

GROUP 13A

MULTIPOINT FUEL INJECTION (MFI) <2.0L ENGINE Non-turbo>

CONTENTS

GENERAL INFORMATION	13A-3	DIAGNOSTIC TROUBLE CODE CHART ..	13A-50
GENERAL SPECIFICATIONS.....	13A-7	SYMPTOM CHART.....	13A-55
SERVICE SPECIFICATIONS.....	13A-8	DIAGNOSTIC TROUBLE CODE PROCEDURES	13A-58
SEALANT AND ADHESIVE.....	13A-8	SYMPTOM PROCEDURES	13A-823
SPECIAL TOOL.....	13A-9	DATA LIST REFERENCE TABLE.....	13A-912
MULTIPOINT FUEL INJECTION (MFI) DIAGNOSIS	13A-11	GENERAL SCAN TOOL (GST) MODE 01 REFERENCE TABLE	13A-930
TROUBLESHOOTING STRATEGY	13A-11	ACTUATOR TEST REFERENCE TABLE..	13A-935
DIAGNOSTIC FUNCTION	13A-12	CHECK AT THE ENGINE CONTROL MODULE (ECM)	13A-937
FAIL-SAFE FUNCTION REFERENCE TABLE.....	13A-48	INSPECTION PROCEDURE USING AN OSCILLOSCOPE	13A-945

Continued on next page

ON-VEHICLE SERVICE..... 13A-955

COMPONENT LOCATION	13A-955
THROTTLE BODY (THROTTLE VALVE AREA) CLEANING	13A-961
FUEL PRESSURE TEST	13A-961
HOW TO REDUCE PRESSURIZED FUEL PRESSURE	13A-964
FUEL TANK PUMP OPERATION CHECK..	13A-964
MULTIPOINT FUEL INJECTION (MPI) RELAY CONTINUITY CHECK	13A-966
FUEL PUMP RELAY CONTINUITY CHECK	13A-967
INJECTOR RELAY AND THROTTLE ACTUATOR CONTROL MOTOR RELAY CONTINUITY CHECK	13A-968
INTAKE AIR TEMPERATURE SENSOR CHECK	13A-968
ENGINE COOLANT TEMPERATURE SENSOR CHECK	13A-969

HEATED OXYGEN SENSOR CHECK	13A-969
INJECTOR CHECK	13A-975
THROTTLE ACTUATOR CONTROL MOTOR CHECK	13A-975
ENGINE OIL CONTROL VALVE CHECK..	13A-976
EVAPORATIVE EMISSION VENTILATION SOLENOID CHECK	13A-977
EVAPORATIVE EMISSION PURGE SOLENOID CHECK	13A-977
EGR VALVE CHECK <CALIFORNIA>	13A-977

INJECTOR

REMOVAL AND INSTALLATION	13A-978
--------------------------------	---------

THROTTLE BODY ASSEMBLY..... 13A-983

REMOVAL AND INSTALLATION	13A-983
--------------------------------	---------

ENGINE CONTROL MODULE (ECM) 13A-985

REMOVAL AND INSTALLATION	13A-985
--------------------------------	---------

GENERAL INFORMATION

M1131000104930

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 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

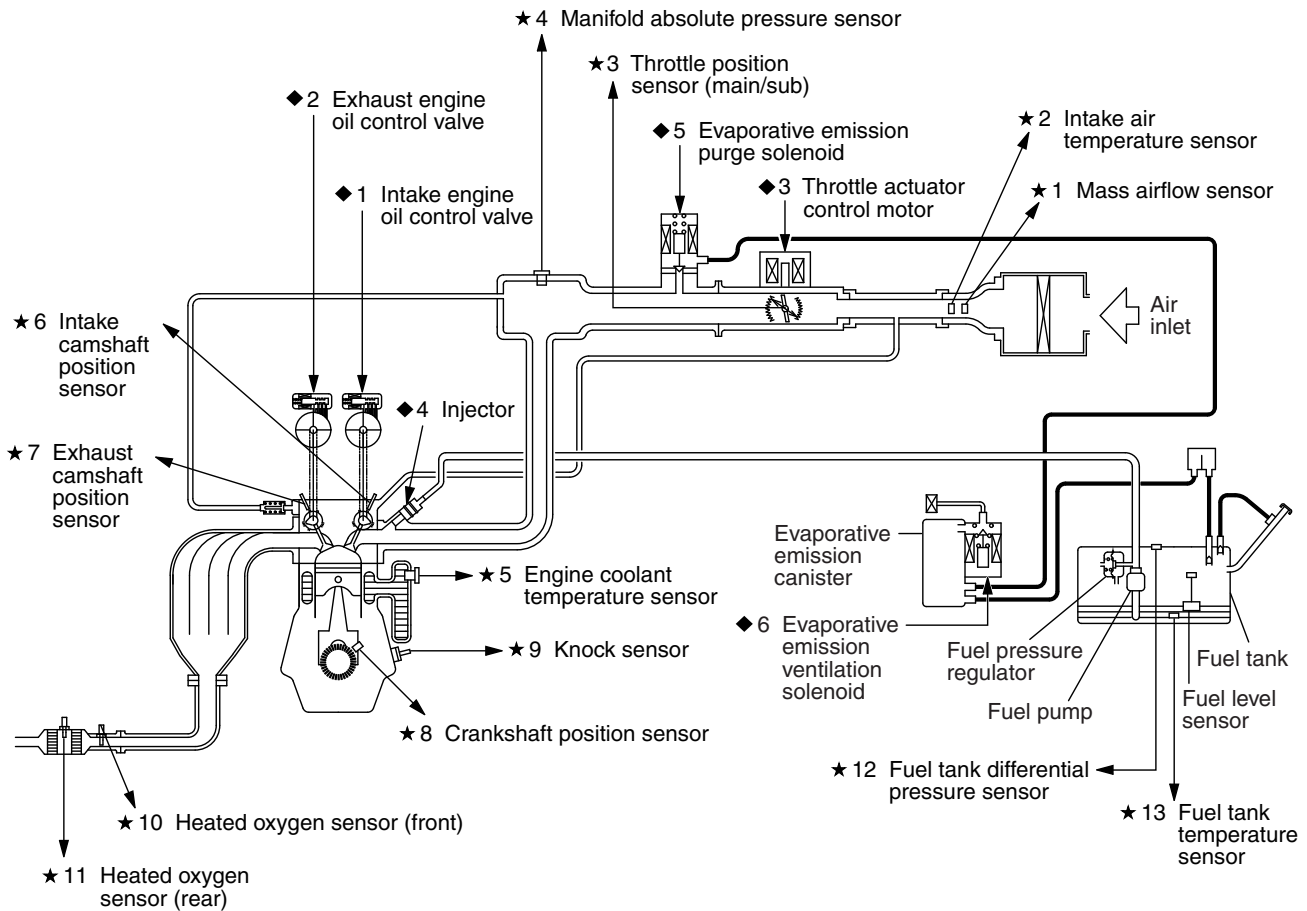
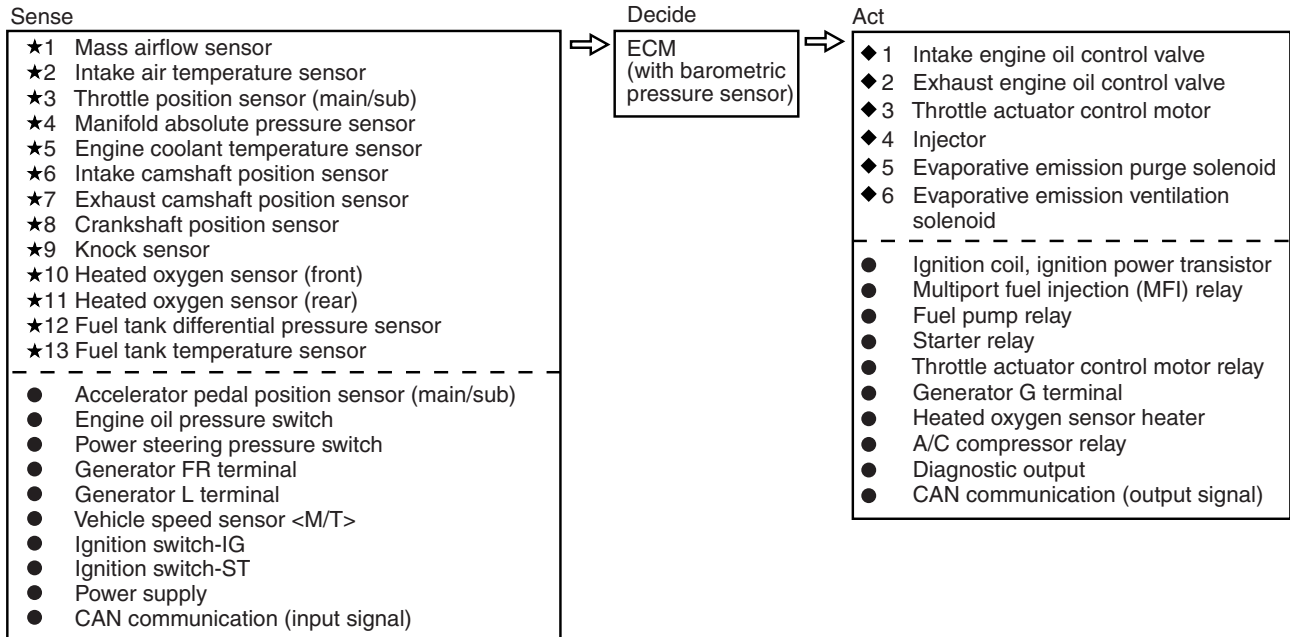
- (Refer to GROUP 17, Emission Control System – Evaporative Emission Control System – General Information [P.17-100.](#))

EGR Control <California>

- (Refer to GROUP 17, Emission Control System – Exhaust Gas Recirculation (EGR) System - General Information <California> [P.17-108.](#))

MULTIPOINT FUEL INJECTION (MFI) SYSTEM DIAGRAM

<Except for California>



AK900711AB

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

<California>**Sense**

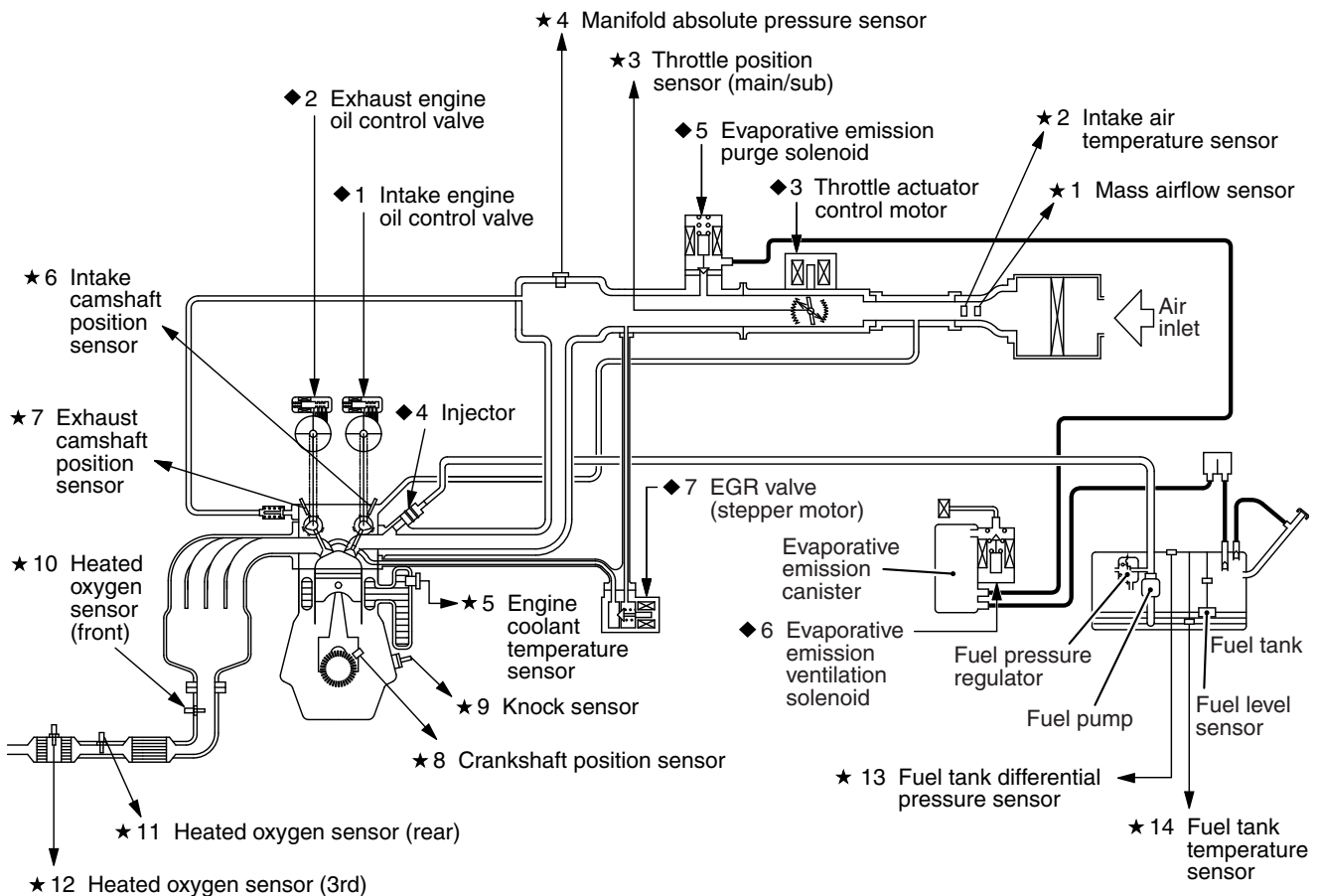
- ★1 Mass airflow sensor
 - ★2 Intake air temperature sensor
 - ★3 Throttle position sensor (main/sub)
 - ★4 Manifold absolute pressure sensor
 - ★5 Engine coolant temperature sensor
 - ★6 Intake camshaft position sensor
 - ★7 Exhaust camshaft position sensor
 - ★8 Crankshaft position sensor
 - ★9 Knock sensor
 - ★10 Heated oxygen sensor (front)
 - ★11 Heated oxygen sensor (rear)
 - ★12 Heated oxygen sensor (3rd)
 - ★13 Fuel tank differential pressure sensor
 - ★14 Fuel tank temperature sensor
-
- Accelerator pedal position sensor (main/sub)
 - Engine oil pressure switch
 - Power steering pressure switch
 - Generator FR terminal
 - Generator L terminal
 - Vehicle speed sensor <M/T>
 - Ignition switch-IG
 - Ignition switch-ST
 - Power supply
 - CAN communication (input signal)

Decide

ECM
(with barometric pressure sensor)

Act

- ◆1 Intake engine oil control valve
 - ◆2 Exhaust engine oil control valve
 - ◆3 Throttle actuator control motor
 - ◆4 Injector
 - ◆5 Evaporative emission purge solenoid
 - ◆6 Evaporative emission ventilation solenoid
 - ◆7 EGR valve (stepper motor)
-
- Ignition coil, ignition power transistor
 - Multipoint fuel injection (MFI) relay
 - Fuel pump relay
 - Starter relay
 - Throttle actuator control motor relay
 - Generator G terminal
 - Heated oxygen sensor heater
 - A/C compressor clutch relay
 - CAN communication (output signal)



AK801822 AB

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

GENERAL SPECIFICATIONS

M1131000201585

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.	Except for California	E6T76475 <M/T> E6T76476 <CVT>
		California	E6T76473 <M/T> E6T76474 <CVT>
Sensors	Mass airflow sensor		Heat sensitizing type
	Barometric pressure sensor		Semi conductor diffused pressure type
	Intake air temperature sensor		Thermistor type
	Engine coolant temperature sensor		Thermistor type
	Heated oxygen sensor		Zirconia type
	Accelerator pedal position sensor		Hall element type
	Transmission range switch		Contact switch 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		JME240B
	Intake engine oil control valve		Duty cycle type solenoid valve
	Exhaust engine oil control valve		Duty cycle type solenoid valve
	EGR valve <California>		Stepper motor type
	Evaporative emission purge solenoid		Duty cycle type solenoid valve
	Evaporative emission ventilation solenoid		ON/OFF type solenoid valve

SERVICE SPECIFICATIONS

M1131000302187

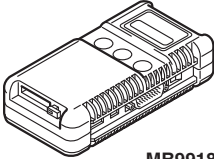
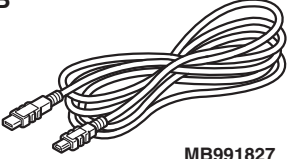
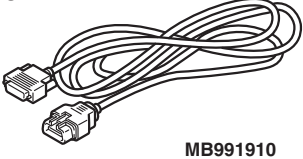
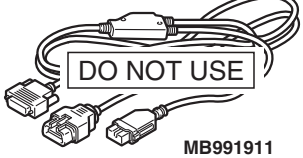
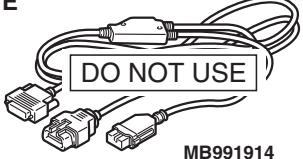
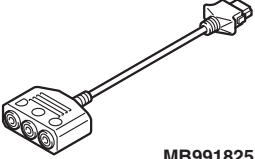
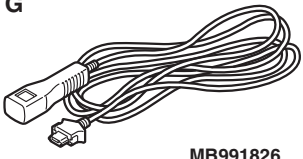
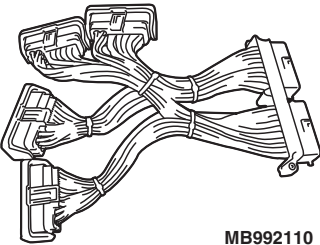
ITEMS		STANDARD VALUE
Fuel pressure kPa (psi)		Approximately 324 (47) at curb idle
Intake air temperature sensor resistance kΩ	-20°C (-4°F)	13 – 17
	0°C (32°F)	5.3 – 6.7
	20°C (68°F)	2.3 – 3.0
	40°C (104°F)	1.0 – 1.5
	60°C (140°F)	0.56 – 0.76
	80°C (176°F)	0.30 – 0.45
Engine coolant temperature sensor 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
Heated oxygen sensor heater resistance Ω	Front, Rear	4.5 – 8.0 [at 20°C (68°F)]
	3rd <California>	11 – 18 [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)]


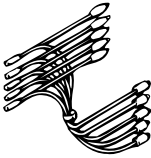

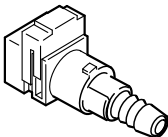
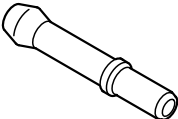
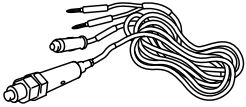
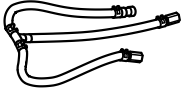
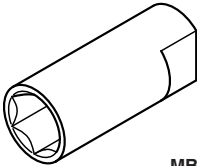
SEALANT AND ADHESIVE

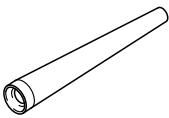
M1131000501650

ITEM	SPECIFIED SEALANT
Engine coolant temperature sensor threaded portion	LOCTITE 262, Three bond 1324N or equivalent

SPECIAL TOOL

Tool	Tool number and name	Supersession	Application
<p>A</p>  <p>MB991824</p> <p>B</p>  <p>MB991827</p> <p>C</p>  <p>MB991910</p> <p>D</p>  <p>MB991911</p> <p>E</p>  <p>MB991914</p> <p>F</p>  <p>MB991825</p> <p>G</p>  <p>MB991826</p> <p>MB991958</p>	<p>MB991958</p> <p>A: MB991824</p> <p>B: MB991827</p> <p>C: MB991910</p> <p>D: MB991911</p> <p>E: MB991914</p> <p>F: MB991825</p> <p>G: MB991826</p> <p>M.U.T.-III sub assembly</p> <p>A: Vehicle Communication Interface (V.C.I.)</p> <p>B: M.U.T.-III USB Cable</p> <p>C: M.U.T.-III Main Harness A (Vehicles with CAN communication system)</p> <p>D: M.U.T.-III Main Harness B (Vehicles without CAN communication system)</p> <p>E: M.U.T.-III Main Harness C (for Chrysler models only)</p> <p>F: M.U.T.-III Measurement Adapter</p> <p>G: M.U.T.-III Trigger Harness</p>	<p>MB991824-KIT</p> <p><i>NOTE: G: MB991826 M.U.T.-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.</i></p>	<ul style="list-style-type: none"> Reading diagnostic trouble code MFI system inspection Measurement of fuel pressure <p>CAUTION</p> <p>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.</p>
 <p>MB992110</p>	<p>MB992110</p> <p>Power plant ECU check harness</p>	<p>—</p>	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Inspection using an oscilloscope • Inspection of heated oxygen sensor • Inspection of engine oil control valve
	MD998464 Test harness (4 pin, square)	Tool not available	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
 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

MULTIPOINT FUEL INJECTION (MFI) DIAGNOSIS

TROUBLESHOOTING STRATEGY

M1131150002489

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.

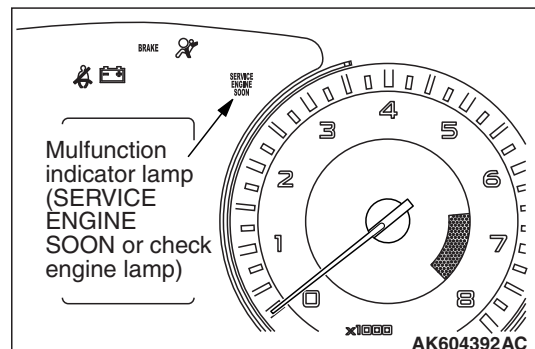
Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure to have exhausted most of the possible ways to find an MFI fault.

- Gather as much information as possible about the complaint from the customer.
- Verify that the condition described by the customer exists.
- Check the vehicle for any MFI Diagnostic Trouble Code (DTC).
- If you cannot verify the condition and there are no DTCs, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).
- 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.
- If there is a DTC, store the number of the code, then erase the code from the memory using the scan tool.
- Reconfirm the malfunction symptom and carry out a test drive with the drive cycle pattern.
- If DTC is set again, carry out an inspection with appropriate diagnostic trouble code procedures.
- If DTC is not set again, the malfunction is intermittent. For information on how to cope with intermittent malfunctions, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-14](#).
- After repairs are completed, conduct a road test duplicating the complaint set conditions to confirm the malfunction has been corrected.
- Erase the permanent DTC. (Refer to Diagnostic Function – Permanent DTC for the procedures of erasing the permanent DTC [P.13A-12](#).)
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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#).

DIAGNOSTIC FUNCTION

M1131155503749

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

NOTE: When the Transmission 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	Heated oxygen sensor (front) heater circuit low
P0032	Heated oxygen sensor (front) heater circuit high
P0037	Heated oxygen sensor (rear) heater circuit low
P0038	Heated oxygen sensor (rear) heater circuit high
P0043	Heated oxygen sensor (3rd) heater circuit low <California>
P0044	Heated oxygen sensor (3rd) heater circuit high <California>
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor
P0101* ¹	Mass airflow circuit range/performance problem
P0102* ¹	Mass airflow circuit low input
P0103* ¹	Mass airflow circuit high input
P0106	Manifold absolute pressure circuit range/performance problem
P0107	Manifold absolute pressure circuit low input
P0108	Manifold absolute pressure circuit high input
P0111* ¹	Intake air temperature circuit range/performance problem
P0112* ¹	Intake air temperature circuit low input
P0113* ¹	Intake air temperature circuit high input
P0116* ¹	Engine coolant temperature circuit range/performance problem
P0117* ¹	Engine coolant temperature circuit low input
P0118* ¹	Engine coolant temperature circuit high input
P0122* ¹	Throttle position sensor (main) circuit low input
P0123* ¹	Throttle position sensor (main) circuit high input
P0125* ¹	Insufficient coolant temperature for closed loop fuel control
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)
P0131	Heated oxygen sensor (front) circuit low voltage
P0132	Heated oxygen sensor (front) circuit high voltage
P0133	Heated oxygen sensor (front) circuit slow response
P0134* ¹	Heated oxygen sensor (front) circuit no activity detected
P0137	Heated oxygen sensor (rear) circuit low voltage
P0138	Heated oxygen sensor (rear) circuit high voltage

DTC	ITEM
P0139	Heated oxygen sensor (rear) circuit slow response
P0140	Heated oxygen sensor (rear) circuit no activity detected
P0143	Heated oxygen sensor (3rd) circuit low voltage <California>
P0144	Heated oxygen sensor (3rd) circuit high voltage <California>
P0145	Heated oxygen sensor (3rd) circuit slow response <California>
P0146	Heated oxygen sensor (3rd) circuit no activity detected <California>
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
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 <California>
P0420	Warm up catalyst efficiency below threshold <Except for California>
P0421	Warm up catalyst efficiency below threshold <California>
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

DTC	ITEM
P0455	Evaporative emission control system leak detected (gross leak)
P0456	Evaporative emission control system leak detected (very small leak)
P0461	Fuel level sensor circuit range/performance
P0462	Fuel level sensor circuit low input
P0463	Fuel level sensor circuit high input
P0489	EGR valve (stepper motor) circuit malfunction (ground short) <California>
P0490	EGR valve (stepper motor) circuit malfunction (battery short) <California>
P0500* ¹	Vehicle speed sensor malfunction <M/T>
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
P0603* ¹	EEPROM malfunction
P0606* ¹	Engine control module main processor malfunction
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
P1233* ¹	Throttle position sensor (main) plausibility
P1234* ¹	Throttle position sensor (sub) plausibility
P1235* ¹	Mass airflow sensor plausibility
P1236* ¹	A/D converter
P1237* ¹	Accelerator pedal position sensor plausibility
P1238* ¹	Mass airflow sensor plausibility (torque monitor)
P1239* ¹	Engine RPM plausibility
P1241* ¹	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 <CVT>
P1603* ¹	Battery backup circuit malfunction
P1676* ¹	Variant coding
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

DTC	ITEM
P2123* ¹	Accelerator pedal position sensor (main) circuit high input
P2127* ¹	Accelerator pedal position sensor (sub) circuit low input
P2128* ¹	Accelerator pedal position sensor (sub) circuit high input
P2135* ¹	Throttle position sensor (main and sub) range/performance problem
P2138* ¹	Accelerator pedal position sensor (main and sub) range/performance problem
P2195	Heated oxygen sensor (front) inactive
P2228* ¹	Barometric pressure circuit low input
P2229* ¹	Barometric pressure circuit high input
P2252	Heated oxygen sensor offset circuit low voltage
P2253	Heated oxygen sensor offset circuit high voltage
P2423	HC adsorber (HC trap catalyst) efficiency below threshold <California>
U0101* ¹	TCM time-out <CVT>
U0141* ¹	ETACS-ECU time-out
U1180* ¹	Combination meter time-out

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

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

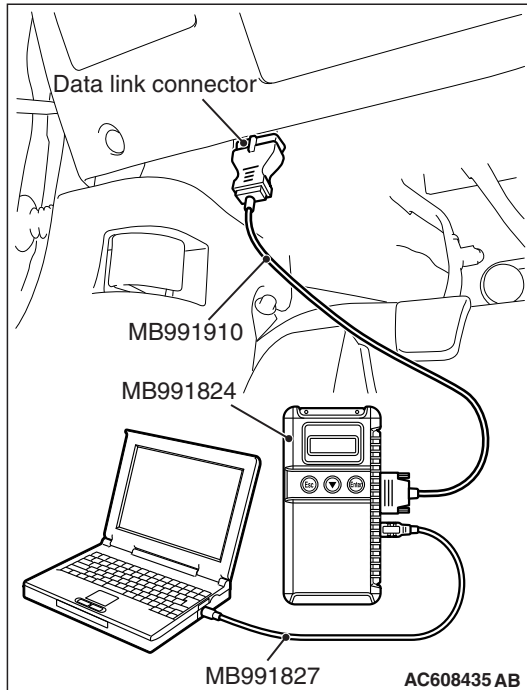
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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.

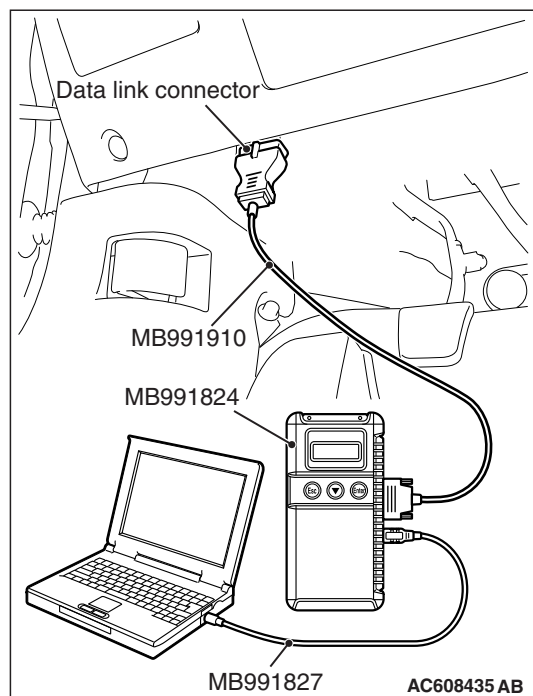
NOTE: Disconnecting the scan tool MB991958 is the reverse of the connecting sequence, making sure that the ignition switch is at the "LOCK" (OFF) position.



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

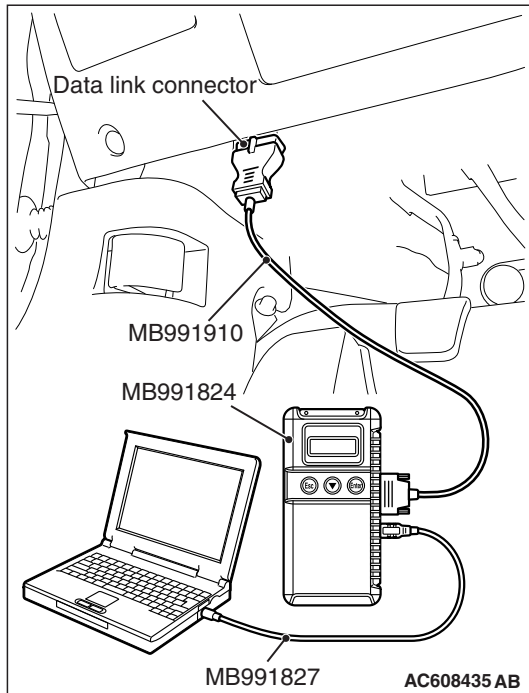
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

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

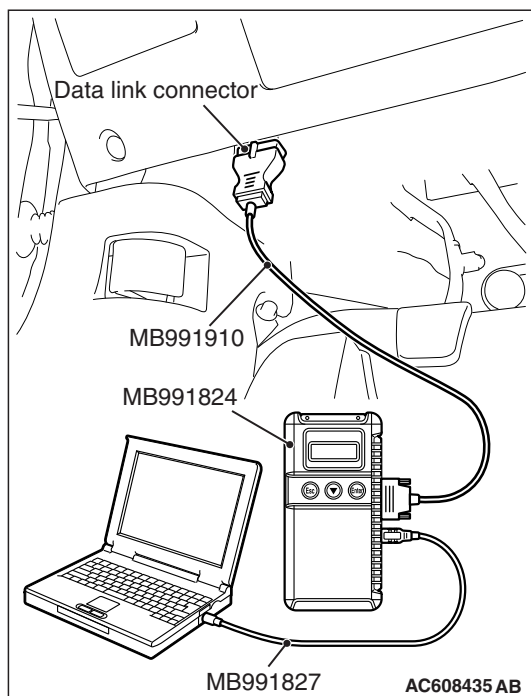
Required Special Tools:

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

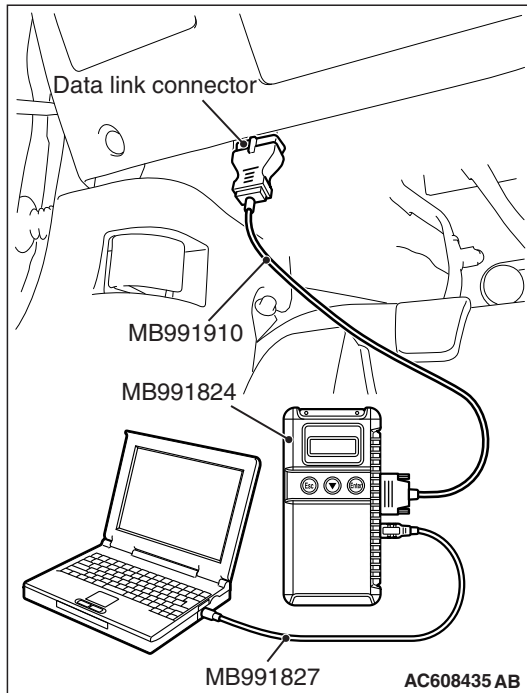
⚠ CAUTION

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

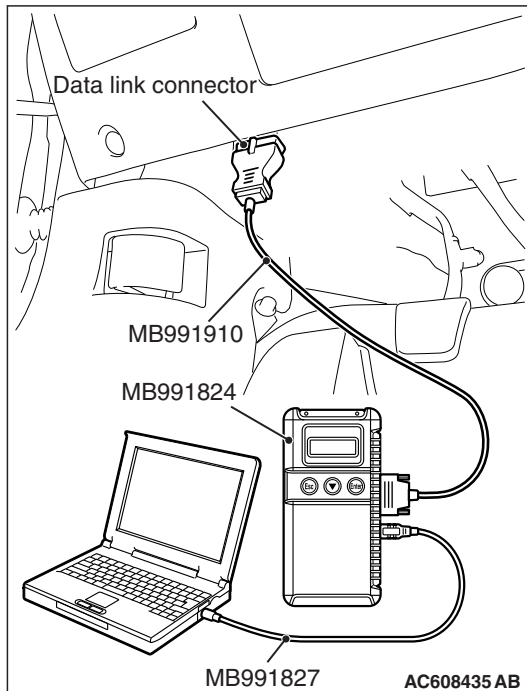
If detecting the malfunction during the first drive cycle, the ECM temporarily stores the diagnosis code as the provisional diagnosis code. If detecting the same malfunction during the next drive cycle, the ECM determines that the malfunction exists. The ECM outputs the diagnosis code. On Scan Tool MB991958, 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:

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 DEFINID TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
01	81	Oxygen Sensor Monitor Bank 1 – Sensor 1 Rich/Lean Switching frequency	ECM monitors the deteriorated condition of the heated oxygen sensor (front) by checking the rich/lean switching frequency of the heated oxygen sensor (front).	× 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 (rear).	× 1 msec

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINITION TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
03 <California>	82	Oxygen Sensor Monitor Bank 1 – Sensor 3 Output Voltage change	ECM checks the output voltage of the heated oxygen sensor (3rd) in order to monitor whether the heated oxygen sensor (3rd) output is stuck.	× 0.122 mV
	05	Oxygen Sensor Monitor Bank 1 – Sensor 3 Rich To Lean Sensor Switch Time	ECM checks the rich to lean switching time of the heated oxygen sensor (3rd) in order to monitor the response of the heated oxygen sensor (3rd).	× 1 msec
	88	Oxygen Sensor Monitor Bank 1 – Sensor 3 Output Voltage drop slope	ECM checks the output voltage drop slope of the heated oxygen sensor (3rd) in order to monitor the response of the heated oxygen sensor (3rd).	× 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 heated oxygen sensor (front) and heated oxygen sensor (rear).	× 0.0039
31 <California>	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°

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINITION TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
39	85	EVAP Monitor (Cap off) Pressure drop during de-pressurizing	ECM 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
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

ON-BOARD DIAGNOSTIC MONITOR ID	STANDARDIZED / MANUFACTURER DEFINITION TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
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
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 137 diagnostic items. The diagnostic results can be read out with a scan tool. Since memorization of the diagnostic trouble codes is backed up directly by the battery, the diagnostic results are memorized even if the ignition key is turned off. The diagnostic trouble codes will, however, be erased when the battery terminal or the 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 137 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 <California >	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 (bank 2)	Fuel control system status (bank 2)	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	%

ITEM NO.	M.U.T.-III SCAN TOOL DISPLAY	DATA ITEM	UNIT or STATE
D8	Power supply voltage	Power supply voltage	V
D9	Absolute load value	Absolute load value	%
DA	Target equivalence ratio	Target equivalence ratio	—
DB	Intake air temperature sensor 1	Intake air temperature sensor (ambient air temperature)	°C or °F
DC	Throttle actuator	Throttle actuator control motor	%
DD	Relative APP sensor	Relative accelerator pedal position sensor	%
242	Fuel tank differential PRS.SNSR	Fuel tank differential pressure sensor	Pa

NOTE: *: Data items are displayed on M.U.T.-III display, but the 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 <California>	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	

COMMON EXAMPLE of GENERAL SCAN TOOL DISPLAY	PRAMETER IDENTIFICATION (PID)	DESCRIPTION	UNIT or STATE
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	Command Throttle Actuator Control	%
APP_R	5A	See M.U.T.-III Item No. DD	

OBD- II DRIVE CYCLE

All kinds of diagnostic trouble codes (DTCs) can be monitored by carrying out a short drive according to the following 23 drive cycle patterns. In other words, doing such a drive regenerates any kind of trouble which involves illuminating the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) and verifies the repair procedure has 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 Vehicle speed sensor monitor (DTC P0500), Power steering pressure switch monitor (P0551), and Fuel level sensor monitor (DTC P0461, P2066). Please reference the M.U.T. data list to judge whether these monitor items are normal.

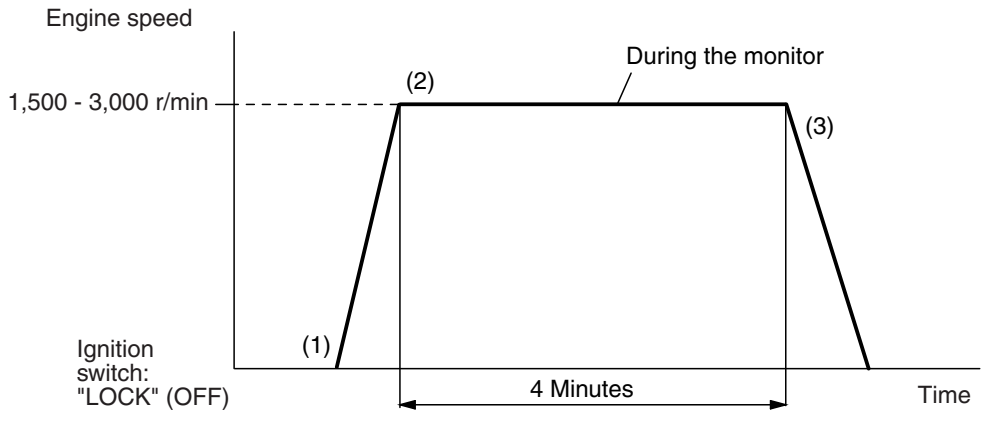
DRIVE CYCLE PATTERN LIST

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
Heated oxygen sensor (front) monitor <Readiness test item>	P0133	1
Heated oxygen sensor (rear) feedback control system monitor	P2096, P2097	
Heated oxygen sensor heater monitor <Readiness test item>	P0031, P0037	2
Heated oxygen sensor heater monitor	P0032, P0038, P0043, P0044	
Exhaust gas recirculation (EGR) system monitor <Readiness test item-California>	P0401, P0489, P0490	3
Catalytic converter monitor <Readiness test item>	P0420, P0421	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

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
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
Heated oxygen sensor (3rd) monitor	P0145	
HC adsorber (HC trap catalyst) monitor	P2423	
Air fuel ratio feedback monitor	P0134	12
Heated oxygen sensor (rear) monitor <Readiness test item>	P0140	13
Heated oxygen sensor (3rd) monitor <California>	P0146	
Fuel tank temperature sensor monitor	P0181	14
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	P1233, P1234	
Mass airflow sensor plausibility monitor	P1235, P1238	
Torque monitor	P1241	
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
Heated oxygen sensor monitor	P0131, P0137, P0143, P2195	22

MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)	PATTERN
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	P0132, P0138, P0144, 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	P1239	
Barometric pressure sensor monitor	P2228, P2229	

PATTERN 1

Drive cycle pattern	 <p align="right">AK402430 AC</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 76°C (169°F) • Condition of CVT: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 4 minutes at the following conditions. (During the monitor) <i>NOTE: When the system is normal, the monitor is completed earlier.</i> <ul style="list-style-type: none"> • Vehicle speed: More than 30 km/h (19 mph) • Engine speed: More than 1,500 r/min, less than 3,000 r/min • Engine load: More than 30 %, less than 60 % • Without rapid accelerator pedal movement 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. <i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i> 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 2

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

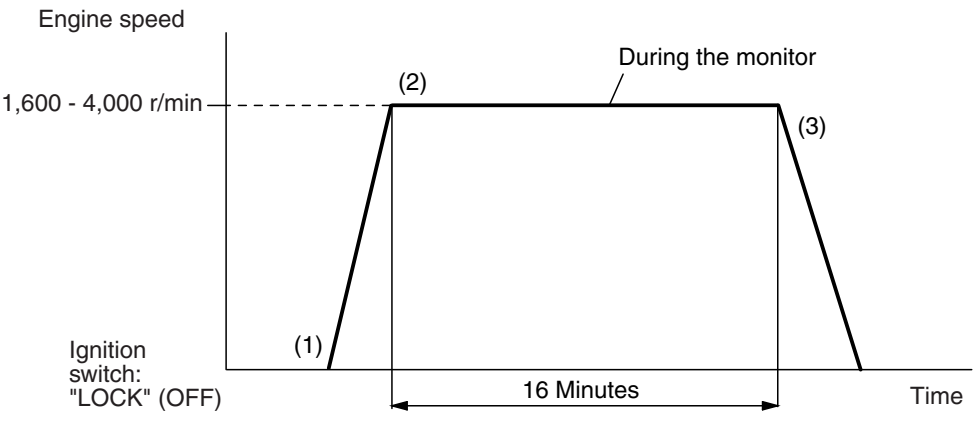
PATTERN 3

<p>Drive cycle pattern</p>	
<p>Inspection conditions</p>	<ul style="list-style-type: none"> • 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
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Accelerate until the vehicle speed is 60 km/h (38 mph) and then drive the vehicle for 90 seconds. 3. Release the accelerator pedal and reduce vehicle speed to 30 km/h (18 mph). (During the monitor) 4. Accelerate until the vehicle speed is 60 km/h (38 mph) and then drive the vehicle for 20 seconds. 5. Release the accelerator pedal and reduce vehicle speed to 30 km/h (18 mph). (During the monitor) 6. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 7. Start the engine and do Steps 1 to 6 again. <p><i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i></p> <ol style="list-style-type: none"> 8. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 4

Drive cycle pattern	<p>Engine speed 3,000 r/min</p> <p>During the monitor</p> <p>During the monitor</p> <p>(1) (2) (3) (4) (5)</p> <p>Ignition switch: "LOCK" (OFF)</p> <p>5 Minutes 5 Seconds 3 Minutes</p> <p>Time</p> <p align="right">AK402432AC</p>
Inspection conditions	<ul style="list-style-type: none"> • 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	<ol style="list-style-type: none"> 1. Start the engine with all accessories switched OFF. 2. Drive the vehicle for 5 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: Less than 3,000 r/min • Airflow rate: More than 13 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) <ul style="list-style-type: none"> • Engine speed: Less than 3,000 r/min • Airflow rate: More than 13 g/sec, less than 45 g/sec • Accelerator pedal: Except full close • Without rapid accelerator pedal movement <p><i>NOTE: When the system is normal, the monitor is completed earlier.</i></p> 5. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Start the engine and do Steps 1 to 5 again. <p><i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i></p> 7. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 5

<p>Drive cycle pattern</p>	 <p>AK402430 AI</p>
<p>Inspection conditions</p>	<ul style="list-style-type: none"> • Engine coolant temperature at engine start: Less than 36°C (96°F) • Intake air temperature at engine start: Less than 36°C (96°F) • Fuel amount at engine start: More than 15 %, less than 40 % • Engine coolant temperature: More than 60°C (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
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 16 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: More than 1,600 r/min, less than 4,000 r/min • Vehicle speed: More than 20 km/h (12 mph) • Engine load: More than 20 %, less than 70 % • Without rapid accelerator pedal movement <p><i>NOTE: Keep running as long as possible with the power steering pressure switch in the OFF position.</i></p> <p><i>NOTE: When the system is normal, the monitor is completed earlier.</i></p> 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. <p><i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i></p> 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 6

Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature at engine start: Less than 36°C (96°F) • Intake air temperature at engine start: Less than 36°C (96°F) • Fuel amount at engine start: More than 40 %, less than 85 % • Engine coolant temperature: More than 20°C (68°F) • Intake air temperature: More than -10°C (14°F) • Barometric pressure: More than 76 kPa (22.4 in.Hg) • Fuel temperature: Less than 33°C (91°F)
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 16 minutes. (During the monitor) <i>NOTE: When the system is normal, the monitor is completed earlier.</i> 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. <i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i> 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 7

Drive cycle pattern	<p>Engine speed</p> <p>During the monitor</p> <p>1,500 r/min</p> <p>Idling</p> <p>Ignition switch: "LOCK" (OFF)</p> <p>30 Seconds</p> <p>2 Seconds</p> <p>Time</p> <p align="right">AK402442AE</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature at engine start: More than 0°C (32°F) • Condition of CVT: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 30 seconds. (During the monitor) 3. Accelerate the vehicle for 2 seconds at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: More than 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.

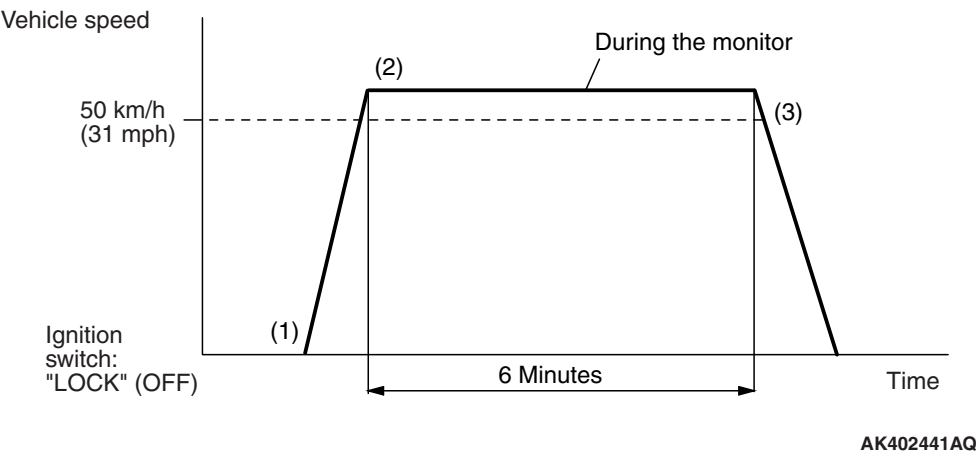
PATTERN 8

Drive cycle pattern	<p align="right">AK402435AC</p>
Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 76°C (169°F) • Condition of CVT: Selector lever "D" range
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 50 km/h (31 mph) for 1 minute. 3. Stop the vehicle in a safe place and let the engine idle for 30 seconds. 4. Repeat Steps 2 and 3 again. 5. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 6. Confirm that the diagnostic trouble code (DTC) is not output.

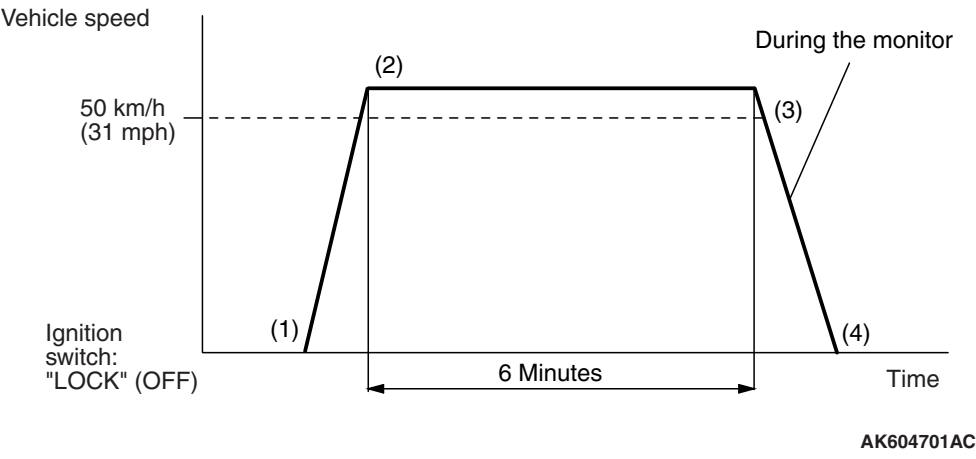
PATTERN 9

Drive cycle pattern	<p align="right">AK900473 AB</p>
Inspection conditions	<ul style="list-style-type: none"> • 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	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 5 minutes at the following condition. <ul style="list-style-type: none"> • 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.

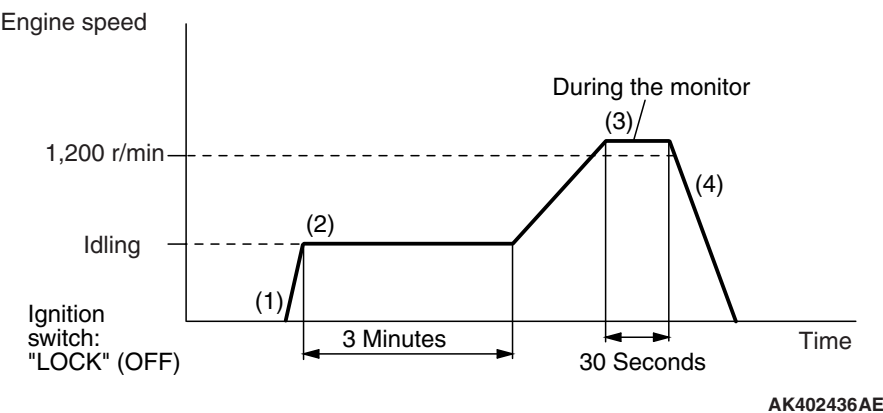
PATTERN 10

Drive cycle pattern	 <p align="right">AK402441AQ</p>
Inspection conditions	<ul style="list-style-type: none"> • 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	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 6 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Vehicle speed: More than 50 km/h (31 mph) • Air flow rate: More than 10 g/sec <p><i>NOTE: The system is normal if engine coolant temperature will rise more than 77°C (171°F) within 6 minutes.</i></p> 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

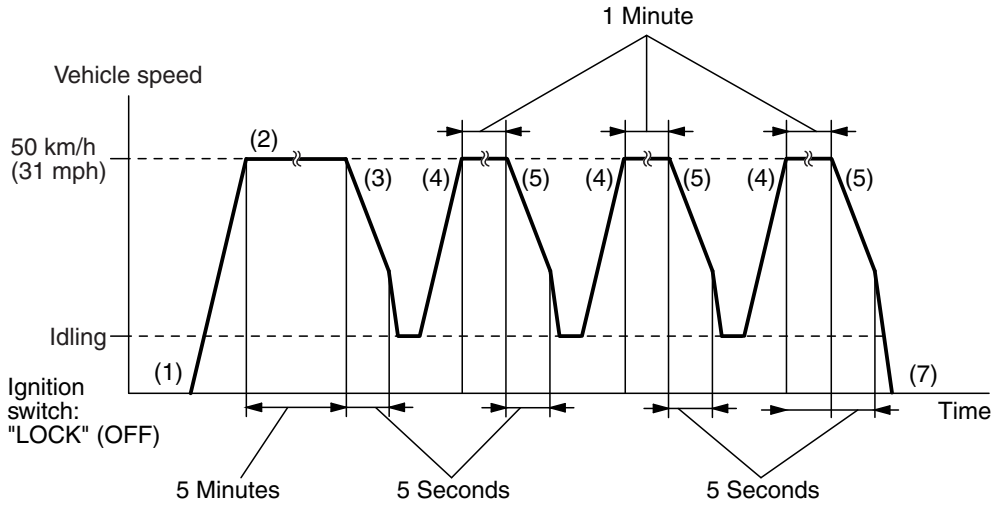
PATTERN 11

Drive cycle pattern	 <p>AK604701AC</p>
Inspection conditions	<ul style="list-style-type: none"> • 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	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at 50 km/h (31 mph) for 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. <p><i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i></p> <ol style="list-style-type: none"> 6. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 12

<p>Drive cycle pattern</p>	 <p align="right">AK402436AE</p>
<p>Inspection conditions</p>	<ul style="list-style-type: none"> • Engine coolant temperature: More than 0°C (32°F) • Condition of CVT: Selector lever "D" range
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 3 minutes. 3. Drive the vehicle for 30 seconds at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: More than 1,200 r/min • Engine load: More than 30 % • Throttle position sensor output: Less than 3.0 volts • Except fuel cut 4. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 13

<p>Drive cycle pattern</p>	 <p align="right">AK900710AB</p>
<p>Inspection conditions</p>	<ul style="list-style-type: none"> • Engine coolant temperature: More than 76°C (169°F) • Condition of CVT: Selector lever "D" range
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle 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. <ul style="list-style-type: none"> • Engine speed: More than 1,500 r/min • Engine load: More than 40 % 5. Release the accelerator pedal for 5 seconds then stop the vehicle in a safe place. 6. Repeat Steps 4 and 5 for 2 times. 7. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 8. Start the engine and do Steps 1 to 7 again. <p><i>NOTE: When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, the Readiness Codes will be set as "Complete" on the first drive cycle. The second drive cycle is required to set the Readiness Codes as "Complete" if a fault is detected during the first drive cycle.</i></p> <ol style="list-style-type: none"> 9. Confirm that the diagnostic trouble code (DTC) is not output.

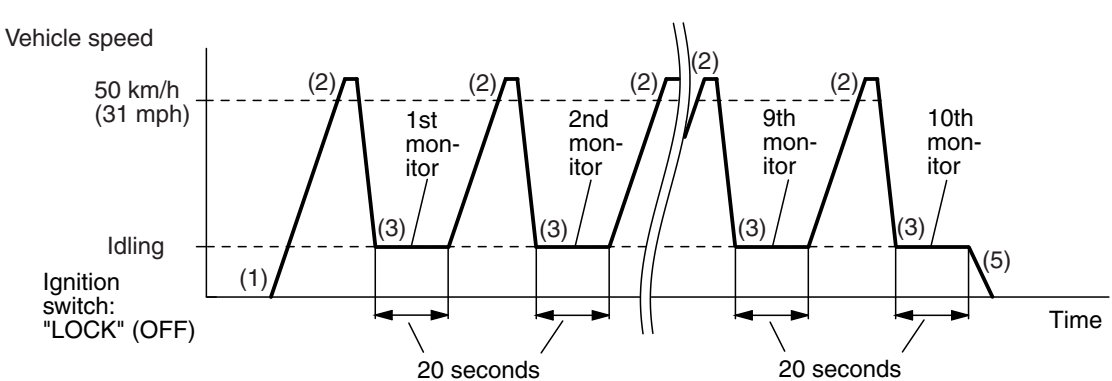
PATTERN 14

<p>Inspection conditions</p>	<ul style="list-style-type: none"> • 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
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 30 km/h (19 mph) until engine coolant temperature rises more than 60°C (140°F). (During the monitor) 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

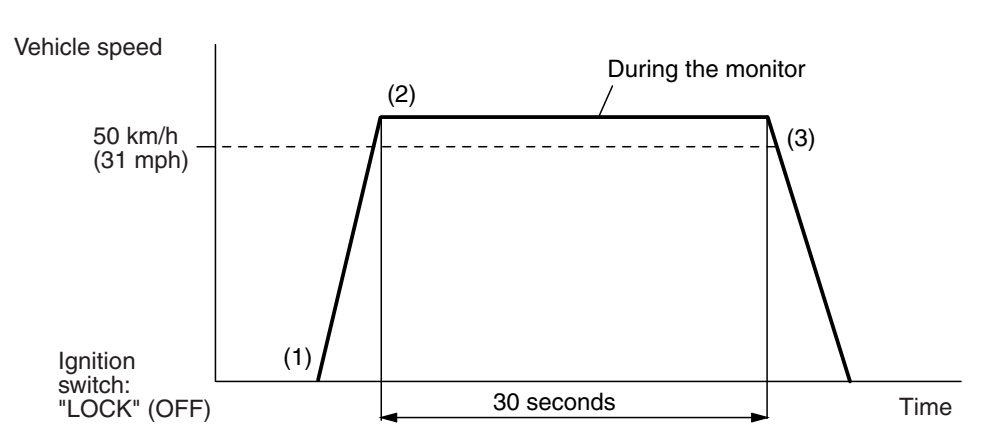
PATTERN 15

Drive cycle pattern	<p align="right">AK402440AE</p>
Inspection conditions	<ul style="list-style-type: none"> • 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	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle for 3 minutes at the following conditions. (During the monitor) <ul style="list-style-type: none"> • Engine speed: More than 500 r/min, less than 3,000 r/min • Engine load: More than 25 % • Without rapid accelerator pedal change • Except fuel cut 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 16

<p>Drive cycle pattern</p>	 <p>Vehicle speed</p> <p>50 km/h (31 mph)</p> <p>Idling</p> <p>Ignition switch: "LOCK" (OFF)</p> <p>1st monitor</p> <p>2nd monitor</p> <p>9th monitor</p> <p>10th monitor</p> <p>20 seconds</p> <p>20 seconds</p> <p>Time</p> <p align="right">AK402438AC</p>
<p>Inspection condition</p>	<p>Condition of CVT: Selector lever "D" range</p>
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Accelerate until the vehicle speed is more than 50 km/h (31 mph). 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

<p>Drive cycle pattern</p>	 <p>Vehicle speed</p> <p>50 km/h (31 mph)</p> <p>Idling</p> <p>Ignition switch: "LOCK" (OFF)</p> <p>During the monitor</p> <p>30 seconds</p> <p>Time</p> <p align="right">AK402441AP</p>
<p>Inspection conditions</p>	<ul style="list-style-type: none"> • Engine coolant temperature: More than 20°C (68°F) • Condition of CVT: Selector lever "D" range
<p>Test procedure</p>	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Drive the vehicle at more than 50 km/h (31 mph) for 30 seconds. (During the monitor) 3. Stop the vehicle in a safe place and turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 18

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

PATTERN 19

Inspection conditions	<ul style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 1 minute. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 20

Inspection condition	Engine coolant temperature: More than 77°C (171°F), less than 87°C (189°F)
Test procedure	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 15 minutes. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. Start the engine and do Steps 1 to 3 again. 5. Confirm that the diagnostic trouble code (DTC) is not output.

PATTERN 22

Inspection conditions	<ul style="list-style-type: none"> Intake air temperature: More than -10°C (14°F) Engine coolant temperature: More than 0°C (32°F)
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle for 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.

PATTERN 23

Inspection conditions	<ul style="list-style-type: none"> • Engine coolant temperature: More than 0°C (32°F) <Manifold absolute pressure sensor monitor> • Fuel temperature: Less than 36°C (96°F) <Fuel tank pressure sensor monitor> • Fuel amount at engine start: Less than 85 % <Fuel tank pressure sensor monitor>
Test procedure	<ol style="list-style-type: none"> 1. Start the engine with all the accessories switched OFF. 2. Let the engine idle at the engine speed less than 1,000 r/min for 15 seconds. (During the monitor) 3. Turn the ignition switch to "LOCK" (OFF) position. 4. 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 <Except for California>, P0421 <California>
- Evaporative system: P0442, P0455, P0456
- Heated oxygen sensor: P0133, P0139, P140
- Heated oxygen sensor heater: P0031, P0037
- EGR system: P0401 <California>

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

M1131153000880

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

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

MALFUNCTION ITEM	CONTROL CONTENTS DURING MALFUNCTION
Throttle position sensor (main)	<ul style="list-style-type: none"> • Controls the throttle valve position through the use of the throttle position sensor (sub) signal. • Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle. • Prohibits the operation of the engine speed feedback control. • Prohibits the operation of the auto-cruise control. • Cuts off fuel when the engine speed exceeds 3,000 r/min. • Suppresses the engine output by stopping the electronically controlled throttle valve system if the throttle position sensor (sub) is also malfunctioning.
Throttle position sensor (sub)	<ul style="list-style-type: none"> • Controls the throttle valve position through the use of the throttle position sensor (main) signal. • Renders the amount of accelerator pedal travel as being approximately one-half the normal opening angle. • Prohibits the operation of the auto-cruise control. • Cuts off fuel when the engine speed exceeds 3,000 r/min. • Prohibits the idle speed control from learning. • Suppresses the engine output by stopping the electronically controlled throttle valve system if the throttle position sensor (main) is also malfunctioning.
Throttle valve position feedback	<ul style="list-style-type: none"> • Suppresses the engine output by stopping the electronically controlled throttle valve system. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control.
Throttle actuator control motor	<ul style="list-style-type: none"> • Suppresses the engine output by stopping the electronically controlled throttle valve system. • Prohibits the operation of the auto-cruise control. • Prohibits the operation of the engine speed feedback control.
Engine oil control valve	Does not control variable valve timing (V. V. T.).

DIAGNOSTIC TROUBLE CODE CHART

⚠ 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	Heated oxygen sensor (front) heater circuit low <Except for California>	P.13A-87
	Heated oxygen sensor (front) heater circuit low <California>	P.13A-94
P0032	Heated oxygen sensor (front) heater circuit high <Except for California>	P.13A-101
	Heated oxygen sensor (front) heater circuit high <California>	P.13A-105
P0037	Heated oxygen sensor (rear) heater circuit low <Except for California>	P.13A-109
	Heated oxygen sensor (rear) heater circuit low <California>	P.13A-116
P0038	Heated oxygen sensor (rear) heater circuit high <Except for California>	P.13A-123
	Heated oxygen sensor (rear) heater circuit high <California>	P.13A-127
P0043	Heated oxygen sensor (3rd) heater circuit low <California>	P.13A-131
P0044	Heated oxygen sensor (3rd) heater circuit high <California>	P.13A-138
P0069	Abnormal correlation between manifold absolute pressure sensor and barometric pressure sensor	P.13A-142
P0101* ¹	Mass airflow circuit range/performance problem	P.13A-147
P0102* ¹	Mass airflow circuit low input	P.13A-153
P0103* ¹	Mass airflow circuit high input	P.13A-160
P0106	Manifold absolute pressure circuit range/performance problem	P.13A-166
P0107	Manifold absolute pressure circuit low input	P.13A-175
P0108	Manifold absolute pressure circuit high input	P.13A-183
P0111* ¹	Intake air temperature circuit range/performance problem	P.13A-188
P0112* ¹	Intake air temperature circuit low input	P.13A-194
P0113* ¹	Intake air temperature circuit high input	P.13A-198
P0116* ¹	Engine coolant temperature circuit range/performance problem	P.13A-204

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0117*1	Engine coolant temperature circuit low input	P.13A-210
P0118*1	Engine coolant temperature circuit high input	P.13A-214
P0122*1	Throttle position sensor (main) circuit low input	P.13A-221
P0123*1	Throttle position sensor (main) circuit high input	P.13A-225
P0125*1	Insufficient coolant temperature for closed loop fuel control	P.13A-232
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	P.13A-240
P0131	Heated oxygen sensor (front) circuit low voltage <Except for California>	P.13A-242
	Heated oxygen sensor (front) circuit low voltage <California>	P.13A-250
P0132	Heated oxygen sensor (front) circuit high voltage <Except for California>	P.13A-258
	Heated oxygen sensor (front) circuit high voltage <California>	P.13A-262
P0133	Heated oxygen sensor (front) circuit slow response <Except for California>	P.13A-266
	Heated oxygen sensor (front) circuit slow response <California>	P.13A-271
P0134*1	Heated oxygen sensor (front) circuit no activity detected <Except for California>	P.13A-276
	Heated oxygen sensor (front) circuit no activity detected <California>	P.13A-282
P0137	Heated oxygen sensor (rear) circuit low voltage <Except for California>	P.13A-288
	Heated oxygen sensor (rear) circuit low voltage <California>	P.13A-297
P0138	Heated oxygen sensor (rear) circuit high voltage <Except for California>	P.13A-306
	Heated oxygen sensor (rear) circuit high voltage <California>	P.13A-310
P0139	Heated oxygen sensor (rear) circuit slow response <Except for California>	P.13A-314
	Heated oxygen sensor (rear) circuit slow response <California>	P.13A-319
P0140	Heated oxygen sensor (rear) circuit no activity detected <Except for California>	P.13A-324
	Heated oxygen sensor (rear) circuit no activity detected <California>	P.13A-328
P0143	Heated oxygen sensor (3rd) circuit low voltage <California>	P.13A-332
P0144	Heated oxygen sensor (3rd) circuit high voltage <California>	P.13A-341
P0145	Heated oxygen sensor (3rd) circuit slow response <California>	P.13A-345
P0146	Heated oxygen sensor (3rd) circuit no activity detected <California>	P.13A-349
P0171	System too lean	P.13A-353
P0172	System too rich	P.13A-360
P0181	Fuel tank temperature sensor circuit range/performance	P.13A-366
P0182	Fuel tank temperature sensor circuit low input	P.13A-373
P0183	Fuel tank temperature sensor circuit high input	P.13A-378
P0201	Injector circuit-cylinder 1	P.13A-385
P0202	Injector circuit-cylinder 2	P.13A-395

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P0203	Injector circuit-cylinder 3	P.13A-405
P0204	Injector circuit-cylinder 4	P.13A-415
P0222* ¹	Throttle position sensor (sub) circuit low input	P.13A-425
P0223* ¹	Throttle position sensor (sub) circuit high input	P.13A-431
P0300* ²	Random/multiple cylinder misfire detected	P.13A-436
P0301* ²	Cylinder 1 misfire detected	P.13A-441
P0302* ²	Cylinder 2 misfire detected	P.13A-444
P0303* ²	Cylinder 3 misfire detected	P.13A-447
P0304* ²	Cylinder 4 misfire detected	P.13A-450
P0327	Knock sensor circuit low	P.13A-454
P0328	Knock sensor circuit high	P.13A-458
P0335* ¹	Crankshaft position sensor circuit	P.13A-462
P0340* ¹	Intake camshaft position sensor circuit	P.13A-472
P0365* ¹	Exhaust camshaft position sensor circuit	P.13A-480
P0401	Exhaust gas recirculation flow insufficient detected <California>	P.13A-489
P0420	Warm up catalyst efficiency below threshold <Except for California>	P.13A-492
P0421	Warm up catalyst efficiency below threshold <California>	P.13A-494
P0441	Evaporative emission control system incorrect purge flow	P.13A-496
P0442	Evaporative emission control system leak detected (small leak)	P.13A-500
P0443	Evaporative emission control system purge control valve circuit	P.13A-512
P0446	Evaporative emission control system vent control circuit	P.13A-519
P0450	Evaporative emission control system pressure sensor malfunction	P.13A-526
P0451	Evaporative emission control system pressure sensor range/performance	P.13A-534
P0452	Evaporative emission control system pressure sensor low input	P.13A-543
P0453	Evaporative emission control system pressure sensor high input	P.13A-554
P0455	Evaporative emission control system leak detected (gross leak)	P.13A-562
P0456	Evaporative emission control system leak detected (very small leak)	P.13A-573
P0461	Fuel level sensor circuit range/performance	P.13A-584
P0462	Fuel level sensor circuit low input	P.13A-587
P0463	Fuel level sensor circuit high input	P.13A-589
P0489	EGR valve (stepper motor) circuit malfunction (ground short) <California>	P.13A-592
P0490	EGR valve (stepper motor) circuit malfunction (battery short) <California>	P.13A-600
P0500* ¹	Vehicle speed sensor malfunction <M/T>	P.13A-605
P0506	Idle control system RPM lower than expected	P.13A-613
P0507	Idle control system RPM higher than expected	P.13A-616

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P050B	Ignition timing retard insufficient	P.13A-619
P0513	Immobilizer malfunction	P.13A-622
P0551	Power steering pressure switch circuit range/performance	P.13A-624
P0554	Power steering pressure switch circuit intermittent	P.13A-631
P0603* ¹	EEPROM malfunction	P.13A-635
P0606* ¹	Engine control module main processor malfunction	P.13A-637
P0622	Generator FR terminal circuit malfunction	P.13A-642
P0630* ¹	Vehicle Identification Number (VIN) malfunction	P.13A-647
P0638* ¹	Throttle actuator control motor circuit range/ performance	P.13A-649
P0642* ¹	Throttle position sensor power supply	P.13A-652
P0657* ¹	Throttle actuator control motor relay circuit malfunction	P.13A-654
P1231	Active stability control plausibility	P.13A-661
P1232	Fail safe system	P.13A-663
P1233* ¹	Throttle position sensor (main) plausibility	P.13A-664
P1234* ¹	Throttle position sensor (sub) plausibility	P.13A-668
P1235* ¹	Mass airflow sensor plausibility	P.13A-672
P1236* ¹	A/D converter	P.13A-676
P1237* ¹	Accelerator pedal position sensor plausibility	P.13A-677
P1238* ¹	Mass airflow sensor plausibility (torque monitor)	P.13A-679
P1239* ¹	Engine RPM plausibility	P.13A-682
P1240	Ignition angle	P.13A-685
P1241* ¹	Torque monitor	P.13A-686
P1242	Fail safe control monitor	P.13A-690
P1243	Inquiry/response error	P.13A-692
P1244	RAM test for all area	P.13A-693
P1245	Cycle RAM test (engine)	P.13A-694
P1247	CVT plausibility <CVT>	P.13A-695
P1506	Idle control system RPM lower than expected at low temperature	P.13A-696
P1507	Idle control system RPM higher than expected at low temperature	P.13A-699
P1590* ¹	TCM to ECM communication error in torque reduction request <CVT>	P.13A-702
P1603* ¹	Battery backup circuit malfunction	P.13A-705
P1676* ¹	Variant coding	P.13A-709
P2096	Post catalyst fuel trim system too lean	P.13A-711
P2097	Post catalyst fuel trim system too rich	P.13A-714
P2100* ¹	Throttle actuator control motor circuit (open)	P.13A-718

DTC	DIAGNOSTIC ITEM	REFERENCE PAGE
P2101* ¹	Throttle actuator control motor magneto malfunction	P.13A-723
P2122* ¹	Accelerator pedal position sensor (main) circuit low input	P.13A-727
P2123* ¹	Accelerator pedal position sensor (main) circuit high input	P.13A-733
P2127* ¹	Accelerator pedal position sensor (sub) circuit low input	P.13A-738
P2128* ¹	Accelerator pedal position sensor (sub) circuit high input	P.13A-744
P2135* ¹	Throttle position sensor (main and sub) range/performance problem	P.13A-748
P2138* ¹	Accelerator pedal position sensor (main and sub) range/performance problem	P.13A-754
P2195	Heated oxygen sensor (front) inactive <Except for California>	P.13A-761
	Heated oxygen sensor (front) inactive <California>	P.13A-764
P2228* ¹	Barometric pressure circuit low input	P.13A-767
P2229* ¹	Barometric pressure circuit high input	P.13A-769
P2252	Heated oxygen sensor offset circuit low voltage <Except for California>	P.13A-771
	Heated oxygen sensor offset circuit low voltage <California>	P.13A-777
P2253	Heated oxygen sensor offset circuit high voltage <Except for California>	P.13A-785
	Heated oxygen sensor offset circuit high voltage <California>	P.13A-793
P2423	HC adsorber (HC trap catalyst) efficiency below threshold <California>	P.13A-803
U0001	Bus off	P.13A-805
U0101* ¹	TCM time-out <CVT>	P.13A-807
U0121	ASC-ECU time-out	P.13A-811
U0141* ¹	ETACS-ECU time-out	P.13A-814
U0167	Immobilizer communication error	P.13A-817
U1180* ¹	Combination meter time-out	P.13A-819

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

M1131151503059

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.

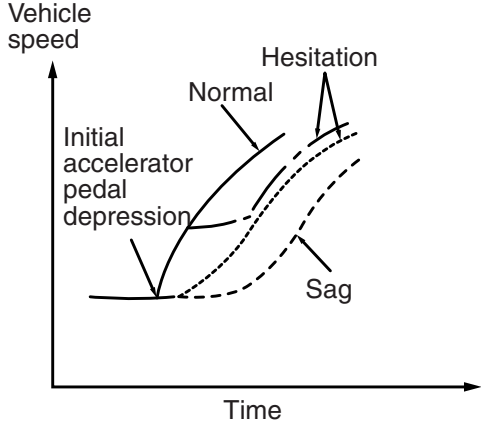
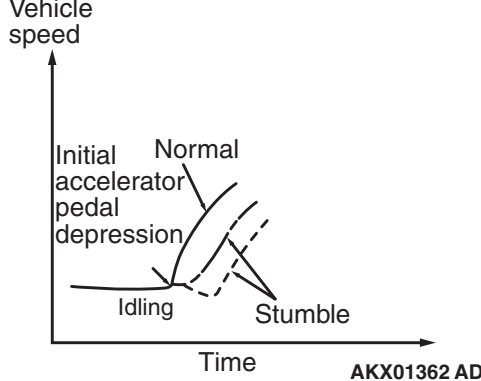
NOTE: When the racing (2,000 to 5,000 r/min or more) continues on the vehicle stopped with no load during the specified time or more, the increase in the engine speed might be limited. This comes from the engine protection and control functions and is not a malfunction.

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Communication with scan tool is impossible	Communication with ECM only is not possible	1	P.13A-823
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-827
	The Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) remains illuminated and never goes out	3	P.13A-827
Starting	Cranks, won't start	4	P.13A-829
	Starts up and dies	5	P.13A-834
	Hard starting	6	P.13A-838
Idling stability (improper idling)	Unstable idle (rough idle, hunting)	7	P.13A-842
	Idle speed is high (improper idle speed)	8	P.13A-846
	Idle speed is low (improper idle speed)	9	P.13A-848
Idling stability (engine stalls)	When the engine is cold, it stalls at idle (die out)	10	P.13A-849
	When the engine is hot, it stalls at idle (die out)	11	P.13A-851
	The engine stalls when accelerating (pass out)	12	P.13A-854
	The engine stalls when decelerating	13	P.13A-856

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Driving	Hesitation, sag, Stumble, Poor acceleration or Surge	14	P.13A-858
	Acceleration shock	15	P.13A-862
	Knocking	16	P.13A-863
Too high CO and HC concentration when idling		17	P.13A-866
IM240 test failure	Transient, mass emission tailpipe test failure	18	P.13A-868
	Purge flow test of the evaporative emission canister failure	19	P.13A-872
	Pressure test of the evaporative system failure	20	P.13A-873
Power supply system and ignition switch-IG system		21	P.13A-875
Fuel pump system		22	P.13A-881
Ignition switch-ST and starter relay system <M/T>		23	P.13A-887
Ignition switch-ST system and starter relay system <CVT>		24	P.13A-894
Ignition circuit system		25	P.13A-900
A/C system		26	P.13A-905
Engine oil pressure switch system		27	P.13A-908

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

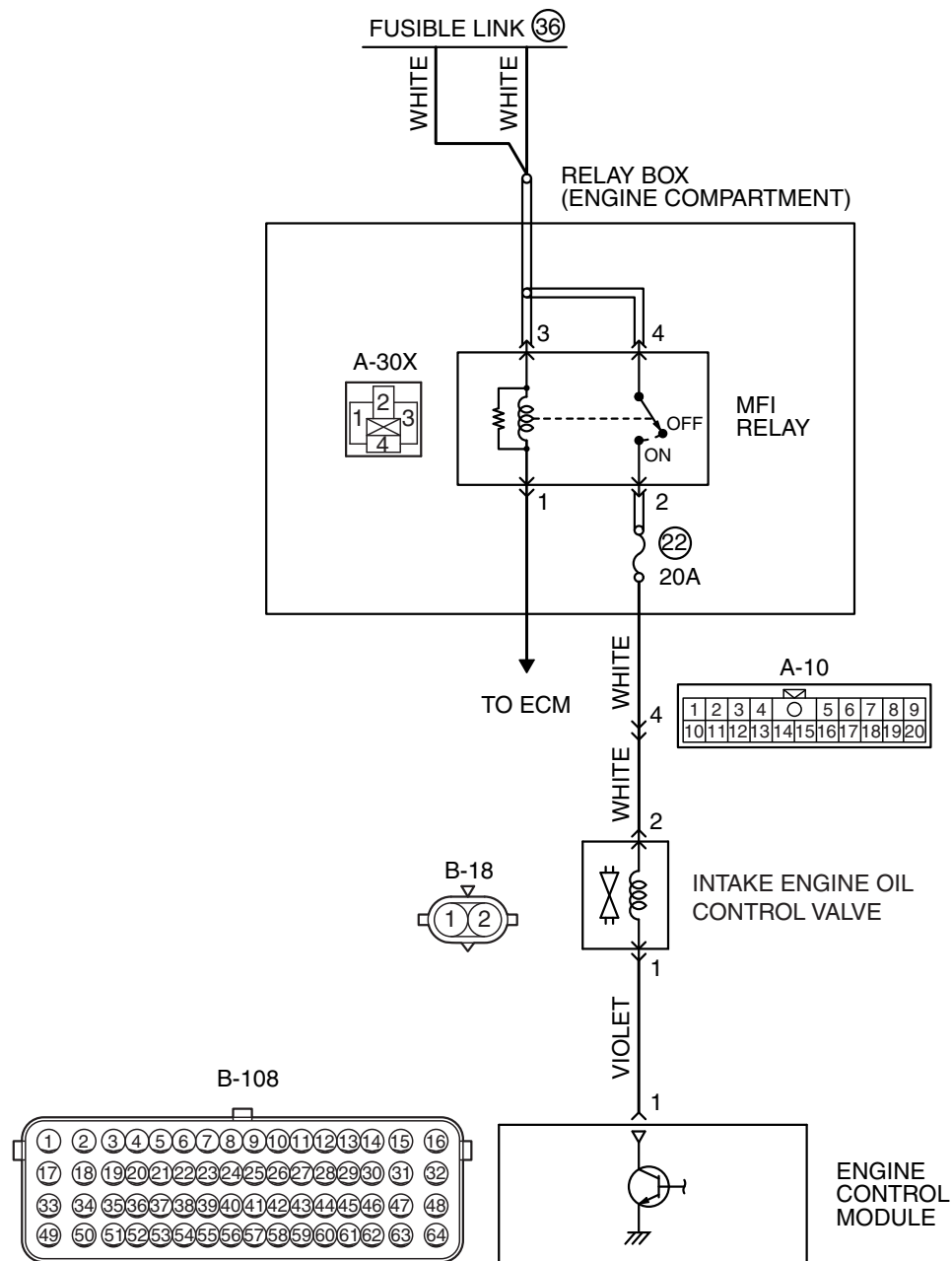
ITEMS		SYMPTOM
At starting	Won't start	The starter cranks the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starts up and dies	The engine starts, but then engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc.
	Incorrect idle speed	The engine doesn't idle at the correct speed.
	Engine stall (die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not.
	Engine stall (pass out)	The engine stalls when the accelerator pedal is depressed.

ITEMS		SYMPTOM
At driving	Hesitation Sag	<p>"Hesitation" is the delay in response of the vehicle speed (engine speed). This occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag".</p>  <p align="right">AKX01361AC</p>
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth. Also the inability to reach maximum speed.
	Stumble	<p>Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration.</p>  <p align="right">AKX01362 AD</p>
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is slight acceleration and deceleration feel usually felt during steady, light throttle cruise. Most notable under light loads.
	Knocking	A sharp sound during driving, which sounds like a hammer striking the cylinder walls. It makes poor driveability.
At stopped	Run on ("Dieseling")	The condition in which the engine continues to run after the ignition switch is turned to the "LOCK" (OFF) position. Also called "dieseling".

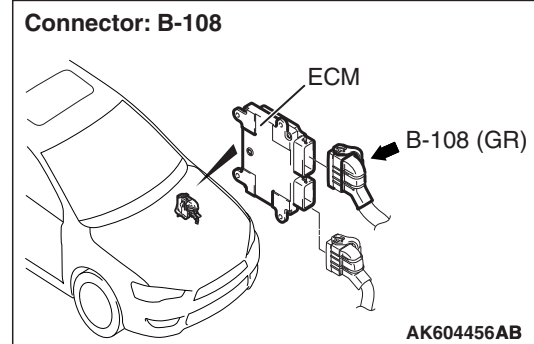
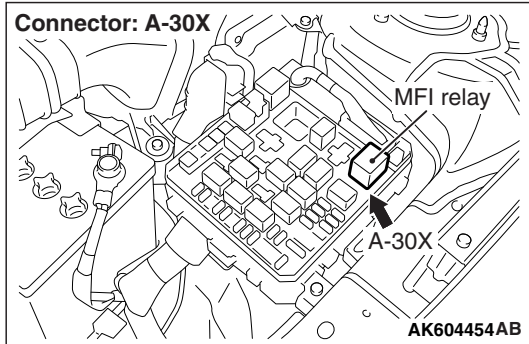
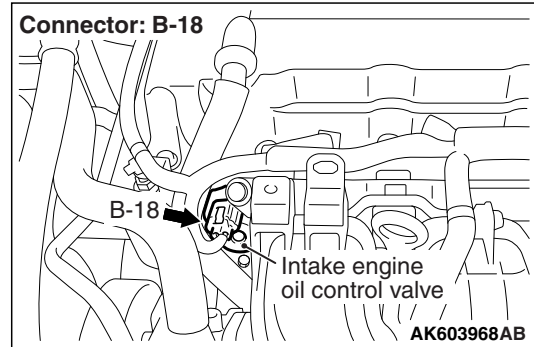
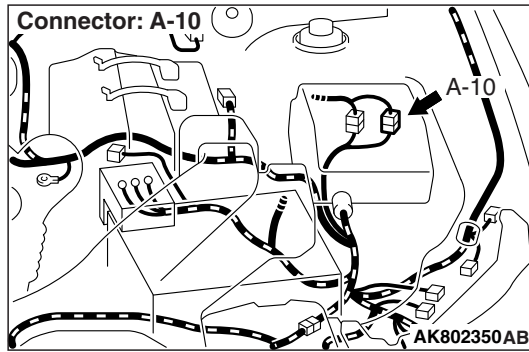
DIAGNOSTIC TROUBLE CODE PROCEDURES

DTC P0010: Intake Engine Oil Control Valve Circuit

INTAKE ENGINE OIL CONTROL VALVE CIRCUIT



AK704780AB



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)

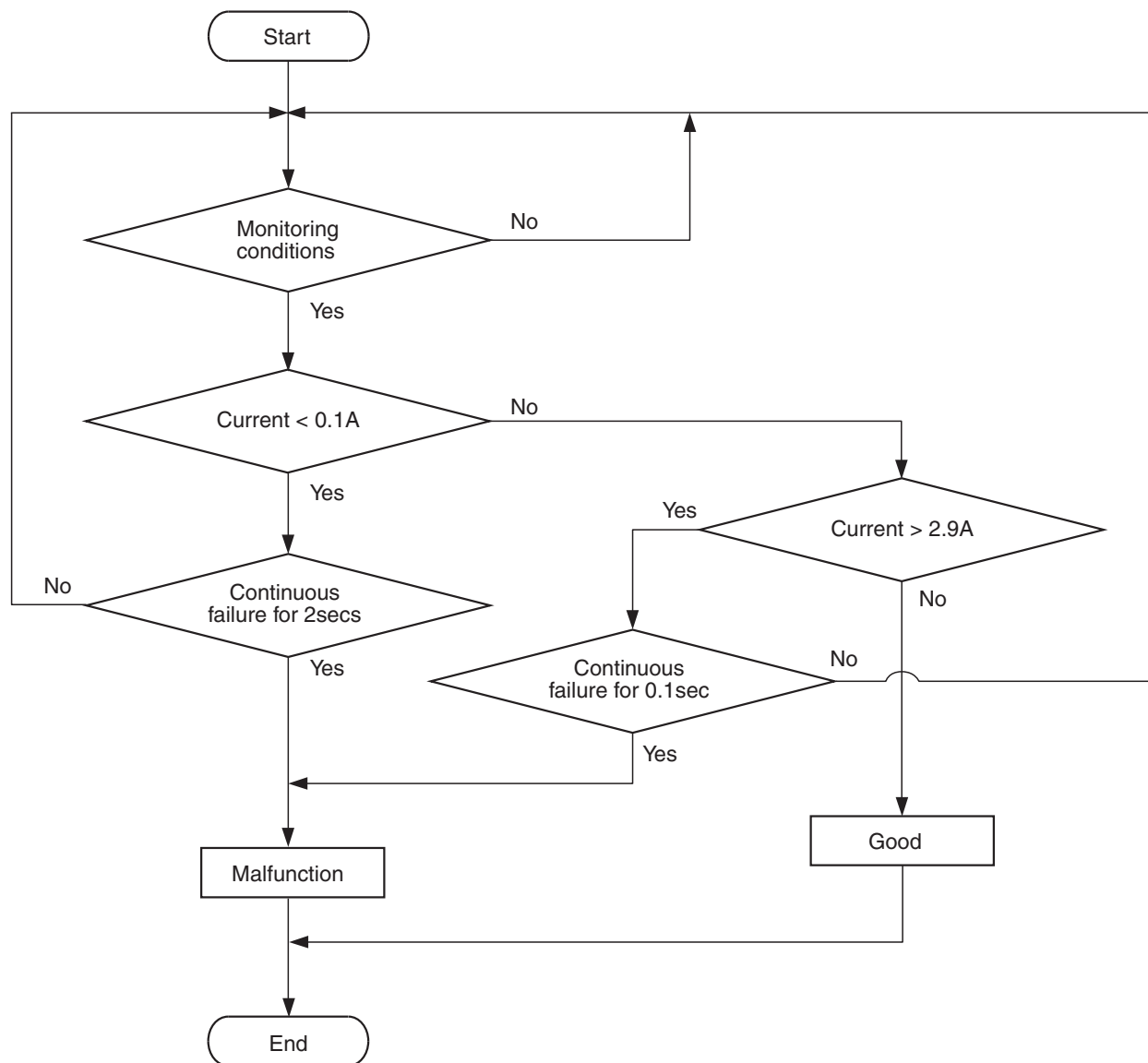
- Not applicable

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



AK704777

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.

- 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-12](#).

Check Conditions

- Ignition switch is "ON" position.

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, or 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
 - MB991911: Main Harness B
- MB992110: Power Plant ECU Check Harness

STEP 1. Check harness connector B-18 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.

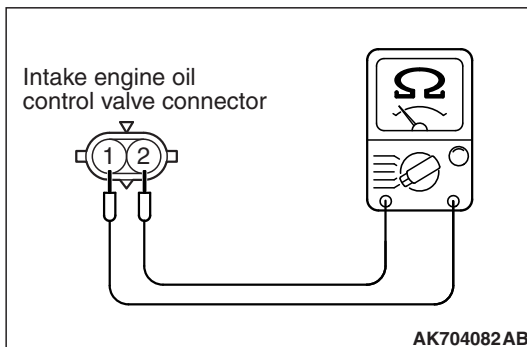
- (1) Disconnect the intake engine oil control valve connector B-18.
- (2) Measure the resistance between intake engine oil control valve side connector terminal No. 1 and No. 2.

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

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

YES : Go to Step 3.

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



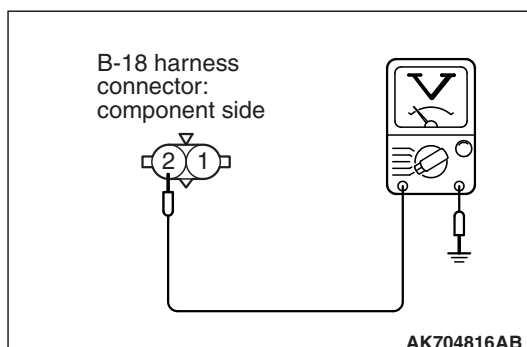
STEP 3. Measure the power supply voltage at intake engine oil control valve harness side connector B-18.

- (1) Disconnect the connector B-18 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-30X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector A-10 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-30X (terminal No. 2) and intake engine oil control valve connector B-18 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

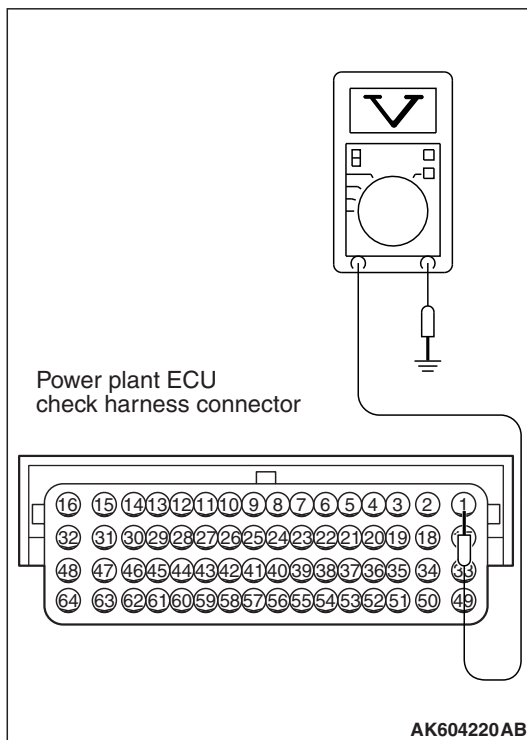
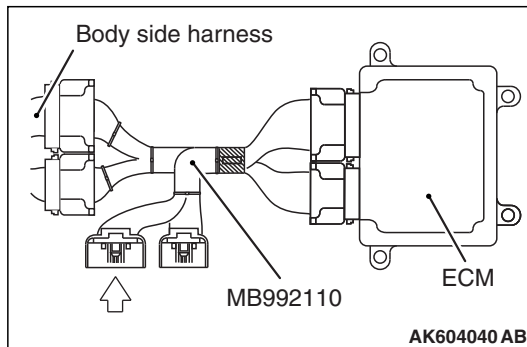
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.

STEP 5. Check harness connector B-108 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-108 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-18 (terminal No. 1) and ECM connector B-108 (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-30X (terminal No. 2) and intake engine oil control valve connector B-18 (terminal No. 2).

NOTE: Check harness after checking intermediate connector A-10. 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-18 (terminal No. 1) and ECM connector B-108 (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-12](#).

(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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-14](#).

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-12](#).

(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 difference between the actual intake valve opening timing and the intake valve target opening timing is over 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)

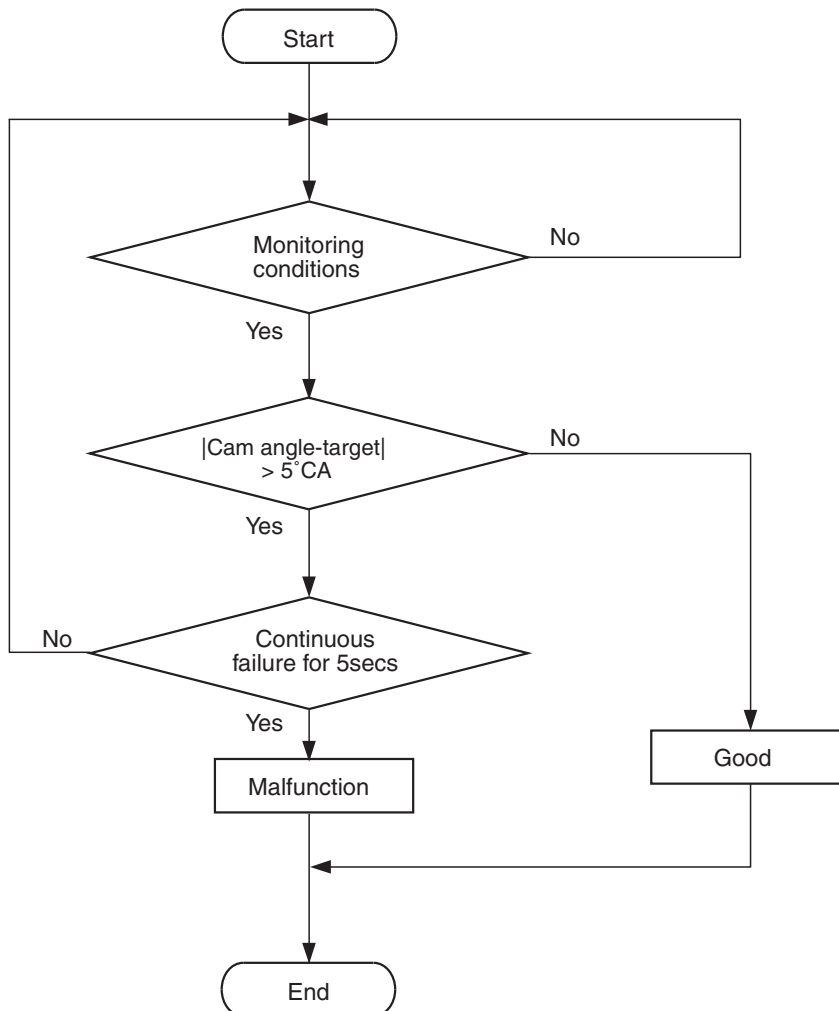
- Not applicable

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



AK604305

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-12](#).

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.

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).

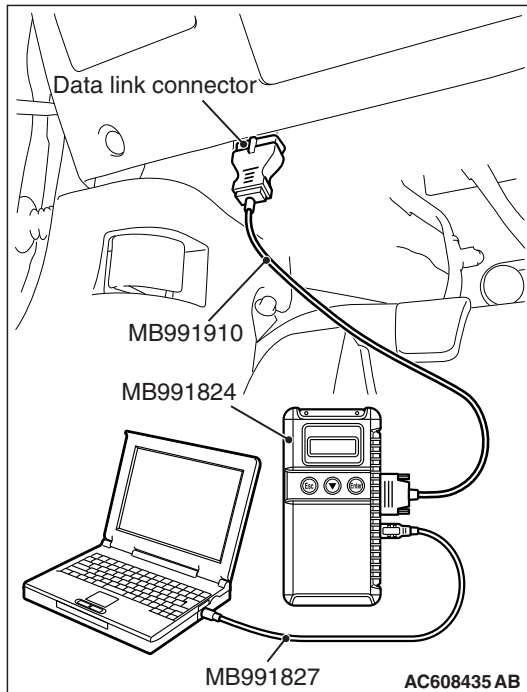
⚠ CAUTION

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-50](#).
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-976](#)).

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.

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-12](#).
- (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, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-14](#).

STEP 6. Test the OBD-II drive cycle.

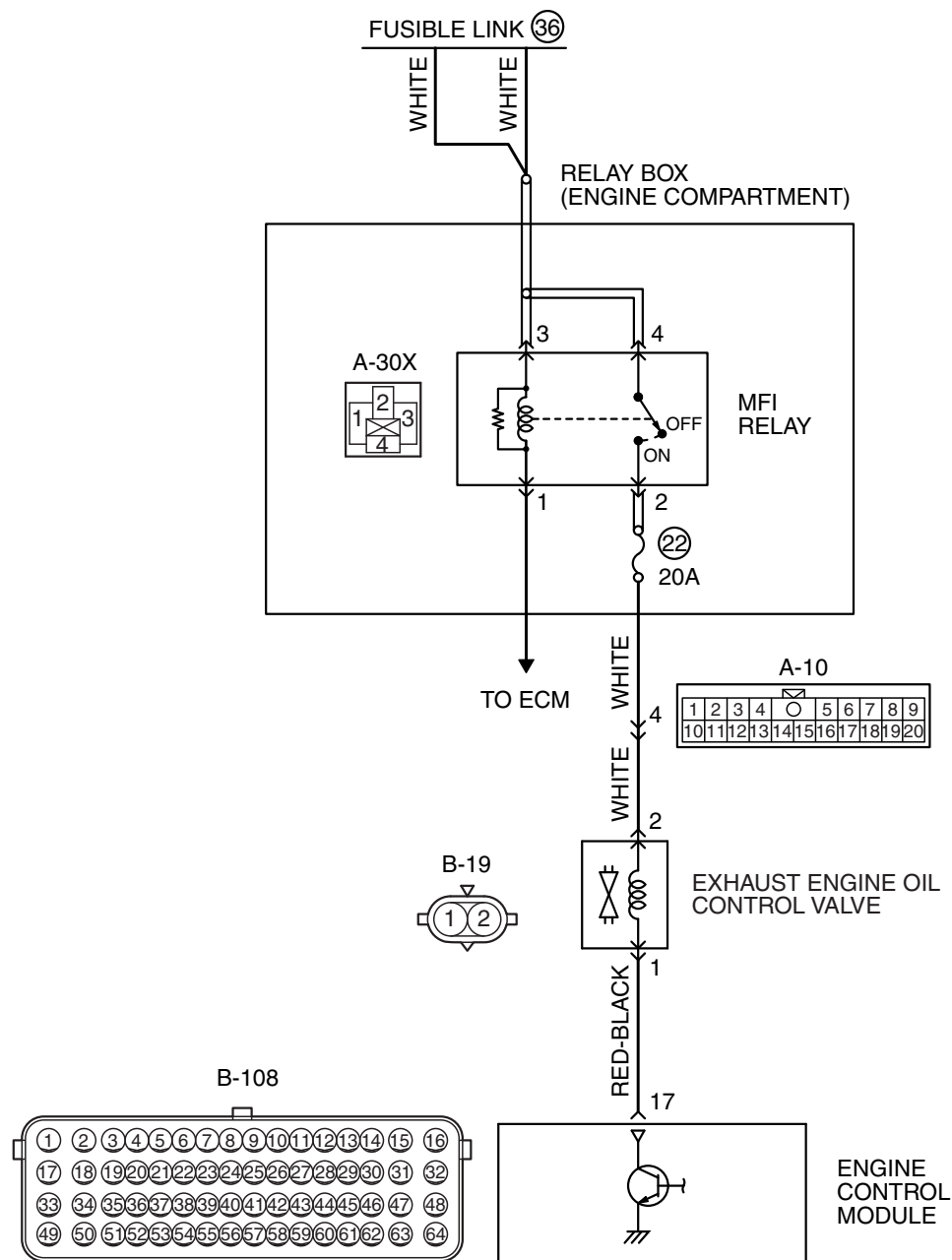
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 20 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0011 set?

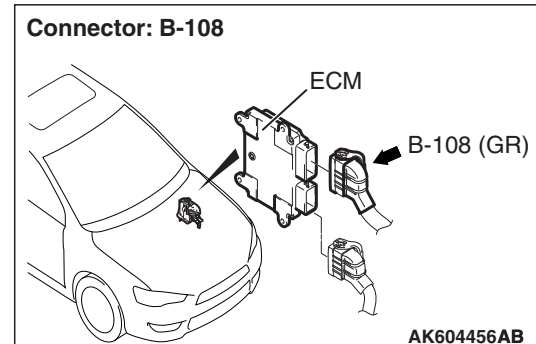
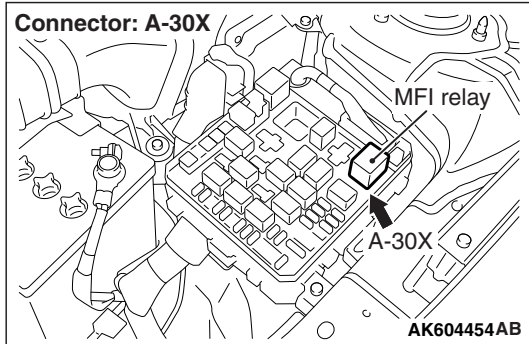
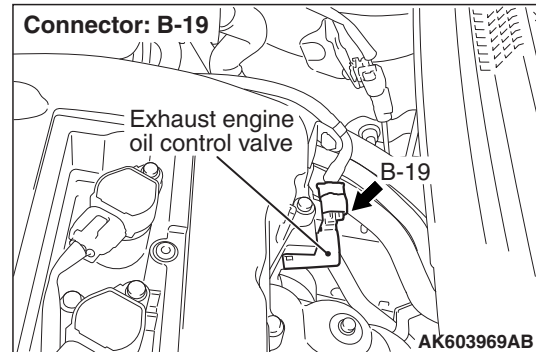
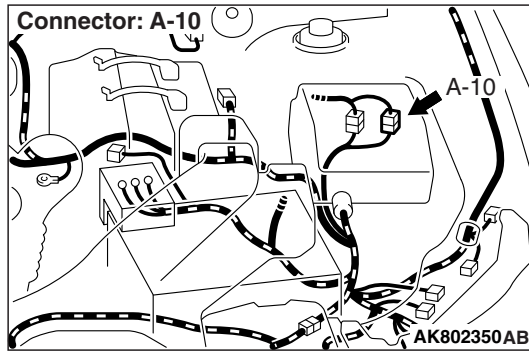
- YES :** Retry the troubleshooting.
- NO :** The inspection is complete.

DTC P0013: Exhaust Engine Oil Control Valve Circuit

EXHAUST ENGINE OIL CONTROL VALVE CIRCUIT



AK704780AC



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 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)

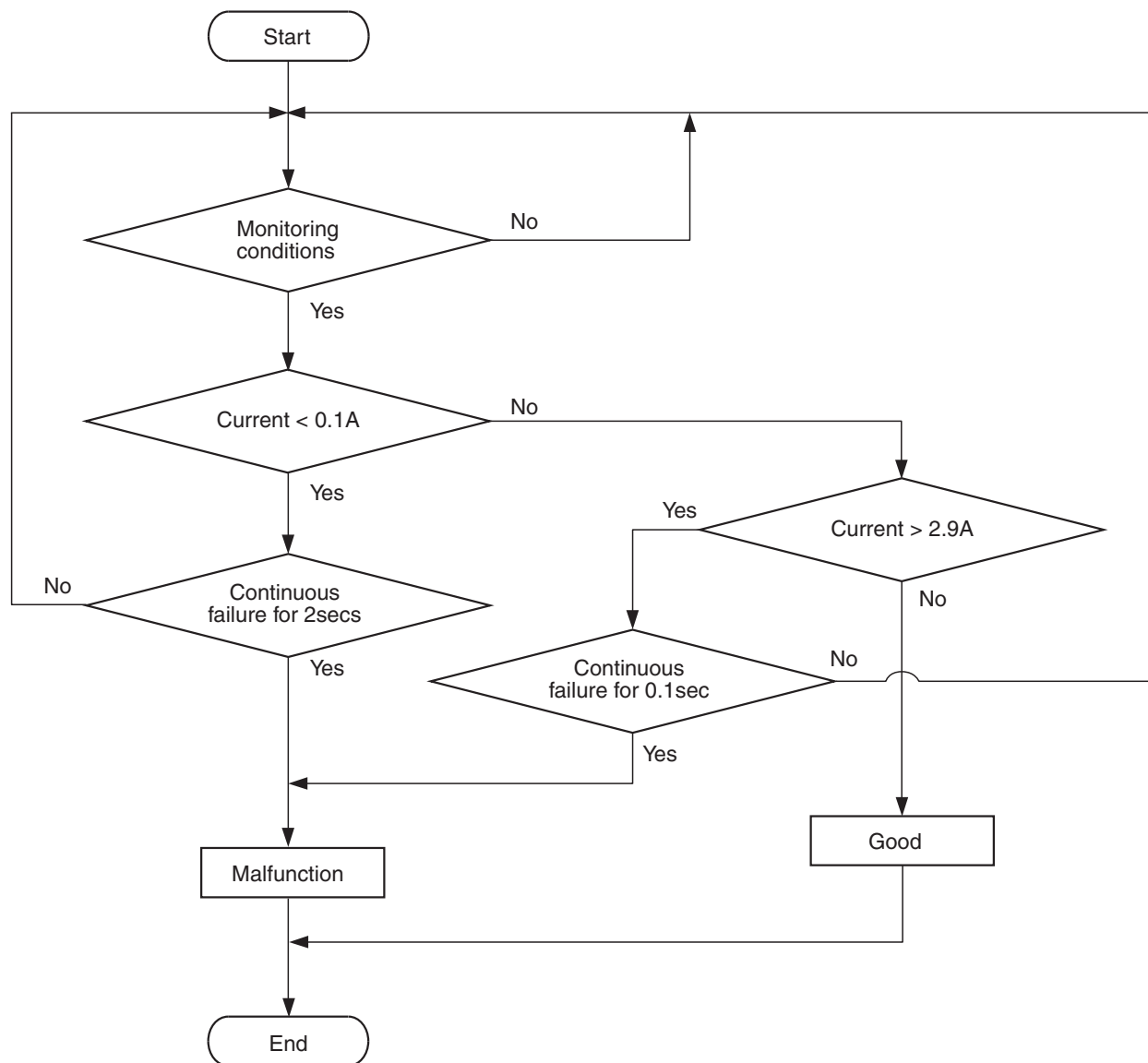
- Not applicable

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



AK704777

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.

- 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-12](#).

Check Conditions

- Ignition switch is "ON" position.

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, or 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
 - MB991911: Main Harness B
- MB992110: Power Plant ECU Check Harness

STEP 1. Check harness connector B-19 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.

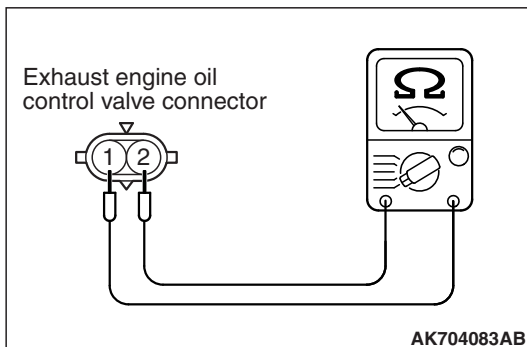
- (1) Disconnect the exhaust engine oil control valve connector B-19.
- (2) Measure the resistance between exhaust engine oil control valve side connector terminal No. 1 and No. 2.

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

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

YES : Go to Step 3.

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



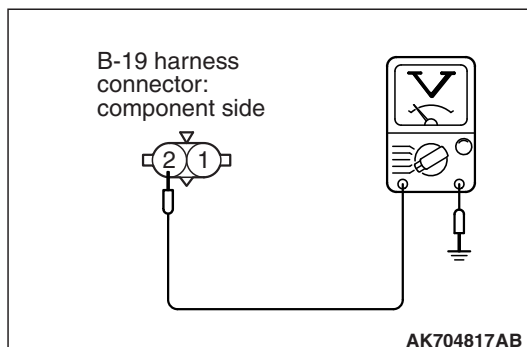
STEP 3. Measure the power supply voltage at exhaust engine oil control valve harness side connector B-19.

- (1) Disconnect the connector B-19 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-30X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Check harness connector A-10 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-30X (terminal No. 2) and exhaust engine oil control valve connector B-19 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

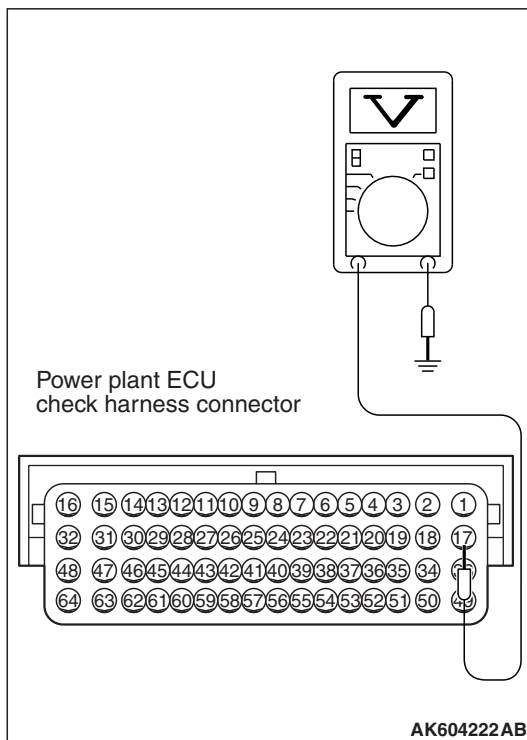
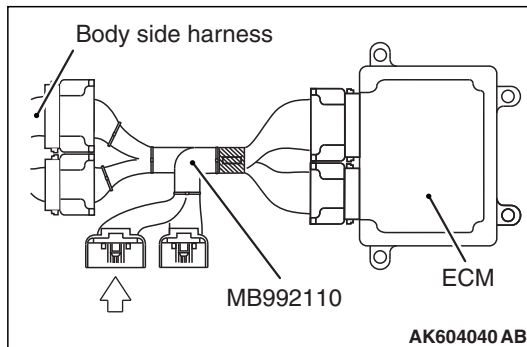
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.

STEP 5. Check harness connector B-108 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-108 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-19 (terminal No. 1) and ECM connector B-108 (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-30X (terminal No. 2) and exhaust engine oil control valve connector B-19 (terminal No. 2).

NOTE: Check harness after checking intermediate connector A-10. 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-19 (terminal No. 1) and ECM connector B-108 (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-12](#).

(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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-14](#).

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-12](#).

(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 difference between the actual exhaust valve closing timing and the exhaust valve target closing timing is over 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)

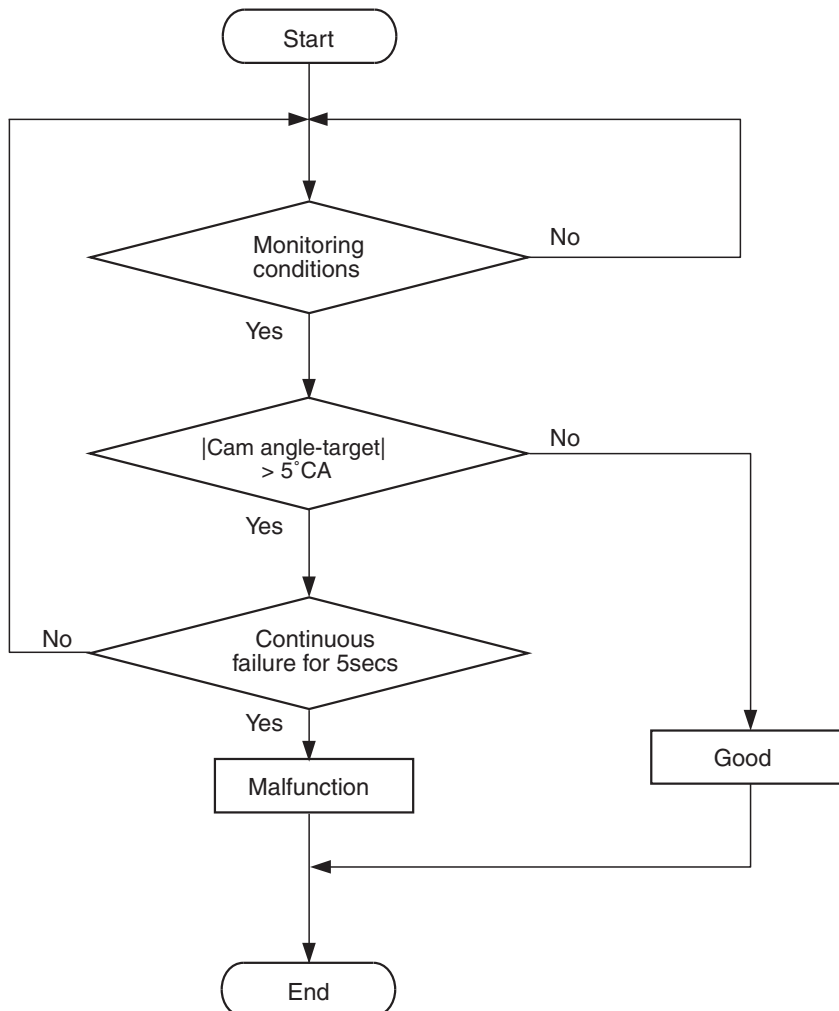
- Not applicable

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



AK604305

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-12](#).

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.

DIAGNOSIS**Required Special Tools**

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

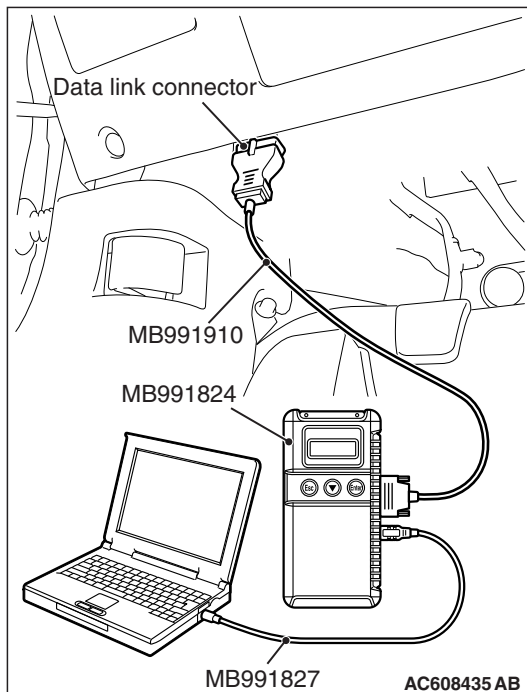
STEP 1. Using scan tool MB991958, read the diagnostic trouble code (DTC).**⚠ CAUTION**

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-50](#).
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-976](#)).

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.

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-12](#).
- (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, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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.00-14](#).

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-12](#).
- (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)

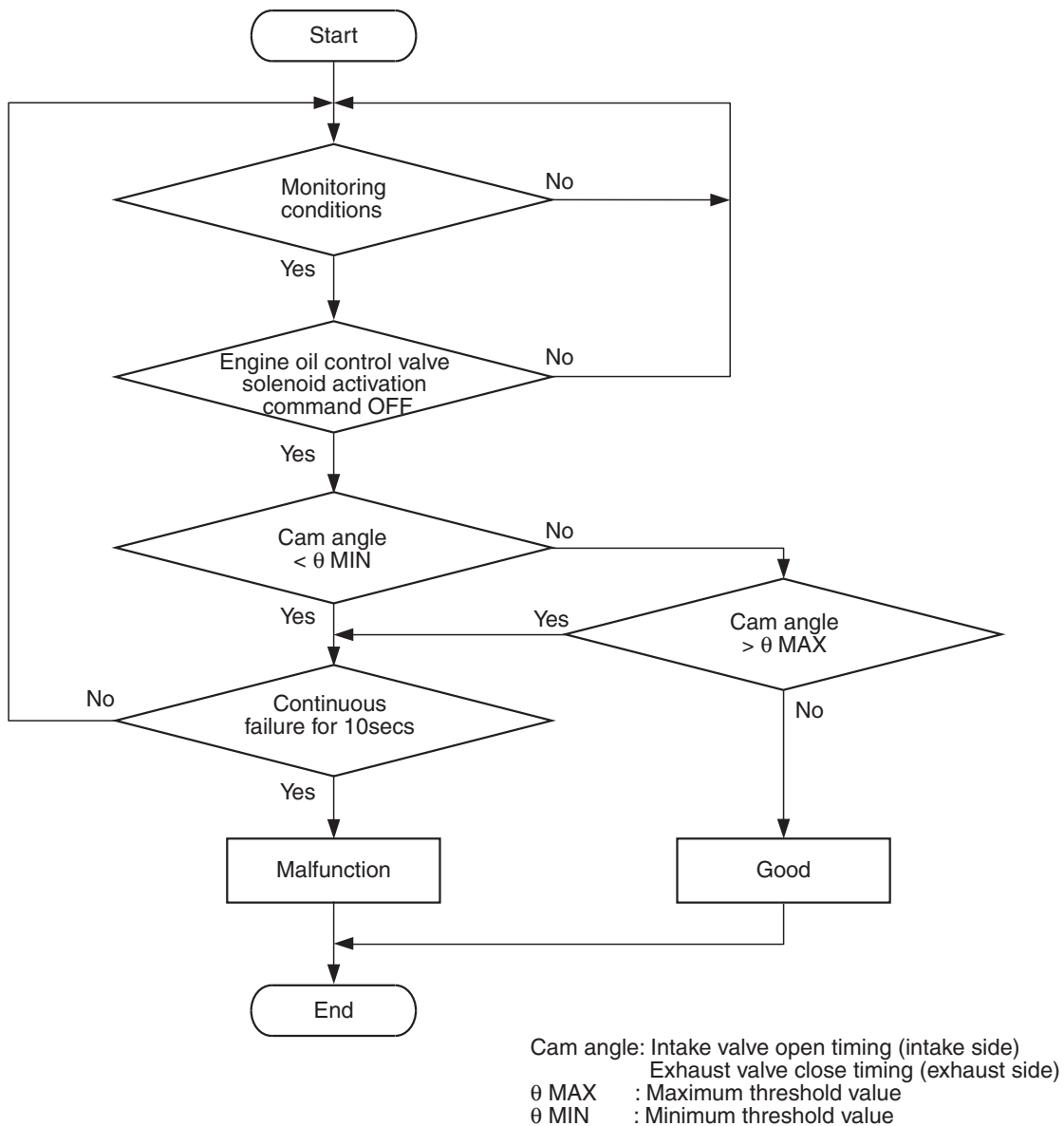
- Not applicable

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



AK900350

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) <Except for California> or –10.0 degrees (ATDC) <California> for 10 seconds.
- or
- The open timing of the intake valve is slower than 6.1 degrees (ATDC) <Except for California> or 3.1 degrees (ATDC) <California> for 10 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 20 [P.13A-12](#).

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.

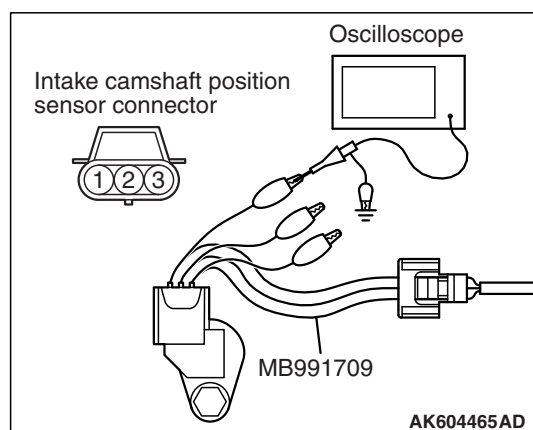
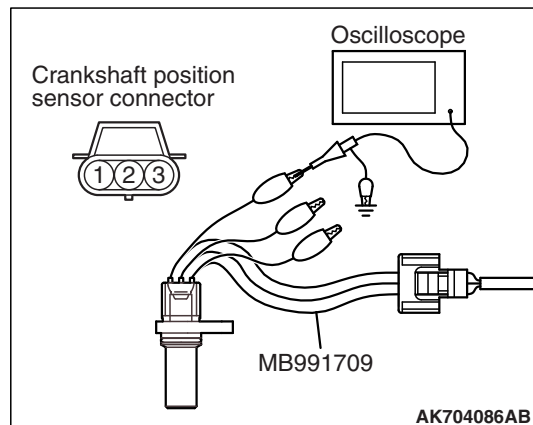
DIAGNOSIS

Required Special Tools

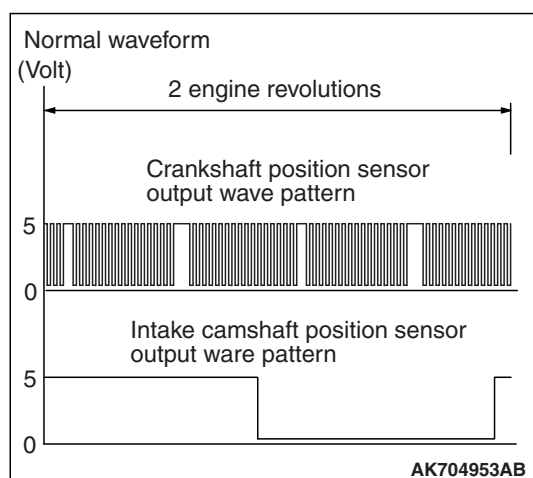
- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- MB991709: Test Harness
- MB992110: Power Plant ECU Check Harness

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-105 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-106, 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-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 4.

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

STEP 3. Check timing mark on the timing chain.

Q: Is timing chain in out of place?

YES : Repair it. 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 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-12](#).
- (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)

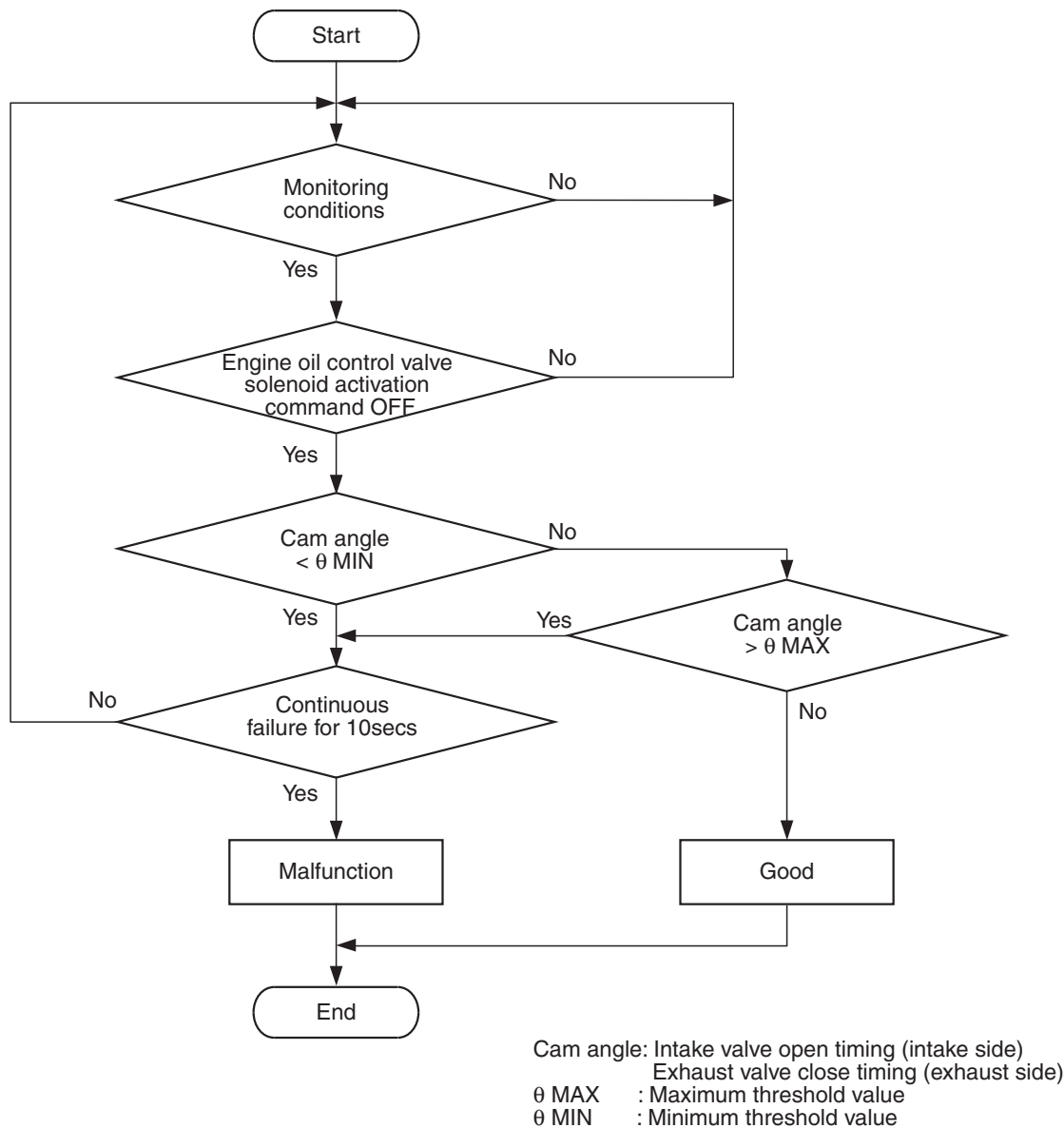
- Not applicable

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



AK900350

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) <Except for California> or -4.7 degrees (ATDC) <California> for 10 seconds.
- or
- The close timing of the exhaust valve is slower than 5.4 degrees (ATDC) <Except for California> or 8.4 degrees (ATDC) <California> for 10 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 20 [P.13A-12](#).

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

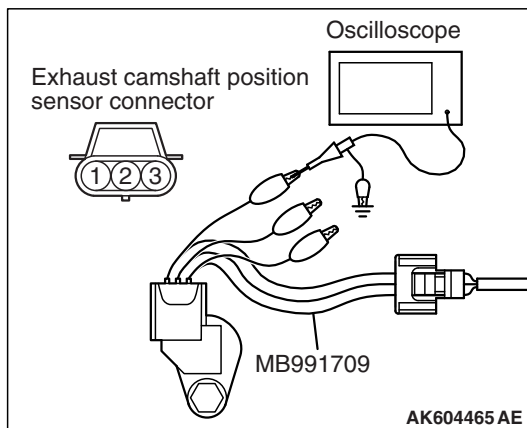
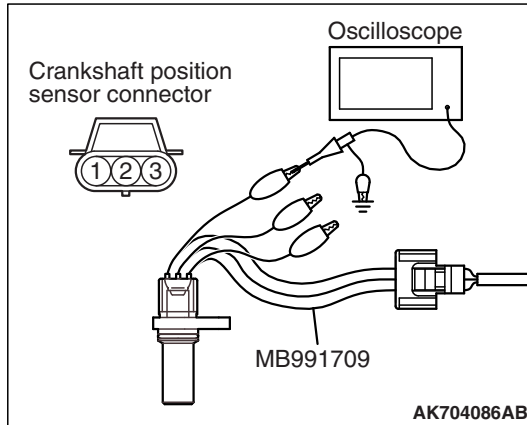
- Timing chain in out of place.
- Loose timing chain.
- Exhaust variable valve timing sprocket tooth coming off.
- ECM failed.

DIAGNOSIS**Required Special Tools**

- MB991958: Scan tool (M.U.T.-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991910: Main Harness A
- 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-105 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-107, 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.

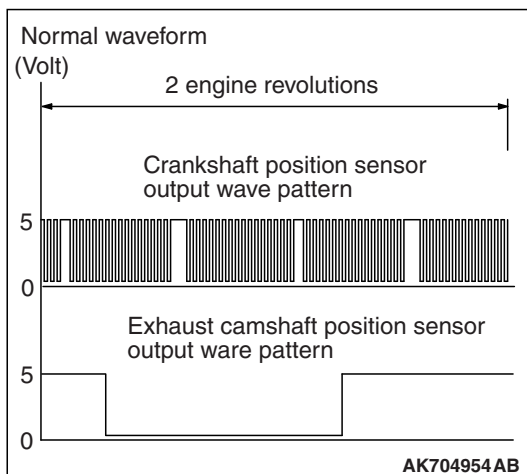
- The waveform should show a pattern similar to the illustration.

- (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.



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-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 4.

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

STEP 3. Check timing mark on the timing chain.**Q: Is timing chain in out of place?**

YES : Repair it. 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 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-12](#).
- (2) Check the diagnostic trouble code (DTC).

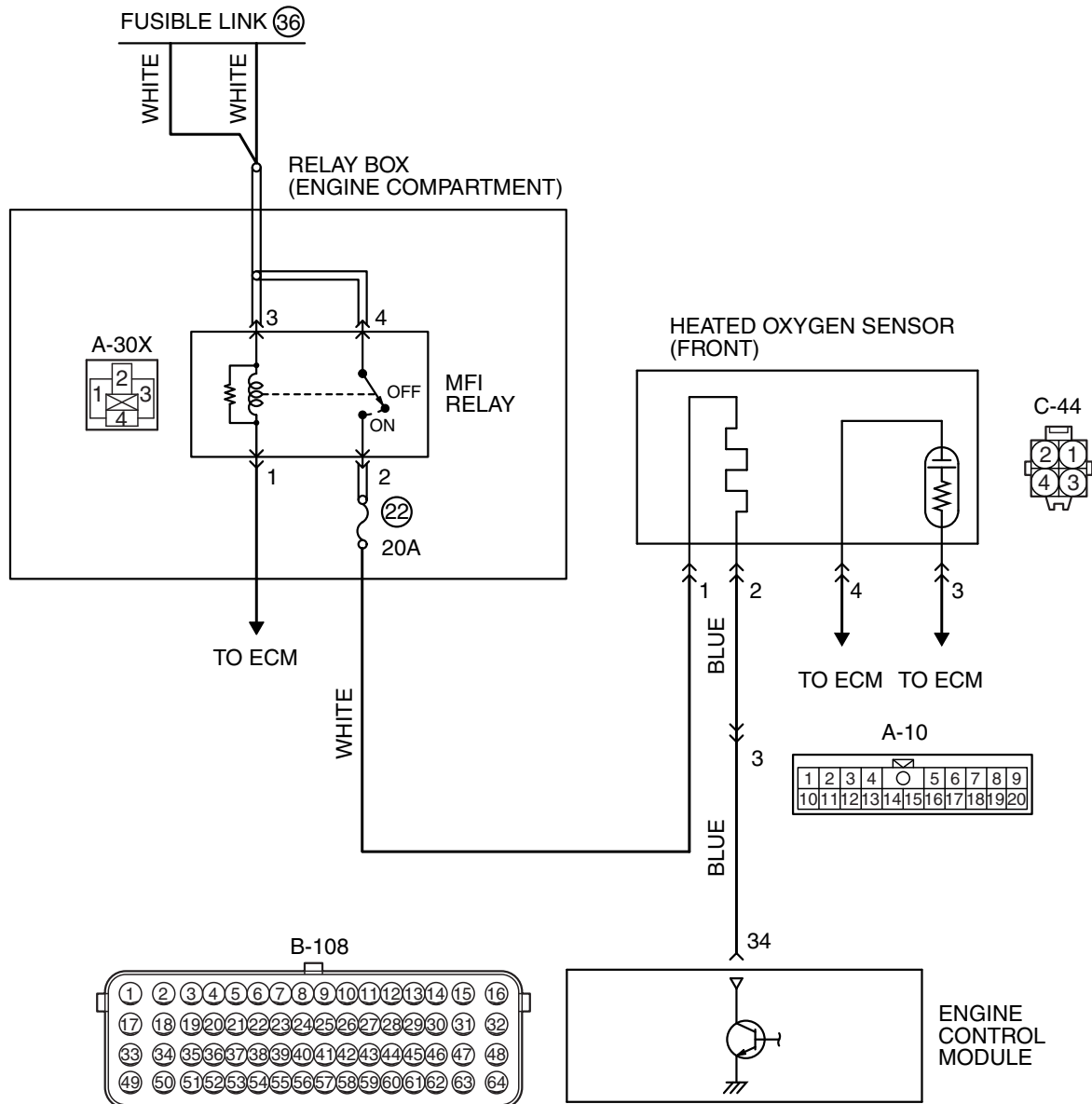
Q: Is DTC P0017 set?

YES : Retry the troubleshooting.

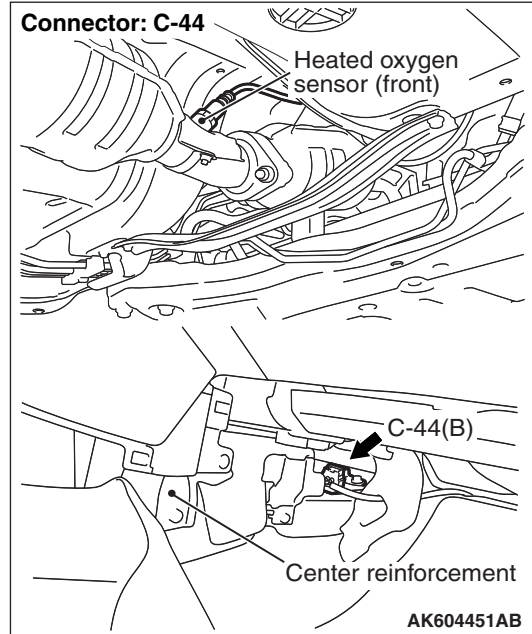
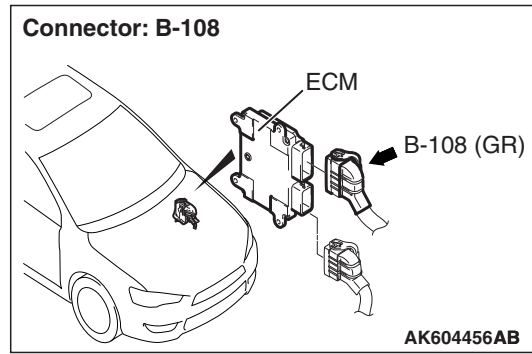
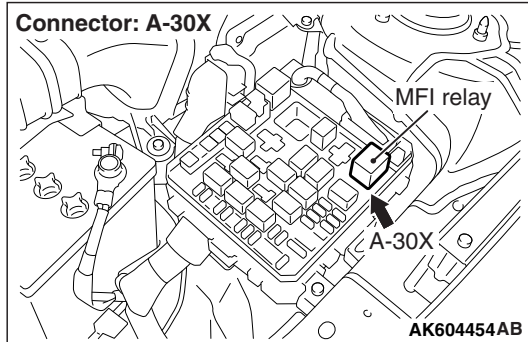
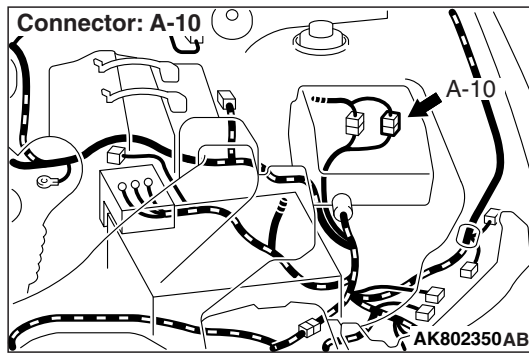
NO : The inspection is complete.

DTC P0031: Heated Oxygen Sensor (front) Heater Control Circuit Low <Except for California>

HEATED OXYGEN SENSOR (FRONT) HEATER CIRCUIT <EXCEPT FOR CALIFORNIA>



AK604023AC



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the heated oxygen sensor (front) heater.
- The ECM (terminal No. 34) controls continuity to the heated oxygen sensor (front) 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 heater (front) current or voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

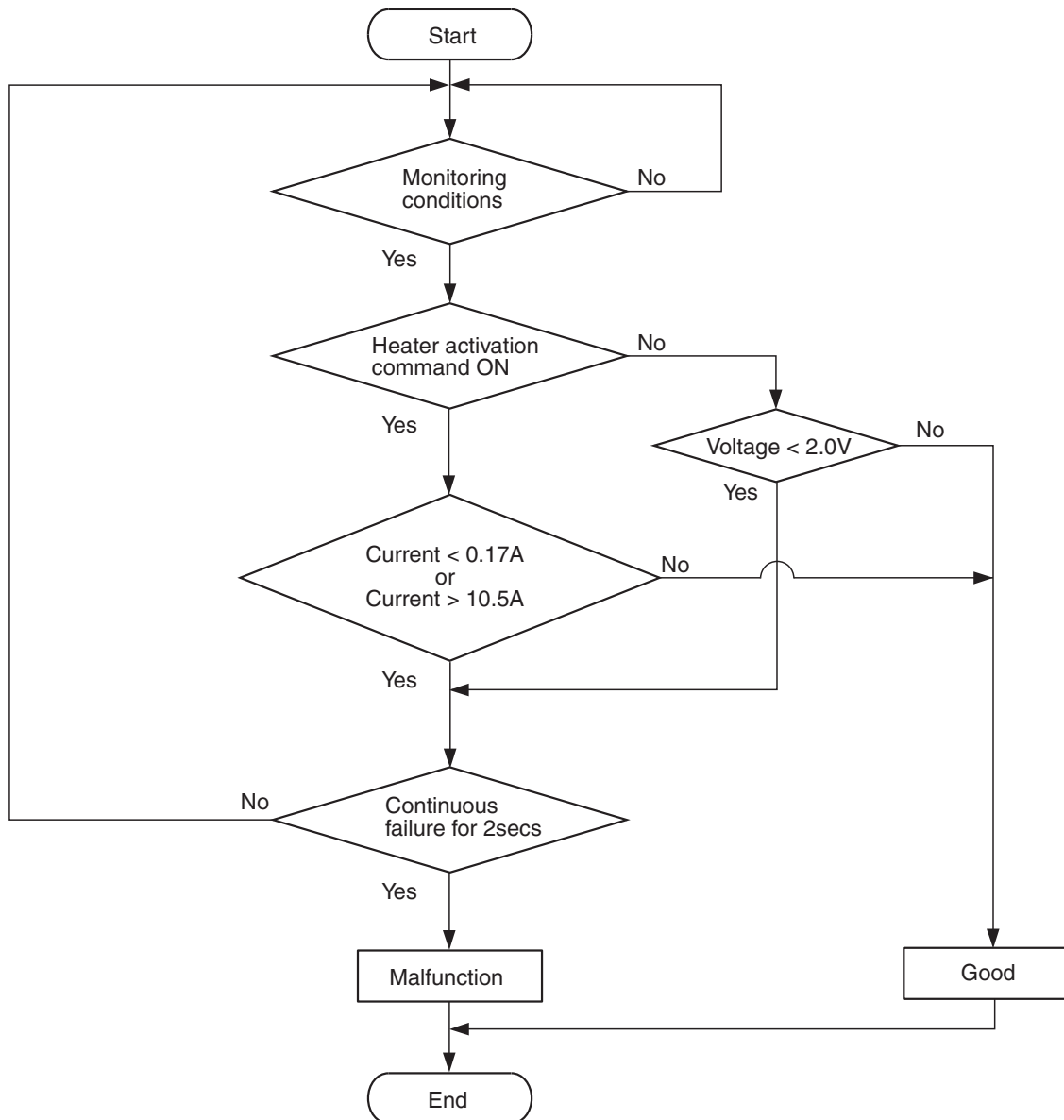
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

Check Conditions

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

Judgement Criterion

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

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tools:**

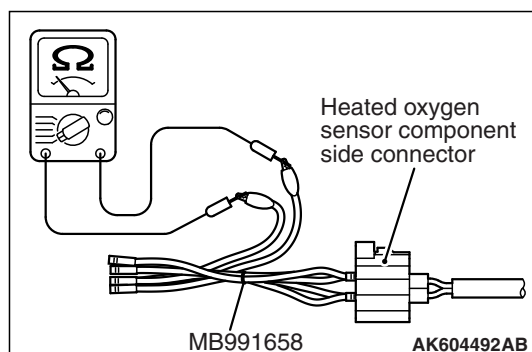
- MB991658: Test Harness
- MB992110: Power Plant ECU Check Harness

STEP 1. Check harness connector C-44 at the heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

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

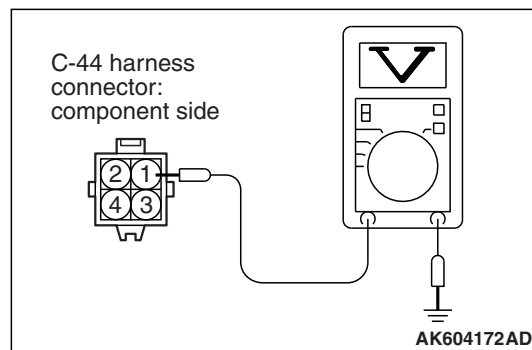
- (1) Disconnect heated oxygen sensor (front) connector C-44 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (front) side.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 and terminal No. 2.

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

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

YES : Go to Step 3.

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

**STEP 3. Measure the power supply voltage at heated oxygen sensor (front) harness side connector C-44.**

- (1) Disconnect the connector C-44 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check harness connector A-30X at the MFI relay for damage.

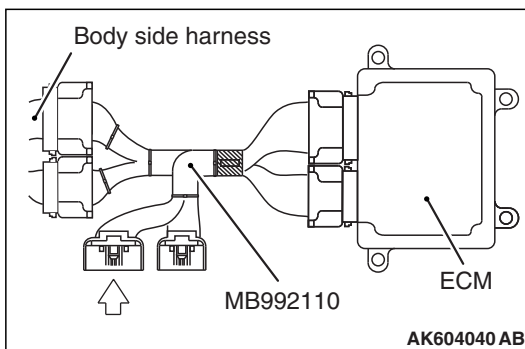
Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector A-30X (terminal No. 2) and heated oxygen sensor (front) connector C-44 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

STEP 5. Measure the power supply voltage at ECM connector B-108 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.

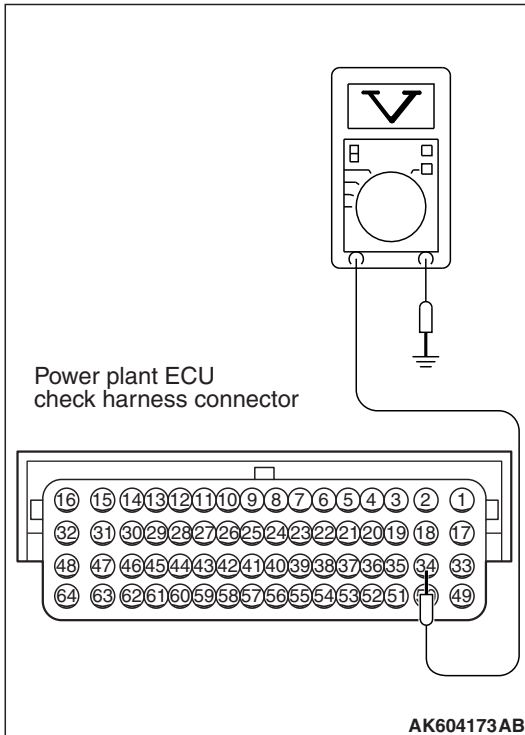


- (3) Measure the voltage between terminal No. 34 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

NO : Go to Step 6.



STEP 6. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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

STEP 7. Check for open circuit or short circuit to ground between heated oxygen sensor (front) connector C-44 (terminal No. 2) and ECM connector B-108 (terminal No. 34).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Replace the 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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.

STEP 8. Check harness connector B-108 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. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and heated oxygen sensor (front) connector C-44 (terminal No. 1).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between heated oxygen sensor (front) connector C-44 (terminal No. 2) and ECM connector B-108 (terminal No. 34).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

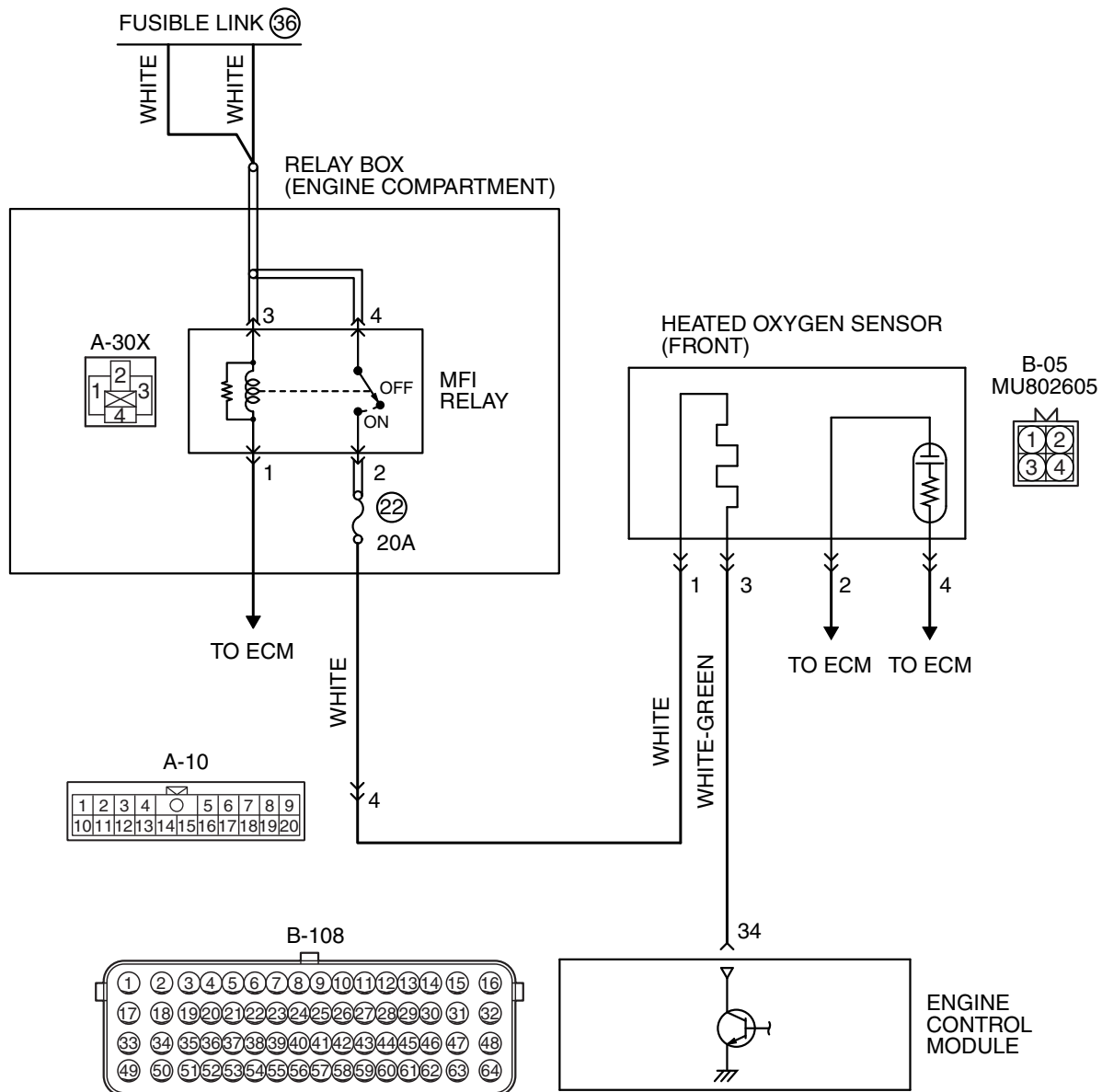
Q: Is DTC P0031 set?

YES : Retry the troubleshooting.

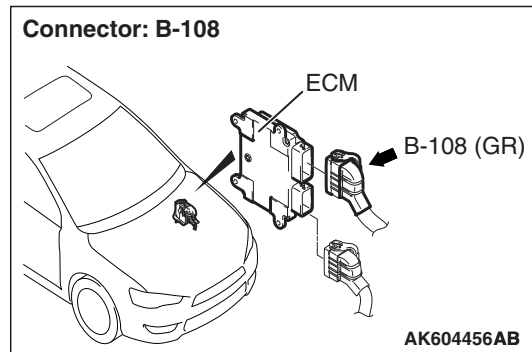
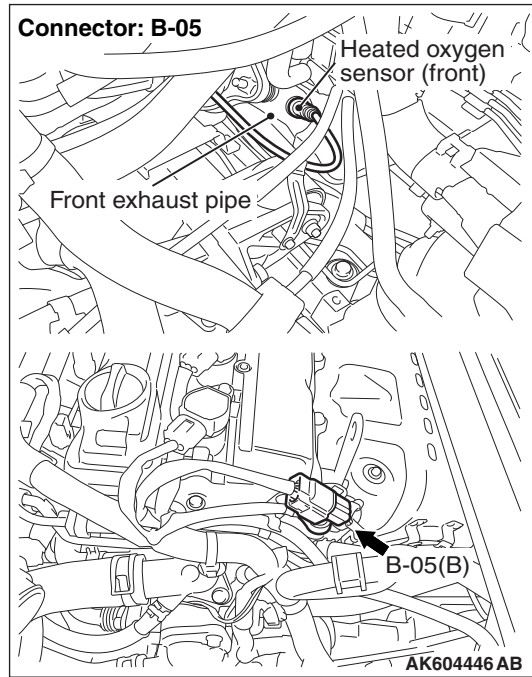
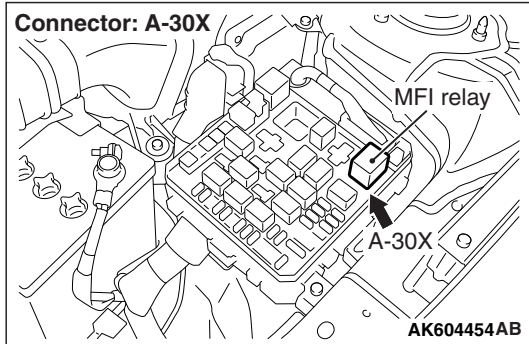
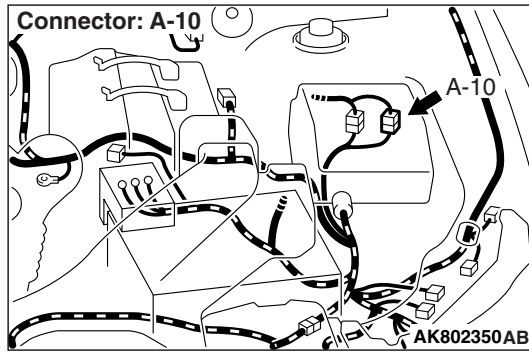
NO : The inspection is complete.

DTC P0031: Heated Oxygen Sensor (front) Heater Control Circuit Low <California>

HEATED OXYGEN SENSOR (FRONT) HEATER CIRCUIT <CALIFORNIA>



AK704941 AC



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the heated oxygen sensor (front) heater.
- The ECM (terminal No. 34) controls continuity to the heated oxygen sensor (front) 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 heater (front) current or voltage is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

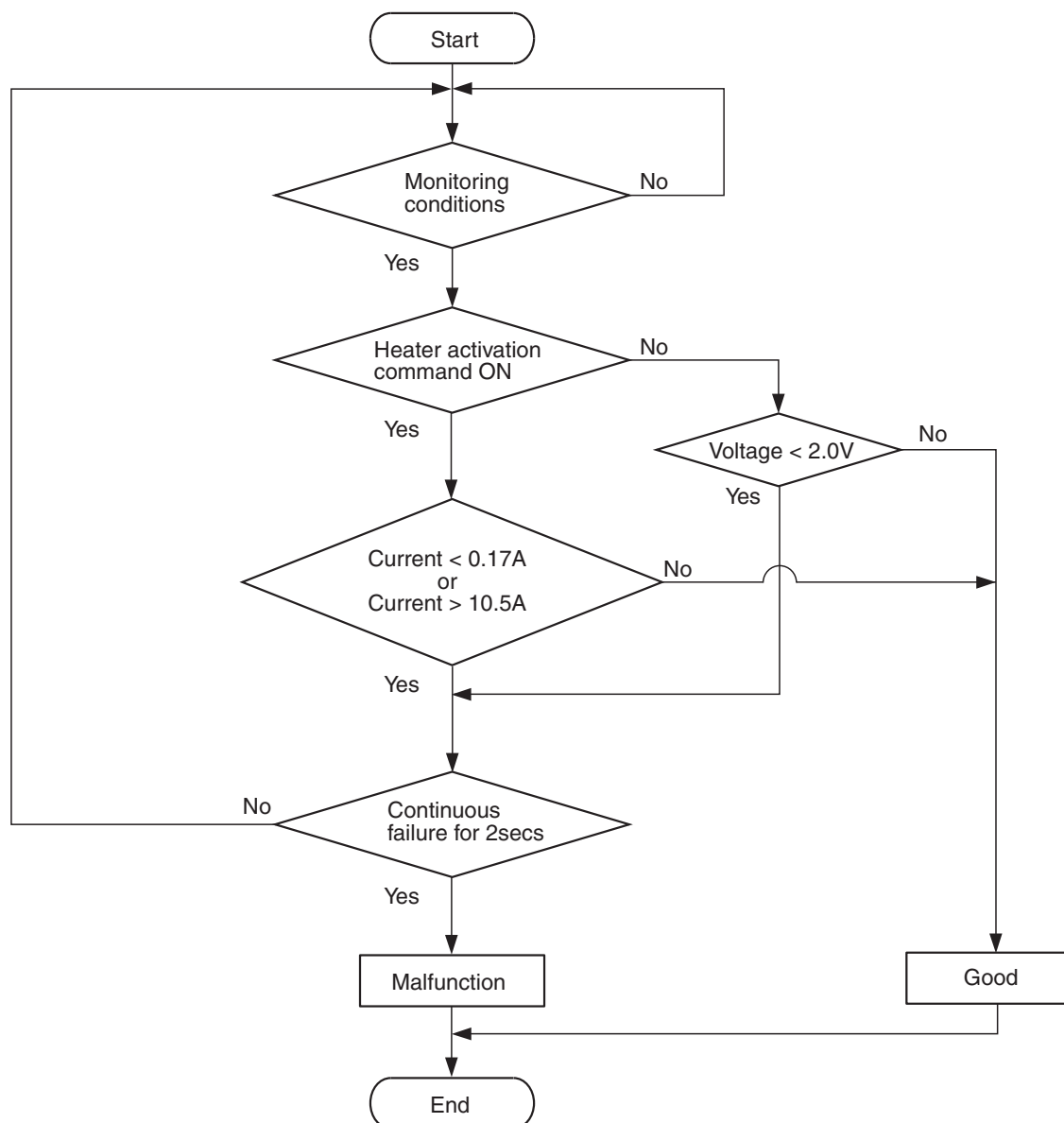
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

Check Conditions

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

Judgement Criterion

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

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

- MD998464: Test Harness
- MB992110: Power Plant ECU Check Harness

STEP 1. Check harness connector B-05 at the heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

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

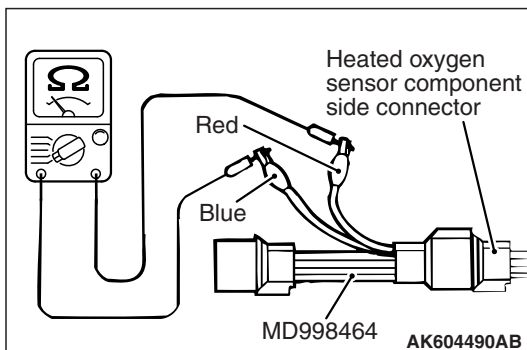
- (1) Disconnect heated oxygen sensor (front) connector B-05 and connect test harness special tool, MD998464, to the connector on the heated oxygen sensor (front) side.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

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

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

YES : Go to Step 3.

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



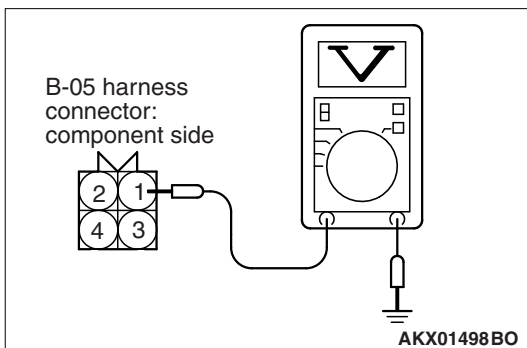
STEP 3. Measure the power supply voltage at heated oxygen sensor (front) harness side connector B-05.

- (1) Disconnect the connector B-05 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 5.

NO : Go to Step 4.



STEP 4. Check harness connector A-30X at the MFI relay for damage.

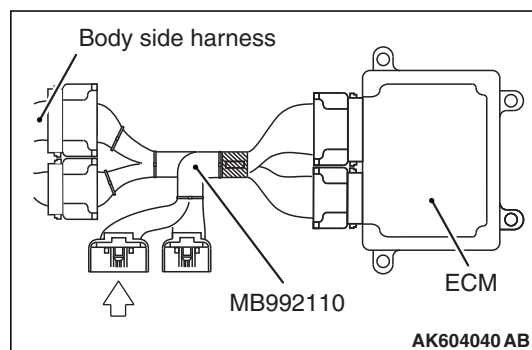
Q: Is the harness connector in good condition?

YES : Check harness connector A-10 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-30X (terminal No. 2) and heated oxygen sensor (front) connector B-05 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

STEP 5. Measure the power supply voltage at ECM connector B-108 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.

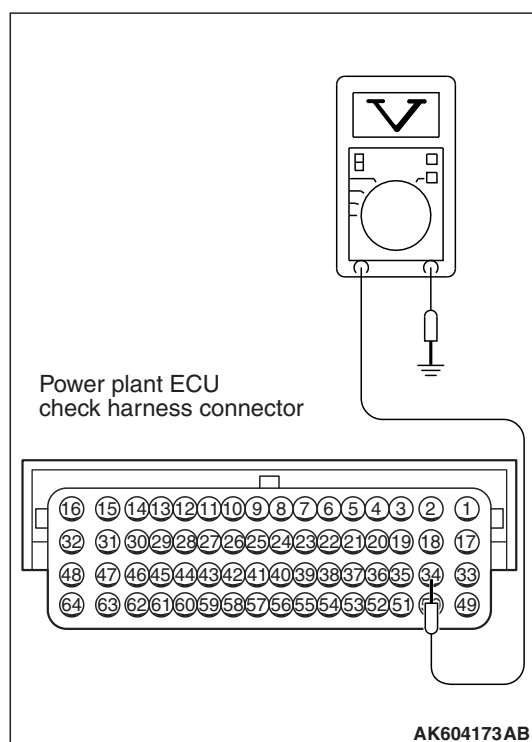


- (3) Measure the voltage between terminal No. 34 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

NO : Go to Step 6.



STEP 6. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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

STEP 7. Check for open circuit or short circuit to ground between heated oxygen sensor (front) connector B-05 (terminal No. 3) and ECM connector B-108 (terminal No. 34).

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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.

STEP 8. Check harness connector B-108 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. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and heated oxygen sensor (front) connector B-05 (terminal No. 1).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between heated oxygen sensor (front) connector B-05 (terminal No. 3) and ECM connector B-108 (terminal No. 34).

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

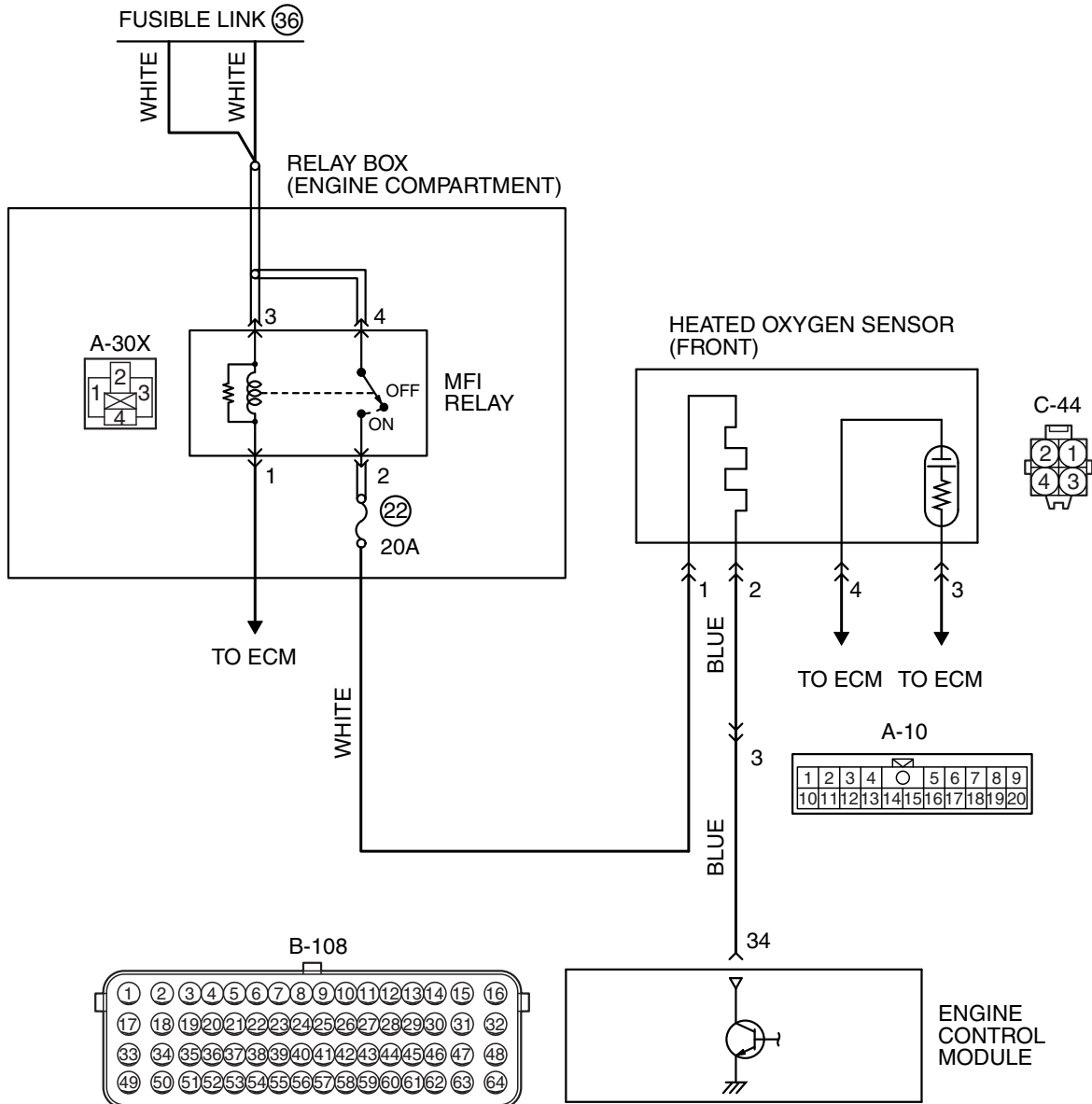
Q: Is DTC P0031 set?

YES : Retry the troubleshooting.

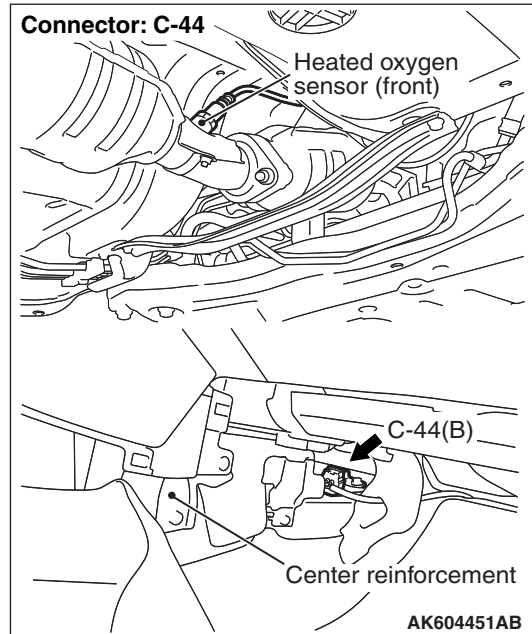
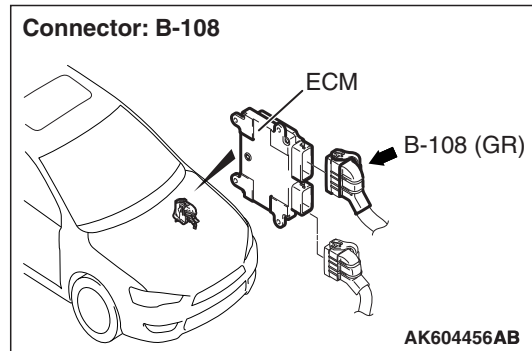
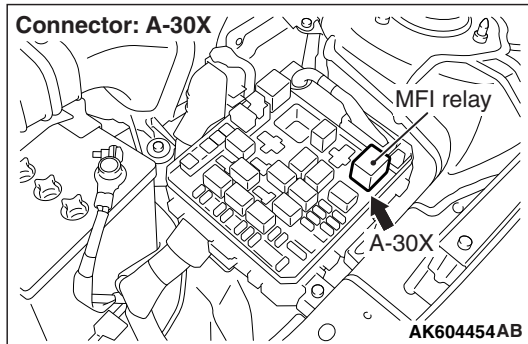
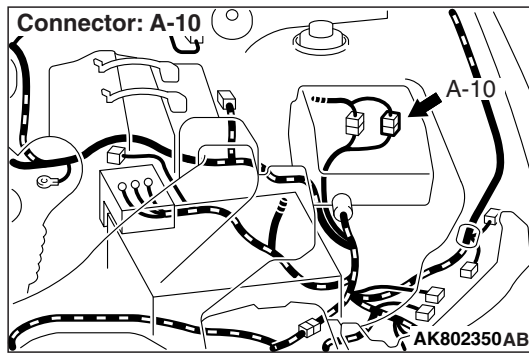
NO : The inspection is complete.

DTC P0032: Heated Oxygen Sensor (front) Heater Control Circuit High <Except for California>

HEATED OXYGEN SENSOR (FRONT) HEATER CIRCUIT <EXCEPT FOR CALIFORNIA>



AK604023AC



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the heated oxygen sensor (front) heater.
- The ECM (terminal No. 34) controls continuity to the heated oxygen sensor (front) 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 (front) current is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

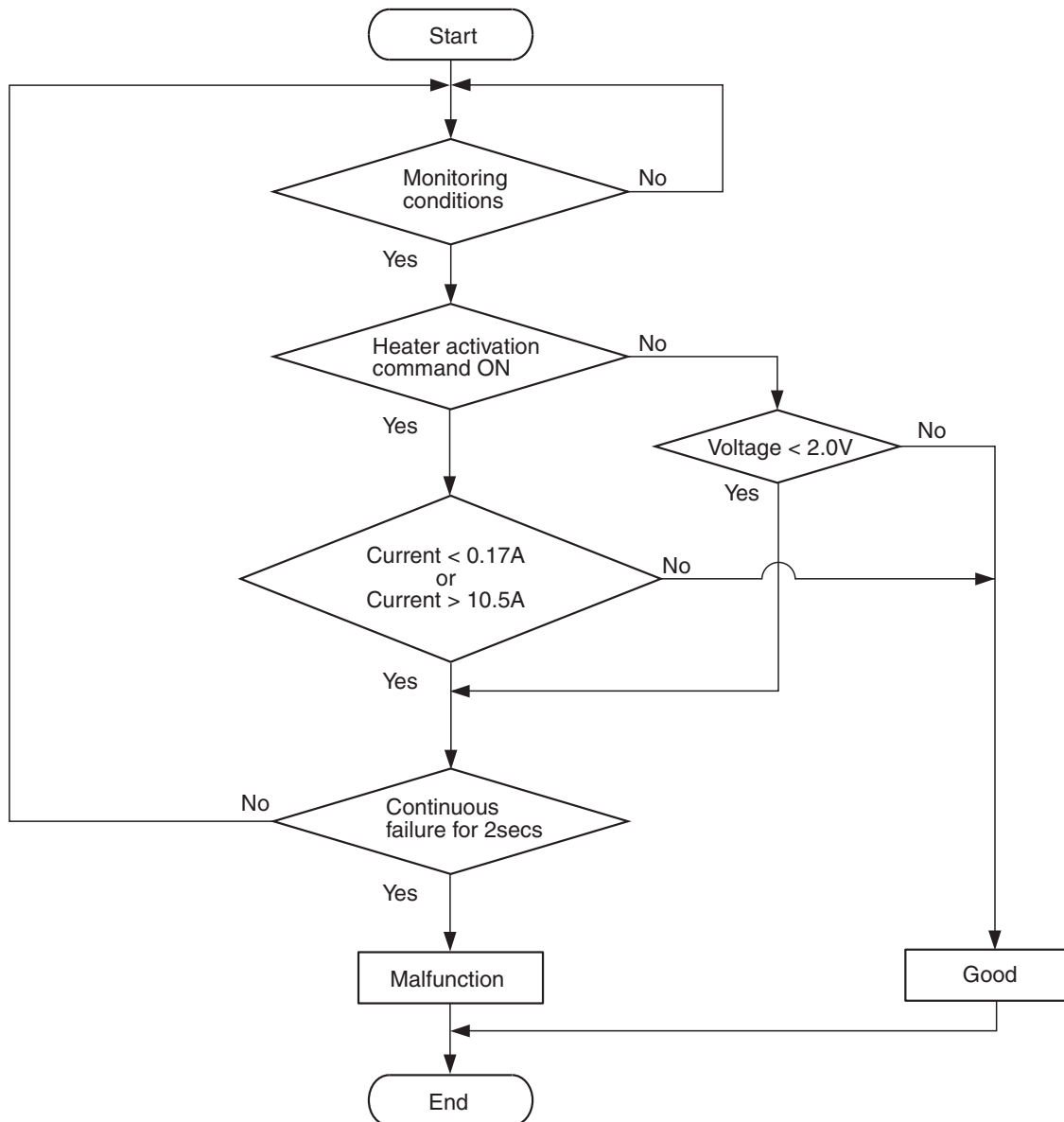
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).

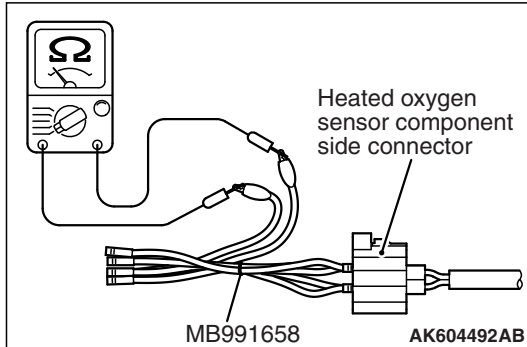
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (front) heater failed.
- ECM failed.

DIAGNOSIS

Required Special Tool:

- MB991658: Test Harness



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

- (1) Disconnect heated oxygen sensor (front) connector C-44 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (front) side.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 and terminal No. 2.

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

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

YES : Go to Step 2.

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

STEP 2. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

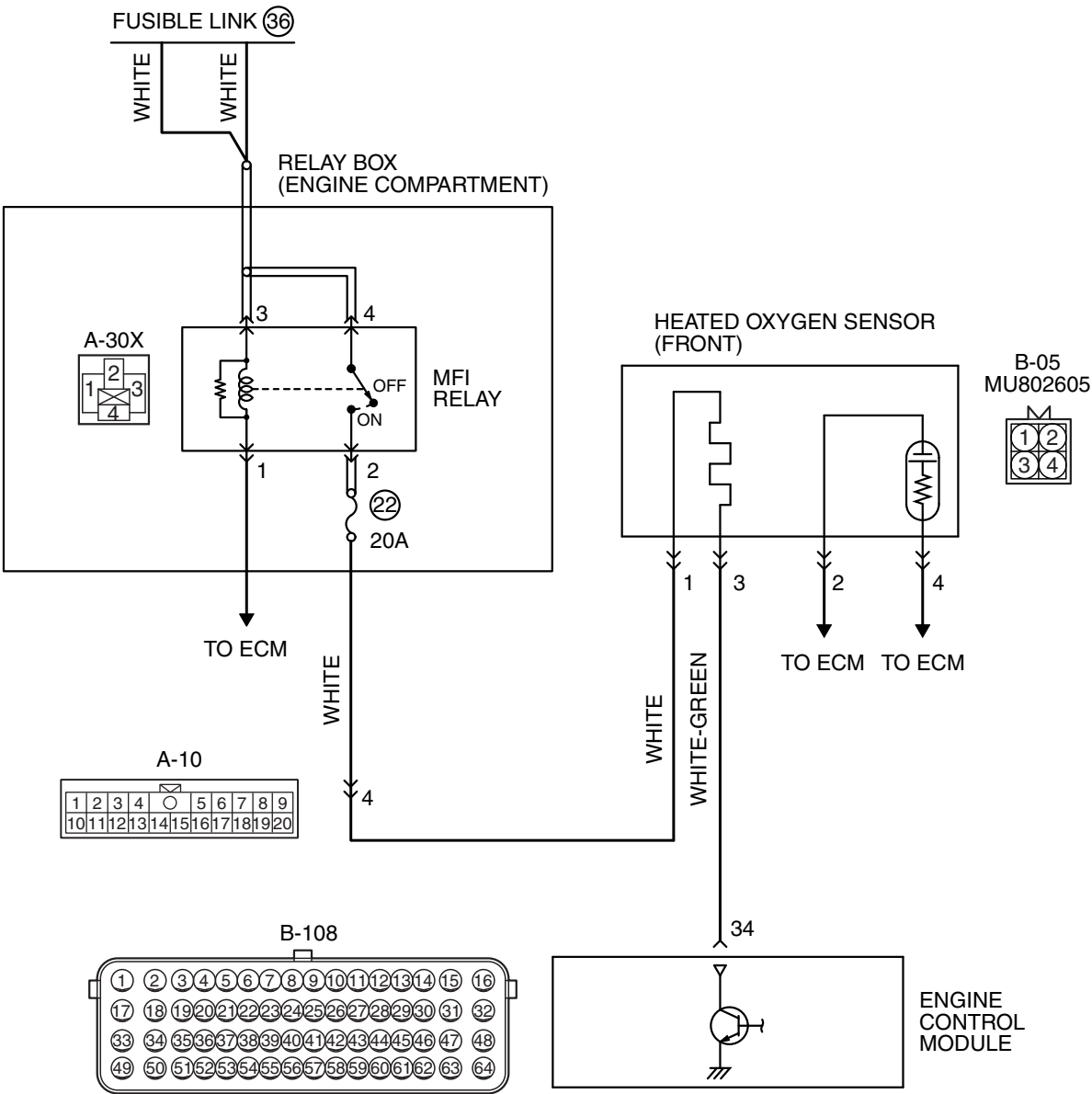
Q: Is DTC P0032 set?

YES : Retry the troubleshooting.

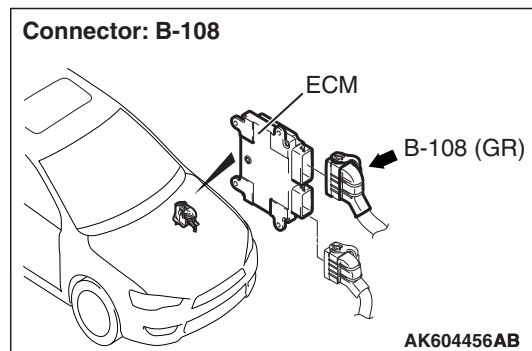
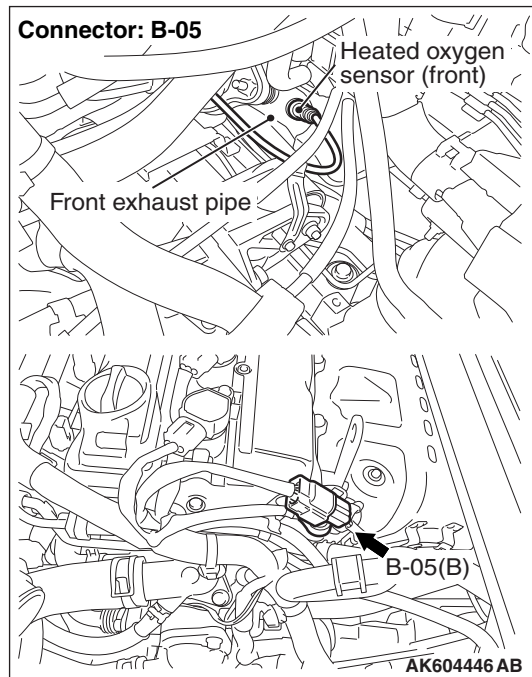
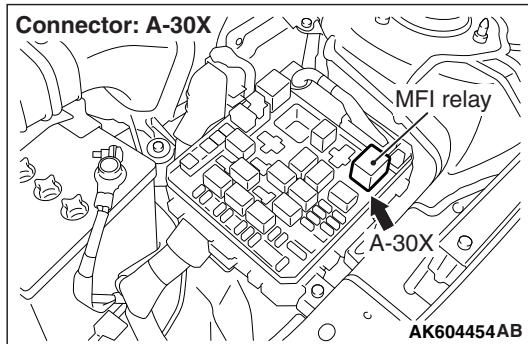
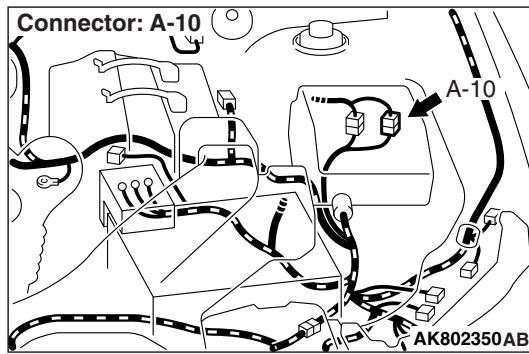
NO : The inspection is complete.

DTC P0032: Heated Oxygen Sensor (front) Heater Control Circuit High <California>

HEATED OXYGEN SENSOR (FRONT) HEATER CIRCUIT <CALIFORNIA>



AK704941 AC



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the heated oxygen sensor (front) heater.
- The ECM (terminal No. 34) controls continuity to the heated oxygen sensor (front) 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 (front) current is out of specified range.

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

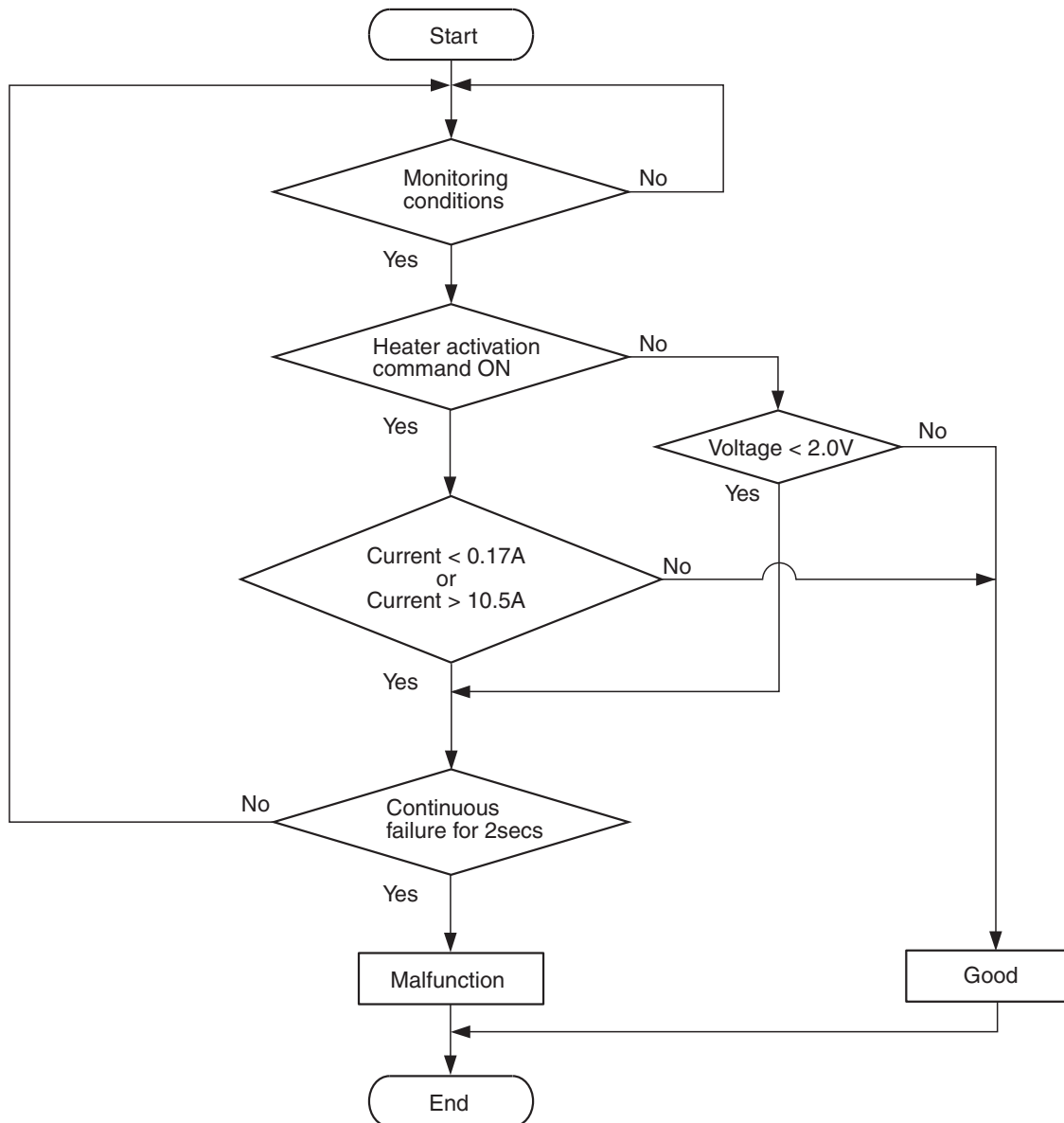
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

Check Conditions

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

Judgement Criterion

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

OBD-II DRIVE CYCLE PATTERN

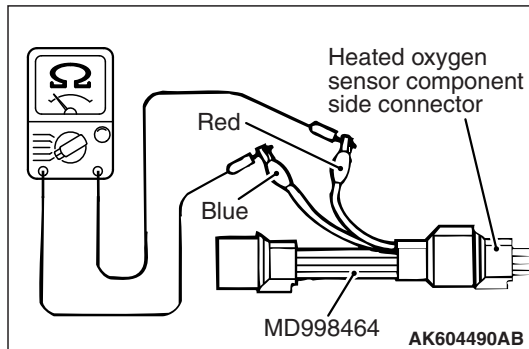
Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).

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

- Heated oxygen sensor (front) heater failed.
- ECM failed.

DIAGNOSIS**Required Special Tool:**

- MD998464: Test Harness

**STEP 1. Check the heated oxygen sensor (front).**

- (1) Disconnect heated oxygen sensor (front) connector B-05 and connect test harness special tool, MD998464, to the connector on the heated oxygen sensor (front) side.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

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

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

YES : Go to Step 2.

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

STEP 2. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

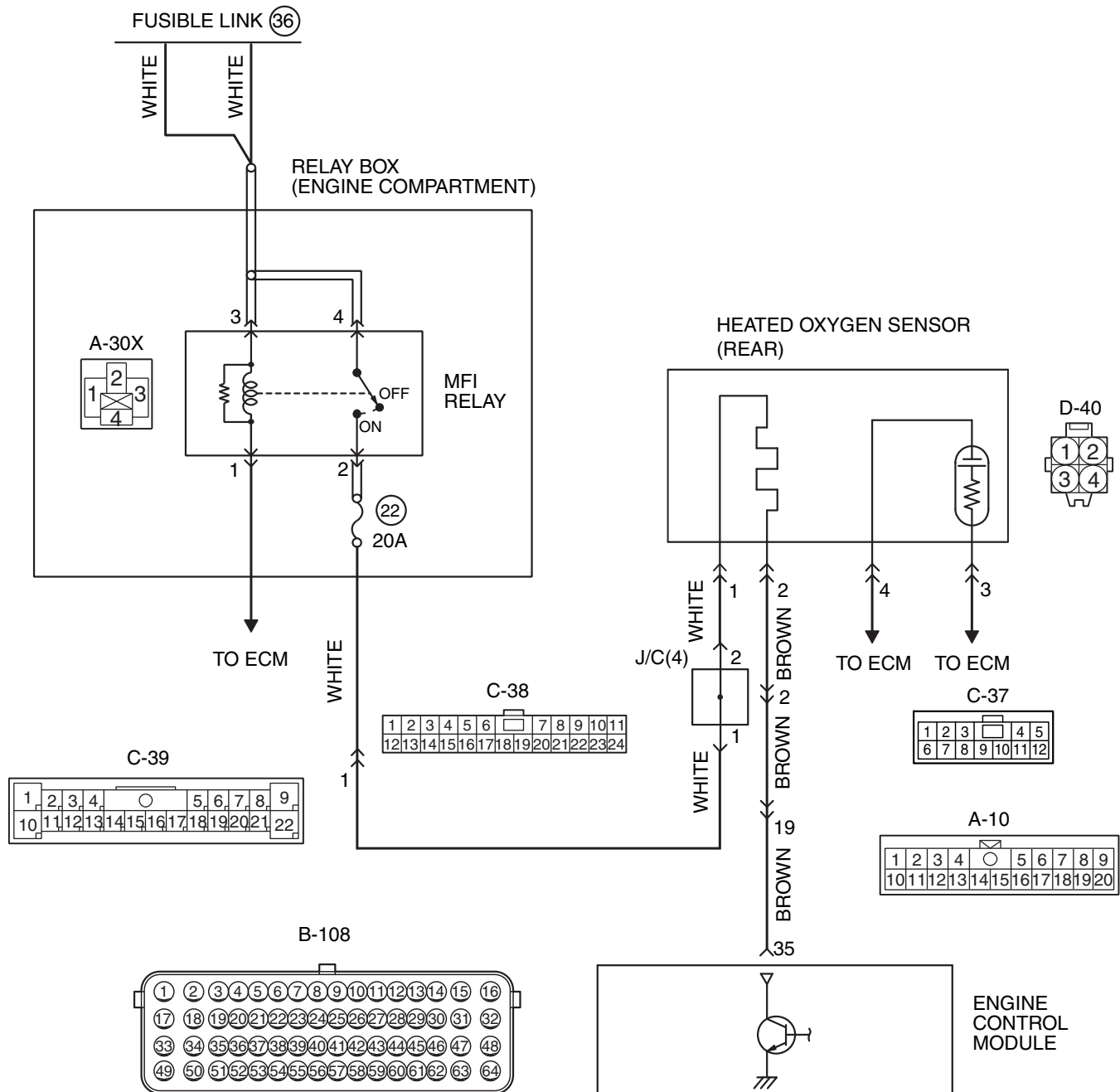
Q: Is DTC P0032 set?

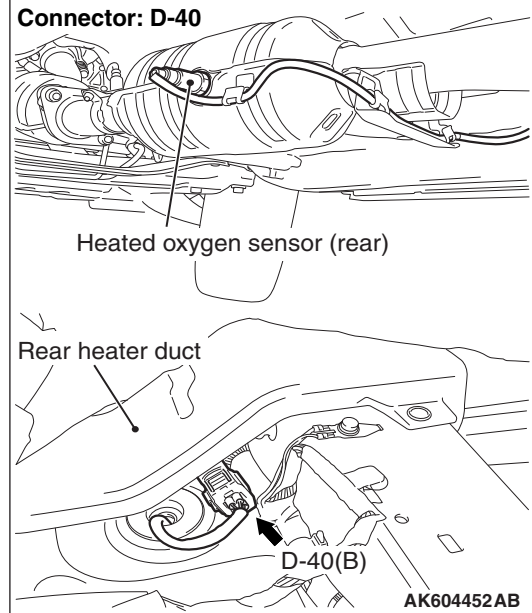
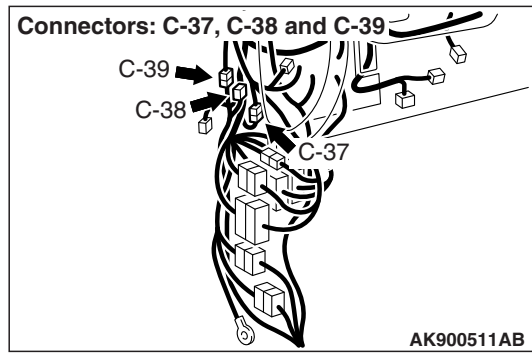
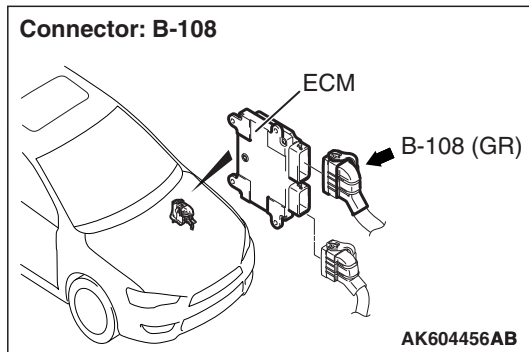
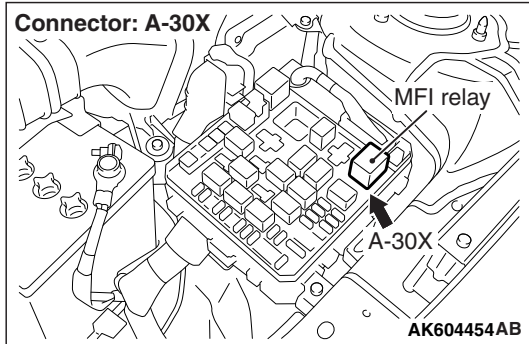
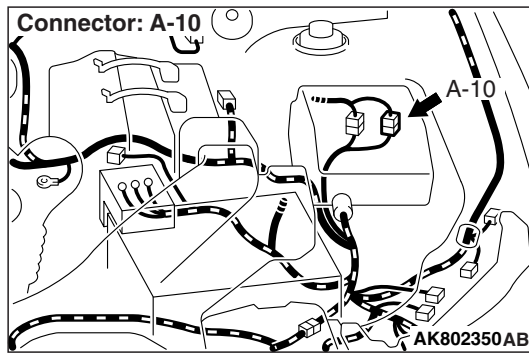
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0037: Heated Oxygen Sensor (rear) Heater Control Circuit Low <Except for California>

HEATED OXYGEN SENSOR (REAR) HEATER CIRCUIT <EXCEPT FOR CALIFORNIA>





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)

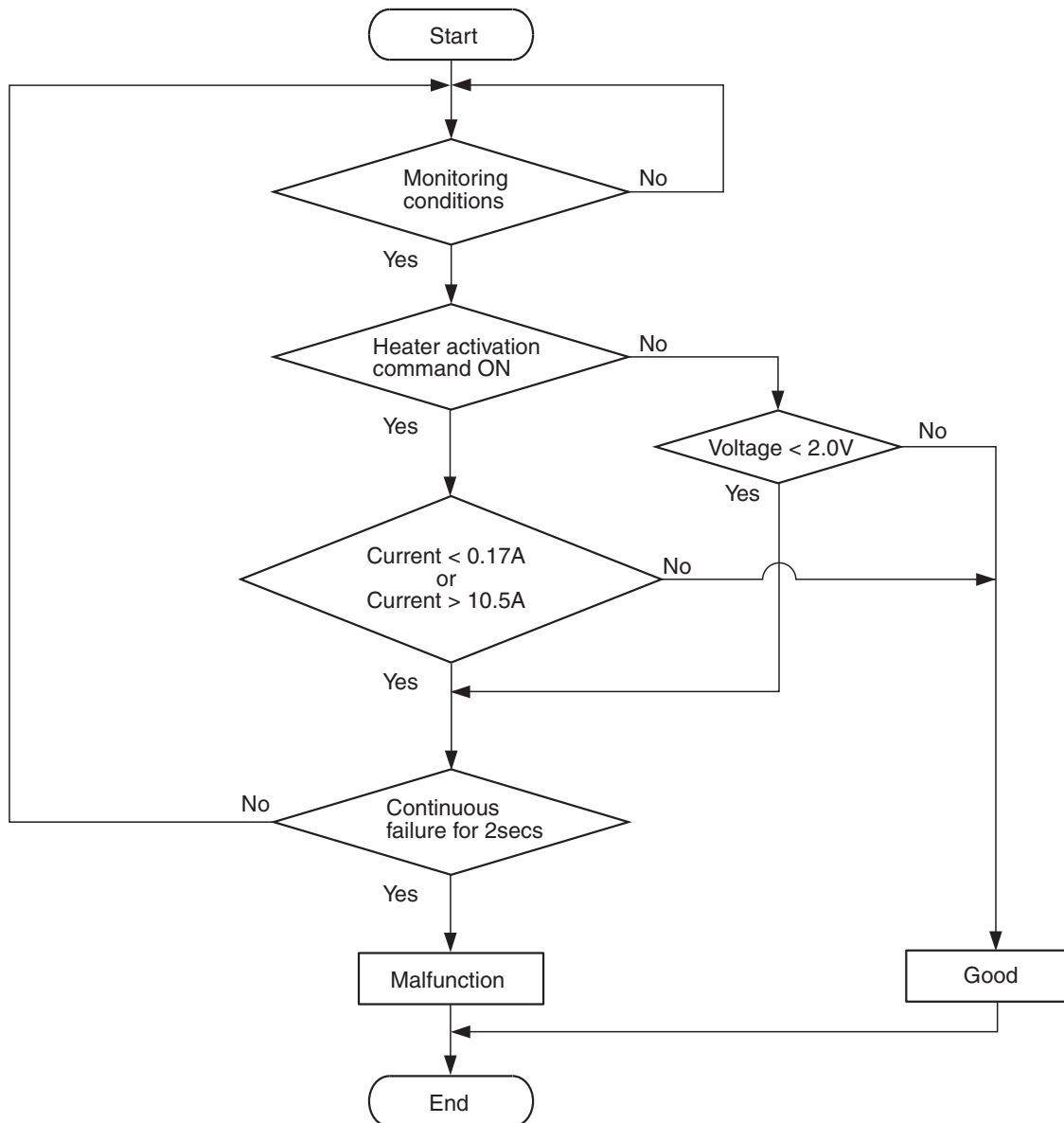
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

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.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tools:**

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

STEP 1. Check harness connector D-40 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 12.

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

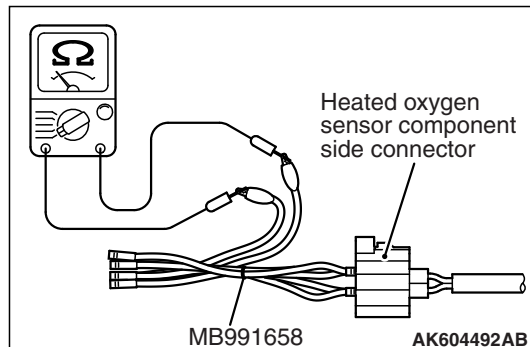
- (1) Disconnect heated oxygen sensor (rear) connector D-40 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (rear) side.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 and terminal No. 2.

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

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

YES : Go to Step 3.

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

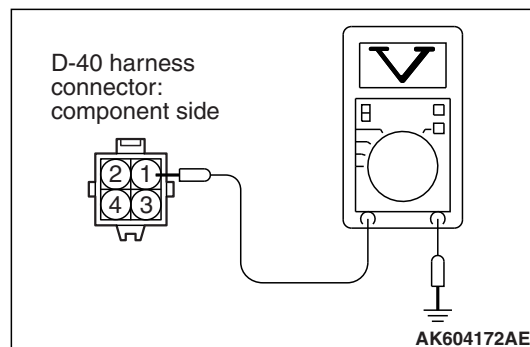
**STEP 3. Measure the power supply voltage at heated oxygen sensor (rear) harness side connector D-40.**

- (1) Disconnect the connector D-40 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 5.

NO : Go to Step 4.



STEP 4. Check harness connector A-30X at the MFI relay for damage.

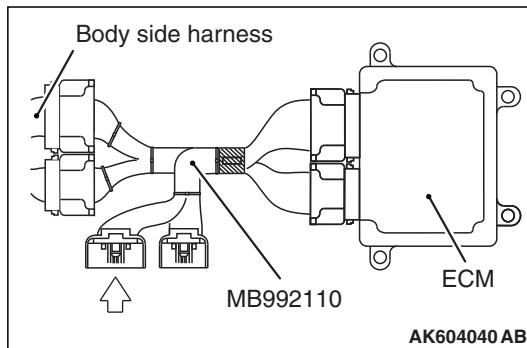
Q: Is the harness connector in good condition?

YES : Check harness connector C-38 and C-39 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-30X (terminal No. 2) and heated oxygen sensor (rear) connector D-40 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

STEP 5. Measure the power supply voltage at ECM connector B-108 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.

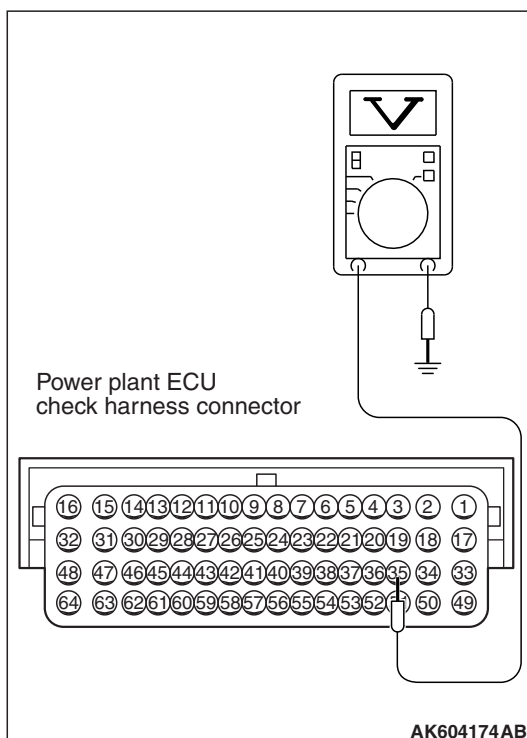


- (3) Measure the voltage between terminal No. 35 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

NO : Go to Step 6.



STEP 6. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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

STEP 7. Check for open circuit or short circuit to ground between heated oxygen sensor (rear) connector D-40 (terminal No. 2) and ECM connector B-108 (terminal No. 35).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Replace the 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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.

STEP 8. Check harness connector B-108 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. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and heated oxygen sensor (rear) connector D-40 (terminal No. 1).

NOTE: Check harness after checking intermediate connector C-38 and C-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between heated oxygen sensor (rear) connector D-40 (terminal No. 2) and ECM connector B-108 (terminal No. 35).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).

(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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).

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

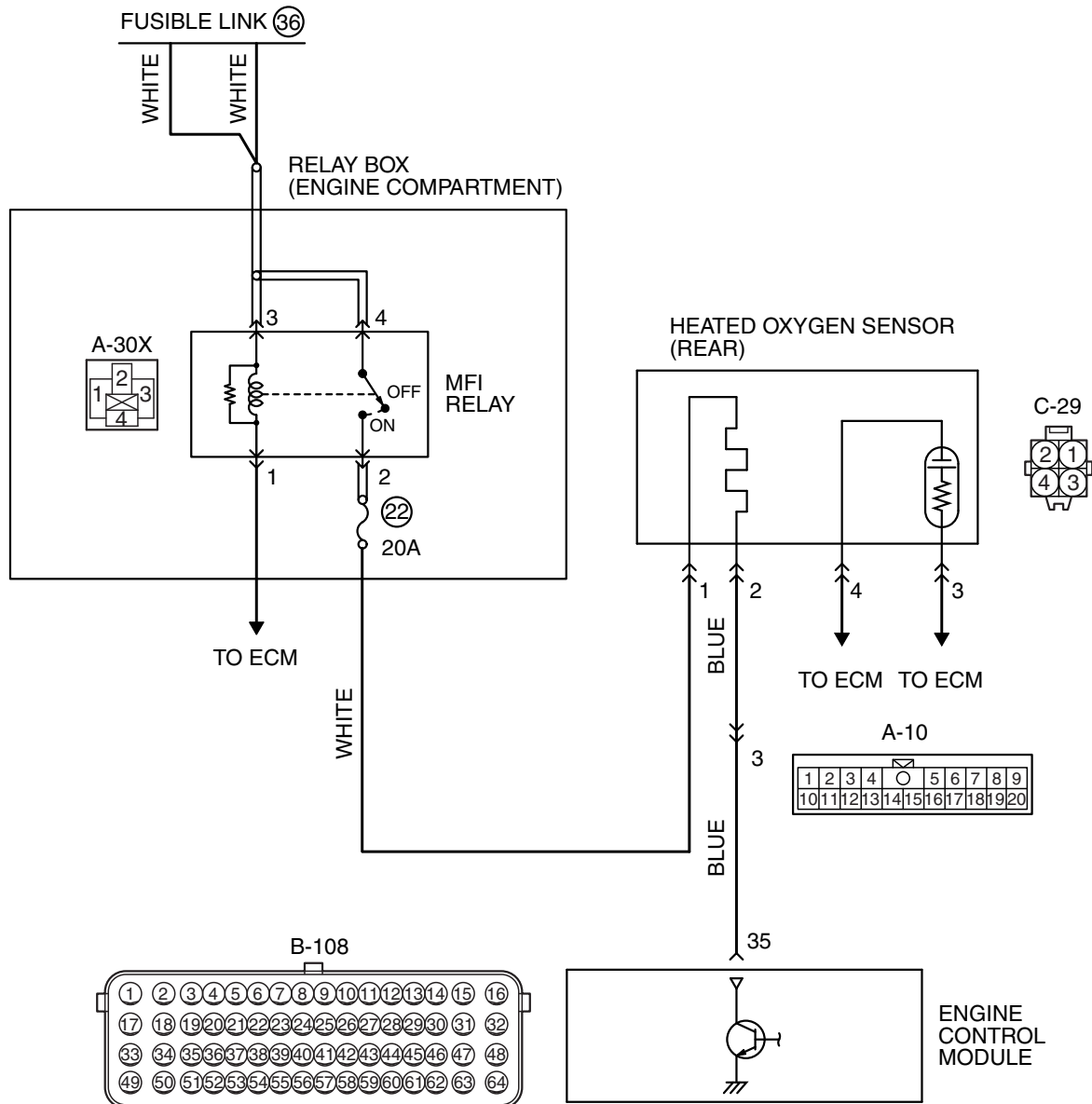
Q: Is DTC P0037 set?

YES : Retry the troubleshooting.

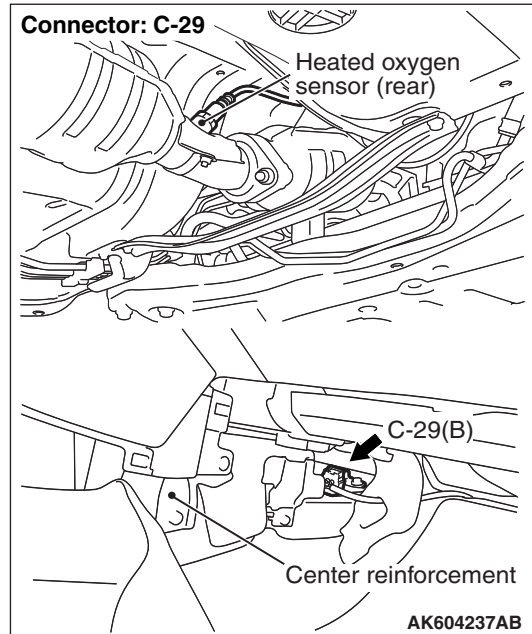
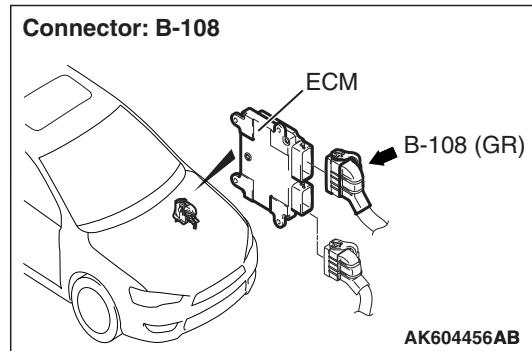
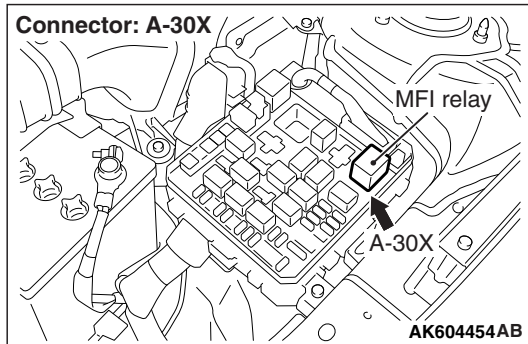
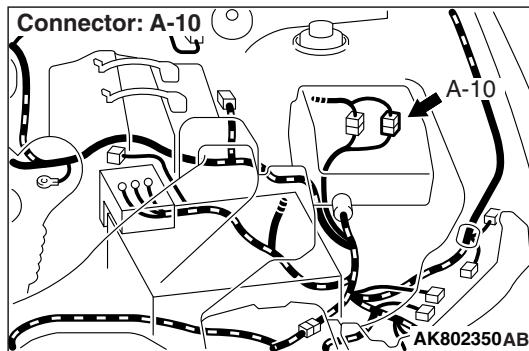
NO : The inspection is complete.

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

HEATED OXYGEN SENSOR (REAR) HEATER CIRCUIT <CALIFORNIA>



AK604023AG



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

MONITOR EXECUTION

Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

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

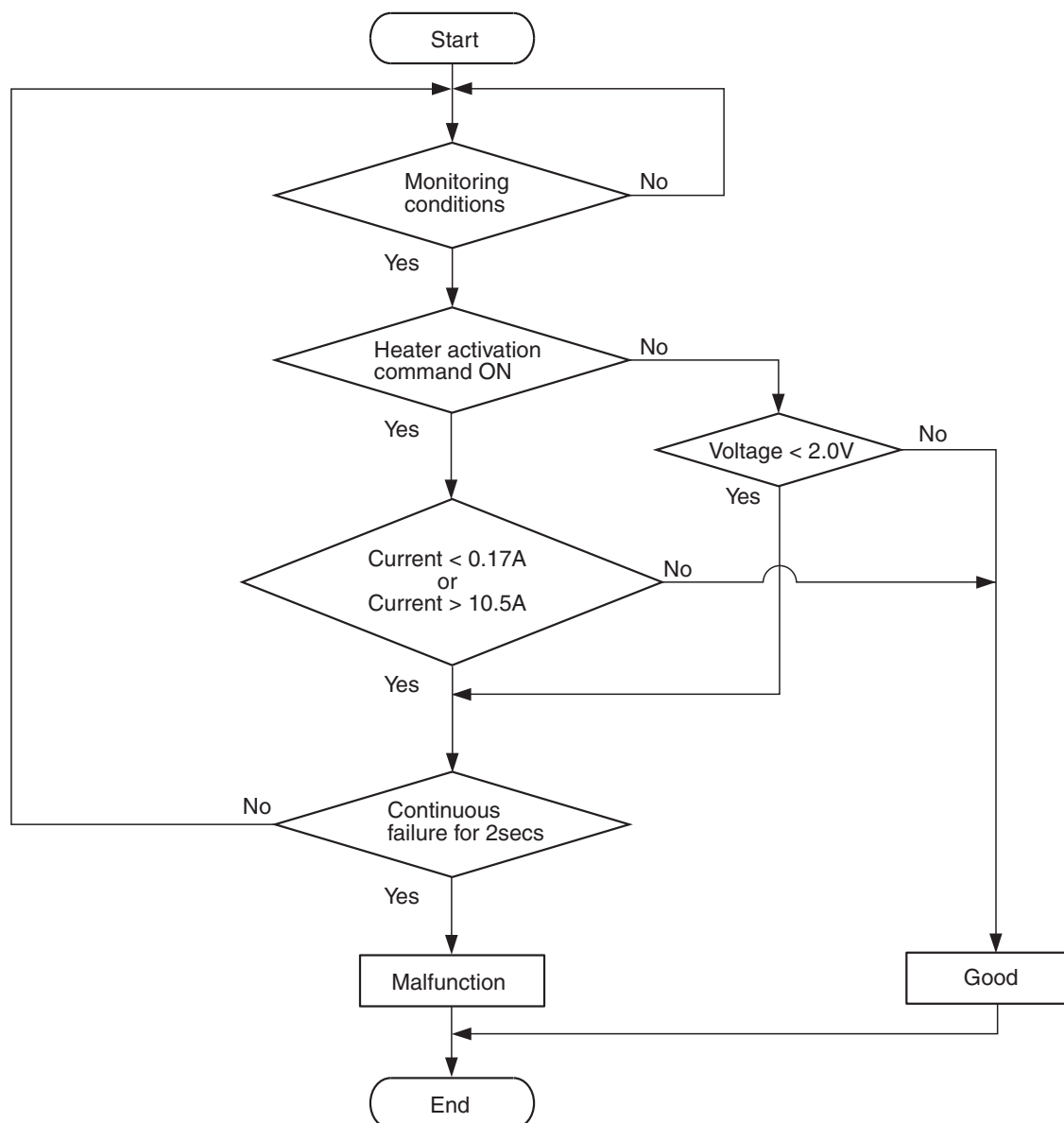
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

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.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13A-12](#).

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

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

DIAGNOSIS

Required Special Tools:

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

STEP 1. Check harness connector C-29 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 12.

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

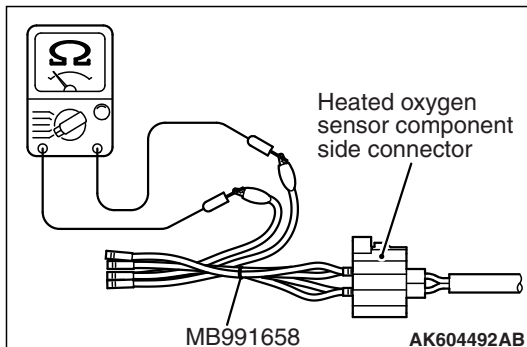
- (1) Disconnect heated oxygen sensor (rear) connector C-29 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (rear) side.
- (2) Measure the resistance between heated oxygen sensor (rear) connector terminal No. 1 and terminal No. 2.

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

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

YES : Go to Step 3.

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



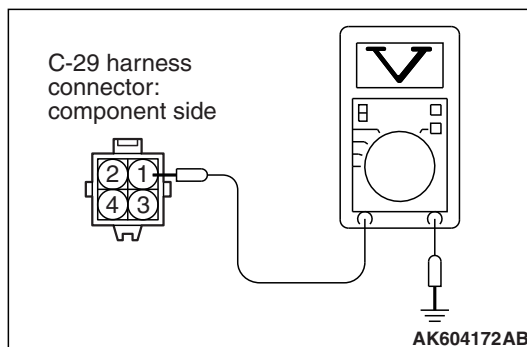
STEP 3. Measure the power supply voltage at heated oxygen sensor (rear) harness side connector C-29.

- (1) Disconnect the connector C-29 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 5.

NO : Go to Step 4.



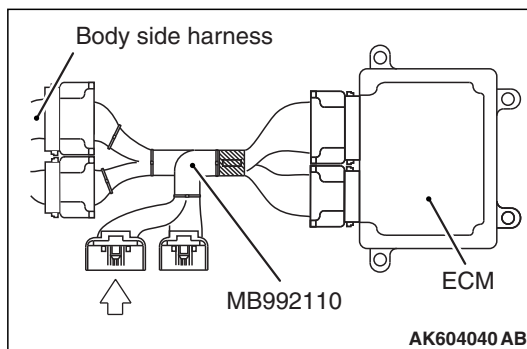
STEP 4. Check harness connector A-30X at the MFI relay for damage.**Q: Is the harness connector in good condition?**

YES : Repair harness wire between MFI relay connector A-30X (terminal No. 2) and heated oxygen sensor (rear) connector C-29 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

STEP 5. Measure the power supply voltage at ECM connector B-108 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.

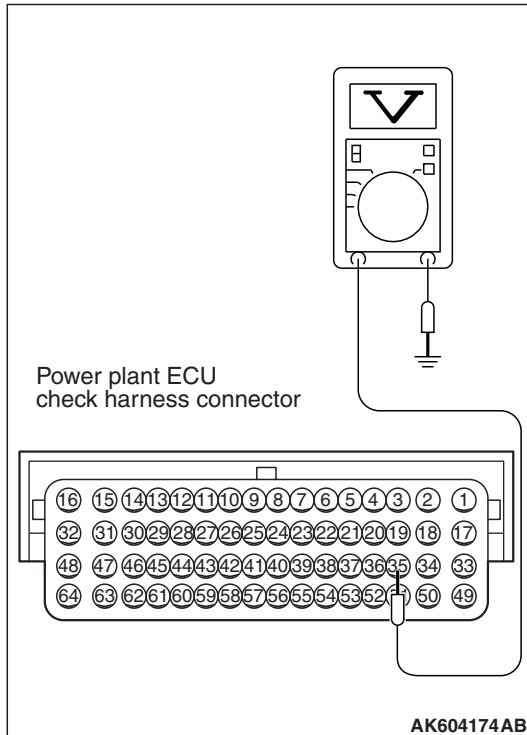


- (3) Measure the voltage between terminal No. 35 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

NO : Go to Step 6.



STEP 6. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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

STEP 7. Check for open circuit or short circuit to ground between heated oxygen sensor (rear) connector C-29 (terminal No. 2) and ECM connector B-108 (terminal No. 35).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Replace the 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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.

STEP 8. Check harness connector B-108 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. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and heated oxygen sensor (rear) connector C-29 (terminal No. 1).

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between heated oxygen sensor (rear) connector C-29 (terminal No. 2) and ECM connector B-108 (terminal No. 35).

NOTE: Check harness after checking intermediate connector A-10. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

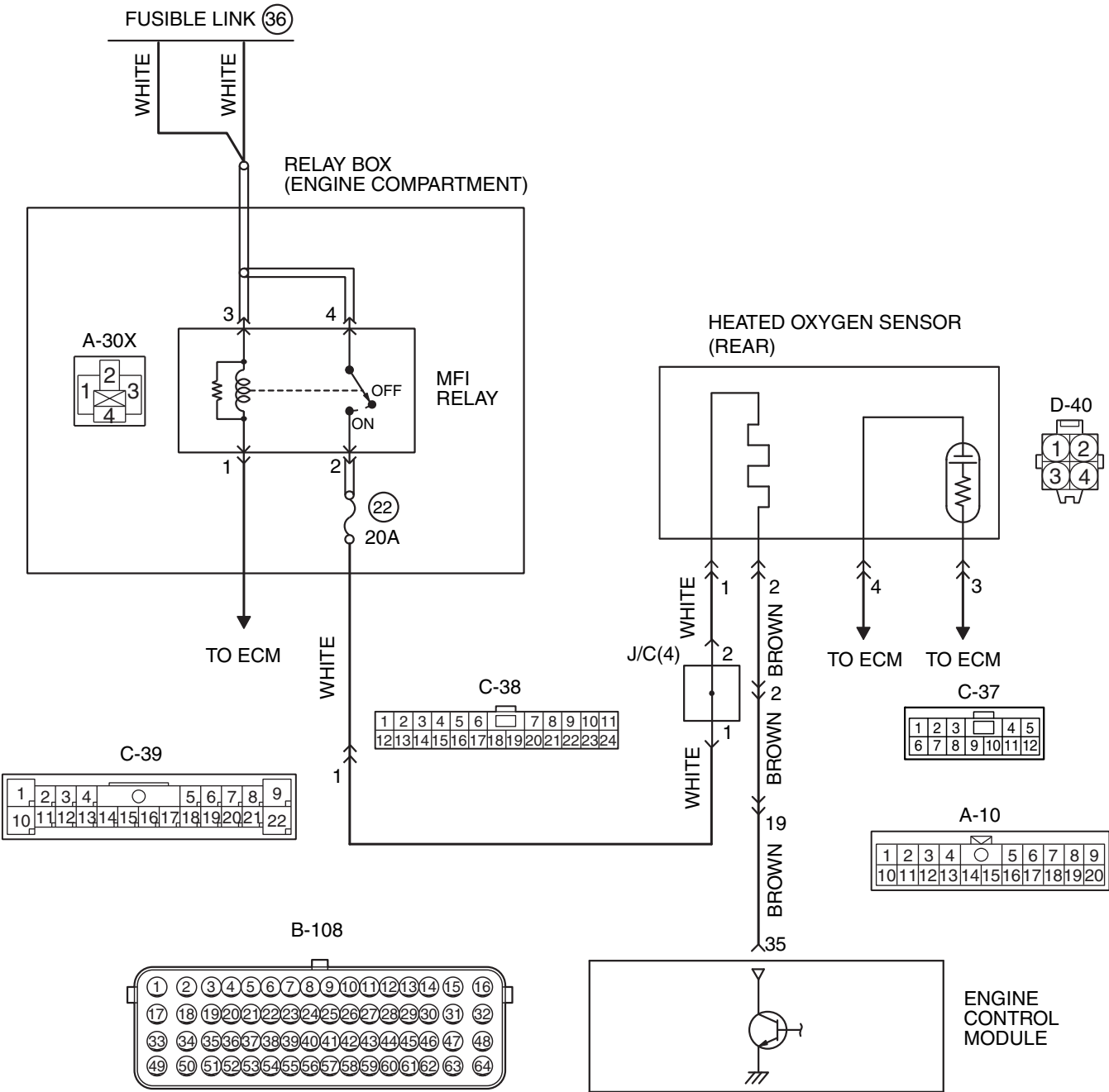
Q: Is DTC P0037 set?

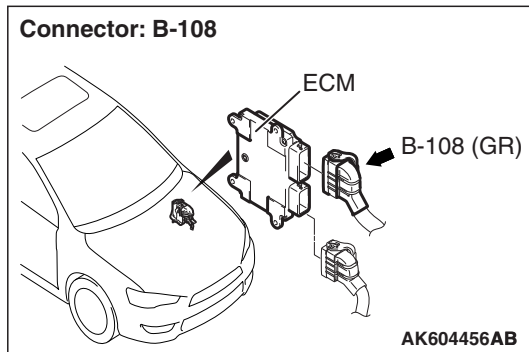
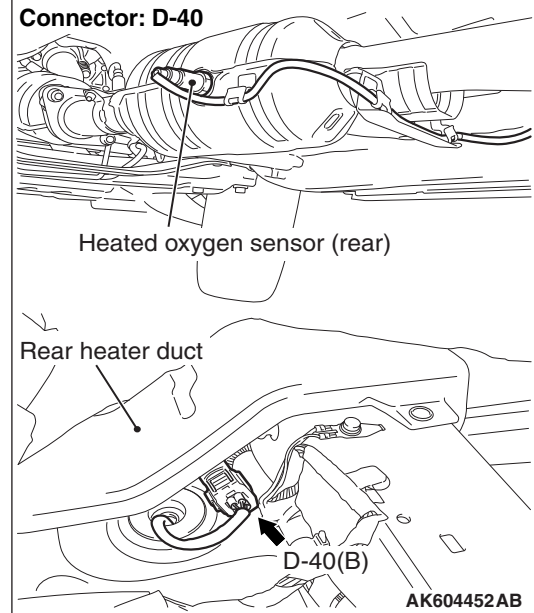
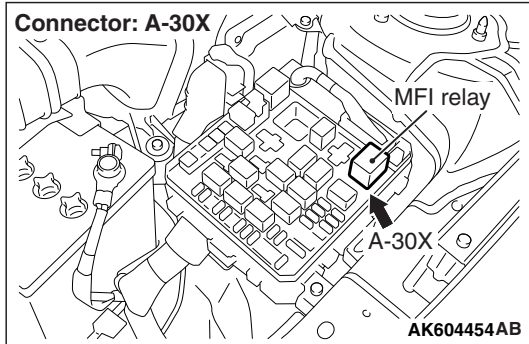
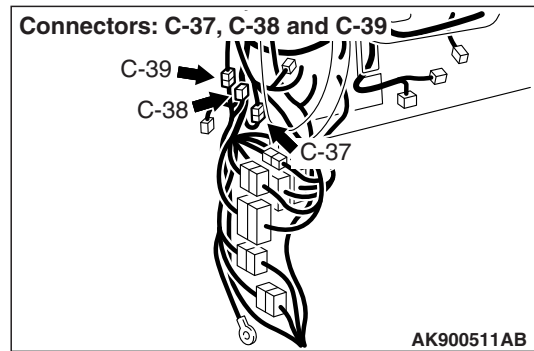
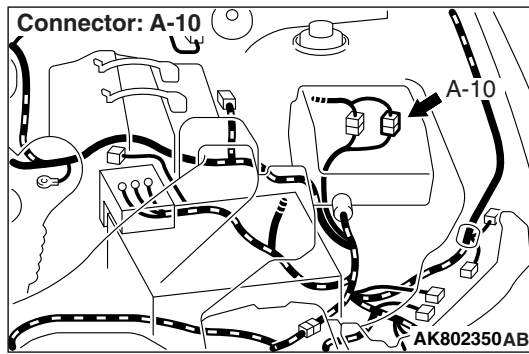
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0038: Heated Oxygen Sensor (rear) Heater Control Circuit High <Except for California>

HEATED OXYGEN SENSOR (REAR) HEATER CIRCUIT <EXCEPT FOR CALIFORNIA>





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)

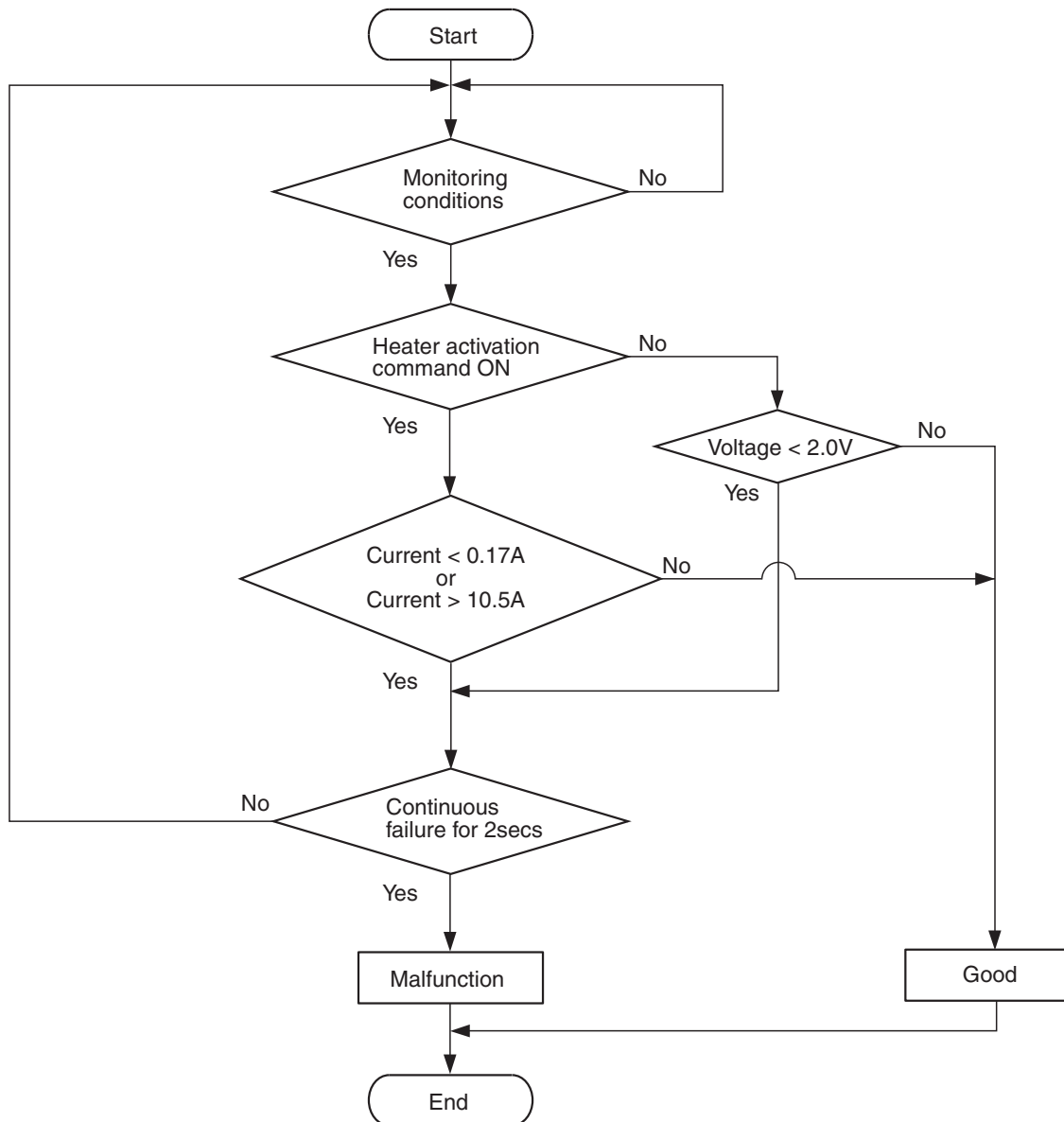
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

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

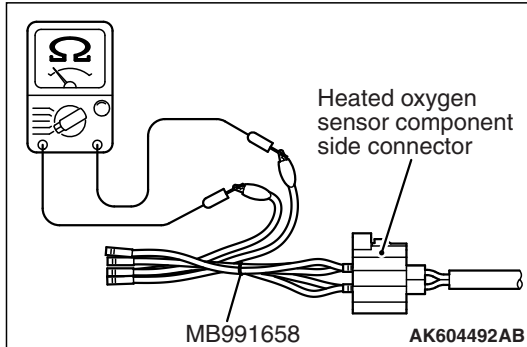
Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tool:**

- MB991658: Test Harness

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

- (1) Disconnect heated oxygen sensor (rear) connector D-40 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 Ω [at 20°C (68°F)]

Q: Is the measured resistance between 4.5 and 8.0 Ω [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-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

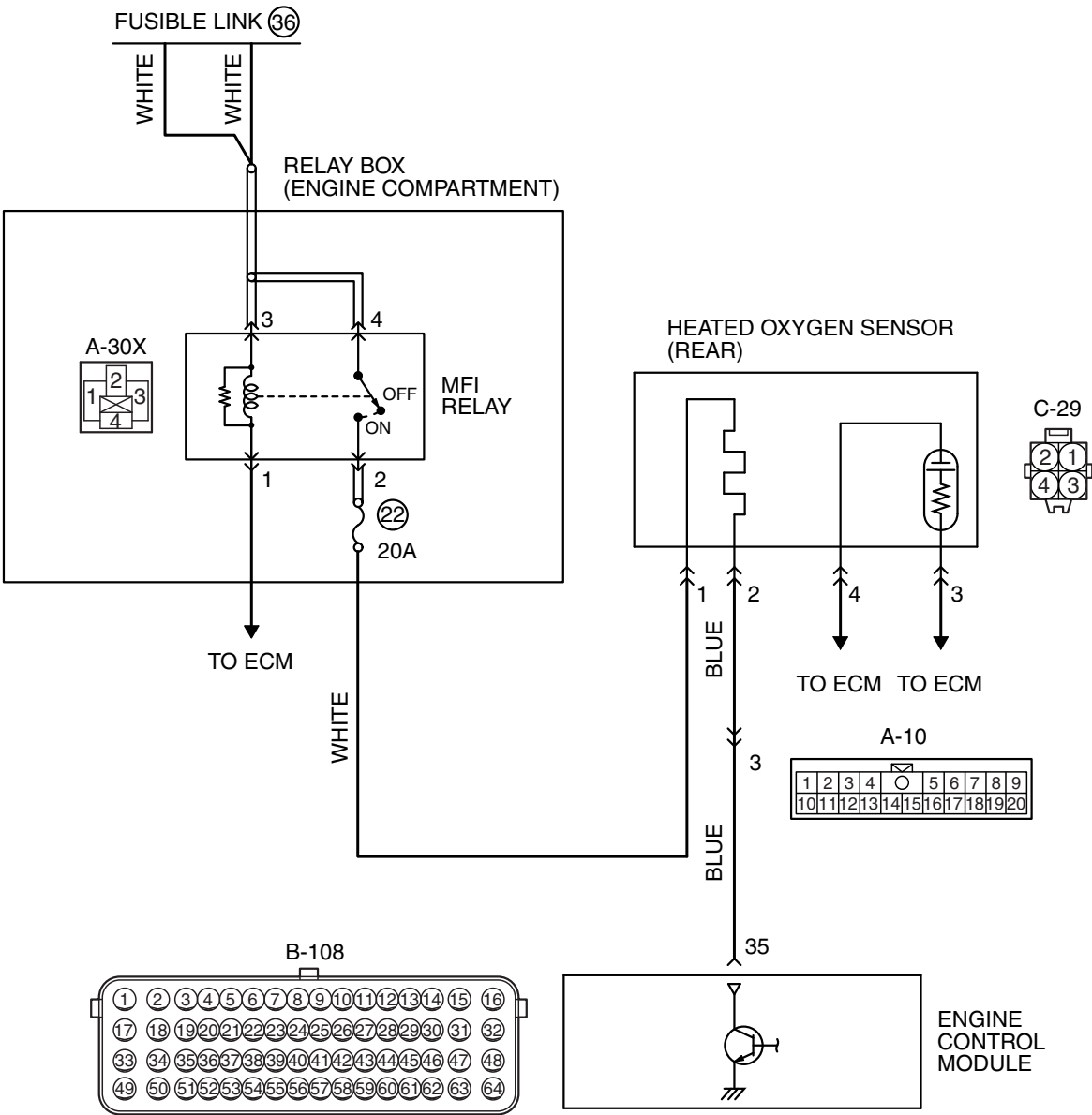
Q: Is DTC P0038 set?

YES : Retry the troubleshooting.

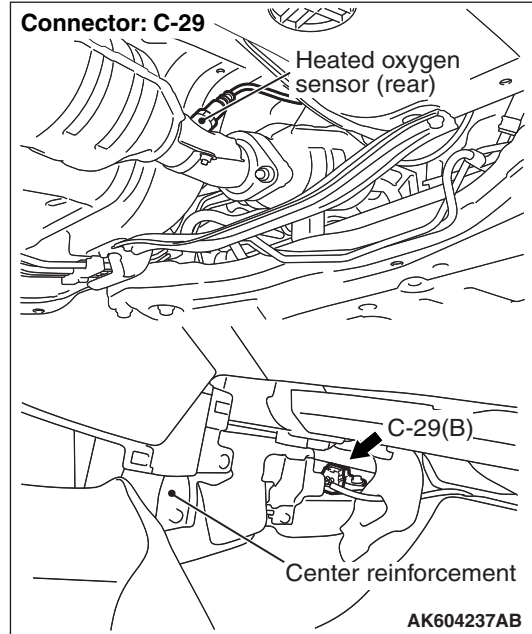
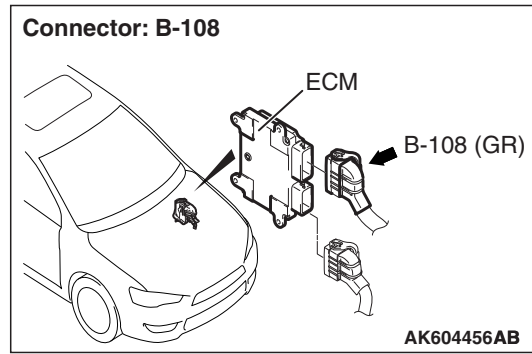
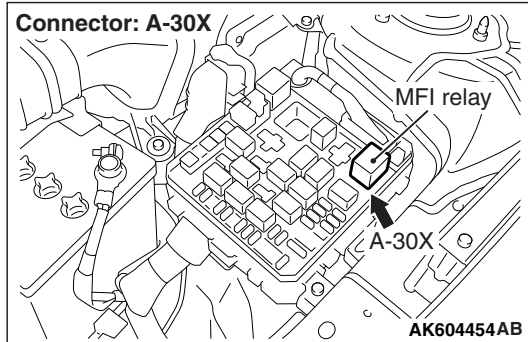
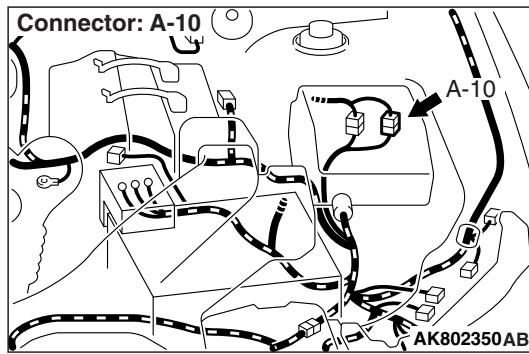
NO : The inspection is complete.

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

HEATED OXYGEN SENSOR (REAR) HEATER CIRCUIT <CALIFORNIA>



AK604023AG



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)

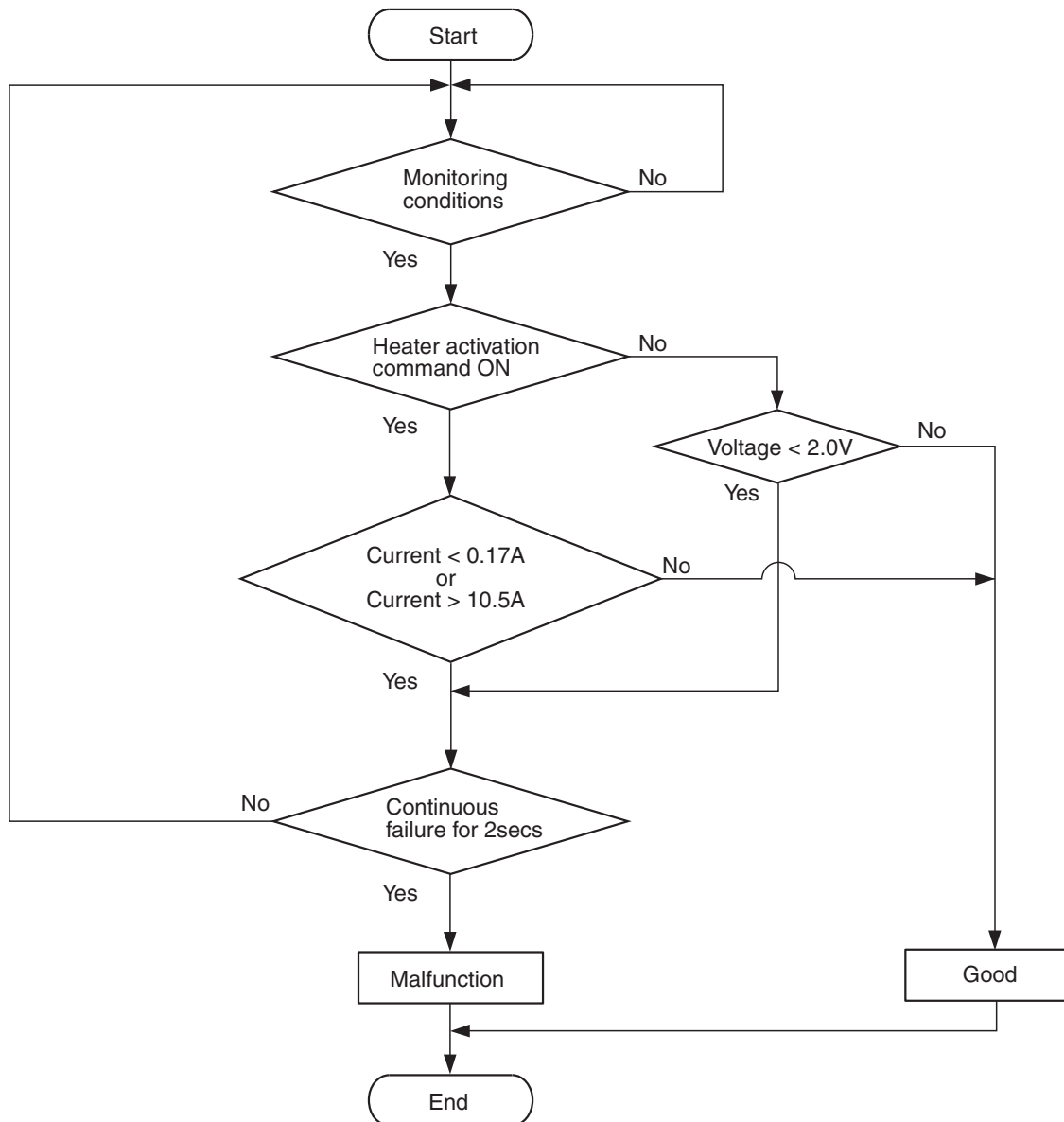
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

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

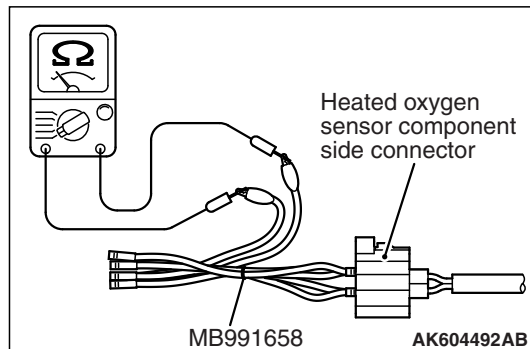
Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).

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

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

DIAGNOSIS**Required Special Tool:**

- MB991658: Test Harness

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

- (1) Disconnect heated oxygen sensor (rear) connector C-29 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 (rear) connector terminal No. 1 and terminal No. 2.

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

Q: Is the measured resistance between 4.5 and 8.0 Ω [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-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

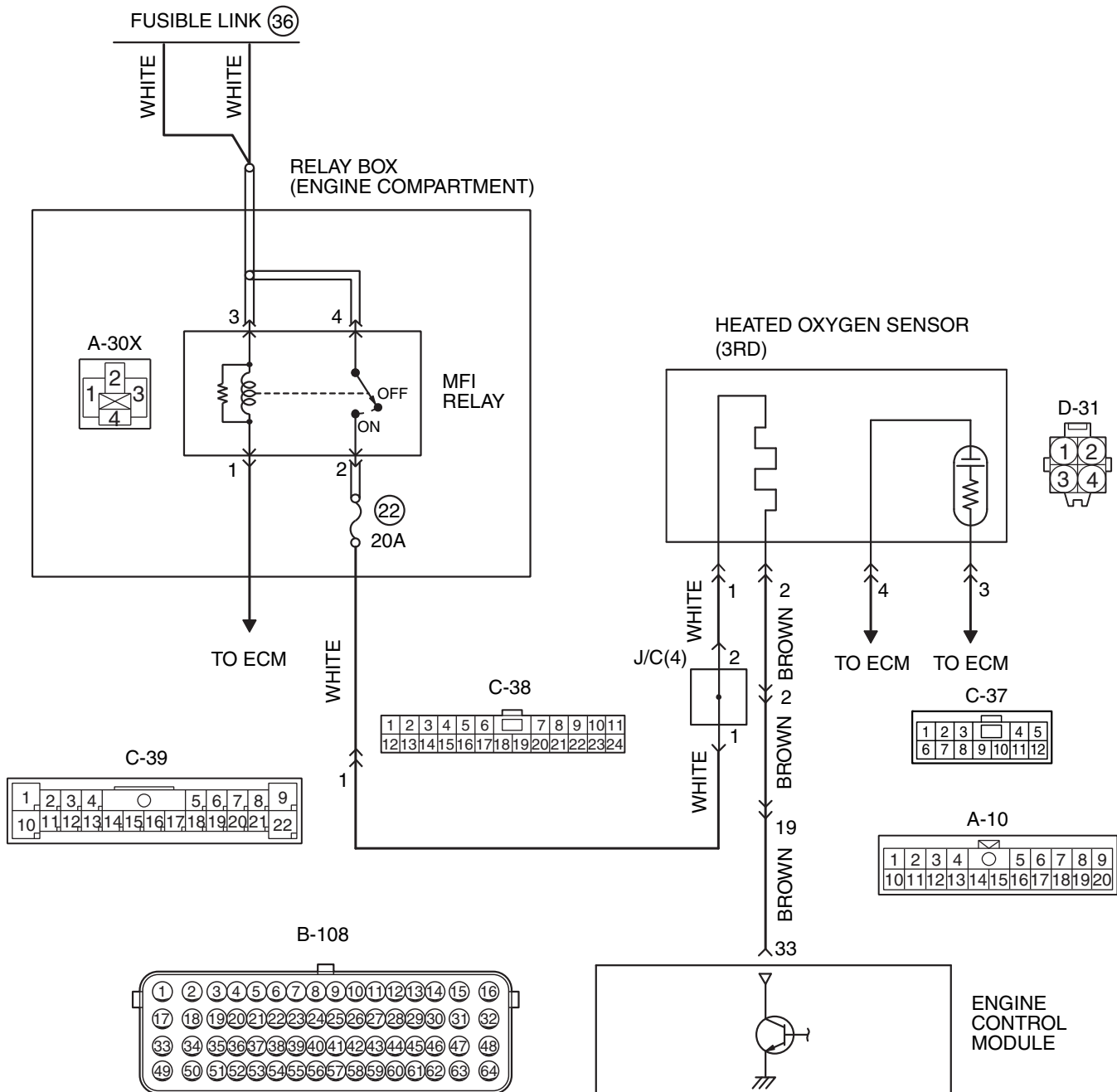
Q: Is DTC P0038 set?

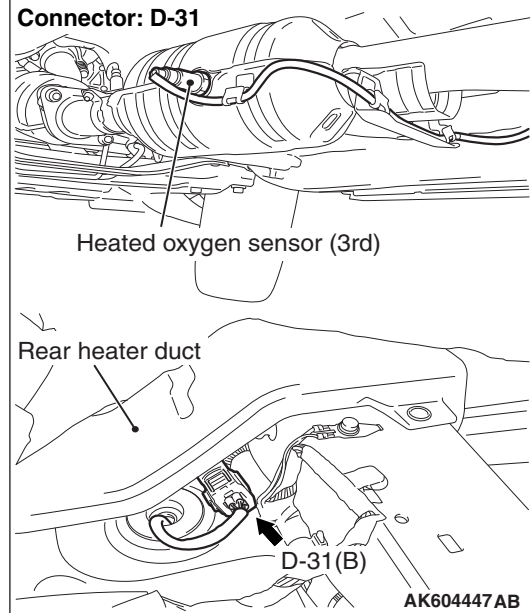
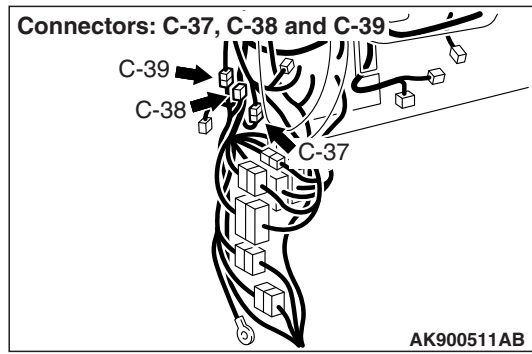
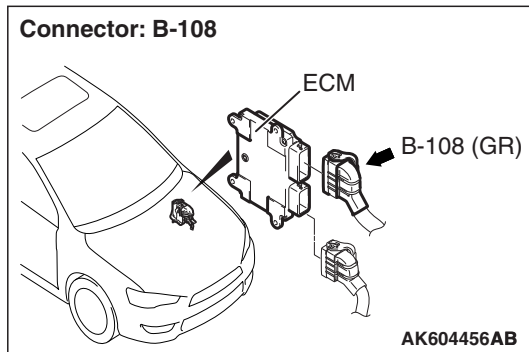
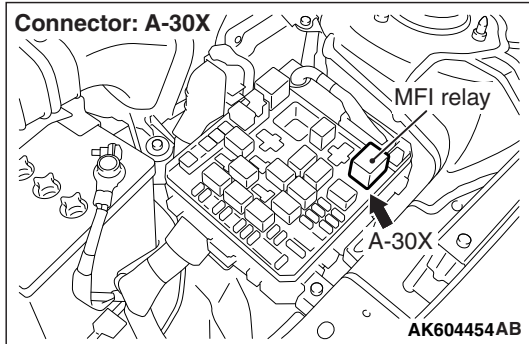
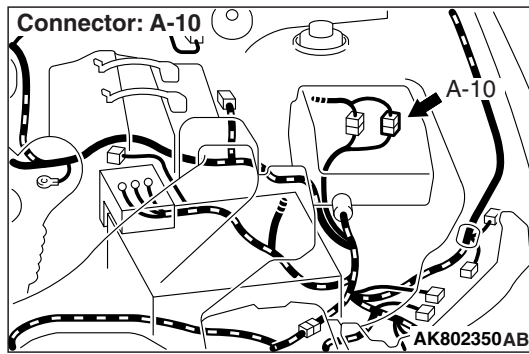
YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0043: Heated Oxygen Sensor (3rd) Heater Control Circuit Low <California>

HEATED OXYGEN SENSOR (3RD) HEATER CIRCUIT <CALIFORNIA>





CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the heated oxygen sensor (3rd) heater.
- The ECM (terminal No. 33) controls continuity to the heated oxygen sensor (3rd) 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 (3rd) 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)

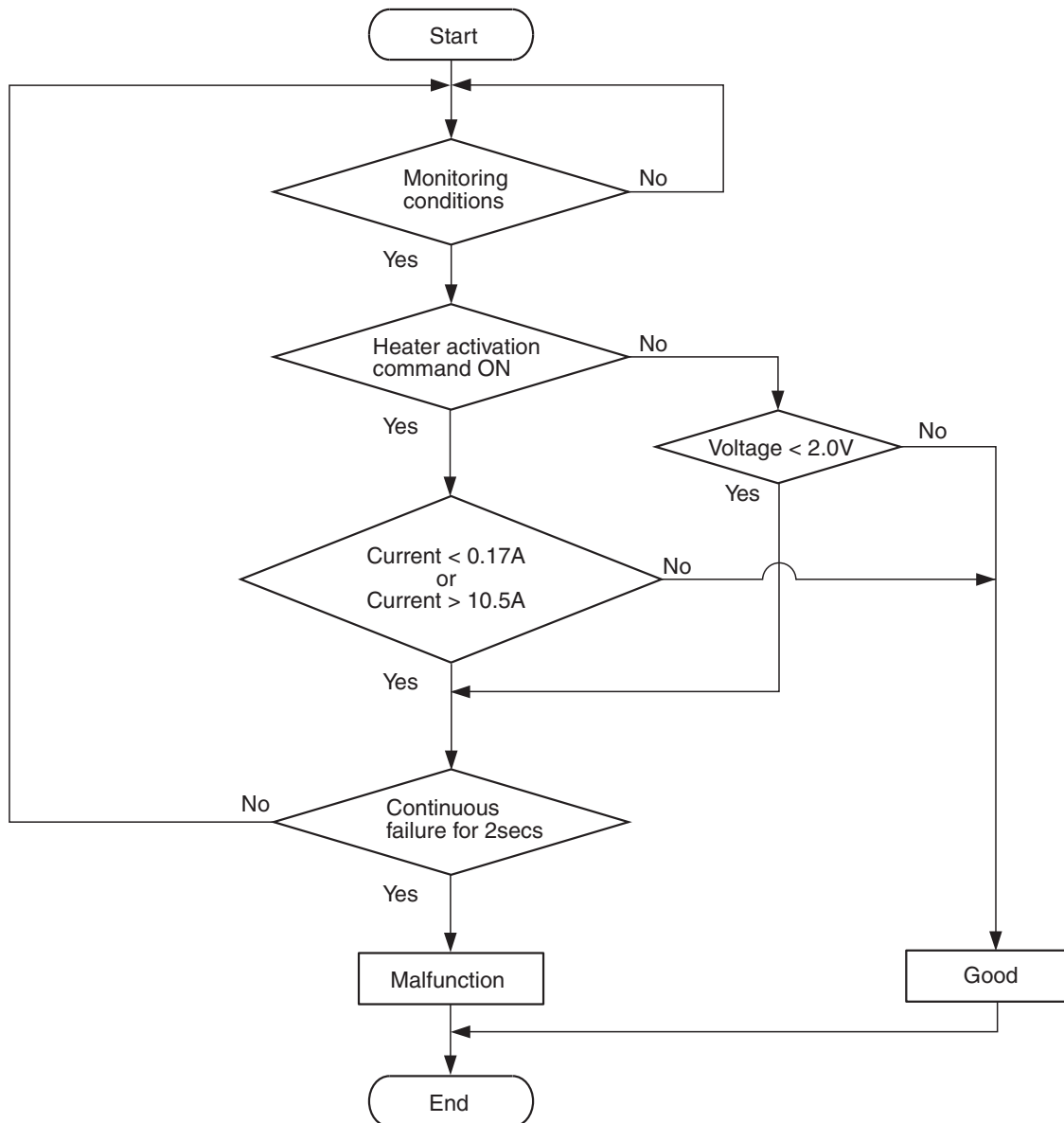
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the heated oxygen sensor (3rd) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The heated oxygen sensor (3rd) 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 (3rd) heater is off.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The heated oxygen sensor (3rd) heater voltage has continued to be lower than 2.0 volts for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Pattern 2 [P.13A-12](#).

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

- Open or shorted heated oxygen sensor (3rd) heater circuit, or harness damage.
- Heated oxygen sensor (3rd) heater failed.
- Connector damage.
- ECM failed.

DIAGNOSIS**Required Special Tools:**

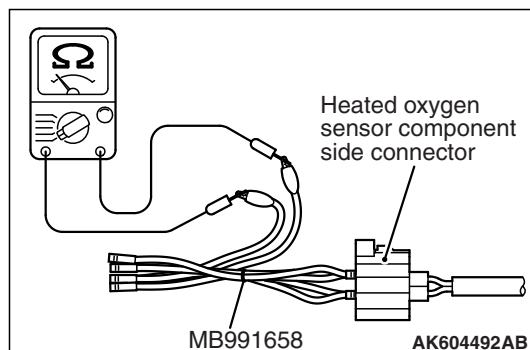
- MB991658: Test Harness
- MB992110: Power Plant ECU Check Harness

STEP 1. Check harness connector D-31 at the heated oxygen sensor (3rd) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

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

**STEP 2. Check the heated oxygen sensor (3rd).**

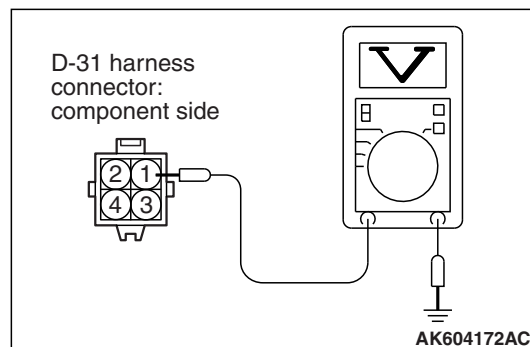
- (1) Disconnect heated oxygen sensor (3rd) connector D-31 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (3rd) side.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 1 and terminal No. 2.

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

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

YES : Go to Step 3.

NO : Replace the heated oxygen sensor (3rd). Then go to Step 12.

**STEP 3. Measure the power supply voltage at heated oxygen sensor (3rd) harness side connector D-31.**

- (1) Disconnect the connector D-31 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check harness connector A-30X at the MFI relay for damage.

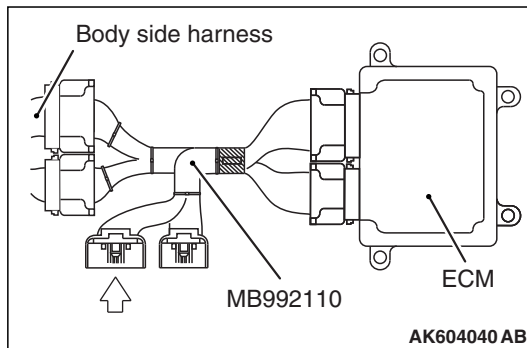
Q: Is the harness connector in good condition?

YES : Check harness connector C-38 and C-39 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-30X (terminal No. 2) and heated oxygen sensor (3rd) connector D-31 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

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

STEP 5. Measure the power supply voltage at ECM connector B-108 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.

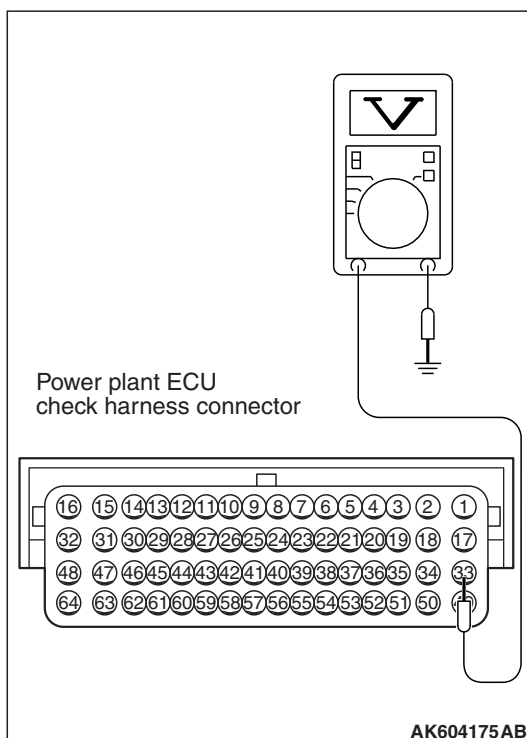


- (3) Measure the voltage between terminal No. 33 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

NO : Go to Step 6.



STEP 6. Check harness connector B-108 at ECM for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

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

STEP 7. Check for open circuit or short circuit to ground between heated oxygen sensor (3rd) connector D-31 (terminal No. 2) and ECM connector B-108 (terminal No. 33).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Replace the 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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

NO : Repair it. Then go to Step 12.

STEP 8. Check harness connector B-108 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. Check for harness damage between MFI relay connector A-30X (terminal No. 2) and heated oxygen sensor (3rd) connector D-31 (terminal No. 1).

NOTE: Check harness after checking intermediate connector C-38 and C-39. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between heated oxygen sensor (3rd) connector D-31 (terminal No. 2) and ECM connector B-108 (terminal No. 33).

NOTE: Check harness after checking intermediate connector A-10 and C-37. If intermediate connector is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).

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

Q: Is DTC P0043 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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 12.

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

STEP 12. Test the OBD-II drive cycle.

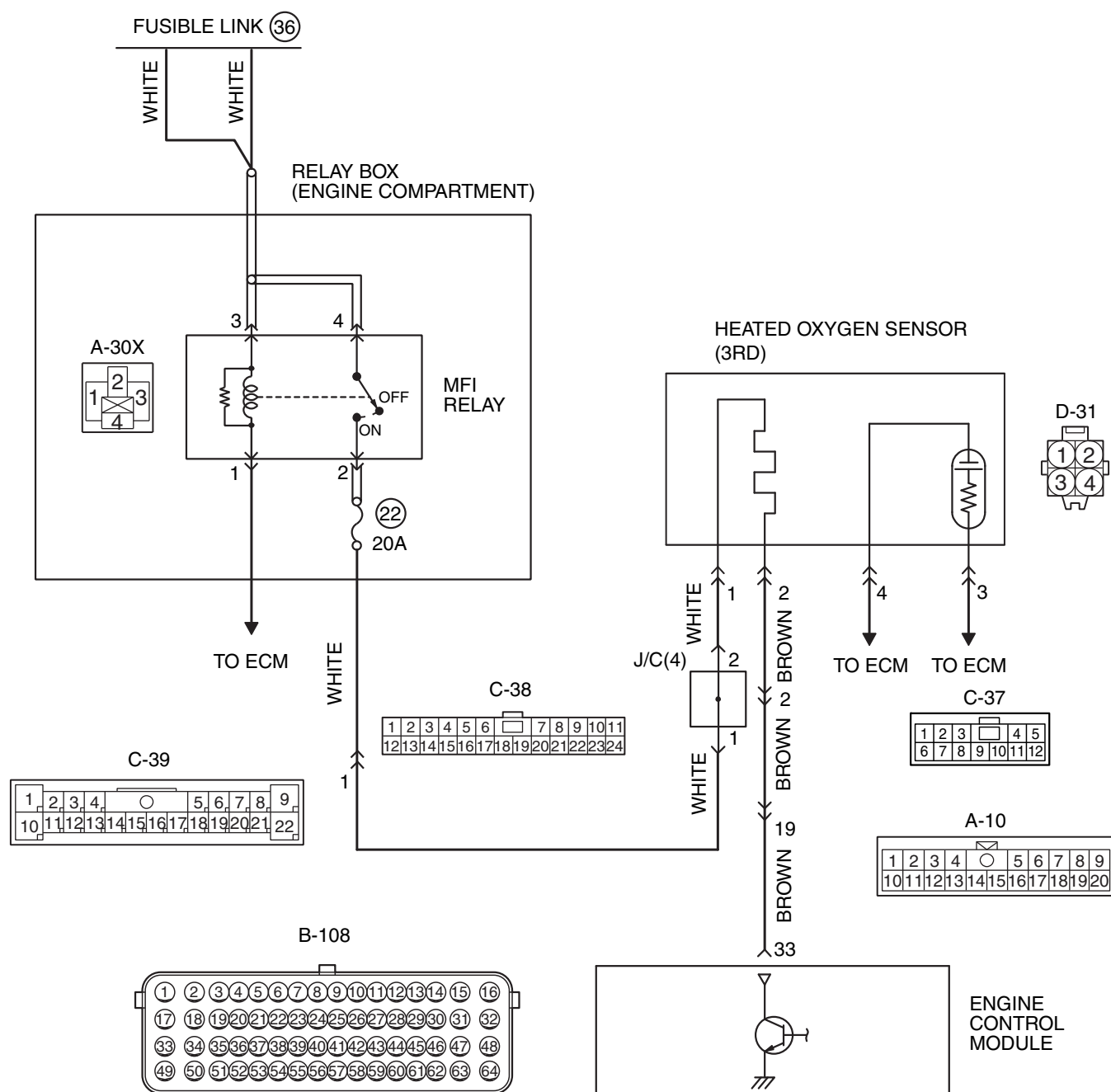
(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).

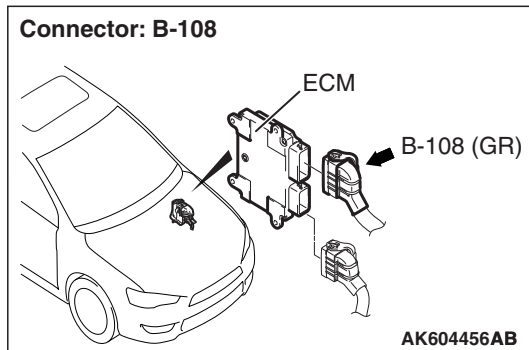
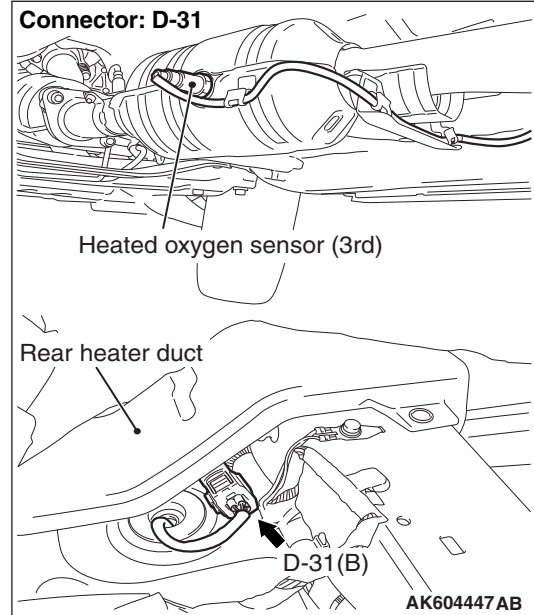
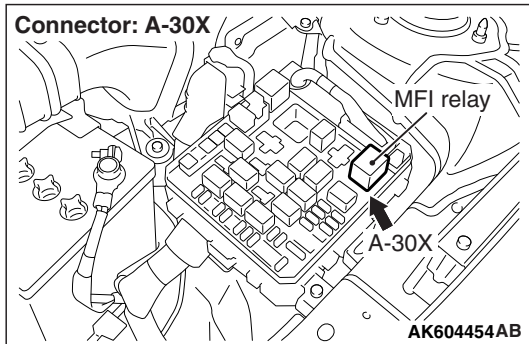
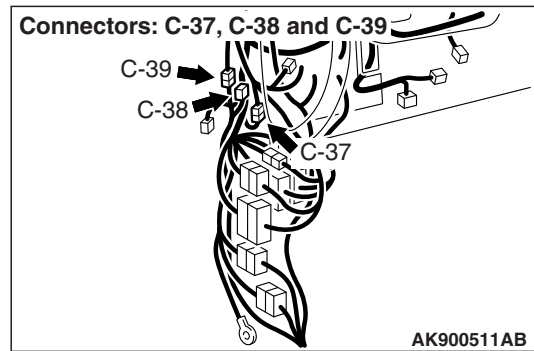
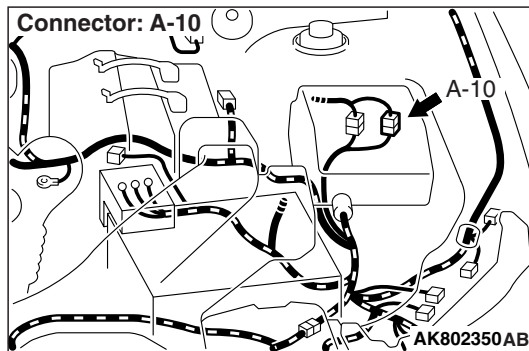
(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0043 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0044: Heated Oxygen Sensor (3rd) Heater Control Circuit High <California>
HEATED OXYGEN SENSOR (3RD) HEATER CIRCUIT <CALIFORNIA>




CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 2) to the heated oxygen sensor (3rd) heater.
- The ECM (terminal No. 33) controls continuity to the heated oxygen sensor (3rd) 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 (3rd) 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)

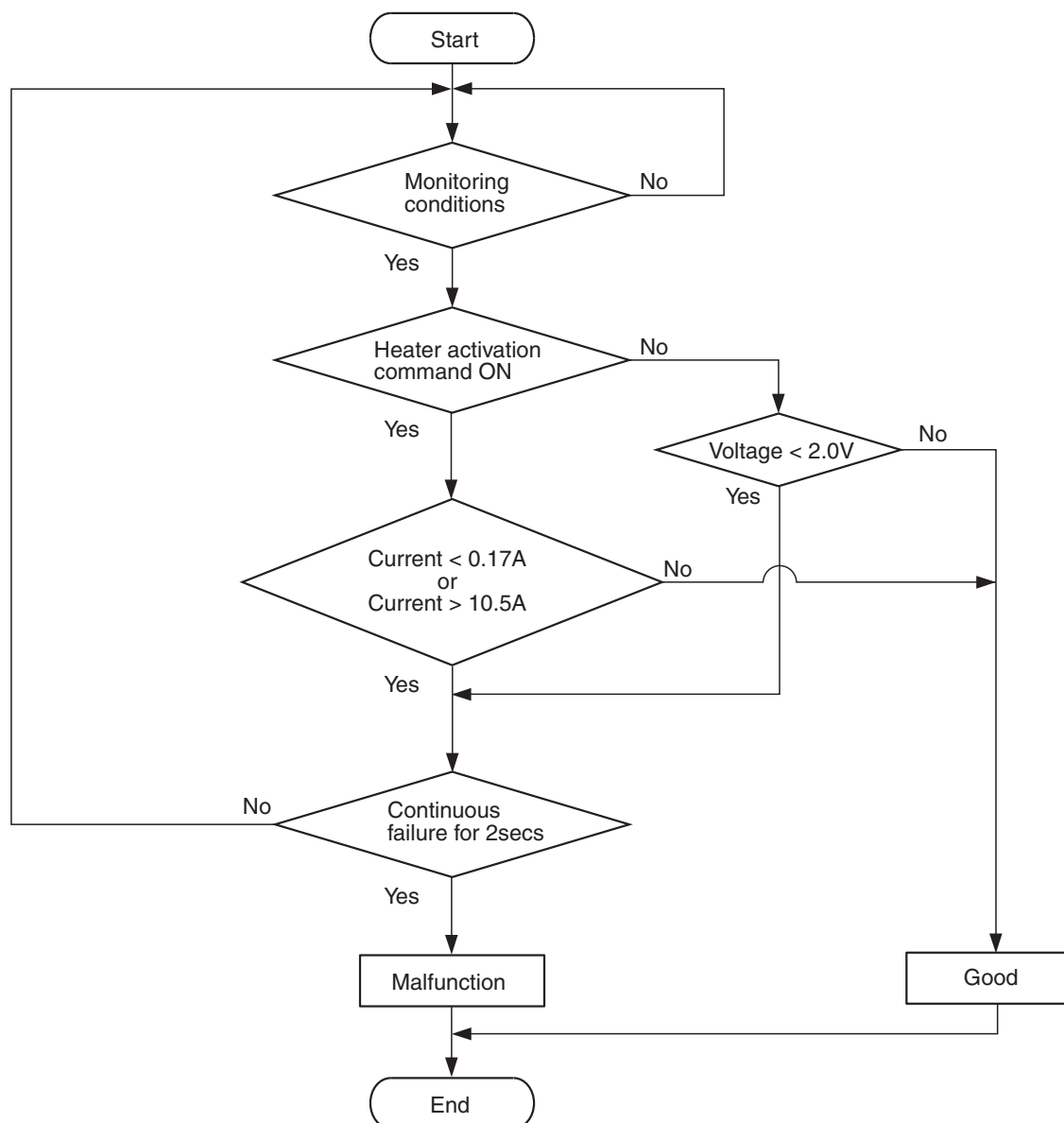
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK900352

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- While the heated oxygen sensor (3rd) heater is on.
- Battery positive voltage is between 11 and 16.5 volts.

Judgement Criterion

- The heated oxygen sensor (3rd) 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-12](#).

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

- Heated oxygen sensor (3rd) heater failed.
- ECM failed.

DIAGNOSIS

Required Special Tool:

- MB991658: Test Harness

STEP 1. Check the heated oxygen sensor (3rd).

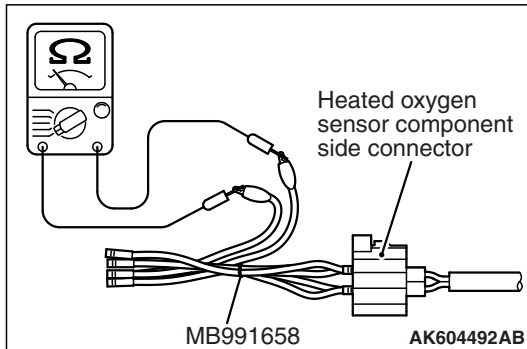
- (1) Disconnect heated oxygen sensor (3rd) connector D-31 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (3rd) side.
- (2) Measure the resistance between heated oxygen sensor (3rd) connector terminal No. 1 and terminal No. 2.

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

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

YES : Go to Step 2.

NO : Replace the heated oxygen sensor (3rd). 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-12](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0044 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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 3.

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

STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 2 [P.13A-12](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0044 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)

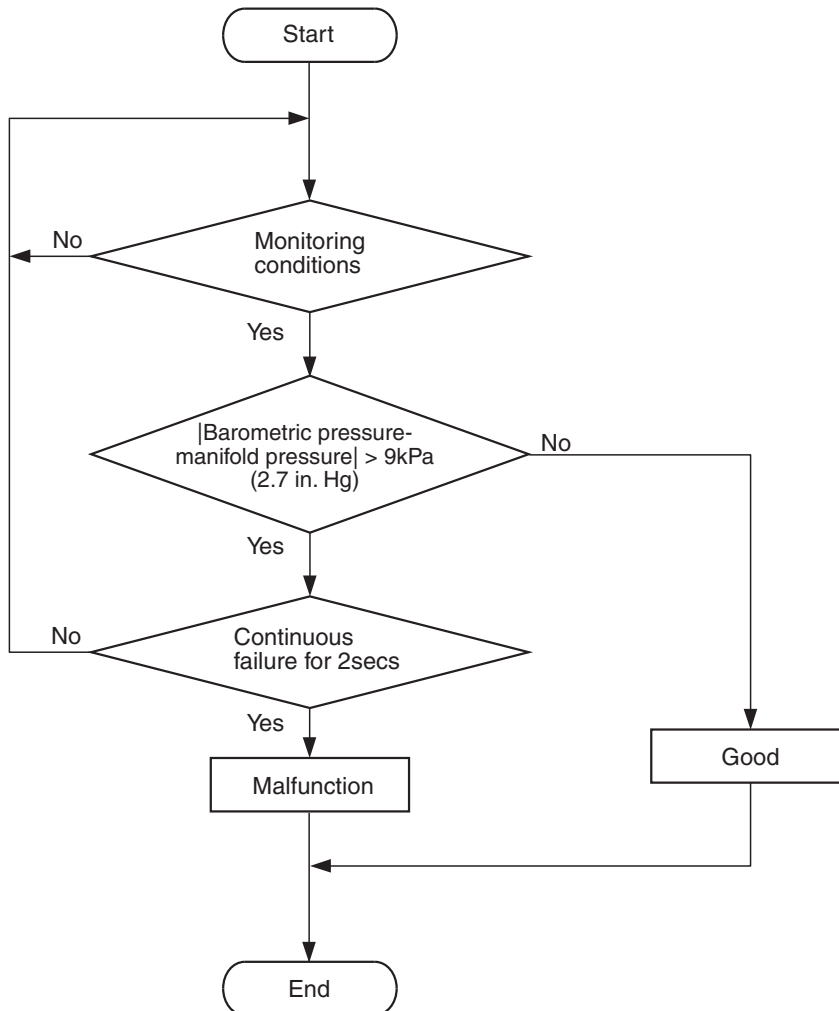
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK704095

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

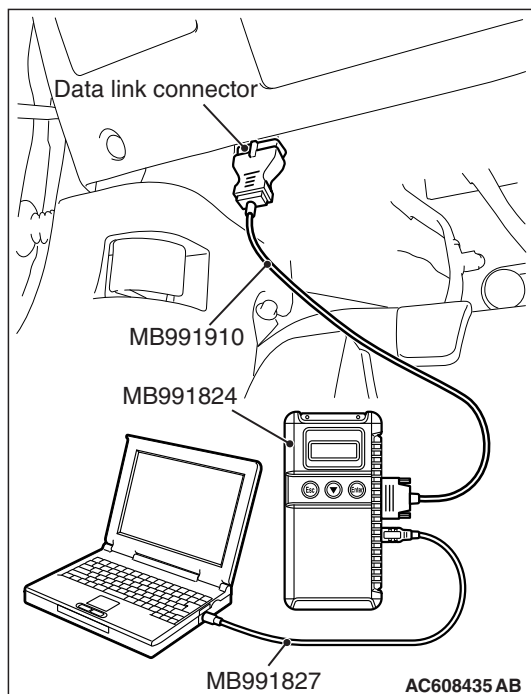
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

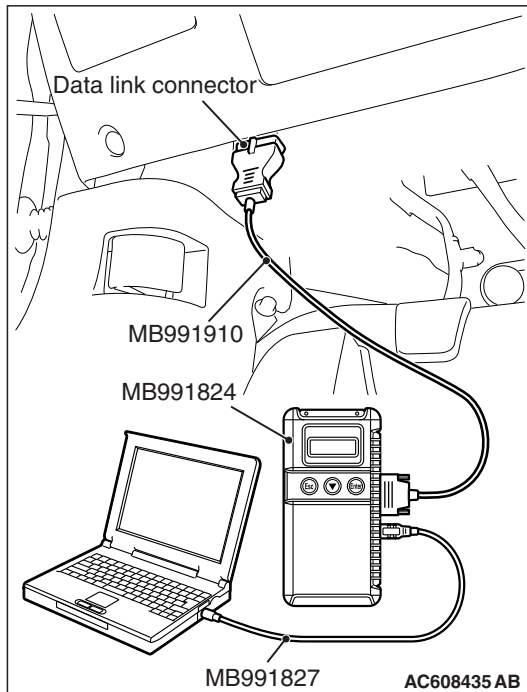
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958, read the DTC.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Refer to, Diagnostic Trouble Code Chart [P.13A-50](#).

NO : Go to Step 2.





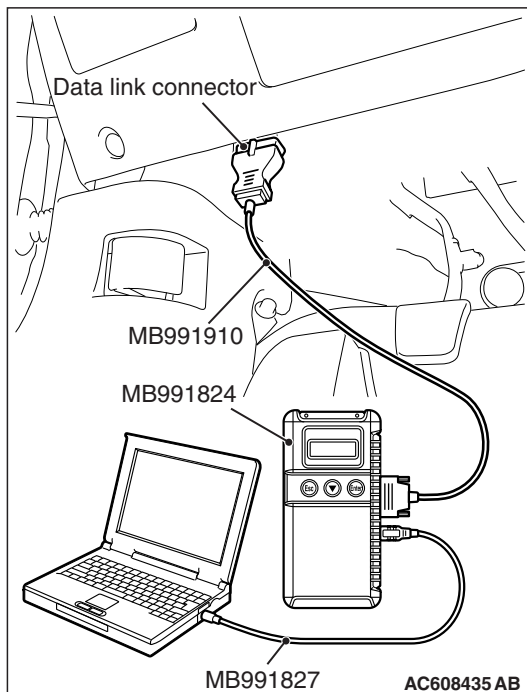
STEP 2. Using scan tool MB991958, check data list item 8: Manifold Absolute Pressure Sensor.

- (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-166](#), DTC P0107 – Manifold Absolute Pressure Circuit Low Input [P.13A-175](#), DTC P0108 – Manifold Absolute Pressure Circuit High Input [P.13A-183](#).



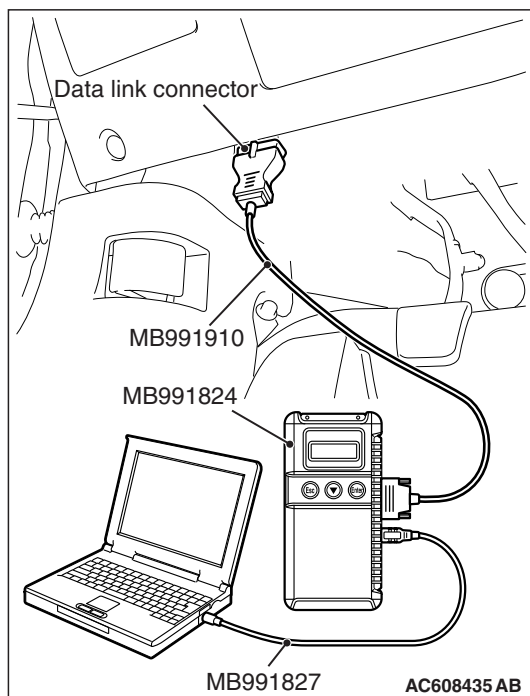
STEP 3. Using scan tool MB991958, read the diagnostic trouble code (DTC).

- (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, ID Code Registration Necessity Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 4.

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

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

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

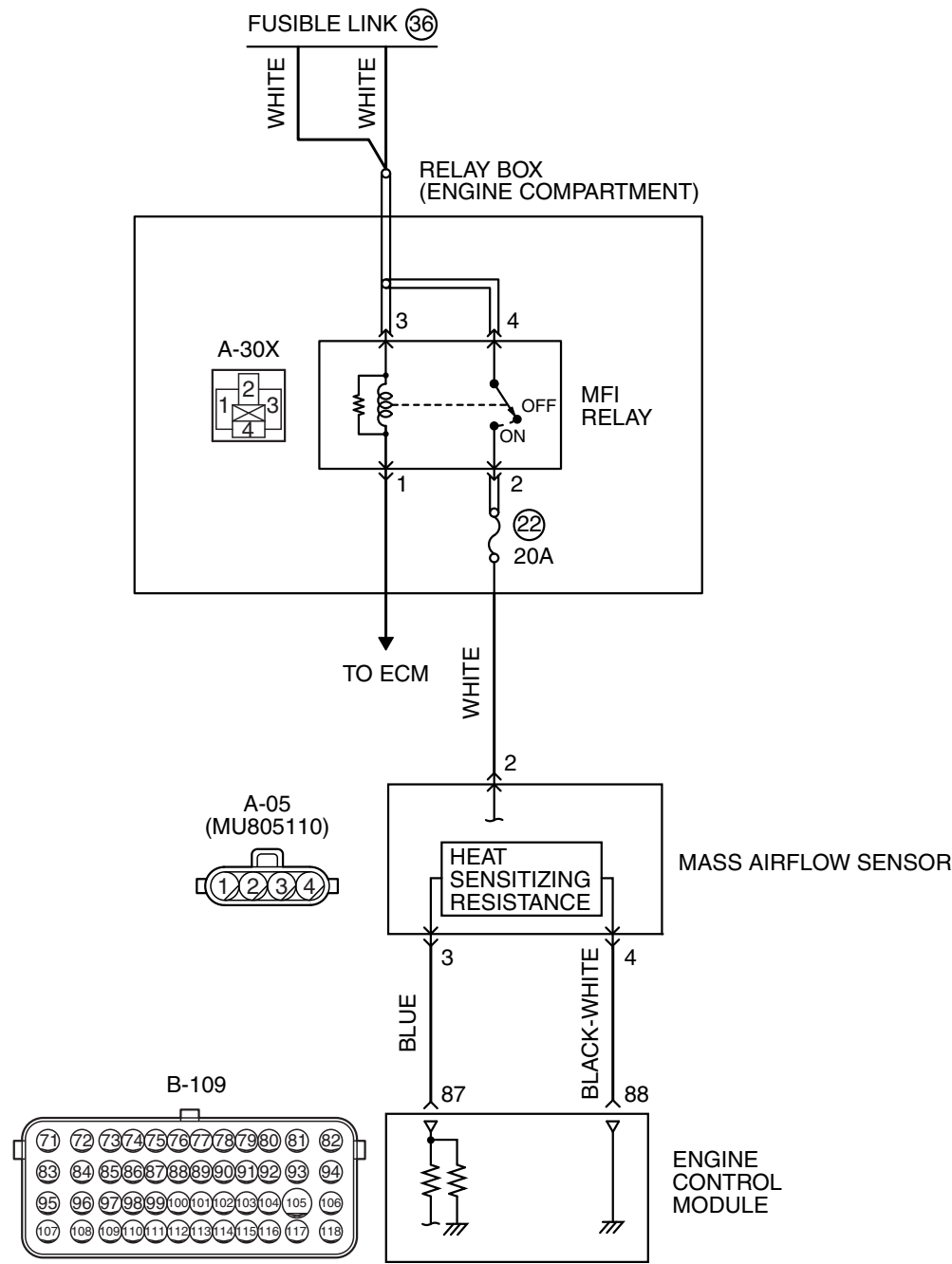
Q: Is DTC P0069 set?

YES : Retry the troubleshooting.

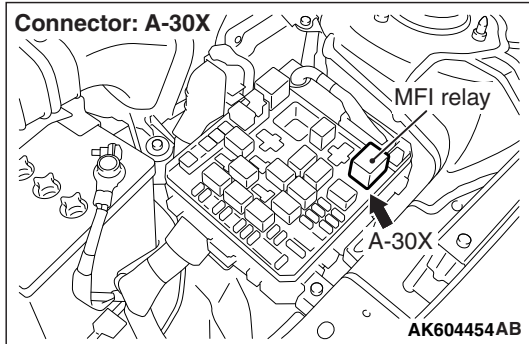
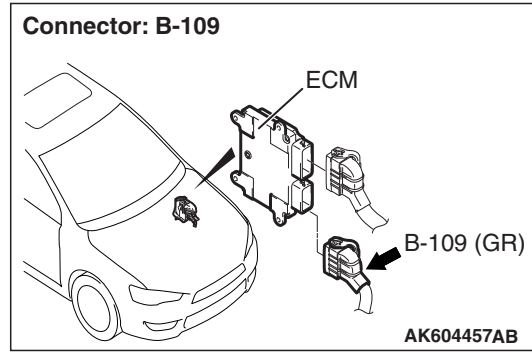
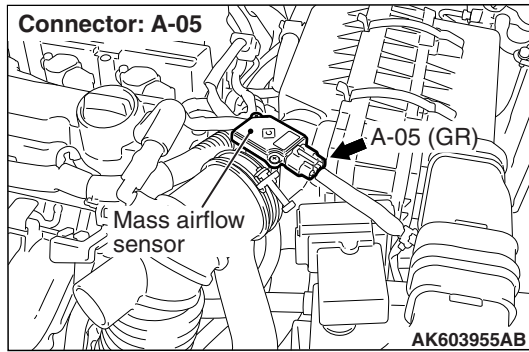
NO : The inspection is complete.

DTC P0101: Mass Airflow Circuit Range/Performance Problem

MASS AIRFLOW SENSOR CIRCUIT



AK604114 AB



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)

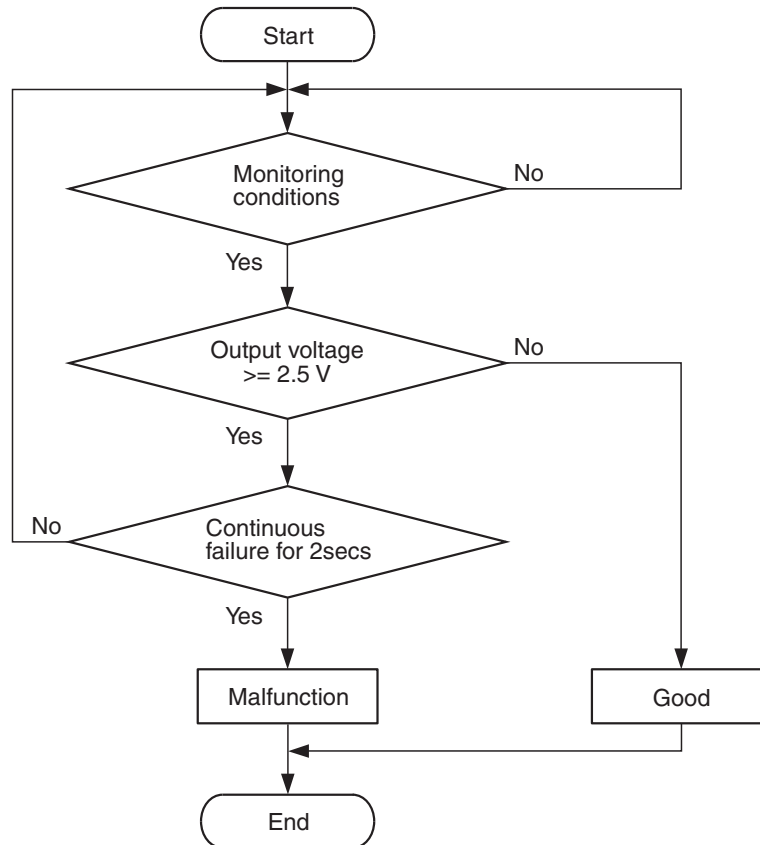
- Not applicable

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

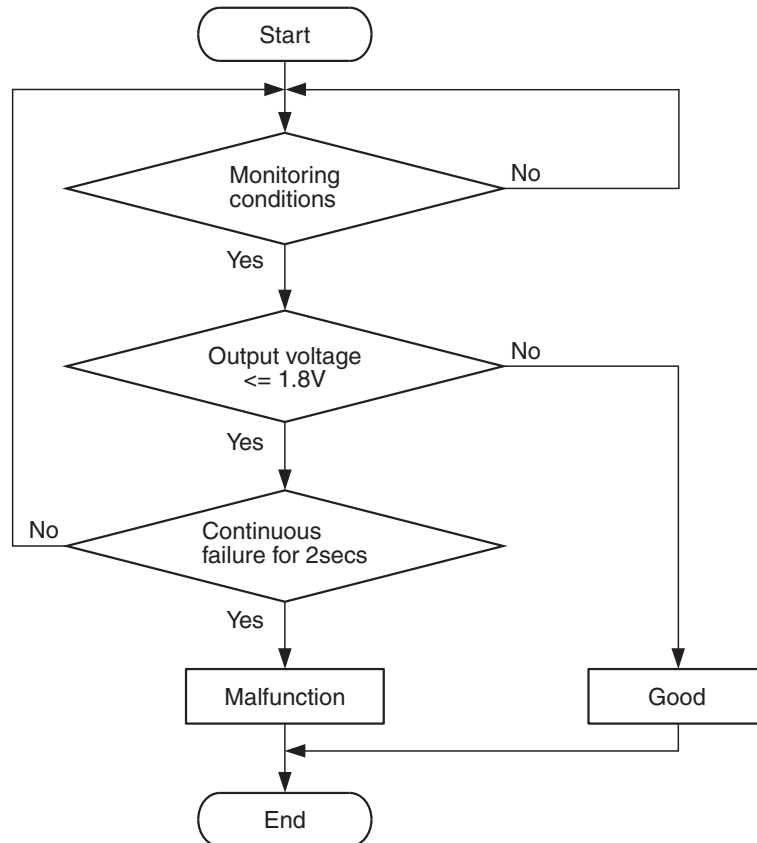
- Throttle position sensor output voltage is 0.8 volt or lower.
- Mass airflow sensor output voltage is 4.9 volts (corresponding to an air flow rate of 263 g/sec) or lower .

Judgement Criterion

- Mass airflow sensor output voltage has continued to be 2.5 volts (corresponding to an air flow rate of 25 g/sec) or higher for 2 seconds.

DTC SET CONDITIONS <Range/Performance problem – low >

Logic Flow Chart



AK604309

Check Conditions

- 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.
- Engine speed is 1,500 r/min or more.

Judgement Criterion

- Mass airflow sensor output voltage has continued to be 1.8 volts (corresponding to an air flow rate of 7 g/sec) or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

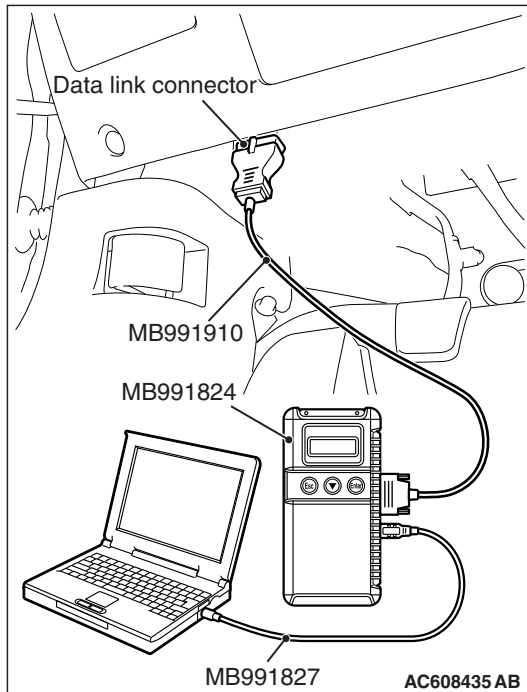
Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 7 [P.13A-12](#).

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



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 mV.
 - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

STEP 2. Check harness connector A-05 at mass airflow sensor and harness connector A-30X 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-30X (terminal No. 2) and mass airflow sensor connector A-05 (terminal No. 2).

Q: Is the harness wire in good condition?

YES : Go to Step 4.

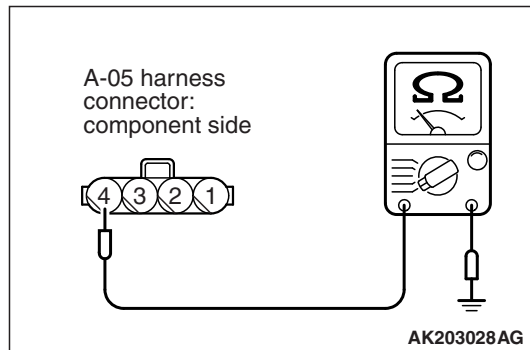
NO : Repair it. Then go to Step 8.

STEP 4. Check harness connector B-109 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-05.**

- (1) Disconnect the connector A-05 and measure at the harness side.
- (2) Check for the continuity between terminal No. 4 and ground.
 - Continuity (2 Ω or less)

Q: Does continuity exist?**YES :** Go to Step 6.**NO :** Repair harness wire between mass airflow sensor connector A-05 (terminal No. 4) and ECM connector B-109 (terminal No. 88) because of harness damage. Then go to Step 8.**STEP 6. Check for harness damage between mass airflow sensor connector A-05 (terminal No. 3) and ECM connector B-109 (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-12](#).
- (3) Check the diagnostic trouble code (DTC).

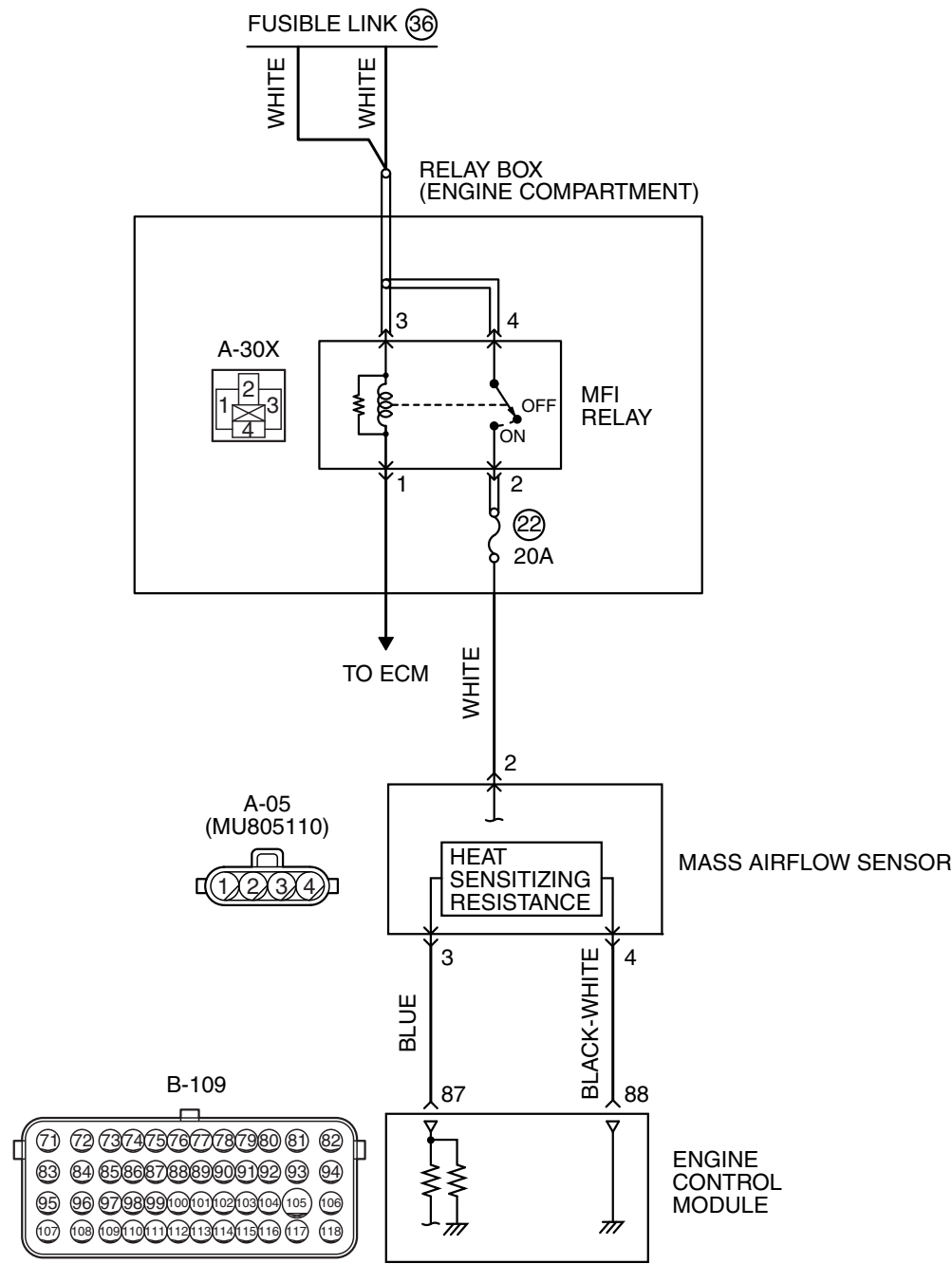
Q: Is DTC P0101 set?**YES :** Replace the ECM. When the ECM is replaced, register the ID code. Refer to GROUP 42B, Diagnosis – ID Code Registration Judgment Table <Vehicles with KOS> [P.42B-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go 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-12](#).
- (2) Check the diagnostic trouble code (DTC).

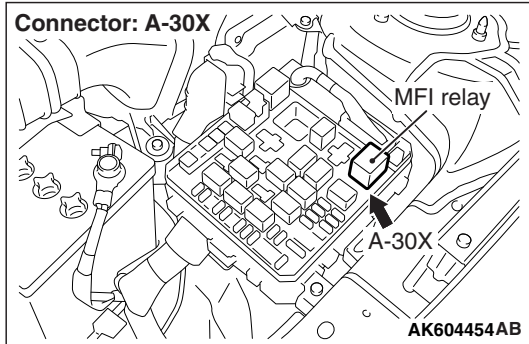
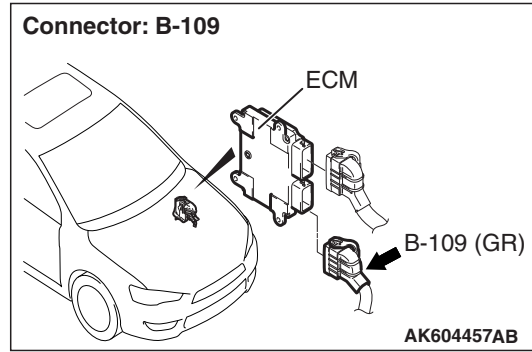
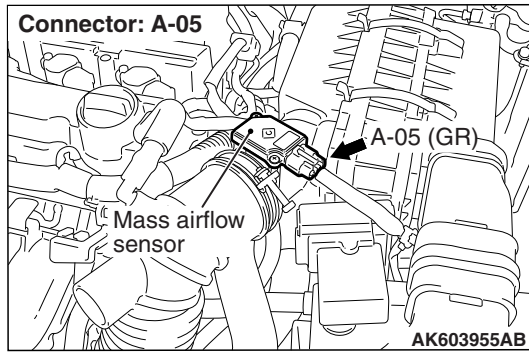
Q: Is DTC P0101 set?**YES :** Retry the troubleshooting.**NO :** The inspection is complete.

DTC P0102: Mass Airflow Circuit Low Input

MASS AIRFLOW SENSOR CIRCUIT



AK604114 AB



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)

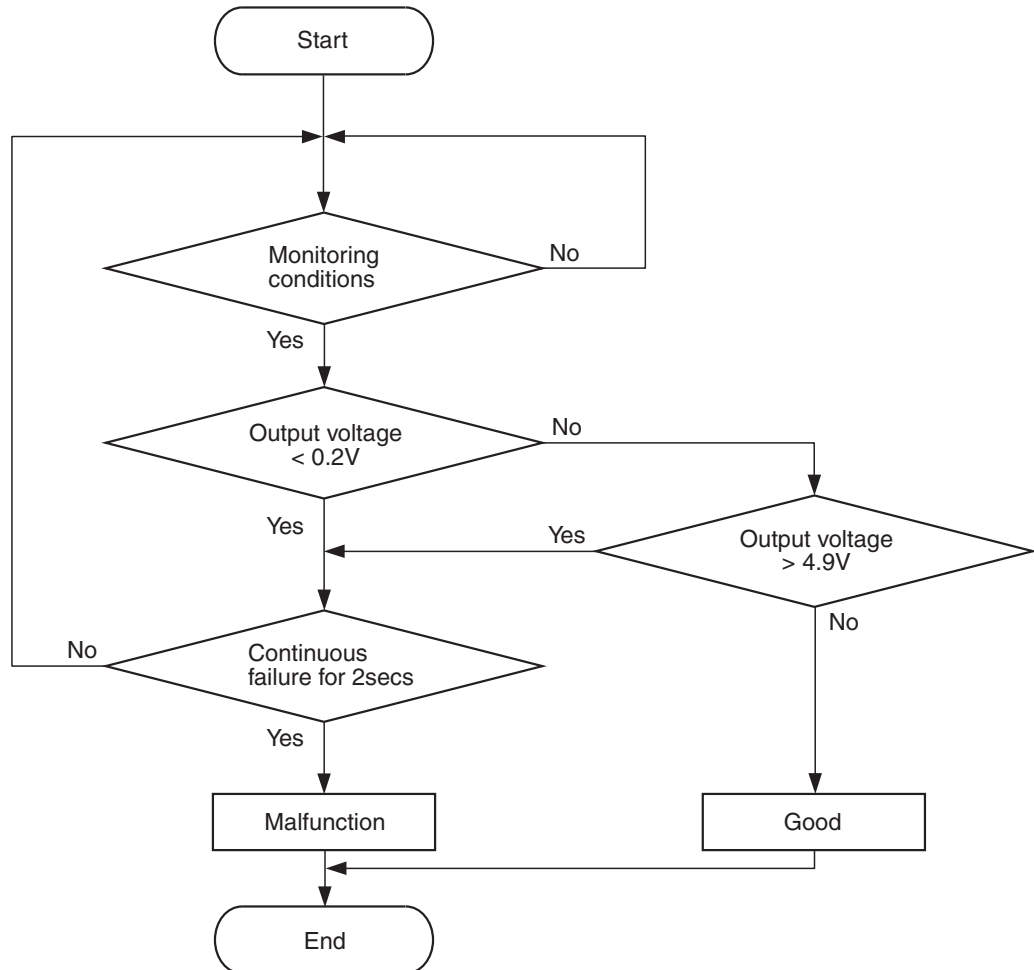
- Not applicable

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 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-12](#).

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.

- 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

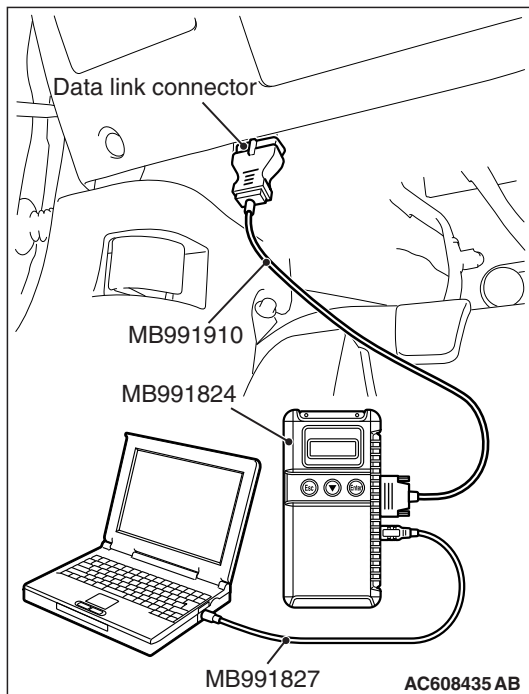
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (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 mV.
 - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.



STEP 2. Check harness connector A-05 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.

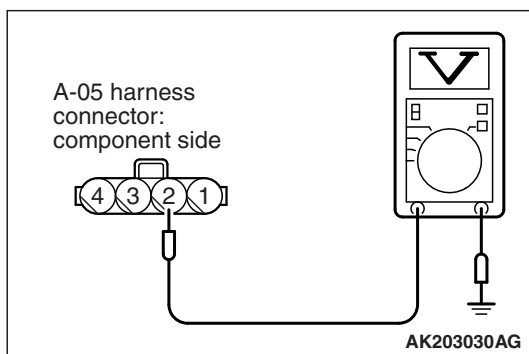
STEP 3. Measure the power supply voltage at mass airflow sensor harness side connector A-05.

- (1) Disconnect the connector A-05 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-30X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector A-30X (terminal No. 2) and mass airflow sensor connector A-05 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 10.

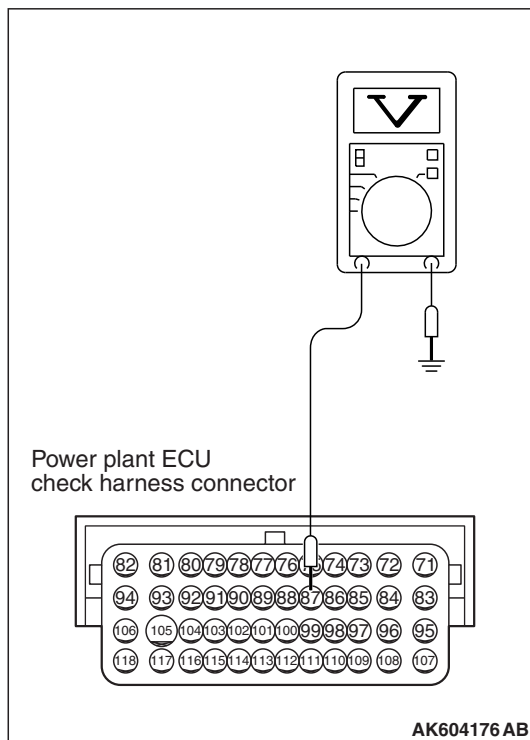
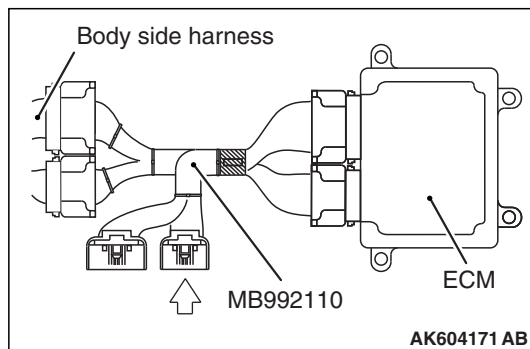
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.

STEP 5. Check harness connector B-109 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-109 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 or short circuit to ground between mass airflow sensor connector A-05 (terminal No. 3) and ECM connector B-109 (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-12](#).
- (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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 10.

NO : The inspection is complete.

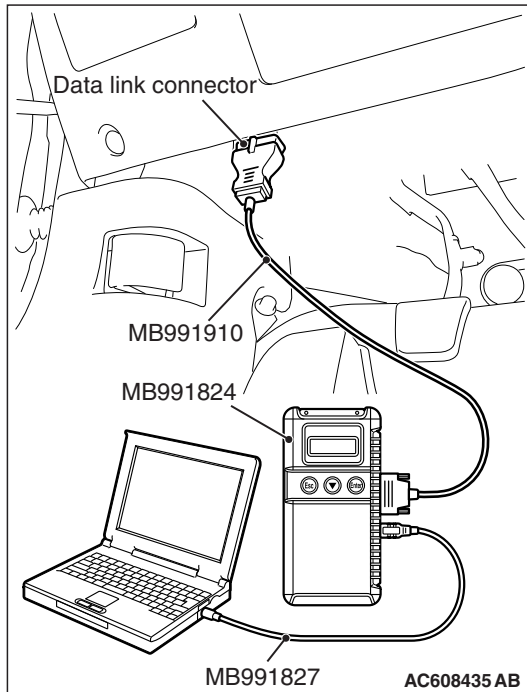
STEP 9. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.

- (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 mV.
 - 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.00-14](#).

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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). 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-12](#).
- (2) Check the diagnostic trouble code (DTC).

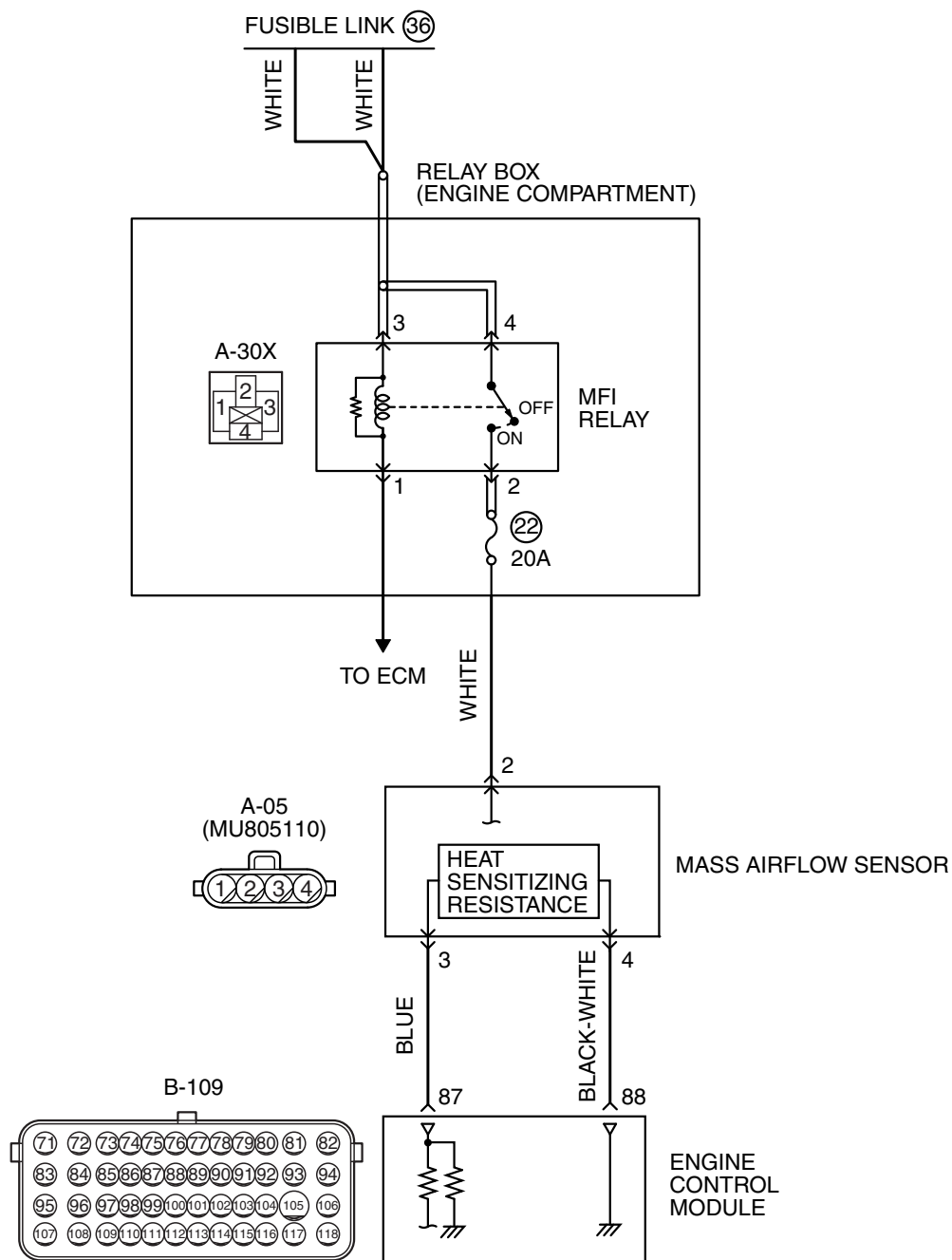
Q: Is DTC P0102 set?

YES : Retry the troubleshooting.

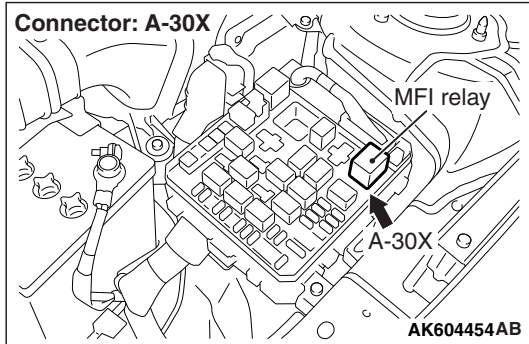
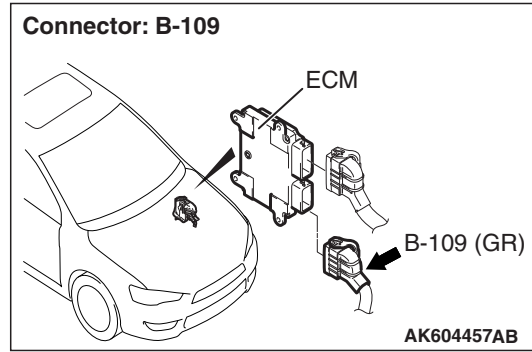
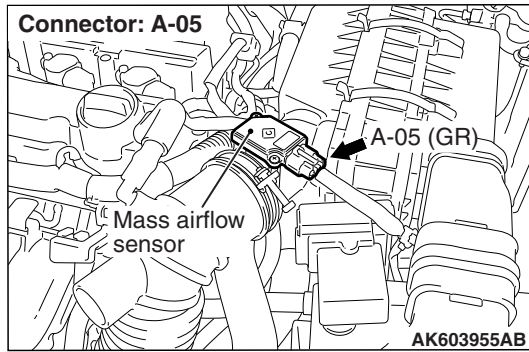
NO : The inspection is complete.

DTC P0103: Mass Airflow Circuit High Input

MASS AIRFLOW SENSOR CIRCUIT



AK604114 AB



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)

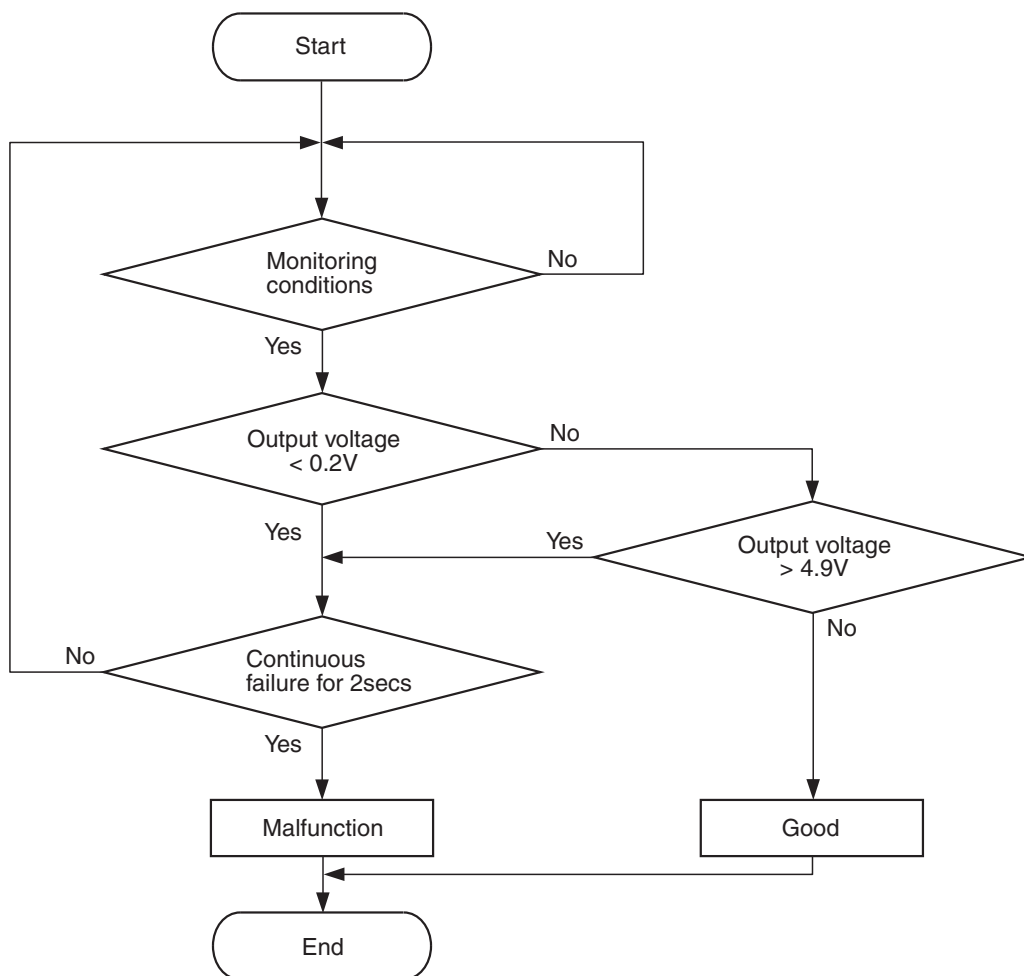
- Not applicable

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 263 g/sec) for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Pattern 23 [P.13A-12](#).

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.
 - 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 mV.
 - When the engine is revved, the mass airflow rate should increase according to the increase in engine speed.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

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

NO : Go to Step 2.

STEP 2. Check harness connector A-05 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.

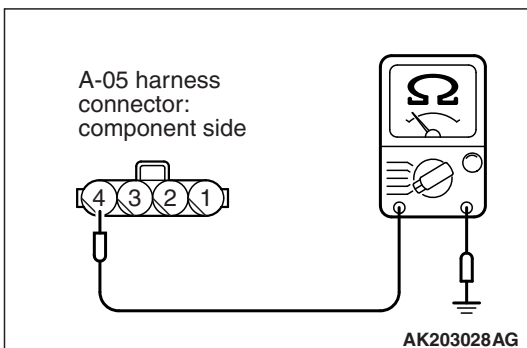
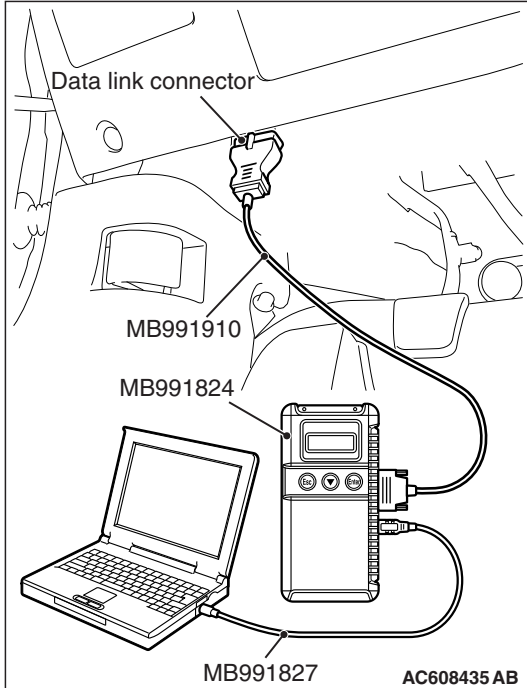
STEP 3. Check the continuity at mass airflow sensor harness side connector A-05.

- (1) Disconnect the connector A-05 and measure at the harness side.
- (2) Check for the continuity between terminal No. 4 and ground.
 - Continuity (2 Ω or less)

Q: Does continuity exist?

YES : Go to Step 7.

NO : Go to Step 4.



STEP 4. Check harness connector B-109 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-05 (terminal No. 4) and ECM connector B-109 (terminal No. 88).

Q: Is the harness wire in good condition?

YES : Go to Step 6.

NO : Repair it. Then go to Step 8.

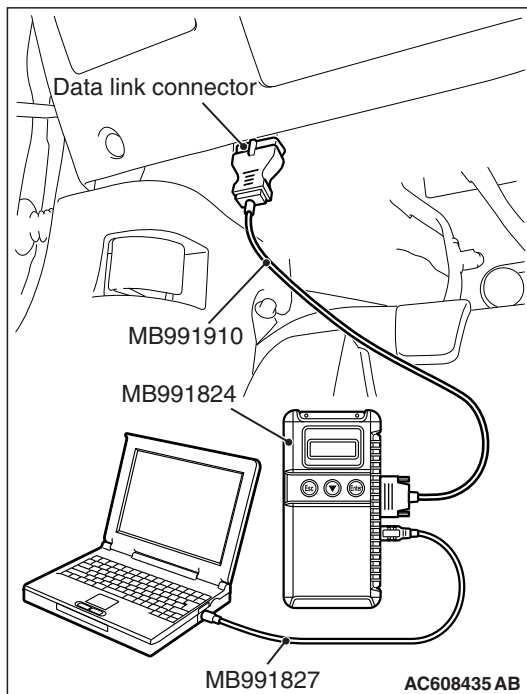
STEP 6. Using scan tool MB991958, check data list item 10: Mass Airflow Sensor.

- (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 mV.
 - 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.00-14](#).

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-11](#) or GROUP 42C, Diagnosis – ID Codes Registration Judgment Table <Vehicles with WCM> [P.42C-9](#). Then go to Step 8.



STEP 7. Check harness connector B-109 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-12](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0103 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.