GROUP 13A

MULTIPORT FUEL INJECTION (MFI) <2.4L ENGINE>

CONTENTS

Continued on next page

GENERAL INFORMATION

M1131000105999

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

FUEL INJECTION CONTROL

The injector drive times and injection 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 1-3-4-2. Each cylinder has a dedicated fuel injector. This is called multiport.
The ECM 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 controls the air/fuel mixture by using the heated oxygen sensor signal or linear air-fuel ratio sensor signal to carry out "closed-loop" control. The closed-loop control achieves the theoretical air/fuel mixture ratio where the catalytic converter can obtain the maximum cleaning performance.

THROTTLE VALVE OPENING CONTROL

This system electrically controls the opening of the throttle valve. The ECM 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 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 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.
- The RAM data inside the ECM that is related to the sensors and actuators can be read with the scan tool. In addition, the actuators can be controlled by scan tool MB991958 (M.U.T.-III sub assembly) under certain circumstances.

OTHER CONTROL FUNCTIONS

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

A/C Compressor Clutch Relay Control
- Turns the compressor clutch of the A/C ON and OFF.

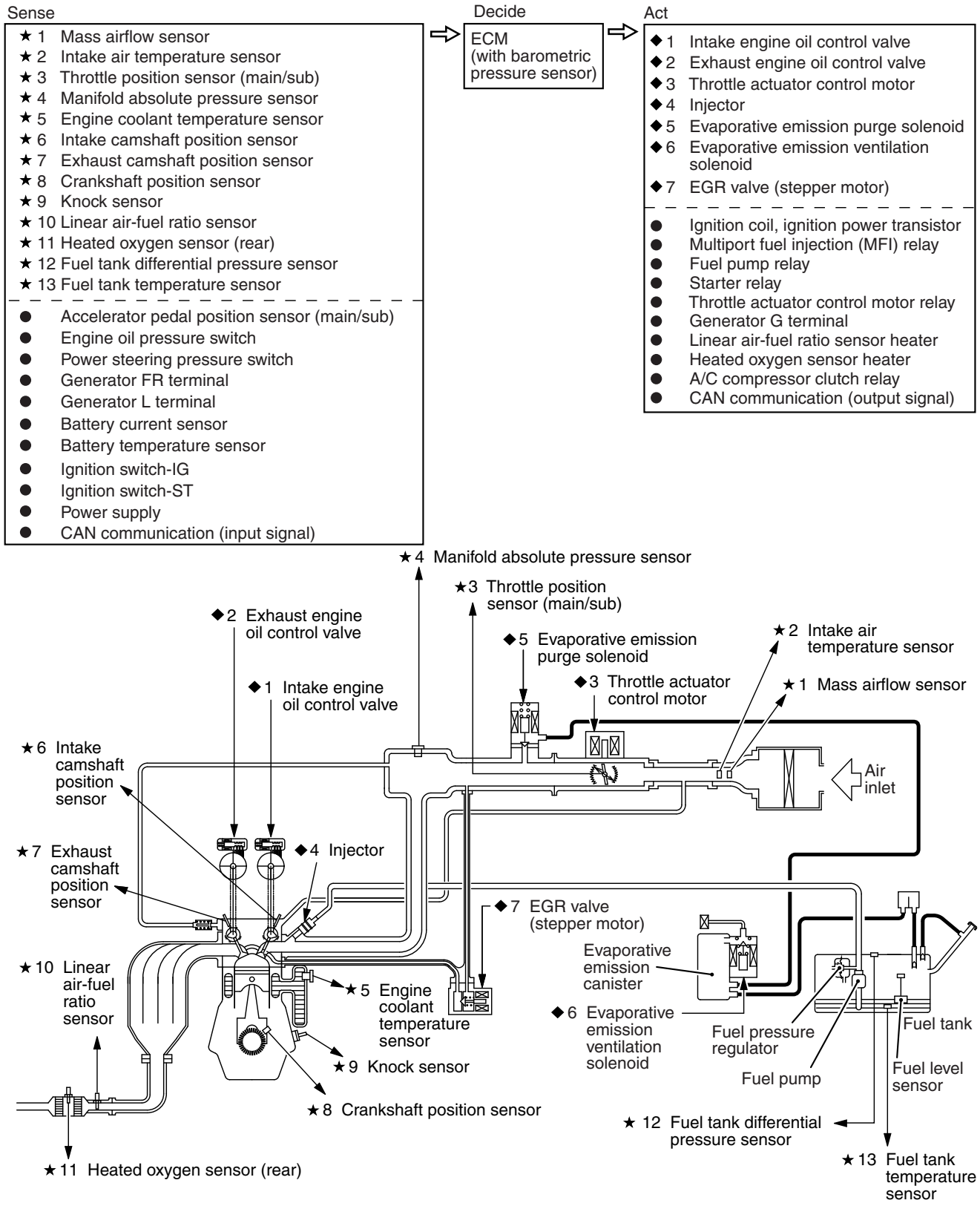
Engine Oil Control Valve Control
- The ECM carries out the duty control of the engine oil control valve according to the operation condition. This varies the phase angle of the camshaft to optimize the valve timing.

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 Control System – General Information P.17-75.)

EGR Control
- (Refer to GROUP 17, Emission Control System – Exhaust Gas Recirculation (EGR) System - General Information P.17-80.)

MULTIPORT FUEL INJECTION (MFI) SYSTEM DIAGRAM



AK901207 AC

NOTE: For the vacuum routing, refer to GROUP 17, Emission Control – Vacuum Hoses – Vacuum Hose Routing P.17-68.

TSB Revision

GENERAL SPECIFICATIONS

M1131000201820

ITEMS		SPECIFICATIONS
Throttle body	Throttle bore mm (in.)	57 (2.24)
	Throttle position sensor	Hall element type
	Throttle actuator control motor	DC motor type, having brushes
Engine control module (ECM)	Identification model No.	E6T76678
Sensors	Mass airflow sensor	Heat sensitizing type
	Barometric pressure sensor	Semiconductor diffused pressure type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Linear air-fuel ratio sensor	Zirconia type
	Heated oxygen sensor	Zirconia type
	Accelerator pedal position sensor	Hall element type
	Intake camshaft position sensor	Magneto resistance element type
	Exhaust camshaft position sensor	Magneto resistance element type
	Crankshaft position sensor	Magneto resistance element type
	Knock sensor	Piezoelectric element type
	Power steering pressure switch	Contact switch type
	Manifold absolute pressure sensor	Piezo resistive semiconductor type
	Fuel tank differential pressure sensor	Piezo resistive semiconductor type
	Fuel tank temperature sensor	Thermistor type
Actuators	Multiport fuel injection (MFI) relay	Contact switch type
	Fuel pump relay	Contact switch type
	Throttle actuator control motor relay	Contact switch type
	Starter relay	Contact switch type
	A/C compressor clutch relay	Contact switch type
	Injector relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	JME290H
	Intake engine oil control valve	Duty cycle type solenoid valve
	Exhaust engine oil control valve	Duty cycle type solenoid valve
	EGR valve	Stepper motor type
	Evaporative emission purge solenoid	Duty cycle type solenoid valve
	Evaporative emission ventilation solenoid	ON/OFF type solenoid valve

SERVICE SPECIFICATIONS

M1131000303113

ITEMS		STANDARD VALUE
Fuel pressure kPa (psi)		Approximately 324 (47) at curb idle
Intake air temperature sensor resistance kΩ	–20°C (–4°F)	13 – 17
	0°C (32°F)	5.3 – 6.7
	20°C (68°F)	2.3 – 3.0
	40°C (104°F)	1.0 – 1.5
	60°C (140°F)	0.56 – 0.76
	80°C (176°F)	0.30 – 0.45
Engine coolant temperature sensor resistance kΩ	–20°C (–4°F)	14 – 17
	0°C (32°F)	5.1 – 6.5
	20°C (68°F)	2.1 – 2.7
	40°C (104°F)	0.9 – 1.3
	60°C (140°F)	0.48 – 0.68
	80°C (176°F)	0.26 – 0.36
Heated oxygen sensor output voltage V		0.6 – 1.0
Linear air-fuel ratio sensor heater resistance Ω		2.3 – 4.2 [at 20°C (68°F)]
Heated oxygen sensor heater resistance Ω		4.5 – 8.0 [at 20°C (68°F)]
Injector coil resistance Ω		10.5 – 13.5 [at 20°C (68°F)]
Throttle actuator control motor coil resistance Ω		0.3 – 80 [at 20°C (68°F)]
Intake engine oil control valve coil resistance Ω		6.9 – 7.9 [at 20°C (68°F)]
Exhaust engine oil control valve coil resistance Ω		6.9 – 7.9 [at 20°C (68°F)]

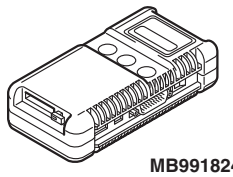
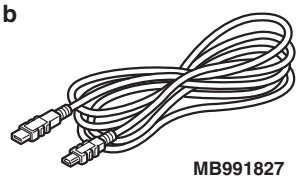
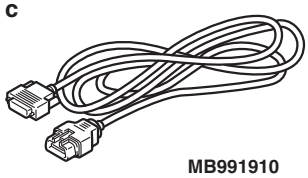
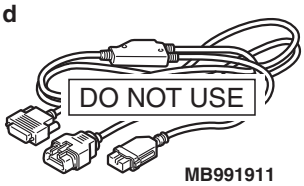
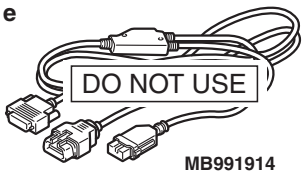
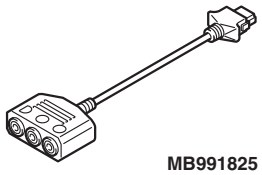
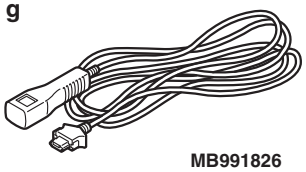
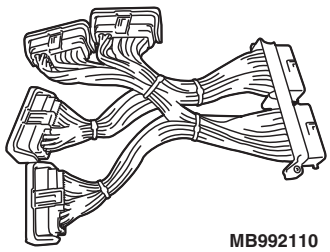
SEALANT AND ADHESIVE

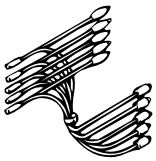
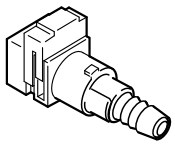
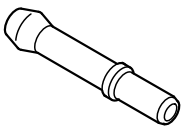
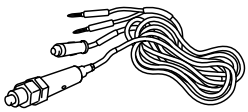
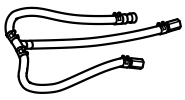
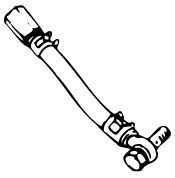
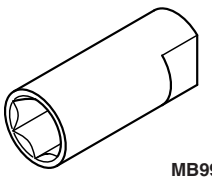
M1131000501456

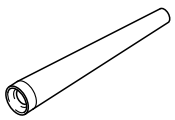
ITEM	SPECIFIED SEALANT
Engine coolant temperature sensor threaded portion	LOCTITE 262 or equivalent

SPECIAL TOOL

M1131000604065

Tool	Tool number and name	Supersession	Application
a  MB991824 b  MB991827 c  MB991910 d  MB991911 e  MB991914 f  MB991825 g  MB991826 MB991958	MB991958 Scan tool (M.U.T.-III sub assembly) a: MB991824 Vehicle communication interface (V.C.I.) b: MB991827 M.U.T.-III USB cable c: MB991910 M.U.T.-III main harness A (Vehicles with CAN communication system) d: MB991911 M.U.T.-III main harness B (Vehicles without CAN communication system) e: MB991914 M.U.T.-III main harness C (for Chrysler models only) f: MB991825 M.U.T.-III adapter harness g: MB991826 M.U.T.-III trigger harness	MB991824-KIT *NOTE: MB991826 M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.*	**⚠ CAUTION** **For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.** • Reading diagnostic trouble code • MFI system inspection • Measurement of fuel pressure
 MB992110	MB992110 Power plant ECU check harness	–	• Inspection using an oscilloscope • Inspection of the engine control module (ECM) terminal voltage check

Tool	Tool number and name	Supersession	Application
	MB991709 Test harness	MB991709-01	Inspection using an oscilloscope
 MB991658	MB991658 Test harness	Tool not available	• Inspection using an oscilloscope • Inspection of throttle position sensor • Inspection of heated oxygen sensor • Inspection of engine oil control valve • Inspection of heated oxygen sensor
 MB992049	MB992049	MB992049-01	Measurement of fuel pressure
 MB992001	MB992001 Hose adaptor	-	Measurement of fuel pressure
 MB991981	MB991981 Fuel pressure gauge set	Tool not available	Measurement of fuel pressure
 MB992076	MB992076 Injector test set	-	Measurement of fuel pressure
	MD998709	Hose adapter	Measurement of fuel pressure
 MB992042	MB992042 Engine coolant temperature sensor wrench	-	Removal and installation of the engine coolant temperature sensor

Tool	Tool number and name	Supersession	Application
 B992106	MB992106 O-ring installer	-	Installation of O-ring on fuel injector injection nozzle side

MULTIPORT FUEL INJECTION (MFI) DIAGNOSIS

TROUBLESHOOTING STRATEGY

M1131150002553

NOTE: If a DTC is erased, its "freeze frame" data will also be 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.

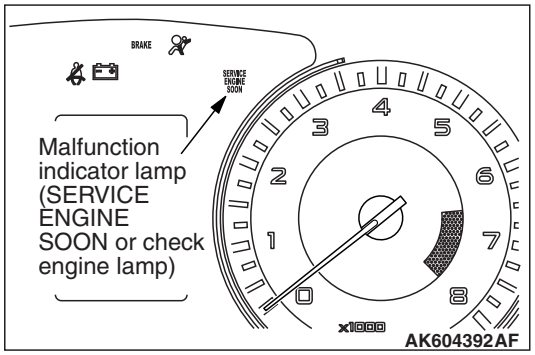
1. Gather as much information as possible about the complaint from the customer.
2. Verify that the condition described by the customer exists.
3. Check the vehicle for any MFI Diagnostic Trouble Code (DTC).
4. If you cannot verify the condition and there are no DTCs, the malfunction is intermittent. 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.00-15.
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, store 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.00-15.
10. After repairs are completed, conduct a road test duplicating the complaint set conditions to confirm the malfunction has been corrected.
11. Erase the permanent DTC. (Refer to DIAGNOSTIC FUNCTION – PERMANENT DTC for the procedures of erasing the permanent DTC P.13A-11.)

    NOTE: This is carried out to prevent the failure to pass the Inspection and Maintenance (I/M) test in the states checking whether the permanent DTC is stored or not.

NOTE: If the engine control module (ECM) is replaced, Immobilizer Encrypted Code Registration should be carried out, refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10.

DIAGNOSTIC FUNCTION

M1131155504601



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 engine control module judges that it has returned to normal, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) will switch off.

There are two methods for checking the indicator lamp burn out: When the ignition switch is in ON position, the indicator lamp is illuminated, and then extinguished few seconds later. When the ignition switch is in ON position and the engine starts, the indicator lamp is extinguished.

NOTE: When the Transaxle Control Module (TCM) detects malfunctions related to the CVT, the Malfunction indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) is also illuminated.

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

DTC	ITEM
P0010	Intake engine oil control valve circuit
P0011	Intake variable valve timing system target error
P0013	Exhaust engine oil control valve circuit
P0014	Exhaust variable valve timing system target error
P0016	Crankshaft/camshaft (intake) position sensor phase problem
P0017	Crankshaft/camshaft (exhaust) position sensor phase problem
P0031	Linear air-fuel ratio sensor heater control circuit low
P0032	Linear air-fuel ratio sensor heater control circuit high
P0037	Heated oxygen sensor (rear) heater control circuit low
P0038	Heated oxygen sensor (rear) heater control circuit high
P0053	Linear air-fuel ratio sensor heater resistance
P0068*1	Mass airflow sensor plausibility
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor
P0101*1	Mass airflow circuit range/performance problem
P0102*1	Mass airflow circuit low input
P0103*1	Mass airflow circuit high input
P0106	Manifold absolute pressure circuit range/performance problem
P0107	Manifold absolute pressure circuit low input
P0108	Manifold absolute pressure circuit high input
P0111*1	Intake air temperature circuit range/performance problem
P0112*1	Intake air temperature circuit low input
P0113*1	Intake air temperature circuit high input
P0116*1	Engine coolant temperature circuit range/performance problem
P0117*1	Engine coolant temperature circuit low input
P0118*1	Engine coolant temperature circuit high input
P0121*1	Throttle position sensor (main) plausibility
P0122*1	Throttle position sensor (main) circuit low input
P0123*1	Throttle position sensor (main) circuit high input
P0125*1	Insufficient coolant temperature for closed loop fuel control
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)
P0130	Linear air-fuel ratio sensor circuit
P0131	Linear air-fuel ratio sensor circuit low voltage
P0132	Linear air-fuel ratio sensor circuit high voltage
P0133	Linear air-fuel ratio sensor circuit slow response
P0134	Linear air-fuel ratio sensor circuit no activity detected

DTC	ITEM
P0137	Heated oxygen sensor (rear) circuit low voltage
P0138	Heated oxygen sensor (rear) circuit high voltage
P0139	Heated oxygen sensor (rear) circuit slow response
P0140	Heated oxygen sensor (rear) circuit no activity detected
P0171	System too lean
P0172	System too rich
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
P0221*1	Throttle position sensor (sub) plausibility
P0222*1	Throttle position sensor (sub) circuit low input
P0223*1	Throttle position sensor (sub) circuit high input
P0300*2	Random/multiple cylinder misfire detected
P0301*2	Cylinder 1 misfire detected
P0302*2	Cylinder 2 misfire detected
P0303*2	Cylinder 3 misfire detected
P0304*2	Cylinder 4 misfire detected
P0327	Knock sensor circuit low
P0328	Knock sensor circuit high
P0335*1	Crankshaft position sensor circuit
P0340*1	Intake camshaft position sensor circuit
P0365*1	Exhaust camshaft position sensor circuit
P0401	Exhaust gas recirculation flow insufficient detected
P0420	Warm up catalyst efficiency below threshold
P0441	Evaporative emission control system incorrect purge flow
P0442	Evaporative emission control system leak detected (small leak)
P0443	Evaporative emission control system purge control valve circuit
P0446	Evaporative emission control system vent control circuit
P0450	Evaporative emission control system pressure sensor malfunction
P0451	Evaporative emission control system pressure sensor range/performance
P0452	Evaporative emission control system pressure sensor low input
P0453	Evaporative emission control system pressure sensor high input
P0455	Evaporative emission control system leak detected (gross leak)
P0456	Evaporative emission control system leak detected (very small leak)

TSB Revision

DTC	ITEM
P0461	Fuel level sensor circuit range/performance <FWD>
	Fuel level sensor (main) circuit range/performance <AWD>
P0462	Fuel level sensor circuit low input <FWD>
	Fuel level sensor (main) circuit low input <AWD>
P0463	Fuel level sensor circuit high input <FWD>
	Fuel level sensor (main) circuit high input <AWD>
P0489	EGR valve (stepper motor) circuit malfunction (ground short)
P0490	EGR valve (stepper motor) circuit malfunction (battery short)
P0506	Idle control system RPM lower than expected
P0507	Idle control system RPM higher than expected
P050B	Ignition timing retard insufficient
P0551	Power steering pressure switch circuit range/performance
P0554	Power steering pressure switch circuit intermittent
P0602*1	Control module programming error
P0606*1	Engine control module main processor malfunction
P060B*1	Internal control module A/D processing performance problem
P060D*1	Internal control module accelerator pedal position performance problem
P061A*1	Internal control module torque performance problem
P061C*1	Internal control module engine RPM performance problem
P062F*1	Internal control module EEPROM error
P0630*1	Vehicle Identification Number (VIN) malfunction
P0638*1	Throttle actuator control motor circuit range/ performance
P0642*1	Throttle position sensor power supply
P0657*1	Throttle actuator control motor relay circuit malfunction
P1238*1	Mass airflow sensor plausibility (torque monitor)
P1506	Idle control system RPM lower than expected at low temperature
P1507	Idle control system RPM higher than expected at low temperature
P1590*1	TCM to ECM communication error in torque reduction request
P1603*1	Battery backup circuit malfunction
P2066	Fuel level sensor (sub) circuit range/performance <AWD>
P2096	Post catalyst fuel trim system too lean
P2097	Post catalyst fuel trim system too rich
P2100*1	Throttle actuator control motor circuit (open)
P2101*1	Throttle actuator control motor magneto malfunction
P2122*1	Accelerator pedal position sensor (main) circuit low input
P2123*1	Accelerator pedal position sensor (main) circuit high input
P2127*1	Accelerator pedal position sensor (sub) circuit low input

TSB Revision

DTC	ITEM
P2128*1	Accelerator pedal position sensor (sub) circuit high input
P2135*1	Throttle position sensor (main and sub) range/performance problem
P2138*1	Accelerator pedal position sensor (main and sub) range/performance problem
P2228*1	Barometric pressure circuit low input
P2229*1	Barometric pressure circuit high input
P2237	Linear air-fuel ratio sensor positive current control circuit/open
P2243	Linear air-fuel ratio sensor reference voltage circuit/open
P2251	Linear air-fuel ratio sensor negative current control circuit/open
P2252	Heated oxygen sensor offset circuit low voltage
P2253	Heated oxygen sensor offset circuit high voltage
U0101*1	TCM time-out
U0141*1	ETACS-ECU time-out
U1180*1	Combination meter time-out

*NOTE: After the ECM 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 "*1" in the DTC NO. column, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates only on the first detection of the malfunction.*

*NOTE: The codes marked with a "*2" in the diagnosis code number column have the following two conditions for illuminating the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp).*

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

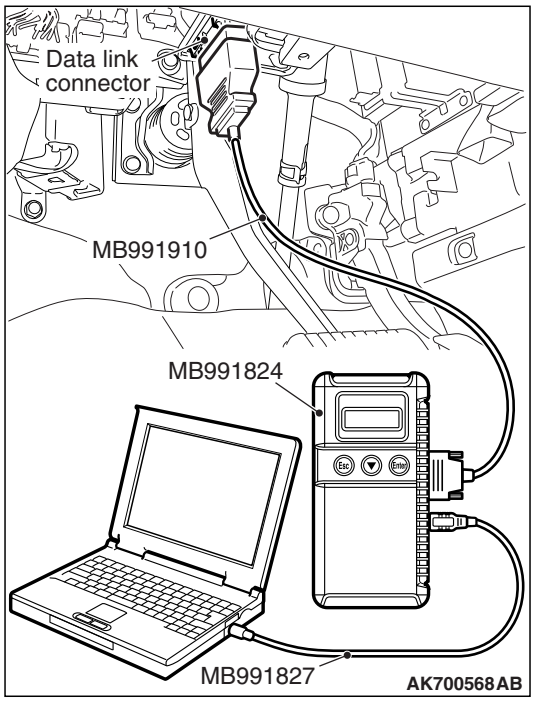
NOTE: After the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates, it will be switched off under the following conditions.

- When the ECM 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.

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

Required Special Tools:

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



⚠ CAUTION

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

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

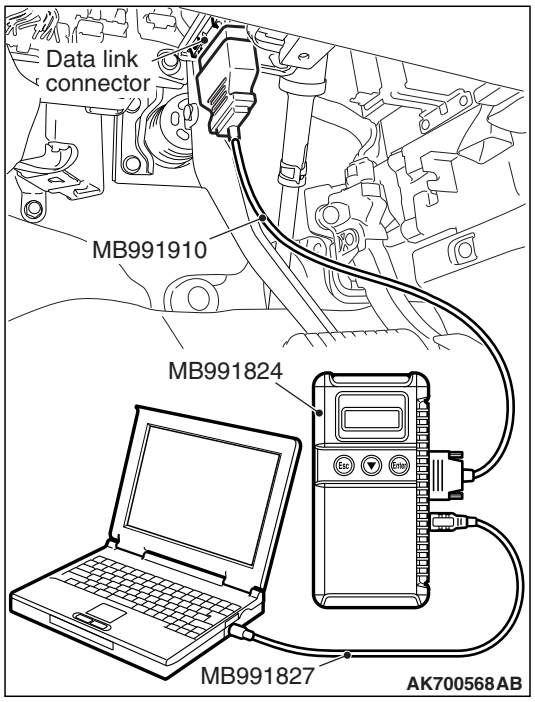
   NOTE: When the special tool MB991824 is energized, special tool MB991824 indicator light will be illuminated in a green color.
7. Start the M.U.T.-III system on the personal computer.

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

HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODES.

Required Special Tools:

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



⚠ CAUTION

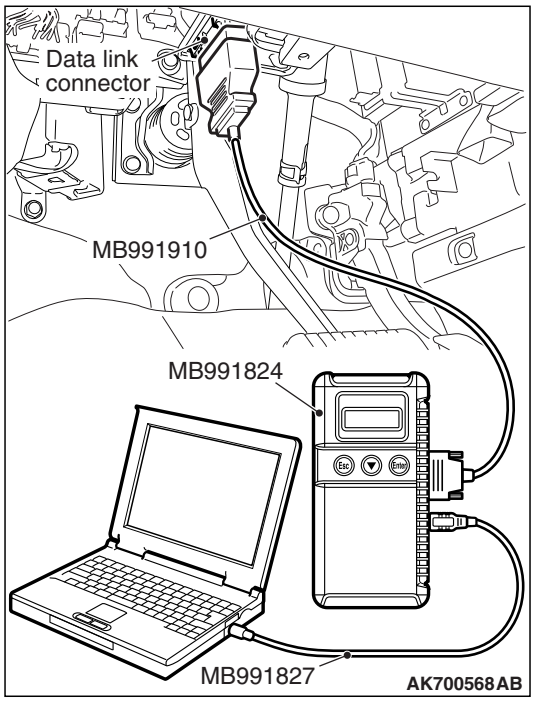
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

HOW TO READ DATA LIST

Required Special Tools:

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



⚠ CAUTION

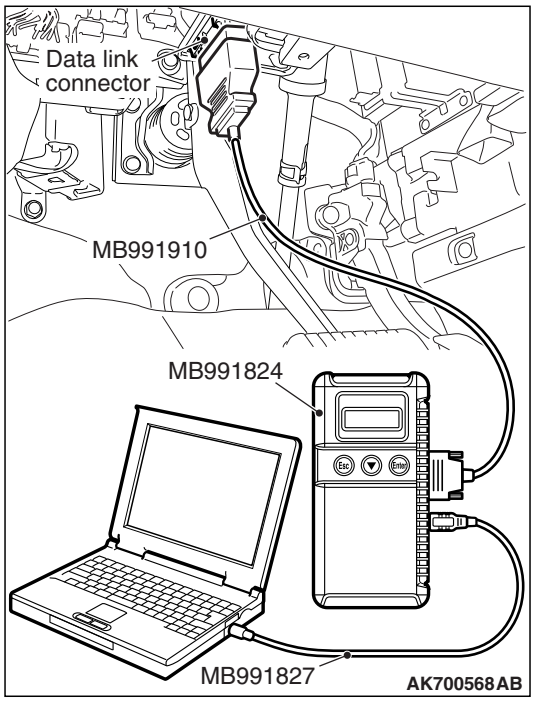
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

HOW TO PERFORM ACTUATOR TEST

Required Special Tools:

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



⚠ CAUTION

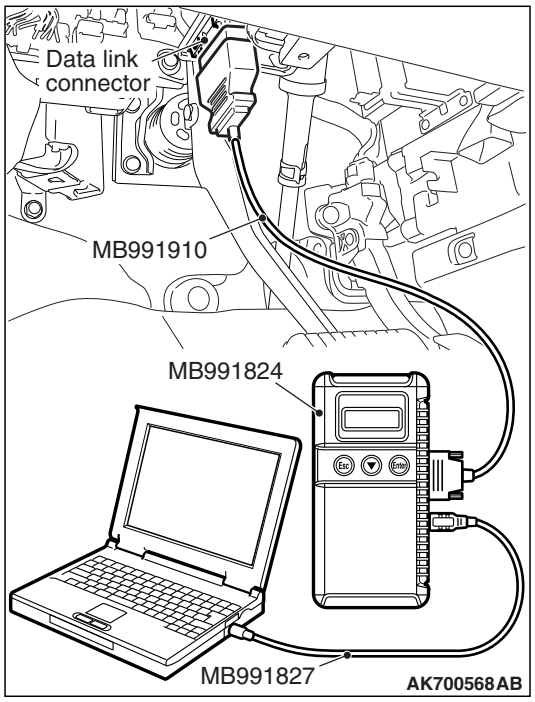
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

HOW TO DIAGNOSE THE CAN BUS LINES

Required Special Tools:

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



⚠ CAUTION

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

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

HOW TO READ PROVISIONAL DIAGNOSTIC TROUBLE CODES

Required Special Tools:

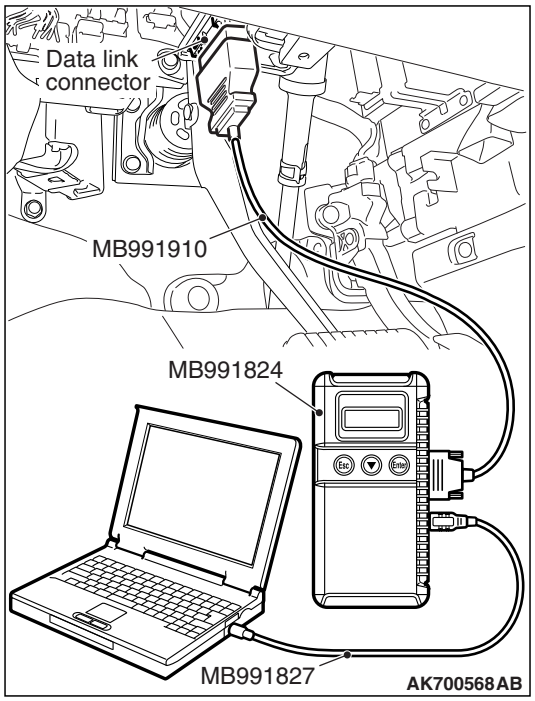
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A

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

CONFIRMATION METHOD

⚠ CAUTION

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



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

PERMANENT DTC

The permanent DTC(PDTC) is stored in the EEPROM of the engine control module (ECM) as the permanent status, which checks that the malfunction of the emission related components/ the system has not been repaired yet. When detecting the malfunction necessary to illuminate the malfunction indicator lamp (SERVICE ENGINE SOON or Check Engine Lamp), the ECM illuminates the MIL and stores the appropriate DTC as the permanent DTC in the EEPROM concurrently. The usual DTC is stored in the EEPROM aside from this. The ECM can store up to 6 PDTCs. The ECM, therefore, cannot store the 7th and subsequent PDTCs. If the temporary malfunction causes the malfunction indicator lamp to be illuminated and then the reinstatement during the subsequent driving causes it to be extinguished, the PDTC is erased. Also if the ECM checks that the DTC malfunction is fixed during the driving after the DTC repair is completed, the PDTC is erased. The permanent DTC, however, is not erased by disconnecting the battery terminal or erasing with the scan tool (M.U.T-III). The permanent DTC can be erased if all readiness statuses are erased or not completed at the time of reprogramming the ECM. If must be erased while the vehicle is repaired, the PDTC can be erased by the procedures shown below. If must be erased because of the failure to pass the Inspection and Maintenance (I/M) test, the permanent DTC can also be erased by the following procedure:

TSB Revision

PROCEDURES FOR ERASING PERMANENT DTC

1. Check that the DTC is not stored. If the DTC is stored, perform the DTC troubleshooting, then repair the DTC.

   NOTE: The order of step 2 and 3 can be exchanged.
2. Drive the vehicle at least once under the conditions satisfying all the following requirements:
   - The total driving (engine running) time must be more than 10 consecutive minutes.
   - More than 30 seconds of idling must be included in the driving
   - More than 5 consecutive minutes of driving at more than 40 km/h (25 mph) must be included in the driving.
3. Drive the vehicle at least two times in the drive cycle pattern suitable for the permanent DTC. (Refer to OBD-II DRIVE CYCLE for the drive cycle pattern.) If the DTC does not have the drive cycle pattern, start and stop the engine. Wait 15 seconds or more to start again after the stop. Repeat at least 2 times.
4. Restart and stop the engine.
5. Check that the permanent DTC is erased. If the permanent DTC is not erased, check the DTC or the provisional DTC. If the malfunction code is stored, repair the DTC. Try to erase the permanent DTC again (from Step 1 to 5). If the malfunction code is not stored, the drive cycle pattern (Step 3) monitoring the malfunction can possibly be insufficient.

MODE 6 REFERENCE TABLE

The engine control module (ECM) 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 monitors can be confirmed. The value at the last monitoring is output by ECM 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	A/F Sensor Monitor Bank 1 – Sensor 1 Rich/Lean Switching frequency	ECM monitors the deteriorated condition of the linear air-fuel ratio sensor by checking the rich/lean switching frequency of the linear air-fuel ratio sensor.	× 1 count
02	08	Oxygen Sensor Monitor Bank 1 – Sensor 2 Maximum Sensor Voltage for Test Cycle	ECM checks the output voltage of the heated oxygen sensor (rear) in order to monitor whether the heated oxygen sensor (rear) outputs the rich signal.	× 0.122 mV
	82	Oxygen Sensor Monitor Bank 1 – Sensor 2 Output Voltage change	ECM checks the output voltage of the heated oxygen sensor (rear) in order to monitor whether the 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 checks the rich to lean switching time of the heated oxygen sensor (rear) in order to monitor the response of the heated oxygen sensor (rear).	× 1 msec
	88	Oxygen Sensor Monitor Bank 1 – Sensor 2 Output Voltage drop slope	ECM checks the output voltage drop slope of the heated oxygen sensor (rear) in order to monitor the response of the heated oxygen sensor.	× 1 msec
21	83	Catalyst Monitor Bank 1 Frequency ratio between Front- and Rear-Oxygen Sensors	ECM monitors the deterioration of catalyst by the output frequency ratio between linear air-fuel ratio sensor and heated oxygen sensor (rear).	× 0.0039

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFIND TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
31	84	EGR Monitor Difference of manifold pressure before and after EGR activation	ECM 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
35	89	VVT Monitor Bank 1 (L4-IN) Cam Phase Angle Deviation (between target and actual position)	ECM monitors the deviation between the intake camshaft target phase angle and the intake camshaft actual phase angle.	× 0.01°
36	89	VVT Monitor Bank 2 (L4-EX) Cam Phase Angle Deviation (between target and actual position)	ECM monitors the deviation between the exhaust camshaft target phase angle and the exhaust camshaft actual phase angle.	× 0.01°
39	85	EVAP Monitor (Cap off) Pressure drop during de-pressurizing	ECM 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 vacuumizes the fuel tank and the fuel line and then the specified time is passed, ECM 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 vacuumizes the fuel tank and the fuel line and then the specified time is passed, ECM 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
41	86	A/F Sensor Heater Monitor Bank1 – Sensor1 Heater Monitoring Current	ECM checks the amperage of the linear air-fuel ratio sensor heater.	× 0.001 A
A2	0B	Mis-Fire Cylinder 1 Data EWMA Misfire Counts For Last 10 Driving Cycles	ECM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1 count
	0C	Mis-Fire Cylinder 1 Data Misfire Counts For Last/Current Driving Cycle	ECM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1 count
A3	0B	Mis-Fire Cylinder 2 Data EWMA Misfire Counts For Last 10 Driving Cycles	ECM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1 count
	0C	Mis-Fire Cylinder 2 Data Misfire Counts For Last/Current Driving Cycle	ECM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1 count
A4	0B	Mis-Fire Cylinder 3 Data EWMA Misfire Counts For Last 10 Driving Cycles	ECM monitors angular acceleration of crankshaft and detect misfire. EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles.	× 1 count
	0C	Mis-Fire Cylinder 3 Data Misfire Counts For Last/Current Driving Cycle	ECM monitors angular acceleration of crankshaft and detect misfire. Misfire counts for last/current driving cycle.	× 1 count

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

*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 outputs the stored latest monitor test result.

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

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

ON-BOARD DIAGNOSTICS

The engine control module (ECM) monitors the input/output signals (some signals all the time and others under specified conditions) of the ECM. When a malfunction continues for a specified time or longer after the irregular signal is initially monitored, the ECM judges that a malfunction has occurred. After the ECM 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 "*1", a diagnostic trouble code is recorded on the first detection of the malfunction. There are 138 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 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.

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 in order to erase the diagnostic memory. The 138 diagnostic items are all indicated sequentially from the smallest code number. The ECM 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 detects multiple malfunctions, the ECM stores the "Freeze-frame" data for only the first item that was detected. However, if the ECM detects a misfire or a fuel system malfunction, the ECM stores the data by giving priority to the misfire or fuel system malfunction, regardless of the order in which the malfunction was detected.

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

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

ITEM NO.	M.U.T.-III SCAN TOOL DISPLAY	DATA ITEM	UNIT or STATE
1	Odometer	Odometer	km or mile
2	Ignition cycle (Warm up cycle)	Ignition cycle (Warm up cycle)	–
4	Accumulated minute	Accumulated minute*	min

*NOTE: *: Accumulated time of current malfunction from time point when malfunction is detected.*

Freeze Frame Data (OBD) for M.U.T.-III

ITEM NO.	M.U.T.-III SCAN TOOL DISPLAY	DATA ITEM	UNIT or STATE
AA	Airflow sensor	Mass airflow sensor	g/s
AB	TP sensor (main)	Throttle position sensor (main)	%
BA	Target EGR	Target EGR stepper motor	%
BB	Barometric pressure sensor	Barometric pressure sensor	kPa or in.Hg
BC	Relative TP sensor	Relative throttle position sensor	%
BD	TP sensor (sub)	Throttle position sensor (sub)	%
BE	APP sensor (main)	Accelerator pedal position sensor (main)	%
BF	APP sensor (sub)	Accelerator pedal position sensor (sub)	%
C0	Fuel system status (bank1)	Fuel control system status	• Open loop
			• Closed loop
			• Open loop-drive condition
			• Open loop-DTC set
			• Closed loop-O2 (rear) failed
C1*	Fuel system status (bank2)	Fuel control system status (bank2)	N/A
C2	Calculated load value	Calculated load value	%
C3	ECT sensor	Engine coolant temperature sensor	°C or °F
C4	Short term fuel trim (bank1)	Short term fuel trim	%
C5*	Short term fuel trim(bank3)	Short term fuel trim (bank3)	****
C6	Long term fuel trim (bank1)	Long term fuel trim	%
C7*	Long term fuel trim (bank3)	Long term fuel trim (bank3)	****
CC	MAP sensor	Manifold absolute pressure sensor	kPa or in.Hg
CD	Crankshaft position sensor	Crankshaft position sensor	r/min
CE	Vehicle speed	Vehicle speed	km/h or mph
CF	Spark advance	Spark advance	°CA
D0	Intake air temperature sensor 1	Intake air temperature sensor	°C or °F
D1	Time since engine running	Time since engine running	sec
D6	EVAP. emission purge SOL. duty	Evaporative emission purge solenoid duty	%
D7	Fuel level gauge	Fuel level gauge	%
D8	Power supply voltage	Power supply voltage	V

ITEM NO.	M.U.T.-III SCAN TOOL DISPLAY	DATA ITEM	UNIT or STATE
D9	Absolute load value	Absolute load value	%
DA	Target equivalence ratio	Target equivalence ratio	–
DB	Intake air temperature sensor 1	Intake air temperature sensor (ambient air temperature)	°C or °F
DC	Throttle actuator	Throttle actuator control motor	%
DD	Relative APP sensor	Relative accelerator pedal position sensor	%
242	Fuel tank differential PRS. SNSR	Fuel tank differential pressure sensor	Pa

*NOTE: *: Data items are displayed on M.U.T.-III display, but the in-line 4 engine is not applicable and its data is displayed as "N/A" or "****".*

Freeze Frame Data for General Scan Tool

COMMON EXAMPLE of GENERAL SCAN TOOL DISPLAY	PRAMETER IDENTIFICATION (PID)	DESCRIPTION	UNIT or STATE
DTCFRZF	02	DTC that caused required freeze frame data storage	Pxxxx, Uxxxx
FUELSYS 1	03	See M.U.T.-III Item No. C0	
LOAD_PCT	04	See M.U.T.-III Item No. C2	
ECT	05	See M.U.T.-III Item No. C3	
SHRTFT 1	06	See M.U.T.-III Item No. C4	
LONGFT 1	07	See M.U.T.-III Item No. C6	
MAP	0B	See M.U.T.-III Item No. CC	
RPM	0C	See M.U.T.-III Item No. CD	
VSS	0D	See M.U.T.-III Item No. CE	
SPARKADV	0E	See M.U.T.-III Item No. CF	
IAT	0F	See M.U.T.-III Item No. D0	
MAF	10	See M.U.T.-III Item No. AA	
TP	11	See M.U.T.-III Item No. AB	
RUNTM	1F	See M.U.T.-III Item No. D1	
EGR_PCT	2C	See M.U.T.-III Item No. BA	
EVAP_PCT	2E	See M.U.T.-III Item No. D6	
FLI	2F	See M.U.T.-III Item No. D7	
EVAP_VP	32	See M.U.T.-III Item No. 242	
BARO	33	See M.U.T.-III Item No. BB	
VPWR	42	See M.U.T.-III Item No. D8	
LOAD_ABS	43	See M.U.T.-III Item No. D9	
EQ_RAT	44	See M.U.T.-III Item No. DA	
TP_R	45	See M.U.T.-III Item No. BC	
AAT	46	See M.U.T.-III Item No. DB	
TP_B	47	See M.U.T.-III Item No. BD	
APP_D	49	See M.U.T.-III Item No. BE	
APP_E	4A	See M.U.T.-III Item No. BF	
TAC_PCT	4C	See M.U.T.-III Item No. DC	
APP_R	5A	See M.U.T.-III Item No. DD	

OBD- II DRIVE CYCLE

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

⚠ CAUTION

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

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

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

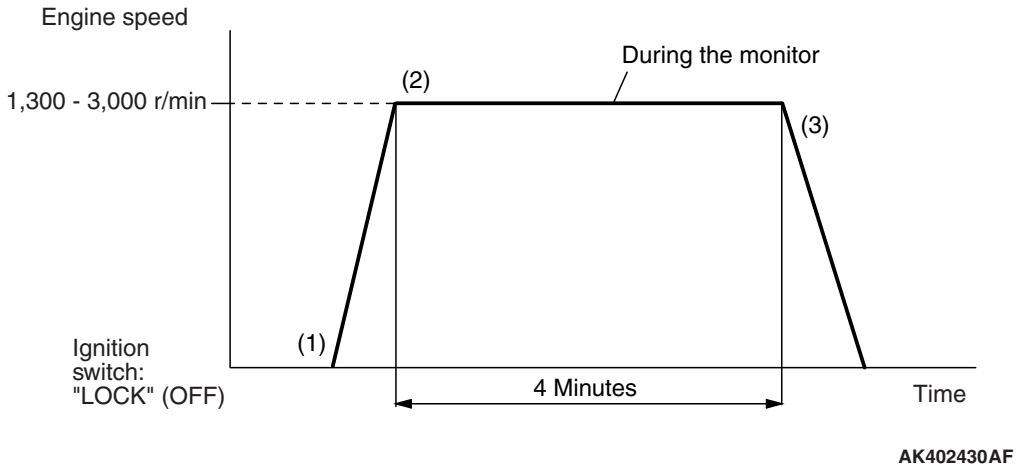
DRIVE CYCLE PATTERN LIST

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Linear air-fuel ratio sensor monitor <Readiness test item>	P0133	1
Heated oxygen sensor (rear) feedback control system monitor	P2096, P2097	
Linear air-fuel ratio sensor heater monitor <Readiness test item>	P0031	2
Heated oxygen sensor heater monitor <Readiness test item>	P0037	
Linear air-fuel ratio sensor heater monitor	P0032	
Heated oxygen sensor heater monitor	P0038	
Exhaust gas recirculation (EGR) system monitor <Readiness test item>	P0401, P0489, P0490	3
Catalytic converter monitor <Readiness test item>	P0420	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
Mass 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	11
Air fuel ratio feedback monitor	–	12
Heated oxygen sensor (rear) monitor <Readiness test item>	P0140	13
Fuel tank temperature sensor monitor	P0181	14

TSB Revision

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Misfire monitor	P0300, P0301, P0302, P0303, P0304	15
Fuel tank pressure sensor monitor	P0451	16
Power steering pressure switch monitor	P0554	17
Throttle position sensor plausibility monitor	P0121, P0221	
Mass airflow sensor plausibility monitor	P0068, P1238	
Torque monitor	P061A	
Idle speed control system monitor	P0506, P0507	18
Ignition timing retard control (cold start strategy) monitor	P050B	19
Idle speed control system monitor	P1506, P1507	
Variable valve timing system (MIVEC) monitor	P0010, P0011, P0013, P0014, P0016, P0017	20
Fuel trim monitor	P0171, P0172	21
Linear air-fuel ratio sensor heater monitor <Readiness test item>	P0053	22
Heated oxygen sensor monitor	P0137	
Linear air-fuel ratio sensor monitor	P0130, P0131, P0132, P0134, P2237, P2243, P2251	
Mass airflow sensor monitor	P0102, P0103	23
Manifold absolute pressure (MAP) sensor monitor	P0108	
Intake air temperature sensor monitor	P0112, P0113	
Engine coolant temperature sensor monitor	P0117, P0118	
Heated oxygen sensor monitor	P0138, P2252, P2253	
Fuel tank temperature sensor monitor	P0182, P0183	
Injector monitor	P0201, P0202, P0203, P0204	
Knock sensor monitor	P0327, P0328	
Crankshaft position sensor monitor	P0335	
Camshaft position sensor monitor	P0340, P0365	
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 RPM plausibility monitor	P061C	
Barometric pressure sensor monitor	P2228, P2229	

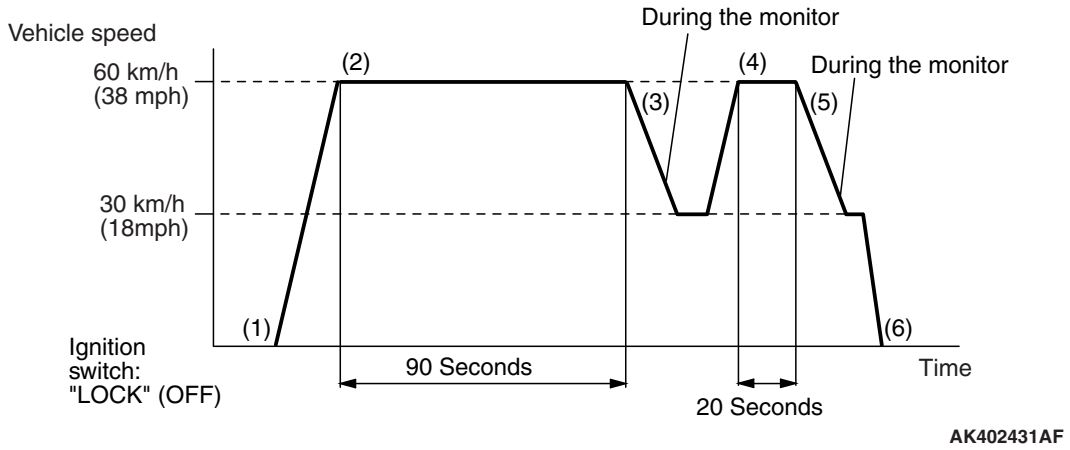
PATTERN 1

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 76°C (140°F) • Condition of CVT: 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 1,300 r/min, less than 3,000 r/min • Engine load: More than 30 %, less than 60 % • Without rapid accelerator pedal movement 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. *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.

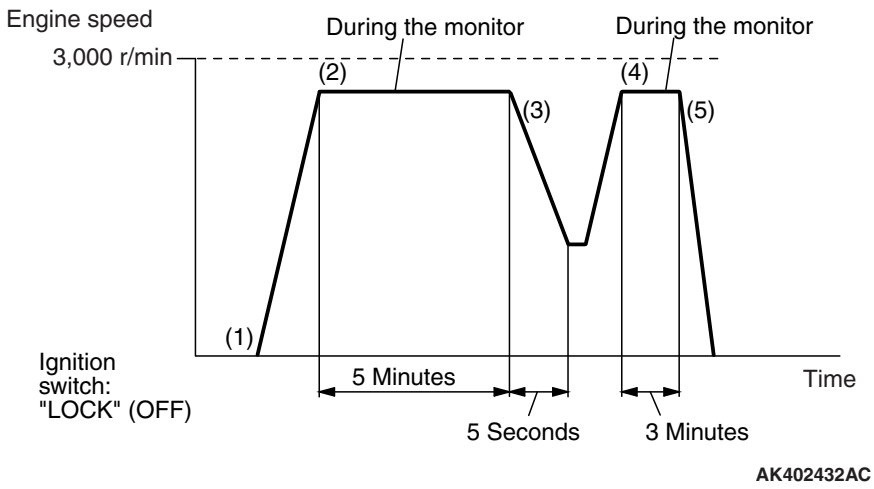
PATTERN 2

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.

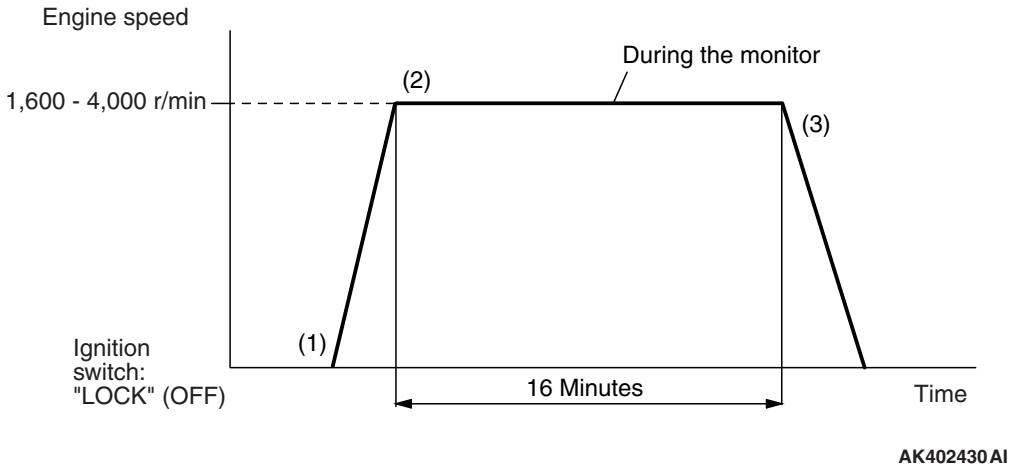
PATTERN 3

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 76°C (169°F) • Intake air temperature: More than –10°C (14°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg) • Condition of CVT: 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 vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 7. Start the engine and do Steps 1 to 6 again. *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 0°C (32°F) • Intake air temperature: More than –10°C (14°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg) • Condition of CVT: 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 10 g/sec, less than 45 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 3 minutes at the following conditions. (During the monitor) • Engine speed: Less than 3,000 r/min • Airflow rate: More than 10 g/sec, less than 45 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 vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Start the engine and do Steps 1 to 5 again. *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.

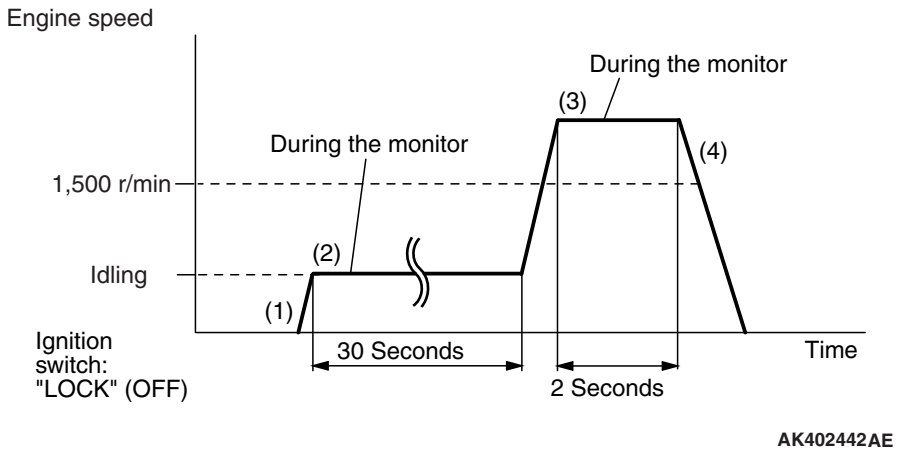
PATTERN 5

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 (140°F) • Intake air temperature: More than 5°C (41°F), less than 45°C (113°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg) • Fuel temperature: Less than 36°C (96°F) • Condition of CVT: 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 20 km/h (12 mph) • Engine load: More than 20 %, less than 70 % • 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 vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. *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.

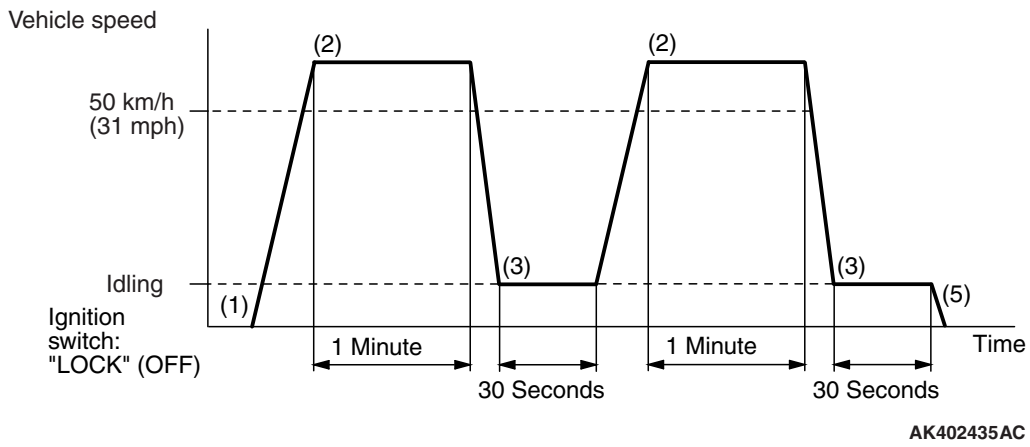
PATTERN 6

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 −10°C (14°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg) • Fuel temperature: Less than 33°C (91°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.

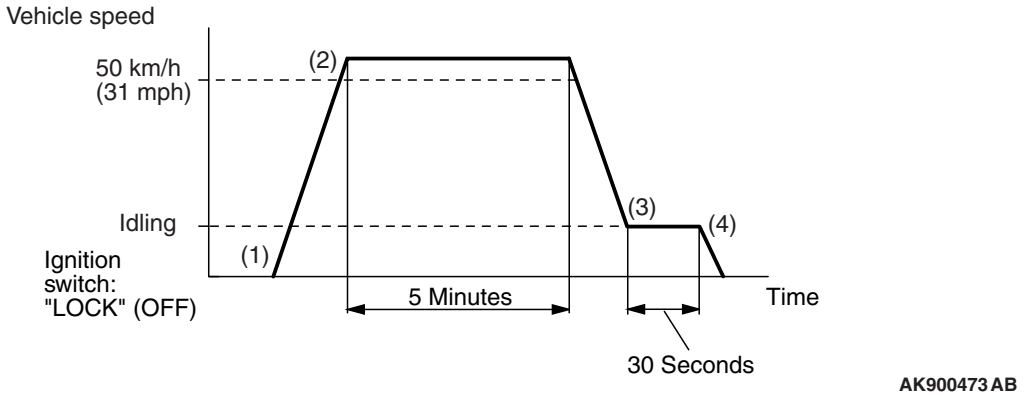
PATTERN 7

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at engine start: More than 0°C (32°F) • Condition of CVT: 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 1,500 r/min • Engine load: More than 20 % • Throttle position sensor output voltage: More than 3.5 volts 4. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 8

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 76°C (169°F) • Condition of CVT: 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 the vehicle in a safe place and let the engine idle for 30 seconds. 4. Repeat Steps 2 and 3 again. 5. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 9

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at engine start: More than 0°C (32°F) • Intake air temperature: Less than 60°C (140°F) • Engine coolant temperature: More than 40°C (104°F) • Condition of CVT: Selector lever "D" range
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 5 minutes at the following condition. • Vehicle speed: More than 50 km/h (31 mph) • Air flow rate: More than 12 g/sec • Except fuel cut 3. Stop the vehicle in a safe place and let the engine idle for 30 seconds. 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output.

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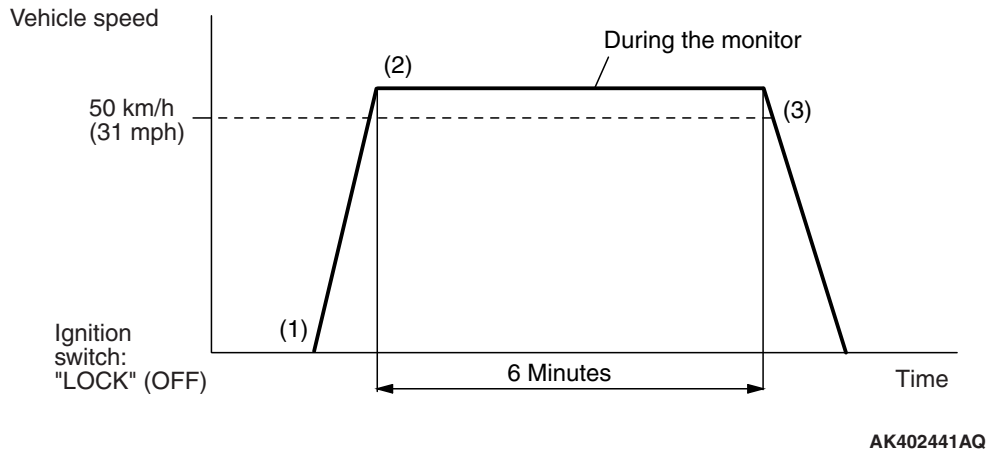
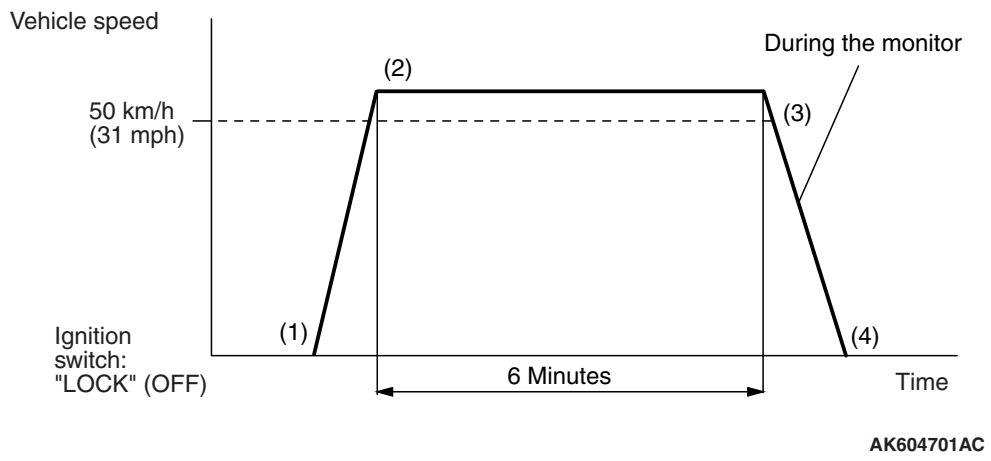
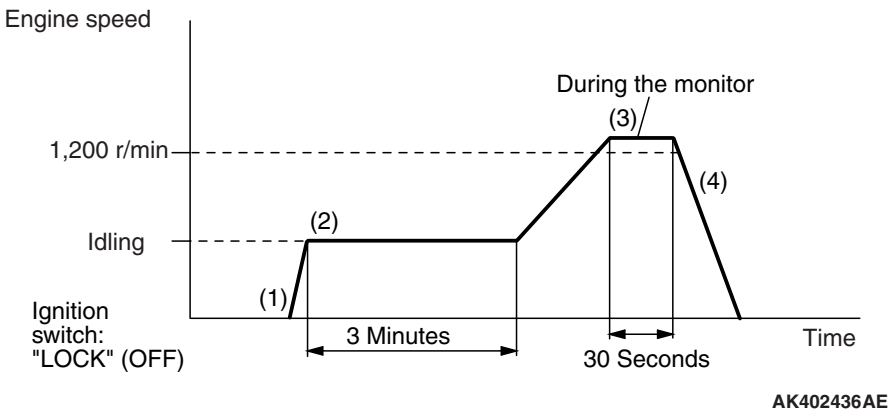
PATTERN 10

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature at engine start: More than –10°C (14°F), less than 60°C (140°F) • Intake air temperature: More than –10°C (14°F) • Dropping of intake air temperature since engine start: Less than 10°C (18°F) • Condition of CVT: 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 conditions. (During the monitor) • Vehicle speed: More than 50 km/h (31 mph) • Air flow rate: More than 10 g/sec *NOTE: The system is normal if engine coolant temperature will rise more than 77°C (171°F) within 6 minutes.* 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

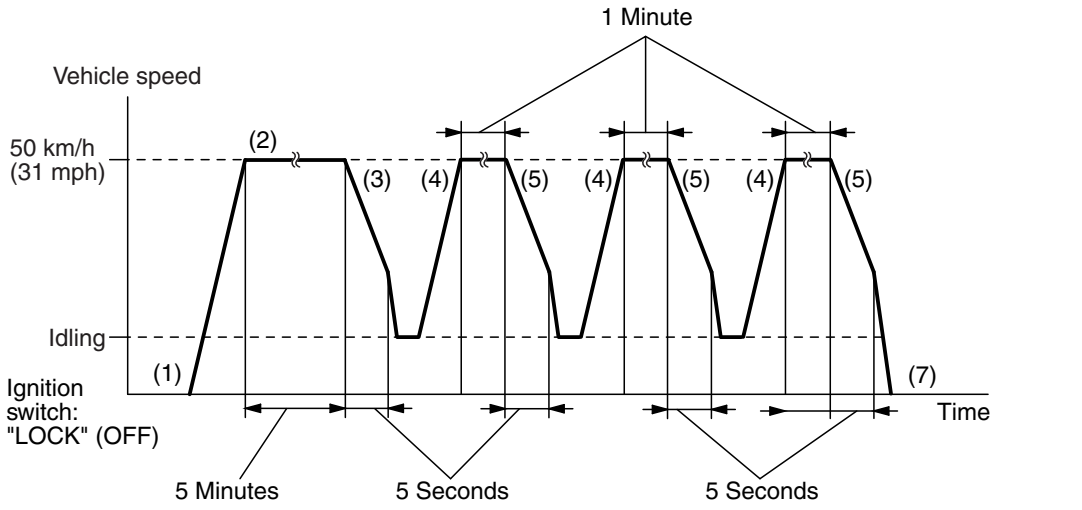
PATTERN 11

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 76°C (169°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg) • Condition of CVT: 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 6 minutes. 3. Release the accelerator pedal for 10 seconds then stop the vehicle in a safe place. (During the monitor) 4. Turn the ignition switch to "LOCK" (OFF) position. 5. Start the engine and do Steps 1 to 4 again. *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.* 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 12

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 0°C (32°F) • Condition of CVT: 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 1,200 r/min • Engine load: More than 30 % • Throttle position sensor output: Less than 3.8 volts • Except fuel cut 4. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 13

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 76°C (169°F) • Condition of CVT: 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 5 minutes. 3. Release the accelerator pedal for 5 seconds then stop the vehicle in a safe place. 4. Increase the speed of the vehicle to 50 km/h (31 mph) under the following conditions, and then drive the vehicle for 1 minute. • Engine speed: More than 1,500 r/min • Engine load: More than 40 % 5. Release the accelerator pedal for 5 seconds then stop the vehicle in a safe place. 6. Repeat Steps 4 and 5 for 2 times. 7. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 8. Start the engine and do Steps 1 to 7 again. *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.* 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 36°C (97°F) • Difference between engine coolant temperature and intake air temperature at engine start: Less than 5°C (9°F) • Condition of CVT: 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 the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

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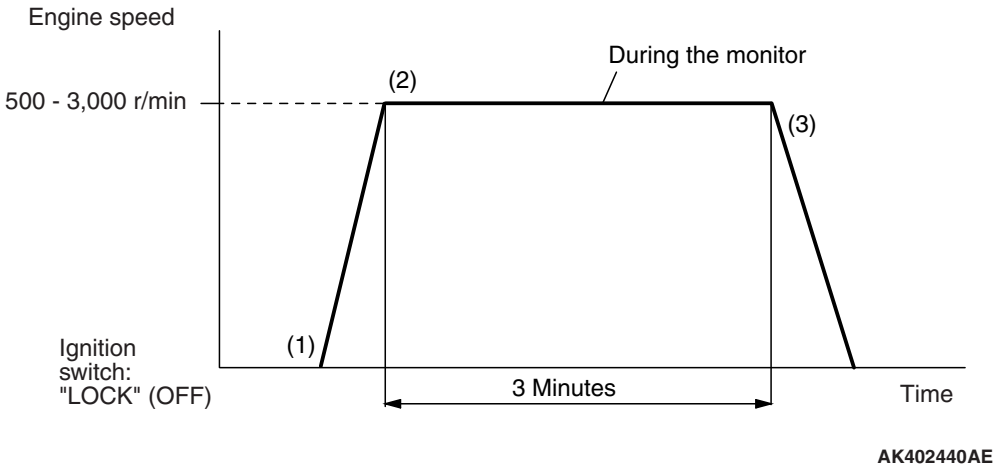
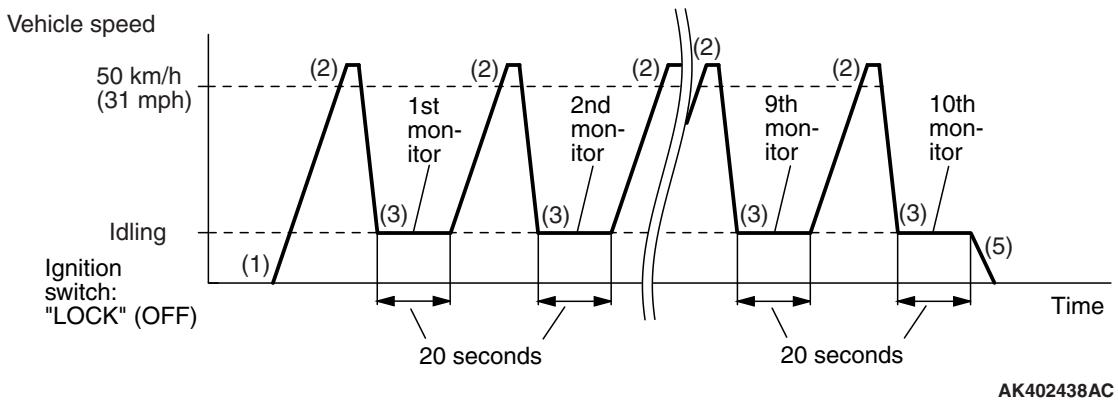
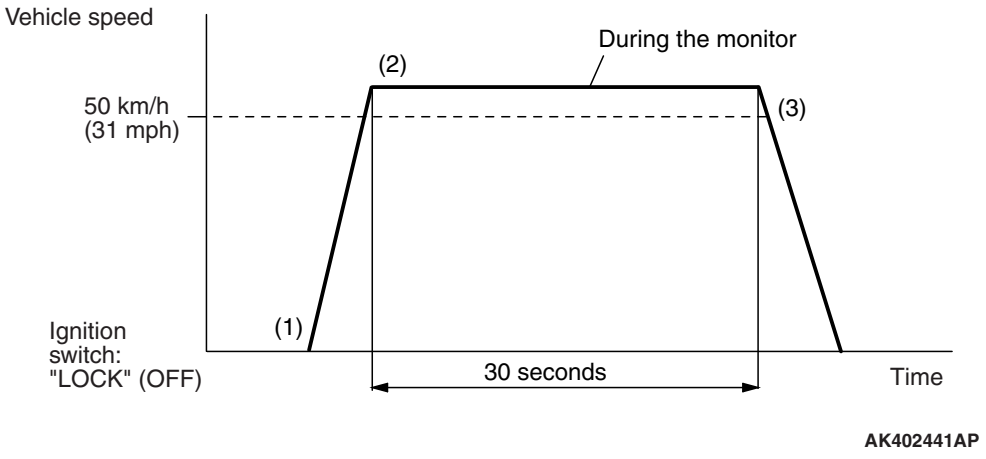
PATTERN 15

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than –10°C (14°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg) • Condition of CVT: 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 in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 16

Drive cycle pattern	
Inspection condition	Condition of CVT: 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). 3. Stop the vehicle in a safe place and let the engine idle for 20 seconds. (During the monitor) 4. Repeat Steps 2 and 3 for 10 times. 5. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Start the engine and do Steps 1 to 5 again. 7. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 17

Drive cycle pattern	
Inspection conditions	• Engine coolant temperature: More than 20°C (68°F) • Condition of CVT: 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 in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

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PATTERN 18

Inspection conditions	• Engine coolant temperature: More than 41°C (106°F) • Intake air temperature: More than –10°C (14°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 1 minute. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 19

Inspection conditions	• Engine coolant temperature: More than 7°C (45°F), less than 41°C (106°F) • Intake air temperature: More than –10°C (14°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 1 minute. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 20

Inspection condition	Engine coolant temperature: More than 77°C (171°F), less than 87°C (189°F)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Drive the engine at 1,200 – 1,500 r/min for 30 seconds. (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 condition	Engine coolant temperature: More than 76°C (169°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 22

Inspection conditions	• Intake air temperature: More than –10°C (14°F) • Engine coolant temperature: More than 0°C (32°F)
Test procedure	1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 5 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.

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PATTERN 23

Inspection conditions	• Engine coolant temperature: More than 0°C (32°F) <Manifold absolute pressure sensor monitor> • Fuel amount at engine start: Less than 80 % <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. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

SYSTEM READINESS TEST STATUS

PURPOSE

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

OVERVIEW

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

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

- Catalyst: P0420
- Evaporative system: P0442, P0455, P0456
- Linear air-fuel ratio sensor: P0133
- Linear air-fuel ratio sensor heater: P0031, P0053
- Heated oxygen sensor: P0139, P0140
- Heated oxygen sensor heater: P0037
- EGR system: P0401

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

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

FAIL-SAFE FUNCTION REFERENCE TABLE

M1131153001010

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.)
Intake camshaft position sensor	• Engine runs in learned pattern until engine stops. • Does not control variable valve timing (V.V.T.).
Exhaust camshaft position sensor	Does not control variable valve timing (V.V.T.).
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.
Linear air-fuel ratio sensor	• Does not control air-fuel ratio closed loop. • Controls linear air-fuel ratio sensor heater off.
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 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.
Engine oil control valve	Does not control variable valve timing (V. V. T.).
Battery current sensor	Prohibits generator output suppression control against current consumers (Operates as a normal generator).
Battery temperature sensor	Prohibits generator output suppression control against current consumers (Operates as a normal generator).

DIAGNOSTIC TROUBLE CODE CHART

M1131151005715

⚠ WARNING

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

⚠ CAUTION

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

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0010	Intake engine oil control valve circuit	P.13A-58
P0011	Intake variable valve timing system target error	P.13A-64
P0013	Exhaust engine oil control valve circuit	P.13A-68
P0014	Exhaust variable valve timing system target error	P.13A-74
P0016	Crankshaft/camshaft (intake) position sensor phase problem	P.13A-77
P0017	Crankshaft/camshaft (exhaust) position sensor phase problem	P.13A-82
P0031	Linear air-fuel ratio sensor heater control circuit low	P.13A-86
P0032	Linear air-fuel ratio sensor heater control circuit high	P.13A-93
P0037	Heated oxygen sensor (rear) heater control circuit low	P.13A-98
P0038	Heated oxygen sensor (rear) heater control circuit high	P.13A-105
P0053	Linear air-fuel ratio sensor heater resistance	P.13A-109
P0068*1	Mass airflow sensor plausibility	P.13A-113
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor	P.13A-116
P0101*1	Mass airflow circuit range/performance problem	P.13A-121
P0102*1	Mass airflow circuit low input	P.13A-127
P0103*1	Mass airflow circuit high input	P.13A-134
P0106	Manifold absolute pressure circuit range/performance problem	P.13A-139
P0107	Manifold absolute pressure circuit low input	P.13A-148
P0108	Manifold absolute pressure circuit high input	P.13A-156
P0111*1	Intake air temperature circuit range/performance problem	P.13A-161
P0112*1	Intake air temperature circuit low input	P.13A-167
P0113*1	Intake air temperature circuit high input	P.13A-171
P0116*1	Engine coolant temperature circuit range/performance problem	P.13A-177
P0117*1	Engine coolant temperature circuit low input	P.13A-183
P0118*1	Engine coolant temperature circuit high input	P.13A-187
P0121*1	Throttle position sensor (main) plausibility	P.13A-193
P0122*1	Throttle position sensor (main) circuit low input	P.13A-197

TSB Revision

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0123*1	Throttle position sensor (main) circuit high input	P.13A-201
P0125*1	Insufficient coolant temperature for closed loop fuel control	P.13A-208
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	P.13A-216
P0130	Linear air-fuel ratio sensor circuit	P.13A-218
P0131	Linear air-fuel ratio sensor circuit low voltage	P.13A-223
P0132	Linear air-fuel ratio sensor circuit high voltage	P.13A-228
P0133	Linear air-fuel ratio sensor circuit slow response	P.13A-233
P0134	Linear air-fuel ratio sensor circuit no activity detected	P.13A-236
P0137	Heated oxygen sensor (rear) circuit low voltage	P.13A-241
P0138	Heated oxygen sensor (rear) circuit high voltage	P.13A-249
P0139	Heated oxygen sensor (rear) circuit slow response	P.13A-253
P0140	Heated oxygen sensor (rear) circuit no activity detected	P.13A-258
P0171	System too lean	P.13A-262
P0172	System too rich	P.13A-268
P0181	Fuel tank temperature sensor circuit range/performance	P.13A-274
P0182	Fuel tank temperature sensor circuit low input	P.13A-280
P0183	Fuel tank temperature sensor circuit high input	P.13A-285
P0201	Injector circuit-cylinder 1	P.13A-292
P0202	Injector circuit-cylinder 2	P.13A-302
P0203	Injector circuit-cylinder 3	P.13A-312
P0204	Injector circuit-cylinder 4	P.13A-322
P0221*1	Throttle position sensor (sub) plausibility	P.13A-331
P0222*1	Throttle position sensor (sub) circuit low input	P.13A-335
P0223*1	Throttle position sensor (sub) circuit high input	P.13A-341
P0300*2	Random/multiple cylinder misfire detected	P.13A-346
P0301*2	Cylinder 1 misfire detected	P.13A-351
P0302*2	Cylinder 2 misfire detected	P.13A-354
P0303*2	Cylinder 3 misfire detected	P.13A-357
P0304*2	Cylinder 4 misfire detected	P.13A-360
P0327	Knock sensor circuit low	P.13A-364
P0328	Knock sensor circuit high	P.13A-368
P0335*1	Crankshaft position sensor circuit	P.13A-372
P0340*1	Intake camshaft position sensor circuit	P.13A-381
P0365*1	Exhaust camshaft position sensor circuit	P.13A-390
P0401	Exhaust gas recirculation flow insufficient detected	P.13A-399

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0420	Warm up catalyst efficiency below threshold	P.13A-401
P0441	Evaporative emission control system incorrect purge flow	P.13A-403
P0442	Evaporative emission control system leak detected (small leak)	P.13A-407
P0443	Evaporative emission control system purge control valve circuit	P.13A-419
P0446	Evaporative emission control system vent control circuit	P.13A-426
P0450	Evaporative emission control system pressure sensor malfunction	P.13A-433
P0451	Evaporative emission control system pressure sensor range/performance	P.13A-442
P0452	Evaporative emission control system pressure sensor low input	P.13A-451
P0453	Evaporative emission control system pressure sensor high input	P.13A-462
P0455	Evaporative emission control system leak detected (gross leak)	P.13A-470
P0456	Evaporative emission control system leak detected (very small leak)	P.13A-481
P0461	Fuel level sensor <FWD> or fuel level sensor (main) <AWD> circuit range/performance	P.13A-492
P0462	Fuel level sensor <FWD> or fuel level sensor (main) <AWD> circuit low input	P.13A-495
P0463	Fuel level sensor circuit high input	P.13A-497
P0489	EGR valve (stepper motor) circuit malfunction (ground short)	P.13A-500
P0490	EGR valve (stepper motor) circuit malfunction (battery short)	P.13A-508
P0506	Idle control system RPM lower than expected	P.13A-512
P0507	Idle control system RPM higher than expected	P.13A-515
P050B	Ignition timing retard insufficient	P.13A-518
P0513	Immobilizer malfunction	P.13A-521
P0515	Battery temperature sensor circuit	P.13A-523
P0551	Power steering pressure switch circuit range/performance	P.13A-528
P0554	Power steering pressure switch circuit intermittent	P.13A-535
P0602*1	Control module programming error	P.13A-539
P0604	Internal control module random access memory (RAM) error	P.13A-540
P0606*1	Engine control module main processor malfunction	P.13A-541
P060B*1	Internal control module A/D processing performance problem	P.13A-546
P060D*1	Internal control module accelerator pedal position performance problem	P.13A-547
P061A*1	Internal control module torque performance problem	P.13A-549
P061C*1	Internal control module engine RPM performance problem	P.13A-553
P061F	Internal control module throttle actuator controller performance problem	P.13A-556
P0620	Generator control circuit	P.13A-558
P0622	Generator FR terminal circuit malfunction	P.13A-562
P062F*1	Internal control module EEPROM error	P.13A-567

TSB Revision

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0630*1	Vehicle Identification Number (VIN) malfunction	P.13A-568
P0638*1	Throttle actuator control motor circuit range/ performance	P.13A-571
P0642*1	Throttle position sensor power supply	P.13A-574
P0657*1	Throttle actuator control motor relay circuit malfunction	P.13A-576
P1231	Active stability control plausibility	P.13A-583
P1238*1	Mass airflow sensor plausibility (torque monitor)	P.13A-584
P1240	Ignition angle	P.13A-588
P1242	Fail safe control monitor	P.13A-589
P1243	Inquiry/response error	P.13A-590
P1247	CVT plausibility	P.13A-591
P1506	Idle control system RPM lower than expected at low temperature	P.13A-593
P1507	Idle control system RPM higher than expected at low temperature	P.13A-596
P1590*1	TCM to ECM communication error in torque reduction request	P.13A-599
P1603*1	Battery backup circuit malfunction	P.13A-602
P1608	Battery current sensor circuit	P.13A-606
P1609	Battery current sensor range/performance	P.13A-611
P2066	Fuel level sensor (sub) circuit range/performance <AWD>	P.13A-614
P2096	Post catalyst fuel trim system too lean	P.13A-617
P2097	Post catalyst fuel trim system too rich	P.13A-620
P2100*1	Throttle actuator control motor circuit (open)	P.13A-624
P2101*1	Throttle actuator control motor magneto malfunction	P.13A-629
P2122*1	Accelerator pedal position sensor (main) circuit low input	P.13A-633
P2123*1	Accelerator pedal position sensor (main) circuit high input	P.13A-639
P2127*1	Accelerator pedal position sensor (sub) circuit low input	P.13A-644
P2128*1	Accelerator pedal position sensor (sub) circuit high input	P.13A-650
P2135*1	Throttle position sensor (main and sub) range/performance problem	P.13A-654
P2138*1	Accelerator pedal position sensor (main and sub) range/performance problem	P.13A-660
P2228*1	Barometric pressure circuit low input	P.13A-667
P2229*1	Barometric pressure circuit high input	P.13A-669
P2237	Linear air-fuel ratio sensor positive current control circuit/open	P.13A-672
P2243	Linear air-fuel ratio sensor reference voltage circuit/open	P.13A-677
P2251	Linear air-fuel ratio sensor negative current control circuit/open	P.13A-682
P2252	Heated oxygen sensor offset circuit low voltage	P.13A-686
P2253	Heated oxygen sensor offset circuit high voltage	P.13A-691

TSB Revision

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P2530	Ignition switch run position circuit	P.13A-696
U0001	Bus off	P.13A-699
U0101*1	TCM time-out	P.13A-700
U0121	ASC-ECU time-out	P.13A-704
U0141*1	ETACS-ECU time-out	P.13A-707
U0167	Immobilizer communication error	P.13A-711
U0415	Invalid data received from ASC-ECU	P.13A-713
U1180*1	Combination meter time-out	P.13A-715

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

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

*NOTE: After the ECM detects a malfunction, a diagnostic trouble code is recorded the next time the engine is started and the same malfunction is re-detected. However, for items marked with a "*1", the diagnostic trouble code is recorded on the first detection of the malfunction.*

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

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

SYMPTOM CHART

M1131151502658

⚠ WARNING

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

⚠ CAUTION

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

⚠ CAUTION

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

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

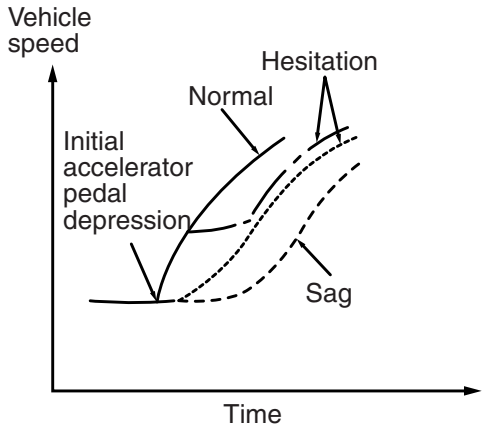
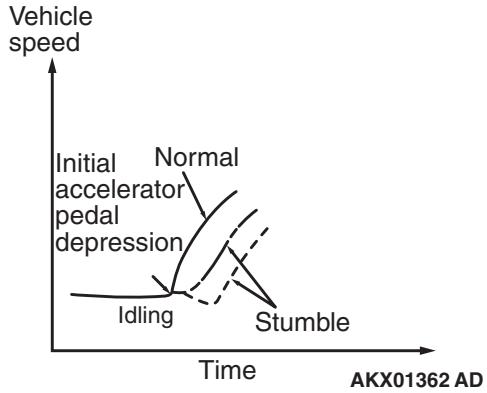
NOTE: When the racing (2,000 to 5,000 r/min or more) continues on the vehicle stopped with no load during the specified time or more, the increase in the engine speed might be limited. This comes from the engine protection and control functions and is not a malfunction.

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Communication with scan tool is impossible	Communication with ECM only is not possible	1	P.13A-719
Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) and related parts	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) does not illuminate right after the ignition switch is turned to the "ON" position	2	P.13A-722
	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) remains illuminated and never goes out	3	P.13A-723
Starting	Cranks, won't start	4	P.13A-725
	Starts up and dies	5	P.13A-732
	Hard starting	6	P.13A-736
Idling stability (improper idling)	Unstable idle (rough idle, hunting)	7	P.13A-741
	Idle speed is high (improper idle speed)	8	P.13A-745
	Idle speed is low (improper idle speed)	9	P.13A-747
Idling stability (engine stalls)	When the engine is cold, it stalls at idle (die out)	10	P.13A-748
	When the engine is hot, it stalls at idle (die out)	11	P.13A-751
	The engine stalls when accelerating (pass out)	12	P.13A-754
	The engine stalls when decelerating	13	P.13A-756

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Driving	Hesitation, sag, Stumble, Poor acceleration or Surge	14	P.13A-758
	Acceleration shock	15	P.13A-761
	Knocking	16	P.13A-763
Too high CO and HC concentration when idling		17	P.13A-764
IM240 test failure	Transient, mass emission tailpipe test failure	18	P.13A-767
	Purge flow test of the evaporative emission canister failure	19	P.13A-771
	Pressure test of the evaporative system failure	20	P.13A-772
Power supply system and ignition switch-IG system		21	P.13A-777
Fuel pump system		22	P.13A-788
Ignition switch-ST system and starter relay system		23	P.13A-795
Ignition circuit system		24	P.13A-807
A/C system		25	P.13A-812
Engine oil pressure switch system		26	P.13A-814

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

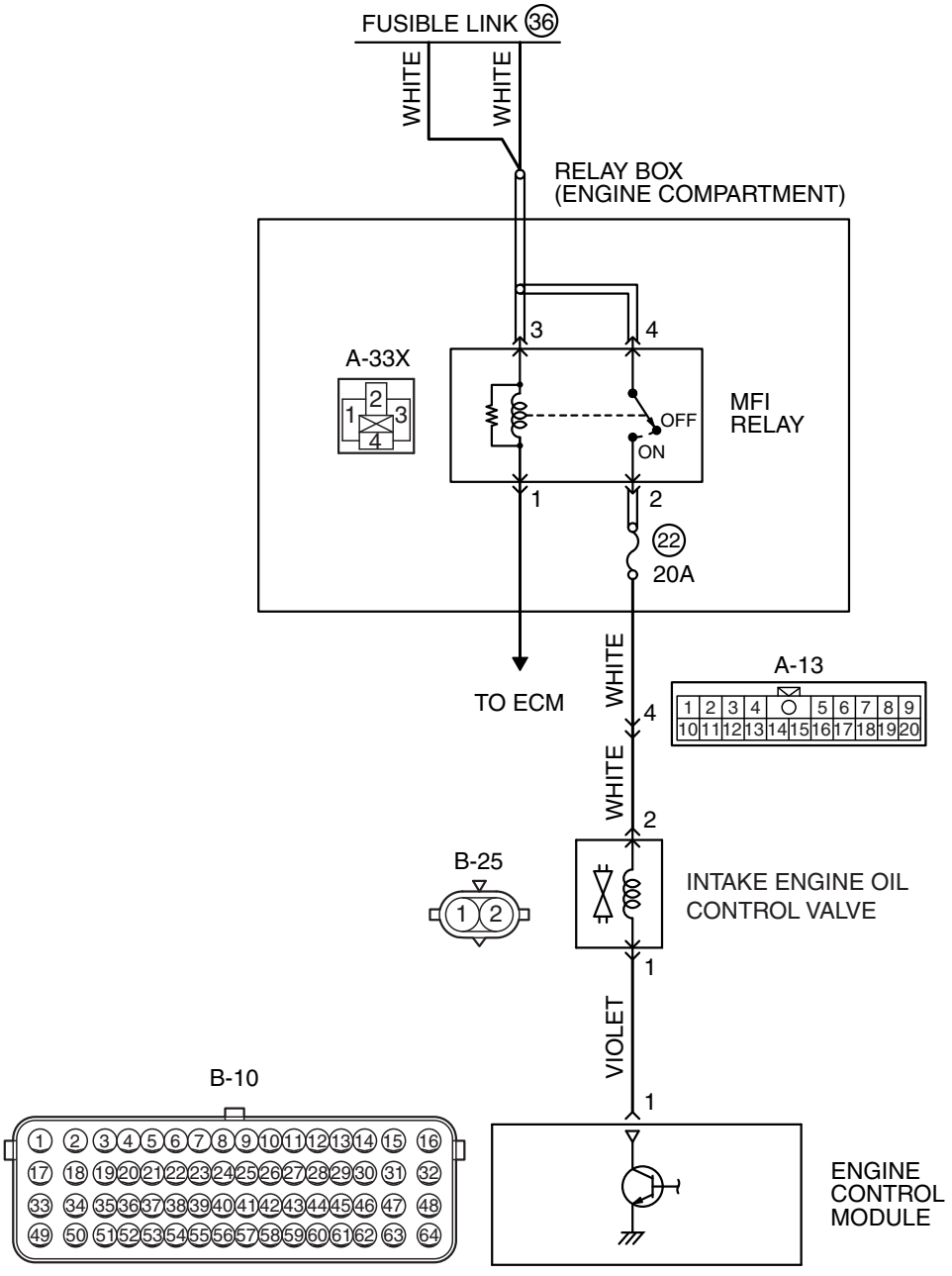
ITEMS		SYMPTOM
At starting	Won't start	The starter cranks the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starts up and dies	The engine starts, but then engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed 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".	 AKX01361AC
	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.	 AKX01362 AD
	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 P0010: Intake Engine Oil Control Valve Circuit

INTAKE ENGINE OIL CONTROL VALVE CIRCUIT



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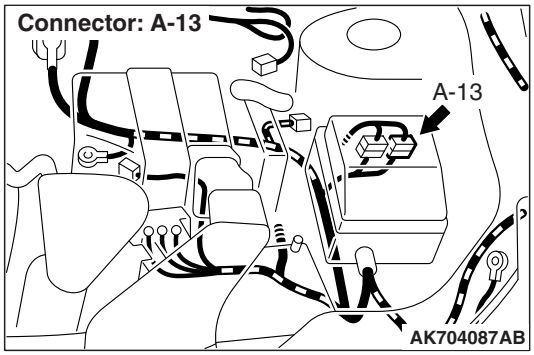
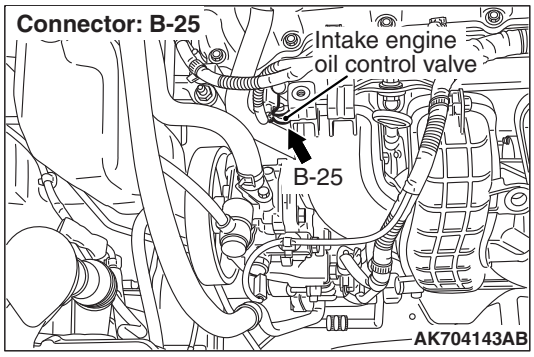
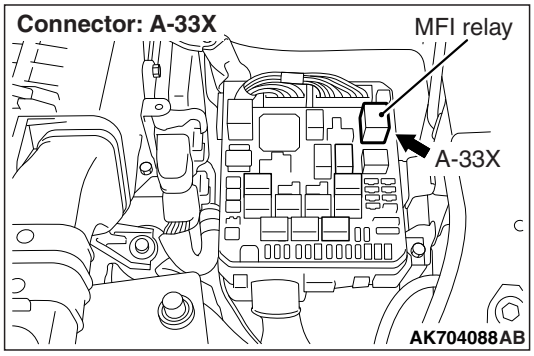
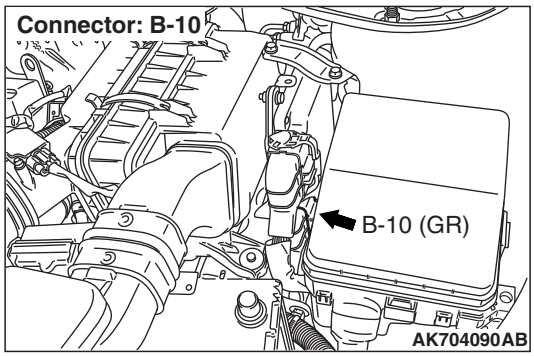
TSB Revision









CIRCUIT OPERATION

- The intake engine oil control valve power is supplied from the MFI relay (terminal No. 2).
- The ECM controls ground intake engine oil control valve by turning the power transistor in the ECM "ON" and "OFF".

TECHNICAL DESCRIPTION

- The intake engine oil control valve changes the phase angle to operate the MIVEC system in the advance or the retard side in accordance with signals from the ECM.

DESCRIPTIONS OF MONITOR METHODS

Intake engine oil control valve circuit current is out of the 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)

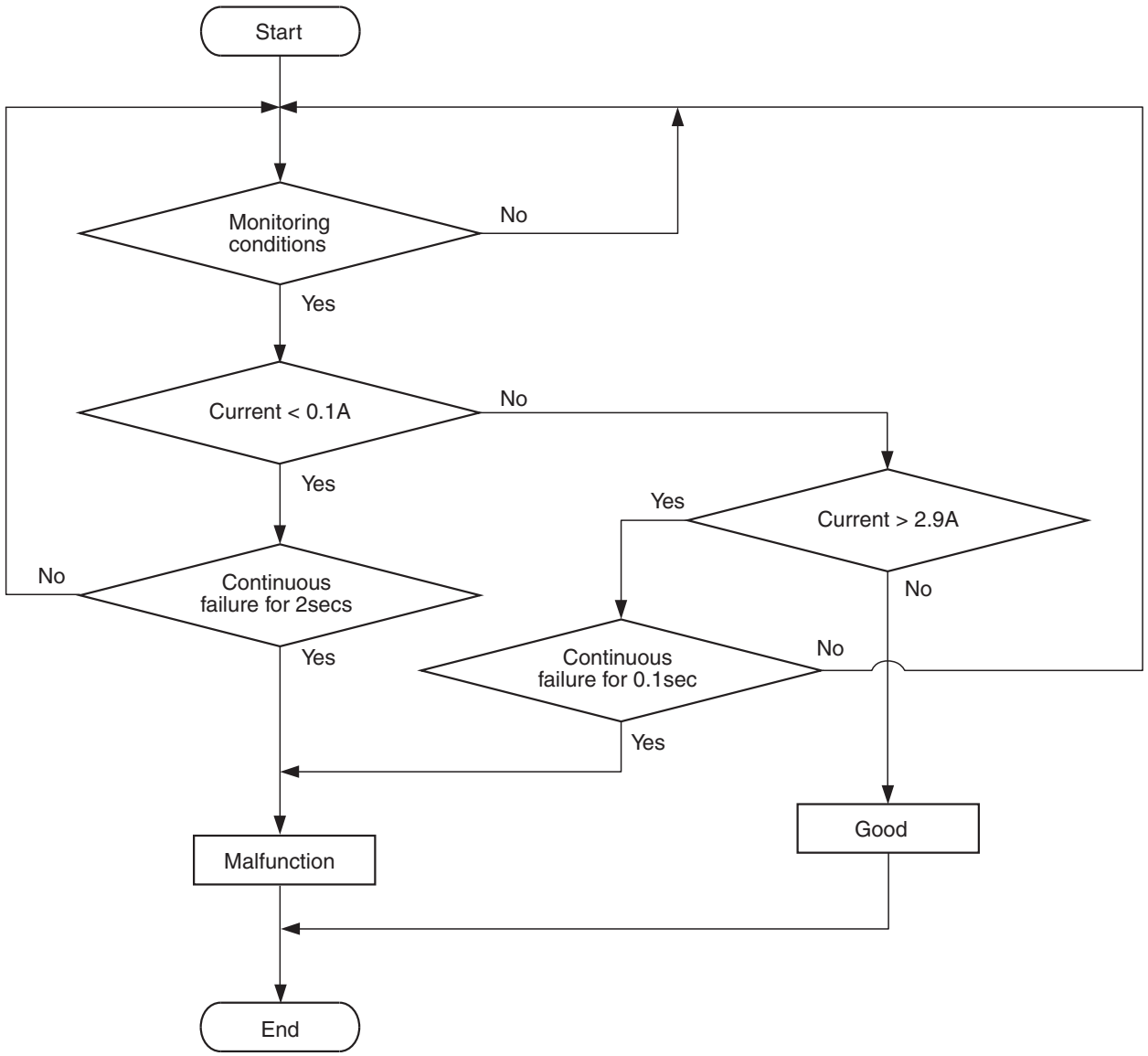
- Not applicable

Sensor (The sensor below is determined to be normal)

- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Engine oil control valve

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions
- Ignition switch is "ON" position
- Battery positive voltage is between 10 and 16.5 volts.
- ON duty cycle of the intake engine oil control valve circuit is higher than 20 percent.

Judgement Criterion
- The ECM terminal current of intake engine oil control valve circuit is less than 0.1 ampere for 2 seconds.

Check Conditions
- Ignition switch is "ON" position
- Battery positive voltage is between 10 and 16.5 volts.

Judgement Criterion
- The ECM terminal current of intake engine oil control valve circuit is higher than 2.9 amperes for 0.1 second.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

TSB Revision

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

- Intake engine oil control valve failed.
- Open or shorted intake engine oil control valve circuit, harness damage, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB992110: Power Plant ECU Check Harness

STEP 1. Check harness connector B-25 at the intake engine oil control valve for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

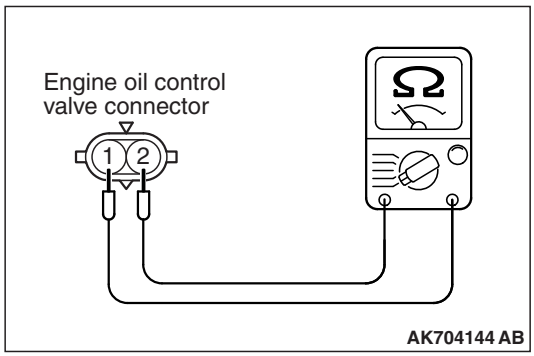
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

STEP 2. Check the intake engine oil control valve.

(1) Disconnect the intake engine oil control valve connector B-25.

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

Standard value: 6.9 – 7.9 ohms [at 20°C (68°F)]



Q: Is the measured resistance between 6.9 and 7.9 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

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

STEP 3. Measure the power supply voltage at intake engine oil control valve harness side connector B-25.

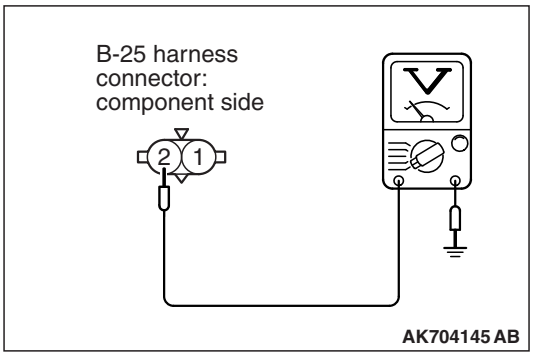
(1) Disconnect the connector B-25 and measure at the harness side.

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

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

- Voltage should be battery positive voltage.

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



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

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check harness connector A-33X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector A-13 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If intermediate connector is in good condition, repair harness wire between MFI relay connector A-33X (terminal No. 2) and intake engine oil control valve connector B-25 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

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

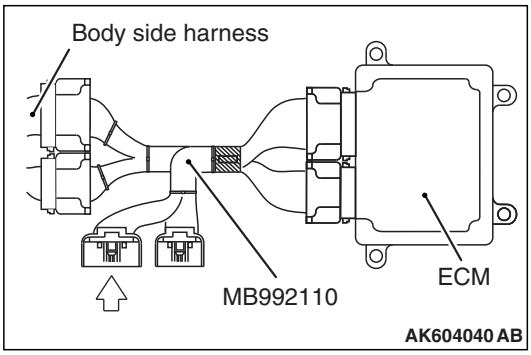
STEP 5. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

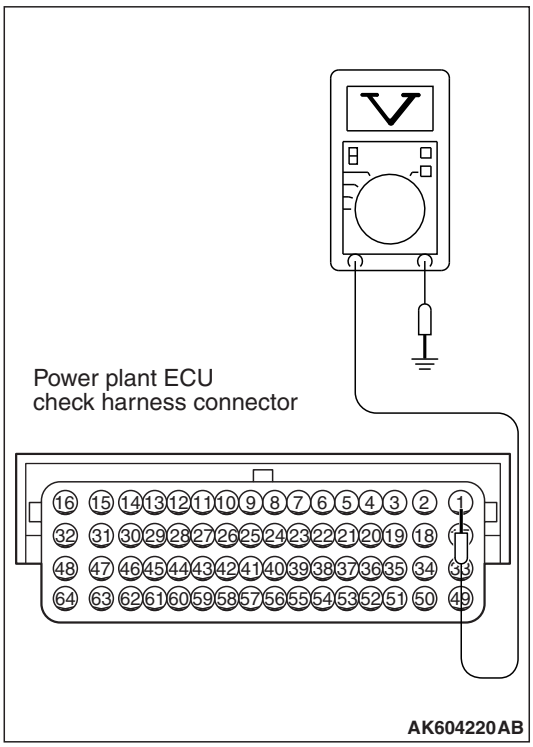
YES : Go to Step 6.

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

STEP 6. Measure the power supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.



(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
(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 7.
NO : Repair harness wire between intake engine oil control valve connector B-25 (terminal No. 1) and ECM connector B-10 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 10.

STEP 7. Check for harness damage between MFI relay connector A-33X (terminal No. 2) and intake engine oil control valve connector B-25 (terminal No. 2).

NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

Q: Is the harness wire in good condition?

YES : Go to Step 8.
NO : Repair it. Then go to Step 10.

STEP 8. Check for harness damage between intake engine oil control valve connector B-25 (terminal No. 1) and ECM connector B-10 (terminal No. 1).

Q: Is the harness wire in good condition?

YES : Go to Step 9.
NO : Repair it. Then go to Step 10.

STEP 9. Check the trouble symptoms.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0010 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.
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.00-15.

STEP 10. Test the OBD-II drive cycle.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0010 set?

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

DTC P0011: Intake Variable Valve Timing System Target Error

TECHNICAL DESCRIPTION

- The ECM checks the variable valve timing system for malfunction.

DESCRIPTIONS OF MONITOR METHODS

The phase angle of the intake camshaft is higher than the specified value.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

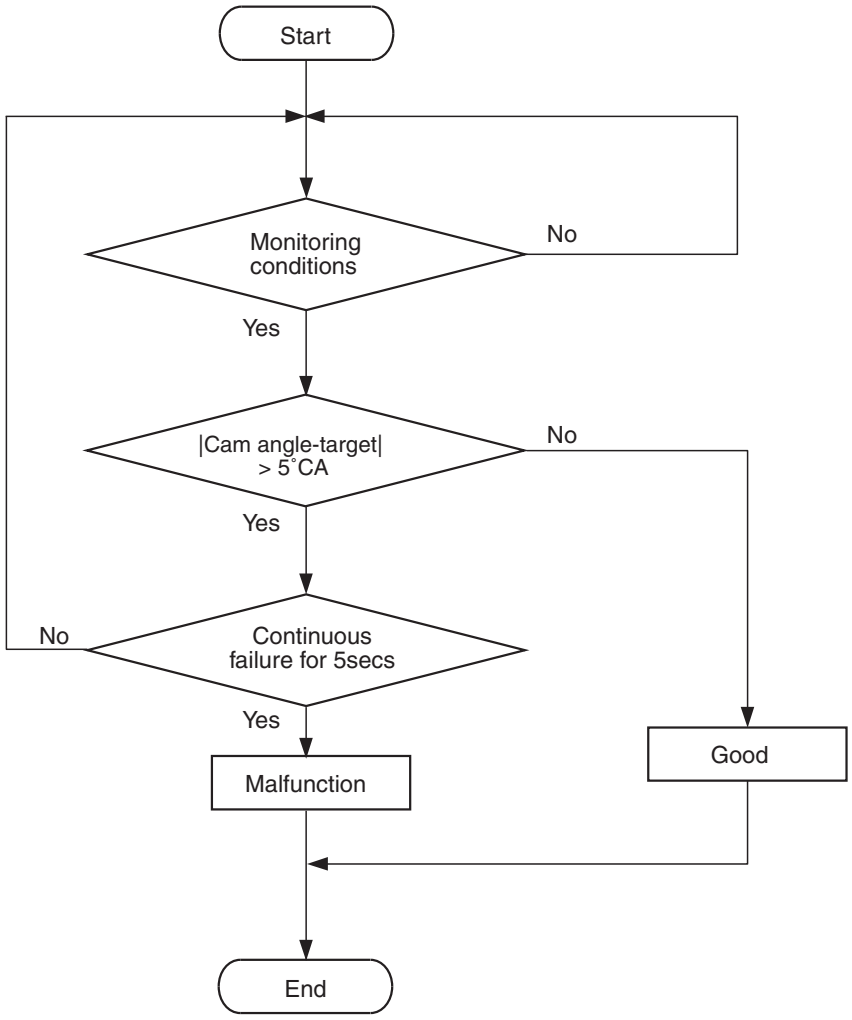
- Not applicable

Sensor (The sensor below is determined to be normal)

- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Engine oil control valve

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

- More than 20 seconds have passed since the engine starting sequence was completed.
- Engine speed is 1,188 r/min or more.
- Engine coolant temperature is higher than 76°C (169°F).

Judgment Criterion

- The difference between the actual intake valve opening timing and the intake valve target opening timing is more than 5 degrees for 5 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

- Intake engine oil control valve failed.
- Oil passage of variable valve timing control system clogged.
- Intake variable valve timing sprocket operation mechanism stuck.
- ECM failed.

TSB Revision

DIAGNOSIS

Required Special Tools

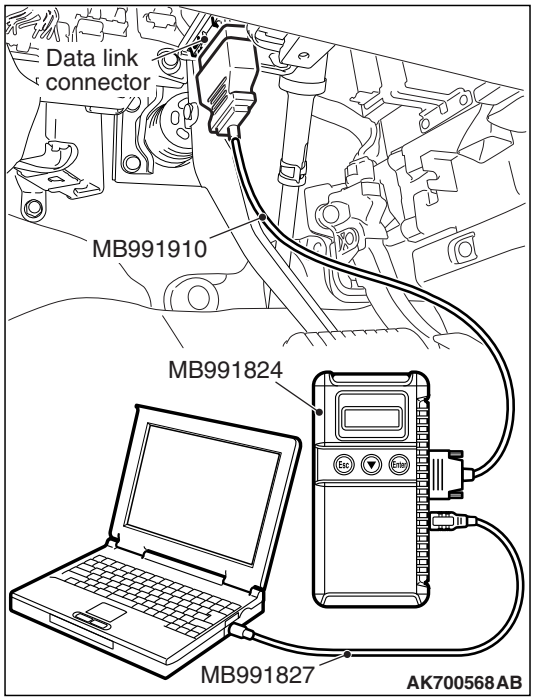
- MB991958: Scan tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A

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

⚠ CAUTION

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

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



Q: Is the diagnostic trouble code other than P0011 set?

YES : Refer to, Diagnostic Trouble Code Chart P.13A-49.
NO : Go to Step 2.

STEP 2. Check intake engine oil control valve itself.

- Check intake engine oil control valve itself (Refer to Engine Oil Control Valve Check P.13A-878).

Q: Is the check result normal?

YES : Go to Step 3.
NO : Replace intake engine oil control valve. Then go to Step 6.

STEP 3. Check oil passage of intake variable valve timing control system for being clogged.

Q: Is the check result normal?

YES : Go to Step 4.
NO : Repair it. Then go to Step 6.

STEP 4. Check intake variable valve timing sprocket operation mechanism for being stuck.

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair it. Then go to Step 6.

TSB Revision

STEP 5. Check the trouble symptoms.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

Q: Is DTC P0011 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 6.

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.00-15.

STEP 6. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

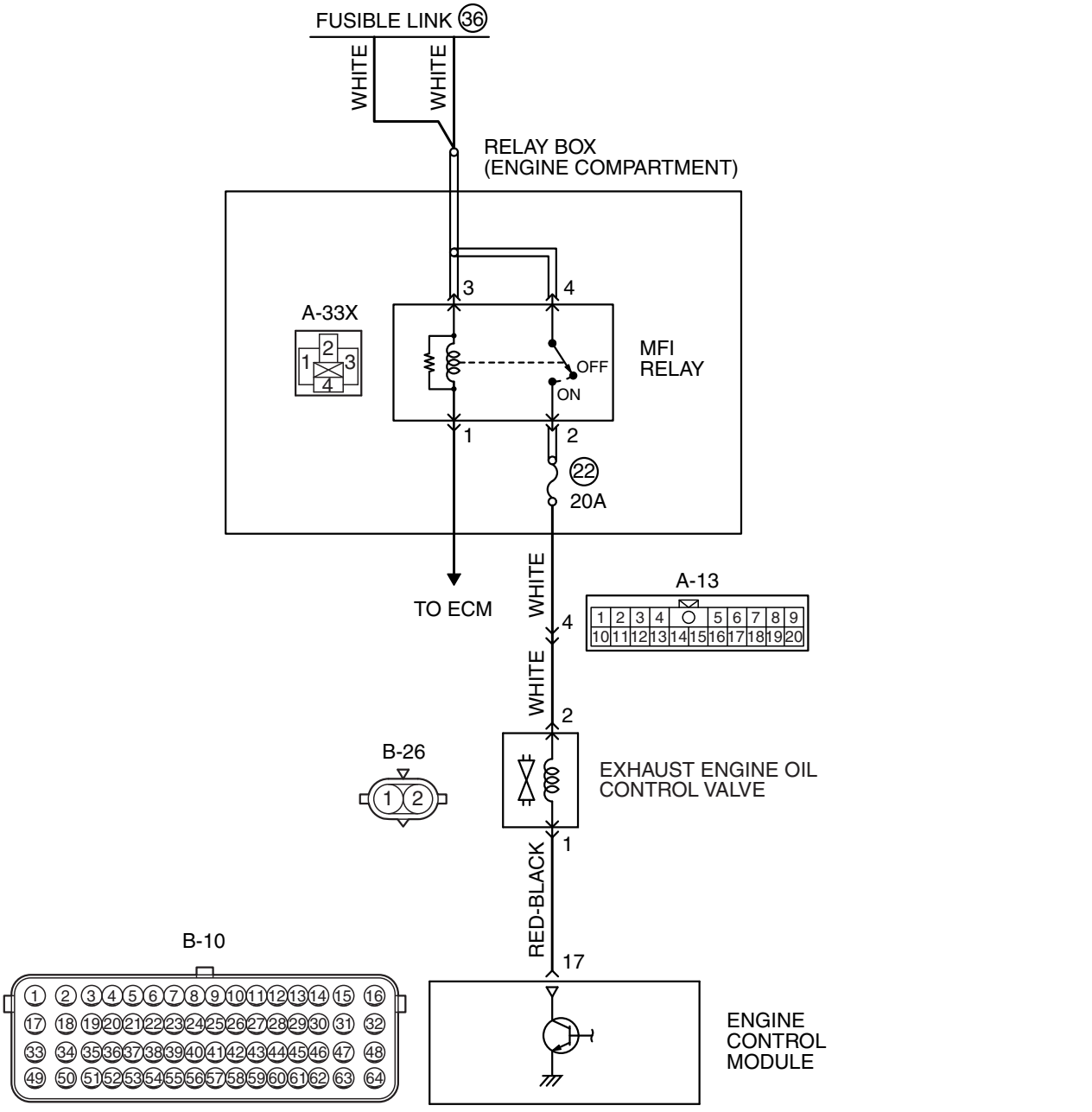
Q: Is DTC P0011 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0013: Exhaust Engine Oil Control Valve Circuit

EXHAUST ENGINE OIL CONTROL VALVE CIRCUIT



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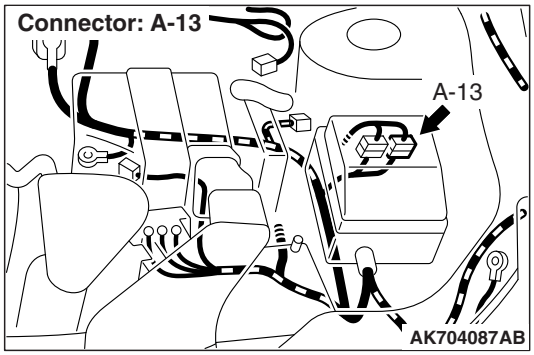
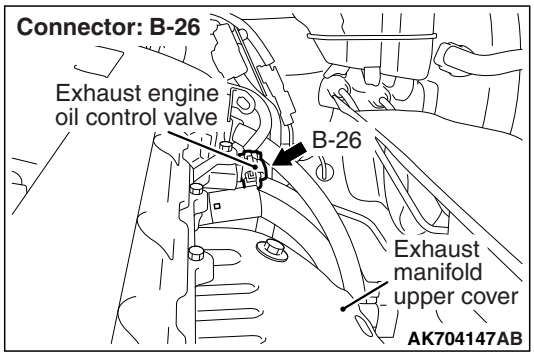
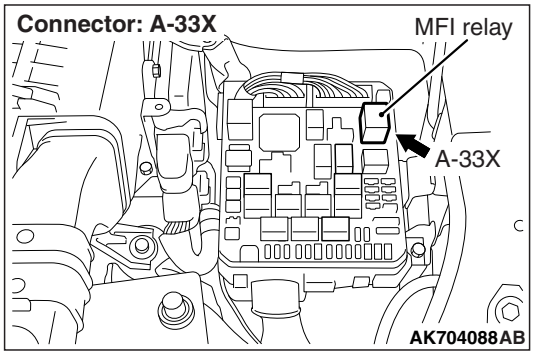
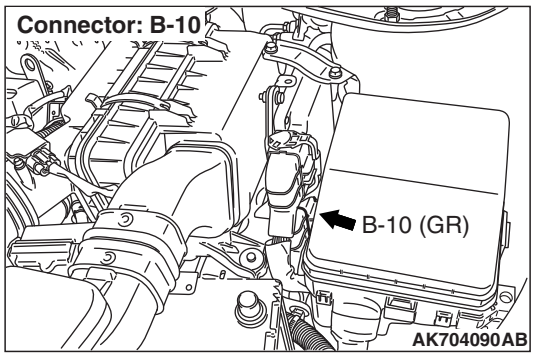
TSB Revision









CIRCUIT OPERATION

- The exhaust engine oil control valve power is supplied from the MFI relay (terminal No. 2).
- The ECM controls ground exhaust engine oil control valve by turning the power transistor in the ECM "ON" and "OFF".

TECHNICAL DESCRIPTION

- The exhaust engine oil control valve changes the phase angle to operate the MIVEC system in the advance or the retard side in accordance with signals from the ECM.

DESCRIPTIONS OF MONITOR METHODS

Exhaust engine oil control valve circuit current is less than specified value.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

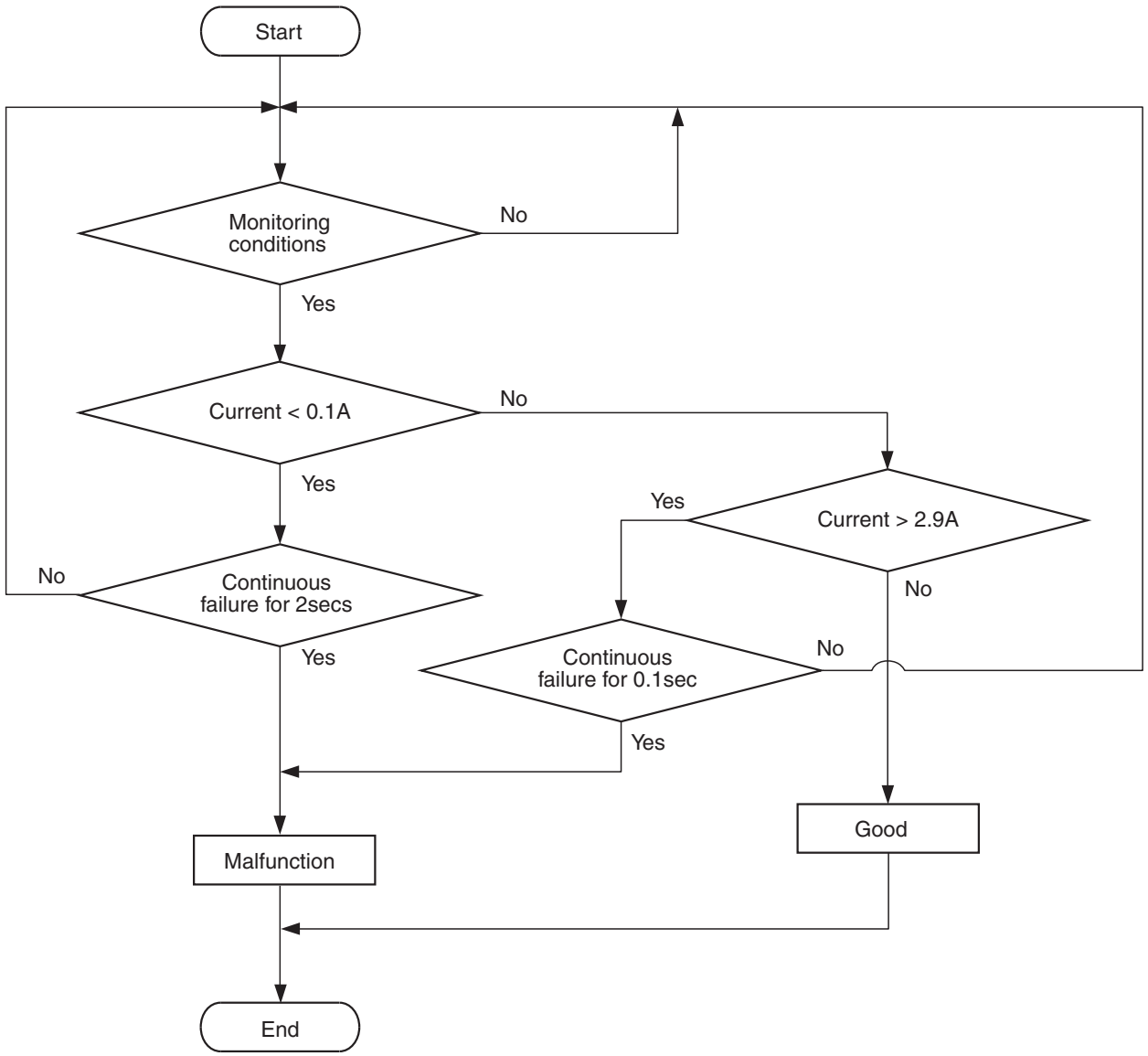
- Not applicable

Sensor (The sensor below is determined to be normal)

- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Engine oil control valve

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions
- Ignition switch is "ON" position.
- Battery positive voltage is between 10 and 16.5 volts.
- ON duty cycle of the exhaust engine oil control valve circuit is higher than 20 percent.

Judgement Criterion
- The ECM terminal current of exhaust engine oil control valve circuit is less than 0.1 ampere for 2 seconds.

Check Conditions
- Ignition switch is "ON" position
- Battery positive voltage is between 10 and 16.5 volts.

Judgement Criterion
- The ECM terminal current of exhaust engine oil control valve circuit is higher than 2.9 amperes for 0.1 second.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

TSB Revision

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

- Exhaust engine oil control valve failed.
- Open or shorted exhaust engine oil control valve circuit, harness damage, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB992110:Power Plant ECU CHeck Harness

STEP 1. Check harness connector B-26 at the exhaust engine oil control valve for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

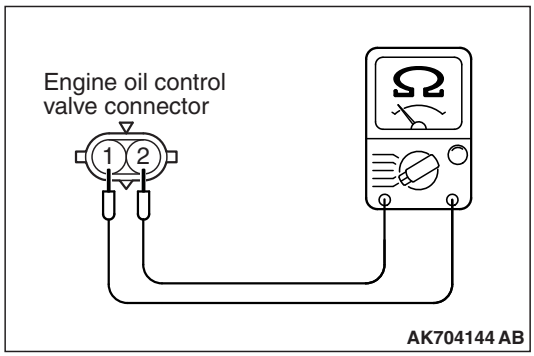
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

STEP 2. Check the exhaust engine oil control valve.

(1) Disconnect the exhaust engine oil control valve connector B-26.

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

Standard value: 6.9 – 7.9 ohms [at 20°C (68°F)]



Q: Is the measured resistance between 6.9 and 7.9 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

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

STEP 3. Measure the power supply voltage at exhaust engine oil control valve harness side connector B-26.

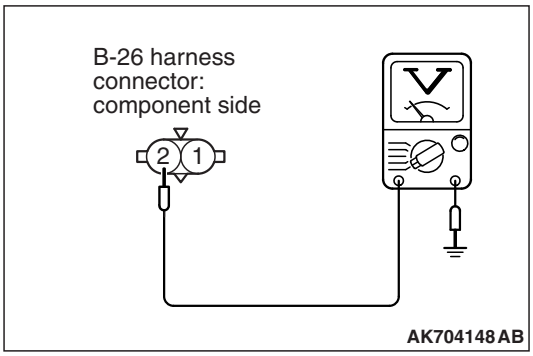
(1) Disconnect the connector B-26 and measure at the harness side.

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

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

- Voltage should be battery positive voltage.

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



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

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check harness connector A-33X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector A-13 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If intermediate connector is in good condition, repair harness wire between MFI relay connector A-33X (terminal No. 2) and exhaust engine oil control valve connector B-26 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

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

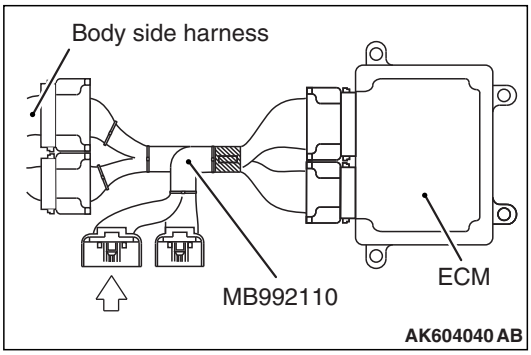
STEP 5. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

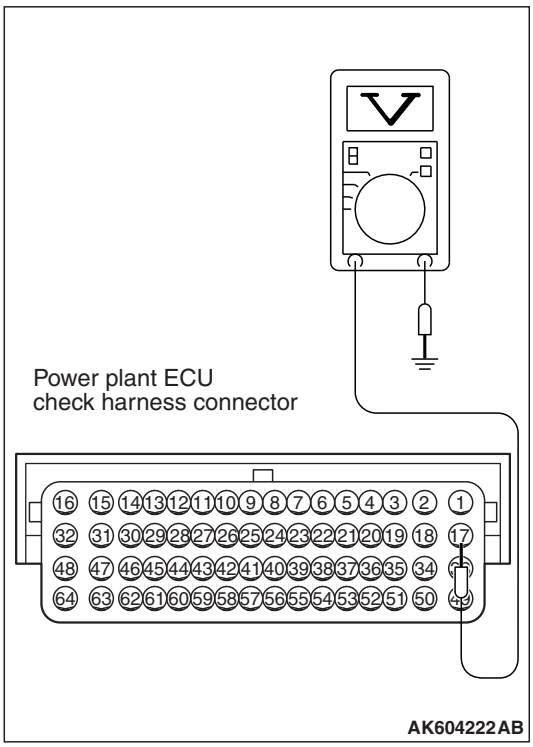
YES : Go to Step 6.

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

STEP 6. Measure the power supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.



(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 17 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 7.
NO : Repair harness wire between exhaust engine oil control valve connector B-26 (terminal No. 1) and ECM connector B-10 (terminal No. 17) because of open circuit or short circuit to ground. Then go to Step 10.

STEP 7. Check for harness damage between MFI relay connector A-33X (terminal No. 2) and exhaust engine oil control valve connector B-26 (terminal No. 2).

NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

Q: Is the harness wire in good condition?

YES : Go to Step 8.
NO : Repair it. Then go to Step 10.

STEP 8. Check for harness damage between exhaust engine oil control valve connector B-26 (terminal No. 1) and ECM connector B-10 (terminal No. 17).

Q: Is the harness wire in good condition?

YES : Go to Step 9.
NO : Repair it. Then go to Step 10.

STEP 9. Check the trouble symptoms.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0013 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.
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.00-15.

STEP 10. Test the OBD-II drive cycle.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0013 set?

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

DTC P0014: Exhaust Variable Valve Timing System Target Error

TECHNICAL DESCRIPTION

- The ECM checks the variable valve timing system for malfunction.

DESCRIPTIONS OF MONITOR METHODS

The phase angle of the exhaust camshaft is higher than the specified value.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

- Not applicable

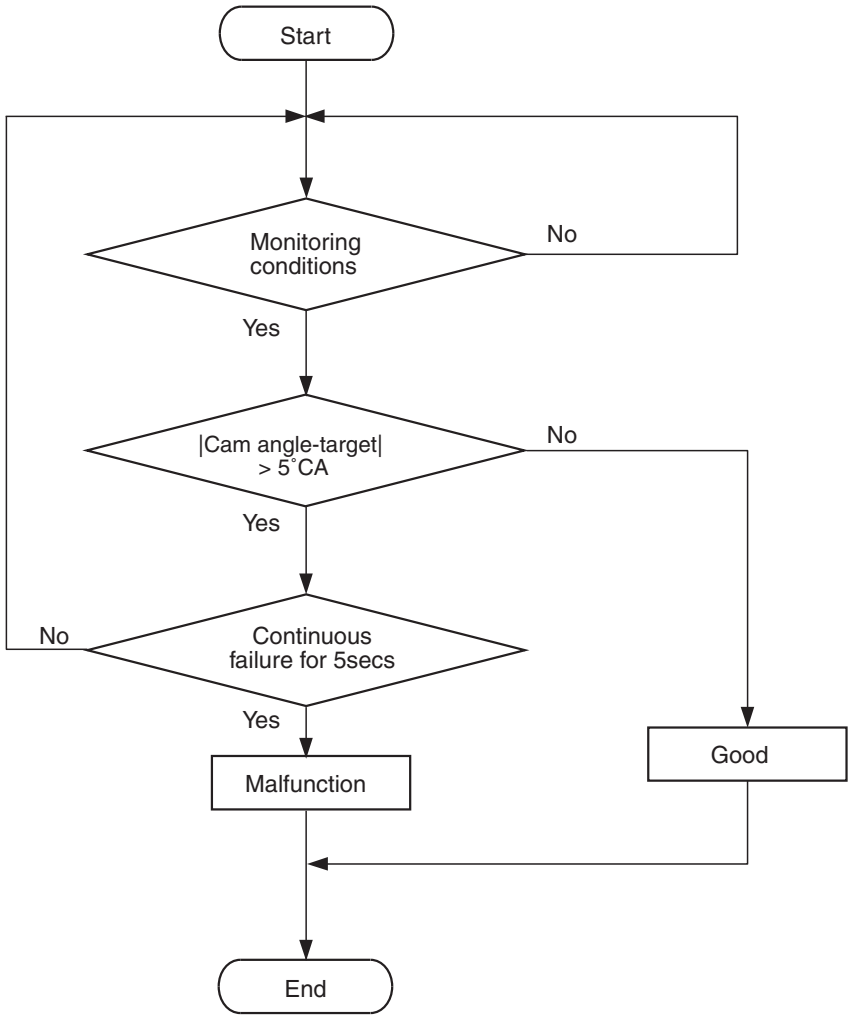
Sensor (The sensor below is determined to be normal)

- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Engine oil control valve

TSB Revision

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

- More than 20 seconds have passed since the engine starting sequence was completed.
- Engine speed is 1,188 r/min or more.
- Engine coolant temperature is higher than 76°C (169°F).

Judgment Criterion

- The difference between the actual exhaust valve closing timing and the exhaust valve target closing timing is more than 5 degrees for 5 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

- Exhaust engine oil control valve failed.
- Oil passage of variable valve timing control system clogged.
- Exhaust variable valve timing sprocket operation mechanism stuck.
- ECM failed.

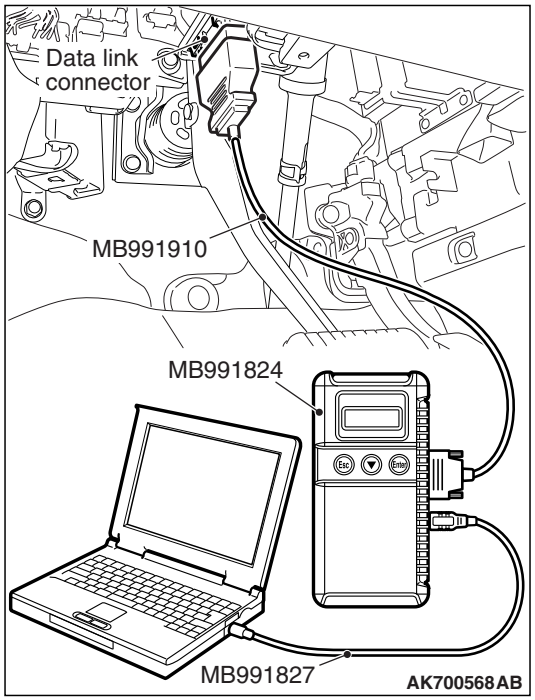
TSB Revision

DIAGNOSIS

Required Special Tools

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

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



⚠ CAUTION

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

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

Q: Is the diagnostic trouble code other than P0014 set?

YES : Refer to, Diagnostic Trouble Code Chart P.13A-49.
NO : Go to Step 2.

STEP 2. Check exhaust engine oil control valve itself.

- Check exhaust engine oil control valve itself (Refer to Engine Oil Control Valve Check P.13A-878).

Q: Is the check result normal?

YES : Go to Step 3.
NO : Replace exhaust engine oil control valve. Then go to Step 6.

STEP 3. Check oil passage of exhaust variable valve timing control system for being clogged.

Q: Is the check result normal?

YES : Go to Step 4.
NO : Repair it. Then go to Step 6.

STEP 4. Check exhaust variable valve timing sprocket operation mechanism for being stuck.

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair it. Then go to Step 6.

TSB Revision

STEP 5. Check the trouble symptoms.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

Q: Is DTC P0014 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 6.

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.00-15.

STEP 6. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

Q: Is DTC P0014 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0016: Crankshaft/camshaft (intake) Position Sensor Phase Problem

TECHNICAL DESCRIPTION

- The ECM checks the variable valve timing system for malfunction.

DESCRIPTIONS OF MONITOR METHODS

The open timing of the intake valve is faster or slower than the specified value.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

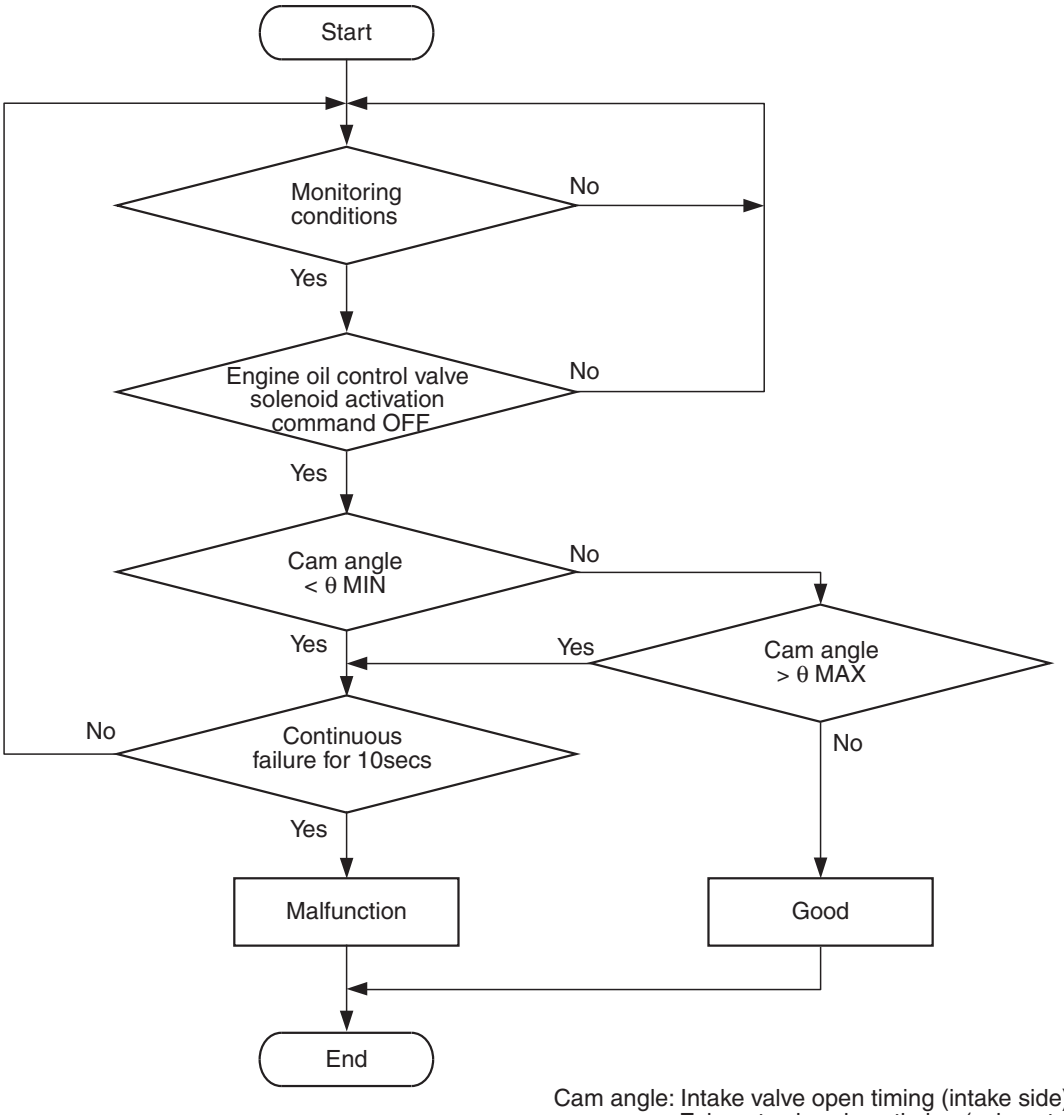
- Not applicable

Sensor (The sensor below is determined to be normal)

- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Engine oil control valve

DTC SET CONDITIONS

Logic Flow Chart



Cam angle: Intake valve open timing (intake side)
Exhaust valve close timing (exhaust side)
θ MAX : Maximum threshold value
θ MIN : Minimum threshold value

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Check Conditions

- Engine speed is between 594 r/min and 1,500 r/min.
- Engine coolant temperature is between 20°C (68°F) and 88°C (190°F).
- Intake engine oil control valve is "OFF".
- 1 second has elapsed after the above mentions have been met.

Judgment Criterion

- The open timing of the intake valve is faster than –7.0 degrees (ATDC) for 10 seconds.

or

- The open timing of the intake valve is slower than 6.1 degrees (ATDC) for 10 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

TSB Revision

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

- Timing chain in out of place.
- Loose timing chain.
- Intake variable valve timing sprocket tooth coming off.
- ECM failed.

DIAGNOSIS

Required Special Tools

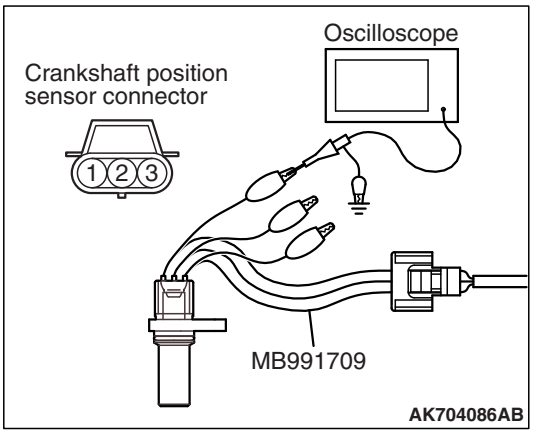
- MB991709: Test Harness
- MB992110: Power Plant ECU Check Harness

STEP 1. Using the oscilloscope, measure output wave pattern at crankshaft position sensor and intake camshaft position sensor.

(1) Disconnect the crankshaft position sensor connector B-119 and connect the test harness special tool (MB991709) between the separated connectors.

(2) Connect the oscilloscope probe to the crankshaft position sensor side connector terminal No. 3.

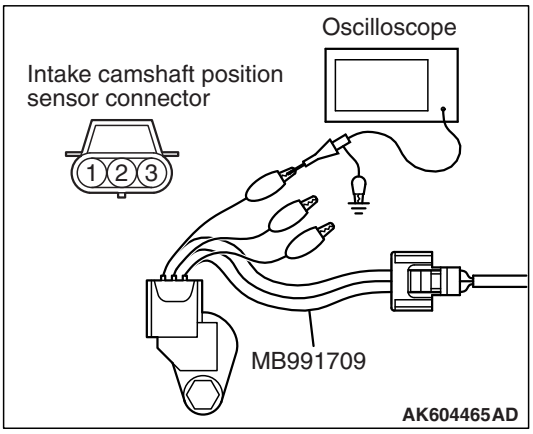
(3) Disconnect the intake camshaft position sensor connector B-123, and connect test harness special tool (MB991709) between the separated connectors.



(4) Connect the oscilloscope probe to the intake camshaft position sensor side connector terminal No. 3.

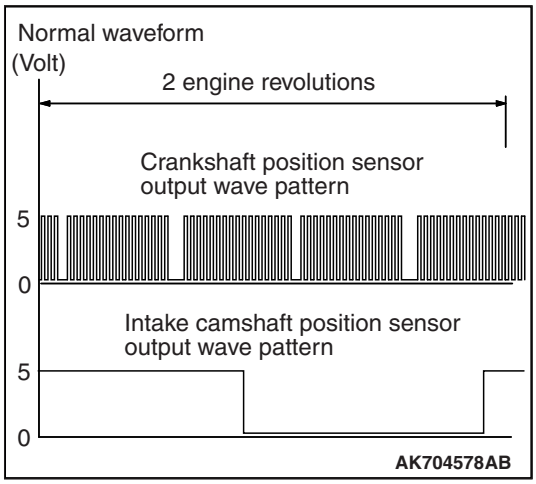
NOTE: When measuring with the ECM side connector, disconnect all ECM connectors. Connect the check harness special tool (MB992110) between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 8 (crankshaft position sensor) and terminal No. 14 (intake camshaft position sensor).

(5) Start the engine and run at idle.



(6) Check the waveform.
- The waveform should show a pattern similar to the illustration.

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



Q: Is the waveform normal?

YES : Go to Step 2.
NO : 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 20 P.13A-11.

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

Q: Is DTC P0016 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 4.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

STEP 3. Check timing mark on the timing chain.

Q: Is timing chain in out of place?

YES : Repair it. Then initialize the learning value for the elongation of the timing chain. Refer to GROUP 00, Precautions Before Service – Timing Chain Learned Value Reset P.00-55. Then go to Step 4.

NO : Check the following items, and repair or replace the defective items.

a. Check the timing chain loose.

b. Check the intake variable valve timing sprocket tooth coming off.

Then initialize the learning value for the elongation of the timing chain. Refer to GROUP 00, Precautions Before Service – Timing Chain Learned Value Reset P.00-55. Then go to Step 4.

STEP 4. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

Q: Is DTC P0016 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0017: Crankshaft/camshaft (exhaust) Position Sensor Phase Problem

TECHNICAL DESCRIPTION

- The ECM checks the variable valve timing system for malfunction.

DESCRIPTIONS OF MONITOR METHODS

The close timing of the exhaust valve is faster or slower than the specified value.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

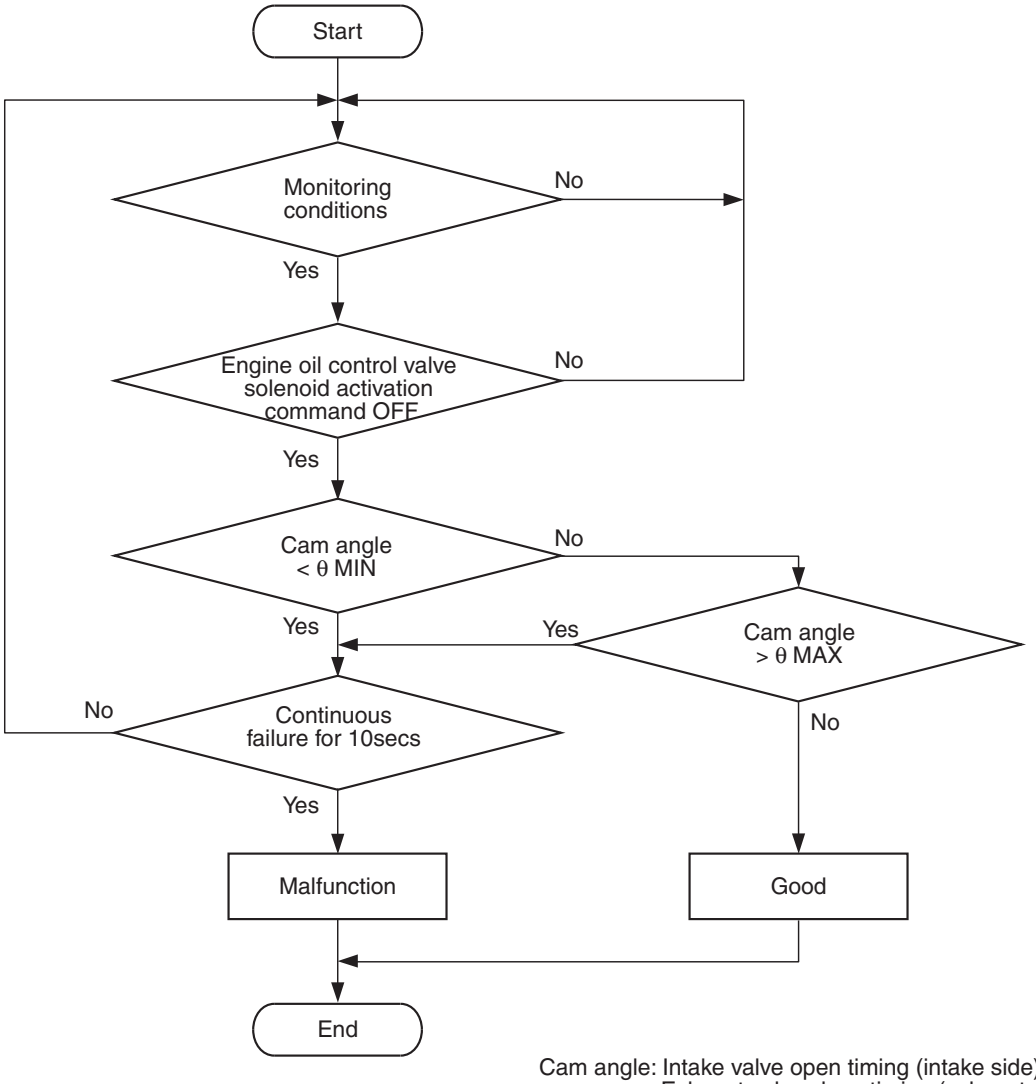
- Not applicable

Sensor (The sensor below is determined to be normal)

- Camshaft position sensor
- Crankshaft position sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Engine oil control valve

DTC SET CONDITIONS

Logic Flow Chart



Cam angle: Intake valve open timing (intake side)
Exhaust valve close timing (exhaust side)
θ MAX : Maximum threshold value
θ MIN : Minimum threshold value

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Check Conditions

- Engine speed is between 594 r/min and 1,500 r/min.
- Engine coolant temperature is between 20°C (68°F) and 88°C (190°F).
- Exhaust engine oil control valve is "OFF".
- 1 second has elapsed after the above mentions have been met.

Judgment Criterion

- The close timing of the exhaust valve is faster than –7.7 degrees (ATDC) for 10 seconds.

or

- The close timing of the exhaust valve is slower than 5.4 degrees (ATDC) for 10 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

- Timing chain in out of place.
- Loose timing chain.
- Exhaust variable valve timing sprocket tooth coming off.
- ECM failed.

TSB Revision

DIAGNOSIS

Required Special Tools

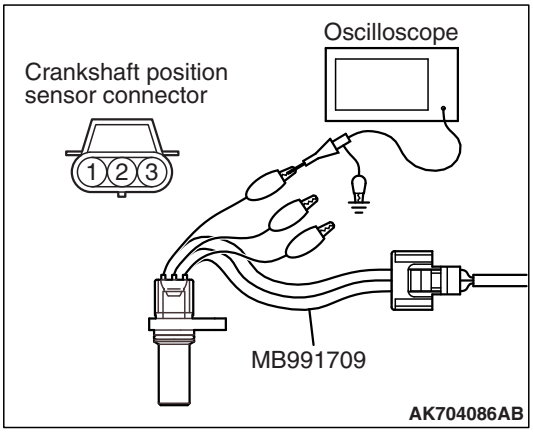
- MB991709: Test Harness
- MB992110: Power Plant ECU Check Harness

STEP 1. Using the oscilloscope, measure output wave pattern at crankshaft position sensor and exhaust camshaft position sensor.

(1) Disconnect the crankshaft position sensor connector B-119 and connect the test harness special tool (MB991709) between the separated connectors.

(2) Connect the oscilloscope probe to the crankshaft position sensor side connector terminal No. 3.

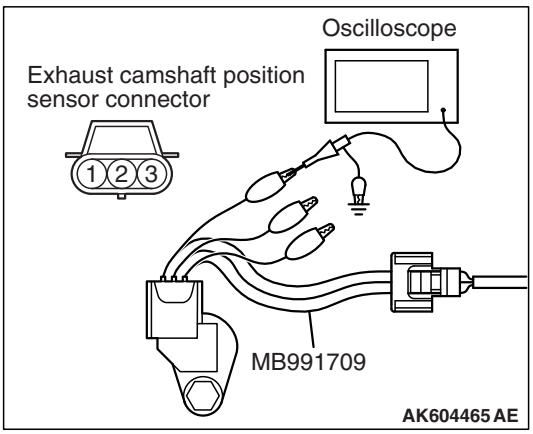
(3) Disconnect the exhaust camshaft position sensor connector B-22, and connect test harness special tool (MB991709) between the separated connectors.



(4) Connect the oscilloscope probe to the exhaust camshaft position sensor side connector terminal No. 3.

NOTE: When measuring with the ECM side connector, disconnect all ECM connectors. Connect the check harness special tool (MB992110) between the separated connectors. Then connect the oscilloscope probe to the check harness connector terminal No. 8 (crankshaft position sensor) and terminal No. 7 (exhaust camshaft position sensor).

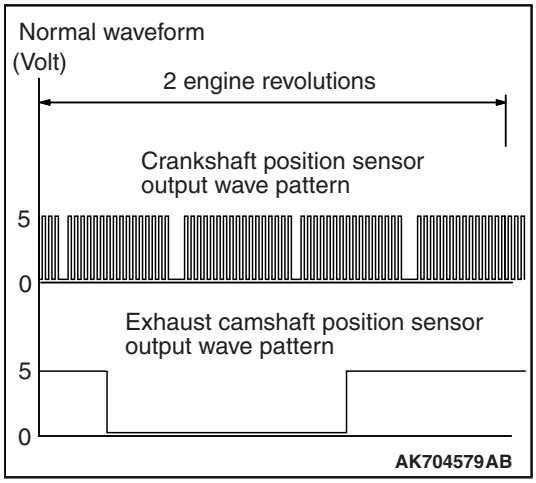
(5) Start the engine and run at idle.



(6) Check the waveform.

- The waveform should show a pattern similar to the illustration.

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



Q: Is the waveform normal?

YES : Go to Step 2.
NO : Go to Step 3.

TSB Revision

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 20 P.13A-11.

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

Q: Is DTC P0017 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 4.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/ Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

STEP 3. Check timing mark on the timing chain.

Q: Is timing chain in out of place?

YES : Repair it. Then initialize the learning value for the elongation of the timing chain. Refer to GROUP 00, Precautions Before Service – Timing Chain Learned Value Reset P.00-55. Then go to Step 4.

NO : Check the following items, and repair or replace the defective items.

a. Check the timing chain loose.

b. Check the exhaust variable valve timing sprocket tooth coming off.

Then initialize the learning value for the elongation of the timing chain. Refer to GROUP 00, Precautions Before Service – Timing Chain Learned Value Reset P.00-55. Then go to Step 4.

STEP 4. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 P.13A-11.

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

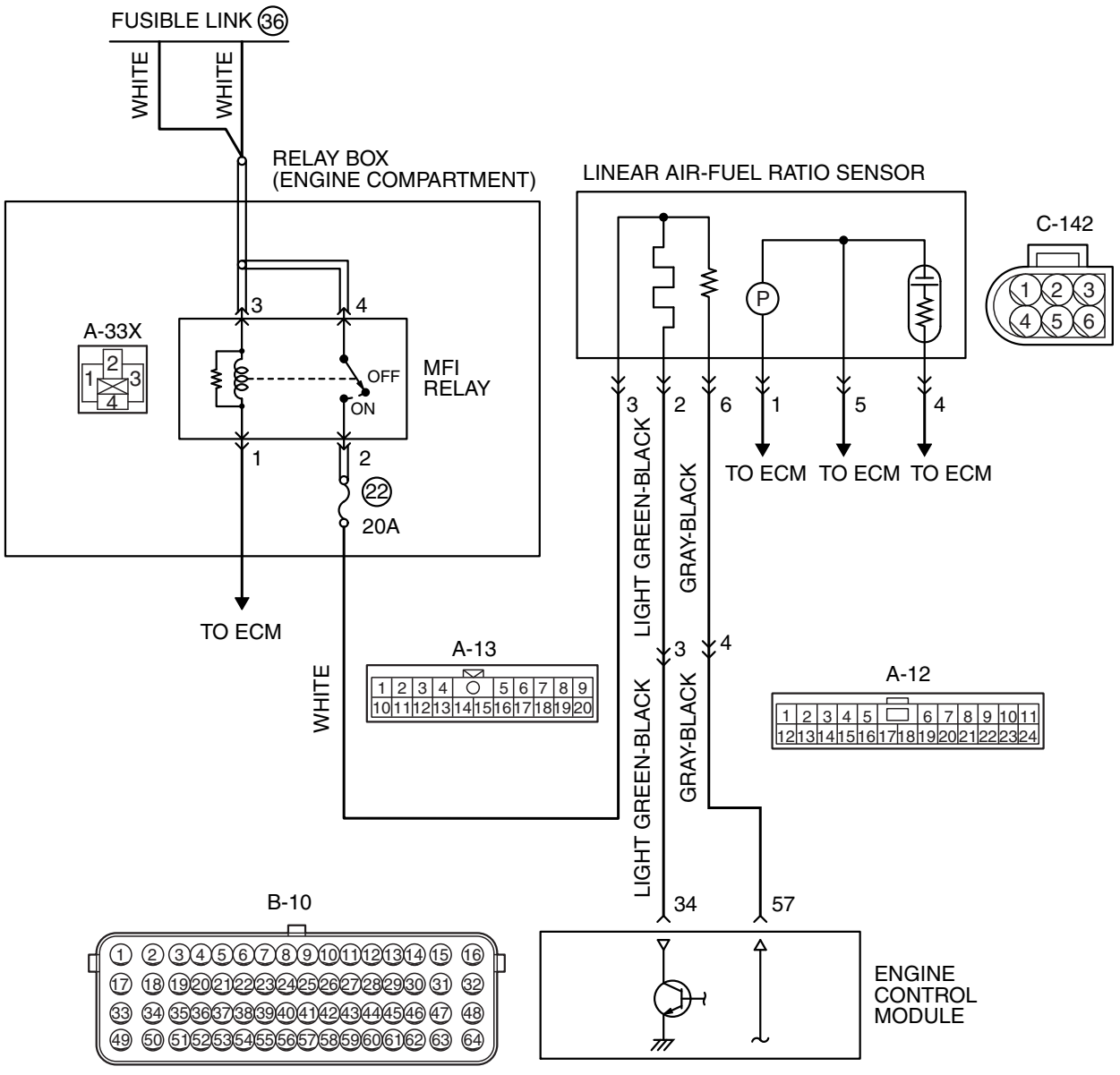
Q: Is DTC P0017 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0031: Linear Air-Fuel Ratio Sensor Heater Control Circuit Low

LINEAR AIR-FUEL RATIO SENSOR HEATER CIRCUIT



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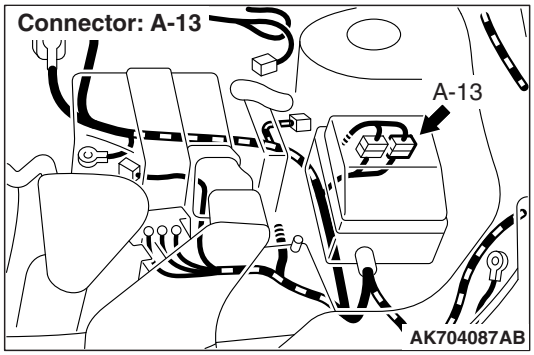
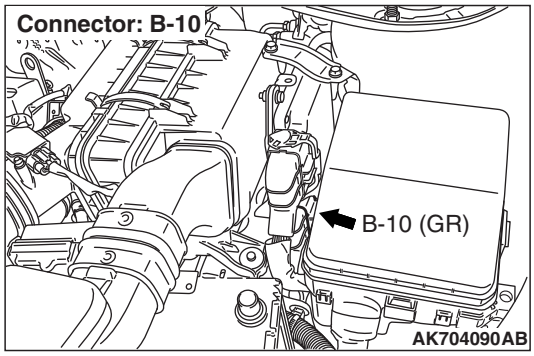
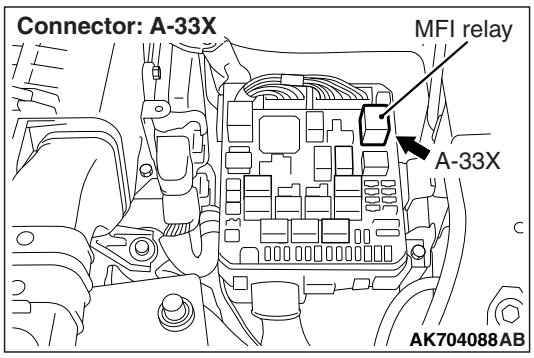
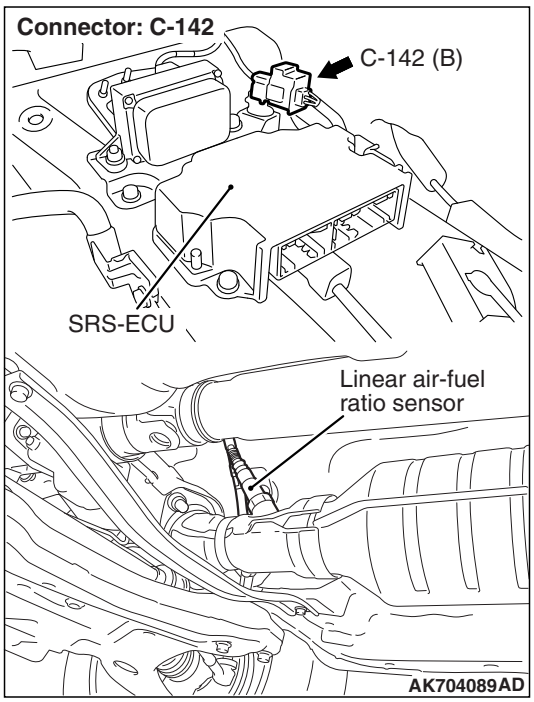








CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the linear air-fuel ratio sensor heater.
- The ECM (terminal No. 34) controls continuity to the linear air-fuel ratio sensor heater by turning the power transistor in the ECM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Linear air-fuel ratio sensor heater current or voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

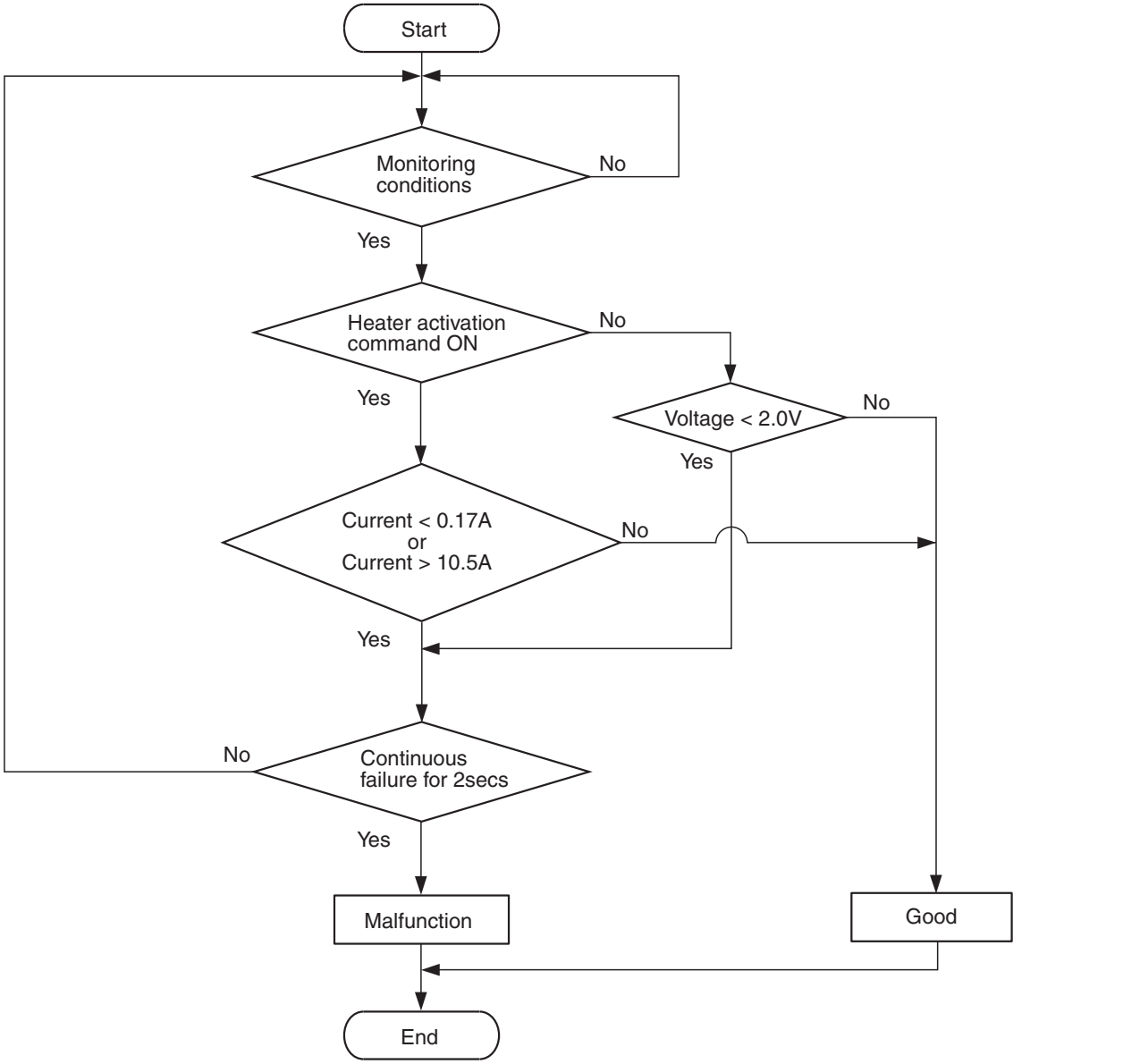
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the linear air-fuel ratio sensor heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The linear air-fuel ratio sensor heater current has continued to be lower than average 0.17 ampere for 2 seconds.

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the linear air-fuel ratio sensor heater is off.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The linear air-fuel ratio sensor heater voltage has continued to be lower than average 2.0 volts for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 P.13A-11.

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

- Open or shorted linear air-fuel ratio sensor heater circuit, harness damage or connector damage.
- Linear air-fuel ratio sensor heater failed.
- ECM failed.

DIAGNOSIS

Required Special Tool:

- MB992110: Power Plant ECU Check Harness

STEP 1. Check harness connector C-142 at linear air-fuel ratio sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

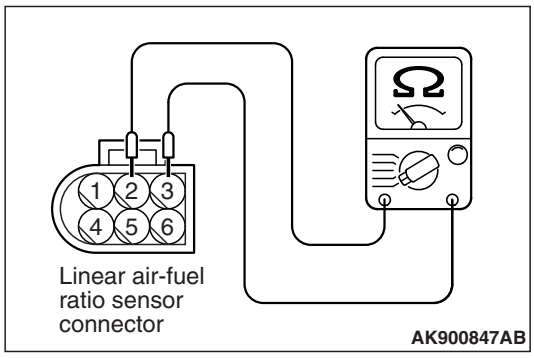
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

STEP 2. Check the linear air-fuel ratio sensor.

(1) Disconnect the linear air-fuel ratio sensor connector C-142.

(2) Measure the resistance between linear air-fuel ratio sensor connector terminal No. 2 and terminal No. 3.

Standard value: 2.3 – 4.2 ohms [at 20°C (68°F)]



Q: Is the measured resistance between 2.3 and 4.2 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the linear air-fuel ratio sensor. Then go to Step 11.

STEP 3. Measure the power supply voltage at linear air-fuel ratio sensor harness side connector C-142.

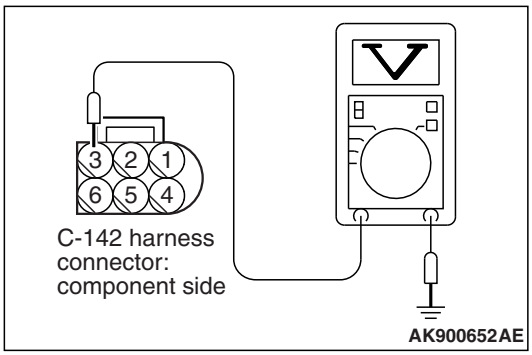
(1) Disconnect the connector C-142 and measure at the harness side.

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

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

- Voltage should be battery positive voltage.

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



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

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check harness connector A-33X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector A-33X (terminal No. 2) and linear air-fuel ratio sensor connector C-142 (terminal No. 3) because of open circuit or short circuit to ground. Then go to Step 11.

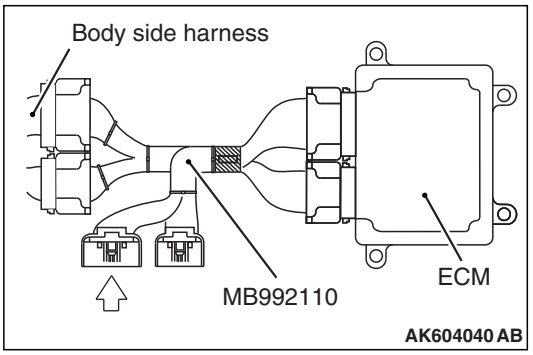
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

STEP 5. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

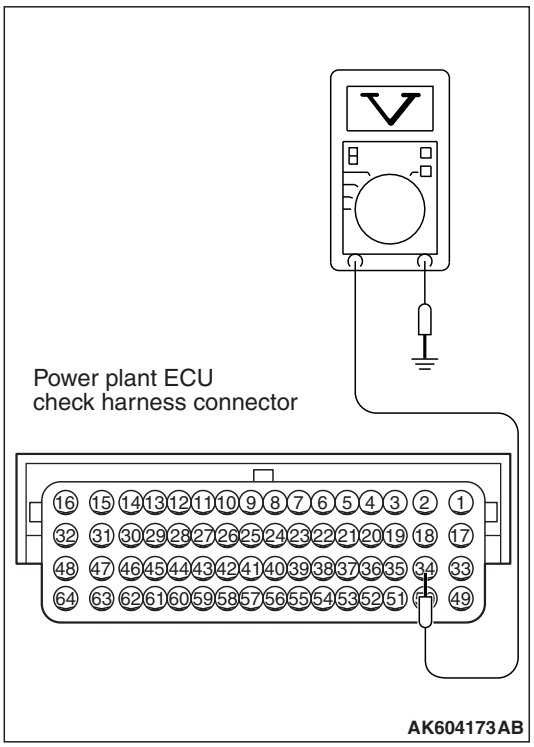
YES : Go to Step 6.

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



STEP 6. Measure the power supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 34 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 7.

NO : Check harness connector A-13 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If intermediate connector is in good condition, repair harness wire between linear air-fuel ratio sensor connector C-142 (terminal No. 2) and ECM connector B-10 (terminal No. 34) because of open circuit or short circuit to ground. Then go to Step 11.

STEP 7. Check harness connector A-33X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

STEP 8. Check for harness damage between MFI relay connector A-33X (terminal No. 2) and linear air-fuel ratio sensor connector C-142 (terminal No. 3).

Q: Is the harness wire in good condition?

YES : Go to Step 9.

NO : Repair it. Then go to Step 11.

STEP 9. Check for harness damage between linear air-fuel ratio sensor connector C-142 (terminal No. 2) and ECM connector B-10 (terminal No. 34).

NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

Q: Is the harness wire in good condition?

YES : Go to Step 10.
NO : Repair it. Then go to Step 11.

STEP 10. 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.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0031 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 11.
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.00-15.

STEP 11. Test the OBD-II drive cycle.

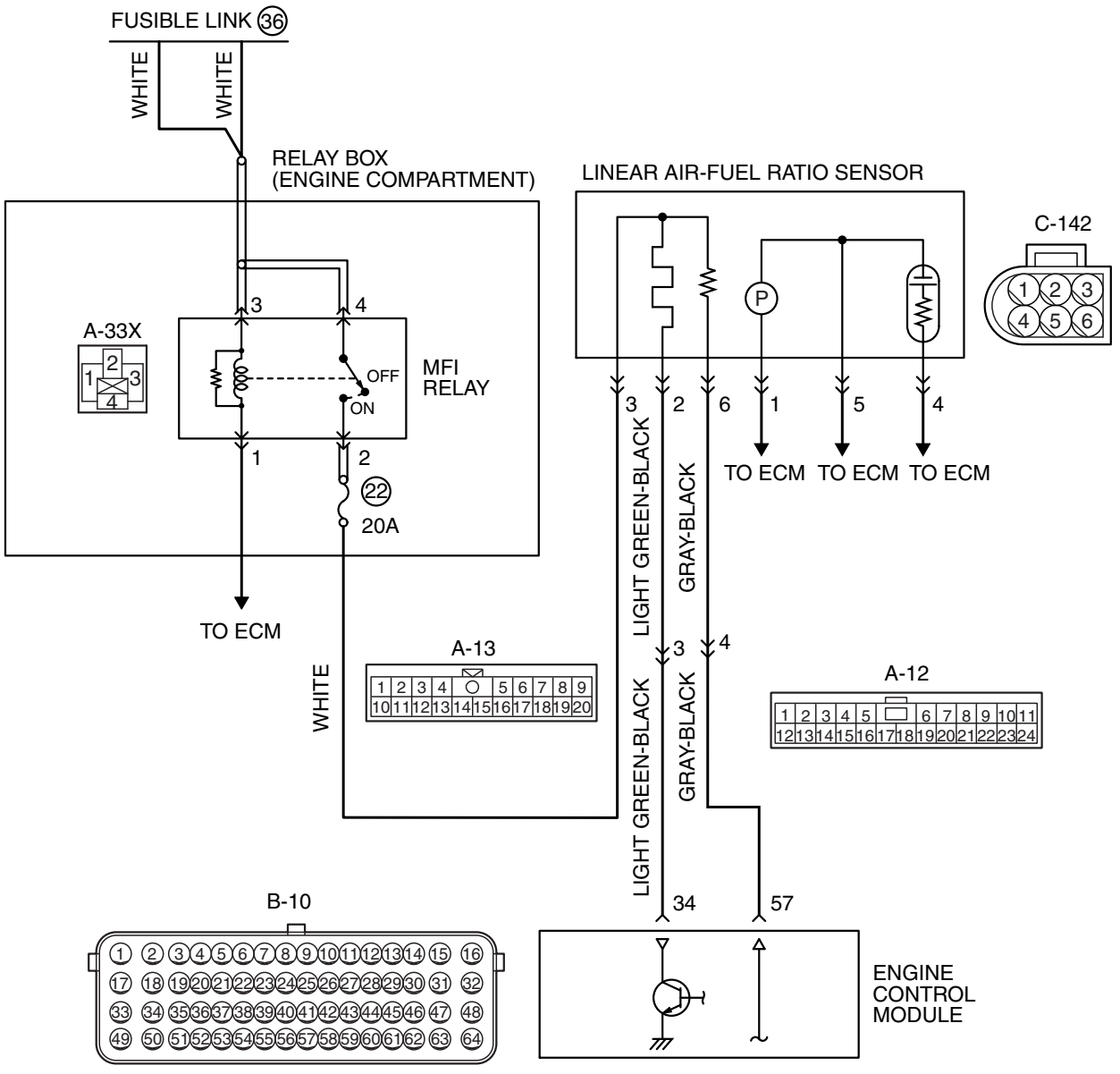
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0031 set?

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

DTC P0032: Linear Air-Fuel Ratio Sensor Heater Control Circuit High

LINEAR AIR-FUEL RATIO SENSOR HEATER CIRCUIT



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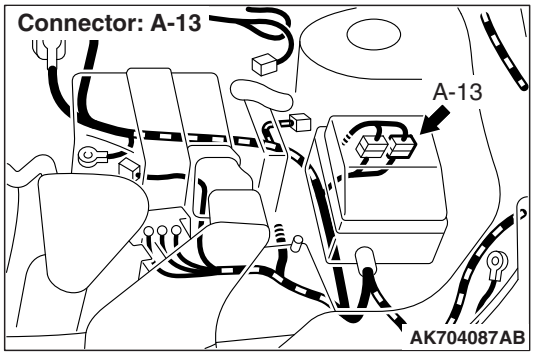
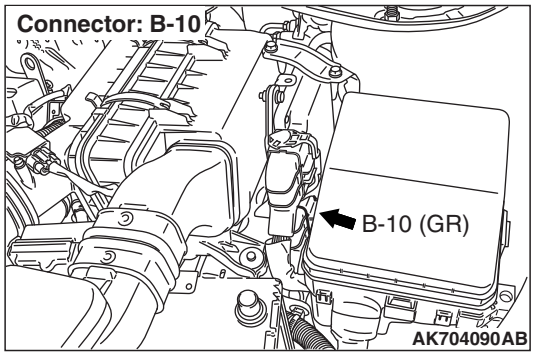
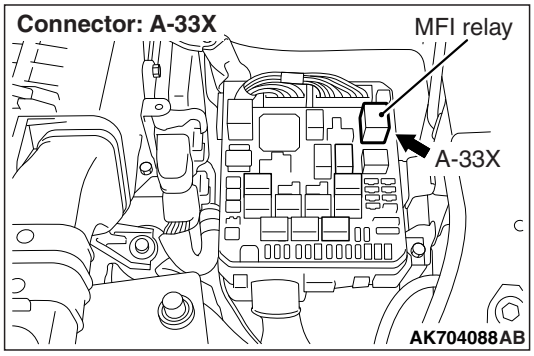
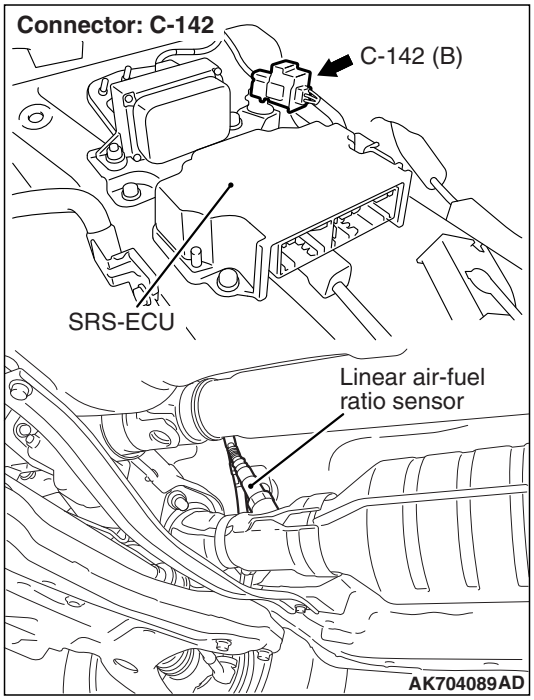








CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the linear air-fuel ratio sensor heater.
- The ECM (terminal No. 34) controls continuity to the linear air-fuel ratio sensor heater by turning the power transistor in the ECM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Linear air-fuel ratio sensor heater current is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

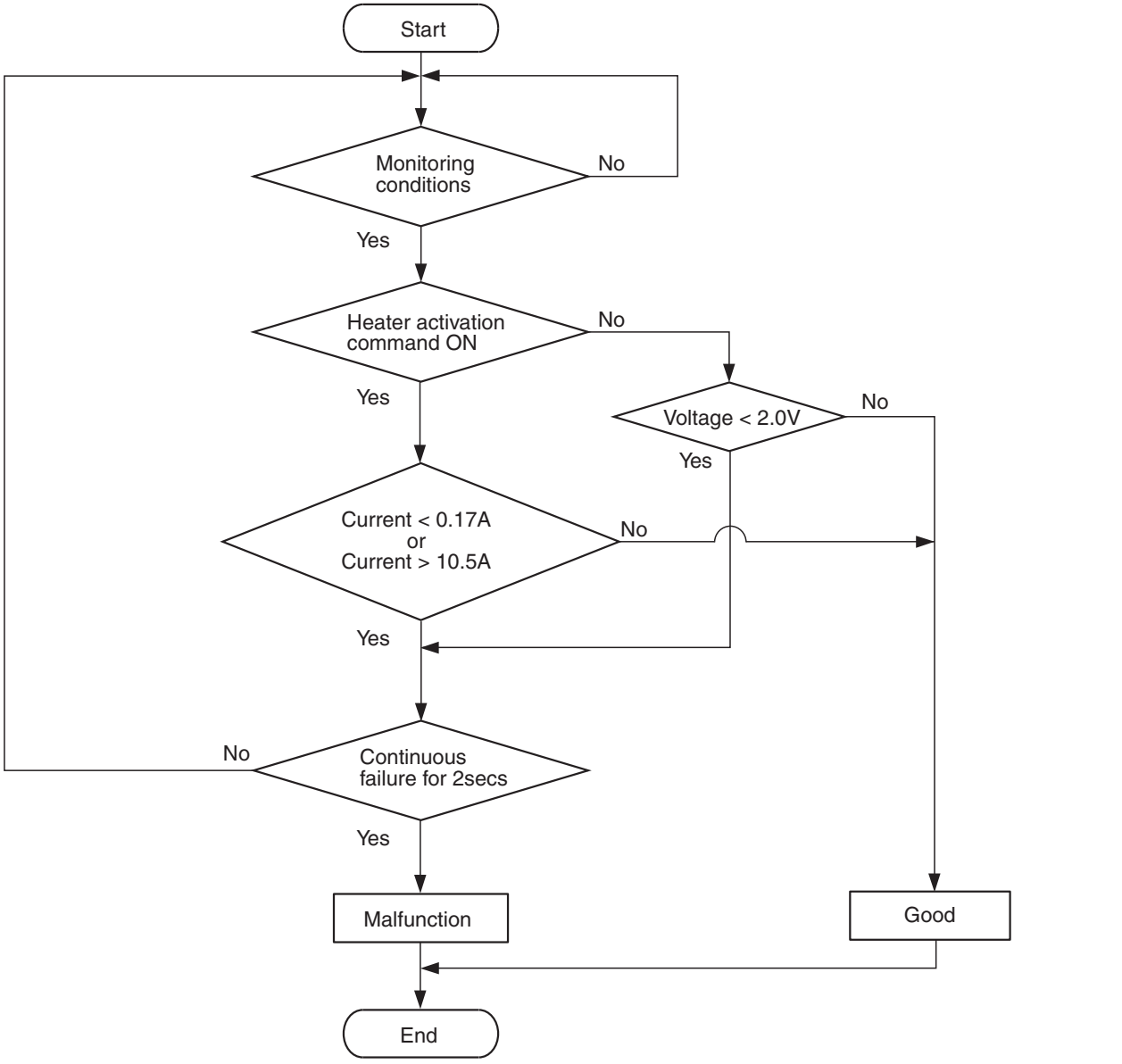
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the linear air-fuel ratio sensor heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The linear air-fuel ratio sensor heater current has continued to be higher than average 10 amperes for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 P.13A-11.

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

- Shorted linear air-fuel ratio sensor heater circuit or connector damage.
- Linear air-fuel ratio sensor heater failed.
- ECM failed.

TSB Revision

DIAGNOSIS

STEP 1. Check harness connector C-142 at linear air-fuel ratio sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

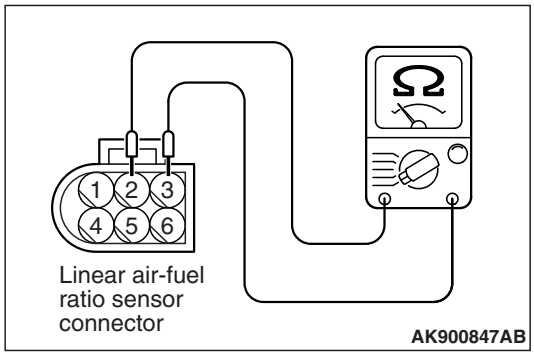
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

STEP 2. Check the linear air-fuel ratio sensor.

(1) Disconnect the linear air-fuel ratio sensor connector C-142.

(2) Measure the resistance between linear air-fuel ratio sensor connector terminal No. 2 and terminal No. 3.

Standard value: 2.3 – 4.2 ohms [at 20°C (68°F)]



Q: Is the measured resistance between 2.3 and 4.2 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the linear air-fuel ratio sensor. Then go to Step 8.

STEP 3. Check harness connector A-33X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

STEP 4. Check for short circuit to power supply between MFI relay connector A-33X (terminal No. 2) and linear air-fuel ratio sensor connector C-142 (terminal No. 3).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 8.

STEP 5. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

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

STEP 6. Check for short circuit to power supply between linear air-fuel ratio sensor connector C-142 (terminal No. 2) and ECM connector B-10 (terminal No. 34).

NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

Q: Is the harness wire in good condition?

YES : Go to Step 7.
NO : Repair it. Then go to Step 8.

STEP 7. 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.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0032 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 8.
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.00-15.

STEP 8. Test the OBD-II drive cycle.

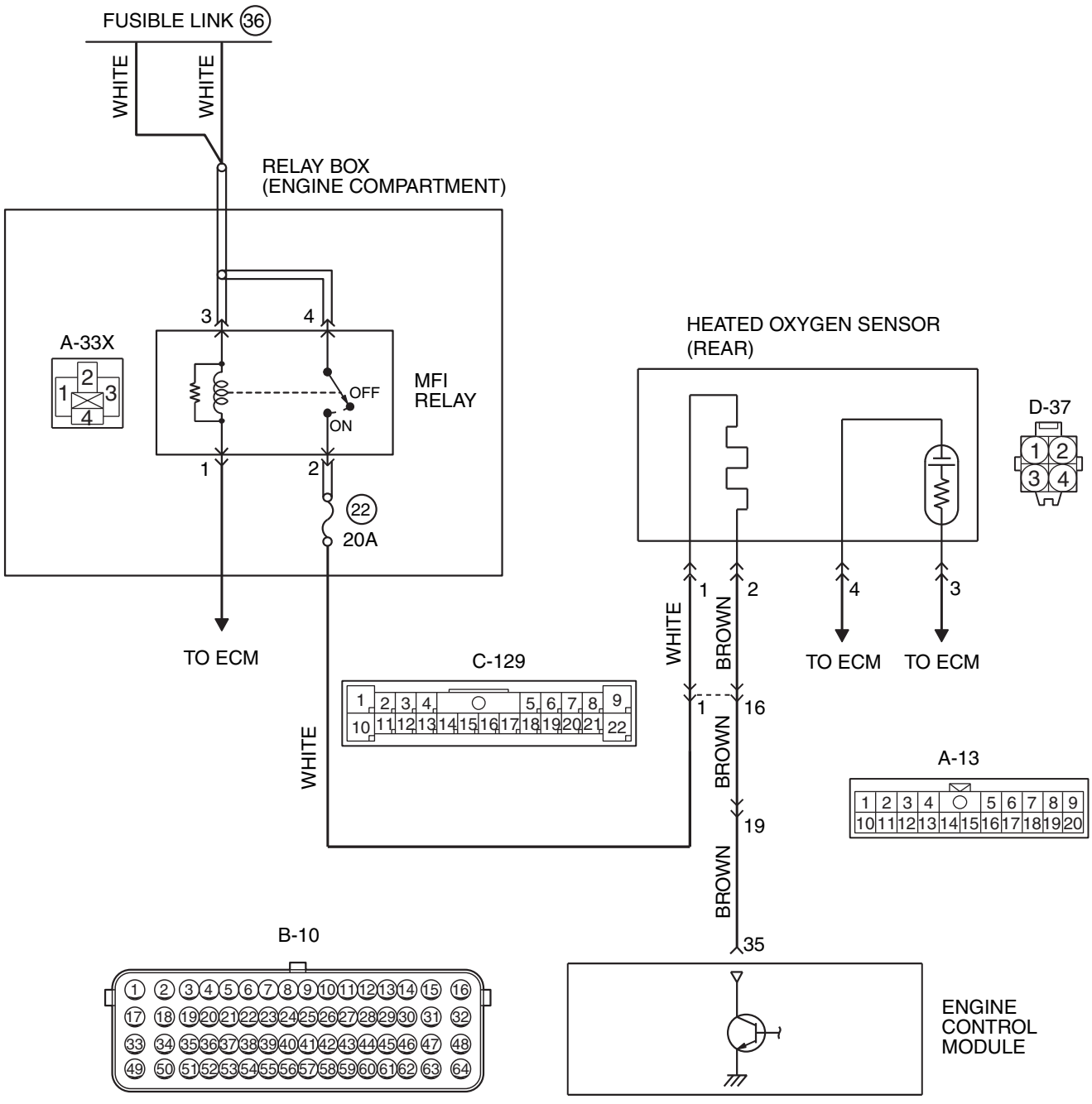
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0032 set?

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

DTC P0037: Heated Oxygen Sensor (rear) Heater Control Circuit Low

HEATED OXYGEN SENSOR (REAR) HEATER CIRCUIT



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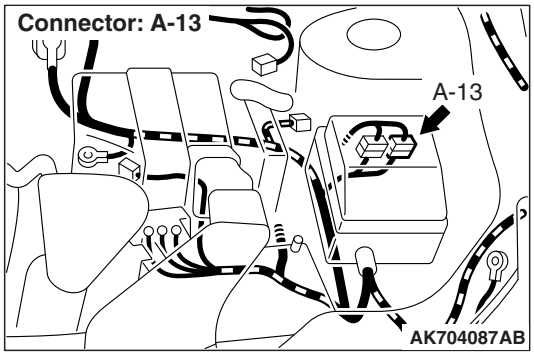
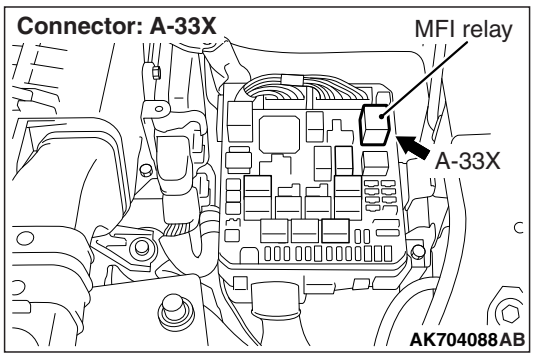
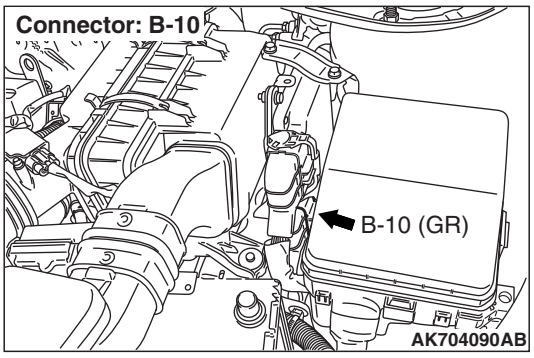
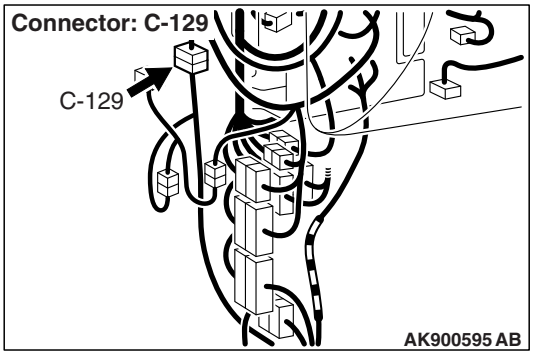
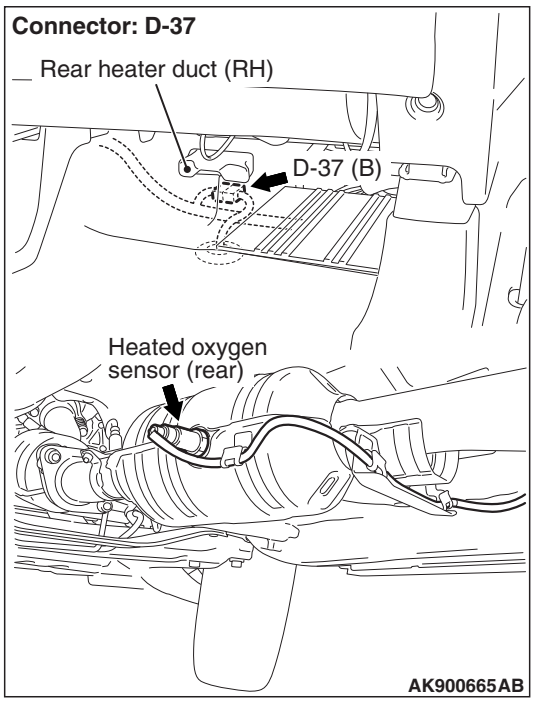
TSB Revision











CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the heated oxygen sensor (rear) heater.
- The ECM (terminal No. 35) controls continuity to the heated oxygen sensor (rear) heater by turning the power transistor in the ECM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Heated oxygen sensor (rear) heater current or voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

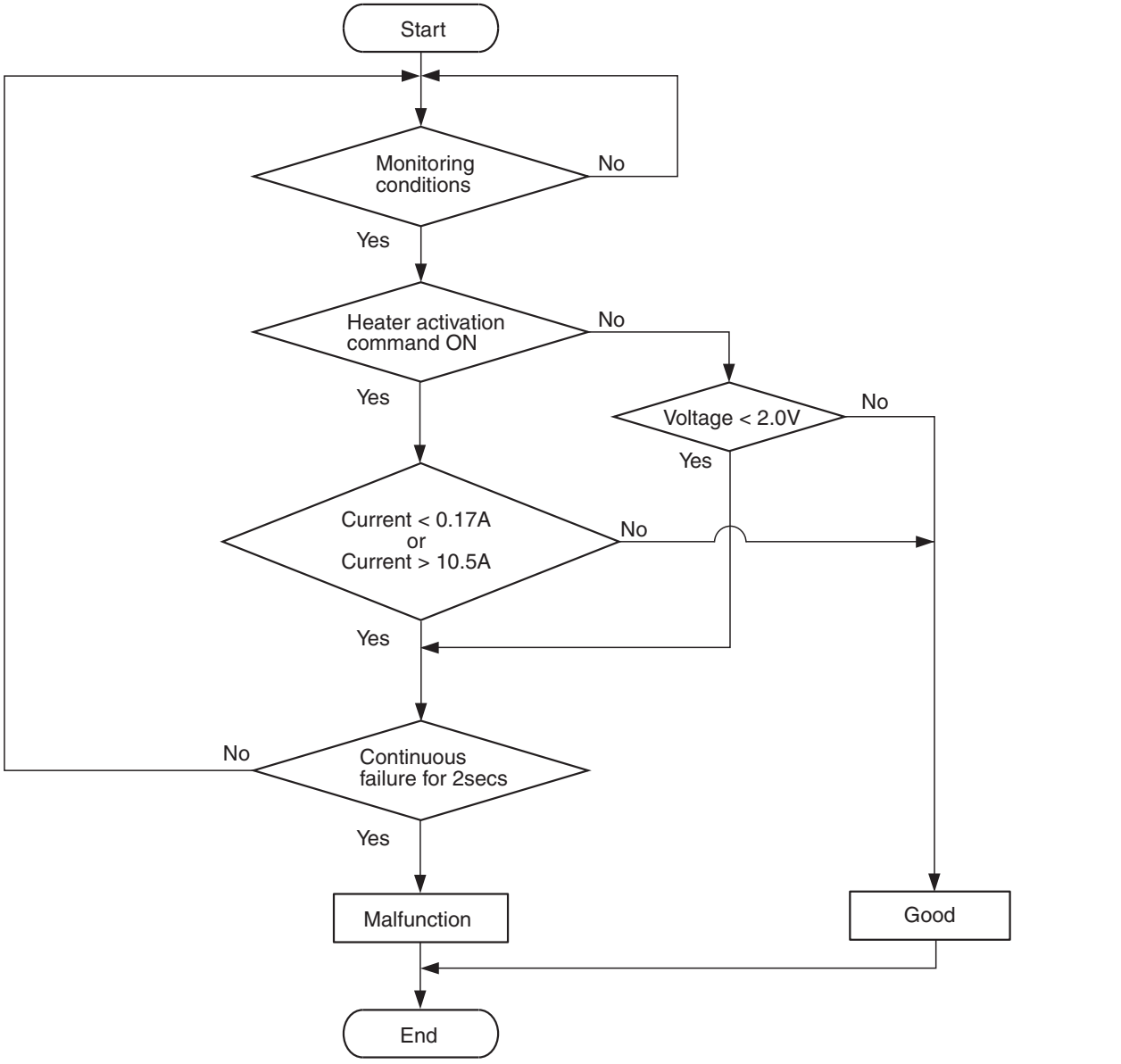
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



Check Conditions

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

Judgement Criterion

- The 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 heated oxygen sensor (rear) heater is off.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

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

TSB Revision

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 P.13A-11.

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

- Open or shorted heated oxygen sensor (rear) heater circuit, harness damage, or connector damage.
- Heated oxygen sensor (rear) heater failed.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991658: Test Harness
- MB992110: Power Plant ECU Check Harness

STEP 1. Check harness connector D-37 at the heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

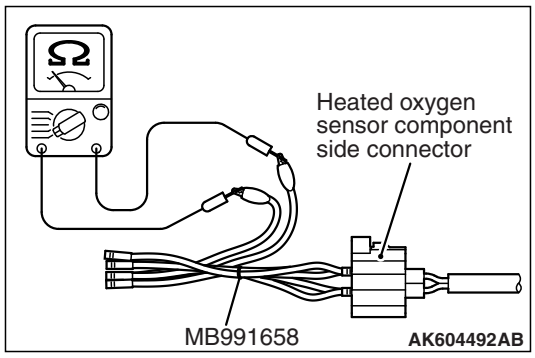
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

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

(1) Disconnect heated oxygen sensor (rear) connector D-37 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (rear) side.

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

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 heated oxygen sensor (rear). Then go to Step 11.

STEP 3. Measure the power supply voltage at heated oxygen sensor (rear) harness side connector D-37.

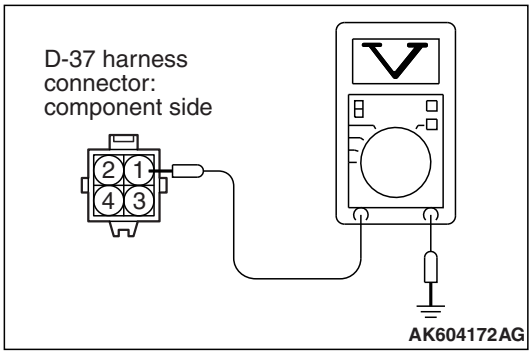
(1) Disconnect the connector D-37 and measure at the harness side.

(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.

TSB Revision

STEP 4. Check harness connector A-33X at the MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector C-129 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If intermediate connector is in good condition, repair harness wire between MFI relay connector A-33X (terminal No. 2) and heated oxygen sensor (rear) connector D-37 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 11.

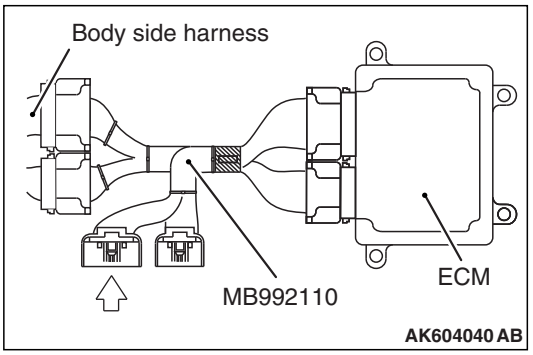
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

STEP 5. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

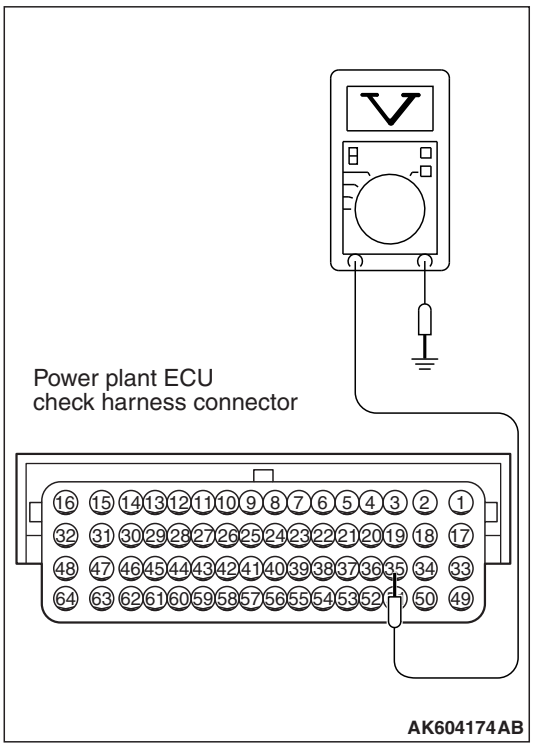
YES : Go to Step 6.

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



STEP 6. Measure the power supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 35 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 7.

STEP 7. Check for open circuit and short circuit to ground between heated oxygen sensor (rear) connector D-37 (terminal No. 2) and ECM connector B-10 (terminal No. 35).

NOTE: Check harness after checking intermediate connectors C-129 and A-13. If intermediate connectors are damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 11.
NO : Repair it. Then go to Step 11.

TSB Revision

STEP 8. Check for harness damage between MFI relay connector A-33X (terminal No. 2) and heated oxygen sensor (rear) connector D-37 (terminal No. 1).

NOTE: Check harness after checking intermediate connector C-129. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

Q: Is the harness wire in good condition?

YES : Go to Step 9.
NO : Repair it. Then go to Step 11.

STEP 9. Check for harness damage between heated oxygen sensor (rear) connector D-37 (terminal No. 2) and ECM connector B-10 (terminal No. 35).

NOTE: Check harness after checking intermediate connectors C-129 and A-13. If intermediate connectors are damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

Q: Is the harness wire in good condition?

YES : Go to Step 10.
NO : Repair it. Then go to Step 11.

STEP 10. 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.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0037 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 11.
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.00-15.

STEP 11. Test the OBD-II drive cycle.

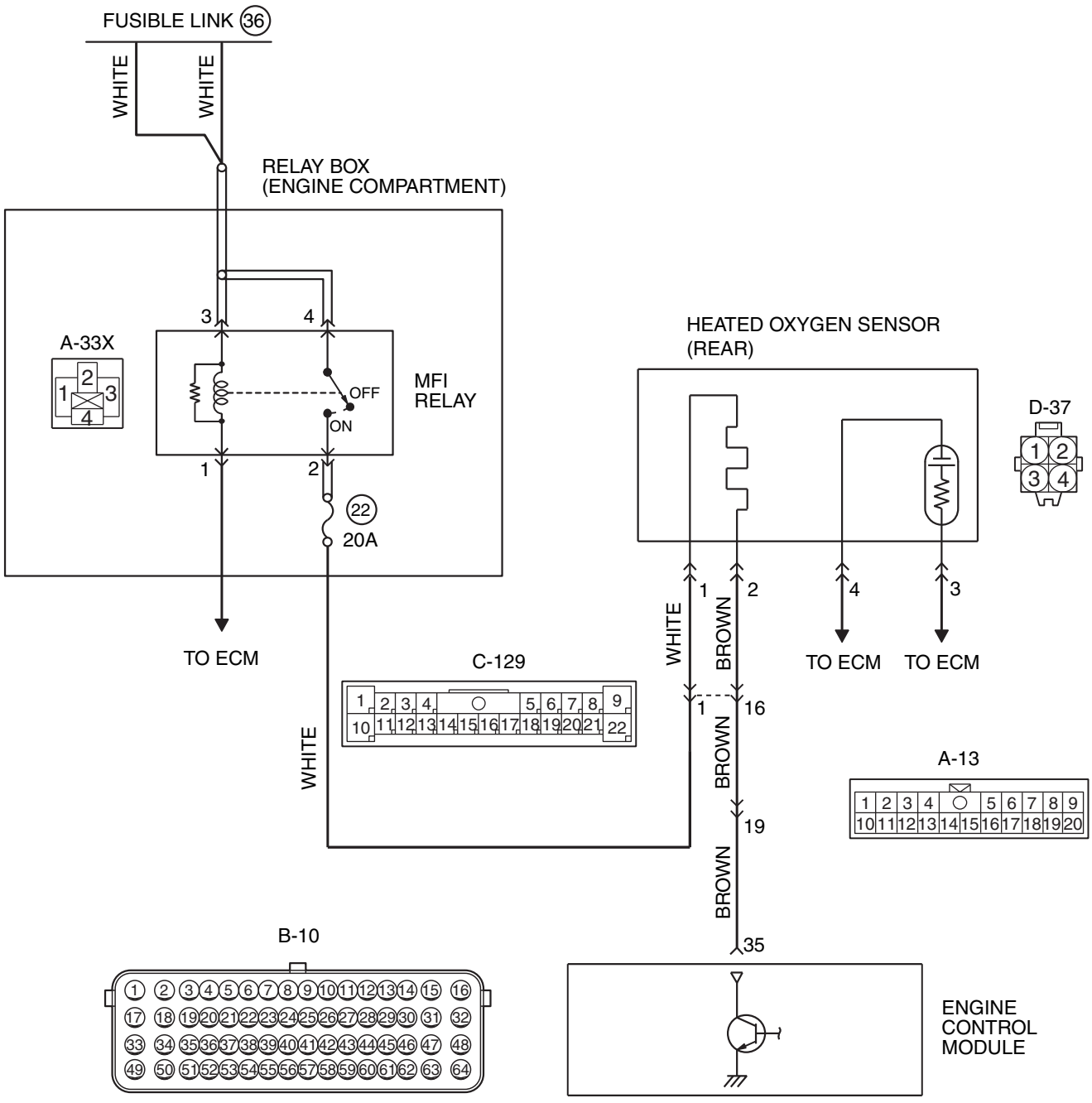
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0037 set?

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

DTC P0038: Heated Oxygen Sensor (rear) Heater Control Circuit High

HEATED OXYGEN SENSOR (REAR) HEATER CIRCUIT



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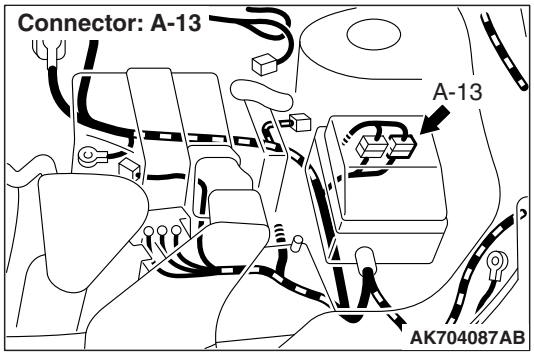
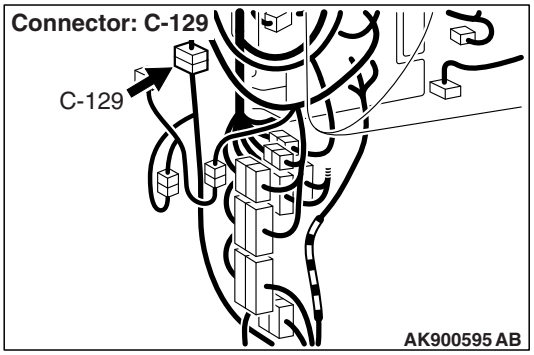
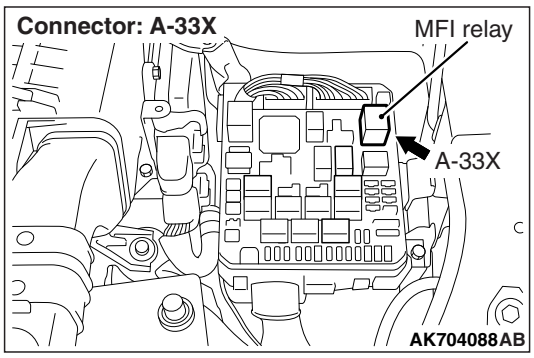
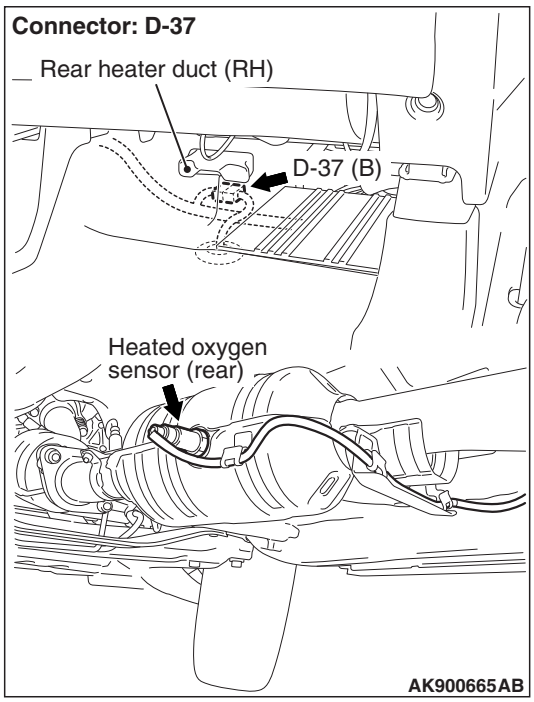
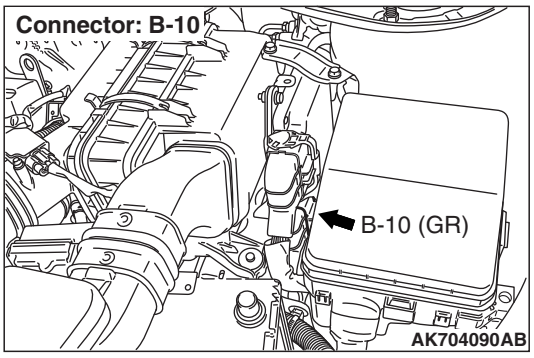










CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the heated oxygen sensor (rear) heater.
- The ECM (terminal No. 35) controls continuity to the heated oxygen sensor (rear) heater by turning the power transistor in the ECM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

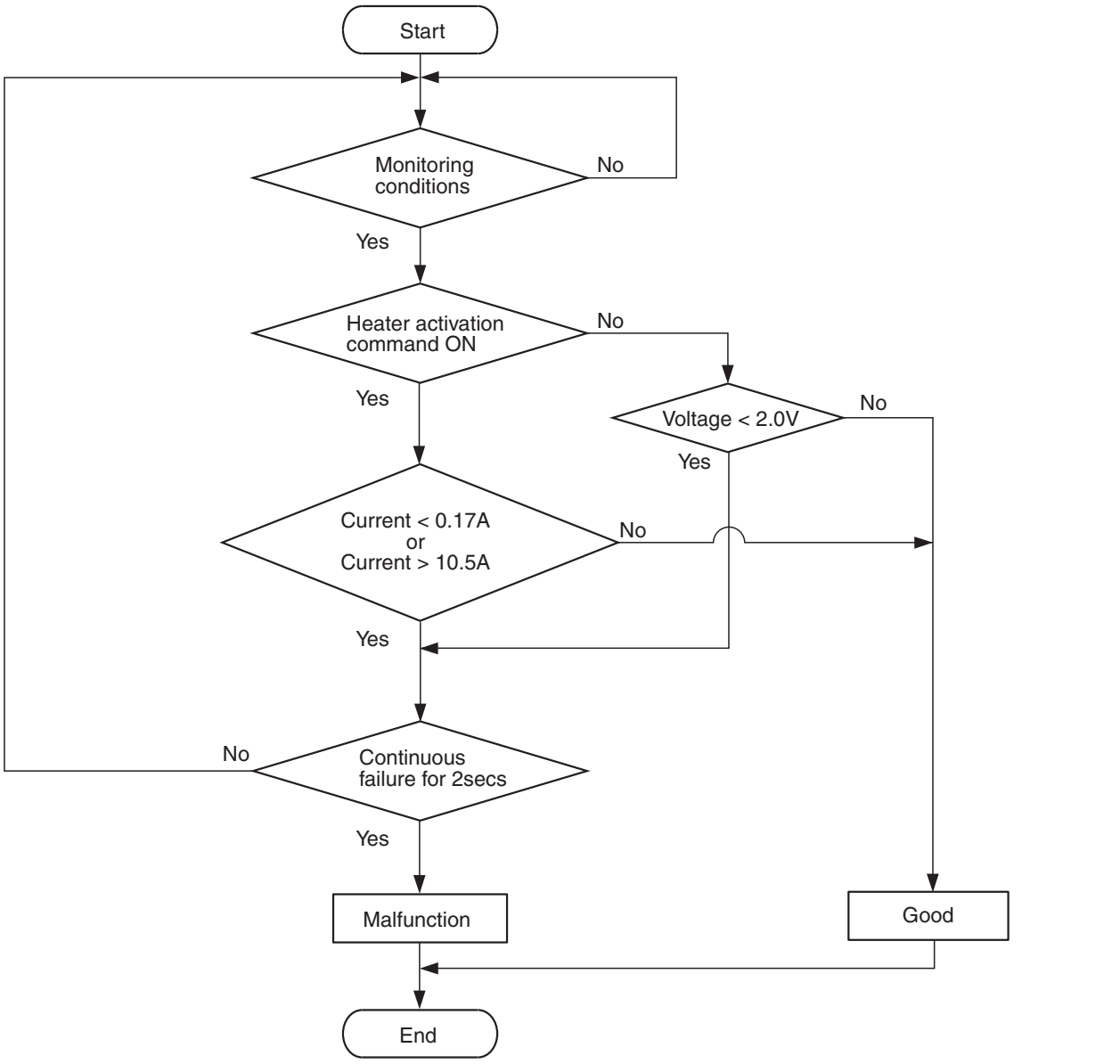
Sensor (The sensor below is determined to be normal)

- Not applicable

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 heated oxygen sensor (rear) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 P.13A-11.

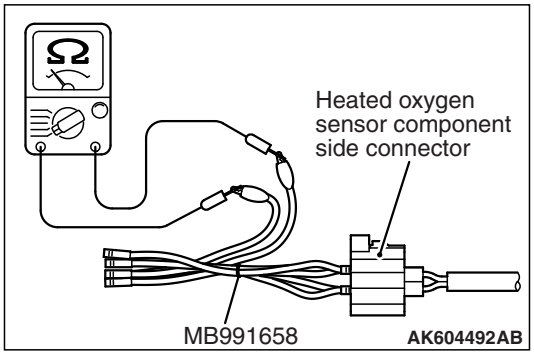
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (rear) failed.
- ECM failed.

TSB Revision

DIAGNOSIS

Required Special Tool:
- MB991658: Test Harness



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

(1) Disconnect heated oxygen sensor (rear) connector D-37 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (rear) side.

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

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 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.13A-11.

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

Q: Is DTC P0038 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 3.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

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.13A-11.

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

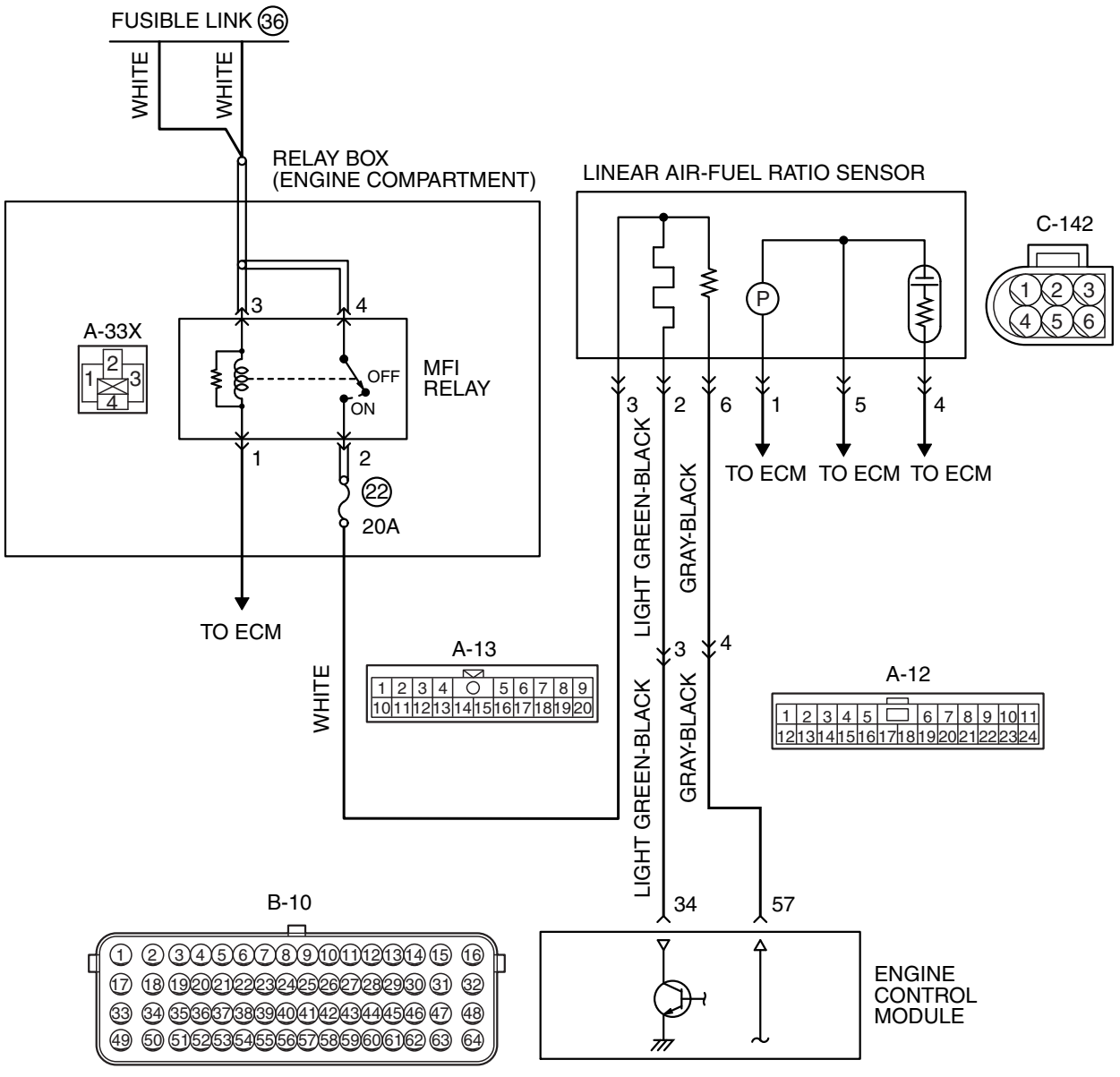
Q: Is DTC P0038 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0053: Linear Air-Fuel Ratio Sensor Heater Resistance

LINEAR AIR-FUEL RATIO SENSOR HEATER CIRCUIT



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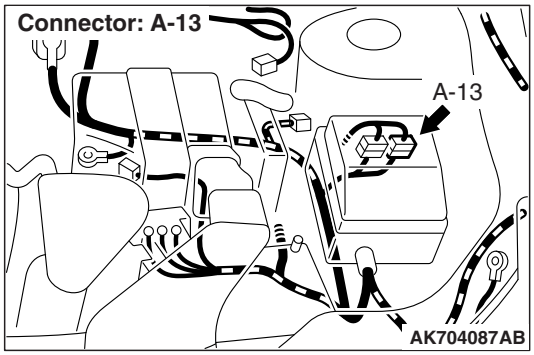
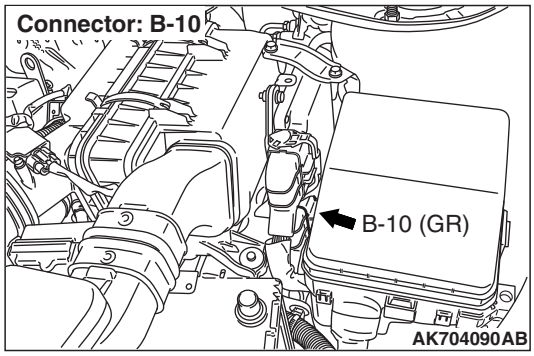
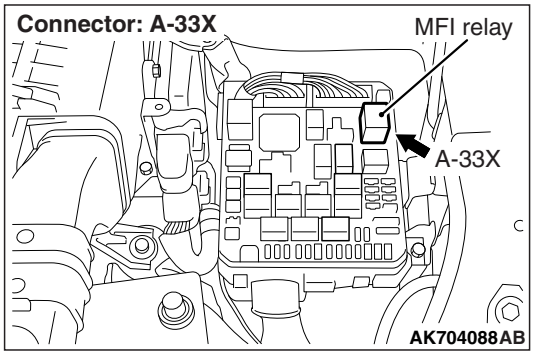
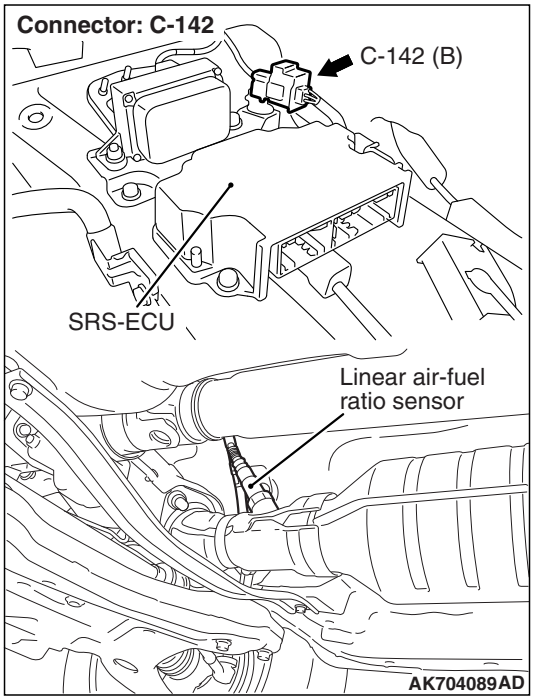








CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the linear air-fuel ratio sensor heater.
- The ECM (terminal No. 34) controls continuity to the linear air-fuel ratio sensor heater by turning the power transistor in the ECM "ON" and "OFF".

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Linear air-fuel ratio sensor heater current is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

- Not applicable

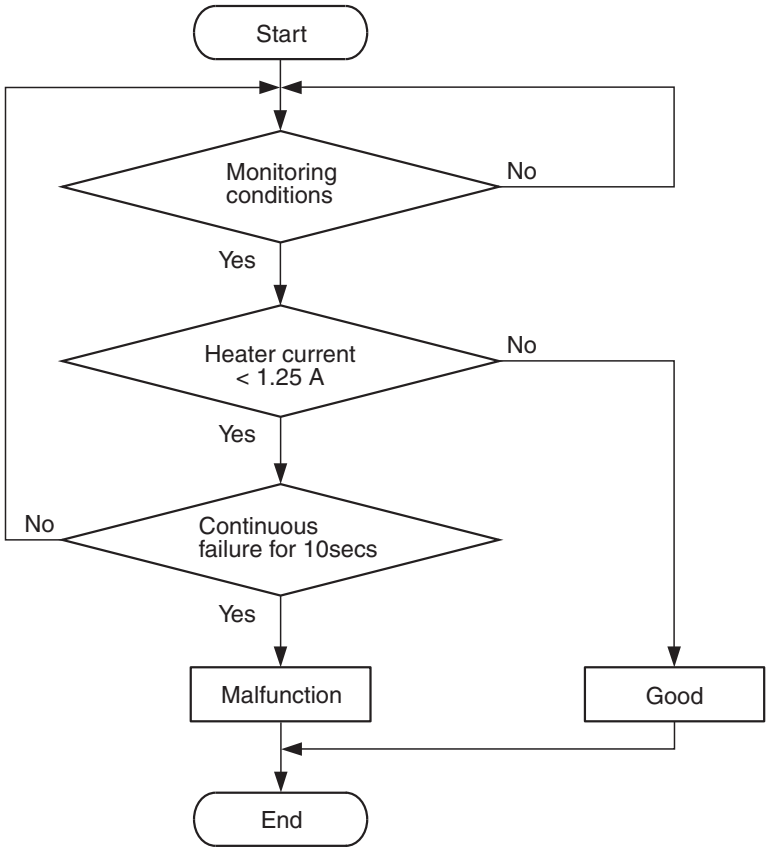
Sensor (The sensor below is determined to be normal)

- Not applicable

TSB Revision

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

- More than 220 seconds have passed since the engine starting sequence was completed.
- While the linear air-fuel ratio sensor heater is on.
- Battery positive voltage is between 11 and 16.5 volts.
- Intake air temperature is more than −10°C (14°F).
- On duty cycle of the linear air-fuel ratio sensor heater is between 3 and 97 percent.

Judgement Criterion

- The linear air-fuel ratio sensor heater current has continued to be lower than average 1.25 ampere for 10 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.

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

- Linear air-fuel ratio sensor circuit harness damage or connector damage.
- Linear air-fuel ratio sensor heater failed.
- ECM failed.

TSB Revision

DIAGNOSIS

STEP 1. Check harness connector C-142 at linear air-fuel ratio sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

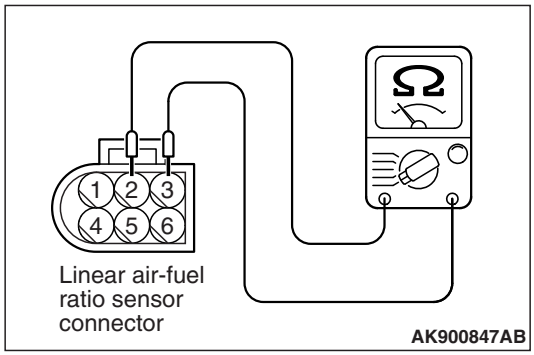
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

STEP 2. Check the linear air-fuel ratio sensor.

(1) Disconnect the linear air-fuel ratio sensor connector C-142.

(2) Measure the resistance between linear air-fuel ratio sensor connector terminal No. 2 and terminal No. 3.

Standard value: 2.3 – 4.2 ohms [at 20°C (68°F)]



Q: Is the measured resistance between 2.3 and 4.2 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the linear air-fuel ratio sensor. Then go to Step 8.

STEP 3. Check harness connector A-33X at the MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

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

STEP 4. Check for harness damage between MFI relay connector A-33X (terminal No. 2) and linear air-fuel ratio sensor connector C-142 (terminal No. 3).

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 8.

STEP 5. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

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

STEP 6. Check for harness damage between linear air-fuel ratio sensor connector C-142 (terminal No. 2) and ECM connector B-10 (terminal No. 34).

NOTE: Check harness after checking intermediate connector A-13. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

Q: Is the harness wire in good condition?

YES : Go to Step 7.
NO : Repair it. Then go to Step 8.

STEP 7. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0053 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 8.
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.00-15.

STEP 8. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0053 set?

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

DTC P0068: Mass Airflow Sensor Plausibility

TECHNICAL DESCRIPTION

Compare the actual measurement of volumetric efficiency by a mass airflow sensor signal with volumetric efficiency estimated from a throttle position sensor (main or sub) signal.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

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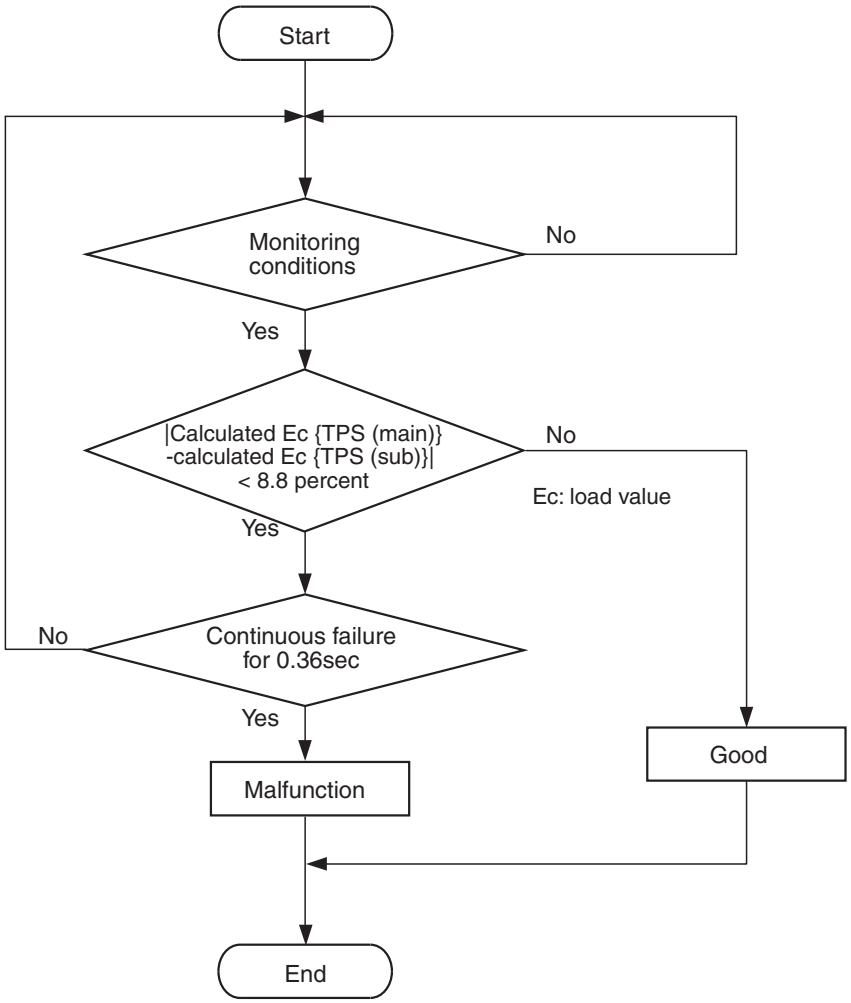
DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

- The plausibility error of the throttle position sensor (main) is detected.
- The plausibility error of the throttle position sensor (sub) is detected.

Judgment Criterion

- For 0.36 second, the difference between the volumetric efficiency estimated by the throttle position sensor (main) and the volumetric efficiency estimated by the throttle position sensor (sub) is 8.8 percent or less.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle Pattern 17 P.13A-11.

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

- Mass airflow sensor system failed.
- ECM failed.

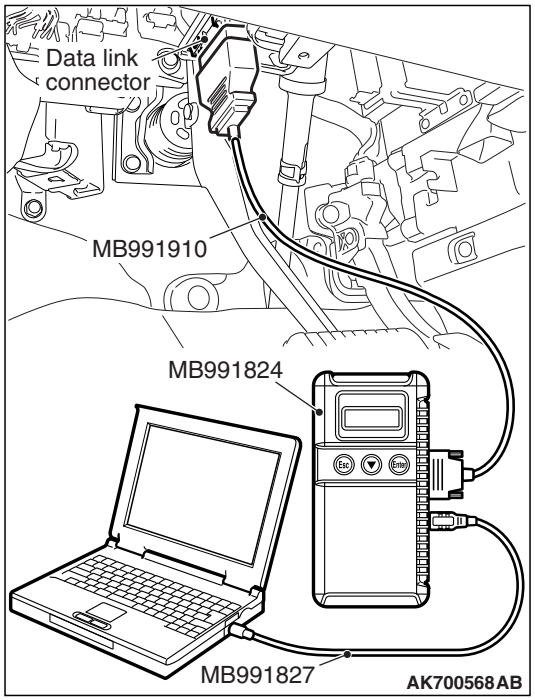
TSB Revision

DIAGNOSIS

Required Special Tools:

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

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



⚠ CAUTION

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

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

Q: Is the diagnostic trouble code other than P0068 set?

YES : Refer to, Diagnostic Trouble Code Chart P.13A-49.
NO : Go to Step 2.

STEP 2. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.

(1) Start the engine and run at idle.
(2) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
(3) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
  - The standard value during idling should be between 1,350 and 1,670 millivolts.
  - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 3.
NO : Refer to, DTC P0101 – Mass Airflow Circuit Range/Performance Problem P.13A-121, DTC P0102 – Mass Airflow Circuit Low Input P.13A-127, DTC P0103 – Mass Airflow Circuit High Input P.13A-134.

STEP 3. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle Pattern 17 P.13A-11.

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

Q: Is DTC P0068 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 4.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

STEP 4. 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 17 P.13A-11.

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

Q: Is DTC P0068 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

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

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

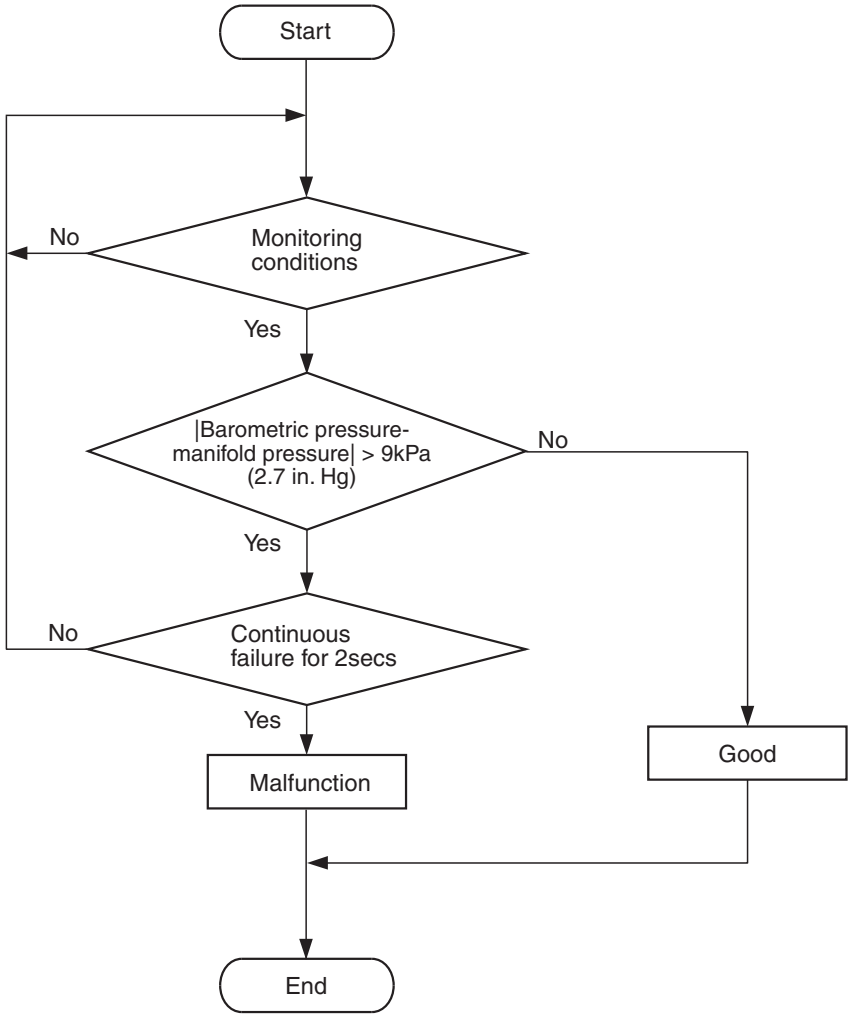
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor
- Manifold absolute pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

None.

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

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

DIAGNOSIS

Required Special Tools

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

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

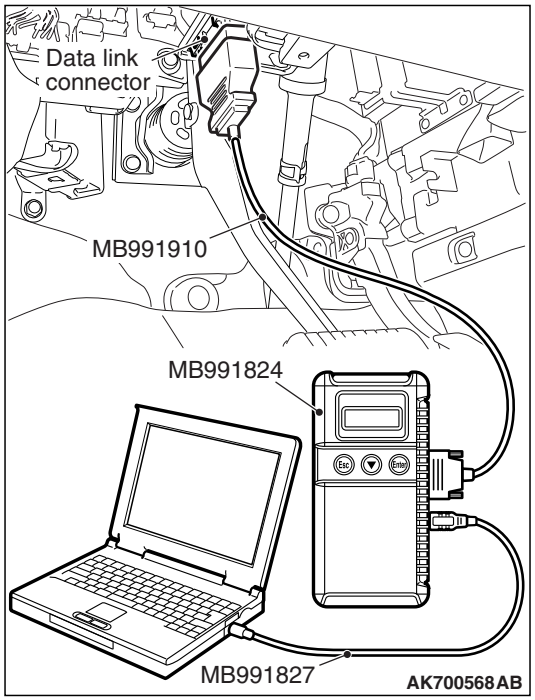
⚠ CAUTION

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

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

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

YES : Refer to, Diagnostic Trouble Code Chart P.13A-49.
NO : Go to Step 2.



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

(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

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

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

Q: Is the sensor operating properly?

YES : Go to Step 3.
NO : Refer to, DTC P0106 – Manifold Absolute Pressure Circuit Range/Performance Problem P.13A-139, DTC P0107 – Manifold Absolute Pressure Circuit Low Input P.13A-148, DTC P0108 – Manifold Absolute Pressure Circuit High Input P.13A-156.

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

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

Q: Is DTC P0069 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 4.
NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

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

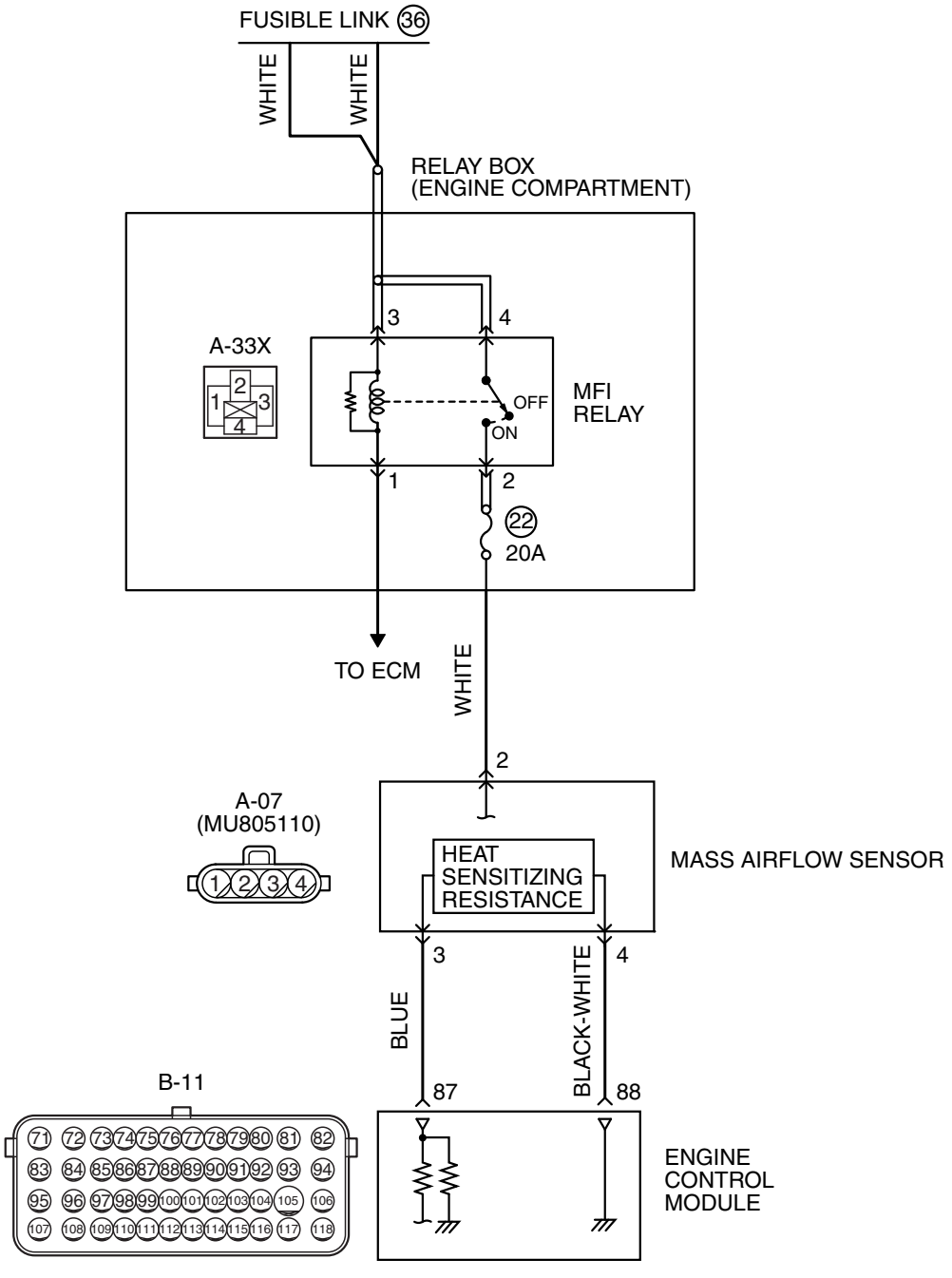
(1) Turn the ignition switch to the "ON" position.
(2) Erase the DTC.
(3) Start the engine.
(4) Turn the ignition switch to "LOCK" (OFF) position and then wait 2 seconds.
(5) Turn the ignition switch to the "ON" position.
(6) Set scan tool MB991958, read the DTC.
(7) Turn the ignition switch to the "LOCK"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

Q: Is DTC P0069 set?

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

DTC P0101: Mass Airflow Circuit Range/Performance Problem

MASS AIRFLOW SENSOR CIRCUIT



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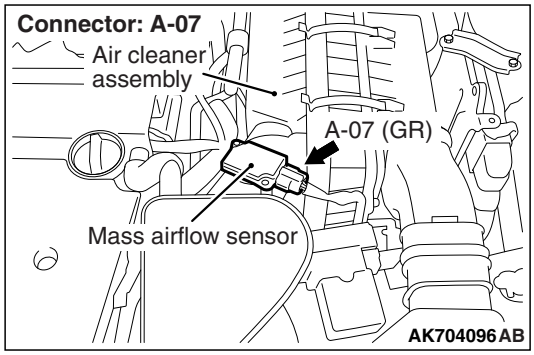
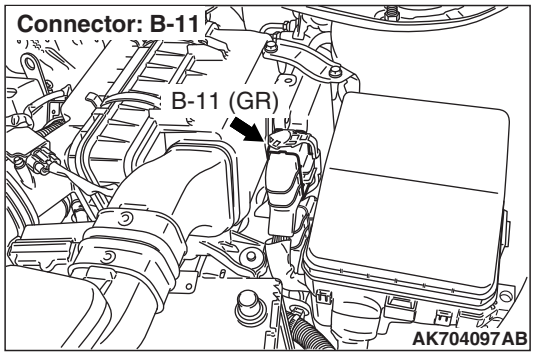
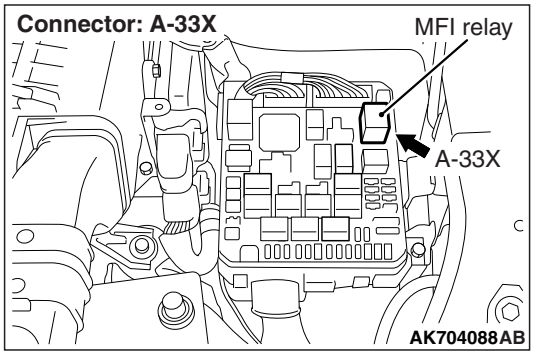






CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 2), and the ground is provided on the ECM (terminal No. 88).
- A voltage that is according to the mass airflow rate is sent to the ECM (terminal No. 87) from the mass airflow sensor output terminal (terminal No. 3).

TECHNICAL DESCRIPTION

- While the engine is running, the mass airflow sensor outputs electric current which corresponds to the mass airflow rate.
- The ECM converts the electric current into the voltage and checks whether the voltage is within a specified range while the engine is running.

DESCRIPTIONS OF MONITOR METHODS

Compare load value with mass airflow sensor output voltage.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

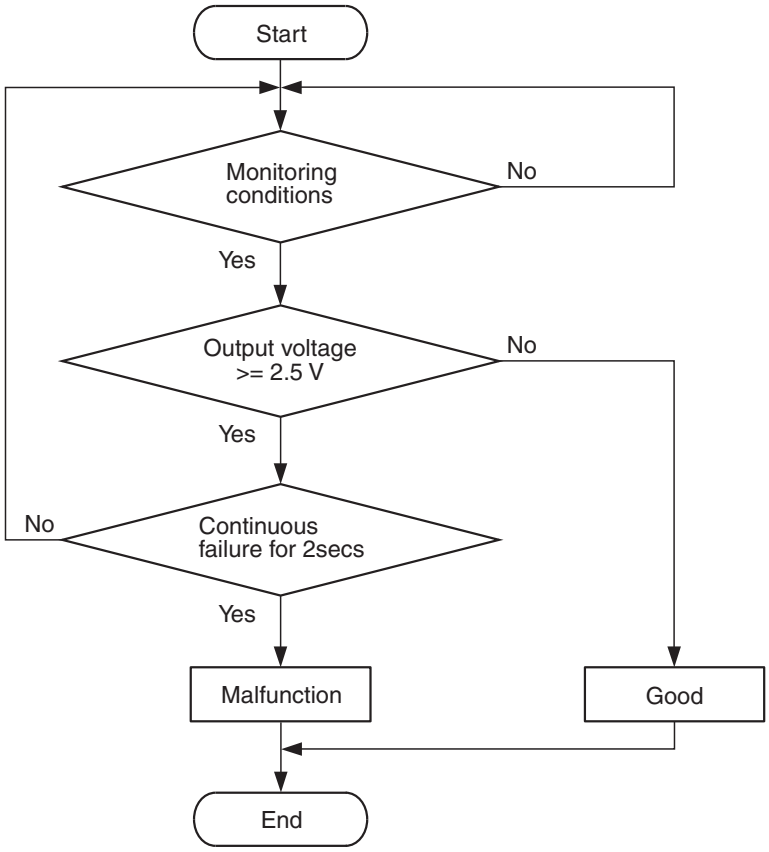
- Not applicable

Sensor (The sensor below is determined to be normal)

- Throttle position sensor

DTC SET CONDITIONS <Range/Performance problem – high>

Logic Flow Chart



AK900353

Check Conditions

- Throttle position sensor output voltage is 0.8 volt or lower.
- Mass airflow sensor output voltage is 4.9 volts (corresponding to an air flow rate of 295 g/sec) or lower.

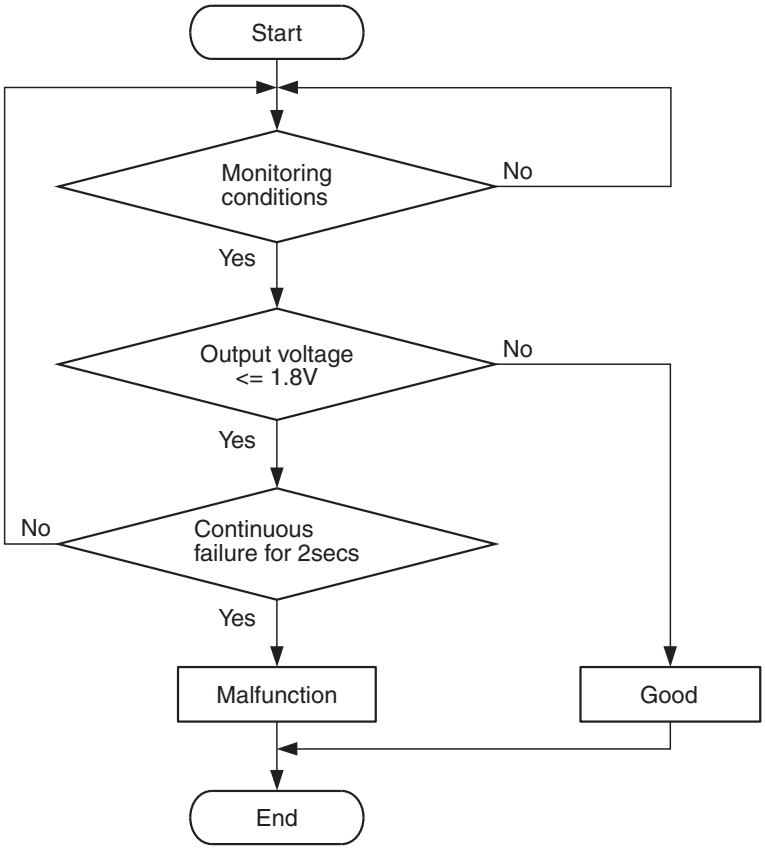
Judgement Criterion

- Mass airflow sensor output voltage has continued to be 2.5 volts (corresponding to an air flow rate of 28 g/sec) or higher for 2 seconds.

TSB Revision

DTC SET CONDITIONS <Range/Performance problem – low >

Logic Flow Chart



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Check Conditions

- Engine speed is 1,500 r/min or more.
- Throttle position sensor output voltage is 1.5 volts or higher.
- Mass airflow sensor output voltage is 0.2 volt (corresponding to an air flow rate of 0 g/sec) or higher.

Judgement Criterion

- Mass airflow sensor output voltage has continued to be 1.8 volts (corresponding to an air flow rate of 8 g/sec) or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 P.13A-11.

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

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

DIAGNOSIS

Required Special Tools:

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

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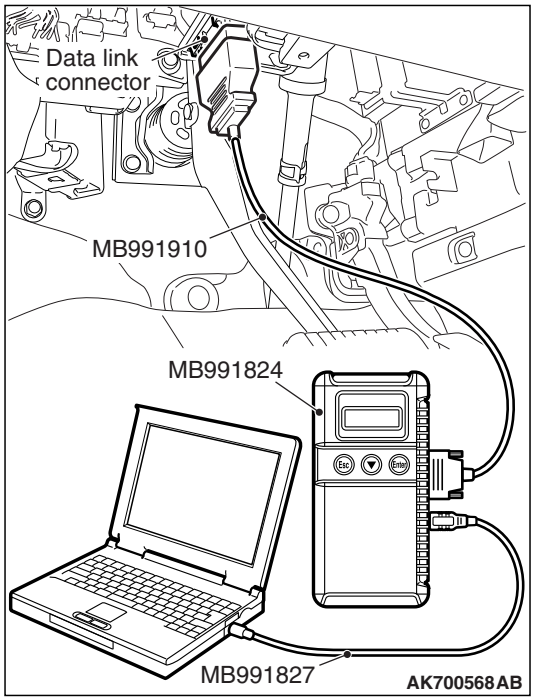


STEP 1. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.

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

(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 1,350 and 1,670 millivolts.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 2.

STEP 2. Check harness connector A-07 at mass airflow sensor and harness connector A-33X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

STEP 3. Check for harness damage between MFI relay connector A-33X (terminal No. 2) and mass airflow sensor connector A-07 (terminal No. 2).

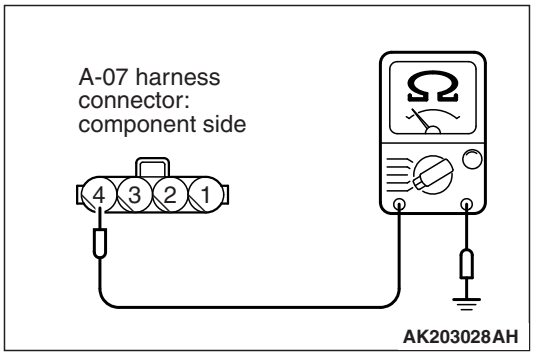
Q: Is the harness wire in good condition?

YES : Go to Step 4.
NO : Repair it. Then go to Step 8.

STEP 4. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.



STEP 5. Check the continuity at mass airflow sensor harness side connector A-07.

(1) Disconnect the connector A-07 and measure at the harness side.
(2) Check for the continuity between terminal No. 4 and ground.
- Continuity (2 ohms or less)

Q: Does continuity exist?

YES : Go to Step 6.
NO : Repair harness wire between mass airflow sensor connector A-07 (terminal No. 4) and ECM connector B-11 (terminal No. 88) because of harness damage. Then go to Step 8.

STEP 6. Check for harness damage between mass airflow sensor connector A-07 (terminal No. 3) and ECM connector B-11 (terminal No. 87).

Q: Is the harness wire in good condition?

YES : Go to Step 7.
NO : Repair it. Then go to Step 8.

STEP 7. Replace the mass airflow sensor.

(1) Replace the mass airflow sensor.
(2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 P.13A-11.
(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0101 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 8.
NO : The inspection is complete.

STEP 8. Test the OBD-II drive cycle.

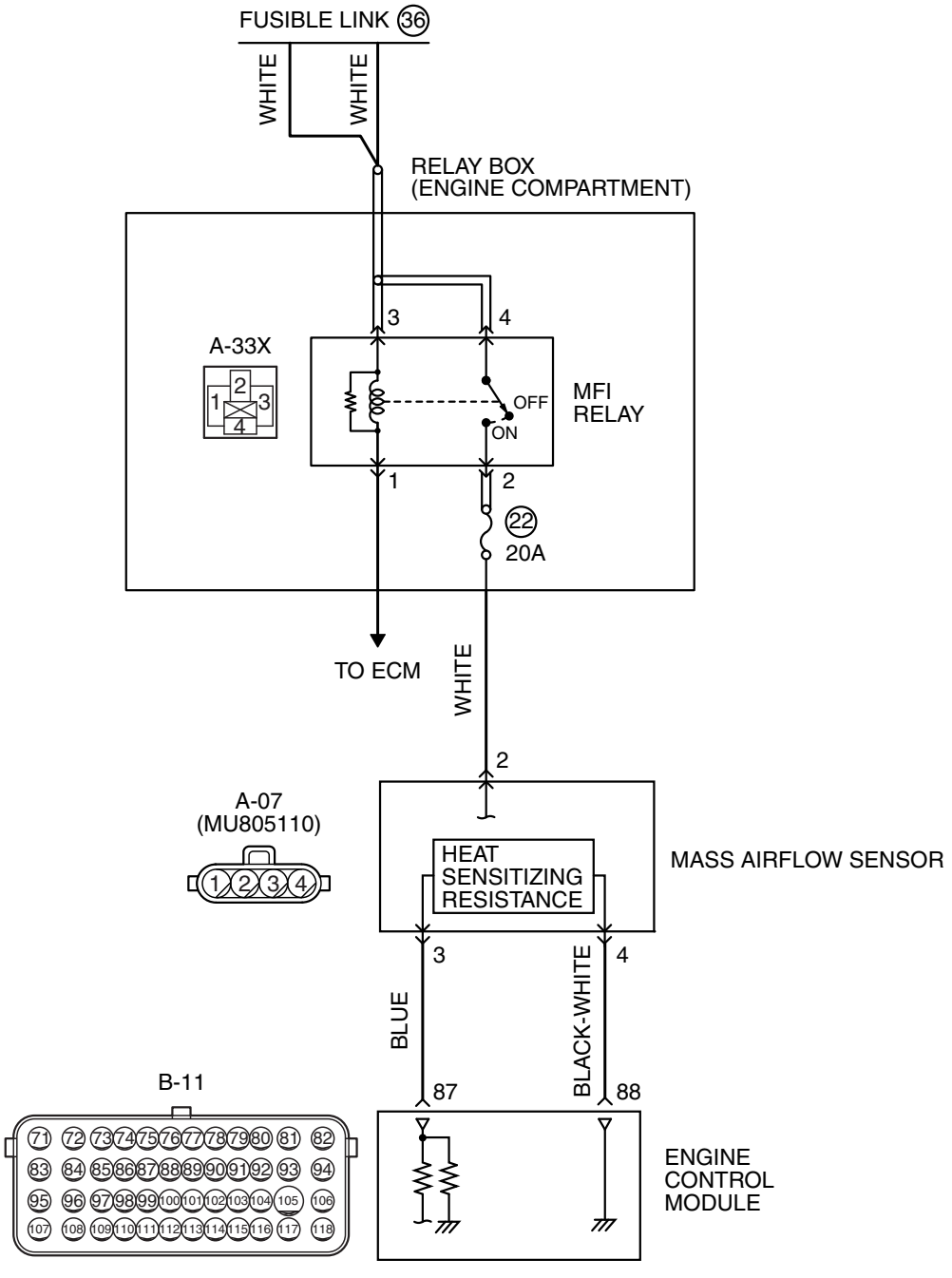
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0101 set?

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

DTC P0102: Mass Airflow Circuit Low Input

MASS AIRFLOW SENSOR CIRCUIT



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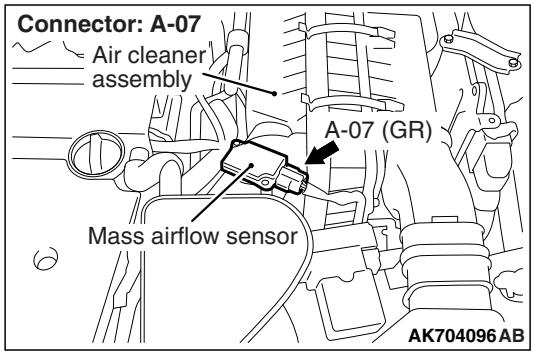

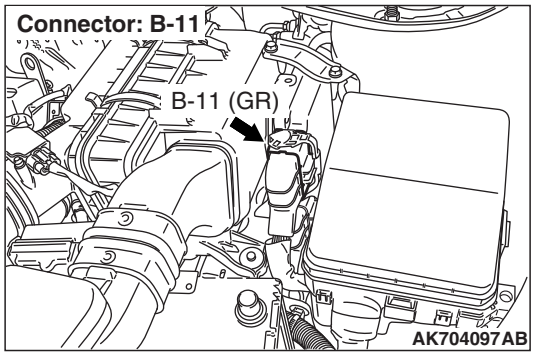

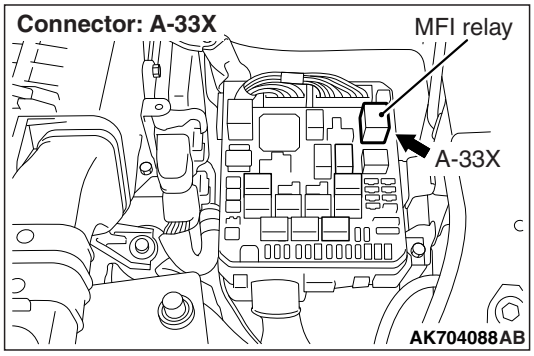

CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 2), and the ground is provided on the ECM (terminal No. 88).
- A voltage that is according to the mass airflow rate is sent to the ECM (terminal No. 87) from the mass airflow sensor output terminal (terminal No. 3).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Mass airflow sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

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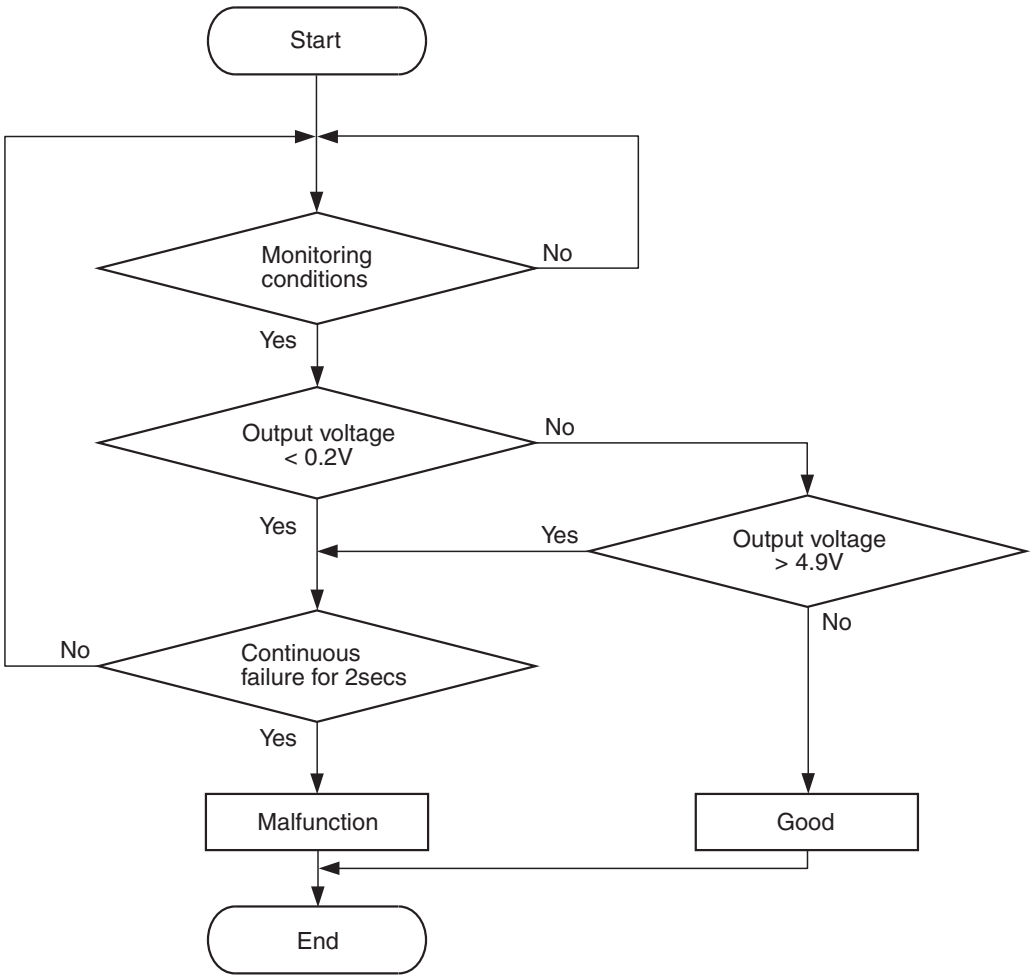
DTC SET CONDITIONS

Logic Flow Chart



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Check Condition

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

Judgement Criterion

- Mass airflow sensor output voltage has continued to be lower than 0.2 volt (corresponding to an air flow rate of 0 g/sec) for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

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

DIAGNOSIS

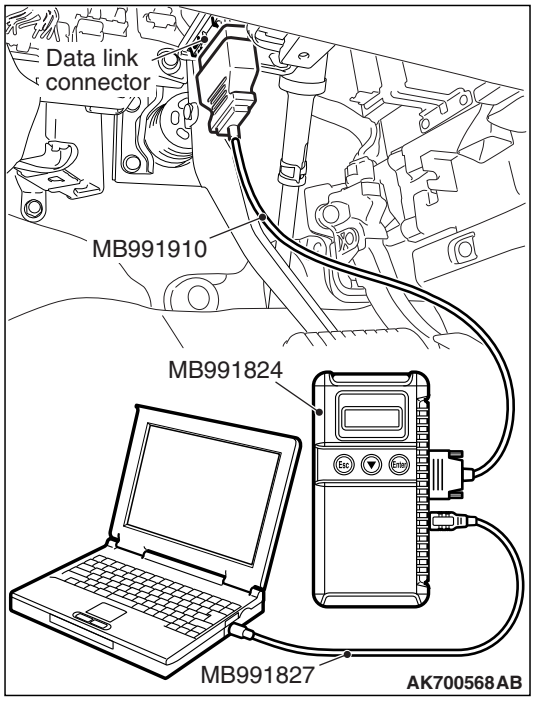
Required Special Tools:

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.

TSB Revision

- MB991827: USB Cable
- MB991910: Main Harness A
- MB992110: Power Plant ECU Check Harness

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



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

(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 1,350 and 1,670 millivolts.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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

Q: Is the sensor operating properly?

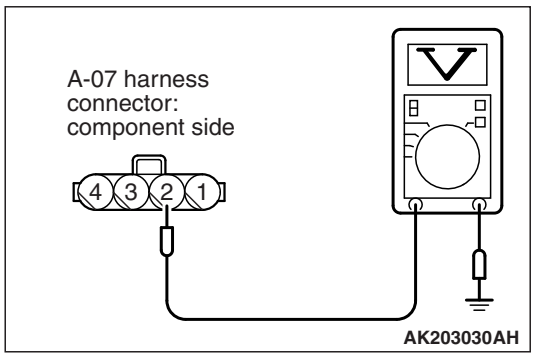
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 2.

STEP 2. Check harness connector A-07 at mass airflow sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

STEP 3. Measure the power supply voltage at mass airflow sensor harness side connector A-07.



(1) Disconnect the connector A-07 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 2 and ground.
- Voltage should be battery positive voltage.

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

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

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

STEP 4. Check harness connector A-33X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector A-33X (terminal No. 2) and mass airflow sensor connector A-07 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

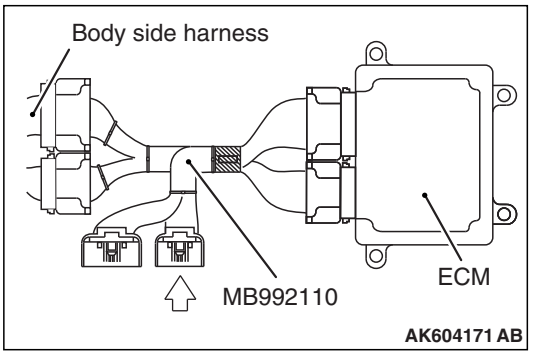
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

STEP 5. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

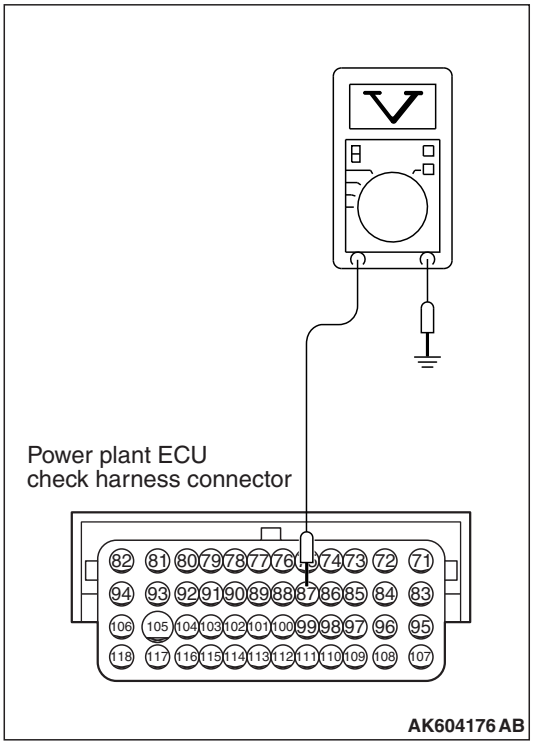
YES : Go to Step 6.

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



STEP 6. Measure the sensor output voltage at ECM connector B-11 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
(2) Start the engine.



(3) Measure the voltage between terminal No. 87 and ground.
- When the engine is revved, voltage should be increase in response to revving.

Q: Is the measured voltage normal?

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

STEP 7. Check for open circuit and short circuit to ground between mass airflow sensor connector A-07 (terminal No. 3) and ECM connector B-11 (terminal No. 87).

Q: Is the harness wire in good condition?

YES : Go to Step 8.
NO : Repair it. Then go to Step 10.

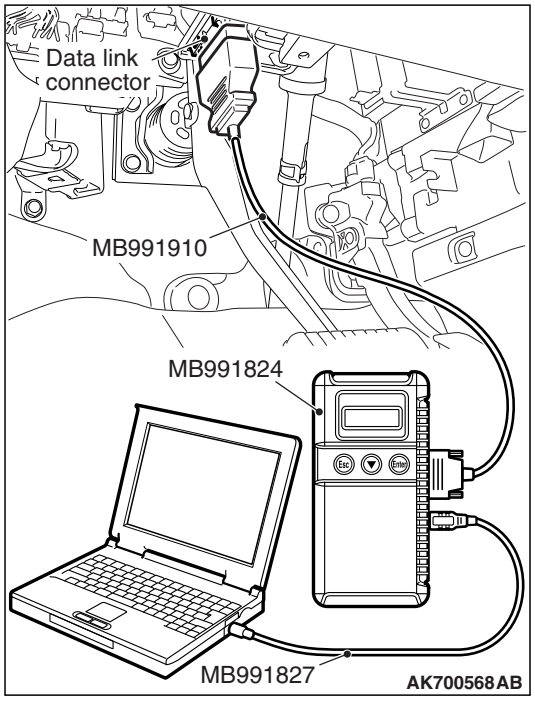
STEP 8. Replace the mass airflow sensor.

(1) Replace the mass airflow sensor.
(2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.
(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0102 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.
NO : The inspection is complete.

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



(1) Start the engine and run at idle.
(2) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
(3) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 1,350 and 1,670 millivolts.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.

STEP 10. Test the OBD-II drive cycle.

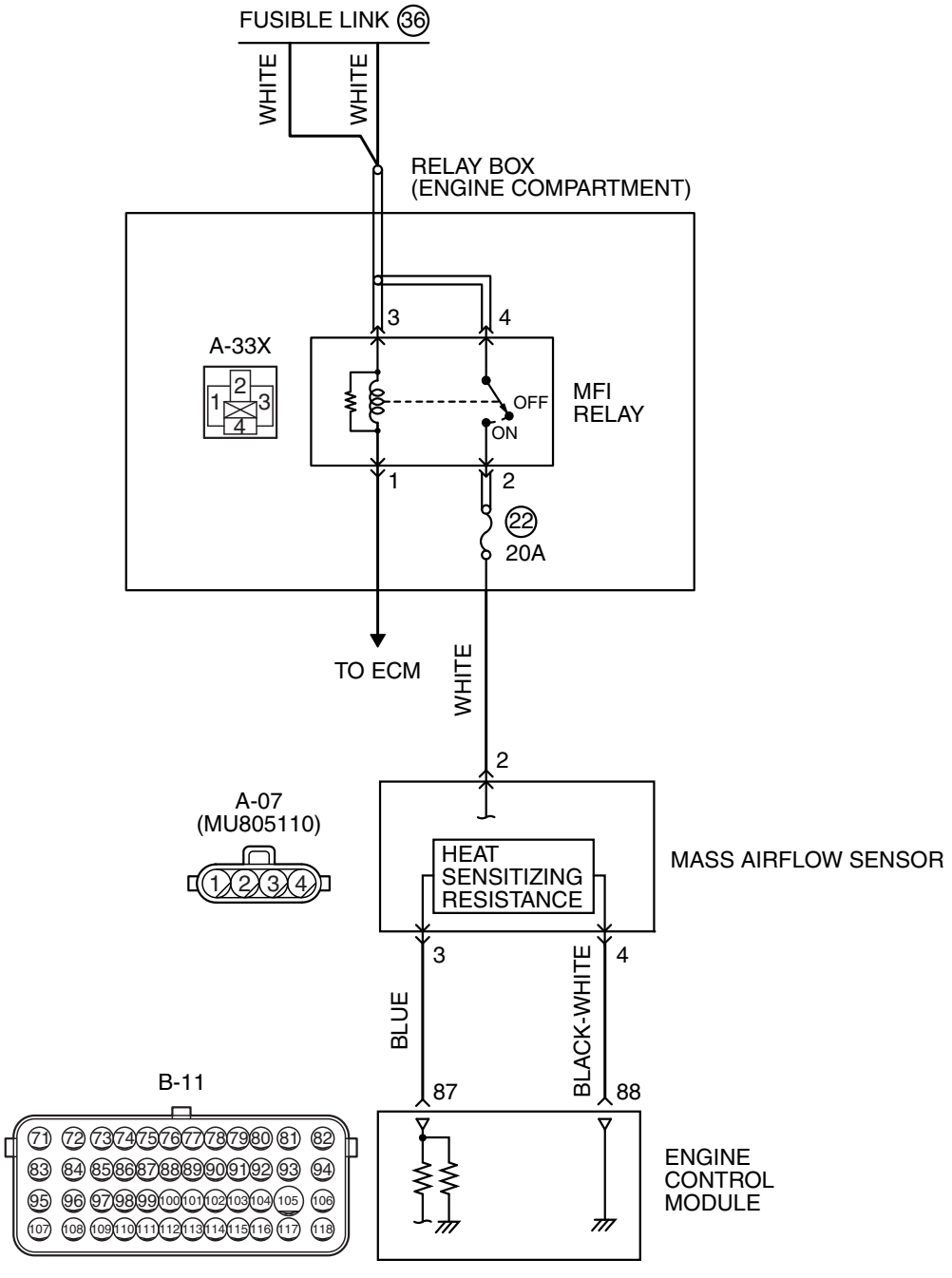
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0102 set?

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

DTC P0103: Mass Airflow Circuit High Input

MASS AIRFLOW SENSOR CIRCUIT



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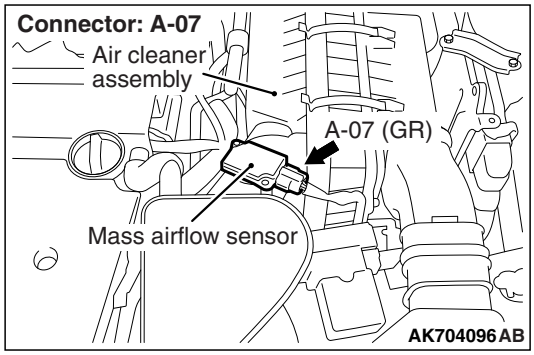
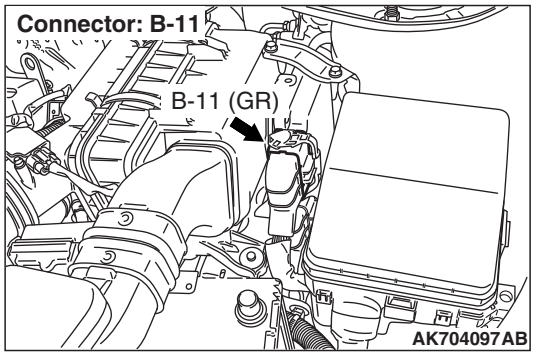
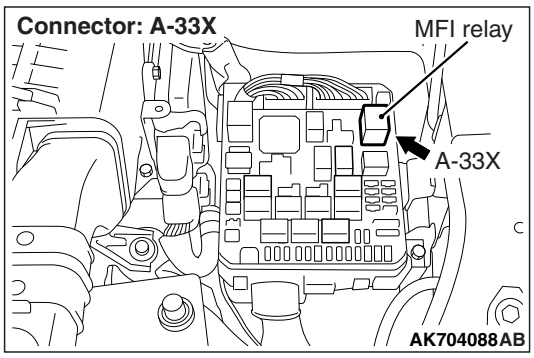






CIRCUIT OPERATION

- The mass airflow sensor power is supplied from the MFI relay (terminal No. 2), and the ground is provided on the ECM (terminal No. 88).
- A voltage that is according to the mass airflow rate is sent to the ECM (terminal No. 87) from the mass airflow sensor output terminal (terminal No. 3).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Mass airflow sensor output voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

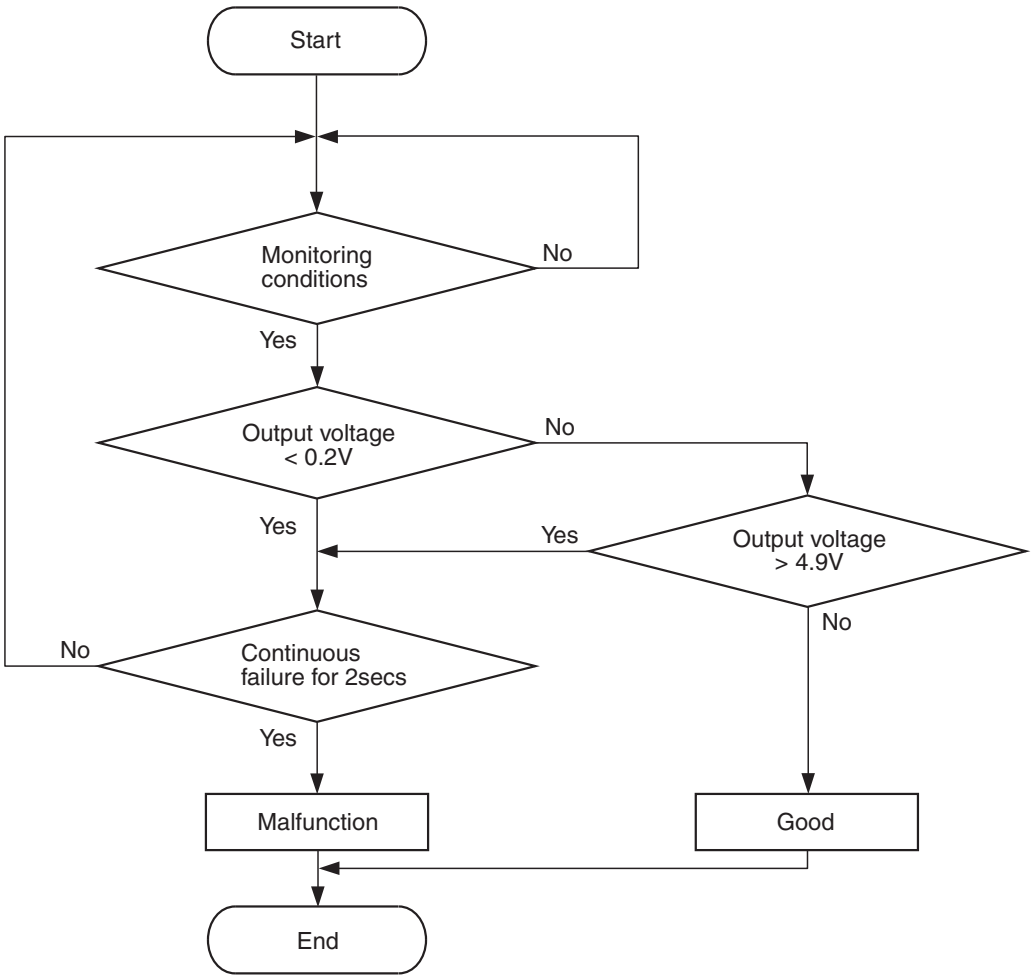
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK604310

Check Condition

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

Judgement Criterion

- Mass airflow sensor output voltage has continued to be higher than 4.9 volts (corresponding to an air flow rate of 295 g/sec) for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

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

DIAGNOSIS

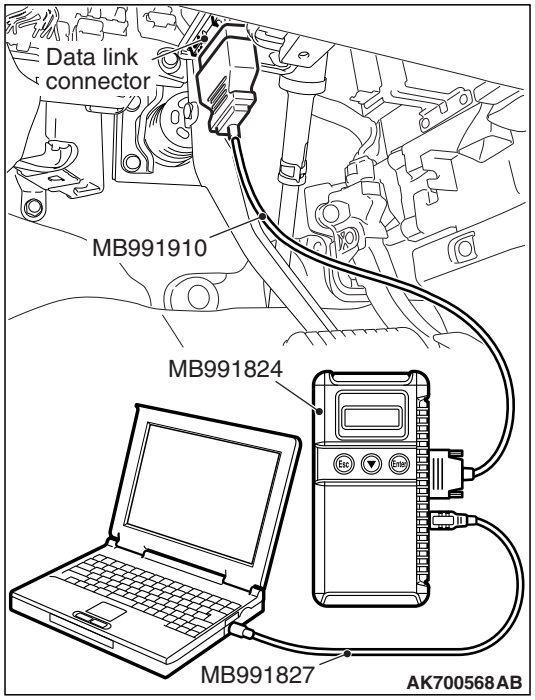
Required Special Tools:

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.

TSB Revision

- MB991827: USB Cable
- MB991910: Main Harness A

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



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

(1) Connect scan tool MB991958 to the data link connector.
(2) Start the engine and run at idle.
(3) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
(4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 1,350 and 1,670 millivolts.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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

Q: Is the sensor operating properly?

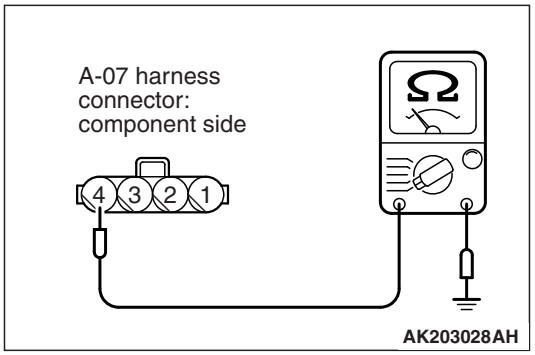
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 2.

STEP 2. Check harness connector A-07 at mass airflow sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

STEP 3. Check the continuity at mass airflow sensor harness side connector A-07.



(1) Disconnect the connector A-07 and measure at the harness side.
(2) Check for the continuity between terminal No. 4 and ground.
- Continuity (2 ohms or less)

Q: Does continuity exist?

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

STEP 4. Check harness connector B-11 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

STEP 5. Check for open circuit between mass airflow sensor connector A-07 (terminal No. 4) and ECM connector B-11 (terminal No. 88).

Q: Is the harness wire in good condition?

YES : Go to Step 6.
NO : Repair it. Then go to Step 8.

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

(1) Start the engine and run at idle.
(2) Set scan tool MB991958 to the data reading mode for item 10, Mass Airflow Sensor.
(3) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
- The standard value during idling should be between 1,350 and 1,670 millivolts.
- When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 8.

STEP 7. Check harness connector B-11 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Replace the mass airflow sensor. Then go to Step 8.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 8.

STEP 8. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

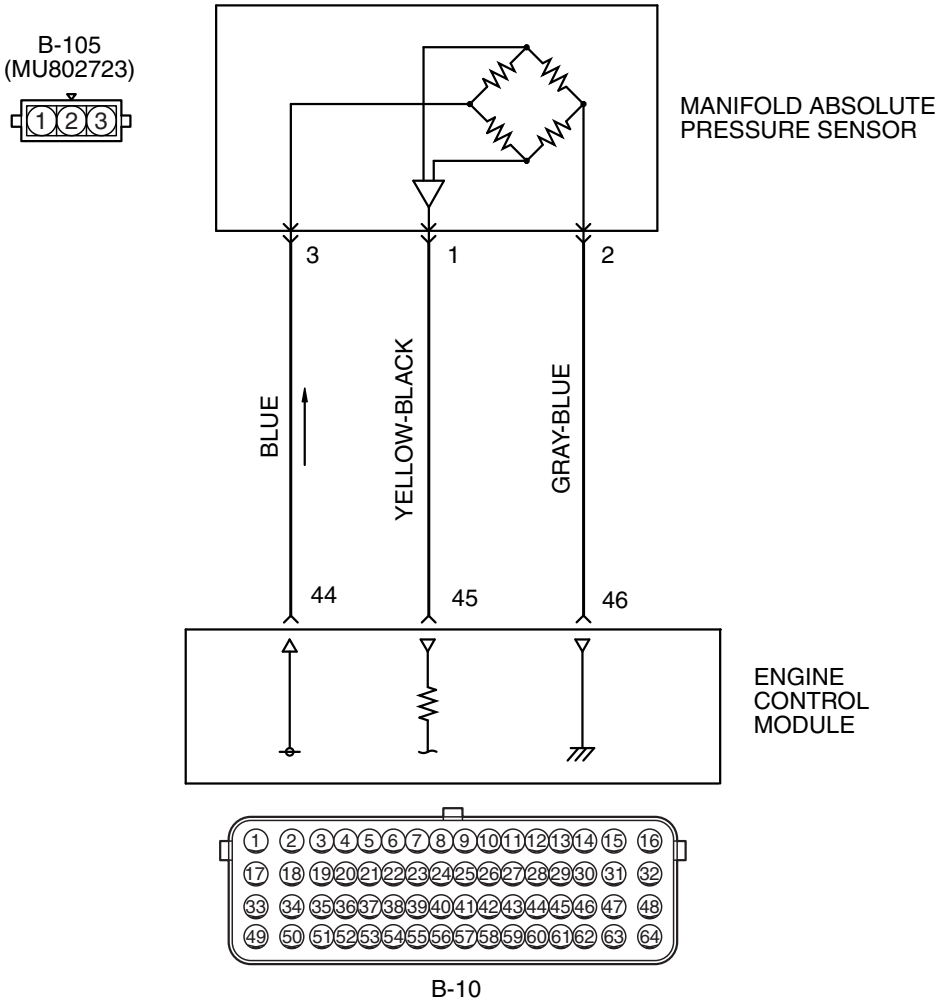
Q: Is DTC P0103 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0106: Manifold Absolute Pressure Circuit Range/Performance Problem

MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT



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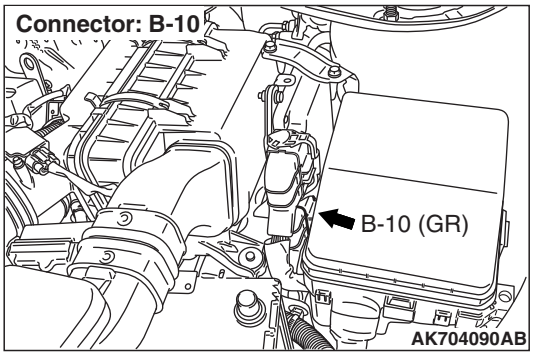
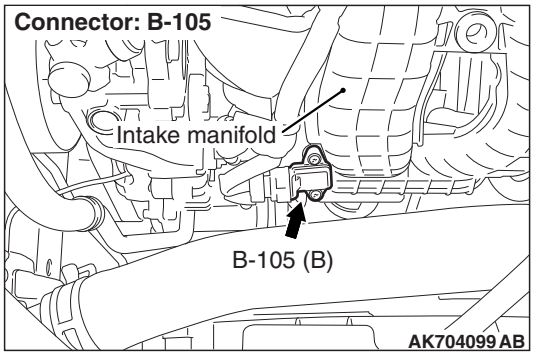




CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the ECM (terminal No. 44). The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 46).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM (terminal No. 45) from the manifold absolute pressure sensor output terminal (terminal No. 1).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

Compare load value with manifold absolute pressure sensor output voltage.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

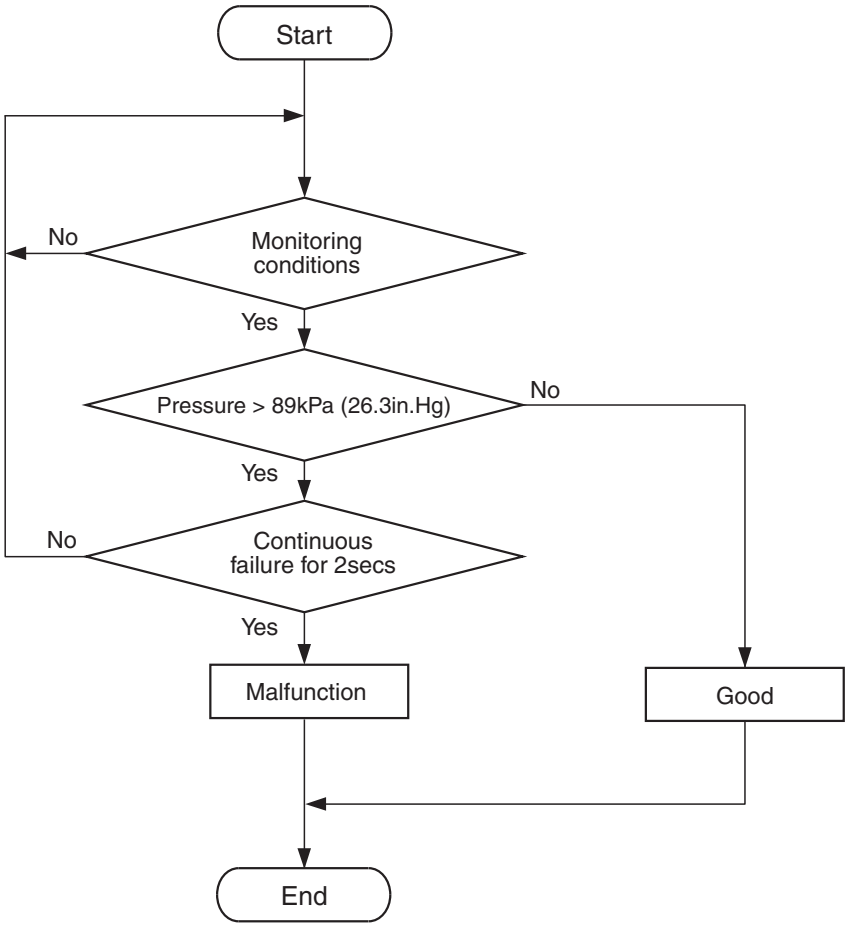
- Not applicable

Sensor (The sensor below is determined to be normal)

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

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

Logic Flow Chart



AK604311

Check Conditions

- 8 minutes or more have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is 0°C (32°F) or lower.
- Engine speed is between 500 r/min and 1,500 r/min.
- Throttle position sensor output voltage is 0.8 volt or lower.

Judgement Criterion

- Manifold absolute pressure sensor output voltage has continued to be 3.5 volts [corresponding to a manifold absolute pressure of 89 kPa (26.3 in.Hg)] or higher for 2 seconds.

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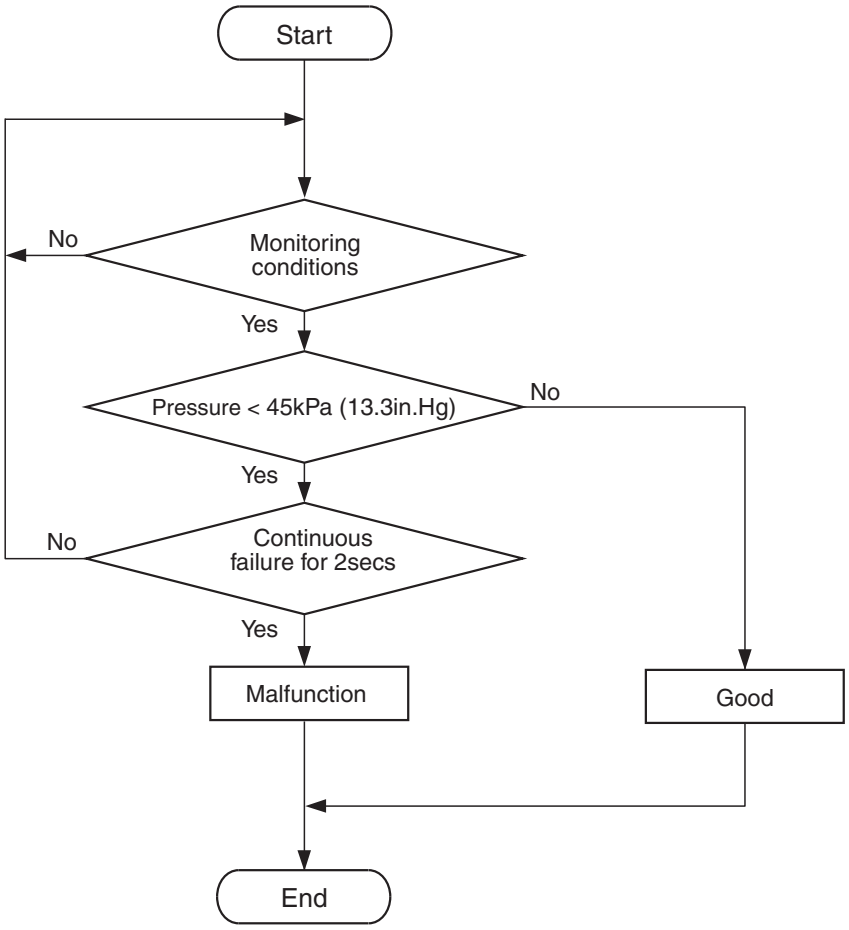
DTC SET CONDITIONS <Range/Performance problem – low input>

Logic Flow Chart



AK604312

Check Conditions

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

Judgement Criterion

- Manifold absolute pressure sensor output voltage has continued to be 1.8 volts [corresponding to a manifold absolute pressure of 45 kPa (13.3 in.Hg)] or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 P.13A-11.

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

- Manifold absolute pressure sensor failed.
- Mass airflow sensor circuit harness damage, or connector damage.
- ECM failed.

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DIAGNOSIS

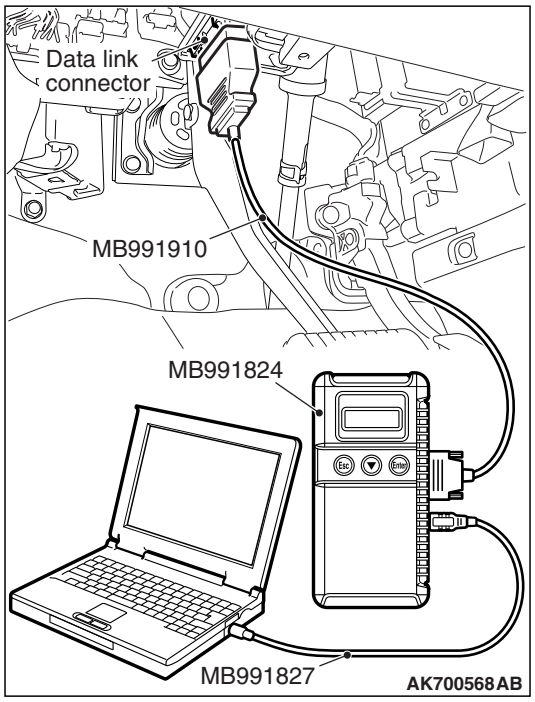
Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- MB992110: Power Plant ECU Check Harness

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

⚠ CAUTION

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

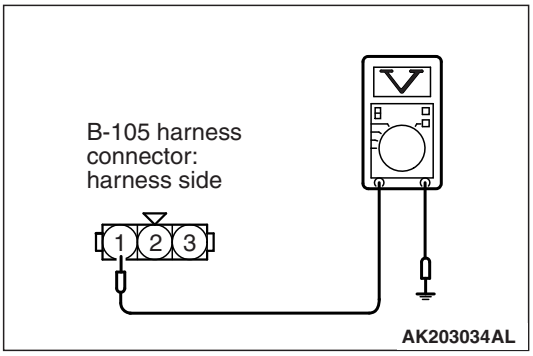


(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
  - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
  - When altitude is 600 m (1,969 feet),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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

NO : Go to Step 2.



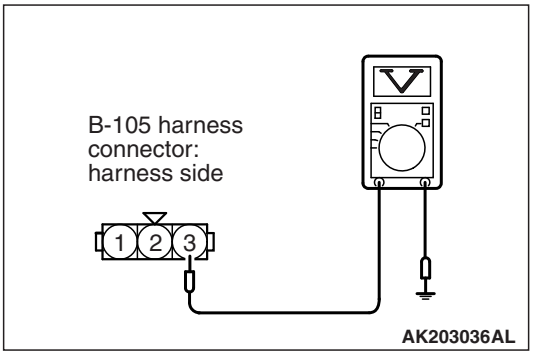
STEP 2. Measure the sensor output voltage at manifold absolute pressure sensor connector B-105 by backprobing.

(1) Do not disconnect the connector B-105.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 1 and ground by backprobing.
- When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
- When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
- When altitude is 1,800 m (5,906 feet), voltage should be between 3.0 and 3.4 volts.

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

Q: Is the measured voltage normal?

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



STEP 3. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-105 by backprobing.

(1) Do not disconnect the connector B-105.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 3 and ground by backprobing.
- Voltage should be between 4.9 and 5.1 volts.

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

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

YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check harness connector B-105 at the manifold absolute pressure sensor and harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to step 5.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.

STEP 5. Check for harness damage between manifold absolute pressure sensor connector B-105 (terminal No. 3) and ECM connector B-10 (terminal No. 44).

Q: Is the harness wire in good condition?

YES : Go to Step 12.
NO : Repair it. Then go to Step 13.

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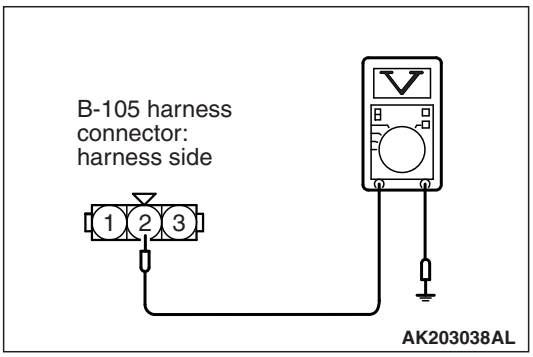


STEP 6. Measure the ground voltage at manifold absolute pressure sensor connector B-105 by backprobing.

(1) Do not disconnect the connector B-105.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 2 and ground by backprobing.
- Voltage should be 0.5 volt or less.

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

Q: Is the measured voltage 0.5 volt or less?

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

STEP 7. Check harness connector B-105 at the manifold absolute pressure sensor and harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

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

STEP 8. Check for harness damage between manifold absolute pressure sensor connector B-105 (terminal No. 2) and ECM connector B-10 (terminal No. 46).

Q: Is the harness wire in good condition?

YES : Go to Step 12.
NO : Repair it. Then go to Step 13.

STEP 9. Check harness connector B-105 at manifold absolute pressure sensor for damage.

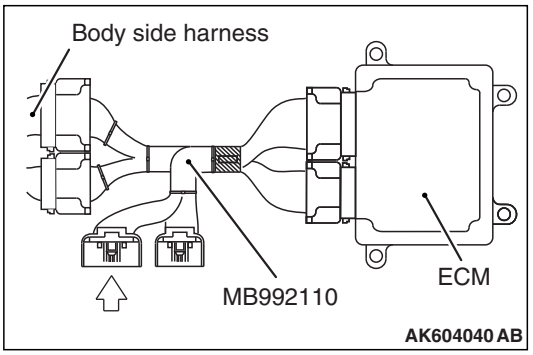
Q: Is the harness connector in good condition?

YES : Replace the manifold absolute pressure sensor. Then go to Step 13.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.

STEP 10. Check harness connector B-105 at the manifold absolute pressure sensor and harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

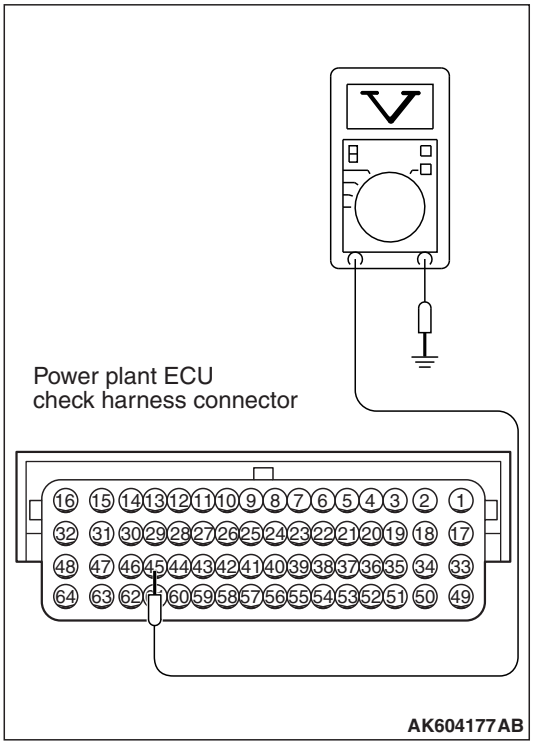
YES : Go to Step 11.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 13.



STEP 11. Measure the sensor output voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.

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



(3) Measure the voltage between terminal No. 45 and ground.
- When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
- When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
- When altitude is 1,800 m (5,906 feet), voltage should be between 3.0 and 3.4 volts.

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

Q: Is the measured voltage normal?

YES : Go to Step 12.

NO : Repair harness wire between manifold absolute pressure sensor connector B-105 (terminal No. 1) and ECM connector B-10 (terminal No. 45) because of harness damage. Then go to Step 13.

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

(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 13.

STEP 13. Test the OBD-II drive cycle.

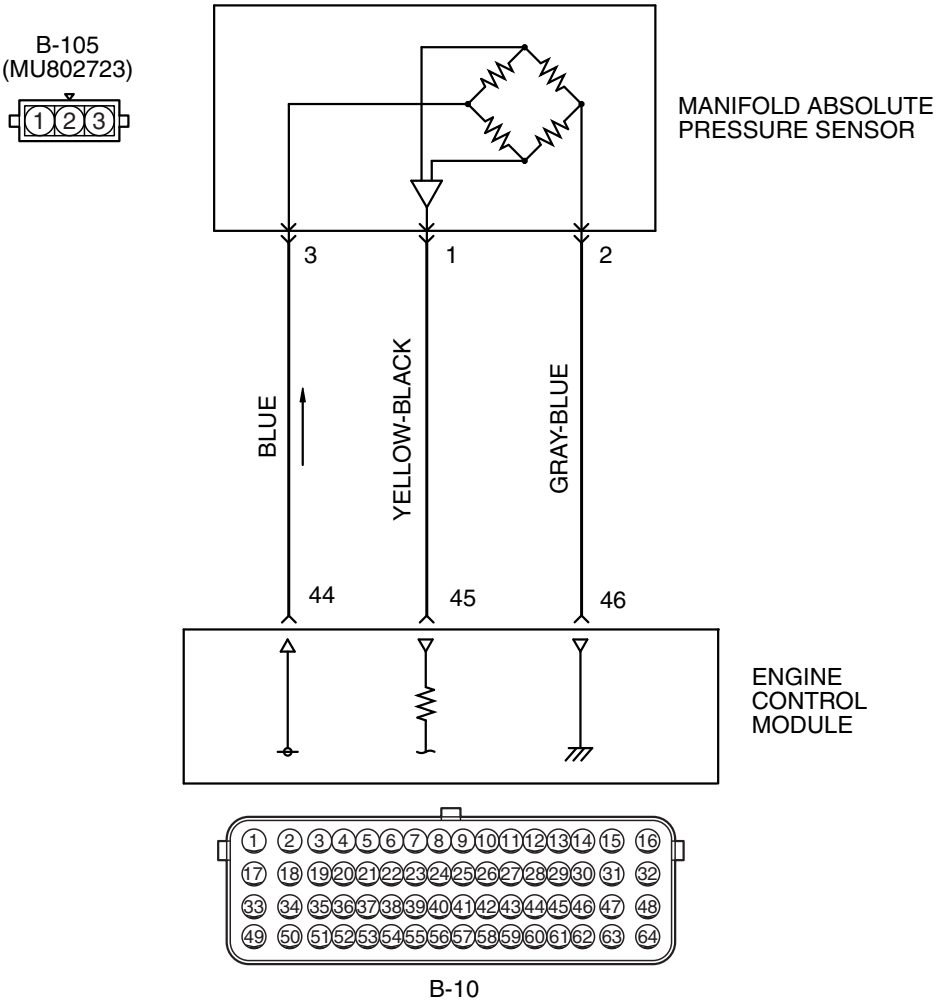
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0106 set?

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

DTC P0107: Manifold Absolute Pressure Circuit Low Input

MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT



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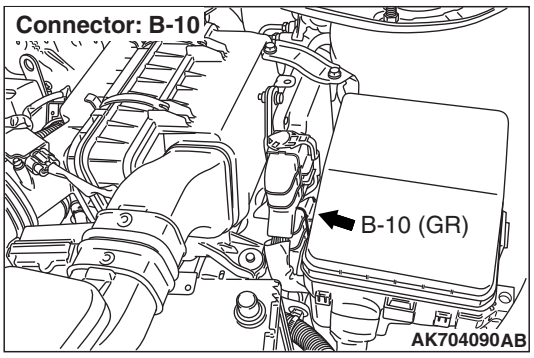

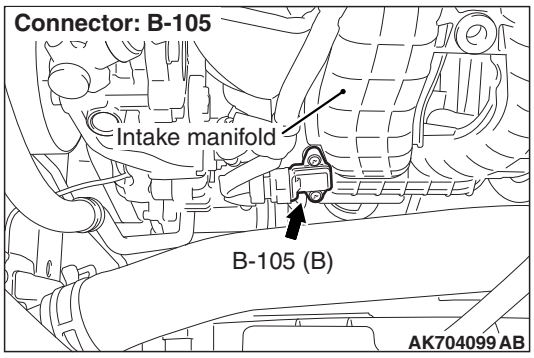

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CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from the ECM (terminal No. 44). The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 46).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM (terminal No. 45) from the manifold absolute pressure sensor output terminal (terminal No. 1).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

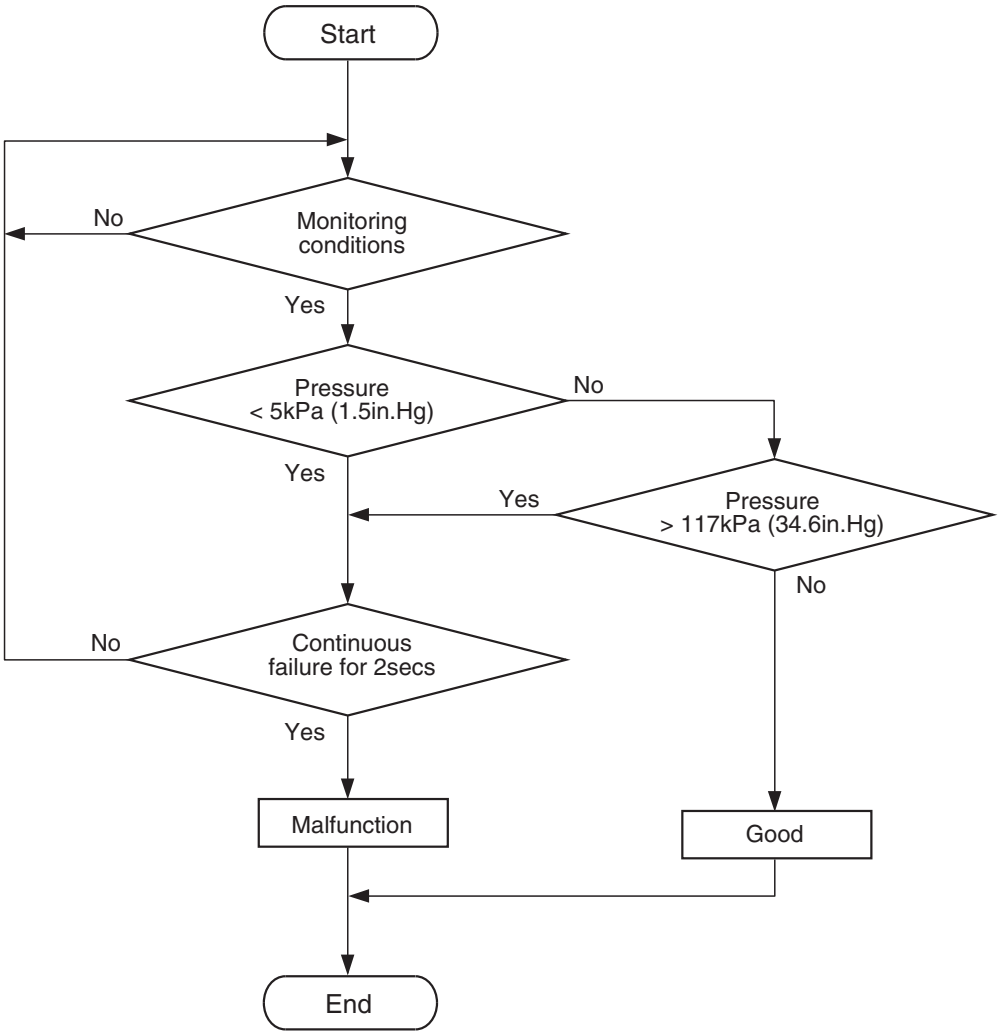
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK604313

Check Conditions

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

Judgement Criterion

- Manifold absolute pressure sensor output voltage has continued to be 0.2 volt [corresponding to a manifold absolute pressure of 5 kPa (1.5 in.Hg)] or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 P.13A-11.

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

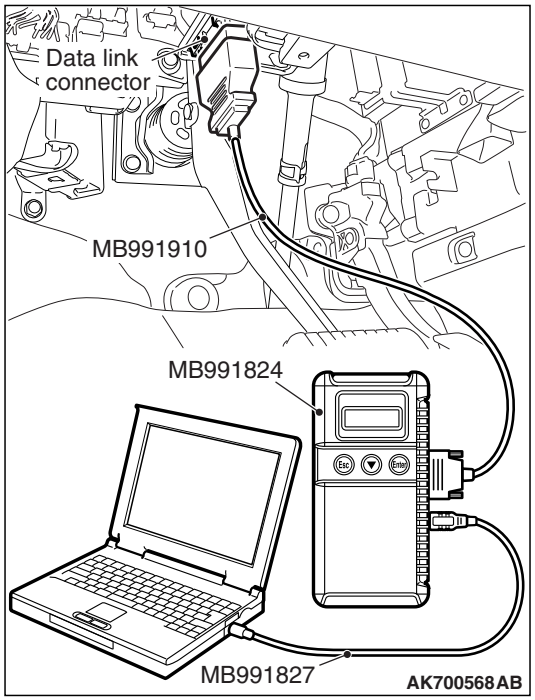
- Manifold absolute pressure sensor failed.
- Open or shorted manifold absolute pressure sensor circuit, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- MB992110: Power Plant ECU Check Harness

TSB Revision



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

⚠ CAUTION

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

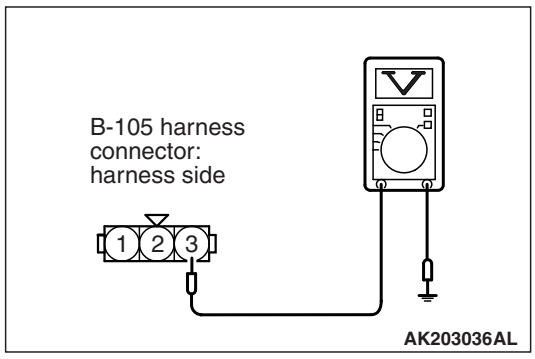
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 2.



STEP 2. Measure the sensor supply voltage at manifold absolute pressure sensor connector B-105 by backprobing.

(1) Do not disconnect the connector B-105.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 3 and ground by backprobing.
- Voltage should be between 4.9 and 5.1 volts.

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

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

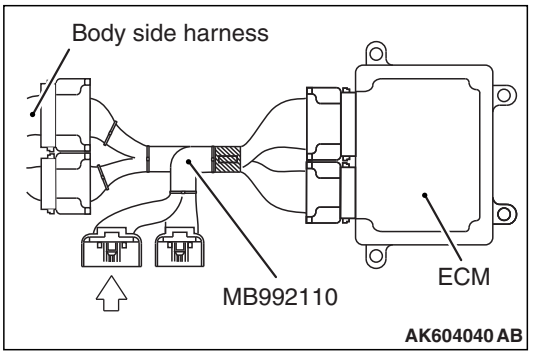
YES : Go to Step 8.
NO : Go to Step 3.

STEP 3. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

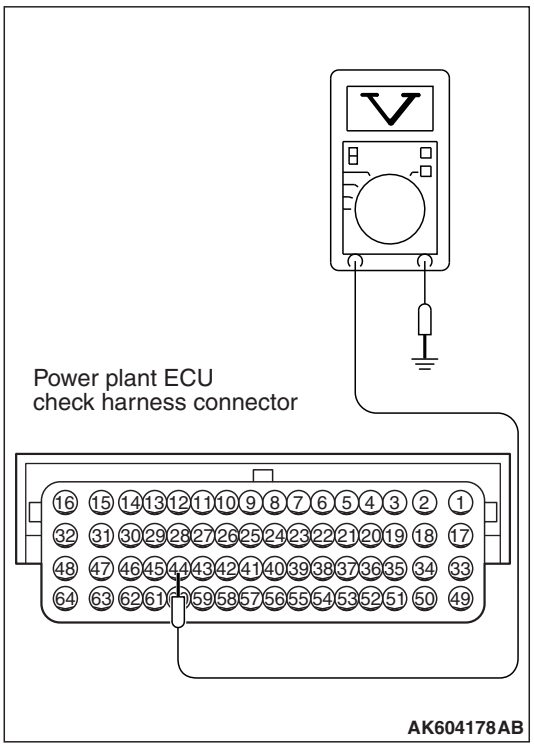
YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

TSB Revision



STEP 4. Measure the sensor supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 44 and ground.
- Voltage should be between 4.9 and 5.1 volts.

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

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

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

STEP 5. Check harness connector B-105 at the manifold absolute pressure sensor for damage.

Q: Is the connector in good condition?

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

STEP 6. Check for short circuit to ground between manifold absolute pressure sensor connector B-105 (terminal No. 3) and ECM connector B-10 (terminal No. 44).

Q: Is the harness wire in good condition?

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

STEP 7. Check harness connector B-105 at the manifold absolute pressure sensor for damage.

Q: Is the connector in good condition?

YES : Repair harness wire between manifold absolute pressure sensor connector B-105 (terminal No. 3) and ECM connector B-10 (terminal No. 44) because of open circuit. Then go to Step 12.

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

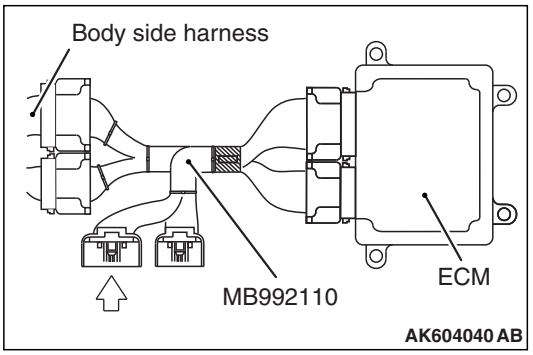
STEP 8. Check harness connector B-105 at the manifold absolute pressure sensor and connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

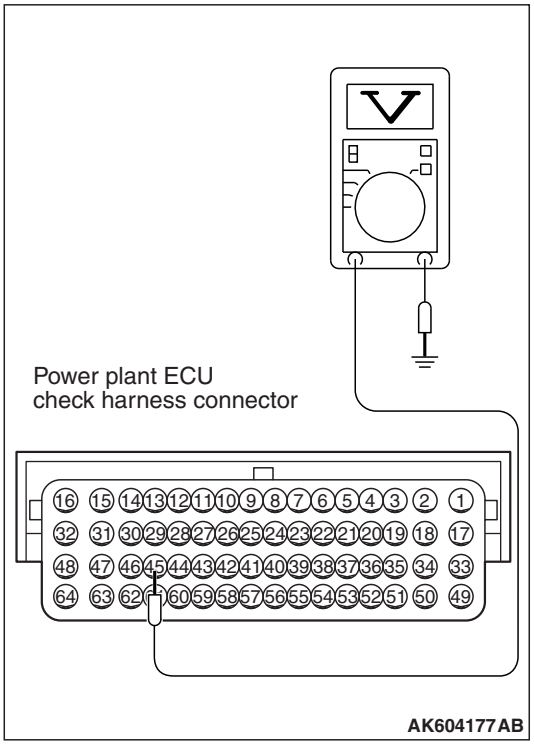
YES : Go to Step 9.

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

STEP 9. Measure the sensor output voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.



(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
(2) Turn the ignition switch to the "ON" position.



(3) Measure the voltage between terminal No. 45 and ground.
- When altitude is 0 m (0 foot), voltage should be between 3.8 and 4.2 volts.
- When altitude is 600 m (1,969 feet), voltage should be between 3.5 and 3.9 volts.
- When altitude is 1,200 m (3,937 feet), voltage should be between 3.3 and 3.7 volts.
- When altitude is 1,800 m (5,906 feet), voltage should be between 3.0 and 3.4 volts.

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

Q: Is the measured voltage normal?

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

STEP 10. Check for open circuit and short circuit to ground between manifold absolute pressure sensor connector B-105 (terminal No. 1) and ECM connector B-10 (terminal No. 45).

Q: Is the harness wire in good condition?

YES : Replace the manifold absolute pressure sensor. Then go to Step 12.
NO : Repair it. Then go to Step 12.

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

(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 12.

STEP 12. Test the OBD-II drive cycle.

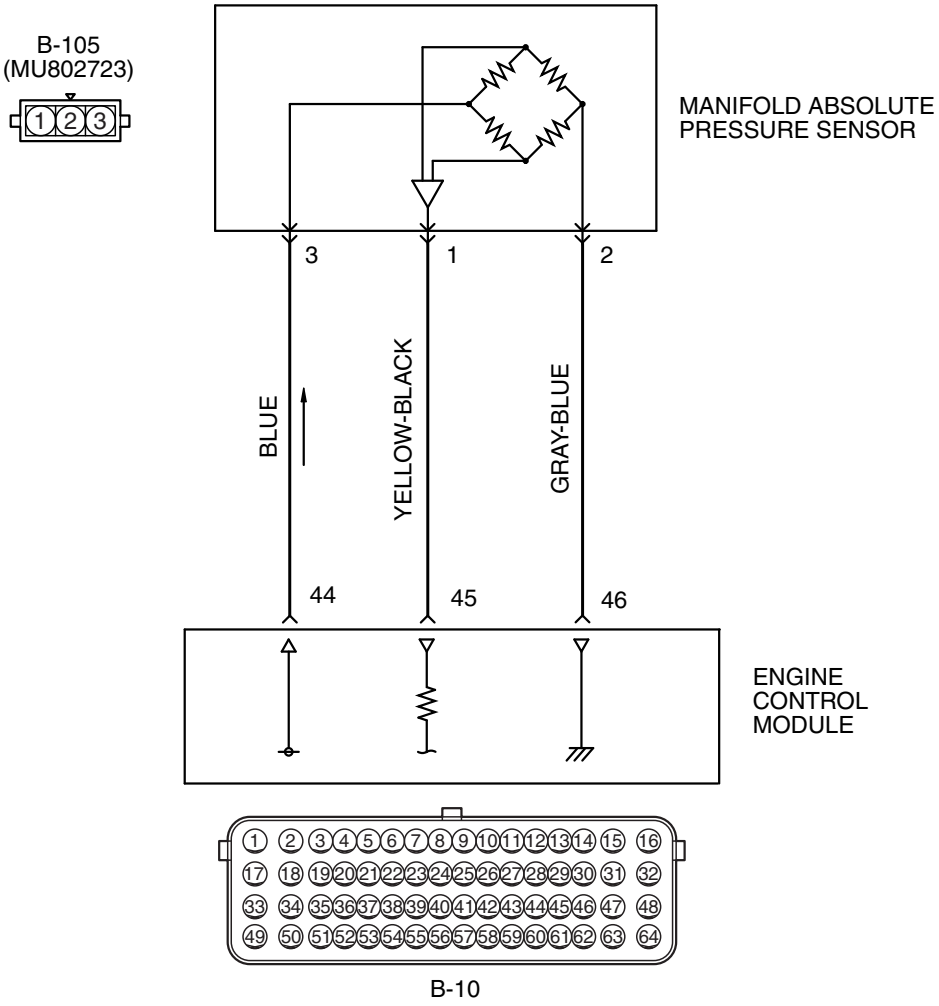
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0107 set?

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

DTC P0108: Manifold Absolute Pressure Circuit High Input

MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT



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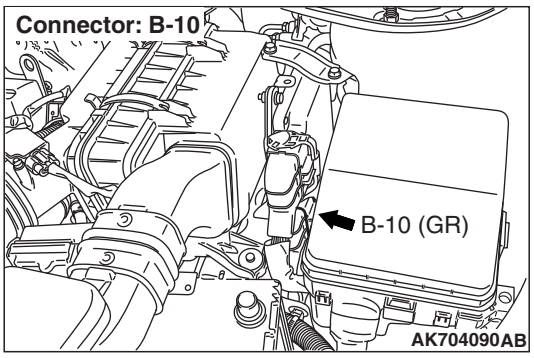
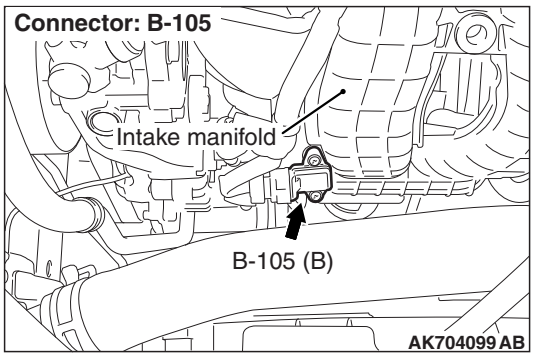




TSB Revision

CIRCUIT OPERATION

- A 5-volt voltage is supplied to the manifold absolute pressure sensor power terminal (terminal No. 3) from ECM (terminal No. 44). The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 46).
- A voltage that is proportional to the intake manifold pressure is sent to the ECM (terminal No. 45) from the manifold absolute pressure sensor output terminal (terminal No. 1).

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

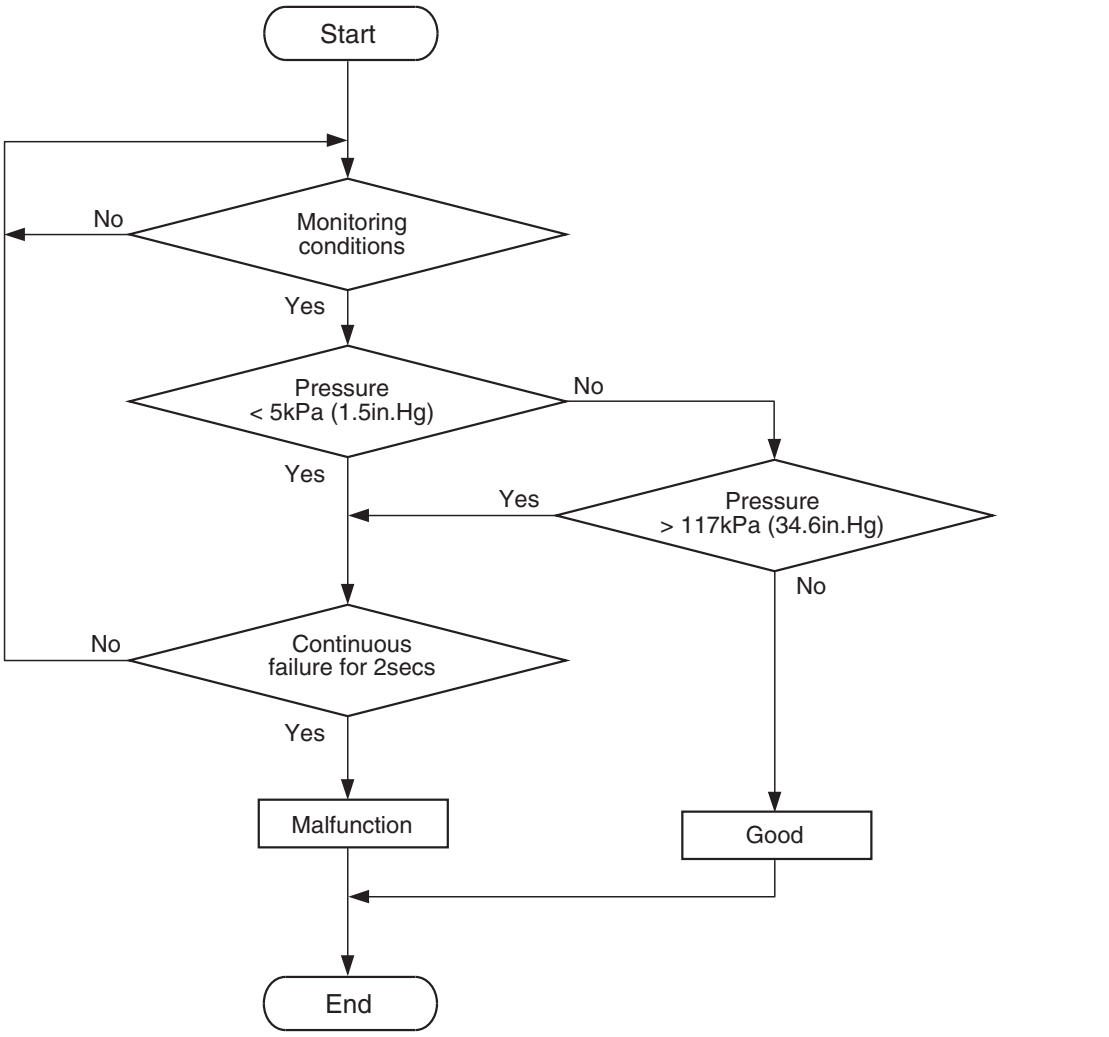
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



Check Condition

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

Judgement Criterion

- Manifold absolute pressure sensor output voltage has continued to be 4.6 volts [corresponding to a manifold absolute pressure of 117 kPa (34.6 in.Hg)] or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

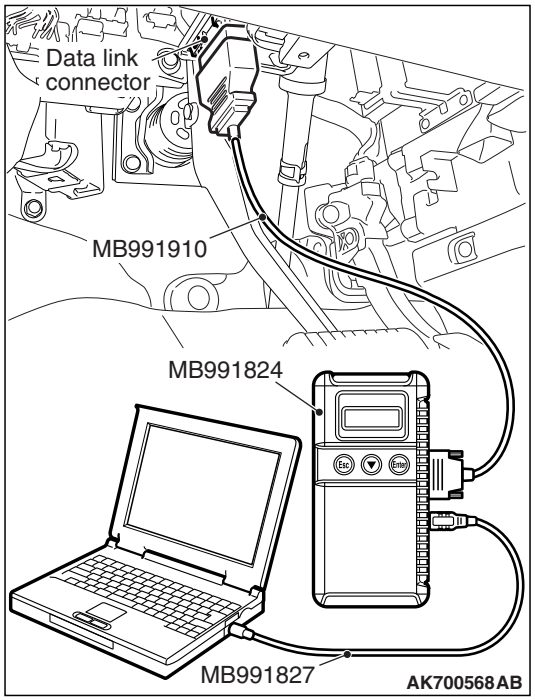
- Manifold absolute pressure sensor failed.
- Open manifold absolute pressure sensor circuit, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

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

TSB Revision



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

⚠ CAUTION

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

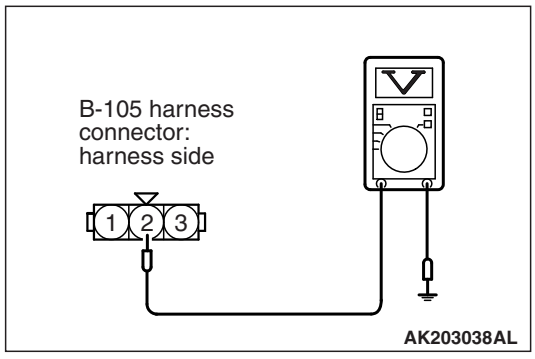
(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 2.



STEP 2. Measure the ground voltage at manifold absolute pressure sensor connector B-105 by backprobing.

(1) Do not disconnect the connector B-105.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 2 and ground by backprobing.
- Voltage should be 0.5 volt or less.

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

Q: Is the measured voltage 0.5 volt or less?

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

STEP 3. Check harness connector B-105 at the manifold absolute pressure sensor and harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 7.

TSB Revision

STEP 4. Check for open circuit between manifold absolute pressure sensor connector B-105 (terminal No. 2) and ECM connector B-10 (terminal No. 46).

Q: Is the harness wire in good condition?

YES : Go to Step 5.
NO : Repair it. Then go to Step 7.

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

(1) Turn the ignition switch to the "ON" position.
(2) Set scan tool MB991958 to the data reading mode for item 8, Manifold Absolute Pressure Sensor.
- When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
- When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
- When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
- When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 7.

STEP 6. Check harness connector B-105 at the manifold absolute pressure sensor and harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

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

STEP 7. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

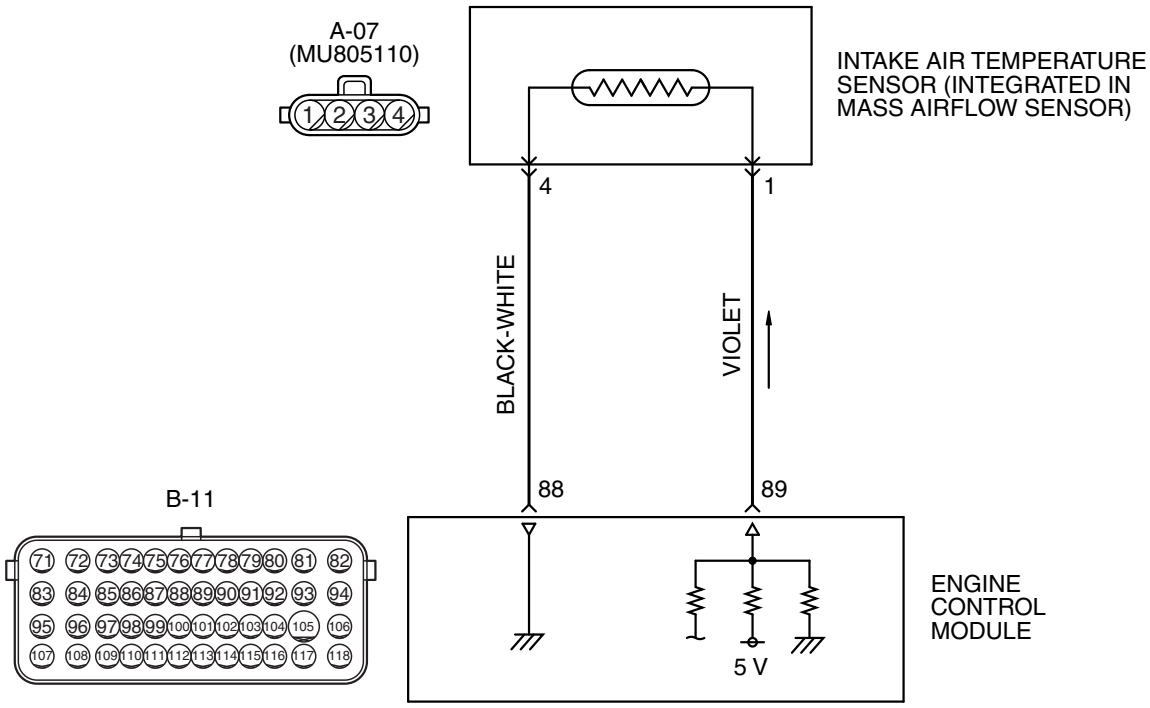
Q: Is DTC P0108 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0111: Intake Air Temperature Circuit Range/Performance Problem

INTAKE AIR TEMPERATURE SENSOR CIRCUIT



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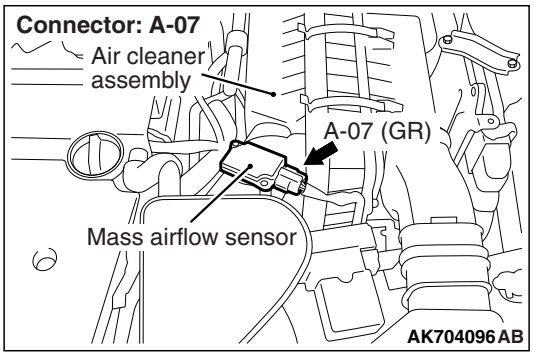
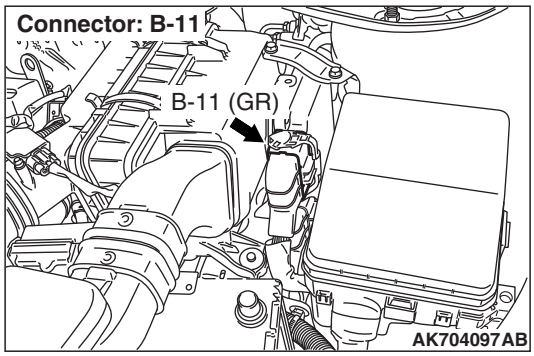




TSB Revision

CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 89) via the resistor in the ECM. The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 88).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

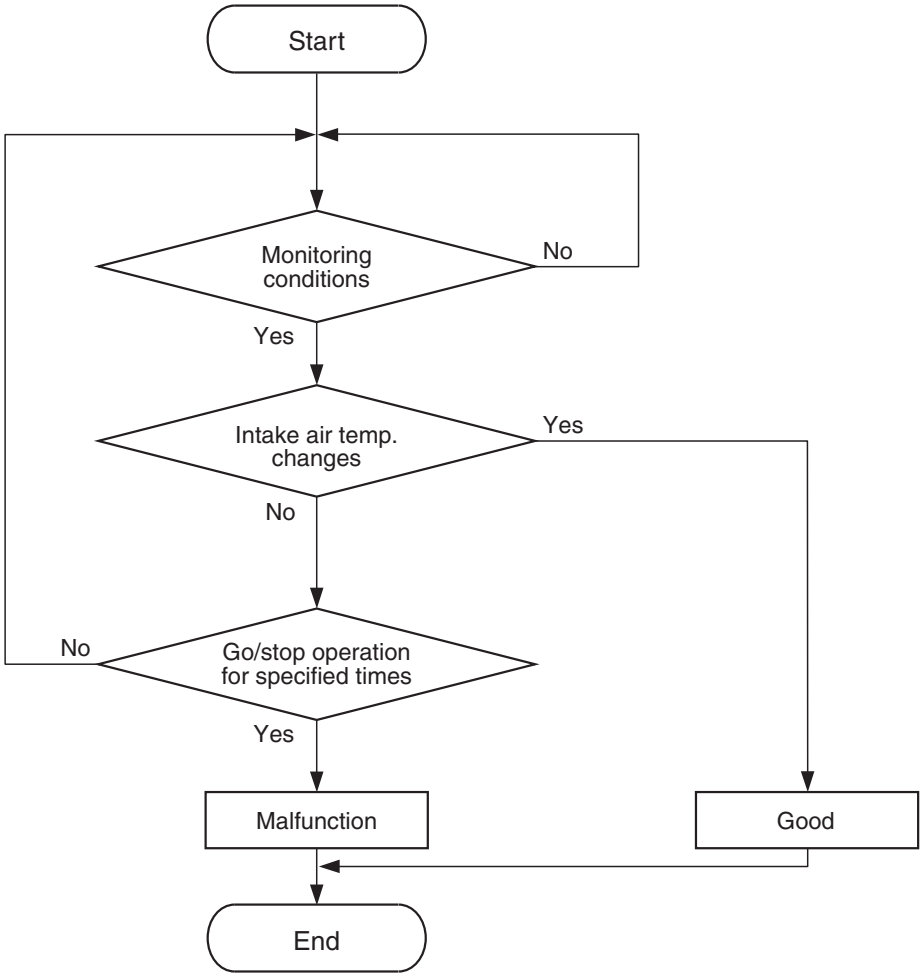
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



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TSB Revision

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- Repeat 2 or more times: drive[*1], stop[*2].

  Drive[*1]: vehicle speed higher than 50 km/h (31 mph) lasting a total of more than 60 seconds.

  Stop[*2]: vehicle speed lower than 1.5 km/h (1.0 mph) lasting more than 30 seconds.

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 P.13A-11.

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

- Intake air temperature sensor failed.
- Intake air temperature sensor circuit harness damage, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

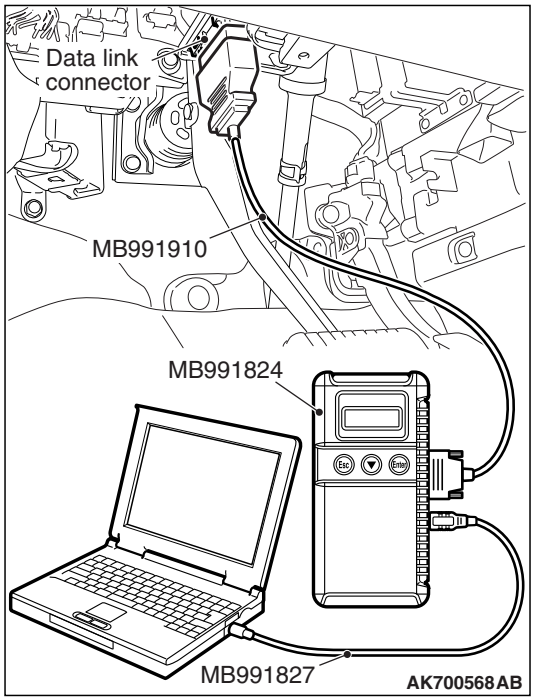
- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A

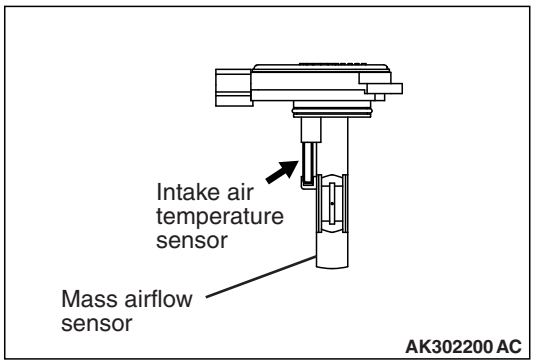
STEP 1. Using scan tool MB991958, check data list item 5: Intake Air Temperature Sensor.

⚠ CAUTION

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

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





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

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

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

Q: Is the sensor operating properly?

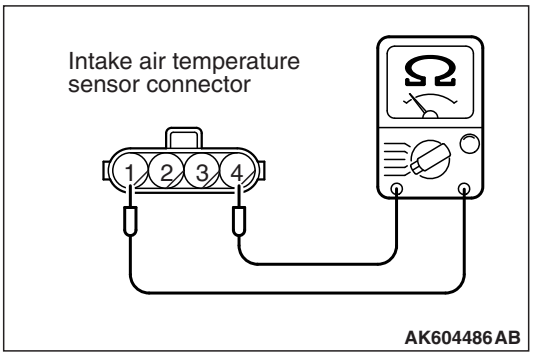
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

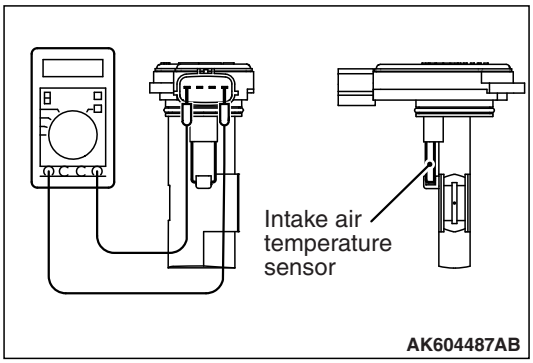
NO : Go to Step 2.

STEP 2. Check the intake air temperature sensor.

(1) Disconnect the intake air temperature sensor connector A-07.

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





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

Standard value:
13 – 17 kΩ [at –20°C (–4°F)]
5.4 – 6.7 kΩ [at 0°C (32°F)]
2.3 – 3.0 kΩ [at 20°C (68°F)]
1.0 – 1.5 kΩ [at 40°C (104°F)]
0.56 – 0.76 kΩ [at 60°C (140°F)]
0.31 – 0.45 kΩ [at 80°C (176°F)]

Q: Is the measured resistance at the standard value?

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

STEP 3. Check harness connector A-07 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

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

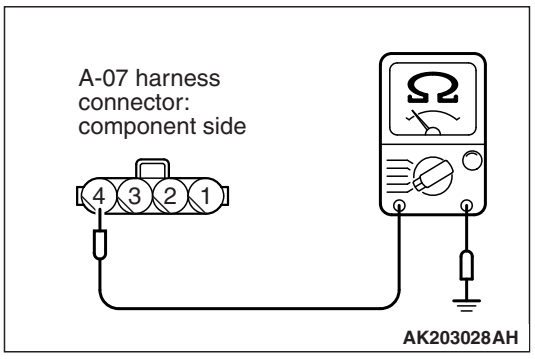
STEP 4. Check the continuity at intake air temperature sensor harness side connector A-07.

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

(2) Check for the continuity between terminal No. 4 and ground.
- Continuity (2 ohms or less)

Q: Does continuity exist?

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



STEP 5. Check harness connector B-11 at ECM for damage.

Q: Is the harness connector in good condition?

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

STEP 6. Check for harness damage between intake air temperature sensor connector A-07 (terminal No. 4) and ECM connector B-11 (terminal No. 88).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 9.
NO : Repair it. Then go to Step 9.

STEP 7. Check harness connector B-11 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 9.

STEP 8. Check for harness damage between intake air temperature sensor connector A-07 (terminal No. 1) and ECM connector B-11 (terminal No. 89).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 9.
NO : Repair it. Then go to Step 9.

STEP 9. Test the OBD-II drive cycle.

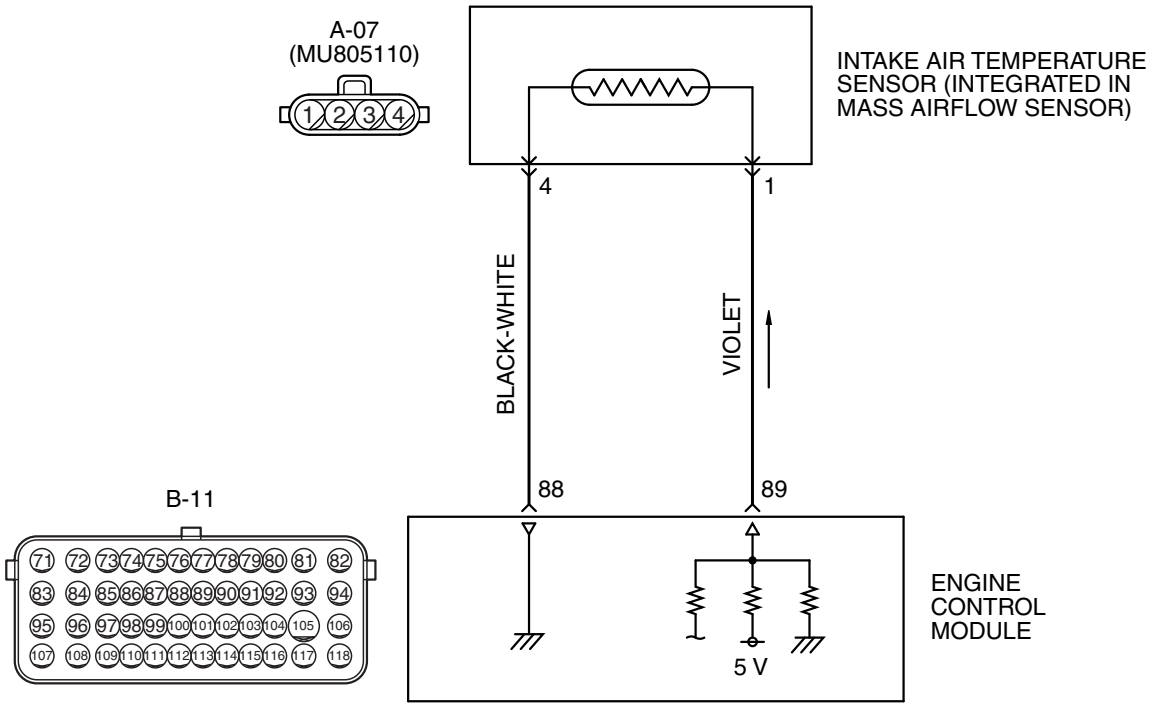
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 8 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0111 set?

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

DTC P0112: Intake Air Temperature Circuit Low Input

INTAKE AIR TEMPERATURE SENSOR CIRCUIT



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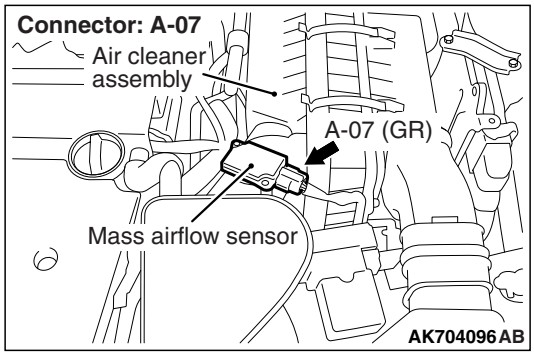
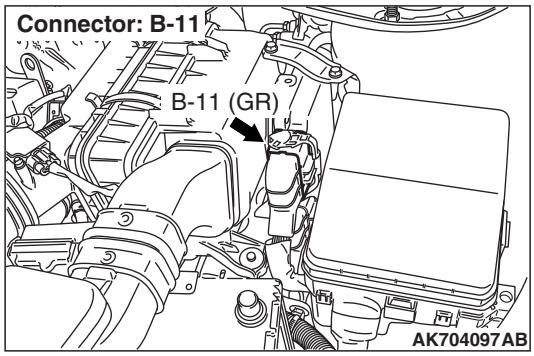




CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 89) via the resistor in the ECM. The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 88).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

TSB Revision

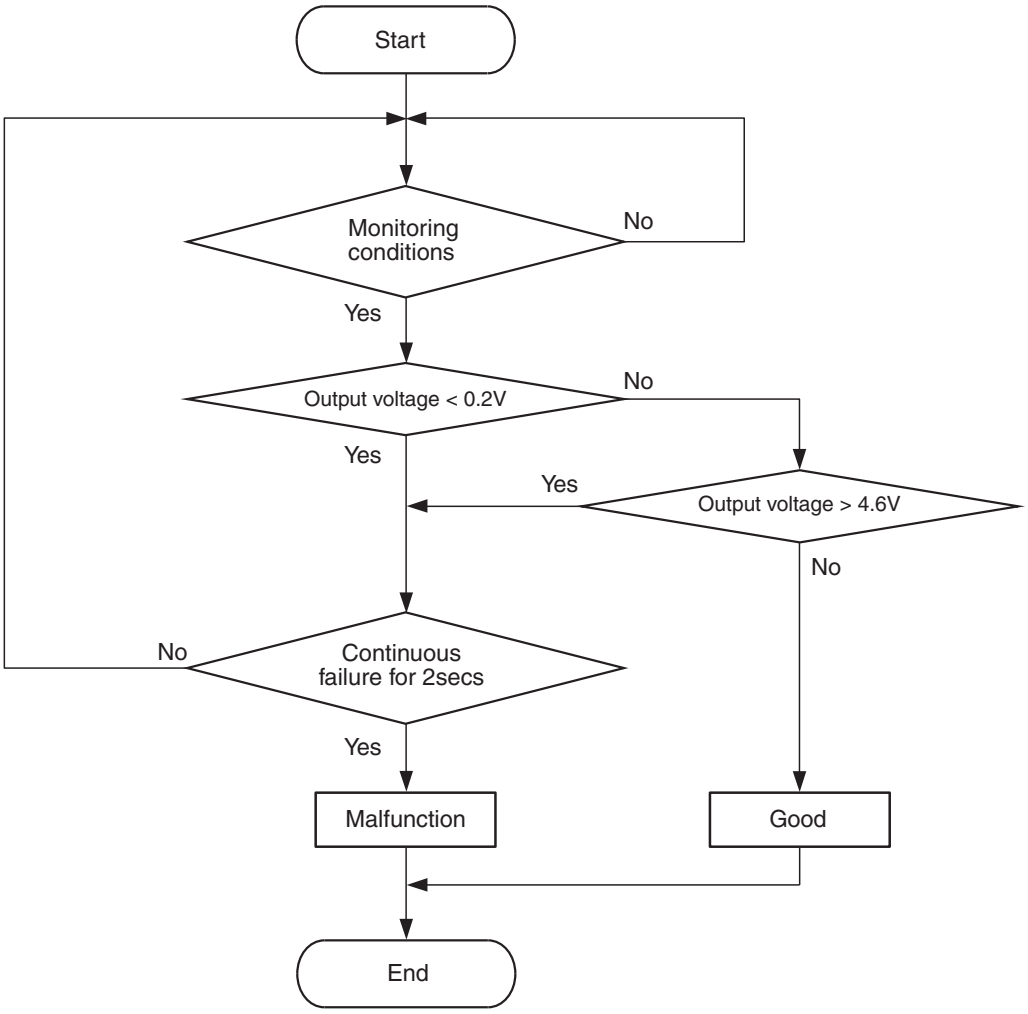
MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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)
- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK604315

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

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

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

TSB Revision

DIAGNOSIS

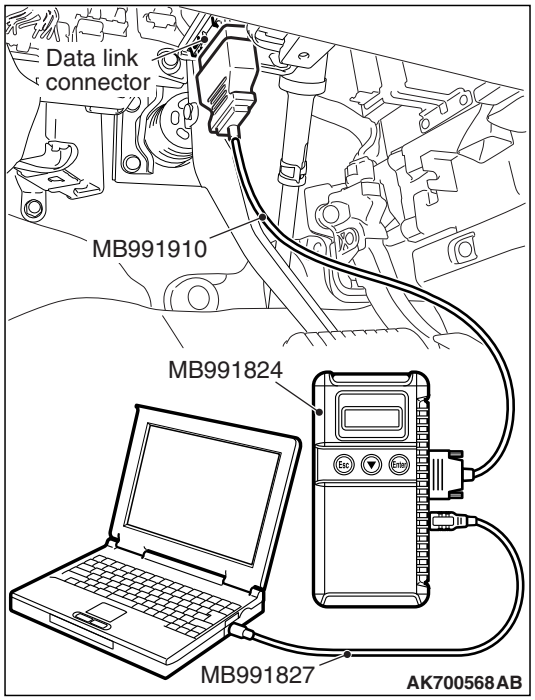
Required Special Tools:

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

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

⚠ CAUTION

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



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

Q: Is the sensor operating properly?

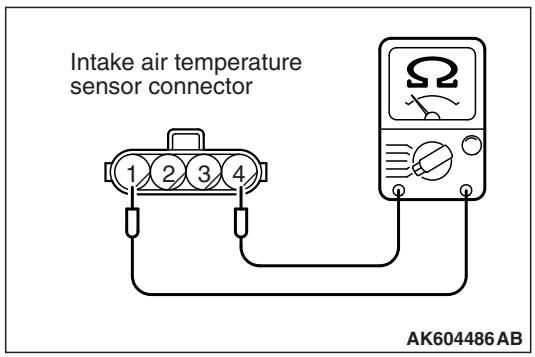
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 2.

STEP 2. Check harness connector A-07 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 6.

STEP 3. Check the intake air temperature sensor.



(1) Disconnect the intake air temperature sensor connector A-07.
(2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.
  - There should be continuity. (0.30 – 17 kΩ)

Q: Is the measured resistance between 0.30 and 17 kΩ?

YES : Go to Step 4.
NO : Replace the mass airflow sensor. Then go to Step 6.

TSB Revision

STEP 4. Check harness connector B-11 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

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

STEP 5. Check for short circuit to ground between intake air temperature sensor connector A-07 (terminal No. 1) and ECM connector B-11 (terminal No. 89).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 6.

NO : Repair it. Then go to Step 6.

STEP 6. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

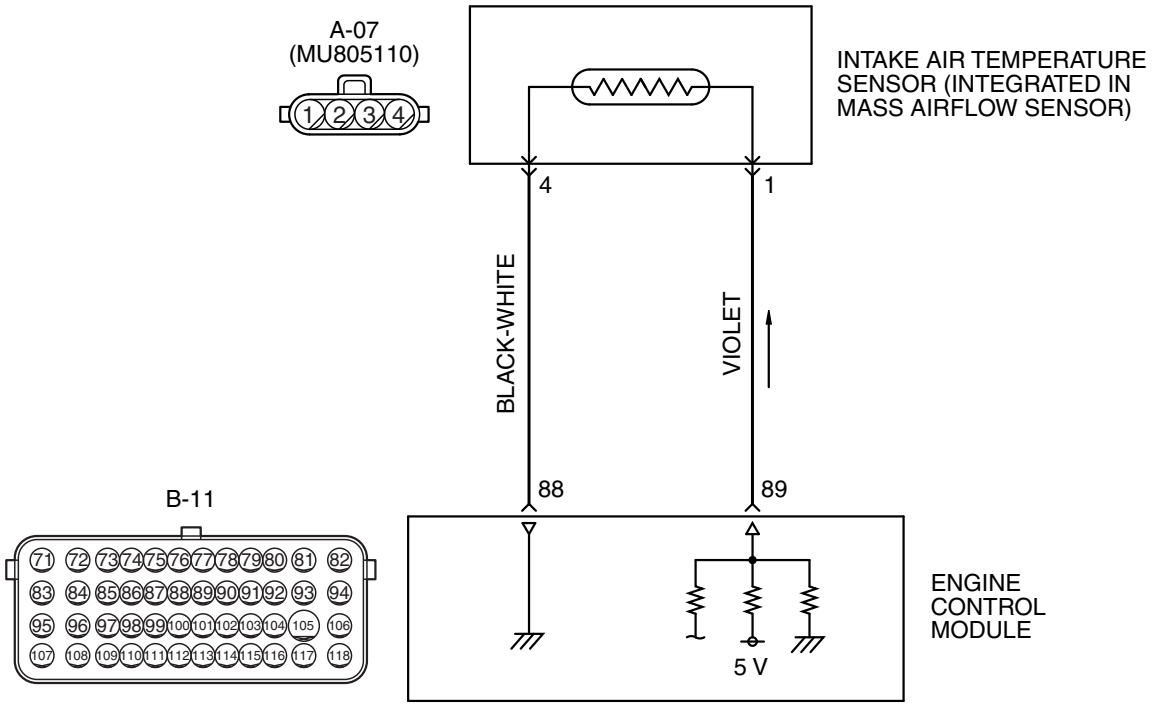
Q: Is DTC P0112 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0113: Intake Air Temperature Circuit High Input

INTAKE AIR TEMPERATURE SENSOR CIRCUIT



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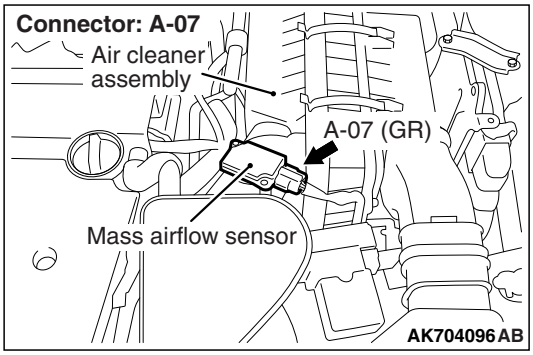
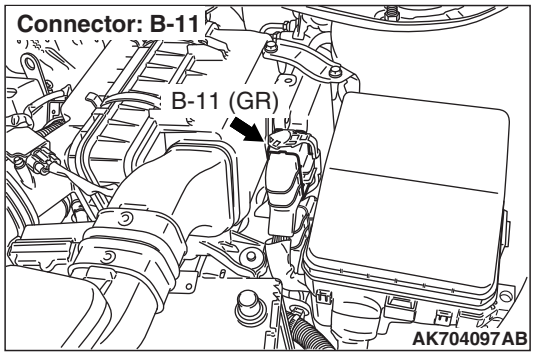




CIRCUIT OPERATION

- Approximately 5 volts are applied to the intake air temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 89) via the resistor in the ECM. The ground terminal (terminal No. 4) is grounded with ECM (terminal No. 88).
- The intake air temperature sensor is a negative temperature coefficient type of resistor. When the intake air temperature rises, the resistance decreases.
- The intake air temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

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

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

TSB Revision

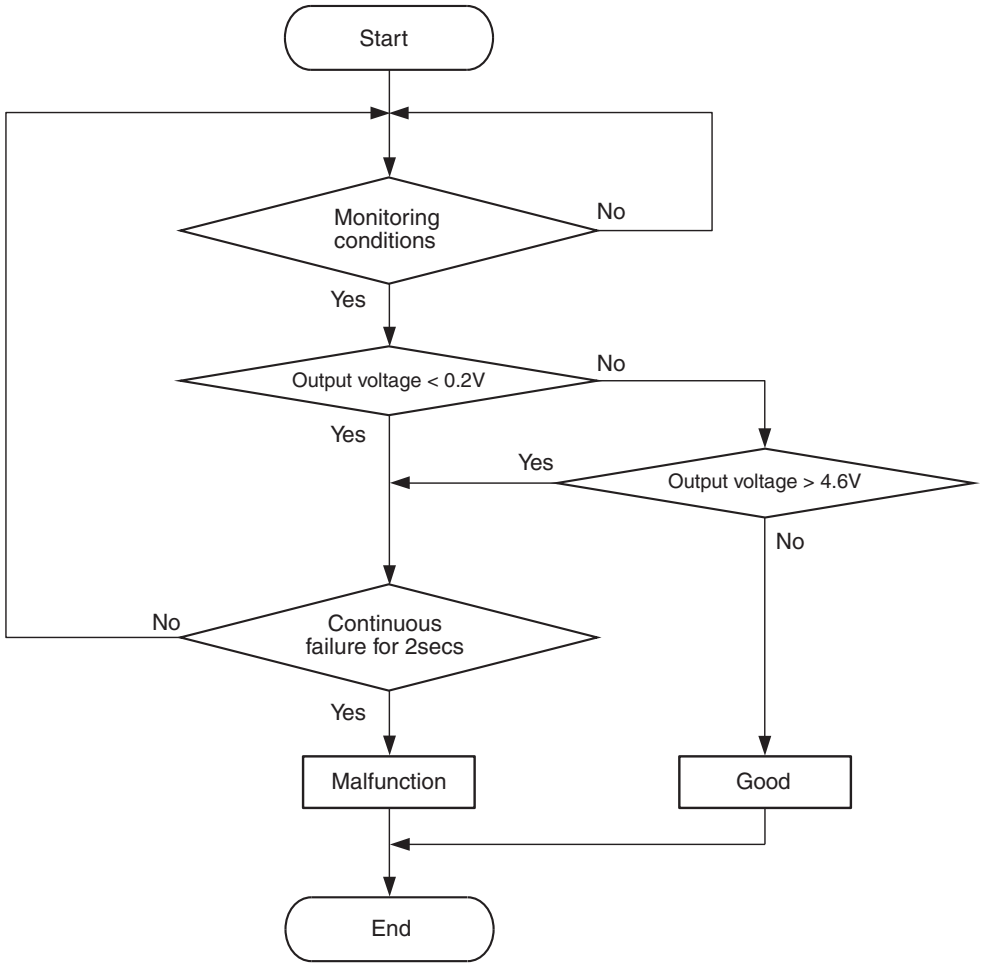
MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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)
- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK604315

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

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

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

DIAGNOSIS

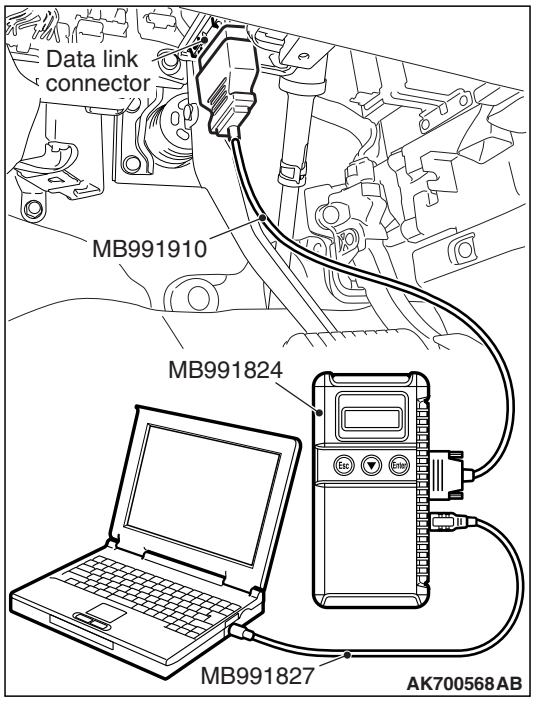
Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- MB992110: Power Plant ECU Check Harness

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

⚠ CAUTION

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



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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

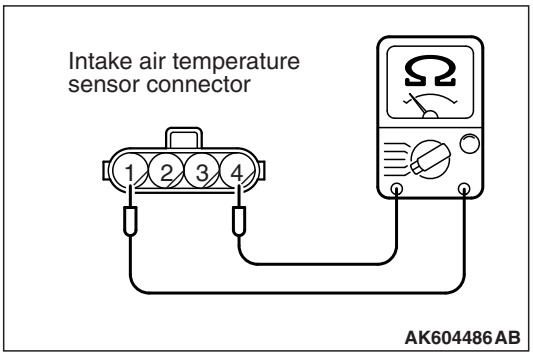
NO : Go to Step 2.

STEP 2. Check harness connector A-07 at the intake air temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

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

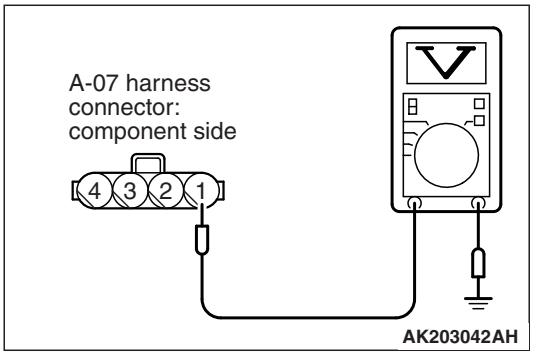


STEP 3. Check the intake air temperature sensor.

(1) Disconnect the intake air temperature sensor connector A-07.
(2) Measure the resistance between intake air temperature sensor side connector terminal No. 1 and No. 4.
- There should be continuity. (0.30 – 17 kΩ)

Q: Is the measured resistance between 0.30 and 17 kΩ?

YES : Go to Step 4.
NO : Replace the mass airflow sensor. Then go to Step 10.



STEP 4. Measure the sensor supply voltage at intake air temperature sensor harness side connector A-07.

(1) Disconnect the connector A-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 between 4.5 and 4.9 volts.

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

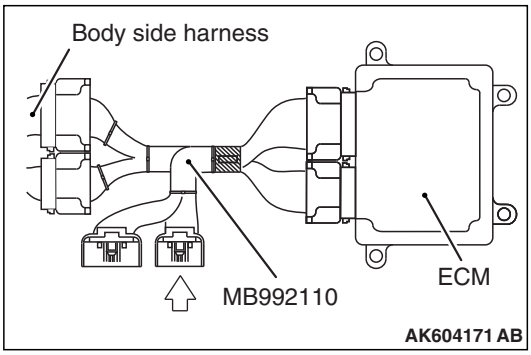
Q: Is the measured voltage between 4.5 and 4.9 volts?

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

STEP 5. Check harness connector B-11 at ECM for damage.

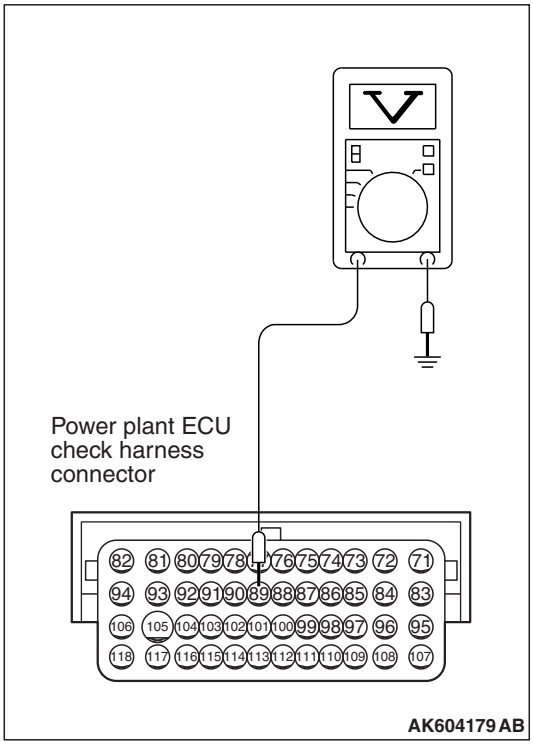
Q: Is the harness connector in good condition?

YES : Go to Step 6.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.



STEP 6. Measure the sensor supply voltage at ECM connector B-11 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.
(2) Disconnect the intake air temperature sensor connector A-07.
(3) Turn the ignition switch to the "ON" position.



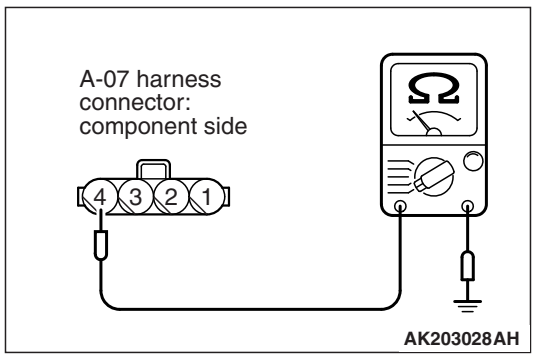
(4) Measure the voltage between terminal No. 89 and ground.
- Voltage should be between 4.5 and 4.9 volts.

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

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

YES : Repair harness wire between intake air temperature sensor connector A-07 (terminal No. 1) and ECM connector B-11 (terminal No. 89) because of open circuit. Then go to Step 10.

NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.



STEP 7. Check the continuity at intake air temperature sensor harness side connector A-07.

(1) Disconnect the connector A-07 and measure at the harness side.
(2) Check for the continuity between terminal No. 4 and ground.
- Continuity (2 ohms or less)

Q: Does continuity exist?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.

NO : Go to Step 8.

TSB Revision

STEP 8. Check harness connector B-11 at ECM 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 10.

STEP 9. Check for open circuit between intake air temperature sensor connector A-07 (terminal No. 4) and ECM connector B-11 (terminal No. 88).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.
NO : Repair it. Then go to Step 10.

STEP 10. Test the OBD-II drive cycle.

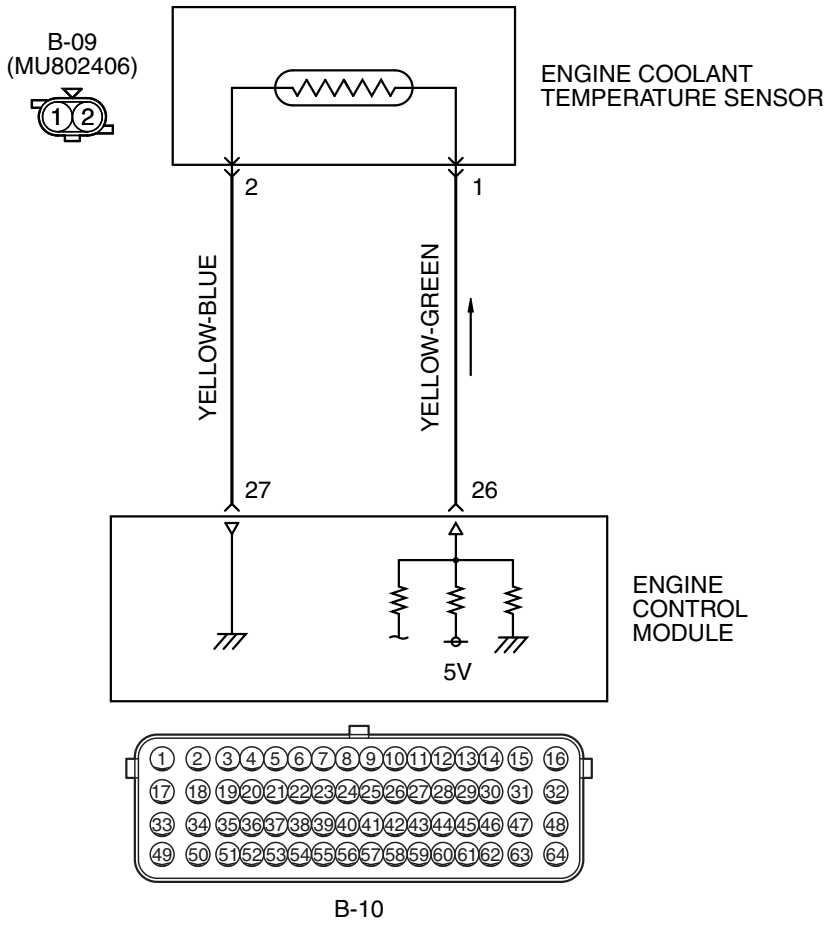
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0113 set?

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

DTC P0116: Engine Coolant Temperature Circuit Range/Performance Problem

ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



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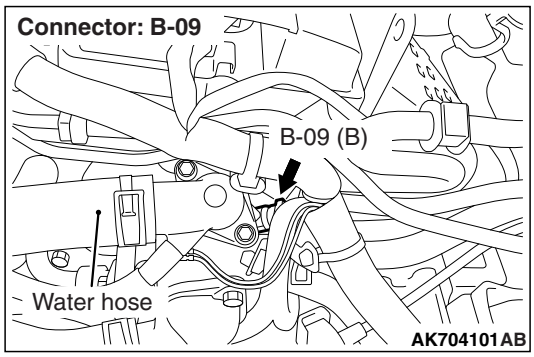
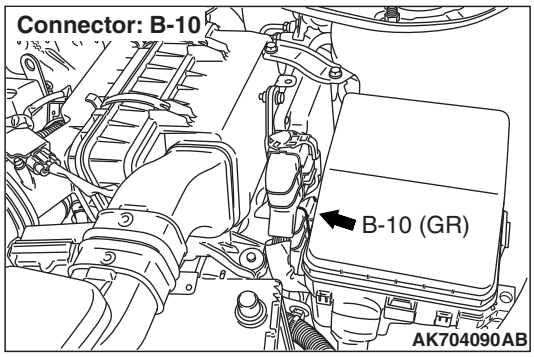




TSB Revision

CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 26) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 27).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

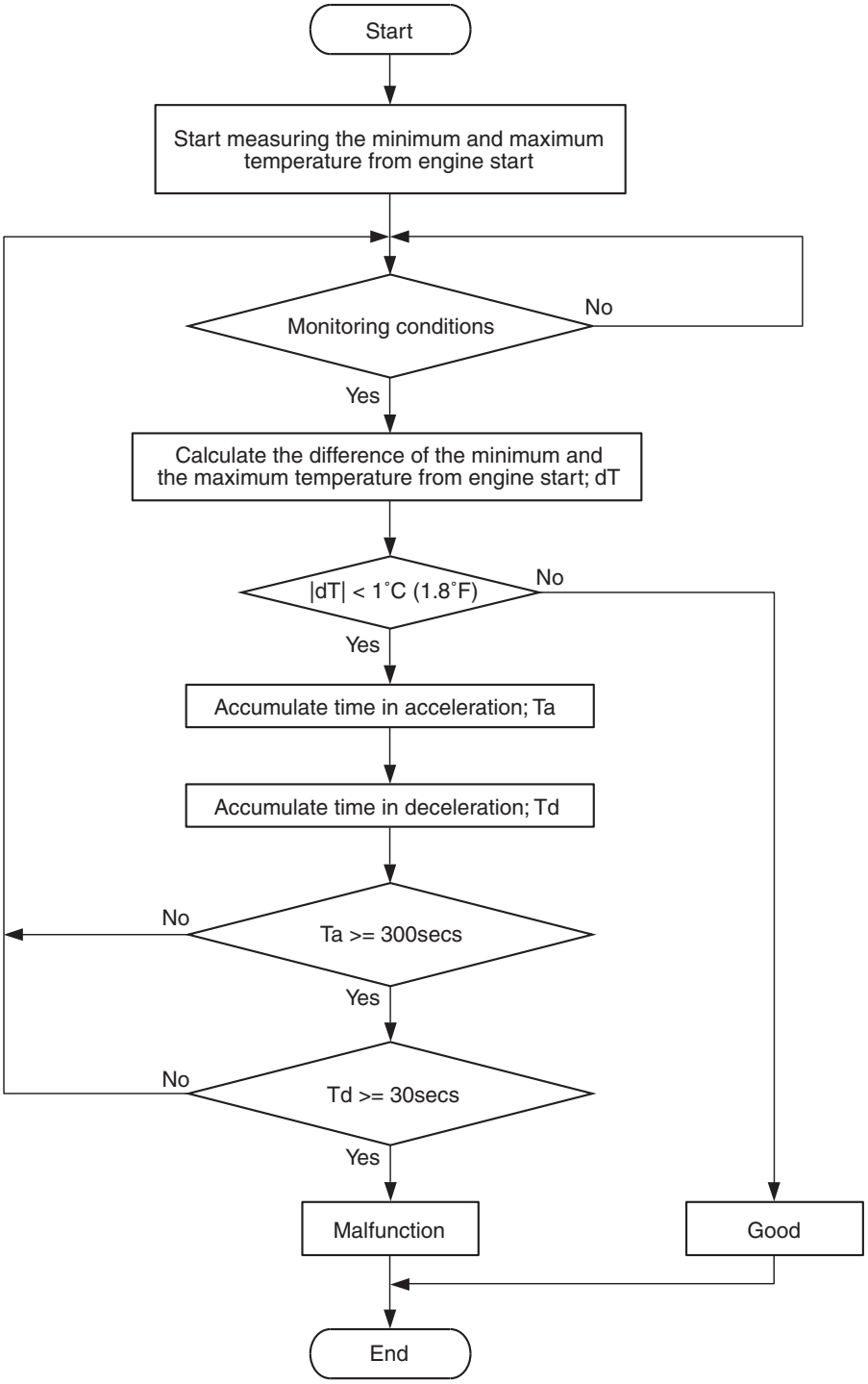
- Not applicable

Sensor (The sensor below is determined to be normal)

- Mass airflow sensor
- Intake air temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



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TSB Revision

Check Conditions

- Engine coolant temperature was more than 0°C (32°F) when the engine started.
- The accumulation is more than 300 seconds during the acceleration having the mass airflow rate of 12 g/sec or more.
- The accumulation is more than 30 seconds during the deceleration having the mass airflow rate of 9 g/sec or less.

Judgement Criteria

- Engine coolant temperature fluctuates within 1°C (1.8°F) after 330 seconds have passed since the engine was started.
- However, time is not counted if any of the following conditions are met.
  1. Intake air temperature is more than 60°C (140°F).
  2. During fuel shut-off operation.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 P.13A-11.

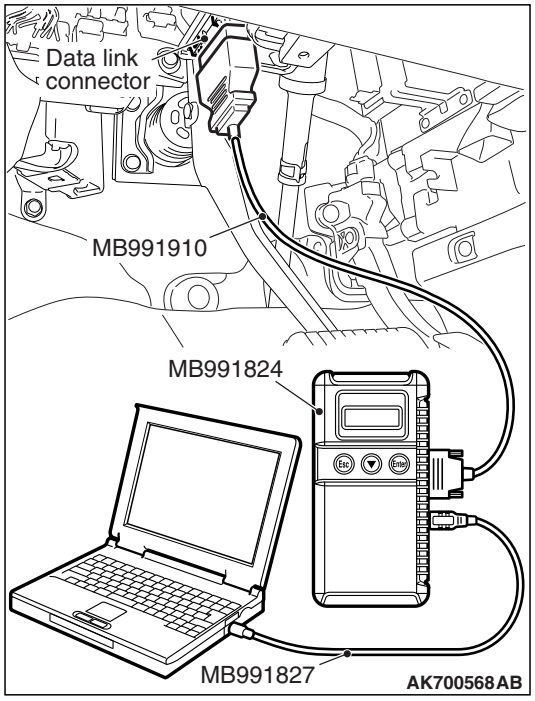
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

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

DIAGNOSIS

Required Special Tools:

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



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

⚠ CAUTION

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

NO : Go to Step 2.

STEP 2. Check the engine coolant temperature sensor.
Refer to Engine Coolant Temperature Sensor P.13A-874.

Q: Is the engine coolant temperature sensor normal?

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

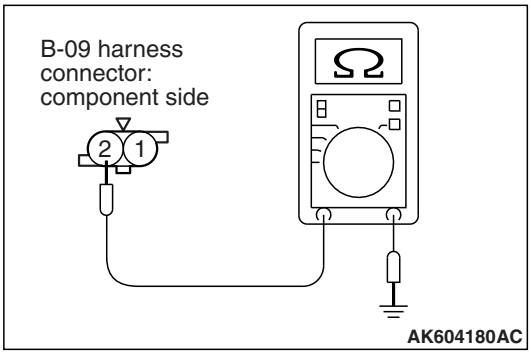
STEP 3. Check harness connector B-09 at the engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

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

STEP 4. Check the continuity at engine coolant temperature sensor harness side connector B-09.

(1) Disconnect the connector B-09 and measure at the harness side.
(2) Check for the continuity between terminal No. 2 and ground.
- Continuity (2 ohms or less)



Q: Does continuity exist?

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

STEP 5. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

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

STEP 6. Check for harness damage between engine coolant temperature sensor connector B-09 (terminal No. 2) and ECM connector B-10 (terminal No. 27).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 9.
NO : Repair it. Then go to Step 9.

STEP 7. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

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

STEP 8. Check for harness damage between engine coolant temperature sensor connector B-09 (terminal No. 1) and ECM connector B-10 (terminal No. 26).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 9.

NO : Repair it. Then go to Step 9.

STEP 9. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 P.13A-11.

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

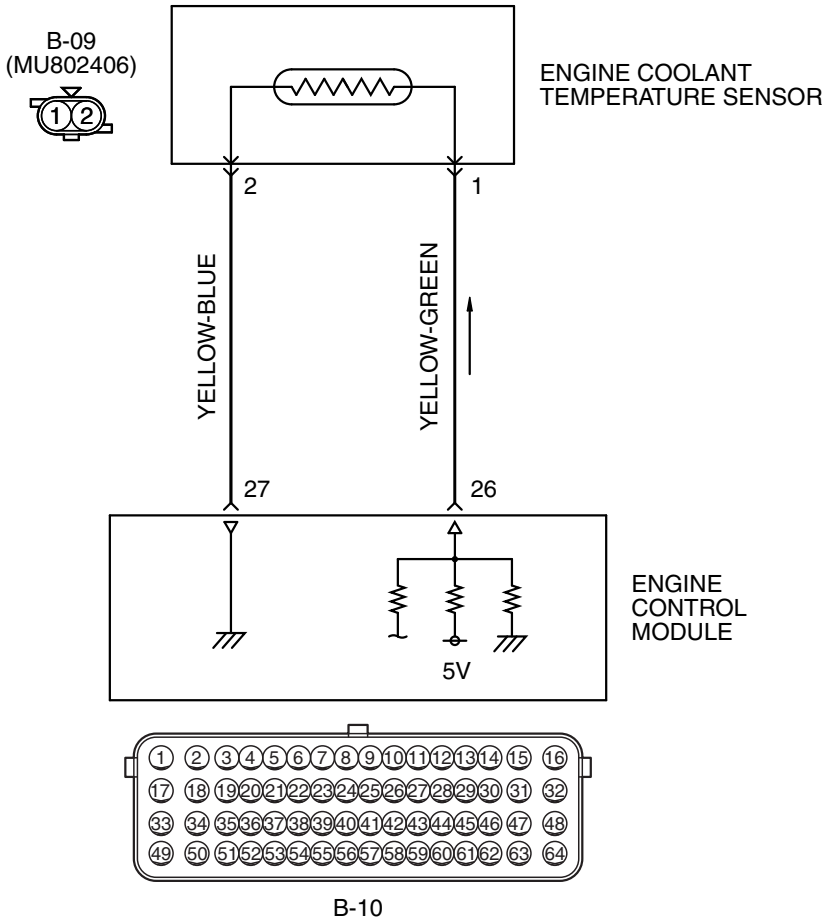
Q: Is DTC P0116 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0117: Engine Coolant Temperature Circuit Low Input

ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



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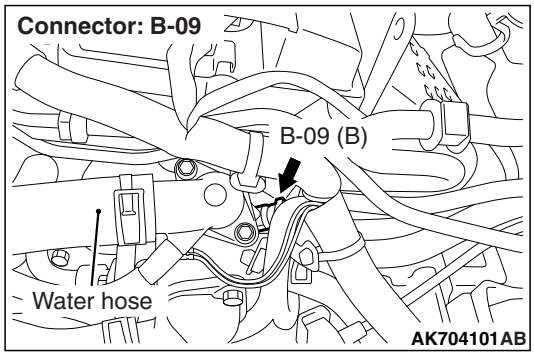
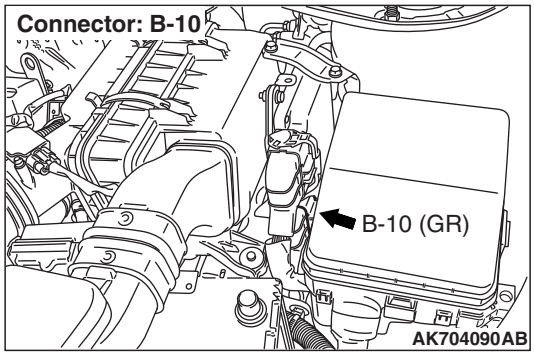




CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 26) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 27).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TSB Revision

TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

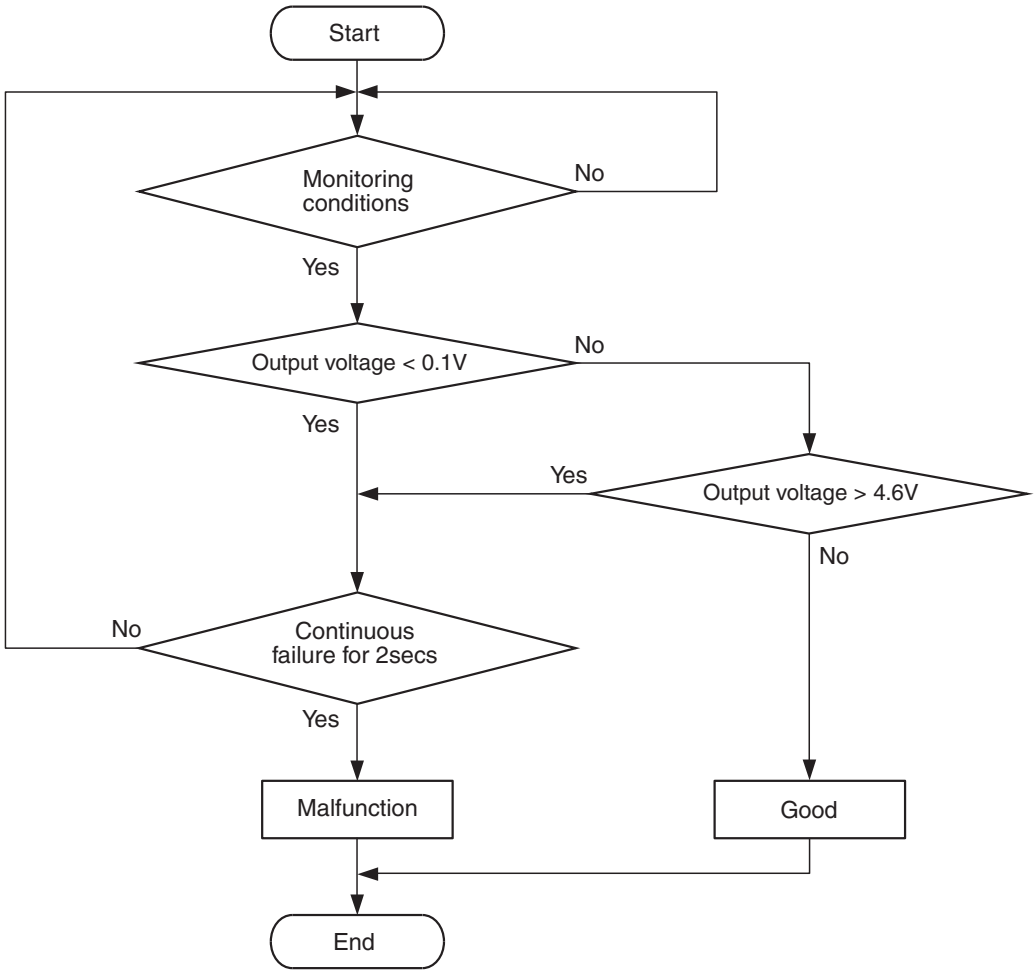
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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TSB Revision

Check Condition

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

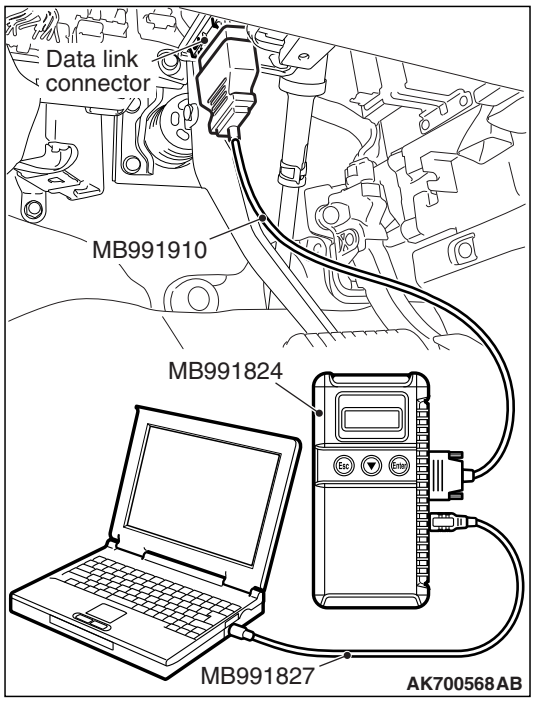
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

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

DIAGNOSIS

Required Special Tools:

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



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

⚠ CAUTION

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

NO : Go to Step 2.

STEP 2. Check harness connector B-09 at the engine coolant temperature sensor and harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 5.

STEP 3. Check for short circuit to ground between engine coolant temperature sensor connector B-09 (terminal No. 1) and ECM connector B-10 (terminal No. 26).

Q: Is the harness wire in good condition?

YES : Go to Step 4.
NO : Repair it. Then go to Step 5.

STEP 4. Check the engine coolant temperature sensor.
Refer to Engine Coolant Temperature Sensor P.13A-874.

Q: Is the engine coolant temperature sensor normal?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 5.
NO : Replace the engine coolant temperature sensor. Then go to Step 5.

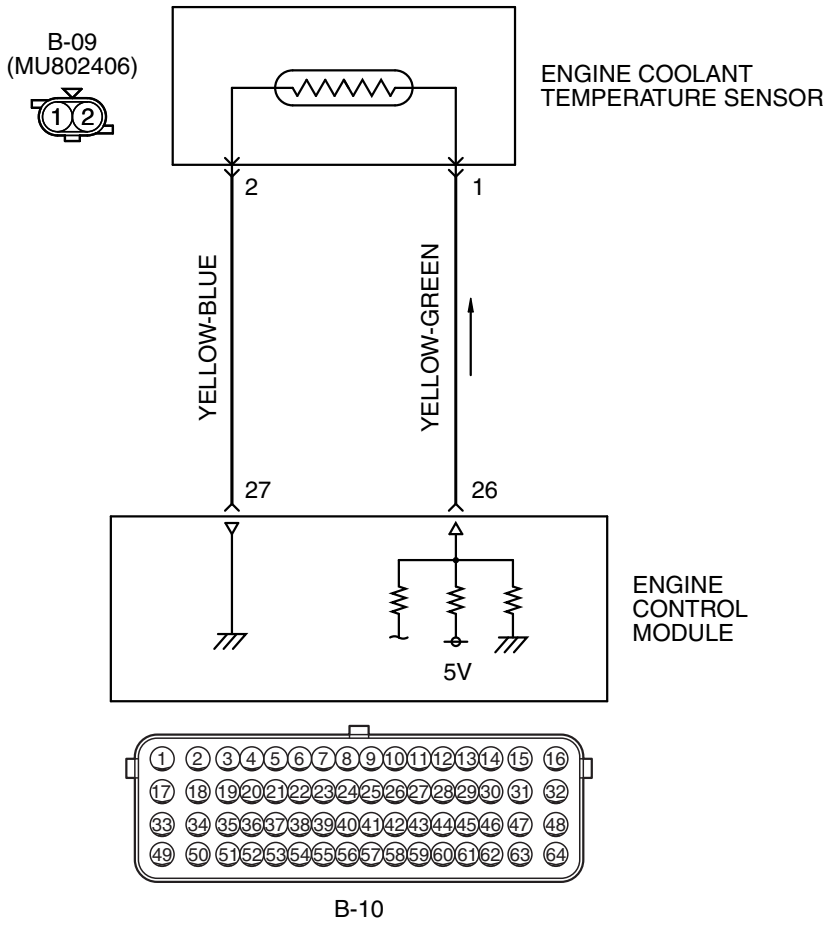
STEP 5. Test the OBD-II drive cycle.
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0117 set?

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

DTC P0118: Engine Coolant Temperature Circuit High Input

ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



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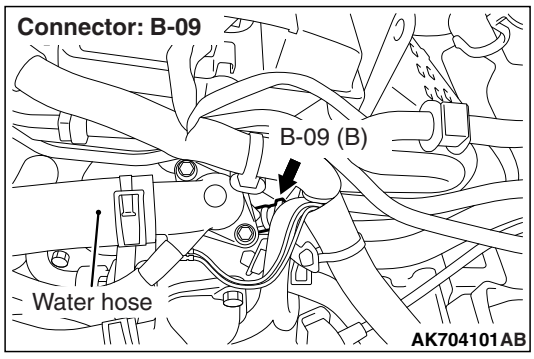
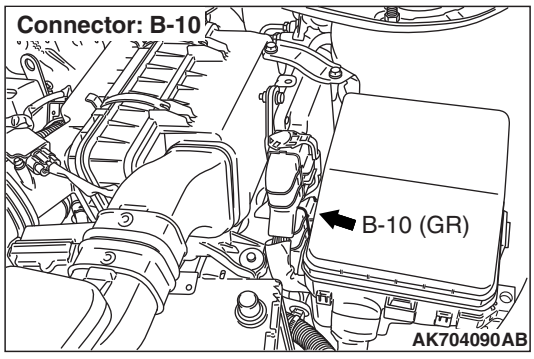




TSB Revision

CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 26) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 27).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

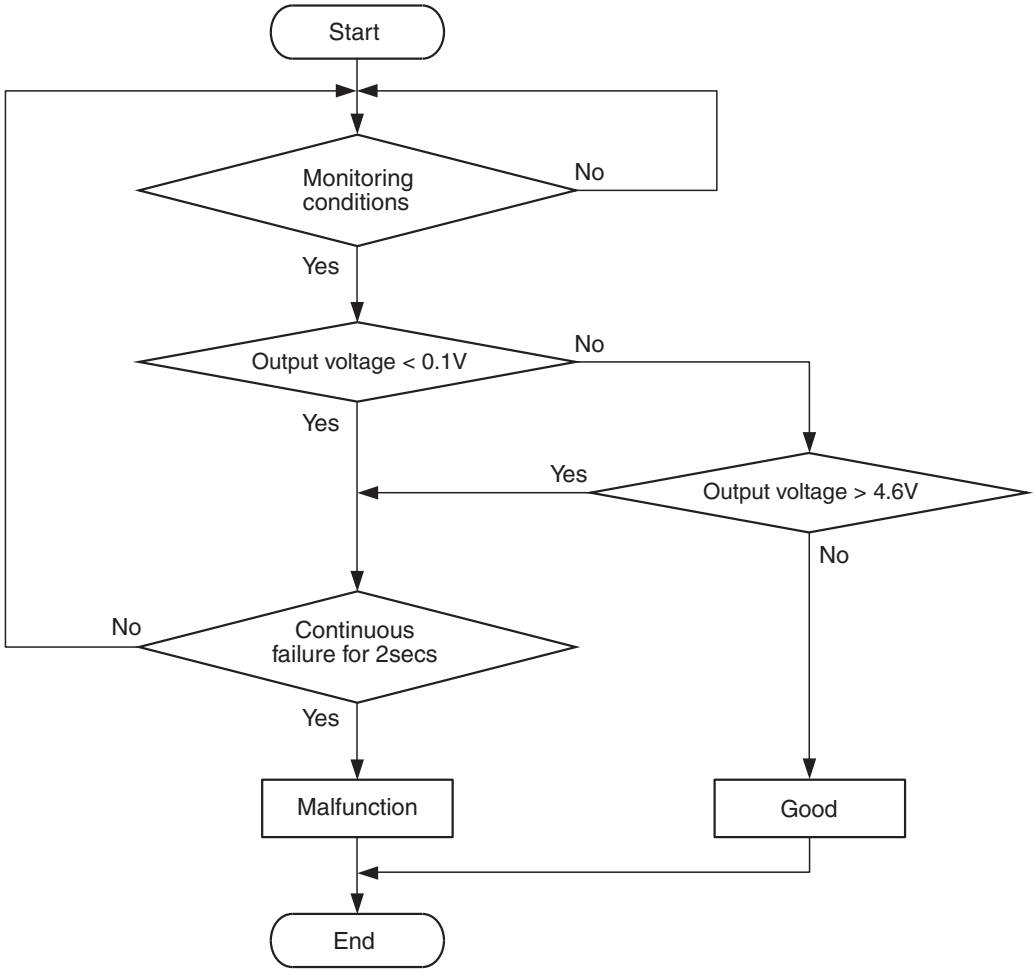
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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Check Condition

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

Judgement Criterion

- Engine coolant temperature sensor output voltage has continued to be 4.6 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function–OBD-II Drive Cycle–Pattern 23 P.13A-11.

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

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

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.

TSB Revision

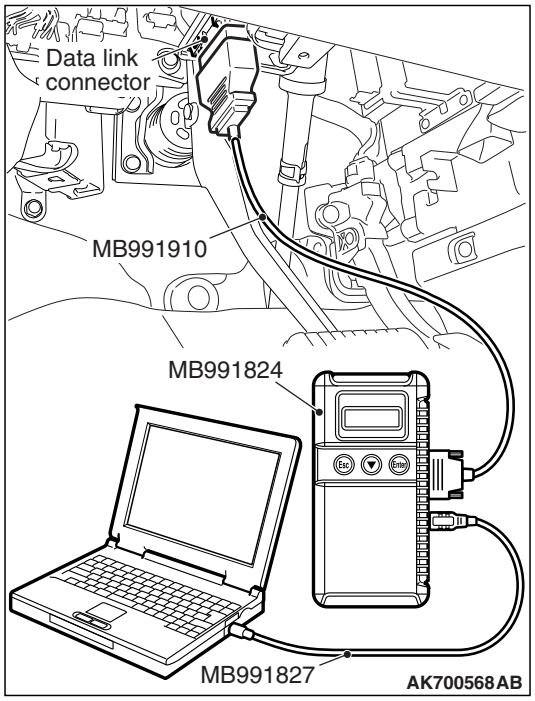
- MB991827: USB Cable
- MB991910: Main Harness A

- MB992110: Power Plant ECU Check Harness

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

⚠ CAUTION

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



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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

NO : Go to Step 2.

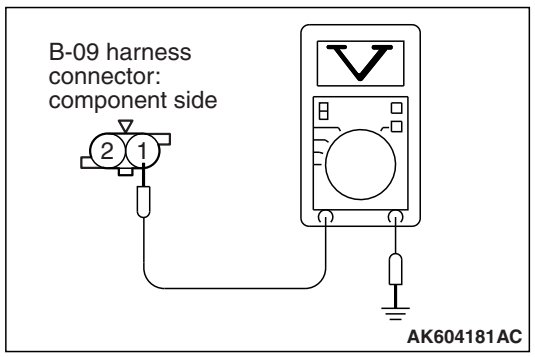
STEP 2. Check harness connector B-09 at the engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

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

STEP 3. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-09.



(1) Disconnect the connector B-09 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be between 4.5 and 4.9 volts.

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

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

YES : Go to Step 6.

NO : Go to Step 4.

STEP 4. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

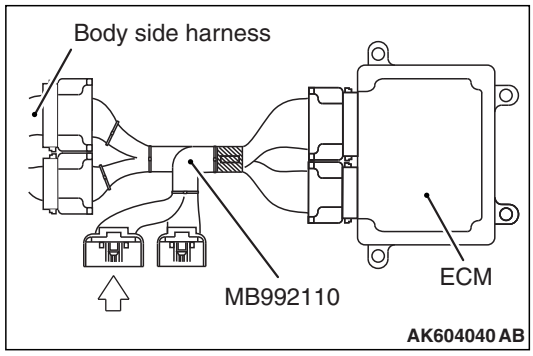
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

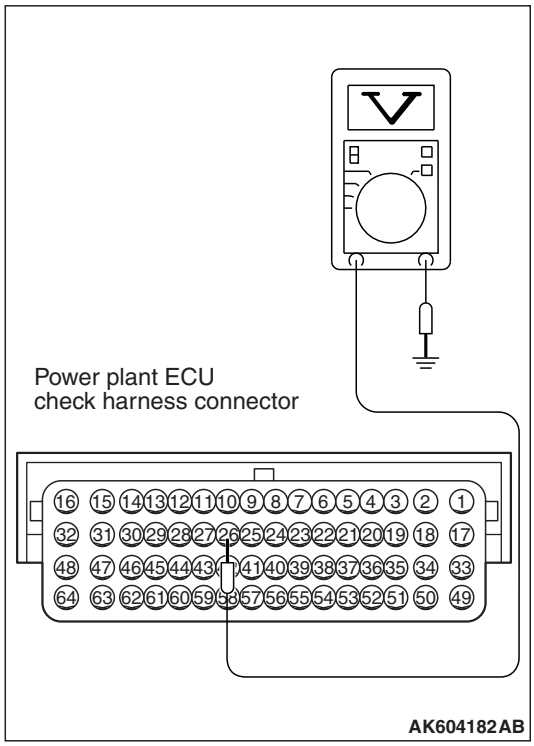
STEP 5. Measure the sensor supply voltage at ECM connector B-10 by using power plant ECU check harness special tool MB992110.

(1) Disconnect all ECM connectors. Connect the power plant ECU check harness special tool MB992110 between the separated connectors.

(2) Disconnect the engine coolant temperature sensor connector B-09.

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





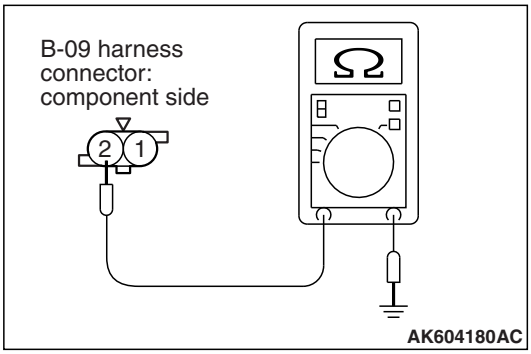
(4) Measure the voltage between terminal No. 26 and ground.
- Voltage should be between 4.5 and 4.9 volts.

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

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

YES : Repair harness wire between engine coolant temperature sensor connector B-09 (terminal No. 1) and ECM connector B-10 (terminal No. 26) because of open circuit. Then go to Step 10.

NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.



STEP 6. Check the continuity at engine coolant temperature sensor harness side connector B-09.

(1) Disconnect the connector B-09 and measure at the harness side.
(2) Check for the continuity between terminal No. 2 and ground.
- Continuity (2 ohms or less)

Q: Does continuity exist?

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

STEP 7. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 10.

STEP 8. Check for open circuit between engine coolant sensor connector B-09 (terminal No. 2) and ECM connector B-10 (terminal No. 27).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step10.
NO : Repair it. Then go to Step 10.

STEP 9. Check the engine coolant temperature sensor.

Refer to Engine Coolant Temperature Sensor P.13A-874.

Q: Is the engine coolant temperature sensor normal?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 10.
NO : Replace the engine coolant temperature sensor. Then go to Step 10.

STEP 10. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 P.13A-11.

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

Q: Is DTC P0118 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0121: Throttle Position Sensor (main) Plausibility

TECHNICAL DESCRIPTION

Compare the actual measurement of volumetric efficiency by a mass airflow sensor signal with the volumetric efficiency estimated from a throttle position sensor (main) signal.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

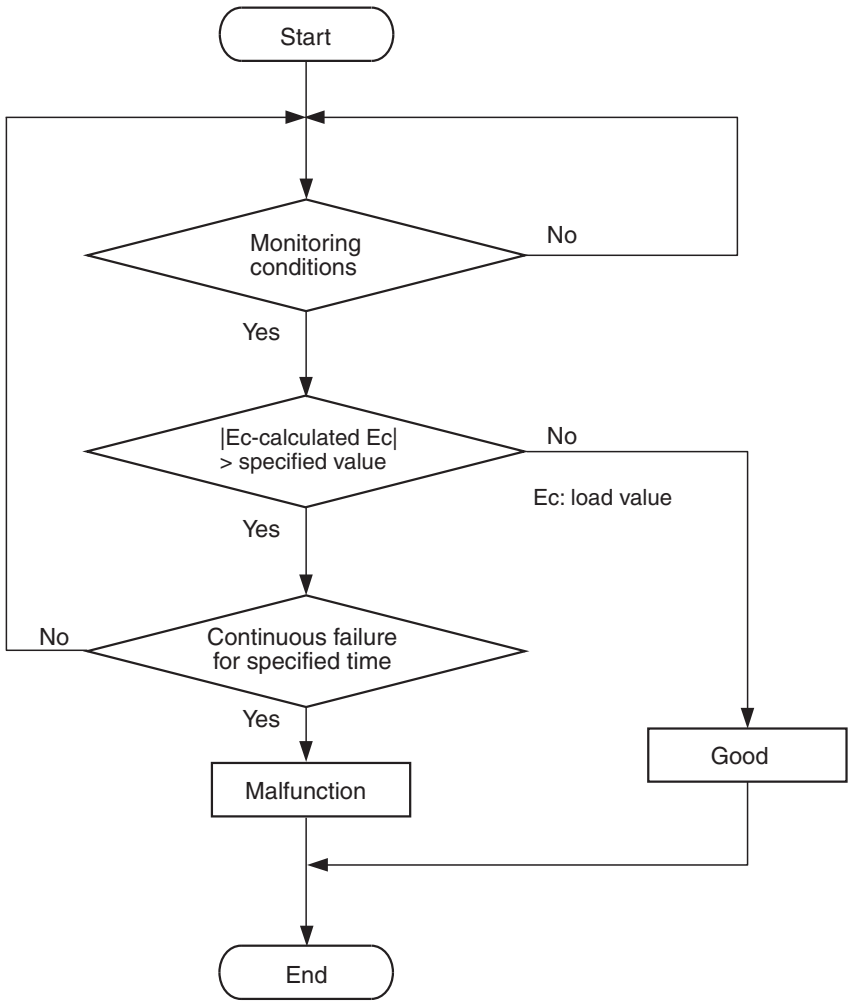
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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Check Conditions

- The difference between the actual volumetric efficiency and the volumetric efficiency estimated by the (main) throttle position sensor is 0 percent or more. Or, the volumetric efficiency is 60 percent or less.
- The engine speed is between 750 and 3,000 r/min. Or, the throttle position sensor (main) output voltage is 3 volts or less.

Judgment Criterion

- For 0.4 second, the difference between the actual volumetric efficiency and the volumetric efficiency estimated by the (main) throttle position sensor is 33 percent or more.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle Pattern 17 P.13A-11.

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

- Throttle position sensor (main) system failed.
- Intake system vacuum leak.
- ECM failed.

TSB Revision

DIAGNOSIS

Required Special Tools:

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

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

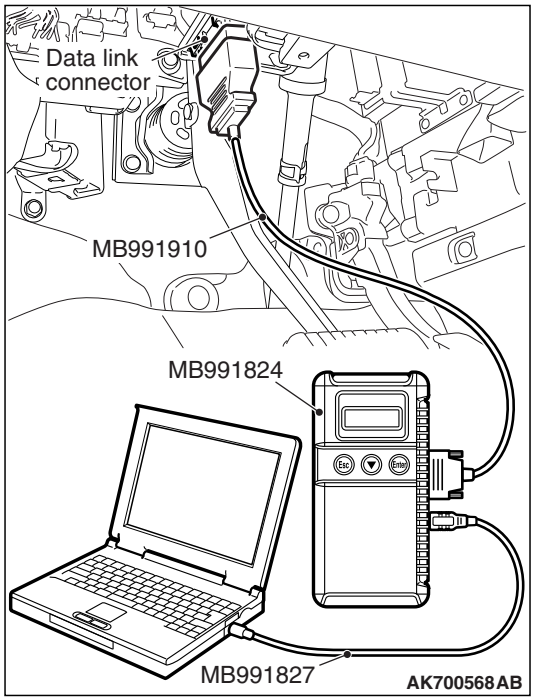
⚠ CAUTION

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

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

Q: Is the diagnostic trouble code other than P0121 set?

YES : Refer to, Diagnostic Trouble Code Chart P.13A-49.
NO : Go to Step 2.



STEP 2. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

(1) Turn the ignition switch to the "ON" position.
(2) Detach the intake air hose at the throttle body.
(3) Disconnect the connector of the throttle position sensor.
(4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
(5) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
  - Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
  - Output voltage should be 4.0 volts or more when the throttle valve is fully open with your finger.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 3.

TSB Revision

STEP 3. Check for intake system vacuum leak.

Q: Are there any abnormalities?

YES : Repair it. Then go to Step 5.
NO : Go to Step 4.

STEP 4. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle Pattern 17 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0121 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 5.
NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

STEP 5. Test the OBD-II drive cycle.

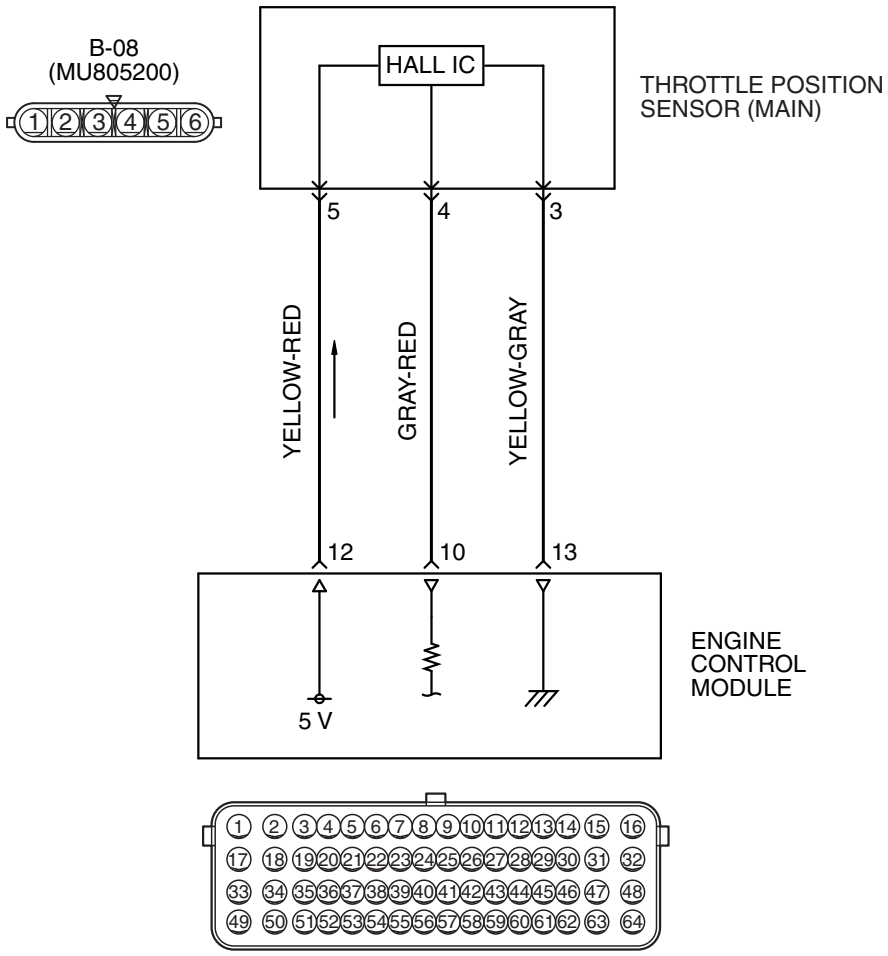
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle Pattern 17 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0121 set?

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

DTC P0122: Throttle Position Sensor (main) Circuit Low Input

THROTTLE POSITION SENSOR (MAIN) CIRCUIT



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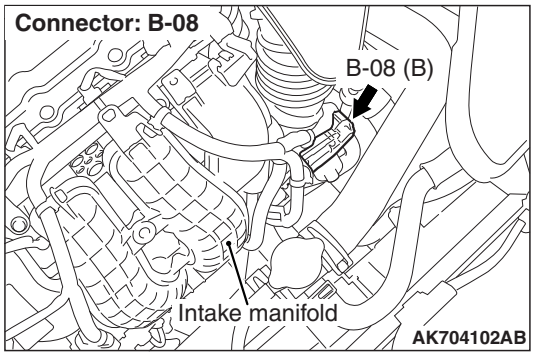
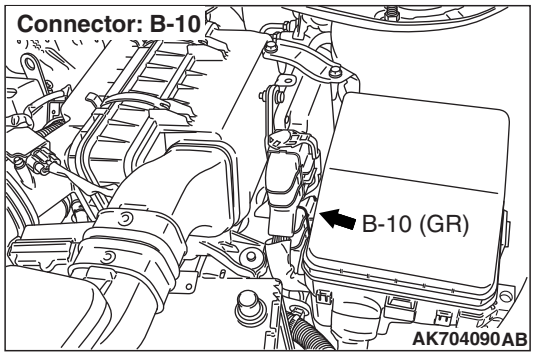




CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the ECM (terminal No. 12).
- A voltage that is according to the throttle opening angle is sent to the ECM (terminal No. 10) from the throttle position sensor (main) output terminal (terminal No. 4).

TSB Revision

- The ground terminal (terminal No. 3) is grounded with ECM (terminal No. 13).

TECHNICAL DESCRIPTION

- The throttle position sensor (main) outputs voltage which corresponds to the throttle valve opening angle.
- The ECM checks whether the voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Throttle position sensor (main) output voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

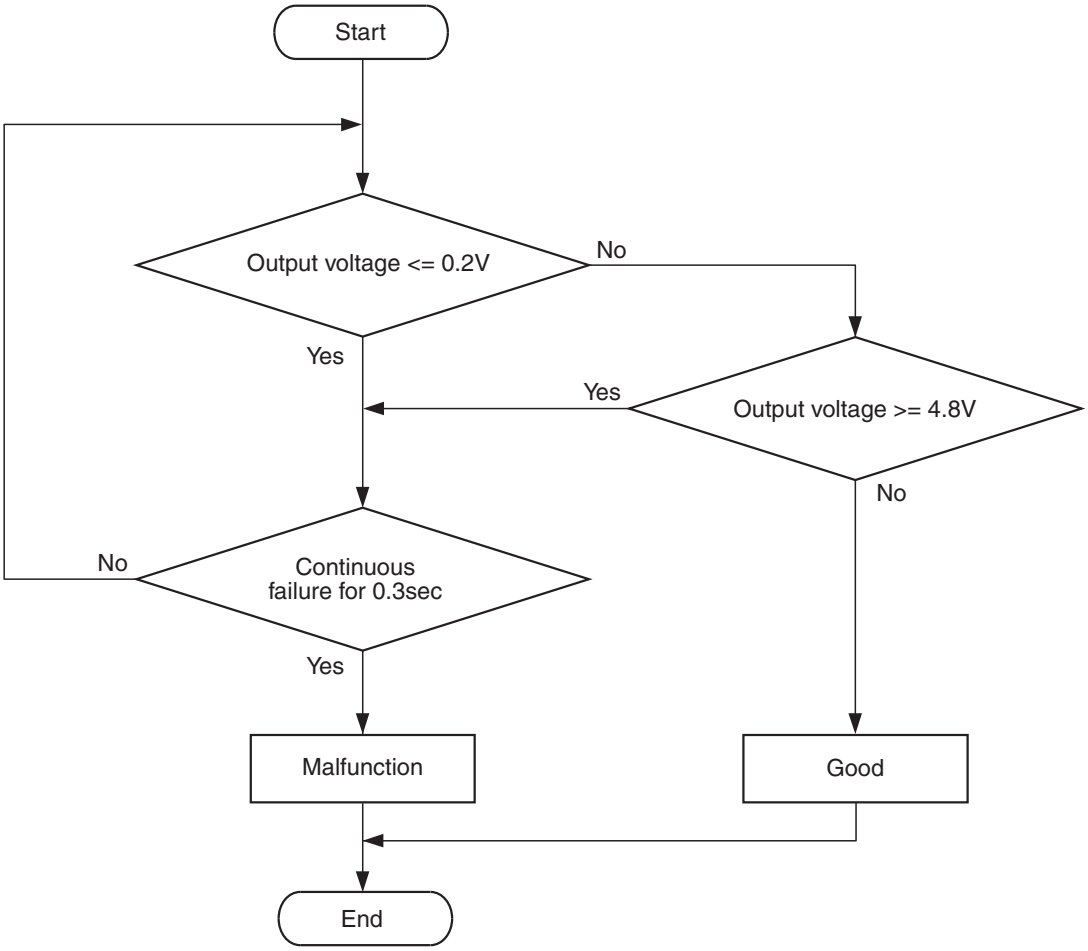
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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TSB Revision

Check Condition
- Ignition switch is "ON" position.

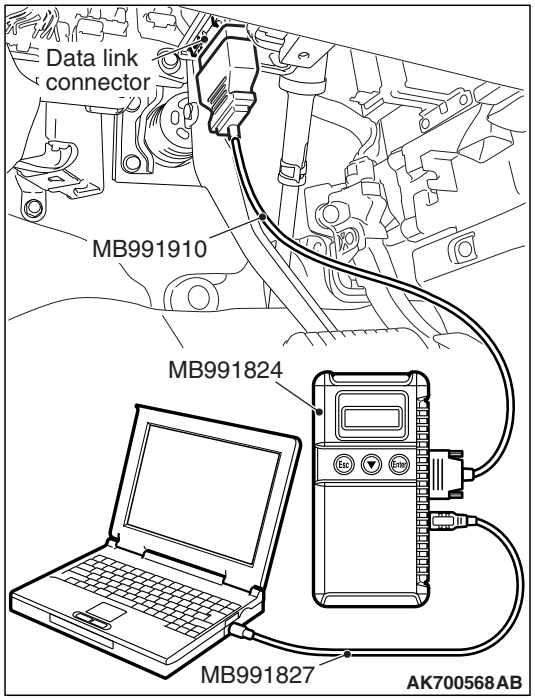
Judgement Criterion
- Throttle position sensor (main) output voltage should be 0.2 volt or less for 0.3 second.

OBD-II DRIVE CYCLE PATTERN
None.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)
- Throttle position sensor failed.
- Shorted throttle position sensor (main) circuit, harness damage, or connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:
- MB991958: Scan tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- MB991658: Test Harness



STEP 1. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

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

(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Detach the intake air hose at the throttle body.
(4) Disconnect the connector of the throttle position sensor.
(5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
(6) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
  - Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
  - Output voltage should be 4.0 volts or more when the throttle valve is fully open with your finger.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 2.

STEP 2. Check harness connector B-08 at throttle position sensor and harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 7.

STEP 3. Check for harness damage between throttle position sensor connector B-08 (terminal No. 5) and ECM connector B-10 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 4.
NO : Repair it. Then go to Step 7.

STEP 4. Check for short circuit to ground and harness damage between throttle position sensor connector B-08 (terminal No. 4) and ECM connector B-10 (terminal No. 10).

Q: Is the harness wire in good condition?

YES : Go to Step 5.
NO : Repair it. Then go to Step 7.

STEP 5. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

(1) Turn the ignition switch to the "ON" position.
(2) Detach the intake air hose at the throttle body.
(3) Disconnect the connector of the throttle position sensor.
(4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
(5) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
- Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
- Output voltage should be 4.0 volts or more when the throttle valve is fully open with your finger.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 6.

STEP 6. Replace the throttle body assembly.

(1) Replace the throttle body assembly.
(2) Turn the ignition switch to the "ON" position.
(3) After the DTC has been deleted, read the DTC again.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0122 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 7.
NO : The inspection is complete.

STEP 7. Using scan tool MB991958, read the diagnostic trouble code (DTC).

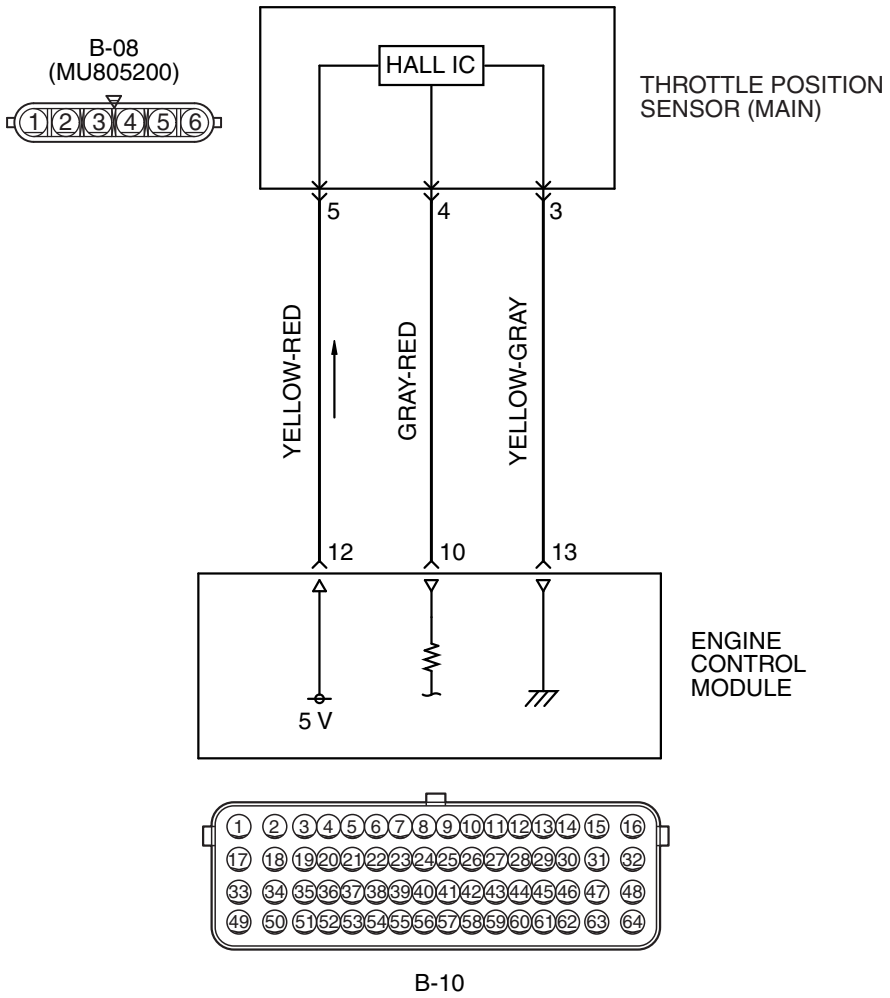
(1) Turn the ignition switch to the "ON" position.
(2) After the DTC has been deleted, read the DTC again.
(3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0122 set?

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

DTC P0123: Throttle Position Sensor (main) Circuit High Input

THROTTLE POSITION SENSOR (MAIN) CIRCUIT



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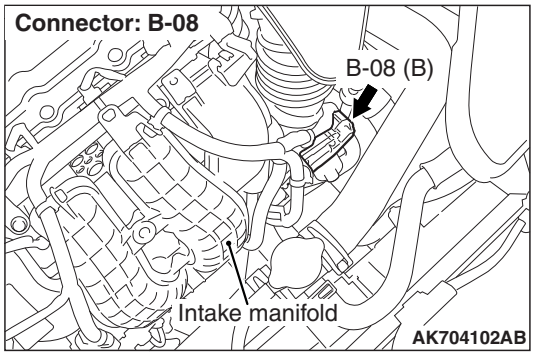
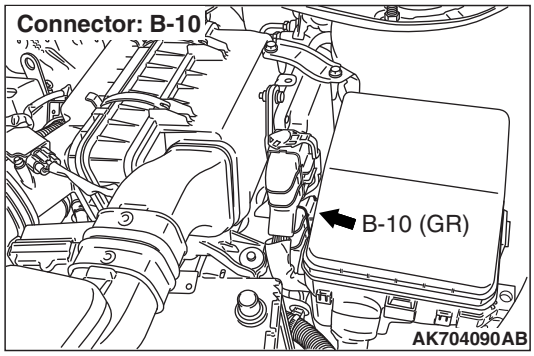




CIRCUIT OPERATION

- A 5-volt power supply is applied on the throttle position sensor (main) power terminal (terminal No. 5) from the ECM (terminal No. 12).
- A voltage that is according to the throttle opening angle is sent to the ECM (terminal No. 10) from the throttle position sensor (main) output terminal (terminal No. 4)
- The ground terminal (terminal No. 3) is grounded with ECM (terminal No. 13).

TECHNICAL DESCRIPTION

- The throttle position sensor (main) outputs voltage which corresponds to the throttle valve opening angle.
- The ECM checks whether the voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

Throttle position sensor (main) output voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

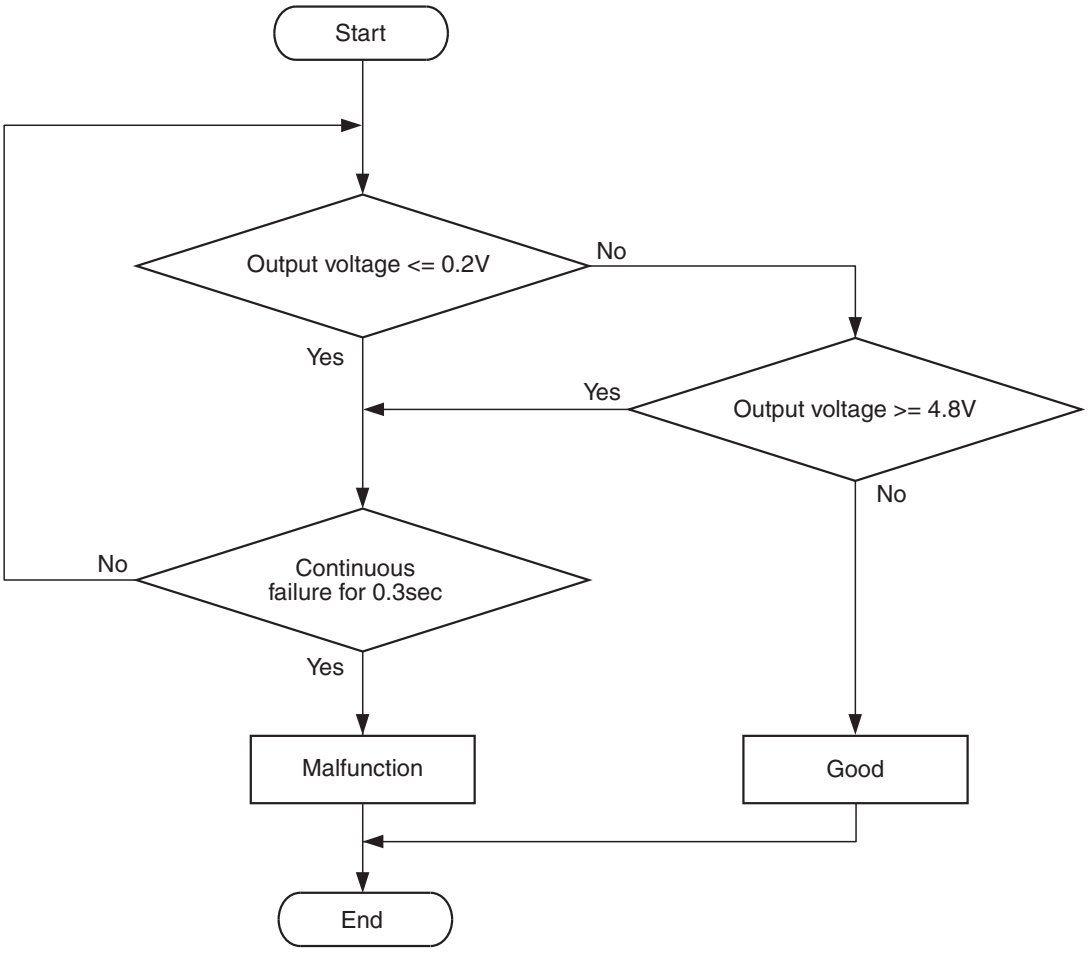
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



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Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (main) output voltage should be 4.8 volts or more for 0.3 second.

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

- Throttle position sensor failed.
- Open or shorted throttle position sensor (main) circuit, harness damage, or connector damage.
- ECM failed.

OBD-II DRIVE CYCLE PATTERN

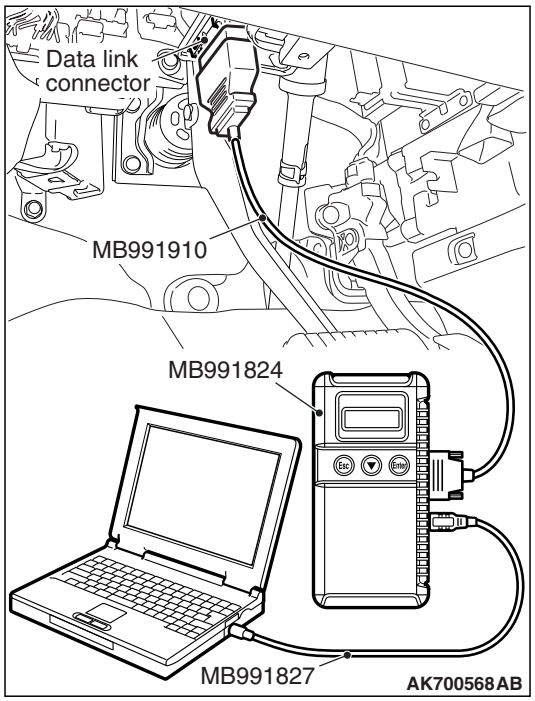
None.

DIAGNOSIS

Required Special Tools:

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
  - MB991824: V.C.I.
  - MB991827: USB Cable
  - MB991910: Main Harness A
- MB991658: Test Harness

TSB Revision



STEP 1. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

⚠ CAUTION

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

(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position.
(3) Detach the intake air hose at the throttle body.
(4) Disconnect the connector of the throttle position sensor.
(5) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
(6) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
- Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
- Output voltage should be 4.0 volts or more when the throttle valve is fully open with your finger.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Go to Step 2.

STEP 2. Check harness connector B-08 at throttle position sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

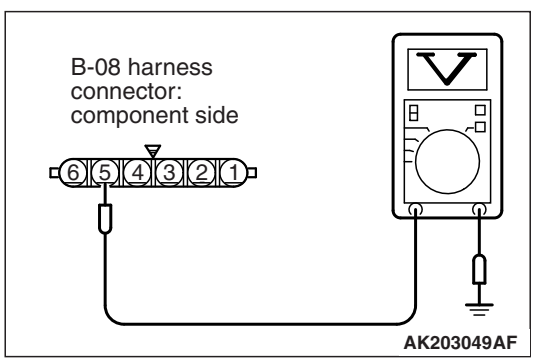
STEP 3. Measure the sensor supply voltage at throttle position sensor harness side connector B-08.

(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. 5 and ground.
- Voltage should be between 4.9 and 5.1 volts.

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

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

YES : Go to Step 6.
NO : Go to Step 4.



STEP 4. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

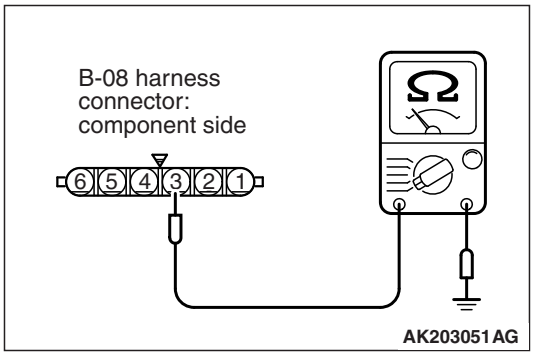
STEP 5. Check for open circuit and short circuit to ground between throttle position sensor connector B-08 (terminal No. 5) and ECM connector B-10 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 9.
NO : Repair it. Then go to Step 14.

STEP 6. Check the continuity at throttle position sensor harness side connector B-08.

(1) Disconnect the connector B-08 and measure at the harness side.
(2) Measure the continuity between terminal No. 3 and ground
- Continuity (2 ohms or less)



Q: Does continuity exist?

YES : Go to Step 10.
NO : Go to Step 7.

STEP 7. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 8. Check for open circuit and harness damage between throttle position sensor connector B-08 (terminal No. 3) and ECM connector B-10 (terminal No. 13).

Q: Is the harness wire in good condition?

YES : Go to Step 9.
NO : Repair it. Then go to Step 14.

STEP 9. Using scan tool MB991958, check data list item 13: Throttle Position Sensor (main).

(1) Turn the ignition switch to the "ON" position.
(2) Detach the intake air hose at the throttle body.
(3) Disconnect the connector of the throttle position sensor.
(4) Use test harness special tool (MB991658) to connect only terminals No. 3, No. 4, No. 5, and No. 6.
(5) Set scan tool MB991958 to the data reading mode for item 13, Throttle Position Sensor (main).
- Output voltage should be between 0.3 and 0.7 volt when the throttle valve is fully closed with your finger.
- Output voltage should be 4.0 volts or more when the throttle valve is fully open with your finger.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 14.

STEP 10. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 11.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 11. Check for harness damage between throttle position sensor connector B-08 (terminal No. 5) and ECM connector B-10 (terminal No. 12).

Q: Is the harness wire in good condition?

YES : Go to Step 12.
NO : Repair it. Then go to Step 14.

STEP 12. Check for open circuit, short circuit to ground and harness damage between throttle position sensor connector B-08 (terminal No. 4) and ECM connector B-10 (terminal No. 10).

Q: Is the harness wire in good condition?

YES : Go to Step 13.
NO : Repair it. Then go to Step 14.

STEP 13. Replace the throttle body assembly.

(1) Replace the throttle body assembly.
(2) Turn the ignition switch to the "ON" position.
(3) After the DTC has been deleted, read the DTC again.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0123 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 14.
NO : The inspection is complete.

STEP 14. Using scan tool MB991958, read the diagnostic trouble code (DTC).

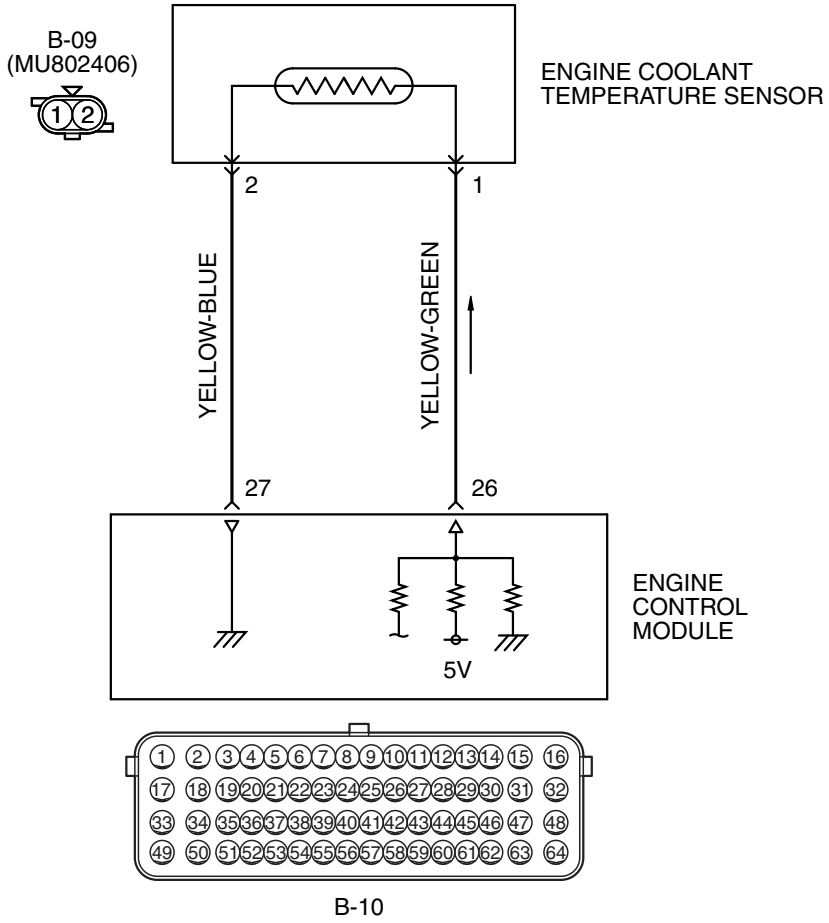
(1) Turn the ignition switch to the "ON" position.
(2) After the DTC has been deleted, read the DTC again.
(3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0123 set?

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

DTC P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control

ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT



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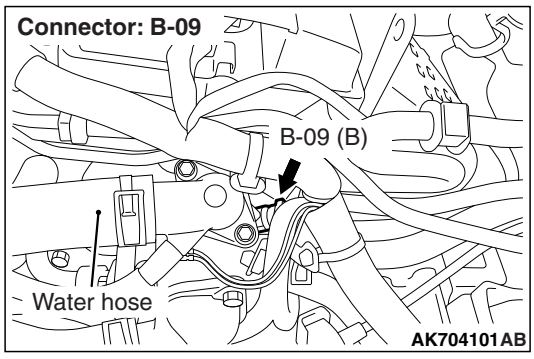

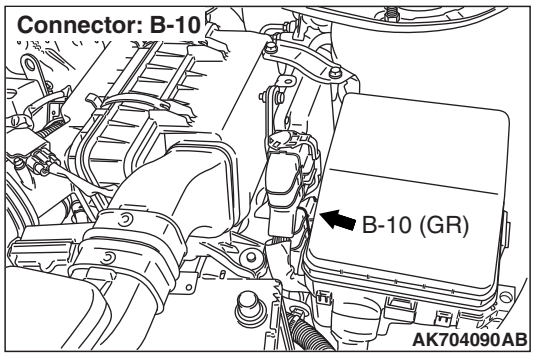

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CIRCUIT OPERATION

- 5-volt voltage is applied to the engine coolant temperature sensor output terminal (terminal No. 1) from the ECM (terminal No. 26) via the resistor in the ECM. The ground terminal (terminal No. 2) is grounded with ECM (terminal No. 27).
- The engine coolant temperature sensor is a negative temperature coefficient type of resistor. It has the characteristic that when the engine coolant temperature rises the resistance decreases.
- The engine coolant temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases.

TECHNICAL DESCRIPTION

- The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it.
- The ECM checks whether this voltage is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

- Engine coolant temperature sensor output voltage drops from over 40°C (104°F) to under 40°C (104°F) and keeps under 40°C (104°F) for 5 minutes.
- Engine coolant temperature sensor output voltage does not reach close loop enable temperature within specified period when engine coolant temperature sensor output voltage at engine start is under 7°C (45°F).

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

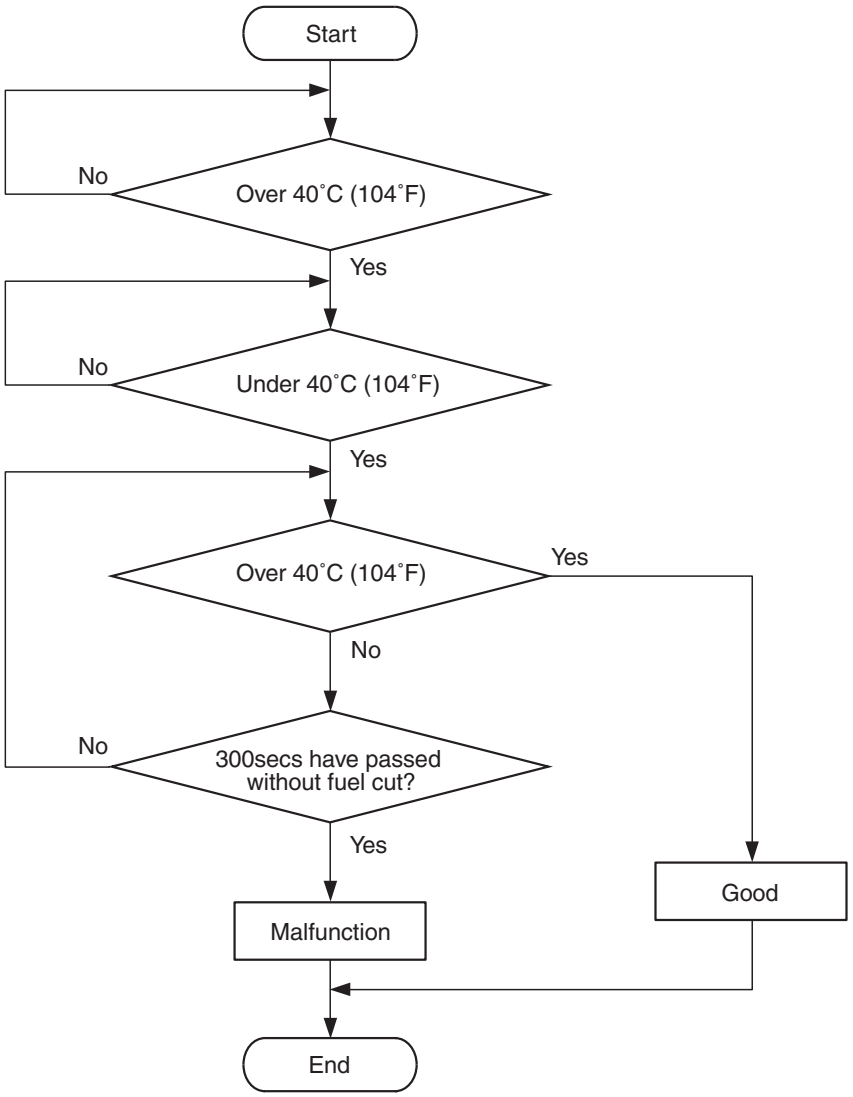
- Not applicable

Sensor (The sensor below is determined to be normal)

- Mass airflow sensor
- Intake air temperature sensor

DTC SET CONDITIONS <Range/Performance problem – drift>

Logic Flow Chart



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Check Conditions, Judgement Criteria

- Engine coolant temperature decreases from higher than 40°C (104°F) to lower than 40°C (104°F).
- Then the engine coolant temperature has continued to be 40°C (104°F) or lower for 5 minutes.
- However, time is not counted when fuel is shut off.

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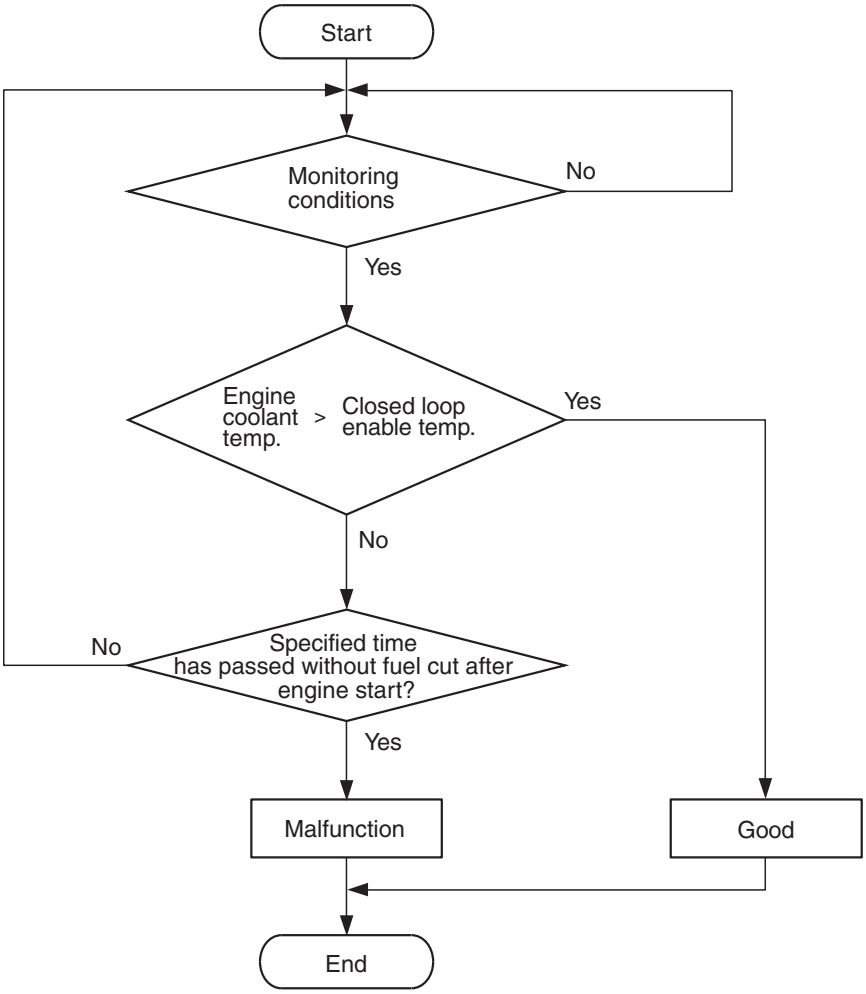
DTC SET CONDITIONS <Range/Performance problem – low input (Time to reach closed loop temperature)>

Logic Flow Chart



AK900354

Check Conditions, Judgement Criteria

- About 90 – 300 seconds have passed for the engine coolant temperature to rise to about 0°C (32°F) after starting sequence was completed.
- However, time is not counted when fuel is shut off.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 P.13A-11.

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

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

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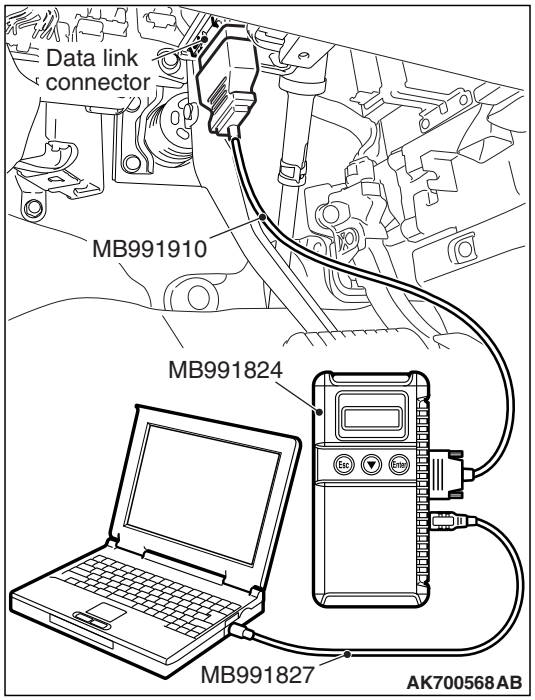
DIAGNOSIS

Required Special Tools:

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

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



⚠ CAUTION

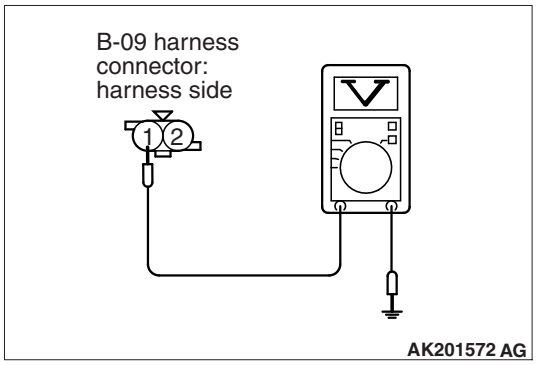
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.

NO : Go to Step 2.



STEP 2. Measure the sensor output voltage at engine coolant temperature sensor connector B-09 by backprobing.

(1) Do not disconnect the connector B-09.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 1 and ground by backprobing.
- When engine coolant temperature is –20°C (–4°F), voltage should be between 3.9 and 4.5 volts.
- When engine coolant temperature is 0°C (32°F), voltage should be between 3.2 and 3.8 volts.
- When engine coolant temperature is 20°C (68°F), voltage should be between 2.3 and 2.9 volts.
- When engine coolant temperature is 40°C (104°F), voltage should be between 1.3 and 1.9 volts.
- When engine coolant temperature is 60°C (140°F), voltage should be between 0.7 and 1.3 volts.
- When engine coolant temperature is 80°C (176°F), voltage should be between 0.3 and 0.9 volt.

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

Q: Is the measured voltage within the specified range?

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

STEP 3. Check harness connector B-09 at the engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 4. Using scan tool MB991958, check data list item 6: Engine Coolant Temperature Sensor.

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

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

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-15.
NO : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 14.

STEP 5. Check harness connector B-09 at engine coolant temperature sensor for damage.

Q: Is the harness connector in good condition?

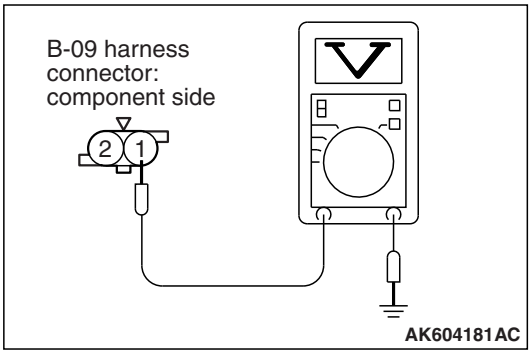
YES : Go to Step 6.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 6. Measure the sensor supply voltage at engine coolant temperature sensor harness side connector B-09.

(1) Disconnect the connector B-09 and measure at the harness side.
(2) Turn the ignition switch to the "ON" position.
(3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be between 4.5 and 4.9 volts.

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



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

YES : Go to Step 8.

NO : Go to Step 7.

STEP 7. Check harness connector B-10 at ECM for damage.

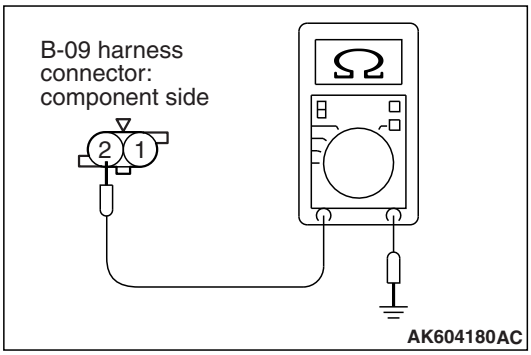
Q: Is the harness connector in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 14.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 8. Check the continuity at engine coolant temperature sensor harness side connector B-09.

(1) Disconnect the connector B-09 and measure at the harness side.
(2) Check for the continuity between terminal No. 2 and ground.
- Continuity (2 ohms or less)



Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.

STEP 9. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 10. Check for harness damage between engine coolant temperature sensor connector B-09 (terminal No. 2) and ECM connector B-10 (terminal No. 27).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 14.

NO : Repair it. Then go to Step 14.

STEP 11. Check the engine coolant temperature sensor.
Refer to Engine Coolant Temperature Sensor P.13A-874.

Q: Is the engine coolant temperature sensor normal?

YES : Go to Step 12.

NO : Replace the engine coolant temperature sensor. Then go to Step 14.

STEP 12. Check harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 13.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 14.

STEP 13. Check for harness damage between engine coolant temperature sensor connector B-09 (terminal No. 1) and ECM connector B-10 (terminal No. 26).

Q: Is the harness wire in good condition?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 14.

NO : Repair it. Then go to Step 14.

STEP 14. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 9 P.13A-11.

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

Q: Is DTC P0125 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0128: Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)

TECHNICAL DESCRIPTION

- The ECM checks the time for the cooling water temperature to reach the judgement temperature.

DESCRIPTIONS OF MONITOR METHODS

Engine coolant temperature does not reach 77°C (171°F) within specified period after cold start.

MONITOR EXECUTION

Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

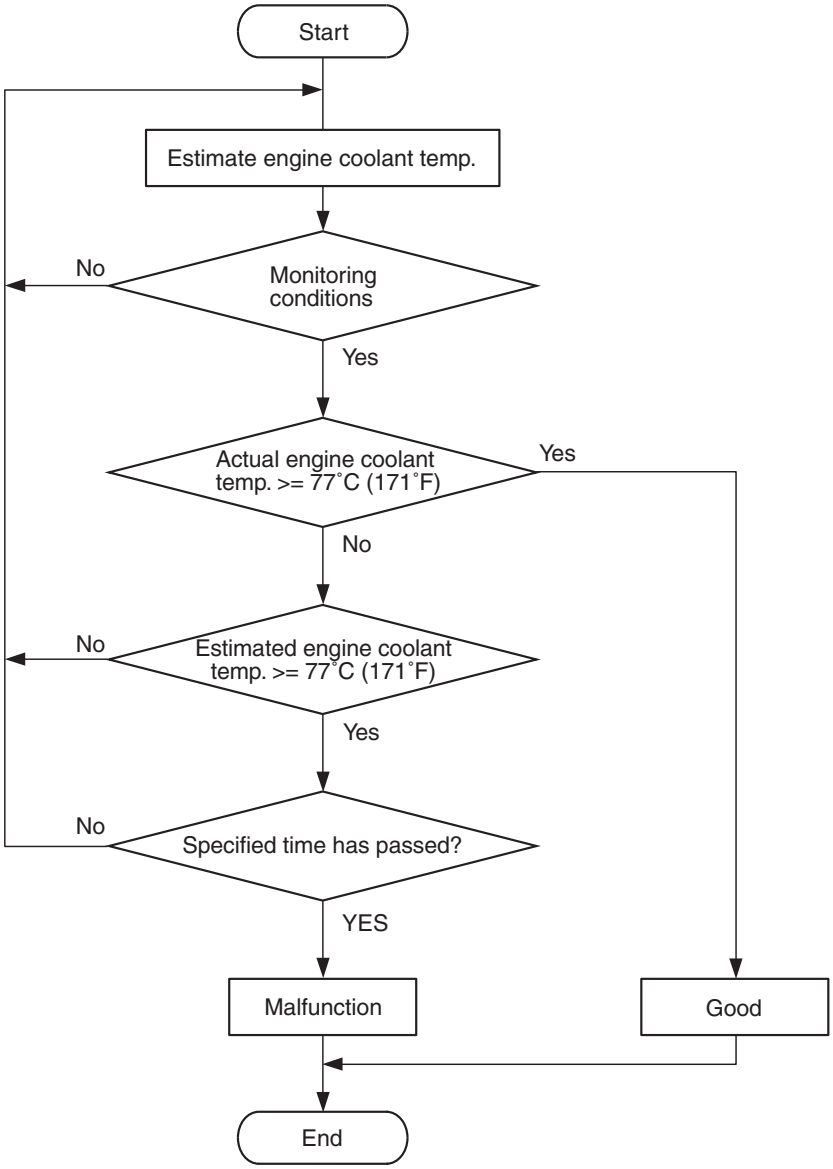
- Not applicable

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK900356

Check Conditions

- Engine coolant temperature is between −10°C (14°F) and 60°C (140°F) when the engine is started.
- Intake air temperature is −10°C (14°F) or higher when the engine is started.
- The intake air temperature subtracted from the intake air temperature when the engine is started is 10°C (18°F) or less.
- The total time when the amount of intake air is small is less than the specified time.

Judgement Criterion

- After the estimated engine coolant temperature rises above 77°C (171°F), the actual engine coolant temperature is less than 77°C (171°F) even though the specified time has passed.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 P.13A-11.

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

- The engine cooling system is faulty.
- ECM failed.

TSB Revision

DIAGNOSIS

STEP 1. Check the cooling system.
Refer to GROUP 14, Engine Cooling Diagnosis – Symptom Chart P.14-4.

Q: Is the cooling system normal?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 2.

NO : Repair it. Then go to Step 2.

STEP 2. Test the OBD-II drive cycle.

(1) Carry out test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 10 P.13A-11.

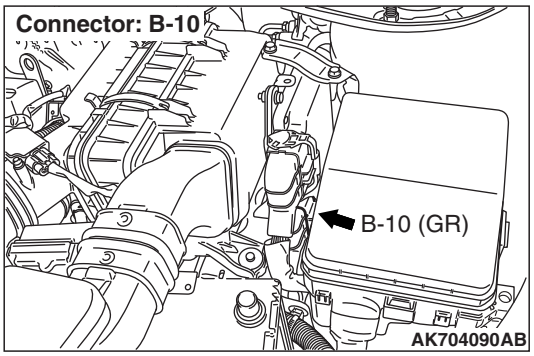
(2) Check the diagnostic trouble code (DTC).

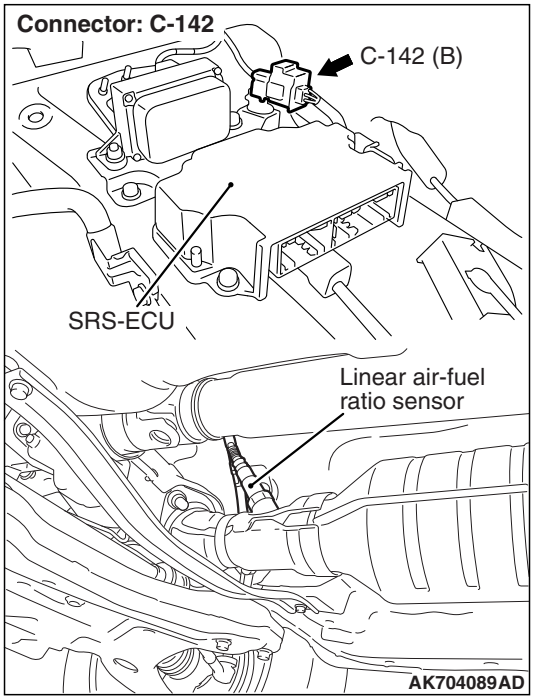
Q: Is DTC P0128 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0130: Linear Air-Fuel Ratio Sensor Circuit





TECHNICAL DESCRIPTION

- The ECM effects air/fuel ratio feedback control in accordance with the signals from the linear air-fuel ratio sensor.
- If the linear air-fuel ratio sensor has deteriorated, corrections will be made by the heated oxygen sensor (rear).

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DESCRIPTIONS OF MONITOR METHODS

- If the air-fuel ratio detection signal has an abnormality although the linear air-fuel ratio sensor is sufficiently ready to operate, the DTC is stored as a malfunction.

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)

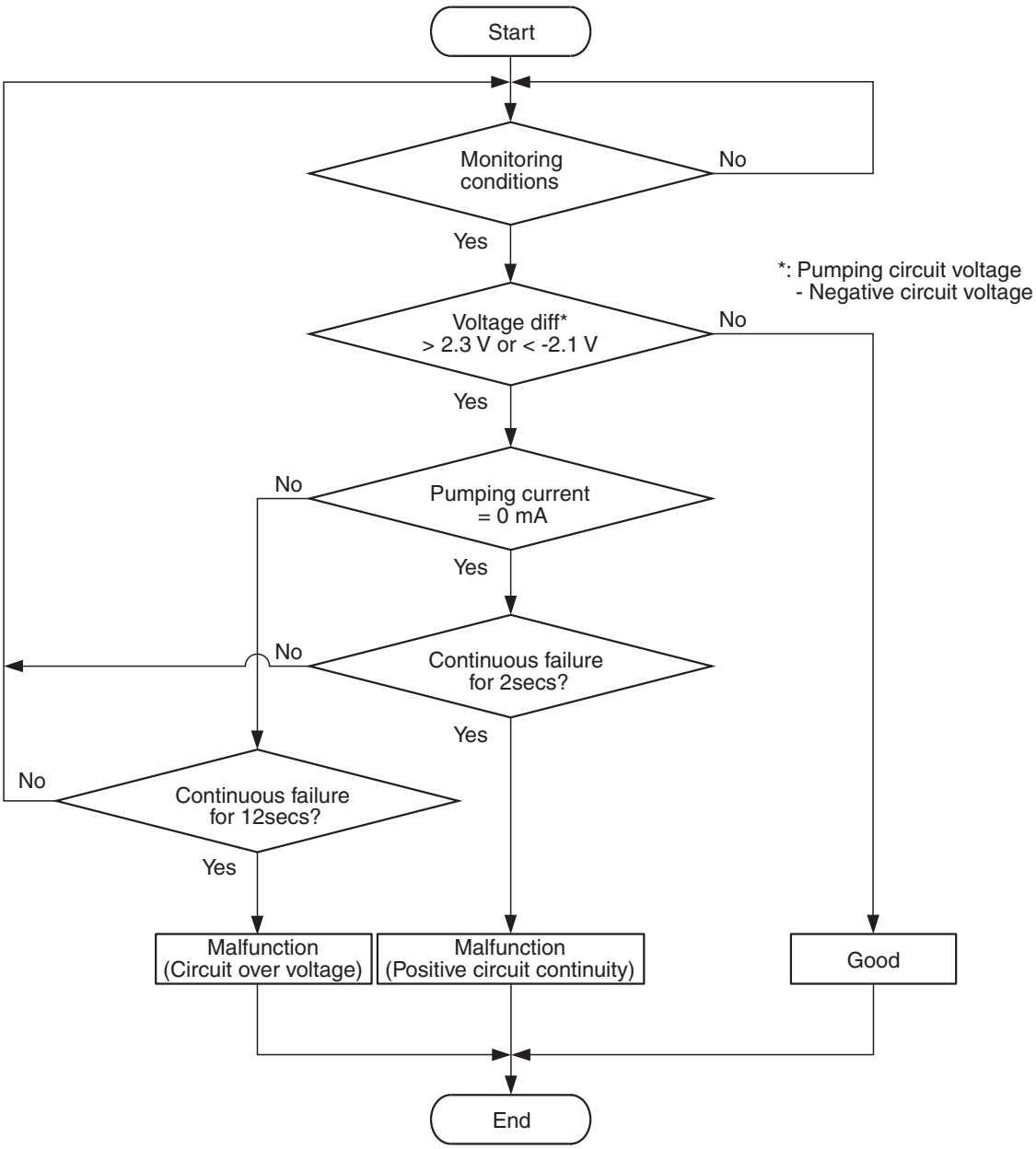
- Linear air-fuel ratio sensor heater monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK900360

Check Conditions

- Battery positive voltage is between 10 and 16.5 volts.
- More than 220 seconds have passed since the engine starting sequence was completed.

Judgement Criteria

- The negative circuit voltage subtracted from the pumping circuit voltage is be lower than –2.1 volts or higher than 2.3 volts for 12 seconds.
- The pumping current is be lower than 0 milli ampere or higher than 0 milli ampere for 12 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.

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

- Linear air-fuel ratio sensor failed.
- Connector damage.
- ECM failed.

DIAGNOSIS

Required Special Tools:

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

STEP 1. Check harness connector C-142 at linear air-fuel ratio sensor and harness connector B-10 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

STEP 2. Test the OBD-II drive cycle.

⚠ CAUTION

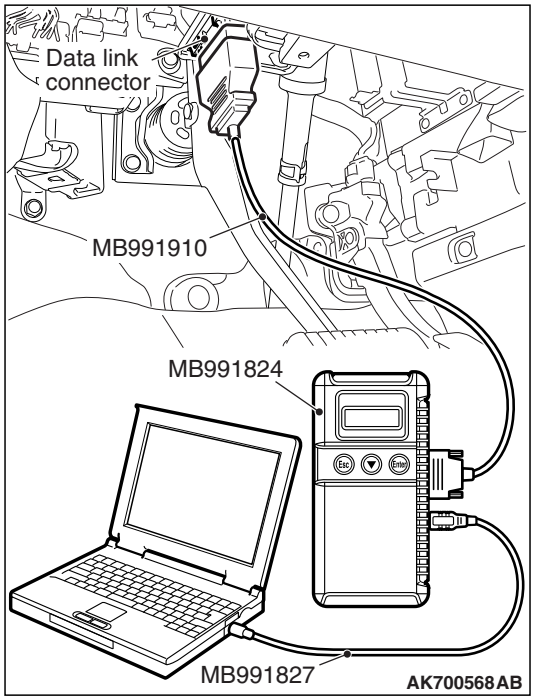
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

(1) Connect scan tool MB991958 to the data link connector.
(2) Turn the ignition switch to the "ON" position and delete the DTC.
(3) Carry out the test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.
(4) Check the diagnostic trouble code (DTC).

Q: Is DTC P0130 set?

YES : 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.00-15.



STEP 3. Replace the linear air-fuel ratio sensor.

(1) Replace the linear air-fuel ratio sensor.
(2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.
(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0130 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 4.
NO : The inspection is complete.

STEP 4. Test the OBD-II drive cycle.

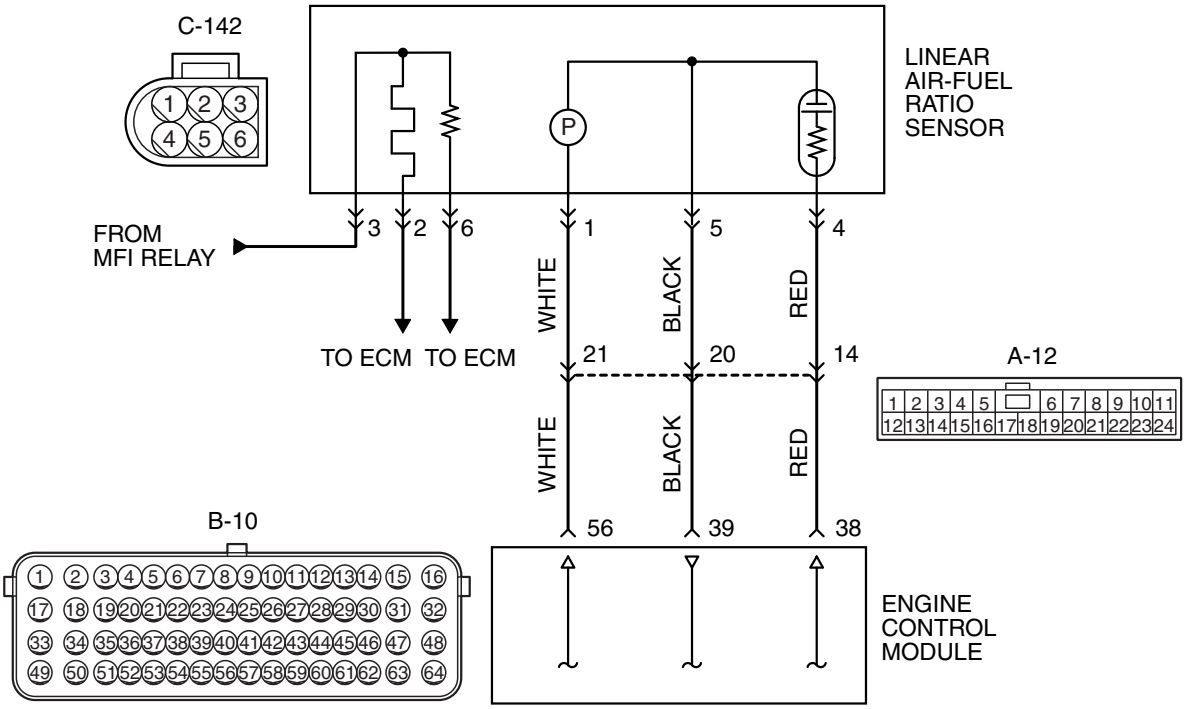
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0130 set?

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

DTC P0131: Linear Air-Fuel Ratio Sensor Circuit Low Voltage

LINEAR AIR-FUEL RATIO SENSOR CIRCUIT



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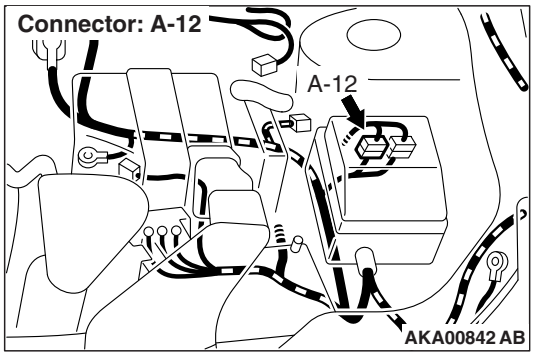

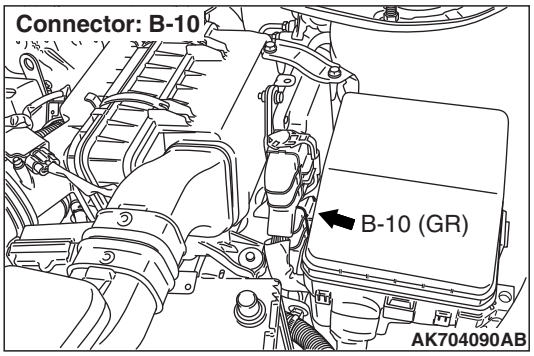

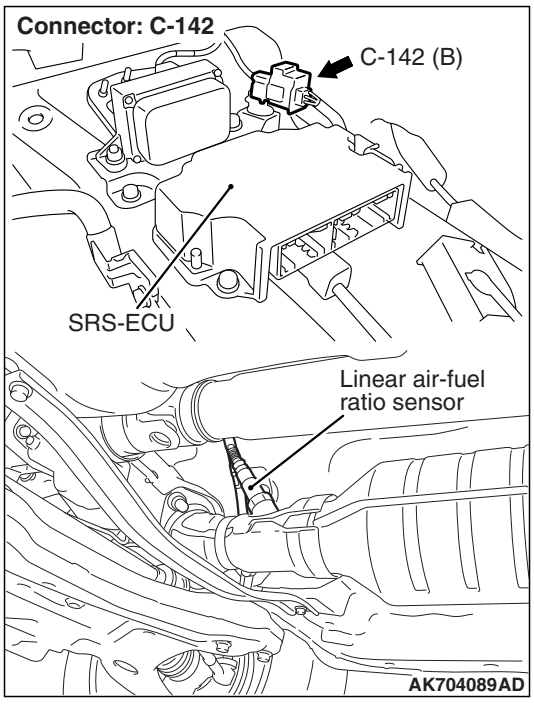

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CIRCUIT OPERATION

The linear air-fuel ratio sensor and the ECM are connected by the following three lines to detect the air-fuel ratio.

- The line between the linear air-fuel ratio sensor (terminal No. 1) and the ECM (terminal No. 56) detects the air-fuel ratio.
- The auxiliary line between the linear air-fuel ratio sensor (terminal No. 4) and the ECM (terminal No. 38) detects the air-fuel ratio.
- The line between the linear air-fuel ratio sensor (terminal No. 5) and the ECM (terminal No. 39) is connected to ground.

TECHNICAL DESCRIPTION

- The ECM effects air/fuel ratio feedback control in accordance with the signals from the linear air-fuel ratio sensor.
- If the linear air-fuel ratio sensor has deteriorated, corrections will be made by the heated oxygen sensor (rear).

DESCRIPTIONS OF MONITOR METHODS

- If one of the three line voltages is excessively low or if all the three line voltages are excessively low, the DTC is stored as a malfunction.

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)

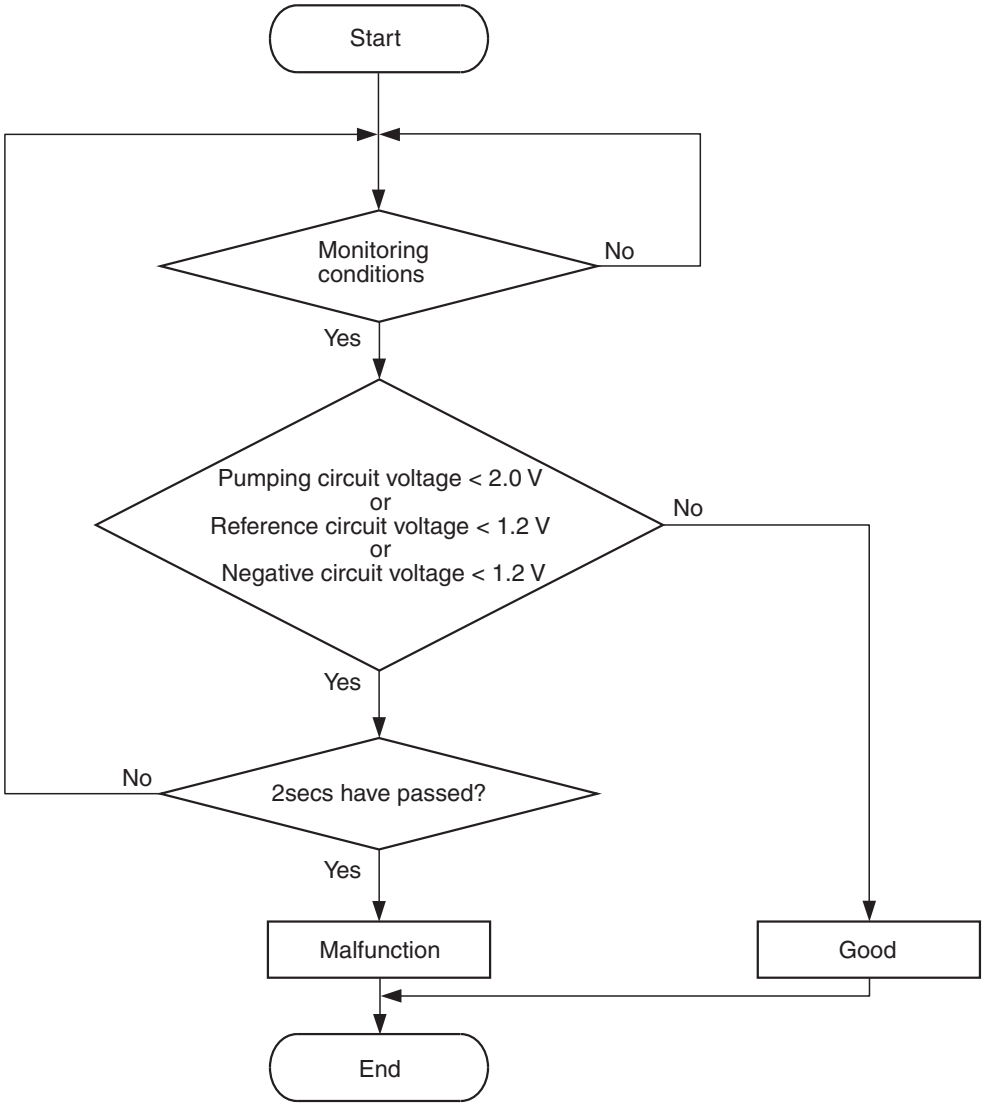
- Linear air-fuel ratio sensor heater monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

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

DTC SET CONDITIONS

Logic Flow Chart



AK900357

Check Conditions

- Battery positive voltage is between 10 and 16.5 volts.
- More than 40 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- The pumping circuit voltage is be lower than 2 volts for 2 seconds.

or

- The reference circuit voltage is be lower than 1.2 volt for 2 seconds.

or

- The negative circuit voltage is be lower than 1.2 volt for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

- Refer to Diagnosis Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.

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

- Linear air-fuel ratio sensor failed.
- Shorted linear air-fuel ratio sensor circuit, or connector damage.
- ECM failed.

TSB Revision

DIAGNOSIS

Required Special Tools:

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

STEP 1. Check harness connector C-142 at linear air-fuel ratio sensor and harness connector B-10 at ECM 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 7.

STEP 2. Check for short circuit to ground between linear air-fuel ratio sensor connector C-142 (terminal No. 4) and ECM connector B-10 (terminal No. 38).

NOTE: Check harness after checking intermediate connector A-12. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 7.

Q: Is the harness wire in good condition?

YES : Go to Step 3.
NO : Repair it. Then go to Step 7.

STEP 3. Check for short circuit to ground between linear air-fuel ratio sensor connector C-142 (terminal No. 1) and ECM connector B-10 (terminal No. 56).

NOTE: Check harness after checking intermediate connector A-12. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 7.

Q: Is the harness wire in good condition?

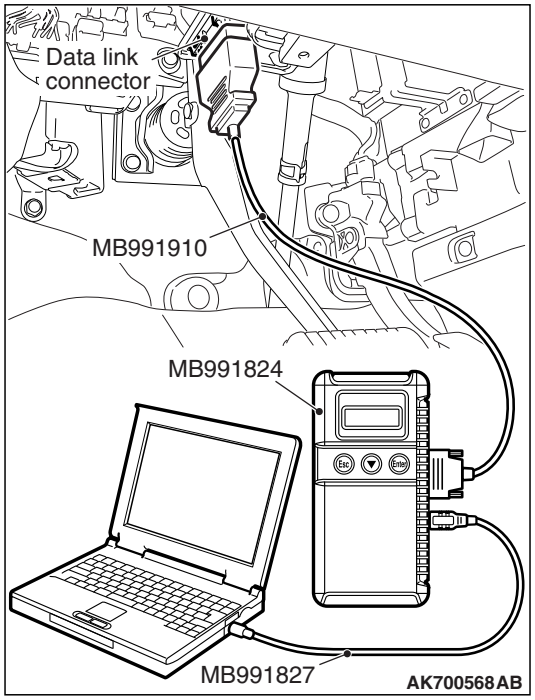
YES : Go to Step 4.
NO : Repair it. Then go to Step 7.

STEP 4. Check for short circuit to ground between linear air-fuel ratio sensor connector C-142 (terminal No. 5) and ECM connector B-10 (terminal No. 39).

NOTE: Check harness after checking intermediate connector A-12. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 7.

Q: Is the harness wire in good condition?

YES : Go to Step 5.
NO : Repair it. Then go to Step 7.



STEP 5. Test the OBD-II drive cycle.

⚠ 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 and delete the DTC.
(3) Carry out the test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.
(4) Check the diagnostic trouble code (DTC).

Q: Is DTC P0131 set?

YES : Then go to Step 6.
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.00-15.

STEP 6. Replace the linear air-fuel ratio sensor.

(1) Replace the linear air-fuel ratio sensor.
(2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.
(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0131 set?

YES : Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> P.42B-15 or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> P.42C-10. Then go to Step 7.
NO : The inspection is complete.

STEP 7. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 22 P.13A-11.
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0131 set?

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

Next>>