GROUP 13B

MULTIPORT FUEL INJECTION (MFI) <3.8L ENGINE>

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GENERAL DESCRIPTION

M1131000102257

The Multiport Fuel Injection System consists of sensors which detect the engine conditions, the ENGINE CONTROL MODULE (ECM) <M/T> POWERTRAIN CONTROL MODULE (PCM) <A/T> which controls the system based on signals from these sensors, and actuators which operate under the control of the ECM <M/T> or the PCM <A/T>.
The ECM <M/T> or the PCM <A/T> carries out activities such as fuel injection control, idle air control, and ignition timing control.
In addition, the ECM <M/T> or the PCM <A/T> 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 ECM <M/T> or the PCM <A/T> 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 ECM <M/T> or the PCM <A/T> 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 ECM <M/T> or the PCM <A/T> detects the amount of travel of the accelerator pedal via the accelerator pedal position sensor, and controls the actuation of the throttle actuator control motor, which is mounted on the throttle body, in order to attain the target throttle valve opening that has been predetermined in accordance with driving conditions.

IDLE AIR CONTROL

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

IGNITION TIMING CONTROL

The ignition power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the ECM <M/T> or the PCM <A/T> from engine speed, intake air volume, engine coolant temperature, and atmospheric pressure.

DIAGNOSTIC TEST MODE

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

Fan Control

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

Generator Output Current Control

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

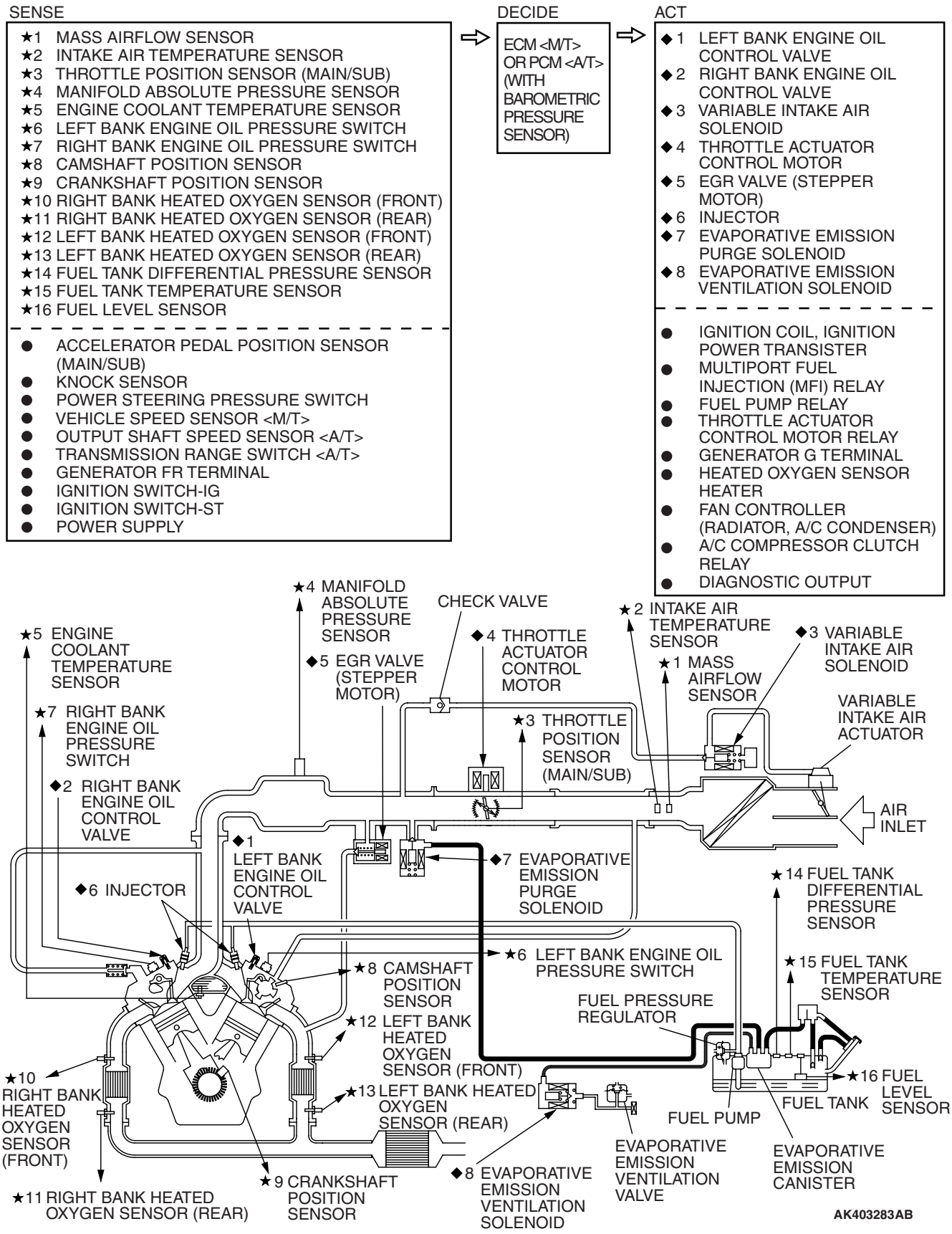
Evaporative Emission Purge Control

- (Refer to GROUP 17, Emission Control System – Evaporative Emission System –General Description P.17-98.)

EGR Control

- (Refer to GROUP 17, Emission Control System – Exhaust Gas Recirculation (EGR) System - General Description P.17-104.)

MULTIPORT FUEL INJECTION (MFI) SYSTEM DIAGRAM



NOTE: For the vacuum routing, refer to GROUP 17, Emission Control System – Vacuum Hoses – Vacuum Hose Routing P.17-92.

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MULTIPORT FUEL INJECTION (MFI) DIAGNOSIS

TROUBLESHOOTING STRATEGY

M1131150001464

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

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

1. Gather as much information as possible about the complaint from the customer.
2. Verify that the condition described by the customer exists.
3. Check the vehicle for any MFI Diagnostic Trouble Code (DTC).
4. If you cannot verify the condition and there are no DTCs, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions P.00-14.
5. If you can verify the condition but there are no DTCs, or the system cannot communicate with the scan tool, refer to the trouble symptom classification table.
6. If there is a DTC, record the number of the code, then erase the code from the memory using the scan tool.
7. Reconfirm the malfunction symptom and carry out a test drive with the drive cycle pattern.
8. If DTC is set again, carry out an inspection with appropriate diagnostic trouble code procedures.
9. If DTC is not set again, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points –How to Cope with Intermittent Malfunctions P.00-14.
10. After repairs are completed, conduct a road test duplicating the complaint set conditions to confirm the malfunction has been corrected.

NOTE: If the engine control module (ECM) <M/T> or the powertrain control module (PCM) <A/T> 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-42.

DIAGNOSTIC FUNCTION

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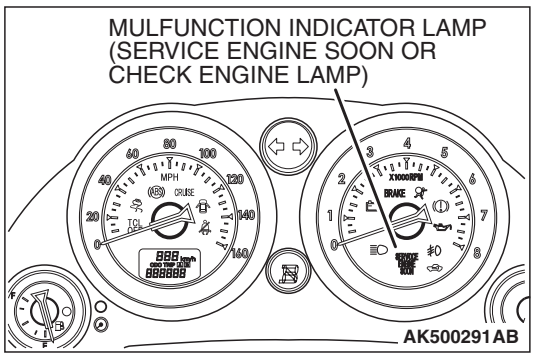

MALFUNCTION INDICATOR LAMP (SERVICE ENGINE SOON OR CHECK ENGINE LAMP)

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

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

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

DTC	ITEM
-	Engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T> malfunction
P0031	Heated oxygen sensor heater circuit low (bank 1 sensor 1)
P0032	Heated oxygen sensor heater circuit high (bank 1 sensor 1)
P0037	Heated oxygen sensor heater circuit low (bank 1 sensor 2)
P0038	Heated oxygen sensor heater circuit high (bank 1 sensor 2)
P0051	Heated oxygen sensor heater circuit low (bank 2 sensor 1)
P0052	Heated oxygen sensor heater circuit high (bank 2 sensor 1)
P0057	Heated oxygen sensor heater circuit low (bank 2 sensor 2)
P0058	Heated oxygen sensor heater circuit high (bank 2 sensor 2)
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor
P0101*	Mass airflow circuit range/performance problem
P0102*	Mass airflow circuit low input
P0103*	Mass airflow circuit high input
P0106	Manifold absolute pressure circuit range/performance problem
P0107	Manifold absolute pressure circuit low input
P0108	Manifold absolute pressure circuit high input
P0111*	Intake air temperature circuit range/performance problem
P0112*	Intake air temperature circuit low input
P0113*	Intake air temperature circuit high input
P0116*	Engine coolant temperature circuit range/performance problem
P0117*	Engine coolant temperature circuit low input
P0118*	Engine coolant temperature circuit high input
P0122*	Throttle position sensor (main) circuit low input
P0123*	Throttle position sensor (main) circuit high input
P0125*	Insufficient coolant temperature for closed loop fuel control
P0128	Coolant thermostat (Coolant temperature below thermostat regulating temperature)
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)
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)
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)

DTC	ITEM
P0154*	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)
P0160	Heated oxygen sensor circuit no activity detected (bank 2 sensor 2)
P0171	System too lean (bank 1)
P0172	System too rich (bank 1)
P0174	System too lean (bank 2)
P0175	System too rich (bank 2)
P0181	Fuel tank temperature sensor circuit range/performance
P0182	Fuel tank temperature sensor circuit low input
P0183	Fuel tank temperature sensor circuit high input
P0201	Injector circuit –cylinder 1
P0202	Injector circuit –cylinder 2
P0203	Injector circuit –cylinder 3
P0204	Injector circuit –cylinder 4
P0205	Injector circuit –cylinder 5
P0206	Injector circuit –cylinder 6
P0222*	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
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

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DTC	ITEM
P0453	Evaporative emission control system pressure sensor high input
P0455	Evaporative emission control system leak detected (gross leak)
P0456	Evaporative emission control system leak detected (very small leak)
P0461	Fuel level sensor (main) circuit range/performance
P0462	Fuel level sensor circuit low input
P0463	Fuel level sensor circuit high input
P0500*	Vehicle speed sensor malfunction <M/T>
P0506	Idle control system RPM lower than expected
P0507	Idle control system RPM higher than expected
P0551	Power steering pressure switch circuit range/performance
P0554	Power steering pressure switch circuit intermittent
P0603*	EEPROM malfunction
P0606*	Engine control module <M/T> or powertrain control module <A/T> 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
P0660	Variable intake air control solenoid circuit
P0705	Transmission range switch circuit malfunction (RPNDL input) <A/T>
P0712*	Transmission fluid temperature sensor circuit low input <A/T>
P0713*	Transmission fluid temperature sensor circuit high input <A/T>
P0715*	Input/Turbine speed sensor circuit <A/T>
P0720*	Output speed sensor circuit <A/T>
P0731*	Gear 1 incorrect ratio <A/T>
P0732*	Gear 2 incorrect ratio <A/T>
P0733*	Gear 3 incorrect ratio <A/T>
P0734*	Gear 4 incorrect ratio <A/T>
P0735	Gear 5 incorrect ratio <A/T>
P0736*	Gear R incorrect ratio <A/T>
P0741	Torque converter clutch circuit performance or stuck off <A/T>
P0742	Torque converter clutch circuit stuck on <A/T>
P0743*	Torque converter clutch circuit electrical <A/T>
P0753*	Shift solenoid "A" electrical <A/T>
P0758*	Shift solenoid "B" electrical <A/T>
P0763*	Shift solenoid "C" electrical <A/T>
P0768	Shift solenoid "D" electrical <A/T>
P0773	Shift solenoid "E" electrical <A/T>
P1020	Mitsubishi innovative valve timing electronic control system (MIVEC) performance problem (bank 1)
P1021	Engine oil control valve circuit (bank 1)

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DTC	ITEM
P1022	Mitsubishi innovative valve timing electronic control system (MIVEC) performance problem (bank 2)
P1023	Engine oil control valve circuit (bank 2)
P1506	Idle control system RPM lower than expected at low engine coolant temperature
P1507	Idle control system RPM higher than expected at low engine coolant temperature
P1602*	Communication malfunction (between ECM <M/T> or PCM <A/T> main processor and system LSI)
P1603*	Battery backup line malfunction
P1751*	A/T control relay malfunction <A/T>
P2066	Fuel level sensor (sub) circuit range/performance
P2100*	Throttle actuator control motor circuit (open)
P2101*	Throttle actuator control motor magneto malfunction
P2122*	Accelerator pedal position sensor (main) circuit low input
P2123*	Accelerator pedal position sensor (main) circuit high input
P2127*	Accelerator pedal position sensor (sub) circuit low input
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	Inactive heated oxygen sensor (bank 1 sensor 1)
P2197	Inactive heated oxygen sensor (bank 2 sensor 1)
P2228*	Barometric pressure circuit low input
P2229*	Barometric pressure circuit high input
P2252	Heated oxygen sensor offset circuit low voltage
P2253	Heated oxygen sensor offset circuit high voltage
U1108*	Combination meter time-out

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

NOTE: After the ECM <M/T> or the PCM <A/T> has detected a malfunction, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "" in the DTC NO. column, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates 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 ECM <M/T> or the PCM <A/T> monitored the powertrain malfunction three times* and met set condition requirements, it detected no malfunction. *: In this case, "one time" indicates from engine start to next engine start.*
- *For misfiring or a fuel trim malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.*

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

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

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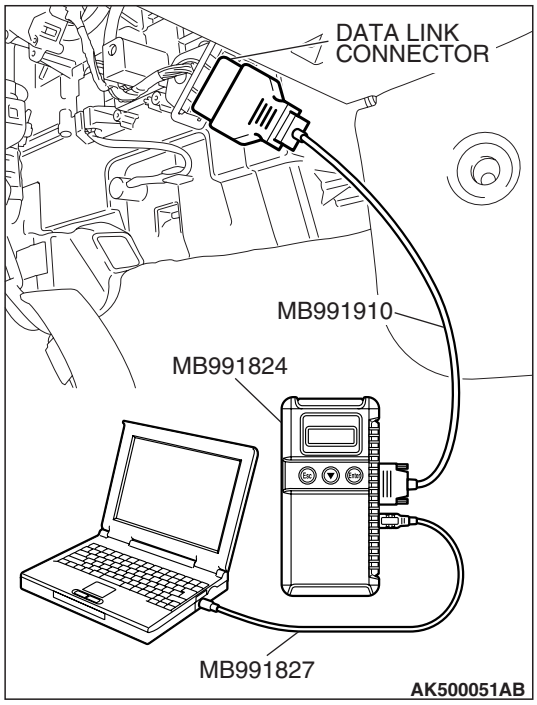
HOW TO CONNECT THE SCAN TOOL (MUT-III)

Required Special Tools:

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

⚠ CAUTION

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



1. Ensure that the ignition switch is at the "LOCK" (OFF) position.
2. Start up the personal computer.
3. Connect special tool MB991827 to special tool MB991824 and the personal computer.
4. Connect special tool MB991910 to special tool MB991824.
5. Connect special tool MB991910 to the data link connector.
6. Turn the power switch of special tool MB991824 to the "ON" position.

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

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

HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODES.

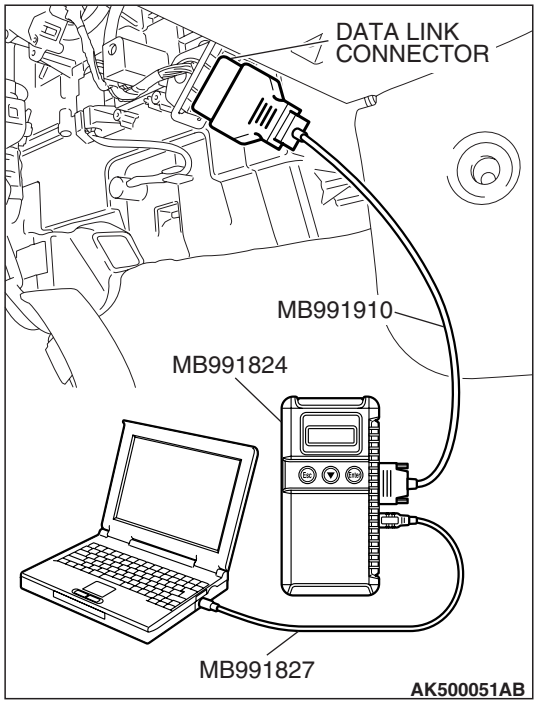
Required Special Tools:

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

⚠ CAUTION

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

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



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

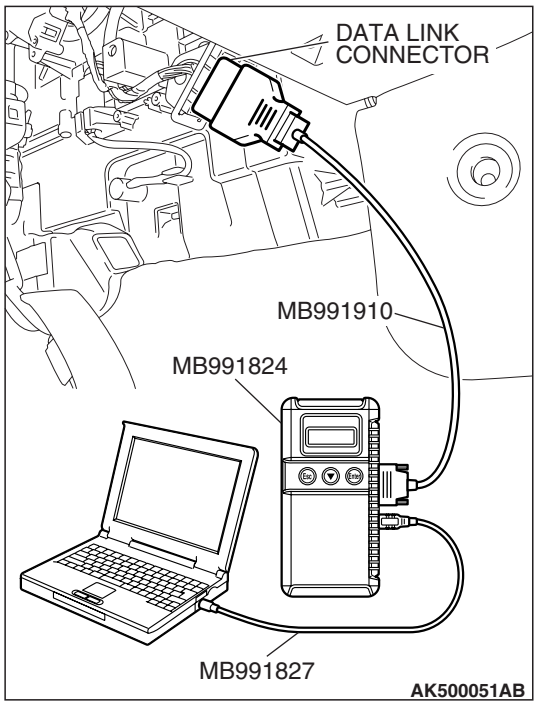
HOW TO READ DATA LIST

Required Special Tools:

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

⚠ CAUTION

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



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

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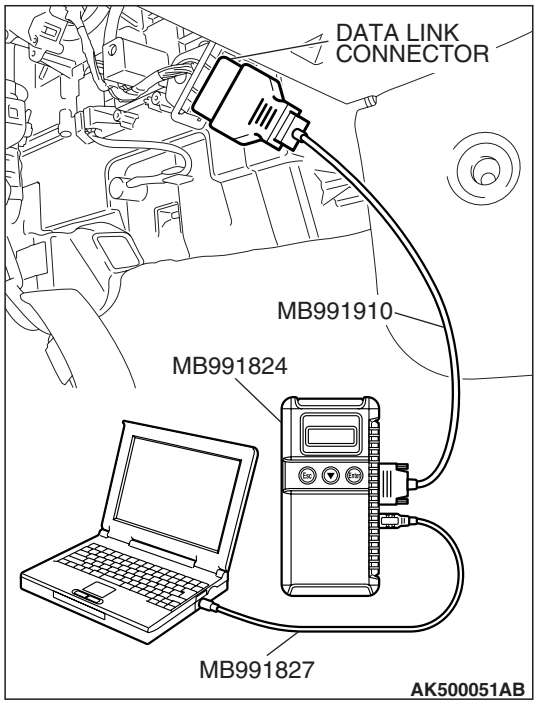
HOW TO PERFORM ACTUATOR TEST

Required Special Tools:

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

⚠ CAUTION

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

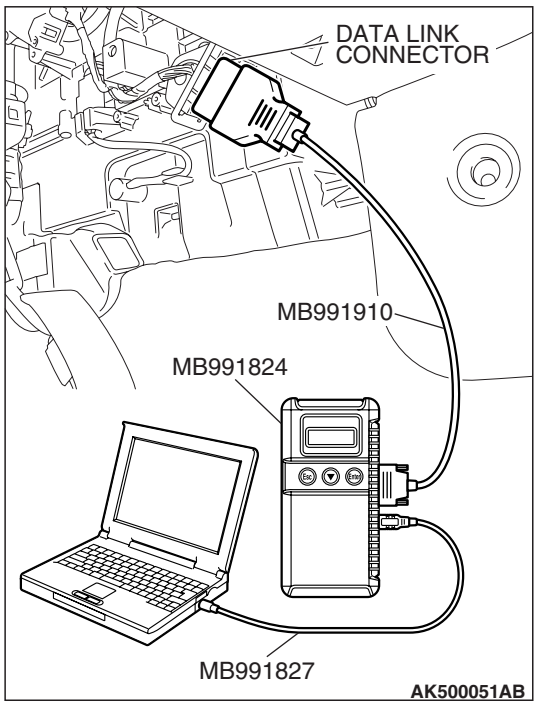


1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "MFI" from the "POWERTRAIN" tab.
6. Select "MITSUBISHI."
7. Select "Actuator Test."
8. Choose an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

HOW TO DIAGNOSE THE CAN BUS LINES

Required Special Tools:

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



⚠ CAUTION

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

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

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

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

MODE 6 REFERENCE TABLE

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

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

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

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFIND TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
06	82	Oxygen Sensor Monitor Bank 2 – Sensor 2 Output Voltage change	ECM/PCM checks the output voltage of the left bank heated oxygen sensor (rear) in order to monitor whether the left bank heated oxygen sensor (rear) output is stuck.	× 0.122 mV
	05	Oxygen Sensor Monitor Bank 2 – Sensor 2 Rich To Lean Sensor Switch Time	ECM/PCM checks the rich to lean switching time of the left bank heated oxygen sensor (rear) in order to monitor the response of the left bank heated oxygen sensor (rear).	× 1 msec
21	83	Catalyst Monitor Bank 1 Frequency ratio between Front- and Rear-Oxygen Sensors	ECM/PCM monitors the deterioration of catalyst at right bank side by the output frequency ratio between right bank heated oxygen sensor (front) and right bank heated oxygen sensor (rear).	× 0.039
22	83	Catalyst Monitor Bank 2 Frequency ratio between Front- and Rear-Oxygen Sensors	ECM/PCM monitors the deterioration of catalyst at left bank side by the output frequency ratio between left bank heated oxygen sensor (front) and left bank heated oxygen sensor (rear).	× 0.039
31	84	EGR Monitor Difference of manifold pressure before and after EGR activation	ECM/PCM monitors the operation of EGR system by the pressure difference of intake manifold between before and after introduction of EGR using the manifold absolute pressure sensor.	× 0.0117 kPa

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFIND TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
39	85	EVAP Monitor (Cap off) Pressure drop during de-pressurizing	ECM/PCM monitors the leak of fuel evaporation gas by checking whether the pressure can be reduced (the amount of pressure reduction) using the fuel tank differential pressure sensor after sealing the fuel tank and the fuel line.	× 0.0117 kPa
3B	85	EVAP Monitor (0.040") Pressure rise during airtight condition	After ECM/PCM vacuumizes the fuel tank and the fuel line and then the specified time is passed, ECM/PCM monitors the leak of fuel evaporation gas through the fuel tank differential pressure sensor to check the reduction of vacuum in the fuel tank.	× 0.0117 kPa
3C	85	EVAP Monitor (0.020") Pressure rise during airtight condition	After ECM/PCM vacuumizes the fuel tank and the fuel line and then the specified time is passed, ECM/PCM monitors the leak of fuel evaporation gas through the fuel tank differential pressure sensor to check the reduction of vacuum in the fuel tank.	× 0.0117 kPa

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFIND TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
A1	0B	Mis-Fire General Data EWMA Misfire Counts For Last 10 Driving Cycles	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire General Data Misfire Counts For Last/Current Driving Cycle	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count
A2	0B	Mis-Fire Cylinder 1 Data EWMA Misfire Counts For Last 10 Driving Cycles	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 1 Data Misfire Counts For Last/Current Driving Cycle	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count
A3	0B	Mis-Fire Cylinder 2 Data EWMA Misfire Counts For Last 10 Driving Cycles	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 2 Data Misfire Counts For Last/Current Driving Cycle	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count

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

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFIND TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
A6	0B	Mis-Fire Cylinder 5 Data EWMA Misfire Counts For Last 10 Driving Cycles	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 5 Data Misfire Counts For Last/Current Driving Cycle	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count
A7	0B	Mis-Fire Cylinder 6 Data EWMA Misfire Counts For Last 10 Driving Cycles	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1count
	0C	Mis-Fire Cylinder 6 Data Misfire Counts For Last/Current Driving Cycle	ECM/PCM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1count

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

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

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

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

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

DIAGNOSTIC BY DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY)

Required Special Tools:

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

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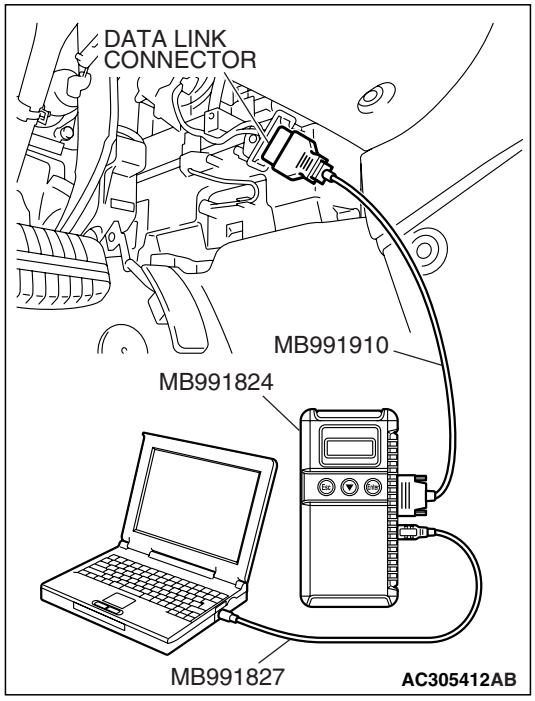

⚠ CAUTION

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

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

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

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ON-BOARD DIAGNOSTICS

The engine control module (ECM) <M/T> or the powertrain control module (PCM) <A/T> monitors the input/output signals (some signals all the time and others under specified conditions) of the ECM <M/T> or the PCM <A/T>. When a malfunction continues for a specified time or longer after the irregular signal is initially monitored, the ECM <M/T> or the PCM <A/T> judges that a malfunction has occurred. After the ECM <M/T> or the PCM <A/T> first detects a malfunction, a diagnostic trouble code is recorded when the engine is restarted and the same malfunction is re-detected. However, for items marked with a "*", a diagnostic trouble code is recorded on the first detection of the malfunction. There are 147 diagnostic items. The diagnostic results can be read out with a scan tool. Since memorization of the diagnostic trouble codes is backed up directly by the battery, the diagnostic results are memorized even if the ignition key is turned off. The diagnostic trouble codes will, however, be erased when the battery terminal or the ECM <M/T> or the PCM <A/T> 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 ECM <M/T> or the PCM <A/T>.

NOTE: If the sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code is memorized. In this case, send the diagnostic trouble code erase signal to the ECM <M/T> or the PCM <A/T> in order to erase the diagnostic memory. The 147 diagnostic items are all indicated sequentially from the smallest code number. The ECM <M/T> or the PCM <A/T> records the engine operating condition when the diagnostic trouble code is set. This data is called "Freeze-frame" data. This data can be read by using the scan tool, and can then be used in simulation tests for troubleshooting. Data items are as follows:

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

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

COMMON EXAMPLE of GENERAL SCAN TOOL DISPLAY	PARAMETER IDENTIFICATION (PID)	DESCRIPTION	UNIT or STATE
DTCFRZF	02	DTC that caused required freeze frame data storage	Pxxxx, Cxxxx, Bxxxx, Uxxxx
FUELSYS 1	03	Fuel system 1 status	• OL (Open Loop) • CL (Closed Loop) • OL-Drive (Open Loop due to driving condition) • OL-Fault (Open Loop due to detected system fault) • CL-Fault (Closed Loop, but fault with at least one oxygen sensor)
FUELSYS 2		Fuel system 2 status	• OL (Open Loop) • CL (Closed Loop) • OL-Drive (Open Loop due to driving condition) • OL-Fault (Open Loop due to detected system fault) • CL-Fault (Closed Loop, but fault with at least one oxygen sensor)
LOAD_PCT	04	Calculated LOAD Value	%
ECT	05	Engine Coolant Temperature	°C (°F)
SHRTFT 1	06	Short Term Fuel Trim –Bank 1	%
LONGFT 1	07	Long Term Fuel Trim –Bank 1	%
SHRTFT 2	08	Short Term Fuel Trim –Bank 2	%
LONGFT 2	09	Long Term Fuel Trim –Bank 2	%
MAP	0B	Intake Manifold Absolute Pressure	kPa (inHg)
RPM	0C	Engine RPM	min^{-1}
VSS	0D	Vehicle Speed Sensor	km/h (mph)
SPARKADV	0E	Ignition Timing Advance for #1 Cylinder	°
IAT	0F	Intake Air Temperature	°C (°F)
MAF	10	Air Flow Rate from Mass Air Flow Sensor	g/s (lb/min)
TP	11	Absolute Throttle Position	%
RUNTM	1F	Time Since Engine Start	sec.
EGR_PCT	2C	Commanded EGR	%
EVAP_PCT	2E	Commanded Evaporative Purge	%
FLI	2F	Fuel Level Input	%
BARO	33	Barometric Pressure	kPa (inHg)
VPWR	42	Control module voltage	V

COMMON EXAMPLE of GENERAL SCAN TOOL DISPLAY	PARAMETER IDENTIFICATION (PID)	DESCRIPTION	UNIT or STATE
LOAD_ABS	43	Absolute Load Value	%
EQ_RAT	44	Commanded Equivalence Ratio	–
TP_R	45	Relative Throttle Position	%
AAT	46	Ambient air temperature	°C (°F)
TP_B	47	Absolute Throttle Position B	%
APP_D	49	Accelerator Pedal Position D	%
APP_E	4A	Accelerator Pedal Position E	%
TAC_PCT	4C	Commanded Throttle Actuator Control	%

OBD- II DRIVE CYCLE

All kinds of diagnostic trouble codes (DTCs) can be monitored by carrying out a short drive according to the following 22 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.

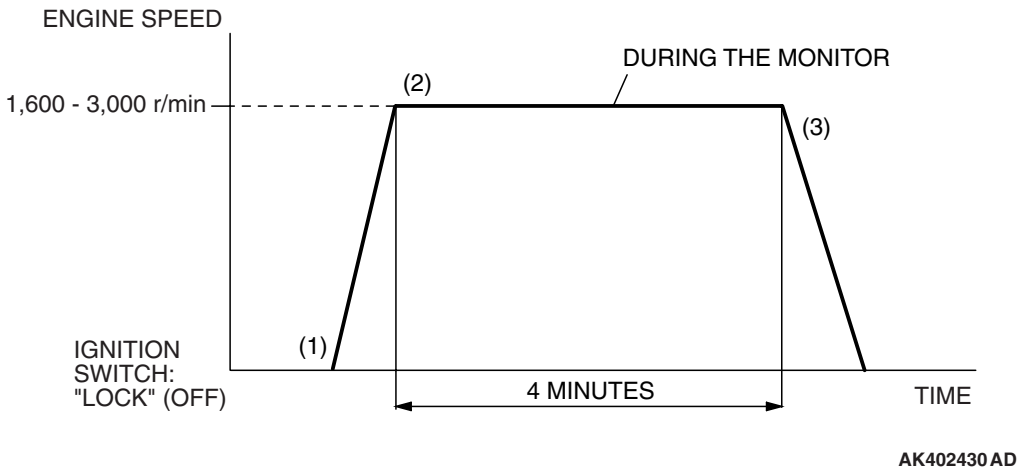
NOTE: Drive cycle patterns are not established for Vehicle speed sensor monitor (DTC P0500), Power steering pressure switch monitor (DTC P0551), and Fuel level sensor monitor (DTC P0461, P2066). Please reference the MUT data list to judge whether these monitor items are normal.

DRIVE CYCLE PATTERN LIST

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Heated oxygen sensor (front) monitor <Readiness test item>	P0133, P0153	1
Heated oxygen sensor heater monitor <Readiness test item>	P0031, P0032, P0037, P0038, P0051, P0052, P0057, P0058	2
Exhaust gas recirculation (EGR) system monitor <Readiness test item>	P0401	3
Catalytic converter monitor <Readiness test item>	P0421, P0431	4
Evaporative emission system leak monitor (small leak and gross leak) <Readiness test item>	P0442, P0455	5
Evaporative purge system monitor	P0441	
Fuel tank pressure sensor monitor	P0450	
Evaporative emission system leak monitor (very small leak) <Readiness test item>	P0456	6
Airflow sensor monitor	P0101	7
Manifold absolute pressure (MAP) sensor monitor	P0106, P0107	
Intake air temperature sensor monitor	P0111	8
Engine coolant temperature sensor monitor	P0116, P0125	9
Thermostat monitor	P0128	10
Heated oxygen sensor (rear) monitor <Readiness test item>	P0139, P0159	11
Air fuel ratio feedback monitor	P0134, P0154	12
Heated oxygen sensor (rear) monitor	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, P1506, P1507	18
MIVEC system monitor	P1020, P1022	19
Fuel trim monitor	P0171, P0172, P0174, P0175	20
Heated oxygen sensor monitor	P0131, P0137, P0151, P0157, P2195, P2197	21

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Airflow sensor monitor	P0102, P0103	22
Manifold absolute pressure (MAP) sensor monitor	P0108	
Intake air temperature sensor monitor	P0112, P0113	
Engine coolant temperature sensor monitor	P0117, P0118	
Heated oxygen sensor monitor	P0132, P0138, P0152, P0158, P2252, P2253	
Fuel tank temperature sensor monitor	P0182, P0183	
Injector monitor	P0201, P0202, P0203, P0204, P0205, P0206	
Crankshaft position sensor monitor	P0335	
Camshaft position sensor monitor	P0340	
Exhaust gas recirculation (EGR) valve (stepper motor) monitor	P0403	
Evaporative emission purge solenoid monitor	P0443	
Evaporative emission ventilation solenoid monitor	P0446	
Fuel tank pressure sensor monitor	P0452, P0453	
Fuel level sensor monitor	P0462, P0463	
Engine oil control valve monitor	P1021, P1023	
Barometric pressure sensor monitor	P2228, P2229	

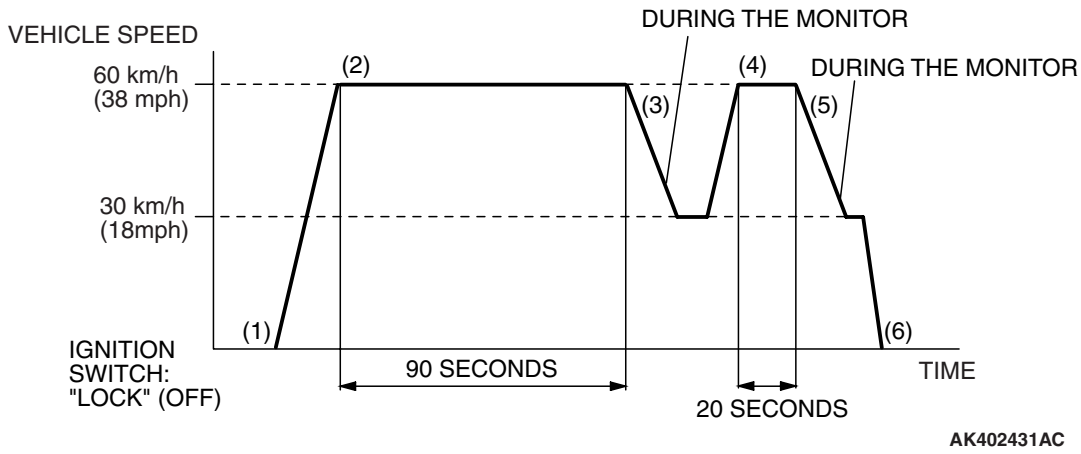
PATTERN 1

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 movement 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.

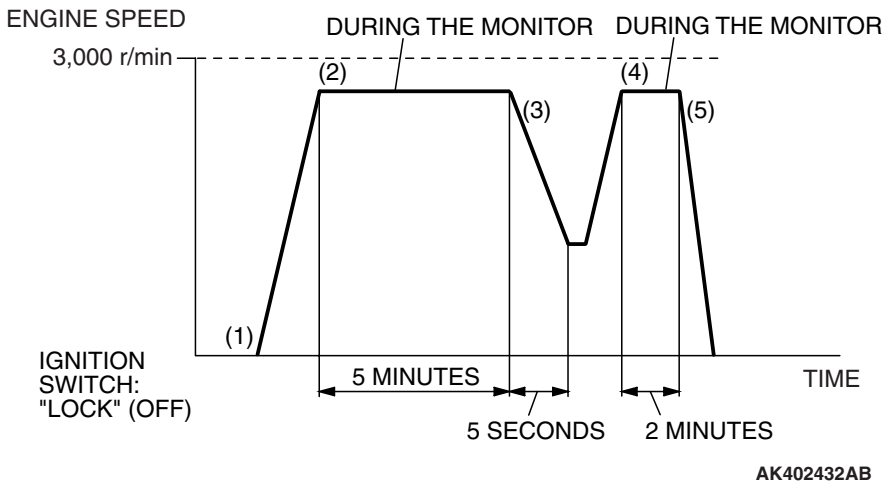
PATTERN 2

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.

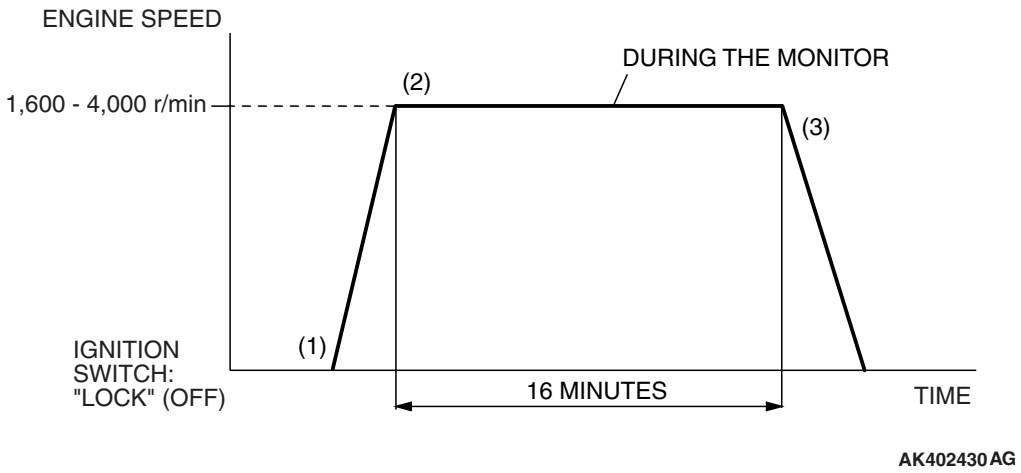
PATTERN 3

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 (18 mph). (During the monitor) 4. Accelerate until the vehicle speed is 60 km/h (38 mph) and then drive the vehicle for 20 seconds. 5. Release the accelerator pedal and reduce vehicle speed to 30 km/h (18 mph). (During the monitor) 6. Stop the 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 4

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 15 g/sec, less than 29 g/sec • Accelerator pedal: Except full close • Without rapid accelerator pedal movement 3. Release the accelerator pedal for 5 seconds. 4. Drive the vehicle for 2 minutes at the following conditions. (During the monitor) • Engine speed: Less than 3,000 r/min • Airflow rate: More than 15 g/sec, less than 29 g/sec • Accelerator pedal: Except full close • Without rapid accelerator pedal movement *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.

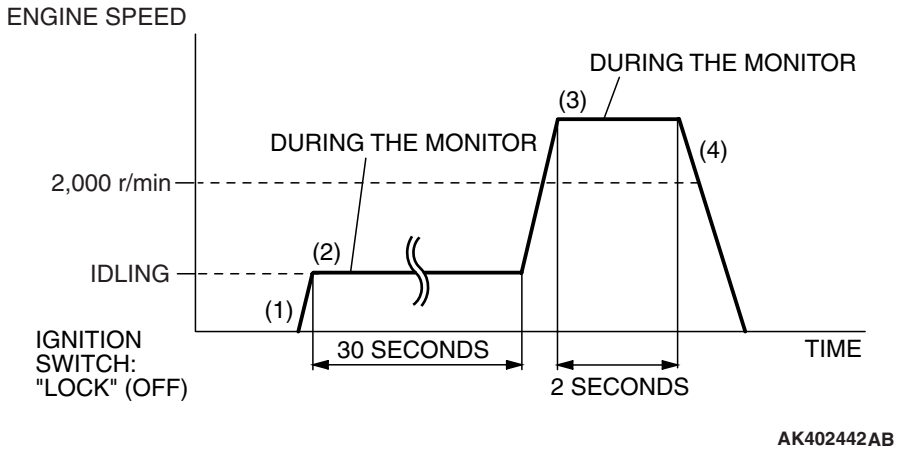
PATTERN 5

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at engine start: Less than 36° C (96° F) • Intake air temperature at engine start: Less than 36° C (96° F) • Fuel amount at engine start: More than 15%, less than 40% • Engine coolant temperature: More than 60° C (41° F) • Intake air temperature: More than 5° C (41° F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Fuel temperature: Less than 36° C (96° F) • Condition of A/T: Selector lever "D" range
Test procedure	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 (18.7 mph) • Engine load: More than 26%, less than 50% • Without rapid accelerator pedal movement *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.

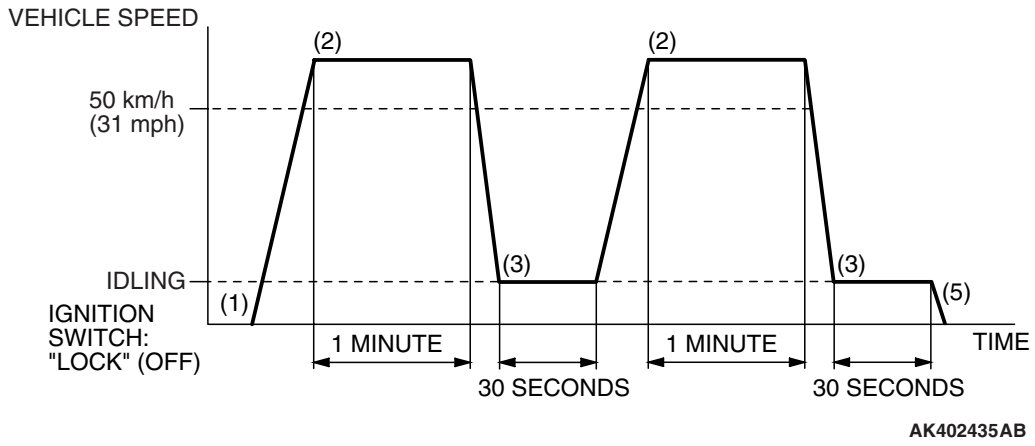
PATTERN 6

Inspection conditions	• Engine coolant temperature at engine start: Less than 36° C (96° F) • Intake air temperature at engine start: Less than 36° C (96° F) • Fuel amount at engine start: More than 40%, less than 85% • Engine coolant temperature: More than 20° C (68° F) • Intake air temperature: More than 5° C (41° F) • Barometric pressure: More than 76 kPa (22.5 inHg) • Fuel temperature: Less than 32° C (90° F)
Test procedure	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.

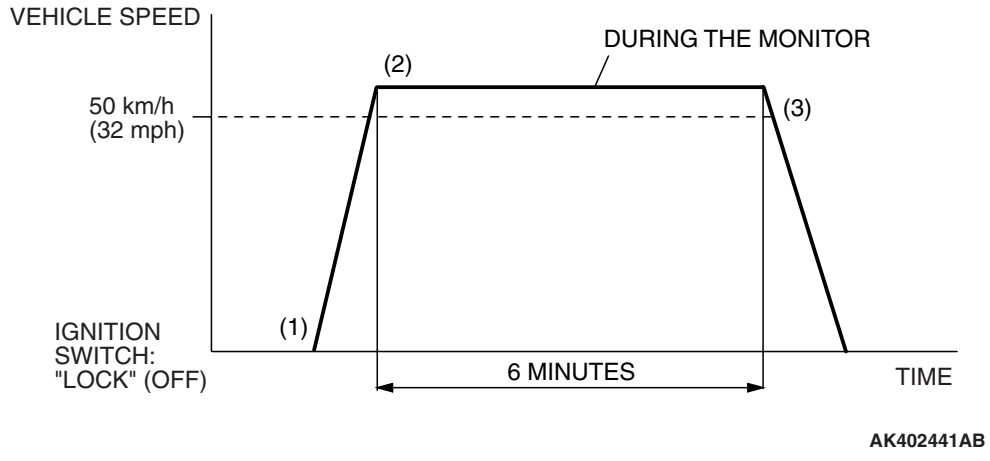
PATTERN 7

Drive cycle pattern	
Inspection condition	• Engine coolant temperature at engine start: 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 8

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 9

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at engine start: More than 7° C (47° F) • Intake air temperature: Less than 60° C (140° F) • Engine coolant temperature: More than 40° C (104° F) • Condition of A/T: Selector lever "D" range
Test procedure	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 (32 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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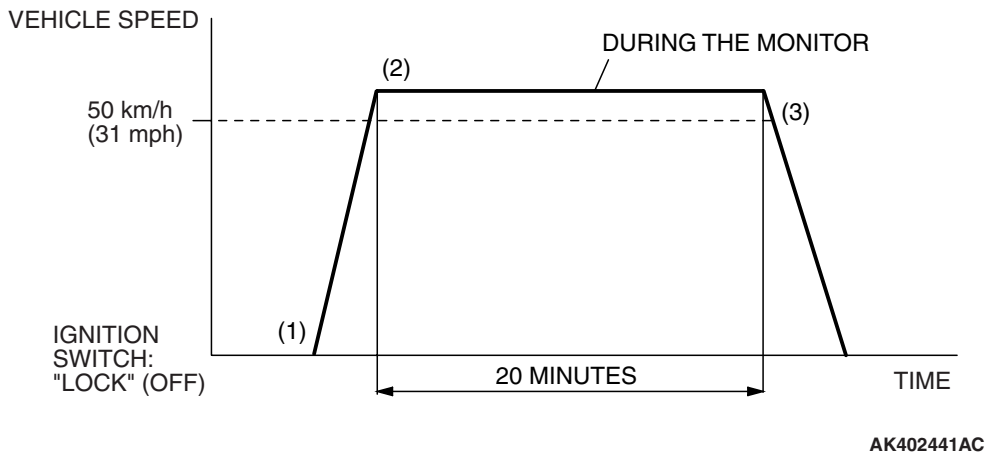
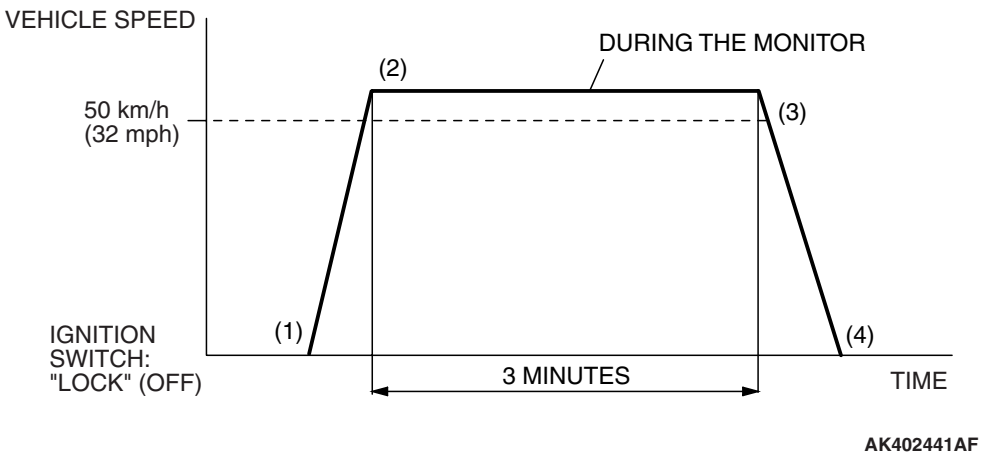
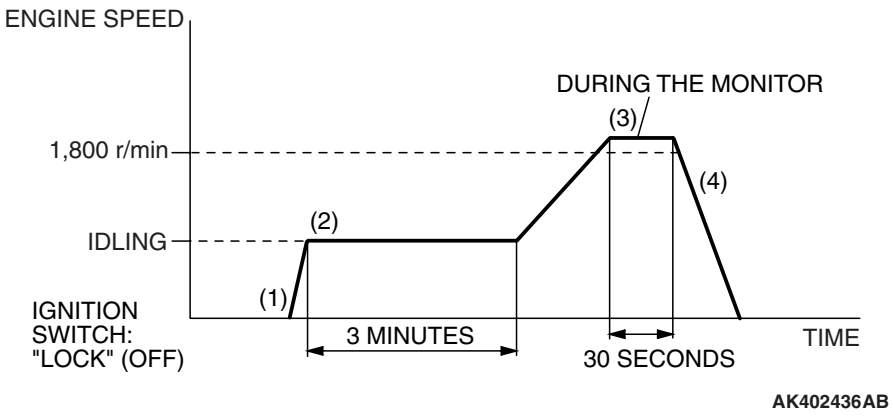
PATTERN 10

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at engine start: More than 10° C (50° F), less than 76° C (168° F) • Difference between engine coolant temperature and intake air temperature at engine start: Less than 5° C (9° F) • Dropping of intake air temperature since engine start: Less than 2° C (3.6° F) • Condition of A/T: Selector lever "D" range
Test procedure	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 (32 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.

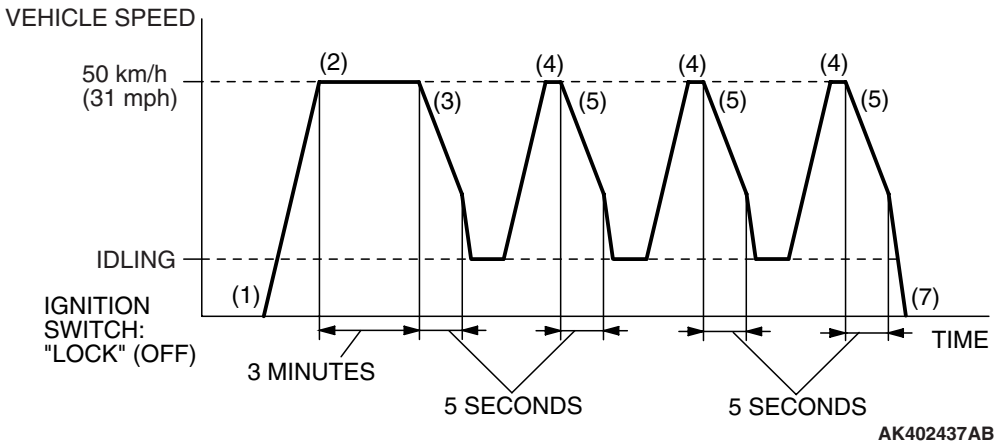
PATTERN 11

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 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. Confirm that the diagnostic trouble code (DTC) is not output.

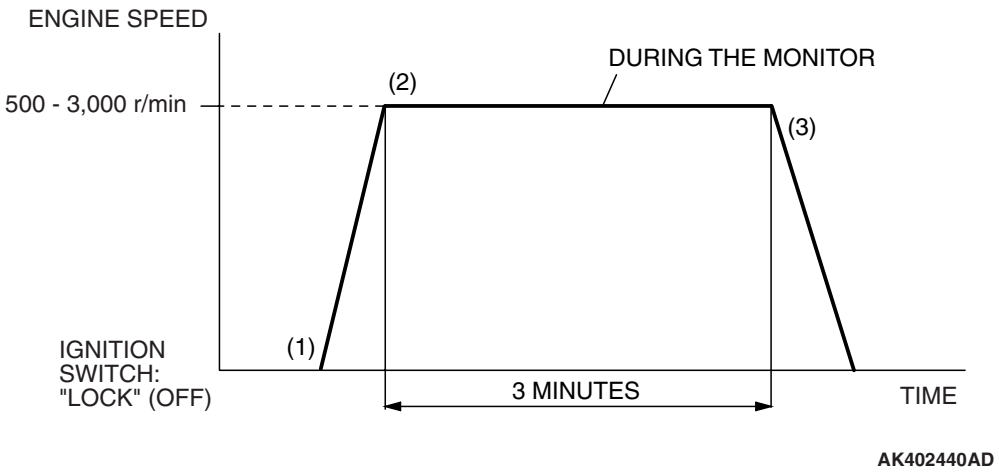
PATTERN 13

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.

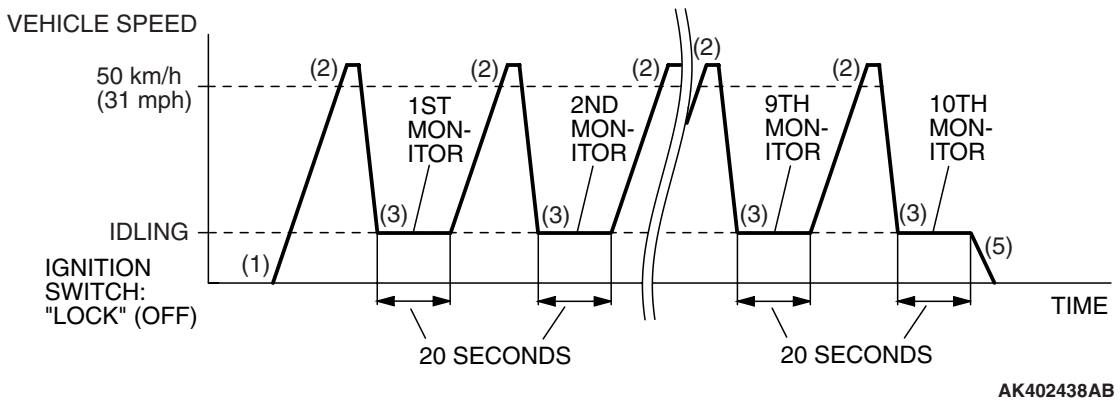
PATTERN 14

Inspection conditions	• Engine coolant temperature at engine start: More than –10° C (14° F), less than 33° C (91° F) • Difference between engine coolant temperature and intake air temperature at engine start: Less than 5° C (9° F) • Condition of A/T: Selector lever "D" range
Test procedure	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.

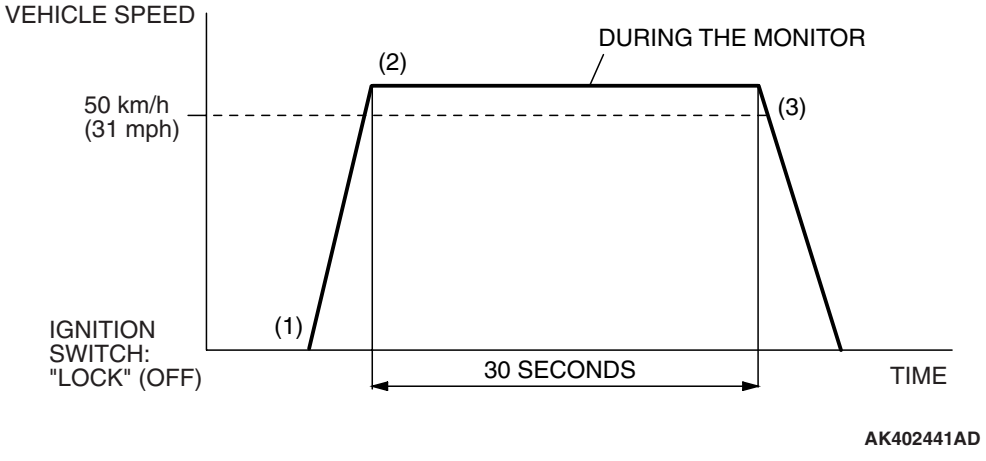
PATTERN 15

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 condition	Engine coolant temperature: More than 77° C (171° F)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 30 seconds. 3. Drive the engine at more than 4,813 r/min for 5 seconds. (During the monitor) 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 20

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 21

Inspection conditions	• Intake air temperature: More than –10° C (14° F) • Engine coolant temperature sensor: More than 7° C (45° F)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 4 minutes. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 22

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

SYSTEM READINESS TEST STATUS

PURPOSE

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

OVERVIEW

The ECM <M/T> or PCM <A/T> 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

M1131153000697

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

MALFUNCTION ITEM	CONTROL CONTENTS DURING MALFUNCTION
Mass airflow sensor	• Uses the throttle position sensor signal and engine speed signal (crankshaft position sensor signal) for basic injector drive time and basic ignition timing from the pre-set mapping.
Intake air temperature sensor	Controls as if the intake air temperature is 25° C (77° F).
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80° C (176° F). (This control will be continued until the ignition switch is turned to "LOCK" (OFF) position even though the sensor signal returns to normal.)
Camshaft position sensor	Injects fuel simultaneously into all cylinders. (After the ignition switch is turned to "ON" position, the No.1 cylinder top dead center is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa (30 in.Hg).
Knock sensor	Switches the ignition timing from ignition timing for high octane to ignition timing for standard octane fuel.
Heated oxygen sensor <front>	Air/fuel ratio closed loop control is not performed.
Heated oxygen sensor <rear>	Performs the closed loop control of the air/fuel ratio by using only the signal of the heated oxygen sensor (front) installed on the front side of the catalytic converter.
Generator FR terminal	No generator output suppression control is performed for the electrical load (to be operated as an ordinary generator).
Misfire detection	The ECM <M/T> or the PCM <A/T> stops supplying fuel to the cylinder with the highest misfire rate if a misfire that could damage the catalytic converter is detected.
Accelerator pedal position sensor (main)	• Detects the amount of the accelerator pedal travel through the use of the accelerator pedal position sensor (sub) signal, but rendering it only as being approximately one-half the normal opening angle. • Prohibits the operation of the auto-cruise control. • Cuts off fuel when the engine speed exceeds 3,000 r/min. • Suppresses the engine output by stopping the electronically controlled throttle valve system if the accelerator pedal position sensor (sub) is also malfunctioning.
Accelerator pedal position sensor (sub)	• Detects the amount of the accelerator pedal travel through the use of the accelerator pedal position sensor (main) signal, but rendering it only as being approximately one-half the normal opening angle. • Prohibits the operation of the auto-cruise control. • Cuts off fuel when the engine speed exceeds 3,000 r/min. • Suppresses the engine output by stopping the electronically controlled throttle valve system if the accelerator pedal position sensor (main) is also malfunctioning.

MALFUNCTION ITEM	CONTROL CONTENTS DURING MALFUNCTION
Throttle position sensor (main)	• Controls the throttle valve position through the use of the throttle position sensor (sub) signal. • Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle. • Prohibits the operation of the engine speed feedback control. • Prohibits the operation of the auto-cruise control. • Cuts off fuel when the engine speed exceeds 3,000 r/min. • Suppresses the engine output by stopping the electronically controlled throttle valve system if the throttle position sensor (sub) is also malfunctioning.
Throttle position sensor (sub)	• Controls the throttle valve position through the use of the throttle position sensor (main) signal. • Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle. • Prohibits the operation of the auto-cruise control. • Cuts off fuel when the engine speed exceeds 3,000 r/min. • Prohibits the idle speed control from learning. • Suppresses the engine output by stopping the electronically controlled throttle valve system if the throttle position sensor (main) is also malfunctioning.
Throttle valve position feedback	• Suppresses the engine output by stopping the electronically controlled throttle valve system. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control.
Throttle actuator control motor	• Suppresses the engine output by stopping the electronically controlled throttle valve system. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control.
Throttle actuator control computer	• Suppresses the engine output by stopping the electronically controlled throttle valve system. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control.
Communication between throttle actuator control computer and engine control computer	• Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control. • Cuts off fuel when the engine speed exceeds 3,000 r/min.
Switching to high-speed cam in Mitsubishi Innovative Valve timing Electronic Control (MIVEC)	• Does not switch to high-speed cam. • Cut off fuel when the engine speed exceeds 5,000 r/min.

DIAGNOSTIC TROUBLE CODE CHART

M1131151001779

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

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0031	Heated oxygen sensor heater low (bank 1 sensor 1)	P.13B-52
P0032	Heated oxygen sensor heater high (bank 1 sensor 1)	P.13B-66
P0037	Heated oxygen sensor heater low (bank 1 sensor 2)	P.13B-70
P0038	Heated oxygen sensor heater high (bank 1 sensor 2)	P.13B-84
P0051	Heated oxygen sensor heater low (bank 2 sensor 1)	P.13B-88
P0052	Heated oxygen sensor heater high (bank 2 sensor 1)	P.13B-102
P0057	Heated oxygen sensor heater low (bank 2 sensor 2)	P.13B-107
P0058	Heated oxygen sensor heater high (bank 2 sensor 2)	P.13B-121
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor	P.13B-126
P0101*	Mass airflow circuit range/performance problem	P.13B-131
P0102*	Mass airflow circuit low input	P.13B-142
P0103*	Mass airflow circuit high input	P.13B-152
P0106	Manifold absolute pressure circuit range/performance problem	P.13B-159
P0107	Manifold absolute pressure circuit low input	P.13B-174
P0108	Manifold absolute pressure circuit high input	P.13B-186
P0111*	Intake air temperature circuit range/performance problem	P.13B-195
P0112*	Intake air temperature circuit low input	P.13B-204
P0113*	Intake air temperature circuit high input	P.13B-211
P0116*	Engine coolant temperature circuit range/performance problem	P.13B-221
P0117*	Engine coolant temperature circuit low input	P.13B-230
P0118*	Engine coolant temperature circuit high input	P.13B-237
P0122*	Throttle position sensor (main) circuit low input	P.13B-248
P0123*	Throttle position sensor (main) circuit high input	P.13B-259
P0125*	Insufficient coolant temperature for closed loop fuel control	P.13B-267
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	P.13B-280
P0131	Heated oxygen sensor circuit low voltage (bank 1 sensor 1)	P.13B-282
P0132	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)	P.13B-298
P0133	Heated oxygen sensor circuit slow response (bank 1 sensor 1)	P.13B-303
P0134*	Heated oxygen sensor circuit no activity detected (bank 1 sensor 1)	P.13B-309

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DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0137	Heated oxygen sensor circuit low voltage (bank 1 sensor 2)	P.13B-319
P0138	Heated oxygen sensor circuit high voltage (bank 1 sensor 2)	P.13B-335
P0139	Heated oxygen sensor circuit slow response (bank 1 sensor 2)	P.13B-340
P0140	Heated oxygen sensor circuit no activity detected (bank 1 sensor 2)	P.13B-344
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)	P.13B-348
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)	P.13B-364
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)	P.13B-369
P0154*	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)	P.13B-375
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)	P.13B-385
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)	P.13B-401
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)	P.13B-406
P0160	Heated oxygen sensor circuit no activity detected (bank 2 sensor 2)	P.13B-410
P0171	System too lean (bank 1)	P.13B-414
P0172	System too rich (bank 1)	P.13B-423
P0174	System too lean (bank 2)	P.13B-430
P0175	System too rich (bank 2)	P.13B-438
P0181	Fuel tank temperature sensor circuit range/performance	P.13B-444
P0182	Fuel tank temperature sensor circuit low input	P.13B-456
P0183	Fuel tank temperature sensor circuit high input	P.13B-463
P0201	Injector circuit-cylinder 1	P.13B-474
P0202	Injector circuit-cylinder 2	P.13B-486
P0203	Injector circuit-cylinder 3	P.13B-497
P0204	Injector circuit-cylinder 4	P.13B-509
P0205	Injector circuit-cylinder 5	P.13B-520
P0206	Injector circuit-cylinder 6	P.13B-532
P0222*	Throttle position sensor (sub) circuit low input	P.13B-543
P0223*	Throttle position sensor (sub) circuit high input	P.13B-554
P0300	Random/multiple cylinder misfire detected	P.13B-561
P0301	Cylinder 1 misfire detected	P.13B-567
P0302	Cylinder 2 misfire detected	P.13B-571
P0303	Cylinder 3 misfire detected	P.13B-575
P0304	Cylinder 4 misfire detected	P.13B-579
P0305	Cylinder 5 misfire detected	P.13B-582
P0306	Cylinder 6 misfire detected	P.13B-585
P0325	Knock sensor circuit	P.13B-589
P0335*	Crankshaft position sensor circuit	P.13B-597

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DTC	DIAGNOSTIC ITEM		REFERENCE PAGE
P0340*	Camshaft position sensor circuit		P.13B-619
P0401	Exhaust gas recirculation flow insufficient detected		P.13B-635
P0403	Exhaust gas recirculation control circuit		P.13B-639
P0421	Warm up catalyst efficiency below threshold (bank 1)		P.13B-652
P0431	Warm up catalyst efficiency below threshold (bank 2)		P.13B-654
P0441	Evaporative emission control system incorrect purge flow		P.13B-656
P0442	Evaporative emission control system leak detected (small leak)		P.13B-660
P0443	Evaporative emission control system purge control valve circuit		P.13B-673
P0446	Evaporative emission control system vent control circuit		P.13B-685
P0450	Evaporative emission control system pressure sensor malfunction		P.13B-697
P0451	Evaporative emission control system pressure sensor range/performance		P.13B-718
P0452	Evaporative emission control system pressure sensor low input		P.13B-740
P0453	Evaporative emission control system pressure sensor high input		P.13B-760
P0455	Evaporative emission control system leak detected (gross leak)		P.13B-781
P0456	Evaporative emission control system leak detected (very small leak)		P.13B-798
P0461	Fuel level sensor (main) circuit range/performance		P.13B-811
P0462	Fuel level sensor circuit low input		P.13B-818
P0463	Fuel level sensor circuit high input		P.13B-825
P0500*	Vehicle speed sensor malfunction <M/T>		P.13B-832
P0506	Idle control system RPM lower than expected		P.13B-846
P0507	Idle control system RPM higher than expected		P.13B-849
P0513	Immobilizer malfunction		P.13B-852
P0551	Power steering pressure switch circuit range/performance		P.13B-854
P0554	Power steering pressure switch circuit intermittent		P.13B-868
P0603*	EEPROM malfunction		P.13B-873
P0606*	Engine control module <M/T> or Powertrain control module <A/T> main processor malfunction		P.13B-875
P0622	Generator FR terminal circuit malfunction		P.13B-877
P0630*	VIN malfunction		P.13B-884
P0638*	Throttle actuator control motor circuit range/ performance		P.13B-887
P0642*	Throttle position sensor power supply		P.13B-893
P0657*	Throttle actuator control motor relay circuit malfunction		P.13B-895
P0660	Variable intake air control solenoid circuit		P.13B-909
P0705	Transmission range switch circuit malfunction (PRNDL input) <A/T>	• A/T DTC No. P1770 (Transmission range switch system: Open circuit) • A/T DTC No. P1771 (Transmission range switch system: Short circuit)	P.23A-63

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DTC	DIAGNOSTIC ITEM		REFERENCE PAGE
P0712*	Transmission fluid temperature sensor low input <A/T>	• A/T DTC No. P1764 (Transmission fluid temperature sensor system: Short circuit)	P.23A-63
P0713*	Transmission fluid temperature sensor high input <A/T>	• A/T DTC No. P1763 (Transmission fluid temperature sensor system: Open circuit)	P.23A-63
P0715*	Input/turbine speed sensor circuit <A/T>	• A/T DTC No. P1766 (Input shaft speed sensor system: Short circuit/Open circuit)	P.23A-63
P0720*	Output speed sensor circuit <A/T>	• A/T DTC No. P1767 (Output shaft speed sensor system: Short circuit/Open circuit)	P.23A-63
P0731*	Gear 1 incorrect ratio <A/T>	• A/T DTC No. P1779 (1st gear incorrect ratio)	P.23A-63
P0732*	Gear 2 incorrect ratio <A/T>	• A/T DTC No. P1780 (2nd gear incorrect ratio)	P.23A-63
P0733*	Gear 3 incorrect ratio <A/T>	• A/T DTC No. P1781 (3rd gear incorrect ratio)	P.23A-63
P0734*	Gear 4 incorrect ratio <A/T>	• A/T DTC No. P1782 (4th gear incorrect ratio)	P.23A-63
P0735	Gear 5 incorrect ratio <A/T>	• A/T DTC No. P1783 (5th gear incorrect ratio <5A/T>)	P.23A-63
P0736*	Gear R incorrect ratio <A/T>	• A/T DTC No. P1784 (Reverse gear incorrect ratio)	P.23A-63
P0741	Torque converter clutch circuit performance or stuck off <A/T>	• A/T DTC No. P1786 (Torque converter clutch solenoid system: Defective system)	P.23A-63
P0742	Torque converter clutch circuit stuck on <A/T>	• A/T DTC No. P1787 (Torque converter clutch solenoid system: Lock-up stuck on)	P.23A-63
P0743*	Torque converter clutch circuit electrical <A/T>	• A/T DTC No. P1778 (Torque converter clutch solenoid system: Short circuit/Open circuit)	P.23A-63
P0753*	Shift solenoid "A" electrical <A/T>	• A/T DTC No. P1773 (Low and reverse solenoid valve system: Short circuit/Open circuit)	P.23A-63
P0758*	Shift solenoid "B" electrical <A/T>	• A/T DTC No. P1774 (Underdrive solenoid valve system: Short circuit/Open circuit)	P.23A-63
P0763*	Shift solenoid "C" electrical <A/T>	• A/T DTC No. P1775 (Second solenoid valve system: Short circuit/Open circuit)	P.23A-63
P0768*	Shift solenoid "D" electrical <A/T>	• A/T DTC No. P1776 (Overdrive solenoid valve system: Short circuit/Open circuit)	P.23A-63
P0773	Shift solenoid "E" electrical <A/T>	• A/T DTC No. P1777 (Reduction solenoid valve system: <5A/T>)	P.23A-63
P1020	Mistubishi innovative valve timing electronic control system (MIVEC) performance problem (bank 1)		P.13B-920
P1021	Engine oil control valve circuit (bank 1)		P.13B-929

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DTC	DIAGNOSTIC ITEM		REFERENCE PAGE
P1022	Mistubishi innovative valve timing electronic control system (MIVEC) performance problem (bank 2)		P.13B-940
P1023	Engine oil control valve circuit (bank 2)		P.13B-949
P1506	Idle control system RPM lower than expected at low engine coolant temperature		P.13B-960
P1507	Idle control system RPM higher than expected at low engine coolant temperature		P.13B-963
P1530	A/C1 switch circuit intermittent		P.13B-966
P1602*	Communication malfunction (between ECM <M/T> or PCM <A/T> main processor and system LSI)		P.13B-967
P1603*	Battery backup line malfunction		P.13B-969
P1751*	A/T control relay malfunction <A/T>	• A/T DTC No. P1788 (A/T control relay system: Short circuit to ground /open circuit)	P.23A-63
P2066	Fuel level sensor (sub) circuit range/performance		P.13B-976
P2100*	Throttle actuator control motor circuit (open)		P.13B-981
P2101*	Throttle actuator control motor magneto malfunction		P.13B-989
P2122*	Accelerator pedal position sensor (main) circuit low input		P.13B-995
P2123*	Accelerator pedal position sensor (main) circuit high input		P.13B-1005
P2127*	Accelerator pedal position sensor (sub) circuit low input		P.13B-1012
P2128*	Accelerator pedal position sensor (sub) circuit high input		P.13B-1022
P2135*	Throttle position sensor (main and sub) range/performance problem		P.13B-1029
P2138*	Accelerator pedal position sensor (main and sub) range/performance problem		P.13B-1035
P2195	Inactive heated oxygen sensor (bank 1 sensor 1)		P.13B-1049
P2197	Inactive heated oxygen sensor (bank 2 sensor 1)		P.13B-1052
P2228*	Barometric pressure circuit low input		P.13B-1059
P2229*	Barometric pressure circuit high input		P.13B-1061
P2252	Heated oxygen sensor offset circuit low voltage		P.13B-1055
P2253	Heated oxygen sensor offset circuit high voltage		P.13B-1057
U1073	Bus off		P.13B-1063
U1102	ABS-ECU time-out		P.13B-1065
U1108*	Combination meter time-out		P.13B-1070
U1109	ETACS-ECU time-out		P.13B-1074
U1110	A/C-ECU time-out		P.13B-1078
U1117	Immobilizer-ECU time-out		P.13B-1082

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

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

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

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

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

SYMPTOM CHART

M1131151501484

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

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

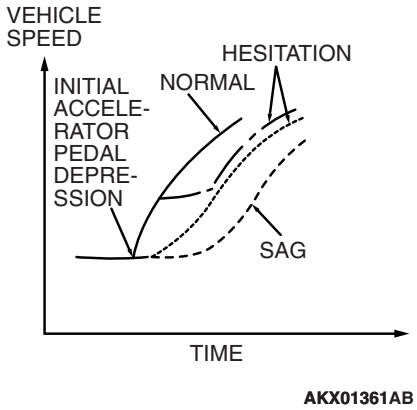
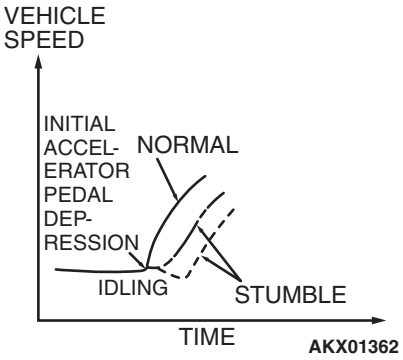
NOTE: Check that the ECM <M/T> or the PCM <A/T> ground circuit is normal before checking for the cause of the problem.

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Communication with scan tool is impossible	Communication with all systems is not possible	1	P.13B-1085
	Communication with ECM <M/T> or PCM <A/T> only is not possible	2	P.13B-1088
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.13B-1091
	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) remains illuminated and never goes out	4	P.13B-1092
Starting	Cranks, won't start	5	P.13B-1094
	Starts up and dies	6	P.13B-1102
	Hard starting	7	P.13B-1110
Idling stability (improper idling)	Unstable idle (rough idle, hunting)	8	P.13B-1117
	Idle speed is high (improper idle speed)	9	P.13B-1121
	Idle speed is low (improper idle speed)	10	P.13B-1123
Idling stability (engine stalls)	When the engine is cold, it stalls at idle (die out)	11	P.13B-1124
	When the engine is hot, it stalls at idle (die out)	12	P.13B-1127
	The engine stalls when accelerating (pass out)	13	P.13B-1132
	The engine stalls when decelerating	14	P.13B-1134

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Driving	Hesitation, sag or stumble	15	P.13B-1136
	Acceleration shock	16	P.13B-1141
	Deceleration shock	17	P.13B-1142
	Poor acceleration	18	P.13B-1143
	Surge	19	P.13B-1148
	Knocking	20	P.13B-1153
Dieseling (Run-on)		21	P.13B-1154
Too high CO and HC concentration when idling		22	P.13B-1154
IM240 test failure	Transient, mass emission tailpipe test failure	23	P.13B-1159
	Purge flow test of the evaporative emission canister failure	24	P.13B-1170
	Pressure test of the evaporative system failure	25	P.13B-1171
Generator output voltage is low (approximately 12.3 volts)		26	P.13B-1172
Fans (radiator fan, A/C condenser fan) are inoperative		27	P.13B-1177
Power supply system and ignition switch-IG system		28	P.13B-1180
Fuel pump system		29	P.13B-1191
Ignition switch-ST system <M/T>		30	P.13B-1204
Ignition switch-ST system and transmission range switch system <A/T>		31	P.13B-1212
Ignition circuit system		32	P.13B-1217
A/C system		33	P.13B-1227

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

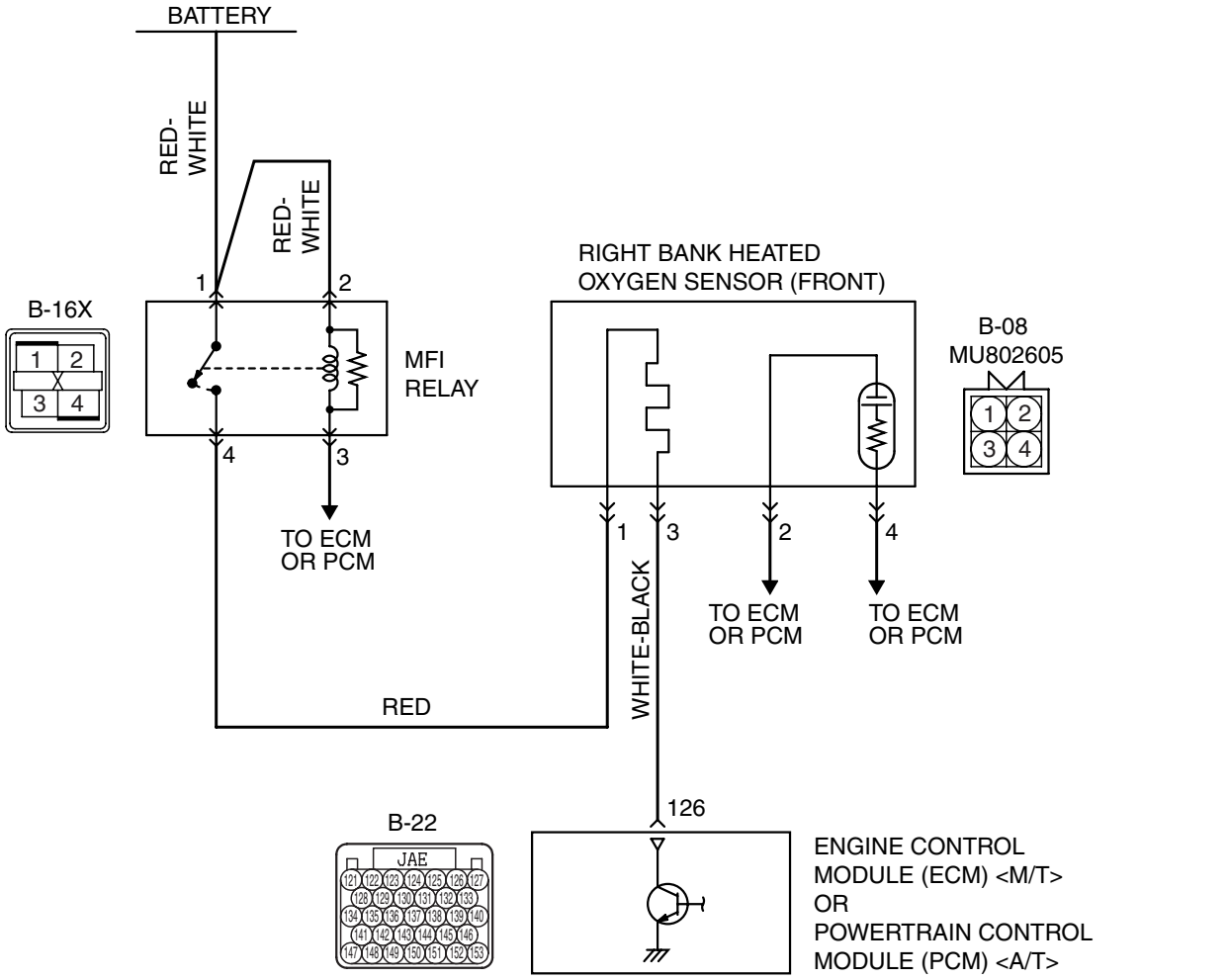
ITEMS		SYMPTOM
At starting	Won't start	The starter cranks the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starts up and dies	The engine starts, but then engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed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



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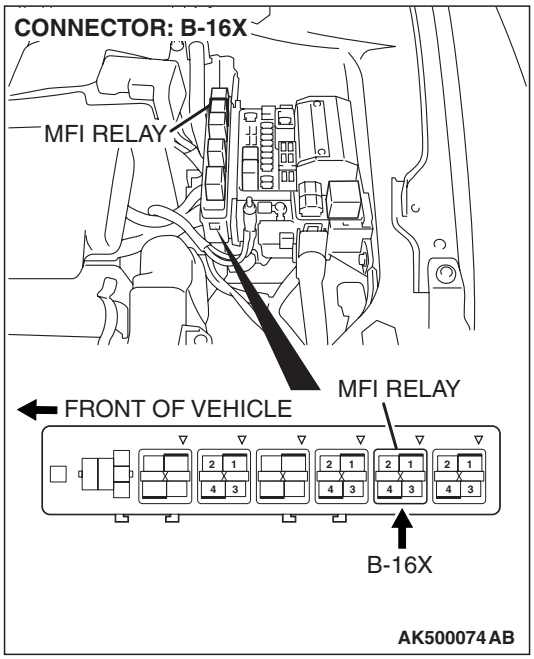

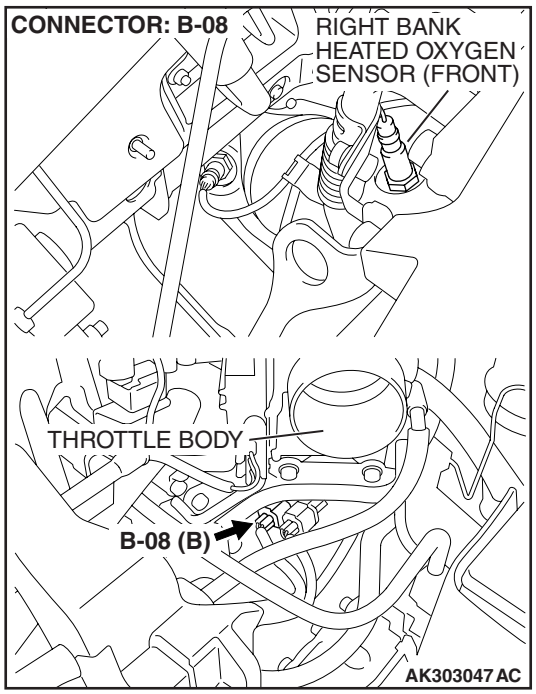

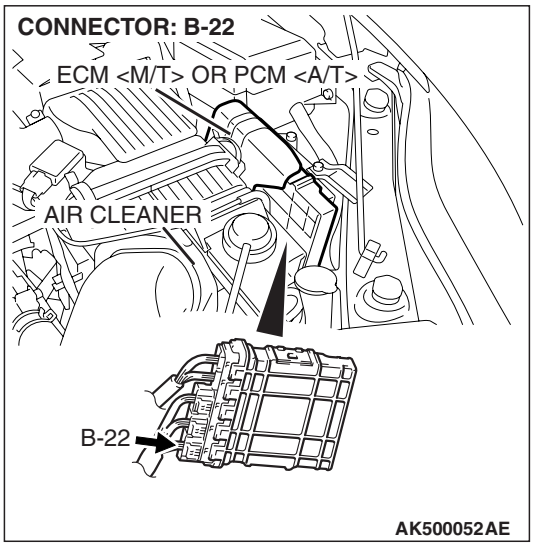

CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

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

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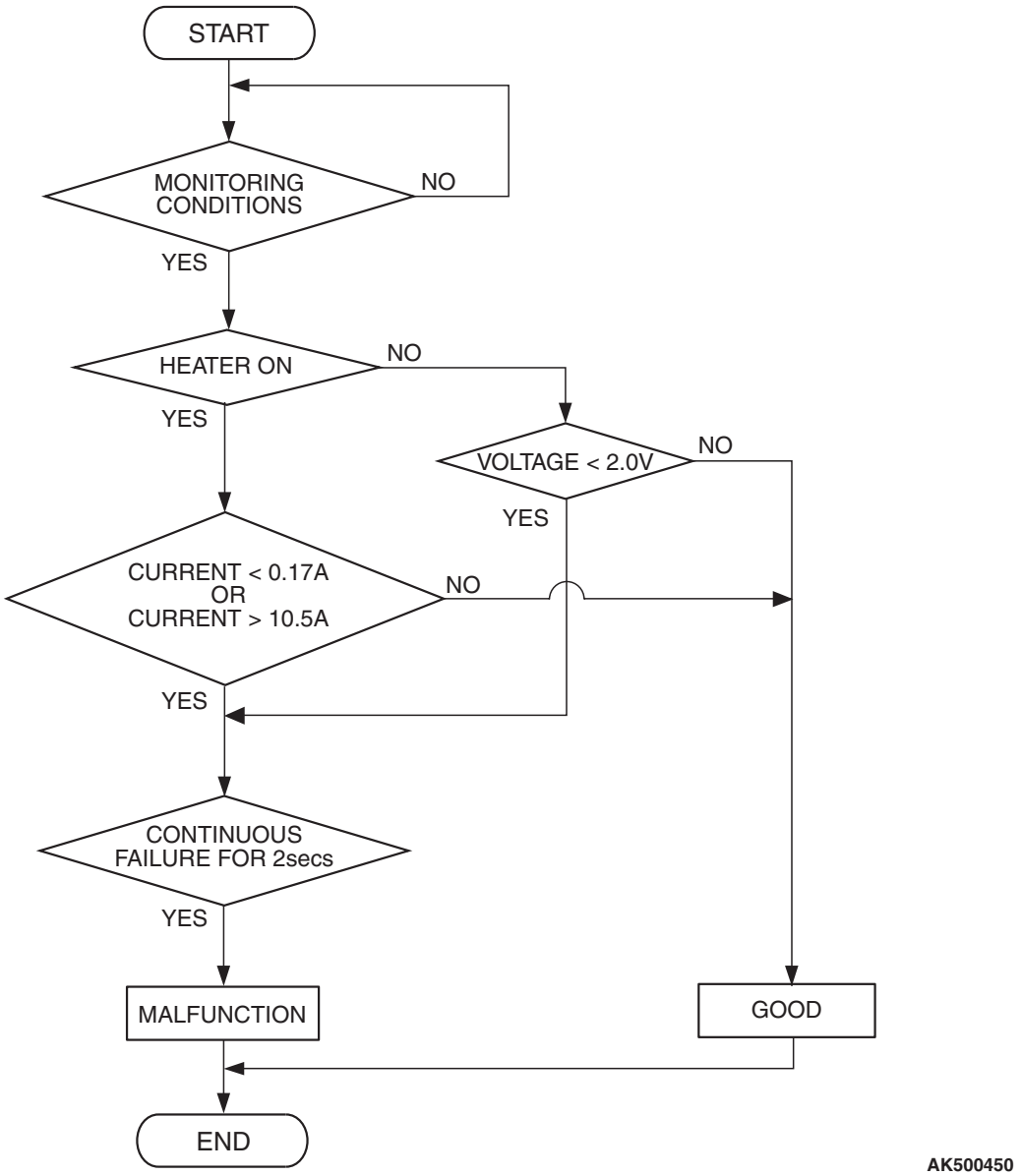
DTC SET CONDITIONS

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 voltage for 2 seconds.

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OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 2 P.13B-6.

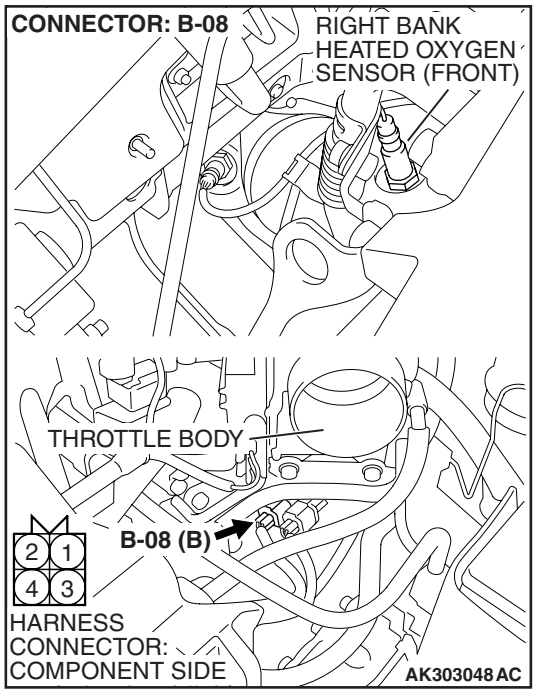
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Open or shorted right bank heated oxygen sensor (front) heater circuit, harness damage, or connector damage.
- Right bank heated oxygen sensor (front) heater.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

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

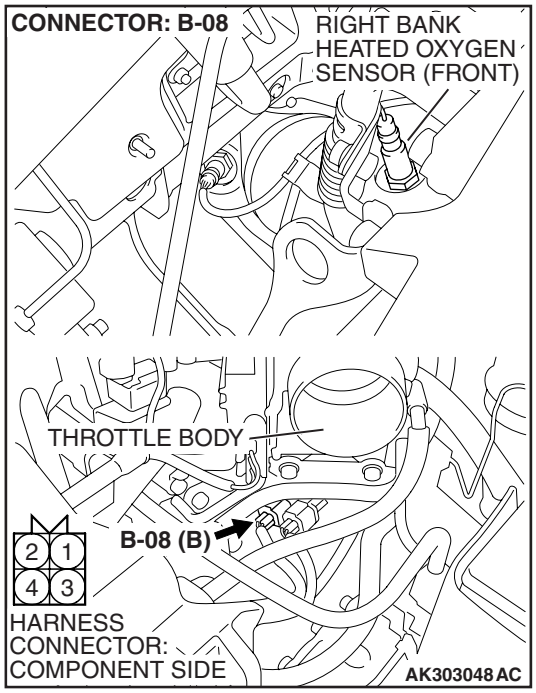


STEP 1. Check harness connector B-08 at the right bank heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

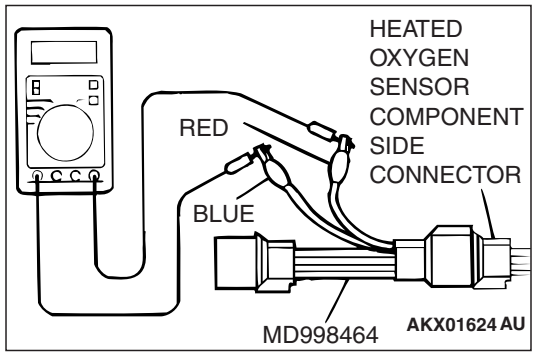
YES : Go to Step 2.

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-08 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)]?

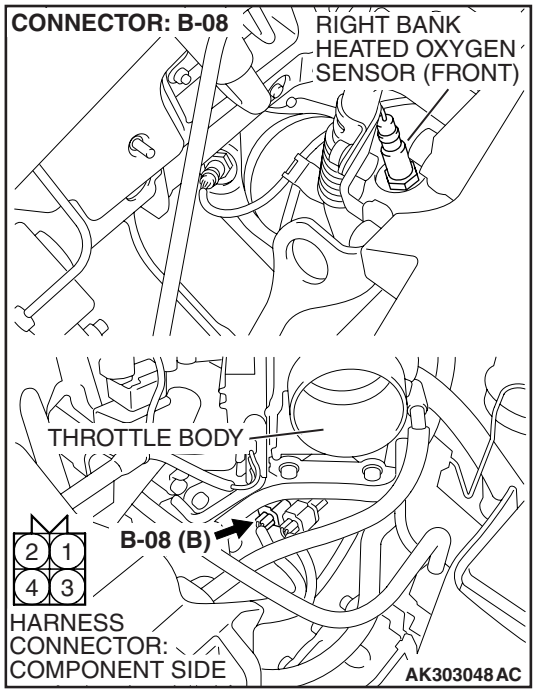
YES : Go to Step 3.

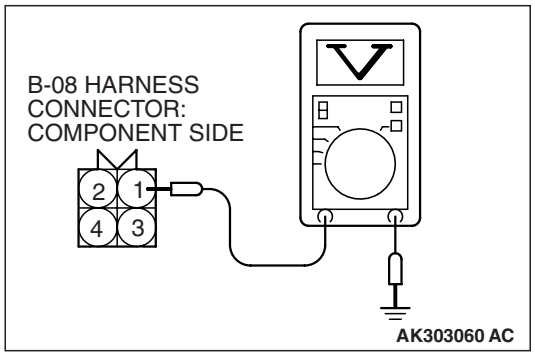
NO : Replace the right bank heated oxygen sensor (front). Then go to Step 12.

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

(1) Disconnect the connector B-08 and measure at the harness side.

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





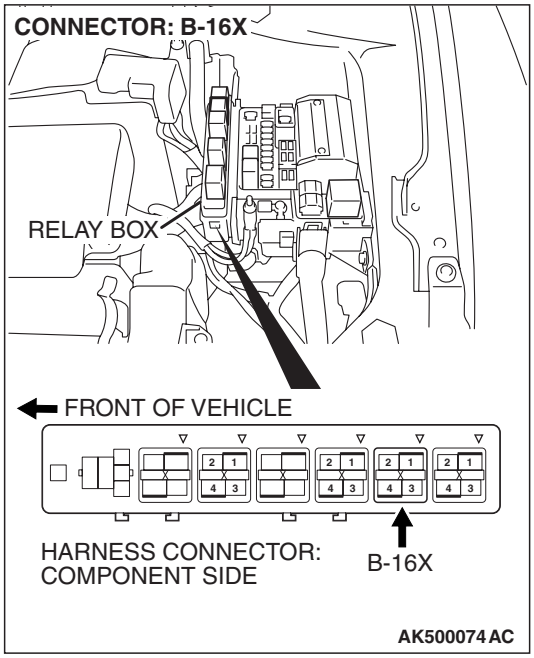
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

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

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

YES : Go to Step 5.

NO : Go to Step 4.

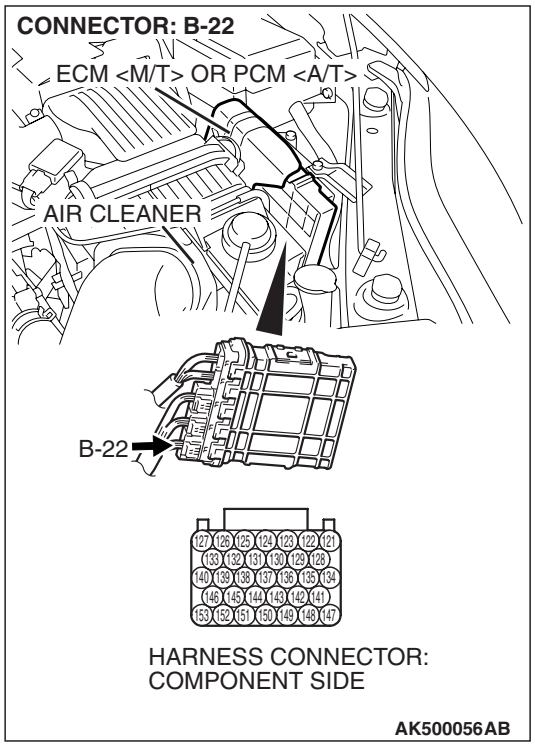


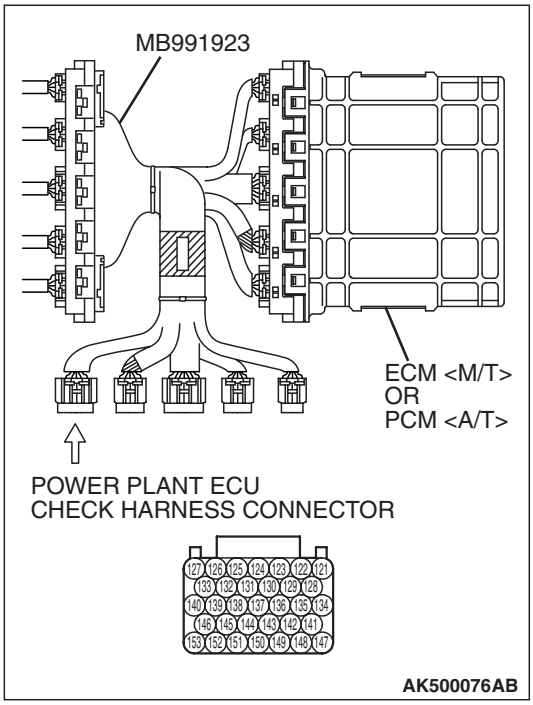
STEP 4. Check harness connector B-16X at the MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-16X (terminal No. 4) and right bank heated oxygen sensor (front) connector B-08 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

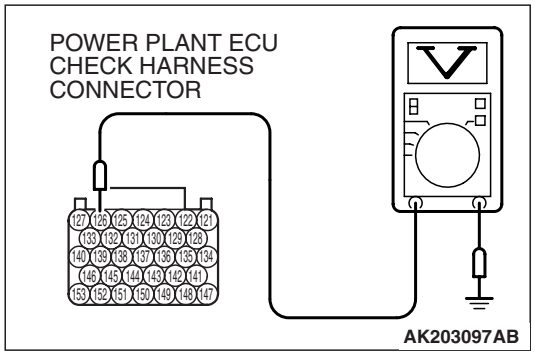
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.





STEP 5. Measure the power supply voltage at ECM <M/T> or PCM <A/T> connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect all ECM <M/T> connectors or PCM <A/T> connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 126 and ground.
- Voltage should be battery positive voltage.

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

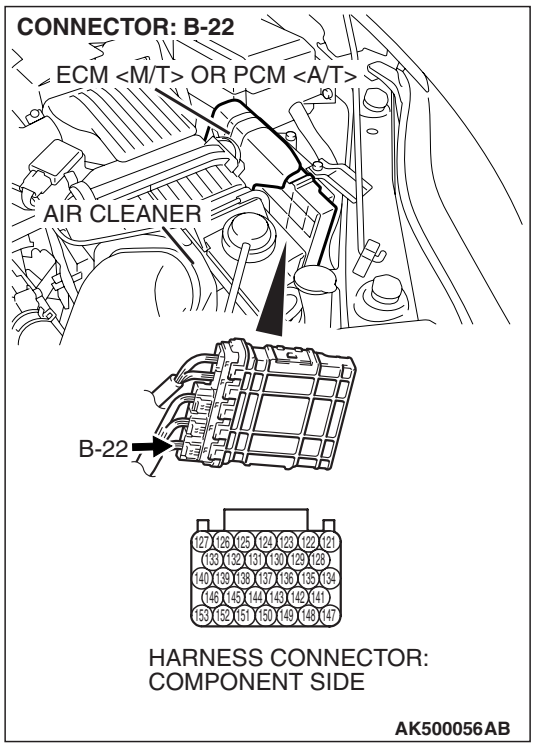
Q: Is battery positive voltage (approximately 12 volts) present?

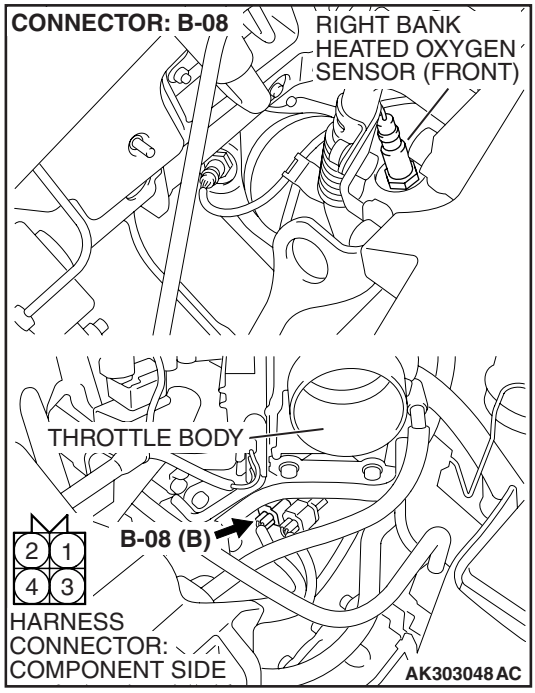
YES : Go to Step 8.
NO : Go to Step 6.

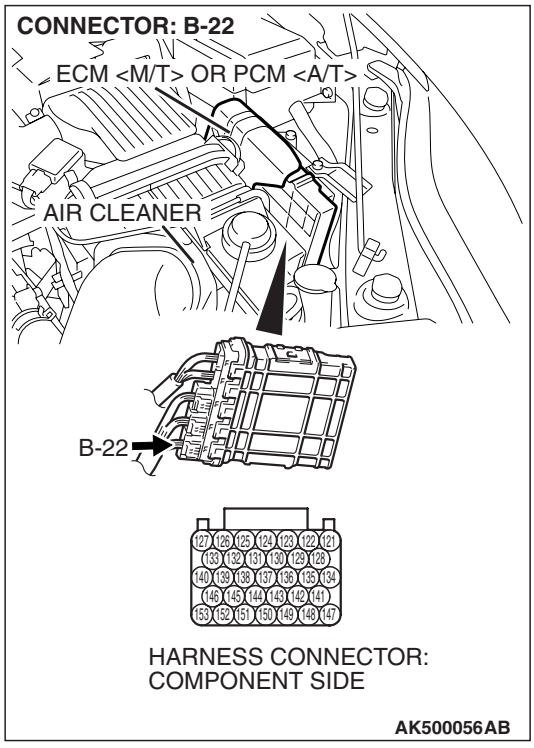
STEP 6. Check harness connector B-22 at ECM <M/T> or PCM <A/T> for damage.

Q: Is the harness connector in good condition?

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





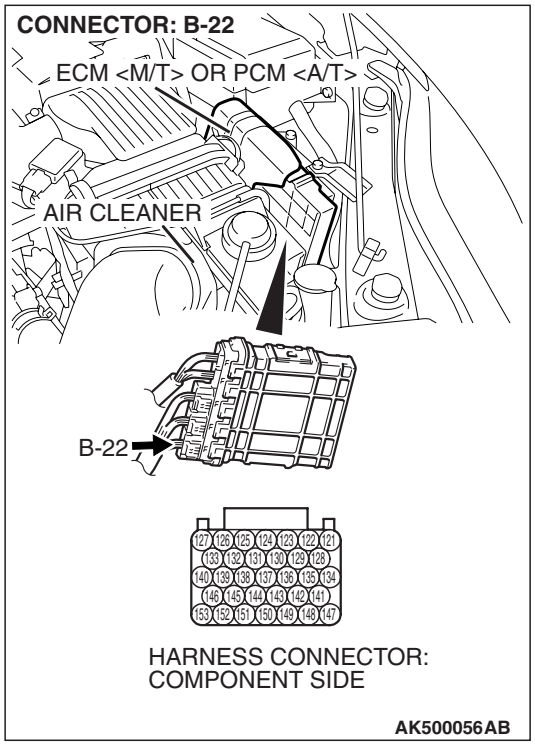


STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (front) connector B-08 (terminal No. 3) and ECM <M/T> or PCM <A/T> connector B-22 (terminal No. 126).

Q: Is the harness wire in good condition?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 12.

NO : Repair it. Then go to Step 12.

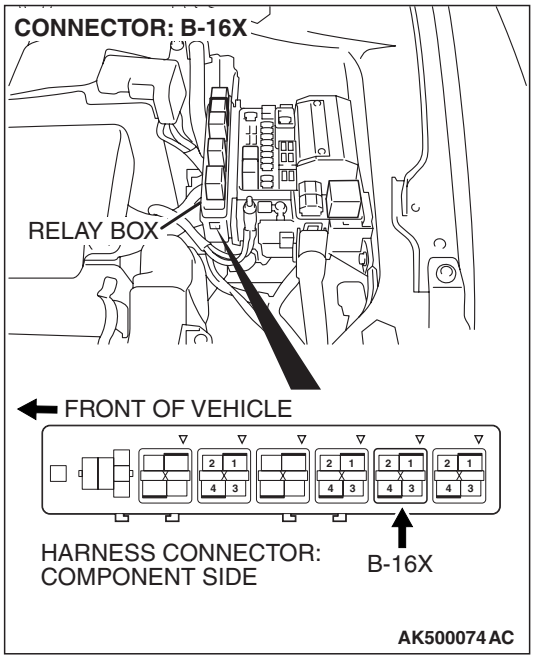


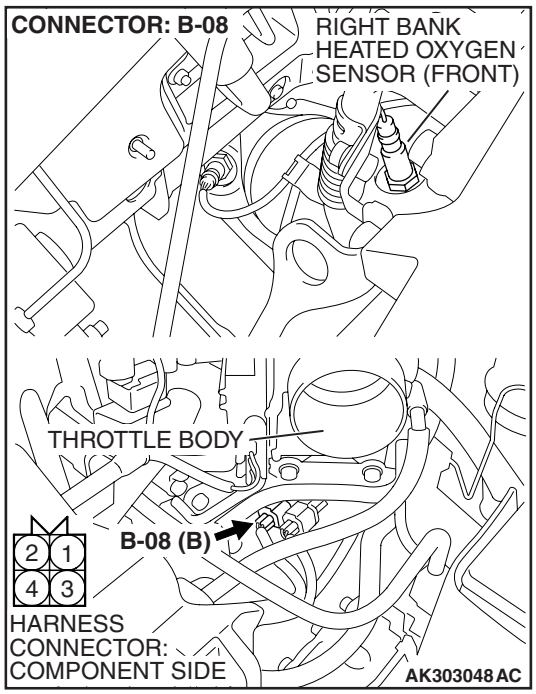
STEP 8. Check harness connector B-22 at ECM <M/T> or PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

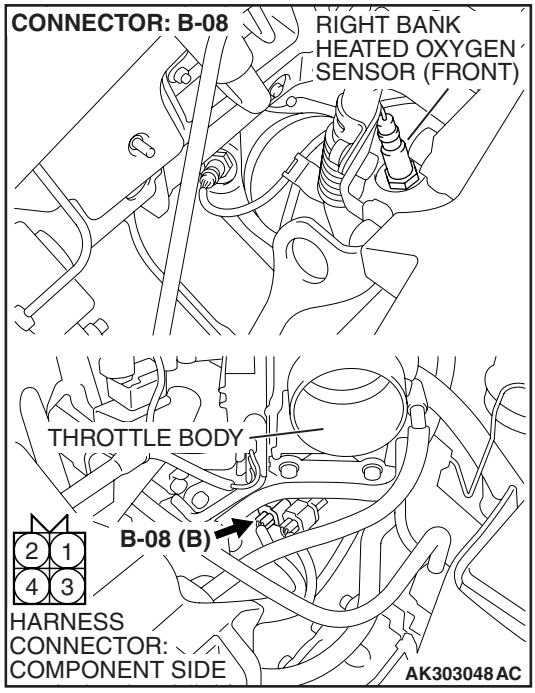
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

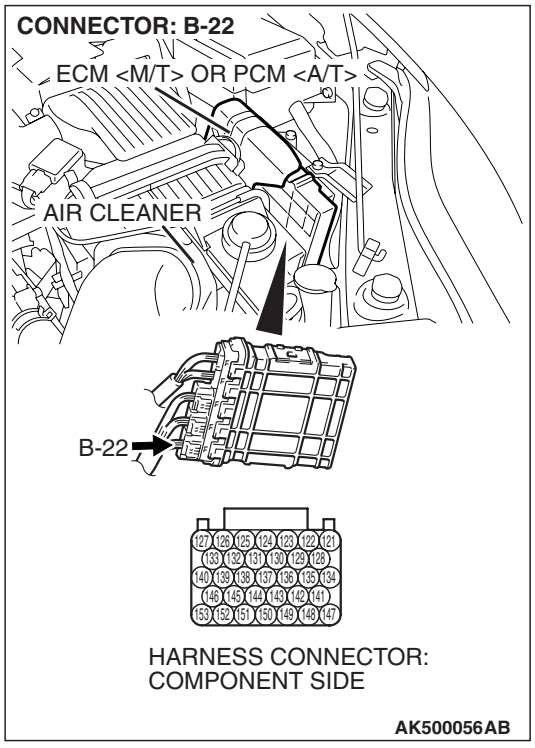




STEP 9. Check for harness damage between MFI relay connector B-16X (terminal No. 4) and right bank heated oxygen sensor (front) connector B-08 (terminal No. 1).
Q: Is the harness wire in good condition?

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





STEP 10. Check for harness damage between right bank heated oxygen sensor (front) connector B-08 (terminal No. 3) and ECM <M/T> or PCM <A/T> connector B-22 (terminal No. 126).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

Q: Is DTC P0031 set?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

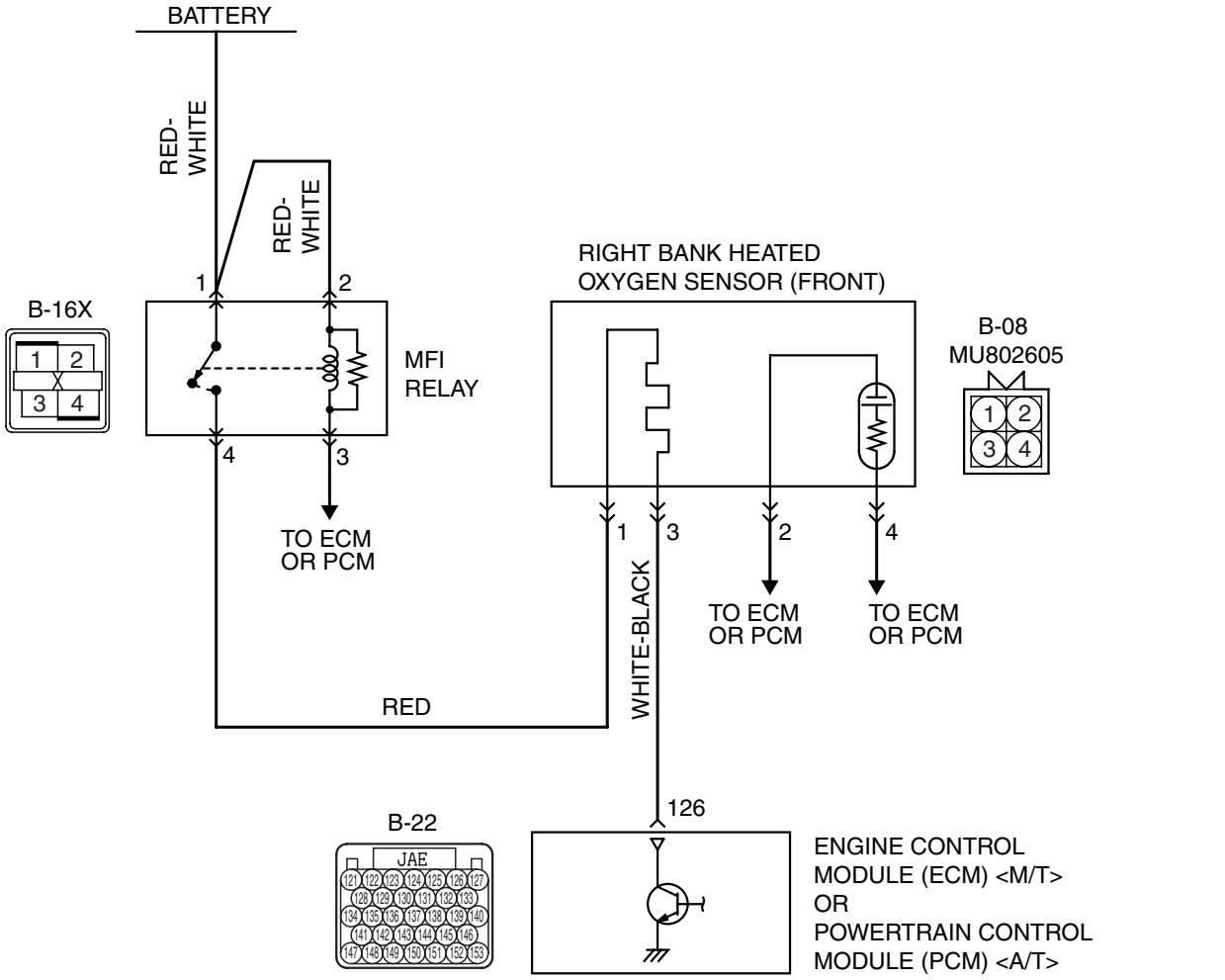
Q: Is DTC P0031 set?

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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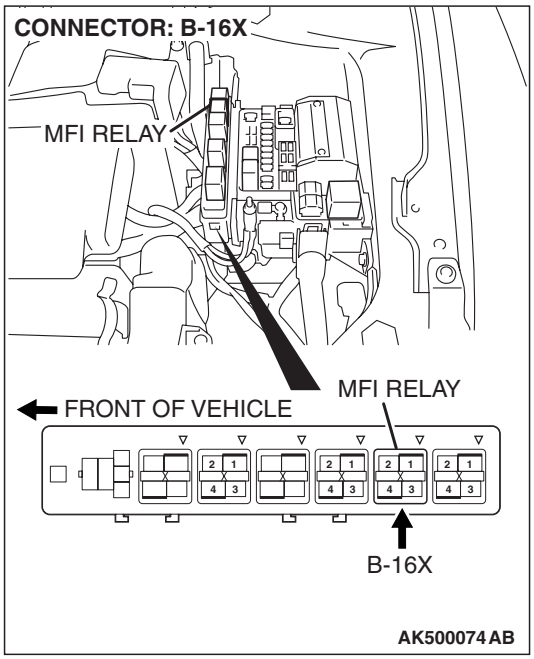
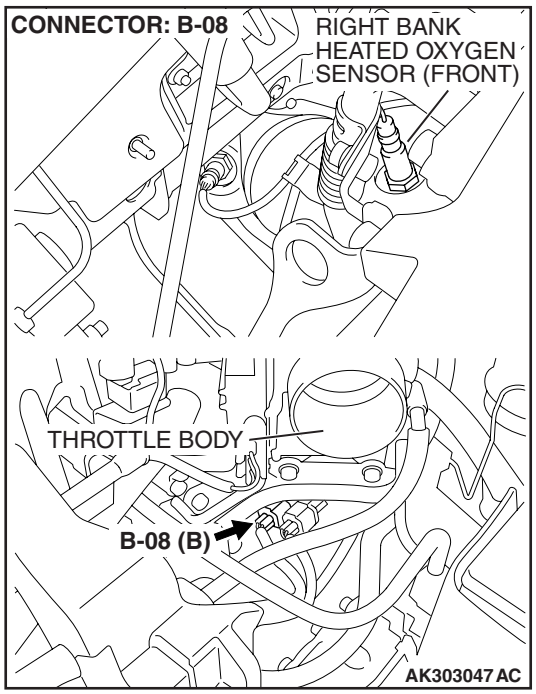
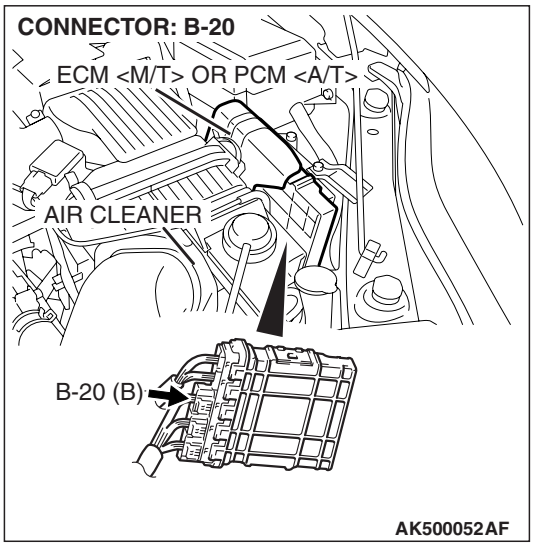






CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

- The ECM <M/T> or the PCM <A/T> 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

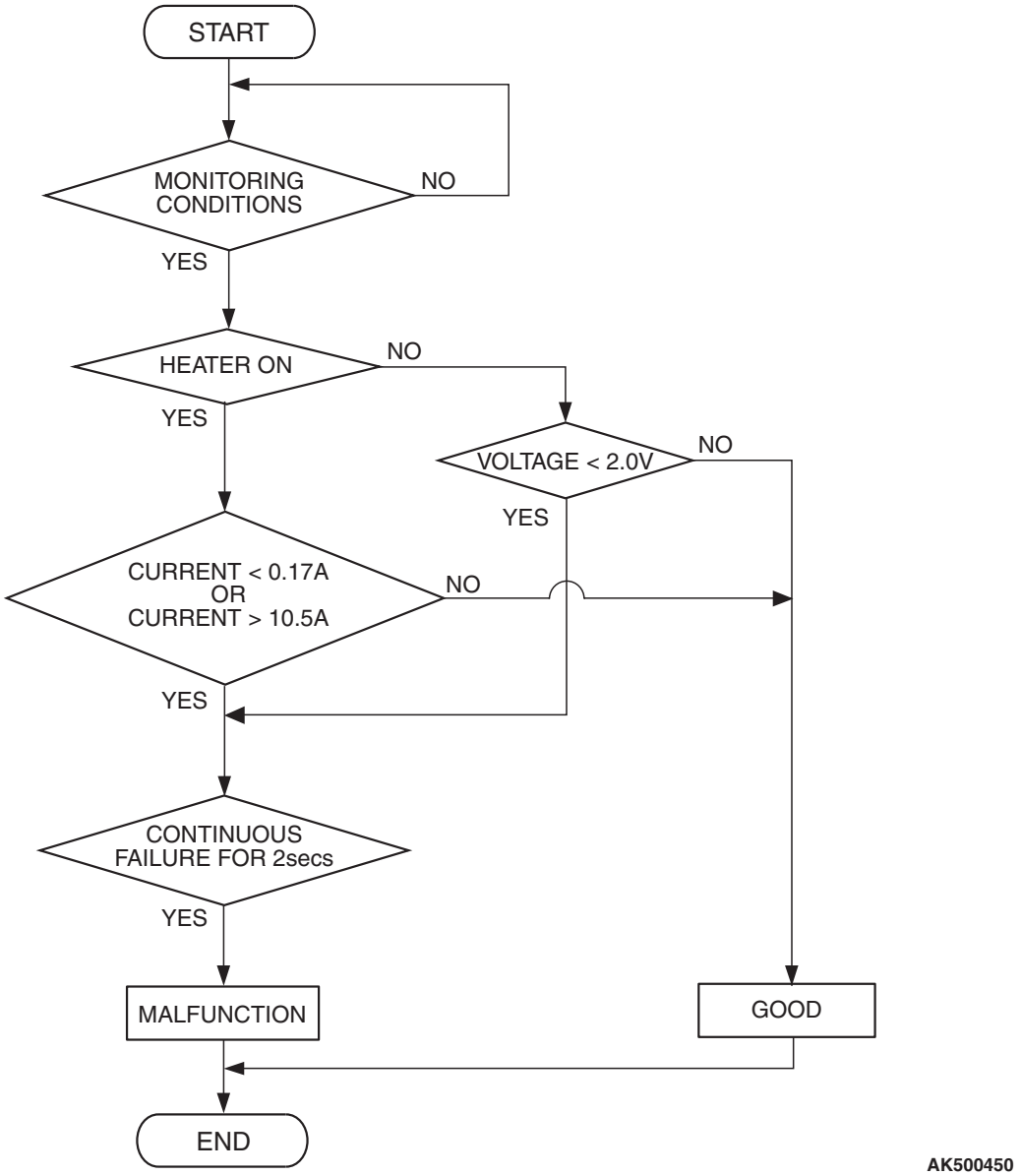
Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

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 (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 2 P.13B-6.

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

- Right bank heated oxygen sensor (front) heater.
- ECM failed. <M/T>
- PCM failed. <A/T>

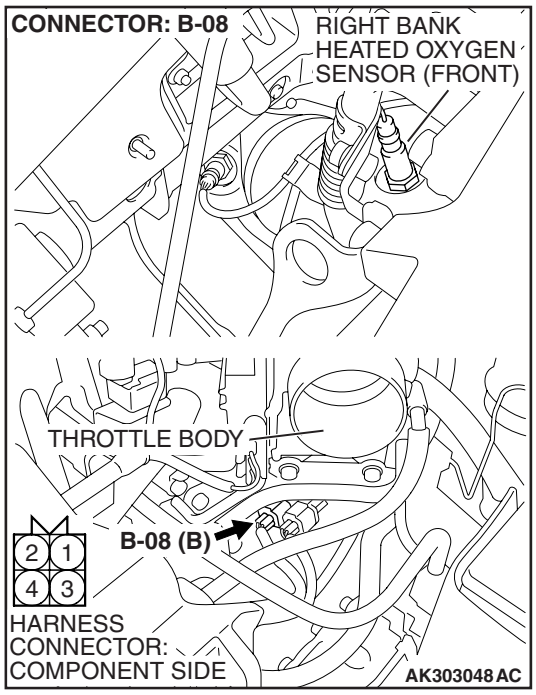
TSB Revision

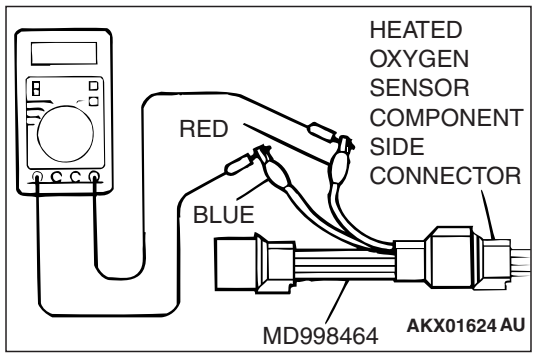
DIAGNOSIS

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-08 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 2 P.13B-6.

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

Q: Is DTC P0032 set?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

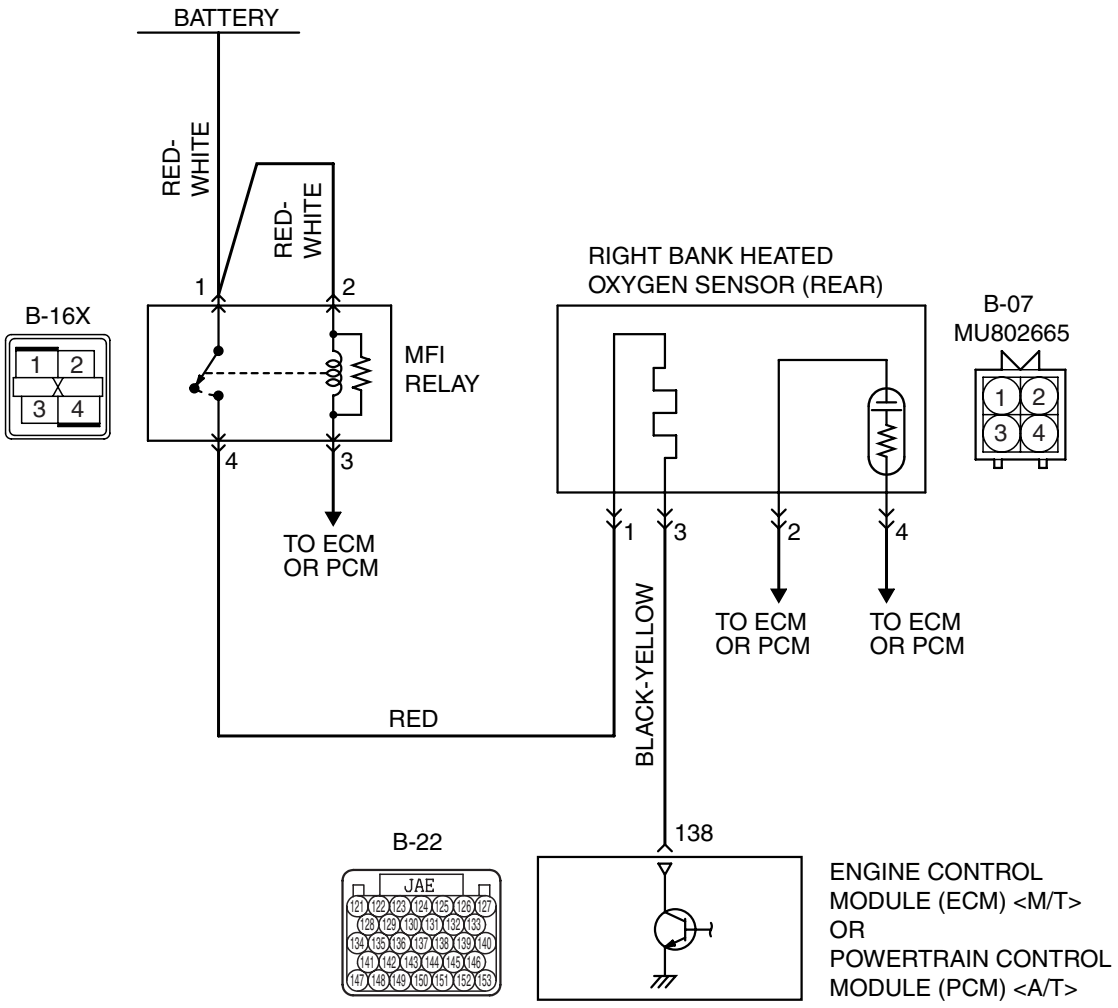
Q: Is DTC P0032 set?

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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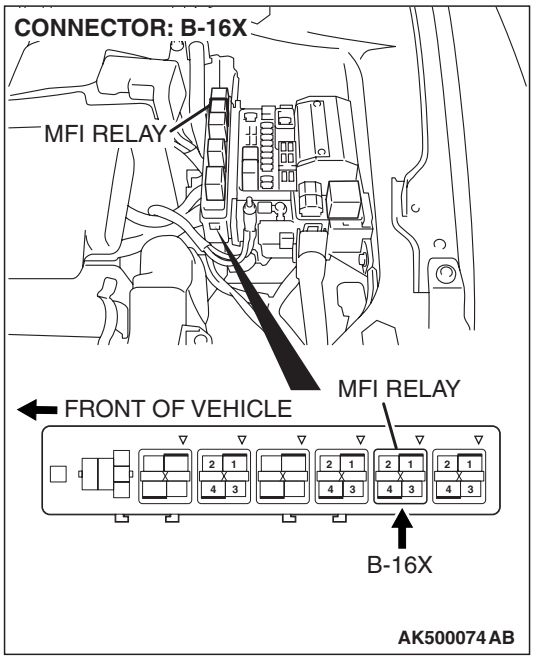
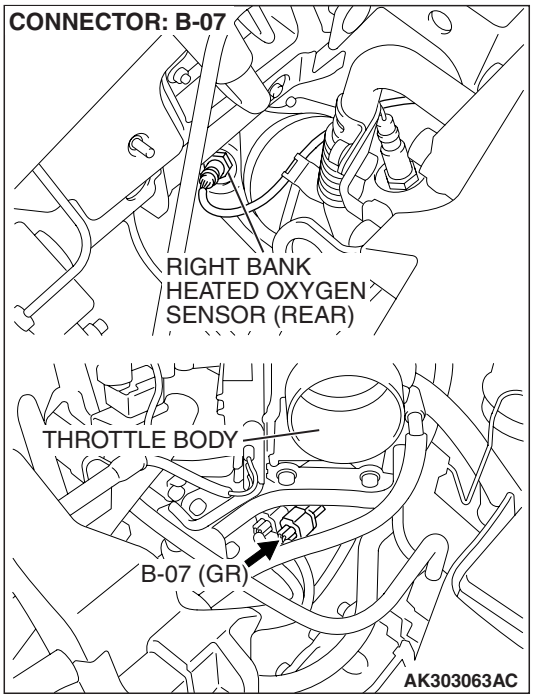
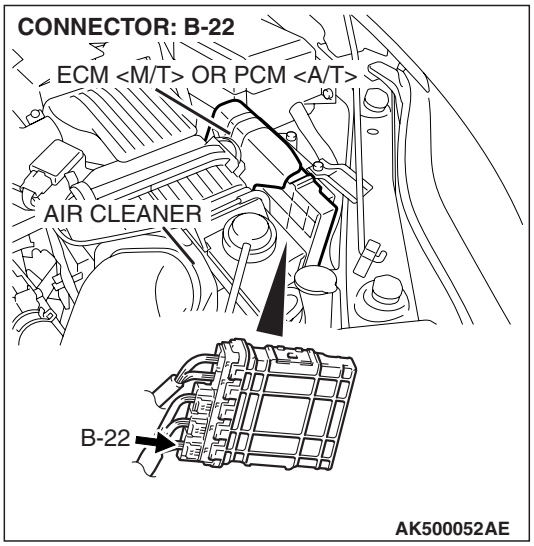
TSB Revision







CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

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

TSB Revision

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

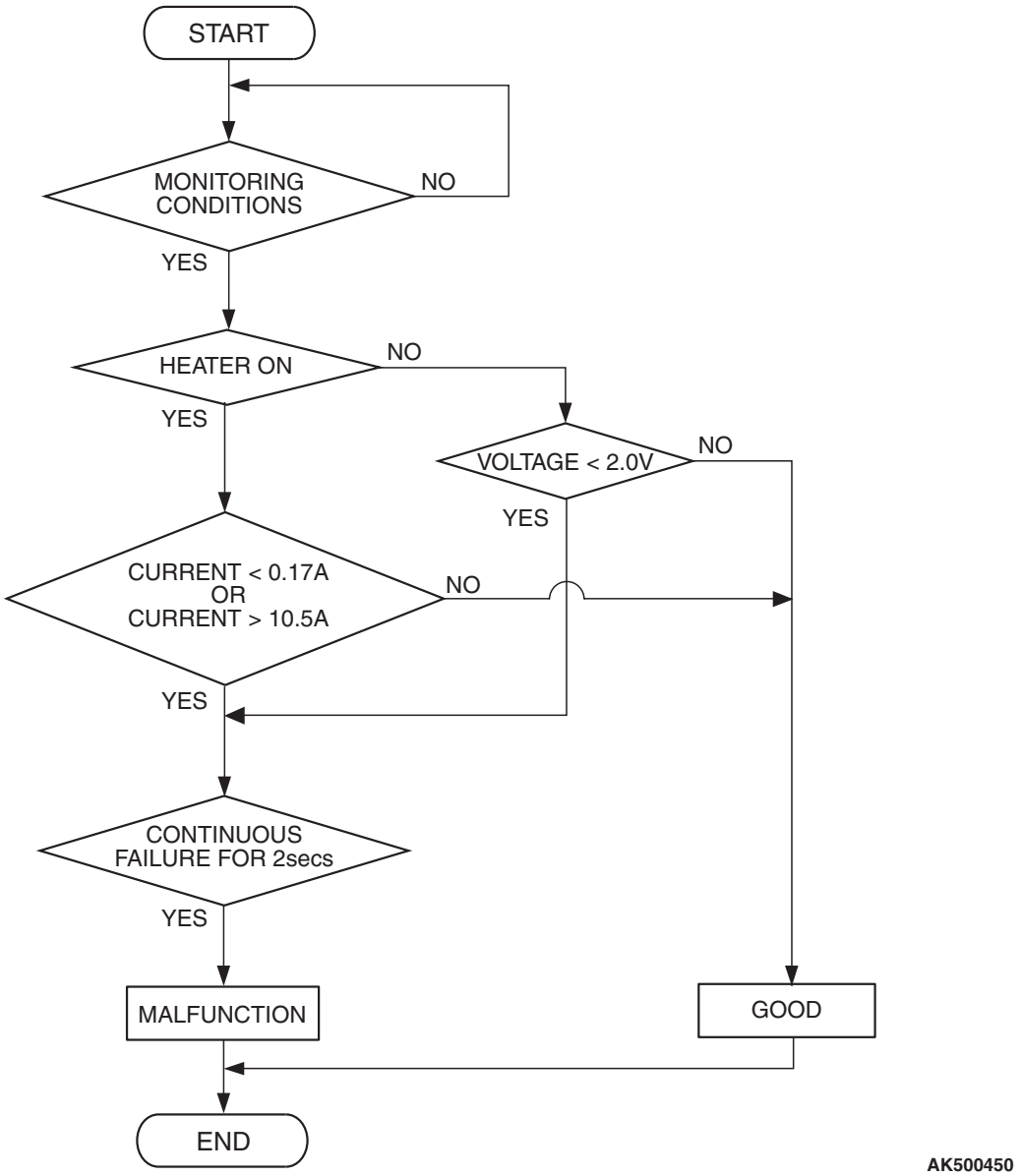
- Not applicable

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 at 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 at 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 voltage for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

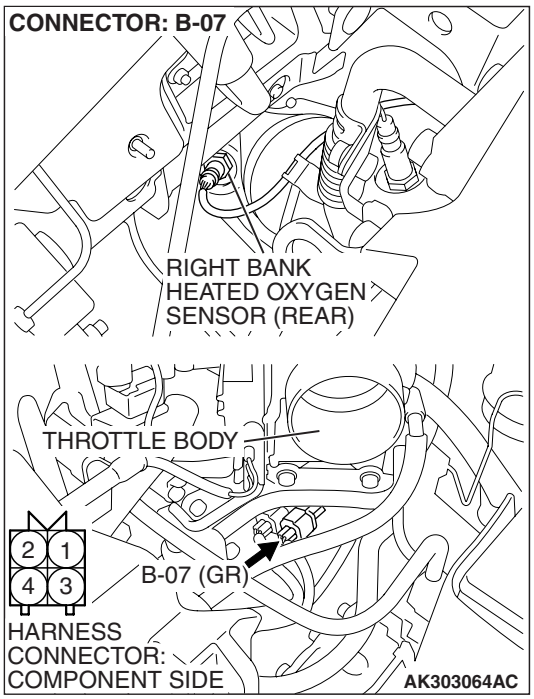
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 2 P.13B-6.

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.
- ECM failed. <M/T>
- PCM failed. <A/T>

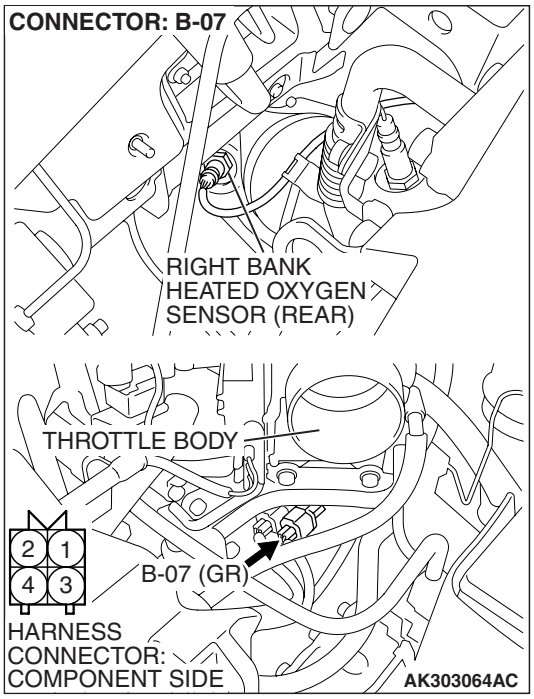
DIAGNOSIS

Required Special Tools:
- MB991316: Test Harness
- MB991923: Power Plant ECU Check Harness



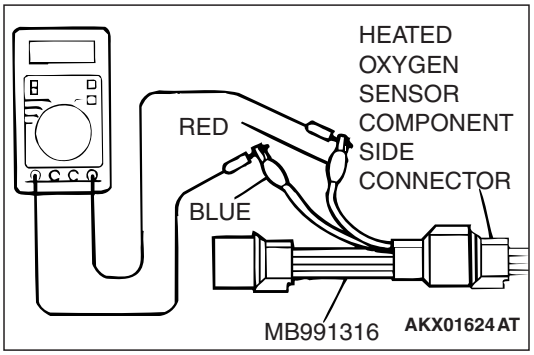
STEP 1. Check harness connector B-07 at the right bank heated oxygen sensor (rear) for damage.
Q: Is the harness connector in good condition?

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



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

(1) Disconnect right bank heated oxygen sensor (rear) connector B-07 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)]?

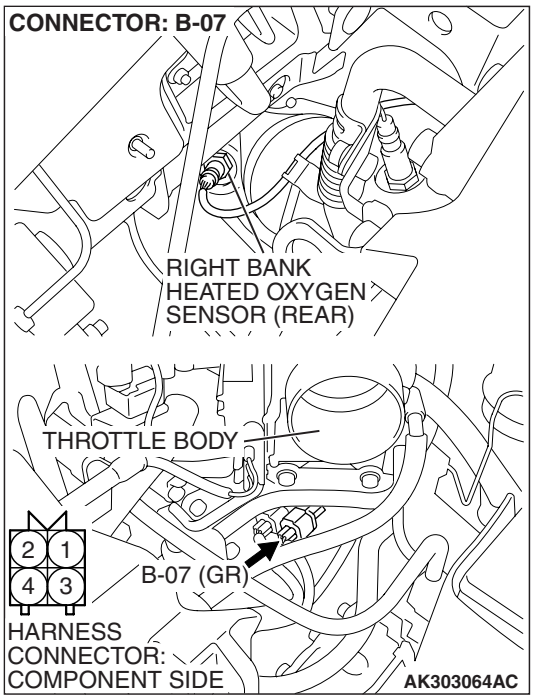
YES : Go to Step 3.

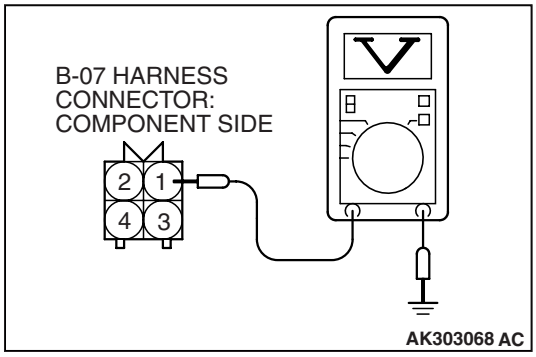
NO : Replace the right bank heated oxygen sensor (rear). Then go to Step 12.

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

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

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





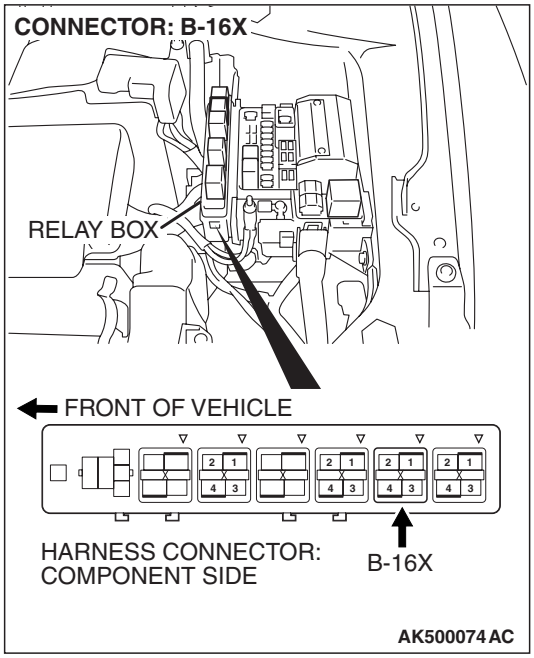
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

(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.

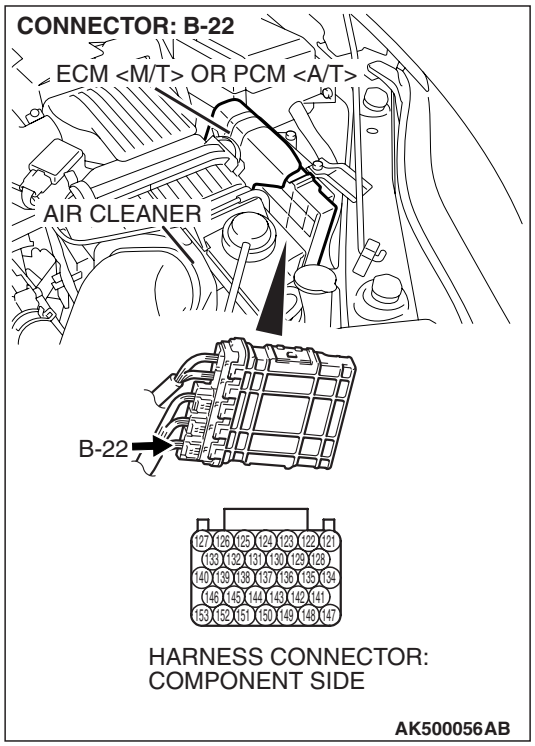


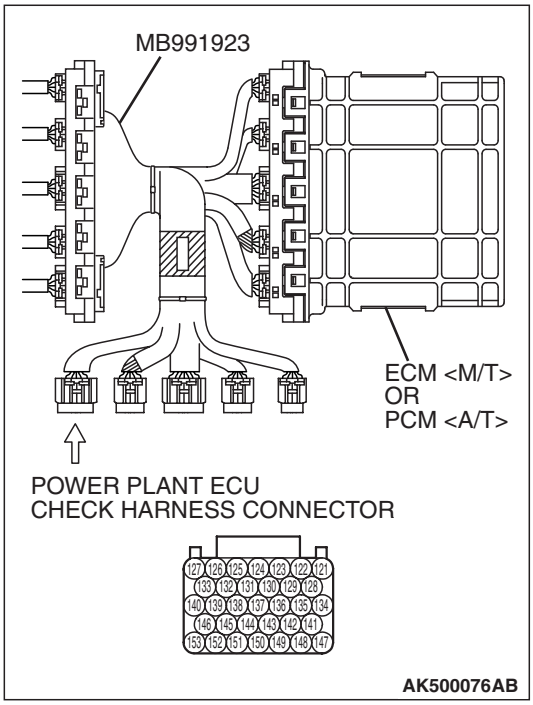
STEP 4. Check harness connector B-16X at the MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-16X (terminal No. 4) and right bank heated oxygen sensor (rear) connector B-07 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

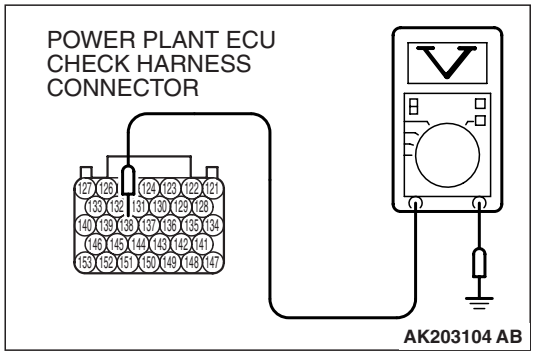
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.





STEP 5. Measure the power supply voltage at ECM <M/T> or PCM <A/T> connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect all ECM <M/T> connectors or PCM <A/T> connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 138 and ground.
- Voltage should be battery positive voltage.

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

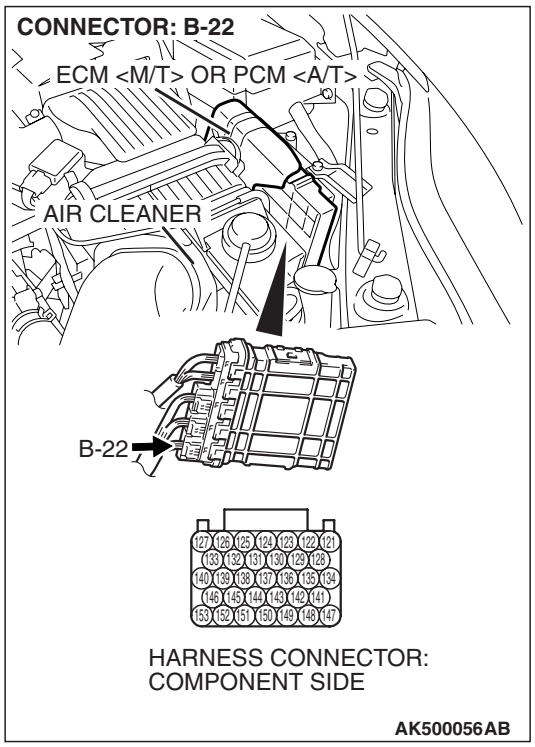
Q: Is battery positive voltage (approximately 12 volts) present?

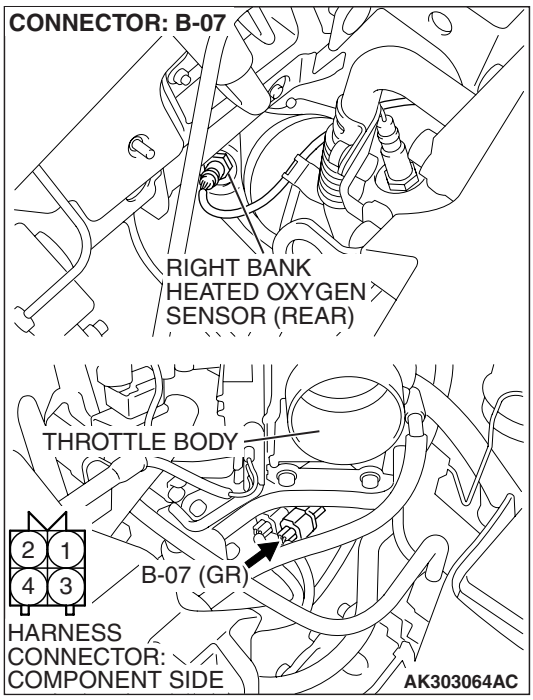
YES : Go to Step 8.
NO : Go to Step 6.

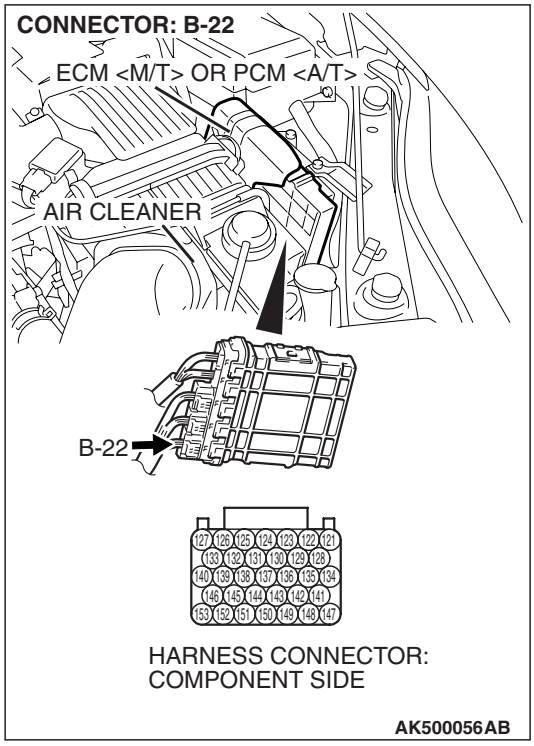
STEP 6. Check harness connector B-22 at ECM <M/T> or PCM <A/T> for damage.

Q: Is the harness connector in good condition?

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





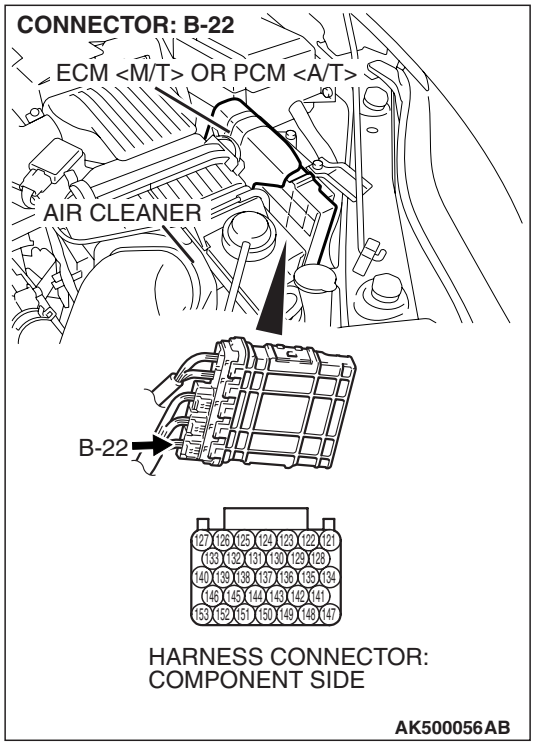


STEP 7. Check for open circuit or short circuit to ground between right bank heated oxygen sensor (rear) connector B-07 (terminal No. 3) and ECM <M/T> or PCM <A/T> connector B-22 (terminal No. 138).

Q: Is the harness wire in good condition?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 12.

NO : Repair it. Then go to Step 12.

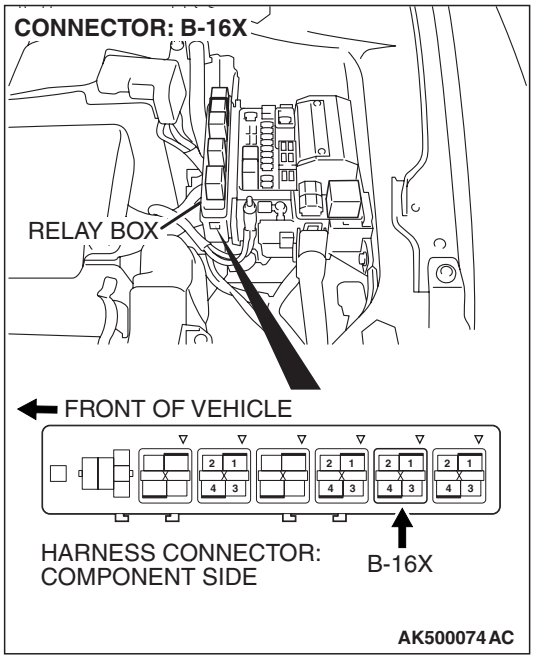


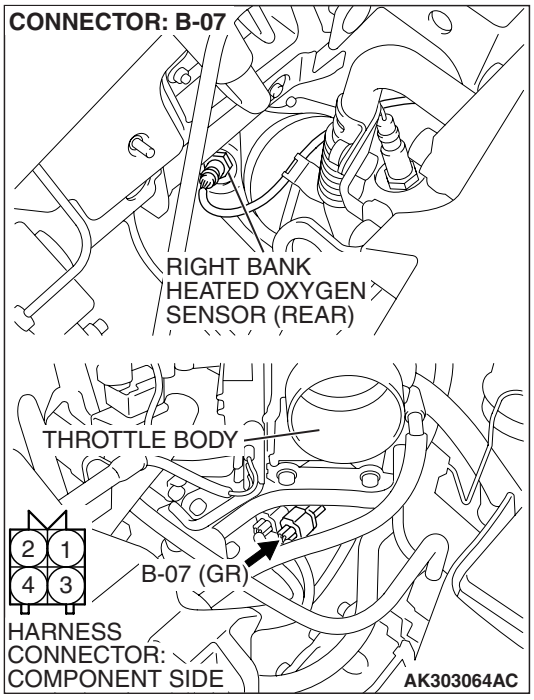
STEP 8. Check harness connector B-22 at ECM <M/T> or PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

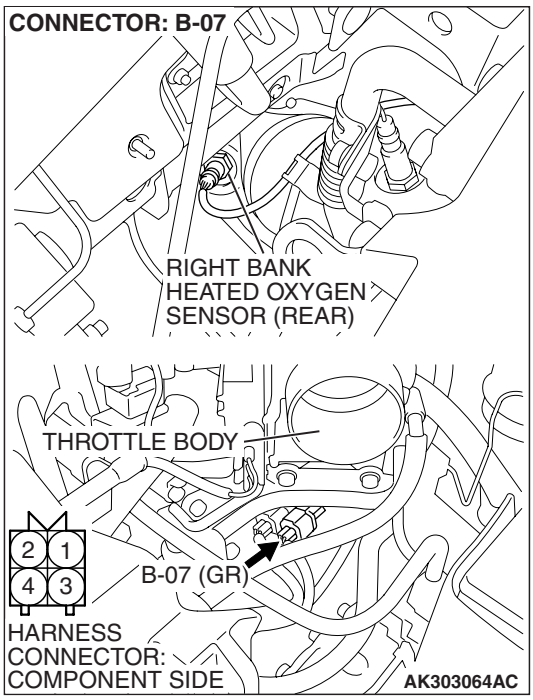
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

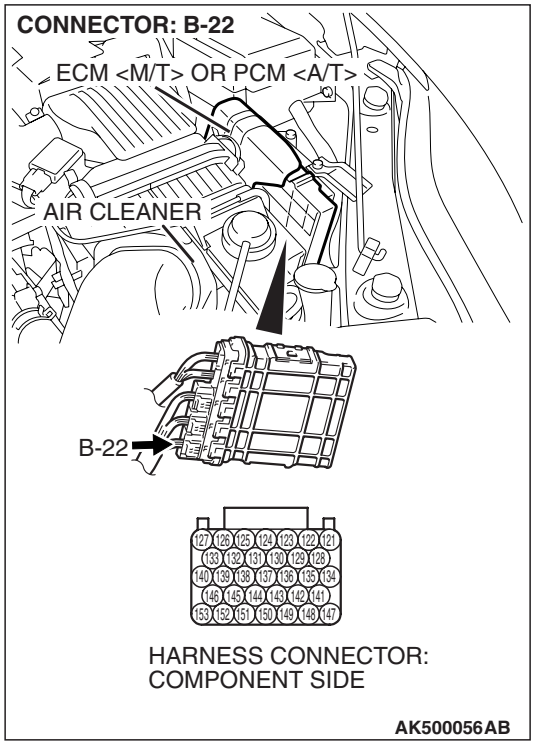




STEP 9. Check for harness damage between MFI relay connector B-16X (terminal No. 4) and right bank heated oxygen sensor (rear) connector B-07 (terminal No. 1).
Q: Is the harness wire in good condition?

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 (rear) connector B-07 (terminal No. 3) and ECM <M/T> or PCM <A/T> connector B-22 (terminal No. 138).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

Q: Is DTC P0037 set?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

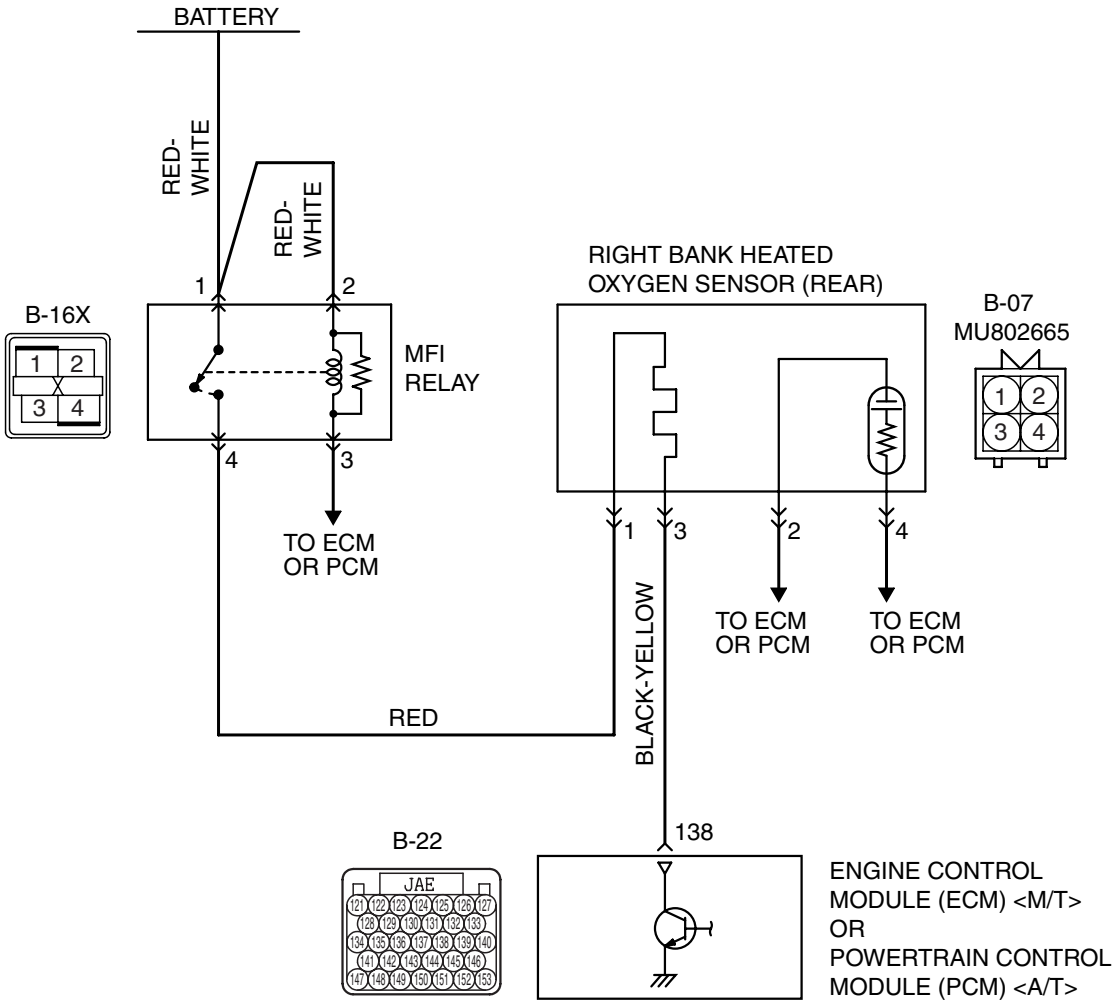
Q: Is DTC P0037 set?

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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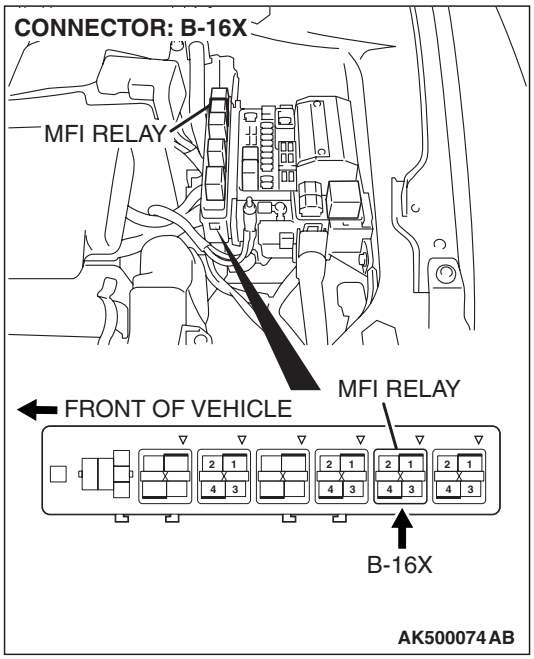
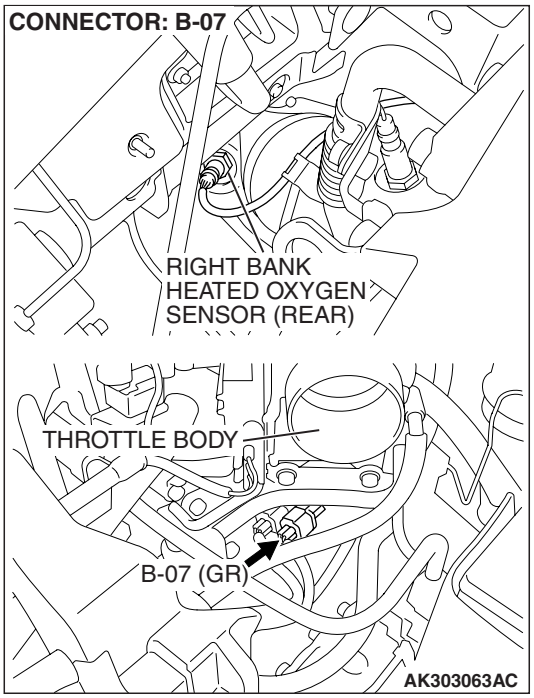
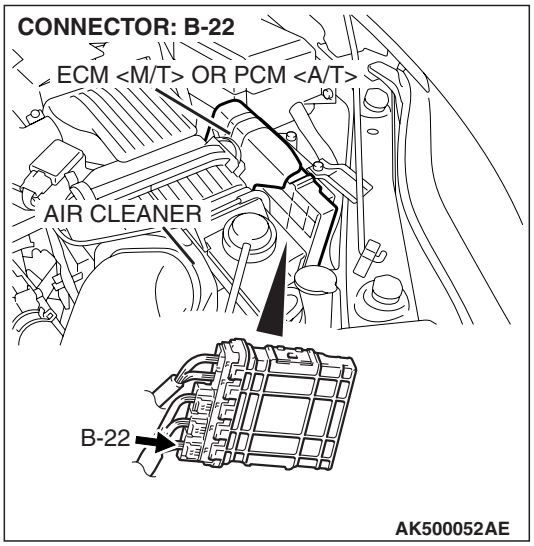






CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

- The ECM <M/T> or the PCM <A/T> 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

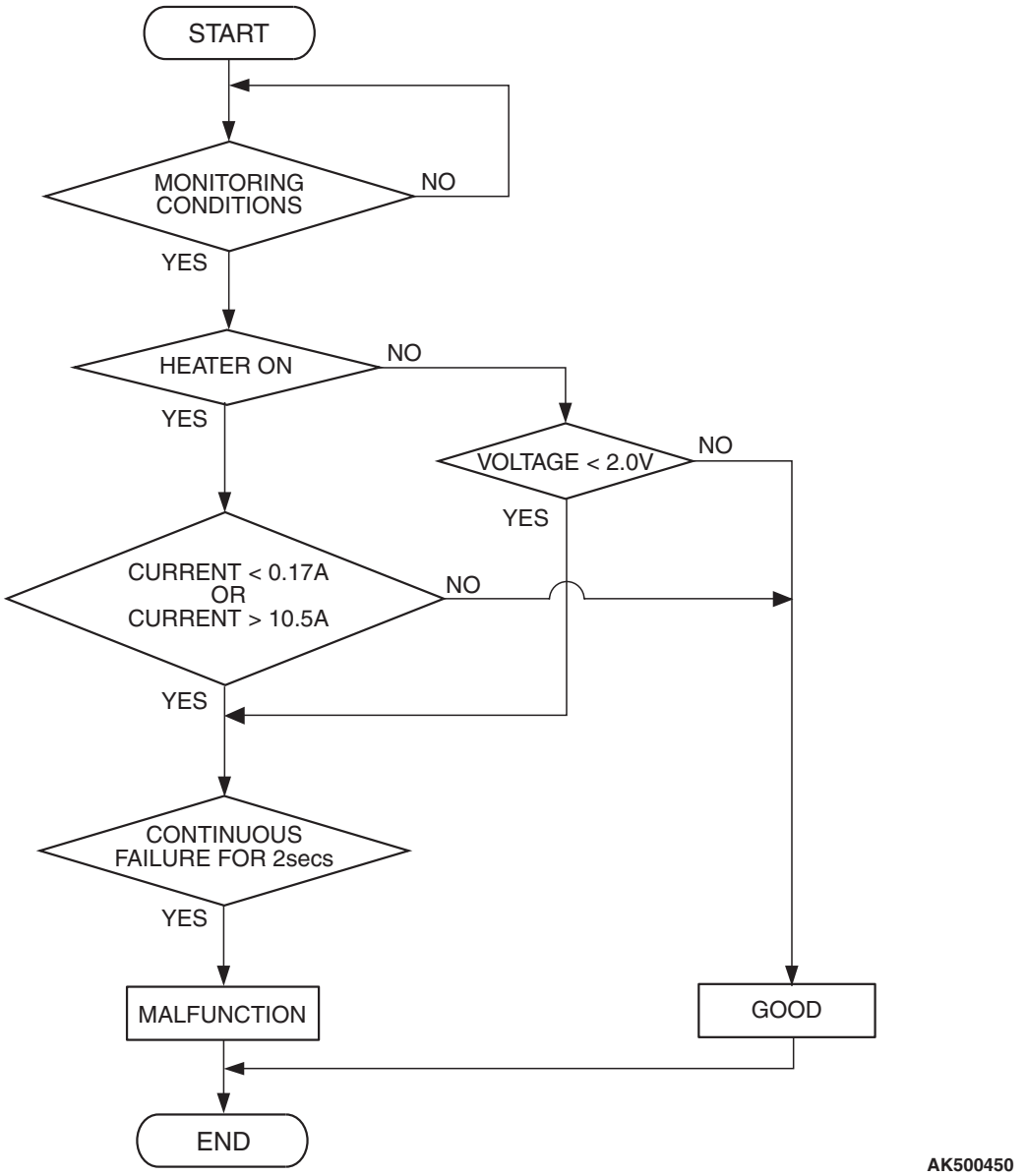
Sensor (The sensor below is determined to be normal)

- 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 at 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 2 P.13B-6.

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

- Right bank heated oxygen sensor (rear) failed.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

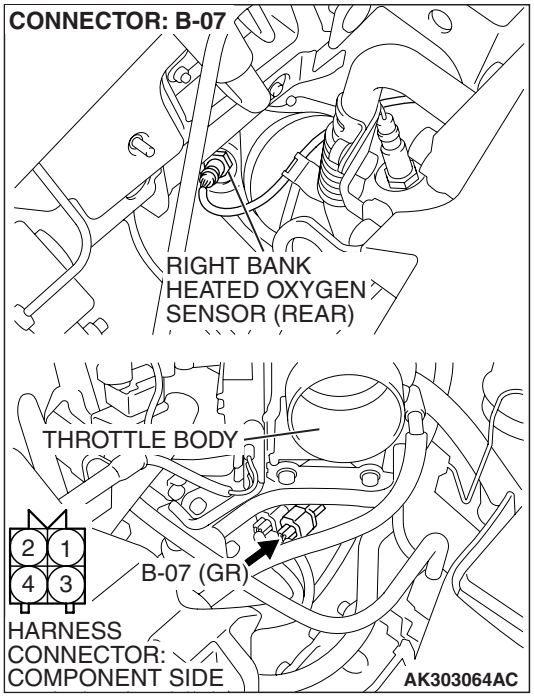
TSB Revision

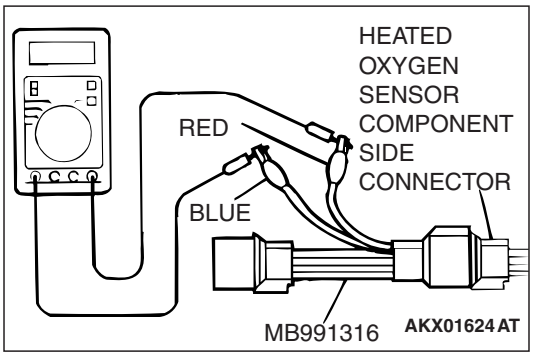
DIAGNOSIS

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 B-07 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 2 P.13B-6.

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

Q: Is DTC P0038 set?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

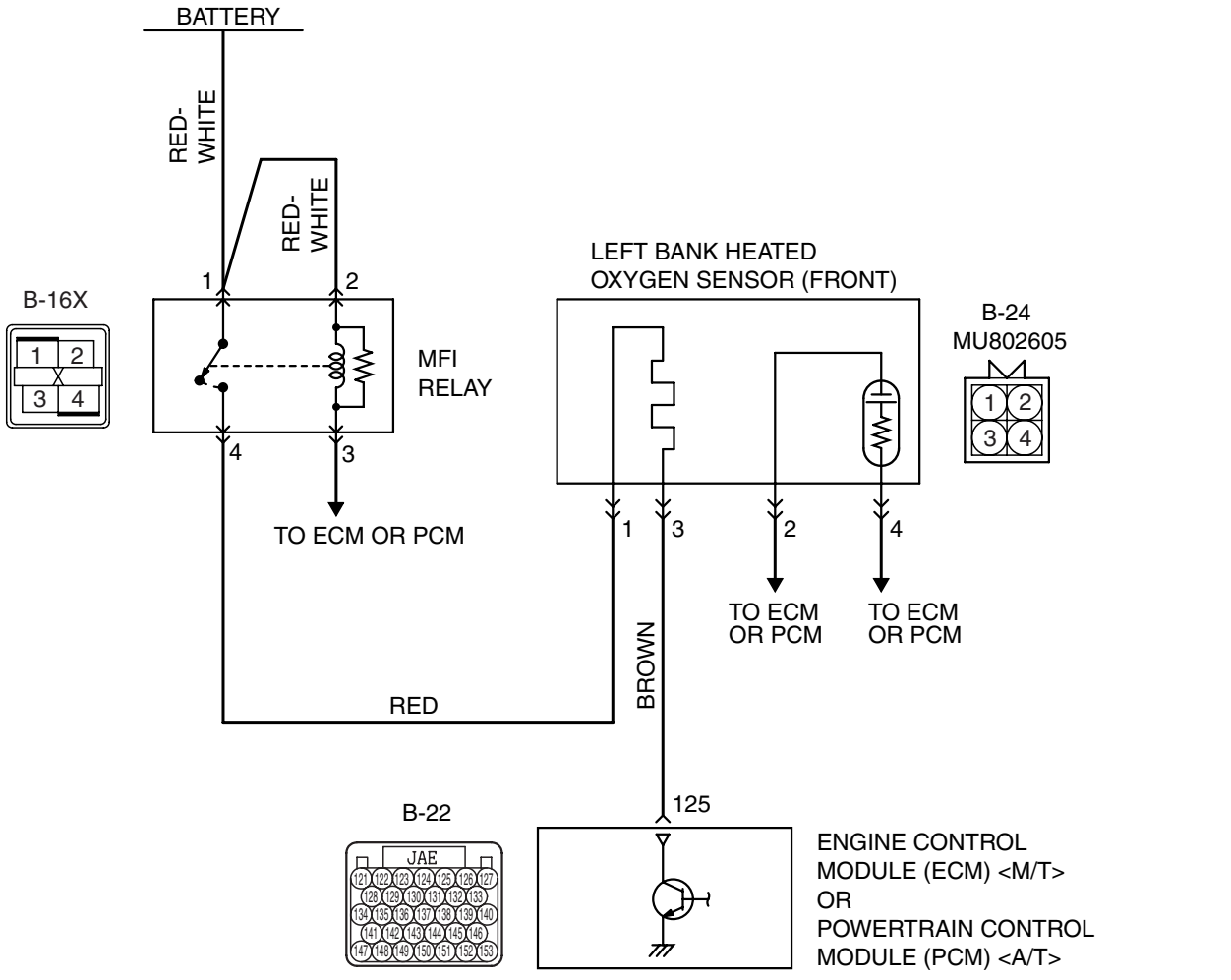
Q: Is DTC P0038 set?

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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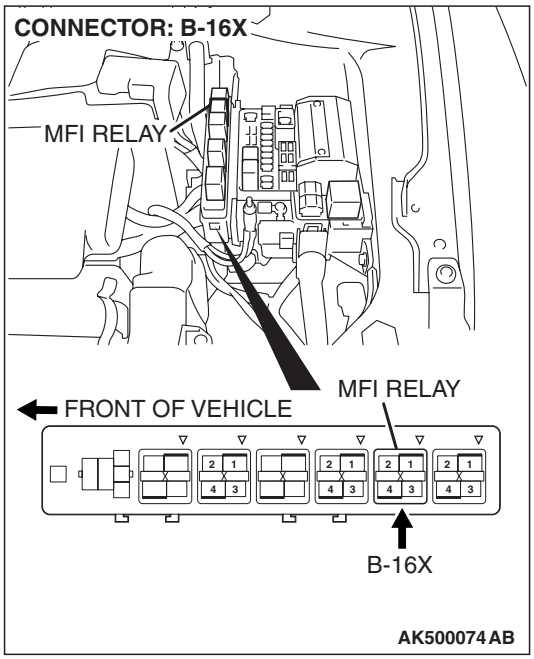

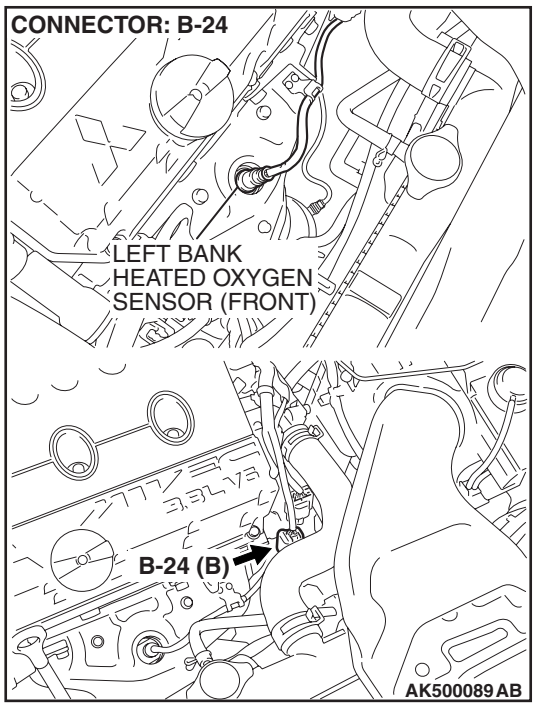

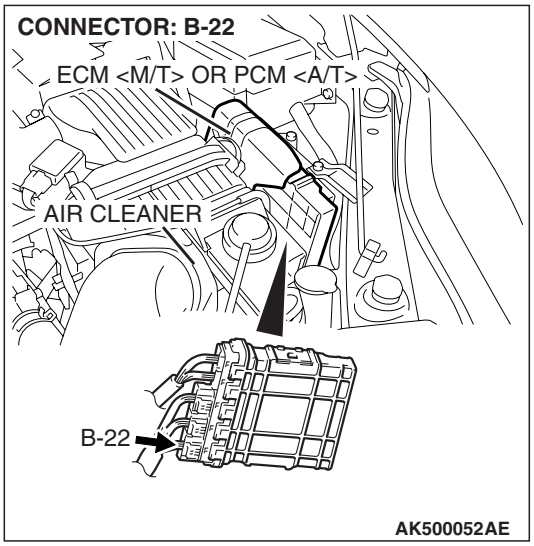

CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

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

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MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

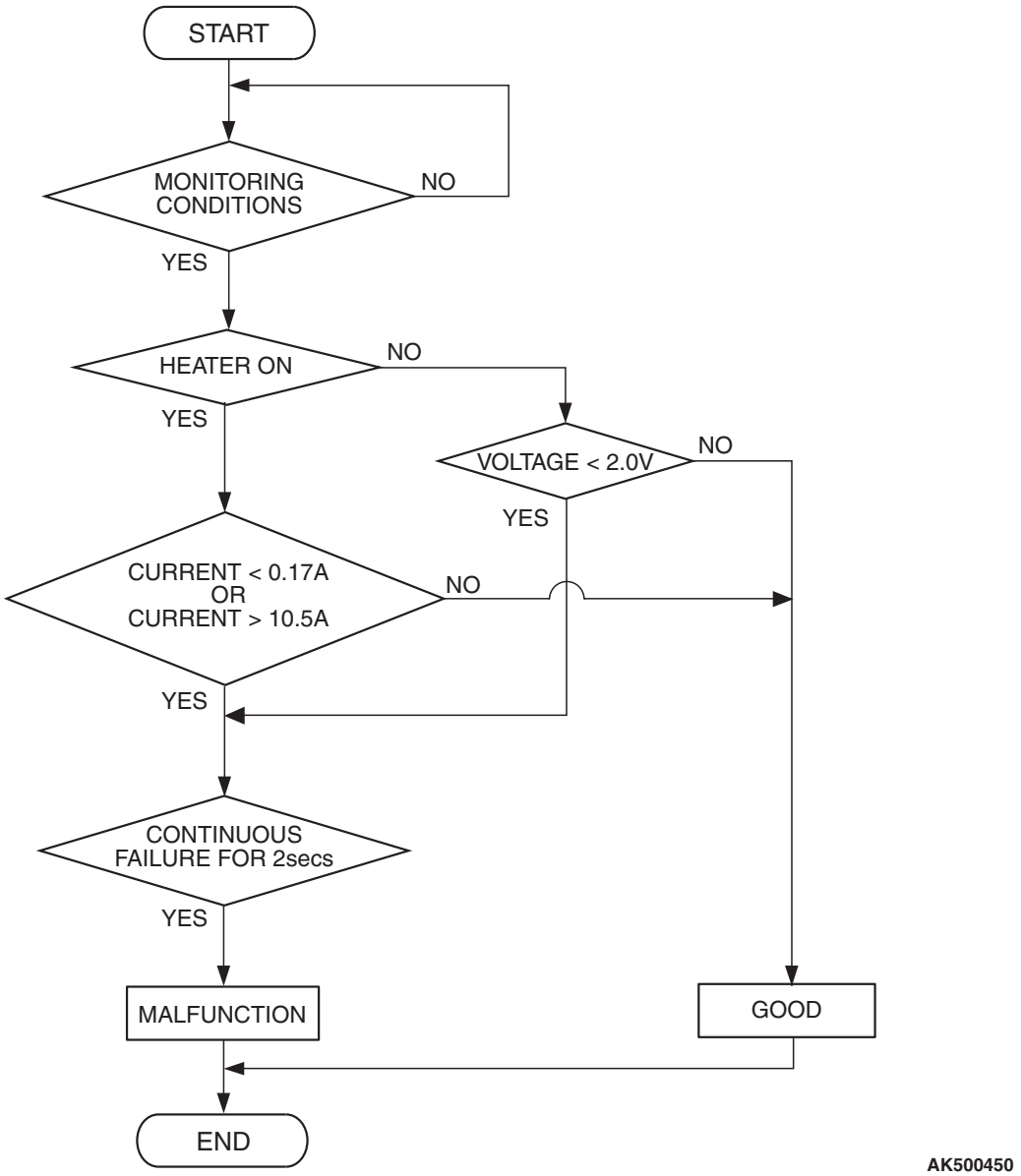
- Not applicable

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 at 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 right bank heated oxygen sensor (front) heater is off.
- Battery positive voltage is at 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 voltage for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

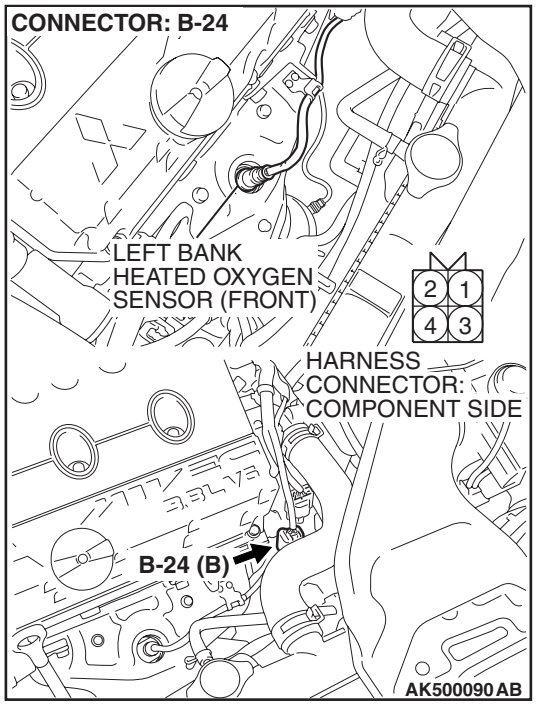
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 2 P.13B-6.

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.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

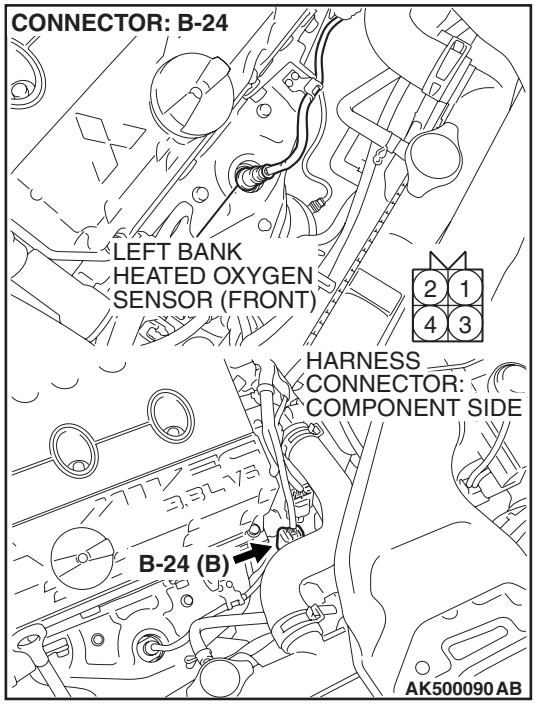
DIAGNOSIS

Required Special Tools:
- MD998464: Test Harness
- MB991923: Check Harness



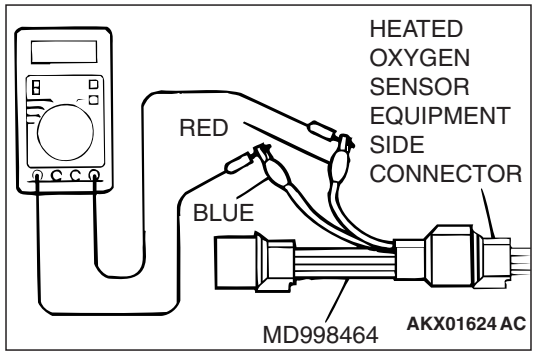
STEP 1. Check harness connector B-24 at the left bank heated oxygen sensor (front) for damage.
Q: Is the harness connector in good condition?

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-24 and connect test harness special tool, MD998464, to the connector on the left bank heated oxygen (front) sensor side.



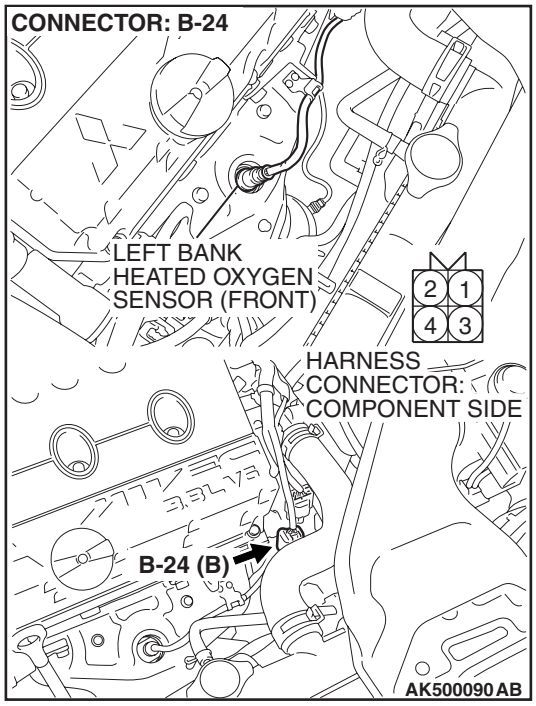
(2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

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.

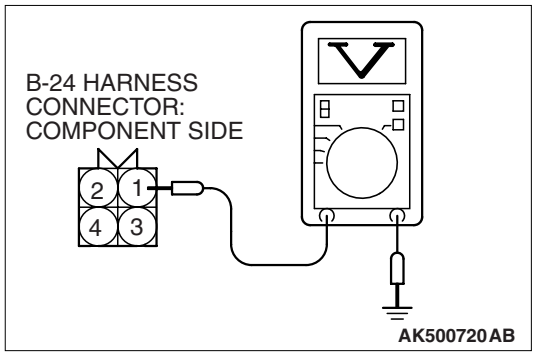
NO : Replace the left bank heated oxygen sensor (front). Then go to Step 12.



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

(1) Disconnect the connector B-24 and measure at the harness side.

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



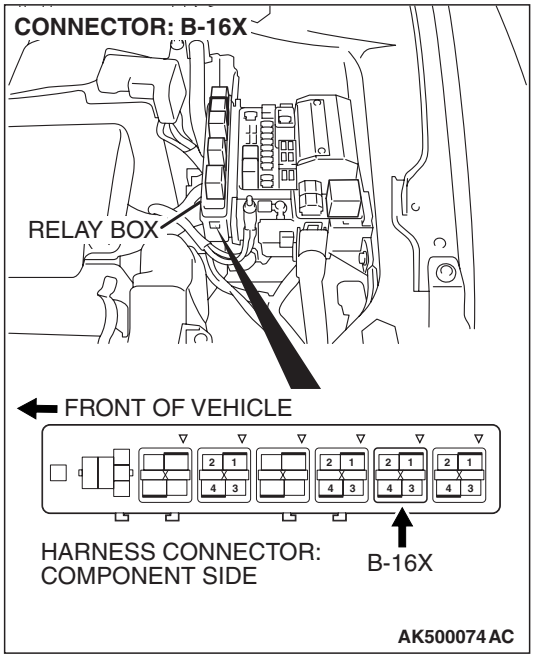
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

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

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

YES : Go to Step 5.

NO : Go to Step 4.

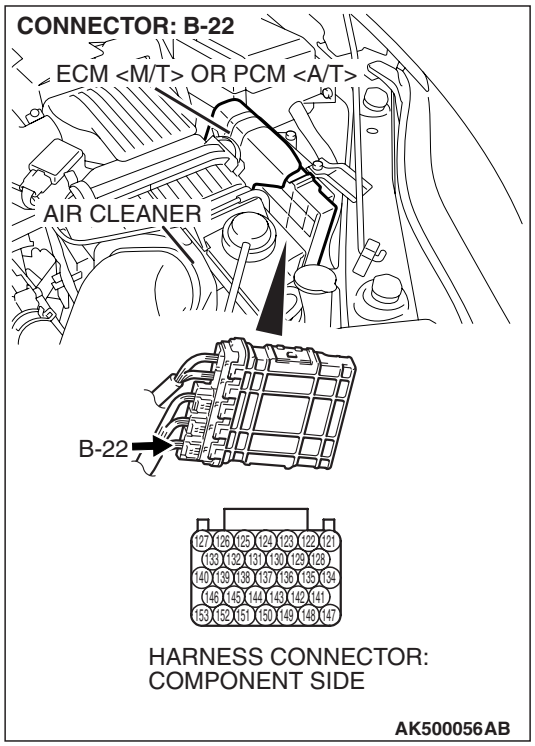


STEP 4. Check harness connector B-16X at the MFI relay for damage.

Q: Is the harness connector in good condition?

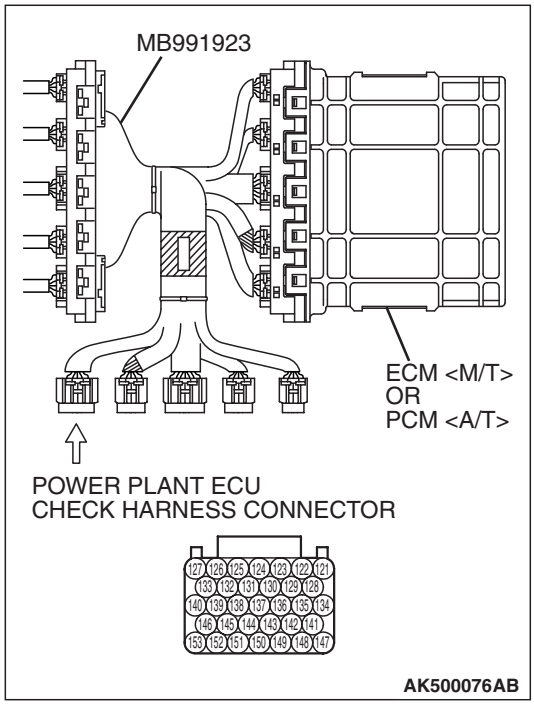
YES : Repair harness wire between MFI relay connector B-16X (terminal No. 4) and left bank heated oxygen sensor (front) connector B-24 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

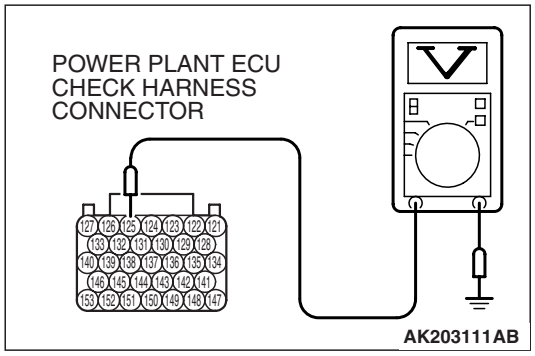
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.



STEP 5. Measure the power supply voltage at ECM <M/T> or PCM <A/T> connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect all ECM <M/T> connectors or PCM <A/T> connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.





(3) Measure the voltage between terminal No. 125 and ground.
- Voltage should be battery positive voltage.

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

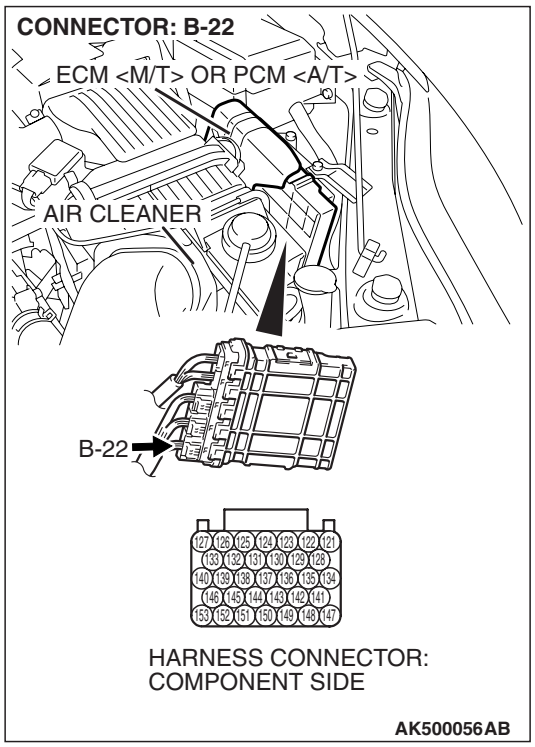
Q: Is battery positive voltage (approximately 12 volts) present?

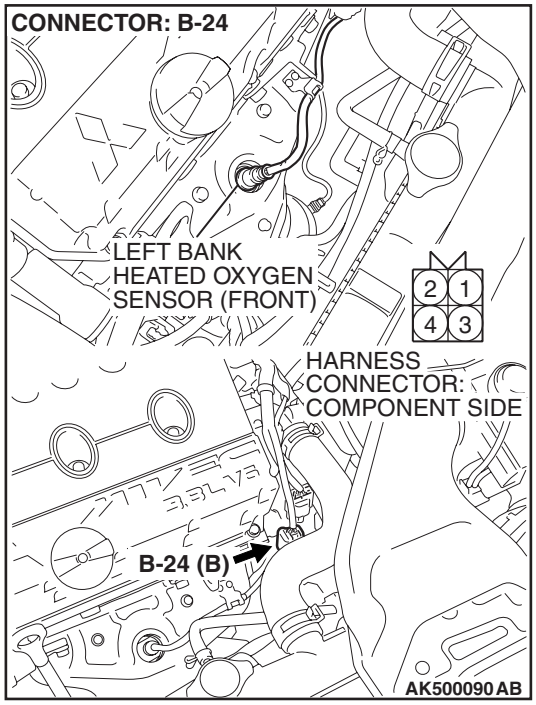
YES : Go to Step 8.
NO : Go to Step 6.

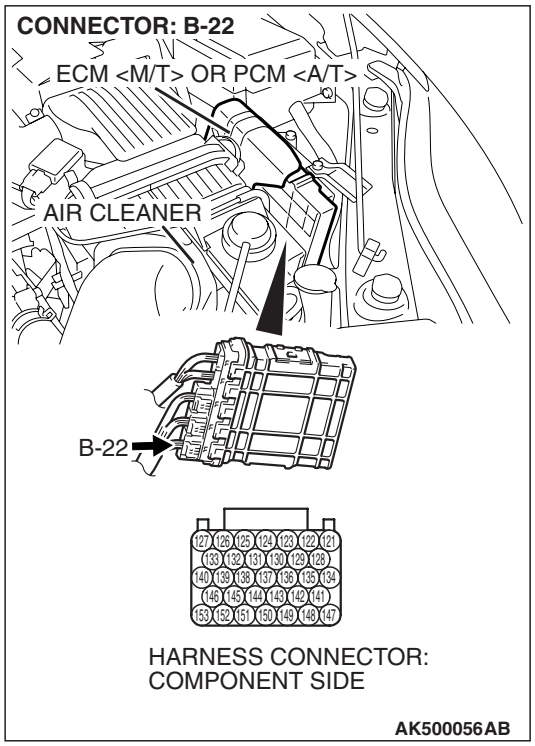
STEP 6. Check harness connector B-22 at ECM <M/T> or PCM <A/T> for damage.

Q: Is the harness connector in good condition?

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





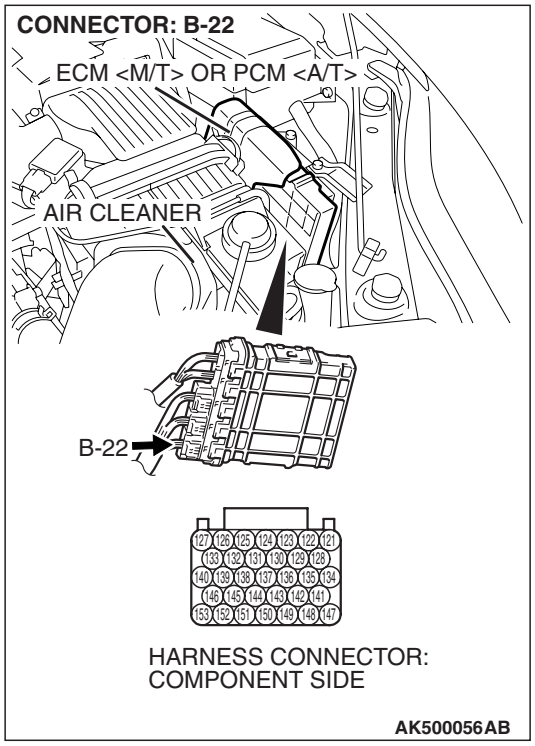


STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (front) connector B-24 (terminal No. 3) and ECM <M/T> or PCM <A/T> connector B-22 (terminal No. 125).

Q: Is the harness wire in good condition?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 12.

NO : Repair it. Then go to Step 12.

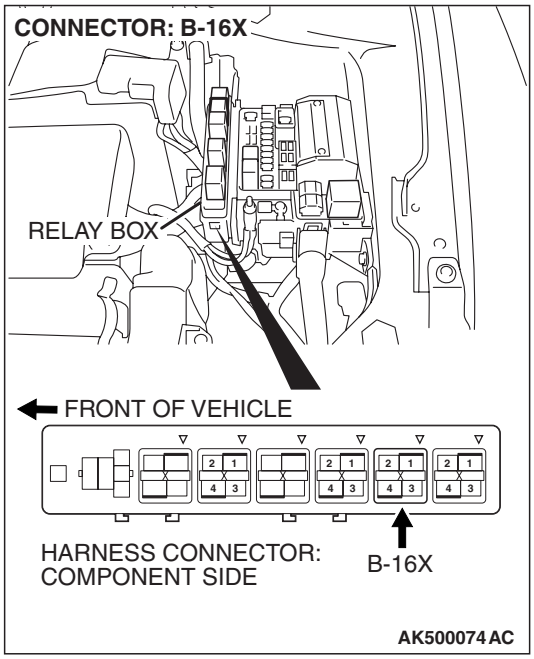


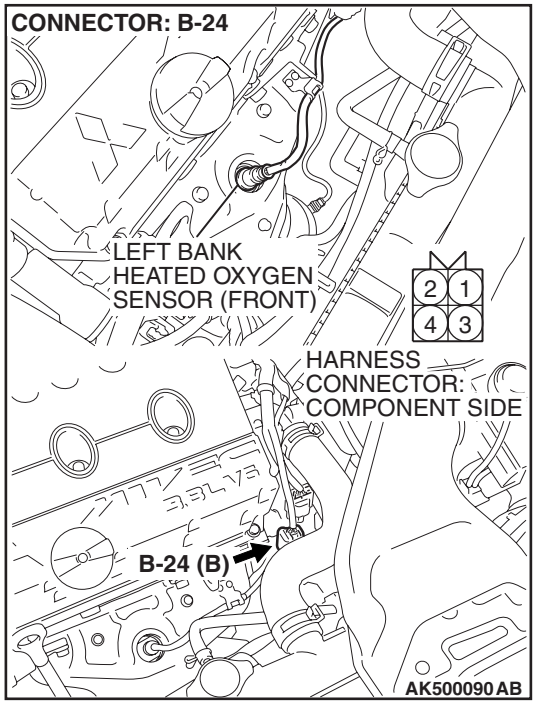
STEP 8. Check harness connector B-22 at ECM <M/T> or PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

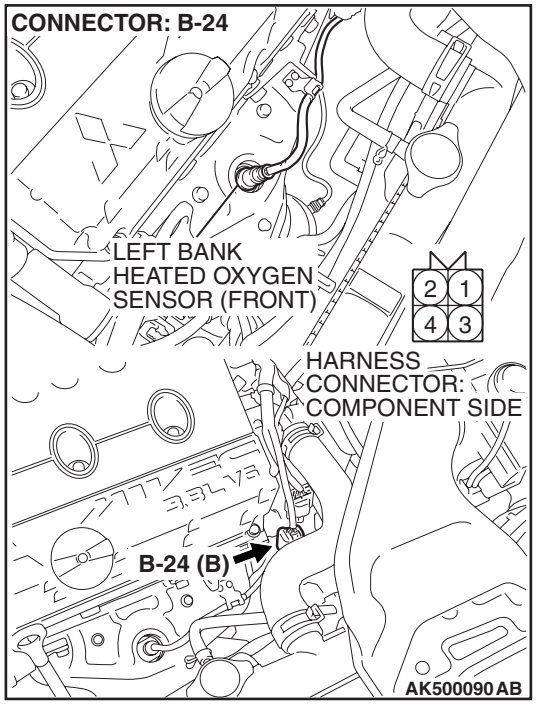
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

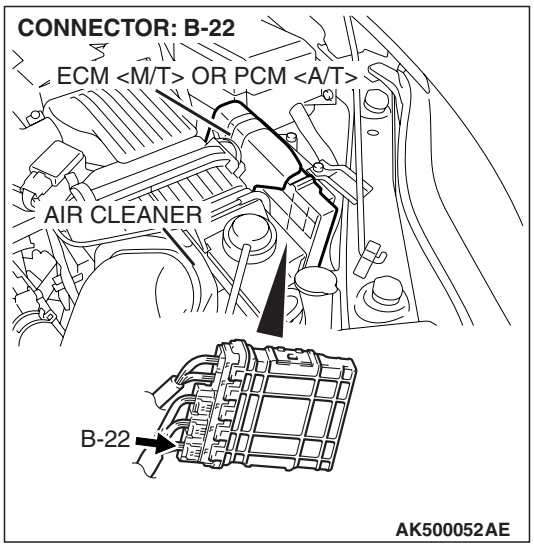




STEP 9. Check for harness damage between MFI relay connector B-16X (terminal No. 4) and left bank heated oxygen sensor (front) connector B-24 (terminal No. 1).
Q: Is the harness wire in good condition?

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





STEP 10. Check for harness damage between left bank heated oxygen sensor (front) connector B-24 (terminal No. 3) and ECM <M/T> or PCM <A/T> connector B-22 (terminal No. 125).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

Q: Is DTC P0051 set?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

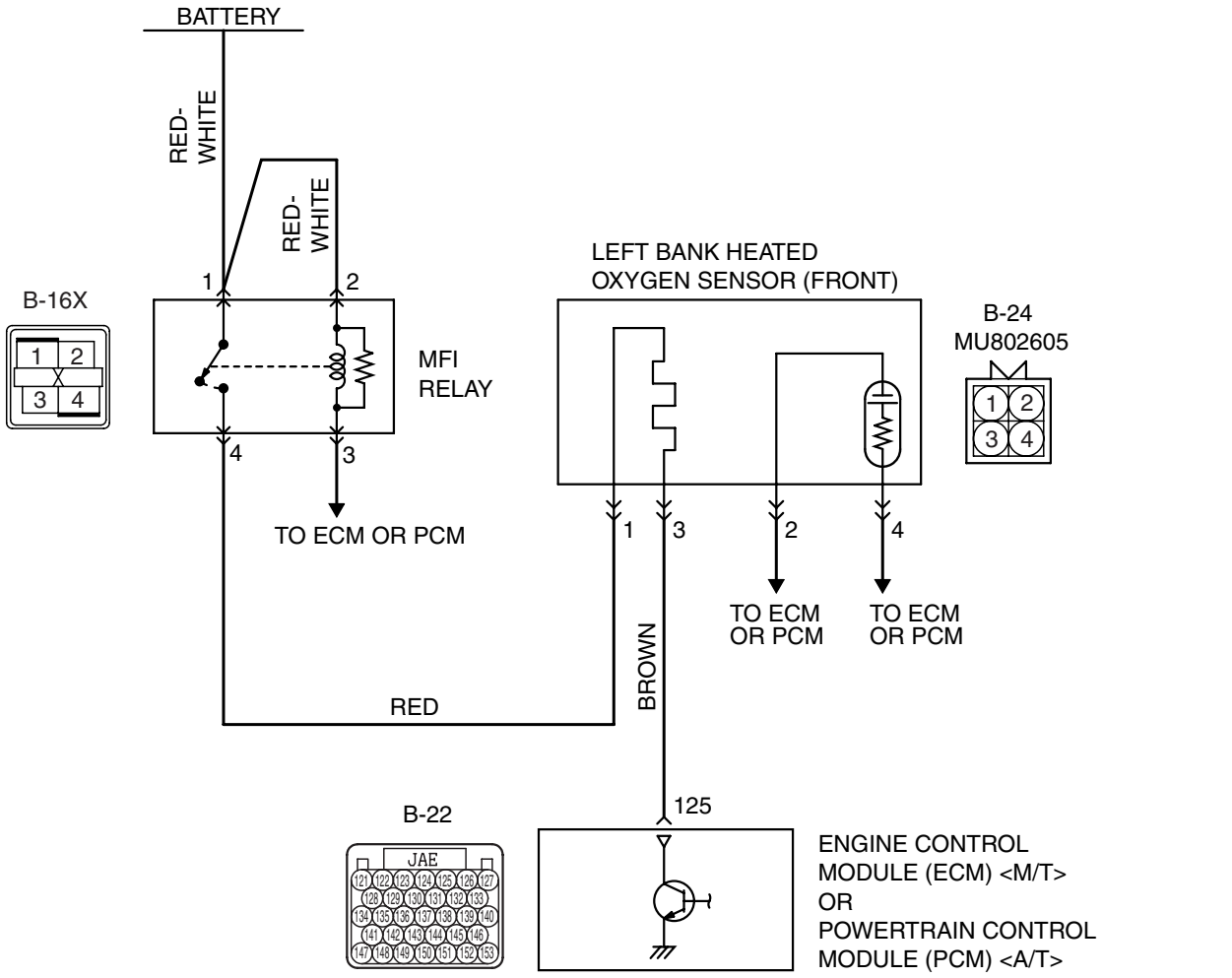
Q: Is DTC P0051 set?

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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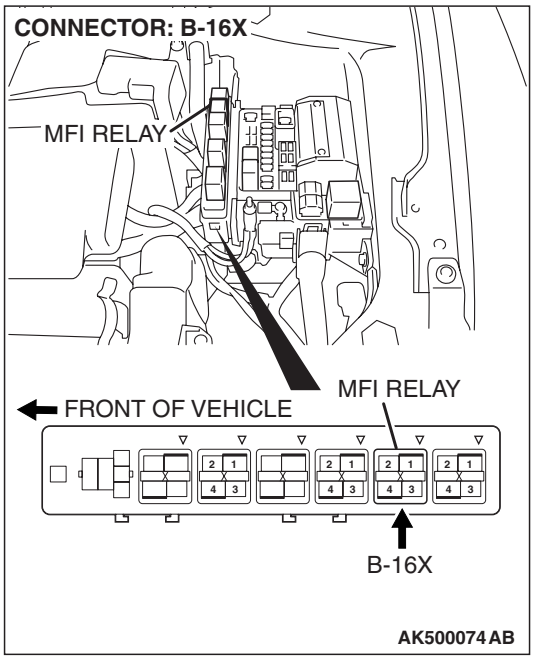

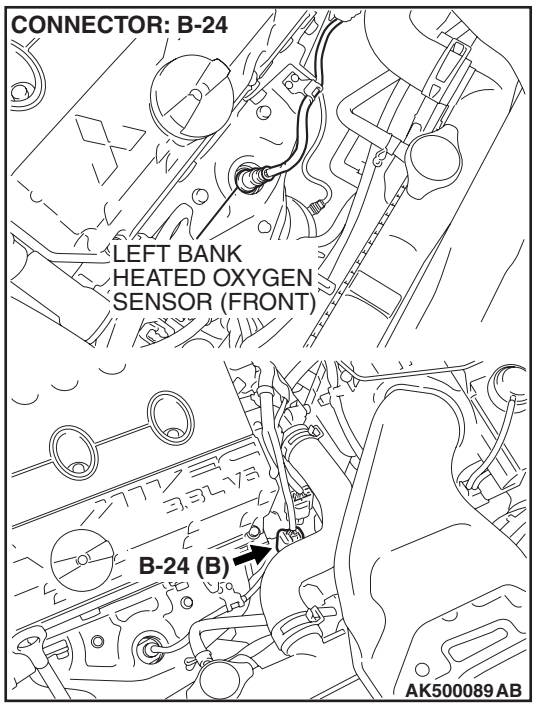

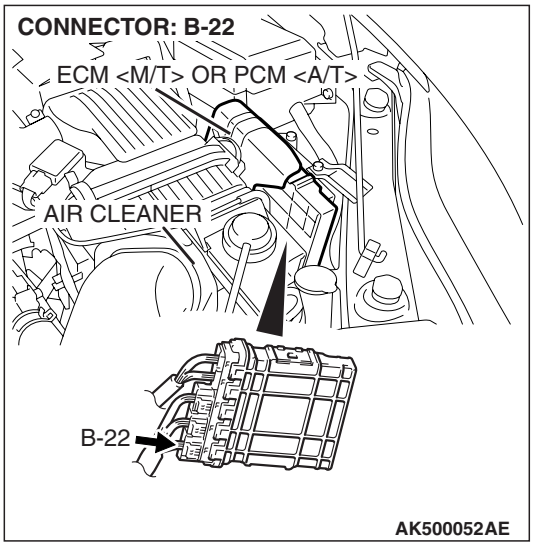

CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

- The ECM <M/T> or the PCM <A/T> 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

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MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

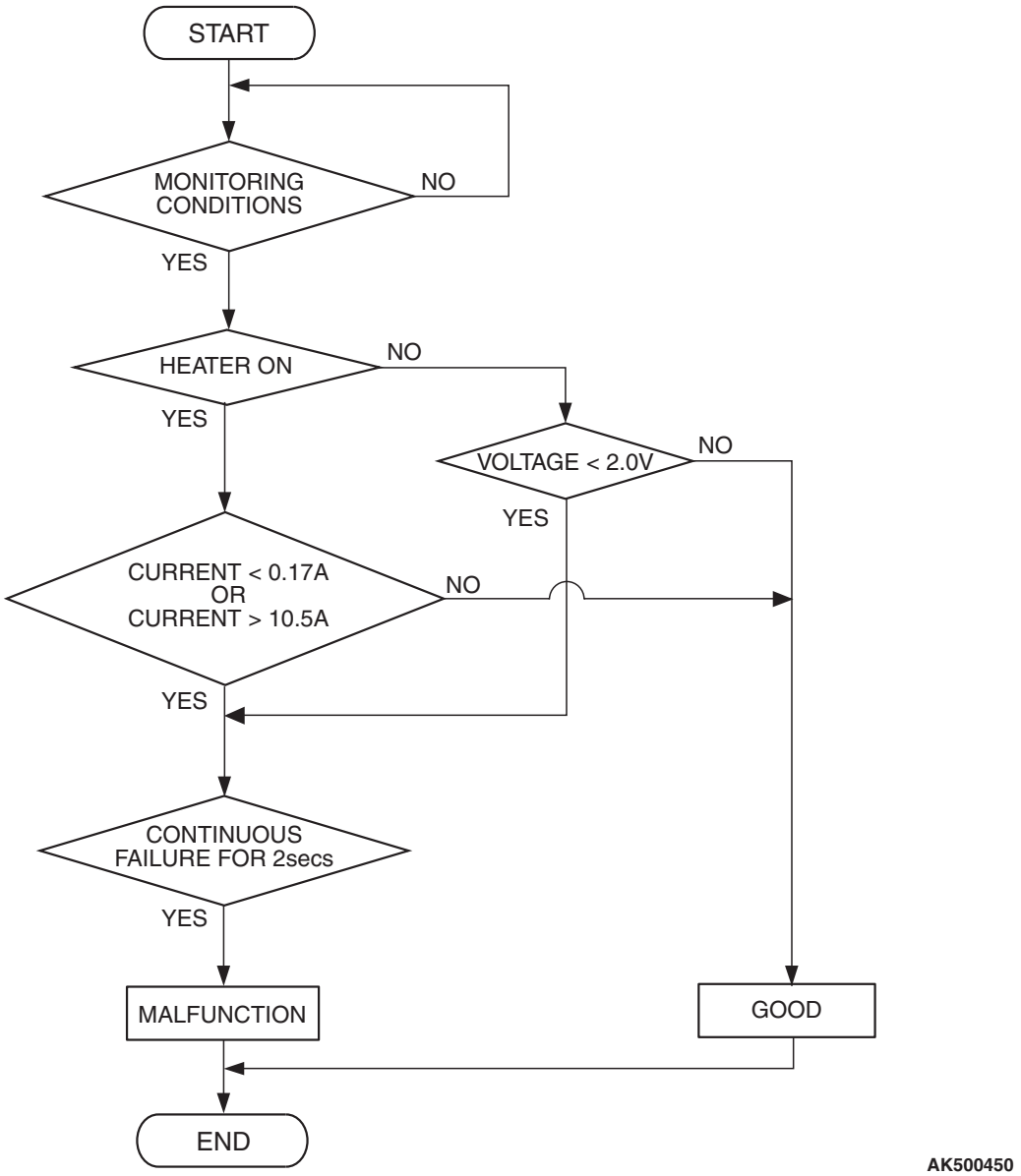
- Not applicable

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 at 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 2 P.13B-6.

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

- Left bank heated oxygen sensor (front) heater failed.
- Connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

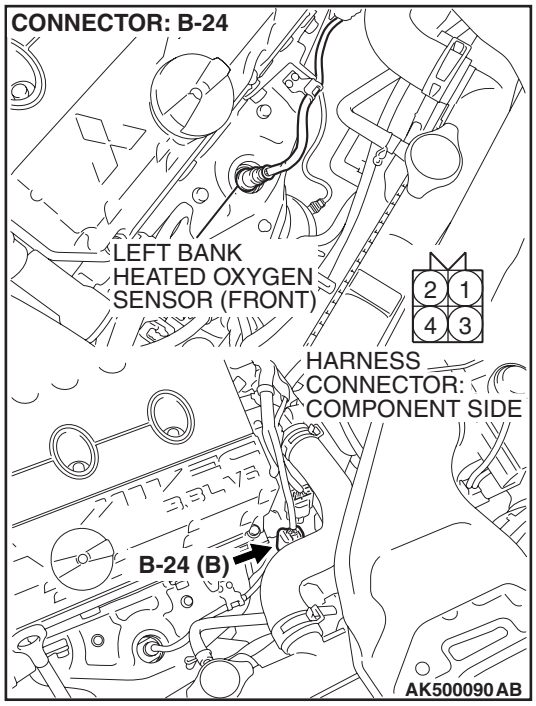
DIAGNOSIS

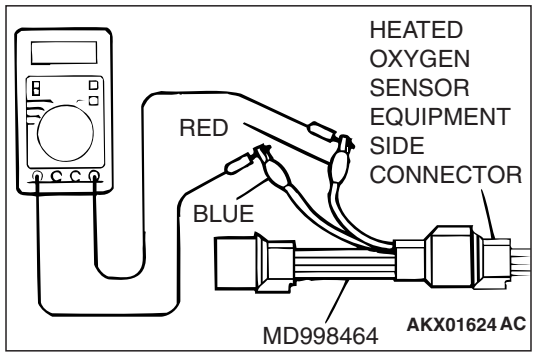
Required Special Tool:

- MD998464: Test Harness

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

(1) Disconnect left bank heated oxygen sensor (front) connector B-24 and connect test harness special tool, MD998464, 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 2 P.13B-6.

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

Q: Is DTC P0052 set?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

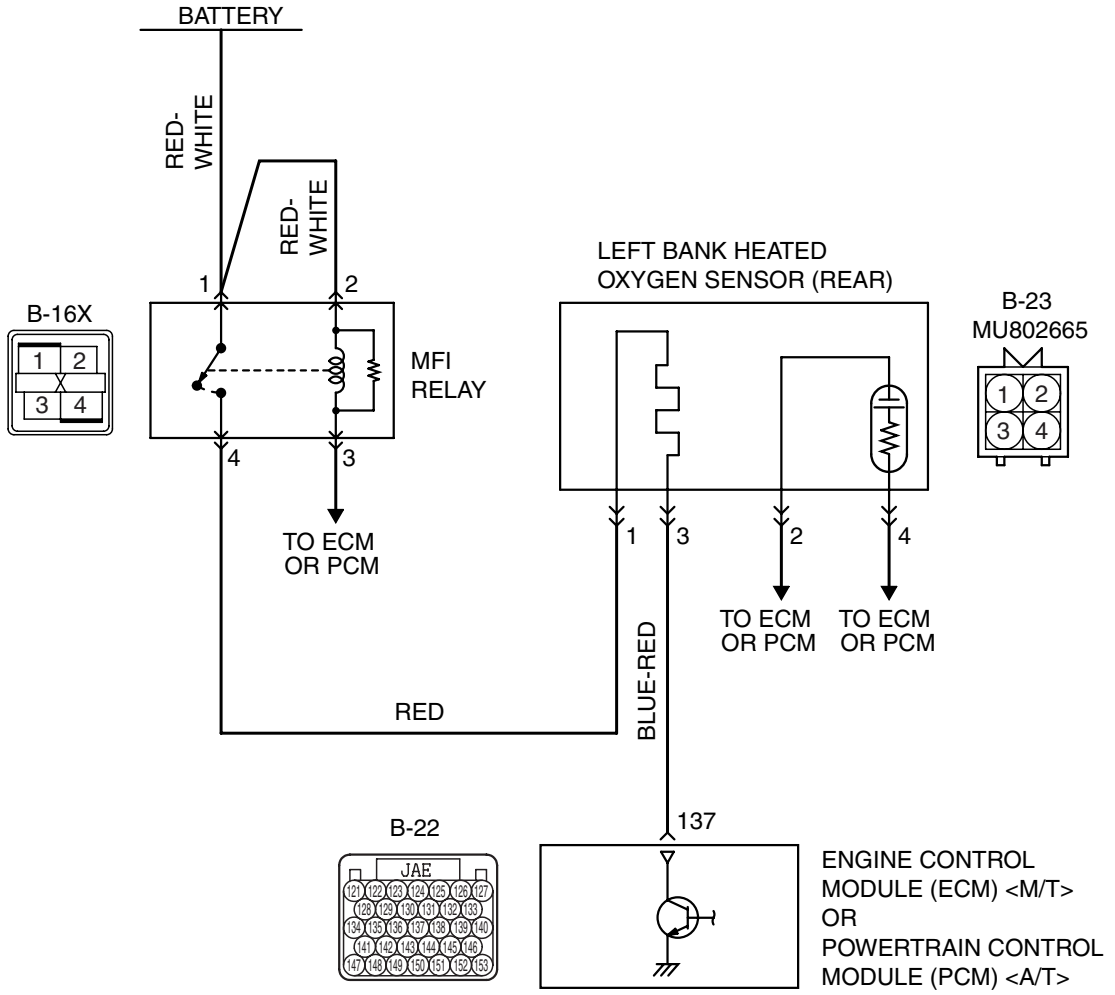
Q: Is DTC P0052 set?

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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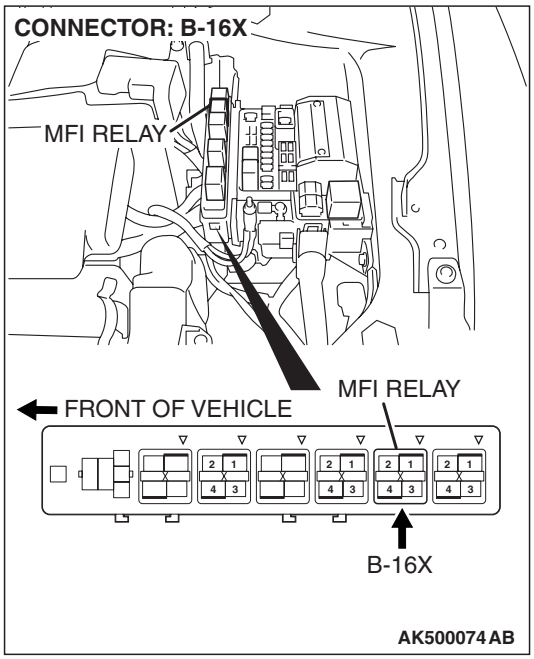
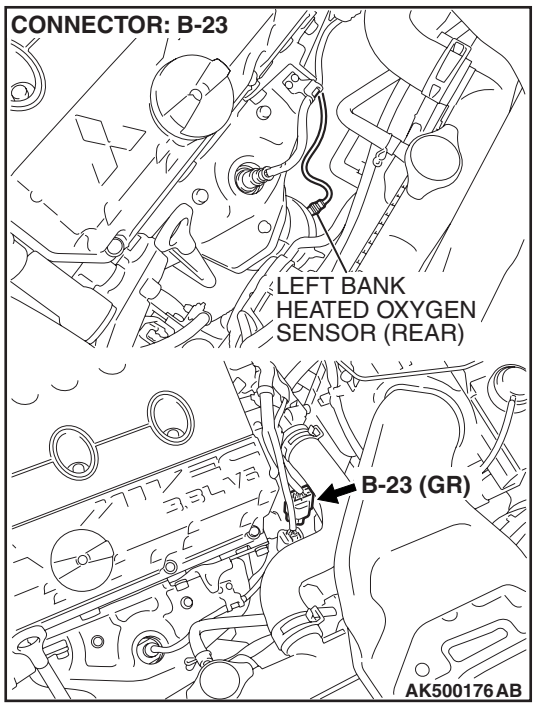
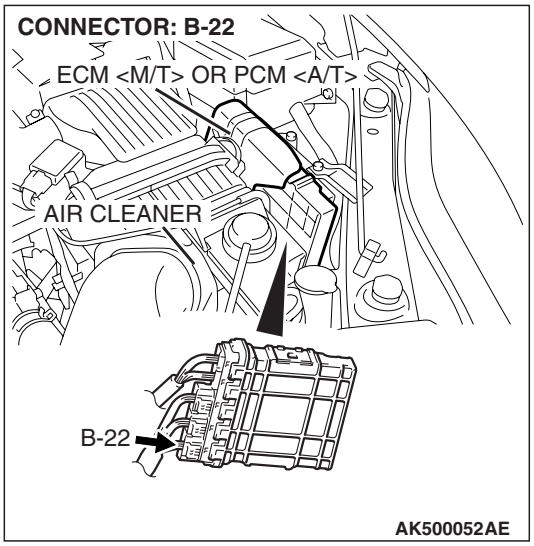






CIRCUIT OPERATION

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

TECHNICAL DESCRIPTION

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

TSB Revision

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

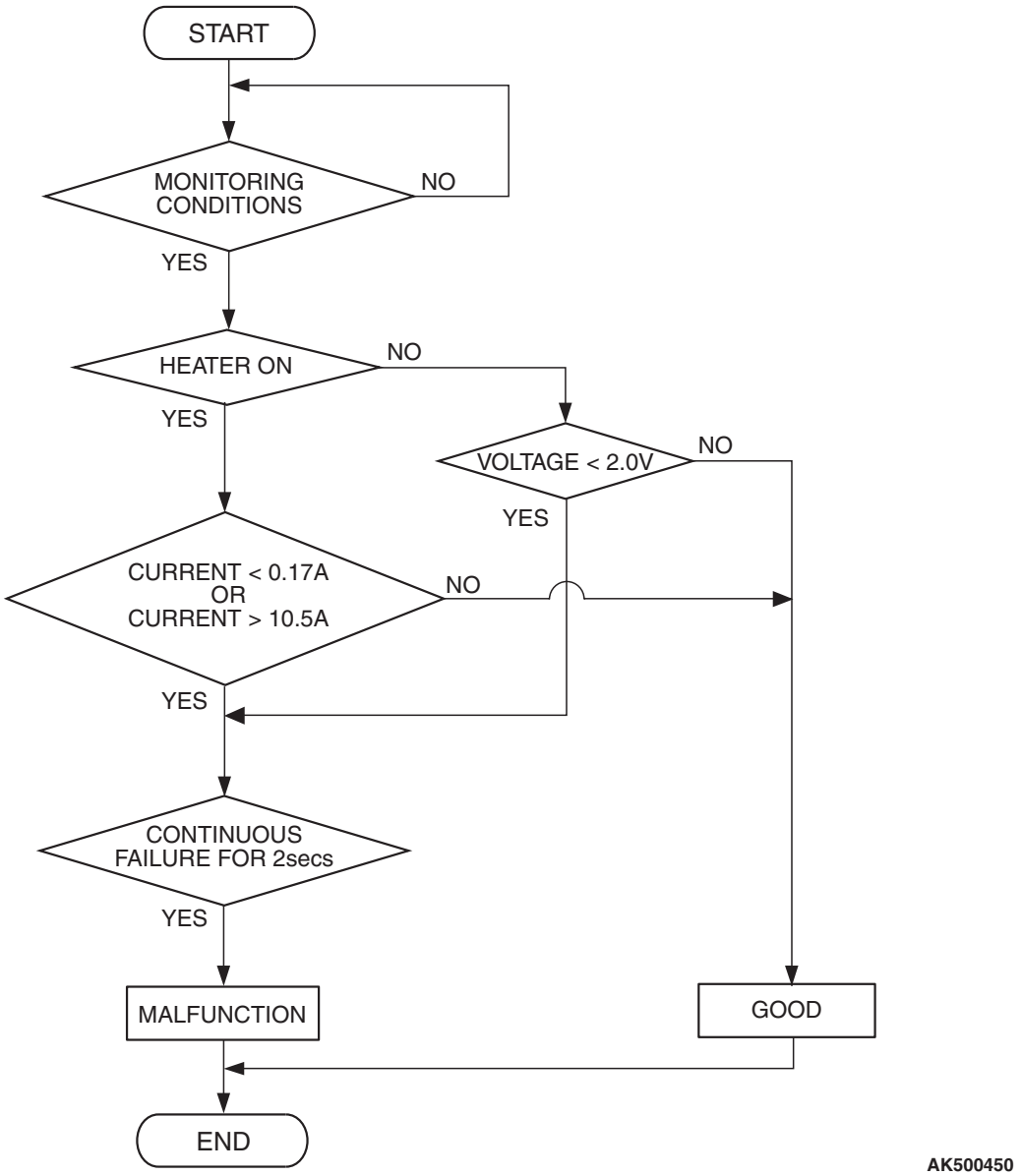
- Not applicable

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 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 voltage for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

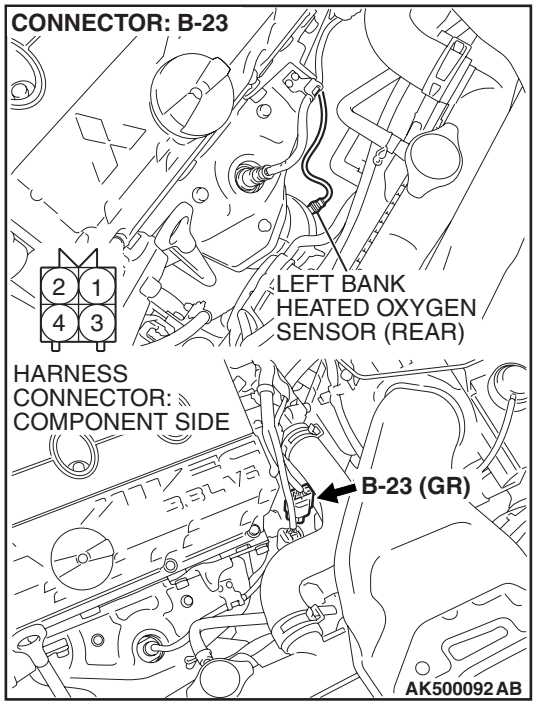
Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 2 P.13B-6.

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.
- Left bank heated oxygen sensor (rear) failed.
- ECM failed. <M/T>
- PCM failed. <A/T>

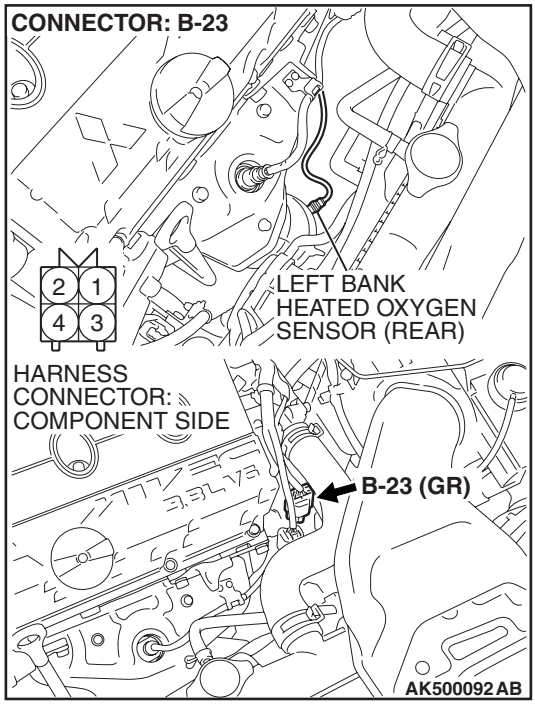
DIAGNOSIS

Required Special Tools:
- MB991316: Test Harness
- MB991923: Power Plant ECU Check Harness



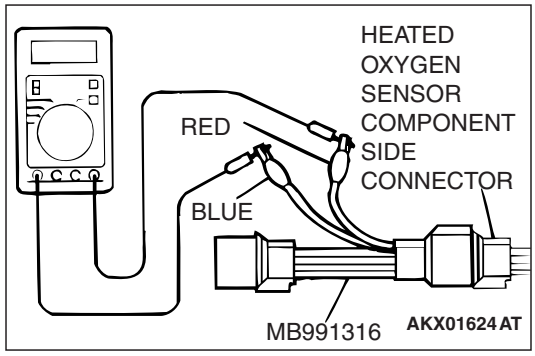
STEP 1. Check harness connector B-23 at the left bank heated oxygen sensor (rear) for damage.
Q: Is the harness connector in good condition?

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



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

(1) Disconnect left bank heated oxygen sensor (rear) connector B-23 and connect test harness special tool, MB991316, 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)]?

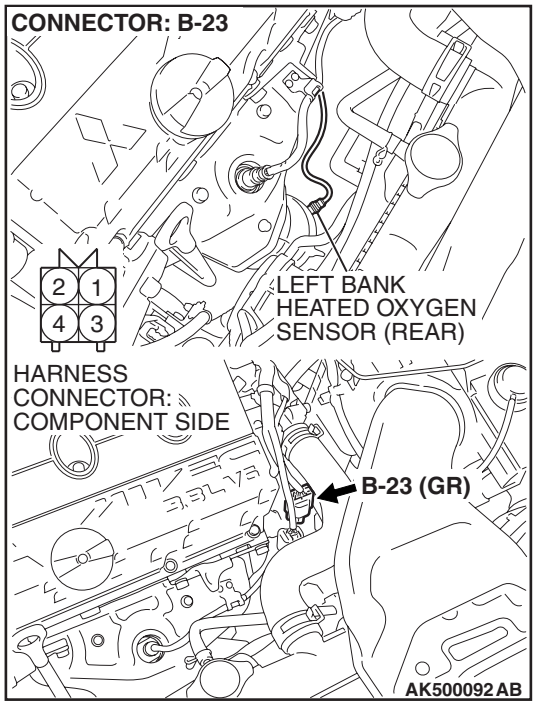
YES : Go to Step 3.

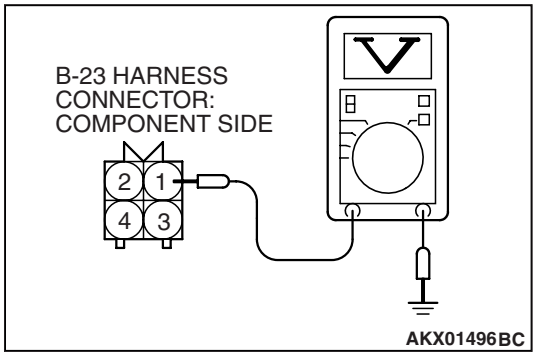
NO : Replace the left bank heated oxygen sensor (rear). Then go to Step 12.

STEP 3. Measure the power supply voltage at left bank heated oxygen sensor (rear) harness side connector B-23.

(1) Disconnect the connector B-23 and measure at the harness side.

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





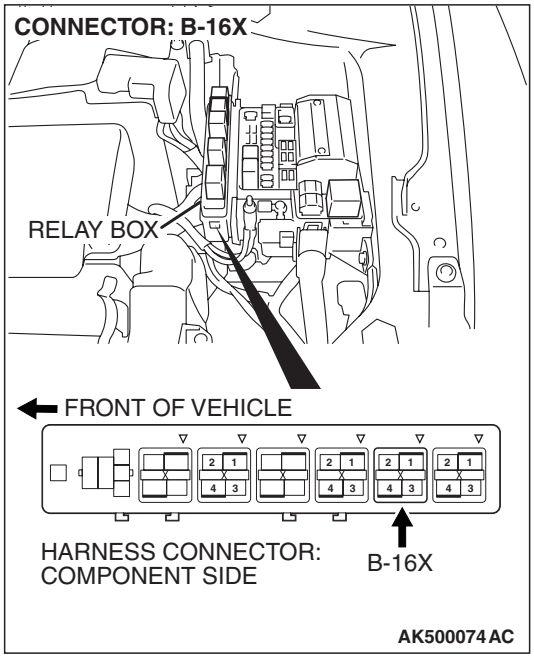
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

(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-16X at the MFI relay for damage.

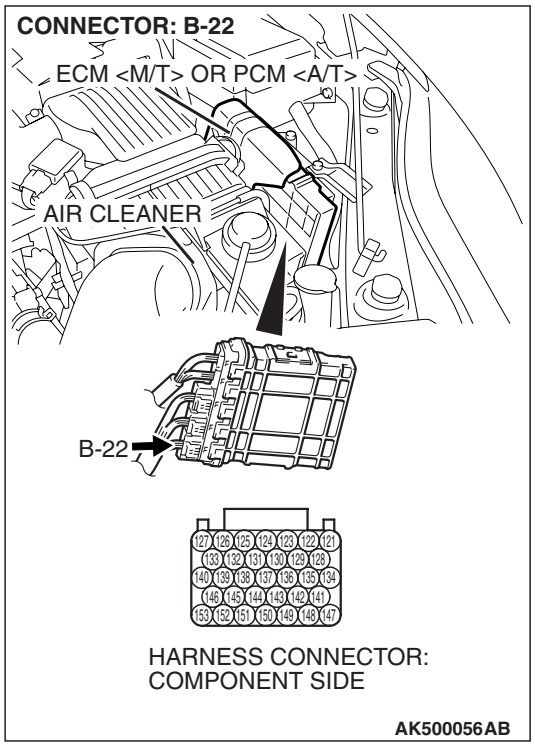
Q: Is the harness connector in good condition?

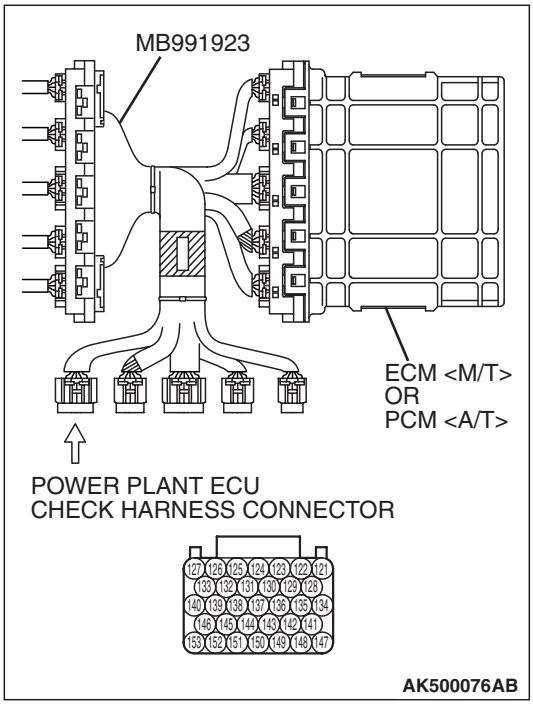
YES : Repair harness wire between MFI relay connector B-16X (terminal No. 4) and left bank heated oxygen sensor (rear) connector B-23 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

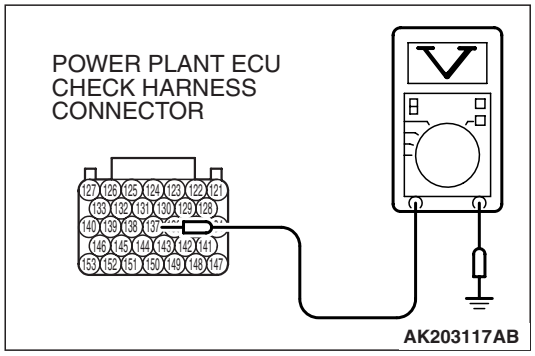
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

STEP 5. Measure the power supply voltage at ECM <M/T> or PCM <A/T> connector B-22 by using power plant ECU check harness special tool MB991923.

(1) Disconnect all ECM <M/T> connectors or PCM <A/T> connectors. Connect the power plant ECU check harness special tool MB991923 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.







(3) Measure the voltage between terminal No. 137 and ground.
- Voltage should be battery positive voltage.

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

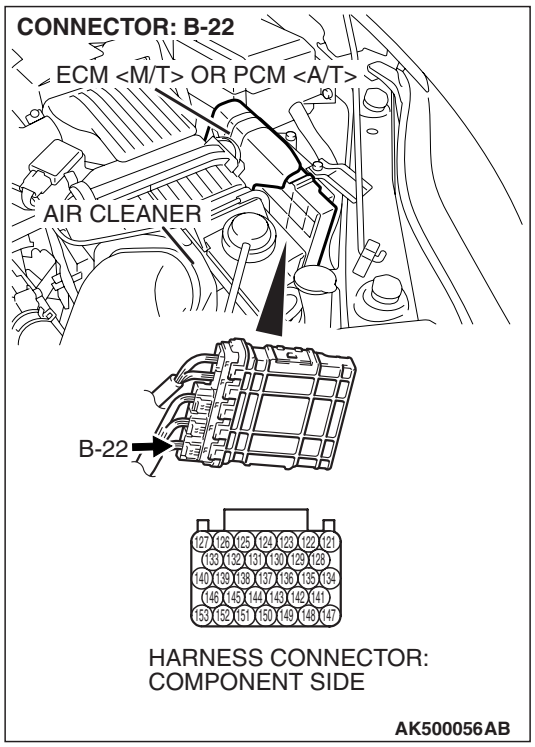
Q: Is battery positive voltage (approximately 12 volts) present?

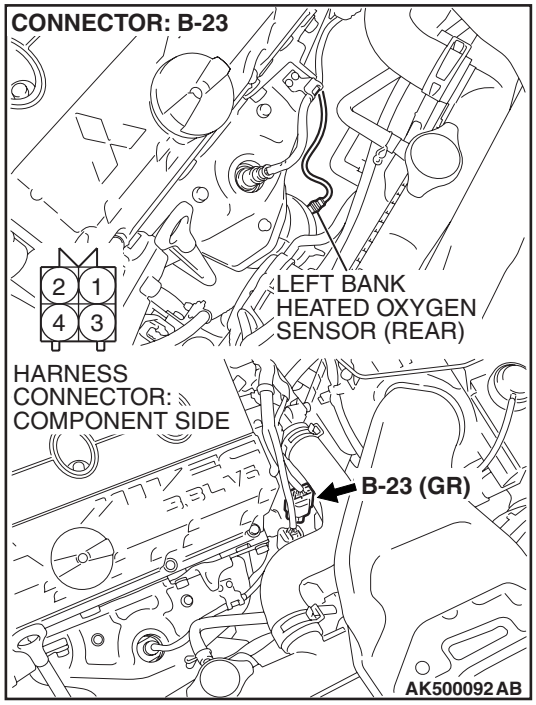
YES : Go to Step 8.
NO : Go to Step 6.

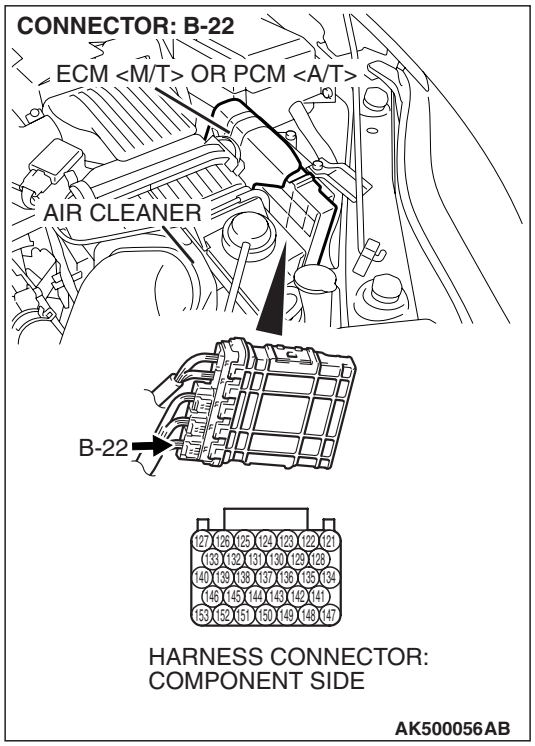
STEP 6. Check harness connector B-22 at ECM <M/T> or PCM <A/T> for damage.

Q: Is the harness connector in good condition?

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





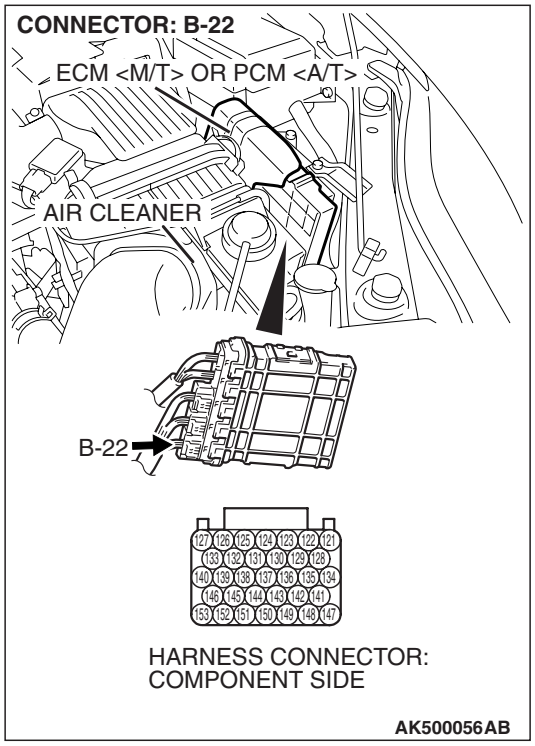


STEP 7. Check for open circuit or short circuit to ground between left bank heated oxygen sensor (rear) connector B-23 (terminal No. 3) and ECM <M/T> or PCM <A/T> connector B-22 (terminal No. 137).

Q: Is the harness wire in good condition?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 12.

NO : Repair it. Then go to Step 12.

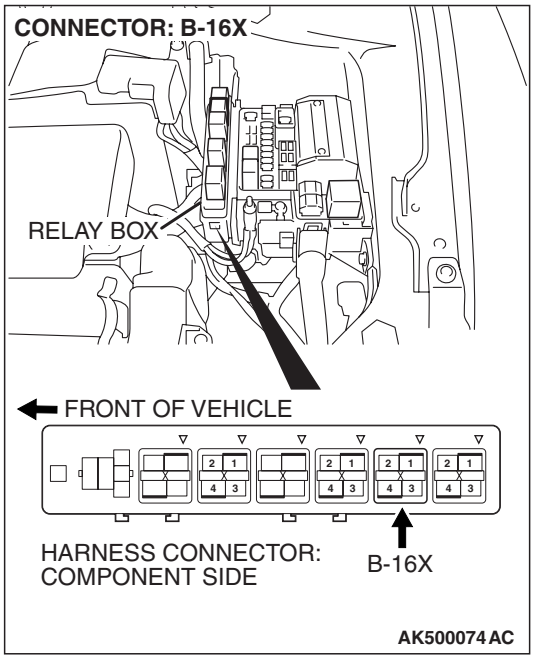


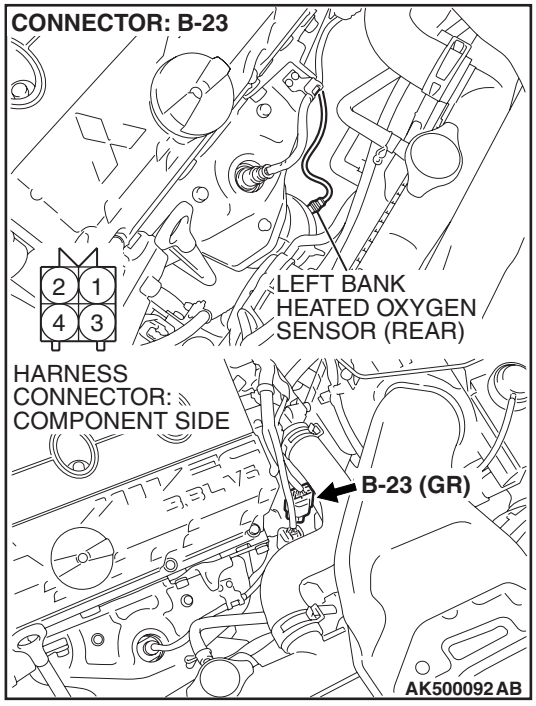
STEP 8. Check harness connector B-22 at ECM <M/T> or PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

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





STEP 9. Check for harness damage between MFI relay connector B-16X (terminal No. 4) and left bank heated oxygen sensor (rear) connector B-23 (terminal No. 1).
Q: Is the harness wire in good condition?

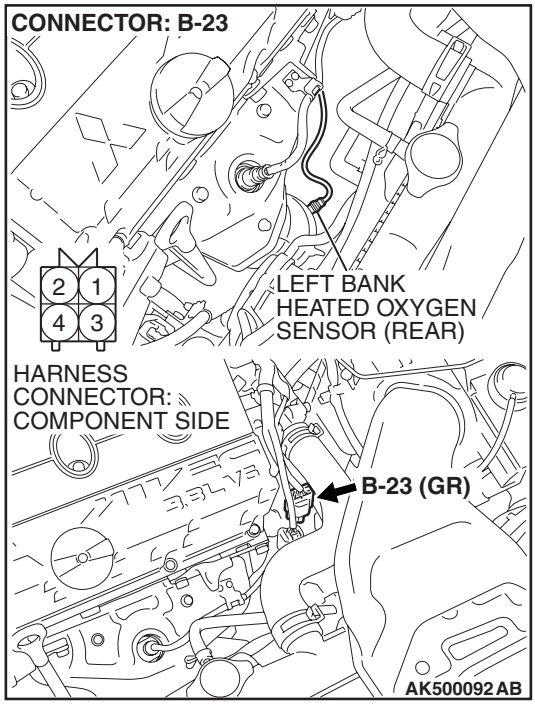
YES : Go to Step 10.
NO : Repair it. Then go to Step 12.

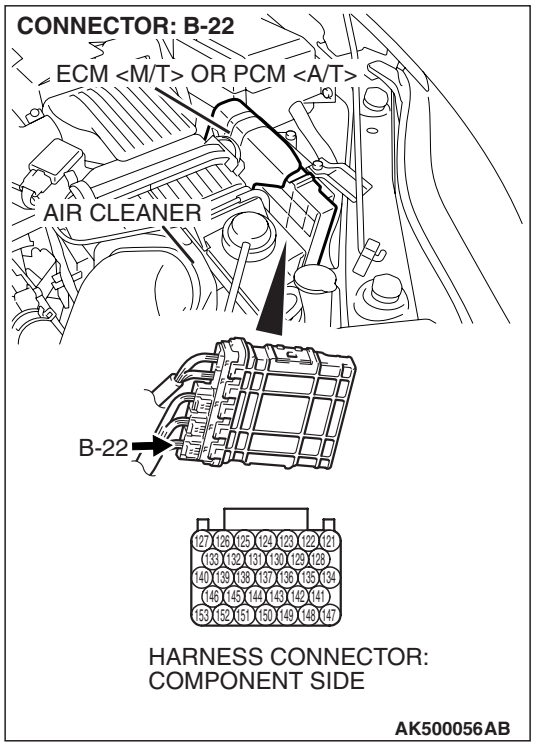
STEP 10. Check for harness damage between left bank heated oxygen sensor (rear) connector B-23 (terminal No. 3) and ECM <M/T> or PCM <A/T> connector B-22 (terminal No. 137).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.





STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

Q: Is DTC P0057 set?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

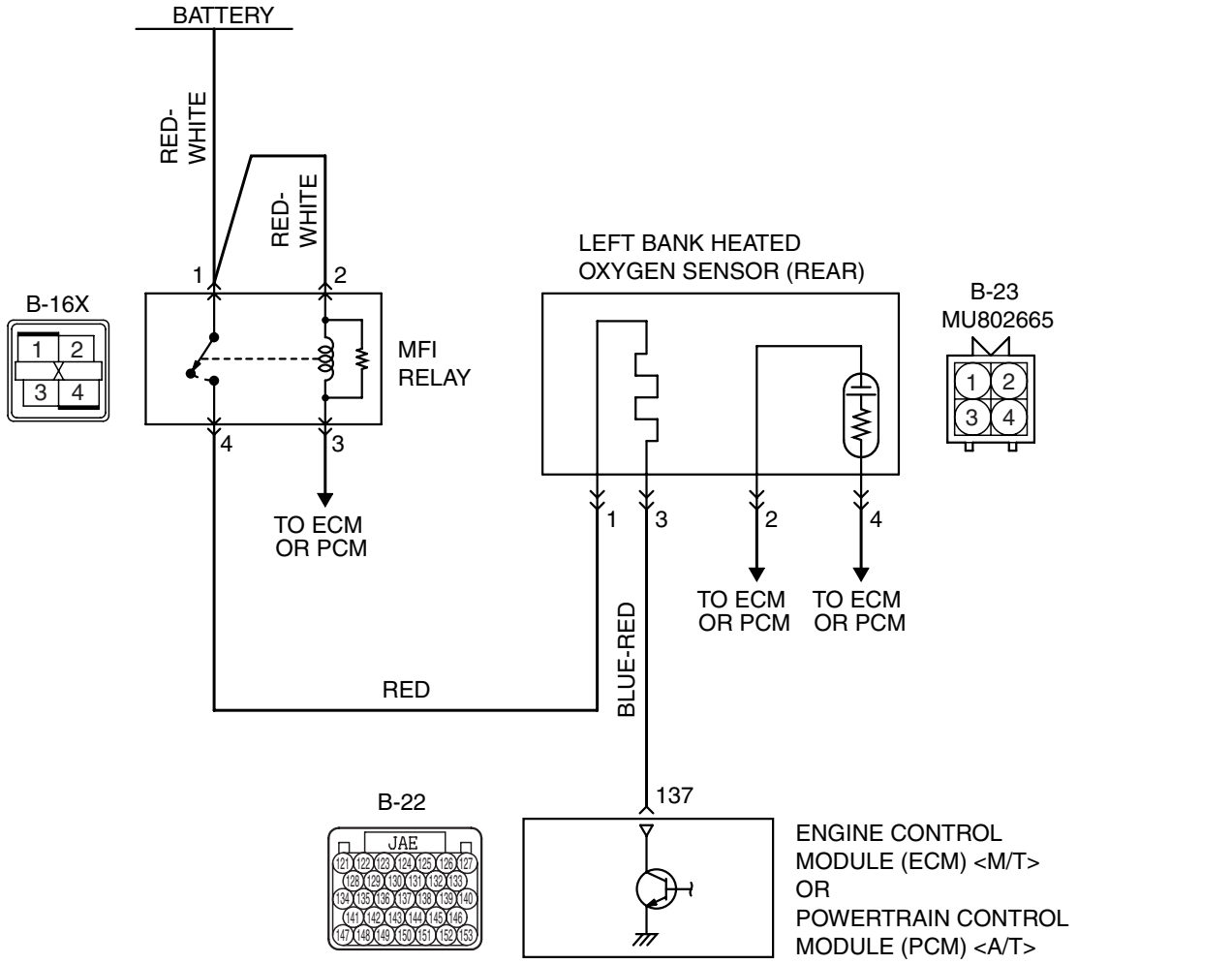
Q: Is DTC P0057 set?

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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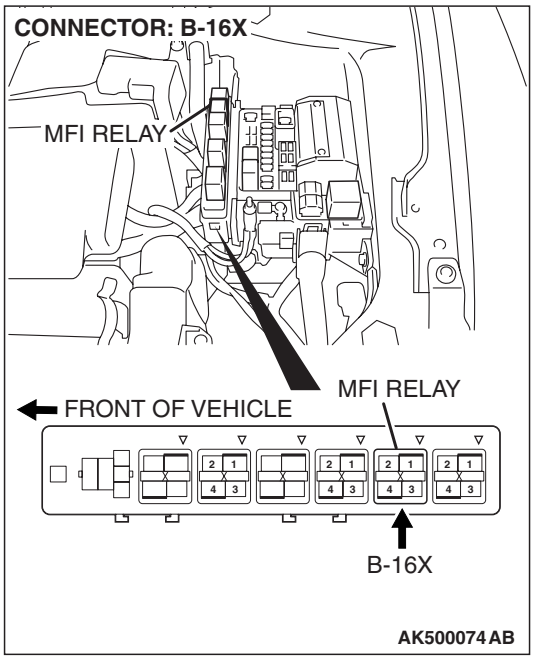
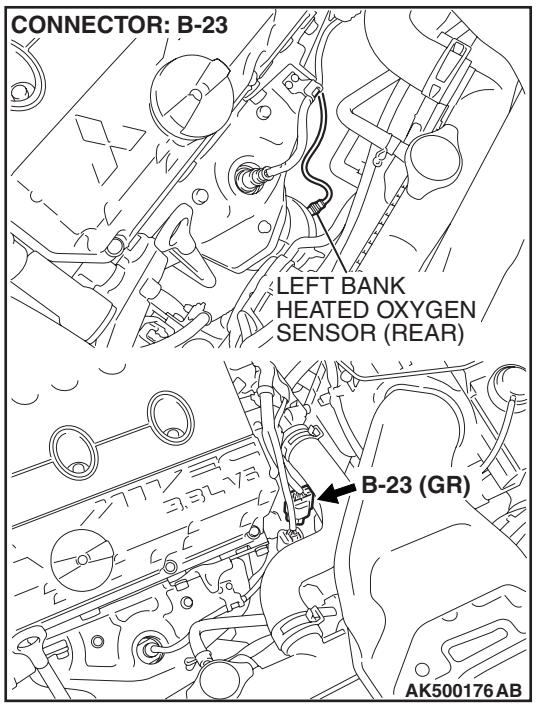
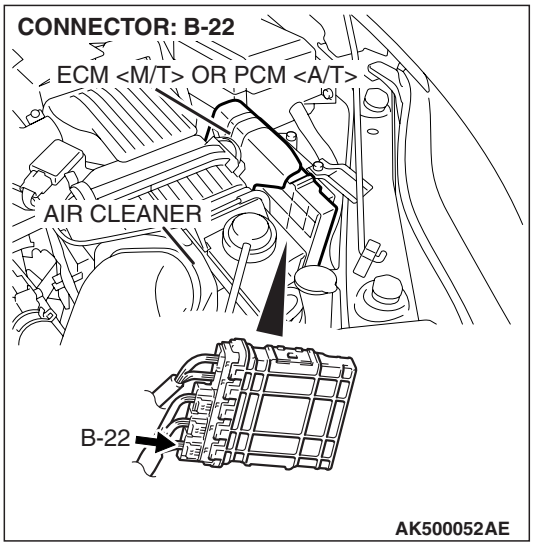






CIRCUIT OPERATION

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

BACKGROUND

- The ECM <M/T> or the PCM <A/T> 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

TSB Revision

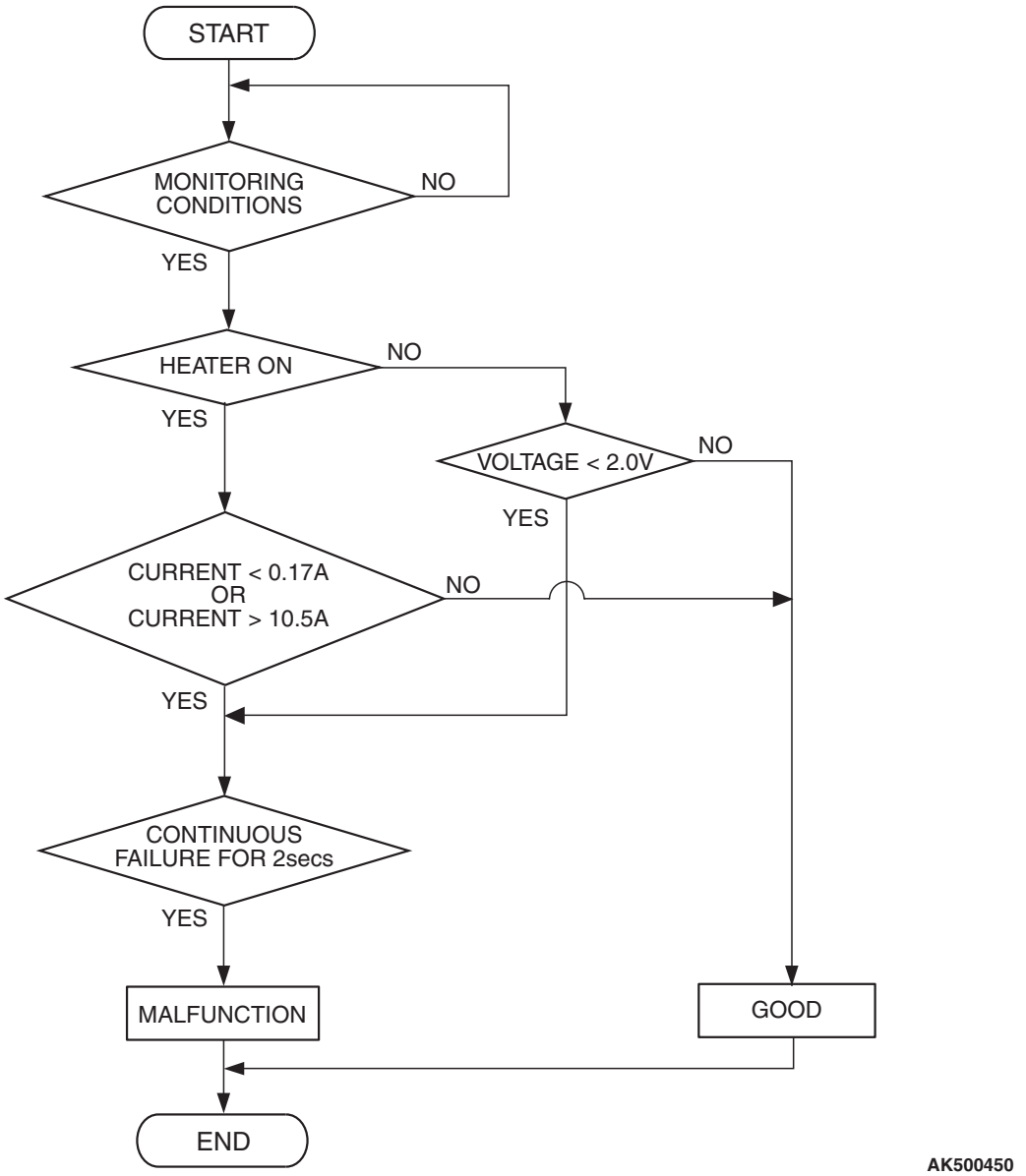
MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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 higher than 10.5 ampere for 2 seconds.

TSB Revision

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function –OBD-II Drive Cycle – Pattern 2 P.13B-6.

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

- Left bank heated oxygen sensor (rear) heater failed.
- Connector damage.
- Left bank heated oxygen sensor (rear) failed.
- ECM failed. <M/T>
- PCM failed. <A/T>

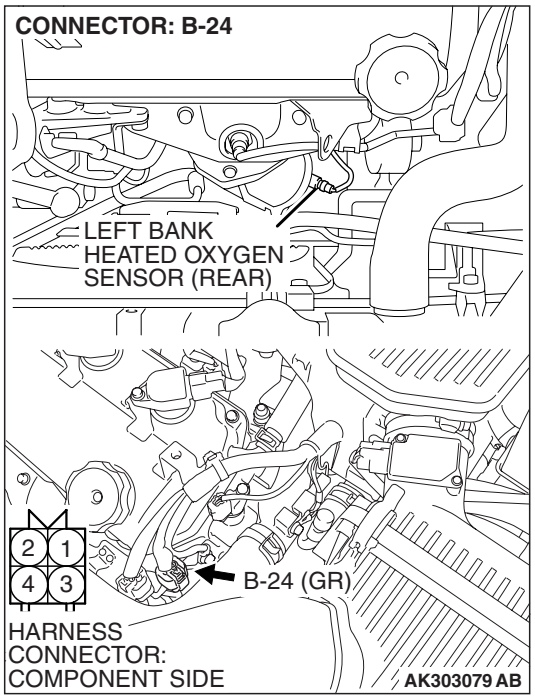
DIAGNOSIS

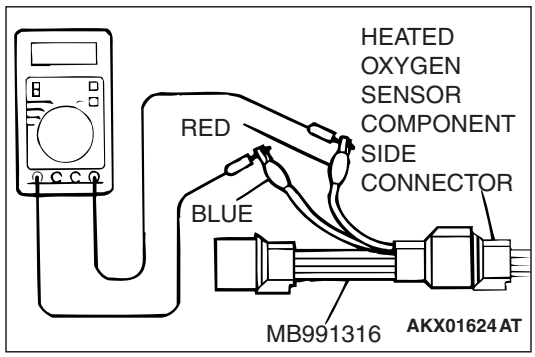
Required Special Tool:

- MB991316: Test Harness

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

(1) Disconnect left bank heated oxygen sensor (rear) connector B-23 and connect test harness special tool, MB991316, 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 2 P.13B-6.

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

Q: Is DTC P0058 set?

YES : Replace the ECM or the PCM. When the ECM or the PCM is replaced, register the encrypted code. Refer to GROUP 54A, Encrypted Code Registration Criteria Table P.54A-13. Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function –OBD-II Drive Cycle –Pattern 2 P.13B-6.

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

Q: Is DTC P0058 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

NEXT>>