

GROUP 13A

MULTIPOINT FUEL INJECTION (MPI)

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GENERAL DESCRIPTION

M1131000101908

The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the ENGINE- ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the ENGINE-ECU. The ENGINE-ECU carries out activities such as fuel injection control, idle air control, and ignition timing control.

In addition, the ENGINE-ECU is equipped with a number of diagnostic test modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions. A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank to the fuel injectors by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The regulated fuel is distributed to each of the injectors.

Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-2-3-4-5-6. Each cylinder has a dedicated fuel injector. This is called multipoint. The ENGINE-ECU provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is under normal operating temperature after warming-up, the ENGINE-ECU controls the air/fuel mixture by using the heated oxygen sensor signal to carry out "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 ENGINE-ECU 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 ENGINE-ECU 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 the primary current flow to the ignition coil. This controls the ignition timing to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the ENGINE-ECU from engine speed, intake air volume, intake air temperature and engine coolant temperature.

DIAGNOSTIC TEST MODE

- When a fault is detected in one of the sensors or actuators related to emission control or major engine control system, the (Check Engine Warning 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 ENGINE-ECU.
- The RAM data inside the ENGINE-ECU that is related to the sensors and actuators can be read with the diagnostic tool. In addition, the actuators can be controlled by diagnostic tool (MUT-III sub assembly) under certain circumstances.

OTHER CONTROL FUNCTIONS

Fuel Pump Control

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

A/C Compressor Clutch Relay Control

- Turns the compressor clutch of the A/C ON and OFF.

Fan Control (PWM)

- The radiator fan and condenser fan speeds are controlled by the Fan Controller unit (PWM) in response to the engine coolant temperature and vehicle speed via the engine ECU.

Evaporative Emission Purge Control

- (Refer to GROUP 17, Emission Control System – Evaporative Emission System – General Description [P.17-81](#).)

MULTIPOINT FUEL INJECTION (MPI) SYSTEM DIAGRAM

SENSE

- ★1 MASS AIRFLOW SENSOR
- ★2 INTAKE AIR TEMPERATURE SENSOR
- ★3 THROTTLE POSITION SENSOR (MAIN/SUB)
- ★4 MANIFOLD ABSOLUTE PRESSURE SENSOR
- ★5 ENGINE COOLANT TEMPERATURE SENSOR
- ★6 CAMSHAFT POSITION SENSOR
- ★7 CRANKSHAFT POSITION SENSOR
- ★8 RIGHT BANK HEATED OXYGEN SENSOR (FRONT)
- ★9 RIGHT BANK HEATED OXYGEN SENSOR (REAR)
- ★10 LEFT BANK HEATED OXYGEN SENSOR (FRONT)
- ★11 LEFT BANK HEATED OXYGEN SENSOR (REAR)
- ★12 FUEL LEVEL SENSOR

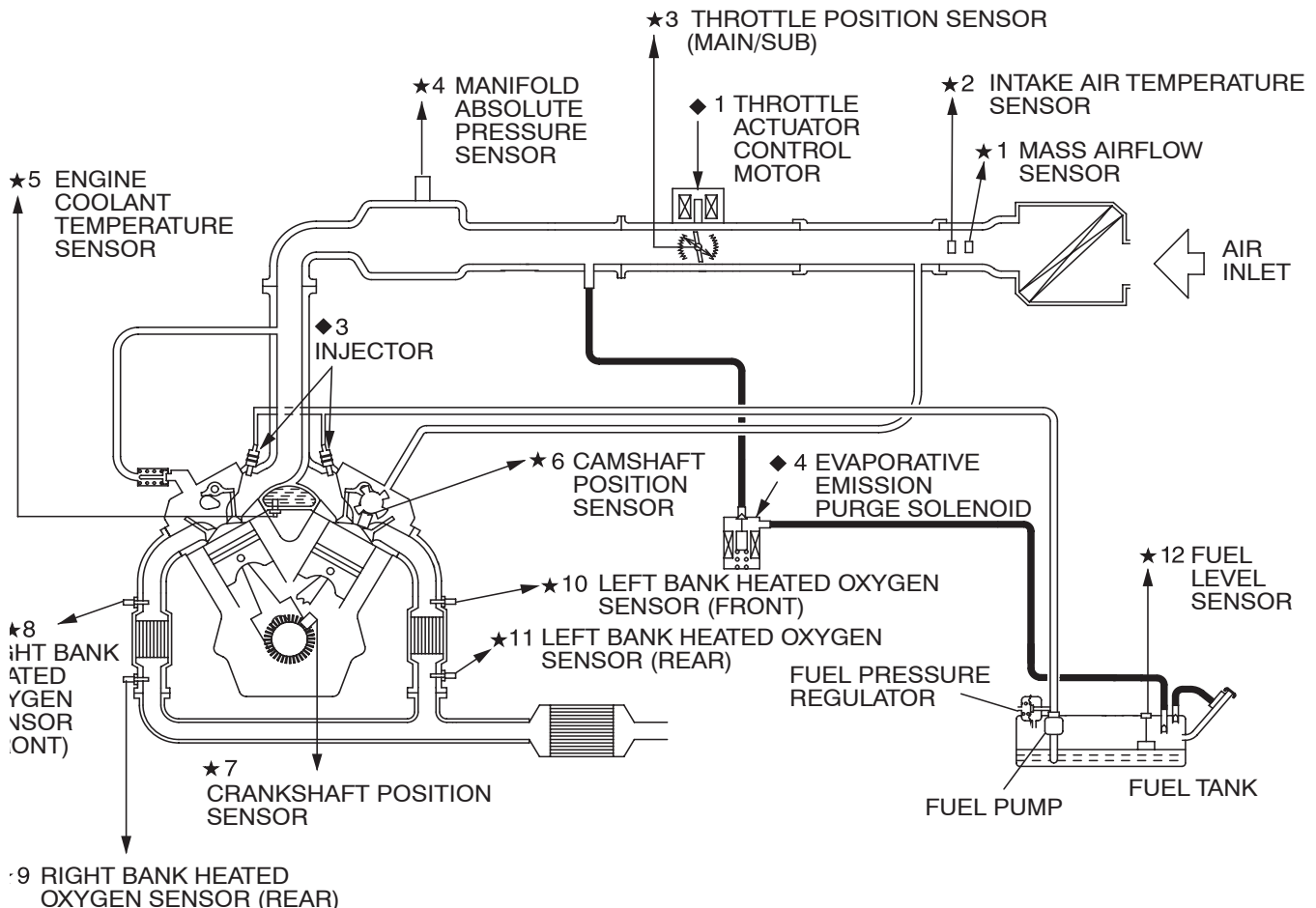
- ◆ ACCELERATOR PEDAL POSITION SENSOR (MAIN/SUB)
- ◆ KNOCK SENSOR
- ◆ POWER STEERING PRESSURE SWITCH
- ◆ OUTPUT SHAFT SPEED SENSOR
- ◆ TRANSMISSION RANGE SWITCH
- ◆ IGNITION SWITCH-IG
- ◆ IGNITION SWITCH-ST
- ◆ POWER SUPPLY

DECIDE

ENGINE-ECU

ACT

- ◆ 1 THROTTLE ACTUATOR CONTROL MOTOR
 - ◆ 2 INJECTOR
 - ◆ 3 EVAPORATIVE EMISSION PURGE SOLENOID
-
- IGNITION COIL, IGNITION POWER TRANSISTER
 - MULTIPOINT FUEL INJECTION (MPI) RELAY
 - FUEL PUMP RELAY
 - THROTTLE ACTUATOR CONTROL MOTOR RELAY
 - ALTERNATOR G TERMINAL
 - HEATED OXYGEN SENSOR HEATER
 - FAN CONTROL MODULE (RADIATOR, A/C CONDENSER)
 - A/C COMPRESSOR CLUTCH RELAY
 - DIAGNOSTIC OUTPUT



NOTE: For the vacuum routing, refer to GROUP 17, Emission Control System – Vacuum Hoses – Vacuum Hose Routing [P.17-77](#).

MULTIPOINT FUEL INJECTION (MPI) DIAGNOSIS

TROUBLESHOOTING STRATEGY

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 MPI 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 MPI 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 Malfunctions [P.00-14](#).
5. If you can verify the condition but there are no DTCs, or the system cannot communicate with the diagnostic 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 diagnostic tool.

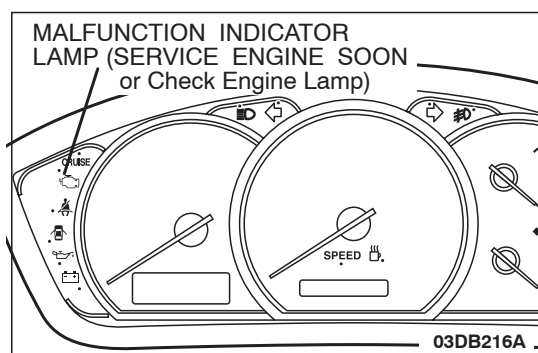
7. Reconfirm the malfunction symptom and carry out a test drive with the appropriate drive cycle pattern.
8. If DTC is set again, carry out an inspection with appropriate diagnostic trouble code procedures. Refer to Diagnostic Trouble Code Chart [P.13A-17](#)
9. If DTC is not set again, the malfunction 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 Malfunctions [P.00-14](#).
10. After repairs are completed, conduct a road test duplicating the complaint set conditions to confirm the malfunction has been corrected.

NOTE: If the ENGINE-ECU is replaced, Immobilizer Encrypted Code Registration should be carried out, Refer to GROUP 54A, Ignition Switch – On-vehicle Service – Immobilizer Encrypted Code Registration [P.54A-37](#).

M1131150001204

DIAGNOSTIC FUNCTION

M1131155500881



CHECK ENGINE WARNING LAMP

Among the on-board diagnostic items, Check Engine Warning Lamp illuminates to notify the driver of an emission control or major engine operating system malfunction.

However, when an irregular signal returns to normal and the Engine-ECU judges that it has returned to normal, the Check Engine Warning Lamp is switched off.

Immediately after the ignition switch is turned on, the Check Engine Warning Lamp is lit for 20 seconds to indicate that the Check Engine Warning Lamp operates normally.

HOW TO CONNECT THE DIAGNOSTIC TOOL (MUT-III)

Required Special Tools:

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

⚠ CAUTION

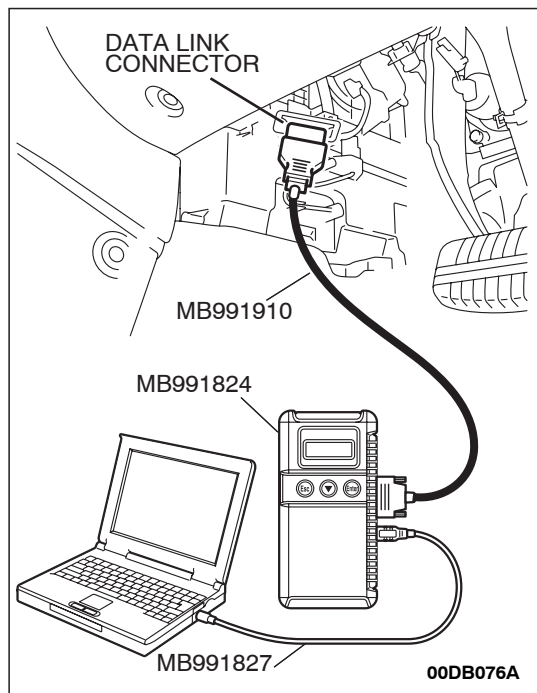
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

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 MB991910 to special tool MB991824.
5. Connect special tool MB991910 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 energised, special tool MB991824 indicator lamp will be illuminated in a green color.

7. Start the MUT-III system on the personal computer.
8. Select "System select."
9. Ensure Model & Class details are correctly entered. Refer to MUTT III Operators Manual if in doubt.

NOTE: Disconnecting the diagnostic tool 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.

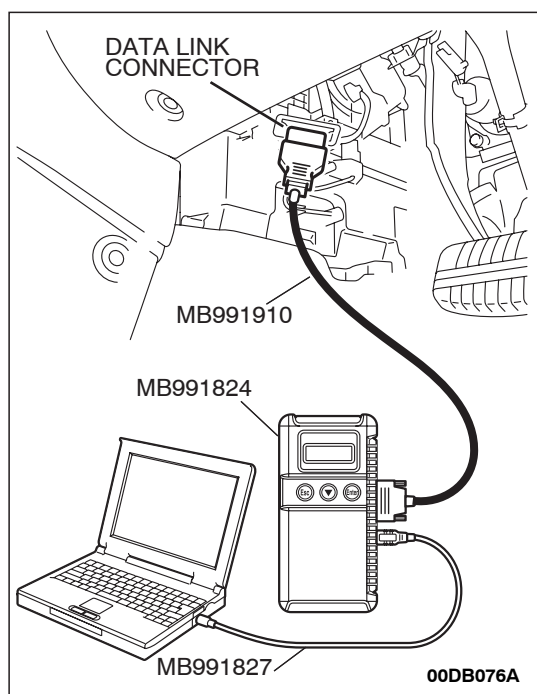
Required Special Tools:

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

⚠ CAUTION

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

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



1. Connect diagnostic tool to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "System select."
4. Ensure Model & Class details are correctly entered. Refer to MUTT III Operators Manual if in doubt.
5. Choose "MPI" from the System List.
6. Select "Self Diagnosis" tab.
7. If a DTC is set, it is shown.
8. Choose "Erase DTCs" to erase the DTC.

HOW TO READ DATA LIST

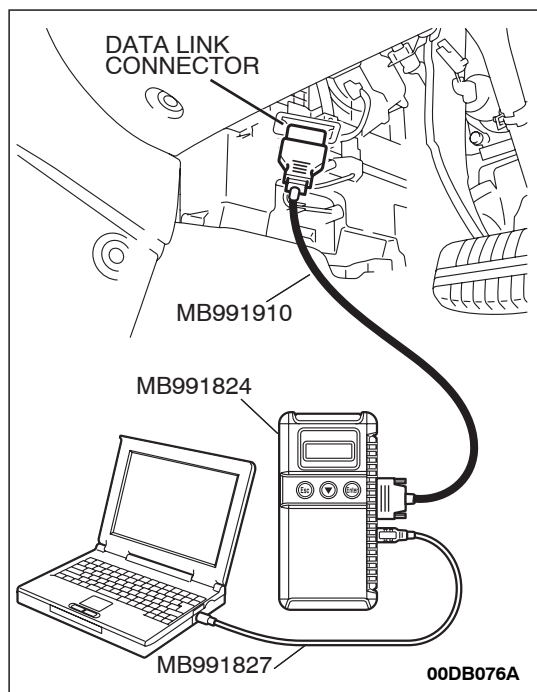
Required Special Tools:

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

⚠ CAUTION

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

1. Connect diagnostic tool to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "System select."
4. Choose "MPI" from the System List.
5. Select "Data List."
6. Choose an appropriate item and select the "OK" button(tick).



HOW TO PERFORM ACTUATOR TEST

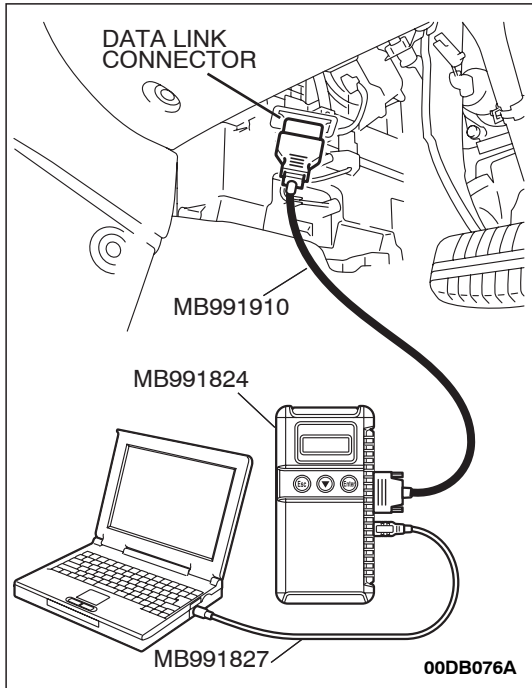
Required Special Tools:

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

CAUTION

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

1. Connect diagnostic tool to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "System select."
4. Choose "MPI" from the System List.
5. Select "Actuator Test."
6. Choose an appropriate item and select the "OK" button(tick).



HOW TO DIAGNOSE THE CAN BUS LINES

Required Special Tools:

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

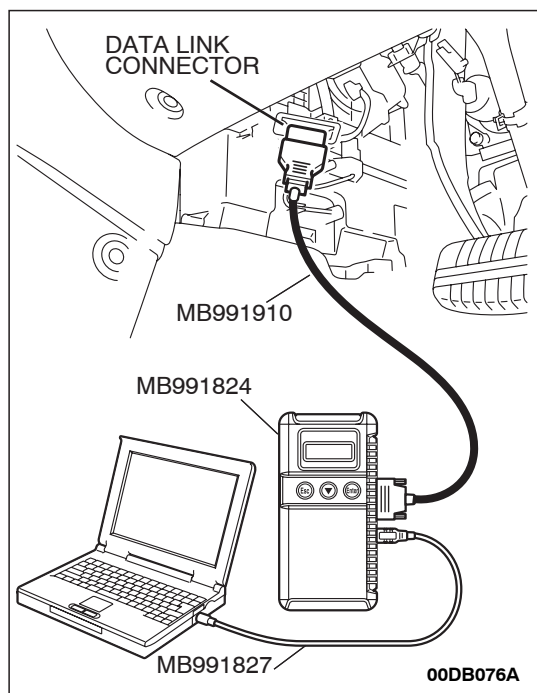
⚠ CAUTION

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

1. Connect diagnostic tool to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "CAN bus diagnosis" from the start-up screen.
4. Ensure Model & Class details are correctly entered. Refer to MUTT III Operators Manual if in doubt.

NOTE: If details are not correct for vehicle ensure "erase" button is used to delete incorrect details prior to entering the correct details.

5. Enter correct vehicle details.
6. Select the "OK" button.
7. When the optional equipment screen is displayed, choose the one which the vehicle is fitted with, and then select the "OK" button.
8. "CAN Bus Diagnosis" screen is displayed. Press the check button to commence diagnosis. the configuration screen will be displayed, showing any errors in "RED".



PROVISIONAL DTCs [MUT-III EOBD Test Mode - Results (Mode 7)]

The diagnostic tool (MUT-III sub assembly) will display the Provisional DTCs reported by ENGINE-ECU if the ENGINE-ECU 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 Check Engine Warning Lamp) will be illuminated and a DTC will set.

DIAGNOSTIC BY DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY - Where Applicable)

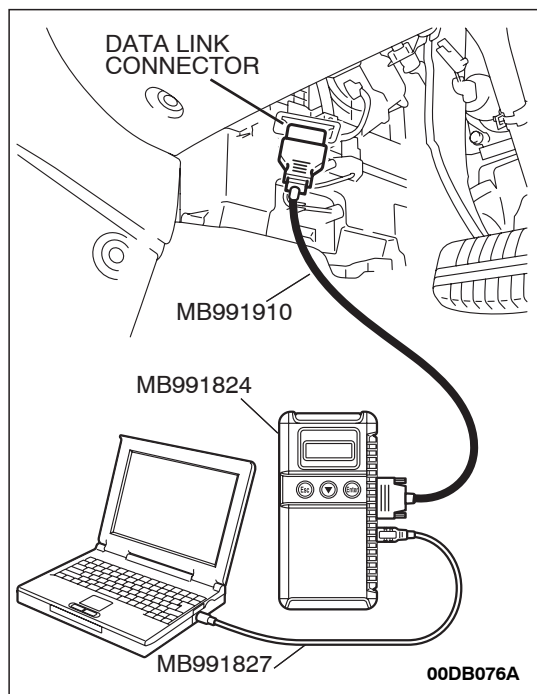
Required Special Tools:

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

⚠ CAUTION

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

NOTE: When mode II is selected with , the Check Engine Warning Lamp will light when the Engine-ECU 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 . The diagnostic trouble code, 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 diagnostic tool to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Change the diagnostic test mode of the Engine-ECU 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 diagnostic tool from the data link connector.

ON-BOARD DIAGNOSTICS

The Engine-ECU monitors the input/output signals (some signals all the time and others under specified conditions) of the ENGINE-ECU. When a malfunction continues for a specified time or longer after the irregular signal is initially monitored, the ENGINE-ECU judges that a malfunction has occurred. After the ENGINE-ECU 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. The diagnostic results can be read out with a diagnostic tool. The diagnostic results are memorized even if the ignition key is turned off or battery terminals are disconnected. In addition, the diagnostic trouble code can also be erased by turning the ignition switch to ON and sending the diagnostic trouble code erase signal from diagnostic tool to the ENGINE-ECU.

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 ENGINE-ECU in order to erase the diagnostic memory. The diagnostic items are all indicated sequentially from the smallest code number.

EOBD- DRIVE CYCLE

All kinds of diagnostic trouble codes (DTCs) can be monitored by carrying out a short drive according to the following three drive cycle patterns. In other words, doing such a drive regenerates any kind of trouble which involves illuminating the Check Engine Warning Lamp and verifies the repair procedure has eliminated the trouble [the Check Engine Warning Lamp is no longer illuminated].

CAUTION

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

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

DRIVE CYCLE PATTERN LIST

PROCEDURE	MONITOR ITEM		DIAGNOSTIC TROUBLE CODE (DTC)
1	Catalytic converter monitor		P0421, P0431
2	Heated oxygen sensor monitor		P0133, P0139, P0153, P0159
3	Other monitor	Main components	P0106, P0107, P0108, P0134, P0154, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0506, P0507
		Sensors and switches	P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0335, P0340, P0461
		Wire breakage and short circuit	P0130, P0131, P0132, P0135, P0136, P0137, P0138, P0140, P0150, P0151, P0152, P0155, P0156, P0157, P0158, P0160, P0161, P0201, P0202, P0203, P0204, P0205, P0206, P0443

PROCEDURE 1

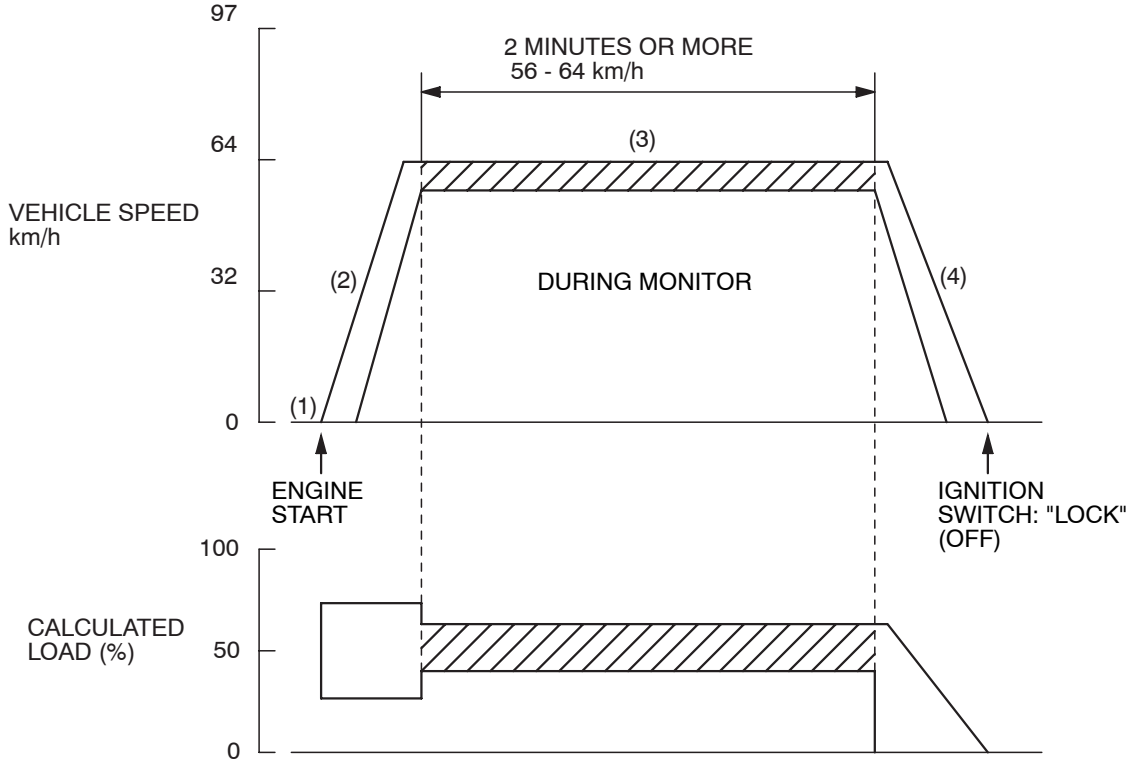
CATALYTIC CONVERTER MONITOR	
DTC	P0421, P0431
Drive cycle pattern	<p>This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 20 minutes. You must complete this drive twice.</p> <p><i>NOTE: Vehicle speed and throttle opening angle should be within the shaded range.</i></p>
Inspection conditions	<ul style="list-style-type: none"> • Atmospheric temperature: -10°C (14°F) or more • A/C switch: OFF • Condition of A/T: Selector lever D range

CATALYTIC CONVERTER MONITOR

Test
procedure

1. Engine: start
2. Accelerate until the vehicle speed is 72 km/h.
3. Travel for 5 minutes or more while keeping the vehicle speed at 72 – 97 km/h.
4. Decelerate until the vehicle speed is within 56 – 64 km/h.
5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 56 – 64 km/h and travel for 1.5 minutes 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. 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 P0421 is output, refer to DTC P0421 – Warm - Up Catalyst Efficiency Below Threshold (Bank 1) .
If DTC P0431 is output, refer to DTC P0431 – Warm - Up Catalyst Efficiency Below Threshold (Bank 2) .

PROCEDURE 2

HEATED OXYGEN SENSOR MONITOR	
DTC	P0133, P0139, P0153, P0159.
Drive cycle pattern	<p>This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 5 minutes or more. You must complete this drive twice.</p>  <p align="right">03DB262A</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: 80°C or more • Atmospheric temperature: -10°C or more
Test procedure	<ol style="list-style-type: none"> 1. Engine: start 2. Accelerate until the vehicle speed is 56 – 64 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 56 – 64 km/h and travel for 2 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output. 6. If a DTC is displayed, refer to Diagnostic Trouble Code Chart P.13A-17.

PROCEDURE 3

OTHER MONITOR (Main components, sensors and switches, wire breakage and short circuit)	
DTC	<ul style="list-style-type: none"> • Main components: P0106, P0107, P0108, P0134, P0154, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0506, P0507 • Sensors and switches: P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0335, P0340, P0461. • Wire breakage and short circuit: P0130, P0131, P0132, P0135, P0136, P0137, P0138, P0140, P0150, P0151, P0152, P0155, P0156, P0157, P0158, P0160, P0161, P0201, P0202, P0203, P0204, P0205, P0206, P0443.
Drive cycle pattern	<p>This monitor [from start to ignition switch "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="321 804 1520 1524"> <p>VEHICLE SPEED km/h</p> <p>64 32 0</p> <p>(1) (2) (3) (4)</p> <p>5 MINUTES OR MORE 56 - 64 km/h</p> <p>ENGINE: IDLING TRANSMISSION: NEUTRAL 5 MINUTES</p> <p>ENGINE START</p> <p>IGNITION SWITCH: "LOCK" (OFF)</p> <p>CALCULATED LOAD (%)</p> <p>100 50 0</p> </div> <p align="right">03DB263A</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: 80°C • Atmospheric temperature: -10°C or more
Test procedure	<ol style="list-style-type: none"> 1. Engine: start 2. Accelerate until the vehicle speed is 56 - 64 km/h and travel for 5 minutes or more. 3. Return the vehicle to shop. 4. After stopping the vehicle, continue idling for 5 minutes, then turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output. 6. If a DTC is displayed, refer to Diagnostic Trouble Code Chart P.13A-17.

SYSTEM READINESS TEST STATUS

PURPOSE

The ENGINE-ECU monitors the following main diagnosis items, judges if these items are in good condition or not, and then stores its history. The history can be read out by using MUT III. (if the ECU has judged an item before, the MUT III displays "Complete").

In addition, if diagnosis codes are erased or the battery cable is disconnected, this history will also be erased (the memory will be reset)

- Catalyst: P0421, P0431
- Heated oxygen sensor: P0130, P0131, P0132, P0133, P0134, P0136, P0137, P0138, P0139, P0150, P0151, P0152, P0153, P0154, P0156, P0157, P0158, P0159
- Heated oxygen sensor heater: P0031, P0032, P0037, P0038, P0051, P0052, P0057, P0058.

NOTE: After a repair is made for a DTC, the technician should drive the EOBD Drive Cycle checking that the diagnostic tool (MUT-III Sub Assembly) displays all the Readiness Codes as "Complete".

DIAGNOSTIC TROUBLE CODE CHART

M1131151001490

CAUTION

During diagnosis, a DTC code associated with other systems may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for DTC(s). If DTC(s) are set, erase them all.

NOTE: If the Check Engine Warning Lamp illuminates because of a malfunction of the Engine-ECU, DTC - P0606 will be initialised. In this case, the ENGINE - ECU is the most probable cause. Refer to DTC-P0606 in table for diagnosis.

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0031	Heated oxygen sensor heater circuit low (bank 1 sensor 1)	P.13A-24
P0032	Heated oxygen sensor heater circuit high (bank 1 sensor 1)	P.13A-34
P0037	Heated oxygen sensor heater circuit low (bank 1 sensor 2)	P.13A-37
P0038	Heated oxygen sensor heater circuit high (bank 1 sensor 2)	P.13A-47
P0051	Heated oxygen sensor heater circuit low (bank 2 sensor 1)	P.13A-50
P0052	Heated oxygen sensor heater circuit high (bank 2 sensor 1)	P.13A-60
P0057	Heated oxygen sensor heater circuit low (bank 2 sensor 2)	P.13A-63
P0058	Heated oxygen sensor heater circuit high (bank 2 sensor 2)	P.13A-73
P0074	Ambient air temperature intermittent	P.13A-76
P0101*	Mass airflow circuit range/performance problem	P.13A-78
P0102*	Mass airflow circuit low input	P.13A-81
P0103*	Mass airflow circuit high input	P.13A-87
P0106	Manifold absolute pressure circuit range/performance problem	P.13A-92
P0107	Manifold absolute pressure circuit low input	P.13A-101
P0108	Manifold absolute pressure circuit high input	P.13A-109
P0112	Intake air temperature circuit low input	P.13A-116
P0113	Intake air temperature circuit high input	P.13A-120
P0116	Engine coolant temperature circuit range/performance problem	P.13A-127
P0117	Engine coolant temperature circuit low input	P.13A-134
P0118	Engine coolant temperature circuit high input	P.13A-139
P0122*	Throttle position sensor (main) circuit low input	P.13A-148
P0123*	Throttle position sensor (main) circuit high input	P.13A-155
P0130	Heated oxygen sensor circuit (bank 1 sensor 1)	P.13A-160
P0131	Heated oxygen sensor circuit low voltage (bank 1 sensor 1)	P.13A-166
P0132	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)	P.13A-172
P0133	Heated oxygen sensor circuit slow response (bank 1 sensor 1)	P.13A-177
P0134	Heated oxygen sensor circuit no activity detected (bank 1 sensor 1)	P.13A-179
P0136	Heated oxygen sensor circuit (bank 1 sensor 2)	P.13A-186
P0137	Heated oxygen sensor circuit low voltage (bank 1 sensor 2)	P.13A-192
P0138	Heated oxygen sensor circuit high voltage (bank 1 sensor 2)	P.13A-198

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0139	Heated oxygen sensor circuit slow response (bank 1 sensor 2)	P.13A-203
P0140	Heated oxygen sensor circuit no activity detected (bank 1 sensor 2)	P.13A-205
P0150	Heated oxygen sensor circuit (bank 2 sensor 1)	P.13A-212
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)	P.13A-218
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)	P.13A-224
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)	P.13A-229
P0154	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)	P.13A-231
P0156	Heated oxygen sensor circuit (bank 2 sensor 2)	P.13A-238
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)	P.13A-244
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)	P.13A-250
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)	P.13A-255
P0160	Heated oxygen sensor circuit no activity detected (bank 2 sensor 2)	P.13A-257
P0171	System too lean (bank 1)	P.13A-264
P0172	System too rich (bank 1)	P.13A-266
P0174	System too lean (bank 2)	P.13A-268
P0175	System too rich (bank 2)	P.13A-270
P0201	Injector circuit-cylinder 1	P.13A-272
P0202	Injector circuit-cylinder 2	P.13A-280
P0203	Injector circuit-cylinder 3	P.13A-287
P0204	Injector circuit-cylinder 4	P.13A-295
P0205	Injector circuit-cylinder 5	P.13A-302
P0206	Injector circuit-cylinder 6	P.13A-310
P0219	Engine overspeed condition	P.13A-317
P0222*	Throttle position sensor (sub) circuit low input	P.13A-318
P0223*	Throttle position sensor (sub) circuit high input	P.13A-324
P0300	Random/multiple cylinder misfire detected	P.13A-330
P0301	Cylinder 1 misfire detected	P.13A-334
P0302	Cylinder 2 misfire detected	P.13A-336
P0303	Cylinder 3 misfire detected	P.13A-338
P0304	Cylinder 4 misfire detected	P.13A-340
P0305	Cylinder 5 misfire detected	P.13A-342
P0306	Cylinder 6 misfire detected	P.13A-344
P0325	Knock sensor circuit	P.13A-346
P0335*	Crankshaft position sensor circuit	P.13A-354
P0340	Camshaft position sensor circuit	P.13A-372
P0421	Warm up catalyst efficiency below threshold (bank 1)	P.13A-383

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0431	Warm up catalyst efficiency below threshold (bank 2)	P.13A-385
P0441	Evaporative emission control system incorrect purge flow	P.13A-387
P0443	Evaporative emission control system purge control valve circuit	P.13A-389
P0461	Fuel level sensor (main) circuit range/performance	P.13A-397
P0500*	Vehicle speed signal	P.13A-399
P0506	Idle control system RPM lower than expected	P.13A-419
P0507	Idle control system RPM higher than expected	P.13A-421
P0513	Immobilizer malfunction	P.13A-423
P0562	Battery voltage too low	P.13A-424
P0563	Battery voltage too high	P.13A-425
P0603*	EEPROM malfunction	P.13A-426
P0606*	Powertrain control module main processor malfunction	P.13A-427
P0630	VIN malfunction	P.13A-428
P0638*	Throttle actuator control motor circuit range/ performance problem	P.13A-430
P0830	Clutch switch - (Refer to Group 17-Auto Cruise Control)	P.17-15
P1564	Auto cruise switch - (Refer to Group 17-Auto Cruise Control)	P.17-19
P1571	Stop lamp switch - (Refer to Group 17-Auto Cruise Control)	P.17-34
P1603	Battery backup line malfunction	P.13A-437
P2096	Post catalyst system too lean 1	P.13A-443
P2097	Post catalyst system too lean 2	P.13A-446
P2098	Post catalyst system too rich 1	P.13A-449
P2099	Post catalyst system too rich 2	P.13A-452
P2100*	Throttle actuator control motor circuit (open)	P.13A-455
P2101*	Throttle actuator control motor magneto malfunction	P.13A-461
P2102*	ETV motor circuit (shorted low)	P.13A-466
P2103*	ETV motor circuit (shorted high)	P.13A-471
P2122*	Accelerator pedal position sensor (main) circuit low input	P.13A-476
P2123*	Accelerator pedal position sensor (main) circuit high input	P.13A-485
P2127*	Accelerator pedal position sensor (sub) circuit low input	P.13A-493
P2128*	Accelerator pedal position sensor (sub) circuit high input	P.13A-502
P2135*	Throttle position sensor (main and sub) range/performance problem	P.13A-510
P2138*	Accelerator pedal position sensor (main and sub) range/performance problem	P.13A-515
U1100	Engine CAN time-out/ not equipped - (Refer to Group 54A)	P.54A-51
U1102	ABS-ECU time-out - (Refer to Group 54A)	P.54A-55
U1120	Engine CAN message - (Refer to Group 54A)	P.54A-64
U1121	T/M CAN message	P.13A-537

NOTE:

- Check that the ENGINE-ECU ground circuit is normal before checking for the cause of the problem.
- After the ENGINE-ECU 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.
- After the Check Engine Warning Lamp illuminates, it will be switched off under the following conditions.
 - When the ENGINE-ECU monitored the engine malfunction four times* and met set condition requirements, it detected no malfunction.
 - *: In this case, "one time" indicates from engine start to stop.
 - 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.
- 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.
- Bank 1 indicates the right bank side cylinder, and Bank 2 indicates the left bank side cylinder.

SYMPTOM CHART

M1131151500726

CAUTION

During diagnosis, a DTC associated with other system may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for DTC(s). If DTC(s) are set, erase them all.

CAUTION

Disconnecting the battery cables or removing the combination meter will erase the learned value of the fuel gauge. To recover the learned value, input a vehicle speed (by actually driving the vehicle or inputting a simulated vehicle speed), and stop the vehicle. This will complete the learning process.

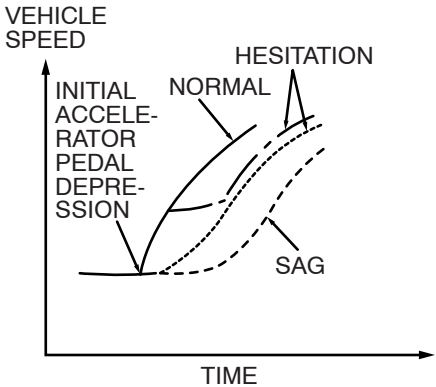
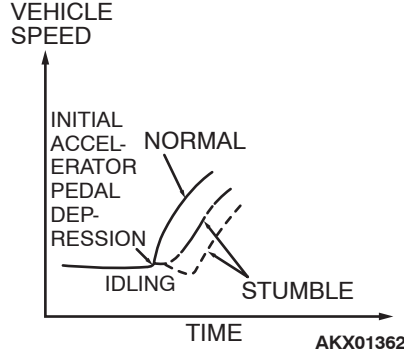
NOTE: Check that the ENGINE-ECU ground circuit is normal before checking for the cause of the problem.

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Communication with diagnostic tool is impossible	Communication with all systems is not possible	1	P.13A-539
	Communication with ENGINE-ECU only is not possible	2	P.13A-541
Check Engine Warning Lamp) and related parts	The Check Engine Lamp) does not illuminate right after the ignition switch is turned to the "ON" position	3	P.13A-543
	The Check Engine Warning Lamp) remains illuminated and never goes out	4	P.13A-544
Starting	Cranks, won't start	5	P.13A-546
	Starts up and dies	6	P.13A-553
	Hard starting	7	P.13A-560
Idling stability (improper idling)	Unstable idle (rough idle, hunting)	8	P.13A-566
	Idle speed is high (improper idle speed)	9	P.13A-571
	Idle speed is low (improper idle speed)	10	P.13A-573
Idling stability (engine stalls)	When the engine is cold, it stalls at idle (die out)	11	P.13A-574
	When the engine is hot, it stalls at idle (die out)	12	P.13A-577
	The engine stalls when accelerating (pass out)	13	P.13A-581
	The engine stalls when decelerating	14	P.13A-583
Driving	Hesitation, sag or stumble	15	P.13A-585
	Acceleration shock	16	P.13A-588
	Deceleration shock	17	P.13A-589
	Poor acceleration	18	P.13A-590
	Surge	19	P.13A-594
	Knocking	20	P.13A-598
Dieseling (Run-on)		21	P.13A-599
Too high CO and HC concentration when idling		22	P.13A-600
IM240 test failure	Purge flow test of the evaporative emission canister failure	23	P.13A-602
Power supply system and ignition switch-IG system		24	P.13A-604

TROUBLE SYMPTOMS	INSPECTION PROCEDURE	REFERENCE PAGE
Fuel pump system	25	P.13A-613
Ignition switch-ST system and transmission range switch system	26	P.13A-624
Ignition circuit system	27	P.13A-628
A/C system	28	P.13A-634

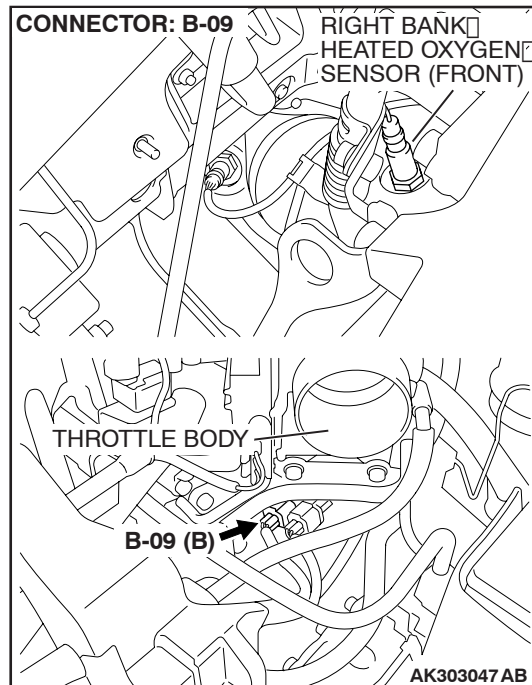
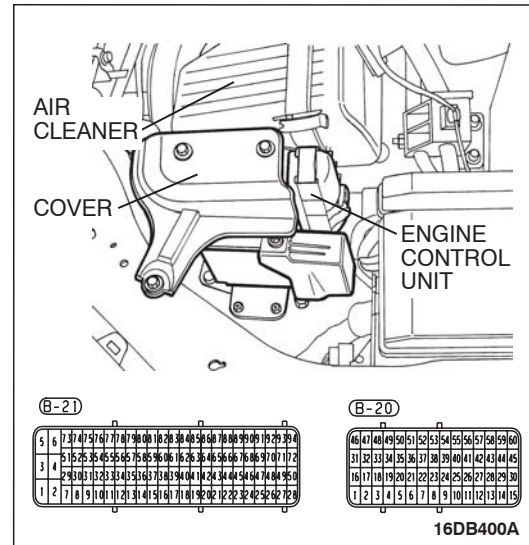
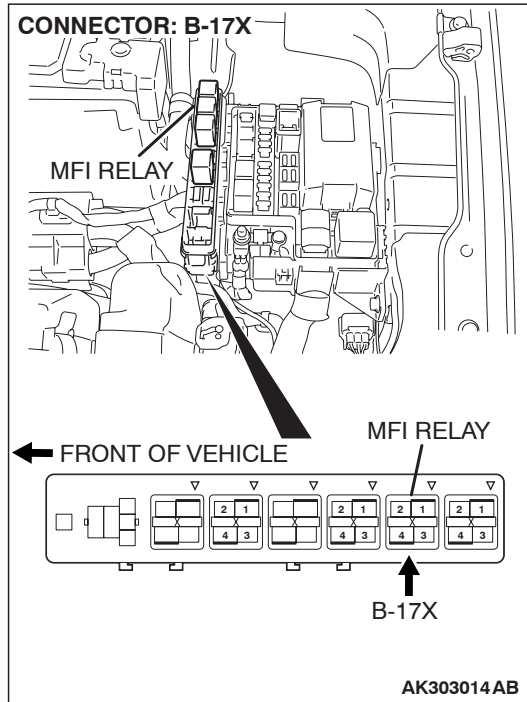
PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

ITEMS		SYMPTOM
At starting	Won't start	The starter cranks 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 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	Run on ("Dieseling")	<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 P0031: Heated Oxygen Sensor Heater Circuit low (bank 1, sensor 1).



CIRCUIT OPERATION

- Power is supplied from the MPI relay (terminal No. 4) to the right bank heated oxygen sensor (front) heater.
- The ENGINE-ECU (terminal No. 47) controls continuity to the right bank heated oxygen sensor (front) heater by turning the power transistor in the ENGINE-ECU "ON" and "OFF".

TECHNICAL DESCRIPTION

- The ENGINE-ECU checks whether the heater current is within a specified range when the heater is energized.
- The ENGINE-ECU checks whether the heater current is within a specified range when the heater is not energized.

DTC SET CONDITIONS

Check Conditions

- Battery voltage is between 10.7 - 16.1 volts.
- Engine starting sequence is completed.
- Engine speed is above 20 r/min.
- Oxygen sensor heater is active.

Judgment Criteria

- The heater voltage is less than 2.4 V during the calibrated time interval.
or
- The heater voltage is not within 2.4 - 3.6 Volts during the calibrated time interval.
- MIL is activated after 2 Driving Cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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

- Open or shorted right bank heated oxygen sensor (front) heater circuit, harness damage, or connector damage.
- Open circuit in right bank heated oxygen sensor (front) heater.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS

Required Special Tools:

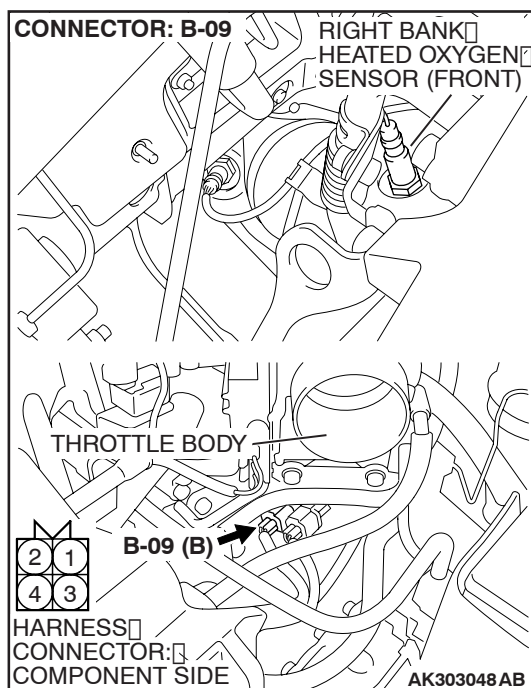
- Diagnostic tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ENGINE-ECU Check Harness

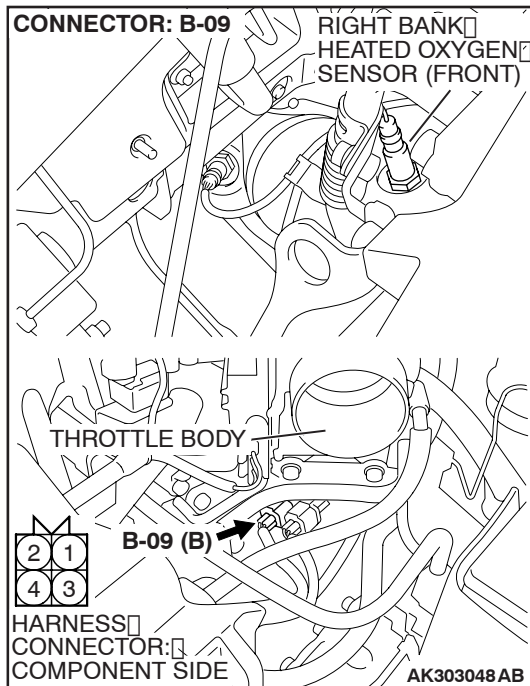
STEP 1. Check harness connector B-09 at the right bank heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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





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

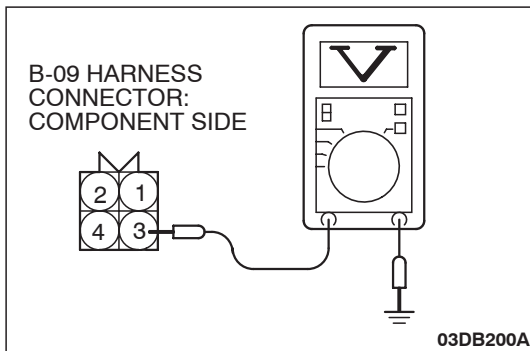
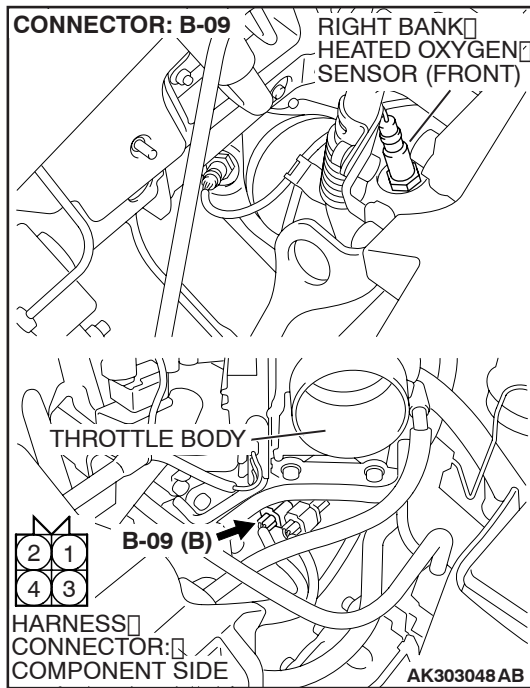
- (1) Disconnect right bank heated oxygen sensor (front) connector B-09.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

Standard value: 9.0 – 11.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 9.0 and 11.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the right bank heated oxygen sensor (front).
Then go to Step 11.



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

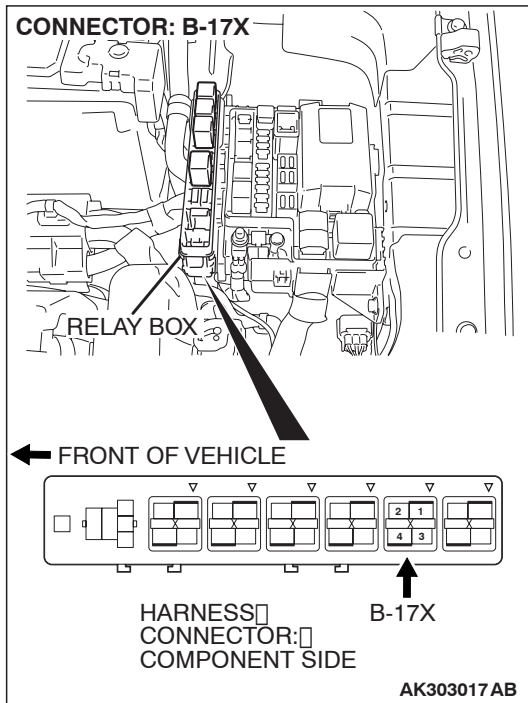
- (1) Disconnect the connector B-09 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 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.

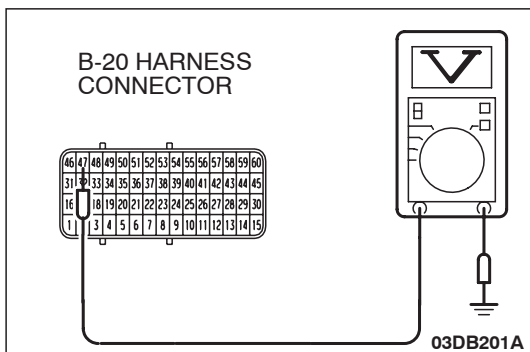
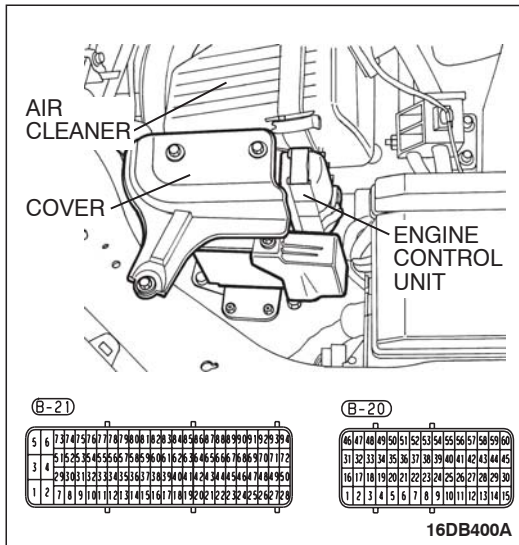


STEP 4. Check harness connector B-17X at the MPI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MPI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (front) connector B-09 (terminal No. 3) 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.



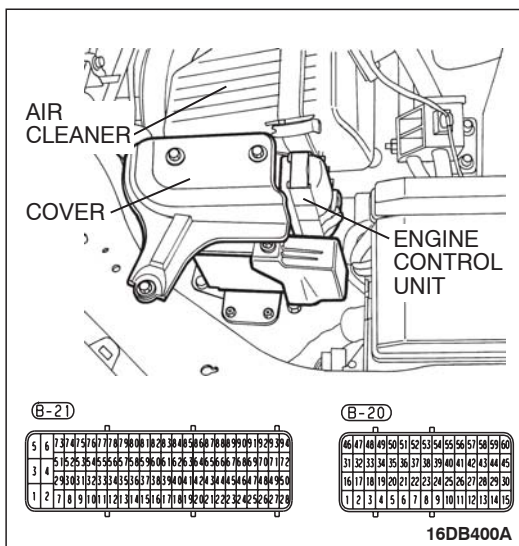
STEP 5. Measure the power supply voltage at ENGINE-ECU connector B-20 by using ENGINE-ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ENGINE-ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 47 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

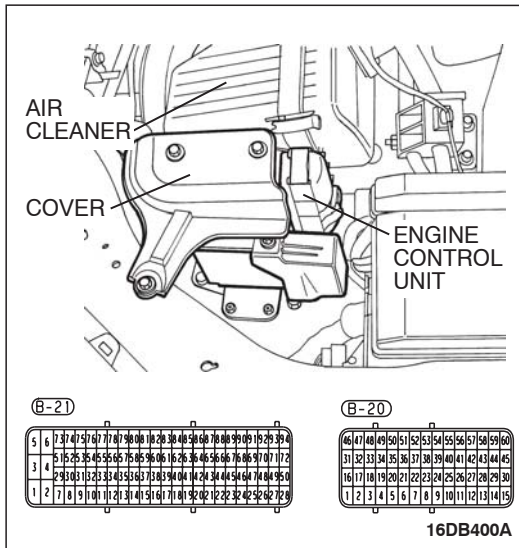
- YES :** Go to Step 8.
NO : Go to Step 6.



STEP 6. Check harness connector B-20 at ENGINE-ECU 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 8. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

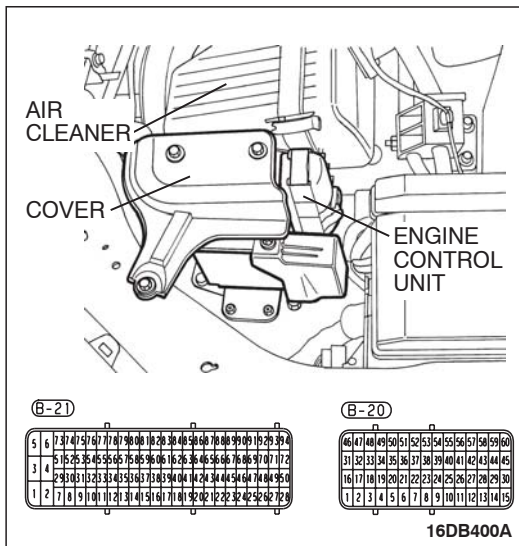
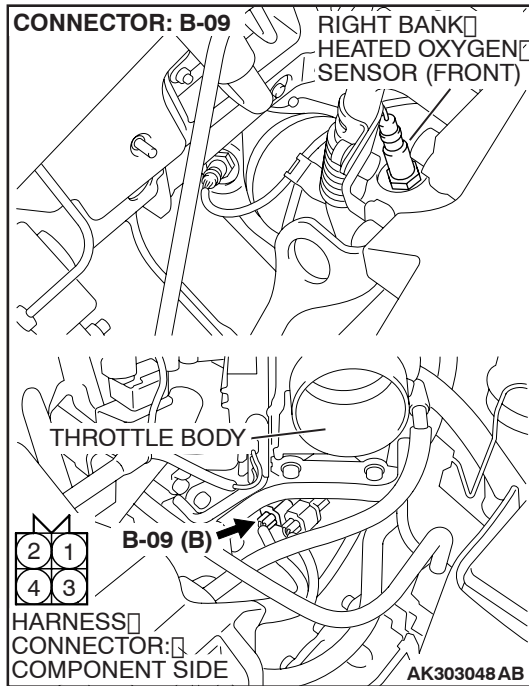
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

STEP 10. Check for harness damage between right bank heated oxygen sensor (front) connector B-09 (terminal No. 4) and ENGINE-ECU connector B-20 (terminal No. 47).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 11.



STEP 11. Test the EOBd drive cycle.

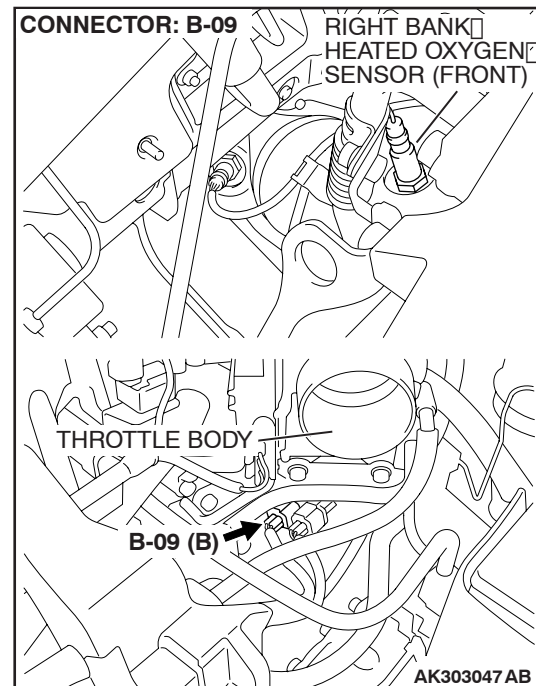
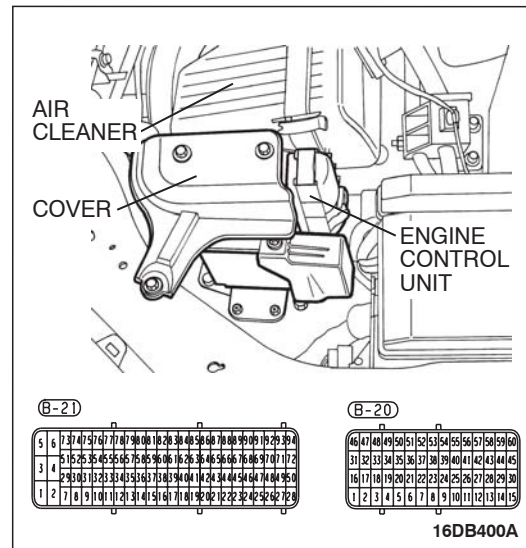
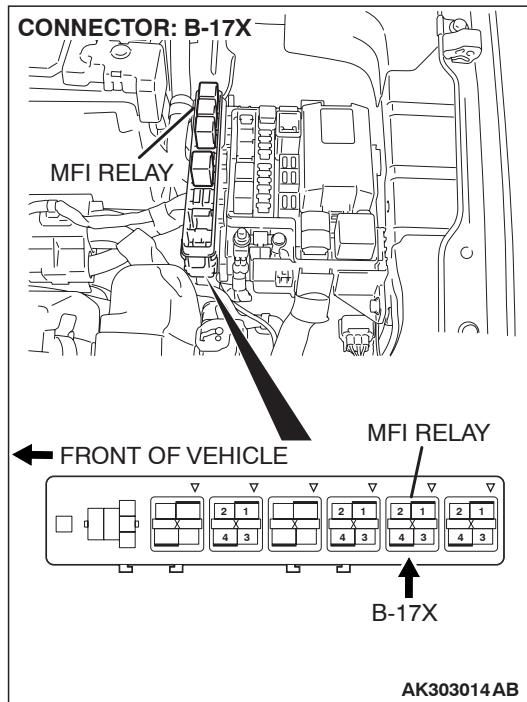
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBd Drive Cycle – [P.13A-11](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0031 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0032: Heated Oxygen Sensor Heater Circuit high (bank 1, sensor 1).



CIRCUIT OPERATION

- Power is supplied from the MPI relay (terminal No. 4) to the right bank heated oxygen sensor (front) heater.
- The ENGINE-ECU (terminal No. 47) controls continuity to the right bank heated oxygen sensor (front) heater by turning the power transistor in the ENGINE-ECU "ON" and "OFF".

DTC SET CONDITIONS

Check Conditions

- Battery voltage is within 10.7 to 16.1 volts.
- Engine speed is above 20 r/min.
- Engine starting sequence is completed.

TECHNICAL DESCRIPTION

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

Judgment Criteria

- Oxygen sensor heater is active.
- Heater voltage is above 3.6 Volts during the calibrated time interval.

- MIL is activated after 2 Driving Cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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

- Right bank heated oxygen sensor (front) failed.
- Short circuit to 12 Volt.
- Connector damaged.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS

Required Special Tools:

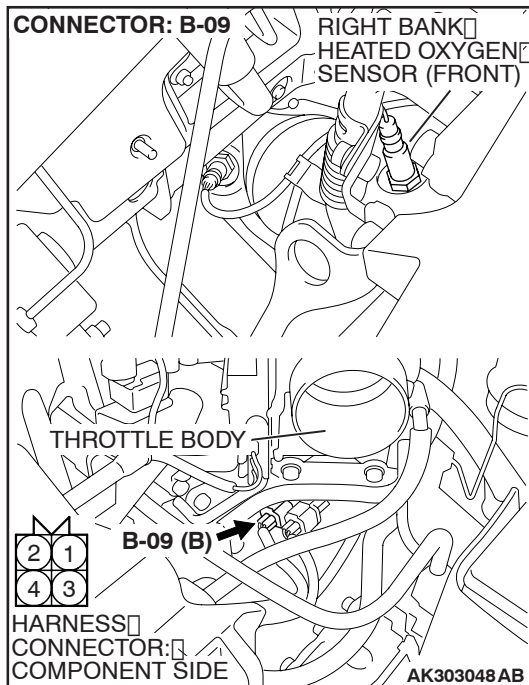
- Diagnostic tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ENGINE-ECU Check Harness

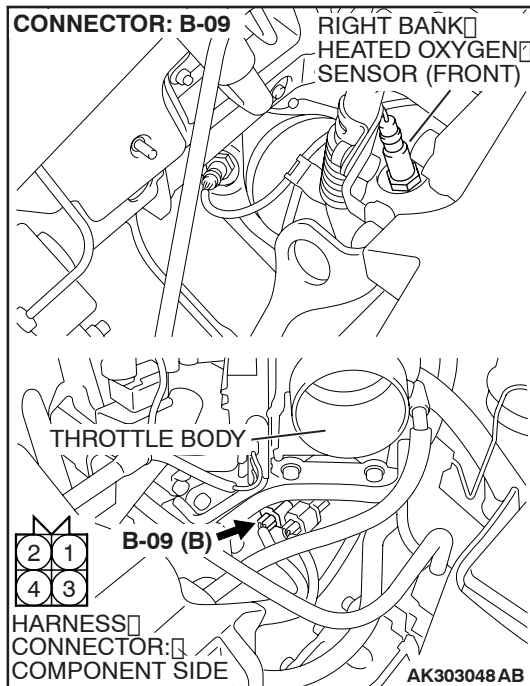
STEP 1. Check harness connector B-09 at the right bank heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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





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

- (1) Disconnect right bank heated oxygen sensor (front) connector B-09.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

Standard value: 9.0 – 11.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 9.0 and 11.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

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

STEP 3. Check the trouble symptoms.

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

Q: Is DTC P0032 set?

YES : Then go to Step 4.

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

STEP 4. Test the EOBD drive cycle.

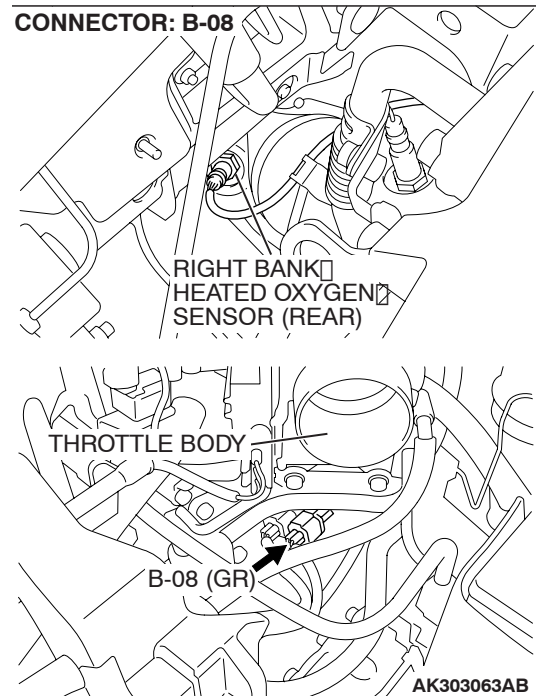
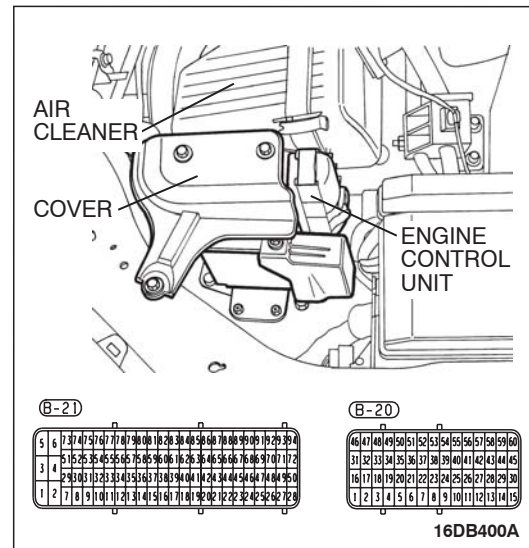
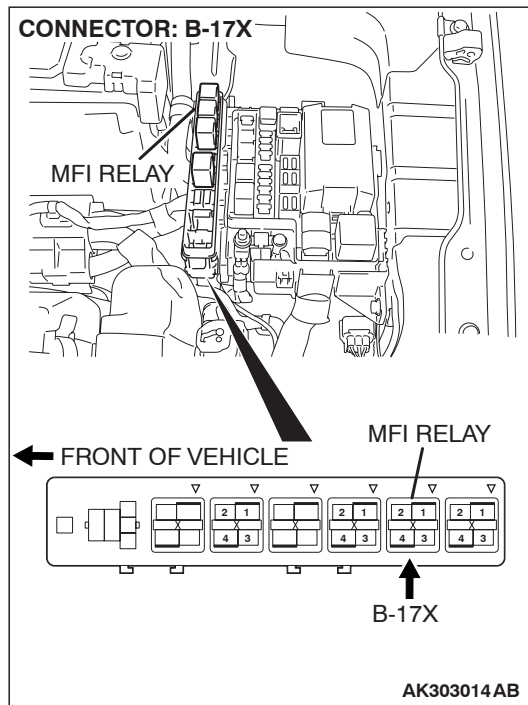
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0032 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0037: Heated Oxygen Sensor Heater Circuit low (bank 1, sensor 2).



CIRCUIT OPERATION

- Power is supplied from the MPI relay (terminal No. 4) to the right bank heated oxygen sensor (rear) heater.
- The ENGINE-ECU (terminal No. 32) controls continuity to the right bank heated oxygen sensor (rear) heater by turning the power transistor in the ENGINE-ECU "ON" and "OFF".

DTC SET CONDITIONS

Check Conditions

- Battery voltage is between 9.04 - 16.1 volts.
- Engine speed is above 801 r/min.
- Engine starting sequence is completed.

TECHNICAL DESCRIPTION

- The ENGINE-ECU checks whether the heater current is within a specified range when the heater is energized.
- The ENGINE-ECU checks whether the heater current is within a specified range when the heater is not energized.

- Oxygen sensor heater is active.

Judgment Criteria

- IC internal test (open circuit, short earth)

- The heater voltage is less than 2.4 V during the calibrated time interval.
or
- The heater voltage is not within 2.4 - 3.6 Volts during the calibrated time interval.
- MIL is activated after 2 Driving Cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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

- Open or shorted right bank heated oxygen sensor (rear) heater circuit, harness damage, or connector damage.
- Right bank heated oxygen sensor (rear) heater failed.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS

Required Special Tools:

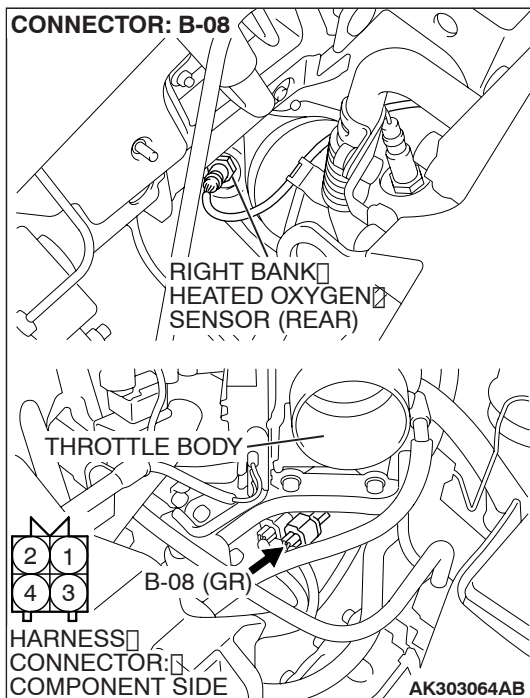
- Diagnostic tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ENGINE-ECU Check Harness

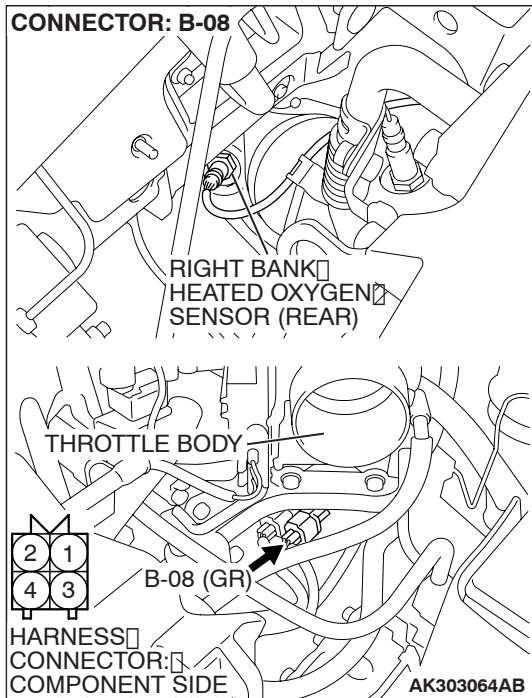
STEP 1. Check harness connector B-08 at the right bank heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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





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

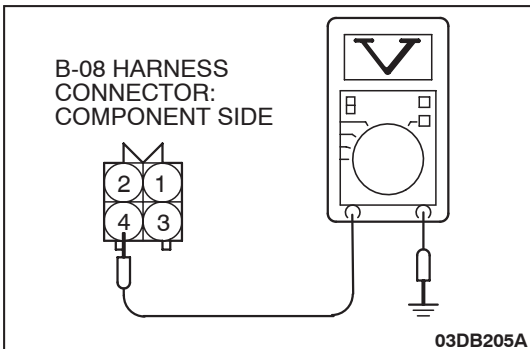
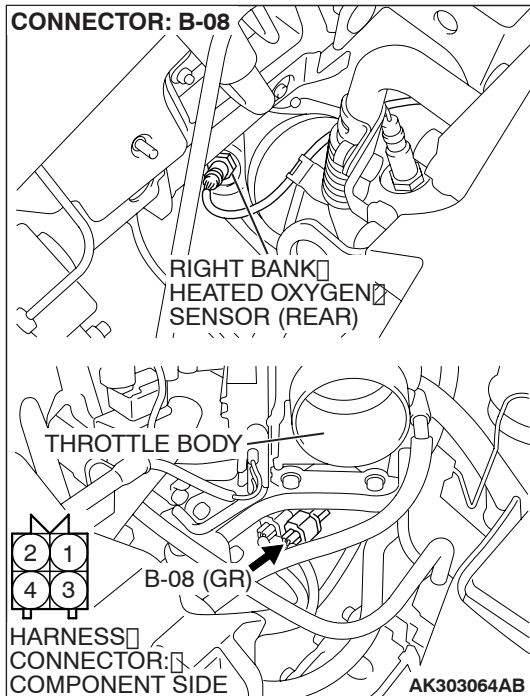
- (1) Disconnect right bank heated oxygen sensor (rear) connector B-08.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

Standard value: 9.0 – 11.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 9.0 and 11.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the right bank heated oxygen sensor (rear).
Then go to Step 11.



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

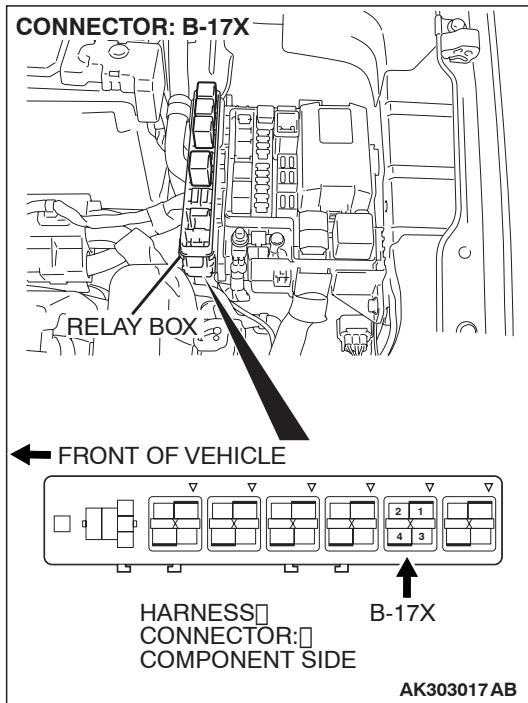
- (1) Disconnect the connector B-08 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

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

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

YES : Go to Step 5.

NO : Go to Step 4.

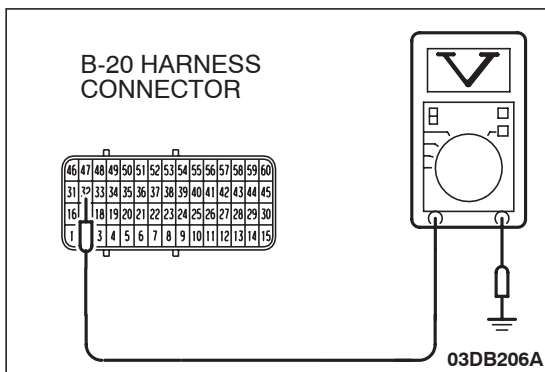
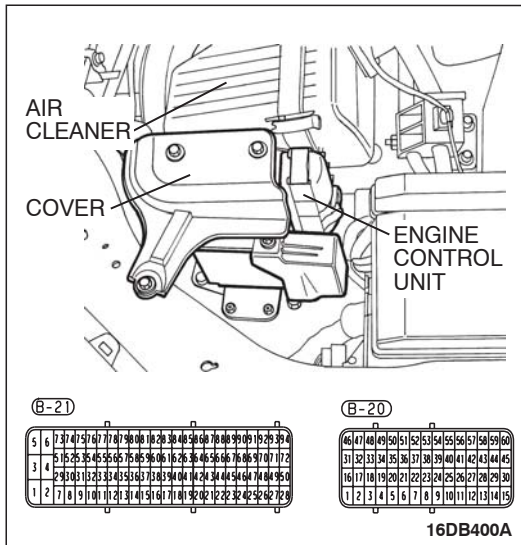


STEP 4. Check harness connector B-17X at the MPI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MPI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (rear) connector B-08 (terminal No. 4) 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 11.



STEP 5. Measure the power supply voltage at ENGINE-ECU connector B-20 by using ENGINE-ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ENGINE-ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 32 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

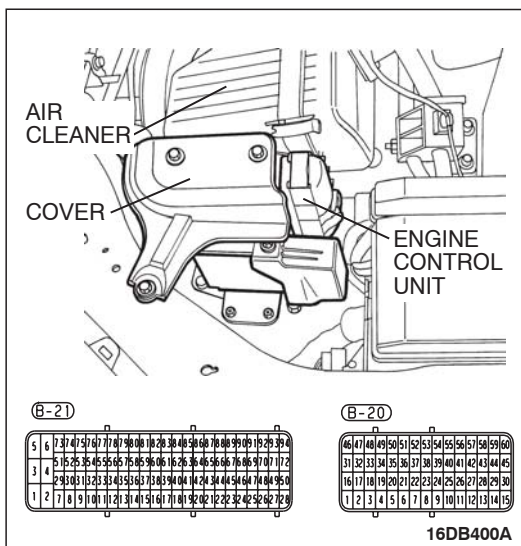
NO : Go to Step 6.

STEP 6. Check harness connector B-20 at ENGINE-ECU 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.

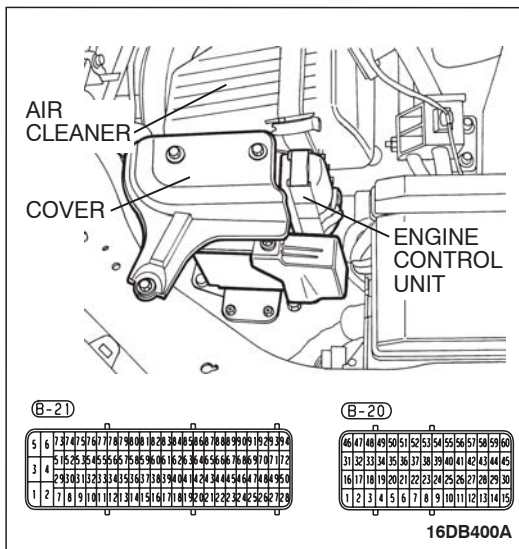
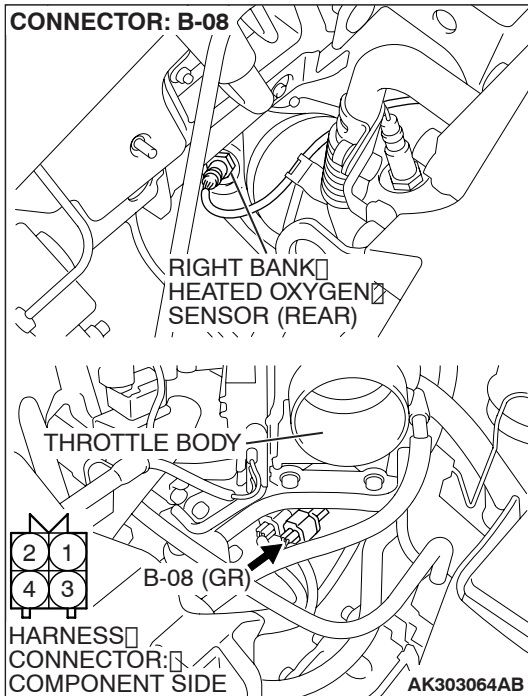


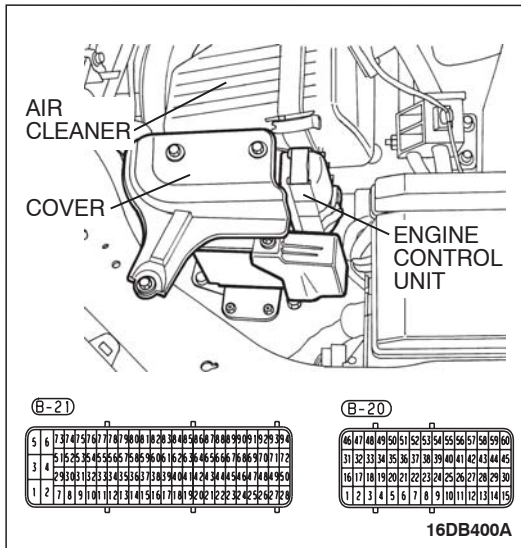
STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 3) and ENGINE-ECU connector B-20 (terminal No. 32).

Q: Is the harness wire in good condition?

YES : Then go to Step 8.

NO : Repair it. Then go to Step 11.





STEP 8. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

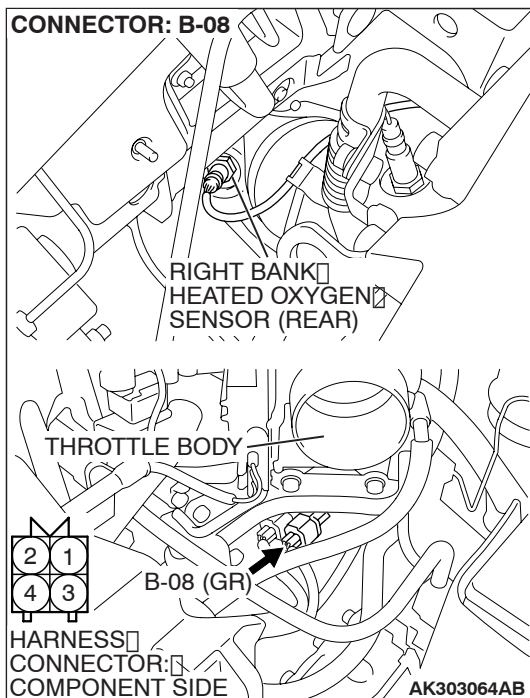
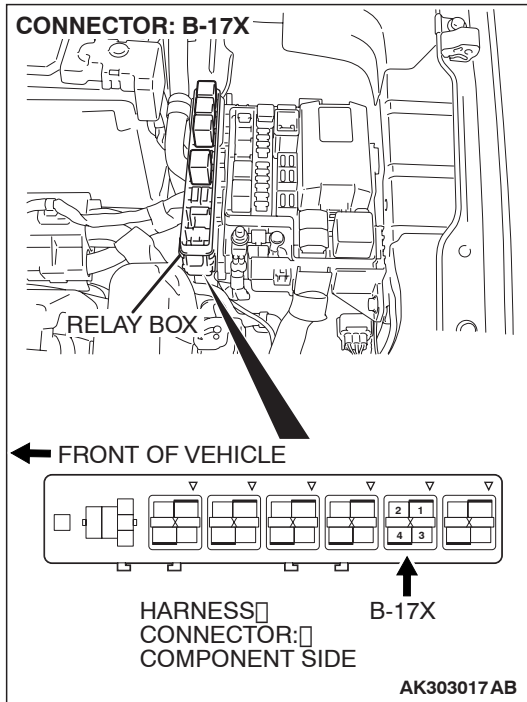
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

STEP 9. Check for harness damage between MPI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (rear) connector B-08 (terminal No. 4).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 11.

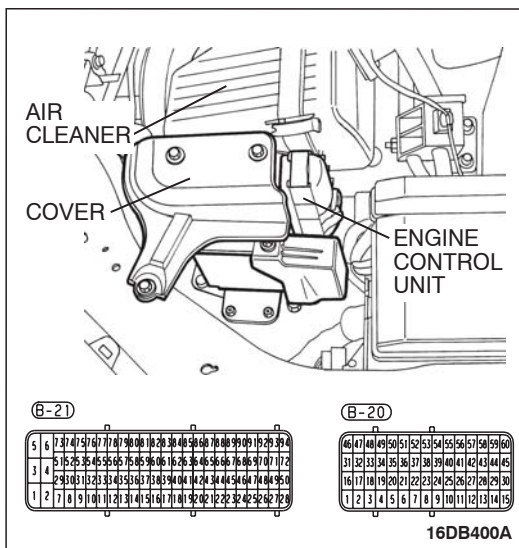
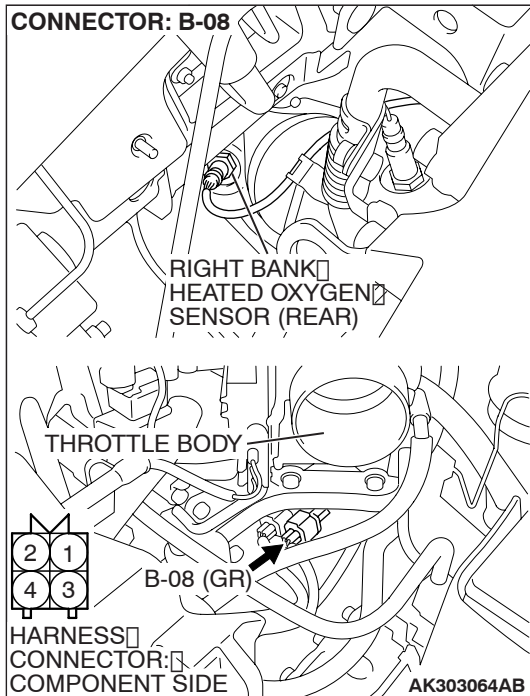


STEP 10. Check for harness damage between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 3) and ENGINE-ECU connector B-20 (terminal No. 32).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 11.



STEP 11. Test the EOBD drive cycle.

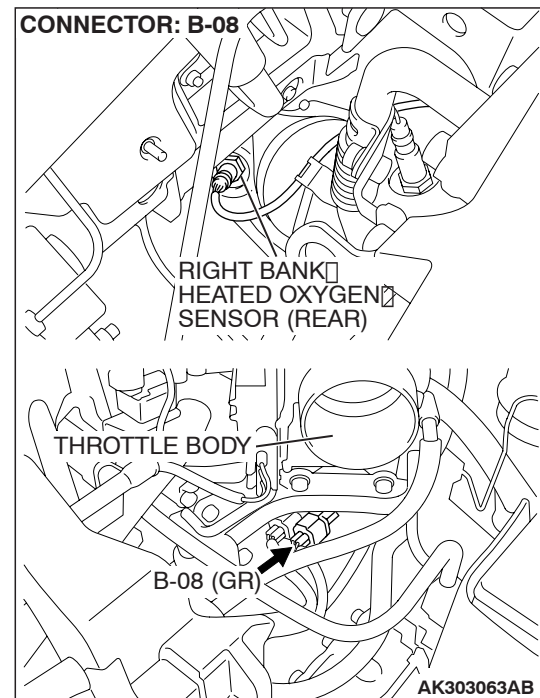
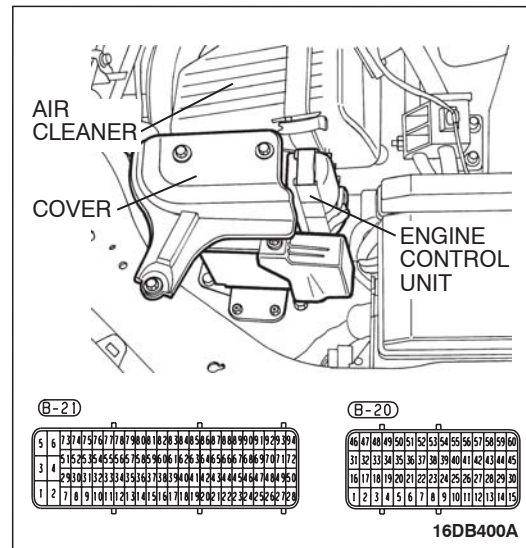
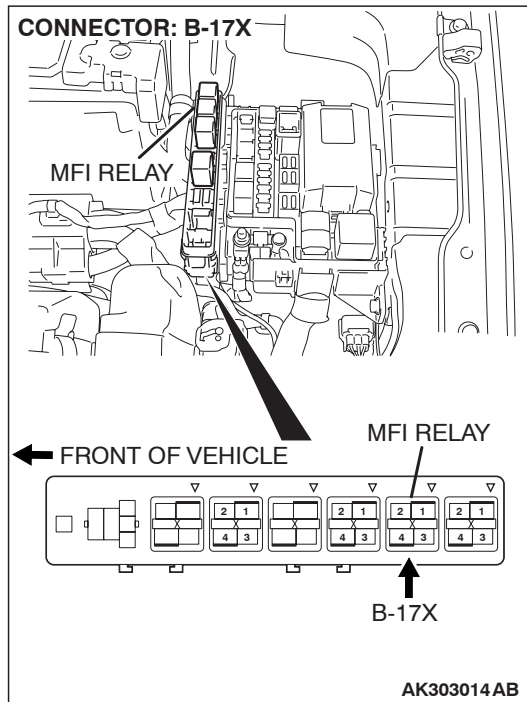
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0037 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0038: Heated Oxygen Sensor Heater Circuit high (bank 1, sensor 2).



CIRCUIT OPERATION

- Power is supplied from the MPI relay (terminal No. 4) to the right bank heated oxygen sensor (rear) heater.
- The ENGINE-ECU (terminal No. 32) controls continuity to the right bank heated oxygen sensor (rear) heater by turning the power transistor in the ENGINE-ECU "ON" and "OFF".

DTC SET CONDITIONS

Check Conditions

- Battery voltage is within 9.04 to 16.01 volts.
- Engine speed is above 801 r/min.

TECHNICAL DESCRIPTION

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

Judgment Criteria

- IC internal test (short circuit to battery).
- MIL is activated after 2 Driving Cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

- Short circuit to 12 Volts.
- Connector damaged.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

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

- Right bank heated oxygen sensor (rear) failed.

DIAGNOSIS

Required Special Tools:

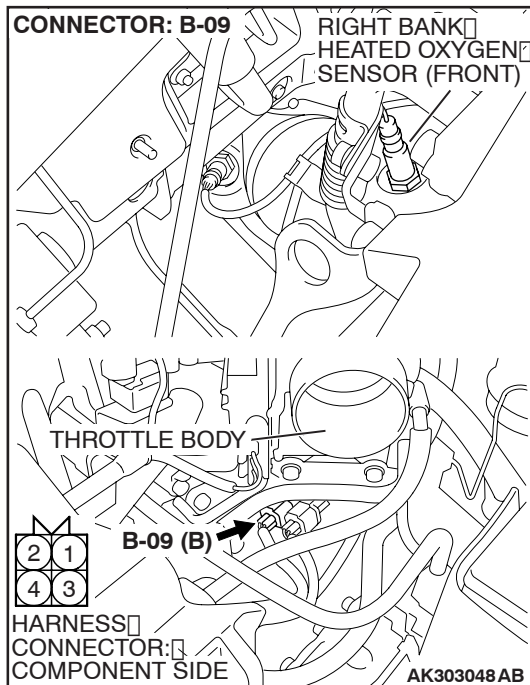
- Diagnostic tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ENGINE-ECU Check Harness

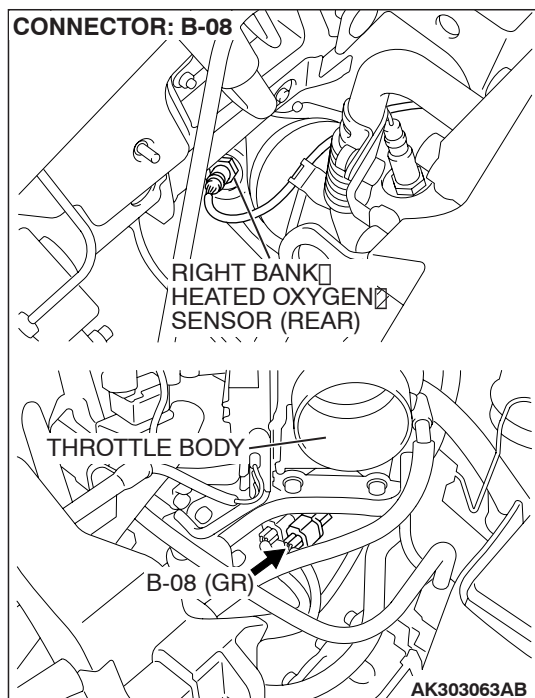
STEP 1. Check harness connector B-09 at the right bank heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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





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

- (1) Disconnect right bank heated oxygen sensor (rear) connector B-08.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

Standard value: 9.0 – 11.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 9.0 and 11.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

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

STEP 3. Check the trouble symptoms.

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

Q: Is DTC P0038 set?

YES : Then go to Step 4.

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

STEP 4. Test the EOB Drive cycle.

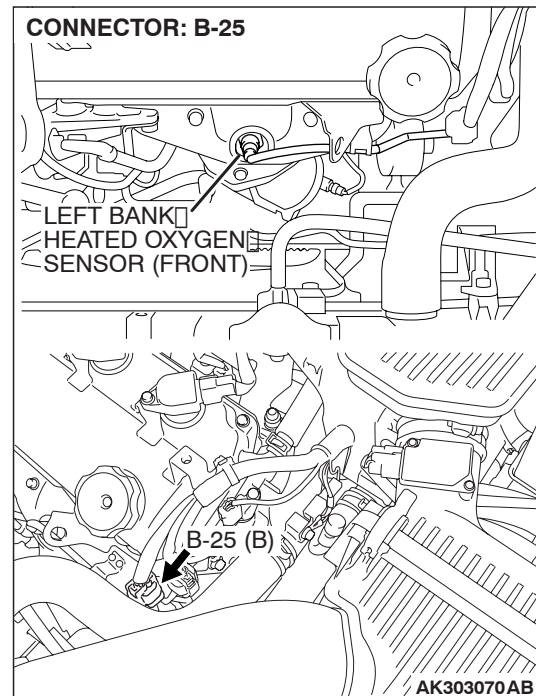
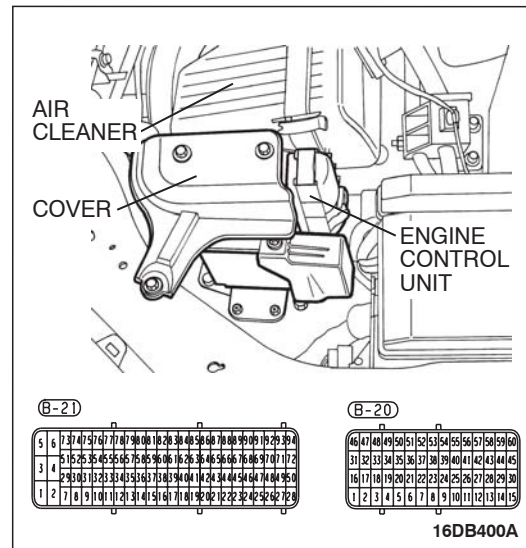
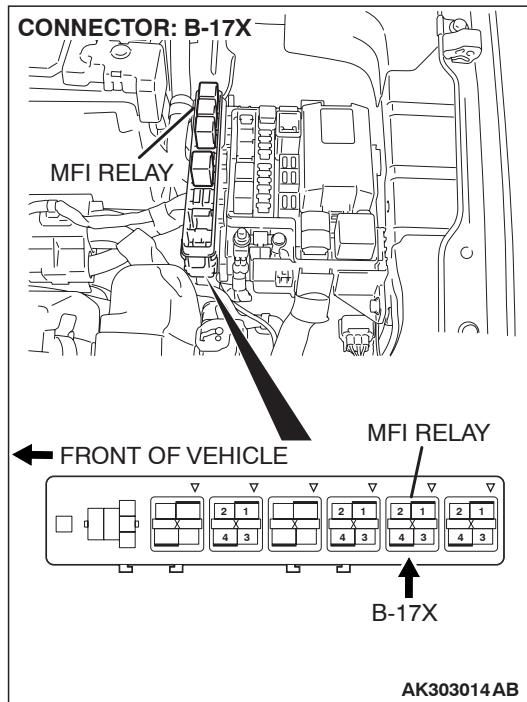
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOB Drive Cycle – [P.13A-11](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0038 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0051: Heated Oxygen Sensor Heater Circuit low (bank 2, sensor 1).



CIRCUIT OPERATION

- Power is supplied from the MPI relay (terminal No. 4) to the left bank heated oxygen sensor (front) heater.
- The ENGINE-ECU (terminal No. 48) controls continuity to the left bank heated oxygen sensor (front) heater by turning the power transistor in the ENGINE-ECU "ON" and "OFF".

DTC SET CONDITIONS

Check Conditions

- Battery voltage is within 10.7 to 16.1 volts.
- Engine speed is above 20 r/min.

TECHNICAL DESCRIPTION

- The ENGINE-ECU checks whether the heater current is within a specified range when the heater is energized.
- The ENGINE-ECU checks whether the heater current is within a specified range when the heater is not energized.

- Engine starting sequence is complete.
- Oxygen sensor heater is active.

Judgment Criteria

- The heater voltage is less than 2.4 V during the calibrated time interval.
or
- The heater voltage is not within 2.4 - 3.6 Volts during the calibrated time interval.
- MIL is activated after 2 Driving Cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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

- Open or shorted left bank heated oxygen sensor (front) heater circuit, harness damage, or connector damage.
- Left bank heated oxygen sensor (front) heater.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS

Required Special Tools:

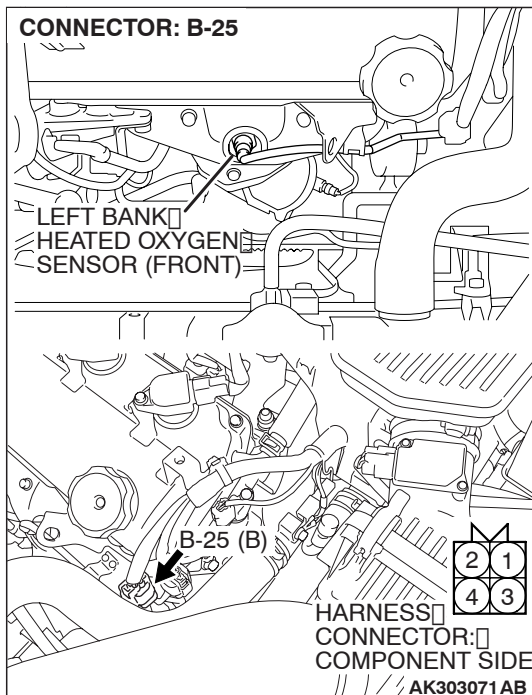
- Diagnostic tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ENGINE-ECU Check Harness

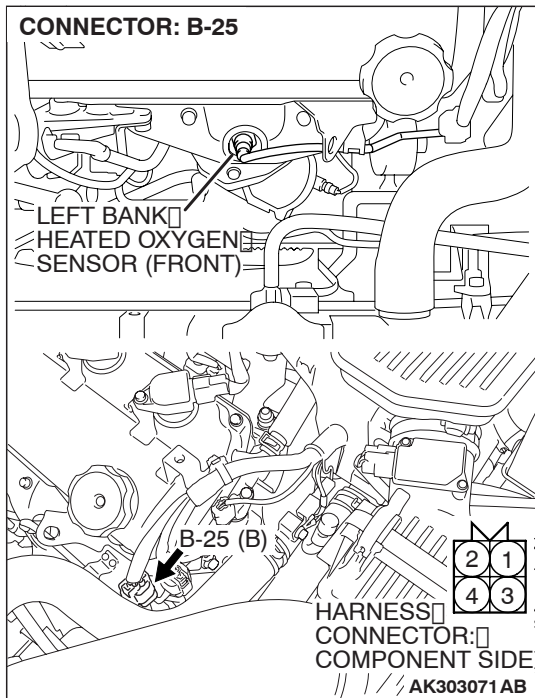
STEP 1. Check harness connector B-25 at the left bank heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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





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

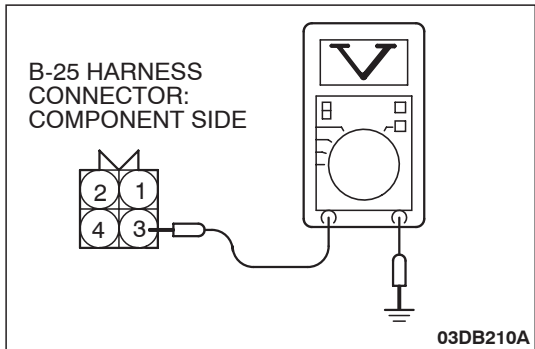
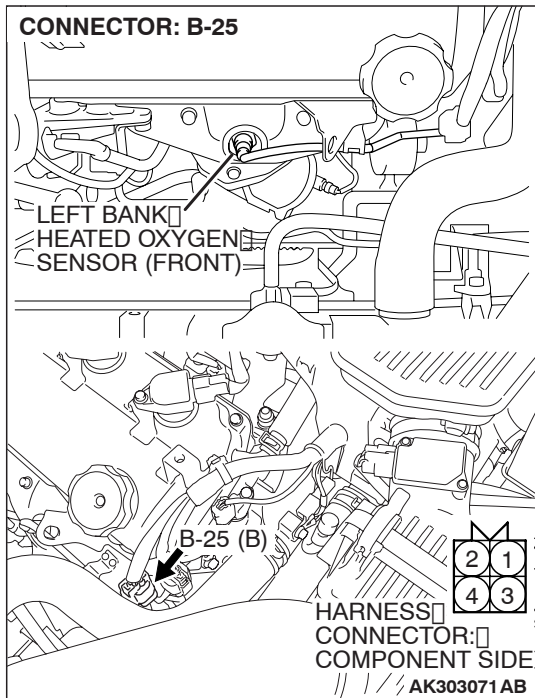
- (1) Disconnect left bank heated oxygen sensor (front) connector B-25.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

Standard value: 9.0 – 11.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 9.0 and 11.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the left bank heated oxygen sensor (front).
Then go to Step 11.



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

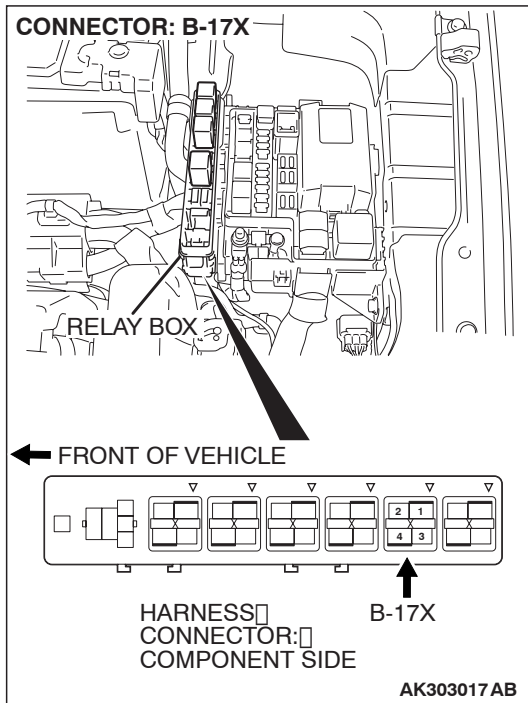
- (1) Disconnect the connector B-25 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 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.

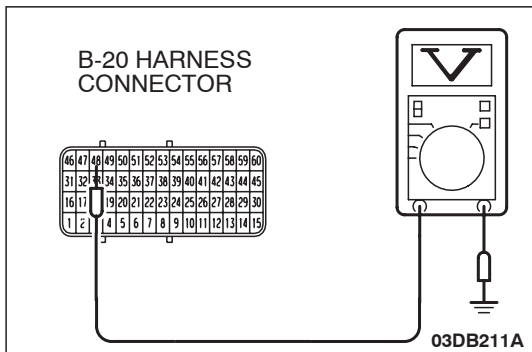


STEP 4. Check harness connector B-17X at the MPI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MPI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (front) connector B-25 (terminal No. 3) 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.



- (3) Measure the voltage between terminal No. 48 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

NO : Go to Step 6.

STEP 6. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

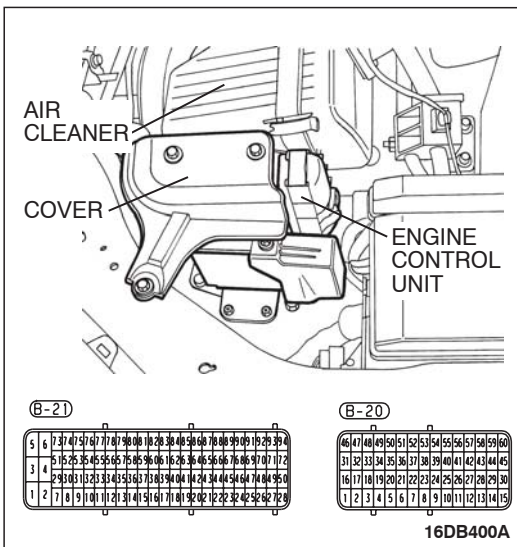
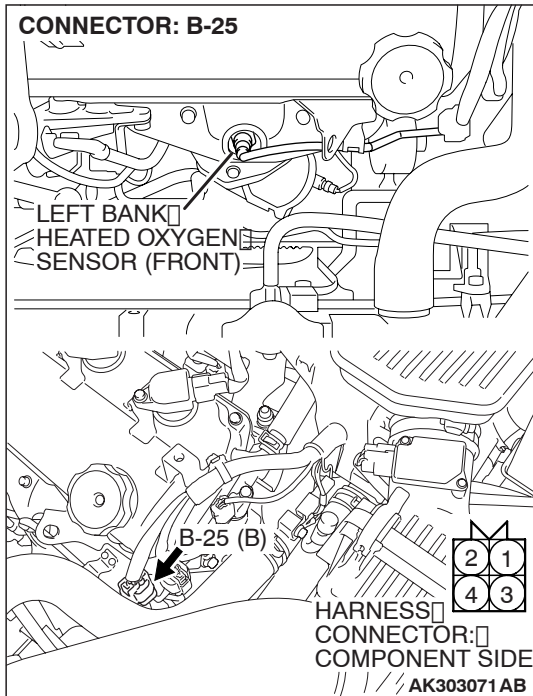
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

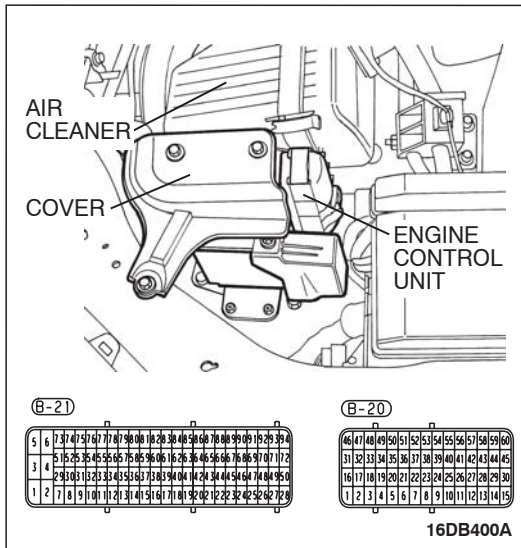
STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (front) connector B-25 (terminal No. 4) and ENGINE-ECU connector B-20 (terminal No. 48).

Q: Is the harness wire in good condition?

YES : Then go to Step 8.

NO : Repair it. Then go to Step 11.





STEP 8. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

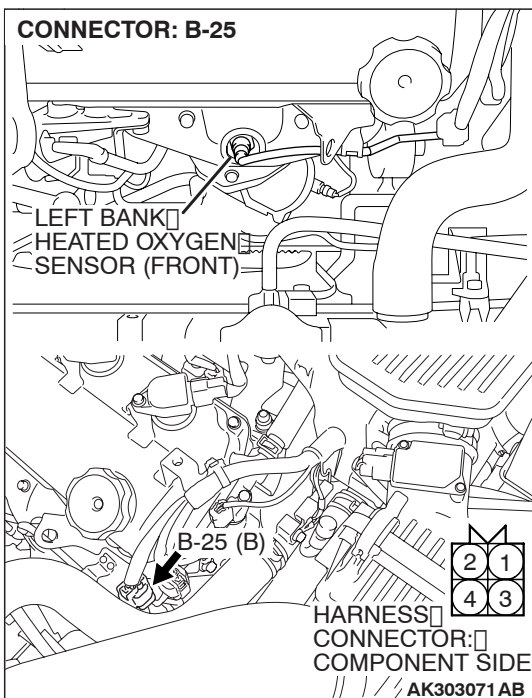
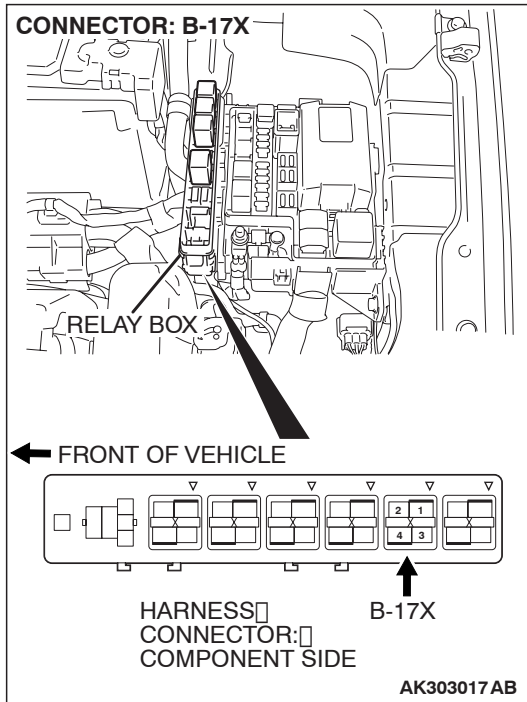
YES : Go to Step 9.

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

STEP 9. Check for harness damage between MPI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (front) connector B-25 (terminal No. 3).
Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 11.

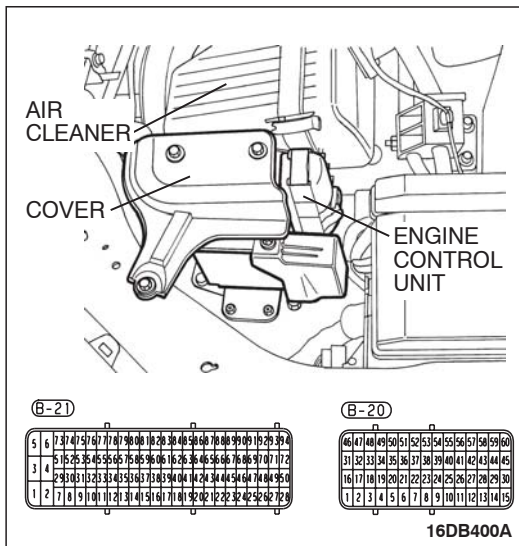
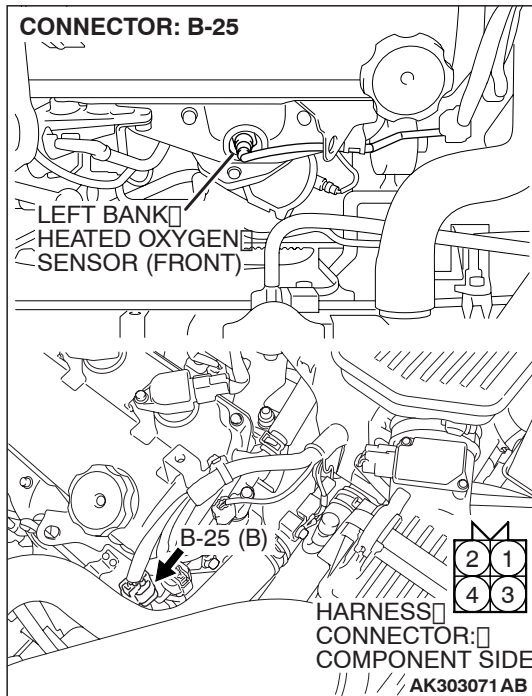


STEP 10. Check for harness damage between left bank heated oxygen sensor (front) connector B-25 (terminal No. 4) and ENGINE-ECU connector B-20 (terminal No. 48).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 11.



STEP 11. Test the EOBD drive cycle.

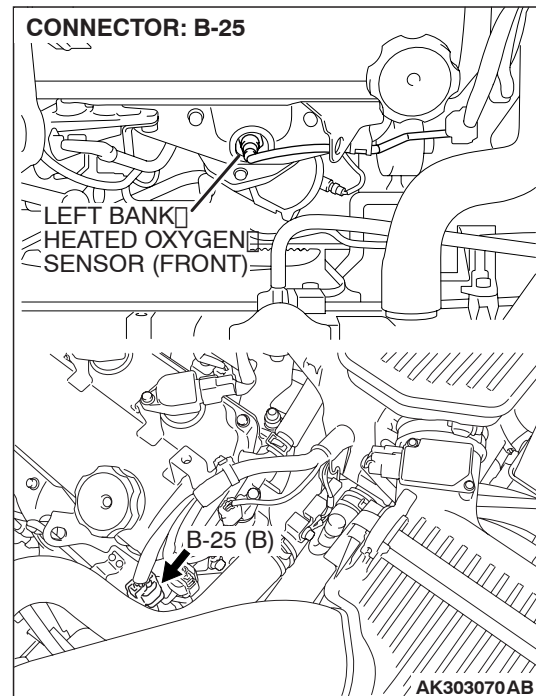
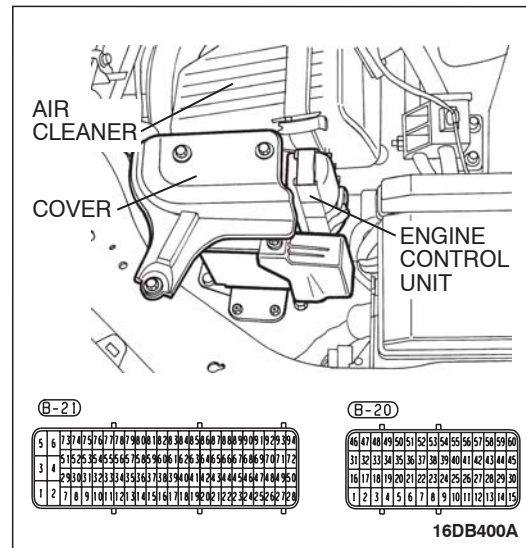
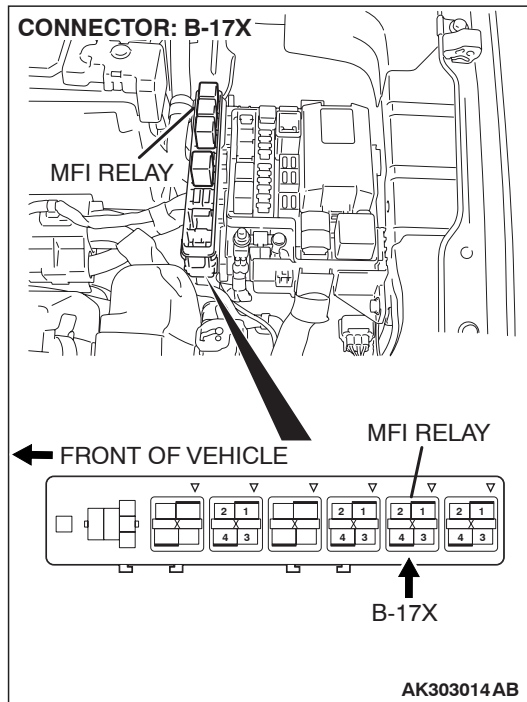
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0051 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0052: Heated Oxygen Sensor Heater Circuit high (bank 2, sensor 1).



CIRCUIT OPERATION

- Power is supplied from the MPI relay (terminal No. 4) to the left bank heated oxygen sensor (front) heater.
- The ENGINE-ECU (terminal No. 48) controls continuity to the left bank heated oxygen sensor (front) heater by turning the power transistor in the ENGINE-ECU "ON" and "OFF".

DTC SET CONDITIONS

Check Conditions

- Battery voltage is within 10.7 to 16.1 volts.
- Engine speed is above 20 r/min.
- Engine starting sequence is completed.

TECHNICAL DESCRIPTION

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

Judgment Criteria

- Oxygen sensor heater is active.
- Heater voltage is above 3.6 Volts during the calibrated time interval.

- MIL is activated after 2 Driving Cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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

- Left bank heated oxygen sensor (front) heater failed.
- Short circuit to 12 Volt.
- Connector damaged.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS

Required Special Tools:

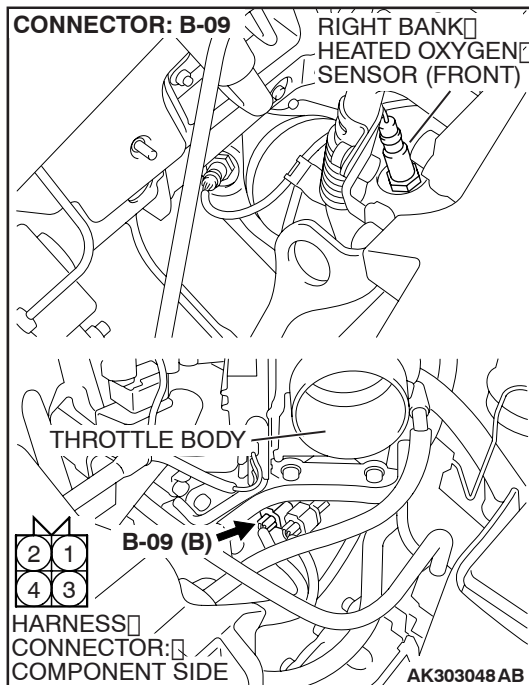
- Diagnostic tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ENGINE-ECU Check Harness

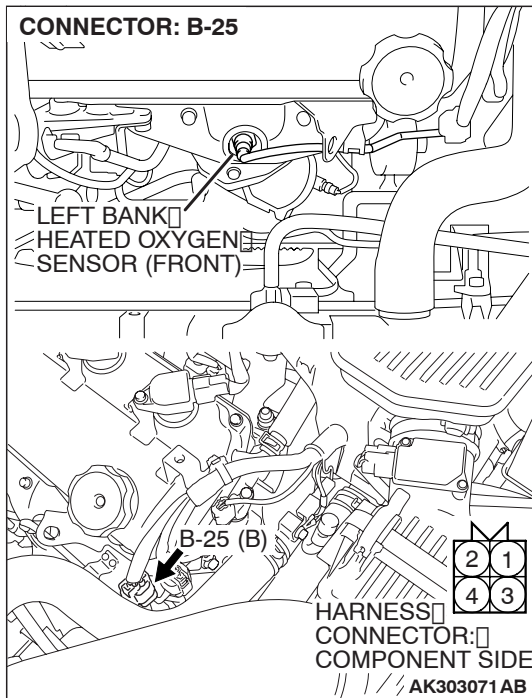
STEP 1. Check harness connector B-09 at the left bank heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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





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

- (1) Disconnect left bank heated oxygen sensor (front) connector B-25.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

Standard value: 9.0 – 11.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 9.0 and 11.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

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

STEP 3. Check the trouble symptoms.

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

Q: Is DTC P0052 set?

YES : Then go to Step 4.

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

STEP 4. Test the EOB Drive cycle.

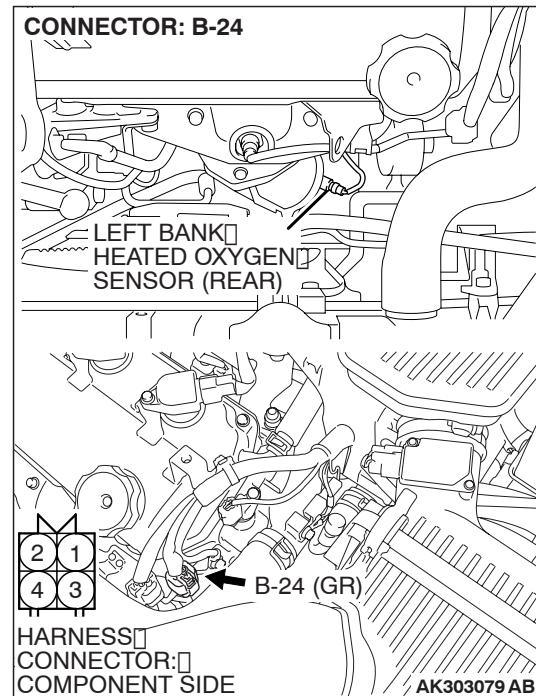
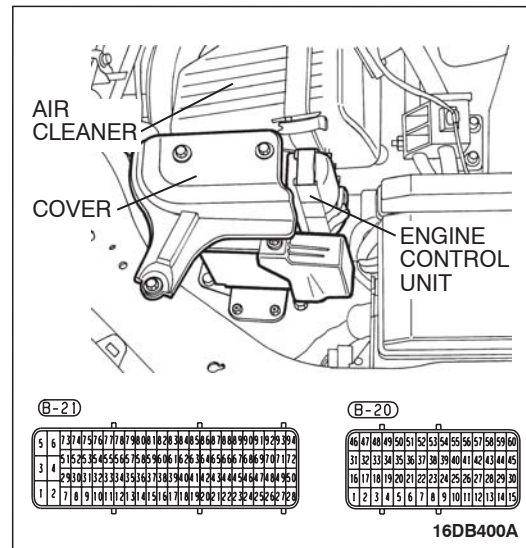
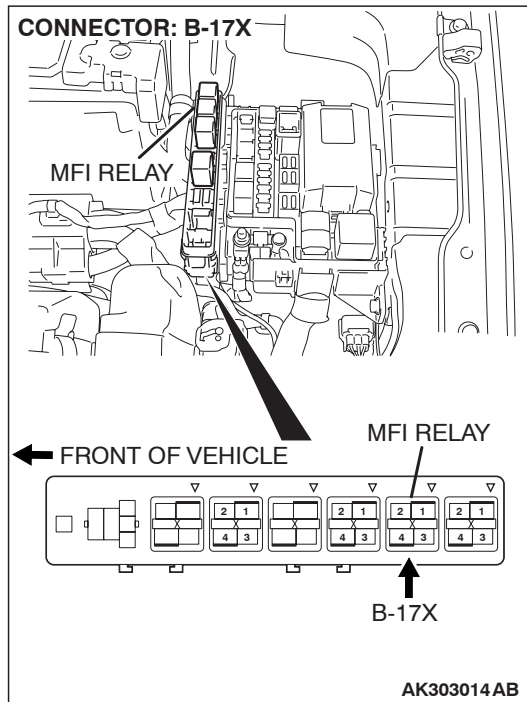
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOB Drive Cycle – [P.13A-11](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0052 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0057: Heated Oxygen Sensor Heater Circuit low (bank 2, sensor 2).



CIRCUIT OPERATION

- Power is supplied from the MPI relay (terminal No. 4) to the left bank heated oxygen sensor (rear) heater.
- The ENGINE-ECU (terminal No. 33) controls continuity to the left bank heated oxygen sensor (rear) heater by turning the power transistor in the ENGINE-ECU "ON" and "OFF".

DTC SET CONDITIONS

Check Conditions

- Battery voltage is within 9.04 to 16.01 volts.
- Engine speed is above 801 r/min.

TECHNICAL DESCRIPTION

- The ENGINE-ECU checks whether the heater current is within a specified range when the heater is energized.
- The ENGINE-ECU checks whether the heater current is within a specified range when the heater is not energized.

Judgment Criteria

- IC internal test (open circuit, short to earth).

- The heater voltage is less than 2.4 V during the calibrated time interval.
or
- The heater voltage is not within 2.4 - 3.6 Volts during the calibrated time interval.
- MIL is activated after 2 Driving Cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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

- Open or shorted left bank heated oxygen sensor (rear) heater circuit, harness damage, or connector damage.
- Left bank heated oxygen sensor (rear) heater failed.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS

Required Special Tools:

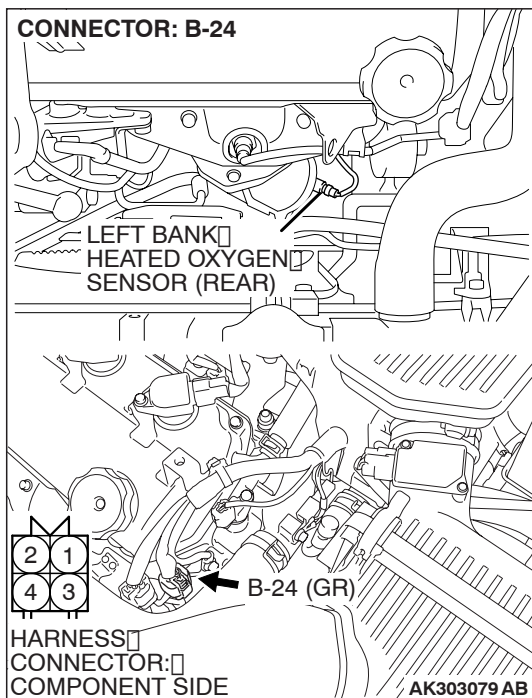
- Diagnostic tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ENGINE-ECU Check Harness

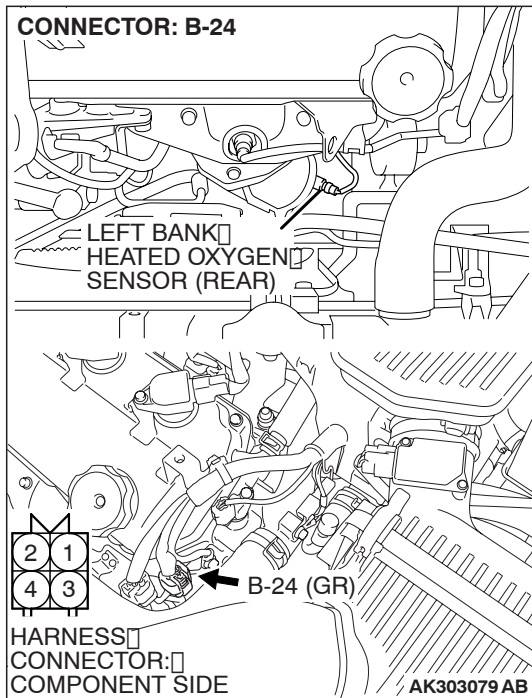
STEP 1. Check harness connector B-24 at the left bank heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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





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

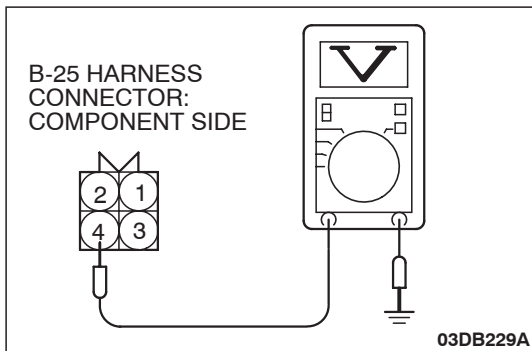
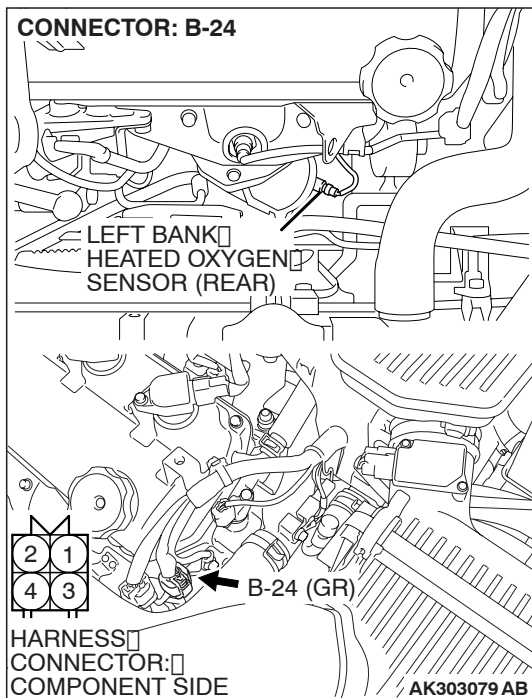
- (1) Disconnect left bank heated oxygen sensor (rear) connector B-24.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

Standard value: 9.0 – 11.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 9.0 and 11.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the left bank heated oxygen sensor (rear).
Then go to Step 11.



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

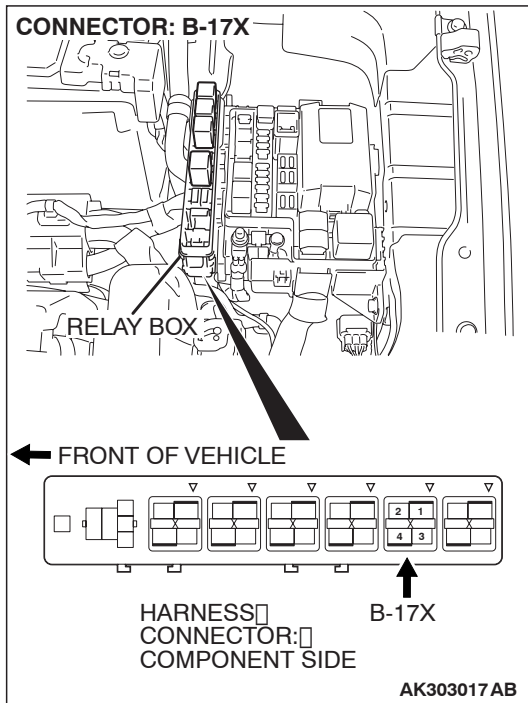
- (1) Disconnect the connector B-24 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

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

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

YES : Go to Step 5.

NO : Go to Step 4.



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

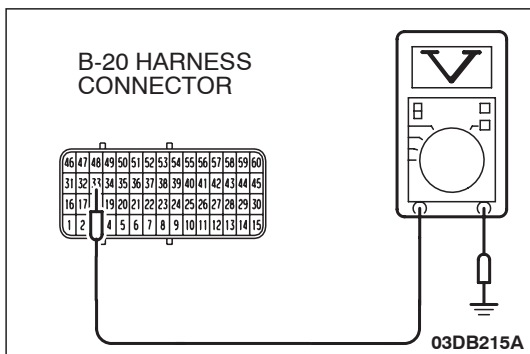
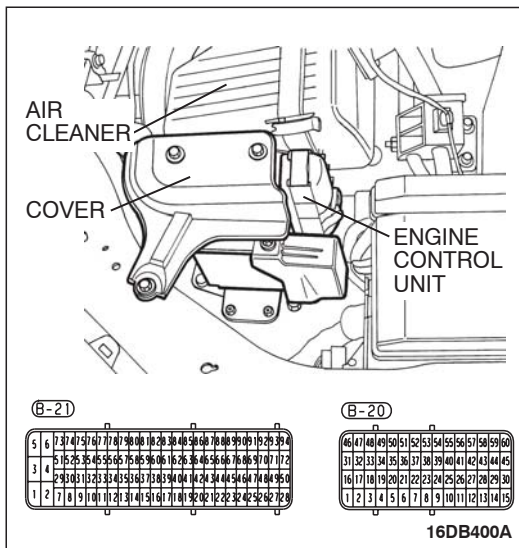
Q: Is the harness connector in good condition?

YES : Repair harness wire between MPI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (rear) connector B-24 (terminal No. 4) 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 power supply voltage at ENGINE-ECU connector B-20 by using ENGINE-ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ENGINE-ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



- (3) Measure the voltage between terminal No. 33 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

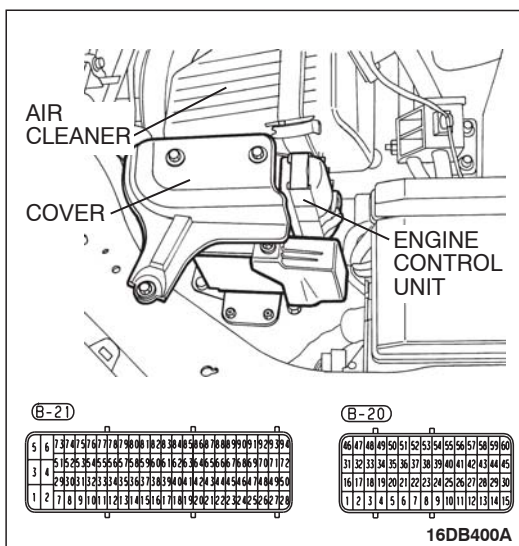
Q: Is battery positive voltage (approximately 12 volts) present?

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

STEP 6. Check harness connector B-20 at ENGINE-ECU 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.

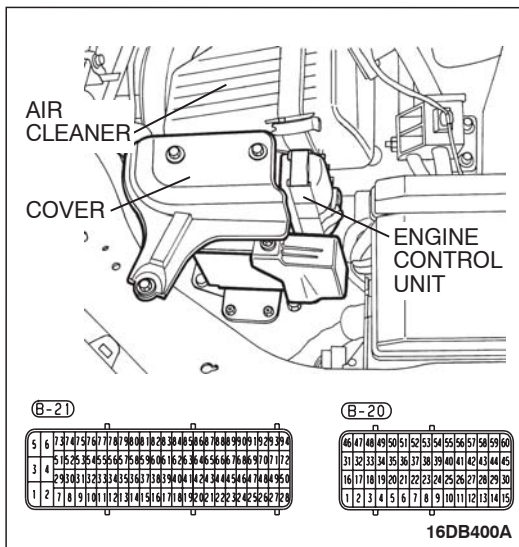
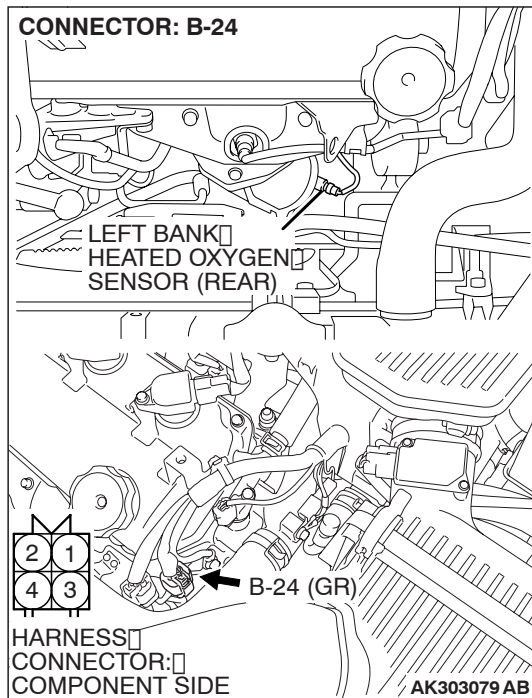


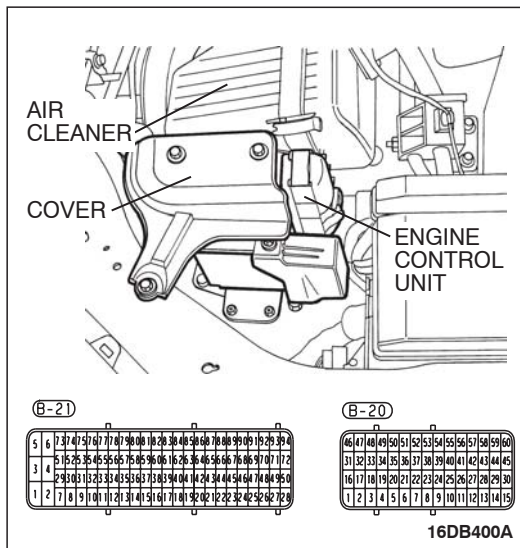
STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 3) and ENGINE-ECU connector B-20 (terminal No. 33).

Q: Is the harness wire in good condition?

YES : Then go to Step 8.

NO : Repair it. Then go to Step 11.





STEP 8. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

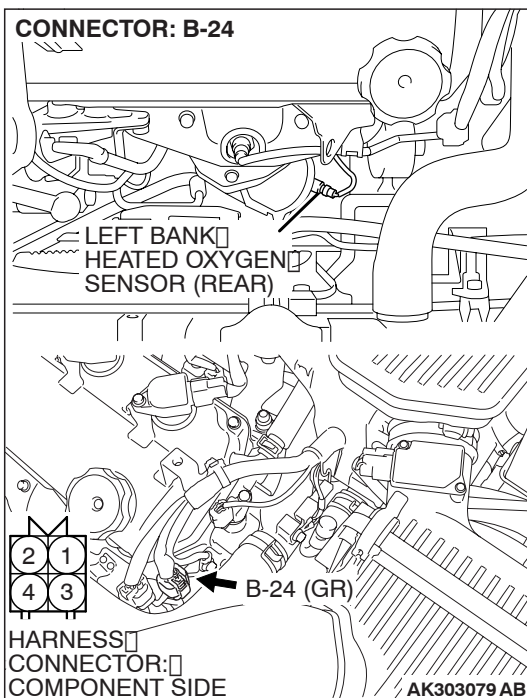
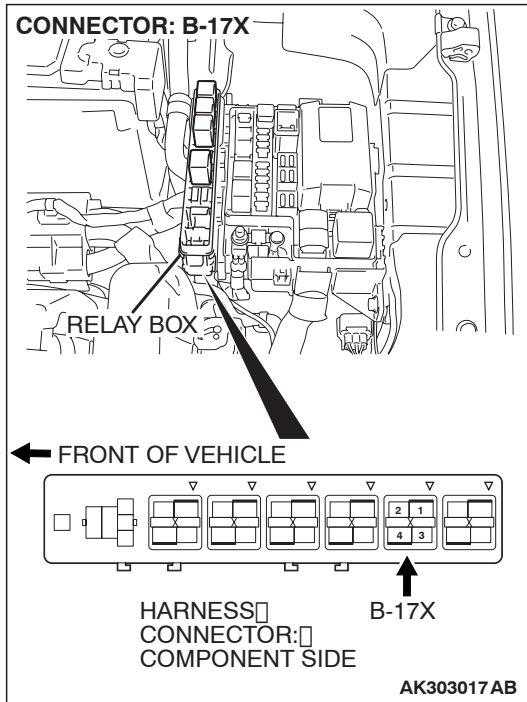
YES : Go to Step 9.

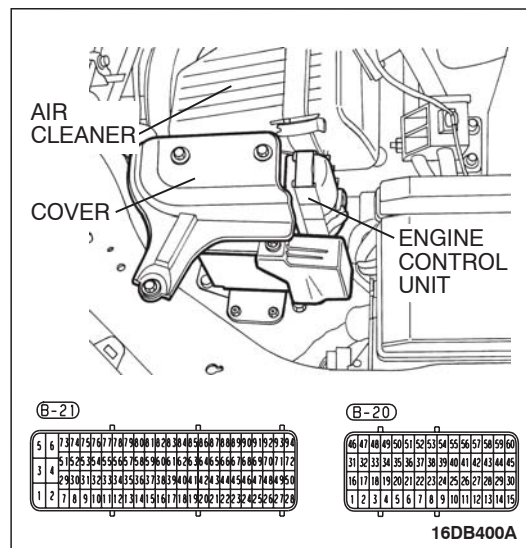
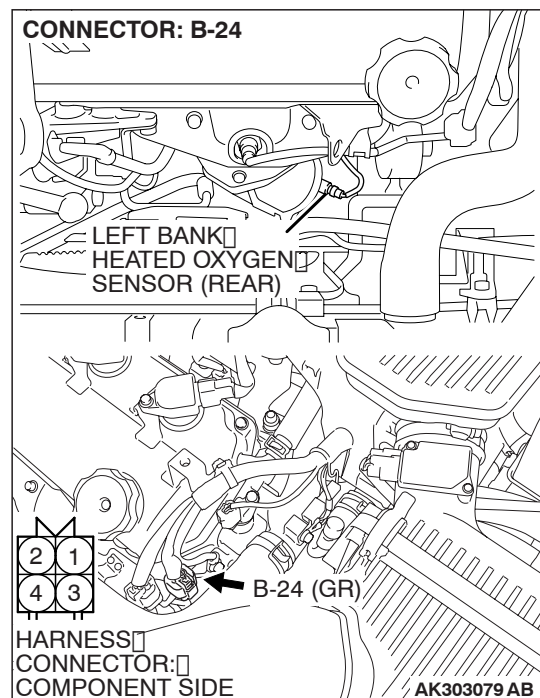
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

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

YES : Go to Step 10.

NO : Repair it. Then go to Step 11.





STEP 10. Check for harness damage between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 3) and ENGINE-ECU connector B-20 (terminal No. 33).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 11.

STEP 11. Test the EOBd drive cycle.

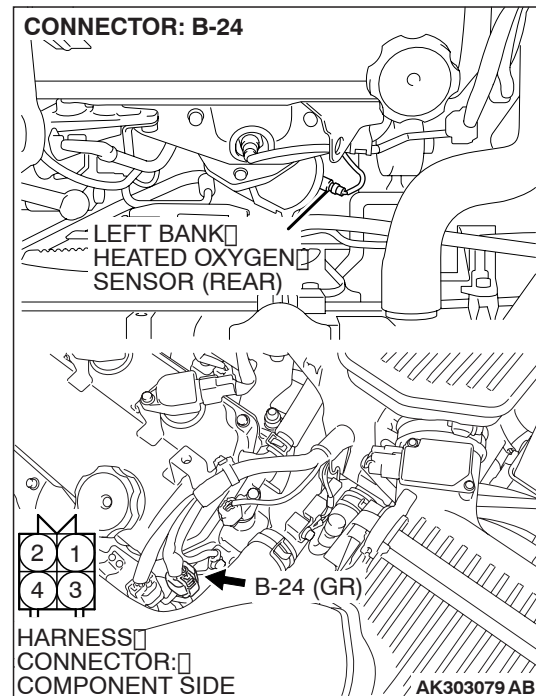
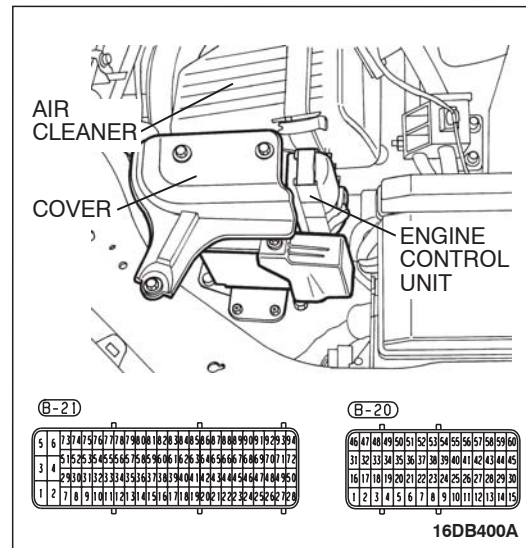
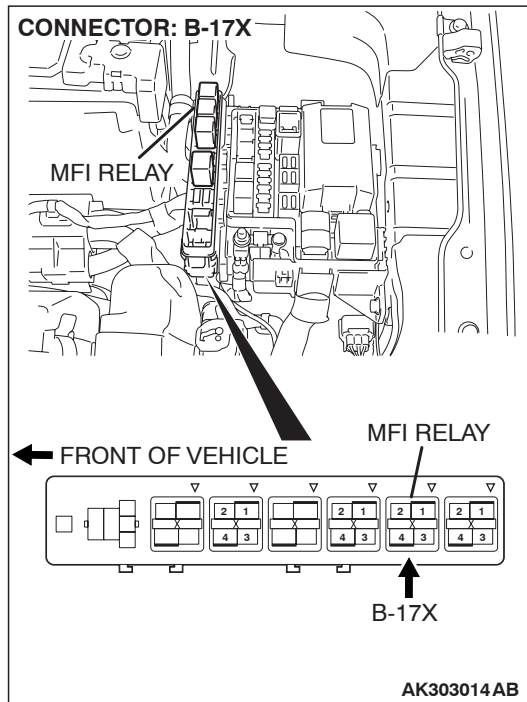
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOB Drive Cycle – [P.13A-11](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0057 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0058: Heated Oxygen Sensor Heater Circuit high (bank 2, sensor 2).



CIRCUIT OPERATION

- Power is supplied from the MPI relay (terminal No. 4) to the left bank heated oxygen sensor (rear) heater.
- The ENGINE-ECU (terminal No. 33) controls continuity to the left bank heated oxygen sensor (rear) heater by turning the power transistor in the ENGINE-ECU "ON" and "OFF".

DTC SET CONDITIONS

Check Conditions

- Battery voltage is within 9.04 to 16.01 volts.
- Engine speed is above 801 r/min.

TECHNICAL DESCRIPTION

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

Judgment Criteria

- IC internal test (short circuit to battery)
- MIL is activated after 2 Driving Cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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

- Open or shorted left bank heated oxygen sensor (rear) heater circuit, harness damage, or connector damage.

- Left bank heated oxygen sensor (rear) heater failed.
- Short circuit to 12 Volts.
- Connector damaged.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS**Required Special Tools:**

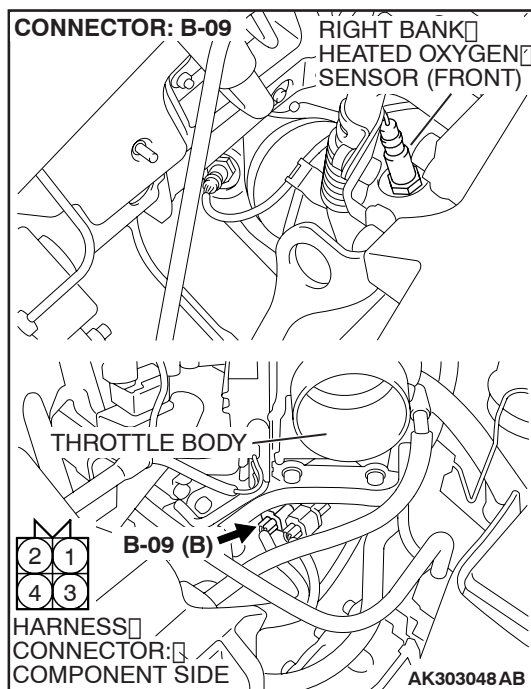
- Diagnostic tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ENGINE-ECU Check Harness

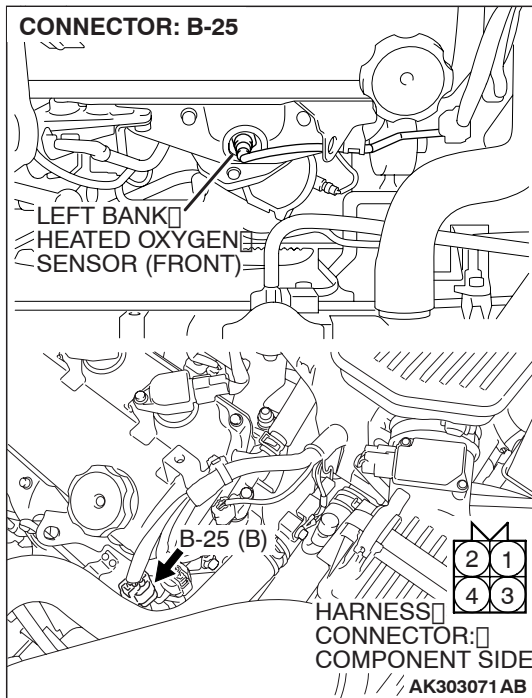
STEP 1. Check harness connector B-09 at the left bank heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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





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

- (1) Disconnect left bank heated oxygen sensor (rear) connector B-24.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

Standard value: 9.0 – 11.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 9.0 and 11.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

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

STEP 3. Check the trouble symptoms.

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

Q: Is DTC P0058 set?

YES : Then go to Step 4.

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

STEP 4. Test the EOB Drive cycle.

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

Q: Is DTC P0058 set?

YES : Retry the troubleshooting.

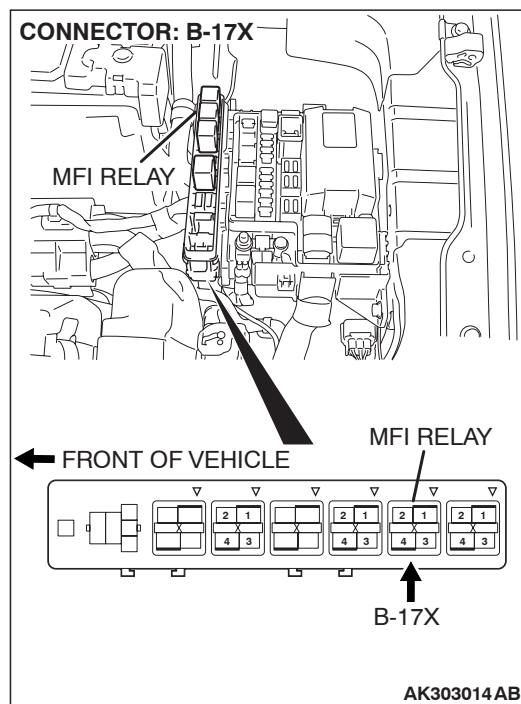
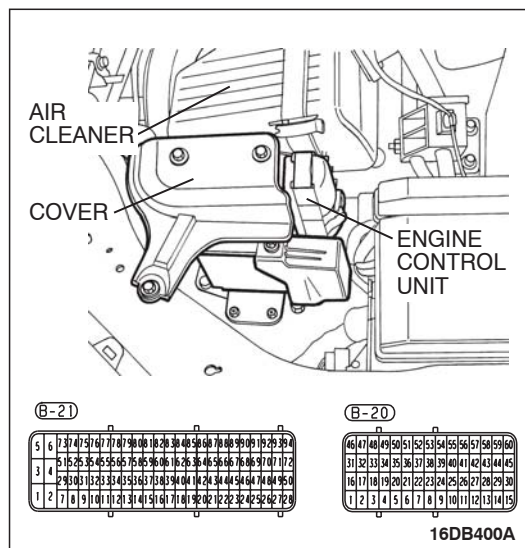
NO : The inspection is complete.

CONNECTOR: B-10

MASS AIRFLOW SENSOR

B-10 (GR)

03DB217A



- No circuit - IC internal test.

- Ambient air temperature is a modelled signal from the intake air temperature.

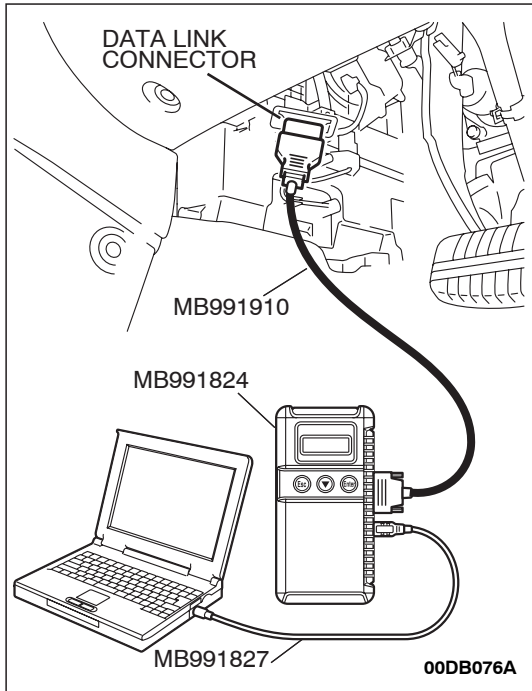
- Signal out of calibrated threshold range.
- No MIL.

- Ambient air temperature is derived from the Intake air temperature.

Refer to Diagnostic Function – EOBD Drive Cycle –
P.13A-11.

- Ambient air temperature was outside threshold values of -38.3°C to 135°C

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



**STEP 1. Using diagnostic tool , check data list item 5:
Intake Air temperature Sensor.**

⚠ CAUTION

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

- (1) Connect diagnostic tool to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set diagnostic tool to the data reading mode for item 5, Intake Air temperature Sensor.
- (4) The intake air temperature sensor reading should be similar outside ambient air temperature.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

STEP 2. Test the EOBD drive cycle.

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

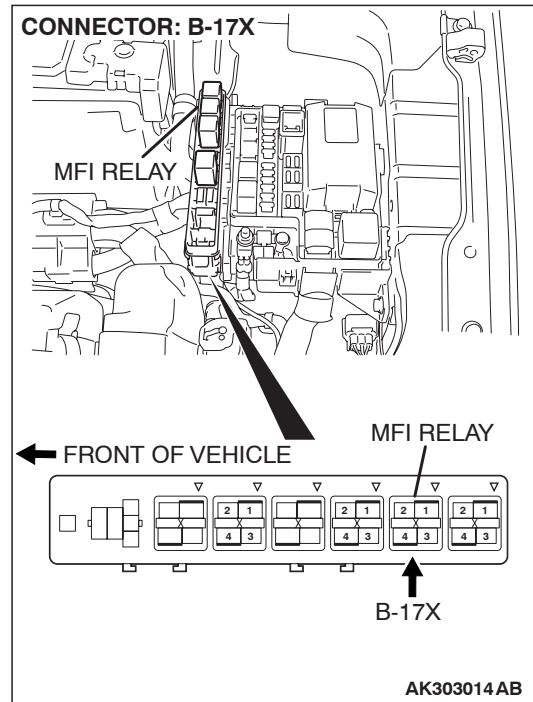
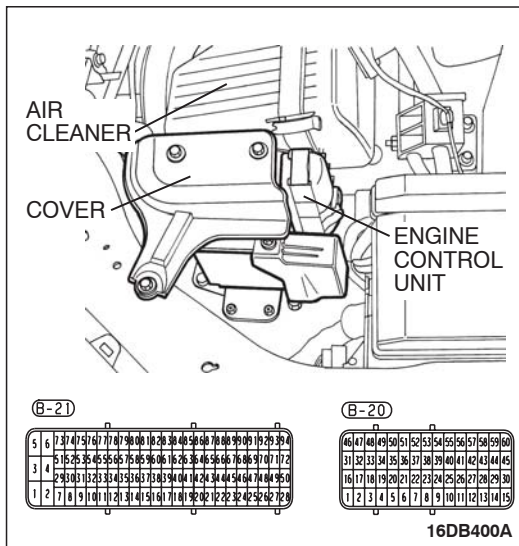
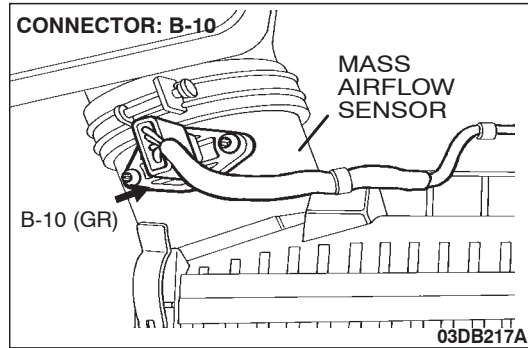
Q: Is DTC P0074 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0101: Mass Airflow Circuit Range/Performance Problem.**CAUTION**

If DTC P0101 has been set, TCL related DTC U1120 is also set. After P0101 has been diagnosed, don't forget to erase DTC U1120.

**CIRCUIT OPERATION**

- The mass airflow sensor power is supplied from the MPI relay (terminal No. 4), and the ground is provided on the ENGINE-ECU (terminal No. 11).
- 5-volt power is applied to the mass airflow sensor output terminal (terminal No. 4) from the ENGINE-ECU (terminal No. 11).

TECHNICAL DESCRIPTION

- While the engine is running, the mass airflow sensor outputs voltage which corresponds to the mass airflow rate.
- The ENGINE-ECU checks whether the voltage output by the mass airflow sensor while the engine is running is within a specified speed and load range.

DTC SET CONDITIONS <Range/Performance problem - low input>**Check Conditions**

- Battery voltage is above 8.01 volts.
- Crankshaft revolution is above 150 r/min.

Judgement Criteria

- Air flow sensor output is below lower threshold (0-283.0 kg/h) for 4 seconds.
- MIL is activated immediately.
- No limp home mode.

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

Check Conditions

- Battery voltage is above 8.01 volts.
- Crankshaft revolution is above 150 r/min.

Judgement Criteria

- Air flow sensor output is above upper threshold (40.9-903.0 kg/h) for 4 seconds.
- MIL is activated immediately.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS

Required Special Tools:

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

STEP 1. Using diagnostic tool , check data list item AA: Mass Airflow Sensor.

CAUTION

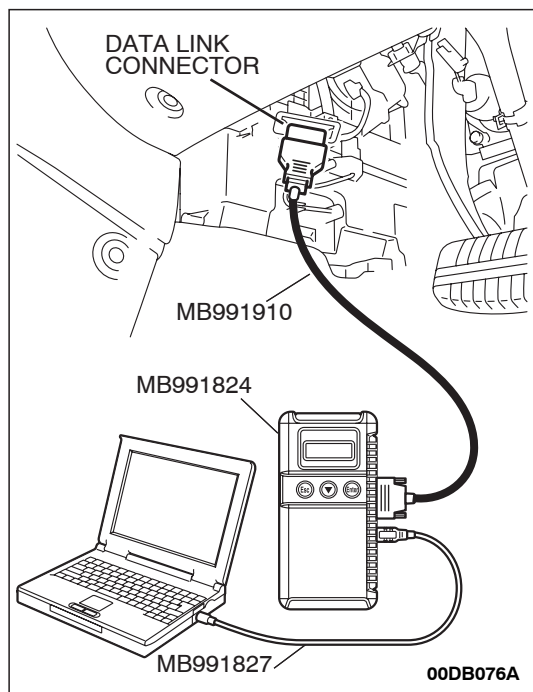
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

- (1) Connect diagnostic tool to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set diagnostic tool to the data reading mode for item AA, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be approximately 4.7 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 – How to Cope with Intermittent Malfunctions [P.00-14](#).

NO : Replace the mass airflow sensor. Then go to Step 2.



STEP 2. Test the EOBD drive cycle.

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

Q: Is DTC P0101 set?

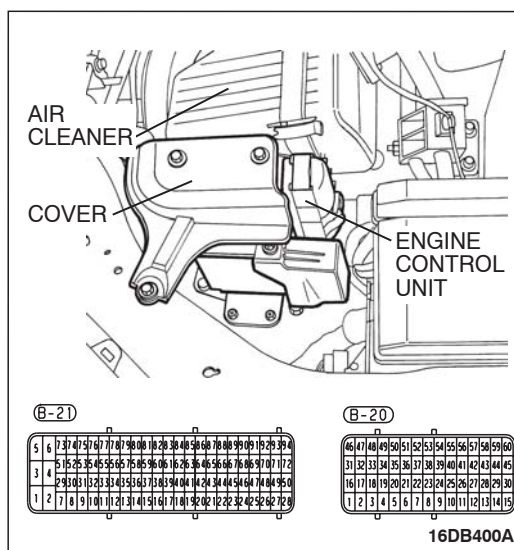
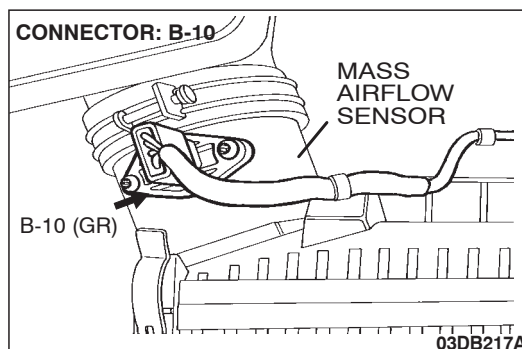
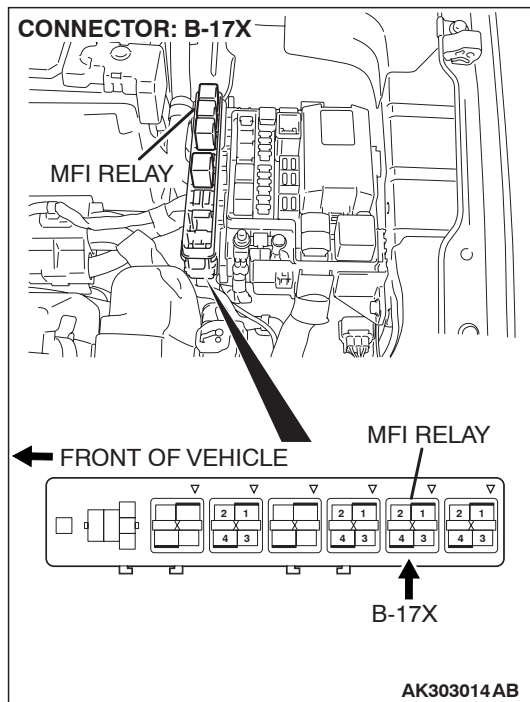
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0102: Mass Airflow Circuit Low Input.

⚠ CAUTION

If DTC P0102 has been set, TCL related DTC U1120 is also set. After P0102 has been diagnosed, don't forget to erase DTC U1120.



CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MPI relay (terminal No. 4), and the ground is provided on the ENGINE-ECU (terminal No. 11).
- 5-volt power is applied to the mass airflow sensor output terminal (terminal No. 4) from the ENGINE-ECU (terminal No. 11).

TECHNICAL DESCRIPTION

- While the engine is running, the mass airflow sensor outputs voltage which corresponds to the mass airflow rate.
- The ENGINE-ECU checks whether the voltage output by the mass airflow sensor while the engine is running is within a specified speed and load range.

DTC SET CONDITIONS

Check Conditions

- Battery voltage is above 8.01 volts.

- Crankshaft revolution is above 150 r/min.

Judgement Criteria

- Air flow sensor output is below lower threshold (0-283.0 kg/h) for 4 seconds.
- MIL is activated immediately.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

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.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS**Required Special Tools:**

- : Diagnostic Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ECU Check Harness

STEP 1. Using diagnostic tool , check data list item AA: Mass Airflow Sensor.**⚠ CAUTION**

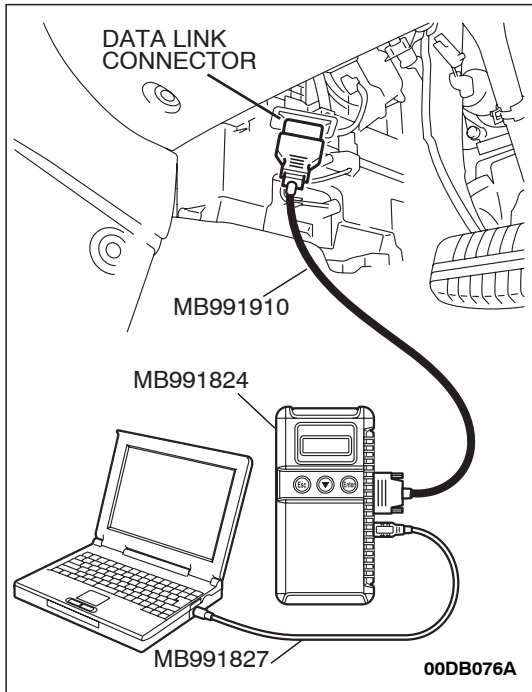
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

- (1) Connect diagnostic tool to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set diagnostic tool to the data reading mode for item AA, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be approximately 4.7 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?

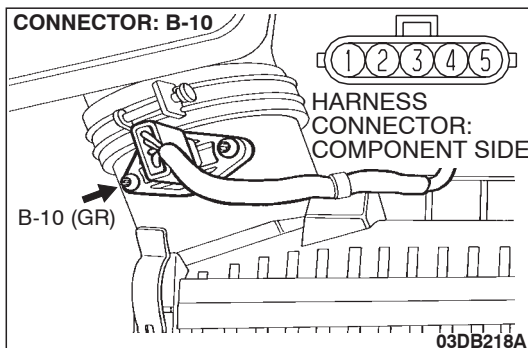
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

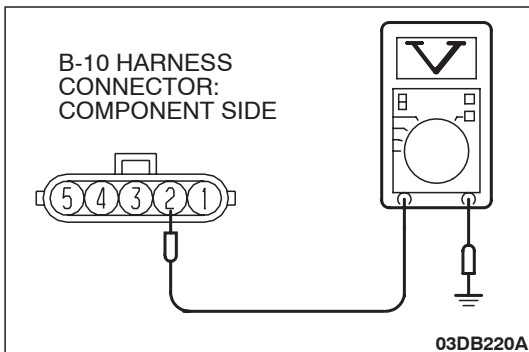
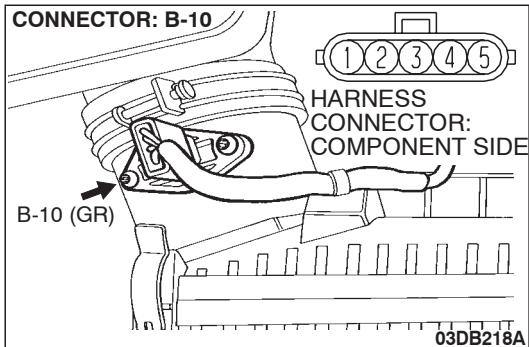
NO : Go to Step 2.

**STEP 2. Check harness connector B-10 at mass airflow 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.





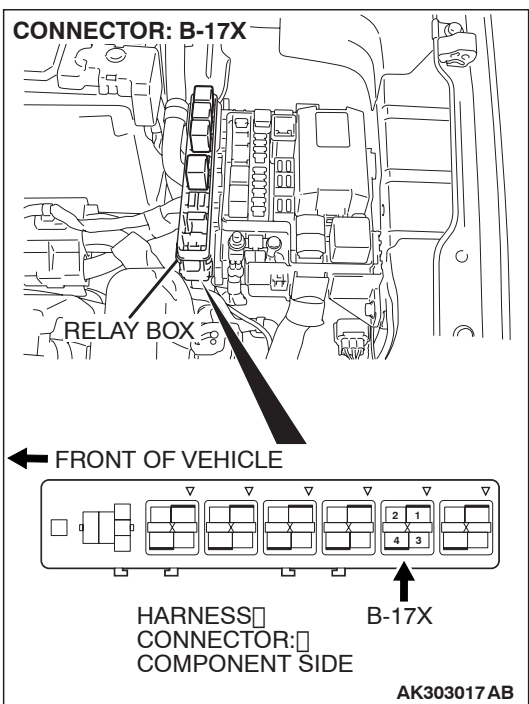
STEP 3. Measure the power supply voltage at mass airflow sensor harness side connector B-10.

- (1) Disconnect the connector B-10 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 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.

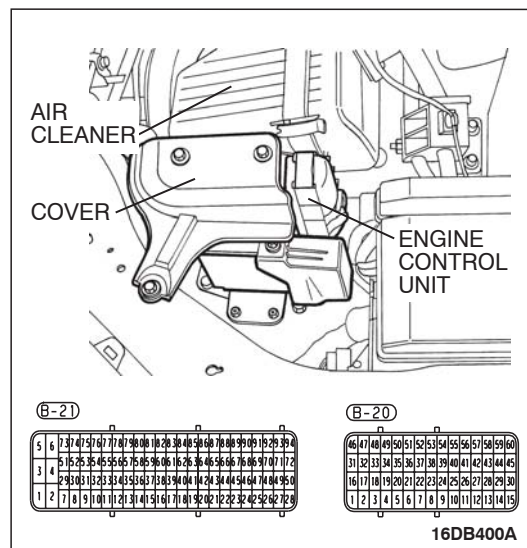


STEP 4. Check harness connector B-17X at MPI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MPI relay connector B-17X (terminal No. 4) and mass airflow sensor connector B-10 (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.

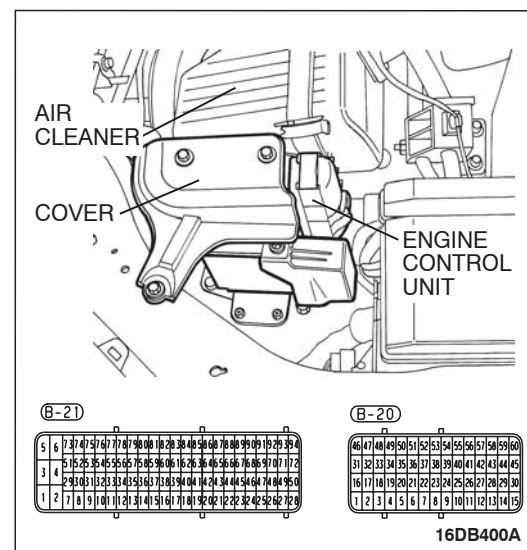


STEP 5. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

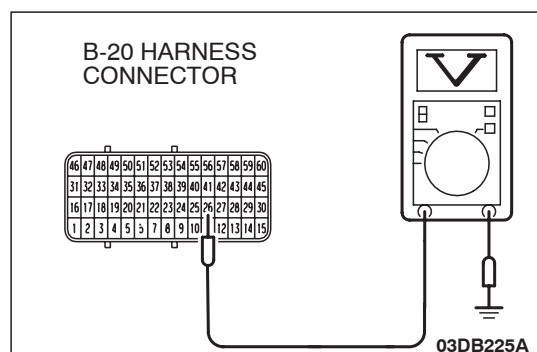
YES : Go to Step 6.

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



STEP 6. Measure the sensor output voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



- (3) Measure the voltage between terminal No. 43 and ground.
 - When the engine is revved, voltage should be increase in response to revving.

Q: Is the measured voltage normal?

YES : Go to Step 9.

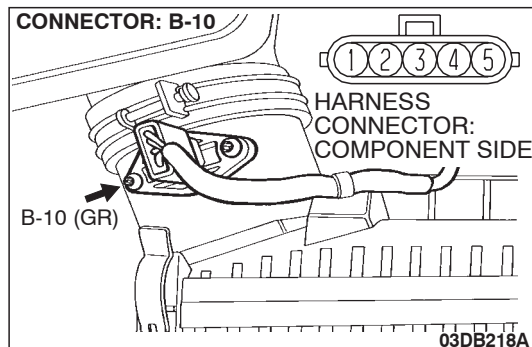
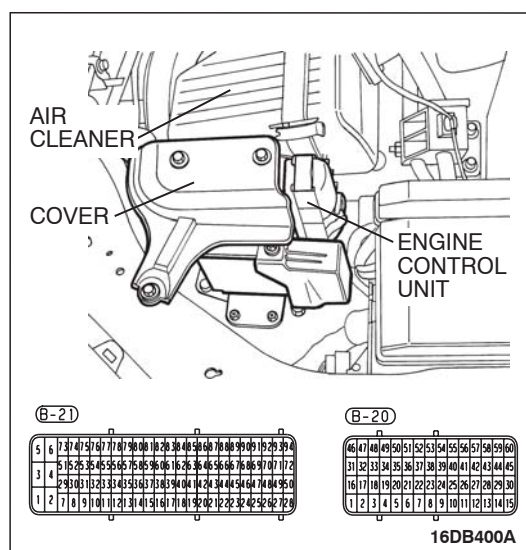
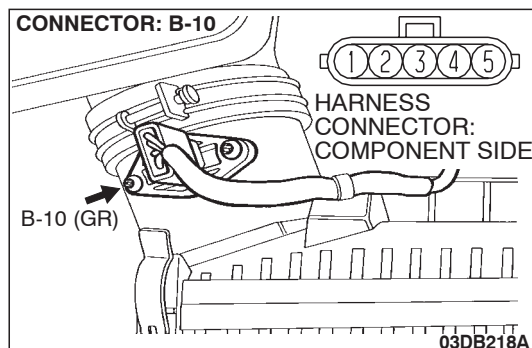
NO : Go to Step 7.

STEP 7. Check for open circuit or short circuit to ground between mass airflow sensor connector B-10 (terminal No. 5) and ENGINE-ECU connector B-20 (terminal No. 43).

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.



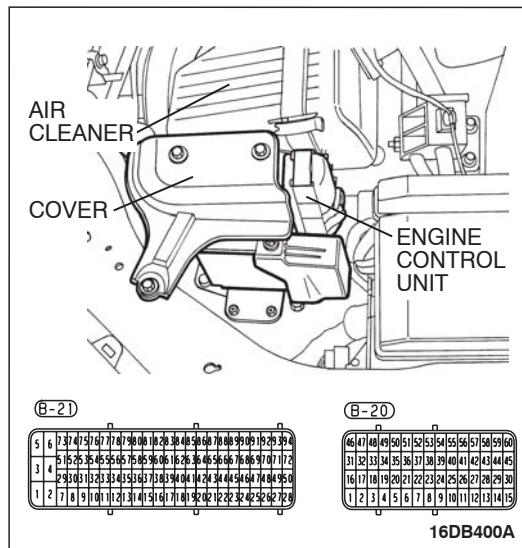
STEP 8. Replace the mass airflow sensor.

- (1) Replace the mass airflow sensor.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0102 set?

YES : Then go to Step 11.

NO : The inspection is complete.

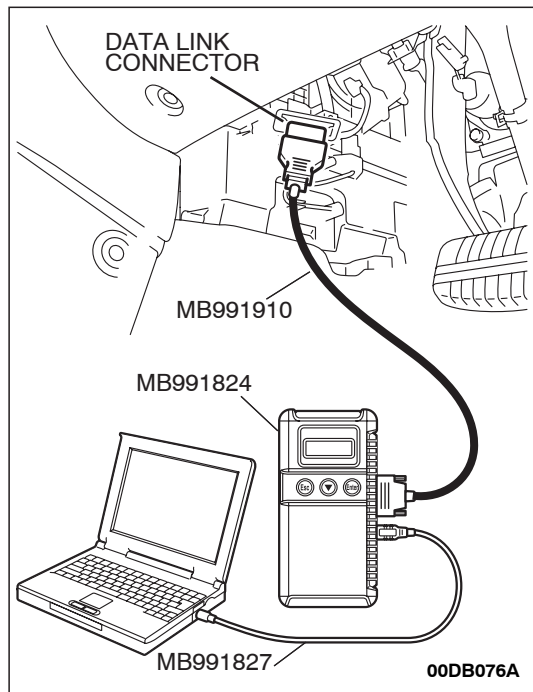


STEP 9. Check harness connector B-20 at ENGINE-ECU for damage.

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 diagnostic tool , check data list item AA: Mass Airflow Sensor.

CAUTION

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

- (1) Connect diagnostic tool to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set diagnostic tool to the data reading mode for item AA, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be approximately 4.7 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 – How to Cope with Intermittent Malfunctions [P.00-14](#).

NO : Then go to Step 11.

STEP 11. Test the EOBd drive cycle.

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

Q: Is DTC P0102 set?

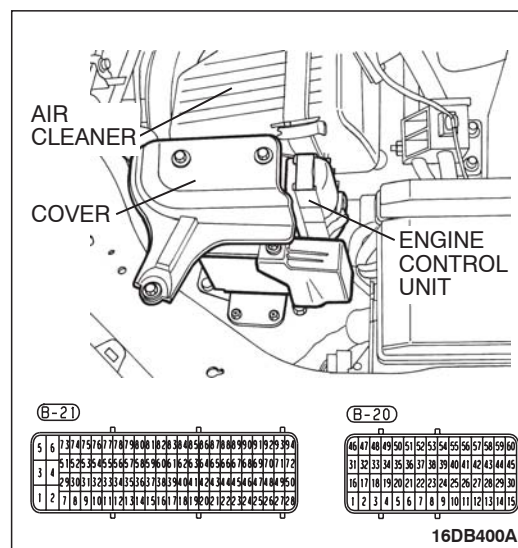
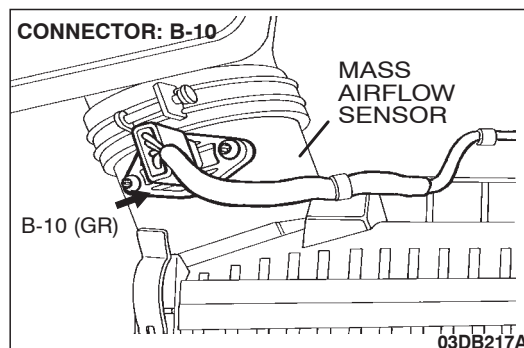
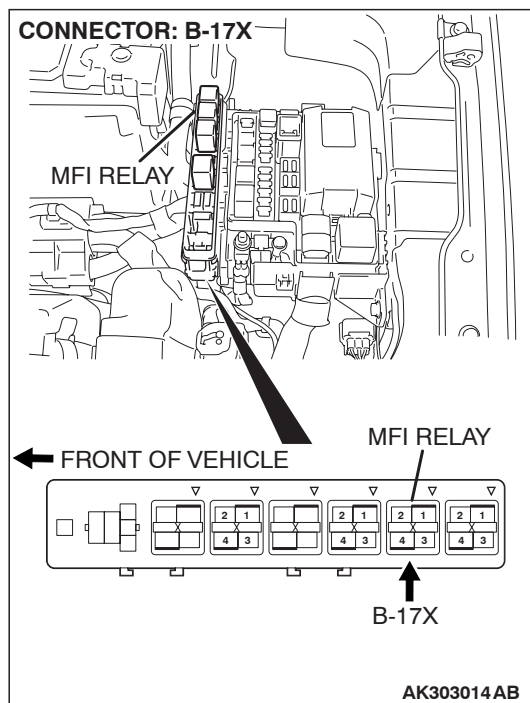
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0103: Mass Airflow Circuit High Input.

CAUTION

If DTC P0103 has been set, TCL related DTC U1120 is also set. After P0103 has been diagnosed, don't forget to erase DTC U1120.



CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MPI relay (terminal No. 4), and the ground is provided on the ENGINE-ECU (terminal No. 11).
- 5-volt power is applied to the mass airflow sensor output terminal (terminal No. 4) from the ENGINE-ECU (terminal No. 11).

TECHNICAL DESCRIPTION

- While the engine is running, the mass airflow sensor outputs voltage which corresponds to the mass airflow rate.
- The ENGINE-ECU checks whether the voltage output by the mass airflow sensor while the engine is running is within a specified speed and load range.

DTC SET CONDITIONS

Check Conditions

- Battery voltage is above 8.01 volts.

Crankshaft revolution is above 150 r/min.

Judgement Criteria

- Air flow sensor output is above upper threshold (40.9-903.0 kg/h) for 4 seconds.
- MIL is activated immediately.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

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

- Mass airflow sensor failed.
- Shorted mass airflow sensor, circuit, or connector damage.
- Refer to component locations GROUP-70
- Refer to configuration diagrams GROUP-80
- Refer to circuit diagrams GROUP-90

DIAGNOSIS**Required Special Tool:**

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

STEP 1. Using diagnostic tool , check data list item AA: Mass Airflow Sensor.**⚠ CAUTION**

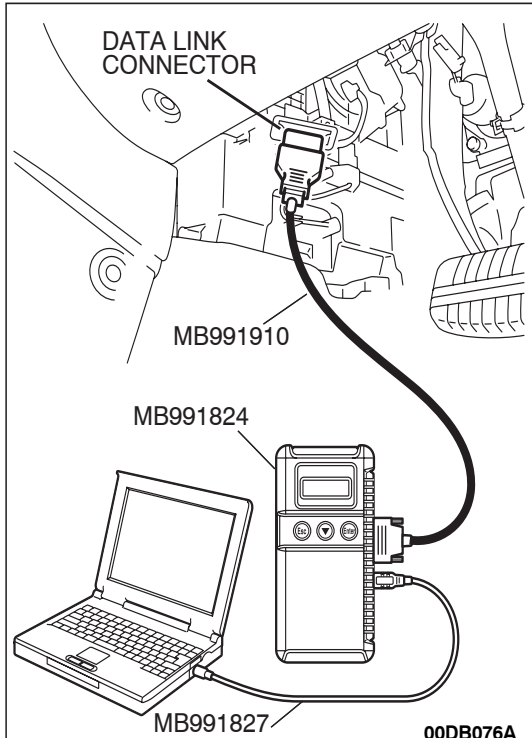
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

- (1) Connect diagnostic tool to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set diagnostic tool to the data reading mode for item AA, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be approximately 4.7 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 – How to Cope with Intermittent Malfunctions [P.00-14](#).

NO : Go to Step 2.

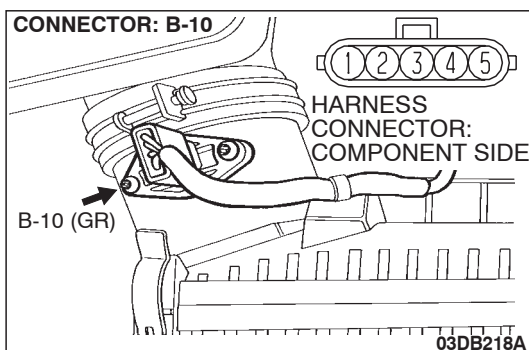


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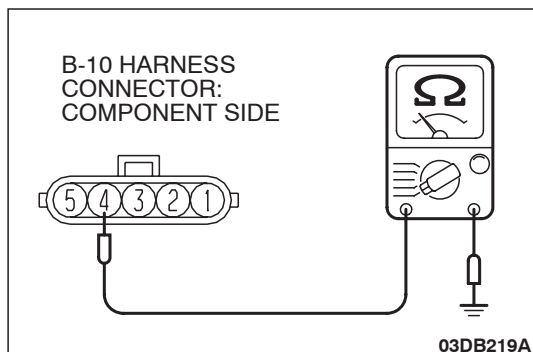
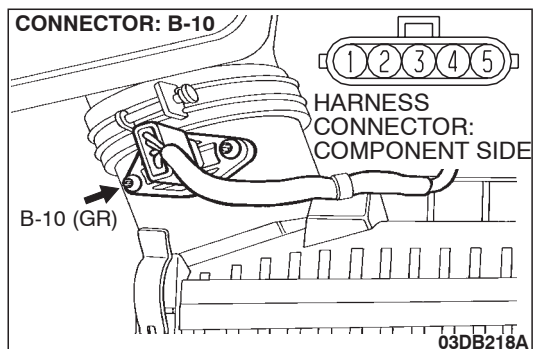
STEP 2. Check harness connector B-10 at mass airflow sensor for damage.**Q: Is the harness connector in good condition?**

YES : Go to Step 3.

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



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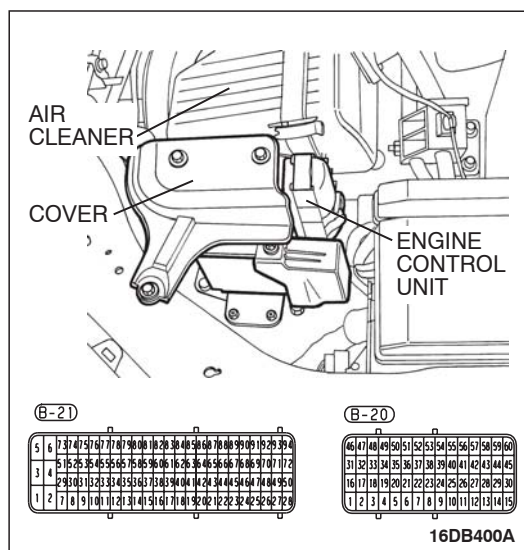
STEP 3. Check the continuity at mass airflow sensor harness side connector B-10.

- (1) Disconnect the connector B-10 and measure at the harness side.
- (2) Check for the continuity between terminal No. 3 and ground.
 - Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 6.

NO : Go to Step 4.



STEP 4. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

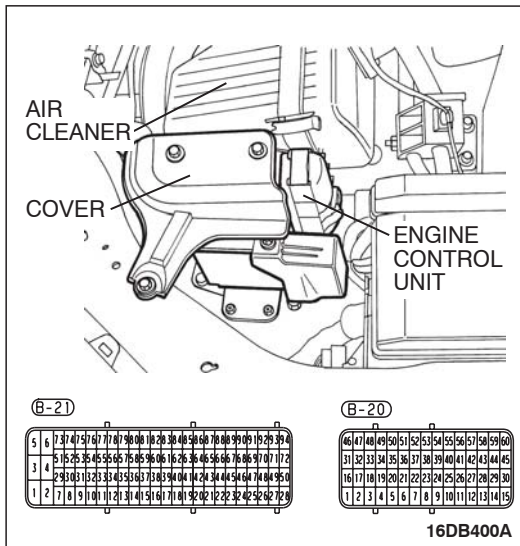
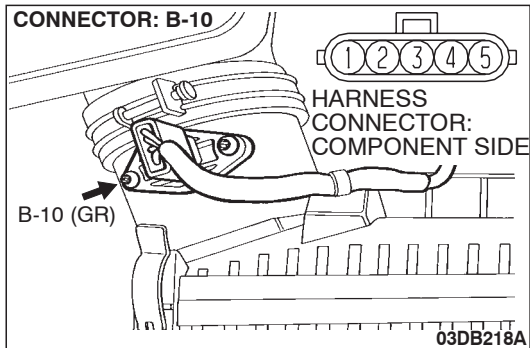
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 7.

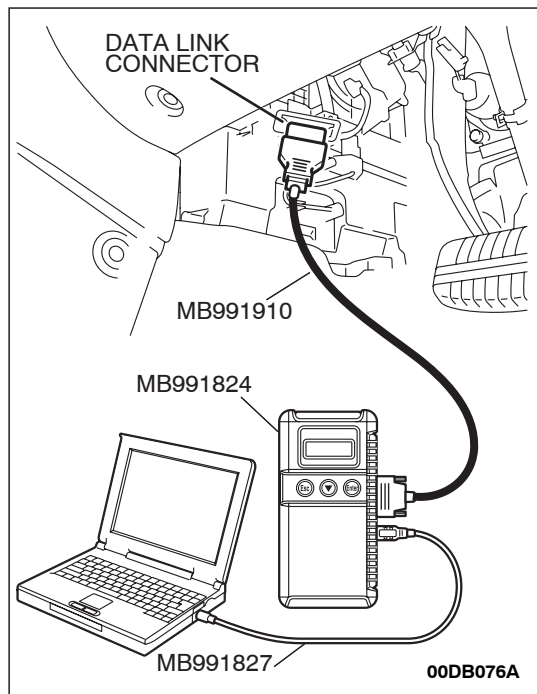
STEP 5. Check for short circuit between mass airflow sensor connector B-10 (terminal No. 3) and ENGINE-ECU connector B-20 (terminal No. 26).

Q: Is the harness wire in good condition?

YES : Go to Step 6.

NO : Repair it. Then go to Step 7.





STEP 6. Using diagnostic tool , check data list item AA: Mass Airflow Sensor.

⚠ CAUTION

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

- (1) Connect diagnostic tool to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set diagnostic tool to the data reading mode for item AA, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be approximately 4.7 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 – How to Cope with Intermittent Malfunctions [P.00-14](#).

NO : Replace the Mass Airflow Sensor. Then go to Step 7.

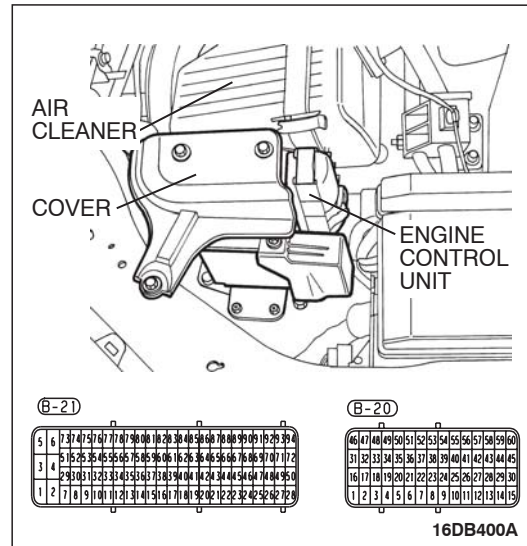
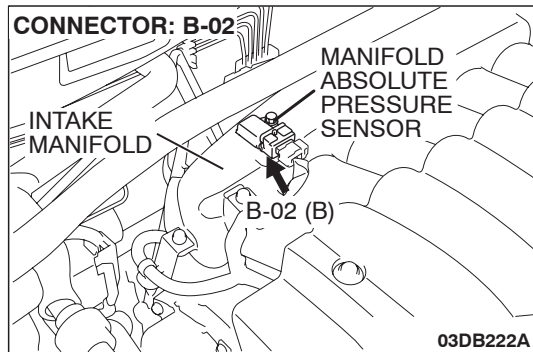
STEP 7. Test the EOBD drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).
- (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.**CIRCUIT OPERATION**

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the ENGINE-ECU (terminal No. 25). The ground terminal (terminal No. 2) is grounded with ENGINE-ECU (terminal No. 12).
- A voltage that is proportional to the intake manifold pressure is sent to the ENGINE-ECU (terminal No. 41) 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 ENGINE-ECU checks whether this voltage is within a specified range.

DTC SET CONDITIONS <Range/Performance problem>**Check Conditions**

- None

Judgement Criteria

- MAP sensor output is above upper threshold (223 - 1300 hPa) for 2 seconds.
or
MAP sensor output is below lower threshold (0 - 395 kg/h) for 2 seconds.
- MIL is activated after 2 Drive cycles.
- No limp home mode (backed-up by AFS).

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

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

- Manifold absolute pressure sensor failed.
- Harness damage.
- Connector damage.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

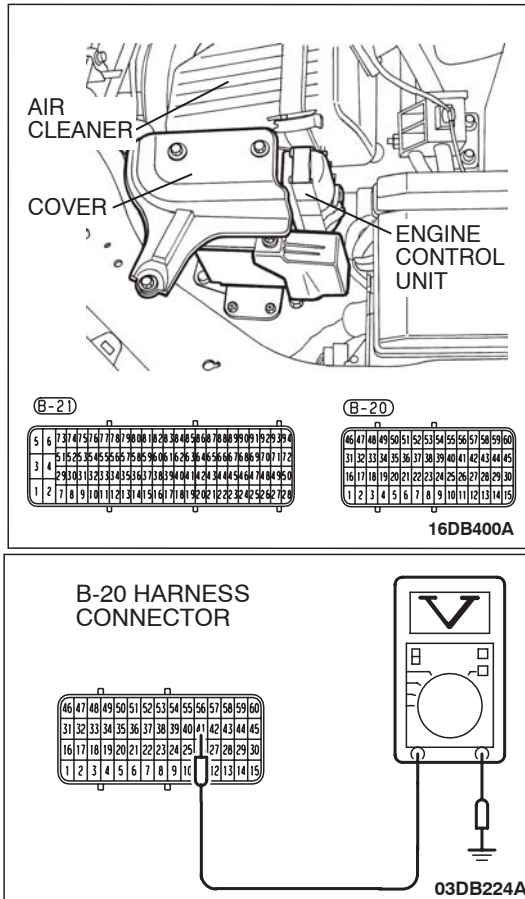
DIAGNOSIS

Required Special Tools:

- : Diagnostic Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ECU Check Harness

STEP 1. Measure the sensor output voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

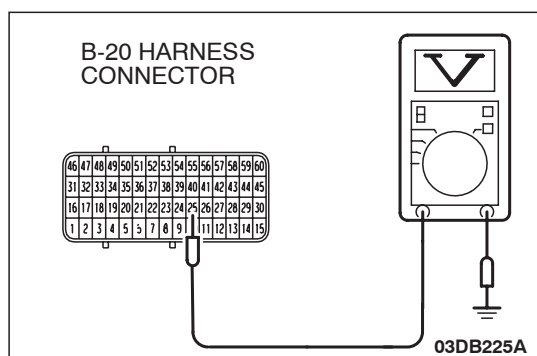
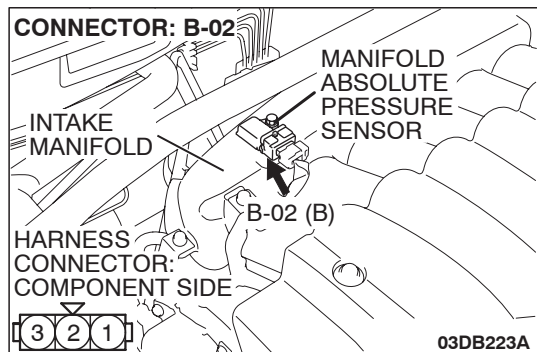
- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



- (3) Measure the voltage between terminal No. 41 of ENGINE-ECU check harness and ground.
 - When altitude is 0 m, voltage should be 4.01 to 4.15 volts.
 - When altitude is 600 m, voltage should be 3.76 to 3.92 volts.
 - When altitude is 1,200 m, voltage should be 3.45 to 3.62 volts.
 - When altitude is 1,800 m, voltage should be 3.2 to 3.3 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage correct?

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



STEP 2. Measure the sensor supply voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the sensor supply voltage between terminal No. 25 and ground.

- Voltage should be between 4.9 and 5.1 volts.

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

Q: Is the measured voltage between 4.9 and 5.1 volts?

YES : Go to Step 3.

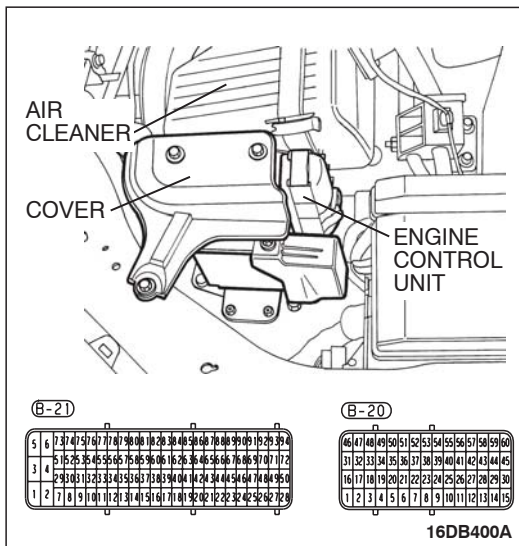
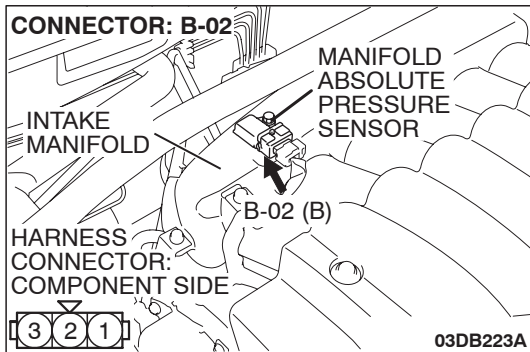
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.

STEP 3. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-20 at ENGINE-ECU 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 10.

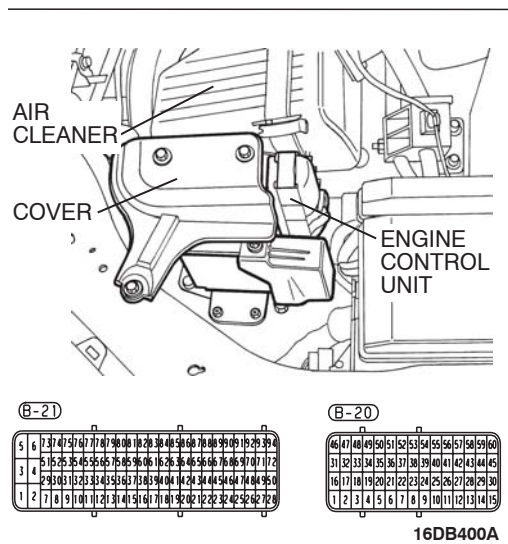
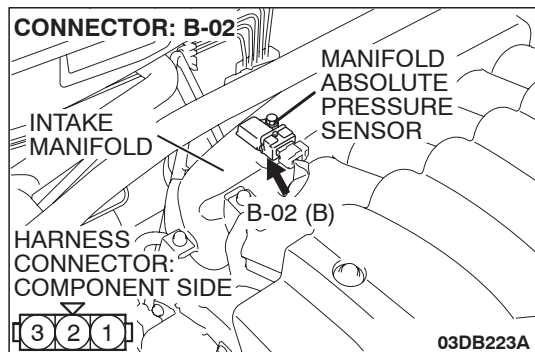


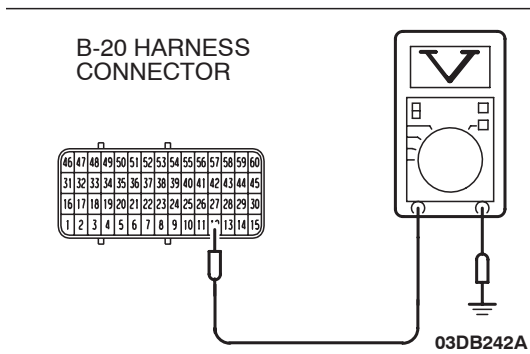
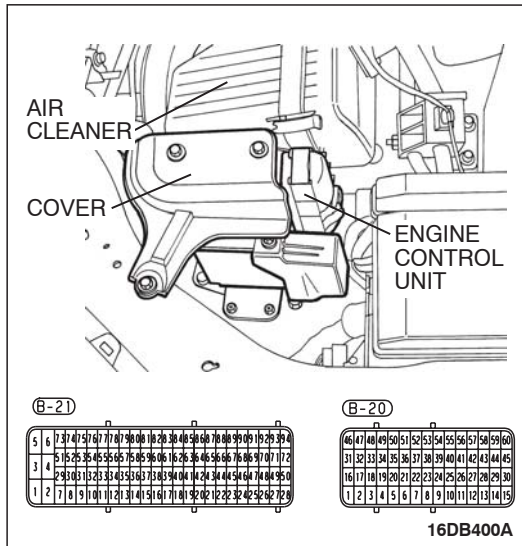
STEP 4. Check for harness damage between manifold absolute pressure sensor connector B-02 (terminal No. 3) and ENGINE-ECU connector B-20 (terminal No. 25).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 10.





STEP 5. Measure the ground voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

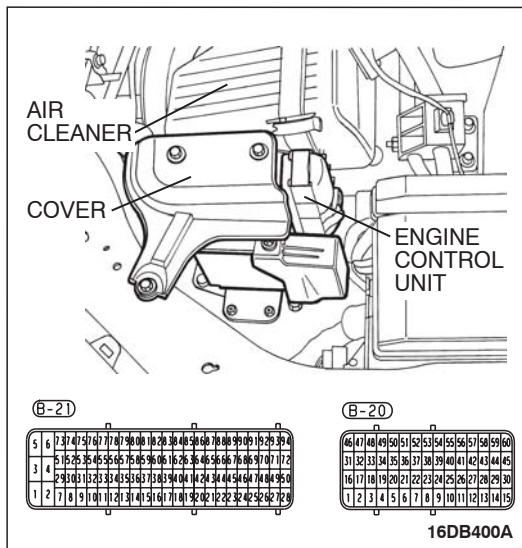
- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 12 and ground.
 - 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 8.

NO : Go to Step 6.

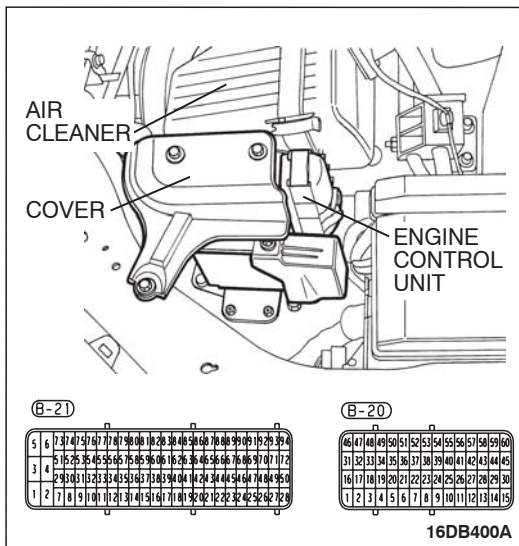
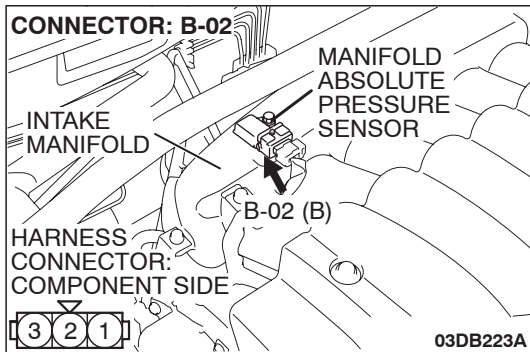


STEP 7. Check for harness damage between manifold absolute pressure sensor connector B-02 (terminal No. 2) and ENGINE-ECU connector B-20 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 9.

NO : Repair it. Then go to Step 10.

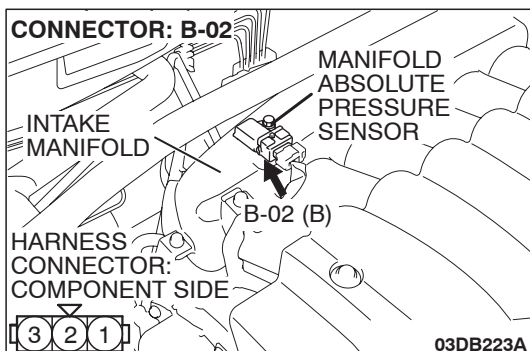


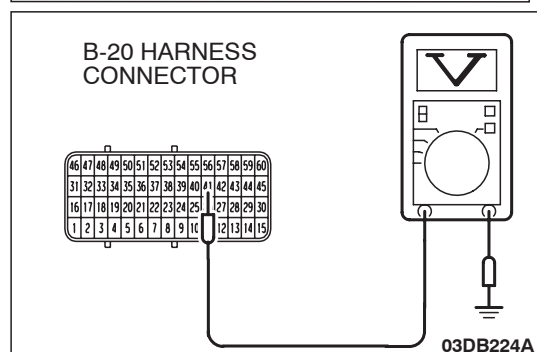
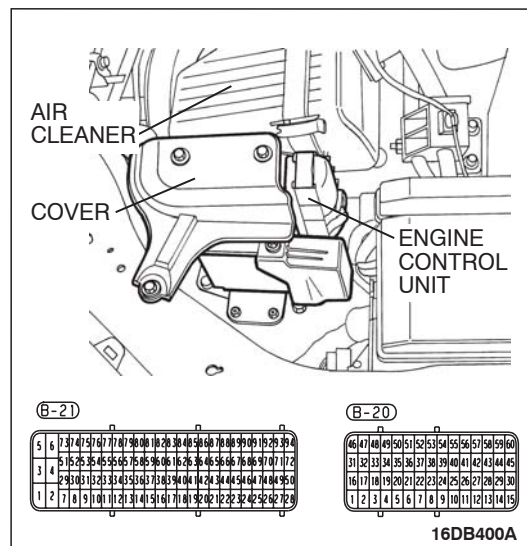
STEP 8. Check harness connector B-02 at manifold absolute pressure sensor for damage.

Q: Is the harness connector in good condition?

YES : Replace the manifold absolute pressure sensor. Then go to Step 10.

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





STEP 9. Measure the sensor output voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 41 of ENGINE-ECU check harness and ground.
 - When altitude is 0 m, voltage should be 4.01 to 4.15 volts.
 - When altitude is 600 m, voltage should be 3.76 to 3.92 volts.
 - When altitude is 1,200 m, voltage should be 3.45 to 3.62 volts.
 - When altitude is 1,800 m, voltage should be 3.2 to 3.3 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage correct?

YES : Go to Step 12.

NO : Repair harness wire between manifold absolute pressure sensor connector B-02 (terminal No. 1) and ENGINE-ECU connector B-20 (terminal No. 41) because of harness damage. Then go to Step 10.

STEP 10. Test the EOBD drive cycle.

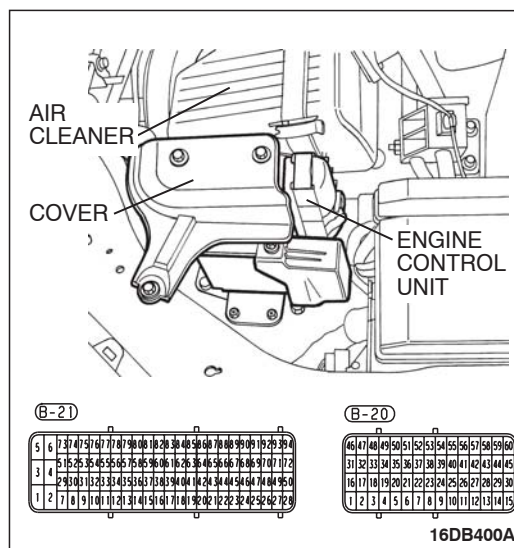
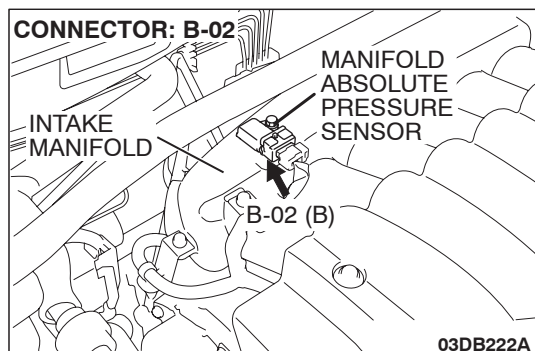
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0106 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0107: Manifold Absolute Pressure Circuit Low Input.



CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the ENGINE-ECU (terminal No. 25). The ground terminal (terminal No. 2) is grounded with ENGINE-ECU (terminal No. 12).
- A voltage that is proportional to the intake manifold pressure is sent to the ENGINE-ECU (terminal No. 41) from the manifold absolute pressure sensor output terminal (terminal No. 1).

DTC SET CONDITIONS

Check Conditions

- None

Judgement Criteria

- MAP sensor output voltage is below 0.2 V for 2 seconds.
- MIL is activated after 2 Drive cycles.
- No limp home mode (backed-up by AFS).

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

TECHNICAL DESCRIPTION

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

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.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

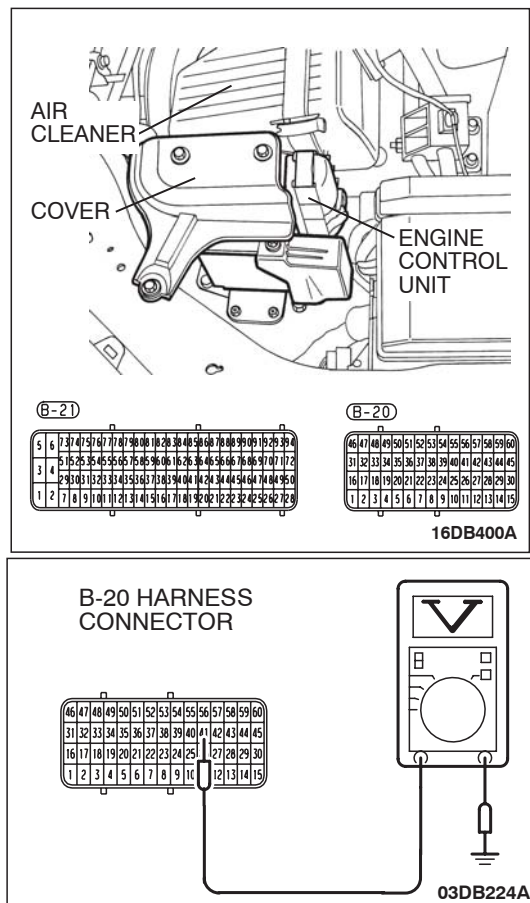
DIAGNOSIS

Required Special Tools:

- : Diagnostic Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ECU Check Harness

STEP 1. Measure the sensor output voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

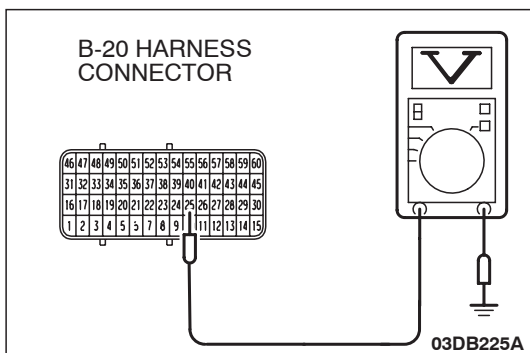
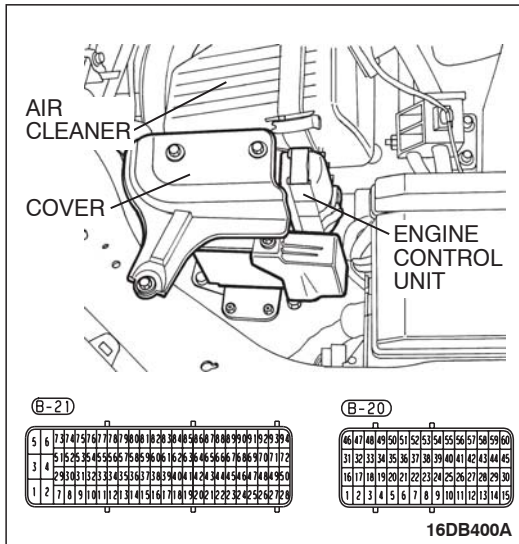


- (3) Measure the voltage between terminal No. 41 of ENGINE-ECU check harness and ground.
 - When altitude is 0 m, voltage should be 4.01 to 4.15 volts.
 - When altitude is 600 m, voltage should be 3.76 to 3.92 volts.
 - When altitude is 1,200 m, voltage should be 3.45 to 3.62 volts.
 - When altitude is 1,800 m, voltage should be 3.2 to 3.3 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage correct?

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

NO : Go to Step 2.



STEP 2. Measure the sensor supply voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the sensor supply voltage between terminal No. 25 and ground.
 - Voltage should be between 4.9 and 5.1 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.9 and 5.1 volts?

YES : Go to Step 8.

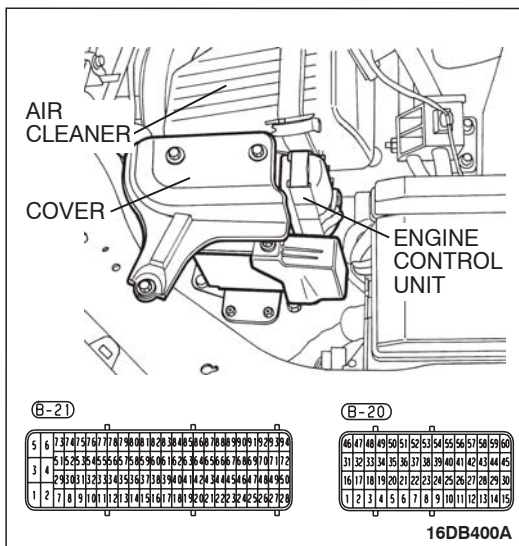
NO : Go to Step 3.

STEP 3. Check harness connector B-20 at ENGINE-ECU 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.

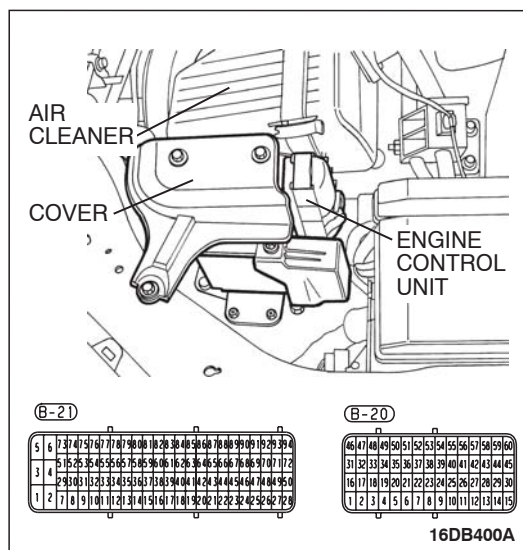
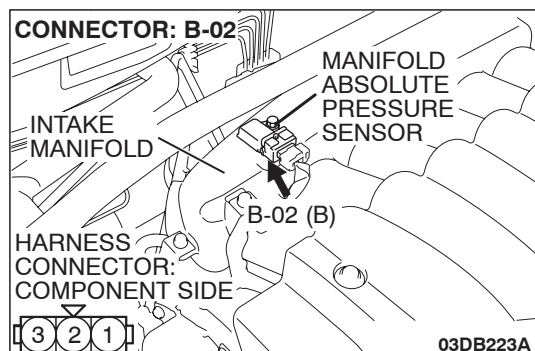


STEP 4. Check for short circuit to ground between manifold absolute pressure sensor connector B-02 (terminal No. 3) and ENGINE-ECU connector B-20 (terminal No. 25).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

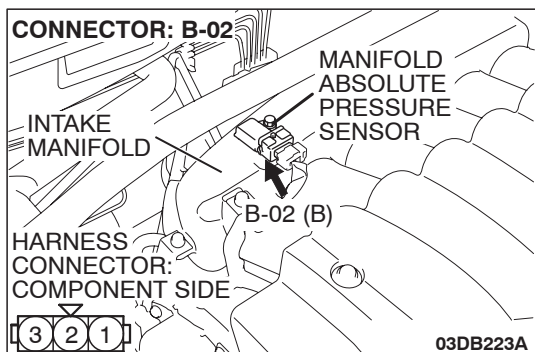


STEP 7. Check harness connector B-02 at the manifold absolute pressure sensor for damage.

Q: Is the connector in good condition?

YES : Repair harness wire between manifold absolute pressure sensor connector B-02 (terminal No. 3) and ENGINE-ECU connector B-20 (terminal No. 25) because of open circuit. Then go to Step 12.

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

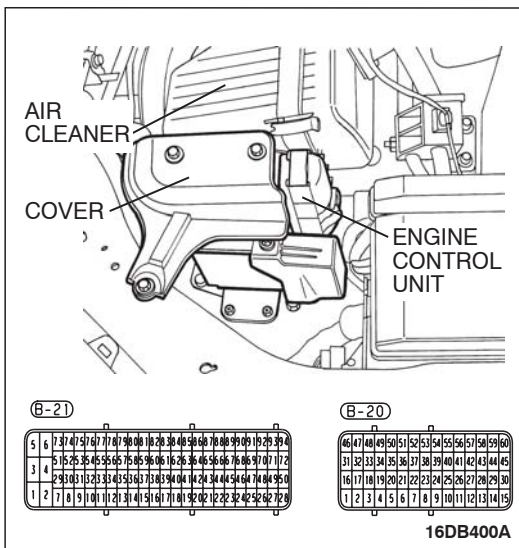
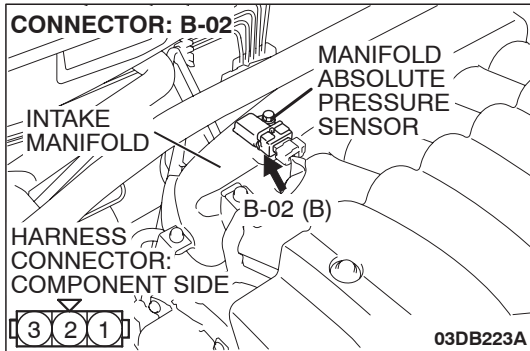


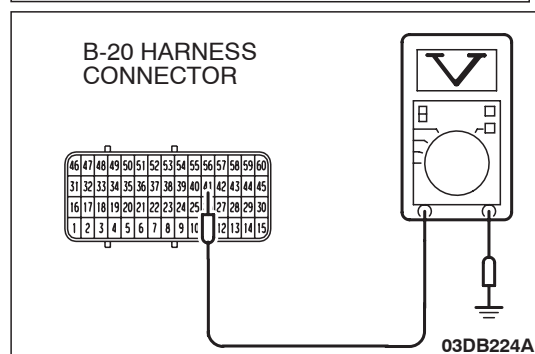
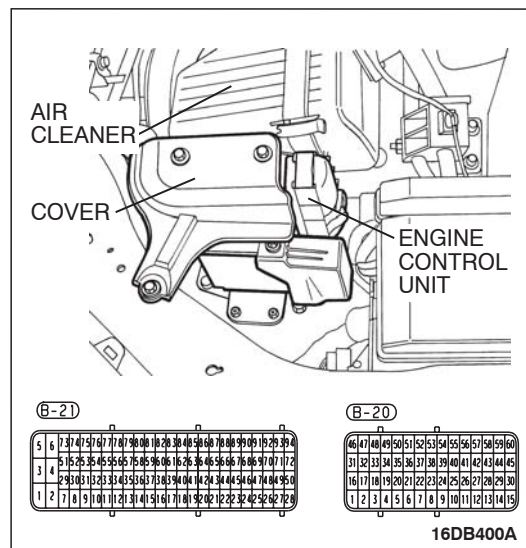
STEP 8. Check harness connector B-02 at the manifold absolute pressure sensor and connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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





STEP 9. Measure the sensor output voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

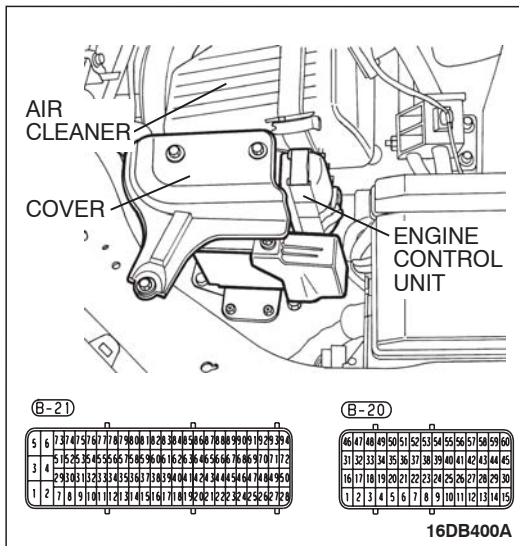
- (3) Measure the voltage between terminal No. 41 of ENGINE-ECU check harness and ground.
 - When altitude is 0 m, voltage should be 4.01 to 4.15 volts.
 - When altitude is 600 m, voltage should be 3.76 to 3.92 volts.
 - When altitude is 1,200 m, voltage should be 3.45 to 3.62 volts.
 - When altitude is 1,800 m, voltage should be 3.2 to 3.3 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

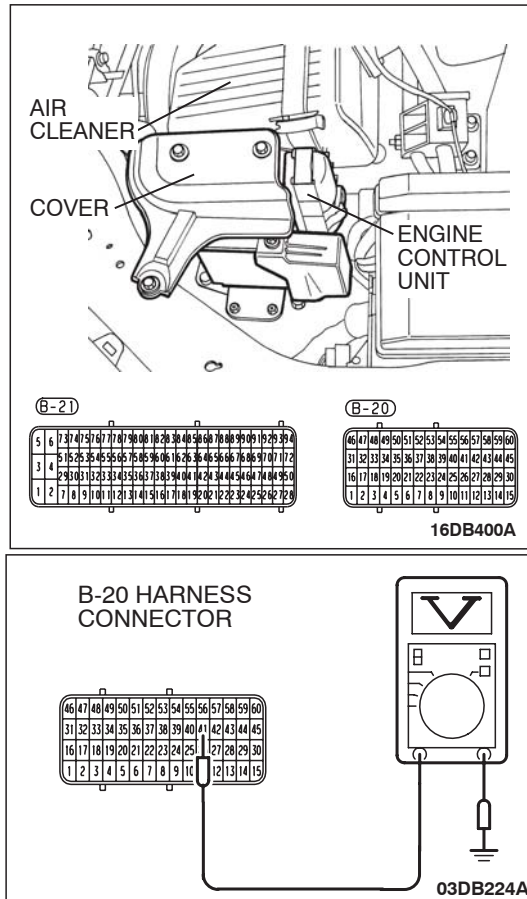
Q: Is the measured voltage correct?

YES : Go to Step 11.

NO : Go to Step 10.

NO : Repair it. Then go to Step 12.





STEP 9. Measure the sensor output voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

(1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.

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

(3) Measure the voltage between terminal No. 41 of ENGINE-ECU check harness and ground.

- When altitude is 0 m, voltage should be 4.01 to 4.15 volts.
- When altitude is 600 m, voltage should be 3.76 to 3.92 volts.
- When altitude is 1,200 m, voltage should be 3.45 to 3.62 volts.
- When altitude is 1,800 m, voltage should be 3.2 to 3.3 volts.

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

Q: Is the measured voltage correct?

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

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

STEP 12. Test the EOBD drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

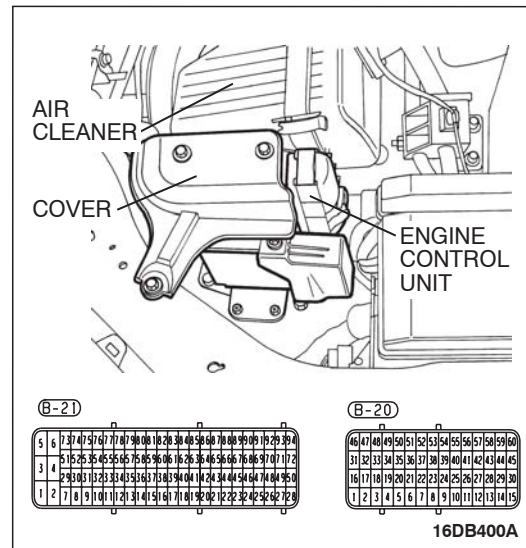
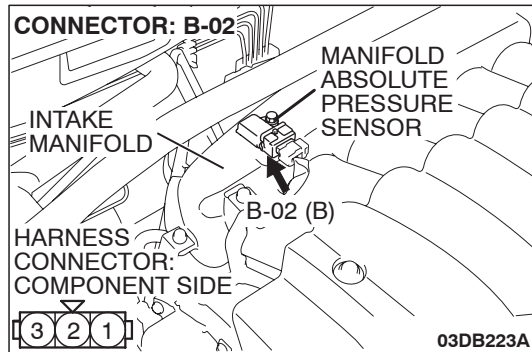
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0107 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0108: Manifold Absolute Pressure Circuit High Input.



CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from ENGINE-ECU (terminal No. 25). The ground terminal (terminal No. 2) is grounded with ENGINE-ECU (terminal No. 12).
- A voltage that is proportional to the intake manifold pressure is sent to the ENGINE-ECU (terminal No. 41) 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 ENGINE-ECU checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- None

Judgement Criteria

- MAP sensor output voltage is above 4.88 V for 2 seconds.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

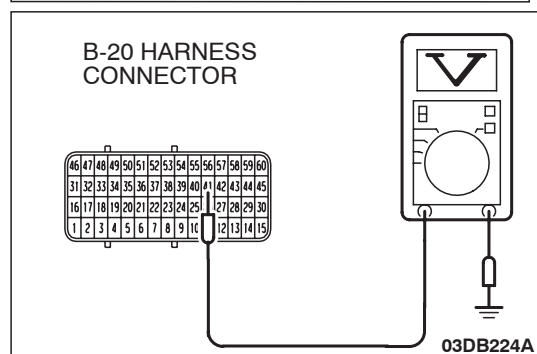
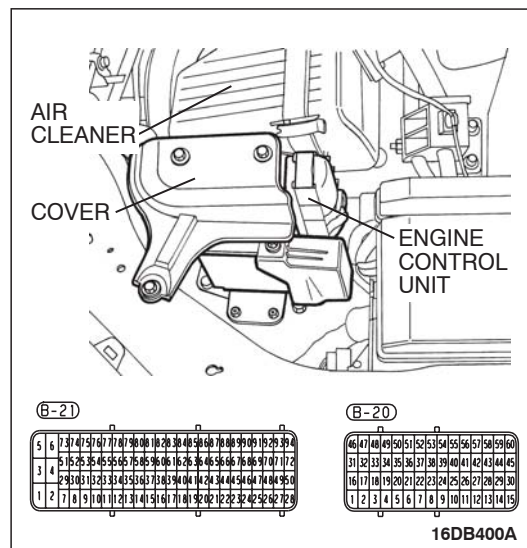
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)
- Manifold absolute pressure sensor failed.
- Open manifold absolute pressure sensor circuit, or connector damage.
- ENGINE-ECU failed.

DIAGNOSIS

Required Special Tools:

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



STEP 1. Measure the sensor output voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

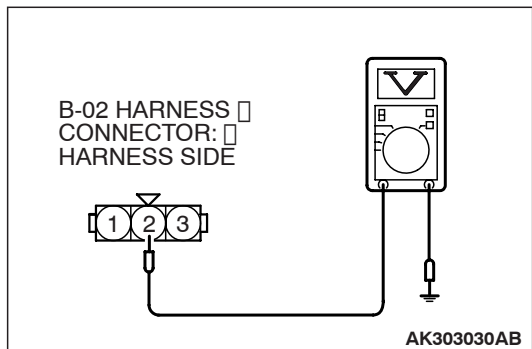
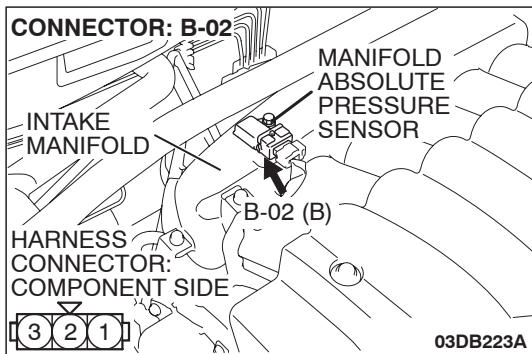
- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure and record the voltage between terminal No. 41 of ENGINE-ECU check harness and ground.
 - When altitude is 0 m, voltage should be 4.01 to 4.15 volts.
 - When altitude is 600 m, voltage should be 3.76 to 3.92 volts.
 - When altitude is 1,200 m, voltage should be 3.45 to 3.62 volts.
 - When altitude is 1,800 m, voltage should be 3.2 to 3.3 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage correct?

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

NO : Go to Step 2.



STEP 2. Measure the ground voltage at manifold absolute pressure sensor connector B-02 by backprobing.

- (1) Do not disconnect the connector B-02.
- (2) Turn the ignition switch to the "ON" position.

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

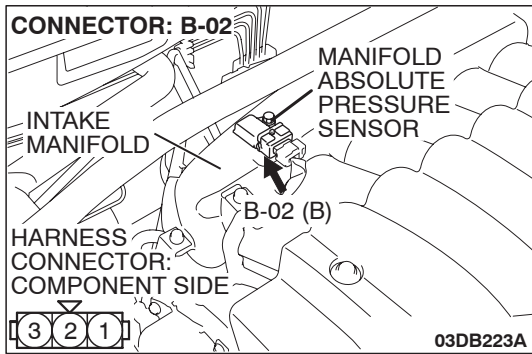
- Voltage should be 0.5 volt or less.

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

Q: Is the measured voltage 0.5 volt or less?

YES : Go to Step 6.

NO : Go to Step 3.

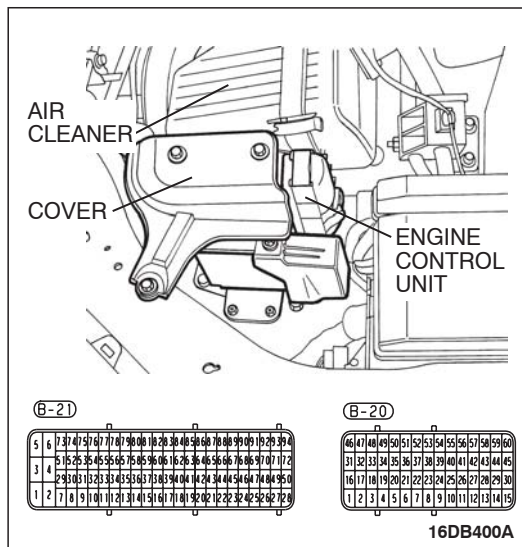


STEP 3. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

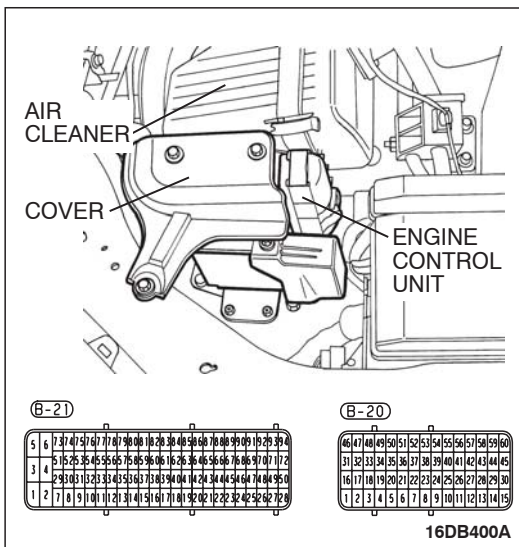
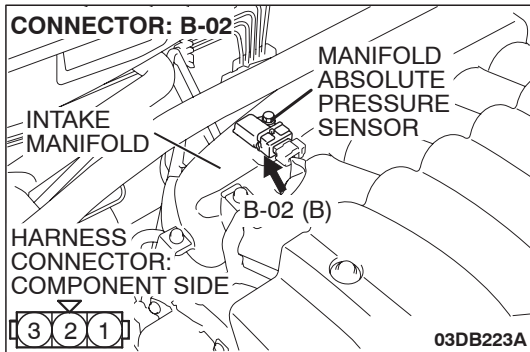


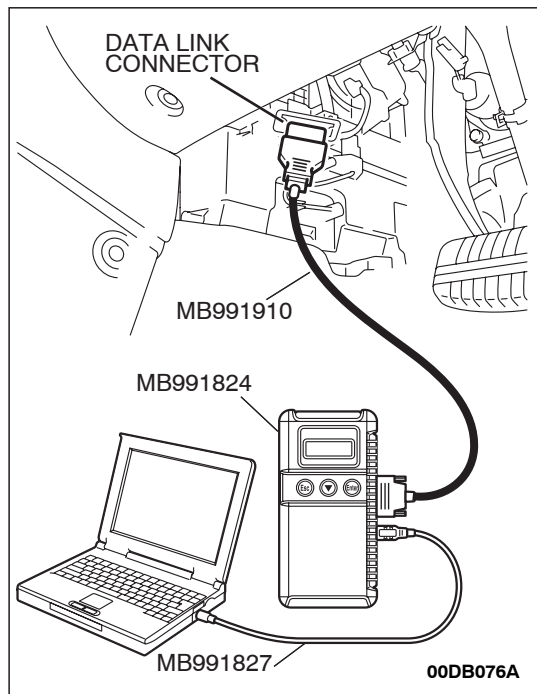
STEP 4. Check for open circuit between manifold absolute pressure sensor connector B-02 (terminal No. 2) and ENGINE-ECU connector B-20 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 7.

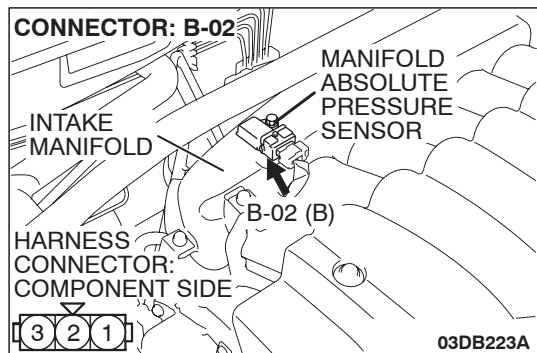


**STEP 5. Refer to data checked in Step 1.**

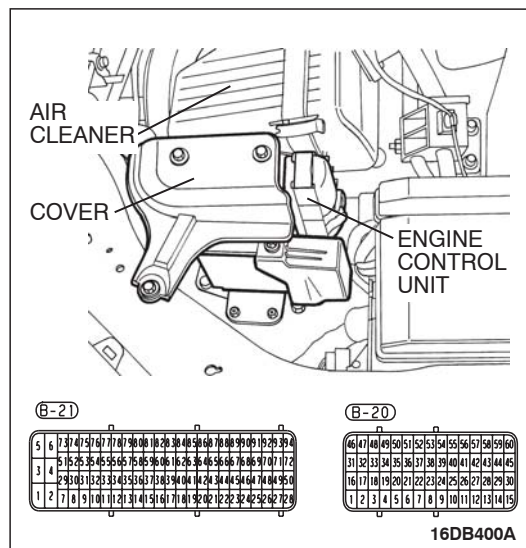
(1) Use the data recorded during Step 1 of diagnosis flow.

Q: Is the sensor operating properly?

- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).
- NO :** Replace the ENGINE-ECU. Then go to Step 7.

**STEP 6. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-20 at ENGINE-ECU for damage.****Q: Is the harness connector in good condition?**

- YES :** Replace the manifold absolute pressure sensor. Then go to Step 7.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 7.



STEP 7. Test the EOBD drive cycle.

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

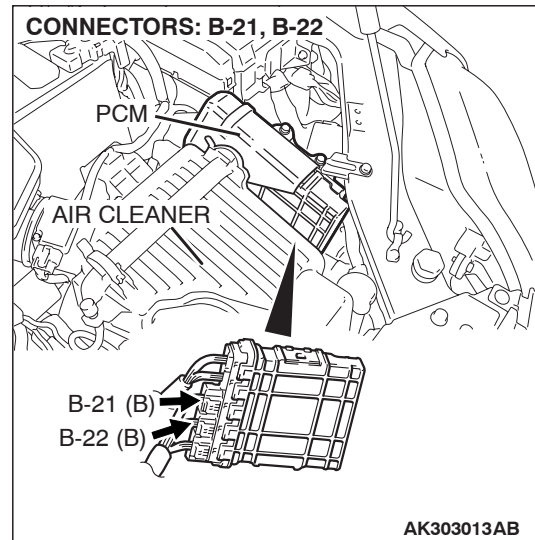
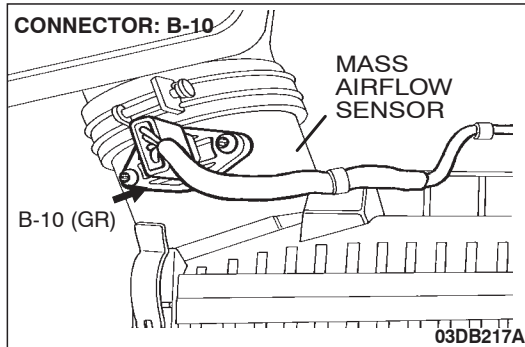
Q: Is DTC P0108 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0112: Intake Air Temperature Circuit Low Input.**CAUTION**

If DTC P0112 has been set, TCL related DTC U1120 is also set. After P0112 has been diagnosed, don't forget to erase DTC U1120.

**CIRCUIT OPERATION**

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ENGINE-ECU (terminal No. 58) via the resistor in the ENGINE-ECU. The ground terminal (terminal No. 3) is grounded with ENGINE-ECU (terminal No. 26).
- 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 is contained within the Mass Airflow Sensor assembly and converts the intake air temperature to a voltage.
- The ENGINE-ECU checks whether this voltage is within a specified range.

DTC SET CONDITIONS**Check Conditions**

- None

Judgement Criteria

- Intake air temperature is below -38.3 degreeC for 2 seconds.
- MIL is activated after 2 Drive cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

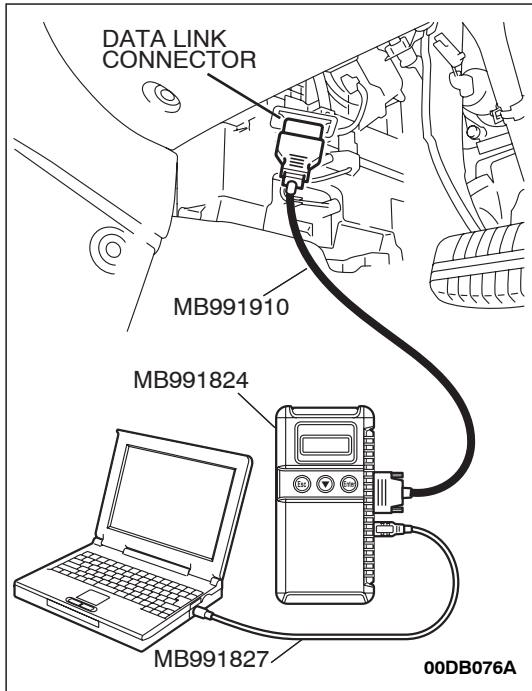
Refer to Diagnostic Function – EOBD Drive Cycle –
[P.13A-11](#).

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.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS**Required Special Tool:**

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



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

⚠ CAUTION

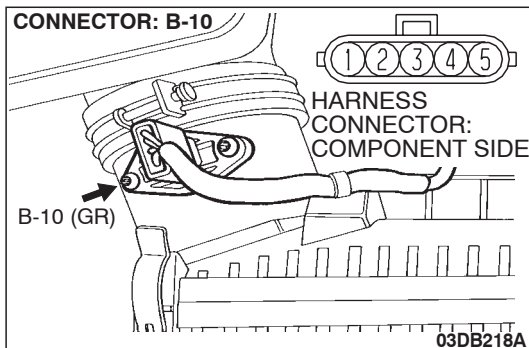
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

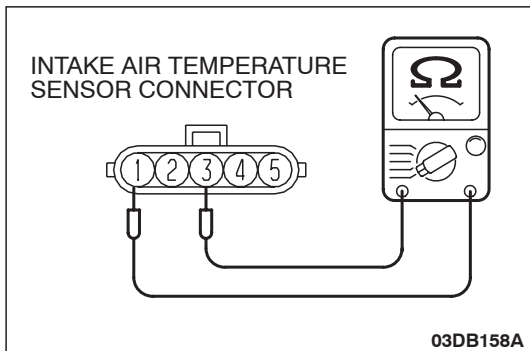
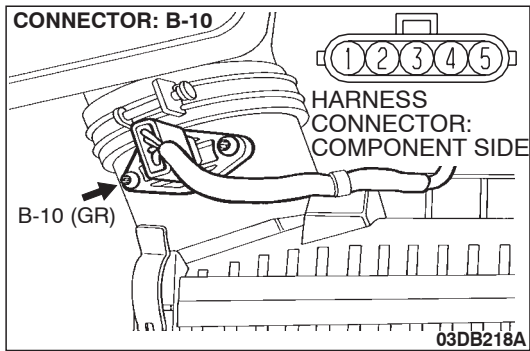


STEP 2. Check harness connector B-10 at the intake air temperature sensor for damage.

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-10.

- (2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 3.
- There should be continuity. (0.30 – 16 kΩ)

Q: Is the measured resistance between 0.30 and 16 kΩ?

YES : Go to Step 4.

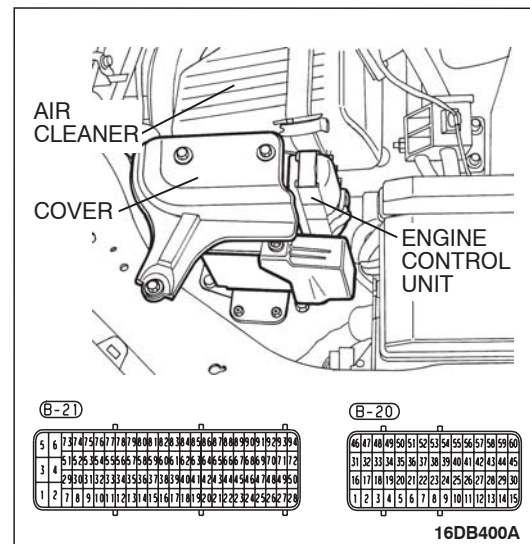
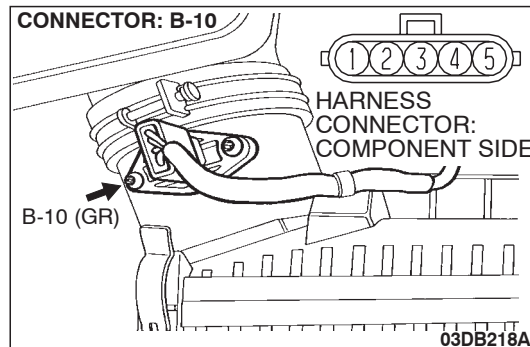
NO : Replace the Mass Airflow Sensor assembly. Then go to Step 6.

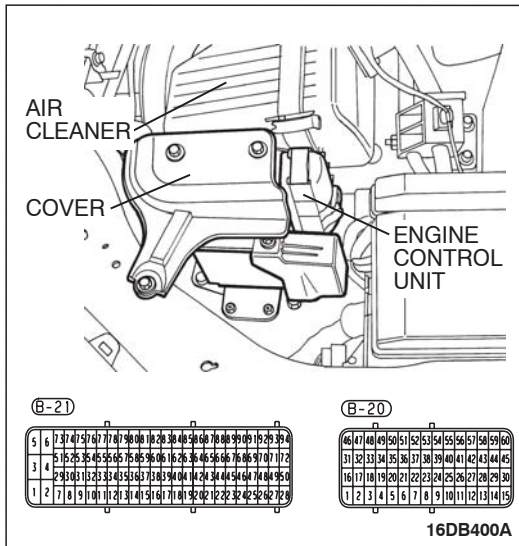
STEP 4. Check for short circuit to ground between intake air temperature sensor connector B-10 (terminal No. 1) and ENGINE-ECU connector B-20 (terminal No. 58).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 6.





STEP 5. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : 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 EOBD drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

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

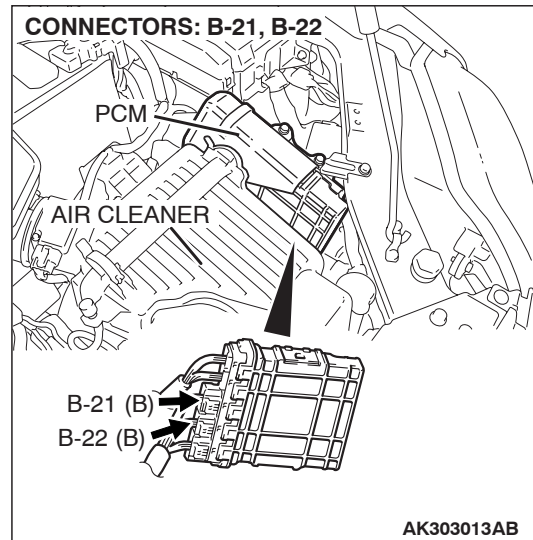
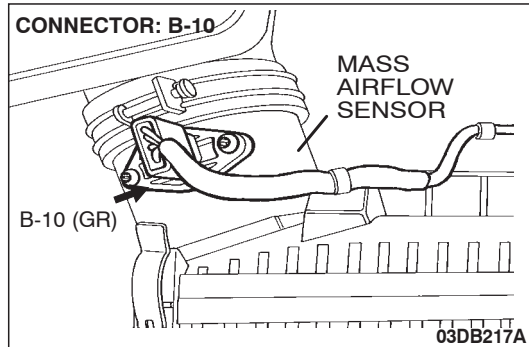
Q: Is DTC P0112 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0113: Intake Air Temperature Circuit High Input.**CAUTION**

If DTC P0113 has been set, TCL related DTC U1120 is also set. After P0113 has been diagnosed, don't forget to erase DTC U1120.

**CIRCUIT OPERATION**

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ENGINE-ECU (terminal No. 58) via the resistor in the ENGINE-ECU. The ground terminal (terminal No. 3) is grounded with ENGINE-ECU (terminal No. 26).
- 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 is contained within the Mass Airflow Sensor assembly and converts the intake air temperature to a voltage.
- The ENGINE-ECU checks whether this voltage is within a specified range.

DTC SET CONDITIONS**Check Conditions**

- None.

Judgement Criteria

- Intake air temperature is above 135 degreeC for 2 seconds.
- MIL is activated after 2 Drive cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

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.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS**Required Special Tools:**

- : Diagnostic Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ECU Check Harness

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

⚠ CAUTION

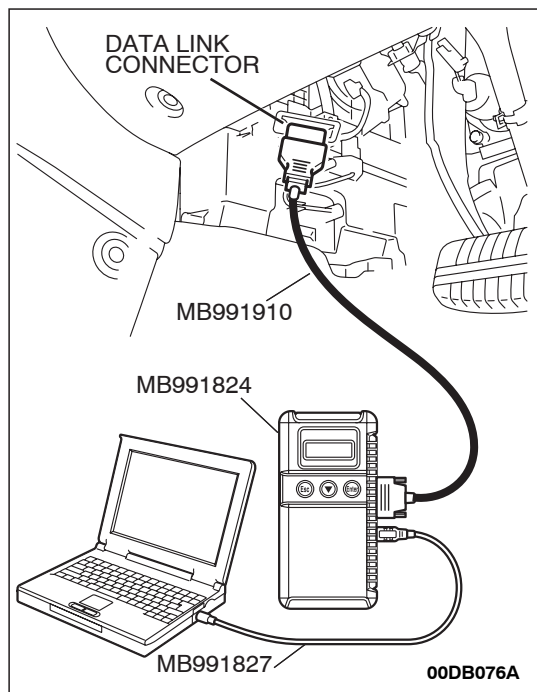
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

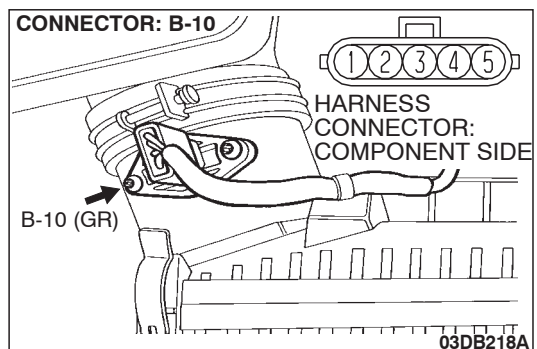


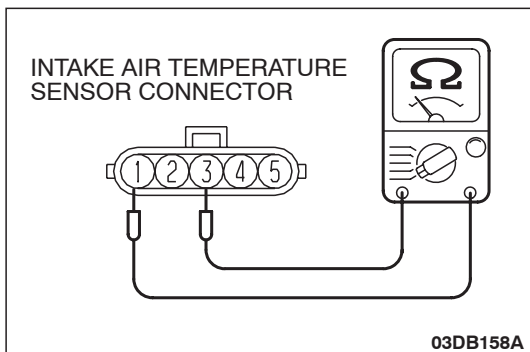
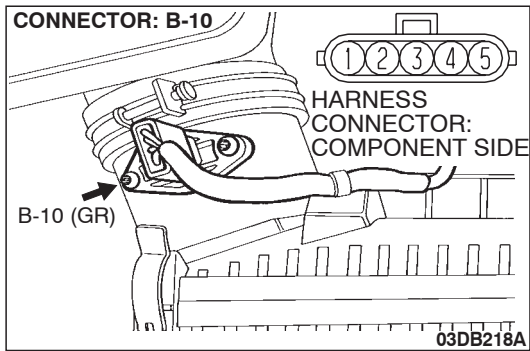
STEP 2. Check harness connector B-10 at the intake air temperature sensor for damage.

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.**

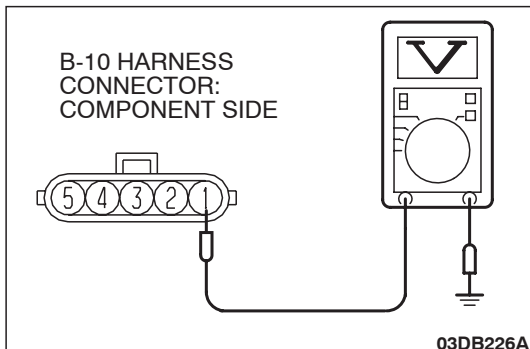
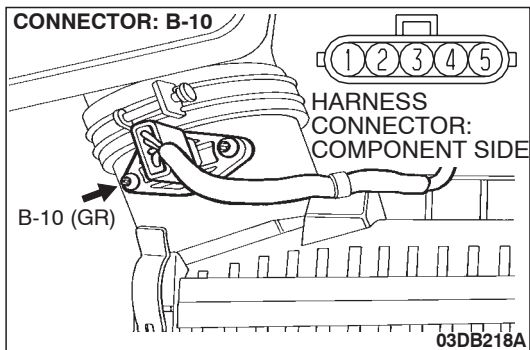
- (1) Disconnect the intake air temperature sensor connector B-10.

- (2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 3.
- There should be continuity. (300Ω – $16\text{ k}\Omega$)

Q: Is the measured resistance between 300Ω and $16\text{ k}\Omega$?

YES : Go to Step 4.

NO : Replace the Mass Airflow Sensor assembly. Then go to Step 11.

**STEP 4. Measure the sensor supply voltage at intake air temperature sensor harness side connector B-10.**

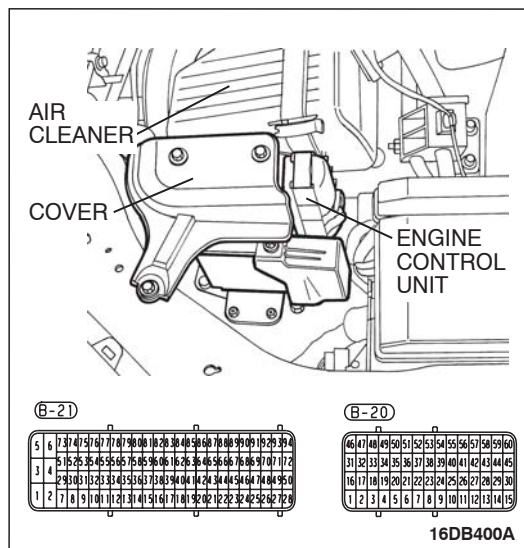
- (1) Disconnect the connector B-10 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

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

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

YES : Go to Step 8.

NO : Go to Step 5.



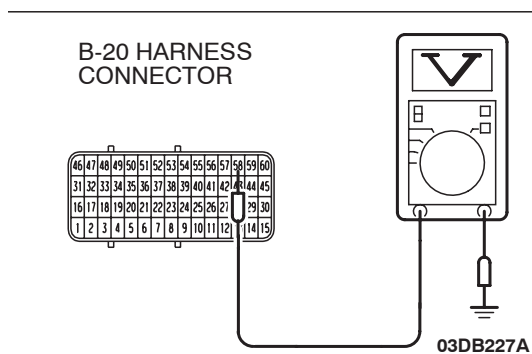
STEP 5. Measure the sensor supply voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Disconnect the intake air temperature sensor connector B-10.
- (3) Turn the ignition switch to the "ON" position.
- (4) Measure the voltage between terminal No. 58 and ground.
 - Voltage should be between 4.5 and 4.9 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 6.

NO : Go to Step 7.

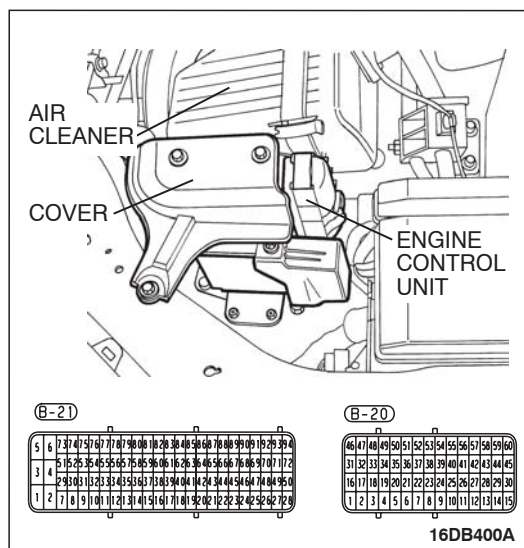


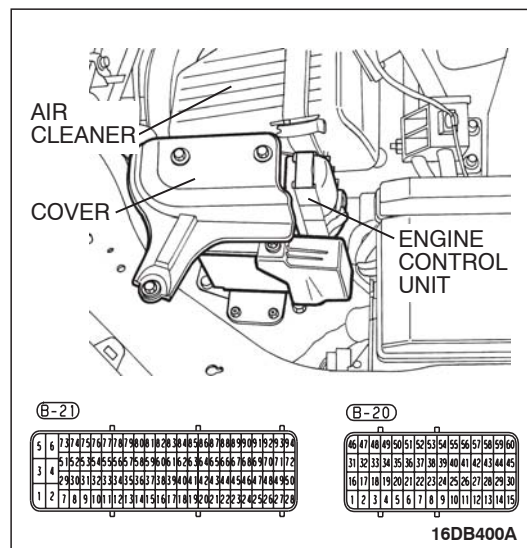
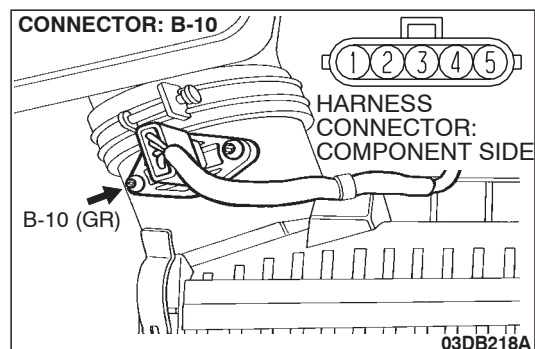
STEP 6. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

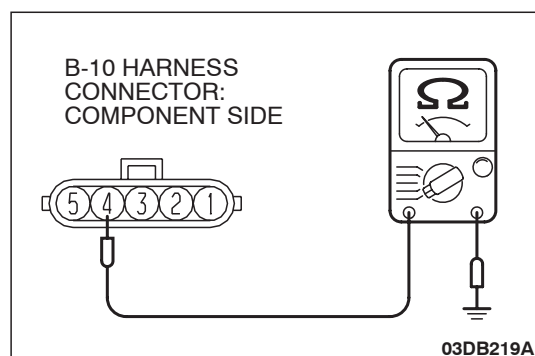
YES : Repair harness wire between intake air temperature sensor connector B-10 (terminal No. 1) and ENGINE-ECU connector B-20 (terminal No. 58) because of open circuit. Then go to Step 11.

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 B-20 at ENGINE-ECU for damage.****Q: Is the harness connector in good condition?****YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to UseTroubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).**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-10.**

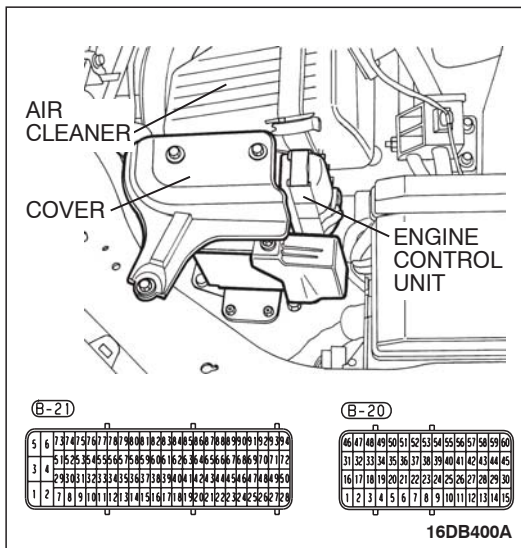
(1) Disconnect the connector B-10 and measure at the harness side.



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

- Should be less than 2 ohms.

Q: Does continuity exist?**YES :** Then go to Step 11.**NO :** Go to Step 9.

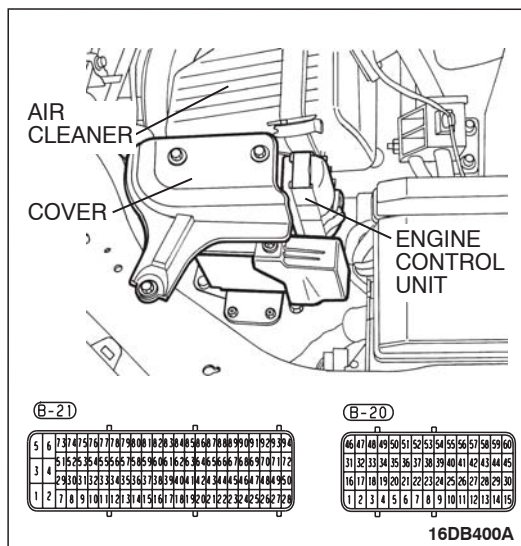
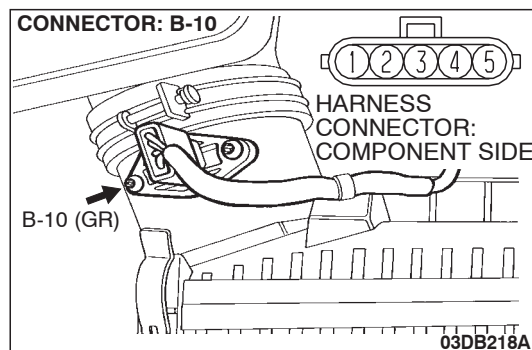


STEP 9. Check harness connector B-20 at ENGINE-ECU for damage.

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 11. Test the EOBD drive cycle.

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

Q: Is DTC P0113 set?

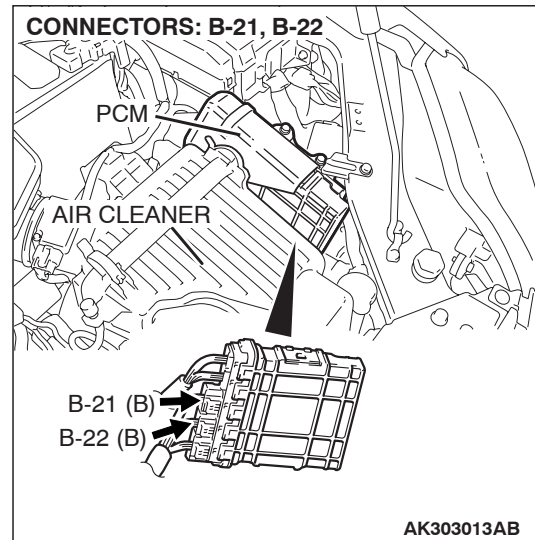
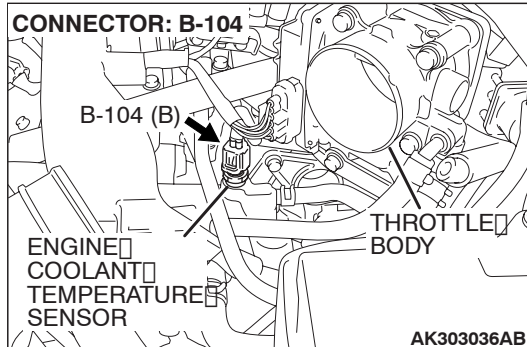
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0116: Engine Coolant Temperature Circuit Range/Performance Problem.

⚠ CAUTION

If DTC P0116 has been set, TCL related DTC U1120 is also set. After P0116 has been diagnosed, don't forget to erase DTC U1120.



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ENGINE-ECU (terminal No. 56) via the resistor in the ENGINE-ECU. The ground terminal (terminal No. 2) is grounded with ENGINE-ECU (terminal No. 12).
- 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 resistor 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 ENGINE-ECU checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- Air mass flow.

Judgement Criteria

- Difference between real engine temperature and model temperature.
- MIL is activated after 2 Drive cycles.
- No limp home mode.

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

- Engine coolant temperature sensor failed.
- Harness damage or connector damage.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

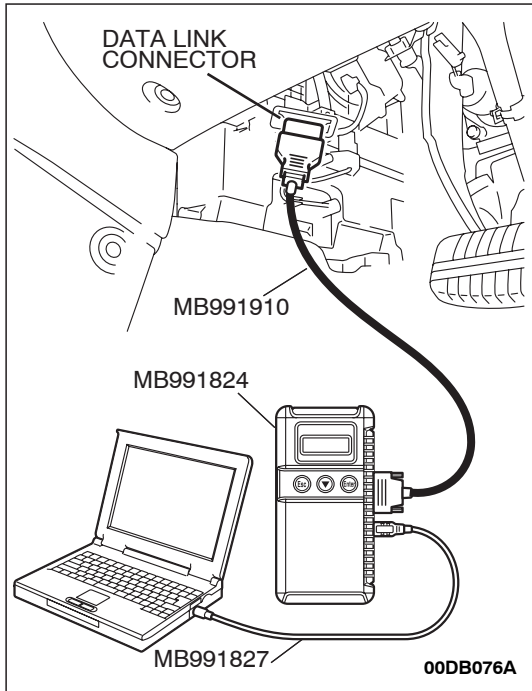
EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function–EOBD Drive Cycle–[P.13A-11](#).

DIAGNOSIS

Required Special Tools:

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



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

⚠ CAUTION

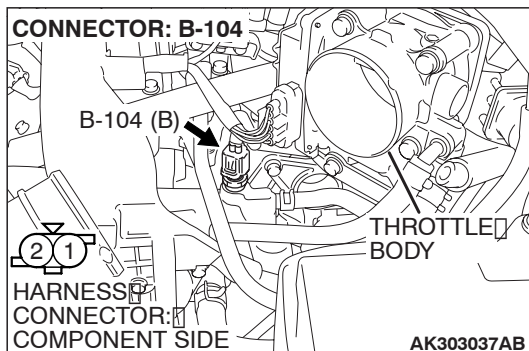
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.



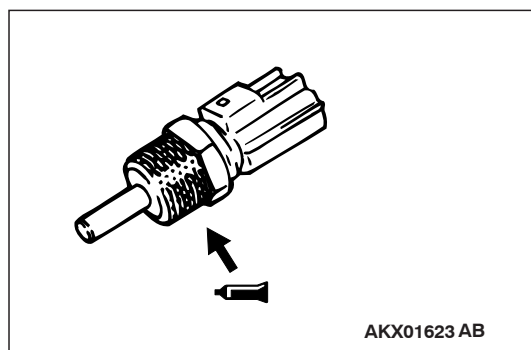
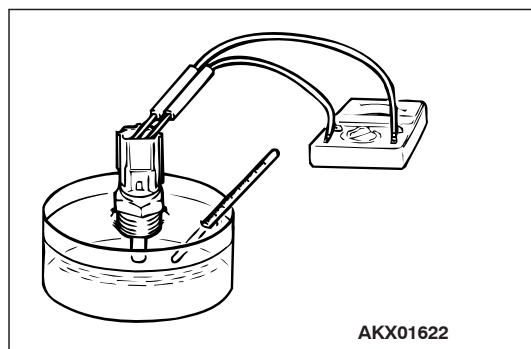
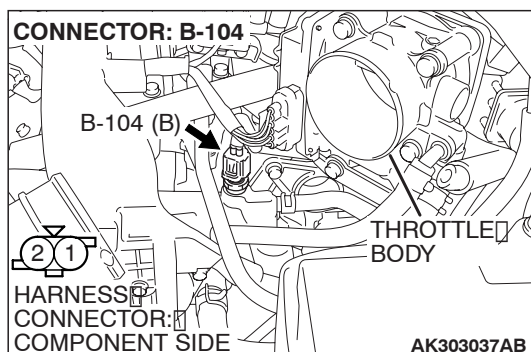
STEP 2. Check the engine coolant temperature sensor(On Car).

- (1) Ensure engine coolant temperature is between 20° C and below 100° C.
- (2) Disconnect the engine coolant temperature sensor connector B-104.
- (3) Check the resistance between terminal No. 1 & No. 2 of the sensor.

Q: Is the measured resistance between 186Ω and 2.4 kΩ?

YES : Go to Step 3.

NO : Replace the sensor and go to Step 10.



STEP 3. Check the engine coolant temperature sensor(Off Car).

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

⚠ WARNING

Ensure cooling system pressure is released at radiator cap slowly, prior to removing sensor to avoid getting burned by hot coolant.

- (3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, measure resistance. Refer to Service Specifications [13A-677](#)

- (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: 21 ± 3 N·m

Q: Is the measured resistance normal?

YES : Go to Step 4.

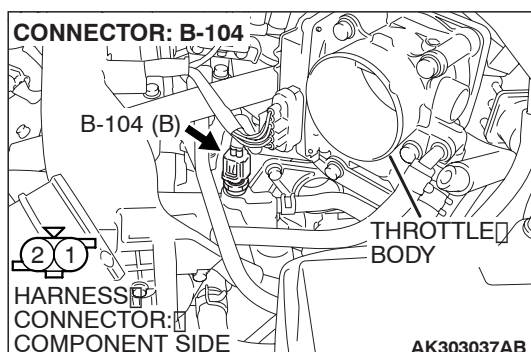
NO : Go to Step 6.

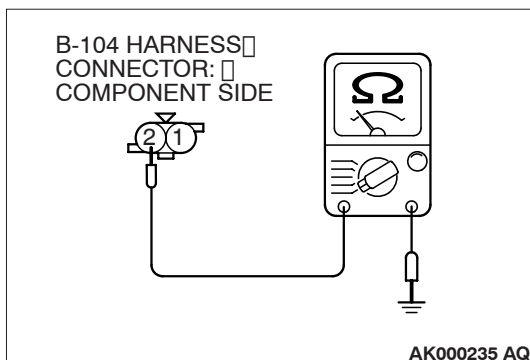
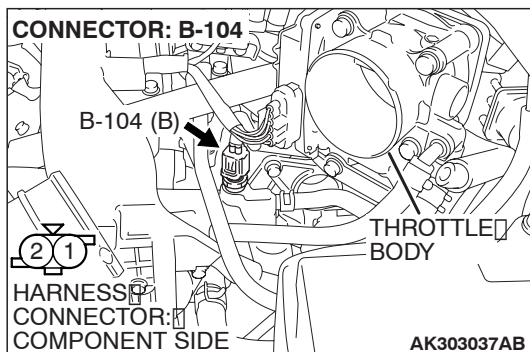
STEP 4. Check harness connector B-104 at the engine coolant temperature sensor for damage.

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 11.





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

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

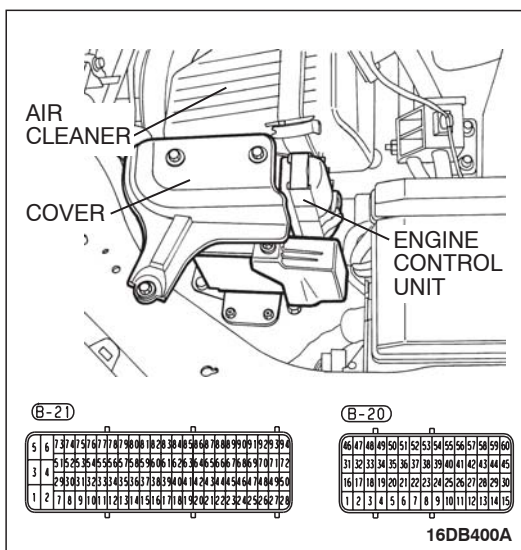
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 8.

NO : Go to Step 6.



STEP 6. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

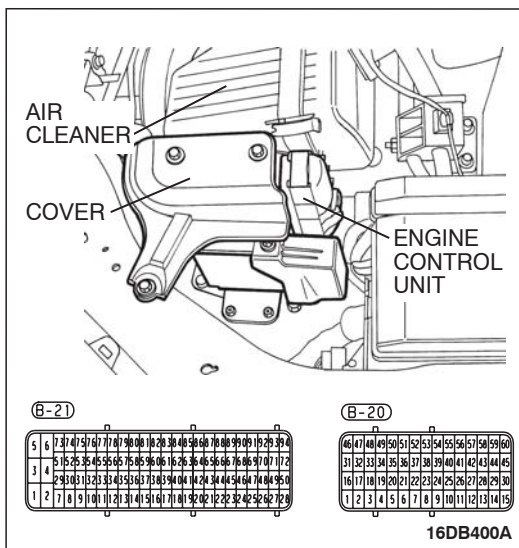
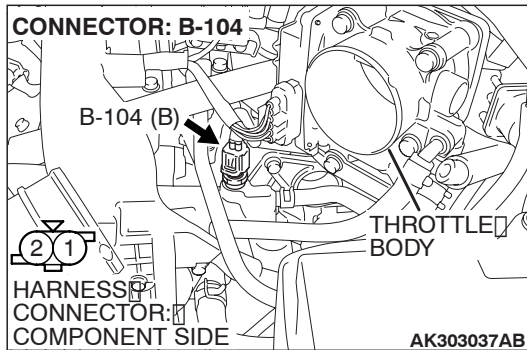
NO : Repair it. Then go to Step 11.

STEP 7. Check for harness damage between engine coolant temperature sensor connector B-104 (terminal No. 2) and ENGINE-ECU connector B-20 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 8.

NO : Repair it. Then go to Step 11.

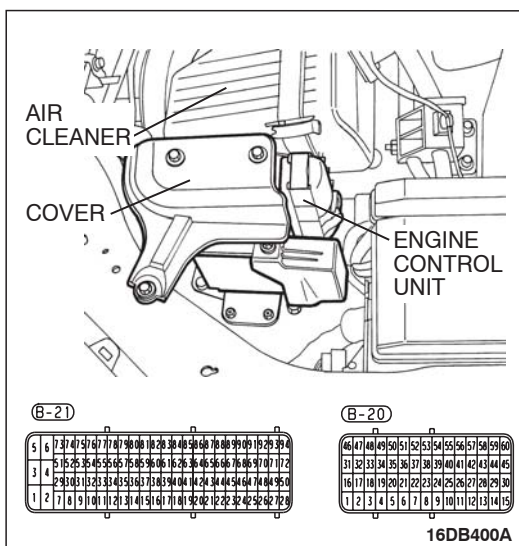


STEP 8. Check harness connector B-20 at ENGINE-ECU for damage.

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.

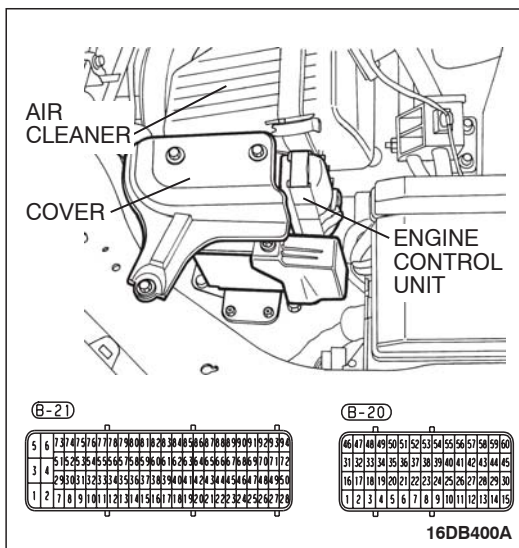
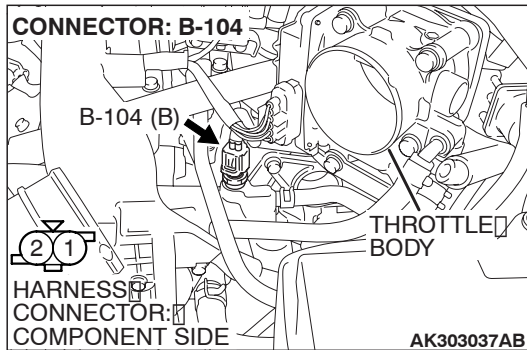


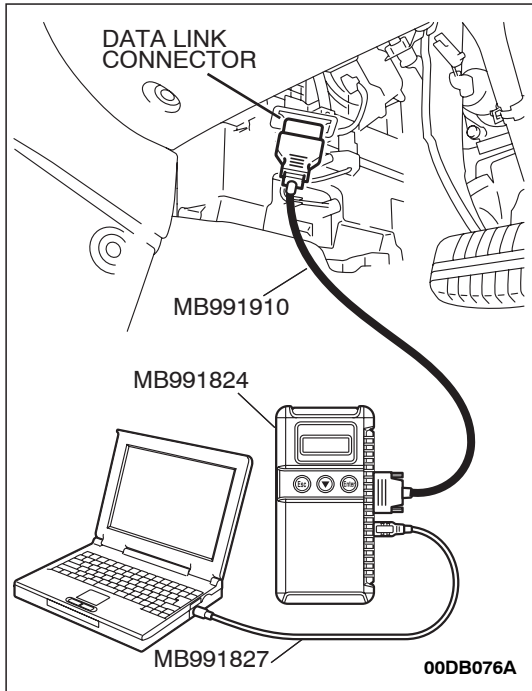
STEP 9. Check for harness damage between engine coolant temperature sensor connector B-104 (terminal No. 1) and ENGINE-ECU connector B-20 (terminal No. 56).

Q: Is the harness wire in good condition?

YES : Then go to Step 10.

NO : Repair it. Then go to Step 11.





STEP 10. Using diagnostic tool , check data list item 6: Engine Coolant Temperature Sensor.

⚠ CAUTION

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

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

Q: Is the sensor operating properly?

YES : The inspection is complete.

NO : Then go to Step 11.

STEP 11. Test the EOBd drive cycle.

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

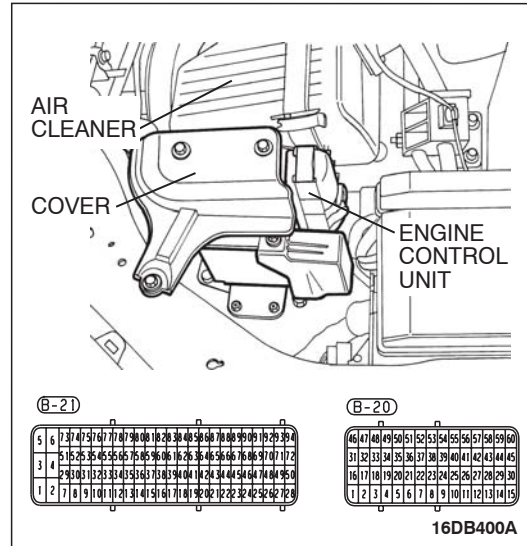
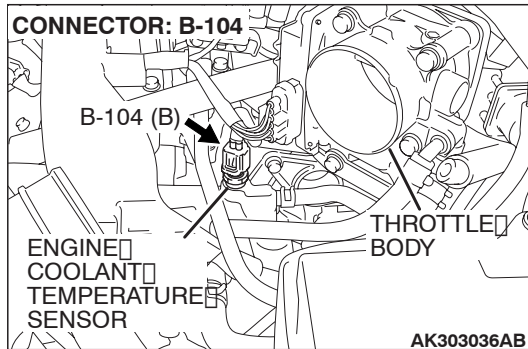
Q: Is DTC P0116 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0117: Engine Coolant Temperature Circuit Low Input.**CAUTION**

If DTC P0117 has been set, TCL and air conditioner related DTC U1120 is also set. After P0117 has been diagnosed, don't forget to erase DTC U1120.

**CIRCUIT OPERATION**

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ENGINE-ECU (terminal No. 56) via the resistor in the ENGINE-ECU. The ground terminal (terminal No. 2) is grounded with ENGINE-ECU (terminal No. 12).
- 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 ENGINE-ECU checks whether this voltage is within a specified range.

DTC SET CONDITIONS**Check Conditions**

- Mass air flow.

Judgement Criteria

- Engine coolant temperature is below -39 degreeC for 0.5 second.
- MIL is activated after 2 Drive cycles.
- No limp home mode.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function – EOBD Drive Cycle – [P.13A-11](#).

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.
- Refer to component locations [GROUP-70](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to circuit diagrams [GROUP-90](#)

DIAGNOSIS**Required Special Tools:**

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

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

⚠ CAUTION

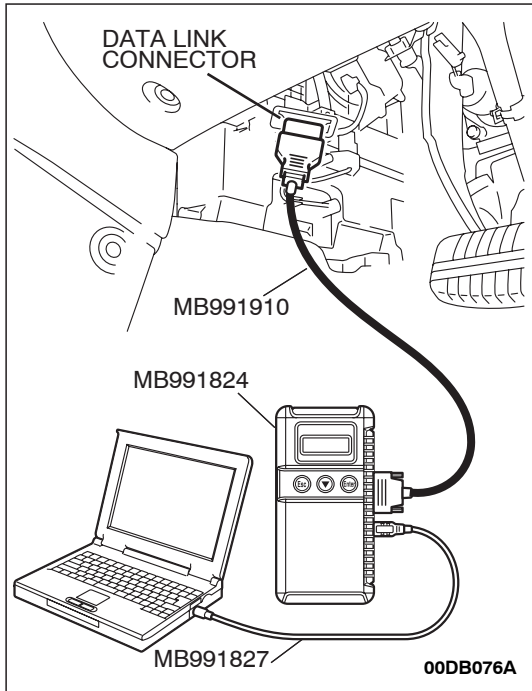
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

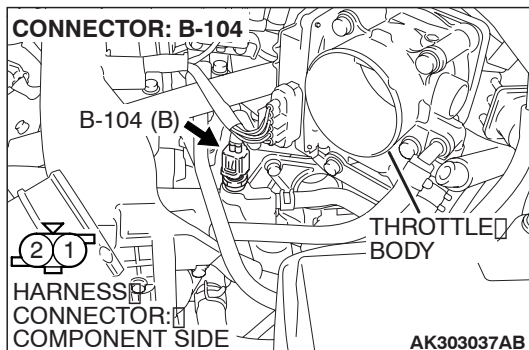


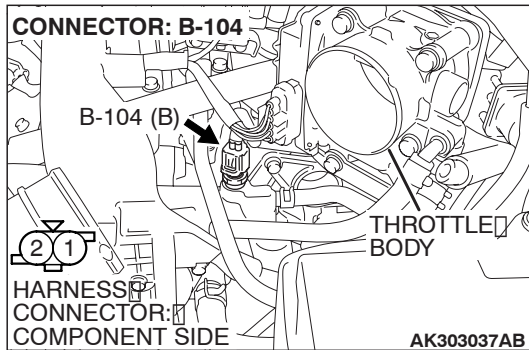
STEP 2. Check harness connector B-104 at the engine coolant temperature sensor for damage.

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 7.



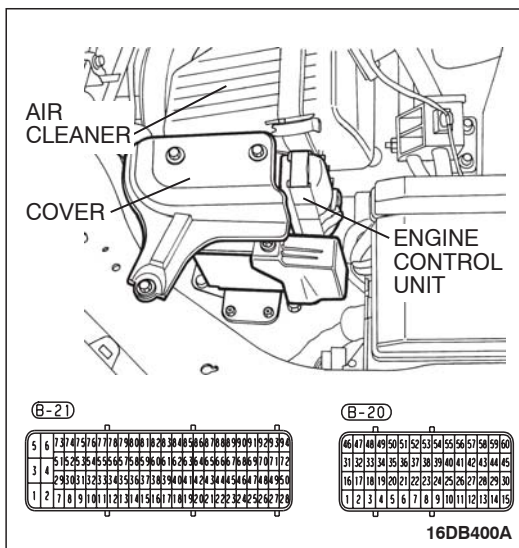


STEP 3. Check for short circuit to ground between engine coolant temperature sensor connector B-104 (terminal No. 1) and ENGINE-ECU connector B-20 (terminal No. 56).

Q: Is the harness wire in good condition?

YES : Go to Step 4.

NO : Repair it. Then go to Step 7.

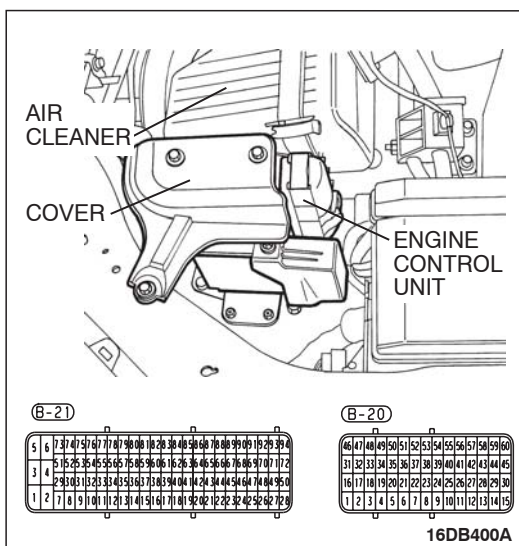


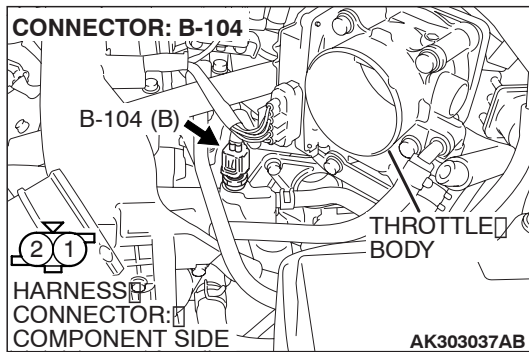
STEP 4. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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





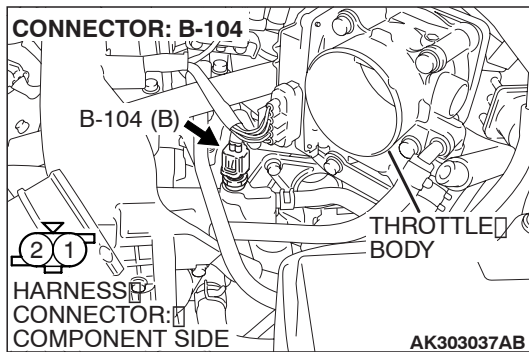
STEP 5. Check the engine coolant temperature sensor(On Car).

- (1) Ensure engine coolant temperature is between 20° C and below 100° C.
- (2) Disconnect the engine coolant temperature sensor connector B-104.
- (3) Check the resistance between terminal No. 1 & No. 2 of the sensor.

Q: Is the measured resistance between 186Ω and 2.4 kΩ?

YES : Go to Step 6.

NO : Replace the sensor and go to Step 7.

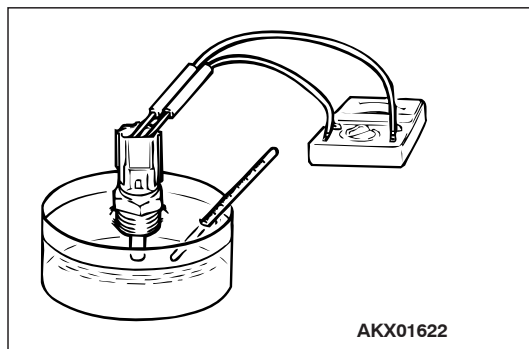


STEP 6. Check the engine coolant temperature sensor(Off Car).

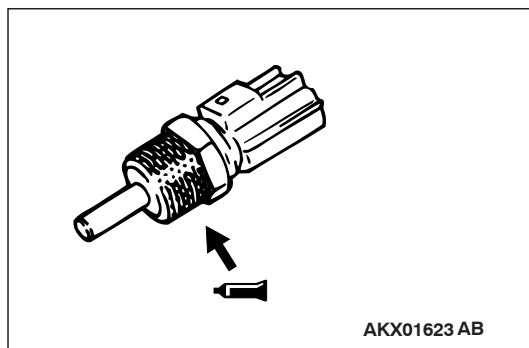
- (1) Disconnect the engine coolant temperature sensor connector B-104.
- (2) Remove the engine coolant temperature sensor.

⚠ WARNING

Ensure cooling system pressure is released at radiator cap slowly, prior to removing sensor to avoid getting burned by hot coolant.



- (3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, measure resistance. Refer to Service Specifications [13A-677](#)



- (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: 21 ± 3 N·m

Q: Is the measured resistance at the standard value?

YES : Then go to Step 7.

NO : Replace the engine coolant sensor. Then go to Step 7.

STEP 7. Test the EOBD drive cycle.

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

Q: Is DTC P0117 set?

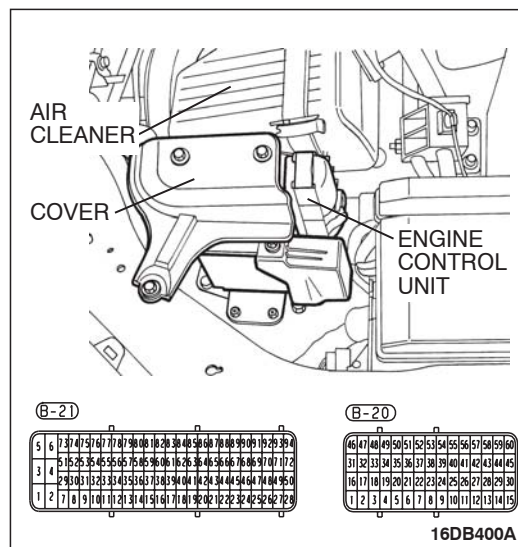
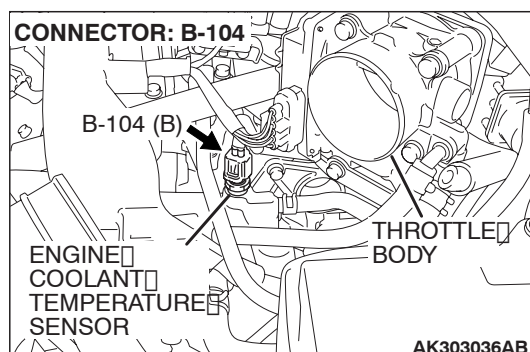
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0118: Engine Coolant Temperature Circuit High Input.

CAUTION

If DTC P0118 has been set, TCL and air conditioner related DTC U1120 is also set. After P0118 has been diagnosed, don't forget to erase DTC U1120.



CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ENGINE-ECU (terminal No. 56) via the resistor in the ENGINE-ECU. The ground terminal (terminal No. 2) is grounded with ENGINE-ECU (terminal No. 12).
- 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 ENGINE-ECU checks whether this voltage is within a specified range.

DTC SET CONDITIONS

Check Conditions

- Mass air flow.

Judgement Criteria

- Engine coolant temperature is above 138.8 degreeC for 0.5 second.

EOBD DRIVE CYCLE PATTERN

Refer to Diagnostic Function-EOBD Drive Cycle-P.13A-11.

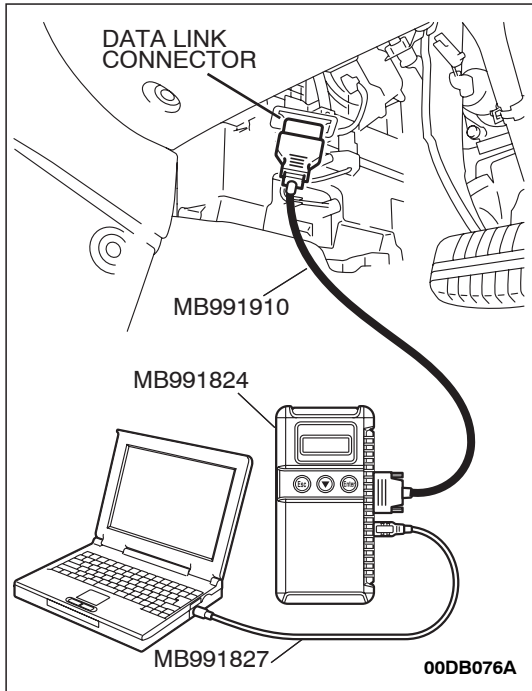
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Engine coolant temperature sensor failed.
- Open engine coolant temperature sensor circuit, or connector damage.
- Short to 12 volt.
- Refer to component locations GROUP-70
- Refer to configuration diagrams GROUP-80
- Refer to circuit diagrams GROUP-90

DIAGNOSIS

Required Special Tools:

- : Diagnostic Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB992044: ECU Check Harness



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

⚠ CAUTION

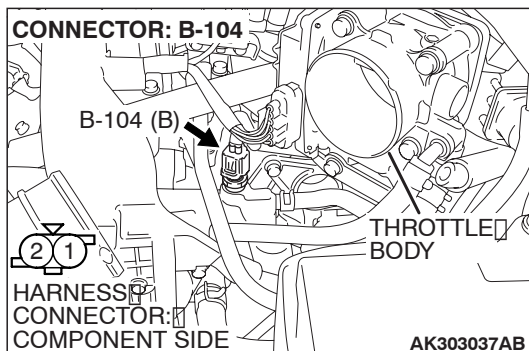
To prevent damage to diagnostic tool , always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool .

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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

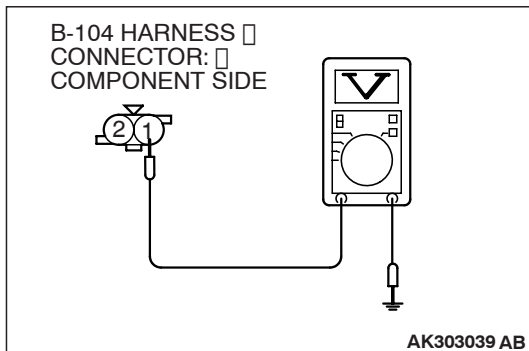
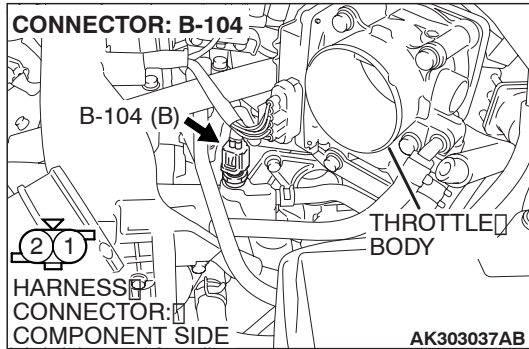


STEP 2. Check harness connector B-104 at the engine coolant temperature sensor for damage.

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 13.



STEP 3. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-104.

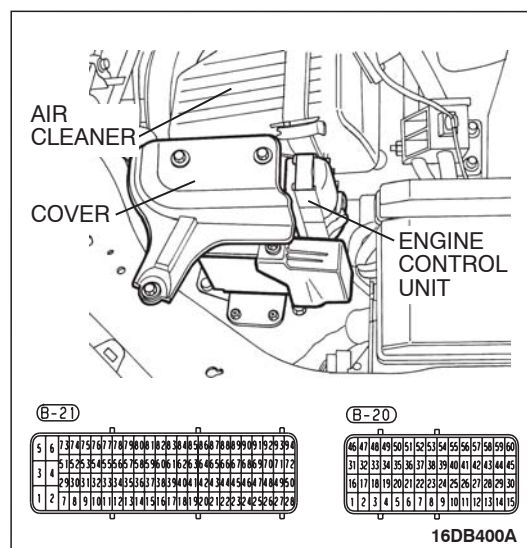
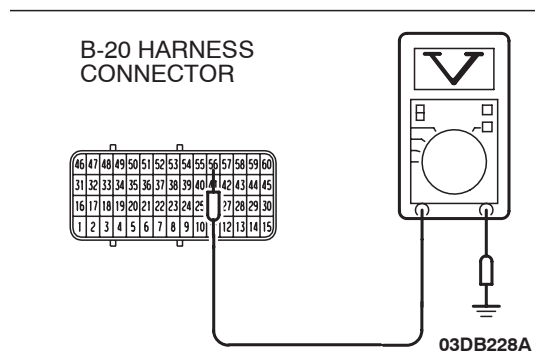
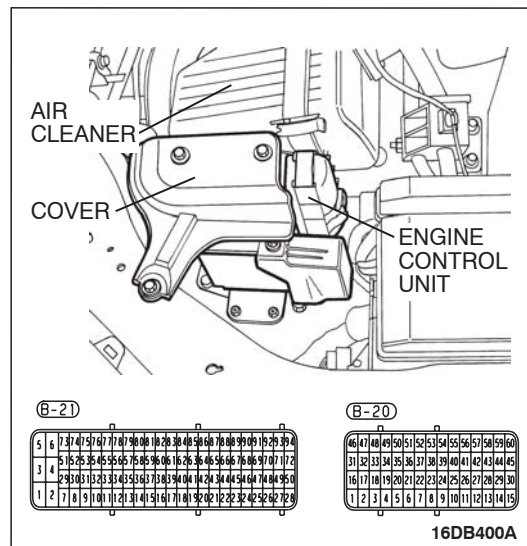
- (1) Disconnect the connector B-104 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

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

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

YES : Go to Step 7.

NO : Go to Step 4.



STEP 4. Measure the sensor supply voltage at ENGINE-ECU connector B-20 by using ECU check harness special tool MB992044.

- (1) Disconnect the all ENGINE-ECU connectors and connect ECU check harness special tool MB992044 between the separated connectors.
- (2) Disconnect the engine coolant temperature sensor connector B-104.
- (3) Turn the ignition switch to the "ON" position.

- (4) Measure the voltage between terminal No. 56 and ground.
 - Voltage should be between 4.5 and 4.9 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 5.

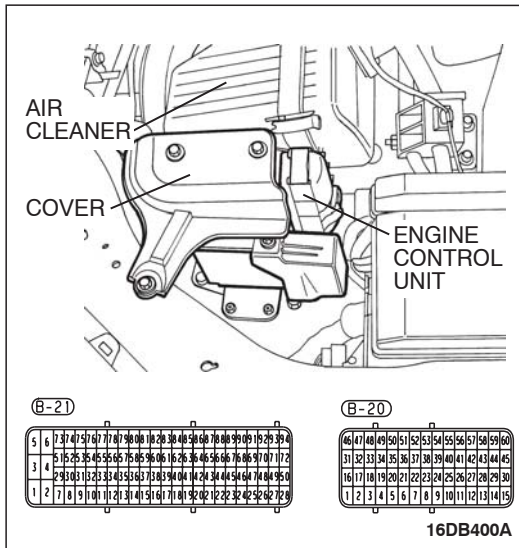
NO : Go to Step 6.

STEP 5. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between engine coolant temperature sensor connector B-104 (terminal No. 1) and ENGINE-ECU connector B-20 (terminal No. 56) because of open circuit. Then go to Step 13.

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

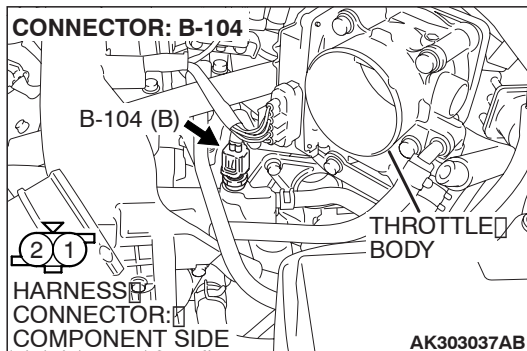


STEP 6. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

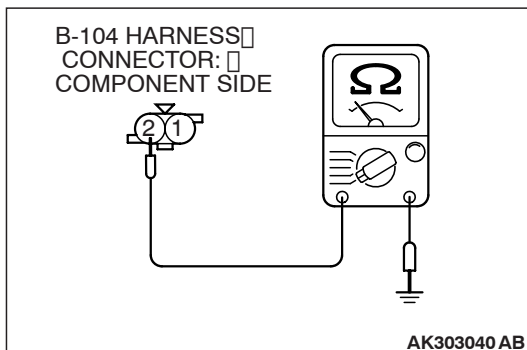
YES : Go to Step 7.

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



STEP 7. Check the continuity at engine coolant temperature sensor harness side connector B-104.

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



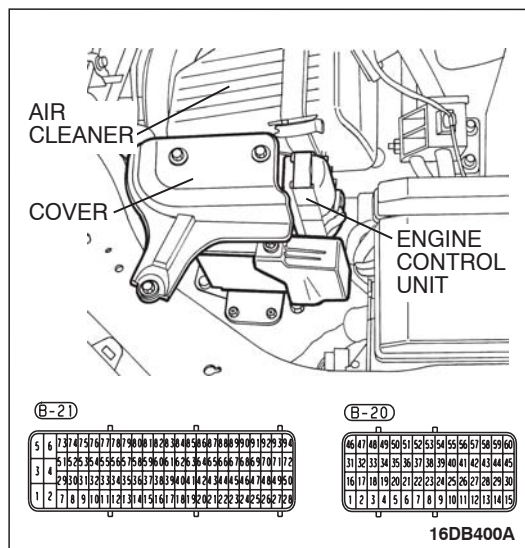
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 10.

NO : Go to Step 8.

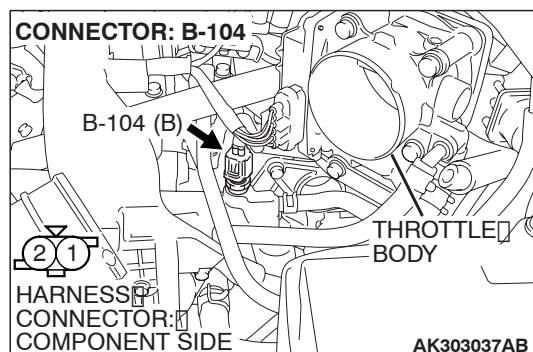


STEP 8. Check harness connector B-20 at ENGINE-ECU for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

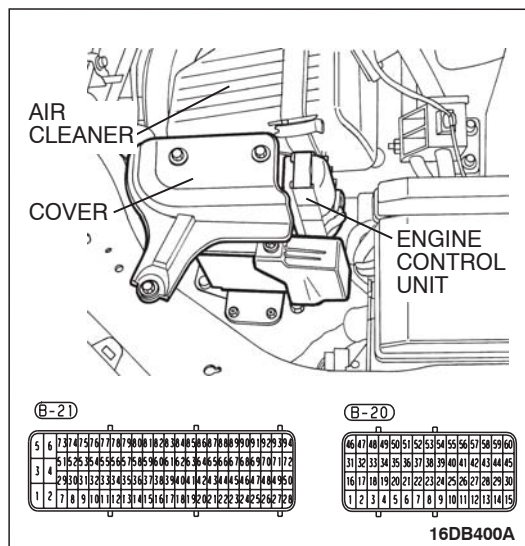


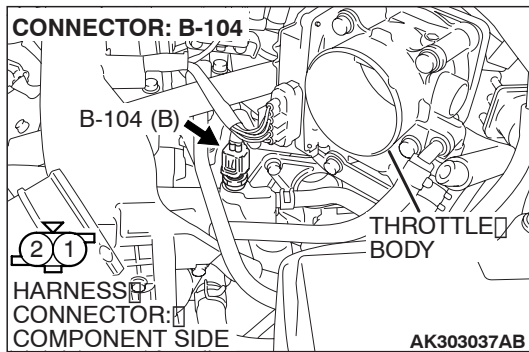
STEP 9. Check for open circuit between engine coolant sensor connector B-104 (terminal No. 2) and ENGINE-ECU connector B-20 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 13.





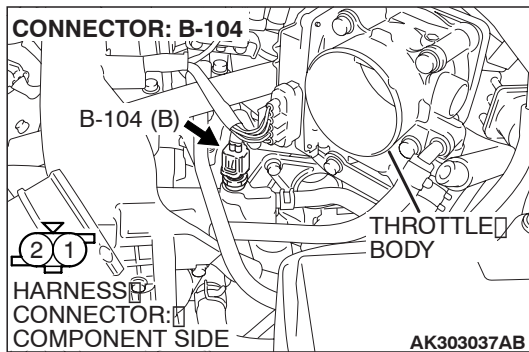
STEP 10. Check the engine coolant temperature sensor(On Car).

- (1) Ensure engine coolant temperature is between 20° C and below 100° C.
- (2) Disconnect the engine coolant temperature sensor connector B-104.
- (3) Check the resistance between terminal No. 1 & No. 2 of the sensor.

Q: Is the measured resistance between 186Ω and 2.4 kΩ?

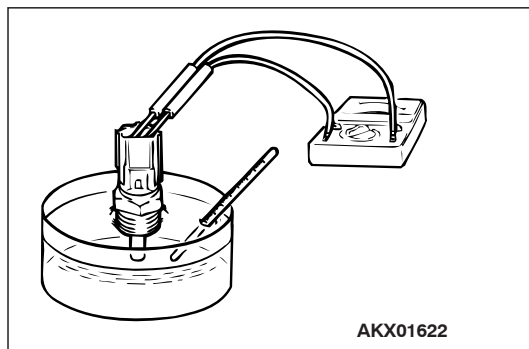
YES : Go to Step 11.

NO : Replace the sensor and go to Step 13.

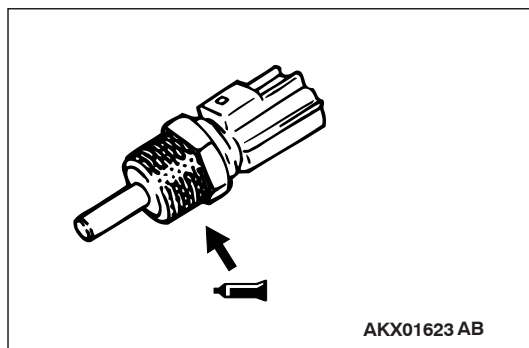


STEP 11. Check the engine coolant temperature sensor(Off Car).

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



- (3) With the temperature sensing portion of engine coolant temperature sensor immersed in hot water, measure resistance. Refer to Service Specifications [13A-677](#)



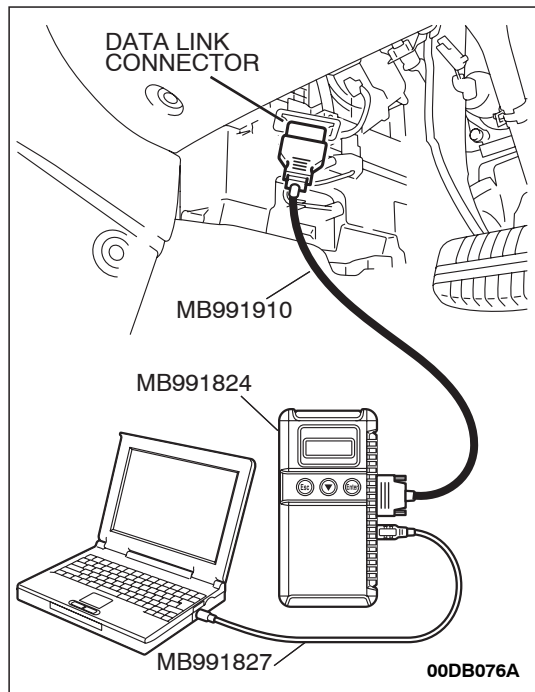
- (4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.
- (5) Install the engine coolant temperature sensor, and tighten to the specified torque.

Tightening torque: 21 ± 3 N·m

Q: Is the measured resistance at the standard value?

YES : Go to Step 12.

NO : Replace the engine coolant sensor. Then go to Step 13.



STEP 12. Using diagnostic tool , check data list item 6: Engine Coolant Temperature Sensor.

⚠ CAUTION

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

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

Q: Is the sensor operating properly?

YES : The inspection is complete.

NO : Then go to Step 13.

STEP 13. Test the EOBd drive cycle.

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

Q: Is DTC P0118 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

[NEXT PAGE](#)