GROUP 13Ab

MULTIPORT FUEL INJECTION (MFI) DIAGNOSIS

CONTENTS

TROUBLESHOOTING STRATEGY

M1131150000115

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

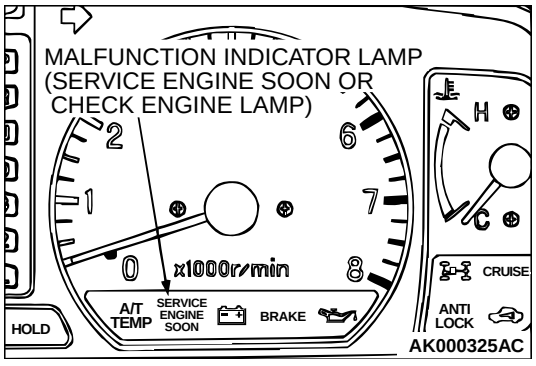
Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure to have exhausted most of the possible ways to find an MFI fault.

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

NOTE: If the powertrain control module (PCM) is replaced, Immobilizer Encrypted Code Registration should be carried out, Refer to GROUP 54A, Ignition Switch – On-vehicle Service – Immobilizer Encrypted Code Registration P.54-58.

TROUBLE CODE DIAGNOSIS

M1131150500303



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

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

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

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

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

DTC NO.	ITEMS
–	Powertrain control module (PCM) malfunction
P0101*	Volume air flow circuit range/performance problem
P0102*	Volume air flow circuit low input
P0106*	Barometric pressure circuit range/performance problem
P0107*	Barometric pressure circuit low input
P0108*	Barometric pressure circuit high input
P0111*	Intake air temperature circuit range/performance problem
P0112*	Intake air temperature circuit low input
P0113*	Intake air temperature circuit high input
P0116*	Engine coolant temperature circuit range/performance problem
P0117*	Engine coolant temperature circuit low input
P0118*	Engine coolant temperature circuit high input
P0121*	Throttle position sensor circuit range/performance problem
P0122*	Throttle position sensor circuit low input
P0123*	Throttle position sensor circuit high input
P0125*	Insufficient coolant temperature for closed loop fuel control
P0128	Coolant thermostat (Coolant temperature below thermostat regulating temperature)
P0130	Heated oxygen sensor circuit (bank 1 sensor 1)
P0131	Heated oxygen sensor circuit Low voltage (bank 1 sensor 1)
P0132	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)
P0133	Heated oxygen sensor circuit slow response (bank 1 sensor 1)
P0134*	Heated oxygen sensor circuit no activity detected (bank 1 sensor 1)
P0135	Heated oxygen sensor heater circuit (bank 1 sensor 1)
P0136	Heated oxygen sensor circuit (bank 1 sensor 2)
P0137	Heated oxygen sensor circuit low voltage (bank 1 sensor 2)
P0138	Heated oxygen sensor circuit high voltage (bank 1 sensor 2)
P0139	Heated oxygen sensor circuit slow response (bank 1 sensor 2)
P0141	Heated oxygen sensor heater circuit (bank 1 sensor 2)
P0150	Heated oxygen sensor circuit (bank 2 sensor 1)
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)
P0154*	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)
P0155	Heated oxygen sensor heater circuit (bank 2 sensor 1)
P0156	Heated oxygen sensor circuit (bank 2 sensor 2)
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)
P0161	Heated oxygen sensor heater circuit (bank 2 sensor 2)

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DTC NO.	ITEMS
P0171	System too lean (bank 1)
P0172	System too rich (bank 1)
P0174	System too lean (bank 2)
P0175	System too rich (bank 2)
P0181	Fuel temperature sensor circuit range/performance
P0182	Fuel temperature sensor circuit low input
P0183	Fuel temperature sensor circuit high input
P0201	Injector circuit – cylinder 1
P0202	Injector circuit – cylinder 2
P0203	Injector circuit – cylinder 3
P0204	Injector circuit – cylinder 4
P0205	Injector circuit – cylinder 5
P0206	Injector circuit – cylinder 6
P0300	Random/multiple cylinder misfire detected
P0301	Cylinder 1 misfire detected
P0302	Cylinder 2 misfire detected
P0303	Cylinder 3 misfire detected
P0304	Cylinder 4 misfire detected
P0305	Cylinder 5 misfire detected
P0306	Cylinder 6 misfire detected
P0335*	Crankshaft position sensor circuit
P0340*	Camshaft position sensor circuit
P0401	Exhaust gas recirculation flow insufficient detected
P0403	Exhaust gas recirculation control circuit
P0421	Warm up catalyst efficiency below threshold (bank 1)
P0431	Warm up catalyst efficiency below threshold (bank 2)
P0441	Evaporative emission control system incorrect purge flow
P0442	Evaporative emission control system leak detected (Small leak)
P0443	Evaporative emission control system purge control valve circuit
P0446	Evaporative emission control system vent control circuit
P0451	Evaporative emission control system pressure sensor range/performance
P0452	Evaporative emission control system pressure sensor low input
P0453	Evaporative emission control system pressure sensor high input
P0455	Evaporative emission control system leak detected (Gross leak)
P0456	Evaporative emission control system leak detected (Very small leak)
P0461	Fuel level sensor circuit range/performance
P0500	Vehicle speed sensor malfunction
P0506	Idle control system RPM lower than expected
P0507	Idle control system RPM higher than expected
P0513	Immobilizer malfunction

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DTC NO.	ITEMS
P0551	Power steering pressure sensor circuit range/performance
P0554	Power steering pressure sensor circuit intermittent
P0705	Transmission range sensor circuit malfunction (RPNDL input)
P0712	Transmission fluid temperature sensor circuit low input
P0713	Transmission fluid temperature sensor circuit high input
P0715	Input/Turbine speed sensor circuit
P0720	Output speed sensor circuit
P0731	Gear 1 incorrect ratio
P0732	Gear 2 incorrect ratio
P0733	Gear 3 incorrect ratio
P0734	Gear 4 incorrect ratio
P0736	Gear R incorrect ratio
P0741	Torque converter clutch circuit performance or stuck off
P0742	Torque converter clutch circuit stuck on
P0743	Torque converter clutch circuit electrical
P0753	Shift solenoid "A" electrical
P0758	Shift solenoid "B" electrical
P0763	Shift solenoid "C" electrical
P0768	Shift solenoid "D" electrical
P1400	Manifold differential pressure sensor circuit malfunction
P1603*	Battery backup circuit malfunction
P1751	A/T control relay malfunction

NOTE: If the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates because of a malfunction of the powertrain control module (PCM), transmission between scan tool MUT-II (MB991502) and the PCM is impossible. In this case, the diagnostic trouble code cannot be read.

NOTE: After the PCM has detected a malfunction, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "" in the DTC NO. column, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) illuminates only on the first detection of the malfunction.*

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

- *When the PCM monitored the power train malfunction three times* and met set condition requirements, it detected no malfunction. *: In this case, "one time" indicates from engine start to stop.*
- *For misfiring or a fuel trim malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.*

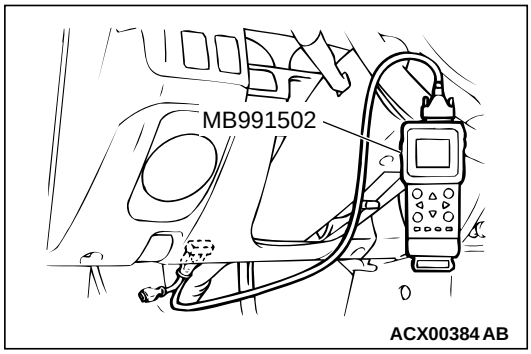
NOTE: Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

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

HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODE

Required Special Tool:

- MB991502: Scan Tool (MUT-II)



⚠ CAUTION

To prevent damage to scan tool MB991502, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502.

NOTE: If Battery positive voltage is low, diagnostic trouble codes may not be output. Be sure to check the battery and charging system before continuing.

NOTE: If battery cable is disconnected or if the powertrain control module (PCM) connector is disconnected, the diagnostic trouble codes will be erased. Do not disconnect the battery cable or PCM connector until the diagnostic trouble codes have been recorded.

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

1. Connect scan tool MB991502 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Read the diagnostic trouble codes for MFI.
4. Refer to the DIAGNOSTIC TROUBLE CODE CHART. P.13Ab-21
5. Turn the ignition switch to the "LOCK" (OFF) position and then back to "ON" again.
6. Erase the diagnostic trouble code(s) using MUT-II screen prompts.
7. Confirm that the diagnostic trouble code output is normal.
8. Turn the ignition switch to the "LOCK" (OFF) position.
9. Disconnect scan tool MB991502 from the data link connector.

PROVISIONAL DTCs [MUT-II OBD-II Test Mode - Results (Mode 5)]

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

MODE 6 REFERENCE TABLE

The powertrain control module (PCM) monitors the condition of emission control system.

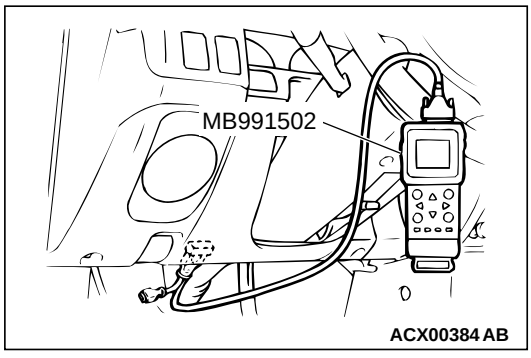
By selecting MODE 6 using scan tool, Test Result and Limit Value (minimum) *1 or (maximum) *2 about the main items of emission control system which PCM monitors can be confirmed. The value at the last monitoring is output by PCM as a test result.

TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	INDICATION OF SCAN TOOL	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
01	Catalyst monitor (Bank 1)	PCM monitors the deterioration of catalyst at right bank side by the output frequency ratio between right bank heated oxygen sensor (front) and right bank heated oxygen sensor (rear).	Catalyst Frequency Ratio Bank 1 Test Result and Limit Value (max.)	× 0.0039
02	Catalyst monitor (Bank 2)	PCM monitors the deterioration of catalyst at left bank side by the output frequency ratio between left bank heated oxygen sensor (front) and left bank heated oxygen sensor (rear).	Catalyst Frequency Ratio Bank 2 Test Result and Limit Value (max.)	× 0.0039
03	EGR monitor	PCM monitors the operation of EGR system by the pressure difference of intake manifold between before and after introduction of EGR using the manifold differential pressure sensor.	EGR Monitor Pressure Value Test Result and Limit Value (min.) kPa	× 0.43 kPa
06	Evaporation leak monitor (Small leak)	PCM monitors the leak of fuel evaporation gas by the reduction of vacuum in tank after appointed time using the fuel tank differential pressure sensor after making the fuel tank and the fuel line vacuum.	EVAP Leak Mon. 1mm Pressure Value Test Result and Limit Value (max.) kPa	× 0.032 kPa
07	Evaporation leak monitor (Gross leak)	PCM monitors the leak of fuel evaporation gas by checking whether the pressure can be reduced (the amount of pressure reduction) using the fuel tank differential pressure sensor after sealing the fuel tank and the fuel line.	EVAP Leak Mon. Gross Pressure Value Test Result and Limit Value (min.) kPa	× 0.032 kPa
08	Evaporation leak monitor (Very small leak)	PCM monitors the leak of fuel evaporation gas by the reduction of vacuum in tank after appointed time using the fuel tank differential pressure sensor after making the fuel tank and the fuel line vacuum.	EVAP Leak Mon. 0.5mm Pressure Value Test Result and Limit Value (max.) kPa	× 0.032 kPa

TEST ID	MONITORING ITEM	SIMPLE TECHNICAL DESCRIPTION	INDICATION OF SCAN TOOL	CONVERSION COEFFICIENT IN USING GENERAL SCAN TOOL
09	Right bank heated oxygen sensor (front) monitor (Rich/ lean switching)	PCM monitors the deteriorated condition of the right bank heated oxygen sensor (front) by checking the lean/rich switching frequency of the right bank heated oxygen sensor (front).	HO2S B1 SENSOR1 Rich/Lean Switching Count Test Result and Limit Value (min.)	× 1 count
0A	Left bank heated oxygen sensor (front) monitor (Rich/ lean switching)	PCM monitors the deteriorated condition of the left bank heated oxygen sensor (front) by checking the lean/rich switching frequency of the left bank heated oxygen sensor (front).	HO2S B2 SENSOR1 Rich/Lean Switching Count Test Result and Limit Value (min.)	× 1 count
0B	Right bank heated oxygen sensor (rear) monitor (Voltage)	PCM checks the output voltage of the right bank heated oxygen sensor (rear) in order to monitor whether the heated right bank oxygen sensor (rear) output is stuck.	HO2S B1 SENSOR2 Change in Volt Test Result and Limit Value (min.)	× 19.5 mV
0C	Left bank heated oxygen sensor (rear) monitor (Voltage)	PCM checks the output voltage of the left bank heated oxygen sensor (rear) in order to monitor whether the left bank heated oxygen sensor (rear) output is stuck.	HO2S B2 SENSOR2 Change in Volt Test Result and Limit Value (min.)	× 19.5 mV

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

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



DIAGNOSTIC BY DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY)

Required Special Tool:

- MB991502: Scan Tool (MUT-II)

⚠ CAUTION

To prevent damage to scan tool MB991502, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502.

NOTE: When mode II is selected with MUT-II, the Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) will light when the powertrain control module (PCM) first detects the trouble (Note that this is only for emission-related trouble). At the same time, the relevant diagnostic trouble codes will be registered. In respect to the comprehensive component electrical faults (opens/shorts), the time for the diagnostic trouble code to be registered after the fault occurrence is four seconds " one second. Therefore, the confirmation of the trouble symptom and the confirmation after completing repairs can be reduced. To return to the normal mode I after mode II

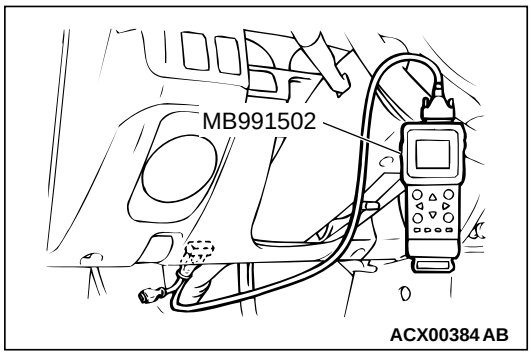
has been selected once, the ignition switch must be turned "OFF" once or mode I must be reselected with MUT-II. The diagnostic trouble code, readiness test status and freeze frame data, etc., will be erased when mode I is returned to, so record these before returning to mode I.

1. Connect scan tool MB991502 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Change the diagnostic test mode of the powertrain control module to DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY).
4. Road test the vehicle.
5. Read the diagnostic trouble code and repair the malfunctioning part.
6. Turn the ignition switch to the "LOCK" (OFF) position.
7. Disconnect scan tool MB991502 from the data link connector.

INSPECTION USING SCAN TOOL MB991502, DATA LIST AND ACTUATOR TESTING

Required Special Tool:

- MB991502: Scan Tool (MUT-II)



⚠ CAUTION

To prevent damage to scan tool MB991502, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502.

1. Connect scan tool MB991502 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Carry out inspection by means of the data list and the actuator test function. If there is an abnormality, check and repair the chassis harnesses and components. Refer to Data List Reference Table P.13Ab-28.
   Refer to Actuator Test Reference Table P.13Ab-41.
4. Re-check using scan tool MB991502 and check to be sure that the abnormal input and output have returned to normal because of the repairs.
5. Erase the diagnostic trouble code(s).
6. Turn the ignition switch to the "LOCK" (OFF) position.
7. Disconnect scan tool MB991502 from the data link connector.
8. Start the engine again and do a test drive to confirm that the problem is eliminated.

ON-BOARD DIAGNOSTICS

The powertrain control module (PCM) monitors the input/output signals (some signals all the time and others under specified conditions) of the PCM. When a malfunction continues for a specified time or longer after the irregular signal is initially monitored, the PCM judges that a malfunction has occurred. After the PCM first detects a malfunction, a diagnostic trouble code is recorded when the engine is restarted and the same malfunction is re-detected. However, for items marked with a "*", a diagnostic trouble code is recorded on the first detection of the malfunction. There are 102 diagnostic items. The diagnostic results can be read out with a scan tool. Since memorization of the diagnostic trouble codes is backed up directly by the battery, the diagnostic results are memorized even if the ignition key is turned off. The diagnostic trouble codes will, however, be erased when the battery terminal or the PCM connector is disconnected. In addition, the diagnostic trouble code can also be erased by turning the ignition switch to "ON" position and sending the diagnostic trouble code erase signal from scan tool MUT-II (MB991502) to the PCM.

NOTE: If the sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code is memorized. In this case, send the diagnostic trouble code erase signal to the PCM in order to erase the diagnostic memory. The 102 diagnostic items are all indicated sequentially from the smallest code number. The PCM records the engine operating condition when the diagnostic trouble code is set. This data is called "Freeze-frame" date. This data can be read by using the scan tool, and can then be used in simulation tests for troubleshooting. Data items are as follows:

NOTE: If the PCM detects multiple malfunctions, the PCM stores the data for only the first item that was detected.

However, if the PCM detects a misfire or a fuel system malfunction, PCM tores the data by giving priority to the misfire or fuel system malfunction, regardless of the order in which the malfunction was detected.

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

MUT-II SCAN TOOL DISPLAY	ITEM NO.	DATA ITEM	UNIT or STATE
ECT SENSOR	21	Engine coolant temperature sensor	°C or °F
ENGINE LOAD	87	Calculation load value	%
ENGINE SPEED	22	Crankshaft position sensor	r/min
IAT SENSOR	13	Intake air temperature sensor	°C or °F
IG. TIMING ADV	44	Ignition coils and ignition power transistor	deg
LONG TRIM B1	81	Long-term fuel compensation	%
LONG TRIM B2	83	Long-term fuel compensation	%
SHORT TRIM B1	82	Short-term fuel compensation	%
SHORT TRIM B2	84	Short-term fuel compensation	%
SYS. STATUS B1	88	Fuel control condition (right bank)	• Open loop • Closed loop • Open loop-drive condition • Open loop-DTC set • Closed loop-O_2 (rear) failed

MUT-II SCAN TOOL DISPLAY	ITEM NO.	DATA ITEM	UNIT or STATE
SYS. STATUS B2	89	Fuel control condition (left bank)	• Open loop • Closed loop • Open loop-drive condition • Open loop-DTC set • Closed loop-O_2 (rear) failed
TP SENSOR	8A	Throttle position sensor	%
VAF SENSOR	12	Volume air flow sensor (mass air flow rate)	gm/s
VSS	24	Vehicle speed sensor	km/h or mph

OBD- II DRIVE CYCLE

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

⚠ CAUTION

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

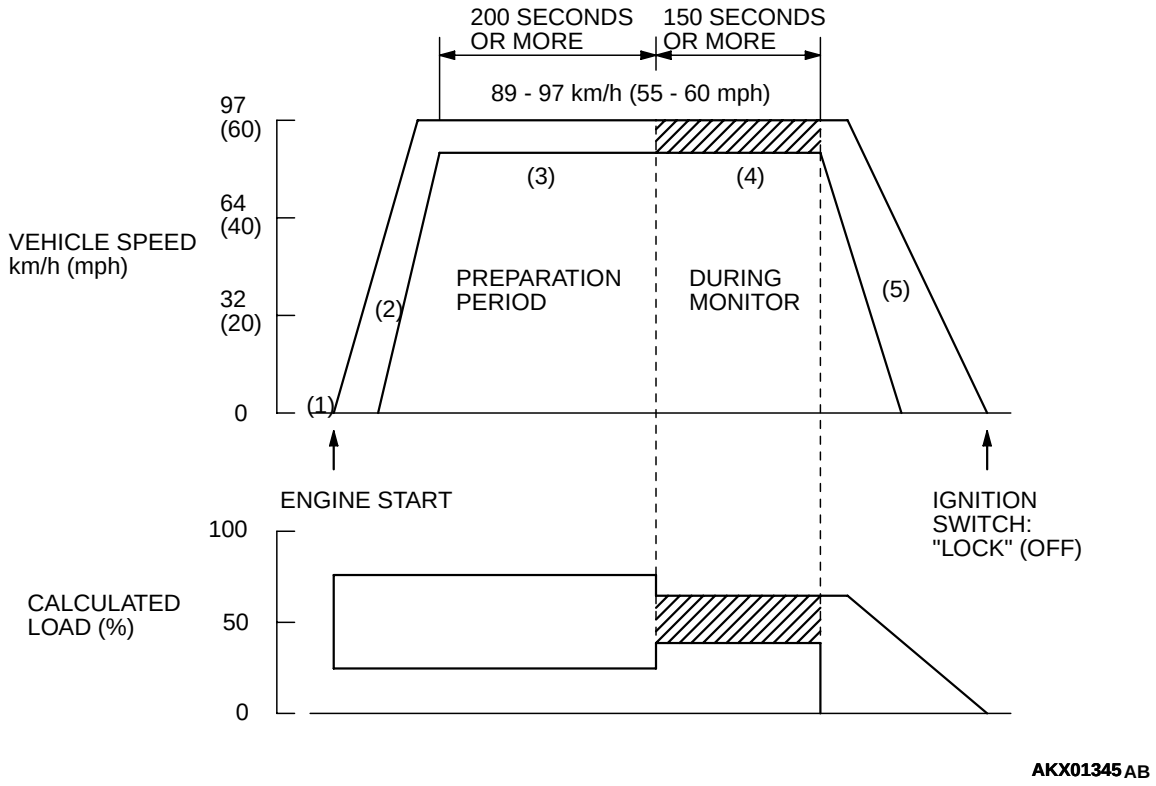
NOTE: Check that the diagnosis trouble code (DTC) is not output before traveling in the drive cycle pattern. Erase the DTC if it has been output.

DRIVE CYCLE PATTERN LIST

PROCEDURE	MONITOR ITEM	DIAGNOSTIC TROUBLE CODE (DTC)
1	Evaporative emission control system leak monitor	P0441, P0442, P0451, P0452, P0453, P0455, P0456
2	Fuel trim monitor	P0171, P0172, P0174, P0175
3	Catalytic converter monitor	P0421, P0431
4	Heated oxygen sensor monitor	P0133, P0139, P0153, P0159
5	Exhaust gas recirculation (EGR) system monitor	P0401

PROCEDURE	MONITOR ITEM		DIAGNOSTIC TROUBLE CODE (DTC)
6	Other monitor	Main components	P0134, P0154, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0506, P0507, P1400
		Sensors and switches	P0101, P0102, P0106, P107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0121, P0122, P0123, P0125, P0181, P0182, P0183, P0325, P0335, P0340, P0461
		Wire breakage and short circuit	P0130, P0131, P0132, P0135, P0136, P0137, P0138, P0141, P0150, P0151, P0152, P0155, P0156, P0157, P0158, P0161, P0201, P0202, P0203, P0204, P0205, P0206, P0403, P0443, P0446

PROCEDURE 1

EVAPORATIVE EMISSION CONTROL SYSTEM LEAK MONITOR	
DTC	P0441, P0442, P0451, P0452, P0453, P0455, P0456
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 8 minutes. You must complete this drive twice. *NOTE: Vehicle speed and throttle opening angle should be within the shaded range.*  AKX01345 AB
Inspection conditions	• Engine coolant temperature: 45°C (113°F) or less (The engine is stopped before the test drive is started) • Atmospheric temperature: 5 – 45°C (41 – 113°F) • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 89 – 97 km/h (55 – 60 mph). 3. Travel for 200 seconds or more while keeping the vehicle speed at 89 – 97 km/h (55 – 60 mph). 4. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 89 – 97 km/h (55 – 60 mph) and travel for 150 seconds or more. (During monitor) 5. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 6. Confirm that the diagnostic trouble code (DTC) is not output. 7. If DTC P0441 is output, refer to GROUP 13A, DTC P0441 – Evaporative Emission Control System Incorrect Purge Flow P.13Ac-376. If DTC P0442 is output, refer to GROUP 13A, DTC P0442 – Evaporative Emission Control System Leak Detected (Small Leak) P.13Ac-378. If DTC P0451 is output, refer to GROUP 13A, DTC P0451 – Evaporative Emission Control System Pressure Sensor Range/performance P.13Ac-407. If DTC P0452 is output, refer to GROUP 13A, DTC P0452 – Evaporative Emission Control System Pressure Sensor Low Input P.13Ac-427. If DTC P0453 is output, refer to GROUP 13A, DTC P0453 – Evaporative Emission Control System Pressure Sensor High Input P.13Ac-446. If DTC P0455 is output, refer to GROUP 13A, DTC P0455 – Evaporative Emission Control System Leak Detected (Gross Leak) P.13Ac-465. If DTC P0456 is output, refer to GROUP 13A, DTC P0456 – Evaporative Emission Control System Leak Detected (Very Small Leak) P.13Ac-478.

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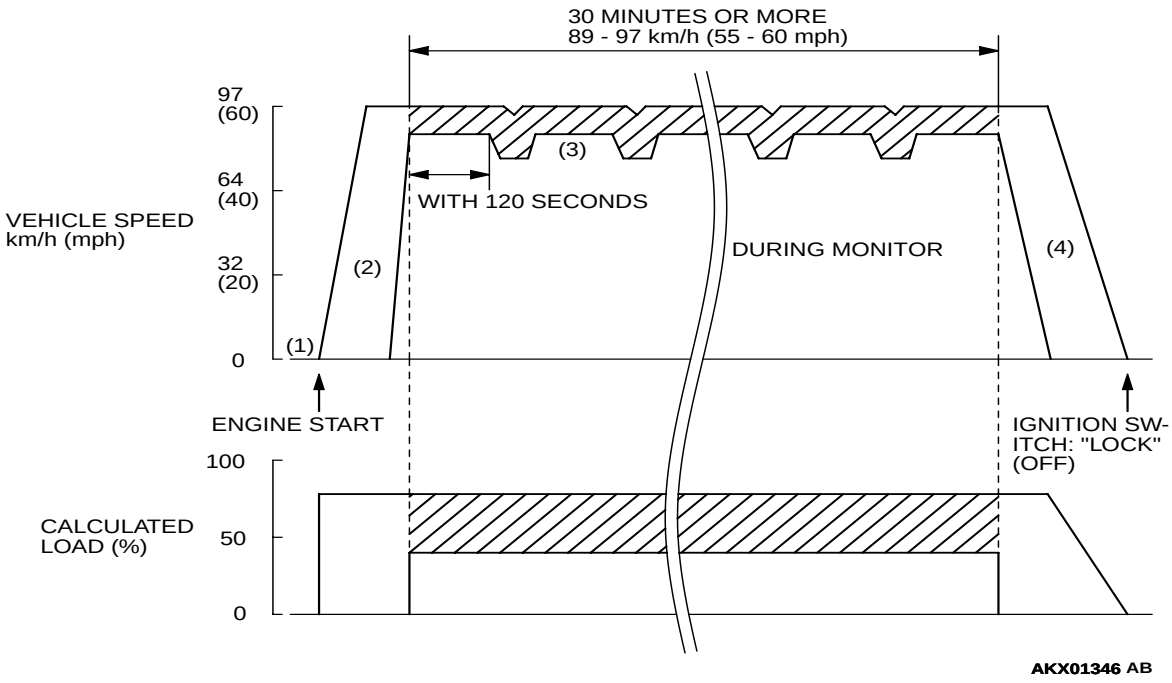
PROCEDURE 2

FUEL TRIM MONITOR	
DTC	P0171, P0172, P0174, P0175
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 35 minutes. You must complete this drive twice. *NOTE: Vehicle speed and throttle opening angle should be within the shaded range.* 
Inspection conditions	• Engine coolant temperature: 80 – 97°C (176 – 207°F) • Atmospheric temperature: –10 – 60°C (14 – 140°F) • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 89 – 97 km/h (55 – 60 mph). 3. Travel for 30 minutes or more while keeping the vehicle speed at 89 – 97 km/h (55 – 60 mph). (M/T: 5th speed) Carry out one gradual deceleration/acceleration returning to 89 – 97 km/h (55 – 60 mph) within 120 seconds. (During monitor) 4. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output. 6. If DTC P0171 is output, refer to GROUP 13A, DTC P0171 – System too lean (Bank 1) P.13Ac-270. If DTC P0172 is output, refer to GROUP 13A, DTC P0172 – System too rich (Bank 1) P.13Ac-277. If DTC P0174 is output, refer to GROUP 13A, DTC P0174 – System too lean (Bank 2) P.13Ac-281. If DTC P0175 is output, refer to GROUP 13A, DTC P0175 – System too rich (Bank 2) P.13Ac-288.

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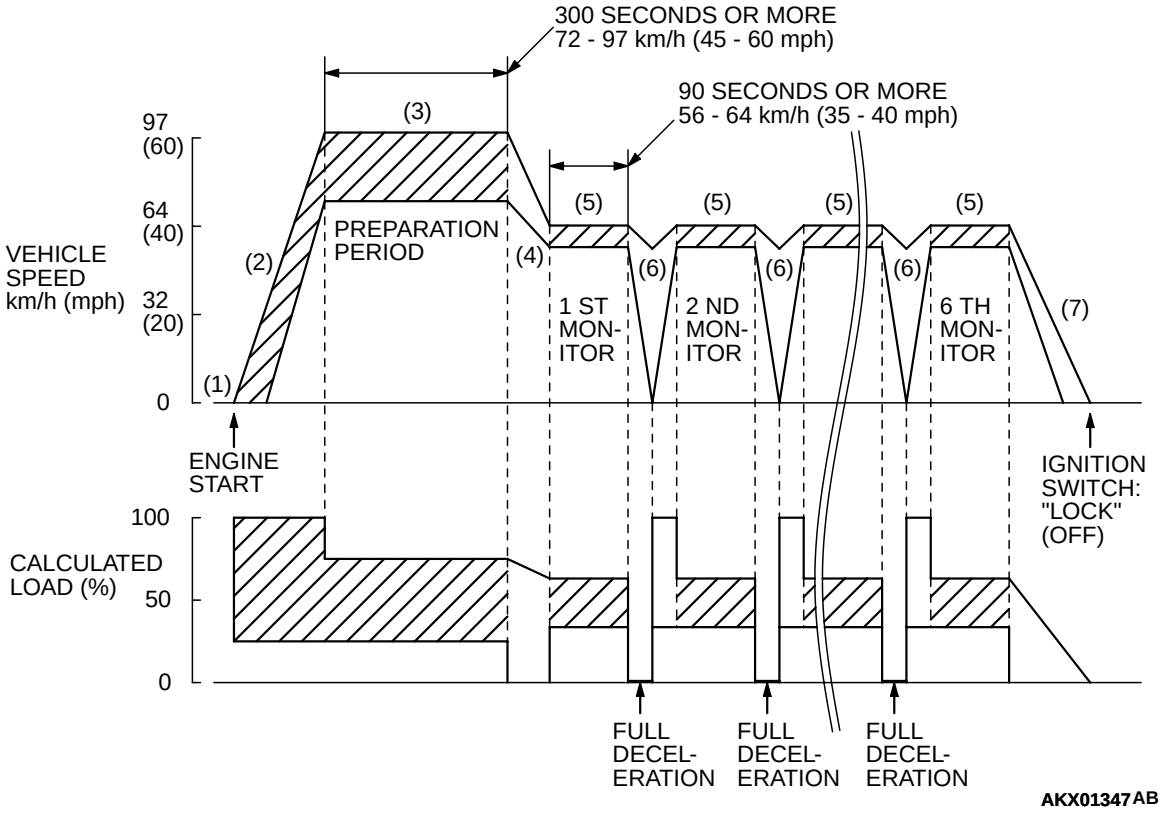
PROCEDURE 3

CATALYTIC CONVERTER MONITOR	
DTC	P0421, P0431
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 20 minutes. You must complete this drive twice. *NOTE: Vehicle speed and throttle opening angle should be within the shaded range.* 
Inspection conditions	• Atmospheric temperature: –10°C (14°F) or more • A/C switch: OFF • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 72 km/h (45 mph). 3. Travel for 300 seconds or more while keeping the vehicle speed at 72 – 97 km/h (45 – 60 mph). 4. Decelerate until the vehicle speed is within 56 – 64 km/h (35 – 40 mph). 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 56 – 64 km/h (35 – 40 mph) and travel for 90 seconds or more. (During monitor) 6. Fully close the throttle and decelerate, and keep the deceleration state for 10 seconds. Then, quickly accelerate until the vehicle speed reaches 56 – 64 km/h (35 – 40 mph). Then, repeat steps 5 and 6, and complete six monitor sessions. 7. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 8. Confirm that the diagnostic trouble code (DTC) is not output. 9. If DTC P0421 is output, refer to GROUP 13A, DTC P0421 – Warm Up Catalyst Efficiency Below Threshold (Bank 1) P.13Ac-370. If DTC P0431 is output, refer to GROUP 13A, DTC P0431 – Warm Up Catalyst Efficiency Below Threshold (Bank 2) P.13Ac-373.

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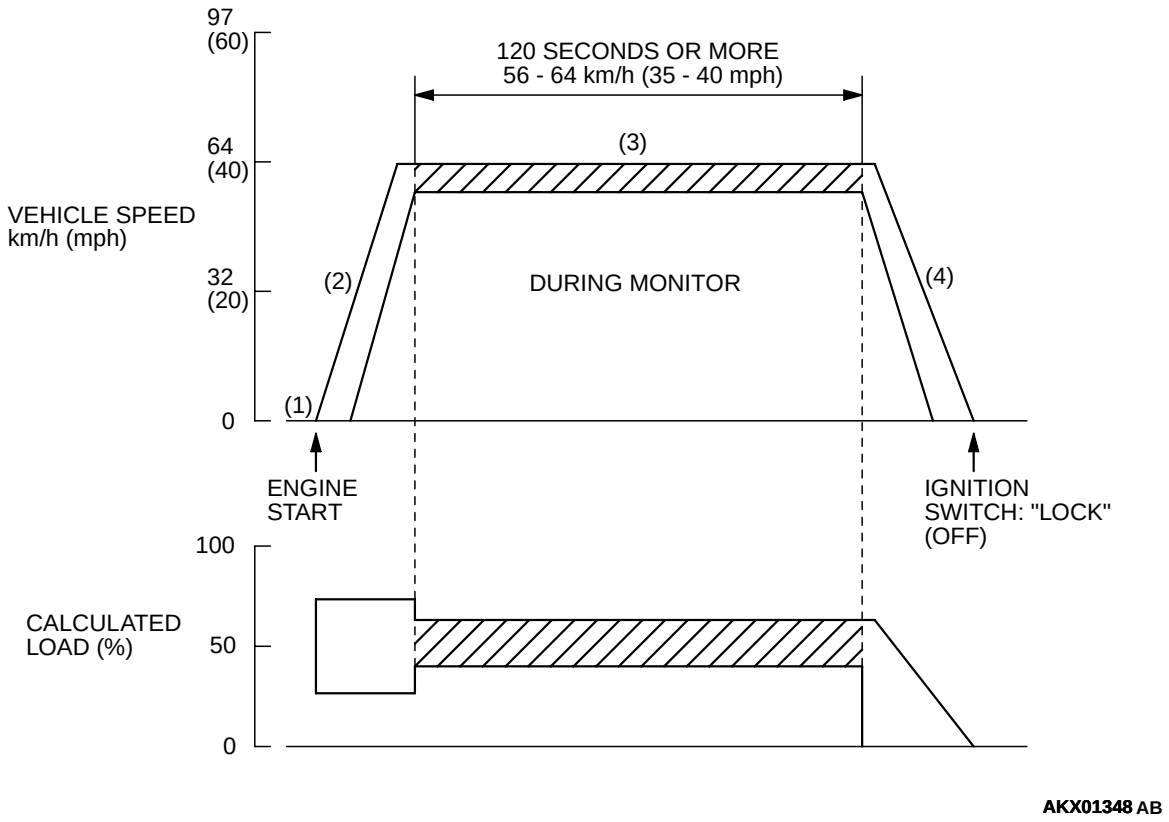
PROCEDURE 4

HEATED OXYGEN SENSOR MONITOR	
DTC	P0133, P0139, P0153, P0159
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes. You must complete this drive twice. *NOTE: Vehicle speed and throttle opening angle should be within the shaded range.*  AKX01348 AB
Inspection conditions	• Engine coolant temperature: 80°C (176°F) or more • Atmospheric temperature: –10°C (14°F) or more • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph). 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 56 – 64 km/h (35 – 40 mph) and travel for 120 seconds or more. (During monitor) 4. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 5. Confirm that the diagnostic trouble code (DTC) is not output. 6. If DTC P0133 is output, refer to GROUP 13A, DTC P0133 – Heated oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1) P.13Ac-142. If DTC P0139 is output, refer to GROUP 13A, DTC P0139 – Heated oxygen Sensor Circuit Slow Response (Bank 1 Sensor 2) P.13Ac-183. If DTC P0153 is output, refer to GROUP 13A, DTC P0153 – Heated oxygen Sensor Circuit Slow Response (Bank 2 Sensor 1) P.13Ac-216. If DTC P0159 is output, refer to GROUP 13A, DTC P0159 – Heated oxygen Sensor Circuit Slow Response (Bank 2 Sensor 2) P.13Ac-257.

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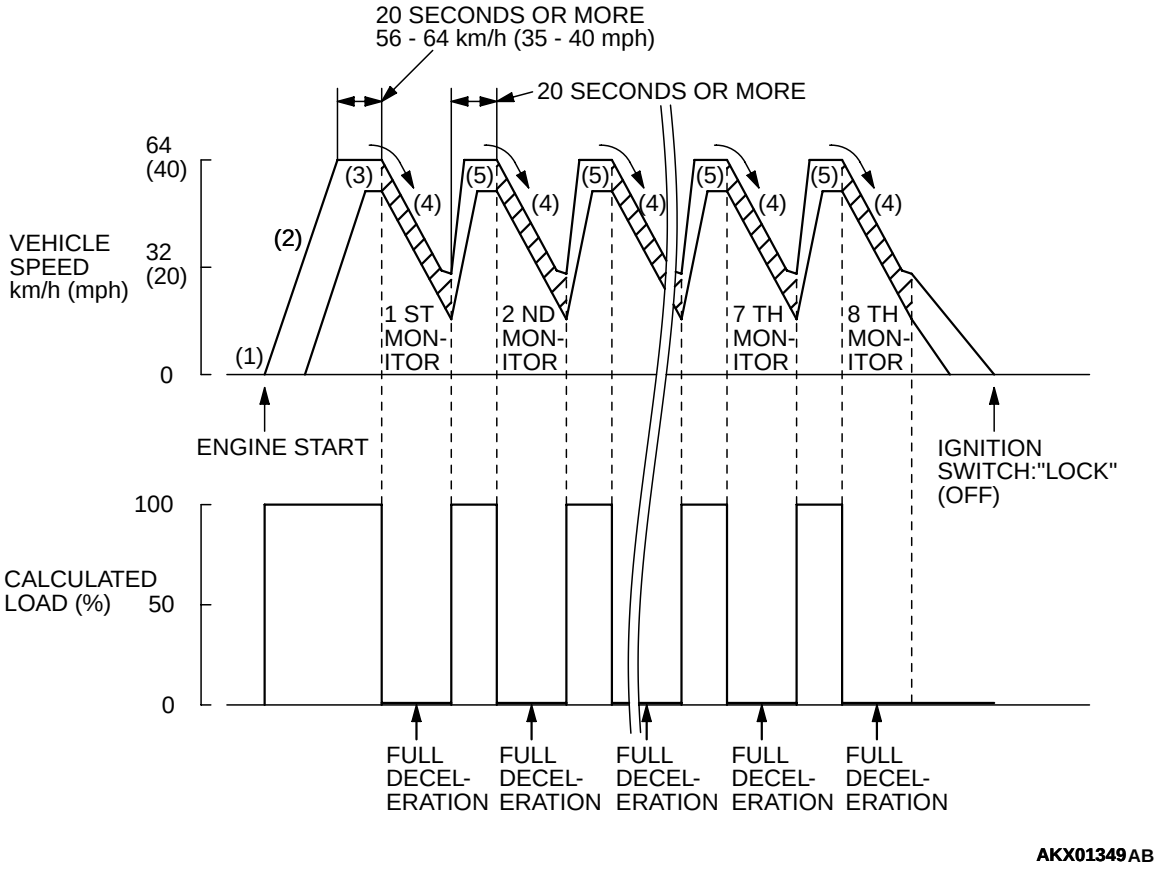
PROCEDURE 5

EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITOR	
DTC	P0401
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes. You must complete this drive twice. *NOTE: Vehicle speed and throttle opening angle should be within the shaded range.* 
Inspection conditions	• Engine coolant temperature: 80°C (176°F) or more • Atmospheric temperature: 5°C (41°F) or more • A/C switch: OFF • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph). 3. Travel for 20 seconds or more while keeping the vehicle speed at 56 – 64 km/h (35 – 40 mph). 4. Fully close the throttle from an engine speed of 2,000 – 3,000 r/min, and while keeping the clutch engaged, decelerate to approximately 900 r/min without applying the brakes. Do not steer the handle or turn the light ON/OFF during this time. (During monitor) 5. Accelerate until the vehicle speed reaches 56 – 64 km/h (35 – 40 mph), and travel for 20 seconds or more. Then, repeat steps 4 and 5 and complete 8 monitor sessions. 6. Return the vehicle to the shop, then turn the ignition switch to "LOCK" (OFF) position. 7. Confirm that the diagnostic trouble code (DTC) is not output. 8. If DTC P0401 is output, refer to GROUP 13A, DTC P0401 – Exhaust Gas Recirculation Flow Insufficient detected P.13Ac-360.

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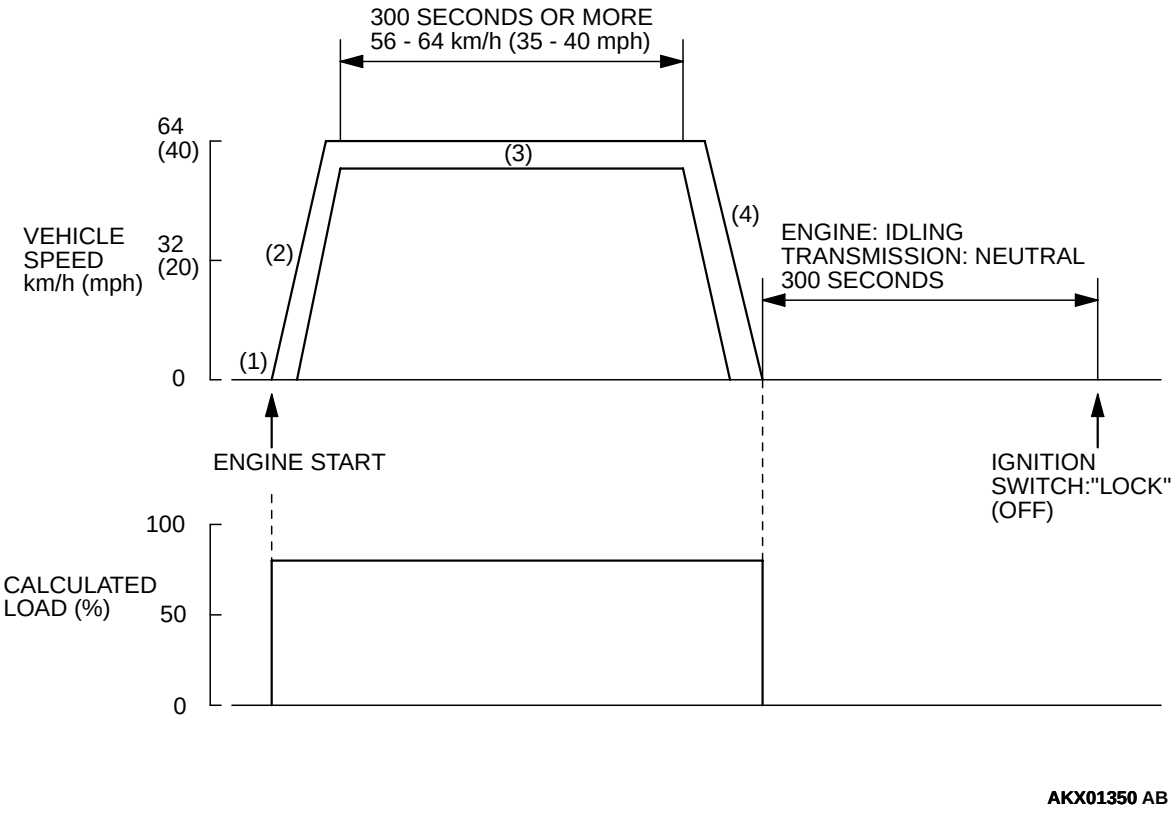
PROCEDURE 6

OTHER MONITOR (Main components, sensors and switches, wire breakage and short circuit)	
DTC	• Main components: P0134, P0154, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0506, P0507, P1400 • Sensors and switches: P0101, P0102, P0106, P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0121, P0122, P0123, P0125, P0181, P0182, P0183, P0325, P0335, P0340, P0461 • Wire breakage and short circuit: P0130, P0131, P0132, P0135, P0136, P0137, P0138, P0141, P0150, P0151, P0152, P0155, P0156, P0157, P0158, P0161, P0201, P0202, P0203, P0204, P0205, P0206, P0403, P0443, P0446
Drive cycle pattern	This monitor [from start to ignition switch "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes. You must complete this drive twice. *NOTE: Drive according to the graph below.*  AKX01350 AB
Inspection conditions	• Engine coolant temperature: 80°C (176°F) or more • Atmospheric temperature: 5°C (41°F) or more • Condition of A/T: Selector lever D range
Test procedure	1. Engine: start 2. Accelerate until the vehicle speed is 56 – 64 km/h (35 – 40 mph), and travel for 300 seconds or more. 3. Return the vehicle to the shop. 4. After stopping the vehicle, continue idling for 300 seconds, and then turn the ignition switch to the "LOCK" (OFF) position. Moreover, the vehicle should be set to the following conditions for idling. • A/C switch: OFF • Lights and all accessories: OFF • Transmission: P range • Steering wheel: Straightforward position 5. Confirm that the diagnostic trouble code (DTC) is not output. 6. If a DTC is displayed, refer to Diagnostic Trouble Code Chart P.13Ab-21.

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READINESS TEST STATUS

PURPOSE

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

OVERVIEW

The PCM monitors the following main diagnosis items and records whether the evaluation was completed or is incomplete. The Readiness codes were established for the I/M programs, thereby confirming that the vehicle was not tampered with by erasing the diagnostic trouble code(s) (DTC's) before I/M testing. The Readiness and DTC codes can be reset by disconnecting the battery or by erasing the codes with a scan tool. For this reason all Readiness codes must read "Complete" before I/M testing.

When the monitors run and complete, the MUT-II will record the Readiness Code as " Complete " (General Scan Tools record as " Ready "). When the vehicle is operating normally and the OBD-II Drive Cycle is carried out, Readiness Code will set as " Complete " on the first drive cycle. If during the first drive cycle a fault is detected then, a second drive is required before the Readiness Code will " Complete. " If the fault is still there, then a DTC will set.

- Catalyst: P0421, P0431
- Evaporative system: P0442, P0455, P0456
- Heated oxygen sensor: P0133, P0153
- Heated oxygen sensor heater: P0135, P0141, P0155, P0161
- EGR system: P0401

After the Readiness is "Complete," the technician is assured that any DTC's associated with that 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 DTC's.

NOTE: After a repair is mode for a DTC the technician should drive the OBD-II drive cycle checking that the MUT-II records all Readiness as "Complete".

FAIL-SAFE/BACKUP FUNCTION TABLE

M1131153000169

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

MALFUNCTION ITEM	DEFAULT VALUES DURING MALFUNCTIONS
Volume air flow sensor	1. 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. 2. Fixes the IAC motor in the appointed position so idle air control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C (77°F).
Throttle position sensor	No increase in fuel injection amount during acceleration due to the unreliable throttle position sensor signal.
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 the "LOCK" (OFF) position even though the sensor signal returns to normal.)
Camshaft position sensor	Injects fuel simultaneously into all cylinders. (After the ignition switch is turned to the "ON" position, the No.1 cylinder top dead center is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa (30 in Hg).
Heated oxygen sensor <front>	Air/fuel ratio closed loop control is not performed.
Heated oxygen sensor <rear>	Performs the closed loop control of the air/fuel ratio by using only the signal of the heated oxygen sensor (front) installed on the front side of the catalytic converter.
Misfire detection	The PCM stops supplying fuel to the cylinder with the highest misfiring rate if a misfiring that could damage the catalytic converter is detected.

DIAGNOSTIC TROUBLE CODE CHART

M1131151000301

DTC CODE	DIAGNOSTIC ITEMS	REFERENCE PAGE
P0101*	Volume air flow circuit range/performance problem	P.13Ac-2
P0102*	Volume air flow circuit low input	P.13Ac-9
P0106*	Barometric pressure circuit range/performance problem	P.13Ac-17
P0107*	Barometric pressure circuit low input	P.13Ac-24
P0108*	Barometric pressure circuit high input	P.13Ac-38
P0111*	Intake air temperature circuit range/performance problem	P.13Ac-47
P0112*	Intake air temperature circuit low input	P.13Ac-54
P0113*	Intake air temperature circuit high input	P.13Ac-59
P0116*	Engine coolant temperature circuit range/performance problem	P.13Ac-66
P0117*	Engine coolant temperature circuit low input	P.13Ac-76
P0118*	Engine coolant temperature circuit high input	P.13Ac-81
P0121*	Throttle position sensor circuit range/performance problem	P.13Ac-89
P0122*	Throttle position sensor circuit low input	P.13Ac-98
P0123*	Throttle position sensor circuit high input	P.13Ac-105
P0125*	Insufficient coolant temperature for closed loop fuel control	P.13Ac-111
P0128	Coolant thermostat (coolant temperature below thermostat regulating temperature)	P.13Ac-121
P0130	Heated oxygen sensor circuit (bank 1 sensor 1)	P.13Ac-122
P0131	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)	P.13Ac-132
P0132	Heated oxygen sensor circuit high voltage (bank 1 sensor 1)	P.13Ac-138
P0133	Heated oxygen sensor circuit slow response (bank 1 sensor 1)	P.13Ac-142
P0134*	Heated oxygen sensor circuit no activity detected (bank 1 sensor 1)	P.13Ac-145
P0135	Heated oxygen sensor heater circuit (bank 1 sensor 1)	P.13Ac-153
P0136	Heated oxygen sensor circuit (bank 1 sensor 2)	P.13Ac-163
P0137	Heated oxygen sensor circuit low voltage (bank 1 sensor 2)	P.13Ac-173
P0138	Heated oxygen sensor circuit high voltage (bank 1 sensor 2)	P.13Ac-179
P0139	Heated oxygen sensor circuit slow response (bank 1 sensor 2)	P.13Ac-183
P0141	Heated oxygen sensor heater circuit (bank 1 sensor 2)	P.13Ac-186
P0150	Heated oxygen sensor circuit (bank 2 sensor 1)	P.13Ac-196
P0151	Heated oxygen sensor circuit low voltage (bank 2 sensor 1)	P.13Ac-206
P0152	Heated oxygen sensor circuit high voltage (bank 2 sensor 1)	P.13Ac-212
P0153	Heated oxygen sensor circuit slow response (bank 2 sensor 1)	P.13Ac-216
P0154*	Heated oxygen sensor circuit no activity detected (bank 2 sensor 1)	P.13Ac-219
P0155	Heated oxygen sensor heater circuit (bank 2 sensor 1)	P.13Ac-227
P0156	Heated oxygen sensor circuit (bank 2 sensor 2)	P.13Ac-237

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DTC CODE	DIAGNOSTIC ITEMS	REFERENCE PAGE
P0157	Heated oxygen sensor circuit low voltage (bank 2 sensor 2)	P.13Ac-247
P0158	Heated oxygen sensor circuit high voltage (bank 2 sensor 2)	P.13Ac-253
P0159	Heated oxygen sensor circuit slow response (bank 2 sensor 2)	P.13Ac-257
P0161	Heated oxygen sensor heater circuit (bank 2 sensor 2)	P.13Ac-261
P0171	System too lean (bank 1)	P.13Ac-270
P0172	System too rich (bank 1)	P.13Ac-277
P0174	System too lean (bank 2)	P.13Ac-281
P0175	System too rich (bank 2)	P.13Ac-288
P0181	Fuel temperature sensor circuit range/performance	P.13Ac-294
P0182	Fuel temperature sensor circuit low input	P.13Ac-301
P0183	Fuel temperature sensor circuit high input	P.13Ac-306
P0201	Injector circuit–Cylinder 1	P.13Ac-313
P0202	Injector circuit–Cylinder 2	P.13Ac-313
P0203	Injector circuit–Cylinder 3	P.13Ac-313
P0204	Injector circuit–Cylinder 4	P.13Ac-313
P0205	Injector circuit–Cylinder 5	P.13Ac-313
P0206	Injector circuit–Cylinder 6	P.13Ac-313
P0300	Random/multiple cylinder misfire detected	P.13Ac-322
P0301	Cylinder 1 misfire detected	P.13Ac-328
P0302	Cylinder 2 misfire detected	P.13Ac-328
P0303	Cylinder 3 misfire detected	P.13Ac-328
P0304	Cylinder 4 misfire detected	P.13Ac-328
P0305	Cylinder 5 misfire detected	P.13Ac-328
P0306	Cylinder 6 misfire detected	P.13Ac-328
P0335*	Crankshaft position sensor circuit	P.13Ac-333
P0340*	Camshaft position sensor circuit	P.13Ac-347
P0401	Exhaust gas recirculation flow insufficient detected	P.13Ac-360
P0403	Exhaust gas recirculation control circuit	P.13Ac-362
P0421	Warm up catalyst efficiency below threshold (bank 1)	P.13Ac-370
P0431	Warm up catalyst efficiency below threshold (bank 2)	P.13Ac-373
P0441	Evaporative emission control system incorrect purge flow	P.13Ac-376
P0442	Evaporative emission control system leak detected (Small leak)	P.13Ac-378
P0443	Evaporative emission control system purge control valve circuit	P.13Ac-391
P0446	Evaporative emission control system vent control	P.13Ac-399
P0451	Evaporative emission control system pressure sensor range/performance	P.13Ac-407
P0452	Evaporative emission control system pressure sensor low input	P.13Ac-427

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DTC CODE	DIAGNOSTIC ITEMS		REFERENCE PAGE
P0453	Evaporative emission control system pressure sensor high input		P.13Ac-446
P0455	Evaporative emission control system leak detected (Gross leak)		P.13Ac-465
P0456	Evaporative emission control system leak detected (Very small leak)		P.13Ac-478
P0461	Fuel level sensor circuit range/performance		P.13Ac-490
P0500	Vehicle speed signal malfunction	• A/T DTC No. 29 (Vehicle speed sensor system: Short circuit/open circuit	P.23Ab-28
P0506	Idle control system RPM lower than expected (3.0L Engine)		P.13Ac-494
P0506	Idle control system RPM lower than expected (3.5L Engine)		P.13Ac-504
P0507	Idle control system RPM higher than expected (3.0L Engine)		P.13Ac-514
P0507	Idle control system RPM higher than expected (3.5L Engine)		P.13Ac-524
P0513	Immobilizer malfunction		P.13Ac-533
P0551	Power steering pressure sensor circuit range/performance		P.13Ac-534
P0554	Power steering pressure sensor circuit intermittent		P.13Ac-542
P0705	Transmission range sensor circuit malfunction (PRNDL input)	• A/T DTC No. 27 (Park/Neutral position switch system: Open circuit) • A/T DTC No. 28 (Park/Neutral position switch system: Short circuit)	P.23Ab-28
P0712	Transmission fluid temperature sensor low input	• A/T DTC No. 16 (Oil temperature sensor system: Short circuit)	P.23Ab-28
P0713	Transmission fluid temperature sensor high input	• A/T DTC No. 15 (Oil temperature sensor system: Open circuit)	P.23Ab-28
P0715	Input/turbine speed sensor circuit	• A/T DTC No. 22 (Input shaft speed sensor system: Short circuit/Open circuit)	P.23Ab-28
P0720	Output speed sensor circuit	• A/T DTC No. 23 (Output shaft speed sensor system: Short circuit/Open circuit)	P.23Ab-28
P0731	Gear 1 incorrect	• A/T DTC No. 41 (1st gear incorrect ratio)	P.23Ab-28
P0732	Gear 2 incorrect	• A/T DTC No. 42 (2nd gear incorrect ratio)	P.23Ab-28
P0733	Gear 3 incorrect	• A/T DTC No. 43 (3rd gear incorrect ratio)	P.23Ab-28
P0734	Gear 4 incorrect	• A/T DTC No. 44 (4th gear incorrect ratio)	P.23Ab-28
P0736	Gear R incorrect	• A/T DTC No. 46 (Reverse gear incorrect ratio)	P.23Ab-28
P0741	Torque converter clutch circuit performance or stuck off	• A/T DTC No.52 (Torque converter clutch solenoid system: Defective system)	P.23Ab-28
P0742	Torque converter clutch circuit stuck on	• A/T DTC No. 53 (Torque converter clutch solenoid system: Lock-up stuck on)	P.23Ab-28
P0743	Torque converter clutch circuit electrical	• A/T DTC No. 36 (Torque converter clutch solenoid system: Short circuit/Open circuit)	P.23Ab-28
P0753	Shift solenoid "A" electrical	• A/T DTC No. 31 (Low and reverse solenoid valve system: Short circuit/Open circuit)	P.23Ab-28

DTC CODE	DIAGNOSTIC ITEMS		REFERENCE PAGE
P0758	Shift solenoid "B" electrical	• A/T DTC No. 32 (Underdrive solenoid valve system: Short circuit/Open circuit)	P.23Ab-28
P0763	Shift solenoid "C" electrical	• A/T DTC No. 33 (Second solenoid valve system: Short circuit/Open circuit)	P.23Ab-28
P0768	Shift solenoid "D" electrical	• A/T DTC No. 34 (Overdrive solenoid valve system: Short circuit/Open circuit)	P.23Ab-28
P1400	Manifold differential pressure sensor circuit malfunction		P.13Ac-547
P1603*	Battery backup circuit malfunction		P.13Ac-555
P1751	A/T control relay malfunction	• A/T DTC No. 54 (A/T control relay system: Short circuit to ground /open circuit)	P.23Ab-28

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

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

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

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

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

SYMPTOM CHART

M1131151500339

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

TROUBLE SYMPTOMS		INSPECTION PROCEDURE	REFERENCE PAGE
Communication with scan tool is impossible	Communication with all systems is not possible	1	P.13Ad-2
	Communication with PCM only is not possible	2	P.13Ad-4
Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp) and related parts	The malfunction indicator lamp (SERVICE ENGINE SOON or check engine lamp) does not illuminate right after the ignition switch is turned to the "ON" position	3	P.13Ad-8
	The malfunction indicator lamp (SERVICE ENGINE SOON or check engine lamp) remains illuminated and never goes out	4	P.13Ad-13
Starting	Cranks, won't start	5	P.13Ad-16
	Starts up and dies	6	P.13Ad-21
	Hard starting	7	P.13Ad-26
Idling stability (improper idling)	Unstable idle (rough idle, hunting)	8	P.13Ad-31
	Idle speed is high (improper idle speed)	9	P.13Ad-35
	Idle speed is low (improper idle speed)	10	P.13Ad-37
Idling stability (engine stalls)	When the engine is cold, it stalls at idle (die out)	11	P.13Ad-39
	When the engine is hot, it stalls at idle (die out)	12	P.13Ad-42
	The engine stalls when accelerating (pass out)	13	P.13Ad-47
	The engine stalls when decelerating	14	P.13Ad-48
Driving	Hesitation, sag or stumble	15	P.13Ad-50
	Acceleration shock	16	P.13Ad-53
	Deceleration shock	17	P.13Ad-54
	Poor acceleration	18	P.13Ad-56
	Surge	19	P.13Ad-59
	Knocking	20	P.13Ad-61
Dieseling (Run-on)		21	P.13Ad-62
Too high CO and HC concentration when idling		22	P.13Ad-62
IM240 test failure	Transient, mass emission tailpipe test failure	23	P.13Ad-64
	Purge flow test of the evaporative emission canister failure	24	P.13Ad-70
	Pressure test of the evaporative system failure	25	P.13Ad-70
Improper idle speed when the A/C is operating (A/C switch 2 signal)		26	P.13Ad-71
A/C condenser fan is inoperative		27	P.13Ad-74
Power supply system and ignition switch-IG system		28	P.13Ad-76
Fuel pump system		29	P.13Ad-85

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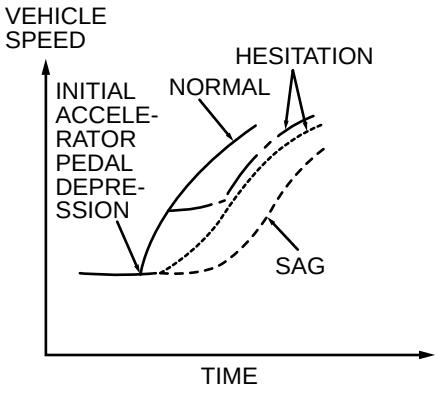
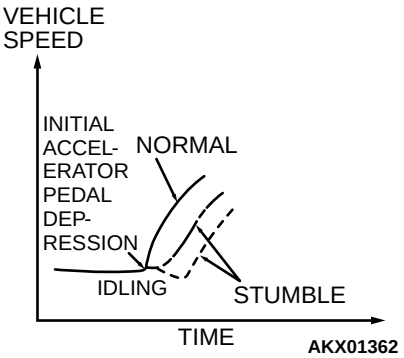
TROUBLE SYMPTOMS	INSPECTION PROCEDURE	REFERENCE PAGE
Ignition switch – ST system and park/neutral position switch system	30	P.13Ad-93
Ignition circuit system	31	P.13Ad-100
A/C system	32	P.13Ad-109

PROBLEM SYMPTOMS TABLE(FOR YOUR INFORMATION)

ITEMS		SYMPTOM
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 usual 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 or while it is being used.

ITEMS		SYMPTOM
Driving	Hesitation Sag	" Hesitation " is the delay in response of the vehicle speed (engine speed). This occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called " sag. "  AKX01361AB
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth. The inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration.  AKX01362
	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 usually work aloud. It sounds like a hammer striking the cylinder walls. It adversely affects driving.
Stopping	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. "

DATA LIST REFERENCE TABLE

M1131152000412

⚠ CAUTION

- **When shifting the selector lever to D range, the brakes should be applied so that the vehicle does not move forward.**
- **Driving tests always need two persons: one driver and one observer.**

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

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

*NOTE: *1: In a new vehicle [driven approximately 500 km (311 mile) or less], the volume air flow sensor output frequency is sometimes 10% higher than the standard frequency.*

*NOTE: *2: If the idle speed is lower than the standard value on a very cold engine [approximately –20°C (–4°F] even when the IAC motor is fully opened, the air volume limiter built in the throttle body could be defective.*

*NOTE: *3: The injector drive time represents the time when the cranking speed is at 250 r/min or below when the power supply voltage is 11 volts.*

*NOTE: *4: In a new vehicle [driven approximately 500 km (311 mile) or less], the injector drive time is sometimes 10% longer than the standard time.*

*NOTE: *5: In a new vehicle [driven approximately 500 km (311 mile) or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.*

*NOTE: *6: Applicable to GST*

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
A/C RELAY	49	A/C compressor clutch relay	Engine: warming up, idling		OFF	Procedure No. 32	P.13Ad-109
			Engine: warming up, idling	A/C compressor clutch is not operating	OFF		
				A/C compressor clutch is operating	ON		
A/C SWITCH	28	A/C switch	Engine: warming up, idling		OFF	Procedure No. 32	P.13Ad-109
			Engine: warming up, idling	A/C compressor clutch is not operating	OFF		
				A/C compressor clutch is operating	ON		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
BARO SENSOR	25	Barometric pressure sensor	Ignition switch: "ON"	At altitude of 0 m (0 ft)	101 kPa (29.8 in.Hg)	Code No.P0106, P0107, P0108	P.13Ac-17, P.13Ac-24, P.13Ac-38
				At altitude of 600 m (1,969 ft)	95 kPa (28.1 in.Hg)		
				At altitude of 1,200 m (3,937 ft)	88 kPa (26.0 in.Hg)		
				At altitude of 1,800 m (5,906 ft)	81 kPa (23.9 in.Hg)		
BATT VOLTAGE	16	Battery voltage (power supply)	Ignition switch: "ON"		Battery positive voltage	Procedure No. 28	P.13Ad-76
CRANK SENSOR	22	Crankshaft position sensor *2	• Engine: cranking • Tachometer: connected		Engine speeds displayed on the scan tool and tachometer are identical.	Code No. P0335	P.13Ac-333
			Engine: idling	Engine coolant temperature is –20°C (–4°F)	1,275 – 1,475 r/min <3.0L Engine> 1,300 – 1,500 r/min <3.5L Engine>		
				Engine coolant temperature is 0°C (32°F)	1,225 – 1,425 r/min <3.0L Engine> 1,200 – 1,400 r/min <3.5L Engine>		
				Engine coolant temperature is 20°C (68°F)	1,100 – 1,300 r/min		
				Engine coolant temperature is 40°C (104°F)	950 – 1,150 r/min <3.0L Engine> 900 – 1,150 r/min <3.5L Engine>		
				Engine coolant temperature is 80°C (176°F)	600 – 800 r/min		
CRANK SENSOR 2	38	Crankshaft position sensor	• Engine: cranking (at less than 2,000 r/min) • Tachometer: connected		The speeds indicated by the scan tool and tachometer match.	Code No. P0335	P.13Ac-333

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
CRANK. SIGNAL	18	Ignition switch crank signal	Ignition switch: "ON"	Engine: stopped	OFF	Procedure No. 30	P.13Ad-93
				Engine: cranking	ON		
ECT SENSOR	21	Engine coolant temperature sensor	Ignition switch: "ON" or with engine running	Engine coolant temperature is –20°C (–4°F)	–20°C (–4°F)	Code No. P0116, P0117, P0118	P.13Ac-66, P.13Ac-76, P.13Ac-81
				Engine coolant temperature is 0°C (32°F)	0°C (32°F)		
				Engine coolant temperature is 20°C (68°F)	20°C (68°F)		
				Engine coolant temperature is 40°C (104°F)	40°C (104°F)		
				Engine coolant temperature is 80°C (176°F)	80°C (176°F)		
ECT SENSOR	21*6	Engine coolant temperature sensor	Ignition switch: "ON" or with engine running	Engine coolant temperature is –20°C (–4°F)	–20°C (–4°F)	Code No. P0116, P0117, P0118	P.13Ac-66, P.13Ac-76, P.13Ac-81
				Engine coolant temperature is 0°C (32°F)	0°C (32°F)		
				Engine coolant temperature is 20°C (68°F)	20°C (68°F)		
				Engine coolant temperature is 40°C (104°F)	40°C (104°F)		
				Engine coolant temperature is 80°C (176°F)	80°C (176°F)		
ENGINE LOAD	37	Engine load (volumetric efficiency)	• Engine coolant temperature : 80 – 95 °C (176 – 203 °F) • Lights, electric cooling fan and all accessories : "OFF" • Transmission : "P" range	Engine is idling	15 – 35%	–	–
				2,500 r/min	15 – 35%		
				Racing	Volumetric efficiency increases according to amount of revving.		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
ENGINE LOAD 2	87*6	Engine load (Calculation load value)	Engine: warming up	Engine is idling	15 – 35%	–	–
				2,500 r/min	15 – 35%		
ENGINE SPEED	22*6	Crankshaft position sensor *2	• Engine: cranking • Tachometer: connected		Engine speeds displayed on the scan tool and tachometer are identical.	Code No.P0335	P.13Ac-333
			Engine: idling	Engine coolant temperature is –20°C (–4°F)	1,275 – 1,475 r/min <3.0L Engine> 1,300 – 1,500 r/min <3.5L Engine>		
				Engine coolant temperature is 0°C (32°F)	1,225 – 1,425 r/min <3.0L Engine> 1,200 – 1,400 r/min <3.5L Engine>		
				Engine coolant temperature is 20°C (68°F)	1,100 – 1,300 r/min		
				Engine coolant temperature is 40°C (104°F)	950 – 1,150 r/min <3.0L Engine> 900 – 1,150 r/min <3.5L Engine>		
				Engine coolant temperature is 80°C (176°F)	600 – 800 r/min		
FUEL TEMP	4A	Fuel tempreature sensor	In cooled srateignittion switch: "ON"		approximately the same as the outdoor temperature	Code No. P0181, P0182, P0183	P.13Ac-294, P.13Ac-301, P.13Ac-306

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
HO2S BANK1 S1	39	Heated oxygen sensor bank 1, sensor 1 (right front)	Engine: Warming up (Air/fuel mixture is made leaner when decelerating, and is made richer when revving.)	When the engine is running at 4,000 r/min, decelerate suddenly.	200 mV or less	Code No. P0130, P0131, P0132, P0133, P0134	P.13Ac-122, P.13Ac-132, P.13Ac-138, P.13Ac-142, P.13Ac-145
				When engine is suddenly raced.	600 – 1,000 mV		
			Engine: Warming up (the heated oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the PCM.)	Engine is idling 2,500 r/min	Voltage changes repeatedly between 400 mV or less and 600 – 1,000 mV.		
HO2S BANK1 S1	A1*6	Heated oxygen sensor bank 1, sensor 1 (right front)	Engine: Warming up (Air/fuel mixture is made leaner when decelerating, and is made richer when revving.)	When the engine is running at 4,000 r/min, decelerate suddenly.	0.2 V or less	Code No. P0130, P0131, P0132, P0133, P0134	P.13Ac-122, P.13Ac-163, P.13Ac-138, P.13Ac-142, P.13Ac-145
				When engine is suddenly raced.	0.6 – 1 V		
			Engine: Warming up (the heated oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the PCM.)	Engine is idling 2,500 r/min	Voltage changes repeatedly between 0.4 V or less and 0.6 – 1 V.		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
HO2S BANK1 S2	69	Heated oxygen sensor bank 1, sensor 2 (right rear)	Engine: warming up	Revving	0 and 600 – 1,000 mV alternate.	Code No. P0136, P0137, P0138, P0139	P.13Ac-163, P.13Ac-173, P.13Ac-179, P.13Ac-183
HO2S BANK1 S2	A2*6	Heated oxygen sensor bank 1, sensor 2 (right rear)	Engine: warming up	Revving	0 and 0.6 – 1 V alternate.	Code No. P0136, P0137, P0138, P0139	P.13Ac-163, P.13Ac-173, P.13Ac-179, P.13Ac-183
HO2S BANK2 S1	11	Heated oxygen sensor bank 2, sensor 1 (left front)	Engine: Warming up (air/fuel mixture is made leaner when decelerating, and is made richer when revving.)	When the engine is running at 4,000 r/min, decelerate suddenly.	200 mV or less	Code No. P0150, P0151, P0152, P0153, P0154	P.13Ac-196, P.13Ac-206, P.13Ac-212, P.13Ac-216, P.13Ac-219
				When engine is suddenly raced.	600 – 1,000 mV		
			Engine: Warming up (the heated oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the PCM)	Engine is idling 2,500 r/min	Voltage changes repeatedly between 400 mV or less and 600 – 1,000 mV.		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
HO2S BANK2 S1	A3*6	Heated oxygen sensor bank 2, sensor 1 (left front)	Engine: Warming up (air/fuel mixture is made leaner when decelerating, and is made richer when revving.)	When the engine is running at 4,000 r/min, decelerate suddenly.	0.2 V or less	Code No. P0150, P0151, P0152, P0153, P0154	P.13Ac-196, P.13Ac-206, P.13Ac-212, P.13Ac-216, P.13Ac-219
				When engine is suddenly raced.	0.6 – 1 V		
			Engine: Warming up (the heated oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the PCM)	Engine is idling 2,500 r/min	Voltage changes repeatedly between 0.4 V or less and 0.6 – 1 V.		
HO2S BANK2 S2	59	Heated oxygen sensor bank 2, sensor 2 (left rear)	Engine: warming up	Revving	0 and 600 – 1,000 mV alternate.	Code No. P0156, P0157, P0158, P0159	P.13Ac-237, P.13Ac-247, P.13Ac-253, P.13Ac-257
HO2S BANK2 S2	A4*6	Heated oxygen sensor bank 2, sensor 2 (left rear)	Engine: warming up	Revving	0 and 0.6 – 1 V alternate.	Code No. P0156, P0157, P0158, P0159	P.13Ac-237, P.13Ac-247, P.13Ac-253, P.13Ac-257

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
IAC VALVE POS	45	Idle air control (stepper) position*5	• Engine coolant temperature : 80 – 95°C (176 – 203°F) • Lights, electric cooling fan and all accessories : OFF • Transmission : "P" range • Engine: idling (when A/C switch is "ON. "A/C compressor should be operating)	A/C switch: "OFF"	2 – 25 STEP	–	–
				A/C switch: "OFF"→"ON"	Increases by 10 – 80 STEP		
				• A/C switch: "OFF" • selector lever: "N"→"D" range	Increases by 5 – 50 STEP		
IAT SENSOR	13	Intake air temperature sensor	Ignition switch: "ON" or with engine running	Intake air temperature is –20°C (–4°F)	–20°C (–4°F)	Code No. P0111, P0112, P0113	P.13Ac-47, P.13Ac-54, P.13Ac-59
				Intake air temperature is 0°C (32°F)	0°C (32°F)		
				Intake air temperature is 20°C (68°F)	20°C (68°F)		
				Intake air temperature is 40°C (104°F)	40°C (104°F)		
				Intake air temperature is 80°C (176°F)	80°C (176°F)		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
IAT SENSOR	13*6	Intake air temperature sensor	Ignition switch: "ON" or with engine running	Intake air temperature is –20°C (–4°F)	–20°C (–4°F)	Code No. P0111, P0112, P0113	P.13Ac-47, P.13Ac-54, P.13Ac-59
				Intake air temperature is 0°C (32°F)	0°C (32°F)		
				Intake air temperature is 20°C (68°F)	20°C (68°F)		
				Intake air temperature is 40°C (104°F)	40°C (104°F)		
				Intake air temperature is 80°C (176°F)	80°C (176°F)		
IG. TIMING ADV	44	Ignition coils and ignition power transistor	• Engine: warming up • Timing light is set (to check actual ignition timing)	Engine is idling	7 – 23°BTDC <3.0L Engine> 2 – 18°BTDC <3.5L Engine>	–	–
				2,500 r/min	27 – 47°BTDC		
IG. TIMING ADV	44*6	Ignition coils and ignition power transistor	• Engine: warming up • Timing light is set (to check actual ignition timing)	Engine is idling	7 – 23 deg <3.0L Engine> 2 – 18 deg <3.5L Engine>	–	–
				2,500 r/min	27 – 47 deg		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
INJECTORS B1	47	Injectors bank 1 (right)*3	Engine: cranking	When engine coolant temperature is 0°C (32°F)	13.8 – 20.6 mS <3.0L Engine> 11.4 – 17.2 mS <3.5L Engine>	–	–
				When engine coolant temperature is 20°C (68°F)	34 – 51 mS <3.0L Engine> 28 – 42 mS <3.5L Engine>		
				When engine coolant temperature is 80°C (176°F)	8.8 – 13.2 mS <3.0L Engine> 7.4 – 11.2 mS <3.5L Engine>		
		Injectors bank 1 (right)*4	• Engine coolant temperature : 80 – 95°C (176 – 203°F) • Lights, electric cooling fan and all accessories : OFF • Transmission : "P" range	Engine is idling	2.6 – 3.8 mS <3.0L Engine> 2.5 – 3.7 mS <3.5L Engine>		
				2,500 r/min	2.3 – 3.5 mS <3.0L Engine> 2.1 – 3.3 mS <3.5L Engine>		
				When engine is suddenly revved	Increases		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
INJECTORS B2	41	Injectors bank 2 (left)*3	Engine: cranking	When engine coolant temperature is 0°C (32°F)	13.8 – 20.6 mS <3.0L Engine> 11.4 – 17.2 mS <3.5L Engine>	–	–
				When engine coolant temperature is 20°C (68°F)	34 – 51 mS <3.0L Engine> 28 –42 mS <3.5L Engine>		
				When engine coolant temperature is 80°C (176°F)	8.8 – 13.2 mS <3.0L Engine> 7.4 – 11.2 mS <3.5L Engine>		
		Injectors bank 2 (left)*4	• Engine coolant temperature : 80 – 95°C (176 – 203°F) • Lights, electric cooling fan and all accessories : OFF • Transmission : "P" range	Engine is idling	2.6 – 3.8 mS <3.0L Engine> 2.5 – 3.7 mS <3.5L Engine>		
				2,500 r/min	2.3 – 3.5 mS <3.0L Engine> 2.1 – 3.3 mS <3.5L Engine>		
				When engine is suddenly revved	Increases		
LONG TRIM B1	81*6	Long-term fuel compensation (trim) bank 1	Engine: warming up, 2,500 r/min without any load (during closed loop)		–12.5 – 12.5%	Code No. P0171, P0172	P.13Ac-270, P.13Ac-277
LONG TRIM B2	83*6	Long-term fuel compensation (trim) bank 2	Engine: warming up, 2,500 r/min without any load (during closed loop)		–12.5 – 12.5%	Code No. P0174, P0175	P.13Ac-281, P.13Ac-288
MANIFOLD SNSR	95	Manifold differential pressure sensor	Engine: warming up, idling		20.6 – 34.0 kPa (6.1 – 10.0 in.Hg)	Code No. P1400	P.13Ac-547
PNP SWITCH	29	Park/neutral position switch	Ignition switch: ON	Selector lever: P or N	P, N	Procedure No. 30	P.13Ad-93
				Selector lever: D, 2, L, or R	D, 2, L, R		
PSP SWITCH	27	Power steering pressure switch	Engine: idling	Steering wheel stationary	OFF	Code No. P0551, P0554	P.13Ac-534, P.13Ac-542
				Steering wheel turning	ON		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
SHORT TRIM B1	82*6	Short-term fuel compensation (trim) bank 1	Engine: warming up, 2,500 r/min without any load (during closed loop)		– 30 – 25%	Code No. P0171, P0172	P.13Ac-270, P.13Ac-277
SHORT TRIM B2	84*6	Short-term fuel compensation (trim) bank 2	Engine: warming up, 2,500 r/min without any load (during closed loop)		–30 – 25%	Code No. P0174, P0175	P.13Ac-281, P.13Ac-288
SYS. STATUS B1	88*6	Fuel control system status bank 1 (right)	Engine: warming up	2,500 r/min	Closed loop	Code No.P0134	P.13Ac-145
				When engine is suddenly revved	Open loop – drive condition		
SYS. STATUS B2	89*6	Fuel control system status bank 2 (left)	Engine: warming up	2,500 r/min	Closed loop	Code No. P0154	P.13Ac-219
				When engine is suddenly revved	Open loop – drive condition		
TANK PRS. SNSR	73	Fuel tank differential pressure sensor	• Ignition switch: "ON" • Fuel cap removal		–3.3 – 3.3 kPa (–0.97 – 0.97 in.Hg)	–	–
TP SENSOR	14	Throttle position sensor	Ignition switch: "ON"	Set to idle position	535 – 735 mV	Code No. P0121, P0122, P0123	P.13Ac-89, P.13Ac-98, P.13Ac-105
				Gradually open	Increases in proportion to throttle opening angle		
				Open fully	4,500 – 5,500 mV		
TP SENSOR	8A*6	Throttle position sensor	Ignition switch: "ON"	Set to idle position	6 – 20%	Code No. P0121, P0122, P0123	P.13Ac-89, P.13Ac-98, P.13Ac-105
				Gradually open	Increases in proportion to throttle opening angle		
				Open fully	80 – 100%		
VAF RESET SIG	34	Volume air flow sensor reset signal	Engine: warming up	Engine is idling	ON	–	–
				2,500 r/min	OFF		

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
VAF SENSOR	12	Volume air flow sensor (mass air flow rate)*1	• Engine coolant temperature : 80 – 95°C (176 – 203°F) • Lights, electric cooling fan and all accessories : "OFF" • Transmission : "P" range	Engine is idling	25 – 51 Hz <3.0L Engine> 18 – 44 Hz <3.5L Engine>	–	–
				2,500 r/min	74 – 114 Hz <3.0L Engine> 58 – 98 Hz <3.5L Engine>		
				Engine is revved	Frequency (or air flow volume) increases in response to revving		
VAF SENSOR	12*6	Volume air flow sensor (mass air flow rate)*1	• Engine coolant temperature : 80 – 95°C (176 – 203°F) • Lights, electric cooling fan and all accessories : "OFF" • Transmission : "P" range	Engine is idling	3.7 – 7.6 gm/s	–	–
				2,500 r/min	11.9 – 17.9 gm/s		
				Engine is revved	Frequency (or air flow volume) increases in response to revving		

ACTUATOR TEST REFERENCE TABLE

M1131152500235

*NOTE: *: Continues for 27 minutes. Can be released by pressing the CLEAR key.*

MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	DRIVE CONTENTS	INSPECTION REQUIREMENT		NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
EGR SOLENOID	10	EGR solenoid	Solenoid valve turns from OFF to ON.	Ignition switch: "ON"		Clicks when solenoid valve is driven.	Code No.P0403	P.13Ac-362
EVAP PURGE	08	Evaporative emission purge solenoid	Solenoid valve turns from OFF to ON.	Ignition switch:"ON"		Clicks when solenoid valve is driven.	Code No.P0443	P.13Ac-391
EVAP VENT	29	Evaporative emission ventilation solenoid	Solenoid valve turns from OFF to ON.	Ignition switch:"ON"		Clicks when solenoid valve is driven.	Code No.P0446	P.13Ac-399
FUEL PUMP	07	Fuel pump	Fuel pump operates and fuel is recirculated	Ignition switch: "ON"	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated	Pulse is felt	Procedure No.29	P.13Ad-85
					Listen near the fuel tank for the sound of fuel pump operation	Sound of operation is heard		
IG 5° BTDC	17*	Basic ignition timing	Set to ignition timing adjustment mode	• Engine: idling • Connect timing light		5° BTDC	-	-

ACTUATOR TEST REFERENCE TABLE

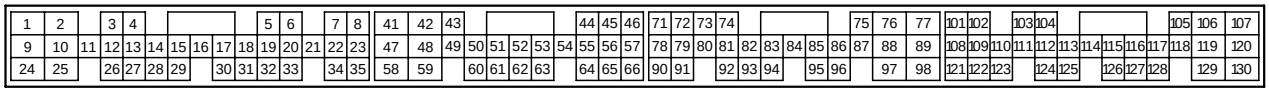
MUT-II SCAN TOOL DISPLAY	ITEM NO.	INSPECTION ITEM	DRIVE CONTENTS	INSPECTION REQUIREMENT	NORMAL CONDITION	INSPECTION PROCEDURE NO.	REFERENCE PAGE
NO. 1 INJECTOR	01	Injectors	Cut fuel to No.1 injector	Engine: warm, idle (cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable)	Code No.P0201, P0202, P0203, P0204, P0205, P0206	P.13Ac-313
NO. 2 INJECTOR	02		Cut fuel to No.2 injector				
NO. 3 INJECTOR	03		Cut fuel to No.3 injector				
NO. 4 INJECTOR	04		Cut fuel to No.4 injector				
NO. 5 INJECTOR	05		Cut fuel to No.5 injector				
NO. 6 INJECTOR	06		Cut fuel to No.6 injector				
RADIAT. FAN LO	21	Fan controller	Drive the fan motor	Ignition switch : "ON"	Radiator fan and A/C condenser fan rotate at high speed	Procedure No.27	P.13Ad-74

CHECK AT PCM TERMINAL

M1131153600127

TERMINAL VOLTAGE CHECK CHART

PCM Connector Terminal Arrangement



AKX01368AB

TERMINAL NO.	INSPECTION ITEM	INSPECTION CONDITION (ENGINE CONDITION)	NORMAL CONDITION
1	No.1 injector	• Engine: warming up, idling • Suddenly depress the accelerator pedal	From 11 – 14 V momentarily drops slightly
9	No.2 injector		
24	No.3 injector		
2	No.4 injector		
10	No.5 injector		
25	No.6 injector		
3	Left bank heated oxygen sensor heater (front)	Engine: warming up, idling (15 seconds after starting engine)	9 – 11 V
		Engine: Revving	9 – 11 V → B+ (momentarily)
4	Right bank heated oxygen sensor heater (front)	Engine: warming up, idling (15 seconds after starting engine)	9 – 11 V
		Engine: Revving	9 – 11 V → B+ (momentarily)
6	EGR solenoid	Ignition switch: "ON"	B+
		• Engine: idling • Suddenly depress the accelerator pedal.	From B+, drops momentarily
11	Ignition power transistor unit A	Engine: 3,000 r/min	0.3 – 3.0 V
12	Ignition power transistor unit B		
13	Ignition power transistor unit C		
14	Stepper motor coil <A1>	• Engine: warming up, idling • A/C switch: OFF → ON • Headlight switch: OFF → ON	B+ ⇔ 1 V or less (changes repeatedly)
28	Stepper motor coil <A2>		
15	Stepper motor coil <B1>		
29	Stepper motor coil <B2>		

TSB Revision

TERMINAL NO.	INSPECTION ITEM	INSPECTION CONDITION (ENGINE CONDITION)	NORMAL CONDITION
18	Condenser fan relay	Condenser fan is not operating	Battery positive voltage
		Condenser fan is operating	1 V or less
19	Volume air flow sensor reset signal	Engine: idling	1 V or less
		Engine: 3,000 r/min	6 – 9 V
20	A/C compressor clutch relay	• Engine: idling • A/C switch: OFF→ ON (A/C compressor is operating)	B+→ 1 V or less as A/C clutch cycles
21	Fuel pump relay	Ignition switch: "ON"	B+
		Engine: idling	1 V or less
22	Malfunction Indicator Lamp (SERVICE ENGINE SOON or Check Engine Lamp)	Ignition switch: "OFF" → "ON"	1 V or less → 9 – 13 V (after several seconds have elapsed)
26	Left bank heated oxygen sensor heater (rear)	Engine: warming up, idling	1 V or less
		Engine: Revving	B+
27	Right bank heated oxygen sensor heater (rear)	Engine: warming up, idling	1 V or less
		Engine: Revving	B+
34	Evaporative emission purge solenoid	Ignition switch: "ON"	B+
		Engine: warm, 3,000 r/min (duty cycle)	1 V or less
35	Evaporative emission ventilation solenoid	Ignition switch: "ON"	B+
		Carry out the actuator test to drive the solenoid valve.	For approximately Six seconds 1V or less
41	Power supply	Ignition switch: "ON"	B+
47			
43	Spark check signal	Engine: 3,000 r/min	0.3 – 3.0 V

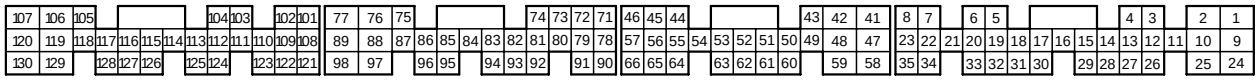
TERMINAL NO.	INSPECTION ITEM	INSPECTION CONDITION (ENGINE CONDITION)		NORMAL CONDITION
44	Engine coolant temperature sensor	Ignition switch: "ON"	When engine coolant temperature is -20° C (-4° F)	3.9 – 4.5 V
			When engine coolant temperature is 0° C (32° F)	3.2 – 3.8 V
			When engine coolant temperature is 20° C (68° F)	2.3 – 2.9 V
			When engine coolant temperature is 40° C (104° F)	1.3 – 1.9 V
			When engine coolant temperature is 60° C (140° F)	0.8 – 1.4 V
			When engine coolant temperature is 80° C (176° F)	0.3 – 0.9 V
45	Crankshaft position sensor	Engine: cranking		0.4 – 4.0 V
		Engine: idling		1.5 – 2.5 V
46	Sensor supplied voltage	Ignition switch: "ON"		4.5 – 5.5 V
49	MFI relay (power supply)	Ignition switch: "OFF"		B+
		Ignition switch: "ON"		1V or less
51	Fuel temperature sensor	Ignition switch: "ON"	When fuel temperature is 0° C (32° F)	2.7 – 3.1 V
			When fuel temperature is 20° C (68° F)	2.1 – 2.5 V
			When fuel temperature is 40° C (104° F)	1.6 – 2.0 V
			When fuel temperature is 80° C (176° F)	0.8 – 1.2 V
52	Power steering pressure switch	Engine: warming up, idling	When steering wheel is stationary	B+
			When steering wheel is turned	1V or less
55	Barometric pressure sensor	Ignition switch: "ON"	When altitude is 0 m (0 ft)	3.7 – 4.3 V
			When altitude is 600 m (1,969 ft)	3.4 – 4.0 V
			When altitude is 1,200 m (3,937 ft)	3.2 – 3.8 V
			When altitude is 1,800 m (5,906 ft)	2.9 – 3.5 V
56	Camshaft position sensor	Engine: cranking		0.4 – 3.0 V
		Engine: idling		0.5 – 2.0 V
58	Ignition switch-ST	Engine: cranking		8 V or more

TERMINAL NO.	INSPECTION ITEM	INSPECTION CONDITION (ENGINE CONDITION)		NORMAL CONDITION
60	Fuel gauge unit	Ignition switch: "ON"	When fuel gauge is near "FULL"	0.1 – 3.6 V
			When fuel gauge is near "EMPTY"	2.7 – 6.2 V
61	A/C switch 2	Engine: idling Outside air temperature: 25° C or more	when A/C is MAX. COOL condition (when the load by A/C is high)	Battery positive voltage
			when A/C is MAX. HOT condition (when the load by A/C is low)	1V or less
64	Intake air temperature sensor	Ignition switch: "ON"	When Intake air temperature is -20° C (-4° F)	3.8 – 4.4 V
			When Intake air temperature is 0° C (32° F)	3.2 – 3.8 V
			When Intake air temperature is 20° C (68° F)	2.3 – 2.9 V
			When Intake air temperature is 40° C (104° F)	1.5 – 2.1 V
			When Intake air temperature is 60° C (140° F)	0.8 – 1.4 V
			When Intake air temperature is 80° C (176° F)	0.4 – 1.0 V
65	Volume air flow sensor	Engine: idling		2.2 – 3.2 V
		Engine: 2,500 r/min		
66	Backup power supply	Ignition switch: "OFF"		B+
71	Left bank heated oxygen sensor (front)	Engine: warming up, 2,500 r/min (check using a digital voltmeter)		0 ⇔ 0.8 V (changes repeatedly)
72	Right bank heated oxygen sensor (front)	Engine: warming up, 2,500 r/min (check using a digital voltmeter)		0 ⇔ 0.8 V (changes repeatedly)
73	Left bank heated oxygen sensor (rear)	• Engine: warming up • Revving		0 and 0.6 – 1.0 V alternates
74	Right bank heated oxygen sensor (rear)	• Engine: warming up • Revving		0 and 0.6 – 1.0 V alternates
78	Throttle position sensor	Ignition switch: "ON" (check for smooth voltage increase as throttle is moved from idle position to wide open throttle)	Closed throttle	0.535 – 0.735 V
			Wide open throttle	4.5 – 5.5 V

TERMINAL NO.	INSPECTION ITEM	INSPECTION CONDITION (ENGINE CONDITION)		NORMAL CONDITION
83	A/C switch	Engine: idling	Turn the A/C switch OFF	1V or less
			Turn the A/C switch ON (A/C compressor is operating)	B+
91	Manifold differential pressure sensor	Engine: idling		0.8 – 2.4 V
		• Engine: idling • Revving (momentary wide open throttle)		Rises from 0.8 – 2.4 V suddenly
92	Fuel tank differential pressure sensor	Engine: idling		1.2 – 3.8 V
96	Fuel level warning light	Ignition switch: "OFF" → "ON" (When fuel gauge is not near "EMPTY")		1 V or less → 9 – 13 V (after several seconds have elapsed)
98	Ignition switch-IG	Ignition switch: "ON"		B+

TERMINAL RESISTANCE AND CONTINUITY CHECK

PCM Harness Side Connector Terminal Arrangement



AKX01369AB

TERMINAL NO.	INSPECTION ITEM	NORMAL CONDITION (INSPECTION CONDITION)
1 – 41	No.1 injector	13 – 16 Ω [at 20° C (68° F)]
9 – 41	No.2 injector	
24 – 41	No.3 injector	
2 – 41	No.4 injector	
10 – 41	No.5 injector	
25 – 41	No.6 injector	
3 – 41	Left bank heated oxygen sensor heater (front)	4.5 – 8.0 Ω [at 20° C (68° F)]
4 – 41	Right bank heated oxygen sensor heater (front)	4.5 – 8.0 Ω [at 20° C (68° F)]
6 – 41	EGR solenoid	30 – 34 Ω [at 20° C (68° F)]
14 – 41	Stepper motor coil (A1)	28 – 33 Ω [at 20° C (68° F)]
28 – 41	Stepper motor coil (A2)	
15 – 41	Stepper motor coil (B1)	
29 – 41	Stepper motor coil (B2)	

TERMINAL NO.	INSPECTION ITEM	NORMAL CONDITION (INSPECTION CONDITION)
26 – 41	Left bank heated oxygen sensor heater (rear)	11 – 18 Ω [at 20° C (68° F)]
27 – 41	Right bank heated oxygen sensor heater (rear)	11 – 18 Ω [at 20° C (68° F)]
34 – 41	Evaporative emission purge solenoid	30 – 34 Ω [at 20° C (68° F)]
35 – 41	Evaporative emission ventilation solenoid	17 – 21 Ω [at 20° C (68° F)]
42 – Body ground	PCM ground	Continuity (0 Ω)
48 – Body ground	PCM ground	
44 – 57	Engine coolant temperature	14 – 17 kΩ [when engine coolant temperature is -20° C (-4° F)]
		5.1 – 6.5 kΩ [when engine coolant temperature is 0° C (32° F)]
		2.1 – 2.7 kΩ [when engine coolant temperature is 20° C (68° F)]
		0.9 – 1.3 kΩ [when engine coolant temperature is 40° C (104° F)]
		0.48 – 0.68 kΩ [when engine coolant temperature is 60° C (140° F)]
		0.26 – 0.36 kΩ [when engine coolant temperature is 80° C (176° F)]
64 – 57	Intake air temperature sensor	13 – 17 kΩ [when intake air temperature is -20° C (-4° F)]
		5.3 – 6.7 kΩ [when intake air temperature is 0° C (32° F)]
		2.3 – 3.0 kΩ [when intake air temperature is 20° C (68° F)]
		1.0 – 1.5 kΩ [when intake air temperature is 40° C (104° F)]
		0.56 – 0.76 kΩ [when intake air temperature is 60° C (140° F)]
		0.30 – 0.42 kΩ [when intake air temperature is 80° C (176° F)]

*NOTE: *: indicates that resistance value should be 400 Ω or less.*

CHECK PROCEDURE WITH OSCILLOSCOPE

M1131154500286

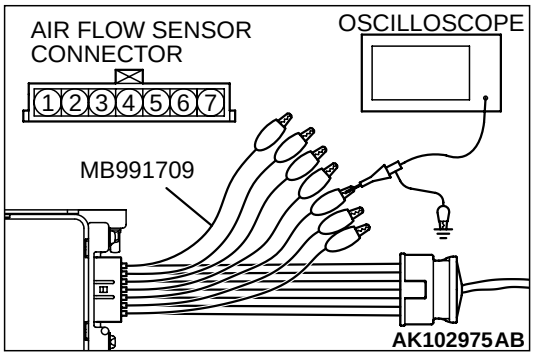
VOLUME AIR FLOW SENSOR

Required Special Tool:

- MB991709: Test Harness Set

Measurement Method

1. Disconnect the volume air flow sensor connector, and connect the test harness special tool (MB991709) in between. (All terminals should be connected.)
2. Connect the oscilloscope probe to volume air flow sensor connector terminal No. 3.



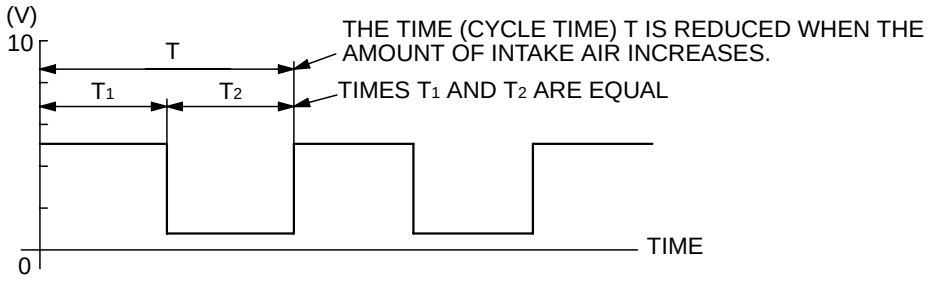
Alternate method (Test harness not available)

1. Connect the oscilloscope probe to PCM terminal No. 65.

Standard Wave Pattern

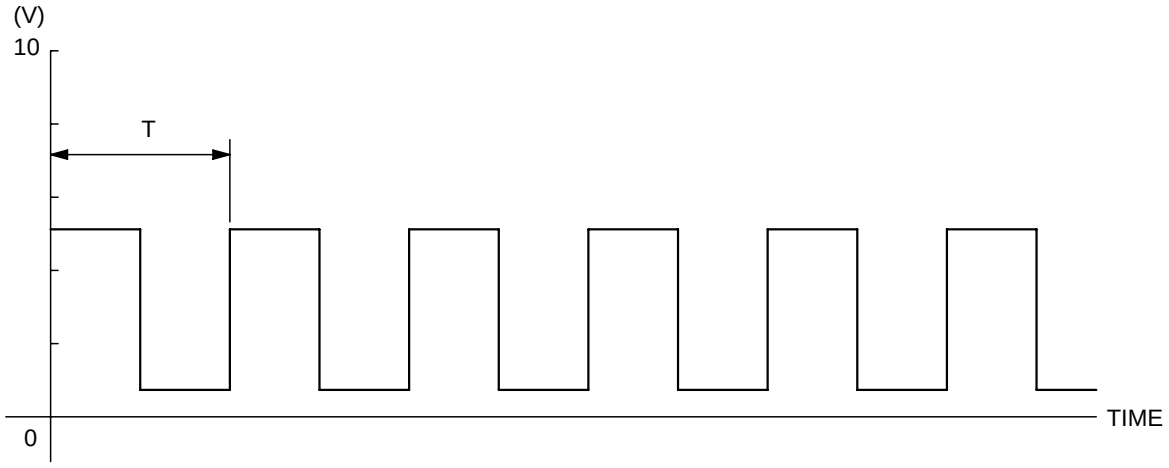
Observation conditions	
Function	**Special pattern**
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Observation conditions
Rev engine, observe T1 and T2 remain equal.

Standard wave pattern



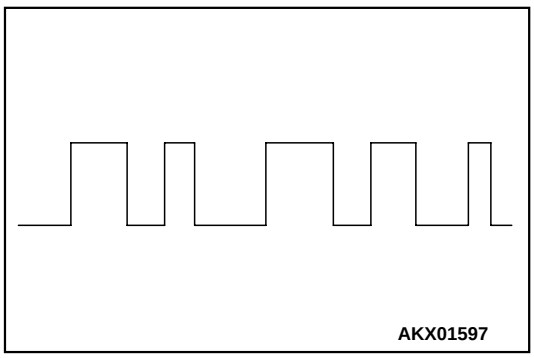
AKX01596 AB

Wave Pattern Observation Points

1. Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.

Examples of Abnormal Wave Patterns

Example 1



Cause of problem

- Sensor interface malfunction.

Wave pattern characteristics

- Rectangular wave pattern is output even when the engine is not started.

Example 2

Cause of problem

- Damaged rectifier or vortex generation column.

Wave pattern characteristics

- Unstable wave pattern with non-uniform frequency.An ignition leak will distort the wave pattern temporarily, even if the volume air flow sensor is normal.

TSB Revision

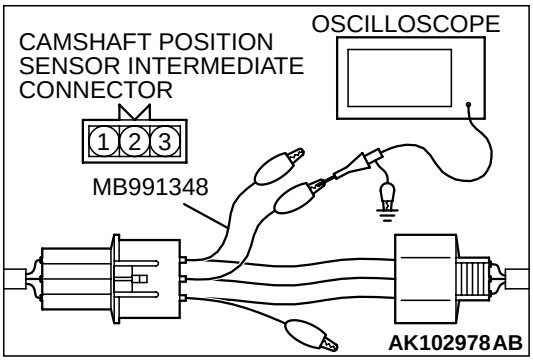
CAMSHAFT POSITION SENSOR AND CRANKSHAFT POSITION SENSOR

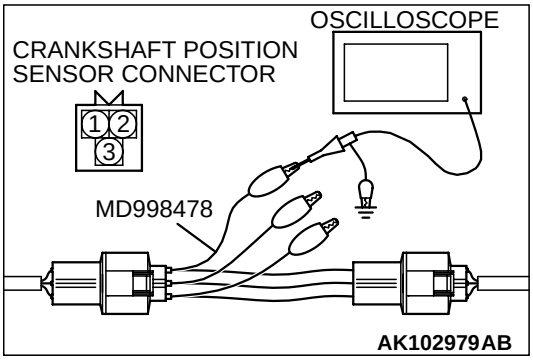
Required Special Tools:

- MB991348: Test Harness Set
- MD998478: Test Harness

Measurement Method

1. Disconnect the camshaft position sensor intermediate connector, and connect the test harness special tool (MB991348) in between. (All terminals should be connected.)
2. Connect the oscilloscope probe to camshaft position sensor intermediate connector terminal No. 2.
3. Disconnect the crankshaft position sensor connector, and connect the test harness special tool (MD998478) in between.
4. Connect the oscilloscope probe to crankshaft position sensor connector terminal No. 2 (black clip of special tool).





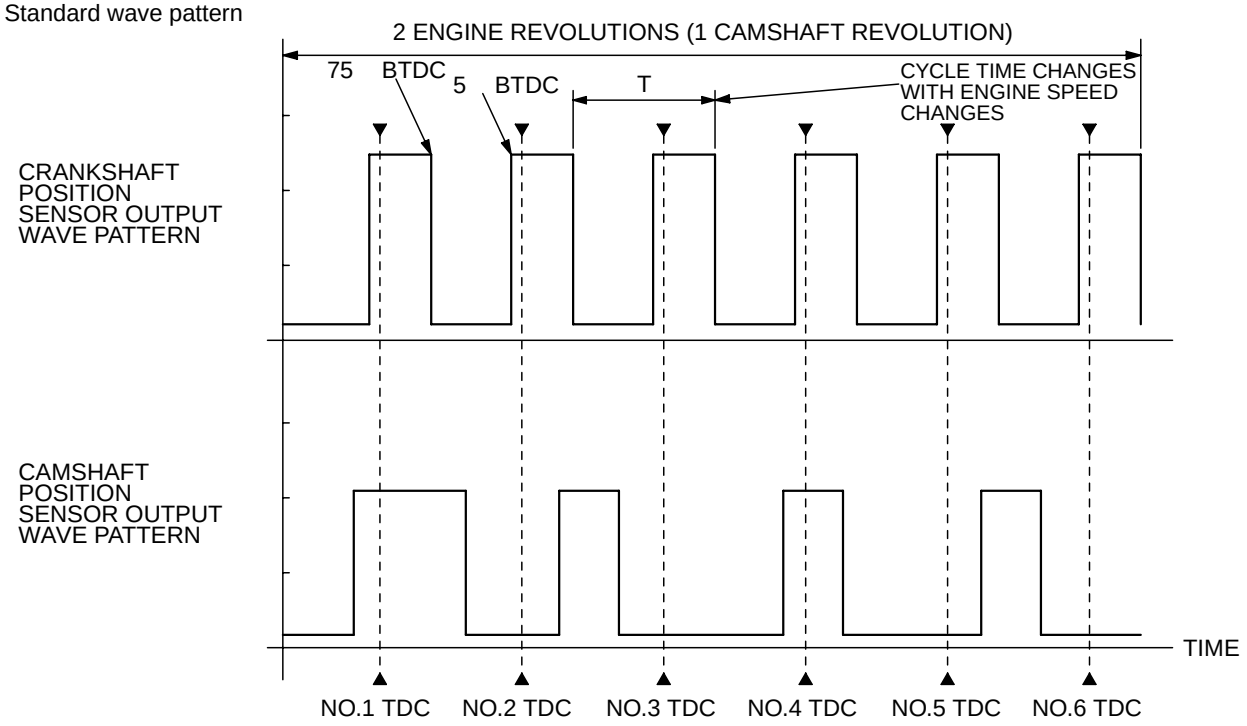
Alternate method (Test harness not available)

1. Connect the oscilloscope probe to PCM terminal No. 56. (Check the camshaft position sensor signal wave pattern.)
2. Connect the oscilloscope probe to PCM terminal No. 45. (Check the crankshaft position sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions	
Function	**Special pattern**
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



TDC: TOP DEAD CENTER

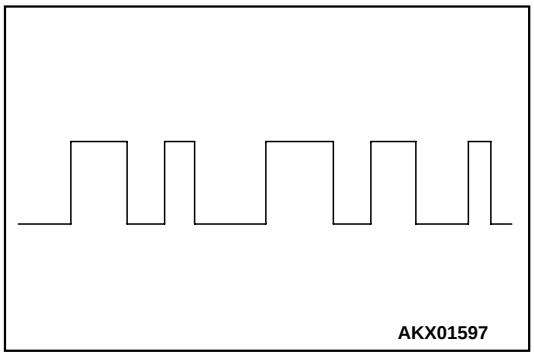
AKX01600 AB

Wave Pattern Observation Points

1. Check that cycle time T becomes shorter when the engine speed increased.

Examples of Abnormal Wave Patterns

Example 1



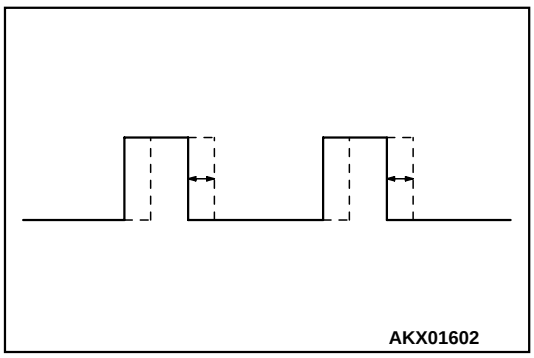
Cause of problem

- Sensor interface malfunction.

Wave pattern characteristics

- Rectangular wave pattern is output even when the engine is not started.

Example 2



Cause of problem

- Loose timing belt.
- Abnormality in sensor disc.

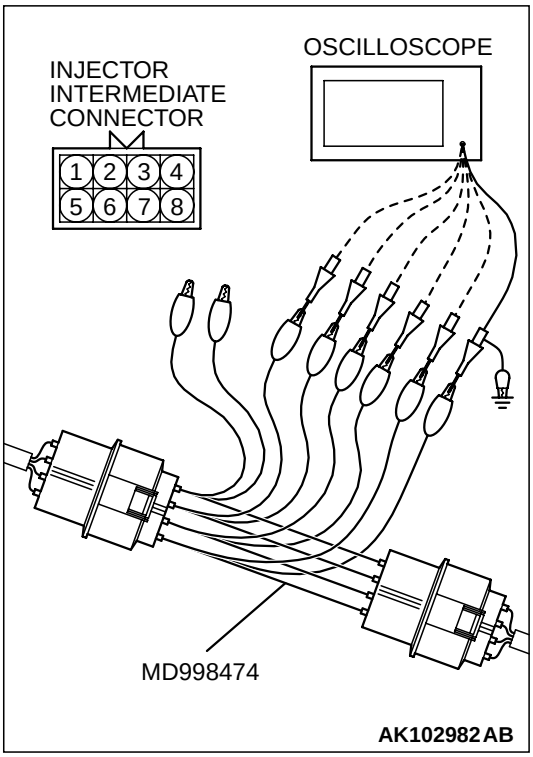
Wave pattern characteristics

- Wave pattern is displaced to the left or right.

INJECTOR

Required Special Tool:
- MD998474: Test Harness

Measurement Method
1. Disconnect the injector intermediate connector, and connect the test harness special tool (MD998474) in between.
2. Connect the oscilloscope probe to each injector intermediate connector terminal to analyze each cylinder:
   - Terminal No. 3 (green clip of special tool) for the number 1 cylinder
   - Terminal No. 2 (white clip) for the number 2 cylinder
   - Terminal No. 1 (blue clip) for the number 3 cylinder
   - Terminal No. 7 (yellow clip) for the number 4 cylinder
   - Terminal No. 6 (red clip) for the number 5 cylinder
   - Terminal No. 5 (black clip) for the number 6 cylinder

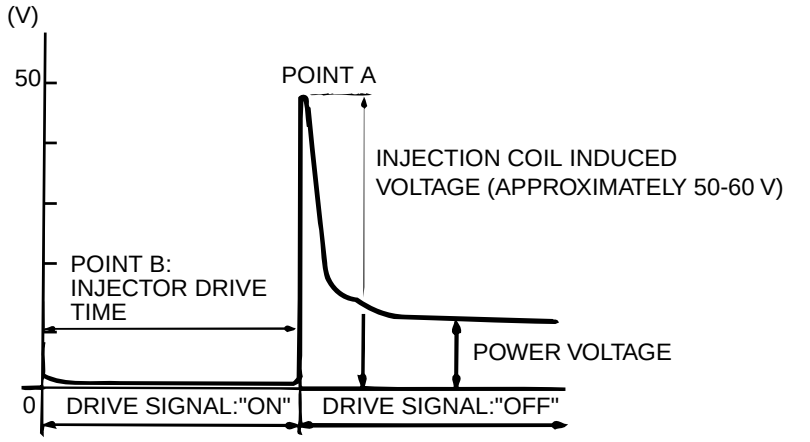


Alternate method (Test harness not available)
1. Connect the oscilloscope probe to PCM terminal No. 1. (When checking the number 1 cylinder.)
2. Connect the oscilloscope probe to PCM terminal No. 9. (When checking the number 2 cylinder.)
3. Connect the oscilloscope probe to PCM terminal No. 24. (When checking the number 3 cylinder.)
4. Connect the oscilloscope probe to PCM terminal No. 2. (When checking the number 4 cylinder.)
5. Connect the oscilloscope probe to to PCM terminal No. 10. (When checking the number 5 cylinder.)
6. Connect the oscilloscope probe to PCM terminal No. 25. (When checking the number 6 cylinder.)

Standard Wave Pattern

Observation conditions	
Function	**Special pattern**
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

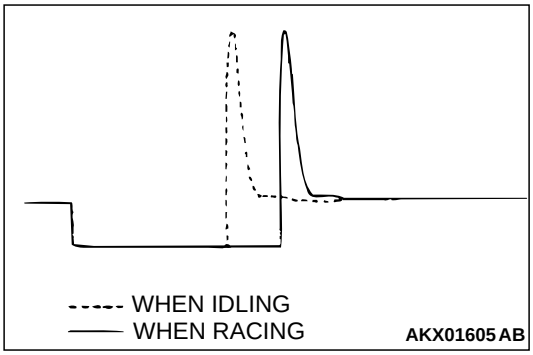


AKX01604 AB

Wave Pattern Observation Points

Point A: Height of injector coil induced voltage.

CONTRAST WITH STANDARD WAVE PATTERN	PROBABLE CAUSE
Injector coil induced voltage is low or doesn't appear at all	Short in the injector solenoid



Point B: Injector drive time

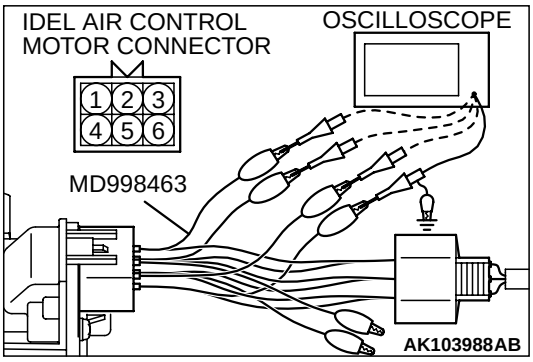
1. The injector drive time should be synchronized with the scan tool tester display.
2. When the engine is suddenly revved, the drive time will be greatly extended at first, but the drive time will soon return to original length.

TSB Revision

IDLE AIR CONTROL MOTOR (STEPPER MOTOR)

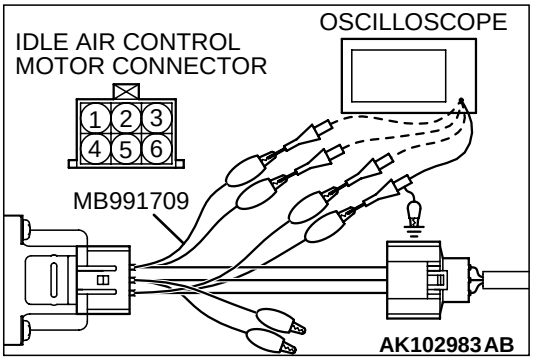
Required Special Tools:

- MD998463: Test Harness <3.0L Engine>
- MB991709: Test Harness Set <3.5L Engine>



Measurement Method <3.0L Engine>

1. Disconnect the idle air control motor connector, and connect the test harness special tool (MD998463) in between.
2. Connect the oscilloscope probe to the idle air control motor connector terminal No. 1 (red clip of special tool), terminal No. 3 (blue clip), terminal No. 4 (black clip) and terminal No. 6 (yellow clip) respectively.



Measurement Method <3.5L Engine>

1. Disconnect the idle air control motor connector, and connect the test harness special tool (MB991709) in between. (All terminals should be connected.)
2. Connect the oscilloscope probe to the idle air control motor connector terminal No. 1, terminal No. 3, terminal No. 4 and terminal No. 6 respectively.

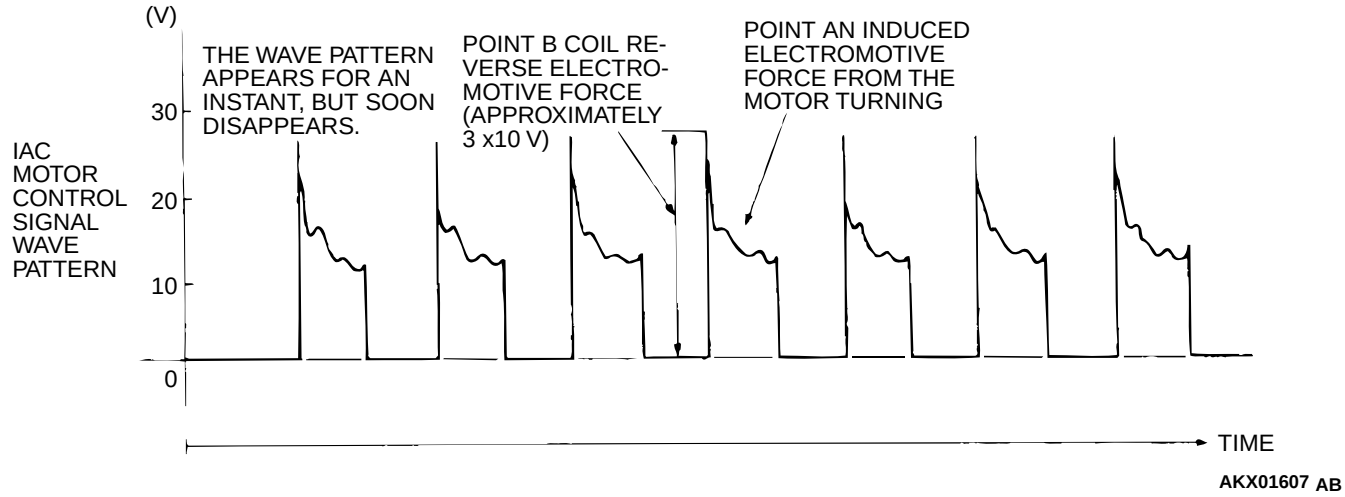
Alternate method (Test harness not available)

1. Connect the oscilloscope probe to PCM terminals No. 14, No. 15, No. 28 and No. 29.

Standard Wave Pattern

Observation conditions	
Function	**Special pattern**
Pattern height	High
Pattern selector	Display
Engine condition	Turn the ignition switch from "OFF" to "ON" (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm the engine (approximately one minute).

Standard wave pattern



Wave Pattern Observation Points

1. Check that the standard wave pattern appears when the idle air control motor is operating.

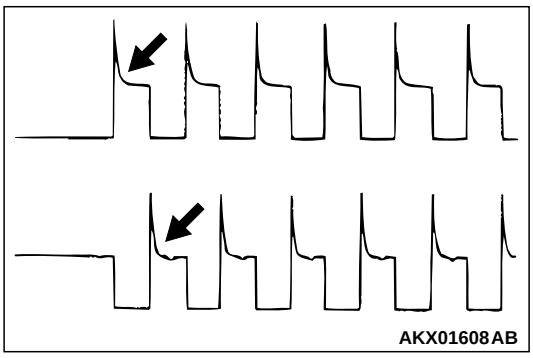
Point A:Presence or absence of induced electromotive force from the motor turning. (Refer to abnormal wave pattern.)

CONTRAST WITH STANDARD WAVE PATTERN	PROBABLE CAUSE
Induced electromotive force does not appear or is extremely small	Malfunction of motor

Point B:Height of coil back electromotive force

CONTRAST WITH STANDARD WAVE PATTERN	PROBABLE CAUSE
Coil reverse electromotive force does not appear or is extremely small	Short in the coil

Examples of Abnormal Wave Patterns



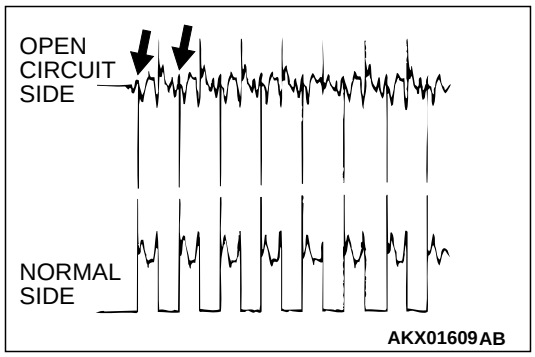
Example 1

Cause of problem

- Malfunction of motor. (Motor is not operating.)

Wave pattern characteristics

- Induced electromotive force from the motor turning does not appear.



Example 2

Cause of problem

- Open circuit in the line between the idle air control motor and the PCM.

Wave pattern characteristics

- Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 volt.) Furthermore, the induced electromotive force wave pattern at the normal side is slightly different from the normal wave pattern.

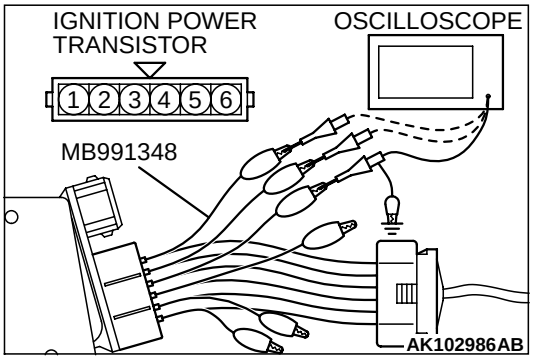
IGNITION COIL AND IGNITION POWER TRANSISTOR

Required Special Tool:

- MB991348: Test Harness Set

Measurement Method

1. Disconnect the connector, and connect test harness special tool (MB991348) in between. (All terminals should be connected.)



2. Connect the oscilloscope probe to each ignition power transistor connector terminal to analyze each cylinder:
   - Terminal No. 1 for the number 3 and 6 cylinders
   - Terminal No. 2 for the number 2 and 5 cylinders
   - Terminal No. 3 for the number 1 and 4 cylinders

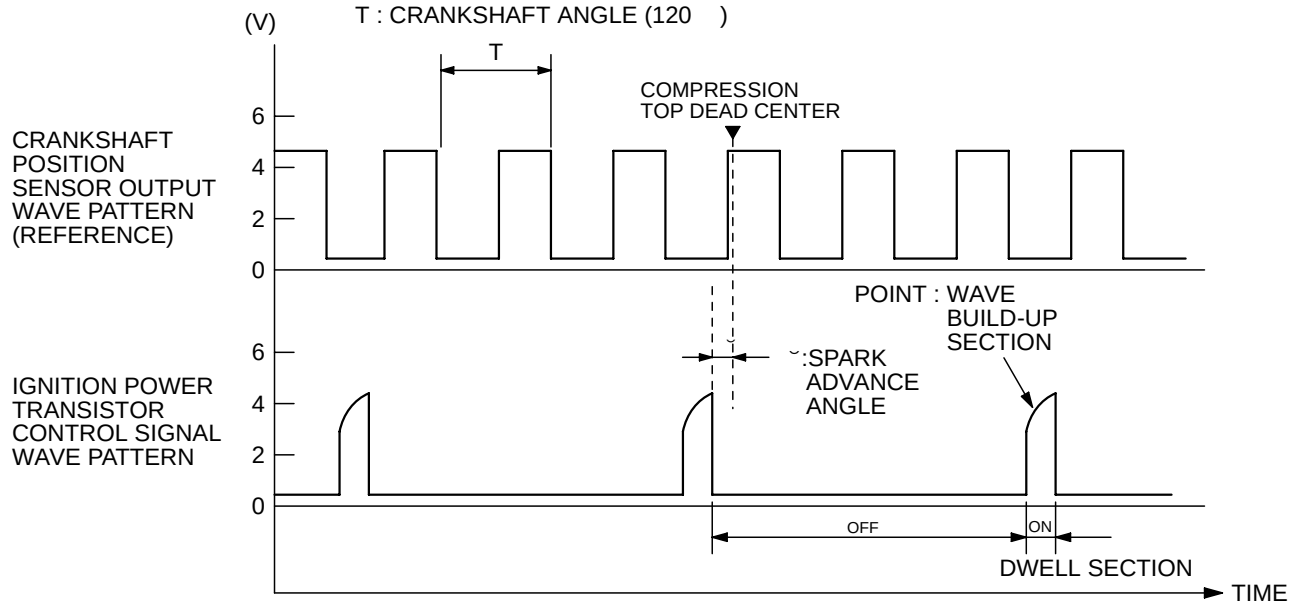
Alternate method (Test harness not available)

1. Connect the oscilloscope probe to PCM terminal No. 11. (When checking the number 1 and 4 cylinders.)
2. Connect the oscilloscope probe to PCM terminal No. 12. (When checking the number 3 and 6 cylinders.)
3. Connect the oscilloscope probe to PCM terminal No. 13. (When checking the number 2 and 5 cylinders.)

Standard Wave Pattern

Observation conditions	
Function	**Special pattern**
Pattern height	Variable
Pattern selector	Display
Engine r/min	Approximately 1,200 r/min

Standard wave pattern



AK000726

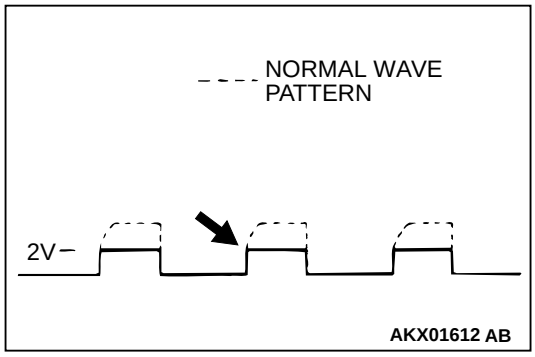
Wave Pattern Observation Points

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

CONDITION OF WAVE PATTERN BUILD-UP SECTION AND MAXIMUM VOLTAGE	PROBABLE CAUSE
Rises from approximate 2 volts to approximate 4.5 volts at the top-right	Normal
2-volt rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Ignition power transistor malfunction

Examples of Abnormal Wave Patterns

Example 1 (Wave pattern during engine cranking)



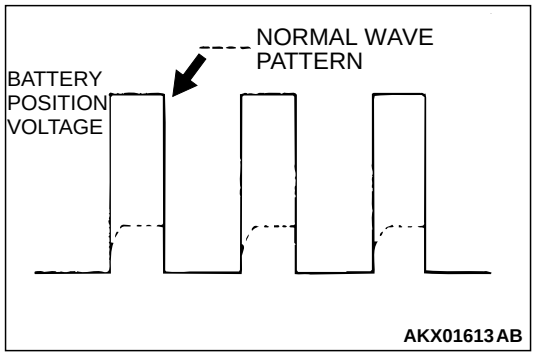
Cause of problem

- Open-circuit in ignition primary circuit

Wave pattern characteristics

- Top-right part of the build-up section cannot be seen, and voltage value is approximately 2 volts too low.

Example 2 (Wave pattern during engine cranking)



Cause of problem

- Malfunction in ignition power transister

Wave pattern characteristics

- Power voltage results when the ignition power transistor is ON.

NOTES