

GROUP 13B

MULTIPOINT FUEL INJECTION (MFI) <3.8L ENGINE>

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GENERAL DESCRIPTION

M1131000104866

The Multiport Fuel Injection System consists of sensors which detect the engine conditions, the POWERTRAIN CONTROL MODULE (PCM) which controls the system based on signals from these sensors, and actuators which operate under the control of the PCM.

The PCM carries out activities such as fuel injection control, idle air control, and ignition timing control. In addition, the PCM is equipped with several 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 multiport. The PCM 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 PCM 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 PCM 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 PCM 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 pass-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 PCM from engine speed, intake air volume, engine coolant temperature, and atmospheric pressure.

DIAGNOSTIC TEST MODE

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

Engine Oil Control Valve Control

- The Mitsubishi Innovative Valve Timing Electronic Control System (MIVEC) has only one engine oil control valve installed to the cylinder head at the right bank side and switches the cams of the right and left banks.

Fan Control

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

Generator Output Current Control

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

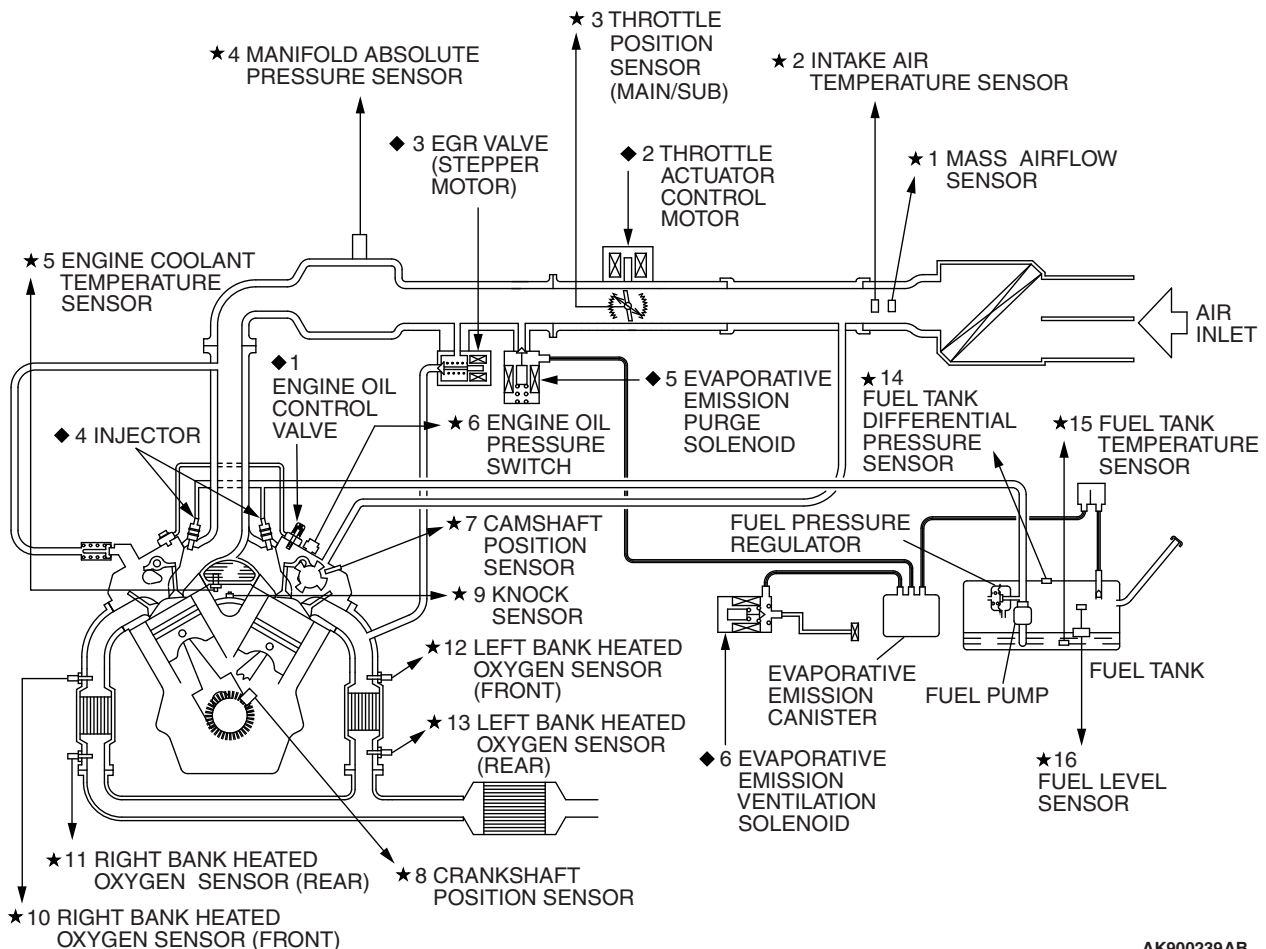
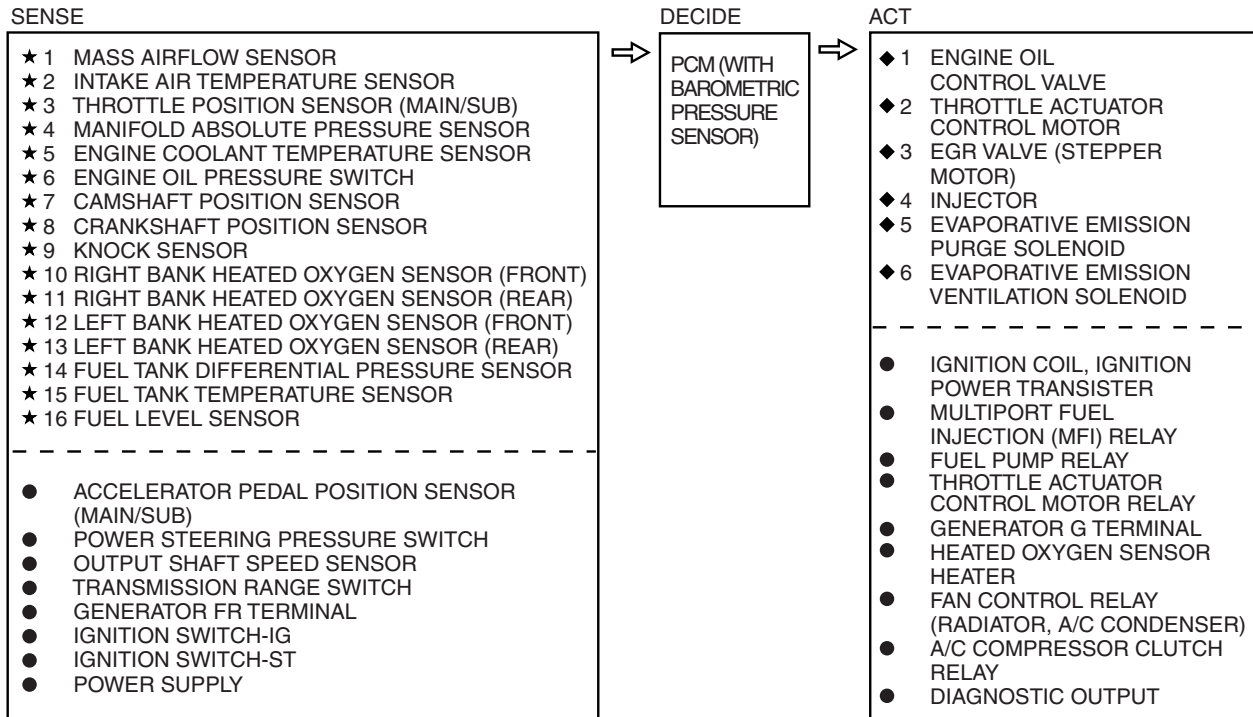
Evaporative Emission Purge Control

- (Refer to GROUP 17, Emission Control – Evaporative Emission Control System – General Description [P.17-87](#).)

EGR Control

- (Refer to GROUP 17, Emission Control – Exhaust Gas Recirculation (EGR) System - General Description [P.17-93](#).)

MULTIPOINT FUEL INJECTION (MFI) SYSTEM DIAGRAM



AK900239AB

NOTE: For the vacuum routing, refer to GROUP 17, Emission Control – Vacuum Hoses – Vacuum Hose Routing P.17-81.

MULTIPOINT FUEL INJECTION (MFI) DIAGNOSIS

TROUBLESHOOTING STRATEGY

M1131150001981

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

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

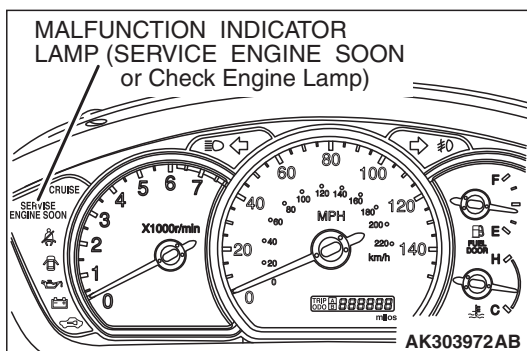
1. Gather as much information as possible about the complaint from the customer.
2. Verify that the condition described by the customer exists.
3. Check the vehicle for any MFI Diagnostic Trouble Code (DTC).
4. If you cannot verify the condition and there are no DTCs, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).
5. If you can verify the condition but there are no DTCs, or the system cannot communicate with the scan tool, refer to the trouble symptom classification table.

6. If there is a DTC, record the number of the code, then erase the code from the memory using the scan tool.
7. Reconfirm the malfunction symptom and carry out a test drive with the drive cycle pattern.
8. If DTC is set again, carry out an inspection with appropriate diagnostic trouble code procedures.
9. If DTC is not set again, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent 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 powertrain control module (PCM) is replaced, Immobilizer Encrypted Code Registration should be carried out. Refer to GROUP 54A, Ignition Switch – On-vehicle Service – Encrypted Code Registration Procedure [P.54A-40](#).

DIAGNOSTIC FUNCTION

M1131155503675



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

Among the on-board diagnostic items, Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates to notify the driver of an emission control malfunction. However, when an irregular signal returns to normal and the powertrain control module judges that it has returned to normal, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) will switch off.

There are two methods for checking the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) burn out: When the ignition switch is in ON position, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is illuminated, and then extinguished few seconds later. When the ignition switch is in ON position and the engine starts, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is extinguished.

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

DTC	ITEM
–	Powertrain control module (PCM) malfunction
P001A	Camshaft profile control (engine oil control valve) circuit
P0031	Heated oxygen sensor heater circuit low (bank 1 sensor 1)
P0032	Heated oxygen sensor heater circuit high (bank 1 sensor 1)
P0037	Heated oxygen sensor heater circuit low (bank 1 sensor 2)
P0038	Heated oxygen sensor heater circuit high (bank 1 sensor 2)
P003C	Mitsubishi innovative valve timing electronic control system (MIVEC) performance problem
P0051	Heated oxygen sensor heater circuit low (bank 2 sensor 1)
P0052	Heated oxygen sensor heater circuit high (bank 2 sensor 1)
P0057	Heated oxygen sensor heater circuit low (bank 2 sensor 2)
P0058	Heated oxygen sensor heater circuit high (bank 2 sensor 2)
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor
P0101 ^{*1}	Mass airflow circuit range/performance problem
P0102 ^{*1}	Mass airflow circuit low input
P0103 ^{*1}	Mass airflow circuit high input
P0106	Manifold absolute pressure circuit range/performance problem
P0107	Manifold absolute pressure circuit low input
P0108	Manifold absolute pressure circuit high input
P0111 ^{*1}	Intake air temperature circuit range/performance problem
P0112 ^{*1}	Intake air temperature circuit low input
P0113 ^{*1}	Intake air temperature circuit high input
P0116 ^{*1}	Engine coolant temperature circuit range/performance problem
P0117 ^{*1}	Engine coolant temperature circuit low input
P0118 ^{*1}	Engine coolant temperature circuit high input
P0122 ^{*1}	Throttle position sensor (main) circuit low input
P0123 ^{*1}	Throttle position sensor (main) circuit high input
P0125 ^{*1}	Insufficient coolant temperature for closed loop fuel control
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)
P0131	Heated oxygen sensor circuit low voltage (bank 1 sensor 1)
P0132	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)
P0133	Heated oxygen sensor circuit slow response (bank 1 sensor 1)
P0134 ^{*1}	Heated oxygen sensor circuit no activity detected (bank 1 sensor 1)
P0137	Heated oxygen sensor circuit low voltage (bank 1 sensor 2)
P0138	Heated oxygen sensor circuit high voltage (bank 1 sensor 2)

DTC	ITEM
P0139	Heated oxygen sensor circuit slow response (bank 1 sensor 2)
P0140	Heated oxygen sensor circuit no activity detected (bank 1 sensor 2)
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)
P0154 ^{*1}	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)
P0160	Heated oxygen sensor circuit no activity detected (bank 2 sensor 2)
P0171	System too lean (bank 1)
P0172	System too rich (bank 1)
P0174	System too lean (bank 2)
P0175	System too rich (bank 2)
P0181	Fuel tank temperature sensor circuit range/performance
P0182	Fuel tank temperature sensor circuit low input
P0183	Fuel tank temperature sensor circuit high input
P0201	Injector circuit – cylinder 1
P0202	Injector circuit – cylinder 2
P0203	Injector circuit – cylinder 3
P0204	Injector circuit – cylinder 4
P0205	Injector circuit – cylinder 5
P0206	Injector circuit – cylinder 6
P0222 ^{*1}	Throttle position sensor (sub) circuit low input
P0223 ^{*1}	Throttle position sensor (sub) circuit high input
P0300 ^{*2}	Random/multiple cylinder misfire detected
P0301 ^{*2}	Cylinder 1 misfire detected
P0302 ^{*2}	Cylinder 2 misfire detected
P0303 ^{*2}	Cylinder 3 misfire detected
P0304 ^{*2}	Cylinder 4 misfire detected
P0305 ^{*2}	Cylinder 5 misfire detected
P0306 ^{*2}	Cylinder 6 misfire detected
P0325	Knock sensor circuit
P0335 ^{*1}	Crankshaft position sensor circuit
P0340 ^{*1}	Camshaft position sensor circuit
P0401	Exhaust gas recirculation flow insufficient detected
P0403	Exhaust gas recirculation control circuit
P0421	Warm up catalyst efficiency below threshold (bank 1)

DTC	ITEM
P0431	Warm up catalyst efficiency below threshold (bank 2)
P0441	Evaporative emission control system incorrect purge flow
P0442	Evaporative emission control system leak detected (small leak)
P0443	Evaporative emission control system purge control valve circuit
P0446	Evaporative emission control system vent control circuit
P0450	Evaporative emission control system pressure sensor malfunction
P0451	Evaporative emission control system pressure sensor range/performance
P0452	Evaporative emission control system pressure sensor low input
P0453	Evaporative emission control system pressure sensor high input
P0455	Evaporative emission control system leak detected (gross leak)
P0456	Evaporative emission control system leak detected (very small leak)
P0461	Fuel level sensor (main) circuit range/performance
P0462	Fuel level sensor circuit low input
P0463	Fuel level sensor circuit high input
P0506	Idle control system RPM lower than expected
P0507	Idle control system RPM higher than expected
P0551	Power steering pressure switch circuit range/performance
P0554	Power steering pressure switch circuit intermittent
P0603 ^{*1}	EEPROM malfunction
P0606 ^{*1}	Powertrain control module main processor malfunction
P0630 ^{*1}	Vehicle Identification Number (VIN) malfunction
P0638 ^{*1}	Throttle actuator control motor circuit range/ performance problem
P0642 ^{*1}	Throttle position sensor power supply
P0657 ^{*1}	Throttle actuator control motor relay circuit malfunction
P0705	Transmission range switch circuit malfunction (RPNDL input)
P0712 ^{*1}	Transmission fluid temperature sensor circuit low input
P0713 ^{*1}	Transmission fluid temperature sensor circuit high input
P0715 ^{*1}	Input/Turbine speed sensor circuit
P0720 ^{*1}	Output speed sensor circuit
P0731 ^{*1}	Gear 1 incorrect ratio
P0732 ^{*1}	Gear 2 incorrect ratio
P0733 ^{*1}	Gear 3 incorrect ratio
P0734 ^{*1}	Gear 4 incorrect ratio
P0735 ^{*1}	Gear 5 incorrect ratio
P0736 ^{*1}	Gear R incorrect ratio
P0741	Torque converter clutch circuit performance or stuck off
P0742	Torque converter clutch circuit stuck on

DTC	ITEM
P0743 ^{*1}	Torque converter clutch circuit electrical
P0753 ^{*1}	Shift solenoid "A" electrical
P0758 ^{*1}	Shift solenoid "B" electrical
P0763 ^{*1}	Shift solenoid "C" electrical
P0768 ^{*1}	Shift solenoid "D" electrical
P0773 ^{*1}	Shift solenoid "E" electrical
P1506	Idle control system RPM lower than expected at low engine coolant temperature
P1507	Idle control system RPM higher than expected at low engine coolant temperature
P1602 ^{*1}	Communication malfunction (between PCM main processor and system LSI)
P1603 ^{*1}	Battery backup line malfunction
P1751 ^{*1}	A/T control relay malfunction
P2066	Fuel level sensor (sub) circuit range/performance
P2100 ^{*1}	Throttle actuator control motor circuit (open)
P2101 ^{*1}	Throttle actuator control motor magneto malfunction
P2122 ^{*1}	Accelerator pedal position sensor (main) circuit low input
P2123 ^{*1}	Accelerator pedal position sensor (main) circuit high input
P2127 ^{*1}	Accelerator pedal position sensor (sub) circuit low input
P2128 ^{*1}	Accelerator pedal position sensor (sub) circuit high input
P2135 ^{*1}	Throttle position sensor (main and sub) range/performance problem
P2138 ^{*1}	Accelerator pedal position sensor (main and sub) range/performance problem
P2195	Heated oxygen sensor inactive (bank 1 sensor 1)
P2197	Heated oxygen sensor inactive (bank 2 sensor 1)
P2228 ^{*1}	Barometric pressure circuit low input
P2229 ^{*1}	Barometric pressure circuit high input
P2252	Heated oxygen sensor offset circuit low voltage
P2253	Heated oxygen sensor offset circuit high voltage
U1108 ^{*1}	Combination meter time-out

NOTE: If the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates because of a malfunction of the powertrain control module (PCM), communication between the scan tool MB991958 (M.U.T.-III sub assembly) and the PCM is impossible. In this case, the diagnostic trouble code cannot be read.

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

NOTE: The codes marked with a "" in the diagnosis code number column have the following two conditions for illuminating the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp).*

- In case that the misfire causing the damaged catalyst is detected, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is illuminated at the time.*

- In case that the misfire deteriorating the exhaust gas is detected, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is illuminated when the same malfunction is redetected after the next engine start.

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

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

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

NOTE: Bank 1 indicates the right bank side cylinder, and bank 2 indicates the left bank side cylinder.

HOW TO CONNECT THE SCAN TOOL (M.U.T.-III)

Required Special Tools:

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

⚠ CAUTION

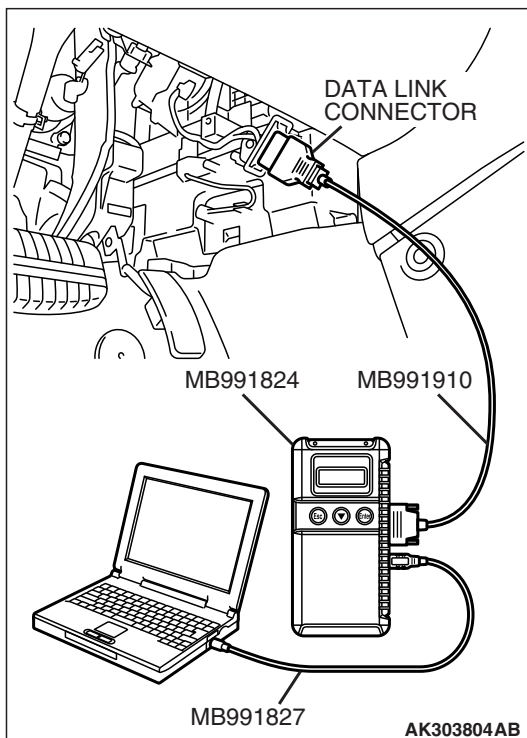
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

1. Ensure that the ignition switch is at the "LOCK" (OFF) position.
2. Start up the personal computer.
3. Connect special tool MB991827 to special tool MB991824 and the personal computer.
4. Connect special tool 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 energized, special tool MB991824 indicator light will be illuminated in a green color.

7. Start the M.U.T.-III system on the personal computer.

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



HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODES.

Required Special Tools:

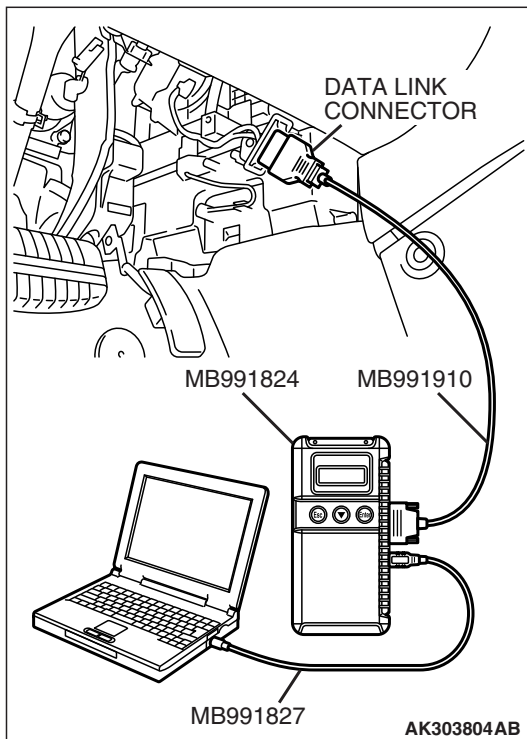
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A

CAUTION

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

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

1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "System select."
4. Choose "from 2006 MY" under "MODEL YEAR".
5. Check that "Vehicle Information" contents are correct.
6. Choose "MFI".
7. Select "Diagnostic Trouble Code"
8. If a DTC is set, it is shown.
9. Choose "Erase DTCs" to erase the DTC.



HOW TO READ DATA LIST

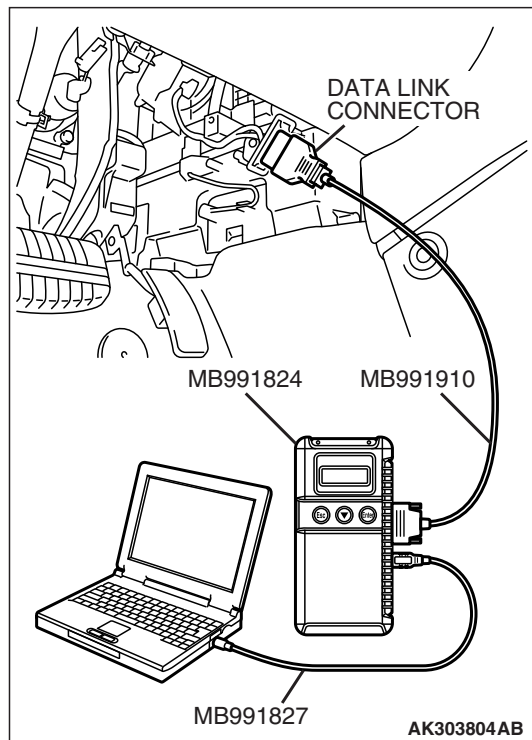
Required Special Tools:

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

CAUTION

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

1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "System select."
4. Choose "from 2006 MY" under "MODEL YEAR".
5. Check that "Vehicle Information" contents are correct.
6. Choose "MFI".
7. Select "Data List."
8. Choose an appropriate item and select the "OK" button.



HOW TO PERFORM ACTUATOR TEST

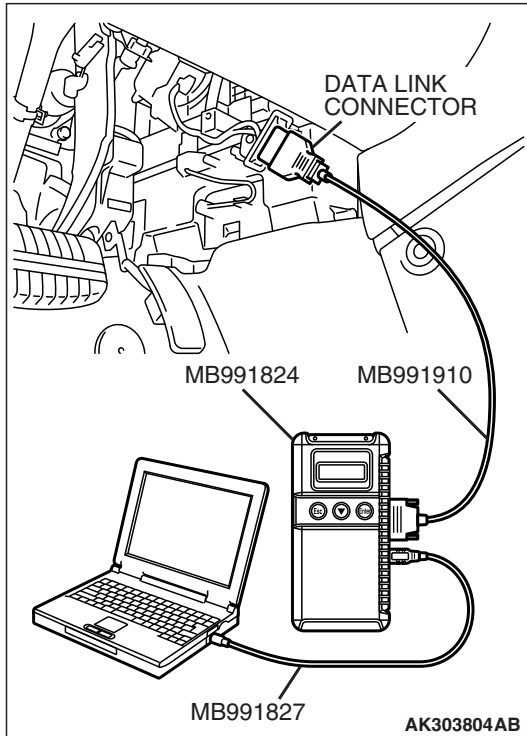
Required Special Tools:

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

CAUTION

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

1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "System select."
4. Choose "from 2006 MY" under "MODEL YEAR".
5. Check that "Vehicle Information" contents are correct.
6. Choose "MFI".
7. Select "Actuator Test."
8. Choose an appropriate item and select the "OK" button.



HOW TO DIAGNOSE THE CAN BUS LINES

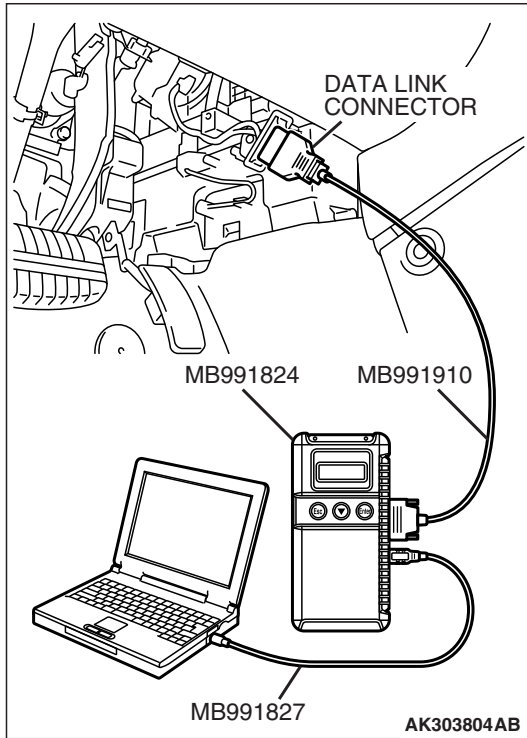
Required Special Tools:

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

⚠ CAUTION

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

1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "CAN bus diagnosis" from the start-up screen.
4. When the vehicle information is displayed, confirm that it matches the vehicle whose CAN bus lines will be diagnosed.
 - If they matches, go to step 8.
 - If not, go to step 5.
5. Select the "view vehicle information" button.
6. Enter the vehicle information and select the "OK" button.
7. When the vehicle information is displayed, confirm again that it matches the vehicle whose CAN bus lines will be diagnosed.
 - If they matches, go to step 8.
 - If not, go to step 5.
8. Select the "OK" button.
9. When the optional equipment screen is displayed, choose the one which the vehicle is fitted with, and then select the "OK" button.



HOW TO READ PROVISIONAL DIAGNOSTIC TROUBLE CODES

Required Special Tools:

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

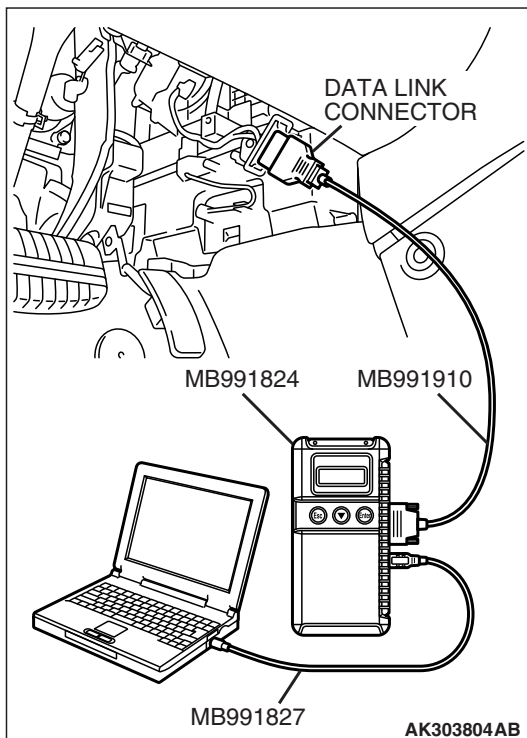
If detecting the malfunction during the first drive cycle, the PCM temporarily stores the diagnosis code as the provisional diagnosis code. If detecting the same malfunction during the next drive cycle, the PCM determines that the malfunction exists. The PCM outputs the diagnosis code. On Scan Tool MB991958, it is possible to display the stored provisional diagnosis code which the PCM had detected during the first drive cycle. This makes it possible to confirm in one drive cycle whether the malfunction could happen again after the repair.

CONFIRMATION METHOD

⚠ CAUTION

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

1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "System select."
4. Choose "from 2006 MY" under "MODEL YEAR".
5. Check that "Vehicle Information" contents are correct.
6. Choose "MFI".
7. Select "Special Function" from MFI Screen.
8. Select "Provisional DTCs" from Special Function Screen.



MODE 6 REFERENCE TABLE

The powertrain control module (PCM) monitors the condition of emission control system.

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

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINE TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
01	81	Oxygen Sensor Monitor Bank 1 – Sensor 1 Rich/Lean Switching frequency	PCM monitors the deteriorated condition of the right bank heated oxygen sensor (front) by checking the rich/lean switching frequency of the right bank heated oxygen sensor (front).	× 1count
02	08	Oxygen Sensor Monitor Bank 1 – Sensor 2 Maximum Sensor Voltage for Test Cycle	PCM checks the output voltage of the right bank heated oxygen sensor (rear) in order to monitor whether the right bank heated oxygen sensor (rear) outputs the rich signal.	× 0.122 mV
	82	Oxygen Sensor Monitor Bank 1 – Sensor 2 Output Voltage change	PCM checks the output voltage of the right bank heated oxygen sensor (rear) in order to monitor whether the right bank heated oxygen sensor (rear) output is stuck.	× 0.122 mV
	05	Oxygen Sensor Monitor Bank 1 – Sensor 2 Rich To Lean Sensor Switch Time	PCM checks the rich to lean switching time of the right bank heated oxygen sensor (rear) in order to monitor the response of the right bank heated oxygen sensor (rear).	× 1 msec
	88	Oxygen Sensor Monitor Bank 1 – Sensor 2 Output Voltage drop slope	PCM checks the output voltage drop slope of the right bank heated oxygen sensor (rear) in order to monitor the response of the right bank heated oxygen sensor (rear).	× 1 msec

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINED TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
05	81	Oxygen Sensor Monitor Bank 2 – Sensor 1 Rich/Lean Switching frequency	PCM monitors the deteriorated condition of the left bank heated oxygen sensor (front) by checking the rich/lean switching frequency of the left bank heated oxygen sensor (front).	× 1count
06	08	Oxygen Sensor Monitor Bank 2 – Sensor 2 Maximum Sensor Voltage for Test Cycle	PCM checks the output voltage of the left bank heated oxygen sensor (rear) in order to monitor whether the left bank heated oxygen sensor (rear) outputs the rich signal.	× 0.122 mV
	82	Oxygen Sensor Monitor Bank 2 – Sensor 2 Output Voltage change	PCM checks the output voltage of the left bank heated oxygen sensor (rear) in order to monitor whether the left bank heated oxygen sensor (rear) output is stuck.	× 0.122 mV
	05	Oxygen Sensor Monitor Bank 2 – Sensor 2 Rich To Lean Sensor Switch Time	PCM checks the rich to lean switching time of the left bank heated oxygen sensor (rear) in order to monitor the response of the left bank heated oxygen sensor (rear).	× 1 msec
	88	Oxygen Sensor Monitor Bank 2 – Sensor 2 Output Voltage drop slope	PCM checks the output voltage drop slope of the left bank heated oxygen sensor (rear) in order to monitor the response of the left bank heated oxygen sensor (rear).	× 1 msec
21	83	Catalyst Monitor Bank 1 Frequency ratio between Front- and Rear-Oxygen Sensors	PCM monitors the deterioration of catalyst at right bank side by the output frequency ratio between right bank heated oxygen sensor (front) and right bank heated oxygen sensor (rear).	× 0.0039

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINE TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
22	83	Catalyst Monitor Bank 2 Frequency ratio between Front- and Rear-Oxygen Sensors	PCM monitors the deterioration of catalyst at left bank side by the output frequency ratio between left bank heated oxygen sensor (front) and left bank heated oxygen sensor (rear).	× 0.0039
31	84	EGR Monitor Difference of manifold pressure before and after EGR activation	PCM monitors the operation of EGR system by the pressure difference of intake manifold between before and after introduction of EGR using the manifold absolute pressure sensor.	× 0.0117 kPa
39	85	EVAP Monitor (Cap off) Pressure drop during de-pressurizing	PCM monitors the leak of fuel evaporation gas by checking whether the pressure can be reduced (the amount of pressure reduction) using the fuel tank differential pressure sensor after sealing the fuel tank and the fuel line.	× 0.0117 kPa
3B	85	EVAP Monitor (0.040") Pressure rise during airtight condition	After PCM vacuumizes the fuel tank and the fuel line and then the specified time is passed, PCM monitors the leak of fuel evaporation gas through the fuel tank differential pressure sensor to check the reduction of vacuum in the fuel tank.	× 0.0117 kPa

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINE TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
3C	85	EVAP Monitor (0.020") Pressure rise during airtight condition	After PCM vacuumizes the fuel tank and the fuel line and then the specified time is passed, PCM monitors the leak of fuel evaporation gas through the fuel tank differential pressure sensor to check the reduction of vacuum in the fuel tank.	× 0.0117 kPa
A2	0B	Mis-Fire Cylinder 1 Data EWMA Misfire Counts For Last 10 Driving Cycles	PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 1 Data Misfire Counts For Last/Current Driving Cycle	PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count
A3	0B	Mis-Fire Cylinder 2 Data EWMA Misfire Counts For Last 10 Driving Cycles	PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 2 Data Misfire Counts For Last/Current Driving Cycle	PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINED TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
A4	0B	Mis-Fire Cylinder 3 Data EWMA Misfire Counts For Last 10 Driving Cycles	PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 3 Data Misfire Counts For Last/Current Driving Cycle	PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count
A5	0B	Mis-Fire Cylinder 4 Data EWMA Misfire Counts For Last 10 Driving Cycles	PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 4 Data Misfire Counts For Last/Current Driving Cycle	PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count
A6	0B	Mis-Fire Cylinder 5 Data EWMA Misfire Counts For Last 10 Driving Cycles	PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 5 Data Misfire Counts For Last/Current Driving Cycle	PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINED TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
A7	0B	Mis-Fire Cylinder 6 Data EWMA Misfire Counts For Last 10 Driving Cycles	PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 6 Data Misfire Counts For Last/Current Driving Cycle	PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count

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

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

NOTE: When not finishing the monitor of the driving cycle for the request of On-Board Monitoring Test Request, the PCM outputs the stored latest monitor test result.

NOTE: When the monitored test results are erased by the battery disconnection and so on, the PCM outputs the values in hexadecimal of "0000" or "FFFF", otherwise it outputs abnormal values and so on. In case of this, the PCM outputs are handled as invalid-values. When the first monitor (Readiness Status) is completed after this, the PCM outputs the valid-values.

NOTE: "Test Limit Type & Component ID byte" output from the PCM is given in hexadecimal of "00" or "80". "00" means the maximum value and "80" means the minimum value.

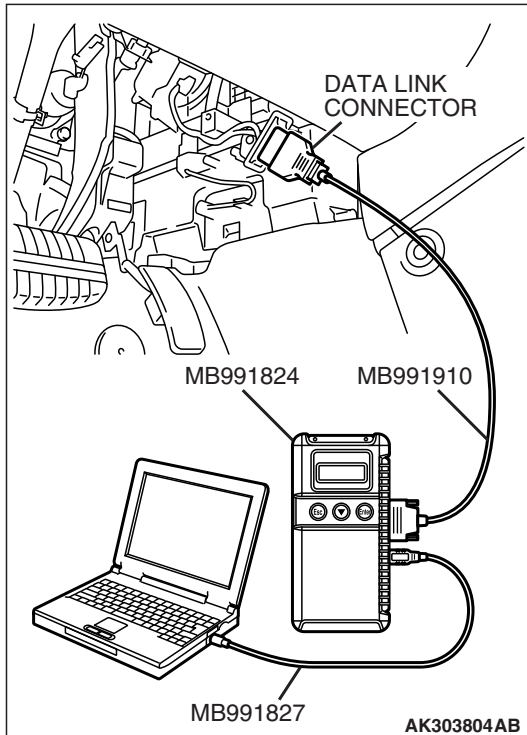
**DIAGNOSTIC BY DIAGNOSTIC TEST MODE II
(INCREASED SENSITIVITY)****Required Special Tools:**

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

⚠ CAUTION

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

NOTE: When mode II is selected with MB991958, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) will light when the powertrain control module (PCM) 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 scan tool MB991958. 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 scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Change the diagnostic test mode of the powertrain control module to DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY).
4. Road test the vehicle.
5. Read the diagnostic trouble code and repair the malfunctioning part.
6. Turn the ignition switch to the "LOCK" (OFF) position.
7. Disconnect scan tool MB991958 from the data link connector.

ON-BOARD DIAGNOSTICS

The powertrain control module (PCM) monitors the input/output signals (some signals all the time and others under specified conditions) of the PCM. When a malfunction continues for a specified time or longer after the irregular signal is initially monitored, the PCM judges that a malfunction has occurred. After the PCM first detects a malfunction, a diagnostic trouble code is recorded when the engine is restarted and the same malfunction is re-detected. However, for items marked with a "*", a diagnostic trouble code is recorded on the first detection of the malfunction. There are 142 diagnostic items. The diagnostic results can be read out with a scan tool. Since memorization of the diagnostic trouble codes is backed up directly by the battery, the diagnostic results are memorized even if the ignition key is turned off. The diagnostic trouble codes will, however, be erased when the battery terminal or the PCM connector is 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 scan tool MB991958 to the PCM.

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 PCM in order to erase the diagnostic memory. The 142 diagnostic items are all indicated sequentially from the smallest code number. The PCM records the engine operating condition when the diagnostic trouble code is set. This data is called "Freeze-frame" data. This data can be read by using the scan tool, and can then be used in simulation tests for troubleshooting. Data items are as follows:

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

NOTE: As for Diagnostic trouble code P1603, "Freeze-frame" data is not memorized.

Freeze Frame Data Item for M.U.T.-III

ITEM NO.	M.U.T.-III SCAN TOOL DISPLAY	DATA ITEM	UNIT or STATE
AA	Airflow sensor	Airflow sensor	g/s
AB	TP sensor (main)	Throttle position sensor (main)	%
BA	Target EGR	Target EGR stepper motor	%
BB	Barometric pressure sensor	Barometric pressure sensor	kPa or in.Hg
BC	Relative TP sensor	Relative throttle position sensor	%
BD	TP sensor (sub)	Throttle position sensor (sub)	%
BE	APP sensor (main)	Accelerator pedal position sensor (main)	%
BF	APP sensor (sub)	Accelerator pedal position sensor (sub)	%
C0	Fuel system status (bank 1)	Fuel system status (bank 1)	• Open loop
			• Closed loop
			• Open loop-drive condition
			• Open loop-DTC set
			• Closed loop-O ₂ (rear) failed
C1	Fuel system status (bank 2)	Fuel system status (bank 2)	• Open loop
			• Closed loop
			• Open loop-drive condition
			• Open loop-DTC set
			• Closed loop-O ₂ (rear) failed
C2	Calculated load value	Calculated load value	%
C3	ECT sensor	Engine coolant temperature sensor	°C or °F
C4	Short term fuel trim (bank 1)	Short term fuel trim (bank 1)	%
C5*	Short term fuel trim (bank 3)	Short term fuel trim (bank 3)	%
C6	Long term fuel trim (bank 1)	Long term fuel trim (bank 1)	%
C7*	Long term fuel trim (bank 3)	Long term fuel trim (bank 3)	%
C8	Short term fuel trim (bank 2)	Short term fuel trim (bank 2)	%
C9*	Short term fuel trim (bank 4)	Short term fuel trim (bank 4)	%
CA	Long term fuel trim (bank 2)	Long term fuel trim (bank 2)	%
CB*	Long term fuel trim (bank 4)	Long term fuel trim (bank 4)	%
CC	MAP sensor	Manifold absolute pressure sensor	kPa or in.Hg

ITEM NO.	M.U.T.-III SCAN TOOL DISPLAY	DATA ITEM	UNIT or STATE
CD	Crankshaft position sensor	Crankshaft position sensor	r/min
CE	Vehicle speed	Vehicle speed	km/h or mph
CF	Spark advance	Spark advance	°CA
D0	Intake air temperature sensor 1	Intake air temperature sensor	°C or °F
D1	Time since engine running	Time since engine running	sec
D6	EVAP. emission purge SOL. duty	Evaporative emission purge solenoid duty	%
D7	Fuel level gauge	Fuel level gauge	%
D8	Power supply voltage	Power supply voltage	V
D9	Absolute load value	Absolute load value	%
DA	Target equivalence ratio	Target equivalence ratio	—
DB	Intake air temperature sensor 1	Intake air temperature sensor (ambient air temperature)	°C or °F
DC	Throttle actuator	Throttle actuator control motor	%
DD	Relative APP sensor	Relative accelerator pedal position sensor	%
242	Fuel tank differential PRS.SNSR	Fuel tank differential pressure sensor	Pa

*NOTE: *: Data items are displayed on M.U.T.-III display, but the V-type 6-cylinder engine is not applicable and its data is displayed as "*****".*

Freeze Frame Data Item for General Scan Tool

COMMON EXAMPLE of GENERAL SCAN TOOL DISPLAY	PRAMETER IDENTIFICATION (PID)	DESCRIPTION	UNIT or STATE
DTCFRZF	02	DTC that caused required freeze frame data storage	Pxxxx, Uxxxx
FUELSYS 1	03	See M.U.T.-III Item No. C0	
FUELSYS 2		See M.U.T.-III Item No. C1	
LOAD_PCT	04	See M.U.T.-III Item No. C2	
ECT	05	See M.U.T.-III Item No. C3	
SHRTFT 1	06	See M.U.T.-III Item No. C4	
LONGFT 1	07	See M.U.T.-III Item No. C6	
SHRTFT 2	08	See M.U.T.-III Item No. C8	
LONGFT 2	09	See M.U.T.-III Item No. CA	
MAP	0B	See M.U.T.-III Item No. CC	
RPM	0C	See M.U.T.-III Item No. CD	
VSS	0D	See M.U.T.-III Item No. CE	
SPARKADV	0E	See M.U.T.-III Item No. CF	
IAT	0F	See M.U.T.-III Item No. D0	
MAF	10	See M.U.T.-III Item No. AA	
TP	11	See M.U.T.-III Item No. AB	
RUNTM	1F	See M.U.T.-III Item No. D1	
EGR_PCT	2C	See M.U.T.-III Item No. BA	
EVAP_PCT	2E	See M.U.T.-III Item No. D6	
FLI	2F	See M.U.T.-III Item No. D7	
EVAP_VP	32	See M.U.T.-III Item No. 242	
BARO	33	See M.U.T.-III Item No. BB	
VPWR	42	Control module voltage	V
LOAD_ABS	43	Absolute Load Value	%
EQ_RAT	44	Commanded Equivalence Ratio	%
TP_R	45	Relative Throttle Position	%
AAT	46	Ambient air temperature	°C (°F)
TP_B	47	Absolute Throttle Position B	%
APP_D	49	Accelerator pedal position D	%
APP_E	4A	Accelerator pedal position E	%
TAC_PCT	4C	Command Throttle Actuator Control	%
APP_R	5A	See M.U.T.-III Item No. DD	

OBD- II DRIVE CYCLE

All kinds of diagnostic trouble codes (DTCs) can be monitored by carrying out a short drive according to the following 23 drive cycle patterns. In other words, doing such a drive regenerates any kind of trouble which involves illuminating the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) and verifies the repair procedure has eliminated [the trouble the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is no longer illuminated].

⚠ CAUTION

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

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

NOTE: Drive cycle patterns are not established for Power steering pressure switch monitor (DTC P0551), and Fuel level sensor monitor (DTC P0461, P2066). Please reference the M.U.T. data list to judge whether these monitor items are normal.

DRIVE CYCLE PATTERN LIST

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Heated oxygen sensor (front) monitor <Readiness test item>	P0133, P0153	1
Heated oxygen sensor heater monitor <Readiness test item>	P0031, P0032, P0037, P0038, P0051, P0052, P0057, P0058	2
Exhaust gas recirculation (EGR) system monitor <Readiness test item>	P0401	3
Catalytic converter monitor <Readiness test item>	P0421, P0431	4
Evaporative emission system leak monitor (small leak and gross leak) <Readiness test item>	P0442, P0455	5
Evaporative purge system monitor	P0441	
Fuel tank pressure sensor monitor	P0450	
Evaporative emission system leak monitor (very small leak) <Readiness test item>	P0456	6
Airflow sensor monitor	P0101	7
Manifold absolute pressure (MAP) sensor monitor	P0106, P0107	
Knock sensor monitor	P0325	
Intake air temperature sensor monitor	P0111	8
Engine coolant temperature sensor monitor	P0116, P0125	9
Thermostat monitor	P0128	10
Heated oxygen sensor (rear) monitor <Readiness test item>	P0139, P0159	11
Air fuel ratio feedback monitor	P0134, P0154	12
Heated oxygen sensor (rear) monitor <Readiness test item>	P0140, P0160	13
Fuel tank temperature sensor monitor	P0181	14
Misfire monitor	P0300, P0301, P0302, P0303, P0304, P0305, P0306	15
Fuel tank pressure sensor monitor	P0451	16

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Power steering pressure switch monitor	P0554	17
Idle speed control system monitor	P0506, P0507	18
Idle speed control system monitor	P1506, P1507	19
MIVEC system monitor	P003C	20
Fuel trim monitor	P0171, P0172, P0174, P0175	21
Heated oxygen sensor monitor	P0131, P0137, P0151, P0157, P2195, P2197	22
Airflow sensor monitor	P0102, P0103	23
Manifold absolute pressure (MAP) sensor monitor	P0108	
Intake air temperature sensor monitor	P0112, P0113	
Engine coolant temperature sensor monitor	P0117, P0118	
Heated oxygen sensor monitor	P0132, P0138, P0152, P0158, P2252, P2253	
Fuel tank temperature sensor monitor	P0182, P0183	
Injector monitor	P0201, P0202, P0203, P0204, P0205, P0206	
Crankshaft position sensor monitor	P0335	
Camshaft position sensor monitor	P0340	
Exhaust gas recirculation (EGR) valve (stepper motor) monitor	P0403	
Evaporative emission purge solenoid monitor	P0443	
Evaporative emission ventilation solenoid monitor	P0446	
Fuel tank pressure sensor monitor	P0452, P0453	
Fuel level sensor monitor	P0462, P0463	
Engine oil control valve monitor	P001A	
Barometric pressure sensor monitor	P2228, P2229	

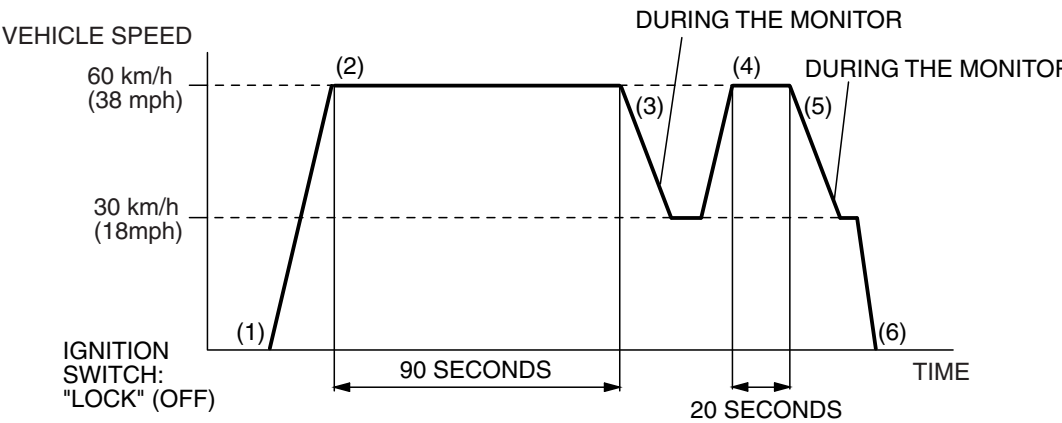
PATTERN 1

Drive cycle pattern	<p align="right">AK402430 AD</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 82°C (180°F) • Intake air temperature: More than -10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 4 minutes at the following conditions. (During the monitor) <i>NOTE: When the system is normal, the monitor is completed earlier.</i> <ul style="list-style-type: none"> • Vehicle speed: More than 30 km/h (19 mph) • Engine speed: More than 1,600 r/min, less than 3,000 r/min • Engine load: More than 30 %, less than 60 % • Without rapid accelerator pedal movement 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. <i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i> 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 2

Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 10 seconds. (During the monitor) 3. Turn the ignition switch to the "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. <i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i> 5. Confirm that the diagnostic trouble code (DTC) is not output.
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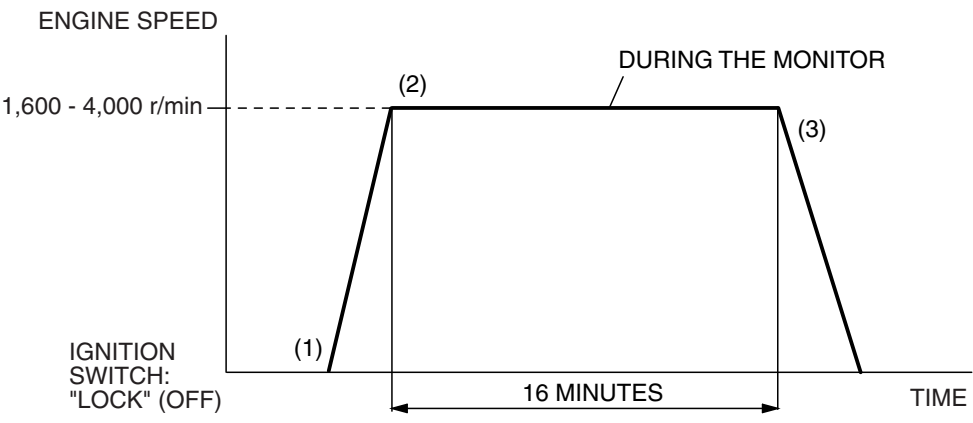
PATTERN 3

Drive cycle pattern	 <p>VEHICLE SPEED</p> <p>60 km/h (38 mph)</p> <p>30 km/h (18 mph)</p> <p>IGNITION SWITCH: "LOCK" (OFF)</p> <p>(1)</p> <p>(2)</p> <p>(3)</p> <p>(4)</p> <p>(5)</p> <p>(6)</p> <p>90 SECONDS</p> <p>20 SECONDS</p> <p>TIME</p> <p>DURING THE MONITOR</p> <p>DURING THE MONITOR</p> <p>AK402431AC</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 82°C (180°F) • Intake air temperature: More than 5°C (41°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Accelerate until the vehicle speed is 60 km/h (38 mph) and then drive the vehicle for 90 seconds. 3. Release the accelerator pedal and reduce vehicle speed to 30 km/h (18 mph). (During the monitor) 4. Accelerate until the vehicle speed is 60 km/h (38 mph) and then drive the vehicle for 20 seconds. 5. Release the accelerator pedal and reduce vehicle speed to 30 km/h (18 mph). (During the monitor) 6. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 7. Start the engine and do Steps 1 to 6 again. <p><i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i></p> <ol style="list-style-type: none"> 8. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 4

<p>Drive cycle pattern</p>	<p align="right">AK402432AB</p>
<p>Inspection conditions</p>	<ul style="list-style-type: none"> • Engine coolant temperature: More than 30°C (86°F) • Intake air temperature: More than -10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all accessories switched OFF. 2. Drive the vehicle for 5 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: Less than 3,000 r/min • Airflow rate: More than 10 g/sec, less than 35 g/sec • Accelerator pedal: Except full close • Without rapid accelerator pedal movement 3. Release the accelerator pedal for 5 seconds. 4. Drive the vehicle for 2 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: Less than 3,000 r/min • Airflow rate: More than 10 g/sec, less than 35 g/sec • Accelerator pedal: Except full close • Without rapid accelerator pedal movement <p><i>NOTE: When the system is normal, the monitor is completed earlier.</i></p> 5. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Start the engine and do Steps 1 to 5 again. <p><i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i></p> 7. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 5

Drive cycle pattern	 <p>ENGINE SPEED</p> <p>1,600 - 4,000 r/min</p> <p>(2)</p> <p>DURING THE MONITOR</p> <p>(3)</p> <p>IGNITION SWITCH: "LOCK" (OFF)</p> <p>(1)</p> <p>16 MINUTES</p> <p>TIME</p> <p>AK402430 AG</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature at engine start: Less than 36°C (96°F) • Intake air temperature at engine start: Less than 36°C (96°F) • Fuel amount at engine start: More than 15 %, less than 40 % • Engine coolant temperature: More than 60°C (41°F) • Intake air temperature: More than 5°C (41°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Fuel temperature: Less than 36°C (96°F) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 16 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: More than 1,600 r/min, less than 4,000 r/min • Vehicle speed: More than 30 km/h (18.7 mph) • Engine load: More than 26 %, less than 50 % • Without rapid accelerator pedal movement <p><i>NOTE: Keep running as long as possible with the power steering pressure switch in the OFF position.</i></p> <p><i>NOTE: When the system is normal, the monitor is completed earlier.</i></p> 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. <p><i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i></p> 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 6

Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature at engine start: Less than 36°C (96°F) • Intake air temperature at engine start: Less than 36°C (96°F) • Fuel amount at engine start: More than 40 %, less than 85 % • Engine coolant temperature: More than 20°C (68°F) • Intake air temperature: More than 5°C (41°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Fuel temperature: Less than 32°C (90°F)
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 16 minutes. (During the monitor) <i>NOTE: When the system is normal, the monitor is completed earlier.</i> 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. <i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i> 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 7

Drive cycle pattern	<p align="right">AK402442AD</p>
Inspection condition	<ul style="list-style-type: none"> • Engine coolant temperature at engine start: More than 0°C (32°F) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 30 seconds. (During the monitor) 3. Accelerate the vehicle for 2 seconds at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: More than 2,500 r/min • Engine load: More than 60 % • Throttle position sensor output voltage: More than 3.5 volts 4. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 8

Drive cycle pattern	<p>VEHICLE SPEED</p> <p>50 km/h (31 mph)</p> <p>IDLING</p> <p>IGNITION SWITCH: "LOCK" (OFF)</p> <p>1 MINUTE</p> <p>30 SECONDS</p> <p>1 MINUTE</p> <p>30 SECONDS</p> <p>TIME</p> <p>AK402435AB</p>
Inspection conditions	<ul style="list-style-type: none"> Engine coolant temperature: More than 76°C (169°F) Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 50 km/h (31 mph) for 1 minute. 3. Stop the vehicle in a safe place and let the engine idle for 30 seconds. 4. Repeat Steps 2 and 3 again. 5. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 9

Drive cycle pattern	<p>VEHICLE SPEED</p> <p>50 km/h (32 mph)</p> <p>IGNITION SWITCH: "LOCK" (OFF)</p> <p>DURING THE MONITOR</p> <p>6 MINUTES</p> <p>TIME</p> <p>AK402441AB</p>
Inspection conditions	<ul style="list-style-type: none"> Engine coolant temperature at engine start: More than 7°C (47°F) Intake air temperature: Less than 60°C (140°F) Engine coolant temperature: More than 40°C (104°F) Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 6 minutes at the following condition. (During the monitor) <ul style="list-style-type: none"> Vehicle speed: More than 50 km/h (32 mph) Except fuel cut 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Confirm that the diagnostic trouble code (DTC) is not output.

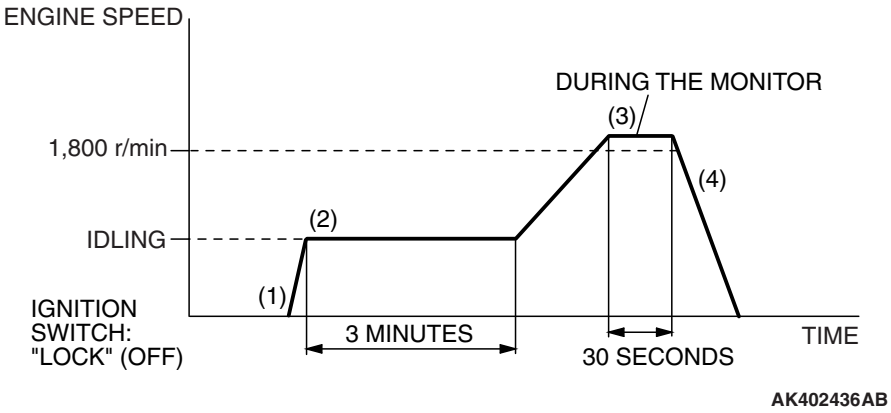
PATTERN 10

Drive cycle pattern	<p>AK402441AC</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature at engine start: More than 10°C (50°F), less than 76°C (168°F) • Difference between engine coolant temperature and intake air temperature at engine start: Less than 5°C (9°F) • Dropping of intake air temperature since engine start: Less than 2°C (3.6°F) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 20 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Vehicle speed: More than 50 km/h (32 mph) • Except fuel cut <p><i>NOTE: The system is normal if engine coolant temperature will rise more than 82°C (180°F) within 20 minutes.</i></p> 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 11

Drive cycle pattern	<p>VEHICLE SPEED</p> <p>50 km/h (32 mph)</p> <p>IGNITION SWITCH: "LOCK" (OFF)</p> <p>(1) (2) (3) (4)</p> <p>3 MINUTES</p> <p>TIME</p> <p>AK402441AF</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 76°C (169°F) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at 50 km/h (31 mph) for 3 minutes. 3. Release the accelerator pedal for 10 seconds then stop the vehicle in a safe place. (During the monitor) 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 12

<p>Drive cycle pattern</p>	 <p align="right">AK402436AB</p>
<p>Inspection conditions</p>	<ul style="list-style-type: none"> • Engine coolant temperature: More than 82°C (180°F) • Condition of A/T: Selector lever "D" range
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 3 minutes. 3. Drive the vehicle for 30 seconds at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: More than 1,800 r/m • Engine load: More than 30 %, less than 80 % • Throttle position sensor output: Less than 3.0 volts • Except fuel cut 4. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 13

Drive cycle pattern	
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 76°C (169°F) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at 50 km/h (31 mph) for 3 minutes. 3. Release the accelerator pedal for 5 seconds then stop the vehicle in a safe place. 4. Accelerate until the vehicle speed is at 50 km/h (31 mph) at the following conditions. <ul style="list-style-type: none"> • Engine speed: More than 1,500 r/min • Engine load: More than 40 % 5. Release the accelerator pedal for 5 seconds then stop the vehicle in a safe place. 6. Repeat Steps 4 and 5 for 2 times. 7. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 8. Start the engine and do Steps 1 to 7 again. 9. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 14

Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature at engine start: More than -10°C (14°F), less than 33°C (91°F) • Difference between engine coolant temperature and intake air temperature at engine start: Less than 5°C (9°F) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 30 km/h (19 mph) until engine coolant temperature rises more than 60°C (140°F). (During the monitor) 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 15

<p>Drive cycle pattern</p>	<p align="right">AK402440AD</p>
<p>Inspection conditions</p>	<ul style="list-style-type: none"> • Engine coolant temperature: More than -10°C (14°F) • Intake air temperature: More than -10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 3 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: More than 500 r/min, less than 3,000 r/min • Engine load: More than 25 % • Without rapid accelerator pedal change • Except fuel cut 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 16

Drive cycle pattern	<p style="text-align: right;">AK402438AB</p>
Inspection condition	Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Accelerate until the vehicle speed is more than 50 km/h (31 mph). <ul style="list-style-type: none"> • Engine speed: More than 2,500 r/min • Engine load: More than 55 % 3. Stop the vehicle in a safe place and let the engine idle for 20 seconds. (During the monitor) 4. Repeat Steps 2 and 3 for 10 times. 5. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Start the engine and do Steps 1 to 5 again. 7. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 17

Drive cycle pattern	<p align="right">AK402441AD</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 30°C (86°F) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 50 km/h (31 mph) for 30 seconds. (During the monitor) 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 18

Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 82°C (180°F) • Intake air temperature: More than -10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Accelerate until the vehicle speed is more than 1.5 km/h (1 mph). 3. Stop the vehicle in a safe place and let the engine idle for 1 minute. (During the monitor) 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 19

Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 7°C (45°F), less than 40°C (104°F) • Intake air temperature: More than -10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg)
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 1 minute. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 20

Inspection condition	Engine coolant temperature: More than 77°C (171°F)
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 30 seconds. 3. Drive engine at more than 4,813 r/min for 5 seconds. (During the monitor) 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 21

Inspection condition	Engine coolant temperature: More than 82°C (180°F)
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 15 minutes. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 22

Inspection conditions	<ul style="list-style-type: none"> • Intake air temperature: More than -10°C (14°F) • Engine coolant temperature sensor: More than 7°C (45°F)
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 4 minutes. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 23

Inspection conditions	<ul style="list-style-type: none"> • Fuel temperature sensor: Less than 36°C (96°F) <Fuel tank pressure sensor monitor> • Fuel amount at engine start: Less than 85 % <Fuel tank pressure sensor monitor>
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle at the engine speed less than 1,000 r/min for 15 seconds. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Confirm that the diagnostic trouble code (DTC) is not output.

SYSTEM READINESS TEST STATUS

PURPOSE

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

OVERVIEW

The PCM monitors the following main diagnosis items and records whether the evaluation was completed or is incomplete. The Readiness Codes are established for the I/M programs, thereby confirming that the vehicles have not been tampered with by erasing the diagnostic trouble code(s) (DTCs) before I/M testing. The Readiness Codes and DTCs can be reset by disconnecting the battery or by erasing the codes with a scan tool MB991958 (M.U.T.-III sub assembly). For this reason, all the Readiness Codes must be displayed "Complete" before I/M testing.

When the monitors run and complete, the scan tool MB991958 (M.U.T.-III sub assembly) will display the Readiness Codes as "Complete" (General Scan Tools display as "Ready"). When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. For DTCs requiring two drive cycles to detect a fault, the second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle. If the fault is still there after the second drive cycle, a DTC will be set.

- Catalyst: P0421, P0431
- Evaporative system: P0442, P0455, P0456
- Heated oxygen sensor: P0133, P0139, P0140, P0153, P0159, P0160
- Heated oxygen sensor heater: P0031, P0037, P0051, P0057
- EGR system: P0401

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

NOTE: After a repair is made for a DTC, the technician should drive the OBD-II Drive Cycle checking that the scan tool MB991958 (M.U.T.-III Sub Assembly) displays all the Readiness Codes as "Complete".

FAIL-SAFE FUNCTION REFERENCE TABLE

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

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

MALFUNCTION ITEM	CONTROL CONTENTS DURING MALFUNCTION
Throttle position sensor (main)	<ul style="list-style-type: none"> • Controls the throttle valve position through the use of the throttle position sensor (sub) signal. • Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle. • Prohibits the operation of the engine speed feedback control. • Prohibits the operation of the auto-cruise control. • Cuts off fuel when the engine speed exceeds 3,000 r/min. • Suppresses the engine output by stopping the electronically controlled throttle valve system if the throttle position sensor (sub) is also malfunctioning.
Throttle position sensor (sub)	<ul style="list-style-type: none"> • Controls the throttle valve position through the use of the throttle position sensor (main) signal. • Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle. • Prohibits the operation of the auto-cruise control. • Cuts off fuel when the engine speed exceeds 3,000 r/min. • Prohibits the idle speed control from learning. • Suppresses the engine output by stopping the electronically controlled throttle valve system if the throttle position sensor (main) is also malfunctioning.
Throttle valve position feedback	<ul style="list-style-type: none"> • Suppresses the engine output by stopping the electronically controlled throttle valve system. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control.
Throttle actuator control motor	<ul style="list-style-type: none"> • Suppresses the engine output by stopping the electronically controlled throttle valve system. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control.
Throttle actuator control computer	<ul style="list-style-type: none"> • Suppresses the engine output by stopping the electronically controlled throttle valve system. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control.
Communication between throttle actuator control computer and engine control computer	<ul style="list-style-type: none"> • Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control. • Cuts off fuel when the engine speed exceeds 3,000 r/min.
Switching to high-speed cam in Mitsubishi Innovative Valve timing Electronic Control (MIVEC)	<ul style="list-style-type: none"> • Does not switch to high-speed cam. • Cut off fuel when the engine speed exceeds 5,000 r/min.

DIAGNOSTIC TROUBLE CODE CHART

M1131151004671

⚠ WARNING

When touching the throttle valve, surely shut off the driving circuits of the throttle valve. In the event that the throttle valve is operated, a finger might be injured as the result of being caught by the throttle valve.

⚠ CAUTION

During diagnosis, a DTC code 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.

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P001A	Camshaft profile control (engine oil control valve) circuit	P.13B-55
P0031	Heated oxygen sensor heater circuit low (bank 1 sensor 1)	P.13B-67
P0032	Heated oxygen sensor heater circuit high (bank 1 sensor 1)	P.13B-81
P0037	Heated oxygen sensor heater circuit low (bank 1 sensor 2)	P.13B-85
P0038	Heated oxygen sensor heater circuit high (bank 1 sensor 2)	P.13B-99
P003C	Mitsubishi innovative valve timing electronic control system (MIVEC) performance problem	P.13B-103
P0051	Heated oxygen sensor heater circuit low (bank 2 sensor 1)	P.13B-114
P0052	Heated oxygen sensor heater circuit high (bank 2 sensor 1)	P.13B-128
P0057	Heated oxygen sensor heater circuit low (bank 2 sensor 2)	P.13B-132
P0058	Heated oxygen sensor heater circuit high (bank 2 sensor 2)	P.13B-146
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor	P.13B-150
P0101 ^{*1}	Mass airflow circuit range/performance problem	P.13B-155
P0102 ^{*1}	Mass airflow circuit low input	P.13B-166
P0103 ^{*1}	Mass airflow circuit high input	P.13B-175
P0106	Manifold absolute pressure circuit range/performance problem	P.13B-182
P0107	Manifold absolute pressure circuit low input	P.13B-196
P0108	Manifold absolute pressure circuit high input	P.13B-208
P0111 ^{*1}	Intake air temperature circuit range/performance problem	P.13B-217
P0112 ^{*1}	Intake air temperature circuit low input	P.13B-226
P0113 ^{*1}	Intake air temperature circuit high input	P.13B-233
P0116 ^{*1}	Engine coolant temperature circuit range/performance problem	P.13B-243
P0117 ^{*1}	Engine coolant temperature circuit low input	P.13B-252
P0118 ^{*1}	Engine coolant temperature circuit high input	P.13B-259
P0122 ^{*1}	Throttle position sensor (main) circuit low input	P.13B-270
P0123 ^{*1}	Throttle position sensor (main) circuit high input	P.13B-281
P0125 ^{*1}	Insufficient coolant temperature for closed loop fuel control	P.13B-289

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	P.13B-302
P0131	Heated oxygen sensor circuit low voltage (bank 1 sensor 1)	P.13B-304
P0132	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)	P.13B-320
P0133	Heated oxygen sensor circuit slow response (bank 1 sensor 1)	P.13B-325
P0134 ^{*1}	Heated oxygen sensor circuit no activity detected (bank 1 sensor 1)	P.13B-331
P0137	Heated oxygen sensor circuit low voltage (bank 1 sensor 2)	P.13B-341
P0138	Heated oxygen sensor circuit high voltage (bank 1 sensor 2)	P.13B-357
P0139	Heated oxygen sensor circuit slow response (bank 1 sensor 2)	P.13B-362
P0140	Heated oxygen sensor circuit no activity detected (bank 1 sensor 2)	P.13B-367
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)	P.13B-371
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)	P.13B-388
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)	P.13B-393
P0154 ^{*1}	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)	P.13B-399
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)	P.13B-408
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)	P.13B-425
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)	P.13B-430
P0160	Heated oxygen sensor circuit no activity detected (bank 2 sensor 2)	P.13B-435
P0171	System too lean (bank 1)	P.13B-439
P0172	System too rich (bank 1)	P.13B-448
P0174	System too lean (bank 2)	P.13B-454
P0175	System too rich (bank 2)	P.13B-462
P0181	Fuel tank temperature sensor circuit range/performance	P.13B-468
P0182	Fuel tank temperature sensor circuit low input	P.13B-475
P0183	Fuel tank temperature sensor circuit high input	P.13B-481
P0201	Injector circuit-cylinder 1	P.13B-492
P0202	Injector circuit-cylinder 2	P.13B-504
P0203	Injector circuit-cylinder 3	P.13B-515
P0204	Injector circuit-cylinder 4	P.13B-527
P0205	Injector circuit-cylinder 5	P.13B-538
P0206	Injector circuit-cylinder 6	P.13B-550
P0222 ^{*1}	Throttle position sensor (sub) circuit low input	P.13B-561
P0223 ^{*1}	Throttle position sensor (sub) circuit high input	P.13B-572
P0300 ^{*2}	Random/multiple cylinder misfire detected	P.13B-579
P0301 ^{*2}	Cylinder 1 misfire detected	P.13B-584
P0302 ^{*2}	Cylinder 2 misfire detected	P.13B-587

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0303 ^{*2}	Cylinder 3 misfire detected	P.13B-590
P0304 ^{*2}	Cylinder 4 misfire detected	P.13B-593
P0305 ^{*2}	Cylinder 5 misfire detected	P.13B-596
P0306 ^{*2}	Cylinder 6 misfire detected	P.13B-599
P0325	Knock sensor circuit	P.13B-603
P0335 ^{*1}	Crankshaft position sensor circuit	P.13B-610
P0340 ^{*1}	Camshaft position sensor circuit	P.13B-632
P0401	Exhaust gas recirculation flow insufficient detected	P.13B-649
P0403	Exhaust gas recirculation control circuit	P.13B-653
P0421	Warm up catalyst efficiency below threshold (bank 1)	P.13B-665
P0431	Warm up catalyst efficiency below threshold (bank 2)	P.13B-667
P0441	Evaporative emission control system incorrect purge flow	P.13B-670
P0442	Evaporative emission control system leak detected (small leak)	P.13B-674
P0443	Evaporative emission control system purge control valve circuit	P.13B-686
P0446	Evaporative emission control system vent control circuit	P.13B-698
P0450	Evaporative emission control system pressure sensor malfunction	P.13B-710
P0451	Evaporative emission control system pressure sensor range/performance	P.13B-731
P0452	Evaporative emission control system pressure sensor low input	P.13B-752
P0453	Evaporative emission control system pressure sensor high input	P.13B-773
P0455	Evaporative emission control system leak detected (gross leak)	P.13B-794
P0456	Evaporative emission control system leak detected (very small leak)	P.13B-808
P0461	Fuel level sensor (main) circuit range/performance	P.13B-820
P0462	Fuel level sensor circuit low input	P.13B-827
P0463	Fuel level sensor circuit high input	P.13B-834
P0506	Idle control system RPM lower than expected	P.13B-840
P0507	Idle control system RPM higher than expected	P.13B-843
P0513	Immobilizer malfunction	P.13B-846
P0551	Power steering pressure switch circuit range/performance	P.13B-848
P0554	Power steering pressure switch circuit intermittent	P.13B-861
P0603 ^{*1}	EEPROM malfunction	P.13B-866
P0606 ^{*1}	Powertrain control module main processor malfunction	P.13B-868
P0622	Generator FR terminal circuit malfunction	P.13B-875
P0630 ^{*1}	Vehicle Identification Number (VIN) malfunction	P.13B-882
P0638 ^{*1}	Throttle actuator control motor circuit range/ performance problem	P.13B-885
P0642 ^{*1}	Throttle position sensor power supply	P.13B-891

DTC	DIAGNOSTIC ITEM		REFERENCE PAGE
P0657* ¹	Throttle actuator control motor relay circuit malfunction		P.13B-893
P0705	Transmission range switch circuit malfunction (PRNDL input)	<ul style="list-style-type: none"> • A/T DTC No. P1770 (Transmission range switch system: Open circuit) • A/T DTC No. P1771 (Transmission range switch system: Short circuit) 	P.23A-65
P0712* ¹	Transmission fluid temperature sensor low input	<ul style="list-style-type: none"> • A/T DTC No. P1764 (Transmission fluid temperature sensor system: Short circuit) 	P.23A-65
P0713* ¹	Transmission fluid temperature sensor high input	<ul style="list-style-type: none"> • A/T DTC No. P1763 (Transmission fluid temperature sensor system: Open circuit) 	P.23A-65
P0715* ¹	Input/turbine speed sensor circuit	<ul style="list-style-type: none"> • A/T DTC No. P1766 (Input shaft speed sensor system: Short circuit/Open circuit) 	P.23A-65
P0720* ¹	Output speed sensor circuit	<ul style="list-style-type: none"> • A/T DTC No. P1767 (Output shaft speed sensor system: Short circuit/Open circuit) 	P.23A-65
P0731* ¹	Gear 1 incorrect ratio	<ul style="list-style-type: none"> • A/T DTC No. P1779 (1st gear incorrect ratio) 	P.23A-65
P0732* ¹	Gear 2 incorrect ratio	<ul style="list-style-type: none"> • A/T DTC No. P1780 (2nd gear incorrect ratio) 	P.23A-65
P0733* ¹	Gear 3 incorrect ratio	<ul style="list-style-type: none"> • A/T DTC No. P1781 (3rd gear incorrect ratio) 	P.23A-65
P0734* ¹	Gear 4 incorrect ratio	<ul style="list-style-type: none"> • A/T DTC No. P1782 (4th gear incorrect ratio) 	P.23A-65
P0735* ¹	Gear 5 incorrect ratio	<ul style="list-style-type: none"> • A/T DTC No. P1783 (5th gear incorrect ratio) 	P.23A-65
P0736* ¹	Gear R incorrect ratio	<ul style="list-style-type: none"> • A/T DTC No. P1784 (Reverse gear incorrect ratio) 	P.23A-65
P0741	Torque converter clutch circuit performance or stuck off	<ul style="list-style-type: none"> • A/T DTC No. P1786 (Torque converter clutch solenoid system: Defective system) 	P.23A-65
P0742	Torque converter clutch circuit stuck on	<ul style="list-style-type: none"> • A/T DTC No. P1787 (Torque converter clutch solenoid system: Lock-up stuck on) 	P.23A-65
P0743* ¹	Torque converter clutch circuit electrical	<ul style="list-style-type: none"> • A/T DTC No. P1778 (Torque converter clutch solenoid system: Short circuit/Open circuit) 	P.23A-65
P0753* ¹	Shift solenoid "A" electrical	<ul style="list-style-type: none"> • A/T DTC No. P1773 (Low and reverse solenoid valve system: Short circuit/Open circuit) 	P.23A-65
P0758* ¹	Shift solenoid "B" electrical	<ul style="list-style-type: none"> • A/T DTC No. P1774 (Underdrive solenoid valve system: Short circuit/Open circuit) 	P.23A-65
P0763* ¹	Shift solenoid "C" electrical	<ul style="list-style-type: none"> • A/T DTC No. P1775 (Second solenoid valve system: Short circuit/Open circuit) 	P.23A-65
P0768* ¹	Shift solenoid "D" electrical	<ul style="list-style-type: none"> • A/T DTC No. P1776 (Overdrive solenoid valve system: Short circuit/Open circuit) 	P.23A-65

DTC	DIAGNOSTIC ITEM		REFERENCE PAGE
P0773 ^{*1}	Shift solenoid "E" electrical	• A/T DTC No. P1777 (Reduction solenoid valve system: Short circuit/Open circuit)	P.23A-65
P1506	Idle control system RPM lower than expected at low engine coolant temperature		P.13B-906
P1507	Idle control system RPM higher than expected at low engine coolant temperature		P.13B-909
P1513	Remote control engine starter system <Vehicles with remote control engine starter>		_ ^{*3}
P1602 ^{*1}	Communication malfunction (between PCM main processor and system LSI)		P.13B-912
P1603 ^{*1}	Battery backup line malfunction		P.13B-914
P1751 ^{*1}	A/T control relay malfunction	• A/T DTC No. P1788 (A/T control relay system: Short circuit to ground /open circuit)	P.23A-65
P2066	Fuel level sensor (sub) circuit range/performance		P.13B-921
P2100 ^{*1}	Throttle actuator control motor circuit (open)		P.13B-926
P2101 ^{*1}	Throttle actuator control motor magneto malfunction		P.13B-935
P2122 ^{*1}	Accelerator pedal position sensor (main) circuit low input		P.13B-941
P2123 ^{*1}	Accelerator pedal position sensor (main) circuit high input		P.13B-951
P2127 ^{*1}	Accelerator pedal position sensor (sub) circuit low input		P.13B-958
P2128 ^{*1}	Accelerator pedal position sensor (sub) circuit high input		P.13B-968
P2135 ^{*1}	Throttle position sensor (main and sub) range/performance problem		P.13B-975
P2138 ^{*1}	Accelerator pedal position sensor (main and sub) range/performance problem		P.13B-981
P2195	Heated oxygen sensor inactive (bank 1 sensor 1)		P.13B-995
P2197	Heated oxygen sensor inactive (bank 2 sensor 1)		P.13B-998
P2228 ^{*1}	Barometric pressure circuit low input		P.13B-1001
P2229 ^{*1}	Barometric pressure circuit high input		P.13B-1003
P2252	Heated oxygen sensor offset circuit low voltage		P.13B-1006
P2253	Heated oxygen sensor offset circuit high voltage		P.13B-1028
U1073	Bus off		P.13B-1055
U1102 ^{*4}	ASC-ECU time-out		P.13B-1057
U1108 ^{*1*4}	Combination meter time-out		P.13B-1062
U1109 ^{*4}	ETACS-ECU time-out		P.13B-1067
U1110 ^{*4}	A/C-ECU time-out		P.13B-1071
U1117 ^{*4}	Immobilizer-ECU time-out		P.13B-1075

NOTE: Do not replace the powertrain control module (PCM) until a through terminal check reveals there are no short/open circuits.

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

*NOTE: After the PCM 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 "**1", the diagnostic trouble code is recorded on the first detection of the malfunction.*

*NOTE: The codes marked with a "**2" in the diagnosis code number column have the following two conditions for recording the diagnostic trouble code.*

- *In case that the misfire causing the damaged catalyst is detected, the diagnostic trouble code is recorded at the time.*
- *In case that the misfire deteriorating the exhaust gas is detected, the diagnostic trouble code is recorded when the same malfunction is redetected after the next engine start.*

*NOTE: *3: Carry out the troubleshooting of the installation instructions packaged together with the remote control engine starter.*

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

NOTE: Bank 1 indicates the right bank side cylinder, and Bank 2 indicates the left bank side cylinder.

*NOTE: *4: When the diagnosis codes relating to the CAN communication error are output, make sure of the vehicle equipment. When the vehicle is not equipped with the system the PCM communications to, the diagnosis code is always output. This is not abnormal.*

SYMPTOM CHART

M1131151503491

WARNING

When touching the throttle valve, surely shut off the driving circuits of the throttle valve. In the event that the throttle valve is operated, a finger might be injured as the result of being caught by the throttle valve.

CAUTION

During diagnosis, a DTC 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.

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 PCM ground circuit is normal before checking for the cause of the problem.

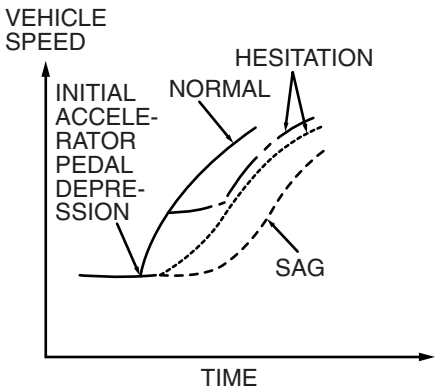
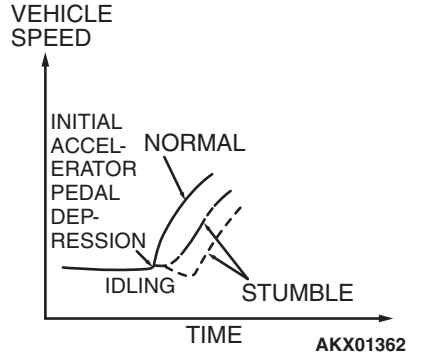
NOTE: When the racing (2,000 to 5,000 r/min or more) continues on the vehicle stopped with no load during the specified time or more, the increase in the engine speed might be limited. This comes from the engine protection and control functions and is not a malfunction.

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Communication with scan tool is impossible	Communication with PCM only is not possible	1	P.13B-1078
Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) and related parts	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) does not illuminate right after the ignition switch is turned to the "ON" position	2	P.13B-1082
	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) remains illuminated and never goes out	3	P.13B-1083
Starting	Cranks, won't start	4	P.13B-1085
	Starts up and dies	5	P.13B-1091
	Hard starting	6	P.13B-1098
Idling stability (improper idling)	Unstable idle (rough idle, hunting)	7	P.13B-1106
	Idle speed is high (improper idle speed)	8	P.13B-1110
	Idle speed is low (improper idle speed)	9	P.13B-1112
Idling stability (engine stalls)	When the engine is cold, it stalls at idle (die out)	10	P.13B-1114
	When the engine is hot, it stalls at idle (die out)	11	P.13B-1117
	The engine stalls when accelerating (pass out)	12	P.13B-1120
	The engine stalls when decelerating	13	P.13B-1122
Driving	Hesitation, sag or stumble	14	P.13B-1123
	Acceleration shock	15	P.13B-1127
	Deceleration shock	16	P.13B-1128
	Poor acceleration	17	P.13B-1129
	Surge	18	P.13B-1133
	Knocking	19	P.13B-1137
Dieseling (Run-on)		20	P.13B-1138
Too high CO and HC concentration when idling		21	P.13B-1138
IM240 test failure	Transient, mass emission tailpipe test failure	22	P.13B-1141
	Purge flow test of the evaporative emission canister failure	23	P.13B-1146
	Pressure test of the evaporative system failure	24	P.13B-1147
Generator output voltage is low (approximately 12.3 volts)		25	P.13B-1148
Fans (radiator fan, A/C condenser fan) are inoperative		26	P.13B-1154
Power supply system and ignition switch-IG system		27	P.13B-1157
Fuel pump system		28	P.13B-1168

TROUBLE SYMPTOMS	INSPECTION PROCEDURE	REFERENCE PAGE
Ignition switch-ST system and transmission range switch system	29	P.13B-1182
Ignition circuit system	30	P.13B-1187
A/C system	31	P.13B-1196

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

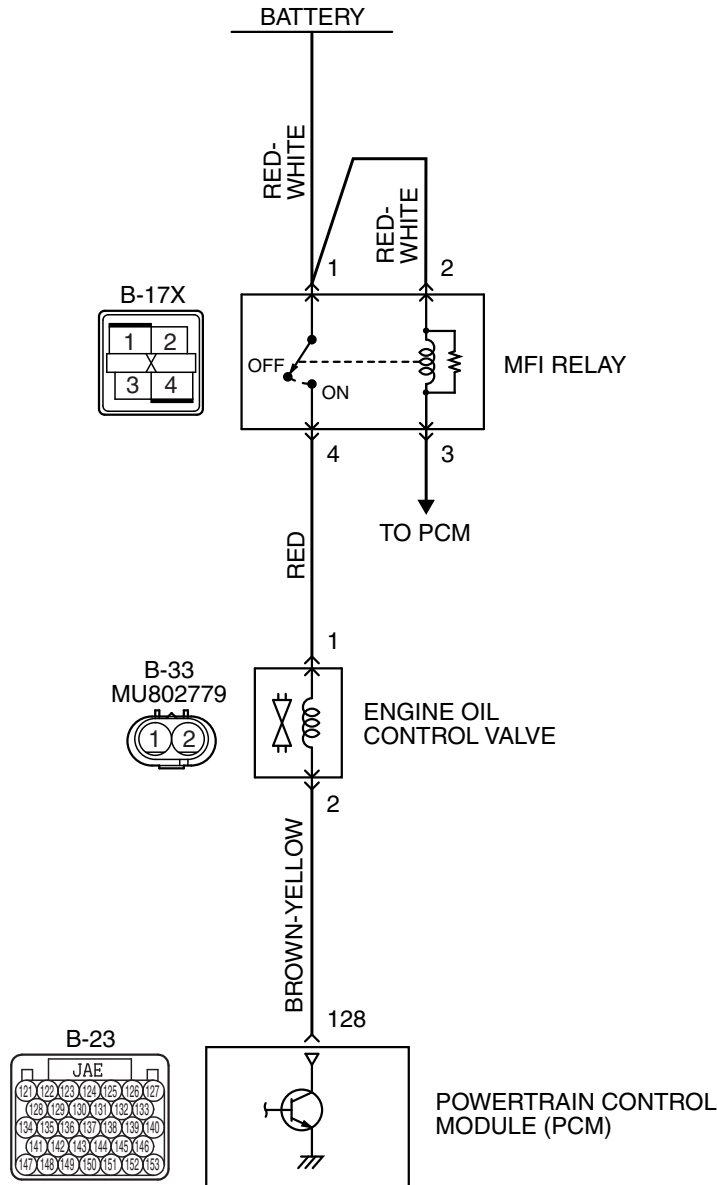
ITEMS		SYMPTOM
At starting	Won't start	The starter cranks the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starts up and dies	The engine starts, but then engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed 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 style="text-align: right;">AKX01361AB</p>
	Poor acceleration	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.
	Stumble	<p>Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration.</p>  <p style="text-align: right;">AKX01362</p>
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is slight acceleration and deceleration feel usually felt during steady, light throttle cruise. Most notable under light loads.
	Knocking	A sharp sound during driving, which sounds like a hammer striking the cylinder walls. It makes poor driveability.
At stopped	Run on ("Dieseling")	The condition in which the engine continues to run after the ignition switch is turned to the "LOCK" (OFF) position. Also called "dieseling".

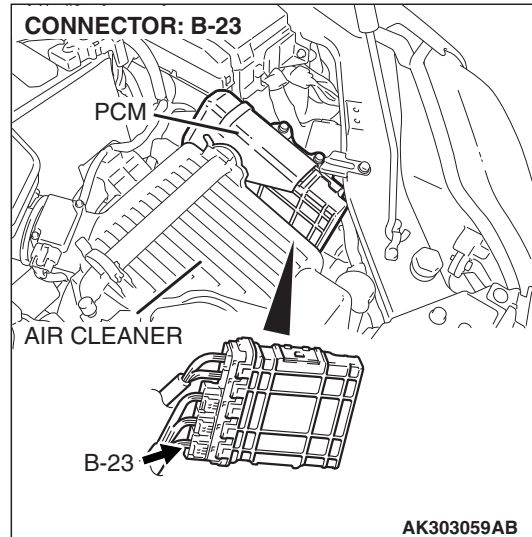
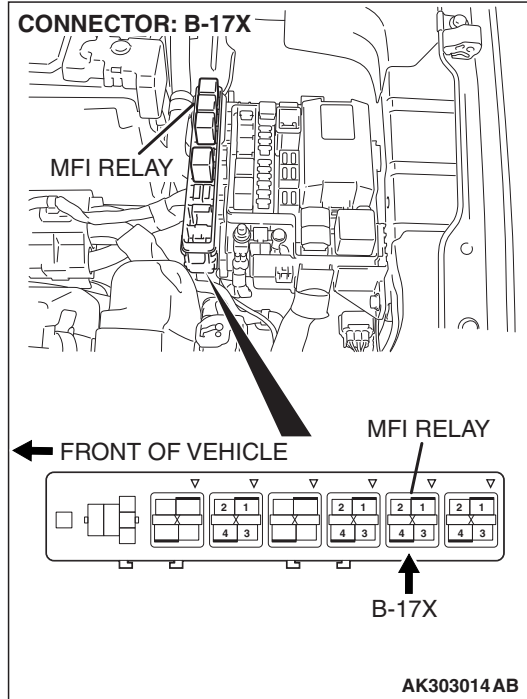
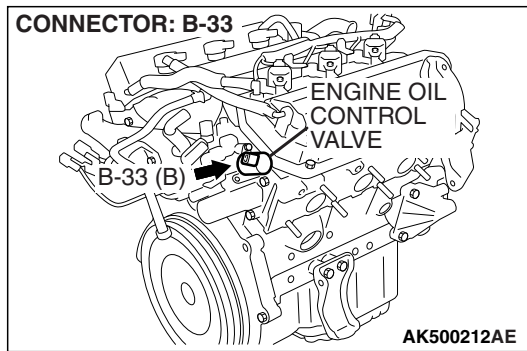
DIAGNOSTIC TROUBLE CODE PROCEDURES

DTC P001A: Camshaft Profile Control (engine oil control valve) Circuit

Engine Oil Control Valve Circuit



AK701434



CIRCUIT OPERATION

- The engine oil control valve power is supplied from the MFI relay (terminal No. 4).
- The PCM controls ground engine oil control valve by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

- The engine oil control valve switches the cams to operate the MIVEC system in the low-speed or high-speed mode in accordance with the signals from the PCM.

DESCRIPTIONS OF MONITOR METHODS

Circuit voltage stays low when solenoid status is off.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

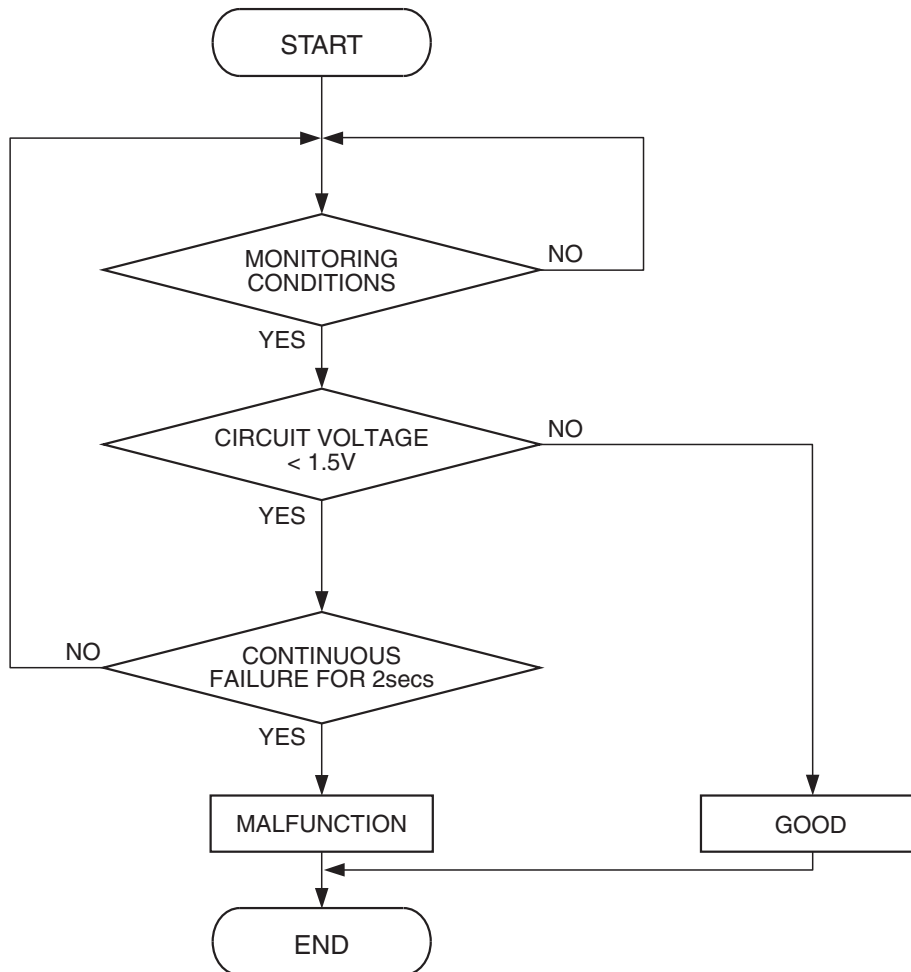
- Not applicable

Sensor (The sensor below is determined to be normal)

- Camshaft position sensor
- Mass airflow sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Injection valve

DTC SET CONDITIONS

Logic Flow Chart



AK403642

Check Conditions

- Ignition switch: "ON"
- Engine oil control valve is OFF.
- Battery positive voltage is between 10 and 16.5 volts.
- 0.1 seconds has elapsed after the above mentioned conditions have been met.

Judgment Criterion

- The PCM terminal voltage of engine oil control valve circuit is less than 1.5 volts for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

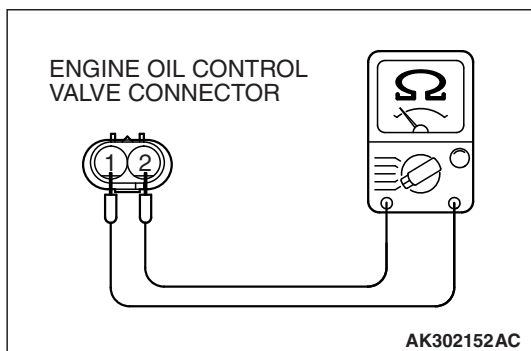
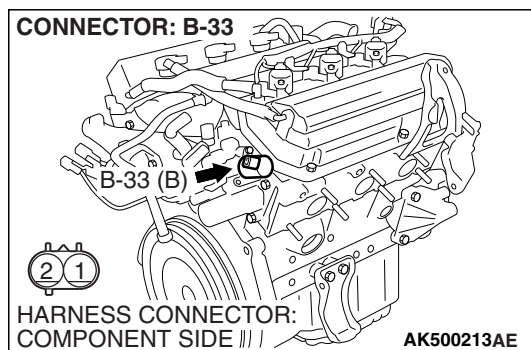
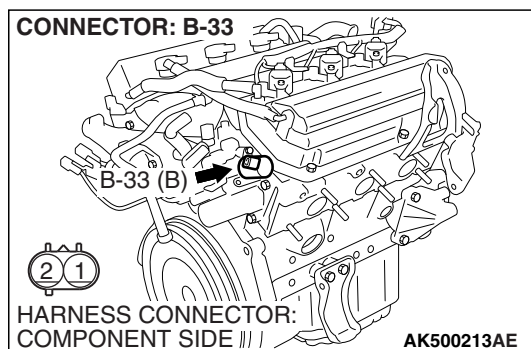
Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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

- Engine oil control valve failed.
- Open or shorted engine oil control valve circuit, harness damage or connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

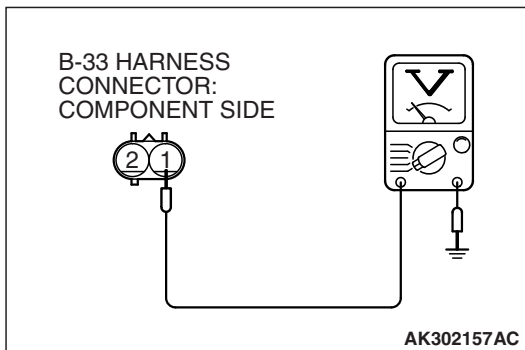
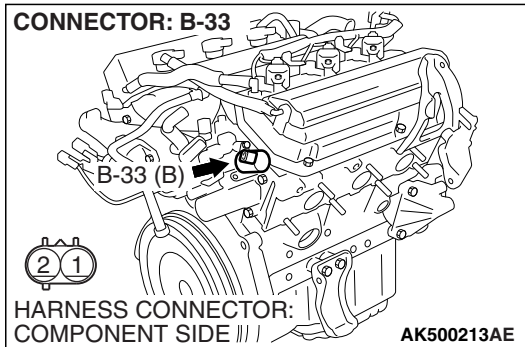
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991923: Power Plant ECU Check Harness

STEP 1. Check harness connector B-33 at the engine oil control valve 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 engine oil control valve.**

(1) Disconnect the engine oil control valve connector B-33.

(2) Measure the resistance between engine oil control valve side connector terminal No. 1 and No. 2.

Standard value: 6.9 – 7.9 Ω [at 20°C (68°F)]**Q: Is the measured resistance between 6.9 and 7.9 ohms [at 20°C (68°F)]?****YES :** Go to Step 3.**NO :** Replace the engine oil control valve. Then go to Step 12.



STEP 3. Measure the power supply voltage at engine oil control valve harness side connector B-33.

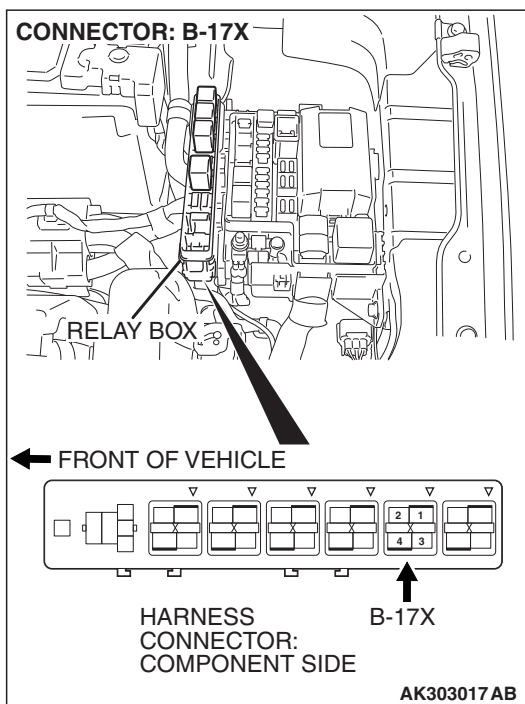
- (1) Disconnect the connector B-33 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

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

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

YES : Go to Step 5.

NO : Go to Step 4.

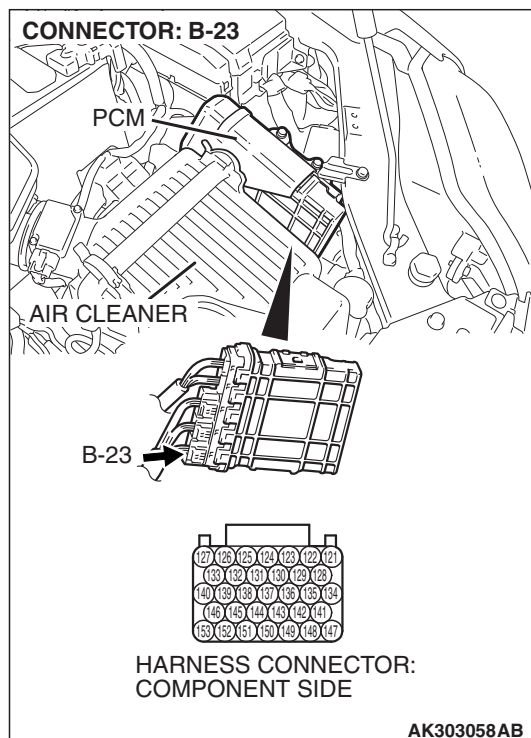


STEP 4. Check harness connector B-17X at MFI relay for damage.

Q: Is the harness connector in good condition?

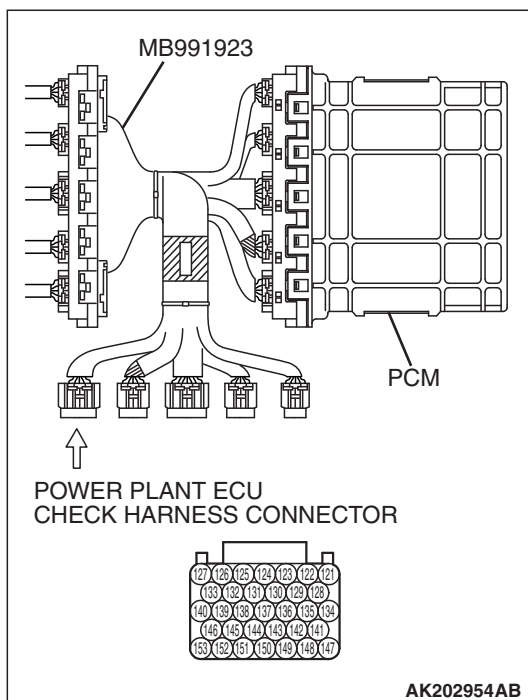
YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and engine oil control valve connector B-33 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

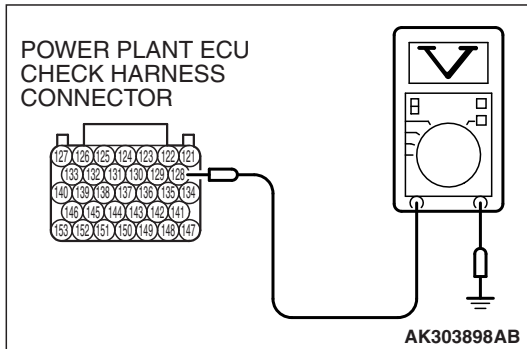
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 5. Measure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



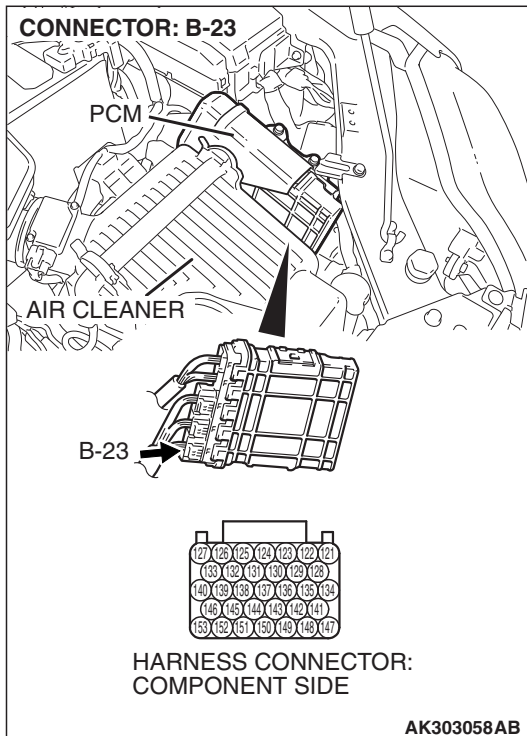


- (3) Measure the voltage between terminal No. 128 and ground.
• Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

NO : Go to Step 6.

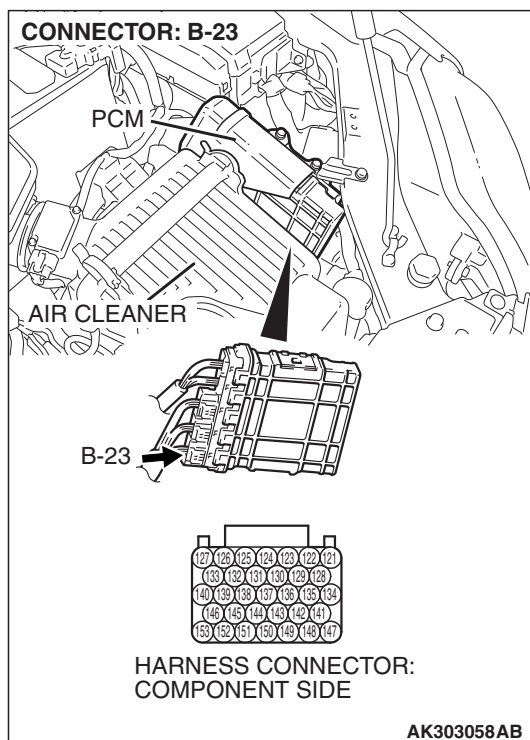
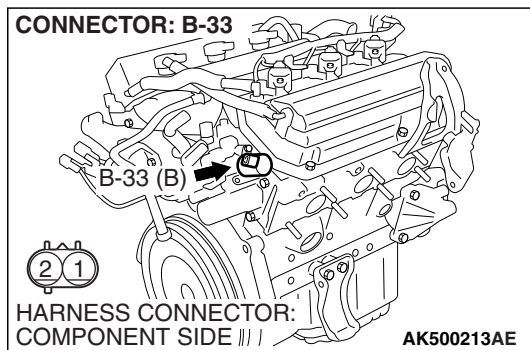


STEP 6. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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



STEP 7. Check for open circuit and short circuit to ground between engine oil control valve connector B-33 (terminal No. 2) and PCM connector B-23 (terminal No. 128).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

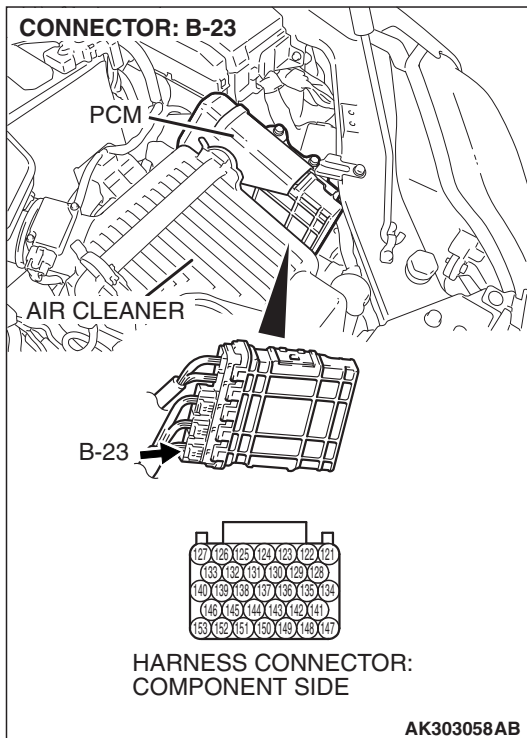
NO : Repair it. Then go to Step 12.

STEP 8. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

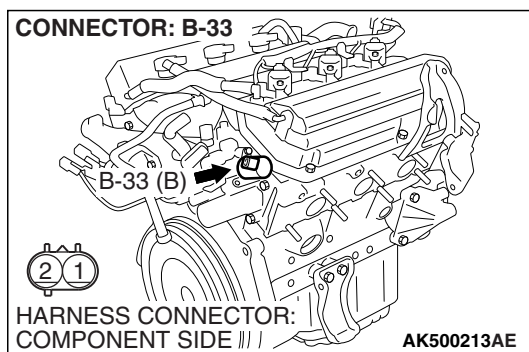
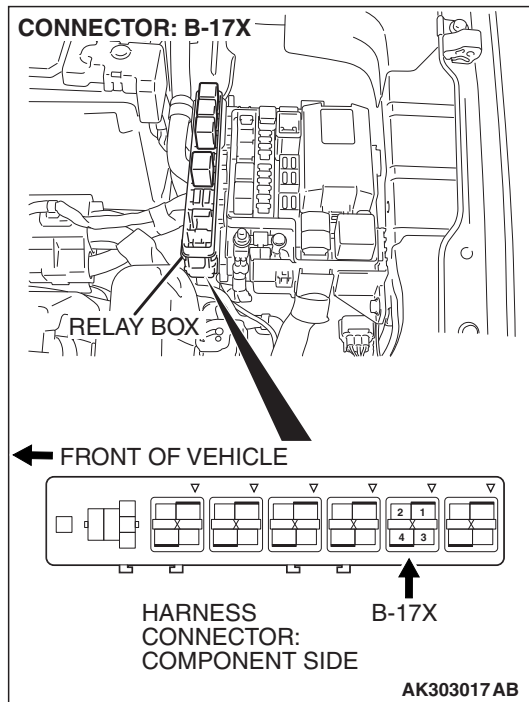


STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and engine oil control valve connector B-33 (terminal No. 1).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

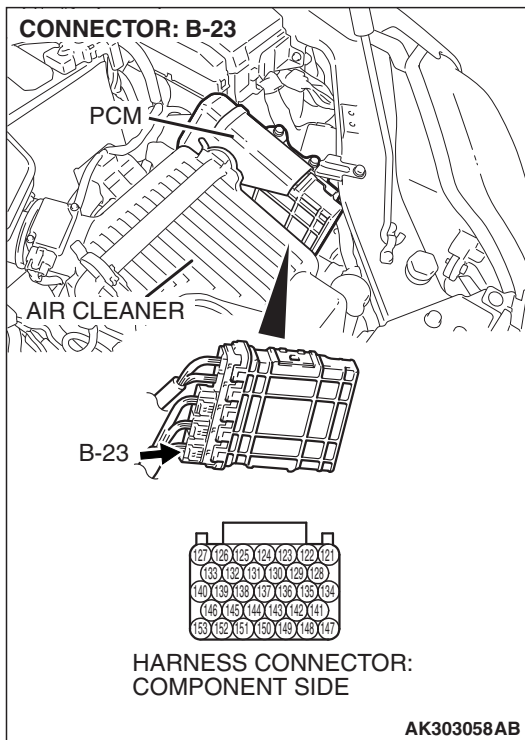
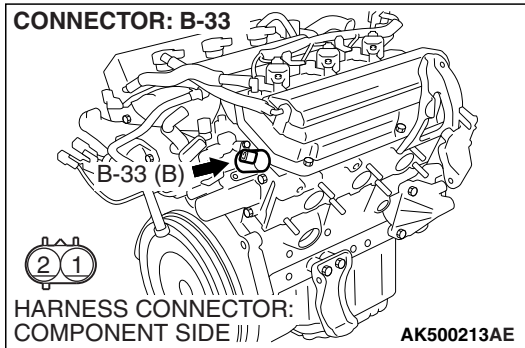


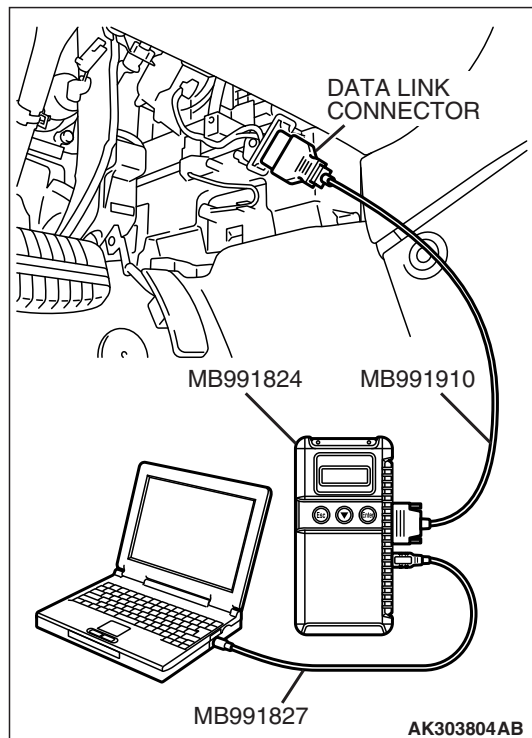
STEP 10. Check for harness damage between engine oil control valve connector B-33 (terminal No. 2) and PCM connector B-23 (terminal No. 128).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.



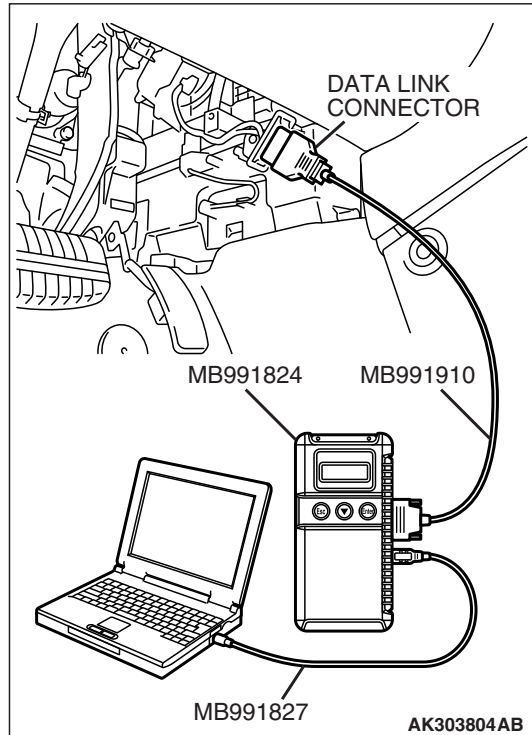
**STEP 11. Test the OBD-II Drive Cycle.**

- (1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P001A set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

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

**STEP 12. Test the OBD-II Drive Cycle.**

- (1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

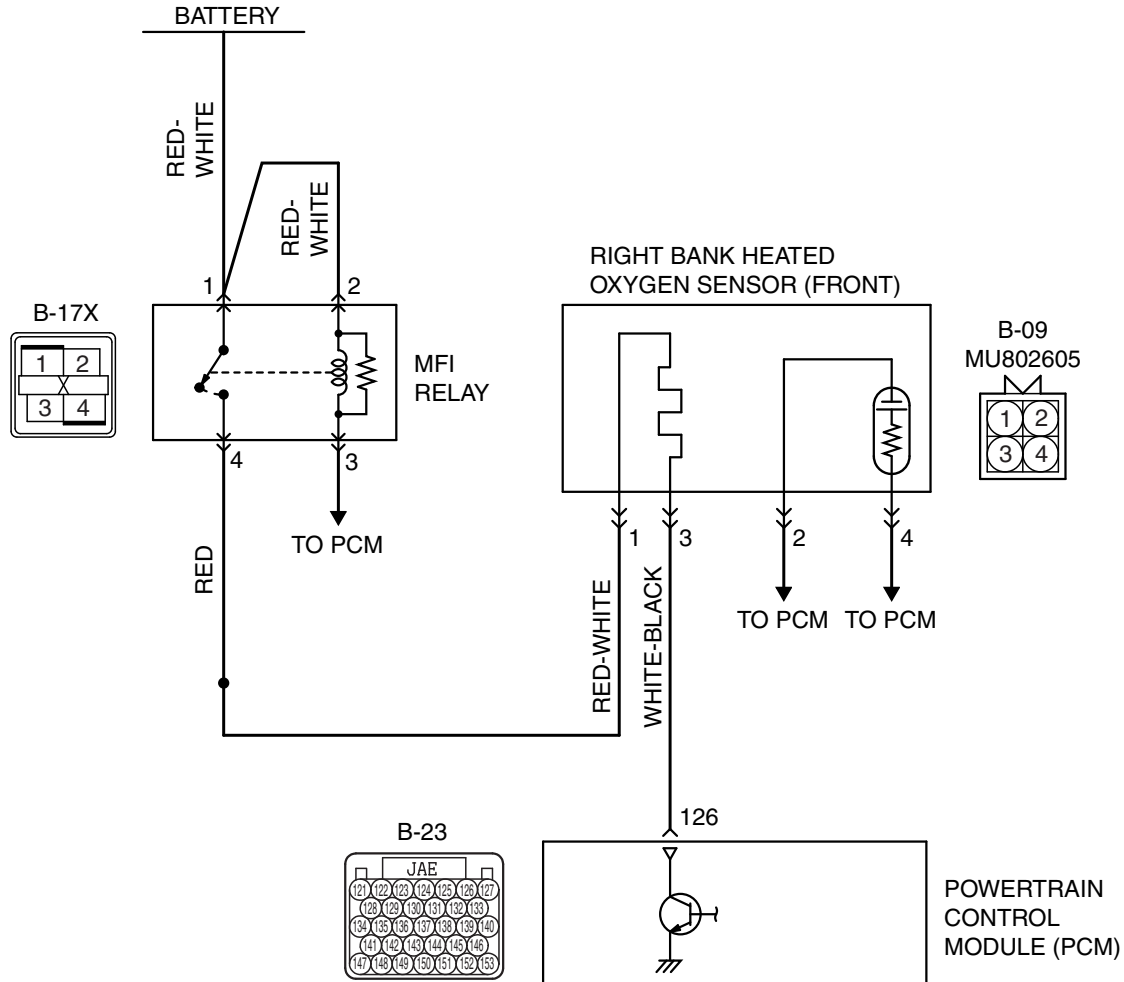
Q: Is DTC P001A set?

YES : Retry the troubleshooting.

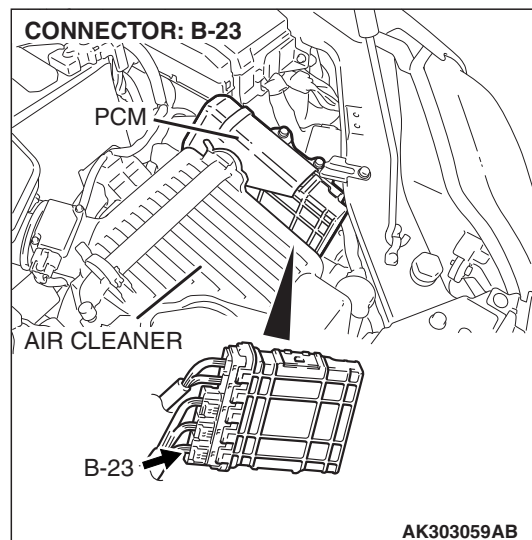
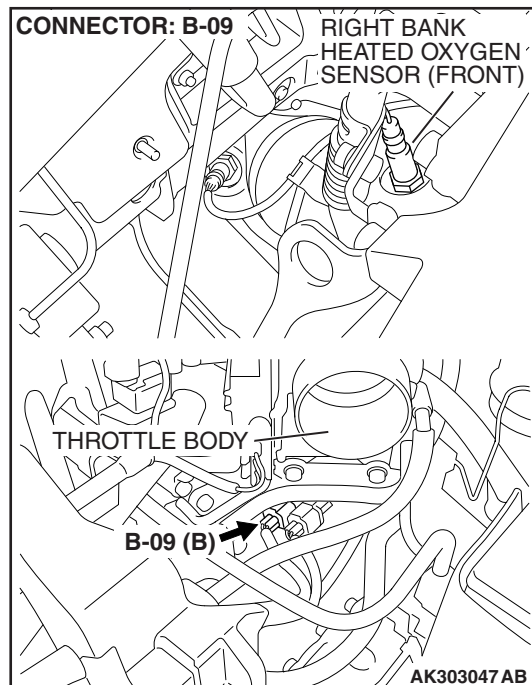
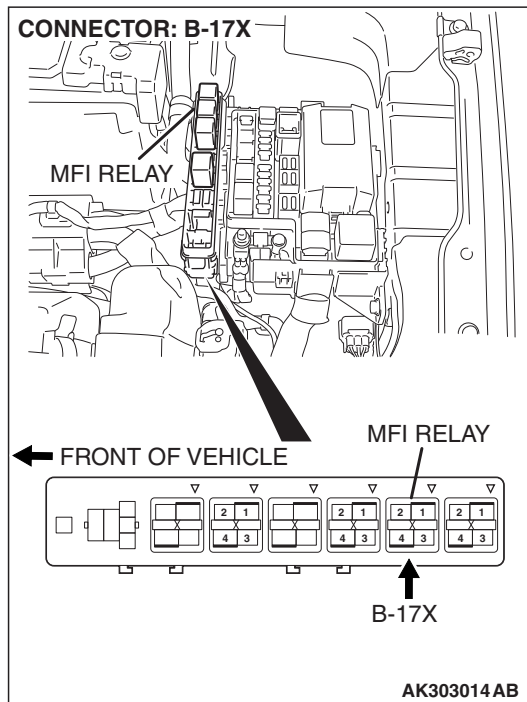
NO : The inspection is complete.

DTC P0031: Heated Oxygen Sensor Heater Circuit Low (bank 1 sensor 1)

Right Bank Heated Oxygen Sensor (front) Heater Circuit



AK400901



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the right bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 126) controls continuity to the right bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (front) heater current or voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

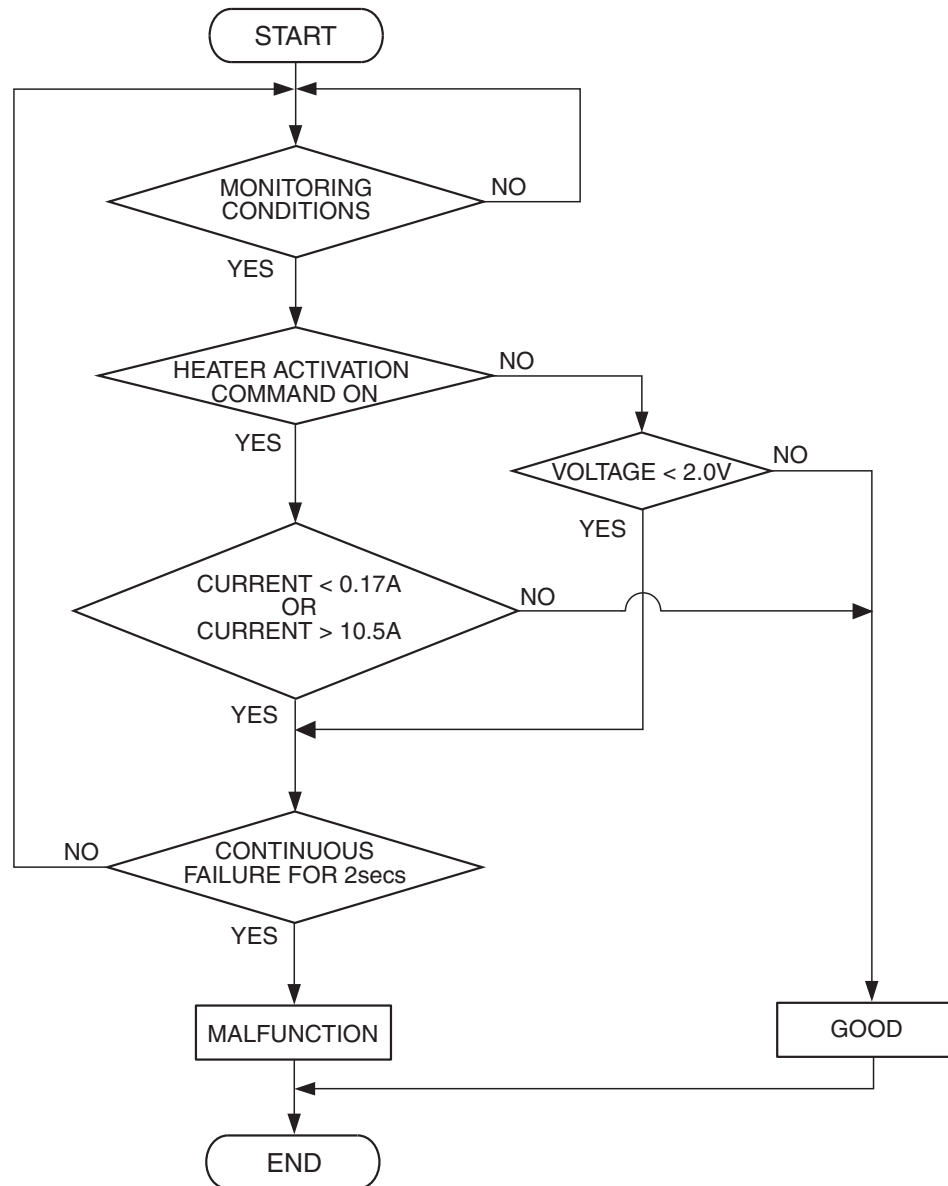
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK802635

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank heated oxygen sensor (front) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The right bank heated oxygen sensor (front) heater current has continued to be lower than 0.17 ampere for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank heated oxygen sensor (front) heater is off.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The right bank heated oxygen sensor (front) heater voltage has continued to be lower than 2.0 volts for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13B-5](#).

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.
- Right bank heated oxygen sensor (front) heater failed.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

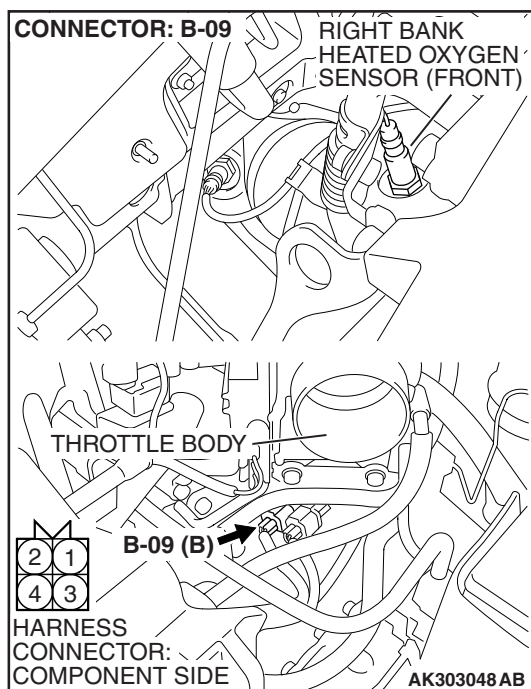
- MD998464: Test Harness
- MB991923: Power Plant ECU Check Harness

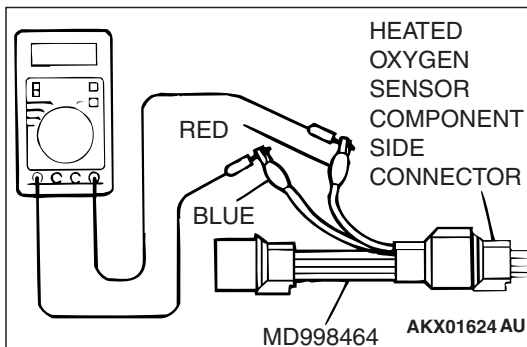
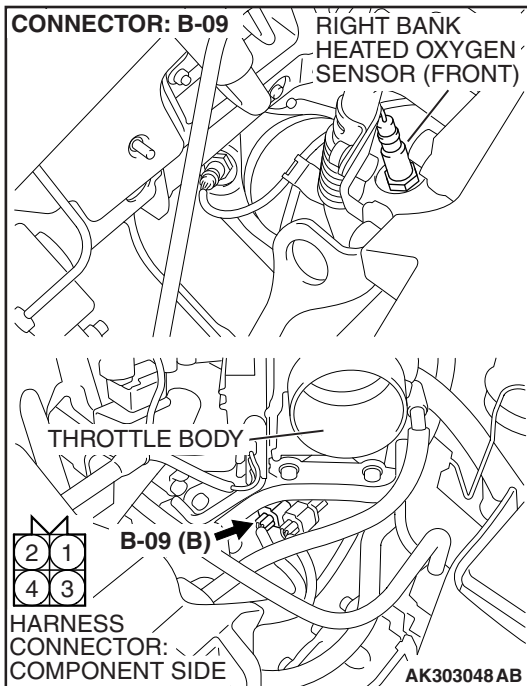
STEP 1. Check harness connector B-09 at the right bank heated oxygen sensor (front) for damage.

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 12.





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

- (1) Disconnect right bank heated oxygen sensor (front) connector B-09 and connect test harness special tool, MD998464, to the connector on the right bank heated oxygen sensor (front) side.

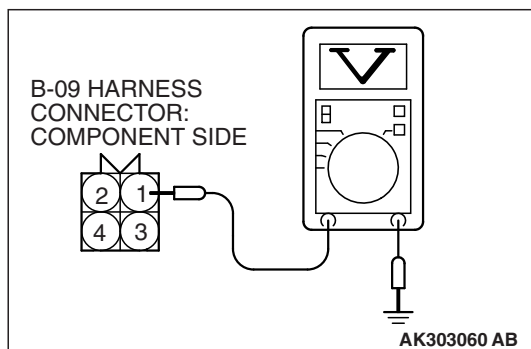
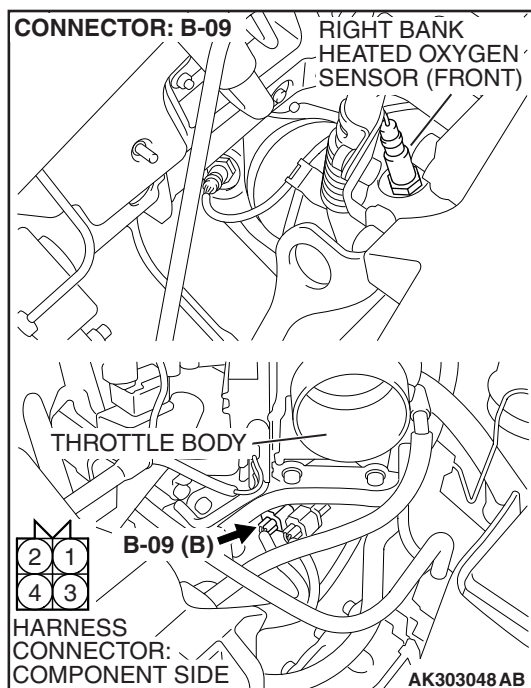
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 4.5 – 8.0 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 4.5 and 8.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

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

**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.

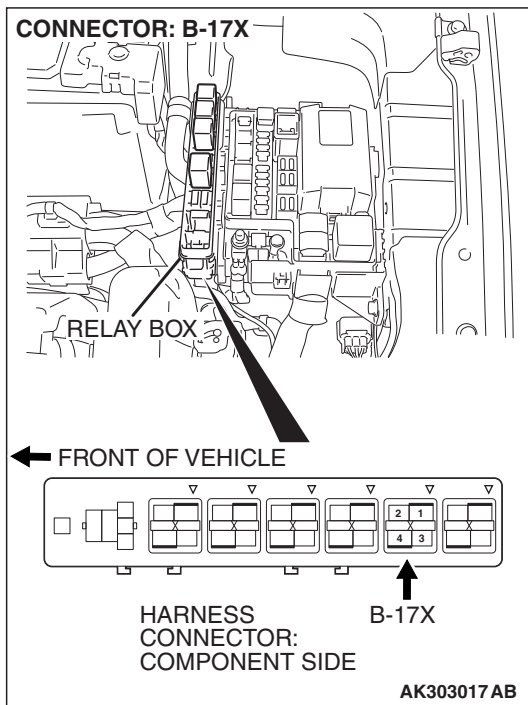
- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be battery positive voltage.

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

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

YES : Go to Step 5.

NO : Go to Step 4.

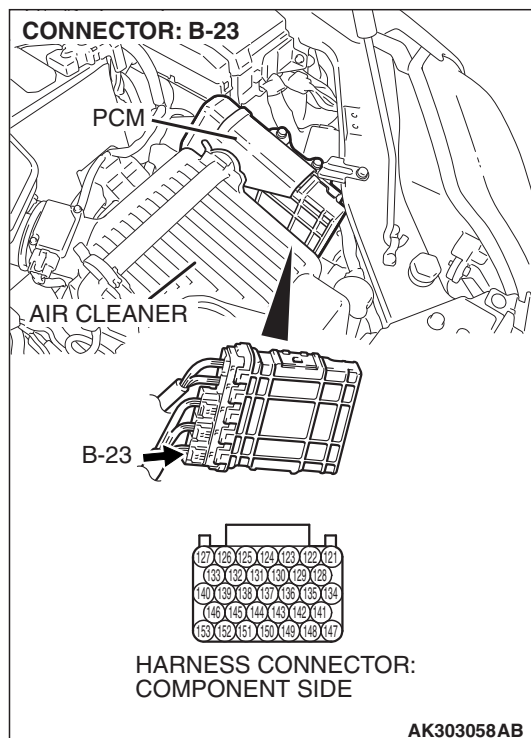


STEP 4. Check harness connector B-17X at the MFI relay for damage.

Q: Is the harness connector in good condition?

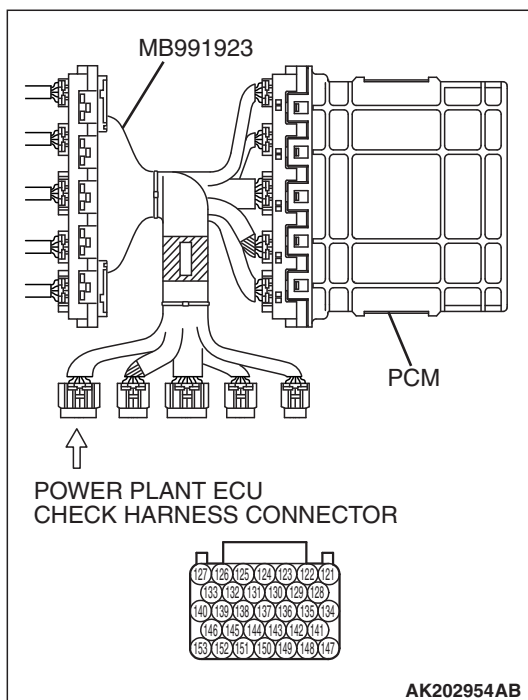
YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (front) connector B-09 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

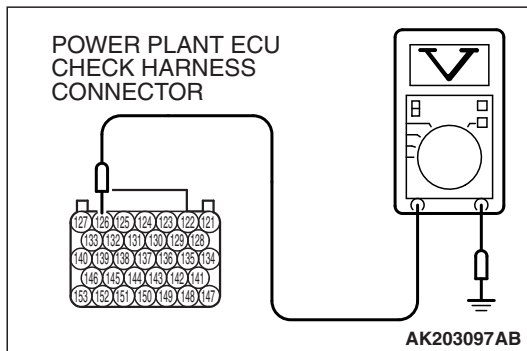
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 5. Measure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



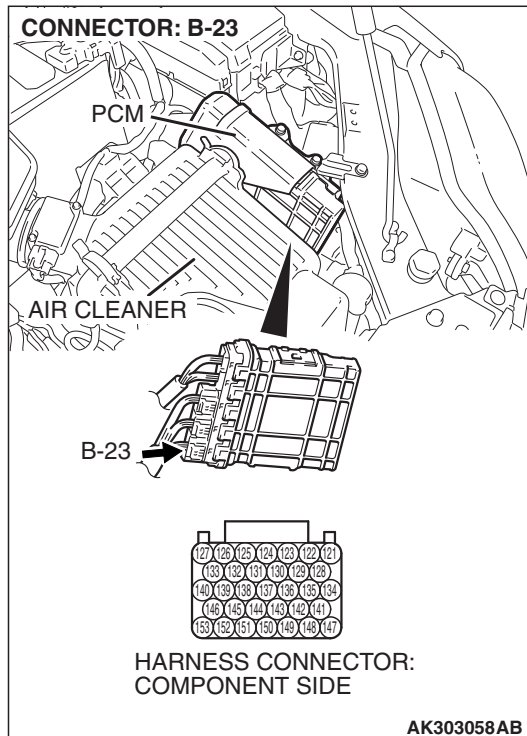


- (3) Measure the voltage between terminal No. 126 and ground.
• Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

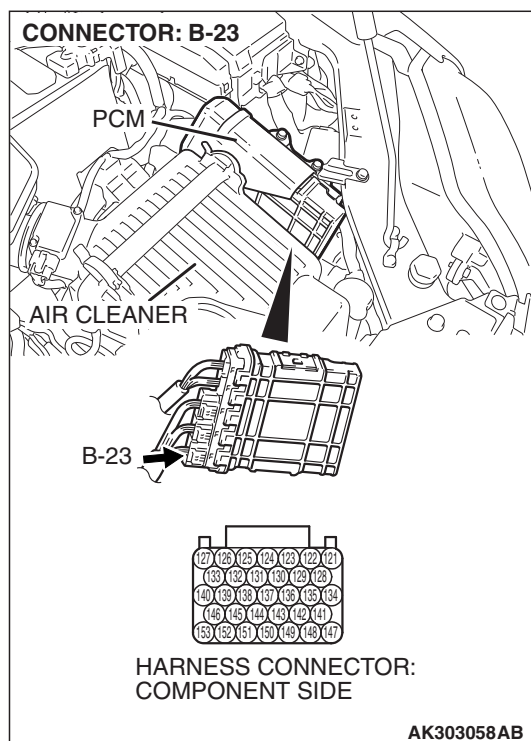
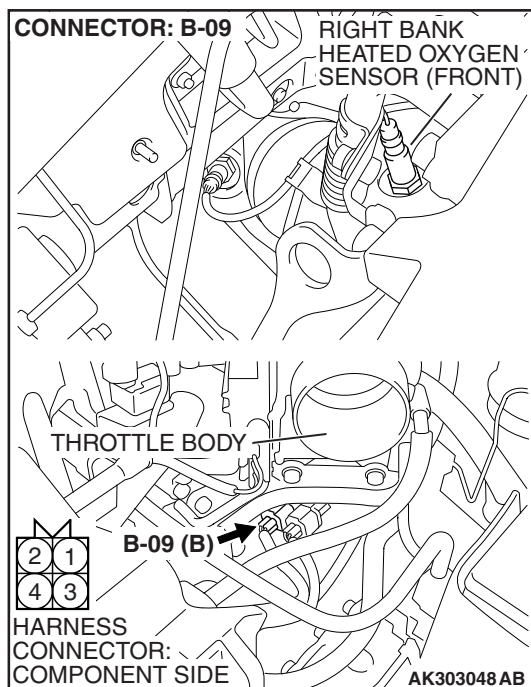
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (front) connector B-09 (terminal No. 3) and PCM connector B-23 (terminal No. 126).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.

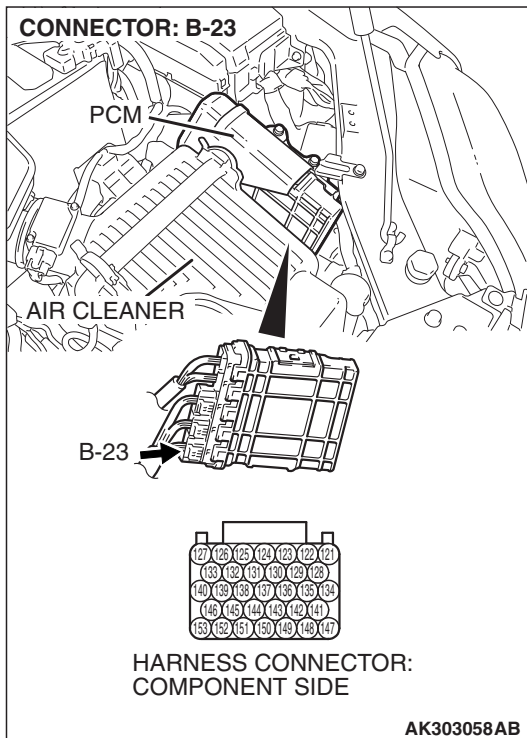


STEP 8. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

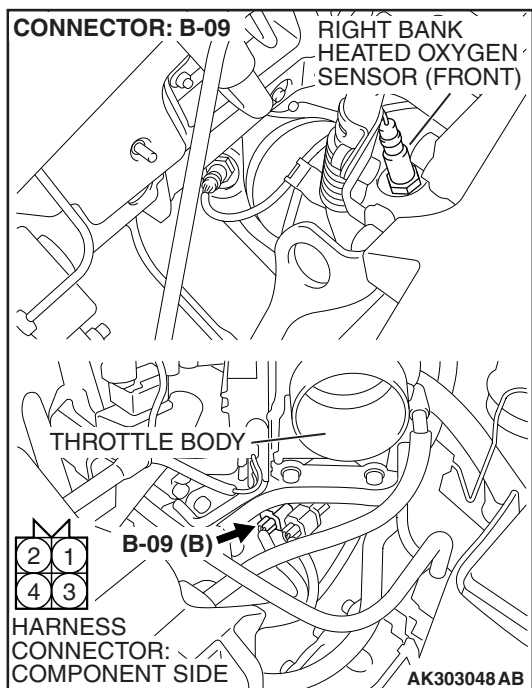
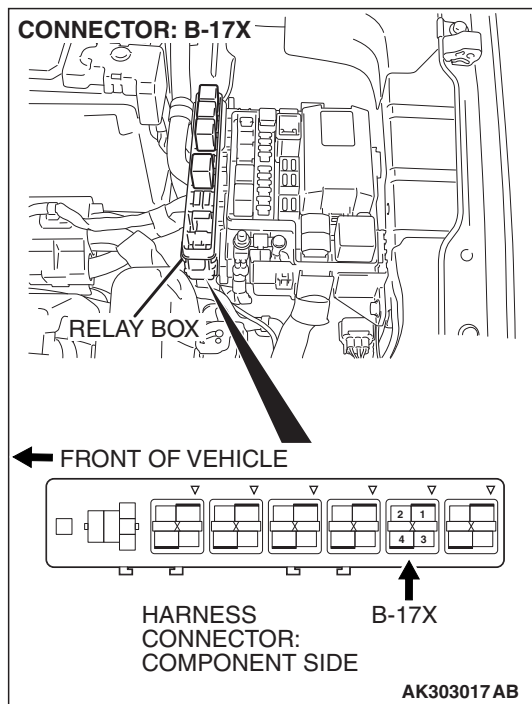
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (front) connector B-09 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

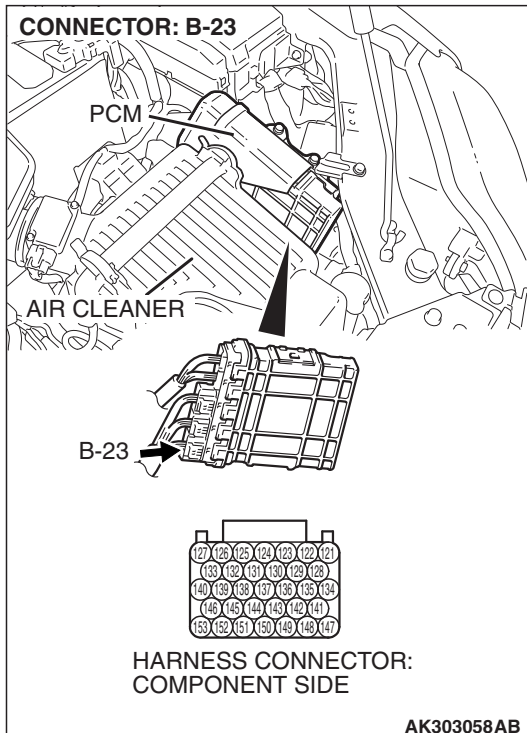
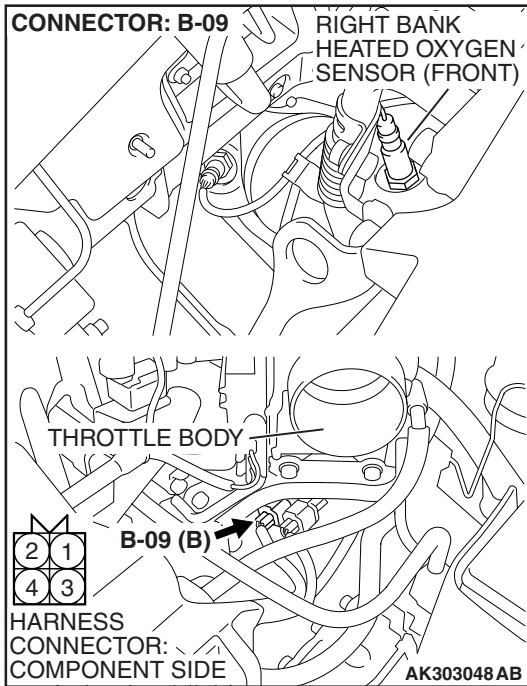


STEP 10. Check for harness damage between right bank heated oxygen sensor (front) connector B-09 (terminal No. 3) and PCM connector B-23 (terminal No. 126).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.



STEP 11. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0031 set?

- YES** : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.
- NO** : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

STEP 12. Test the OBD-II drive cycle.

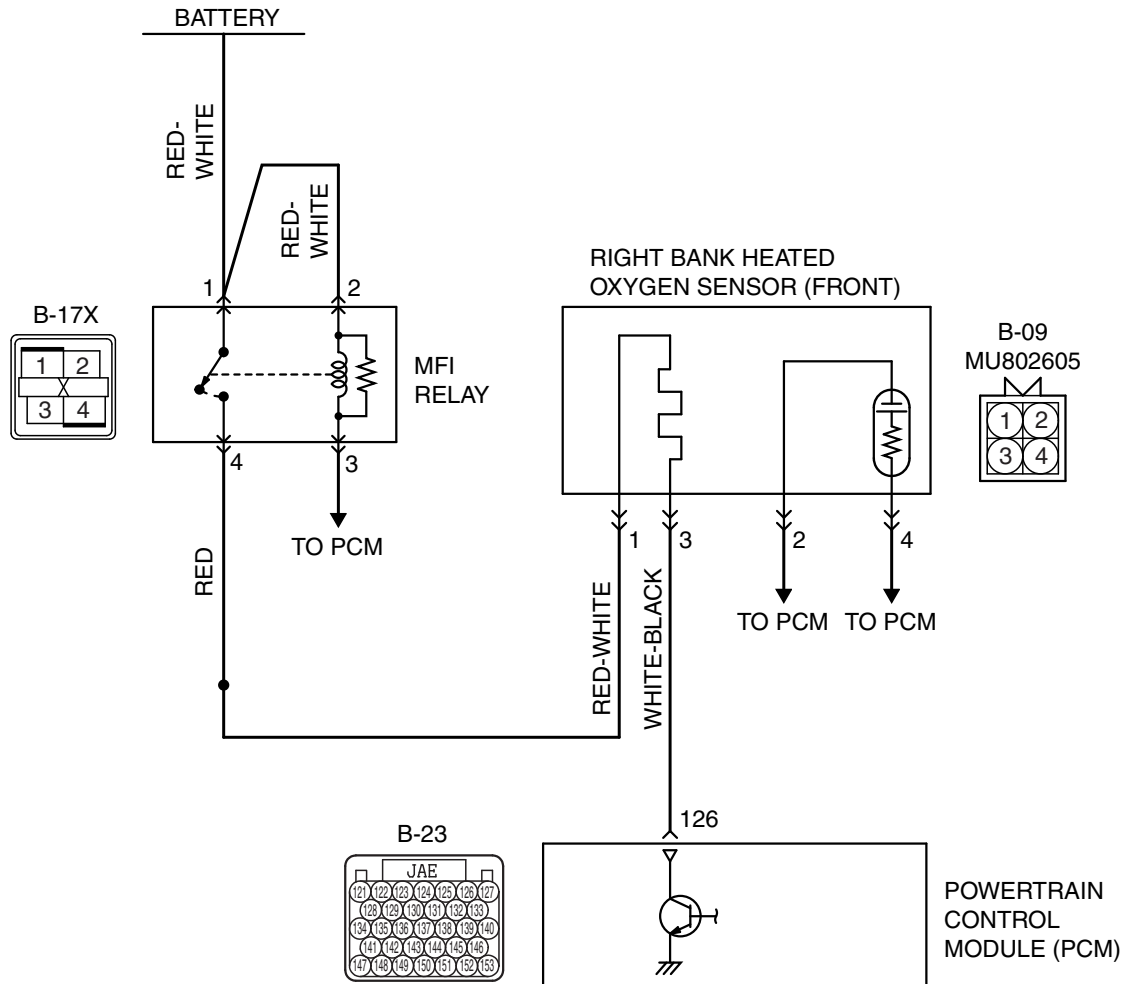
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0031 set?

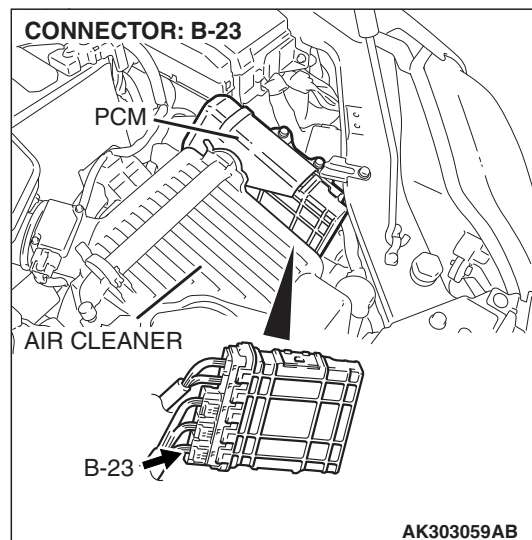
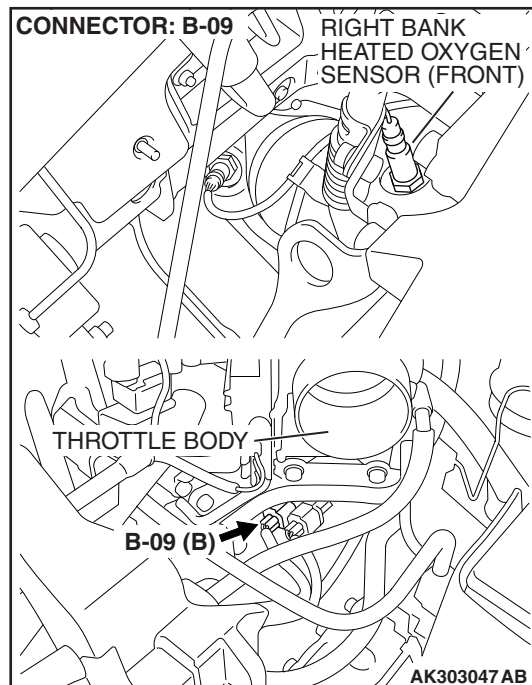
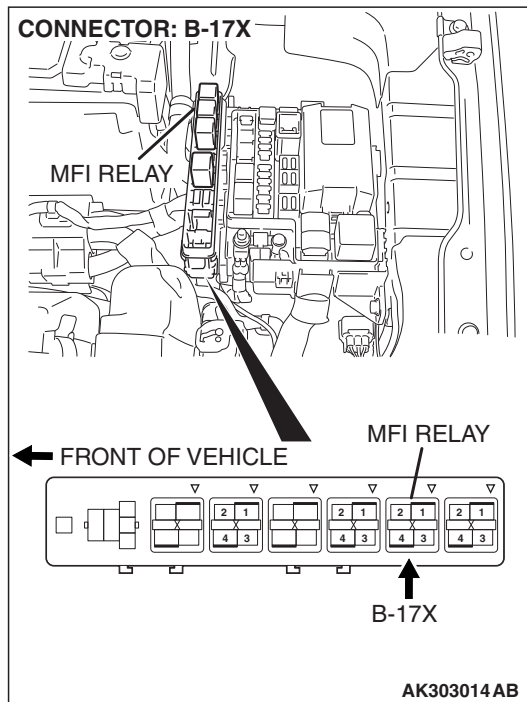
- YES** : Retry the troubleshooting.
- NO** : The inspection is complete.

DTC P0032: Heated Oxygen Sensor Heater Circuit High (bank 1 sensor 1)

Right Bank Heated Oxygen Sensor (front) Heater Circuit



AK400901



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the right bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 126) controls continuity to the right bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (front) heater current is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

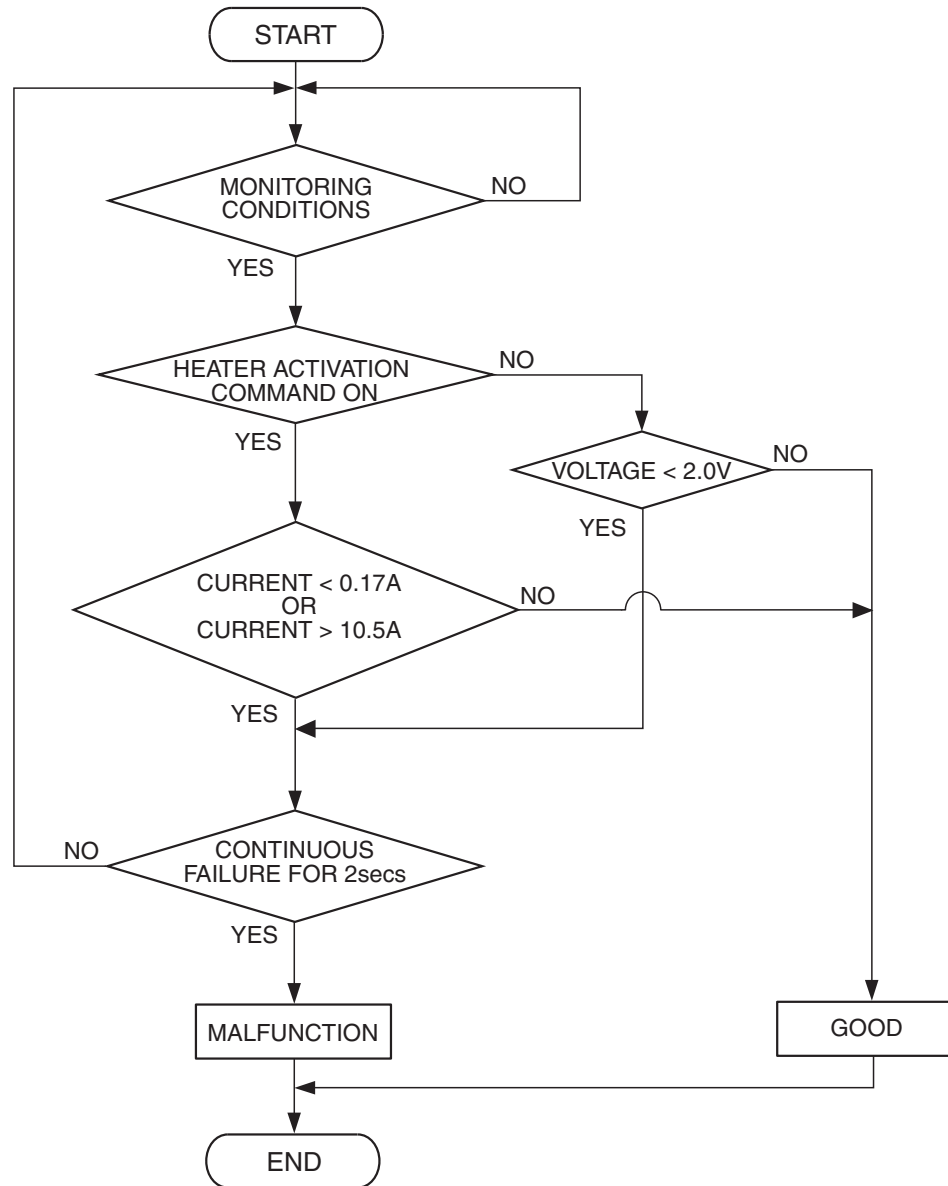
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK802635

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank heated oxygen sensor (front) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The right bank heated oxygen sensor (front) heater current has continued to be higher than 10.5 amperes for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).

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

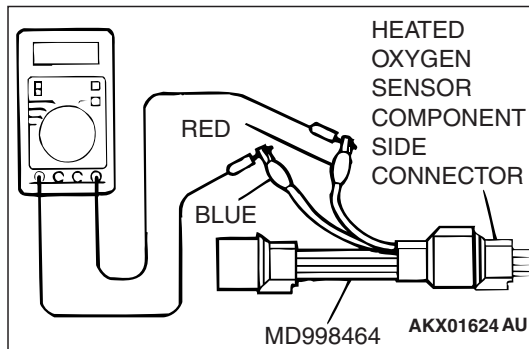
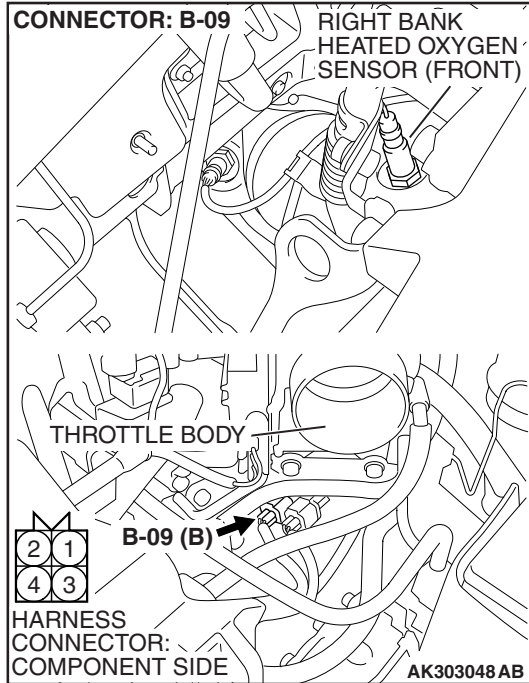
- Right bank heated oxygen sensor (front) heater failed.
- PCM failed.

DIAGNOSIS**Required Special Tool:**

- MD998464: Test Harness

STEP 1. Check the right bank heated oxygen sensor (front).

- (1) Disconnect right bank heated oxygen sensor (front) connector B-09 and connect test harness special tool, MD998464, to the connector on the right bank heated oxygen sensor (front) side.



- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 4.5 – 8.0 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 4.5 and 8.0 ohms [at 20°C (68°F)]?

YES : Go to Step 2.

NO : Replace the right bank heated oxygen sensor (front). Then go to Step 3.

STEP 2. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0032 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 3.

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 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

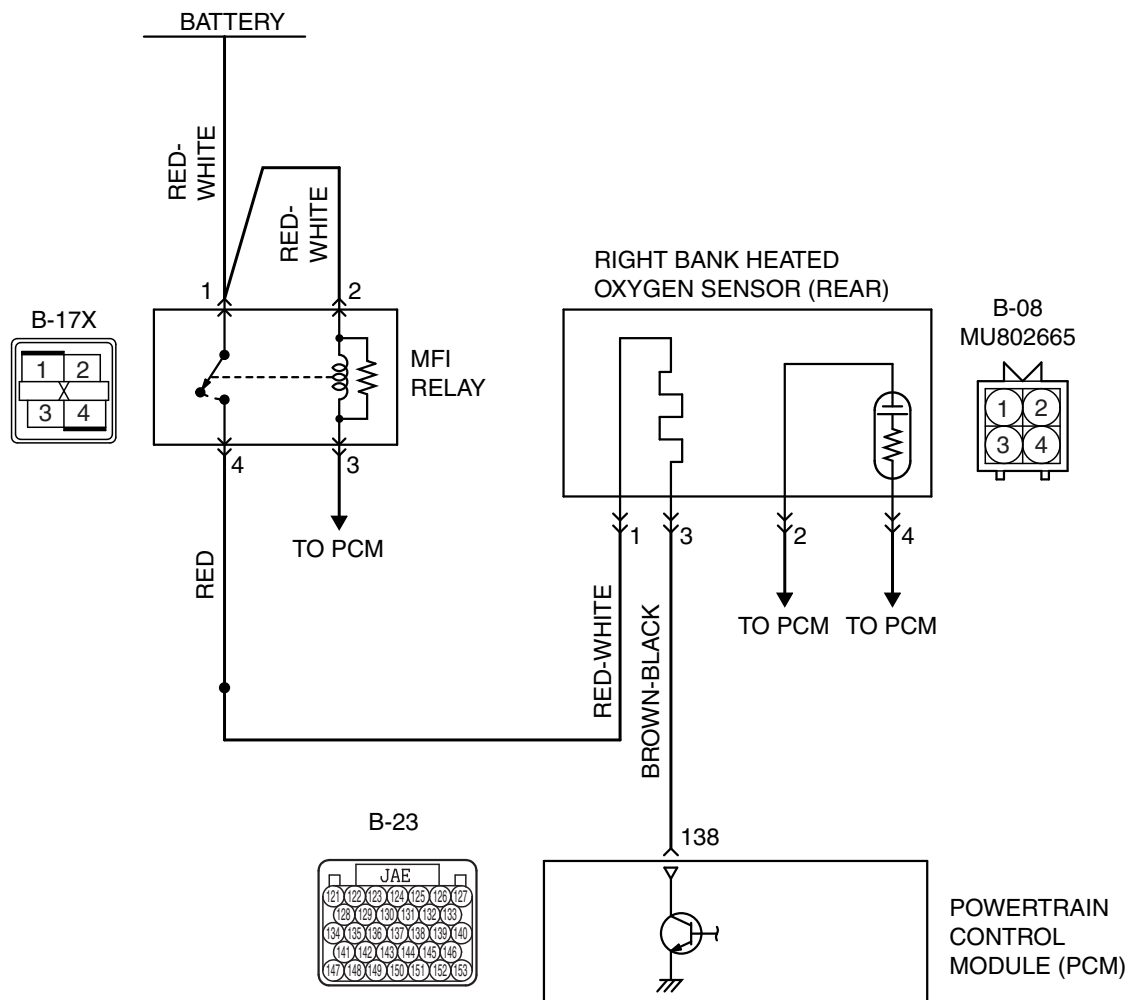
Q: Is DTC P0032 set?

YES : Retry the troubleshooting.

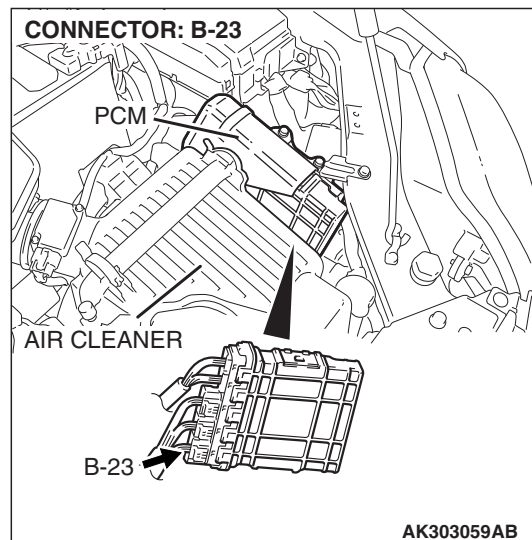
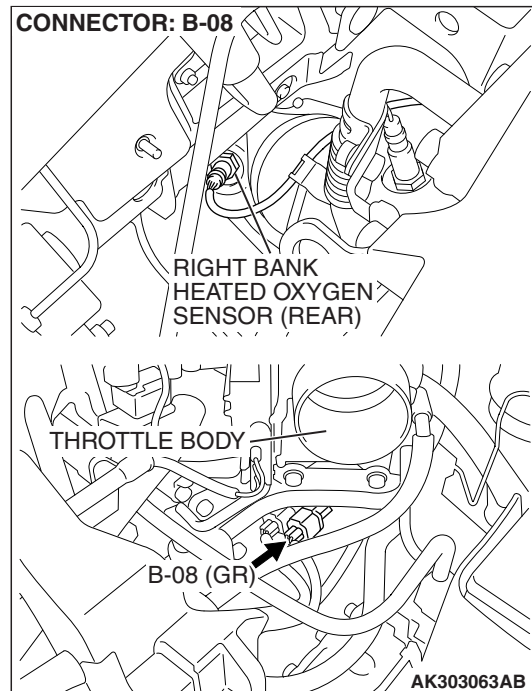
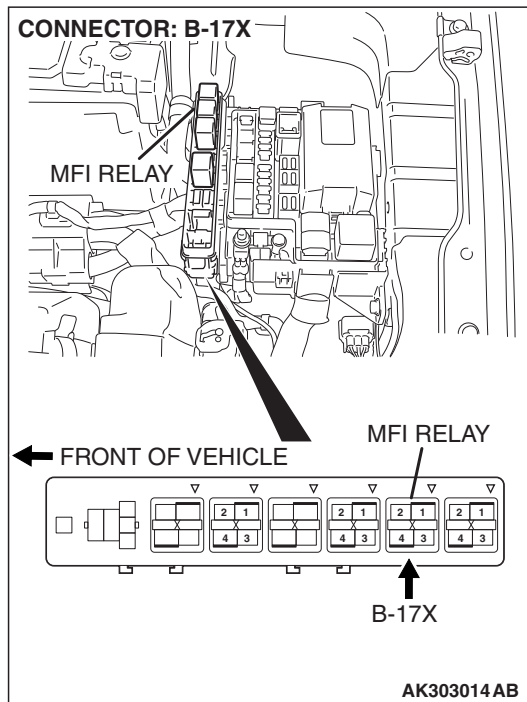
NO : The inspection is complete.

DTC P0037: Heated Oxygen Sensor Heater Circuit Low (bank 1 sensor 2)

Right Bank Heated Oxygen Sensor (rear) Heater Circuit



AK501563



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the right bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 138) controls continuity to the right bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (rear) heater current or voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

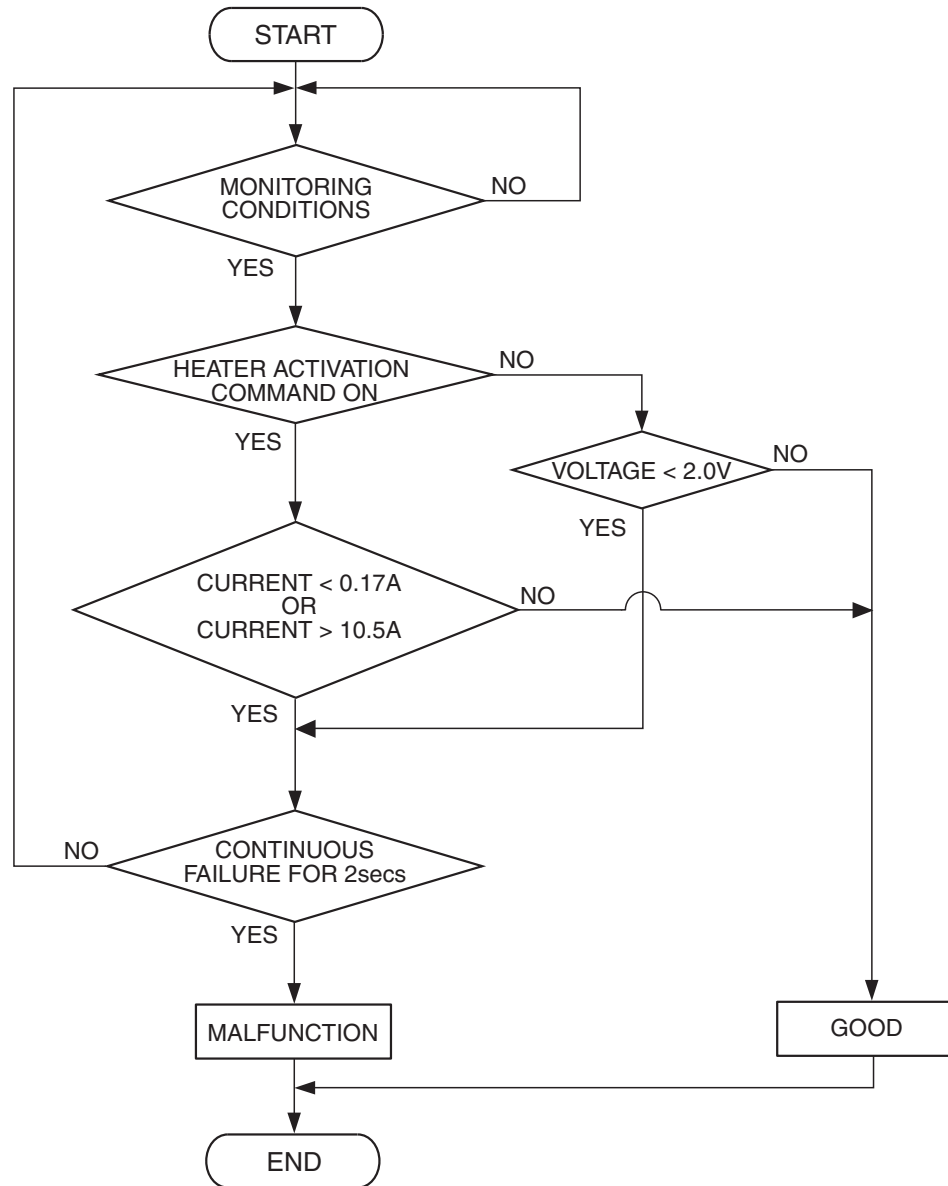
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK802635

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank heated oxygen sensor (rear) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The right bank heated oxygen sensor (rear) heater current has continued to be lower than 0.17 ampere for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank heated oxygen sensor (rear) heater is off.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The right bank heated oxygen sensor (rear) heater voltage has continued to be lower than 2.0 volts for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13B-5](#).

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.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

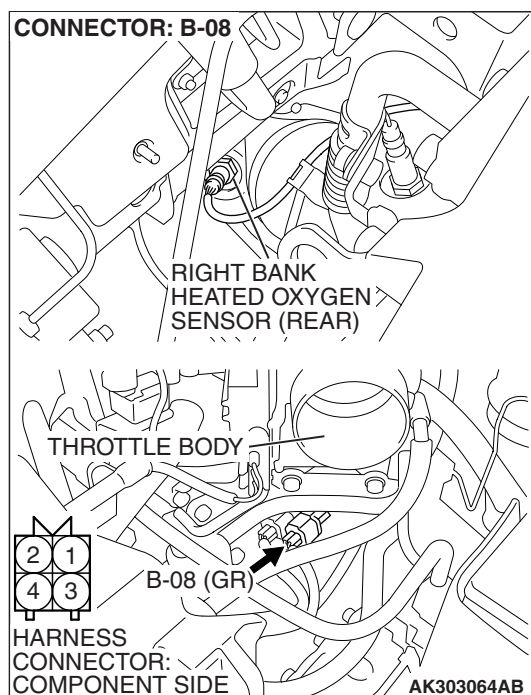
- MB991316: Test Harness
- MB991923: Power Plant ECU Check Harness

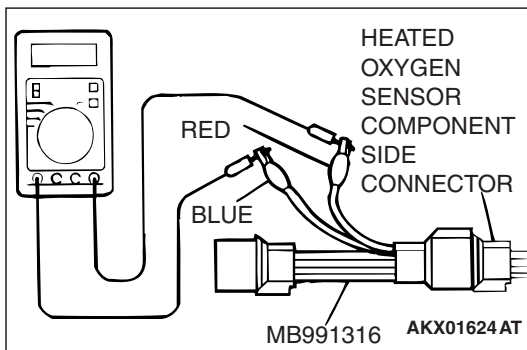
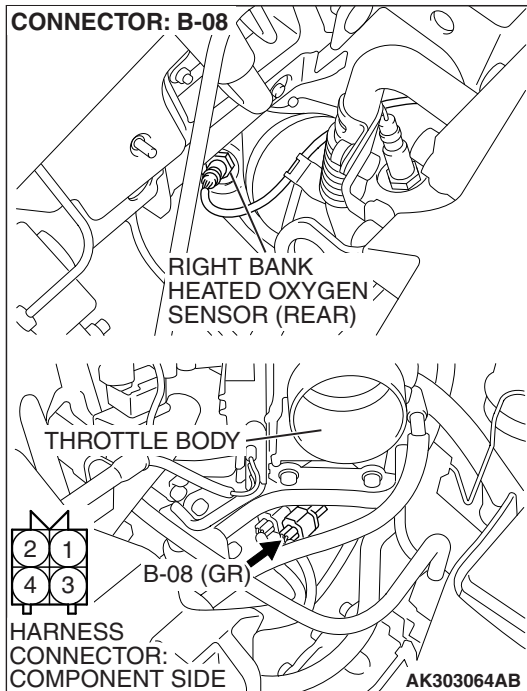
STEP 1. Check harness connector B-08 at the right bank heated oxygen sensor (rear) for damage.

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 and connect test harness special tool, MB991316, to the connector on the right bank heated oxygen sensor (rear) side.

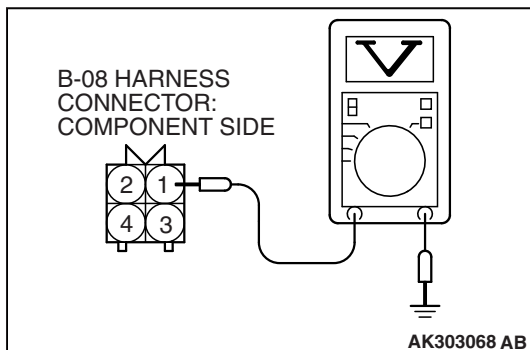
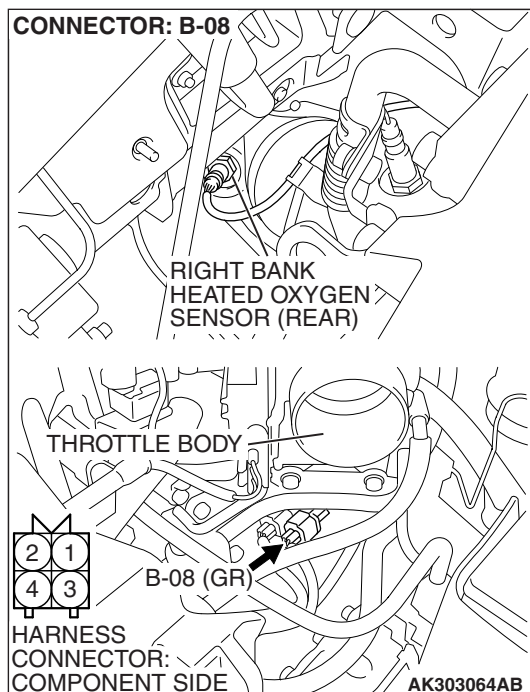
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 11 – 18 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 11 and 18 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the right bank heated oxygen sensor (rear).
Then go to Step 12.

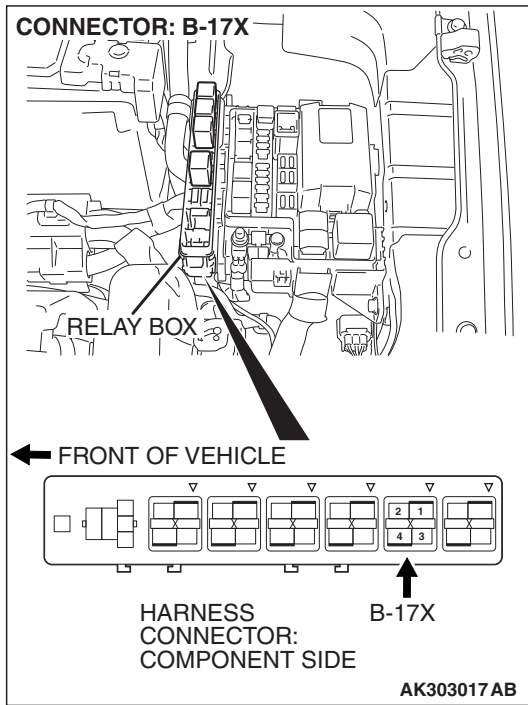
**STEP 3. Measure the power supply voltage at right bank heated oxygen sensor (rear) harness side connector B-08.**

- (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. 1 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

- YES :** Go to Step 5.
NO : Go to Step 4.

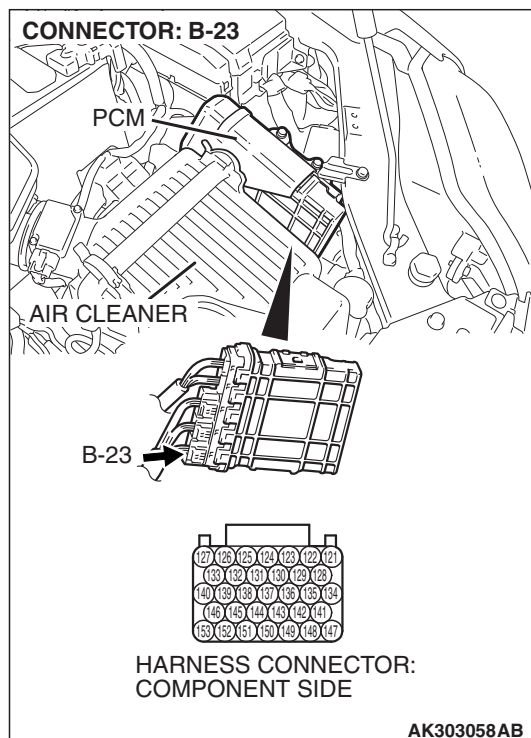


STEP 4. Check harness connector B-17X at the MFI relay for damage.

Q: Is the harness connector in good condition?

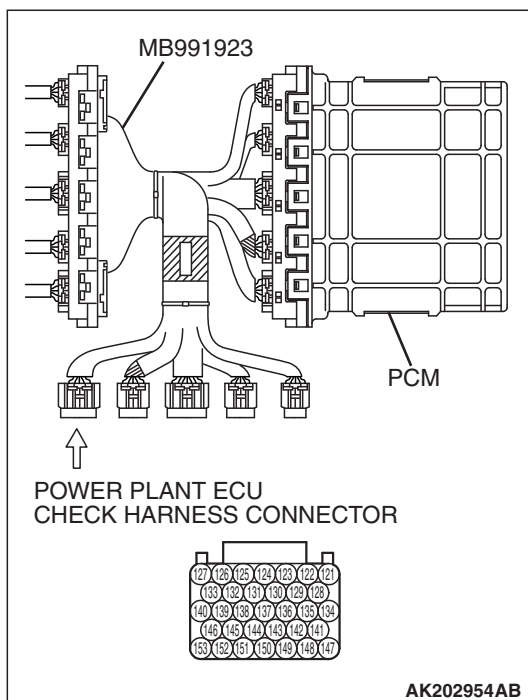
YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (rear) connector B-08 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

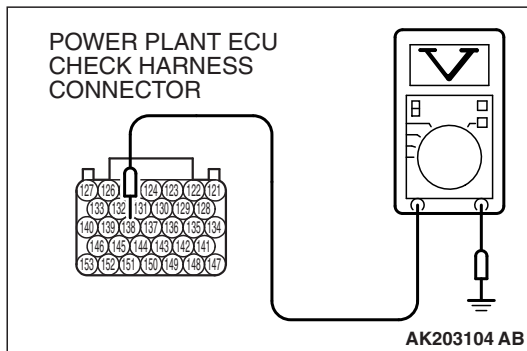
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 5. Measure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



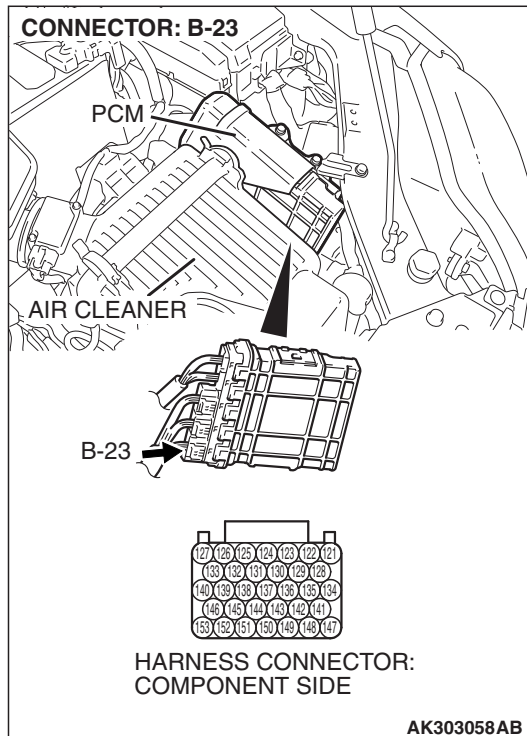


- (3) Measure the voltage between terminal No. 138 and ground.
• Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

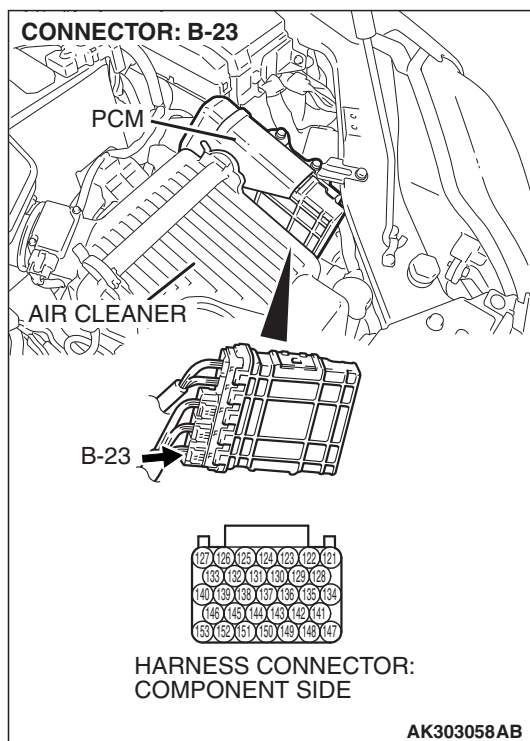
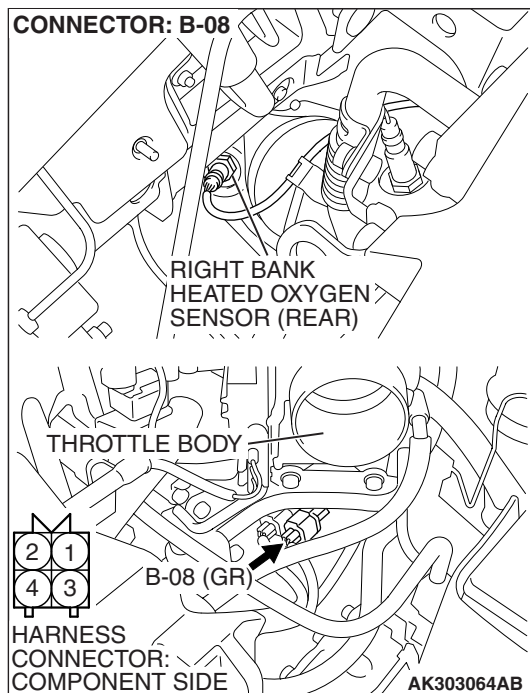
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 3) and PCM connector B-23 (terminal No. 138).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.

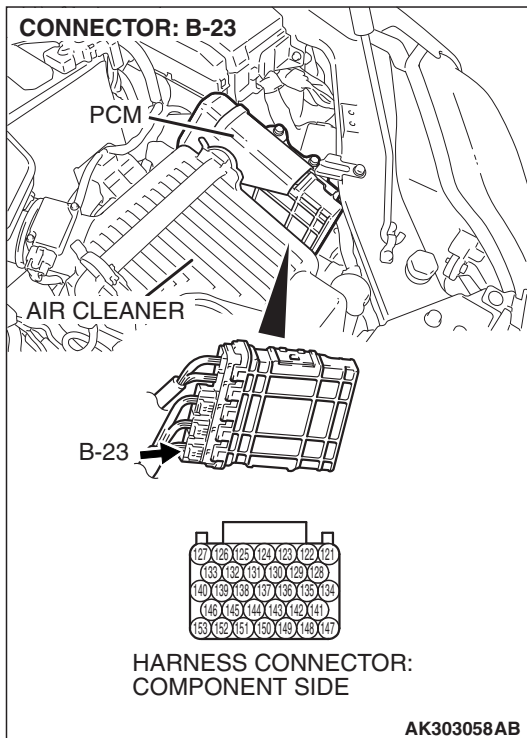


STEP 8. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

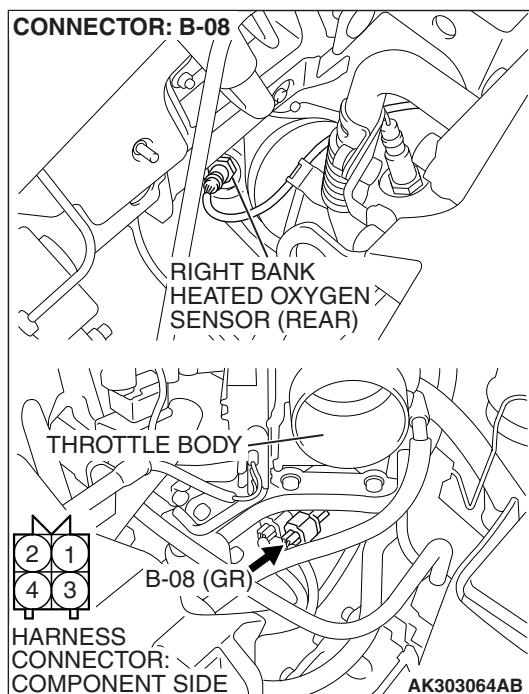
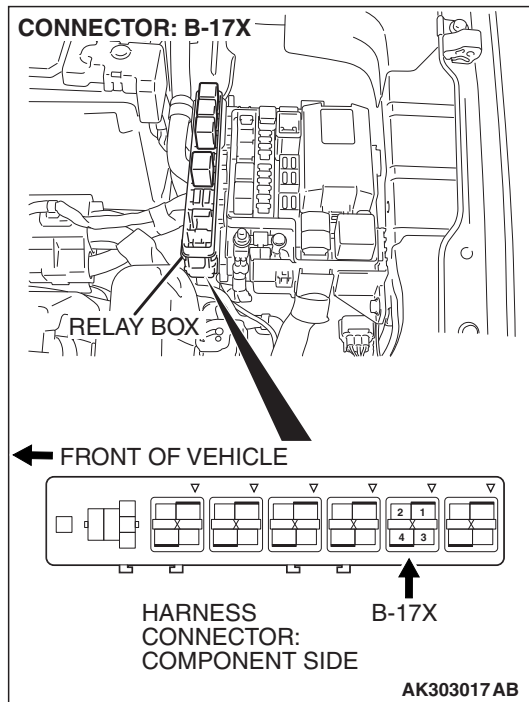


STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and right bank heated oxygen sensor (rear) connector B-08 (terminal No. 1).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

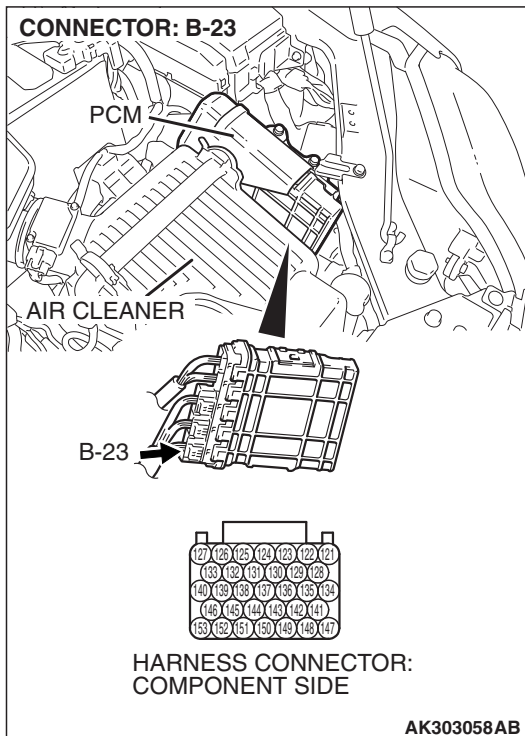
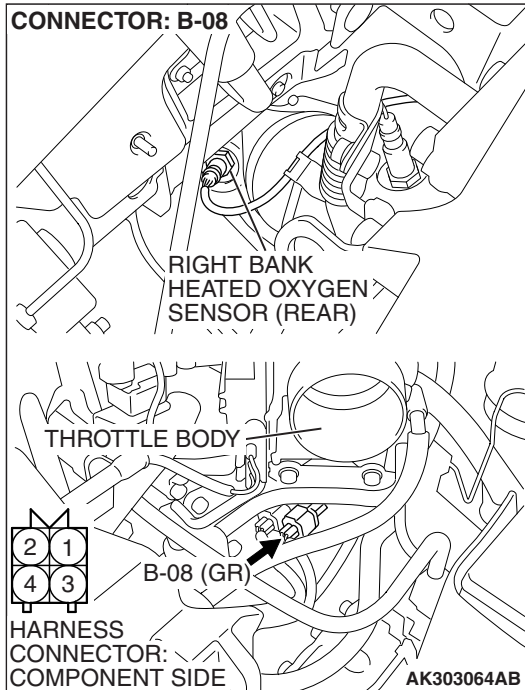


STEP 10. Check for harness damage between right bank heated oxygen sensor (rear) connector B-08 (terminal No. 3) and PCM connector B-23 (terminal No. 138).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.



STEP 11. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0037 set?

- YES** : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.
- NO** : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

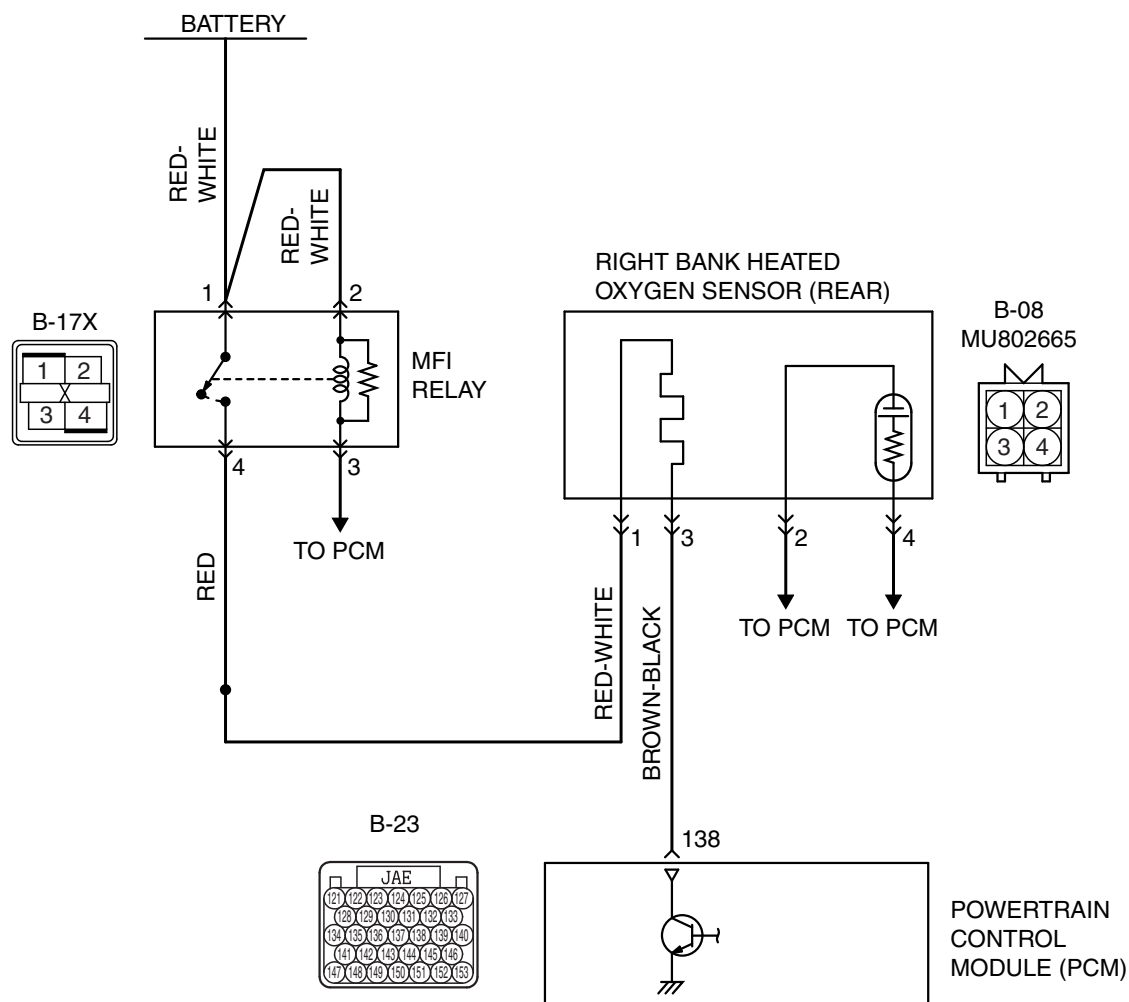
STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

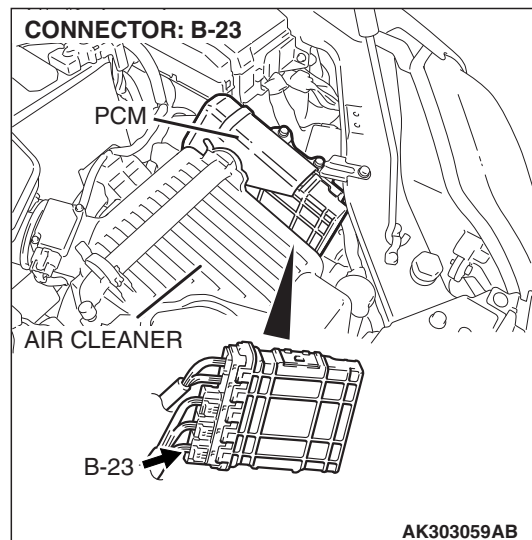
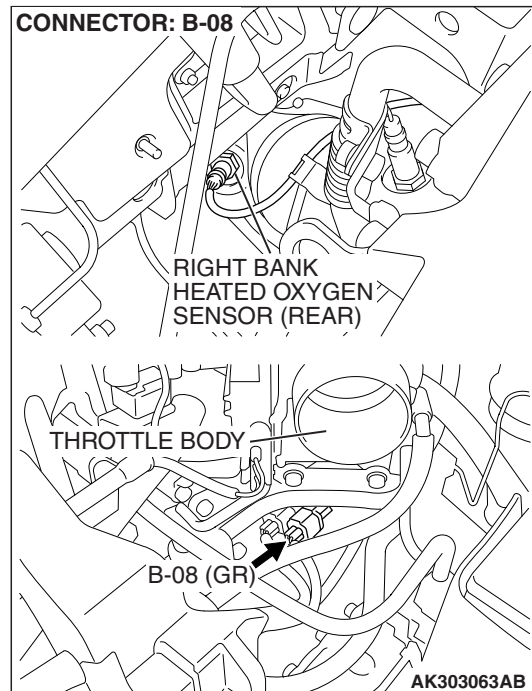
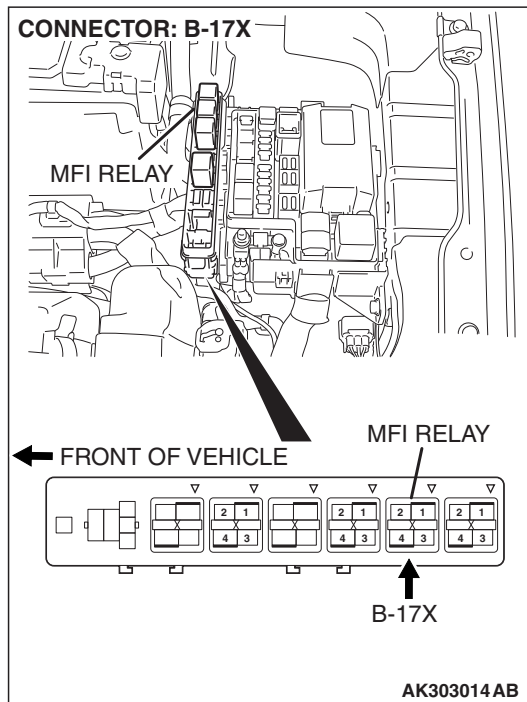
Q: Is DTC P0037 set?

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

Right Bank Heated Oxygen Sensor (rear) Heater Circuit



AK501563



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the right bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 138) controls continuity to the right bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Right bank heated oxygen sensor (rear) heater current is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

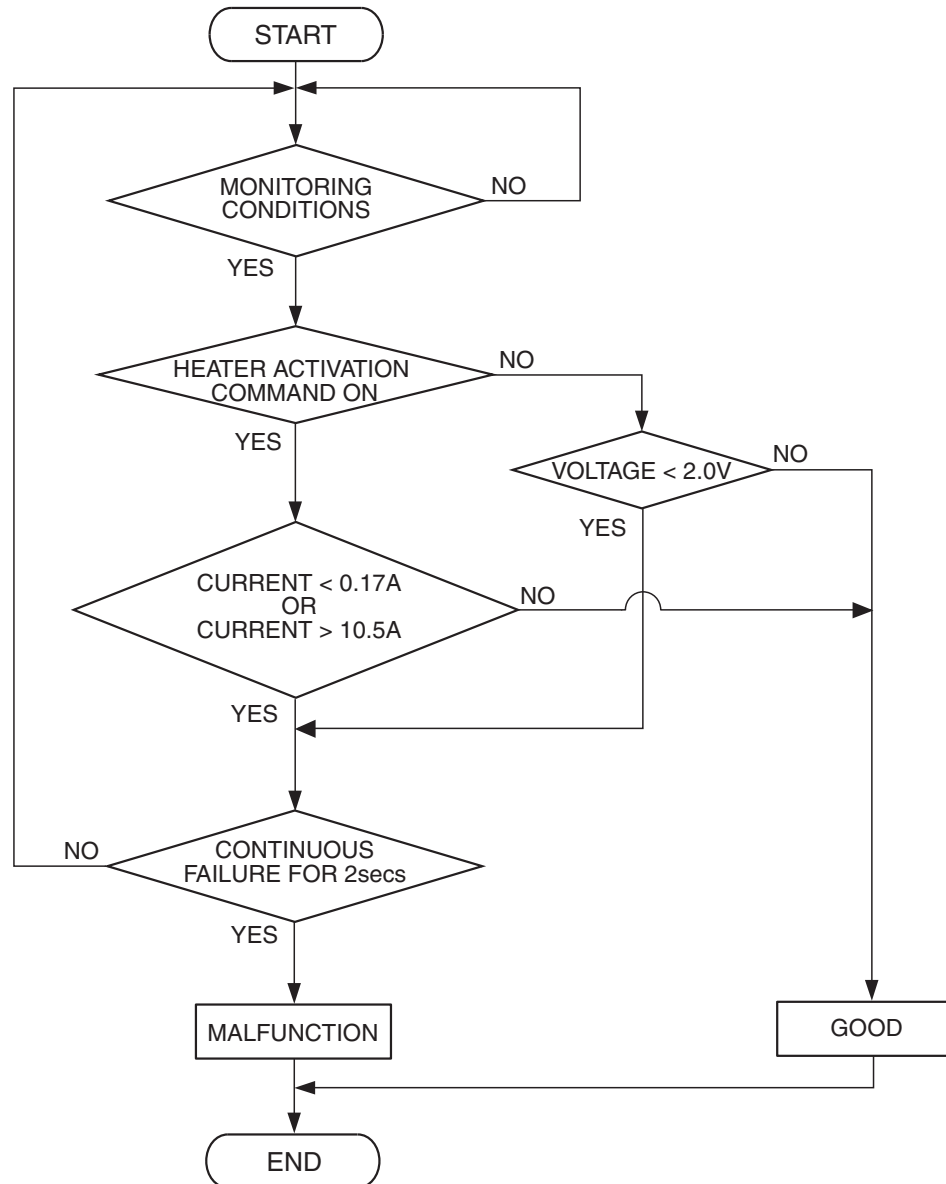
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK802635

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the right bank heated oxygen sensor (rear) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The right bank heated oxygen sensor (rear) heater current has continued to be higher than 10.5 amperes for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).

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

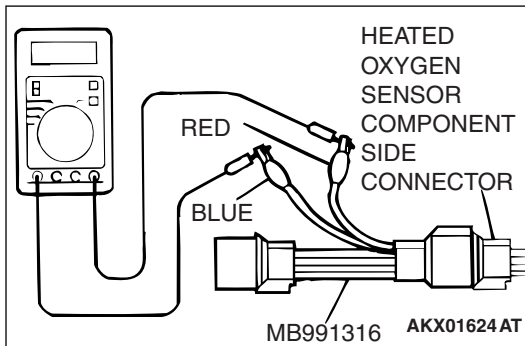
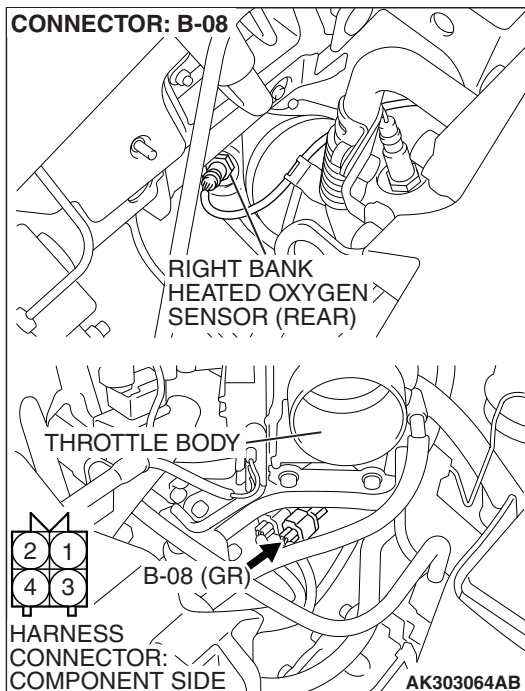
- Right bank heated oxygen sensor (rear) heater failed.
- PCM failed.

DIAGNOSIS**Required Special Tool:**

- MB991316: Test Harness

STEP 1. Check the right bank heated oxygen sensor (rear).

- (1) Disconnect right bank heated oxygen sensor (rear) connector B-08 and connect test harness special tool, MB991316, to the connector on the right bank heated oxygen sensor (rear) side.



- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 11 – 18 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 11 and 18 ohms [at 20°C (68°F)]?

YES : Go to Step 2.

NO : Replace the right bank heated oxygen sensor (rear). Then go to Step 3.

STEP 2. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0038 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 3.

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 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

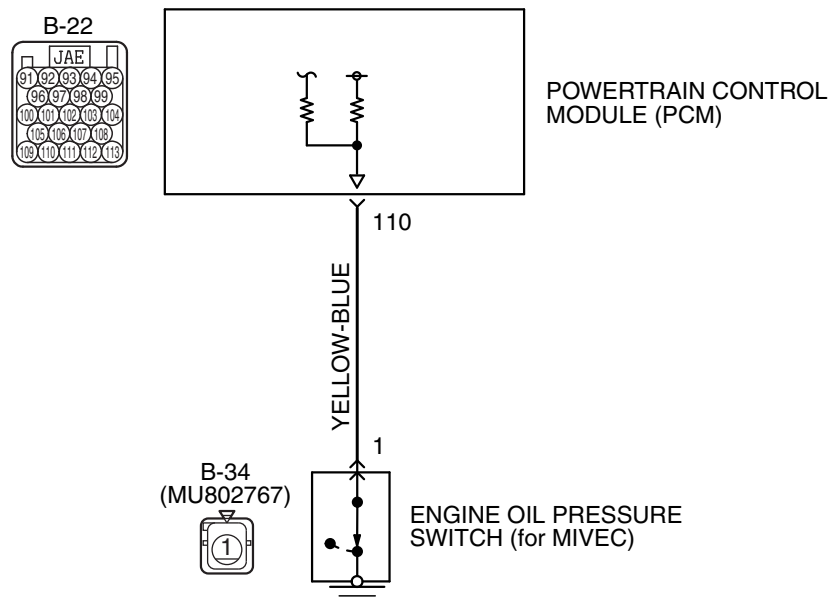
Q: Is DTC P0038 set?

YES : Retry the troubleshooting.

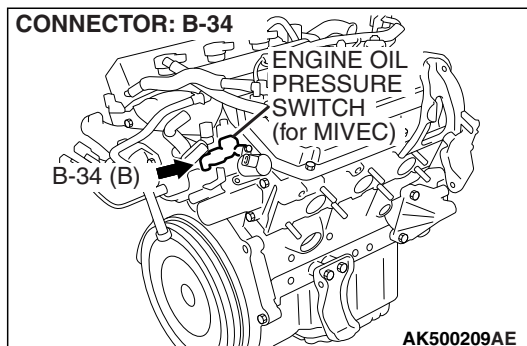
NO : The inspection is complete.

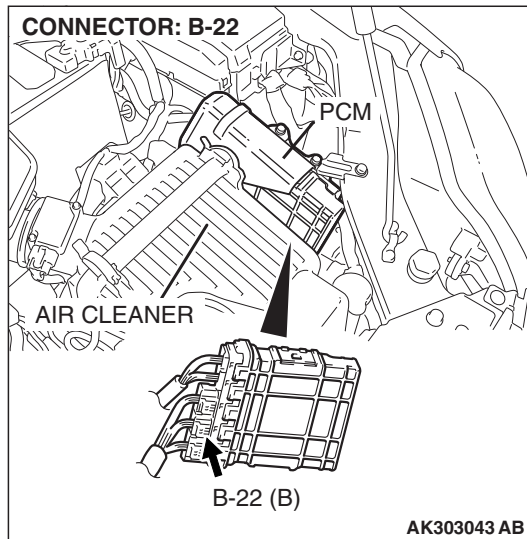
DTC P003C: Mitsubishi Innovative Valve Timing Electronic Control System (MIVEC) Performance

Engine Oil Pressure Switch (for MIVEC) Circuit



AK701432





CIRCUIT OPERATION

- A battery positive voltage is applied to the engine oil pressure switch (for MIVEC) output terminal (terminal No. 1) from the PCM (terminal No. 110) via the resistor in the PCM.

TECHNICAL DESCRIPTION

- The engine oil pressure switch (for MIVEC) converts the existence of a engine oil pressure into a high/low voltage, and inputs it into the PCM.
- When the engine oil control valve operates, the engine oil pressure in the MIVEC system rises. The engine oil pressure switch (for MIVEC) opens, thus interrupting the application of the battery positive voltage. As a result, the output voltage of the engine oil pressure switch (for MIVEC) will fluctuate between 0 and 12 volts.
- The PCM checks whether the engine oil pressure switch (for MIVEC) "OFF" or "ON" during driving.

DESCRIPTIONS OF MONITOR METHODS

Compare engine oil pressure switch (for MIVEC) status with engine operating condition.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

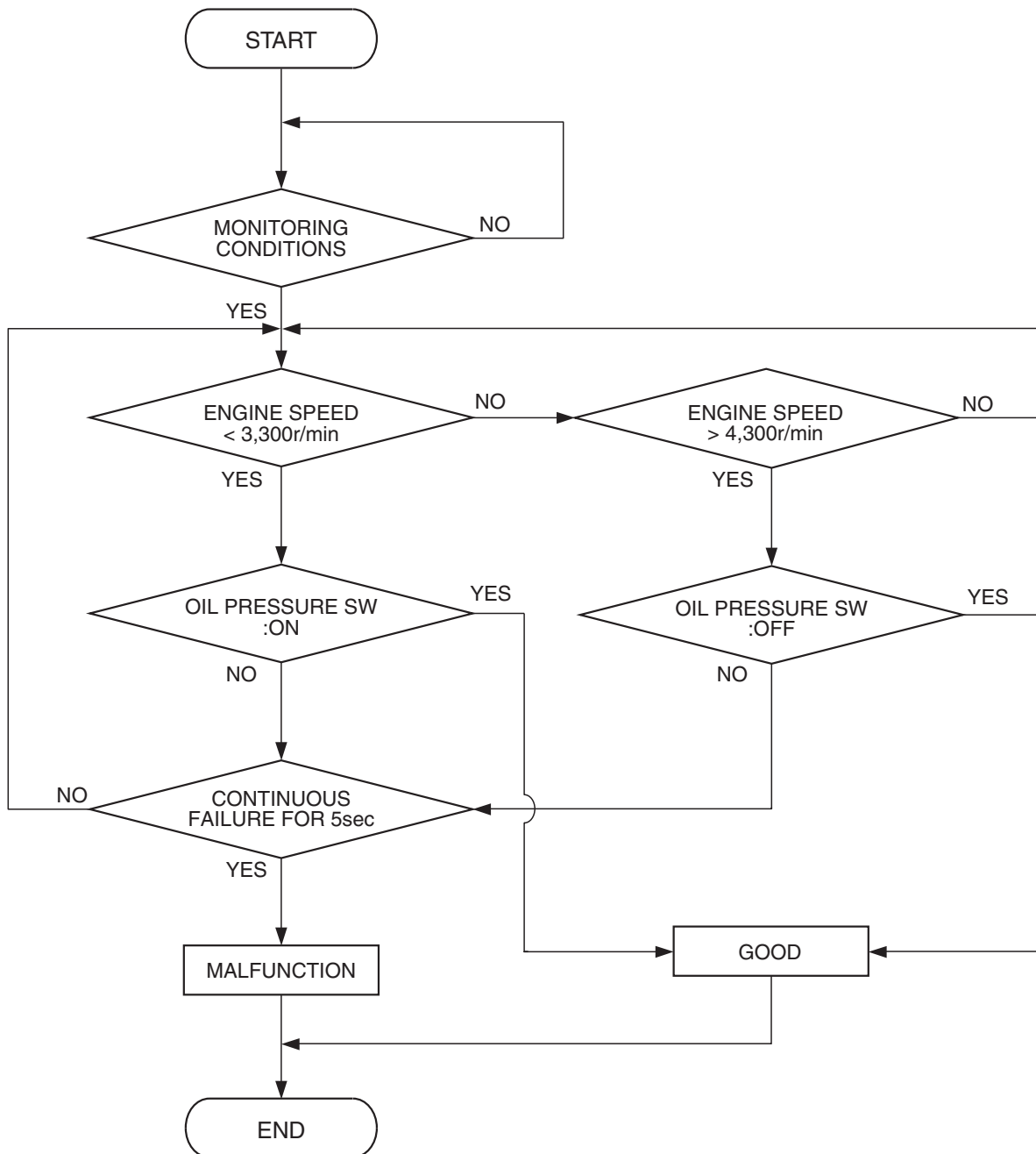
- Not applicable

Sensor (The sensor below is determined to be normal)

- Camshaft position sensor
- Mass airflow sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Injection valve

DTC SET CONDITIONS

Logic Flow Chart



AK701433

Check Conditions

- Engine speed is less than 3,300 r/min.
- Engine coolant temperature is 77°C (171°F) or more.
- Battery positive voltage is between 10 and 16.5 volts.
- 30 seconds or more have passed since the engine starting sequence was completed.

Judgment Criterion

- Engine oil pressure switch (for MIVEC) has been OFF for 5 seconds.

Check Conditions

- Engine speed is more than 4,300 r/min.
- Engine coolant temperature is 77°C (171°F) or more.
- Battery positive voltage is between 10 and 16.5 volts.
- 30 seconds or more have passed since the engine starting sequence was completed.

Judgment Criterion

- Engine oil pressure switch (for MIVEC) has been ON for 5 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13B-5](#).

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

- Engine oil pressure switch (for MIVEC) failed.
- Engine oil control valve failed.
- Open or shorted engine oil pressure switch (for MIVEC) circuit, harness damage or connector damage.

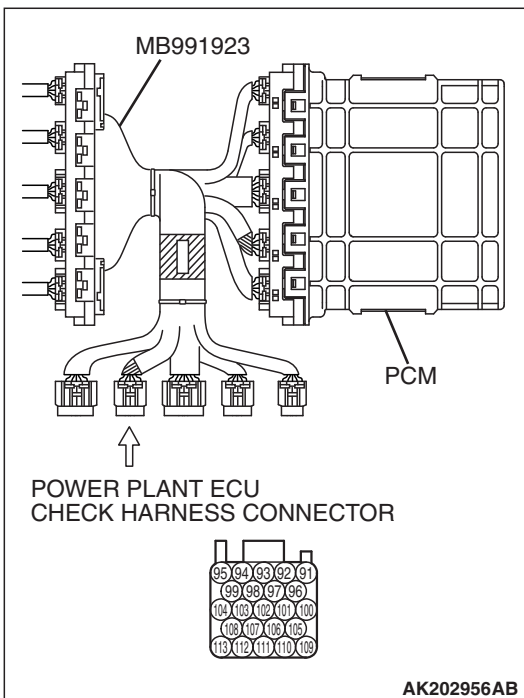
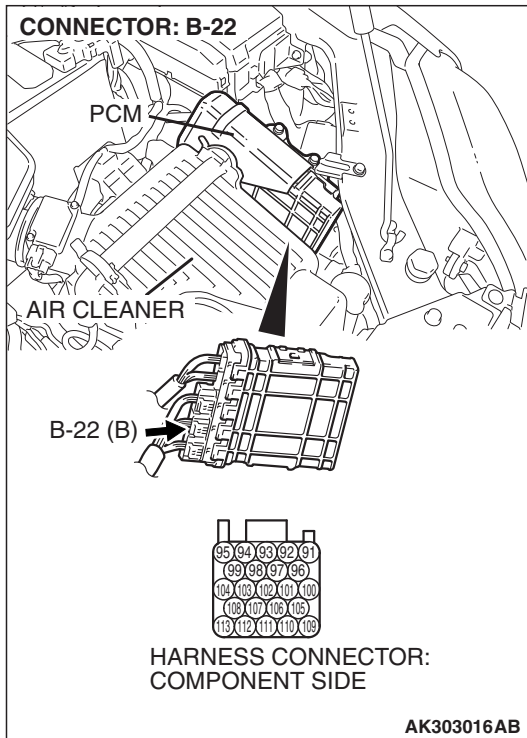
DIAGNOSIS**Required Special Tools:**

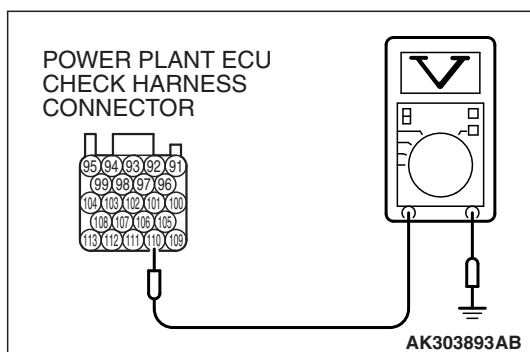
- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991923: Power Plant ECU Check Harness

STEP 1. Measure the power supply voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.

(2) Start the engine and run at idle.





- (3) Measure the voltage between terminal No. 110 and ground.
 - Voltage should be 1 volt or less when engine is idling.
 - Voltage should be battery positive voltage when engine speed is higher than 4,300 r/min.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage normal?

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

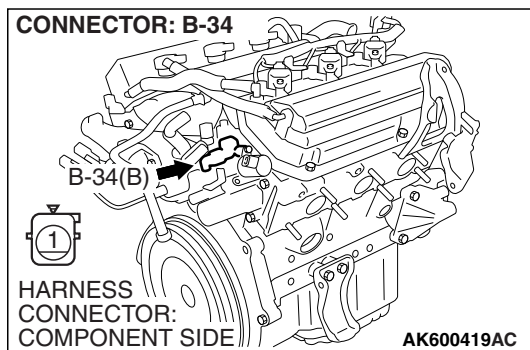
NO : Go to Step 2.

STEP 2. Check harness connector B-34 at engine oil pressure switch (for MIVEC) for damage.

Q: Is the harness connector in good condition?

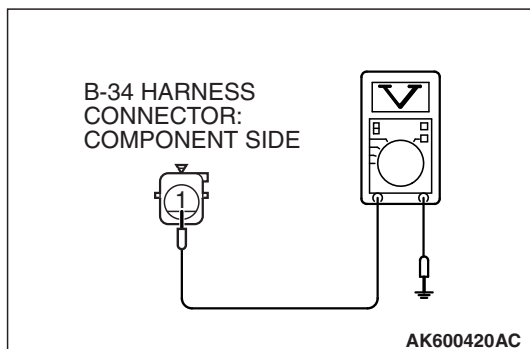
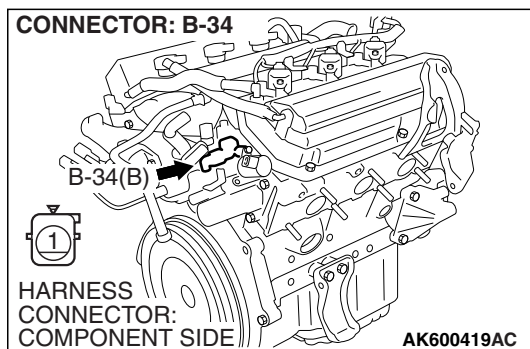
YES : Go to Step 3.

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



STEP 3. Measure the power supply voltage at engine oil pressure switch (for MIVEC) connector B-34.

- (1) Disconnect the connector B-34 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.



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

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

YES : Go to Step 6.

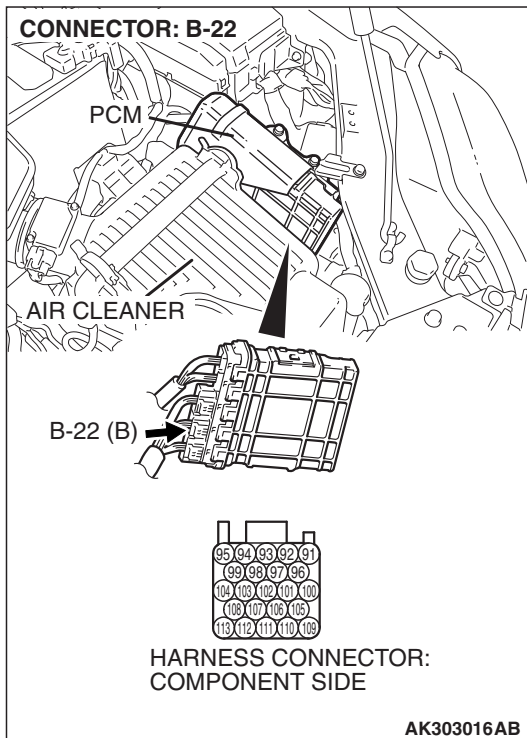
NO : Go to Step 4.

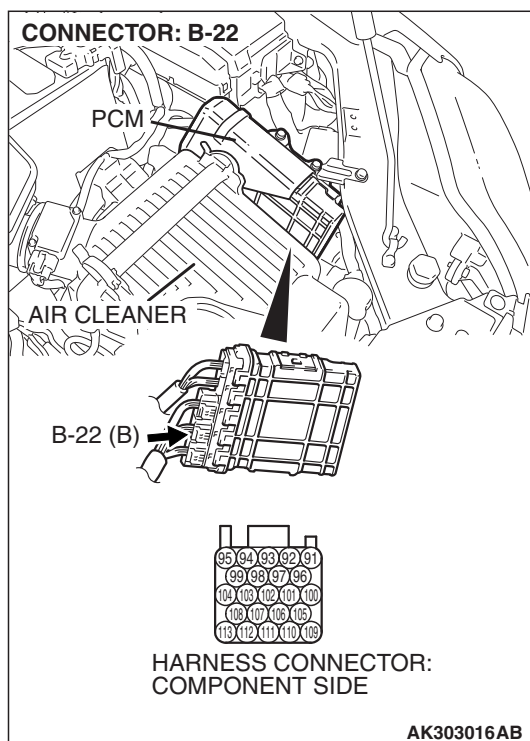
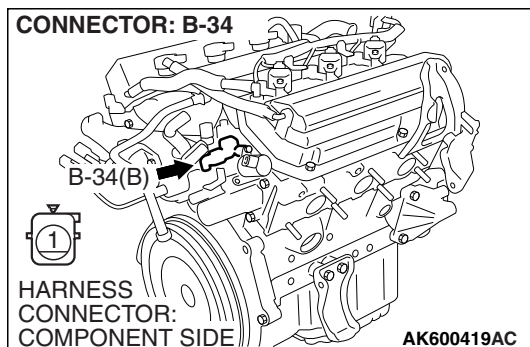
STEP 4. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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





STEP 5. Check for open circuit and short circuit to ground between engine oil pressure switch (for MIVEC) connector B-34 (terminal No. 1) and PCM connector B-22 (terminal No. 110).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 10.

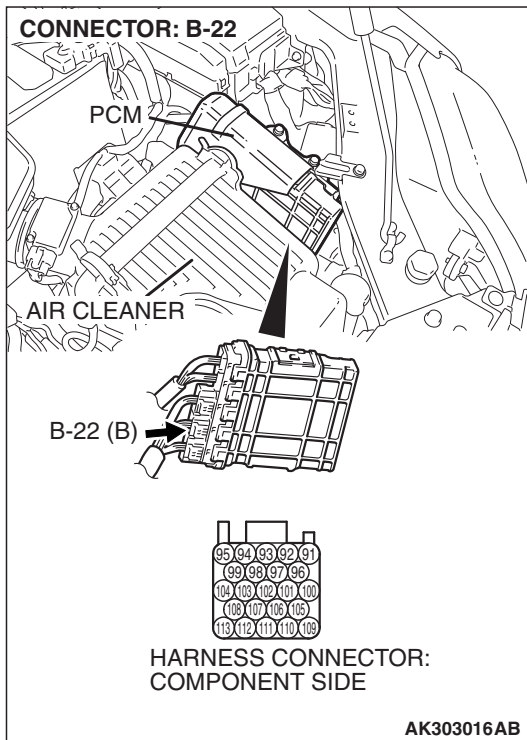
NO : Repair it. Then go to Step 10.

STEP 6. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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

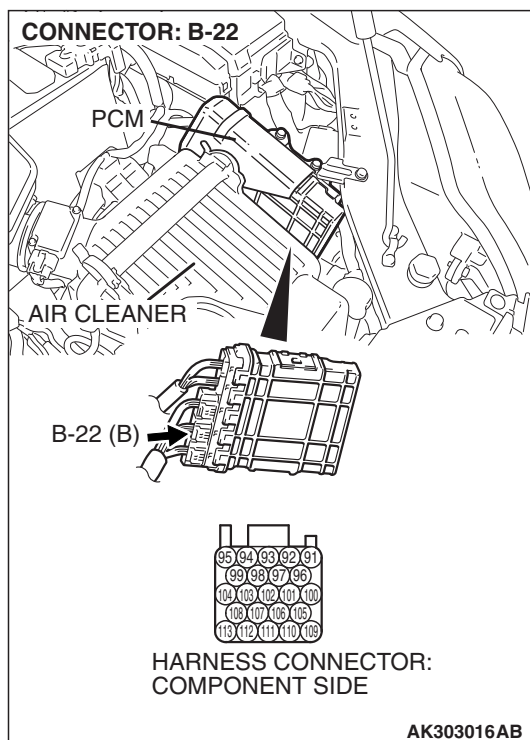
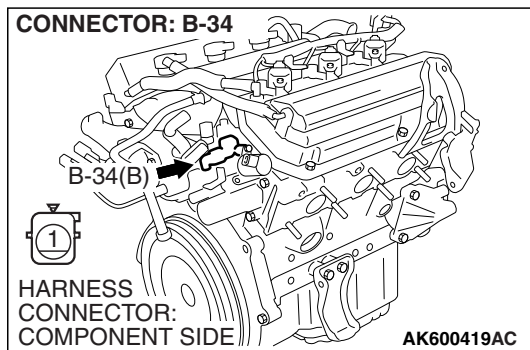


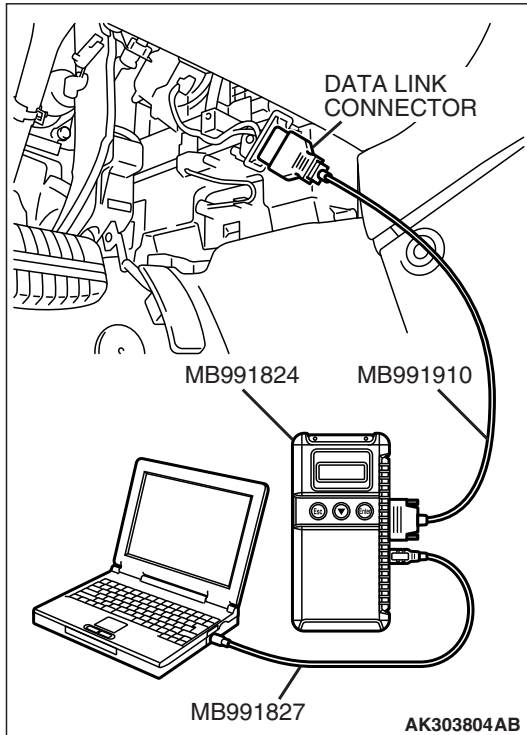
STEP 7. Check for harness damage between engine oil pressure switch (for MIVEC) connector B-34 (terminal No. 1) and PCM connector B-22 (terminal No. 110).

Q: Is the harness wire in good condition?

YES : Go to Step 8.

NO : Repair it. Then go to Step 10.





STEP 8. Using scan tool MB991958, check data item 98: Engine oil control valve.

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 98, Engine oil control valve.
 - Warm up the engine. With the engine is idling, the engine oil control valve should be "OFF"
 - Warm up the engine. With the engine is 4,300 r/min, the engine oil control valve should be "ON"
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the engine oil control valve operating properly?

YES : Replace the engine oil pressure switch. Then go to Step 9.

NO : Replace the engine oil control valve. Then go to Step 10.

STEP 9. Test the OBD-II Drive Cycle.

- (1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P003C set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 10.

NO : The Inspection is complete.

STEP 10. Test the OBD-II Drive Cycle.

- (1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

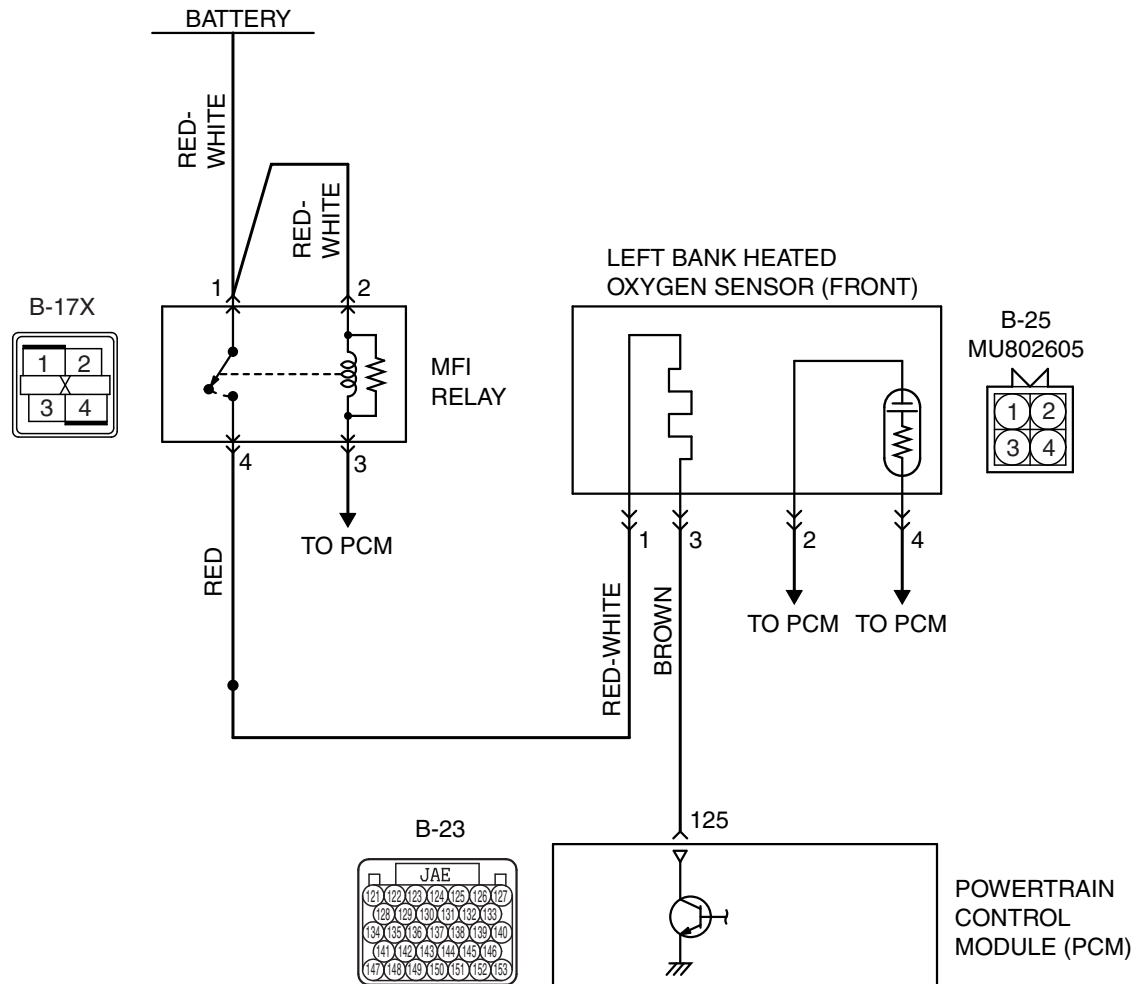
Q: Is DTC P003C set?

YES : Retry the troubleshooting.

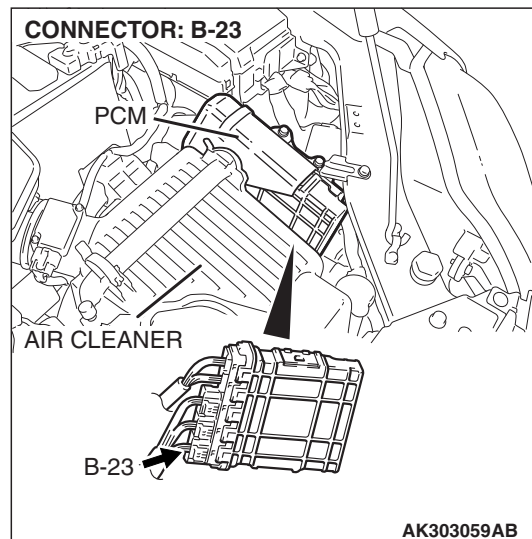
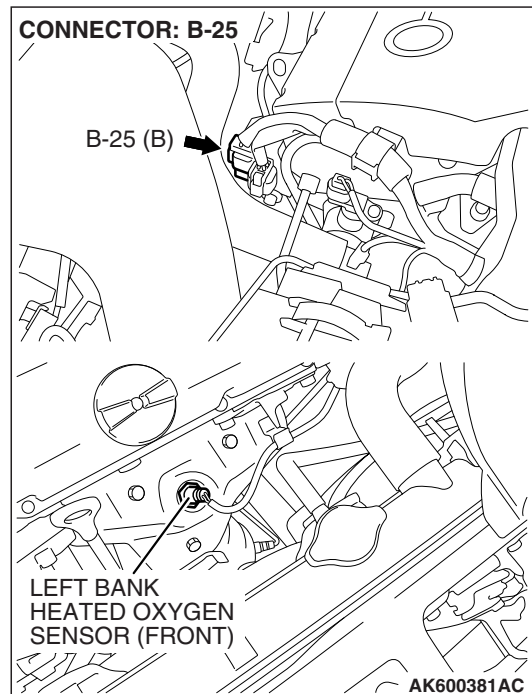
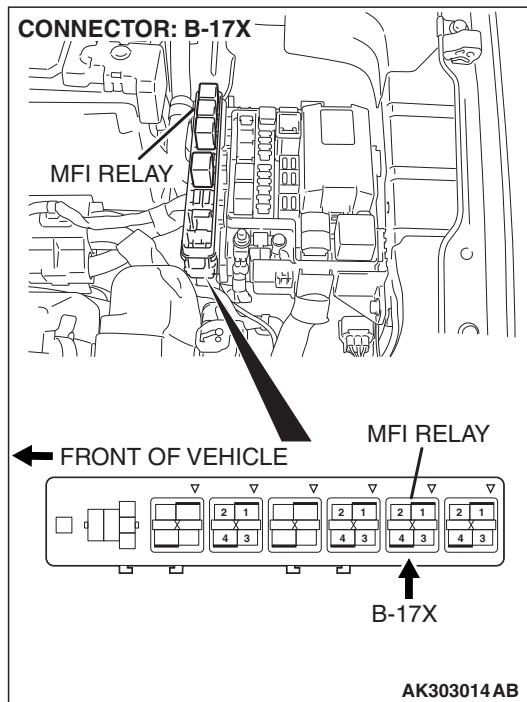
NO : The inspection is complete.

DTC P0051: Heated Oxygen Sensor Heater Circuit Low (bank 2 sensor 1)

Left Bank Heated Oxygen Sensor (front) Heater Circuit



AK400904



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the left bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 125) controls continuity to the left bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (front) heater current or voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

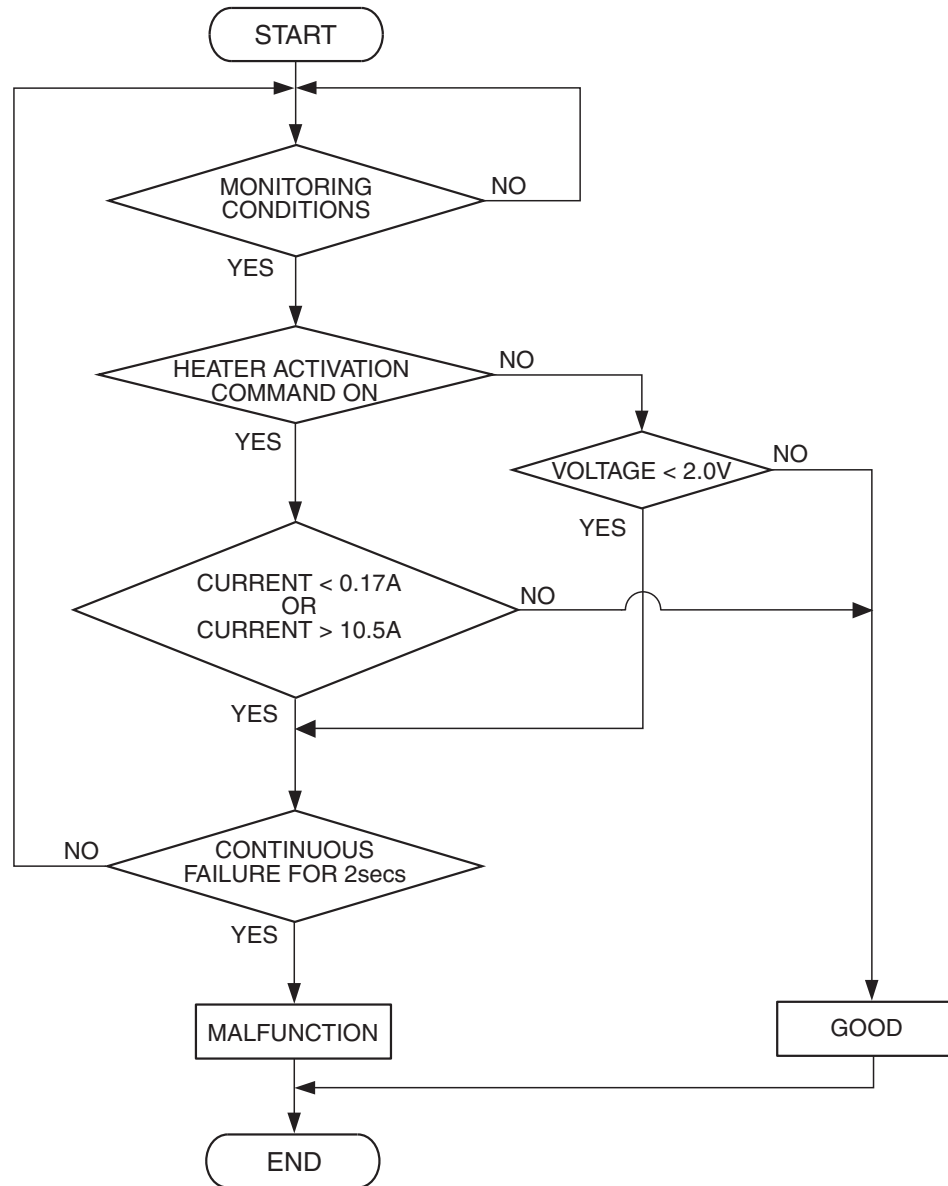
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK802635

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank heated oxygen sensor (front) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The left bank heated oxygen sensor (front) heater current has continued to be lower than 0.17 ampere for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank heated oxygen sensor (front) heater is off.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The left bank heated oxygen sensor (front) heater voltage has continued to be lower than 2.0 volts for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13B-5](#).

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 failed.
- PCM failed.

DIAGNOSIS

Required Special Tools:

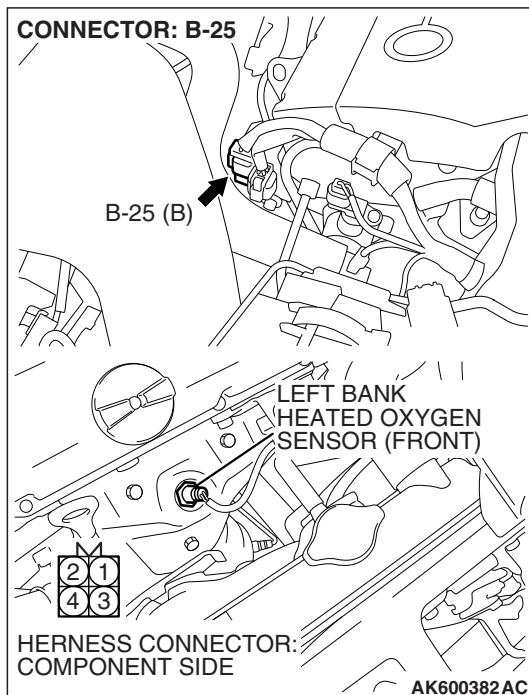
- MD998464: Test Harness
- MB991923: Power Plant ECU Check Harness

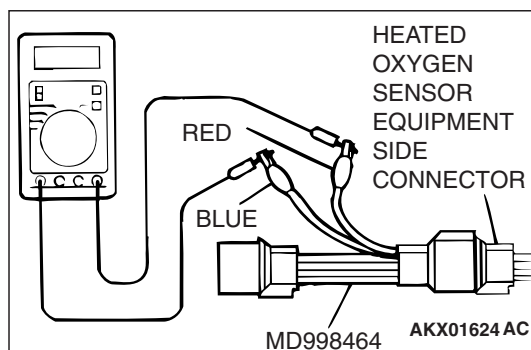
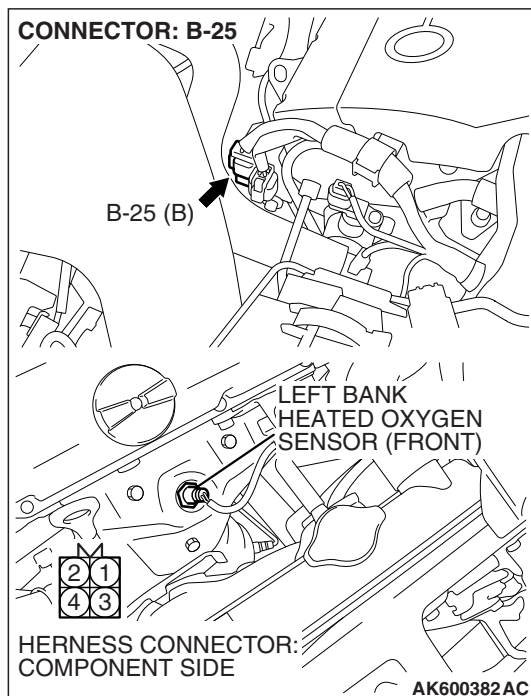
STEP 1. Check harness connector B-25 at the left bank heated oxygen sensor (front) for damage.

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 12.



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

- (1) Disconnect left bank heated oxygen sensor (front) connector B-25 and connect test harness special tool, MD998464, to the connector on the left bank heated oxygen sensor (front) side.

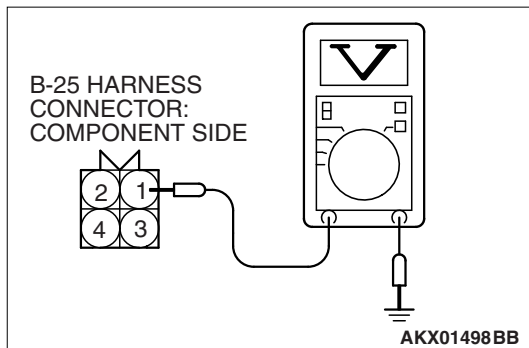
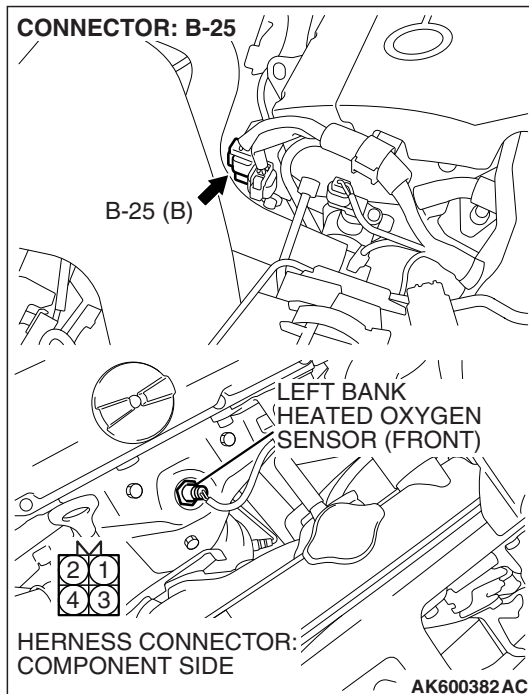
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 4.5 – 8.0 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 4.5 and 8.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

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



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. 1 and ground.

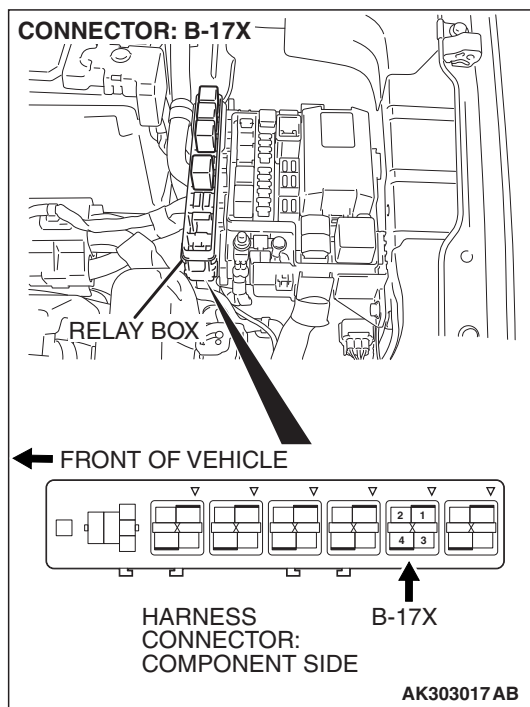
- Voltage should be battery positive voltage.

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

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

YES : Go to Step 5.

NO : Go to Step 4.



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

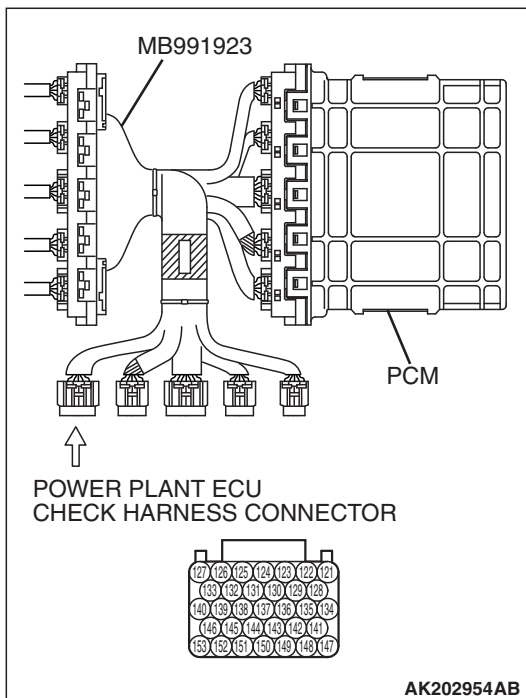
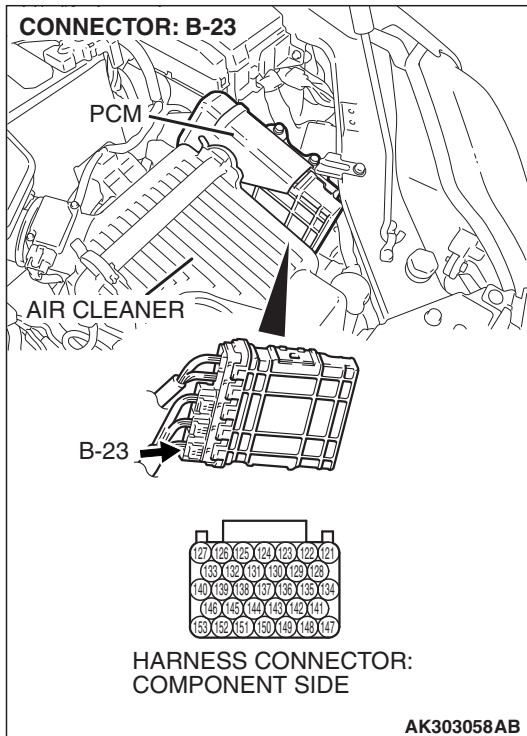
Q: Is the harness connector in good condition?

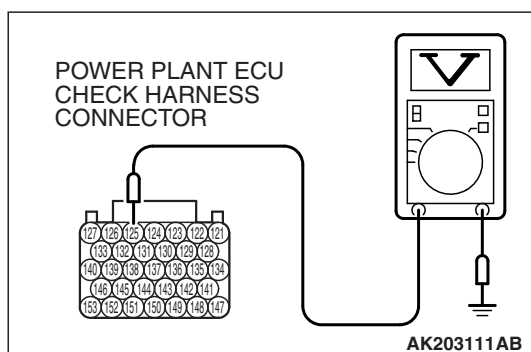
YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (front) connector B-25 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

STEP 5. Measure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



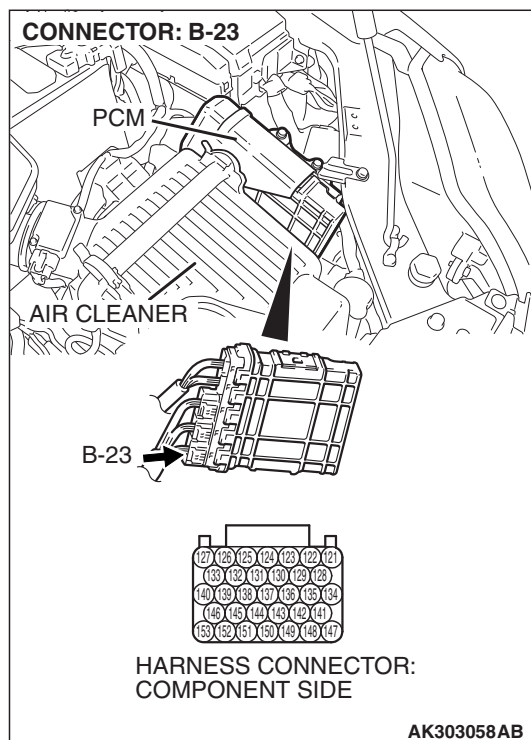


- (3) Measure the voltage between terminal No. 125 and ground.
 • Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

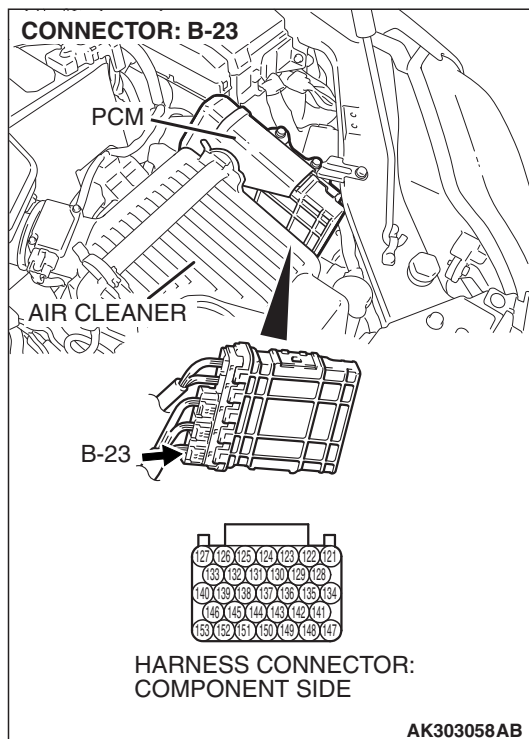
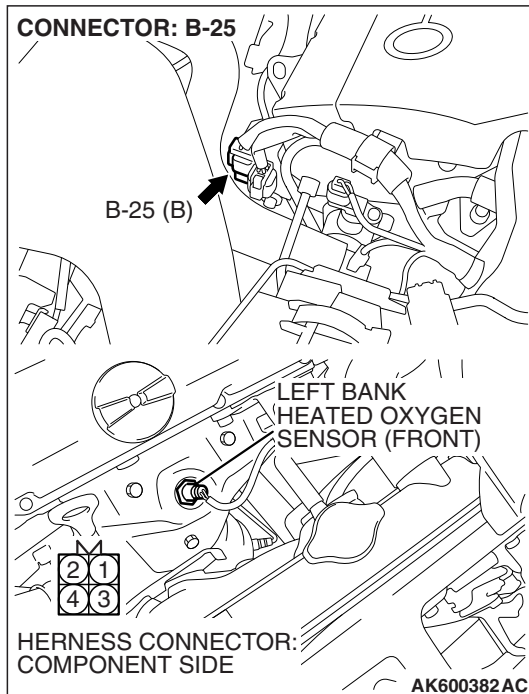
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

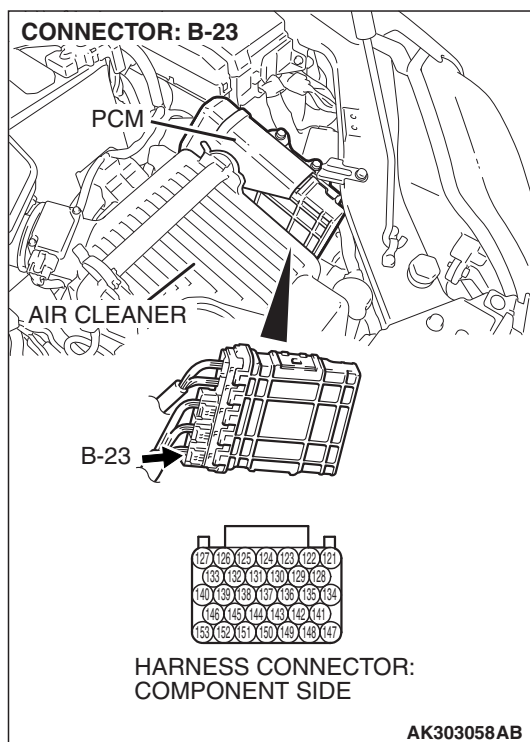
STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (front) connector B-25 (terminal No. 3) and PCM connector B-23 (terminal No. 125).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.





STEP 8. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

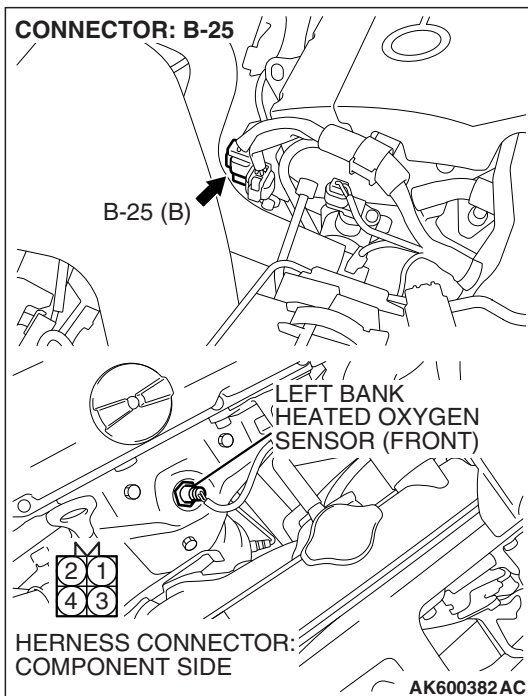
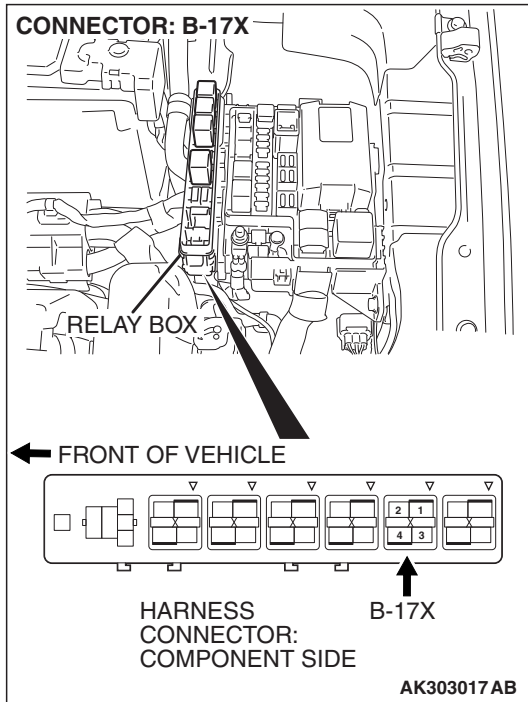
YES : Go to Step 9.

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

STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (front) connector B-25 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

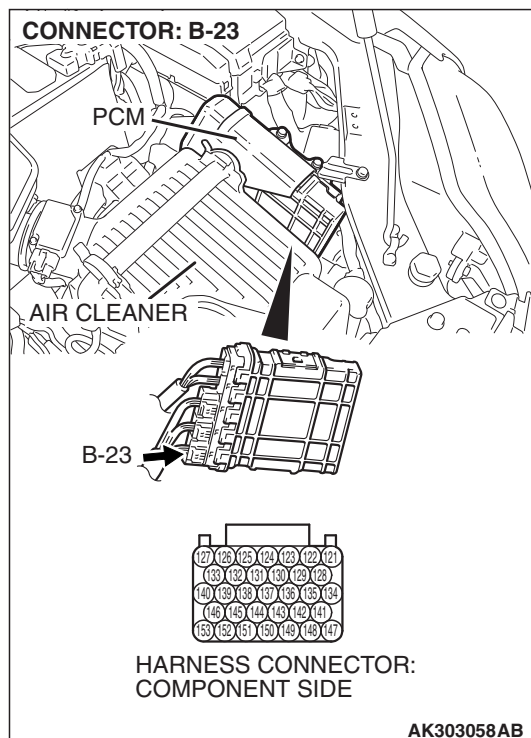
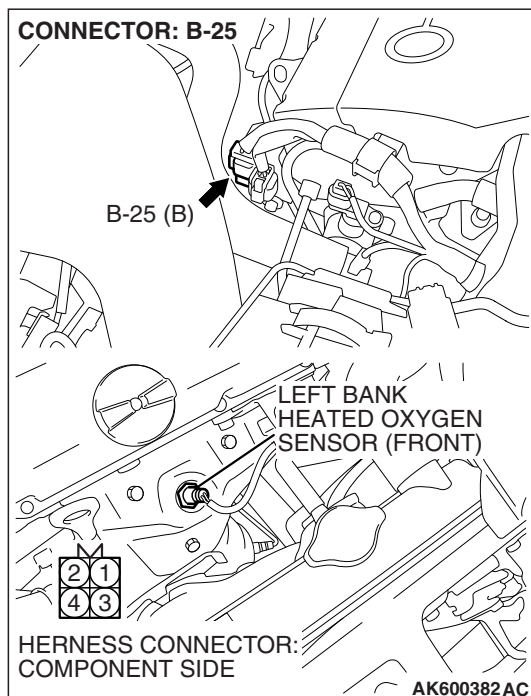


STEP 10. Check for harness damage between left bank heated oxygen sensor (front) connector B-25 (terminal No. 3) and PCM connector B-23 (terminal No. 125).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.



STEP 11. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0051 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

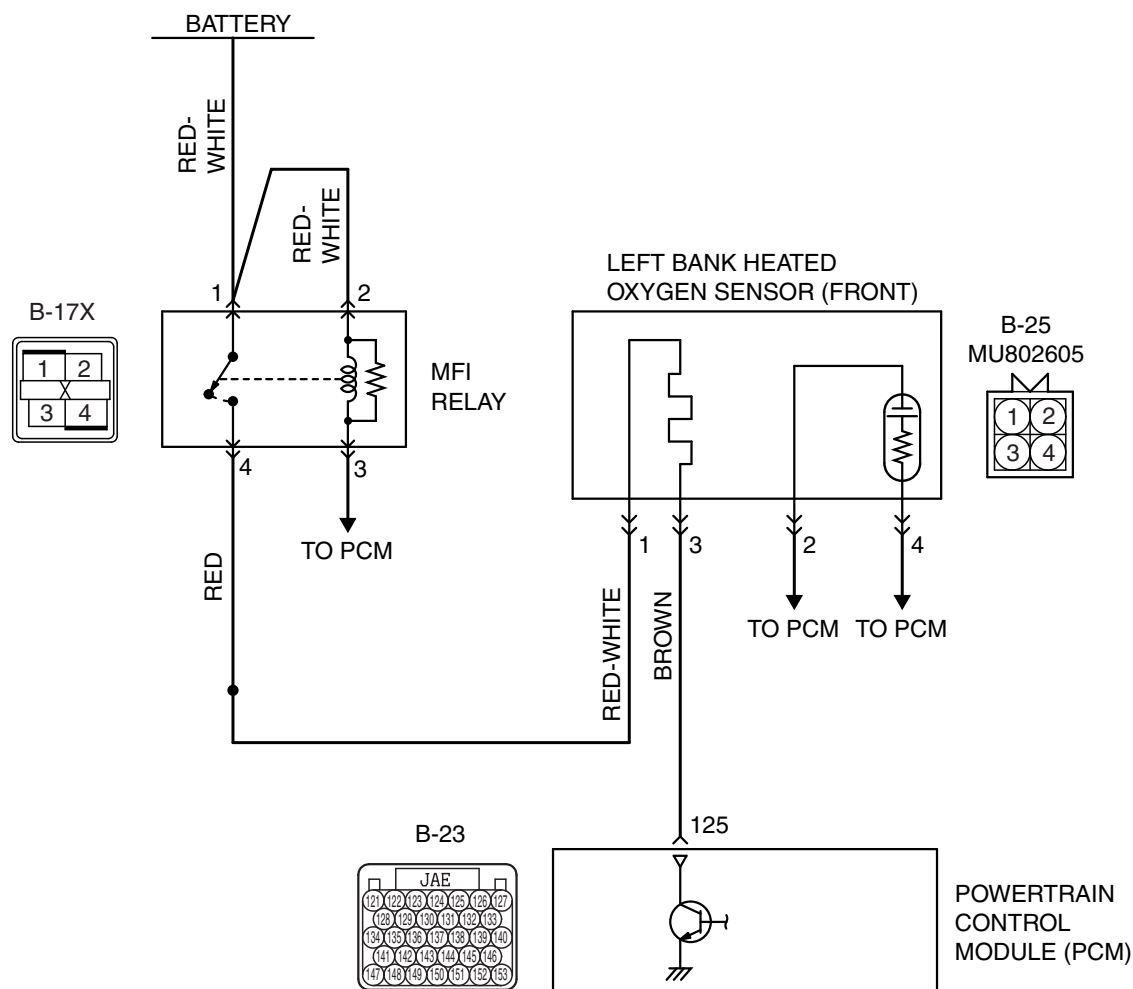
Q: Is DTC P0051 set?

YES : Retry the troubleshooting.

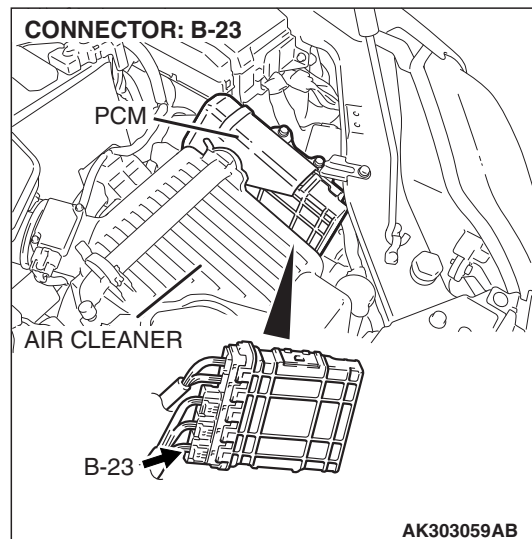
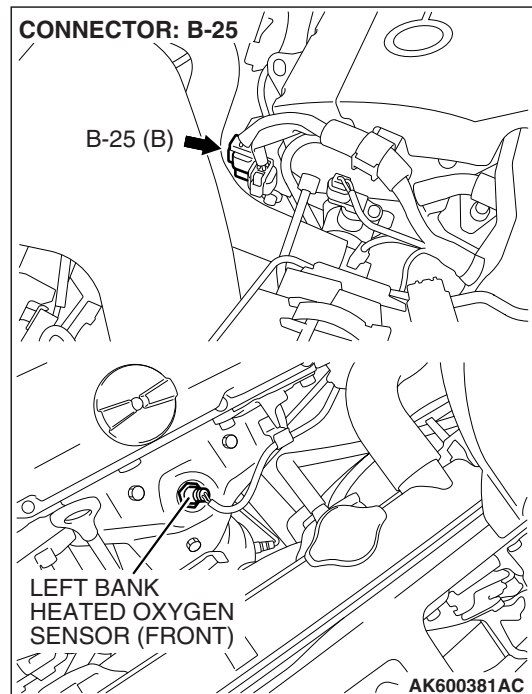
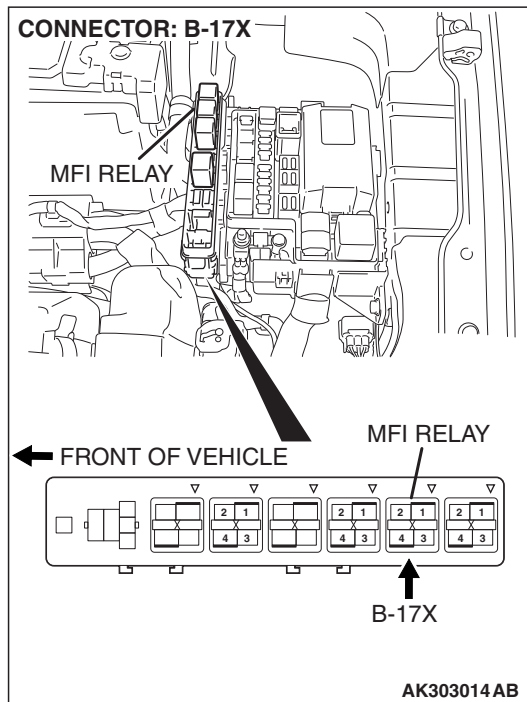
NO : The inspection is complete.

DTC P0052: Heated Oxygen Sensor Heater Circuit High (bank 2 sensor 1)

Left Bank Heated Oxygen Sensor (front) Heater Circuit



AK400904



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the left bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 125) controls continuity to the left bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (front) heater current is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

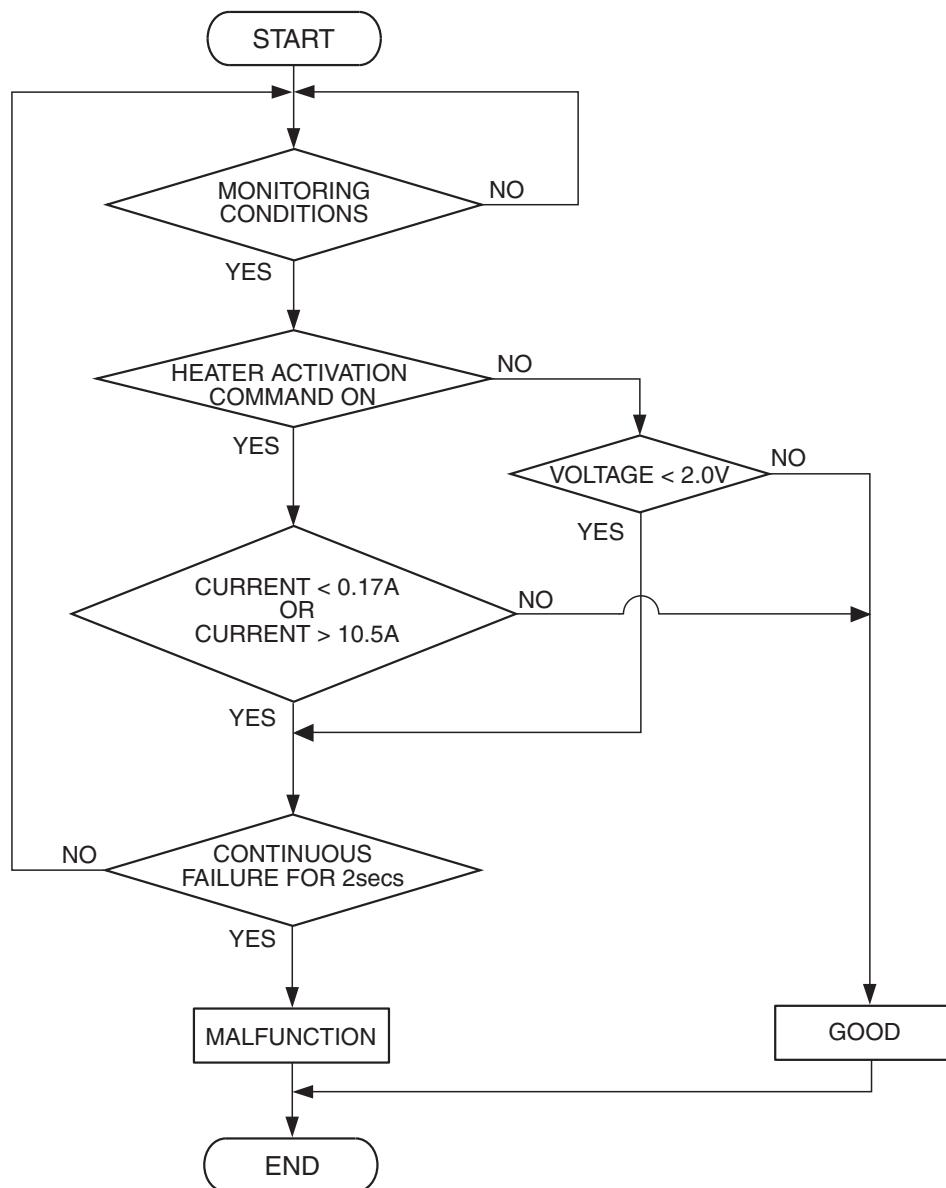
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK802635

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank heated oxygen sensor (front) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The left bank heated oxygen sensor (front) heater current has continued to be higher than 10.5 amperes for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).

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

- Left bank heated oxygen sensor (front) heater failed.
- PCM failed.

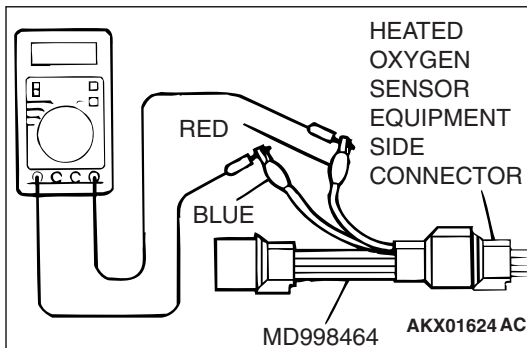
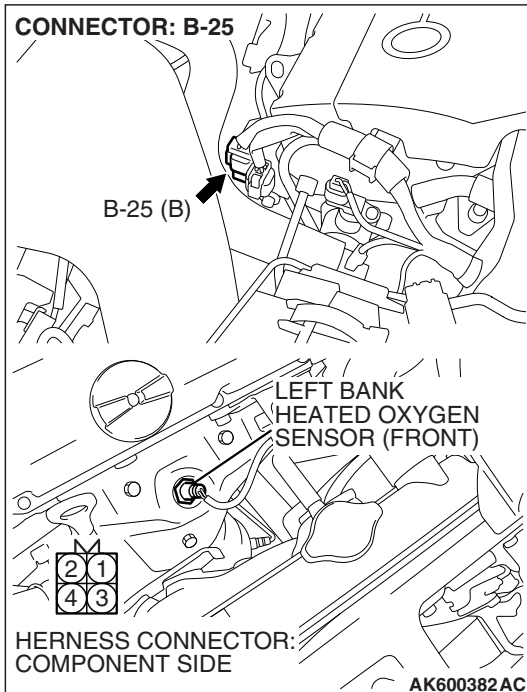
DIAGNOSIS

Required Special Tool:

- MD998464: Test Harness

STEP 1. Check the left bank heated oxygen sensor (front).

- (1) Disconnect left bank heated oxygen sensor (front) connector B-25 and connect test harness special tool, MD998464, to the connector on the left bank heated oxygen sensor (front) side.



- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 4.5 – 8.0 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 4.5 and 8.0 ohms [at 20°C (68°F)]?

YES : Go to Step 2.

NO : Replace the left bank heated oxygen sensor (front). Then go to Step 3.

STEP 2. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

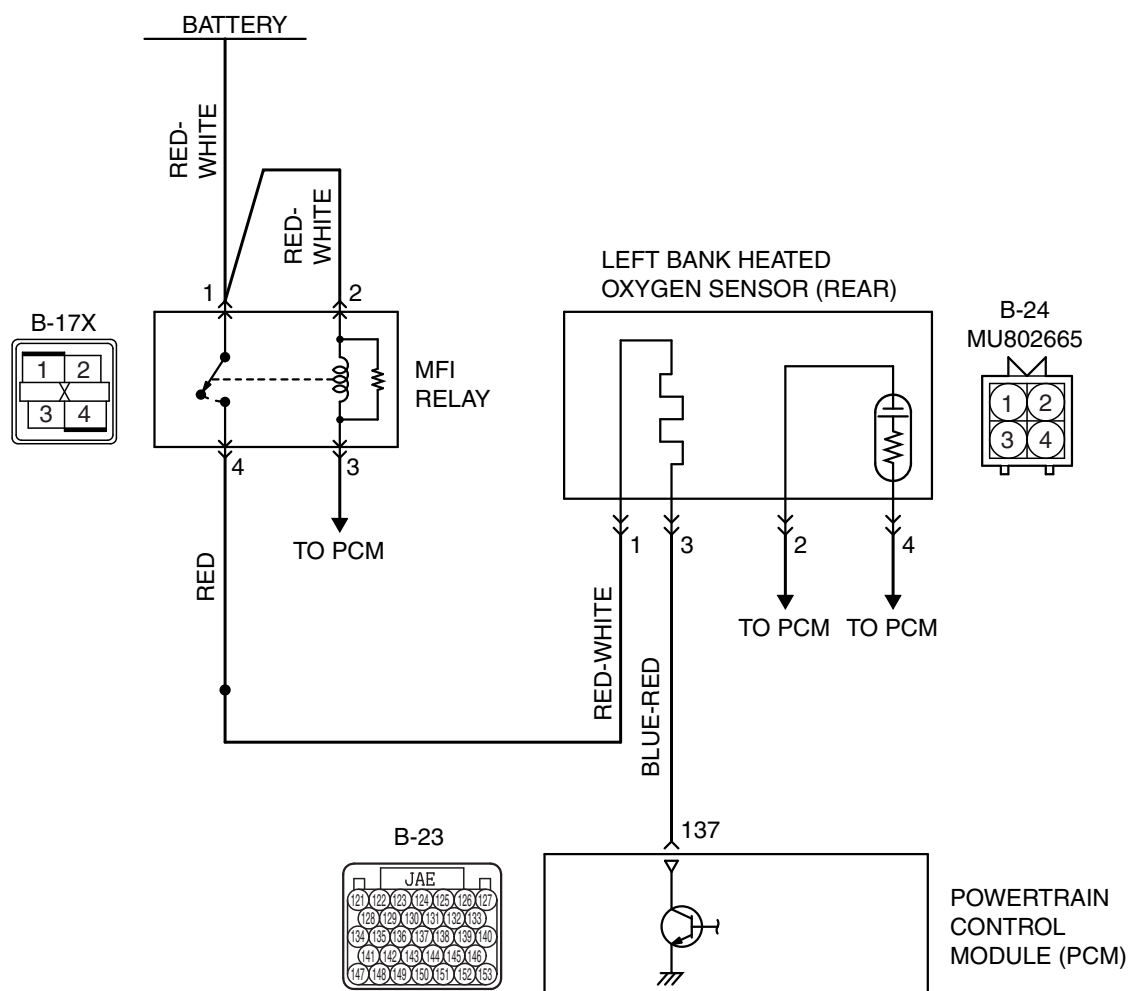
Q: Is DTC P0052 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 3.

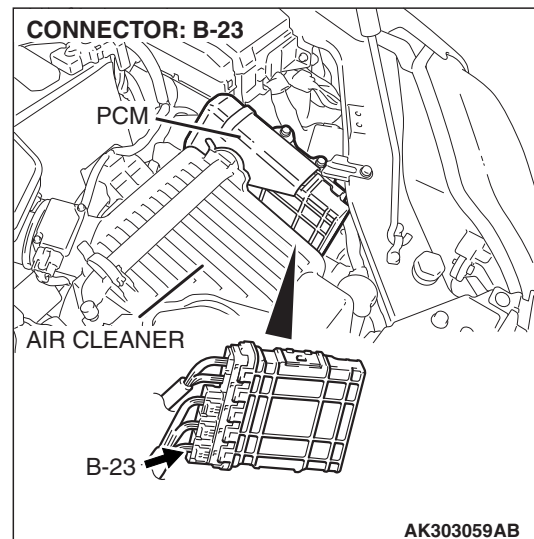
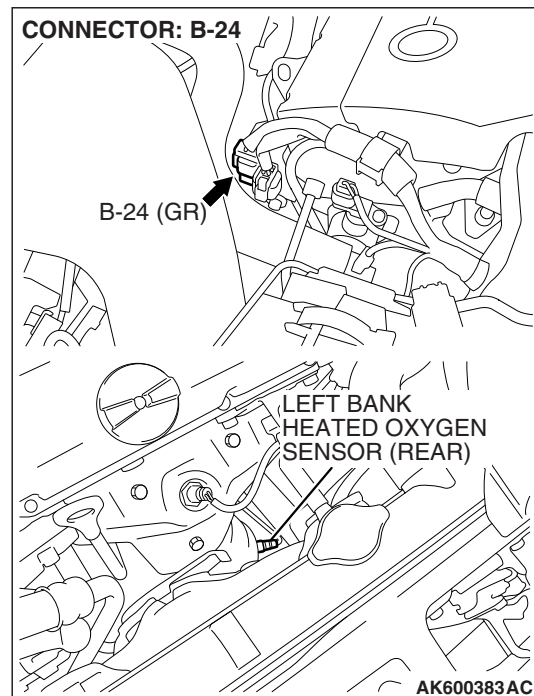
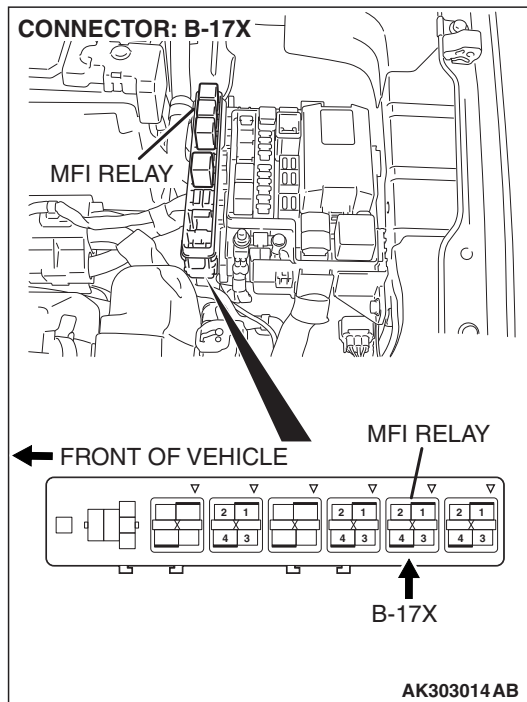
NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (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)****Left Bank Heated Oxygen Sensor (rear) Heater Circuit**

AK400906



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the left bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 137) controls continuity to the left bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (rear) heater current or voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

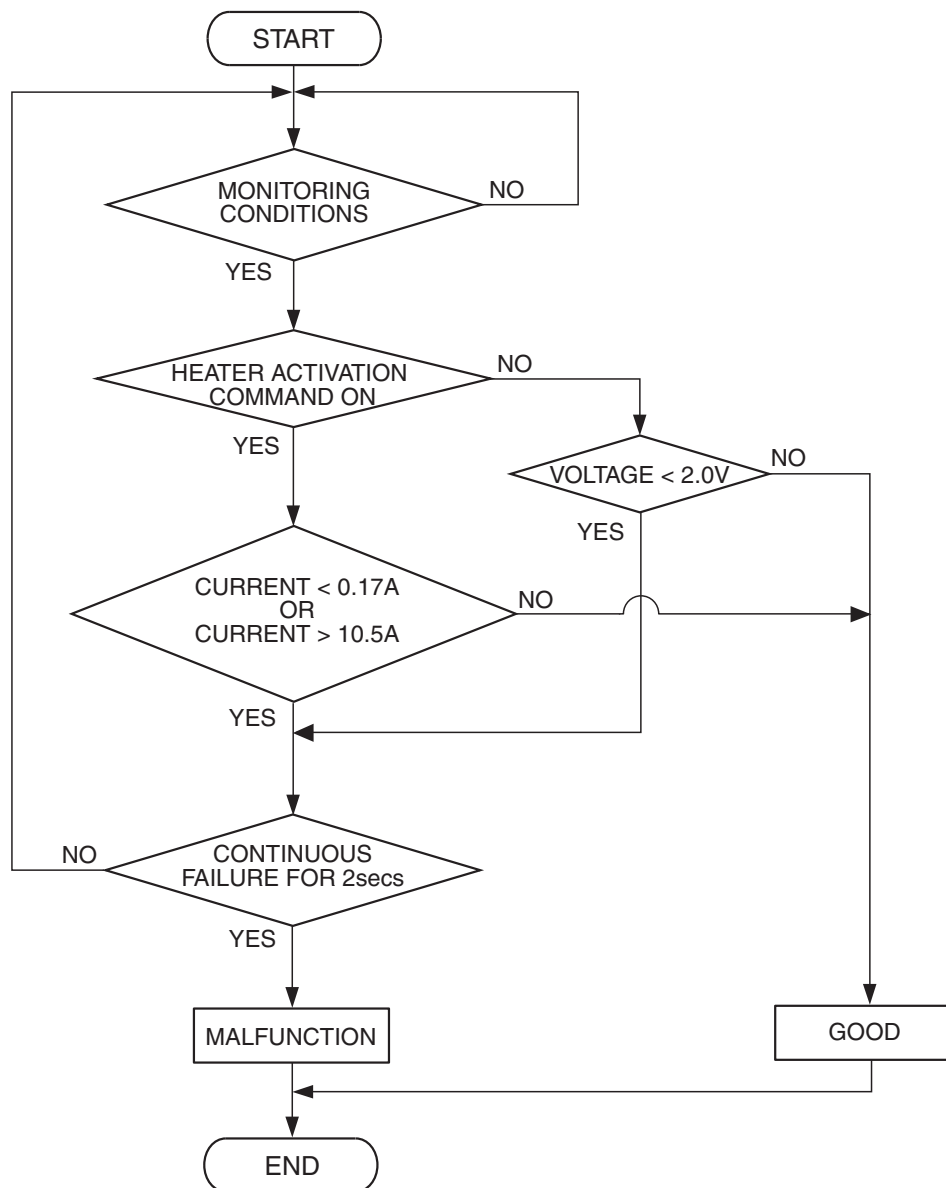
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK802635

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank heated oxygen sensor (rear) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The left bank heated oxygen sensor (rear) heater current has continued to be lower than 0.17 ampere for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank heated oxygen sensor (front) heater is off.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The left bank heated oxygen sensor (rear) heater voltage has continued to be lower than 2.0 volts for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13B-5](#).

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.
- PCM failed.

DIAGNOSIS

Required Special Tools:

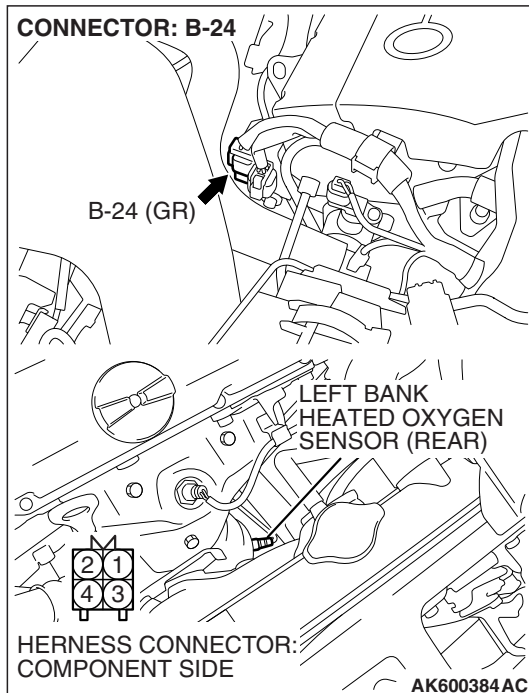
- MB991316: Test Harness
- MB991923: Power Plant ECU Check Harness

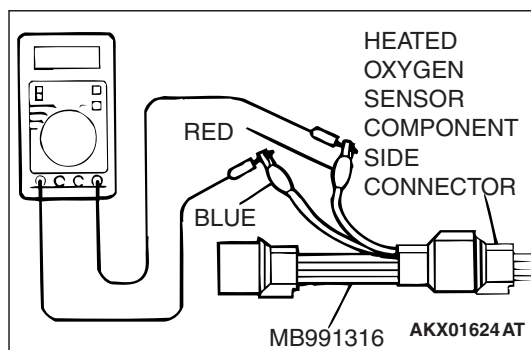
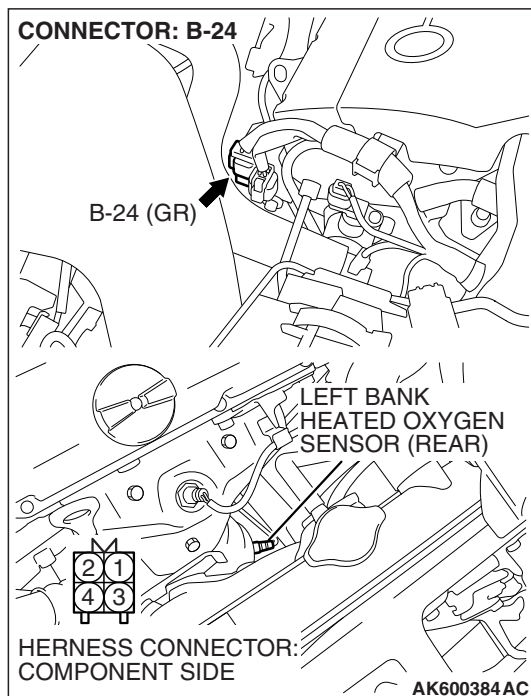
STEP 1. Check harness connector B-24 at the left bank heated oxygen sensor (rear) for damage.

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 12.



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

- (1) Disconnect left bank heated oxygen sensor (rear) connector B-24 and connect test harness special tool, MB991316, to the connector on the left bank heated oxygen sensor (rear) side.

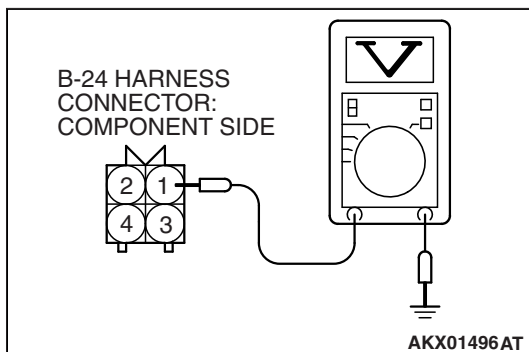
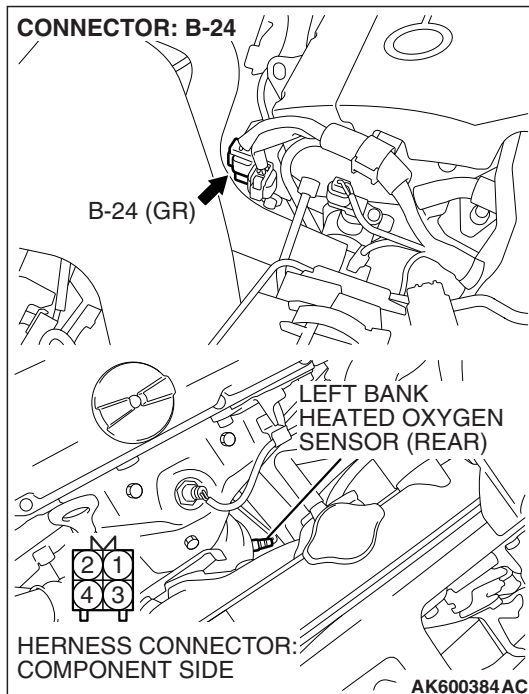
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 11 – 18 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 11 and 18 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the left bank heated oxygen sensor (rear).
Then go to Step 12.



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

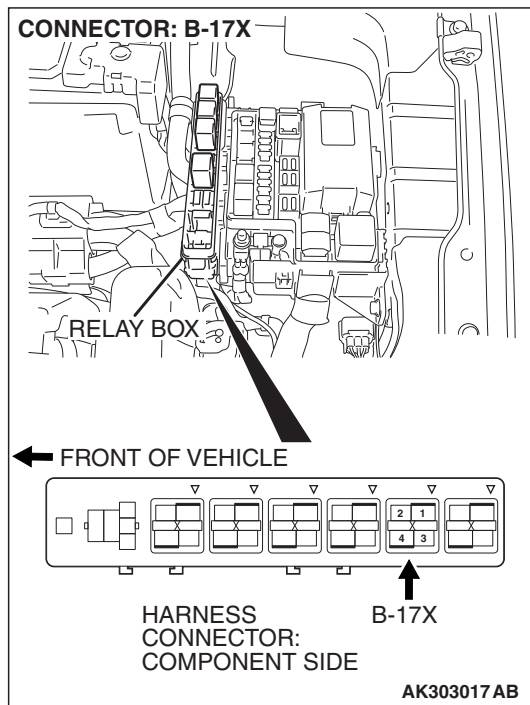
- (1) Disconnect the connector B-24 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

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

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

YES : Go to Step 5.

NO : Go to Step 4.



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

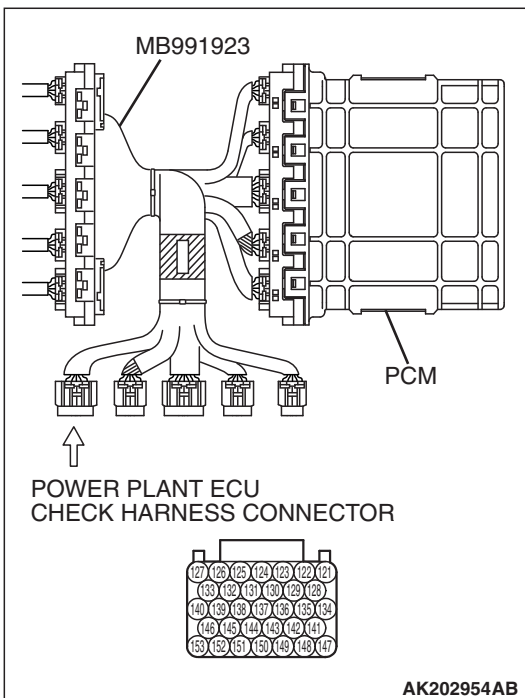
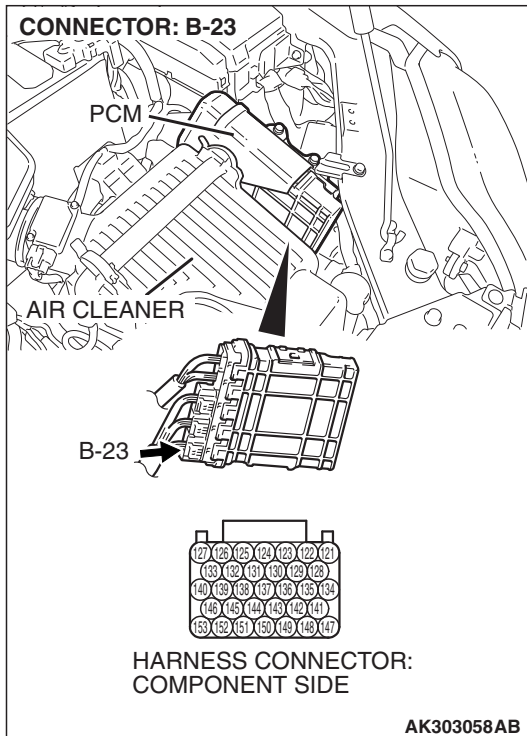
Q: Is the harness connector in good condition?

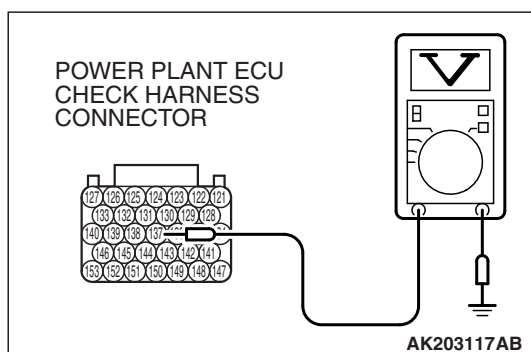
YES : Repair harness wire between MFI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (rear) connector B-24 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

STEP 5. Measure the power supply voltage at PCM connector B-23 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



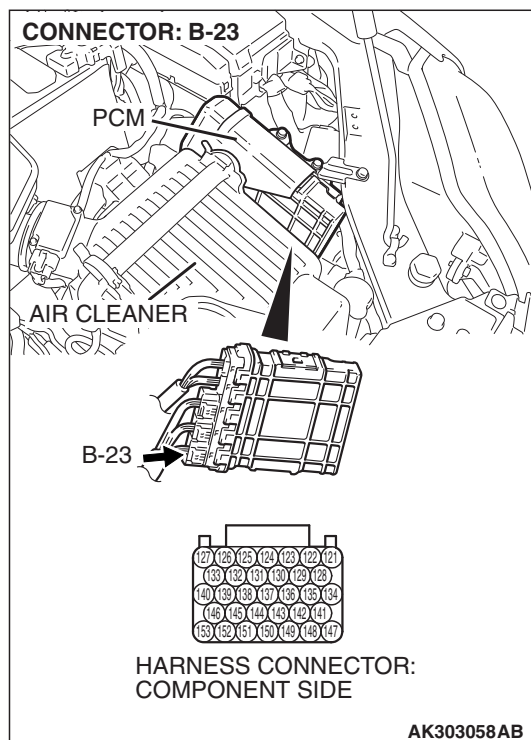


- (3) Measure the voltage between terminal No. 137 and ground.
 • Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

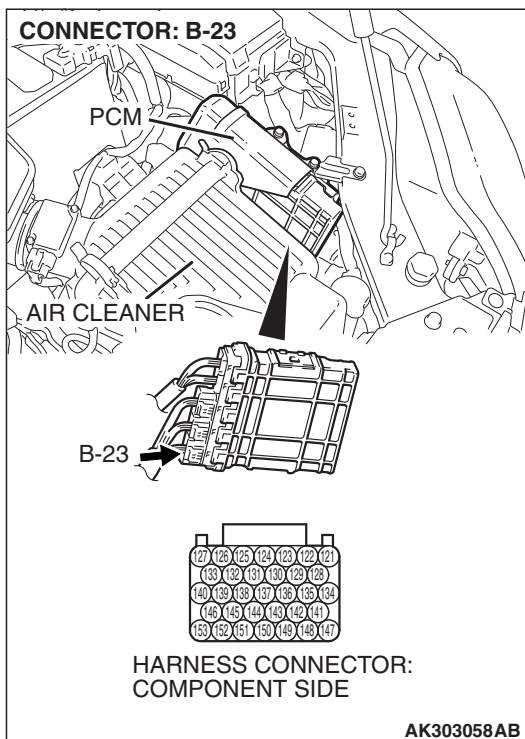
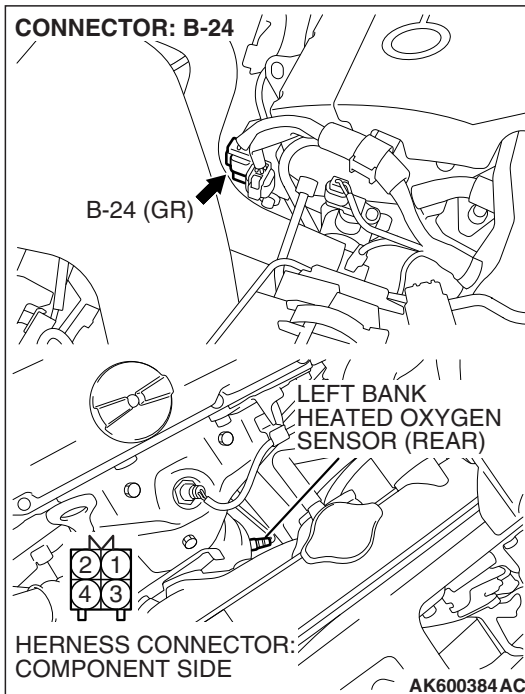
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

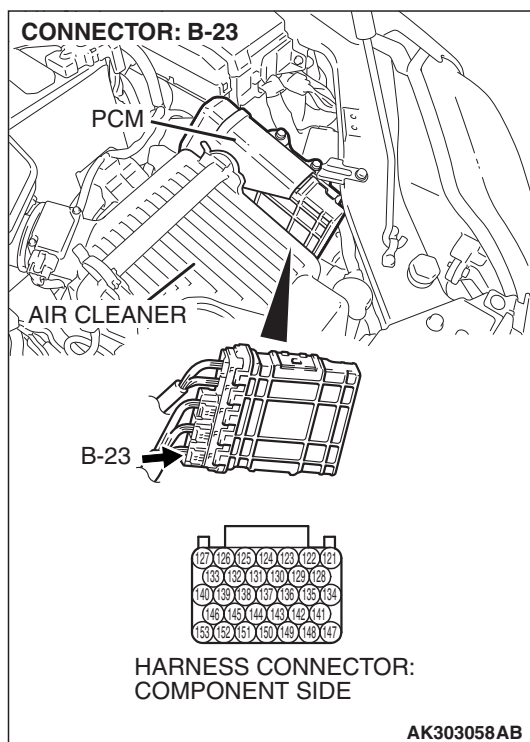
STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 3) and PCM connector B-23 (terminal No. 137).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.





STEP 8. Check harness connector B-23 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

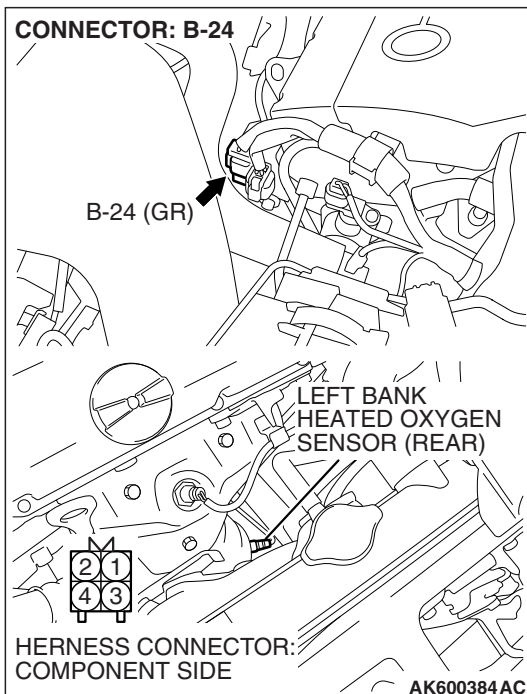
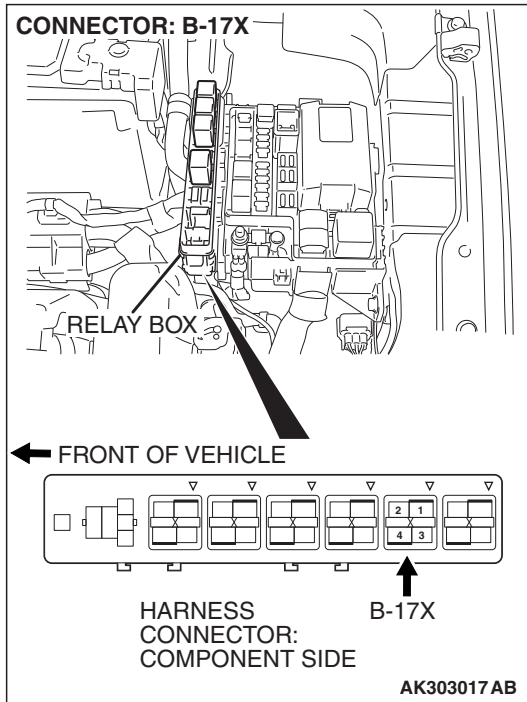
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

STEP 9. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and left bank heated oxygen sensor (rear) connector B-24 (terminal No. 1).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

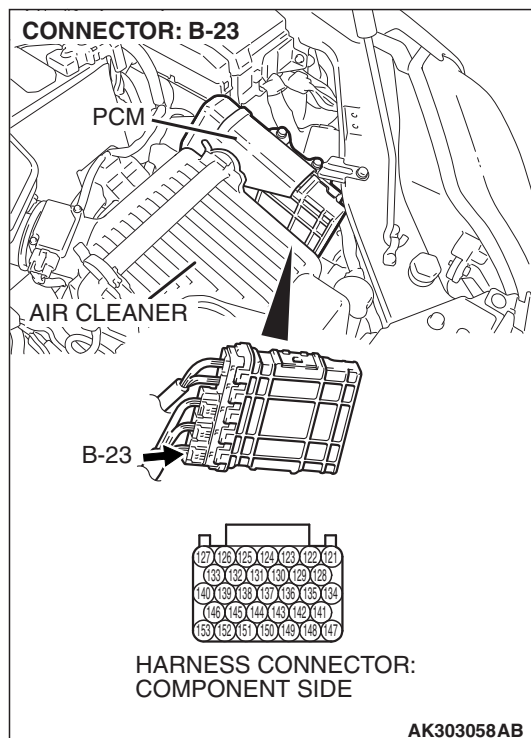
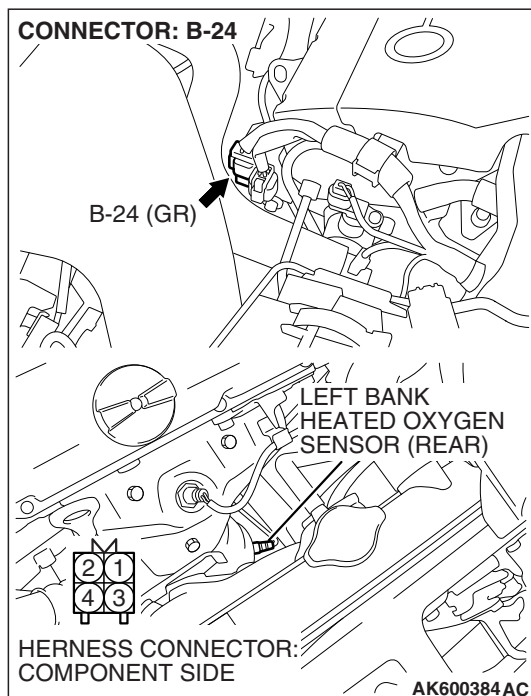


STEP 10. Check for harness damage between left bank heated oxygen sensor (rear) connector B-24 (terminal No. 3) and PCM connector B-23 (terminal No. 137).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.



STEP 11. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0057 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

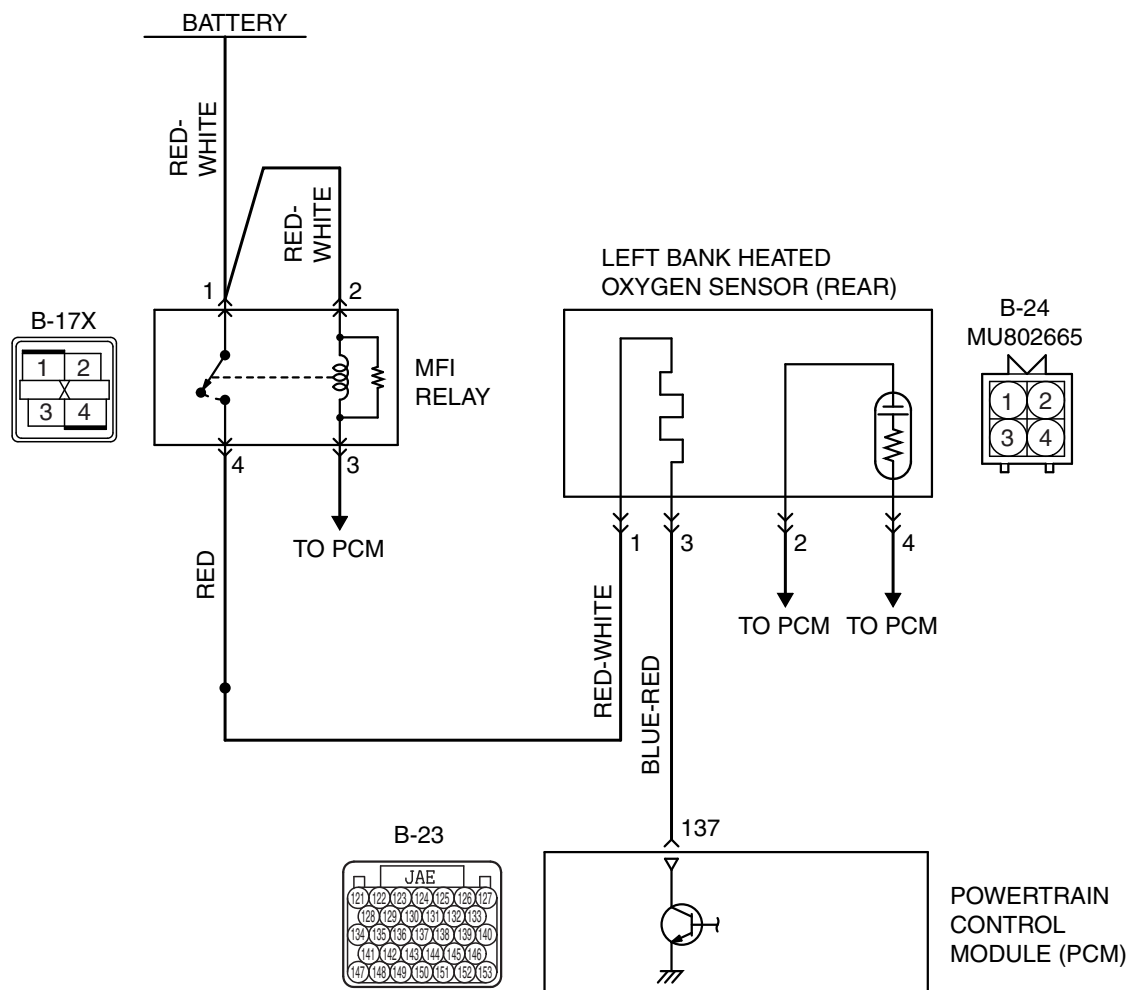
Q: Is DTC P0057 set?

YES : Retry the troubleshooting.

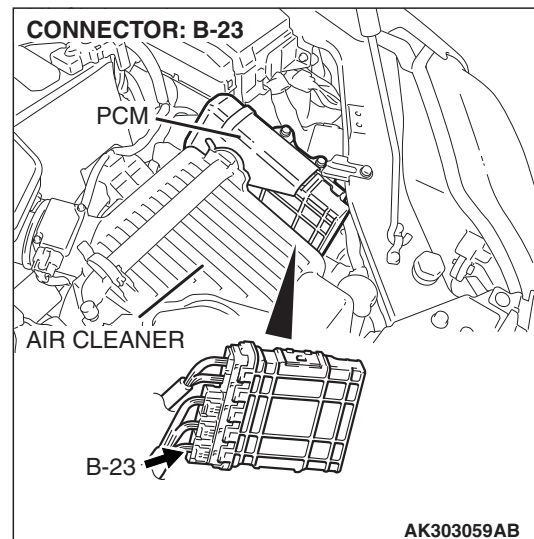
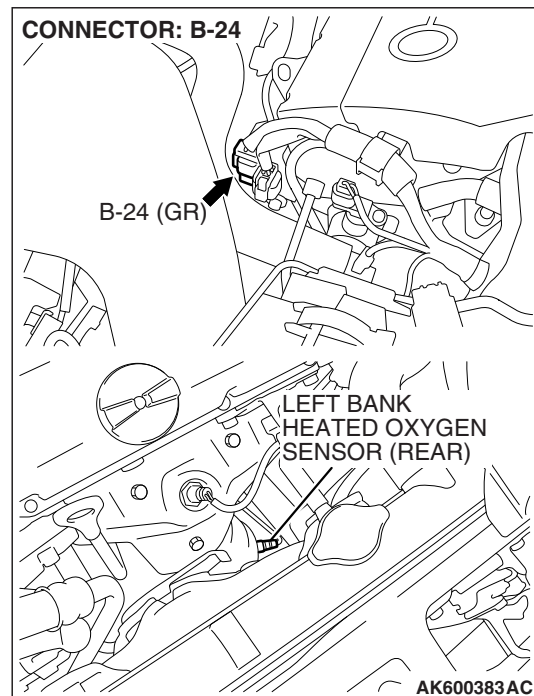
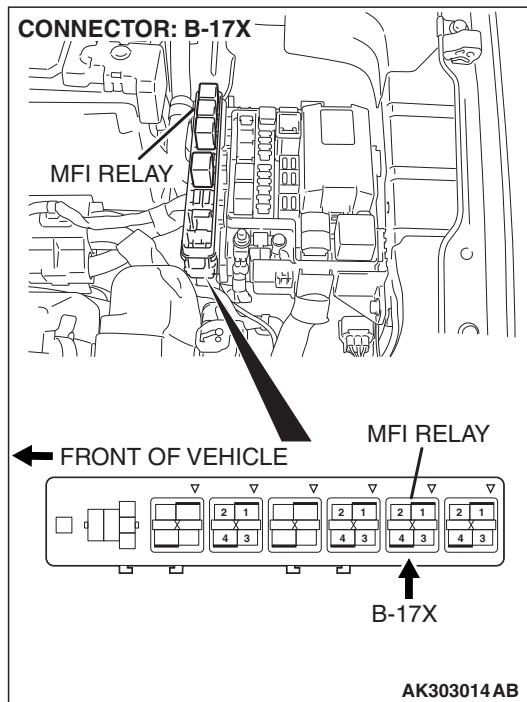
NO : The inspection is complete.

DTC P0058: Heated Oxygen Sensor Heater Circuit High (bank 2 sensor 2)

Left Bank Heated Oxygen Sensor (rear) Heater Circuit



AK400906



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the left bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 137) controls continuity to the left bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Left bank heated oxygen sensor (rear) heater current is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

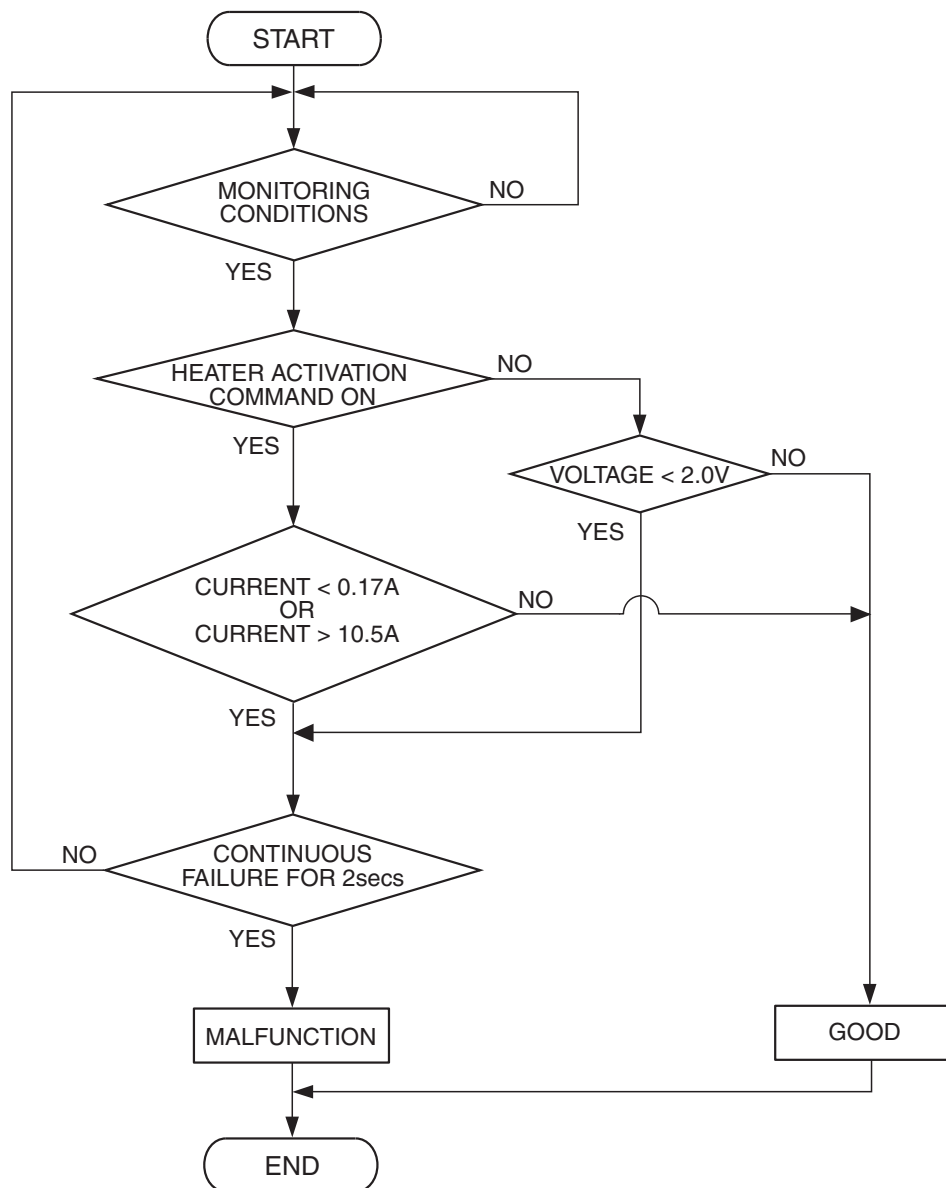
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK802635

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the left bank heated oxygen sensor (rear) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The left bank heated oxygen sensor (rear) heater current has continued to be higher than 10.5 amperes for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).

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

- Left bank heated oxygen sensor (rear) heater failed.
- PCM failed.

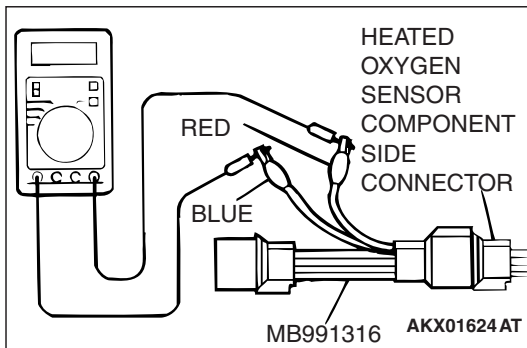
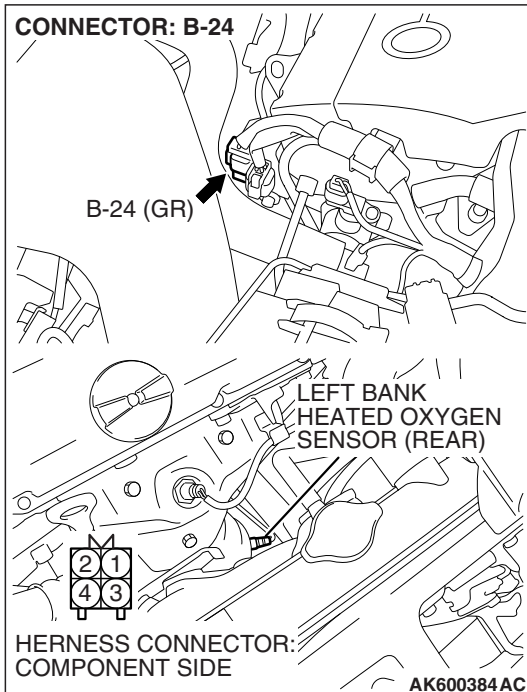
DIAGNOSIS

Required Special Tool:

- MB991316: Test Harness

STEP 1. Check the left bank heated oxygen sensor (rear).

- (1) Disconnect left bank heated oxygen sensor (rear) connector B-24 and connect test harness special tool, MB991316, to the connector on the left bank heated oxygen sensor (rear) side.



- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

Standard value: 11 – 18 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 11 and 18 ohms [at 20°C (68°F)]?

YES : Go to Step 2.

NO : Replace the left bank heated oxygen sensor (rear).
Then go to Step 3.

STEP 2. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0058 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 3.

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 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0058 set?**YES** : Retry the troubleshooting.**NO** : The inspection is complete.

DTC P0069: Abnormal Correlation Between Manifold Absolute Pressure Sensor And Barometric Pressure Sensor

TECHNICAL DESCRIPTION

- The PCM detects abnormality in the sensor by comparing the manifold absolute pressure sensor output with the barometric pressure sensor output.

DESCRIPTIONS OF MONITOR METHODS

The PCM compares the manifold absolute pressure sensor output with the barometric pressure sensor output while the engine control relay is in "ON" position after the ignition switch is in "LOCK" (OFF) position. When the difference exceeds the specified value between them, the PCM determines whether the manifold absolute pressure sensor / the barometric pressure sensor has malfunction or not.

MONITOR EXECUTION

Continuous

**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)****Other Monitor (There is no temporary DTC stored in memory for the item monitored below)**

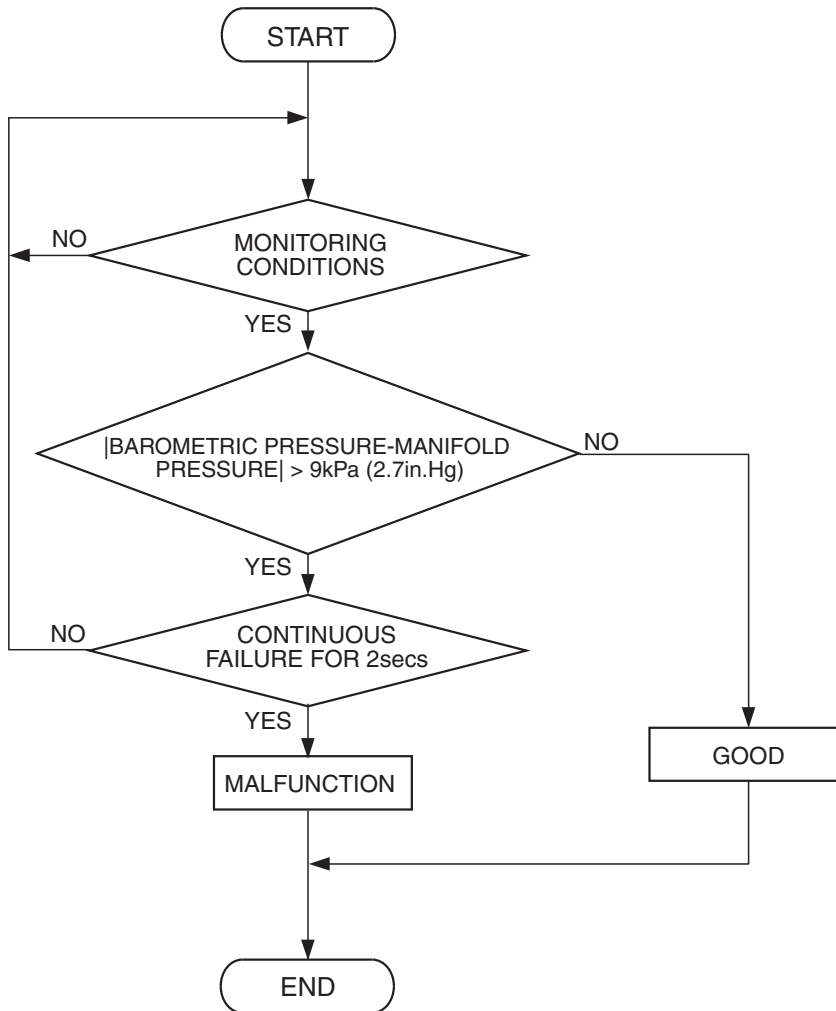
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor
- Manifold absolute pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



AK701541

Check Conditions

- Ignition switch is in "LOCK" (OFF) position.
- After 2 seconds pass from the time when the engine is stopped.
- Engine coolant temperature is higher than 0°C (32°F).

Judgement Criterion

- Difference between manifold absolute pressure sensor output and barometric pressure sensor output is more than 9 kPa (2.7 in.Hg) for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

None.

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

- Manifold absolute pressure sensor failed.
- Barometric pressure sensor failed.
- PCM failed.

DIAGNOSIS**Required Special Tools**

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

STEP 1. Using scan tool MB991958, read the diagnostic trouble code (DTC).

⚠ CAUTION

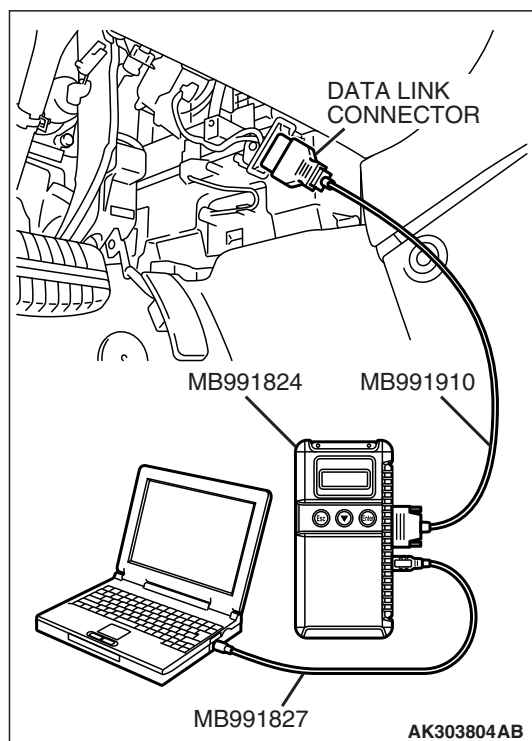
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

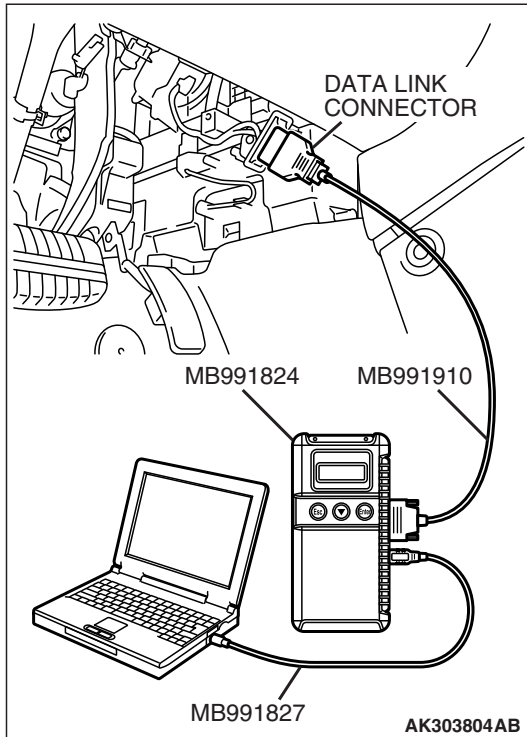
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958, read the DTC.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the diagnostic trouble code other than P0069 set?

YES : Refer to, Diagnostic Trouble Code Chart [P.13B-46](#).

NO : Go to Step 2.





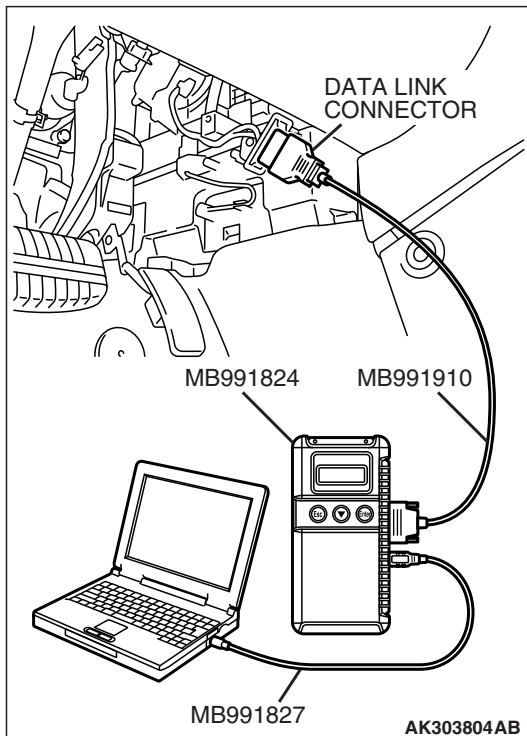
STEP 2. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine and run at idle.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F)
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 3.

NO : Refer to, DTC P0106 – Manifold Absolute Pressure Circuit Range/Performance Problem [P.13B-182](#), DTC P0107 – Manifold Absolute Pressure Circuit Low Input [P.13B-196](#), DTC P0108 – Manifold Absolute Pressure Circuit High Input [P.13B-208](#).



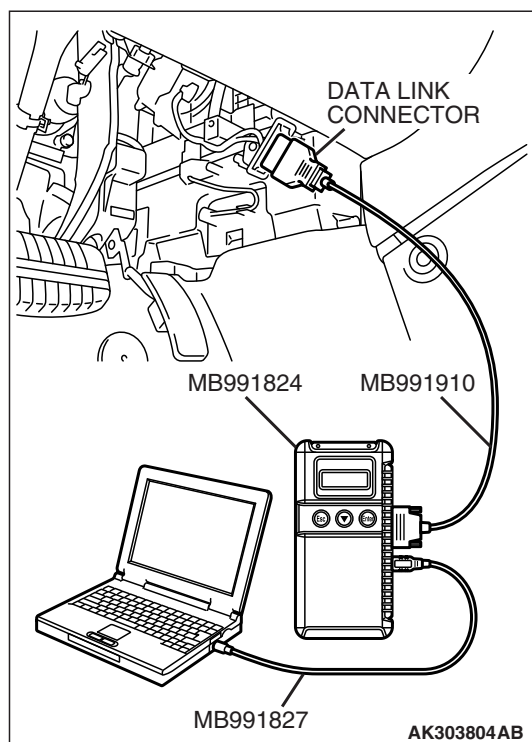
STEP 3. Using scan tool MB991958, read the diagnostic trouble code (DTC).

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Start the engine.
- (4) Turn the ignition switch to "LOCK" (OFF) position and then wait 2 seconds.
- (5) Turn the ignition switch to the "ON" position.
- (6) Set scan tool MB991958, read the DTC.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0069 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). 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. Using scan tool MB991958, read the diagnostic trouble code (DTC).**

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Start the engine.
- (4) Turn the ignition switch to "LOCK" (OFF) position and then wait 2 seconds.
- (5) Turn the ignition switch to the "ON" position.
- (6) Set scan tool MB991958, read the DTC.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0069 set?

YES : Retry the troubleshooting.

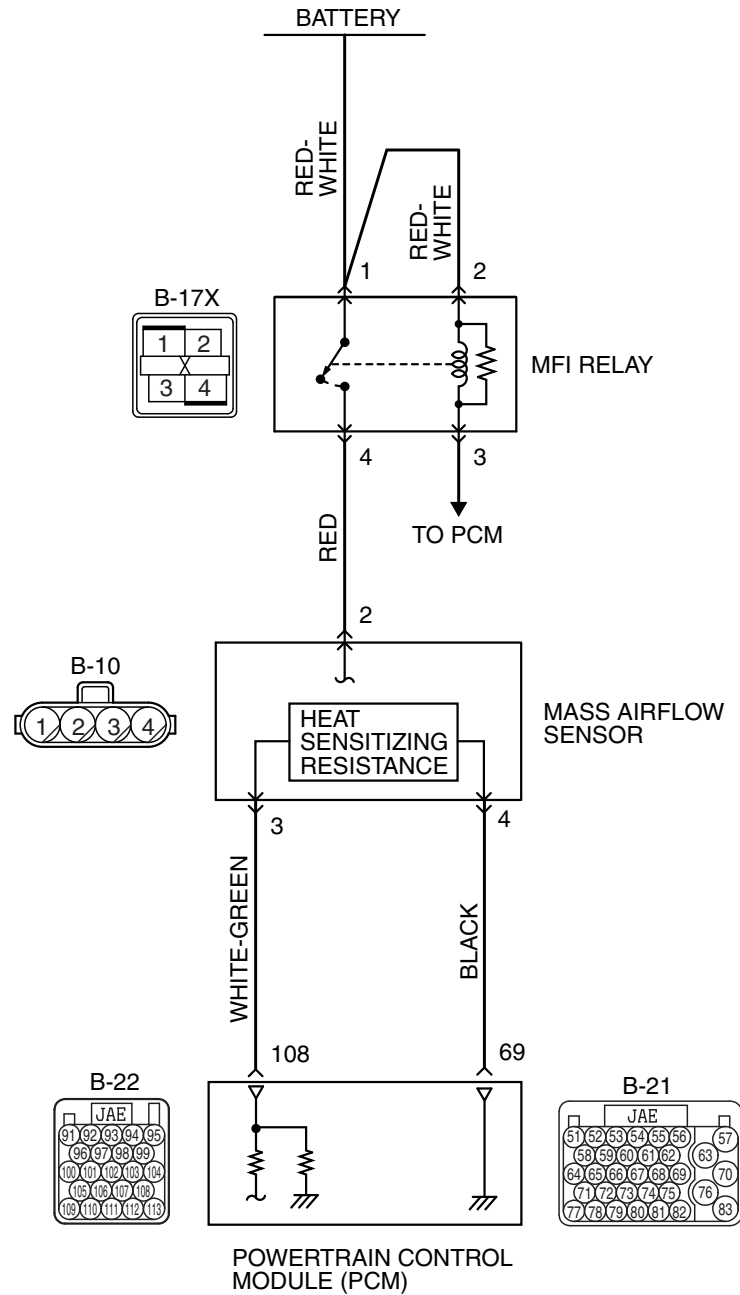
NO : The inspection is complete.

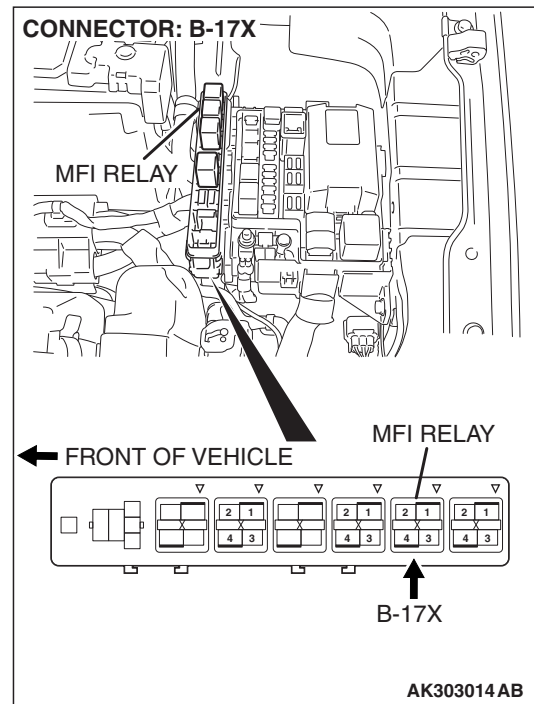
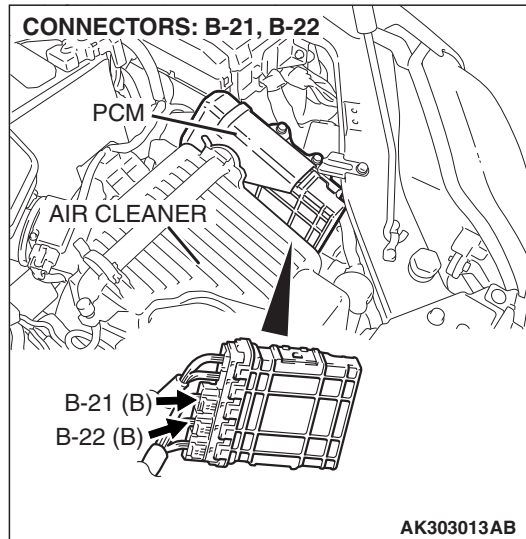
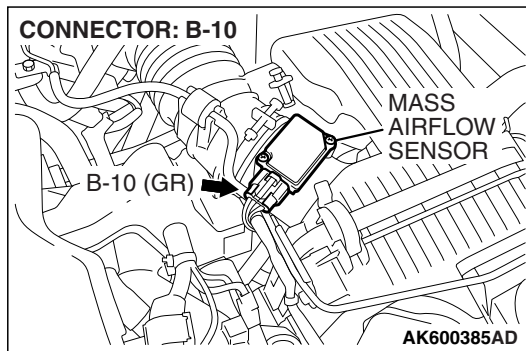
DTC P0101: Mass Airflow Circuit Range/Performance Problem

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.

Mass Airflow Sensor Circuit





CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 4), and the ground is provided on the PCM (terminal No. 69).
- A voltage that is according to the mass airflow rate is sent to the PCM (terminal No. 108) from the mass airflow sensor output terminal (terminal No. 3).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Compare load value with mass airflow sensor output voltage.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

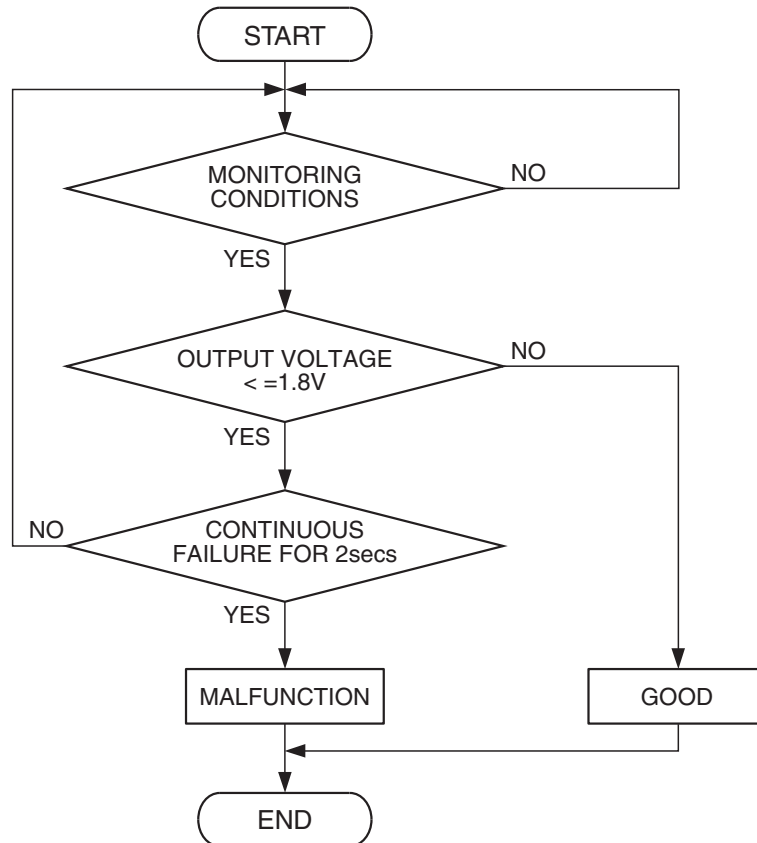
- Not applicable

Sensor (The sensor below is determined to be normal)

- Throttle position sensor

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

Logic Flow Chart



AK401683

Check Conditions

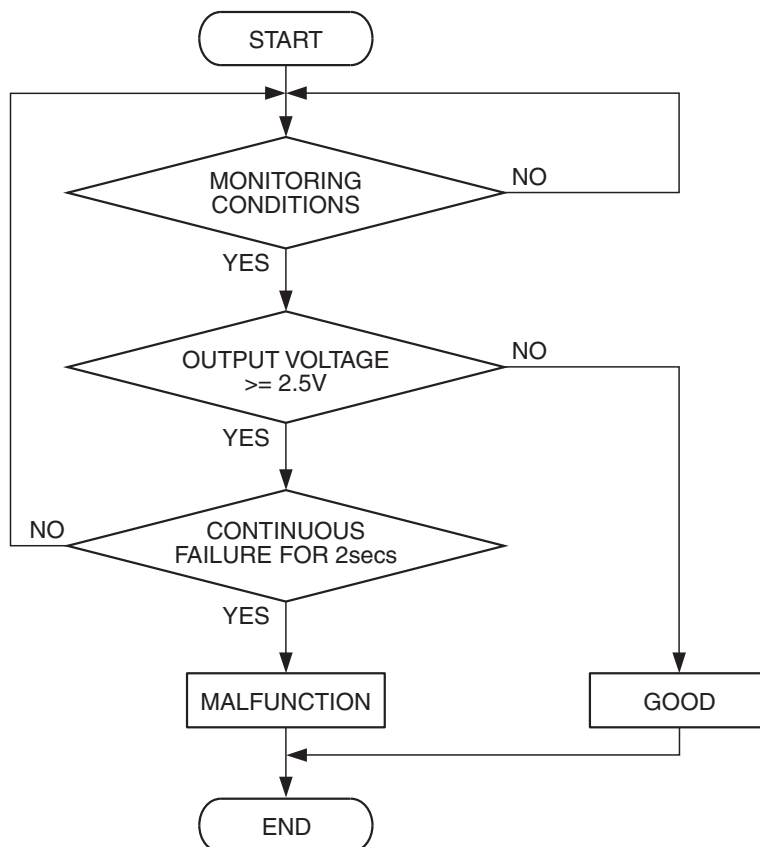
- Engine speed is higher than 1,500 r/min.
- Throttle position sensor output voltage is 1.5 volts or higher.
- Mass airflow sensor output voltage is 0.2 volt or higher.

Judgement Criterion

- Mass airflow sensor output voltage has continued to be 1.8 volts or lower for 2 seconds.

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

Logic Flow Chart



AK704990

Check Conditions

- Throttle position sensor output voltage is 0.8 volt or lower.
- Mass airflow sensor output voltage is 4.9 volts or lower.

Judgement Criterion

- Mass airflow sensor output voltage has continued to be 2.5 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13B-5](#).

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.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

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

⚠ CAUTION

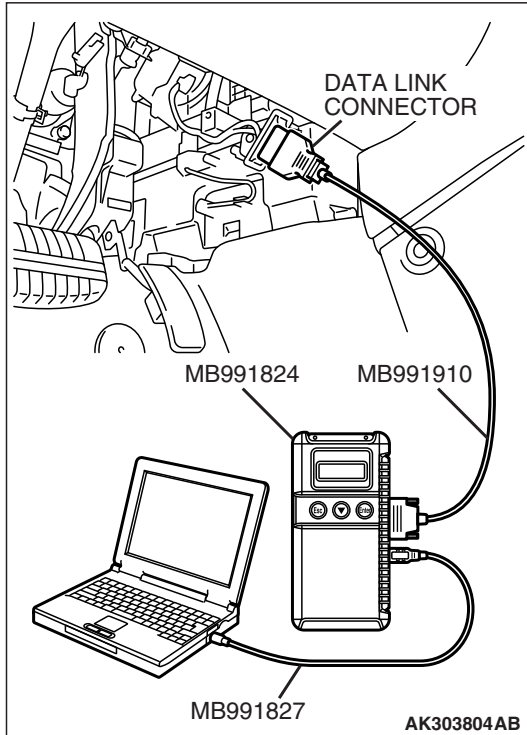
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be between 1,360 and 1,650 millivolts.
 - 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.

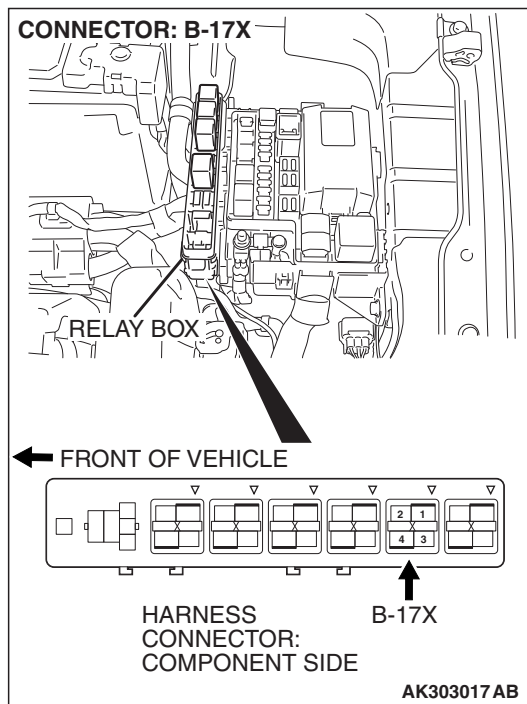
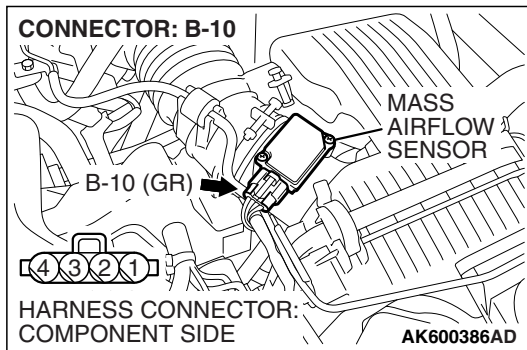


STEP 2. Check harness connector B-10 at mass airflow sensor and harness connector B-17X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

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

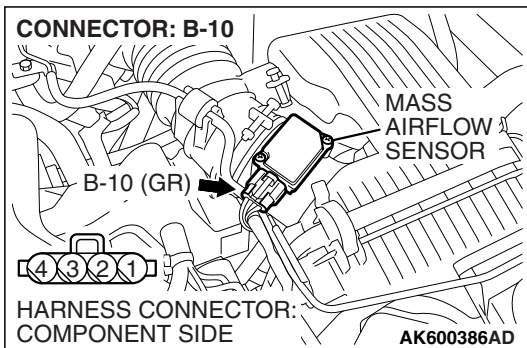
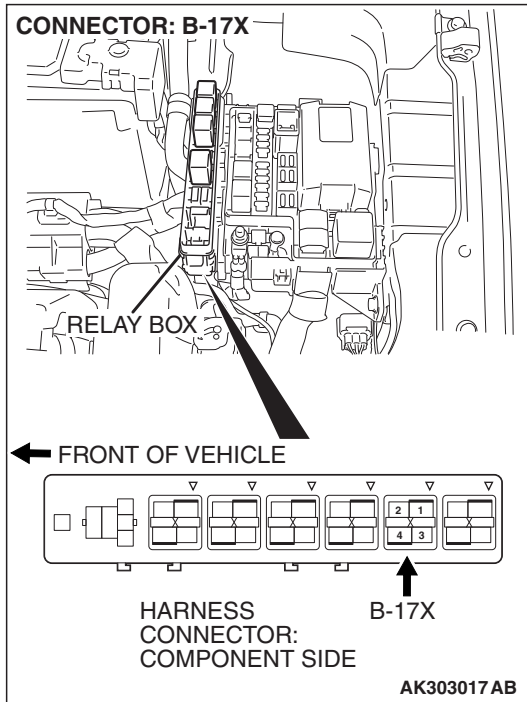


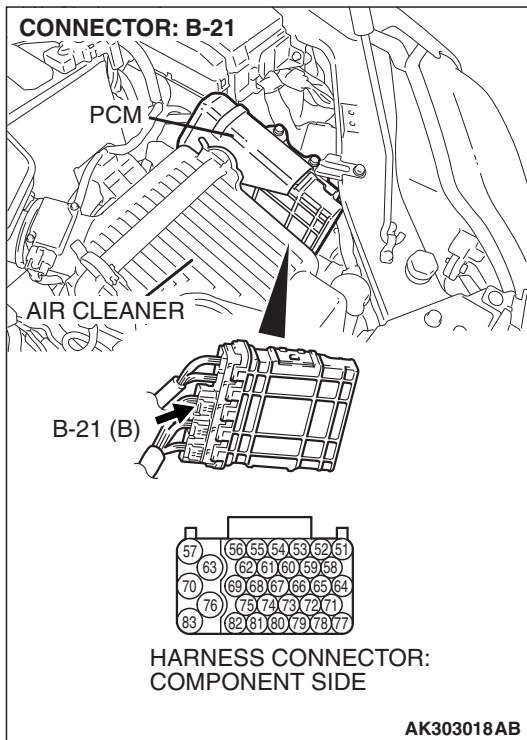
STEP 3. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and mass airflow sensor connector B-10 (terminal No. 2).

Q: Is the harness wire in good condition?

YES : Go to Step 4.

NO : Repair it. Then go to Step 9.



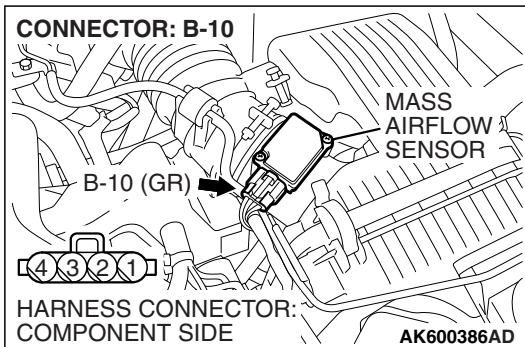


STEP 4. Check harness connector B-21 at PCM for damage.

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 9.



STEP 5. Check the continuity at mass airflow sensor harness side connector B-10.

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

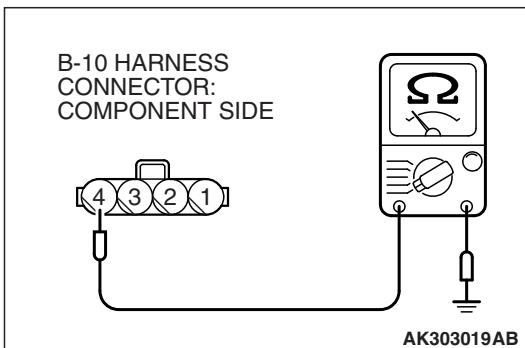
(2) Check for the continuity between terminal No. 4 and ground.

- Continuity ($2\ \Omega$ or less)

Q: Does continuity exist?

YES : Go to Step 6.

NO : Repair harness wire between mass airflow sensor connector B-10 (terminal No. 4) and PCM connector B-21 (terminal No. 69) because of harness damage. Then go to Step 9.

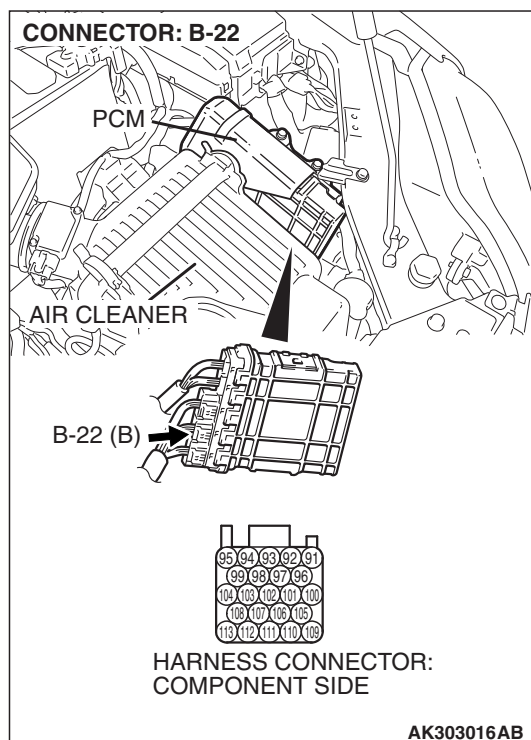


STEP 6. Check harness connector B-22 at PCM for damage.

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 9.

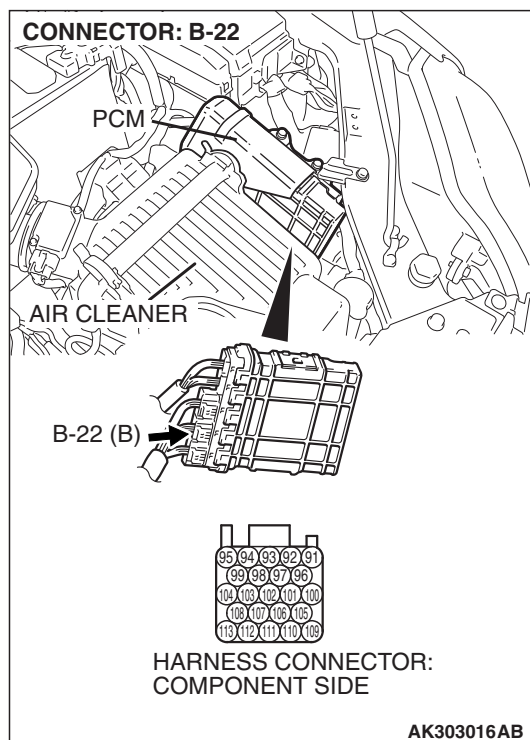
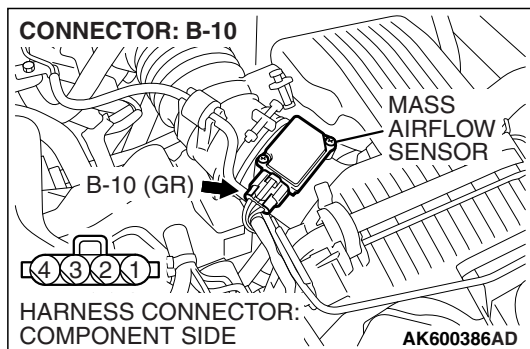


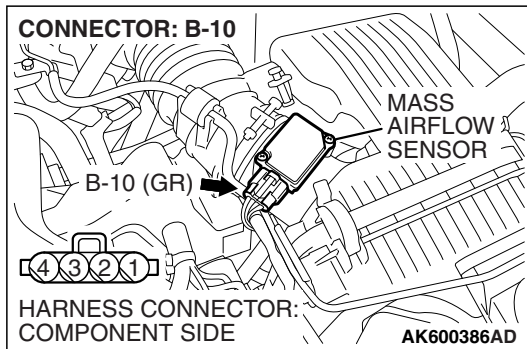
STEP 7. Check for harness damage between mass airflow sensor connector B-10 (terminal No. 3) and PCM connector B-22 (terminal No. 108).

Q: Is the harness wire in good condition?

YES : Go to Step 8.

NO : Repair it. Then go to Step 9.





STEP 8. Replace the mass airflow sensor.

- (1) Replace the mass airflow sensor.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13B-5](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0101 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 9.

NO : The inspection is complete.

STEP 9. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0101 set?

YES : Retry the troubleshooting.

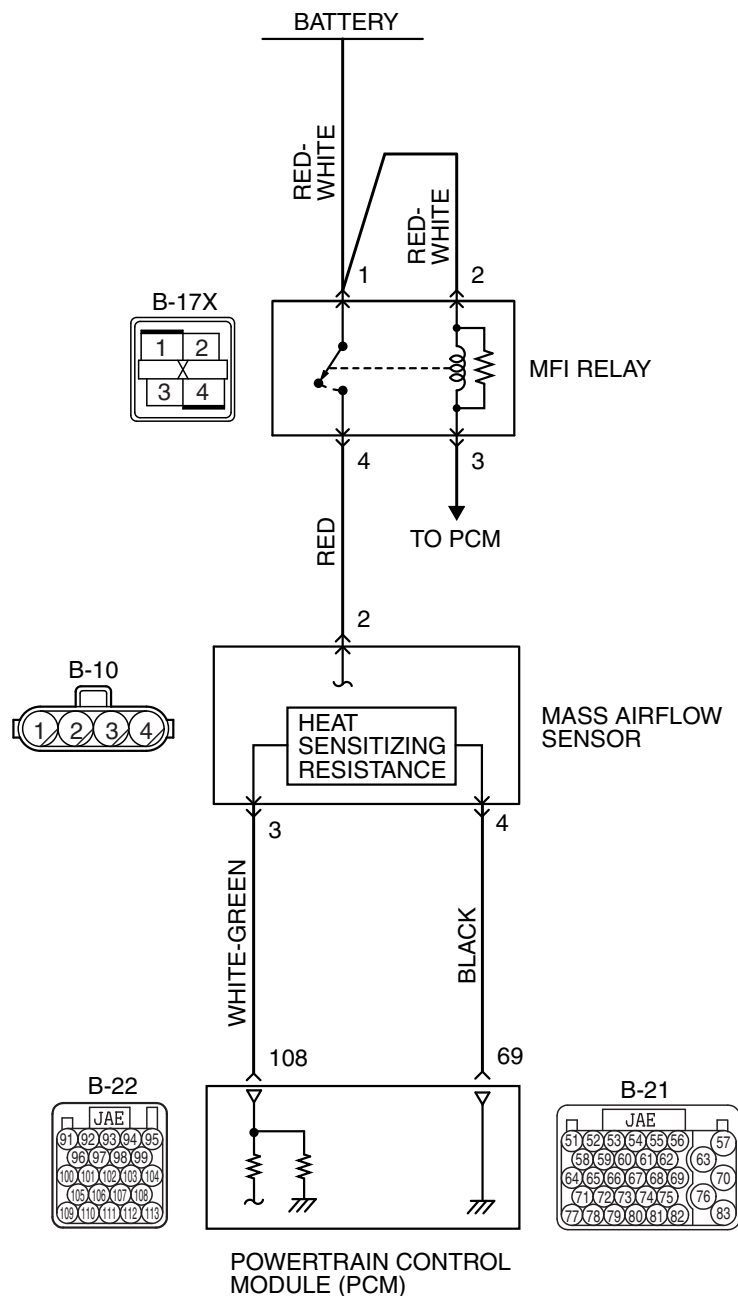
NO : The inspection is complete.

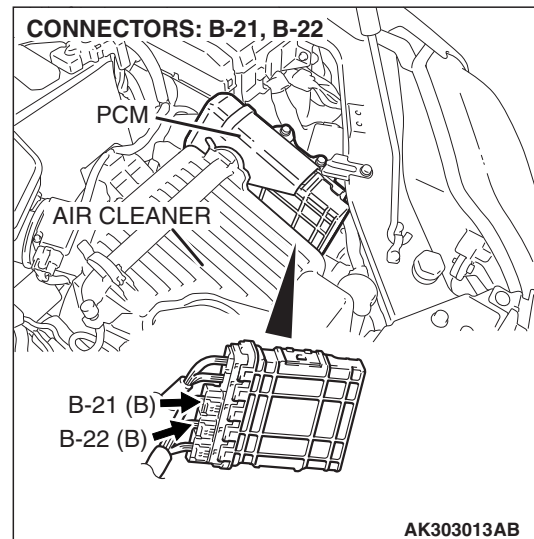
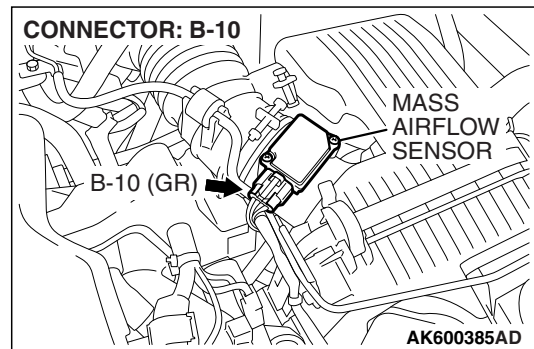
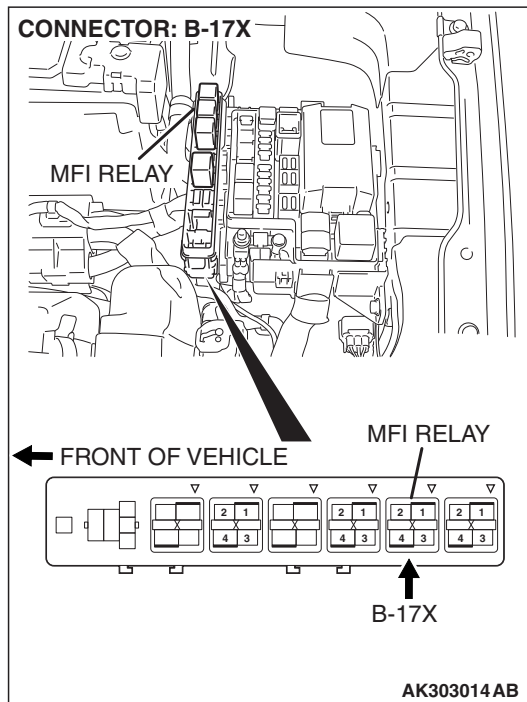
DTC P0102: Mass Airflow Circuit Low Input

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.

Mass Airflow Sensor Circuit





CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 4), and the ground is provided on the PCM (terminal No. 69).
- A voltage that is according to the mass airflow rate is sent to the PCM (terminal No. 108) from the mass airflow sensor output terminal (terminal No. 3).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Mass airflow sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

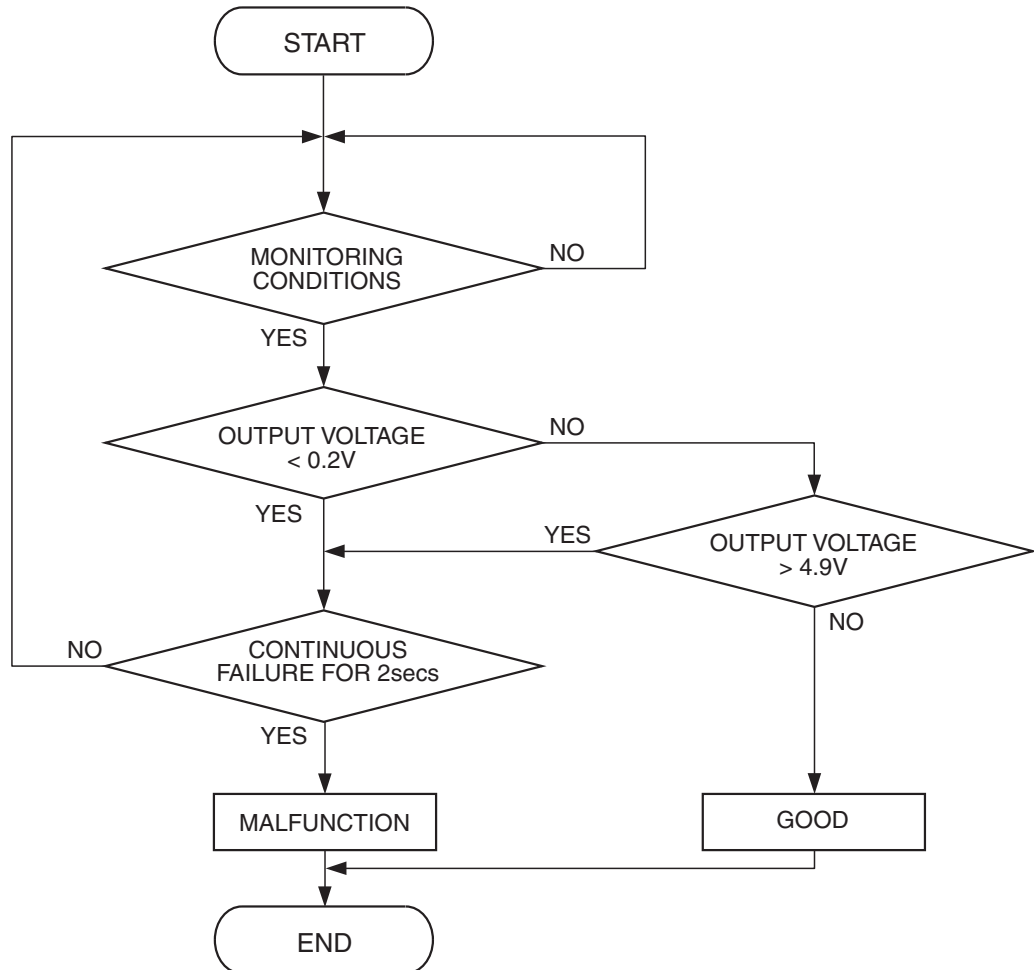
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302377

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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.
- PCM failed.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991923: Power Plant ECU Check Harness

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

⚠ CAUTION

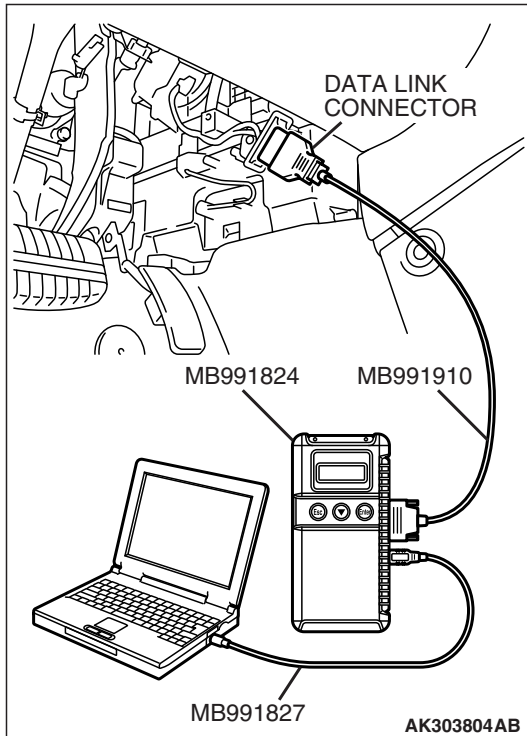
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be between 1,360 and 1,650 millivolts.
 - 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.

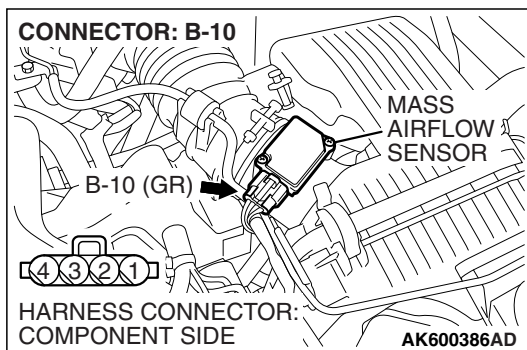


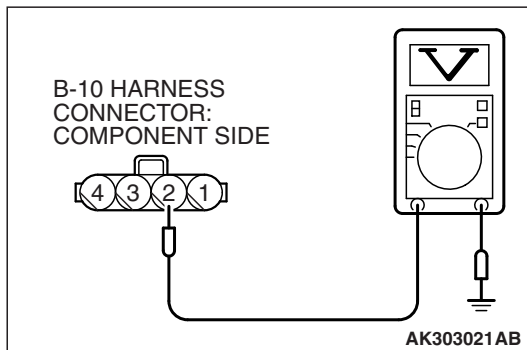
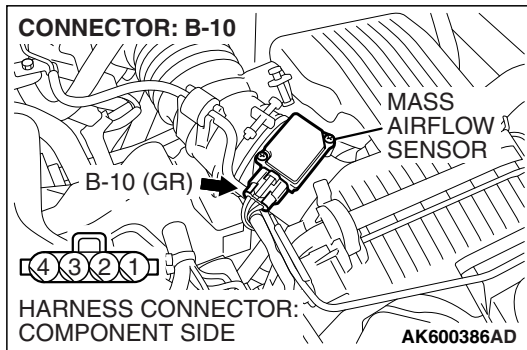
STEP 2. Check harness connector B-10 at mass airflow sensor for damage.

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 10.





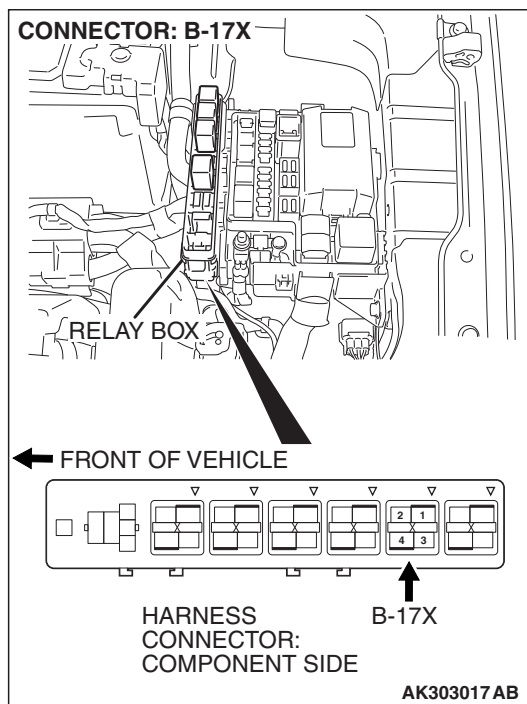
STEP 3. Measure the power supply voltage at mass airflow sensor harness side connector B-10.

- (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 MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI 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 10.

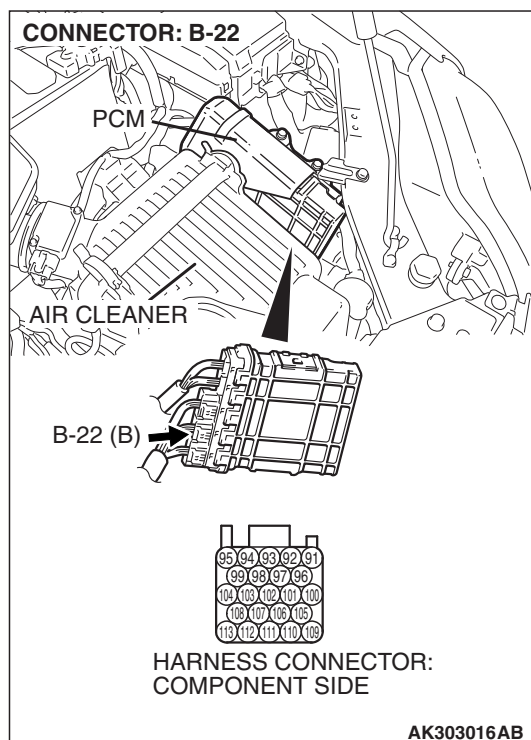
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.

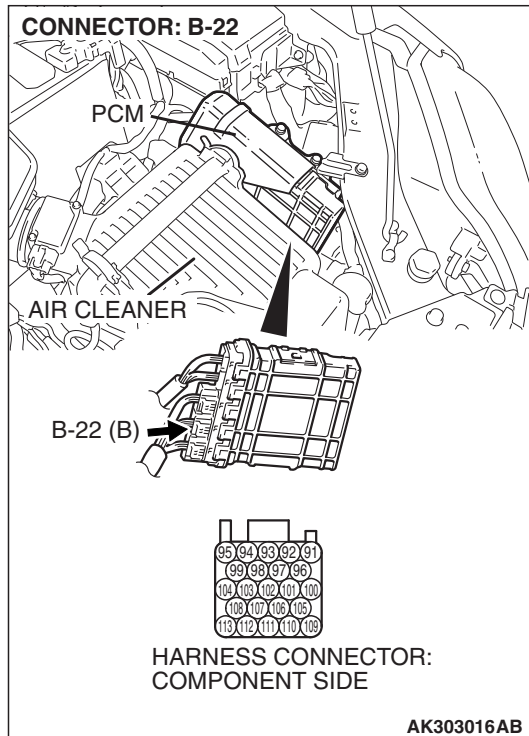
STEP 5. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

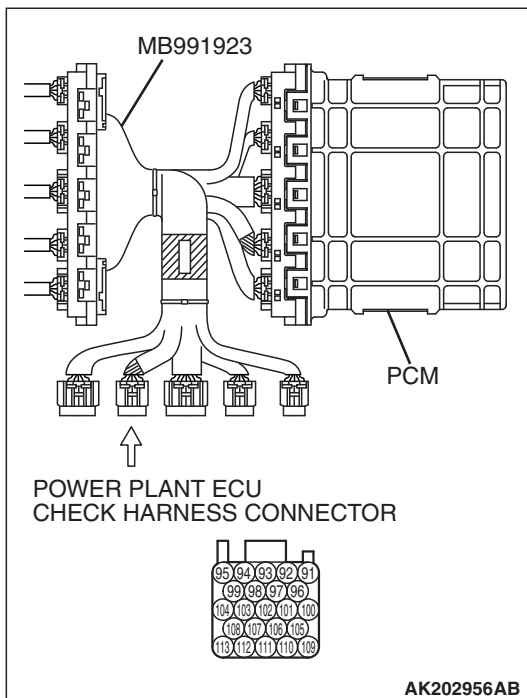
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.

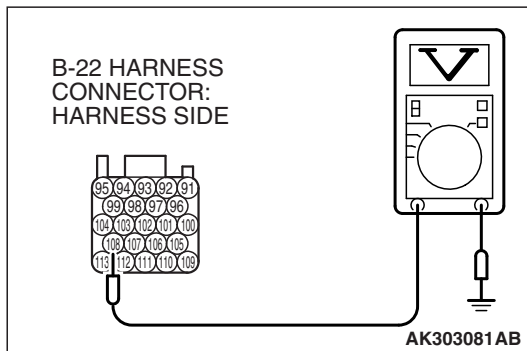




STEP 6. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.



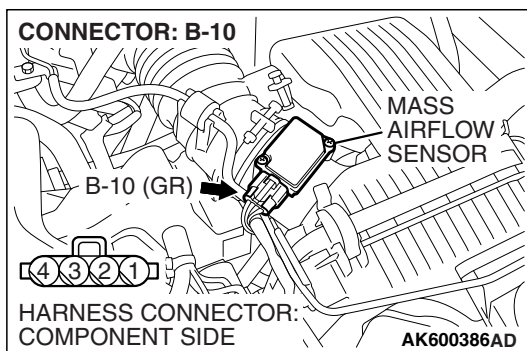


- (3) Measure the voltage between terminal No. 108 and ground.
- When the engine is revved, voltage should increase in response to revving.

Q: Is the measured voltage normal?

YES : Go to Step 9.

NO : Go to Step 7.

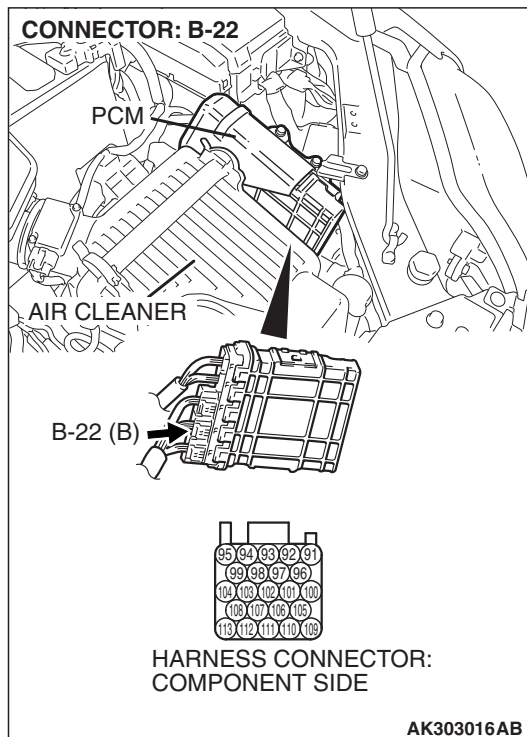


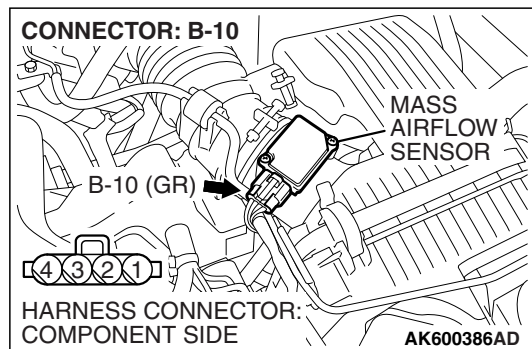
STEP 7. Check for open circuit or short circuit to ground between mass airflow sensor connector B-10 (terminal No. 3) and PCM connector B-22 (terminal No. 108).

Q: Is the harness wire in good condition?

YES : Go to Step 8.

NO : Repair it. Then go to Step 10.



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

- (1) Replace the mass airflow sensor.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0102 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 10.

NO : The inspection is complete.

STEP 9. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.**⚠ CAUTION**

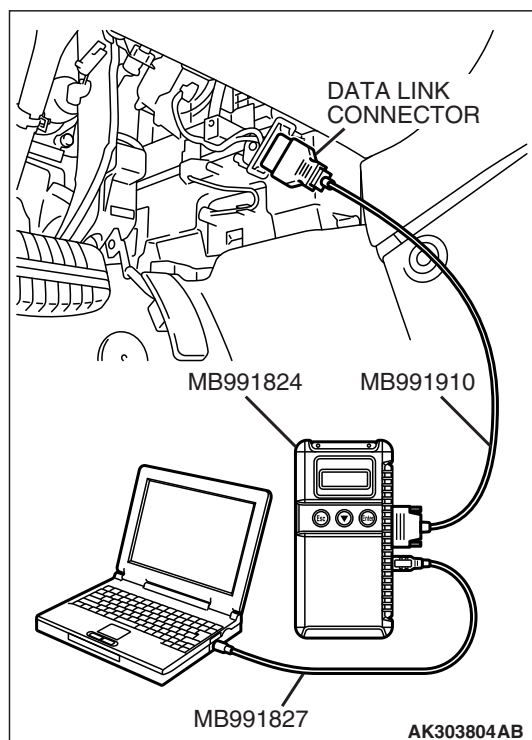
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be between 1,360 and 1,650 millivolts.
 - 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 PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 10.

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

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0102 set?

YES : Retry the troubleshooting.

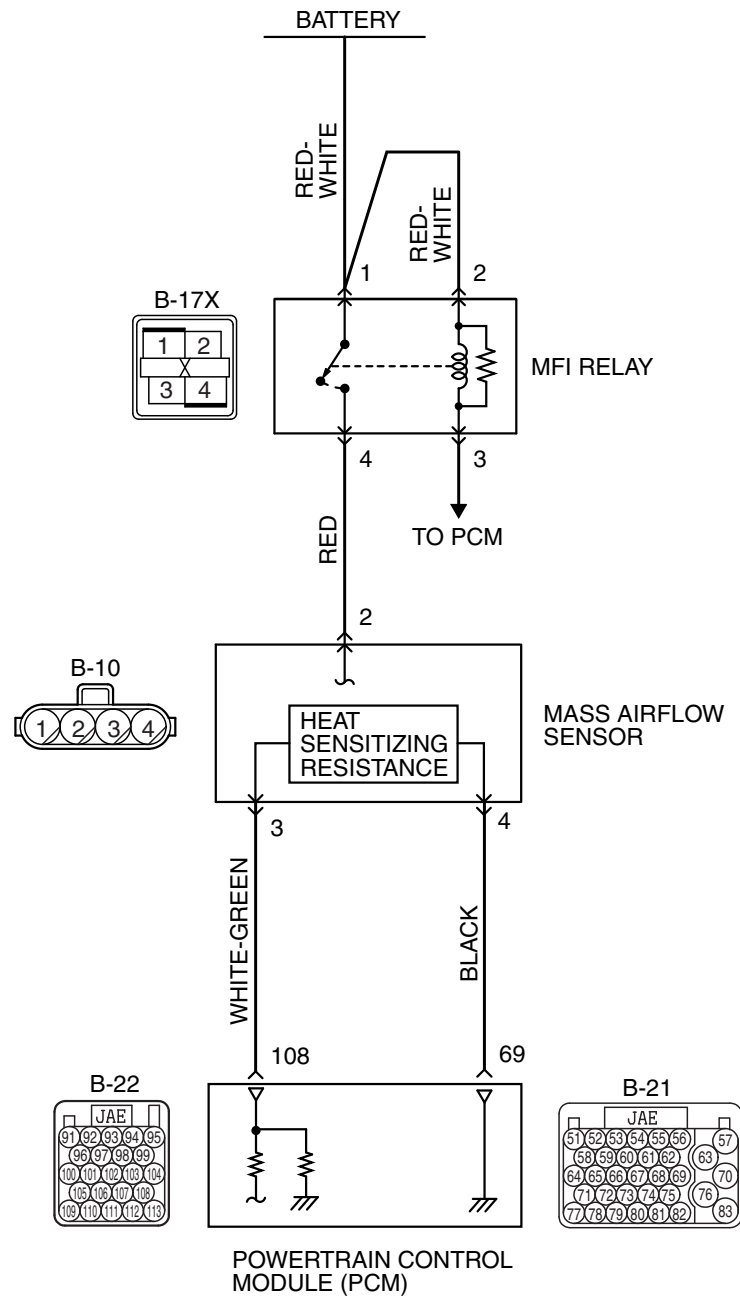
NO : The inspection is complete.

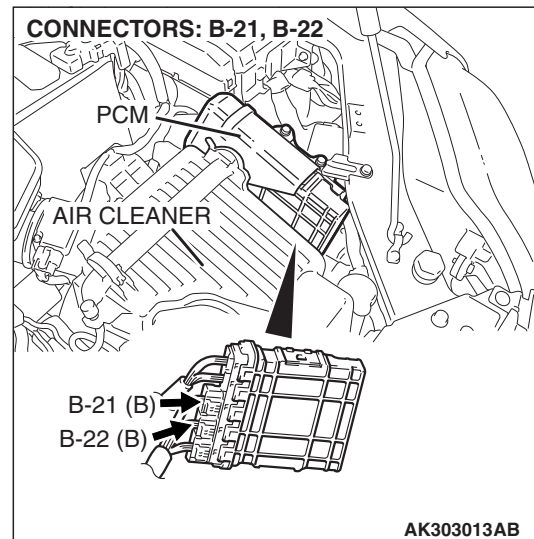
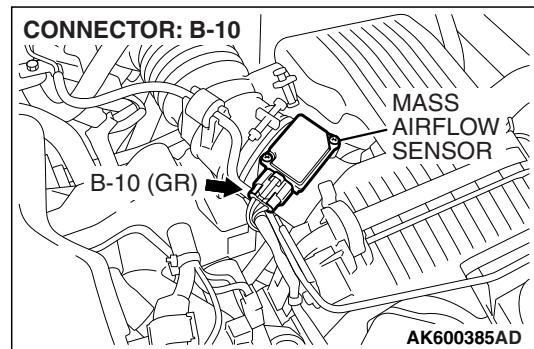
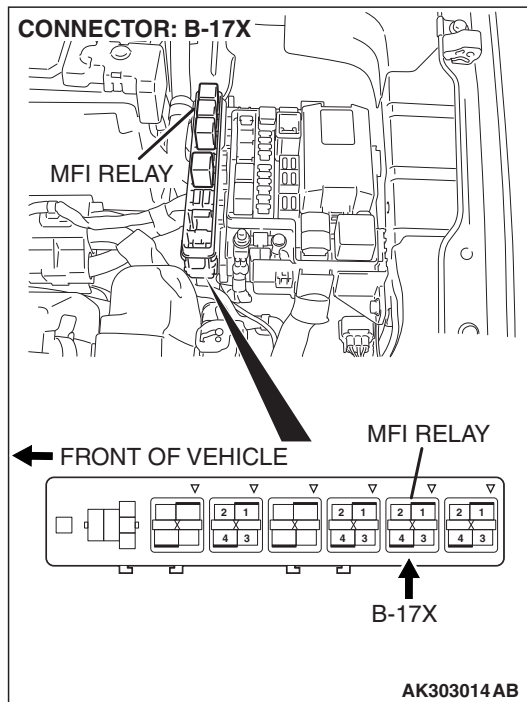
DTC P0103: Mass Airflow Circuit High Input

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.

Mass Airflow Sensor Circuit





CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 4), and the ground is provided on the PCM (terminal No. 69).
- A voltage that is according to the mass airflow rate is sent to the PCM (terminal No. 108) from the mass airflow sensor output terminal (terminal No. 3).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Mass airflow sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

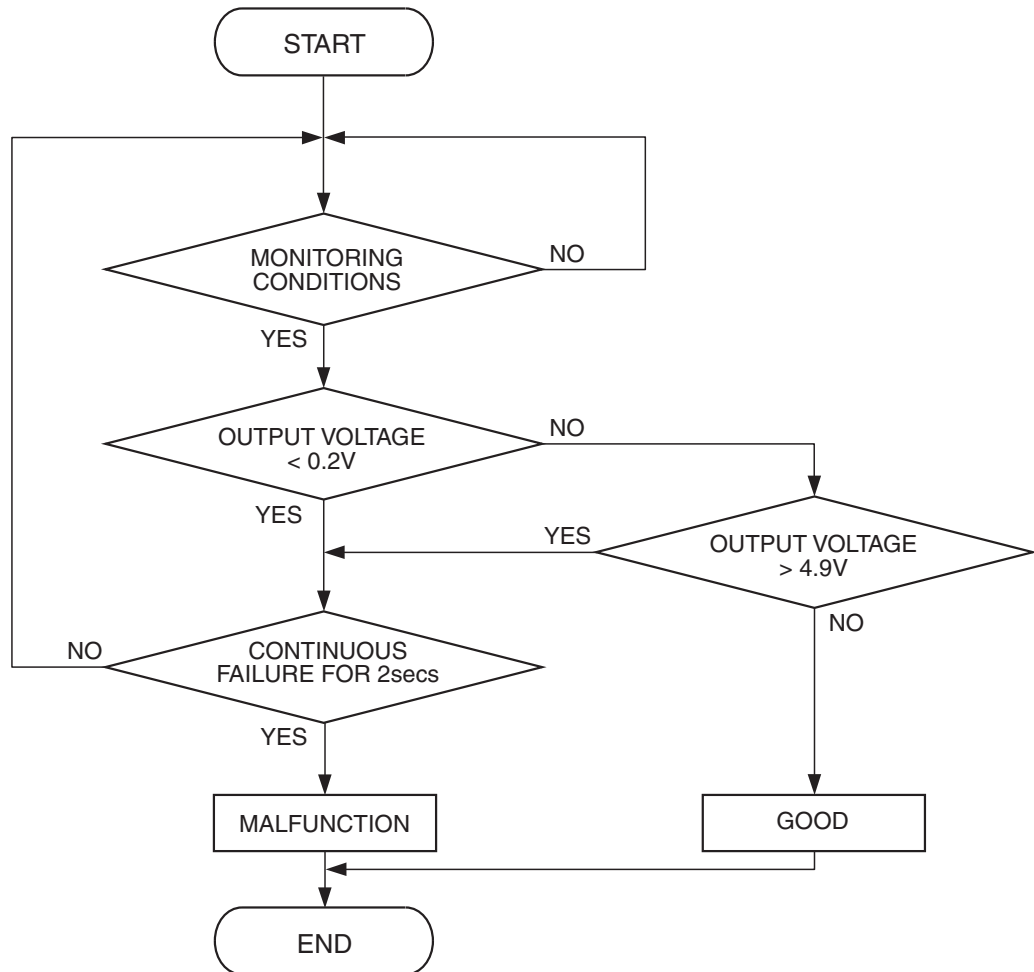
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302377

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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

- Mass airflow sensor failed.
- Open mass airflow sensor circuit, or connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

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

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

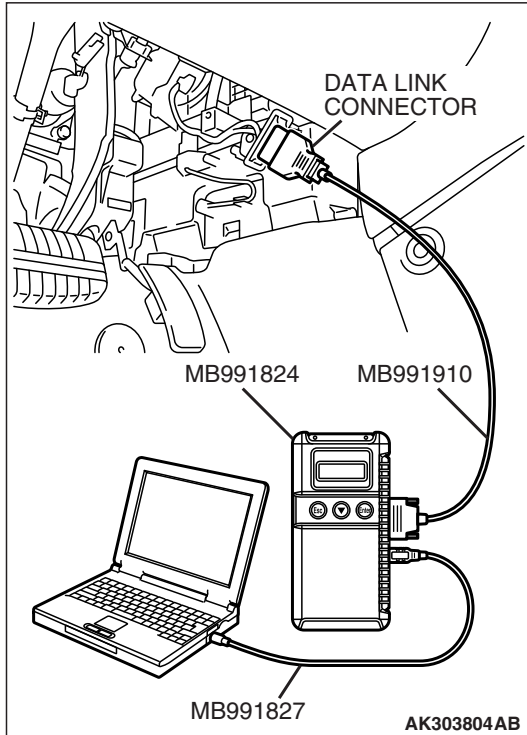
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be between 1,360 and 1,650 millivolts.
 - 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?

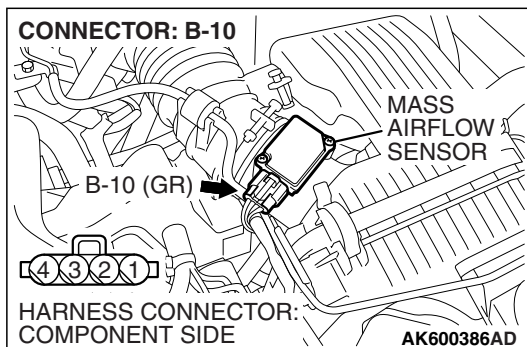
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

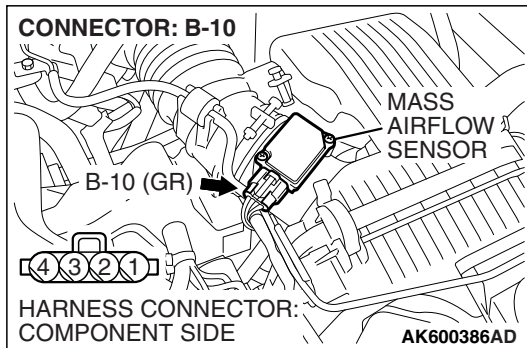
NO : Go to Step 2.

**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 8.





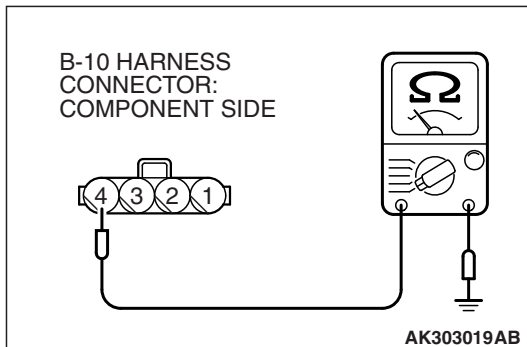
STEP 3. Check the continuity at mass airflow sensor harness side connector B-10.

- (1) Disconnect the connector B-10 and measure at the harness side.
- (2) Check for the continuity between terminal No. 4 and ground.
 - Continuity ($2\ \Omega$ or less)

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 4.

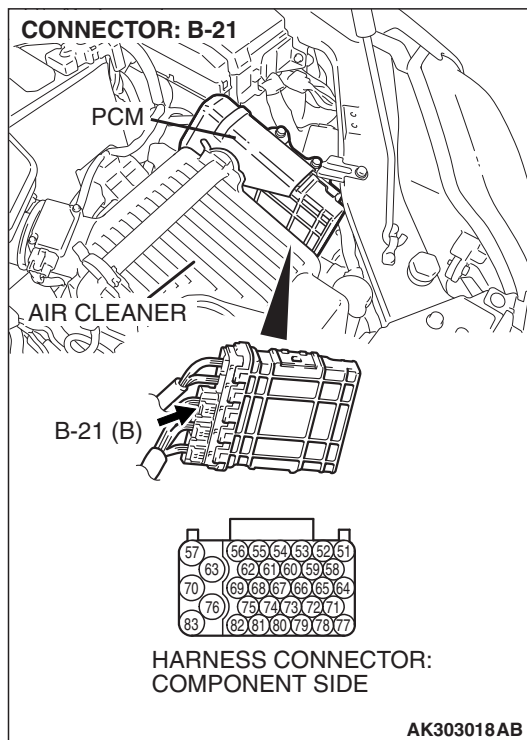


STEP 4. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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

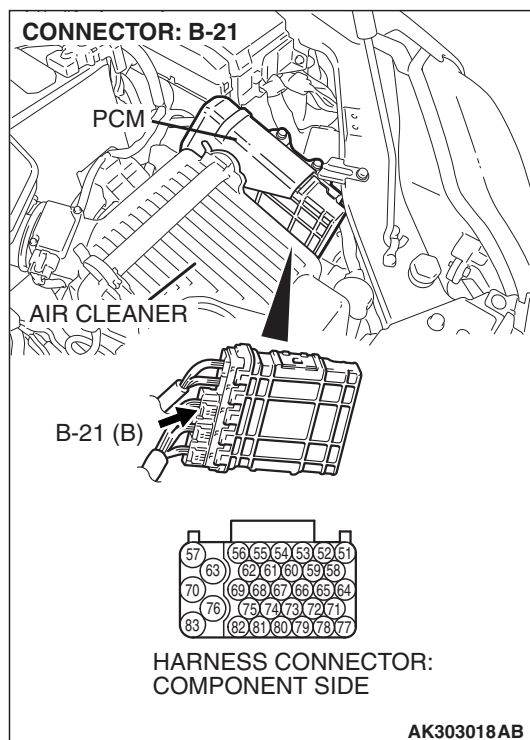
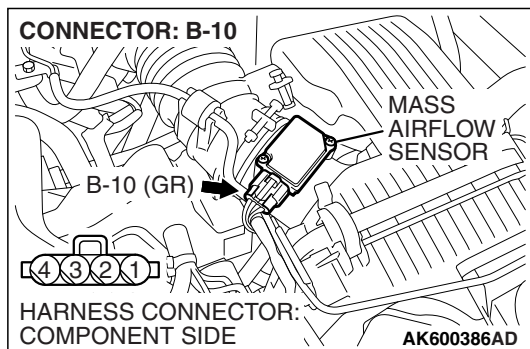


STEP 5. Check for open circuit between mass airflow sensor connector B-10 (terminal No. 4) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Go to Step 6.

NO : Repair it. Then go to Step 8.



STEP 6. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.

⚠ CAUTION

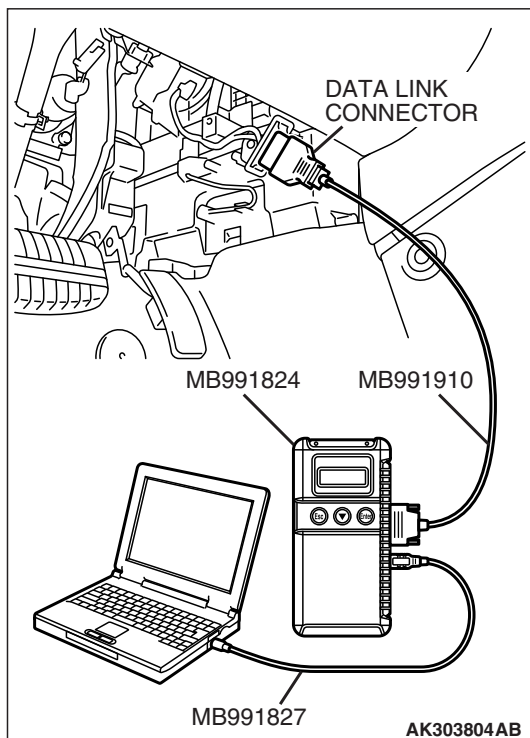
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - The standard value during idling should be between 1,360 and 1,650 millivolts.
 - 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 PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 8.

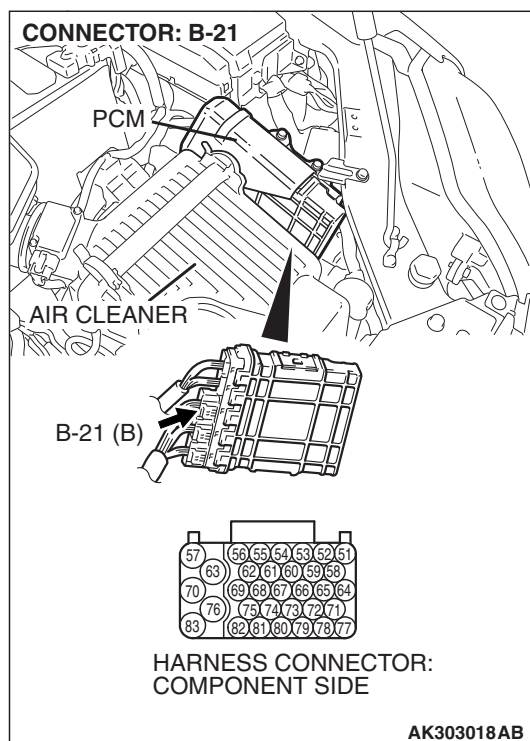


STEP 7. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

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

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

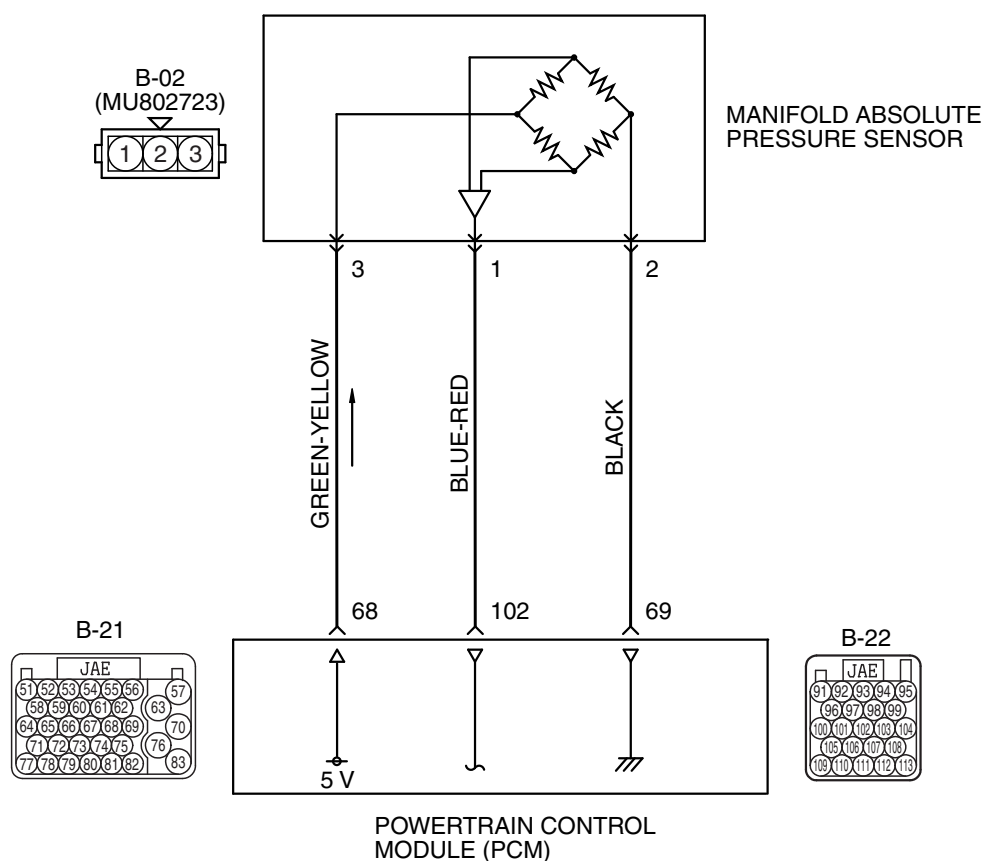


STEP 8. Test the OBD-II drive cycle.

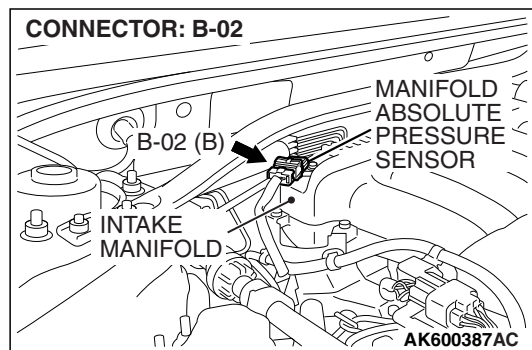
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13B-5.
- (2) Check the diagnostic trouble code (DTC).

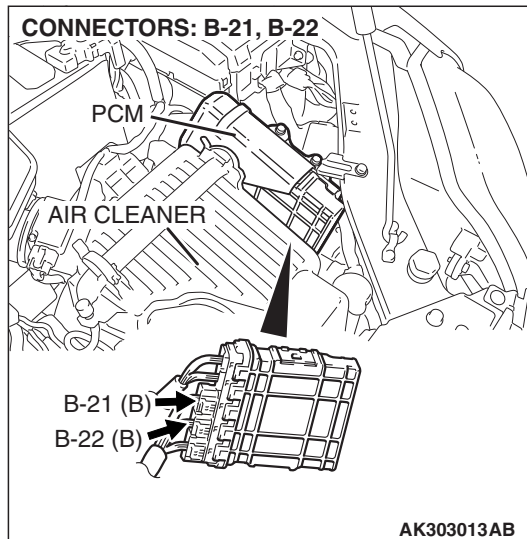
Q: Is DTC P0103 set?**YES** : Retry the troubleshooting.**NO** : The inspection is complete.**DTC P0106: Manifold Absolute Pressure Circuit Range/Performance Problem**

Manifold Absolute Pressure Sensor Circuit



AK400877





CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the PCM (terminal No. 68). The ground terminal (terminal No. 2) is grounded with PCM (terminal No. 69).
- A voltage that is proportional to the intake manifold pressure is sent to the PCM (terminal No. 102) 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Compare load value with manifold absolute pressure sensor output voltage.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

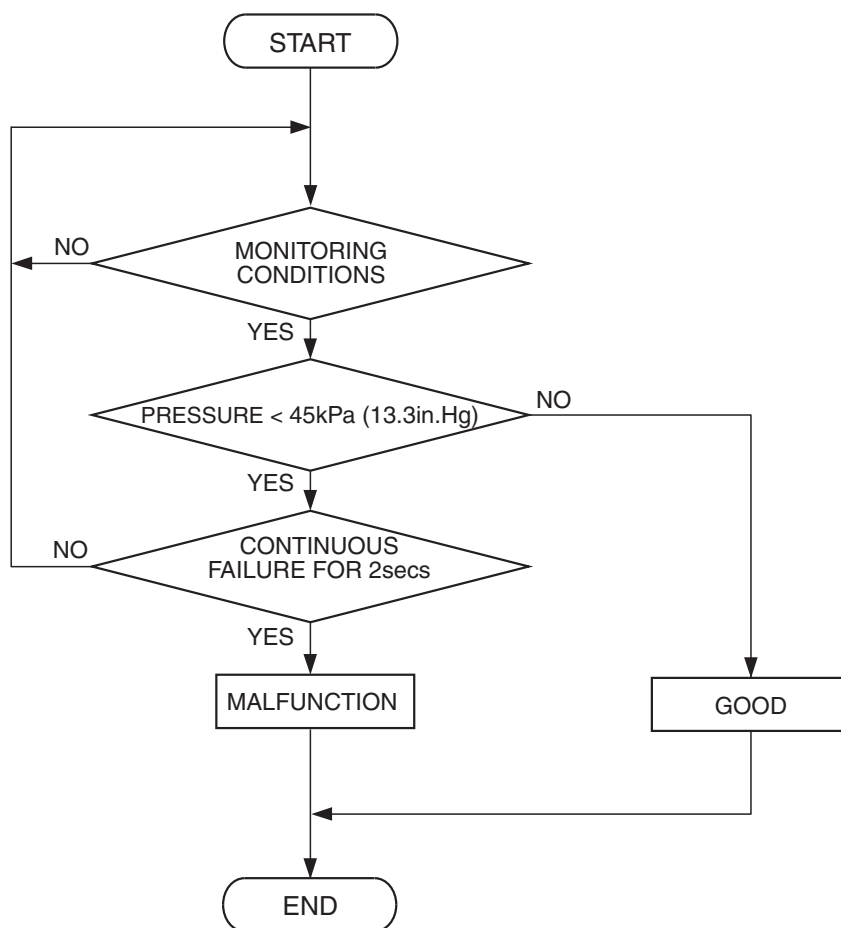
- Not applicable

Sensor (The sensor below is determined to be normal)

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

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

Logic Flow Chart



AK401474

Check Conditions

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

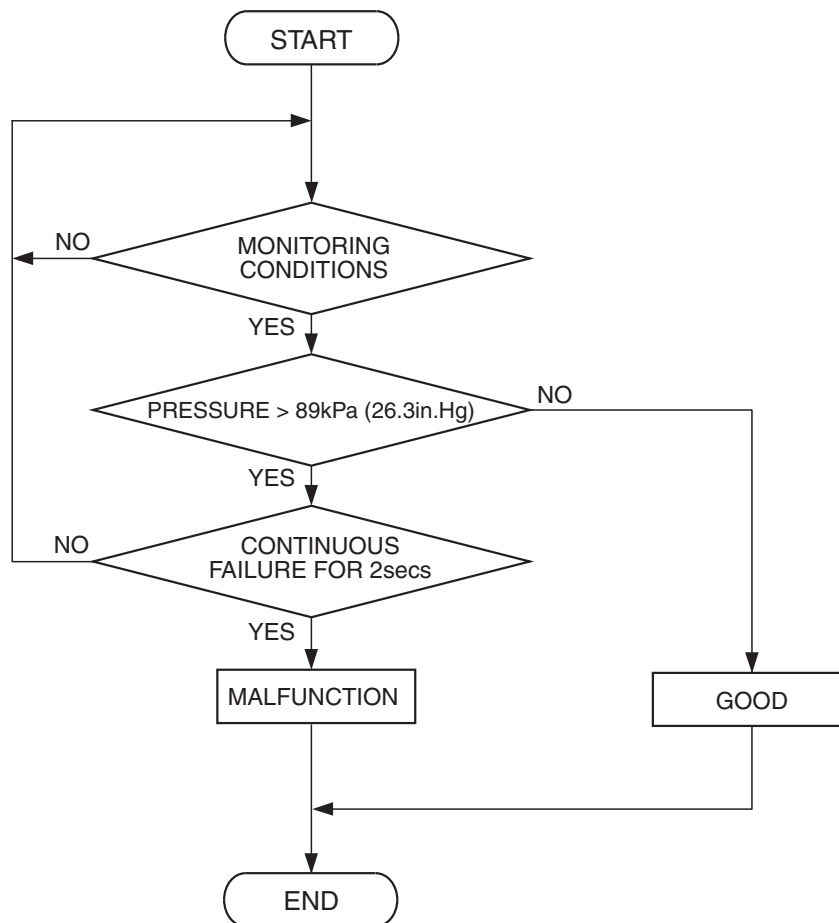
- Throttle position sensor output voltage is higher than 3.5 volts.

Judgement Criterion

- Manifold absolute pressure is 45 kPa (13.3 in.Hg) or lower for 2 seconds.

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

Logic Flow Chart



AK401473

Check Conditions

- 8 minutes or more have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is 0°C (32°F) or lower.
- Engine speed is between 500 and 1,500 r/min.
- Throttle position sensor output voltage is lower than 0.9 volt.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13B-5](#).

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

- Manifold absolute pressure sensor failed.
- Manifold absolute pressure sensor circuit harness damage, or connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991923: Power Plant ECU Check Harness

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

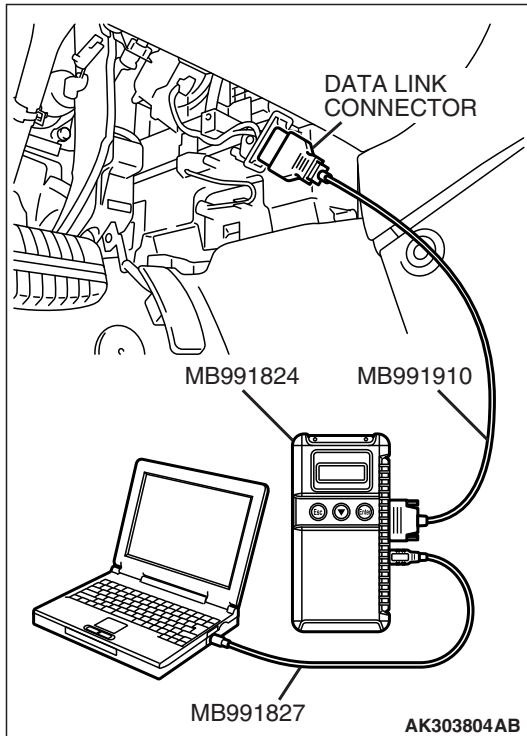
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

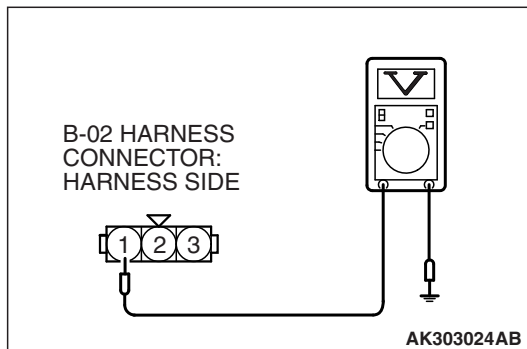
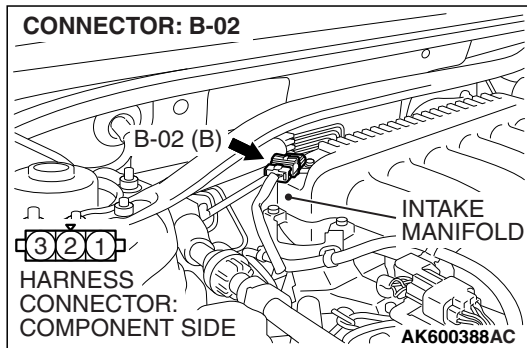
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine and run at idle.
- (5) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F)
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.





STEP 2. Measure the sensor output 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. 1 and ground by backprobing.

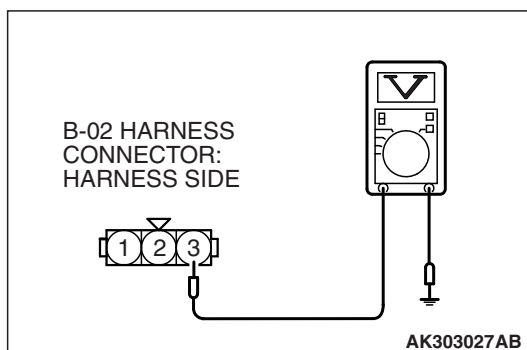
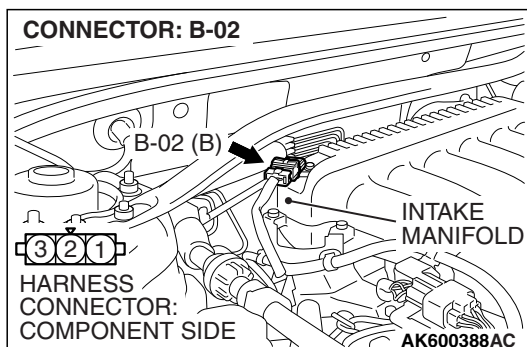
- When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
- When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
- When altitude is 1,800 m (5,906 feet), voltage should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

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

Q: Is measured the voltage normal?

YES : Go to Step 10.

NO : Go to Step 3.



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

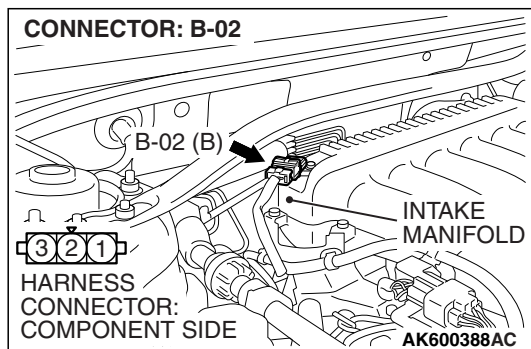
- Voltage should be between 4.9 and 5.1 volts.

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

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

YES : Go to Step 6.

NO : Go to Step 4.

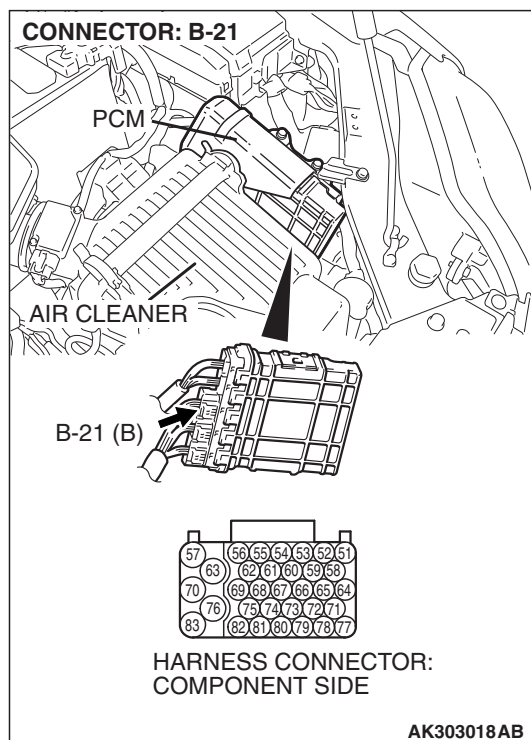


STEP 4. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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

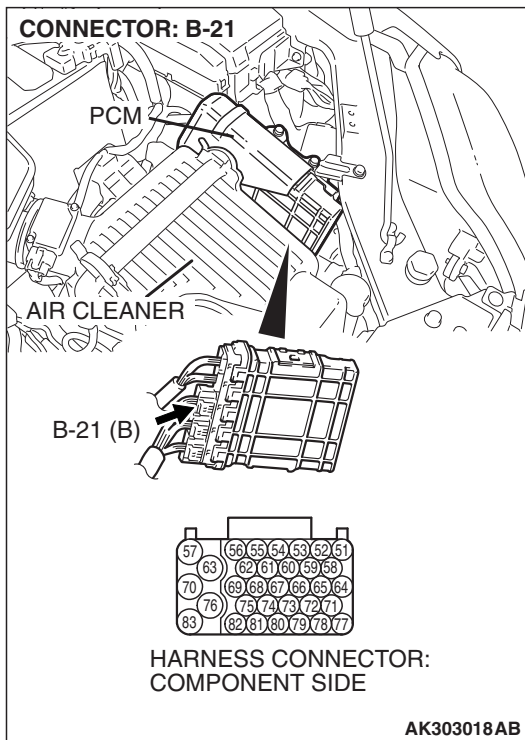
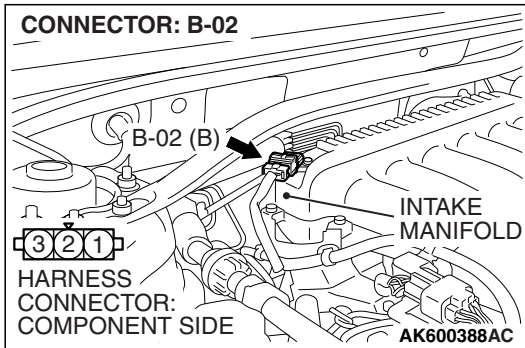


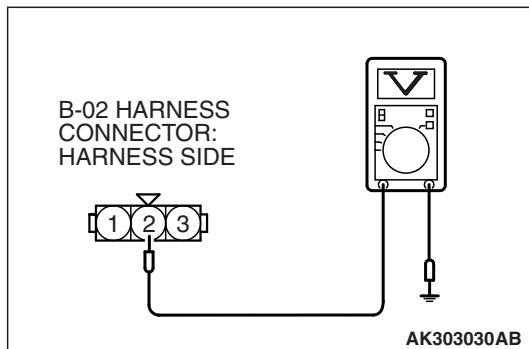
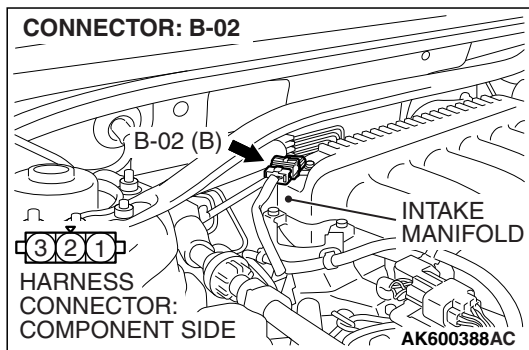
STEP 5. Check for harness damage between manifold absolute pressure sensor connector B-02 (terminal No. 3) and PCM connector B-21 (terminal No. 68).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 13.



**STEP 6. Measure the ground voltage at manifold absolute pressure sensor connector B-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 9.

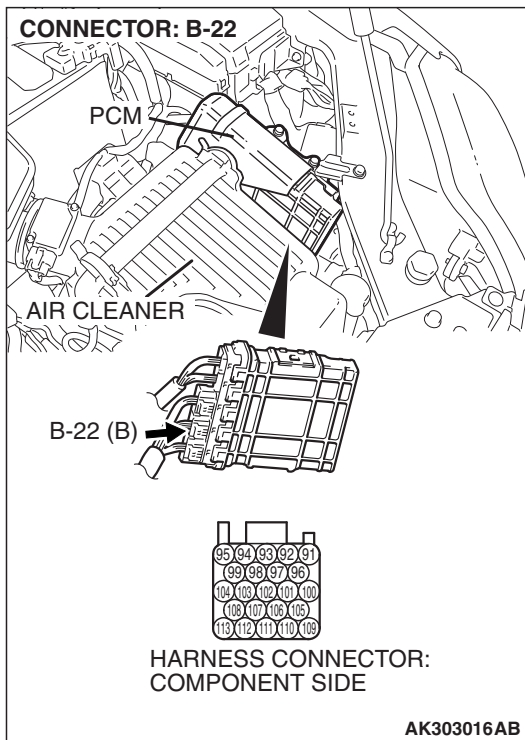
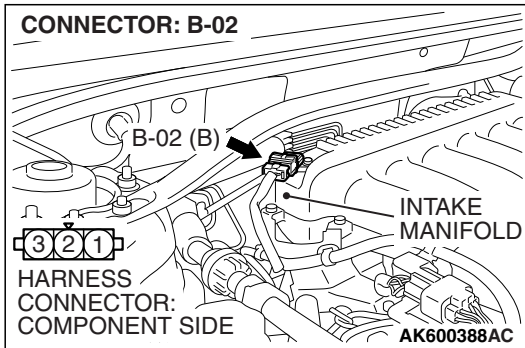
NO : Go to Step 7.

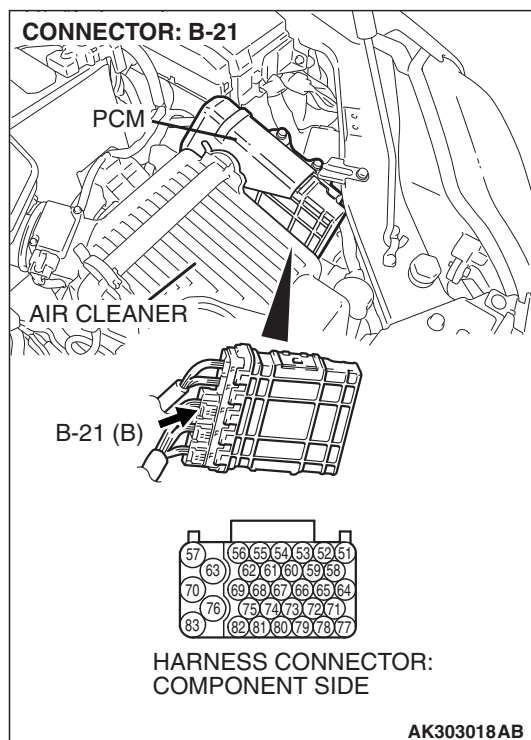
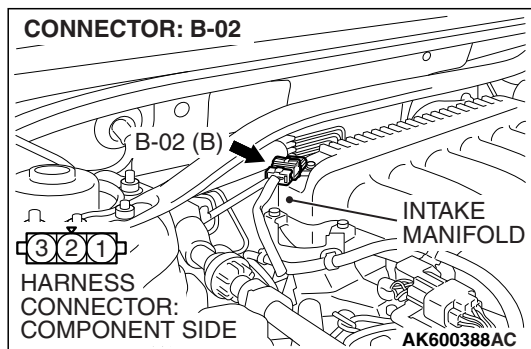
STEP 7. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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



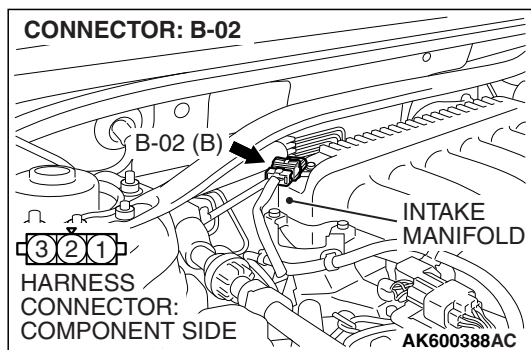


STEP 8. Check for harness damage between manifold absolute pressure sensor connector B-02 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 13.



STEP 9. Check harness connector B-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 13.

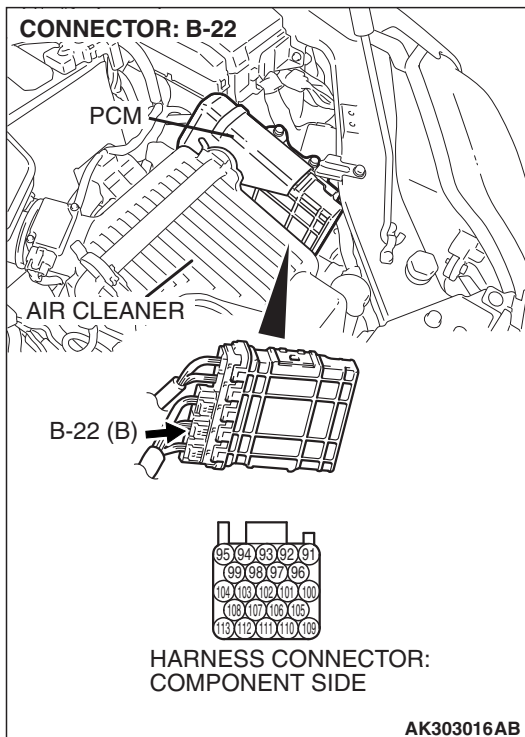
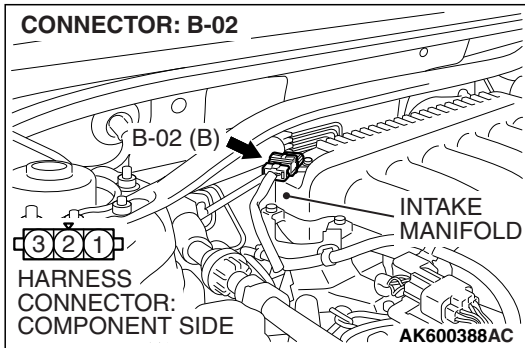
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 13.

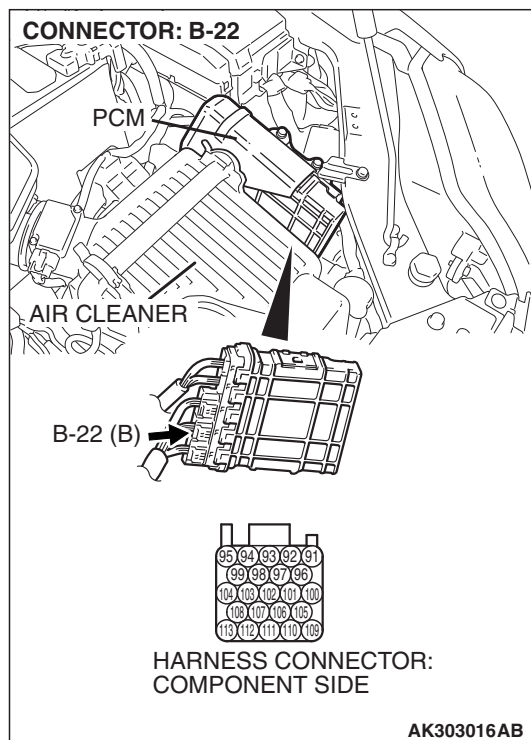
STEP 10. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 11.

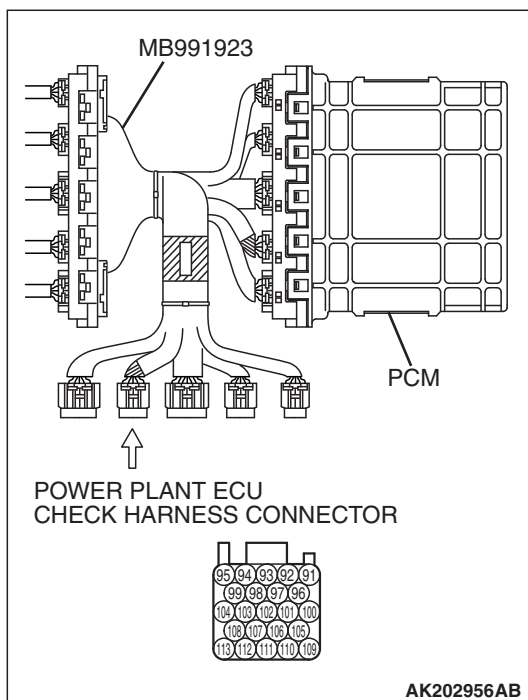
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 13.

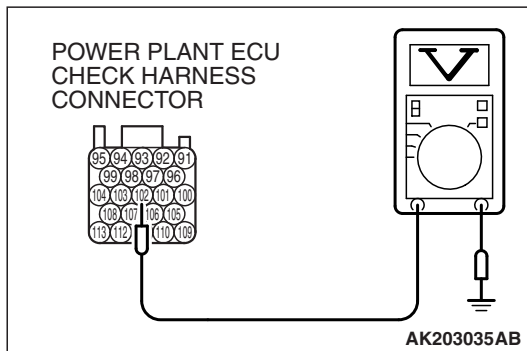




STEP 11. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.





- (3) Measure the voltage between terminal No. 102 and ground.
- When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
 - When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
 - When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
 - When altitude is 1,800 m (5,906 feet), voltage should be between 3.0 and 3.4 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage normal?

YES : Go to Step 12.

NO : Repair harness wire between manifold absolute pressure sensor connector B-02 (terminal No. 1) and PCM connector B-22 (terminal No. 102) because of harness damage. Then go to Step 13.

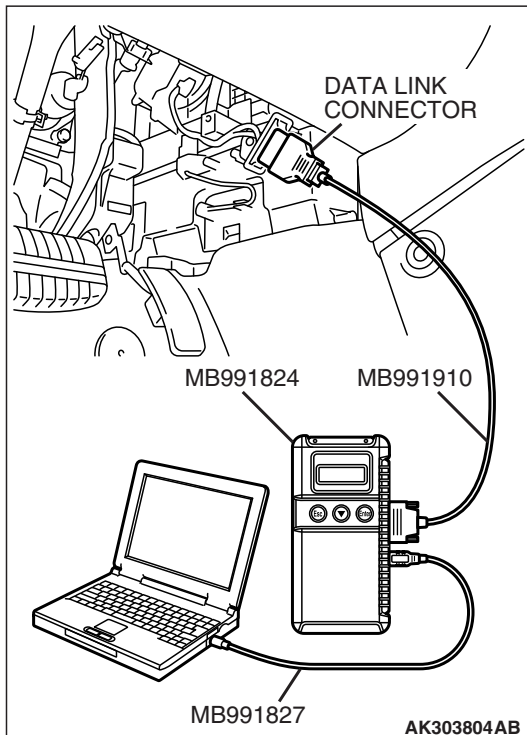
STEP 12. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine and run at idle.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F)
- When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 13.

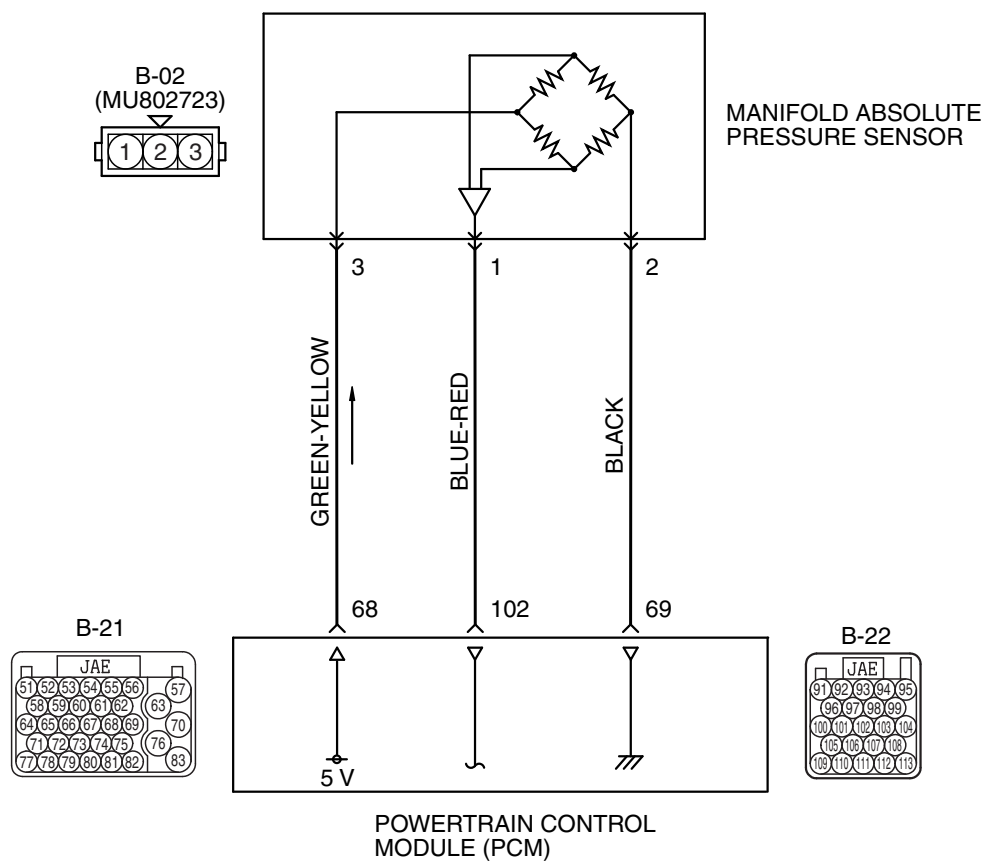


STEP 13. Test the OBD-II drive cycle.

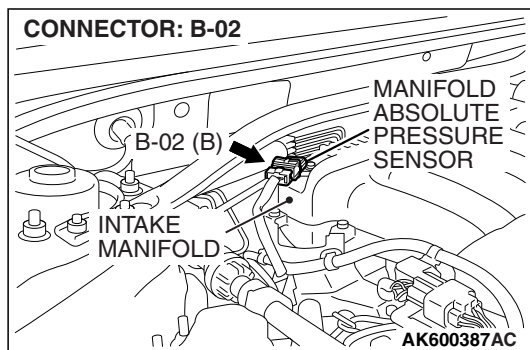
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

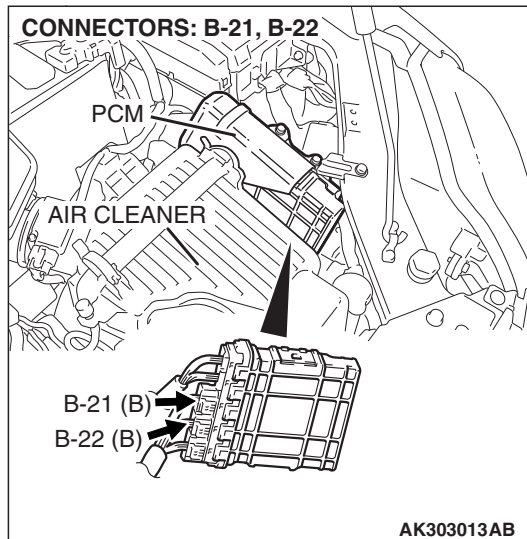
Q: Is DTC P0106 set?**YES** : Retry the troubleshooting.**NO** : The inspection is complete.**DTC P0107: Manifold Absolute Pressure Circuit Low Input**

Manifold Absolute Pressure Sensor Circuit



AK400877





CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the PCM (terminal No. 68). The ground terminal (terminal No. 2) is grounded with PCM (terminal No. 69).
- A voltage that is proportional to the intake manifold pressure is sent to the PCM (terminal No. 102) 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

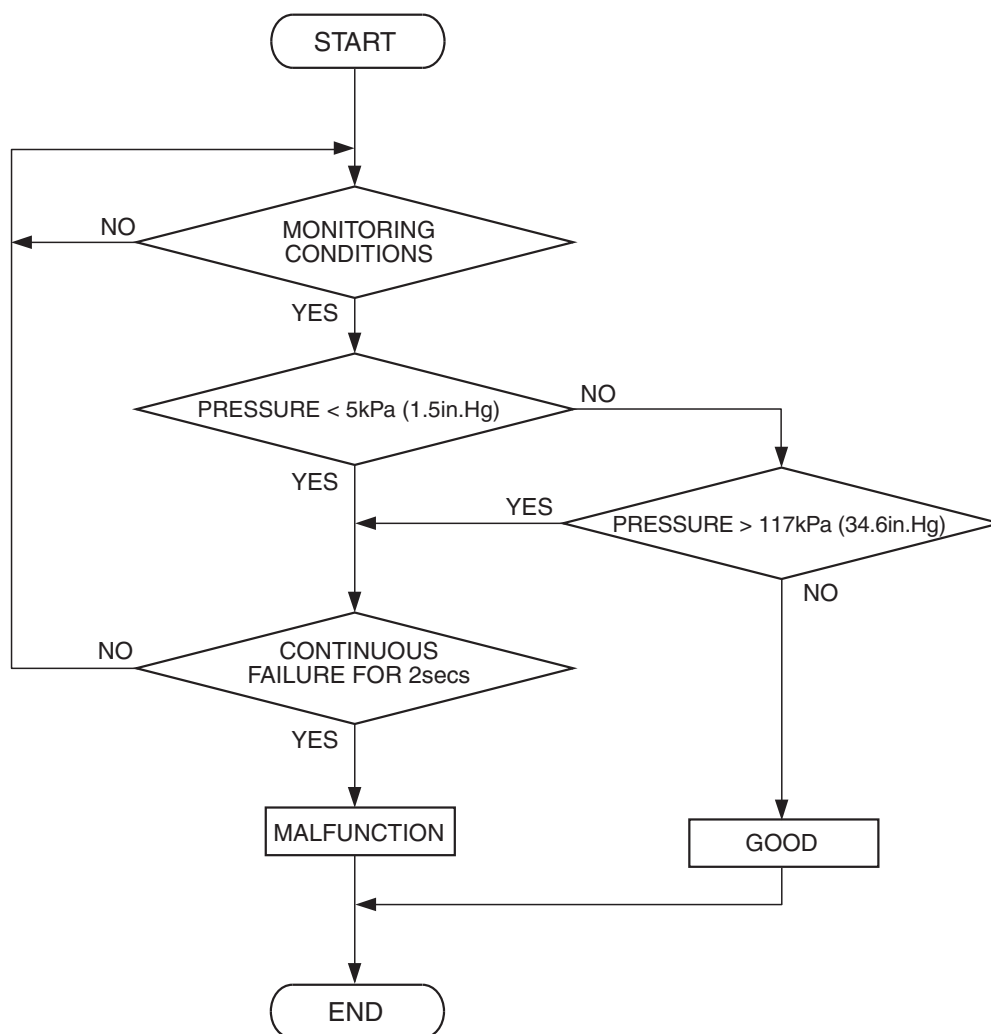
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK302382

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13B-5](#).

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, or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991923: Power Plant ECU Check Harness

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

⚠ CAUTION

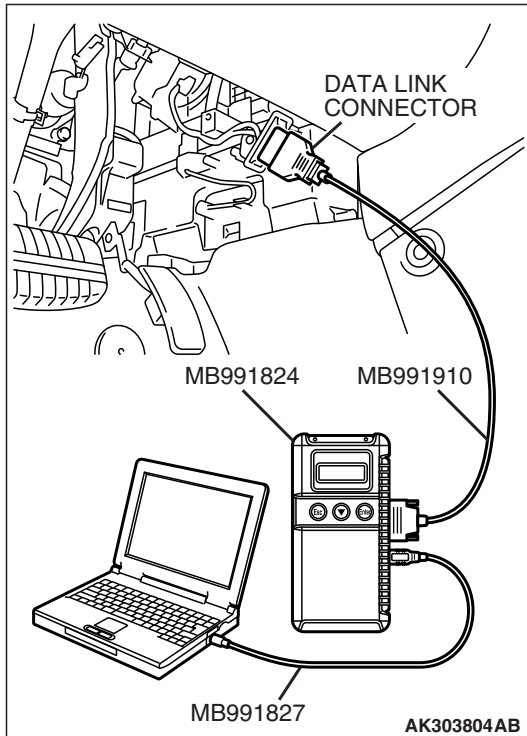
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

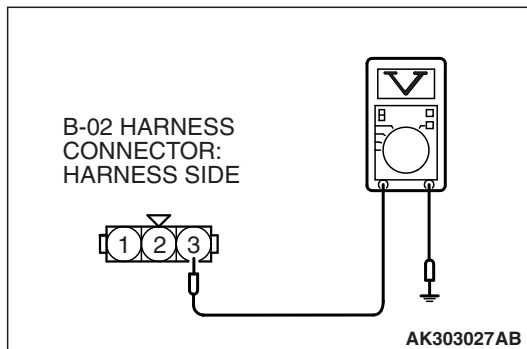
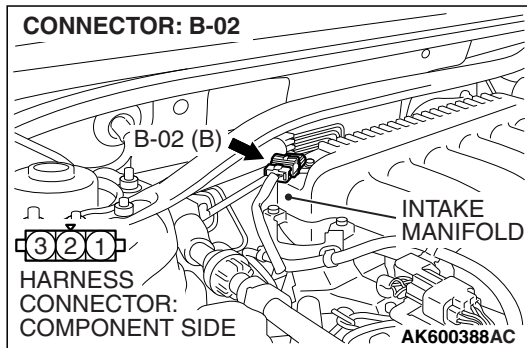
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine and run at idle.
- (5) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F)
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.





STEP 2. Measure the sensor supply 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. 3 and ground by backprobing.

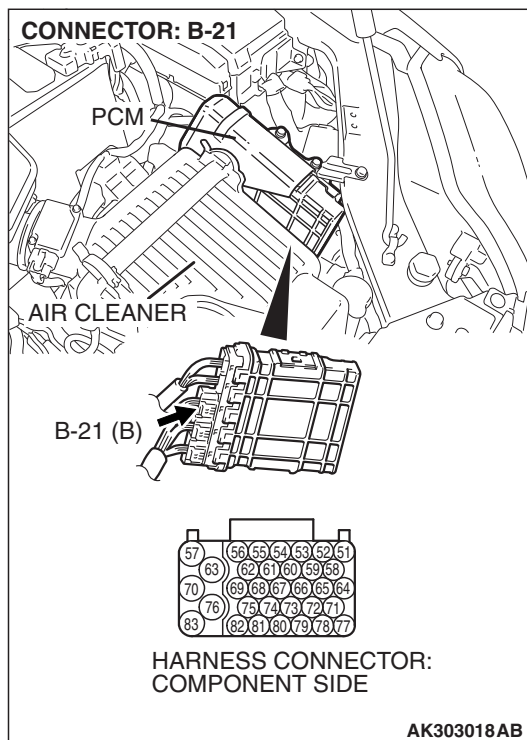
- Voltage should be between 4.9 and 5.1 volts.

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

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

YES : Go to Step 8.

NO : Go to Step 3.



STEP 3. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

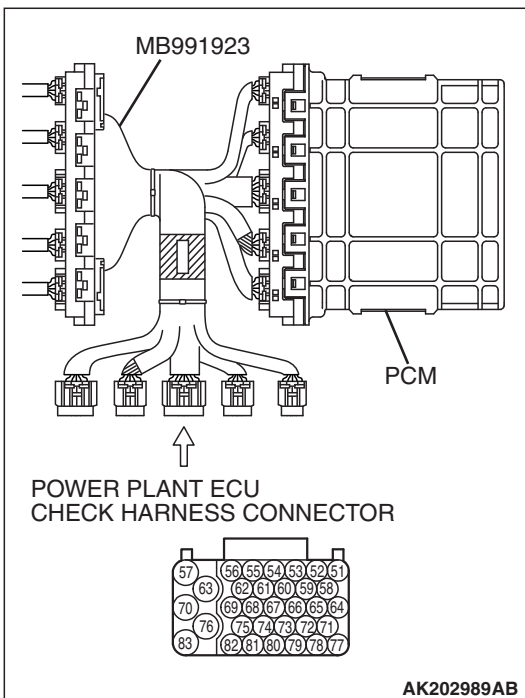
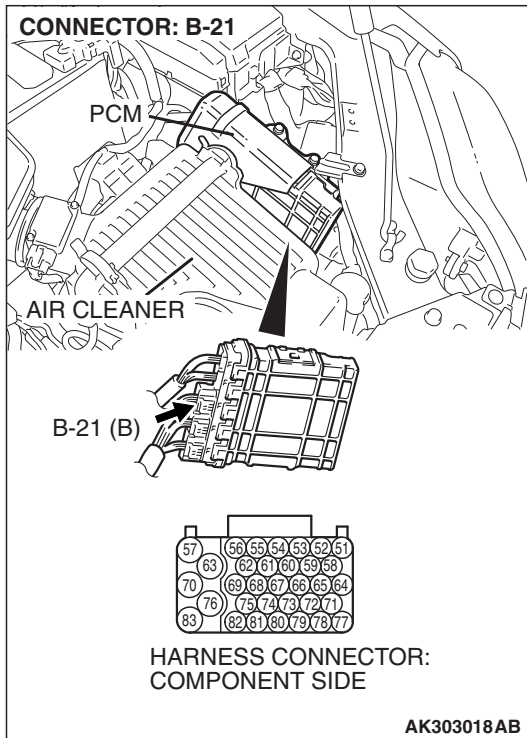
YES : Go to Step 4.

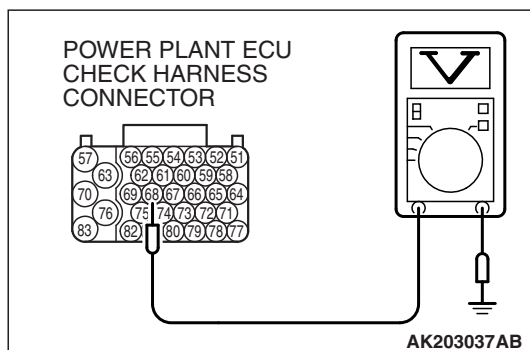
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

STEP 4. Measure the sensor supply voltage at PCM connector B-21 by using power plant ECU check harness special tool MB991923.

(1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.

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



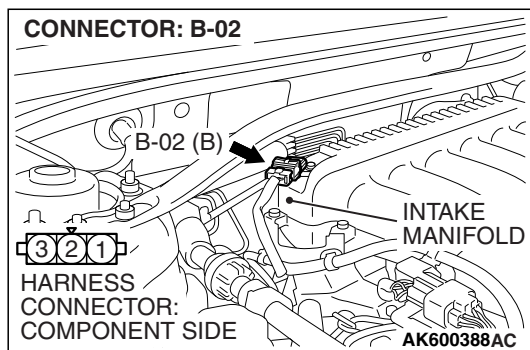


- (3) Measure the voltage between terminal No. 68 and ground.
 • Voltage should be between 4.9 and 5.1 volts.
 (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 7.

NO : Go to Step 5.



STEP 5. Check harness connector B-02 at the manifold absolute pressure sensor for damage.

Q: Is the connector in good condition?

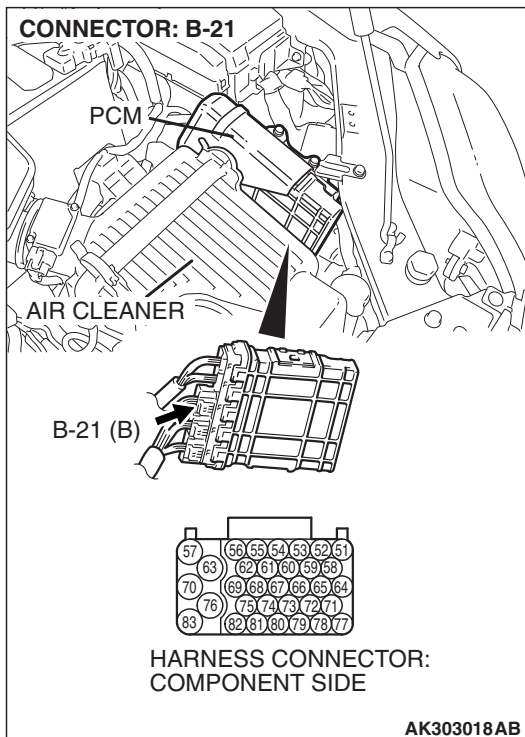
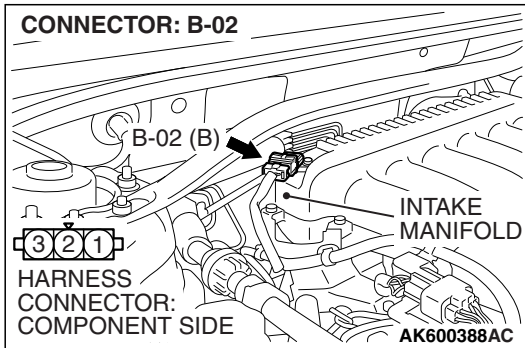
YES : Go to Step 6.

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

STEP 6. Check for short circuit to ground between manifold absolute pressure sensor connector B-02 (terminal No. 3) and PCM connector B-21 (terminal No. 68).
Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

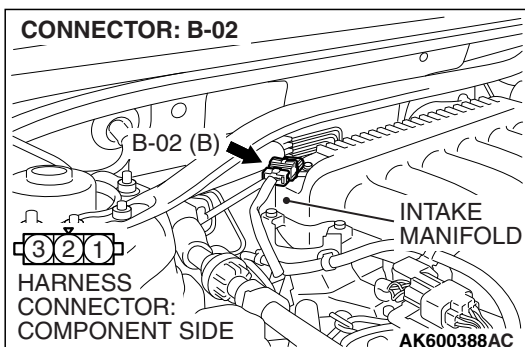


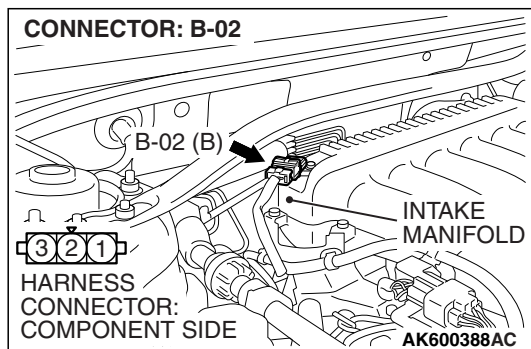
STEP 7. Check harness connector B-02 at the manifold absolute pressure sensor for damage.

Q: Is the connector in good condition?

YES : Repair harness wire between manifold absolute pressure sensor connector B-02 (terminal No. 3) and PCM connector B-21 (terminal No. 68) 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.



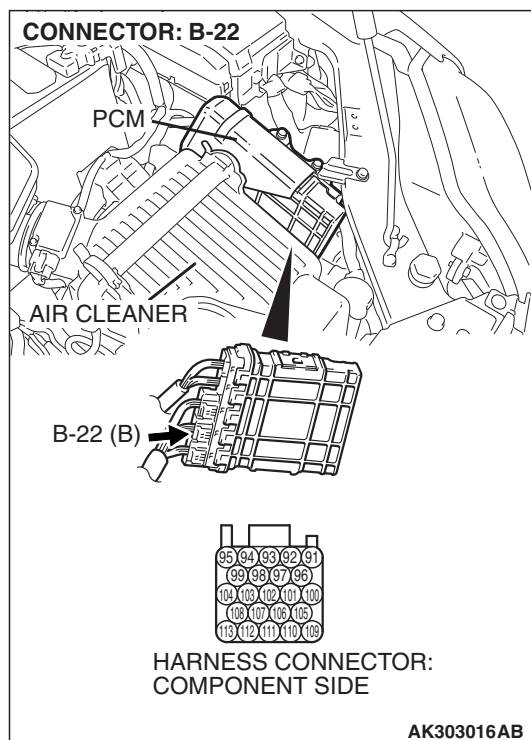


STEP 8. Check harness connector B-02 at the manifold absolute pressure sensor and connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

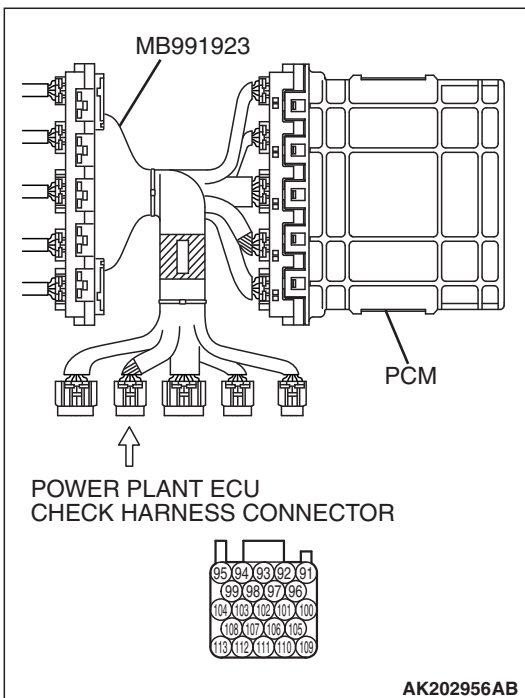
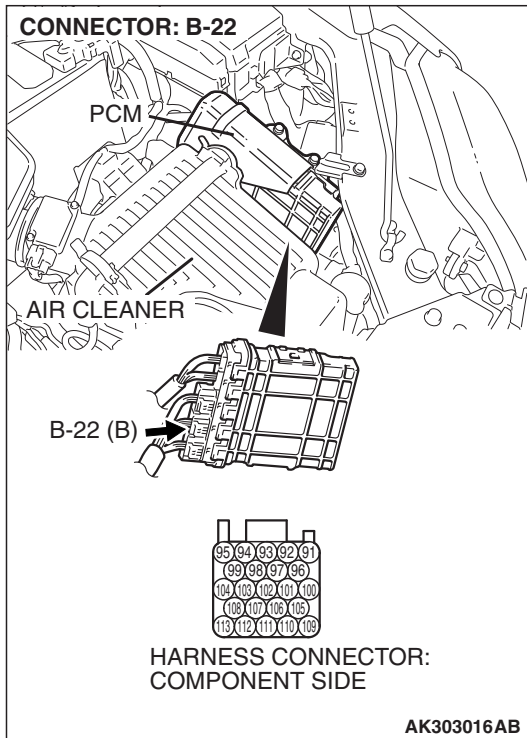
YES : Go to Step 9.

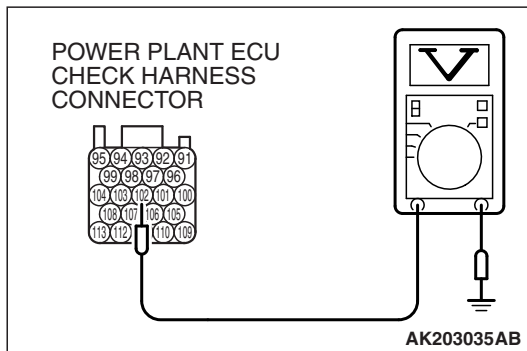
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 9. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Turn the ignition switch to the "ON" position.





- (3) Measure the voltage between terminal No. 102 and ground.
- When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
 - When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
 - When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
 - When altitude is 1,800 m (5,906 feet), voltage should be between 3.0 and 3.4 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage normal?

YES : Go to Step 11.

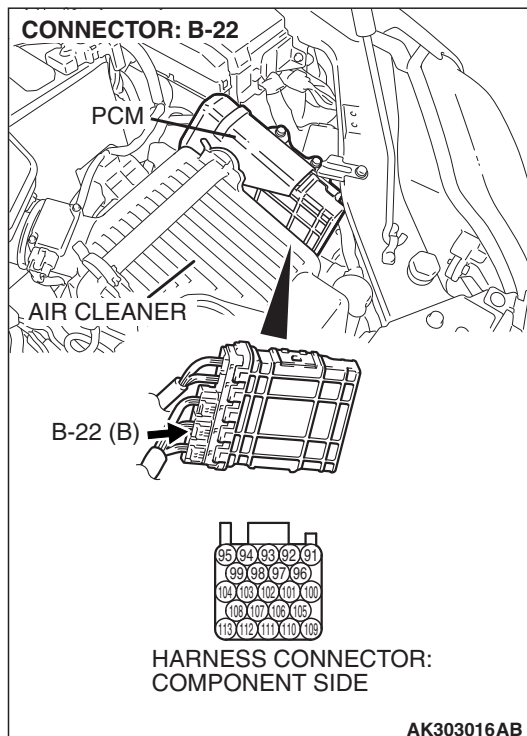
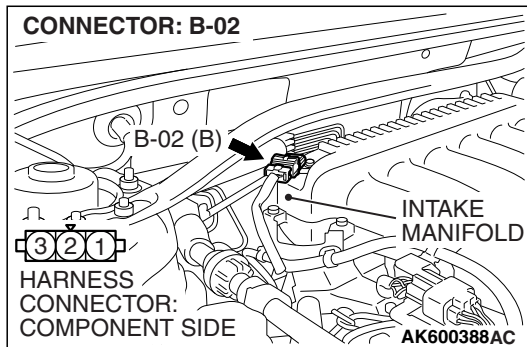
NO : Go to Step 10.

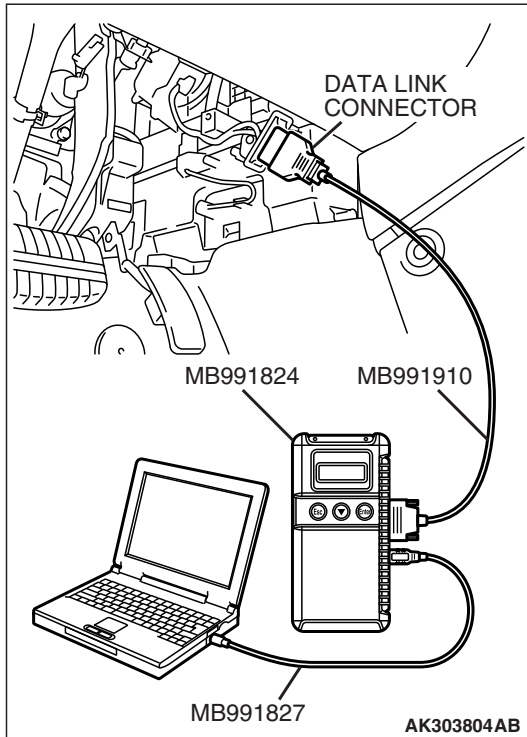
STEP 10. Check for open or short circuit to ground between manifold absolute pressure sensor connector B-02 (terminal No. 1) and PCM connector B-22 (terminal No. 102).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 12.





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

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine and run at idle.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F)
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 12.

STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

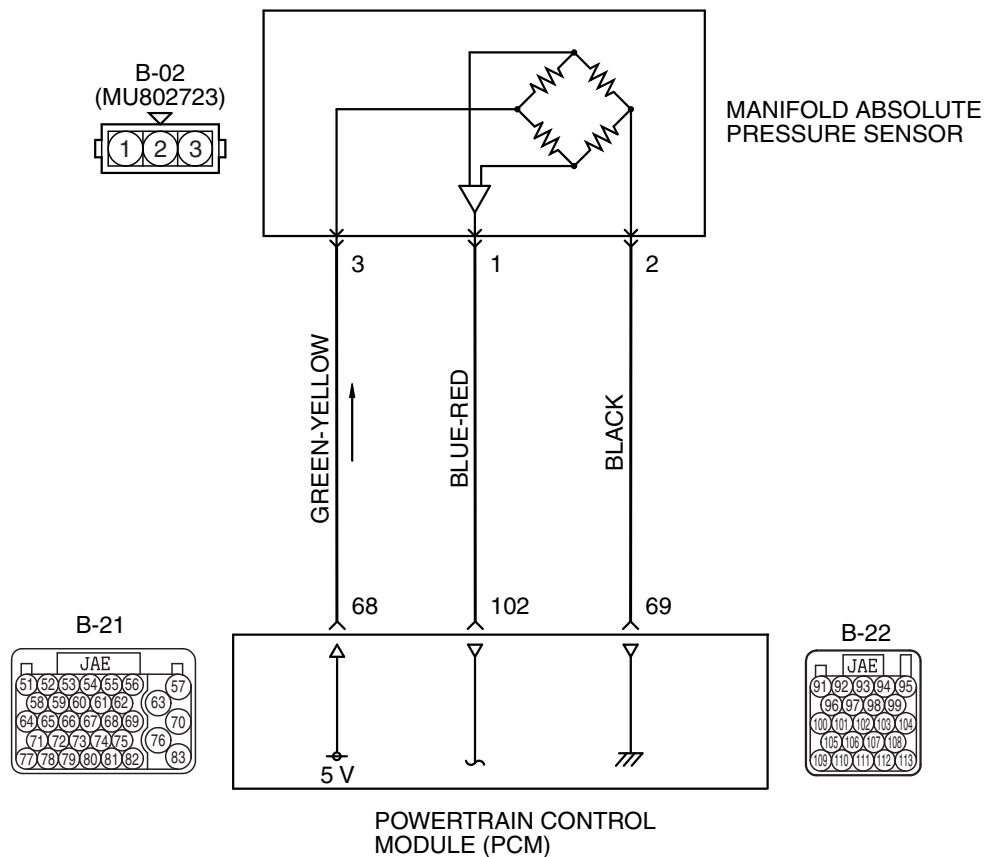
Q: Is DTC P0107 set?

YES : Retry the troubleshooting.

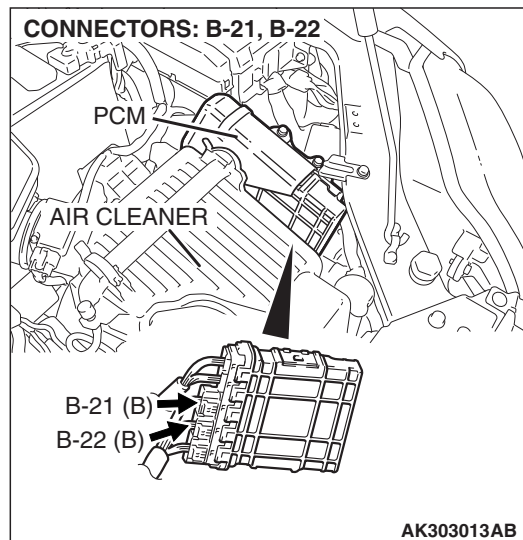
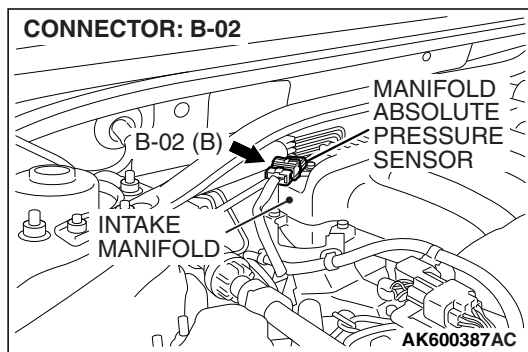
NO : The inspection is complete.

DTC P0108: Manifold Absolute Pressure Circuit High Input

Manifold Absolute Pressure Sensor Circuit



AK400877



CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the PCM (terminal No. 68). The ground terminal (terminal No. 2) is grounded with PCM (terminal No. 69).
- A voltage that is proportional to the intake manifold pressure is sent to the PCM (terminal No. 102) 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

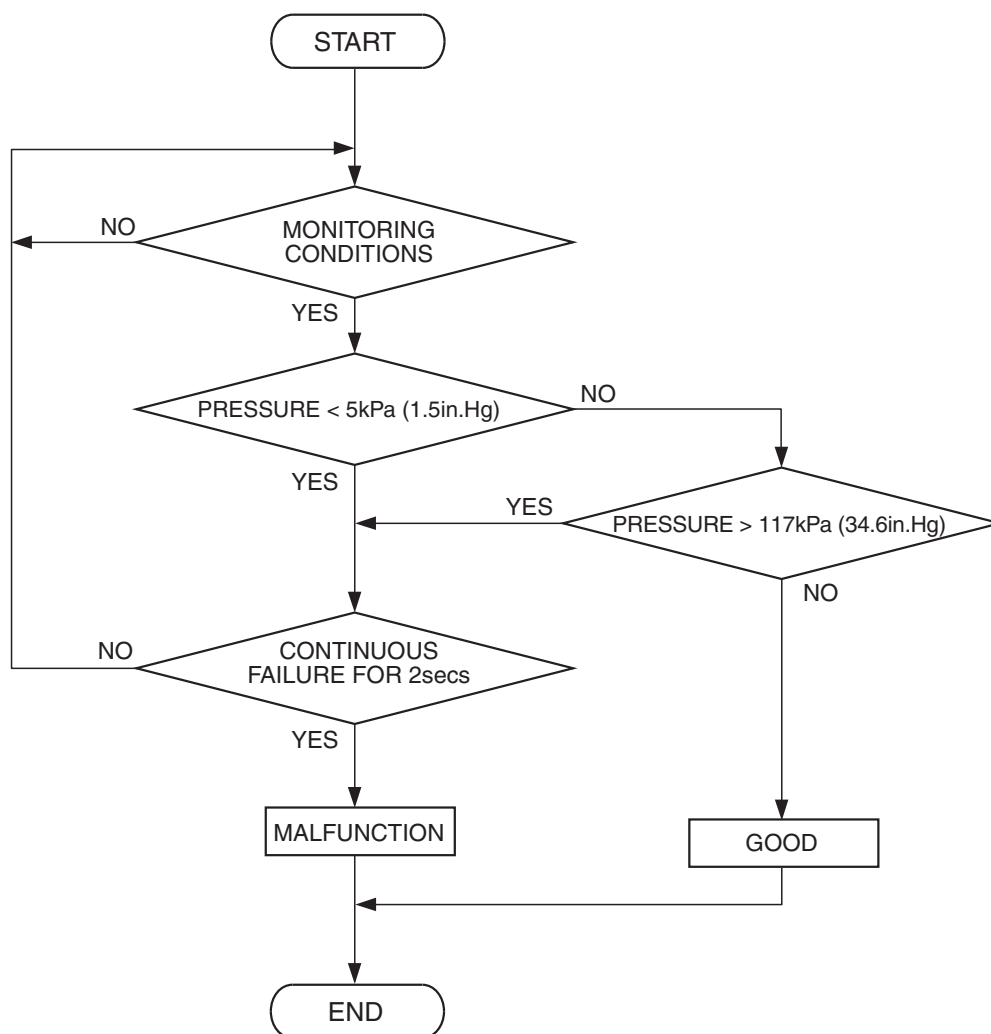
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK302382

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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

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

DIAGNOSIS

Required Special Tools:

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

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

⚠ CAUTION

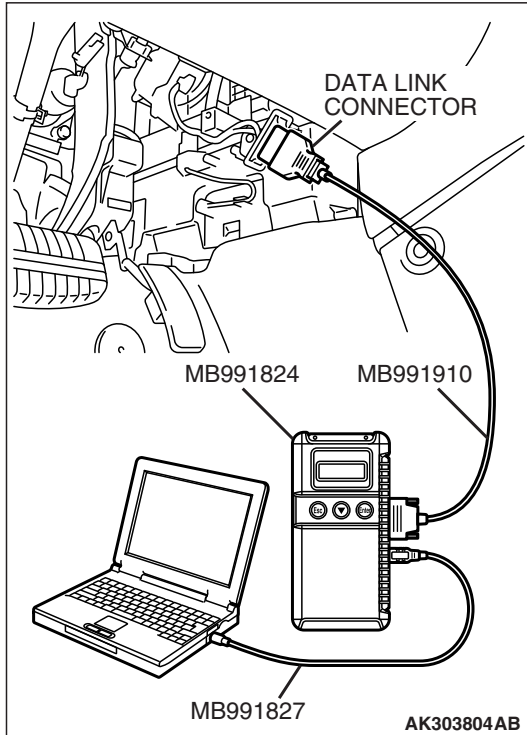
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

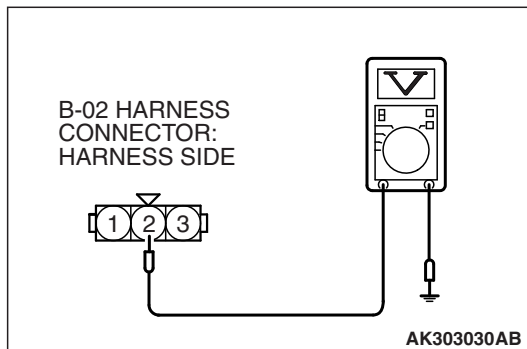
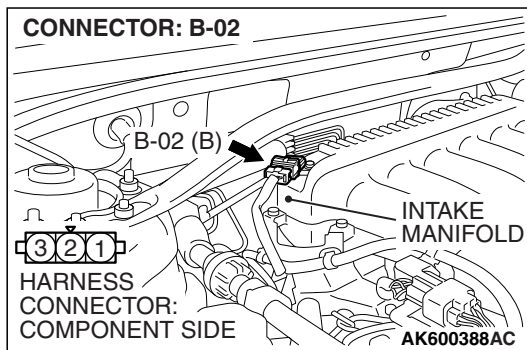
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (4) Start the engine and run at idle.
- (5) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F)
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 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.

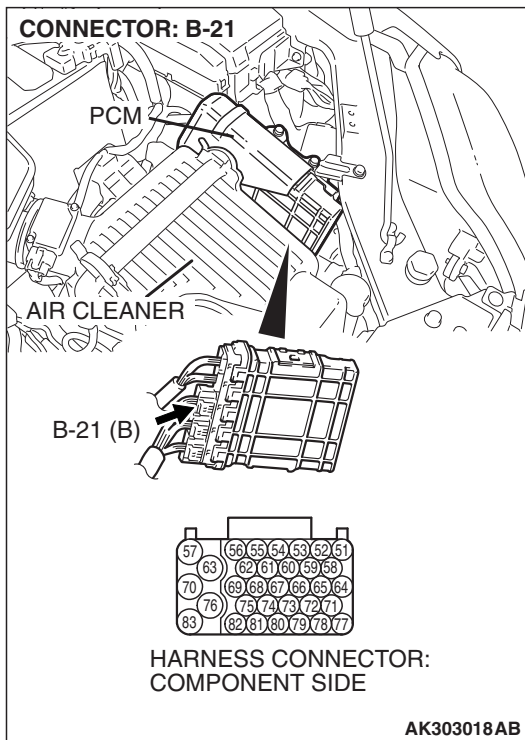
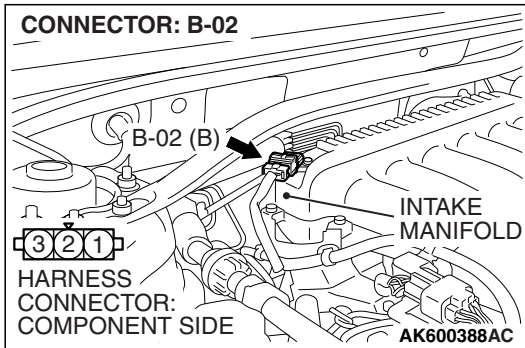
NO : Go to Step 3.

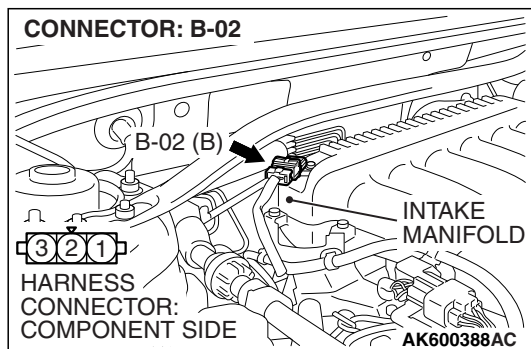
STEP 3. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-21 at PCM for damage.

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.



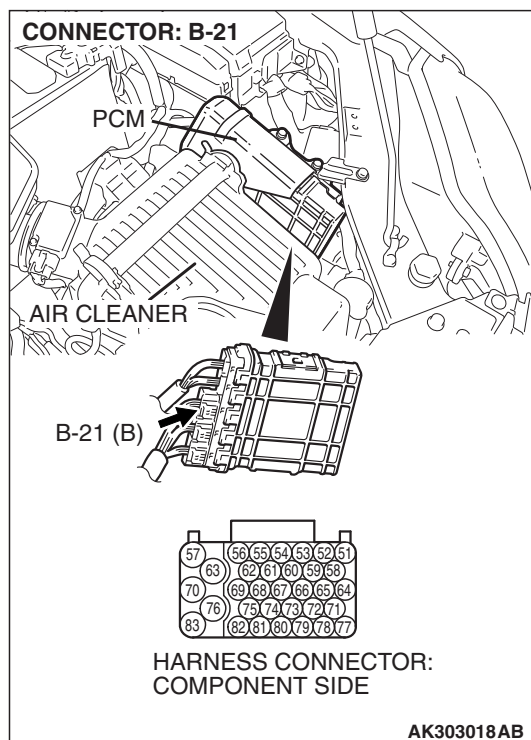


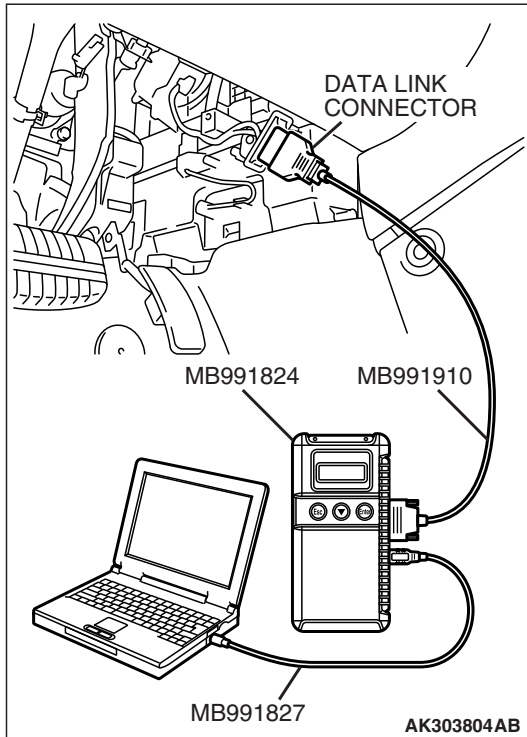
STEP 4. Check for open circuit between manifold absolute pressure sensor connector B-02 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 7.





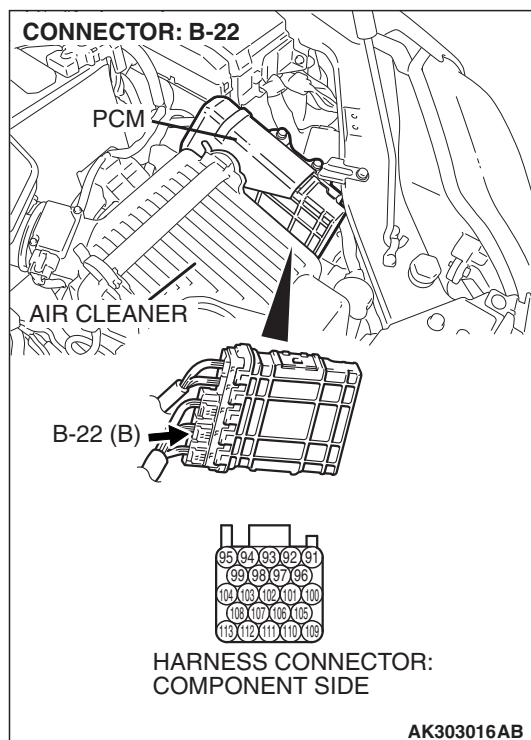
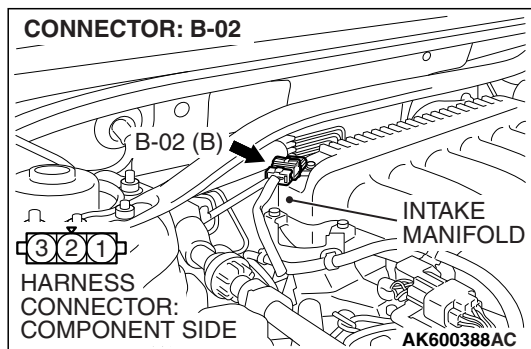
STEP 5. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Start the engine and run at idle.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F)
 - When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
 - When the engine is suddenly revved, manifold absolute pressure varies.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 7.



STEP 6. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

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

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

STEP 7. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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

Q: Is DTC P0108 set?

YES : Retry the troubleshooting.

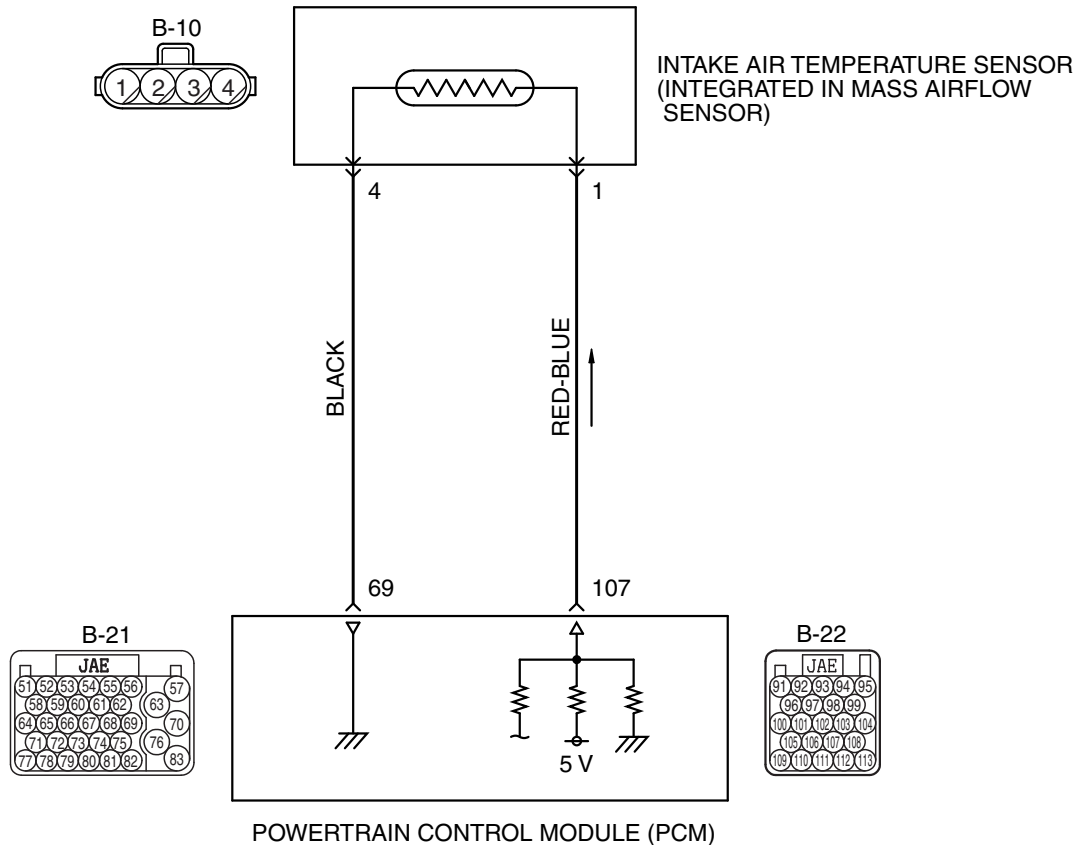
NO : The inspection is complete.

DTC P0111: Intake Air Temperature Circuit Range/Performance Problem

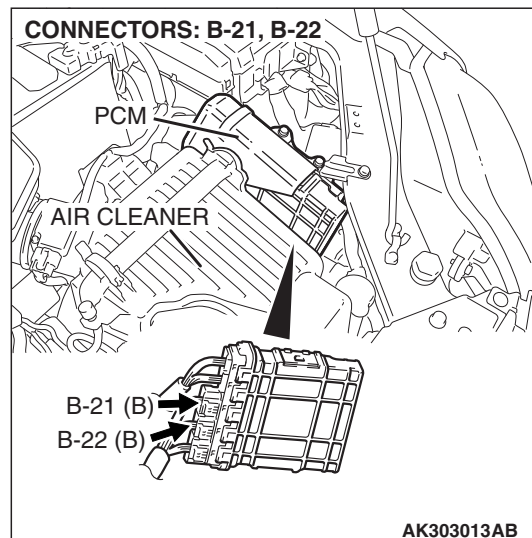
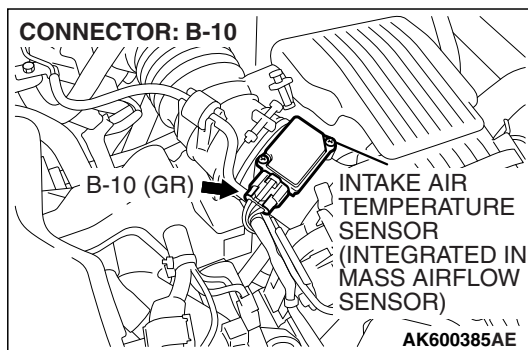
CAUTION

If DTC P0111 has been set, TCL related DTC U1120 is also set. After P0111 has been diagnosed, don't forget to erase DTC U1120.

Intake Air Temperature Sensor Circuit



AK303812



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 107) via the resistor in the PCM. The ground terminal (terminal No. 4) is grounded with PCM (terminal No. 69).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

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

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

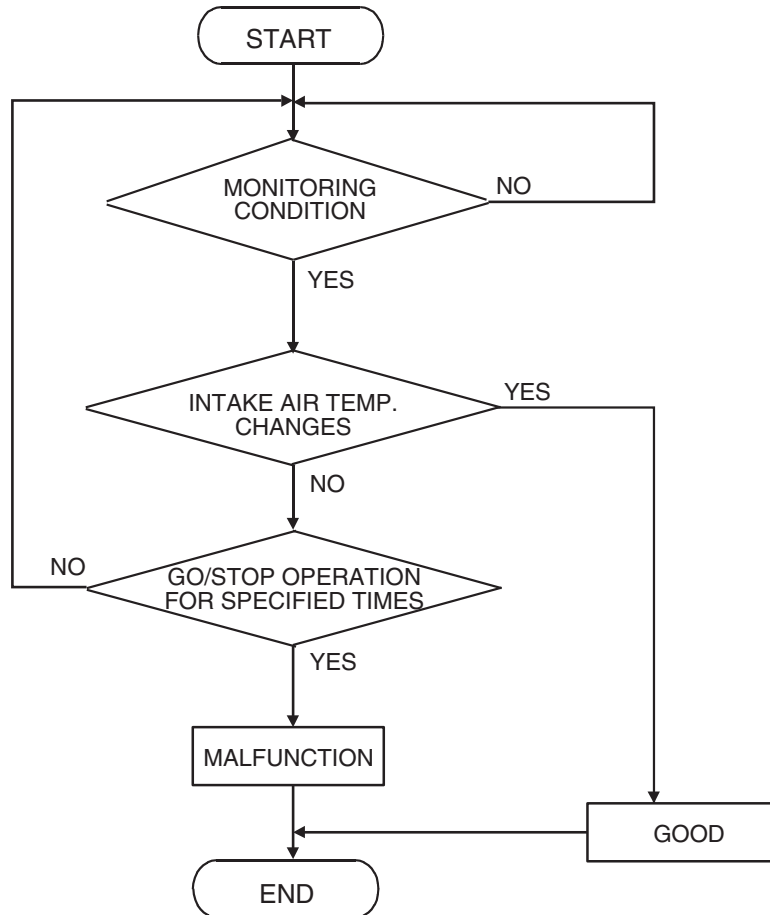
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302383

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 [P.13B-5](#).

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

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

DIAGNOSIS

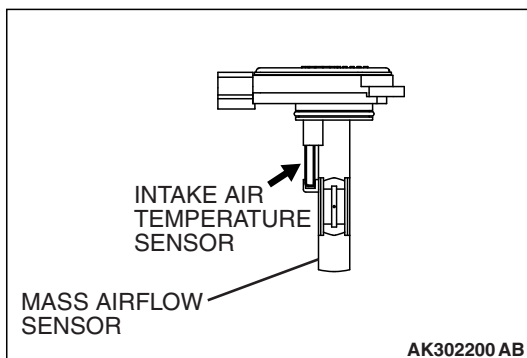
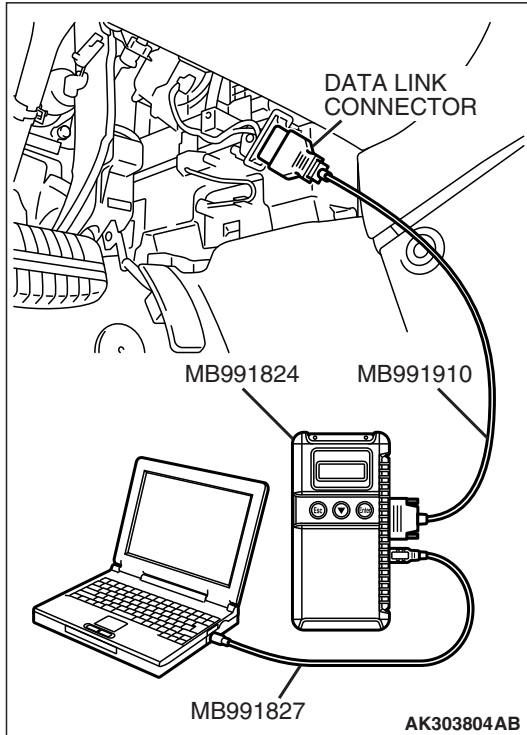
Required Special Tools:

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

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

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

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



- (5) Heating the sensor using a hair drier.

- The indicated temperature increases.

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

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

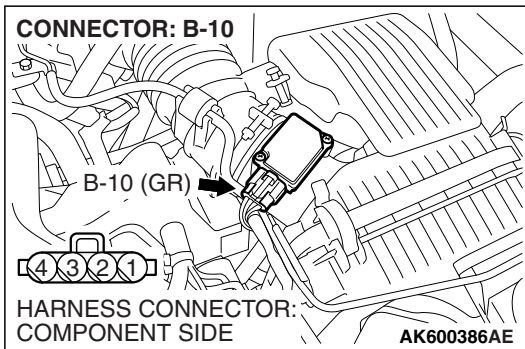
Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent.

Refer to GROUP 00, How to Use

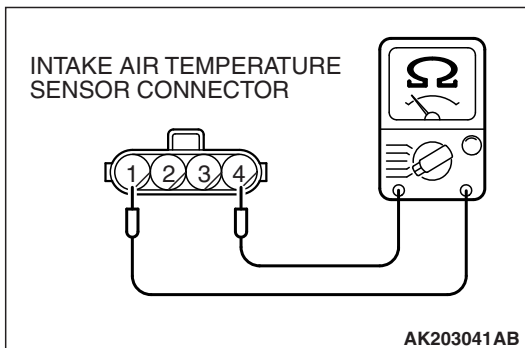
Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

NO : Go to Step 2.

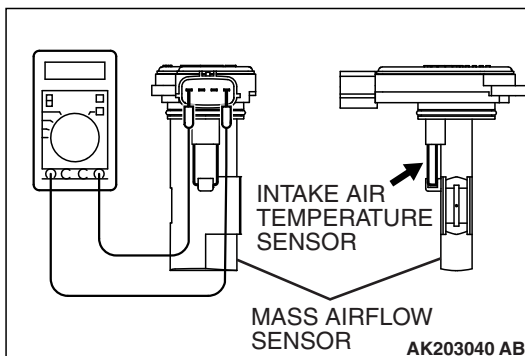


STEP 2. Check the intake air temperature sensor.

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



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



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

Standard value:

13 – 17 k Ω [at – 20°C (– 4°F)]

5.3 – 6.7 k Ω [at 0°C (32°F)]

2.3 – 3.0 k Ω [at 20°C (68°F)]

1.0 – 1.5 k Ω [at 40°C (104°F)]

0.56 – 0.76 k Ω [at 60°C (140°F)]

0.30 – 0.45 k Ω [at 80°C (176°F)]

Q: Is the measured resistance at the standard value?

YES : Go to Step 3.

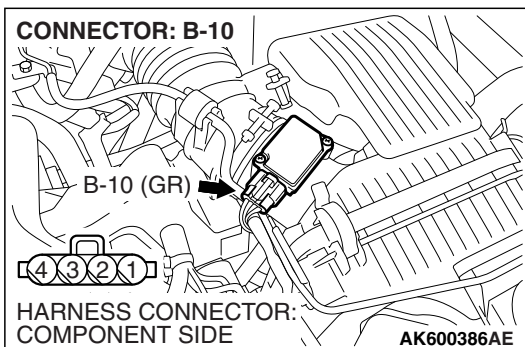
NO : Replace the mass airflow sensor. Then go to Step 9.

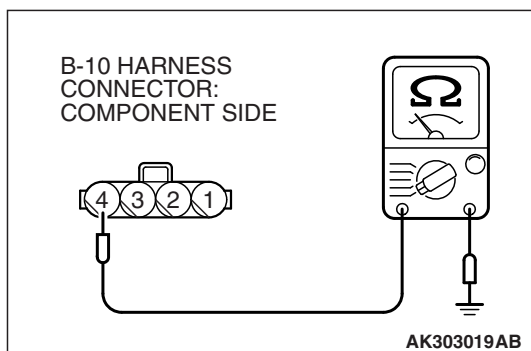
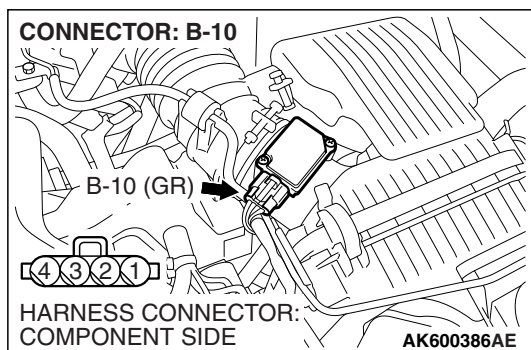
STEP 3. Check harness connector B-10 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

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





STEP 4. Check the continuity at intake air temperature sensor harness side connector B-10.

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

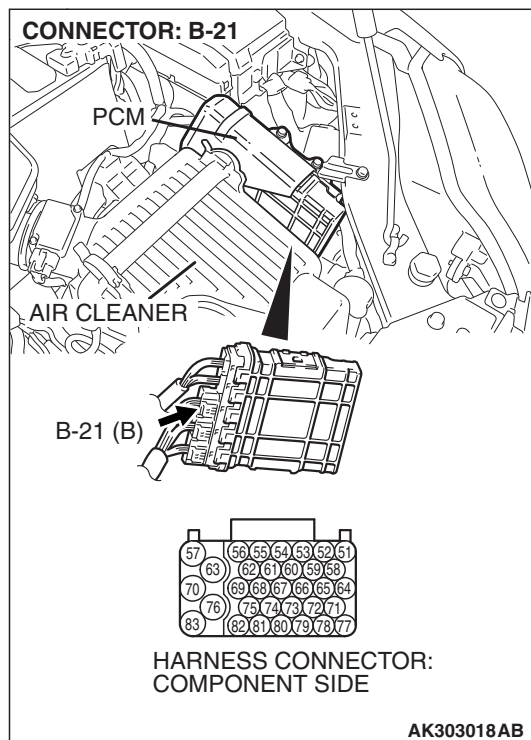
(2) Check for the continuity between terminal No. 4 and ground.

- Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 5.



STEP 5. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

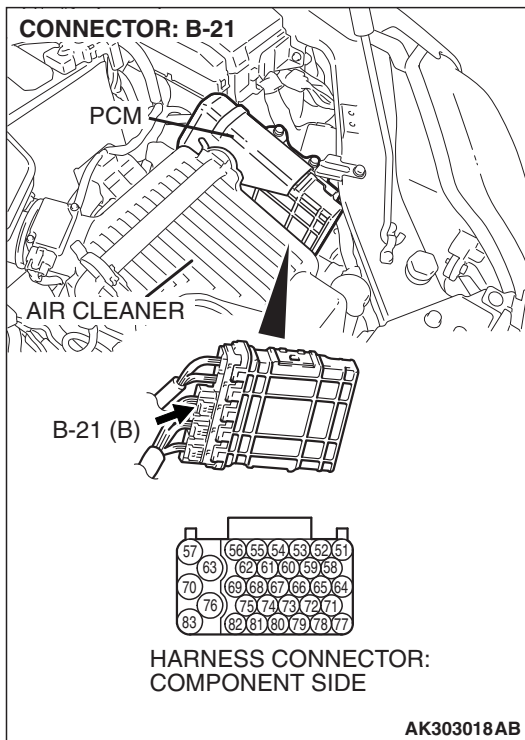
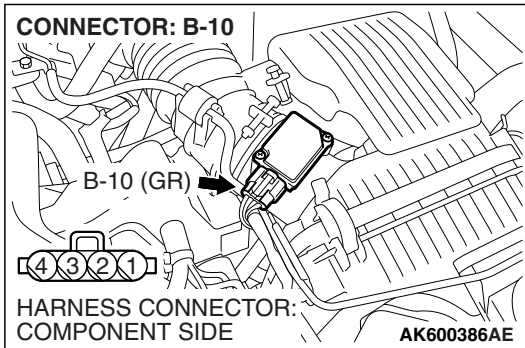
YES : Go to Step 6.

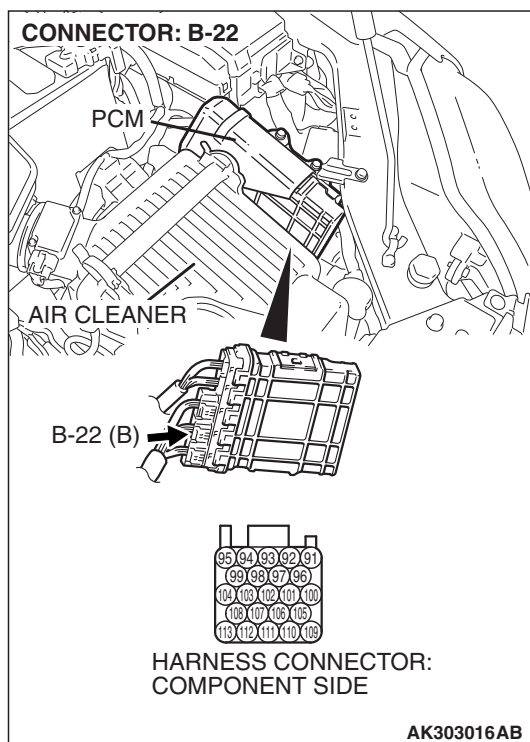
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 9.

STEP 6. Check for open circuit and harness damage between intake air temperature sensor connector B-10 (terminal No. 4) and PCM connector B-21 (terminal No. 69).
Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 9.

NO : Repair it. Then go to Step 9.





STEP 7. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

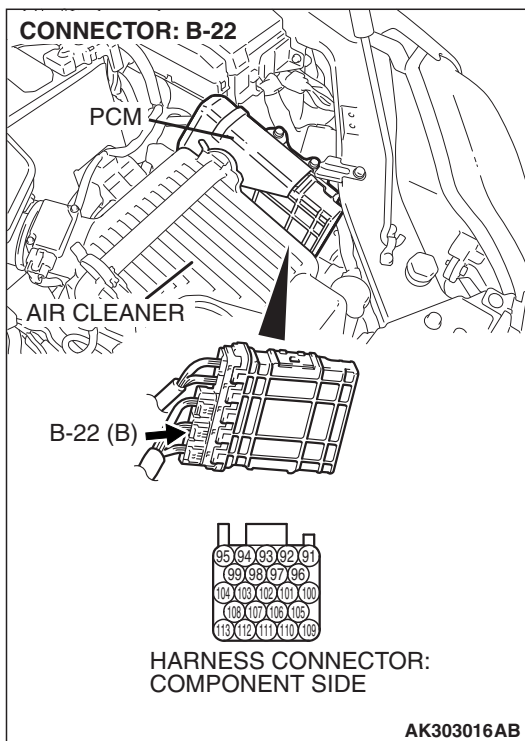
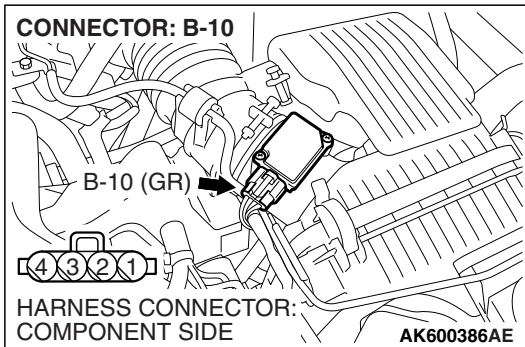
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 9.

STEP 8. Check for open circuit and harness damage between intake air temperature sensor connector B-10 (terminal No. 1) and PCM connector B-22 (terminal No. 107).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 9.

NO : Repair it. Then go to Step 9.



STEP 9. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 [P.13B-5](#).

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

Q: Is DTC P0111 set?

YES : Retry the troubleshooting.

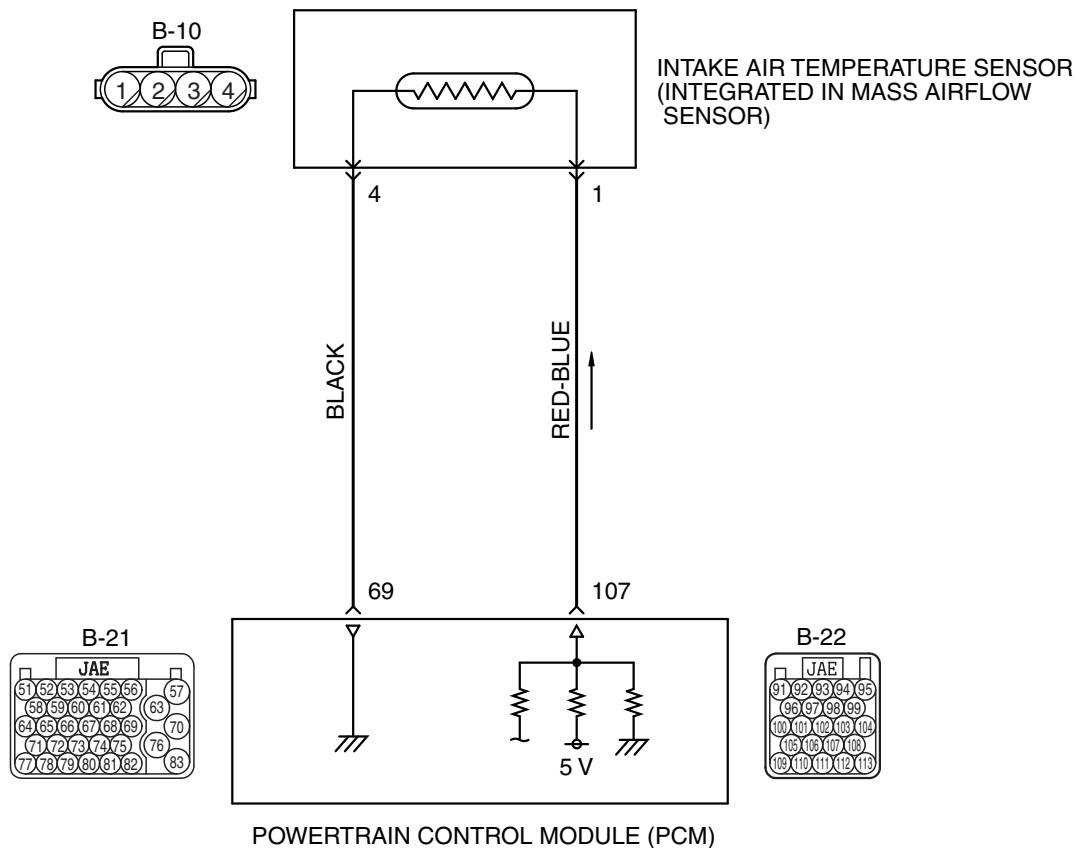
NO : The inspection is complete.

DTC P0112: Intake Air Temperature Circuit Low Input

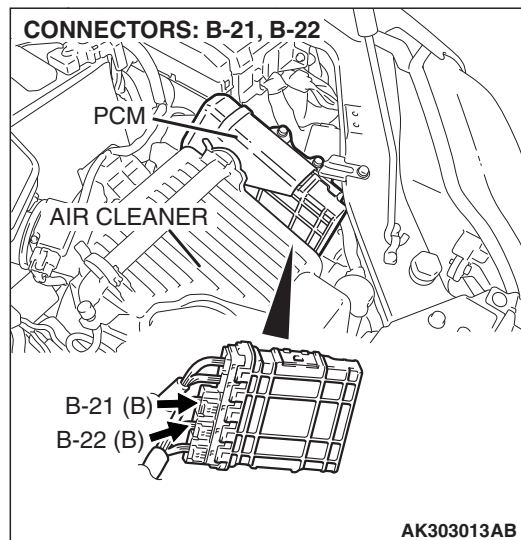
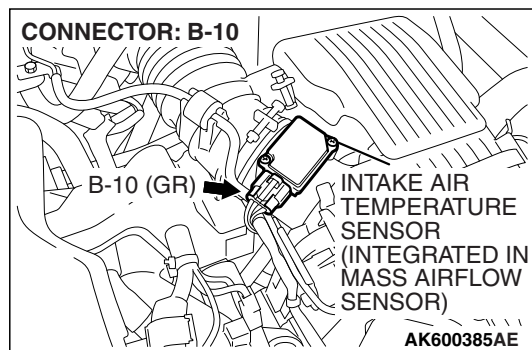
CAUTION

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.

Intake Air Temperature Sensor Circuit



AK303812



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 107) via the resistor in the PCM. The ground terminal (terminal No. 4) is grounded with PCM (terminal No. 69).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

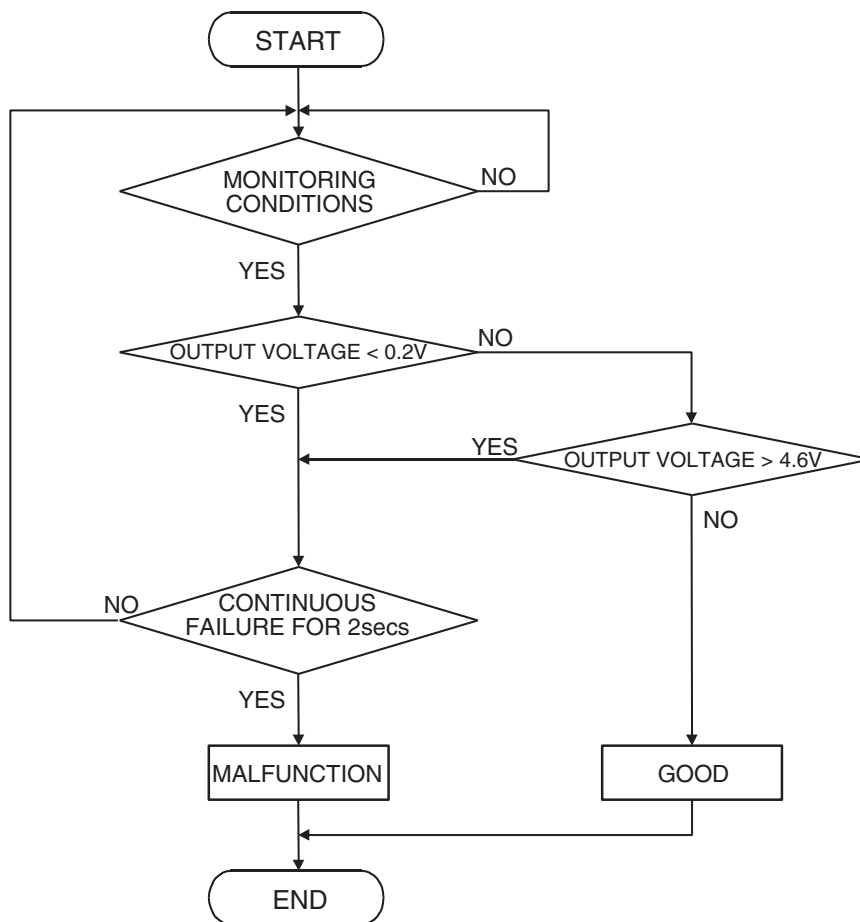
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302384

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

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

⚠ CAUTION

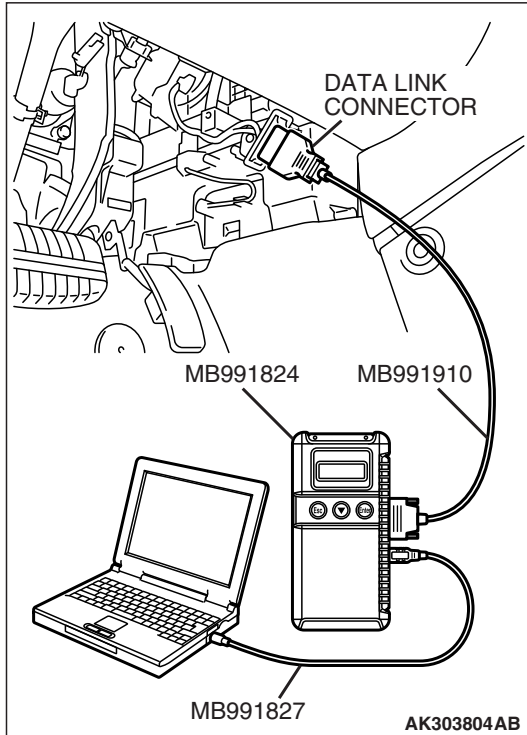
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

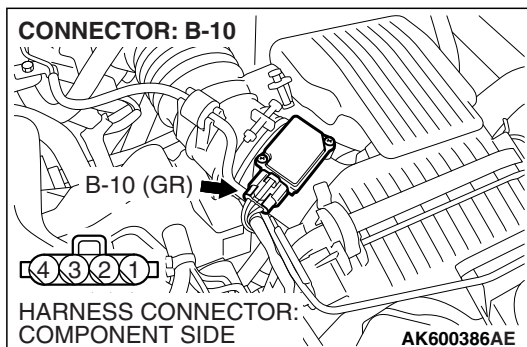


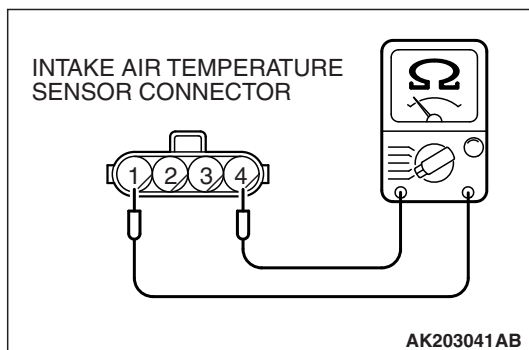
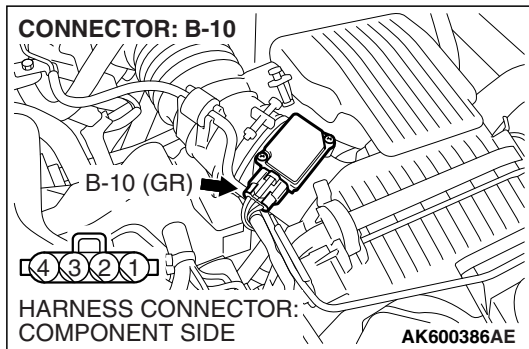
STEP 2. Check harness connector B-10 at the intake air temperature sensor for damage.

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. 4.
- There should be continuity. (0.30 – 17 k Ω)

Q: Is the measured resistance between 0.30 and 17 k Ω ?

YES : Go to Step 4.

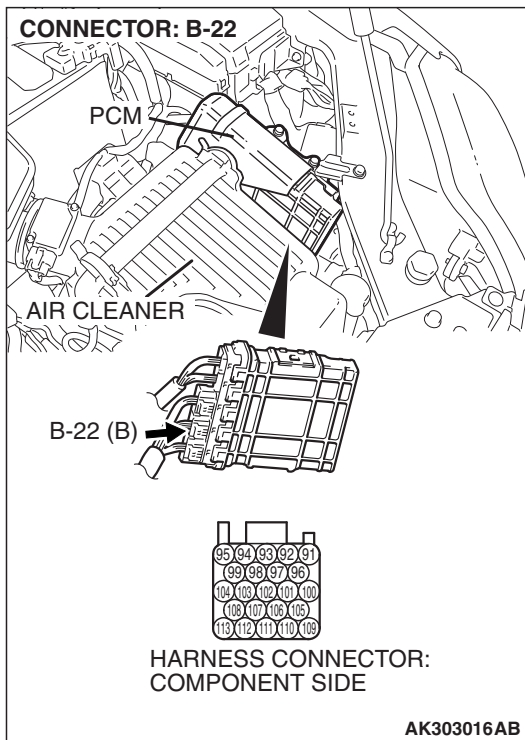
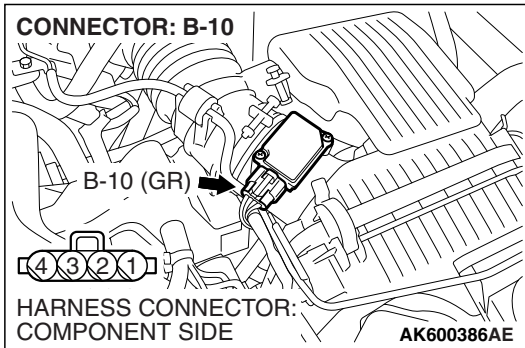
NO : Replace the mass airflow sensor. Then go to Step 6.

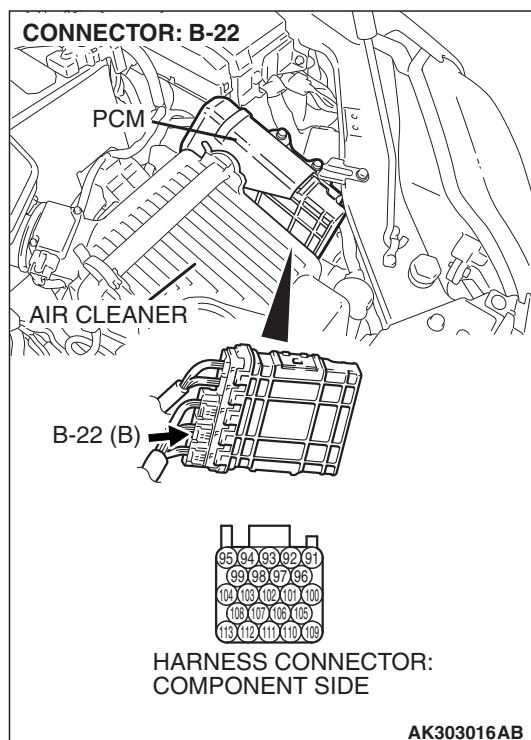
STEP 4. Check for short circuit to ground between intake air temperature sensor connector B-10 (terminal No. 1) and PCM connector B-22 (terminal No. 107).

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-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 6.

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

STEP 6. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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

Q: Is DTC P0112 set?

YES : Retry the troubleshooting.

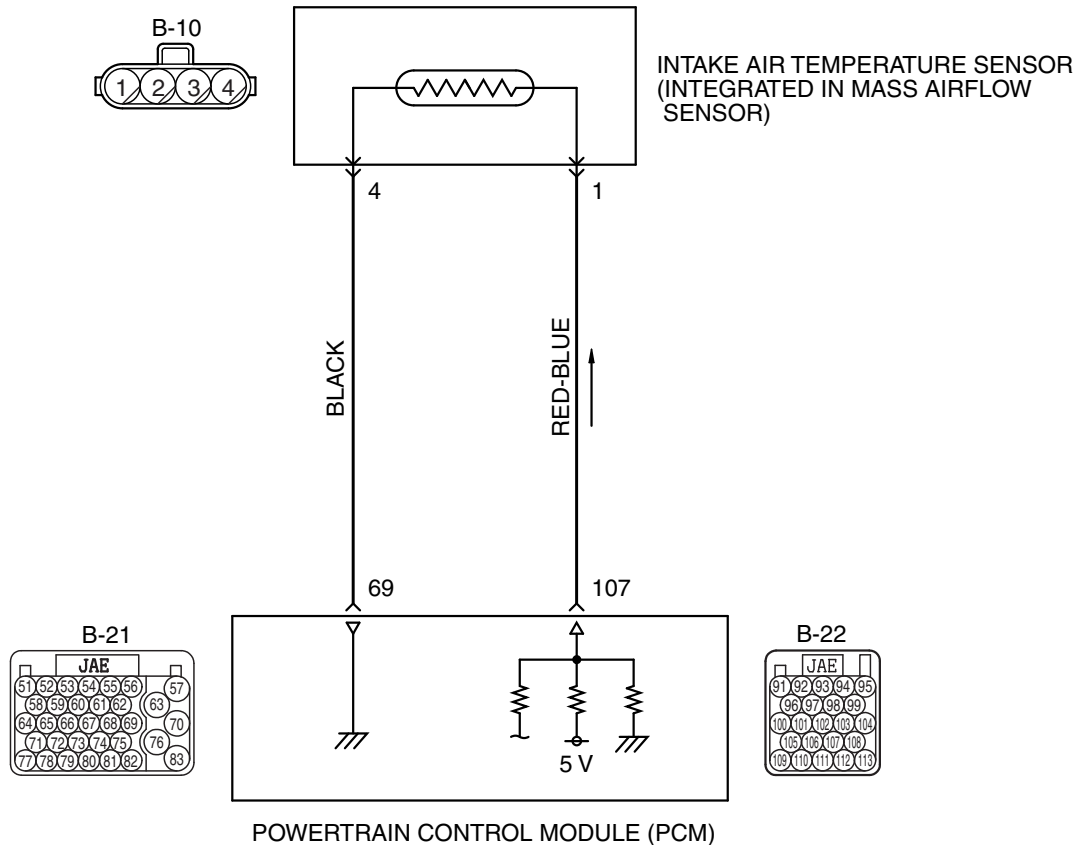
NO : The inspection is complete.

DTC P0113: Intake Air Temperature Circuit High Input

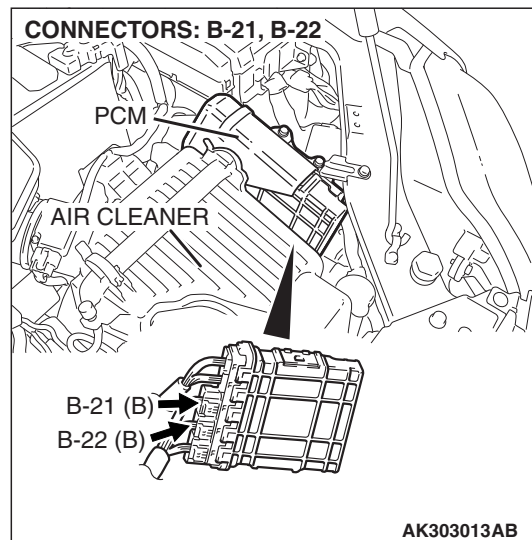
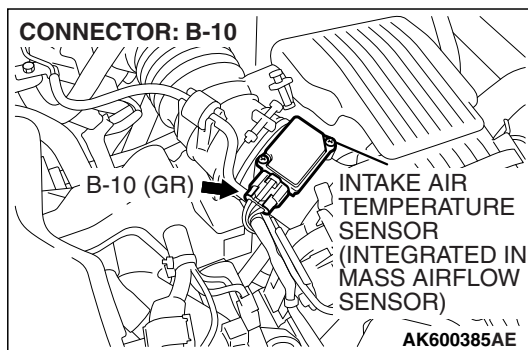
CAUTION

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.

Intake Air Temperature Sensor Circuit



AK303812



CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 107) via the resistor in the PCM. The ground terminal (terminal No. 4) is grounded with PCM (terminal No. 69).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

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

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

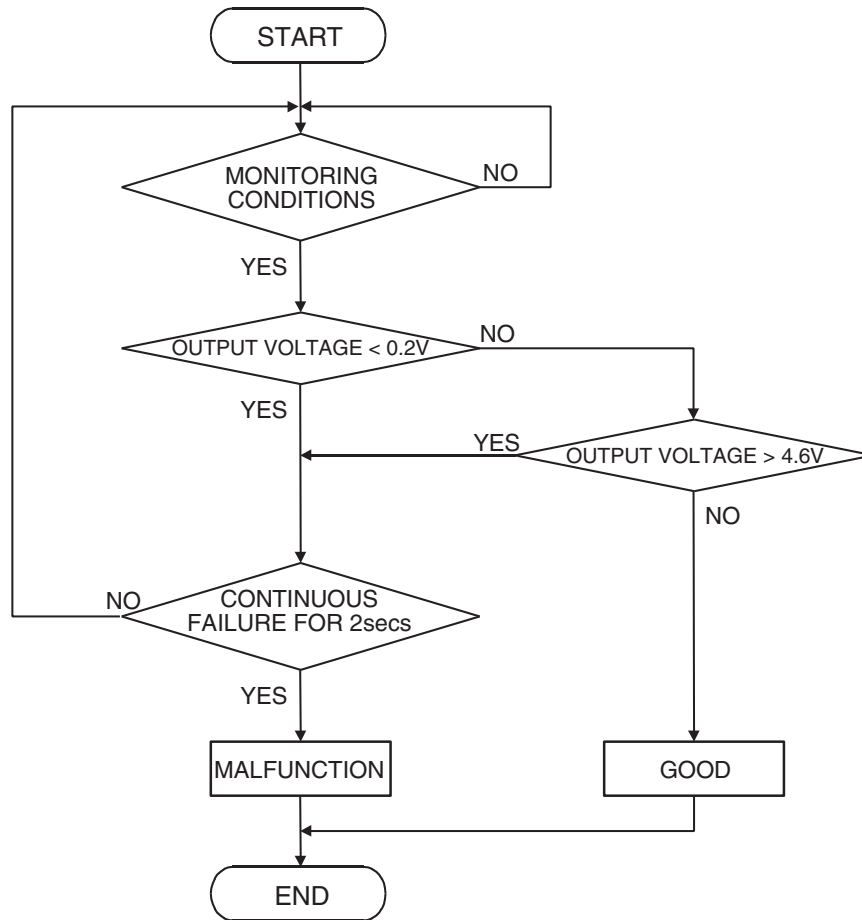
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302384

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991923: Power Plant ECU Check Harness

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

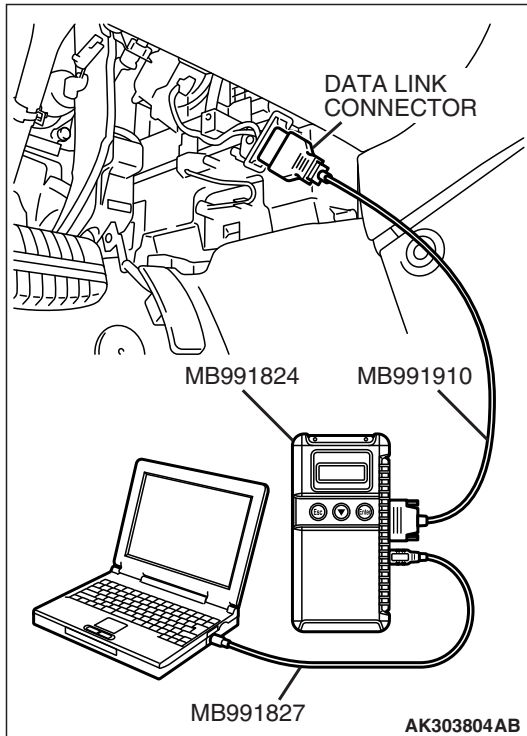
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

Q: Is the sensor operating properly?

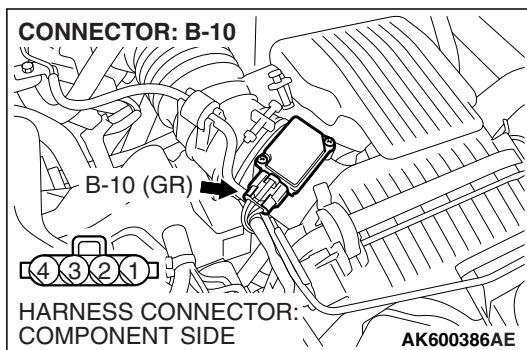
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

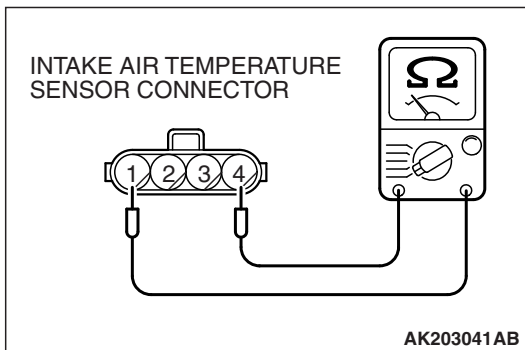
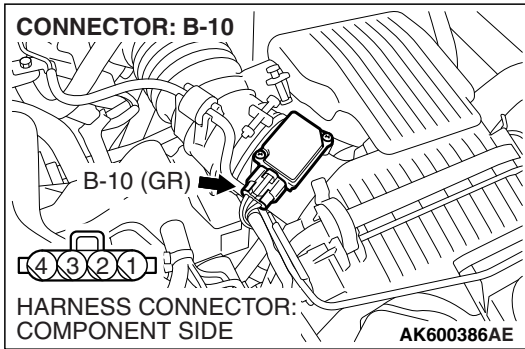
NO : Go to Step 2.

**STEP 2. Check harness connector 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.

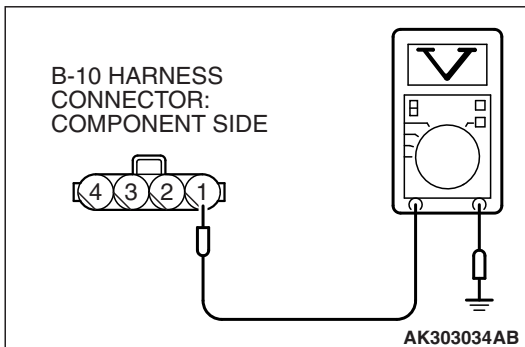
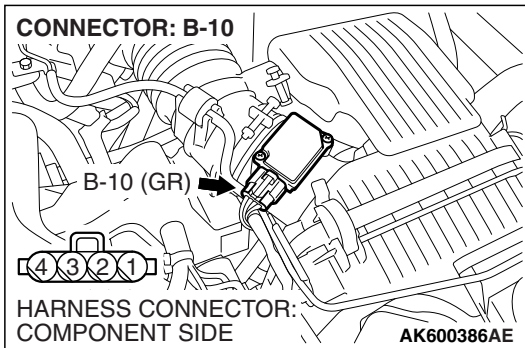
- (1) Disconnect the intake air temperature sensor connector B-10.

- (2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.
- There should be continuity. (0.30 – 17 k Ω)

Q: Is the measured resistance between 0.30 and 17 k Ω ?

YES : Go to Step 4.

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



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

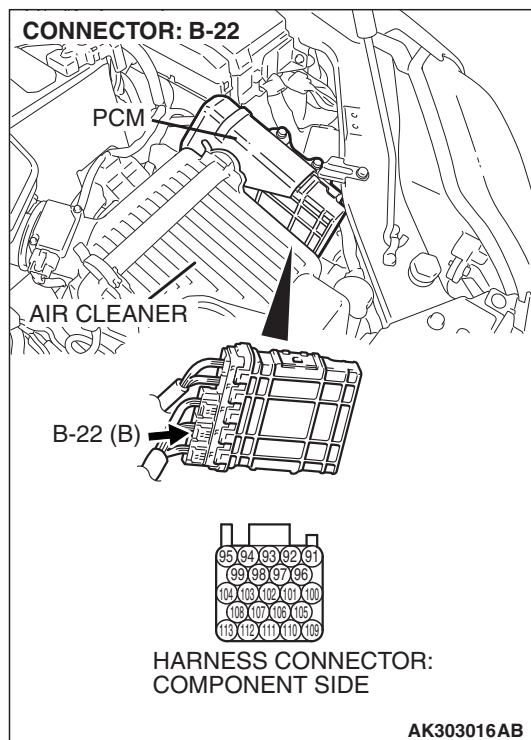
- (1) Disconnect the connector B-10 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (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?

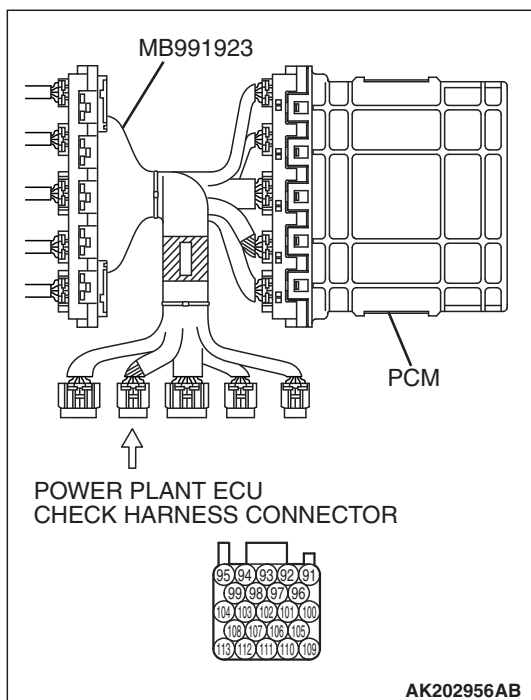
YES : Go to Step 8.

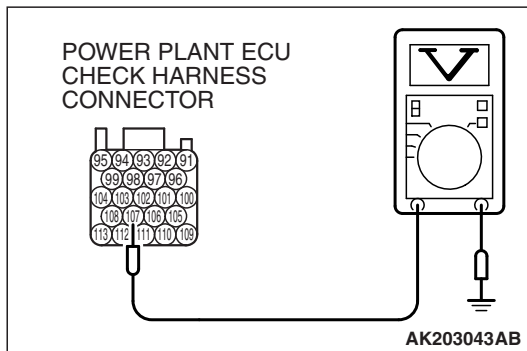
NO : Go to Step 5.



STEP 5. Measure the sensor supply voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Disconnect the intake air temperature sensor connector B-10.
- (3) Turn the ignition switch to the "ON" position.



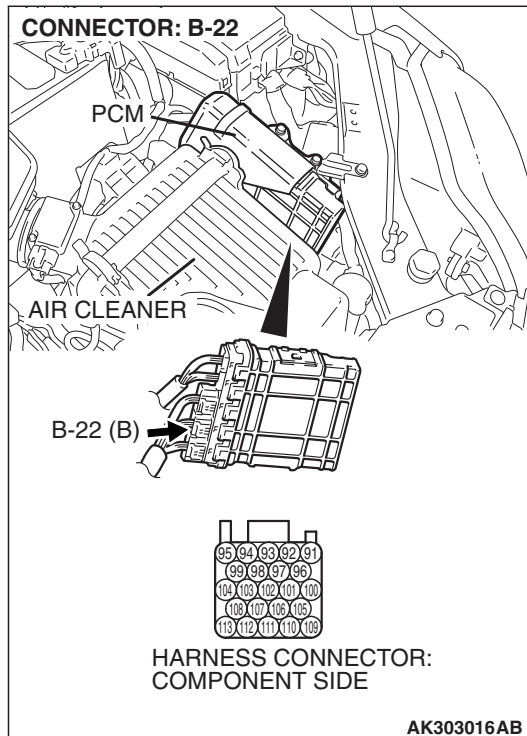


- (4) Measure the voltage between terminal No. 107 and ground.
• Voltage should be between 4.5 and 4.9 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 6.

NO : Go to Step 7.

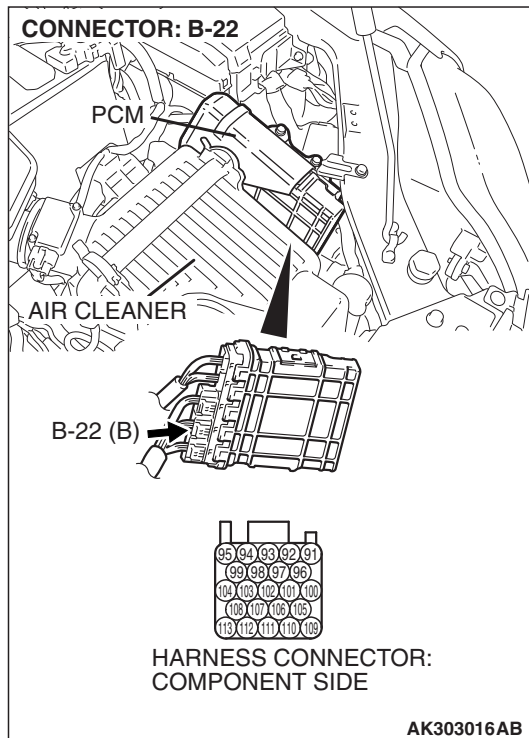


STEP 6. Check harness connector B-22 at PCM for damage.

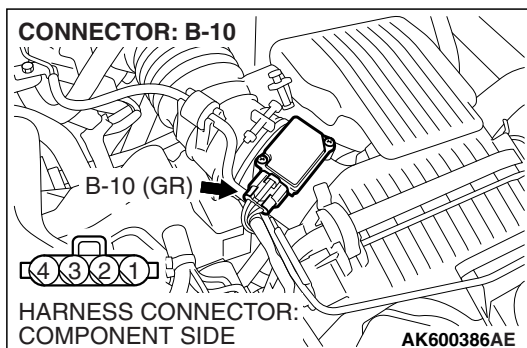
Q: Is the harness connector in good condition?

YES : Repair harness wire between intake air temperature sensor connector B-10 (terminal No. 1) and PCM connector B-22 (terminal No. 107) because of open circuit. Then go to Step 11.

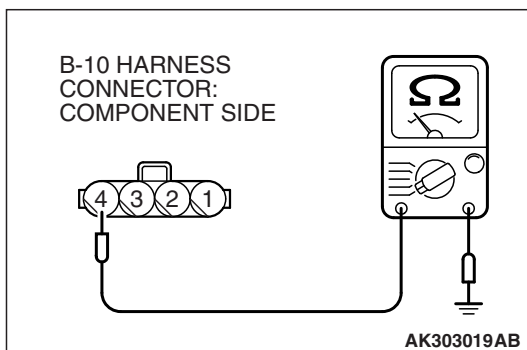
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

**STEP 7. Check harness connector B-22 at PCM for damage.****Q: Is the harness connector in good condition?**

- YES :** Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 11.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

**STEP 8. Check the continuity at intake air temperature sensor harness side connector B-10.**

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



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

- Continuity (2 Ω or less)

Q: Does continuity exist?

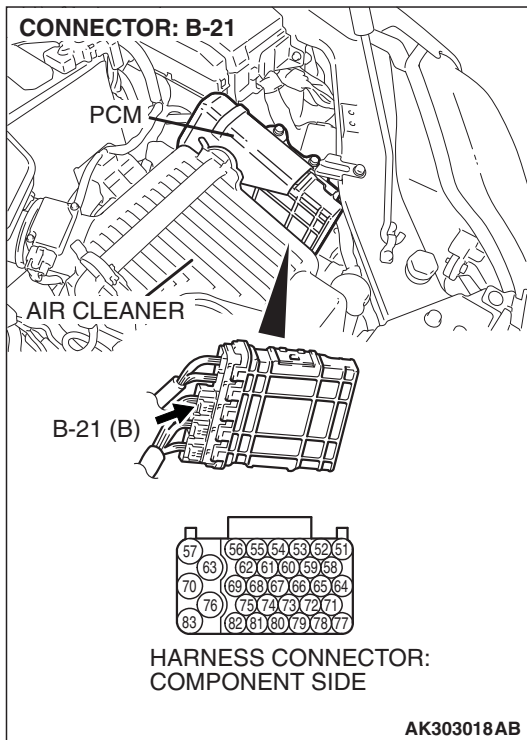
- YES :** Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 11.
- NO :** Go to Step 9.

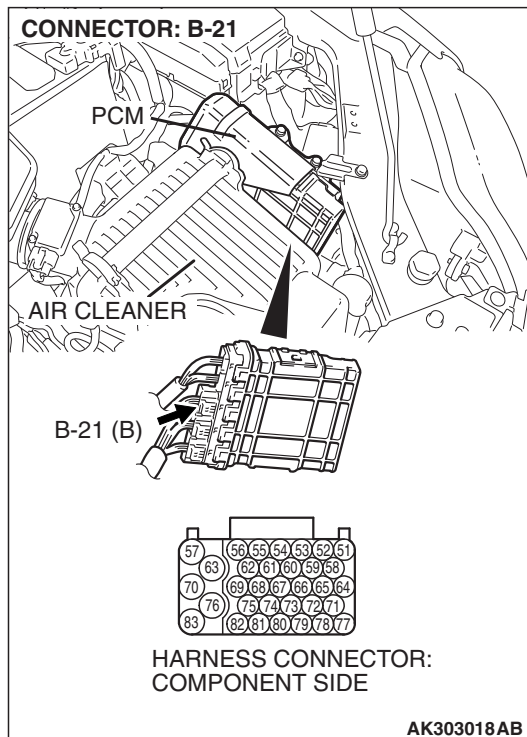
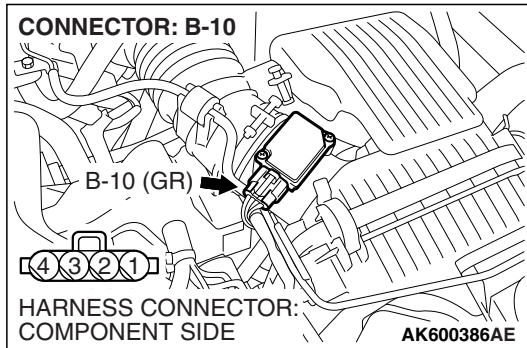
STEP 9. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

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





STEP 10. Check for open circuit between intake air temperature sensor connector B-10 (terminal No. 4) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 11.

NO : Repair it. Then go to Step 11.

STEP 11. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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

Q: Is DTC P0113 set?

YES : Retry the troubleshooting.

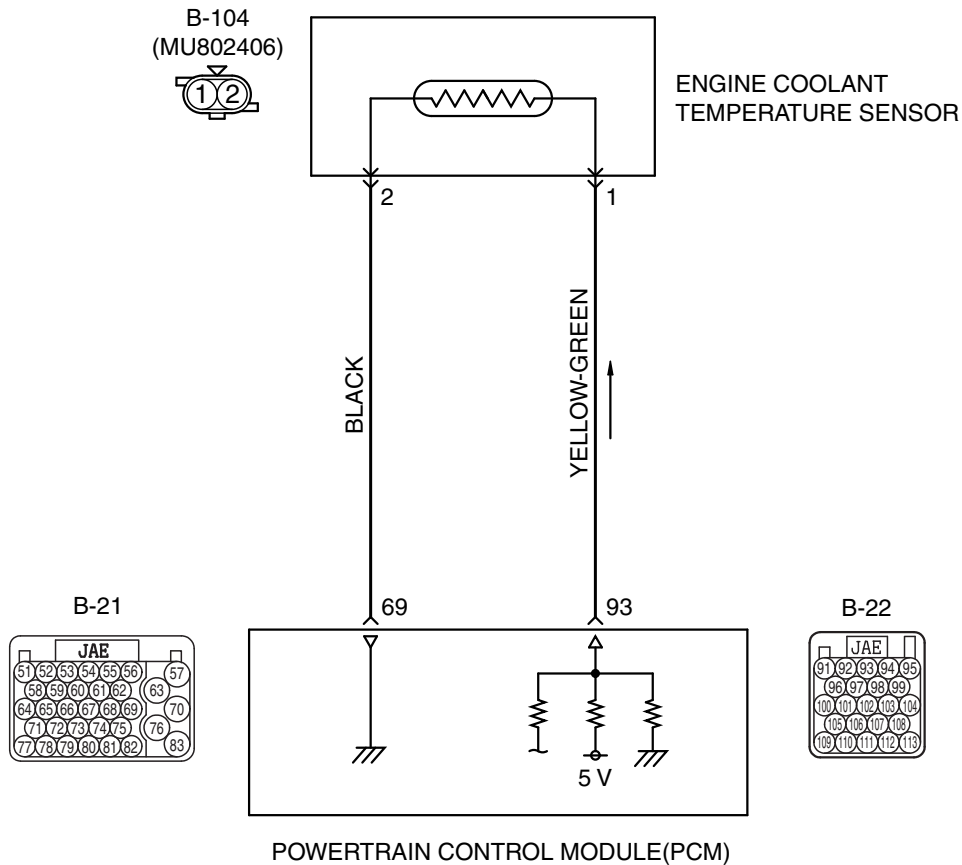
NO : The inspection is complete.

DTC P0116: Engine Coolant Temperature Circuit Range/Performance Problem

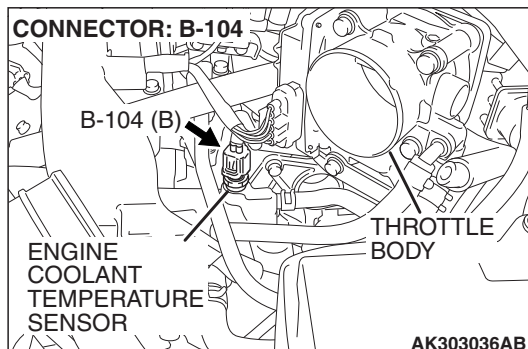
CAUTION

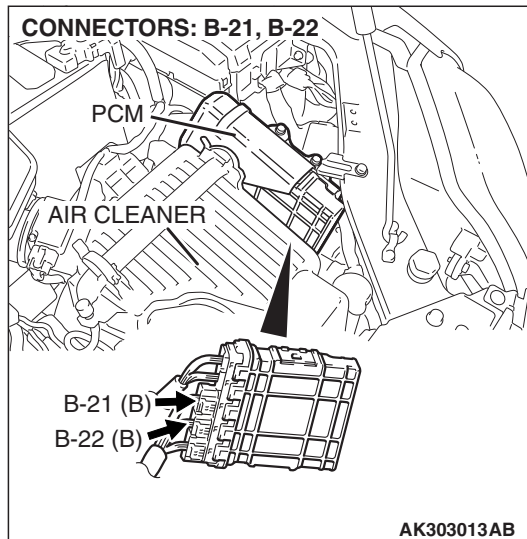
If DTC P0116 has been set, TCL related DTC U1120 is also set. After P0116 has been diagnosed, don't forget to erase DTC U1120.

Engine Coolant Temperature Sensor Circuit



AK302836





CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 93) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded with PCM (terminal No. 69).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

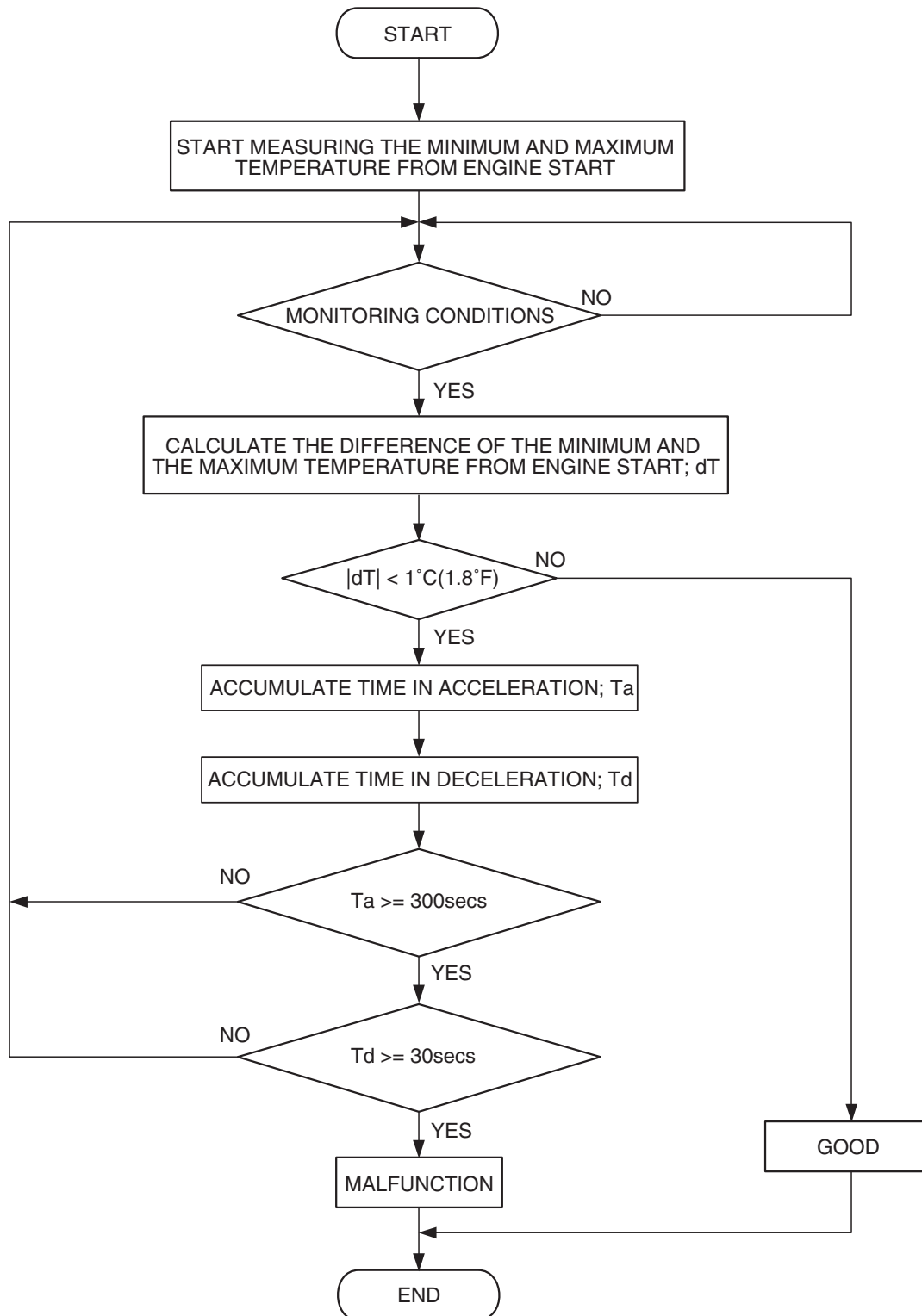
- Not applicable

Sensor (The sensor below is determined to be normal)

- Mass airflow sensor
- Intake air temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

- Engine coolant temperature was more than 7°C (45°F) when the engine started.
- The accumulation is more than 300 seconds during the acceleration having the mass airflow rate of 12 g/sec or more.
- The accumulation is more than 30 seconds during the deceleration having the mass airflow rate of 9 g/sec or less.

Judgement Criterion

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

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function–OBD-II Drive Cycle–Pattern 9 [P.13B-5](#).

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

- Engine coolant temperature sensor failed.
- Engine coolant temperature sensor harness damage, or connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

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

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

⚠ CAUTION

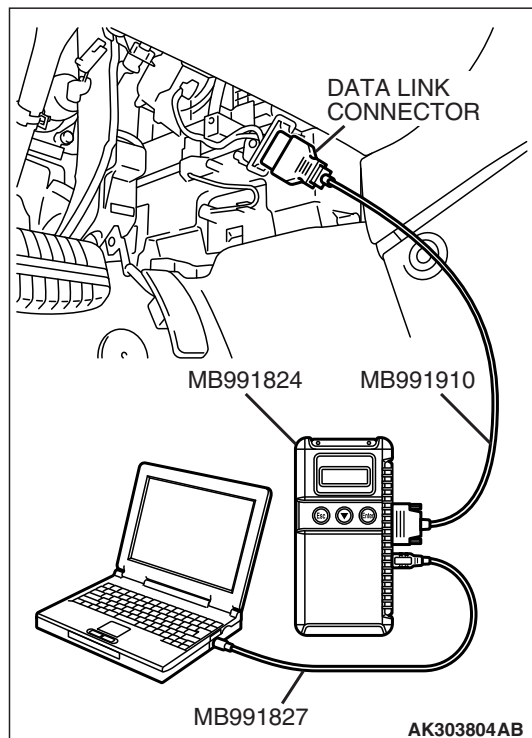
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

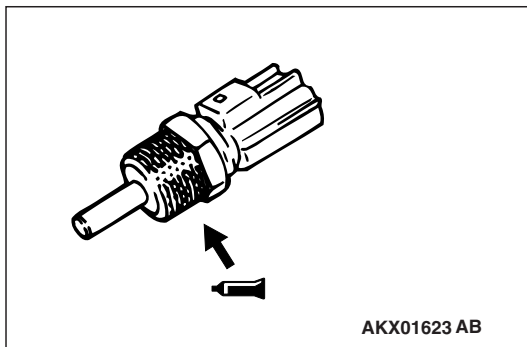
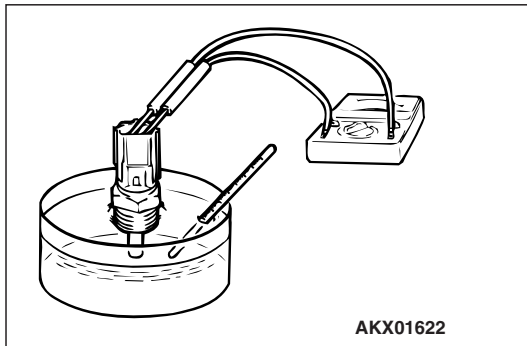
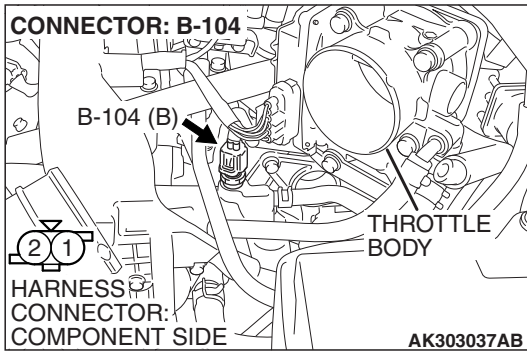
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 6, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.





STEP 2. Check the engine coolant temperature sensor.

- (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.

Standard value:

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

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

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

Q: Is the measured resistance normal?

YES : Go to Step 3.

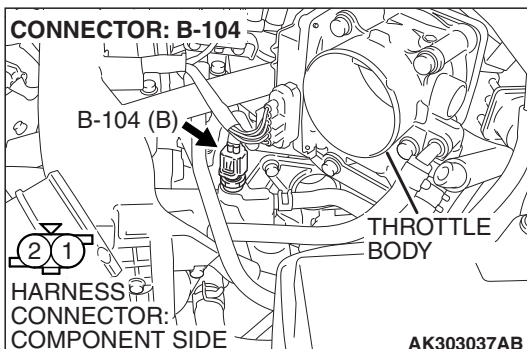
NO : Replace the engine coolant temperature sensor. Then go to Step 9.

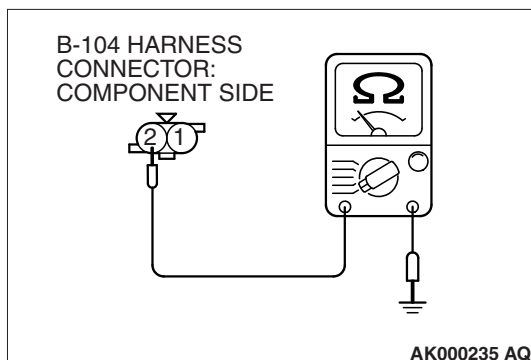
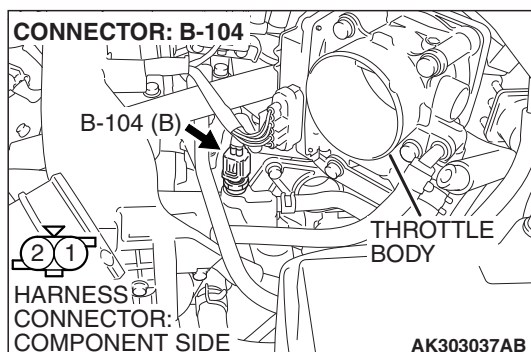
STEP 3. Check harness connector B-104 at the engine coolant temperature sensor for damage.

Q: Is the connector in good condition?

YES : Go to Step 4.

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





STEP 4. Check for continuity at engine coolant temperature sensor harness side connector B-104.

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

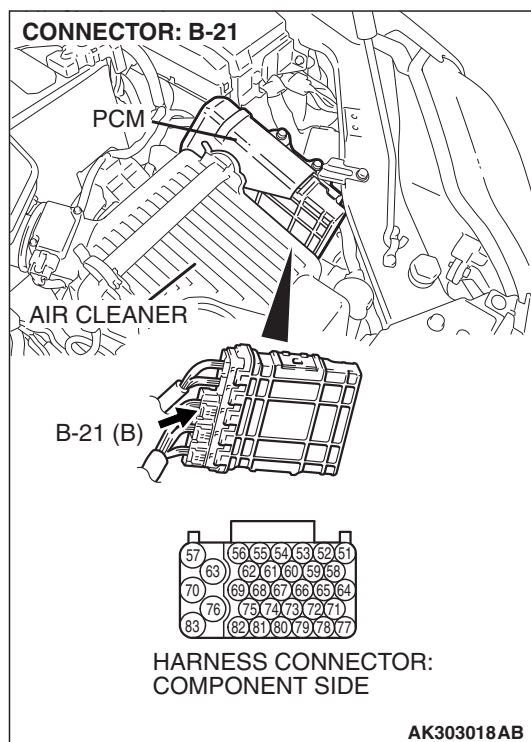
(2) Check for the continuity between terminal No. 2 and ground.

- Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 5.



STEP 5. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

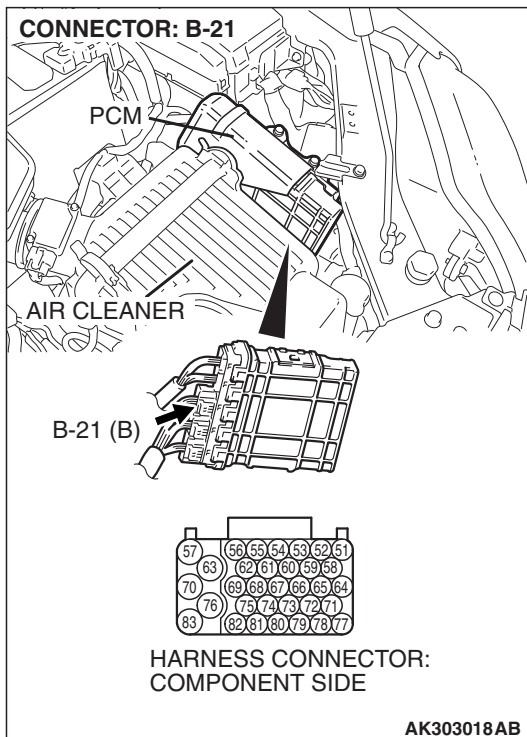
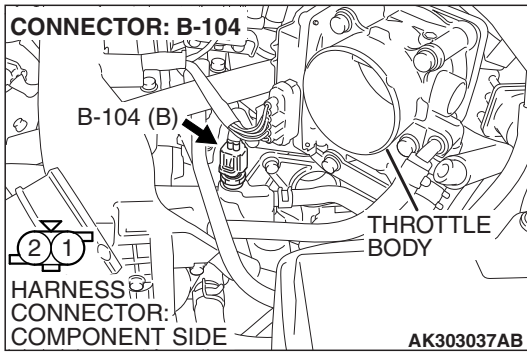
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#) Then go to Step 9.

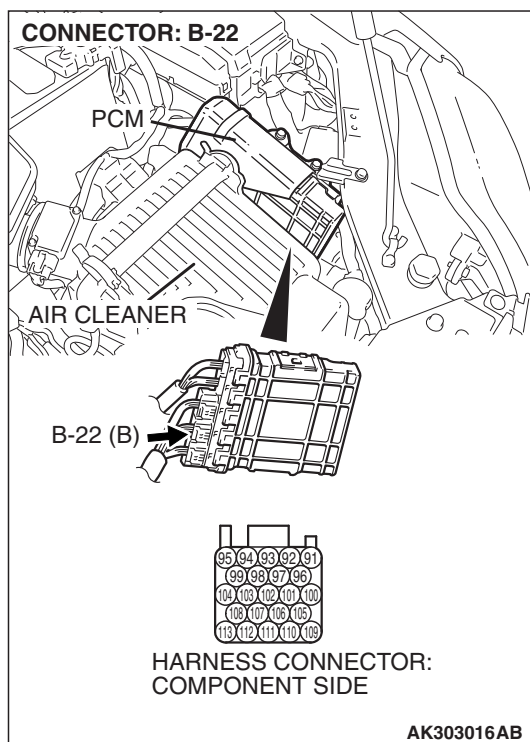
STEP 6. Check for harness damage between engine coolant temperature sensor connector B-104 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 9.

NO : Repair it. Then go to Step 9.



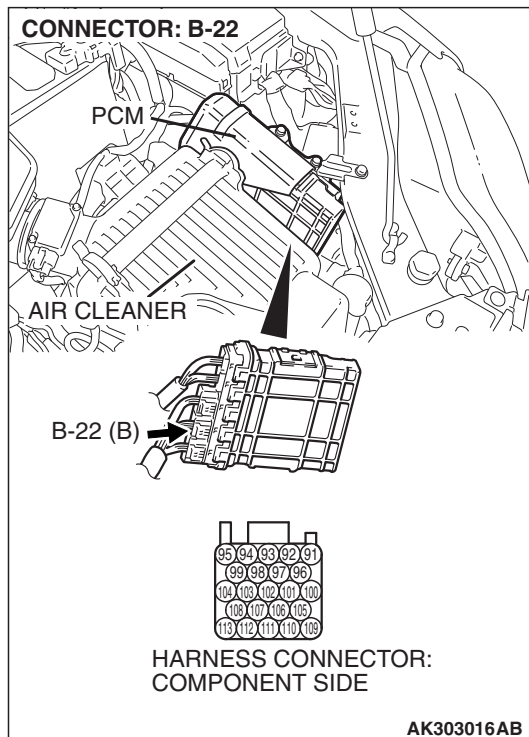
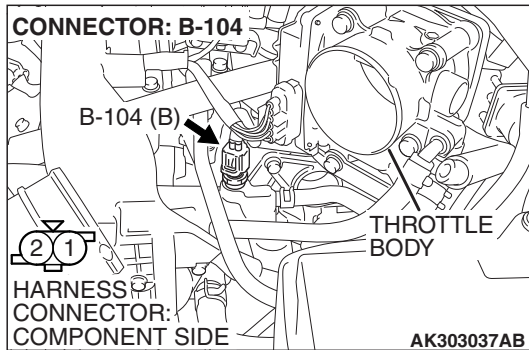


STEP 7. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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



STEP 8. Check for harness damage between engine coolant temperature sensor connector B-104 (terminal No. 1) and PCM connector B-22 (terminal No. 93).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 9. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 [P.13B-5](#).

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

Q: Is DTC P0116 set?

YES : Retry the troubleshooting.

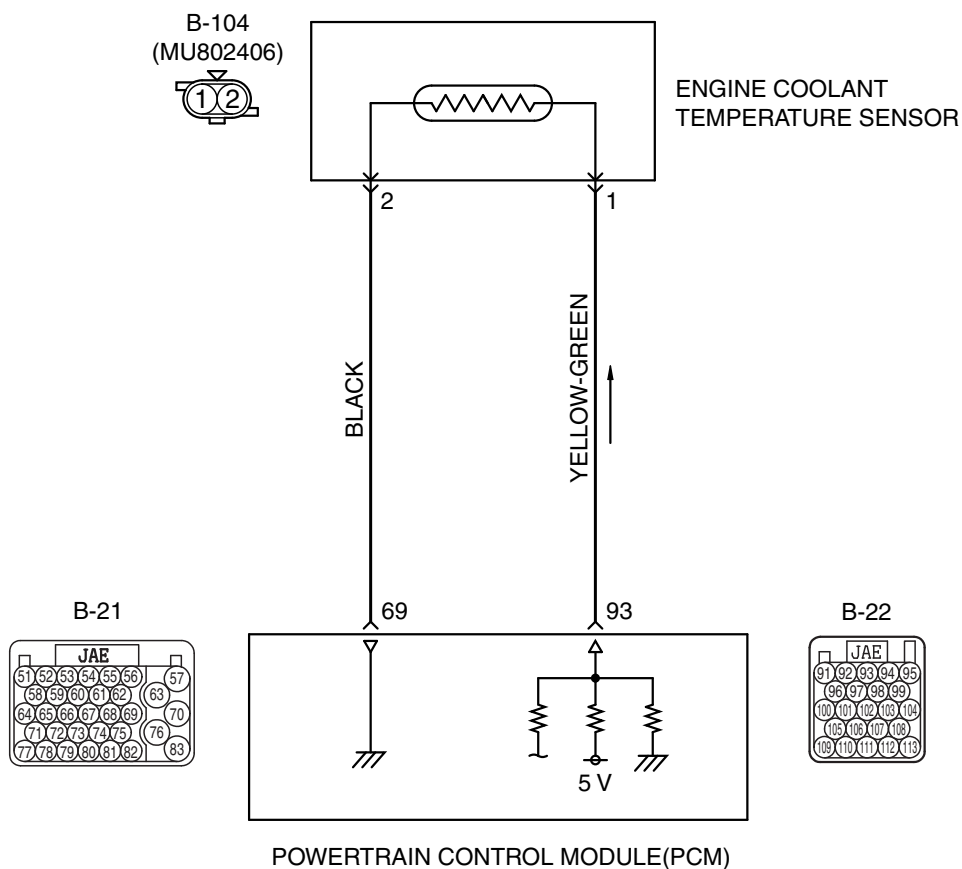
NO : The inspection is complete.

DTC P0117: Engine Coolant Temperature Circuit Low Input

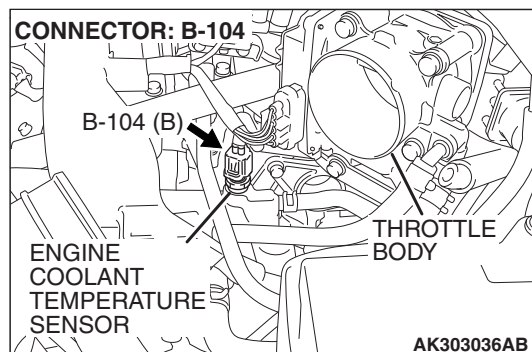
CAUTION

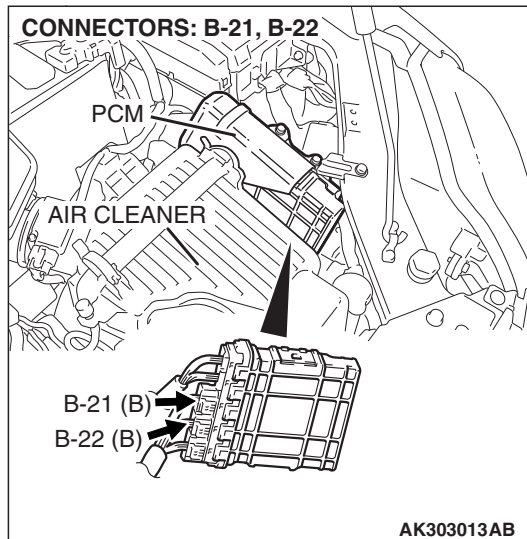
If DTC P0117 has been set, TCL and air conditioner related DTC U1120 is also set. After P0117 has been diagnosed, don't forget to erase DTC U1120.

Engine Coolant Temperature Sensor Circuit



AK302836





CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 93) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded with PCM (terminal No. 69).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

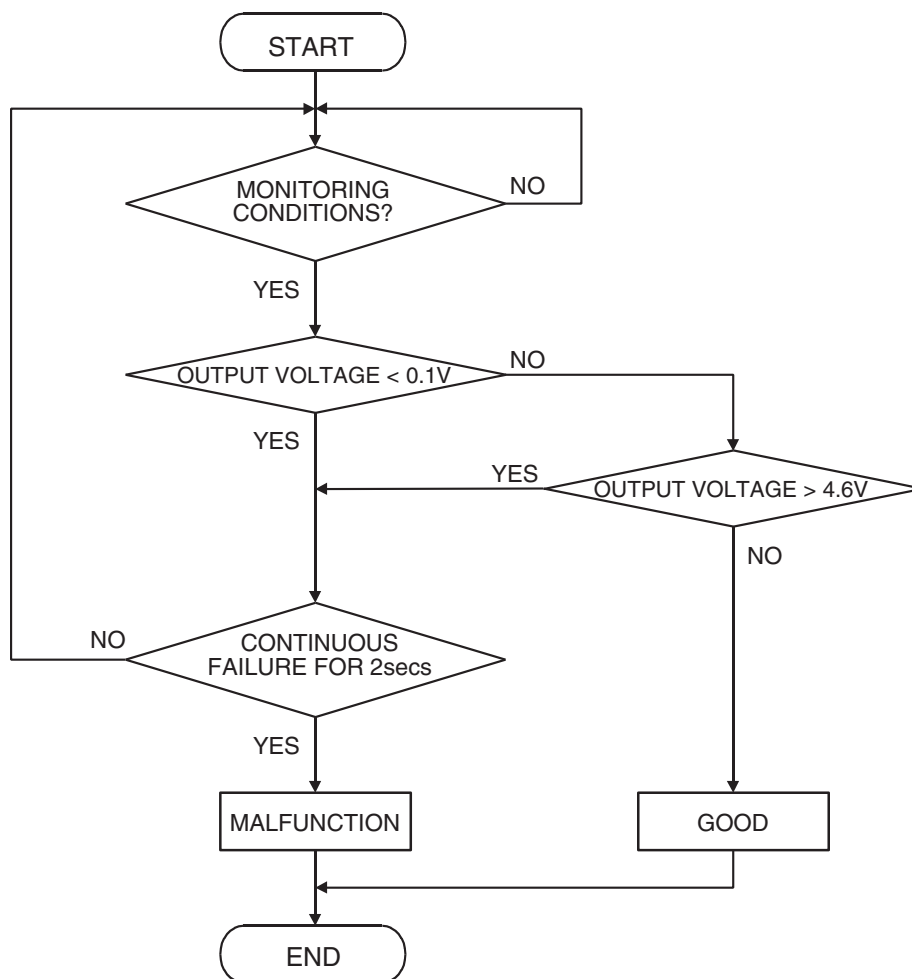
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302388

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).

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.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

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

⚠ CAUTION

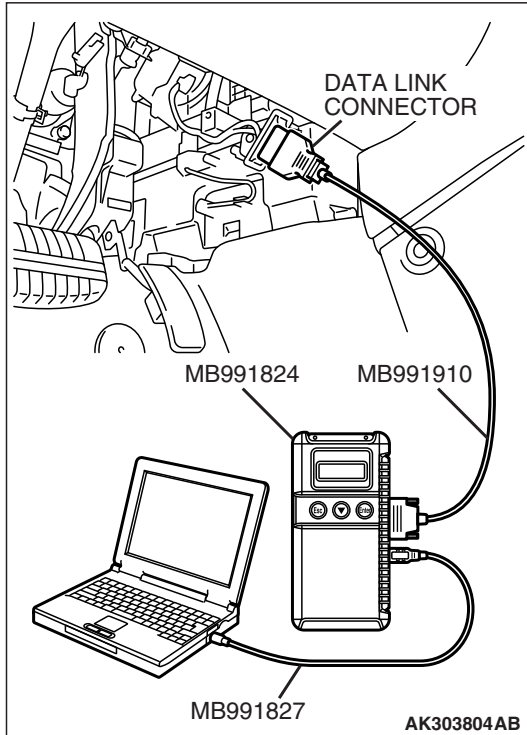
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

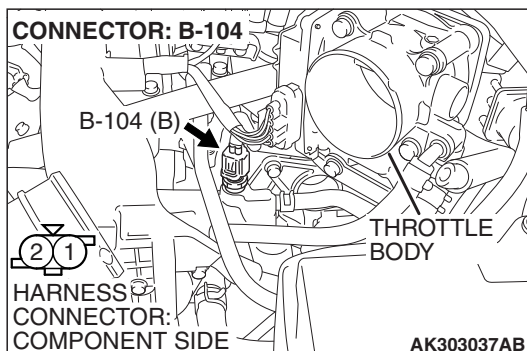


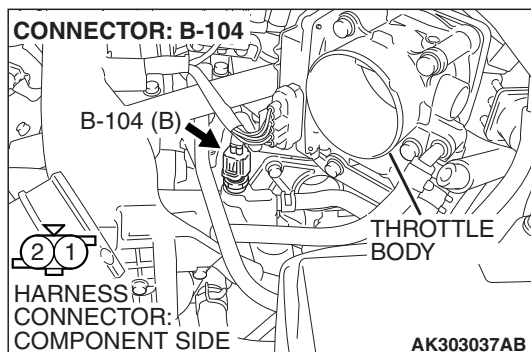
STEP 2. Check harness connector B-104 at the engine coolant temperature sensor for damage.

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 6.



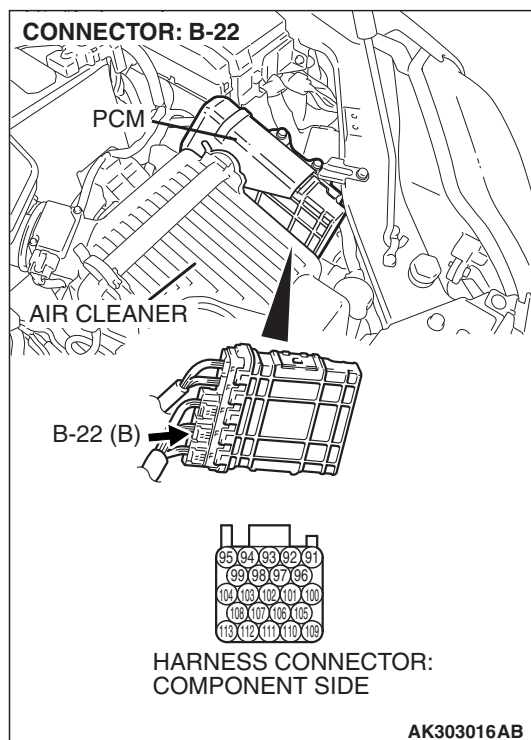


STEP 3. Check for short circuit to ground between engine coolant temperature sensor connector B-104 (terminal No. 1) and PCM connector B-22 (terminal No. 93).

Q: Is the harness wire in good condition?

YES : Go to Step 4.

NO : Repair it. Then go to Step 6.

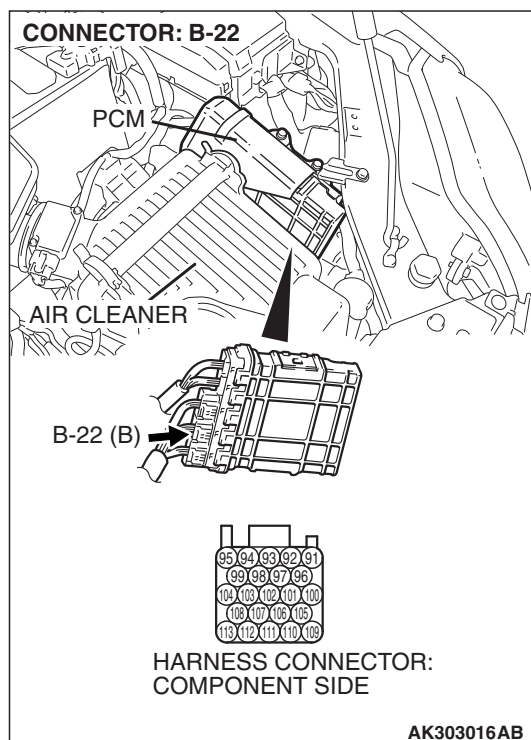


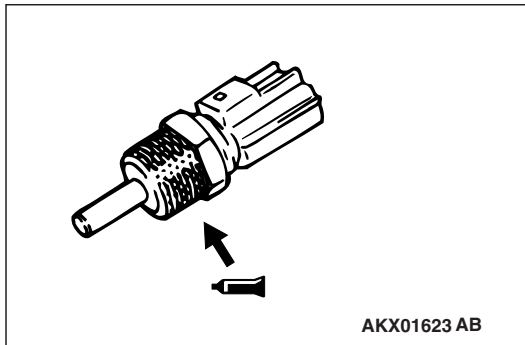
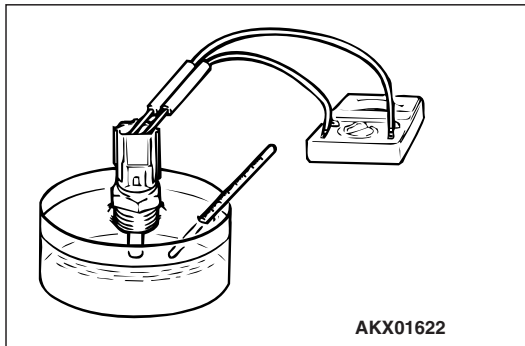
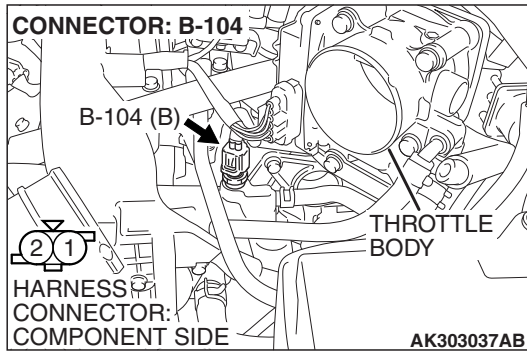
STEP 4. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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



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

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

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

Standard value:

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

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

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

Q: Is the measured resistance at the standard value?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 6.

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

STEP 6. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0117 set?

YES : Retry the troubleshooting.

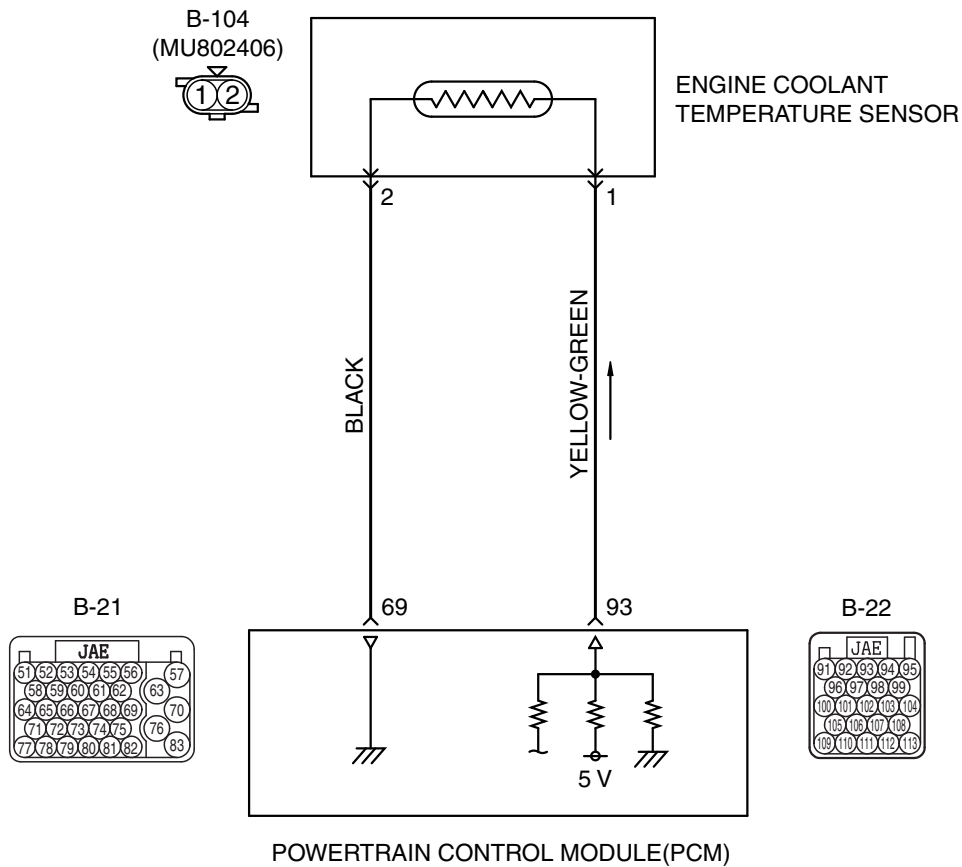
NO : The inspection is complete.

DTC P0118: Engine Coolant Temperature Circuit High Input

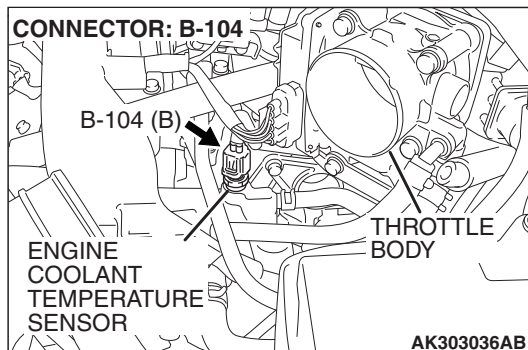
CAUTION

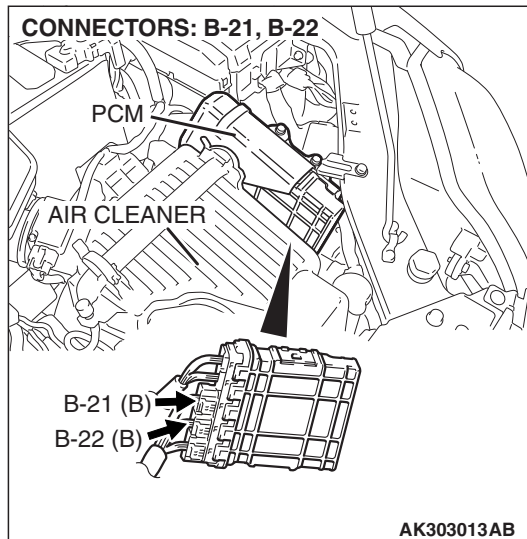
If DTC P0118 has been set, TCL and air conditioner related DTC U1120 is also set. After P0118 has been diagnosed, don't forget to erase DTC U1120.

Engine Coolant Temperature Sensor Circuit



AK302836





CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 93) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded with PCM (terminal No. 69).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

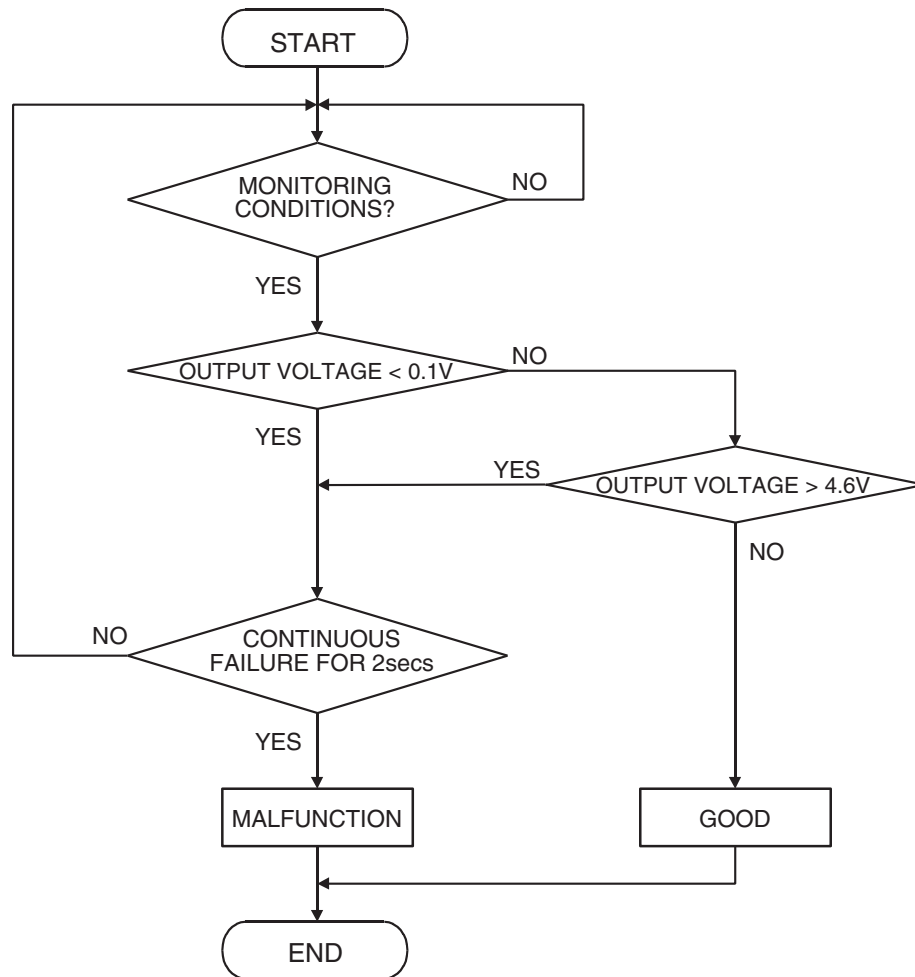
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302388

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function—OBD-II Drive Cycle—Pattern 23 [P.13B-5](#).

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.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991923: Power Plant ECU Check Harness

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

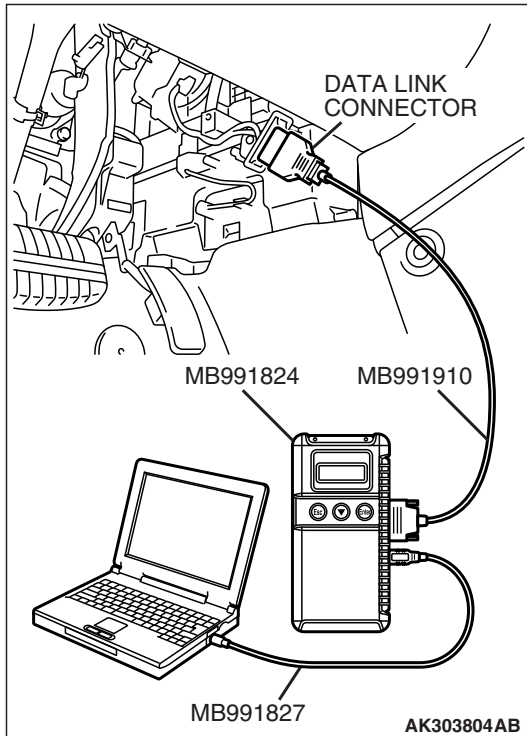
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

Q: Is the sensor operating properly?

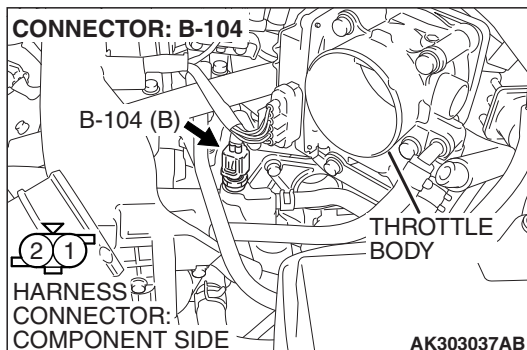
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).

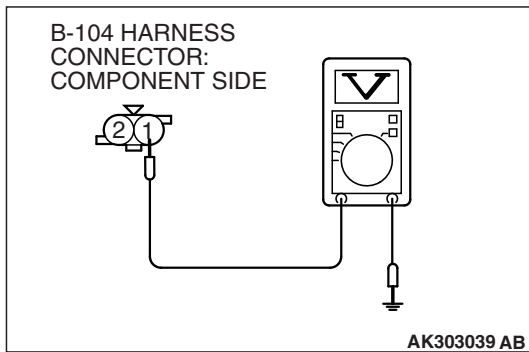
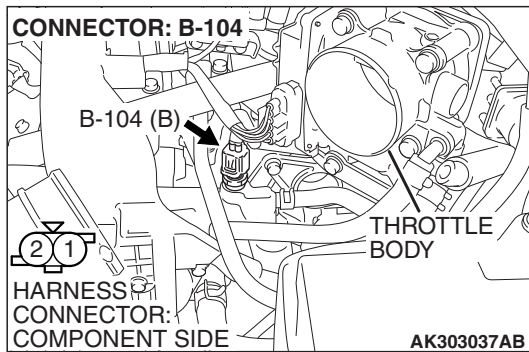
NO : Go to Step 2.

**STEP 2. Check harness connector B-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 11.





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.

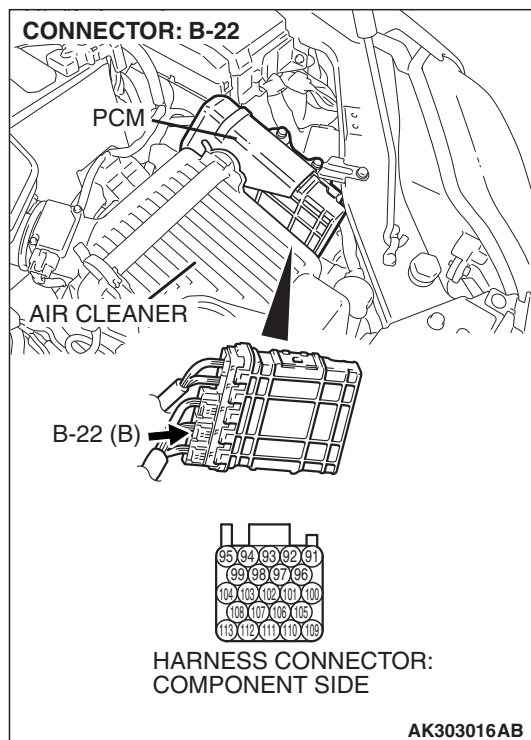
- Voltage should be between 4.5 and 4.9 volts.

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

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

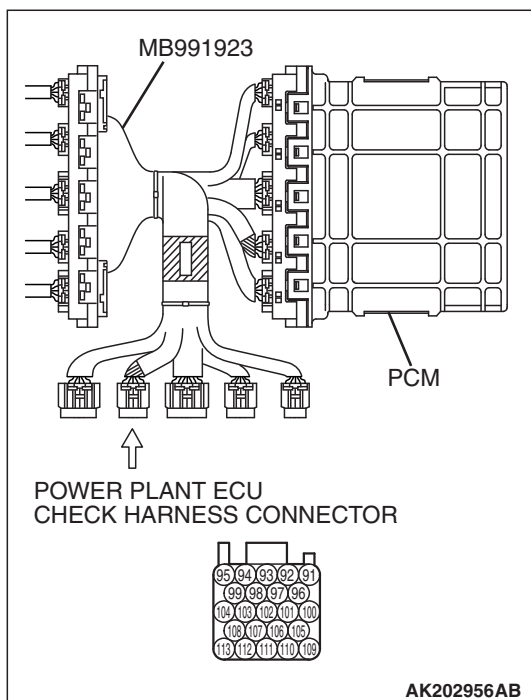
YES : Go to Step 7.

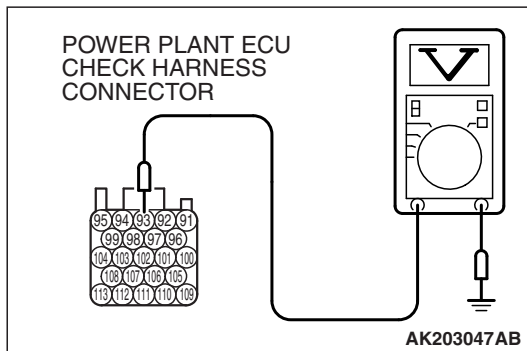
NO : Go to Step 4.



STEP 4. Measure the sensor supply voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

- (1) Disconnect all PCM connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
- (2) Disconnect the engine coolant temperature sensor connector B-104.
- (3) Turn the ignition switch to the "ON" position.



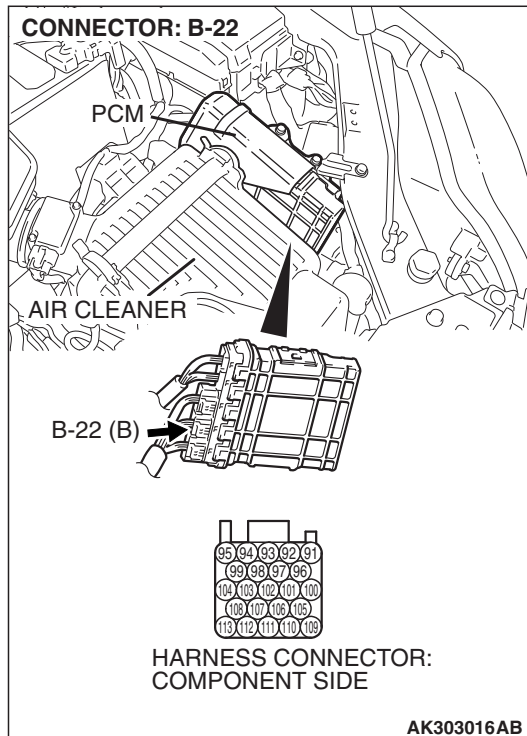


- (4) Measure the voltage between terminal No. 93 and ground.
• Voltage should be between 4.5 and 4.9 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 5.

NO : Go to Step 6.

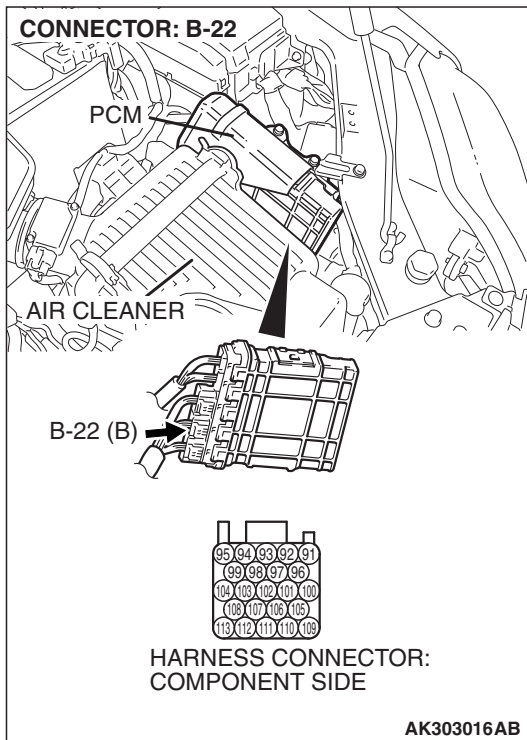


STEP 5. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between engine coolant temperature sensor connector B-104 (terminal No. 1) and PCM connector B-22 (terminal No. 93) because of open circuit. Then go to Step 11.

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

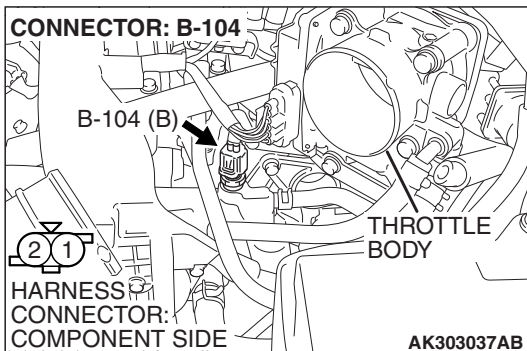


STEP 6. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

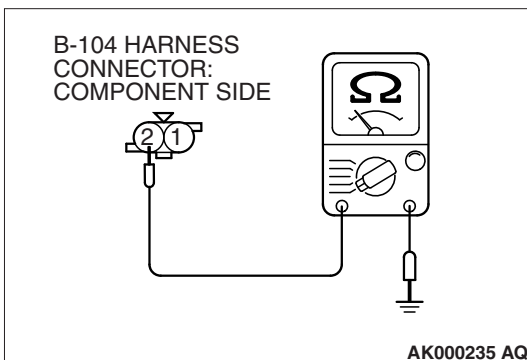
YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 11.

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



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

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



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

- Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 10.

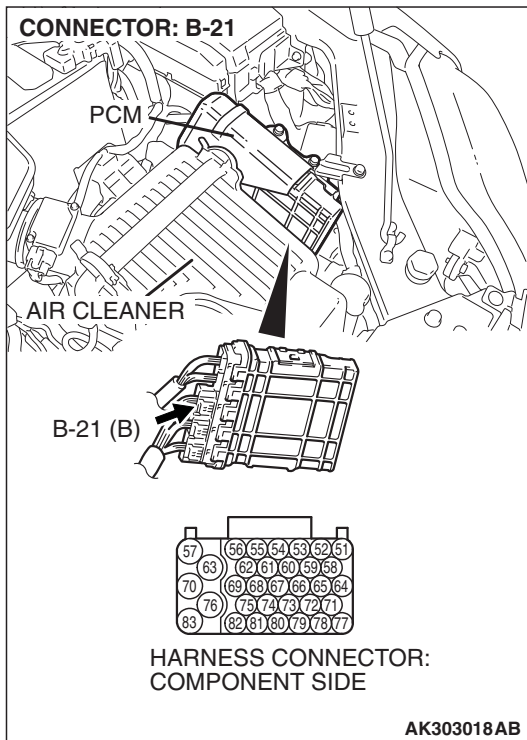
NO : Go to Step 8.

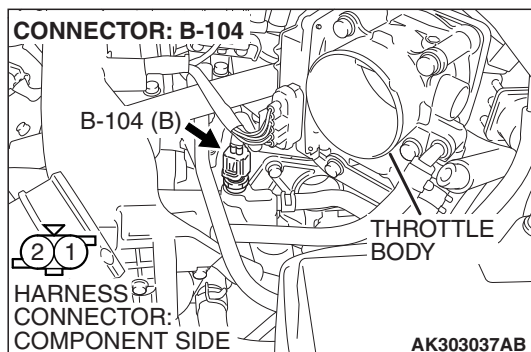
STEP 8. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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



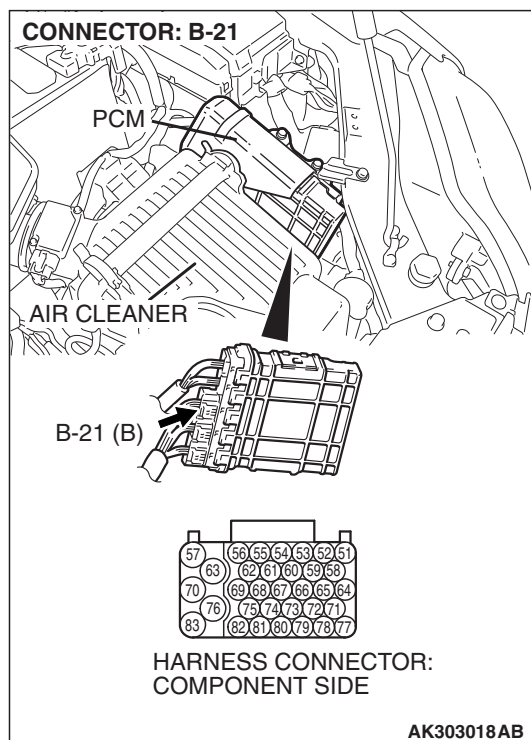


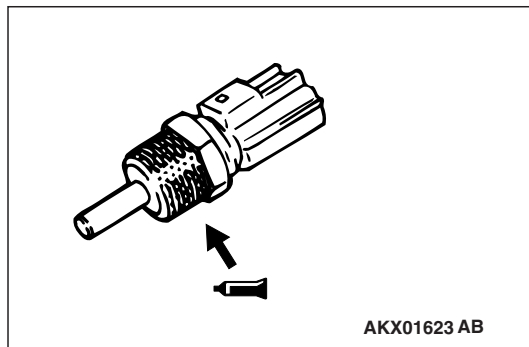
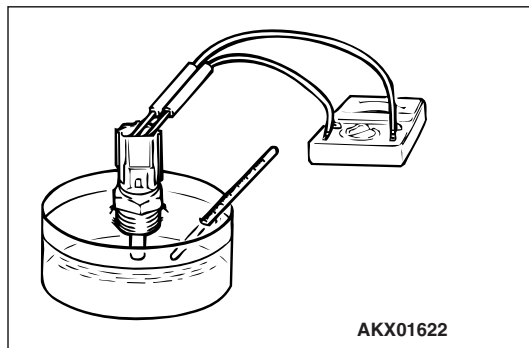
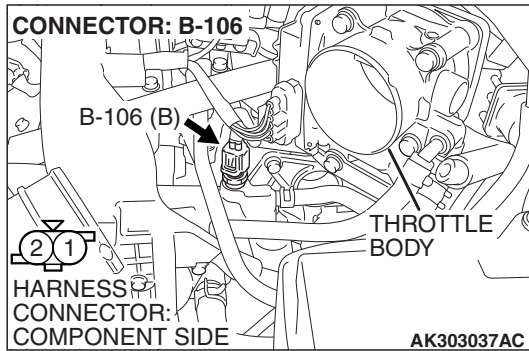
STEP 9. Check for open circuit between engine coolant sensor connector B-104 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 11.

NO : Repair it. Then go to Step 11.





STEP 10. Check the engine coolant temperature sensor.

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

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

Standard value:

14 – 17 k Ω [at – 20°C (– 4°F)]

5.1 – 6.5 k Ω [at 0°C (32°F)]

2.1 – 2.7 k Ω [at 20°C (68°F)]

0.9 – 1.3 k Ω [at 40°C (104°F)]

0.48 – 0.68 k Ω [at 60°C (140°F)]

0.26 – 0.36 k Ω [at 80°C (176°F)]

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

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

Q: Is the measured resistance at the standard value?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 11.

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

STEP 11. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13B-5](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0118 set?

YES : Retry the troubleshooting.

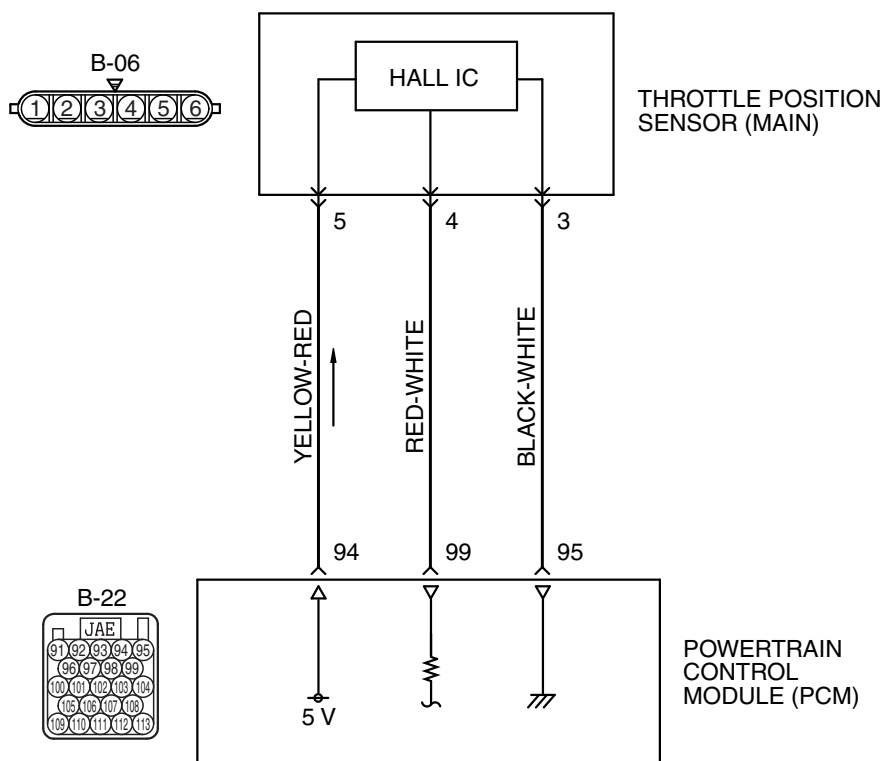
NO : The inspection is complete.

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

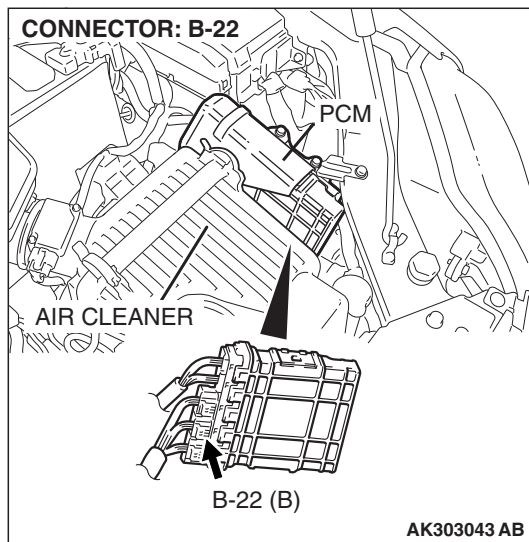
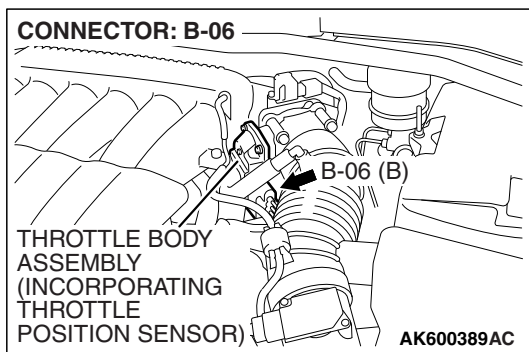
CAUTION

If DTC P0122 has been set, TCL related DTC U1120 is also set. After P0122 has been diagnosed, don't forget to erase DTC U1120.

Throttle Position Sensor (main) Circuit



AK503863



CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the PCM (terminal No. 94).
- A voltage that is according to the throttle opening angle is sent to the PCM (terminal No. 99) from the throttle position sensor (main) output terminal (terminal No. 4).
- The ground terminal (terminal No. 3) is grounded with PCM (terminal No. 95).

TECHNICAL DESCRIPTION

- The throttle position sensor (main) outputs voltage which corresponds to the throttle valve opening angle.
- The PCM checks whether the voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

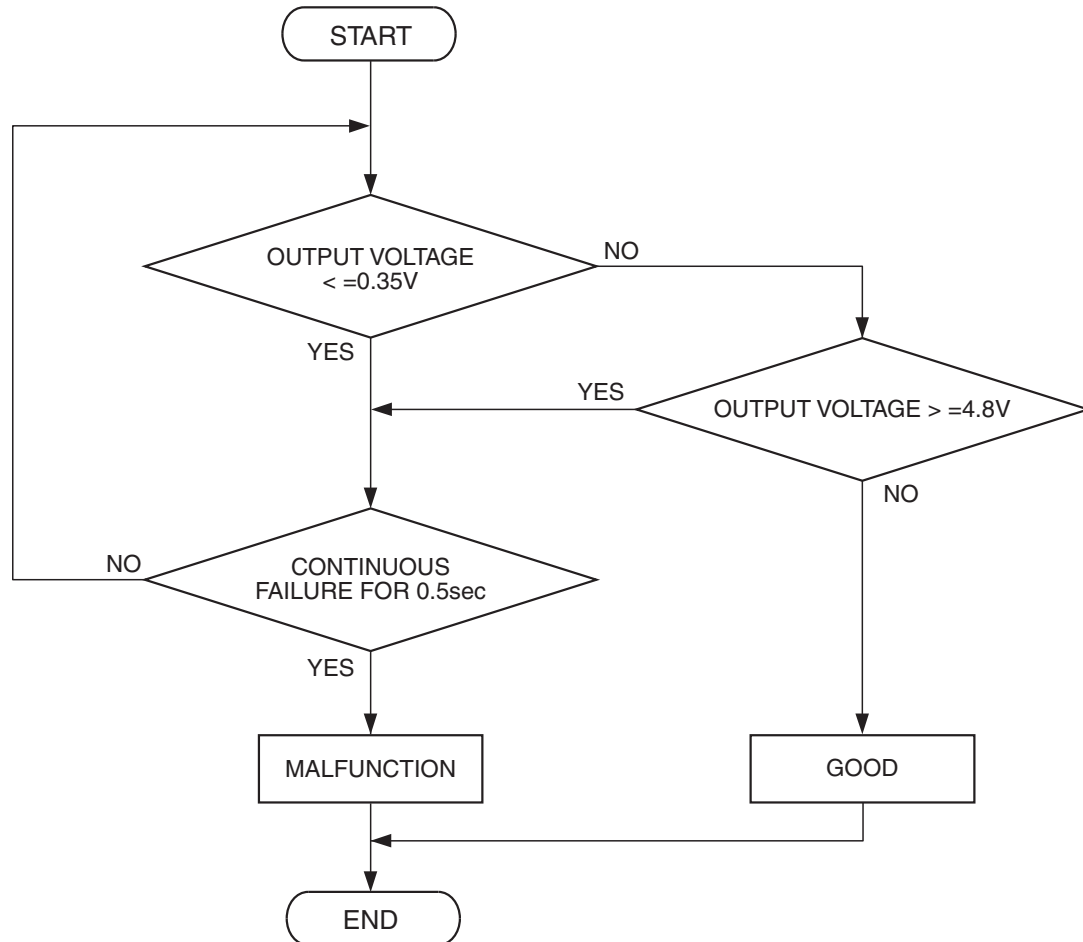
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302389

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

None.

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

- Throttle position sensor failed.
- Open or shorted throttle position sensor (main) circuit, harness damage, or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

STEP 1. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (6) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
 - Output voltage should be between 300 and 700 millivolts when the throttle valve is fully closed with your finger.
 - Output voltage should be 4,000 millivolts or more when the throttle valve is fully open with your finger.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

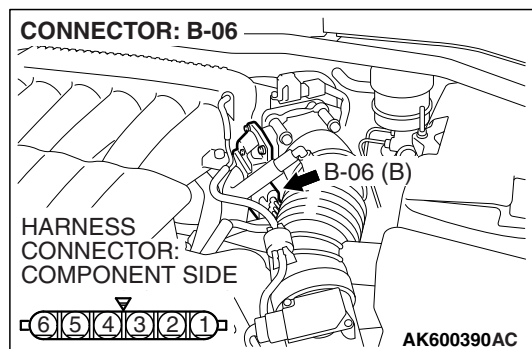
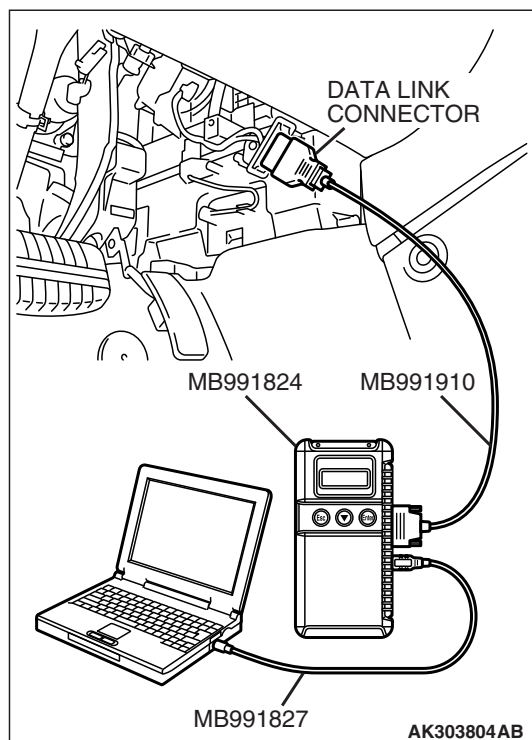
NO : Go to Step 2.

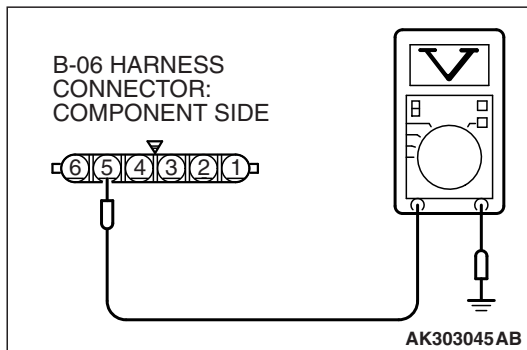
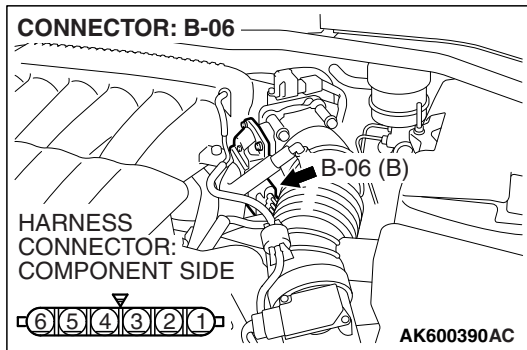
STEP 2. Check harness connector B-06 at throttle position sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

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



**STEP 3. Measure the sensor supply voltage at throttle position sensor harness side connector B-06.**

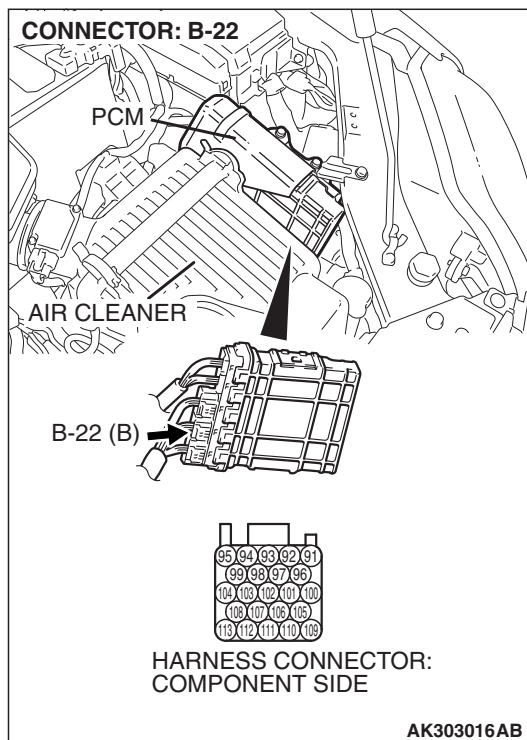
- (1) Disconnect the connector B-06 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 5 and ground.
 - Voltage should be between 4.9 and 5.1 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 7.

NO : Go to Step 4.

**STEP 4. Check harness connector B-22 at PCM for damage.**

Q: Is the harness connector in good condition?

YES : Go to Step 5.

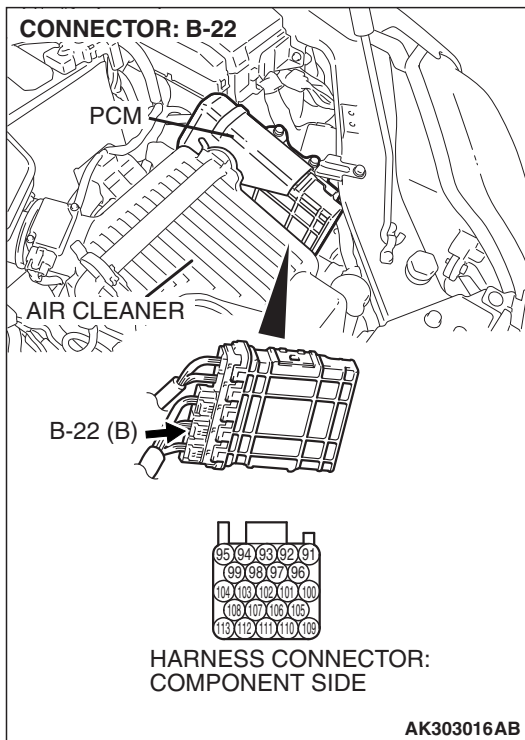
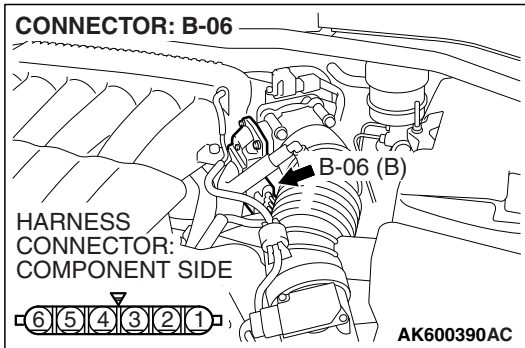
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

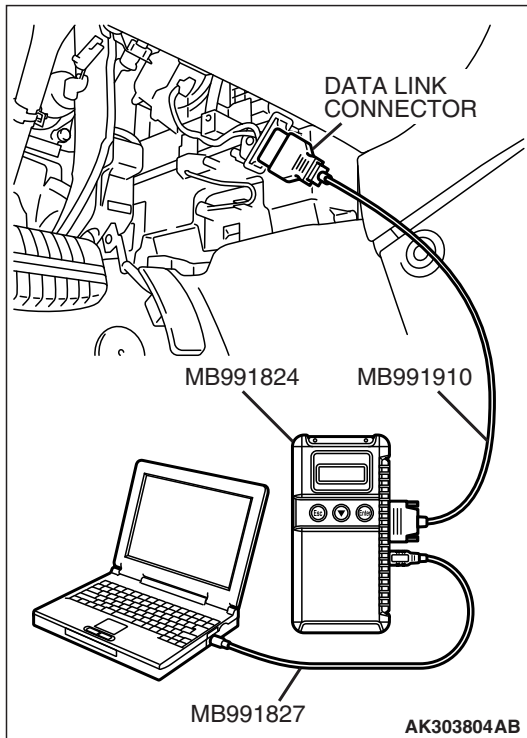
STEP 5. Check for open circuit and short circuit to ground between throttle position sensor connector B-06 (terminal No. 5) and PCM connector B-22 (terminal No. 94).

Q: Is the harness wire in good condition?

YES : Go to Step 6.

NO : Repair it. Then go to Step 11.





STEP 6. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (6) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
 - Output voltage should be between 300 and 700 millivolts when the throttle valve is fully closed with your finger.
 - Output voltage should be 4,000 millivolts or more when the throttle valve is fully open with your finger.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

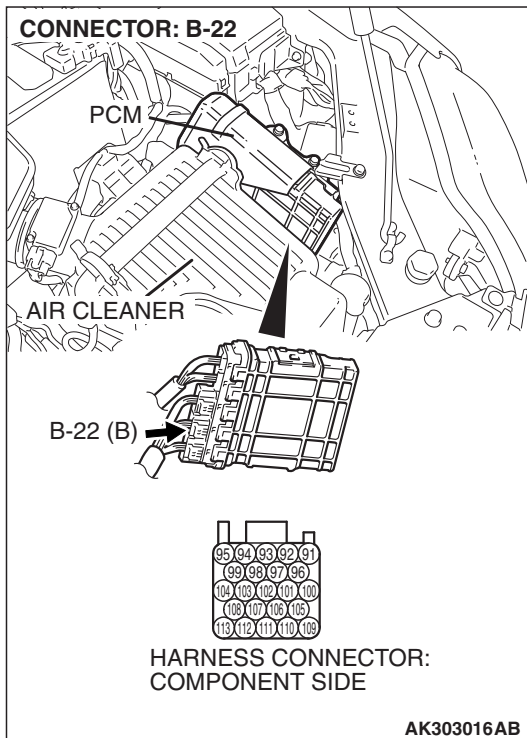
- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).
- NO :** Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 11.

STEP 7. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

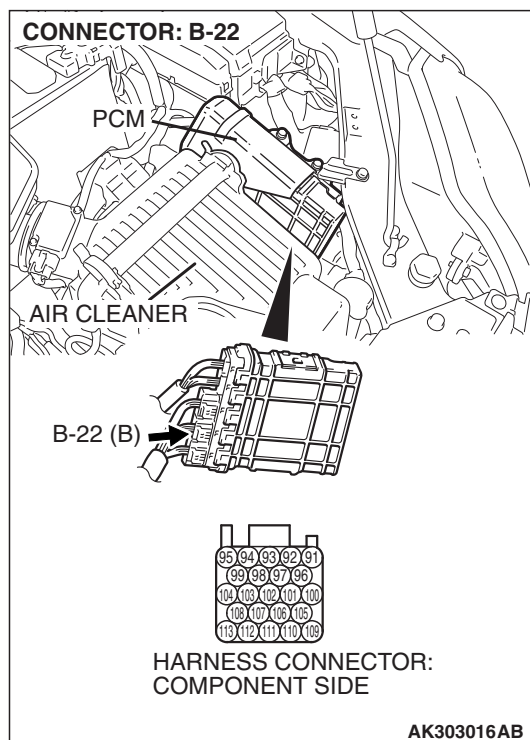
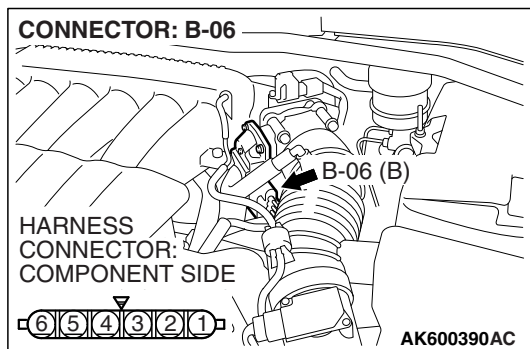


STEP 8. Check for harness damage between throttle position sensor connector B-06 (terminal No. 5) and PCM connector B-22 (terminal No. 94).

Q: Is the harness wire in good condition?

YES : Go to Step 9.

NO : Repair it. Then go to Step 11.

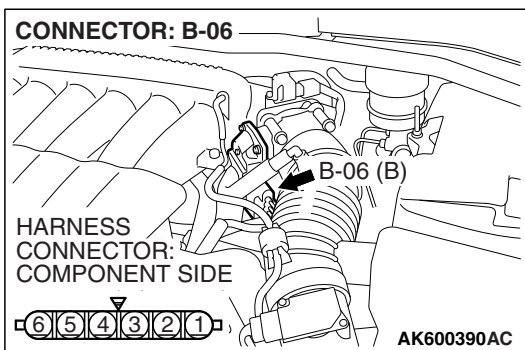
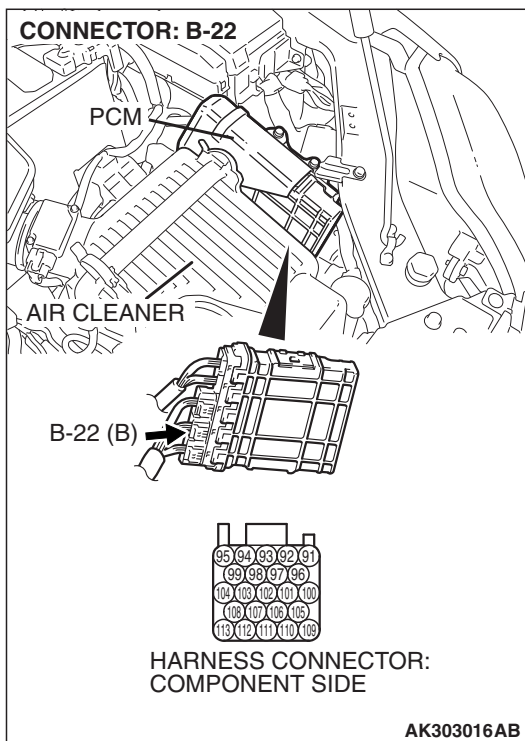
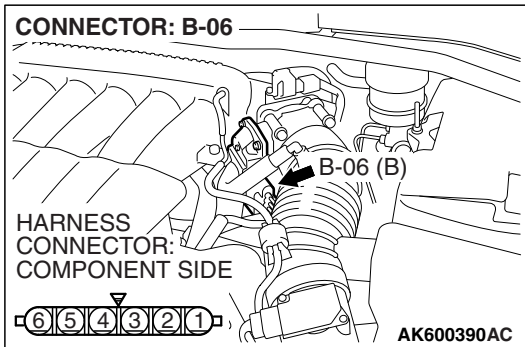


STEP 9. Check for open circuit, short circuit to ground and harness damage between throttle position sensor connector B-06 (terminal No. 4) and PCM connector B-22 (terminal No. 99).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 11.



STEP 10. Replace the throttle body assembly.

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

Q: Is DTC P0122 set?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table P.54A-10. Then go to Step 11.

NO : The inspection is complete.

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

⚠ CAUTION

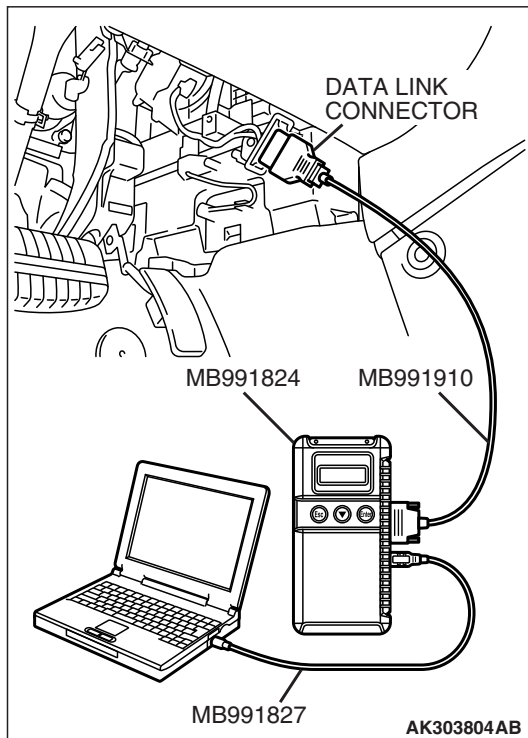
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

Q: Is DTC P0122 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

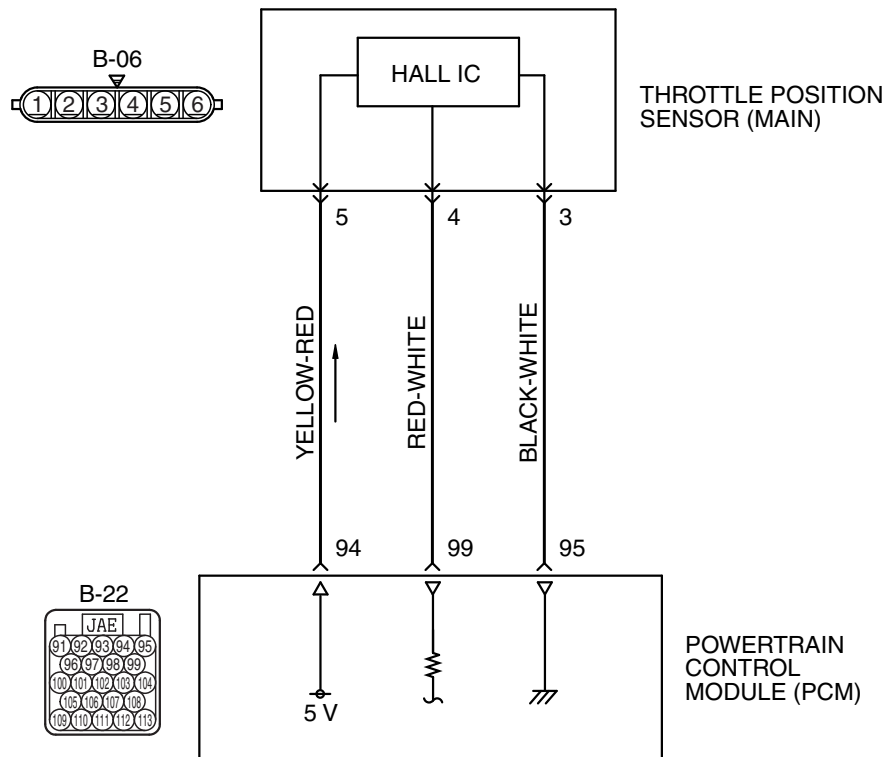


DTC P0123: Throttle Position Sensor (main) Circuit High Input

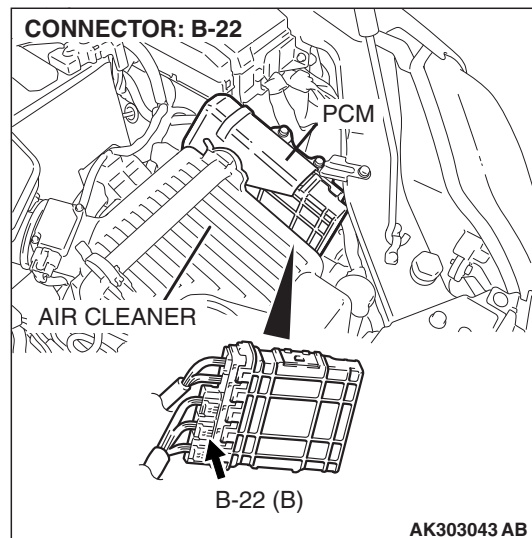
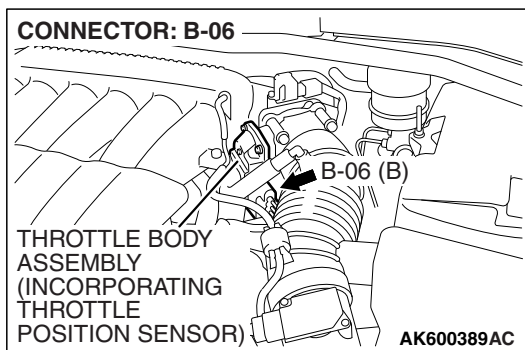
CAUTION

If DTC P0123 has been set, TCL related DTC U1120 is also set. After P0123 has been diagnosed, don't forget to erase DTC U1120.

Throttle Position Sensor (main) Circuit



AK503863



CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the PCM (terminal No. 94).
- A voltage that is according to the throttle opening angle is sent to the PCM (terminal No. 99) from the throttle position sensor (main) output terminal (terminal No. 4).
- The ground terminal (terminal No. 3) is grounded with PCM (terminal No. 95).

TECHNICAL DESCRIPTION

- The throttle position sensor (main) outputs voltage which corresponds to the throttle valve opening angle.
- The PCM checks whether the voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

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

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

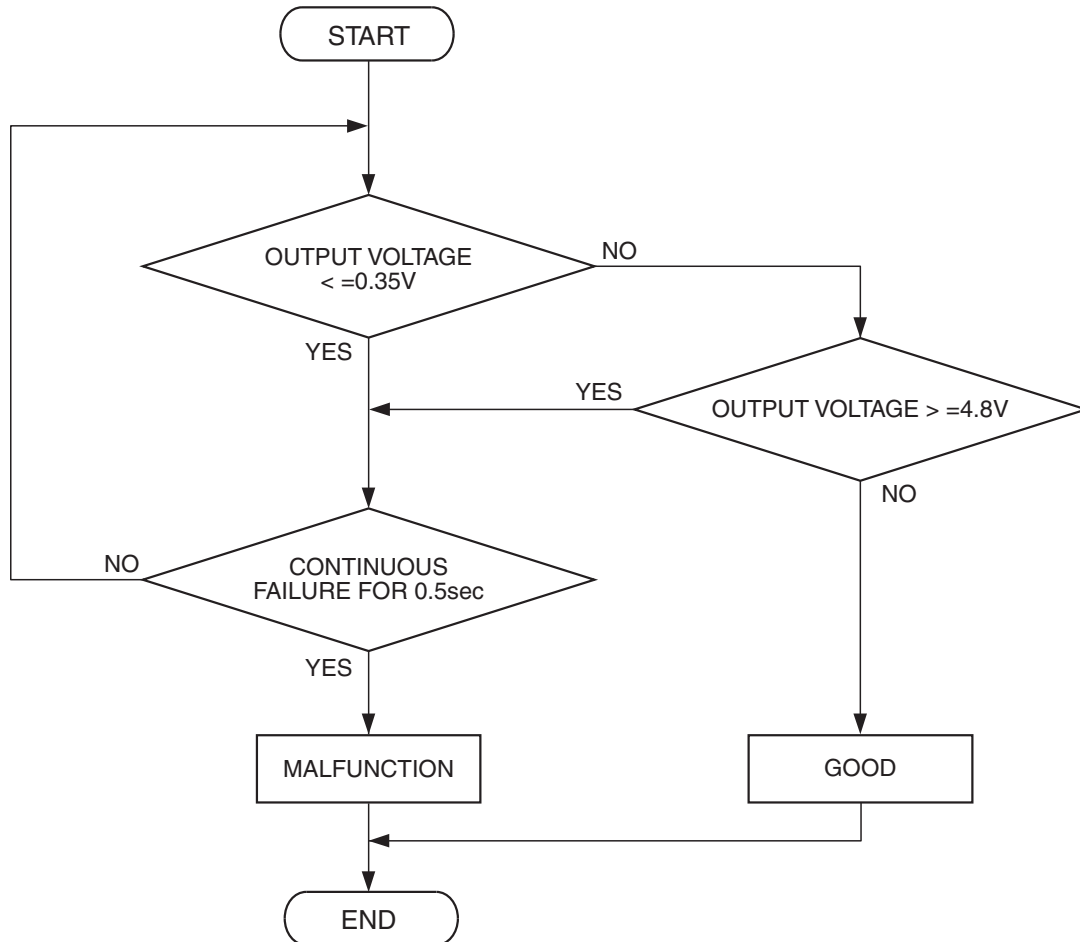
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302389

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

None.

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

- Throttle position sensor failed.
- Open throttle position sensor (main) circuit, harness damage, or connector damage.
- PCM failed.

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (6) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
 - Output voltage should be between 300 and 700 millivolts when the throttle valve is fully closed with your finger.
 - Output voltage should be 4,000 millivolts or more when the throttle valve is fully open with your finger.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

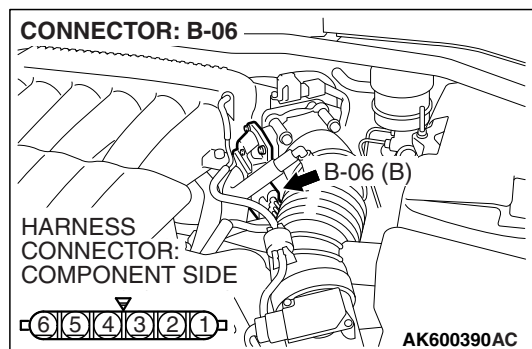
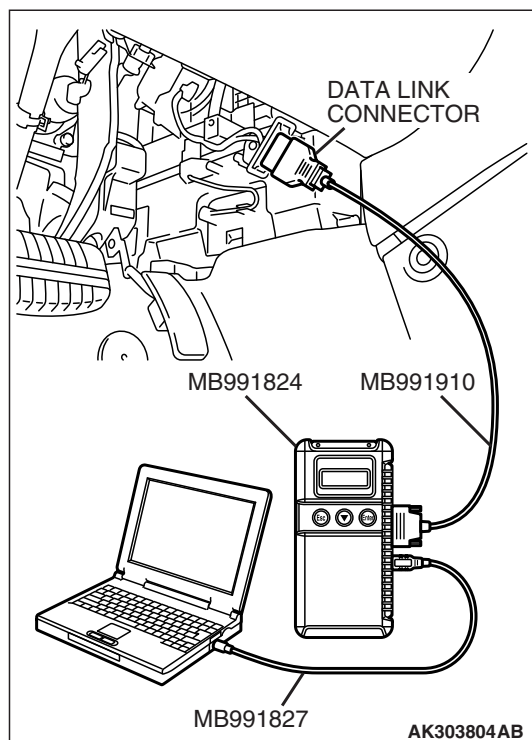
NO : Go to Step 2.

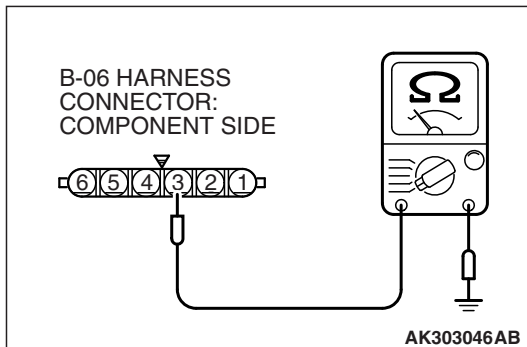
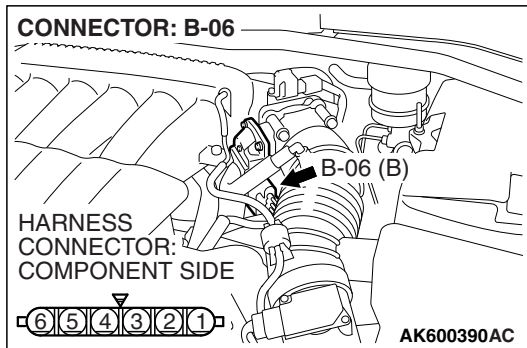
STEP 2. Check harness connector B-06 at throttle position sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

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





STEP 3. Check the continuity at throttle position sensor harness side connector B-06.

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

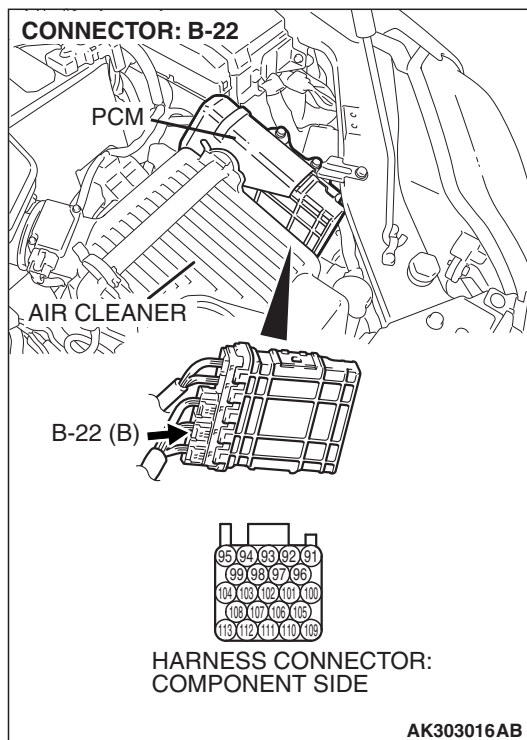
(2) Measure the continuity between terminal No. 3 and ground

- Continuity ($2\ \Omega$ or less)

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 4.



STEP 4. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

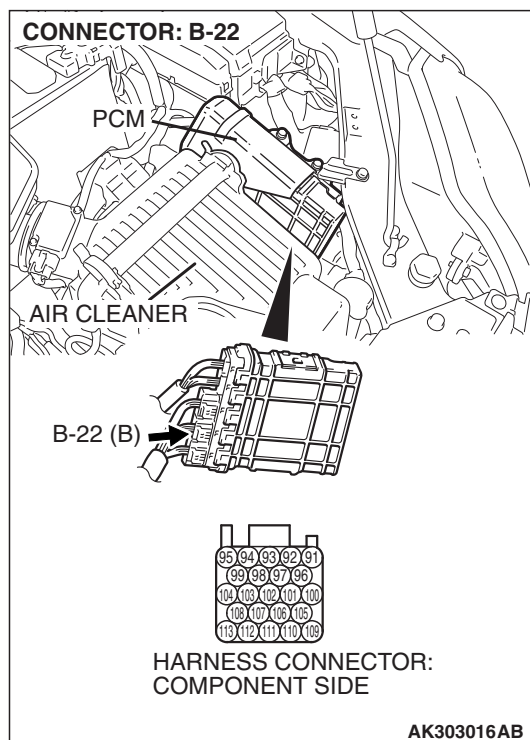
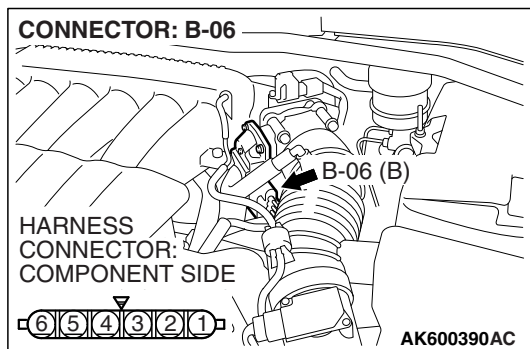
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 8.

STEP 5. Check for open circuit and harness damage between throttle position sensor connector B-06 (terminal No. 3) and PCM connector B-22 (terminal No. 95).

Q: Is the harness wire in good condition?

YES : Go to Step 6.

NO : Repair it. Then go to Step 8.



STEP 6. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

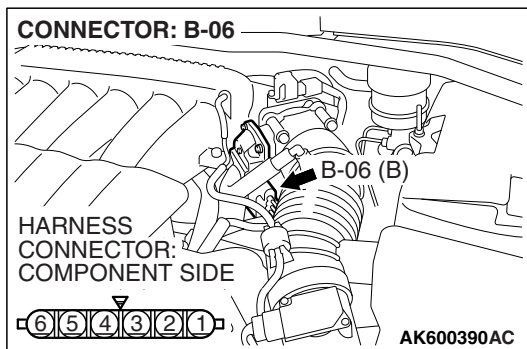
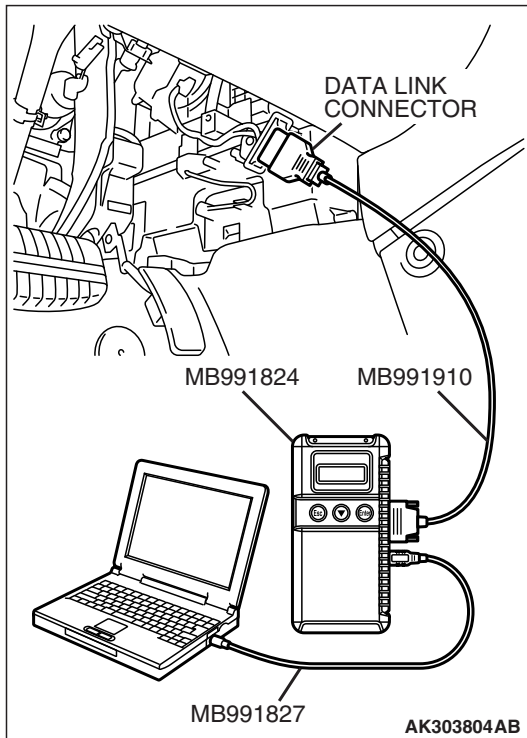
⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Detach the intake air hose at the throttle body.
- (4) Disconnect the connector of the throttle position sensor.
- (5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
- (6) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
 - Output voltage should be between 300 and 700 millivolts when the throttle valve is fully closed with your finger.
 - Output voltage should be 4,000 millivolts or more when the throttle valve is fully open with your finger.
- (7) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).
- NO :** Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 8.



STEP 7. Replace the throttle body assembly.

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

Q: Is DTC P0123 set?

- YES :** Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 8.
- NO :** The inspection is complete.

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

⚠ CAUTION

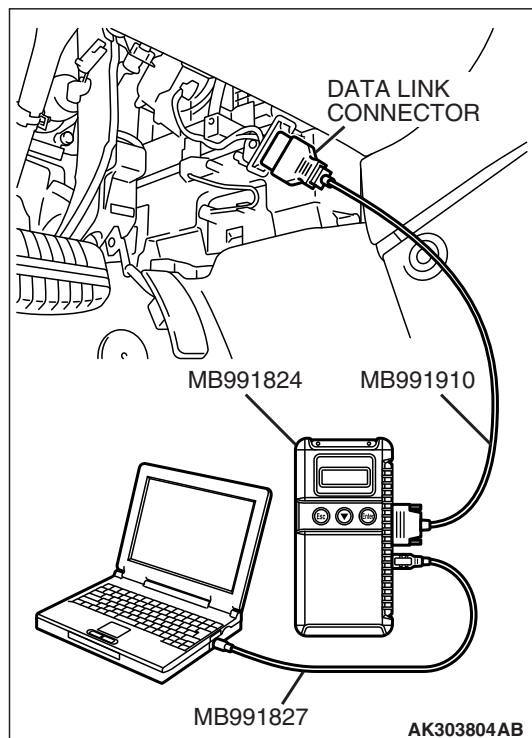
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

Q: Is DTC P0123 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

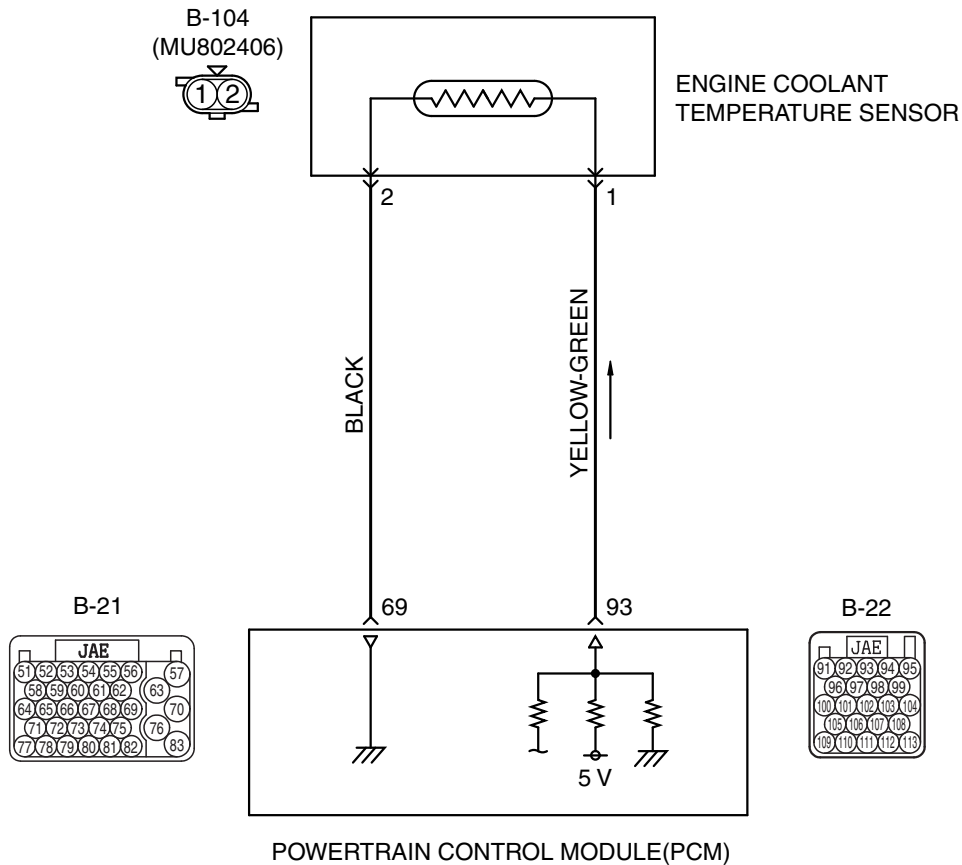


DTC P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control

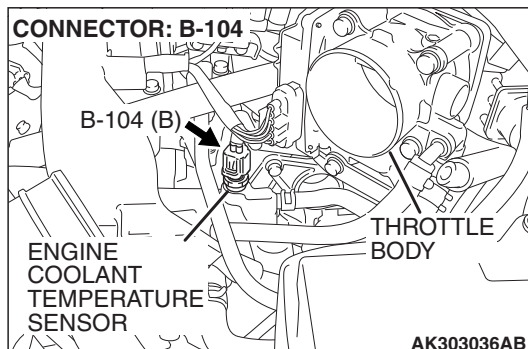
CAUTION

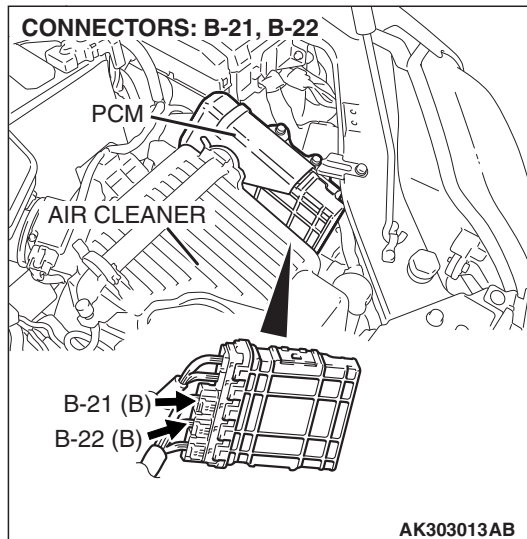
If DTC P0125 has been set, TCL related DTC U1120 is also set. After P0125 has been diagnosed, don't forget to erase DTC U1120.

Engine Coolant Temperature Sensor Circuit



AK302836





CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the PCM (terminal No. 93) via the resistor in the PCM. The ground terminal (terminal No. 2) is grounded with PCM (terminal No. 69).
- 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 PCM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

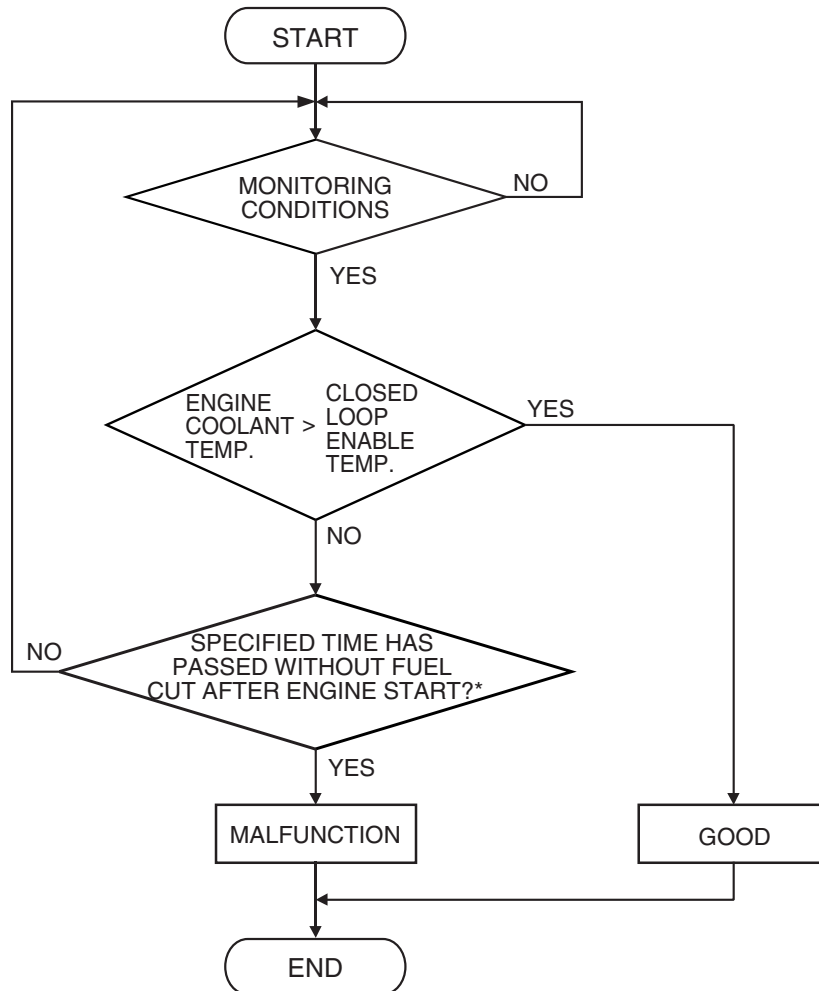
- Not applicable

Sensor (The sensor below is determined to be normal)

- Mass airflow sensor
- Intake air temperature sensor

DTC SET CONDITIONS <Range/Performance problem - low input (time to reach closed loop enable temperature)>

Logic Flow Chart



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

AK900275

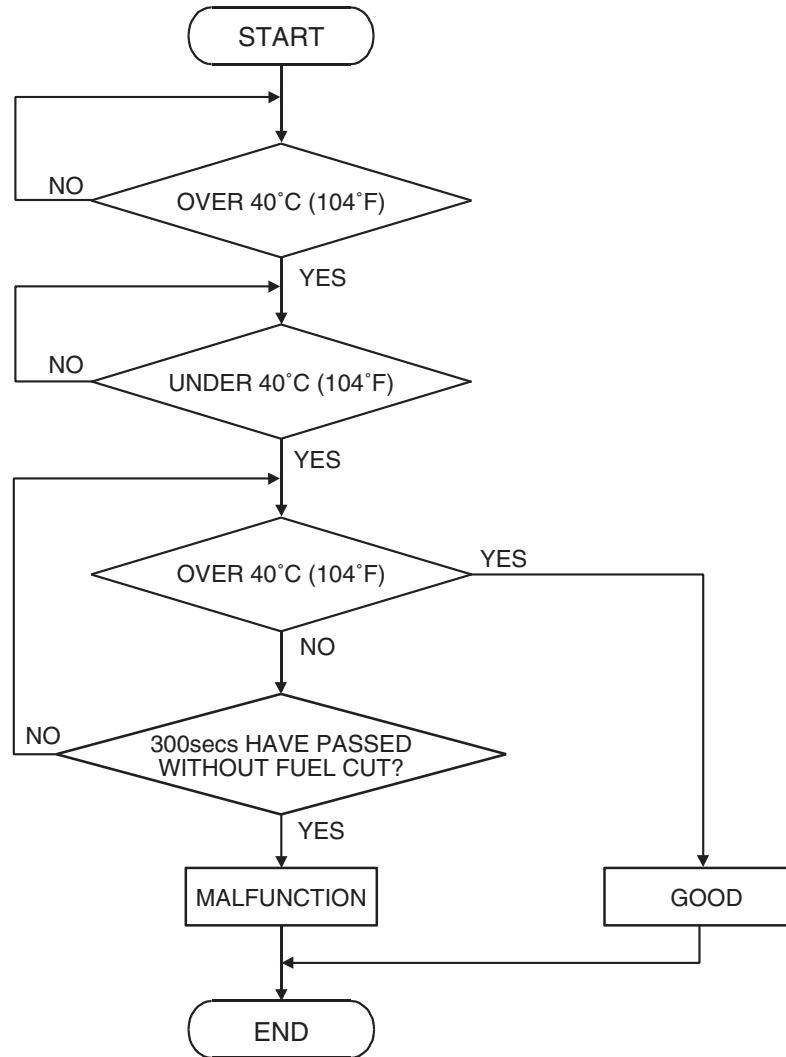
Check Conditions, Judgement Criteria

- About 90 – 300 seconds have passed for the engine coolant temperature to rise to about 7°C (45°F) after starting sequence was completed.

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

DTC SET CONDITIONS <Range/Performance problem - drift>

Logic Flow Chart



AK802637

Check Conditions, Judgement Criteria

- Engine coolant temperature decreases from higher than 40°C (104°F) to lower than 40°C (104°F).
- Then the engine coolant temperature has continued to be 40°C (104°F) or lower for 5 minutes.
- However, time is not counted when fuel is shut off.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 [P.13B-5](#).

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

- Engine coolant temperature sensor failed.
- Engine coolant temperature sensor circuit harness damage, or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

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

⚠ CAUTION

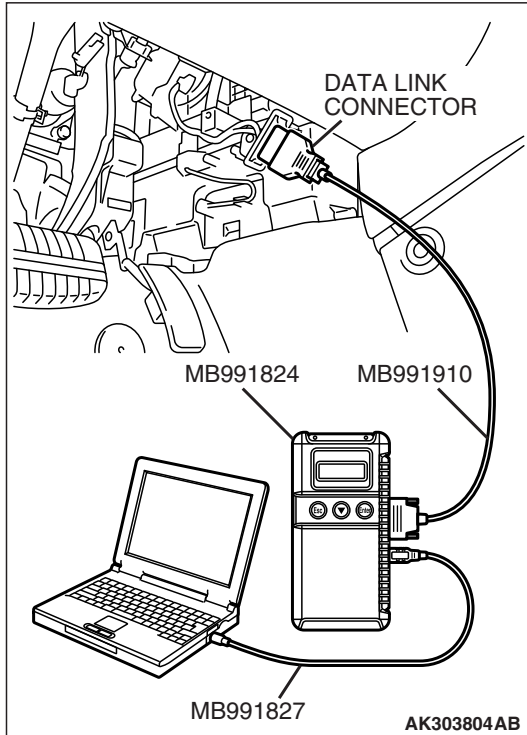
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

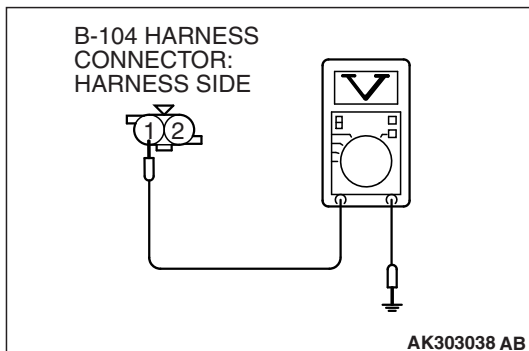
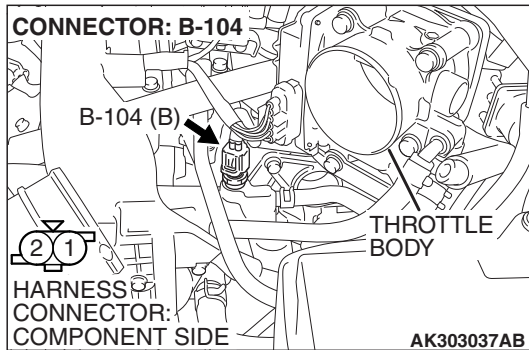
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 6, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.





STEP 2. Measure the sensor output voltage at engine coolant temperature sensor connector B-104 by backprobing.

- (1) Do not disconnect the connector B-104.
- (2) Turn the ignition switch to the "ON" position.

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

- When engine coolant temperature is -20°C (-4°F), voltage should be between 3.9 and 4.5 volts.
- When engine coolant temperature is 0°C (32°F), voltage should be between 3.2 and 3.8 volts.
- When engine coolant temperature is 20°C (68°F), voltage should be between 2.3 and 2.9 volts.
- When engine coolant temperature is 40°C (104°F), voltage should be between 1.3 and 1.9 volts.
- When engine coolant temperature is 60°C (140°F), voltage should be between 0.7 and 1.3 volts.
- When engine coolant temperature is 80°C (176°F), voltage should be between 0.3 and 0.9 volt.

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

Q: Is the measured voltage within the specified range?

YES : Go to Step 3.

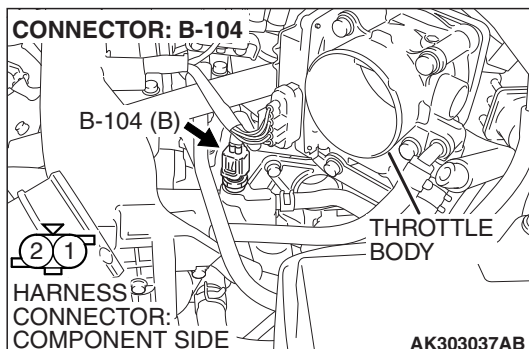
NO : Go to Step 5.

STEP 3. Check harness connector B-104 at the engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

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



STEP 4. Using scan tool MB991958, check data list item 6: Engine Coolant Temperature Sensor.

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 6, Engine Coolant Temperature Sensor.

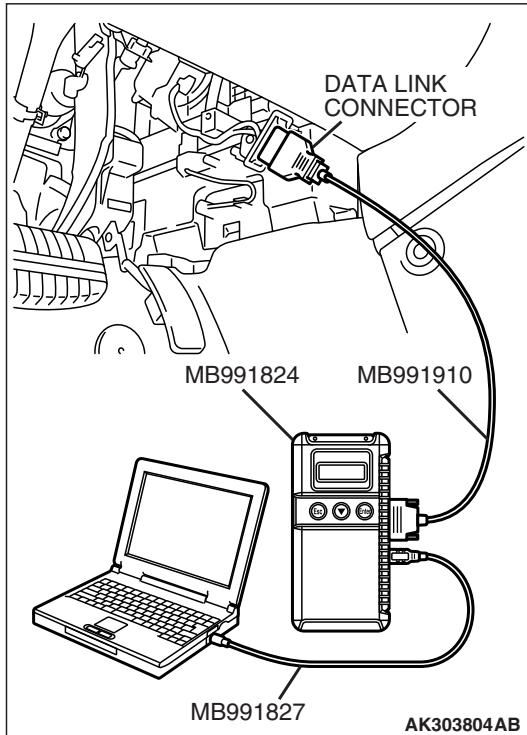
- The engine coolant temperature and temperature shown with the scan tool should approximately match.

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

Q: Is the sensor operating properly?

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

NO : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 14.

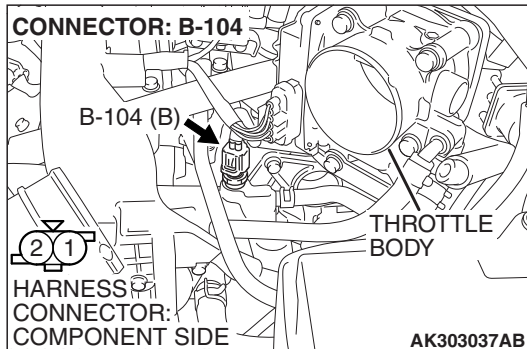


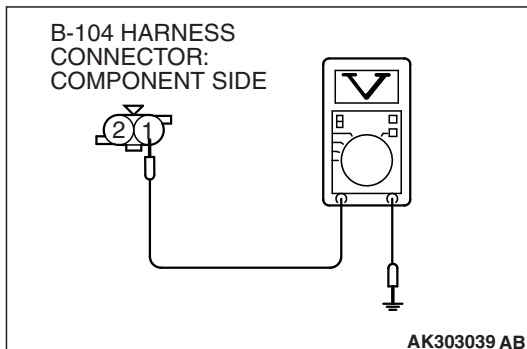
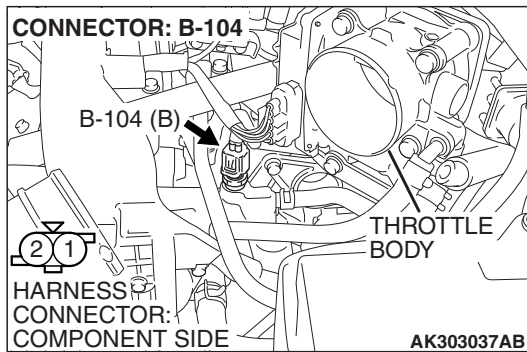
STEP 5. Check harness connector B-104 at engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

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





STEP 6. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-104.

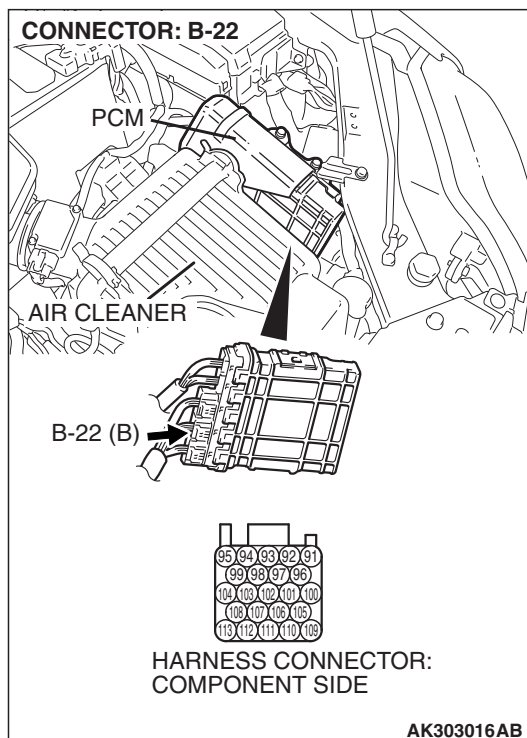
- (1) Disconnect the connector B-104 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (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 8.

NO : Go to Step 7.

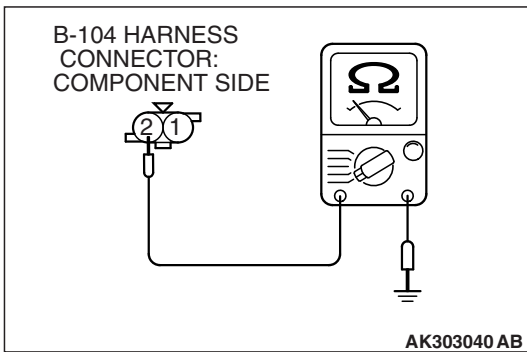
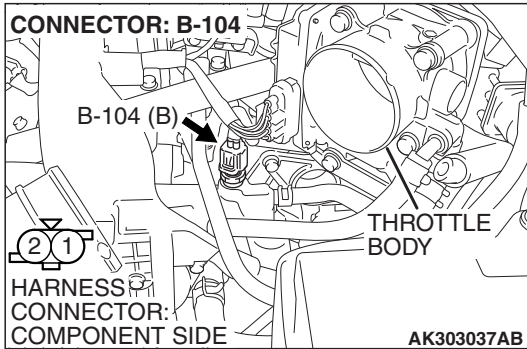


STEP 7. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 14.

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



STEP 8. Check the continuity at engine coolant temperature sensor harness side connector B-104.

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

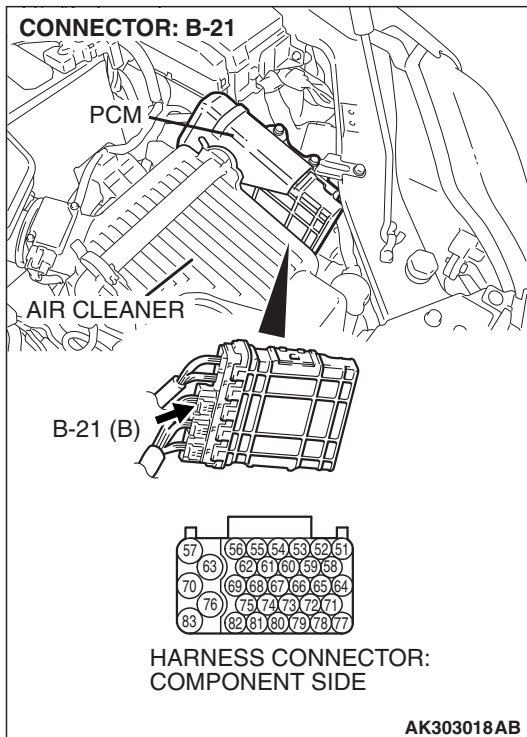
(2) Check for the continuity between terminal No. 2 and ground.

- Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.

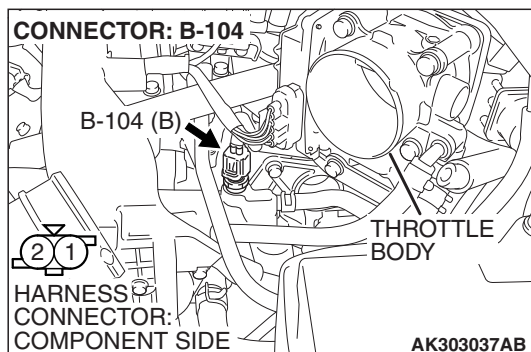


STEP 9. Check harness connector B-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

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

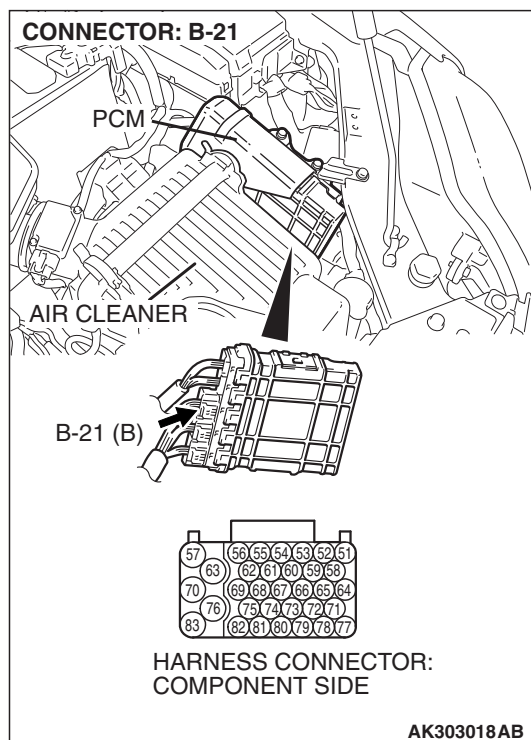


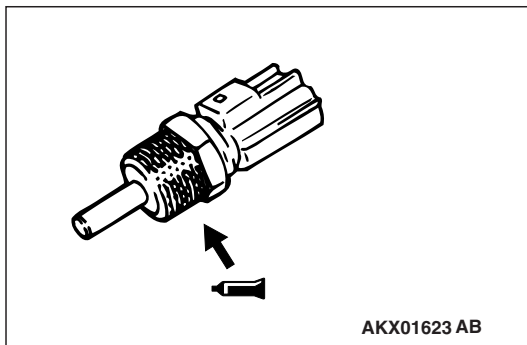
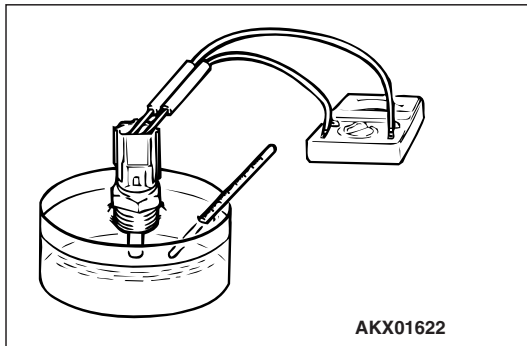
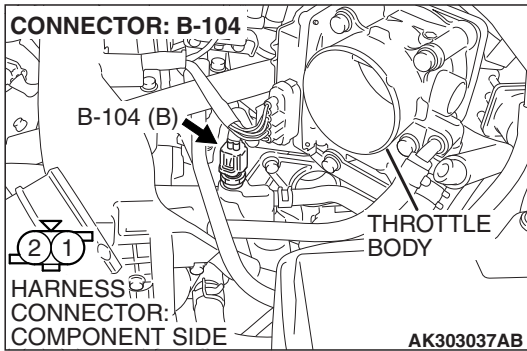
STEP 10. Check for harness damage between engine coolant temperature sensor connector B-104 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 14.

NO : Repair it. Then go to Step 14.





STEP 11. Check the engine coolant temperature sensor.

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

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

Standard value:

14 – 17 k Ω [at – 20°C (– 4°F)]

5.1 – 6.5 k Ω [at 0°C (32°F)]

2.1 – 2.7 k Ω [at 20°C (68°F)]

0.9 – 1.3 k Ω [at 40°C (104°F)]

0.48 – 0.68 k Ω [at 60°C (140°F)]

0.26 – 0.36 k Ω [at 80°C (176°F)]

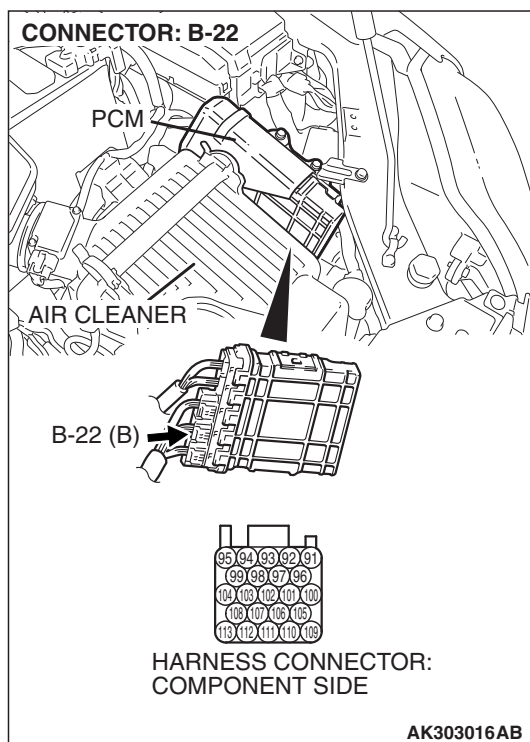
- (4) Apply 3M™ AAD part number 8731 or equivalent on the screw section of the engine coolant temperature sensor.
- (5) Install the engine coolant temperature sensor, and tighten to the specified torque.

Tightening torque: 30 \pm 9 N·m (22 \pm 7 ft-lb)

Q: Is the measured resistance at the standard value?

YES : Go to Step 12.

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

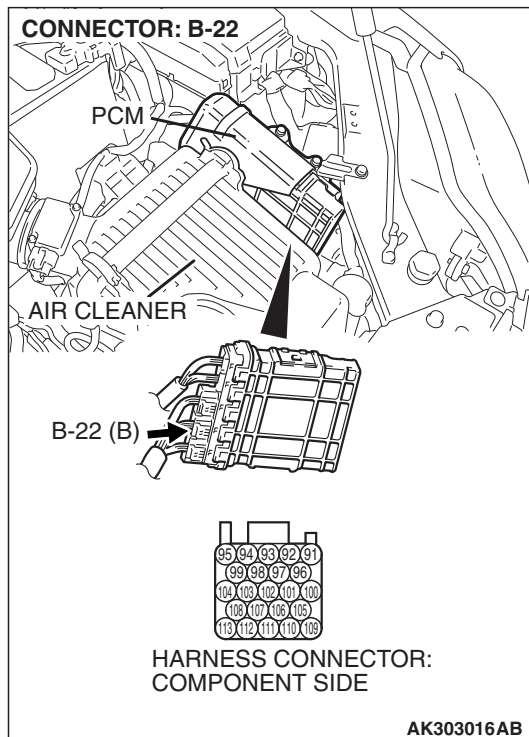
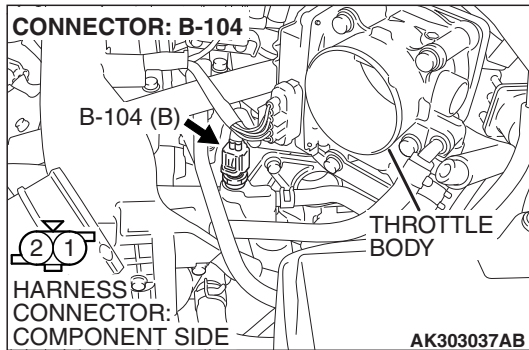


STEP 12. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 13.

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



STEP 13. Check for harness damage between engine coolant temperature sensor connector B-104 (terminal No. 1) and PCM connector B-22 (terminal No. 93).

Q: Is the harness wire in good condition?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 14.

NO : Repair it. Then go to Step 14.

STEP 14. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 [P.13B-5](#).

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

Q: Is DTC P0125 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0128: Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)**TECHNICAL DESCRIPTION**

- The PCM checks the time for the cooling water temperature to reach the judgment temperature.

DESCRIPTIONS OF MONITOR METHODS

Engine coolant temperature does not reach 77°C (171°F) within specified period after cold start.

MONITOR EXECUTION

Once per driving cycle

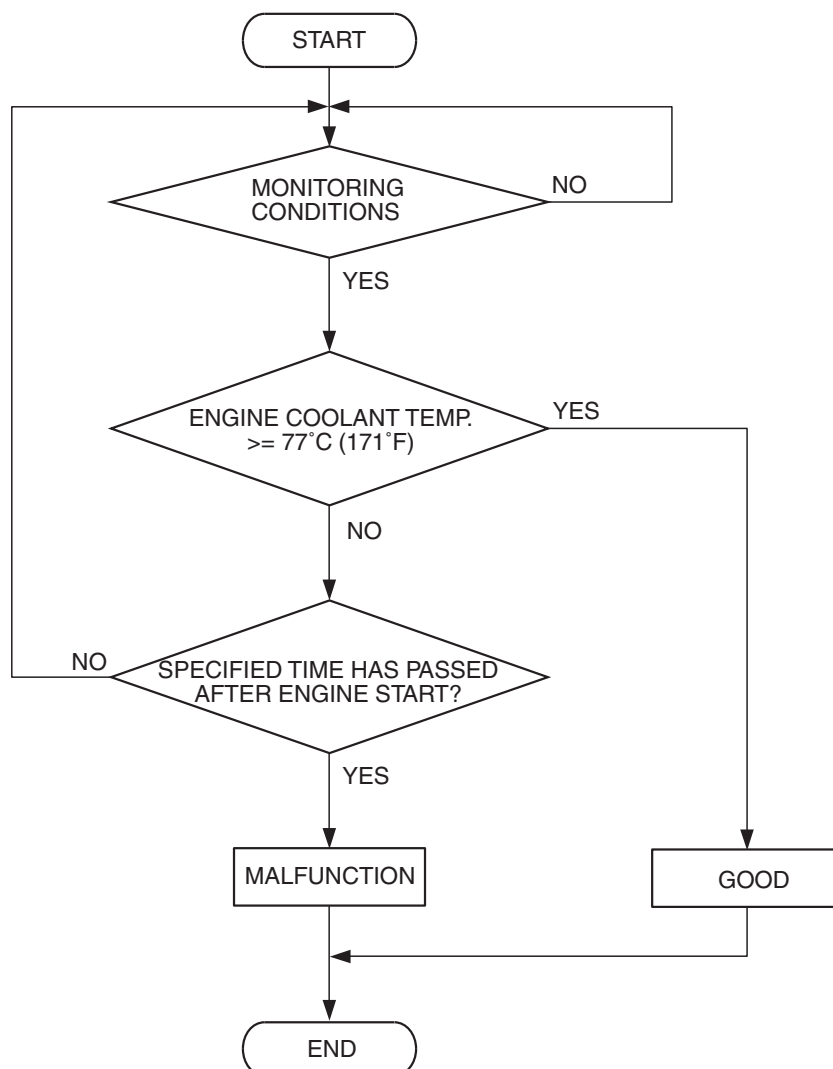
**MONITOR EXECUTION CONDITIONS
(Other monitor and Sensor)**

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

- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS**Logic Flow Chart**

AK700573

Check Conditions

- Engine coolant temperature is between – 10°C (14°F) and 60°C (140°F) when the engine is started.
- Intake air temperature is – 10°C (14°F) or higher.
- The intake air temperature when the engine is started – intake air temperature is 5°C (9°F) or less.
- The total time of the mass airflow sensor output whose state is over 10g/sec within 300 seconds.

Judgement Criterion

- The time for the engine coolant temperature to rise to 77°C (171°F) takes longer than approximately 9.5 to 33.5 minutes.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 [P.13B-5](#).

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

- The thermostat is faulty.
- PCM failed.

DIAGNOSIS

STEP 1. Check the cooling system.

Refer to GROUP 14, Engine Cooling Diagnosis – Symptom Chart [P.14-3](#).

Q: Is the cooling system normal?

YES : Replace the PCM. When the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Ignition Switch – Encrypted Code Registration Criteria Table [P.54A-10](#). Then go to Step 2.

NO : Repair it. Then go to Step 2.

STEP 2. Test the OBD-II drive cycle.

1. Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 [P.13B-5](#).

2. Check the diagnostic trouble code (DTC).

Q: Is DTC P0128 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.