GROUP 13A

MULTIPOINT FUEL INJECTION (MPI)

CONTENTS

GENERAL INFORMATION

M1131000106680

The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the engine-ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU. The engine-ECU carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injection timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions.
A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors.
Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-3-4-2. This is called sequential fuel injection. The engine-ECU provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the engine-ECU controls the air/fuel mixture by using the oxygen sensor signal to carry out "closed-loop" control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst.

THROTTLE VALVE OPENING CONTROL

This system electronically controls the opening of the throttle valve. The engine-ECU detects the amount of travel of the accelerator pedal via the accelerator pedal position sensor, and controls the actuation of the throttle valve control servo, which is mounted on the throttle body, in order to attain the target throttle valve opening that has been predetermined in accordance with driving conditions.

IDLE SPEED CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that passes through the throttle valve in accordance with changes in idling conditions and engine load during idling.

The engine-ECU drives the throttle valve control servo to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and A/C and other electrical load. In addition, when the A/C switch is turned off and on while the engine is idling, the throttle valve control servo adjusts the throttle valve passes through air amount according to the engine load conditions to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the engine-ECU from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is set.
- The RAM data inside the engine-ECU that is related to the sensors and actuators can be read by means of the M.U.T.-III. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control

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

2. A/C Relay Control

Turns the compressor clutch of the A/C ON and OFF.

3. Oil Feeder Control Valve Control

The engine-ECU carries out the duty control of the oil feeder control valve according to the operation condition. This varies the phase angle of the camshaft to optimize the valve timing.

4. Alternator Output Current Control

Prevents alternator output current from increasing suddenly and idle speed from dropping at times such as when the headlamp are turned on.

5. Purge Control Solenoid Valve Control

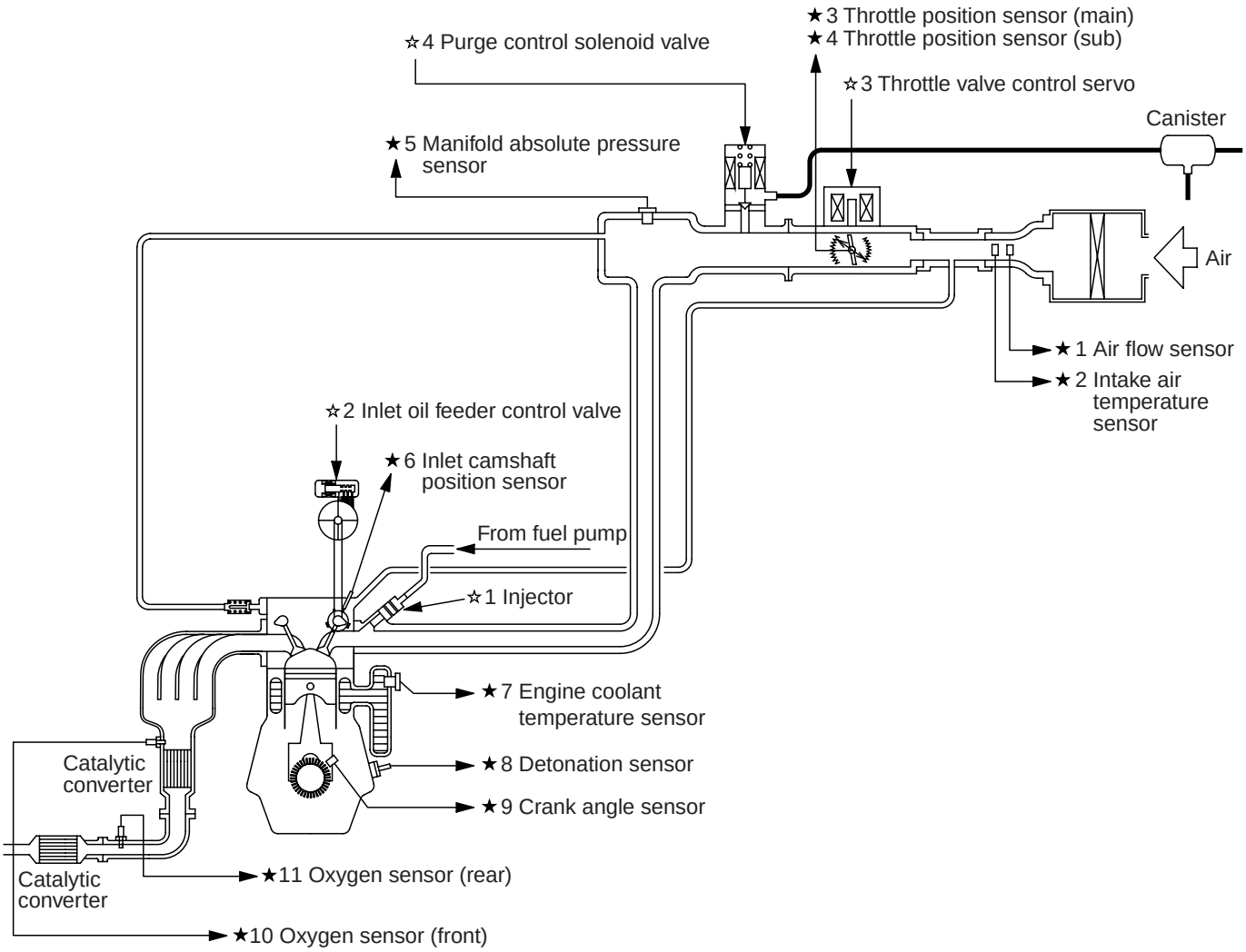
[Refer to GROUP 17 – Emission Control – Evaporative Emission Control System – General Information (Evaporative Emission Control System)].

GENERAL SPECIFICATIONS

Items		**Specifications**
Throttle body	Throttle bore mm	57
	Throttle position sensor	Hall element type
	Throttle valve control servo	DC motor type, having brushes
Engine-ECU	Identification No.	E6T79771 <4B11> E6T79871 <4B12>
Sensors	Air flow sensor	Heat sensitizing type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Accelerator pedal position sensor	Hall element type
	Inlet camshaft position sensor	Magneto resistance element type
	Crank angle sensor	Magneto resistance element type
	Detonation sensor	Piezoelectric type
	Manifold absolute pressure sensor	Semiconductor type

Items		Specifications
Actuators	Engine control relay	Contact switch type
	Fuel pump relay	Contact switch type
	A/C compressor relay	Contact switch type
	Starter relay	Contact switch type
	Injector relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	KME 340C
	Throttle valve control servo relay	Contact switch type
	Inlet oil feeder control valve	Duty cycle type solenoid valve
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	324

★1 Air flow sensor ★2 Intake air temperature sensor ★3 Throttle position sensor (main) ★4 Throttle position sensor (sub) ★5 Manifold absolute pressure sensor ★6 Inlet camshaft position sensor ★7 Engine coolant temperature sensor ★8 Detonation sensor ★9 Crank angle sensor ★10 Oxygen sensor (front) ★11 Oxygen sensor (rear)	● Power supply ● Ignition switch-IG ● Ignition switch-ST ● Accelerator pedal position sensor (main) ● Accelerator pedal position sensor (sub) ● Engine oil pressure switch ● Alternator FR terminal ● Alternator L terminal ● CAN communication (input signal)	⇨	Engine-ECU ● Barometric pressure sensor	⇨	☆1 Injector ☆2 Inlet oil feeder control valve ☆3 Throttle valve control servo ☆4 Purge control solenoid valve	● Ignition coil ● Engine control relay ● Fuel pump relay ● Starter relay ● Throttle valve control servo relay ● A/C compressor relay ● Alternator G terminal ● Oxygen sensor (front) heater ● Oxygen sensor (rear) heater ● CAN communication (input signal)



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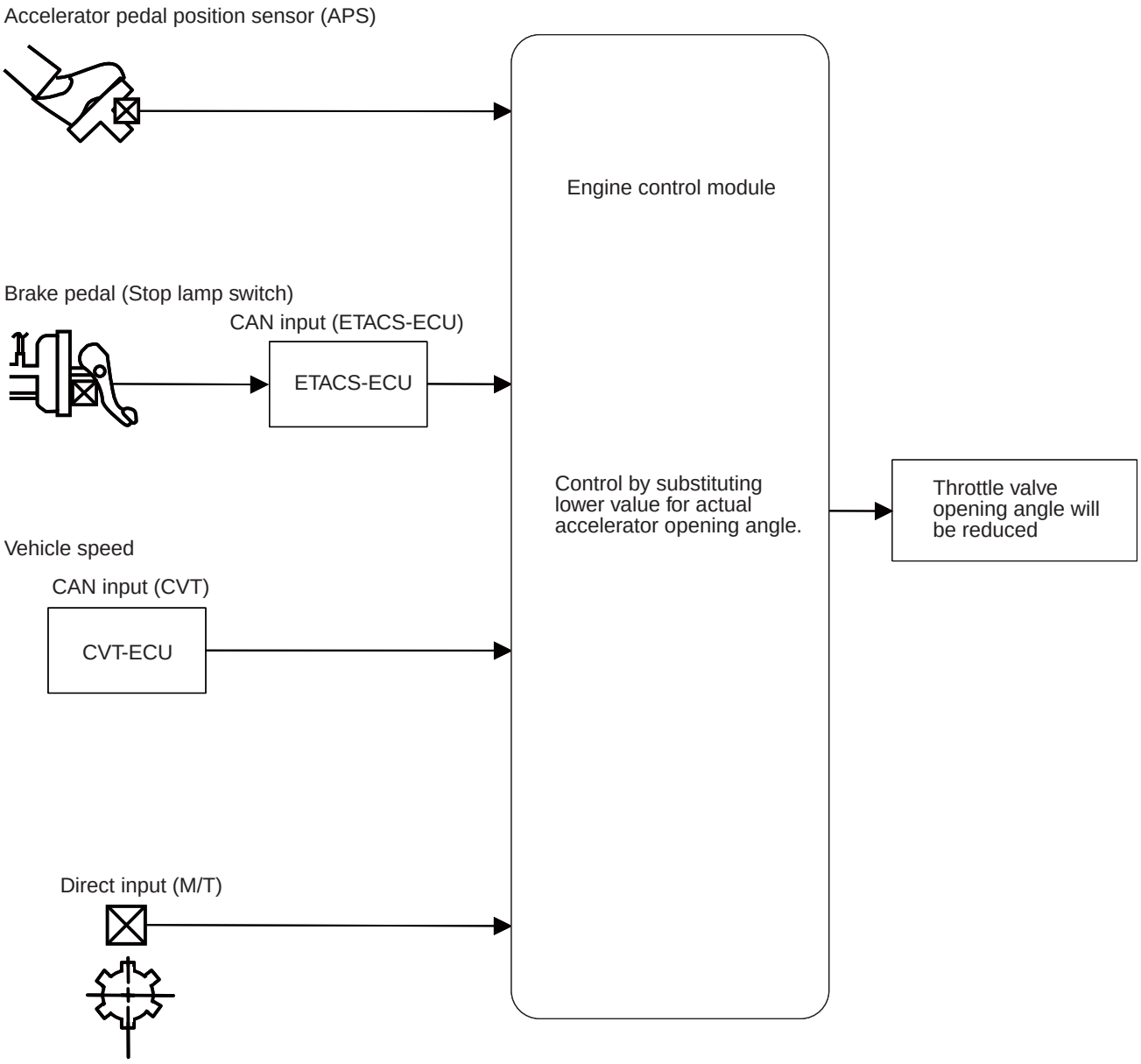
BRAKE OVERRIDE CONTROL

A brake override control has been installed. This enables the brake to override the accelerator if the accelerator pedal and the brake pedal are depressed simultaneously during driving.

System schematic diagram



Operation condition

Control will be activated when all of the following conditions are satisfied.

- Voltage at the accelerator pedal position sensor (APS main) is 1.3 V or more, and the stop lamp switch remains on
- Vehicle speed is 5 km/h or more

Control will be deactivated when any of the following conditions is satisfied.

- Voltage at the accelerator pedal position sensor (APS main) is less than 1.3 V
- The stop lamp switch remains off

SERVICE SPECIFICATION(S)

M1131000303306

Item		Specifications
Intake air temperature sensor resistance kΩ	at –20°C	13 – 18
	at 0 °C	5.3 – 6.7
	at 20 °C	2.3 – 3.0
	at 80 °C	0.30 – 0.45
Engine coolant temperature sensor resistance kΩ	at –20°C	14 – 17
	at 0 °C	5.1 – 6.5
	at 20 °C	2.1 – 2.7
	at 40 °C	0.9 – 1.3
	at 60 °C	0.48 – 0.68
	at 80 °C	0.26 – 0.36
Fuel pressure kPa		Approximately 324
Injector coil resistance (at 20°C) Ω		10.5 – 13.5
Oxygen sensor output voltage (during racing) V		0.6 – 1.0
Oxygen sensor heater resistance (at 20°C) Ω		4.5 – 8.0
Throttle valve control servo coil resistance (at 20°C) Ω		0.3 – 80
Inlet oil feeder control valve resistance (at 20°C) Ω		6.9 – 7.9

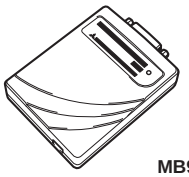
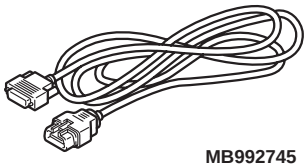
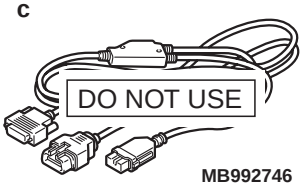
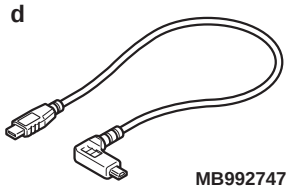
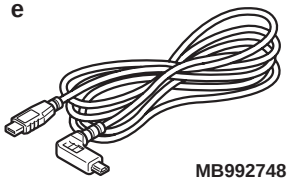
SEALANT(S) OR ADHESIVE(S)

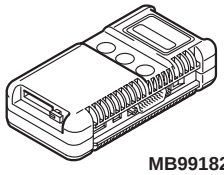
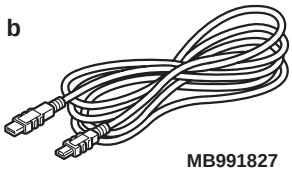
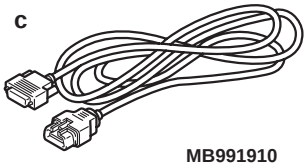
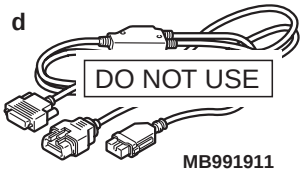
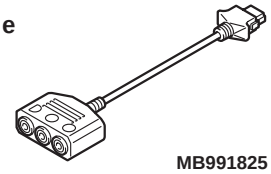
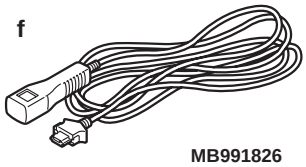
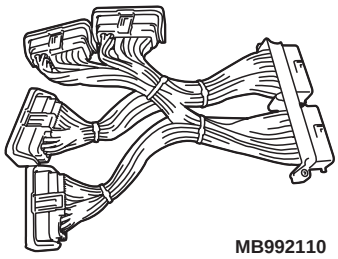
M1131000501962

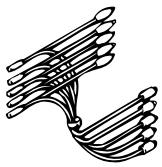
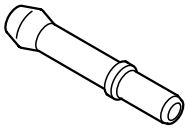
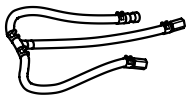
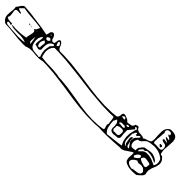
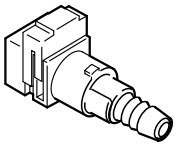
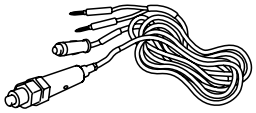
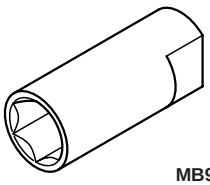
Points of application	Specified sealant
Engine coolant temperature sensor threaded portion	LOCTITE 262, Three bond 1324N or equivalent

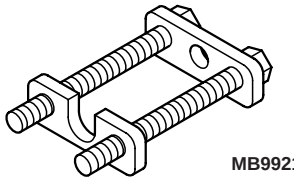
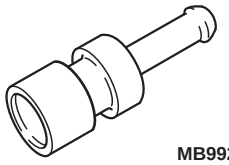
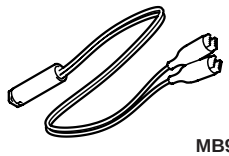
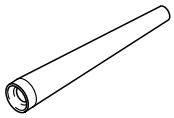
SPECIAL TOOLS

M1131000604195

Tool	Number	Name	Use
a  MB992744 b  MB992745 c  MB992746 d  MB992747 e  MB992748 ACB05421AB	a. MB992744 b. MB992745 c. MB992746 d. MB992747 e. MB992748	a. Vehicle communication interface-Lite (V.C.I.-Lite) b. V.C.I.-Lite main harness A (for vehicles with CAN communication) c. V.C.I.-Lite main harness B (for vehicles without CAN communication) d. V.C.I.-Lite USB cable short e. V.C.I.-Lite USB cable long	• MPI system inspection

Tool	Number	Name	Use
a  MB991824 b  MB991827 c  MB991910 d  MB991911 e  MB991825 f  MB991826 MB991955	MB991955 a: MB991824 b: MB991827 c: MB991910 d: MB991911 e: MB991825 f: MB991826	M.U.T.-III sub assembly a: Vehicle communication interface (V.C.I.) b: USB cable c: M.U.T.-III main harness A (Vehicles with CAN communication system) d: M.U.T.-III main harness B (Vehicles without CAN communication system) e: Adapter for measurement f: Trigger harness	• MPI system inspection • Fuel pressure test **⚠ CAUTION** **For vehicle with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.**
 MB992110	MB992110	Power plant ECU check harness	• Measurement of voltage during troubleshooting • Measure engine-ECU terminal voltage. • Inspection using an oscilloscope
	MB991709	Test harness	• Measurement of voltage during troubleshooting • Inspection using an oscilloscope

Tool	Number	Name	Use
 MB991658	MB991658	Test harness	• Measurement of voltage during troubleshooting • Inspection using an oscilloscope • Oxygen sensor check
 MB992001	MB992001	Hose adaptor	• Measure fuel pressure • Check the spray condition of injectors
 MB992076	MB992076	Injector test set	
	MD998709	Adapter hose	Measure fuel pressure
 MB992049	MB992049	Quick connector	
 MB991981	MB991981	Fuel pressure gauge set	
 MB992042	MB992042	Engine coolant temperature sensor wrench	Removal and installation of the engine coolant temperature sensor.

Tool	Number	Name	Use
 MB992184	MB992184	Injector holder	Check the spray condition of injectors
 MB992088	MB992088	Injector test nipple	
 MB991607	MB991607	Injector test harness	
 B992106	MB992106	O-ring installer	Installation of O-ring on fuel injector injection nozzle side

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

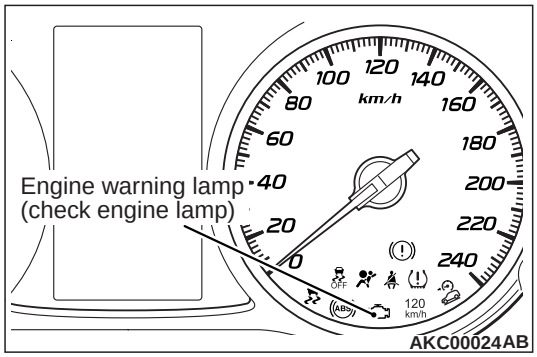
M1131150002616

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – Contents of Troubleshooting .

DIAGNOSIS FUNCTION

M1131155504935

ENGINE WARNING LAMP (CHECK ENGINE LAMP)



When the abnormal condition occurs with respect to the items of Multipoint Fuel Injection (MPI) system shown in the table, the engine warning lamp will illuminate or flash. When the lamp remains illuminated after the engine start, or when the lamp is illuminated while the engine is running, check the diagnosis code output. There are two methods for checking the indicator lamp burn out: When the ignition switch is in "ON" position, the indicator lamp is illuminated, and then extinguished few seconds later. When the ignition switch is in "ON" position and the engine starts, the indicator lamp is extinguished.

NOTE: When the CVT-ECU detects malfunctions related to the CVT, the engine warning lamp is also illuminated.

ENGINE WARNING LAMP INSPECTION ITEMS

⚠ CAUTION

The engine warning lamp continuously illuminates when the engine-ECU malfunctions.

P0010	Inlet oil feeder control valve system
P0031	Oxygen sensor (front) heater circuit low input
P0032	Oxygen sensor (front) heater circuit high input
P0037	Oxygen sensor (rear) heater circuit low input
P0038	Oxygen sensor (rear) heater circuit high input
P0068*1	Trustful check air flow sensor
P0102*1	Air flow sensor circuit low input
P0103*1	Air flow sensor circuit high input
P0107	Manifold absolute pressure sensor circuit low input
P0108	Manifold absolute pressure sensor circuit high input
P0112*1	Intake air temperature sensor circuit low input
P0113*1	Intake air temperature sensor circuit high input
P0117*1	Engine coolant temperature sensor circuit low input
P0118*1	Engine coolant temperature sensor circuit high input
P0121*1	Trustful check throttle position sensor (main)
P0122*1	Throttle position sensor (main) circuit low input
P0123*1	Throttle position sensor (main) circuit high input
P0125	Insufficient coolant temperature for closed loop fuel control
P0131	Oxygen sensor (front) circuit low voltage
P0132	Oxygen sensor (front) circuit high voltage
P0133	Oxygen sensor (front) circuit slow response
P0134	Oxygen sensor (front) circuit no activity detected
P0137	Oxygen sensor (rear) circuit low voltage
P0138	Oxygen sensor (rear) circuit high voltage
P0171	Abnormal fuel system (lean)
P0172	Abnormal fuel system (rich)
P0221*1	Trustful check throttle position sensor (sub)
P0222*1	Throttle position sensor (sub) circuit low input
P0223*1	Throttle position sensor (sub) circuit high input
P0261	No. 1 injector circuit low input
P0262	No. 1 injector circuit high input
P0264	No. 2 injector circuit low input
P0265	No. 2 injector circuit high input
P0267	No. 3 injector circuit low input
P0268	No. 3 injector circuit high input
P0270	No. 4 injector circuit low input

P0271	No. 4 injector circuit high input
P0300*2	Random/multiple cylinder misfire detected
P0301*2	No. 1 cylinder misfire detected
P0302*2	No. 2 cylinder misfire detected
P0303*2	No. 3 cylinder misfire detected
P0304*2	No. 4 cylinder misfire detected
P0335*1	Crank angle sensor system
P0340*1	Inlet camshaft position sensor system
P0421	Catalyst malfunction
P0458	Purge control solenoid valve circuit low input
P0459	Purge control solenoid valve circuit high input
P0602*1	Variant coding system
P0606*1	Engine-ECU main processor malfunction
P060B*1	A/D converter
P060D*1	Trustful check accelerator pedal position sensor
P061A*1	Torque monitoring
P061C*1	Trustful check engine speed
P062F*1	EEPROM malfunction
P0630*1	Chassis number not programmed
P0638*1	Throttle valve control servo circuit range/performance problem
P0642*1	Throttle position sensor power supply
P0657*1	Throttle valve control servo relay circuit malfunction
P1238*1	Air flow sensor trustful for torque monitoring
P1590*1	CVT-ECU to engine-ECU communication error in torque reduction request
P1603*1	Battery backup circuit malfunction
P2100*1	Throttle valve control servo circuit (open)
P2101*1	Throttle valve control servo magneto malfunction
P2122*1	Accelerator pedal position sensor (main) circuit low input
P2123*1	Accelerator pedal position sensor (main) circuit high input
P2127*1	Accelerator pedal position sensor (sub) circuit low input
P2128*1	Accelerator pedal position sensor (sub) circuit high input
P2135*1	Throttle position sensor (main and sub) range/performance problem
P2138*1	Accelerator pedal position sensor (main and sub) range/performance problem
P2228*1	Barometric pressure sensor circuit low input
P2229*1	Barometric pressure sensor circuit high input
P2252	Oxygen sensor offset circuit low voltage

P2253	Oxygen sensor offset circuit high voltage
U0101*1	CVT-ECU time-out
U0141*1	ETACS-ECU time-out

*NOTE: After the engine-ECU has detected a malfunction, the engine warning lamp illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "*1" in the diagnosis code number column, the engine warning lamp illuminates only on the first detection of the malfunction.*

*NOTE: The codes marked with a "*2" in the diagnosis code number column have the following two conditions for illuminating the engine warning lamp.*

- *In case that the misfire causing the damaged catalyst is detected, the engine warning lamp will flash until the condition is corrected. If the system detects the same malfunction after the next engine start and then the condition is corrected, the engine warning lamp will flash (not illuminate).*
- *In case that the misfire deteriorating the exhaust gas is detected, the engine warning lamp is illuminated when the same malfunction is redetected after the next engine start.*

NOTE: Even if the malfunction is not detected when the engine-ECU monitors the malfunction three consecutive times after the engine warning lamp illuminates, turn off the engine warning lamp when the engine starts next time.*

**: In this case, "one time" in monitoring the malfunction means the period from the time of the current engine start to the time of the next engine start. "One time" in monitoring the misfire or the fuel system malfunction means the time when the operating conditions (such as the engine speed or the engine coolant temperature) becomes similar operating conditions of the first detected malfunction.*

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – Diagnosis Function .

INSPECTION WITH M.U.T.-III DATA LIST AND ACTUATOR TEST

Reading data list or performing an actuator test using M.U.T.-III enables you to check the vehicle body harnesses and components for abnormalities. Sensor input or output to the actuator can be displayed in numerical values or graphs in the data list while in the actuator test the actuator can be forced to drive (ON/OFF driving in the specified time).

DIAGNOSIS PROCEDURE

1. Connect M.U.T.-III to perform inspection with the data list and actuator test function.
2. If any abnormality is found, inspect and repair vehicle body harnesses and components.
3. After repair, check that input and output have returned to normal.
4. If a failure code which is caused by inspection and repair work is generated, erase the failure code.
5. Disconnect M.U.T.-III and perform a test run to check that the malfunction phenomenon is resolved.

PROVISIONAL DIAGNOSIS CODE CONFIRMED

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

CONFIRMATION METHOD

1. After the ignition switch is in "LOCK" (OFF) position, connect the M.U.T.-III to the diagnosis connector.
2. Turn the ignition switch to the "ON" position.
3. Select "MPI/GDI/DIESEL" from System select Screen of the M.U.T.-III.
4. Select "Special Function" from MPI/GDI/DIESEL Screen.

5. Select "Provisional DTCs" from Special Function Screen.

FREEZE FRAME DATA

When the engine-ECU detects a malfunction and stores a diagnosis code, it also stores a current status of the engine. This function is called "Freeze frame data". By analyzing this "Freeze frame" data with the M.U.T.-III, an effective troubleshooting can be performed.
The display items of freeze frame data are shown below.

DISPLAY ITEM LIST

Item No.	Date Item	Unit/Condition
1	Odometer	km
2	Ignition cycle (Warm up cycle)	–
4	Accumulated minute*1	min
AA*2	Air flow sensor	g/s
AB*2	Throttle position sensor (main)	%
BB*2	Barometric pressure sensor	kPa
BC*2	Relative throttle position sensor	%
BD*2	Throttle position sensor (sub)	%
BE*2	Accelerator pedal position sensor (main)	%
BF*2	Accelerator pedal position sensor (sub)	%
C0*2	Fuel system status 1	• CL (closed loop)*3 • OL (open loop)*4 • OL:DRV (condition of open loop due to acceleration and deceleration driving) • OL:SYS (condition of open loop due to system failure) • CL:HO2S (condition of closed loop only using front oxygen sensor when rear oxygen sensor is failed)
C1*2*5	Fuel system status 2	N/A
C2*2	Calculated load value	%
C3*2	Engine coolant temperature sensor	°C
C4*2	Short term fuel trim 1	%
C5*2*5	Short term fuel trim 3	****
C6*2	Long term fuel trim 1	%
C7*2*5	Long term fuel trim 3	****
CC*2	Manifold absolute pressure sensor	kPa
CD*2	Crank angle sensor	r/min
CE*2	Vehicle speed	km/h

Item No.	Date Item	Unit/Condition
CF*2	Advance ignition	°CA
D0*2	Intake air temperature sensor 1	°C
D1*2	Time since engine running*6	sec
D6*2	Purge solenoid duty	%
D8*2	Power supply voltage	V
D9*2	Absolute load value	%
DA*2	Target equivalence ratio	–
DB*2	Intake air temperature sensor 1	°C
DC*2	Throttle actuator	%
DD*2	Relative accelerator pedal position sensor	%

*NOTE: *1: Accumulated time of current malfunction from time point when malfunction is detected.*

*NOTE: *2: The items can be seen by selecting "Freeze Frame Data (OBD)" on Self-diagnosis Screen of MUT-III. If detecting multiple malfunctions, the engine-ECU stores the data for only the first item that was detected. If detecting the misfire or fuel system malfunction, the engine-ECU stores the data by giving priority to the misfire or fuel system malfunction in spite of the chronological order of the detected malfunction.*

NOTE: The Freeze Frame Data (OBD) should not be stored for the diagnosis code when the engine warning lamp does not illuminate.

*NOTE: *3: Condition in which oxygen sensor signals are fed back to the engine-ECU for controlling fuel.*

*NOTE: *4: Condition in which fuel is controlled without oxygen sensor signals being fed back to the engine-ECU because the condition to shift to the closed loop is not met.*

*NOTE: *5: Data items are displayed on M.U.T.-III display, but the in-line 4 engine is not applicable and its data is displayed as "N/A" or "****".*

*NOTE: *6: Time between engine start and malfunction detection*

FAIL-SAFE AND BACKUP FUNCTION

This function exercises control, by predetermined control logic, to keep a condition in which a vehicle can be safely driven when main sensor failures are detected by the diagnosis function.

List of fail-safe and backup function items

Code No.	Diagnosis item	Control content during malfunction
P0010	Inlet oil feeder control valve system	V.V.T. phase angle (intake) becomes most retarded angle.
P0068	Trustful check air flow sensor	Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.
P0102	Air flow sensor circuit low input	Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.
P0103	Air flow sensor circuit high input	Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.

Code No.	Diagnosis item	Control content during malfunction
P0107	Manifold absolute pressure sensor circuit low input	Control as if the inlet manifold vacuum pressure is 101 kPa.
P0108	Manifold absolute pressure sensor circuit high input	Control as if the inlet manifold vacuum pressure is 101 kPa.
P0112	Intake air temperature sensor circuit low input	Control as if the intake air temperature is 25°C.
P0113	Intake air temperature sensor circuit high input	Control as if the intake air temperature is 25°C.
P0117	Engine coolant temperature sensor circuit low input	Control as if the engine coolant temperature is 80°C.
P0118	Engine coolant temperature sensor circuit high input	Control as if the engine coolant temperature is 80°C.
P0121	Trustful check throttle position sensor (main)	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (sub) fails.
P0122	Throttle position sensor (main) circuit low input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (sub) fails.
P0123	Throttle position sensor (main) circuit high input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (sub) fails.
P0125	Insufficient coolant temperature for closed loop fuel control	Control as if the engine coolant temperature is 80°C.
P0221	Trustful check throttle position sensor (sub)	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (main) fails.
P0222	Throttle position sensor (sub) circuit low input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (main) fails.
P0223	Throttle position sensor (sub) circuit high input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if throttle position sensor (main) fails.
P0300	Random/multiple cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0301	No. 1 cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0302	No. 2 cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0303	No. 3 cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.
P0304	No. 4 cylinder misfire detected	The supply of fuel to the misfiring cylinder can possibly be cut.

Code No.	Diagnosis item	Control content during malfunction
P0327	Detonation sensor circuit low input	Fix the ignition timing with an allowance against detonation.
P0328	Detonation sensor circuit high input	Fix the ignition timing with an allowance against detonation.
P0340	Inlet camshaft position sensor system	• Engine runs in learned pattern until engine stops. • Does not control variable valve timing (V.V.T.).
P0513	Immobilizer malfunction	Engine start is prohibited.
P0604	RAM error	• Microcomputer is reset. or • Throttle opening degree position is in default position.
P0606	Engine-ECU main processor malfunction	Throttle opening degree position is in default position.
P060B	A/D converter	Throttle opening degree position is in default position.
P060D	Trustful check accelerator pedal position sensor	Throttle opening degree position is in default position.
P061A	Torque monitoring	Throttle opening degree position is in default position.
P061C	Trustful check engine speed	Throttle opening degree position is in default position.
P061F	Fail-safe control system	Microcomputer is reset.
P0622	Alternator FR terminal system	Prohibits alternator output suppression control against current consumers. (Operates as a normal alternator.)
P0638	Throttle valve control servo circuit range/performance problem	Throttle opening degree position is in default position.
P0642	Throttle position sensor power supply	Throttle opening degree position is in default position.
P0657	Throttle valve control servo relay circuit malfunction	Throttle opening degree position is in default position.
P1231	Trustful check active stability control (ASC)	Torque requested by active stability control (ASC) is ignored.
P1238	Air flow sensor trustful for torque monitoring	Throttle opening degree position is in default position.
P1240	Trustful check ignition angle	Ignition retard is not carried out.
P1242	Fail safe control monitoring	Throttle opening degree position is in default position.
P1243	Inquiry/response error	Microcomputer is reset.
P1247	Trustful Check CVT	Torque requested by CVT-ECU is ignored.
P1590	CVT-ECU to engine-ECU communication error in torque reduction request	Engine output is restricted.
P1603	Battery backup circuit malfunction	All diagnosis codes are stored once failure judgment is completed.

Code No.	Diagnosis item	Control content during malfunction
P2100	Throttle valve control servo circuit (open)	Throttle opening degree position is in default position.
P2101	Throttle valve control servo magneto malfunction	Throttle opening degree position is in default position.
P2122	Accelerator pedal position sensor (main) circuit low input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.
P2123	Accelerator pedal position sensor (main) circuit high input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.
P2127	Accelerator pedal position sensor (sub) circuit low input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (main) fails.
P2128	Accelerator pedal position sensor (sub) circuit high input	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (main) fails.
P2135	Throttle position sensor (main and sub) circuit range/performance problem	Throttle opening degree position is in default position.
P2138	Accelerator pedal position sensor (main and sub) circuit range/performance	• Throttle opening degree is restricted. • Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.
P2228	Barometric pressure sensor circuit low input	Control as if the barometric pressure is 101 kPa.
P2229	Barometric pressure sensor circuit high input	Control as if the barometric pressure is 101 kPa.
P2253	Oxygen sensor offset circuit high voltage	Does not control air-fuel ratio closed loop.
U0167	KOS-ECU communication error	Engine start is prohibited.
U0415	ASC-ECU CAN data abnormality	Torque requested by active stability control (ASC) is ignored.

INSPECTION CHART FOR DIAGNOSIS CODE

M1131151006224

⚠ ***WARNING***

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

⚠ **CAUTION**

When the ignition switch is turned ON with the connector disconnected in proceeding with trouble-shooting, the diagnosis code may be stored in other systems. Erase codes if diagnosis codes of all the systems are checked and the codes are output after completion of the troubleshooting.

Code No.	Diagnosis item	Reference page
P0010	Inlet oil feeder control valve system	P.13A-25
P0011	Intake variable valve timing system	P.13A-27
P0031	Oxygen sensor (front) heater circuit low input	P.13A-28
P0032	Oxygen sensor (front) heater circuit high input	P.13A-29
P0037	Oxygen sensor (rear) heater circuit low input	P.13A-30
P0038	Oxygen sensor (rear) heater circuit high input	P.13A-32
P0068	Trustful check air flow sensor	P.13A-32
P0102	Air flow sensor circuit low input	P.13A-33
P0103	Air flow sensor circuit high input	P.13A-35
P0107	Manifold absolute pressure sensor circuit low input	P.13A-36
P0108	Manifold absolute pressure sensor circuit high input	P.13A-37
P0112	Intake air temperature sensor circuit low input	P.13A-39
P0113	Intake air temperature sensor circuit high input	P.13A-40
P0117	Engine coolant temperature sensor circuit low input	P.13A-41
P0118	Engine coolant temperature sensor circuit high input	P.13A-42
P0121	Trustful check throttle position sensor (main)	P.13A-44
P0122	Throttle position sensor (main) circuit low input	P.13A-45
P0123	Throttle position sensor (main) circuit high input	P.13A-46
P0125	Insufficient coolant temperature for closed loop fuel control	P.13A-47
P0131	Oxygen sensor (front) circuit low voltage	P.13A-49
P0132	Oxygen sensor (front) circuit high voltage	P.13A-50
P0133	Oxygen sensor (front) circuit slow response	P.13A-51
P0134	Oxygen sensor (front) circuit no activity detected	P.13A-52
P0137	Oxygen sensor (rear) circuit low voltage	P.13A-54
P0138	Oxygen sensor (rear) circuit high voltage	P.13A-55
P0171	Abnormal fuel system (lean)	P.13A-56
P0172	Abnormal fuel system (rich)	P.13A-58
P0221	Trustful check throttle position sensor (sub)	P.13A-59
P0222	Throttle position sensor (sub) circuit low input	P.13A-60

Code No.	Diagnosis item	Reference page
P0223	Throttle position sensor (sub) circuit high input	P.13A-61
P0261	No. 1 injector circuit low input	P.13A-62
P0262	No. 1 injector circuit high input	P.13A-63
P0264	No. 2 injector circuit low input	P.13A-64
P0265	No. 2 injector circuit high input	P.13A-65
P0267	No. 3 injector circuit low input	P.13A-66
P0268	No. 3 injector circuit high input	P.13A-67
P0270	No. 4 injector circuit low input	P.13A-68
P0271	No. 4 injector circuit high input	P.13A-69
P0300	Random/multiple cylinder misfire detected	P.13A-70
P0301	No. 1 cylinder misfire detected	P.13A-72
P0302	No. 2 cylinder misfire detected	P.13A-73
P0303	No. 3 cylinder misfire detected	P.13A-74
P0304	No. 4 cylinder misfire detected	P.13A-75
P0327	Detonation sensor circuit low input	P.13A-77
P0328	Detonation sensor circuit high input	P.13A-78
P0335	Crank angle sensor system	P.13A-78
P0340	Inlet camshaft position sensor system	P.13A-80
P0421	Catalyst malfunction	P.13A-82
P0458	Purge control solenoid valve circuit low input	P.13A-83
P0459	Purge control solenoid valve circuit high input	P.13A-84
P0513	Immobilizer malfunction	P.13A-85
P0602	Variant coding system	P.13A-86
P0604	RAM error	P.13A-87
P0606	Engine-ECU main processor malfunction	P.13A-87
P060B	A/D converter	P.13A-88
P060D	Trustful check accelerator pedal position sensor	P.13A-89
P061A	Torque monitoring	P.13A-89
P061C	Trustful check engine speed	P.13A-90
P061F	Fail-safe control system	P.13A-91
P0622	Alternator FR terminal system	P.13A-91
P062F	EEPROM malfunction	P.13A-92
P0630	Chassis number not programmed	P.13A-93
P0638	Throttle valve control servo circuit range/performance problem	P.13A-93
P0642	Throttle position sensor power supply	P.13A-94
P0657	Throttle valve control servo relay circuit malfunction	P.13A-94
P1231	Trustful check active stability control (ASC) <Vehicles with ASC>	P.13A-96

Code No.	Diagnosis item	Reference page
P1238	Air flow sensor trustful for torque monitoring	P.13A-97
P1240	Trustful check ignition angle <Vehicles with ASC>	P.13A-97
P1242	Fail safe control monitoring	P.13A-98
P1243	Inquiry/response error	P.13A-98
P1247	Trustful check CVT	P.13A-99
P1590	CVT-ECU to engine-ECU communication error in torque reduction request	P.13A-99
P1603	Battery backup circuit malfunction	P.13A-100
P2100	Throttle valve control servo circuit (open)	P.13A-100
P2101	Throttle valve control servo magneto malfunction	P.13A-102
P2122	Accelerator pedal position sensor (main) circuit low input	P.13A-102
P2123	Accelerator pedal position sensor (main) circuit high input	P.13A-104
P2127	Accelerator pedal position sensor (sub) circuit low input	P.13A-105
P2128	Accelerator pedal position sensor (sub) circuit high input	P.13A-106
P2135	Throttle position sensor (main and sub) range/performance problem	P.13A-107
P2138	Accelerator pedal position sensor (main and sub) range/performance problem	P.13A-108
P2228	Barometric pressure sensor circuit low input	P.13A-110
P2229	Barometric pressure sensor circuit high input	P.13A-110
P2252	Oxygen sensor offset circuit low voltage	P.13A-111
P2253	Oxygen sensor offset circuit high voltage	P.13A-112
P2530	Ignition switch-IG1 circuit	P.13A-113
U0101	CVT-ECU time-out	P.13A-114
U0121	ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC> time-out	P.13A-116
U0131	EPS-ECU time-out	P.13A-117
U0141	ETACS-ECU time-out	P.13A-119
U0167	KOS-ECU communication error <Vehicles with KOS>	P.13A-120
U0415	ASC-ECU CAN data abnormality <Vehicles with ASC>	P.13A-121

DIAGNOSIS CODE PROCEDURES

Code No. P0010: Inlet Oil Feeder Control Valve System

OPERATION

- Power is supplied to the inlet oil feeder control valve connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal OCVI makes the power transistor in the unit be in ON position, and that makes currents go on the inlet oil feeder control valve connector terminal.

FUNCTION

- The engine-ECU controls the spool valve position of the inlet oil feeder control valve corresponding to the driving condition of the engine and continuously changes the angle of the intake camshaft.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.
- Inlet oil feeder control valve is OFF.
- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criterion

- The engine-ECU terminal current value of inlet oil feeder control valve circuit is less than 0.1 A for 2 seconds.
- The engine-ECU terminal current value of inlet oil feeder control valve circuit is more than 2.9 A.

FAIL-SAFE AND BACKUP FUNCTION

- V.V.T. phase angle (inlet) becomes most retarded angle.

PROBABLE CAUSES

- Failed inlet oil feeder control valve
- Open/short circuit or harness damage in inlet oil feeder control valve circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check inlet oil feeder control valve itself.

- Inlet oil feeder control valve connector check.
- Oil feeder control valve check (Refer to P.13A-190).

Q: Is the check result normal?

YES : Go to Step 2.
NO : Repair or replace the connector, or replace the inlet oil feeder control valve.

STEP 2. Perform voltage measurement at inlet oil feeder control valve connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 4.
NO : Go to Step 3.

STEP 3. Connector check: engine control relay connector

Q: Is the check result normal?

YES : Check intermediate connector, and repair if necessary. If intermediate connector is normal, check and repair harness between engine control relay connector terminal and inlet oil feeder control valve connector terminal power supply line.
- Check power supply line for open/short circuit.

NO : Repair or replace the connector.

STEP 4. Perform voltage measurement at engine-ECU connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal OCVI and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair or replace the connector, or check and repair harness between inlet oil feeder control valve connector terminal and engine-ECU connector terminal OCVI.
- Check output line for open/short circuit.

STEP 5. Check harness between engine control relay connector terminal and inlet oil feeder control valve connector terminal power supply line.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Check harness between inlet oil feeder control valve connector terminal and engine-ECU connector terminal OCVI.

- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 7.
NO : Repair the damaged harness wire.

STEP 7. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0011: Inlet Variable Valve Timing System

OPERATION

- Check code No. P0010: inlet oil feeder control valve system (Refer to P.13A-25).

FUNCTION

- The engine-ECU controls the spool valve position of the inlet oil feeder control valve corresponding to the driving condition of the engine and continuously changes the phase of the inlet camshaft.
- The phase angle of the inlet camshaft is computed from the signal patterns of the crank angle sensor and inlet camshaft position sensor.

TROUBLE JUDGMENT

Check Conditions

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

Judgment Criterion

- Difference between inlet valve open timing and target inlet valve open timing is more than 5°CA for 5 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed inlet oil feeder control valve
- Damage in inlet oil feeder control valve circuit or loose connector contact
- Failed inlet timing sprocket operation
- Clogged oil passage
- Failed inlet camshaft
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 36: V.V.T. phase angle (inlet)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check inlet oil feeder control valve itself.

- Oil feeder control valve check (Refer to P.13A-190).

Q: Is the check result normal?

YES : Go to Step 3.
NO : Replace the inlet oil feeder control valve.

STEP 3. Check harness between inlet oil feeder control valve connector terminal and engine-ECU connector terminal OCVI.

- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check harness between engine control relay connector terminal and inlet oil feeder control valve connector terminal.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check inlet camshaft sensing portion.

Q: Is the check result normal?

YES : Go to Step 6.
NO : Replace the inlet camshaft.

STEP 6. Check inlet variable valve timing sprocket operation mechanism for being stuck.
- Check inlet variable valve timing sprocket (Refer to GROUP 11B – Timing Chain – Inspection).

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair it.

STEP 7. Check oil passage of inlet variable valve timing control system for being clogged.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair it.

STEP 8. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0031: Oxygen Sensor (front) Heater Circuit Low Input

OPERATION
- Power is supplied to the heater power terminal of the oxygen sensor (front) connector from the engine control relay connector terminal.
- The heater of the oxygen sensor (front) connector terminal is controlled by the power transistor in the engine-ECU connector terminal OHFL.

FUNCTION
- The power supply to the oxygen sensor (front) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the oxygen sensor (front) heater enables the oxygen sensor (front) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the oxygen sensor (front) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion
- The oxygen sensor (front) heater current is less than 0.17 A for 2 seconds.

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the oxygen sensor (front) heater is off.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion
- The oxygen sensor (front) heater voltage is less than 2.0 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed oxygen sensor (front) heater
- Open/short circuit or harness damage in oxygen sensor (front) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Perform resistance measurement at oxygen sensor (front) connector.
- Disconnect connector, and measure at sensor side.
- Resistance between terminal power supply line and engine-ECU OHFL line.

OK: 4.5 – 8.0 Ω (at 20°C)

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector, or replace the oxygen sensor (front).

STEP 2. Perform voltage measurement at oxygen sensor (front) connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or check and repair harness between oxygen sensor (front) connector terminal and engine control relay connector terminal.
- Check power supply line for open/short circuit.

STEP 3. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal OHFL and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or check intermediate connector, and repair if necessary. If intermediate connector is normal, check and repair harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal OHFL.
- Check earthing line for open/short circuit.

STEP 4. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal OHFL.
- Check earthing line for damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between oxygen sensor (front) connector terminal and engine control relay connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0032: Oxygen Sensor (front) Heater Circuit High Input

OPERATION
- Power is supplied to the heater power terminal of the oxygen sensor (front) connector from the engine control relay connector terminal.
- The heater of the oxygen sensor (front) connector terminal is controlled by the power transistor in the engine-ECU connector terminal OHFL.

FUNCTION
- The power supply to the oxygen sensor (front) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the oxygen sensor (front) heater enables the oxygen sensor (front) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the oxygen sensor (front) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion
- The oxygen sensor (front) heater current is more than 10.5 A for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed oxygen sensor (front) heater
- Short circuit in oxygen sensor (front) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Perform resistance measurement at oxygen sensor (front) connector.
- Disconnect connector, and measure at sensor side.
- Resistance between terminal power supply line and engine-ECU OHFL line.

OK: 4.5 – 8.0 Ω (at 20°C)

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector, or replace the oxygen sensor (front).

STEP 2. Check harness between engine control relay connector terminal and oxygen sensor (front) connector terminal.
- Check power supply line for short circuit.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal OHFL.
- Check earthing line for short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0037: Oxygen Sensor (rear) Heater Circuit Low Input

OPERATION
- Power is supplied to the heater power connector terminal of the oxygen sensor (rear) connector from the engine control relay connector terminal.
- The heater of the oxygen sensor (rear) connector terminal is controlled by the power transistor in the engine-ECU connector terminal OHRL.

FUNCTION
- The power supply to the oxygen sensor (rear) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the oxygen sensor (rear) heater enables the oxygen sensor (rear) to provide good response even when the exhaust emission temperature is low.

Judgement Criterion
- The oxygen sensor (rear) heater voltage is less than 2.0 V for 2 seconds.

TROUBLE JUDGMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the oxygen sensor (rear) heater is on.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

Judgement Criterion
- The oxygen sensor (rear) heater current is less than 0.17 A for 2 seconds.

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- While the oxygen sensor (rear) heater is off.
- Battery positive voltage is more than 11 V and is less than 16.5 V.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed oxygen sensor (rear) heater
- Open/short circuit or harness damage in oxygen sensor (rear) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Perform resistance measurement at oxygen sensor (rear) connector.

- Disconnect connector, and measure at sensor side.
- Resistance between terminals.

OK: 4.5 – 8.0 Ω (at 20°C)

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair or replace the connector, or replace the oxygen sensor (rear).

STEP 2. Perform voltage measurement at oxygen sensor (rear) connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or check intermediate connector, and repair if necessary. If intermediate connector is normal, check and repair harness between oxygen sensor (rear) connector terminal and engine control relay connector terminal.

- Check power supply line for open/short circuit.

STEP 3. Perform voltage measurement at engine-ECU connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal OHRL and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or check intermediate connectors, and repair if necessary. If intermediate connectors are normal, check and repair harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal OHRL.

- Check earthing line for open/short circuit.

STEP 4. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal OHRL.

- Check earthing line for damage.

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between oxygen sensor (rear) connector terminal and engine control relay connector terminal.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 6.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0038: Oxygen Sensor (rear) Heater Circuit High Input

OPERATION

- Power is supplied to the heater power connector terminal of the oxygen sensor (rear) connector from the engine control relay connector terminal.
- The heater the oxygen sensor (rear) connector terminal is controlled by the power transistor in the engine-ECU connector terminal OHRL.

FUNCTION

- The power supply to the oxygen sensor (rear) heater is controlled by the ON/OFF control of the power transistor in the engine-ECU.
- Heating the oxygen sensor (rear) heater enables the oxygen sensor (rear) to provide good response even when the exhaust emission temperature is low.

TROUBLE JUDGMENT

Check Conditions

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

Judgement Criterion

- The oxygen sensor (rear) heater current is more than 10.5 A for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed oxygen sensor (rear) heater
- Short circuit in oxygen sensor (rear) heater circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Perform resistance measurement at oxygen sensor (rear) connector.

- Disconnect connector, and measure at sensor side.
- Resistance between terminals.

OK: 4.5 – 8.0 Ω (at 20°C)

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector, or replace the oxygen sensor (rear).

STEP 2. Check harness between engine control relay connector terminal and oxygen sensor (rear) connector terminal.

- Check power supply line for short circuit.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal OHRL.

- Check earthing line for short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0068: Trustful Check Air Flow Sensor

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main and sub) signal.

TROUBLE JUDGMENT

Check Condition

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

Judgement Criterion

- Difference between the volumetric efficiency estimated by the throttle position sensor (main) and the volumetric efficiency estimated by the throttle position sensor (sub) is less than 8.8 %.

FAIL-SAFE AND BACKUP FUNCTION

- Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.

PROBABLE CAUSES

- Failed air flow sensor
- Harness damage in air flow sensor circuit or loose connector contact
- There is some foreign matter around air flow sensor
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0068 set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Go to Step 3.
NO : Check air flow sensor system. Check code No. P0102: air flow sensor circuit low input (Refer to P.13A-33). Check code No. P0103: air flow sensor circuit high input (Refer to P.13A-35).

STEP 3. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check air flow sensor.

- Check that there is not foreign matter around air flow sensor.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0102: Air Flow Sensor Circuit Low Input

OPERATION

- Power is supplied by the engine control relay connector terminal to the air flow sensor connector terminal.
- Power is supplied by the engine-ECU connector terminal AFS5 to the air flow sensor connector terminal, and the air flow sensor connector terminal is earthed through the engine-ECU connector terminal AFSE.
- The air flow sensor connector terminal outputs a sensor signal, which is input into the engine-ECU connector terminal AFS.

FUNCTION

- The air flow sensor outputs current that varies in accordance with the intake air volume.
- The engine-ECU uses the amperage output by the air flow sensor and the engine speed signal in order to determine the basic injection duration of the injector.

TROUBLE JUDGMENT

Check Condition

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

Judgement Criterion
- Air flow sensor output voltage is less than 0.2 V (corresponding to an air flow rate of 0 g/sec or less) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.

PROBABLE CAUSES
- Failed air flow sensor
- Open/short circuit or harness damage in air flow sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform voltage measurement at air flow sensor connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or check and repair harness between engine control relay connector terminal and air flow sensor connector terminal.
- Check power supply line for open/short circuit.

STEP 3. Perform voltage measurement at air flow sensor connector.
- Use special tool test harness (MB991709) to connect connector, and measure at pick-up harness.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU AFS5 line and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 4.

STEP 4. Perform voltage measurement at engine-ECU connector.
- Measure engine-ECU connector terminal voltage.
- Ignition switch: "ON"
- Voltage between terminal AFS5 and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or check and repair harness between engine-ECU connector terminal AFS5 and air flow sensor connector terminal No. 2.
- Check power supply line for open/short circuit.

STEP 5. Check harness between air flow sensor connector terminal and engine-ECU connector terminal AFS.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Check harness between engine control relay connector terminal and air flow sensor connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 10: Air flow sensor

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 8.

STEP 8. Replace the air flow sensor
- After replacing the air flow sensor, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0103: Air Flow Sensor Circuit High Input

OPERATION
- Power is supplied by the engine control relay connector terminal to the air flow sensor connector terminal.
- Power is supplied by the engine-ECU connector terminal AFS5 to the air flow sensor connector terminal, and the air flow sensor connector terminal is earthed through the engine-ECU connector terminal AFSE.
- The air flow sensor connector terminal outputs a sensor signal, which is input into the engine-ECU connector terminal AFS.

FUNCTION
- The air flow sensor outputs current that varies in accordance with the intake air volume.
- The engine-ECU uses the amperage output by the air flow sensor and the engine speed signal in order to determine the basic injection duration of the injector.

TROUBLE JUDGMENT

Check Condition
- More than 3 seconds have passed since the ignition switch was turned to "ON" position.

Judgement Criterion
- Air flow sensor output voltage is more than 4.9 V (corresponding to an air flow rate of 300 g/sec or more) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Fuel control is carried out using throttle opening degree and engine speed in accordance with preset map.

PROBABLE CAUSES
- Failed air flow sensor
- Open circuit or harness damage in air flow sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform resistance measurement at air flow sensor connector.
- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU AFSE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between air flow sensor connector terminal and engine-ECU connector terminal AFSE.
- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 10: Air flow sensor

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 6.

STEP 6. Replace the air flow sensor
- After replacing the air flow sensor, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0107: Manifold Absolute Pressure Sensor Circuit Low Input

OPERATION
- A power voltage of 5 V is applied to the manifold absolute pressure sensor power terminal from the engine-ECU connector terminal MAP5 and earthed to the engine-ECU connector terminal MAPE from the manifold absolute pressure sensor connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal MAP from the manifold absolute pressure sensor output terminal.

FUNCTION
- The manifold absolute pressure sensor detects a change in inlet manifold pressure and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGMENT

Check Conditions
- More than 8 minutes have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is less than 0°C.
- Volumetric efficiency is more than 20 %.

Judgement Criterion
- Manifold absolute pressure sensor output voltage is less than 0.2 V (corresponding to a manifold absolute pressure of 5 kPa or less) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Control as if the inlet manifold vacuum pressure is 101 kPa.

PROBABLE CAUSES
- Failed manifold absolute pressure sensor
- Open/short circuit or harness damage in manifold absolute pressure sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform voltage measurement at manifold absolute pressure sensor connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU MAP5 line and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between manifold absolute pressure sensor connector terminal and engine-ECU connector terminal MAP5.

- Check power supply line for open/short circuit.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

STEP 5. Check harness between manifold absolute pressure sensor connector terminal and engine-ECU connector terminal MAP5.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 6.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform voltage measurement at manifold absolute pressure sensor connector.

- Use special tool test harness (MB991709) to connect connector, and measure at pick-up harness.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU MAP line and body earth.

Altitude 0 m: 3.8 – 4.2 V
Altitude 600 m: 3.5 – 3.9 V
Altitude 1,200 m: 3.3 – 3.7 V
Altitude 1,800 m: 3.0 – 3.4 V

Q: Is the check result normal?

YES : Go to Step 8.

NO : Go to Step 7.

STEP 7. Check harness between manifold absolute pressure sensor connector terminal and engine-ECU connector terminal MAP.

- Check output line for short circuit.

Q: Is the check result normal?

YES : Replace the manifold absolute pressure sensor.

NO : Repair the damaged harness wire.

STEP 8. Perform voltage measurement at engine-ECU connector.

- Disconnect engine-ECU harness, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Ignition switch: "ON"
- Voltage between terminal MAP and body earth.

Altitude 0 m: 3.8 – 4.2 V
Altitude 600 m: 3.5 – 3.9 V
Altitude 1,200 m: 3.3 – 3.7 V
Altitude 1,800 m: 3.0 – 3.4 V

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or check and repair harness between manifold absolute pressure sensor connector terminal and engine-ECU connector terminal MAP.

- Check output line for open circuit and damage.

Code No. P0108: Manifold Absolute Pressure Sensor Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the manifold absolute pressure sensor power terminal from the engine-ECU connector terminal MAP5 and earthed to the engine-ECU connector terminal MAPE from the manifold absolute pressure sensor connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal MAP from the manifold absolute pressure sensor output terminal.

FUNCTION

- The manifold absolute pressure sensor detects a change in inlet manifold pressure and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGMENT

Check Condition

- More than 8 minutes have passed since the engine starting sequence was completed, when the engine coolant temperature at engine start is less than 0°C.

Judgement Criterion

- Manifold absolute pressure sensor output voltage is more than 4.6 V (corresponding to a manifold absolute pressure of 117 kPa or more) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the inlet manifold vacuum pressure is 101 kPa.

PROBABLE CAUSES

- Failed manifold absolute pressure sensor
- Open circuit or harness damage in manifold absolute pressure sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform resistance measurement at manifold absolute pressure sensor connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU MAPE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between manifold absolute pressure sensor connector terminal and engine-ECU connector terminal MAPE.

- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 8: Manifold absolute pressure sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 6.

STEP 6. Replace the manifold absolute pressure sensor

- After replacing the manifold absolute pressure sensor, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0112: Intake Air Temperature Sensor Circuit Low Input

OPERATION

- A power voltage of 5 V is applied to the intake air temperature sensor power terminal of air flow sensor from the engine-ECU connector terminal AFS5, ATS.
- The power voltage is earthed to the engine-ECU connector terminal AFSE from the intake air temperature sensor connector terminal.

FUNCTION

- The intake air temperature sensor converts the intake air temperature into a voltage and inputs the voltage signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.
- The intake air temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the intake air temperature rises. Therefore, the sensor output voltage varies with the intake air temperature, and becomes lower as the intake air temperature rises.

TROUBLE JUDGMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Intake air temperature sensor output voltage is less than 0.2 V (corresponding to an intake air temperature of 115°C or more) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the intake air temperature is 25°C.

PROBABLE CAUSES

- Failed intake air temperature sensor
- Short circuit in intake air temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 5: Intake air temperature sensor

  OK: At ambient temperature (atmospheric temperature) or equivalent.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check intake air temperature sensor itself.

- Air flow sensor connector check.
- Intake air temperature sensor check (Refer to P.13A-185).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or replace the air flow sensor.

STEP 3. Perform voltage measurement at air flow sensor connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU AFS5 or ATS line and body earth.

  OK: 4.5 – 4.9 V

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check harness between air flow sensor connector terminal and engine-ECU connector terminal AFS5, ATS.

- Check power line for short circuit.

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. M.U.T.-III data list

- Item 5: Intake air temperature sensor

  OK: At ambient temperature (atmospheric temperature) or equivalent.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0113: Intake Air Temperature Sensor Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the intake air temperature sensor power terminal of air flow sensor connector from the engine-ECU connector terminal AFS5, ATS.
- The power voltage is earthed to the engine-ECU connector terminal AFSE from the intake air temperature sensor connector terminal.

FUNCTION

- The intake air temperature sensor converts the intake air temperature into a voltage and inputs the voltage signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.
- The intake air temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the intake air temperature rises. Therefore, the sensor output voltage varies with the intake air temperature, and becomes lower as the intake air temperature rises.

TROUBLE JUDGMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Intake air temperature sensor output voltage is more than 4.6 V (corresponding to an intake air temperature of –40°C or less) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the intake air temperature is 25°C.

PROBABLE CAUSES

- Failed intake air temperature sensor
- Open circuit or harness damage in intake air temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 5: Intake air temperature sensor

  OK: At ambient temperature (atmospheric temperature) or equivalent.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check intake air temperature sensor itself.

- Air flow sensor connector check.
- Intake air temperature sensor check (Refer to P.13A-185).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the air flow sensor.

STEP 3. Perform voltage measurement at air flow sensor connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU AFS5 or ATS line and body earth.

  OK: 4.5 – 4.9 V

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check harness between air flow sensor connector terminal and engine-ECU connector terminal AFS5, ATS.

- Check power line for open circuit.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. M.U.T.-III data list

- Item 5: Intake air temperature sensor

OK: At ambient temperature (atmospheric temperature) or equivalent.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 6. Perform resistance measurement at air flow sensor connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU AFSE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check harness between air flow sensor connector terminal and engine-ECU connector terminal AFSE.

- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Check harness between air flow sensor connector terminal and engine-ECU connector terminal AFS5, ATS.

- Check power line for damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

Code No. P0117: Engine Coolant Temperature Sensor Circuit Low Input

OPERATION

- A power voltage of 5 V is applied to the engine coolant temperature sensor power terminal from the engine-ECU connector terminal WTS.
- The power voltage is earthed to the engine-ECU connector terminal WTSE from the engine coolant temperature sensor connector terminal.

FUNCTION

- The engine coolant temperature sensor converts the engine coolant temperature into a voltage signal, and inputs the voltage to the engine-ECU.
- In response to the signal, the engine-ECU controls the fuel injection amount and the fast idle speed when the engine is cold state.
- The engine coolant temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the engine coolant temperature rises. Therefore, the sensor output voltage varies with the engine coolant temperature, and becomes lower as the engine coolant temperature rises.

TROUBLE JUDGMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Engine coolant temperature sensor output voltage is less than 0.1 V (corresponding to an engine coolant temperature of 140°C or more) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the engine coolant temperature is 80°C.

PROBABLE CAUSES

- Failed engine coolant temperature sensor
- Short circuit in engine coolant temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120°C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform resistance measurement at engine coolant temperature sensor connector.

- Disconnect connector, and measure at sensor side.
- Resistance between terminals.

OK:
Engine coolant temperature at –20°C: 14 – 17 kΩ
Engine coolant temperature at 0°C: 5.1 – 6.5 kΩ
Engine coolant temperature at 20°C: 2.1 – 2.7 kΩ
Engine coolant temperature at 40°C: 0.9 – 1.3 kΩ
Engine coolant temperature at 60°C: 0.48 – 0.68 kΩ
Engine coolant temperature at 80°C: 0.26 – 0.36 kΩ

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the engine coolant temperature sensor.

STEP 3. Perform voltage measurement at engine coolant temperature sensor connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU WTS line and body earth.

OK: 4.5 – 4.9 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 4.

STEP 4. Check harness between engine coolant temperature sensor connector terminal and engine-ECU connector terminal WTS.

- Check power line for short circuit.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120 °C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0118: Engine Coolant Temperature Sensor Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the engine coolant temperature sensor power terminal from the engine-ECU connector terminal WTS.

- The power voltage is earthed to the engine-ECU connector terminal WTSE from the engine coolant temperature sensor connector terminal.

FUNCTION

- The engine coolant temperature sensor converts the engine coolant temperature into a voltage signal, and inputs the voltage to the engine-ECU.
- In response to the signal, the engine-ECU controls the fuel injection amount and the fast idle speed when the engine is cold state.
- The engine coolant temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the engine coolant temperature rises. Therefore, the sensor output voltage varies with the engine coolant temperature, and becomes lower as the engine coolant temperature rises.

TROUBLE JUDGMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Engine coolant temperature sensor output voltage is more than 4.6 V (corresponding to an engine coolant temperature of –45°C or less) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the engine coolant temperature is 80°C.

PROBABLE CAUSES

- Failed engine coolant temperature sensor
- Open circuit or harness damage in engine coolant temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120°C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform resistance measurement at engine coolant temperature sensor connector.

- Disconnect connector, and measure at sensor side.
- Resistance between terminals.

OK:
Engine coolant temperature at –20°C: 14 – 17 kΩ
Engine coolant temperature at 0°C: 5.1 – 6.5 kΩ
Engine coolant temperature at 20°C: 2.1 – 2.7 kΩ
Engine coolant temperature at 40°C: 0.9 – 1.3 kΩ
Engine coolant temperature at 60°C: 0.48 – 0.68 kΩ
Engine coolant temperature at 80°C: 0.26 – 0.36 kΩ

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the engine coolant temperature sensor.

STEP 3. Perform voltage measurement at engine coolant temperature sensor connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU WTS line and body earth.

OK: 4.5 – 4.9 V

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check harness between engine coolant temperature sensor connector terminal and engine-ECU connector terminal WTS.

- Check output line for open circuit.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120 °C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 6. Perform resistance measurement at engine coolant temperature sensor connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU WTSE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check harness between engine coolant temperature sensor connector terminal and engine-ECU connector terminal WTSE.

- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Check harness between engine coolant temperature sensor connector terminal and engine-ECU connector terminal WTS.

- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

Code No. P0121: Trustful Check Throttle Position Sensor (main)

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main) signal.

TROUBLE JUDGMENT

Check Conditions

- Difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (main) is more than 0 %. Or, the volumetric efficiency is less than 60 %.
- Engine speed is more than 750 r/min and is less than 3,000r/min. Or, the throttle position sensor (main) output voltage is less than 3 V.

Judgement Criterion

- Difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (main) is more than 33 %.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (sub) fails.

PROBABLE CAUSES

- Failed throttle position sensor (main)
- Harness damage in throttle position sensor (main) circuit or loose connector contact
- Failed intake air system
- There is some foreign matter around air flow sensor
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0121 set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?

YES : Go to Step 3.
NO : Check throttle position sensor (main) system. Check code No. P0122: throttle position sensor (main) circuit low input (Refer to P.13A-45). Check code No. P0123: throttle position sensor (main) circuit high input (Refer to P.13A-46).

STEP 3. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check air flow sensor.
- Check that there is not foreign matter around air flow sensor.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0122: Throttle Position Sensor (main) Circuit Low Input

OPERATION
- A power voltage of 5 V is applied to the electronic-controlled throttle valve connector terminal from the engine-ECU connector terminal TPS5.
- The power voltage is earthed to the engine-ECU connector terminal TPSE from the electronic-controlled throttle valve connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal TPSM from the electronic-controlled throttle valve output terminal.

FUNCTION
- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve opening angle.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Throttle position sensor (main) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (sub) fails.

PROBABLE CAUSES
- Failed throttle position sensor (main)
- Short circuit or harness damage in throttle position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPS5.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPSM.

- Check output line for short circuit.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 5.

STEP 5. Replace the electronic-controlled throttle valve

- After replacing the electronic-controlled throttle valve, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?

YES : Replace the engine-ECU.

NO : Check end.

Code No. P0123: Throttle Position Sensor (main) Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve connector terminal from the engine-ECU connector terminal TPS5.
- The power voltage is earthed to the engine-ECU connector terminal TPSE from the electronic-controlled throttle valve connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal TPSM from the electronic-controlled throttle valve output terminal.

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve opening angle.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (main) output voltage is more than 4.8 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (sub) fails.

PROBABLE CAUSES

- Failed throttle position sensor (main)
- Open/short circuit or harness damage in throttle position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Perform voltage measurement at electronic-controlled throttle valve connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU TPS5 line and body earth.

  OK: 4.9 – 5.1 V

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 3.

STEP 3. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPS5.

- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Perform resistance measurement at electronic-controlled throttle valve connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU TPSE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 7.
NO : Go to Step 6.

STEP 6. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPSE.

- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPS5.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPSM.

- Check output line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 9. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 13: Throttle position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 10.

STEP 10. Replace the electronic-controlled throttle valve

- After replacing the electronic-controlled throttle valve, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control

OPERATION

- A power voltage of 5 V is applied to the engine coolant temperature sensor power terminal from the engine-ECU connector terminal WTS.
- The power voltage is earthed to the engine-ECU connector terminal WTSE from the engine coolant temperature sensor connector terminal.

FUNCTION

- The engine coolant temperature sensor converts the engine coolant temperature into a voltage signal, and inputs the voltage to the engine-ECU.
- In response to the signal, the engine-ECU controls the fuel injection amount and the fast idle speed when the engine is cold state.
- The engine coolant temperature sensor is a kind of resistor, which has characteristics to reduce its resistance as the engine coolant temperature rises. Therefore, the sensor output voltage varies with the engine coolant temperature, and becomes lower as the engine coolant temperature rises.

TROUBLE JUDGMENT

Check Conditions, Judgement Criteria

- While engine is running.
- Engine coolant temperature decreases from more than 40°C to less than 40°C.
- Then the engine coolant temperature is less than 40°C for 5 minutes.

FAIL-SAFE AND BACKUP FUNCTION

- Control as if the engine coolant temperature is 80°C.

PROBABLE CAUSES

- Failed engine coolant temperature sensor
- Harness damage in engine coolant temperature sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:

Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.

Engine hot state: At 80 – 120°C

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Perform resistance measurement at engine coolant temperature sensor connector.

- Disconnect connector, and measure at sensor side.
- Resistance between terminals.

OK:

Engine coolant temperature at –20°C: 14 – 17 kΩ

Engine coolant temperature at 0°C: 5.1 – 6.5 kΩ

Engine coolant temperature at 20°C: 2.1 – 2.7 kΩ

Engine coolant temperature at 40°C: 0.9 – 1.3 kΩ

Engine coolant temperature at 60°C: 0.48 – 0.68 kΩ

Engine coolant temperature at 80°C: 0.26 – 0.36 kΩ

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or replace the engine coolant temperature sensor.

STEP 3. Perform voltage measurement at engine coolant temperature sensor connector.

- Use special tool test harness (MB991709) to connect connector, and measure at pick-up harness.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU WTS line and body earth.

OK:

Engine coolant temperature at –20°C: 3.9 – 4.5 V

Engine coolant temperature at 0°C: 3.2 – 3.8 V

Engine coolant temperature at 20°C: 2.3 – 2.9 V

Engine coolant temperature at 40°C: 1.3 – 1.9 V

Engine coolant temperature at 60°C: 0.7 – 1.3 V

Engine coolant temperature at 80°C: 0.3 – 0.9 V

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check harness between engine coolant temperature sensor connector terminal and engine-ECU connector terminal WTS.

- Check power line for damage.

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between engine coolant temperature sensor connector terminal and engine-ECU connector terminal WTSE.
- Check earthing line for damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. M.U.T.-III data list
- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120 °C

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0131: Oxygen Sensor (front) Circuit Low Voltage

OPERATION
- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the oxygen sensor (front) output terminal.
- The oxygen sensor (front) connector terminal is earthed with engine-ECU connector terminal OFLE.

FUNCTION
- The oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGMENT

Check Conditions
- More than 1 minute have passed since the engine starting sequence was completed.
- Battery positive voltage is more than 11 V and is less than 16.5 V.
- Oxygen sensor (front) offset voltage is more than 0.4 V and is less than 0.6 V.

Judgement Criterion
- Oxygen sensor (front) output voltage is less than 0.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed oxygen sensor (front)
- Open/short circuit or harness damage in oxygen sensor (front) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform voltage measurement at oxygen sensor (front) connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU OFLE line and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal OFLE.

- Check earthing line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal OFLE.

- Check earthing line for damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform voltage measurement at oxygen sensor (front) connector.

- Use special tool test harness (MB991658) to connect connector, and measure at pick-up harness.
- Engine: After warm-up
- Transmission: P range
- Voltage between terminal engine-ECU O2FL line and earth.

OK:
When the engine is 2,500 r/min, the output voltage should repeat 0.9 V or less ⇔ 1.1 to 1.5 V alternately.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check oxygen sensor (front) itself.

- Oxygen sensor check (Refer to P.13A-186).

Q: Is the check result normal?
YES : Repair or replace the connector, or check intermediate connector, and repair if necessary. If intermediate connector is normal, check and repair harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal O2FL.
- Check output line for short circuit.

NO : Replace oxygen sensor (front).

STEP 8. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal O2FL.

- Check output line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the damaged harness wire.

Code No. P0132: Oxygen Sensor (front) Circuit High Voltage

OPERATION

- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the oxygen sensor (front) output terminal.
- The oxygen sensor (front) connector terminal is earthed with engine-ECU connector terminal OFLE.

FUNCTION

- The oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGMENT

Check Conditions

- Oxygen sensor (front) offset voltage is more than 0.4 V and is less than 3.8 V.
- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Oxygen sensor (front) output voltage is more than 1.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Short circuit in oxygen sensor (front) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)

Q: Are the check results normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal O2FL.

- Check output line for short circuit.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal OFLE.

- Check earthing line for short circuit.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

Code No. P0133: Oxygen Sensor (front) Circuit Slow Response

OPERATION

- The sensor signal is inputted to the engine-ECU connector terminal O2FL from the oxygen sensor (front) output terminal.
- The oxygen sensor (front) connector terminal is earthed with engine-ECU connector terminal OFLE.

FUNCTION

- The oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGMENT

Check Conditions

- Engine coolant temperature is more than 60°C.
- Engine speed is more than 1,200 r/min and is less than 3,000 r/min. <4B11>
- Engine speed is more than 1,100 r/min and is less than 3,000 r/min. <4B12>
- Volumetric efficiency is more than 27 % and is less than 65 %. <4B11>
- Volumetric efficiency is more than 18 % and is less than 60 %. <4B12>
- Under the closed loop air/fuel control.

- The accelerator pedal is open.
- Short-term fuel trim is more than –25 % and is less than +25 %.
- More than 2 seconds have elapsed after the above mentioned conditions have been met.
- The engine-ECU monitors for this condition for 7 cycles of 10 seconds each during the drive cycle.

Judgement Criterion

- The average of the oxygen sensor (front) rich/lean switching frequency is less than 6 times per 10 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed oxygen sensor (front)
- Loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check oxygen sensor (front) itself.

- Oxygen sensor (front) check (Refer to P.13A-186).

Q: Is the check result normal?

YES : Go to Step 3.
NO : Replace oxygen sensor (front).

STEP 3. Connector check: oxygen sensor (front) connector and engine-ECU connector

Q: Are the check results normal?

YES : Go to Step 4.
NO : Repair or replace the connector.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0134: Oxygen Sensor (front) Circuit No Activity Detected

OPERATION

- Check code No. P0131: oxygen sensor (front) circuit low voltage (Refer to P.13A-49).
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62).
- Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63).
- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64).
- Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65).
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66).
- Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67).
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68).
- Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).

FUNCTION

- The oxygen sensor (front) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the oxygen sensor (front) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGMENT

Check Conditions

- Typically 20 seconds have passed since the engine starting sequence was completed.
- Engine coolant temperature is more than 76°C. <4B11>
- Engine coolant temperature is more than 60°C. <4B12>
- Engine speed is more than 1,188 r/min.
- Volumetric efficiency is more than 30 %.
- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgement Criterion

- Oxygen sensor (front) output voltage does not get across lean/rich criteria (about 0.5 V) within about 30 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed oxygen sensor (front)
- Harness damage in oxygen sensor (front) circuit
- Failed injector
- Harness damage in injector circuit
- Exhaust leak
- Air drawn in from gaps in gasket, seal, etc.
- Incorrect fuel pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check for exhaust leaks.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair.

STEP 3. Check for intake system vacuum leak.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check oxygen sensor (front) itself.

- Oxygen sensor (front) connector check.
- Oxygen sensor (front) check (Refer to P.13A-186).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or replace the oxygen sensor (front).

STEP 5. Check injector itself.

- No.1, No.2, No.3, No.4 injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or replace the injector.

STEP 6. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal O2FL.

- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Check harness between injector connector and engine-ECU connector.

a. Check and repair harness between No. 1 injector connector terminal and engine-ECU connector terminal INJ1.
b. Check and repair harness between No. 2 injector connector terminal and engine-ECU connector terminal INJ2.
c. Check and repair harness between No. 3 injector connector terminal and engine-ECU connector terminal INJ3.
d. Check and repair harness between No. 4 injector connector terminal and engine-ECU connector terminal INJ4.
   - Check output line for damage.

Q: Are the check result normal?
YES : Go to Step 8.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13A-179).

Q: Is the check result normal?

YES : Replace the engine-ECU.
NO : Repair.

Code No. P0137: Oxygen Sensor (rear) Circuit Low Voltage

OPERATION
- The sensor signal is inputted to the engine-ECU connector terminal O2RL from the oxygen sensor (rear) output terminal.
- The oxygen sensor (rear) connector terminal is earthed with engine-ECU connector terminal ORLE.

FUNCTION
- The oxygen sensor (rear) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the oxygen sensor (rear) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGMENT

Check Conditions
- Oxygen sensor (rear) offset voltage is more than 0.4 V and is less than 0.6 V.
- Battery positive voltage is more than 11 V and is less than 16.5 V.
- More than 5 minutes have passed since the engine starting sequence was completed.

Judgement Criterion
- Oxygen sensor (rear) output voltage is less than 0.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed oxygen sensor (rear)
- Open/short circuit or harness damage in oxygen sensor (rear) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item AD: Oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform voltage measurement at oxygen sensor (rear) connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU ORLE line and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal ORLE.
- Check earthing line for open circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item AD: Oxygen sensor (rear)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal ORLE.

- Check earthing line for damage.

Q: Is the check result normal?

YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform voltage measurement at oxygen sensor (rear) connector.

- Use special tool test harness (MB991658) to connect connector, and measure at pick-up harness.
- Transmission: 2nd speed
- Drive with wide open throttle
- Engine: 3,500 r/min or more
- Voltage between terminal engine-ECU O2RL line and body earth.

OK:
The output voltage should be 1.1 – 1.5 V.

Q: Is the check result normal?

YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check oxygen sensor (rear) itself.

- Oxygen sensor check (Refer to P.13A-186).

Q: Is the check result normal?

YES : Repair or replace the connector, or check intermediate connectors, and repair if necessary. If intermediate connectors are normal, check and repair harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal O2RL.
- Check output line for short circuit.

NO : Replace oxygen sensor (rear).

STEP 8. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal O2RL.

- Check output line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 4.
NO : Repair the damaged harness wire.

Code No. P0138: Oxygen Sensor (rear) Circuit High Voltage

OPERATION

- The sensor signal is inputted to the engine-ECU connector terminal O2RL from the oxygen sensor (rear) output terminal.
- The oxygen sensor (rear) connector terminal is earthed with engine-ECU connector terminal ORLE.

FUNCTION

- The oxygen sensor (rear) converts the concentration of oxygen in the exhaust emission into a voltage and inputs the signal to the engine-ECU.
- When the air-fuel ratio is richer than the theoretical air-fuel ratio, the oxygen sensor (rear) outputs a voltage of about 1 V. When it is leaner than the theoretical air-fuel ratio, it outputs a voltage of about 0 V.
- In response to the signal, the engine-ECU controls the fuel injection amount so that the air-fuel ratio can be equivalent to the theoretical air-fuel ratio.

TROUBLE JUDGMENT

Check Conditions

- More than 2 seconds have passed since the engine starting sequence was completed.
- Oxygen sensor (rear) offset voltage is more than 0.4 V and is less than 3.8 V.

Judgement Criterion

- Oxygen sensor (rear) output voltage is more than 1.2 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed oxygen sensor (rear)
- Short circuit in oxygen sensor (rear) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AD: Oxygen sensor (rear)

Q: Are the check results normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal O2RL.
- Check output line for short circuit.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal ORLE.
- Check earthing line for short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item AD: Oxygen sensor (rear)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0171: Abnormal Fuel System (lean)

OPERATION
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62).
- Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63).
- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64).
- Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65).
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66).
- Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67).
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68).
- Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).

FUNCTION
- If the fuel system goes out of order, the fuel correction value will become larger.
- The engine-ECU checks whether the fuel trim value is within a specified range.

TROUBLE JUDGMENT

Check Conditions
- Engine coolant temperature is less than 100°C when the engine is started.
- Intake air temperature is less than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is more than 6.4 g/sec.

Judgement Criterion
- Long-term fuel trim is more than +12.5 % for 5 seconds.

or
- Short-term fuel trim is more than +7.0 % for 5 seconds. <4B11>
- Short-term fuel trim is more than +10.0 % for 5 seconds. <4B12>

Check Conditions
- Engine coolant temperature is more than 100°C when the engine is started.
- Intake air temperature is more than 60°C when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.
- Air flow sensor output is more than 6.4 g/sec.

Judgement Criterion
- Long-term fuel trim is more than +12.5 % for 5 seconds.

or
- Short-term fuel trim is more than +17.2 % for 5 seconds. <4B11>

- Short-term fuel trim is more than +19.9 % for 5 seconds. <4B12>

Check Conditions

- Engine coolant temperature is more than 76°C.
- Under the closed loop air/fuel ratio control.

Judgement Criterion

- Long-term fuel trim is +12.5 % for 2 seconds.

or

- Short-term fuel trim is +25.0 % for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed intake air temperature sensor
- Failed air flow sensor
- Failed injector
- Air drawn in from gaps in gasket, seals, etc.
- Failed engine coolant temperature sensor
- Failed manifold absolute pressure sensor
- Failed barometric pressure sensor
- Exhaust leak
- Incorrect fuel pressure
- Use of incorrect or contaminated fuel
- Harness damage in injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0171 set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor
  e. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 3. Check for exhaust leaks

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check for intake system vacuum leaks.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Check injector itself.

- No. 1 injector connector.
- No. 2 injector connector.
- No. 3 injector connector.
- No. 4 injector connector.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector or replace the injector.

STEP 6. Check harness between injector connector and engine-ECU connector.

a. Check and repair harness between No. 1 injector connector terminal and engine-ECU connector terminal INJ1.
b. Check and repair harness between No. 2 injector connector terminal and engine-ECU connector terminal INJ2.
c. Check and repair harness between No. 3 injector connector terminal and engine-ECU connector terminal INJ3.
d. Check and repair harness between No. 4 injector connector terminal and engine-ECU connector terminal INJ4.
   - Check output line for damage.

Q: Are the check results normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Fuel pressure measurement.

- Fuel pressure test (Refer to P.13A-179).

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair.

STEP 8. Check fuel.
- Check for entry of foreign matter (water, diesel fuel, etc.) into fuel.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Replace the fuel.

STEP 9. Replace the injector.
- After replacing the injector, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0172: Abnormal Fuel System (rich)

OPERATION
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62).
- Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63).
- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64).
- Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65).
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66).
- Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67).
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68).
- Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).

FUNCTION
- If the fuel system goes out of order, the fuel correction value will become larger.
- The engine-ECU checks whether the fuel trim value is within a specified range.

TROUBLE JUDGMENT

Check Conditions
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is more than 76°C.

Judgement Criterion
- Long-term fuel trim is less than –12.5 % for 5 seconds.

or
- Short-term fuel trim is less than –10.2 % for 5 seconds.

Check Conditions
- Engine coolant temperature is more than 76°C.
- Under the closed loop air/fuel ratio control.

Judgement Criterion
- Long-term fuel trim is –12.5 % for 2 seconds.

or
- Short-term fuel trim is –25.0 % for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed intake air temperature sensor
- Failed air flow sensor
- Failed injector
- Failed engine coolant temperature sensor
- Failed manifold absolute pressure sensor
- Failed barometric pressure sensor
- Incorrect fuel pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0172 set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor
  e. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 3. Check injector itself.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Replace the injector.

STEP 4. Fuel pressure measurement.

- Fuel pressure test (Refer to P.13A-179).

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair.

STEP 5. Replace the injector.

- After replacing the injector, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?

YES : Replace the engine-ECU.
NO : Check end.

Code No. P0221: Trustful Check Throttle Position Sensor (sub)

FUNCTION

- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (sub) signal.

TROUBLE JUDGMENT

Check Conditions

- Difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (sub) is more than 0 %. Or, the volumetric efficiency is less than 60 %.
- Engine speed is more than 750 r/min and is less than 3,000 r/min. Or, the throttle position sensor (sub) output voltage is less than 3 V.

Judgement Criterion

- Difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (sub) is more than 33 %.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (main) fails.

PROBABLE CAUSES

- Failed throttle position sensor (sub)
- Harness damage in throttle position sensor (sub) circuit or loose connector contact
- Failed intake air system
- There is some foreign matter around air flow sensor.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P0221 set?

YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Go to Step 3.
NO : Check throttle position sensor (sub) system. Check code No. P0222: throttle position sensor (sub) circuit low input (Refer to P.13A-60). Check code No. P0223: throttle position sensor (sub) circuit high input (Refer to P.13A-61).

STEP 3. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?

YES : Go to Step 4.
NO : Repair.

STEP 4. Check air flow sensor.

- Check that there is not foreign matter around air flow sensor.

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair.

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0222: Throttle Position Sensor (sub) Circuit Low Input

OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve connector terminal from the engine-ECU connector terminal TPS5.
- The power voltage is earthed to the engine-ECU connector terminal TPSE from the electronic-controlled throttle valve connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal TPSS from the electronic-controlled throttle valve output terminal.

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve opening angle.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (sub) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (main) fails.

PROBABLE CAUSES

- Failed throttle position sensor (sub)
- Open/short circuit or harness damage in throttle position sensor (sub) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Perform voltage measurement at electronic-controlled throttle valve connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU TPS5 line and body earth.

  OK: 4.9 – 5.1 V

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 3.

STEP 3. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPS5.

- Check power supply line for open/short circuit.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

STEP 5. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPS5.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 6.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPSS.

- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Replace the electronic-controlled throttle valve

- After replacing the electronic-controlled throttle valve, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0223: Throttle Position Sensor (sub) Circuit High Input

OPERATION

- A power voltage of 5 V is applied to the electronic-controlled throttle valve connector terminal from the engine-ECU connector terminal TPS5.
- The power voltage is earthed to the engine-ECU connector terminal TPSE from the electronic-controlled throttle valve connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal TPSS from the electronic-controlled throttle valve output terminal.

FUNCTION

- The throttle position sensor converts the throttle valve position into voltage and inputs it into the engine-ECU.
- The engine-ECU controls the throttle valve opening angle.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Throttle position sensor (sub) output voltage is more than 4.8 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if throttle position sensor (main) fails.

PROBABLE CAUSES

- Failed throttle position sensor (sub)
- Open circuit and harness damage in throttle position sensor (sub) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform resistance measurement at electronic-controlled throttle valve connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU TPSE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPSE.

- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 15: Throttle position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

STEP 5. Replace the electronic-controlled throttle valve

- After replacing the electronic-controlled throttle valve, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?

YES : Replace the engine-ECU.

NO : Check end.

Code No. P0261: No. 1 Injector Circuit Low Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ1 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGMENT

Check Condition

- Engine is running.

Judgement Criterion

- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 1 injector
- Open/short circuit or harness damage in No. 1 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 1: No. 1 injector

OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check No. 1 injector itself.

- No. 1 Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or replace the No. 1 injector.

STEP 3. Perform voltage measurement at No. 1 injector connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check harness between engine control relay connector terminal and No. 1 injector connector terminal power supply line.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between No. 1 injector connector terminal and engine-ECU connector terminal INJ1.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Transmission: P range
- Voltage between terminal INJ1 and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0262: No. 1 Injector Circuit High Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ1 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGMENT

Check Condition
- Engine is running.

Judgement Criterion
- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 1 injector
- Open/short circuit or harness damage in No. 1 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 1 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 1 injector itself.
- No. 1 Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the No. 1 injector.

STEP 3. Check harness between No. 1 injector connector terminal and engine-ECU connector terminal INJ1.

- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Transmission: P range
- Voltage between terminal INJ1 and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

Code No. P0264: No. 2 Injector Circuit Low Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ2 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGMENT

Check Condition

- Engine is running.

Judgement Criterion

- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 2 injector
- Open/short circuit or harness damage in No. 2 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 1: No. 2 injector

OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check No. 2 injector itself.

- No. 2 Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or replace the No. 2 injector.

STEP 3. Perform voltage measurement at No. 2 injector connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?

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

STEP 4. Check harness between engine control relay connector terminal and No. 2 injector connector terminal power supply line.

- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between No. 2 injector connector terminal and engine-ECU connector terminal INJ2.

- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).

- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Transmission: P range
- Voltage between terminal INJ2 and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0265: No. 2 Injector Circuit High Input

OPERATION

- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ2 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION

- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGMENT

Check Condition

- Engine is running.

Judgement Criterion

- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed No. 2 injector
- Open/short circuit or harness damage in No. 2 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 1: No. 2 injector

OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 2 injector itself.
- No. 2 Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the No. 2 injector.

STEP 3. Check harness between No. 2 injector connector terminal and engine-ECU connector terminal INJ2.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Transmission: P range
- Voltage between terminal INJ2 and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0267: No. 3 Injector Circuit Low Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ3 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGMENT
Check Condition
- Engine is running.

Judgement Criterion
- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 3 injector
- Open/short circuit or harness damage in No. 3 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 3 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 3 injector itself.
- No.3 Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?

YES : Go to Step 3.
NO : Repair or replace the connector, or replace the No. 3 injector.

STEP 3. Perform voltage measurement at No. 3 injector connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 4.

STEP 4. Check harness between engine control relay connector terminal and No. 3 injector connector terminal power supply line.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between No. 3 injector connector terminal and engine-ECU connector terminal INJ3.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Transmission: P range
- Voltage between terminal INJ3 and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0268: No. 3 Injector Circuit High Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ3 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGMENT

Check Condition
- Engine is running.

Judgement Criterion
- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 3 injector
- Open/short circuit or harness damage in No. 3 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 3 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 3 injector itself.
- No. 3 Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the No. 3 injector.

STEP 3. Check harness between No. 3 injector connector terminal and engine-ECU connector terminal INJ3.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Transmission: P range
- Voltage between terminal INJ3 and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0270: No. 4 Injector Circuit Low Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ4 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGMENT

Check Condition
- Engine is running.

Judgement Criterion
- The supply voltage is less than 3 V without the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 4 injector
- Open/short circuit or harness damage in No. 4 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 4 injector

OK: Idling state varies.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 4 injector itself.
- No. 4 Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the No. 4 injector.

STEP 3. Perform voltage measurement at No. 4 injector connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 4.

STEP 4. Check harness between engine control relay connector terminal and No. 4 injector connector terminal power supply line.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between No. 4 injector connector terminal and engine-ECU connector terminal INJ4.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Transmission: P range
- Voltage between terminal INJ4 and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0271: No. 4 Injector Circuit High Input

OPERATION
- Power is supplied to the injector connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal INJ4 makes the power transistor in the unit be in ON position, and that makes currents go on the injector connector terminal.

FUNCTION
- The engine-ECU controls the power supply interval of the injector.
- The fuel injection amount of the injector depends on the power supply interval.

TROUBLE JUDGMENT

Check Condition
- Engine is running.

Judgement Criterion
- The coil current is more than 4.5 A with the injector driving.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed No. 4 injector

- Open/short circuit or harness damage in No. 4 injector circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test
- Item 1: No. 4 injector

OK: Idling state varies.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Check No. 4 injector itself.
- No. 4 Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the No. 4 injector.

STEP 3. Check harness between No. 4 injector connector terminal and engine-ECU connector terminal INJ4.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Perform signal wave pattern measurement at engine-ECU connector (Using an oscilloscope).
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Transmission: P range
- Voltage between terminal INJ4 and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0300: Random/Multiple Cylinder Misfire Detected

OPERATION
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62).
- Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63).
- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64).
- Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65).
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66).
- Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67).
- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68).
- Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).
- Adaptive learning is complete for the vane which generates a crankshaft position signal.

FUNCTION
- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions
- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C.
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 20 % and is less than 40 %. <4B11>
- Volumetric efficiency is more than 30 % and is less than 60 %. <4B12>

- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is -0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions (when the catalyst temperature is more than 1,000°C).

or

- Misfire has occurred in 15 or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard).

FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed crank angle sensor
- Failed injector
- Incorrect air-fuel ratio
- Low compression pressure
- Failed intake air temperature sensor
- Failed engine coolant temperature sensor
- Failed air flow sensor
- Skipping of timing chain teeth.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).

a. Item 2: Crank angle sensor
b. Item 5: Intake air temperature sensor
c. Item 6: Engine coolant temperature sensor
d. Item 10: Air flow sensor
e. Item 26: Long-term fuel trim
f. Item 28: Short-term fuel trim

Q: Are the check results normal?
YES : Go to Step 2.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 2. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 3. Check injector itself.

a. No. 1 injector connector
b. No. 2 injector connector
c. No. 3 injector connector
d. No. 4 injector connector
e. Injector check (Refer to P.13A-188).

Q: Are the check results normal?
YES : Go to Step 4.
NO : Repair or replace the connector or replace the injector.

STEP 4. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Fuel pressure measurement.

- Fuel pressure test (Refer to P.13A-179)

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair.

STEP 6. Check for skipped timing chain teeth.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Replace the timing chain.

STEP 7. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair.

STEP 8. Replace the engine-ECU.
- After replacing the engine-ECU, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?

YES : Check for foreign matters (water, diesel fuel, etc.) in fuel and replace if necessary.
NO : Check end.

Code No. P0301: No. 1 Cylinder Misfire Detected

OPERATION
- Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62).
- Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63).

FUNCTION
- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions
- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C. (However, 20°C when the engine coolant temperature at engine start is -10°C or less).
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 20 % and is less than 60 %. <4B11>
- Volumetric efficiency is more than 30 % and is less than 60 %. <4B12>
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is -0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).
- Misfire has occurred more frequently than allowed during the last 200 revolutions (when the catalyst temperature is more than 1,000°C).

or
- Misfire has occurred a predetermined value (2%) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or
- After the first 1,000 revolutions, the following criterion is safisfied 4 times cumulatively.
- Misfire counts per 1,000 revolutions exceeds a predetermined value (2%) (corresponding to 1.5 times the limit of emission standard).

FAIL-SAFE AND BACKUP FUNCTION
- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES
- Ignition system related part(s) failed
- Failed No. 1 injector
- Harness damage in No. 1 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark on No. 1 cylinder.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 2
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 2. Check No. 1 injector itself.
- Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3
NO : Repair or replace the connector, or replace the No. 1 injector.

STEP 3. Check harness between engine control relay connector terminal and No. 1 injector connector terminal power supply line.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 4
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check harness between No. 1 injector connector terminal and engine-ECU connector terminal INJ1.

- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 5
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check compression pressure of No. 1 cylinder.

- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check .

Q: Is the check result normal?
YES : Go to Step 6
NO : Repair.

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0302: No. 2 Cylinder Misfire Detected

OPERATION

- Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64).
- Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65).

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions

- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C. (However, 20°C when the engine coolant temperature at engine start is -10°C or less).
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 20 % and is less than 60 %. <4B11>
- Volumetric efficiency is more than 30 % and is less than 60 %. <4B12>
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is -0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions (when the catalyst temperature is more than 1,000°C).

or

- Misfire has occurred a predetermined value (2%) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or

- After the first 1,000 revolutions, the following criterion is safisfied 4 times cumulatively.
- Misfire counts per 1,000 revolutions exceeds a predetermined value (2%) (corresponding to 1.5 times the limit of emission standard).

FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed No. 2 injector
- Harness damage in No. 2 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark on No. 2 cylinder.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 2
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 2. Check No. 2 injector itself.
- Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3
NO : Repair or replace the connector, or replace the No. 2 injector.

STEP 3. Check harness between engine control relay connector terminal and No. 2 injector connector terminal power supply line.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 4
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check harness between No. 2 injector connector terminal and engine-ECU connector terminal INJ2.
- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 5
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check compression pressure of No. 2 cylinder.
- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?
YES : Go to Step 6
NO : Repair.

STEP 6. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0303: No. 3 Cylinder Misfire Detected

OPERATION
- Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66).
- Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67).

FUNCTION
- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions
- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than –10°C. (However, 20°C when the engine coolant temperature at engine start is -10°C or less).
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 20 % and is less than 60 %. <4B11>
- Volumetric efficiency is more than 30 % and is less than 60 %. <4B12>
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is -0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions (when the catalyst temperature is more than 1,000°C).

or

- Misfire has occurred a predetermined value (2%) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or

- After the first 1,000 revolutions, the following criterion is safisfied 4 times cumulatively.
- Misfire counts per 1,000 revolutions exceeds a predetermined value (2%) (corresponding to 1.5 times the limit of emission standard).

FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed No. 3 injector
- Harness damage in No. 3 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark on No. 3 cylinder.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 2
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 2. Check No. 3 injector itself.

- Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3
NO : Repair or replace the connector, replace the No. 3 injector.

STEP 3. Check harness between engine control relay connector terminal and No. 3 injector connector terminal power supply line.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 4
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check harness between No. 3 injector connector terminal and engine-ECU connector terminal INJ3.

- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 5
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check compression pressure of No. 3 cylinder.

- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?
YES : Go to Step 6
NO : Repair.

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0304: No. 4 Cylinder Misfire Detected

OPERATION

- Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68).

- Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).

FUNCTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The engine-ECU checks for such changes in engine speed.

TROUBLE JUDGMENT

Check Conditions

- Engine speed is more than 440 r/min and is less than 4,500 r/min.
- Engine coolant temperature is more than −10°C. (However, 20°C when the engine coolant temperature at engine start is -10°C or less).
- Barometric pressure is more than 76 kPa.
- Volumetric efficiency is more than 20 % and is less than 60 %. <4B11>
- Volumetric efficiency is more than 30 % and is less than 60 %. <4B12>
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is -0.06 V/10 ms to +0.06 V/10 ms.

Judgement Criterion (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions (when the catalyst temperature is more than 1,000°C).

or

- Misfire has occurred a predetermined value (2%) or more in the first 1,000 revolutions from engine start-up (corresponding to 1.5 times the limit of emission standard).

or

- After the first 1,000 revolutions, the following criterion is safisfied 4 times cumulatively.
- Misfire counts per 1,000 revolutions exceeds a predetermined value (2%) (corresponding to 1.5 times the limit of emission standard).

FAIL-SAFE AND BACKUP FUNCTION

- The supply of fuel to the misfiring cylinder can possibly be cut.

PROBABLE CAUSES

- Ignition system related part(s) failed
- Failed No. 4 injector
- Harness damage in No. 4 injector circuit
- Low compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark on No. 4 cylinder.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 2
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 2. Check No. 4 injector itself.

- Injector connector check.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 3
NO : Repair or replace the connector, or replace the No. 4 injector.

STEP 3. Check harness between engine control relay connector terminal and No. 4 injector connector terminal power supply line.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 4
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check harness between No. 4 injector connector terminal and engine-ECU connector terminal INJ4.

- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 5
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check compression pressure of No. 4 cylinder.

- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?
YES : Go to Step 6
NO : Repair.

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0327: Detonation Sensor Circuit Low Input

OPERATION

- A power voltage of 5 V is applied to the detonation sensor terminal from the engine-ECU connector terminal K/S.
- The power voltage is earthed to the engine-ECU connector terminal K/SE from the detonation sensor connector terminal.

FUNCTION

- The detonation sensor detects the vibration of the cylinder block caused by detonation waves, and inputs a signal to the engine-ECU.
- In response to the signal, the engine-ECU provides controls to retard the ignition timing when the detonation occurs.

TROUBLE JUDGMENT

Check Condition

- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion

- Detonation sensor output voltage is less than 0.5 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Fix the ignition timing with an allowance against detonation.

PROBABLE CAUSES

- Failed detonation sensor
- Open/short circuit or harness damage in detonation sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check harness between detonation sensor connector terminal and engine-ECU connector terminal K/SE.

- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 2. Check harness between detonation sensor terminal and engine-ECU connector terminal K/S.

- Check power line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Go to Step 4.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Replace the detonation sensor

- After replacing the detonation sensor, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0328: Detonation Sensor Circuit High Input

OPERATION
- A power voltage of 5 V is applied to the detonation sensor terminal from the engine-ECU connector terminal K/S.
- The power voltage is earthed to the engine-ECU connector terminal K/SE from the detonation sensor connector terminal.

FUNCTION
- The detonation sensor detects the vibration of the cylinder block caused by detonation waves, and inputs a signal to the engine-ECU.
- In response to the signal, the engine-ECU provides controls to retard the ignition timing when the detonation occurs.

TROUBLE JUDGMENT
Check Condition
- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion
- Detonation sensor output voltage is more than 2.25 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Fix the ignition timing with an allowance against detonation.

PROBABLE CAUSES
- Short circuit in detonation sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check harness between detonation sensor connector terminal and engine-ECU connector terminal K/SE.
- Check earthing line for short circuit.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector, repair the damaged harness wire.

STEP 2. Check harness between detonation sensor connector terminal and engine-ECU connector terminal K/S.
- Check power line for short circuit.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair the damaged harness wire.

STEP 3. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0335: Crank Angle Sensor System

OPERATION
- Output signal is supplied to the engine-ECU connector terminal SGT from the crank angle sensor connector terminal and is earthed to the engine-ECU connector terminal SGTE from the crank angle sensor connector terminal.
- A power voltage of 5 V is applied to the crank angle sensor connector terminal from the engine-ECU connector terminal 5V.

FUNCTION
- The crank angle sensor detects the crank angle and inputs a pulse signal to the engine-ECU.
- In response to the signal, the engine-ECU controls the injector, etc.

TROUBLE JUDGMENT
Check Condition, Judgement Criterion
- Normal signal pattern has not been input for cylinder identification from the crank angle sensor signal and inlet camshaft position sensor signal for 2 seconds.

Check Condition
- Engine is being cranked.

Judgement Criterion
- Crank angle sensor output voltage has not changed (no pulse signal is input) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed crank angle sensor
- Open/short circuit or harness damage in crank angle sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 2: Crank angle sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform voltage measurement at crank angle sensor connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU 5V line and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between crank angle sensor connector terminal and engine-ECU connector terminal 5V.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 2: Crank angle sensor

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Perform voltage measurement at crank angle sensor connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU SGT line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 7.
NO : Go to Step 6.

STEP 6. Check harness between crank angle sensor connector terminal and engine-ECU connector terminal SGT.
- Check output line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Perform resistance measurement at crank angle sensor connector.
- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU SGTE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 9.
NO : Go to Step 8.

STEP 8. Check harness between crank angle sensor connector terminal and engine-ECU connector terminal SGTE.
- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 9. Perform output wave pattern measurement at crank angle sensor connector (Using an oscilloscope).

- Use special tool test harness (MB991709) to connect connector, and measure at pick-up harness.
- Engine: Idling
- Transmission: P range
- Voltage between terminal engine-ECU 5V line and earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less. There must be no noise in the output wave pattern.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 10.

STEP 10. Check harness between crank angle sensor connector terminal and engine-ECU connector terminal 5V.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 11. Check harness between crank angle sensor connector terminal and engine-ECU connector terminal SGT.

- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 12. Replace the crank angle sensor

- After replacing the crank angle sensor, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the crank angle sensor sensing ring.
NO : Check end.

Code No. P0340: Inlet Camshaft Position Sensor System

OPERATION

- Output signal is supplied to the engine-ECU connector terminal CPI from the crank angle sensor connector terminal and is earthed to the engine-ECU connector terminal CPIE from the crank angle sensor connector terminal.
- A power voltage of 5 V is applied to the inlet camshaft position sensor output terminal connector terminal from the engine-ECU connector terminal 5V.

FUNCTION

- The inlet camshaft position sensor detects the position of the inlet camshaft and inputs the pulse signal to the engine-ECU.
- In response to the inlet camshaft position sensor signal and the crank angle sensor signal, the engine-ECU detects the compression top dead centre of the No. 1 cylinder.
- Also, in response to the inlet camshaft position sensor signal, the engine-ECU controls variable valve timing (V.V.T.).

TROUBLE JUDGMENT

Check Condition, Judgment Criterion

- Normal signal pattern has not been input for cylinder identification from the crank angle sensor signal and inlet camshaft position sensor signal for 2 seconds.

Check Condition

- Engine is being cranked.

Judgement Criterion

- Inlet camshaft position sensor output voltage has not changed (no pulse signal is input) for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Engine runs is learned pattern until engine stops.
- Does not control variable valve timing (V.V.T.).

PROBABLE CAUSES

- Failed inlet camshaft position sensor
- Open/short circuit or harness damage in inlet camshaft position sensor circuit or loose connector contact

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Perform voltage measurement at inlet camshaft position sensor connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU 5V line and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check harness between inlet camshaft position sensor connector terminal and engine-ECU connector terminal 5V.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Perform voltage measurement at inlet camshaft position sensor connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU CPI line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 5.

STEP 5. Check harness between inlet camshaft position sensor connector terminal and engine-ECU connector terminal CPI.
- Check output line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform resistance measurement at inlet camshaft position sensor connector.
- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU CPIE line and earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 7.

STEP 7. Check harness between inlet camshaft position sensor connector terminal and engine-ECU connector terminal CPIE.
- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Perform output wave pattern measurement at inlet camshaft position sensor connector (Using an oscilloscope).
- Use special tool test harness (MB991709) to connect connector, and measure at pick-up harness.
- Engine: Idling
- Transmission: P range
- Voltage between terminal engine-ECU 5V line and body earth.

OK: Waveforms should be displayed on inspection procedure using an oscilloscope (Refer to P.13A-174), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less. There must be no noise in the output wave pattern.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 9.

STEP 9. Check harness between inlet camshaft position sensor connector terminal and engine-ECU connector terminal 5V.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 10. Check harness between inlet camshaft position sensor connector terminal and engine-ECU connector terminal CPI.
- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair the damaged harness wire.

STEP 11. Check intake camshaft sensing position.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Replace the intake camshaft.

STEP 12. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace the inlet camshaft position sensor.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0421: Catalyst Malfunction

FUNCTION
- The signal from the oxygen sensor (rear) differs from the oxygen sensor (front). That is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the oxygen sensor (front) becomes similar to the oxygen sensor (rear).
- The engine-ECU compares the output of the front and rear oxygen sensor signals.

TROUBLE JUDGMENT

Check Conditions
- Engine speed is less than 3,000 r/min.
- Accelerator pedal is open.
- Air flow sensor output is more than 5 g/sec and is less than 50 g/sec. <4B11>
- Air flow sensor output is more than 6.4 g/sec and is less than 65 g/sec. <4B12>
- More than 3 seconds have elapsed after the above mentioned three conditions have been met.
- Intake air temperature is more than −10°C.
- Barometric pressure is more than 76 kPa.
- Under the closed loop air/fuel ratio control.
- Vehicle speed is more than 1.5 km/h.
- The engine-ECU monitors for this condition for 5 cycles of 10 seconds each during the drive cycle.
- Short-term fuel trim is more than −25 % and is less than +25 %.
- The cumulative air flow is more than 3,700 g. <4B11>
- The cumulative air flow is more than 2,834 g. <4B12>

Judgement Criterion
- When the monitoring for 10 seconds is carried out 5 times, the frequency ratio of oxygen sensor (rear) and oxygen sensor (front) is more than 0.85.

NOTE: The specified value varies depending on the average air flow rate.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Catalytic converter deteriorated
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Replace the catalytic converter.
- After replacing the catalytic converter, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P0458: Purge Control Solenoid Valve Circuit Low Input

OPERATION

- Power is supplied to the purge control solenoid valve connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal PURG makes the power transistor in the unit be in ON position, and that makes currents go on the purge control solenoid valve connector terminal.

FUNCTION

- In response to a signal from the engine-ECU, the purge control solenoid valve controls the flow rate of the purge air to be introduced into the inlet manifold.

TROUBLE JUDGMENT

Check Conditions

- Engine is being cranked.
- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criteria

- The solenoid voltage is more than 3 V with the purge control solenoid driving.
- The engine-ECU monitors this condition once during the drive cycle.

Check Conditions

- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criterion

- The solenoid voltage is more than 3 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed purge control solenoid valve
- Open/short circuit or harness damage in purge control solenoid value circuit or loose connector contact
- Failed engine-ECU

YES : Check intermediate connector, and repair if necessary. If intermediate connector is normal, check and repair harness between purge control solenoid valve connector terminal and engine control relay connector terminal power supply line.
- Check power supply line for open/short circuit.

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 10: Purge control solenoid valve

OK: Operating sound can be heard and the valve vibrates

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform resistance measurement at purge control solenoid valve connector.

- Disconnect connector, and measure at solenoid valve side.
- Resistance between terminals.

OK: 22 – 26 Ω (at 20°C)

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the purge control solenoid valve.

STEP 3. Perform voltage measurement at purge control solenoid valve connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 4.

STEP 4. Connector check: engine control relay connector

Q: Is the check result normal?
NO : Repair or replace the connector.

STEP 5. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal PURG and earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or check and repair harness between purge control solenoid valve connector terminal and engine-ECU connector terminal PURG.
- Check output line for open/short circuit.

STEP 6. Check harness between purge control solenoid valve connector terminal and engine-ECU connector terminal PURG.
- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Check harness between purge control solenoid valve connector terminal and engine control relay connector terminal power supply line.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. M.U.T.-III actuator test
- Item 10: purge control solenoid valve

OK: Operating sound can be heard and the valve vibrates

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Code No. P0459: Purge Control Solenoid Valve Circuit High Input

OPERATION
- Power is supplied to the purge control solenoid valve connector terminal from the engine control relay connector terminal.
- The engine-ECU connector terminal PURG makes the power transistor in the unit be in ON position, and that makes currents go on the purge control solenoid valve connector terminal.

FUNCTION
- In response to a signal from the engine-ECU, the purge control solenoid valve controls the flow rate of the purge air to be introduced into the inlet manifold.

TROUBLE JUDGMENT

Check Conditions
- Engine is being cranked.
- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criteria
- The solenoid current is more than 2.3 A with the purge control solenoid driving.
- The engine-ECU monitors this condition once during the drive cycle.

Check Conditions
- Battery positive voltage is more than 10 V and is less than 16.5 V.

Judgement Criterion
- The solenoid current is more than 2.3 A for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed purge control solenoid valve
- Short circuit or harness damage in purge control solenoid value circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III actuator test

- Item 10: Purge control solenoid valve

OK: Operating sound can be heard and the valve vibrates

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Perform resistance measurement at purge control solenoid valve connector.

- Disconnect connector, and measure at solenoid valve side.
- Resistance between terminals.

OK: 22 – 26 Ω (at 20°C)

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or replace the purge control solenoid valve.

STEP 3. Perform voltage measurement at engine-ECU connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal PURG and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or check and repair harness between purge control solenoid valve connector terminal and engine-ECU connector terminal PURG.

- Check output line for short circuit.

STEP 4. Check harness between purge control solenoid valve connector terminal and engine-ECU connector terminal PURG.

- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. M.U.T.-III actuator test

- Item 10: purge control solenoid valve

OK: Operating sound can be heard and the valve vibrates

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

Code No. P0513: Immobilizer Malfunction

⚠ CAUTION

- **When the ETACS-ECU of vehicles without KOS is replaced, the encrypted code of the ignition key needs to be registered to the ETACS-ECU. (If the encrypted code is not registered, the engine cannot be started. Register the encrypted code as described in GROUP 54A, Immobilizer System – How to Register Key ID .)**

FUNCTION

- The engine-ECU transmits to and receives from KOS-ECU <Vehicles with KOS> or ETACS-ECU <Vehicles without KOS> a control signal to authenticate the ignition key.

NOTE:

- *This code may be displayed due to radio interference if there are multiple registered ignition keys nearby during engine start.*
- *This code may be displayed when the transponder ID code is registered.*
- *This code is also displayed when the ignition key code is not recognized.*
- *When this code is displayed, it is also sent to KOS-ECU <Vehicles with KOS> or ETACS-ECU <Vehicles without KOS>*

TROUBLE JUDGMENT

Check Conditions
- Ignition switch is "ON" position.
- After the engine is cranked.

Judgement Criterion
- When it was different in the encrypted code sent from KOS-ECU <Vehicles with KOS> or ETACS-ECU <Vehicles without KOS> and operation result by engine-ECU.

FAIL-SAFE AND BACKUP FUNCTION
- Engine start is prohibited.

PROBABLE CAUSES
- Failed KOS-ECU <Vehicles with KOS> or ETACS-ECU <Vehicles without KOS>
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III other system diagnosis code
- Reconfirmation whether diagnosis code is output from KOS-ECU <Vehicles with KOS> or ETACS-ECU <Vehicles without KOS>.

Q: Is the diagnosis code set?

YES : Perform the troubleshooting of KOS-ECU <Vehicles with KOS> or ETACS-ECU <Vehicles without KOS> (Refer to GROUP 42B – Troubleshooting – Diagnosis Code Chart <Vehicles with KOS>, Refer to GROUP 54A – Troubleshooting – Diagnosis Code Chart <Vehicles without KOS>).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Replace the KOS-ECU <Vehicles with KOS> or ETACS-ECU <Vehicles without KOS>. After the replacement, put the each identification code into KOS-ECU <Vehicles with KOS> or ETACS-ECU <Vehicles without KOS>. Then go to Step 3.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent malfunctions).

STEP 3. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Replace the engine-ECU.
NO : Check end.

Code No. P0602: Variant Coding System

FUNCTION
- The engine-ECU performs proper engine control based on vehicle information entered.
- A vehicle identification number (VIN) is entered at a plant before shipment. This diagnosis code occurs when no vehicle information is entered during engine-ECU replacement.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgment Criterion
- Vehicle information is not entered into the engine-ECU.

or
- The tester write area of EEPROM is abnormal.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Replace the engine-ECU with one into which vehicle information is correctly entered.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0604: RAM Error

FUNCTION
- Monitors the computation function of the engine-ECU periodically.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- All RAM data of engine-ECU are defect.

or
- RAM data (engine) is defect.

FAIL-SAFE AND BACKUP FUNCTION
- Microcomputer is reset.

or
- Throttle opening degree position is in default position.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0606: Engine-ECU main processor malfunction

OPERATION
- Check Inspection Procedure – engine-ECU power supply, engine control relay, ignition switch-IG1 system (Refer to P.13A-147).

FUNCTION
- The engine-ECU check whether the microcomputer, which performs the drive control of the throttle valve, is normal.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- No surveillance pulse signals should be input.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSES
- Failed engine control relay
- Short circuit in the engine control relay circuit or loose connector contact.
- Open/short circuit or harness damage in the ignition switch (IG) circuit or loose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.
- Battery check (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test).

Q: Is the check result normal?

YES : Go to Step 2.
NO : Replace the battery.

STEP 2. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal IGN and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or check and repair harness between ETACS-ECU connector terminal IGN and engine-ECU connector terminal IGN.
- Check signal line for open/short circuit.

STEP 3. Check harness between ETACS-ECU connector terminal IGN and engine-ECU connector terminal IGN.
- Check signal line for damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check engine control relay itself.
- Engine control relay connector check.
- Engine control relay continuity check (Refer to P.13A-184).

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or replace the engine control relay.

STEP 5. Check harness between engine control relay connector terminal and engine-ECU connector terminal C/R.
- Check signal line for short circuit.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the damaged harness wire.

STEP 6. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P060B: A/D Converter

FUNCTION
- Monitors whether input voltage from the accelerator pedal position sensor (sub) is normally converted into a digital signal in the engine-ECU.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- When the input voltage from the accelerator pedal position sensor (sub) is made 0 V periodically, the digital value of the input voltage indicates more than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P060D: Trustful Check Accelerator Pedal Position Sensor

FUNCTION

- Compare the output value of the accelerator pedal position sensor (main) with that of the accelerator pedal position sensor (sub).

TROUBLE JUDGMENT

Check Condition

- Change of accelerator pedal position sensor (sub) output voltage per 40 milliseconds is less than 0.06 V.

Judgement Criterion

- Voltage obtained with the formula given below is more than 0.4 V: accelerator pedal position sensor (main) output voltage – accelerator pedal position sensor (sub) output voltage.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed accelerator pedal position sensor
- Harness damage in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P060D set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)

Q: Are the check results normal?
YES : Replace the engine-ECU.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

Code No. P061A: Torque Monitoring

FUNCTION

- Compares the actual torque signal computed from an air flow sensor signal with the driver demand torque signal computed from an accelerator pedal position sensor signal.

TROUBLE JUDGMENT

Check Conditions

- Engine speed is more than 500 r/min.
- Volumetric efficiency is more than 16 %.

Judgement Criterion

- Difference between the actual torque signal and the requested torque signal is more than 50 N·m for 1 second.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed throttle valve control servo
- Harness damage in throttle valve control servo circuit or loose connector contact.
- Failed intake air system
- There is some foreign matter around air flow sensor
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P061A set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 10: Air flow sensor
  b. Item 11: Accelerator pedal position sensor (main)
  c. Item 12: Accelerator pedal position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 3. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check air flow sensor

- Check that there is not foreign matter around air flow sensor

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Check throttle valve control servo itself.

- Throttle valve control servo check (Refer to P.13A-189).

Q: Is the check result normal?
YES : Go to Step 6.
NO : Replace the throttle body assembly.

STEP 6. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal ETV-.

- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal ETV+.

- Check signal line for damage.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair the damaged harness wire.

STEP 8. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P061C: Trustful Check Engine Speed

FUNCTION

- Compares the actual engine speed calculated from the crank angle sensor signal cycle with the estimated engine speed calculated from the number of the crank angle sensor signal pulses after a lapse of the specified time.

TROUBLE JUDGMENT

Check Condition

- Engine speed monitored with a 180 degree-cycle pulse is more than 500 r/min.

Judgement Criterion

- Difference between the engine speed monitored with a 180 degree-cycle pulse and the engine speed monitored with a 10 degree-cycle pulse is more than 500 r/min.

Check Condition

- Engine speed monitored with a 180 degree-cycle pulse is more than 500 r/min.

Judgement Criterion

- Engine speed monitored with a 10 degree-cycle pulse is more than 1,000 r/min.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default

position.

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P061F: Fail-safe Control System

FUNCTION

- To judge whether fail-safe control can be performed, check that power supply to the throttle valve control motor circuit can be stopped by turning the throttle valve control servo relay to OFF position momentarily.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Power supply to the throttle valve control servo cannot be shut down (though power supply is stopped).

FAIL-SAFE AND BACKUP FUNCTION

- Microcomputer is reset.

PROBABLE CAUSES

- Failed throttle valve control servo relay circuit
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Go to Step 2.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 2. M.U.T.-III diagnosis code

Q: Is diagnosis code of P0657 set?

YES : Check throttle valve control servo power system. Check code No. P0657: throttle valve control servo relay circuit malfunction (Refer to P.13A-94).
NO : Replace the engine-ECU.

Code No. P0622: Alternator FR Terminal System

OPERATION

- The energized state of the alternator field coil is inputted from the alternator connector terminal to the engine-ECU connector terminal ALTF.

FUNCTION

- A signal of the power supply duty ratio for the alternator field coil is inputted to the engine-ECU.
- In response to the signal, the engine-ECU detects the alternator output current and controls the idling speed according to the output current (electric load).

TROUBLE JUDGMENT

Check Condition

- Engine speed is more than 500 r/min.

Judgement Criterion

- Input voltage from the alternator FR terminal is approximately battery positive voltage for 20 seconds.

FAIL-SAFE AND BACKUP FUNCTION

- Prohibits alternator output suppression control against current consumers. (operate as a normal alternator.)

PROBABLE CAUSES

- Failed alternator
- Open circuit or harness damage in alternator circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Perform voltage measurement at alternator connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU ALTF line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check harness between alternator connector terminal and engine-ECU connector terminal ALTF.

- Check output line for open circuit.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Check harness between alternator connector terminal and engine-ECU connector terminal ALTF.

- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair the damaged harness wire.

STEP 5. Perform voltage measurement at engine-ECU connector.

- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idle operation after warm-up
- Transmission: P range
- Radiator fan: Not operated
- Voltage between terminal ALTF and body earth.

OK: Voltage decreases when the headlamps are extinguished → illuminated.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the alternator.

Code No. P062F: EEPROM Malfunction

FUNCTION

- The engine-ECU checks whether information such as idling learned value is stored.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- The latest data that was flashed while the ignition switch was in "LOCK" (OFF) position are not stored correctly.

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSE

- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0630: Chassis Number not Programmed

FUNCTION
- An engine-ECU checks whether vehicle chassis number is stored or not.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Chassis number has not been written.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Entered chassis number confirmed.

Q: Is a chassis number entered?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU with one into which vehicle information is correctly entered.

Code No. P0638: Throttle Valve Control Servo Circuit Range/Performance Problem

OPERATION
- Check code No. P2101: throttle valve control servo magneto malfunction (Refer to P.13A-102).

FUNCTION
- Engine-ECU checks the electronic controlled throttle system for abnormal conditions.

TROUBLE JUDGMENT

Check Conditions
- Battery positive voltage is more than 8.3 V.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Drop of throttle position sensor (main) output voltage per 100 milliseconds is more than 0.04 V.

Judgement Criterion
- Throttle position sensor (main) output voltage is higher than the target throttle position sensor (main) voltage by 0.5 V or more.

Check Conditions
- Battery positive voltage is more than 8.3 V.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Target throttle position sensor (main) output voltage is less than 1.5 V.

Judgement Criterion
- Difference between throttle position sensor (main) output voltage and target throttle position sensor (main) voltage is more than 0.6 V.

Check Conditions
- Battery positive voltage is more than 8.3 V.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.

Judgement Criterion
- Difference between throttle position sensor (main) output voltage and target throttle position sensor (main) voltage is more than 1 V.

Check Condition
- Battery positive voltage is more than 8.3 V.

Judgement Criterion
- Throttle position sensor (main) default opening learnt value is more than 4 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSES
- Failed throttle valve return spring.
- Failed throttle valve operation.
- Failed throttle valve control servo.
- Harness damage in throttle valve control servo circuit or loose connector contact.
- Failed engine-ECU.

DIAGNOSIS PROCEDURE

STEP 1. Check throttle body.
- Check whether the throttle valve return spring is normal.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the throttle body assembly.

STEP 2. Check throttle valve control servo itself.
- Electronic-controlled throttle valve control check.
- Throttle valve control servo check (Refer to P.13A-189).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the throttle body assembly.

STEP 3. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal ETV+.
- Check signal line for damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal ETV-.
- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0642: Throttle Position Sensor Power Supply

FUNCTION
- Engine-ECU checks the throttle position sensor power voltage for abnormal conditions.

TROUBLE JUDGMENT

Check Condition
- Battery positive voltage is more than 6.3 V.

Judgement Criterion
- Throttle position sensor power voltage is less than 4.3 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P0657: Throttle Valve Control Servo Relay Circuit Malfunction

OPERATION
- Battery voltage is applied to the throttle valve control servo relay terminal connector terminal.

- Battery voltage is applied to the throttle valve control servo relay terminal connector terminal from the engine control relay connector terminal.
- Engine-ECU connector terminal C/RL applies current to the throttle valve control servo relay coil by turning ON the power transistor in the unit in order to turn the relay ON.
- When the throttle valve control servo relay turns ON, battery voltage is supplied by the throttle valve control servo relay connector terminal to the engine-ECU connector terminal RSB.

FUNCTION

- When the ignition switch ON signal is input into the engine-ECU, the engine-ECU turns ON the throttle valve control servo.

TROUBLE JUDGMENT

Check Condition

- Battery positive voltage is more than 8.3 V.

Judgement Criterion

- The power line voltage of the electronic-controlled throttle system is less than 6.0 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed throttle valve control servo relay
- Open/short circuit or harness damage in throttle valve control servo relay circuit or loose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check throttle valve control servo relay itself.

- Throttle valve control servo relay connector check.
- Throttle valve control servo relay check (Refer to P.13A-185).

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair or replace the connector, or replace the throttle valve control servo relay.

STEP 2. Perform voltage measurement at throttle valve control servo relay connector.

- Remove relay, and measure at relay box side.
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or check and repair harness between throttle valve control servo relay connector terminal power supply line and battery.

- Check power supply line for open/short circuit.

YES : Go to Step 5.

NO : Repair or replace the connector, or check and repair harness between throttle valve control servo relay connector terminal and engine-ECU connector terminal C/RL.

- Check earthing line for open/short

STEP 3. Perform voltage measurement at throttle valve control servo relay connector.

- Remove relay, and measure at relay box side.
- Ignition switch: ON
- Voltage between terminal engine control relay line and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or check and repair harness between engine control relay connector terminal and throttle valve control servo relay connector terminal.

- Check power supply line for open/short circuit.

STEP 4. Perform voltage measurement at engine-ECU connector.

- Disconnect connector, and measure at harness side.
- Short-circuit engine-ECU connector the terminal C/R to the body earth.
- Voltage between terminal C/RL and body earth.

OK: System voltage

Q: Is the check result normal?

circuit.

STEP 5. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Short-circuit engine-ECU connector terminals C/R and C/RL to the body earth.
- Voltage between terminal RSB and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 6.

STEP 6. Check harness between throttle valve control servo relay connector terminal and engine-ECU connector terminal RSB.
- Check output line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Check harness between engine control relay connector terminal and throttle valve control servo relay connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Repair or replace the connector, or check and repair harness between throttle valve control servo relay connector terminal and engine-ECU connector terminal C/RL.
  - Check earthing line for damage.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Check harness between throttle valve control servo relay connector terminal and battery.
- Check power supply line for damage.

Q: Is the harness connector in good condition?
YES : Go to Step 9.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 9. Check harness between throttle valve control servo relay connector terminal and engine-ECU connector terminal RSB.
- Check output line for damage.

Q: Is the harness connector in good condition?
YES : Go to Step 10.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 10. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1231: Trustful Check Active Stability Control (ASC) <Vehicles with ASC>

FUNCTION
- Checks for an abnormal signal of active stability control (ASC) via the CAN communication.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgment Criterion
- A torque demand signal from the active stability control (ASC) is abnormal.

FAIL-SAFE AND BACKUP FUNCTION
- Torque requested by active stability control (ASC) is ignored.

PROBABLE CAUSES
- Failed active stability control system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Go to Step 2.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is set from the ASC-ECU.

Q: Is diagnosis code set?
YES : Perform troubleshooting of the active stability control system (ASC) (Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart).
NO : Replace the engine-ECU.

Code No. P1238: Air Flow Sensor Trustful For Torque Monitoring

FUNCTION
- Compare the actual measurement of volumetric efficiency by an air flow sensor signal with volumetric efficiency estimated from a throttle position sensor (main and sub) signal.

TROUBLE JUDGMENT

Check Conditions
- Difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (main) is more than 0 %. Or, the volumetric efficiency is less than 60 %.
- Engine speed is more than 750 r/min.

Judgement Criterion
- Difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (main) is more than 35 %.

Check Conditions
- Difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (sub) is more than 0 %. Or, the volumetric efficiency is less than 60 %.
- Engine speed is more than 750 r/min.

Judgement Criterion
- Difference between the actual volumetric efficiency and the volumetric efficiency estimated by the throttle position sensor (sub) is more than 35 %.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSES
- Failed air flow sensor
- Harness damage in air flow sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P1238 set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 10: Air flow sensor

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Check air flow sensor system. Check code No. P0102: air flow sensor circuit low input (Refer to P.13A-33. Check code No. P0103: air flow sensor circuit high input (Refer to P.13A-35).

Code No. P1240: Trustful Check Ignition Angle <Vehicles with ASC>

FUNCTION
- Checks for an abnormal ignition timing retard angle demand signal from the active stability control (ASC).

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgment Criterion
- Ignition timing retard angle demand signal is abnormal.

FAIL-SAFE AND BACKUP FUNCTION
- Ignition retard is not carried out.

PROBABLE CAUSES
- Failed active stability control system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code related to CAN communication set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is set from the ASC-ECU.

Q: Is diagnosis code set?
YES : Perform troubleshooting of the active stability control system (ASC) (Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart).
NO : Replace the engine-ECU.

Code No. P1242: Fail-safe Control Monitoring

FUNCTION
- Monitors the engine speed during fail-safe control.

TROUBLE JUDGMENT

Check Condition
- During fail safe control.

Judgement Criterion
- Engine speed is more than assumed.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is default position.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is any other diagnosis code than P1242 set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1243: Inquiry/Response Error

FUNCTION
- Monitors the computation function of the engine-ECU.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Engine-ECU can not calculate input data.

FAIL-SAFE AND BACKUP FUNCTION
- Microcomputer is reset.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1247: Trustful Check CVT

FUNCTION
- Checks for an abnormal signal of CVT.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- A torque demand signal from CVT-ECU is abnormal.

FAIL-SAFE AND BACKUP FUNCTION
- Torque requested by CVT-ECU is ignored.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Confirm the diagnosis code is set from the CVT-ECU.

Q: Is diagnosis code set?
YES : Perform troubleshooting of CVT system (Refer to GROUP 23A – Diagnosis Code Chart).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1590: CVT-ECU to Engine-ECU Communication Error in Torque Reduction Request

FUNCTION
- The engine-ECU monitors and checks communication with the CVT-ECU.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Engine-ECU detects an error in communication between engine-ECU and CVT-ECU.

FAIL-SAFE AND BACKUP FUNCTION
- Engine output is restricted.

PROBABLE CAUSE
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code of U0101 set?
YES : Perform troubleshooting of CVT-ECU time-out. Check code No. U0101 CVT-ECU time-out (Refer to P.13A-114).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P1603: Battery Backup Circuit Malfunction

OPERATION
- Power is directly supplied to the engine-ECU connector terminal BACK from the battery.

FUNCTION
- The engine-ECU checks open circuit in the battery backup line.

TROUBLE JUDGMENT

Check Conditions
- Engine starting sequence was completed.
- Battery positive voltage is more than 10 V.

Judgment Criterion
- Battery backup line voltage is less than 6 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- All diagnosis codes are stored once failure judgment is completed.

PROBABLE CAUSES
- Open/short circuit or harness damage in battery backup line circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Temporarily place the ignition switch in LOCK (OFF) position, and 10 seconds after that, place it in ON position again.

Q: Is the diagnosis code of P1603 set?
YES : Go to Step 2.
NO : Check end.

STEP 2. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Voltage between terminal BACK and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or check and repair harness between the battery and engine-ECU connector terminal BACK.
- Check power supply line for open/short circuit.

STEP 3. Check harness between the battery and engine-ECU connector terminal BACK.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2100: Throttle Valve Control Servo Circuit (open)

OPERATION
- Controls the current that is applied from the engine-ECU connector terminals ETV+, ETV- to the electronic-controlled throttle valve connector terminals.

FUNCTION

- Engine-ECU varies the direction and the amperage of the current that is applied to the throttle valve control servo in order to control the opening of the throttle valve.

TROUBLE JUDGMENT

Check Conditions

- Battery positive voltage is more than 8.3 V.
- Difference between the throttle position sensor (main) output voltage and the target throttle position sensor (main) voltage is more than 0.1 V.
- Difference between the throttle position sensor (sub) output voltage and the target throttle position sensor (sub) voltage is more than 0.1 V.
- The drive duty of the throttle valve control servo is more than 100 %.
- Except while engine is being cranked.

or

- Battery positive voltage is more than 8.3 V.
- Difference between the target throttle position sensor (main) voltage and the throttle position sensor (main) output voltage is more than 0.1 V.
- Difference between the target throttle position sensor (sub) voltage and the throttle position sensor (sub) output voltage is more than 0.1 V.
- The drive duty of the throttle valve control servo is more than 100 %.
- Except while engine is being cranked.

Judgement Criterion

- Difference between the throttle position sensor (main) output voltage and the learning value of the middle-opened degree is less than 0.2 V.

or

- Difference between the throttle position sensor (sub) output voltage and the learning value of the middle-opened degree is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed throttle valve control servo.
- Open circuit or harness damage in throttle valve control servo circuit or lose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check throttle valve control servo itself.

- Electronic-controlled throttle valve control check.
- Throttle valve control servo check (Refer to P.13A-189).

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair or replace the connector, or replace the throttle body assembly.

STEP 2. Perform resistance measurement at engine-ECU connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal RSG, RSH and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair or replace the connector, or check and repair harness between engine-ECU connector terminal RSG, RSH and body earth.

- Check earthing line for open circuit and damage.

STEP 3. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal ETV+.

- Check output line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal ETV-.

- Check signal line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. M.U.T-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2101: Throttle Valve Control Servo Magneto Malfunction

OPERATION
- Controls the current that is applied from the engine-ECU connector terminals ETV+, ETV- to the electronic-controlled throttle valve connector terminals.

FUNCTION
- Engine-ECU check whether the throttle valve control servo magneto failed.

TROUBLE JUDGMENT

Check Condition
- Battery positive voltage is more than 8.3 V.

Judgement Criterion
- The coil current of the throttle valve control servo is more than 8 A.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree position is in default position.

PROBABLE CAUSES
- Failed throttle valve control servo.
- Short circuit or harness damage in throttle valve control servo circuit or lose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check throttle valve control servo itself.
- Electronic-controlled throttle valve control check.
- Throttle valve control servo check (Refer to P.13A-189).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector, or replace the throttle body assembly.

STEP 2. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal ETV+.
- Check output line for short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal ETV-.
- Check signal line for short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2122: Accelerator Pedal Position Sensor (main) Circuit Low Input

OPERATION
- A power voltage of 5 V is applied to the accelerator pedal position sensor connector terminal from the engine-ECU connector terminal APS5.

- The power voltage is earthed to the engine-ECU connector terminal APSE from the accelerator pedal position sensor connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal APSM from the accelerator pedal position sensor output terminal.

FUNCTION

- The accelerator pedal position sensor (main) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGMENT

Check Condition

- Ignition switch is "ON" position.

Judgement Criterion

- Accelerator pedal position sensor (main) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.

PROBABLE CAUSES

- Failed accelerator pedal position sensor
- Open/short circuit or harness damage in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 11: Accelerator pedal position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform voltage measurement at accelerator pedal position sensor connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU APS5 line and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APS5.

- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 11: Accelerator pedal position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APS5.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APSM.

- Check output line for open/short circuit and damage.

Q: Is the check result normal?

YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Replace the accelerator pedal assembly
- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2123: Accelerator Pedal Position Sensor (main) Circuit High Input

OPERATION
- A power voltage of 5 V is applied to the accelerator pedal position sensor connector terminal from the engine-ECU connector terminal APS5.
- The power voltage is earthed to the engine-ECU connector terminal APSE from the accelerator pedal position sensor connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal APSM from the accelerator pedal position sensor output terminal.

FUNCTION
- The accelerator pedal position sensor (main) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Accelerator pedal position sensor (main) output voltage is more than 4.8 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.

PROBABLE CAUSES
- Failed accelerator pedal position sensor
- Open circuit or harness damage in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 11: Accelerator pedal position sensor (main)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform resistance measurement at accelerator pedal position sensor connector.
- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU APSE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APSE.
- Check earthing line for open circuit and damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 11: Accelerator pedal position sensor (main)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Replace the accelerator pedal assembly
- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2127: Accelerator Pedal Position Sensor (sub) Circuit Low Input

OPERATION
- A power voltage of 5 V is applied to the accelerator pedal position sensor connector terminal from the engine-ECU connector terminal 5VV.
- The power voltage is earthed to the engine-ECU connector terminal EV from the accelerator pedal position sensor connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal APSS from the accelerator pedal position sensor output terminal.

FUNCTION
- The accelerator pedal position sensor (sub) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Accelerator pedal position sensor (sub) output voltage is less than 0.2 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (main) fails.

PROBABLE CAUSES
- Failed accelerator pedal position sensor
- Open/short circuit or harness damage in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 12: Accelerator pedal position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform voltage measurement at accelerator pedal position sensor connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU 5VV and body earth.

OK: 4.9 – 5.1 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal 5VV.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 12: Accelerator pedal position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 5. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal 5VV.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APSS.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Replace the accelerator pedal assembly
- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2128: Accelerator Pedal Position Sensor (sub) Circuit High Input

OPERATION
- A power voltage of 5 V is applied to the accelerator pedal position sensor connector terminal from the engine-ECU connector terminal 5VV.
- The power voltage is earthed to the engine-ECU connector terminal EV from the accelerator pedal position sensor connector terminal.
- The sensor signal is inputted to the engine-ECU connector terminal APSS from the accelerator pedal position sensor output terminal.

FUNCTION
- The accelerator pedal position sensor (sub) outputs voltage which corresponds to the accelerator pedal depression.
- The engine-ECU checks whether the voltage is within a specified range.

TROUBLE JUDGMENT

Check Condition
- Ignition switch is "ON" position.

Judgement Criterion
- Accelerator pedal position sensor (sub) output voltage is more than 2.5 V.

FAIL-SAFE AND BACKUP FUNCTION
- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (main) fails.

YES : Go to Step 5.

PROBABLE CAUSES
- Failed accelerator pedal position sensor
- Open circuit or harness damage in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 12: Accelerator pedal position sensor (sub)

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 2.

STEP 2. Perform resistance measurement at accelerator pedal position sensor connector.
- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU EV line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
NO : Go to Step 3.

STEP 3. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal EV.

- Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 12: Accelerator pedal position sensor (sub)

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Replace the engine-ECU.

STEP 5. Replace the accelerator pedal assembly

- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?

YES : Replace the engine-ECU.

NO : Check end.

Code No. P2135: Throttle Position Sensor (main and sub) Range/Performance Problem

OPERATION

- Check code No. P0122: throttle position sensor (main) circuit low input (Refer to P.13A-45).
- Check code No. P0222: throttle position sensor (sub) circuit low input (Refer to P.13A-60).

FUNCTION

- Engine-ECU checks the throttle position sensor output signal characteristics for abnormal conditions.

TROUBLE JUDGMENT

Check Conditions

- Ignition switch is "ON" position.
- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Throttle position sensor (sub) output voltage is more than 0.2 V and is less than 4.8 V.

Judgement Criterion

- The sum of the output voltage of the throttle position sensors (main and sub) is less than 4.5 V, or more than 5.5 V.

Check Conditions

- Throttle position sensor (main) output voltage is more than 0.2 V and is less than 4.8 V.
- Throttle position sensor (sub) output voltage is more than 0.2 V and is less than 4.8 V.
- Ignition switch is "ON" position.
- Throttle position sensor (main and sub) output voltage is less than the target throttle position sensor (main) voltage by 0.9 V or less.

Judgement Criterion

- Voltage obtained with the formula given below is more than 0.3 V: throttle position sensor (main) voltage – throttle position sensor (sub) voltage

NOTE: The throttle position sensor voltage used for the judgment is converted into the throttle position sensor voltage for the internal processing by the engine-ECU.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree position is in default position.

PROBABLE CAUSES

- Failed throttle position sensor
- Harness damage in throttle position sensor circuit or loose connector contact

DIAGNOSIS PROCEDURE

STEP 1. Perform resistance measurement at electronic-controlled throttle valve connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU TPSE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?

YES : Go to Step 4.

NO : Go to Step 2.

STEP 2. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPSE.
- Check earthing line for damage.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, repair the damaged harness wire.

STEP 3. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPS5.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector repair the damaged harness wire.

STEP 5. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPSM.
- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair or replace the connector repair the damaged harness wire.

STEP 6. Check harness between electronic-controlled throttle valve connector terminal and engine-ECU connector terminal TPSS.
- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector repair the damaged harness wire.

STEP 7. Replace throttle body assembly.
- After replacing the throttle body assembly, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2138: Accelerator Pedal Position Sensor (main and sub) Range/Performance Problem

OPERATION
- Check code No. P2122: accelerator pedal position sensor (main) circuit low input (Refer to P.13A-102).
- Check code No. P2127: accelerator pedal position sensor (sub) circuit low input (Refer to P.13A-105).

FUNCTION
- Engine-ECU checks the accelerator pedal position sensor output signal characteristics for abnormal conditions.

TROUBLE JUDGMENT

Check Conditions
- Ignition switch is "ON" position.
- Change of accelerator pedal position sensor (sub) output voltage per 25 milliseconds is less than 0.06 V.

Judgement Criterion
- Voltage obtained with the formula given below is more than 0.4 V: accelerator pedal position sensor (sub) voltage – accelerator pedal position sensor (main) voltage

NOTE: The accelerator pedal position sensor voltage used for the judgment is converted into the accelerator pedal position sensor voltage for the internal processing by the engine-ECU.

Check Conditions
- Ignition switch is "ON" position.
- Change of accelerator pedal position sensor (main) output voltage per 25 milliseconds is less than 0.06 V.

Judgement Criterion

- Voltage obtained with the formula given below is more than 0.4 V: accelerator pedal position sensor (main) voltage − accelerator pedal position sensor (sub) voltage

NOTE: The accelerator pedal position sensor voltage used for the judgment is converted into the accelerator pedal position sensor voltage for the internal processing by the engine-ECU.

FAIL-SAFE AND BACKUP FUNCTION

- Throttle opening degree is restricted.
- Throttle opening degree position is in default position if accelerator pedal position sensor (sub) fails.

PROBABLE CAUSES

- Failed accelerator pedal position sensor
- Harness damage in accelerator pedal position sensor circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Perform resistance measurement at accelerator pedal position sensor connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU APSE line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APSE.

- Check earthing line for damage.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 − How to Use Troubleshooting/Inspection Service Points − How to Cope with Intermittent Malfunctions).

STEP 4. Perform resistance measurement at accelerator pedal position sensor connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal engine-ECU EV line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 5.

STEP 5. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal EV.

- Check earthing line for damage.

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APS5.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal 5VV.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APSM.

- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 9.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 9. Check harness between accelerator pedal position sensor connector terminal and engine-ECU connector terminal APSS.
- Check output line for damage.

Q: Is the check result normal?

YES : Go to Step 10.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 10. Replace the accelerator pedal assembly
- After replacing the accelerator pedal assembly, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. P2228: Barometric Pressure Sensor Circuit Low Input

FUNCTION
- The barometric pressure sensor converts the barometric pressure into a voltage signal and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- Battery positive voltage is more than 8 V.

Judgement Criterion
- Barometric pressure sensor output signal is less than 49 kPa (approximately 4,600m above sea level) for 10 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Control as if the barometric pressure is 101 kPa.

PROBABLE CAUSE
- Failed barometric pressure sensor

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2229: Barometric Pressure Sensor Circuit High Input

FUNCTION
- The barometric pressure sensor converts the barometric pressure into a voltage signal and inputs the signal to the engine-ECU.
- In response to the signal, the engine-ECU corrects the fuel injection amount, etc.

TROUBLE JUDGMENT

Check Conditions
- More than 2 seconds have passed since the engine starting sequence was completed.
- Battery positive voltage is more than 8 V.

Judgement Criterion
- Barometric pressure sensor output signal is more than 113 kPa (approximately 1,200 m below sea level) for 10 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Control as if the barometric pressure is 101 kPa.

PROBABLE CAUSE
- Failed barometric pressure sensor

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Code No. P2252: Oxygen Sensor Offset Circuit Low Voltage

OPERATION
- Check code No. P0131: oxygen sensor (front) circuit low voltage (Refer to P.13A-49).
- Check code No. P0137: oxygen sensor (rear) circuit low voltage (Refer to P.13A-54).

FUNCTION
- The engine-ECU watches and checks whether the offset voltage of the oxygen sensor is normal or not.

TROUBLE JUDGMENT

Check Condition
- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion
- Oxygen sensor offset voltage is less than 0.4 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed oxygen sensor (front)
- Failed oxygen sensor (rear)
- Short circuit in oxygen sensor (front) circuit or loose connector contact
- Short circuit in oxygen sensor (rear) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check oxygen sensor (front) itself.
- Oxygen sensor (front) connector check.
- Oxygen sensor check (Refer to P.13A-186).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector, or replace the oxygen sensor.

STEP 2. Check oxygen sensor (rear) itself.
- Oxygen sensor (rear) connector check.
- Oxygen sensor check (Refer to P.13A-186).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the oxygen sensor (rear).

STEP 3. Perform voltage measurement at oxygen sensor (front) connector.
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU OFLE line and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal OFLE.
- Check earthing line for short circuit.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. Perform voltage measurement at oxygen sensor (rear) connector.
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU ORLE line and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 7.

STEP 7. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal ORLE.
- Check earthing line for short circuit.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

Code No. P2253: Oxygen Sensor Offset Circuit High Voltage

OPERATION
- Check code No. P0131: oxygen sensor (front) circuit low voltage (Refer to P.13A-49).
- Check code No. P0137: oxygen sensor (rear) circuit low voltage (Refer to P.13A-54).

FUNCTION
- The engine-ECU watches and checks whether the offset voltage of the oxygen sensor is normal or not.

TROUBLE JUDGMENT

Check Condition
- More than 2 seconds have passed since the engine starting sequence was completed.

Judgement Criterion
- Oxygen sensor offset voltage is more than 0.6 V for 2 seconds.

FAIL-SAFE AND BACKUP FUNCTION
- Does not control air-fuel ratio closed loop.

PROBABLE CAUSES
- Failed oxygen sensor (front)
- Failed oxygen sensor (rear)
- Short circuit in oxygen sensor (front) circuit or loose connector contact
- Short circuit in oxygen sensor (rear) circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check oxygen sensor (front) itself.
- Oxygen sensor (front) connector check.
- Oxygen sensor check (Refer to P.13A-186).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector, or replace the oxygen sensor (front).

STEP 2. Check oxygen sensor (rear) itself.
- Oxygen sensor (rear) connector check.
- Oxygen sensor check (Refer to P.13A-186).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the oxygen sensor (rear).

STEP 3. Perform voltage measurement at engine-ECU connector.
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Ignition switch: "ON"
- Voltage between terminal OFLE and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?
YES : Go to Step 7.
NO : Go to Step 4.

STEP 4. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal OFLE.
- Check earthing line for short circuit.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between oxygen sensor (front) connector terminal and engine-ECU connector terminal O2FL.

- Check output line for short circuit.

Q: Is the check result normal?

YES : Go to Step 6.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Q: Is the diagnosis code set?

YES : Replace the engine-ECU.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 7. Perform voltage measurement at engine-ECU connector.

- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Ignition switch: "ON"
- Voltage between terminal ORLE and body earth.

OK: 0.4 – 0.6 V

Q: Is the check result normal?

YES : Go to Step 6.

NO : Go to Step 8.

STEP 8. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal ORLE.

- Check earthing line for short circuit.

Q: Is the check result normal?

YES : Go to Step 9.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 9. Check harness between oxygen sensor (rear) connector terminal and engine-ECU connector terminal O2RL.

- Check output line for short circuit.

Q: Is the check result normal?

YES : Go to Step 6.

NO : Repair or replace the connector, or repair the damaged harness wire.

Code No. P2530: Ignition Switch-IG1 Circuit

⚠ CAUTION

- **When the ETACS-ECU of vehicles without KOS is replaced, the encrypted code of the ignition key needs to be registered to the ETACS-ECU. (If the encrypted code is not registered, the engine cannot be started. Register the encrypted code as described in GROUP 54A, Immobilizer System – How to Register Key ID .)**

OPERATION

- When the ignition switch is turned on, the ignition switch ON signal is input into the engine-ECU connector terminal IGN and also into the ETACS-ECU.

FUNCTION

- The engine-ECU compares the ignition switch ON signal sent from the ignition switch <Vehicles without KOS> or OSS-ECU <Vehicles with KOS> with ignition switch information sent from ETACS-ECU. The engine-ECU checks for the abnormality.

TROUBLE JUDGMENT

Check Condition

- Ignition switch: "ON" → "LOCK" (OFF)

Judgement Criterion

- While the ignition switch ON signal is input into the engine-ECU, the ignition switch information, sent from the ETACS-ECU via CAN, is turned to OFF from ON. This allows the CAN to be stopped.

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Short circuit in ignition switch-IG1 circuit or loose connector contact
- Failed CAN
- Failed ETACS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis
- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table).

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is set from ETACS-ECU.

Q: Is diagnosis code set?
YES : Perform troubleshooting of ETACS (Refer to GROUP 54A – ETACS – Diagnosis Code Chart).
NO : Go to Step 3.

STEP 3. Check harness between engine-ECU connector terminal IGN and ETACS-ECU connector terminal IGN.
- Check signal line for short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. M.U.T.-III diagnosis code
- Reconfirmation of diagnosis code.

Q: Is diagnosis code set?
YES : Go to Step 5.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. Replace the ETACS-ECU
- After replacing the ETACS-ECU, reconfirm whether the diagnosis code is set.

Q: Is the diagnosis code set?
YES : Replace the engine-ECU.
NO : Check end.

Code No. U0101: CVT-ECU Time-out

⚠ CAUTION
If diagnosis code U0101 is set from engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION
Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGMENT

Check Conditions
- More than 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V and is less than 16 V.

Judgement Criterion
- Unable to receive CVT-ECU signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction
- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and CVT-ECU, by malfunction in the power supply system of CVT-ECU, in CVT-ECU itself, in engine-ECU.

Past malfunction
- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and CVT-ECU and malfunction in the power supply system of CVT-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes set to each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed harness and connector
- Failed CVT-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table). After repairing CAN bus line, go to Step 6 .

STEP 2. M.U.T.-III diagnosis code

- Confirm the diagnosis code is set from the CVT-ECU.

Q: Is diagnosis code set?

YES : Perform troubleshooting of CVT (Refer to GROUP 23A – Diagnosis Code Chart).

NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code

Check that the other ECU performing CAN communication with CVT-ECU sets diagnosis code No. U0101 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code set?

YES : Go to Step 4.

NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing CVT-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and CVT-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : Replace engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and CVT-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : Go to Step 1.

NO : Check end.

Code No. U0121: ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC> Time-out

⚠ CAUTION
If diagnosis code U0121 is set from engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION
Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGMENT

Check Conditions
- More than 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V and is less than 16 V.

Judgement Criterion
- Unable to receive ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC> signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction
- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC>, by malfunction in the power supply system of ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC>, in ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC> itself, in engine-ECU.

Past malfunction
- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC> and malfunction in the power supply system of ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC>.For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes set to each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed harness and connector
- Failed ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC>
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis
- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table). After repairing CAN bus line, go to Step 6 .

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is set from the ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC>.

Q: Is diagnosis code set?
YES : Perform troubleshooting of the anti-lock brake system (ABS) or the active stability control (ASC) system (Refer to GROUP 35B – Troubleshooting <Vehicles with ABS>, Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart <Vehicles with ASC>).
NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code
Check that the other ECU performing CAN communication with ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC> sets diagnosis code No. U0121 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code set?
YES : Go to Step 4.
NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC>, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC> (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ABS-ECU <Vehicles with ABS> or ASC-ECU <Vehicles with ASC> (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : Go to Step 1.

NO : Check end.

Code No. U0131: EPS-ECU Time-out

⚠ CAUTION

If diagnosis code U0131 is set from engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION

Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGMENT

Check Condition

- More than 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V.

Judgement Criterion

- Unable to receive EPS-ECU signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction

- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and EPS-ECU, by malfunction in the power supply system of EPS-ECU, in EPS-ECU itself, in engine-ECU.

Past malfunction

- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and EPS-ECU and malfunction in the power supply system of EPS-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes set to each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION

- None

PROBABLE CAUSES

- Failed harness and connector
- Failed EPS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table). After repairing CAN bus line, go to Step 6.

STEP 2. M.U.T.-III diagnosis code

- Confirm the diagnosis code is set from the EPS-ECU.

Q: Is diagnosis code set?

YES : Perform troubleshooting of EPS (Refer to GROUP 37 – Diagnosis Code Chart).

NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code

Check that the other ECU performing CAN communication with EPS-ECU sets diagnosis code No. U0131 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code set?

YES : Go to Step 4.

NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing EPS-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and EPS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : Replace engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and EPS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : Go to Step 1.

NO : Check end.

Code No. U0141: ETACS-ECU Time-out

⚠ CAUTION
- **If diagnosis code U0141 is set from engine-ECU, surely perform CAN bus line diagnosis.**
- **Replace ECU after certainly confirming that the communication circuits are normal.**
- **When the ETACS-ECU of vehicles without KOS is replaced, the encrypted code of the ignition key needs to be registered to the ETACS-ECU. (If the encrypted code is not registered, the engine cannot be started. Register the encrypted code as described in GROUP 54A, Immobilizer System – How to Register Key ID .)**

TROUBLE JUDGMENT

Check Conditions
- More than 2 seconds have passed since the ignition switch was turned to "ON" position.
- Battery positive voltage is more than 10 V and is less than 16 V.

Judgement Criterion
- Unable to receive ETACS-ECU signals through the CAN bus line for 4 seconds.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction
- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and ETACS-ECU, by malfunction in the power supply system of ETACS-ECU, in ETACS-ECU itself, in engine-ECU.

Past malfunction
- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and ETACS-ECU and malfunction in the power supply system of ETACS-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes set to each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION
- None

PROBABLE CAUSES
- Failed harness and connector
- Failed ETACS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis
- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table). After repairing CAN bus line, go to Step 6.

STEP 2. M.U.T.-III diagnosis code
- Confirm the diagnosis code is set from ETACS-ECU.

Q: Is diagnosis code set?
YES : Perform troubleshooting of ETACS (Refer to GROUP 54A – ETACS – Diagnosis Code Chart).
NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code
Check that the other ECU performing CAN communication with ETACS-ECU sets diagnosis code No. U0141 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code set?
YES : Go to Step 4.
NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing the ETACS-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ETACS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing the engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ETACS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : Go to Step 1.

NO : Check end.

Code No. U0167: KOS-ECU Communication Error <Vehicles with KOS>

⚠ CAUTION

If diagnosis code U0167 is set from engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION

Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGMENT

Check Condition

- After the engine is cranked.
- Ignition switch is "ON" position.

Judgement Criterion

- Unable to receive KOS-ECU signals through the CAN bus line.

COMMENTS ON TROUBLE SYMPTOM

Current malfunction

- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and KOS-ECU, by malfunction in the power supply system of KOS-ECU, in KOS-ECU itself, in engine-ECU.

Past malfunction

- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and KOS-ECU and malfunction in the power supply system of KOS-ECU. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to

GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes set to each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION

- Engine start is prohibited.

PROBABLE CAUSES

- Failed harness and connector
- Failed KOS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair the CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table). After repairing the CAN bus line, go to Step 4.

STEP 2. M.U.T.-III diagnosis code

- Confirm the diagnosis code is set from the KOS-ECU.

Q: Is diagnosis code set?

YES : Perform troubleshooting of KOS-system (Refer to GROUP 42B – Troubleshooting – Diagnosis Code Chart).

NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing engine-ECU, go to Step 4.

NO : Intermittent malfunction in CAN bus line between engine-ECU and KOS-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : Go to Step 1.

NO : Check end.

Code No. U0415: ASC-ECU CAN Data Abnormality <Vehicles with ASC>

⚠ CAUTION

If diagnosis code U0415 is set from engine-ECU, surely perform CAN bus line diagnosis.

⚠ CAUTION

Replace ECU after certainly confirming that the communication circuits are normal.

TROUBLE JUDGMENT

Check Conditions

- More than 5 seconds have passed since the ignition switch was turned to "ON" position.
- During engine running.

Judgement Criterion

- When the communication error is judged between the engine-ECU and the ASC-ECU

COMMENTS ON TROUBLE SYMPTOM

Current malfunction

- The failure is possibly caused by malfunction of the harness and connector in CAN bus line between engine-ECU and ASC-ECU, by malfunction in ASC-ECU signals, in ASC-ECU itself, in engine-ECU.

Past malfunction

- Proceed with troubleshooting focusing on malfunction of the harness and connector in CAN bus line between engine-ECU and ASC-ECU and malfunction in ASC-ECU signals. For diagnosis procedure, refer to how to cope with past malfunctions. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Treat Past Trouble).

NOTE: In the case of past malfunctions, M.U.T.-III CAN bus line diagnosis cannot detect a malfunction even if there is a malfunction in CAN bus. Therefore, check CAN bus line as in the case of response to intermittent malfunctions (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions). It is possible to narrow down areas with a high possibility of malfunctions from diagnosis codes set to each ECU that performs CAN communication (Refer to GROUP 54C – Explanation about the M.U.T.-III CAN Bus Diagnostics).

FAIL-SAFE AND BACKUP FUNCTION

- Torque requested by active stability control (ASC) is ignored.

PROBABLE CAUSES

- Failed harness and connector
- Signal failure input into engine-ECU sent from ASC-ECU through CAN communication
- Failed ASC-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnosis

- Use M.U.T.-III to perform CAN bus line diagnosis.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair CAN bus line (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnosis Table). After repairing CAN bus line, go to Step 6.

STEP 2. M.U.T.-III diagnosis code

- Confirm the diagnosis code is set from the ASC-ECU.

Q: Is diagnosis code set?

YES : Perform troubleshooting of the active stability control (ASC) system (Refer to GROUP 35C – Troubleshooting – Diagnosis Code Chart).

NO : Go to Step 3.

STEP 3. M.U.T.-III diagnosis code

Check that the other ECU performing CAN communication with ASC-ECU sets diagnosis code No. U0415 [Refer to GROUP 54C – CAN Communication-related Diagnosis Code (U-code) Table].

Q: Is diagnosis code set?

YES : Go to Step 4.

NO : Go to Step 5.

STEP 4. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing ASC-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ASC-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : After replacing engine-ECU, go to Step 6.

NO : Intermittent malfunction in CAN bus line between engine-ECU and ASC-ECU (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 6. M.U.T.-III diagnosis code

- Reconfirmation of diagnosis code.

Confirm again the diagnosis code is set from the engine-ECU.

1. Erase the set diagnosis code.
2. Ignition switch: "LOCK" (OFF) → "ON"
3. Confirm whether the diagnosis code is set.

Q: Is diagnosis code set?

YES : Go to Step 1.
NO : Check end.

INSPECTION CHART FOR TROUBLE SYMPTOMS

M1131151504267

Item	Trouble Symptom		Inspection Procedure No.
Communication with M.U.T.-III is impossible	Communication between M.U.T.-III and engine-ECU is not possible.		1
Engine warning lamp	The engine warning lamp does not illuminate right after the ignition switch is turned to "ON".		2
	The engine warning lamp remains illuminating and never goes out.		3
Starting	Starting impossible (starter not operative)	The starter is not operable.	4
	Starting impossible (Starter operative but no initial combustion)	The starter is operative and cranks the engine, but no initial combustion occurs in the cylinders to start the engine.	5
	Starting impossible (Initial combustion but no complete combustion)	Initial combustion occurs, but the engine stalls soon due to the incomplete combustion.	6
	Engine does not start properly (Long time to start)	The engine starts, but it takes too long for cranking.	
Improper idling	Unstable idling (Rough idling, hunting)	The engine speed is not constant and fluctuates during the idling. Usually, this malfunction can be judged from the shaking tachometer pointer or vibrations transmitted to the steering wheel, shift lever, vehicle body and so on.	7
	Improper idling speed (Too high or too low)	The idling speed is not within the normal range.	
	Engine stalls during idling (Die out)	The engine stalls during the idling in no relation to the vehicle movement.	
Engine stalls	The engine stalls when starting the car (pass out)	The engine stalls when the accelerator pedal is depressed in the idling speed, or during the operation.	8
	Engine stalls at deceleration	The engine stalls at the deceleration.	

Item	Trouble Symptom		Inspection Procedure No.
Driving	Engine does not revolve up	The engine speed does not increase even when the accelerator pedal is depressed.	9
	Hesitation, sag	The response of vehicle speed (engine speed) is delayed when the accelerator pedal is depressed to accelerate vehicle speed, or the vehicle speed (engine speed) is temporarily dropped during the acceleration. This phenomenon is called "hesitation" and a serious hesitation is called "sag".	10
	Poor acceleration	The engine operates smoothly at a constant-speed run, but the vehicle does not accelerate properly as the throttle valve opening changes. In addition, vehicle will not run in the specified maximum speed.	
	Stumble	The engine speed increase is delayed when the accelerator pedal is initially depressed at the starting.	
	Surge	At a constant-speed or acceleration the vehicle is subject to repeated jerking (in terms of the drive speed) in the driving direction.	
	The feeling of impact or vibration when accelerating	The driver feels a sudden impact when the vehicle is accelerated.	11
	The feeling of impact or vibration when decelerating	The driver feels a sudden impact when the vehicle is decelerated.	12
	Knocking	Sharp sound like a hammer striking on the cylinder walls during the driving can be heard and wrongly affects the driving.	13
	Ignition timing deviation	The basic ignition timing is deviated from the datum value.	14
Stopping	Run on (Dieseling)	The engine continues to run after the ignition switch is in "LOCK " (OFF) position.	15
Exhaust gas	Odour, white smoke, black smoke The concentration of CO/HC is high during the idling.	The exhaust has an abnormal odour. Either white or black exhaust gas comes out. The concentration of CO/HC is high during the idling.	16
Charging performance	Battery run down	The battery is soon rundown. Or, the charging ability of battery is small.	17

Item	Trouble Symptom		Inspection Procedure No.
Cooling performance	Overheating	The temperature of engine cooling water is extremely high.	18
ECO mode indicator	In running, the ECO mode indicator shows nothing.		24

PROBLEM SYMPTOMS TABLE

⚠ ***WARNING***

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

⚠ **CAUTION**

During troubleshooting if the ignition switch is turned to ON with the connectors, etc. disconnected, some diagnosis code may be saved in other system. After the troubleshooting is completed, always make sure the diagnosis codes of the entire systems. If it is found that some diagnosis codes have been outputted, erase them.

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

Inspection Procedure No.	Inspection Item	Reference Page
1	The communication between M.U.T.-III and engine-ECU is not possible	P.13A-126
2	The engine warning lamp does not illuminate right after the ignition switch is turned the ON position	P.13A-127
3	The engine warning lamp remains illuminating and never goes out	P.13A-128
4	Starting impossible (starter not operative)	P.13A-128
5	Starting impossible (starter operative but no initial combustion)	P.13A-132
6	Starting impossible (initial combustion but no complete combustion)	P.13A-133
	Improper starting (long time to start)	
7	Unstable idling (rough idling, hunting)	P.13A-135
	Improper idling speed (too high or too low)	
	Engine stalls during idling (die out)	
8	The engine stalls when starting the car (pass out)	P.13A-137
	The engine stalls when decelerating	
9	Engine does not revolve up	P.13A-137
10	Hesitation, sag	P.13A-138
	Poor acceleration	
	Stumble	
	Surge	
11	The feeling of impact or vibration when accelerating	P.13A-140
12	The feeling of impact or vibration when decelerating	P.13A-141

Inspection Procedure No.	Inspection Item	Reference Page
13	Knocking	P.13A-141
14	Ignition timing deviation	P.13A-142
15	Run on (dieseling)	P.13A-143
16	Odour, white smoke, black smoke, and high-concentration CO/HC during idling	P.13A-143
17	Battery run down	P.13A-145
18	Overheating	P.13A-146
19	Engine-ECU power supply, engine control relay, ignition switch–IG1 system	P.13A-147
20	Fuel pump system	P.13A-149
21	A/C compressor relay system	P.13A-151
22	Ignition circuit system	P.13A-152
23	Engine oil pressure switch system	P.13A-154
24	In running, the ECO mode indicator shows nothing	P.13A-155

SYMPTOM PROCEDURES

Inspection Procedure 1: The Communication Between M.U.T.-III and Engine-ECU is Not Possible

OPERATION
- Battery voltage is applied to the diagnosis connector terminal.
- The diagnosis connector terminal is earthed to the vehicle body.

COMMENTS ON TROUBLE SYMPTOM
- When the communication between M.U.T.-III and the engine-ECU is impossible, the CAN bus line, power supply circuit of the diagnosis connector, and/or earthing circuit could possibly be defective. The communication cannot be achieved either if the wrong vehicle type is selected on M.U.T.-III.

PROBABLE CAUSES
- Defective diagnosis connector.
- Open/short circuit or harness damage in diagnosis connector circuit or loose connector contact.
- Defective CAN communication.
- Defective M.U.T.-III.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check the Vehicle Communication Interface (V.C.I.) operations
- Connect the M.U.T.-III to the diagnosis connector.
- When the power of Vehicle Communication Interface (V.C.I.) is turned to ON, the indicator lamp of the Vehicle Communication Interface (V.C.I.) illuminates in green.

  OK: The indicator lamp of the Vehicle Communication Interface (V.C.I.) illuminates in green.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Go to Step 2.

STEP 2. Check battery.
- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the battery.

STEP 3. Perform voltage measurement at diagnosis connector.
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 4.

STEP 4. Check harness between ETACS-ECU connector terminal MUT and diagnosis connector terminal.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 5. Check harness between battery and ETACS-ECU terminal +B1 connector.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Check fuse in the ETACS-ECU, and replace if necessary. If the fuse is normal, replace the ETACS-ECU.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform resistance measurement at diagnosis connector.
- Resistance between terminals earth lines and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 7.
NO : Check intermediate connector, and repair if necessary. If intermediate connector is normal, check and repair the harness between the diagnosis connector terminals earth lines and body earth.
  - Check earthing line for open circuit and damage.

STEP 7. Continuity check on ETACS-ECU connectors
- Disconnect connectors, and measure at ETACS-ECU side.
- Continuity check between terminal +B1 and IG1.

OK: Continuity

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair or replace the connector, or check fuse in the ETACS-ECU, and replace if necessary. If the fuse is normal, replace the ETACS-ECU.

STEP 8. Check harness between battery and ETACS-ECU connector terminal +B1.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair the damaged harness wire.

STEP 9. Check harness between ETACS-ECU connector MUT and diagnosis connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Refer to the M.U.T.-III reference manual.
NO : Repair the damaged harness wire.

STEP 10. M.U.T.-III CAN bus diagnosis
- Use M.U.T.-III, perform CAN bus line diagnosis.

Q: Is the check result normal?
YES : Check Inspection Procedure – engine-ECU power supply, engine control relay, ignition switch-IG1 system (Refer to P.13A-147).
NO : Perform troubleshooting for CAN (Refer to GROUP 54C – Troubleshooting – CAN Bus Diagnostics Table).

Inspection Procedure 2: The Engine Warning Lamp Does Not Illuminate Right after the Ignition Switch is Turned to the "ON" Position

COMMENTS ON TROUBLE SYMPTOM
- The combination meter illuminates the engine warning lamp just after the ignition switch is in the "ON" position.

- If the engine warning lamp is not illuminated just after the ignition switch is in the "ON" position, the failure could possibly be caused by the defective engine warning lamp, open/short circuit of the combination meter and so on.

PROBABLE CAUSE

- Failed combination meter

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?

YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. Check the trouble symptom.

Q: Does the trouble symptom persist?

YES : Check combination meter system (Refer to GROUP 54A – Combination Meter – Trouble Symptom Chart).
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Inspection Procedure 3: The Engine Warning Lamp Remains Illuminating and Never Goes Out

COMMENTS ON TROUBLE SYMPTOM

- The engine-ECU detects failures, or the failures could possibly be caused by the short circuit of the combination meter and so on.

PROBABLE CAUSE

- Failed combination meter

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?

YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. Check the trouble symptom.

Q: Does the trouble symptom persist?

YES : Check combination meter system (Refer to GROUP 54A – Combination Meter – Trouble System Chart).
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Inspection Procedure 4: Starting Impossible (starter not operative)

OPERATION

- The power source is supplied from the battery to the starter connector terminal.
- The battery voltage is applied to the starter relay connector terminal.
- When the ignition switch-ST signal is input to the engine-ECU connector terminal STOE, the engine-ECU connector terminal STRL turns ON the power transistor inside the unit, and makes the current flow into the starter relay connector terminal to turn ON the relay.
- When the starter relay is turned ON, the current flows into the starter connector terminal from the starter relay connector terminal to drive the starter motor.

COMMENTS ON TROUBLE SYMPTOM

- The failure could possibly be caused by the malfunction of the starter or starter system circuits.

PROBABLE CAUSES

- Failed battery
- Failed ignition switch <Vehicles without KOS>
- Failed OSS-ECU <Vehicles with KOS>
- Failed starter relay
- Failed starter motor
- Open/short circuit or harness damage in starter system circuit or loose connector contact.
- Failed inhibitor switch
- Failed ETACS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.
- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. M.U.T.-III data list
- Item 79: Cranking signal

OK:
ON (ignition switch: "ST")
OFF (ignition switch: "ON")

Q: Is the check result normal?
YES : Go to Step 15.
NO : Go to Step 3.

STEP 3. Connector check: engine-ECU connector

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector.

STEP 4. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ST"
- Voltage between terminal STOE and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 10 <Vehicles without KOS>.
YES : Go to Step 11 <Vehicles with KOS>.
NO : Go to Step 5.

STEP 5. Connector check: ETACS-ECU connectors

Q: Are the check results normal?
YES : Go to Step 6.
NO : Repair or replace the connector.

STEP 6. Perform voltage measurement at ETACS-ECU connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ST"
- Voltage between terminal STOE and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 9.
NO : Go to Step 7 <Vehicles without KOS>.
NO : Go to Step 8 <Vehicles with KOS>.

STEP 7. Check ignition switch itself.
- Ignition switch connector check.
- Check ignition switch itself (Refer to GROUP 54A – Ignition Switch – Inspection – Ignition Switch Check).

Q: Is the check result normal?
YES : Repair or replace the connector, or check and repair the harness between ignition switch connector terminal and ETACS-ECU connector terminal ST.
  - Check power supply line for open/short circuit.

NO : Replace the ignition switch.

STEP 8. Check harness between OSS-ECU connector terminal STO and ETACS-ECU connector terminal ST.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Perform troubleshooting of OSS System (Refer to GROUP 42B – Troubleshooting – Trouble Symptom Chart).
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 9. Continuity check on ETACS-ECU connectors
- Disconnect connectors, and measure at ETACS-ECU side.
- Continuity check between terminal ST and STOE.

OK: Continuity

Q: Is the check result normal?
YES : Check and repair the harness between ETACS-ECU connector terminal STOE and engine-ECU connector terminal STOE.
  - Check power supply line for open/short circuit.

NO : Replace the ETACS-ECU.

STEP 10. Check harness between ignition switch connector terminal and ETACS-ECU connector terminal ST.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 11. Check harness between OSS-ECU connector terminal STO and ETACS-ECU connector terminal ST.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 12. Continuity check on ETACS-ECU connectors

- Disconnect connectors, and measure at ETACS-ECU side.
- Continuity check between terminal ST and STOE.

OK: Continuity

Q: Is the check result normal?
YES : Go to Step 13.
NO : Replace the ETACS-ECU.

STEP 13. Check harness between ETACS-ECU connector terminal STOE and engine-ECU connector terminal STOE.

- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 14.
NO : Repair the damaged harness wire.

STEP 14. M.U.T.-III data list

- Item 79: Cranking signal

OK:
ON (ignition switch: "ST")
OFF (ignition switch: "ON")

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 15. Check starter relay itself.

- Starter relay connector check.
- Check starter relay itself (Refer to GROUP 16 – Starting System – On-vehicle Service – Starter Relay Continuity Check).

Q: Is the check result normal?
YES : Go to Step 16.
NO : Repair or replace the connector, or replace the starter relay.

STEP 16. Perform resistance measurement at starter relay connector.

- Remove relay, and measure at relay box side.
- Resistance between terminal earth line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 17.
NO : Check and repair harness between starter relay connector terminal earth line and body earth.
- Check earthing line for open circuit and damage.

STEP 17. Perform voltage measurement at starter relay connector.

- Remove relay, and measure at relay box side.
- Transmission: P or N range
- Ignition switch: "ST"
- Voltage between inhibitor switch connector terminal, its terminal line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 23.
NO : Go to Step 18.

STEP 18. Check inhibitor switch

- Inhibitor switch connector check.
- Check inhibitor switch (Refer to GROUP 23A – On-vehicle Service).

Q: Is the check result normal?
YES : Go to Step 19.
NO : Repair or replace the connector, or replace the inhibitor switch.

STEP 19. Check harness between inhibitor switch connector terminal and starter relay connector terminal.

- Check power supply line for open/short circuit.

Q: Is the check result normal?

YES : Go to Step 20.
NO : Repair the damaged harness wire.

STEP 20. Check harness between engine-ECU connector terminal STRL and inhibitor switch connector terminal.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 21.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 21. Check harness between engine-ECU connector terminal NTSW and starter relay connector terminal.
- Check output line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 22.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 22. M.U.T.-III data list
- Item 102: Starter relay

OK:
ON (ignition switch: "ST")
OFF (ignition switch: "ON")

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 23. Perform voltage measurement at starter relay connector.
- Remove relay, and measure at relay box side.
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 24.
NO : Check and repair harness between battery and starter relay connector terminal.
  - Check power supply line for open/short circuit.

STEP 24. Perform voltage measurement at starter connector.
- Disconnect connector, and measure at harness side.
- Transmission: P or N range
- Ignition switch: "ST"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 29.
NO : Go to Step 25.

STEP 25. Check harness between starter relay connector terminal and starter connector terminal.
- Check output line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 26.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 26. Check inhibitor switch
- Check inhibitor switch (Refer to GROUP 23A – On-vehicle Service).

Q: Is the check result normal?
YES : Go to Step 27.
NO : Repair or replace the connector, or replace the inhibitor switch.

STEP 27. Check harness between inhibitor switch connector terminal and starter relay connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 28.
NO : Repair the damaged harness wire.

STEP 28. Connector check: engine-ECU connector

Q: Is the check result normal?
YES : Check intermediate connector, and repair if necessary. If intermediate connector is normal, check and repair harness between engine-ECU connector terminal STRL and inhibitor switch connector terminal.
  - Check power supply line for damage.

NO : Repair or replace the connector.

STEP 29. Check harness between battery and starter relay connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 30.
NO : Repair the damaged harness wire.

STEP 30. Check harness between starter relay connector terminal and starter connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 31.
NO : Repair the damaged harness wire.

STEP 31. Perform voltage measurement at starter terminal.
- Disconnect terminal, and measure at harness side.
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 32.
NO : Repair or replace the terminal, or check and repair harness between battery and starter terminal.
- Check power supply line for open/short circuit.

STEP 32. Check harness between battery and starter terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Replace the starter.
NO : Repair the damaged harness wire.

Inspection Procedure 5: Starting Impossible (starter operative but no initial combustion)

COMMENTS ON TROUBLE SYMPTOM
- The failure could possibly be caused by the failed ignition circuit, defective fuel feed and so on.

PROBABLE CAUSES
- Failed battery
- Timing chain broken
- Contamination around the throttle valve
- Failed ignition system
- Failed fuel system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.
- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 3.

STEP 3. M.U.T.-III actuator test
- Item 9: Fuel pump

OK: Operating sound of fuel pump can be heard

Q: Is the check result normal?
YES : Go to Step 4.
NO : Check Inspection Procedure – fuel pump system (Refer to P.13A-149).

STEP 4. Check timing chain for breakage.
- Engine: Cranking

OK: Camshaft rotates

Q: Is the check result normal?
YES : Go to Step 5.
NO : Replace the timing chain.

STEP 5. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?

YES : Go to Step 6.
NO : Throttle body (throttle valve area) cleaning (Refer to P.13A-179).

STEP 6. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 2: Crank angle sensor

Q: Is the check result normal?
YES : Go to Step 7.
NO : Check code No. P0335: crank angle sensor system (Refer to P.13A-78).

STEP 7. Visual check of ignition spark.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Go to Step 8.

STEP 8. Check spark plug.
- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning).

Q: Is the check result normal?
YES : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).
NO : Replace the spark plug.

STEP 9. Check injector for operating sound.
- Injector check (Refer to P.13A-188).

Q: Is operating sound audible?
YES : Go to Step 10.
NO : Check the injector system of the defective cylinder. Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62). Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63). Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64). Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65). Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66). Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67). Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68). Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).

STEP 10. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13A-179).

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair.

STEP 11. Replace the engine-ECU.
- After replacing the engine-ECU re-check the trouble symptoms.

Q: Does the trouble symptom persist?
YES : Check for foreign matters (water, diesel fuel, etc.) in fuel and replace if necessary.
NO : Check end.

Inspection Procedure 6: Starting Impossible (initial combustion but no complete combustion), Improper Starting (long time to start)

COMMENTS ON TROUBLE SYMPTOM
- The failure could possibly be caused by the poor ignition, improper air-fuel ratio at cranking, failed fuel pressure and so on.

PROBABLE CAUSES
- Failed battery
- Failed ignition system
- Failed fuel system
- Failed air-fuel ratio control system
- Failed intake air system
- Contamination around the throttle valve
- Timing chain in out of place
- Improper compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.
- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 3.

STEP 3. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor
  e. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 4.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 4. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Throttle body (throttle valve area) cleaning (Refer to P.13A-179).

STEP 5. M.U.T.-III actuator test

- Item 9: Fuel pump

OK: Operating sound of fuel pump can be heard.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Check Inspection Procedure – fuel pump system (Refer to P.13A-149).

STEP 6. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. Check injector for operating sound.

- Injector check (Refer to P.13A-188).

Q: Is operating sound audible?
YES : Go to Step 8.
NO : Check the injector system of the defective cylinder. Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62). Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63). Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64). Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65). Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66). Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67). Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68). Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).

STEP 8. Check timing mark on the timing chain.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Align the timing marks.

STEP 9. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 10. Check injector for spray condition.

- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 11.
NO : Replace the injector.

STEP 11. Fuel pressure measurement.

- Fuel pressure test (Refer to P.13A-179).

Q: Is the check result normal?
YES : Go to Step 12.
NO : Repair.

STEP 12. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?

YES : Go to Step 13.
NO : Repair.

STEP 13. Replace the engine-ECU.

- After replacing the engine-ECU re-check the trouble symptoms.

Q: Does the trouble symptom persist?

YES : Check for foreign matters (water, diesel fuel, etc.) in fuel and replace if necessary.
NO : Check end.

Inspection Procedure 7: Unstable Idling (rough idling, hunting), Improper Idling Speed (too high or too low), Engine Stalls during Idling (die out)

COMMENTS ON TROUBLE SYMPTOM

- Probable causes can be widely found in the ignition system, air-fuel ratio control system, electronic-controlled throttle valve system, fuel system and so on. A sudden engine stall could possibly be caused by the poor contact at the connectors.

PROBABLE CAUSES

- Failed ignition system
- Failed fuel system
- Failed air-fuel ratio control system
- Failed intake air system
- Contamination around the throttle valve
- Timing chain in out of place
- Improper compression pressure
- Failed variable valve timing control system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor
  e. Item 11: Accelerator pedal position sensor (main)
  f. Item 12: Accelerator pedal position sensor (sub)
  g. Item 13: Throttle position sensor (main)
  h. Item 15: Throttle position sensor (sub)
  i. Item 36: V.V.T.phase angle (inlet)
  j. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 3. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 87: Neutral switch

Q: Is the check result normal?
YES : Go to Step 4.
NO : Carry out checks relating to the system.

STEP 4. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Check timing mark on the timing chain.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Align the timing marks.

STEP 6. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Throttle body (throttle valve area) cleaning (Refer to P.13A-179).

STEP 7. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)
  b. Item AD: Oxygen sensor (rear)

Q: Are the check results normal?
YES : Go to Step 8.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 8. Perform voltage measurement at engine-ECU connector.
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idle operation after warm-up
- Transmission: P range
- Radiator fan: Not operated
- Voltage between terminal ALTG and body earth.

OK: The voltage increases when the headlamp switch and the rear window defogger switch are turned ON from OFF.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Go to Step 9.

STEP 9. Check harness between engine-ECU connector terminal ALTG and alternator connector terminal.
- Check output line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 10. Check the trouble symptom.

Q: Does the trouble symptom persist?
YES : Replace the alternator.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 11. Visual check of ignition spark.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 12. Check purge control solenoid valve itself.
- Check purge control solenoid valve itself (Refer to GROUP 17 – Emission Control – Evaporative Emission Control System – Purge Control Solenoid Valve Check).

Q: Is the check result normal?
YES : Go to Step 13.
NO : Replace the purge control solenoid valve.

STEP 13. Check injector for spray condition.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 14.
NO : Replace the injector.

STEP 14. Check compression pressure.
- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?
YES : Go to Step 15.
NO : Repair.

STEP 15. Replace the engine-ECU.
- After replacing the engine-ECU re-check the trouble symptoms.

Q: Does the trouble symptom persist?
YES : Check for foreign matters (water, diesel fuel, etc.) in fuel and replace if necessary.
NO : Check end.

Inspection Procedure 8: The Engine Stalls when Starting the Car (pass out), The Engine Stalls when Decelerating

COMMENTS ON TROUBLE SYMPTOM

- The failure could possibly be caused by the misfire due to the failed spark plug, improper air-fuel ratio at the accelerator pedal depression and so on when the engine stalls at the acceleration.
- The failure could possibly be caused by the improper air-fuel ratio due to the insufficient amount of intake air and so on when the engine stalls at the deceleration.

PROBABLE CAUSES

- Failed ignition system
- Failed intake air system
- Contamination around the throttle valve
- Improper compression pressure
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)
  c. Item 13: Throttle position sensor (main)
  d. Item 15: Throttle position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 3. Check air inlet from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair.

STEP 4. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Throttle body (throttle valve area) cleaning (Refer to P.13A-179).

STEP 5. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 6. Check compression pressure.

- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Inspection Procedure 9: Engine Does Not Revolve Up

COMMENTS ON TROUBLE SYMPTOM

- The failure could possibly be caused by the failed electronic-controlled throttle valve system, faulty fuel system, defective ignition system and so on.

PROBABLE CAUSES

- Failed ignition system
- Failed fuel system
- Failed electronic-controlled throttle valve system
- Timing chain in out of place

- Failed CVT
- Failed engine-ECU

DIAGNOSIS PROCEDURE

NOTE: To protect the CVT, the CVT-ECU outputs, into the engine-ECU, the request signal to reduce the engine torque according to the operation condition. Based on the signal, the engine-ECU closes the throttle valve, retards the ignition or carries out fuel cut. At that time, the engine output seems to temporarily reduce, but there is no malfunction.

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code

NOTE: When the CVT has a malfunction, the CVT-ECU might output the request signal of reducing the engine torque in order to protect the CVT.

- Confirm the diagnosis code is set from CVT-ECU

Q: Is the diagnosis code set?
YES : Perform troubleshooting of CVT System (Refer to GROUP 23A – Diagnosis Code Chart).
NO : Go to Step 3.

STEP 3. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)
  c. Item 13: Throttle position sensor (main)
  d. Item 15: Throttle position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 4.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 4. Check timing mark on the timing chain.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Align the timing marks.

STEP 5. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 6. Fuel pressure measurement.

- Fuel pressure test (Refer to P.13A-179).

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Inspection Procedure 10: Hesitation, Sag, Poor Acceleration, Stumble or Surge

COMMENTS ON TROUBLE SYMPTOM

- The failure could possibly be caused by the failed ignition system, improper air-fuel ratio, faulty compression pressure and so on.

PROBABLE CAUSES

- Failed air-fuel ratio control system
- Failed ignition system
- Failed fuel system
- Failed intake and exhaust air system
- Failed electronic-controlled throttle valve system
- Contamination around the throttle valve
- Improper compression pressure
- Failed CVT
- Failed engine-ECU

DIAGNOSIS PROCEDURE

NOTE: To protect the CVT, the CVT-ECU outputs, into the engine-ECU, the request signal to reduce the engine torque according to the operation condition. Based on the signal, the engine-ECU closes the throttle valve, retards the ignition or carries out fuel cut. At that time, the engine output seems to temporarily reduce, but there is no malfunction.

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code

NOTE: When the CVT has a malfunction, the CVT-ECU might output the request signal of reducing the engine torque in order to protect the CVT.

- Confirm the diagnosis code is set from CVT-ECU.

Q: Is the diagnosis code set?
YES : Perform troubleshooting of CVT System (Refer to GROUP 23A – Diagnosis Code Chart).
NO : Go to Step 3.

STEP 3. Check injector for operating sound.

- Injector check (Refer to P.13A-188).

Q: Is operating sound audible?
YES : Go to Step 4.
NO : Check the injector system of the defective cylinder. Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62). Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63). Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64). Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65). Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66). Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67). Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68). Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 11: Accelerator pedal position sensor (main)
  d. Item 12: Accelerator pedal position sensor (sub)
  e. Item 13: Throttle position sensor (main)
  f. Item 15: Throttle position sensor (sub)
  g. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 5.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 5. Check purge control solenoid valve itself.

- Check purge control solenoid valve itself (Refer to GROUP 17– Emission Control – Evaporative Emission Control System – Purge Control Solenoid Valve Check).

Q: Is the check result normal?
YES : Go to Step 6.
NO : Replace the purge control solenoid valve.

STEP 6. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)
  b. Item AD: Oxygen sensor (rear)

Q: Are the check results normal?
YES : Go to Step 7.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 7. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

STEP 8. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Throttle body (throttle valve area) cleaning (Refer to P.13A-179).

STEP 9. Check compression pressure.
- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair.

STEP 10. Fuel pressure measurement.
- Fuel pressure test (Refer to P.13A-179).

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair.

STEP 11. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Repair.

STEP 12. Check exhaust leak from exhaust manifold.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Repair.

Inspection Procedure 11: The Feeling of Impact or Vibration when Accelerating

COMMENTS ON TROUBLE SYMPTOM
- The failure could possibly be caused by the ignition leak occurring in association with the increase in the voltage required by the spark plug during the acceleration, failed electronic-controlled throttle valve system and so on.

PROBABLE CAUSES
- Failed ignition system
- Failed electronic-controlled throttle valve system
- Contamination around the throttle valve
- Failed CVT
- Failed engine-ECU

DIAGNOSIS PROCEDURE
NOTE: To protect the CVT, the CVT-ECU outputs, into the engine-ECU, the request signal to reduce the engine torque according to the operation condition, Based on the signal, the engine-ECU closes the throttle valve, retards the ignition or carries out fuel cut. At that time, the engine output seems to temporarily reduce, but there is no malfunction.

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III diagnosis code

NOTE: When the CVT has a malfunction, the CVT-ECU might output the request signal of reducing the engine torque in order to protect the CVT.
- Confirm the diagnosis code is set from CVT-ECU.

Q: Is the diagnosis code set?
YES : Perform troubleshooting of CVT System (Refer to GROUP 23A – Diagnosis Code Chart).
NO : Go to Step 3.

STEP 3. M.U.T.-III data list
- Data list reference table (Refer to P.13A-155).
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)
  c. Item 13: Throttle position sensor (main)
  d. Item 15: Throttle position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 4.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 4. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Throttle body (throttle valve area) cleaning (Refer to P.13A-179).

STEP 5. Visual check of ignition spark.
- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

Inspection Procedure 12: The Feeling of Impact or Vibration when Decelerating

COMMENTS ON TROUBLE SYMPTOM
- Failure is possibly caused by an insufficient amount of intake air due to failed electronic-controlled throttle valve system.

PROBABLE CAUSES
- Failed electronic control throttle valve system
- Contamination around the throttle valve
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. M.U.T.-III data list
- Refer to Data List Reference Table P.13A-155.
  a. Item 11: Accelerator pedal position sensor (main)
  b. Item 12: Accelerator pedal position sensor (sub)
  c. Item 13: Throttle position sensor (main)
  d. Item 15: Throttle position sensor (sub)

Q: Are the check results normal?
YES : Go to Step 3.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value (Refer to Inspection Chart for Diagnosis Code P.13A-23).

STEP 3. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Clean throttle body (throttle valve portion) (Refer to Throttle Body (Throttle Valve Area) Cleaning P.13A-179).

Inspection Procedure 13: Knocking

COMMENTS ON TROUBLE SYMPTOM
- The failure could possibly be caused by the failed detonation control system, improper thermal value of the spark plug and so on.

PROBABLE CAUSES
- Failed detonation sensor
- Failed detonation control system
- Failed spark plug
- Failed ignition system
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?

YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Check detonation sensor system. Check code No.P0327: detonation sensor circuit low input (Refer to P.13A-77). Check code No.P0328: detonation sensor circuit high Input (Refer to P.13A-78).
NO : Check Inspection Procedure – ignition circuit system (Refer to P.13A-152).

Inspection Procedure 14: Ignition Timing Deviation

COMMENTS ON TROUBLE SYMPTOM

- The failure could possibly be caused by the failed crank angle sensor, faulty inlet camshaft position sensor, improper assembled timing chain and so on.

PROBABLE CAUSES

- Failed crank angle sensor
- Failed inlet camshaft position sensor
- Timing chain in out of place
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. Perform output wave pattern measurement at crank angle sensor and inlet camshaft position sensor (Using an oscilloscope).

<Crank angle sensor>

- Use the test harness (MB991709) to connect crank angle sensor connector, and measure at the pick-up harness.
- Engine: Idling
- Transmission: P range
- Voltage between terminal engine-ECU SGT line and body earth.

<Inlet camshaft position sensor>

- Use the test harness (MB991709) to connect inlet camshaft position sensor connector, and measure at pick-up harness.
- Engine: Idling
- Transmission: P range
- Voltage between terminal engine-ECU CPI line and body earth.

OK: The timings on the output wave pattern at the both sensors should be the same as the specification in the inspection procedure using an oscilloscope (Refer to P.13A-174).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Go to Step 4.

STEP 3. Check the trouble symptom.

Q: Does the trouble symptom persist?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 4. Check crank angle sensor and inlet camshaft position sensor for correct mounting condition.

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair.

STEP 5. Check timing mark on the timing chain.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Align the timing marks on timing chain.

STEP 6. Check inlet camshaft sensing portion.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Replace the inlet camshaft.

STEP 7. Replace the crank angle sensor.
- After replacing the crank angle sensor, re-check the trouble symptoms.

Q: Does the trouble symptom persist?
YES : Go to Step 8.
NO : Check end.

STEP 8. Replace the inlet camshaft position sensor.

Q: Does the trouble symptom persist?
YES : Go to Step 9.
NO : Check end.

STEP 9. Replace the crankshaft sensing ring.
- After replacing the crankshaft sensing ring, re-check the trouble symptoms.

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Check end.

Inspection Procedure 15: Run On (Dieseling)

COMMENTS ON TROUBLE SYMPTOM
- Failure is possibly caused by leakage from injectors.

PROBABLE CAUSES
- Failed injector
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check injector for its spray condition.
- Check each injector for spray condition (Refer to Injector Check P.13A-188).

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Replace the injector.

Inspection Procedure 16: Odour, White Smoke, Black Smoke and High-concentration of CO/HC during Idling

COMMENTS ON TROUBLE SYMPTOM
- The failure could possibly be caused by the improper air-fuel ratio, deteriorated catalyst, failed ignition system, defective fuel system, faulty compression pressure and so on.

PROBABLE CAUSES
- Failed air-fuel ratio control system
- Failed ignition system
- Failed fuel system
- Failed intake and exhaust air system
- Improper compression pressure
- Deteriorated catalyst
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. Check injector for operating sound.
- Injector check (Refer to P.13A-188).

Q: Is operating sound audible?

YES : Go to Step 3.
NO : Check the injector system of the defective cylinder. Check code No. P0261: No. 1 injector circuit low input (Refer to P.13A-62). Check code No. P0262: No. 1 injector circuit high input (Refer to P.13A-63). Check code No. P0264: No. 2 injector circuit low input (Refer to P.13A-64). Check code No. P0265: No. 2 injector circuit high input (Refer to P.13A-65). Check code No. P0267: No. 3 injector circuit low input (Refer to P.13A-66). Check code No. P0268: No. 3 injector circuit high input (Refer to P.13A-67). Check code No. P0270: No. 4 injector circuit low input (Refer to P.13A-68). Check code No. P0271: No. 4 injector circuit high input (Refer to P.13A-69).

STEP 3. Check ignition timing.

- Check ignition timing (Refer to GROUP 11A – On-vehicle Service – Ignition Timing Check).

Q: Is the check result normal?
YES : Go to Step 4.
NO : Check Inspection Procedure – ignition timing deviation (Refer to P.13A-142).

STEP 4. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 5: Intake air temperature sensor
  b. Item 6: Engine coolant temperature sensor
  c. Item 8: Manifold absolute pressure sensor
  d. Item 10: Air flow sensor
  e. Item BB: Barometric pressure sensor

Q: Are the check results normal?
YES : Go to Step 5.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 5. Check air intake from inlet hose and inlet manifold.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair.

STEP 6. Check exhaust leak from exhaust manifold.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair.

STEP 7. Check throttle body (throttle valve portion) contamination.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Throttle body (throttle valve area) cleaning (Refer to P.13A-179).

STEP 8. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item AC: Oxygen sensor (front)
  b. Item AD: Oxygen sensor (rear)

Q: Are the check results normal?
YES : Go to Step 9.
NO : Perform the diagnosis code classified check procedure for the sensor that has shown an abnormal data value. Inspection chart for diagnosis code (Refer to P.13A-23).

STEP 9. Check purge control solenoid valve itself.

- Check purge control solenoid valve itself (Refer to GROUP 17– Emission Control – Evaporative Emission Control System – Purge Control Solenoid Valve Check).

Q: Is the check result normal?
YES : Go to Step 10.
NO : Replace the purge control solenoid valve.

STEP 10. Fuel pressure measurement.

- Fuel pressure test (Refer to P.13A-179).

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair.

STEP 11. Check positive crankcase ventilation valve itself.

- Check positive crankcase ventilation valve itself (Refer to GROUP 17 – Emission Control – Crankcase Emission Control System – Positive Crankcase Ventilation Valve Check).

Q: Is the check result normal?
YES : Go to Step 12.
NO : Replace the positive crankcase ventilation valve.

STEP 12. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle service – Spark Plug Check and Cleaning).

Q: Is the check result normal?

YES : Go to Step 13.
NO : Replace the spark plug.

STEP 13. Check compression pressure.
- Check the compression pressure (Refer to GROUP 11A – On-vehicle Service – Compression Pressure Check).

Q: Is the check result normal?
YES : Go to Step 14.
NO : Repair.

STEP 14. Check injector for spray condition.
- Injector check (Refer to P.13A-188).

Q: Is the check result normal?
YES : Go to Step 15.
NO : Replace the injector.

STEP 15. Replace the catalytic converter.
- After the replacing the catalytic converter, re-check the trouble symptoms.

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Check end.

Inspection Procedure 17: Battery Run Down

OPERATION
- The exciting currents of the alternator field coil are input into the engine-ECU connector terminal ALTL from the alternator connector.
- The electric generating capacity of the alternator connector terminal is restricted according to the signal from the engine-ECU connector terminal ALTG.

COMMENTS ON TROUBLE SYMPTOM
- The failure could possibly be caused by the failed alternator, defective alternator control system and so on.

PROBABLE CAUSES
- Failed battery
- Open/short circuit or harness damage in alternator L terminal circuit
- Short circuit in alternator G terminal
- Failed alternator
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.
- Check battery (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. Perform voltage measurement at alternator connector
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU ALTL line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Go to Step 3.

STEP 3. Check harness between engine-ECU connector terminal ALTL and alternator connector terminal.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 4. Check the trouble symptom.

Q: Does the trouble symptom persist?
YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

STEP 5. Check harness between engine-ECU connector terminal ALTL and alternator connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?

YES : Go to Step 6.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 6. Perform voltage measurement at alternator connector.
- Disconnect connector, and measure at alternator side.
- Connect special tool Test Harness (MB991658) to all terminals except the terminal engine-ECU ALTG line.
- Ignition switch: "ON"
- Voltage between terminal engine-ECU ALTG line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 7.
NO : Replace the alternator.

STEP 7. Check harness between engine-ECU connector terminal ALTG and alternator connector terminal.
- Check output line for short circuit.

Q: Is the check result normal?
YES : Go to Step 8.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Perform voltage measurement at engine-ECU connector.
- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idle operation after warm-up
- Transmission: P range
- Cooling fan: Not operated
- Voltage between terminal ALTG and body earth.

OK: The voltage increases when the headlamp switch and the rear window defogger switch are turned "ON" from "OFF".

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Go to Step 4.

Inspection Procedure 18: Overheating

COMMENTS ON TROUBLE SYMPTOM
- The failure could possibly be caused by the failed engine cooling system, defective cooling fan system, faulty engine coolant temperature sensor and so on.

PROBABLE CAUSES
- Insufficient amount or deteriorated quality of engine coolant
- Failed cooling fan system
- Failed engine coolant temperature sensor
- Failed thermostat
- Failed water pump
- Failed radiator core
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is the diagnosis code set?
YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2.

STEP 2. Check engine coolant.

NOTE: When the engine coolant level is too low, check for any section that cases leakage and repair, if necessary.
- Check engine coolant (Refer to GROUP 14 – On-vehicle Service – Engine Coolant Leak Check).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace or fill the engine coolant.

STEP 3. M.U.T.-III actuator test
- Item 14: Cooling fan motor

OK: Fan motor rotates at high speed.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Check fan control relay system (Refer to GROUP 14 – Troubleshooting).

STEP 4. M.U.T.-III data list

- Item 6: Engine coolant temperature sensor

OK:
Engine cold state: At ambient temperature (atmospheric temperature) or equivalent.
Engine hot state: At 80 – 120°C

Q: Is the check result normal?
YES : Go to Step 5.
NO : Check engine coolant temperature sensor system. Check code No. P0117: engine coolant temperature sensor circuit low input (Refer to P.13A-41). Check code No. P0118: engine coolant temperature sensor circuit high input (Refer to P.13A-42).

STEP 5. Check thermostat.

- Check thermostat (Refer to GROUP 14 – Thermostat – Inspection).

Q: Is the check result normal?
YES : Go to Step 6.
NO : Replace the thermostat.

STEP 6. Check water pump.

- Check water pump (Refer to GROUP 14 – On-vehicle Service – Water Pump Coolant Leak Check).

Q: Is the check result normal?
YES : Replace the radiator.
NO : Replace the water pump.

Inspection Procedure 19: Engine-ECU Power Supply, Engine Control Relay, Ignition Switch-IG1 System

OPERATION

- Battery voltage is applied to the engine control relay power supply line.
- Engine-ECU connector terminal C/R applies current to the engine control relay coil by turning ON the power transistor in the unit in order to turn the relay ON.
- When the engine control relay is turned ON, the battery power will be supplied from the engine control relay to the engine-ECU, sensor and actuator.

FUNCTION

- When the ignition switch ON signal is input into the engine-ECU via ETACS-ECU, the engine-ECU turns ON the engine control relay. This causes battery voltage to be supplied to the engine-ECU, sensor and actuator.

PROBABLE CAUSES

- Failed battery
- Failed engine control relay
- Failed ignition switch <Vehicles without KOS>
- Failed OSS-ECU <Vehicles with KOS>
- Open/short circuit or harness damage in engine control relay circuit, or loose connector contact.
- Open/short circuit or harness damage in ignition switch (IG1) circuit, or loose connector contact.
- Open circuit or harness damage in engine-ECU earth circuit, or loose connector contact.
- Failed ETACS-ECU
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check battery.

- Battery check (Refer to GROUP 54A – Battery – On-vehicle Service – Battery Test).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Replace the battery.

STEP 2. Check engine control relay itself.

- Engine control relay connector check.
- Engine control relay continuity check (Refer to P.13A-184).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Repair or replace the connector, or replace the engine control relay.

STEP 3. Perform voltage measurement at engine control relay connector

- Remove relay, and measure at relay box side.
- Voltage between terminal power supply lines and body earth

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Check and repair harness between battery and engine control relay connector power supply line.
  - Check power supply line for open/short circuit.

STEP 4. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Voltage between terminal C/R and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or check and repair harness between engine control relay connector terminal and engine-ECU connector terminal C/R.
- Check signal line for open/short circuit.

STEP 5. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Short-circuit engine-ECU connector terminal C/R to the body earth.
- Voltage between terminal BAT1 and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 8.
NO : Go to Step 6.

STEP 6. Check harness between engine control relay connector terminal and engine-ECU connector terminal BAT1.
- Check output line for open/short circuit.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Check harness between the battery and engine control relay connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Check and repair harness between engine control relay connector terminal and engine-ECU connector terminal C/R.
- Check signal line for damage.

NO : Repair the damaged harness wire.

YES : Check and repair harness between ignition switch connector terminal IG1 line and ETACS-ECU connector terminal IG1.
- Check signal line for open/short circuit.

STEP 8. Check harness between engine-ECU connector terminal BAT1 and engine control relay connector terminal.
- Check output line for damage.

Q: Is the check result normal?
YES : Go to Step 9.
NO : Repair the damaged harness wire.

STEP 9. Check harness between battery and engine control relay connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 10.
NO : Repair the damaged harness wire.

STEP 10. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal IGN and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 15 <Vehicles without KOS>.
YES : Go to Step 16 <Vehicles with KOS>.
NO : Go to Step 11.

STEP 11. Perform voltage measurement at ETACS-ECU connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal IGN and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 14.
NO : Go to Step 12 <Vehicles without KOS>.
NO : Go to Step 13 <Vehicles with KOS>.

STEP 12. Check ignition switch itself.
- Check ignition switch connector check.
- Check ignition switch itself (Refer to GROUP 54A – Ignition switch – Inspection – Ignition Switch Check).

Q: Is the check result normal?
NO : Repair or replace the connector, or replace the ignition switch.

STEP 13. Check harness between OSS-ECU connector terminal IG1 and ETACS-ECU connector terminal IG1.

- Check power supply line for open/short circuit.

Q: Is the check result normal?

YES : Perform troubleshooting of OSS System (Refer to GROUP 42B – Troubleshooting – Trouble Symptom Chart).

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 14. Continuity check on ETACS-ECU connectors

- Disconnect connectors, and measure at the ETACS-ECU side.
- Continuity test between terminal IG1 and IGN.

NOTE: Connect the (+) side of circuit tester to terminal IGN.

OK: Continuity

Q: Is the check result normal?

YES : Check and repair harness between ETACS-ECU connector terminal IGN and engine-ECU connector terminal IGN.
- Check signal line for open/short circuit.

NO : Replace the ETACS-ECU.

STEP 15. Check harness between ignition switch connector terminal IG1 line and ETACS-ECU connector IG1.

- Check signal line for damage.

Q: Is the check result normal?

YES : Go to Step 17.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 16. Check harness between OSS-ECU connector terminal IG1 and ETACS-ECU connector terminal IG1.

- Check signal line for damage.

Q: Is the check result normal?

YES : Go to Step 17.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 17. Continuity check on ETACS-ECU connectors

- Disconnect connectors, and measure at the ETACS-ECU side.
- Continuity test between terminal IG1 and IGN.

NOTE: Connect the (+) side of circuit tester to terminal IGN.

OK: Continuity

Q: Is the check result normal?

YES : Go to Step 18.

NO : Replace the ETACS-ECU.

STEP 18. Check harness between ETACS-ECU connector terminal IGN and engine-ECU connector terminal IGN.

- Check signal line for damage.

Q: Is the check result normal?

YES : Go to Step 19.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 19. Check harness between engine-ECU connector terminal GNDB, GNDE and body earth.

- Check earthing line for open circuit and damage.

Q: Is the check result normal?

YES : Replace the engine-ECU.

NO : Repair the damaged harness wire.

Inspection Procedure 20: Fuel Pump System

OPERATION

- The fuel pump drive power is supplied from engine control relay to fuel pump relay (ETACS-ECU connector terminal F/PB) in the ETACS-ECU.
- The battery voltage is applied by the ignition switch <Vehicles without KOS> or the OSS-ECU <Vehicles with KOS> to the fuel pump relay coil (ETACS-ECU connector terminal IG1) in the ETACS-ECU. The engine-ECU turns on the relay by turning ON the power transistor in the unit so as to conduct power to the fuel pump relay coil (via the ETACS-ECU connector terminal FP/R).

- When the fuel pump relay is turned ON, the battery voltage will be supplied from the fuel pump relay (ETACS-ECU connector terminal F/PB) to the fuel pump connector terminal.

FUNCTION

- When the ignition switch ON signal is inputted into the engine-ECU, the engine-ECU turns ON the fuel pump relay. This causes the battery voltage to be supplied to the fuel pump.

PROBABLE CAUSES

- Failed fuel pump relay in the ETACS-ECU
- Failed fuel pump
- Open/short circuit or harness damage in fuel pump drive circuit, or loose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Connector check: ETACS-ECU connectors

Q: Are the check results normal?
YES : Go to Step 2.
NO : Repair or replace the connector.

STEP 2. Check fuel pump relay.

- Fuel pump relay continuity check (Refer to P.13A-184).

Q: Is the check result normal?
YES : Go to Step 3.
NO : Replace the ETACS-ECU.

STEP 3. Perform voltage measurement at engine-ECU connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal FP/R and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair or replace the connector, or check and repair harness between engine-ECU connector terminal FP/R and ETACS-ECU connector terminal FP/R.
- Check power supply line for open/short circuit.

STEP 4. Perform voltage measurement at ETACS-ECU connector.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal F/PB and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 6.
NO : Go to Step 5.

STEP 5. Connector check: Engine control relay connector

Q: Is the check result normal?
YES : Check and repair harness between engine control relay connector terminal and ETACS-ECU connector terminal F/PB.
- Check power supply line for open/short circuit.

NO : Repair or replace the connector.

STEP 6. Check fuel pump operations.

- Fuel pump connector check.
- Fuel tank pump operation check (Refer to P.13A-182).

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or replace the fuel tank pump and gauge assembly.

STEP 7. Perform resistance measurement at fuel pump connector.

- Disconnect connector, and measure at harness side.
- Resistance between terminal earth line and body earth.

OK: Continuity (2 Ω or less)

Q: Is the check result normal?
YES : Go to Step 8.
NO : Check and repair harness between fuel pump connector terminal earth line and body earth.
- Check earthing line for open circuit and damage.

STEP 8. Perform voltage measurement at fuel pump connector.
- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 10.
NO : Go to Step 9.

STEP 9. Check harness between ETACS-ECU connector terminal F/P and fuel pump connector.
- Check power supply line for open/short circuit.

Q: Is the check result normal?
YES : Check and repair harness between engine-ECU connector terminal FP/R and ETACS-ECU connector terminal FP/R.
- Check power supply line for damage.

NO : Repair the damaged harness wire.

STEP 10. Check harness between engine control relay connector terminal and ETACS-ECU connector terminal F/PB.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 11.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 11. Check harness between ETACS-ECU connector terminal F/P and fuel pump connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 12.
NO : Repair the damaged harness wire.

STEP 12. M.U.T.-III actuator test
- Item 9: Fuel pump

OK: Operating sound of fuel pump can be heard.

Q: Is the check result normal?
YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

Inspection Procedure 21: A/C Compressor Relay System

OPERATION
- Battery voltage is applied to the A/C compressor relay connector terminal.
- Engine-ECU connector terminal AC/R applies current to the A/C compressor relay coil by turning ON the power transistor in the unit in order to turn the relay ON.
- When the A/C compressor relay turns ON, battery voltage is supplied by the A/C compressor relay connector terminal to the A/C compressor connector terminal.

FUNCTION
- When the A/C switch ON signal is input into the engine-ECU, the engine-ECU turns ON the A/C compressor relay. This causes battery voltage to be supplied to the A/C compressor assembly and the A/C compressor clutch actuates.

PROBABLE CAUSES
- Failed A/C compressor relay
- Failed A/C compressor assembly
- Open/short circuit or harness damage in A/C compressor relay circuit, or loose connector contact.
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Check A/C compressor relay itself.
- A/C compressor relay connector check.
- Check A/C compressor relay itself (Refer to GROUP 55 – On-vehicle Service – Relay Check).

Q: Is the check result normal?
YES : Go to Step 2.
NO : Repair or replace the connector or replace the A/C compressor relay.

STEP 2. Perform voltage measurement at A/C compressor relay.
- Disconnect relay, and measure at relay box side.
- Voltage between terminal power supply lines and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 3.
NO : Check and repair harness between battery and A/C compressor relay connector terminals.
- Check power supply line for open/short circuit.

STEP 3. Check harness between battery and A/C compressor relay connector terminal.
- Check power supply line for damage.

Q: Is the check result normal?
YES : Go to Step 4.
NO : Repair the damaged harness wire.

STEP 4. Perform voltage measurement at engine-ECU connector.
- Disconnect connector, and measure at harness side.
- Voltage between terminal AC/R and body earth.

OK: System voltage

Q: Is the check result normal?
YES : Go to Step 5.
NO : Repair or replace the connector, or check and repair harness between A/C compressor relay connector terminal and engine-ECU connector terminal AC/R.
- Check signal line for open/short circuit.

STEP 5. Check harness between A/C compressor relay connector terminal and engine-ECU connector terminal AC/R.
- Check signal line for damage.

Q: Is the check result normal?
YES : Go to Step 6.
NO : Repair the damaged harness wire.

STEP 6. Check harness between A/C compressor relay connector terminal and A/C compressor assembly connector terminal.
- Check power supply line for open/short circuit and damage.

Q: Is the check result normal?
YES : Go to Step 7.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 7. Check A/C compressor clutch operating conditions.
- Disconnect engine-ECU connector, and short-circuit terminal AC/R to the body earth.

OK: A/C compressor clutch operates.

Q: Is the check result normal?
YES : Replace the engine-ECU.
NO : Replace the A/C compressor assembly.

Inspection Procedure 22: Ignition Circuit System

OPERATION
- The battery voltage is applied from the engine control relay connector terminal to the ignition coil connector terminal and is earthed to the vehicle body via the ignition coil connector terminal No. 1.
- A power voltage of 12 V is applied to the ignition coil connector terminal from the engine-ECU connector terminal CIL1, CIL2, CIL3 and CIL4).
- When the power transistor in the ignition coil is turned to ON with any signal from the engine-ECU, the primary voltage will be applied through the ignition coil. When the power transistor in the ignition coil is turned OFF, the primary current is blocked and high voltage is generated in the secondary coil.

FUNCTION
- When the engine-ECU turn the power transistor in the unit to OFF, the battery voltage is applied to the power transistor in the ignition coil, resulting that the power transistor is ON. And, when the engine-ECU turns the power transistor in the unit to ON, the power transistor in the ignition coil will be turned OFF.

PROBABLE CAUSES

- Failed spark plug
- Failed ignition coil
- Open/short circuit or harness damage in ignition system circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Visual check of ignition spark.

- Remove the spark plug and install it to the ignition coil.
- Connect the ignition coil connector.
- Disconnect all injector connectors.
- At the engine start, check each spark plug produces a spark.

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

NO : Go to Step 2.

STEP 2. Check spark plug.

- Check spark plug (Refer to GROUP 16 – Ignition System – On-vehicle Service – Spark Plug Check and Cleaning).

Q: Is the check result normal?

YES : Go to Step 3.

NO : Replace the spark plug.

STEP 3. Check ignition coil itself.

- Ignition coil connector check.
- Check ignition coil itself (Refer to GROUP 16 – Ignition System – On-vehicle Service – Ignition Coil Check).

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair or replace the connector, or replace the ignition coil.

STEP 4. Perform voltage measurement at ignition coil connectors.

- Disconnect connector, and measure at harness side.
- Ignition switch: "ON"
- Voltage between terminal power supply line and body earth.

OK: System voltage

Q: Are the check results normal?

YES : Go to Step 6.

NO : Go to Step 5.

STEP 5. Connector check: engine control relay connector

Q: Is the check result normal?

YES : Check intermediate connector, and repair if necessary. If intermediate connector is normal, check and repair harness between engine control relay connector terminal and ignition coil connector terminal.

- Check power supply line for open/short circuit.

NO : Repair or replace the connector.

STEP 6. Perform resistance measurement at ignition coil connectors.

- Disconnect connector, and measure at harness side.
- Resistance between terminal earth line and body earth.

OK: Continuity (2 Ω or less)

Q: Are the check results normal?

YES : Go to Step 7.

NO : Check and repair harness between ignition coil connector terminal earth line and body earth.

- Check earthing line for open circuit and damage.

STEP 7. Check harness between ignition coil connector and engine-ECU connector.

a. Check and repair harness between ignition coil connector terminal and engine-ECU connector terminal CIL1.
b. Check and repair harness between ignition coil connector terminal and engine-ECU connector terminal CIL2.
c. Check and repair harness between ignition coil connector terminal and engine-ECU connector terminal CIL3.
d. Check and repair harness between ignition coil connector terminal and engine-ECU connector terminal CIL4.

- Check signal line for open/short circuit and damage.

Q: Are the check results normal?

YES : Go to Step 8.

NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 8. Check harness between engine control relay connector terminal and ignition coil connector terminal.

- Check power supply line for damage.

Q: Are the check results normal?

YES : Go to Step 9.
NO : Repair the damaged harness wire.

STEP 9. Check the trouble symptom.

Q: Does the trouble symptom persist?

YES : Replace the engine-ECU.
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

Inspection Procedure 23: Engine Oil Pressure Switch System

OPERATION

- Battery voltage is applied to the engine oil pressure switch connector terminal from the engine-ECU connector terminal OPSW.

FUNCTION

- Detect the oil pressure conditions and enter the result into the engine-ECU. After starting the engine if the oil pressure rises to higher than the given pressure, the engine oil pressure switch turns OFF. Under this condition the engine-ECU sends the command of turning off the oil warning lamp to the combination meter via CAN.

PROBABLE CAUSES

- Failed engine oil pressure switch
- Open/short circuit or harness damage in engine oil pressure switch circuit or loose connector contact
- Failed engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. Perform voltage measurement at engine oil pressure switch connector

- Disconnect connector, and measure at the harness side.
- Ignition switch: "ON"
- Voltage between terminal and body earth.

OK: System voltage

Q: Is the check result normal?

YES : Go to Step 4.
NO : Go to Step 2.

STEP 2. Check harness between engine oil pressure switch connector terminal and engine-ECU connector terminal OPSW.

- Check output line for open/short circuit.

Q: Is the check result normal?

YES : Go to Step 3.
NO : Repair or replace the connector, or repair the damaged harness wire.

STEP 3. M.U.T.-III data list

- Data list reference table (Refer to P.13A-155).
  a. Item 90: Engine oil pressure switch

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).
NO : Replace the engine-ECU.

STEP 4. Perform voltage measurement at engine-ECU connector.

- Disconnect engine-ECU connector, and connect special tool power plant ECU check harness (MB992110) to measure at connector for inspection.
- Engine: Idling
- Voltage between terminal OPSW and body earth.

OK:
1 V or less (ignition switch: "ON")
System voltage (during idling)

Q: Is the check result normal?

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

STEP 5. Check harness between engine oil pressure switch connector terminal and engine-ECU connector terminal OPSW.

- Check output line for damage.

Q: Is the check result normal?

YES : Replace the engine oil pressure switch.
NO : Repair or replace the connector, or repair the damaged harness wire.

Inspection Procedure 24: In Running, The ECO Mode Indicator Shows Nothing

COMMENTS ON TROUBLE SYMPTOM

- Under a good driving conditions of fuel consumption, the engine-ECU shows ECO mode indicator through the CAN.
- If the engine-ECU does not show ECO mode indicator no matter how the vehicle runs, the possible causes are a abnormal combination meter, also abnormal communication between the engine-ECU and the combination meter.

PROBABLE CAUSES

- Failed ECO mode indicator
- Open/short circuit in combination meter circuit

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III diagnosis code

Q: Is diagnosis code set?

YES : Inspection chart for diagnosis code (Refer to P.13A-23).
NO : Go to Step 2P.13A-155.

STEP 2. Check the trouble symptom.

Q: Does the trouble symptom persist?

YES : Check combination meter system (Refer to GROUP 54A – Combination Meter – Trouble Symptom Chart).
NO : Intermittent malfunction (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions).

DATA LIST REFERENCE TABLE

M1131152005462

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

Item No.	Inspection Item	Inspection condition	Normal condition	Code No. or inspection procedure No.	Reference page
1	Battery voltage	Ignition switch: "ON"	System voltage	Procedure No. 19	P.13A-147

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
2	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare engine speed on tachometer with the value displayed on M.U.T.-III	Matched	Code No. P0335	P.13A-78
		Engine: Idle operation	Engine coolant temperature: –20°C	1,400 – 1,600 r/min <4B11>		
				1,300 – 1,500 r/min <4B12>		
			Engine coolant temperature: 0°C	1,350 – 1,550 r/min <4B11>		
				1,300 – 1,500 r/min <4B12>		
			Engine coolant temperature: 20°C	1,200 – 1,400 r/min <4B11>		
				1,300 – 1,500 r/min <4B12>		
			Engine coolant temperature: 40°C	950 – 1,150 r/min <4B11>		
				1,200 – 1,400 r/min <4B12>		
			Engine coolant temperature: 80°C	600 – 800 r/min <4B11>		
				550 – 750 r/min <4B12>		

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
3	Target idling speed	Engine: Idle operation	Engine coolant temperature: –20°C	1,400 – 1,600 r/min <4B11>	–	–
				1,300 – 1,500 r/min <4B12>		
			Engine coolant temperature: 0°C	1,350 – 1,550 r/min <4B11>		
				1,300 – 1,500 r/min <4B12>		
			Engine coolant temperature: 20°C	1,200 – 1,400 r/min <4B11>		
				1,300 – 1,500 r/min <4B12>		
			Engine coolant temperature: 40°C	950 – 1,150 r/min <4B11>		
				1,200 – 1,400 r/min <4B12>		
			Engine coolant temperature: 80°C	600 – 800 r/min <4B11>		
				550 – 750 r/min <4B12>		
4	Vehicle speed	Running at 40 km/h		Approximately 40 km/h	–	–
5	Intake air temperature sensor	Ignition switch: "ON" or engine running	Intake air temperature: –20°C	–20°C	Code No. P0112, P0113	P.13A-39, P.13A-40
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
6	Engine coolant temperature sensor	Ignition switch: "ON" or engine running	Engine coolant temperature: –20°C	–20°C	Code No. P0117, P0118	P.13A-41, P.13A-42
			Engine coolant temperature: 0°C	0°C		
			Engine coolant temperature: 20°C	20°C		
			Engine coolant temperature: 40°C	40°C		
			Engine coolant temperature: 80°C	80°C		
8	Manifold absolute pressure sensor	Ignition switch: "ON" (engine stopped)	Altitude: 0 m	101 kPa	Code No. P0107, P0108	P.13A-36, P.13A-37
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
		Set the vehicles to the pre-inspection condition	Engine: Idle operation	28.0 – 41.4 kPa		
			Engine: Excessive acceleration	Varies depending on the negative pressure at the inlet manifold		
10	Air flow sensor *1	Set the vehicles to the pre-inspection condition	Engine: Idle operation	1,350 – 1,670 mV <4B11>	Code No. P0102, P0103	P.13A-33, P.13A-35
				1,360 – 1,650 mV <4B12>		
			Engine: 2,500 r/min	1,620 – 2,020 mV <4B11>		
				1,800 – 2,100 mV <4B12>		
			Engine: Excessive acceleration	Varies depending on the acceleration		
11	Accelerator pedal position sensor (main)	Ignition switch: "ON"	Release the accelerator pedal	900 – 1,100 mV	Code No. P2122, P2123	P.13A-102, P.13A-104
			Depress the accelerator pedal	Increases in response to the pedal depression stroke		
			Depress the accelerator pedal fully	4,000 mV or more		

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
12	Accelerator pedal position sensor (sub)	Ignition switch: "ON"	Release the accelerator pedal	400 – 600 mV	Code No. P2127, P2128	P.13A-105, P.13A-106
			Depress the accelerator pedal	Increases in response to the pedal depression stroke		
			Depress the accelerator pedal fully	2,000 mV or more		
13	Throttle position sensor (main)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: "ON" (engine stopped)	Fully close the throttle valve with your finger	300 – 700 mV	Code No. P0122, P0123	P.13A-45, P.13A-46
			Fully open the throttle valve with your finger	4,000 mV or more		
		• Set the vehicle to the pre-inspection condition • Engine: Idle operation	No load	500 – 660 mV		
			A/C switch: "OFF" → "ON"	Voltage rises		
			Transmission: N → D range			

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
15	Throttle position sensor (sub)	• Remove the intake air hose at the throttle body. • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: "ON" (engine stopped)	Fully close the throttle valve with your finger	4,000 mV or more	Code No. P0222, P0223	P.13A-60, P.13A-61
			Fully open the throttle valve with your finger	1,000 mV or less		
16	Ignition advance	• Set the vehicle to the pre-inspection condition • Install timing light (for use to measure actual ignition timing)	Engine: Idle operation (Approximately 1 minute passes after the engine starting sequence is completed, and then the engine is in the steady state)	2 – 18 °CA (BTDC)	–	–
			Engine: 2,500 r/min	34 – 50 °CA (BTDC) <4B11>		
				30 – 46 °CA (BTDC) <4B12>		
17	Injector drive time*2	Set the vehicles to the pre-inspection condition	Engine: Idle operation	1.3 – 3.3 ms <4B11>	–	–
				2.1 – 3.3 ms <4B12>		
			Engine: 2,500 r/min	1.0 – 3.0 ms <4B11>		
				2.0 – 3.2 ms <4B12>		
			Engine: Excessive acceleration	Increased		

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
21	Electric power steering current value	• Engine: Idle operation after warm-up • Turn the steering wheel to the left and right with a vehicle stationary.		Approximately 110 A or less	–	–
36	V.V.T. phase angle (intake)	Engine: Idle operation		–6 to 0 °CA (ATDC) <4B11>	Code No. P0011	P.13A-27
				–3 to 3 °CA (ATDC) <4B12>		
		Engine: Middle speed and high load operation		Decreases (advances)		
74	Stop lamp switch	Ignition switch: "ON"	Depressed the brake pedal	ON	–	–
			Released the brake pedal	OFF		
76	A/C switch	Engine: Idle operation after warm-up	A/C switch: "OFF"	OFF	–	–
			A/C switch: "ON" (when the compressor clutch is operated)	ON		
79	Cranking signal (Ignition switch-ST)	Ignition switch: "ON"		OFF	Procedure No. 4	P.13A-128
		Engine: Cranking		ON		
83	Power steering fluid pressure switch	Data items are displayed on M.U.T.-III display, but this item is not applicable and its data is displayed as "OFF".		OFF	–	–
84	Idling switch	Ignition switch: "ON"	Depress the accelerator pedal.	OFF	–	–
			Release the accelerator pedal.	ON		
85	Ignition switch-IG	Ignition switch: "ON"		ON	–	–
87	Neutral switch	Ignition switch: "ON"	Selector lever: P or N	ON	–	–
			Selector lever: Other than P or N	OFF		
89	Normally closed brake switch	Ignition switch: "ON"	Depress the brake pedal.	OFF	–	–
			Release the brake pedal.	ON		

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
90	Oil pressure switch	Ignition switch: "ON"		ON	Procedure No. 23	P.13A-154
		Engine: Idle operation after warm-up		OFF		
93	A/C compressor relay	Engine: Idle operation after warm-up	A/C switch: "OFF"	OFF	Procedure No. 21	P.13A-151
			A/C switch: "ON" (when the compressor clutch is operated)	ON		
95	Engine control relay	Ignition switch: "ON"		ON	–	–
96	Throttle valve control servo relay	Ignition switch: "ON"		ON	–	–
97	Fuel pump relay	Ignition switch: "ON"		OFF	Procedure No. 20	P.13A-149
		Engine: Idle operation		ON		
102	Starter relay	Ignition switch: "ON"		OFF	Procedure No. 4	P.13A-128
		Engine: Cranking		ON		
AA	Air flow sensor*1	Set the vehicles to the pre-inspection condition	Engine: Idle operation	1.3 – 5.3 g/s <4B11>	Code No. P0102, P0103	P.13A-33, P.13A-35
				2.0 – 4.0 g/s <4B12>		
			Engine: 2,500 r/min	5.0 – 13.0 g/s <4B11>		
				8.0 – 12.0 g/s <4B12>		
			Engine: Excessive acceleration	Varies depending on the acceleration		

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
AB	Throttle position sensor (main)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: "ON" (engine stopped)	Fully close the throttle valve with your finger	6 – 14 %	Code No. P0122, P0123	P.13A-45, P.13A-46
			Fully open the throttle valve with your finger	80 – 96 %		
AC	Oxygen sensor (front)	Engine: After warm-up (leaner by deceleration, richer acceleration)	Engine: Excessive deceleration from 4,000 r/min	0.2 V or less	P0131, P0132, P0133, P0134	P.13A-49, P.13A-50, P.13A-51, P.13A-52
			Engine: At excessive acceleration	0.6 to 1.0 V		
		Engine: After warm-up (use oxygen sensor signals, check the air-fuel ratio and the conditions under the control of the engine-ECU)	Engine: Idle operation	0.4 V or less ⇔ 0.6 to 1.0 V (varies)		
			Engine: 2,500 r/min			
AD	Oxygen sensor (rear)	• Transmission: Ds range • The engine speed is maintained to 3,500 r/min or more during an accelerated driving with the throttle full-open		0.6 – 1.0 V	Code No. P0137, P0138	P.13A-54, P.13A-55
BB	Barometric pressure	Ignition switch: "ON"	Altitude: 0 m	101 kPa	–	–
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
BC	Throttle position sensor (relative value)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: "ON" (engine stopped)	Fully close the throttle valve with your finger	0 – 5 %	–	–
			Fully open the throttle valve with your finger	88 – 100 %		
BD	Throttle position sensor (sub)	• Remove the intake air hose at the throttle body • Disconnect the connector of the electronic-controlled throttle valve • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors • Ignition switch: "ON" (engine stopped)	Fully close the throttle valve with your finger	6 – 14 %	Code No. P0222, P0223	P.13A-60, P.13A-61
			Fully open the throttle valve with your finger	87 – 96 %		

Item No.	Inspection Item	Inspection condition		Normal condition	Code No. or inspection procedure No.	Reference page
BE	Accelerator pedal position sensor (main)	Ignition switch: "ON"	Release the accelerator pedal	16 – 24 %	Code No. P2122, P2123	P.13A-102, P.13A-104
			Depress the accelerator pedal	Increases in response to the pedal depression stroke		
			Depress the accelerator pedal fully	80 % or more		
BF	Accelerator pedal position sensor (sub)	Ignition switch: "ON"	Release the accelerator pedal	6 – 14 %	Code No. P2127, P2128	P.13A-105, P.13A-106
			Depress the accelerator pedal	Increases in response to the pedal depression stroke		
			Depress the accelerator pedal fully	40 % or more		
DD	Accelerator pedal position sensor (relative value)	Ignition switch: "ON"	Release the accelerator pedal	0 – 5 %	–	–
			Depress the accelerator pedal	Increases in response to the pedal depression stroke		
			Depress the accelerator pedal fully	95 – 100 %		

*NOTE: *1: On the new vehicle (mileage: 500 km or less), air flow sensor output value may be higher by approximately 10 %.*

*NOTE: *2: On the new vehicle (mileage: 500 km or less), injector drive time may be longer by approximately 10 %.*

Engine-ECU monitoring items

- This monitor item includes many useful items for understanding the engine conditions controlled by the engine-ECU.
- However, it is hard to show the definite specification of each item, since its value may vary to a large extent with a little difference in the measuring conditions, environment, and changes with the lapse of time, etc. on the objective vehicle. Therefore, this document will describe only the check conditions, display range, and behaviour of numeric values.

Item No.	INSPECTION ITEM	M.U.T.-III display descriptions	Standards at each check	Display range, and numeric value
14	Throttle position sensor (main) learning value	• The following shows learning values of throttle valve opening angle at idling.	Ignition switch: "ON"	500 – 2,000 mV
26	Long-term fuel trim	• Indicates the long-term air-fuel ratio feedback amount. • The negative side shows a reduction in the injection amount, while the positive side shows an increase.	Ignition switch: "ON"	–10 to 10 % <4B11> –12.5 to 12.5 % <4B12>
28	Short-term fuel trim	• Indicates the short-term air-fuel ratio feedback amount. • The negative side shows a reduction in the injection amount, while the positive side shows an increase.	Engine: After warm-up, 2,500 r/min without any load (under the air-fuel ratio feedback control)	–25 to 25 %
32	Detonation retard	• Indicates the ignition timing retardation angle that is controlled by the detonation sensor output.	Engine: Excessive acceleration after warm-up	Retards depending on the degree (angle) of acceleration
33	Detonation control learned value	• Indicates the learning value to compensate for the ignition timing that is controlled by the detonation sensor output. • 0 %side is retardation, and 100 % side is advance.	Ignition switch: "ON"	0 – 100 %
47	Fan motor duty	• Indicates the duty ratio for the electric cooling fan.	• Engine: After warm-up • A/C switch: "ON" (when the compressor is active)	0 – 100 %
49	Purge control solenoid valve duty	• Indicates the duty ratio for the purge control solenoid valve.	Engine: After warm-up (when 1 minute has elapsed)	0 – 100 %
58	Throttle valve control servo	• Indicates the target opening angle of throttle valve.	Engine: After warm-up	0 – 100 %
59	Throttle valve control servo target value	• Indicates the target opening angle of throttle valve.	Engine: After warm-up	0 – 5.0 V

Item No.	INSPECTION ITEM	M.U.T.-III display descriptions	Standards at each check	Display range, and numeric value
68	Idle speed control learned value (A/C OFF)	• Indicates the leaning value to compensate for the opening angle of idling speed control (opening angle of throttle valve). • The negative side shows "close" side, while the positive side shows "open" side.	Ignition switch: "ON"	–1 to 2.5 L/s
69	Idle speed control learned value (A/C ON)	• Indicates the leaning value to compensate for the opening angle of idling speed control (opening angle of throttle valve) with the air conditioner turned "ON". • The negative side shows "close" side, while the positive side shows "open" side.	Ignition switch: "ON"	–1 to 2.5 L/s
72	Absolute load value	• Indicates the size of engine load.	Engine: After warm-up	0 – 100 %
73	Calculated load value	• Indicates the size of engine load.	Engine: After warm-up	0 – 100 %
105	Fuel system status	• Indicates the air-fuel ratio feedback control conditions. OL: Open loop*1 CL: Closed loop*2 OL-DRV: Condition of open loop due to acceleration and deceleration driving OL-SYS: Condition of open loop due to system failure. CL-HO2: Condition of closed loop only using front oxygen sensor when rear oxygen sensor is failed	Engine: After warm-up	Varies depending on the drive conditions
106	Fuel system status 2	Data items are displayed on M.U.T.-III display, but the in-line 4 engine is not applicable and its data is displayed as "N/A".		N/A

*NOTE: *1: Condition in which fuel is controlled without oxygen sensor signals being fed back to the engine-ECU because the condition to shift to the closed loop is not met.*

*NOTE: *2: Condition in which oxygen sensor signals are fed back to the engine-ECU for controlling fuel.*

ACTUATOR TEST REFERENCE TABLE

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Item No.	Inspection Item	Drive content	Inspection condition	Normal condition	Code No. or inspection procedure No.	Reference page
1	Injectors	Specified injector is stopped	Engine: warm up, idle (cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idle condition is changed by stopping selected cylinder: this can cause an unstable condition and the engine may stall.	Code No. P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271	P.13A-62, P.13A-63, P.13A-64, P.13A-65, P.13A-66, P.13A-67, P.13A-68, P.13A-69
9	Fuel pump	Drive fuel pump to circulate fuel	• Ignition switch: "ON" • Check for pump operating noise near fuel tank	Operating noise audible	Procedure No. 20	P.13A-149
10	Purge control solenoid valve	Switch solenoid valve from OFF to ON	Ignition switch: "ON"	When the valve is actuated, operating noise is audible	Code No. P0458, P0459	P.13A-83, P.13A-84
14	Cooling fan motor	Actuate the fan motor	Ignition switch: "ON"	Fan motor rotates at high speed	–	–
16	A/C compressor relay	Switch the A/C compressor relay from OFF to ON	Ignition switch: "ON"	The operating sound of A/C compressor is audible	Procedure No. 21	P.13A-151
17	Inlet oil feeder control valve	Switch the inlet oil feeder control valve from OFF to ON	Ignition switch: "ON"	When the valve is actuated, operating noise is audible	Code No. P0010	P.13A-25

CHECK AT THE ECU TERMINALS

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Disconnect the engine-ECU connectors, and connect check harness special tool MB992110 between the engine-ECU connectors.

1. Measure the voltage between each check harness connector terminal and check harness connector earth terminal (GNDB or GNDE).
2. Connect a needle-nosed wire probe to a voltmeter probe.
3. Referring to the check sheet, insert the micromini probe into the check harness connector and measure the voltage.

   NOTE:

   1. *You may find it convenient to pull out the engine-ECU to make it easier to reach the connector terminals.*
   2. *The chart procedures do not have the particular order.*

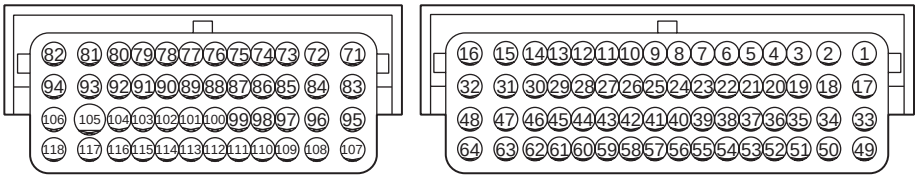
⚠ CAUTION

Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine-ECU or all of them. Be careful to prevent this!

4. If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
5. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

TERMINAL VOLTAGE CHECK CHART

Special Tool Check Harness (MB992110) Connector Terminal Arrangement



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Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)	Normal condition
1	OCVI	Inlet oil feeder control valve	Ignition switch: "ON"	System voltage
			Under the high load operation.	4 – 10 V[*1]
2	INJ1	No. 1 injector	Engine: While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 9 – 15 V[*1], it is slightly reduced temporarily.
3	INJ2	No. 2 injector		
18	INJ3	No. 3 injector		
19	INJ4	No. 4 injector		
4	CIL1	Ignition coil No. 1	Engine: 3,000 r/min	0.3 – 3.0 V[*1]
5	CIL2	Ignition coil No. 2		
20	CIL3	Ignition coil No. 3		
21	CIL4	Ignition coil No. 4		
6	NTSW	Starter active signal	Engine: Cranking	System voltage
			Engine: Idling	1 V or less
8	SGT	Crank angle sensor	Engine: Cranking	0.4 – 4.0 V[*1]
			Engine: Idle operation	2.0 – 3.0 V[*1]
9	5V	Sensor impressed voltage	Ignition switch: "ON"	System voltage

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
10	TPSM	Throttle position sensor (main)	• Remove the intake air hose at the throttle body. • Disconnect the connector of the electronic-controlled throttle valve. • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors. • Ignition switch: "ON" (engine stopped)	Fully close the throttle valve with your finger.	0.3 – 0.7 V
				Fully open the throttle valve with your finger.	4.0 – 4.8 V
11	TPSS	Throttle position sensor (sub)	• Remove the intake air hose at the throttle body. • Disconnect the connector of the electronic-controlled throttle valve. • With the special tool test harness (MB991658) bridge only the mating terminals of No. 3, No. 4, No. 5, and No. 6 of the disconnected connectors. • Ignition switch: "ON" (engine stopped)	Fully close the throttle valve with your finger.	4 V or more
				Fully open the throttle valve with your finger.	1 V or less
12	TPS5	Applied voltage to the throttle position sensor	Ignition switch: "ON"		4.9 – 5.1 V
14	CPI	Inlet camshaft position sensor	Engine: Cranking		2.0 – 4.8 V[*1]
			Engine: Idle operation		2.0 – 3.0 V[*1]
15	ETV+	Throttle valve control servo (+)	• Ignition switch: "ON" • Accelerator pedal: fully closed → fully opened		Decreases slightly from the battery voltage

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
16	ETV-	Throttle valve control servo (–)	• Ignition switch: "ON" • Accelerator pedal: fully closed → fully opened		Decreases slightly from the battery voltage
26	WTS	Engine coolant temperature sensor	Ignition switch: "ON"	When engine coolant temperature is –20°C	3.9 – 4.5 V
				When engine coolant temperature is 0°C	3.2 – 3.8 V
				When engine coolant temperature is 20°C	2.3 – 2.9 V
				When engine coolant temperature is 40°C	1.3 – 1.9 V
				When engine coolant temperature is 60°C	0.7 – 1.3 V
				When engine coolant temperature is 80°C	0.3 – 0.9 V
34	OHFL	Oxygen sensor (front) heater	Engine: Idle operation after warm-up (20 seconds after starting engine)		9 – 11 V[*1]
			Engine: Racing		System voltage
35	OHRL	Oxygen sensor (rear) heater	Engine: Idle operation after warm-up (20 seconds after starting engine)		9 – 11 V[*1]
			Engine: Racing		System voltage
36	OPSW	Engine oil pressure switch	Ignition switch: "ON"		1 V or less
			Engine: Idle operation		System voltage
37	PURG	Purge control solenoid valve	Ignition switch: "ON"		System voltage
			Engine: 3,000 r/min after warm-up (with 4 minutes after the engine starting sequence is completed)		Voltage decreases
38	O2FL	Oxygen sensor (front)	Engine: Maintain 2,500 r/min after warm-up		0.6 ⇔ 1.0 V (repeat the alteration)
39	OFLE	Oxygen sensor (front) offset voltage	Ignition switch: "ON"		0.4 – 0.6 V
40	O2RL	Oxygen sensor (rear)	• Transmission: Ds range • The engine speed is maintained to 3,500 r/min or more during an accelerated driving with the throttle full-open		1.0 – 1.5 V
41	ORLE	Oxygen sensor (rear) offset voltage	Ignition switch: "ON"		0.4 – 0.6 V

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
44	MAP5	Applied voltage to the manifold absolute pressure sensor	Ignition switch: "ON"		4.9 – 5.1 V
45	MAP	Manifold absolute pressure sensor	Ignition switch: "ON"	At 0 m altitude	3.8 – 4.2 V
				At 600 m altitude	3.5 – 3.9 V
				At 1,200 m altitude	3.3 – 3.7 V
				At 1,800 m altitude	3.0 – 3.4 V
			Engine: Idle operation after warm-up		0.6 – 1.4 V
			Engine: While the engine is idling after warm-up, quickly depress the accelerator pedal		Varies depending on the negative pressure at the inlet manifold
60	ALTG	Alternator G terminal	• Engine: Idle operation after warm-up • Radiator fan: Non-operation • Head lamp switch: "OFF" → "ON" • Stop lamp: "OFF" → "ON" • Rear defogger switch: "OFF" → "ON"		Voltage rises
61	ALTF	Alternator FR terminal	• Engine: Idle operation after warm-up • Radiator fan: Non-operation • Head lamp switch: "OFF" → "ON" • Stop lamp: "OFF" → "ON" • Rear defogger switch: "OFF" → "ON"		Voltage decreases
62	ALTL	Alternator L terminal	Ignition switch: "ON"		0.5 – 2.0 V
			Engine: Idle operation		System voltage
72	RBB	Power supply voltage applied to throttle valve control servo	Ignition switch: "ON"		System voltage
73	C/R	Engine control relay	Ignition switch: "LOCK" (OFF)		System voltage
			Ignition switch: "ON"		1 V or less
74	APSM	Accelerator pedal position sensor (main)	Ignition switch: "ON"	Release the accelerator pedal	0.9 – 1.1 V
				Depress the accelerator pedal fully	4.0 – 4.8 V
75	APS5	Applied voltage to the accelerator pedal position sensor (main)	Ignition switch: "ON"		4.9 – 5.1 V
77	APSS	Accelerator pedal position sensor (sub)	Ignition switch: "ON"	Release the accelerator pedal.	0.4 – 0.6 V
				Depress the accelerator pedal fully	2.0 – 2.5 V
78	5VV	Applied voltage to the accelerator pedal position sensor (sub)	Ignition switch: "ON"		4.9 – 5.1 V

Terminal No.	Terminal code	Inspection Item	Check condition (Engine condition)		Normal condition
82	BAT1	Power supply	Ignition switch: "ON"		System voltage
84	C/RL	Throttle valve control servo relay	Ignition switch: "LOCK" (OFF)		0 – 0.1 V
			Ignition switch: "ON"		1 V or less
87	AFS	Air flow sensor	Engine: Gradually increase the speed		Voltage increase in response to revving
89	ATS	Intake air temperature sensor	Ignition switch: "ON"	When the intake air temperature is –20°C	3.8 – 4.4 V
				When the intake air temperature is 0°C	3.2 – 3.8 V
				When the intake air temperature is 20°C	2.3 – 2.9 V
				When the intake air temperature is 80°C	0.4 – 1.0 V
92	IGN	Ignition switch – IG	Ignition switch: "ON"		System voltage
96	FP/R	Fuel pump relay	Ignition switch: "ON"		System voltage
			Engine: Idle operation		1 V or less
97	AFS5	Applied voltage to the air flow sensor	Ignition switch: "ON"		4.9 – 5.1 V
102	AC/R	A/C compressor relay	• Engine: Idle operation • A/C switch: "OFF" → "ON" (when the compressor is active)		System voltage → 1 V or less.
104	BACK	Backup power supply	Ignition switch: "LOCK" (OFF)		System voltage
105	ST	Ignition switch – ST	Engine: Cranking		System voltage
106	STRL	Starter relay	Engine: Cranking		System voltage
			Engine: Idle operation		1 V or less

*NOTE: *1: The shown voltage is the average value where an analogue voltmeter is used (because a digital voltmeter may not be able to indicate the average voltage stably).*

*NOTE: *2: If the battery is fully charged, the output reading may be incorrect.*

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

1. Turn the ignition switch to "LOCK" (OFF) position.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

⚠ CAUTION

If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter. Be careful to prevent this!

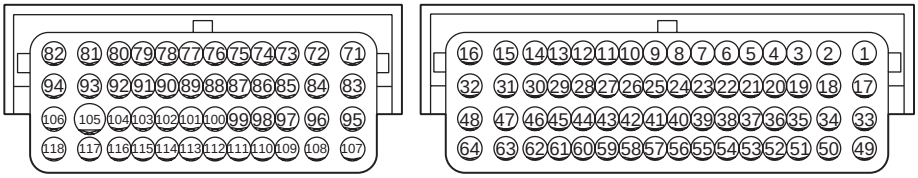
NOTE:

1. *When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.*
2. *Checking need not be carried out in the order given in the chart.*

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and the repair or replace.

5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector



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Terminal No.	Terminal code	Inspection Item	Standard value, normal condition (Check condition)
1 – 82	DCV1 – BAT1	Inlet oil feeder control valve	6.9 – 7.9 Ω (at 20°C)
15 – 16	ETV+ – ETV-	Throttle valve control servo	0.3 – 80 Ω (at 20°C)
26 – 27	WTS – WTSE	Engine coolant temperature sensor	14 – 17 kΩ (at –20°C)
			5.1 – 6.5 kΩ (at 0°C)
			2.1 – 2.7 kΩ (at 20°C)
			0.9 – 1.3 kΩ (at 40°C)
			0.48 – 0.68 kΩ (at 60°C)
			0.26 – 0.36 kΩ (at 80°C)
34 – 82	OHFL – BAT1	Oxygen sensor (front) heater	4.5 – 8.0 Ω (at 20°C)
35 – 82	OHRL – BAT1	Oxygen sensor (rear) heater	4.5 – 8.0 Ω (at 20°C)
37 – 82	PURG – BAT1	Purge control solenoid valve	22 – 26 Ω (at 20°C)
71 – body earth	RSG – body earth	ECU earth	Continuity (2 Ω or less)
81 – body earth	GNDB – body earth		
83 – body earth	RSH – body earth		
93 – body earth	GNDE – body earth		
88 – 89	AFSE – ATS	Intake air temperature sensor	13 – 18 kΩ (at –20°C)
			5.3 – 6.7 kΩ (at 0°C)
			2.3 – 3.0 kΩ (at 20°C)
			0.30 – 0.45 kΩ (at 80°C)

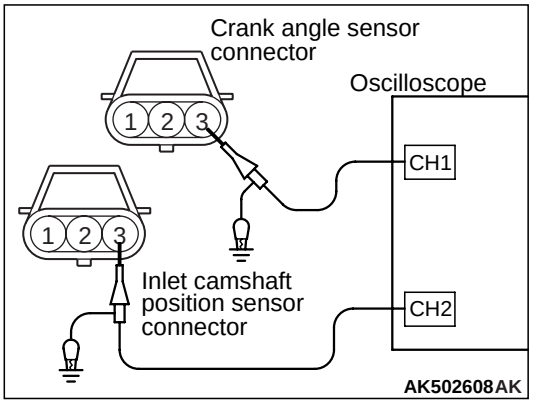
INSPECTION PROCEDURE USING AN OSCILLOSCOPE

M1131154503423

The output signals of the sensors and the conditions of the actuation signals of the actuators can be inspected visually by observing the waveforms on the oscilloscope.

INLET CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method



1. Disconnect the intake camshaft position sensor connector and insert the special tool test harness (MB991709) in-between the separated connectors. (Always mate all the terminals.)
2. Disconnect the crank angle sensor connector and insert the special tool test harness (MB991709) in-between the separated connectors.
3. Connect the probe of each channel of the oscilloscope to terminal No. 3 of the intake camshaft position sensor connector and terminal No. 3 of the crank angle sensor connector, respectively.

Alternate Method (Measure at the engine-ECU)

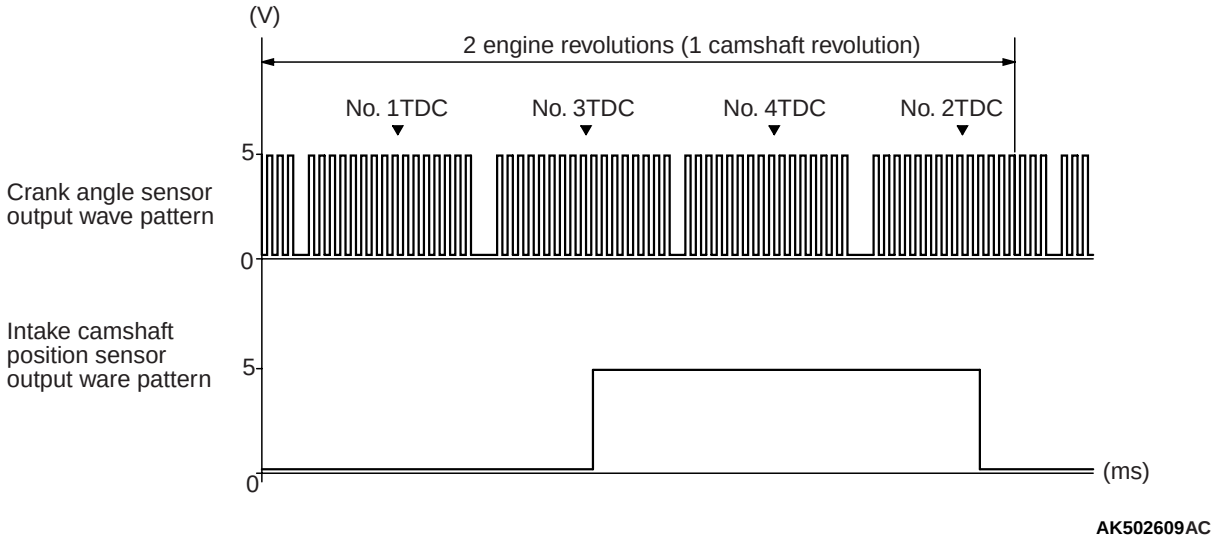
1. Disconnect the engine-ECU connector and connect the special tool Power plant ECU check harness (MB992110) in between.
2. Connect the oscilloscope special patterns pickup to engine-ECU terminal CPI (When checking the intake camshaft position sensor signal wave pattern).
3. Connect the oscilloscope special patterns pickup to engine-ECU terminal SGT (When checking the crank angle sensor signal wave pattern).

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine	Idle

Standard wave pattern



Description of Wave Patterns

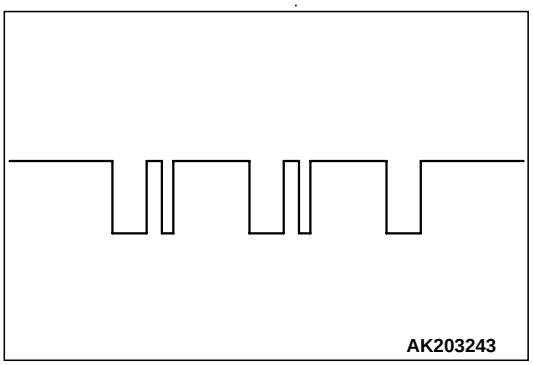
- The inlet camshaft position sensor serves as to detect the compression top dead centre of each cylinder. By observing this signal simultaneously with the crank angle sensor signal, it is possible to identify each cylinder.

- The crank angle sensor is used to detect the crank angle of each cylinder. While the engine revolves for two cycles, 72 pieces of the crank angle sensor signal (including any missing) will be outputted.
- The engine ECU carries out the engine control, using the fall signal (from 5 to 0 V) of the crank angle sensor. The rise signal (from 0 to 5 V) position does not affect the control.

Wave Pattern Observation Points

- Verify that the sensor signal frequency increases as the engine speed rises.

Examples of Abnormal Wave Pattern



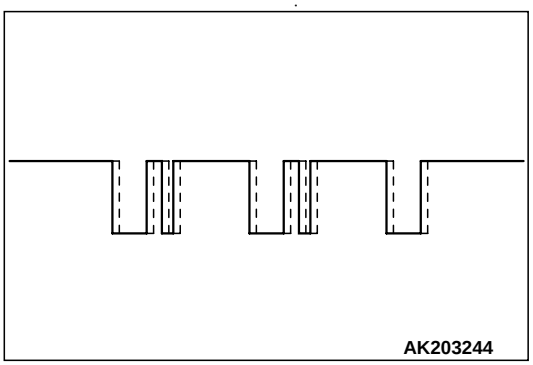
Example 1

Wave pattern characteristics

Rectangular wave will be outputted while the engine is not started.

Cause of problem

Failed sensor interface



Example 2

Wave pattern characteristics

Wave pattern is displaced in the forward or backward direction.

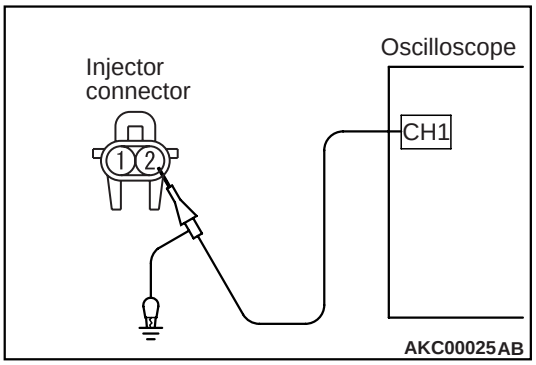
Cause of problem

Loose timing belt

Abnormal sensing section

INJECTOR

Measurement Method



1. Disconnect the injector connector and insert the special tool Test harness (MB991658) in-between the separated connectors. (Always mate all the terminals.)
2. Connect the oscilloscope probe to terminal No. 2 of the injector connector.

Alternate Method (Measure at the engine-ECU)

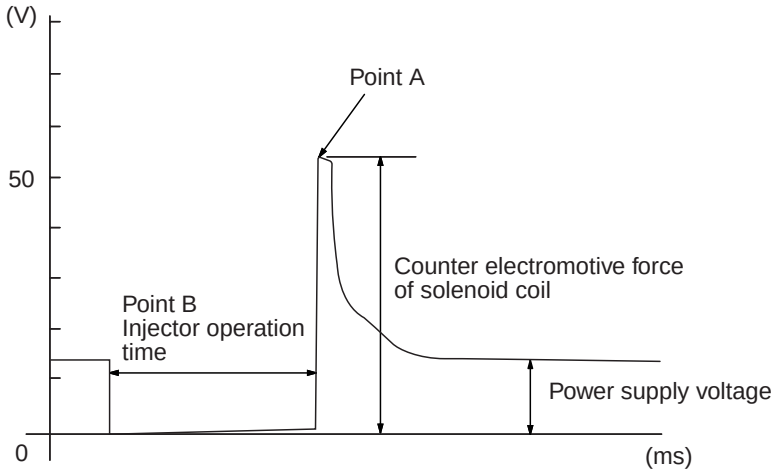
1. Disconnect the engine-ECU connector and connect the special tool Power plant ECU check harness (MB992110) in between.
2. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ1 (When checking the No. 1 cylinder).
3. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ2 (When checking the No. 2 cylinder).
4. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ3 (When checking the No. 3 cylinder).
5. Connect the oscilloscope special patterns pickup to engine-ECU terminal INJ4 (When checking the No. 4 cylinder).

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine	Idle

Standard wave pattern



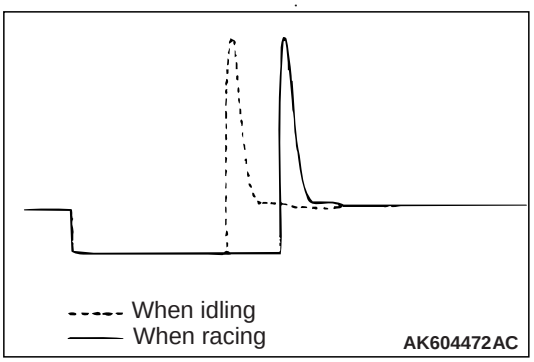
Description of Wave Patterns

- Normally the power supply voltage is shown. When the engine-ECU outputs the injector drive signal ON, the voltage falls to approximately 0V during the period of the signal ON. (See Point B.)
- When the engine-ECU stops the output of the injector drive signal, the voltage peak appears due to the counter electromotive force of the coil. (See Point A.) And then the power supply voltage returns to its normal value.
- Injector operation time: fuel injection period determined by engine-ECU according to various sensor output values. Injector operation time = effective injection period + invalid injection period (invalid injection period: compensation of injector response delay due to decrease in power supply voltage)
- Counter electromotive force of solenoid coil: the counter electromotive force is created in the injector coil when the engine-ECU stops the output of the injector drive signal.
- Power supply voltage: the power supply voltage is shown when the engine-ECU stops the output of the injector drive signal ON. If this supply voltage is low, the injector operation time becomes longer as the invalid injection time becomes longer.

Wave Pattern Observation Points

- Point A: The level of counter electromotive force of solenoid coil:

Solenoid coil counter electromotive force is low or doesn't appear at all.	Short-circuit in the injector solenoid

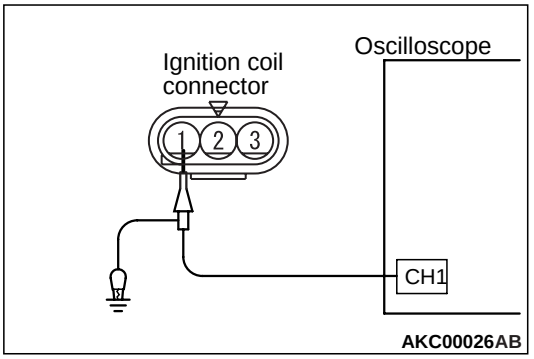


Point B: Injector operation time

Operation time	Consistent with the displayed time on M.U.T.-III.
Force an excessive acceleration.	The drive period will once extend greatly, then will be settled to that corresponding to the engine speed.

IGNITION COIL (POWER TRANSISTOR CONTROL SIGNAL)

Measurement Method



1. Disconnect the ignition coil connector and insert the special tool test harness (MB991658) in-between the separated connectors. (Always mate all the terminals.)
2. Connect the oscilloscope probe to terminal No. 1 of the ignition coil connector.
3. To verify the ignition advance angle, observe it simultaneously with the crank angle sensor output signals.

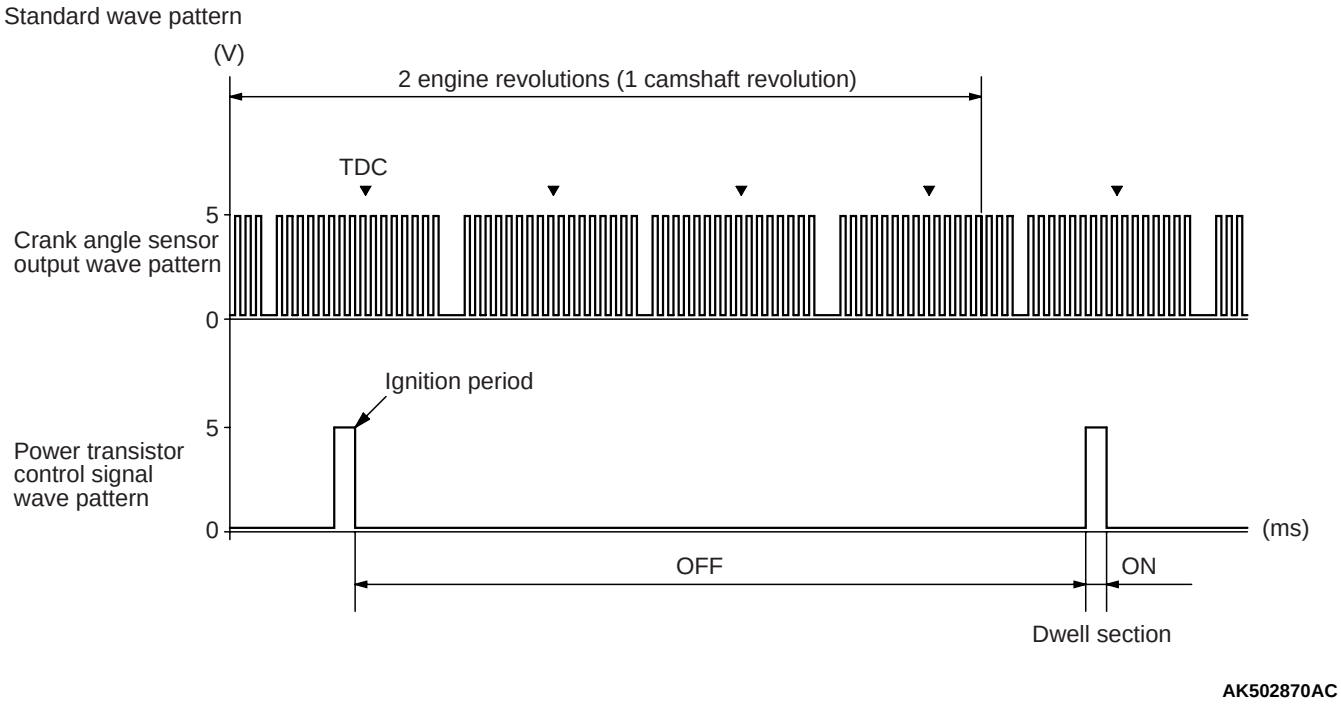
Alternate Method (Measure at the engine-ECU)

1. Disconnect the engine-ECU connector and connect the special tool Power plant ECU check harness (MB992110) in between.
2. Connect the oscilloscope probe to engine-ECU terminal CIL1. (When checking the No. 1 cylinder.)
3. Connect the oscilloscope probe to engine-ECU terminal CIL2. (When checking the No. 2 cylinder.)
4. Connect the oscilloscope probe to engine-ECU terminal CIL3. (When checking the No. 3 cylinder.)
5. Connect the oscilloscope probe to engine-ECU terminal CIL4. (When checking the No. 4 cylinder.)

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine	Idle



Description of Wave Patterns

- Power transistor ON condition:

An interval when the power transistor is ON and the primary side of ignition coil is conducted (referred to as "dwell interval") This conduction period gets longer if the battery voltage is low or vice versa so that the primary voltage at ignition can be controlled to a constant level.

- Power transistor OFF condition:

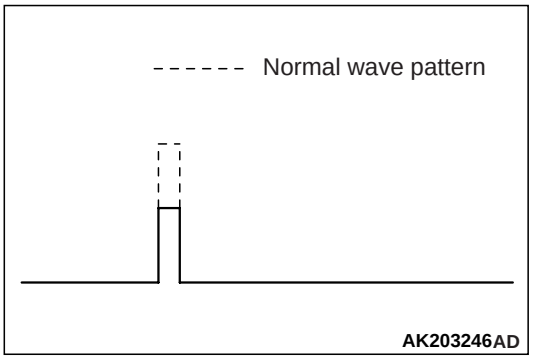
This interval corresponds to when the power transistor is OFF and the power transistor drive signal is not outputted from the engine-ECU.

Wave Pattern Observation Points

- Verify that the power transistor control signal (ignition timing) advances as the engine speed increases.

Examples of Abnormal Wave Pattern

Wave pattern characteristics



The voltage is low.

Cause of problem

Open-circuit in the ignition primary circuit.

ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

M1131001002457

⚠ ***WARNING***

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

⚠ **CAUTION**

When throttle body is cleaned, use the M.U.T.-III to initialise the learning value (Refer to GROUP 00 – Precautions Before Service – Initialisation Procedure for Learning Value in MPI Engine).

1. Disconnect the electronic-controlled throttle valve connector.
2. Remove the air intake hose from the throttle body.
3. Remove the throttle body assembly.

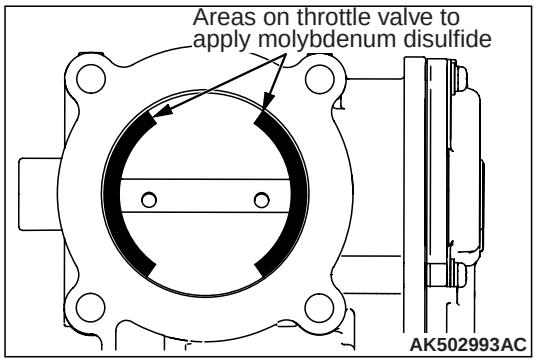
⚠ **CAUTION**

Do not spray the cleaning fluid directly to the throttle valve.

4. Spray the cleaning fluid on a clean cloth.

⚠ **CAUTION**

- **Make sure it does not enter the sensor through the shaft.**
- **Do not remove molybdenum. which is applied around the throttle valve of the throttle body.**



5. Wipe off the dirt around the throttle valve with the cloth sprayed with cleaning fluid.
6. Install the throttle body assembly.
7. Install the air intake hose.
8. Connect the electronic-controlled throttle valve connector.

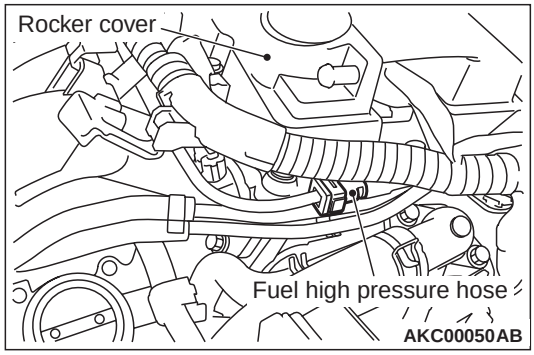
FUEL PRESSURE TEST

M1131001902999

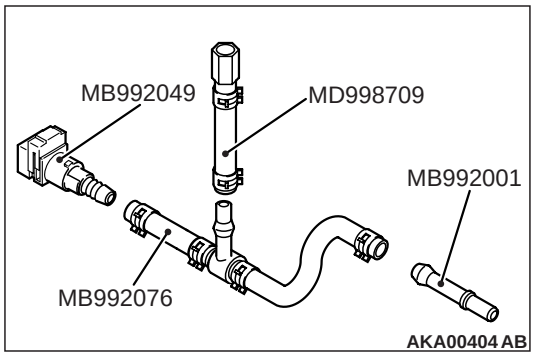
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. Reduce pressurized fuel lines (Refer to P.13A-181).

⚠ CAUTION

Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

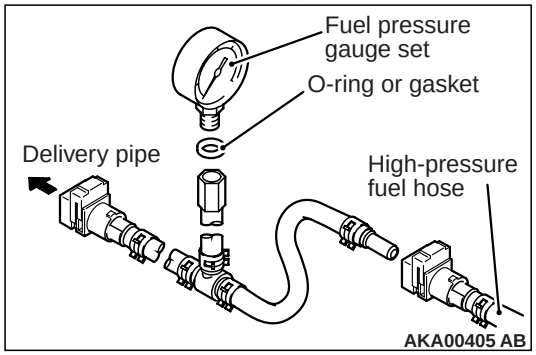


2. Remove the fuel high-pressure hose at the delivery pipe.



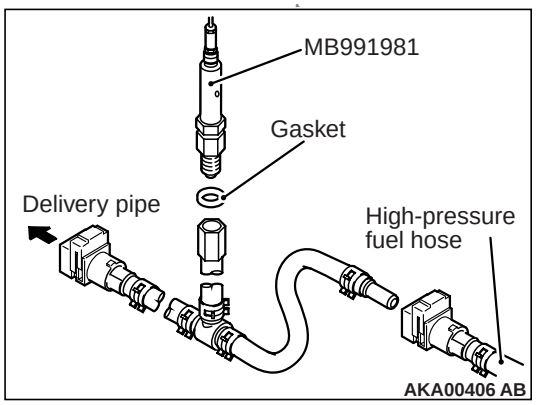
3. Assemble the special tool called injector test set (MB992076) as shown in the figure according to the following procedure.
   a. Remove the injector installation adapter from the hose. Remove another hose together with the adapter and remove the adopter from the remaining hose.
   b. Install the special tool MB992049 (quick connector) and the special tool MB992001 (hose adapter) to the hose without the adapter.
   c. Remove the nipple of the bolt of the special tool MD998709 (adapter hose).
   d. Install the special tool prepared in the procedure "c" to the nipple that was removed together with hose in the procedure "a".
4. Install the special tool assembled in Step 3 between the delivery pipe and fuel high-pressure hose.

<Where the fuel pressure gauge is used>



Install the fuel pressure gauge on the special tool for measuring the fuel pressure via an appropriate O-ring or gasket.

<Where the fuel pressure gauge set is used>



Install the special tool fuel pressure gauge set (MB991981) on the special tool for measuring the fuel pressure via an appropriate gasket.

   b. Connect the leads from the fuel pressure gauge set to the power supply (cigarette lighter socket) and special tool vehicle communication interface (V.C.I.) (MB991824).

⚠ CAUTION

Connection and disconnection of M.U.T.-III should be always performed with the ignition switch turned to the LOCK (OFF) position.

5. Connect the M.U.T.-III to the diagnosis connector.
6. Turn the ignition switch to the ON position. (But do not start the engine.)
7. Select "Item No. 9" from the M.U.T.-III actuator test to drive the fuel pump. Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to "LOCK" (OFF) position.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

Standard value: Approximately 324 kPa

11.Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.

12.If any of fuel pressure measured in steps 10 and 11 is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure is too low. • Fuel pressure drops after racing.	Clogged fuel filter	Replace the fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring.	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure is too high.	Binding valve in fuel pressure regulator	Replace fuel pressure regulator

13.Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky injector	Replace injector
	Leaky fuel regulator valve seat	Replace fuel pressure regulator
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump is held open	Replace fuel pump

14.Release residual pressure from the fuel pipe line. Reduce pressurized fuel lines (Refer to P.13A-181).

⚠ CAUTION

Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

15.Remove the fuel pressure gauge and special tool from the delivery pipe.

16.Install the fuel high-pressure hose over the delivery pipe.

17.Check for any fuel leaks by following the procedure in Step 7.

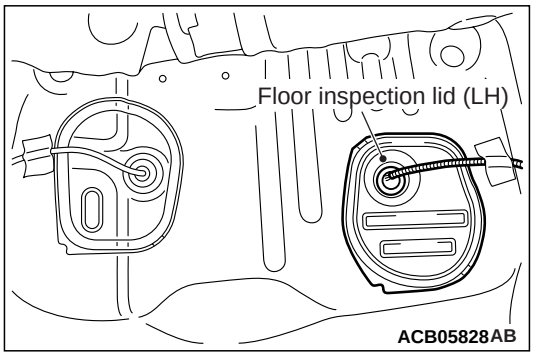
18.Disconnect the M.U.T.-III.

REDUCE PRESSURIZED FUEL LINES

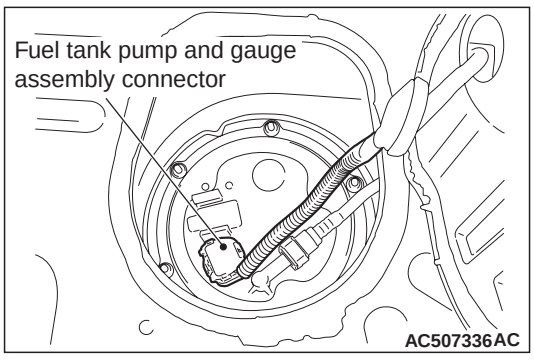
M1131000902800

When removing the fuel pipes and fuel hoses, follow the procedure below to release fuel pressure in the line and prevent fuel from running out, because fuel pressure in the fuel line is high.

1. Remove the second seat assembly (Refer to GROUP 52A – Second Seat Assembly) and turn up the floor carpet.



2. Remove the floor inspection lid (LH).



3. Disconnect the fuel tank pump and gauge assembly connector.
4. Crank the engine for at least two seconds.
5. If the engine does not start, turn the ignition switch to the "LOCK" (OFF) position.

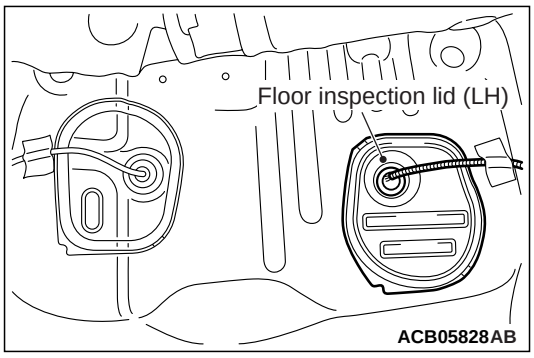
6. If the engine is started, turn the ignition switch to the "LOCK" (OFF) position after the engine stopped.
7. Connect the fuel tank pump and gauge assembly connector.
8. Install the floor inspection lid (LH).
9. Return the floor carpet to the original condition and install the second seat assembly (Refer to GROUP 52A – Second Seat Assembly).

FUEL PUMP OPERATION CHECK

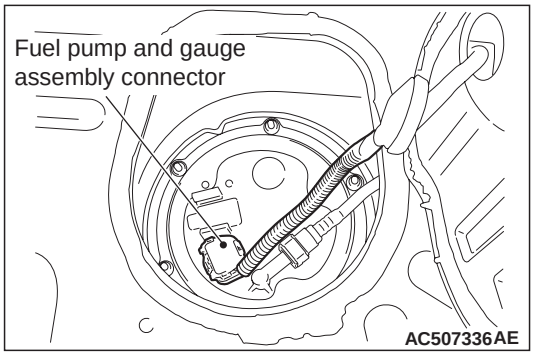
M1131002003044

1. Remove the fuel tank cap.
2. Using M.U.T.-III, forcibly drive the fuel pump (integrated in the fuel pump and gauge assembly) to check the fuel pump operation.

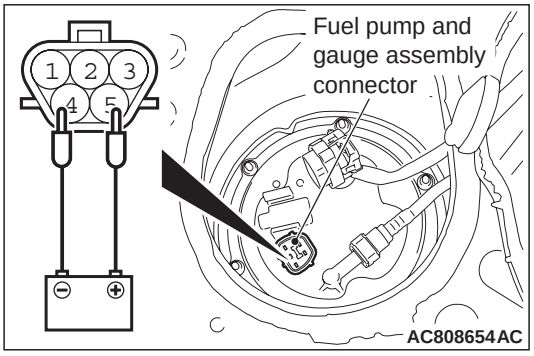
   NOTE: The operating sound of the fuel pump is difficult to be heard because the pump is in-tank type. Therefore, remove the fuel filler cap to check the sound from the fuel filler port.
3. If the fuel pump does not operate, follow the procedure below to check the pump for operation. If it is normal, check the driving circuit.
   (1) Turn the ignition switch to the "LOCK" (OFF) position.
   (2) Remove the second seat assembly (refer to GROUP 52A – Second Seat Assembly) and turn up the floor carpet.



   (3) Remove the floor inspection lid (LH).



   (4) Disconnect the fuel pump and gauge assembly connector.



   (5) When the battery is connected to the fuel pump and gauge assembly connector terminals No. 4 and 5 (fuel tank pump and gauge assembly side), check that the pump operating sound can be heard. When the pump operating sound cannot be heard, replace the fuel pump (Refer to GROUP 13B– On-vehicle Service – Fuel Pump and Gauge Assembly Replacement).

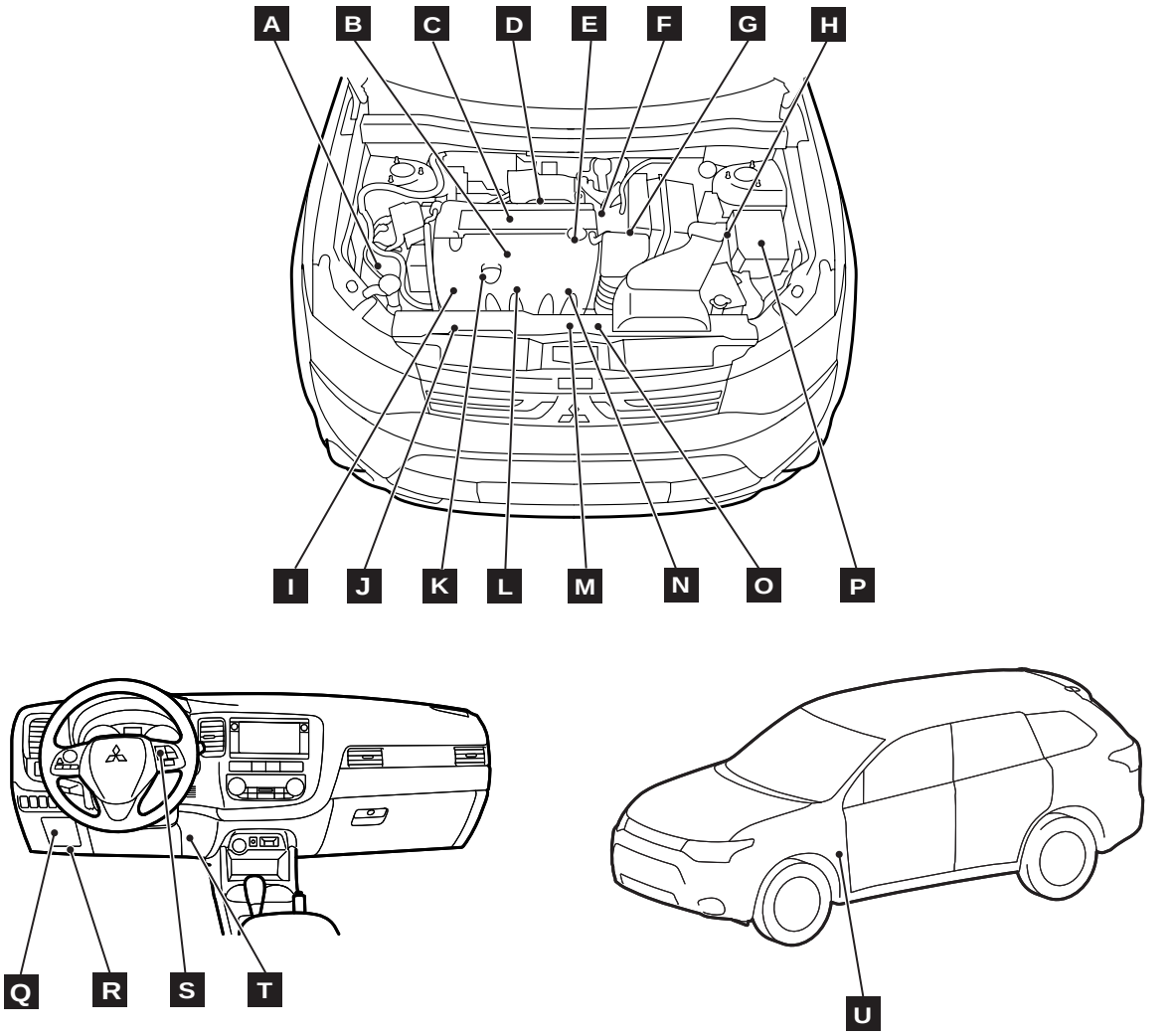
   NOTE: The operating sound of the fuel pump is difficult to be heard because the pump is in-tank type. Therefore, remove the fuel filler cap to check the sound from the fuel filler port.
   (6) Install the fuel tank cap.
   (7) Connect the fuel pump and gauge assembly connector.
   (8) Install the floor inspection lid (LH).
   (9) Return the floor carpet to the original condition and install the second seat assembly (Refer to GROUP 52A – Second Seat Assembly).

COMPONENT LOCATION

M1131002103870

Name	Symbol	Name	Symbol
Accelerator pedal position sensor	T	ETACS-ECU (fuel pump relay)	Q
A/C compressor relay	P	Ignition coil (with the built-in power transistor)	C
Air flow sensor (with intake air temperature sensor)	G	Injector	B

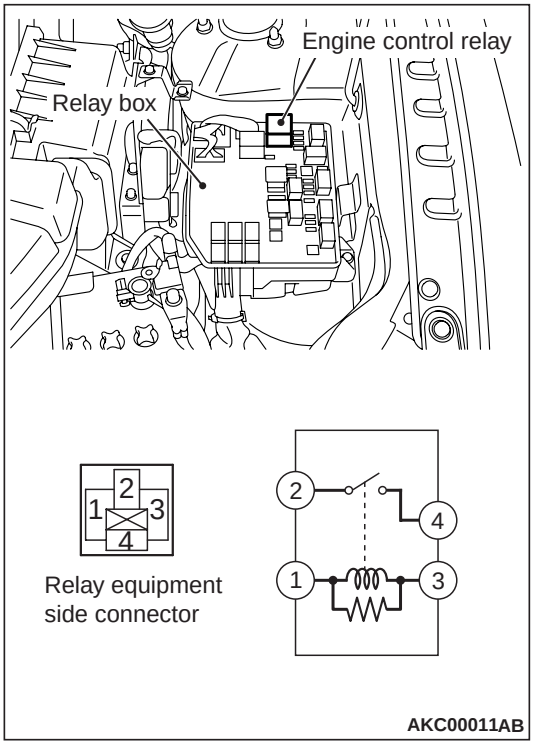
Name	Symbol	Name	Symbol
Crank angle sensor	N	Inlet camshaft position sensor	E
Detonation sensor	L	Inlet oil feeder control valve	I
Diagnosis connector	R	Manifold absolute pressure sensor	J
Electronic-controlled throttle valve (throttle position sensor and throttle valve control servo)	O	Oxygen sensor (front)	D
Engine control relay	P	Oxygen sensor (rear)	U
Engine coolant temperature sensor	F	Purge control solenoid valve	M
Engine-ECU	H	Starter relay	P
Engine warning lamp	S	Throttle valve control servo relay	P
Engine oil pressure switch	K		



AKC00023AB

ENGINE CONTROL RELAY CONTINUITY CHECK

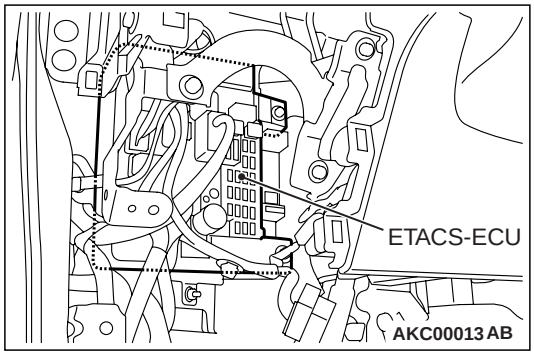
M1131050002040

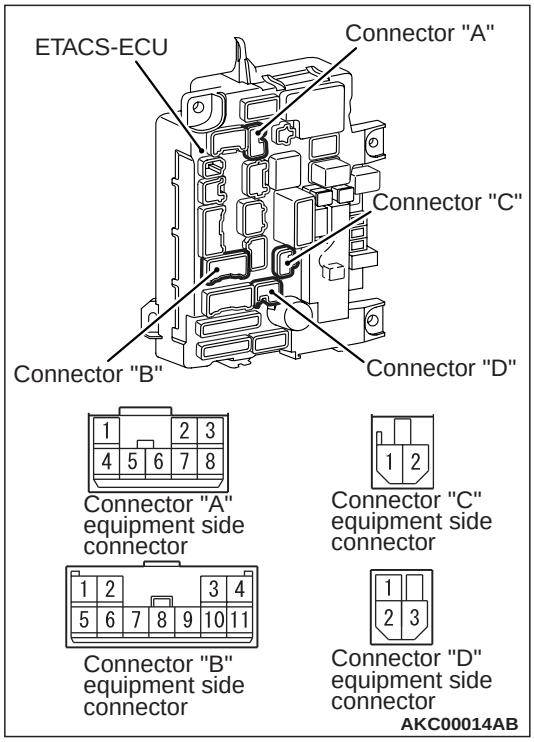


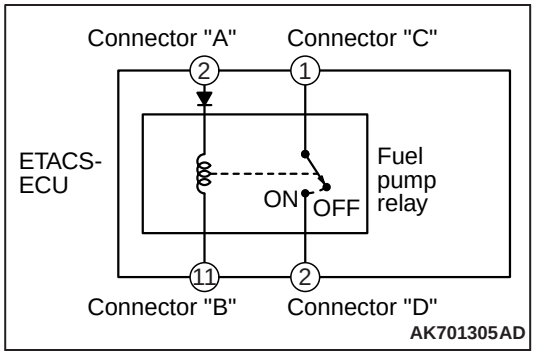
Tester connection terminal	Battery voltage	Normal condition
1 – 3	No voltage	Continuity
2 – 4	No voltage	No continuity
	Voltage (Connect the positive (+) terminal of battery to terminal No. 3 and the negative (–) terminal of battery to terminal No. 1.)	Continuity (2 Ω or less)

FUEL PUMP RELAY CONTINUITY CHECK

M1131033002100



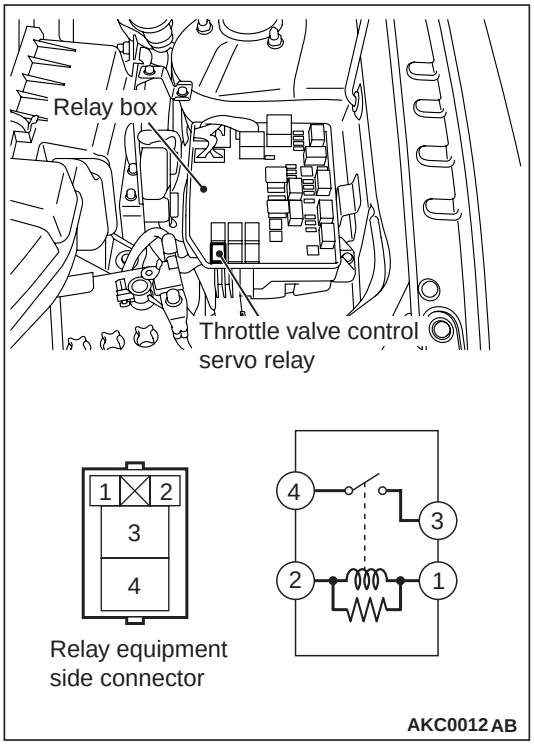




Tester connection terminal	Battery voltage	Normal condition
Connector "C" terminal No. 1 – Connector "D" terminal No. 2	No voltage	No continuity
	Voltage (Connect the positive (+) terminal of battery to terminal No. 2 of connector "A" and the negative (–) terminal of battery to terminal No. 11 of connector "B".)	Continuity (2 Ω or less)

THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

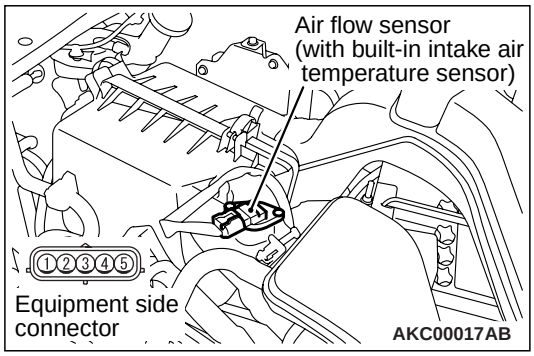
M1131053501074



Tester connection terminal	Battery voltage	Normal condition
1 – 2	No voltage	Continuity
3 – 4	No voltage	No continuity
	Voltage (Connect the positive (+) terminal of battery to terminal No. 2 and the negative (–) terminal of battery to terminal No. 1.)	Continuity (2 Ω or less)

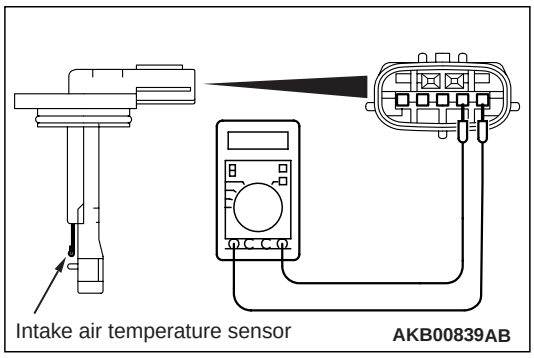
INTAKE AIR TEMPERATURE SENSOR CHECK

M1131002802359



1. Disconnect the air flow sensor connector.
2. Measure the resistance between terminal No. 4 and No. 5 of the air flow sensor connector.

   Standard value:
   13 – 18 kΩ (at –20°C)
   5.3 – 6.7 kΩ (at 0°C)
   2.3 – 3.0 kΩ (at 20°C)
   0.30 – 0.45 kΩ (at 80°C)
3. Remove the air flow sensor.



4. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

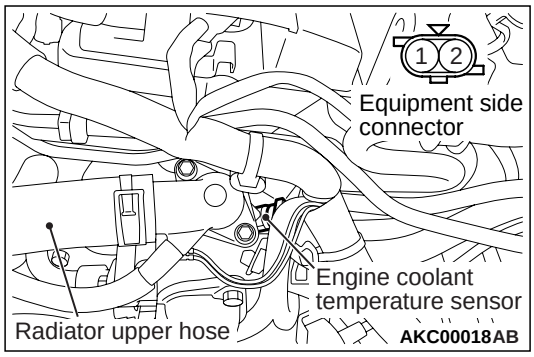
Temperature (°C)	Resistance (kΩ)
Higher	Smaller

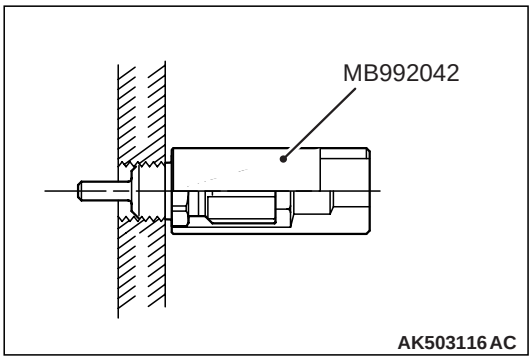
5. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.
6. Install the air flow sensor and tighten it to the specified torque.

   Tightening torque: 1.5 ± 0.3 N·m

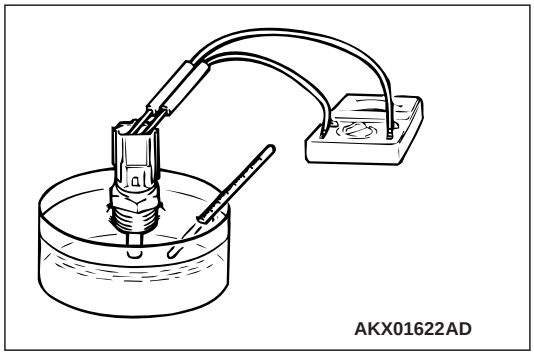
ENGINE COOLANT TEMPERATURE SENSOR CHECK

M1131003102364





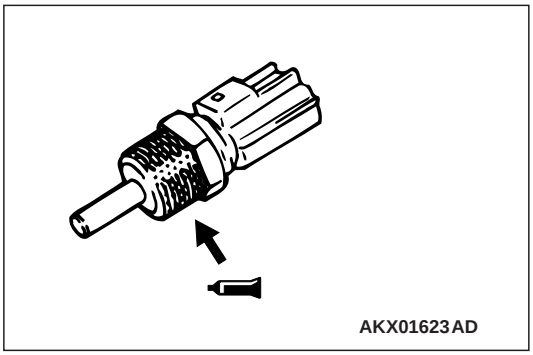
1. Remove the engine coolant temperature sensor using the special tool engine coolant temperature sensor wrench (MB992042).



2. With temperature sensing portion of the engine coolant temperature sensor immersed in the hot water, measure the resistance between connector terminals.

   Standard value:
   14 – 17 kΩ (at –20°C)
   5.1 – 6.5 kΩ (at 0°C)
   2.1 – 2.7 kΩ (at 20°C)
   0.9 – 1.3 kΩ (at 40°C)
   0.48 – 0.68 kΩ (at 60°C)
   0.26 – 0.36 kΩ (at 80°C)

3. If the resistance deviates from the standard value greatly, replace the sensor.



4. Apply the sealant over the screw sections on the engine coolant temperature sensor.

   Specified sealant: LOCTITE 262, Three bond 1324N or equivalent

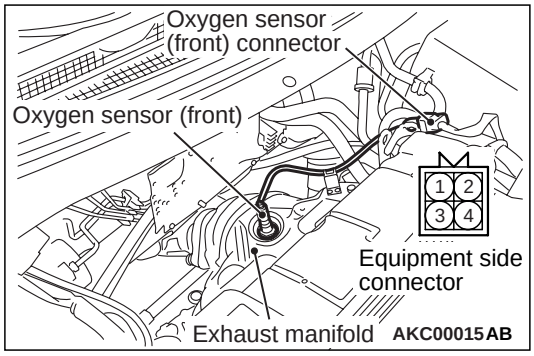
5. With the special tool engine coolant temperature sensor wrench (MB992042) tighten the engine coolant temperature sensor to the specified torque.

   Tightening torque: 30 ± 9 N·m

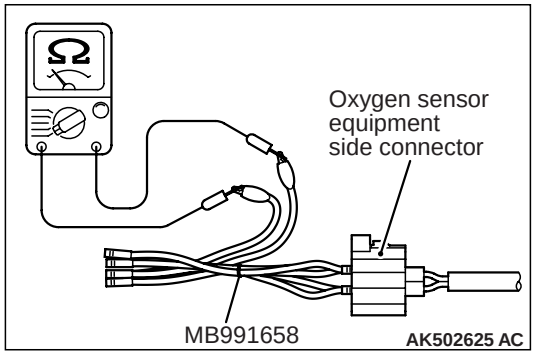
OXYGEN SENSOR CHECK

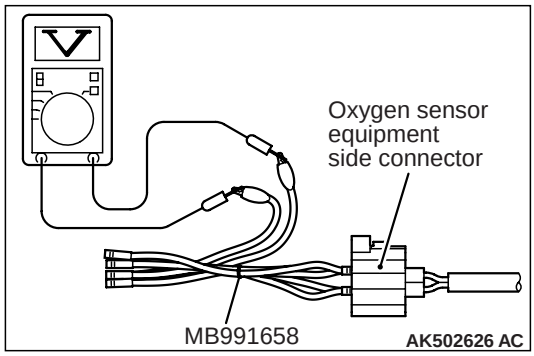
M1131005003946

Oxygen sensor (front)



1. Disconnect the oxygen sensor connector and connect the special tool test harness (MB991658) to the connector on the oxygen sensor side.





2. Measure the resistance between terminal No. 1 and No. 3 of the oxygen sensor connector.

   Standard value: 4.5 – 8.0 Ω (at 20°C)

3. If the resistance deviates from the standard value, replace the oxygen sensor.
4. Warm up the engine until the engine coolant temperature is 80°C or higher.
5. Perform a racing for 5 minutes or more with the engine speed of 2,000 r/min.
6. Connect the digital voltmeter between terminal No. 2 and No. 4.
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air-fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

⚠ CAUTION

- **Be very careful when connecting the jumper wire, or incorrect connection can damage the oxygen sensor.**
- **Exercise sufficient care so as not to apply voltage exceeding 8 V onto the oxygen sensor heater; otherwise the heater may be damaged.**

NOTE: If the temperature of sensing area does not reach the high temperature (of approximately 400°C or more) even though the oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.
Therefore, if the output voltage is low, use a jumper wire to connect the terminal No. 1 and No. 3 of the oxygen sensor with the (+) and (–) terminals of 8 V power supply respectively, then check the voltage again.

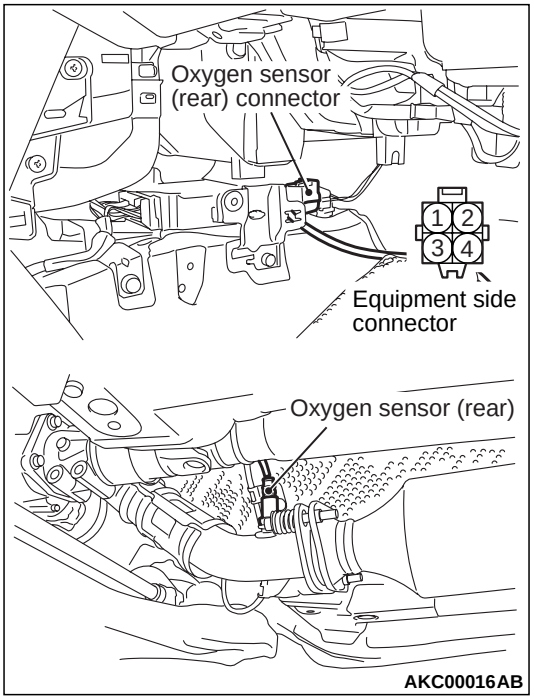
8. If the voltage deviates from the standard value, replace the oxygen sensor.

   NOTE: For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler – Removal and Installation .

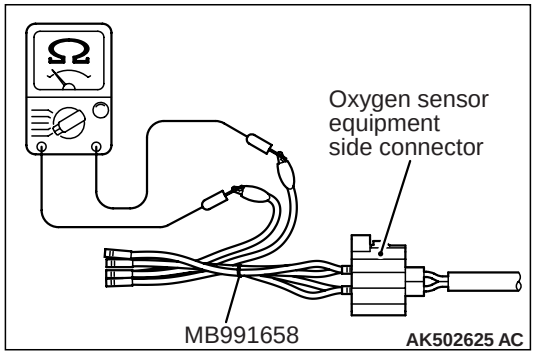
Oxygen Sensor (rear)

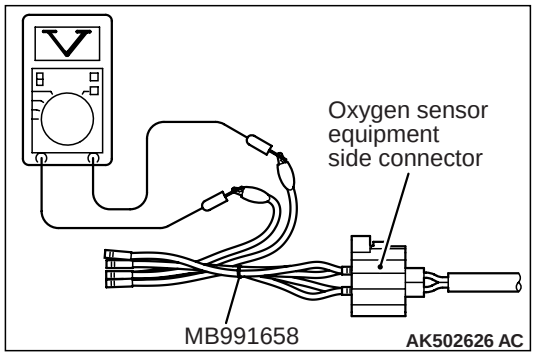
⚠ CAUTION

Drive test must be performed, while two persons are onboard, in a place where a full-throttle accelerating drive can be attempted safely.



1. Disconnect the oxygen sensor connector and connect the special tool test harness (MB991658) to the connector on the oxygen sensor side.





2. Measure the resistance between terminal No. 1 and No. 2 of the oxygen sensor connector.

   Standard value: 4.5 – 8.0 Ω (at 20°C)

3. If the resistance deviates from the standard value, replace the oxygen sensor.
4. Warm up the engine until the engine coolant temperature is 80°C or higher.
5. Drive at 50 km/h or more for 10 minutes.
6. Connect the digital voltmeter between terminal No. 3 and No. 4.
7. Measure the output voltage of the oxygen sensor under the following driving.
   - Transmission: 2nd
   - Drive with wide open throttle
   - Engine: 3,500 r/min or more

   Standard value:

Oxygen sensor output voltage	Remarks
0.6 – 1.0 V	High load operation makes air/fuel ratio richer and normal oxygen sensor also can output voltage of 0.6 – 1.0 V

NOTE: If the temperature of sensing area does not reach the high temperature (of approximately 400°C or more) even though the oxygen sensor is normal, the output voltage would be possibly low in spite of the rich air-fuel ratio.

NOTE: When the vehicle is driven with high loads, the temperature of the sensing area of the oxygen sensor is sufficiently high. Thus, it is not necessary to apply the voltage to the heater.

8. If the voltage deviates from the standard value, replace the oxygen sensor.

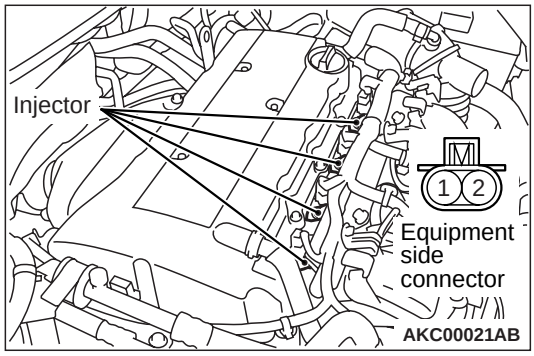
   NOTE: For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler – Removal and Installation .

INJECTOR CHECK

M1131005202981

CHECK THE OPERATION SOUND

⚠ CAUTION



Beware that, even if the injector to be checked is not operating, the operation sound of other injectors may be heard.

1. Use a stethoscope to listen to the operation sound (ticks) from the injectors while the engine is idling or cranking.
2. Verify that the operation sound increases with the higher engine speed.

NOTE: If the operating sound cannot be heard, inspect the injector actuation circuit.

MEASUREMENT OF RESISTANCE BETWEEN TERMINALS

1. Disconnect the injector connector.
2. Measure the resistance between terminals.

   Standard value: 10.5 – 13.5 Ω (at 20°C)

3. If the resistance is deviates from the standard value, replace the injector.

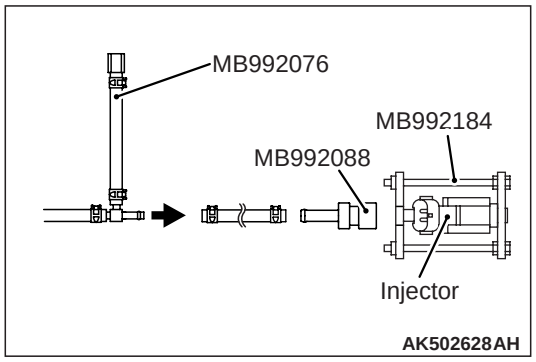
CHECK THE INJECTION CONDITION

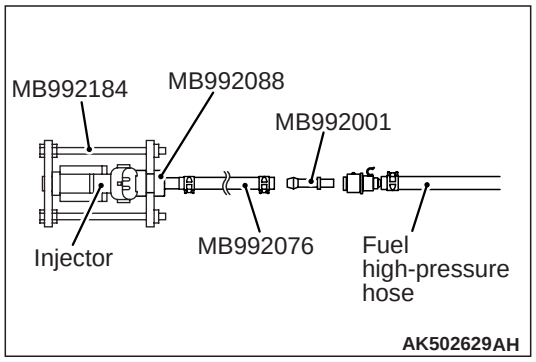
1. Release the residual pressure in the fuel pipe line to prevent the fuel from running out. Reduce pressurized fuel lines (Refer to P.13A-181).

⚠ CAUTION

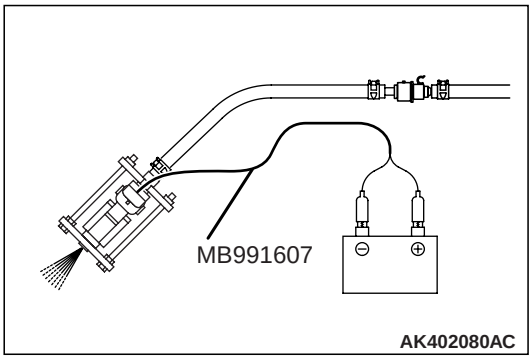
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

2. Remove the fuel high-pressure hose at the delivery pipe.
3. Remove the injector.





4. Assemble the special tool called injector test set (MB992076) as shown in the figure according to the following procedure.
   a. Disconnect the injector mounting hose.
   b. Remove the adapter for mounting injector and attach the special tool Injector test nipple (MB992088) instead.
   c. After attaching the injector on the special tool Injector test nipple (MB992088), secure it with the special tool injector holder (MB992184).
5. Mount the injector test set (MB992076) prepared with the special tool hose adapter (MB992001) onto the fuel high-pressure hose.
6. Connect the M.U.T.-III to the diagnosis connector.
7. Turn the ignition switch to the ON position. (But do not start the engine.)
8. Select "Item No. 9" of the M.U.T.-III actuator test to drive the fuel pump.



9. Connect the special tool Injector test harness (MB991607) between the injector and battery to drive the injector.
10. Check each injector for spray conditions. The condition can be considered satisfactory unless it is extremely poor.
11. Stop the actuation of the injector, and check for leakage from the injector nozzle.

Standard value: 1 drop or less per minute

12. After turning the ignition switch to the "LOCK" (OFF) position, remove the M.U.T.-III.
13. Actuate the injector until it does not spray fuel any longer, then drain the fuel inside the special tool.
14. Remove the special tool.
15. When the spray condition is extremely poor or any fuel leaks from the injector nozzle, replace the injector.
16. Replace the injector and fuel high-pressure hose in the original places.

THROTTLE VALVE CONTROL SERVO CHECK

M1131051001631

OPERATION CHECK

⚠ WARNING

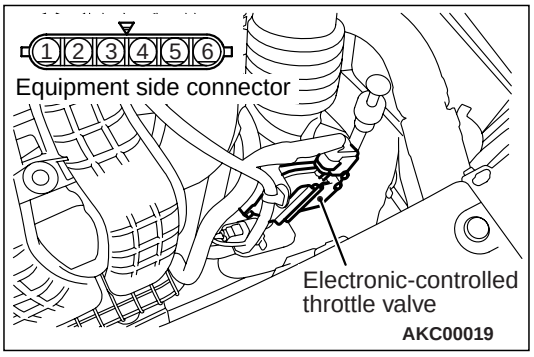
When checking the throttle valve operation, never insert fingers into the throttle valve. The extremely strong power of the throttle valve motor might trap and injure fingers.

1. Remove the air intake hose from the throttle body assembly.
2. Turn the ignition switch to the ON position.
3. Verify that the throttle valve opens or closes according to the accelerator pedal operated.

CHECK THE COIL RESISTANCE

⚠ ***WARNING***

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



1. Disconnect the electronic-controlled throttle valve connector.
2. Measure the resistance between terminal No. 1 and No. 2 of the electronic-controlled throttle valve connector.

Standard value: 0.3 – 80 Ω (at 20°C)

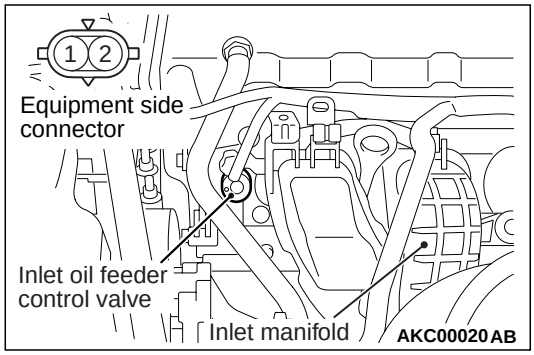
NOTE: If the measured resistance deviates from the standard value, fully open the throttle valve with your finger more than five times, then check the result again.
If the throttle valve control serve is not used for an extended period of time, the resistance may be increased as a result of internal forming of oxide film. Therefore, it means that the oxide film can be removed through a self cleaning capability of the throttle valve control servo, if forcibly moved.

3. If the resistance deviates from the standard value, replace the throttle body assembly.

OIL FEEDER CONTROL VALVE CHECK

M1131053800458

OPERATION CHECK



1. Disconnect the inlet oil feeder control valve connector.

⚠ **CAUTION**

To prevent the coil from burning, keep the duration of the voltage application as short as possible.

2. Make sure that the inlet oil feeder control valve generates a tick sound when the battery voltage is applied between the connector terminals at the inlet oil feeder control valve side.

RESISTANCE BETWEEN TERMINALS

1. Disconnect the inlet oil feeder control valve connector.
2. Measure the resistance between the terminals of the connector at the inlet oil feeder control valve.

Standard value: 6.9 – 7.9 Ω (at 20°C)

3. If the resistance deviates from the standard value, replace inlet oil feeder control valve.

INJECTOR

REMOVAL AND INSTALLATION

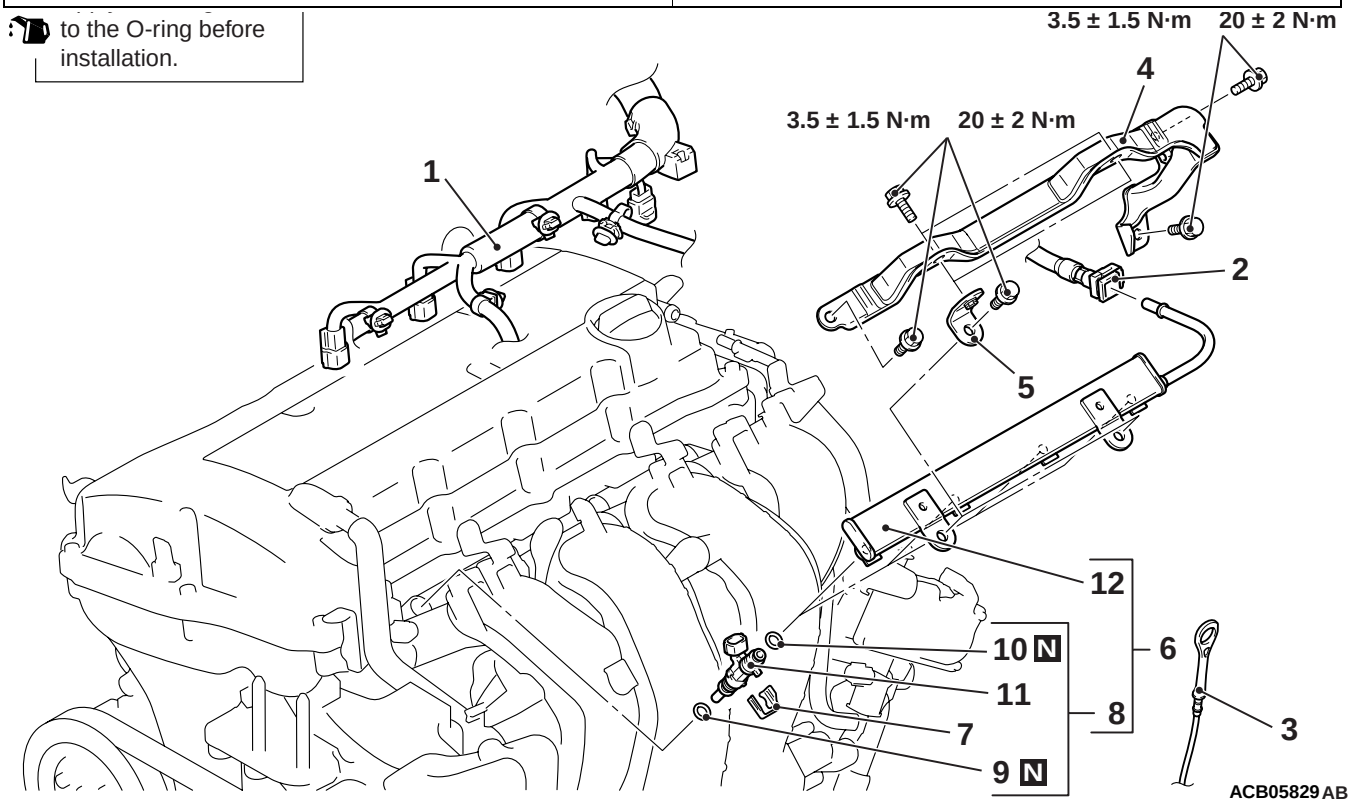
M1131007104191

⚠ CAUTION

When the fuel injector is replaced, initialise the learned value using M.U.T.-III (Refer to GROUP 00 – Precautions before Service, Initialisation Procedure for Learning Value in MPI Engine).

Pre-removal operation	Post-installation operation
• Fuel Line Pressure Reduction (Refer to P.13A-181). • Engine Upper Cover Removal (Refer to GROUP 11A – Camshaft). • Air Cleaner Intake Hose Removal (Refer to GROUP 15 – Air Cleaner).	• Air Cleaner Intake Hose Installation (Refer to GROUP 15 – Air Cleaner). • Fuel Leak Check. • Engine Upper Cover Installation (Refer to GROUP 11A – Camshaft).

to the O-ring before installation.

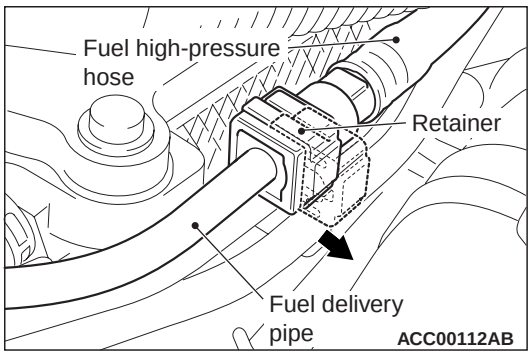


Removal steps

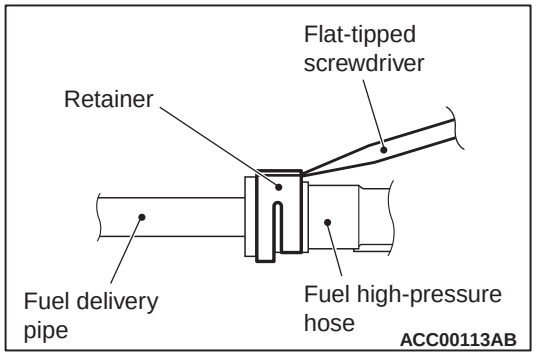
		1.	Control wiring harness connection
<<**A**>>	>>**F**<<	2.	Fuel high-pressure hose connection
		3.	Engine oil level gauge
	>>**E**<<	4.	Injector protector rear
	>>**E**<<	5.	Bracket
<<**B**>>	>>**E**<<	6.	Fuel delivery pipe and fuel injector assembly
	>>**D**<<	7.	Fuel injector support
	>>**C**<<	8.	Fuel injector assembly
	>>**B**<<	9.	O-ring
	>>**A**<<	10.	O-ring
		11.	Fuel injector
		12.	Fuel delivery pipe

REMOVAL SERVICE POINTS

<<A>> FUEL HIGH-PRESSURE HOSE DISCONNECTION



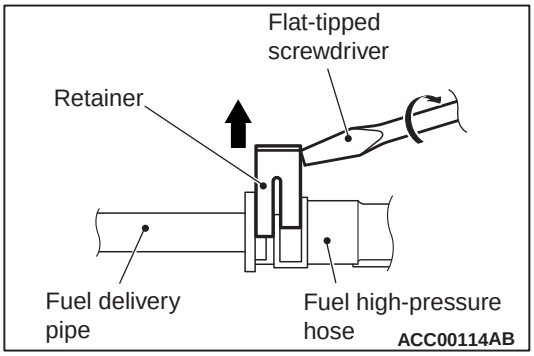
1. Follow the steps below to unlock the fuel high-pressure hose connector.



(1) Insert a flat-tipped screwdriver (6 mm wide and 1 mm thick) into the retainer of the fuel high-pressure hose connector.

⚠ CAUTION

When pushing up the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.



(2) Turn the flat-tipped screwdriver inserted into the retainer by 90° to push up the retainer and unlock the fuel high-pressure hose connector.

2. Remove the fuel high-pressure hose.

<<B>> FUEL DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY REMOVAL

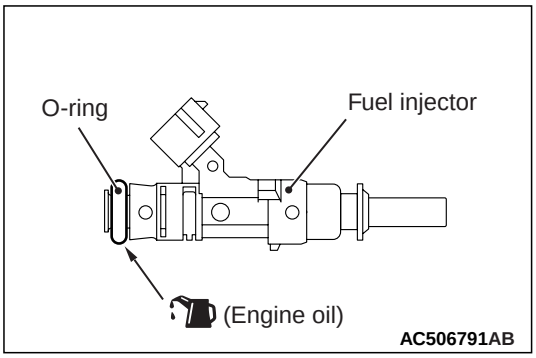
⚠ CAUTION

Do not drop the fuel injector.

Remove the fuel delivery pipe with the fuel injectors attached to it.

INSTALLATION SERVICE POINTS

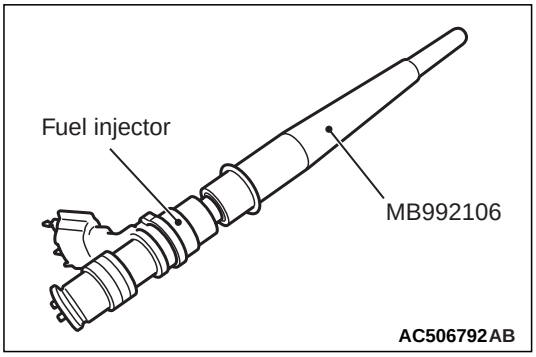
>>A<< O-RING INSTALLATION



1. Apply a small amount of new engine oil to the O-ring.
2. While turning the fuel injector to right and left, install the O-ring to the fuel injector with care to avoid damage to the O-ring.

>>B<< O-RING INSTALLATION

1. Apply a small amount of new engine oil to the O-ring.



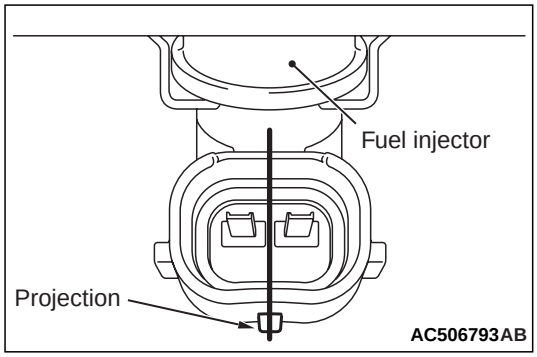
2. Using special tool O-ring installer (MB992106), install the fuel injector paying attention to avoid damage to the O-ring.

>>C<< FUEL INJECTOR ASSEMBLY INSTALLATION

⚠ CAUTION

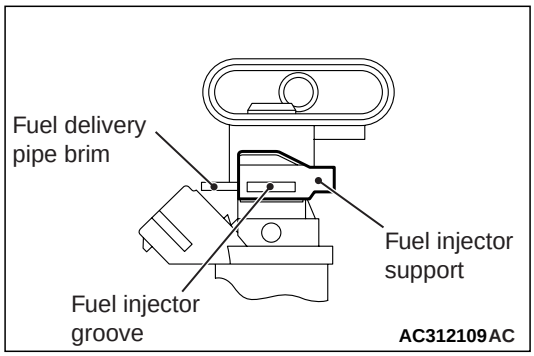
When applying the engine oil, make sure not to allow the engine oil to enter the fuel delivery pipe inside.

1. Apply a small amount of new engine oil to the O-ring.



2. Turning the fuel injector assembly to right and left, install it to the fuel delivery pipe with care not to damage the O-ring. After the installation, check for its smooth rotation. At this time, check that the projection part of the fuel injector assembly is in the centre.
3. If the rotation is not smooth, the O-ring may be caught. Remove the fuel injector assembly and check the O-ring for damage. After this, re-insert it to the fuel delivery pipe and check for its smooth rotation.

>>D<< FUEL INJECTOR SUPPORT INSTALLATION



Install the fuel injector support to the fuel injector groove and fuel delivery pipe brim, and fix the fuel injector assembly and fuel delivery pipe.

>>E<< FUEL DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY/BRACKET/INJECTOR PROTECTOR REAR INSTALLATION

⚠ CAUTION

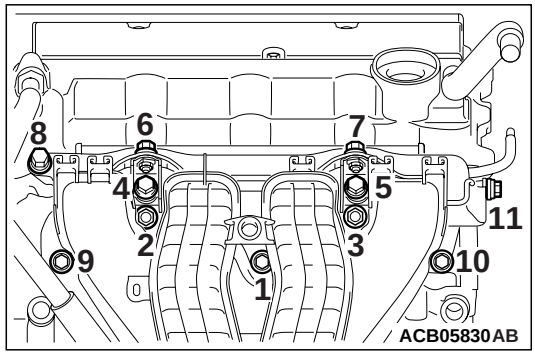
When applying the engine oil, make sure not to allow the engine oil to enter the inlet manifold inside.

1. Apply a small amount of new engine oil to the O-ring at the end of fuel injector assembly.

⚠ CAUTION

When installing the fuel delivery pipe and fuel injector assembly to the inlet manifold, pay attention to avoid damage to the O-ring at the end of the fuel injector assembly.

2. Install the fuel delivery pipe and fuel injector assembly to the inlet manifold.
3. Install the bracket and injector protector rear.



4. Loosen the inlet manifold mounting bolts and nuts (Bolts and nuts 1, 2, 3 and 9 shown in the figure).
5. Loosen the inlet manifold stay mounting bolts (Refer to GROUP 15 – Inlet Manifold).
6. Temporarily tighten the mounting bolts and nuts of the inlet manifold, bracket, fuel delivery pipe and injector protector rear to the specified torque in the order of number shown in the figure.

   Tightening torque: 3.5 ± 1.5 N·m

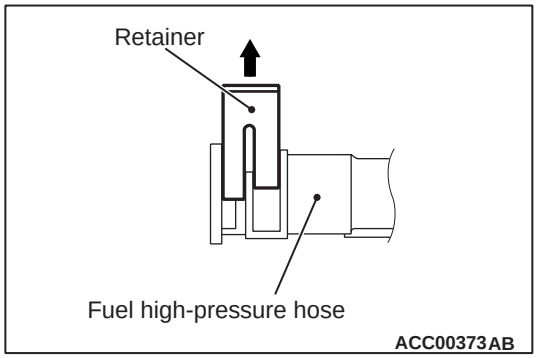
7. Tighten the mounting bolts of the fuel delivery pipe, and the mounting bolts and nuts of the bracket, injector protector rear and inlet manifold to the specified torque in the order of number shown in the figure.

   Tightening torque: 20 ± 2 N·m

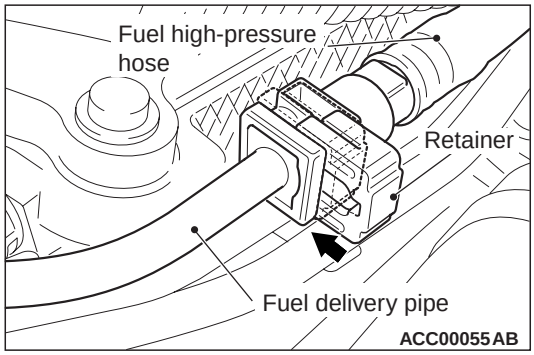
8. Tighten the inlet manifold stay mounting bolts to the specified torque (Refer to GROUP 15 – Inlet Manifold).

   Tightening torque: 20 ± 2 N·m

>>F<< FUEL HIGH-PRESSURE HOSE CONNECTION



1. Pull up the retainer of fuel high-pressure hose to unlock before installing.



2. Install the fuel high-pressure hose to the fuel delivery pipe.

⚠ CAUTION

- **When pushing in the retainer of the fuel high-pressure hose connector, pay attention to avoid damage to the retainer.**
- **After the installation of the fuel high-pressure hose, slightly pull the fuel high-pressure hose to check that it is connected securely. At this time, also check that there is approximately 1 mm play.**

3. Push in the retainer of the fuel high-pressure hose connector to lock the fuel high-pressure hose and fuel delivery pipe.

THROTTLE BODY ASSEMBLY

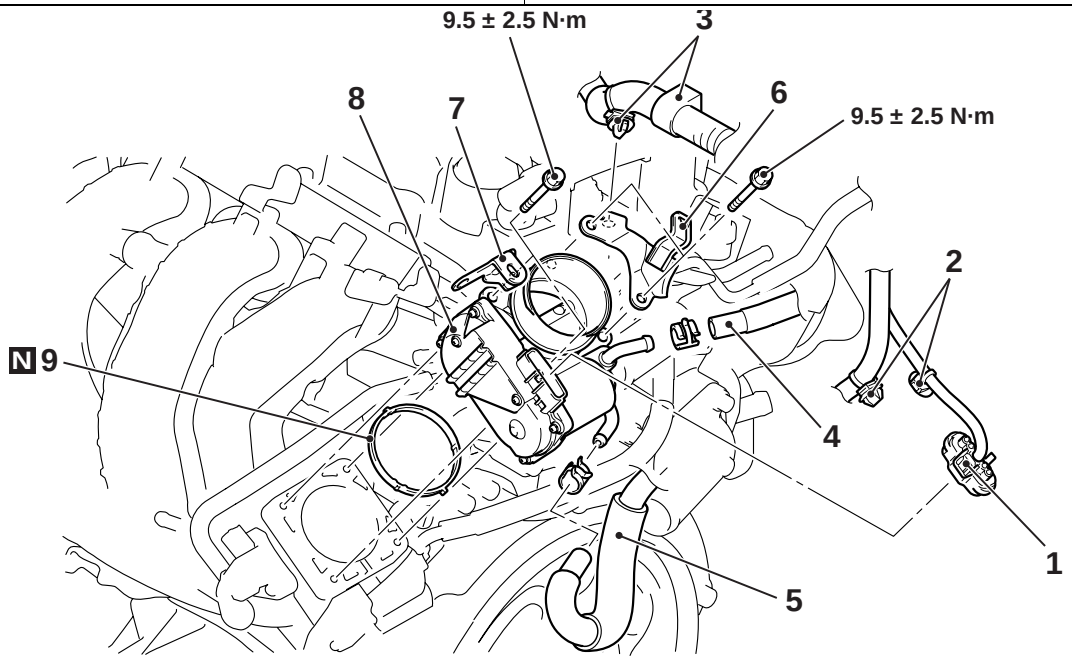
REMOVAL AND INSTALLATION

M1131007703264

⚠ CAUTION

- **When the throttle body assembly is replaced, initialise the learned value using M.U.T.-III (Refer to GROUP 00 – Precautions before Service, Initialisation Procedure for Learning Value in MPI Engine).**
- **Never loosen the screw fixing the throttle body assembly resin cover. If the screw is loosened, the sensor incorporated in the resin cover is misaligned and the throttle body assembly does not work normally.**

Pre-removal operation	Post-installation operation
• Engine Upper Cover Removal (Refer to GROUP 11A – Camshaft). • Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement). • Air Cleaner Intake Hose Removal (Refer to GROUP 15 – Air Cleaner).	• Air Cleaner Intake Hose Installation (Refer to GROUP 15 – Air Cleaner). • Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service, Engine Coolant Replacement). • Engine Upper Cover Installation (Refer to GROUP 11A – Camshaft).



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Removal steps

>>B<< • Initialisation operation <only at installation>
1. Electronic control throttle valve connector connection
2. Control wiring harness clip connection
3. Battery cable clip connection
4. Throttle body water feed hose connection

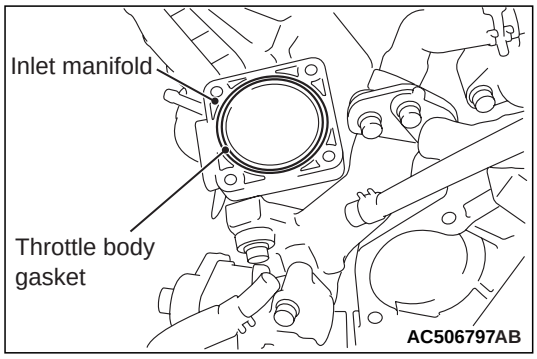
Removal steps (Continued)

5. Throttle body water return hose connection
6. Throttle body stay
7. Throttle body wiring harness connector bracket
8. Throttle body assembly

>>A<< 9. Throttle body gasket

INSTALLATION SERVICE POINTS

>>A<< THROTTLE BODY GASKET INSTALLATION



Fit the throttle body gasket in the inlet manifold groove securely with neither twisting nor damage given.

>>B<< INITIALISATION OPERATION

Turn the ignition switch to the "ON" position and then to "LOCK" (OFF) position and hold it for at least 10 seconds.

ENGINE-ECU

REMOVAL AND INSTALLATION

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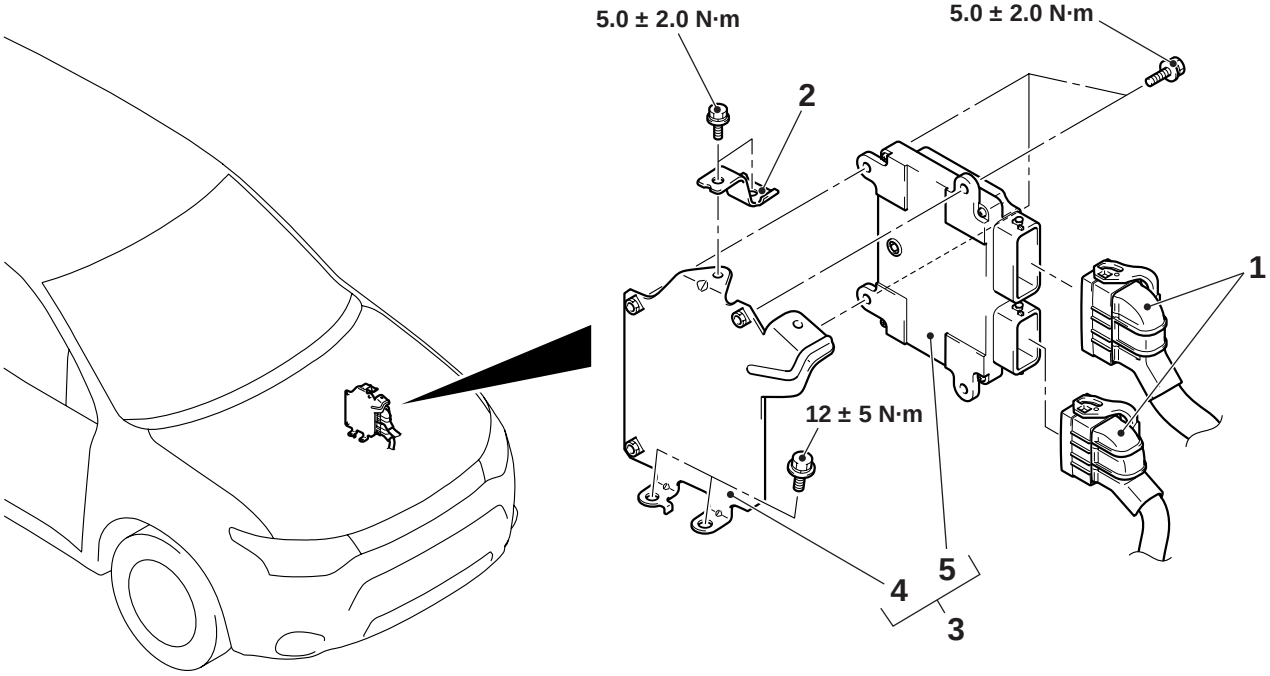
⚠ CAUTION

- **If the engine-ECU is replaced, another ECU related to KOS system should not be replaced together. If at least two ECUs needs to be replaced, replace one ECU and then register its ID with M.U.T.-III. Then proceed to the replacement of the other ECU.**
- **If the engine-ECU is replaced, perform the coding for it.**
- **If the engine-ECU is replaced, use M.U.T.-III to write the Chassis No. (Refer to GROUP 00 – How to Perform Chassis Number Writing).**
- **After the engine-ECU replacement, idling speed may be unstable because the MPI engine learning is not completed. To make it stable, let the system learn the idling (Refer to GROUP 00 – Precautions before Service, Learning Procedure for Idling in MPI Engine).**

Pre-removal and post-installation operation
- Air Cleaner Assembly Removal and Installation (Refer to GROUP 15 – Air Cleaner) .



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Removal steps

>>A<< • Initialisation operation <only at installation>
1. Engine-ECU connector connection
2. Engine-ECU stay
3. Engine-ECU and engine-ECU bracket
4. Engine-ECU bracket
5. Engine-ECU

INSTALLATION SERVICE POINTS

>>A<< INITIALISATION OPERATION

Turn the ignition switch to the "ON" position and then to "LOCK" (OFF) position and hold it for at least 10 seconds.