GROUP 13A

MULTIPORT FUEL INJECTION (MFI)

CONTENTS

GENERAL DESCRIPTION

M1131000102280

The Multiport Fuel Injection System consists of sensors which detect the engine conditions, the POWERTRAIN CONTROL MODULE (PCM) which controls the system based on signals from these sensors, and actuators which operate under the control of the PCM.
The PCM carries out activities such as fuel injection control, idle air control, and ignition timing control. In addition, the PCM is equipped with several diagnostic test modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions.
A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank to the fuel injectors by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The regulated fuel is distributed to each of the injectors.
Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-2-3-4-5-6. Each cylinder has a dedicated fuel injector. This is called multiport.
The PCM provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is under normal operating temperature after warming-up, the PCM controls the air/fuel mixture by using the heated oxygen sensor signal to carry out "closed-loop" control. The closed-loop control achieves the theoretical air/fuel mixture ratio where the catalytic converter can obtains 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 the primary current flow to the ignition coil. This controls the ignition timing to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the PCM from engine speed, intake air volume, engine coolant temperature, and atmospheric pressure.

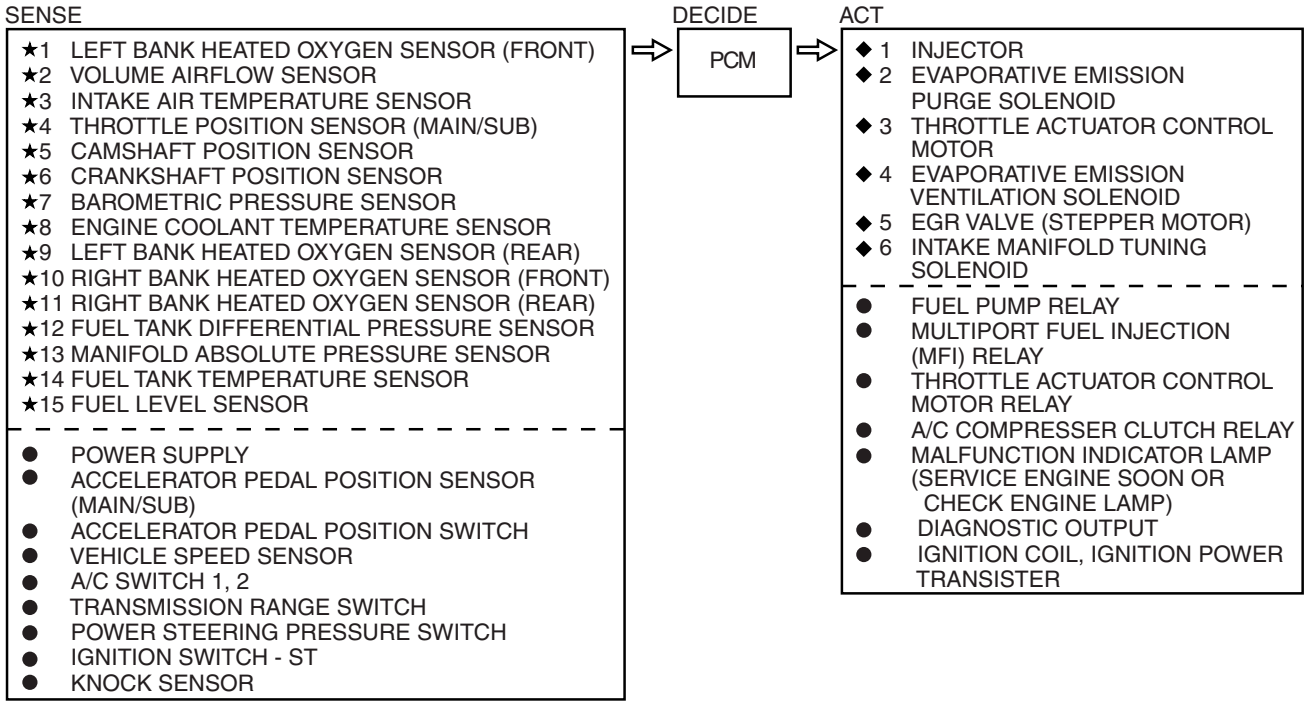
DIAGNOSTIC TEST MODE

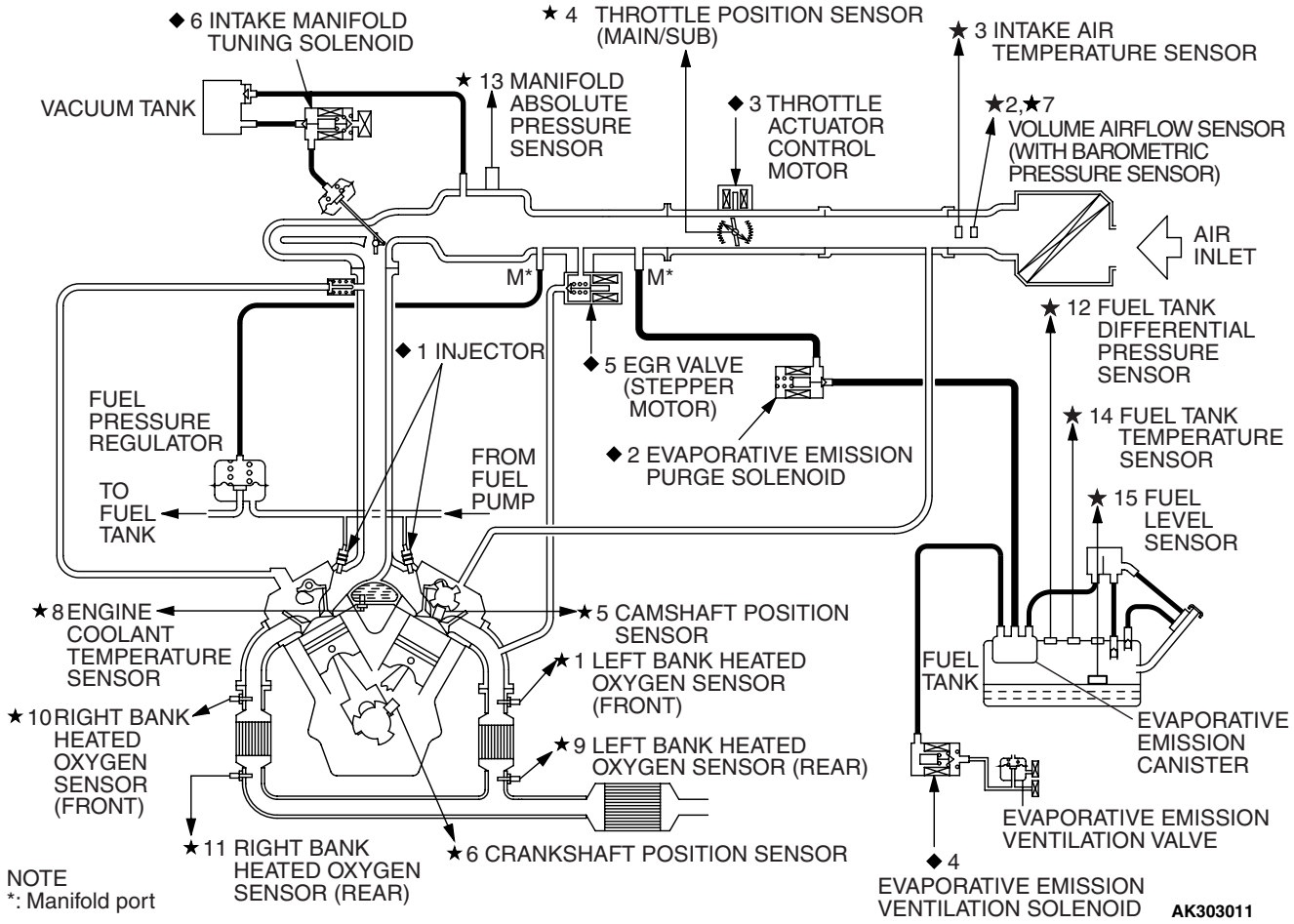
- When an abnormality is detected in one of the sensors or actuators related to emission control, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates to warn the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnostic trouble code corresponding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

OTHER CONTROL FUNCTIONS

- Fuel Pump Control
  Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
- A/C Compressor Clutch Relay Control
  Turns the compressor clutch of the A/C ON and OFF.
- Evaporative Emission Purge Control
  (Refer to GROUP 17, Emission Control System – Evaporative Emission System – General Description P.17-65).
- EGR Control
  (Refer to GROUP 17, Emission Control System – Exhaust Gas Recirculation (EGR) System – General Description P.17-69).

MULTIPORT FUEL INJECTION (MFI) SYSTEM DIAGRAM





NOTE: For the vacuum hose routing, refer to GROUP 17, Emission Control – Vacuum Hoses – Vacuum Hose Routing P.17-61.

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MULTIPORT FUEL INJECTION (MFI) DIAGNOSIS

TROUBLESHOOTING STRATEGY

M1131150001486

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.

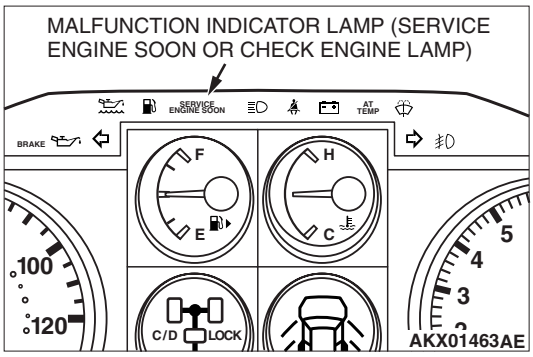
1. Gather as much information as possible about the complaint from the customer.
2. Verify that the condition described by the customer exists.
3. Check the vehicle for any MFI Diagnostic Trouble Code (DTC).
4. If you cannot verify the condition and there are no DTCs, the malfunction is intermittent. 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.00-13.
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.00-13.
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-29.

DIAGNOSTIC FUNCTION

M1131155501389

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



Among the on-board diagnostic items, the 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.

Moreover, when the ignition switch is turned off, the lamp is switched off. Even if the ignition switch is turned on again, the lamp does not illuminate until the malfunction is detected.

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 NO.	ITEMS
–	Powertrain control module (PCM) malfunction
P0031	Heated oxygen sensor heater control circuit low (bank 1 sensor 1)
P0032	Heated oxygen sensor heater control circuit high (bank 1 sensor 1)
P0037	Heated oxygen sensor heater control circuit low (bank 1 sensor 2)
P0038	Heated oxygen sensor heater control circuit high (bank 1 sensor 2)
P0051	Heated oxygen sensor heater control circuit low (bank 2 sensor 1)
P0052	Heated oxygen sensor heater control circuit high (bank 2 sensor 1)
P0057	Heated oxygen sensor heater control circuit low (bank 2 sensor 2)
P0058	Heated oxygen sensor heater control circuit high (bank 2 sensor 2)
P0069	Abnormal correlation between manifold absolute pressure and barometric pressure sensor
P0101*	Volume airflow circuit range/performance problem
P0102*	Volume airflow circuit low input
P0106	Manifold absolute pressure circuit range/performance problem
P0107	Manifold absolute pressure circuit low input
P0108	Manifold absolute pressure circuit high input
P0111*	Intake air temperature circuit range/performance problem
P0112*	Intake air temperature circuit low input
P0113*	Intake air temperature circuit high input
P0116*	Engine coolant temperature circuit range/performance problem
P0117*	Engine coolant temperature circuit low input
P0118*	Engine coolant temperature circuit high input
P0122*	Throttle position sensor (main) circuit low input
P0123*	Throttle position sensor (main) circuit high input
P0125*	Insufficient coolant temperature for closed loop fuel control
P0128	Coolant thermostat (Coolant temperature below thermostat regulating temperature)
P0130	Heated oxygen sensor circuit (bank 1 sensor 1)
P0131	Heated oxygen sensor circuit low voltage (bank 1 sensor 1)
P0132	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)
P0133	Heated oxygen sensor circuit slow response (bank 1 sensor 1)
P0134*	Heated oxygen sensor circuit no activity detected (bank 1 sensor 1)
P0136	Heated oxygen sensor circuit (bank 1 sensor 2)
P0137	Heated oxygen sensor circuit low voltage (bank 1 sensor 2)
P0138	Heated oxygen sensor circuit high voltage (bank 1 sensor 2)
P0139	Heated oxygen sensor circuit slow response (bank 1 sensor 2)
P0140	Heated oxygen sensor circuit no activity detected (bank 1 sensor 2)
P0150	Heated oxygen sensor circuit (bank 2 sensor 1)
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)

DTC NO.	ITEMS
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)
P0154*	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)
P0156	Heated oxygen sensor circuit (bank 2 sensor 2)
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)
P0160	Heated oxygen sensor circuit no activity detected (bank 2 sensor 2)
P0171	System too lean (bank 1)
P0172	System too rich (bank 1)
P0174	System too lean (bank 2)
P0175	System too rich (bank 2)
P0181	Fuel tank temperature sensor circuit range/performance
P0182	Fuel tank temperature sensor circuit low input
P0183	Fuel tank temperature sensor circuit high input
P0201	Injector circuit – cylinder 1
P0202	Injector circuit – cylinder 2
P0203	Injector circuit – cylinder 3
P0204	Injector circuit – cylinder 4
P0205	Injector circuit – cylinder 5
P0206	Injector circuit – cylinder 6
P0222*	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
P0305	Cylinder 5 misfire detected
P0306	Cylinder 6 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 (bank 1)
P0431	Warm up catalyst efficiency below threshold (bank 2)
P0441	Evaporative emission control system incorrect purge flow
P0442	Evaporative emission control system leak detected (Small leak)
P0443	Evaporative emission control system purge control valve circuit
P0446	Evaporative emission control system vent control circuit

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DTC NO.	ITEMS
P0450	Evaporative emission control system pressure sensor malfunction
P0451	Evaporative emission control system pressure sensor range/performance
P0452	Evaporative emission control system pressure sensor low input
P0453	Evaporative emission control system pressure sensor high input
P0455	Evaporative emission control system leak detected (Gross leak)
P0456	Evaporative emission control system leak detected (Very small leak)
P0461	Fuel level sensor circuit range/performance
P0462	Fuel level sensor circuit low input
P0463	Fuel level sensor circuit high input
P0500*	Vehicle speed sensor malfunction
P0506	Idle control system RPM lower than expected
P0507	Idle control system RPM higher than expected
P0510	Accelerator pedal position switch circuit
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
P0735	Gear 5 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
P0773	Shift solenoid "E" electrical

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DTC NO.	ITEMS
P1602*	Communication malfunction (between PCM main processor and system LSI)
P1603*	Battery backup circuit malfunction
P1751	A/T control relay malfunction
P2100*	Throttle actuator control motor circuit (open)
P2101*	Throttle actuator control motor magneto malfunction
P2121*	Accelerator pedal position sensor (main) circuit range/performance problem
P2122*	Accelerator pedal position sensor (main) circuit low input
P2123*	Accelerator pedal position sensor (main) circuit high input
P2126*	Accelerator pedal position sensor (sub) circuit range/performance problem
P2127*	Accelerator pedal position sensor (sub) circuit low input
P2128*	Accelerator pedal position sensor (sub) circuit high input
P2135*	Throttle position sensor (main and sub) range/performance problem
P2138*	Accelerator pedal position sensor (main and sub) range/performance problem
P2195	Heated oxygen sensor inactive (bank 1 sensor 1)
P2197	Heated oxygen sensor inactive (bank 2 sensor 1)
P2228*	Barometric pressure circuit low input
P2229*	Barometric pressure circuit high input

NOTE: If the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates because of a malfunction of the 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 stop.*
- *For misfiring or a fuel trim malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.*

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

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

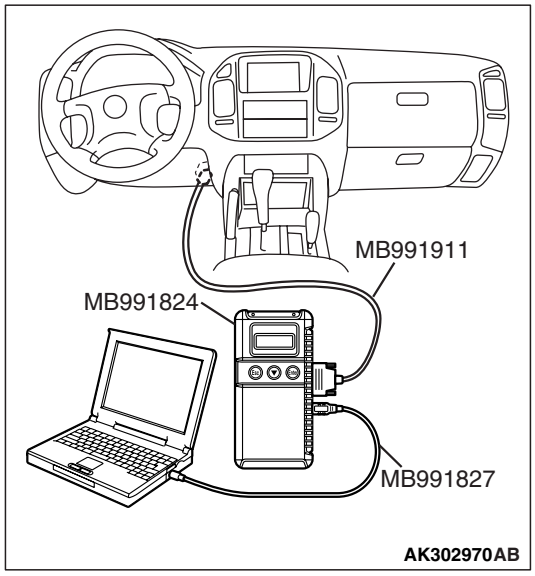
HOW TO CONNECT THE SCAN TOOL (MUT-III)

Required Special Tools:

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

⚠ CAUTION

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



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

   NOTE: When the special tool MB991824 is energized, special tool MB991824 indicator light will be illuminated in a green color.
7. Start the MUT-III system on the personal computer.

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

HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODES.

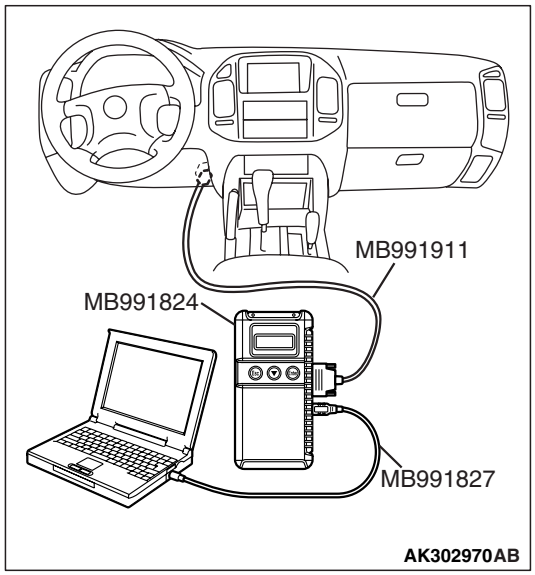
Required Special Tools:

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

⚠ CAUTION

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

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



1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "MFI" from the "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.

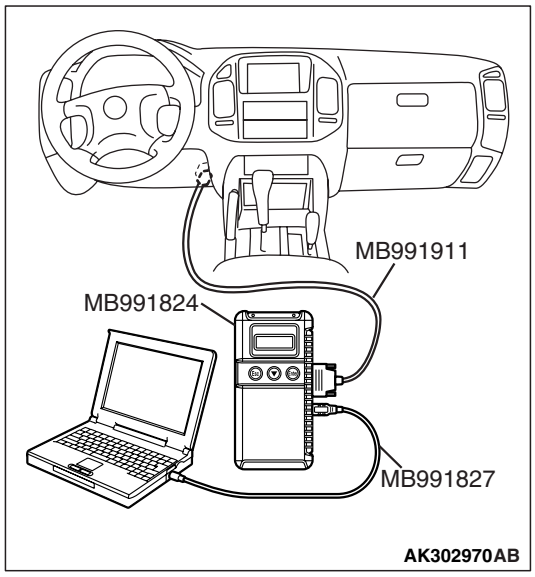
HOW TO READ DATA LIST

Required Special Tools:

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

⚠ CAUTION

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



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

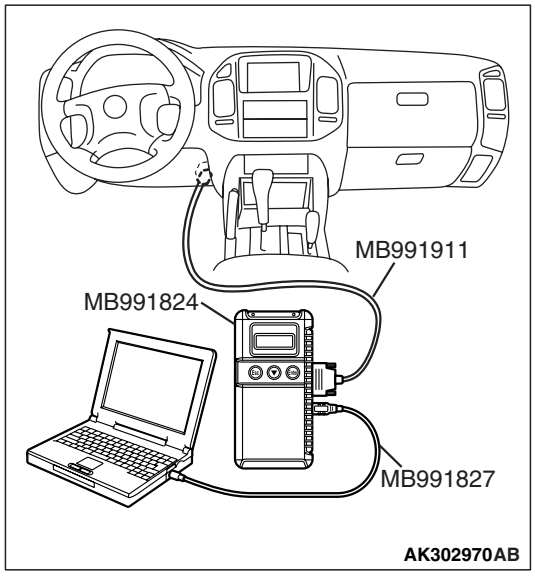
HOW TO PERFORM ACTUATOR TEST

Required Special Tools:

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

⚠ CAUTION

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



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

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

The scan tool MB991958 (MUT-III Sub Assembly) will display the Provisional DTCs reported by 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 the test results indicate a failure after ADDITIONAL (consecutive) driving, then the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) will be illuminated and a DTC will be set.

MODE 6 REFERENCE TABLE

The 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 (Bank 1)	PCM monitors the deterioration of catalyst at right bank side by the output frequency ratio between right bank heated oxygen sensor (front) and right bank heated oxygen sensor (rear).	Catalyst Mon. Freq. ratio B1	× 0.0039
02	Catalyst monitor (Bank 2)	PCM monitors the deterioration of catalyst at left bank side by the output frequency ratio between left bank heated oxygen sensor (front) and left bank heated oxygen sensor (rear).	Catalyst Mon. Freq. ratio B2	× 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	× 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.	EVP Leak 1 mm Pressure	× 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.	EVP Leak GRS Pressure	× 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.	EVP Leak 0.5 Pressure	× 0.032 kPa
09	Heated oxygen sensor monitor (Rich/Lean Switching) (Bank 1 Sensor 1)	PCM monitors the deteriorated condition of the heated oxygen sensor by checking the lean/rich switching frequency of the heated oxygen sensor.	HO2S B1 S1 R/L Switching	× 1 count
0A	Heated oxygen sensor monitor (Rich/Lean Switching) (Bank 2 Sensor 1)	PCM monitors the deteriorated condition of the heated oxygen sensor by checking the lean/rich switching frequency of the heated oxygen sensor.	HO2S B2 S1 R/L Switching	× 1 count
0B	Heated oxygen sensor monitor (Voltage) (Bank 1 Sensor 2)	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 S2 Voltage	× 19.5 mV
0C	Heated oxygen sensor monitor (Voltage) (Bank 2 Sensor 2)	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 S2 Voltage	× 19.5 mV

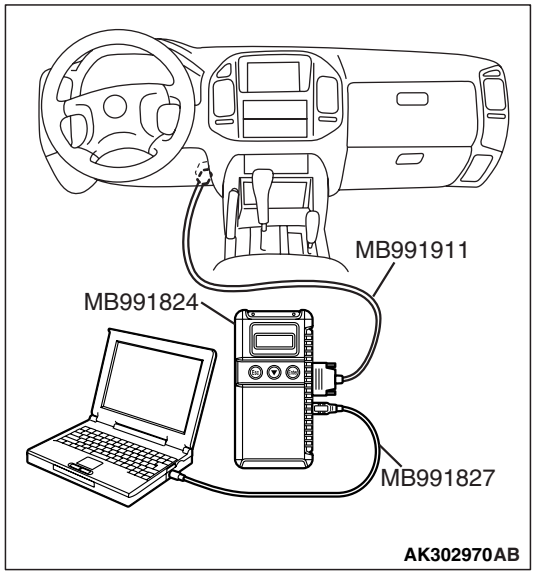
*NOTE: *1: Minimum value: The test fails if test value is less than this value.*

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

DIAGNOSTIC BY DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY)

Required Special Tools:

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



⚠ CAUTION

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

NOTE: When mode II is selected with MB991958, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) will light when the 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 137 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 137 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 (engine speed)	r/min
IAT SENSOR	13	Intake air temperature sensor	°C or °F
IG. TIMING ADV	44	Ignition coils and ignition power transistor	deg
LONG TRIM B1	81	Long-term fuel trim (trim) bank 1	%
LONG TRIM B2	83	Long-term fuel trim (trim) bank 2	%
MAP/MDP SNSR.	32	Manifold absolute pressure sensor	kPa or in.Hg
SHORT TRIM B1	82	Short-term fuel trim (trim) bank 1	%
SHORT TRIM B2	84	Short-term fuel trim (trim) bank 2	%
SYS. STATUS B1	88	Fuel control system status bank 1 (right)	• Open loop • Closed loop • Open loop-drive condition • Open loop-DTC set • Closed loop-O_2 (rear) failed

MUT-III SCAN TOOL DISPLAY	ITEM NO.	DATA ITEM	UNIT or STATE
SYS. STATUS B2	89	Fuel control system status bank 2 (left)	• 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	Volume airflow sensor (mass airflow rate)	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 20 drive cycle patterns. In other words, doing such a drive regenerates any kind of trouble which involves illuminating the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) and verifies the repair procedure has eliminated [the trouble the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is no longer illuminated].

⚠ CAUTION

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

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

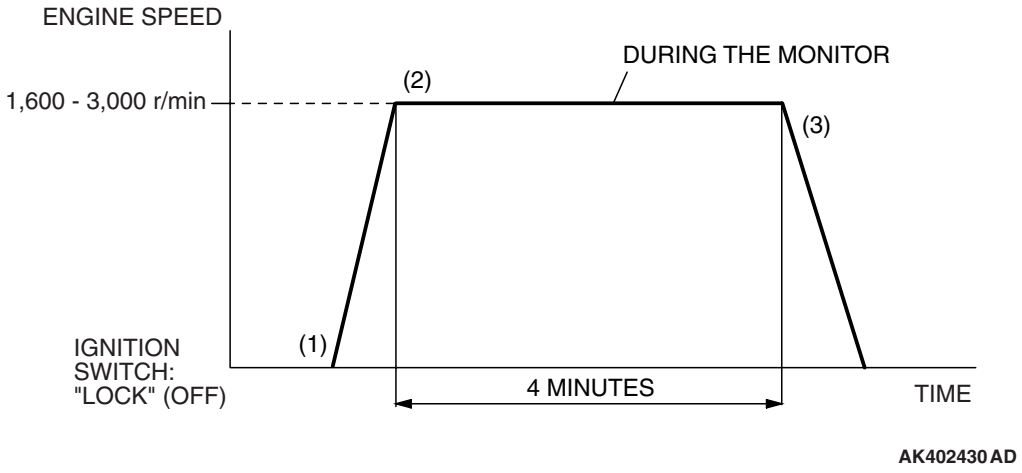
NOTE: Drive cycle patterns are not established for Vehicle speed sensor monitor (DTC P0500), Accelerator pedal position switch monitor (DTC P0510), Power steering pressure switch monitor (DTC P0551). Please reference the MUT data list to judge whether these monitor items are normal.

DRIVE CYCLE PATTERN LIST for 05MY

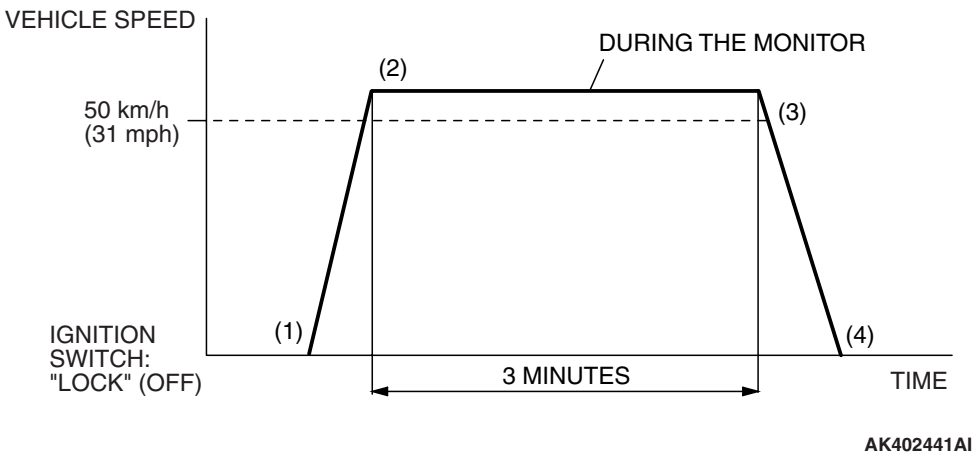
MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Heated oxygen sensor (front) monitor	P0133, P0153	1
Heated oxygen sensor (rear) monitor <Readiness test item>	P0139, P0159	2
Heated oxygen sensor heater monitor	P0031, P0032, P0037, P0038, P0051, P0052, P0057, P0058	3
Exhaust gas recirculation (EGR) system monitor	P0401	4
Catalytic converter monitor	P0421, P0431	5
Evaporative emission system leak monitor (small leak and gross leak)	P0442, P0455	6
Evaporative purge system monitor	P0441	
Fuel tank pressure sensor monitor	P0450	
Evaporative emission system leak monitor (very small leak)	P0456	7
Airflow sensor monitor	P0101	8
Manifold absolute pressure (MAP) sensor monitor	P0106, P0107	
Intake air temperature sensor monitor	P0111	9
Engine coolant temperature sensor monitor	P0116, P0125	10

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Thermostat monitor	P0128	11
Air fuel ratio feedback monitor	P0134, P0154	12
Heated oxygen sensor monitor	P0130, P0131, P0136, P0137, P0150, P0151, P0156, P0157, P2195, P2197	
Heated oxygen sensor (rear) monitor	P0140, P0160	13
Fuel tank temperature sensor monitor	P0181	14
Misfire monitor	P0300, P0301, P0302, P0303, P0304, P0305, P0306	15
Fuel tank pressure sensor monitor	P0451	16
Power steering pressure switch monitor	P0554	17
Idle speed control system monitor	P0506, P0507	18
Fuel trim monitor	P0171, P0172, P0174, P0175	19
Airflow sensor monitor	P0102	20
Manifold absolute pressure (MAP) sensor monitor	P0108	
Intake air temperature sensor monitor	P0112, P0113	
Engine coolant temperature sensor monitor	P0117, P0118	
Heated oxygen sensor monitor	P0132, P0138, P0152, P0158	
Fuel tank temperature sensor monitor	P0182, P0183	
Injector monitor	P0201, P0202, P0203, P0204, P0205, P0206	
Crankshaft position sensor monitor	P0335	
Camshaft position sensor monitor	P0340	
Exhaust gas recirculation (EGR) valve (stepper motor) monitor	P0403	
Evaporative emission purge solenoid monitor	P0443	
Evaporative emission ventilation solenoid monitor	P0446	
Fuel tank pressure sensor monitor	P0452, P0453	
Fuel level sensor monitor	P0462, P0463	
Barometric pressure sensor monitor	P2228, P2229	

PATTERN 1

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 82°C (180°F) • Intake air temperature: More than −10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 4 minutes at the following conditions. (During the monitor) *NOTE: When the system is normal, the monitor is completed earlier.* • Vehicle speed: More than 30 km/h (19 mph) • Engine speed: More than 1,600 r/min, less than 3,000 r/min • Engine load: More than 30%, less than 60% • Without rapid accelerator pedal work 3. Stop the vehicle at the safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. *NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.* 5. Confirm that the diagnostic trouble code (DTC) is not output.

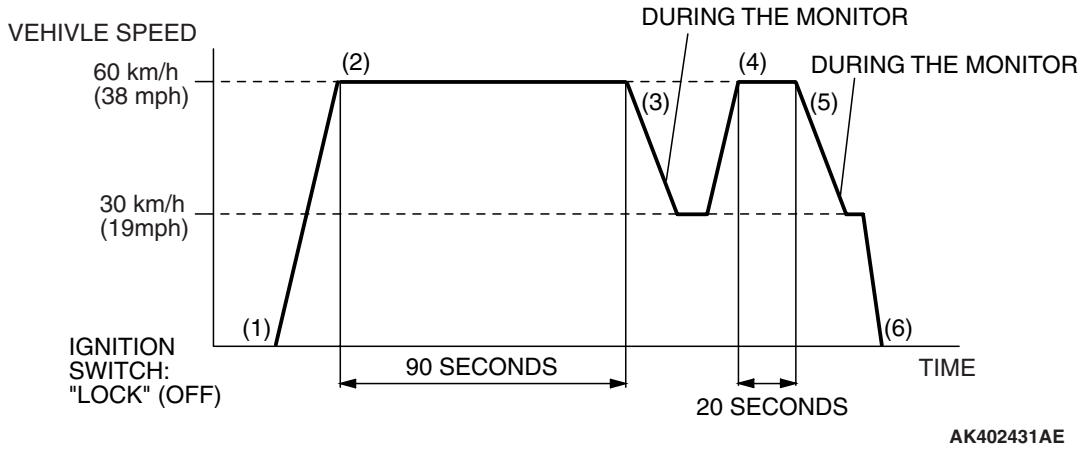
PATTERN 2

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 76°C (169°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at 50 km/h (31 mph) for 3 minutes. 3. Release the accelerator pedal for 10 seconds then stop the safe place. (During the monitor) 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

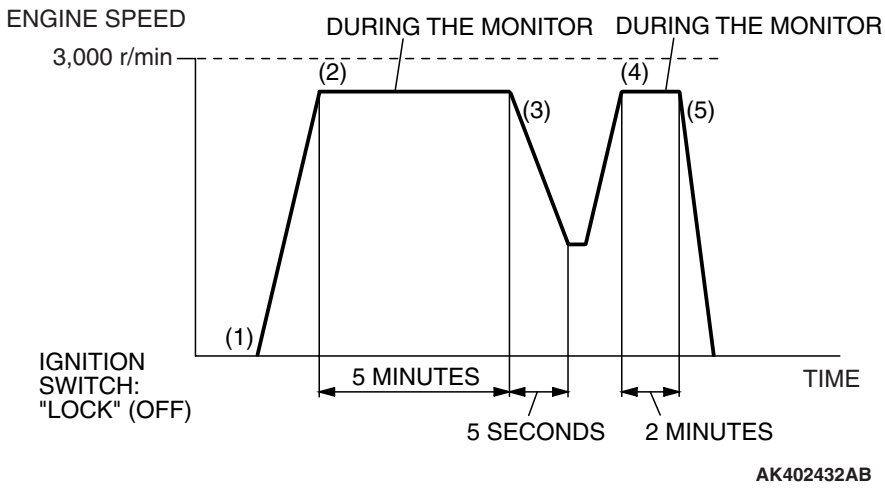
PATTERN 3

Inspection condition	Engine coolant temperature at the engine started: More than 20°C (68°F)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 10 seconds. (During the monitor) 3. Turn the ignition switch to the "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. *NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.* 5. Confirm that the diagnostic trouble code (DTC) is not output.

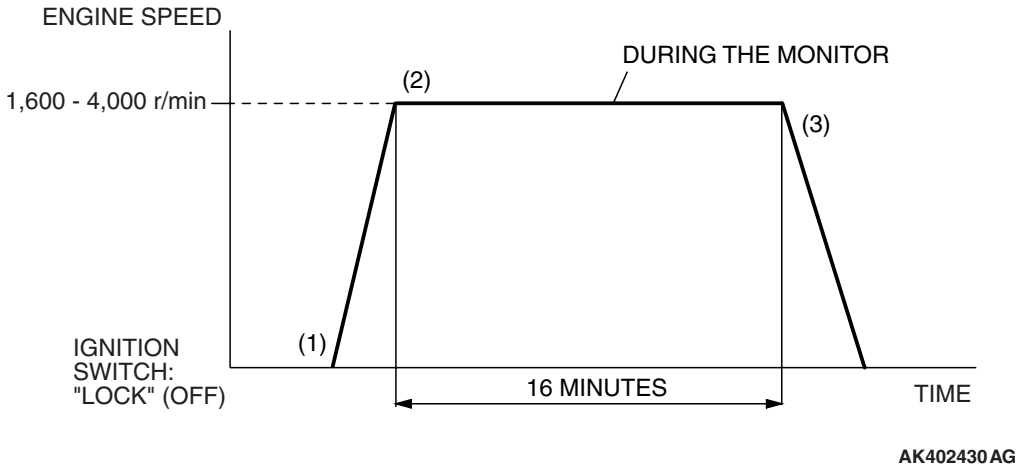
PATTERN 4

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 82°C (180°F) • Intake air temperature: More than 5°C (41°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Accelerate until the vehicle speed is 60 km/h (38 mph) and then drive the vehicle for 90 seconds. 3. Release the accelerator pedal and reduce vehicle speed to 30 km/h (19 mph). (During the monitor) 4. Accelerate until the vehicle speed is 60 km/h (38 mph) and then drive the vehicle for 20 seconds. 5. Release the accelerator pedal and reduce vehicle speed to 30 km/h (18 mph). (During the monitor) 6. Stop the safe place and turn the ignition switch to "LOCK" (OFF) position. 7. Start the engine and do Steps 1 to 6 again. *NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.* 8. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 5

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 30°C (86°F) • Intake air temperature: More than −10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all accessories switched OFF. 2. Drive the vehicle for 5 minutes at the following conditions. (During the monitor) • Engine speed: Less than 3,000 r/min • Airflow rate: More than 95 Hz, less than 149 Hz • Accelerator pedal: Except full close • Without rapid accelerator pedal work 3. Release the accelerator pedal for 5 seconds. 4. Drive the vehicle for 2 minutes at the following conditions. (During the monitor) • Engine speed: Less than 3,000 r/min • Airflow rate: More than 95 Hz, less than 149 Hz • Accelerator pedal: Except full close • Without rapid accelerator pedal work *NOTE: When the system is normal, the monitor is completed earlier.* 5. Stop the safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Start the engine and do Steps 1 to 5 again. *NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.* 7. Confirm that the diagnostic trouble code (DTC) is not output.

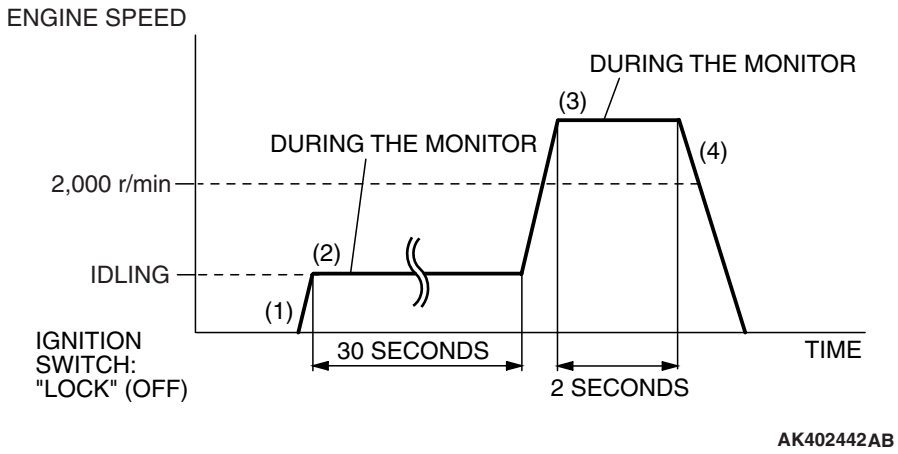
PATTERN 6

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at the engine started: Less than 36°C (96°F) • Intake air temperature at the engine started: Less than 36°C (96°F) • Rest of the fuel amount at the engine started: More than 15%, less than 40% • Engine coolant temperature: More than 60°C (41°F) • Intake air temperature: More than 5°C (41°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Fuel temperature: Less than 36°C (96°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 16 minutes at the following conditions. (During the monitor) • Engine speed: More than 1,600 r/min, less than 4,000 r/min • Vehicle speed: More than 30 km/h (19 mph) • Engine load: More than 26%, less than 50% • Without rapid accelerator pedal work *NOTE: Keep running as long as possible with the power steering pressure switch in the OFF position.* *NOTE: When the system is normal, the monitor is completed earlier.* 3. Stop the safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. *NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.* 5. Confirm that the diagnostic trouble code (DTC) is not output.

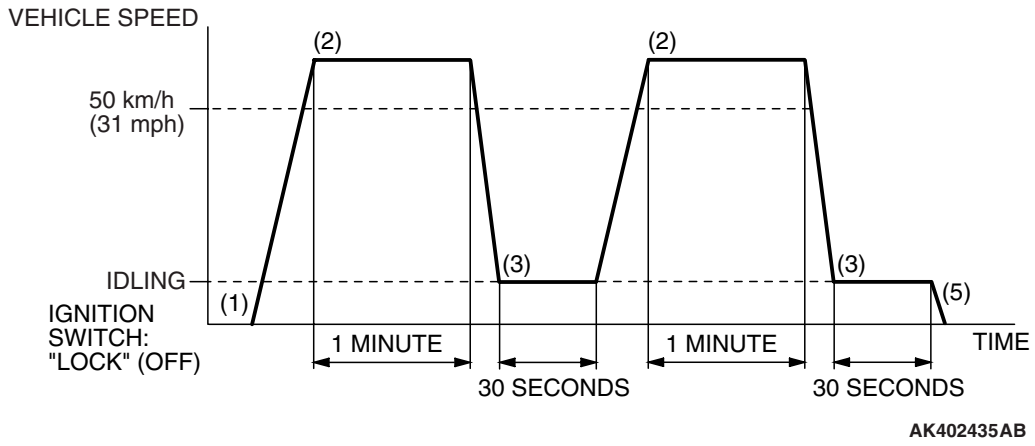
PATTERN 7

Inspection conditions	• Engine coolant temperature at the engine started: Less than 36°C (96°F) • Intake air temperature at the engine started: Less than 36°C (96°F) • Rest of the fuel amount at the engine started: More than 40%, less than 85% • Engine coolant temperature: More than 20°C (68°F) • Intake air temperature: More than 5°C (41°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Fuel temperature: Less than 32°C (90°F)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 16 minutes. (During the monitor) *NOTE: When the system is normal, the monitor is completed earlier.* 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. *NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.* 5. Confirm that the diagnostic trouble code (DTC) is not output.

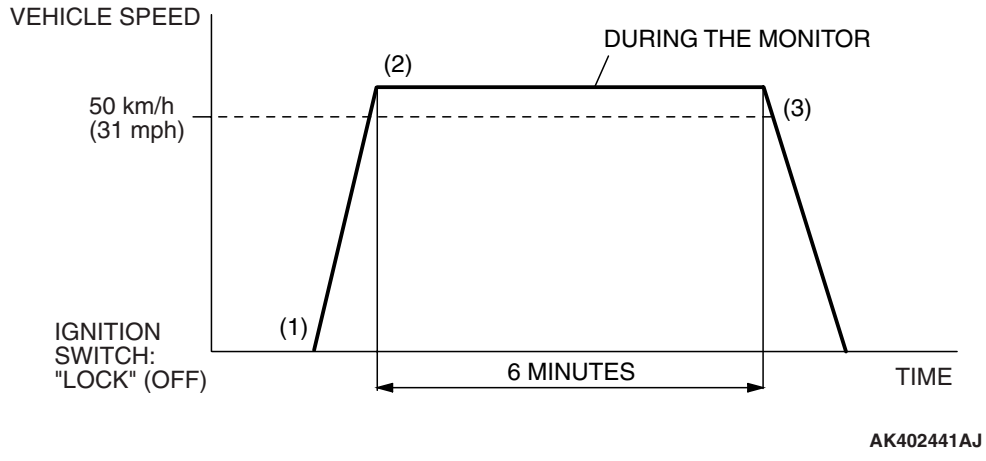
PATTERN 8

Drive cycle pattern	
Inspection condition	• Engine coolant temperature at the engine started: More than 0°C (32°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 30 seconds. (During the monitor) 3. Accelerate the vehicle for 2 seconds at the following conditions. (During the monitor) • Engine speed: More than 2,000 r/min • Engine load: More than 60% • Throttle position sensor output voltage: More than 3.5 volts 4. Stop the safe place and turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 9

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 76°C (169°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 50 km/h (31 mph) for 1 minute. 3. Stop at safe place and let the engine idle for 30 seconds. 4. Repeat Steps 2 and 3 again. 5. Stop the safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 10

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at the engine started: More than 7°C (47°F) • Intake air temperature: Less than 60°C (140°F) • Engine coolant temperature: More than 40°C (104°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 6 minutes at the following condition. (During the monitor) • Vehicle speed: More than 50 km/h (31 mph) • Except fuel cut 3. Stop at safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Confirm that the diagnostic trouble code (DTC) is not output.

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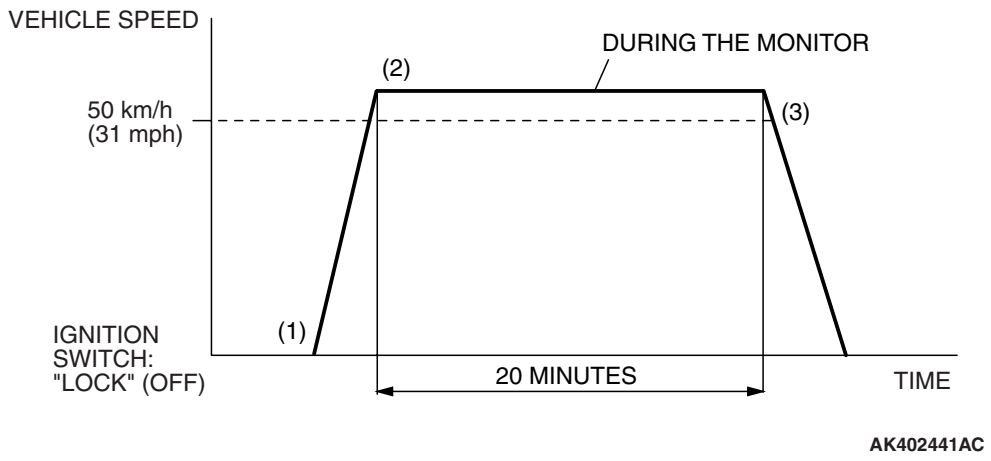
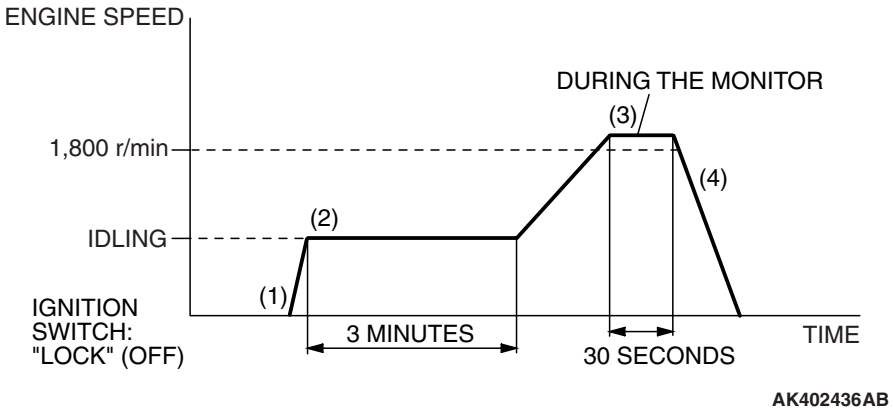
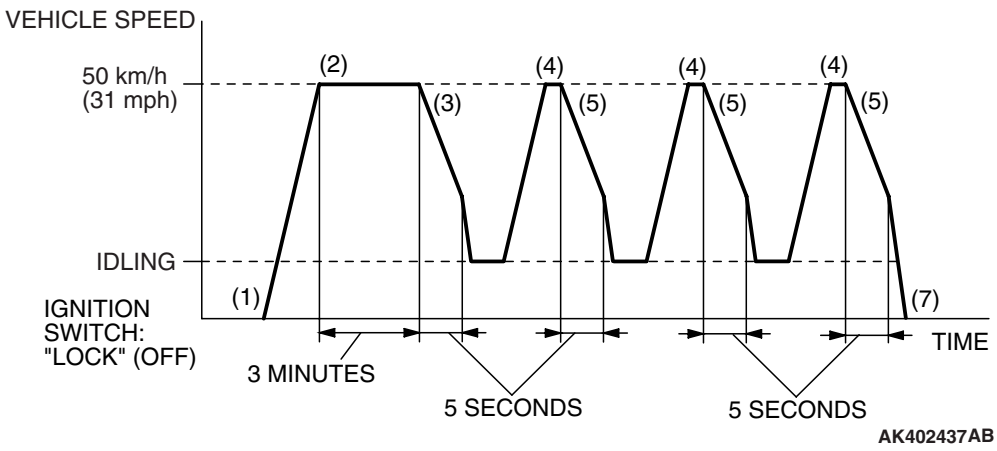
PATTERN 11

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at the engine started: More than 10°C (50°F), less than 76°C (168°F) • Difference between engine coolant temperature and intake air temperature at the engine started: Less than 5°C (9°F) • Dropping of intake air temperature since the engine started: Less than 2°C (3.6°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 20 minutes at the following conditions. (During the monitor) • Vehicle speed: More than 50 km/h (31 mph) • Except fuel cut *NOTE: The system is normal if engine coolant temperature will rise more than 82°C (180°F) within 20 minutes.* 3. Stop at safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 12

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 82°C (180°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 3 minutes. 3. Drive the vehicle for 30 seconds at the following conditions. (During the monitor) • Engine speed: More than 1,800 r/m • Engine load: More than 30%, less than 80% • Throttle position sensor output: Less than 3.0 volts • Except fuel cut 4. Stop the safe place and turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. <Heated oxygen sensor monitor> 6. Confirm that the diagnostic trouble code (DTC) is not output.

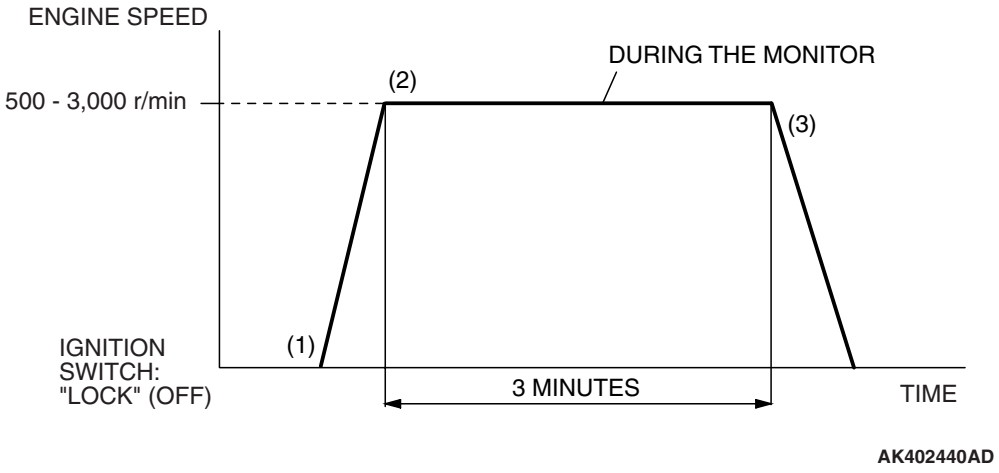
PATTERN 13

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 76°C (169°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at 50 km/h (31 mph) for 3 minutes. 3. Release the accelerator pedal for 5 seconds then stop the safe place. 4. Accelerate until the vehicle speed is at 50 km/h (31 mph) at the following conditions. • Engine speed: More than 1,500 r/min • Engine load: More than 40% 5. Release the accelerator pedal for 5 seconds then stop the safe place. 6. Repeat Steps 4 and 5 for 2 times. 7. Stop the safe place and turn the ignition switch to "LOCK" (OFF) position. 8. Start the engine and do Steps 1 to 7 again. 9. Confirm that the diagnostic trouble code (DTC) is not output.

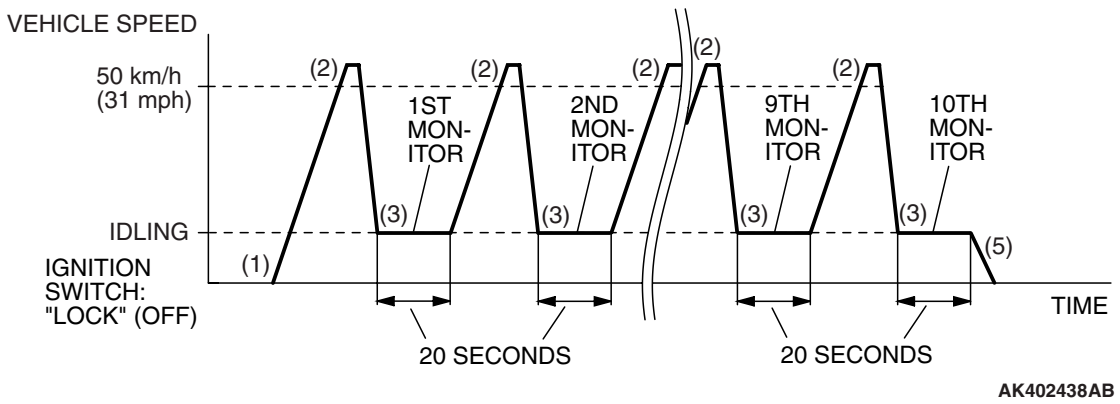
PATTERN 14

Inspection conditions	Engine coolant temperature at the engine started: More than −10°C (14°F), less than 33°C (91°F) Difference between engine coolant temperature and intake air temperature at the engine started: Less than 5°C (9°F) Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 30 km/h (19 mph) until engine coolant temperature rises more than 60°C (140°F). (During the monitor) 3. Stop at safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

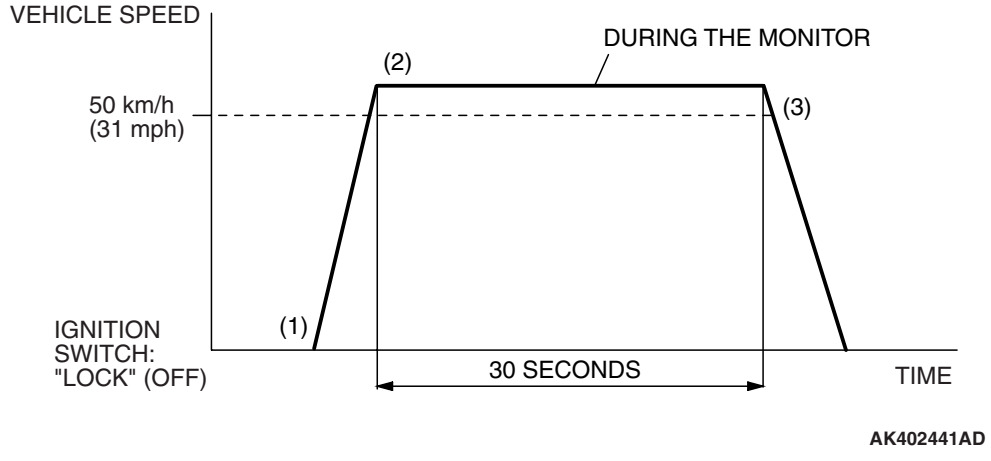
PATTERN 15

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than −10°C (14°F) • Intake air temperature: More than −10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 3 minutes at the following conditions. (During the monitor) • Engine speed: More than 500 r/min, less than 3,000 r/min • Engine load: More than 25% • Without rapid accelerator pedal change • Except fuel cut 3. Stop the vehicle at the safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 16

Drive cycle pattern	
Inspection condition	Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Accelerate until the vehicle speed is more than 50 km/h (31 mph). • Engine speed: More than 2,500 r/min • Engine load: More than 55% 3. Stop at safe place and let the engine idle for 20 seconds. (During the monitor) 4. Repeat Steps 2 and 3 for 10 times. 5. Stop the vehicle at the safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Start the engine and do Steps 1 to 5 again. 7. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 17

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 30°C (86°F) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 50 km/h (31 mph) for 30 seconds. (During the monitor) 3. Stop the vehicle at the safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

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PATTERN 18

Inspection conditions	• Engine coolant temperature: More than 82°C (180°F) • Intake air temperature: More than −10°C (14°F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Condition of A/T: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Accelerate until the vehicle speed is more than 1.5 km/h (1 mph). 3. Stop at safe place and let the engine idle for 1 minute. (During the monitor) 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 19

Inspection conditions	Engine coolant temperature: More than 82°C (180°F)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 15 minutes. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 20

Inspection conditions	• Fuel temperature sensor: Less than 36°C (96°F) < Fuel tank pressure sensor monitor> • Rest of the fuel amount at the engine started: Less than 85% <Fuel tank pressure sensor monitor>
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle at the engine speed less than 1,000 r/min for 15 seconds. (During the monitor) 3. Shift the selector lever to "D" range with braking, then let the engine idle for 30 seconds. (During the monitor) 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output.

SYSTEM READINESS TEST STATUS

PURPOSE

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

OVERVIEW

The powertrain control module (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: P0133, P0139, P0153, P0159
- Heated oxygen sensor heater: P0031, P0032, P0037, P0038, P0051, P0052, P0057, P0058
- 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

M1131153000716

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
Volume 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. • Fixes the IAC motor in the appointed position so idle air control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C (77°F).
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C (176°F). (This control will be continued until the ignition switch is turned to "LOCK" (OFF) position even though the sensor signal returns to normal.)
Camshaft position sensor	Injects fuel simultaneously into all cylinders. (After the ignition switch is turned to "ON" position, the No.1 cylinder top dead center is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa (30 in.Hg).
Knock sensor	Switches the ignition timing from ignition timing for high octane to ignition timing for standard octane fuel.
Heated oxygen sensor <front>	Air/fuel ratio closed loop control is not performed.
Heated oxygen sensor <rear>	Performs the closed loop control of the air/fuel ratio by using only the signal of the heated oxygen sensor (front) installed on the front side of the catalytic converter.
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.

MALFUNCTION ITEM	CONTROL CONTENTS DURING MALFUNCTION
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.
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.

DIAGNOSTIC TROUBLE CODE CHART

M1131151001791

DTC NO.	DIAGNOSTIC ITEM	REFERENCE PAGE
P0031	Heated oxygen sensor heater control circuit low (bank 1 sensor 1)	P.13A-41
P0032	Heated oxygen sensor heater control circuit high (bank 1 sensor 1)	P.13A-52
P0037	Heated oxygen sensor heater control circuit low (bank 1 sensor 2)	P.13A-57
P0038	Heated oxygen sensor heater control circuit high (bank 1 sensor 2)	P.13A-69
P0051	Heated oxygen sensor heater control circuit low (bank 2 sensor 1)	P.13A-73
P0052	Heated oxygen sensor heater control circuit high (bank 2 sensor 1)	P.13A-83
P0057	Heated oxygen sensor heater control circuit low (bank 2 sensor 2)	P.13A-88
P0058	Heated oxygen sensor heater control circuit high (bank 2 sensor 2)	P.13A-100
P0069	abnormal correlation between manifold absolute pressure and barometric pressure sensor	P.13A-104
P0101*	Volume airflow circuit range/performance problem	P.13A-109
P0102*	Volume airflow circuit low input	P.13A-118
P0106	Manifold absolute pressure circuit range/performance problem	P.13A-127
P0107	Manifold absolute pressure circuit low input	P.13A-139
P0108	Manifold absolute pressure circuit high input	P.13A-149
P0111*	Intake air temperature circuit range/performance problem	P.13A-156
P0112*	Intake air temperature circuit low input	P.13A-163
P0113*	Intake air temperature circuit high input	P.13A-168
P0116*	Engine coolant temperature circuit range/performance problem	P.13A-175
P0117*	Engine coolant temperature circuit low input	P.13A-183
P0118*	Engine coolant temperature circuit high input	P.13A-188
P0122*	Throttle position sensor (main) circuit low input	P.13A-196
P0123*	Throttle position sensor (main) circuit high input	P.13A-204
P0125*	Insufficient coolant temperature for closed loop fuel control	P.13A-212
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	P.13A-223
P0130	Heated oxygen sensor circuit (bank 1 sensor 1)	P.13A-225
P0131	Heated oxygen sensor circuit low voltage (bank 1 sensor 1)	P.13A-241
P0132	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)	P.13A-248
P0133	Heated oxygen sensor circuit slow response (bank 1 sensor 1)	P.13A-253
P0134*	Heated oxygen sensor circuit no activity detected (bank 1 sensor 1)	P.13A-259
P0136	Heated oxygen sensor circuit (bank 1 sensor 2)	P.13A-269
P0137	Heated oxygen sensor circuit low voltage (bank 1 sensor 2)	P.13A-285
P0138	Heated oxygen sensor circuit high voltage (bank 1 sensor 2)	P.13A-292
P0139	Heated oxygen sensor circuit slow response (bank 1 sensor 2)	P.13A-297
P0140	Heated oxygen sensor circuit no activity detected (bank 1 sensor 2)	P.13A-301

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DTC NO.	DIAGNOSTIC ITEM	REFERENCE PAGE
P0150	Heated oxygen sensor circuit (bank 2 sensor 1)	P.13A-305
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)	P.13A-321
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)	P.13A-328
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)	P.13A-333
P0154*	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)	P.13A-339
P0156	Heated oxygen sensor circuit (bank 2 sensor 2)	P.13A-349
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)	P.13A-365
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)	P.13A-372
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)	P.13A-377
P0160	Heated oxygen sensor circuit no activity detected (bank 2 senosor 2)	P.13A-381
P0171	System too lean (bank 1)	P.13A-385
P0172	System too rich (bank 1)	P.13A-393
P0174	System too lean (bank 2)	P.13A-399
P0175	System too rich (bank 2)	P.13A-407
P0181	Fuel tank temperature sensor circuit range/performance	P.13A-414
P0182	Fuel tank temperature sensor circuit low input	P.13A-421
P0183	Fuel tank temperature sensor circuit high input	P.13A-427
P0201	Injector circuit-Cylinder 1	P.13A-436
P0202	Injector circuit-Cylinder 2	P.13A-436
P0203	Injector circuit-Cylinder 3	P.13A-436
P0204	Injector circuit-Cylinder 4	P.13A-436
P0205	Injector circuit-Cylinder 5	P.13A-436
P0206	Injector circuit-Cylinder 6	P.13A-436
P0222*	Throttle position sensor (sub) circuit low input	P.13A-447
P0223*	Throttle position sensor (sub) circuit high input	P.13A-456
P0300	Random/multiple cylinder misfire detected	P.13A-463
P0301	Cylinder 1 misfire detected	P.13A-470
P0302	Cylinder 2 misfire detected	P.13A-470
P0303	Cylinder 3 misfire detected	P.13A-470
P0304	Cylinder 4 misfire detected	P.13A-470
P0305	Cylinder 5 misfire detected	P.13A-470
P0306	Cylinder 6 misfire detected	P.13A-470
P0325	Knock sensor circuit	P.13A-476
P0335*	Crankshaft position sensor circuit	P.13A-483
P0340*	Camshaft position sensor circuit	P.13A-501
P0401	Exhaust gas recirculation flow insufficient detected	P.13A-515

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DTC NO.	DIAGNOSTIC ITEM		REFERENCE PAGE
P0403	Exhaust gas recirculation control circuit		P.13A-519
P0421	Warm up catalyst efficiency below threshold (bank 1)		P.13A-528
P0431	Warm up catalyst efficiency below threshold (bank 2)		P.13A-532
P0441	Evaporative emission control system incorrect purge flow		P.13A-537
P0442	Evaporative emission control system leak detected (Small leak)		P.13A-541
P0443	Evaporative emission control system purge control valve circuit		P.13A-556
P0446	Evaporative emission control system vent control		P.13A-565
P0450	Evaporative emission control system pressure sensor malfunction		P.13A-574
P0451	Evaporative emission control system pressure sensor range/performance		P.13A-596
P0452	Evaporative emission control system pressure sensor low input		P.13A-618
P0453	Evaporative emission control system pressure sensor high input		P.13A-640
P0455	Evaporative emission control system leak detected (Gross leak)		P.13A-662
P0456	Evaporative emission control system leak detected (Very small leak)		P.13A-681
P0461	Fuel level sensor circuit range/performance		P.13A-696
P0462	Fuel level sensor circuit low input		P.13A-701
P0463	Fuel level sensor circuit high input		P.13A-709
P0500*	Vehicle speed sensor malfunction	• A/T DTC No. 29 (Vehicle speed sensor system: Short circuit/open circuit	P.23A-42
P0506	Idle control system RPM lower than expected		P.13A-712
P0507	Idle control system RPM higher than expected		P.13A-715
P0510	Accelerator pedal position switch circuit		P.13A-718
P0513	Immobilizer malfunction		P.13A-727
P0551	Power steering pressure switch circuit range/performance		P.13A-728
P0554	Power steering pressure switch circuit intermittent		P.13A-737
P0603*	EEPROM malfunction		P.13A-742
P0606*	Powertrain control module main processor malfunction		P.13A-744
P0630*	VIN malfunction		P.13A-745
P0638*	Throttle actuator control motor circuit range/ performance problem		P.13A-748
P0642*	Throttle position sensor power supply		P.13A-759
P0657*	Throttle actuator control motor relay circuit malfunction		P.13A-761
P0660	Intake manifold tuning circuit malfunction		P.13A-772
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

TSB Revision

DTC NO.	DIAGNOSTIC ITEM		REFERENCE PAGE
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
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
P0735	Gear 5 incorrect	• A/T DTC No. 45 (5th 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
P0773	Shift solenoid "E" electrical	• A/T DTC No. 35 (Reduction solenoid valve system: Short circuit/Open circuit)	P.23A-42
P1530	A/C1 switch circuit intermittent		P.13A-780
P1602*	Communication malfunction (between PCM main processor and system LSI)		P.13A-781
P1603*	Battery backup circuit malfunction		P.13A-782
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
P2100*	Throttle actuator control motor circuit (open)		P.13A-788
P2101*	Throttle actuator control motor magneto malfunction		P.13A-794
P2121*	Accelerator pedal position sensor (main) circuit range/performance problem		P.13A-799
P2122*	Accelerator pedal position sensor (main) circuit low input		P.13A-807

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DTC NO.	DIAGNOSTIC ITEM	REFERENCE PAGE
P2123*	Accelerator pedal position sensor (main) circuit high input	P.13A-816
P2126*	Accelerator pedal position sensor (sub) circuit range/performance problem	P.13A-824
P2127*	Accelerator pedal position sensor (sub) circuit low input	P.13A-831
P2128*	Accelerator pedal position sensor (sub) circuit high input	P.13A-840
P2135*	Throttle position sensor (main and sub) range/performance problem	P.13A-847
P2138*	Accelerator pedal position sensor (main and sub) range/performance problem	P.13A-853
P2195	Heated oxygen sensor inactive (bank 1 sensor 1)	P.13A-865
P2197	Heated oxygen sensor inactive (bank 2 sensor 1)	P.13A-868
P2228*	Barometric pressure circuit low input	P.13A-872
P2229*	Barometric pressure circuit high input	P.13A-881

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.

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

SYMPTOM CHART

M1131151501503

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-888
	Communication with PCM only is not possible	2	P.13A-891
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-894
	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) remains illuminated and never goes out	4	P.13A-900
Starting	Cranks, won't start	5	P.13A-904
	Starts up and dies	6	P.13A-910
	Hard starting	7	P.13A-917
Idling stability (improper idling)	Unstable idle (rough idle, hunting)	8	P.13A-924
	Idle speed is high (improper idle speed)	9	P.13A-927
	Idle speed is low (improper idle speed)	10	P.13A-929
Idling stability (engine stalls)	When the engine is cold, it stalls at idle (die out)	11	P.13A-930
	When the engine is hot, it stalls at idle (die out)	12	P.13A-933
	The engine stalls when accelerating (pass out)	13	P.13A-937
	The engine stalls when decelerating	14	P.13A-939
Driving	Hesitation, sag or stumble	15	P.13A-940
	Acceleration shock	16	P.13A-944
	Deceleration shock	17	P.13A-945
	Poor acceleration	18	P.13A-946
	Surge	19	P.13A-949
	Knocking	20	P.13A-952
Dieseling (Run-on)		21	P.13A-954
Too high CO and HC concentration when idling		22	P.13A-954
IM240 test failure	Transient, mass emission tailpipe test failure	23	P.13A-956
	Purge flow test of the evaporative emission canister failure	24	P.13A-962
	Pressure test of the evaporative system failure	25	P.13A-963
Improper idle speed when the A/C is operating (A/C switch 2 signal)		26	P.13A-964
A/C condenser fan is inoperative		27	P.13A-966
Power supply system and ignition switch-IG system		28	P.13A-968
Fuel pump system		29	P.13A-976

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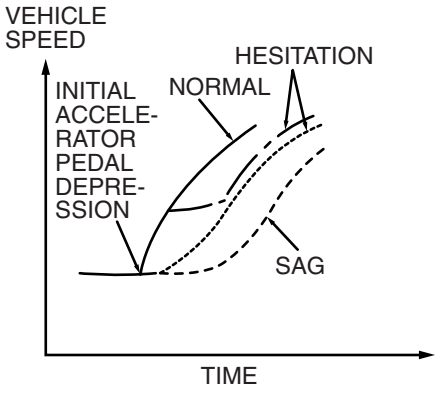
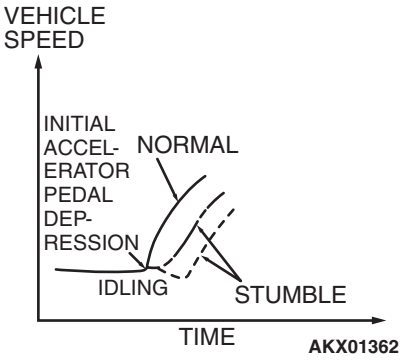
TROUBLE SYMPTOMS	INSPECTION PROCEDURE	REFERENCE PAGE
Ignition switch-ST system and transmission range switch system	30	P.13A-986
Ignition circuit system	31	P.13A-991
A/C system	32	P.13A-999

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

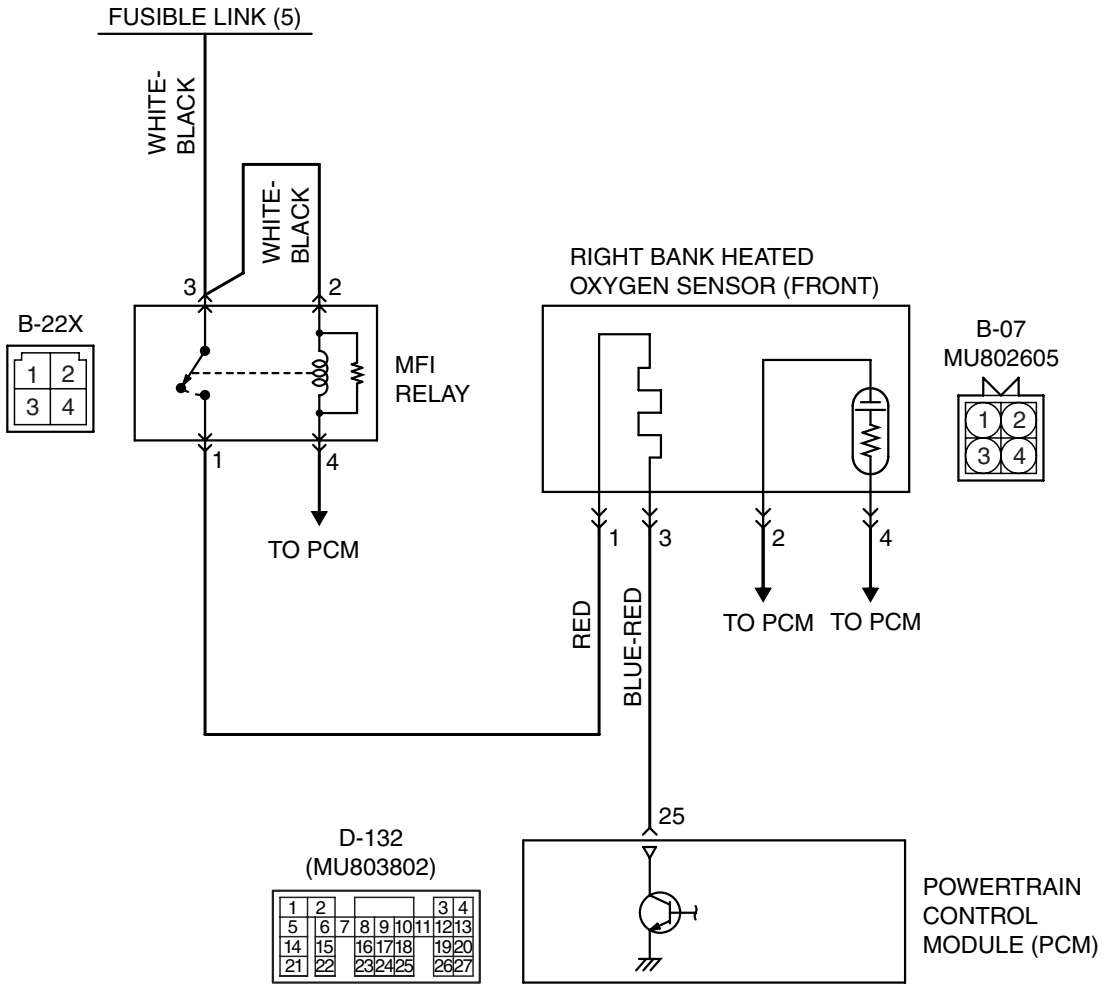
ITEMS		SYMPTOM
At Starting	Won't start	The starter cranks the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starts up and dies	The engine starts, but then engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed 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".

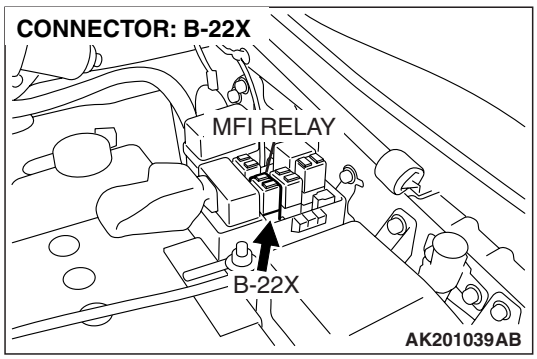
DIAGNOSTIC TROUBLE CODE PROCEDURES

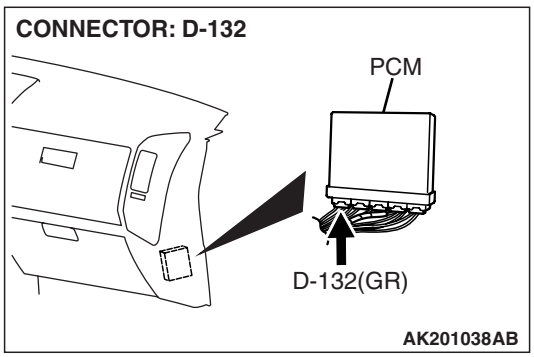
DTC P0031: Heated Oxygen Sensor Heater Control Circuit Low (bank 1, sensor 1)

Right Bank Heated Oxygen Sensor (front) Heater Circuit

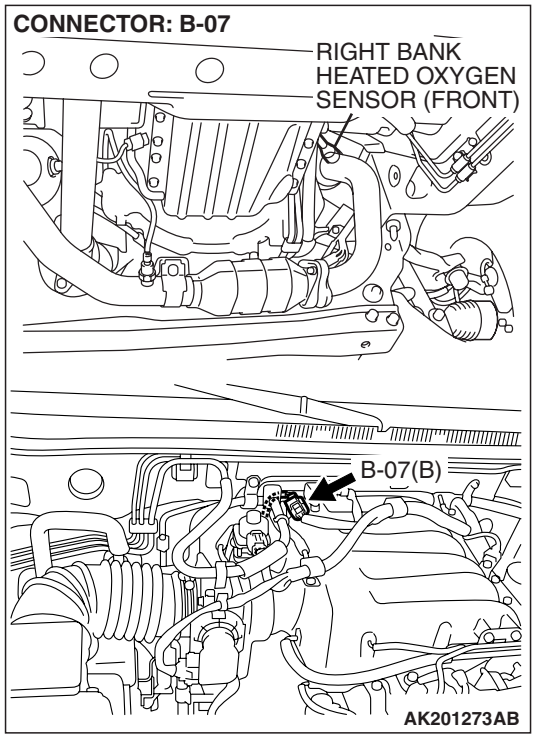


AK400975





TSB Revision



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 1) to the right bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 25) controls continuity to the right bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

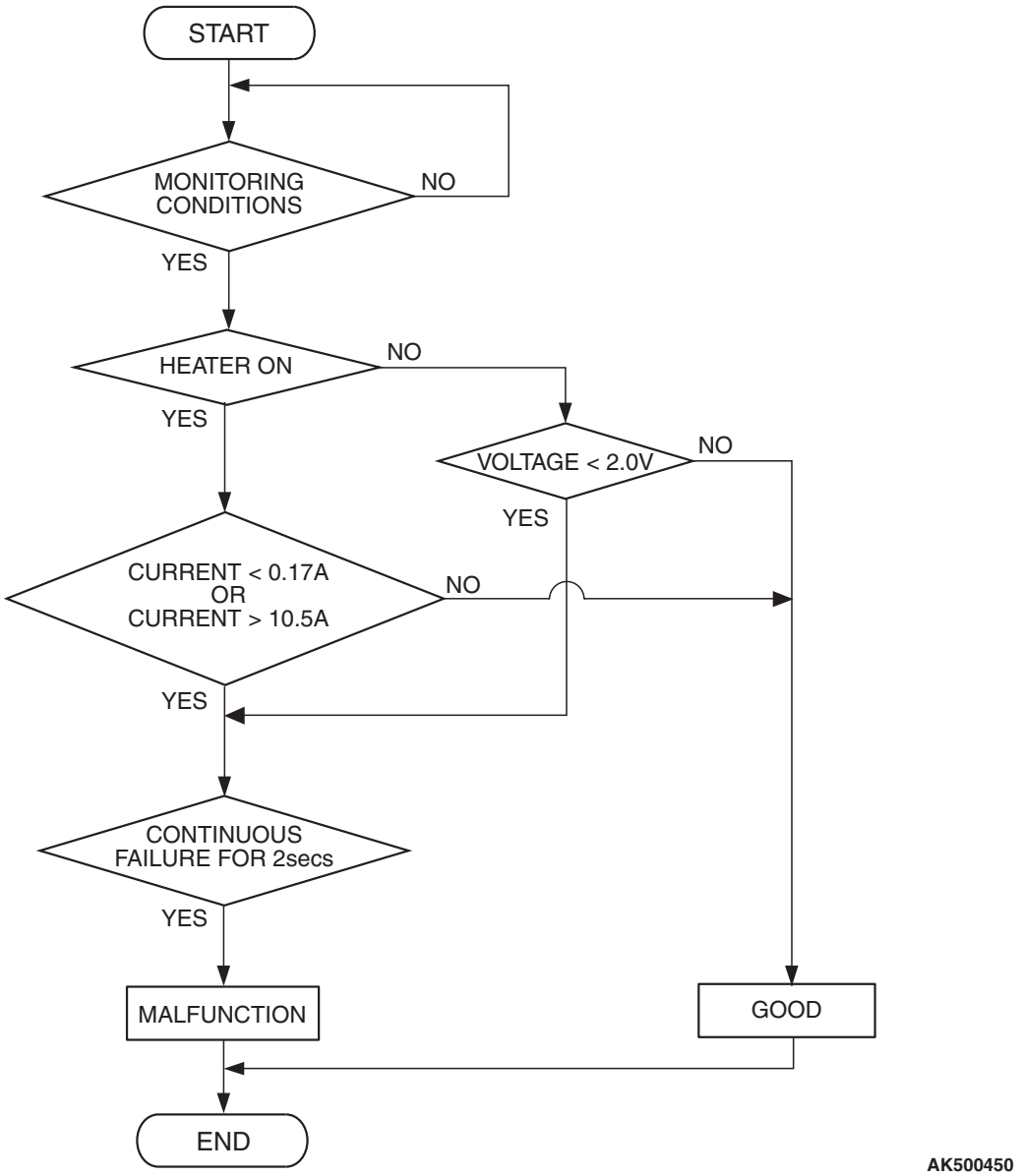
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

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

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

TSB Revision

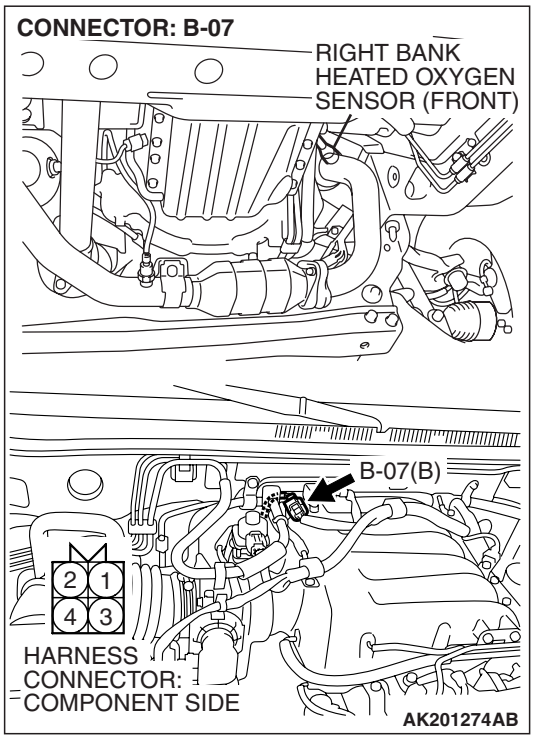
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Open or shorted right bank heated oxygen sensor (front) heater circuit, or harness damage.
- Right bank heated oxygen sensor (front) heater failed.
- Connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tool:

- MD998464: Test Harness



STEP 1. Check harness connector B-07 at the right bank heated oxygen sensor (front) for damage.

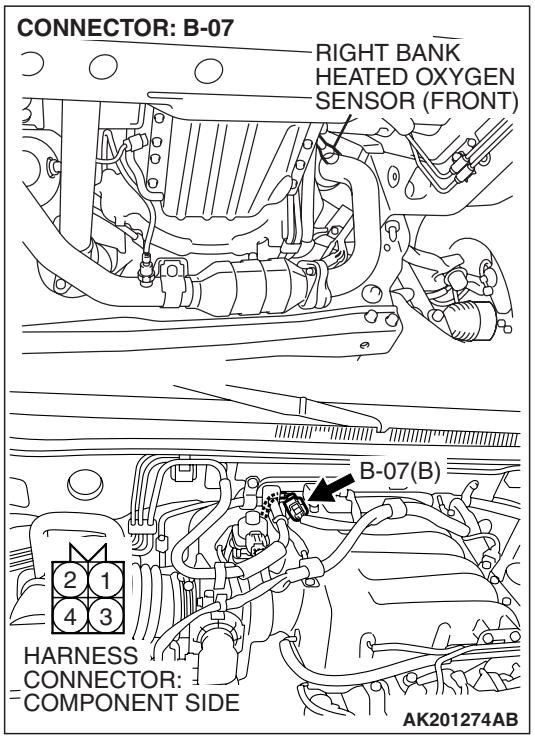
Q: Is the harness connector in good condition?

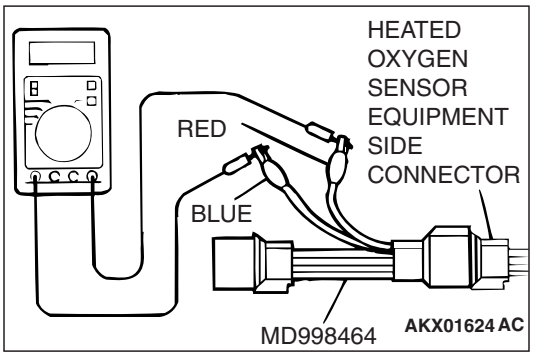
YES : Go to Step 2.

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

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

(1) Disconnect right bank heated oxygen sensor (front) connector B-07 and connect test harness special tool, MD998464, to the connector on the right bank heated oxygen (front) sensor side.





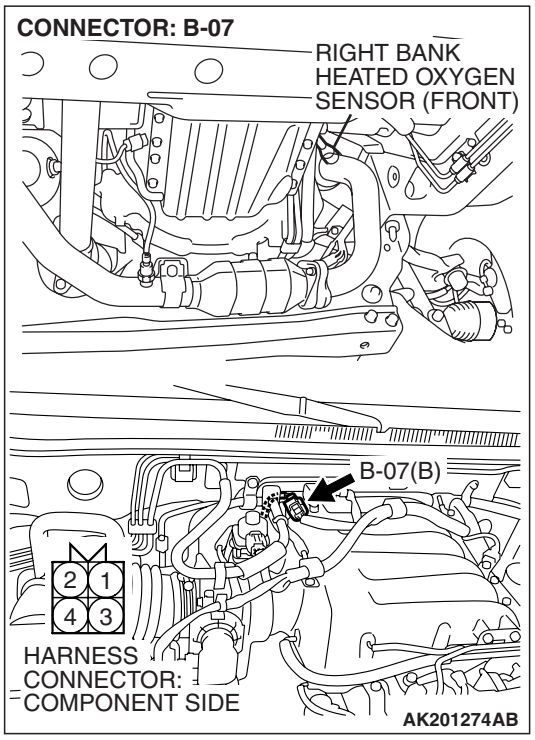
(2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

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

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

YES : Go to Step 3.

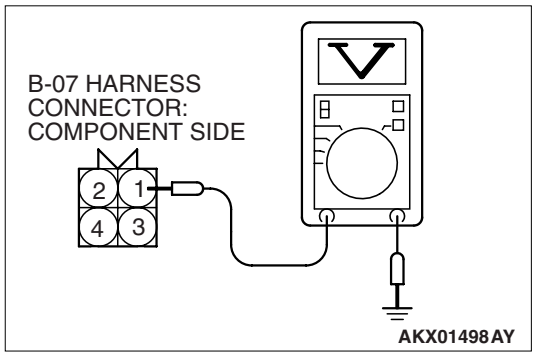
NO : Replace the right bank heated oxygen sensor (front). Then go to Step 12.



STEP 3. Measure the power supply voltage at right bank heated oxygen sensor (front) harness side connector B-07.

(1) Disconnect the connector B-07 and measure at the harness side.

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



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

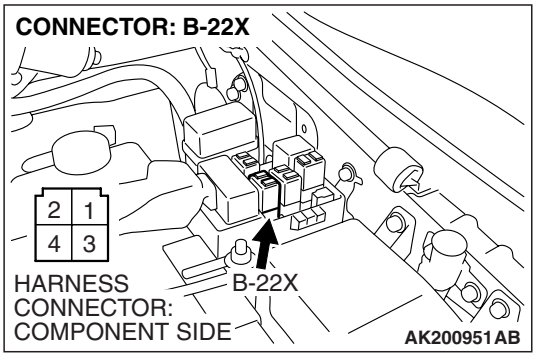
NO : Go to Step 4.

STEP 4. Check harness connector B-22X at the MFI relay for damage.

Q: Is the harness connector in good condition?

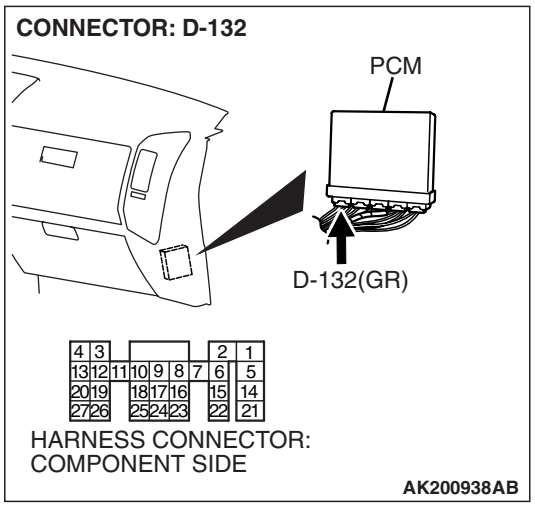
YES : Repair harness wire between MFI relay connector B-22X (terminal No. 1) and right bank heated oxygen sensor (front) connector B-07 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

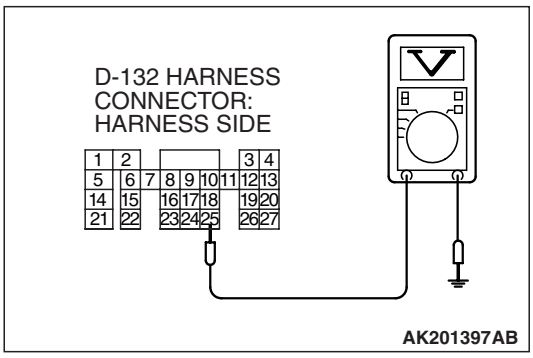
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 5. Measure the power supply voltage at PCM connector D-132 by backprobing.

(1) Do not disconnect the connector D-132.
(2) Turn the ignition switch to the "ON" position.





(3) Measure the voltage between terminal No. 25 and ground by backprobing.
- Voltage should be battery positive voltage.

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

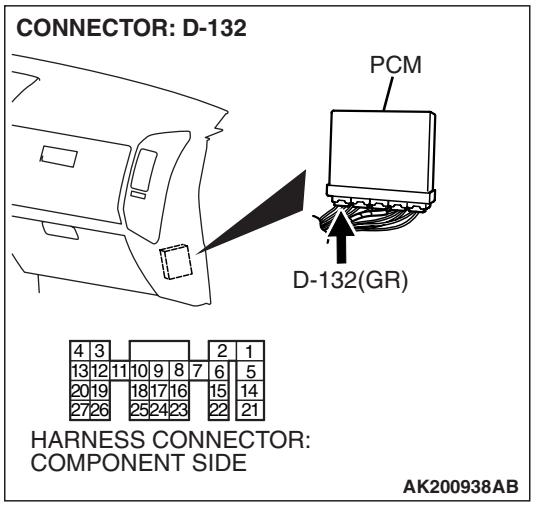
Q: Is battery positive voltage (approximately 12 volts) present?

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

STEP 6. Check harness connector D-132 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

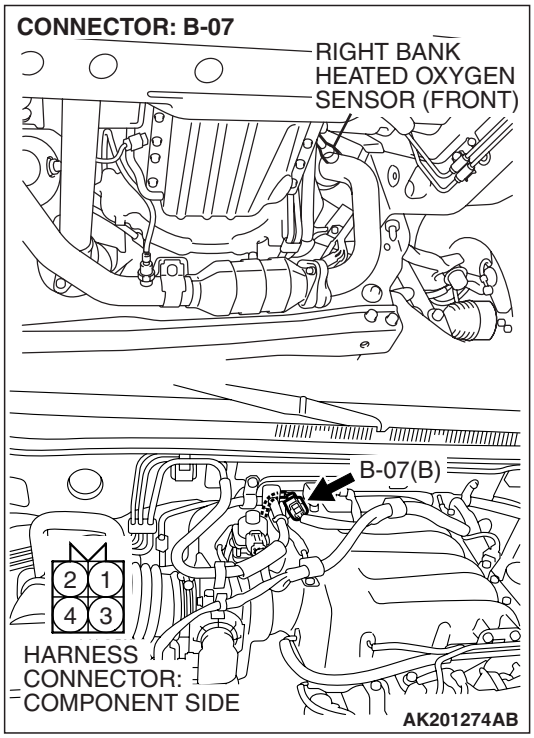


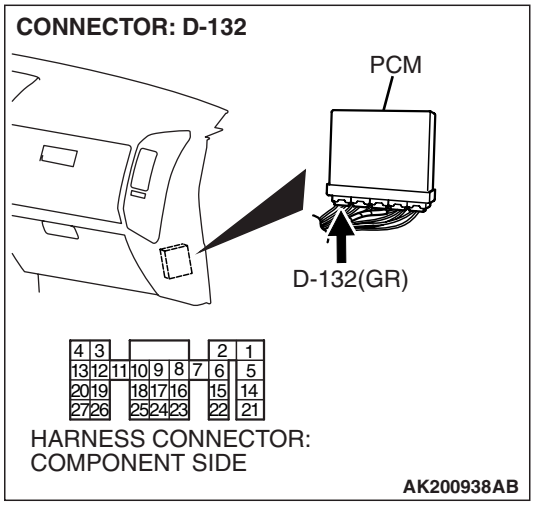
STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (front) connector B-07 (terminal No. 3) and PCM connector D-132 (terminal No. 25).

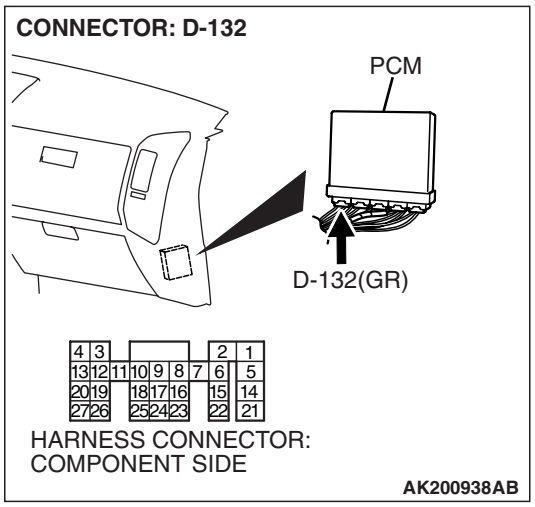
Q: Is the harness wire in good condition?

YES : Replace the PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.





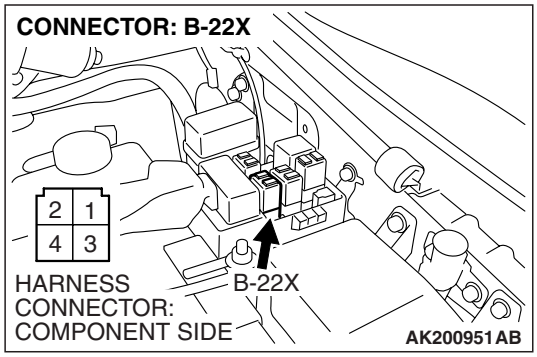


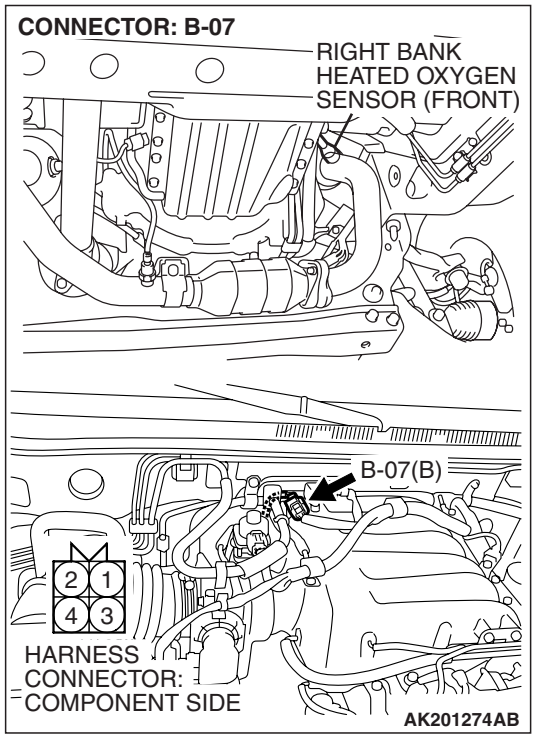
STEP 8. Check harness connector D-132 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

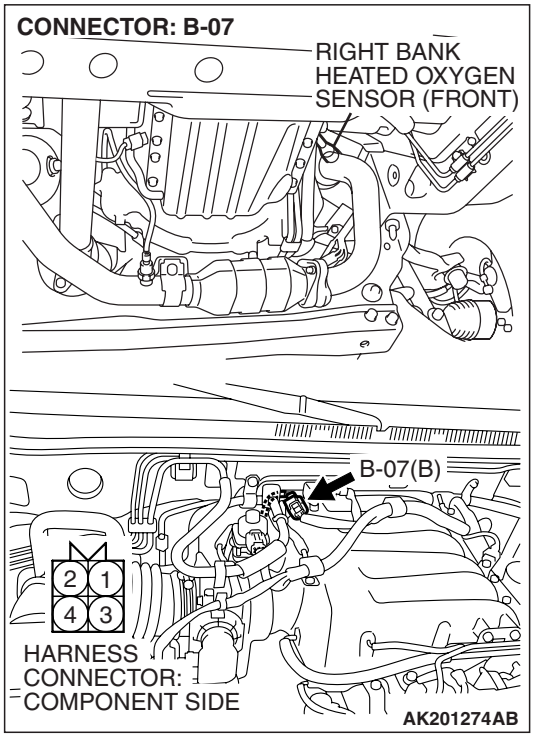
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

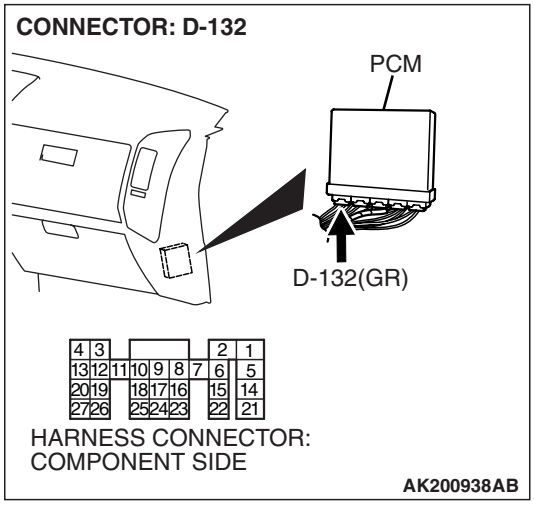




STEP 9. Check for harness damage between MFI relay connector B-22X (terminal No. 1) and right bank heated oxygen sensor (front) connector B-07 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 10.
NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between right bank heated oxygen sensor (front) connector B-07 (terminal No. 3) and PCM connector D-132 (terminal No. 25).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0031 set?

YES : Replace the PCM. Then go to Step 12.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

TSB Revision

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

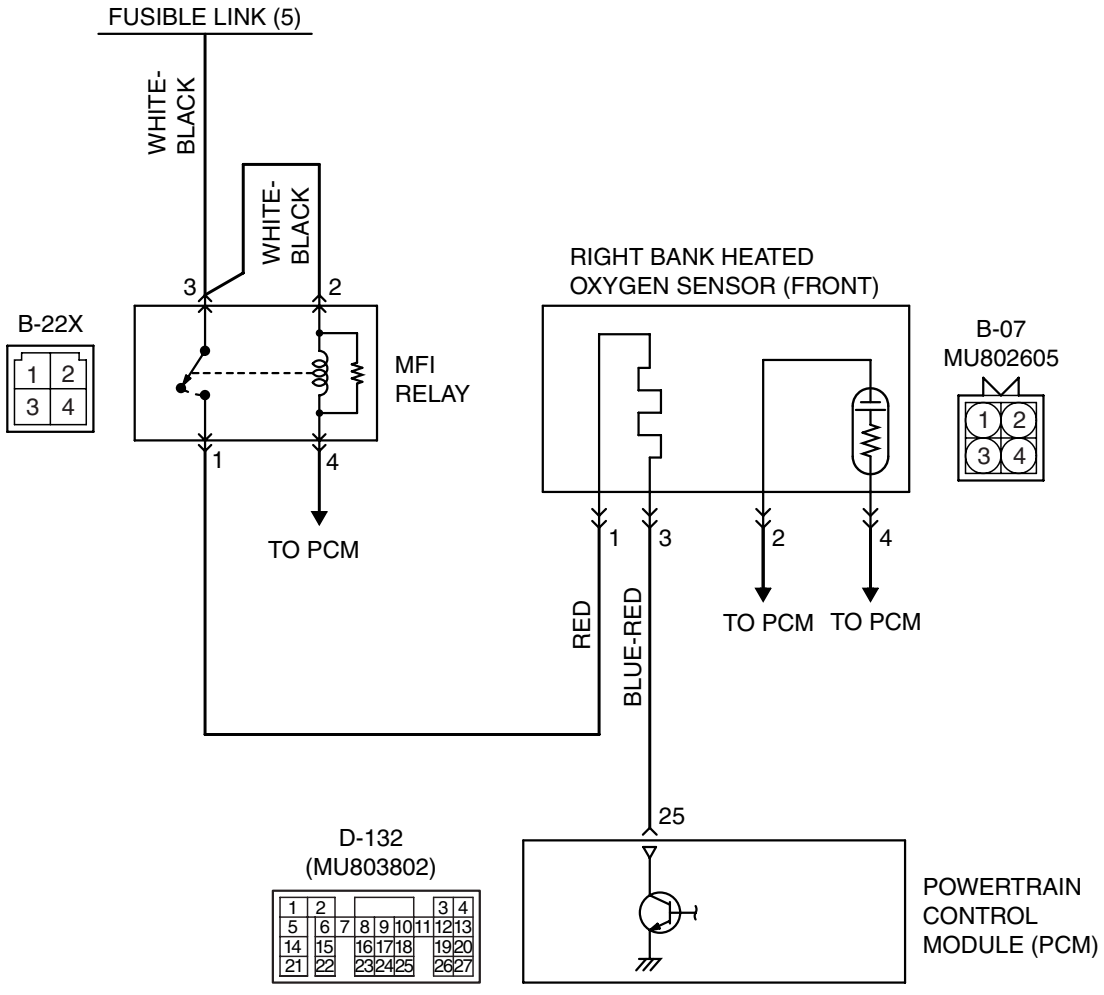
Q: Is DTC P0031 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

Right Bank Heated Oxygen Sensor (front) Heater Circuit



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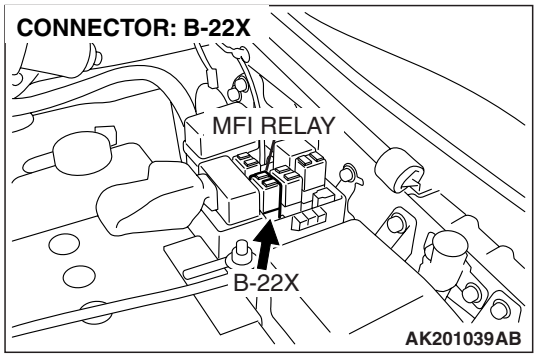
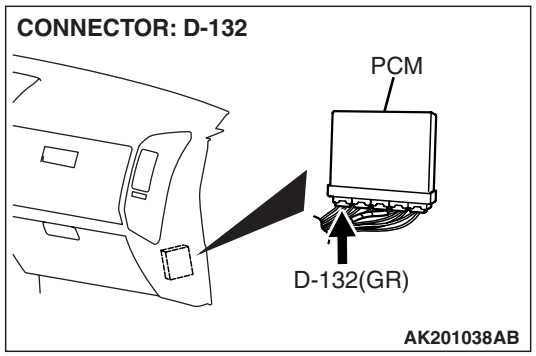
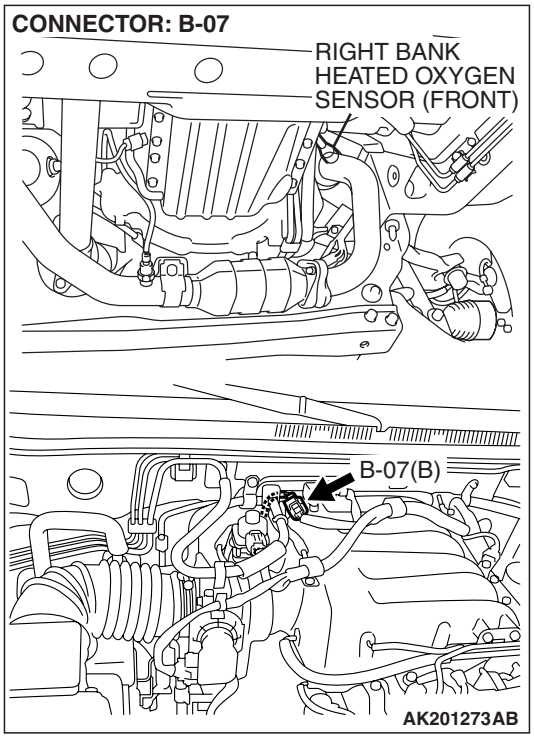






CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 1) to the right bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 25) controls continuity to the right bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

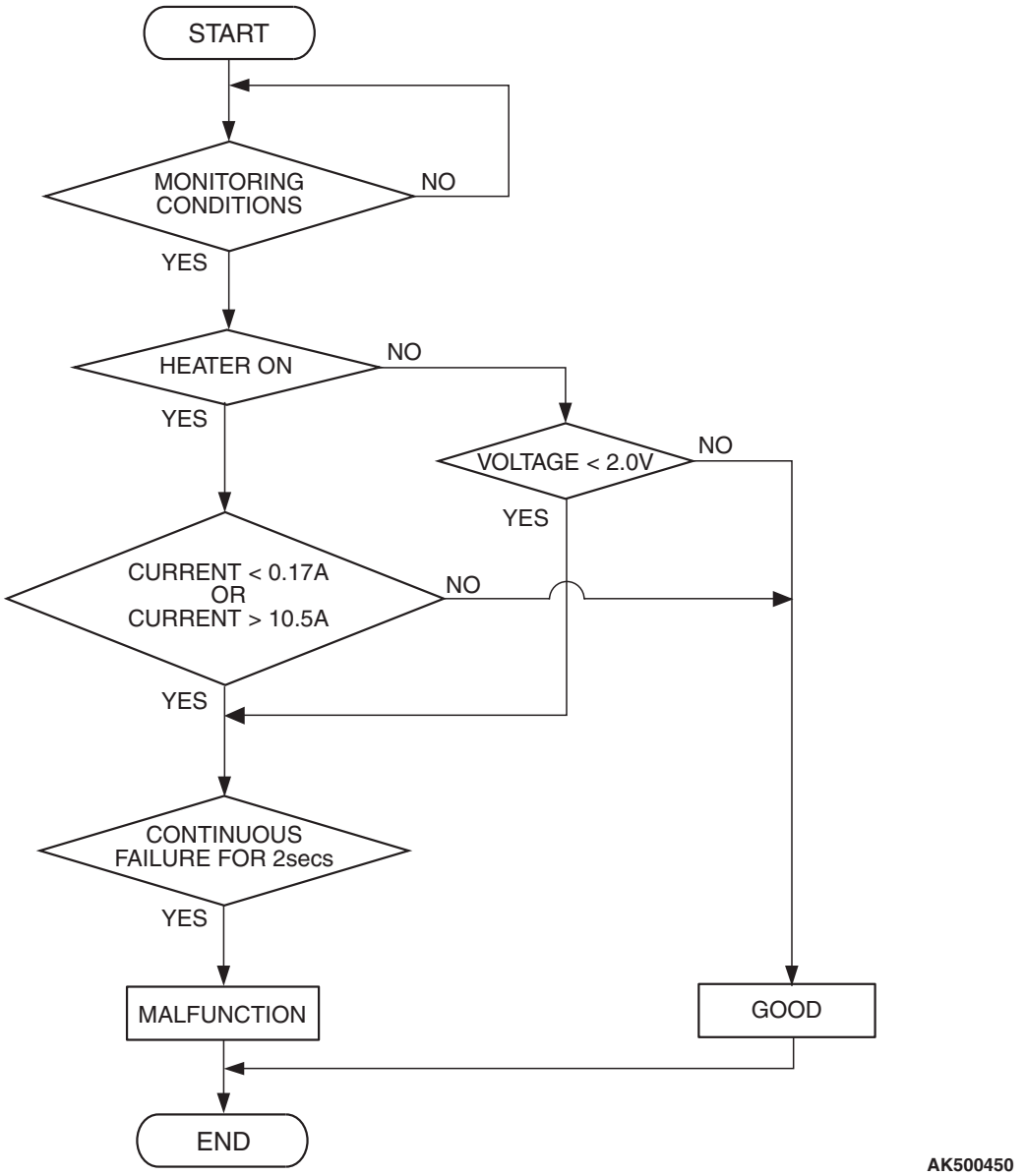
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

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

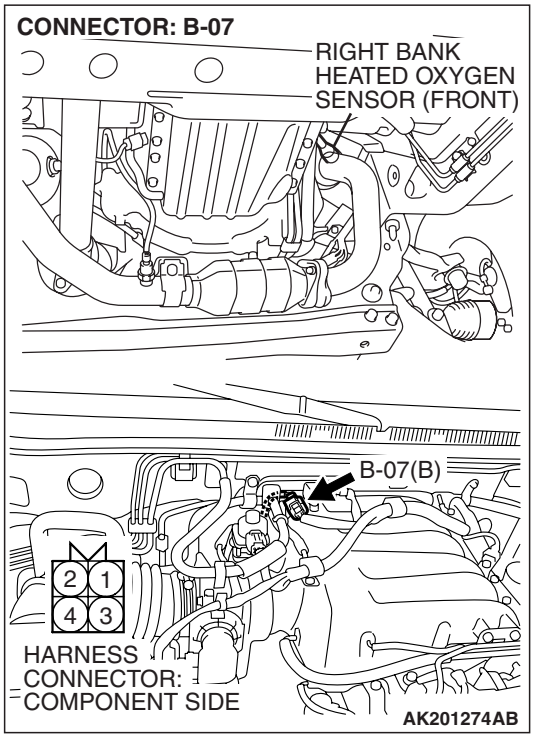
TSB Revision

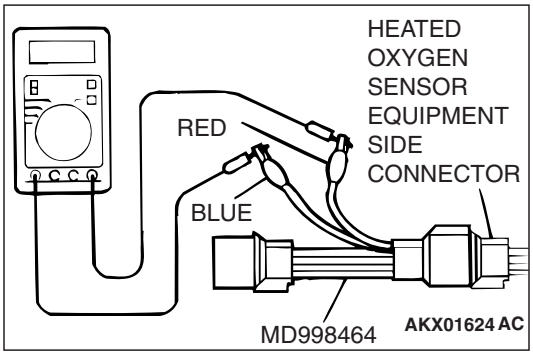
DIAGNOSIS

Required Special Tool:
- MD998464: Test Harness

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

(1) Disconnect right bank heated oxygen sensor (front) connector B-07 and connect test harness special tool, MD998464, to the connector on the right bank heated oxygen (front) sensor side.





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

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

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

YES : Go to Step 2.

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

STEP 2. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0032 set?

YES : Replace the PCM. Then go to Step 3.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

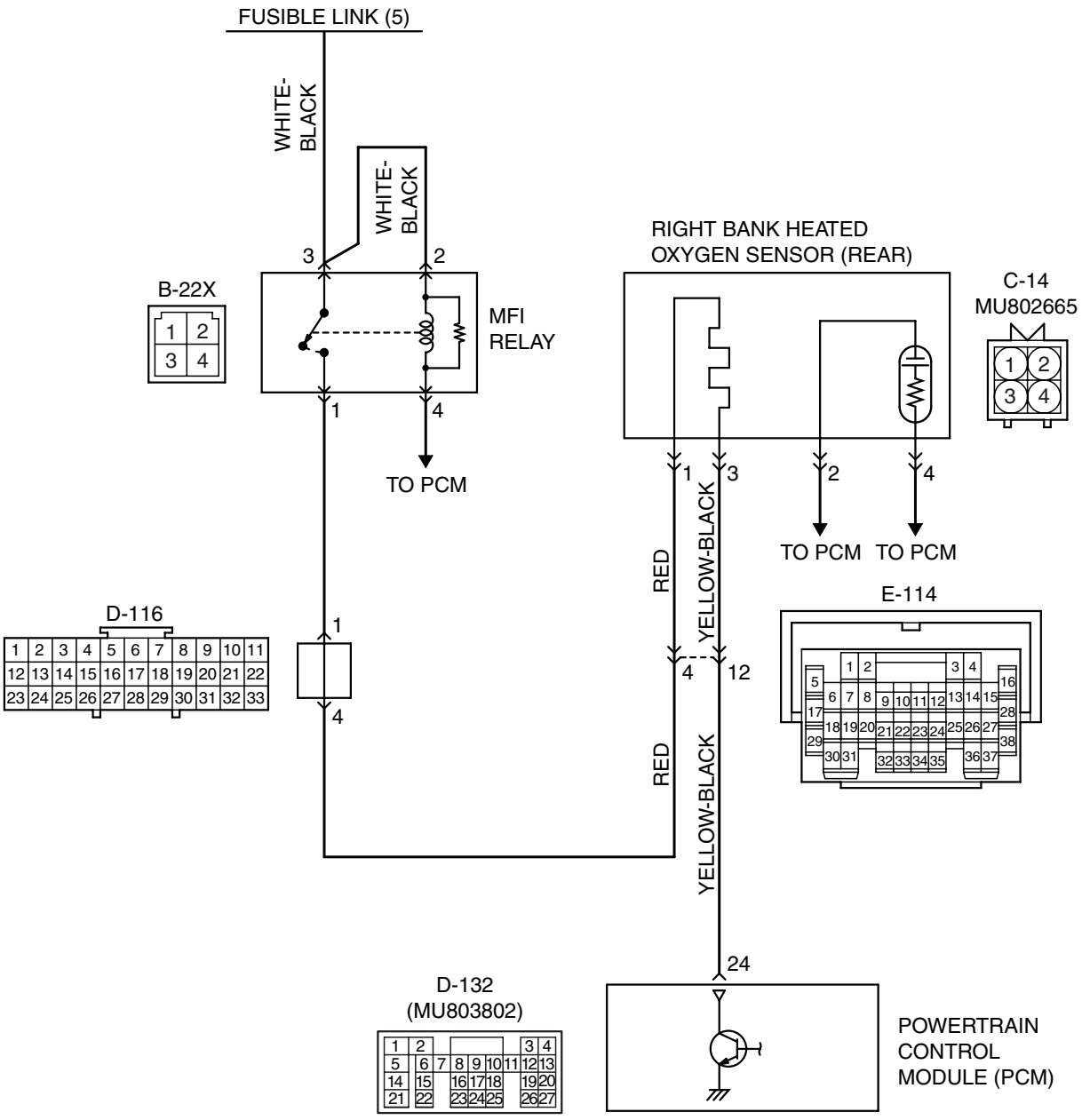
Q: Is DTC P0032 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

Right Bank Heated Oxygen Sensor (rear) Heater Circuit



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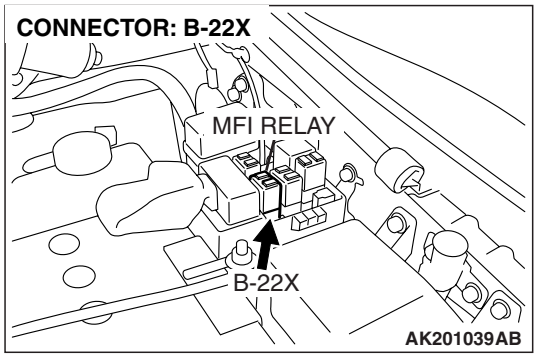
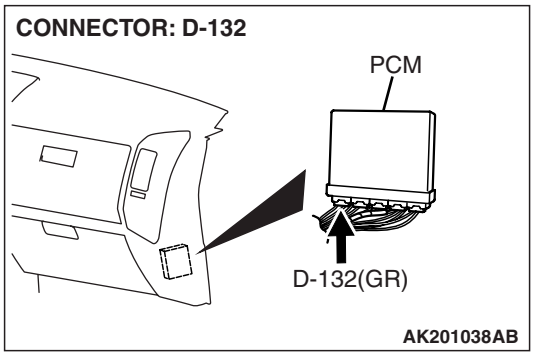
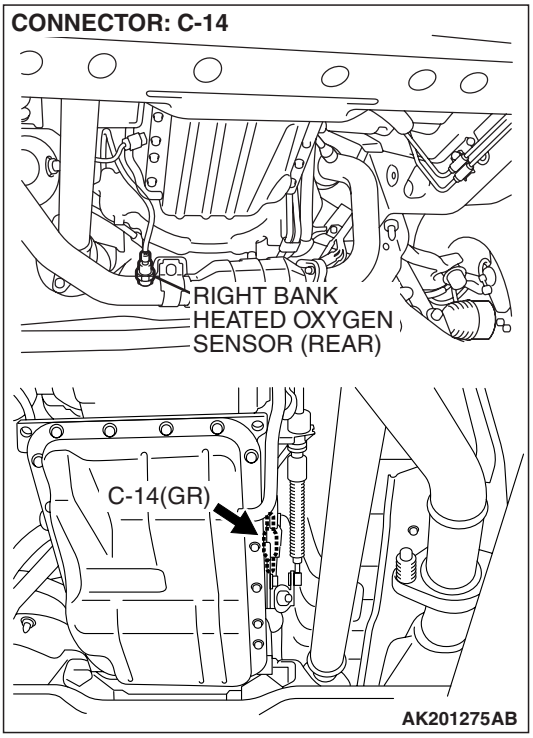
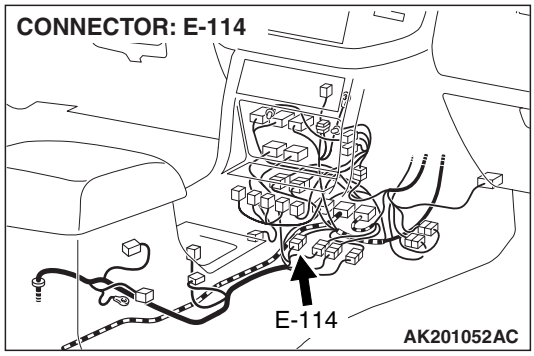
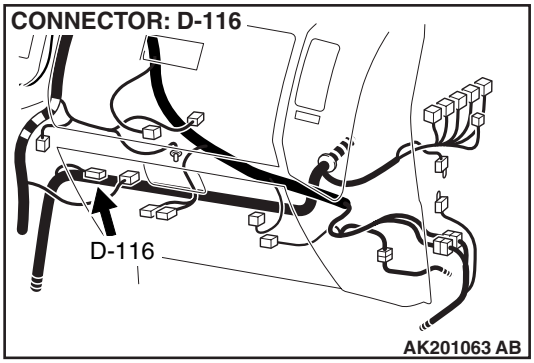










CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 1) to the right bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 24) controls continuity to the right bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

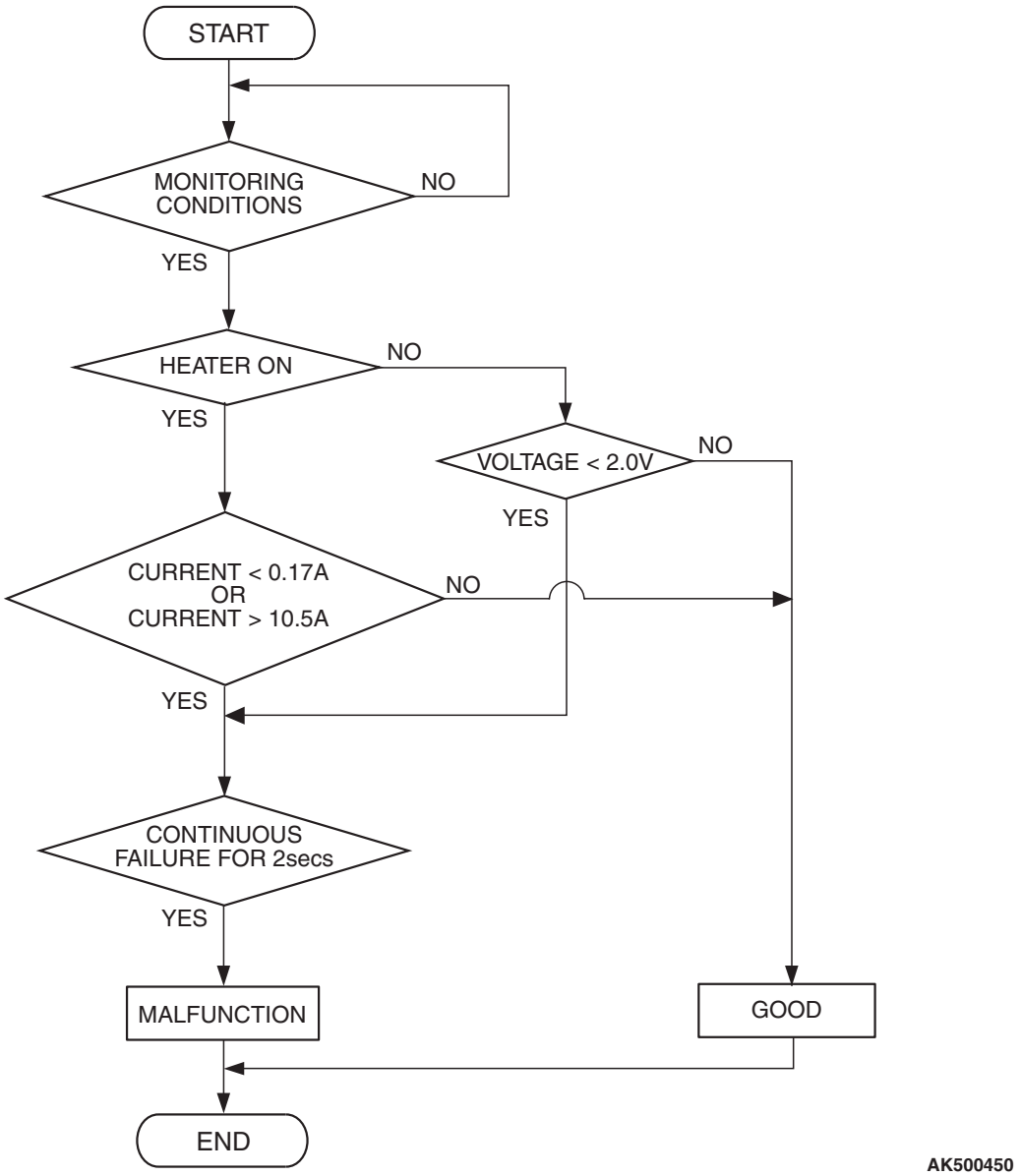
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

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

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

TSB Revision

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

- Open or shorted right bank heated oxygen sensor (rear) heater circuit, or harness damage.
- Right bank heated oxygen sensor (rear) heater failed.
- Connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tool:

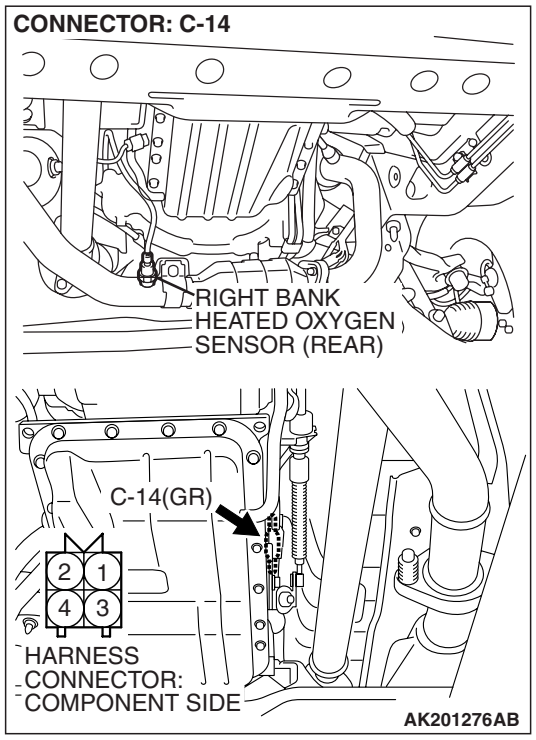
- MB991316: Test Harness

STEP 1. Check harness connector C-14 at the right bank heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

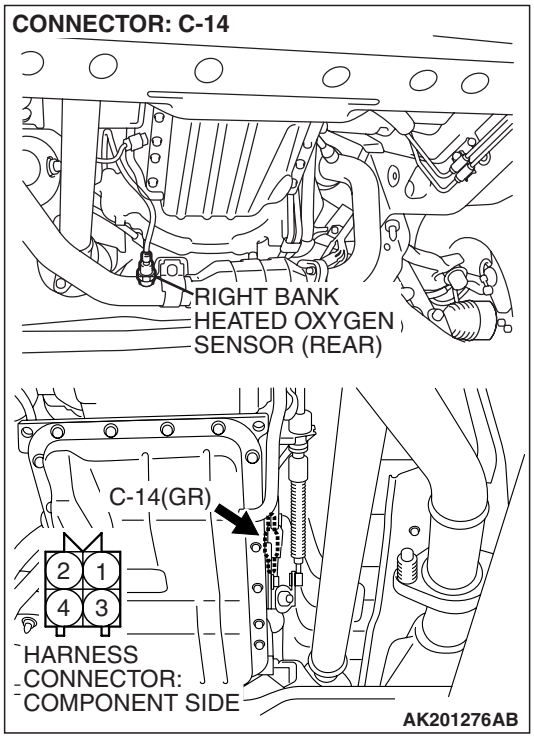
YES : Go to Step 2.

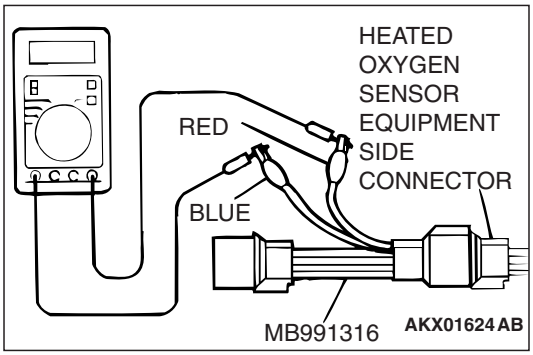
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



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

(1) Disconnect right bank heated oxygen sensor (rear) connector C-14 and connect test harness special tool, MB991316, to the connector on the right bank heated oxygen (rear) sensor side.





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

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

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

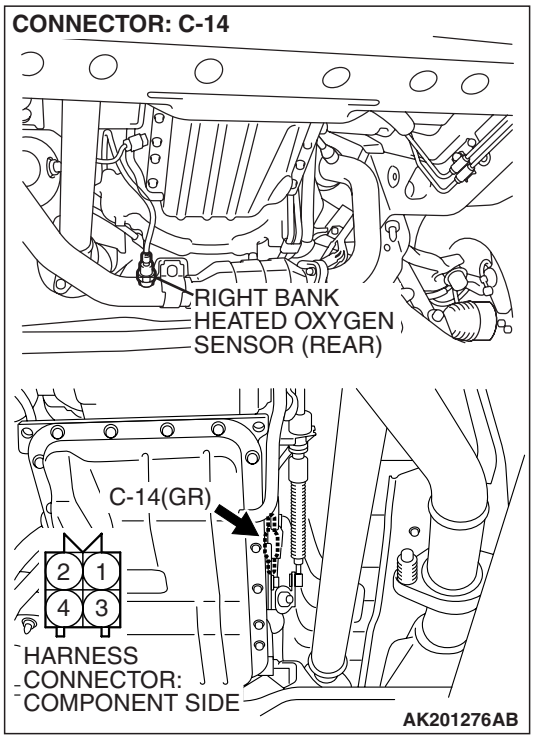
YES : Go to Step 3.

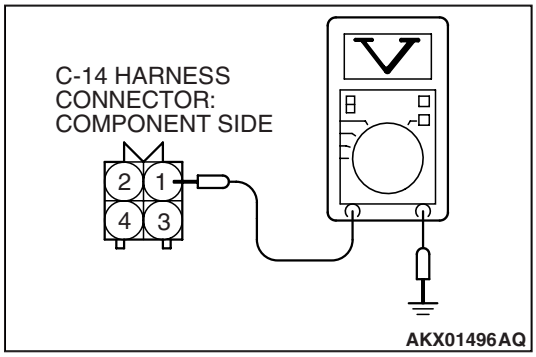
NO : Replace the right bank heated oxygen sensor (rear). Then go to Step 12.

STEP 3. Measure the power supply voltage at right bank heated oxygen sensor (rear) harness side connector C-14.

(1) Disconnect the connector C-14 and measure at the harness side.

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





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

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

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

YES : Go to Step 5.

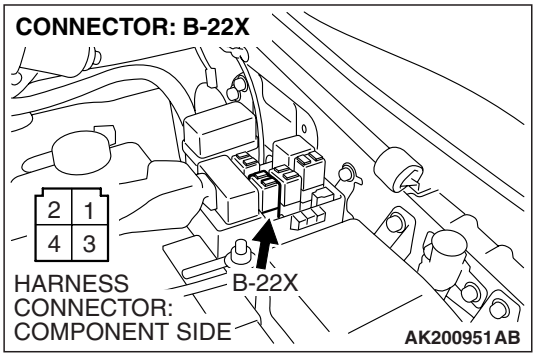
NO : Go to Step 4.

STEP 4. Check harness connector B-22X at the MFI relay for damage.

Q: Is the harness connector in good condition?

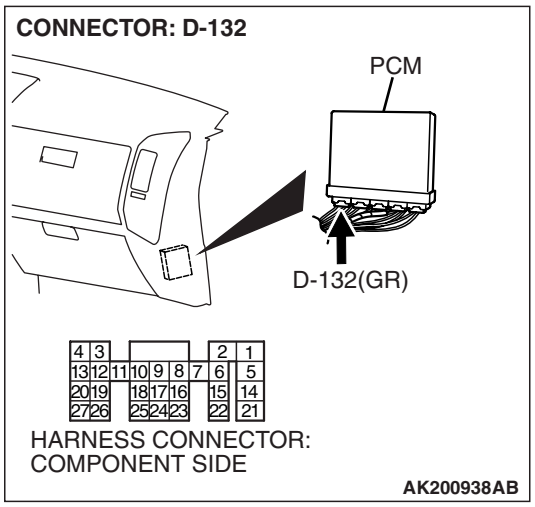
YES : Check harness connectors E-114 and D-116 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If intermediate connector E-114 and D-116 are in good condition, repair harness wire between MFI relay connector B-22X (terminal No. 1) and right bank oxgen sensor (rear) connector C-14 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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



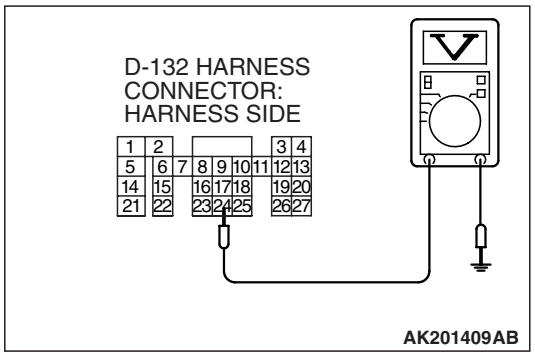
STEP 5. Measure the power supply voltage at PCM connector D-132 by backprobing.

(1) Do not disconnect the connector D-132.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 24 and ground by backprobing.
- Voltage should be battery positive voltage.

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



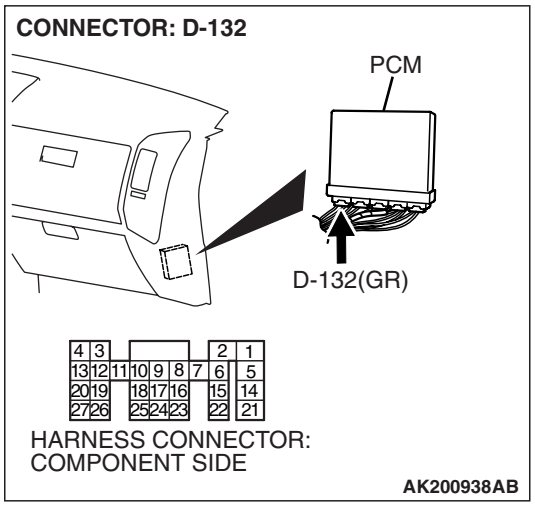
Q: Is battery positive voltage (approximately 12 volts) present?

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

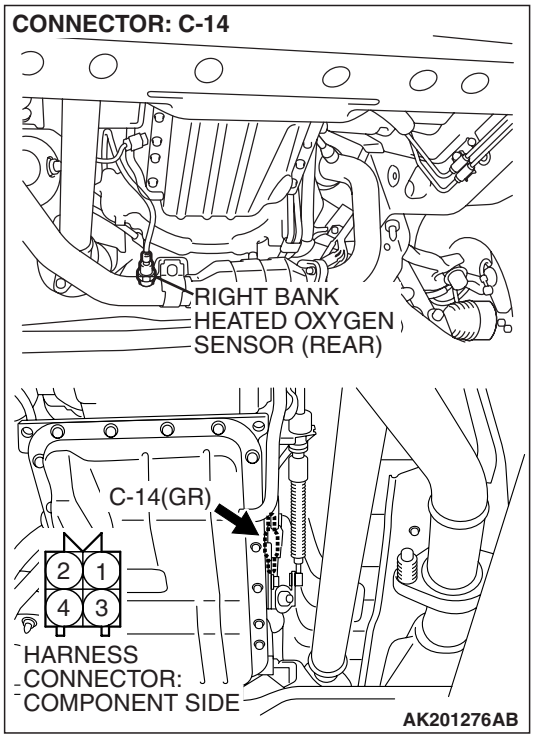
STEP 6. Check harness connector D-132 at PCM for damage.

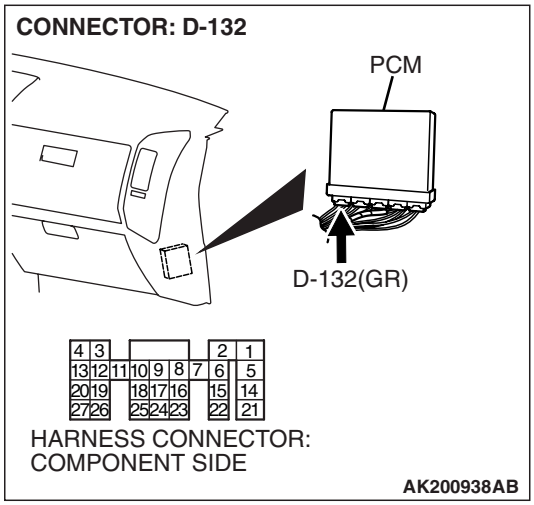
Q: Is the harness connector in good condition?

YES : Go to Step 7.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (rear) connector C-14 (terminal No. 3) and PCM connector D-132 (terminal No. 24).



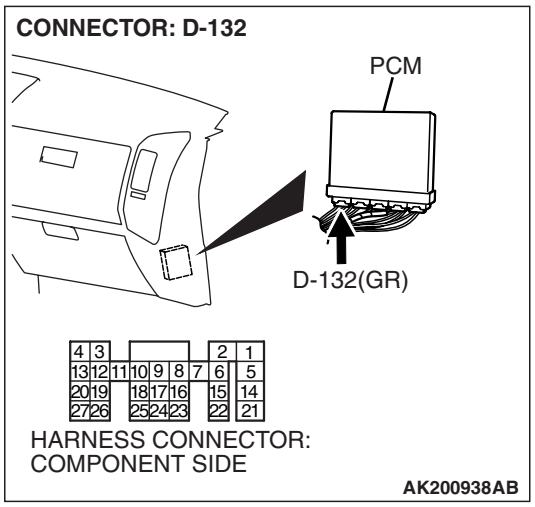


NOTE: Check harness after checking intermediate connector E-114. If intermediate connector E-114 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Replace the PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.



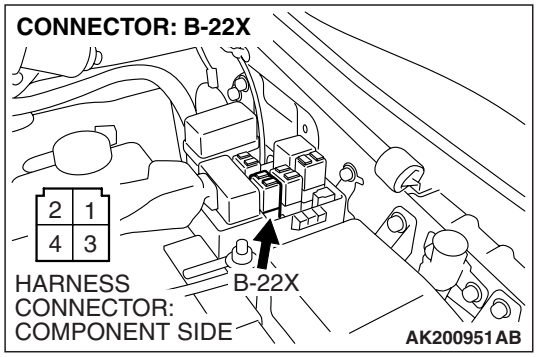
STEP 8. Check harness connector D-132 at PCM for damage.

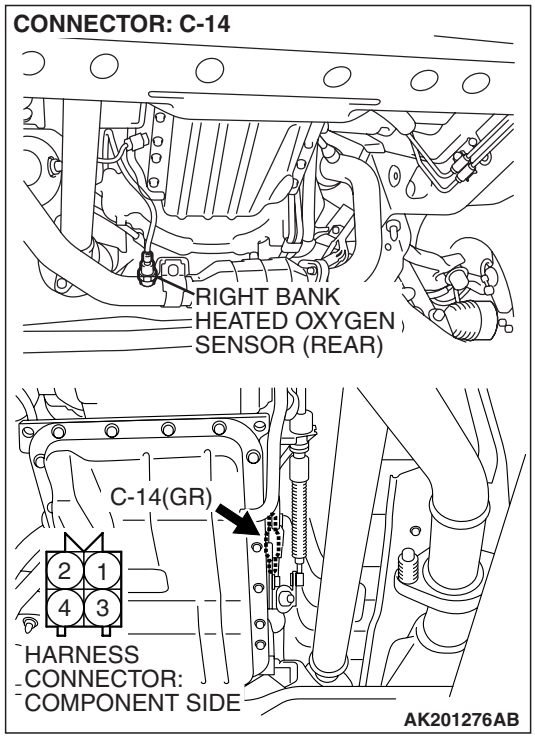
Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

STEP 9. Check for harness damage between MFI relay connector B-22X (terminal No. 1) and right bank heated oxygen sensor (rear) connector C-14 (terminal No. 1).





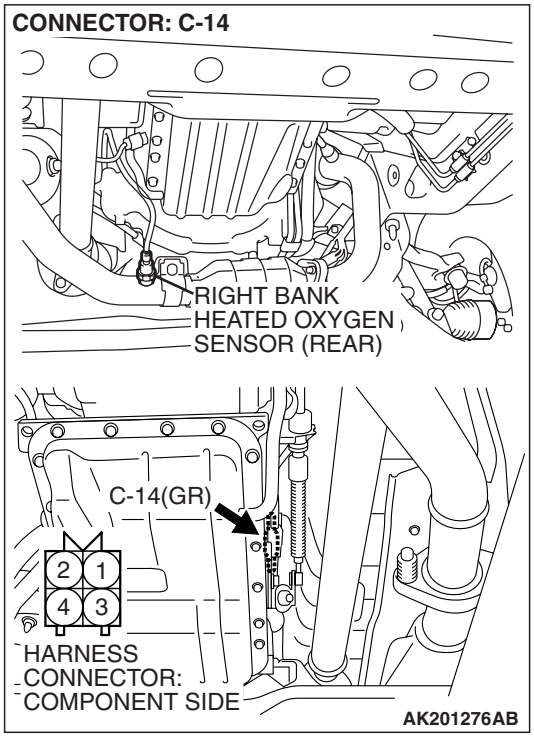
NOTE: Check harness after checking intermediate connectors E-114 and D-116. If intermediate connectors E-114 and D-116 are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.Then go to Step 12.

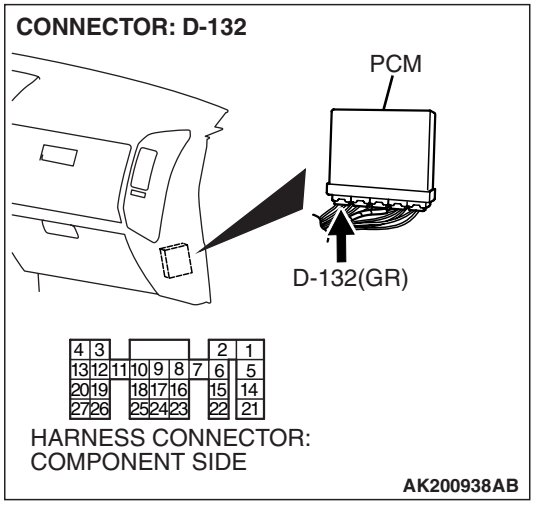
Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between right bank heated oxygen sensor (rear) connector C-14 (terminal No. 3) and PCM connector D-132 (terminal No. 24).





NOTE: Check harness after checking intermediate connector E-114. If intermediate connector E-114 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.Then go to Step 12.

Q: Is the harness wire in good condition?

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

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0037 set?

YES : Replace the PCM. Then go to Step 12.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

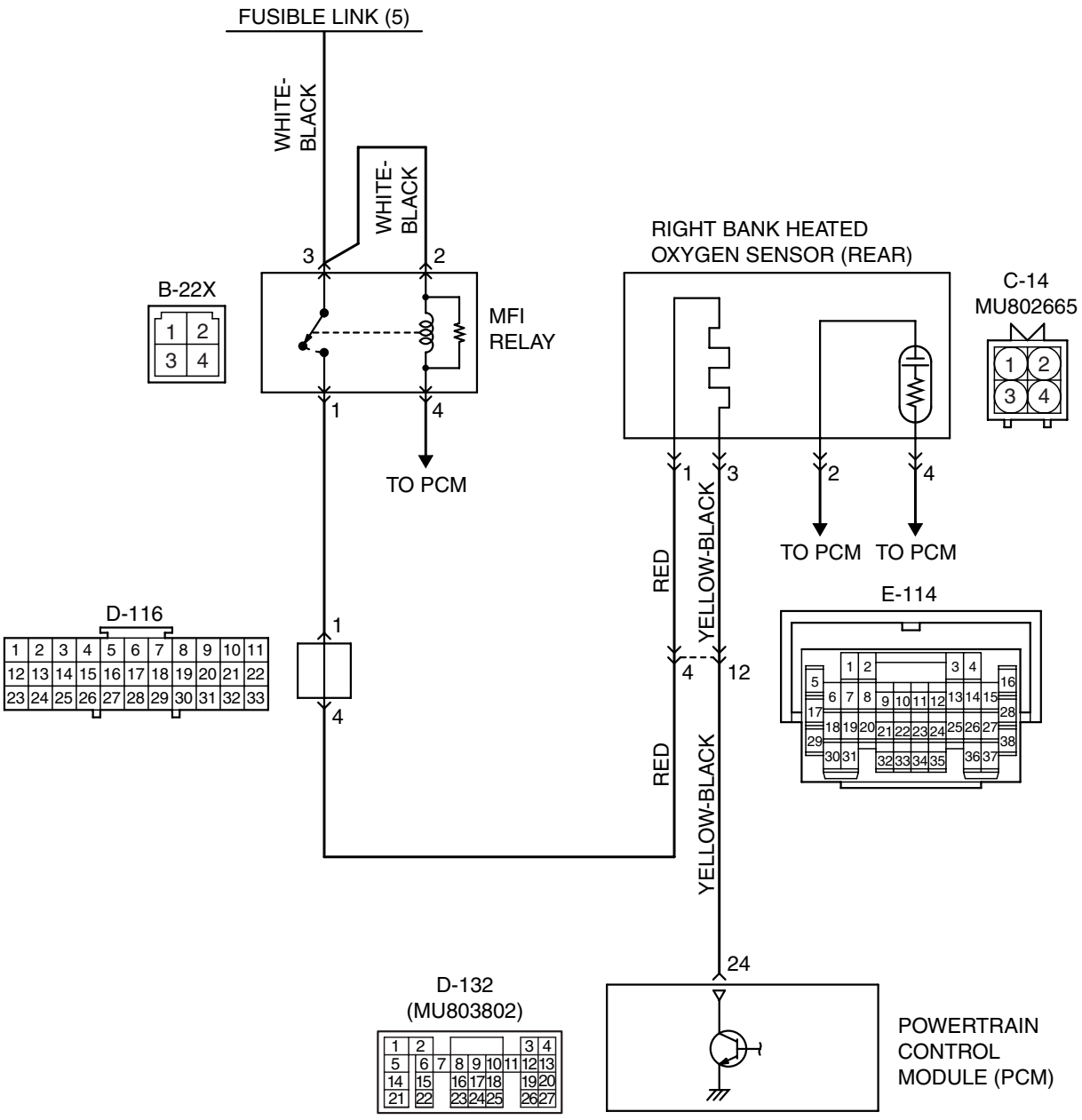
Q: Is DTC P0037 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0038: Heated Oxygen Sensor Heater Control Circuit High (bank 1, sensor 2)

Right Bank Heated Oxygen Sensor (rear) Heater Circuit



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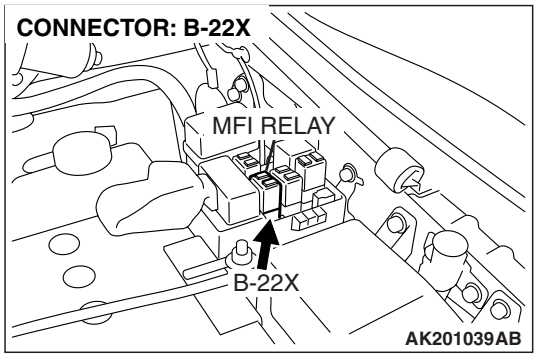
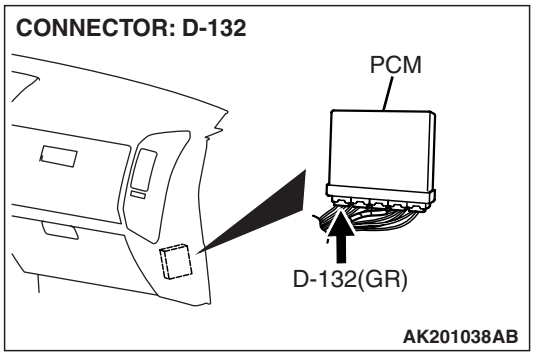
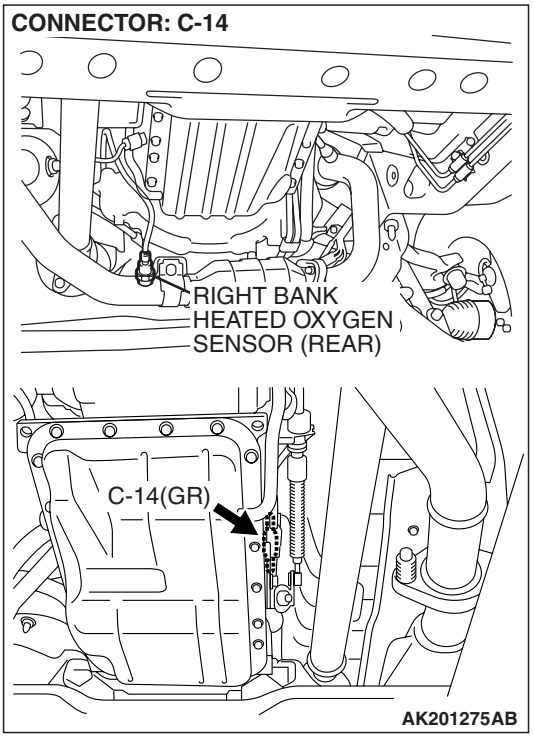
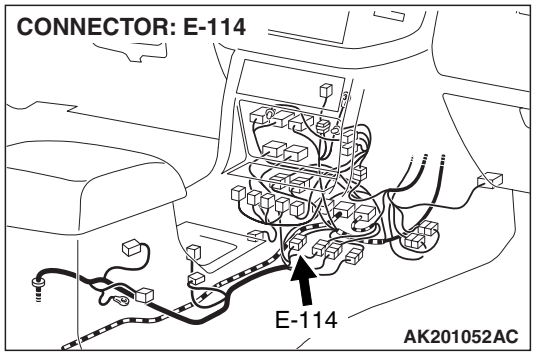
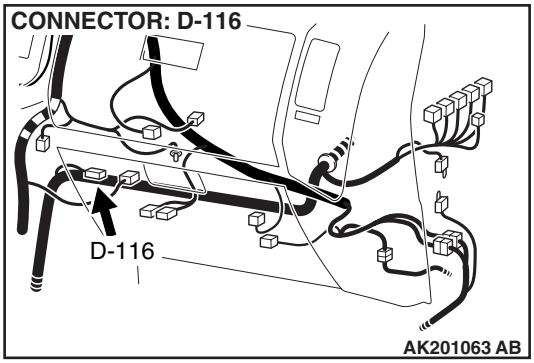










CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 1) to the right bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 24) controls continuity to the right bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

- Not applicable

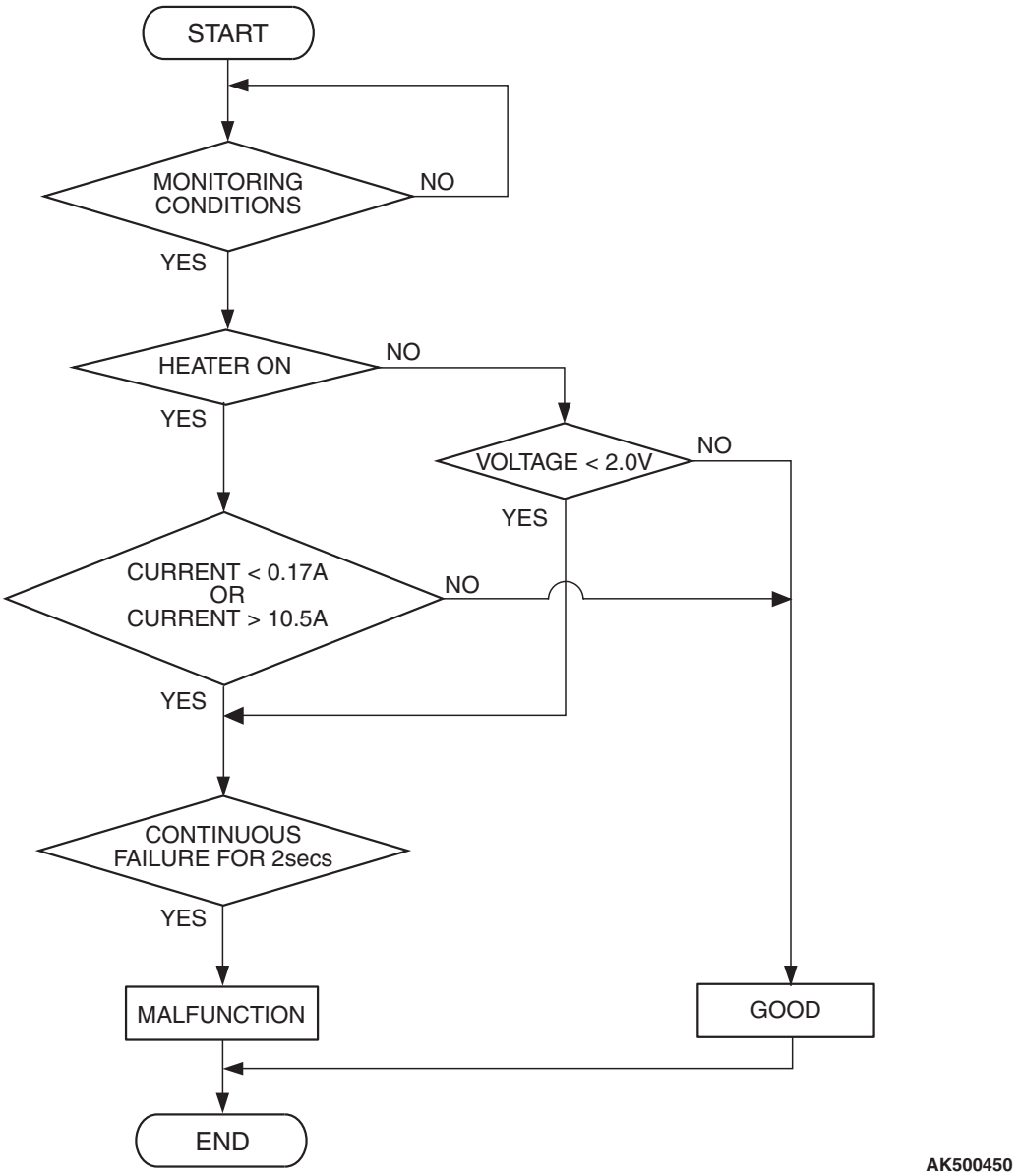
Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

TSB Revision

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

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

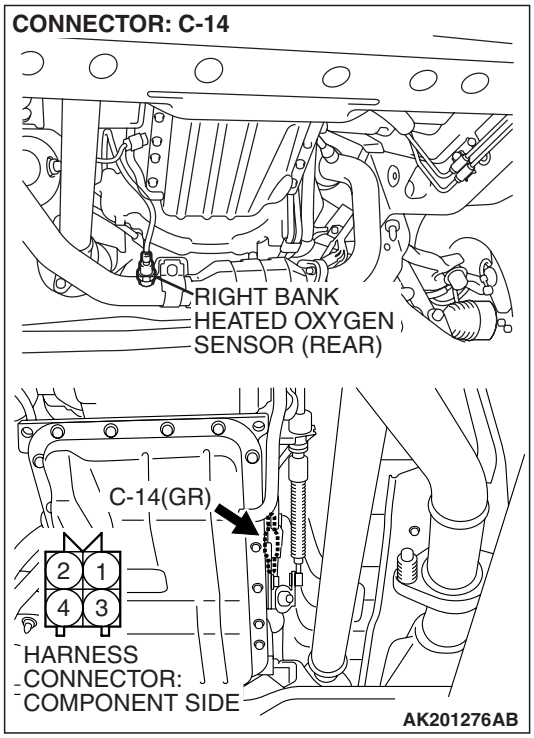
TSB Revision

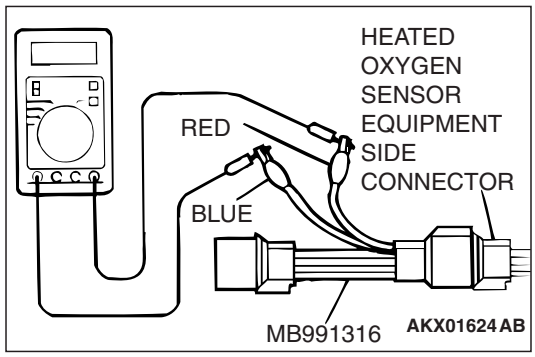
DIAGNOSIS

Required Special Tool:
- MB991316: Test Harness

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

(1) Disconnect right bank heated oxygen sensor (rear) connector C-14 and connect test harness special tool, MB991316, to the connector on the right bank heated oxygen (rear) sensor side.





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

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

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

YES : Go to Step 2.

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

STEP 2. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0038 set?

YES : Replace the PCM. Then go to Step 3.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

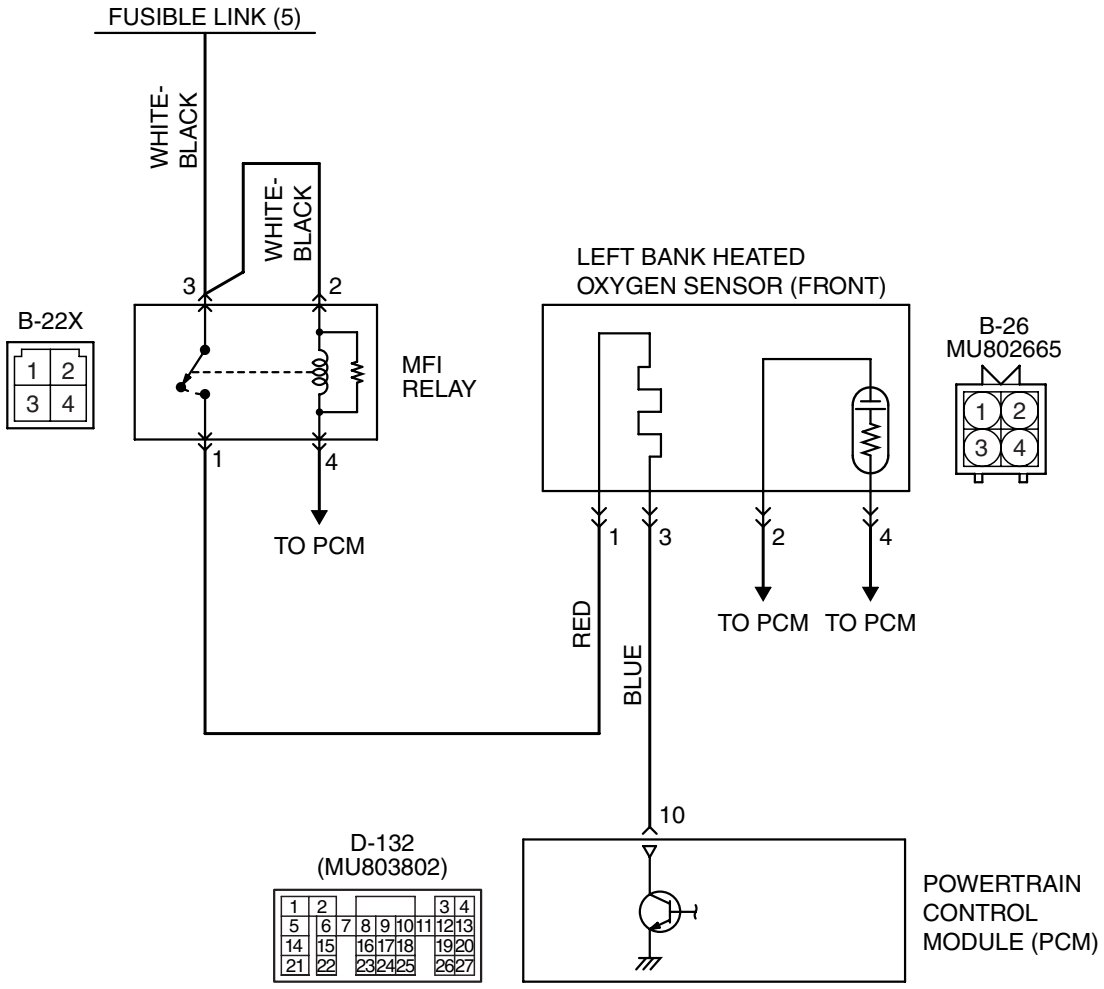
Q: Is DTC P0038 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

Left Bank Heated Oxygen Sensor (front) Heater Circuit



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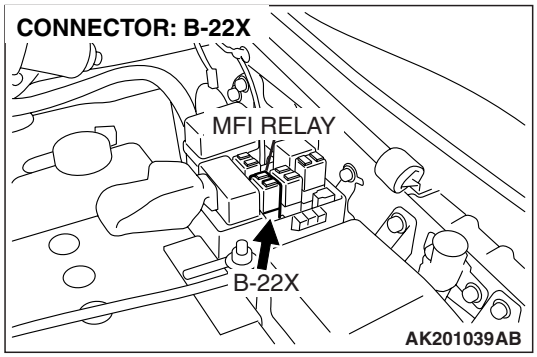
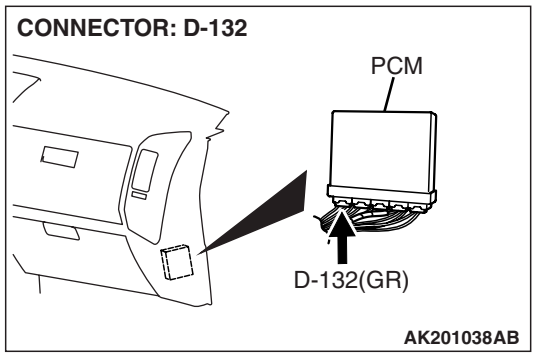
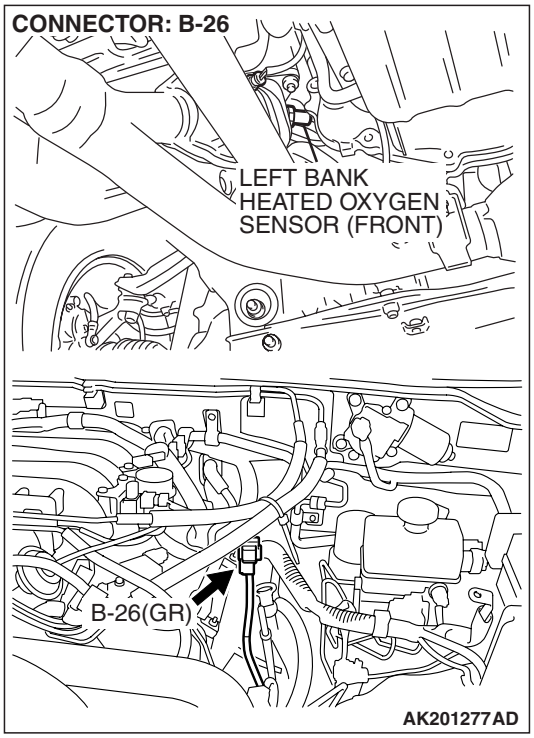






CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 1) to the left bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 10) controls continuity to the left bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

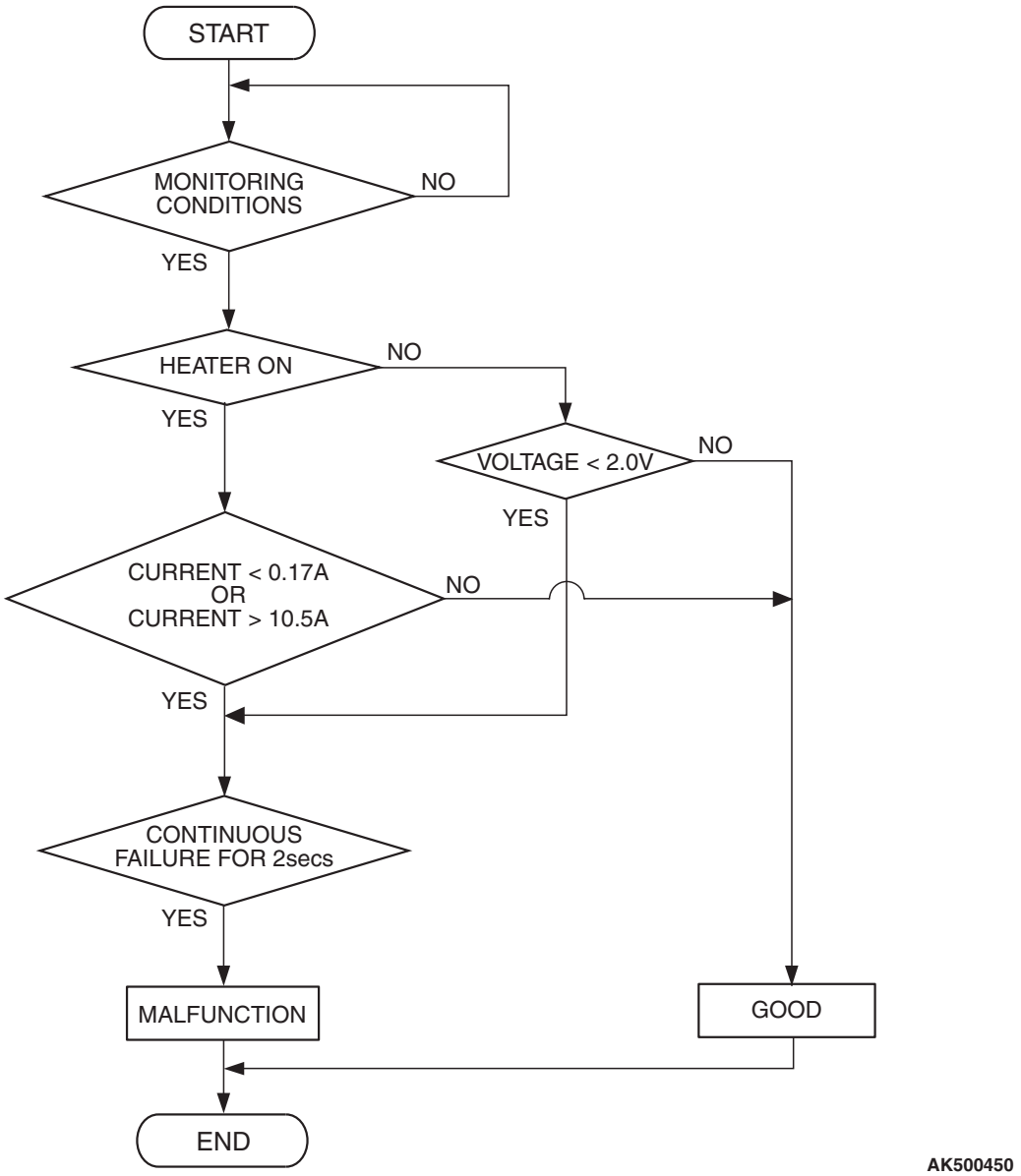
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

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

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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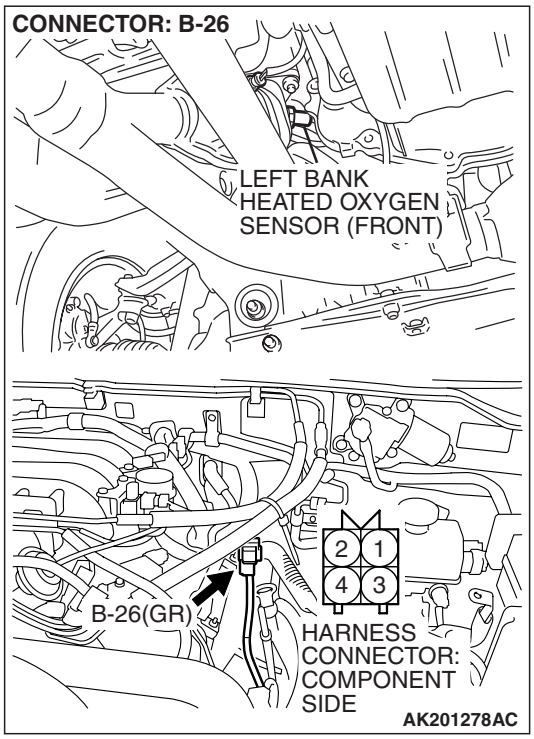
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Open or shorted left bank heated oxygen sensor (front) heater circuit, or harness damage.
- Left bank heated oxygen sensor (front) heater failed.
- Connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

- MB991316: Test Harness

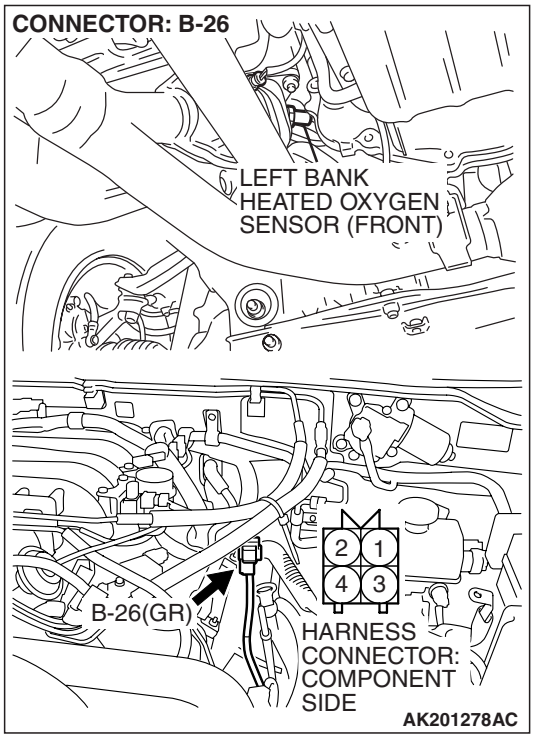


STEP 1. Check harness connector B-26 at the left bank heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

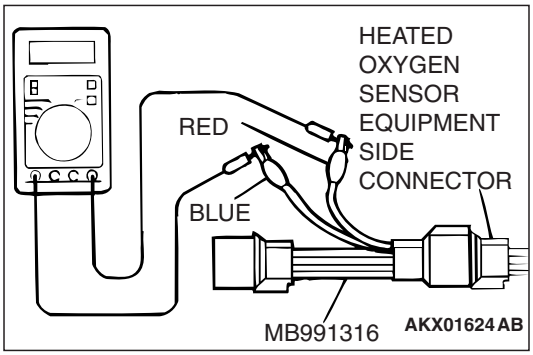
YES : Go to Step 2.

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



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

(1) Disconnect left bank heated oxygen sensor (front) connector B-26 and connect test harness special tool, MB991316, to the connector on the left bank heated oxygen (front) sensor side.



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

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

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

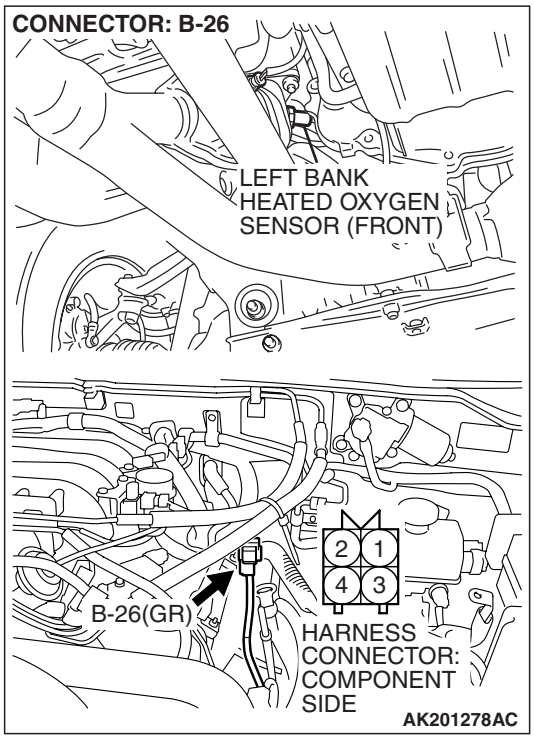
YES : Go to Step 3.

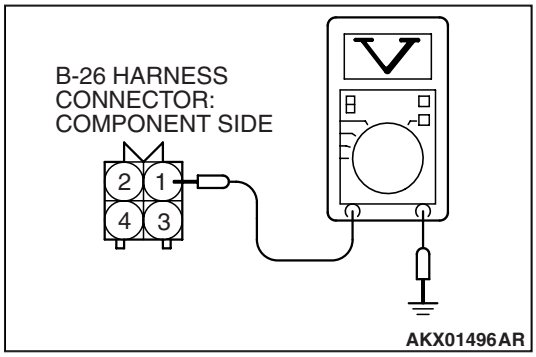
NO : Replace the left bank heated oxygen sensor (front). Then go to Step 12.

STEP 3. Measure the power supply voltage at left bank heated oxygen sensor (front) harness side connector B-26.

(1) Disconnect the connector B-26 and measure at the harness side.

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





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

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

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

YES : Go to Step 5.

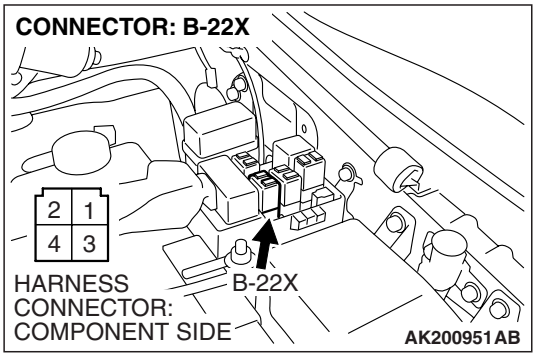
NO : Go to Step 4.

STEP 4. Check harness connector B-22X at the MFI relay for damage.

Q: Is the harness connector in good condition?

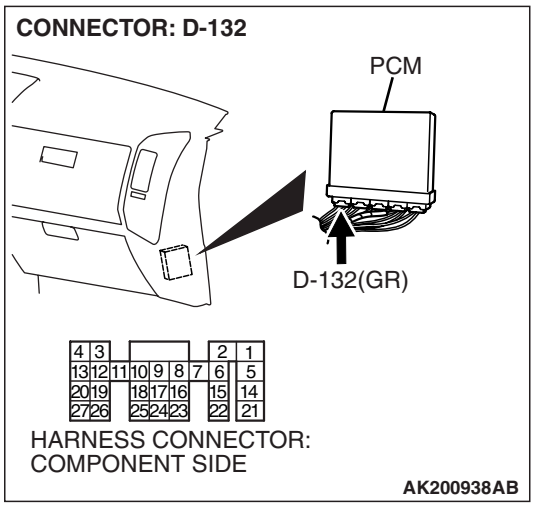
YES : Repair harness wire between MFI relay connector B-22X (terminal No. 1) and left bank heated oxygen sensor (front) connector B-26 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

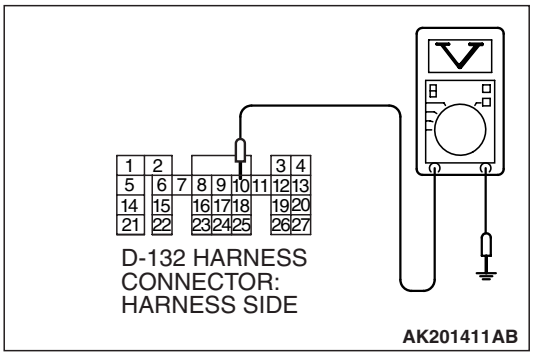
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 5. Measure the power supply voltage at PCM connector D-132 by backprobing.

(1) Do not disconnect the connector D-132.
(2) Turn the ignition switch to the "ON" position.





(3) Measure the voltage between terminal No. 10 and ground by backprobing.
- Voltage should be battery positive voltage.

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

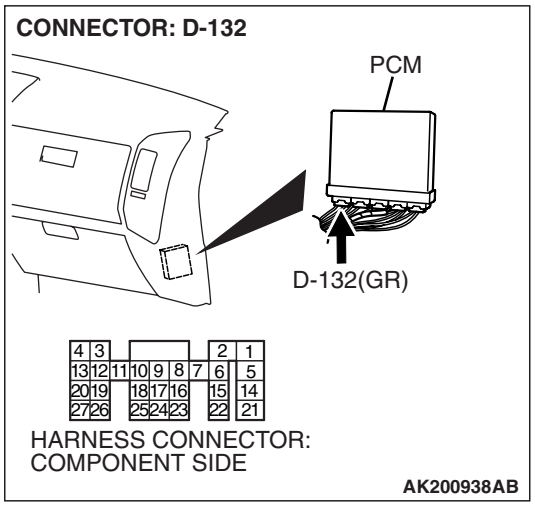
Q: Is battery positive voltage (approximately 12 volts) present?

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

STEP 6. Check harness connector D-132 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

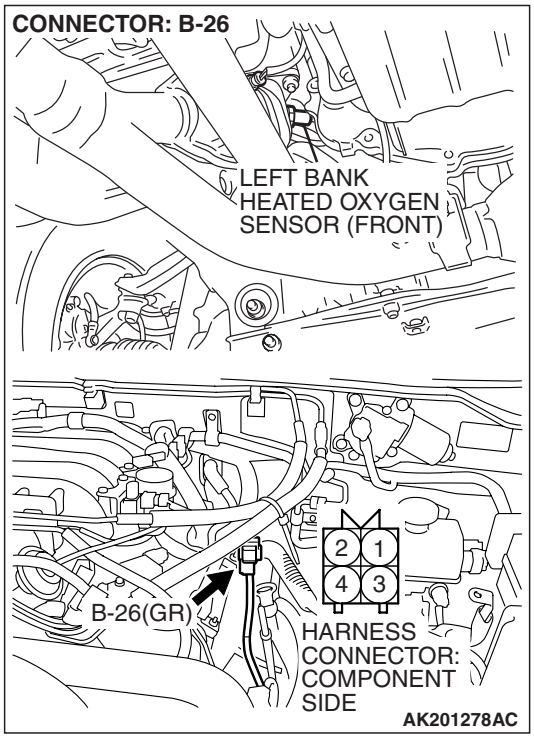


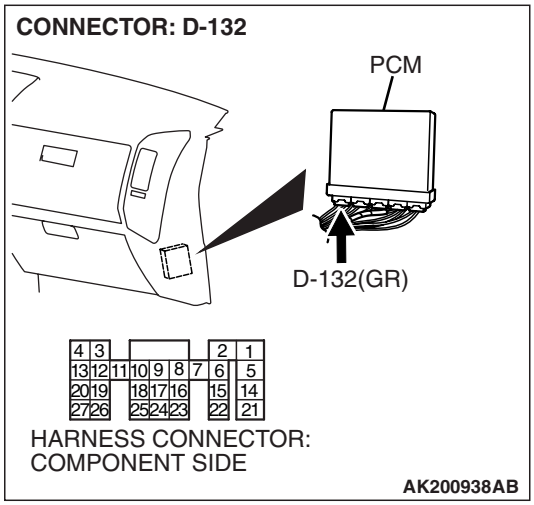
STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (front) connector B-26 (terminal No. 3) and PCM connector D-132 (terminal No. 10).

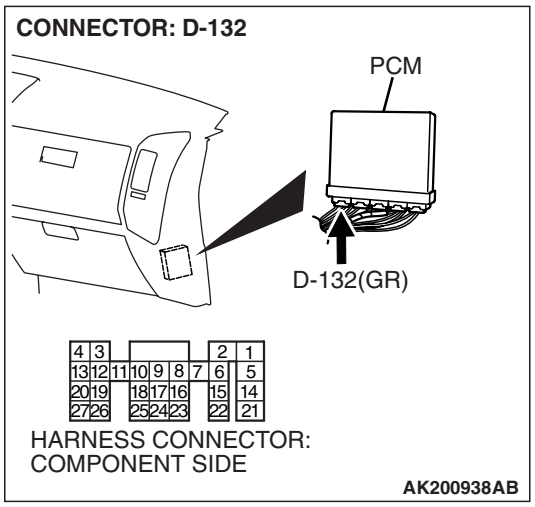
Q: Is the harness wire in good condition?

YES : Replace the PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.





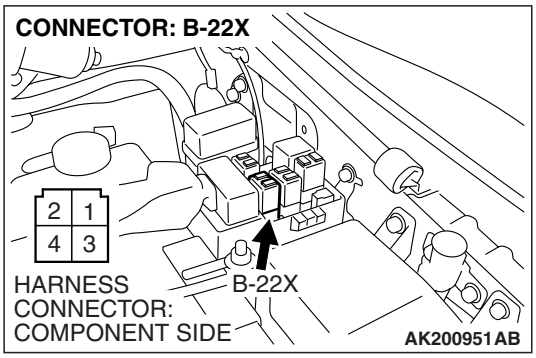


STEP 8. Check harness connector D-132 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

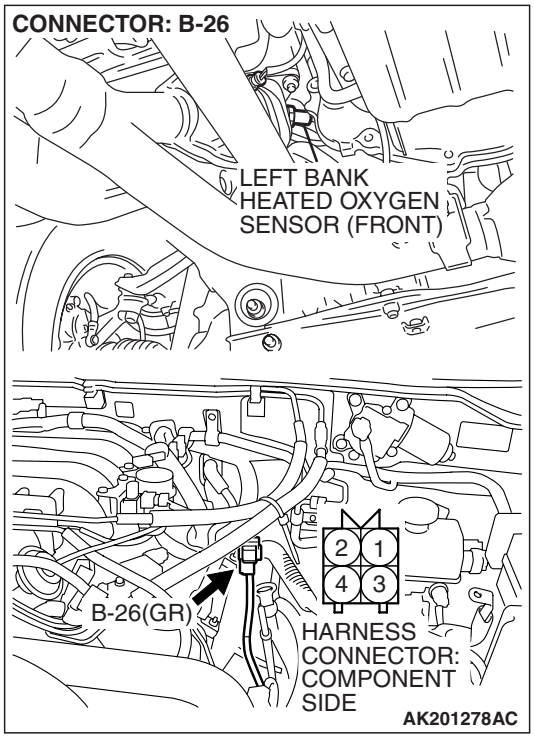


STEP 9. Check for harness damage between MFI relay connector B-22X (terminal No. 1) and left bank heated oxygen sensor (front) connector B-26 (terminal No. 1).

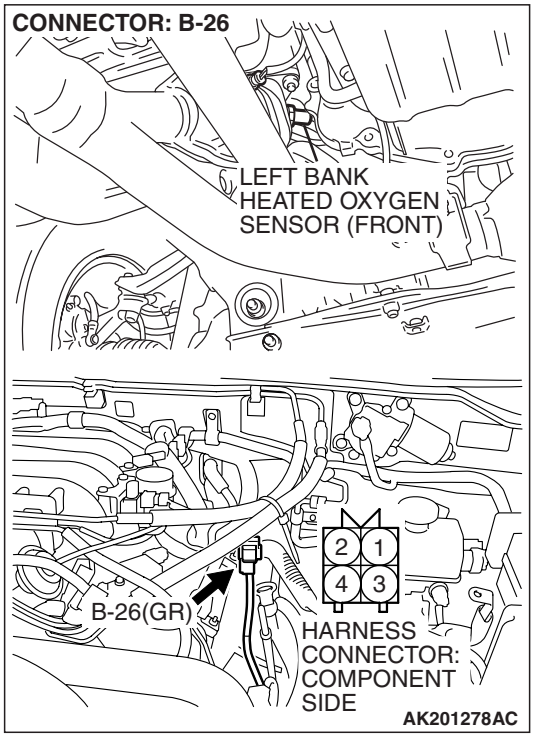
Q: Is the harness wire in good condition?

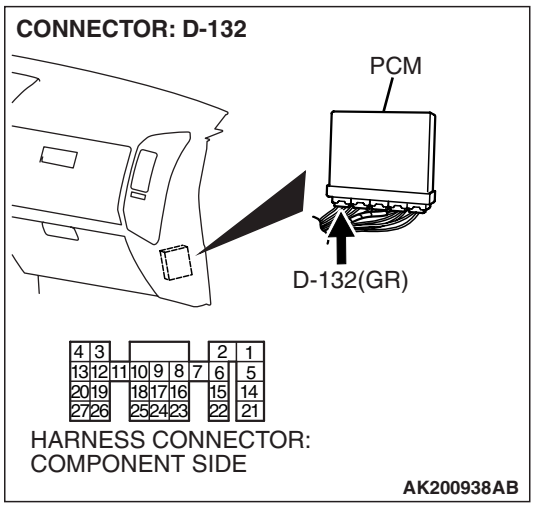
YES : Go to Step 10.

NO : Repair it. Then go to Step 12.



TSB Revision





STEP 10. Check for harness damage between left bank heated oxygen sensor (front) connector B-26 (terminal No. 3) and PCM connector D-132 (terminal No. 10).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0051 set?

YES : Replace the PCM. Then go to Step 12.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

TSB Revision

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

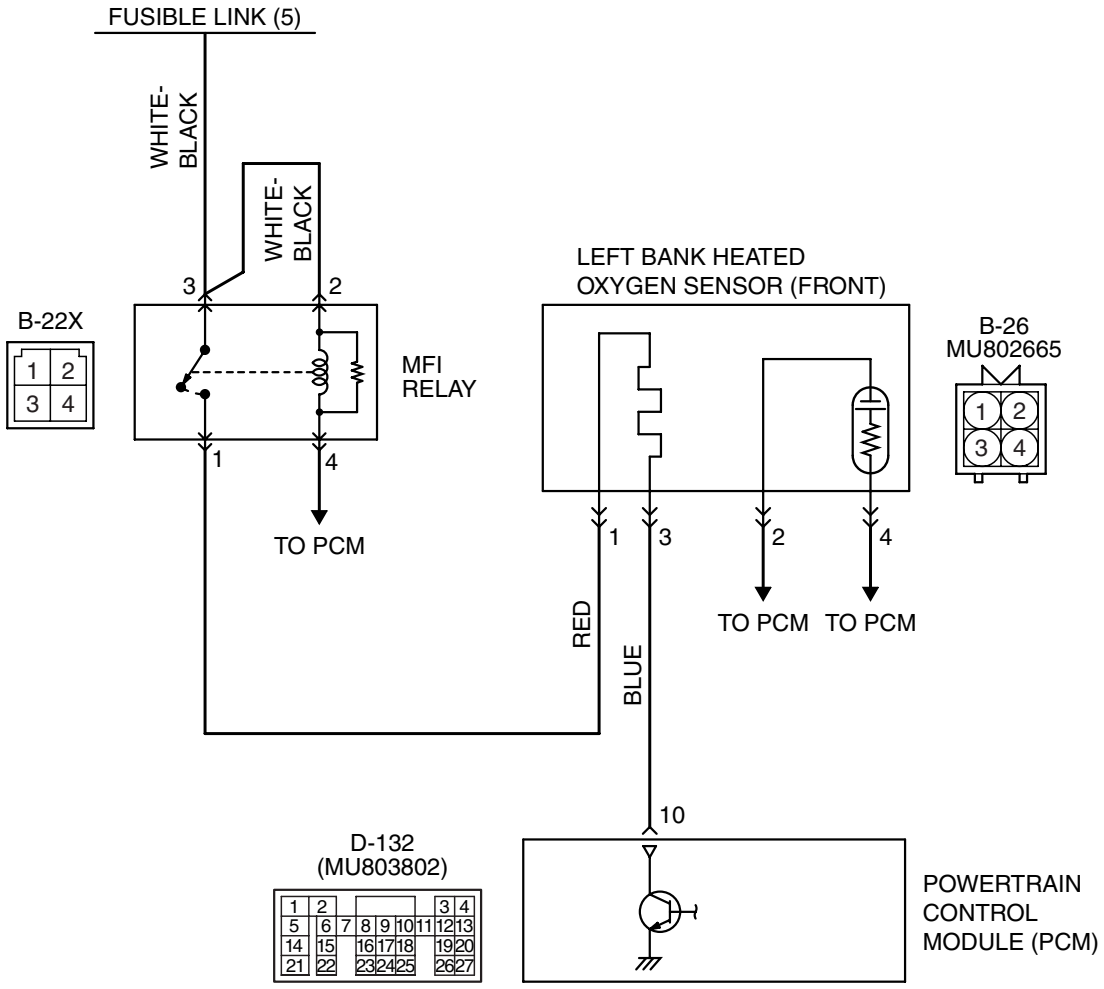
Q: Is DTC P0051 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

Left Bank Heated Oxygen Sensor (front) Heater Circuit



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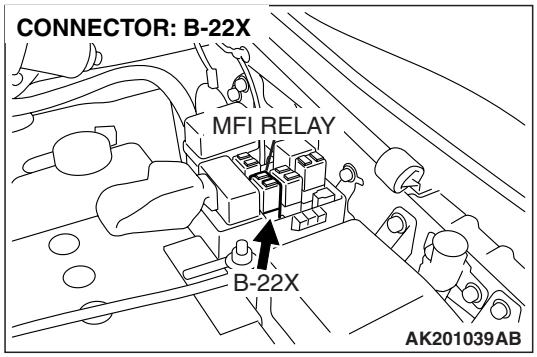
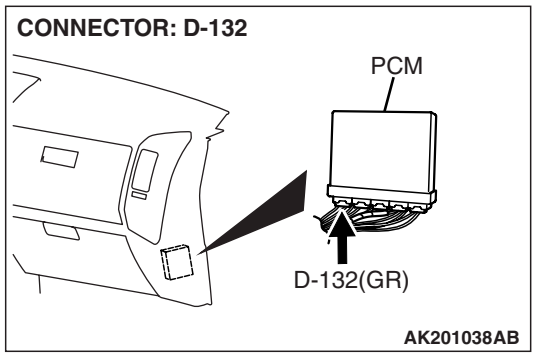
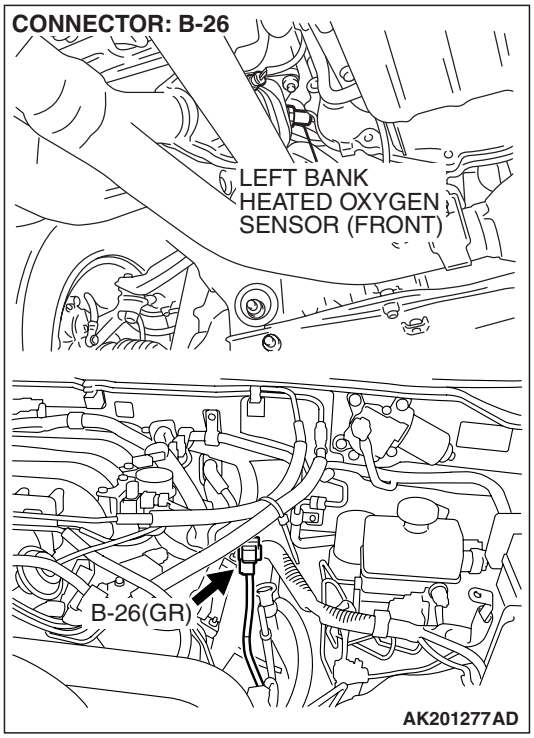






CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 1) to the left bank heated oxygen sensor (front) heater.
- The PCM (terminal No. 10) controls continuity to the left bank heated oxygen sensor (front) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

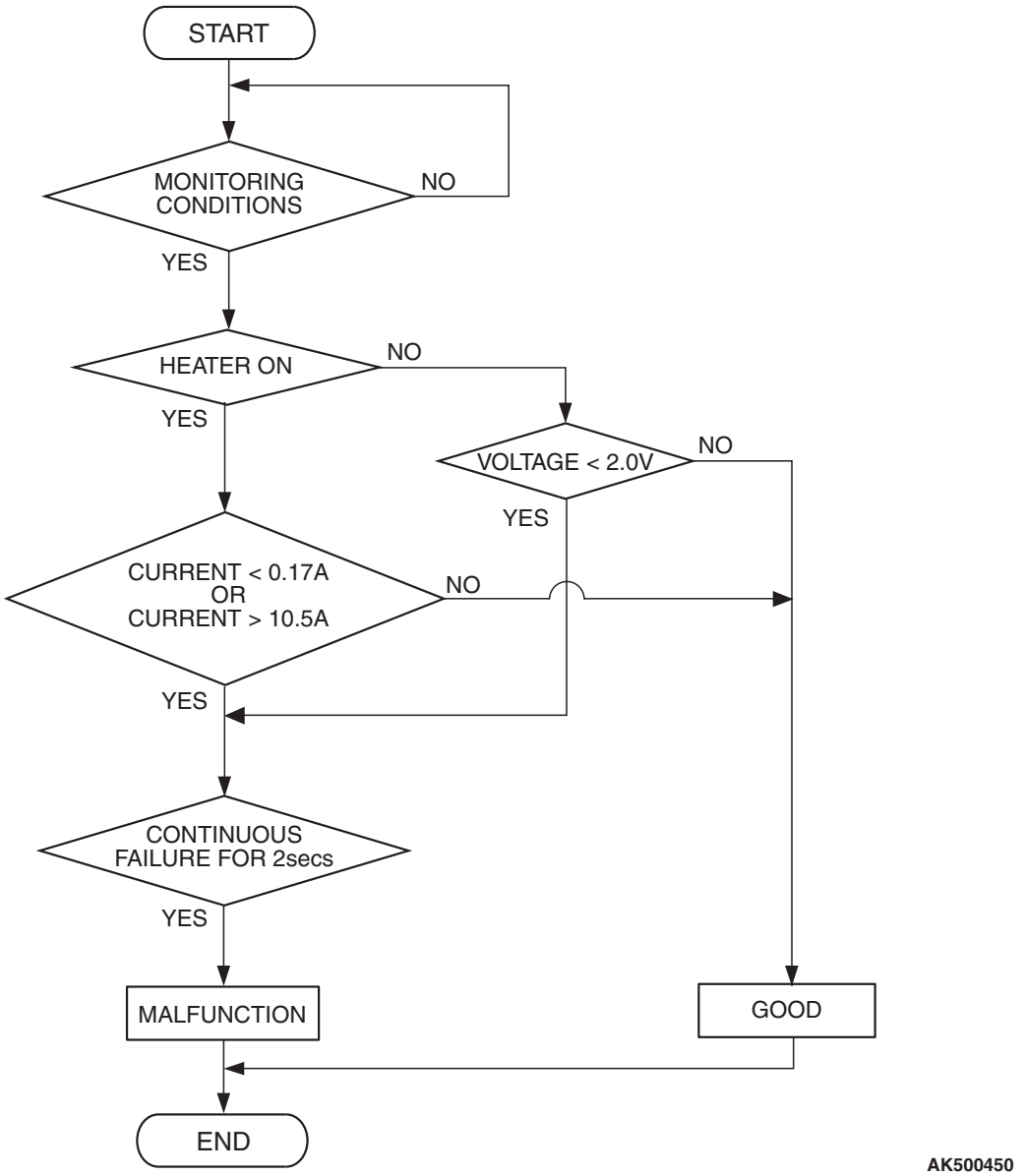
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

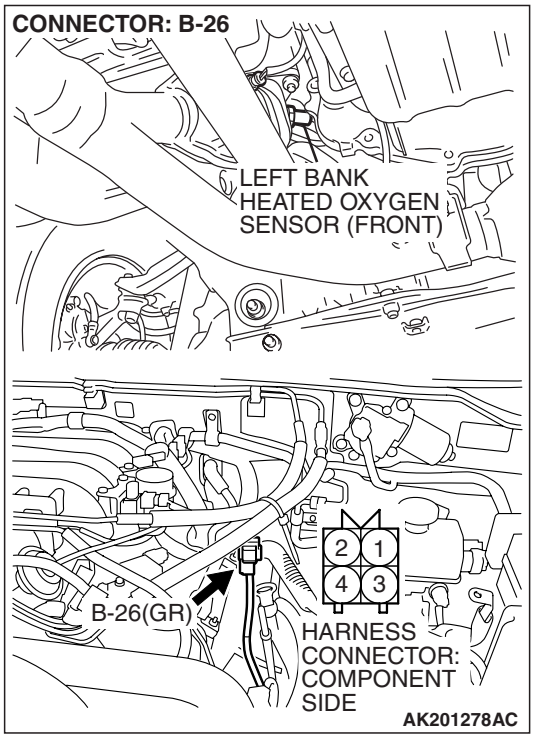
- Left bank heated oxygen sensor (front) heater failed.
- PCM failed.

TSB Revision

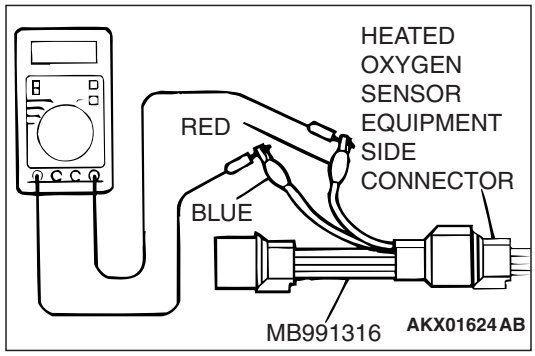
DIAGNOSIS

Required Special Tool:
- MB991316: Test Harness

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



(1) Disconnect left bank heated oxygen sensor (front) connector B-26 and connect test harness special tool, MB991316, to the connector on the left bank heated oxygen (front) sensor side.



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

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

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

YES : Go to Step 2.

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

STEP 2. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0052 set?

YES : Replace the PCM. Then go to Step 3.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

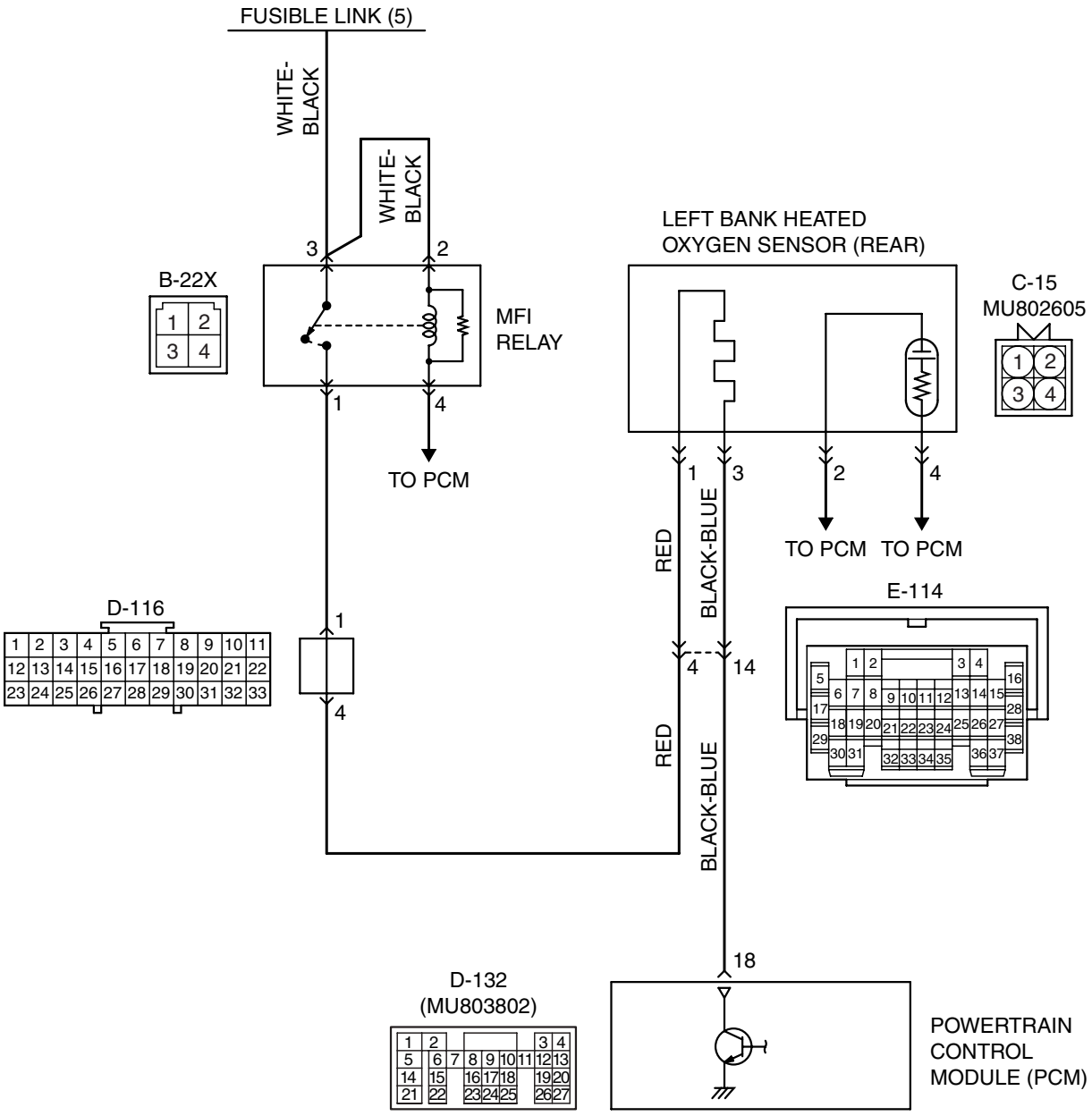
Q: Is DTC P0052 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0057: Heated Oxygen Sensor Heater Control Circuit Low (bank 2, sensor 2)

Left Bank Heated Oxygen Sensor (rear) Heater Circuit



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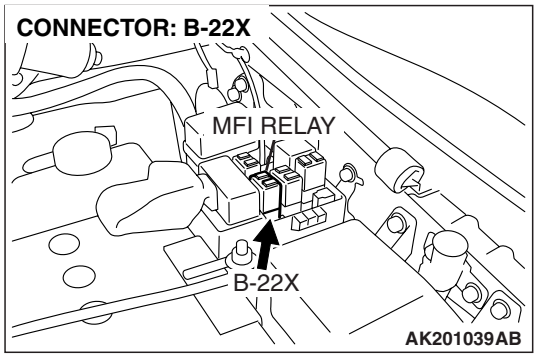
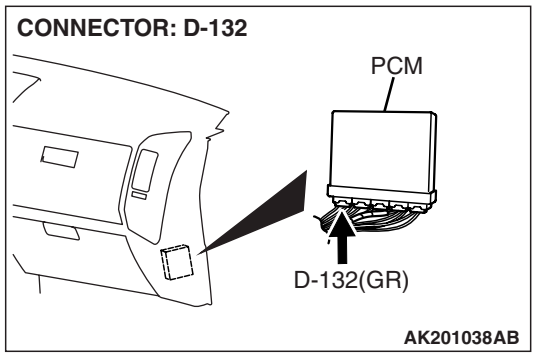
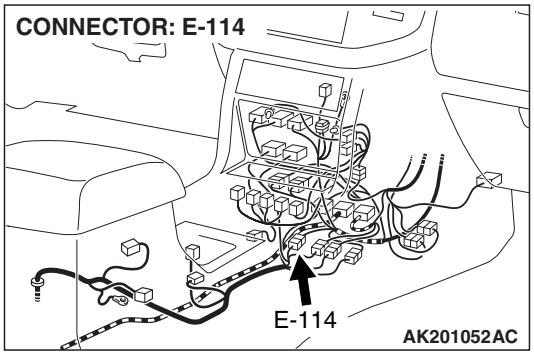
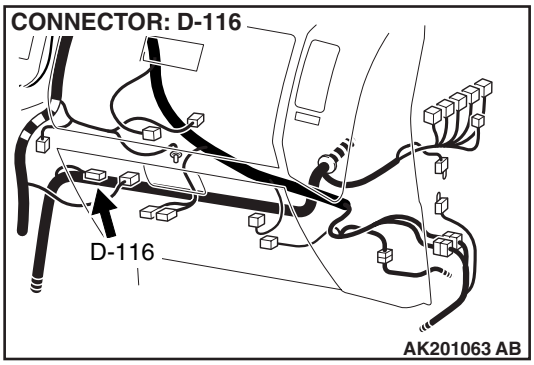
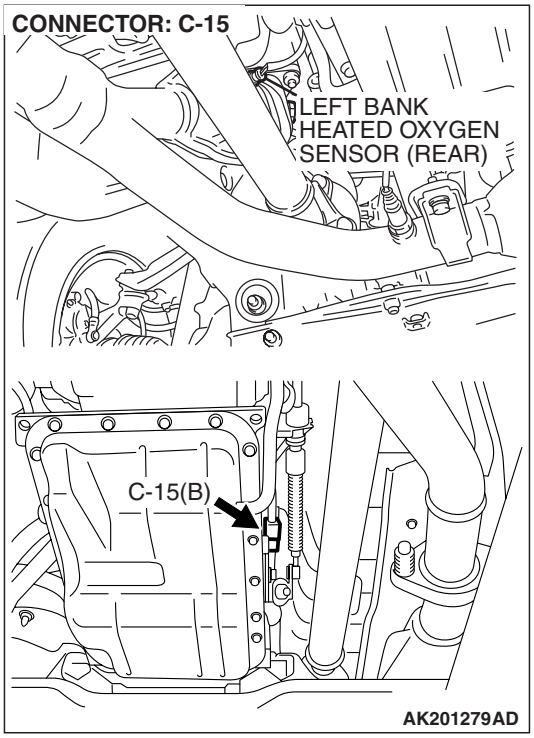
TSB Revision











CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 1) to the left bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 18) controls continuity to the left bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

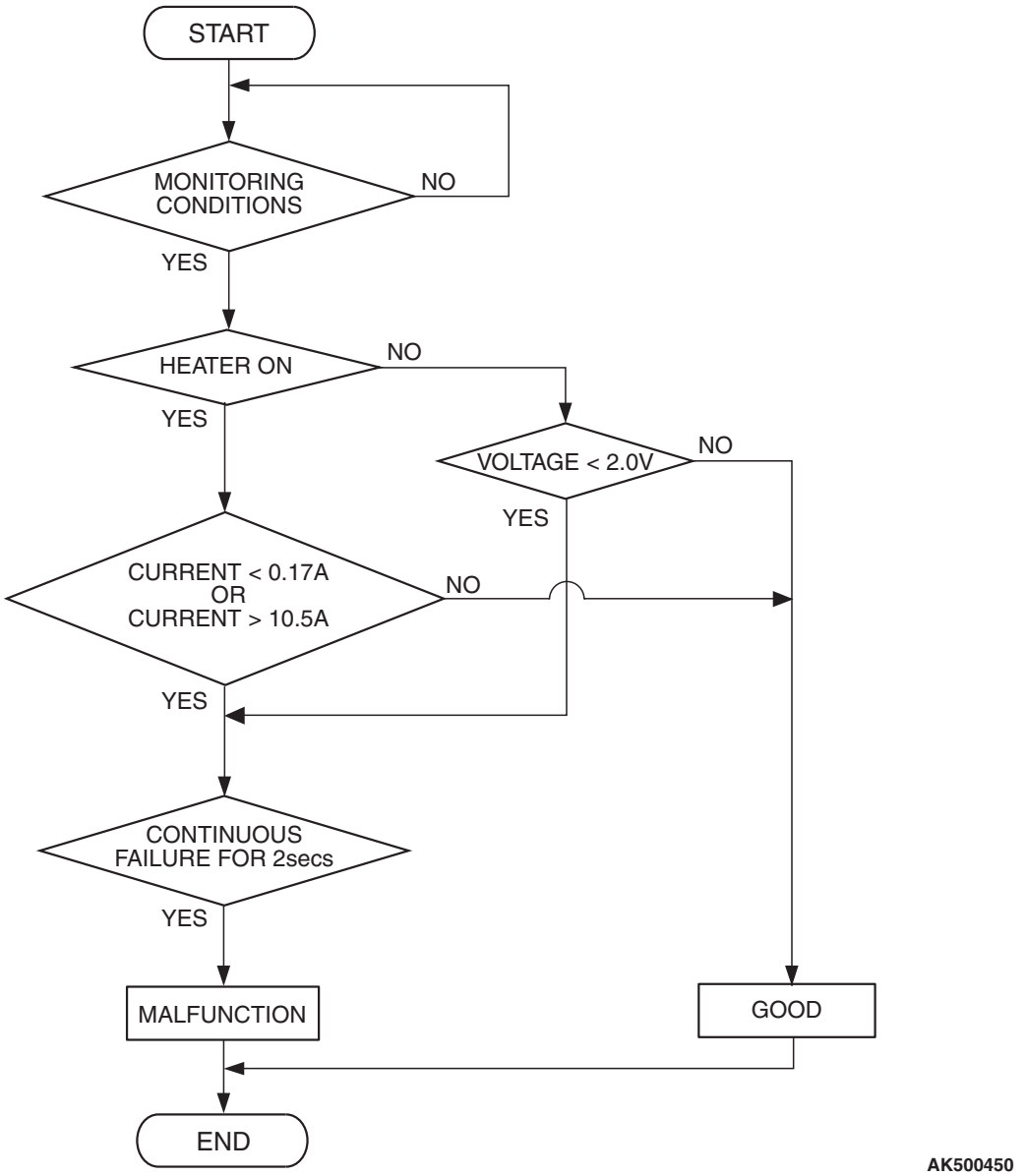
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

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

Check Conditions

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

Judgement Criterion

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

TSB Revision

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

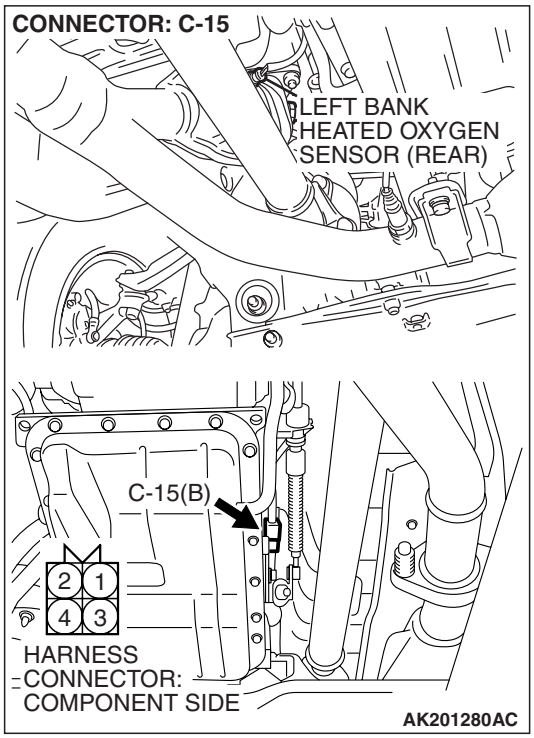
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Open or shorted left bank heated oxygen sensor (rear) heater circuit, or harness damage.
- Left bank heated oxygen sensor (rear) heater failed.
- Connector damage failed.
- PCM failed.

DIAGNOSIS

Required Special Tool:

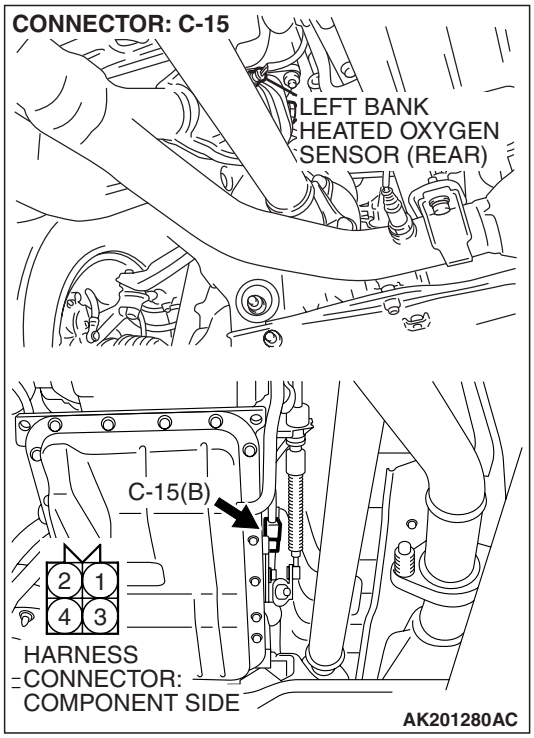
- MD998464: Test Harness



STEP 1. Check harness connector C-15 at the left bank heated oxygen sensor (rear) for damage.
Q: Is the harness connector in good condition?

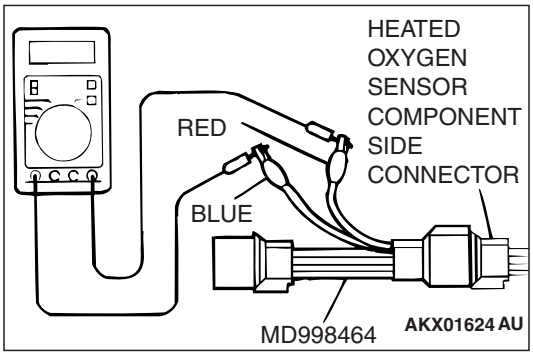
YES : Go to Step 2.

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



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

(1) Disconnect left bank heated oxygen sensor (rear) connector C-15 and connect test harness special tool, MD998464, to the connector on the left bank heated oxygen (rear) sensor side.



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

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

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

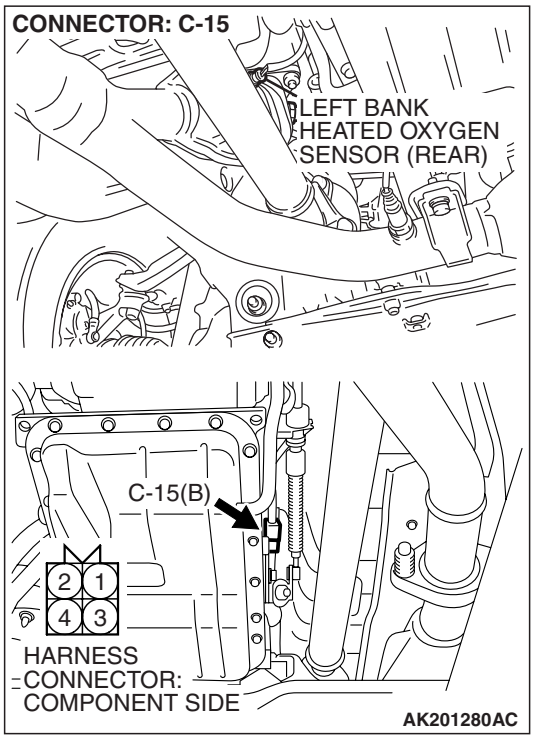
YES : Go to Step 3.

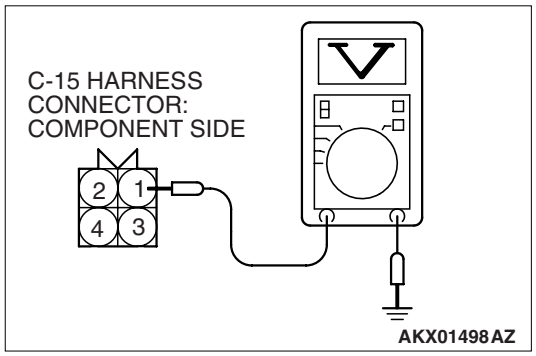
NO : Replace the left bank heated oxygen sensor (rear). Then go to Step 12.

STEP 3. Measure the power supply voltage at left bank heated oxygen sensor (rear) harness side connector C-15.

(1) Disconnect the connector C-15 and measure at the harness side.

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





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

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

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

YES : Go to Step 5.

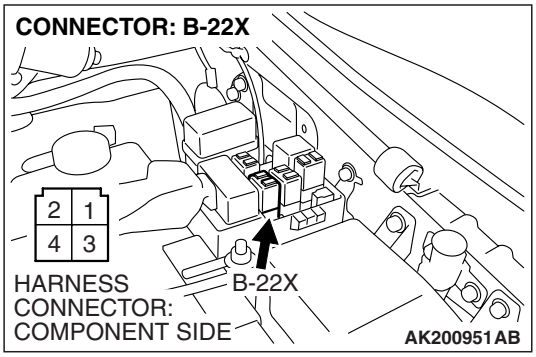
NO : Go to Step 4.

STEP 4. Check harness connector B-22X at the MFI relay for damage.

Q: Is the harness connector in good condition?

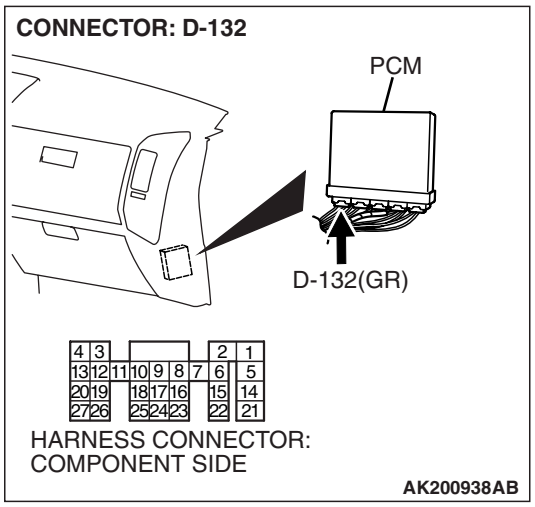
YES : Check harness connectors E-114 and D-116 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If intermediate connectors E-114 and D-116 are in good condition, repair harness wire between MFI relay connector B-22X (terminal No. 1) and left bank heated oxygen sensor (rear) connector C-15 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

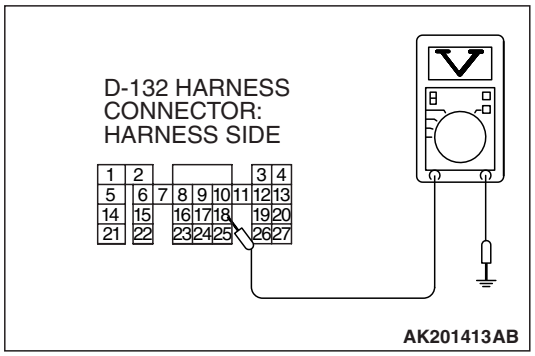
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 5. Measure the power supply voltage at PCM connector D-132 by backprobing.

(1) Do not disconnect the connector D-132.
(2) Turn the ignition switch to the "ON" position.





(3) Measure the voltage between terminal No. 18 and ground by backprobing.
- Voltage should be battery positive voltage.

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

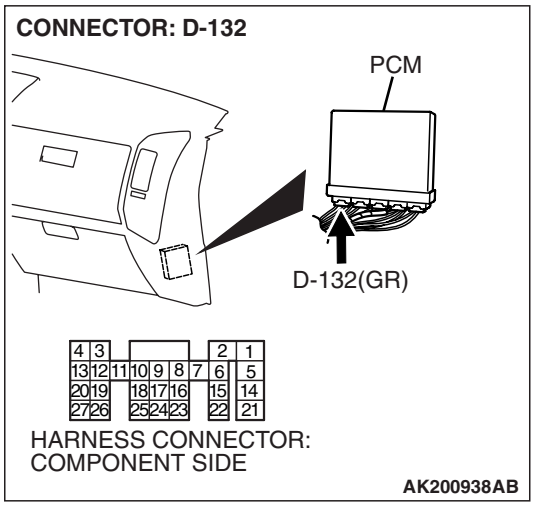
Q: Is battery positive voltage (approximately 12 volts) present?

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

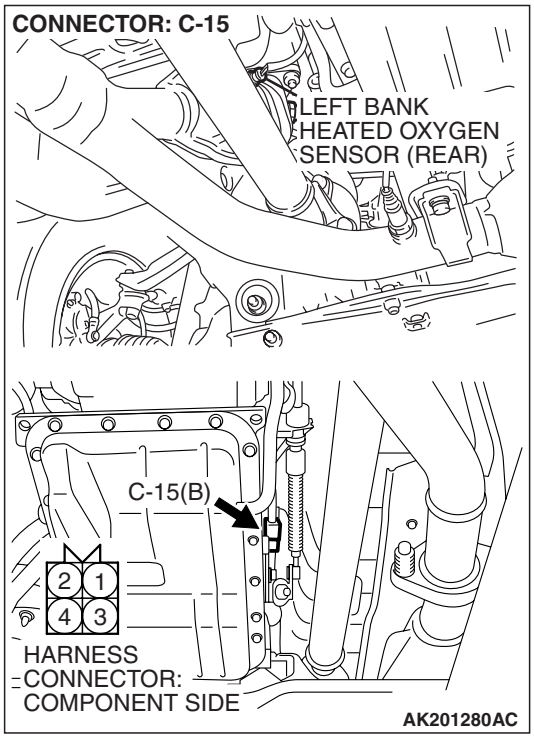
STEP 6. Check harness connector D-132 at PCM for damage.

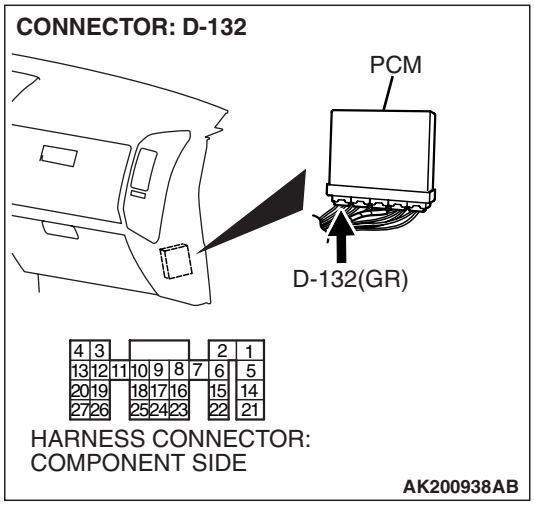
Q: Is the harness connector in good condition?

YES : Go to Step 7.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (rear) connector C-15 (terminal No. 3) and PCM connector D-132 (terminal No. 18).

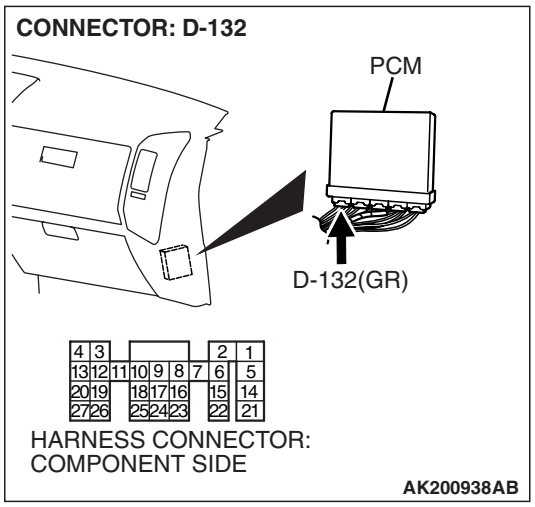




NOTE: Check harness after checking intermediate connector E-114. If intermediate connector E-114 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Replace PCM. Then go to Step 12.
NO : Repair it. Then go to Step 12.



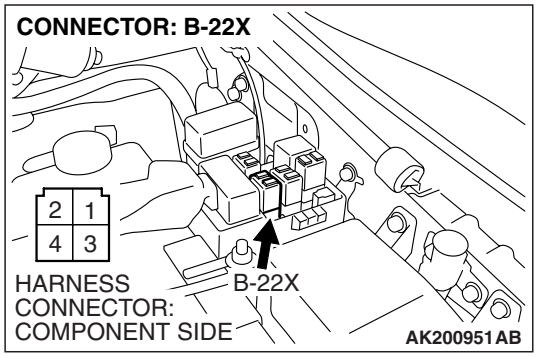
STEP 8. Check harness connector D-132 at PCM for damage.

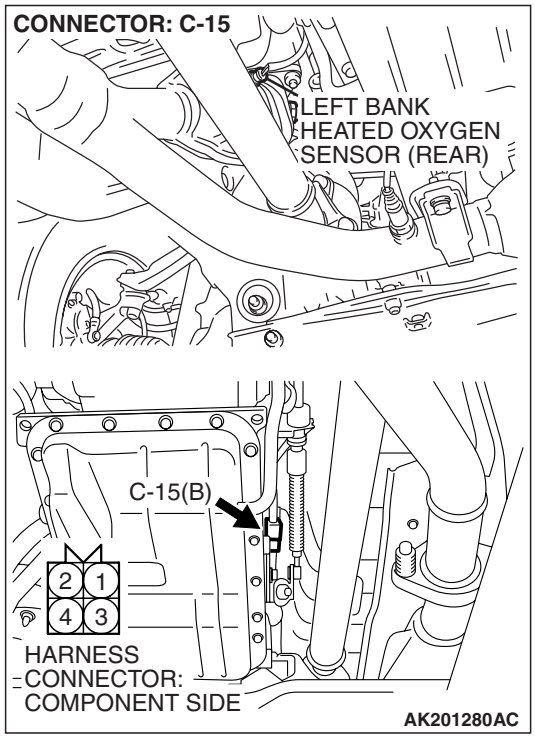
Q: Is the harness connector in good condition?

YES : Go to Step 9.

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

STEP 9. Check for harness damage between MFI relay connector B-22X (terminal No. 1) and left bank heated oxygen sensor (rear) connector C-15 (terminal No. 1).





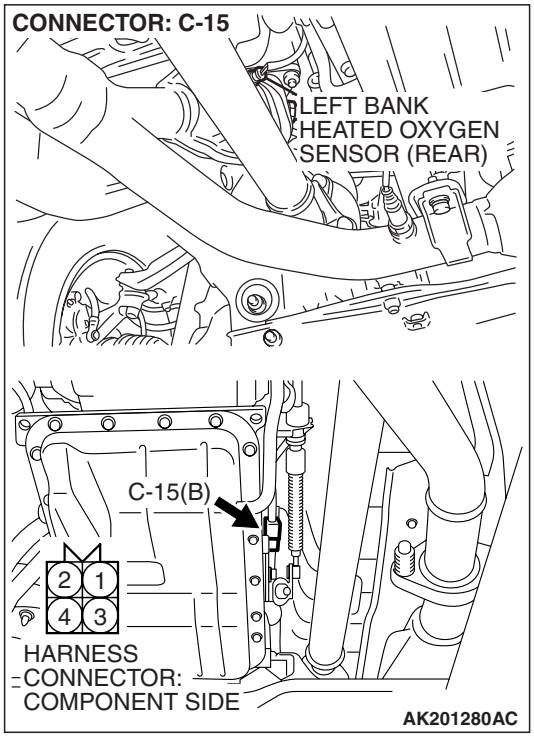
NOTE: Check harness after checking intermediate connectors E-114 and D-116. If intermediate connectors E-114 and D-116 are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.Then go to Step 12.

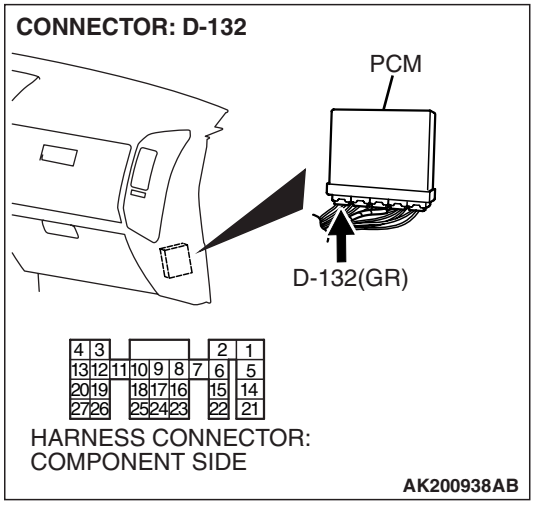
Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between left bank heated oxygen sensor (rear) connector C-15 (terminal No. 3) and PCM connector D-132 (terminal No. 18).





NOTE: Check harness after checking intermediate connector E-114. If intermediate connector E-114 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.Then go to Step 12.

Q: Is the harness wire in good condition?

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

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0057 set?

YES : Replace the PCM. Then go to Step 12.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

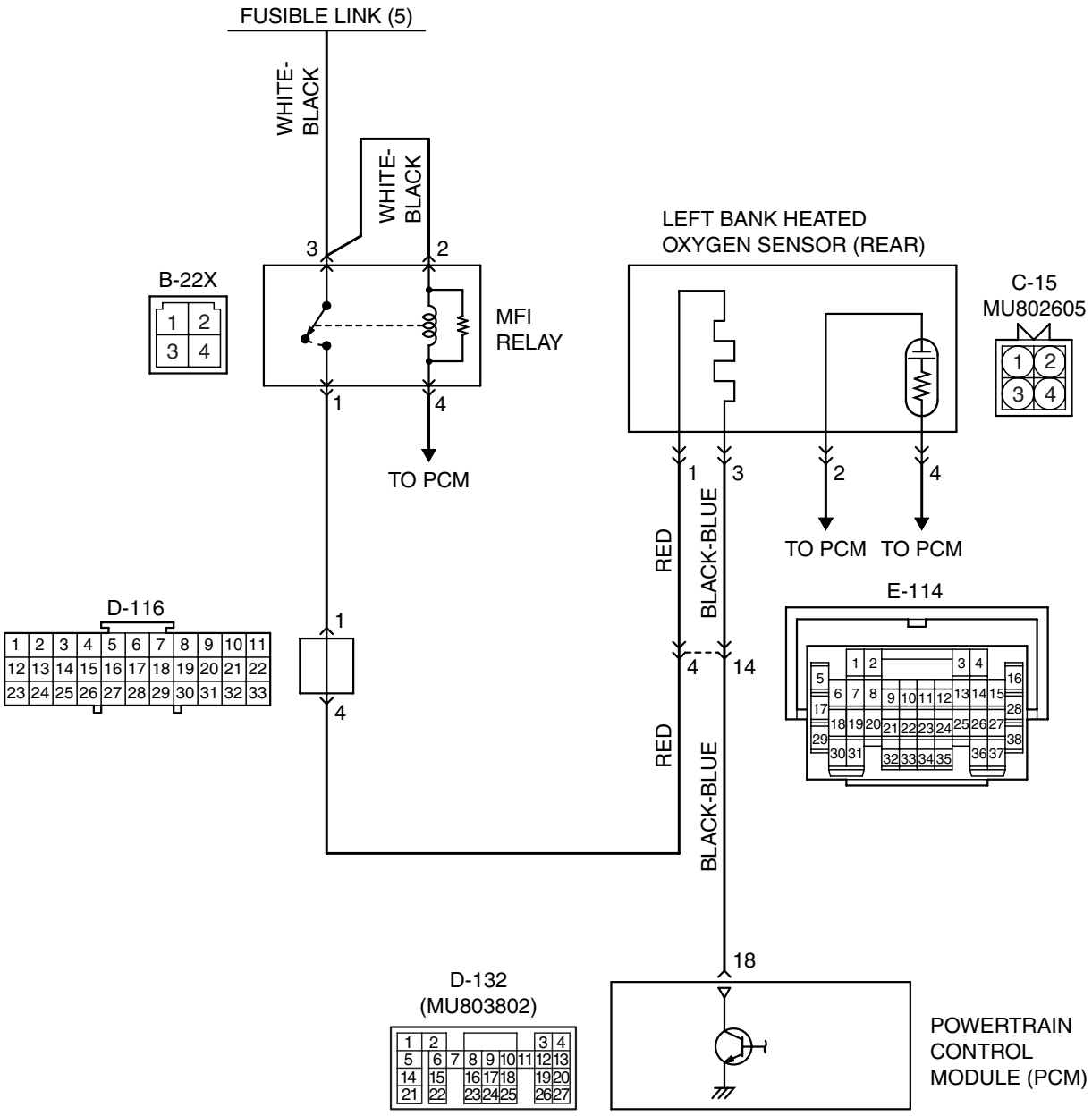
Q: Is DTC P0057 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

Left Bank Heated Oxygen Sensor (rear) Heater Circuit



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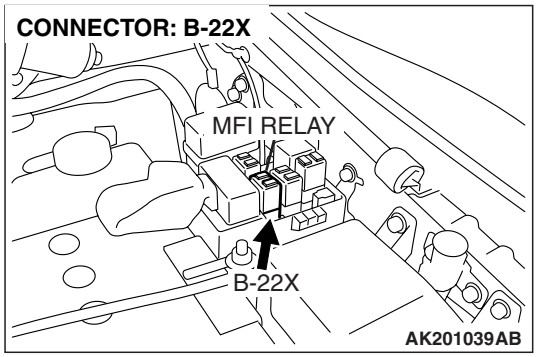
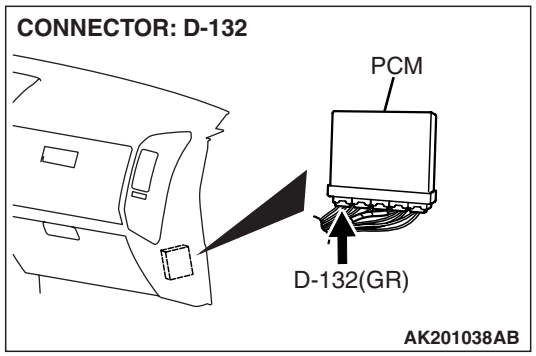
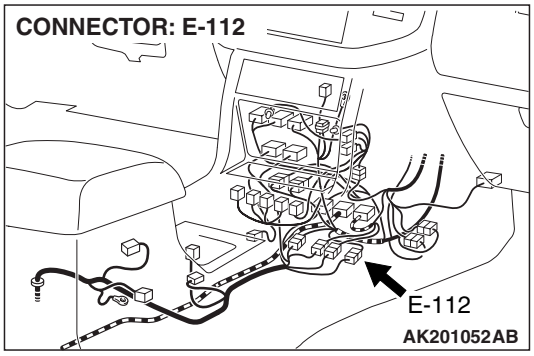
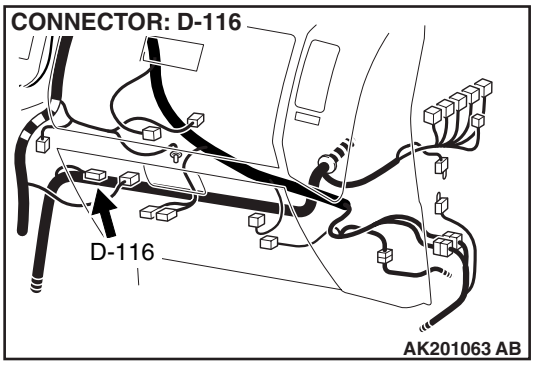
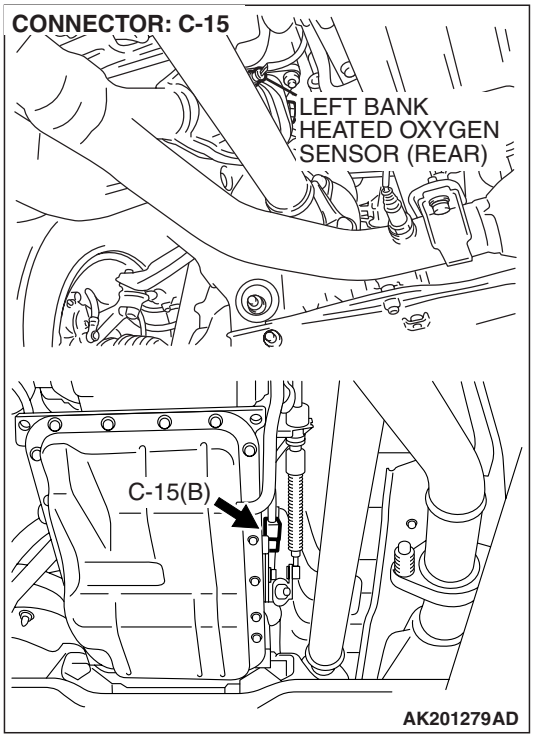
TSB Revision











CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 1) to the left bank heated oxygen sensor (rear) heater.
- The PCM (terminal No. 18) controls continuity to the left bank heated oxygen sensor (rear) heater by turning the power transistor in the PCM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

- Not applicable

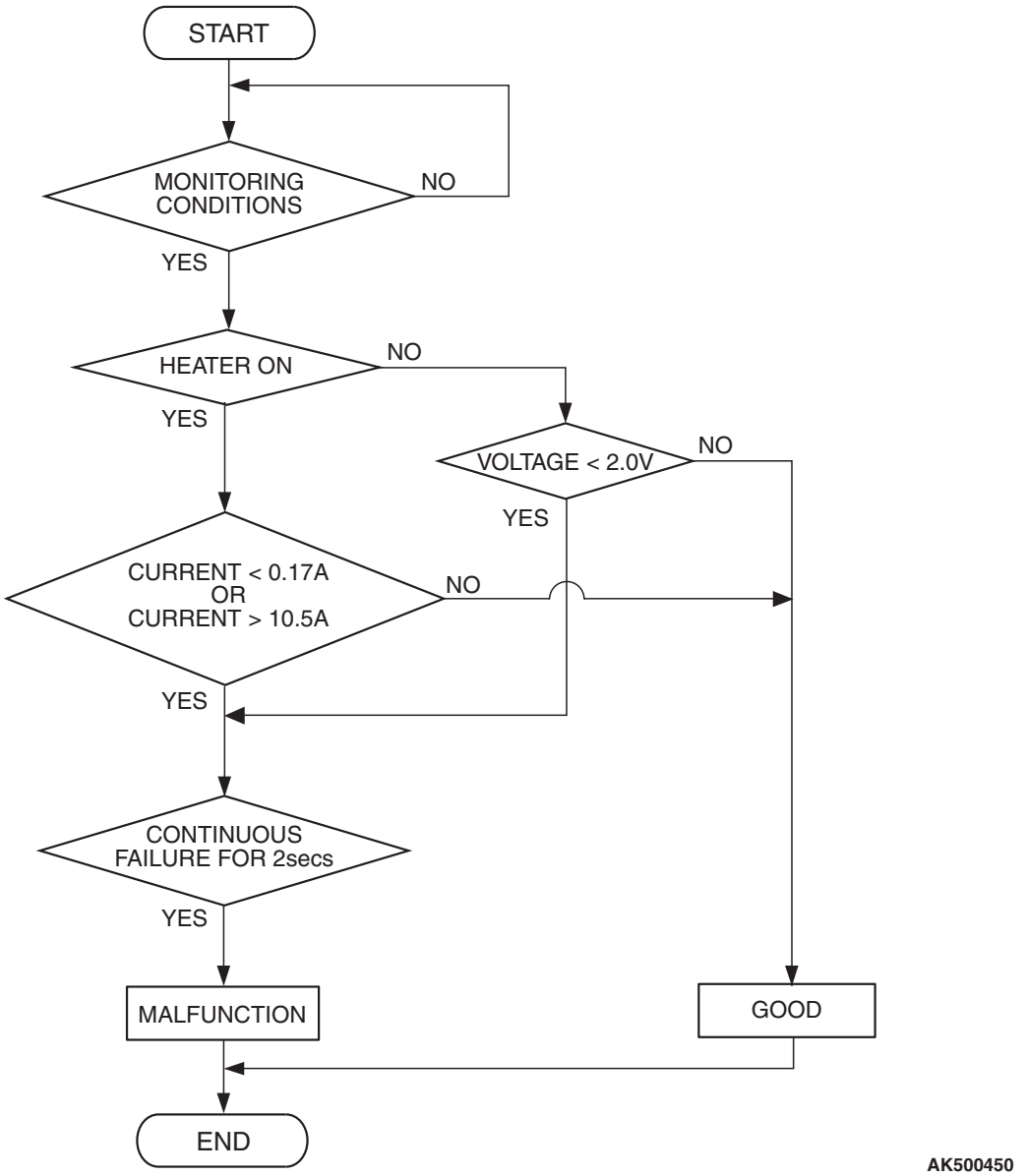
Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

TSB Revision

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

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

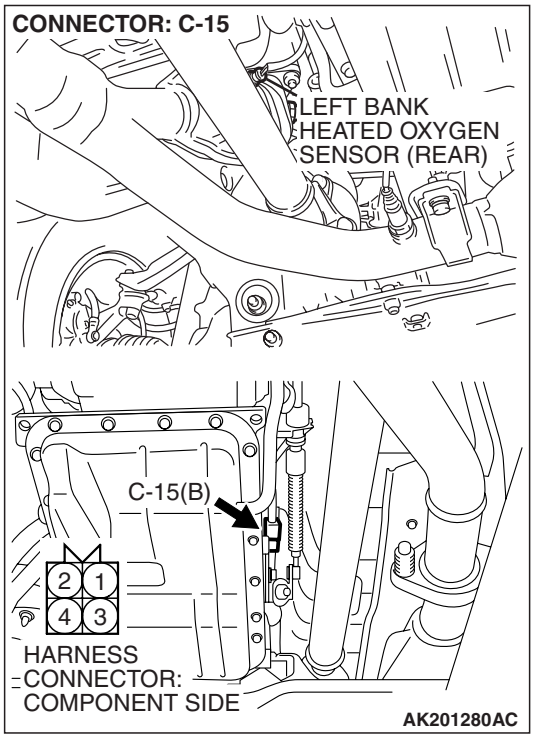
TSB Revision

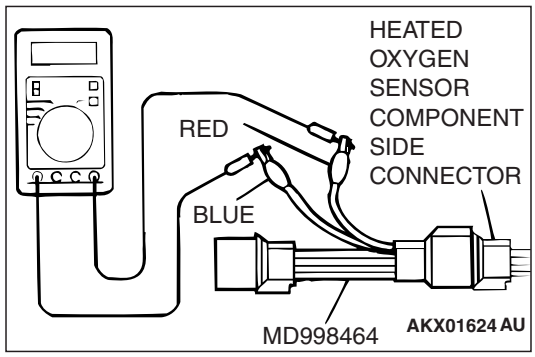
DIAGNOSIS

Required Special Tool:
- MD998464: Test Harness

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

(1) Disconnect left bank heated oxygen sensor (rear) connector C-15 and connect test harness special tool, MD998464, to the connector on the left bank heated oxygen (rear) sensor side.





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

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

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

YES : Go to Step 2.

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

STEP 2. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0058 set?

YES : Replace the PCM. Then go to Step 3.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 3 P.13A-4.

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

Q: Is DTC P0058 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

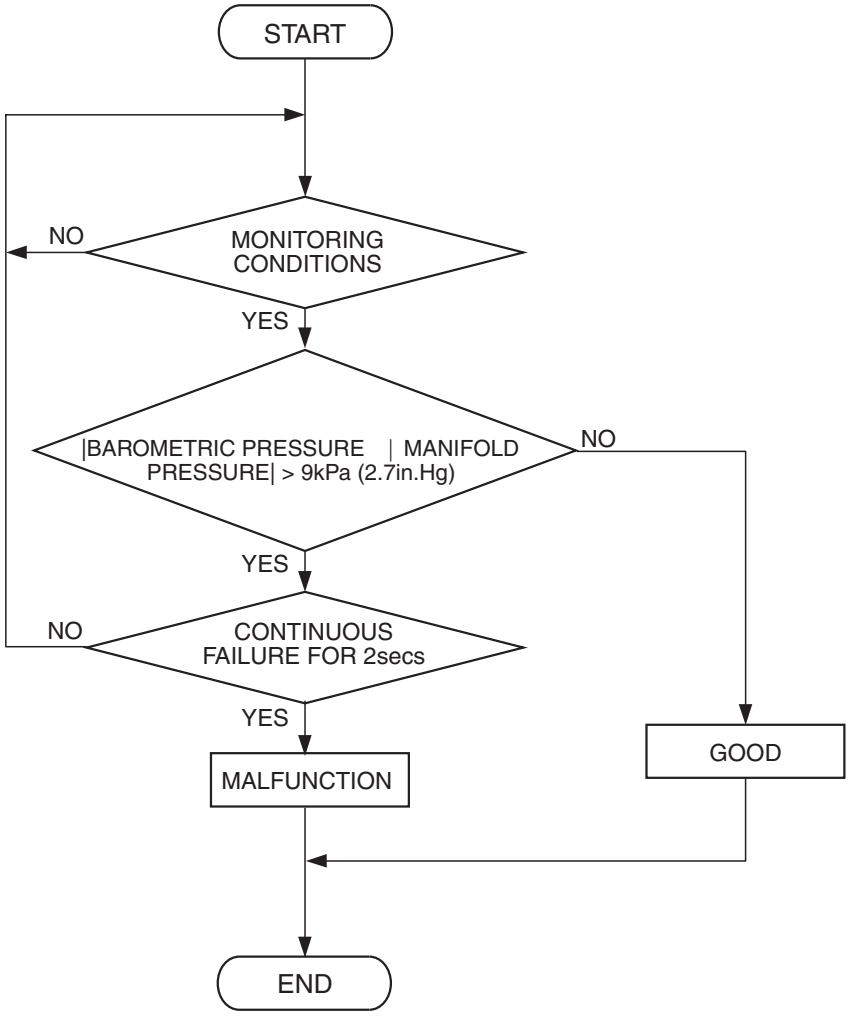
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgment Criterion

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

OBD-II DRIVE CYCLE PATTERN

None.

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

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

DIAGNOSIS

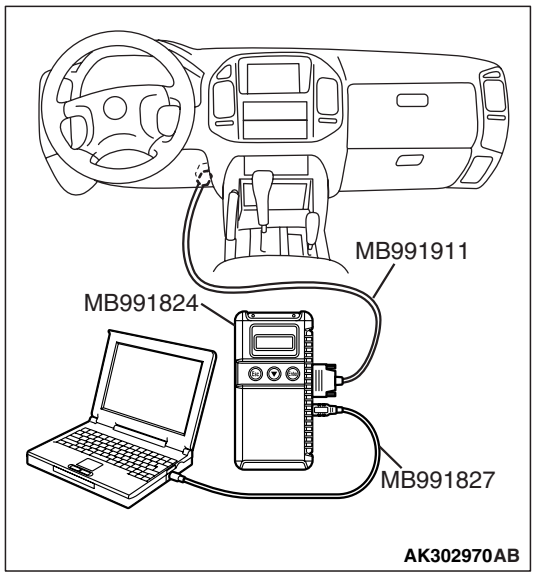
Required Special Tools

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

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.

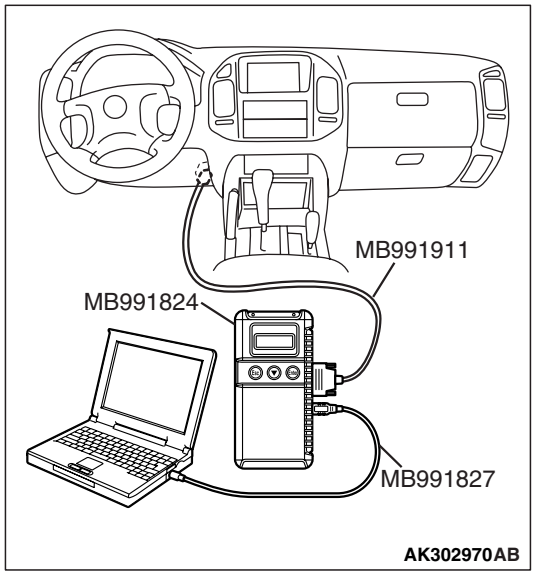


(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958, read the DTC.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

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.

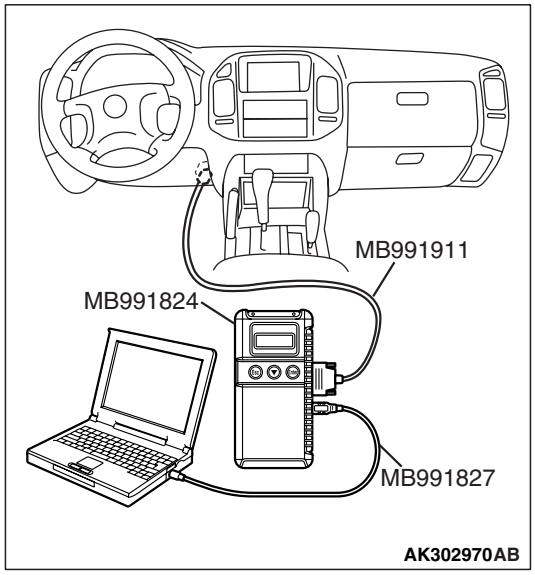
STEP 2. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.



(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 : Replace the manifold absolute pressure sensor. Then go to Step 5.



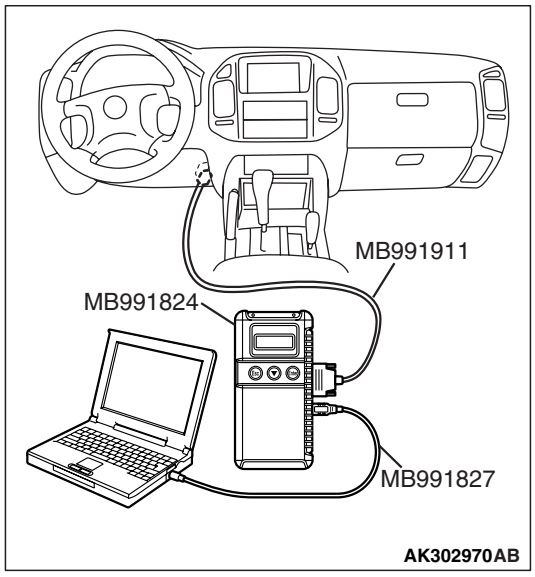
STEP 3. Using scan tool MB991502 or MB991958, check data list item 25: Barometric Pressure Sensor.

(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 : Replace the barometric pressure sensor. Then go to Step 5.

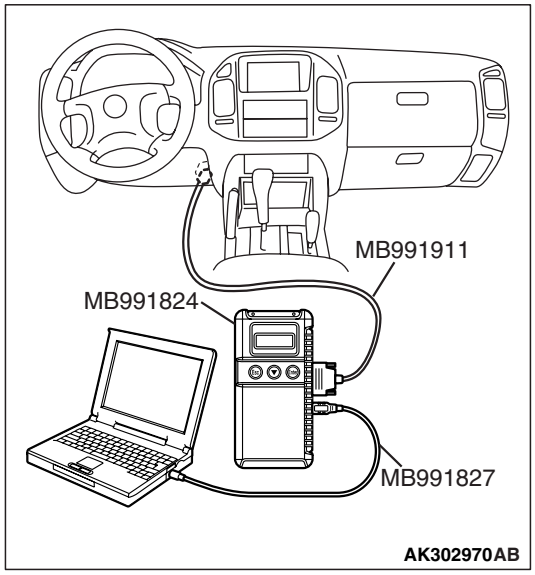


STEP 4. Using scan tool MB991958, read the diagnostic trouble code (DTC).

(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.00-13.



STEP 5. Using scan tool MB991958, read the diagnostic trouble code (DTC).

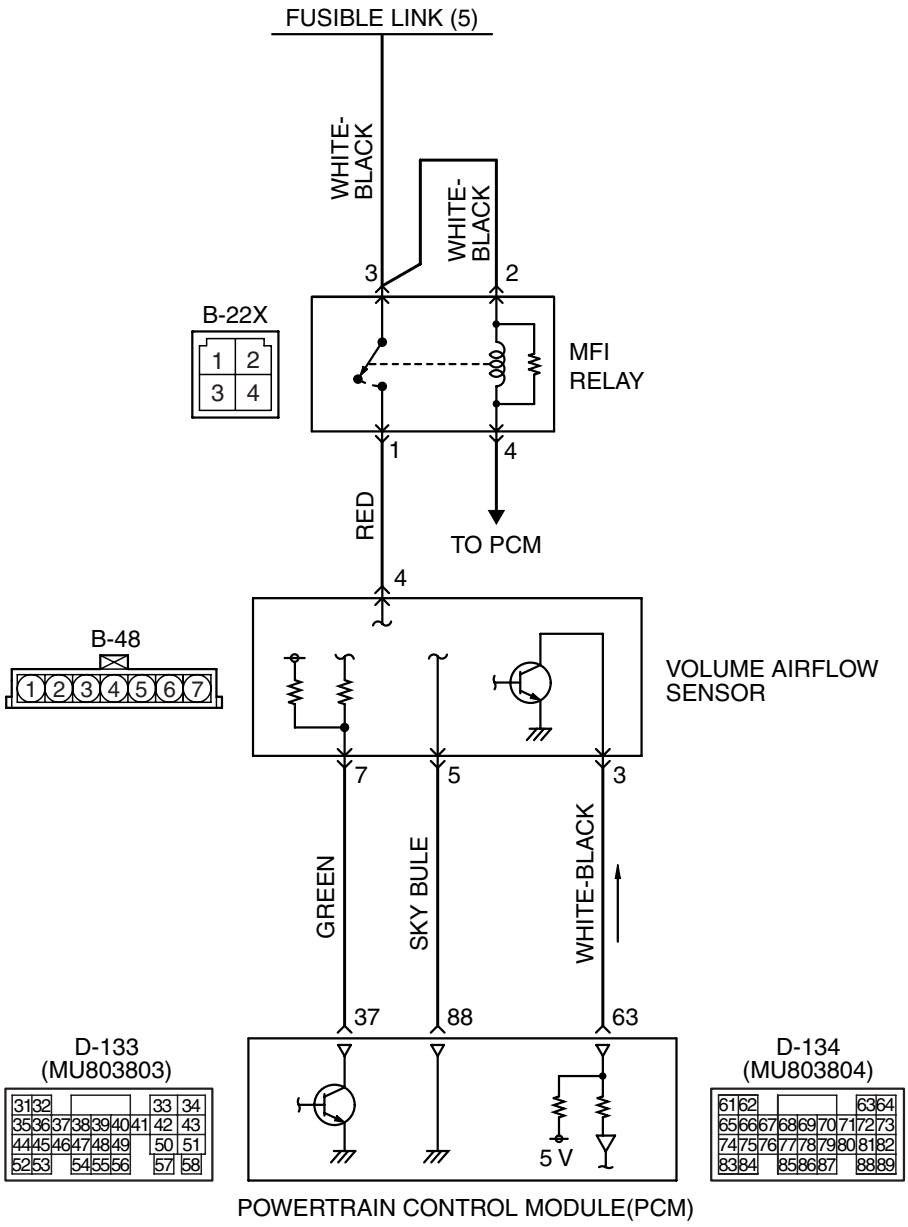
(1) Turn the ignition switch to the "ON" position.
(2) Erase the DTC.
(3) Start the engine.
(4) Turn the ignition switch to "LOCK" (OFF) position and then wait 2 seconds.
(5) Turn the ignition switch to the "ON" position.
(6) Set scan tool MB991958, read the DTC.
(7) Turn the ignition switch to the "LOCK"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

Q: Is DTC P0069 set?

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

DTC P0101: Volume Airflow Circuit Range/Performance Problem

Volume Airflow Sensor Circuit



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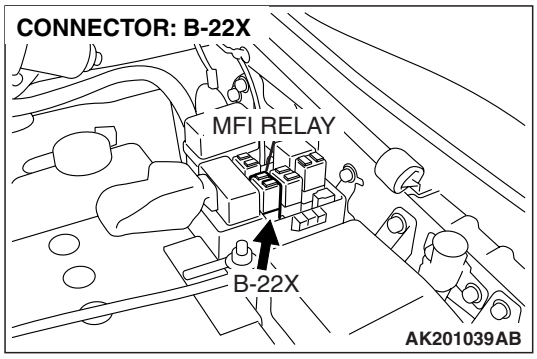

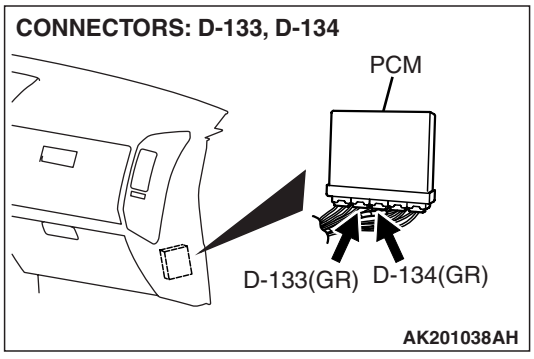

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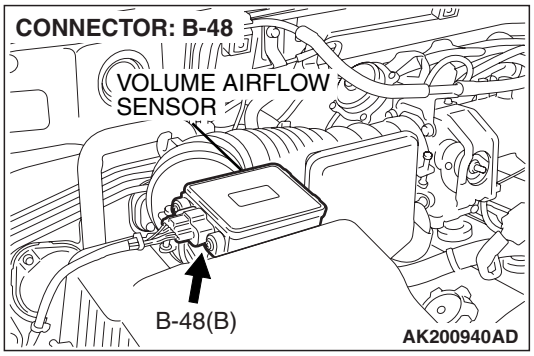


CIRCUIT OPERATION

- The volume airflow sensor power is supplied from the MFI relay (terminal No. 1), and the ground is provided on the PCM (terminal No. 88).
- 5-volt power is applied to the volume airflow sensor output terminal (terminal No. 3) from the PCM (terminal No. 63). The volume airflow sensor generates a pulse signal when the output terminal and ground are opened/closed (opened/short).

TECHNICAL DESCRIPTION

- While the engine is running, the volume airflow sensor outputs a pulse signal which corresponds to the volume of airflow.
- The PCM checks whether the frequency of this signal output by the volume airflow sensor while the engine is running is at or above the set value.
- When the throttle position sensor output voltage is low, the PCM causes the power transistor to be "ON" to send an volume airflow sensor reset signal to the volume airflow sensor. In response to the reset signal, the volume airflow sensor resets the filter circuit and improves the ability of the volume airflow sensor to measure the amount of air in a small air intake region.

DESCRIPTIONS OF MONITOR METHODS

- An abnormal condition is detected in the volume airflow sensor output through a comparison between the driving load and the output frequency of the volume airflow sensor.

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)

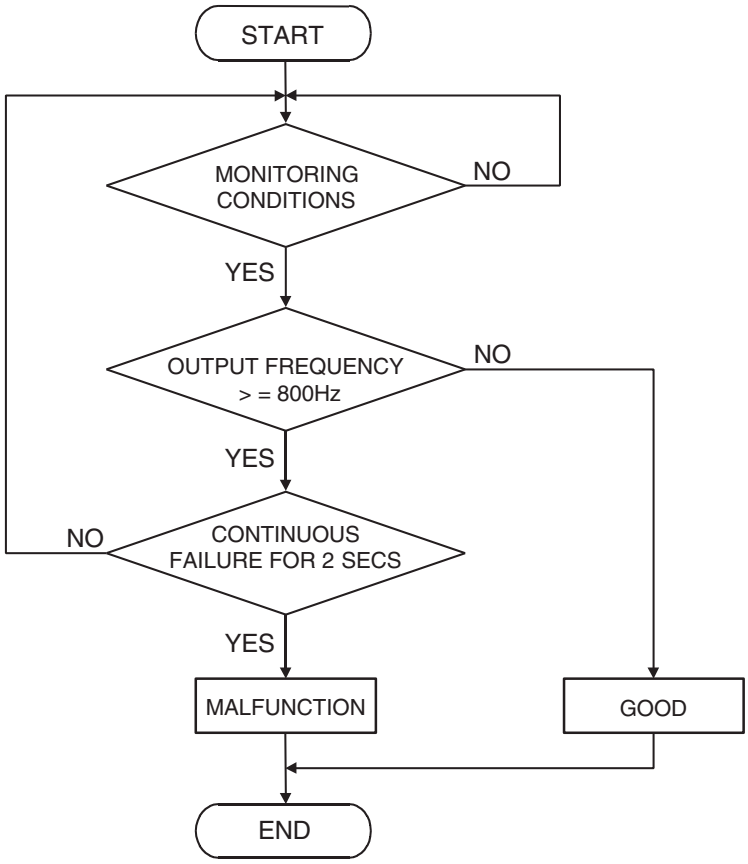
- Not applicable

Sensor (The sensor below is determined to be normal)

- Throttle position sensor

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

Logic Flow Chart



AK400994

Check Conditions

- Throttle position sensor output voltage is 2 volts or lower.
- Engine speed is lower than 2,000 r/min.

Judgement Criterion

- Volume airflow sensor output frequency has continued to be 800 Hz or higher for 2 seconds.

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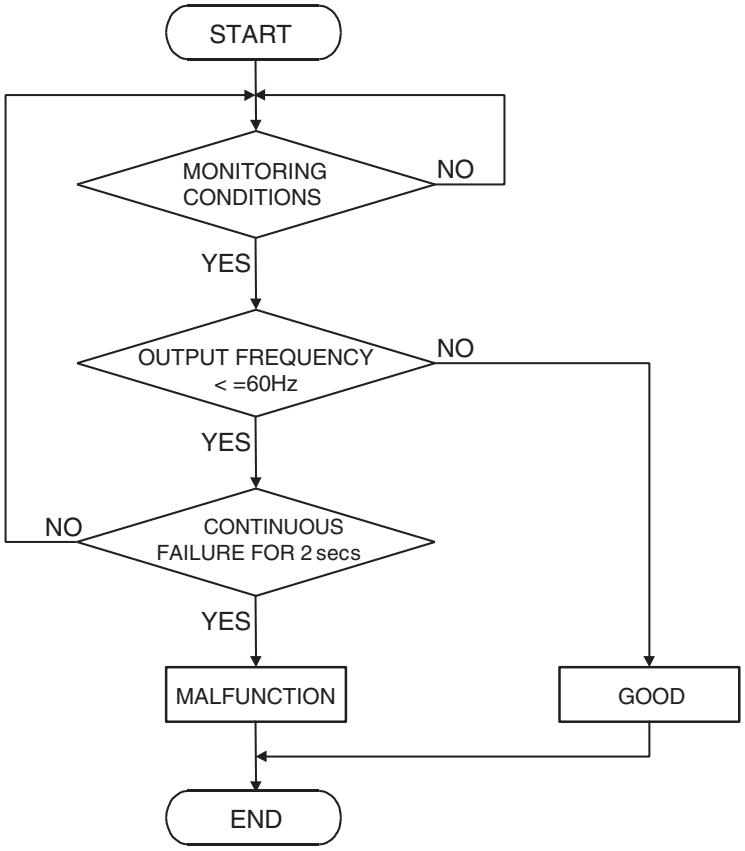
DTC SET CONDITIONS <Range/Performance problem – low input>

Logic Flow Chart



AK302918

Check Conditions

- Throttle position sensor output voltage is 1.5 volts or higher.
- Engine speed is higher than 2,000 r/min.

Judgement Criterion

- Volume airflow sensor output frequency has continued to be 60 Hz or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 P.13A-4.

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

- Volume airflow sensor failed.
- Open or shorted volume 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
  - MB991911: Main Harness B

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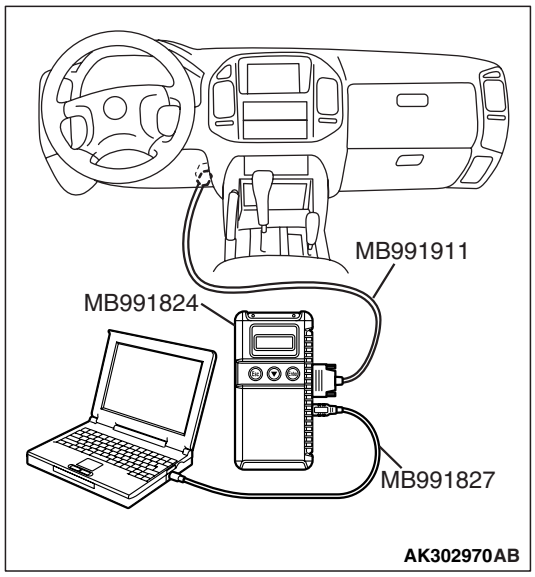


STEP 1. Using scan tool MB991958, check data list item 12: Volume Airflow Sensor.

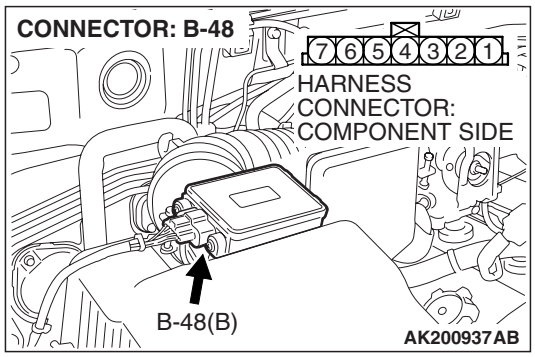
⚠ CAUTION
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(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, Volume 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 10 Hz or more.
- When the engine is revved, the frequency should increase according to the increase in engine speed.

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

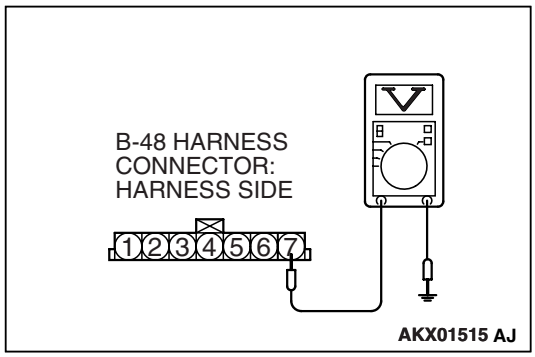
Q: Is the sensor operating properly?

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.00-13.
NO : Go to Step 2.



STEP 2. Measure the reset signal voltage at volume airflow sensor connector B-48 by backprobing.

(1) Do not disconnect the connector B-48.
(2) Turn the ignition switch to the "ON" position.

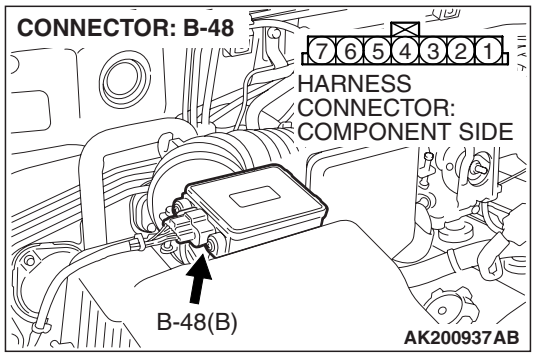


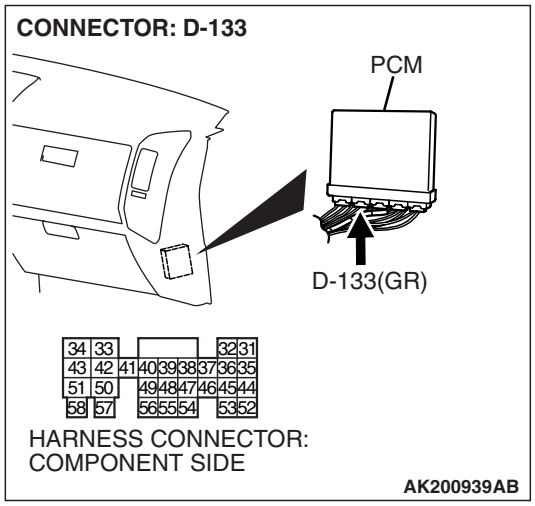
(3) Measure the voltage between terminal No. 7 and ground by backprobing.
- Voltage should be between 6.0 and 9.0 volts.

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

Q: Is the measured voltage between 6.0 and 9.0 volts?

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





STEP 3. Check harness connector B-48 at volume airflow sensor and harness connector D-133 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

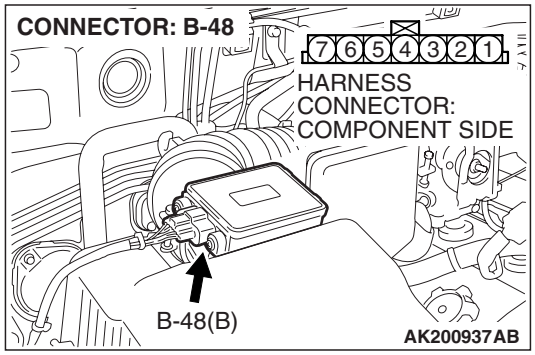
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.

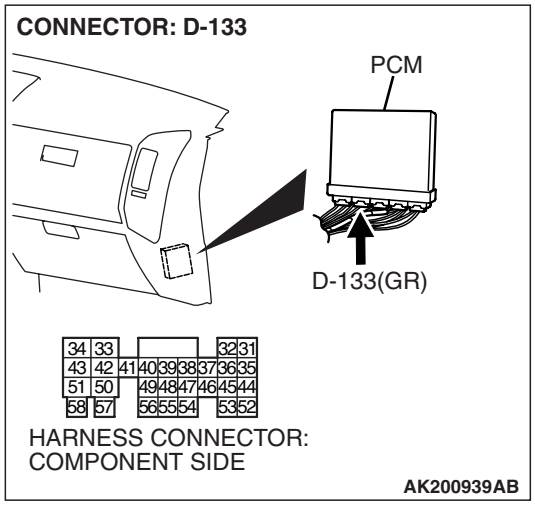
STEP 4. Check for short circuit to ground between volume airflow sensor connector B-48 (terminal No. 7) and PCM connector D-133 (terminal No. 37).

Q: Is the harness wire in good condition?

YES : Replace the volume airflow sensor. Then go to Step 9.

NO : Repair it. Then go to Step 9.

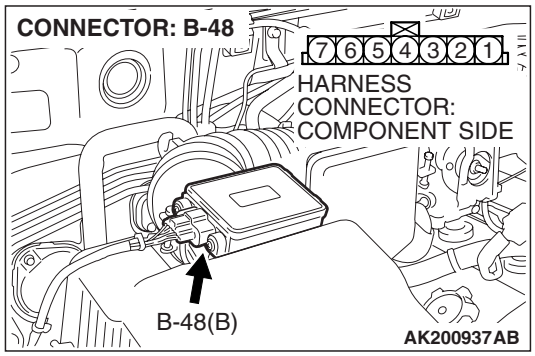


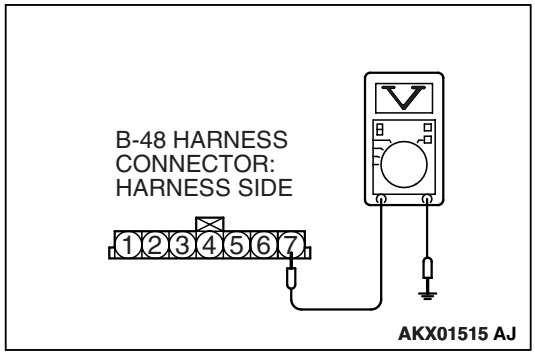


STEP 5. Measure the reset signal voltage at volume airflow sensor connector B-48 by backprobing.

(1) Do not disconnect the connector B-48.

(2) Start the engine and run at idle.





(3) Measure the voltage between terminal No. 7 and ground by backprobing.
- When the engine idling, voltage should be 1.0 volt or less.
- When the engine speed is 3,000 r/min, voltage should be between 6.0 and 9.0 volts.

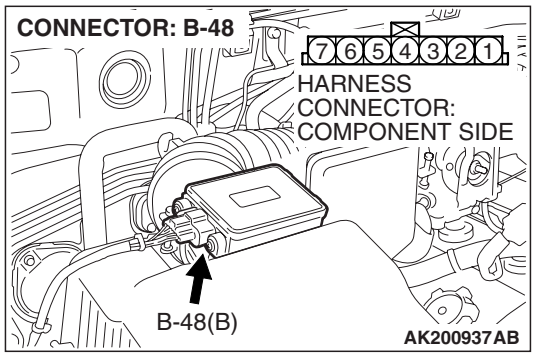
(4) Turn the ignition switch to the "LOCK" (OFF) position.

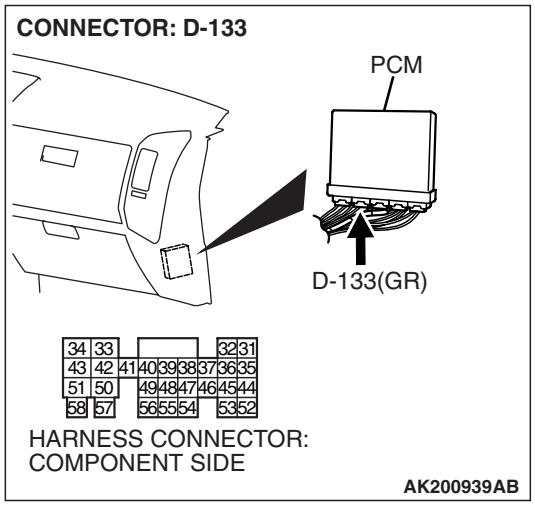
Q: Is the measured voltage normal?

YES : Go to Step 8.

NO : Go to Step 6.

TSB Revision





STEP 6. Check harness connector B-48 at volume airflow sensor and harness connector D-133 at PCM for damage.
Q: Is the harness connector in good condition?

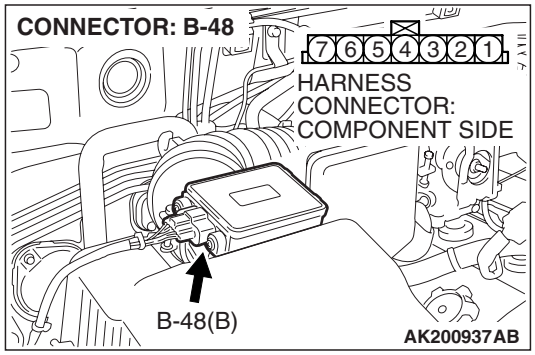
YES : Go to Step 7.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.

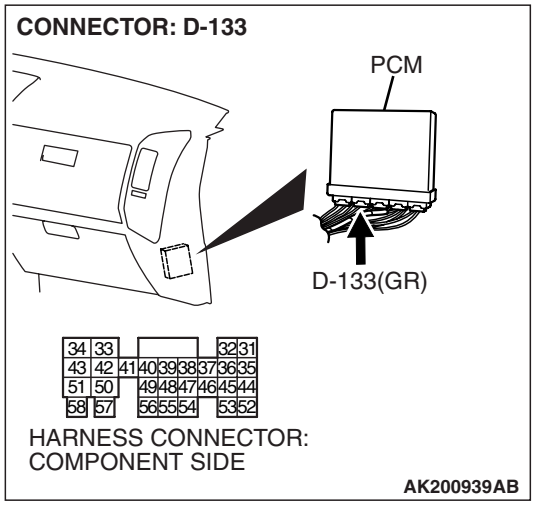
STEP 7. Check for open circuit and harness damage between volume airflow sensor connector B-48 (terminal No. 7) and PCM connector D-133 (terminal No. 37).

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 8. Replace the volume airflow sensor.

(1) Replace the volume airflow sensor.

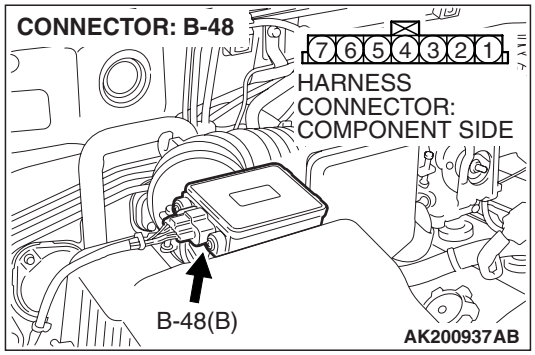
(2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 P.13A-4.

(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 – Pattern 8 P.13A-4.

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

Q: Is DTC P0101 set?

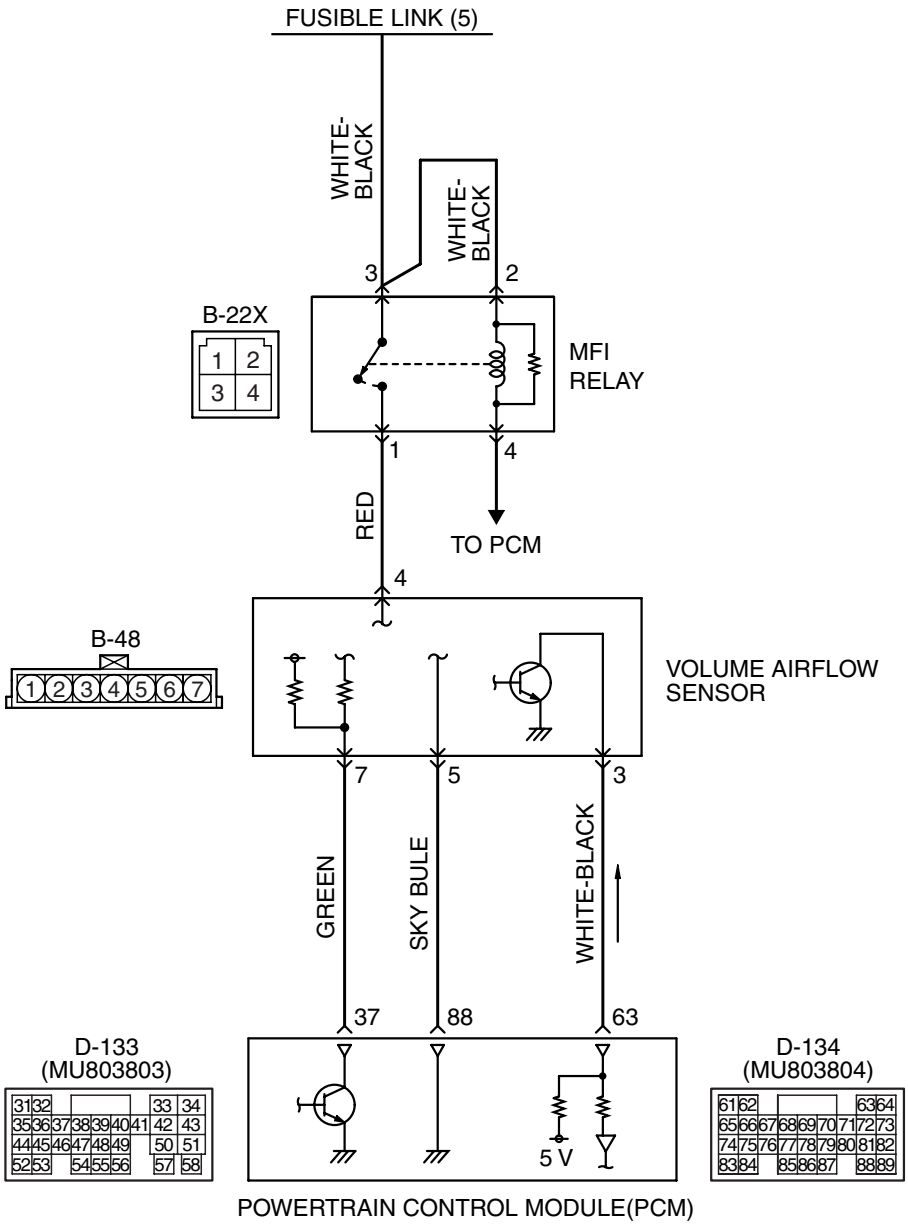
YES : Retry the troubleshooting.

NO : The inspection is complete.

TSB Revision

DTC P0102: Volume Airflow Circuit Low Input

Volume Airflow Sensor Circuit



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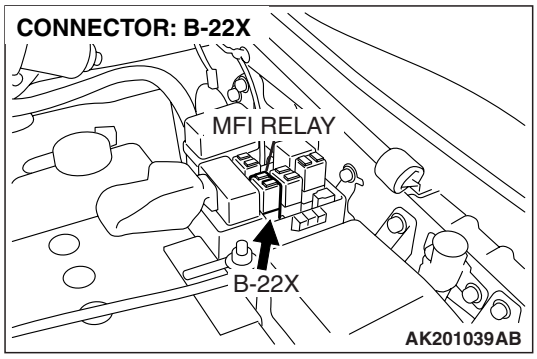
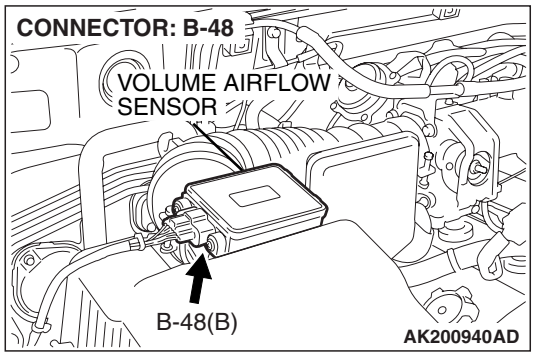
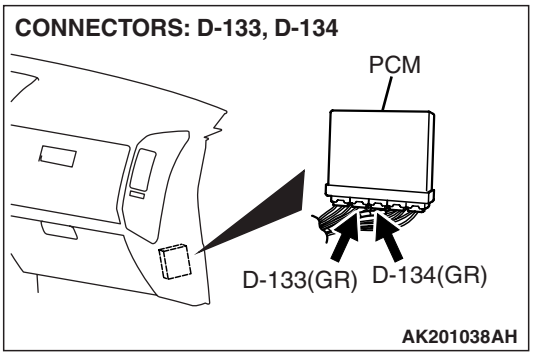




TSB Revision



CIRCUIT OPERATION

- The volume airflow sensor power is supplied from the MFI relay (terminal No. 1), and the ground is provided on the PCM (terminal No. 88).
- 5-volt power is applied to the volume airflow sensor output terminal (terminal No. 3) from the PCM (terminal No. 63). The volume airflow sensor generates a pulse signal when the output terminal and ground are opened/closed (opened/short).

TECHNICAL DESCRIPTION

- While the engine is running, the volume airflow sensor outputs a pulse signal which corresponds to the volume of airflow.
- The PCM checks whether the frequency of this signal output by the volume airflow sensor while the engine is running is at or above the set value.

DESCRIPTIONS OF MONITOR METHODS

- An open or short circuit is detected while monitoring the output frequency of the volume airflow sensor.

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)

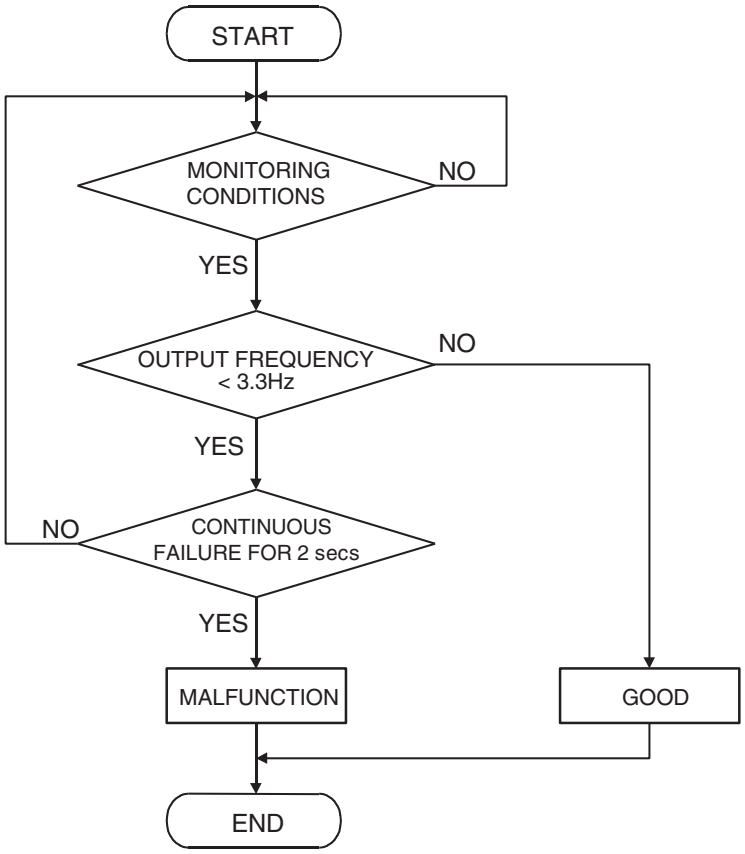
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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Check Condition

- Engine speed is higher than 500 r/min.

Judgement Criterion

- Volume airflow sensor output frequency has continued to be 3.3 Hz or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.

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

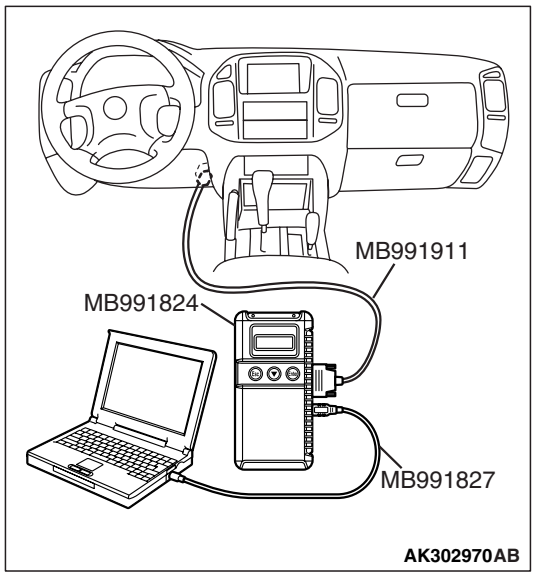
- Volume airflow sensor failed.
- Open or shorted volume airflow sensor circuit, harness damage, or connector damage.
- PCM failed.

DIAGNOSIS

Required Special Tools:

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

TSB Revision



STEP 1. Using scan tool MB991958, check data list item 12: Volume 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.

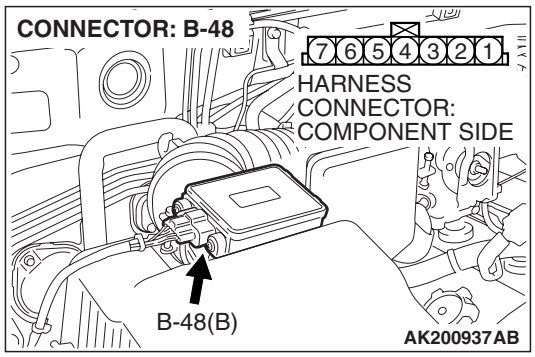
(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 12, Volume Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be 10 Hz or more.
- When the engine is revved, the frequency 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?

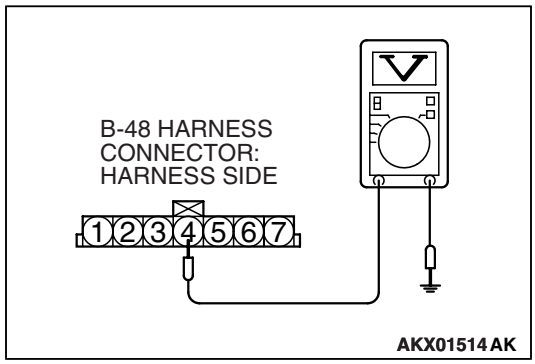
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

NO : Go to Step 2.



STEP 2. Measure the power supply voltage at volume airflow sensor connector B-48 by backprobing.

(1) Do not disconnect the connector B-48.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No.4 and ground by backprobing.
- Voltage should be battery positive voltage.

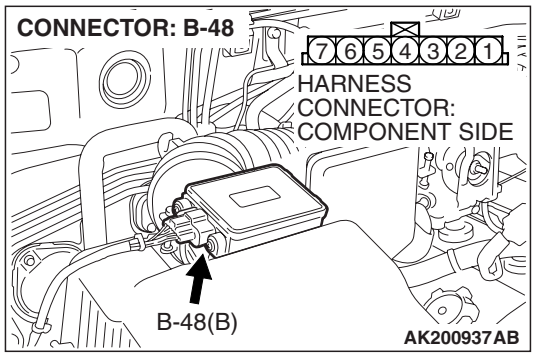
(4) Turn the ignition switch to the "LOCK" (OFF) position.

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

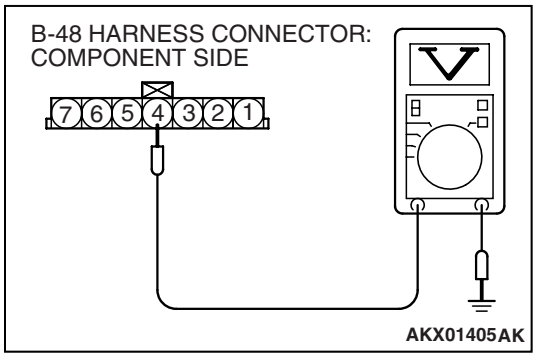
YES : Go to Step 5.

NO : Go to Step 3.

STEP 3. Measure the power supply voltage at volume airflow sensor harness side connector B-48.



(1) Disconnect the connector B-48 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 4 and ground.
- Voltage should be battery positive voltage.

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

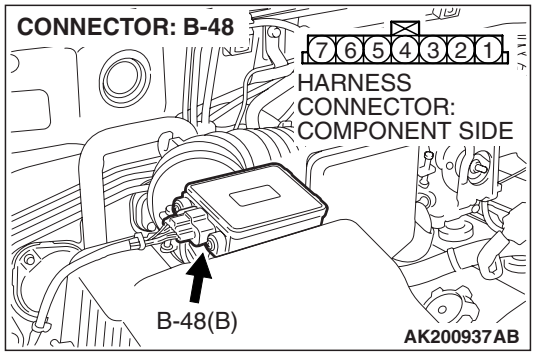
Q: Is battery positive voltage (approximately 12 volts) present?

YES : Go to Step 4.

NO : Repair harness wire between MFI relay connector B-22X (terminal No. 1) and volume airflow sensor connector B-48 (terminal No. 4) because of open circuit or short circuit to ground. Then go to Step 13.

STEP 4. Check harness connector B-48 at the volume airflow sensor for damage.

Q: Is the harness connector in good condition?

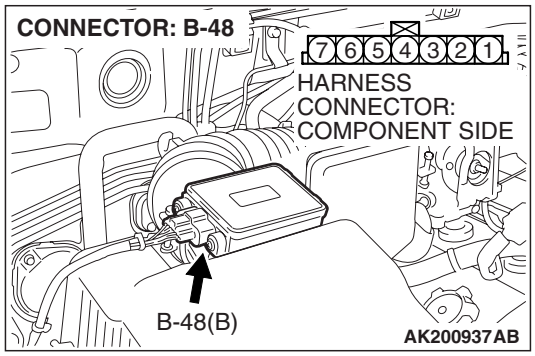


YES : Repair harness wire between MFI relay connector B-22X (terminal No. 1) and volume airflow sensor connector B-48 (terminal No. 4) because of harness damage. Then go to Step 13.

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

STEP 5. Check harness connector B-48 at volume airflow sensor for damage.

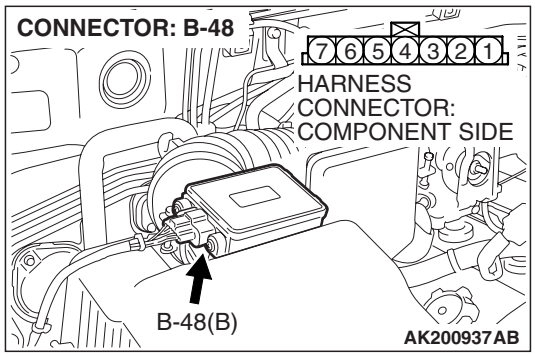
Q: Is the harness connector in good condition?



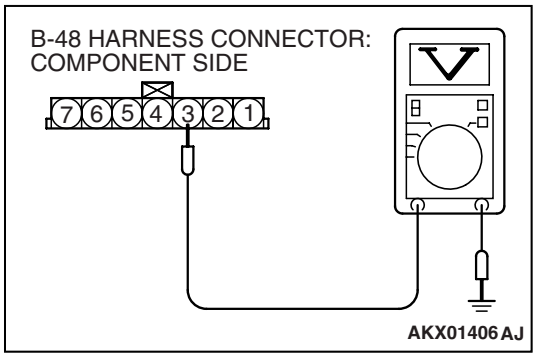
YES : Go to Step 6.

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

STEP 6. Measure the sensor supply voltage at volume airflow sensor harness side connector B-48.



(1) Disconnect the connector B-48 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.



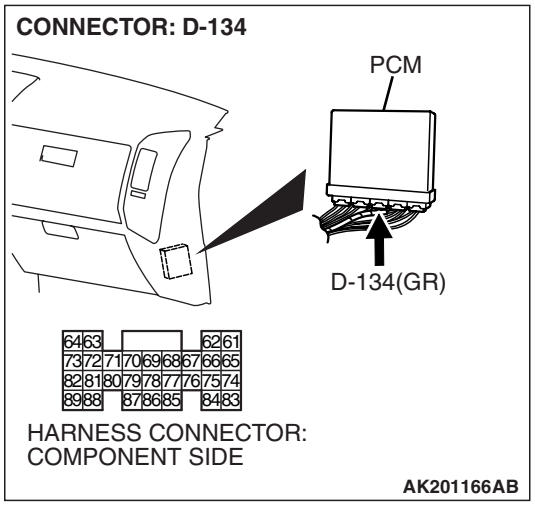
(3) Measure the voltage between terminal No. 3 and ground.
- Voltage should be between 4.9 and 5.1 volts.

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

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

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

STEP 7. Check harness connector D-134 at PCM for damage.



Q: Is the harness connector in good condition?

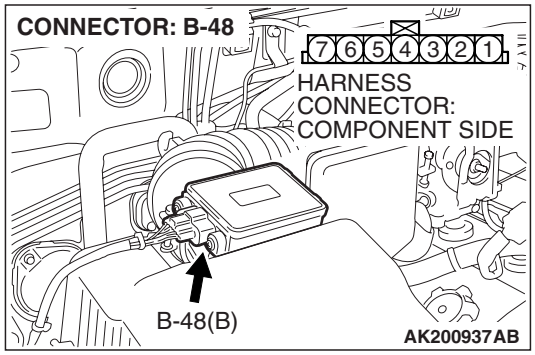
YES : Go to Step 8.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.

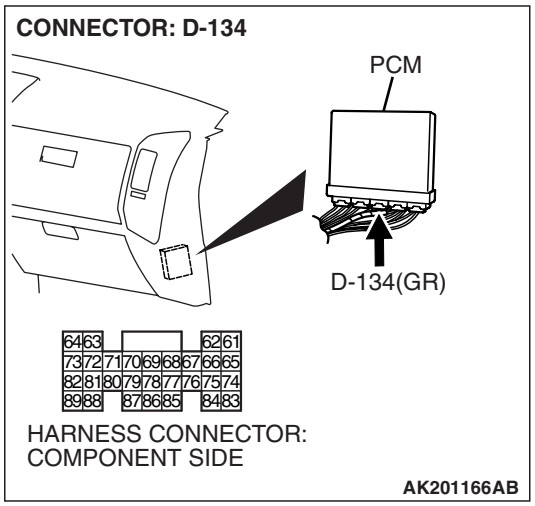
STEP 8. Check for open circuit and short circuit to ground between volume airflow sensor connector B-48 (terminal No. 3) and PCM connector D-134 (terminal No. 63).

Q: Is the harness wire in good condition?

YES : Replace the PCM. Then go to Step 13.

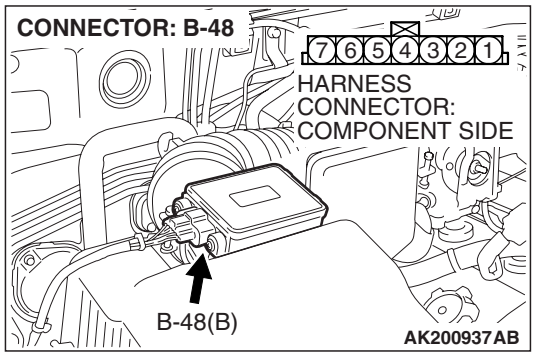
NO : Repair it. Then go to Step 13.





STEP 9. Check the continuity at volume airflow sensor harness side connector B-48.

(1) Disconnect the connector B-48 and measure at the harness side.

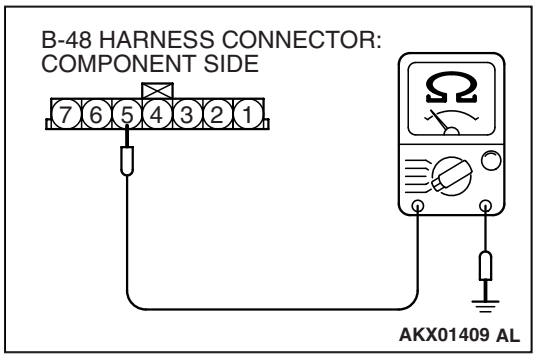


(2) Check for the continuity between terminal No. 5 and ground.
- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 12.

NO : Go to Step 10.

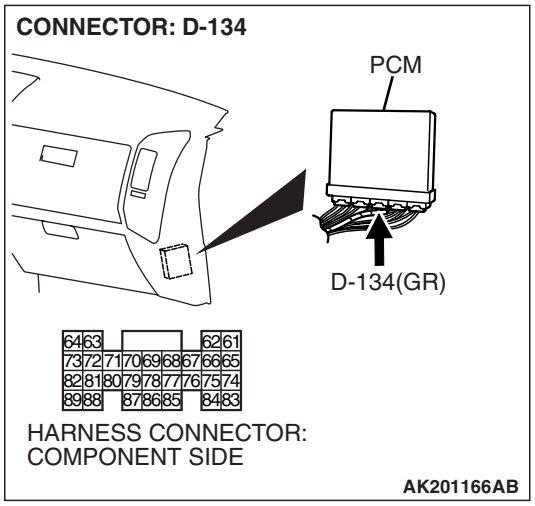


STEP 10. Check harness connector D-134 at PCM for damage.

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.

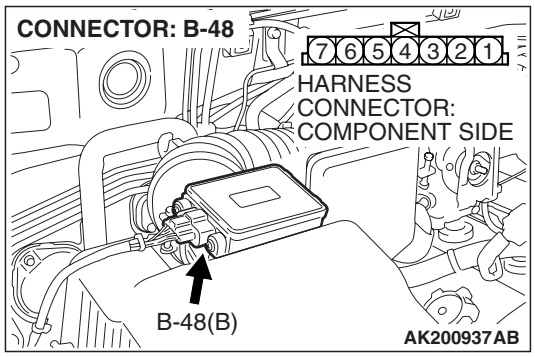


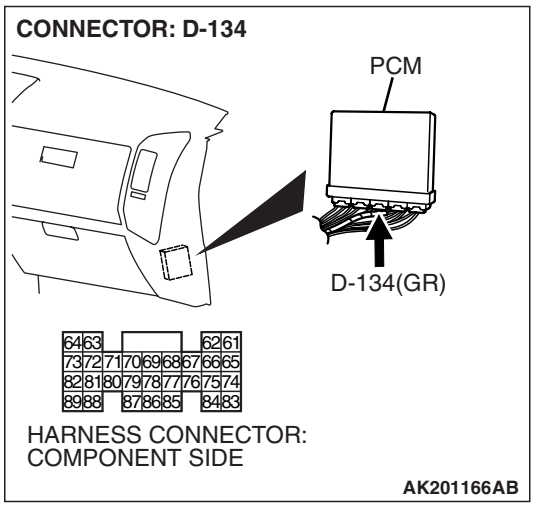
STEP 11. Check for open circuit and harness damage between volume airflow sensor connector B-48 (terminal No. 5) and PCM connector D-134 (terminal No. 88).

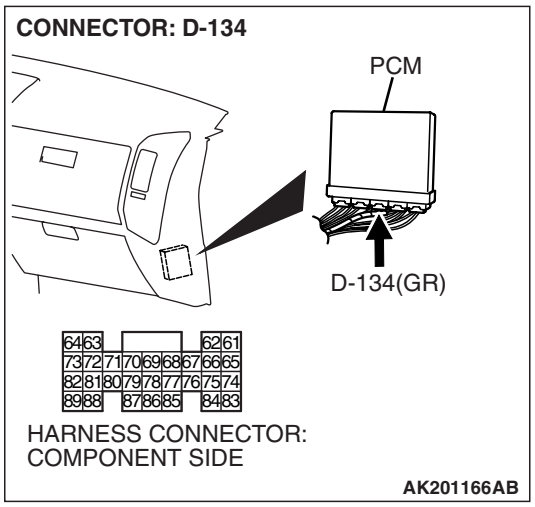
Q: Is the harness wire in good condition?

YES : Replace the PCM. Then go to Step 13.

NO : Repair it. Then go to Step 13.







STEP 12. Check harness connector D-134 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Replace the volume airflow 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 13. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.

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

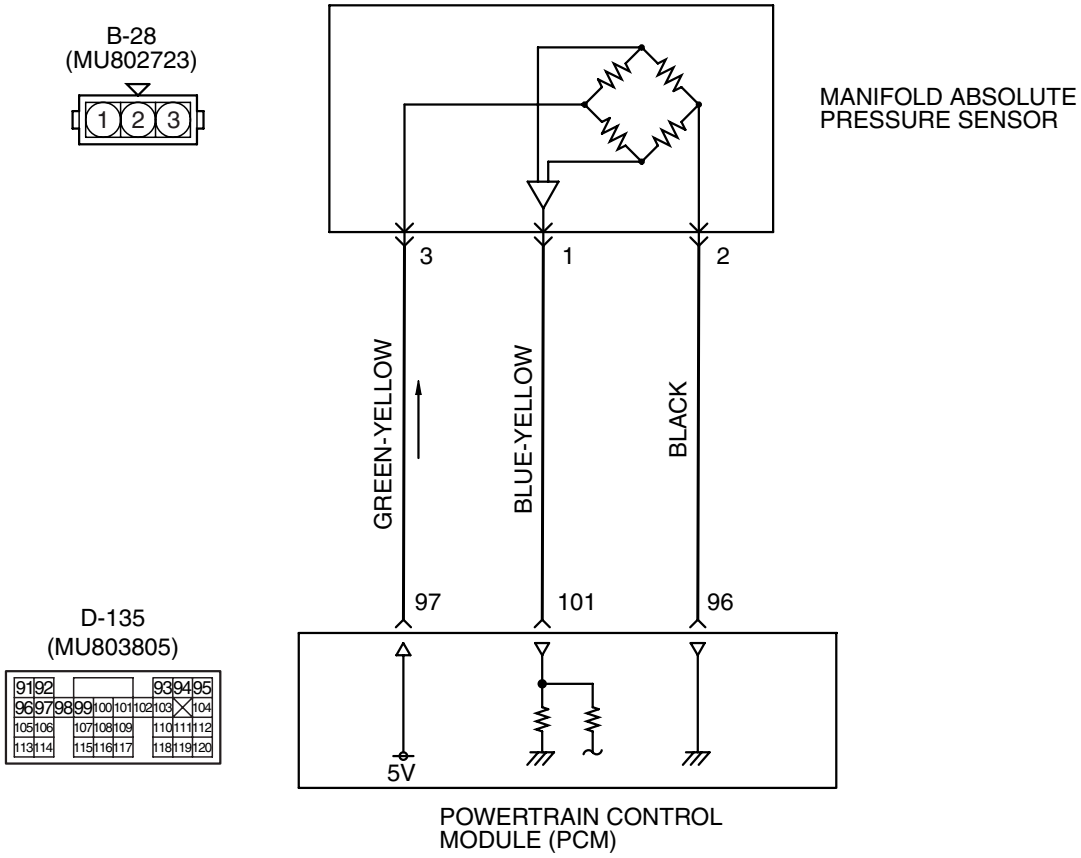
Q: Is DTC P0102 set?

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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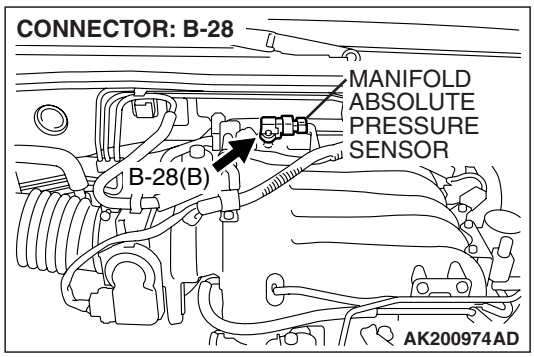
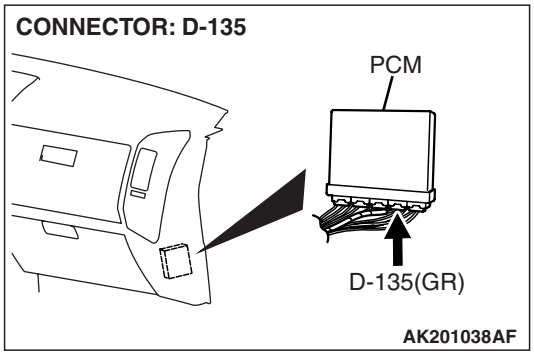




CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

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

TSB Revision

DESCRIPTIONS OF MONITOR METHODS

Compare load value with manifold absolute pressure sensor output voltage.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

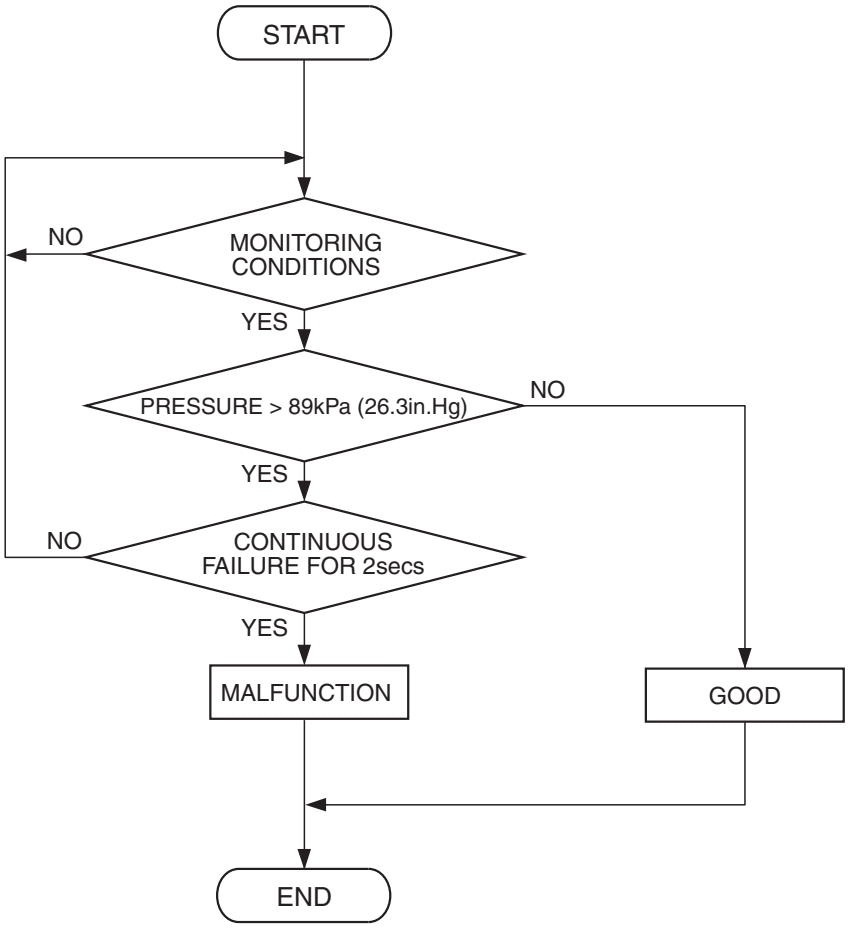
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor
- Throttle position sensor

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

Logic Flow Chart



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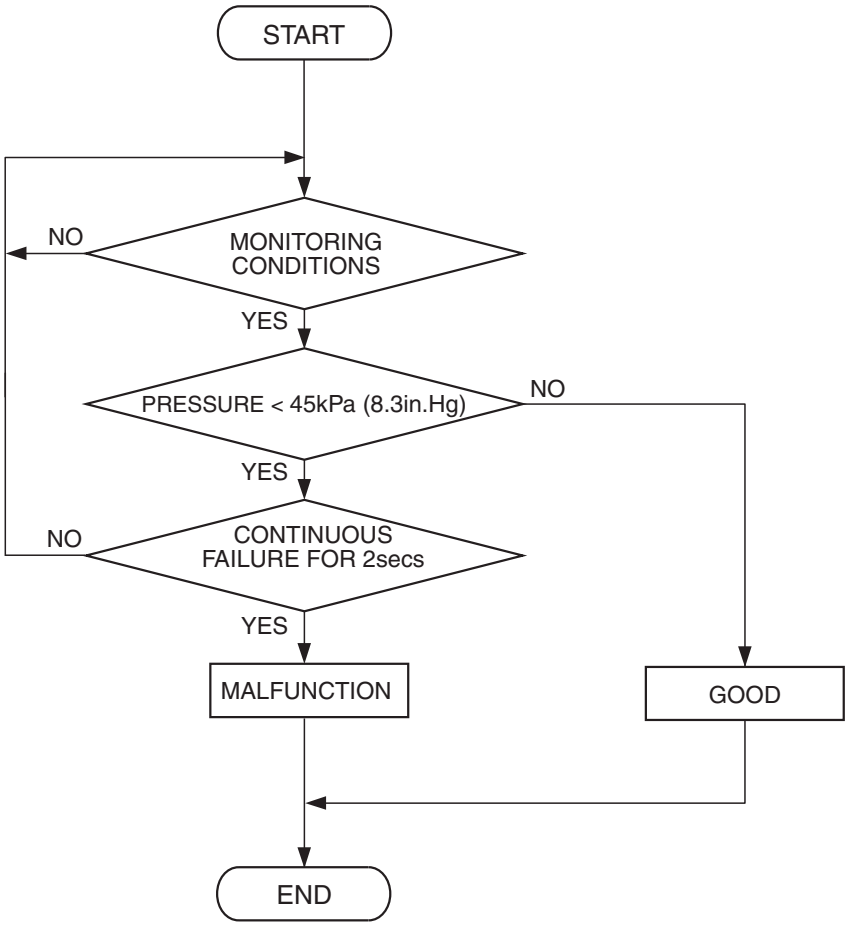
TSB Revision

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

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

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

Logic Flow Chart



AK401590

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

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

TSB Revision

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 P.13A-4.

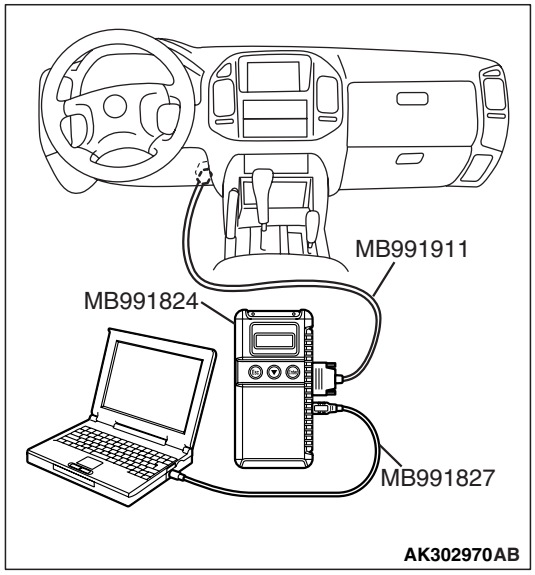
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

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

DIAGNOSIS

Required Special Tools:

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



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

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

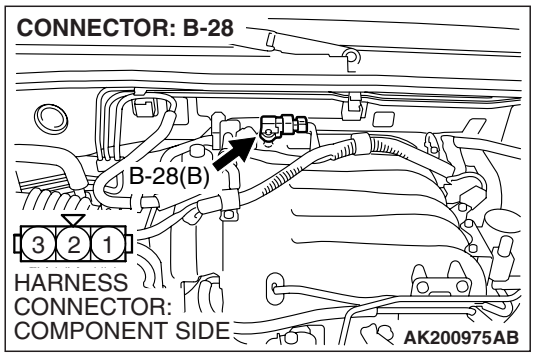
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969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

Q: Is the sensor operating properly?

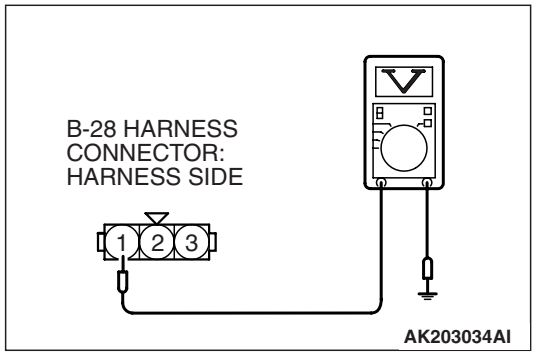
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

NO : Go to Step 2.

STEP 2. Measure the sensor output voltage at manifold absolute pressure sensor connector B-28 by backprobing.



(1) Do not disconnect the connector B-28.
(2) Turn the ignition switch to the "ON" position.



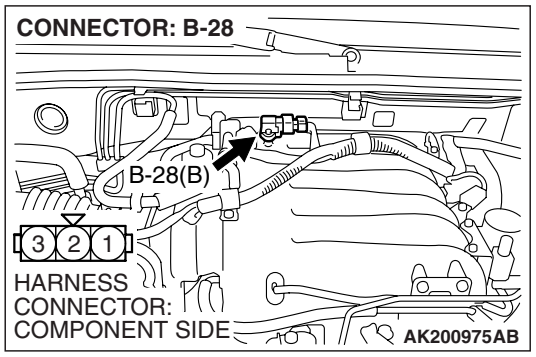
(3) Measure the voltage between terminal No. 1 and ground by backprobing.
- When altitude is 0 m (0 foot), voltage should be 3.7 and 4.3 volts.
- When altitude is 600 m (1,969 feet), voltage should be 3.4 and 4.0 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be 3.2 and 3.8 volts.
- When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

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

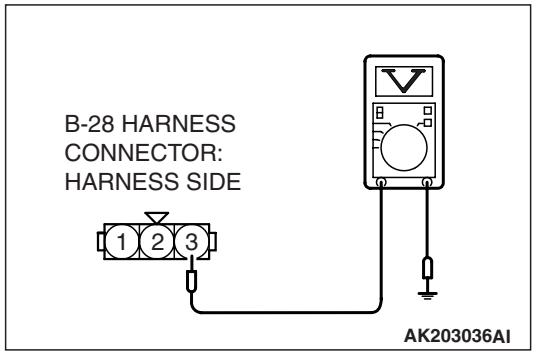
Q: Is the measured voltage normal?

YES : Go to Step 10.
NO : Go to Step 3.

STEP 3. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-28 by backprobing.



(1) Do not disconnect the connector B-28.
(2) Turn the ignition switch to the "ON" position.

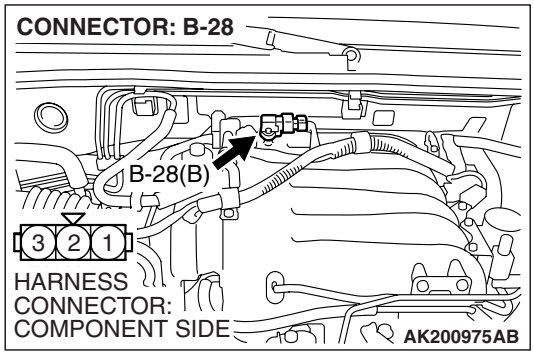


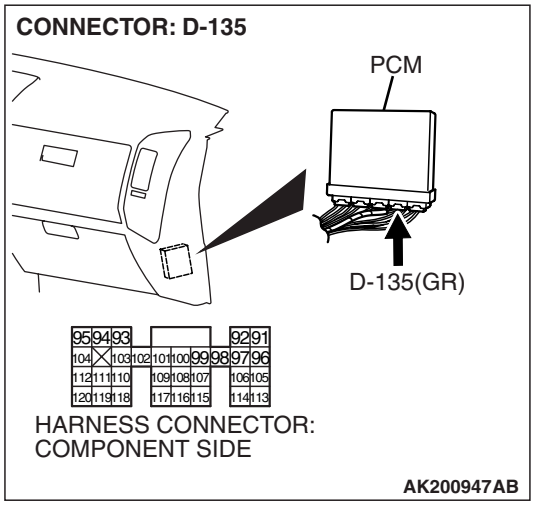
(3) Measure the voltage between terminal No. 3 and ground by backprobing.
- Voltage should be between 4.9 and 5.1 volts.

(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-28 at the manifold absolute pressure sensor and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

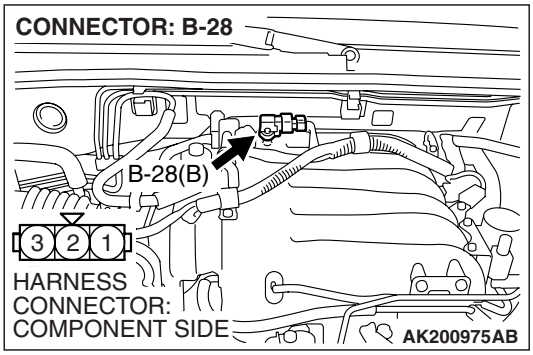
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.

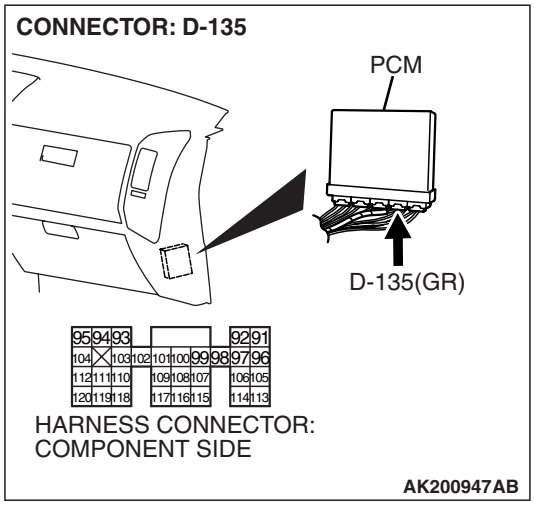
STEP 5. Check for harness damage between manifold absolute pressure sensor connector B-28 (terminal No. 3) and PCM connector D-135 (terminal No. 97).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 13.

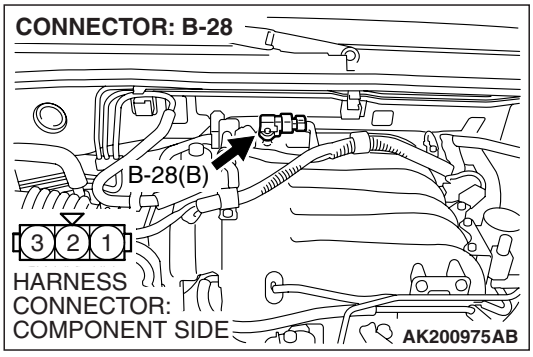


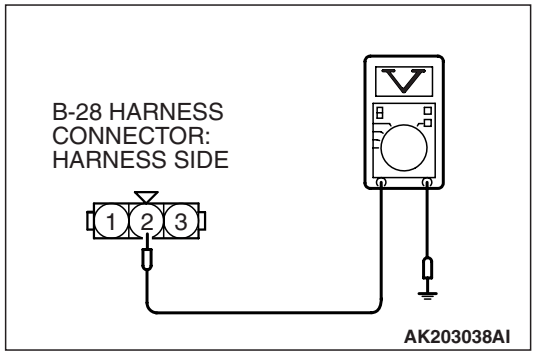


STEP 6. Measure the ground voltage at manifold absolute pressure sensor connector B-28 by backprobing.

(1) Do not disconnect the connector B-28.

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





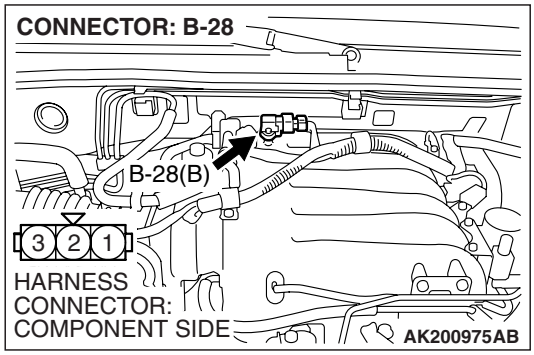
(3) Measure the voltage between terminal No. 2 and ground by backprobing.
- Voltage should be 0.5 volt or less.

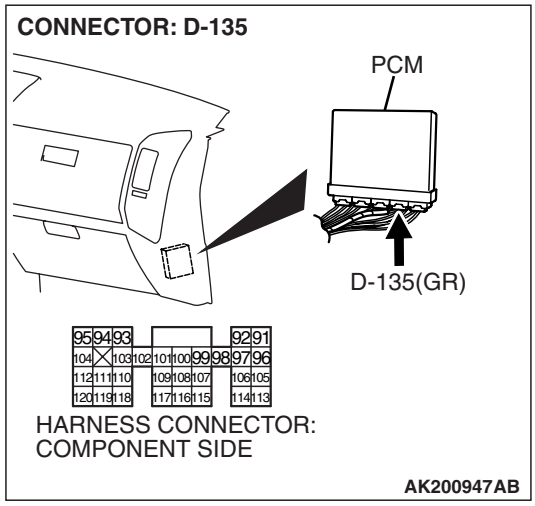
(4) Turn the ignition switch to the "LOCK" (OFF) position.

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-28 at the manifold absolute pressure sensor and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

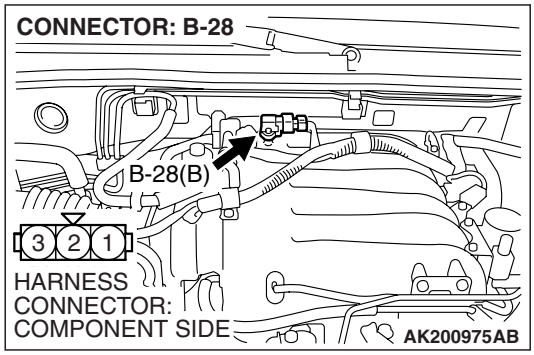
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.

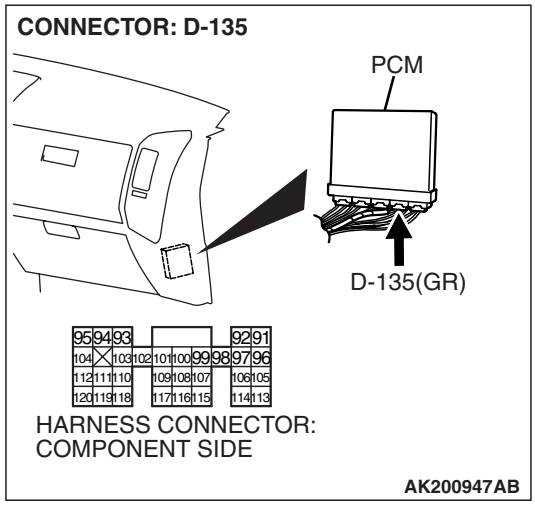
STEP 8. Check for harness damage between manifold absolute pressure sensor connector B-28 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

Q: Is the harness wire in good condition?

YES : Go to Step 12.

NO : Repair it. Then go to Step 13.



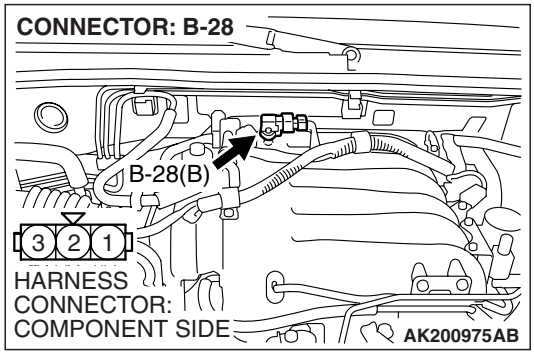


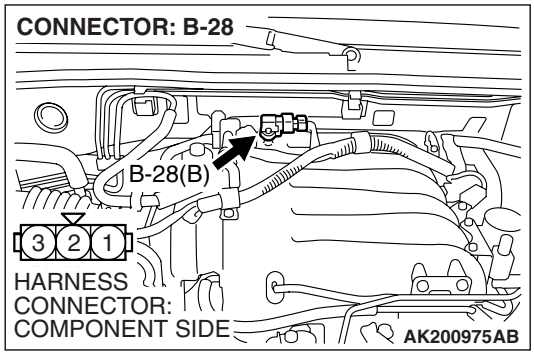
STEP 9. Check harness connector B-28 at manifold absolute pressure sensor for damage.

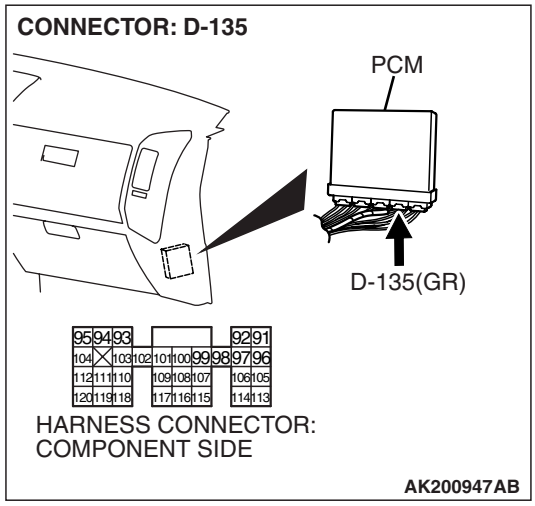
Q: Is the harness connector in good condition?

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-28 at the manifold absolute pressure sensor and harness connector D-135 at PCM for damage.

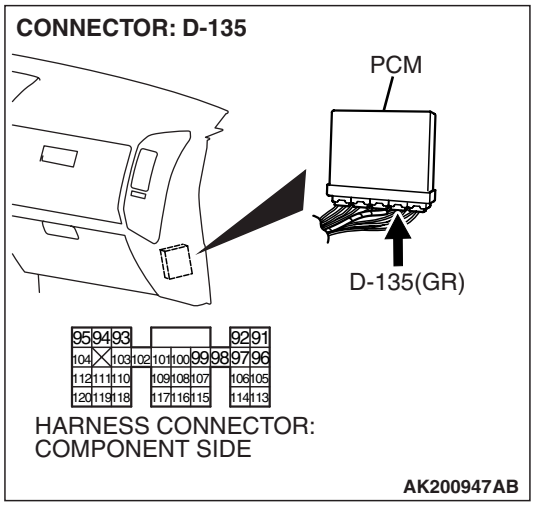
Q: Is the harness connector in good condition?

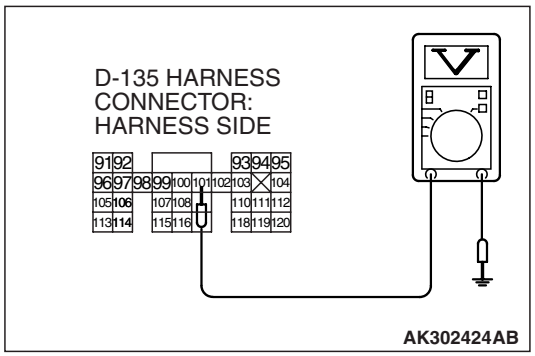
YES : Go to Step 11.

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 D-135 by backprobing.

(1) Do not disconnect the connector D-135.
(2) Turn the ignition switch to the "ON" position.



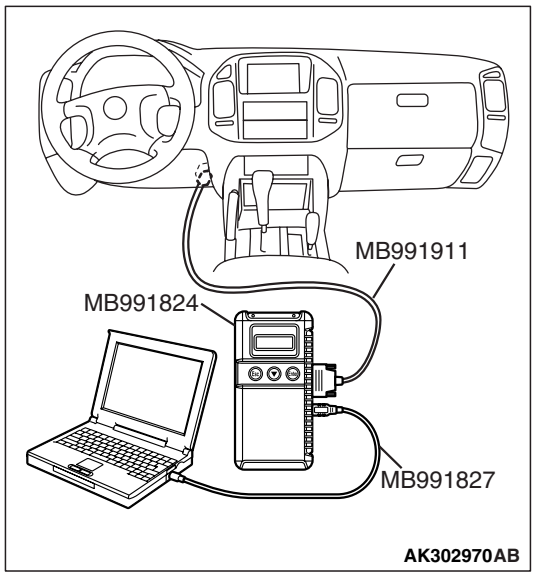


(3) Measure the voltage between terminal No. 101 and ground.
- When altitude is 0 m (0 foot), voltage should be 3.7 and 4.3 volts.
- When altitude is 600 m (1,969 feet), voltage should be 3.4 and 4.0 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be 3.2 and 3.8 volts.
- When altitude 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-28 (terminal No.1) and PCM connector D-135 (terminal No.101) because of harness damage. Then go to Step 13.



STEP 12. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.

⚠ CAUTION

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

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

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

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

Q: Is the sensor operating properly?

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

STEP 13. Test the OBD-II drive cycle.

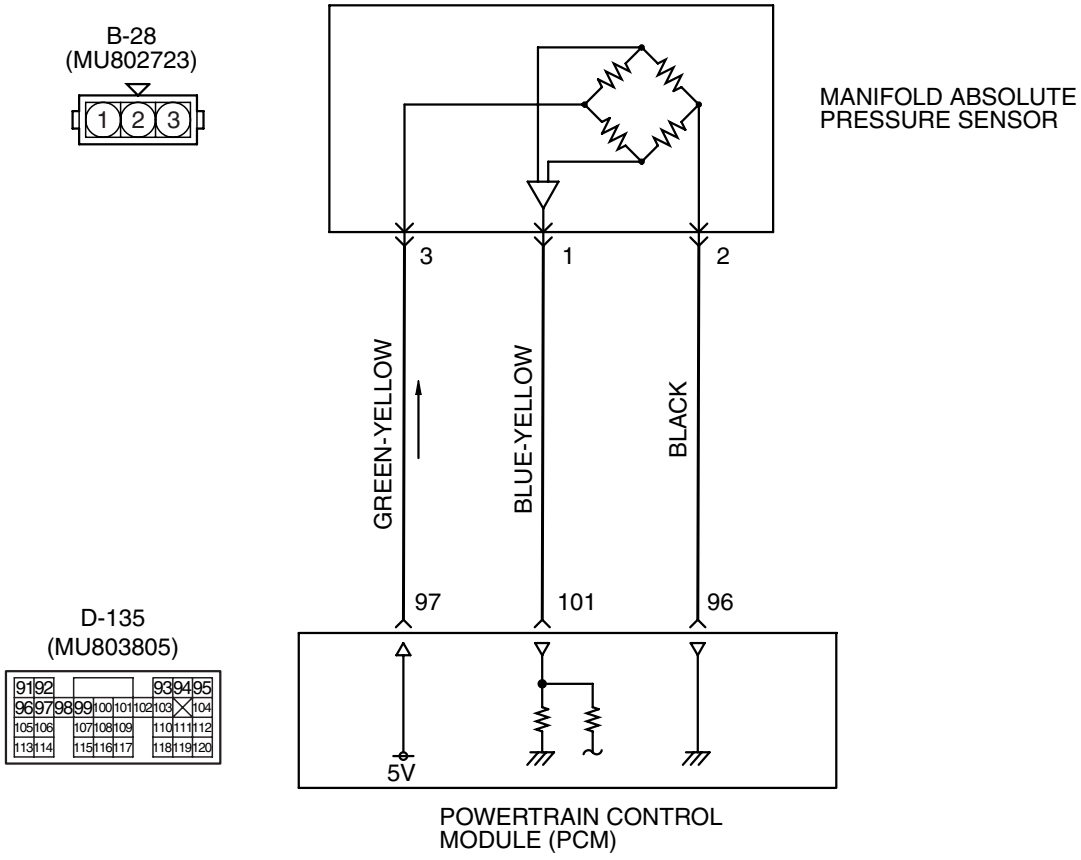
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 P.13A-4.
(2) Check the diagnostic trouble code (DTC).

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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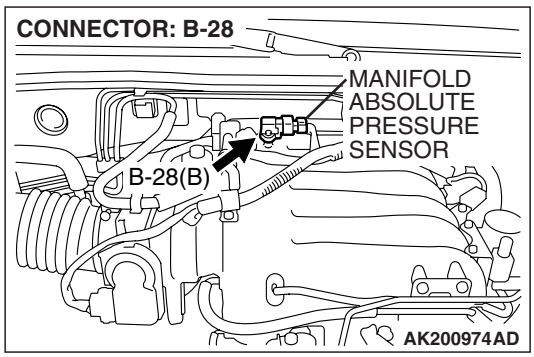
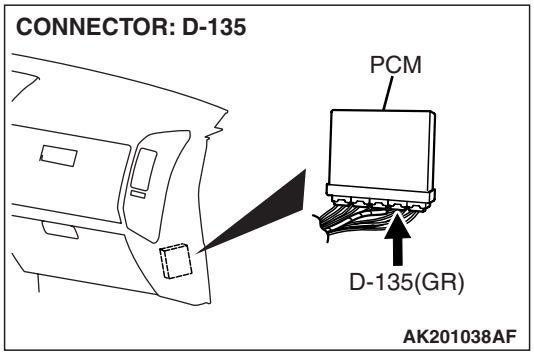




CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

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

TSB Revision

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

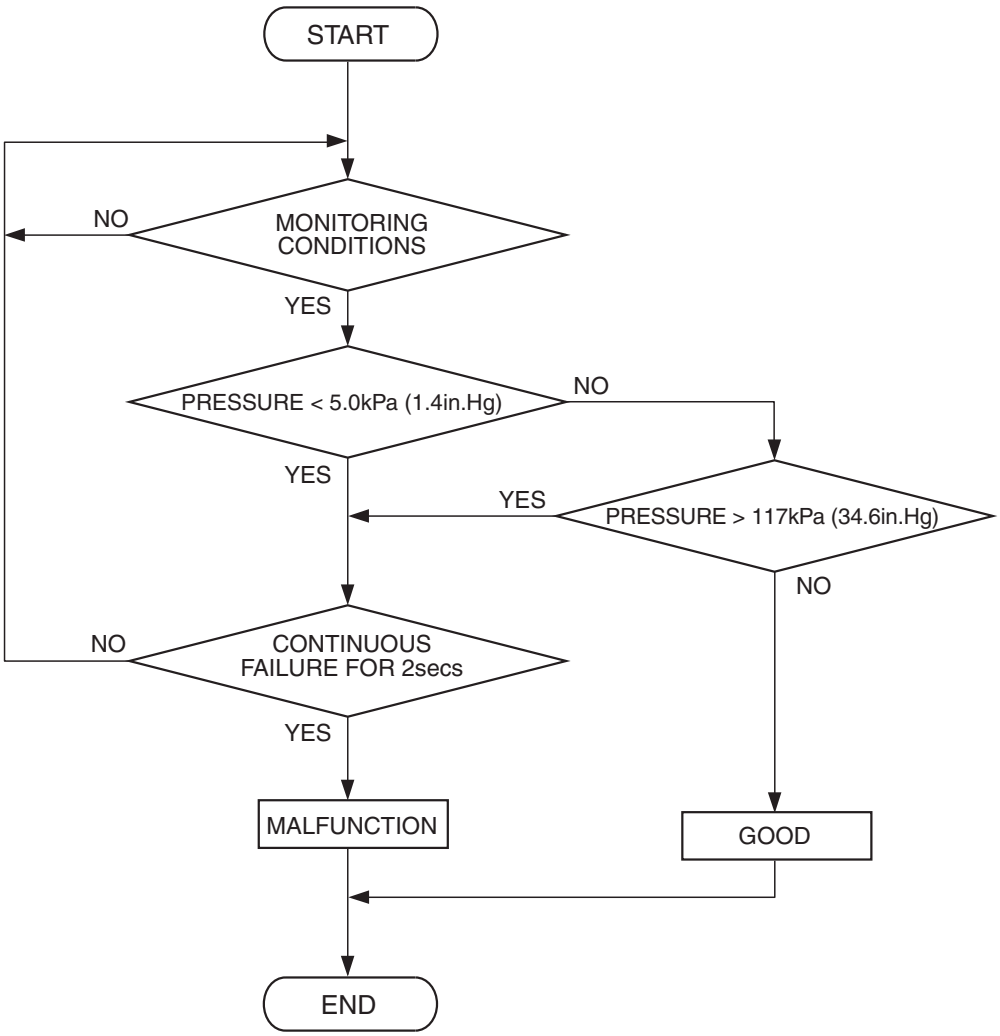
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302688

TSB Revision

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 20 percent or higher.

Judgement Criterion

- Manifold absolute pressure is 5 kPa (1.4 in.Hg) or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 P.13A-4.

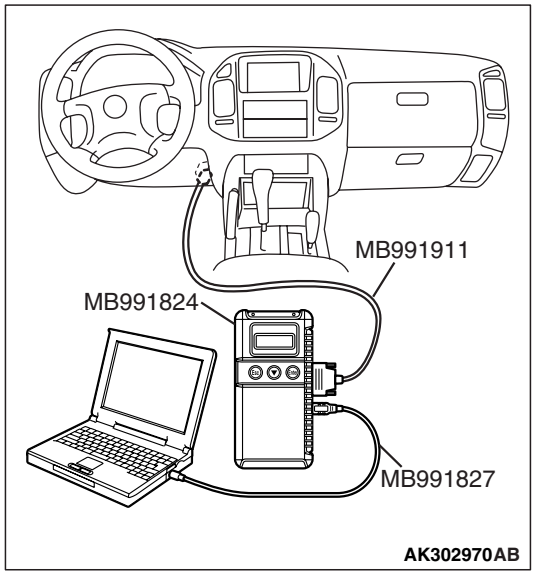
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991911: Main Harness B



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

⚠ CAUTION

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

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

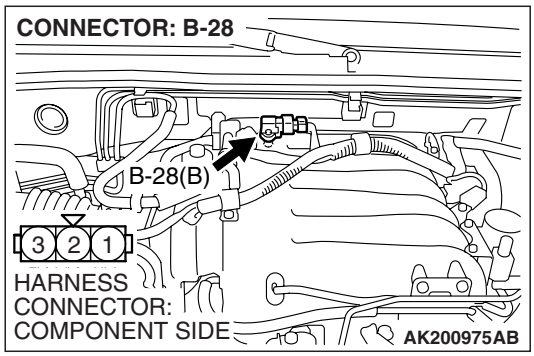
Q: Is the sensor operating properly?

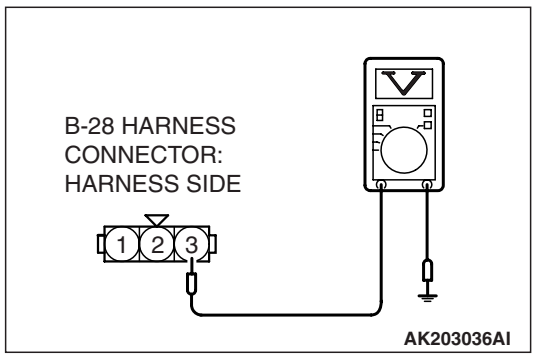
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

NO : Go to Step 2.

STEP 2. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-28 by backprobing.

(1) Do not disconnect the connector B-28.
(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.

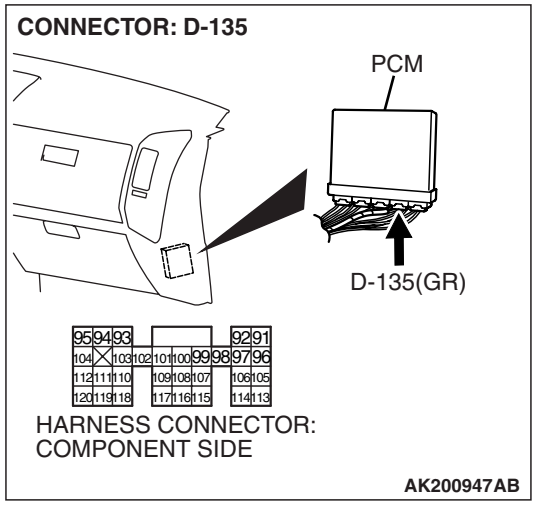
Q: Is the measured voltage between 4.9 and 5.1 volts?

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

STEP 3. Check harness connector D-135 at PCM for damage.

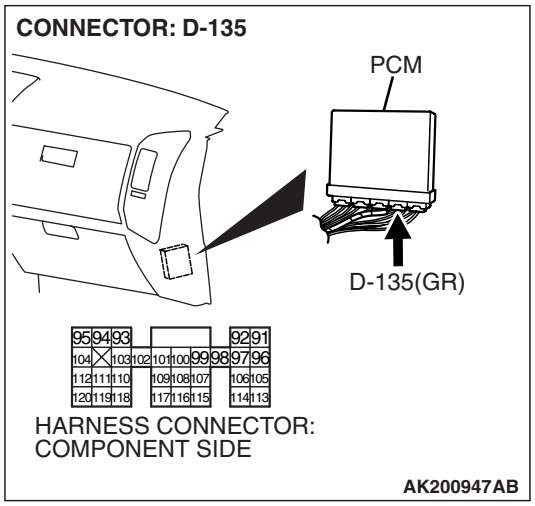
Q: Is the harness connector in good condition?

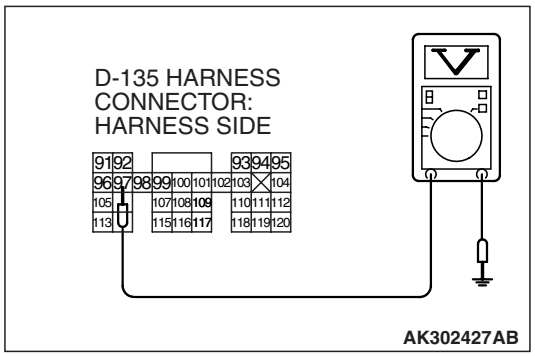
YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 4. Measure the sensor supply voltage at PCM connector D-135 by backprobing.

(1) Do not disconnect the connector D-135.
(2) Turn the ignition switch to the "ON" position.





(3) Measure the voltage between terminal No. 97 and ground by backprobing.
- Voltage should be between 4.9 and 5.1 volts.

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

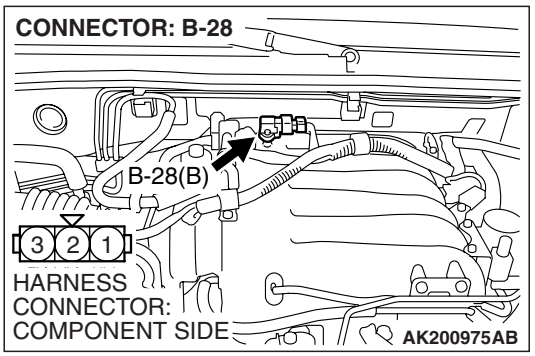
Q: Is the measured voltage between 4.9 and 5.1 volts?

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

STEP 5. Check harness connector B-28 at manifold absolute pressure sensor for damage.

Q: Is the harness connector in good condition?

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

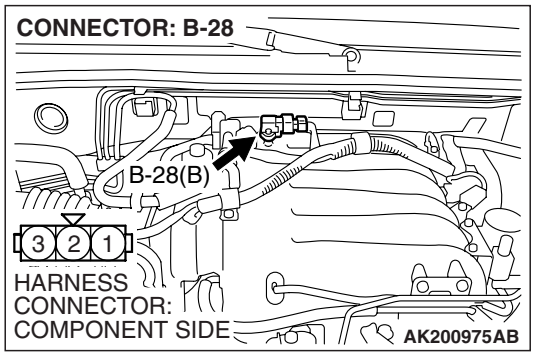


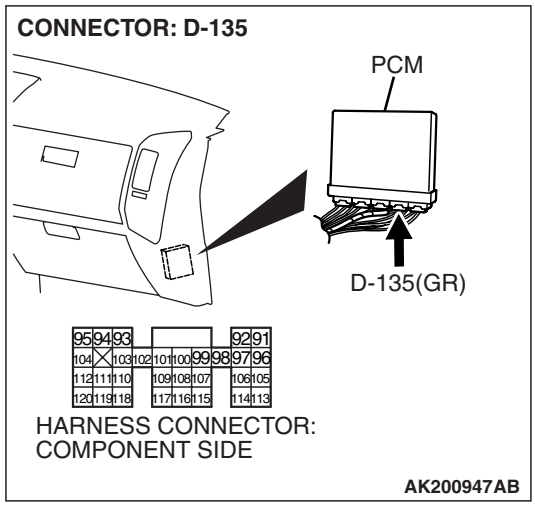
STEP 6. Check for short circuit to ground between manifold absolute pressure sensor connector B-28 (terminal No. 3) and PCM connector D-135 (terminal No. 97).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.



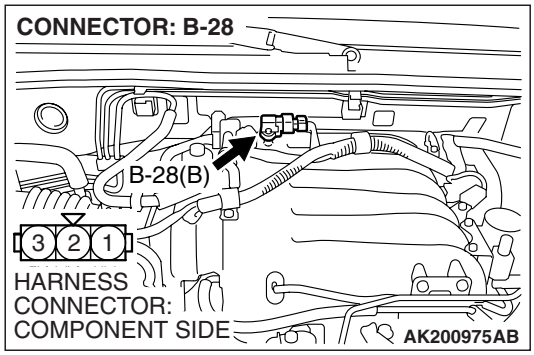


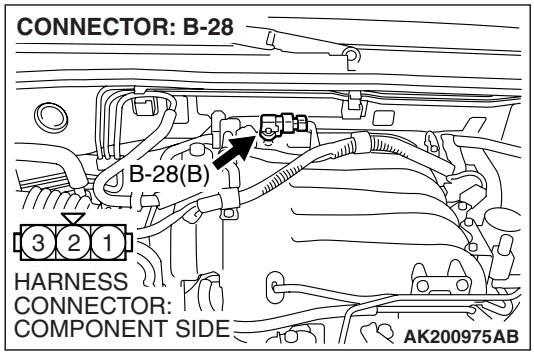
STEP 7. Check harness connector B-28 at the manifold absolute pressure sensor for damage.

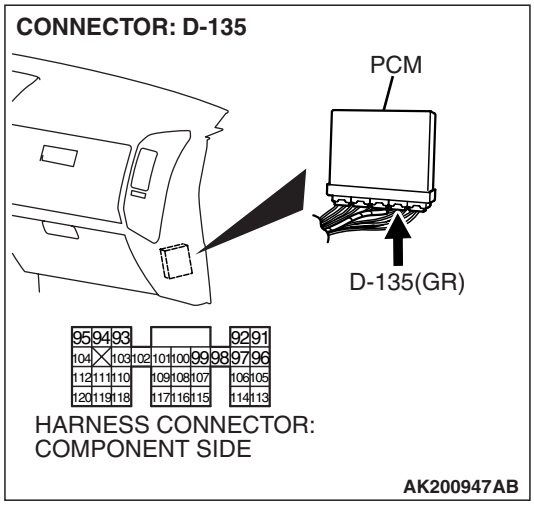
Q: Is the harness connector in good condition?

YES : Repair harness wire between manifold absolute pressure sensor connector B-28 (terminal No. 3) and PCM connector D-135 (terminal No. 97) 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-28 at the manifold absolute pressure sensor and harness connector D-135 at PCM for damage.

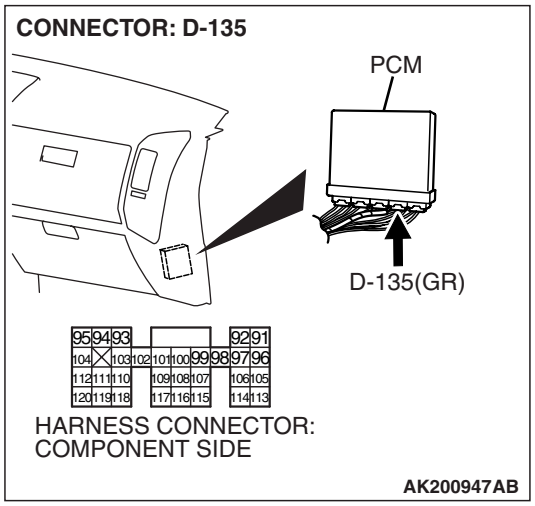
Q: Is the harness connector in good condition?

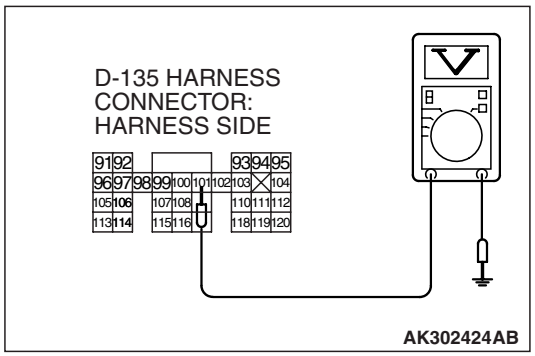
YES : Go to Step 9.

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 D-135 by backprobing.

(1) Do not disconnect the connector D-135.
(2) Turn the ignition switch to the "ON" position.



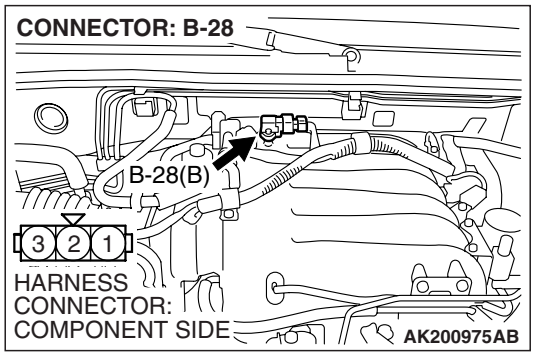


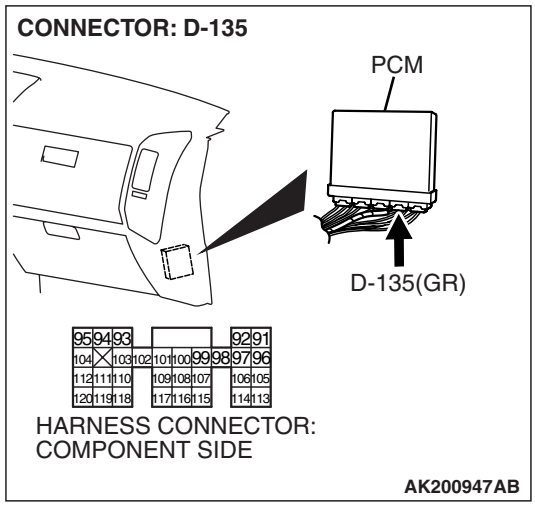
(3) Measure the voltage between terminal No. 101 and ground by backprobing.
- When altitude is 0 m (0 foot), voltage should be 3.7 and 4.3 volts.
- When altitude is 600 m (1,969 feet), voltage should be 3.4 and 4.0 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be 3.2 and 3.8 volts.
-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

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

Q: Is the measured voltage normal?

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



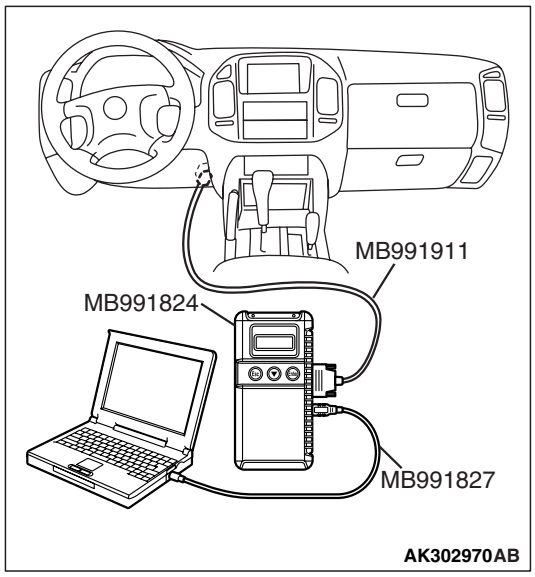


STEP 10. Check for open or short circuit to ground between manifold absolute pressure sensor connector B-28 (terminal No. 1) and PCM connector D-135 (terminal No. 101).

Q: Is the harness wire in good condition?

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

NO : Repair it. Then go to Step 12.



STEP 11. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.

⚠ CAUTION

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

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

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.
NO : Replace the PCM. Then go to Step 12.

STEP 12. Test the OBD-II drive cycle.

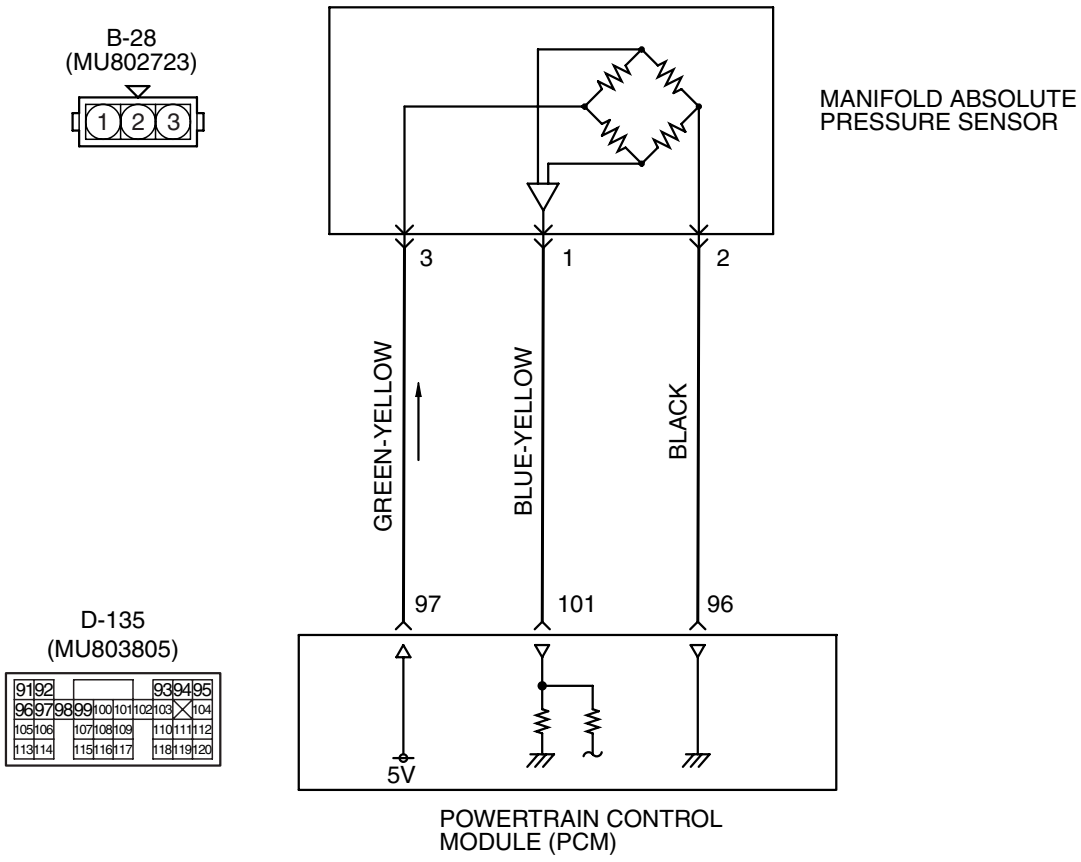
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 P.13A-4.
(2) Check the diagnostic trouble code (DTC).

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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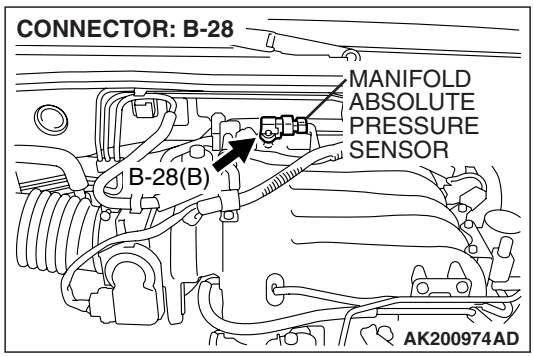
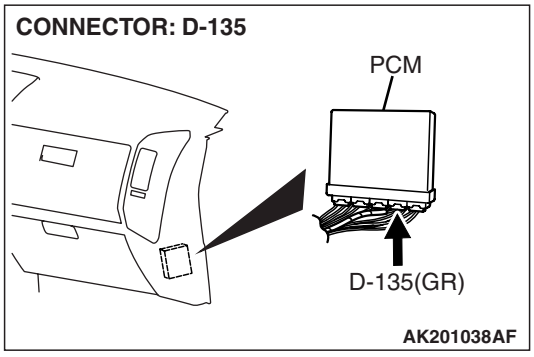




CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

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

TSB Revision

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

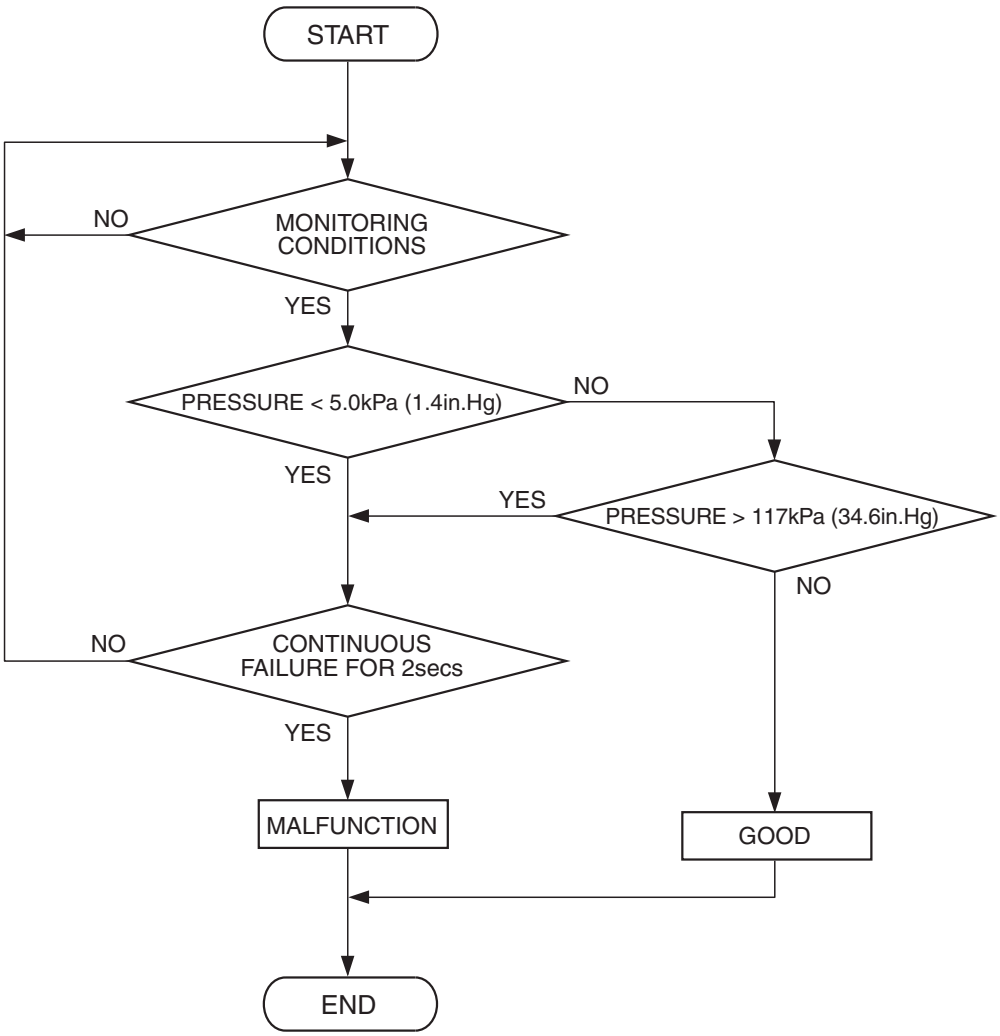
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



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TSB Revision

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.

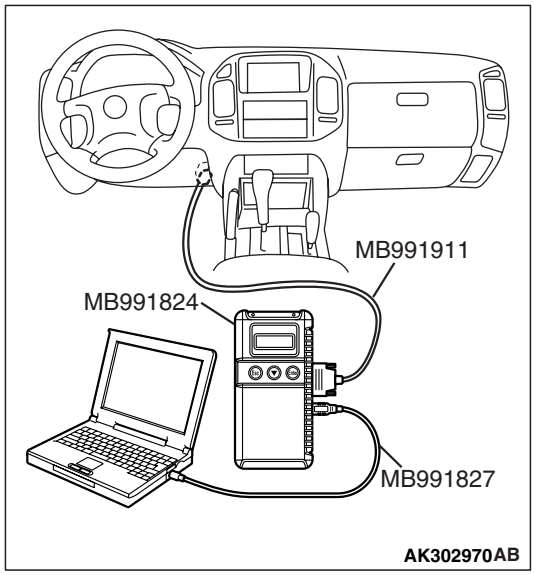
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- 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
  - MB991911: Main Harness B



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

⚠ CAUTION

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

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

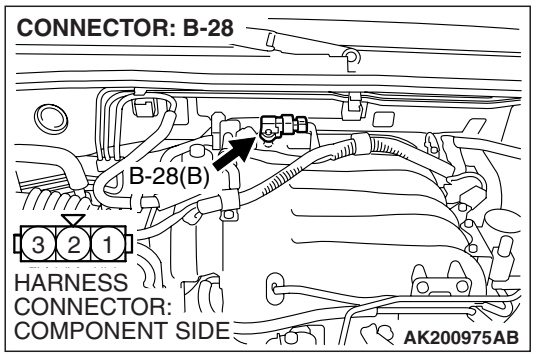
Q: Is the sensor operating properly?

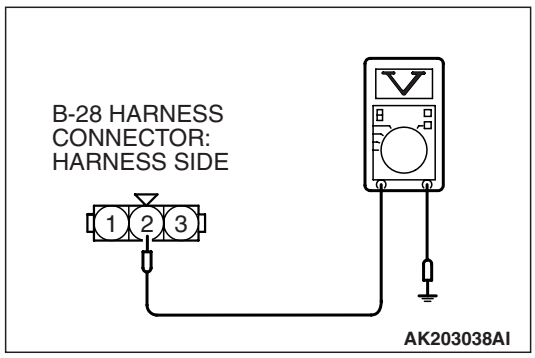
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

NO : Go to Step 2.

STEP 2. Measure the ground voltage at manifold absolute pressure sensor connector B-28 by backprobing.

(1) Do not disconnect the connector B-28.
(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.

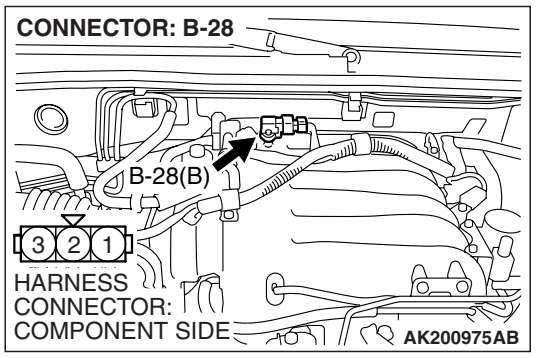
Q: Is the measured voltage 0.5 volt or less?

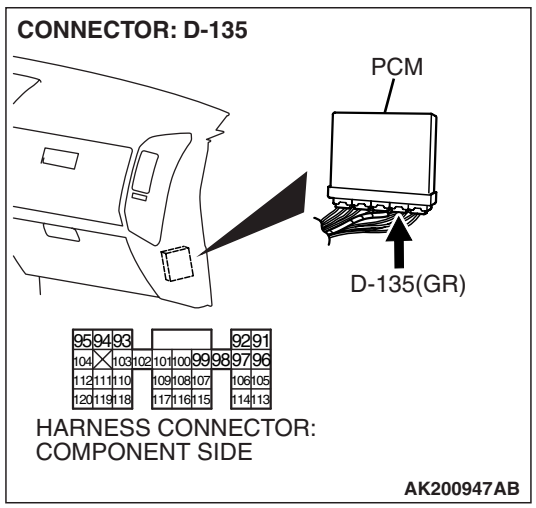
YES : Go to Step 6.
NO : Go to Step 3.

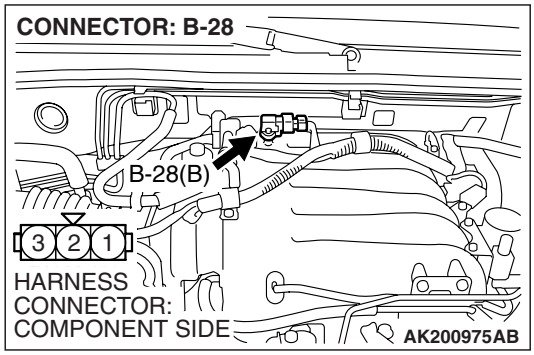
STEP 3. Check harness connector B-28 at the manifold absolute pressure sensor and harness connector D-135 at PCM for damage.

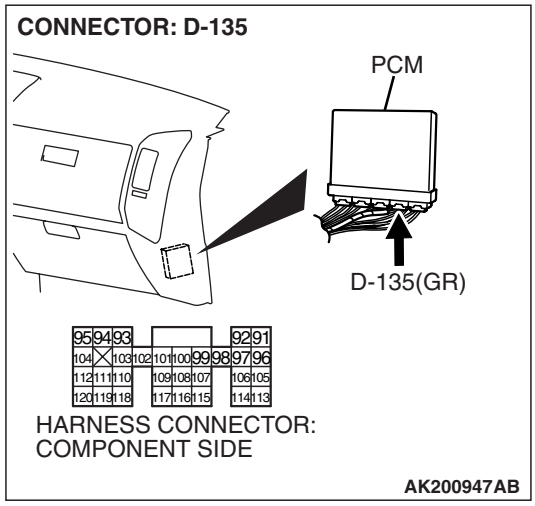
Q: Is the harness connector in good condition?

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.







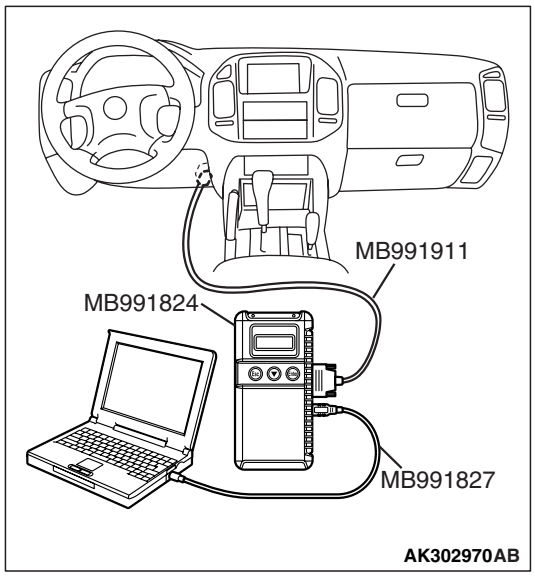


STEP 4. Check for open circuit between manifold absolute pressure sensor connector B-28 (terminal No. 2) and PCM connector D-135 (terminal No. 96).

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.

⚠ CAUTION

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

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

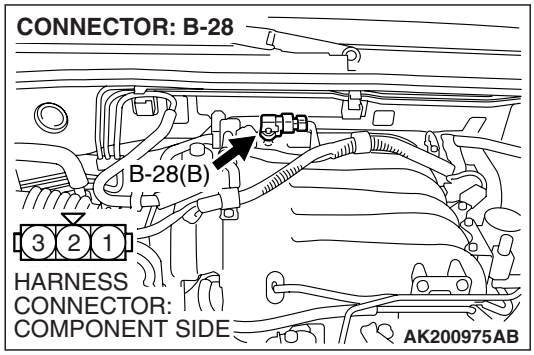
(4) Start the engine.
- When the engine is idling, 16 – 36 kPa (4.7 – 10.6 in.Hg).
- When the engine is suddenly revved, manifold absolute pressure increases.

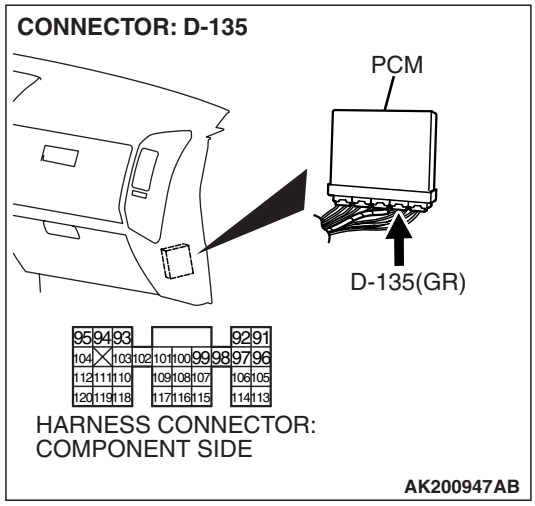
(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-13.

NO : Replace the PCM. Then go to Step 7.





STEP 6. Check harness connector B-28 at the manifold absolute pressure sensor and harness connector D-135 at PCM for damage.

Q: Is the harness connector in good condition?

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

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

STEP 7. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-4.

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

Q: Is DTC P0108 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

NEXT>>