITIONS

## Logic Flow Chart



AK302170

**Check Conditions**

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative mass airflow sensor output is higher than 2,931 g.
- Repeat 3 or more times: drive\*<sup>1</sup>, stop\*<sup>2</sup>.

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

- Engine speed is higher than 1,500 r/min.
- Volumetric efficiency is higher than 40 per cent.
- Vehicle speed is higher than 30 km/h (19 mph).

- A total of more than 26 seconds have elapsed with the above mentioned conditions, and more than 2 seconds have elapsed with the fuel shut off.

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

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

**Judgement Criteria**

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

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

## OBD-II DRIVE CYCLE PATTERN

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

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

- Heated oxygen sensor (rear) deteriorated.

## DIAGNOSIS

### Required Special Tools:

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

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

#### ⚠ CAUTION

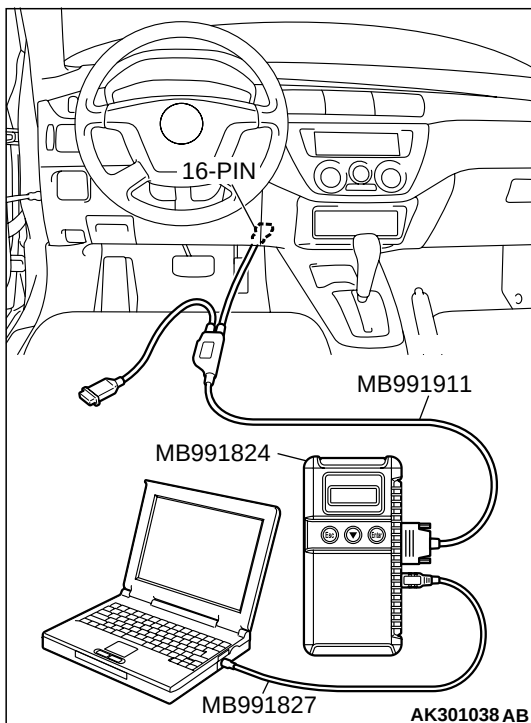
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 59, Heated Oxygen Sensor (rear).
- (4) Warm up the engine.
  - After increasing the output voltage 0.15 volt or more by the engine revving, finish it. Then confirm that the output voltage reduces to 0.15 volt or less within 3 seconds.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

### Q: Is the sensor operating properly?

**YES** : It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

**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 – Procedure 4 – Heated Oxygen Sensor Monitor [P.13B-6](#).
- (2) Check the diagnostic trouble code (DTC).

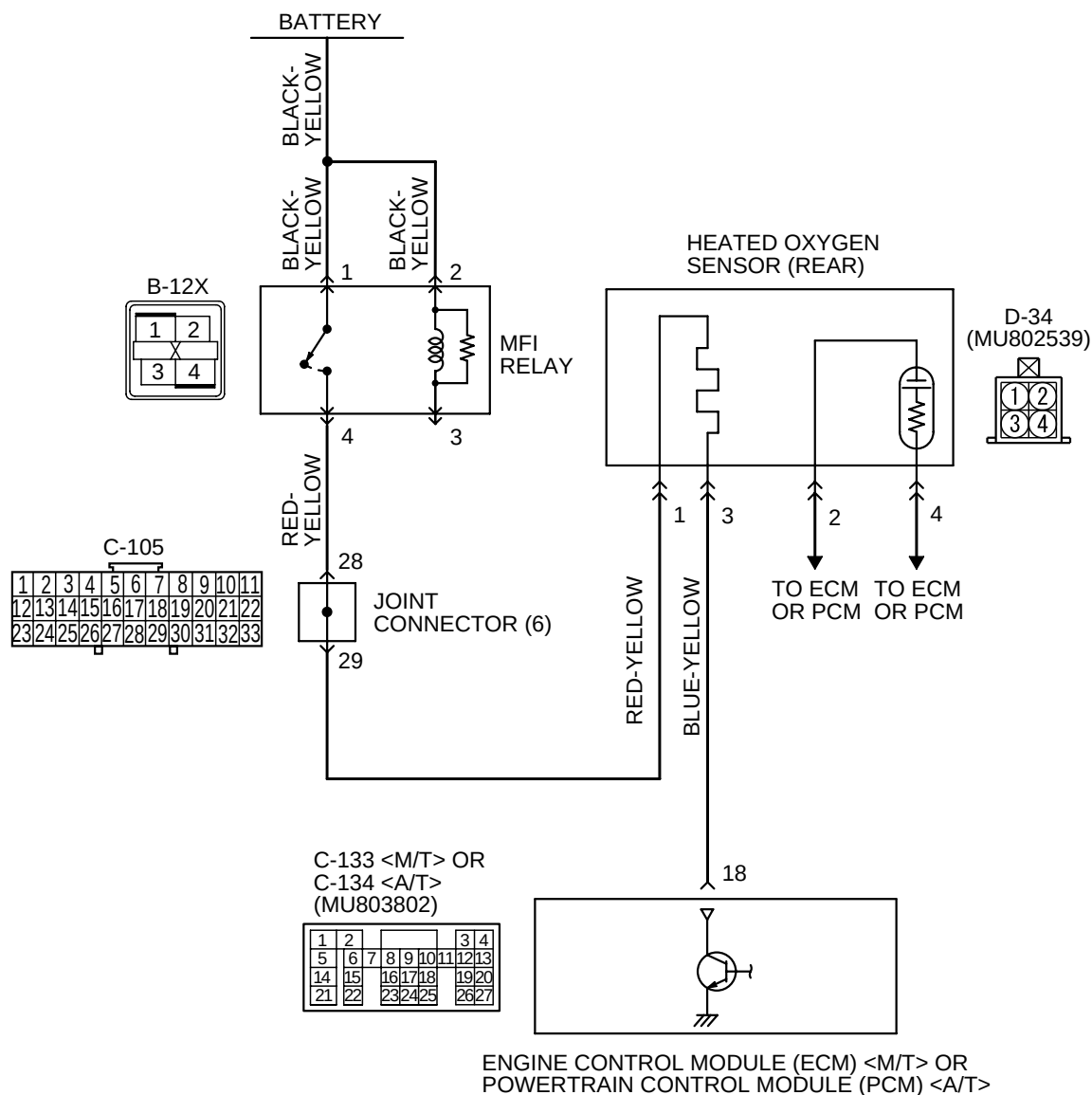
### Q: Is DTC P0139 set?

**YES** : Retry the troubleshooting.

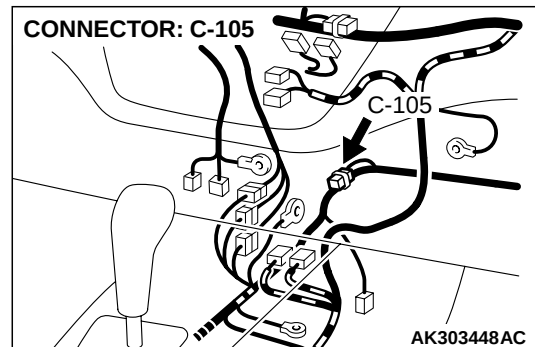
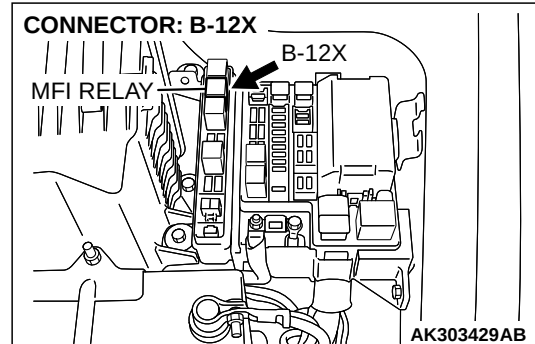
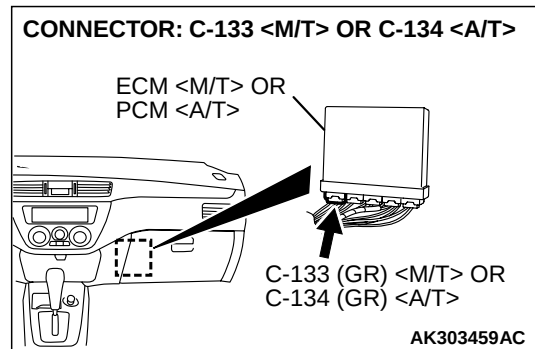
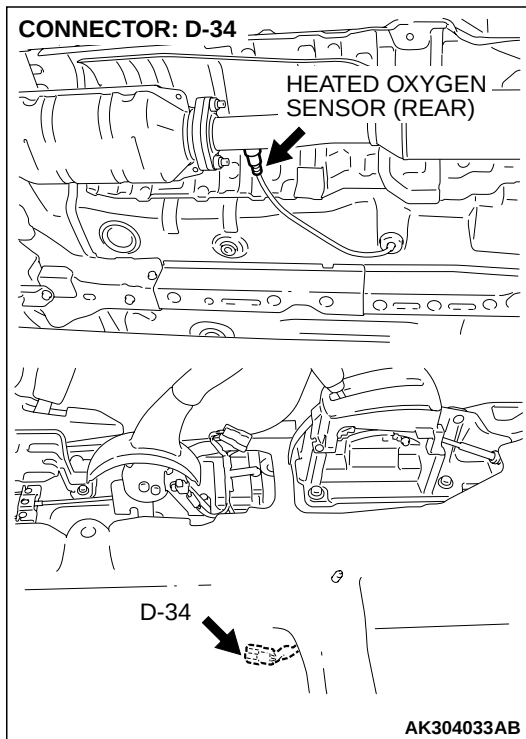
**NO** : The inspection is complete.

## DTC P0141: Heated Oxygen Sensor Heater Circuit (sensor 2)

Heated Oxygen Sensor (rear) Heater Circuit



AK304017



### CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 3) to the heated oxygen sensor (rear) heater.
- The ECM <M/T> or PCM <A/T> (terminal No. 18) controls continuity to the heated oxygen sensor (rear) heater by turning the power transistor in the ECM <M/T> or PCM <A/T> "ON" and "OFF".

### TECHNICAL DESCRIPTION

- The ECM <M/T> or PCM <A/T> checks whether the heater current is within a specified range when the heater is energized.

### DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor heater (rear) current is out of specified range when engine coolant temperature is over 20°C (68°F).

### MONITOR EXECUTION

Continuous

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

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

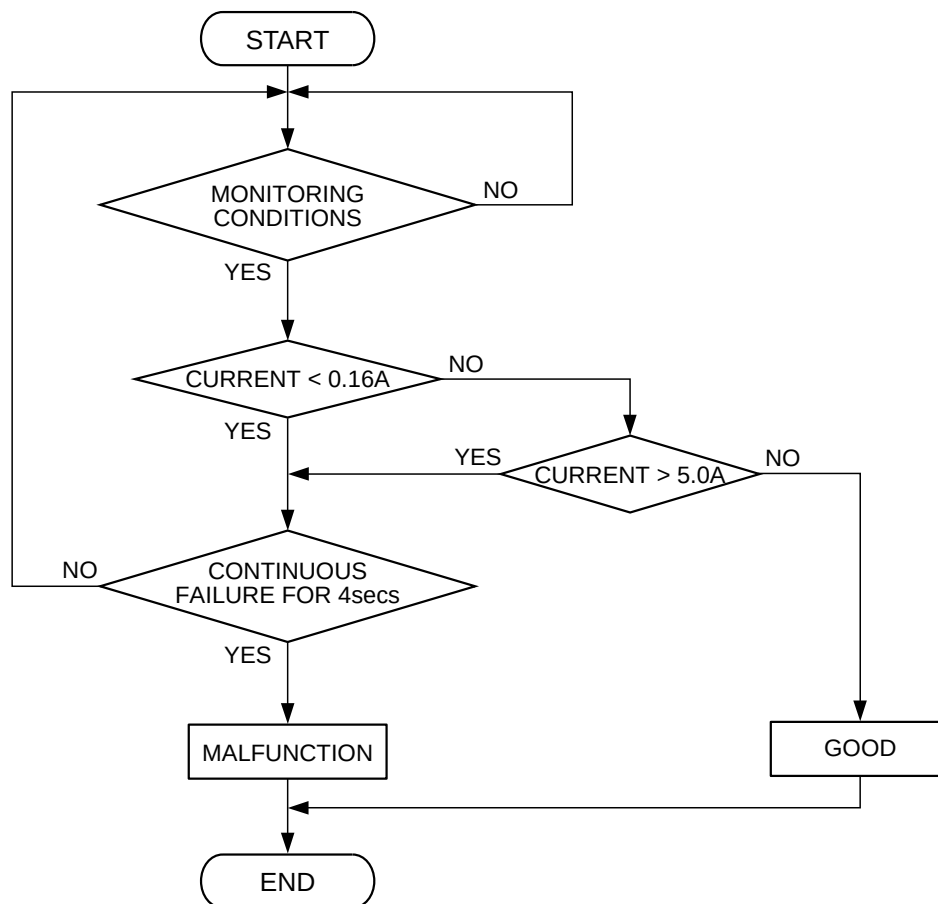
- Not applicable

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

- Engine coolant temperature sensor

## DTC SET CONDITIONS

## Logic Flow Chart



AK302027

**Check Conditions**

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

**Judgment Criteria**

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

**OBD-II DRIVE CYCLE PATTERN**

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13B-6](#).

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

- Open or shorted heated oxygen sensor (rear) heater circuit, harness damage or connector damage.
- Open circuit in heated oxygen sensor (rear) heater.
- ECM failed. <M/T>
- PCM failed. <A/T>

## DIAGNOSIS

### Required Special Tool:

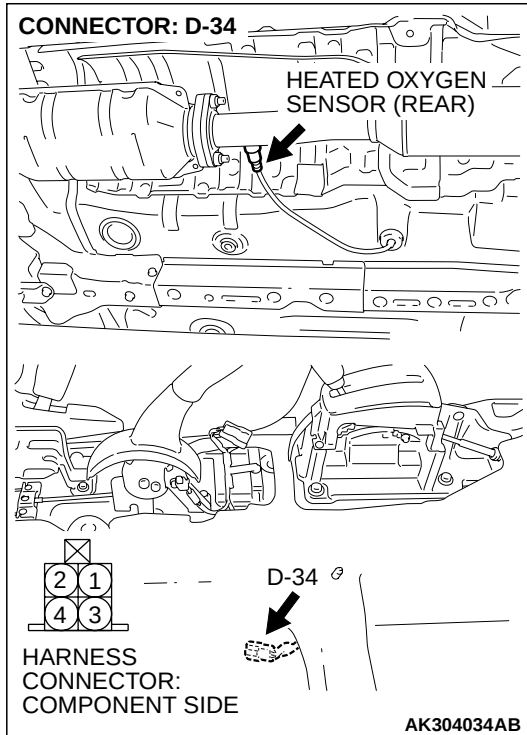
- MB991658: Test Harness

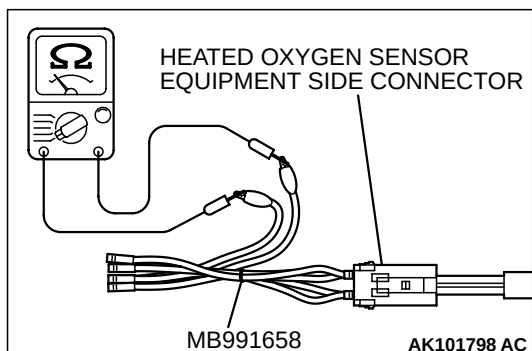
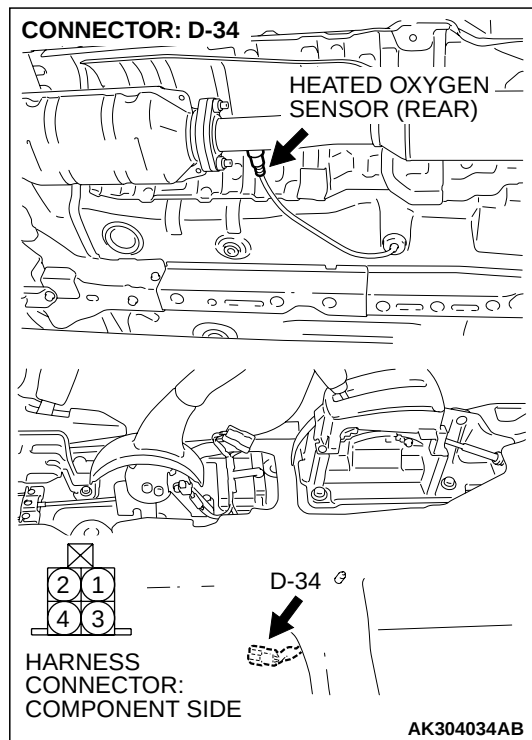
**STEP 1. Check harness connector D-34 at the heated oxygen sensor (rear) for damage.**

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

**YES :** Go to Step 2.

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



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

- (1) Disconnect heated oxygen sensor (rear) connector D-34 and connect test harness special tool, MB991658, to the connector on the heated oxygen (rear) sensor side.

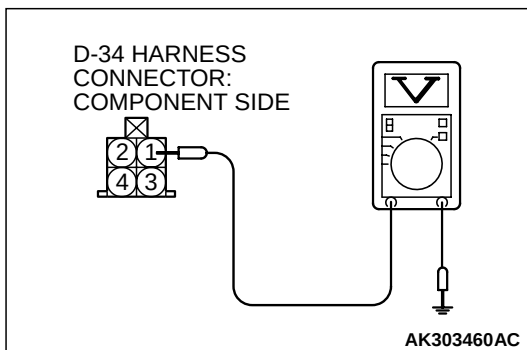
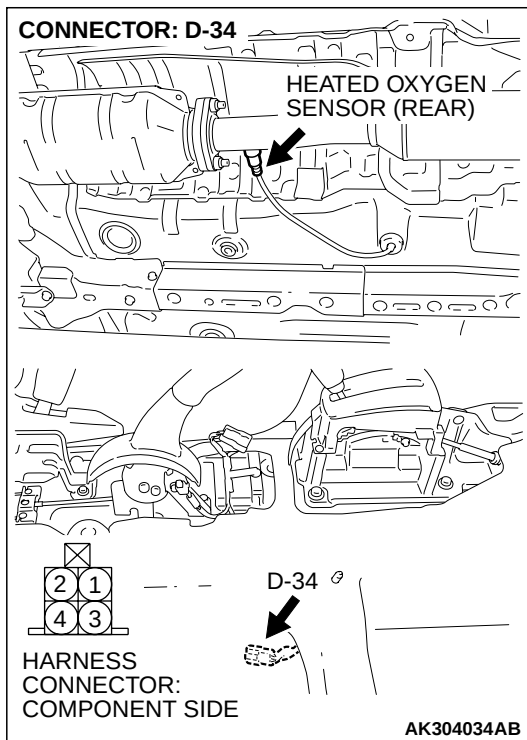
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 and terminal No. 3.

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

**Q: Is the measured resistance between 11 and 18 ohms [at 20°C (60°F)]?**

**YES :** Go to Step 3.

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



**STEP 3. Measure the power supply voltage at heated oxygen sensor (rear) harness side connector D-34.**

- (1) Disconnect the connector D-34 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 1 and ground.
  - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

**YES :** Go to Step 5.

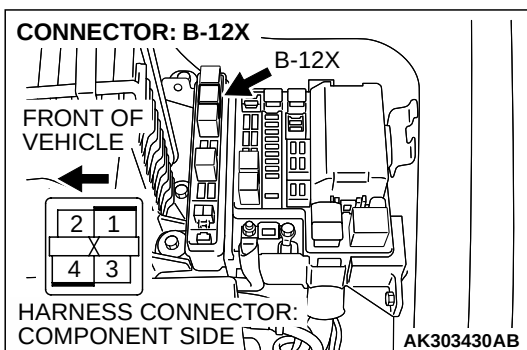
**NO :** Go to Step 4.

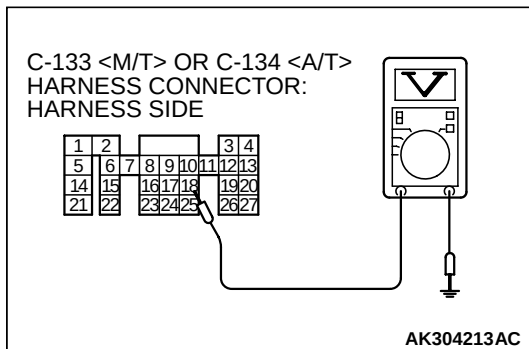
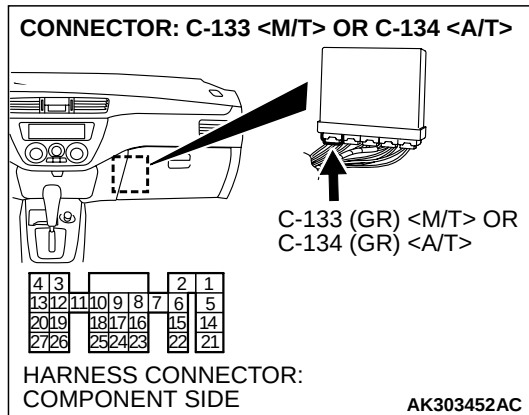
**STEP 4. Check harness connector B-12X at the MFI relay for damage.**

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

**YES :** Check harness connector C-105 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 B-12X (terminal No. 4) and heated oxygen sensor (rear) connector D-34 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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





**STEP 5. Measure the power supply voltage at ECM harness side connector C-133 <M/T> or PCM harness side connector C-134 <A/T> by backprobing.**

- (1) Do not disconnect the connector C-133 <M/T> or C-134 <A/T>.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 18 and ground by backprobing.

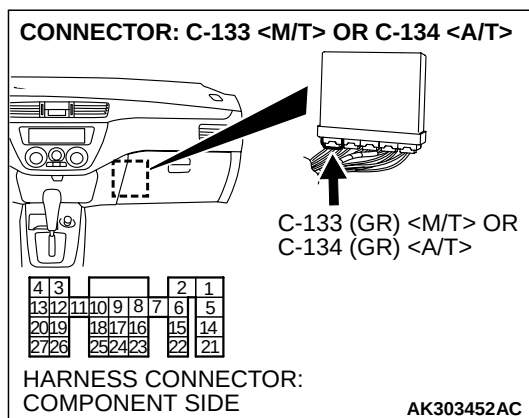
- Voltage should be battery positive voltage.

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

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

**YES :** Go to Step 8.

**NO :** Go to Step 6.



**STEP 6. Check harness connector C-133 at ECM <M/T> or C-134 at PCM <A/T> for damage.**

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

**YES :** Go to Step 7.

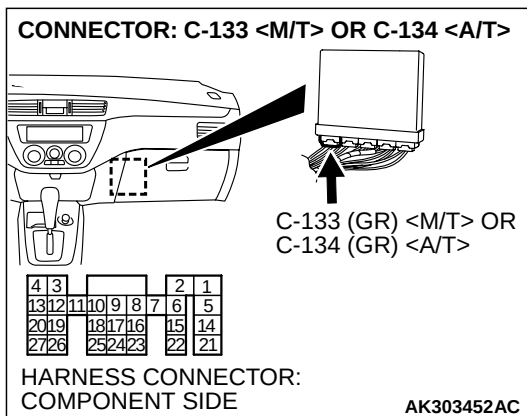
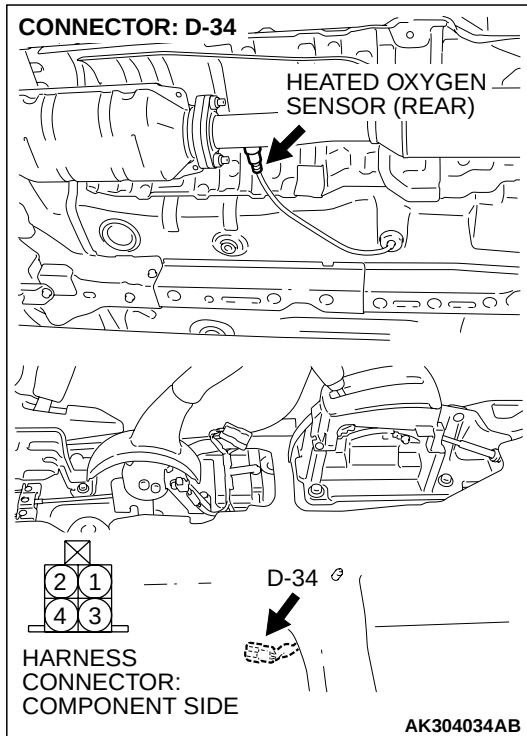
**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

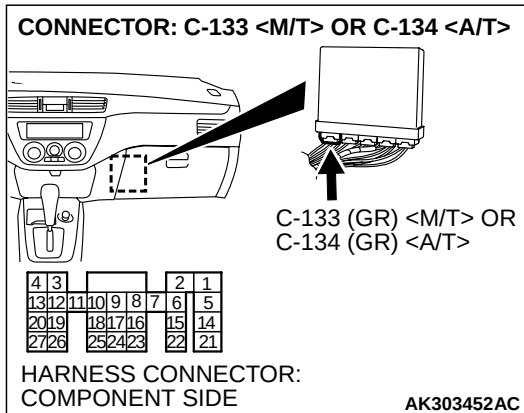
**STEP 7.** Check for open circuit or short circuit to ground between heated oxygen sensor (rear) connector D-34 (terminal No. 3) and ECM connector C-133 <M/T> or PCM connector C-134 <A/T> (terminal No. 18).

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

**YES :** Replace the ECM or PCM. Then go to Step 12.

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



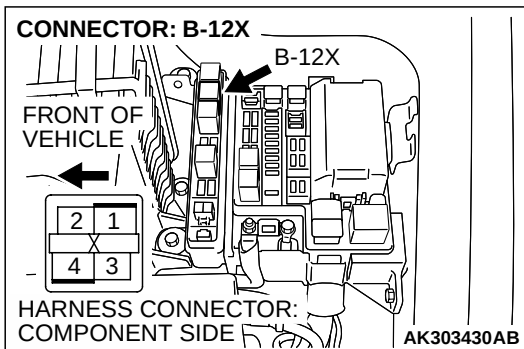


**STEP 8. Check harness connector C-133 at ECM <M/T> or C-134 at PCM <A/T> for damage.**

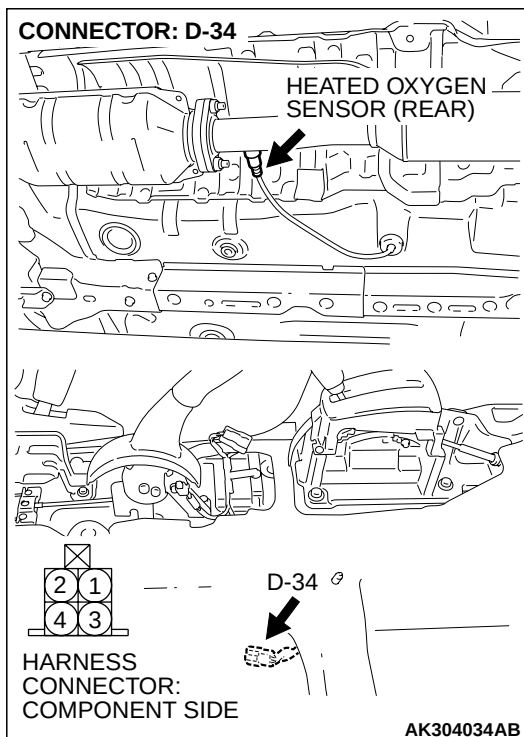
**Q: Is the harness connector in good condition?**

**YES :** Go to Step 9.

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



**STEP 9. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (rear) connector D-34 (terminal No. 1).**



*NOTE: Check harness after checking intermediate connector C-105. 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.

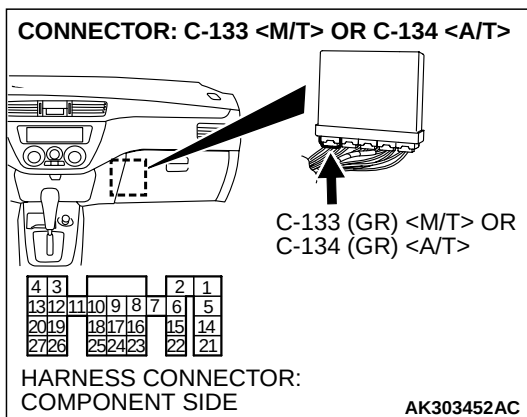
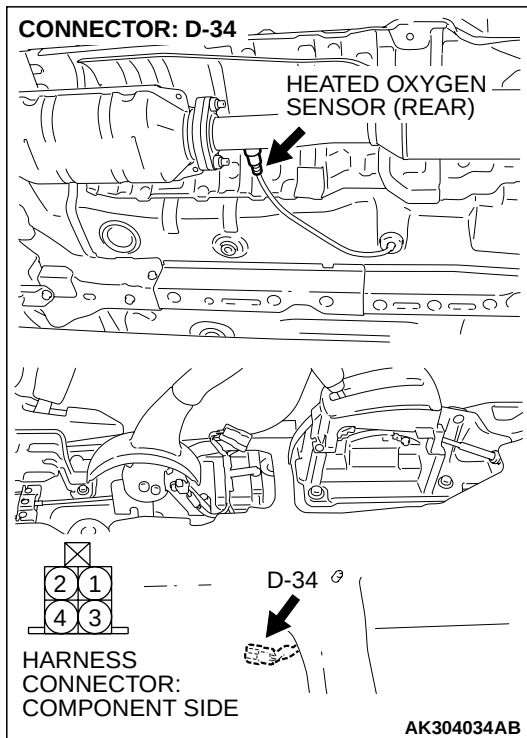
**NO :** Repair it. Then go to Step 12.

**STEP 10. Check for harness damage between heated oxygen sensor (rear) connector D-34 (terminal No. 3) and ECM connector C-133 <M/T> or PCM connector C-134 <A/T> (terminal No. 18).**

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

**YES :** Go to Step 11.

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



**STEP 11. Check the trouble symptoms.**

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

**Q: Is DTC P0141 set?**

**YES :** Replace the ECM or PCM. Then go to Step 12.

**NO :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points [P.00-6](#).

---

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

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

**Q: Is DTC P0141 set?**

**YES :** Retry the troubleshooting.

**NO :** The inspection is complete.

**Continue**