GROUP 13A

MULTIPORT FUEL INJECTION (MFI) <2.4L ENGINE>

CONTENTS

Continued on next page

GENERAL DESCRIPTION

M1131000101890

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

FUEL INJECTION CONTROL

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

THROTTLE VALVE OPENING CONTROL

This system electrically controls the opening of the throttle valve. The 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 passes through air amount according to the engine load conditions to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

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

DIAGNOSTIC TEST MODE

- When a fault is detected in any of the sensors or actuators related to emission control, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates to warn the driver.
- When a fault is detected in one of the sensors or actuators, a diagnostic trouble code corresponding to the fault is stored in the 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 the scan tool MB991958 (MUT-III sub assembly) under certain circumstances.

OTHER CONTROL FUNCTIONS

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

A/C Compressor Clutch Relay Control
- Turns on and off the A/C compressor clutch.

Engine Oil Control Valve Control
- The PCM effects duty cycle control on the engine oil control valve, in accordance with the engine speed. This regulates the supply of engine oil to the intake rocker shaft, which switches the cams.

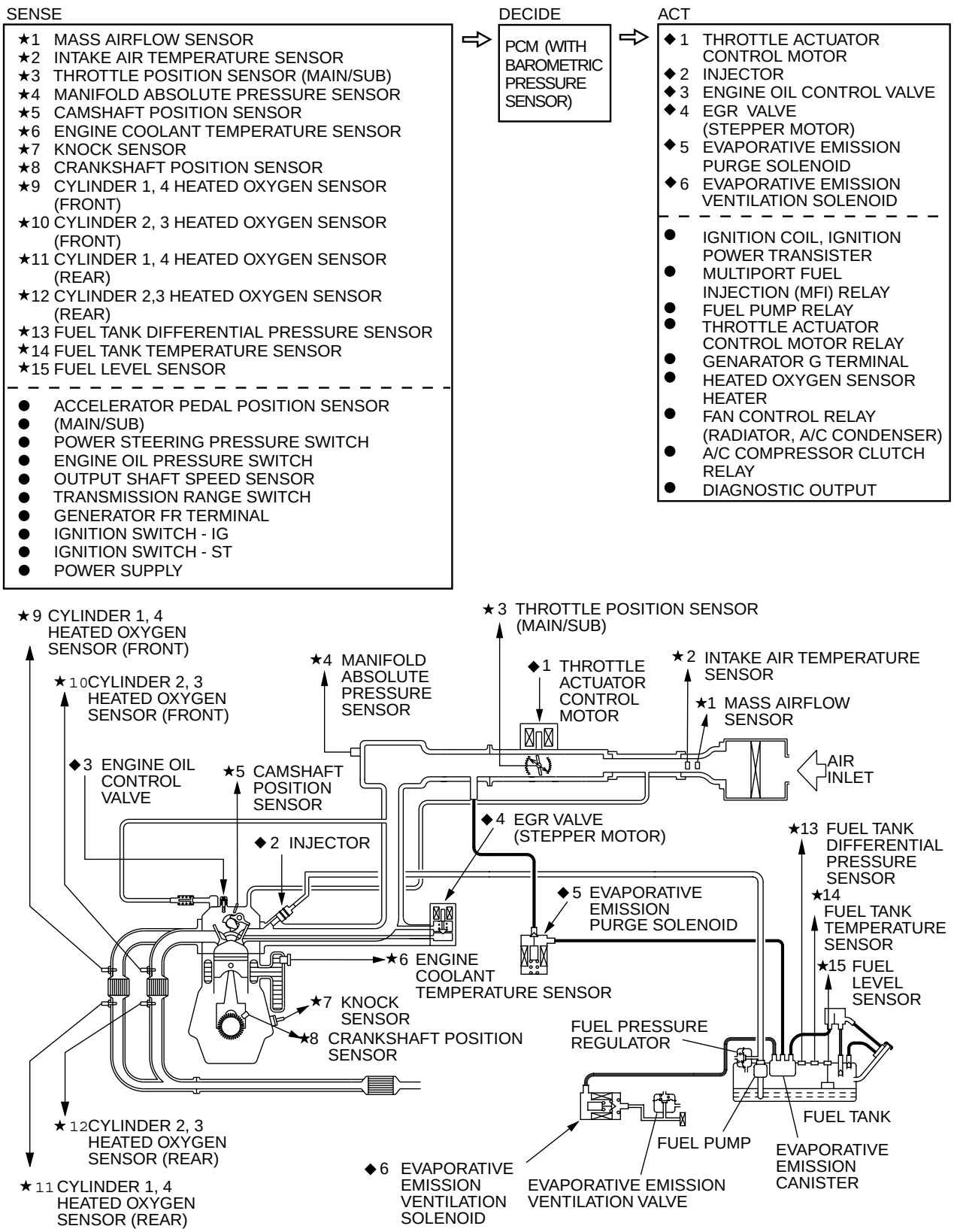
Fan Relay Control
- The radiator fan and condenser fan speeds are controlled in response to the engine coolant temperature and vehicle speed.

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

Evaporative Emission Purge Control
- (Refer to GROUP 17, Emission Control System – Evaporative Emission System – General Information. P.17-83)

EGR Control
- (Refer to GROUP 17, Emission Control System – Exhaust Gas Recirculation (EGR) System – General Information. P.17-89)

MULTIPORT FUEL INJECTION (MFI) SYSTEM DIAGRAM



AK302201AC

NOTE: For the vacuum hose routing, refer to GROUP 17, Vacuum Hoses P.17-77.

TSB Revision

MULTIPORT FUEL INJECTION (MFI) DIAGNOSIS

TROUBLESHOOTING STRATEGY

M1131150001196

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

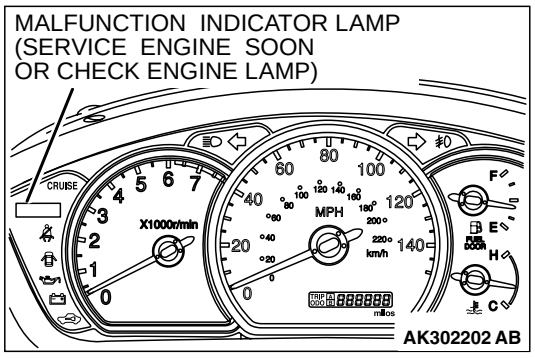
Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure to have exhausted most of the possible ways to find an MFI fault.

1. Gather as much information as possible about the complaint from the customer.
2. Verify that the condition described by the customer exists.
3. Check the vehicle for any MFI Diagnostic Trouble Code (DTC).
4. If you cannot verify the condition and there are no DTCs, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent 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 – Immobilizer Encrypted Code Registration P.54A-37.

DIAGNOSTIC FUNCTION

M1131155500870



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) is switched off.

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

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

DTC	ITEM
-	Powertrain control module (PCM) malfunction
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor
P0101*	Mass airflow circuit range/performance problem
P0102*	Mass airflow circuit low input
P0103*	Mass airflow circuit high input
P0106	Manifold absolute pressure circuit range/performance problem
P0107	Manifold absolute pressure circuit low input
P0108	Manifold absolute pressure circuit high input
P0111*	Intake air temperature circuit range/performance problem
P0112*	Intake air temperature circuit low input
P0113*	Intake air temperature circuit high input
P0116*	Engine coolant temperature circuit range/performance problem
P0117*	Engine coolant temperature circuit low input
P0118*	Engine coolant temperature circuit high input
P0122*	Throttle position sensor (main) circuit low input
P0123*	Throttle position sensor (main) circuit high input
P0125*	Insufficient coolant temperature for closed loop fuel control
P0128	Coolant thermostat (Coolant temperature below thermostat regulating temperature)
P0130	Cylinder 1, 4 heated oxygen sensor circuit (sensor 1)
P0131	Cylinder 1, 4 heated oxygen sensor circuit low voltage (sensor 1)
P0132	Cylinder 1, 4 heated oxygen sensor circuit high voltage (sensor 1)
P0133	Cylinder 1, 4 heated oxygen sensor circuit slow response (sensor 1)
P0134*	Cylinder 1, 4 heated oxygen sensor circuit no activity detected (sensor 1)
P0135	Cylinder 1, 4 heated oxygen sensor heater circuit (sensor 1)
P0136	Cylinder 1, 4 heated oxygen sensor circuit (sensor 2)
P0137	Cylinder 1, 4 heated oxygen sensor circuit low voltage (sensor 2)
P0138	Cylinder 1, 4 heated oxygen sensor circuit high voltage (sensor 2)
P0139	Cylinder 1, 4 heated oxygen sensor circuit slow response (sensor 2)
P0141	Cylinder 1, 4 heated oxygen sensor heater circuit (sensor 2)
P0150	Cylinder 2, 3 heated oxygen sensor circuit (sensor 1)
P0151	Cylinder 2, 3 heated oxygen sensor circuit low voltage (sensor 1)
P0152	Cylinder 2, 3 heated oxygen sensor circuit high voltage (sensor 1)
P0153	Cylinder 2, 3 heated oxygen sensor circuit slow response (sensor 1)
P0154*	Cylinder 2, 3 heated oxygen sensor circuit no activity detected (sensor 1)
P0155	Cylinder 2, 3 heated oxygen sensor heater circuit (sensor 1)
P0156	Cylinder 2, 3 heated oxygen sensor circuit (sensor 2)
P0157	Cylinder 2, 3 heated oxygen sensor circuit low voltage (sensor 2)

DTC	ITEM
P0158	Cylinder 2, 3 heated oxygen sensor circuit high voltage (sensor 2)
P0159	Cylinder 2, 3 heated oxygen sensor circuit slow response (sensor 2)
P0161	Cylinder 2, 3 heated oxygen sensor heater circuit (sensor 2)
P0171	System too lean (cylinder 1, 4)
P0172	System too rich (cylinder 1, 4)
P0174	System too lean (cylinder 2, 3)
P0175	System too rich (cylinder 2, 3)
P0181	Fuel tank temperature sensor circuit range/performance
P0182	Fuel tank temperature sensor circuit low input
P0183	Fuel tank temperature sensor circuit high input
P0201	Injector circuit-cylinder 1
P0202	Injector circuit-cylinder 2
P0203	Injector circuit-cylinder 3
P0204	Injector circuit-cylinder 4
P0222*	Throttle position sensor (sub) circuit low input
P0223*	Throttle position sensor (sub) circuit high input
P0300	Random/multiple cylinder misfire detected
P0301	Cylinder 1 misfire detected
P0302	Cylinder 2 misfire detected
P0303	Cylinder 3 misfire detected
P0304	Cylinder 4 misfire detected
P0335*	Crankshaft position sensor circuit
P0340*	Camshaft position sensor circuit
P0401	Exhaust gas recirculation flow insufficient detected
P0403	Exhaust gas recirculation control circuit
P0421	Warm up catalyst efficiency below threshold (cylinder 1, 4)
P0431	Warm up catalyst efficiency below threshold (cylinder 2, 3)
P0441	Evaporative emission control system incorrect purge flow
P0442	Evaporative emission control system leak detected (Small leak)
P0443	Evaporative emission control system purge control valve circuit
P0446	Evaporative emission control system vent control circuit
P0451	Evaporative emission control system pressure sensor range/performance
P0452	Evaporative emission control system pressure sensor low input
P0453	Evaporative emission control system pressure sensor high input
P0455	Evaporative emission control system leak detected (Gross leak)
P0456	Evaporative emission control system leak detected (Very small leak)
P0461	Fuel level sensor circuit range/performance (main)
P0462	Fuel level sensor circuit low input
P0463	Fuel level sensor circuit high input
P0506	Idle control system RPM lower than expected

DTC	ITEM
P0507	Idle control system RPM higher than expected
P0513	Immobilizer malfunction
P0551	Power steering pressure switch circuit range/performance
P0554	Power steering pressure switch circuit intermittent
P0603	EEPROM malfunction
P0606*	Powertrain control module main processor malfunction
P0630	VIN malfunction
P0638*	Throttle actuator control motor circuit range/performance
P0642*	Throttle position sensor power supply
P0657*	Throttle actuator control motor relay circuit malfunction
P0705	Transmission range switch circuit malfunction (RPNDL input)
P0712*	Transmission fluid temperature sensor circuit low input
P0713*	Transmission fluid temperature sensor circuit high input
P0715*	Input/Turbine speed sensor circuit
P0720*	Output speed sensor circuit
P0731*	Gear 1 incorrect ratio
P0732*	Gear 2 incorrect ratio
P0733*	Gear 3 incorrect ratio
P0734*	Gear 4 incorrect ratio
P0736*	Gear R incorrect ratio
P0741	Torque converter clutch circuit performance or stuck off
P0742	Torque converter clutch circuit stuck on
P0743*	Torque converter clutch circuit electrical
P0753*	Shift solenoid "A" electrical
P0758*	Shift solenoid "B" electrical
P0763*	Shift solenoid "C" electrical
P0768*	Shift solenoid "D" electrical
P1020	Mitsubishi innovative valve timing and lift electronic control system (MIVEC) performance problem
P1021	Engine oil control valve circuit
P1530	A/C1 switch circuit intermittent
P1602	Communication malfunction (between PCM main processor and system LSI)
P1603*	Battery backup line malfunction
P1751*	A/T control relay malfunction
P2066	Fuel level sensor circuit range/performance (sub)
P2100*	Throttle actuator control motor circuit (open)
P2101*	Throttle actuator control motor magneto malfunction
P2122*	Accelerator pedal position sensor (main) circuit low input
P2123*	Accelerator pedal position sensor (main) circuit high input
P2127*	Accelerator pedal position sensor (sub) circuit low input

DTC	ITEM
P2128*	Accelerator pedal position sensor (sub) circuit high input
P2135*	Throttle position sensor (main and sub) range/performance problem
P2138*	Accelerator pedal position sensor (main and sub) range/performance problem
P2228*	Barometric pressure circuit low input
P2229*	Barometric pressure circuit high input
U1108*	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 (MUT-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: 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.

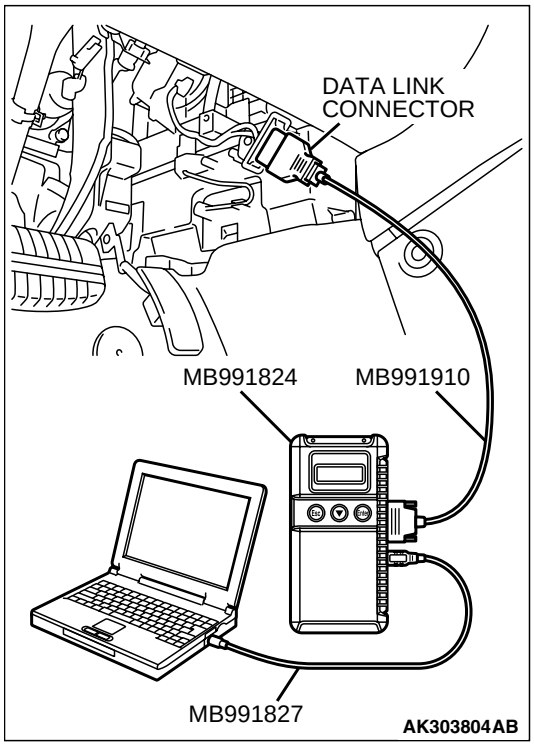
HOW TO CONNECT THE SCAN TOOL (MUT-III)

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I
  - MB991827: USB Cable
  - 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 MUT-III system on the personal computer.

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

HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODES.

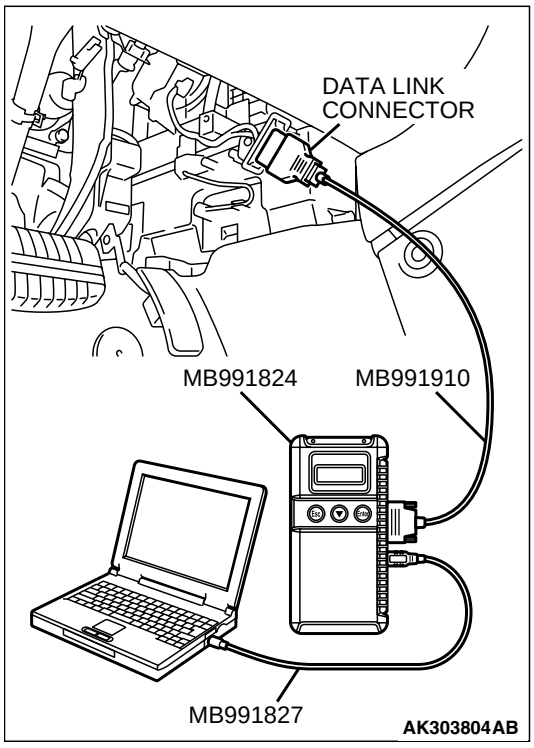
Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - 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 "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "MFI" from the "POWERTRAIN" tab.
6. Select "MITSUBISHI."
7. Select "Diagnostic Trouble Code"
8. If a DTC is set, it is shown.
9. Choose "Erase DTCs" to erase the DTC.

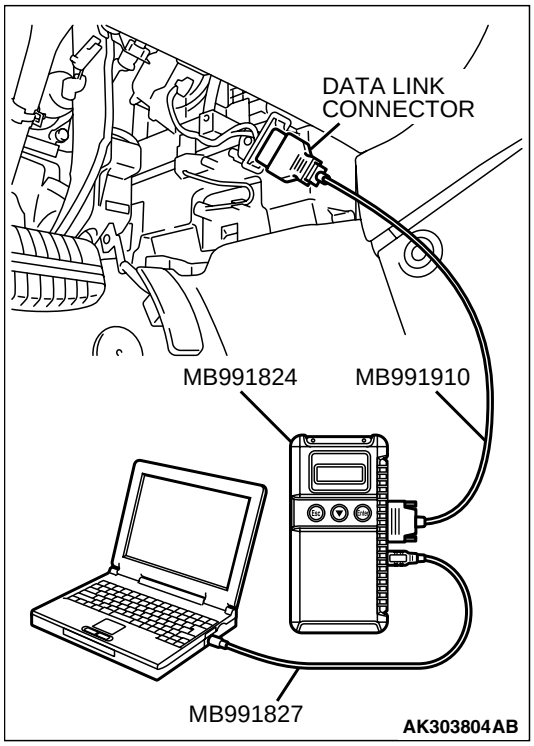
HOW TO READ DATA LIST

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - 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 "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "MFI" from the "POWERTRAIN" tab.
6. Select "MITSUBISHI."
7. Select "Data List."
8. Choose an appropriate item and select the "OK" button.

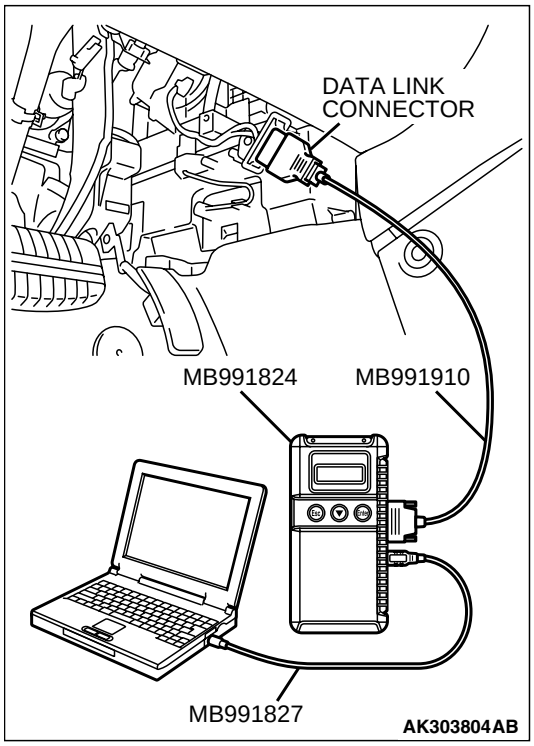
HOW TO PERFORM ACTUATOR TEST

Required Special Tools:

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

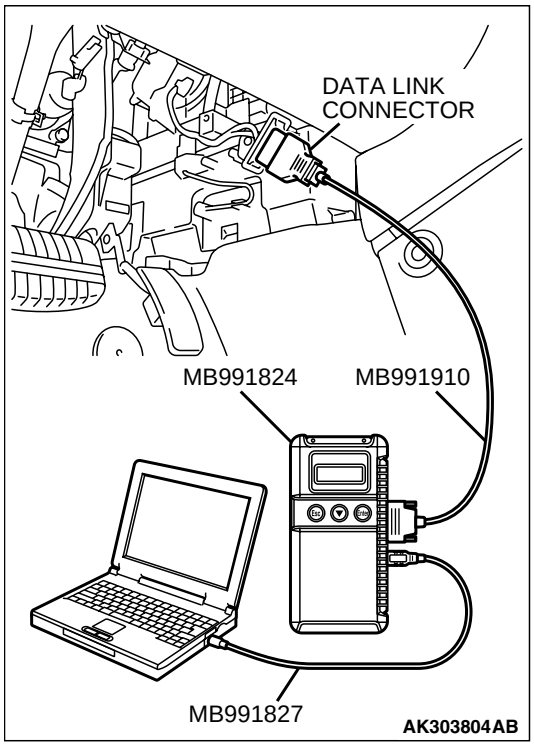


1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "MFI" from the "POWERTRAIN" tab.
6. Select "MITSUBISHI."
7. Select "Actuator Test."
8. Choose an appropriate item and select the "OK" button.

HOW TO DIAGNOSE THE CAN BUS LINES

Required Special Tools:

- MB991958: Scan Tool (MUT-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.

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

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

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.

TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	INDICATION OF SCAN TOOL	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
01	Catalyst monitor (Cylinder 1, 4)	PCM monitors the deterioration of catalyst at cylinder 1, 4 side by the output frequency ratio between cylinder 1, 4 heated oxygen sensor (front) and cylinder 1, 4 heated oxygen sensor (rear).	Catalyst Frequency Ratio Bank 1 Test Result and Limit Value (max.)	× 0.0039
02	Catalyst monitor (Cylinder 2, 3)	PCM monitors the deterioration of catalyst at cylinder 2, 3 side by the output frequency ratio between cylinder 1, 4 heated oxygen sensor (front) and cylinder 2, 3 heated oxygen sensor (rear).	Catalyst Frequency Ratio Bank 2 Test Result and Limit Value (max.)	× 0.0039
03	EGR monitor	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.	EGR Monitor Pressure Value Test Result and Limit Value (min.) kPa	× 0.43 kPa
06	Evaporation leak monitor (Small leak)	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.	EVAP Leak Mon. 1 mm Pressure Value Test Result and Limit Value (max.) kPa	× 0.032 kPa
07	Evaporation leak monitor (Gross leak)	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.	EVAP Leak Mon. Gross Pressure Value Test Result and Limit Value (min.) kPa	× 0.032 kPa

TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	INDICATION OF SCAN TOOL	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
08	Evaporation leak monitor (Very small leak)	After 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.	EVAP Leak Mon. 0.5 mm Pressure Value Test Result and Limit Value (max.) kPa	× 0.032 kPa
09	Heated oxygen sensor monitor (Rich/Lean Switching) (Cylinder 1, 4)	PCM monitors the deteriorated condition of the heated oxygen sensor by checking the lean/rich switching frequency of the heated oxygen sensor.	HO2S B1 SENSOR 1 Rich/Lean Switching Count Test Result and Limit Value (min.)	×1 count
0A	Heated oxygen sensor monitor (Rich/Lean Switching) (Cylinder 2, 3)	PCM monitors the deteriorated condition of the heated oxygen sensor by checking the lean/rich Switching frequency of the heater oxygen sensor.	HO2S B2 SENSOR 1 Rich/Lean Switching Count Test Result and Limit Value (min.)	×1 count
0B	Heated oxygen sensor monitor (Voltage) (Cylinder 1, 4)	PCM checks the output voltage of the heated oxygen sensor (rear) in order to monitor whether the heated oxygen sensor output is stuck.	HO2S B1 SENSOR2 Change in Volt Test Result and Limit Value (min.)	× 19.5mV
0C	Heated oxygen sensor monitor (Voltage) (Cylinder 2, 3)	PCM checks the output voltage of the heated oxygen sensor (rear) in order to monitor whether the heated oxygen sensor output is stuck.	HO2S B2 SENSOR 2 Change in Volt Test Result and Limit Value (min.)	× 19.5mV

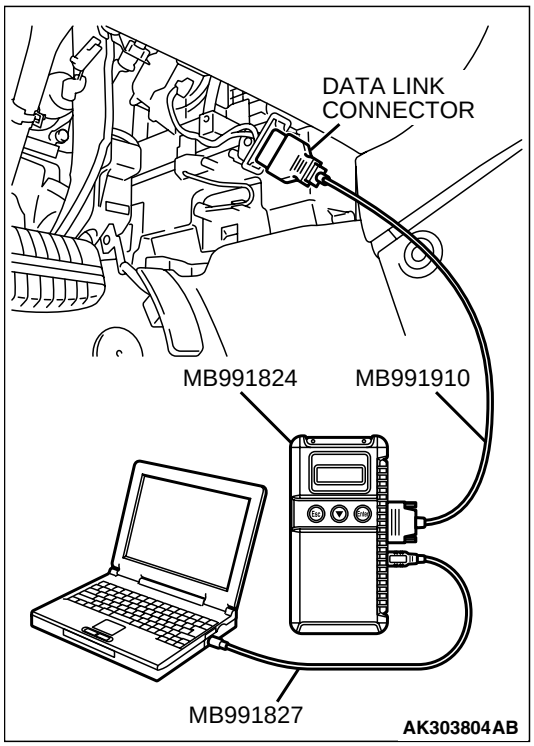
*NOTE: *1: Minimum value: The test fails if test value is less than this value.*

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

DIAGNOSTIC BY DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY)

Required Special Tools:

- MB991958: Scan tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - 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 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 126 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 126 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.

MUT-III SCAN TOOL DISPLAY	ITEM NO.	DATA ITEM	UNIT or STATE
ECT SENSOR	21	Engine coolant temperature sensor	°C or °F
ENGINE LOAD	87	Calculated load value	%
ENGINE SPEED	22	Crankshaft position sensor	r/min
IAT SENSOR	13	Intake air temperature sensor	°C or °F
IG.TIMING ADV	44	Ignition coils and ignition power transistor	deg
LONG TRIM B1	81	Cylinder 1, 4 long-term fuel trim	%
LONG TRIM B2	83	Cylinder 2, 3 long-term fuel trim	%
MAP/MDP SNSR.	32	Manifold absolute pressure sensor	kPa or in.Hg
SHORT TRIM B1	82	Cylinder 1, 4 short-term fuel trim	%
SHORT TRIM B2	84	Cylinder 2, 3 short-term fuel trim	%
SYS.STATUS B1	88	Cylinder 1, 4 fuel control system status	• Open loop • Closed loop • Open loop-drive condition • Open loop-DTC set • Closed loop-O_2 (rear) failed
SYS. STATUS B2	89	Cylinder 2, 3 fuel control system status	• Open loop • Closed loop • Open loop-drive condition • Open loop-DTC set • Closed loop-O_2 (rear) failed
TP SENSOR	8A	Throttle position sensor	%
VAF/MAF SNSR.	12	Mass airflow sensor	gm/s
VSS	24	Vehicle speed signal	km/h or mph

OBD- II DRIVE CYCLE

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

⚠ CAUTION

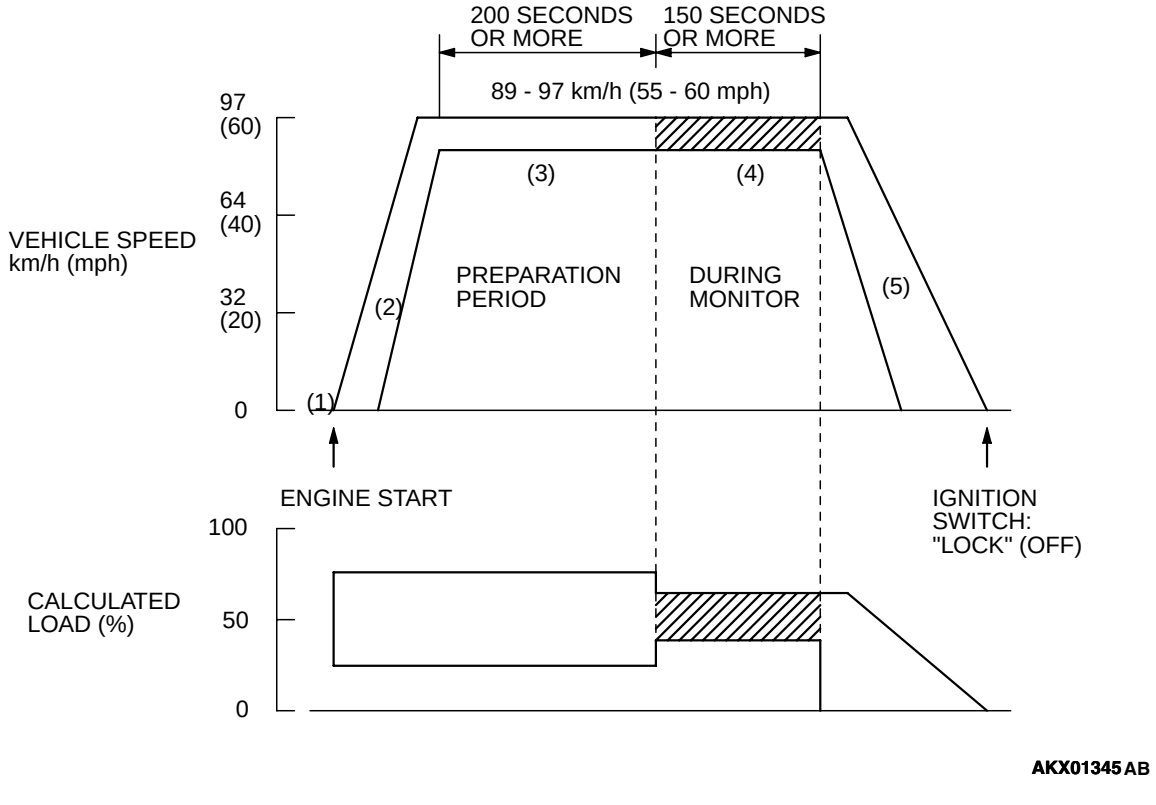
Two technicians should always be in the vehicle when carrying out a test.

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

DRIVE CYCLE PATTERN LIST

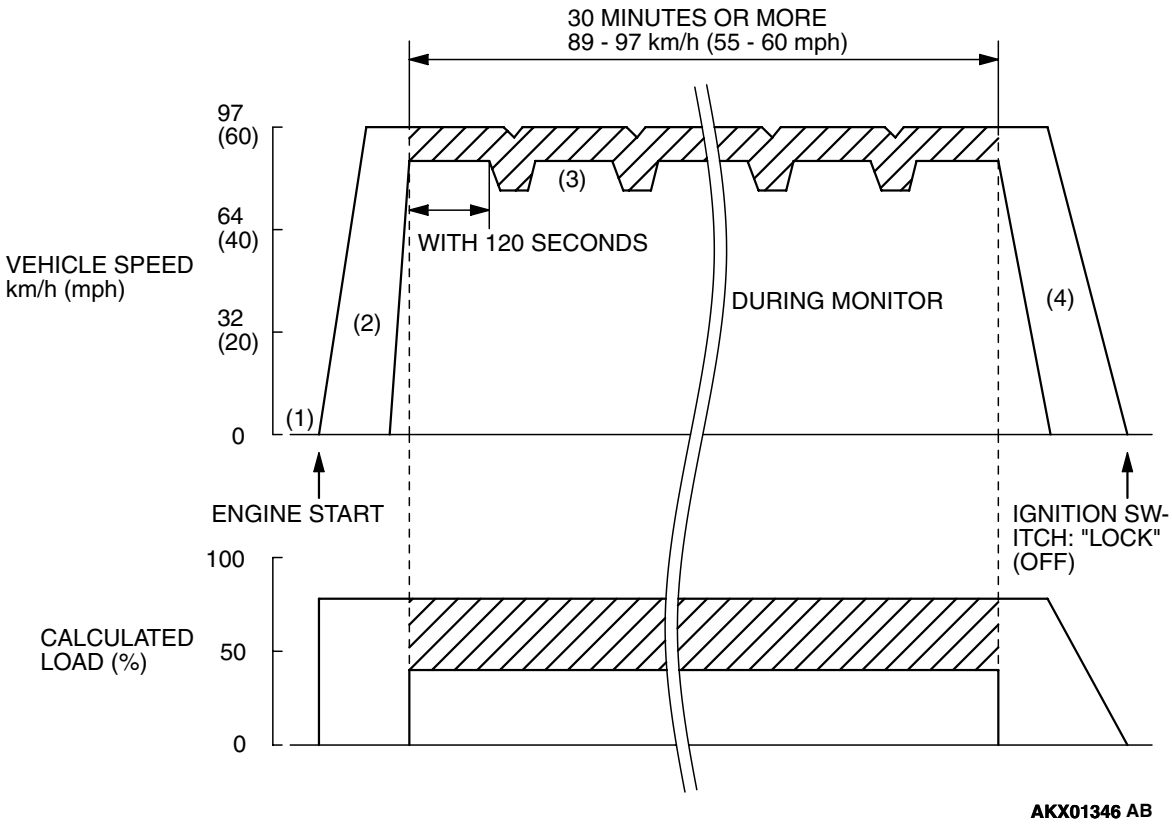
PROCEDURE	MONITOR ITEM		DIAGNOSTIC TROUBLE CODE (DTC)
1	Evaporative emission system leak monitor		P0441, P0442, P0451, P0452, P0453, P0455, P0456
2	Fuel trim monitor		P0171, P0172, P0174, P0175
3	Catalytic converter monitor		P0421, P0431
4	Heated oxygen sensor monitor		P0133, P0139, P0153, P0159
5	Exhaust gas recirculation (EGR) system monitor		P0401
6	Other monitor	Main components	P0106, P0107, P0108, P0134, P0154, P0300, P0301, P0302, P0303, P0304, P0506, P0507
		Sensors and switches	P0069, P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0181, P0182, P0183, P0335, P0340, P0461, P2066,
		Wire breakage and short circuit	P0130, P0131, P0132, P0135, P0136, P0137, P0138, P0141, P0150, P0151, P0152, P0155, P0156, P0157, P0158, P0161, P0201, P0202, P0203, P0204, P0403, P0443, P0446, P0462, P0463, P2228, P2229

PROCEDURE 1

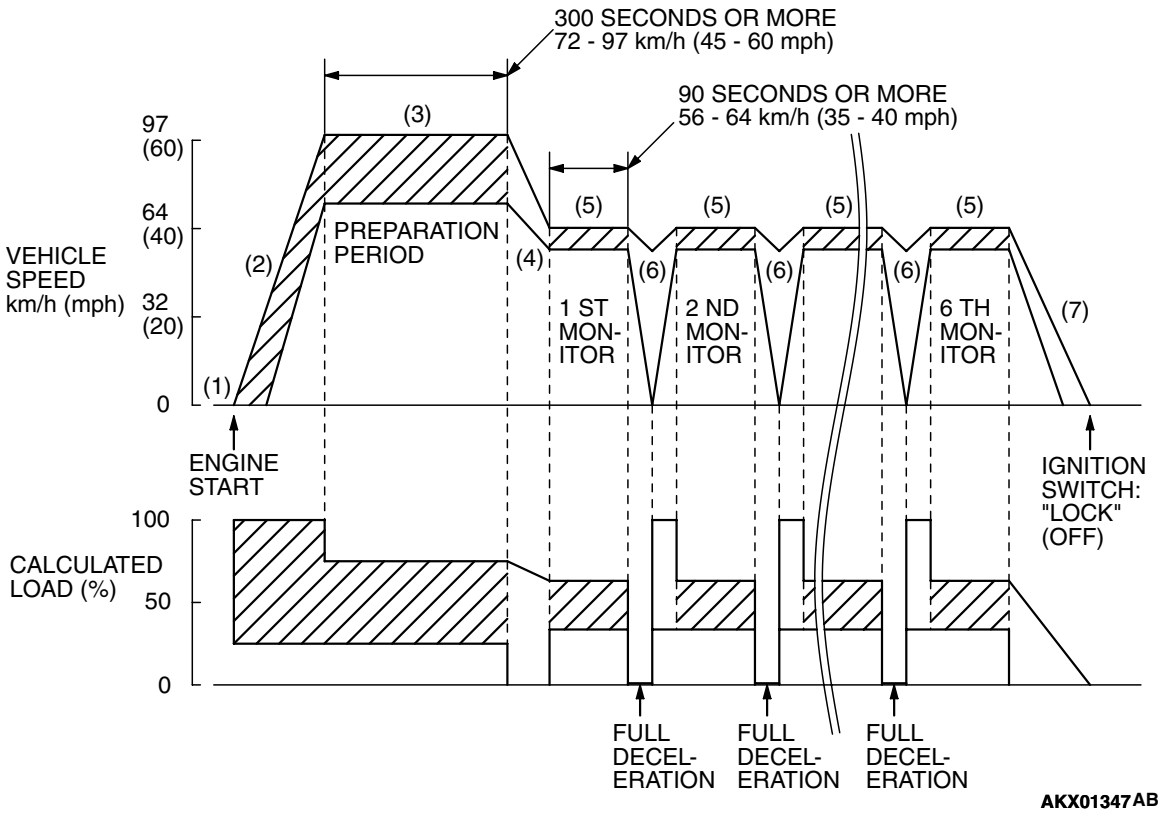
EVAPORATIVE EMISSION SYSTEM LEAK MONITOR	
DTC	P0441, P0442, P0451, P0452, P0453, P0455, P0456
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 8 minutes. You must complete this drive twice. *NOTE: Vehicle speed and throttle opening angle should be within the shaded range.* 
Inspection conditions	• Engine coolant temperature: 45°C (113°F) or less (The engine is stopped before the test drive is started) • Atmospheric temperature: 5 – 45°C (41 – 113°F) • Condition of A/T: Selector lever D range

EVAPORATIVE EMISSION SYSTEM LEAK MONITOR	
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 89 – 97 km/h (55 – 60 mph). 3. Travel for 200 seconds or more while keeping the vehicle speed at 89 – 97 km/h (55 – 60 mph). 4. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 89 – 97 km/h (55 – 60 mph) and travel for 150 seconds or more. (During monitor) 5. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 6. Confirm that the diagnostic trouble code (DTC) is not output. 7. If DTC P0441 is output, refer to DTC P0441 – Evaporative Emission Control System Incorrect Purge Flow P.13A-606. If DTC P0442 is output, refer to DTC P0442 – Evaporative Emission Control System Leak Detected (Small Leak) P.13A-611. If DTC P0451 is output, refer to DTC P0451 – Evaporative Emission Control System Pressure Sensor Range/performance P.13A-669. If DTC P0452 is output, refer to DTC P0452 – Evaporative Emission Control System Pressure Sensor Low Input P.13A-690. If DTC P0453 is output, refer to DTC P0453 – Evaporative Emission Control System Pressure Sensor High Input P.13A-711. If DTC P0455 is output, refer to DTC P0455 – Evaporative Emission Control System Leak Detected (Gross Leak) P.13A-732. If DTC P0456 is output, refer to DTC P0456 – Evaporative Emission Control System Leak Detected (Very Small Leak) P.13A-749.

PROCEDURE 2

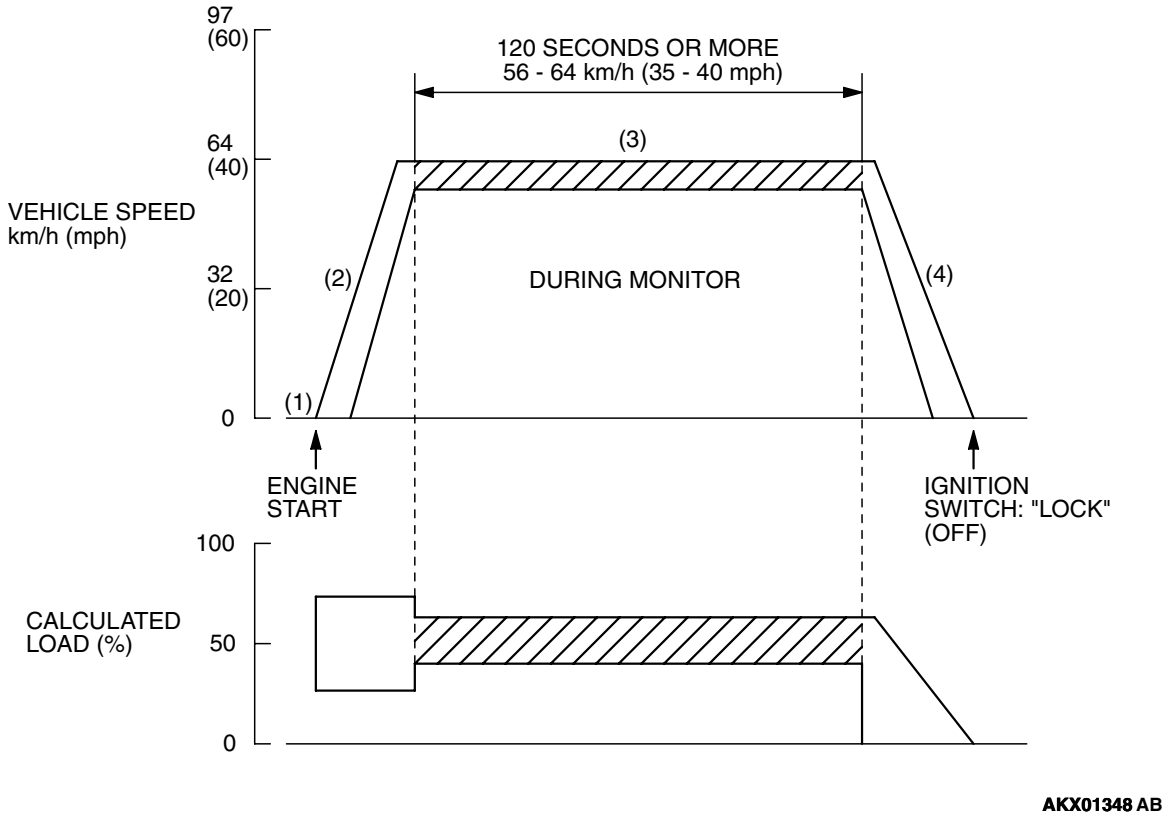
FUEL TRIM MONITOR	
DTC	P0171, P0172, P0174, P0175
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 35 minutes. You must complete this drive twice. *NOTE: Vehicle speed and throttle opening angle should be within the shaded range.* 
Inspection conditions	• Engine coolant temperature: 80 – 97°C (176 – 207°F) • Atmospheric temperature: –10 to 60°C (14 – 140°F) • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 89 – 97 km/h (55 – 60 mph). 3. Travel for 30 minutes or more while keeping the vehicle speed at 89 – 97 km/h (55 – 60 mph). Carry out one gradual deceleration/acceleration returning to 89 – 97 km/h (55 – 60 mph) within 120 seconds. (During monitor) 4. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output. 6. If DTC P0171 is output, refer to DTC P0171 – System too lean (cylinder 1, 4) P.13A-406. If DTC P0172 is output, refer to DTC P0172 – System too rich (cylinder 1, 4) P.13A-415. If DTC P0174 is output, refer to DTC P0174 – System too lean (cylinder 2, 3) P.13A-421. If DTC P0175 is output, refer to DTC P0175 – System too rich (cylinder 2, 3) P.13A-430.

PROCEDURE 3

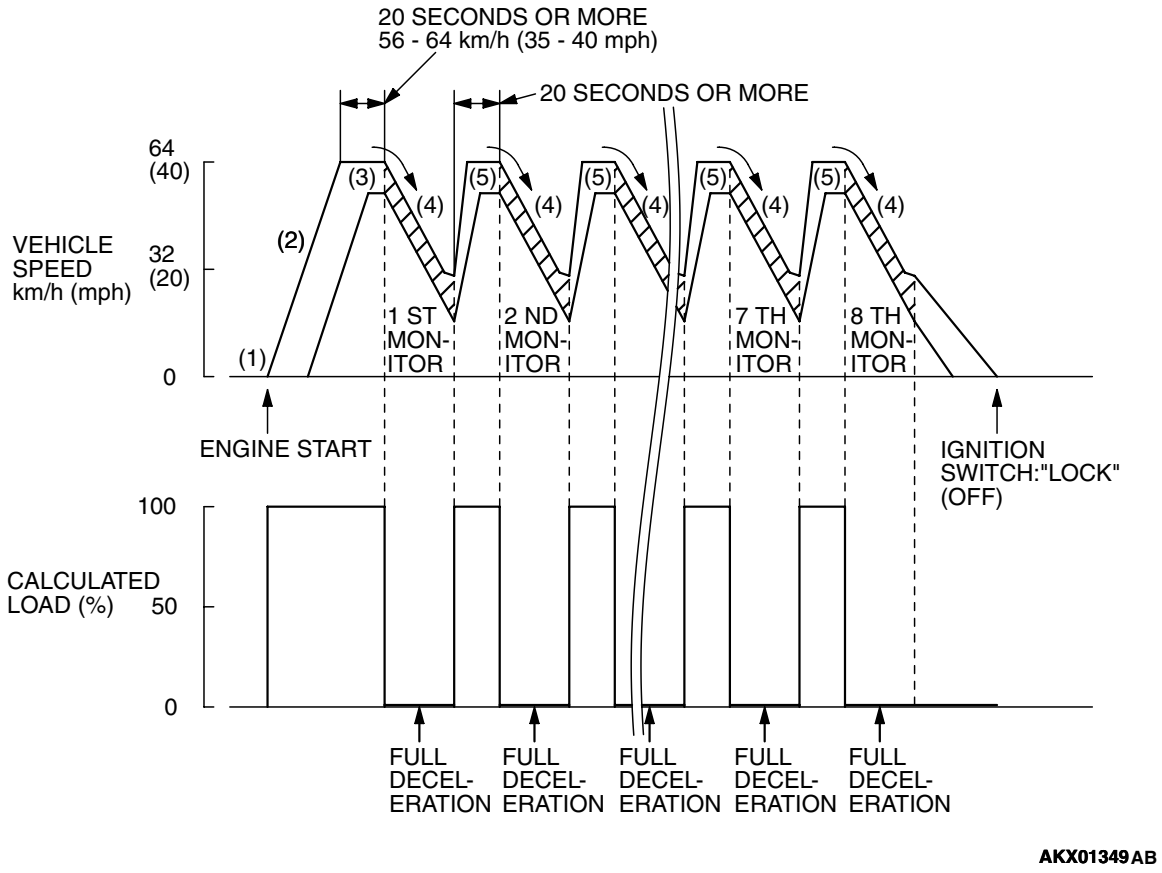
CATALYTIC CONVERTER MONITOR	
DTC	P0421, P0431
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 20 minutes. You must complete this drive twice. *NOTE: Vehicle speed and throttle opening angle should be within the shaded range.* 
Inspection conditions	• Atmospheric temperature: –10°C (14°F) or more • A/C switch: OFF • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 72 km/h (45 mph). 3. Travel for 300 seconds or more while keeping the vehicle speed at 72 – 97 km/h (45 – 60 mph). 4. Decelerate until the vehicle speed is within 56 – 64 km/h (35 – 40 mph). 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 56 – 64 km/h (35 – 40 mph) and travel for 90 seconds or more. (During monitor) 6. Fully close the throttle and decelerate, and keep the deceleration state for 10 seconds. Then, quickly accelerate until the vehicle speed reaches 56 – 64 km/h (35 – 40 mph). Then, repeat steps 5 and 6, and complete six monitor sessions. 7. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 8. Confirm that the diagnostic trouble code (DTC) is not output. 9. If DTC P0421 is output, refer to DTC P0421 – Warm Up Catalyst Efficiency Below Threshold (cylinder 1, 4) P.13A-598. If DTC P0431 is output, refer to DTC P0431 – Warm Up Catalyst Efficiency Below Threshold (cylinder 2, 3) P.13A-602.

TSB Revision

PROCEDURE 4

HEATED OXYGEN SENSOR MONITOR	
DTC	P0133, P0139, P0153, P0159
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 5 minutes. You must complete this drive twice. *NOTE: . Vehicle speed and throttle opening angle should be within the shaded range.*  AKX01348 AB
Inspection conditions	• Engine coolant temperature: 80°C (176°F) or more • Atmospheric temperature: –10°C (14°F) or more • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph). 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 56 – 64 km/h (35 – 40 mph) and travel for 120 seconds or more. (During monitor) 4. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output. 6. If DTC P0133 is output, refer to DTC P0133 – Cylinder 1, 4 Heated Oxygen Sensor Circuit Slow Response (Sensor 1) P.13A-222. If DTC P0139 is output, refer to DTC P0139 – Cylinder 1, 4 Heated Oxygen Sensor Circuit Slow Response (Sensor 2) P.13A-280. If DTC P0153 is output, refer to DTC P0153 – Cylinder 2, 3 Heated Oxygen Sensor Circuit Slow Response (Sensor 1) P.13A-329. If DTC P0159 is output, refer to DTC P0159 – Cylinder 2, 3 Heated Oxygen Sensor Circuit Slow Response (Sensor 2) P.13A-387.

PROCEDURE 5

EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITOR	
DTC	P0401
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 10 minutes. You must complete this drive twice. *NOTE: . Vehicle speed and throttle opening angle should be within the shaded range.*  AKX01349AB
Inspection conditions	• Engine coolant temperature: 80°C (176°F) or more • Atmospheric temperature: 5°C (41°F) or more • A/C switch: OFF • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph). 3. Travel for 20 seconds or more while keeping the vehicle speed at 56 – 64 km/h (35 – 40 mph). 4. Fully close the throttle from an engine speed of 2,000 – 3,000 r/min, and while keeping the clutch engaged, decelerate to approximately 900 r/min without applying the brakes. Do not steer the handle or turn the light ON/OFF during this time. (During monitor) 5. Accelerate until the vehicle speed reaches 56 – 64 km/h (35 – 40 mph), and travel for 20 seconds or more. Then, repeat steps 4 and 5 and complete 8 monitor sessions. 6. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 7. Confirm that the diagnostic trouble code (DTC) is not output. 8. If DTC P0401 is output, refer to DTC P0401 – Exhaust Gas Recirculation Flow Insufficient detected P.13A-581.

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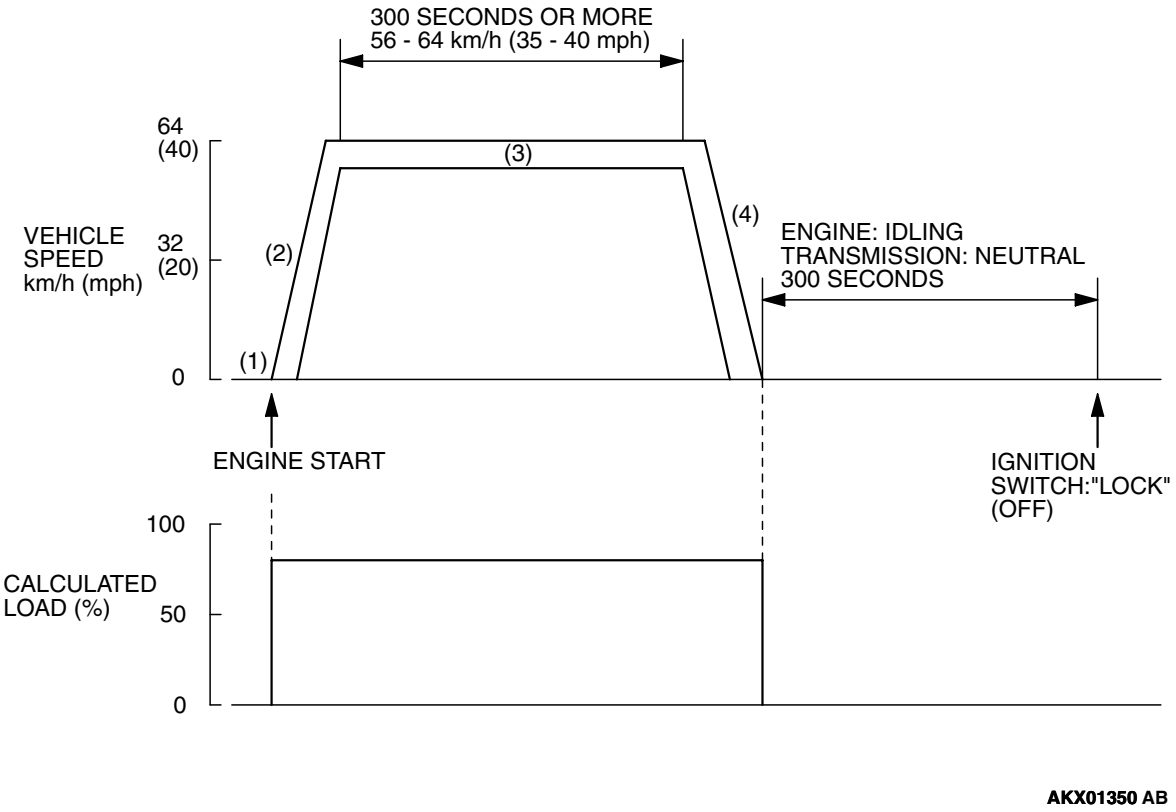
PROCEDURE 6

OTHER MONITOR (Main components, sensors and switches, wire breakage and short circuit)	
DTC	• Main components: P0106, P0107, P0108, P0134, P0154, P0300, P0301, P0302, P0303, P0304, P0506, P0507 • Sensors and switches: P0069, P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0125, P0181, P0182, P0183, P0335, P0340, P0461, P2066, • Wire breakage and short circuit: P0130, P0131, P0132, P0135, P0136, P0137, P0138, P0141, P0150, P0151, P0152, P0155, P0156, P0157, P0158, P0161, P0201, P0202, P0203, P0204, P0403, P0443, P0446, P0462, P0463, P2228, P2229

OTHER MONITOR (Main components, sensors and switches, wire breakage and short circuit)	
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while driving the vehicle with the following drive cycle pattern. It will take 10 minutes. You must complete this drive twice. *NOTE: Drive according to the graph below.*  AKX01350 AB
Inspection conditions	• Engine coolant temperature: 80°C (176°F) or more • Atmospheric temperature: 5°C (41°F) or more • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph), and travel for 300 seconds or more. 3. Return the vehicle to the shop. 4. After stopping the vehicle, continue idling for 300 seconds, and then turn the ignition switch to the "LOCK" (OFF) position. Moreover, the vehicle should be set to the following conditions for idling. *NOTE: Vehicles for Canada, the headlight, taillight, etc. remain lit even when the lighting switch is in "OFF" positions but this is no problem for checks.* • A/C switch: OFF • Lights and all accessories: OFF • Transaxle: P range • Steering wheel: Straightforward position 5. Confirm that the diagnostic trouble code (DTC) is not output. 6. If a DTC is displayed, refer to Diagnostic Trouble Code Chart P.13A-33.

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 (MUT-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 (MUT-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: P0130, P0131, P0132, P0133, P0134, P0136, P0137, P0138, P0139, P0150, P0151, P0152, P0153, P0154, P0156, P0157, P0158, P0159
- Heated oxygen sensor heater: P0135, P0141, P0155, P0161
- 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 (MUT-III Sub Assembly) displays all the Readiness Codes as "Complete"

FAIL-SAFE FUNCTION REFERENCE TABLE

M1131153000374

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	• 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 into the cylinders in the order 1-3-4-2 with irregular timing. (After the ignition switch is turned to the "ON" position, the No. 1 cylinder top dead center is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa (30 in.Hg).
Knock sensor	Switches the ignition timing from ignition timing for high octane to ignition timing for standard octane fuel.
Heated oxygen sensor <front>	Air/fuel ratio closed loop control is not performed.
Heated oxygen sensor <rear>	Performs the closed loop control of the air/fuel ratio by using only the signal of the heated oxygen sensor (front) installed on the front side of the catalytic converter.
Generator FR terminal	No generator output suppression control is performed for the electrical load (to be operated as an ordinary generator).
Misfire detection	The PCM stops supplying fuel to the cylinder with the highest misfiring rate if a misfiring that could damage the catalytic converter is detected.
Accelerator pedal position sensor (main)	• 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)	• 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)	• 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)	• 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	• 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	• 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	• 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	• 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 and lift electronic control	• Do not switch to high-speed cam. • Cut off fuel when the engine speed exceeds 5,000 r/min.

DIAGNOSTIC TROUBLE CODE CHART

M1131151001489

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

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor	P.13A-41
P0101*	Mass airflow circuit range/performance problem	P.13A-46
P0102*	Mass airflow circuit low input	P.13A-55
P0103*	Mass airflow circuit high input	P.13A-65
P0106	Manifold absolute pressure circuit range/performance problem	P.13A-72
P0107	Manifold absolute pressure circuit low input	P.13A-86
P0108	Manifold absolute pressure circuit high input	P.13A-98
P0111*	Intake air temperature circuit range/performance problem	P.13A-107
P0112*	Intake air temperature circuit low input	P.13A-116
P0113*	Intake air temperature circuit high input	P.13A-123
P0116*	Engine coolant temperature circuit range/performance problem	P.13A-133
P0117*	Engine coolant temperature circuit low input	P.13A-142
P0118*	Engine coolant temperature circuit high input	P.13A-149
P0122*	Throttle position sensor (main) circuit low input	P.13A-159
P0123*	Throttle position sensor (main) circuit high input	P.13A-169
P0125*	Insufficient coolant temperature for closed loop fuel control	P.13A-177
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	P.13A-190
P0130	Cylinder 1, 4 heated oxygen sensor circuit (sensor 1)	P.13A-192
P0131	Cylinder 1, 4 heated oxygen sensor circuit low voltage (sensor 1)	P.13A-210
P0132	Cylinder 1, 4 heated oxygen sensor circuit high voltage (sensor 1)	P.13A-217
P0133	Cylinder 1, 4 heated oxygen sensor circuit slow response (sensor 1)	P.13A-222
P0134*	Cylinder 1, 4 heated oxygen sensor circuit no activity detected (sensor 1)	P.13A-228
P0135	Cylinder 1, 4 heated oxygen sensor heater circuit (sensor 1)	P.13A-237
P0136	Cylinder 1, 4 heated oxygen sensor circuit (sensor 2)	P.13A-250
P0137	Cylinder 1, 4 heated oxygen sensor circuit low voltage (sensor 2)	P.13A-268
P0138	Cylinder 1, 4 heated oxygen sensor circuit high voltage (sensor 2)	P.13A-275
P0139	Cylinder 1, 4 heated oxygen sensor circuit slow response (sensor 2)	P.13A-280
P0141	Cylinder 1, 4 heated oxygen sensor heater circuit (sensor 2)	P.13A-286
P0150	Cylinder 2, 3 heated oxygen sensor circuit (sensor 1)	P.13A-299

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0151	Cylinder 2, 3 heated oxygen sensor circuit low voltage (sensor 1)	P.13A-317
P0152	Cylinder 2, 3 heated oxygen sensor circuit high voltage (sensor 1)	P.13A-324
P0153	Cylinder 2, 3 heated oxygen sensor circuit slow response (sensor 1)	P.13A-329
P0154*	Cylinder 2, 3 heated oxygen sensor circuit no activity detected (sensor 1)	P.13A-335
P0155	Cylinder 2, 3 heated oxygen sensor heater circuit (sensor 1)	P.13A-344
P0156	Cylinder 2, 3 heated oxygen sensor circuit (sensor 2)	P.13A-357
P0157	Cylinder 2, 3 heated oxygen sensor circuit low voltage (sensor 2)	P.13A-375
P0158	Cylinder 2, 3 heated oxygen sensor circuit high voltage (sensor 2)	P.13A-382
P0159	Cylinder 2, 3 heated oxygen sensor circuit slow response (sensor 2)	P.13A-387
P0161	Cylinder 2, 3 heated oxygen sensor heater circuit (sensor 2)	P.13A-393
P0171	System too lean (cylinder 1, 4)	P.13A-406
P0172	System too rich (cylinder 1, 4)	P.13A-415
P0174	System too lean (cylinder 2, 3)	P.13A-421
P0175	System too rich (cylinder 2, 3)	P.13A-430
P0181	Fuel tank temperature sensor circuit range/performance	P.13A-436
P0182	Fuel tank temperature sensor circuit low input	P.13A-448
P0183	Fuel tank temperature sensor circuit high input	P.13A-454
P0201	Injector circuit-cylinder 1	P.13A-464
P0202	Injector circuit-cylinder 2	P.13A-474
P0203	Injector circuit-cylinder 3	P.13A-484
P0204	Injector circuit-cylinder 4	P.13A-494
P0222*	Throttle position sensor (sub) circuit low input	P.13A-504
P0223*	Throttle position sensor (sub) circuit high input	P.13A-514
P0300	Random/multiple cylinder misfire detected	P.13A-521
P0301	Cylinder 1 misfire detected	P.13A-527
P0302	Cylinder 2 misfire detected	P.13A-530
P0303	Cylinder 3 misfire detected	P.13A-533
P0304	Cylinder 4 misfire detected	P.13A-536
P0325	Knock sensor circuit	P.13A-540
P0335*	Crankshaft position sensor circuit	P.13A-548
P0340*	Camshaft position sensor circuit	P.13A-566
P0401	Exhaust gas recirculation flow insufficient detected	P.13A-581
P0403	Exhaust gas recirculation control circuit	P.13A-585
P0421	Warm up catalyst efficiency below threshold (cylinder 1, 4)	P.13A-598
P0431	Warm up catalyst efficiency below threshold (cylinder 2, 3)	P.13A-602
P0441	Evaporative emission control system incorrect purge flow	P.13A-606

DTC	DIAGNOSTIC ITEM		REFERENCE PAGE
P0442	Evaporative emission control system leak detected (Small leak)		P.13A-611
P0443	Evaporative emission control system purge control valve circuit		P.13A-626
P0446	Evaporative emission control system vent control circuit		P.13A-637
P0451	Evaporative emission control system pressure sensor range/performance		P.13A-669
P0452	Evaporative emission control system pressure sensor low input		P.13A-690
P0453	Evaporative emission control system pressure sensor high input		P.13A-711
P0455	Evaporative emission control system leak detected (Gross leak)		P.13A-732
P0456	Evaporative emission control system leak detected (Very small leak)		P.13A-749
P0461	Fuel level sensor (main) circuit range/performance		P.13A-764
P0462	Fuel level sensor circuit low input		P.13A-771
P0463	Fuel level sensor circuit high input		P.13A-777
P0506	Idle control system RPM lower than expected		P.13A-783
P0507	Idle control system RPM higher than expected		P.13A-786
P0513	Immobilizer malfunction		P.13A-789
P0551	Power steering pressure switch circuit range/performance		P.13A-791
P0554	Power steering pressure switch circuit intermittent		P.13A-804
P0603	EEPROM malfunction		P.13A-810
P0606*	Powertrain control module main processor malfunction		P.13A-811
P0622	Generator FR terminal circuit malfunction		P.13A-813
P0630	VIN malfunction		P.13A-820
P0638*	Throttle actuator control motor circuit range/performance		P.13A-823
P0642*	Throttle position sensor power supply		P.13A-830
P0657*	Throttle actuator control motor relay circuit malfunction		P.13A-832
P0705	Transmission range switch circuit malfunction (PRNDL input)	• A/T DTC No. 27 (Transmission range switch system: Open circuit) • A/T DTC No. 28 (Transmission range switch system: Short circuit)	P.23A-42
P0712*	Transmission fluid temperature sensor low input	• A/T DTC No. 16 (Transmission fluid temperature sensor system: Short circuit)	P.23A-42
P0713*	Transmission fluid temperature sensor high input	• A/T DTC No. 15 (Transmission fluid temperature sensor system: Open circuit)	P.23A-42
P0715*	Input/turbine speed sensor circuit	• A/T DTC No. 22 (Input shaft speed sensor system: Short circuit/Open circuit)	P.23A-42
P0720*	Output speed sensor circuit	• A/T DTC No. 23 (Output shaft speed sensor system: Short circuit/Open circuit)	P.23A-42
P0731*	Gear 1 incorrect	• A/T DTC No. 41 (1st gear incorrect ratio)	P.23A-42
P0732*	Gear 2 incorrect	• A/T DTC No. 42 (2nd gear incorrect ratio)	P.23A-42

DTC	DIAGNOSTIC ITEM		REFERENCE PAGE
P0733*	Gear 3 incorrect	• A/T DTC No. 43 (3rd gear incorrect ratio)	P.23A-42
P0734*	Gear 4 incorrect	• A/T DTC No. 44 (4th gear incorrect ratio)	P.23A-42
P0736*	Gear R incorrect	• A/T DTC No. 46 (Reverse gear incorrect ratio)	P.23A-42
P0741	Torque converter clutch circuit performance or stuck off	• A/T DTC No. 52 (Torque converter clutch solenoid system: Defective system)	P.23A-42
P0742	Torque converter clutch circuit stuck on	• A/T DTC No. 53 (Torque converter clutch solenoid system: Lock-up stuck on)	P.23A-42
P0743*	Torque converter clutch circuit electrical	• A/T DTC No. 36 (Torque converter clutch solenoid system: Short circuit/Open circuit)	P.23A-42
P0753*	Shift solenoid "A" electrical	• A/T DTC No. 31 (Low and reverse solenoid valve system: Short circuit/Open circuit)	P.23A-42
P0758*	Shift solenoid "B" electrical	• A/T DTC No. 32 (Underdrive solenoid valve system: Short circuit/Open circuit)	P.23A-42
P0763*	Shift solenoid "C" electrical	• A/T DTC No. 33 (Second solenoid valve system: Short circuit/Open circuit)	P.23A-42
P0768*	Shift solenoid "D" electrical	• A/T DTC No. 34 (Overdrive solenoid valve system: Short circuit/Open circuit)	P.23A-42
P1020	Mitsubishi innovative valve timing and lift electronic control system (MIVEC) performance problem		P.13A-844
P1021	Engine oil control valve circuit		P.13A-854
P1530	A/C1 switch circuit intermittent		P.13A-864
P1602*	Communication malfunction (between PCM main processor and system LSI)		P.13A-865
P1603*	Battery backup line malfunction		P.13A-867
P1751*	A/T control relay malfunction	• A/T DTC No. 54 (A/T control relay system: Short circuit to ground /open circuit)	P.23A-42
P2066	Fuel level sensor (sub) circuit range/performance		P.13A-874
P2100*	Throttle actuator control motor circuit (open)		P.13A-879
P2101*	Throttle actuator control motor magneto malfunction		P.13A-887
P2122*	Accelerator pedal position sensor (main) circuit low input		P.13A-893
P2123*	Accelerator pedal position sensor (main) circuit high input		P.13A-903
P2127*	Accelerator pedal position sensor (sub) circuit low input		P.13A-910
P2128*	Accelerator pedal position sensor (sub) circuit high input		P.13A-920
P2135*	Throttle position sensor (main and sub) range/performance problem		P.13A-927
P2138*	Accelerator pedal position sensor (main and sub) range/performance problem		P.13A-933
P2228*	Barometric pressure circuit low input		P.13A-947
P2229*	Barometric pressure circuit high input		P.13A-949
U1073	Bus off		P.13A-951

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
U1102	ABS–ECU time–out	P.13A-954
U1108*	Combination meter time–out	P.13A-958
U1110	A/C–ECU time–out	P.13A-962

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 "", the diagnostic trouble code is recorded on the first detection of the malfunction.*

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

SYMPTOM CHART

M1131151500760

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

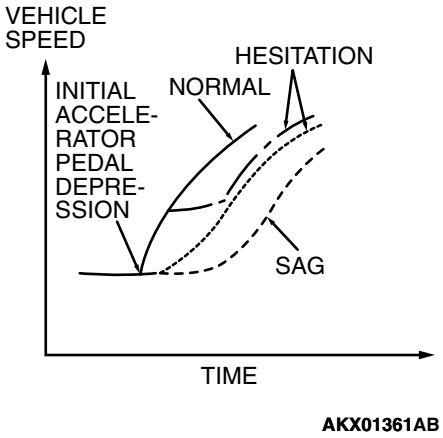
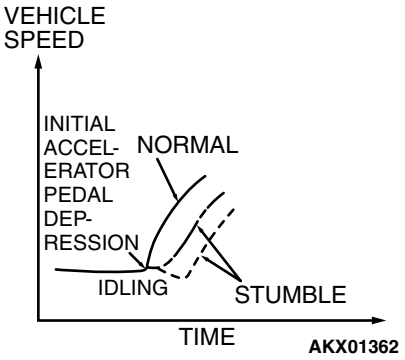
TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Communication with scan tool is impossible	Communication with all systems is not possible	1	P.13A-967
	Communication with PCM only is not possible	2	P.13A-970
Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) and related parts	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) does not illuminate right after the ignition switch is turned to the "ON" position	3	P.13A-973
	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) remains illuminated and never goes out	4	P.13A-974
Starting	Cranks, won't start	5	P.13A-976
	Starts up and dies	6	P.13A-981
	Hard starting	7	P.13A-986
Idling stability (improper idling)	Unstable idle (rough idle, hunting)	8	P.13A-991
	Idle speed is high (improper idle speed)	9	P.13A-995
	Idle speed is low (improper idle speed)	10	P.13A-997
Idling stability (engine stalls)	When the engine is cold, it stalls at idle (die out)	11	P.13A-999
	When the engine is hot, it stalls at idle (die out)	12	P.13A-1002
	The engine stalls when accelerating (pass out)	13	P.13A-1005
	The engine stalls when decelerating	14	P.13A-1007
Driving	Hesitation, sag or stumble	15	P.13A-1009
	Acceleration shock	16	P.13A-1013
	Deceleration shock	17	P.13A-1014
	Poor acceleration	18	P.13A-1015
	Surge	19	P.13A-1018
	Knocking	20	P.13A-1022
Dieseling (Run-on)		21	P.13A-1024

TSB Revision

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Too high CO and HC concentration when idling		22	P.13A-1024
IM240 test failure	Transient, mass emission tailpipe test failure	23	P.13A-1027
	Purge flow test of the evaporative emission canister failure	24	P.13A-1034
	Pressure test of the evaporative system failure	25	P.13A-1035
Generator output voltage is low (approximately 12.3 volts)		26	P.13A-1036
Fans (radiator fan, A/C condenser fan) are inoperative		27	P.13A-1040
Power supply system and ignition switch-IG system		28	P.13A-1043
Fuel pump system		29	P.13A-1054
Ignition switch-ST system and transmission range switch system		30	P.13A-1068
Ignition circuit system		31	P.13A-1073
A/C system		32	P.13A-1081

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	"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". 
	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	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. 
	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 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)

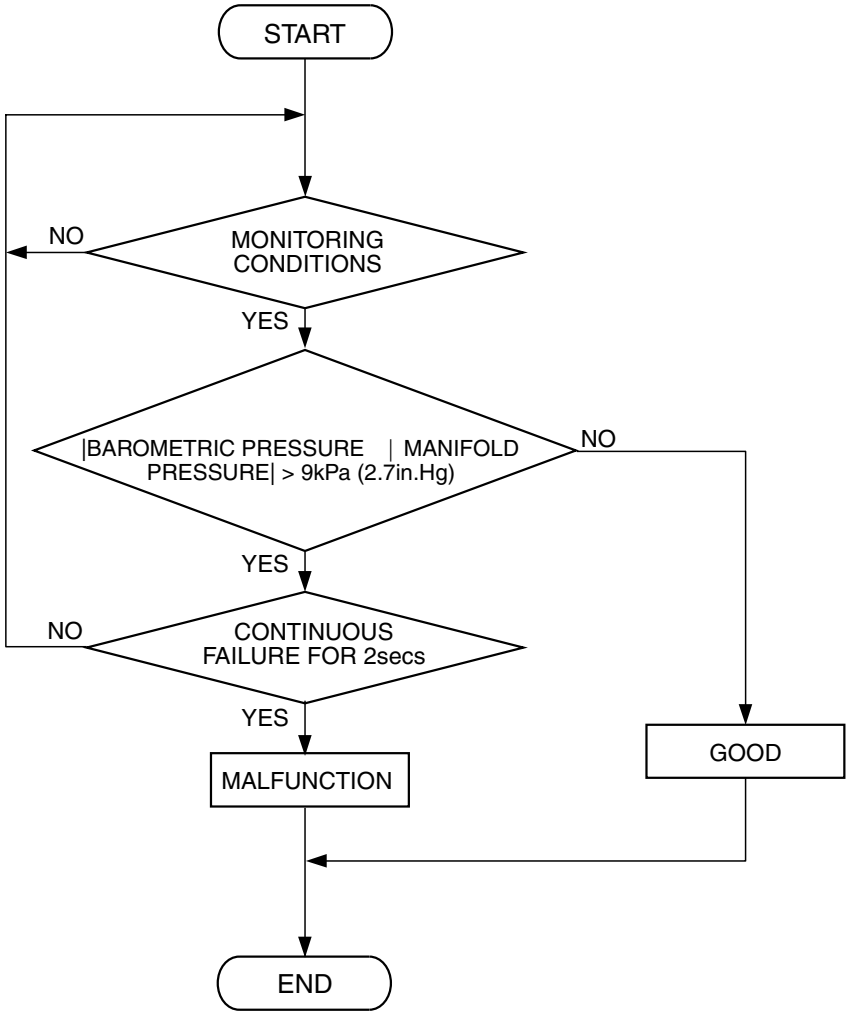
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgment 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.

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DIAGNOSIS

Required Special Tools

- MB991958: Scan tool (MUT-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).

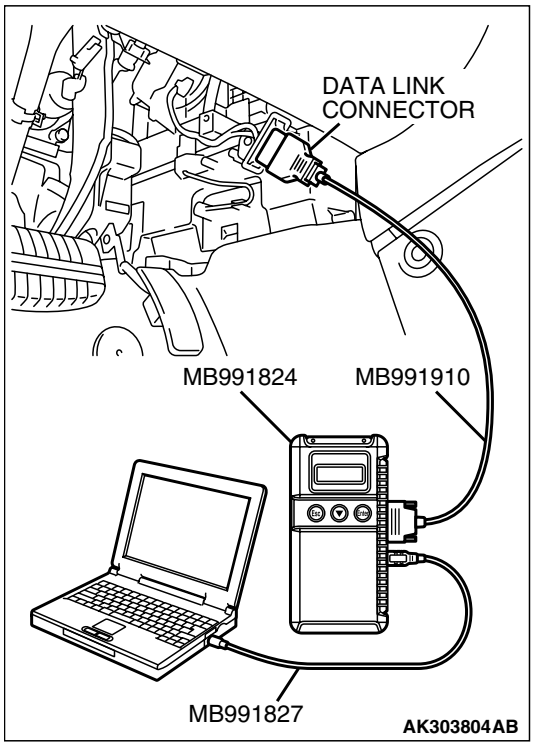
⚠ CAUTION

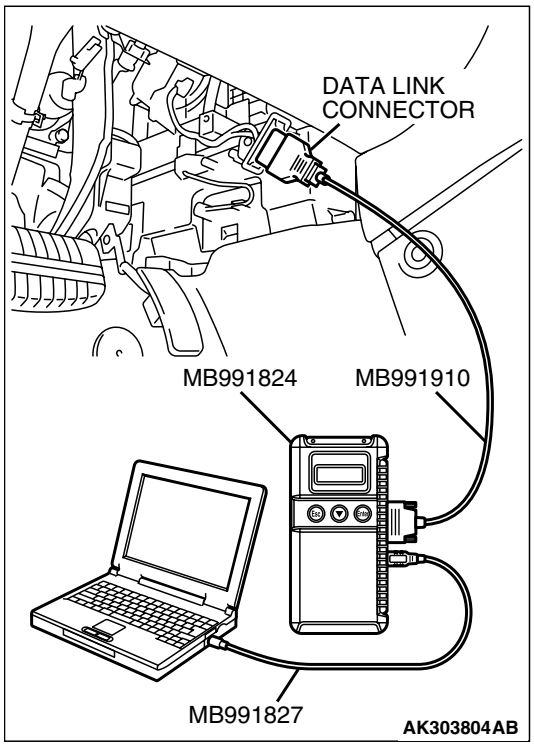
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(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.13A-33.
NO : Go to Step 2.





STEP 2. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.

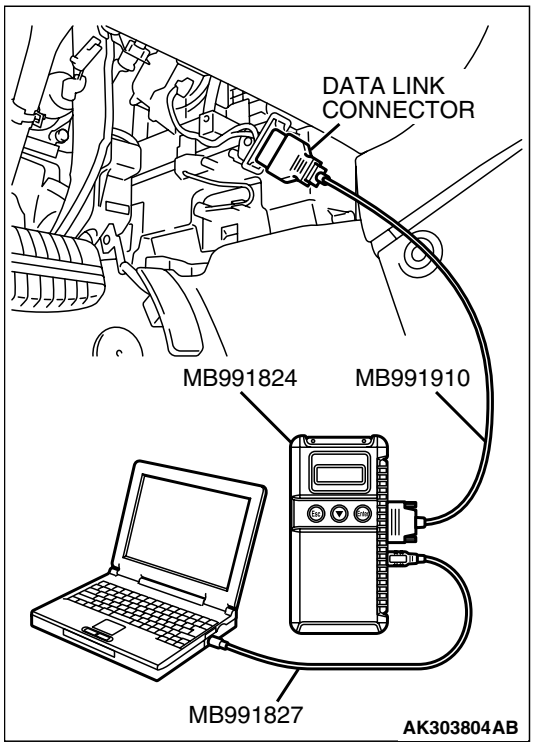
(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

(3) Start the engine.
- When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
- When the engine is suddenly revved, manifold absolute pressure varies.

(4) 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.13A-46, DTC P0107 – Manifold Absolute Pressure Circuit Low Input P.13A-55, DTC P0108 – Manifold Absolute Pressure Circuit High Input P.13A-65.



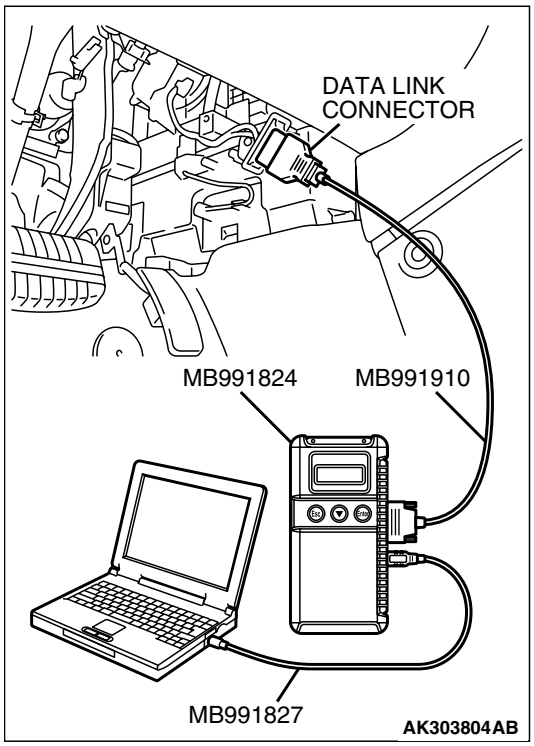
STEP 3. Using scan tool MB991958, check data list item 25: Barometric Pressure Sensor.

(1) Start the engine and run at idle.
(2) Set scan tool MB991958 to the data reading mode for item 25, Barometric 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) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 4.
NO : Refer to, DTC P2228 – Barometric Pressure Circuit Low Input P.13A-55, DTC P2229 – Barometric Pressure Circuit High Input P.13A-65.

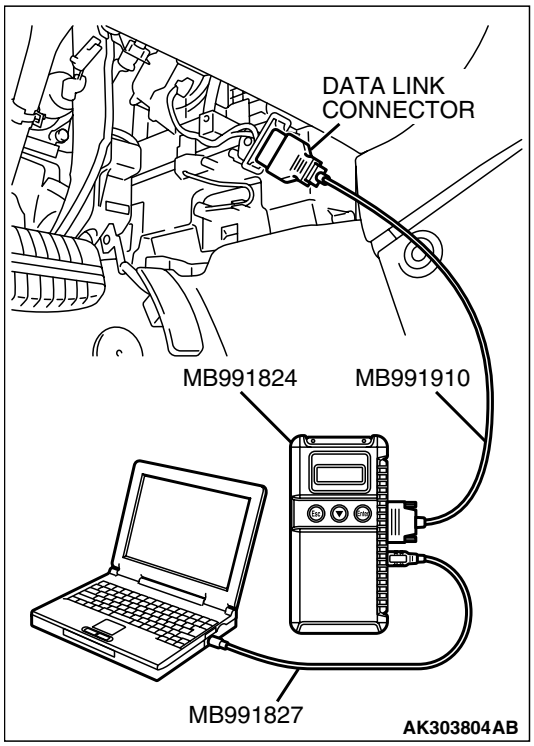


STEP 4. Using scan tool MB991958, read the diagnostic trouble code (DTC).

(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 : Replace the PCM. Then go to Step 5.
NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.



STEP 5. 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.

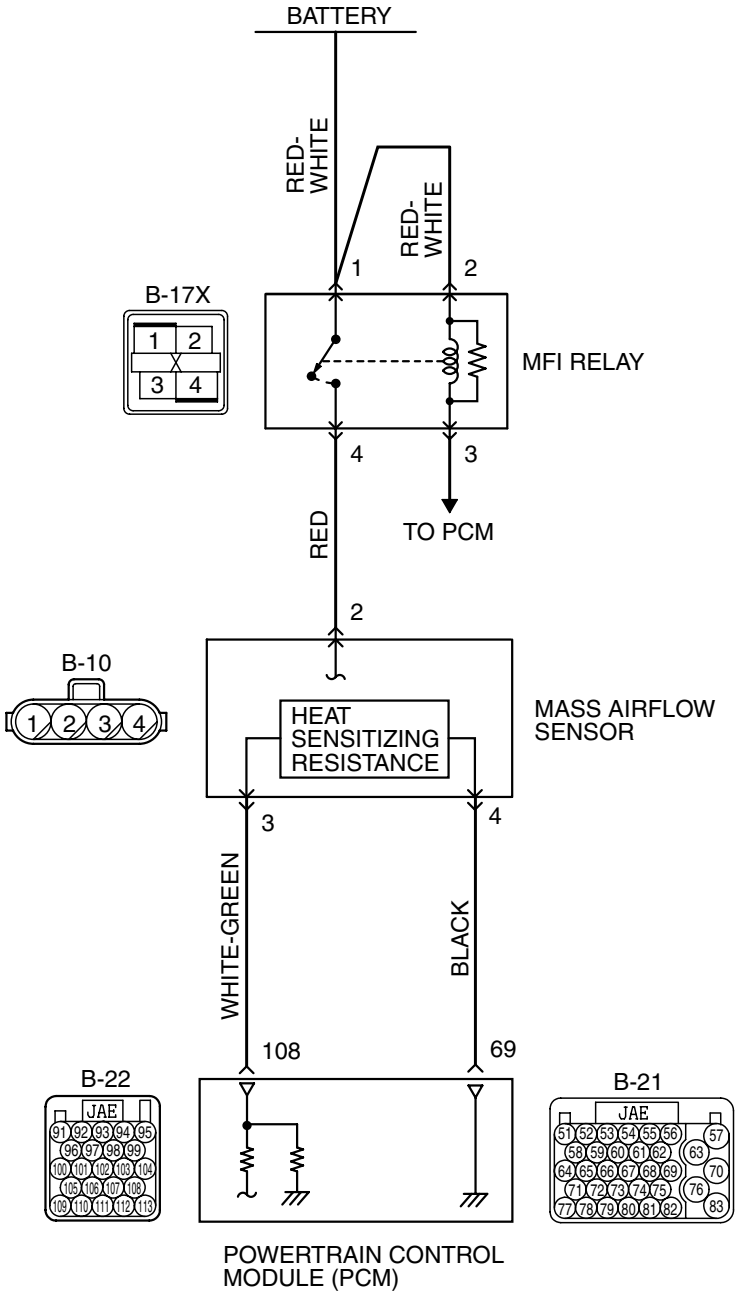
Q: Is DTC P0069 set?

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



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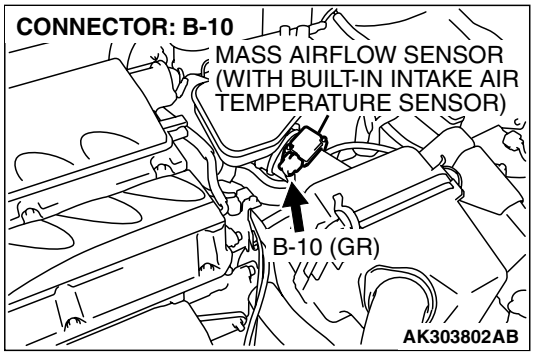
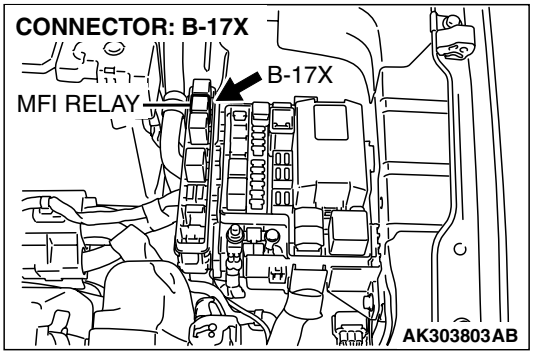
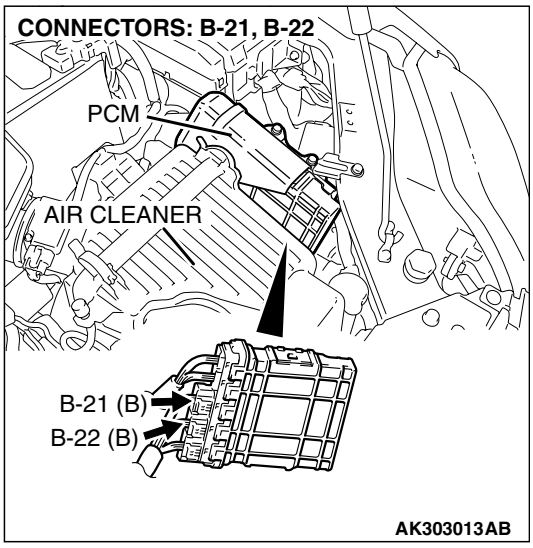






CIRCUIT OPERATION

- 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)

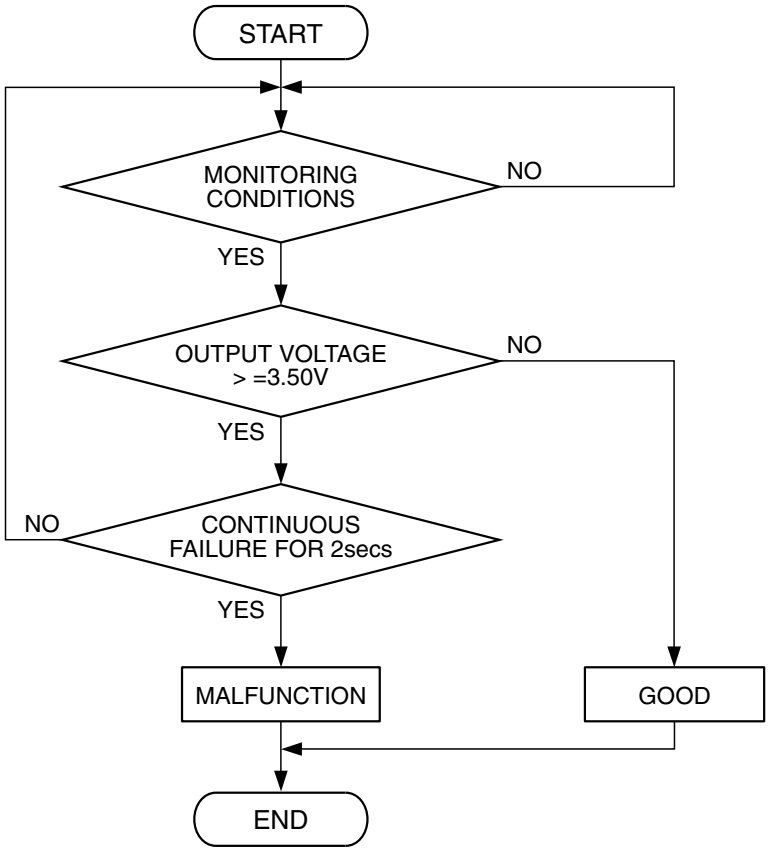
- Not applicable

Sensor (The sensor below is determined to be normal)

- Throttle position sensor

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

Logic Flow Chart



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Check Conditions

- Throttle position sensor output voltage is 1.0 volt or lower.
- Mass airflow sensor output voltage is 4.9 volts or lower.

Judgement Criteria

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

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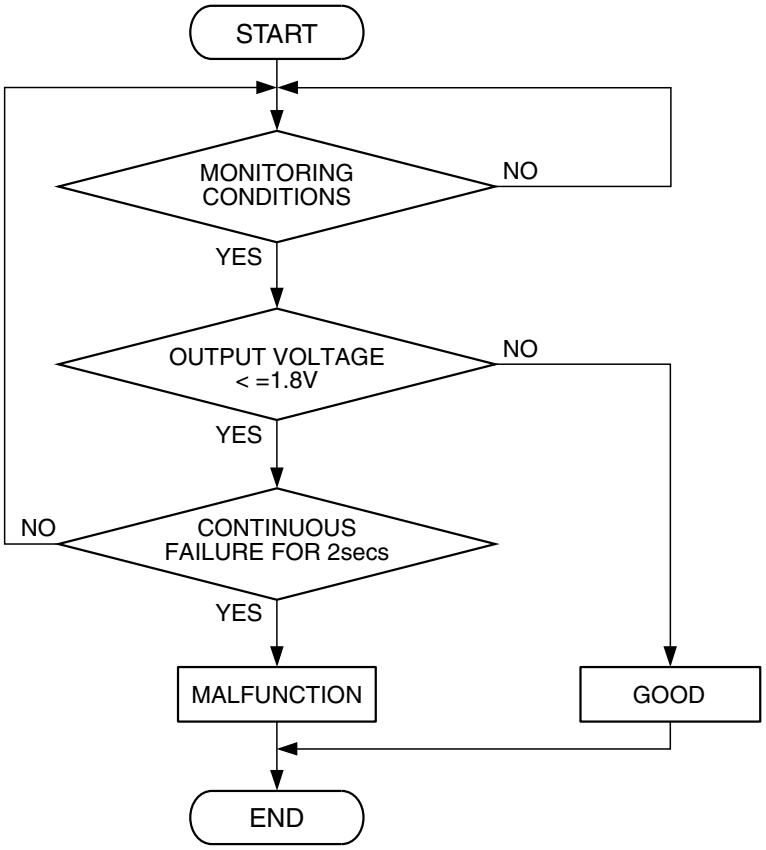
DTC SET CONDITIONS <Range/Performance problem – low input>

Logic Flow Chart



AK401683

Check Conditions

- Throttle position sensor output voltage is 1.5 volts or higher.
- Mass airflow sensor output voltage is 0.2 volt or higher.

Judgement Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

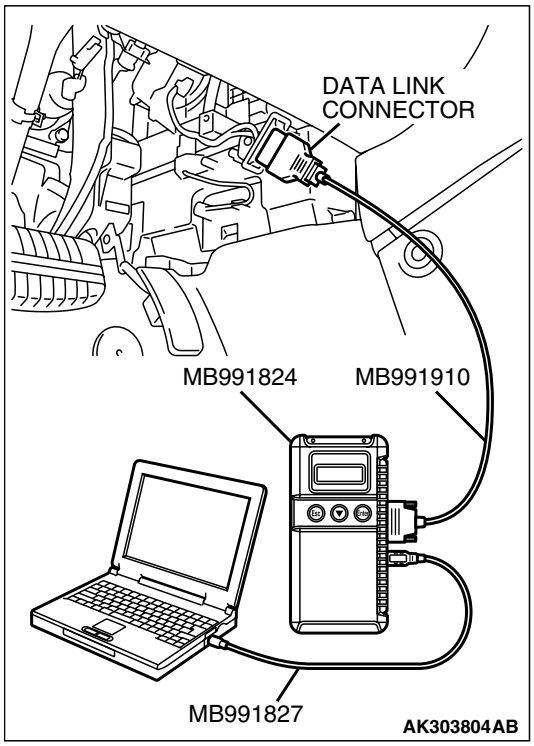
- Mass airflow sensor failed.
- Mass airflow sensor circuit harness damage, or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

TSB Revision



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

⚠ CAUTION

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

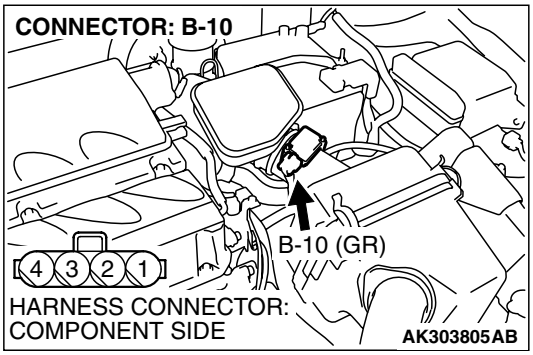
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 12, Mass Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 2.0 and 6.0 g/sec.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

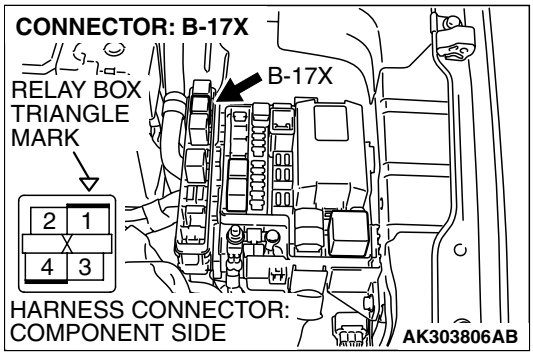


STEP 2. Check harness connector B-10 at mass airflow sensor and harness connector B-17X at MFI relay for damage.

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.

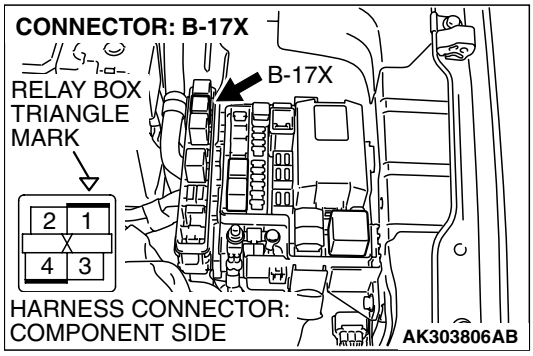


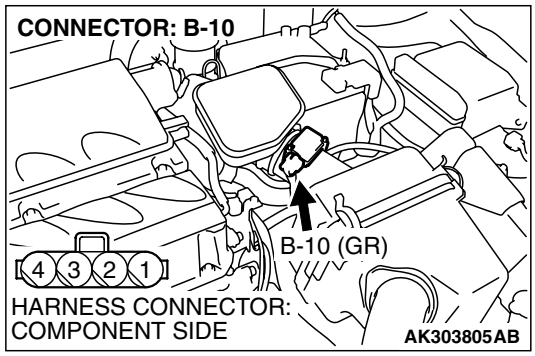
STEP 3. Check for harness damage between MFI relay connector B-17X (terminal No. 4) and mass airflow sensor connector B-10 (terminal No. 2).

Q: Is the harness wire in good condition?

YES : Go to Step 4.

NO : Repair it. Then go to Step 9.



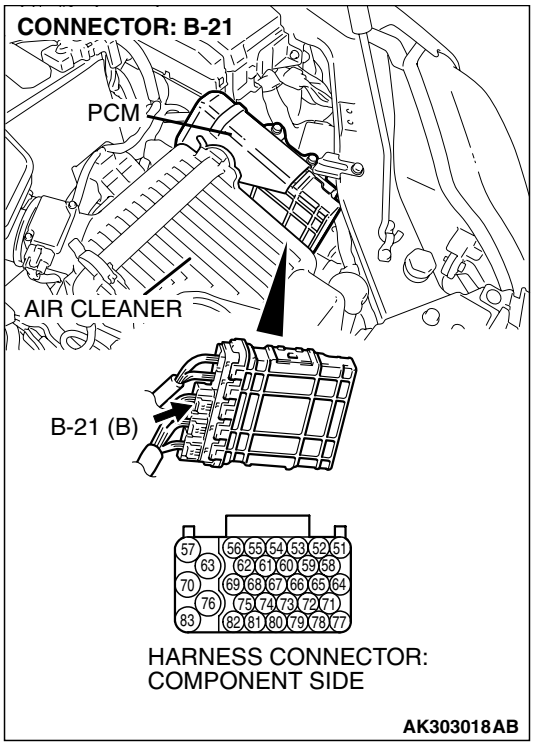


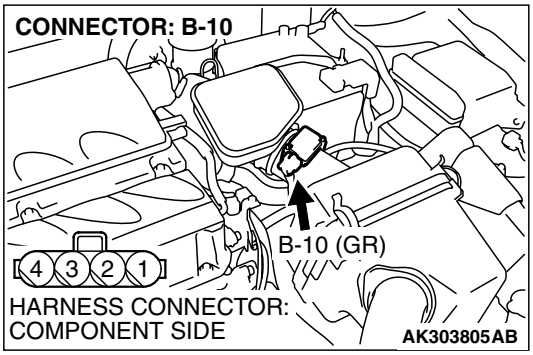
STEP 4. Check harness connector B-21 at PCM for damage.

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.

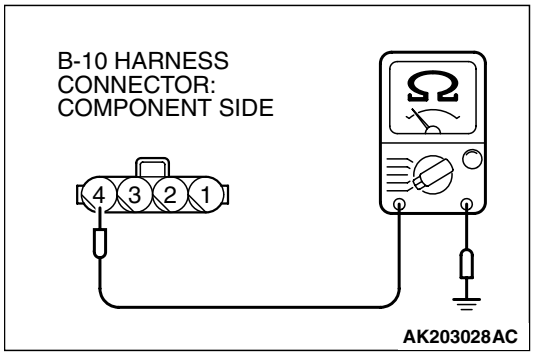
(2) Check for the continuity between terminal No. 4 and ground.

- Should be less than 2 ohms.

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.

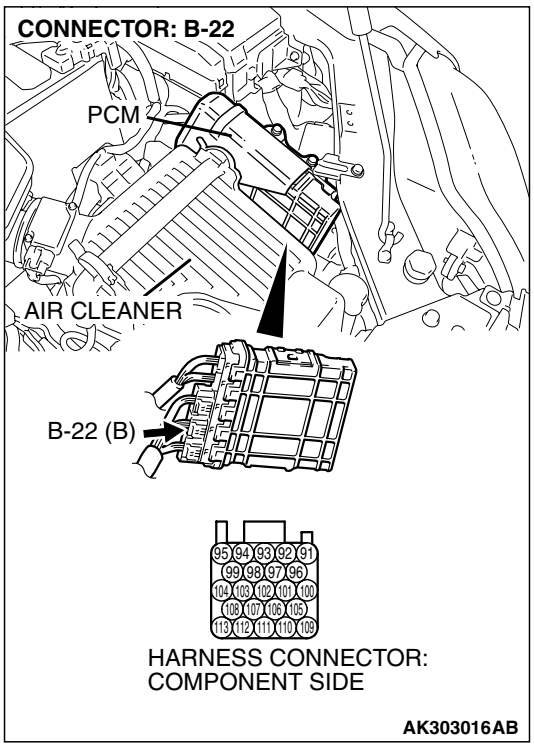


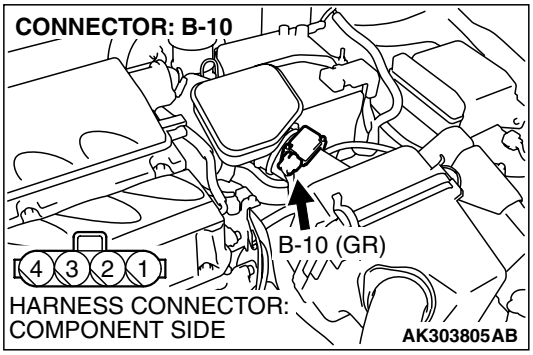
STEP 6. Check harness connector B-22 at PCM for damage.

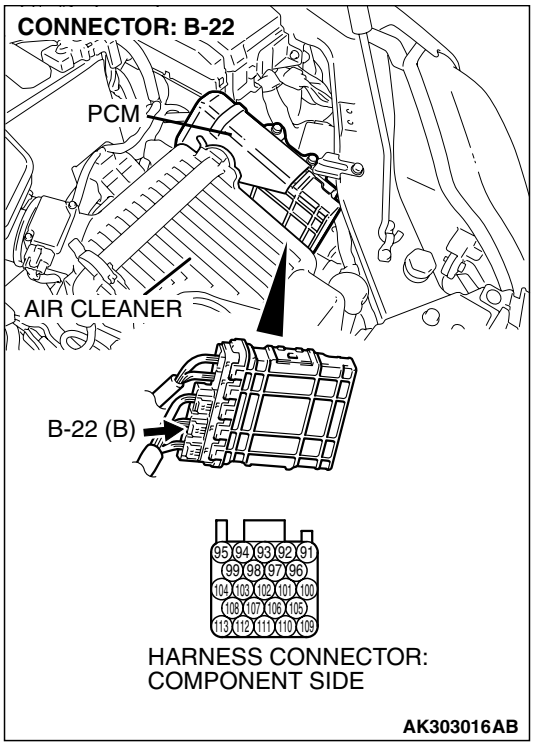
Q: Is the harness connector in good condition?

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.





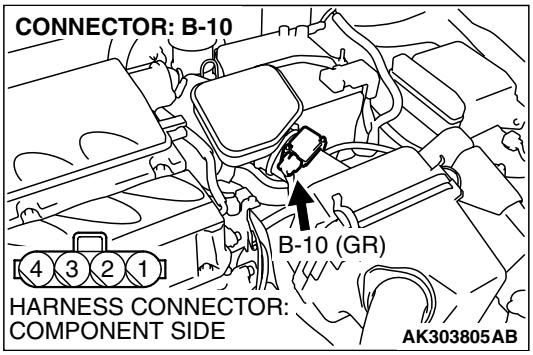


STEP 7. Check for harness damage between mass airflow sensor connector B-10 (terminal No. 3) and PCM connector B-22 (terminal No. 108).

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 – Procedure 6 – Other Monitor P.13A-6.
(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0101 set?

YES : Replace the PCM. Then go to Step 9.
NO : The inspection is complete.

STEP 9. Test the OBD-II drive cycle.

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

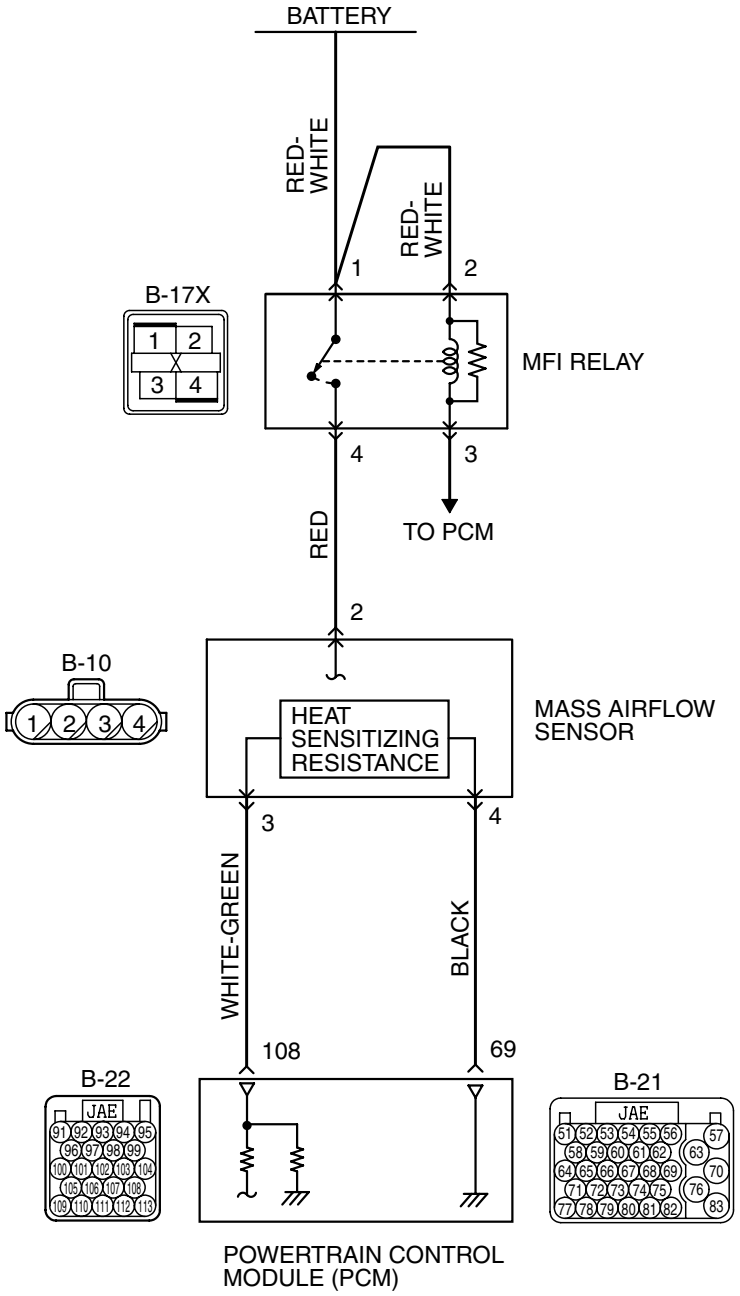
Q: Is DTC P0101 set?

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

DTC P0102: Mass Airflow Circuit Low Input

⚠ 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



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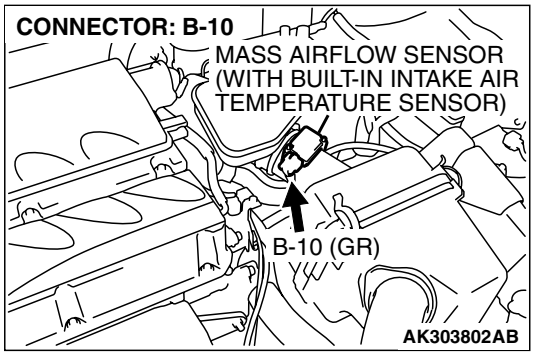
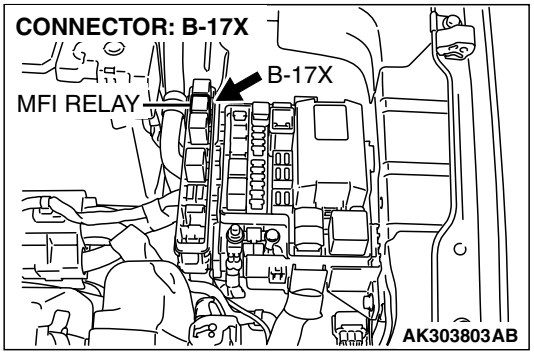
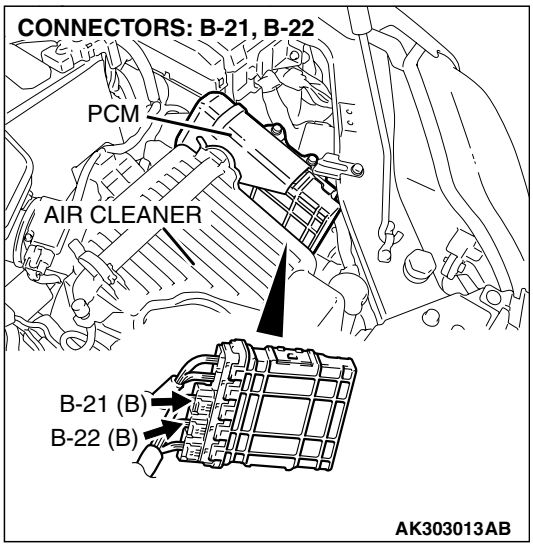
TSB Revision







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)

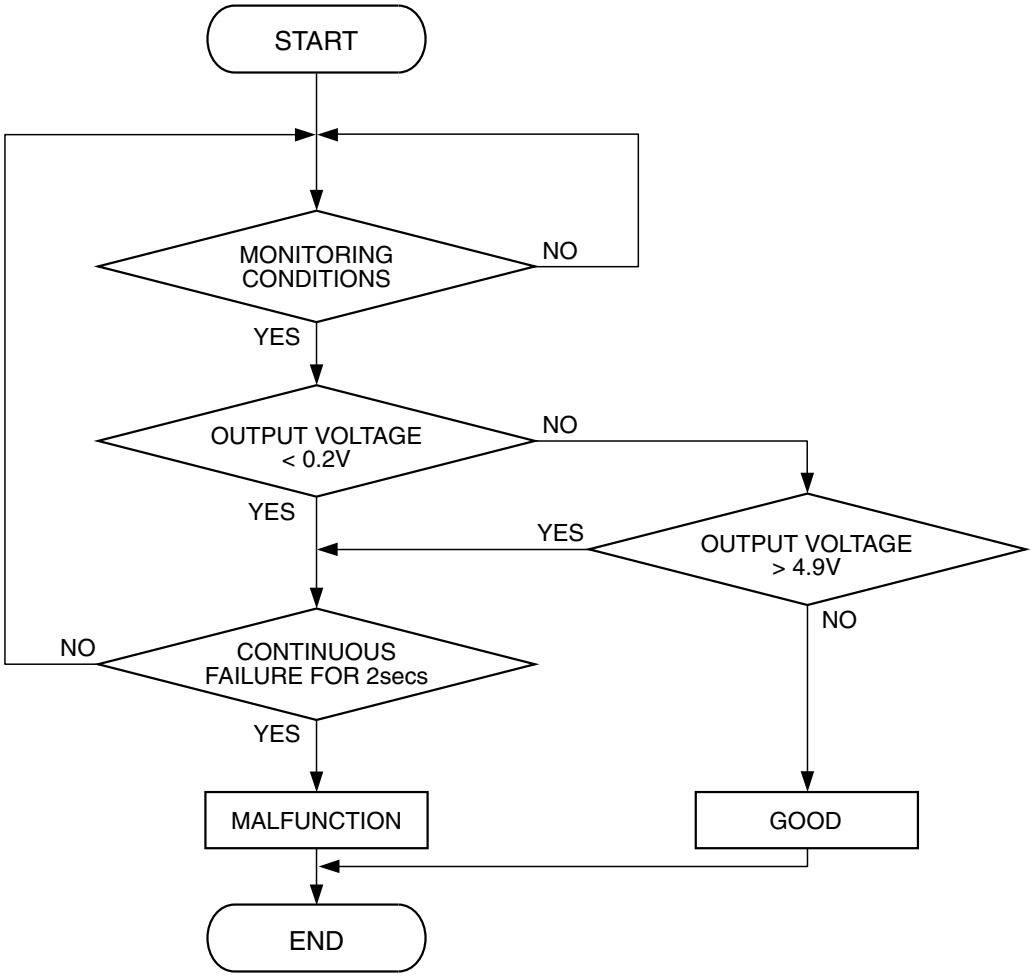
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302008

Check Conditions

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

Judgement Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

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

DIAGNOSIS

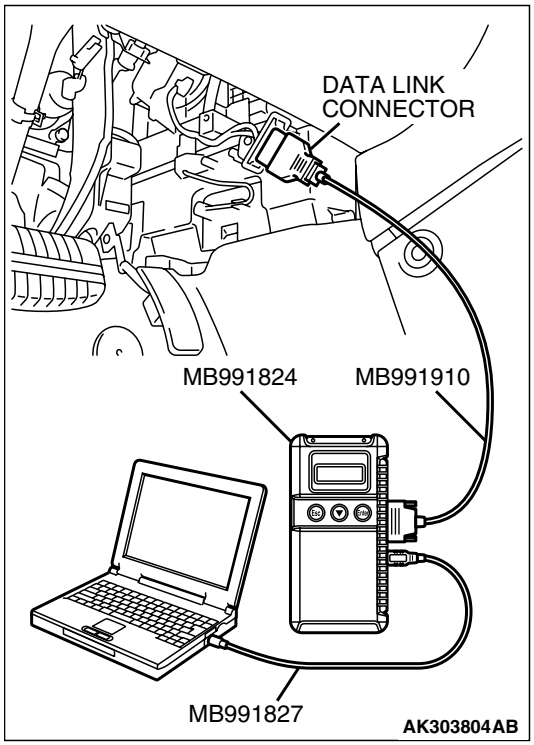
Required Special Tools:

- MB991958: Scan tool (MUT-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 12: Mass Airflow Sensor.

⚠ CAUTION

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



(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 12, Mass Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
  - The standard value during idling should be between 2.0 and 6.0 g/sec.
  - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

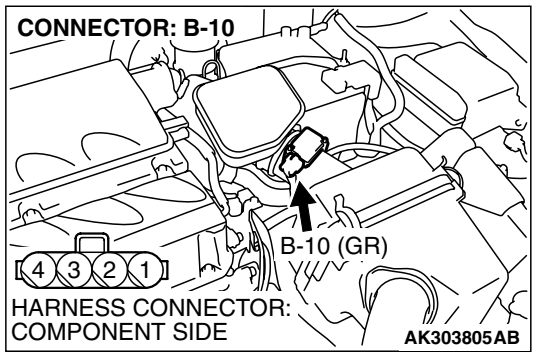
(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

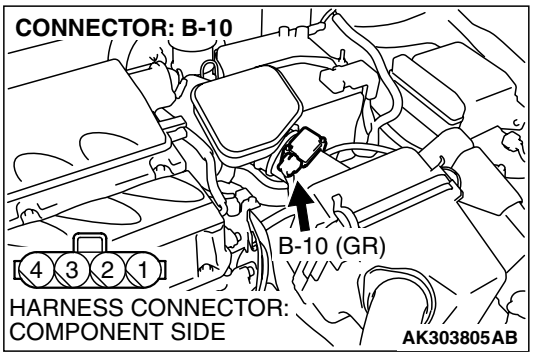
STEP 2. Check harness connector B-10 at mass airflow sensor for damage.



Q: Is the harness connector in good condition?

YES : Go to Step 3.

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



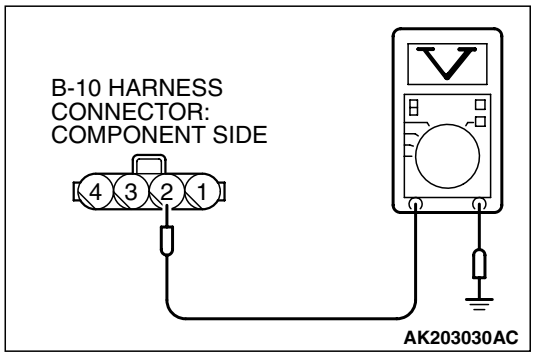
STEP 3. Measure the power supply voltage at mass airflow sensor harness side connector B-10.

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

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

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

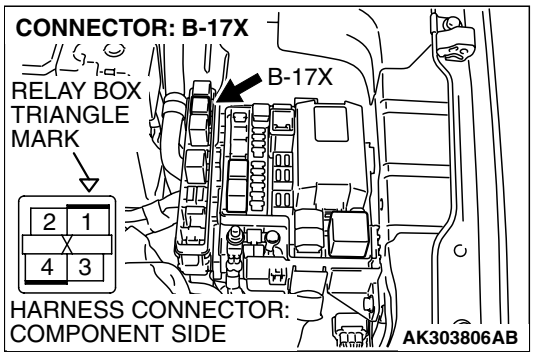
YES : Go to Step 5.
NO : Go to Step 4.

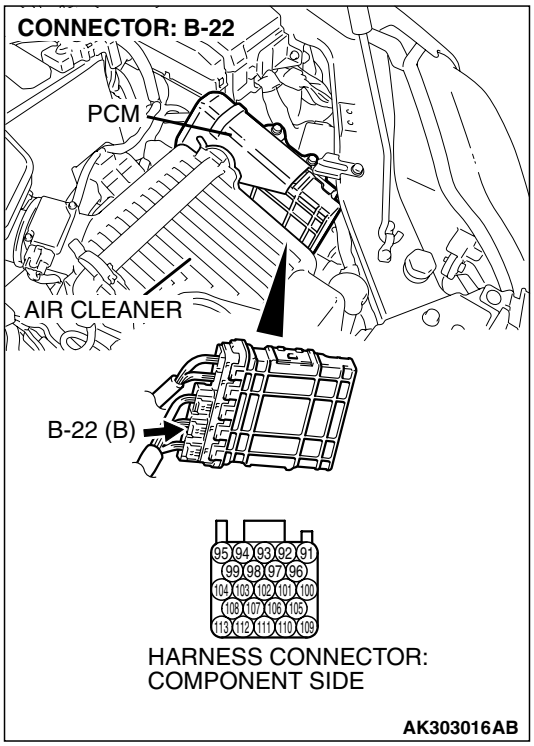


STEP 4. Check harness connector B-17X at MFI relay for damage.

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



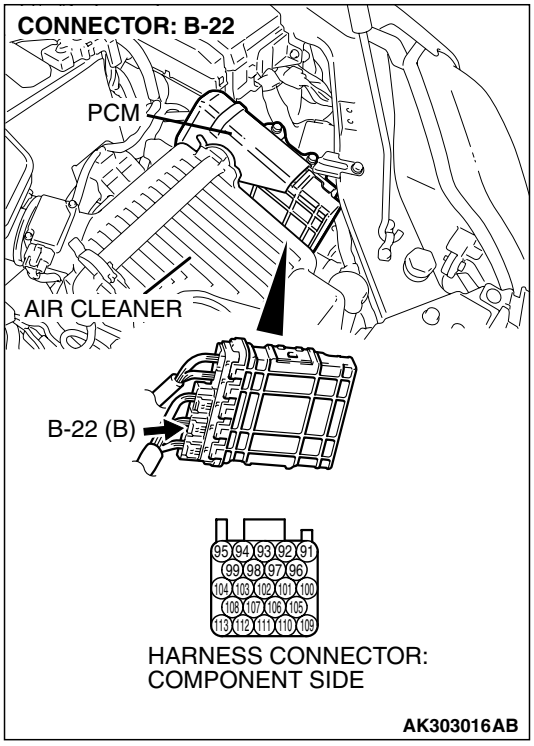


STEP 5. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

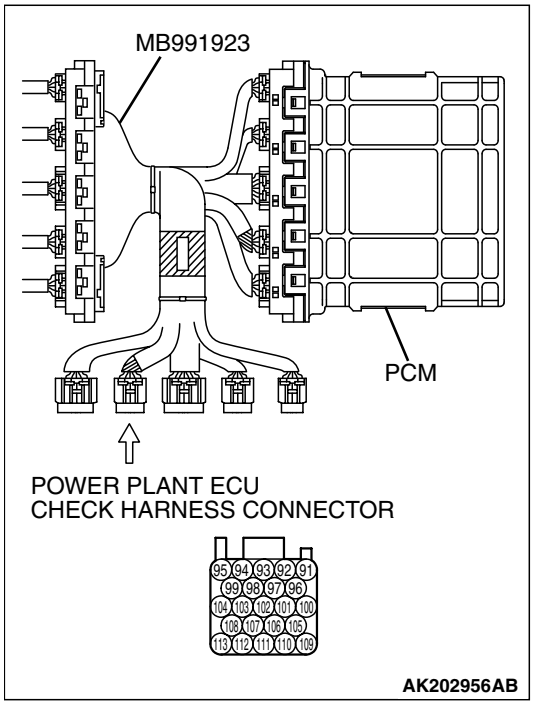
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

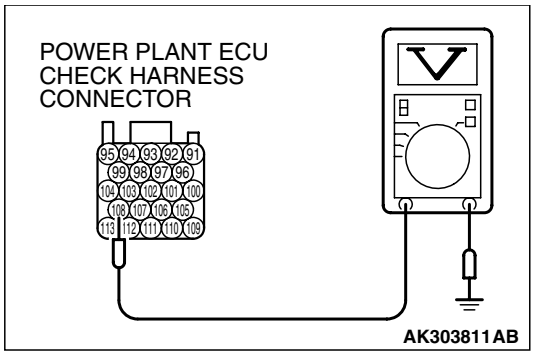


STEP 6. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect 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 be increase in response to revving.

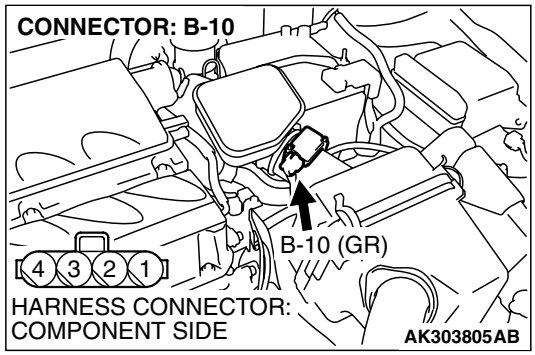
Q: Is the measured voltage normal?

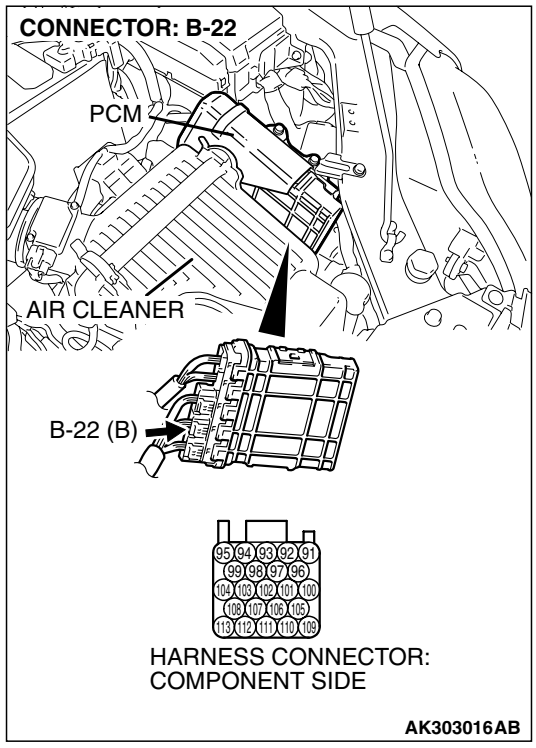
YES : Go to Step 9.
NO : Go to Step 7.

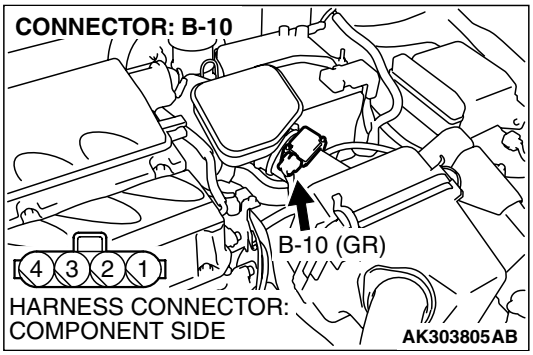
STEP 7. Check for open circuit or short circuit to ground between mass airflow sensor connector B-10 (terminal No. 3) and PCM connector B-22 (terminal No. 108).

Q: Is the harness wire in good condition?

YES : Replace the mass airflow sensor. Then go to Step 8.
NO : Repair it. Then go to Step 11.





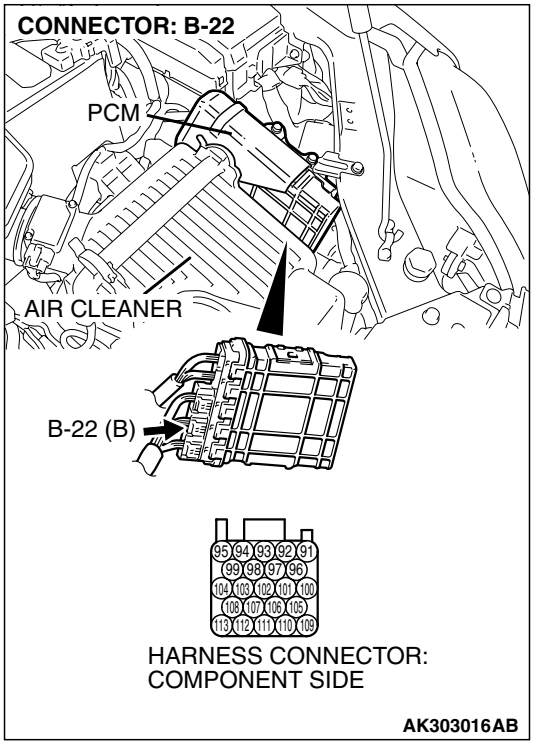


STEP 8. Replace the mass airflow sensor.

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

Q: Is DTC P0102 set?

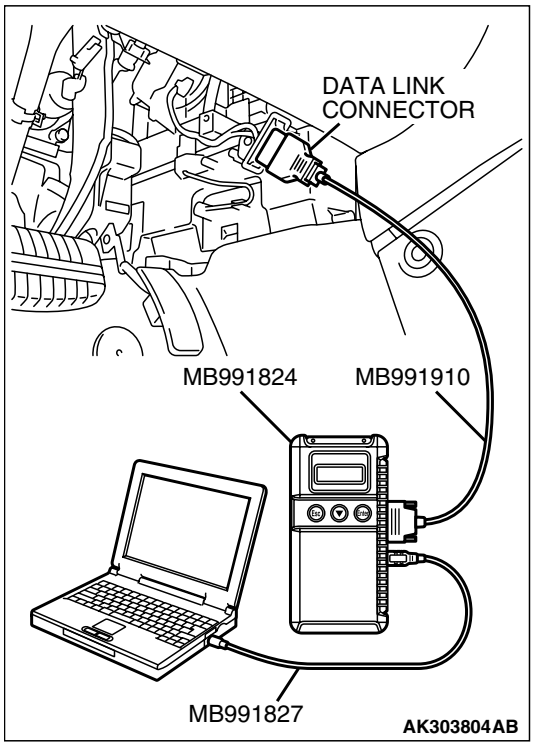
YES : Replace the PCM. Then go to Step 11.
NO : The inspection is complete.



STEP 9. Check harness connector B-22 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 10.



STEP 10. Using scan tool MB991958, check data list item 12: Mass Airflow Sensor.

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

(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 12, Mass Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 2.0 and 6.0 g/sec.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.
NO : Replace the PCM. Then go to Step 11.

STEP 11. Test the OBD-II drive cycle.

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

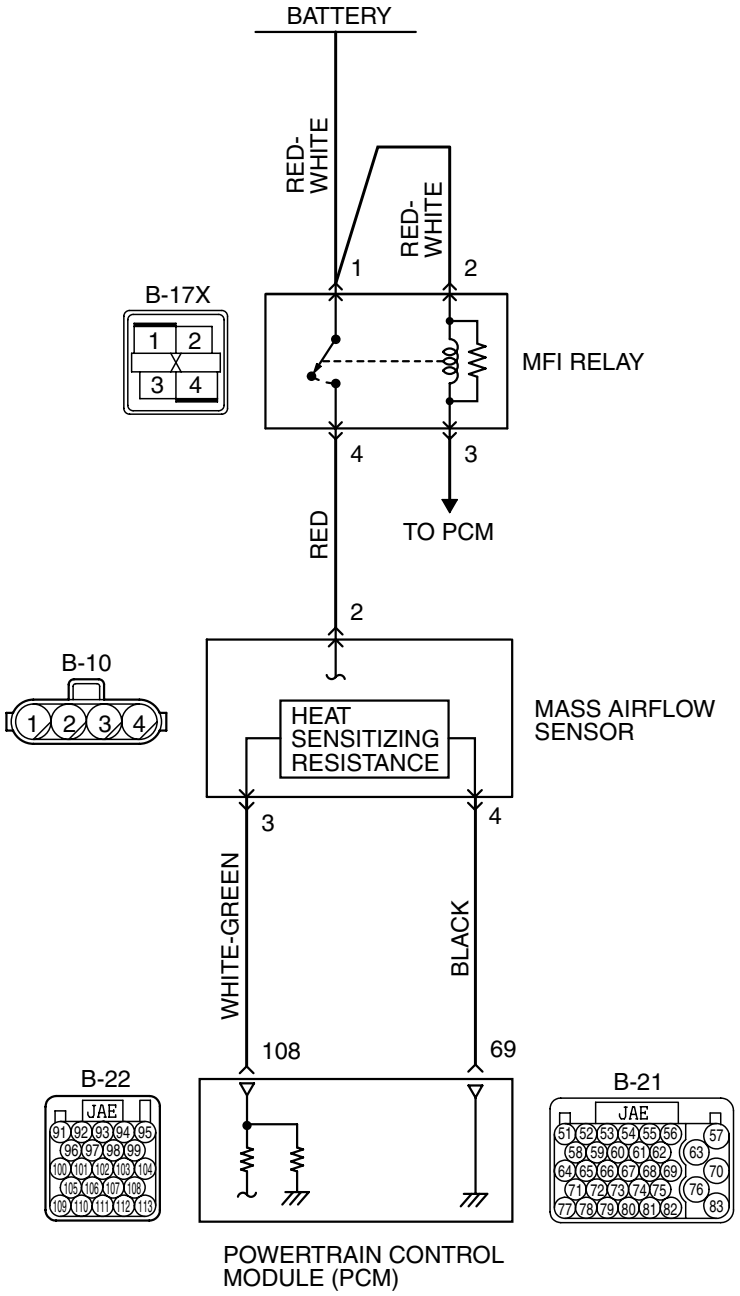
Q: Is DTC P0102 set?

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

DTC P0103: Mass Airflow Circuit High Input

⚠ 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



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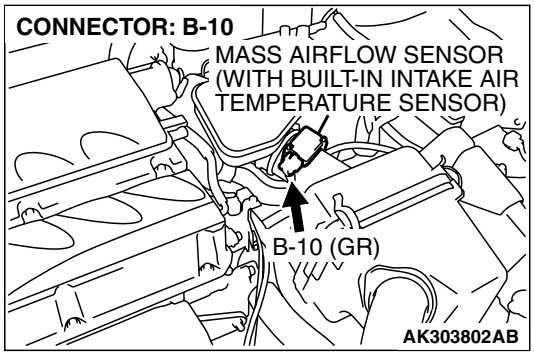
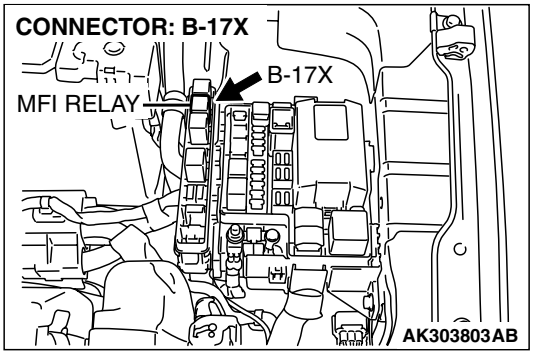
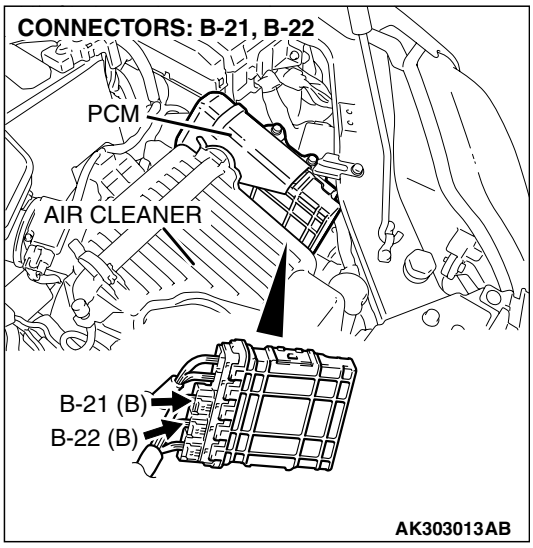
TSB Revision







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)

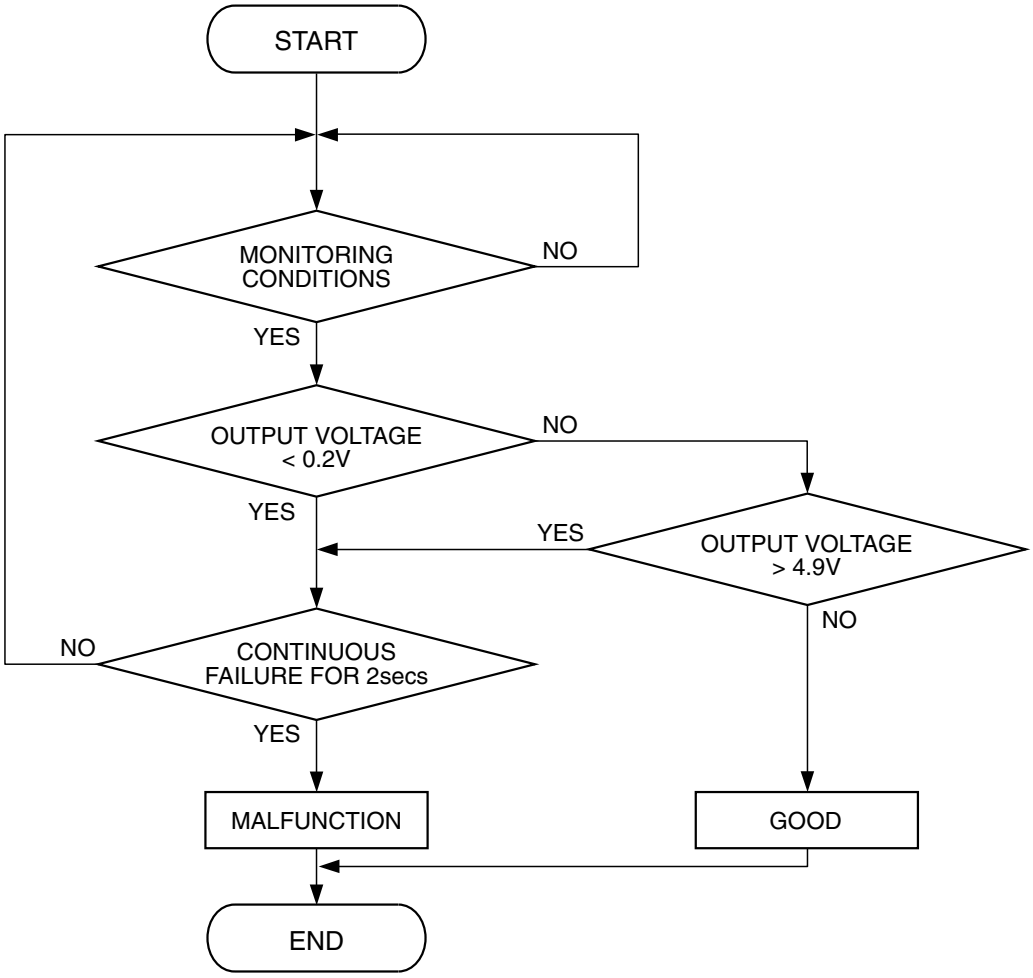
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302008

Check Conditions

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

Judgement Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

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

DIAGNOSIS

Required Special Tool:

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

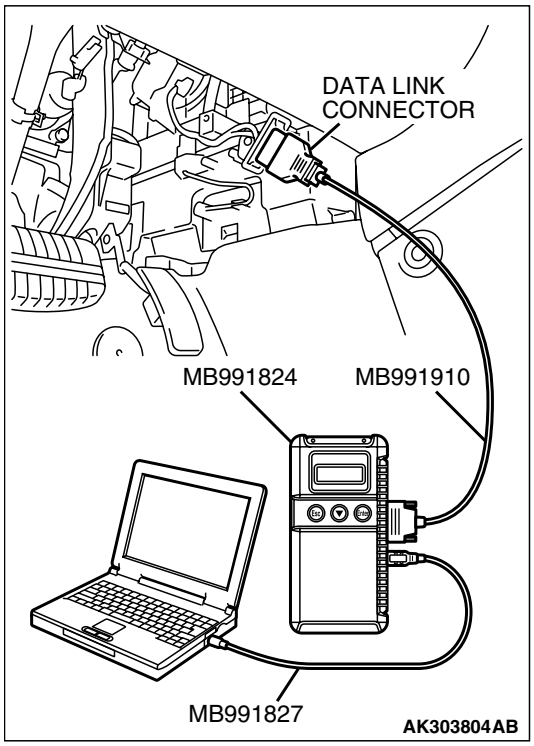
STEP 1. Using scan tool MB991958, check data list item 12: Mass Airflow Sensor.

⚠ CAUTION

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

(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 12, Mass Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 2.0 and 6.0 g/sec.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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



Q: Is the sensor operating properly?

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

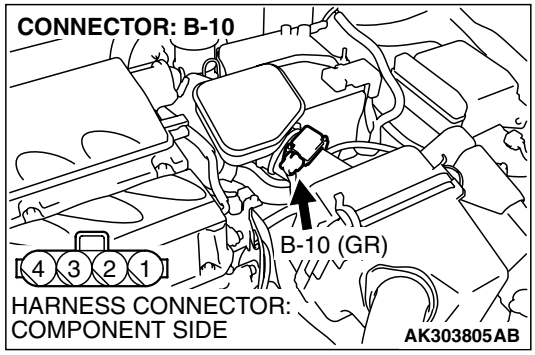
NO : Go to Step 2.

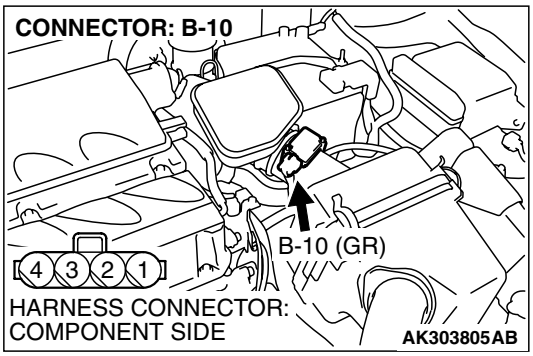
STEP 2. Check harness connector B-10 at mass airflow sensor for damage.

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.

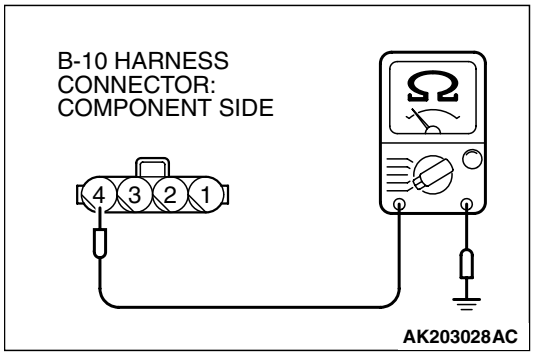
(2) Check for the continuity between terminal No. 4 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 4.

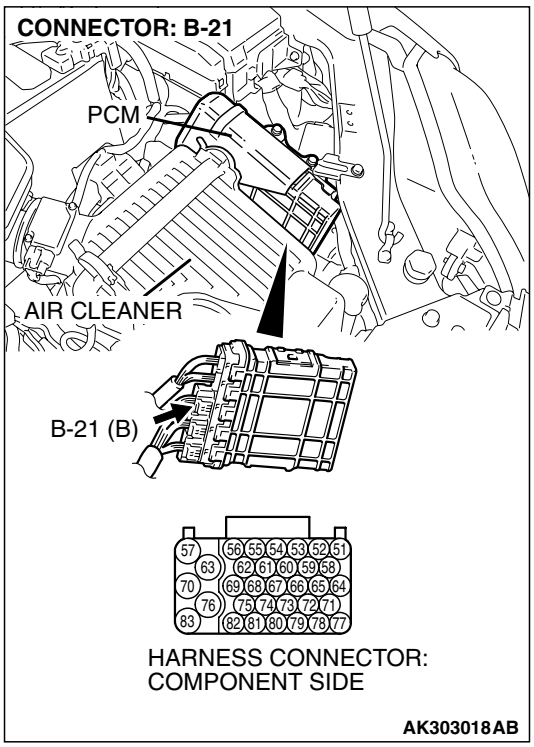


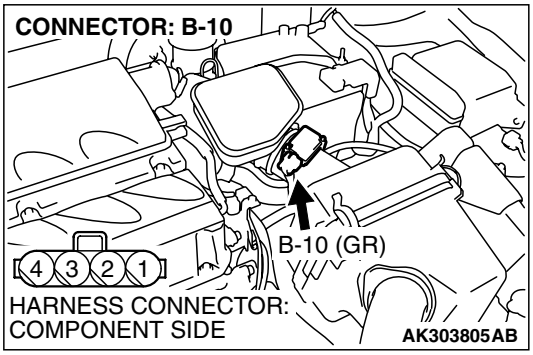
STEP 4. Check harness connector B-21 at PCM for damage.

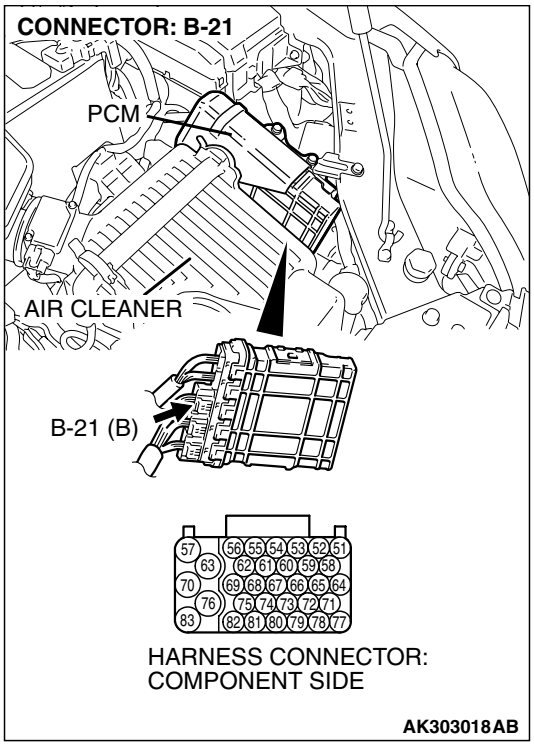
Q: Is the harness connector in good condition?

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.





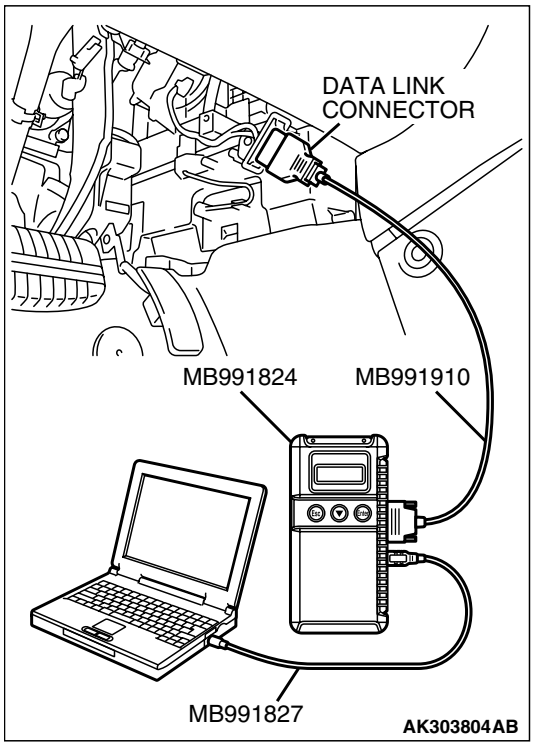


STEP 5. Check for open circuit between mass airflow sensor connector B-10 (terminal No. 4) and PCM connector B-21 (terminal No. 69).

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 12: Mass Airflow Sensor.

⚠ CAUTION

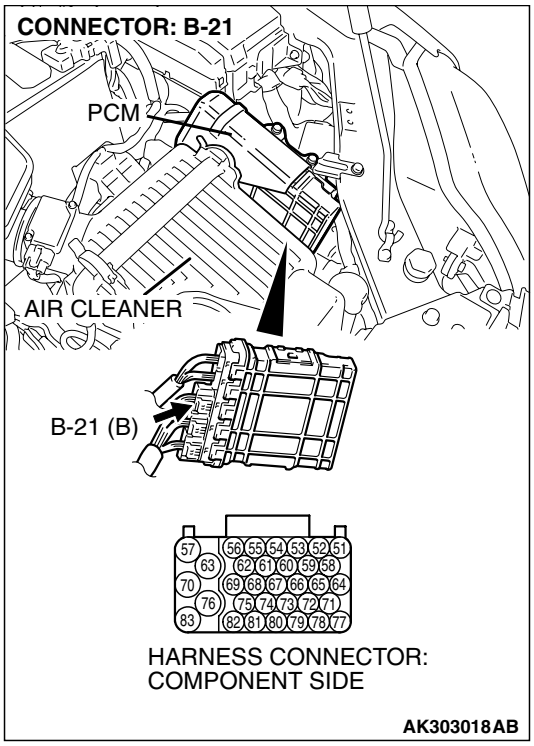
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 12, Mass Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 2.0 and 6.0 g/sec.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.
NO : Replace the PCM. 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 – Procedure 6 – Other Monitor P.13A-6.

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

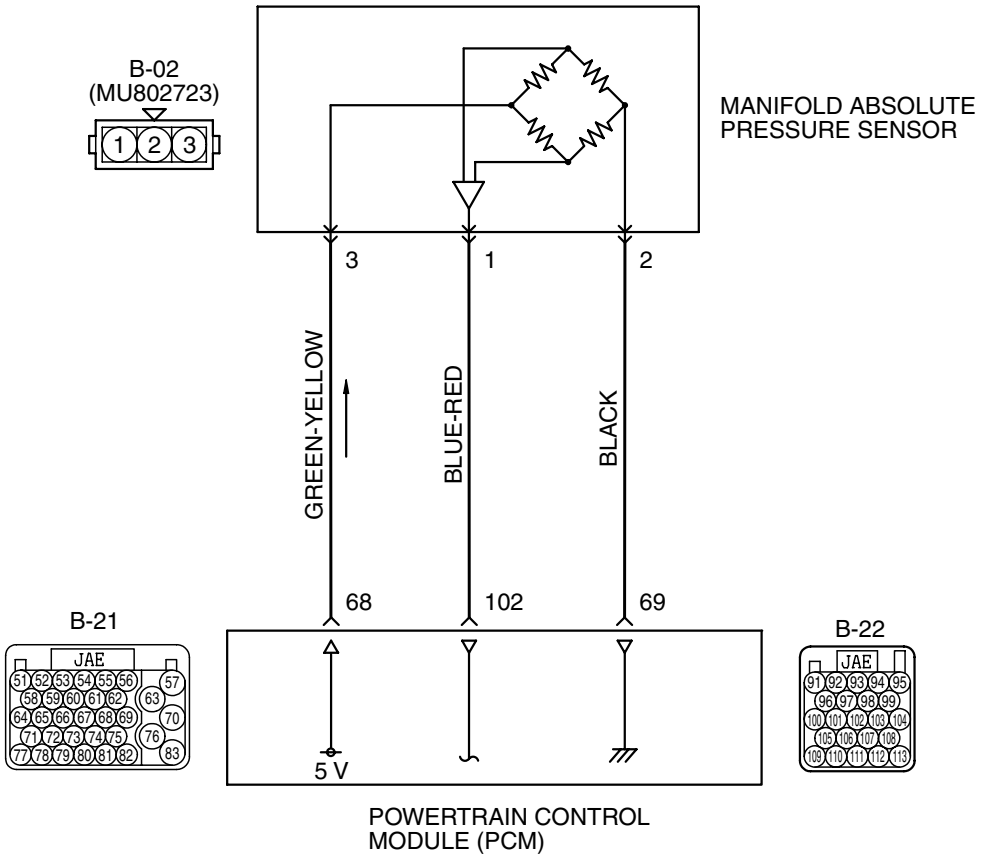
Q: Is DTC P0103 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0106: Manifold Absolute Pressure Circuit Range/Performance Problem

Manifold Absolute Pressure Sensor Circuit



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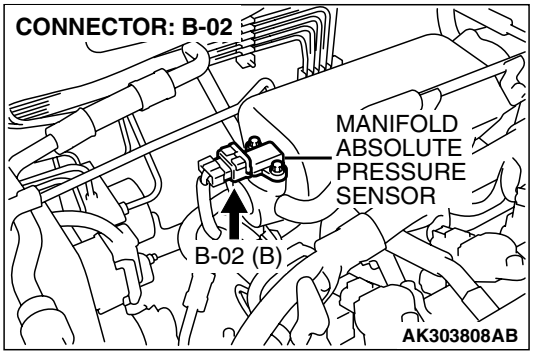
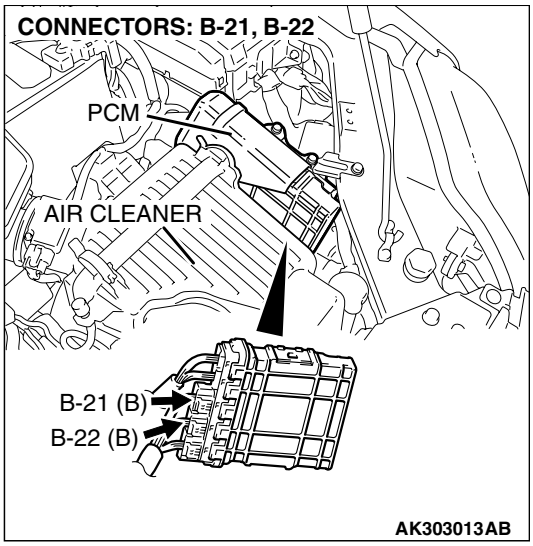


TSB Revision



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)

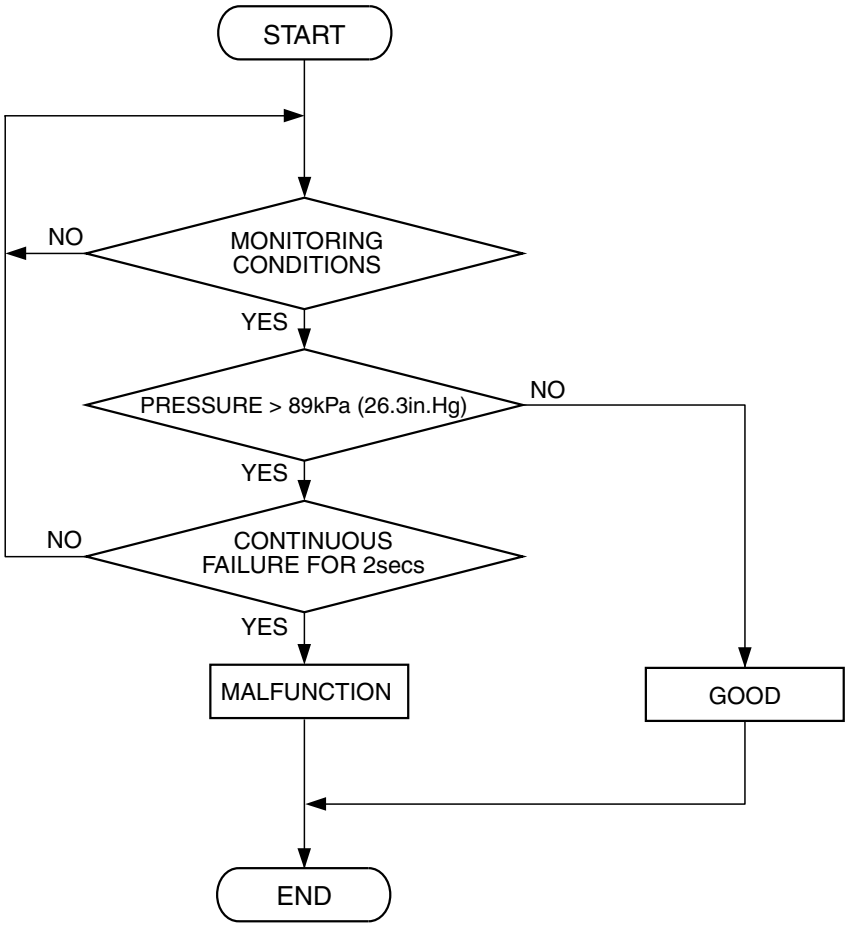
- Not applicable

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 – 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 1,500 r/min or lower.
- Throttle position sensor output voltage is 0.8 volt or lower.

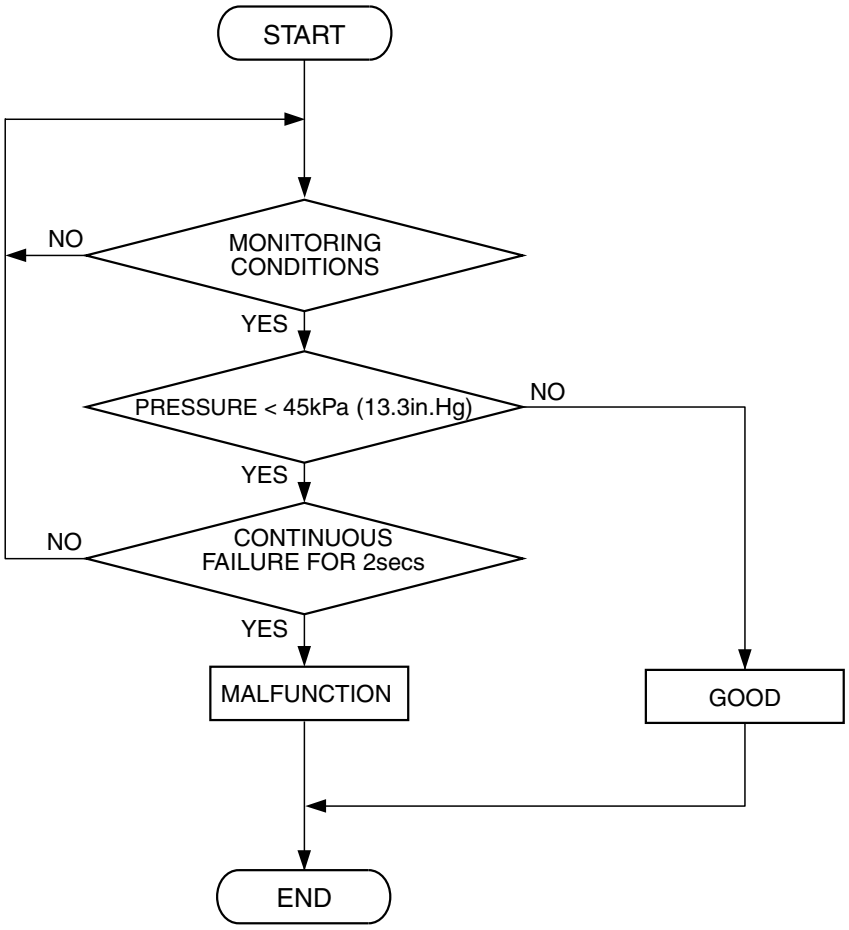
Judgement Criteria

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

TSB Revision

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 1,500 r/min or higher.
- Throttle position sensor output voltage is 3.5 volts or higher.

Judgement Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

- Manifold absolute pressure sensor failed.
- Harness damage.
- Connector damage.
- PCM failed.

TSB Revision

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-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 95: Manifold Absolute Pressure Sensor.

⚠ CAUTION

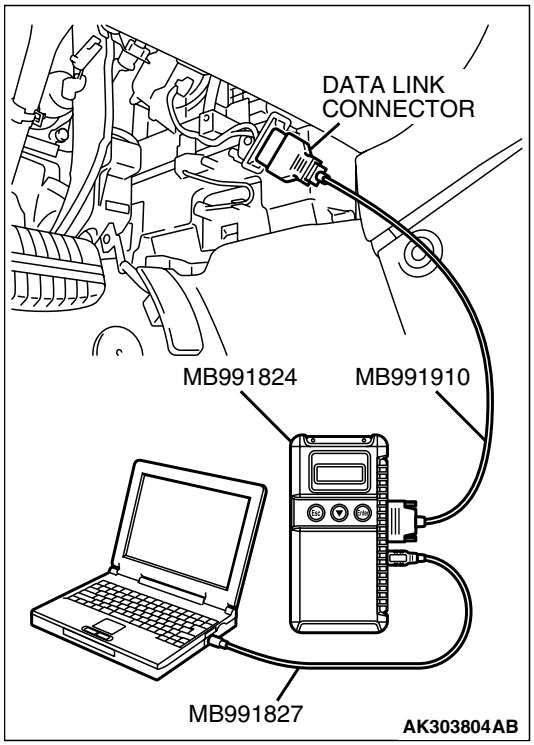
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
  - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
  - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
(4) Start the engine.
  - When the engine is idling, 19 – 33 kPa (5.6 – 9.7 in.Hg).
  - When the engine is suddenly revved, manifold absolute pressure varies.
(5) Turn the ignition switch to the "LOCK" (OFF) position.

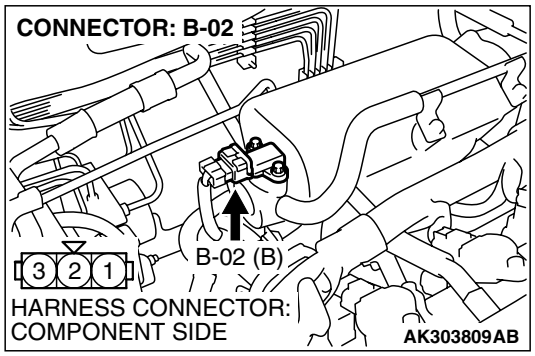
Q: Is the sensor operating properly?

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.

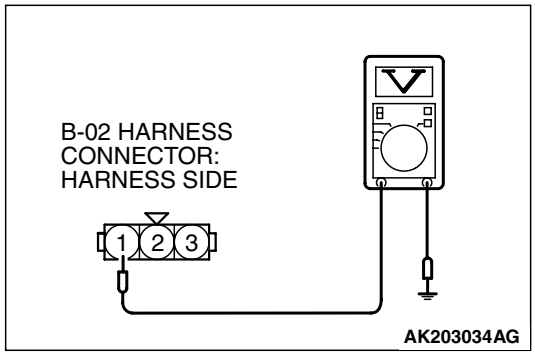
NO : Go to Step 2.



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.



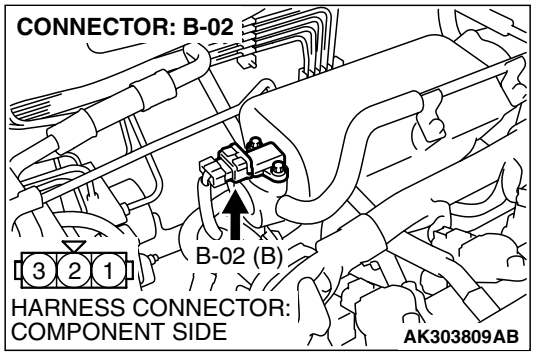
(3) Measure the voltage between terminal No. 1 and ground by backprobing.
- When altitude is 0 m (0 foot), voltage should be 3.7 and 4.3 volts.
- When altitude is 600 m (1,969 feet), voltage should be 3.4 and 4.0 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be 3.2 and 3.8 volts.
- When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

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

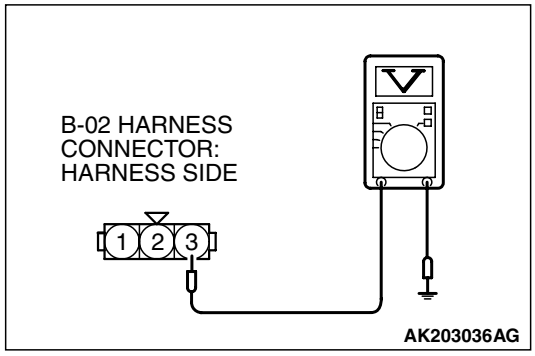
Q: Is measured the voltage normal?

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.

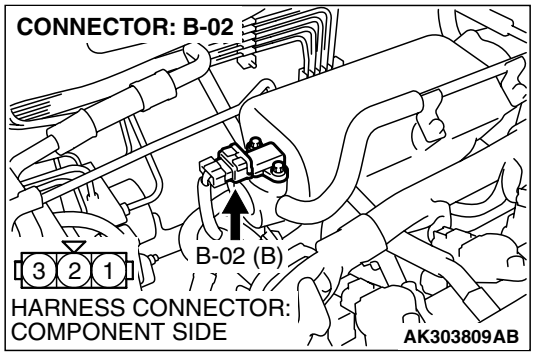


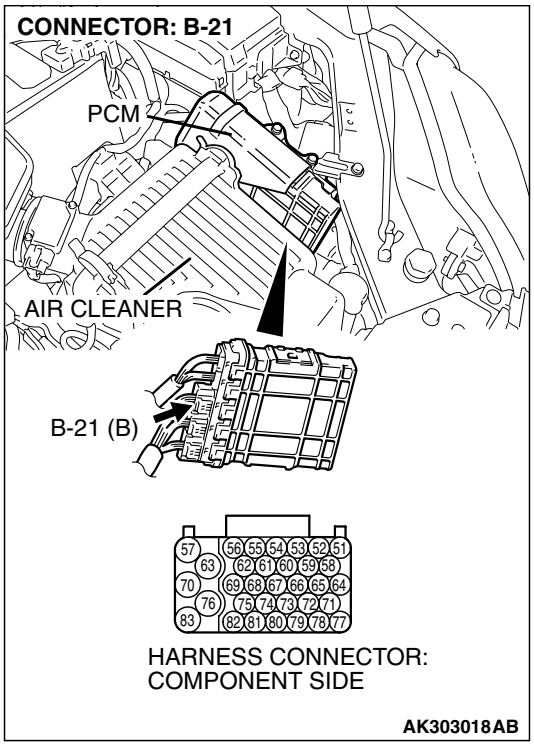
(3) Measure the voltage between terminal No. 3 and ground by backprobing.
- Voltage should be between 4.9 and 5.1 volts.

(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.



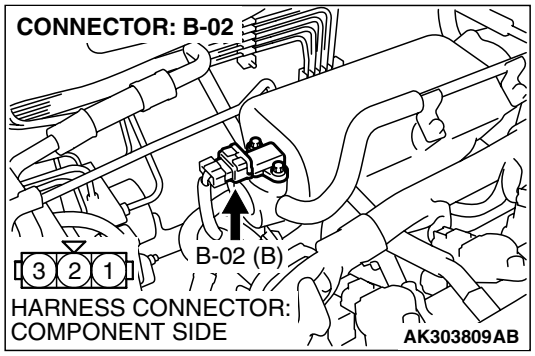


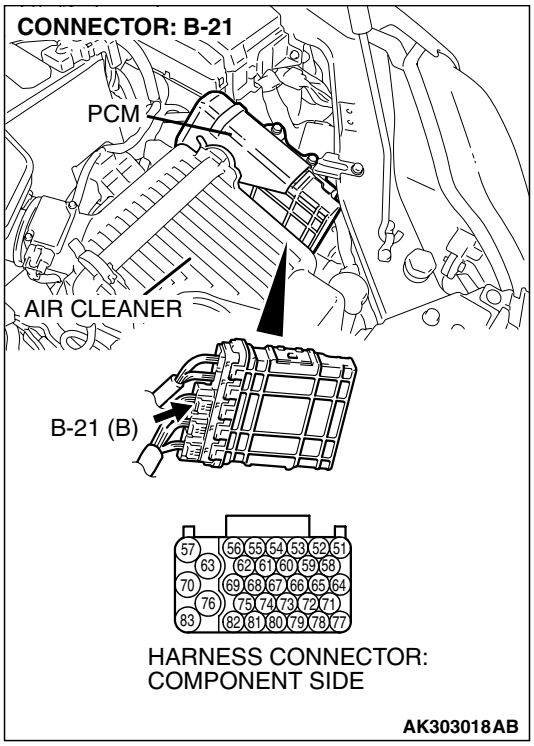
STEP 4. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-21 at PCM for damage.

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.



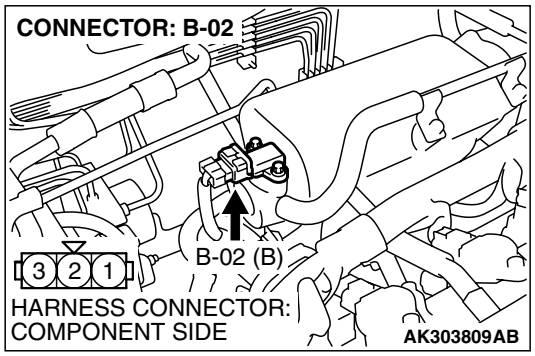


STEP 5. Check for harness damage between manifold absolute pressure sensor connector B-02 (terminal No. 3) and PCM connector B-21 (terminal No. 68).

Q: Is the harness wire in good condition?

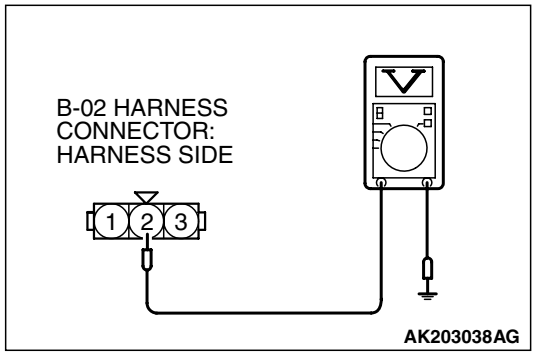
YES : Go to Step 12.

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.

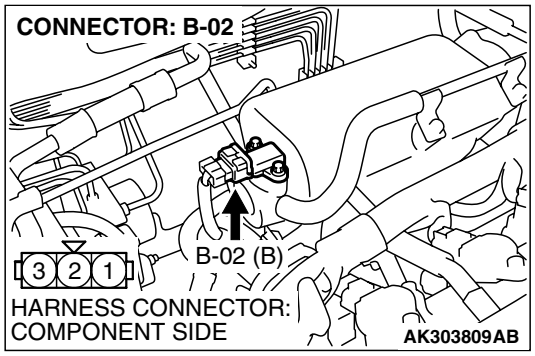


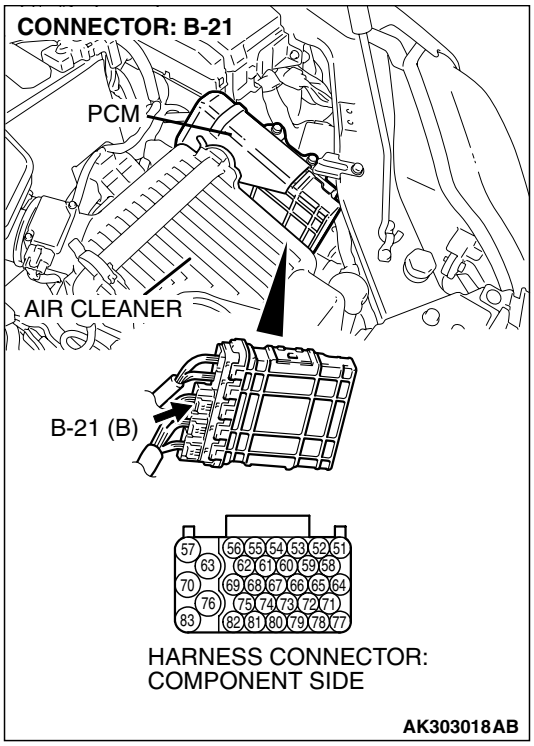
(3) Measure the voltage between terminal No. 2 and ground by backprobing.
- Voltage should be 0.5 volt or less.

(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-21 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

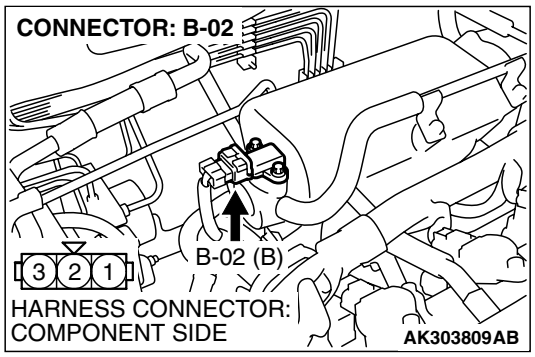
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.

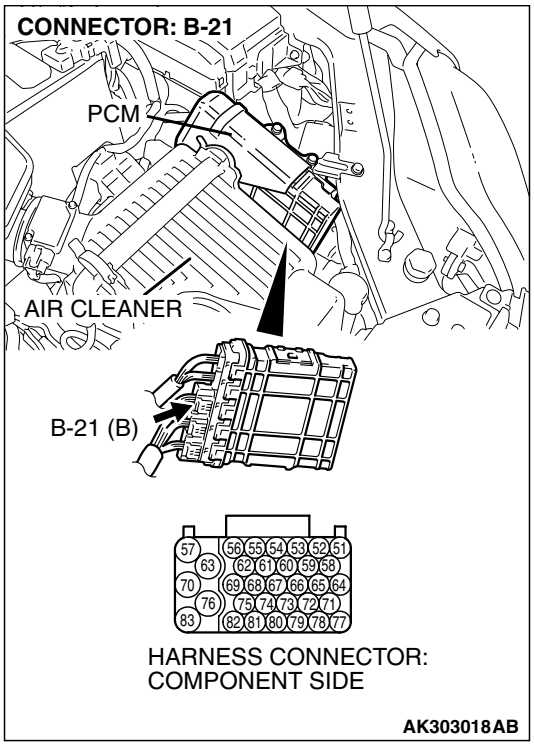
STEP 8. Check for harness damage between manifold absolute pressure sensor connector B-02 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 13.



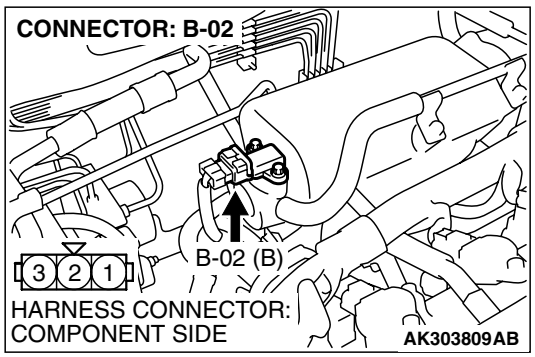


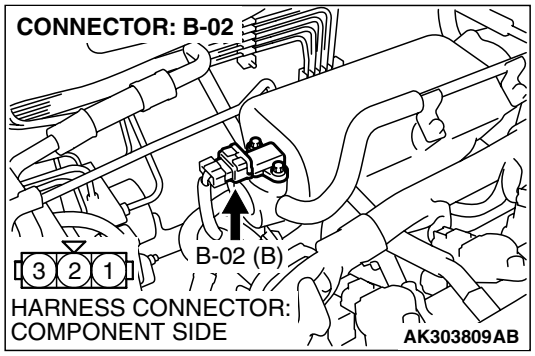
STEP 9. Check harness connector B-02 at manifold absolute pressure sensor for damage.

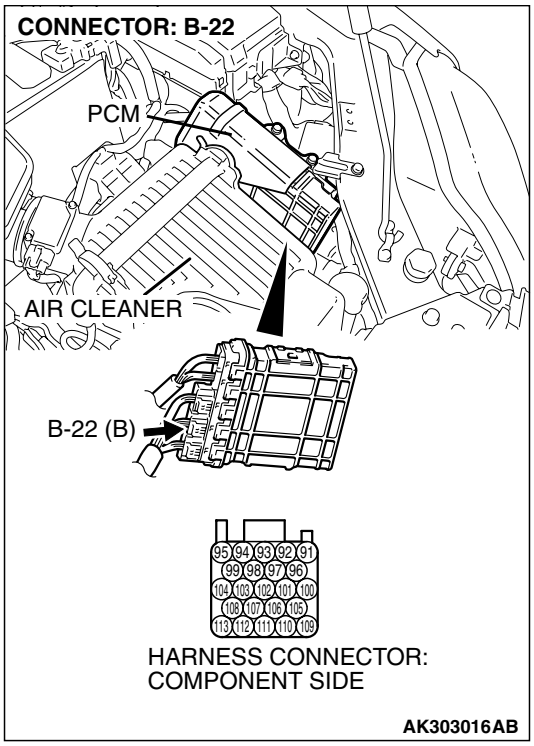
Q: Is the harness connector in good condition?

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.





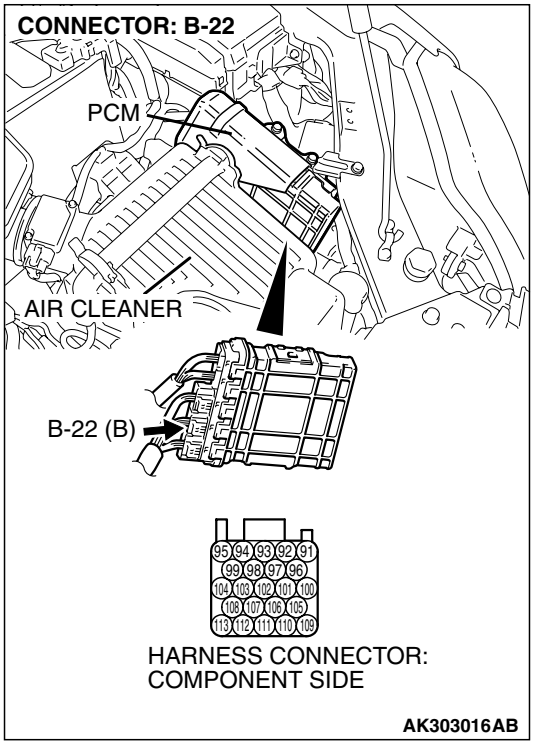


STEP 10. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 11.

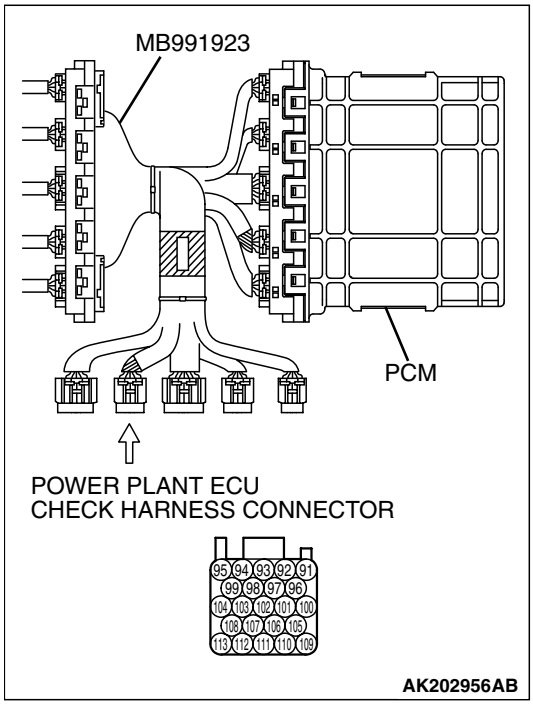
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.

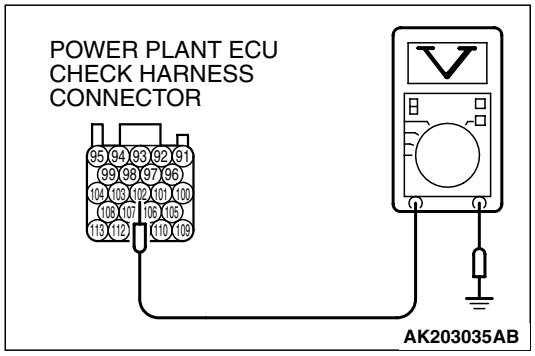


STEP 11. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

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

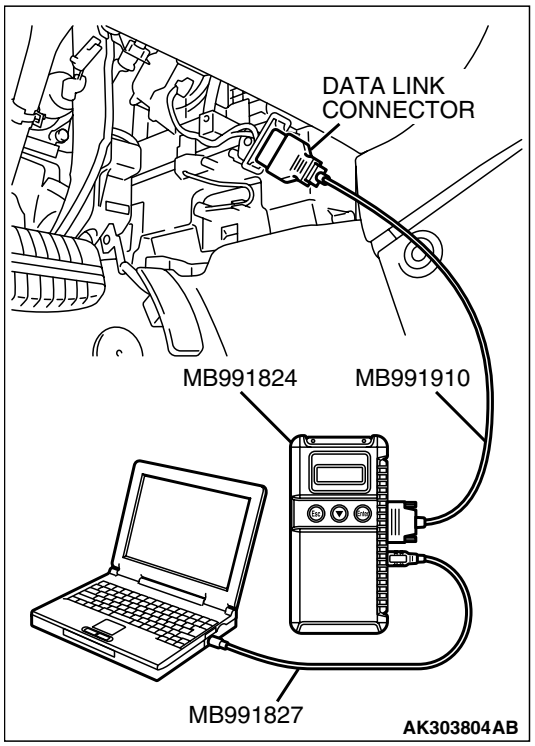
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the 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 95: 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 95, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

(3) Start the engine.
- When the engine is idling, 19 – 33 kPa (5.6 – 9.7 in.Hg).
- When the engine is suddenly revved, manifold absolute pressure varies.

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

Q: Is the sensor operating properly?

YES : 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. 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 – Procedure 6 – Other Monitor P.13A-6.

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

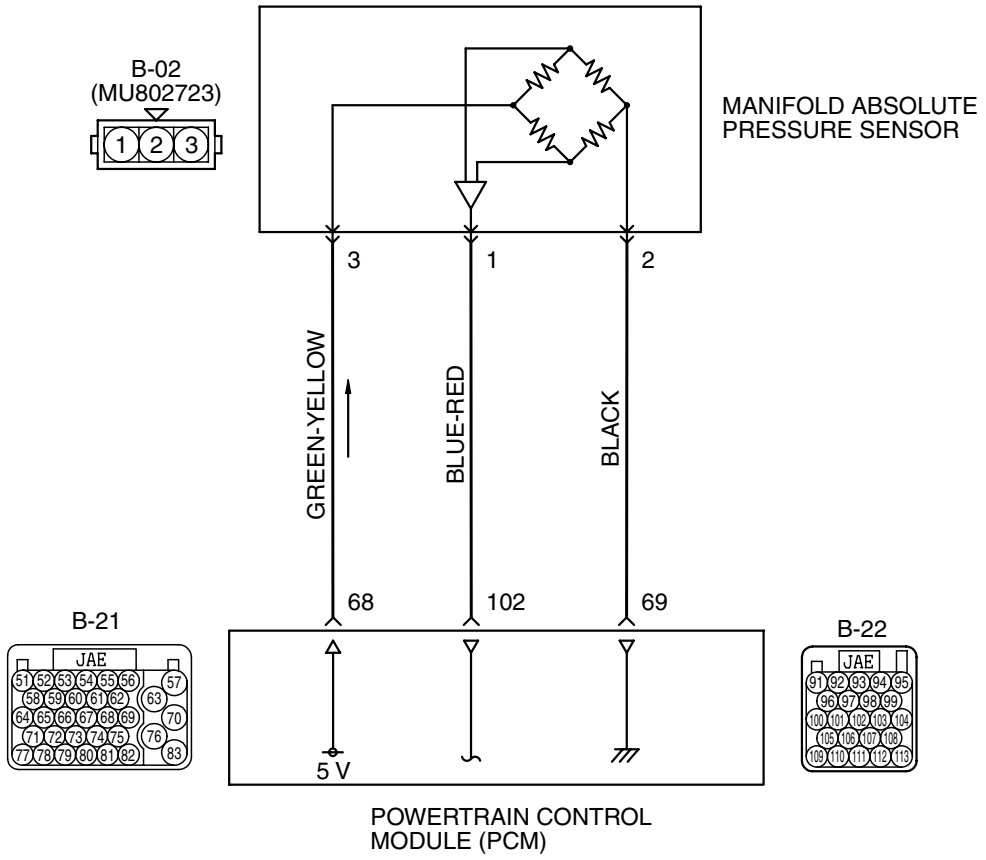
Q: Is DTC P0106 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0107: Manifold Absolute Pressure Circuit Low Input

Manifold Absolute Pressure Sensor Circuit



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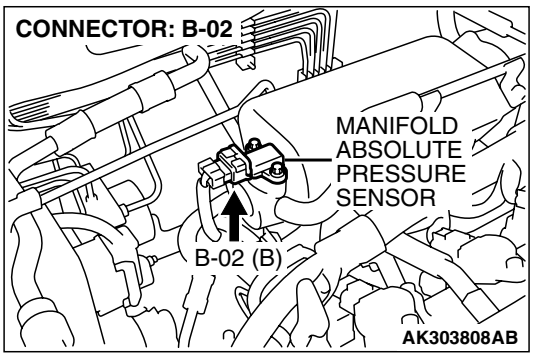

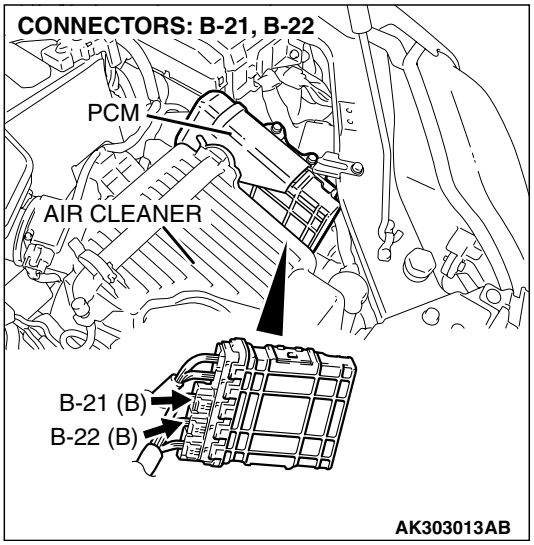

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CIRCUIT OPERATION

- 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)

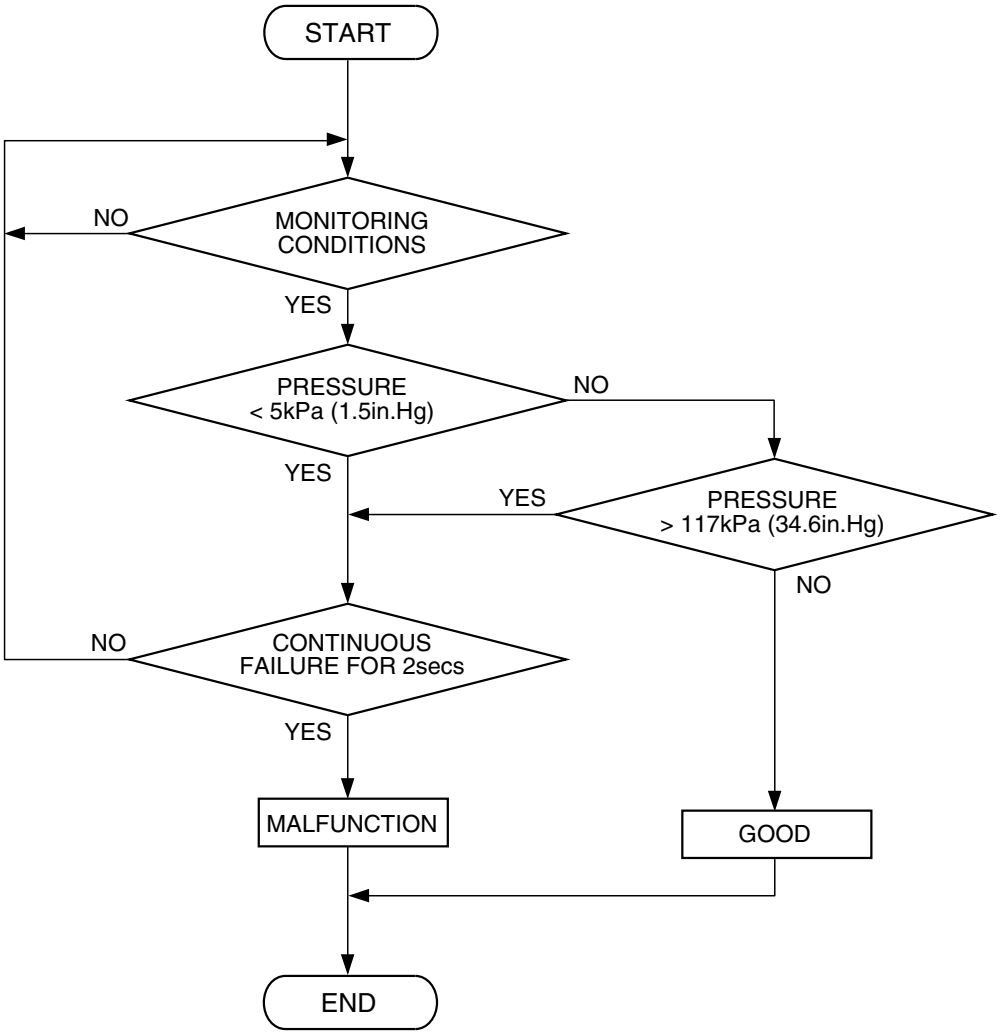
- Not applicable

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



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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 Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

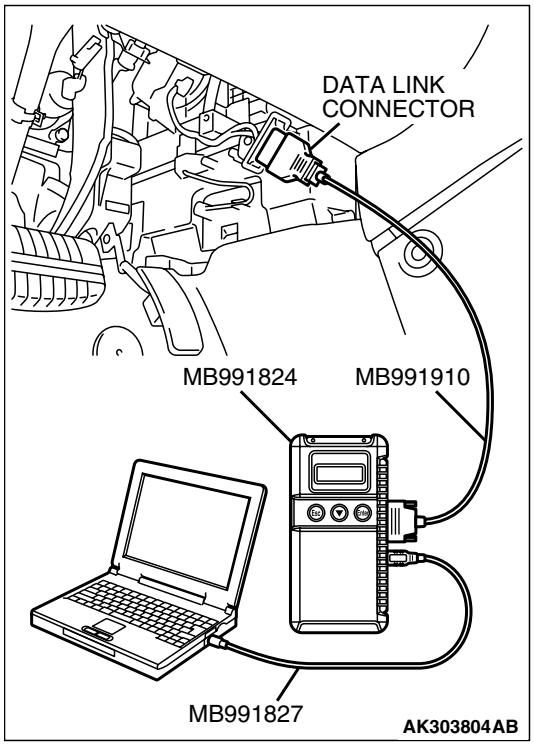
- Manifold absolute pressure sensor failed.
- Open or shorted manifold absolute pressure sensor circuit, harness damage or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-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 95: Manifold Absolute Pressure Sensor.



⚠ CAUTION

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

(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 95, Manifold absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

(4) Start the engine.
- When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
- When the engine is suddenly revved, manifold absolute pressure varies.

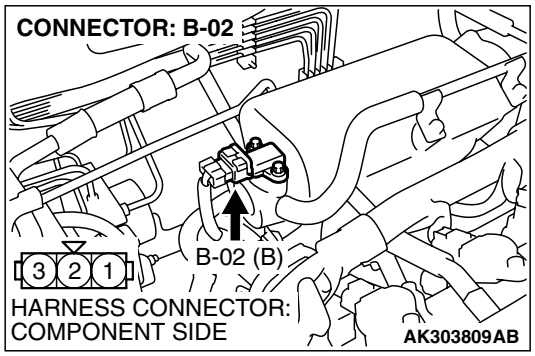
(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

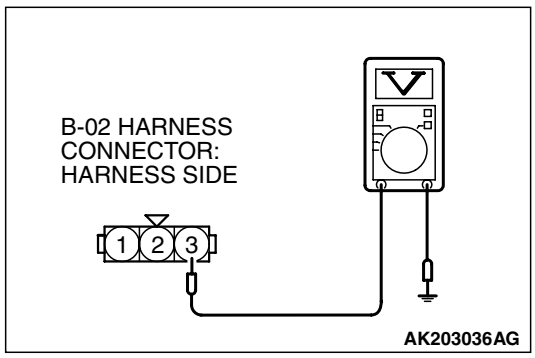
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

NO : 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.



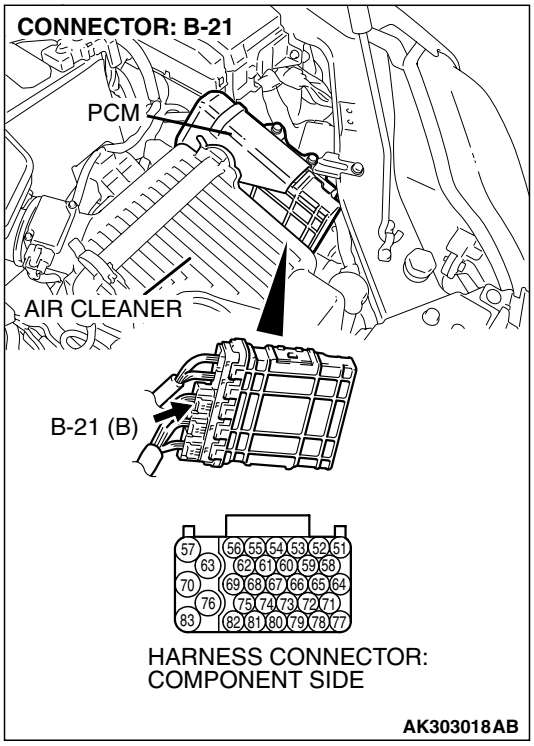
(3) Measure the voltage between terminal No. 3 and ground by backprobing.
- Voltage should be between 4.9 and 5.1 volts.

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

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

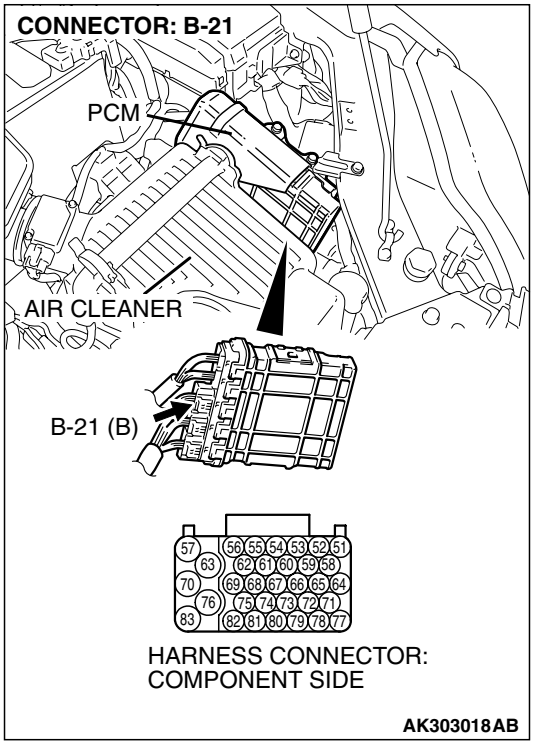
YES : Go to Step 8.
NO : Go to Step 3.

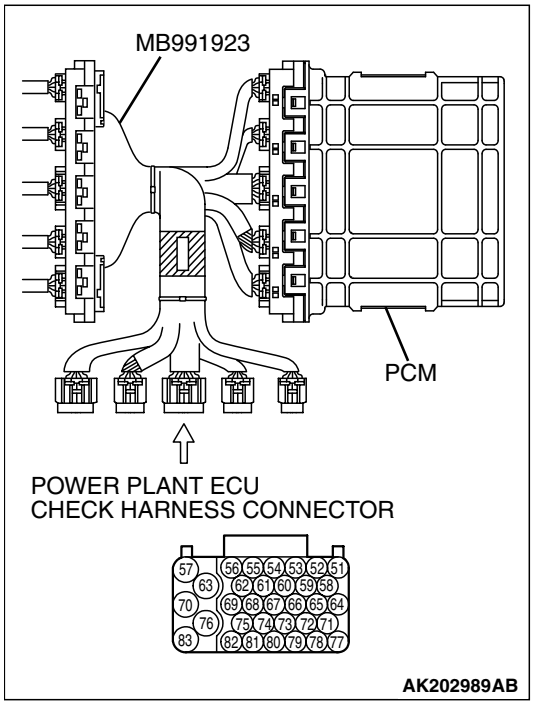
STEP 3. Check harness connector B-21 at PCM for damage.



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.

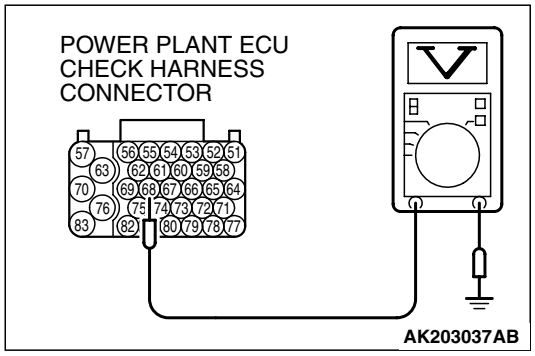




STEP 4. Measure the sensor supply voltage at PCM connector B-21 by using power plant ECU check harness special tool MB991923.

(1) Disconnect the all PCM connectors and connect 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.

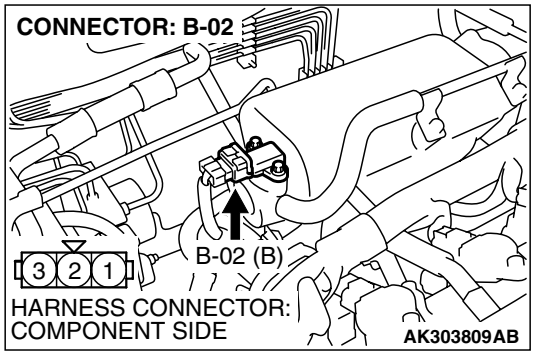
Q: Is the measured voltage between 4.9 and 5.1 volts?

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.

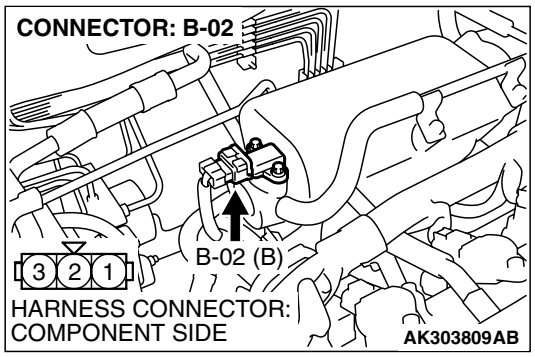
Q: Is the connector in good condition?

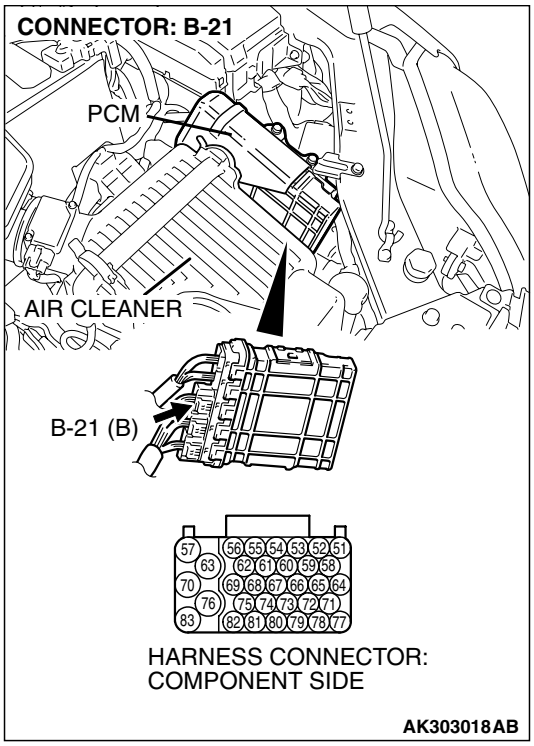
YES : Go to Step 6.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



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?

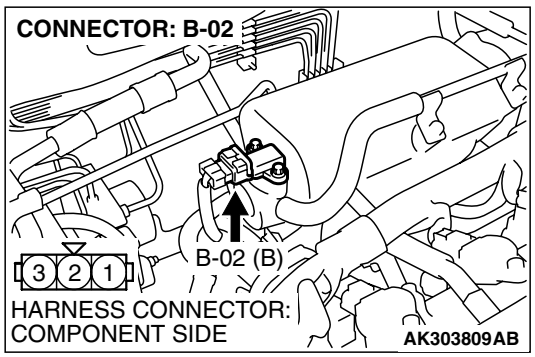
YES : Go to Step 11.
NO : Repair it. Then go to Step 12.

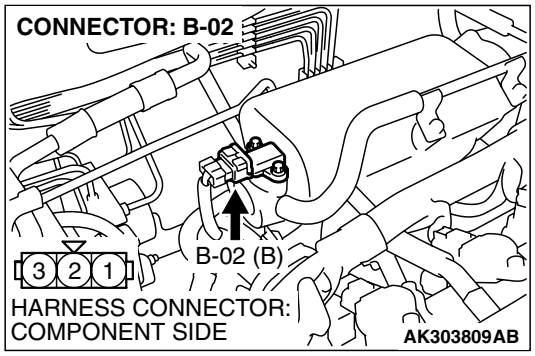


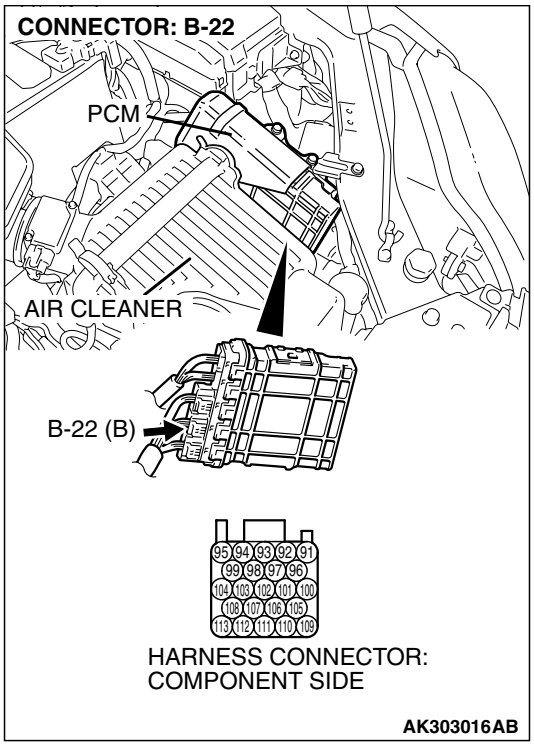


STEP 7. Check harness connector B-02 at the manifold absolute pressure sensor for damage.
Q: Is the connector in good condition?

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.





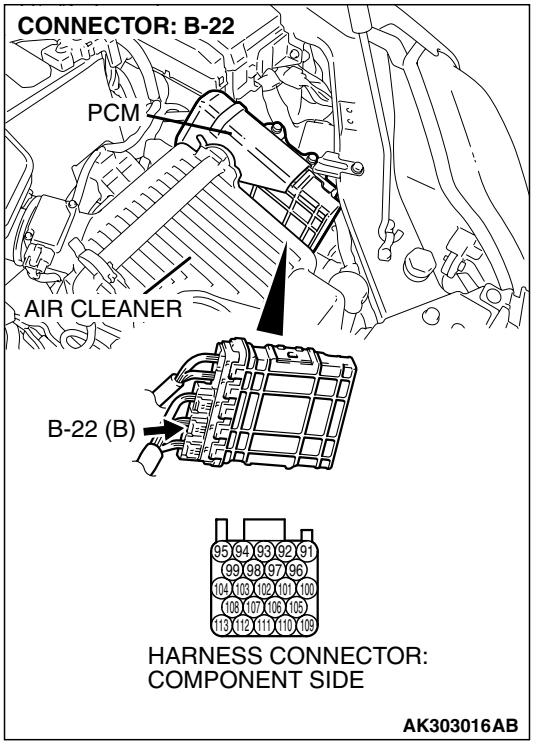


STEP 8. Check harness connector B-02 at the manifold absolute pressure sensor and connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

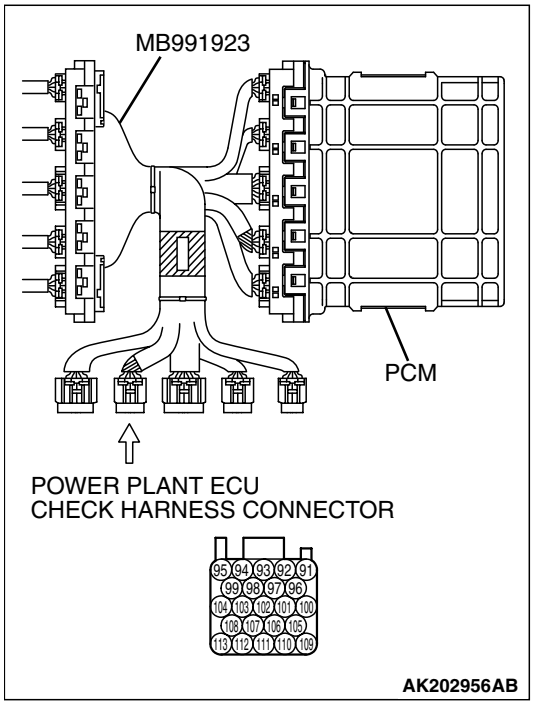
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

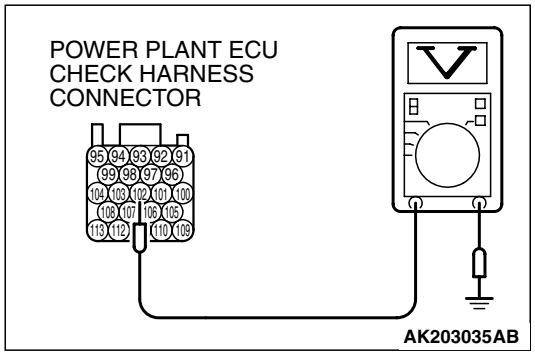


STEP 9. Measure the sensor output voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

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

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

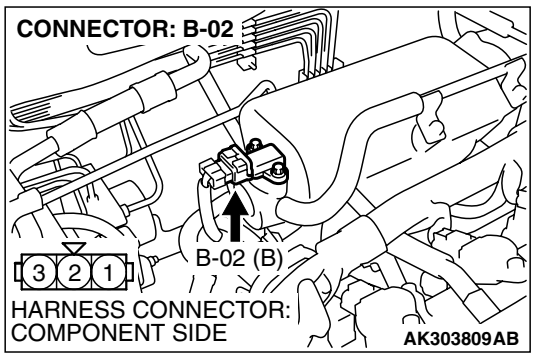
Q: Is the measured voltage normal?

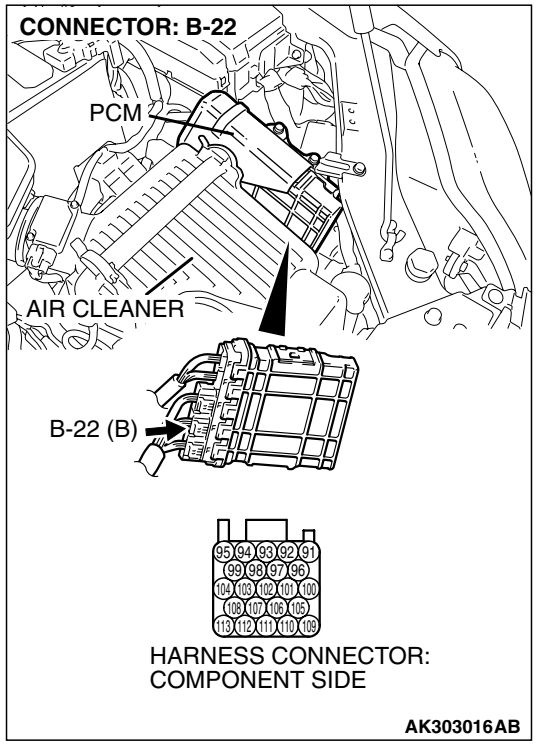
YES : Go to Step 11.
NO : Go to Step 10.

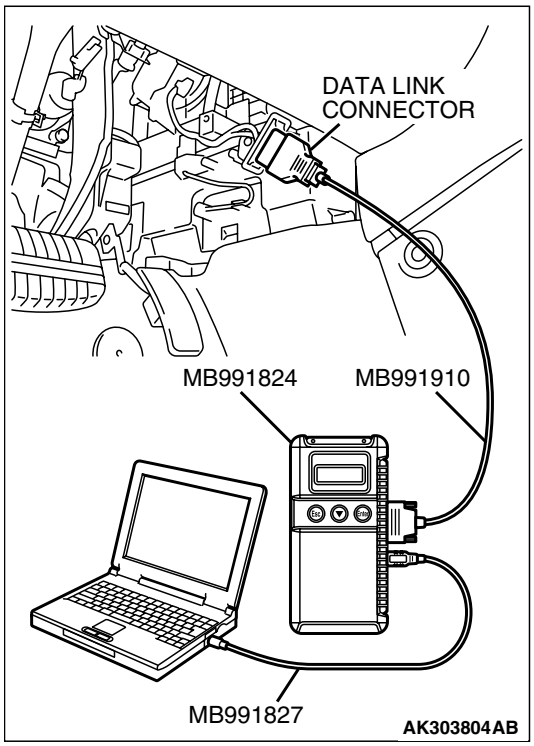
STEP 10. Check for open or short circuit to ground between manifold absolute pressure sensor connector B-02 (terminal No. 1) and PCM connector B-22 (terminal No. 102).

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 95: 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 95, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

(3) Start the engine.
- When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
- When the engine is suddenly revved, manifold absolute pressure varies.

(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. Then go to Step 12.

STEP 12. Test the OBD-II drive cycle.

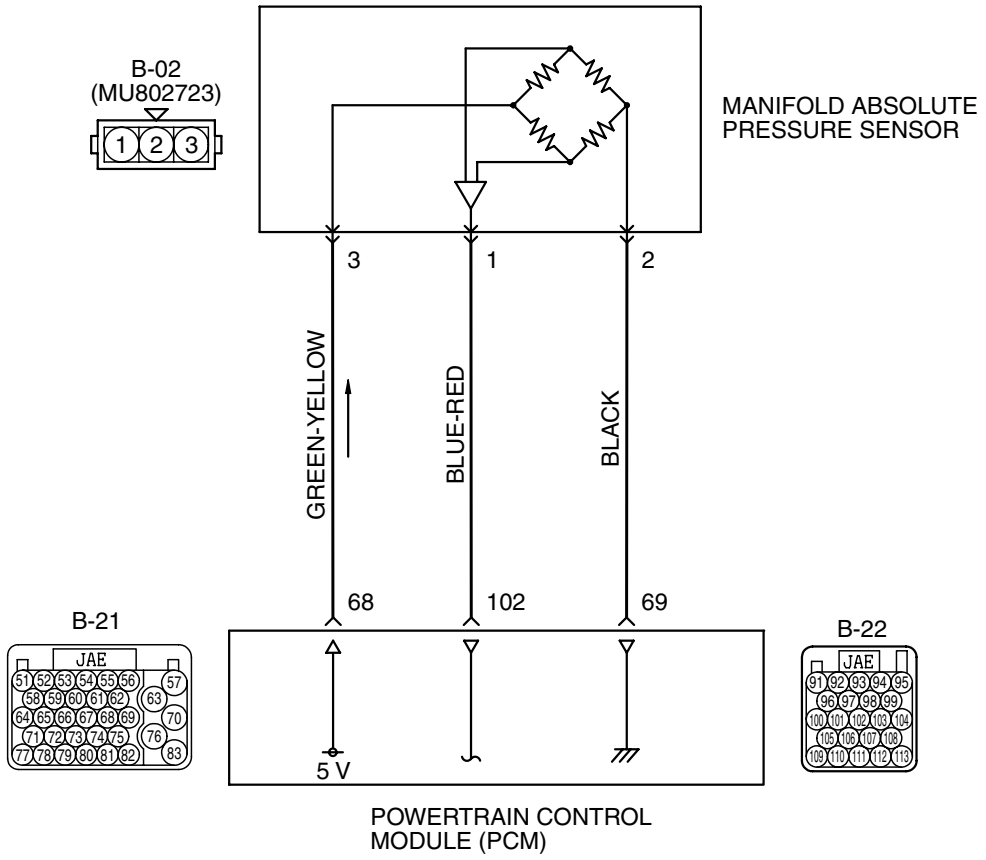
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0107 set?

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

DTC P0108: Manifold Absolute Pressure Circuit High Input

Manifold Absolute Pressure Sensor Circuit



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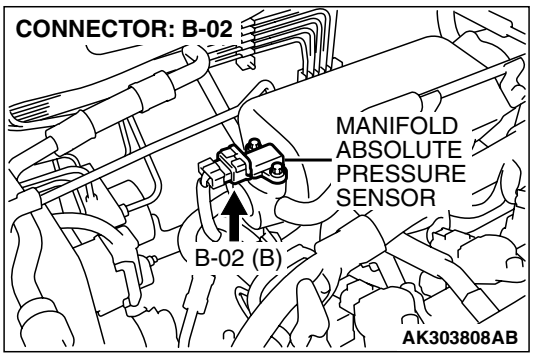

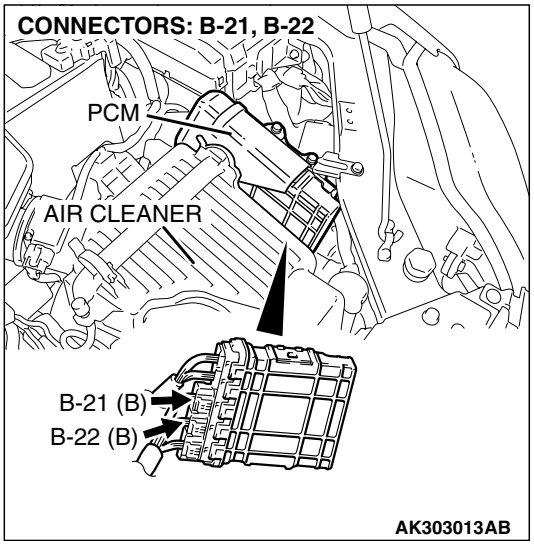

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CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from 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)

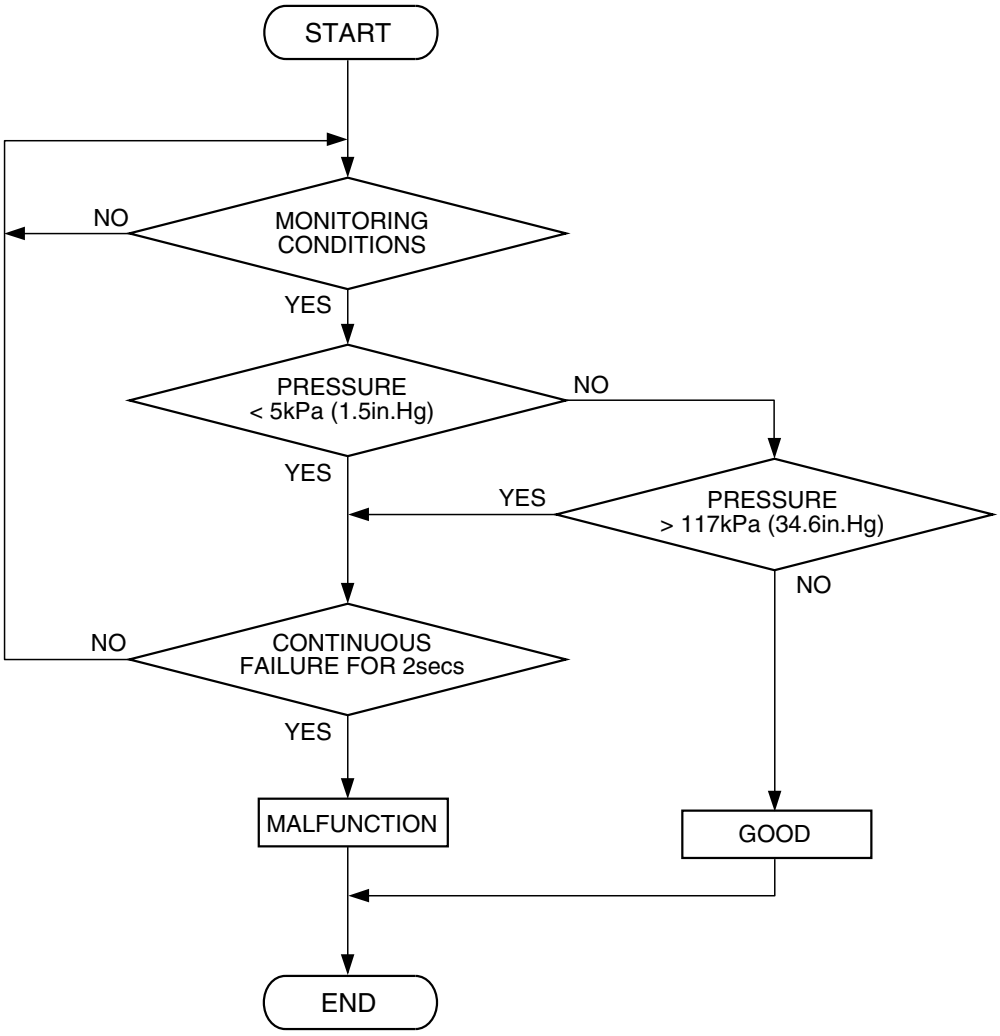
- Not applicable

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



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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.

Judgement Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

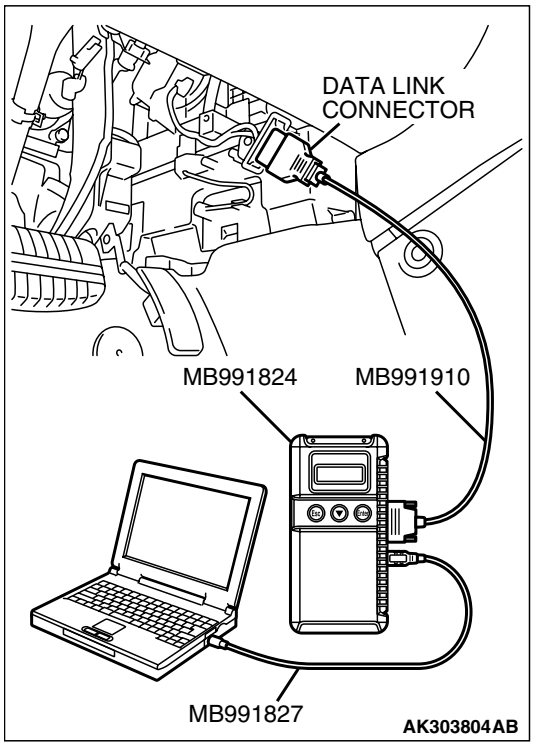
- Manifold absolute pressure sensor failed.
- Open manifold absolute pressure sensor circuit, or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

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



⚠ CAUTION

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

(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

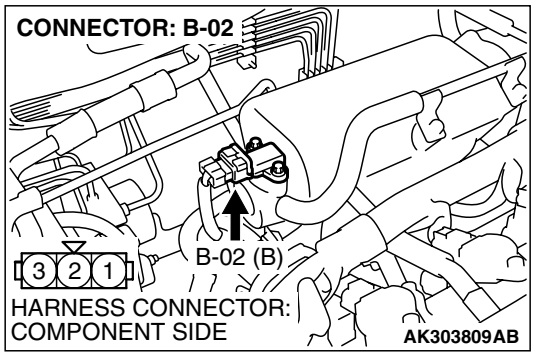
(4) Start the engine.
- When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
- When the engine is suddenly revved, manifold absolute pressure varies.

(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.

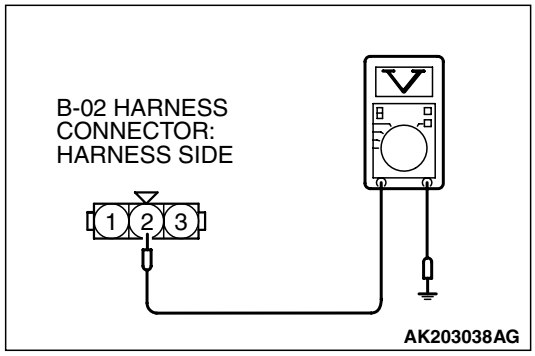
NO : Go to Step 2.



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.



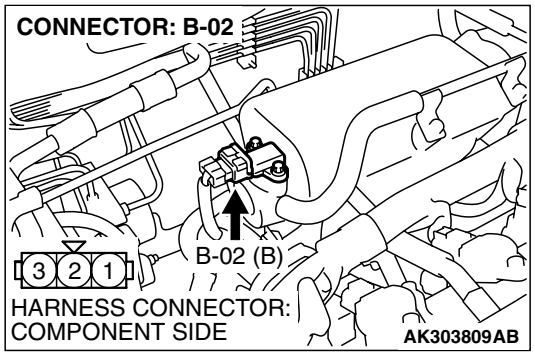
(3) Measure the voltage between terminal No. 2 and ground by backprobing.
- Voltage should be 0.5 volt or less.

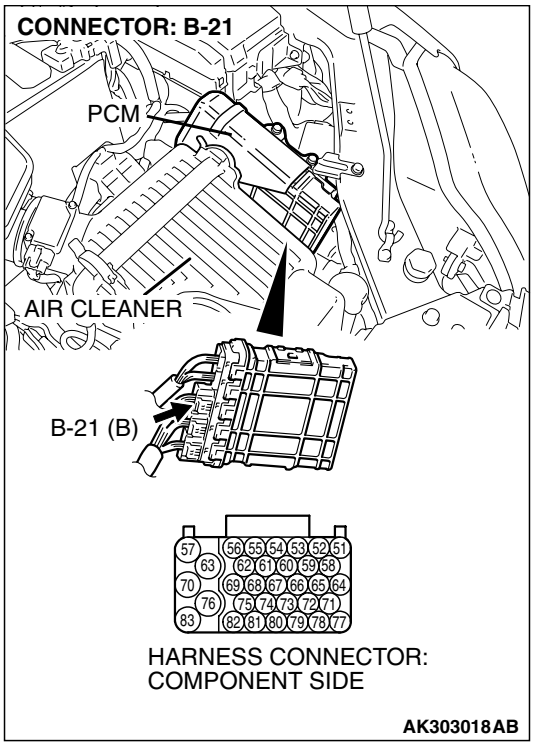
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage 0.5 volt or less?

YES : Go to Step 6.

NO : Go to Step 3.



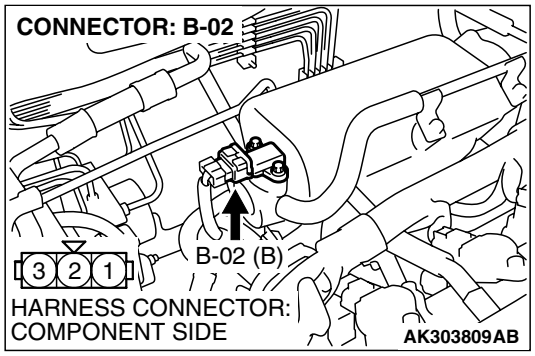


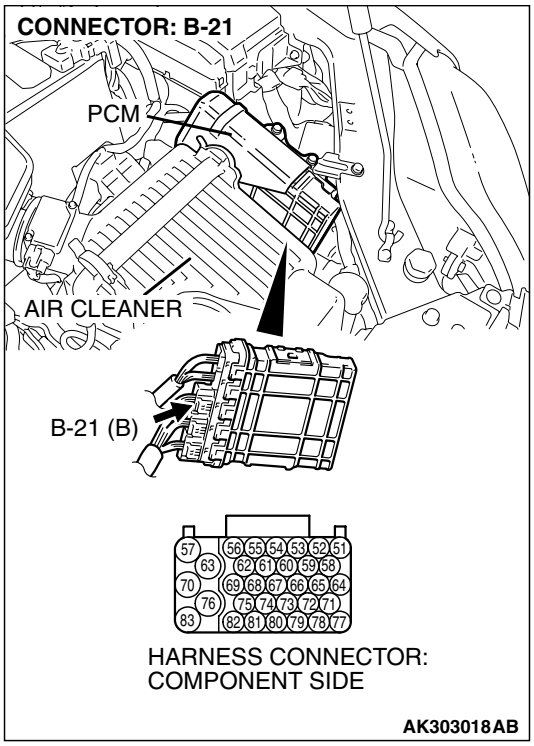
STEP 3. Check harness connector B-02 at the manifold absolute pressure sensor and harness connector B-21 at PCM for damage.

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.



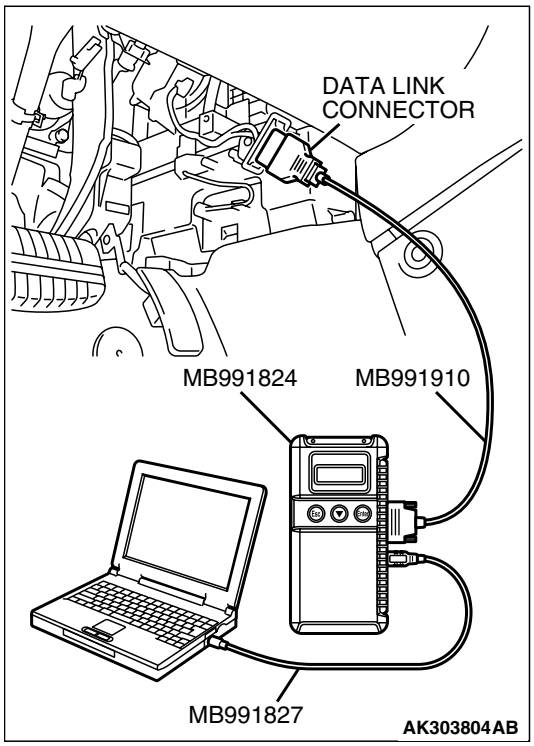


STEP 4. Check for open circuit between manifold absolute pressure sensor connector B-02 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

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 95: 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 95, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

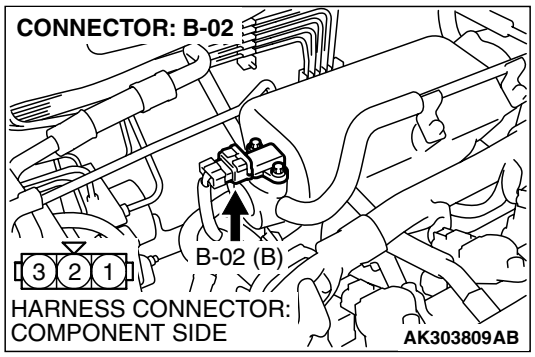
(3) Start the engine.
- When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
- When the engine is suddenly revved, manifold absolute pressure varies.

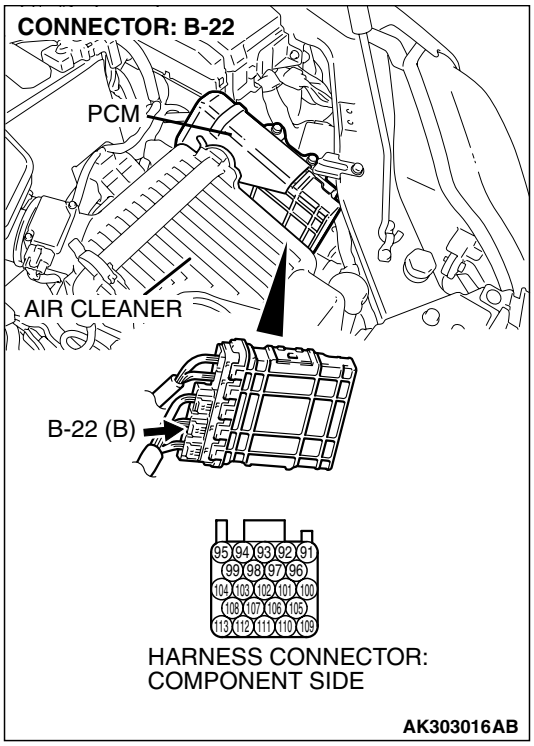
(4) Turn the ignition switch to the "LOCK" (OFF) position.

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. 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 – Procedure 6 – Other Monitor P.13A-6.

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

Q: Is DTC P0108 set?

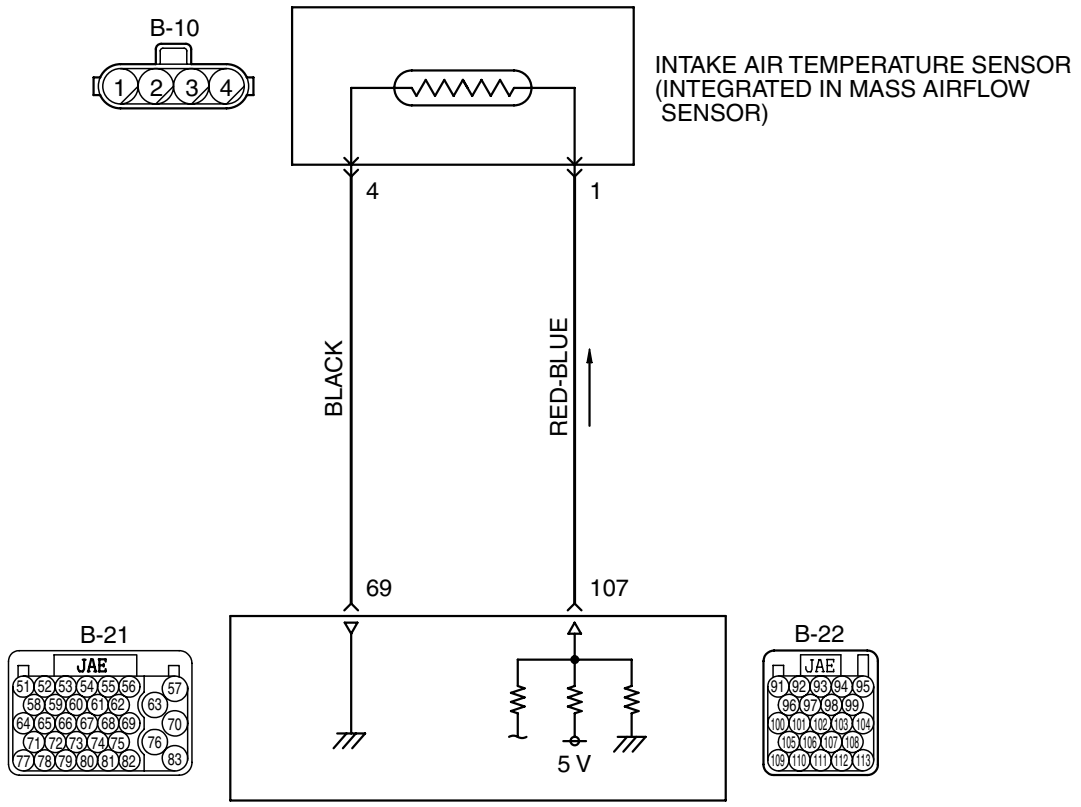
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0111: Intake Air Temperature Circuit Range/Performance Problem

⚠ 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



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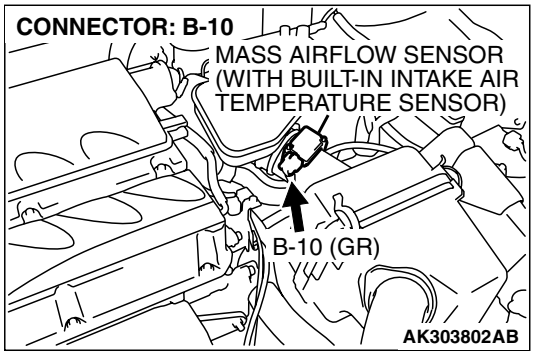
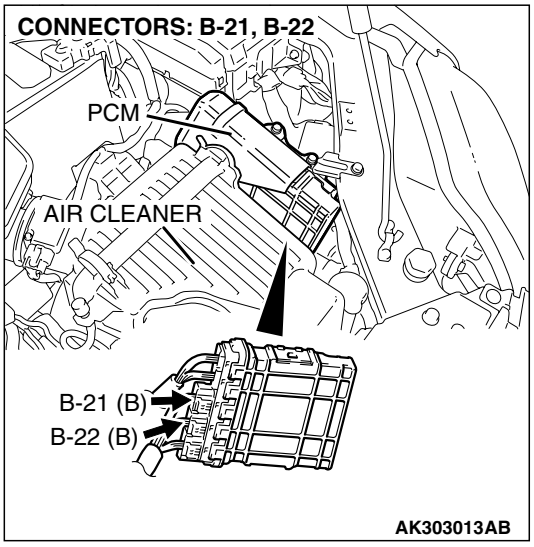




TSB Revision

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)

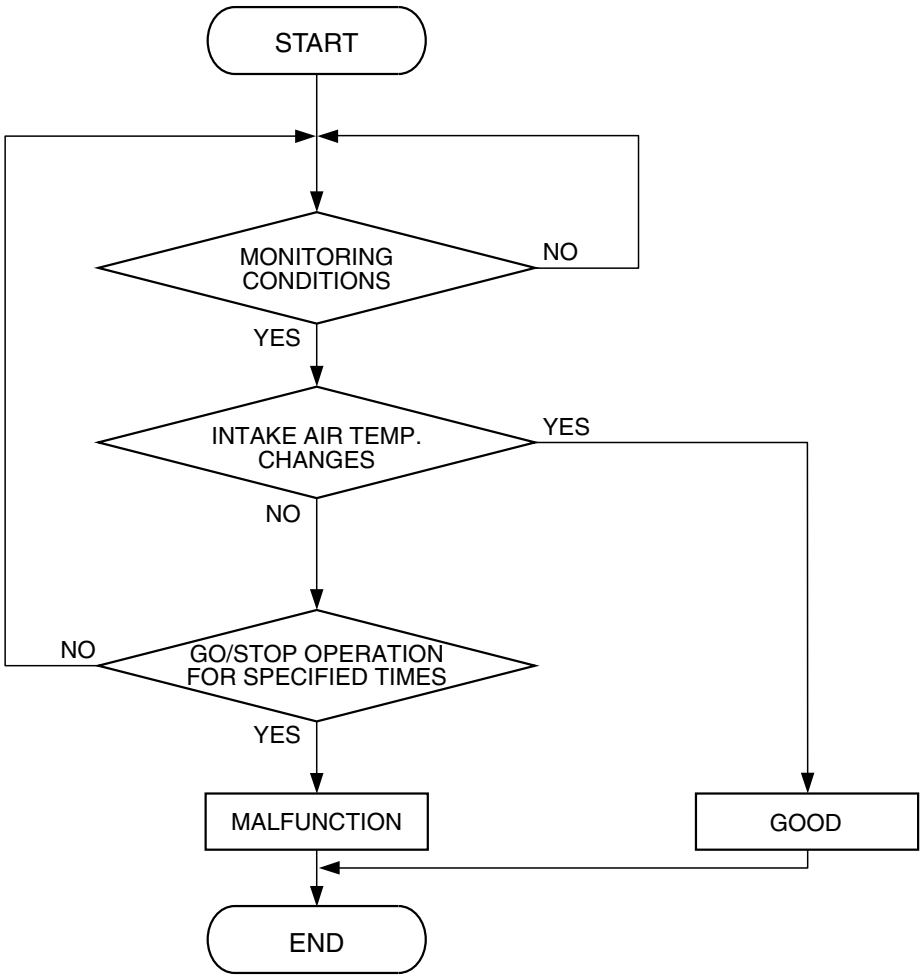
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302012

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 Criteria

- Changes in the intake air temperature is lower than 1°C (34°F).

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

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

TSB Revision

DIAGNOSIS

Required Special Tools:

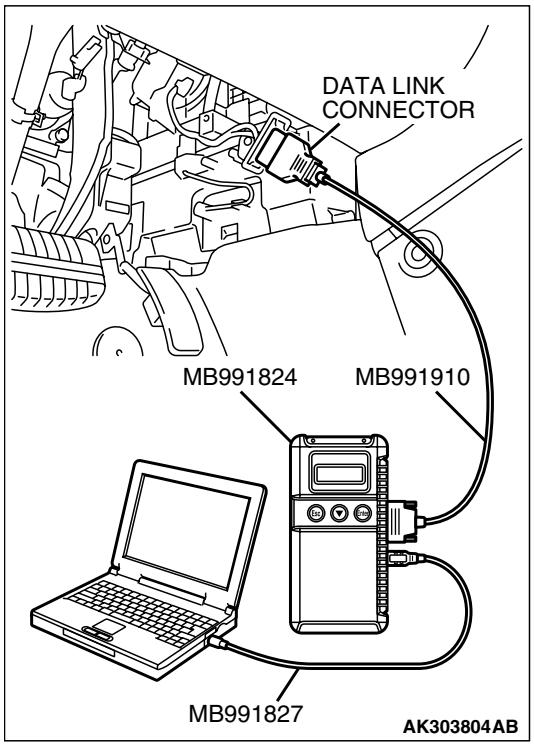
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A

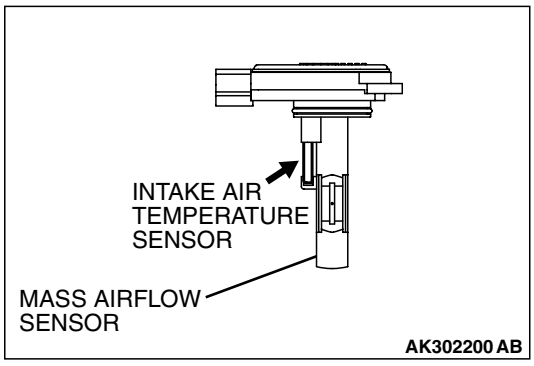
STEP 1. Using scan tool MB991958, check data list item 13: Intake Air Temperature Sensor.

⚠ CAUTION

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

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





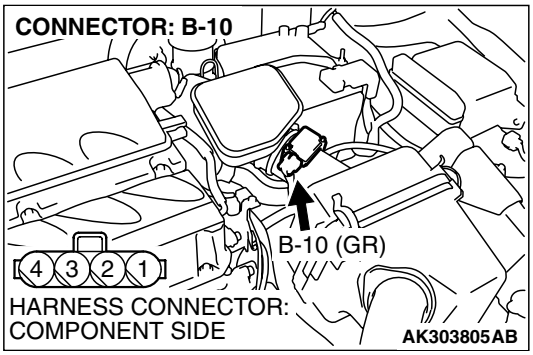
(5) Heating the sensor using a hair drier.
  - The indicated temperature increases.

  NOTE: Do not allow it to increase over 80 °C (176 °F).
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Attach the mass airflow sensor.

Q: Is the sensor operating properly?

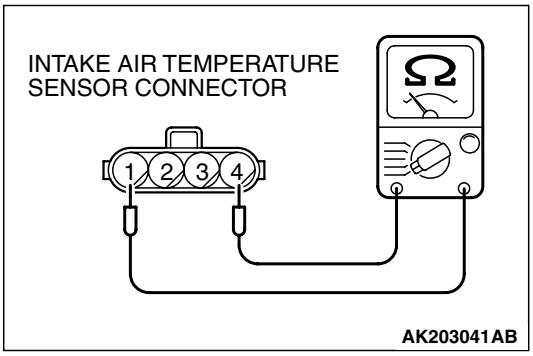
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-14.

NO : Go to Step 2.

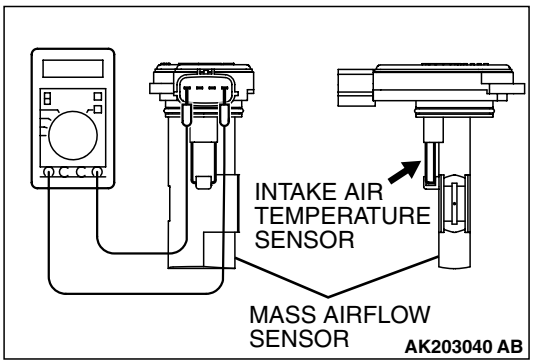


STEP 2. Check the intake air temperature sensor.

(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 kΩ [at –20°C (–4°F)]
5.3 – 6.7 kΩ [at 0°C (32°F)]
2.3 – 3.0 kΩ [at 20°C (68°F)]
1.0 – 1.5 kΩ [at 40°C (104°F)]
0.56 – 0.76 kΩ [at 60°C (140°F)]
0.30 – 0.45 kΩ [at 80°C (176°F)]

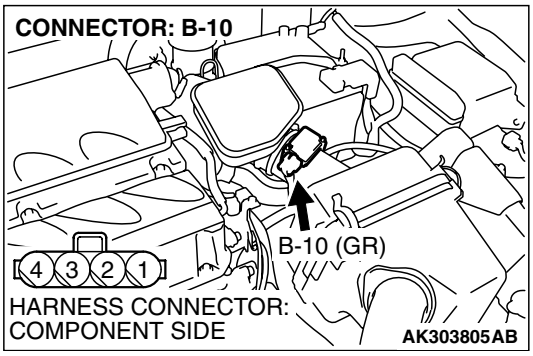
Q: Is the measured resistance at the standard value?

YES : Go to Step 3.
NO : Replace the mass airflow sensor. Then go to Step 9.

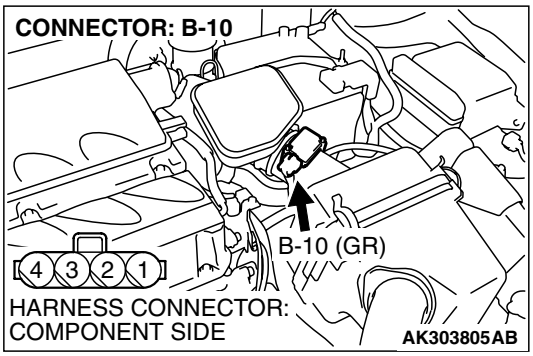
STEP 3. Check harness connector B-10 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

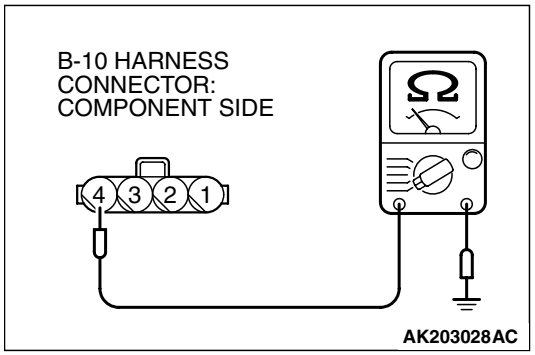
YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.



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.

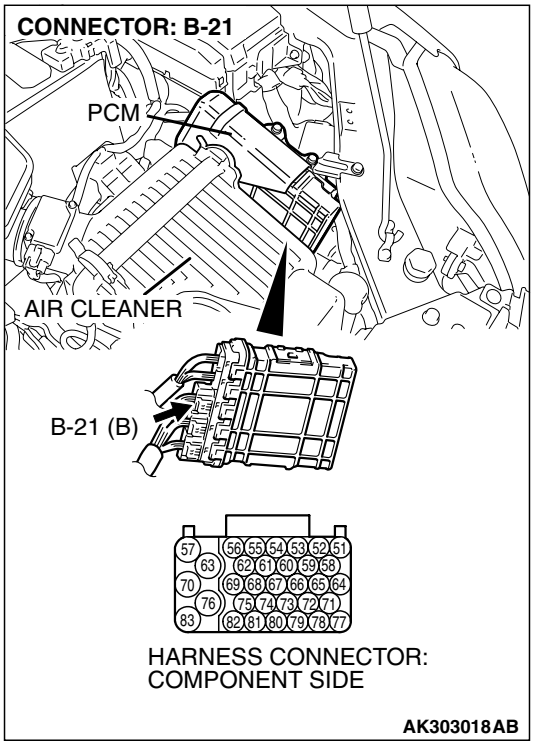


(2) Check for the continuity between terminal No. 4 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

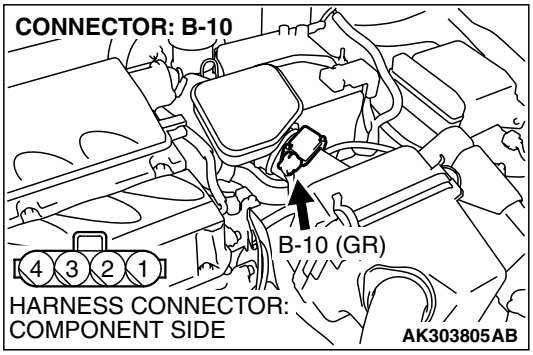
YES : Go to Step 7.
NO : Go to Step 5.

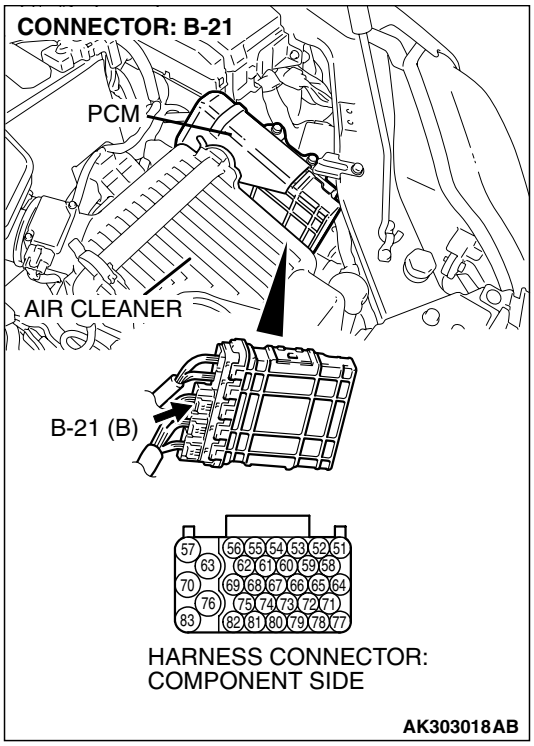
STEP 5. Check harness connector B-21 at PCM for damage.



Q: Is the harness connector in good condition?

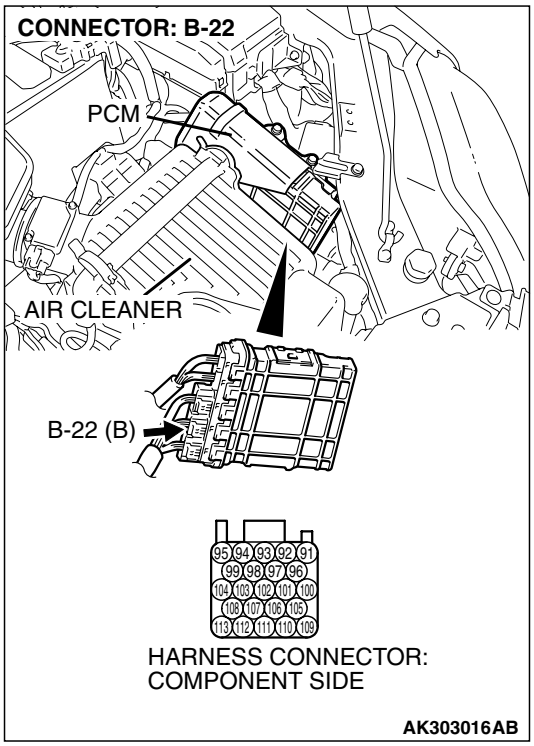
YES : Go to Step 6.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.





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

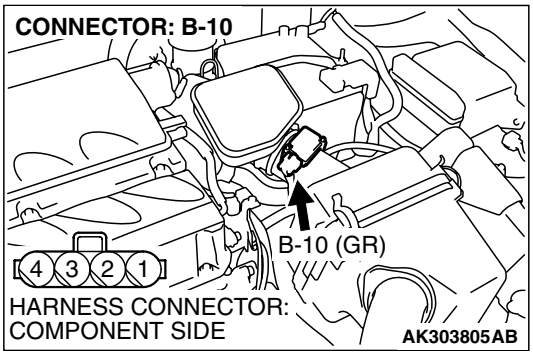


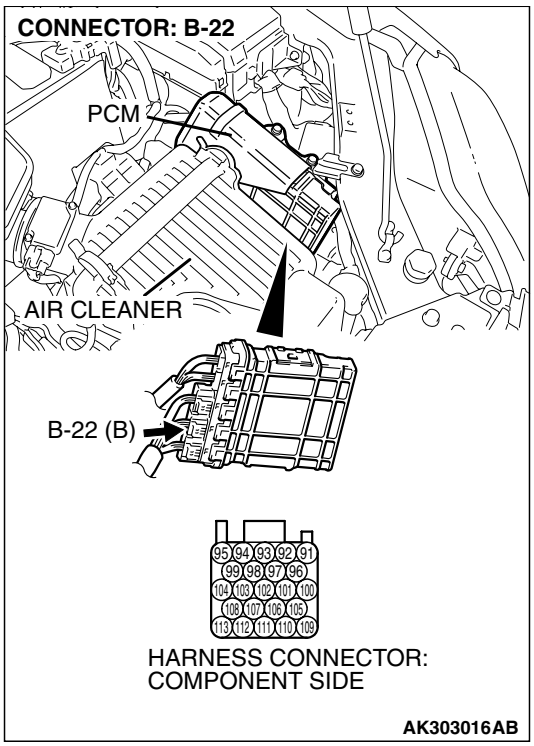
STEP 7. Check harness connector B-22 at PCM for damage.

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. Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 9. Test the OBD-II drive cycle.

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

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

Q: Is DTC P0111 set?

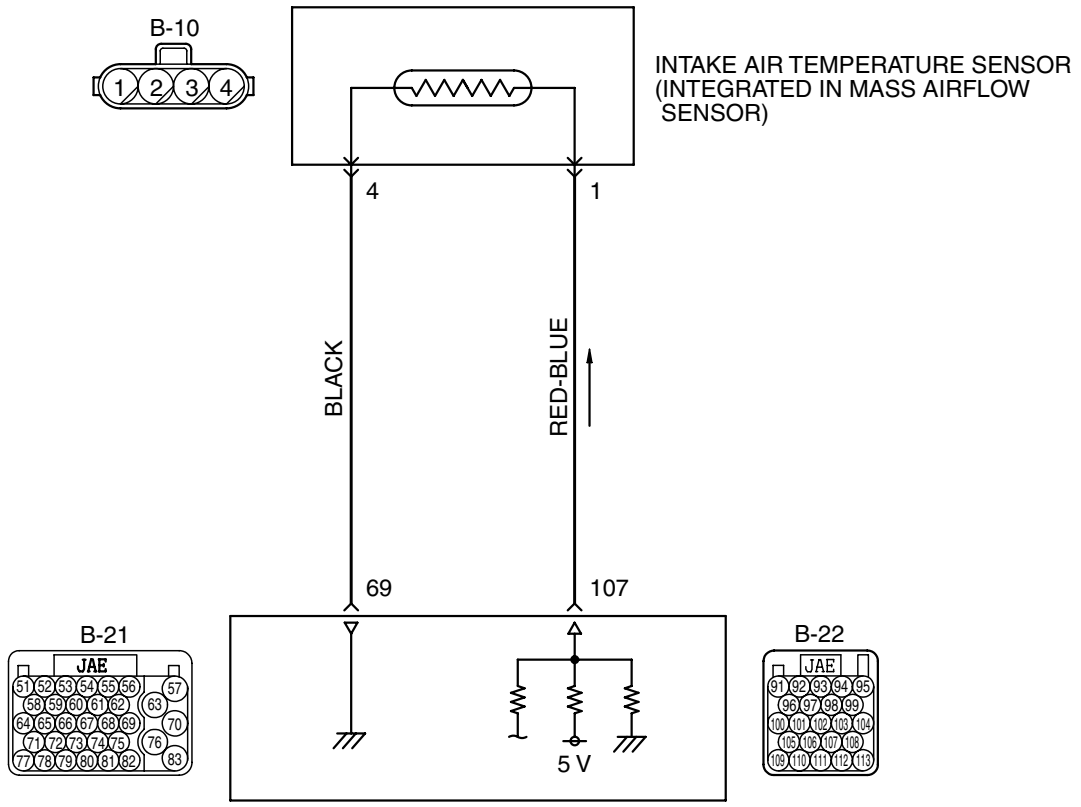
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0112: Intake Air Temperature Circuit Low Input

⚠ 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



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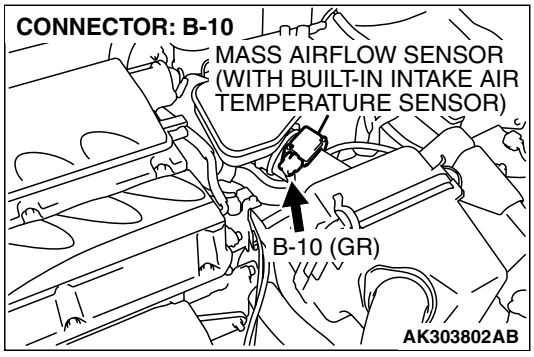
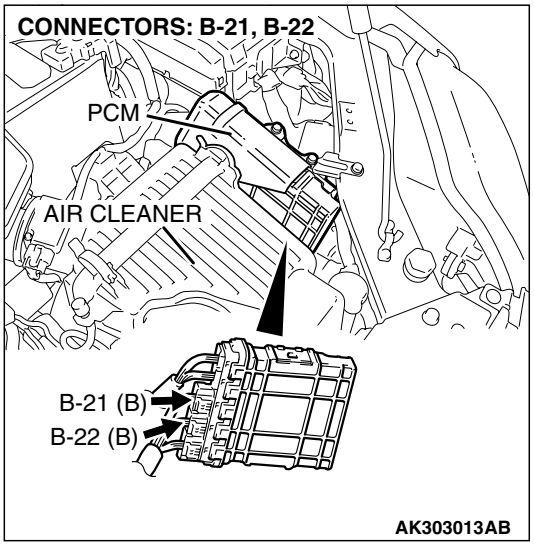




TSB Revision

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)

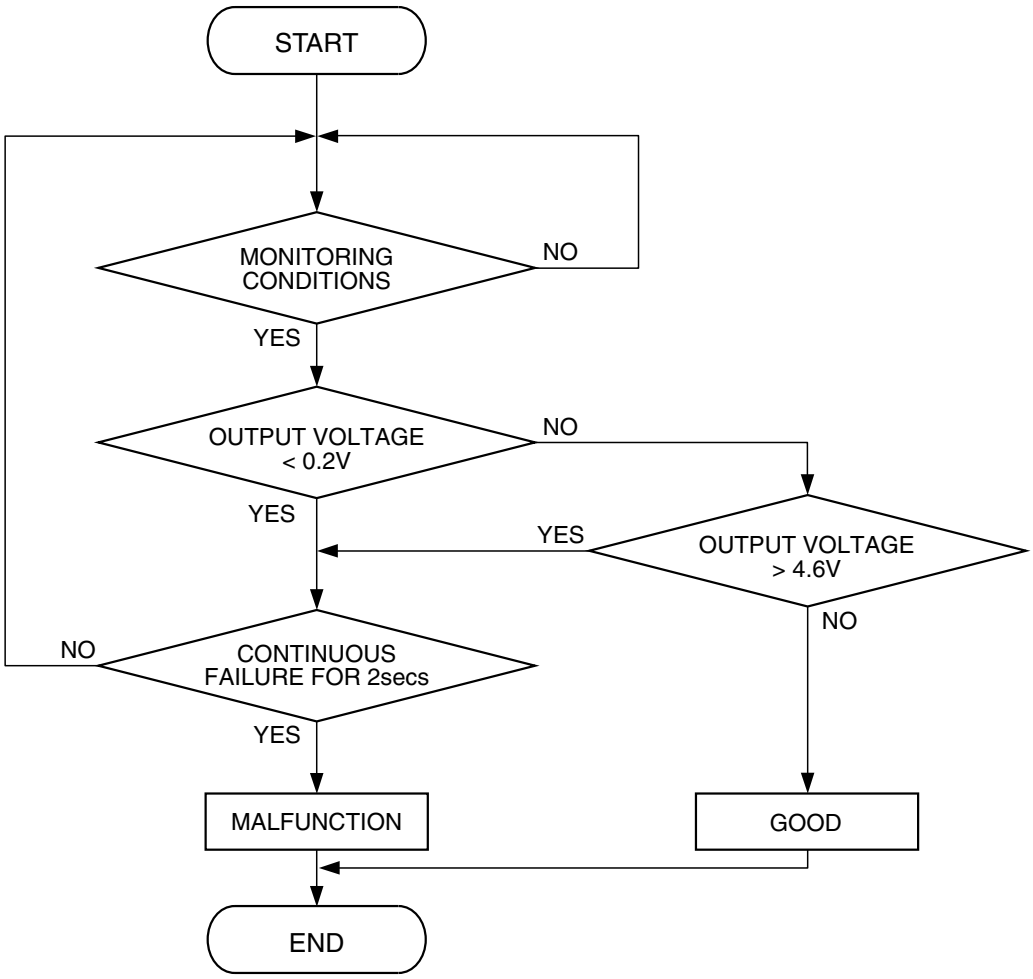
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302013

Check Conditions

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

Judgement Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

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

DIAGNOSIS

Required Special Tool:

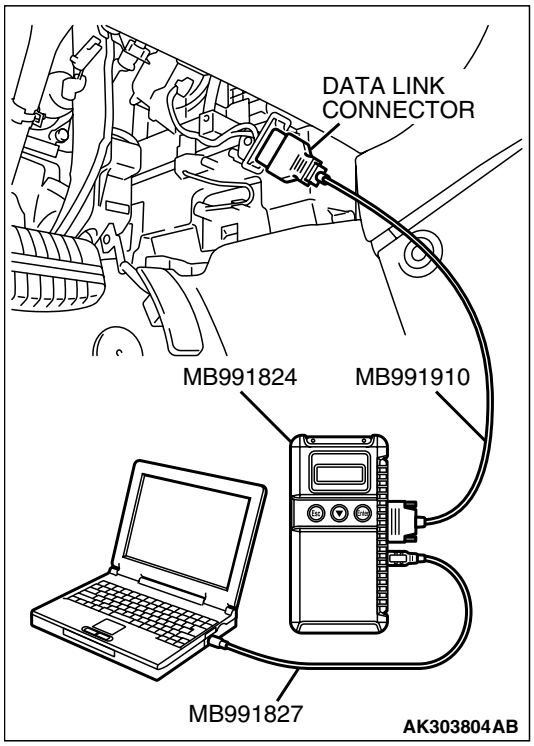
- MB991958: Scan Tool (MUT-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A

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

⚠ CAUTION

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

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



Q: Is the sensor operating properly?

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

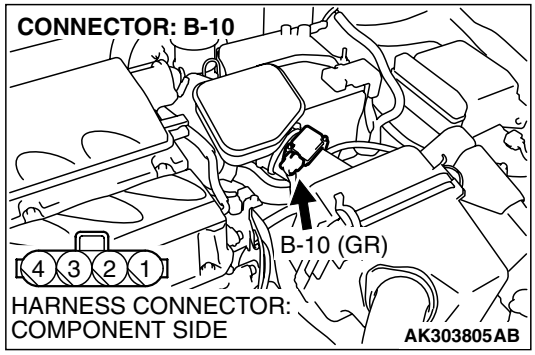
NO : Go to Step 2.

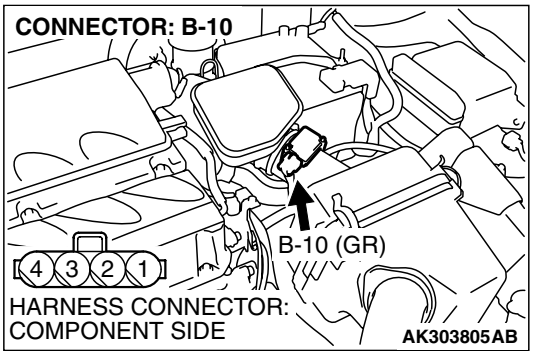
STEP 2. Check harness connector B-10 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

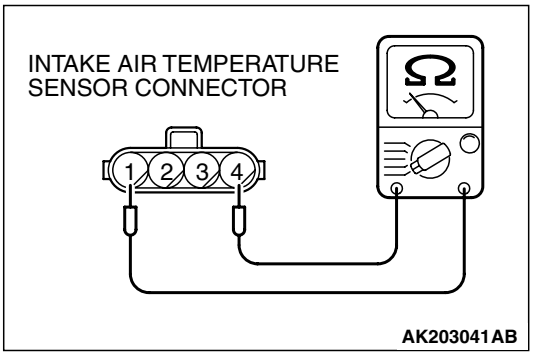
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 6.





STEP 3. Check the intake air temperature sensor.

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

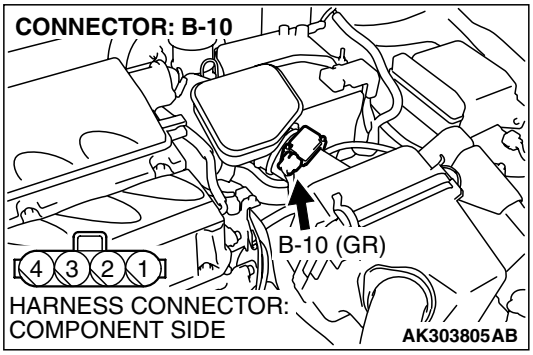


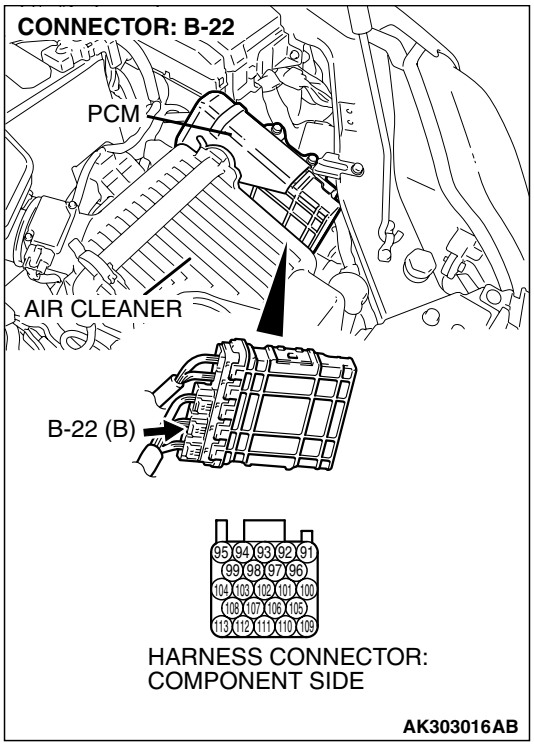
(2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.
- There should be continuity. (0.30 – 20 kΩ)

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

YES : Go to Step 4.

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



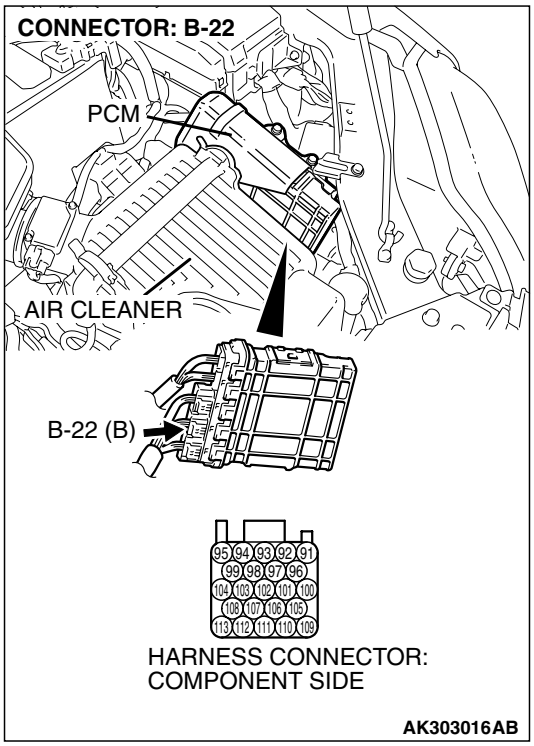


STEP 4. Check for short circuit to ground between intake air temperature sensor connector B-10 (terminal No. 1) and PCM connector B-22 (terminal No. 107).

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. Then go to Step 6.

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

STEP 6. Test the OBD-II drive cycle.

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

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

Q: Is DTC P0112 set?

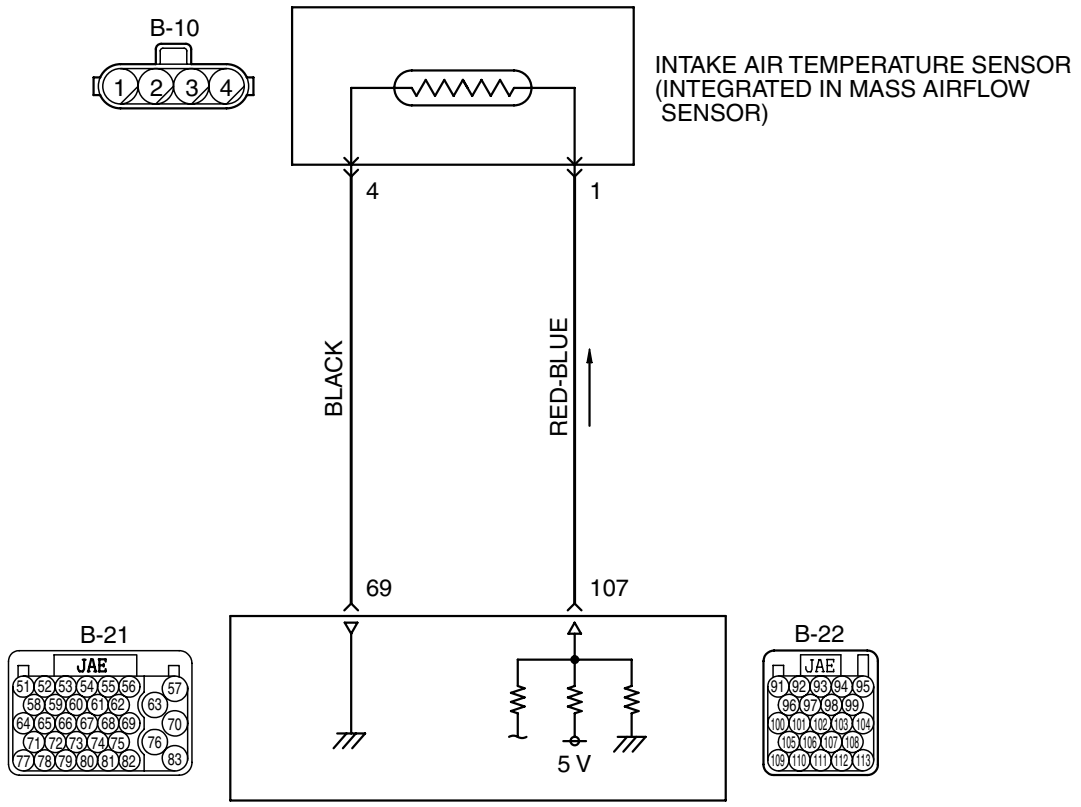
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0113: Intake Air Temperature Circuit High Input

⚠ 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



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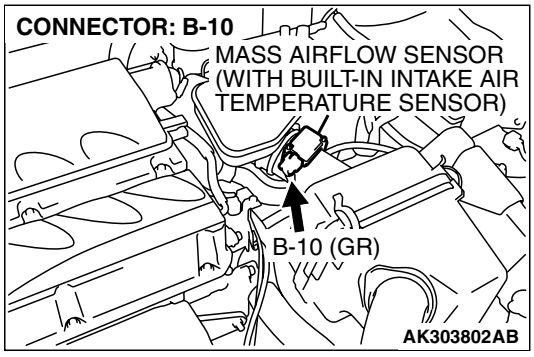
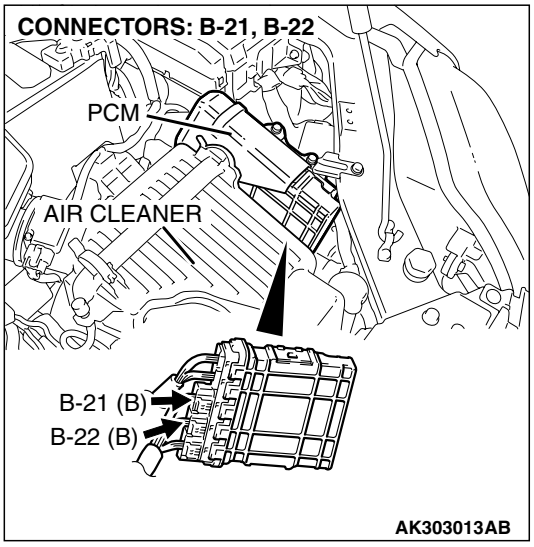




TSB Revision

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)

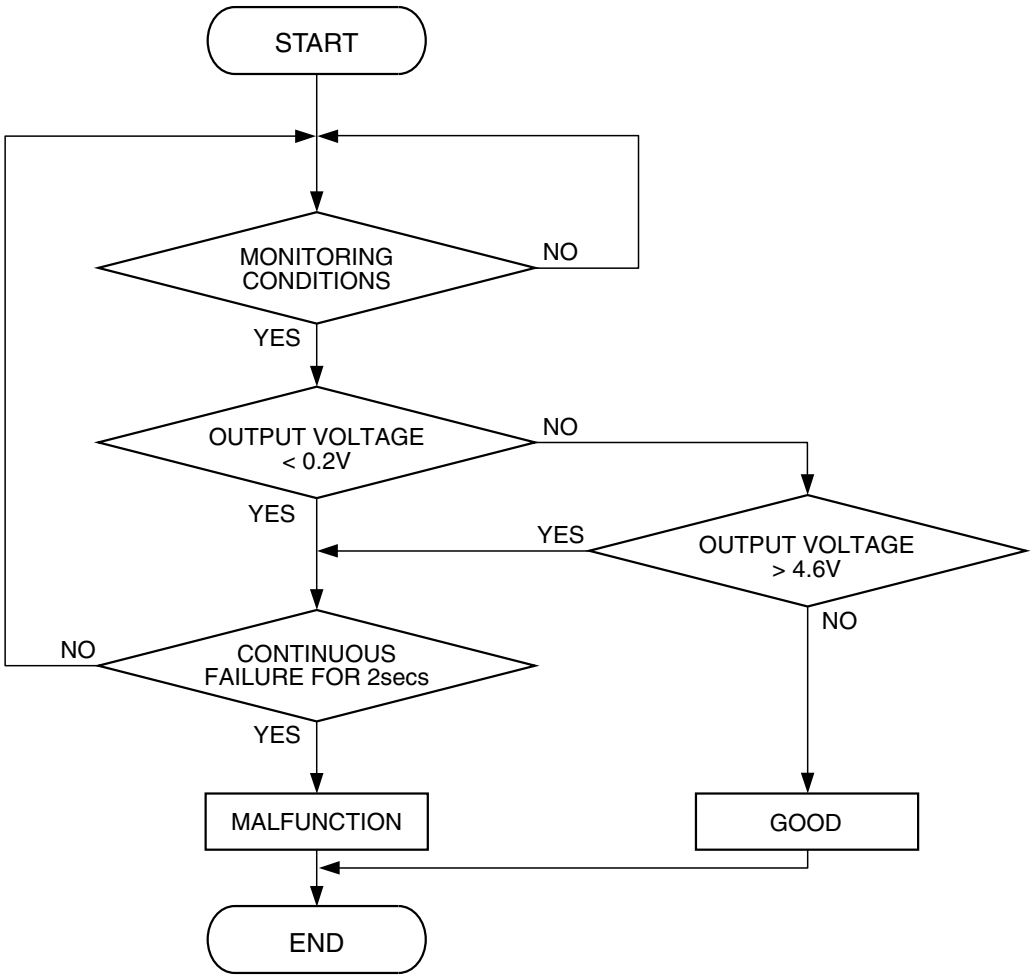
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

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

Judgement Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

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

DIAGNOSIS

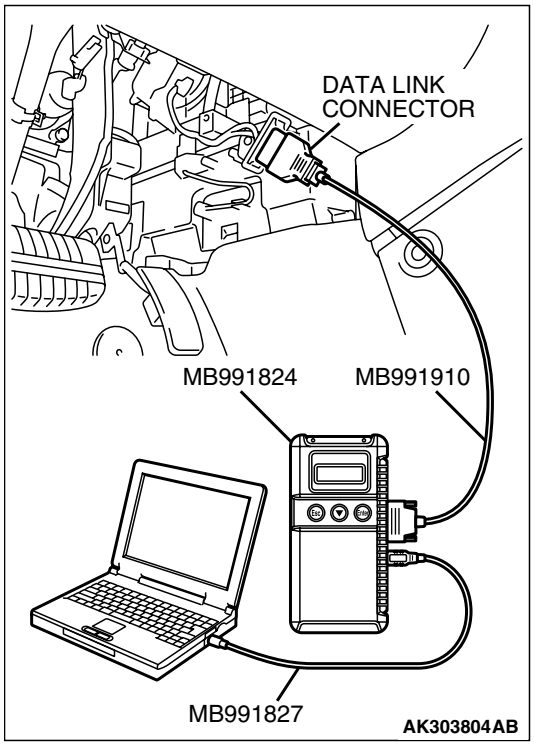
Required Special Tools:

- MB991958: Scan Tool (MUT-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 13: Intake Air Temperature Sensor.

⚠ CAUTION

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



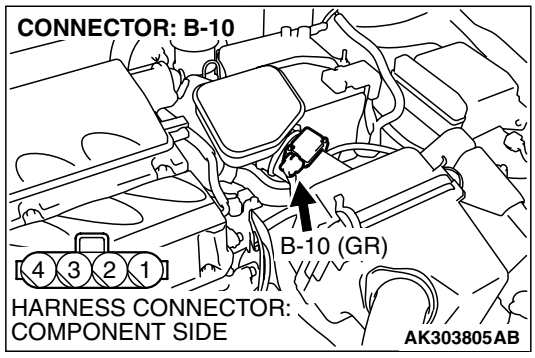
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
  - The intake air temperature and temperature shown with the scan tool should approximately match.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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

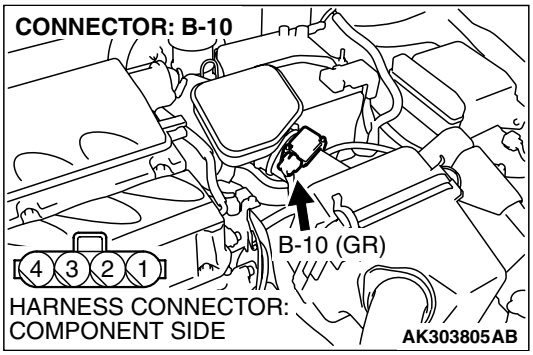
STEP 2. Check harness connector B-10 at the intake air temperature sensor for damage.



Q: Is the harness connector in good condition?

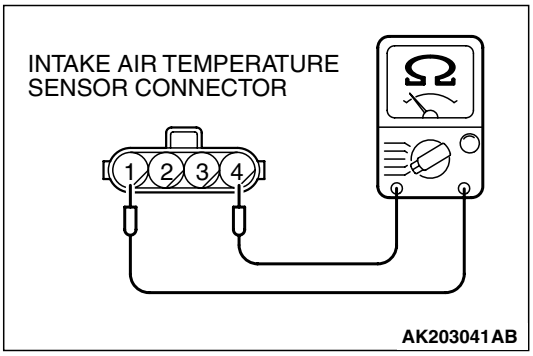
YES : Go to Step 3.

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.



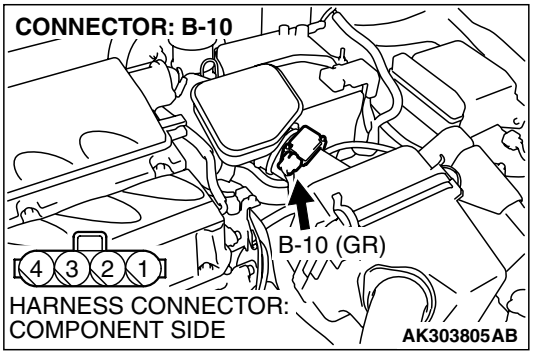
(2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.
- There should be continuity. (0.30 – 20 kΩ)

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

YES : Go to Step 4.

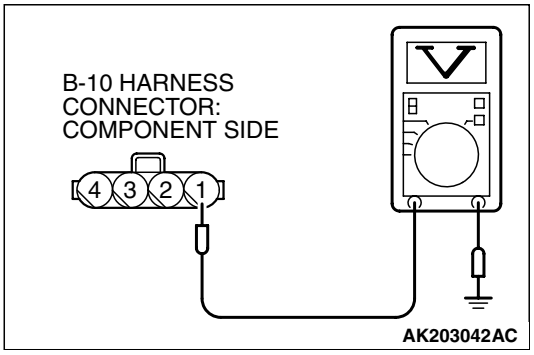
NO : Replace the mass airflow sensor. Then go to Step 11.

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.



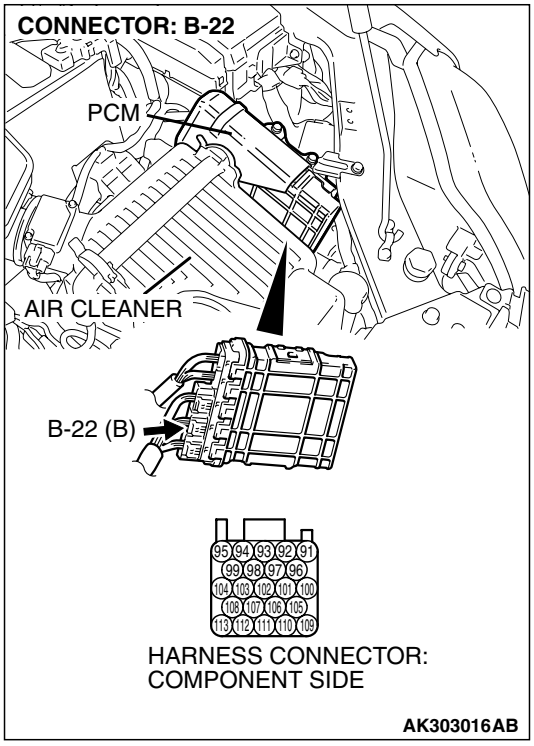
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be between 4.5 and 4.9 volts.

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

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

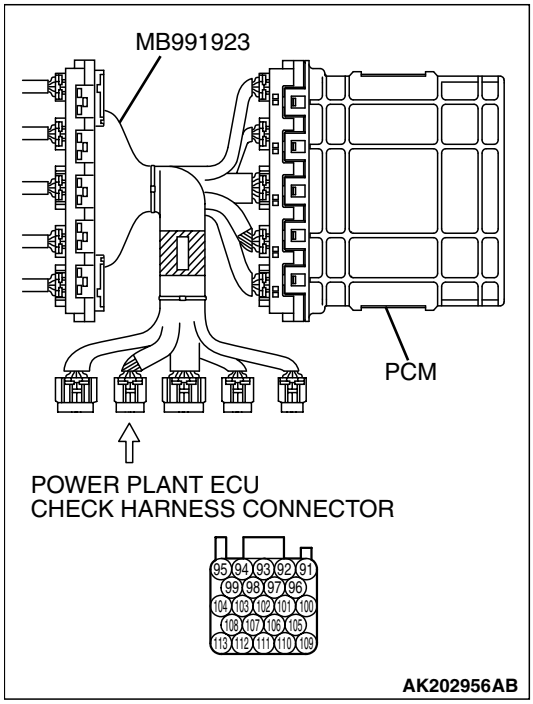
YES : Go to Step 8.

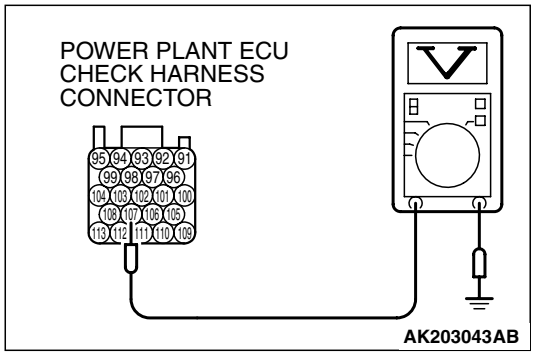
NO : Go to Step 5.



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

(1) Disconnect the all PCM connectors and connect 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.



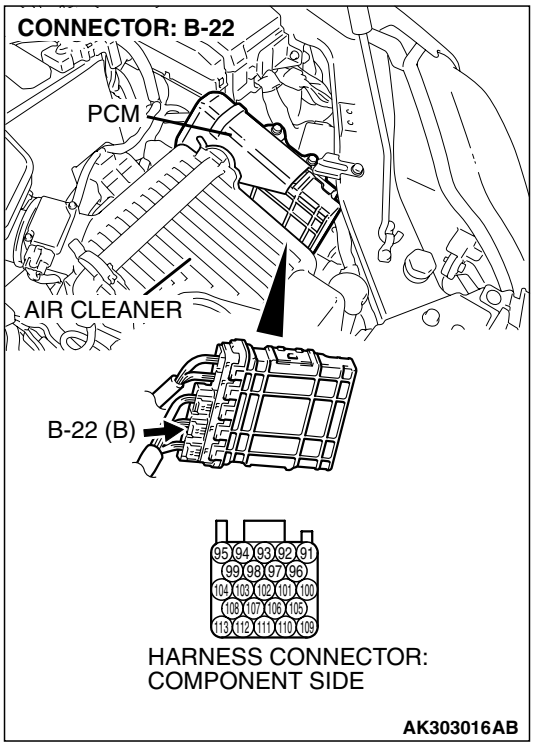


(4) Measure the voltage between terminal No. 107 and ground.
- Voltage should be between 4.5 and 4.9 volts.

(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.

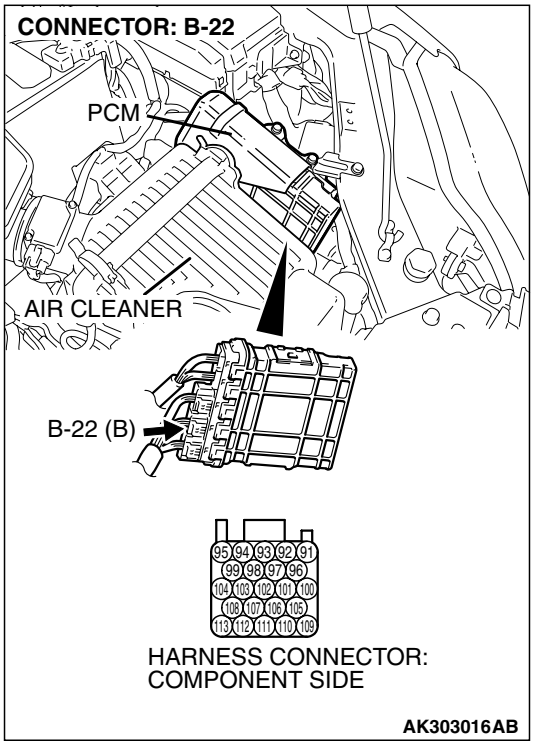


STEP 6. Check harness connector B-22 at PCM for damage.

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.

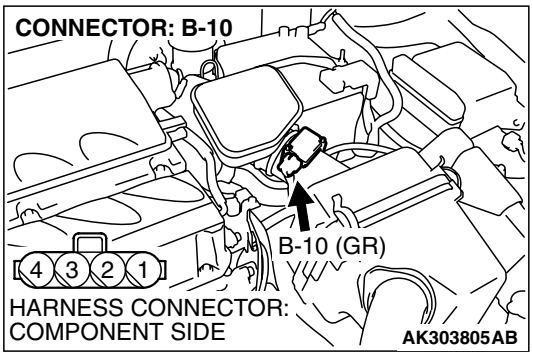


STEP 7. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

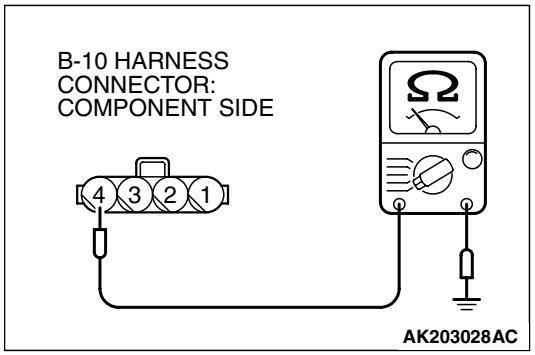
YES : Replace the PCM. Then go to Step 11.

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.
- Should be less than 2 ohms.

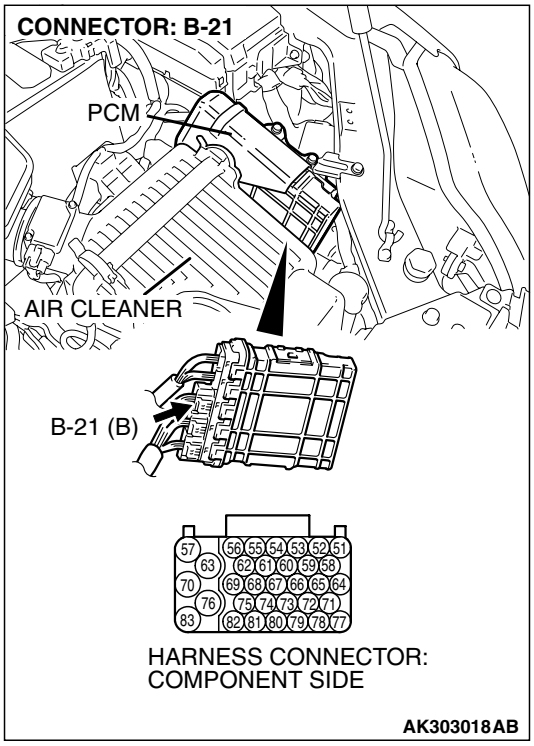
Q: Does continuity exist?

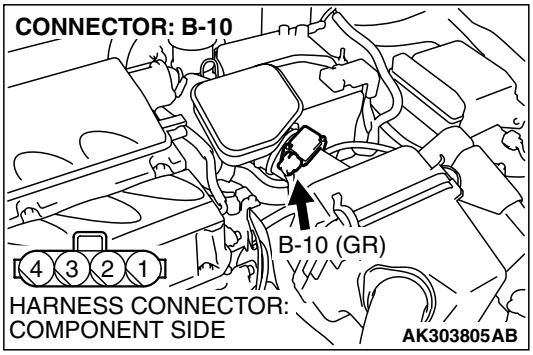
YES : Replace the PCM. Then go to Step 11.
NO : Go to Step 9.

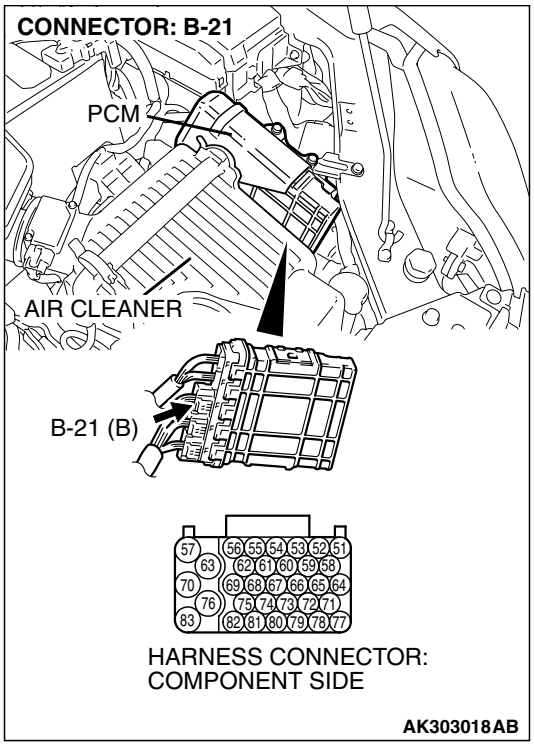
STEP 9. Check harness connector B-21 at PCM for damage.

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. Then go to Step 11.

NO : Repair it. Then go to Step 11.

STEP 11. Test the OBD-II drive cycle.

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

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

Q: Is DTC P0113 set?

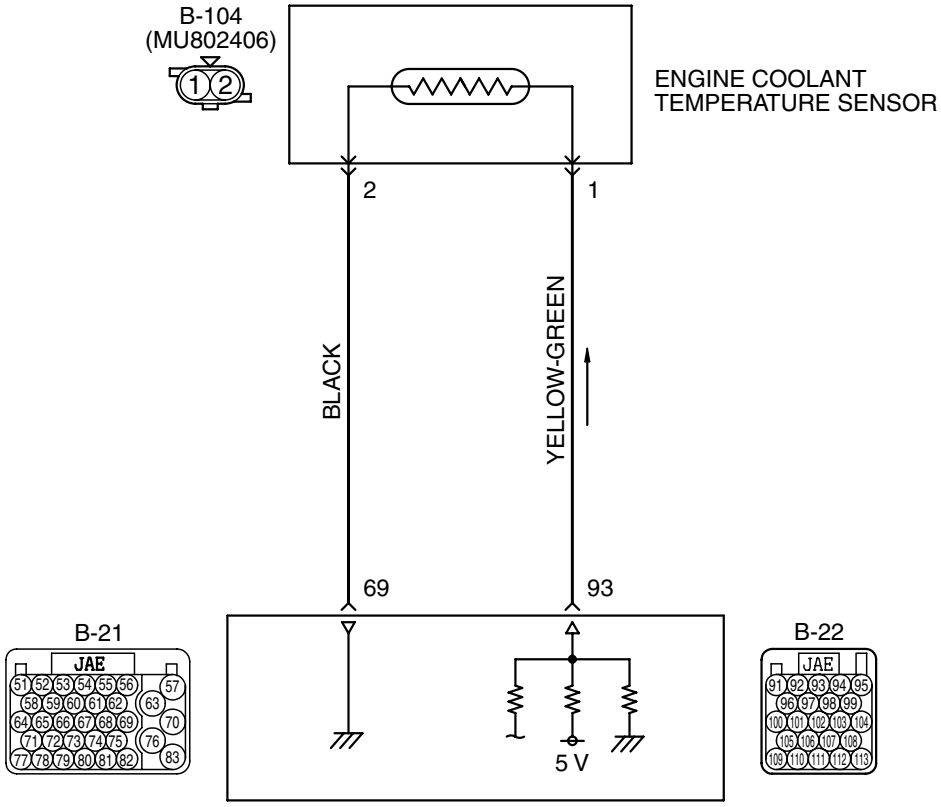
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0116: Engine Coolant Temperature Circuit Range/Performance Problem

⚠ 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



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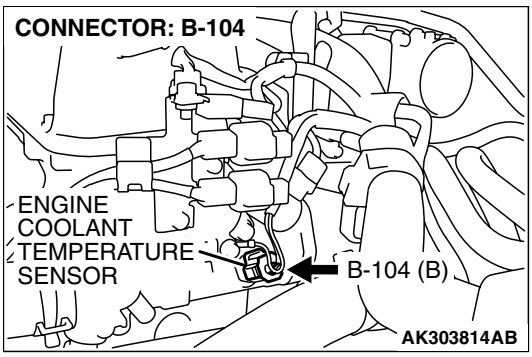
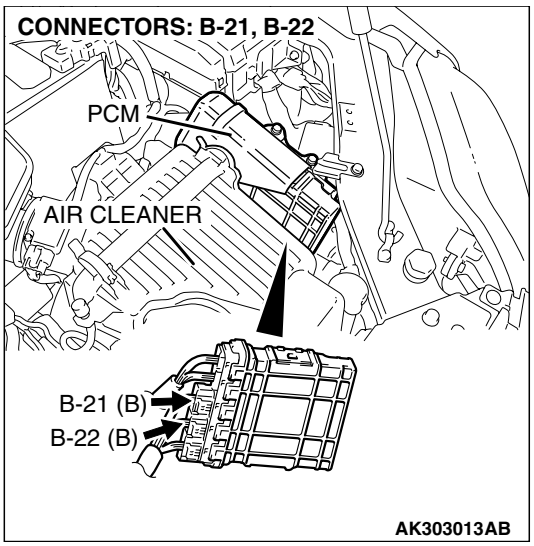




TSB Revision

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

MONITOR EXECUTION

Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

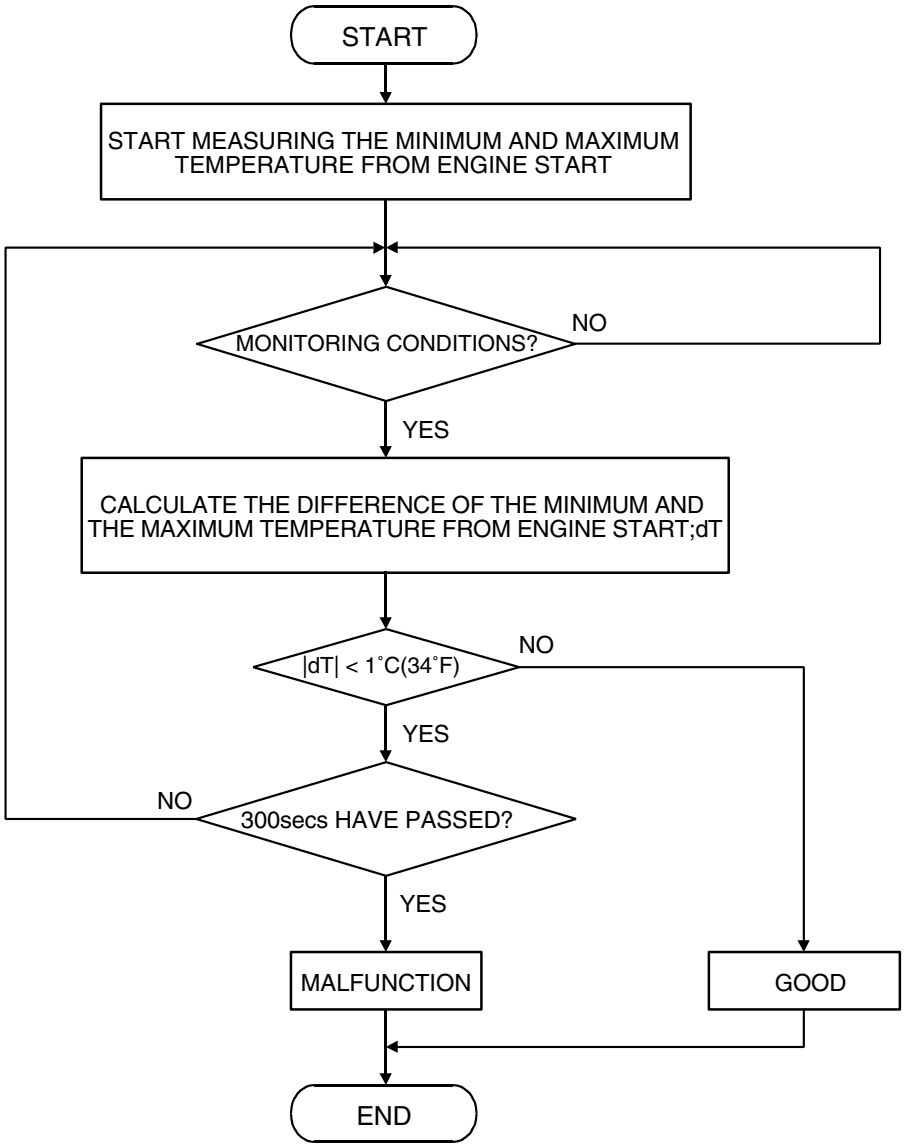
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

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

Judgement Criteria

- Engine coolant temperature fluctuates within 1°C (34°F) after 5 minutes have passed since the engine was started.
- However, time is not counted if any of the following conditions are met.
  1. Intake air temperature is 60°C (140°F) or more.
  2. Mass airflow sensor output is 10 g/sec or less.
  3. During fuel shut-off operation.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function–OBD-II Drive Cycle–Procedure 6–Other Monitor P.13A-6.

TSB Revision

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

- Engine coolant temperature sensor failed.
- Harness damage or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

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

⚠ CAUTION

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

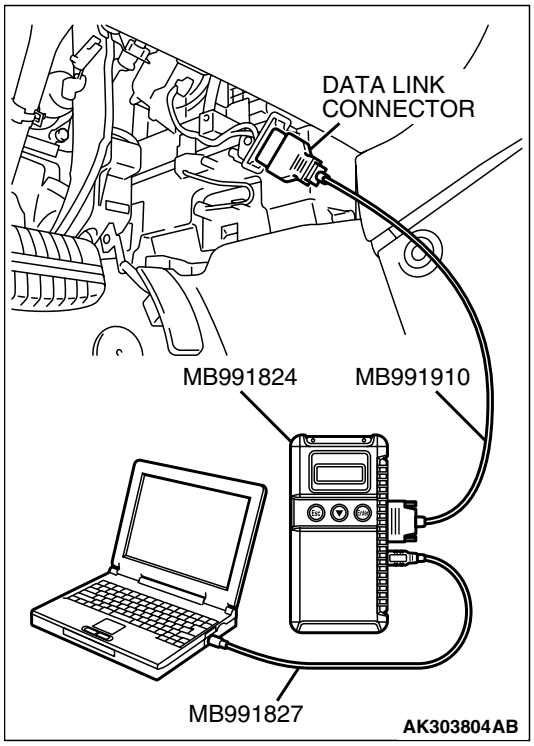
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately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

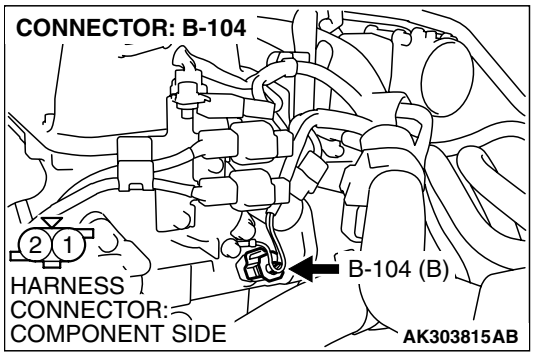
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

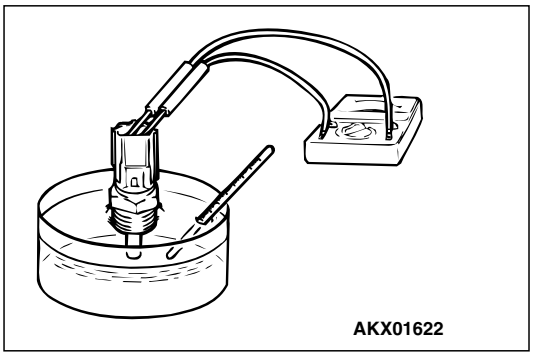
NO : Go to Step 2.





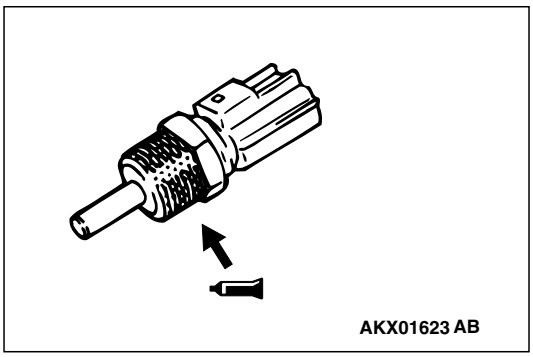
STEP 2. Check the engine coolant temperature sensor.

(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 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)

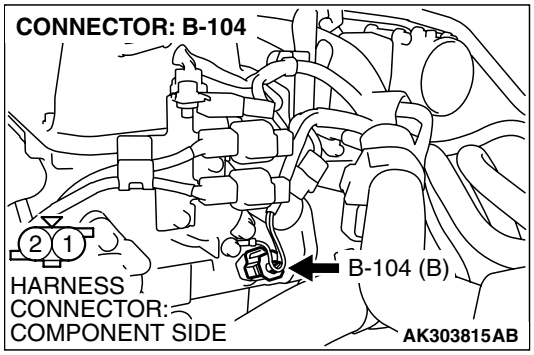
Q: Is the measured resistance at the standard value?

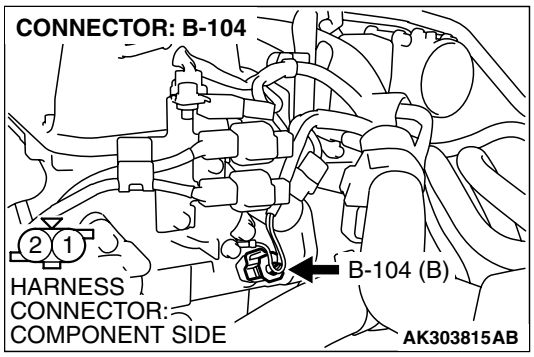
YES : Go to Step 3.
NO : Replace the engine coolant temperature sensor. Then go to Step 9.

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

Q: Is the harness connector in good condition?

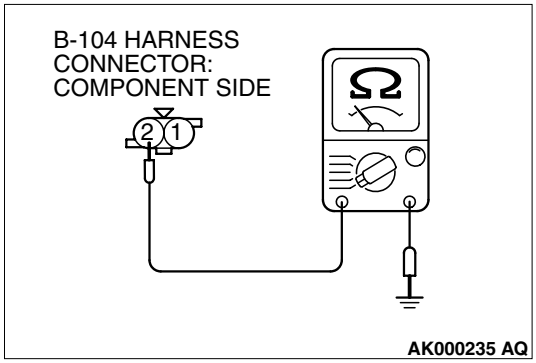
YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.





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

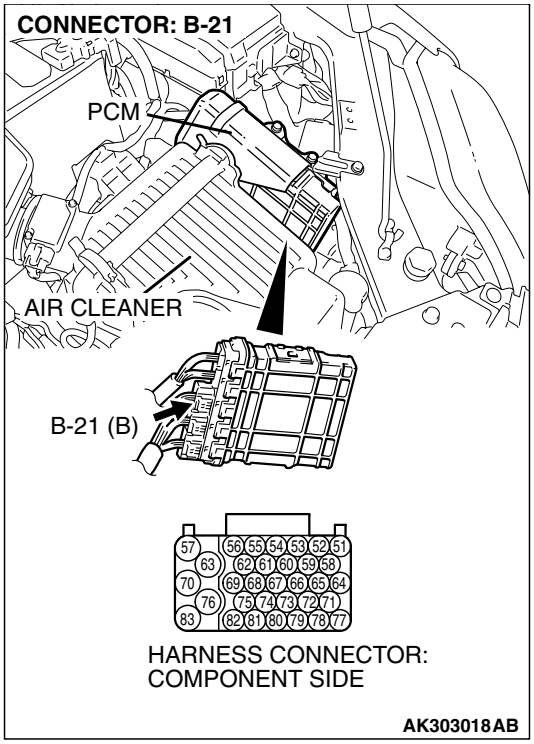
(1) Disconnect the connector B-104 and measure at the harness side.



(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

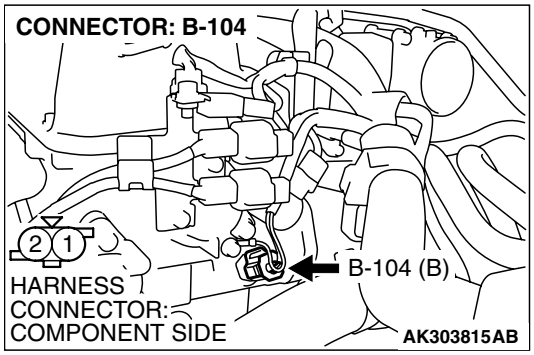
YES : Go to Step 7.
NO : Go to Step 5.

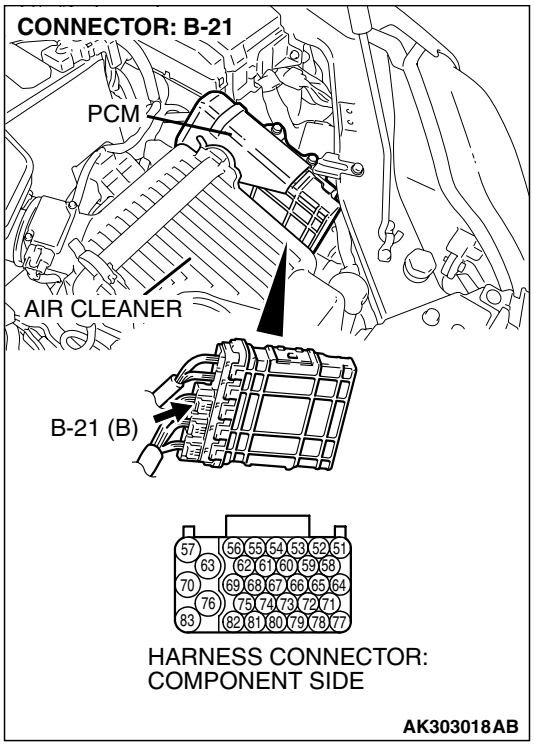


STEP 5. Check harness connector B-21 at PCM for damage.

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.



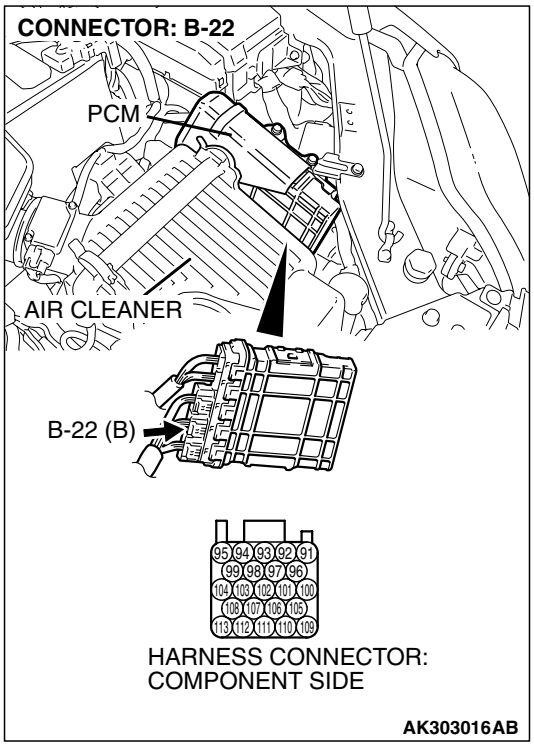


STEP 6. Check for harness damage between engine coolant temperature sensor connector B-104 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

YES : Replace the PCM. Then go to Step 9.

NO : Repair it. Then go to Step 9.

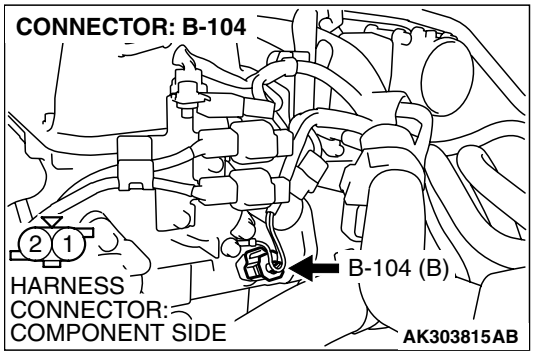


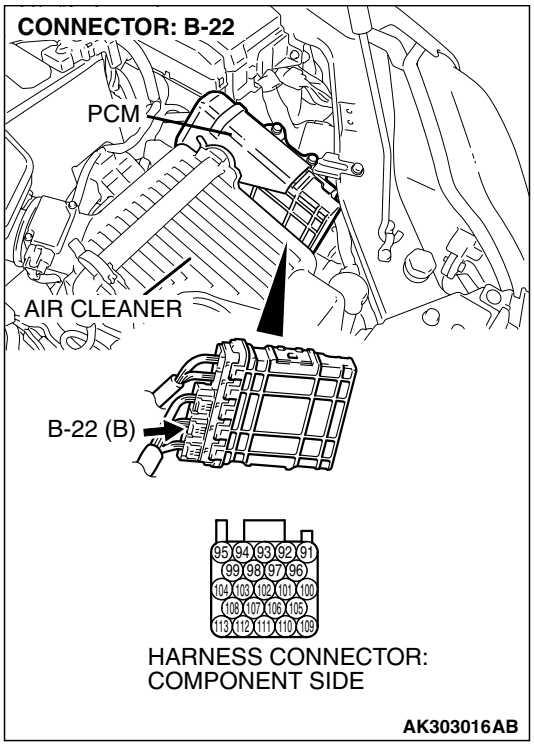
STEP 7. Check harness connector B-22 at PCM for damage.

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. Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 9. Test the OBD-II drive cycle.

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

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

Q: Is DTC P0116 set?

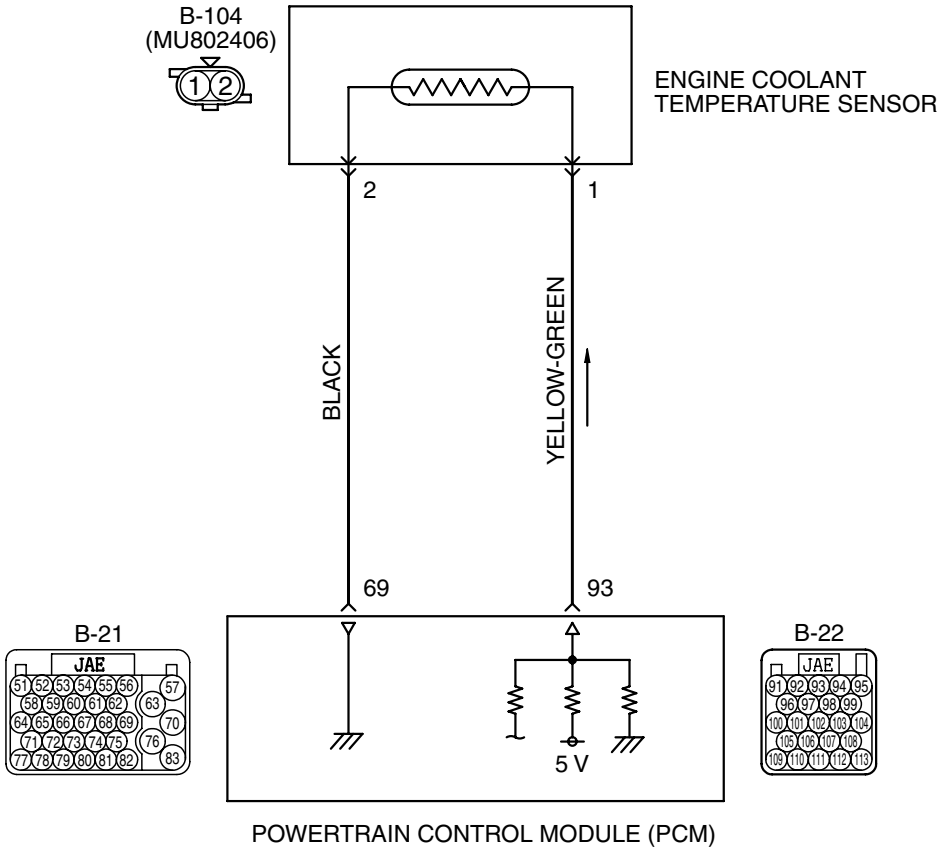
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0117: Engine Coolant Temperature Circuit Low Input

⚠ 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



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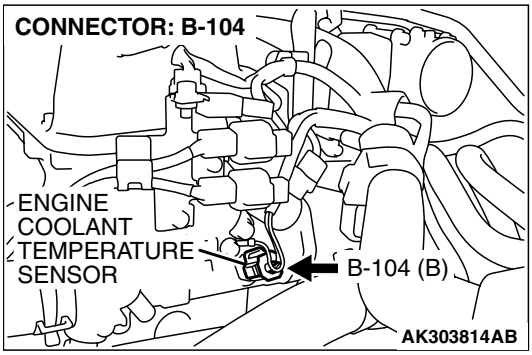

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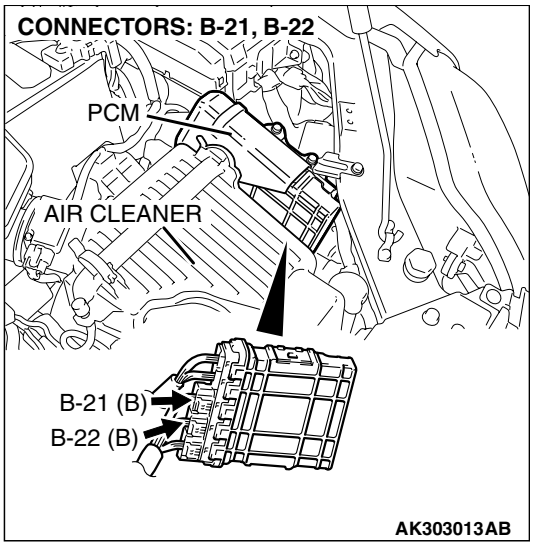


CIRCUIT OPERATION

- 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)

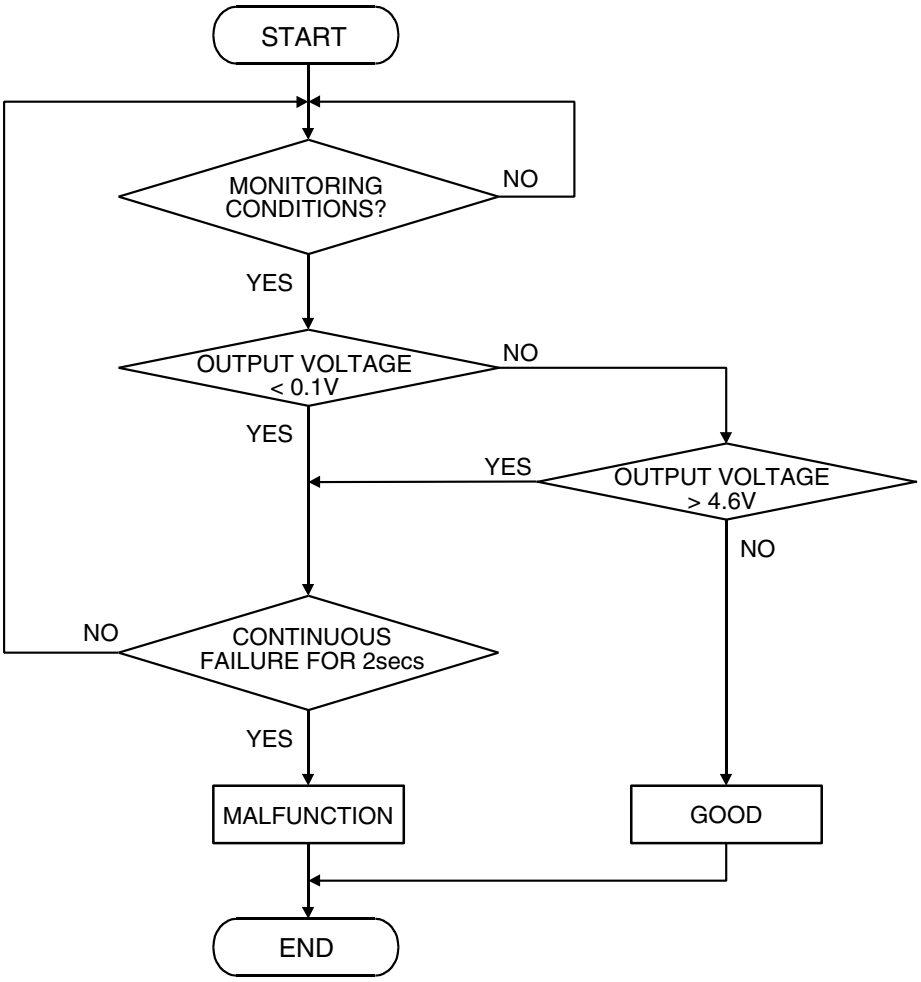
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable.

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

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

Judgement Criteria

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor P.13A-6.

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

- Engine coolant temperature sensor failed.
- Shorted engine coolant temperature sensor circuit, or connector damage.
- PCM failed.

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DIAGNOSIS

Required Special Tools:

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

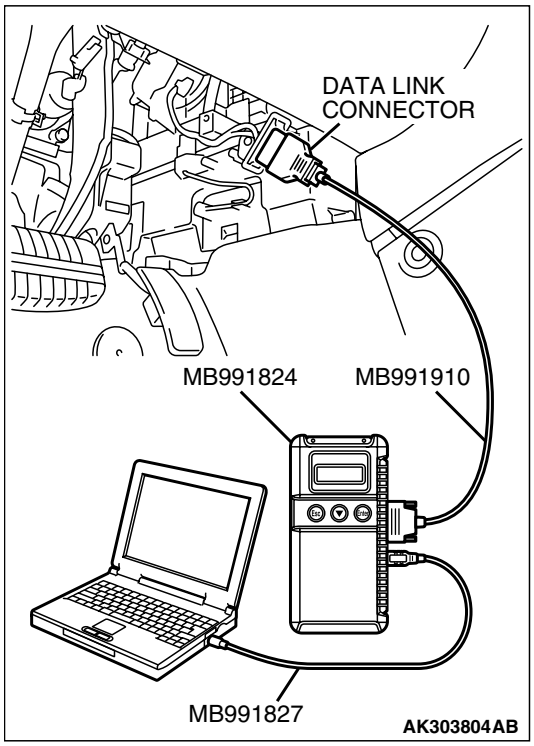
STEP 1. Using scan tool MB991958, check data list item 21: Engine Coolant Temperature Sensor.

⚠ CAUTION

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

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

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

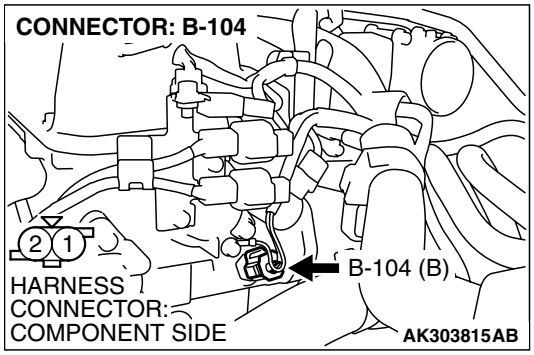


Q: Is the sensor operating properly?

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

NO : Go to Step 2.

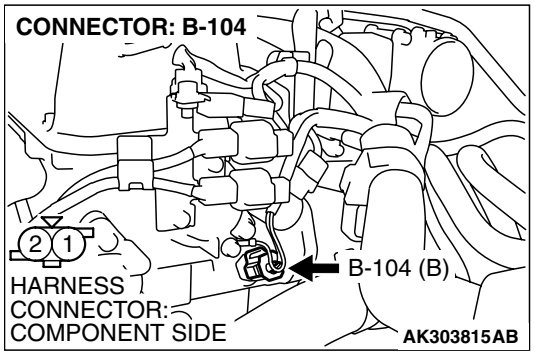
STEP 2. Check harness connector B-104 at the engine coolant temperature sensor for damage.

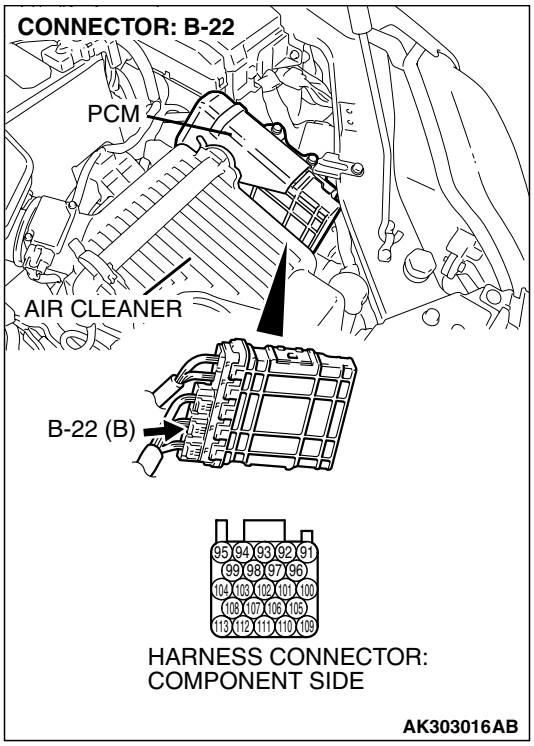


Q: Is the harness connector in good condition?

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.



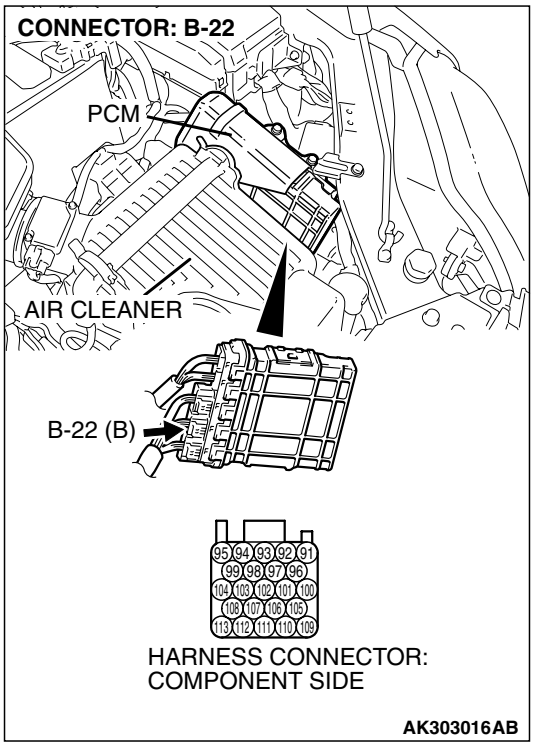


STEP 3. Check for short circuit to ground between engine coolant temperature sensor connector B-104 (terminal No. 1) and PCM connector B-22 (terminal No. 93).

Q: Is the harness wire in good condition?

YES : Go to Step 4.

NO : Repair it. Then go to Step 6.

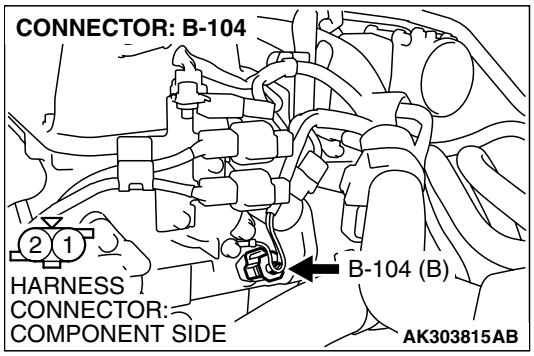


STEP 4. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

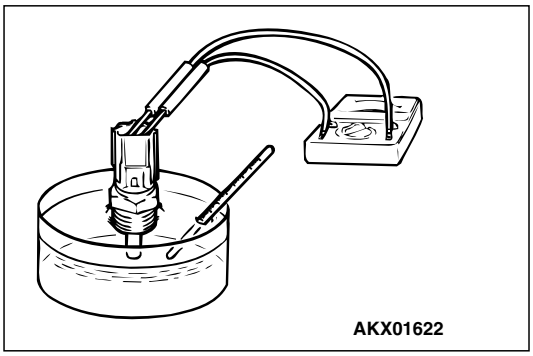
YES : Go to Step 5.

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



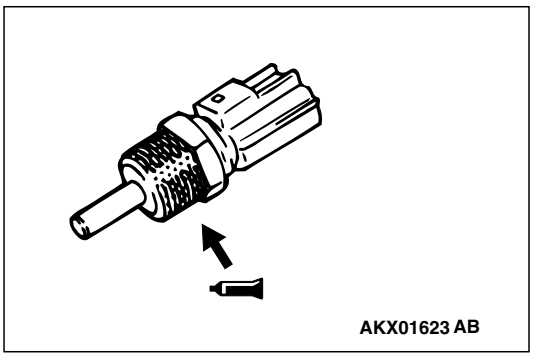
STEP 5. Check the engine coolant temperature sensor.

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

STEP 6. Test the OBD-II drive cycle.

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

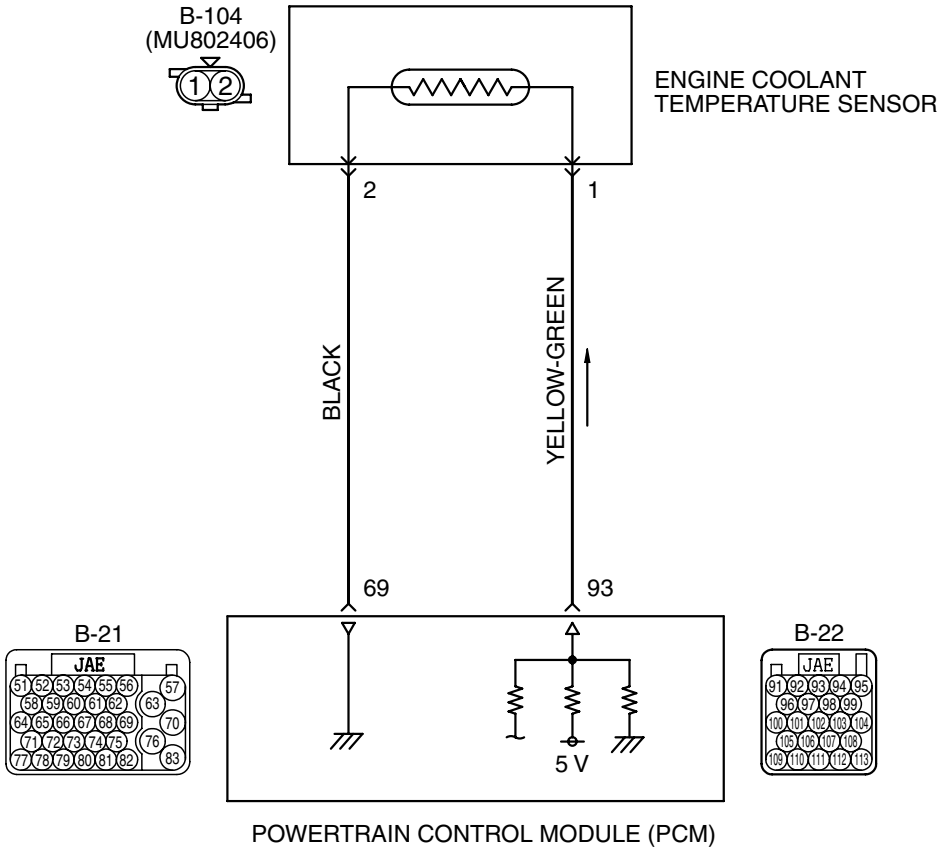
Q: Is DTC P0117 set?

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

DTC P0118: Engine Coolant Temperature Circuit High Input

⚠ 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



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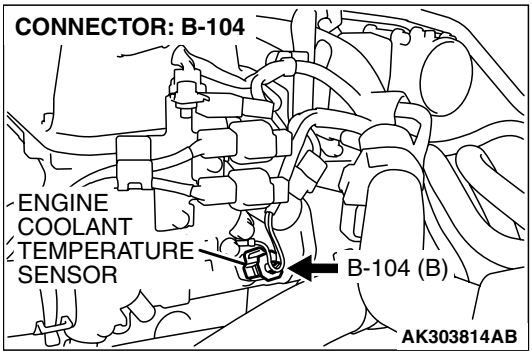

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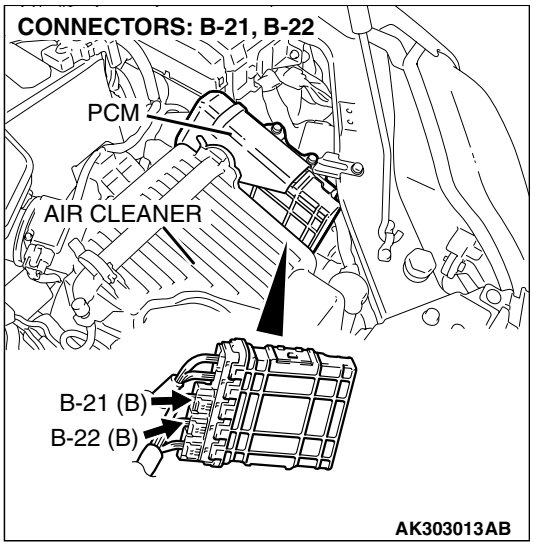


CIRCUIT OPERATION

- 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)

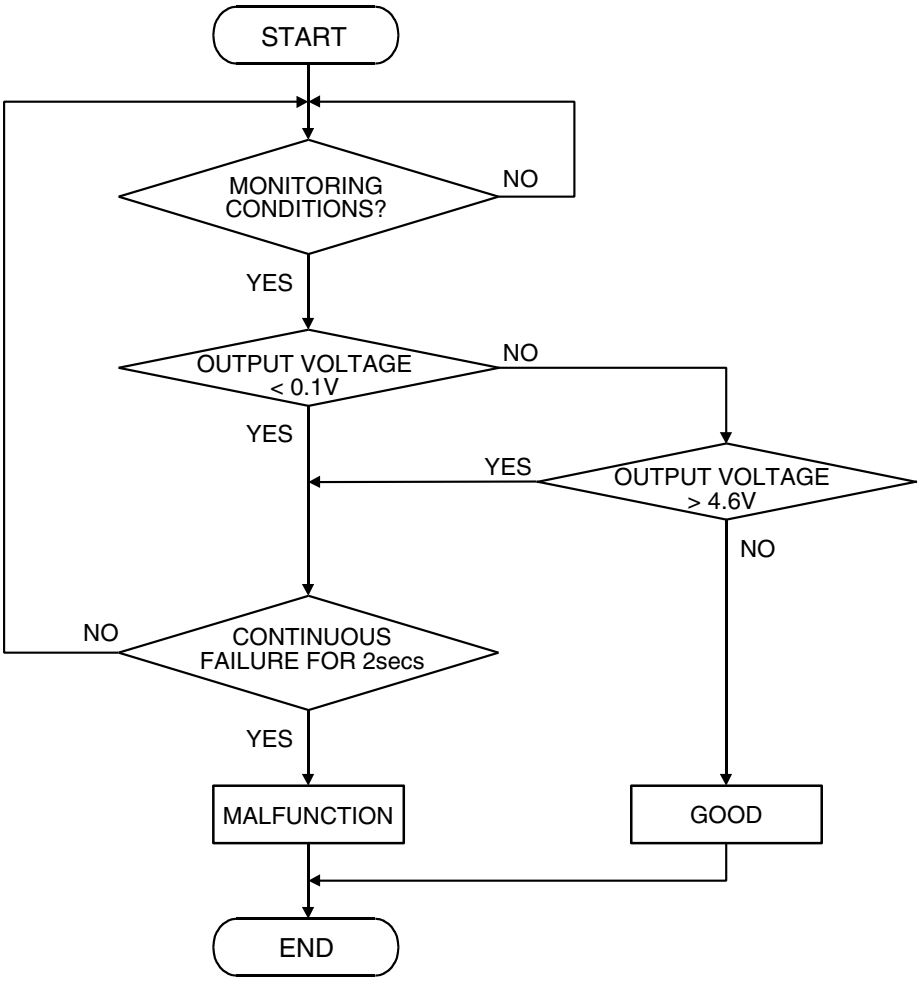
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

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

Judgement Criteria

- Engine coolant temperature sensor output voltage has continued to be 4.6 volts or higher [corresponding to coolant temperature of –45°C (–49°F) or lower] for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function–OBD-II Drive Cycle–Procedure 6–Other Monitor P.13A-6.

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

- Engine coolant temperature sensor failed.
- Open engine coolant temperature sensor circuit, or connector damage.
- PCM failed.

TSB Revision

DIAGNOSIS

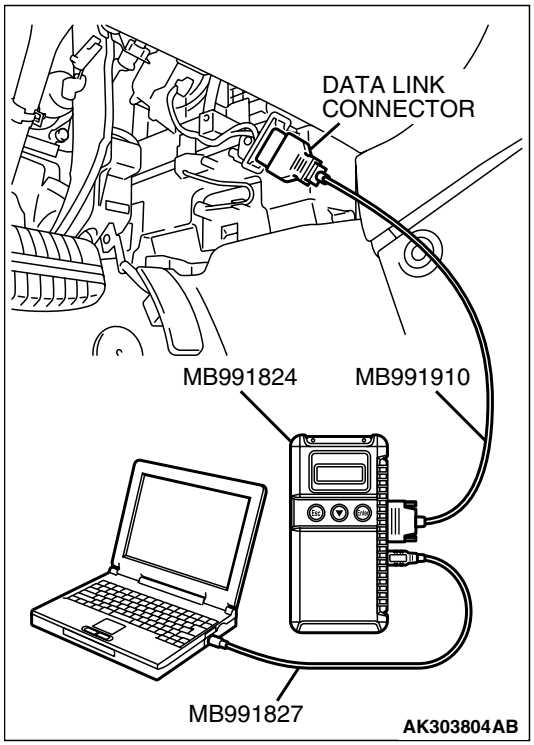
Required Special Tools:

- MB991958: Scan Tool (MUT-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 21: Engine Coolant Temperature Sensor.

⚠ CAUTION

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



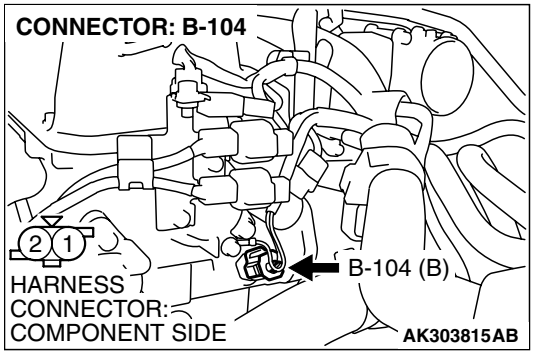
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
  - The engine coolant temperature and temperature shown with the scan tool should approximately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

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

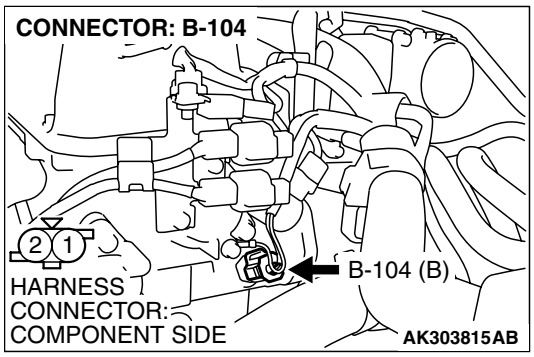
STEP 2. Check harness connector B-104 at the engine coolant temperature sensor for damage.



Q: Is the harness connector in good condition?

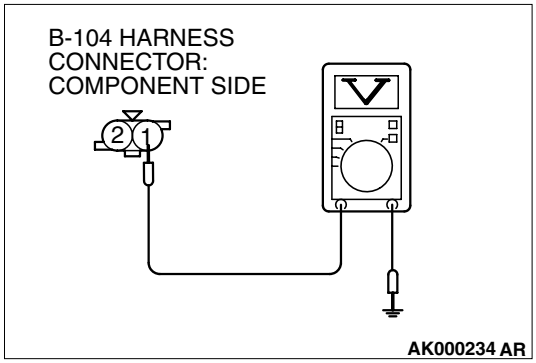
YES : Go to Step 3.

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.

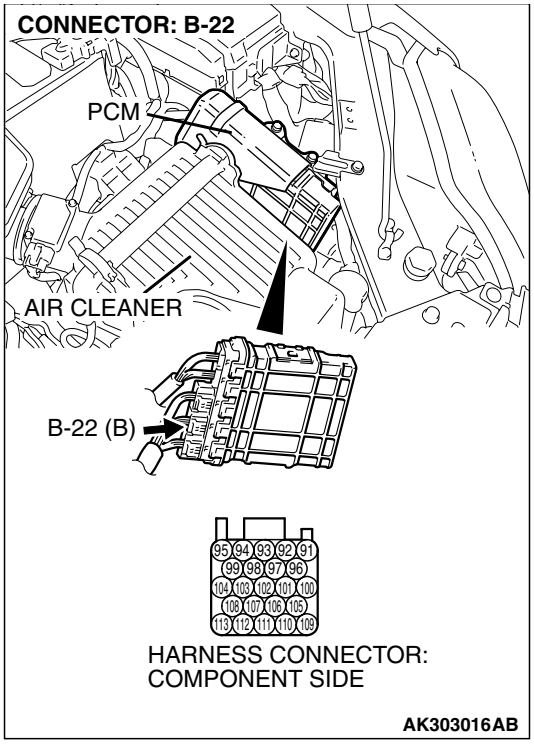
(4) Turn the ignition switch to the "LOCK" (OFF) position.

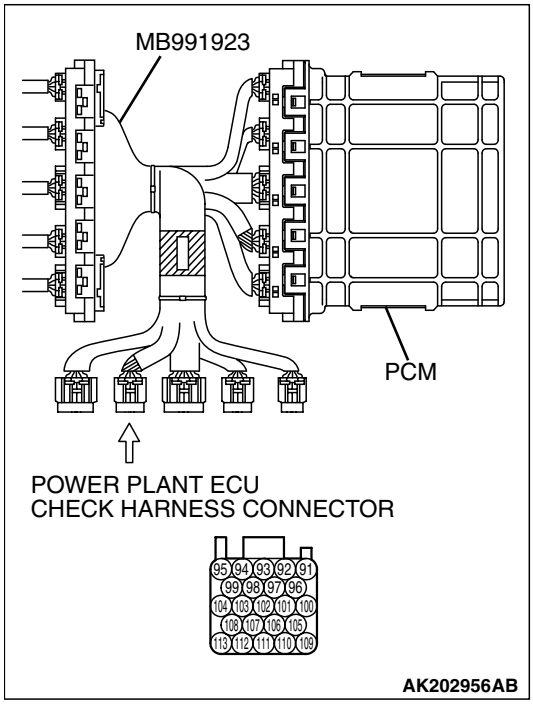
Q: Is the measured voltage between 4.5 and 4.9 volts?

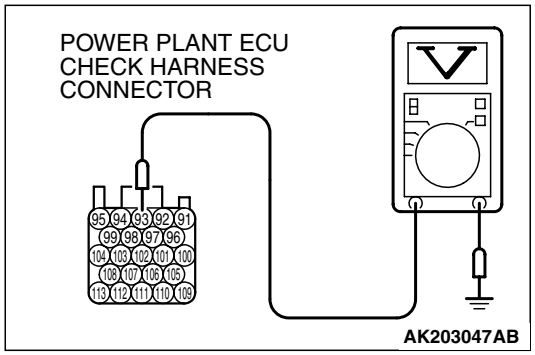
YES : Go to Step 7.
NO : Go to Step 4.

STEP 4. Measure the sensor supply voltage at PCM connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Do not disconnect the all PCM connectors and connect 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.





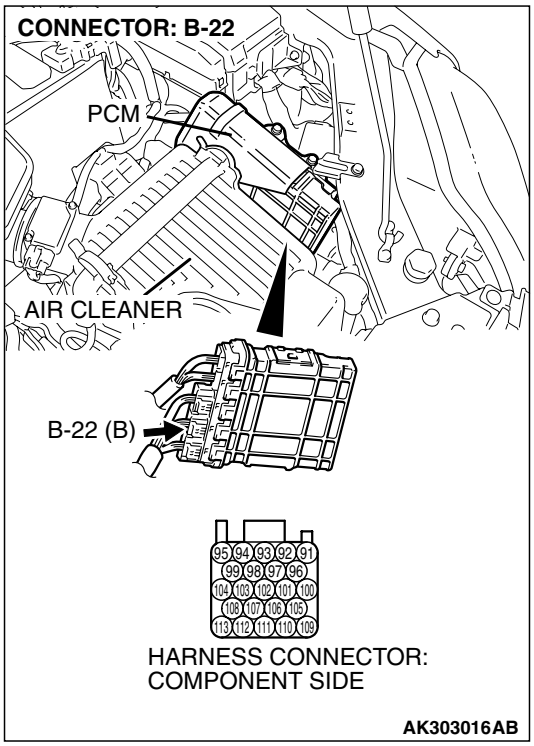


(4) Measure the voltage between terminal No. 93 and ground.
- Voltage should be between 4.5 and 4.9 volts.

(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.

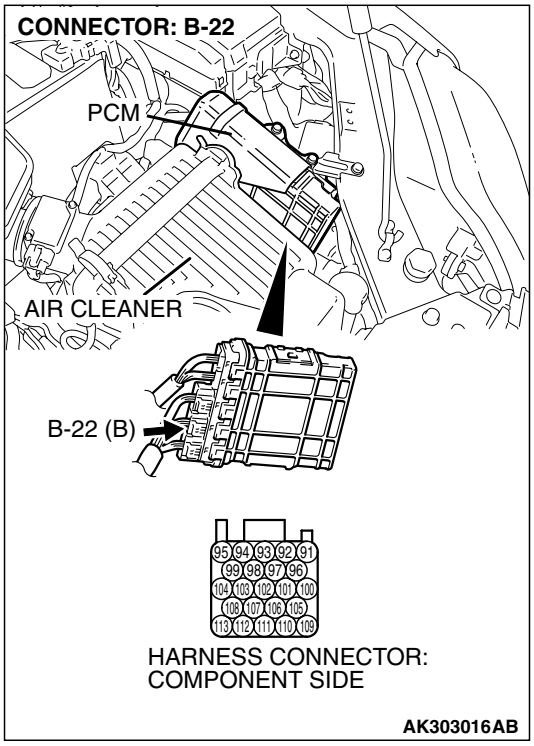


STEP 5. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between engine coolant temperature sensor connector B-104 (termial No. 1) and PCM connector B-22 (termial 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.

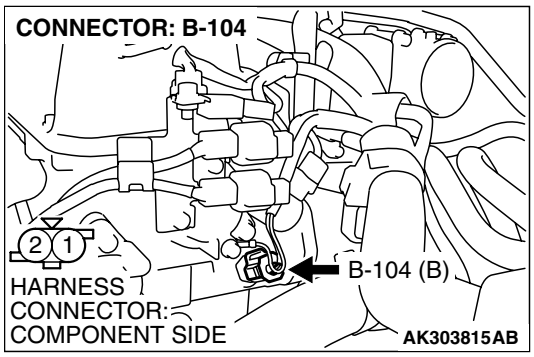


STEP 6. Check harness connector B-22 at PCM for damage.

Q: Is the harness connector in good condition?

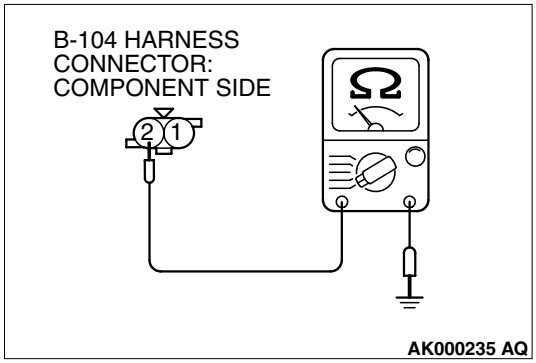
YES : Replace the PCM. Then go to Step 11.

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.

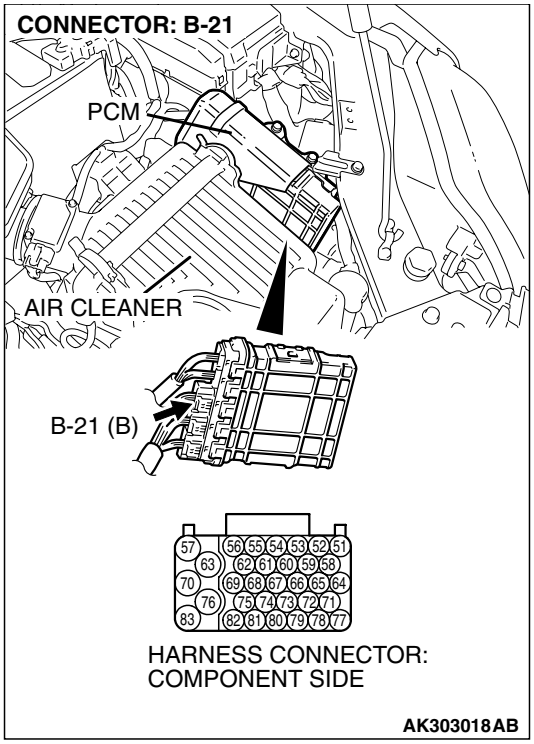
(1) Disconnect the connector B-104 and measure at the harness side.



(2) Check for the continuity between terminal No. 2 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

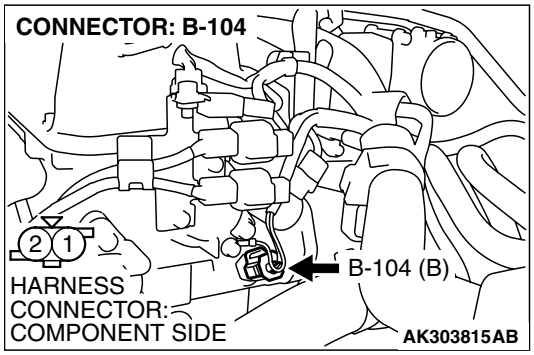
YES : Go to Step 10.
NO : Go to Step 8.

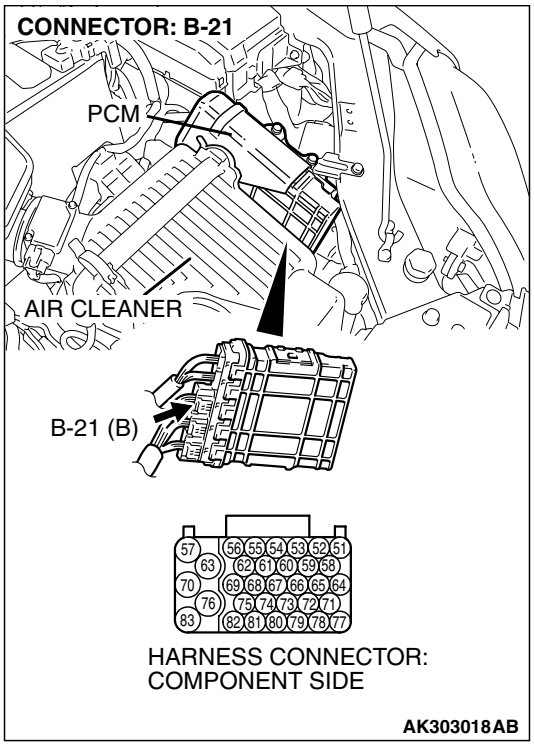


STEP 8. Check harness connector B-21 at PCM for damage.

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.



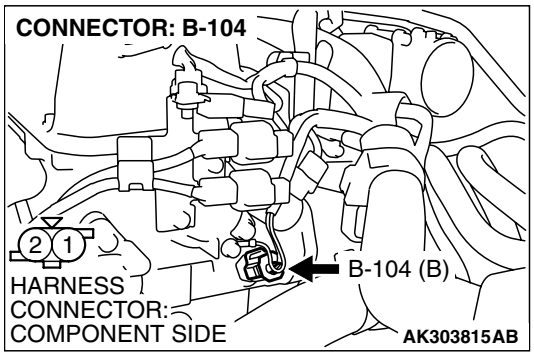


STEP 9. Check for open circuit between engine coolant sensor connector B-104 (terminal No. 2) and PCM connector B-21 (terminal No. 69).

Q: Is the harness wire in good condition?

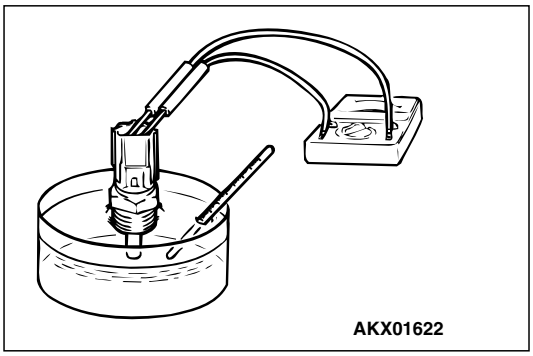
YES : Replace the PCM. Then go to Step 11.

NO : Repair it. Then go to Step 11.



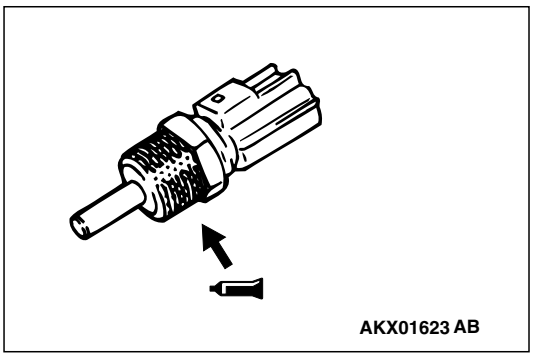
STEP 10. Check the engine coolant temperature sensor.

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

STEP 11. Test the OBD-II drive cycle.

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

Q: Is DTC P0118 set?

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

NEXT>>