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GENERAL INFORMATION

The Gasoline Direct Injection System consists of sensors which detect the engine conditions, the engine-ECU <M/T> or engine-A/T-ECU <A/T> which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

The engine-ECU <M/T> or engine-A/T-ECU <A/T> carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU <M/T> or engine-A/T-ECU <A/T> is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions.

A single injector for each cylinder is mounted at the cylinder head. The fuel is sent under pressure from the fuel tank to the fuel pressure regulator (low pressure) by the fuel pump (low pressure). The pressure is regulated by the fuel pressure regulator (low pressure) and the fuel regulated is then sent to the fuel pump (high pressure). The fuel under increased pressure generated by the fuel pump (high pressure) is then regulated by the fuel pressure regulator (high pressure) and is then distributed to each of the injectors via the delivery pipes.

Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-2-3-4-5-6. This is called sequential fuel injection.

When the engine is cold or under a severe load, the “open-loop” control keeps the air/fuel ratio at a richer than usual level to maintain driveability. When the engine is under low or medium loads, the air/fuel ratio becomes leaner to reduce fuel consumption. When the engine is running at medium or high loads after having warmed up, the “closed-loop” control uses the signal from the oxygen sensor to keep the air/fuel ratio at the optimum theoretical level.

THROTTLE VALVE OPENING ANGLE CONTROL

This system controls throttle valve opening angle electronically. The engine-ECU <M/T> or engine-A/T-ECU <A/T> determines how deeply the accelerator pedal is depressed by means of the accelerator position sensor (APS). Then the engine-ECU <M/T> or engine-A/T-ECU <A/T> sends a target value of the throttle valve opening angle to the throttle valve controller. The throttle valve control servo operates the throttle valve so that it reaches the target opening angle.

IDLE SPEED CONTROL

This system maintains engine idle speed at a predetermined condition by controlling the air flow that passes through the throttle valve according to engine idling condition and engine loads at idling.

The engine-ECU <M/T> or engine-A/T-ECU <A/T> operates the throttle valve control servo so that engine speed is maintained within a map value. The map value is predetermined according to engine coolant temperature and air-conditioning load.

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 <M/T> or engine-A/T-ECU <A/T> from the engine speed, intake air volume, engine coolant temperature, atmospheric pressure and injection timing (intake stroke or compression stroke).

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 or flashes 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 output.
- The engine-ECU records the engine operating condition when the diagnosis code is set. This data is called "freeze frame" data.
  This data can be read by using the MUT-II, and can then be used in simulation tests for troubleshooting. <Only vehicles with M/T>
- The RAM data inside the engine-ECU <M/T> or engine-A/T-ECU <A/T> that is related to the sensors and actuators can be read by means of the MUT-II. 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. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
4. EGR Control Servo Control
   Refer to GROUP 17.

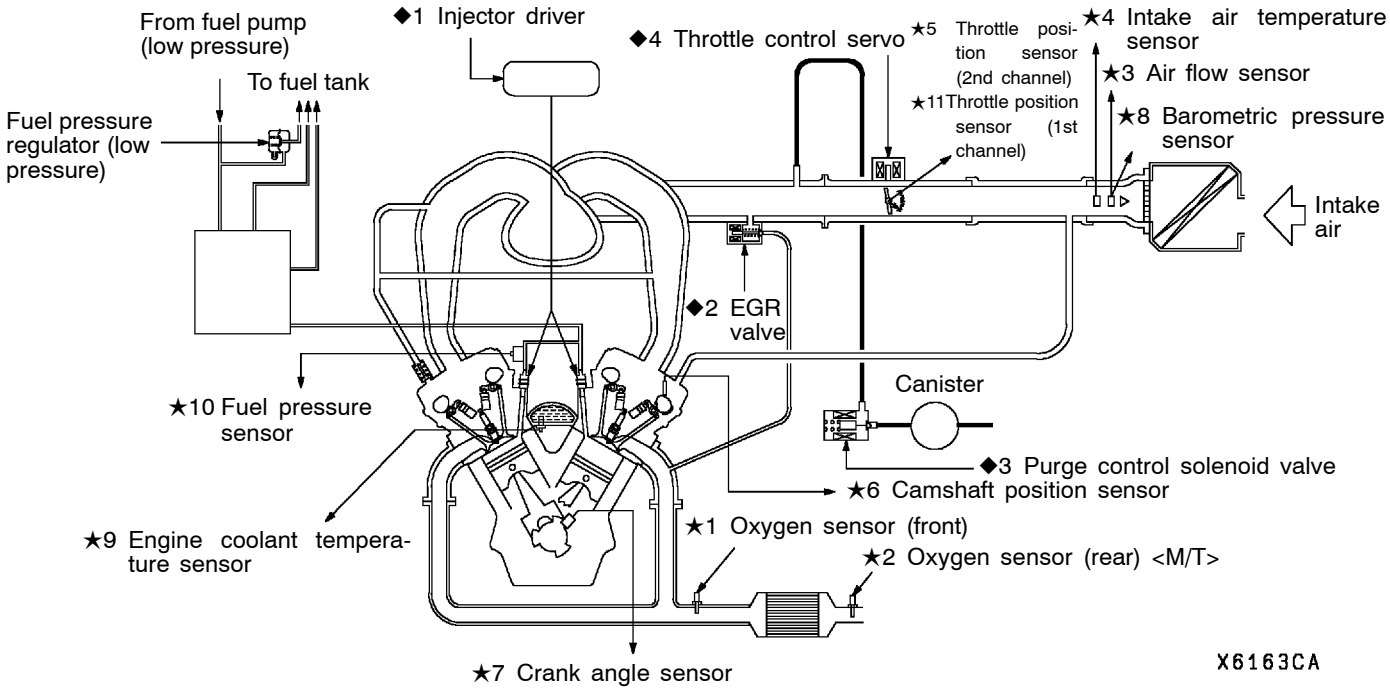
GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	65
	Throttle position sensor	Variable resistor type
	Throttle valve control servo	Brushless DC-motor type
Engine-ECU <M/T>	Identification model No.	E2T79271 <RHD> E2T79272 <LHD>
Engine-A/T-ECU <A/T>	Identification model No.	E2T76277 <RHD> E2T76278 <LHD>

Items		Specifications
Sensors	Air flow sensor	Karman vortex 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 (1st and 2nd channels)	Variable resistor type
	Accelerator pedal position switch	Rotary contact type, within accelerator pedal position sensor (1st channel)
	Vehicle speed sensor	Magnetic resistive element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Fuel pressure sensor	Metallic membrane type
	Power steering fluid pressure switch	Contact switch type
Actuators	Engine control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector driver control relay	Contact switch type
	Injector type and number	Electromagnetic type, 6
	Injector identification mark	DIM 1070
	Throttle valve control servo relay	Contact switch type
	Throttle valve control servo	Brushless DC-motor type
	EGR valve	Stepper motor type
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator (low pressure)	Regulator pressure kPa	329
Fuel pressure regulator (high pressure)	Regulator pressure MPa	5.0

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

★1 Oxygen sensor (front) ★2 Oxygen sensor (rear) <M/T> ★3 Air flow sensor ★4 Intake air temperature sensor ★5 Throttle position sensor (2nd channel) ★6 Camshaft position sensor ★7 Crank angle sensor ★8 Barometric pressure sensor ★9 Engine coolant temperature sensor ★10 Fuel pressure sensor	• Power supply • Ignition switch-IG • Ignition switch-ST • Accelerator pedal position sensor (1st channel) • Accelerator pedal position switch • Detonation sensor • Vehicle speed sensor • A/C switch 1 • A/C switch 2 • Inhibitor switch • Power steering fluid pressure switch • Alternator FR terminal • Stop lamp switch • Clutch switch <M/T> • Small lamp switch • Injector wire open circuit check signal • Throttle valve controller	⇨ Engine-ECU <M/T> or engine-A/T-ECU <A/T> ⇨	◆1 Injector driver (injector) ◆2 EGR valve (stepper motor) ◆3 Purge control solenoid valve	• Engine control relay • Fuel pump relay • Injector driver relay • Throttle control servo relay • A/C relay • Condenser fan relay • Ignition coil • Engine warning lamp • GDI ECO indicator lamp • Diagnosis output • Alternator G terminal • Throttle valve controller • Oxygen sensor heater
★11 Throttle position sensor (1st channel)	• Power supply • Ignition switch-IG • Accelerator pedal position sensor (2nd channel) • Engine-ECU <M/T> or engine-A/T-ECU <A/T>	⇨ Throttle valve controller ⇨	◆4 Throttle valve control servo	• Engine-ECU <M/T> or engine-A/T-ECU <A/T>	



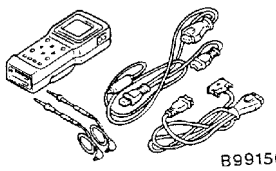
SERVICE SPECIFICATIONS

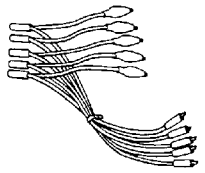
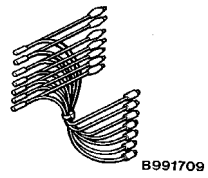
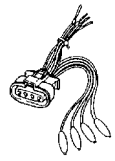
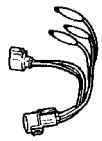
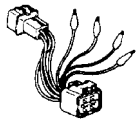
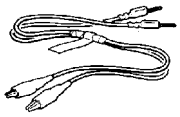
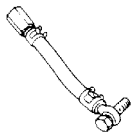
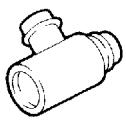
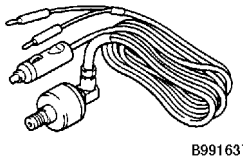
Item		Standard value
Adjustment voltage of throttle position sensor (1st channel) V		0.4 - 0.6
Adjustment voltage of throttle position sensor (2nd channel) V		4.2 - 4.8
Throttle position sensor resistance kΩ		0.9 - 2.5
Adjustment voltage of accelerator pedal position sensors 1 and 2 V		0.985 - 1.085
Resistance of accelerator pedal position sensors 1 and 2 kΩ		3.5 - 6.5
Intake air temperature sensor resistance kΩ	at 20°C	2.3 - 3.0
	at 80°C	0.30 - 0.42
Engine coolant temperature sensor resistance kΩ	at 20°C	2.1 - 2.7
	at 80°C	0.26 - 0.36
Fuel pressure	High-pressure side MPa	4 - 6.9
	Low-pressure side kPa	Approximately 329
Injector coil resistance (at 20°C) Ω		0.9 - 1.1
Oxygen sensor output voltage V (during revving)		0.6 - 1.0
Oxygen sensor heater resistance (at 20°C) Ω		4.5 - 8.0
Throttle control servo coil resistance (at 20°C) Ω		0.6 - 1.0

SEALANT

Item	Specified sealant	Remark
Engine coolant temperature sensor	3M Nut Locking Part No.4171 or equivalent	Drying sealant

SPECIAL TOOLS

Tools	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	● GDI system check ● Take a reading of the diagnosis codes

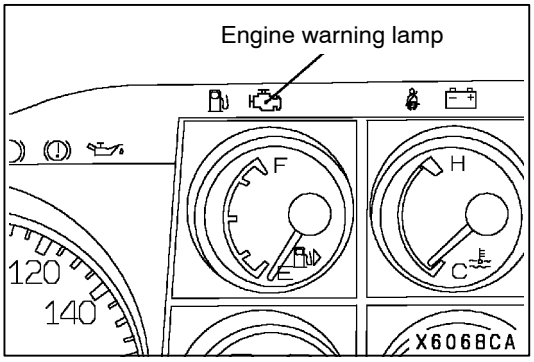
Tools	Number	Name	Use
	MB991348, MB991658	Test harness set	• Troubleshooting - voltage measurement • Inspection using an analyzer
	MB991709		
	MB991519	Alternator harness connector	Troubleshooting - voltage measurement
	MD998478	Test harness (3-pin, square)	• Troubleshooting - voltage measurement • Inspection using an analyzer
	MD998464	Test harness (4-pin, square)	Oxygen sensor check
	MB991529	Diagnosis code checking harness	Take a reading of the diagnosis codes <A/T>
	MD998709	Adaptor hose	Fuel pressure measurement
	MD998742	Hose adaptor	
	MB991637	Fuel pressure gauge set	

TROUBLESHOOTING <M/T>

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

NOTE
When replacing the engine-ECU, replace immobilizer-ECU and ignition key as well at the same time.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the GDI system, the engine warning lamp will illuminate or flash.
If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output.

Engine warning lamp inspection items

Code No.	Diagnosis item
-	Engine-ECU
P0100	Air flow sensor system
P0105	Barometric pressure sensor system
P0110	Intake air temperature sensor system
P0115	Engine coolant temperature sensor system
P0120★	Throttle position sensor (1st channel) system
P0125	Feedback system
P0130	Oxygen sensor (front) system <sensor 1>
P0135	Oxygen sensor heater (front) system <sensor 1>
P0136	Oxygen sensor (rear) system <sensor 2>
P0141	Oxygen sensor heater (rear) system <sensor 2>
P0170	Abnormal fuel system
P0190★	Abnormal fuel pressure
P0201	No.1 injector system
P0202	No.2 injector system
P0203	No.3 injector system
P0204	No.4 injector system
P0205	No.5 injector system

Code No.	Diagnosis item
P0206	No.6 injector system
P0220★	Accelerator pedal position sensor (1st channel) system
P0225★	Throttle position sensor (2nd channel) system
P0300★	Ignition coil (power transistor) system
P0301	No.1 cylinder misfire detected.
P0302	No.2 cylinder misfire detected.
P0303	No.3 cylinder misfire detected.
P0304	No.4 cylinder misfire detected.
P0305	No.5 cylinder misfire detected.
P0306	No.6 cylinder misfire detected.
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0403	EGR valve system
P0420	Catalyst malfunction
P0443	Purge control solenoid valve system
P1200	Injector driver system
P1220★	Electronic-controlled throttle valve system
P1221★	Throttle valve position feedback system
P1222★	Throttle control servo system
P1223★	Communication line system with throttle valve controller
P1225★	Accelerator pedal position sensor (2nd channel) system
P1226★	Throttle valve controller system

NOTE
1. If the engine warning lamp illuminates because of a malfunction of the engine-ECU, communication between MUT-II and the engine-ECU is impossible. In this case, the diagnosis code cannot be read.
2. 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 "★" in the diagnosis code number column, the engine warning lamp illuminates only on the first detection of the malfunction.
   If diagnosis code P0120, P0220, P0225 or P1225 is set, the engine warning lamp will flash. If the 1st and 2nd channels of the throttle postion sensor or the acccelerator pedal position sensor fail at the same time, the engine warning lamp will also flash.
3. After the engine warning lamp illuminates, it will be switched off under the following conditions.
   (1) When the engine-ECU monitored the power train malfunction three times* and met set condition requirements, it detected no malfunction.
      *: In this case, "one time" indicates from engine start to stop.
   (2) For misfiring malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.

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

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine control unit to DIAGNOSIS 2 mode using the MUT-II.
2. Carry out a road test.
3. Take a reading of the diagnosis code and repair the problem location.
4. Turn the ignition switch to OFF and then back to ON again.

NOTE
By turning the ignition switch to OFF, the ENGINE-ECU will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.

5. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function. If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II, and then start the engine again and carry out a road test to confirm that the problem has disappeared.

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 MUT-II, an effective troubleshooting can be performed.

Data item		Unit
Engine coolant temperature sensor		°C
Engine speed		r/min
Vehicle speed		km/h
Long-term fuel compensation (long-term fuel trim)		%
Short-term fuel compensation (short-term fuel trim)		%
Fuel control condition	Open loop	OL
	Closed loop	CL
	Open loop owing to drive condition	OL-DRV.
	Open loop owing to system malfunction	OL-SYS.
	Closed loop based on one oxygen sensor	CL-H02S
Calculation load value		%
Diagnosis code during data recording		-

NOTE
If malfunctions have been detected in multiple systems, store one malfunction only, which has been detected first.

READINESS TEST STATUS

The engine-ECU monitors the following main diagnosis items, judges if these items are in good condition or not, and the stores its history. This history can be read out by using MUT-II. (If the ECU has judged a item before, the MUT-II displays "Complete.")
In addition, if diagnosis codes are erased or the battery cable is disconnected, this history will also be erased (the memory will be reset).

- Catalyst: P0420
- Oxygen sensor: P0130
- Oxygen sensor heater: P0135, P0141

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Suspends lean burn operation. 2. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle opening angle feedback (half as much as the opening rate in the normal condition) by using signals from the throttle position sensor (1st channel). However, this controlling system is not applied if the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V. 3. Refrains from controlling the throttle opening angle feedback if the throttle position sensor (1st channel) is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Moreover, the control system is working until the ignition switch is turned OFF if the sensor signal returns to normal.)
Camshaft position sensor	Cuts the fuel supply once a malfunction is detected. (Only when there has been no occasion of detecting No.1 cylinder top dead centre after the ignition switch is turned ON.)
Vehicle speed sensor	1. Suspends lean burn operation. However, the control is cancelled as a certain time passes by with the engine speed of 1,500 r/min or more. 2. Suspends lean burn operation during the engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Fixes the ignition timing as that for standard petrol.
Injector	1. Suspends lean burn operation. 2. Suspends the exhaust gas recirculation.
Ignition coil (incorporating power transistor)	1. Suspends lean burn operation. 2. Cuts off the fuel supply to cylinders with an abnormal ignition signal.
Fuel pressure sensor	1. Controls as if the fuel pressure is 5MPa. 2. Suspends fuel injection. (when the low pressure is detected and the engine speed is more than 3,000r/min)
Alternator FR terminal	Refrains from controlling to suppress the alternator output to electrical load. (Operated as a normal alternator)
Accelerator pedal position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (1st channel). (However, the control system is not applicable if the difference from the accelerator pedal position sensor (1st channel) output voltage is 1.0 V or higher.) 3. Suspends the electronic controlled throttle valve system if accelerator pedal position sensor (1st channel) is also defective.

Malfunctioning item	Control contents during malfunction
Accelerator pedal position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (2nd channel). (However, this control is not applicable if the voltage difference between the accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) is 1.0 V or higher.) 3. Also suspends the electronic-controlled throttle valve system when the accelerator pedal position sensor (2nd channel) is defective.
Throttle position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls throttle opening angle feedback by using signals from throttle position sensor (2nd channel). (However, the controlling system is not applied when the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V.) 3. Refrains from controlling the throttle opening angle feedback when throttle position sensor (2nd channel) is also defective.
Electronic-controlled throttle valve system	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the idle speed feedback control.
Throttle valve position feedback	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control. However, if the throttle valve opening angle is significantly wide, this system carries out the following controls. 1. Always cuts the fuel supply to three cylinders. 2. Cuts the fuel supply when the engine speed reaches 3,000 r/min or more.
Throttle control servo	1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.
Communication line between the throttle valve controller and the ECU	1. Communication error between the throttle valve controller and the engine-ECU: ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. 2. Communication error between the throttle valve controller and the engine-ECU: ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. ● The throttle valve controller controls the throttle valve opening angle by using signals from accelerator pedal position sensor (2nd channel).
Throttle valve controller	1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.

NOTE
If the electronic-controlled throttle valve system is suspended, the engine warning lamp will illuminate.

INSPECTION CHART FOR DIAGNOSIS CODES

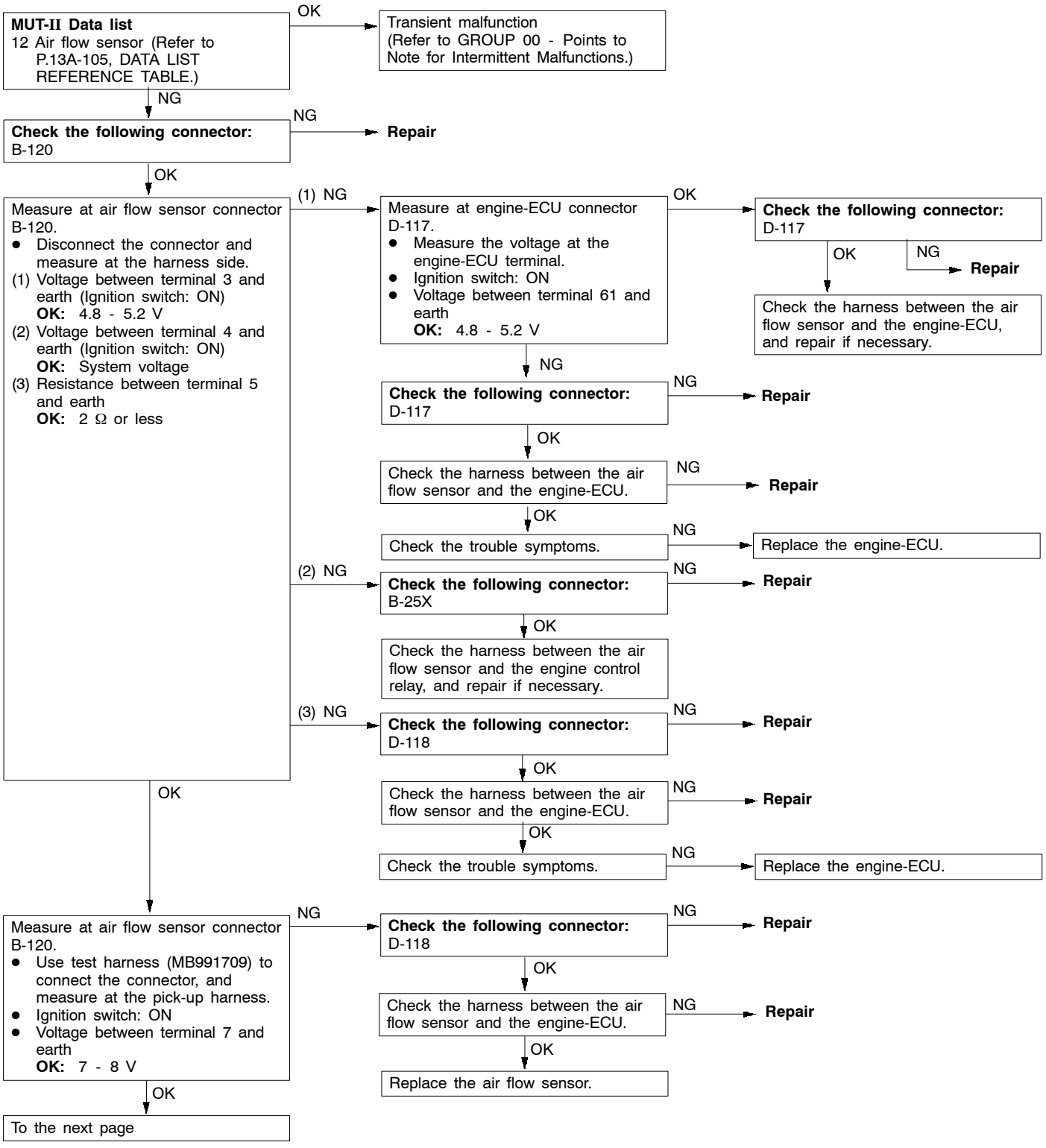
Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13A-17
P0105	Barometric pressure sensor system	13A-19
P0110	Intake air temperature sensor system	13A-21
P0115	Engine coolant temperature sensor system	13A-22
P0120★	Throttle position sensor (1st channel) system	13A-25
P0125	Feedback system	13A-27
P0130	Oxygen sensor (front) system <sensor 1>	13A-28
P0135	Oxygen sensor heater (front) system <sensor 1>	13A-30
P0136	Oxygen sensor (rear) system <sensor 2>	13A-31
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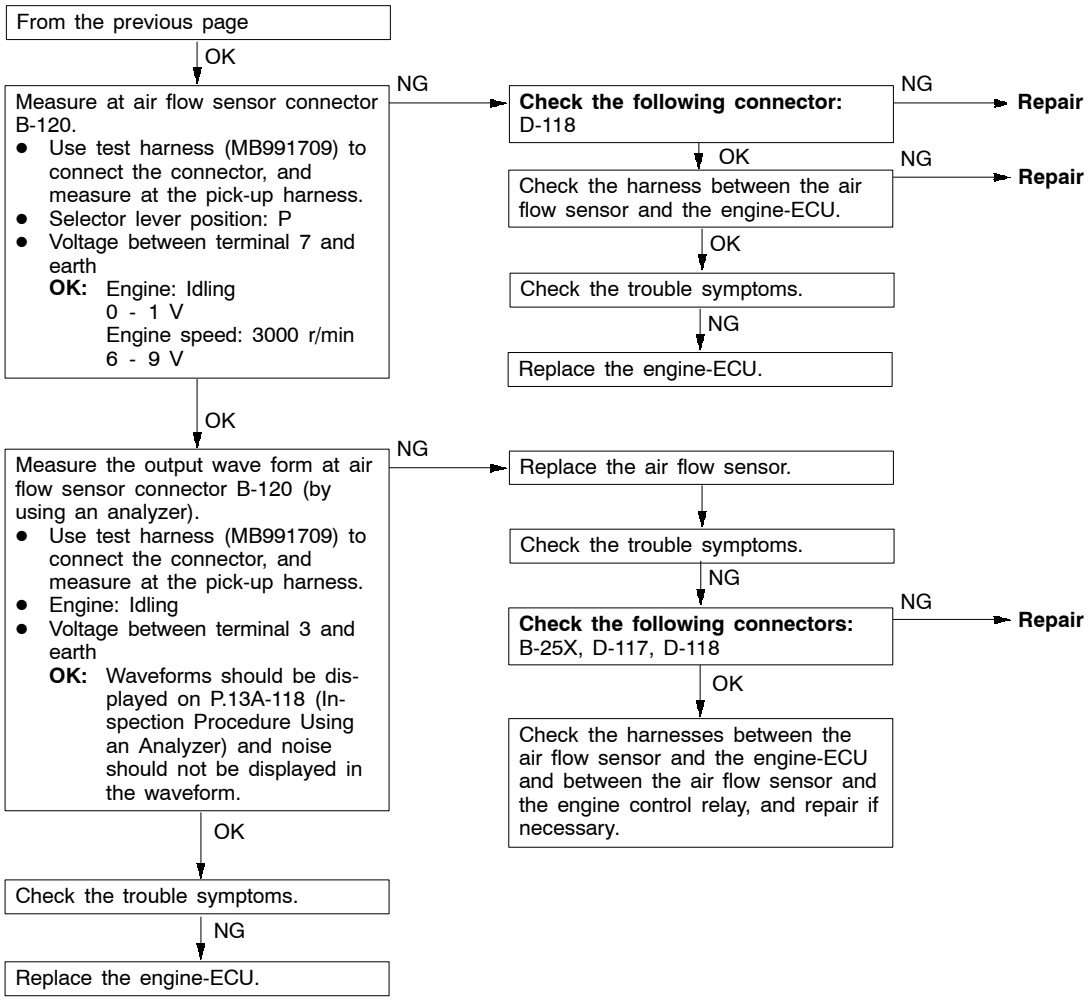
Code No.	Diagnosis item	Reference page
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P0500	Vehicle speed sensor system	13A-63
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P1222★	Throttle control servo system	13A-66
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NOTE
1. Do not replace the engine-ECU until a through terminal check reveals there are no short/open circuit.
2. Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.
3. After the engine-ECU has detected a malfunction, a diagnosis code is recorded the next time the engine is started and the same malfunction is re-detected. However, for items marked with a "★", the diagnosis code is recorded on the first detection of the malfunction.
4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

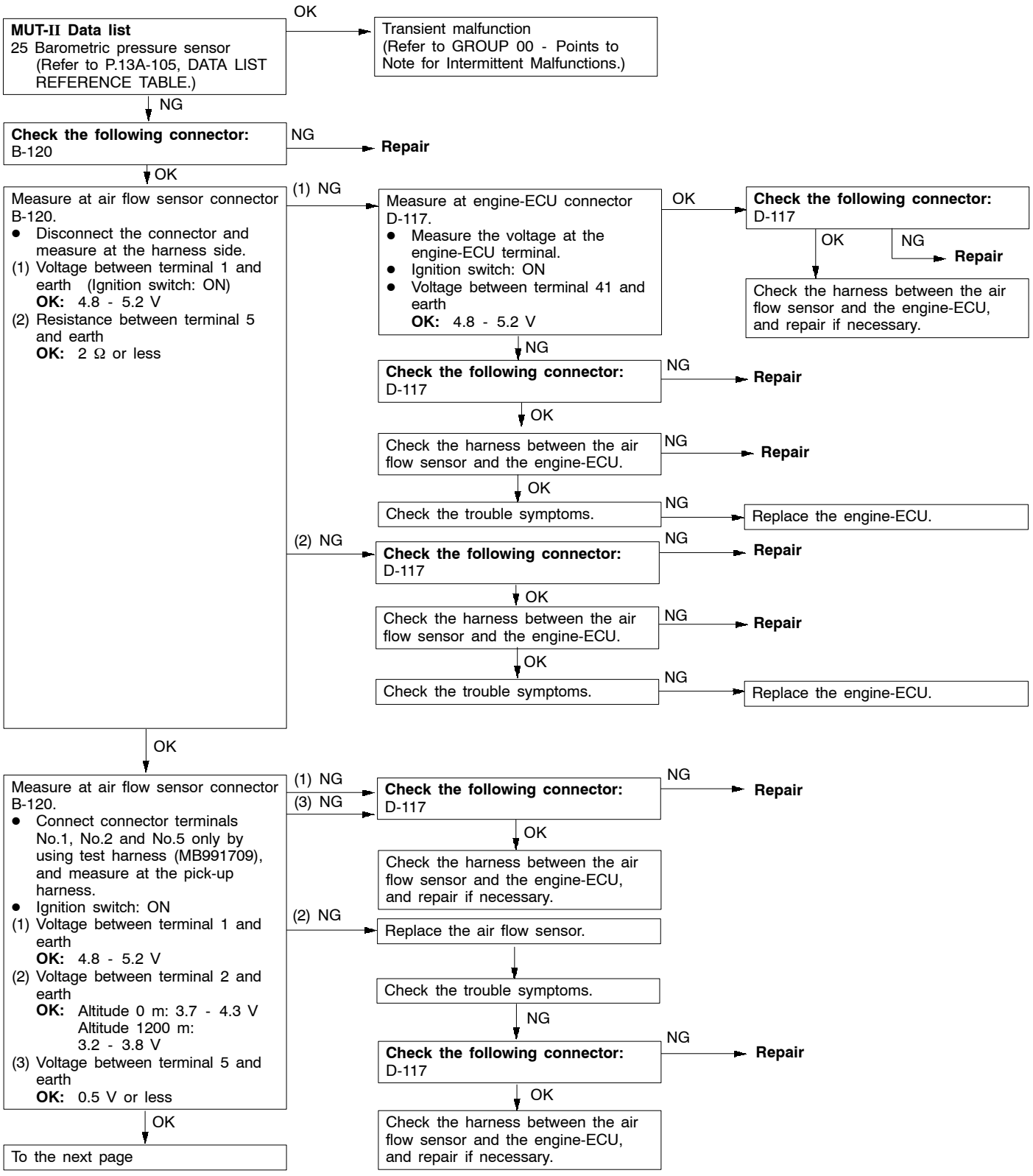
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

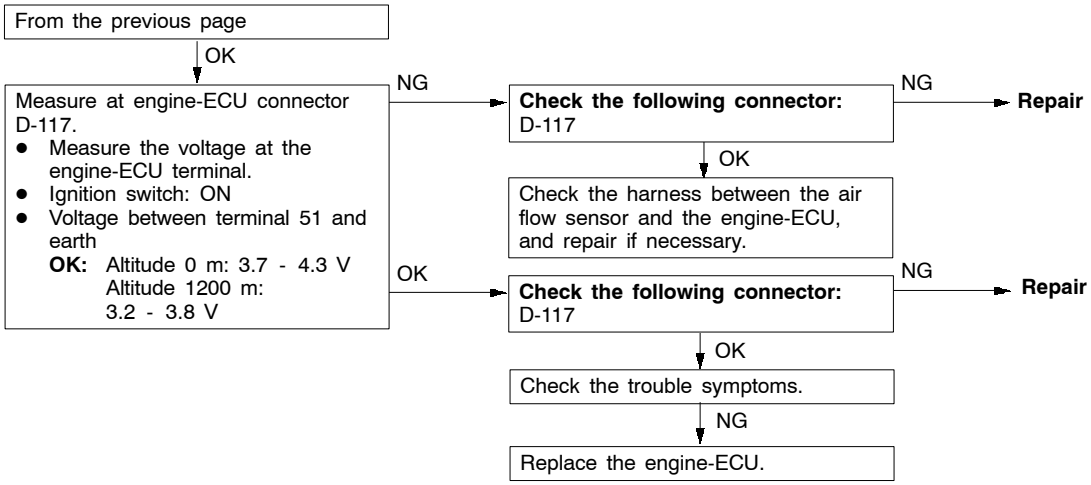
Code No.P0100 Air flow sensor system	Probable cause
Range of Check ● Engine speed: 500 r/min or more Set Conditions ● The sensor output frequency is 3.3 Hz or less for four seconds.	● Malfunction of air flow sensor ● Open or short circuit in air flow sensor circuit or loose connector contact ● Malfunction of engine-ECU



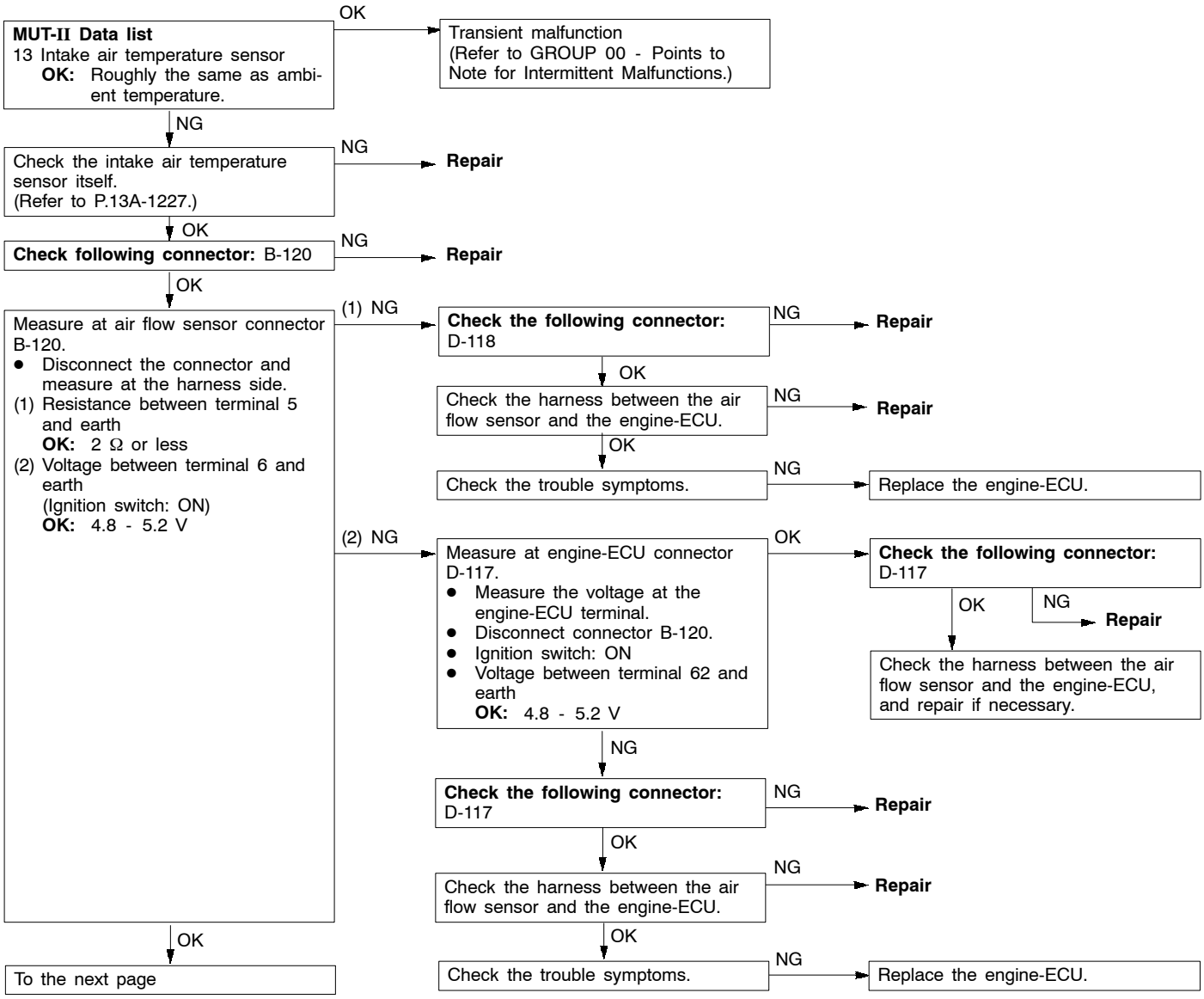

From the previous page
OK
Measure at air flow sensor connector B-120.
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Selector lever position: P
● Voltage between terminal 7 and earth
OK: Engine: Idling
0 - 1 V
Engine speed: 3000 r/min
6 - 9 V
NG
Check the following connector: D-118
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure the output wave form at air flow sensor connector B-120 (by using an analyzer).
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Voltage between terminal 3 and earth
OK: Waveforms should be displayed on P.13A-118 (Inspection Procedure Using an Analyzer) and noise should not be displayed in the waveform.
NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connectors: B-25X, D-117, D-118
NG
Repair
OK
Check the harnesses between the air flow sensor and the engine-ECU and between the air flow sensor and the engine control relay, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

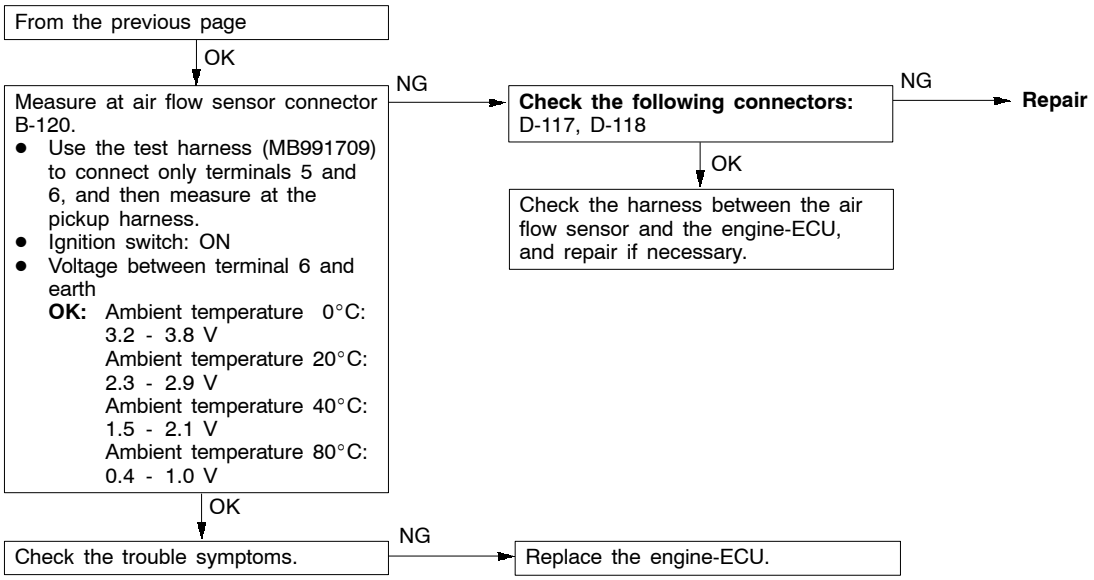
Code No.P0105 Barometric pressure sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. ● Battery voltage: 8 V or more Set Conditions ● The sensor output voltage is 4.5 V or more for four seconds (equivalent to 114 kPa of barometric pressure) or ● The sensor output voltage is 0.2 V or less (equivalent to 53 kPa of barometric pressure)	● Malfunction of barometric pressure sensor ● Open or short circuit in barometric pressure sensor circuit or loose connector contact ● Malfunction of engine-ECU



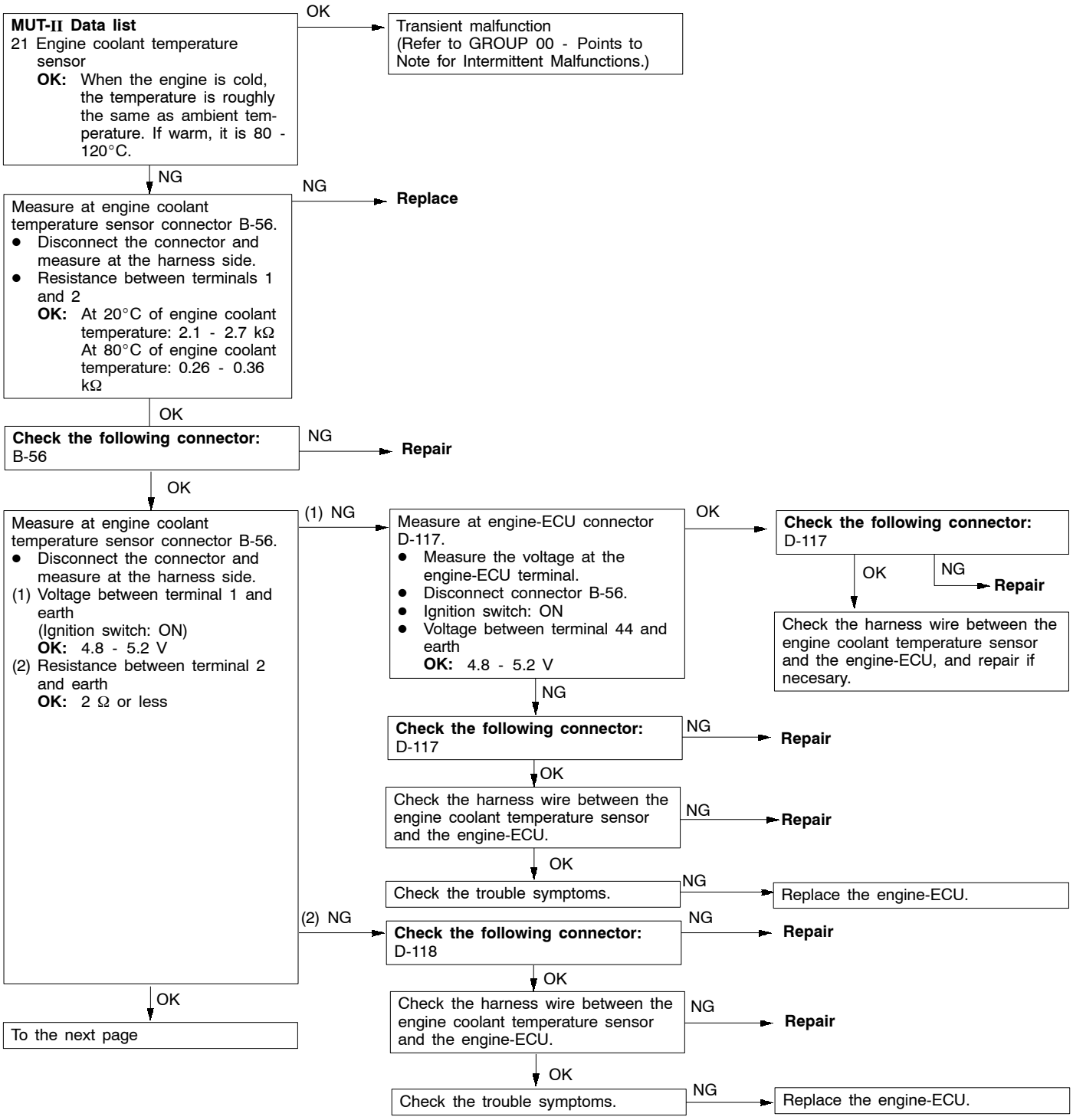

From the previous page
OK
Measure at engine-ECU connector D-117.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 51 and earth
OK: Altitude 0 m: 3.7 - 4.3 V
Altitude 1200 m: 3.2 - 3.8 V
NG
Check the following connector: D-117
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-117
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

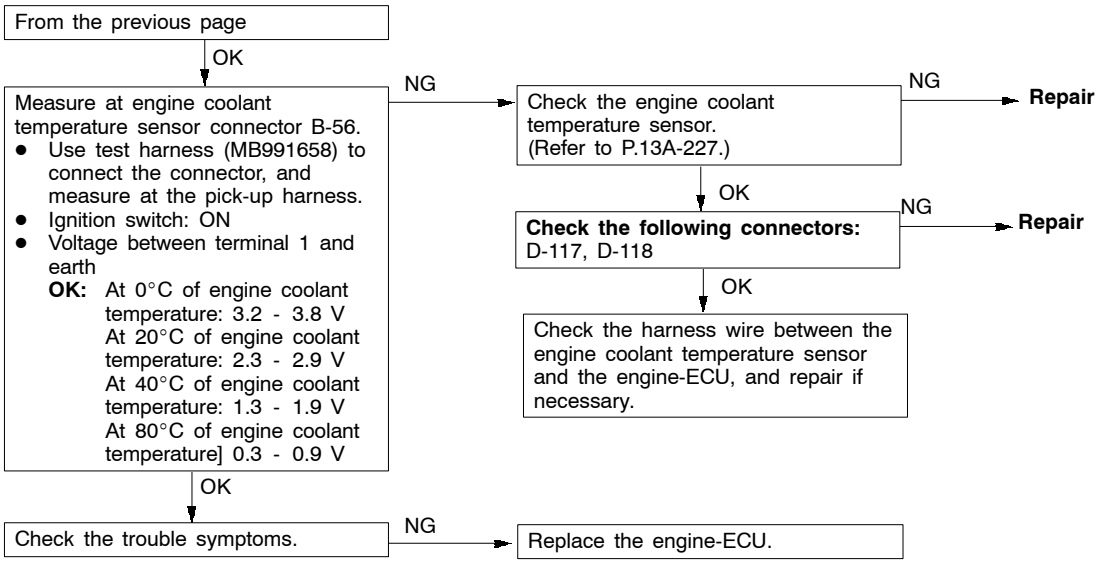
Code No.P0110 Intake air temperature sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of intake air temperature) or ● The sensor output voltage is 0.2 V or more for four seconds (equivalent to 125°C of intake air temperature)	● Malfunction of intake air temperature sensor ● Open or short circuit in intake air temperature sensor or loose connector contact ● Malfunction of engine-ECU



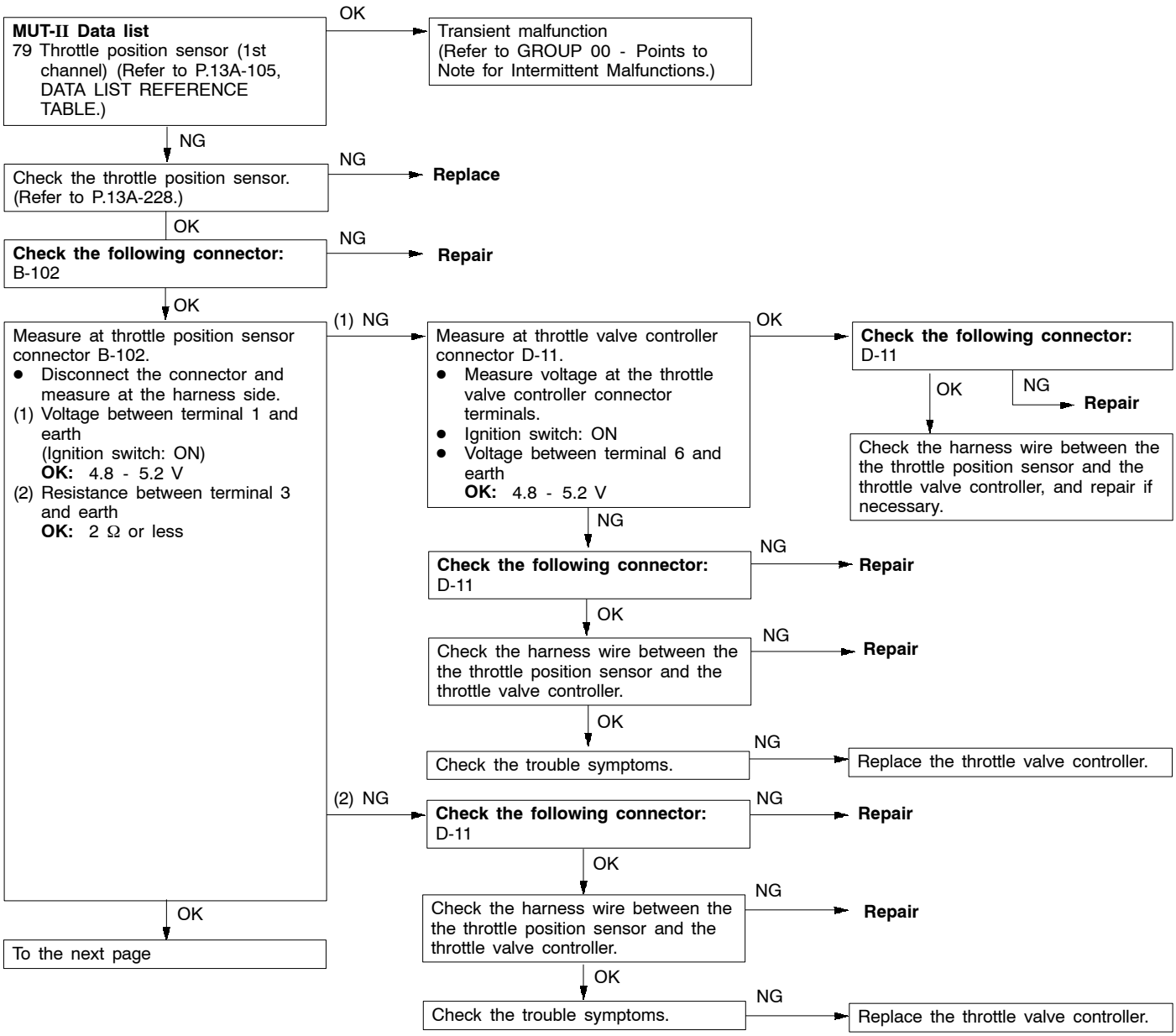


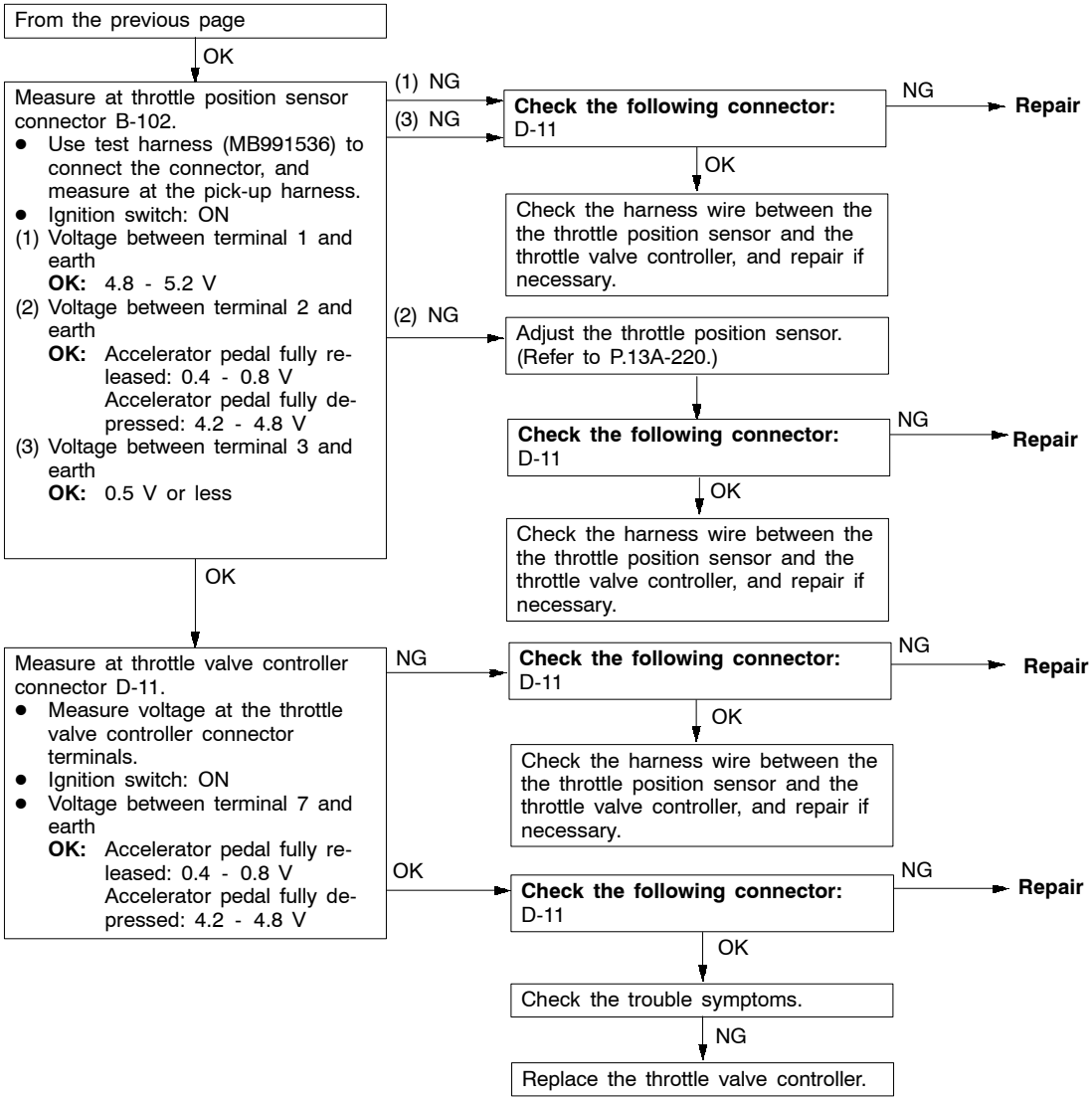
Code No.P0115 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of engine coolant temperature) or ● The sensor output voltage is 0.1 V or less for four seconds (equivalent to 140°C of engine coolant temperature)	● Malfunction of engine coolant temperature sensor ● Open or short circuit in the engine coolant temperature sensor circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Engine: After starting Set Conditions ● The engine coolant temperature has reduced from over 40°C to less than 40°C, and that condition has lasted for five minutes or more.	


MUT-II Data list
21 Engine coolant temperature sensor
OK: When the engine is cold, the temperature is roughly the same as ambient temperature. If warm, it is 80 - 120°C.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Measure at engine coolant temperature sensor connector B-56.
Disconnect the connector and measure at the harness side.
Resistance between terminals 1 and 2
OK: At 20°C of engine coolant temperature: 2.1 - 2.7 kΩ
At 80°C of engine coolant temperature: 0.26 - 0.36 kΩ
NG
Replace
OK
Check the following connector: B-56
NG
Repair
OK
Measure at engine coolant temperature sensor connector B-56.
Disconnect the connector and measure at the harness side.
(1) Voltage between terminal 1 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less
(1) NG
Measure at engine-ECU connector D-117.
Measure the voltage at the engine-ECU terminal.
Disconnect connector B-56.
Ignition switch: ON
Voltage between terminal 44 and earth
OK: 4.8 - 5.2 V
OK
Check the following connector: D-117
OK
NG
Repair
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necesary.
NG
Check the following connector: D-117
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(2) NG
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
To the next page

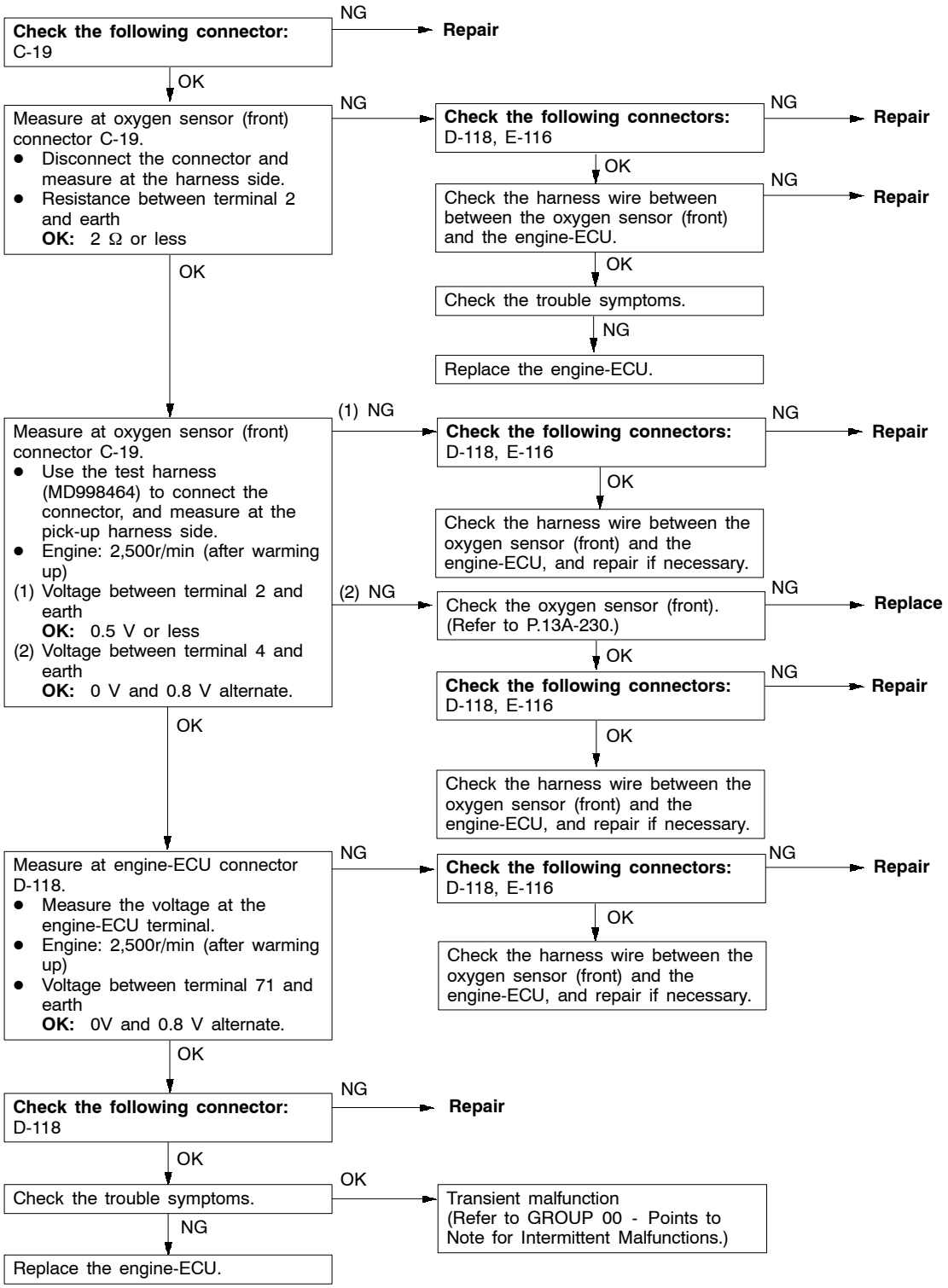

From the previous page
OK
Measure at engine coolant temperature sensor connector B-56.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
● Voltage between terminal 1 and earth
OK: At 0°C of engine coolant temperature: 3.2 - 3.8 V
At 20°C of engine coolant temperature: 2.3 - 2.9 V
At 40°C of engine coolant temperature: 1.3 - 1.9 V
At 80°C of engine coolant temperature] 0.3 - 0.9 V
NG
Check the engine coolant temperature sensor. (Refer to P.13A-227.)
NG
Repair
OK
Check the following connectors: D-117, D-118
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

Code No.P0120 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 0.2 V or less. or ● The sensor output voltage is 4.85 V or more and the throttle position sensor (2nd channel) output voltage is 2.5V or more. or ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V. or ● The opening angle of throttle position sensor (1st channel) is different from its target by 1 V or more. or ● The throttle position sensor (1st channel) output changes within 25 mV when the throttle control servo moves one step.	● Malfunction of throttle position sensor ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of throttle valve controller ● Malfunction of engine-ECU

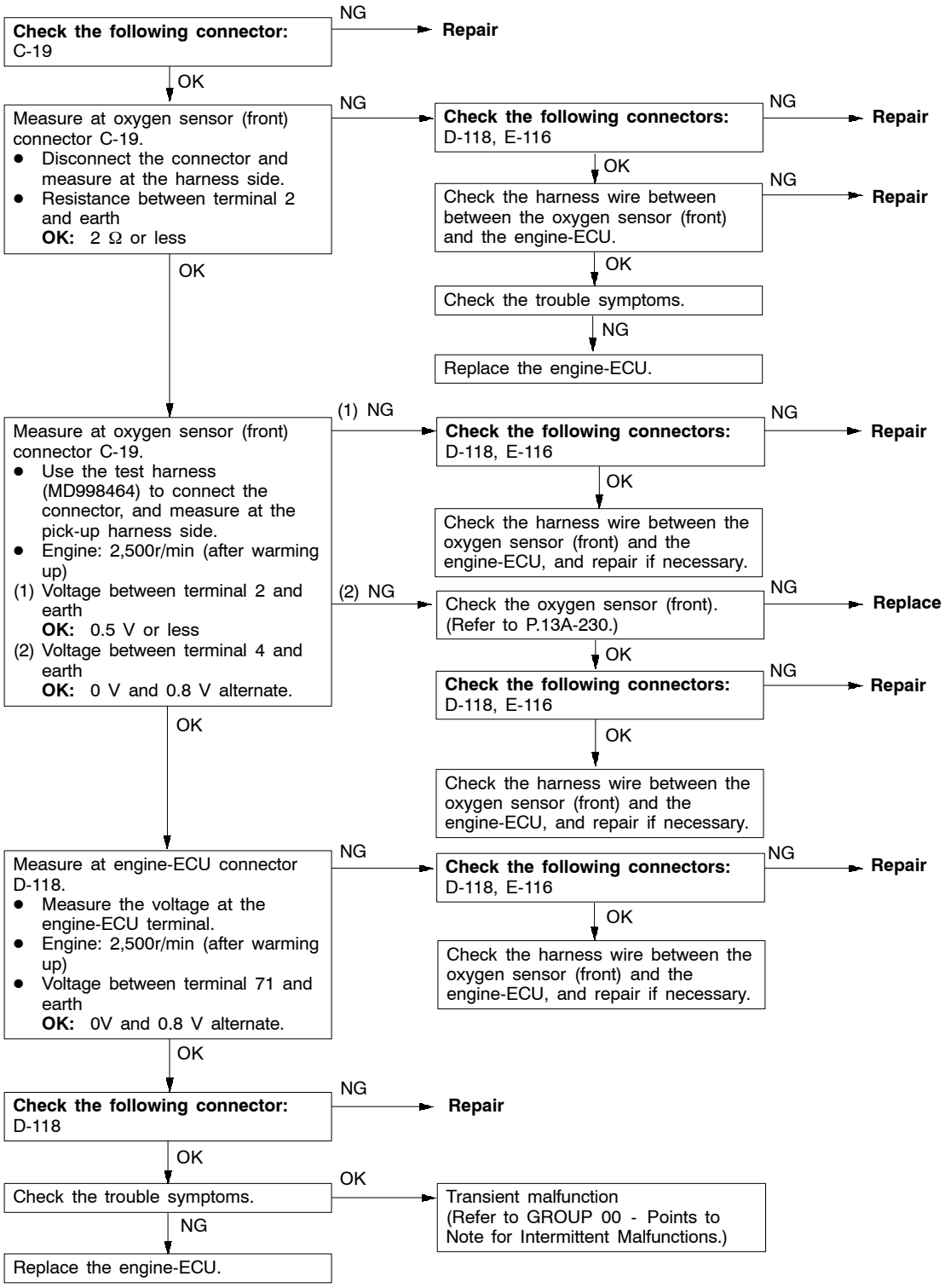



From the previous page
OK
Measure at throttle position sensor connector B-102.
● Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 4.8 - 5.2 V
(2) Voltage between terminal 2 and earth
OK: Accelerator pedal fully released: 0.4 - 0.8 V
Accelerator pedal fully depressed: 4.2 - 4.8 V
(3) Voltage between terminal 3 and earth
OK: 0.5 V or less
(1) NG
(3) NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
(2) NG
Adjust the throttle position sensor. (Refer to P.13A-220.)
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
OK
Measure at throttle valve controller connector D-11.
● Measure voltage at the throttle valve controller connector terminals.
● Ignition switch: ON
● Voltage between terminal 7 and earth
OK: Accelerator pedal fully released: 0.4 - 0.8 V
Accelerator pedal fully depressed: 4.2 - 4.8 V
NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
OK
Check the following connector: D-11
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the throttle valve controller.

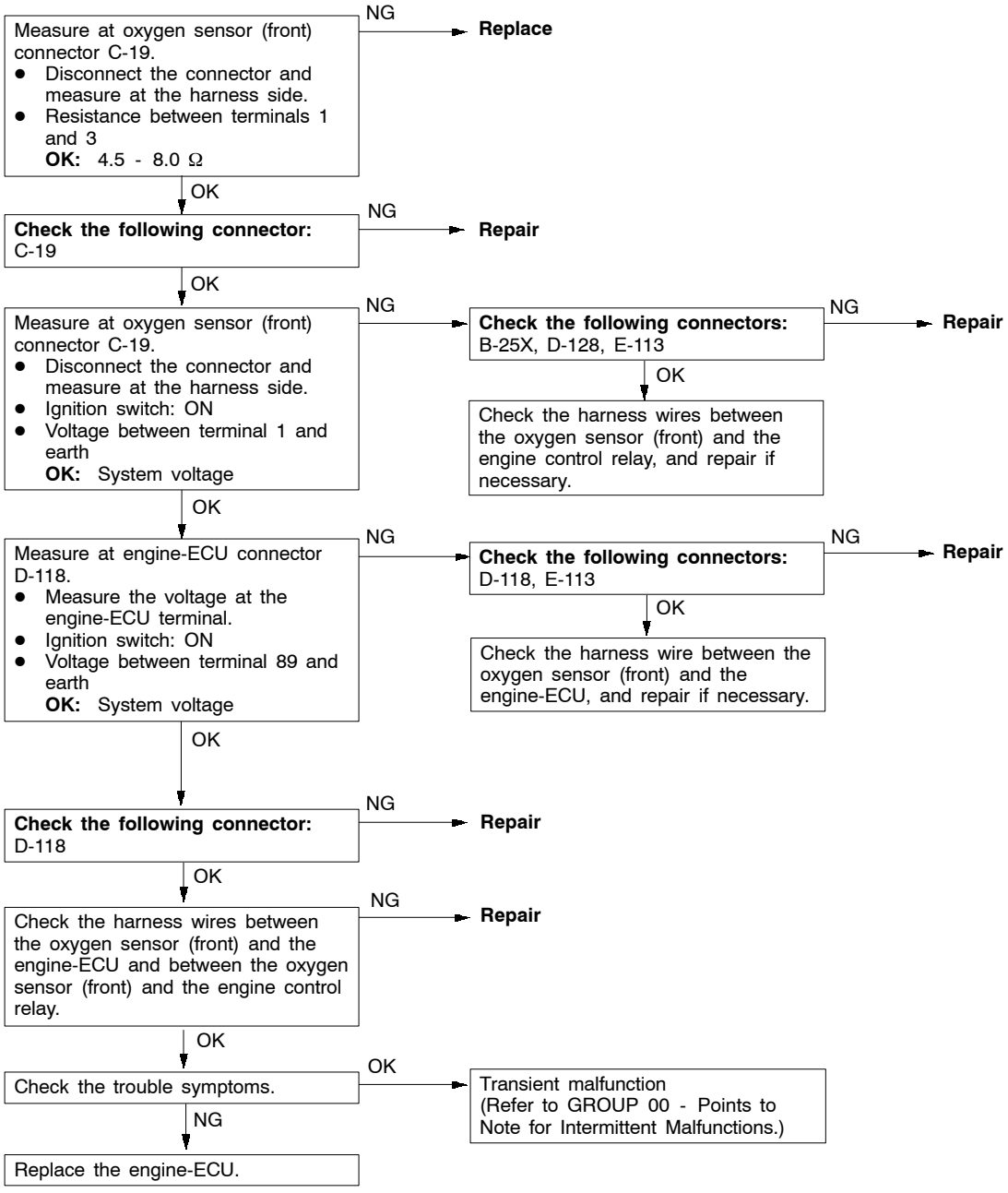
Code No.P0125 Feedback system	Probable cause
Range of Check ● The engine coolant temperature is approx. 80°C or more. ● During stoichiometric feedback control ● The vechile is not being deccelerated. Set Conditions ● Oxygen sensor (front) output voltage has been higher or lower than 0.5 V for at least thirty seconds.	● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU



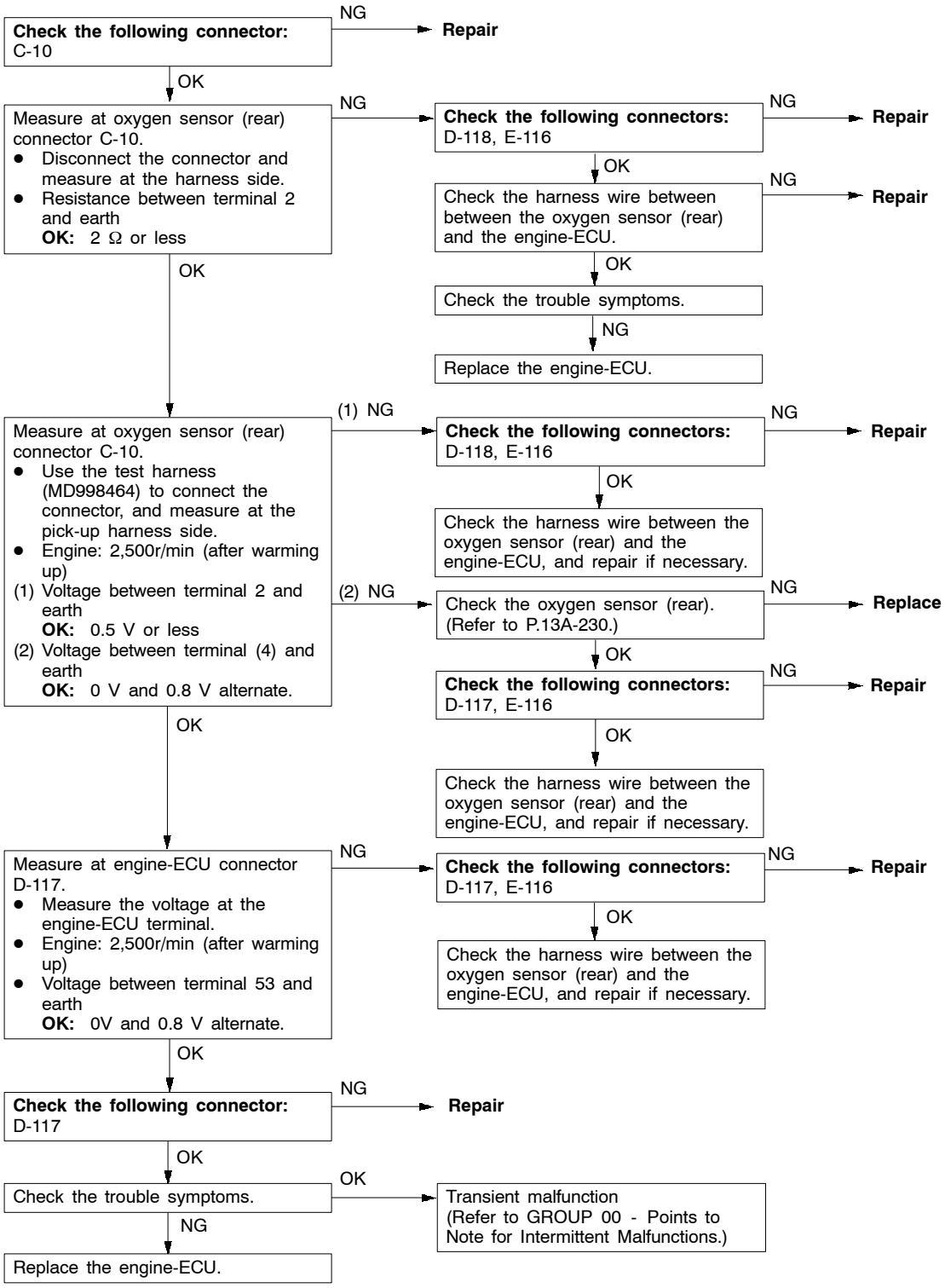
Code No.P0130 Oxygen sensor (front) system <sensor 1>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 50°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor (front) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (front) inside the engine-ECU.	● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Engine speed is 3,000 r/min or less ● During driving ● During air/fuel ratio feedback control Set Conditions ● The oxygen sensor (front) output frequency is five or less per 12 seconds on average.	


Check the following connector: C-19
NG
Repair
OK
Measure at oxygen sensor (front) connector C-19.
● Disconnect the connector and measure at the harness side.
● Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between between the oxygen sensor (front) and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at oxygen sensor (front) connector C-19.
● Use the test harness (MD998464) to connect the connector, and measure at the pick-up harness side.
● Engine: 2,500r/min (after warming up)
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal 4 and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor (front). (Refer to P.13A-230.)
NG
Replace
OK
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector D-118.
● Measure the voltage at the engine-ECU terminal.
● Engine: 2,500r/min (after warming up)
● Voltage between terminal 71 and earth
OK: 0V and 0.8 V alternate.
NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-118
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

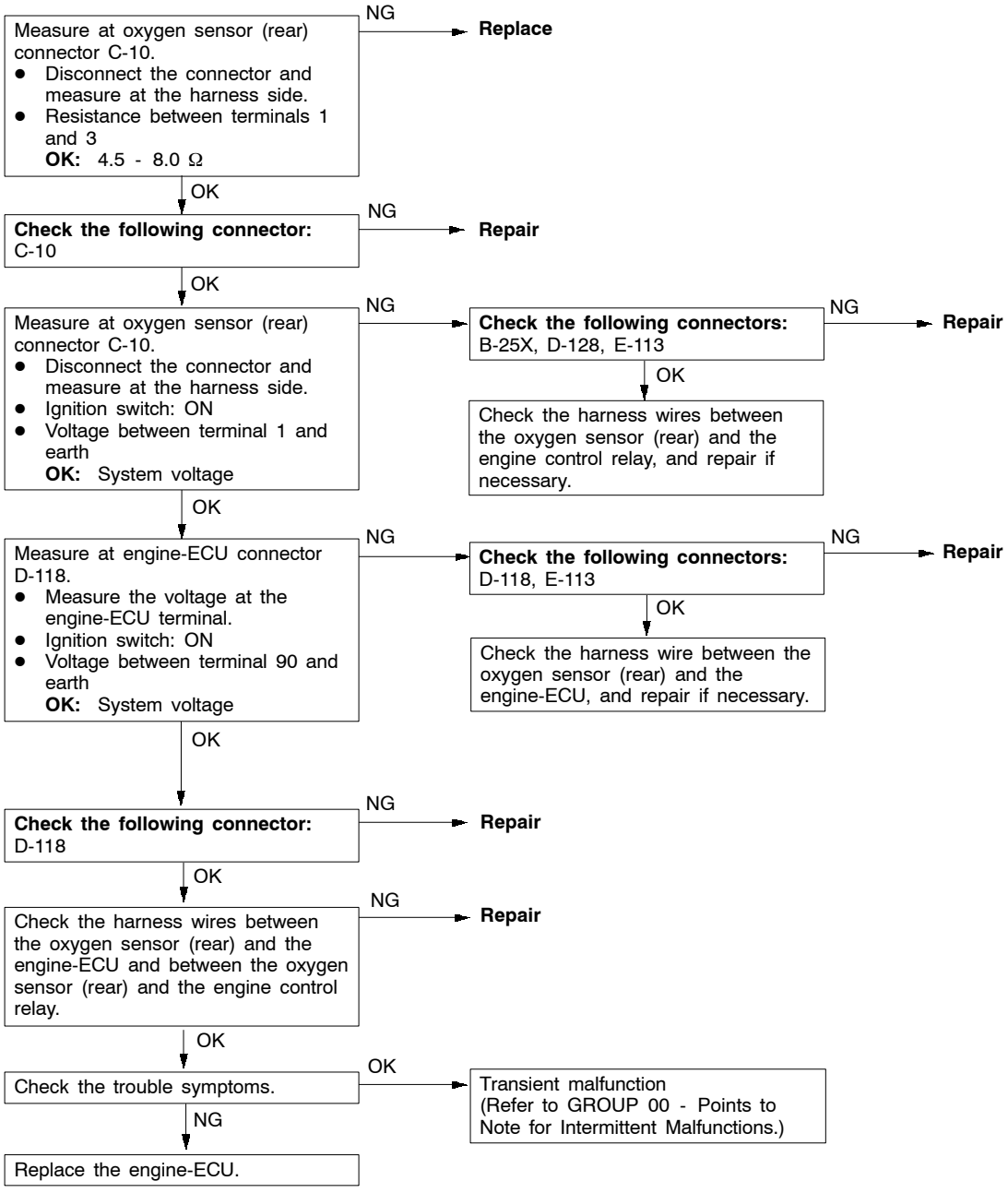
Code No.P0135 Oxygen sensor heater (front) system <sensor 1>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (front) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 - 16 V. Set Conditions ● The current, which flows through the oxygen sensor heater (front), is 0.2 A or less or 3.5 A or more for six seconds.	● Malfunction of oxygen sensor heater (front) ● Open or short circuit in the oxygen sensor heater (front) circuit or loose connector contact ● Malfunction of engine-ECU



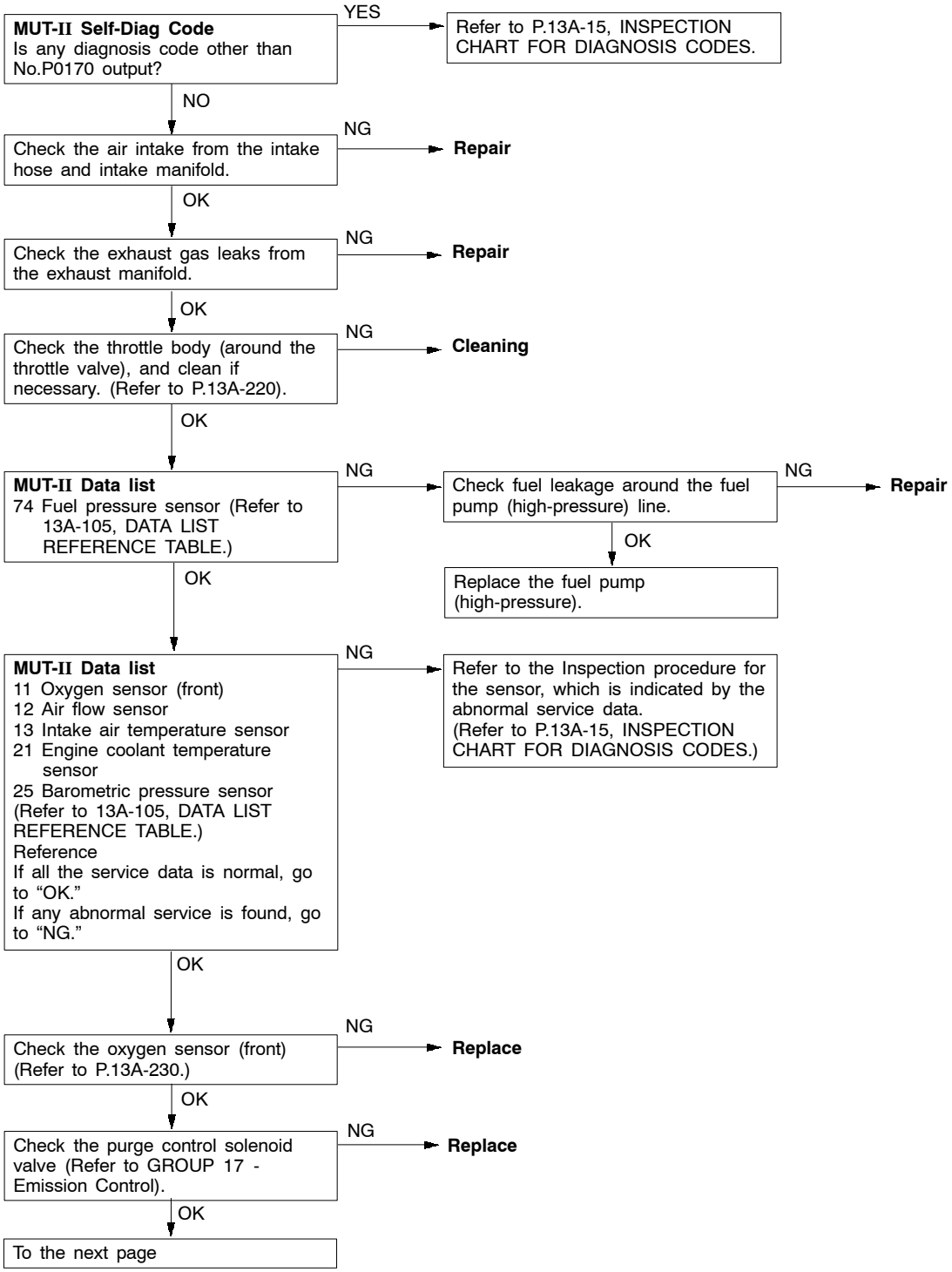
Code No.P0136 Oxygen sensor (rear) system <sensor 2>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 50°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor (rear) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (rear) inside the engine-ECU.	● Malfunction of oxygen sensor (rear) ● Open or short circuit in the oxygen sensor (rear) circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● Two seconds have passed after the ECU detected an open circuit. ● When the oxygen sensor (front) is in good condition. Set Conditions ● When the air/fuel ratio is rich, the oxygen sensor (front) output voltage is 0.5 V or more, the oxygen sensor (rear) output voltage is less than 0.1 V, and the oxygen sensor (rear) output voltage fluctuates within 0.078 V.	

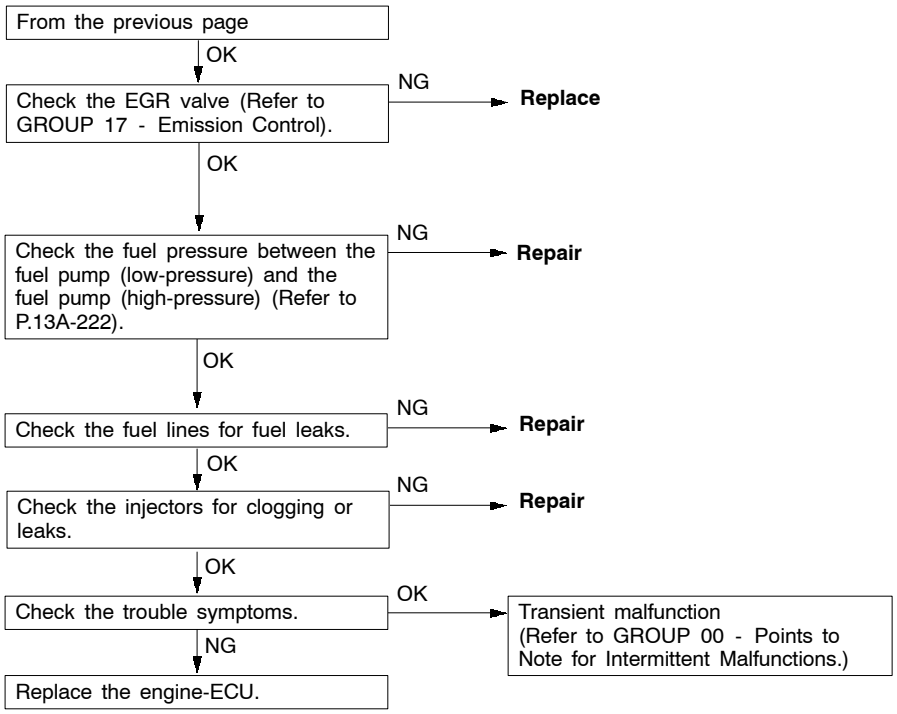

Check the following connector: C-10
NG
Repair
OK
Measure at oxygen sensor (rear) connector C-10.
● Disconnect the connector and measure at the harness side.
● Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between between the oxygen sensor (rear) and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at oxygen sensor (rear) connector C-10.
● Use the test harness (MD998464) to connect the connector, and measure at the pick-up harness side.
● Engine: 2,500r/min (after warming up)
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal (4) and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: D-118, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor (rear). (Refer to P.13A-230.)
NG
Replace
OK
Check the following connectors: D-117, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector D-117.
● Measure the voltage at the engine-ECU terminal.
● Engine: 2,500r/min (after warming up)
● Voltage between terminal 53 and earth
OK: 0V and 0.8 V alternate.
NG
Check the following connectors: D-117, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-117
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

Code No.P0141 Oxygen sensor heater (rear) system <sensor 2>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (rear) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 - 16 V. Set Conditions ● The current, which flows through the oxygen sensor heater (rear), is 0.2 A or less or 3.5 A or more for six seconds.	● Malfunction of oxygen sensor heater (rear) ● Open or short circuit in the oxygen sensor heater (rear) circuit or loose connector contact ● Malfunction of engine-ECU

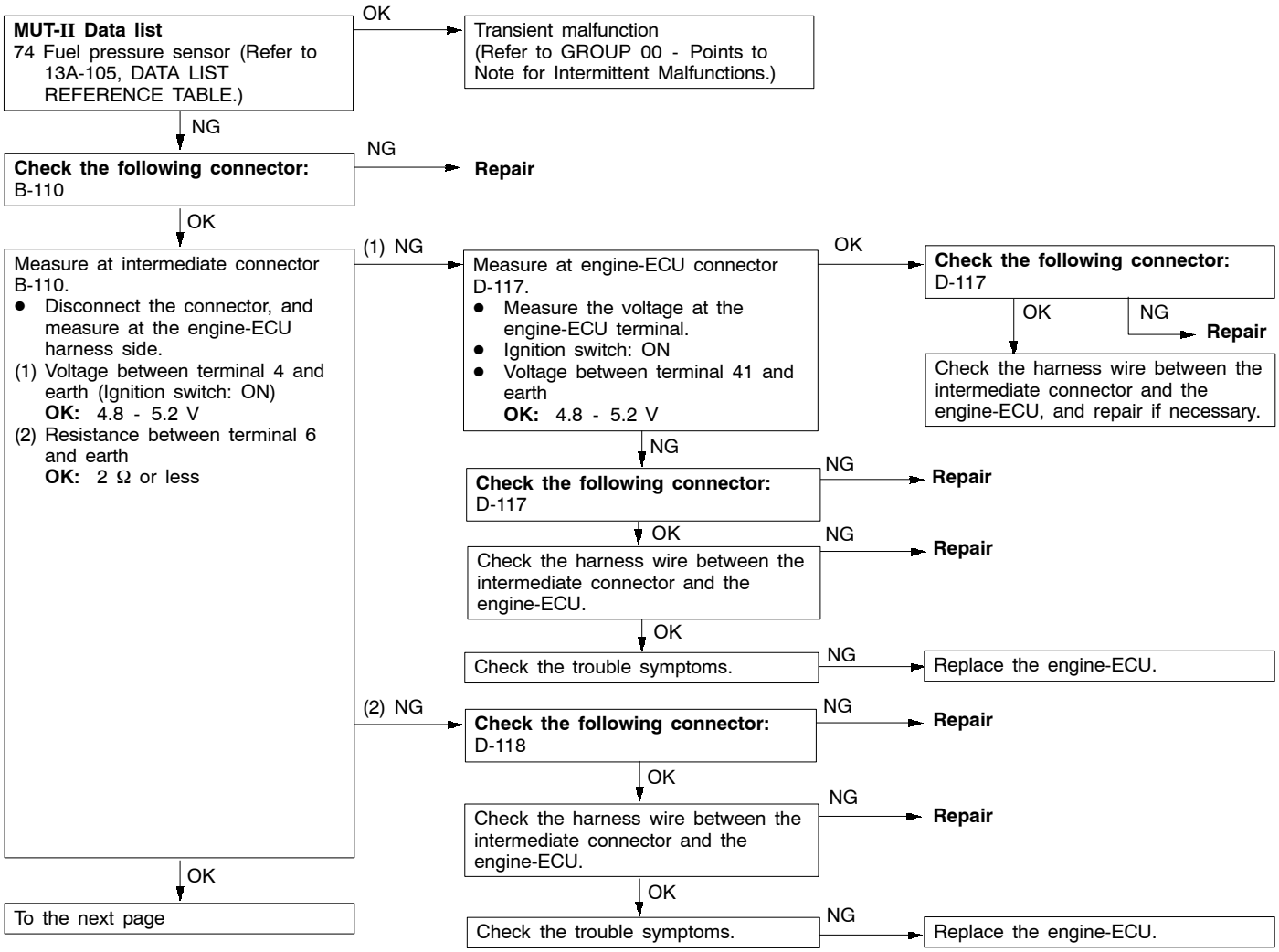


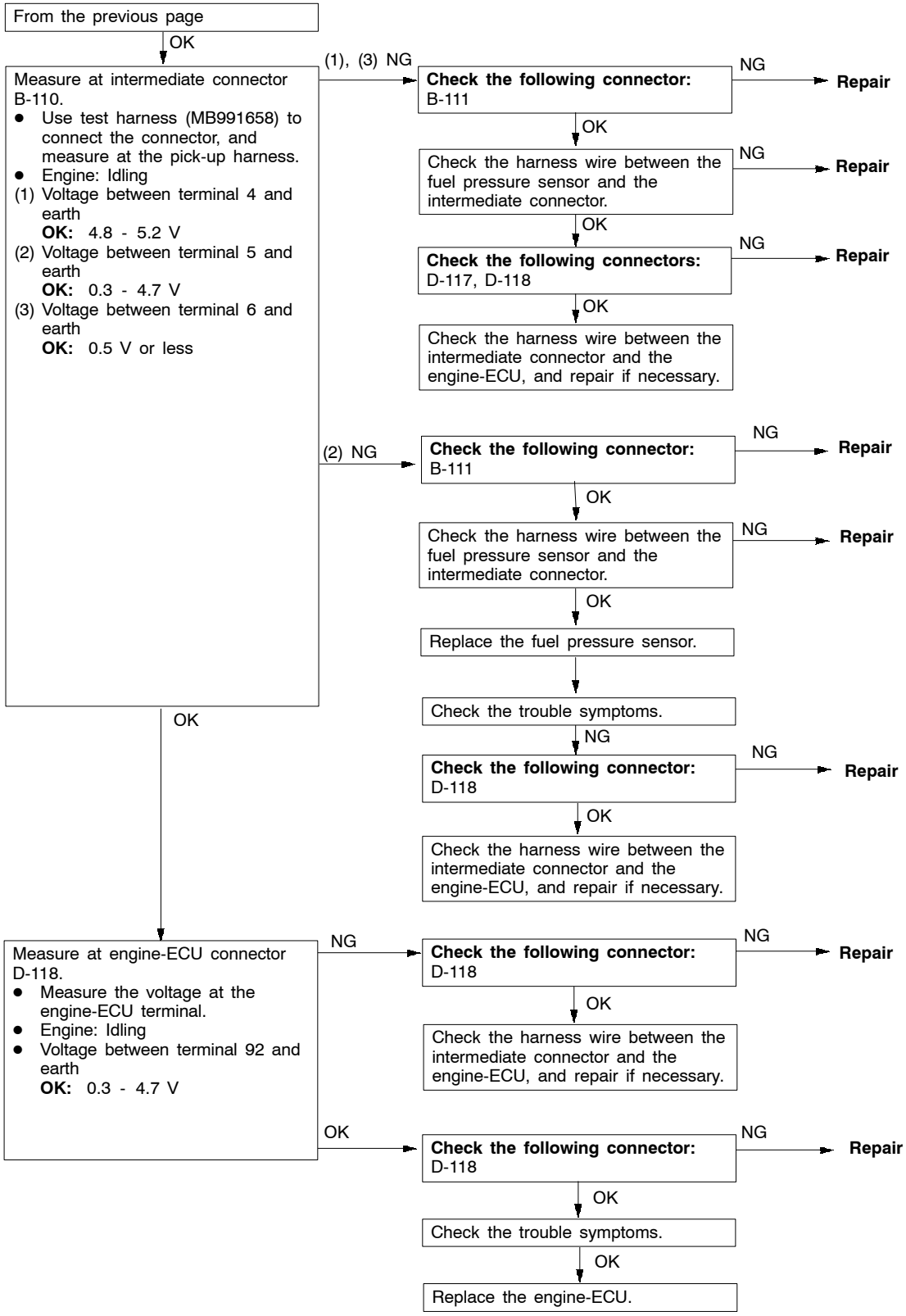
Code No.P0170 Abnormal fuel system	Probable cause
Range of Check • Engine: Being learning the air-fuel ratio Set Conditions • Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or • Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	• Malfunction of fuel supply system • Malfunction of oxygen sensor (front) • Malfunction of intake air temperature sensor • Malfunction of barometric pressure sensor • Malfunction of air flow sensor • Malfunction of engine-ECU



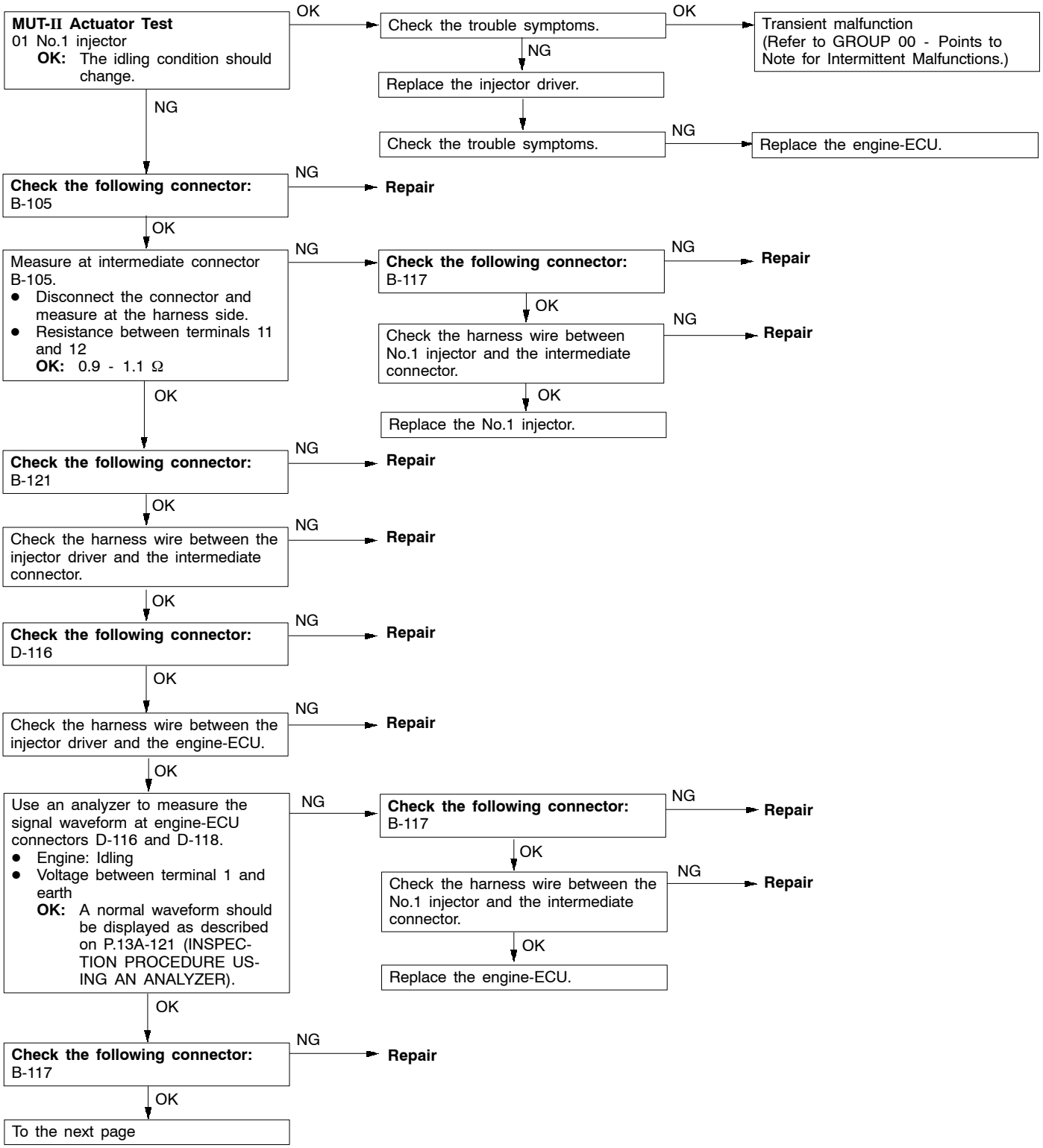

From the previous page
OK
Check the EGR valve (Refer to GROUP 17 - Emission Control).
NG
Replace
OK
Check the fuel pressure between the fuel pump (low-pressure) and the fuel pump (high-pressure) (Refer to P.13A-222).
NG
Repair
OK
Check the fuel lines for fuel leaks.
NG
Repair
OK
Check the injectors for clogging or leaks.
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

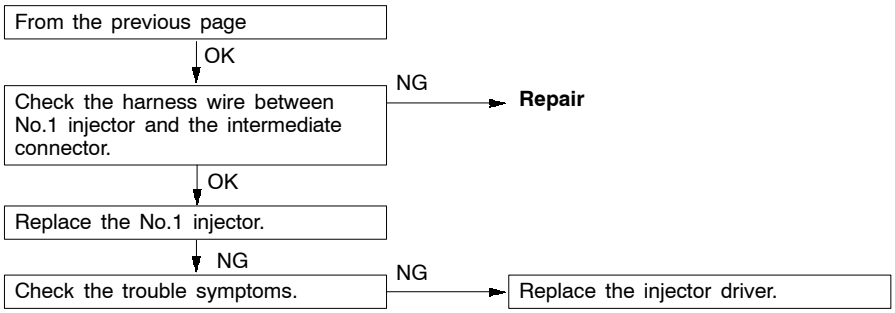
Code No.P0190 Abnormal fuel pressure	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 4.8V or more, or 0.2 V or less for four seconds.	● Malfunction of of fuel pressure sensor ● Open or short circuit in the fuel pressure sensor circuit or loose connector contact ● Malfunction of engine-ECU
Range of Check ● The following conditions are detected temporarily after the engine has been started. (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● Engine running Set Conditions ● The fuel pressure is 6.9 MPa or more, or 2 MPa or less for four seconds.	● Malfunction of high-pressure fuel pump ● Clogging of high-pressure fuel lines
This diagnosis code will also be output when air is trapped into the high-pressure fuel lines (such as poor fuel level). In that case, the air can be evacuated by operating the engine for at least 15 seconds at 2,000 r/min. After the repair, use the MUT-II to erase the diagnosis code.	● Air trapped due to poor fuel level



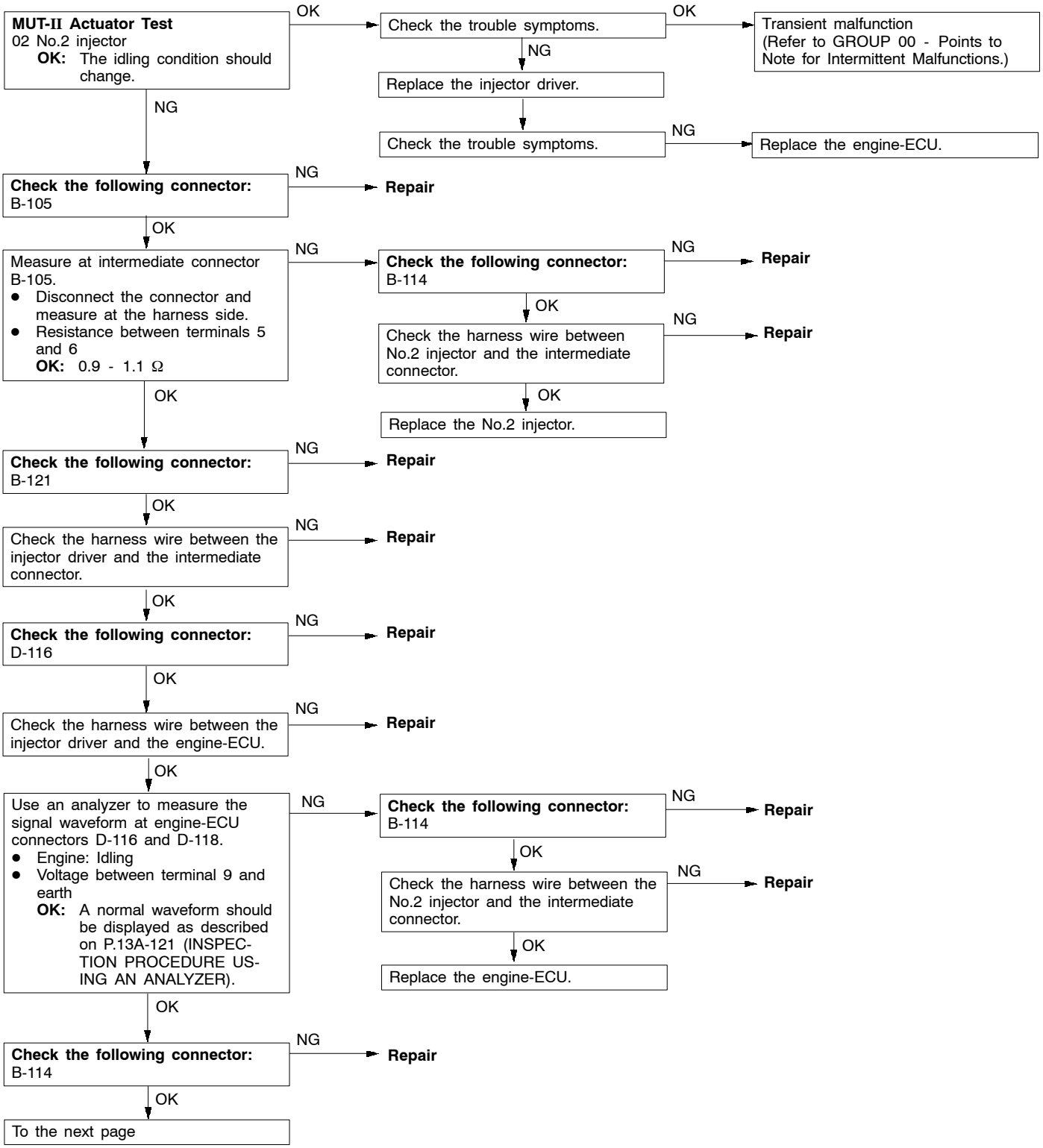

From the previous page
OK
Measure at intermediate connector B-110.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
(1) Voltage between terminal 4 and earth
OK: 4.8 - 5.2 V
(2) Voltage between terminal 5 and earth
OK: 0.3 - 4.7 V
(3) Voltage between terminal 6 and earth
OK: 0.5 V or less
(1), (3) NG
Check the following connector: B-111
NG
Repair
OK
Check the harness wire between the fuel pressure sensor and the intermediate connector.
NG
Repair
OK
Check the following connectors: D-117, D-118
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-ECU, and repair if necessary.
(2) NG
Check the following connector: B-111
NG
Repair
OK
Check the harness wire between the fuel pressure sensor and the intermediate connector.
NG
Repair
OK
Replace the fuel pressure sensor.
Check the trouble symptoms.
NG
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector D-118.
● Measure the voltage at the engine-ECU terminal.
● Engine: Idling
● Voltage between terminal 92 and earth
OK: 0.3 - 4.7 V
NG
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-118
NG
Repair
OK
Check the trouble symptoms.
OK
Replace the engine-ECU.

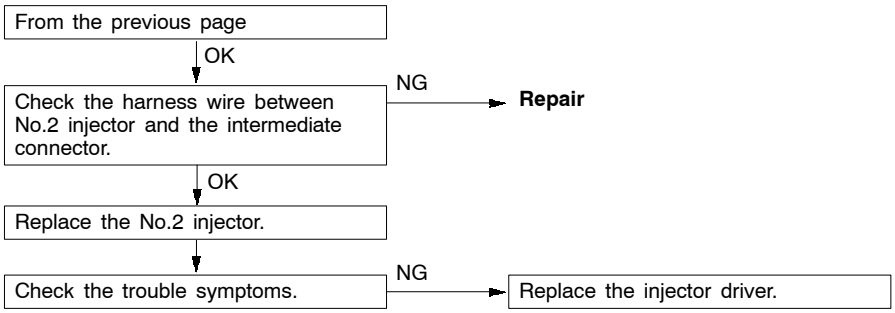
Code No.P0201 No.1 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.1 injector ● Open or short circuit in the No.1 injector circuit or loose connector contact ● Malfunction of engine-ECU



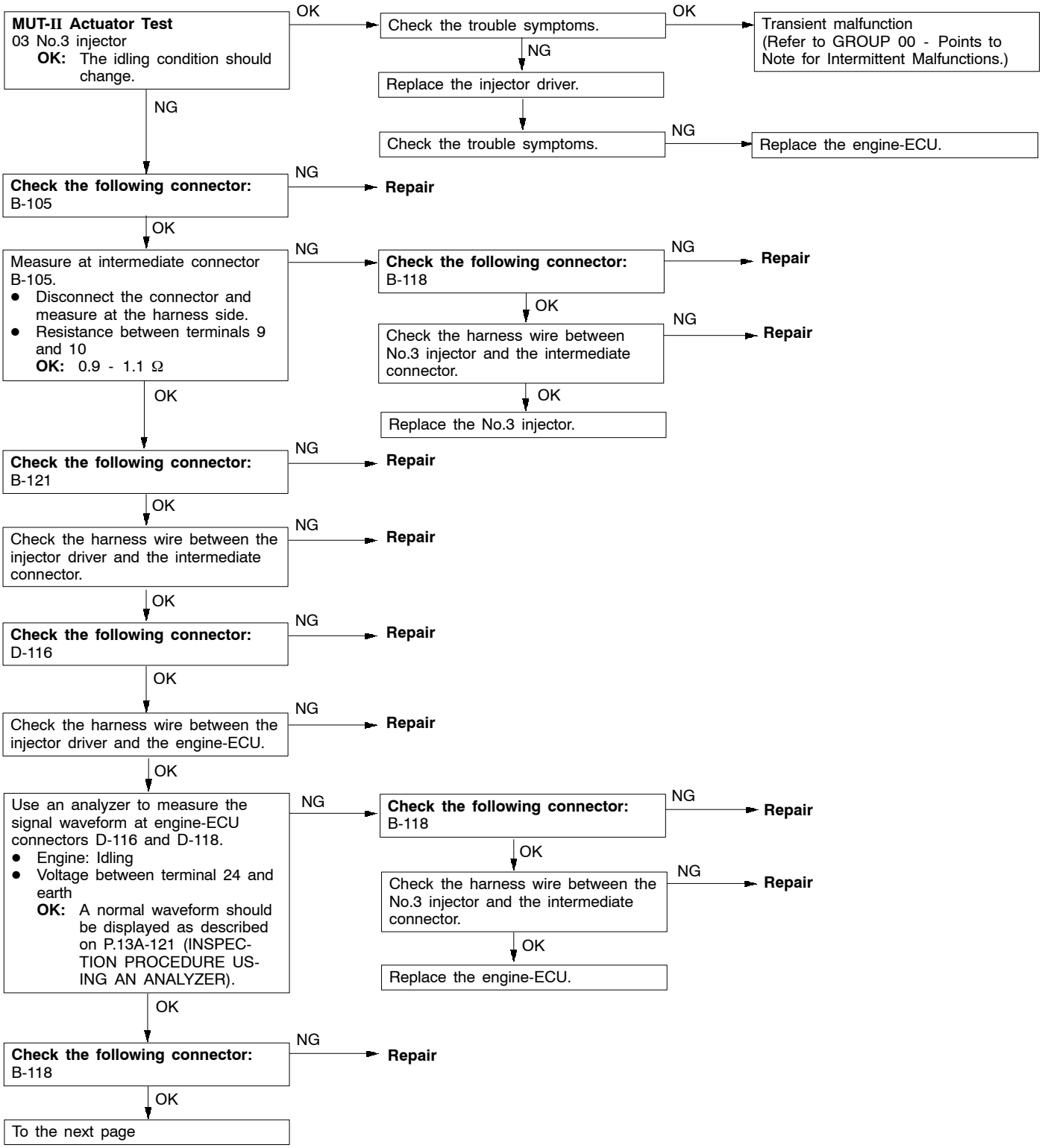

From the previous page
OK
Check the harness wire between No.1 injector and the intermediate connector.
NG
Repair
OK
Replace the No.1 injector.
NG
Check the trouble symptoms.
NG
Replace the injector driver.

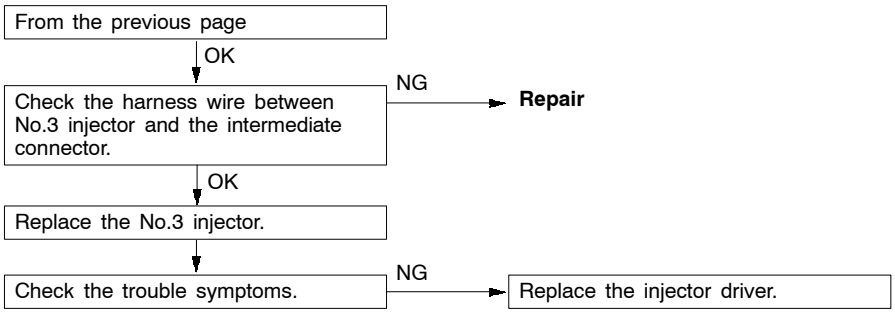
Code No.P0202 No.2 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.2 injector ● Open or short circuit in the No.2 injector circuit or loose connector contact ● Malfunction of engine-ECU



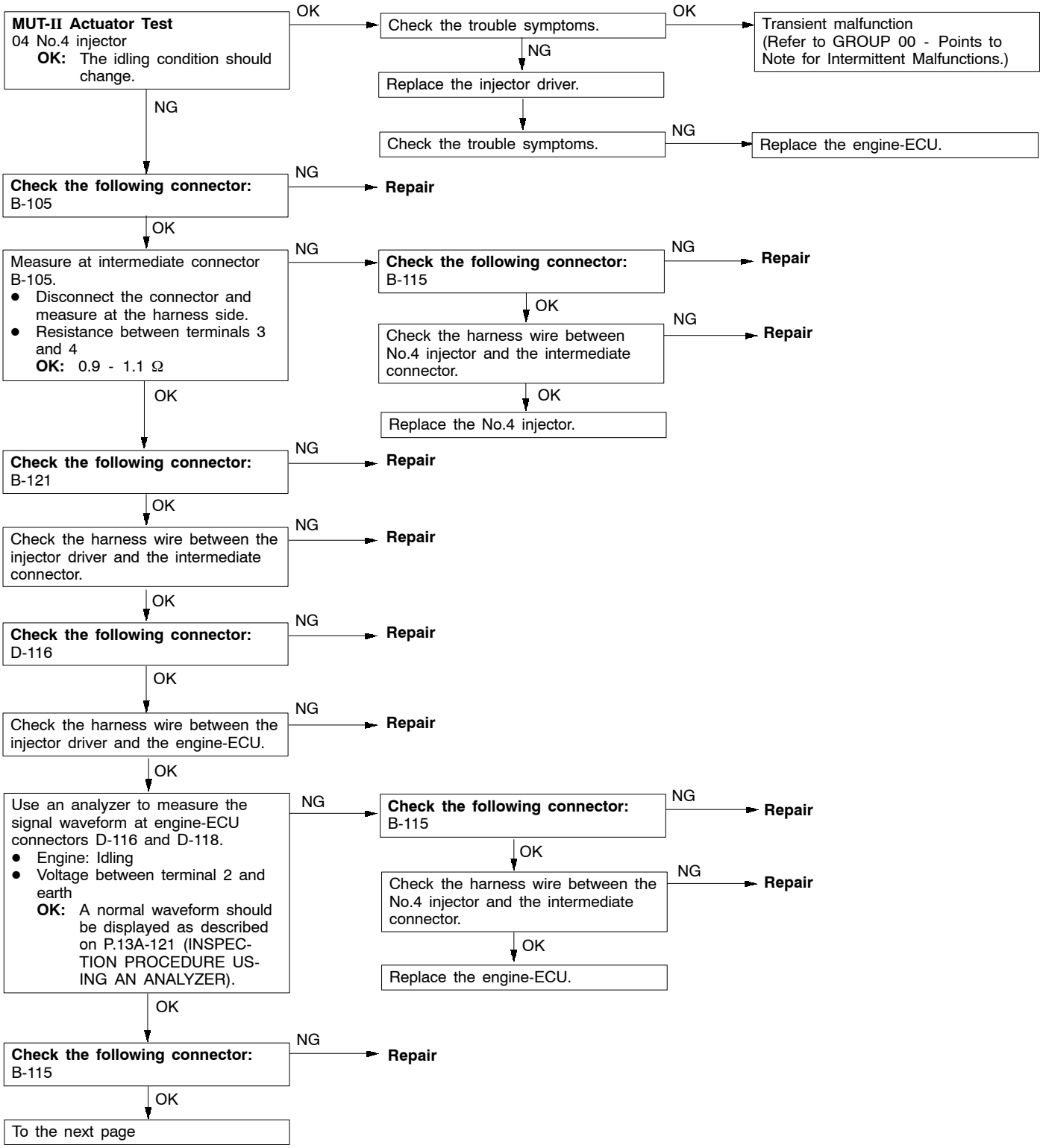

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OK
Check the harness wire between No.2 injector and the intermediate connector.
NG
Repair
OK
Replace the No.2 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

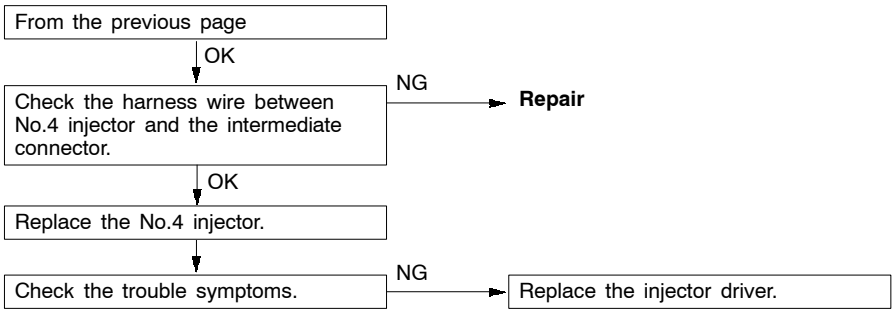
Code No.P0203 No.3 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.3 injector ● Open or short circuit in the No.3 injector circuit or loose connector contact ● Malfunction of engine-ECU



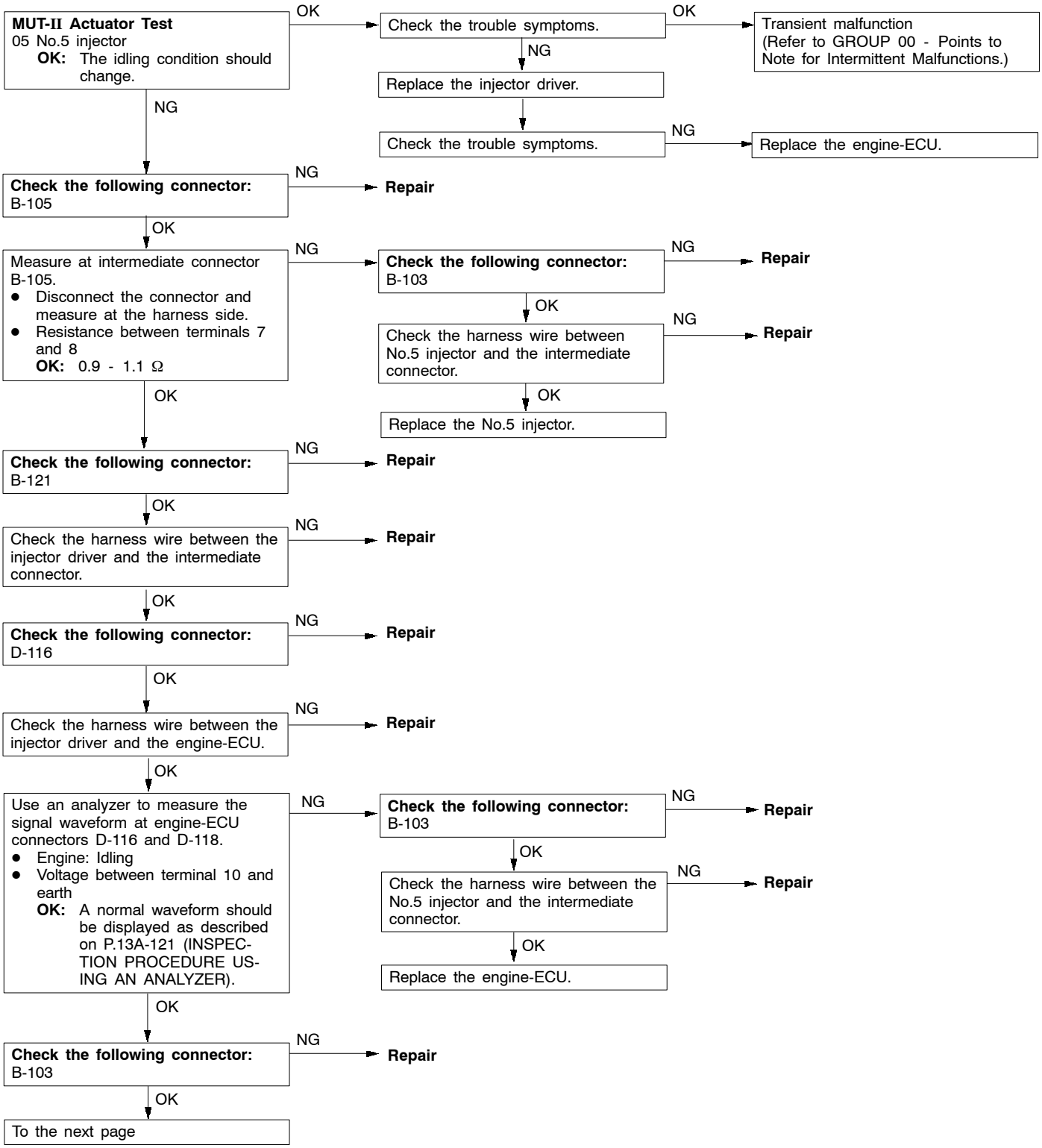

From the previous page
OK
Check the harness wire between No.3 injector and the intermediate connector.
NG
Repair
OK
Replace the No.3 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

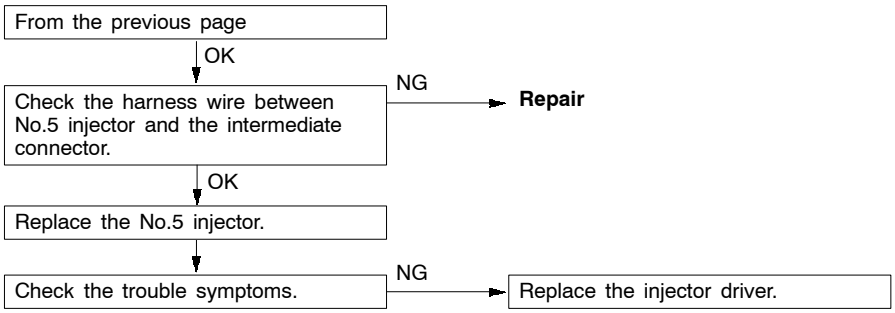
Code No.P0204 No.4 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.4 injector ● Open or short circuit in the No.4 injector circuit or loose connector contact ● Malfunction of engine-ECU



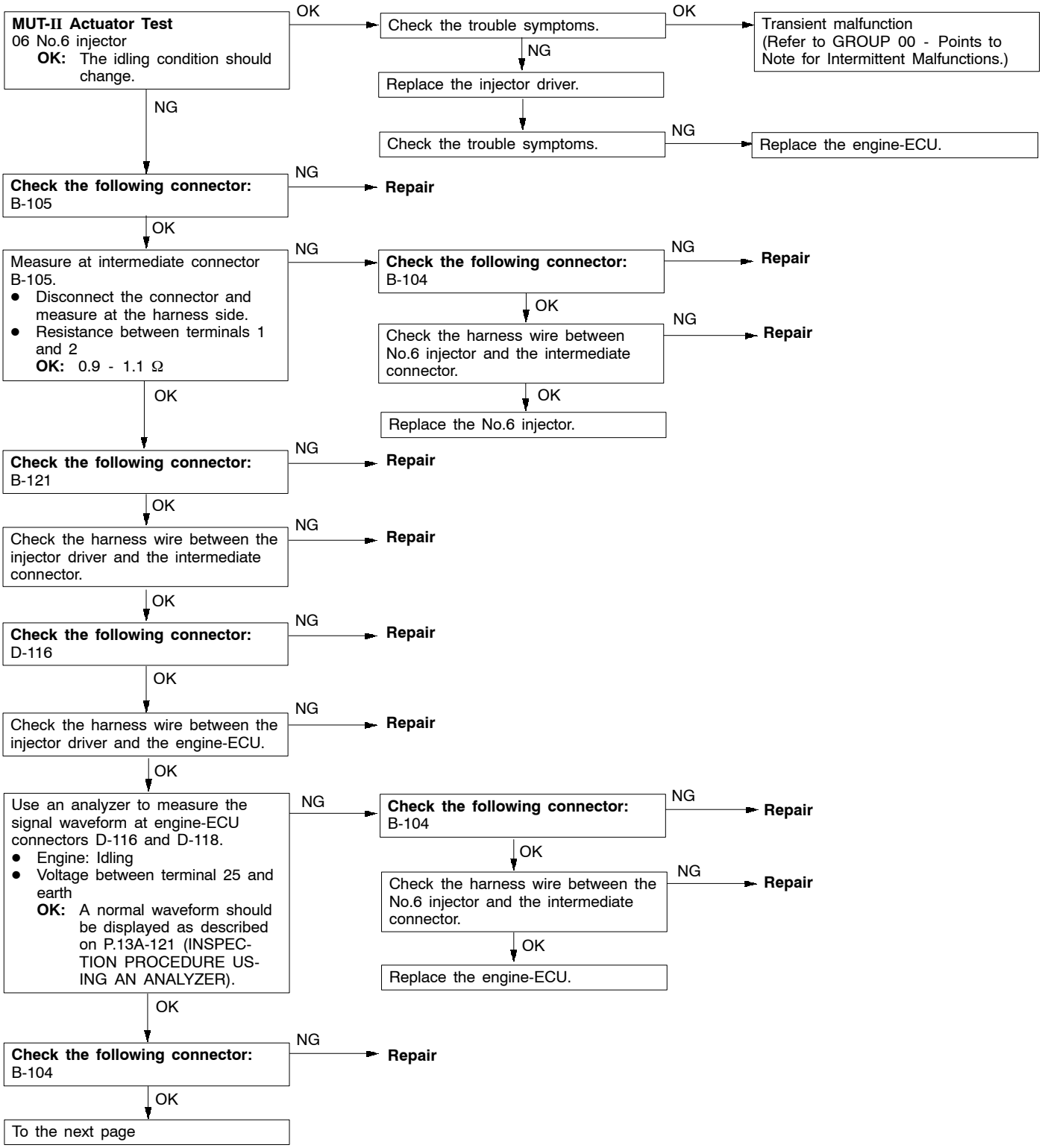

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OK
Check the harness wire between No.4 injector and the intermediate connector.
NG
Repair
OK
Replace the No.4 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

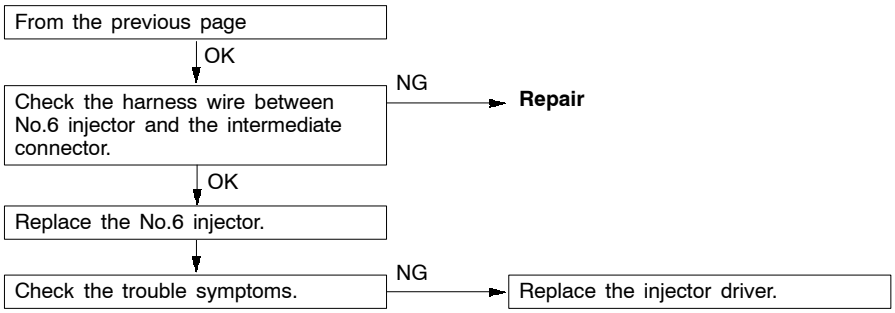
Code No.P0205 No.5 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.5 injector ● Open or short circuit in the No.5 injector circuit or loose connector contact ● Malfunction of engine-ECU



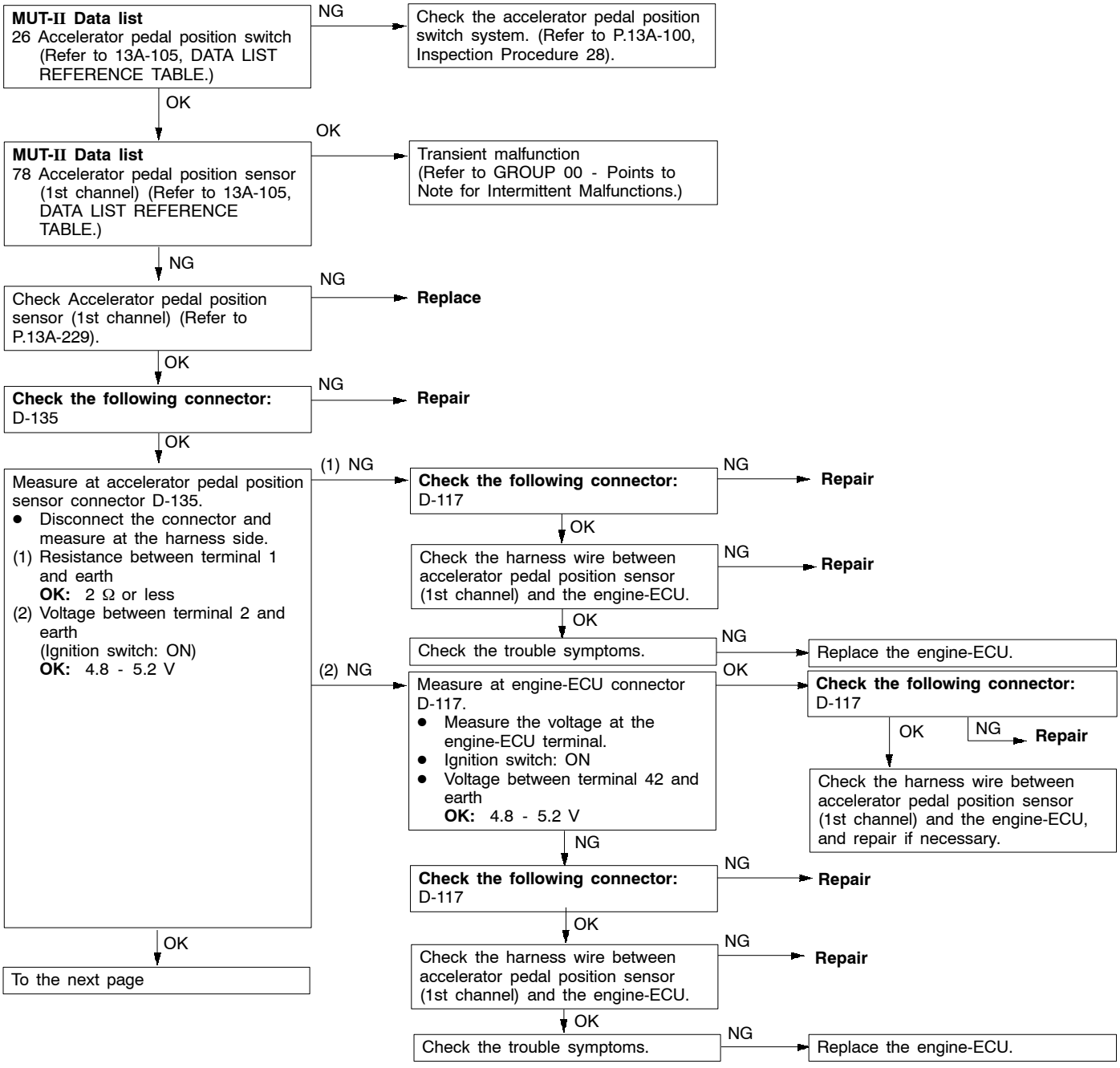

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OK
Check the harness wire between No.5 injector and the intermediate connector.
NG
Repair
OK
Replace the No.5 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

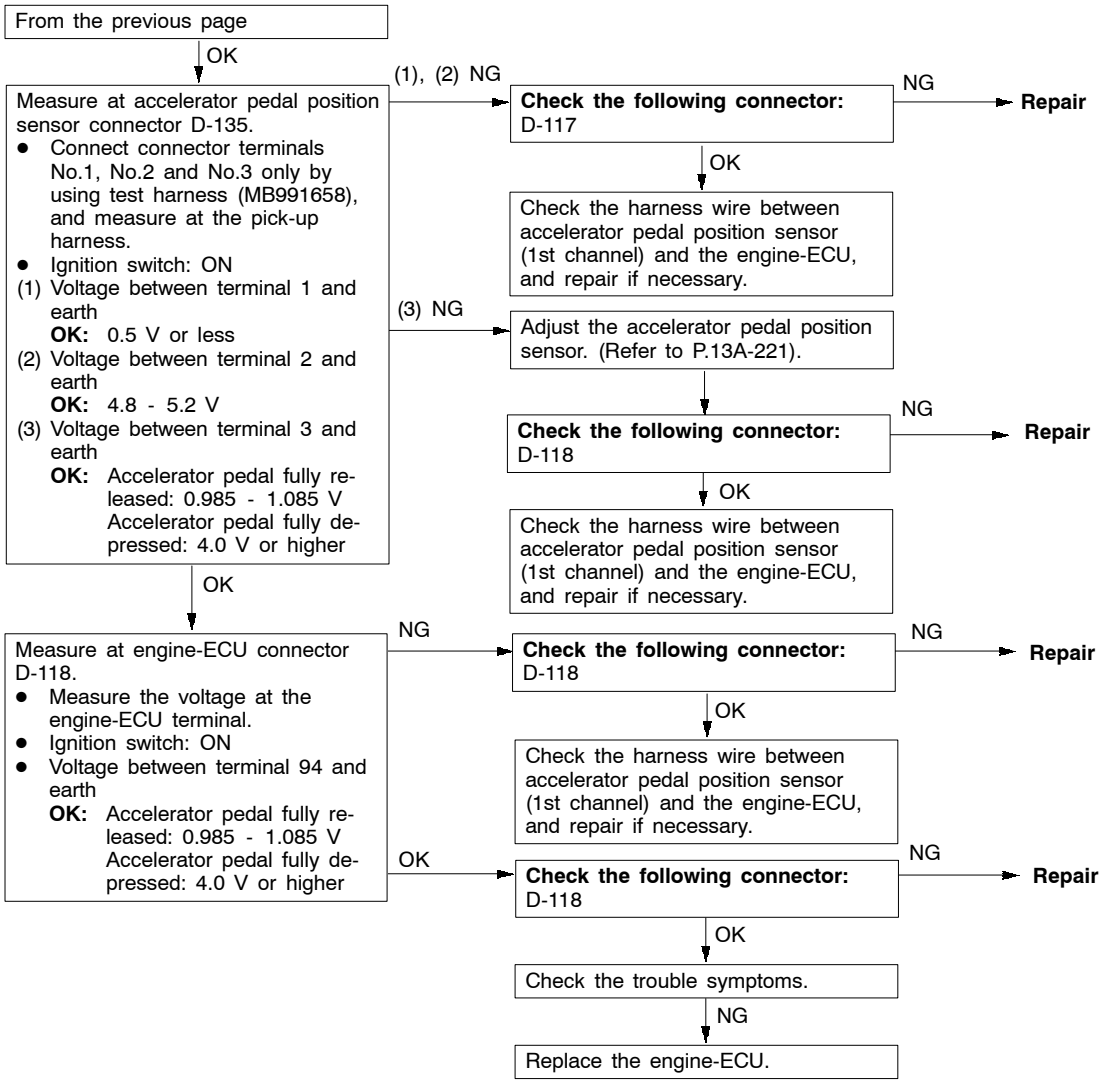
Code No.P0206 No.6 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of No.6 injector ● Open or short circuit in the No.6 injector circuit or loose connector contact ● Malfunction of engine-ECU



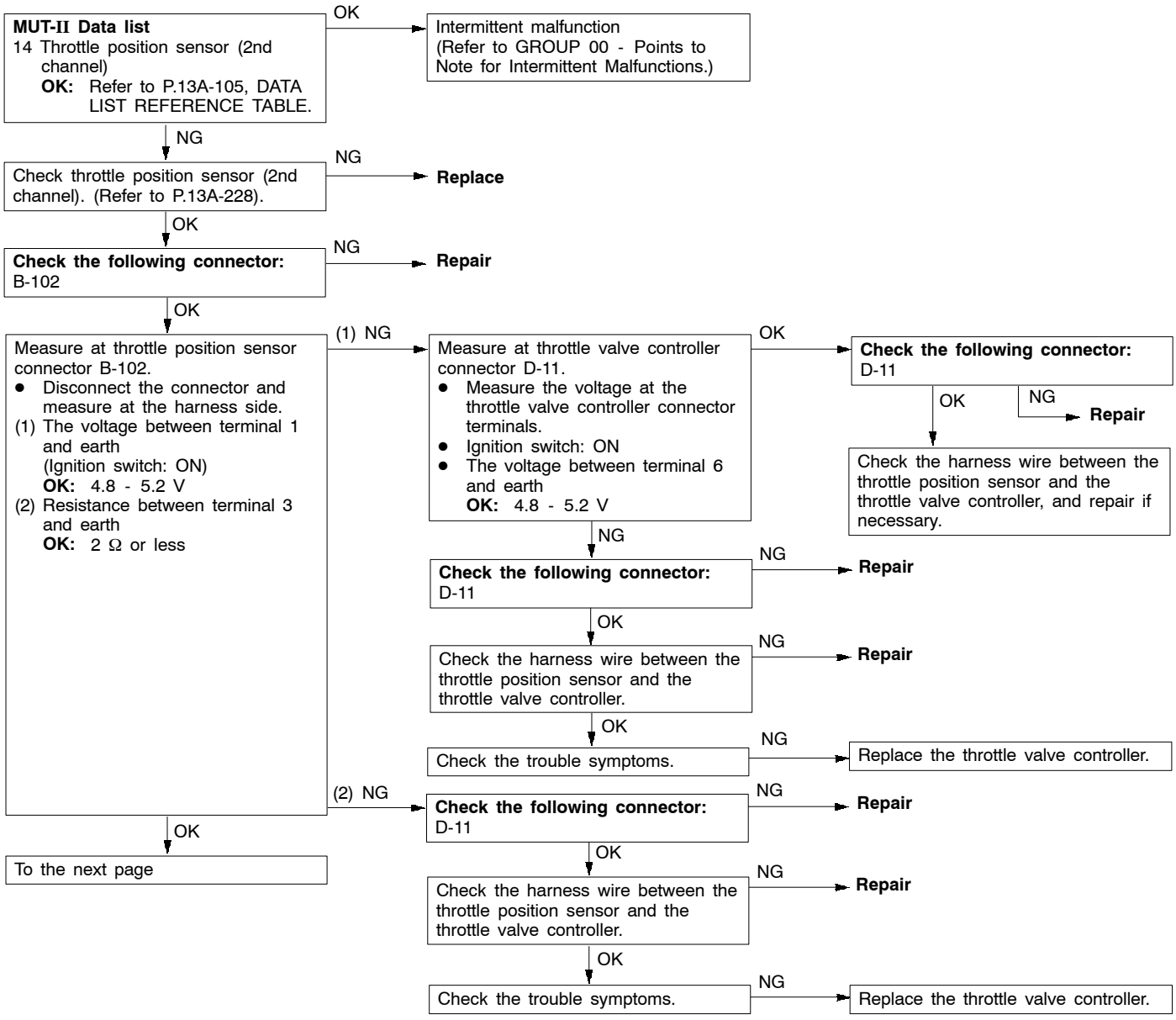

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OK
Check the harness wire between No.6 injector and the intermediate connector.
NG
Repair
OK
Replace the No.6 injector.
Check the trouble symptoms.
NG
Replace the injector driver.

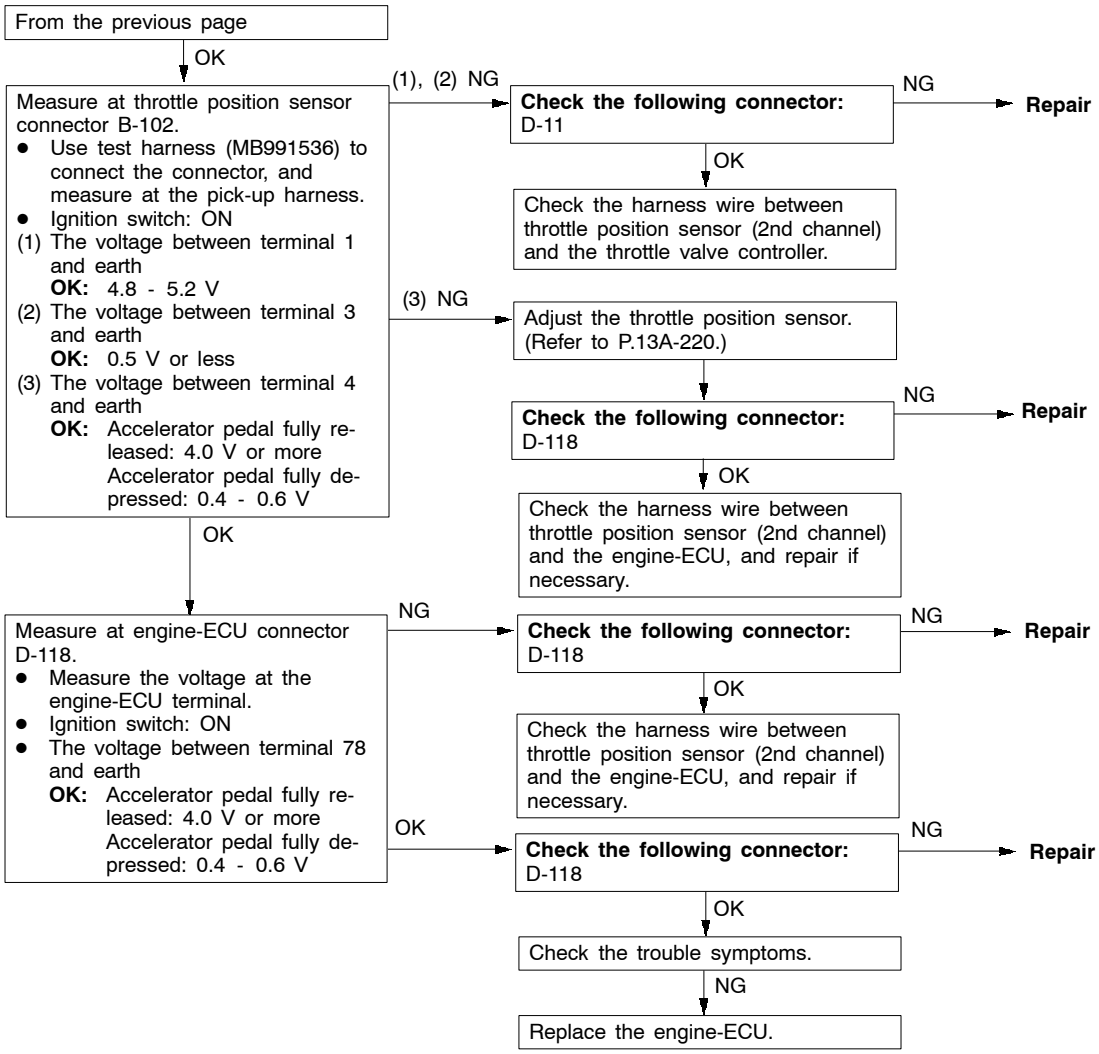
Code No.P0220 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of Check ● Accelerator pedal position sensor (2nd channel) is normal. ● Communication between the engine-ECU and the throttle valve controller is normal. Set Conditions ● The output voltage of accelerator pedal position sensor (1st channel) is 0.2 V or less for one second. or ● The output voltage of accelerator pedal position sensor (2nd channel) is 2.5 V or less, and that of accelerator pedal position sensor (1st channel) is 4.5 V or more for one second or ● The difference between accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) output voltages is 1.0 V or more (i.e. the throttle opening angle changes slightly). or ● The output voltage of accelerator pedal position sensor (1st channel) is 1.1 V or more for one second when the accelerator pedal position switch is turned on.	● Malfunction of accelerator pedal position sensor (1st channel) ● Open or short circuit in the accelerator pedal position sensor (1st channel) circuit or loose connector contact ● Accelerator pedal position switch seized ON ● Malfunction of throttle valve controller ● Malfunction of engine-ECU



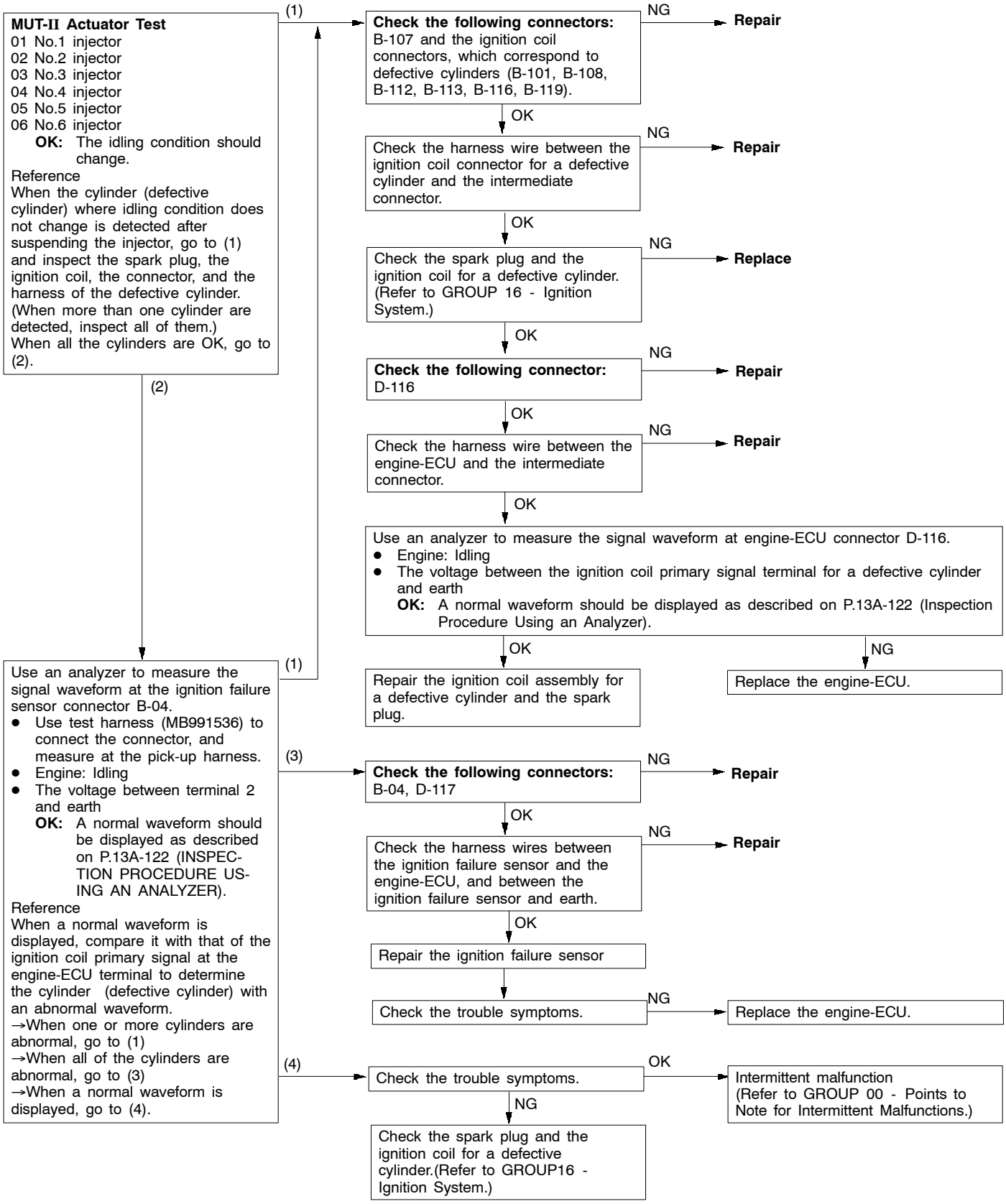

From the previous page
OK
Measure at accelerator pedal position sensor connector D-135.
● Connect connector terminals No.1, No.2 and No.3 only by using test harness (MB991658), and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 0.5 V or less
(2) Voltage between terminal 2 and earth
OK: 4.8 - 5.2 V
(3) Voltage between terminal 3 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
(1), (2) NG
Check the following connector: D-117
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-ECU, and repair if necessary.
(3) NG
Adjust the accelerator pedal position sensor. (Refer to P.13A-221).
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector D-118.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 94 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
NG
Check the following connector: D-118
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-ECU, and repair if necessary.
OK
Check the following connector: D-118
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

Code No.0225 Throttle position sensor (2nd channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check ● Ignition switch: ON ● The throttle position sensor (1st channel) is normal. Set Conditions ● The sensor output voltage is 0.2 V or less for four seconds. or ● The sensor output voltage is 4.85 V or more for four seconds, and the output voltage of the throttle position sensor (1st channel) is 1.2 V or more. or ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V.	● Malfunction of throttle position sensor (2nd channel) ● Open or short circuit in the throttle position sensor (2nd channel) circuit or loose connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU

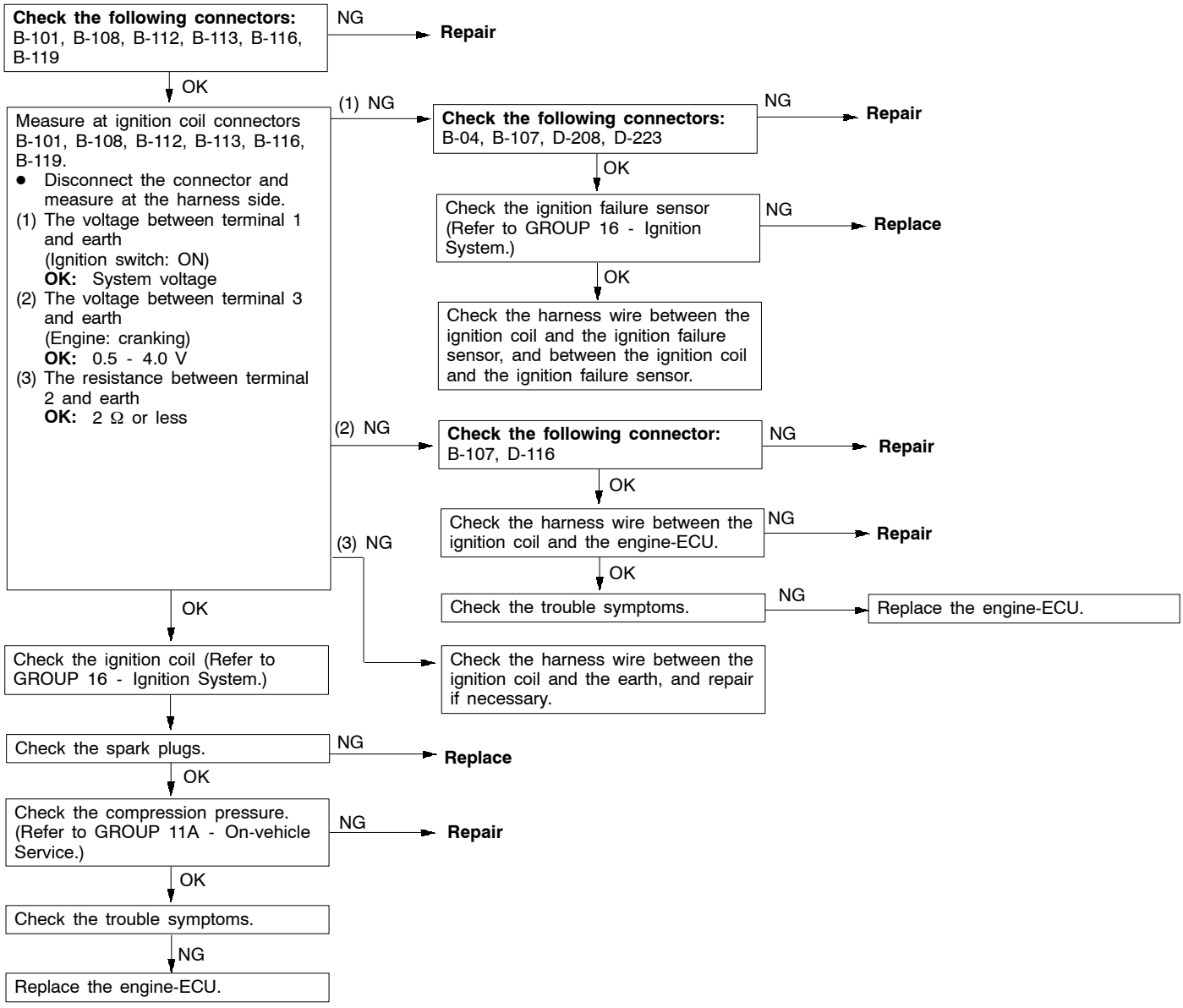




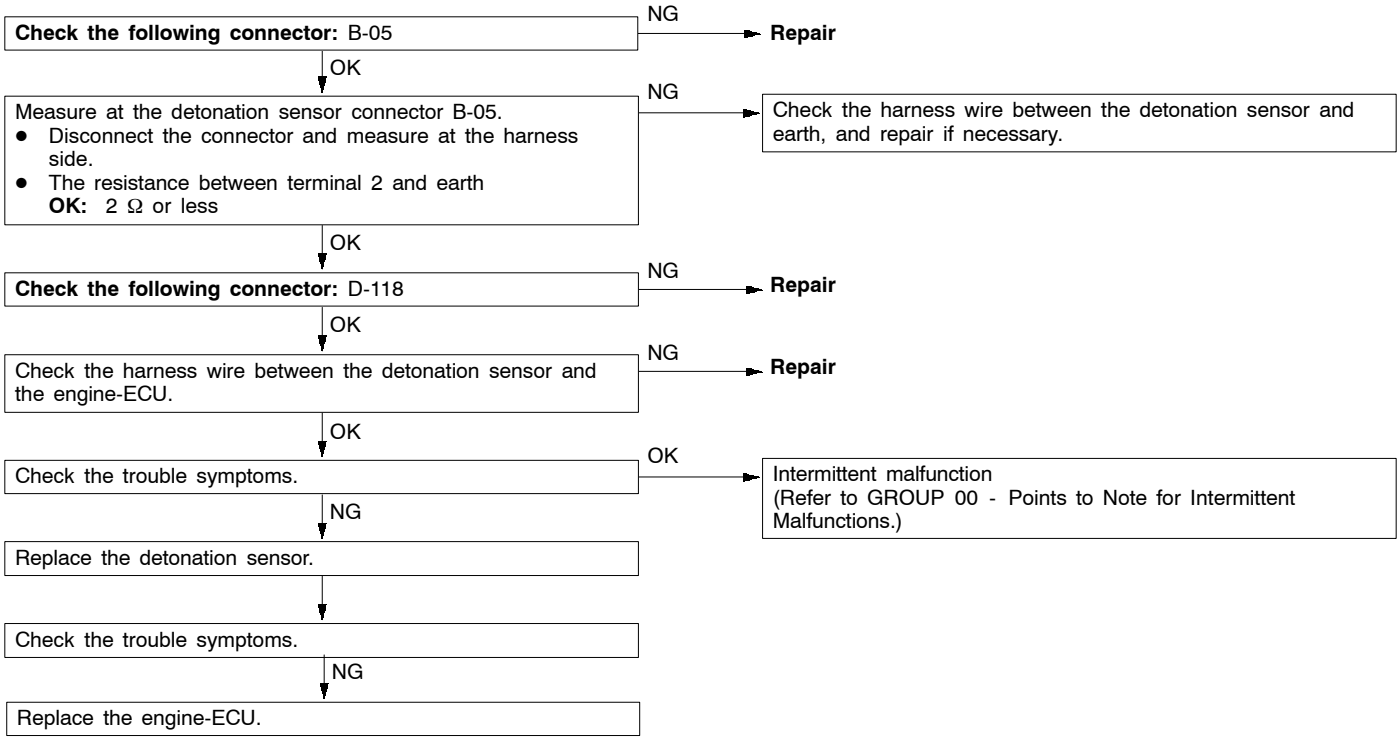
Code No.P0300 Ignition coil (power transistor) system	Probable cause
Range of Check ● Engine speed is approx. 50 - 4,000 r/min. ● Engine is not cranking. Set Conditions ● The ignition failure sensor does not send a signal about a certain cylinder for four seconds.	● Malfunction of the ignition coil ● Malfunction of the ignition failure sensor ● Malfunction of spark plug ● Open or short circuit in the primary ignition circuit or loose connector contact ● Malfunction of engine-ECU


MUT-II Actuator Test
01 No.1 injector
02 No.2 injector
03 No.3 injector
04 No.4 injector
05 No.5 injector
06 No.6 injector
OK: The idling condition should change.
Reference
When the cylinder (defective cylinder) where idling condition does not change is detected after suspending the injector, go to (1) and inspect the spark plug, the ignition coil, the connector, and the harness of the defective cylinder. (When more than one cylinder are detected, inspect all of them.)
When all the cylinders are OK, go to (2).
(1)
Check the following connectors: B-107 and the ignition coil connectors, which correspond to defective cylinders (B-101, B-108, B-112, B-113, B-116, B-119).
NG
Repair
OK
Check the harness wire between the ignition coil connector for a defective cylinder and the intermediate connector.
NG
Repair
OK
Check the spark plug and the ignition coil for a defective cylinder. (Refer to GROUP 16 - Ignition System.)
NG
Replace
OK
Check the following connector: D-116
NG
Repair
OK
Check the harness wire between the engine-ECU and the intermediate connector.
NG
Repair
OK
Use an analyzer to measure the signal waveform at engine-ECU connector D-116.
Engine: Idling
The voltage between the ignition coil primary signal terminal for a defective cylinder and earth
OK: A normal waveform should be displayed as described on P.13A-122 (Inspection Procedure Using an Analyzer).
OK
NG
Repair the ignition coil assembly for a defective cylinder and the spark plug.
Replace the engine-ECU.
(2)
Use an analyzer to measure the signal waveform at the ignition failure sensor connector B-04.
Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
Engine: Idling
The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-122 (INSPECTION PROCEDURE USING AN ANALYZER).
Reference
When a normal waveform is displayed, compare it with that of the ignition coil primary signal at the engine-ECU terminal to determine the cylinder (defective cylinder) with an abnormal waveform.
→When one or more cylinders are abnormal, go to (1)
→When all of the cylinders are abnormal, go to (3)
→When a normal waveform is displayed, go to (4).
(1)
(3)
Check the following connectors: B-04, D-117
NG
Repair
OK
Check the harness wires between the ignition failure sensor and the engine-ECU, and between the ignition failure sensor and earth.
NG
Repair
OK
Repair the ignition failure sensor
Check the trouble symptoms.
NG
Replace the engine-ECU.
(4)
Check the trouble symptoms.
OK
Intermittent malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Check the spark plug and the ignition coil for a defective cylinder.(Refer to GROUP16 - Ignition System.)

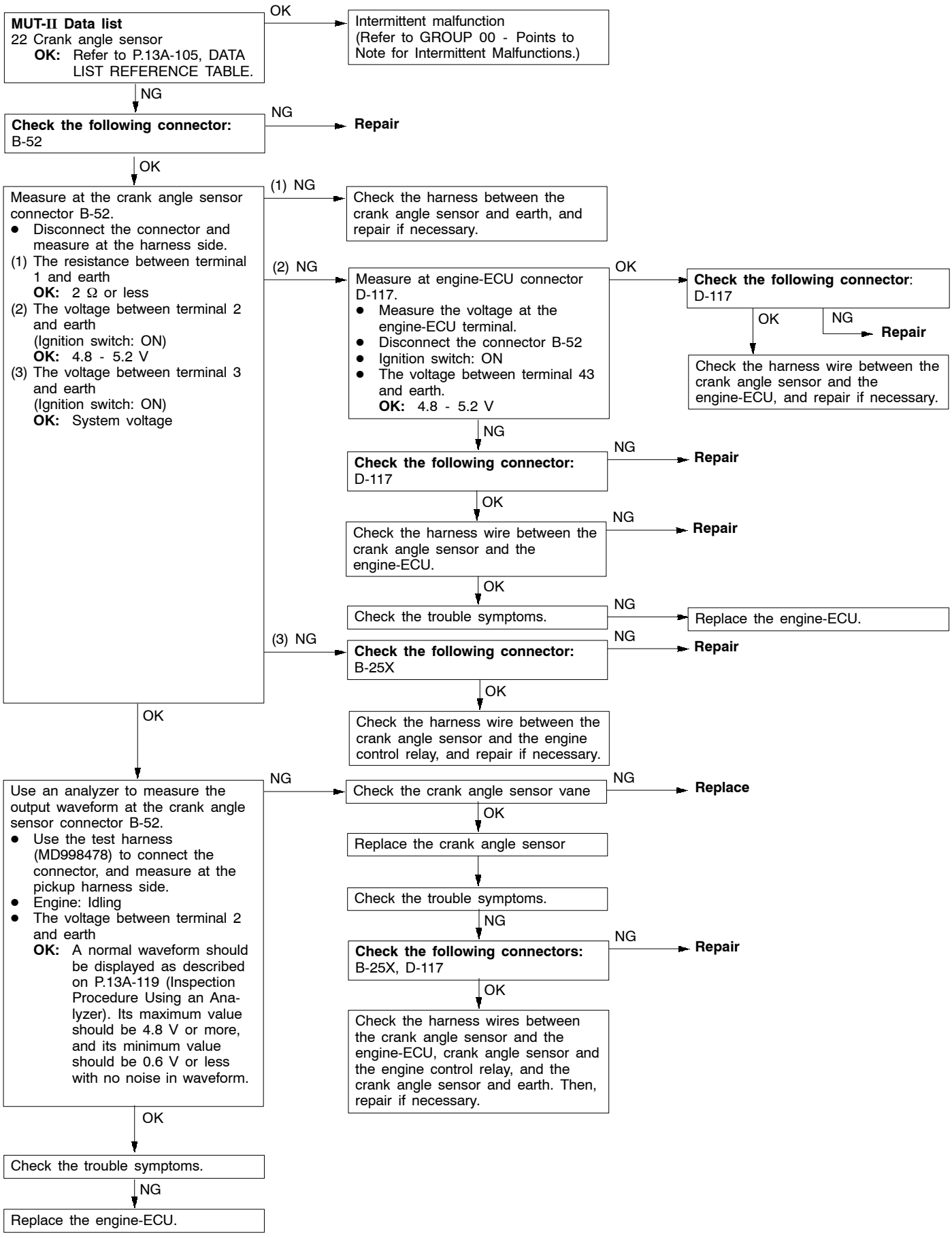
Code No.P0301 No.1 cylinder misfire detected. **Code No.P0302 No.2 cylinder misfire detected.** **Code No.P0303 No.3 cylinder misfire detected.** **Code No.P0304 No.4 cylinder misfire detected.** **Code No.P0305 No.5 cylinder misfire detected.**	**Probable cause**
Range of Check ● The engine speed is 500 - 4,500 r/min. ● While the engine is running except deceleration and sudden acceleration. Set Conditions ● The number of misfires exceeds a predetermined number per 200 engine revolutions (Misfire has occurred in only one cylinder). or ● The number of misfires exceeds a predetermined number per 100 engine revolutions (Misfire has occurred in only one cylinder).	● Malfunction of the ignition system ● Abnormal compression ● Malfunction of injector ● Malfunction of engine-ECU



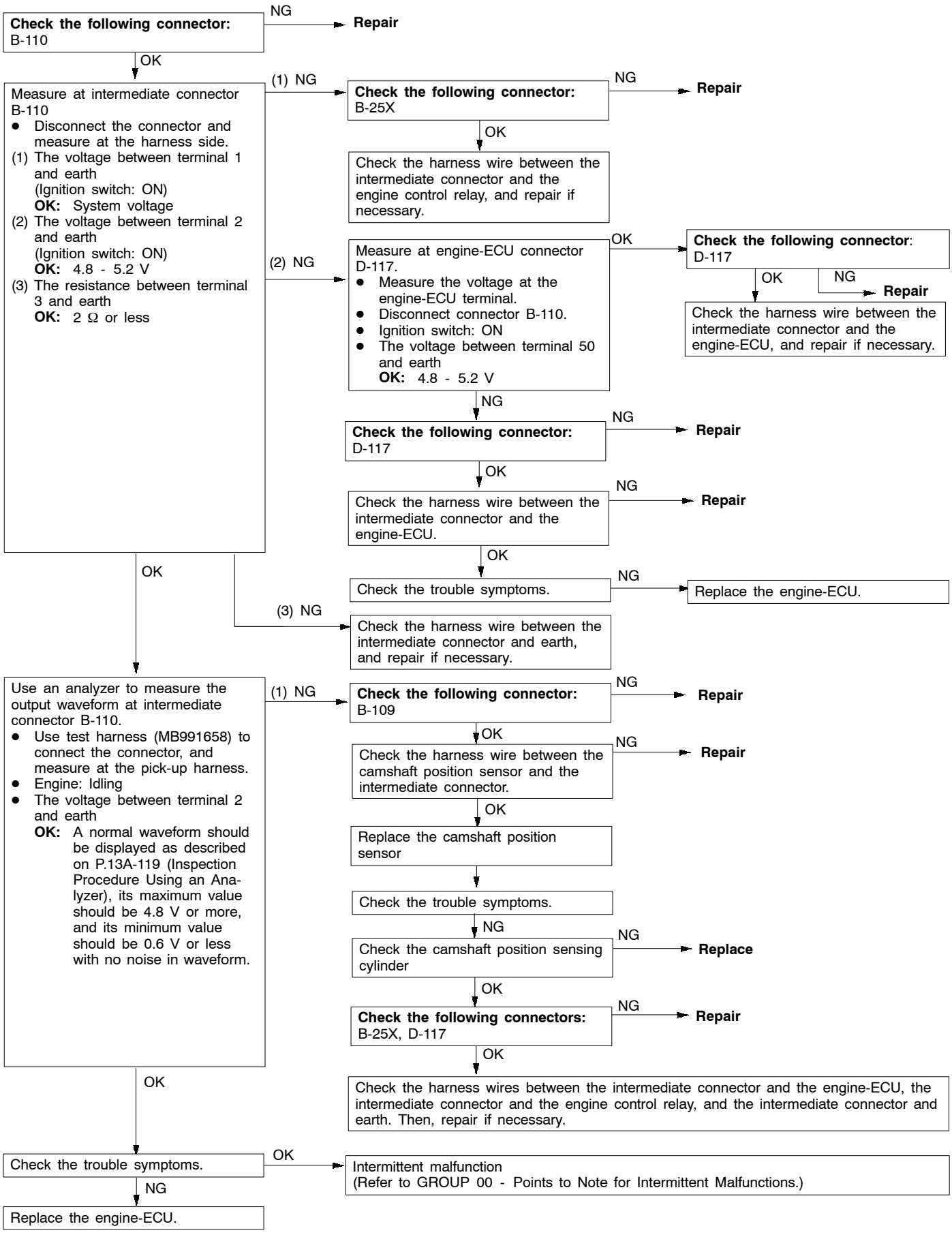
Code No.P0325 Detonation sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● Changes in sensor output voltage (detonation sensor peak voltage per 1/3 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	● Malfunction of the detonation sensor ● Open or short circuit in the detonation sensor circuit or loose connector contact ● Malfunction of engine-ECU



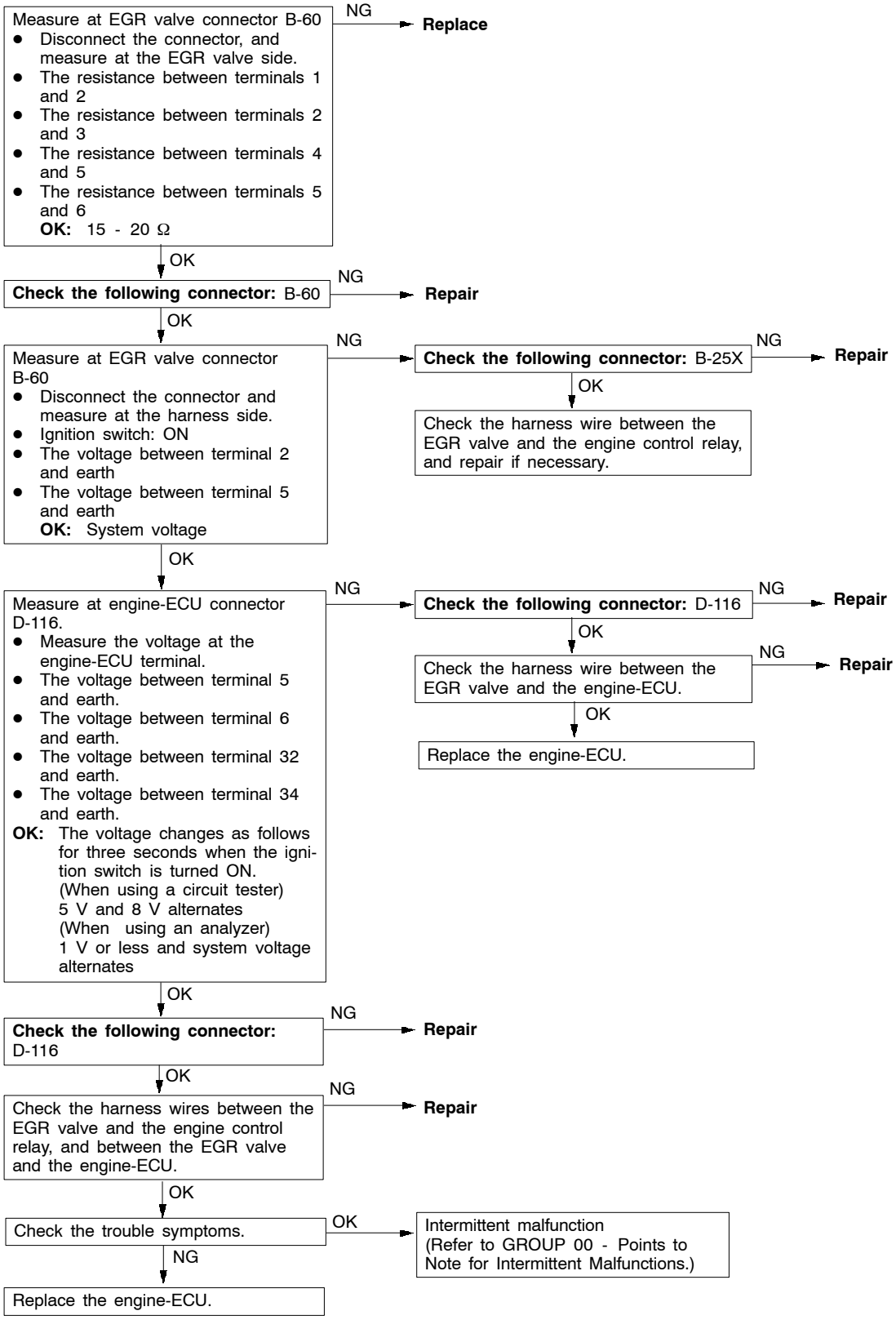
Code No.P0335 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking Set Conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the crank angle sensor. ● Open or short circuit in the crank angle sensor circuit or loose connector contact. ● Malfunction of engine-ECU


MUT-II Data list
22 Crank angle sensor
OK: Refer to P.13A-105, DATA LIST REFERENCE TABLE.
OK
Intermittent malfunction
(Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Check the following connector:
B-52
NG
Repair
OK
Measure at the crank angle sensor connector B-52.
Disconnect the connector and measure at the harness side.
(1) The resistance between terminal 1 and earth
OK: 2 Ω or less
(2) The voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) The voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage
(1) NG
Check the harness between the crank angle sensor and earth, and repair if necessary.
(2) NG
Measure at engine-ECU connector D-117.
Measure the voltage at the engine-ECU terminal.
Disconnect the connector B-52
Ignition switch: ON
The voltage between terminal 43 and earth.
OK: 4.8 - 5.2 V
OK
Check the following connector: D-117
OK
NG
Repair
Check the harness wire between the crank angle sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector:
D-117
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(3) NG
Check the following connector:
B-25X
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine control relay, and repair if necessary.
OK
Use an analyzer to measure the output waveform at the crank angle sensor connector B-52.
Use the test harness (MD998478) to connect the connector, and measure at the pickup harness side.
Engine: Idling
The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-119 (Inspection Procedure Using an Analyzer). Its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
NG
Check the crank angle sensor vane
NG
Replace
OK
Replace the crank angle sensor
Check the trouble symptoms.
NG
Check the following connectors:
B-25X, D-117
NG
Repair
OK
Check the harness wires between the crank angle sensor and the engine-ECU, crank angle sensor and the engine control relay, and the crank angle sensor and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

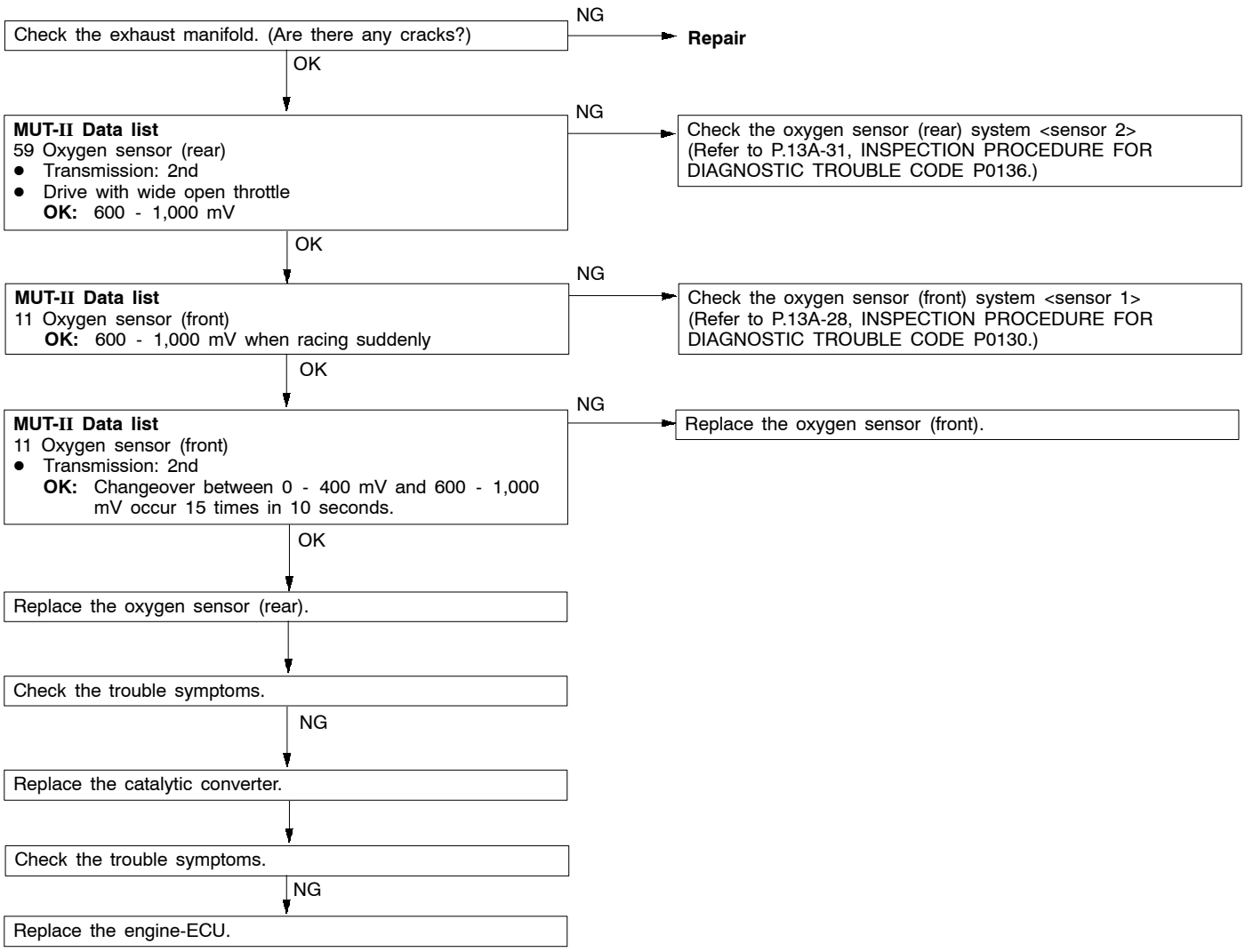
Code No.P0340 Camshaft position sensor system	Probable cause
Range of Check ● After the engine was started Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the camshaft position sensor ● Open or short circuit in the camshaft position sensor circuit or loose connector contact. ● Malfunction of engine-ECU


Check the following connector: B-110
NG
Repair
OK
Measure at intermediate connector B-110
● Disconnect the connector and measure at the harness side.
(1) The voltage between terminal 1 and earth (Ignition switch: ON)
OK: System voltage
(2) The voltage between terminal 2 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) The resistance between terminal 3 and earth
OK: 2 Ω or less
(1) NG
Check the following connector: B-25X
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine control relay, and repair if necessary.
(2) NG
Measure at engine-ECU connector D-117.
● Measure the voltage at the engine-ECU terminal.
● Disconnect connector B-110.
● Ignition switch: ON
● The voltage between terminal 50 and earth
OK: 4.8 - 5.2 V
OK
Check the following connector: D-117
OK
NG
Repair
Check the harness wire between the intermediate connector and the engine-ECU, and repair if necessary.
NG
Check the following connector: D-117
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
(3) NG
Check the harness wire between the intermediate connector and earth, and repair if necessary.
Use an analyzer to measure the output waveform at intermediate connector B-110.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-119 (Inspection Procedure Using an Analyzer), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
(1) NG
Check the following connector: B-109
NG
Repair
OK
Check the harness wire between the camshaft position sensor and the intermediate connector.
NG
Repair
OK
Replace the camshaft position sensor
Check the trouble symptoms.
NG
Check the camshaft position sensing cylinder
NG
Replace
OK
Check the following connectors: B-25X, D-117
NG
Repair
OK
Check the harness wires between the intermediate connector and the engine-ECU, the intermediate connector and the engine control relay, and the intermediate connector and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
OK
Intermittent malfunction
(Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

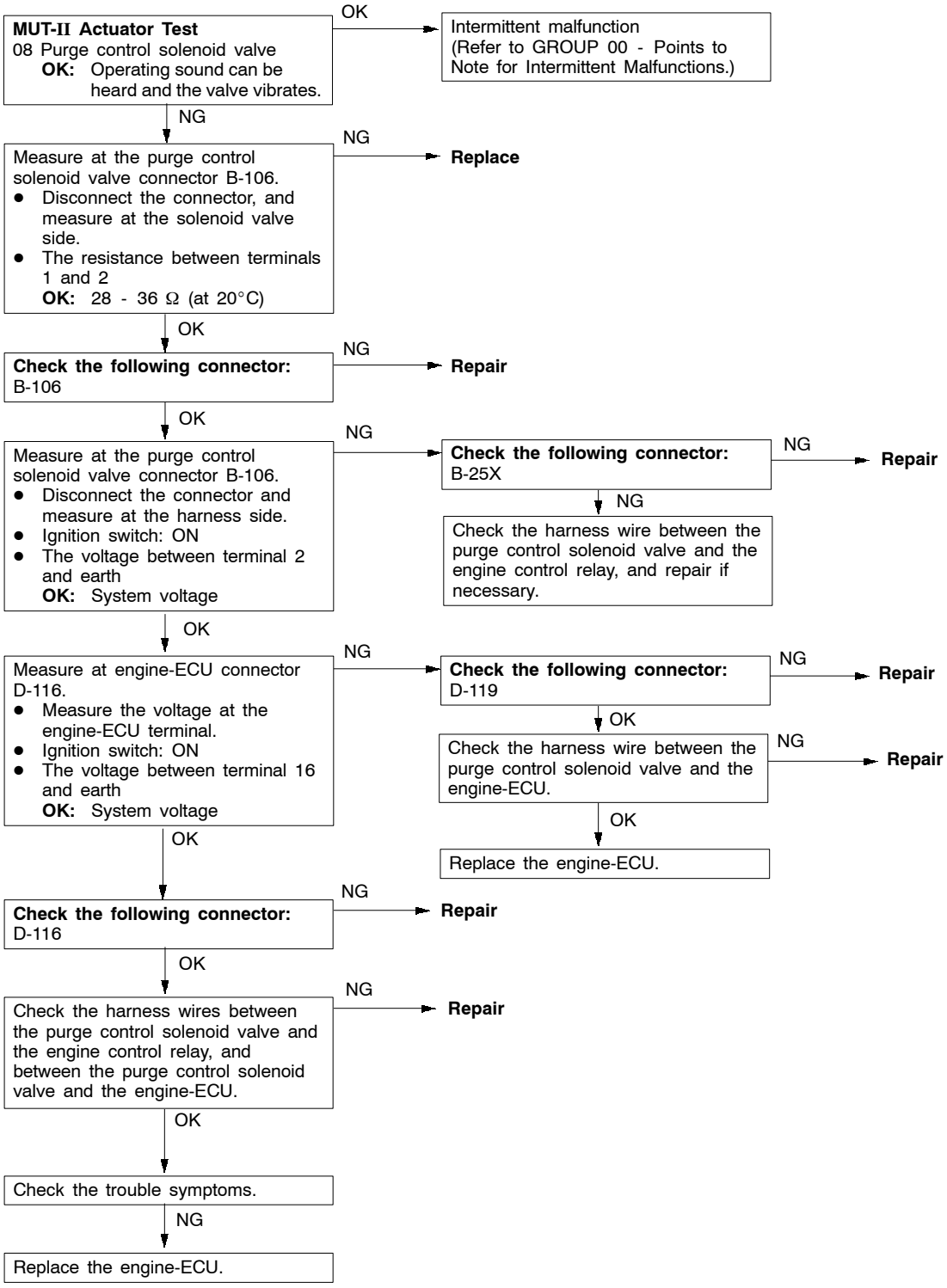
Code No.P0403 EGR valve system	Probable cause
Range of Check ● Ignition switch: OFF to ON ● EGR valve is in operation after the engine starting process is complete. Set Conditions ● Off-surge voltage is not generated from the motor coil while the EGR valve control motor is running.	● Malfunction of the EGR valve ● Open or short circuit in the EGR valve circuit or loose connector contact ● Malfunction of engine-ECU



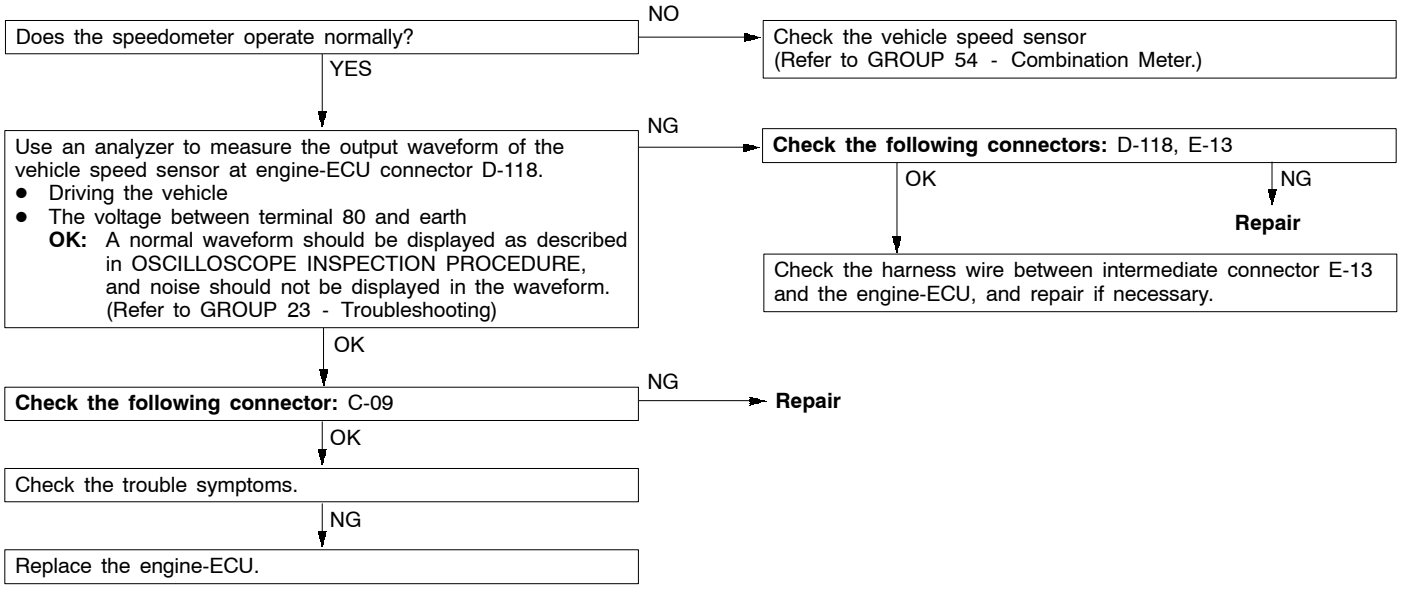
Code No.P0420 Catalyst malfunction	Probable cause
Range of Check ● The engine speed is 3,000 r/min or less. ● During driving ● During air/fuel ratio feedback control Set Conditions ● The ratio between the oxygen sensor (rear) and the oxygen sensor (front) output frequencies reaches 0.8 per 12 seconds on average.	● Malfunction of catalyst ● Malfunction of the oxygen sensor (front) ● Malfunction of the oxygen sensor (rear) ● Malfunction of engine-ECU



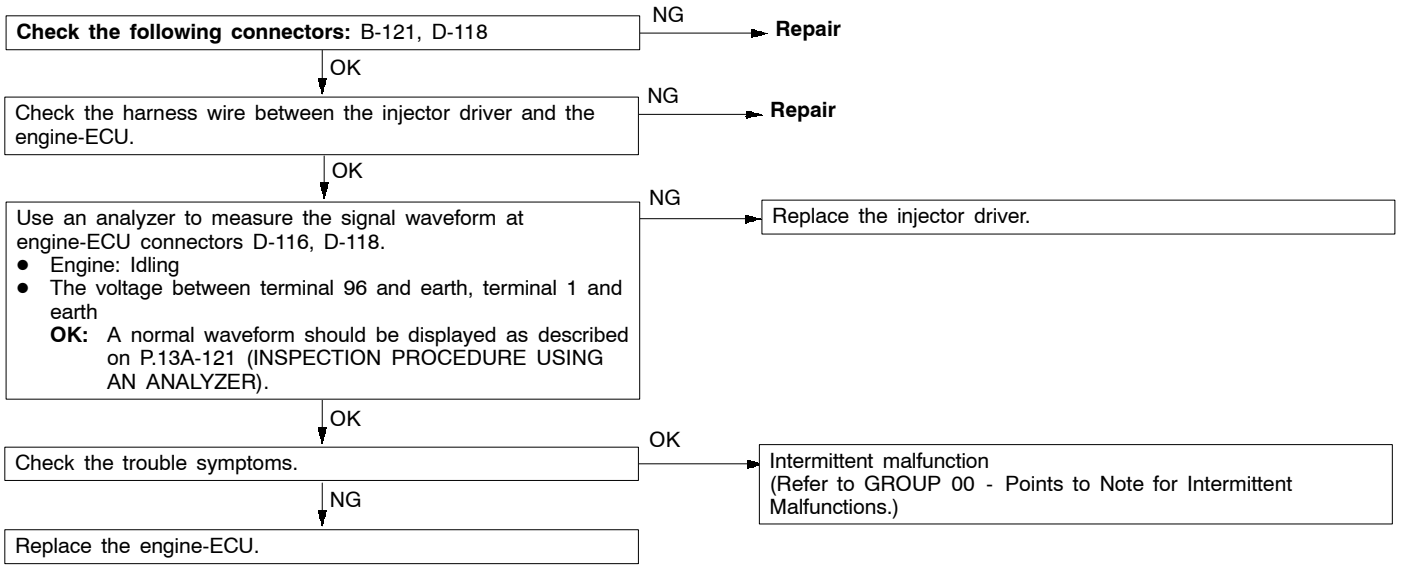
Code No.P0443 Purge control solenoid valve system	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage is 10 V or more. Set Conditions ● The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off.	● Malfunction of the purge control solenoid valve ● Open or short circuit in the purge control solenoid valve circuit or loose connector contact ● Malfunction of engine-ECU



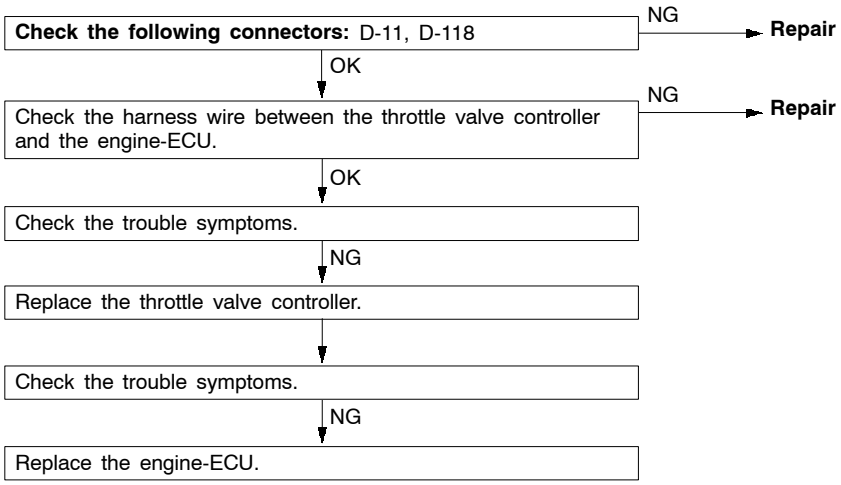
Code No.P0500 Vehicle speed sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Open or short circuit in the vehicle speed sensor circuit or loose connector contact ● Malfunction of engine-ECU



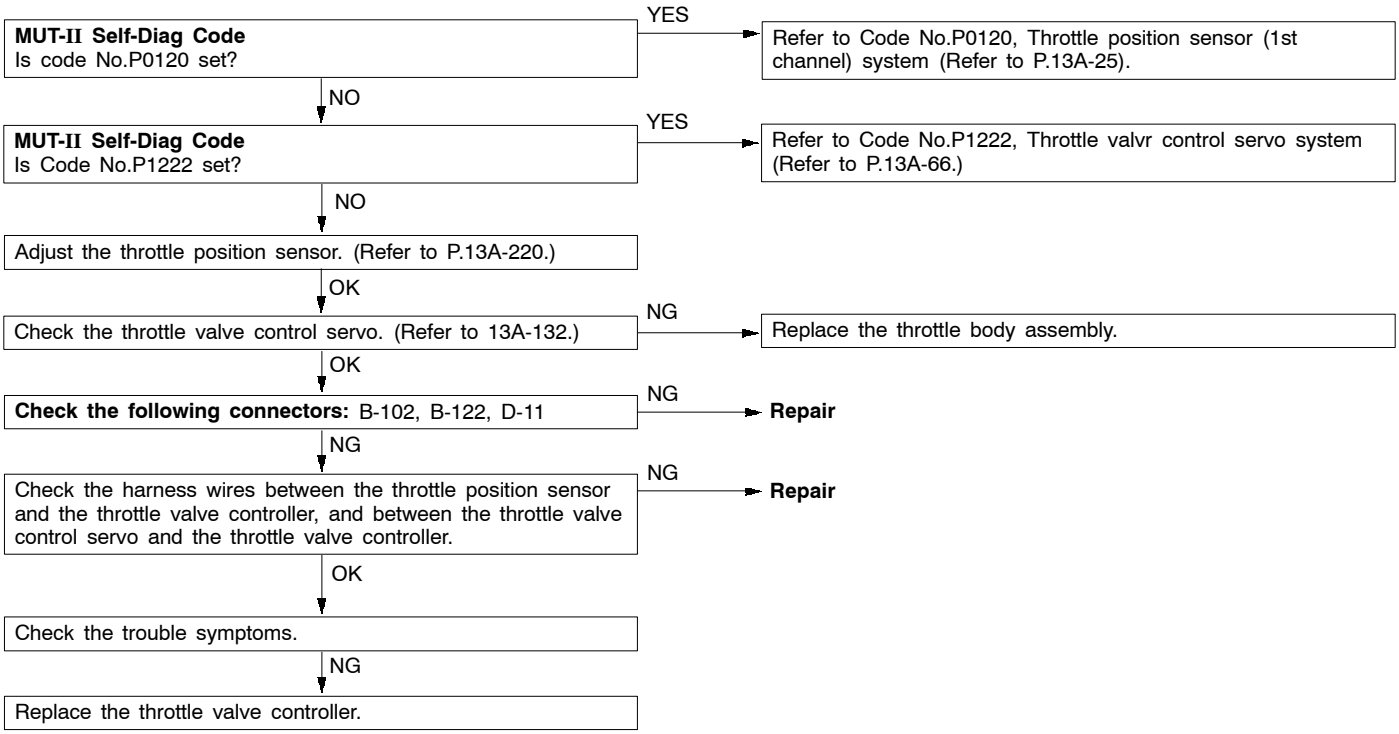
Code No.P1200 Injector driver system	Probable cause
Range of Check ● Engine speed: 4,000 r/m or less ● Battery voltage: 10 V or more ● The fuel cut operation and the injector operation (by carrying out the Actuator test) are not in progress. ● During high engine load Set Conditions ● Injector open circuit check signal is not output from the injector driver.	● Malfunction of the injector driver ● Open or short circuit, or loose connector contact ● Malfunction of engine-ECU



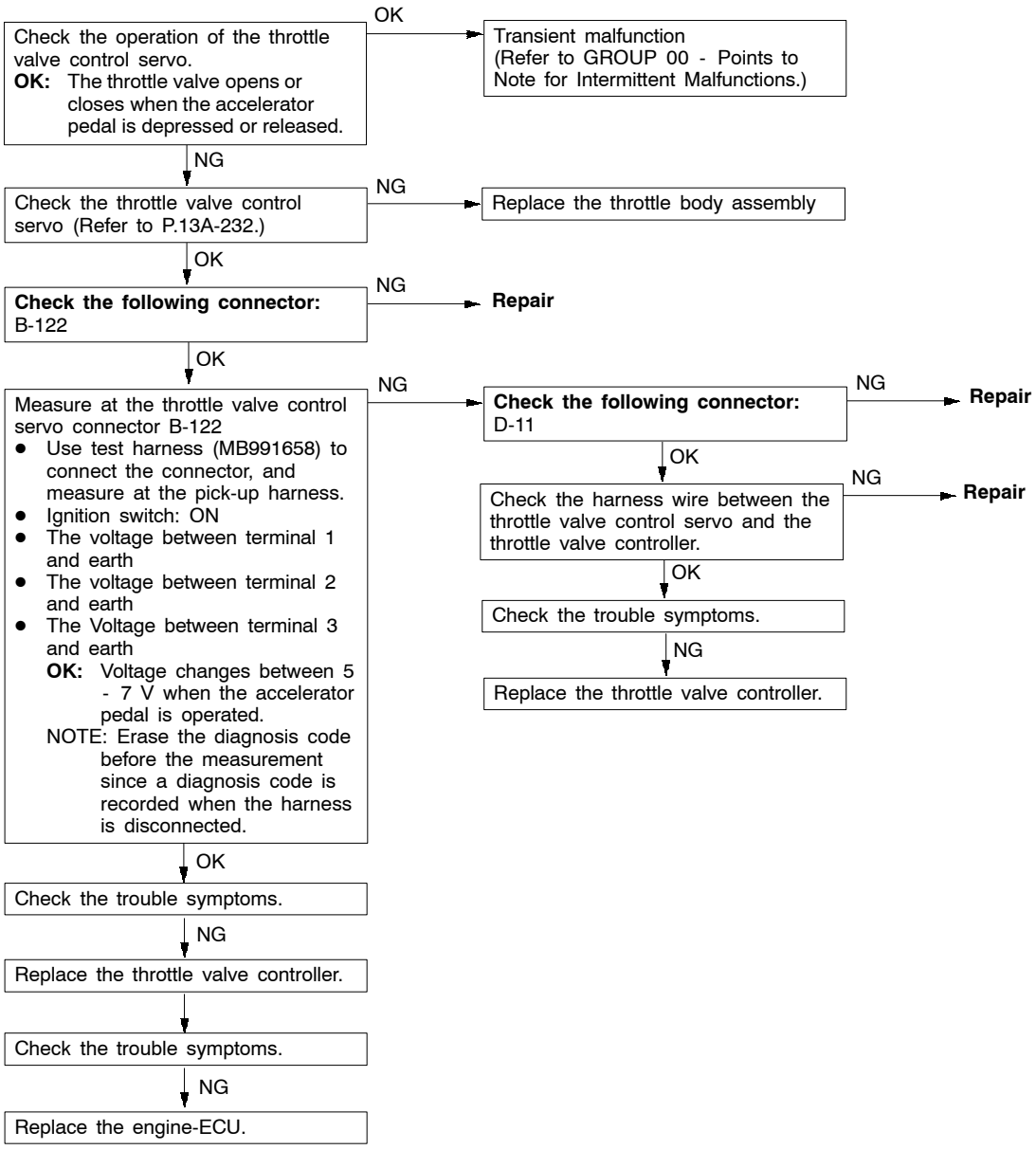
Code No.P1220 Electronic-controlled throttle valve system	Probable cause
Range of Check ● Ignition switch: ON ● Error in communication between the engine-ECU and the throttle valve controller Set Conditions ● Output voltage of throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value, based on that of the accelerator pedal position sensor (2nd channel). Range of Check ● Ignition switch: ON ● Error in communication between the throttle valve controller and the engine-ECU Set Conditions ● The output voltage of the throttle position sensor (2nd channel) is significantly different (approx. 1 V) from the the throttle valve opening angle (voltage), which the engine-ECU request the throttle valve controller.	● Short in communication line ● Malfunction of the engine-ECU ● Malfunction of the throttle valve controller



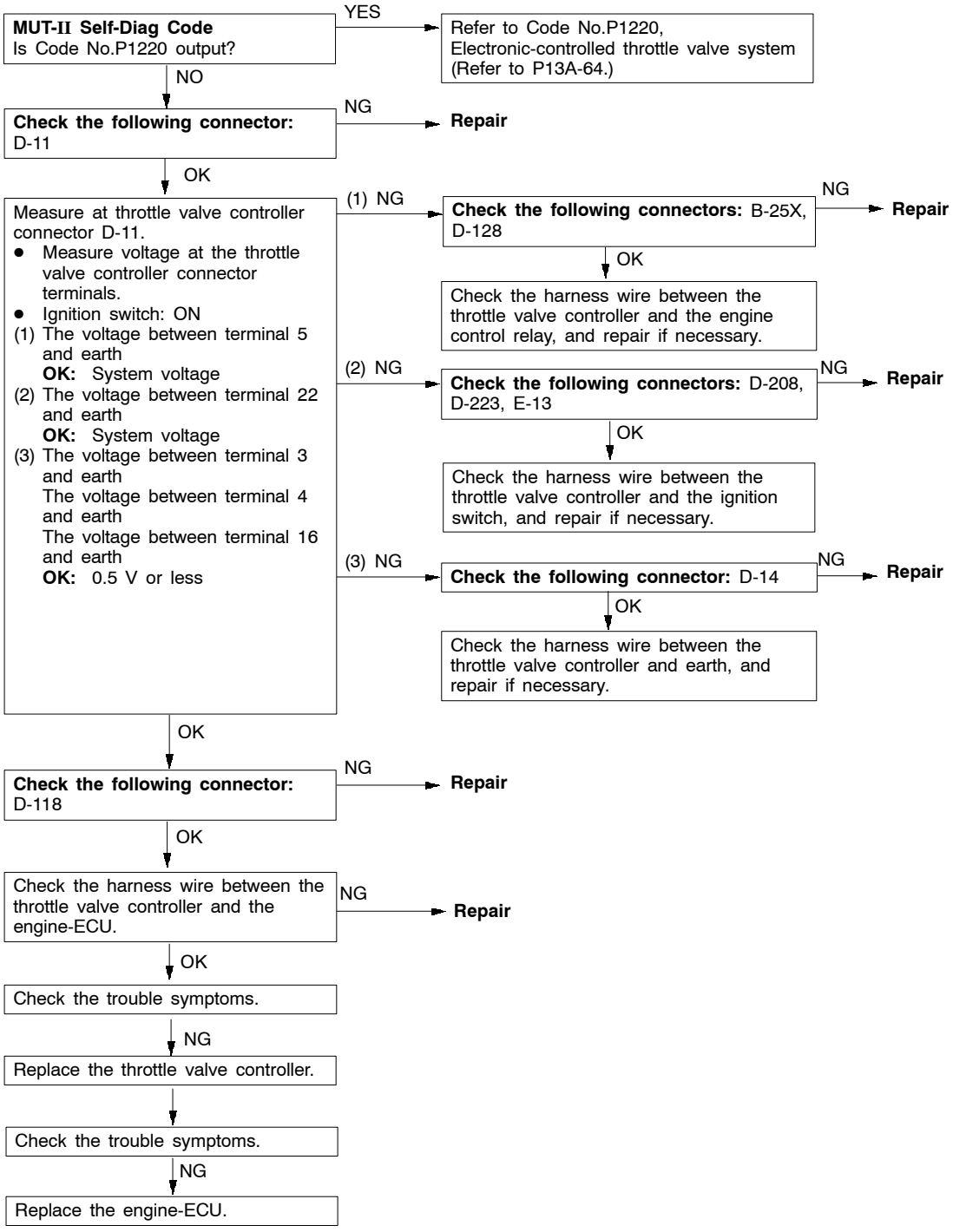
Code No.P1221 Throttle valve position feedback system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check ● Ignition switch: ON ● Battery voltage: 10 V or more Set Conditions ● Failure in the position feedback (The engine-ECU detects that the current in the motor is excessive and the opening angle difference between the target value of throttle position sensor (1st channel) and the actual value of throttle position sensor (1st channel) is 2.0 V or more)	● Malfunction of throttle position sensor (1st channel) ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of the throttle valve controller



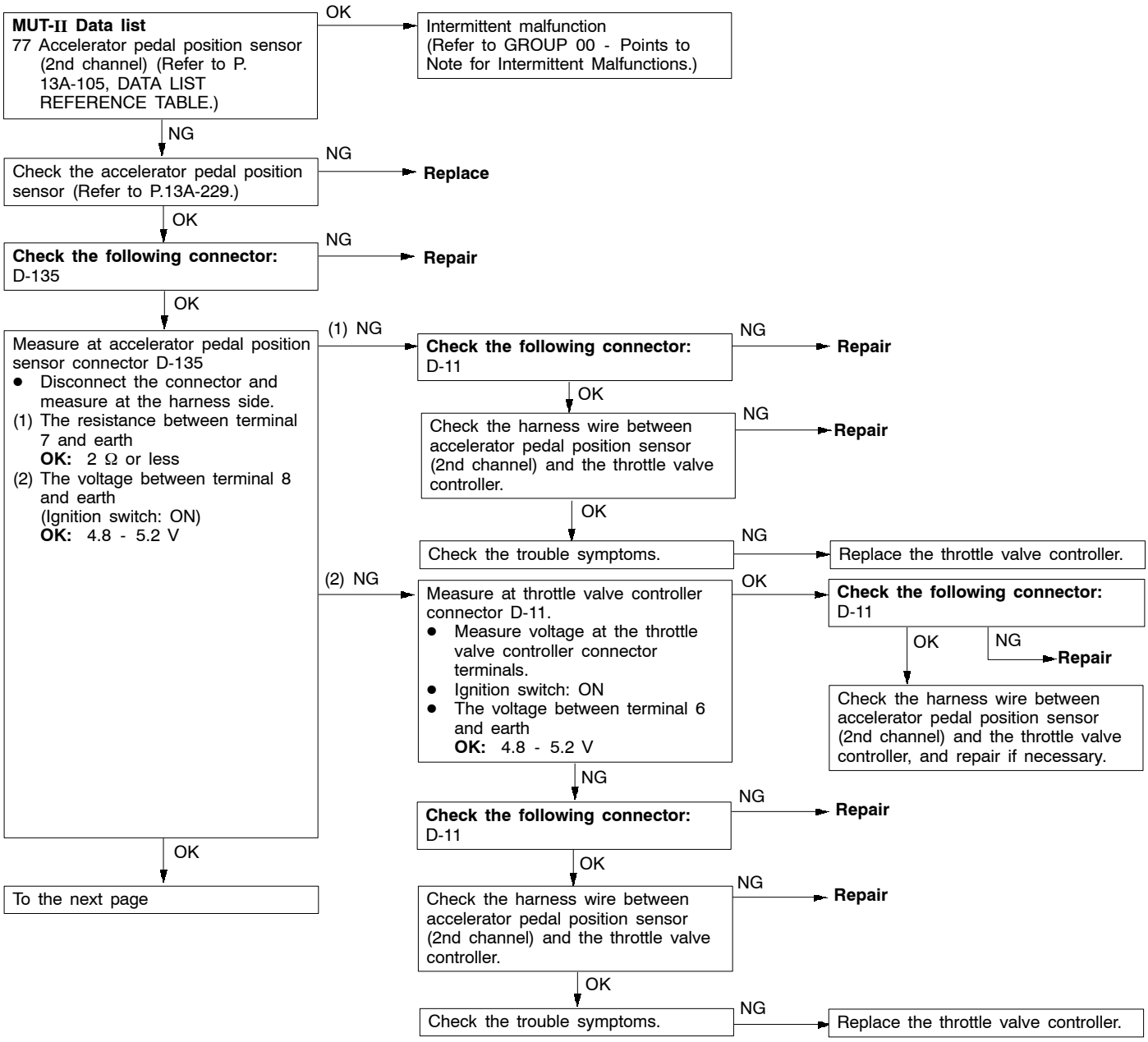
Code No.P1222 throttle valve control servo system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check ● throttle valve control servo relay: ON Set Conditions ● Short circuit of the throttle valve control servo drive circuit to earth ● Power is supplied to the throttle valve control servo circuit from other sources. ● Open circuit in the throttle valve control servo power supply circuit	● Malfunction of the throttle valve control servo ● Open circuit in the throttle valve control servo power supply circuit ● Open or short circuit in the throttle valve control servo circuit or loose connector contact ● Malfunction of throttle valve controller

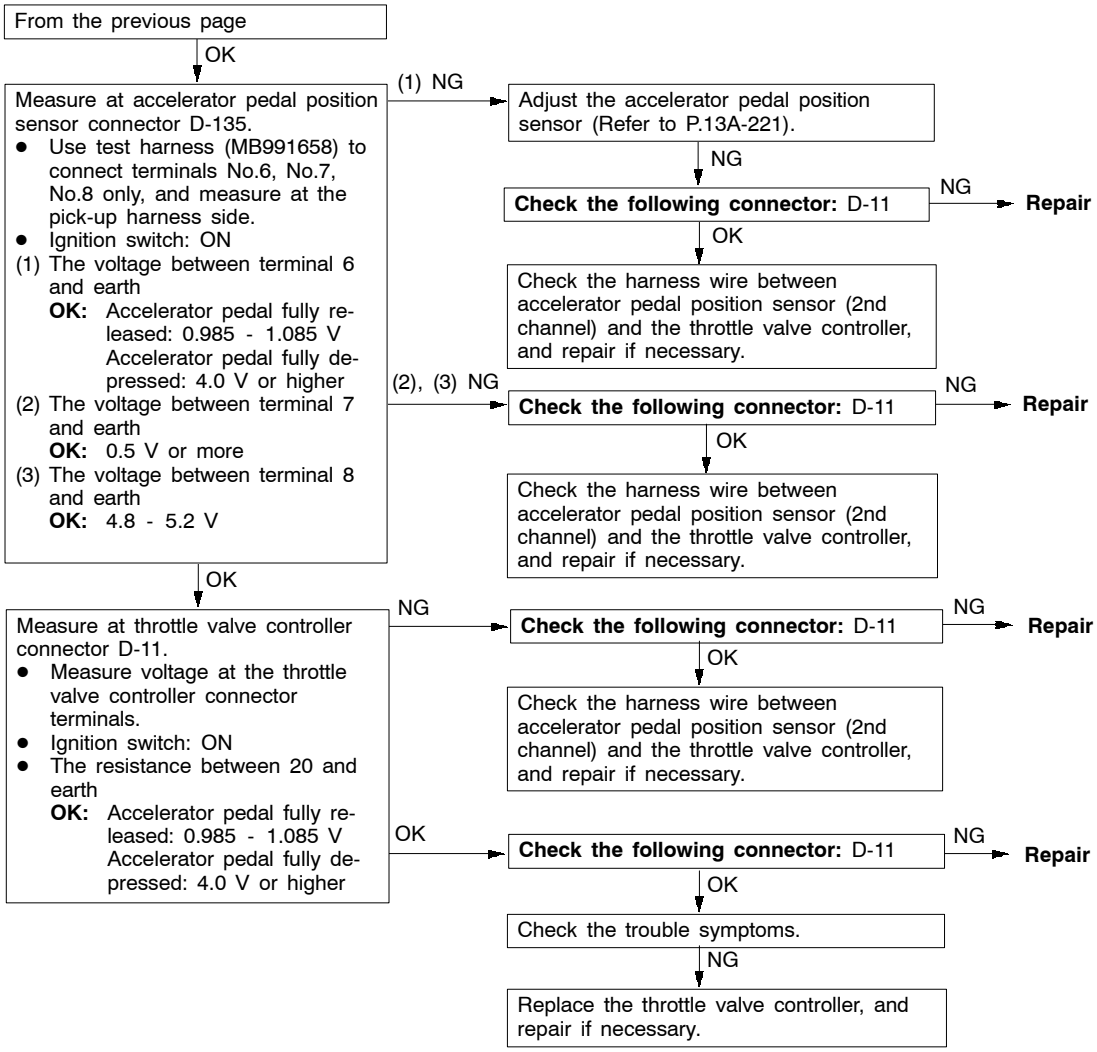


Code No.P1223 Communication line system with the throttle valve controller	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage: 8 V or more. ● Engine: not cranking Set Conditions ● System detects an error in communication line between the engine-ECU and the throttle valve controller, and between the throttle valve controller and the engine-ECU.	● Short in communication line ● Malfunction of engine-ECU ● Malfunction of throttle valve controller



Code No.P1225 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of Check ● Accelerator pedal position sensor (2nd channel) is normal. ● Communication between the engine-ECU and the throttle valve controller is normal. Set Conditions ● Output voltage of the accelerator pedal position sensor (2nd channel) is 0.2 V or less for one second or ● Output voltage of the accelerator pedal position sensor (1st channel) is 2.5 V or less, and output voltage of the accelerator pedal position sensor (2nd channel) is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor (1st and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly).	● Malfunction of accelerator pedal position sensor (2nd channel) ● Open or short circuit in accelerator pedal position sensor (2nd channel) circuit or loose connector contact ● Malfunction of the throttle valve controller ● Malfunction of engine-ECU

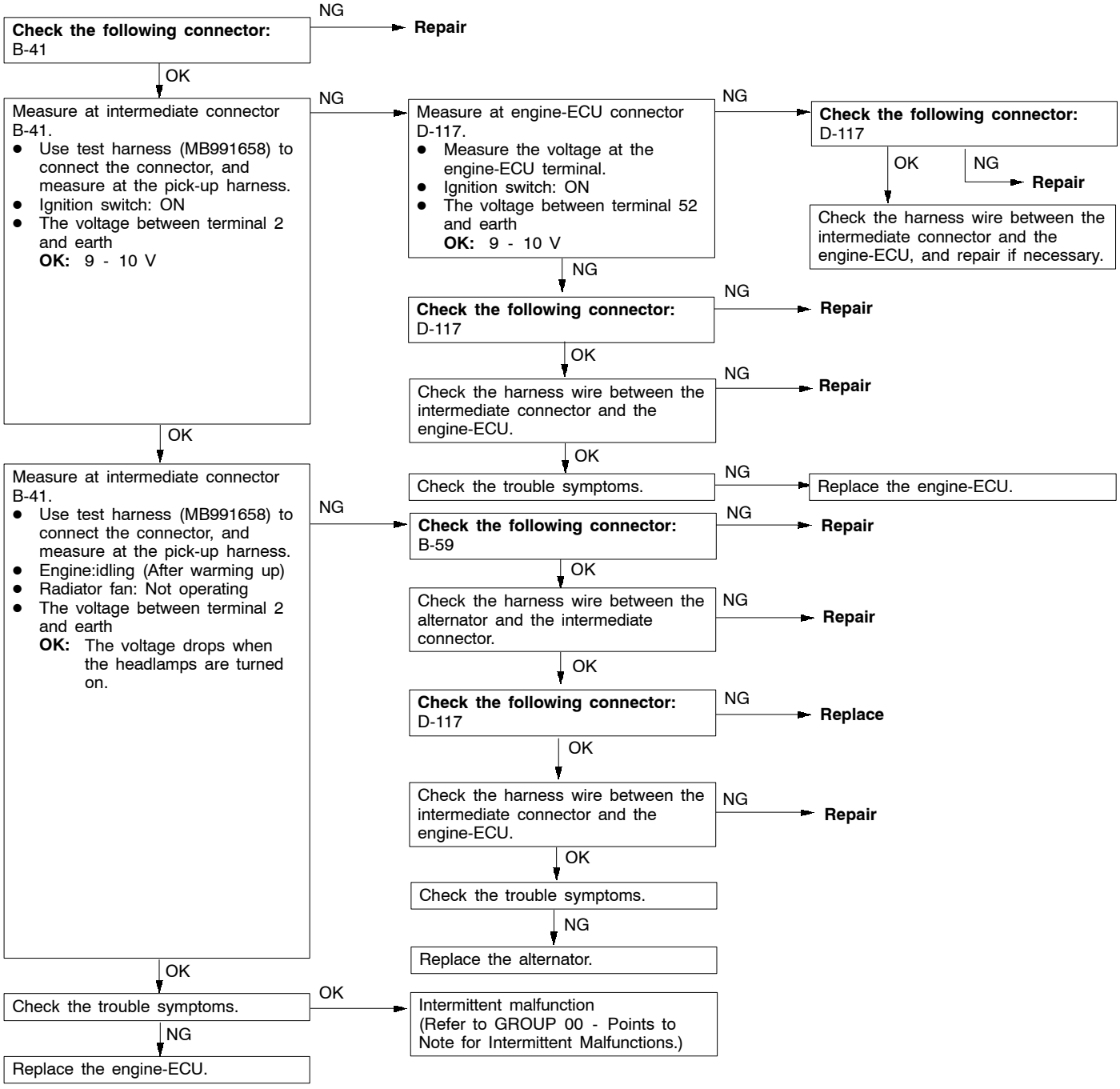




Code No.P1226 Throttle valve controller system	Probable cause
Set Conditions ● Errors in reading or writing to the throttle valve controller ROM.	● Malfunction of the throttle valve controller

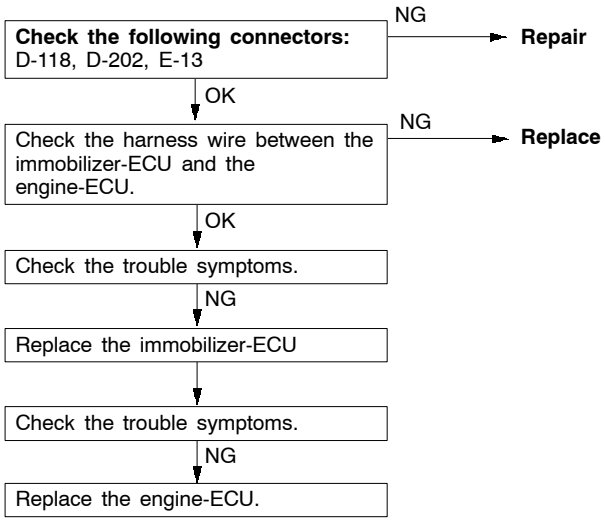
Replace the throttle valve controller.

Code No.P1500 Alternator FR terminal system	Probable cause
Range of Check ● Engine speed: 50 r/min or more Set Conditions ● Input voltage from the alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of engine-ECU



Cord No.P1610 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and the immobilizer-ECU	● Open or short circuit, or loose connector contact ● Malfunction of the immobilizer-ECU ● Malfunction of the engine-ECU

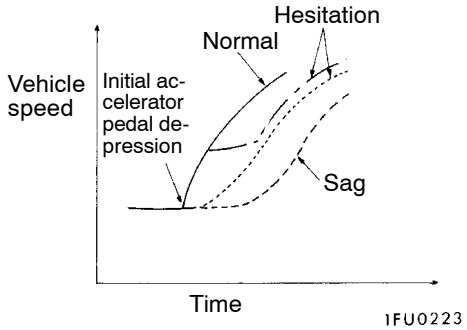
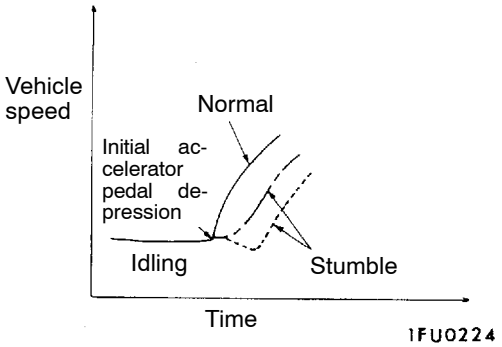
NOTE
(1) If the registered ignition keys are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-74
	Communication with engine-ECU only is not possible.	2	13A-75
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13A-76
	The engine warning lamp remains illuminating and never goes out.	4	13A-76
Starting	No initial combustion (starting impossible)	5	13A-77
	Initial combustion but no complete combustion (starting impossible)	6	13A-79
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-81
	Idling speed is high. (Improper idling speed)	8	13A-83
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-84
	When the engine is hot, it stalls at idling. (Die out)	10	13A-85
	The engine stalls when starting the car. (Pass out)	11	13A-87
	The engine stalls when decelerating.	12	13A-88
Driving	Hesitation, sag or stumble	13	13A-89
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-90
	The feeling of impact or vibration when decelerating	15	13A-91
	Knocking	16	13A-91
Dieseling		17	13A-91
Too high CO and HC concentration when idling		18	13A-92
Low alternator output voltage (approx. 12.3 V)		19	13A-94
Engine idle speed is incorrect while the A/C is on.		20	13A-94
A/C condenser fan is inoperative		21	13A-95
Clutch switch system malfunction		22	13A-96
GDI ECO indicator lamp system	GDI ECO indicator lamp does not illuminate.	23	13A-96
	GDI ECO indicator lamp remains illuminated and does not go off.	24	13A-97

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

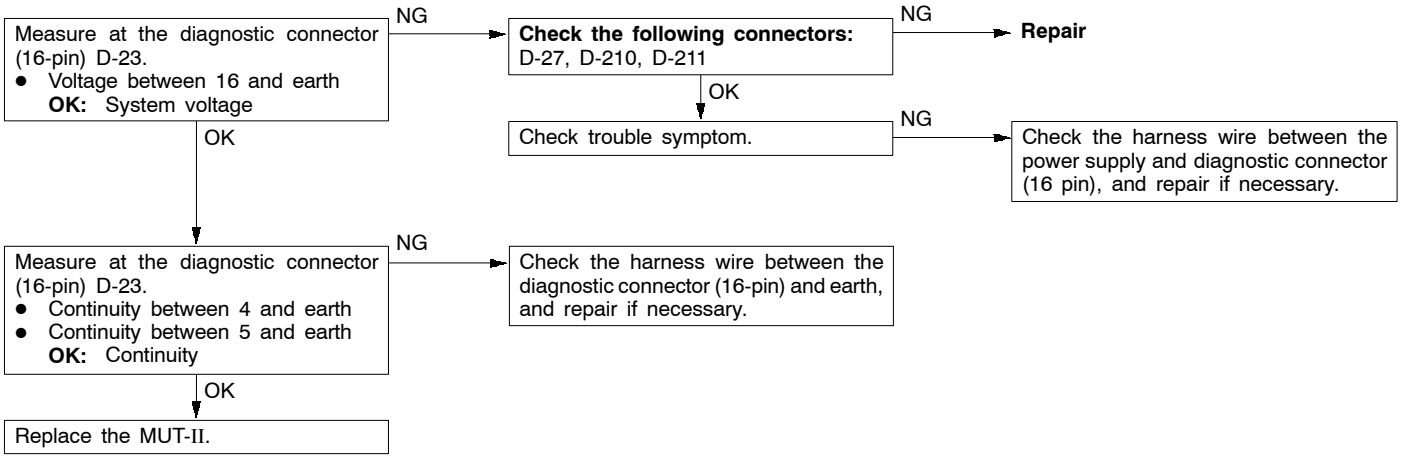
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicles is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation, Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. 

Items		Symptom
Driving	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run on ("Dieseling")	The condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

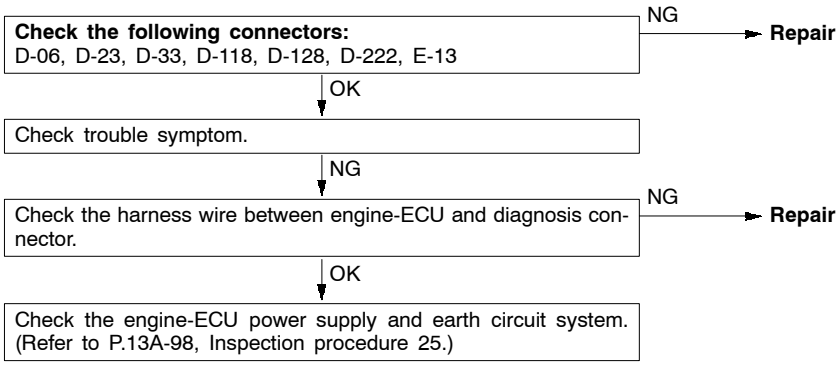
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	**Probable cause**
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of the connector • Malfunction of the harness wire • Malfunction of MUT-II



Inspection procedure 2

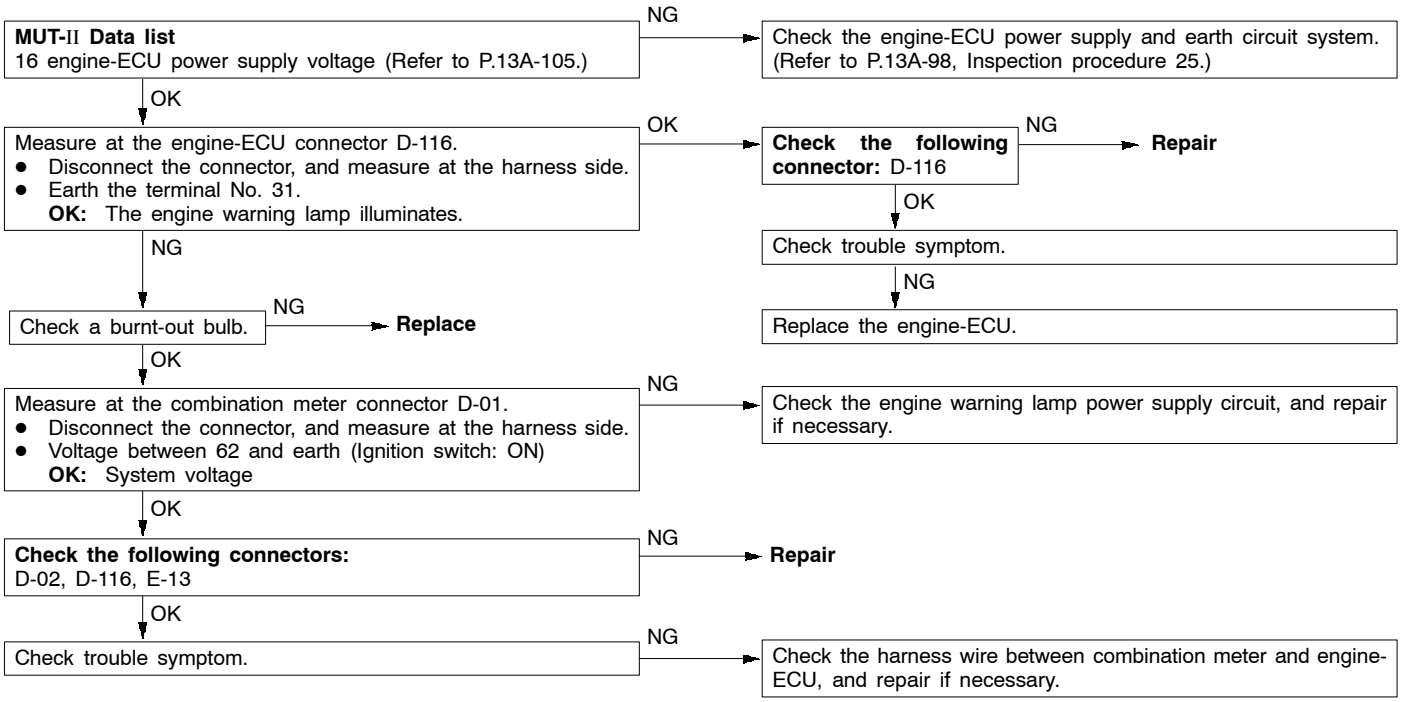
MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. ● No power supply to engine-ECU. ● Defective earth circuit of engine-ECU. ● Defective engine-ECU. ● Improper communication line between engine-ECU and MUT-II	● Malfunction of engine-ECU power supply circuit ● Malfunction of engine-ECU ● Open circuit between the engine-ECU and diagnosis connector



NOTE
On vehicles with center display, if a malfunction cannot be resolved after the procedure above, check the center display and replace if necessary. (Refer to GROUP 54 - Center display.)

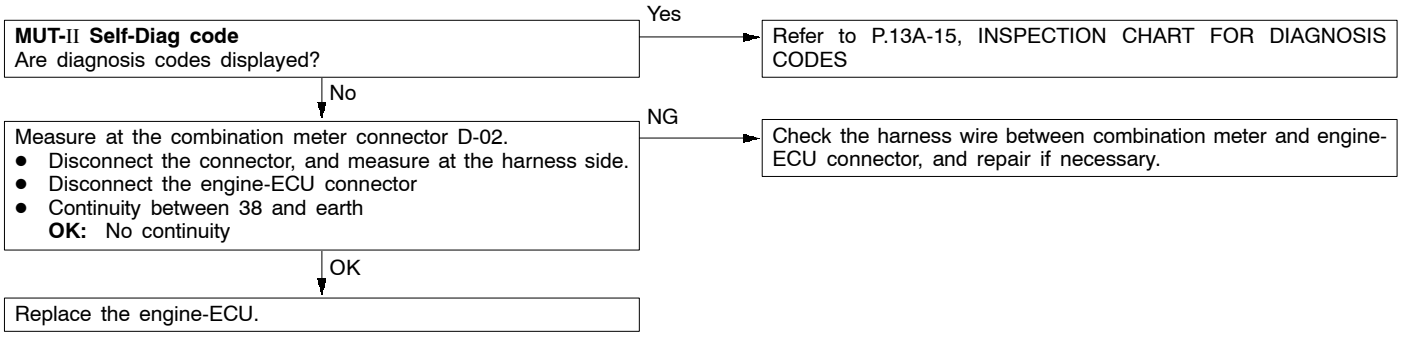
Inspection procedure 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
Because there is a burnt-out bulb, the engine-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.	• Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine-ECU



Inspection procedure 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning lamp and engine-ECU • Malfunction of the engine-ECU



Inspection procedure 5

No initial combustion (starting impossible)	Probable cause
This is caused by incorrect fuel supply into the combustion chamber, and improper ignition circuit. Besides that, foreign material may be contaminated in fuel.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-ECU

Check system voltage while the engine is cranking.
OK: 8 V or more
NG → Check the battery. (Refer to GROUP 55 - Battery.)
OK ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Data list
16 System voltage (Refer to P.13A-105.)
NG → Check the engine control relay and ignition switch-IG system. (Refer to P.13A-99, Inspection procedure 26.)
OK ↓

Does the camshaft rotate when the engine is cranking?
No → Check if the timing belt is broken or damaged.
Yes ↓

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13A-110.)
NG → Check the fuel pump (low pressure) system. (Refer to P.13A-101, Inspection procedure 29.)
OK ↓

MUT-II Data list
22 Crank angle sensor (Refer to P.13A-105.)
NG → Check the crank angle sensor system. (Refer to P.13A-56, code No. P0335.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-105.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-22, code No. P0115.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
NG → Check the throttle position sensor (1st channel) system. (Refer to P.13A-25, code No. P0120.)
OK ↓

Inspect engine start ability by cranking the engine while the accelerator pedal is slightly depressed.
OK → Clean around the throttle valve. (Refer to P.13A-220.)
NG ↓

Measure at injector driver connector B-121.
- Disconnect the connector, and measure at the connector side.
- Voltage between each of terminals 4, 12, 21 and earth (Ignition switch: ON)
  OK: System voltage

NG → Check the injector driver system. (Refer to P.13A-104, Inspection procedure 34.)
OK ↓

Check fuel leakage. (Refer to P.13A-225.)
NG → **Repair**
OK ↓

Measure low fuel pressure between the fuel pump (low pressure) and fuel pump (high pressure). (Refer to P.13A-222.)
NG → **Repair**
OK ↓

Measure at ignition coil connectors B-101, B-108, B-112, B-113, B-116, B-119.
- Connect the connector.
- Connect a timing light to the No.1 terminal of each connector in turn.
  (Engine cranking)
  OK: The timing light flashes.

NG → Check the ignition coil (incorporating power transitor) system. (Refer to P.13A-53, code No. P0300.)
OK ↓

Check ignition timing while the engine is cranking.
OK: Approx. 5° BTDC
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

To the next page

From the previous page

↓ OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

↓ OK

Check all the following items:
- Spark plug
- Compression pressure
- Foreign material (such as water or kerosine) entered the fuel lines

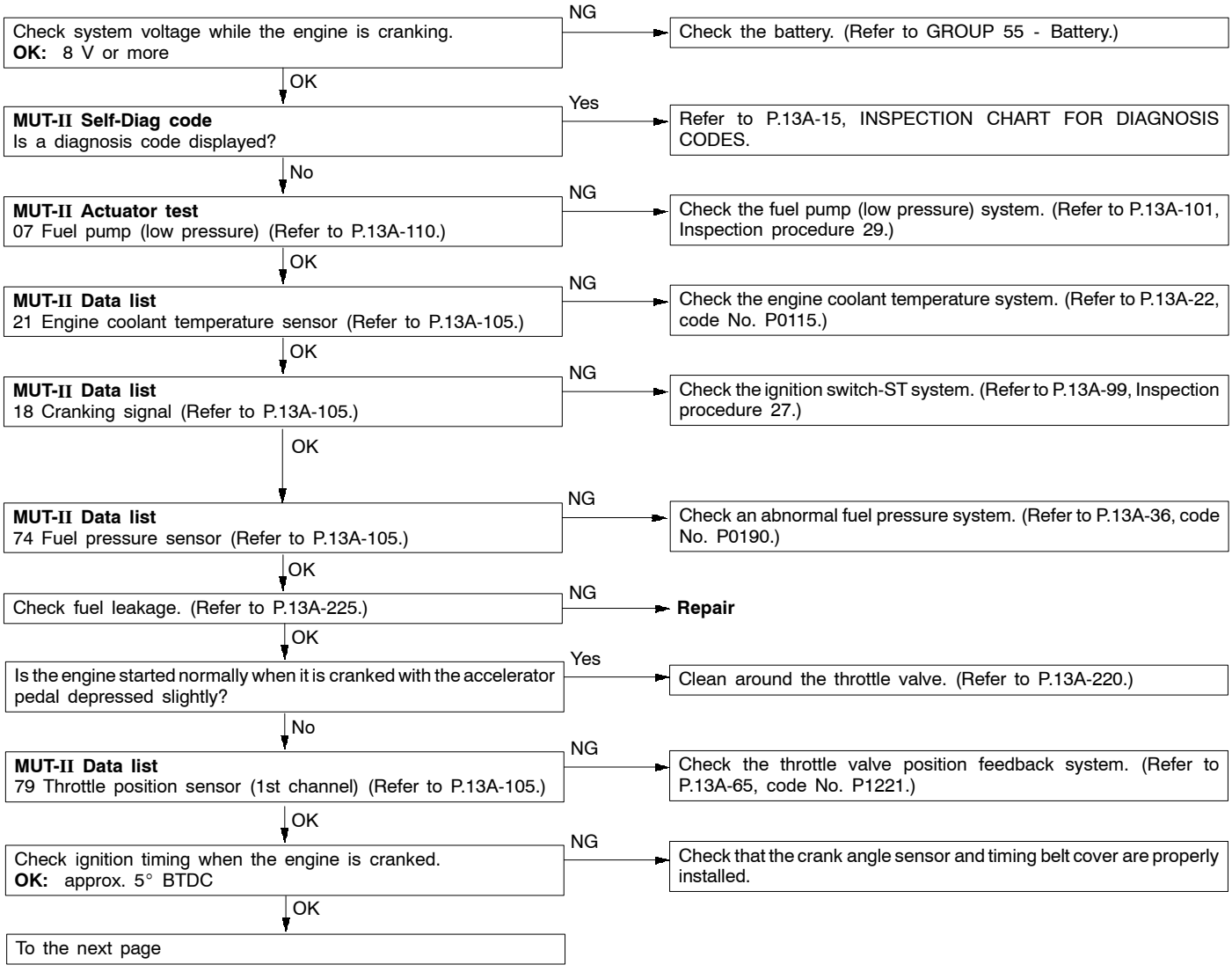
↓ OK

Check trouble symptom.

NG → Replace the injector.

Inspection procedure 6

Initial combustion takes place, but does not complete (start impossible), too long time to start (poor start)	Probable cause
This may be caused by improper spark plug ignition (poor spark), improper mixture during engine cranking, improper fuel pressure.	• Malfunction of the fuel supply system • Malfunction of the fuel pressure sensor • Malfunction of the ignition system • Malfunction of the electronic-controlled throttle vale system • Malfunction of the engine-ECU



From the previous page

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plug
- Compression pressure
- Foreign material (such as water or kerosine) entered the fuel lines

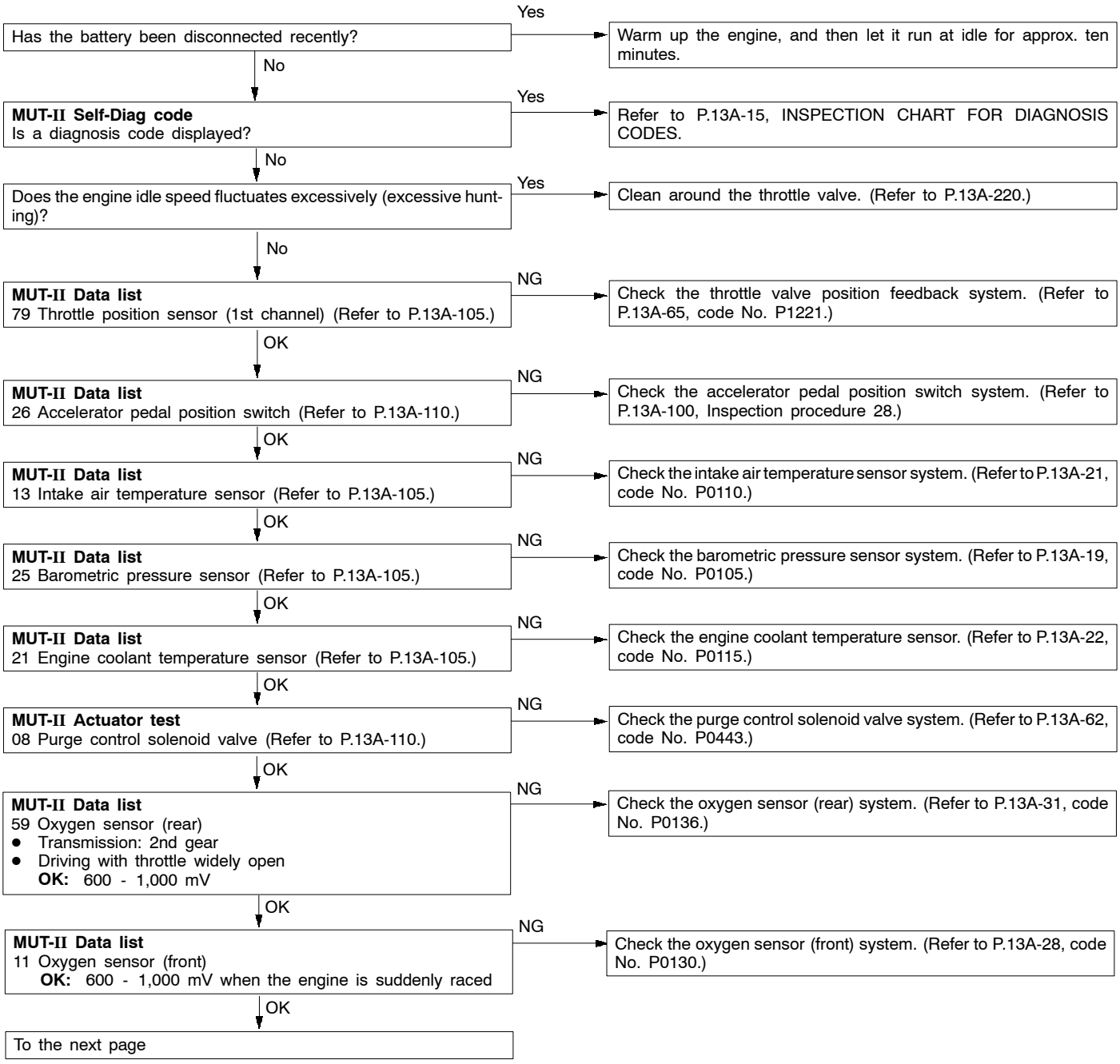
OK

Check trouble symptom.

NG → Replace the injector.

Inspection procedure 7

Unstable idling (rough idle, hunting)	Probable cause
This malfunction is probably caused by a faulty ignition system, improper air/fuel ratio, a faulty electronic-controlled throttle valve system, improper compression pressure, etc. As many causes can be suspected, diagnose from easier items.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-control throttle valve system • Improper compression pressure • Air sucking into the air intake system



From the previous page

OK

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).

NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-224.)

OK → Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

NG → **Repair**

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-105.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-102, Inspection procedure 30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-105.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-102, Inspection procedure 31.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-105.)

NG → Check the stop lamp switch. (Refer to P.13A-103, Inspection procedure 32.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-105.)

NG → Check the small lamp switch system. (Refer to P.13A-104, Inspection procedure 33.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)

NG → Check the EGR valve. (Refer to P.13A-60, code No. P0403.)

OK

Check ignition timing. (Refer to GROUP 11A - Engine Adjustment.)

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Clean around the throttle valve. (Refer to P.13A-220.)

Check trouble symptom.

NG

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items in that order.
(1) Spark plugs
(2) Exhaust gas emission control system
(3) EGR system
(4) Compression pressure
(5) Foreign material (such as water or kerosine)entered the fuel line.
(6) Air is sucked in the air intake system, or EGR gas leaks.
- Damaged intake manifold gasket
- Damaged air intake hose
- Damaged vacuum hose
- Faulty EGR valve seat

Inspection procedure 8

Idle speed is high or low (Improper idling)	Probable cause
The cause is probably that the intake air amount during idling is too great or too small.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No.S P1221.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-110.)
NG → Check the purge control solenoid valve. (Refer to P.13A-62, code No. P0443.)
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-105.)
NG → Check the accelerator pedal position switch system. (Refer to P.13A-100, Inspection procedure 28.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-105.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-22, code No. P0115.)
OK ↓

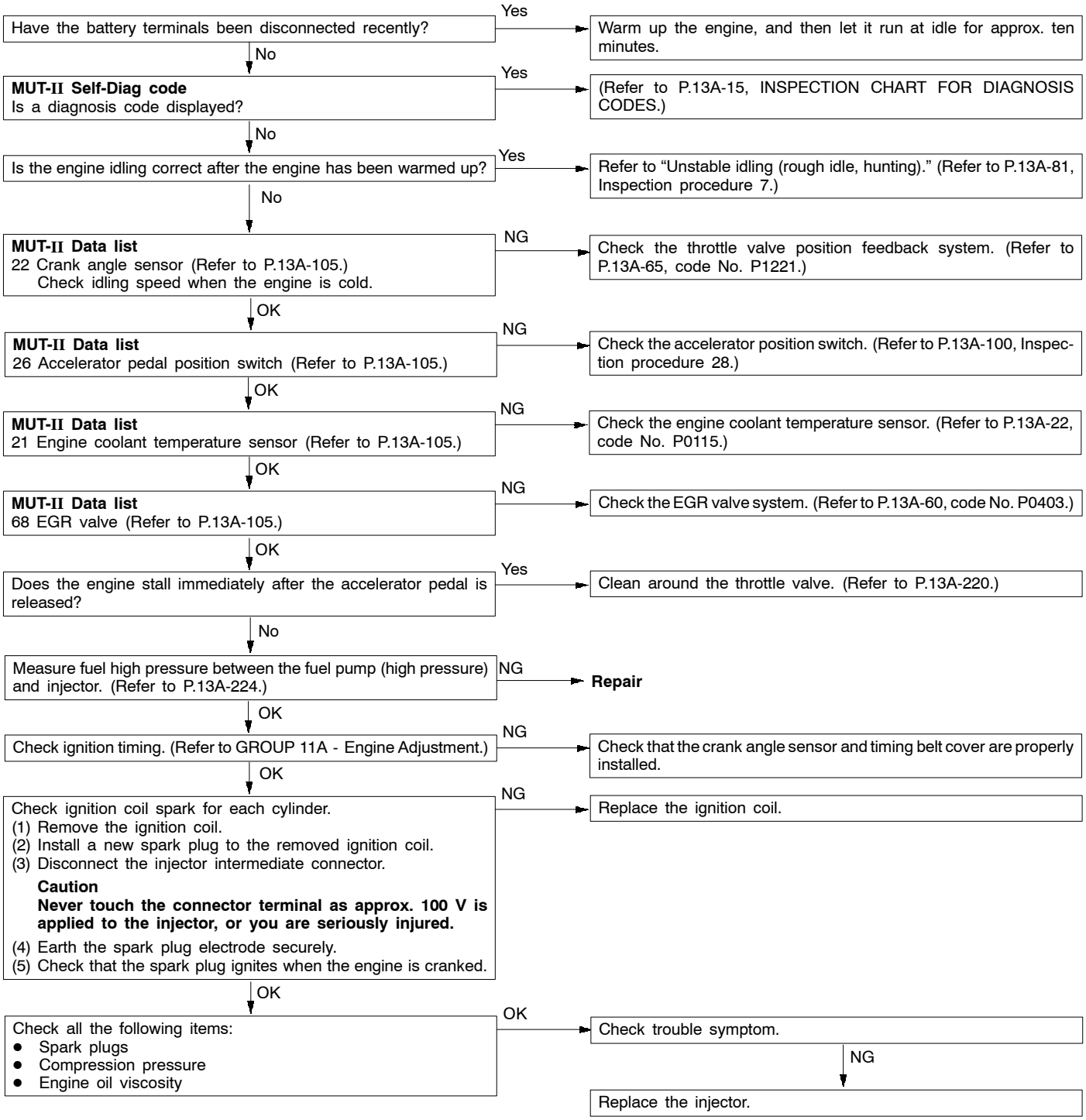
MUT-II Data list
28 A/C switch (Refer to P.13A-105.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13A-102, Inspection procedure 31.)
OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-105.)
NG → Check the stop lamp switch system. (Refer to P.13A-103, Inspection procedure 32.)
OK ↓

- Clean around the throttle valve. (Refer to P.13A-220.)
- Adjust the throttle position sensor. (Refer to P.13A-220.)

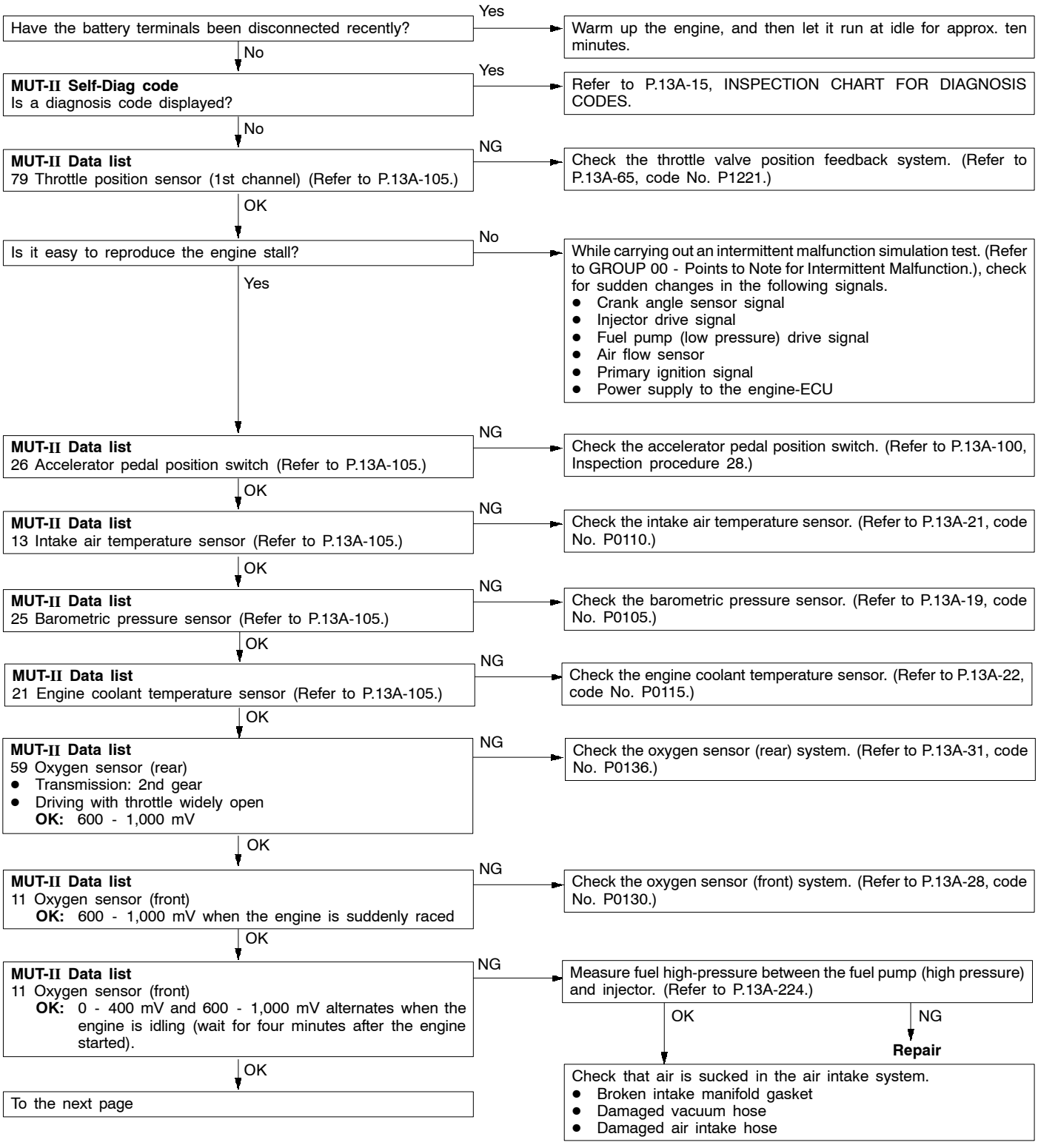
Inspection procedure 9

When the engine is cold, it stalls at idling. (Die out)	Probable cause
The cause is probably an incorrect air/fuel ratio or poor intake air amount when the engine is cold.	• Malfunction of the electronic-control throttle valve system • Malfunction of the throttle body



Inspection procedure 10

When the engine is hot, it stalls at idling. (Die out)	Probable cause
The cause is probably an improper air/fuel ratio, faulty electronic-controlled throttle valve system, compression pressure. In addition, if the engine stalls suddenly, another possible cause might be a poor connector contact.	• Malfunction of the ignition system • Malfunction of air/fuel ratio control system • Malfunction of electronic-controlled throttle valve system • Malfunction of the throttle body • Poor connector contact • Improper compression pressure • Air stuck in the air intake system



From the previous page

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-105.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-102, Inspection procedure 30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-105.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-102, Inspection procedure 31.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-105.)

NG → Check the small lamp switch system. (Refer to P.13A-104, Inspection procedure 33.)

OK

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13A-105.)

NG → Check the air flow sensor system. (Refer to P.13A-17, code No. P0100.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)

NG → Check the EGR valve. (Refer to P.13A-60, code No. P0403.)

OK

Does the engine stall immediately after the accelerator pedal is released?

Yes → Clean around the throttle valve. (Refer to P.13A-220.)

No

Check ignition timing. (Refer to GROUP 11A - Engine Adjustment.)

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plugs
- Compression pressure
- Foreign material (such as water or kerosine) entered the fuel lines

Inspection procedure 11

The engine stalls when starting the car. (Pass out)	Probable cause
The cause is probably poor ignition due to a malfunctioning spark plug (weak spark), or an incorrect air/fuel ratio when the accelerator is depressed.	• Malfunction of the ignition system • Malfunction of the EGR valve • Air stuck in the air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)
- NG → Check the EGR valve. (Refer to P.13A-60, code No. P0403.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-110.)
- NG → Check the purge control solenoid valve system. (Refer to P.13A-62, code No. P0443.)
- OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
- NG → Replace the ignition coil.
- OK ↓

Check all the following items:
(1) Spark plug
(2) Check if air is stuck in the air intake system.
- Damage intake manifold gasket
- Damaged or disconnected vacuum hose
- Damaged air intake hose

Inspection procedure 12

The engine stalls when decelerating.	Probable cause
The cause is probably an improper air/fuel ratio due to a faulty EGR system, or poor intake air volume due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the EGR valve

Have the battery terminals been disconnected recently?
- Yes → Warm up the engine, and then let it run at idle for approx. ten minutes.
- No ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-105.)
- NG → Check the accelerator pedal position switch. (Refer to P.13A-100, Inspection procedure 28.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No. P1221.)
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)
- NG → Check the EGR valve system. (Refer to P.13A-69, code No. P0403.)
- OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
- NG → Replace the ignition coil.
- OK ↓

Check all the following items:
- Spark plug
- Clean around the throttle valve (Refer to P.13A-220.)

Inspection procedure 13

Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, electronic-controlled throttle valve system, compression pressure, etc.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Improper compression pressure • Air stuck in the air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
OK ↓

Check ignition timing. (Refer to GROUP 11A - Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-105.)
NG → Check the accelerator pedal position switch. (Refer to P.13A-100, Inspection procedure 28.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-105.)
NG → Check the intake air temperature sensor. (Refer to P.13A-21, code No. P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-105.)
NG → Check the barometric pressure sensor. (Refer to P.13A-19, code No. P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-105.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-22, code No. P0115.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No. P1221.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A-78.)
- Transmission: 2nd gear
- Driving with throttle widely open
  OK: 600 - 1,000 mV

NG → Check the oxygen sensor (rear) system. (Refer to P.13A-31, code No. P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 - 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13A-28, code No. P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-224.)
OK ↓

Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-105.)
NG → Check the EGR valve. (Refer to P.13A-60, code No. P0403.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-110.)
NG → Check the purge control solenoid valve. (Refer to P.13A-62, code No. P0443.)
OK ↓

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OK

Measure high fuel pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-224.)

NG → **Repair**

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plug
- EGR system
- Compression pressure
- Clogged fuel filter, fuel line

OK → Check trouble symptom.

NG → Replace the injector.

Inspection procedure 14

The feeling of impact when accelerating	Probable cause
The cause is probably an ignition leak being generated in line with an increase in the spark plug request voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag code
Is a diagnosis code displayed?

Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)

No

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)

NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No. P1221.)

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

OK → Check all the following items:
- Spark plug
- Ignition current leak

NG → Replace the ignition coil.

Inspection procedure 15

The feeling of impact when decelerating	Probable cause
The cause is probably insufficient intake air due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-105.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-65, code No. P1221.)
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-105.)
NG → Check the accelerator pedal position switch system. (Refer to P.13A-100, Inspection procedure 28.)
OK ↓

Clean around the throttle valve. (Refer to P.13A-220.)

Inspection procedure 16

Knocking	Probable cause
The cause is probably incorrect detonation control or improper heat range of the spark plugs.	• Malfunction of the detonation sensor • Improper heat range of the spark plugs

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

Does knocking occur when the vehicle is driven with the detonation sensor disconnected?
(At this time, use the MUT-II to check whether the ignition timing is retarded from when the detonation sensor connector is connected.)
No → Check the detonation sensor system. (Refer to P.13A-56, code No. P0325.)
Yes ↓

Check all the following items:
- Spark plug
- Foreign material (such as water or kerosine) entered the fuel lines

Inspection procedure 17

Run-on (dieseling)	Probable cause
The cause is probably fuel leak from injector(s)	• Malfunction of the injector

Replace the injector.

Inspection procedure 18

Too high CO and HC concentration when idling	Probable cause
The cause is probably an incorrect air/fuel ratio	• Malfunction of air/fuel ratio control system • Deterioration of the catalyst

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-15, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

Check ignition timing. (Refer to GROUP 11A - Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-105.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-22, code No. P0115.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-105.)
NG → Check the intake air temperature sensor. (Refer to P.13A-21, code No. P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-105.)
NG → Check the barometric pressure sensor. (Refer to P.13A-19, code No. P0105.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A-78.)
- Transmission: 2nd gear
- Driving with throttle widely open

OK: 600 - 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13A-31, code No. P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 - 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13A-31, code No. P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
OK → Replace the oxygen sensor (front).
Check trouble symptom.
NG ↓

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-224.)
NG → **Repair**
OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

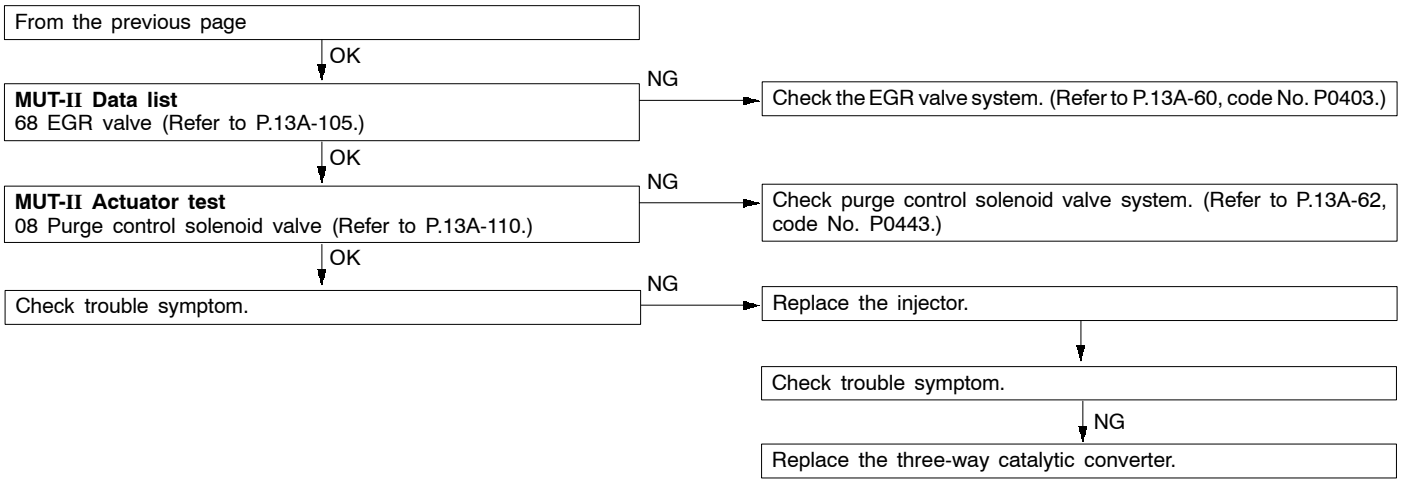
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

OK ↓
NG → Replace the ignition coil.

Check all the following items:
- Spark plug
- EGR system
- Compression pressure
- Clogged fuel filter or line

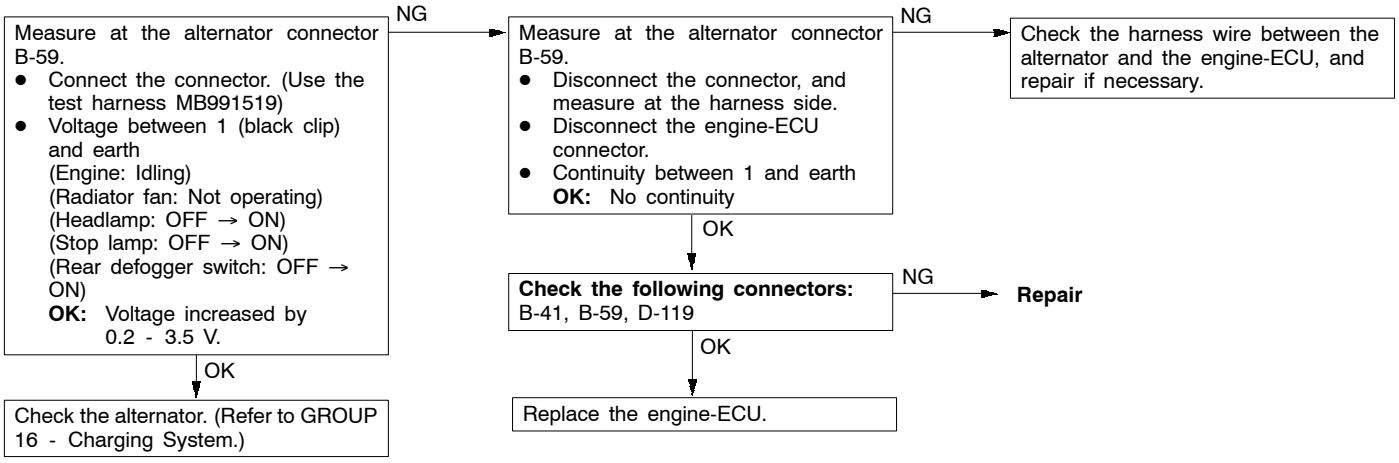
OK ↓

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From the previous page
OK
MUT-II Data list
68 EGR valve (Refer to P.13A-105.)
NG
Check the EGR valve system. (Refer to P.13A-60, code No. P0403.)
OK
MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-110.)
NG
Check purge control solenoid valve system. (Refer to P.13A-62, code No. P0443.)
OK
Check trouble symptom.
NG
Replace the injector.
Check trouble symptom.
NG
Replace the three-way catalytic converter.

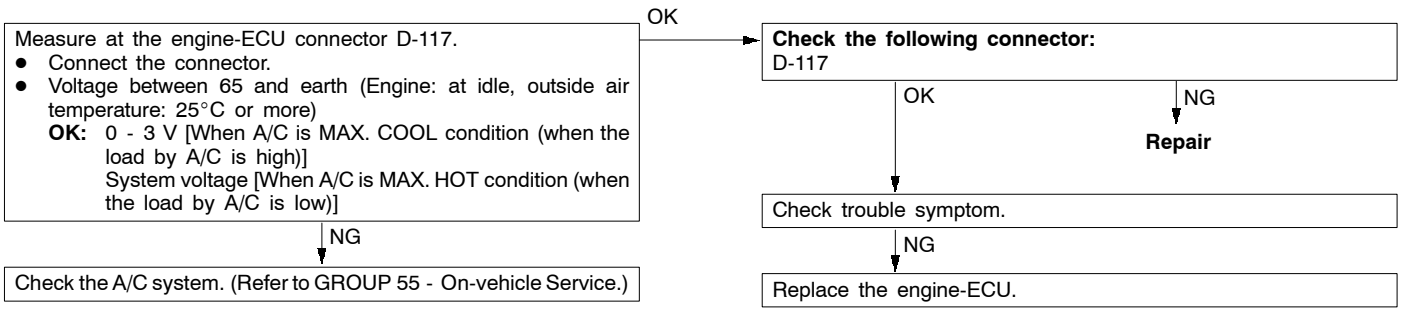
Inspection procedure 19

Low alternator output voltage (approx. 12.3 V)	Probable cause
The cause is probably a malfunction of the alternator or one of the problems listed at right.	• Malfunction of the charging system • Open circuit between the alternator G terminal and the engine-ECU • Malfunction of the engine-ECU



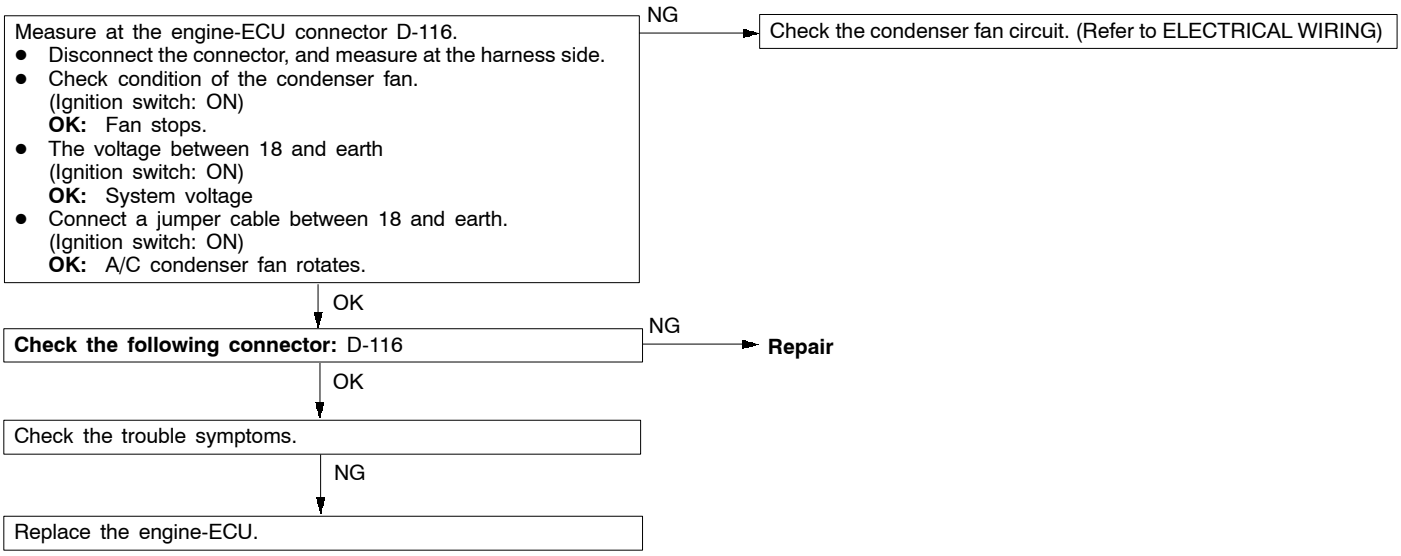
Inspection procedure 20

Idling speed is improper when A/C is operating	Probable cause
If the engine-ECU detects that the air conditioner is on, it activates the throttle control servo to control idle-up operation. The A/C-ECU judges if the load caused by air conditioner operation is high or low, and converts it to voltage signal (high or low voltage) and inputs the signal to the engine-ECU. Based on this voltage signal, the engine-ECU controls the idle-up speed (for high or low load).	• Malfunction of the A/C control system • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



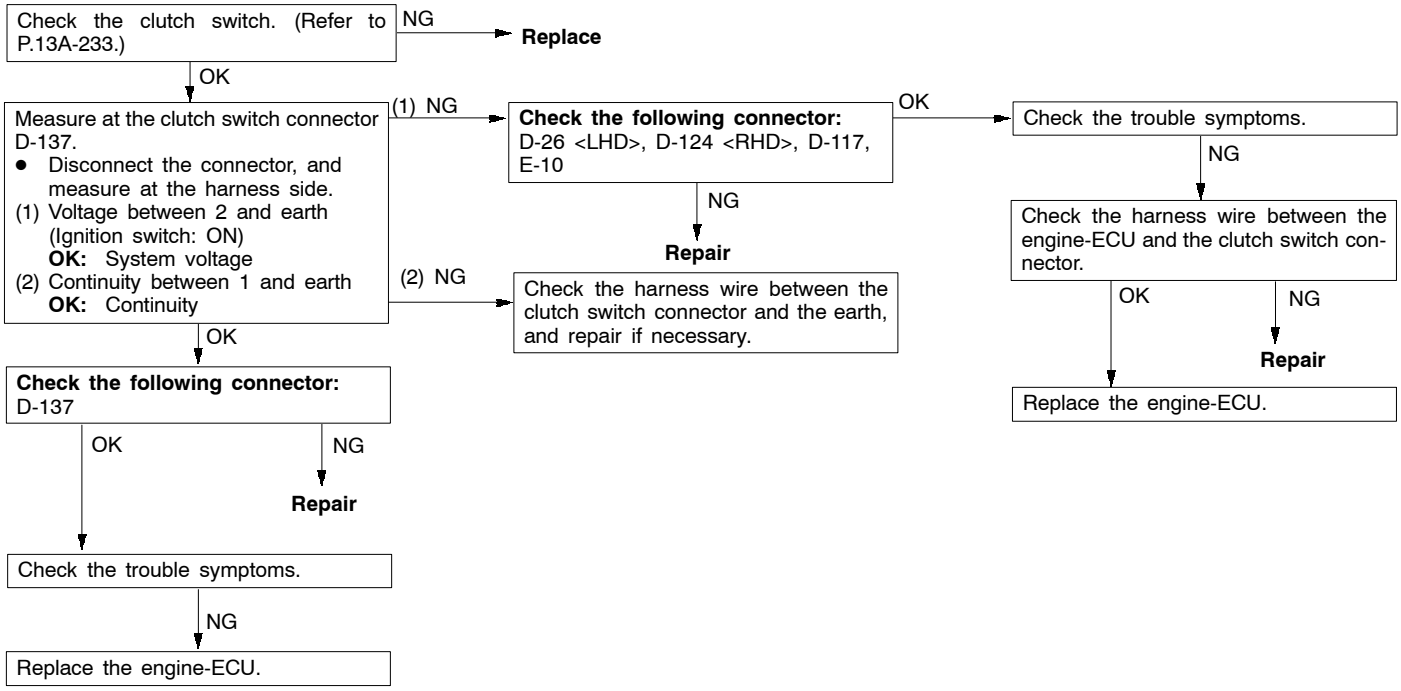
Inspection procedure 21

A/C condenser fan is inoperative	Probable cause
The fan motor relay is controlled by turning on and off the power transistor in the engine-ECU.	• Malfunction of the A/C condenser fan relay. • Malfunction of the condenser fan motor. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



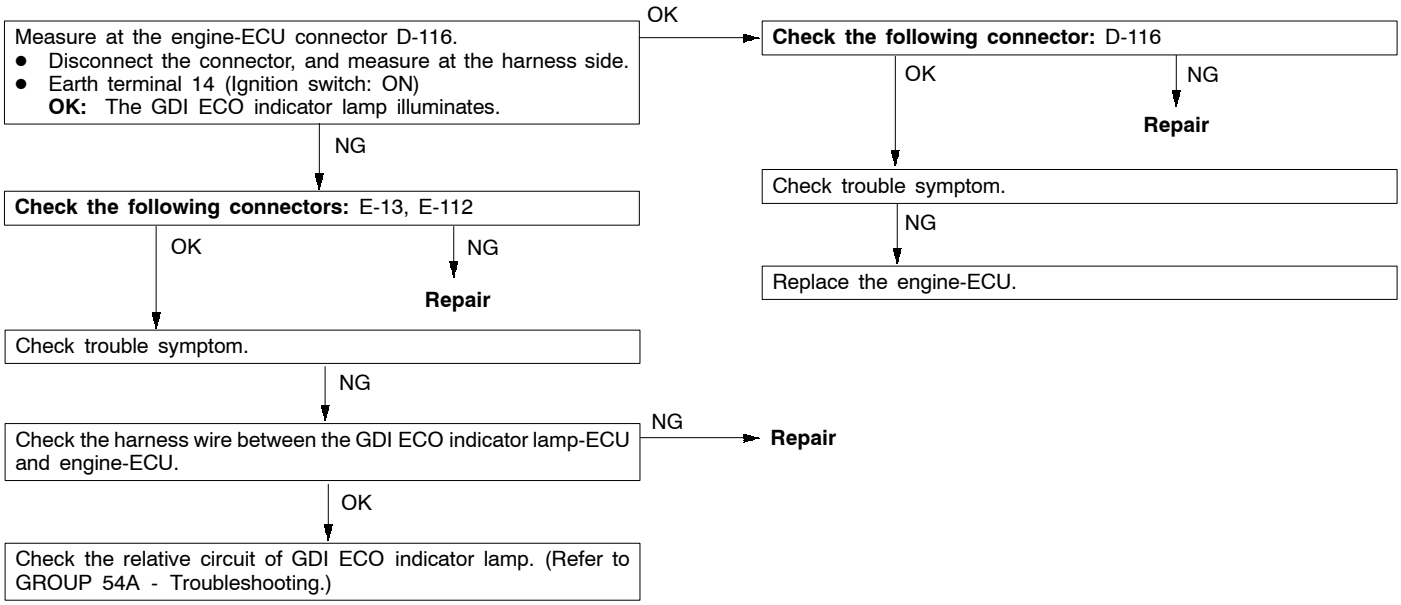
Inspection procedure 22

Clutch switch system malfunction	Probable cause
The clutch pedal switch sends a signal indicating clutch pedal depression to the engine-ECU. The engine-ECU controls the fuel injection properly according to this signal, thus prevents the fluctuation of the engine speed during shift change.	• Malfunction of the clutch switch • Open circuit or short-circuited harness wire in the clutch switch circuit • Malfunction of the engine-ECU



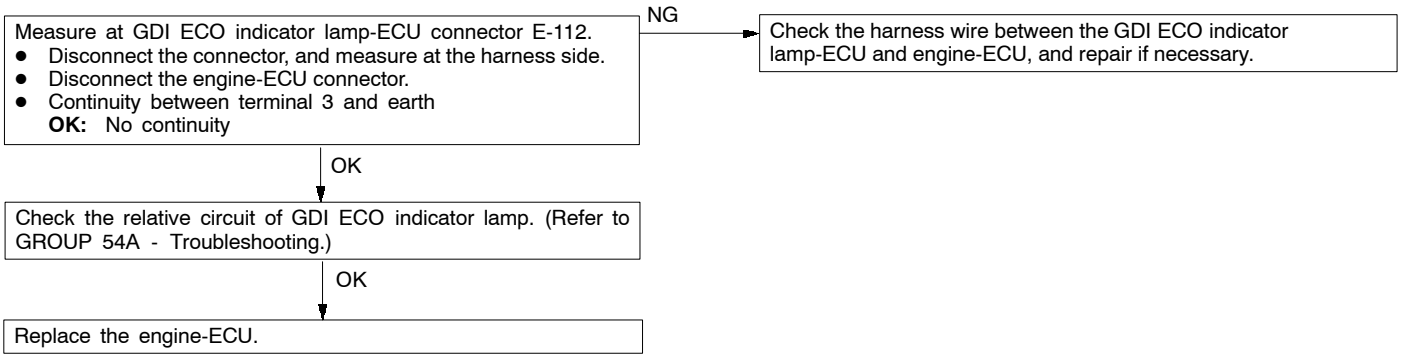
Inspection procedure 23

GDI ECO indicator lamp does not illuminate.	Probable cause
If the GDI ECO indicator lamp does not illuminate after turning switch, the causes listed in the right column are suspected.	• Burned-out GDI ECO indicator lamp bulb • Open circuit or short-circuited harness wire in the GDI ECO indicator lamp circuit • Malfunction of the engine-ECU • Malfunction of the GDI ECO indicator lamp-ECU



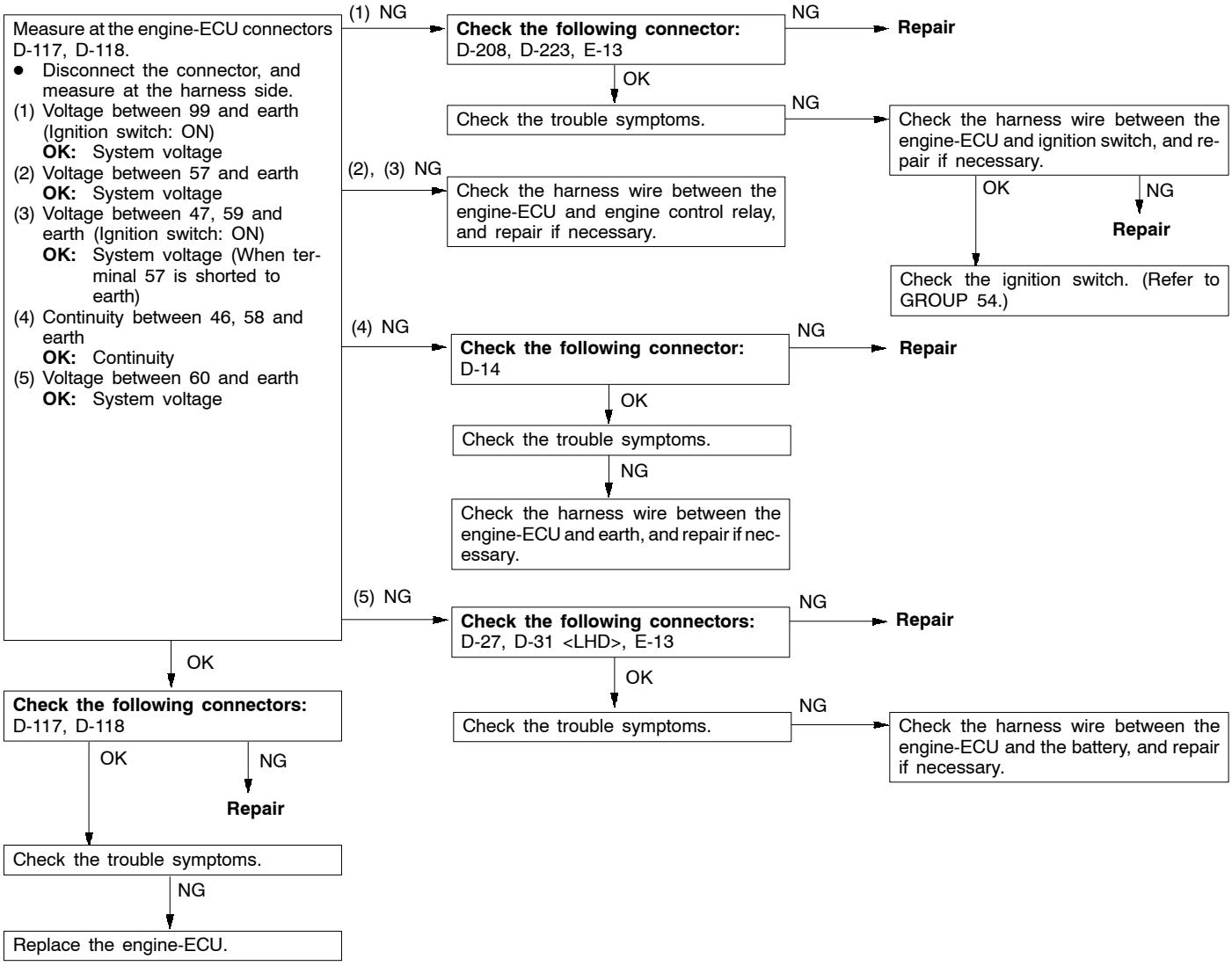
Inspection procedure 24

GDI ECO indicator lamp remains illuminated and does not go off.	Probable cause
If the GDI ECO indicator lamp does not go off during high load operation, the causes listed in the right column are suspected.	• Short circuit between the GDI ECO indicator lamp and engine-ECU • Malfunction of the engine-ECU • Malfunction of the GDI ECO indicator lamp-ECU



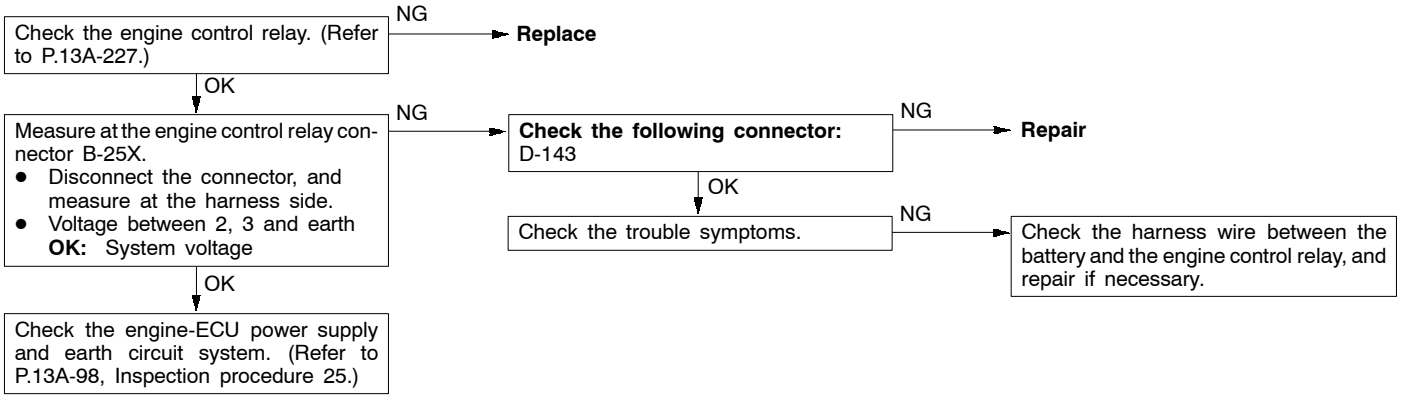
Inspection procedure 25

Engine-ECU power supply and earth circuit system	Probable cause
The cause is probably a malfunction of the engine-ECU or one of the problems listed at right.	• Open circuit or short-circuited harness wire in the engine-ECU power supply circuit • Open circuit or short-circuited harness wire in the engine-ECU earth circuit • Malfunction of the engine-ECU



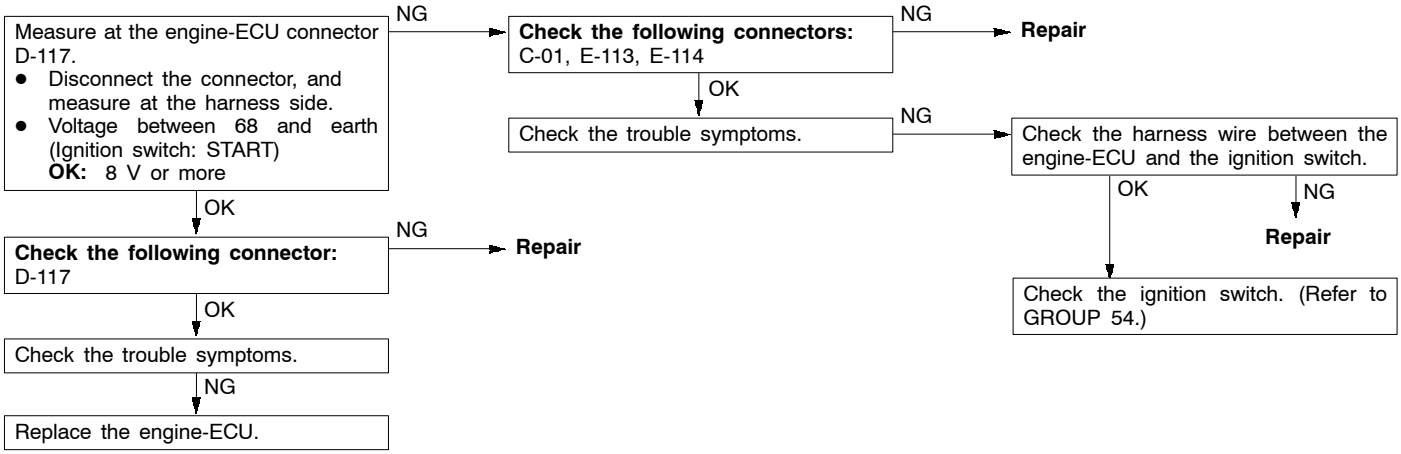
Inspection procedure 26

Engine control relay and ignition switch-IG system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, the engine-ECU turns on the engine control relay. This causes system voltage to be supplied to the engine-ECU and to the sensors and actuators.	• Malfunction of the ignition switch • Malfunction of the engine control relay • Open circuit or short-circuited harness wire of the engine control relay circuit • Malfunction of the engine-ECU



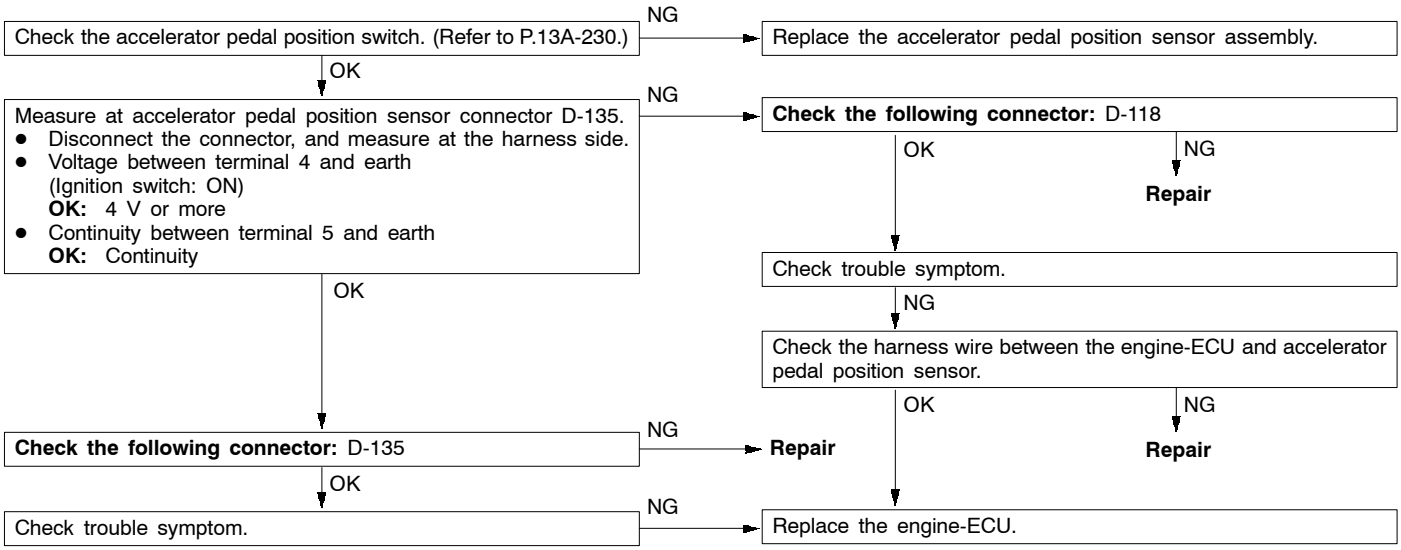
Inspection procedure 27

Ignition switch-ST system	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU uses this signal to carry out functions such as fuel injection control during starting.	• Malfunction of the ignition switch • Open circuit or short-circuited harness wire of the ignition switch circuit • Malfunction of the engine-ECU



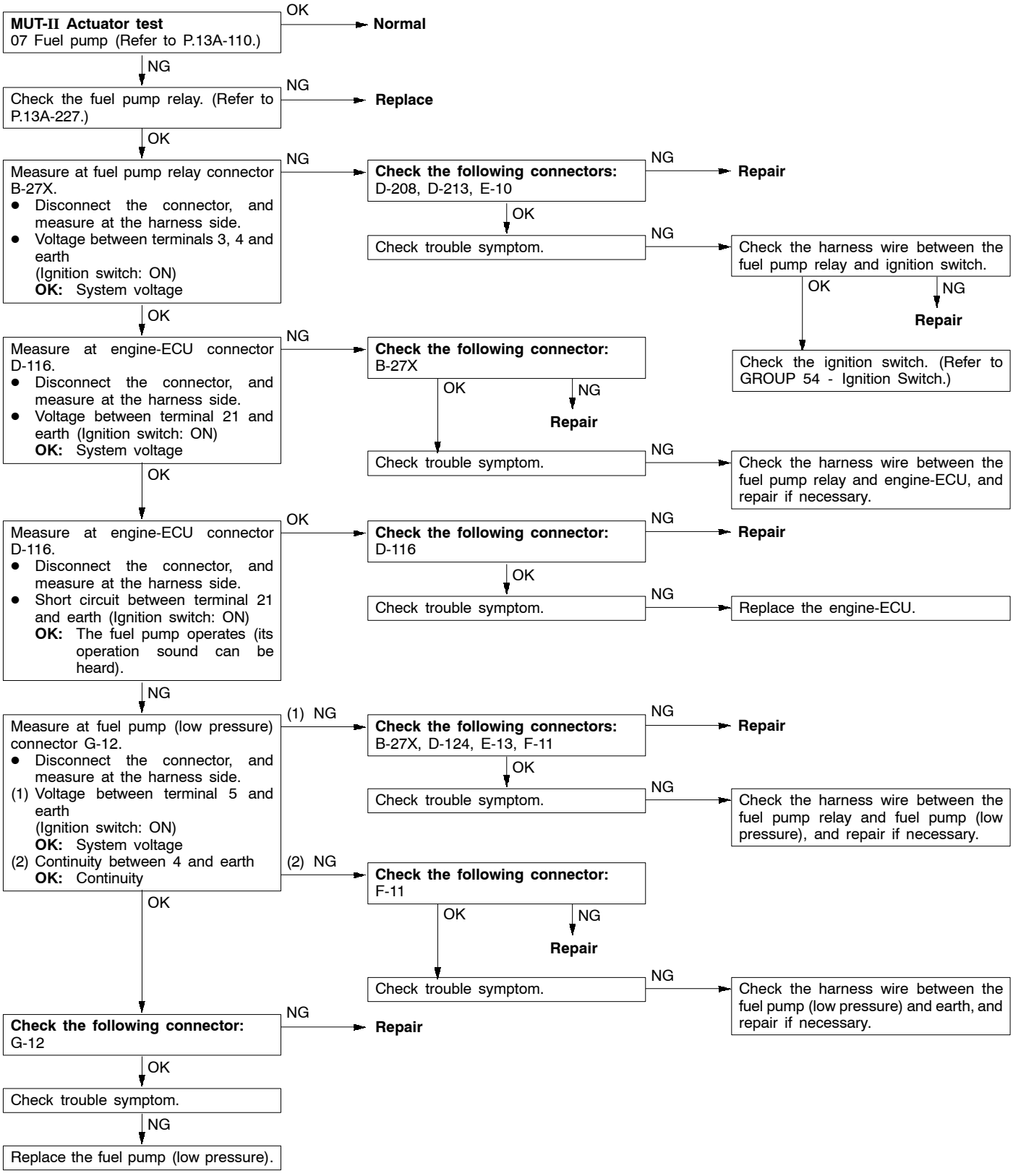
Inspection procedure 28

Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-ECU. The engine-ECU controls idle speed, based on this signal.	• Maladjustment of the accelerator cable • Maladjustment of the accelerator pedal position switch • Open circuit or short-circuited harness wire in the accelerator pedal position switch system, or poor connector contact • Malfunction of the engine-ECU



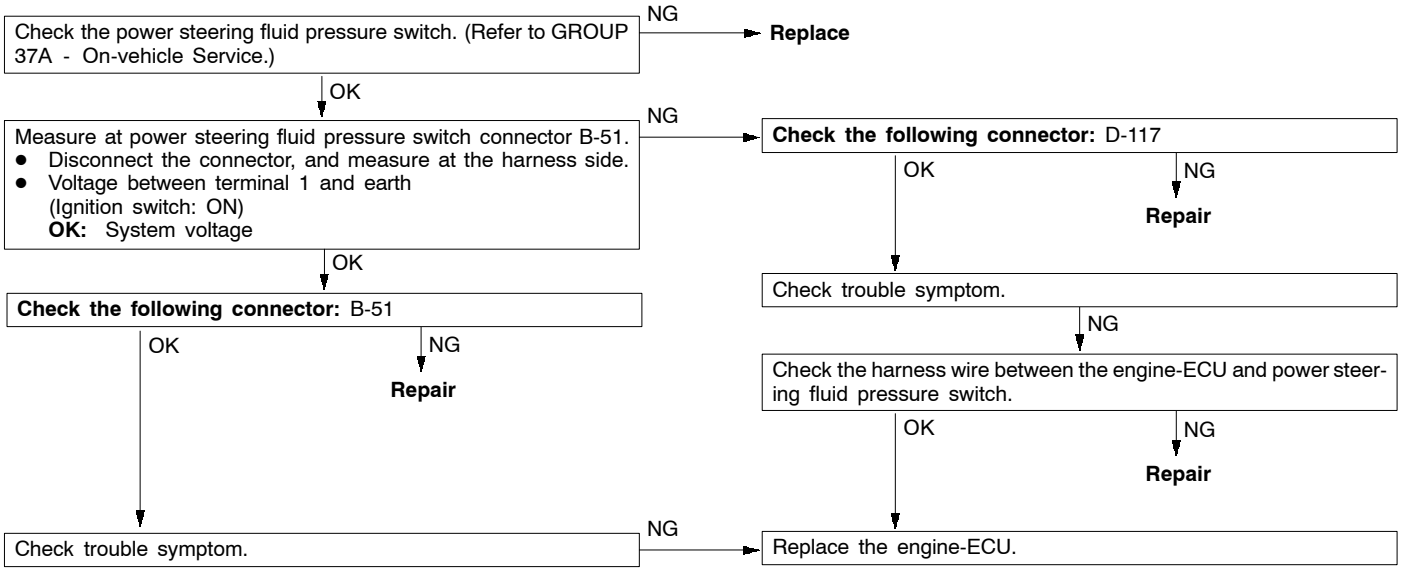
Inspection procedure 29

Fuel pump (low pressure) system	Probable cause
The engine-ECU turns on the fuel pump relay while the engine is cranking or running, and supplies power source to the fuel pump (low pressure).	• Malfunction of the fuel pump relay • Malfunction of the fuel pump (low pressure) • Open circuit or short-circuited harness wire in the fuel pump (low pressure) circuit, or poor connector contact • Malfunction of the engine-ECU



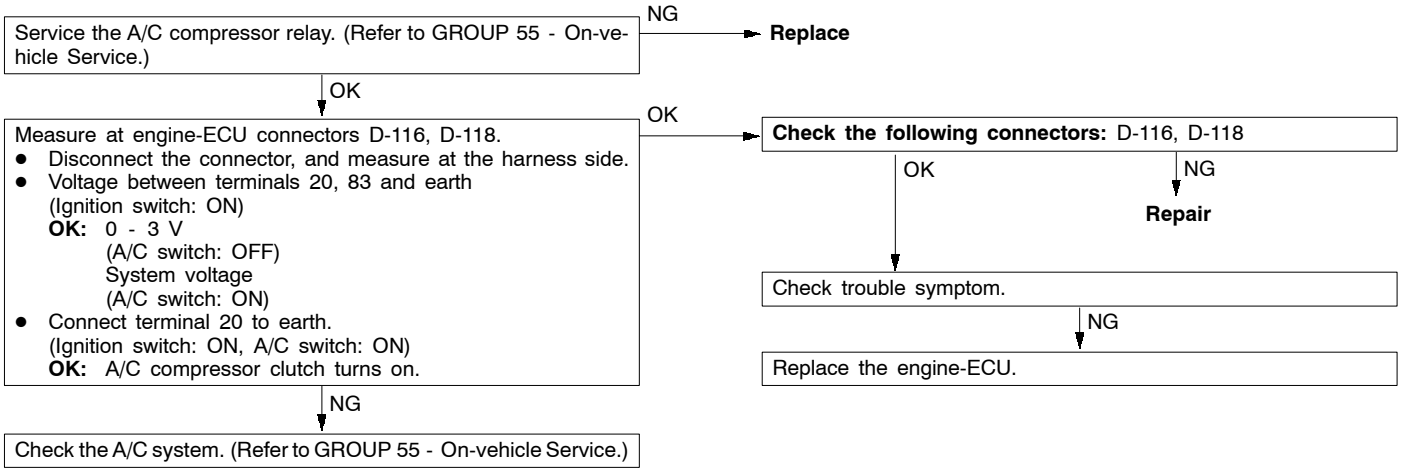
Inspection procedure 30

Power steering fluid pressure switch system	Probable cause
The power steering fluid pressure switch sends a signal to the engine-ECU according to power steering load. Based on this signal, the engine-ECU controls the throttle control servo so that idle speed increases when the power steering is in operation.	• Malfunction of the power steering fluid pressure switch • Open circuit or short-circuited harness wire in the power steering fluid pressure switch circuit, or poor connector contact • Malfunction of the engine-ECU



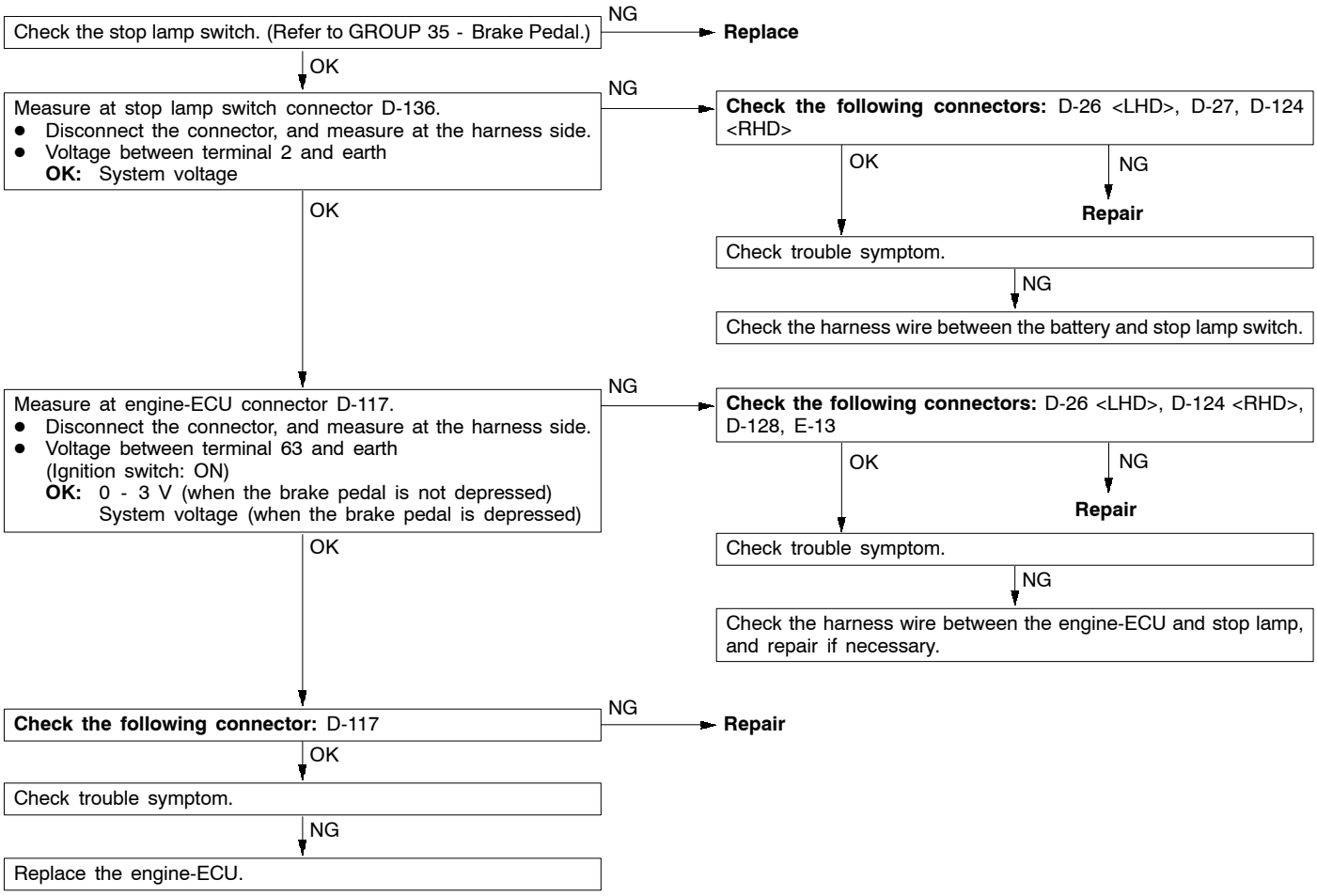
Inspection procedure 31

A/C switch and A/C relay system	Probable cause
If the engine-ECU receives a 'A/C on' signal, it operates the throttle control servo and A/C compressor magnetic clutch so that idle speed increases.	• Malfunction of the A/C control system • Malfunction of the A/C switch • Open circuit or short-circuited harness wire in the A/C switch circuit, or poor connector contact • Malfunction of the engine-ECU



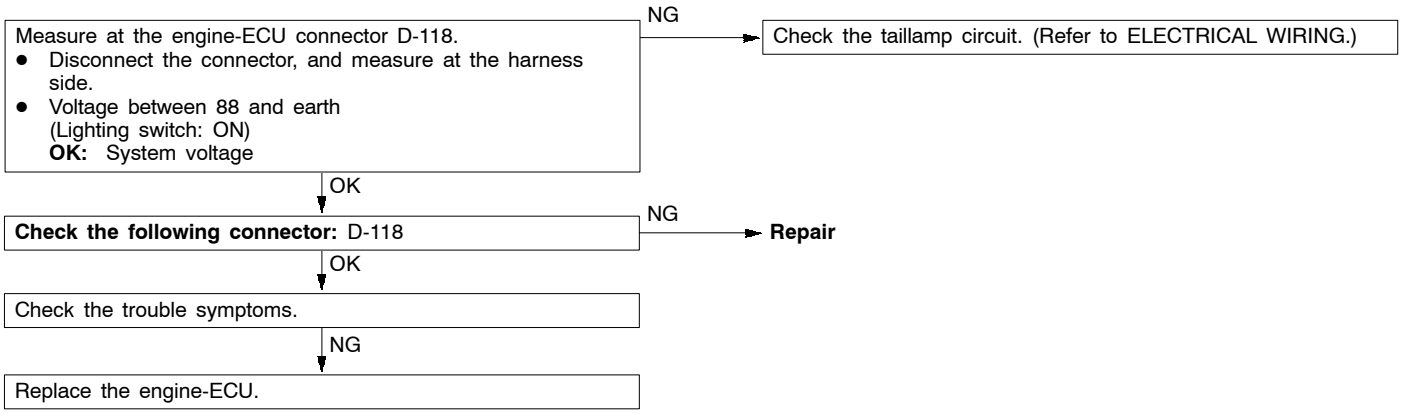
Inspection procedure 32

Stop lamp switch system	Probable cause
The engine-ECU determines whether the brake pedal is depressed or not, by means of the stop lamp switch input signal.	• Malfunction of the stop lamp switch • Open circuit or short-circuited harness wire in the stop lamp circuit, or poor connector contact • Malfunction of the engine-ECU



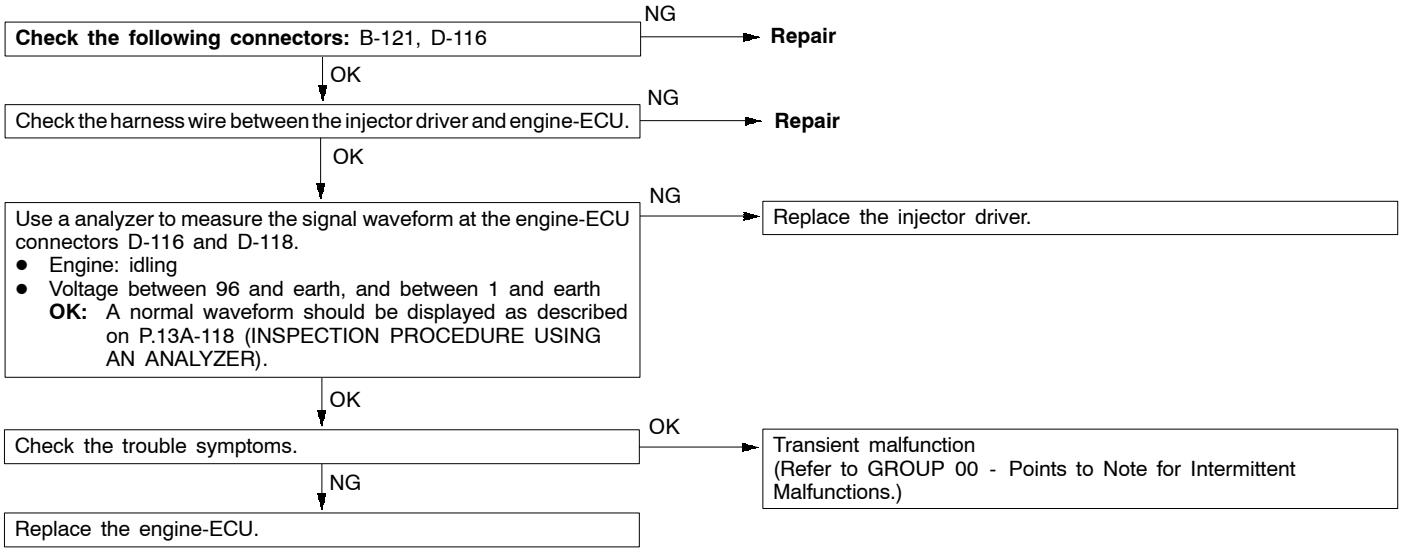
Inspection procedure 33

Small lamp switch system	Probable cause
The engine-ECU determines whether the small lamp switch is on or off. According to that information, the engine-ECU controls alternator output current when the vehicle is started.	• Improper connector contact, open circuit or short-circuited harness wire in the taillamp circuit • Malfunction of the engine-ECU



Inspection procedure 34

Injector driver system	Probable cause
The engine-ECU drives the injector by the drive signal.	• Malfunction of the injector driver • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



DATA LIST REFERENCE TABLE

Caution
When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.

NOTE
*1: Within four minutes after starting the engine
*2: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
*3: The accelerator pedal position switch normally turns off when the voltage of the accelerator pedal position sensor (1st channel) is 200 - 600 mV higher than the voltage at the idle position. If the accelerator pedal position switch turns back on after the accelerator pedal position sensor voltage has risen by 100 mV and the throttle valve has opened, the accelerator pedal position switch and the accelerator pedal position sensor (1st channel) need to be adjusted.

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front)	Engine: After warm-up	Idling	200 mV or less*1	Code No. P0130	13A-28
			Sudden racing	600 - 1,000 mV		
			2,500 r/min	400 mV or less and 600 - 1,000 mV alternates.		
12	Air flow sensor	● Engine coolant temperature: 80 - 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral	Idling	22 - 48 Hz	Code No. P0100	13A-17
			2,500 r/min	60 - 100 Hz		
			Racing	Frequency increases in response to racing.		
13	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: -20°C	-20°C	Code No. P0110	13A-21
			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.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (2nd channel)	• Engine coolant temperature: 80 - 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	4,000 mV or more	Code No. P0225	13A-52
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	400 - 600 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No.25	13A-98
18	Cranking signal (Ignition switch - ST)	Transmission: Neutral	Engine: Stopped	OFF	Procedure No.27	13A-99
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: -20°C	-20°C	Code No. P0115	13A-22
			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		
22	Crank angle sensor	• Engine: cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13A-56
		• Engine: Idling • Accelerator pedal position switch: ON	Engine coolant temperature: -20°C	1,250 - 1,450 r/min		
			Engine coolant temperature: 0°C	1,100 - 1,300 r/min		
			Engine coolant temperature: 20°C	1,000 - 1,200 r/min		
			Engine coolant temperature: 40°C	900 - 1,100 r/min		
			Engine coolant temperature: 80°C	550 - 650 r/min*1		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No. P0105	13A-19
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No.28	13A-100
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No.30	13A-102
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No.31	13A-100
			A/C switch: ON	ON		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.33	13A-104
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No. P0100	13A-17
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Engine is idling	20 - 40%	-	-
			2,500 r/min	10 - 30%		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	• Engine: Cranking [reading is possible at 2,000 r/min or less] • Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	-	-

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time *2	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idling	0.3 - 0.8 ms*1	-	-
			2,500 r/min	0.4 - 1.0 ms		
			Sudden racing	Increases		
44	Ignition advance	• Engine: After warm-up • Set a timing light.	Idling	5 - 20°BTDC *1	Code No. P0300	13A-53
			2,500 r/min	15 - 35°BTDC		
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.31	13A-102
			A/C switch: ON	ON (compressor clutch is operating)		
59	Oxygen sensor (rear)	• Transmission: 2nd gear • Drive with throttle widely open	3,500 r/min	600 - 1,000 mV	Code No. P0136	13A-31
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.32	13A-103
			Brake pedal: Released	ON		
68	EGR valve	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idling	2 - 20 STEP	Code No. P0403	13A-60
			2,500 r/min	0 - 10 STEP		
74	Fuel pressure sensor	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Engine: Idling	4 - 6.9 MPa	Code No. P0190	13A-36

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	985 - 1085 mV	Code No.P1225	13A-68
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
78	Accelerator pedal position sensor (1st channel) *3	Ignition switch: ON	Release the accelerator pedal.	985 - 1085 mV	Code No.P0220	13A-50
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 - 4,800 mV		
79	Throttle position sensor (1st channel)	• Engine coolant temperature: 80 - 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	400 - 800 mV	Code No.0120	13A-25
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			4,600 - 5,200 mV	4,200 - 4,800 mV		
		Engine: After warm-up, idling	No load	450 - 1,000 mV		
			A/C switch: OFF → ON	Increases by 100 - 600 mV.		
99	Fuel injection mode	Engine: After warm up	Idling (after four minutes or more have passed since engine start)	Lean compression	-	-
			2,500 r/min	Stoichiometric metric feedback		
			Sudden racing after idle position	Open loop		

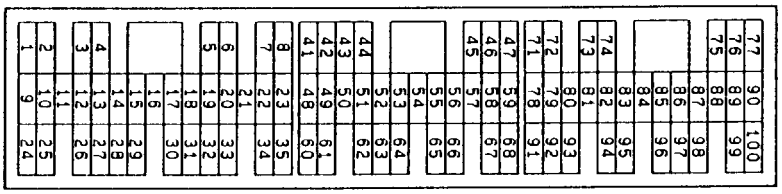
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. P0201	13A-38
02		Cut fuel to No. 2 injector			Code No. P0202	13A-40
03		Cut fuel to No. 3 injector			Code No. P0203	13A-42
04		Cut fuel to No. 4 injector			Code No. P0204	13A-44
05		Cut fuel to No. 5 injector			Code No. P0205	13A-46
06		Cut fuel to No. 6 injector			Code No. P0206	13A-48
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 29	13A-101
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Code No. P0443	13A-62
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Idling after engine warm up	5°BTDC	-	-
21	Condenser fan	Drive the fan motor	Ignition switch: ON	The fan motor operates	Procedure No.21	13A-95
34	Electronic-controlled throttle valve system	Stop the throttle control servo.	Ignition switch: ON	Throttle valve is opened slightly.	Code No. P1220	13A-64

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



Terminal No.	Check item	Check requirements (engine condition)	Normal condition
1	No.1 injector	Engine: Warm up, and then depress the accelerator pedal suddenly from the idle speed.	Decreases slightly for short time from 9 - 13 V.
9	No.2 injector		
24	No.3 injector		
2	No.4 injector		
10	No.5 injector		
25	No.6 injector		
3	No.1 ignition coil	Engine: 3,000 r/min	0.3 - 3.0 V.
12	No.2 ignition coil		
26	No.3 ignition coil		
4	No.4 ignition coil		
13	No.5 ignition coil		
27	No.6 ignition coil		
5	EGR valve (D)	Ignition switch: Immediately after turning ON	5 - 8 V (fluctuates for approx. three seconds)
6	EGR valve (C)		
32	EGR valve (B)		
34	EGR valve (A)		
8	Alternator G terminal	• Engine: Warm up, and then idling • Radiator fan: not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON	Voltage increases by 0.2 - 3.5 V
14	GDI ECO indication lamp	Ignition switch: OFF → ON	0 - 3 V (system voltage after five seconds)
		Engine: When the accelerator pedal is suddenly depressed while the engine is idling	System voltage

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
16	Purge control solenoid valve	● Engine coolant temperature: 80 - 95°C ● Ignition switch: ON	Engine: stopped	System voltage
			Engine: Start the engine, and then increase engine speed up to 3,500 r/min.	Voltage decreases.
18	Condenser fan relay	Condenser fan is not operating.		System voltage
		Condenser fan is operating.		0 - 3 V
20	Fuel pump relay	Ignition switch: ON	Engine: stopped	System voltage
			Engine: idling	0 - 3 V
21	A/C relay	● Engine: idling ● A/C switch: OFF → ON (Compressor is operating)		System voltage, or changes from momentarily 6 V or more to 0 → 3 V
31	Engine warning lamp	Ignition switch: OFF → ON		0 - 3 V → System voltage (after several seconds)
41	Sensor power supply	Ignition switch: ON		4.5 - 5.5 V
42	Power supply to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 - 5.5 V
43	Crank angle sensor	Engine: Cranking		0.4 - 4.0 V
		Engine: Idling		1.5 - 2.5 V
44	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0 °C	3.2 - 3.5 V
			Engine coolant temperature: 20 °C	2.3 - 2.9 V
			Engine coolant temperature: 40 °C	1.5 - 2.1 V
			Engine coolant temperature: 80 °C	0.4 - 1.0 V
45	Engine ignition signal	Engine: 3,000 r/min		0.3 - 3.0 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
47	Power supply	Ignition switch: ON		System voltage
59				
50	Camshaft position sensor	Engine: Cranking		0.4 - 3.0 V
		Engine: Idling		0.5 - 2.0 V
51	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 - 4.3 V
			Altitude: 1,200 m	3.2 - 3.8 V
52	Alternator FR terminal	● Engine: Warm up, and then idling ● Radiator fan: not operating ● Headlamp: OFF → ON ● Stop lamp: OFF → ON ● Rear defogger: OFF → ON		Voltage decreases
53	Oxygen sensor (rear)	● Transmission: 2nd gear ● Engine speed: 3,500 r/min or more ● Driving with the throttle valve widely open		0.6 - 1.0 V
54	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 - 3 V
55	Injector driver relay	Ignition switch: OFF		0 - 0.1 V
		Ignition switch: ON		0.5 - 1.0 V
56	Throttle valve control servo relay	Ignition switch: OFF		0 - 0.3 V
		Ignition switch: ON		0.5 - 1.0 V
57	Engine control relay	Ignition switch: OFF		0 - 3 V
		Ignition switch: ON		System voltage
60	Back-up power source	Ignition switch: OFF		System voltage
61	Air flow sensor	Engine: Idling		2.2 - 3.2 V
		Engine: 2,500 r/min		
62	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 - 3.8 V
			Intake air temperature: 20°C	2.3 - 2.9 V
			Intake air temperature: 40°C	1.5 - 2.1 V
			Intake air temperature: 80°C	0.4 - 1.0 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
63	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 - 3 V
65	A/C switch (2nd channel)	Refer to GROUP 55 - Troubleshooting “Check at the A/C-ECU terminal, engine-ECU output terminals.”		
66	Clutch switch	Depress the clutch pedal.		0 - 3 V
		Release the clutch pedal.		System voltage
68	Ignition switch-ST	Engine: Cranking		8V or more
71	Oxygen sensor (front)	Engine: Warm up, and then hold the engine speed at 2,500r/min (Use a digital voltmeter).		0 ↔ 0.8 V alternates.
76	Air flow sensor reset signal	Engine: Idling		0 - 1 V
		Engine: 3,000 r/min		6 - 9 V
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.5 - 5.5 V
			Depress the accelerator pedal fully.	0.4 - 0.6 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 - 1 V
			Depress the accelerator pedal fully.	4V or more
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward.		0 ↔ system voltage alternates.
83	A/C switch (1st channel)	Engine: Idling	A/C switch: OFF	0 - 3 V
			A/C switch: ON (Compressor is operating)	System voltage
88	Small lamp switch	Lighting switch: OFF		0 - 3 V
		Lighting switch: ON (Taillamp: ON)		System voltage
89	Oxygen sensor heater (front)	Engine: Idling		0 - 3 V
		Engine: 3,500 r/min		System voltage
90	Oxygen sensor heater (rear)	Engine: Idling		0 - 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 - 4.7 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
94	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.3 - 1.0 V*1
			Depress the accelerator pedal fully.	4.2 - 5.5 V*2
96	Injector open circuit check signal	Engine: Increase engine speed from idle speed to 4,000 r/min.		Decreases slightly (approx. 0.7V) from 4.5 V - 5.0 V.
99	Ignition switch - IG	Ignition switch: ON		System voltage

NOTE
Check if the difference in output between *1 and *2 is 4 V or more.

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

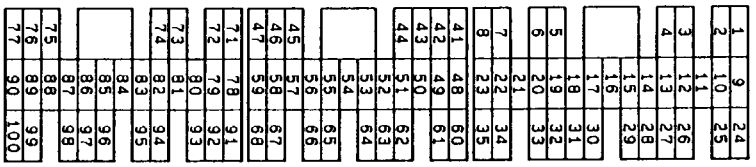
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   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.

   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!

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then 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 Terminal Arrangement

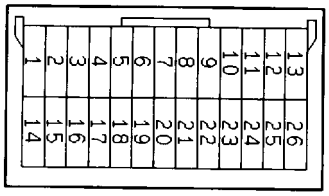


Terminal No.	Check item	Standard value, normal condition (check requirements)
5 - 47	EGR valve (D)	15 - 20 Ω (at 20°C)
6 - 47	EGR valve (C)	
32 - 47	EGR valve (B)	
34 - 47	EGR valve (A)	
16 - 47	Purge control solenoid valve	36 - 44 Ω (at 20°C)
44 - 72	Engine coolant temperature sensor	5.1 - 6.5 kΩ (when engine coolant temperature is 0°C)
		2.1 - 2.7 kΩ (when engine coolant temperature is 20°C)
		0.9 - 1.3 kΩ (when engine coolant temperature is 40°C)
		0.26 - 0.36 kΩ (when engine coolant temperature is 80°C)
46 - Body earth	Earth	Continuity (0 Ω)
58 - Body earth		
62 - 72	Intake air temperature sensor	5.3 - 6.7 kΩ (when intake air temperature is 0°C)
		2.3 - 3.0 kΩ (when intake air temperature is 20°C)
		1.0 - 1.5 kΩ (when intake air temperature is 40°C)
		0.30 - 0.42 kΩ (when intake air temperature is 80°C)
79 - 49	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
89 - 47	Oxygen sensor heater control (front)	4.5 - 8.0 Ω (at 20°C)
90 - 47	Oxygen sensor heater (rear)	4.5 - 8.0 Ω (at 20°C)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

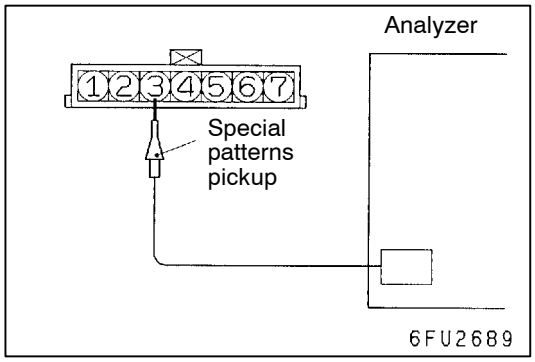
TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



7FU2290

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
1	Throttle control servo (U)	• Ignition switch: ON • Accelerator pedal: From released position to fully depressed position		Changes
14	Throttle control servo (V)			
15	Throttle control servo (W)			
2	Throttle control servo power supply	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor applied voltage	Ignition switch: ON		4.5 - 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.4 - 0.8 V
			Depress the accelerator pedal fully.	4.2 - 4.8 V
18	Backup power supply	Ignition switch: OFF		System voltage
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.985 - 1.085 V
			Depress the accelerator pedal fully.	4.0 V or higher
22	Ignition switch-IG	Ignition switch: ON		System voltage



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to air flow sensor connector terminal 3.

Alternate Method (Test harness not available)

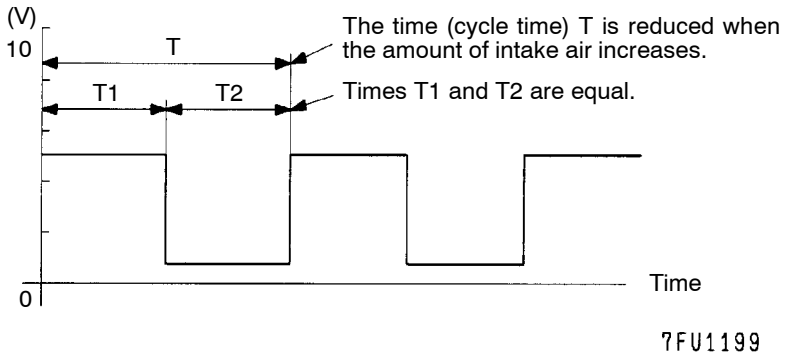
1. Connect the analyzer special patterns pickup to engine-ECU terminal 61.

Standard Wave Pattern

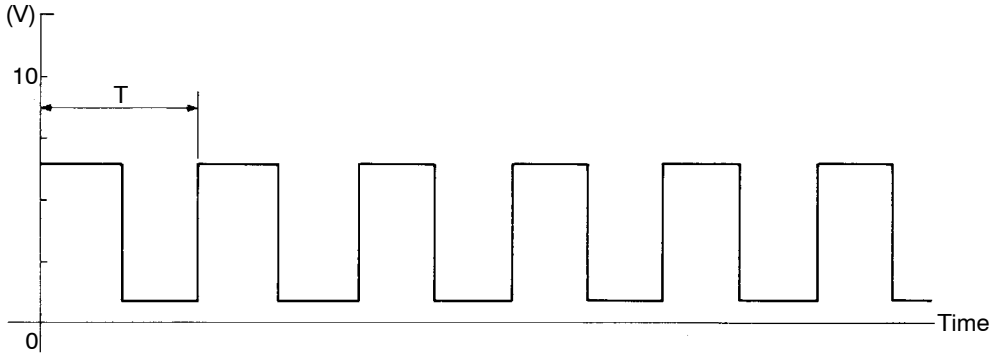
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

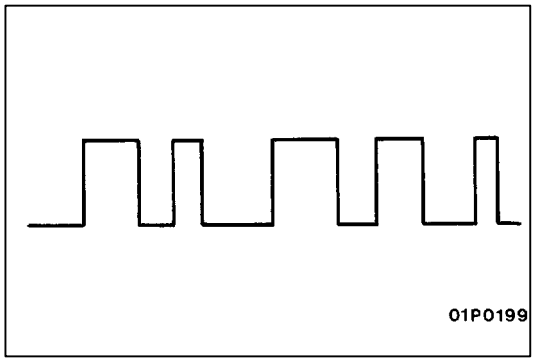


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

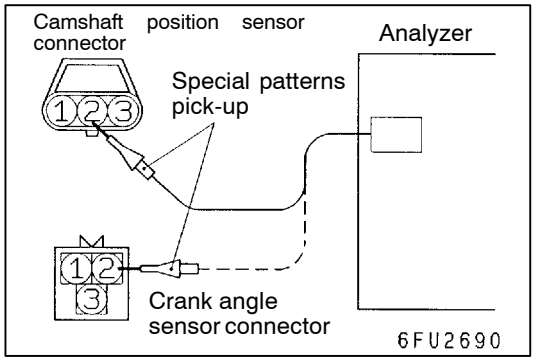
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

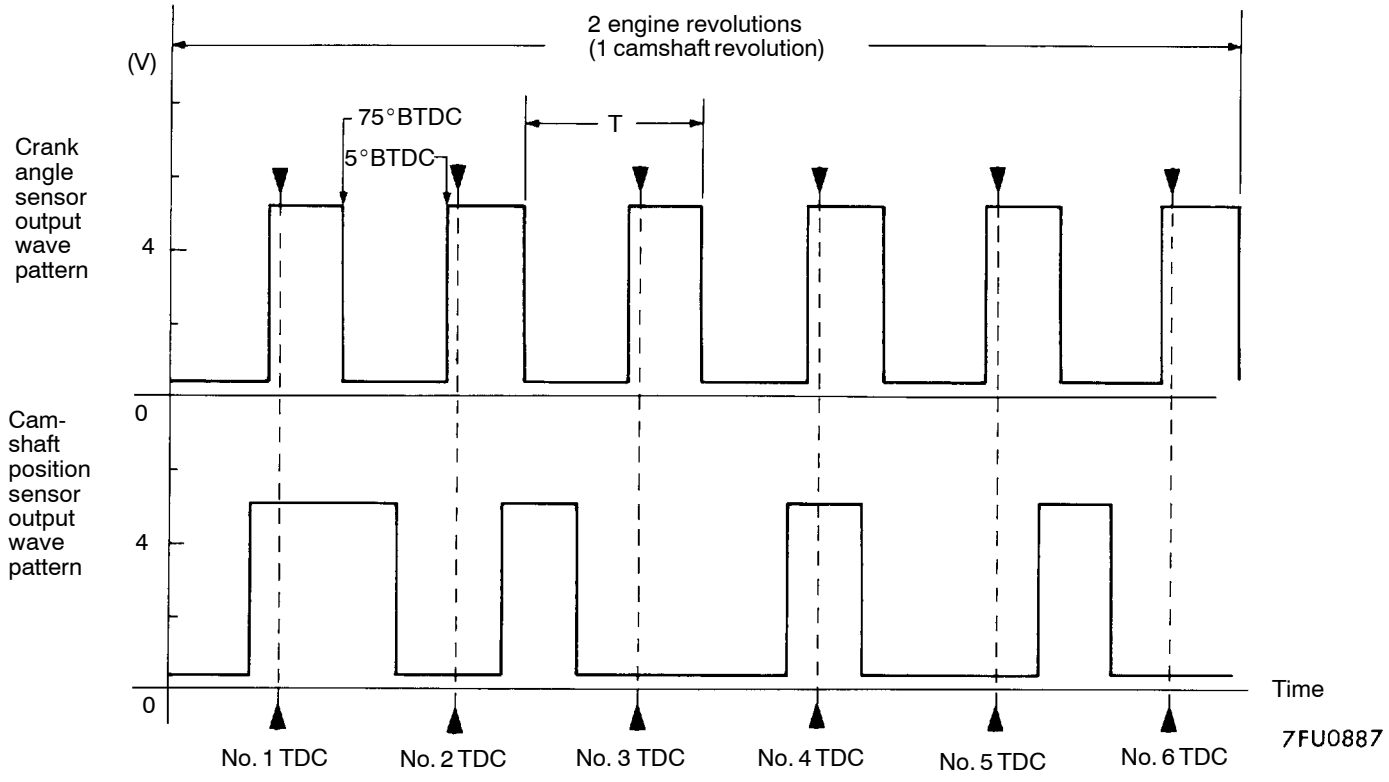
1. Connect the analyzer special patterns pickup to engine-ECU terminal 50. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 43. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

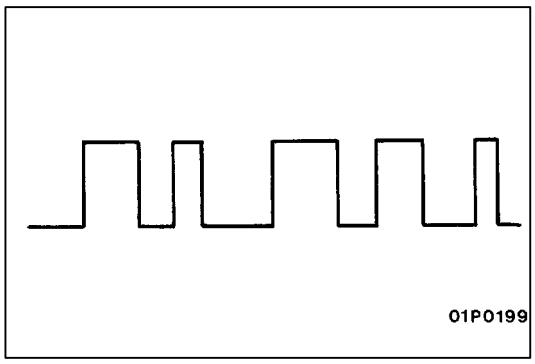
Standard wave pattern



NOTE
1. TDC: Top dead centre
2. The time (cycle time) T is reduced when the engine speed increases

Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

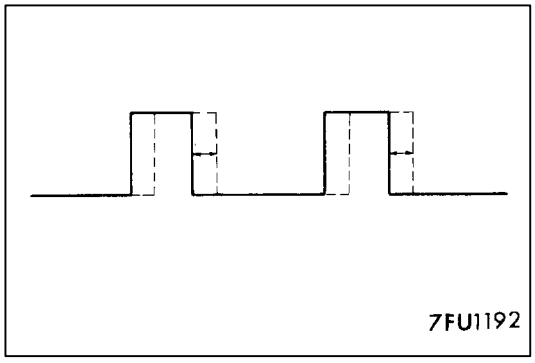
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



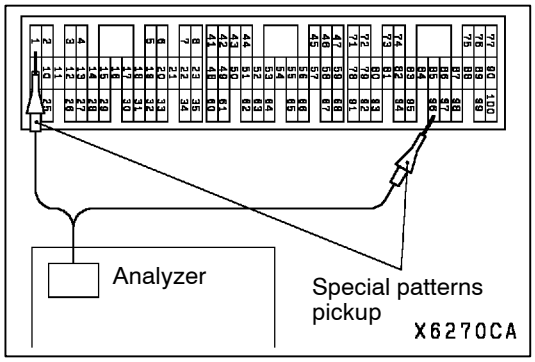
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTORS AND INJECTOR OPEN CIRCUIT CHECK SIGNAL

Measurement Method

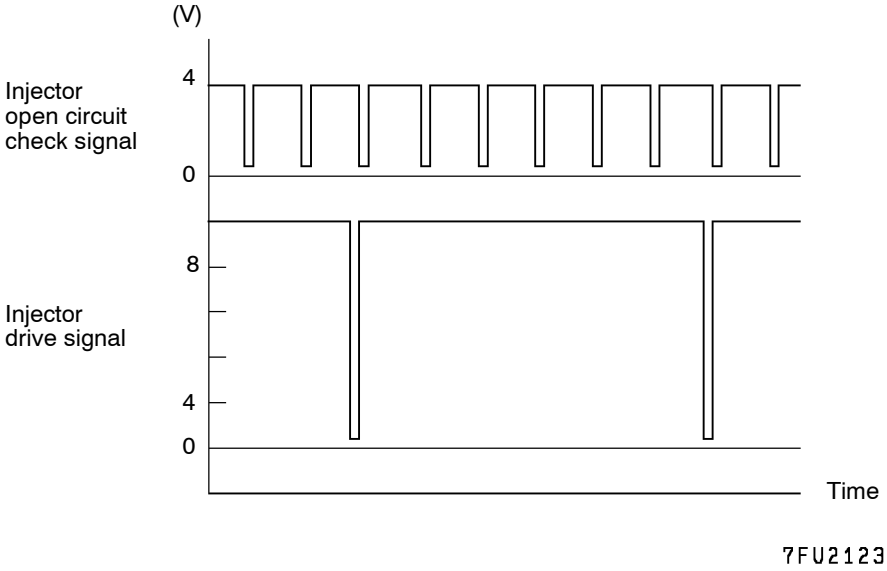
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 96 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 9 (No.2 injector), terminal 24 (No.3 injector) and terminal 2 (No.4 injector), terminal 10 (No.5 injector), terminal 25 (No.6 injector).

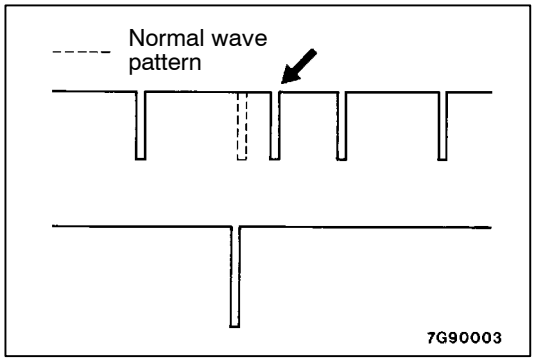
Standard Wave Pattern

Observation conditions

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

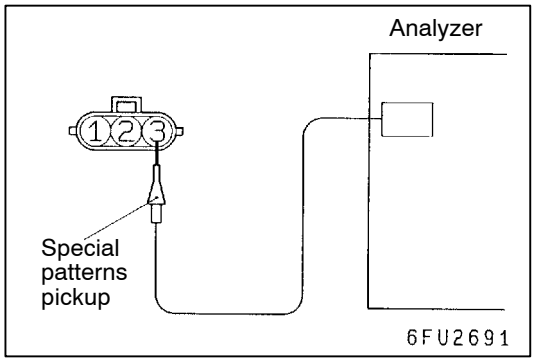
Standard wave pattern





Wave Pattern Observation Points

- Check that the injector drive time is identical to the time displayed on the MUT-II.
- Check that the injector signals become greatly extended but soon return to their normal wave length when the engine is suddenly raced.
- Check that the injector open circuit check signal is synchronized with each rising portion of the injector drive signal.



IGNITION COIL AND POWER TRANSISTOR

Power transistor control signal

Measurement Method

1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

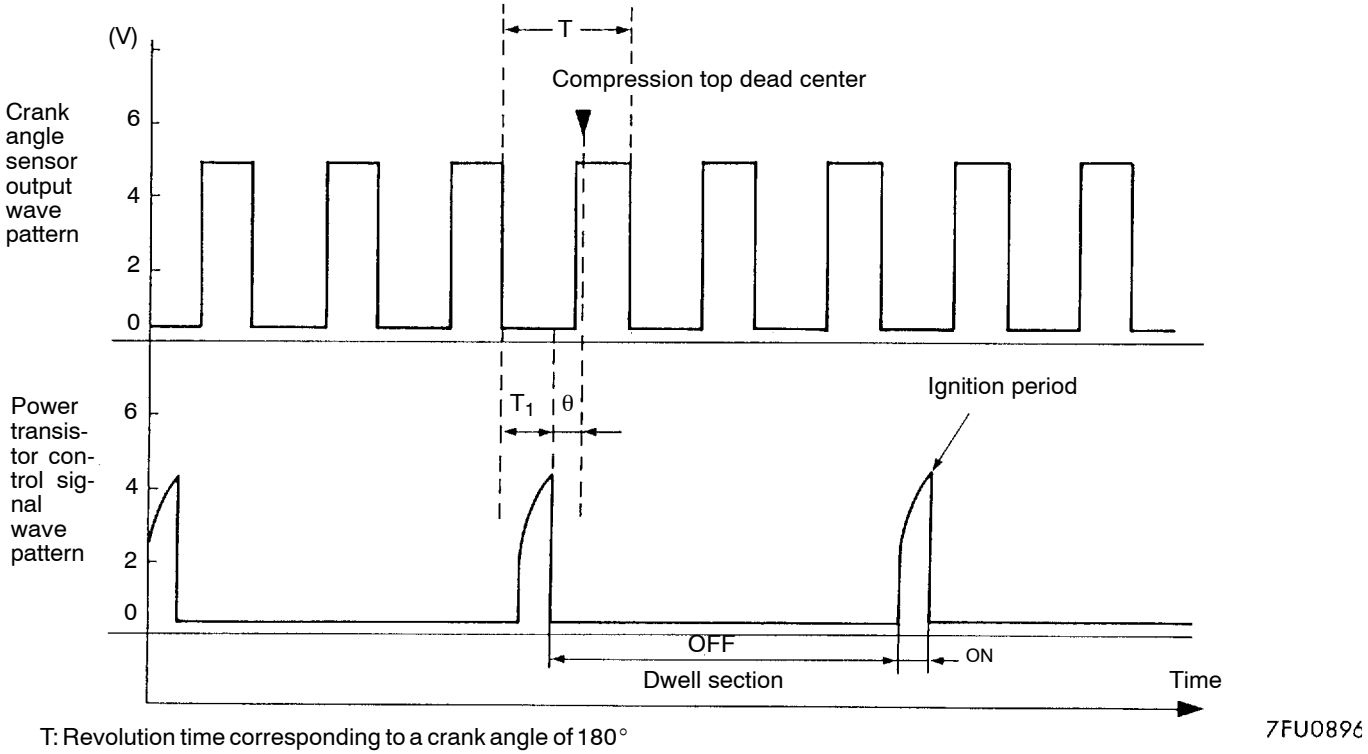
1. Connect the analyzer special patterns pickup to engine-ECU terminal 3 (No. 1 ignition coil), terminal 12 (No. 2 ignition coil), terminal 26 (No. 3 ignition coil), terminal 4 (No. 4 ignition coil), terminal 13 (No.5 ignition coil), terminal 27 (No.6 ignition coil) respectively.

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approx. 1,200 r/min

Standard wave pattern



T: Revolution time corresponding to a crank angle of 180°

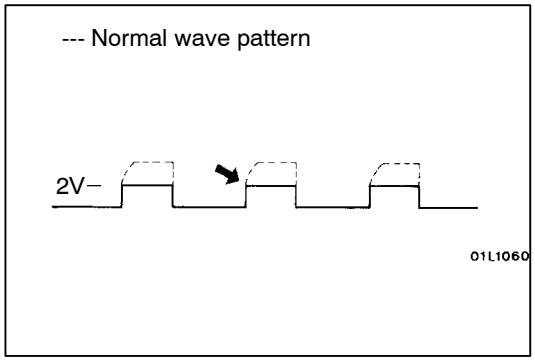
T_1: Time calculated by the engine-ECU

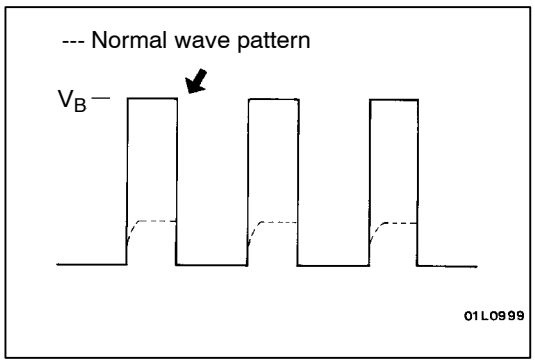
θ: Spark advance angle

Wave Pattern Observation Points

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

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction





Examples of Abnormal Wave Patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Open-circuit in ignition primary circuit

  Wave pattern characteristics

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

- Example 2

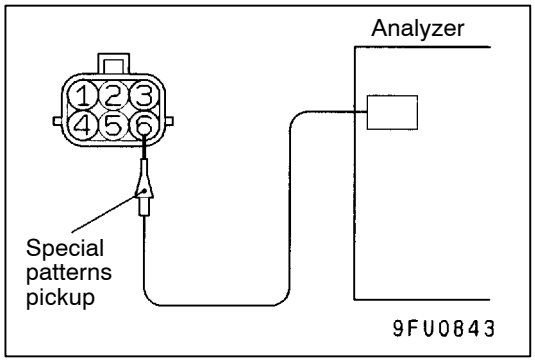
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.



EGR VALVE (STEPPER MOTOR)

Measurement Method

1. Disconnect the EGR valve connector, and connect the special tool (test harness: MB991658) in between.
2. Connect the analyzer special patterns pickup to the EGR valve-side connector terminal 1, terminal 3, terminal 4 and terminal 6 respectively.

Alternate Method (Test harness not available)

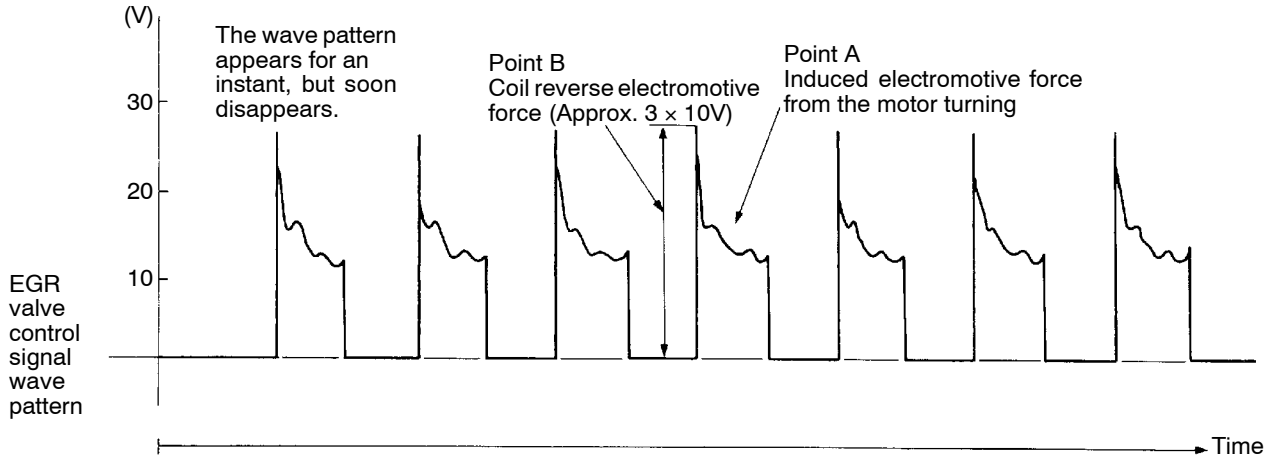
1. Connect the analyzer special patterns pickup to engine-ECU terminal 32, connection terminal 34, connection terminal 5, and connection terminal 6 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine

Standard wave pattern



7FU1204

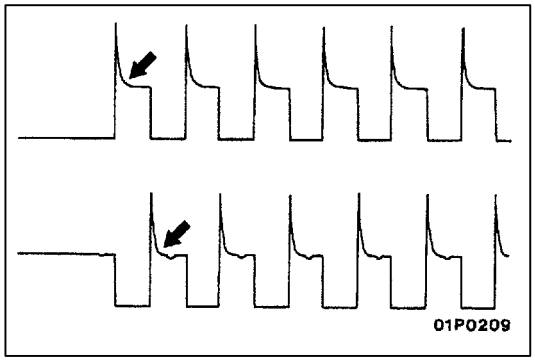
Wave Pattern Observation Points

Check that the standard wave pattern appears when the EGR control servo is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Motor is malfunctioning

Point B: Height of coil reverse electromotive force

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in the coil



Examples of Abnormal Wave Pattern

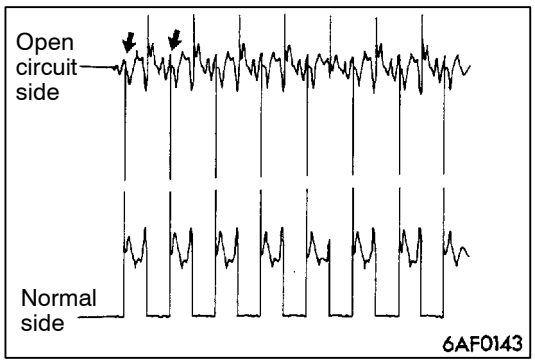
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



- Example 2

  Cause of problem

  Open circuit in the line between the EGR valve and the engine-ECU

  Wave pattern characteristics

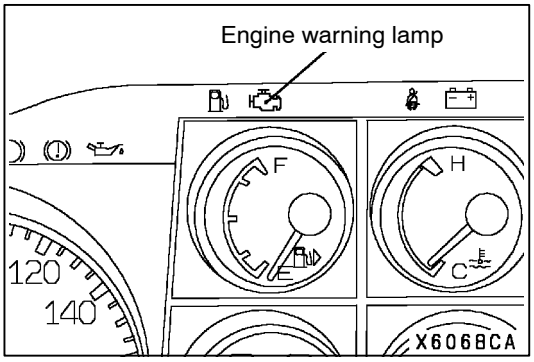
  Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 V.)
  Furthermore, the induced electromotive force waveform at the normal side is slightly different from the normal waveform.

TROUBLESHOOTING <A/T>

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

NOTE
When replacing the engine-A/T-ECU, replace immobilizer-ECU as well at the same time.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the GDI system, the engine warning lamp will illuminate. If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output. However, the warning lamp will illuminate as bulb check for five seconds whenever the ignition switch is turned to the ON position.

Engine warning lamp inspection items

Air flow sensor	Ignition coil (power transistor)
Barometric pressure sensor	Detonation sensor
Intake air temperature sensor	Crank angle sensor
Engine coolant temperature sensor	Camshaft position sensor
Oxygen sensor	EGR valve
Oxygen sensor heater	Purge control solenoid valve
Fuel system malfunction	Injector driver
Abnormal fuel pressure	Electronic-controlled throttle valve system
Injector	Throttle control servo
Throttle position sensor (1st channel)	Throttle valve controller
Throttle position sensor (2nd channel)	Immobilizer system
Accelerator pedal position sensor (1st channel)	Engine-A/T-ECU
Accelerator pedal position sensor (2nd channel)	-

Caution
If a malfunction occurred inside the engine-A/T-ECU, the engine warning lamp will remain illuminated.

NOTE
The engine warning lamp will flash when the electronic-controlled throttle valve system is suspended by the fail-safe function.

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine-A/T-ECU to DIAGNOSIS 2 mode using the MUT-II, and then carry out a road test.
2. Take a reading of the diagnosis code and repair the problem location.
3. Turn the ignition switch to the LOCK (OFF) position, and then back to ON again.

   NOTE
   By turning the ignition switch to the LOCK (OFF) position, the engine-A/T-ECU will switch the DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.
4. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and actuator test function. If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II, and then start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Suspends lean burn operation. 2. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle opening angle feedback (half as much as the opening rate in the normal condition) by using signals from the throttle position sensor (1st channel). However, this controlling system is not applied if the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V. 3. Refrains from controlling the throttle opening angle feedback if the throttle position sensor (1st channel) is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Moreover, the control system is working until the ignition switch is turned OFF if the sensor signal returns to normal.)
Camshaft position sensor	Cuts the fuel supply once a malfunction is detected. (Only when there has been no occasion of detecting No.1 cylinder top dead centre after the ignition switch is turned ON.)
Vehicle speed sensor	1. Suspends lean burn operation. However, the control is cancelled as a certain time passes by with the engine speed of 1,500 r/min or more. 2. Suspends lean burn operation during the engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Fixes the ignition timing as that for regular gasoline.
Injector	1. Suspends lean burn operation. 2. Suspends the exhaust gas recirculation.
Ignition coil (incorporating power transistor)	1. Suspends lean burn operation. 2. Cuts off the fuel supply to cylinders with an abnormal ignition signal.
Fuel pressure sensor	1. Controls as if the fuel pressure is 5MPa. 2. Suspends fuel injection. (when the low pressure is detected and the engine speed is more than 3,000r/min)
Alternator FR terminal	Refrains from controlling to suppress the alternator output to electrical load. (Operated as a normal alternator)
Accelerator pedal position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (1st channel). (However, the control system is not applicable if the difference from the accelerator pedal position sensor (1st channel) output voltage is 1.0V or higher.) 3. Suspends the electronic controlled throttle valve system if accelerator pedal position sensor (1st channel) is also defective.

Malfunctioning item	Control contents during malfunction
Accelerator pedal position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (2nd channel). (However, this control is not applicable if the voltage difference between the accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) is 1.0 V or higher.) 3. Also suspends the electronic-controlled throttle valve system when the accelerator pedal position sensor (2nd channel) is defective.
Throttle position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls throttle opening angle feedback by using signals from throttle position sensor (2nd channel). (However, the controlling system is not applied when the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V.) 3. Refrains from controlling the throttle opening angle feedback when throttle position sensor (2nd channel) is also defective.
Electronic-controlled throttle valve system	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the idle speed feedback control.
Throttle valve position feedback	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control. However, if the throttle valve opening angle is significantly wide, this system carries out the following controls. 1. Always cuts the fuel supply to three cylinders. 2. Cuts the fuel supply when the engine speed reaches 3,000 r/min or more.
Throttle control servo	1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.
Communication line between the throttle valve controller and the ECU	1. Communication error between the throttle valve controller and the engine-A/T-ECU: ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. 2. Communication error between the throttle valve controller and the engine-A/T-ECU: ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. ● The throttle valve controller controls the throttle valve opening angle by using signals from accelerator pedal position sensor (2nd channel).
Throttle valve controller	1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.

NOTE
If the electronic-controlled throttle valve system is suspended, the engine warning lamp will illuminate.

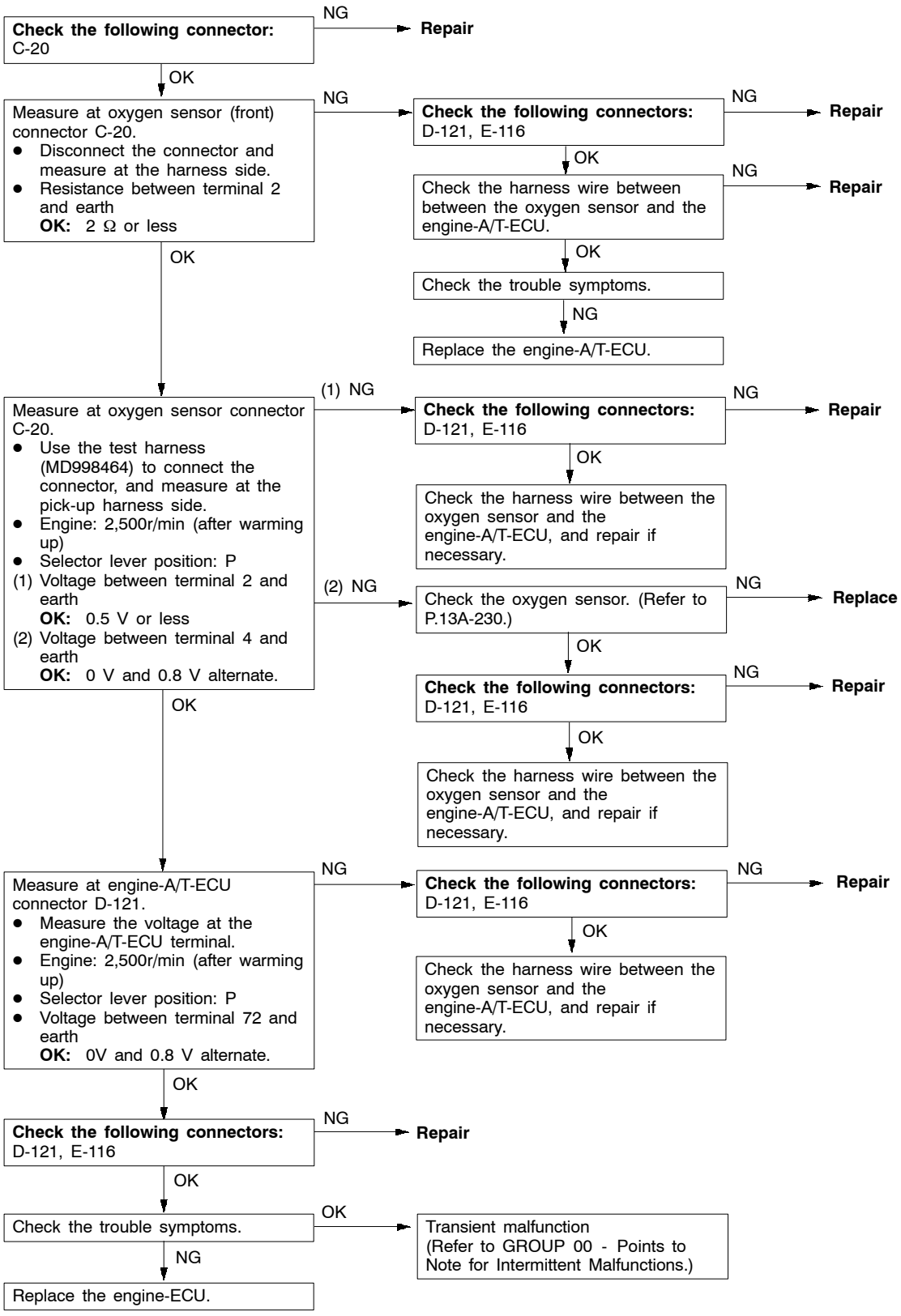
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13A-131
12	Air flow sensor system	13A-133
13	Intake air temperature sensor system	13A-135
14	Throttle position sensor (2nd channel) system	13A-137
21	Engine coolant temperature sensor system	13A-138
22	Crank angle sensor system	13A-140
23	Camshaft position sensor system	13A-142
24	Vehicle speed sensor system	13A-144
25	Barometric pressure sensor system	13A-145
31	Detonation sensor system	13A-146
41	Injector system	13A-147
44	Ignition coil (incorporating power transistor) system (for No. 1 and No. 4 cylinders)	13A-148
52	Ignition coil (incorporating power transistor) system (for No. 2 and No. 5 cylinders)	13A-148
53	Ignition coil (incorporating power transistor) system (for No. 3 and No. 6 cylinders)	13A-148
54	Immobilizer system	13A-150
56	Abnormal fuel pressure system	13A-151
64	Alternator FR terminal system	13A-153
77	Accelerator pedal position sensor (2nd channel) system	13A-154
78	Accelerator pedal position sensor (1st channel) system	13A-156
79	Throttle position sensor (1st channel) system	13A-158
89	Abnormality in fuel pressure system	13A-160
91	Electronic-controlled throttle valve system	13A-161
92	Throttle valve position feedback system	13A-162
93	Throttle valve control servo system	13A-163
94	Communication line system with throttle valve controller	13A-164
96	Throttle valve controller system	13A-165

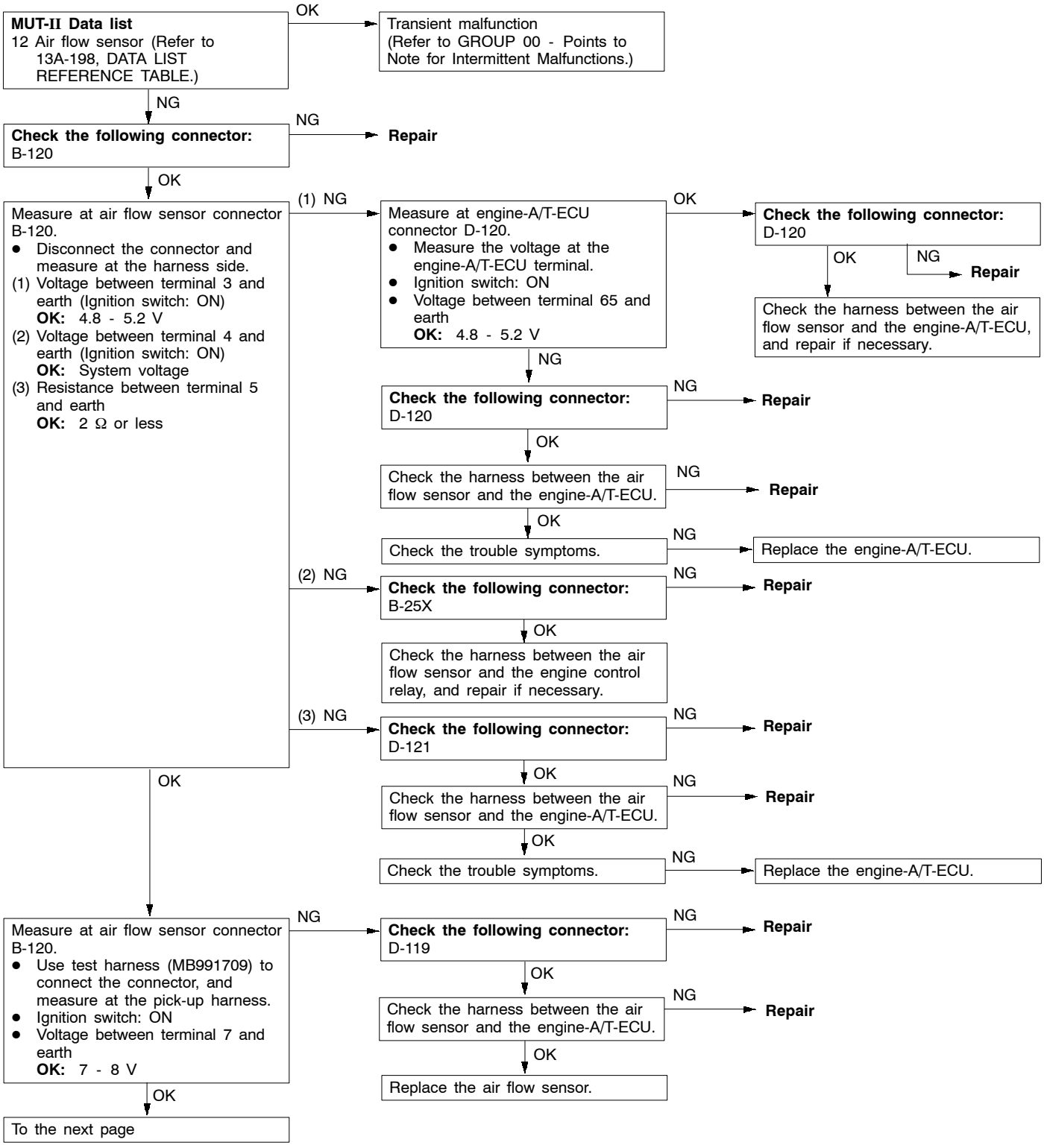
NOTE
Code No. 56 may be also output when air is sucked in high-pressure fuel line due to no fuel supply.

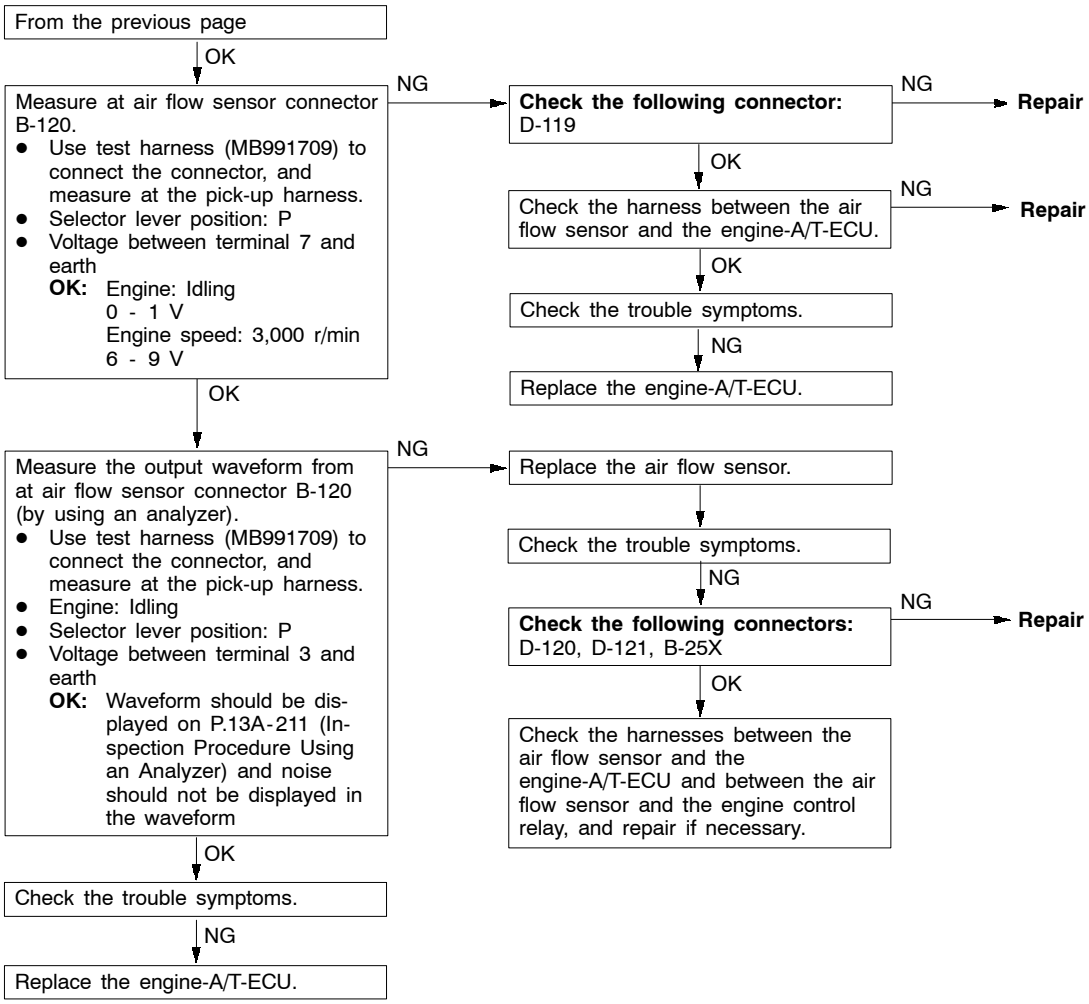
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No.11 Oxygen sensor system	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 30°C ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set Conditions ● The oxygen sensor output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor inside the engine-A/T-ECU.	● Malfunction of oxygen sensor ● Open or short circuit in the oxygen sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU

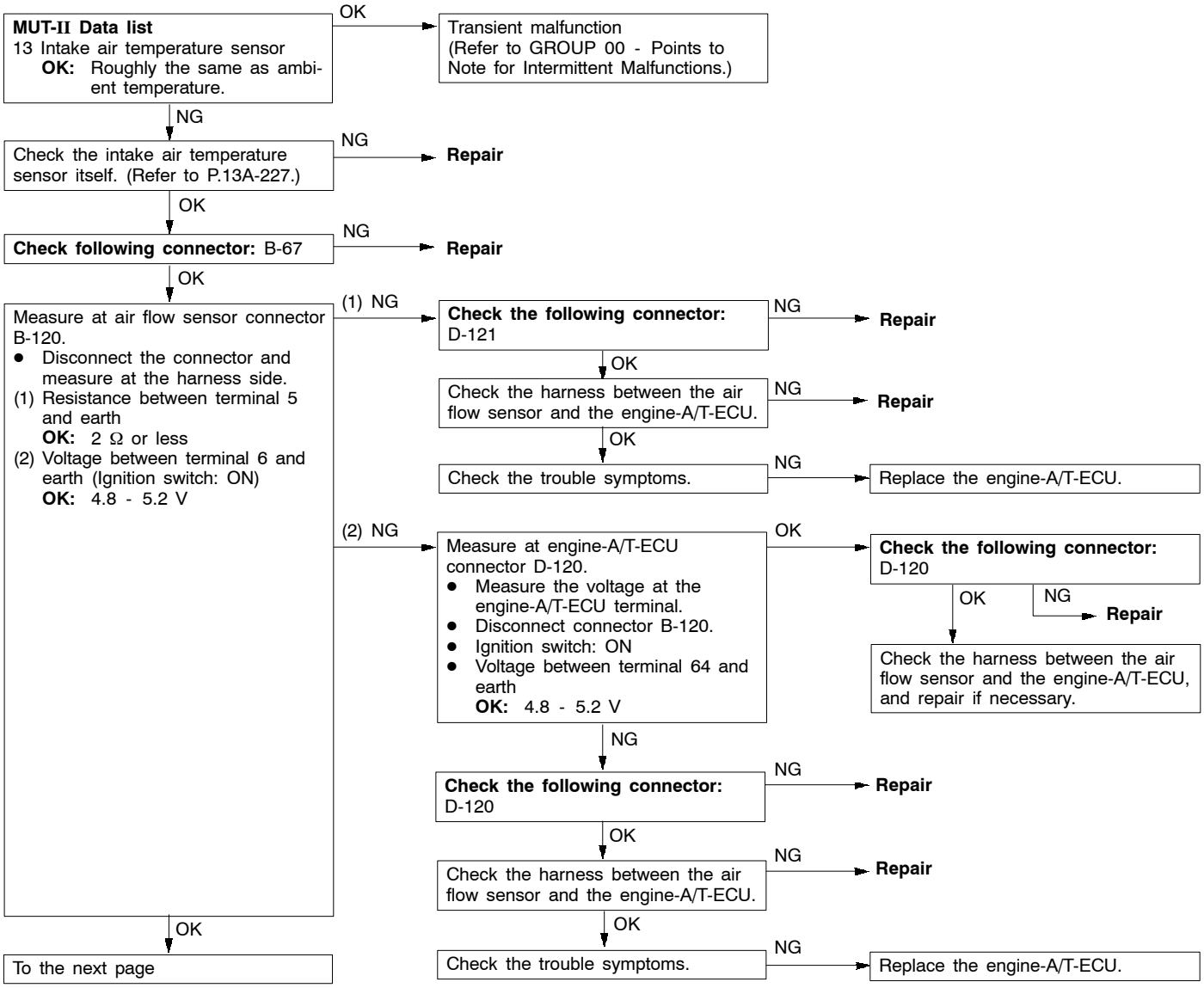

Check the following connector: C-20
NG
Repair
OK
Measure at oxygen sensor (front) connector C-20.
● Disconnect the connector and measure at the harness side.
● Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the harness wire between between the oxygen sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
OK
Measure at oxygen sensor connector C-20.
● Use the test harness (MD998464) to connect the connector, and measure at the pick-up harness side.
● Engine: 2,500r/min (after warming up)
● Selector lever position: P
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal 4 and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor and the engine-A/T-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor. (Refer to P.13A-230.)
NG
Replace
OK
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor and the engine-A/T-ECU, and repair if necessary.
OK
Measure at engine-A/T-ECU connector D-121.
● Measure the voltage at the engine-A/T-ECU terminal.
● Engine: 2,500r/min (after warming up)
● Selector lever position: P
● Voltage between terminal 72 and earth
OK: 0V and 0.8 V alternate.
NG
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the harness wire between the oxygen sensor and the engine-A/T-ECU, and repair if necessary.
OK
Check the following connectors: D-121, E-116
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

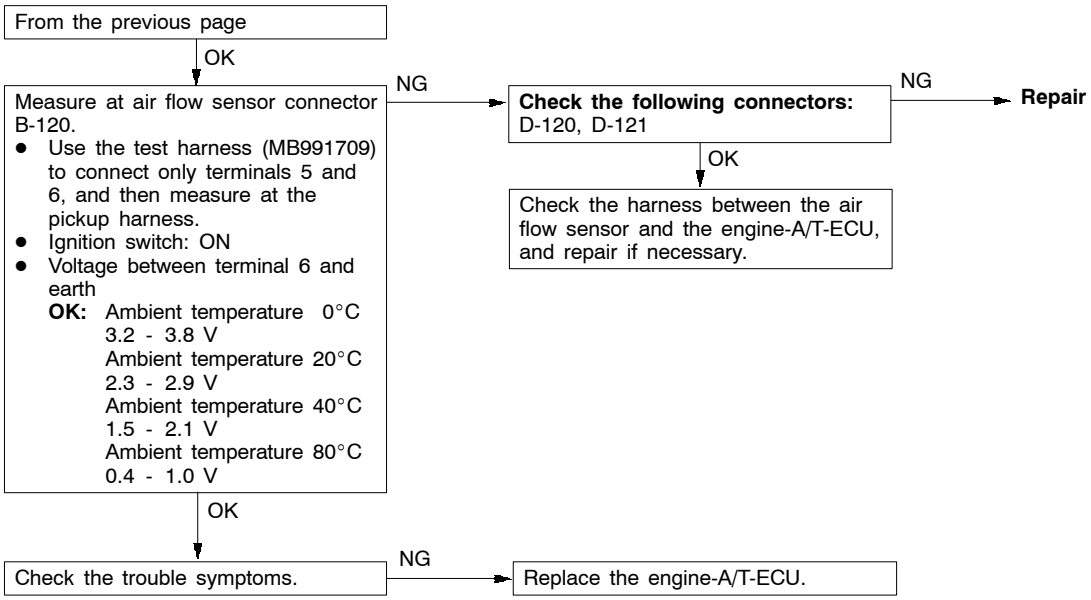
Code No.12 Air flow sensor system	Probable cause
Range of Check ● Engine speed: 500 r/min or more Set Conditions ● The sensor output frequency is 3.3 Hz or less for four seconds.	● Malfunction of air flow sensor ● Open or short circuit in air flow sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU



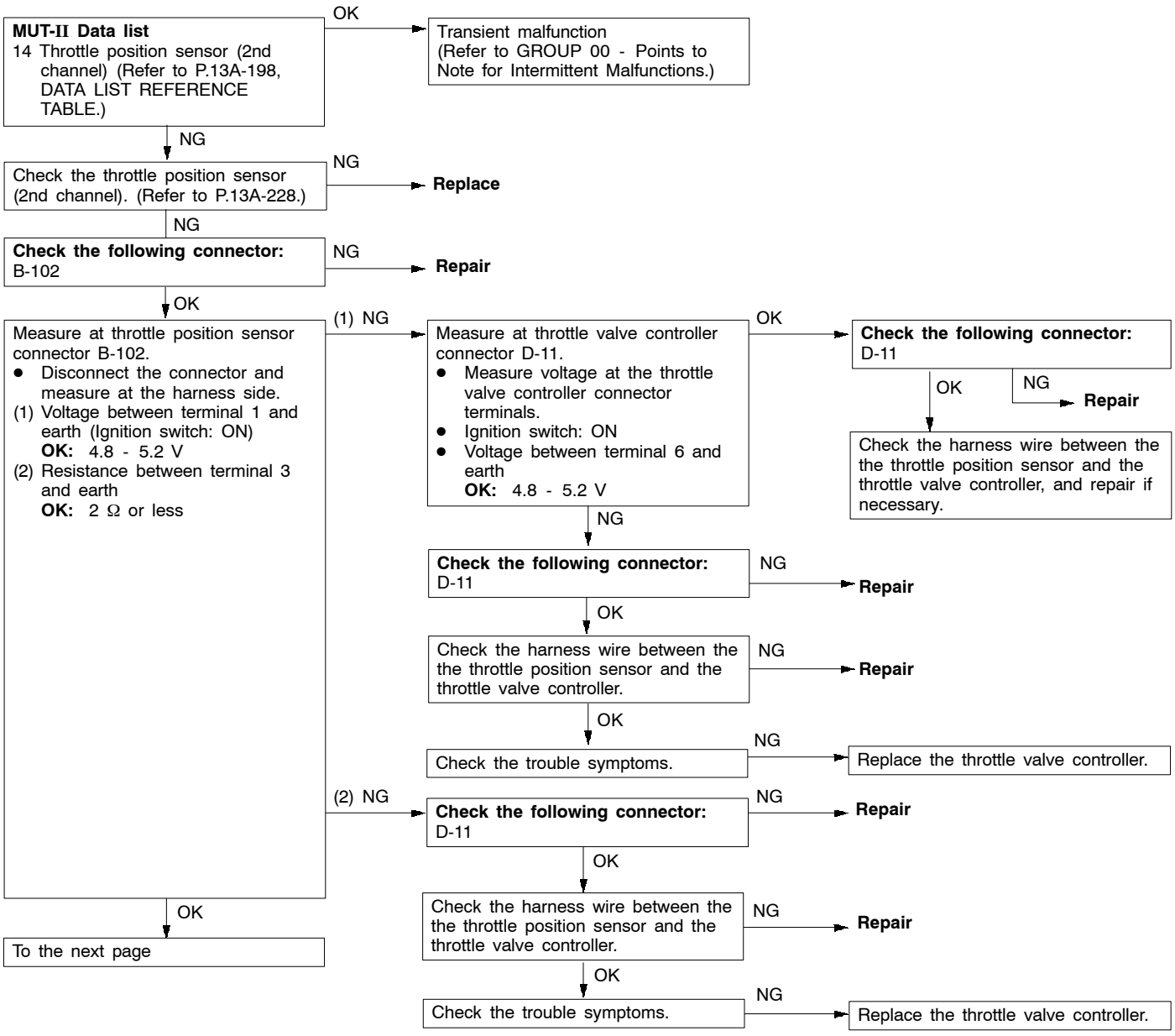

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OK
Measure at air flow sensor connector B-120.
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Selector lever position: P
● Voltage between terminal 7 and earth
OK: Engine: Idling
0 - 1 V
Engine speed: 3,000 r/min
6 - 9 V
NG
Check the following connector: D-119
NG
Repair
OK
Check the harness between the air flow sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
OK
Measure the output waveform from at air flow sensor connector B-120 (by using an analyzer).
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Selector lever position: P
● Voltage between terminal 3 and earth
OK: Waveform should be displayed on P.13A-211 (Inspection Procedure Using an Analyzer) and noise should not be displayed in the waveform
NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connectors: D-120, D-121, B-25X
NG
Repair
OK
Check the harnesses between the air flow sensor and the engine-A/T-ECU and between the air flow sensor and the engine control relay, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.

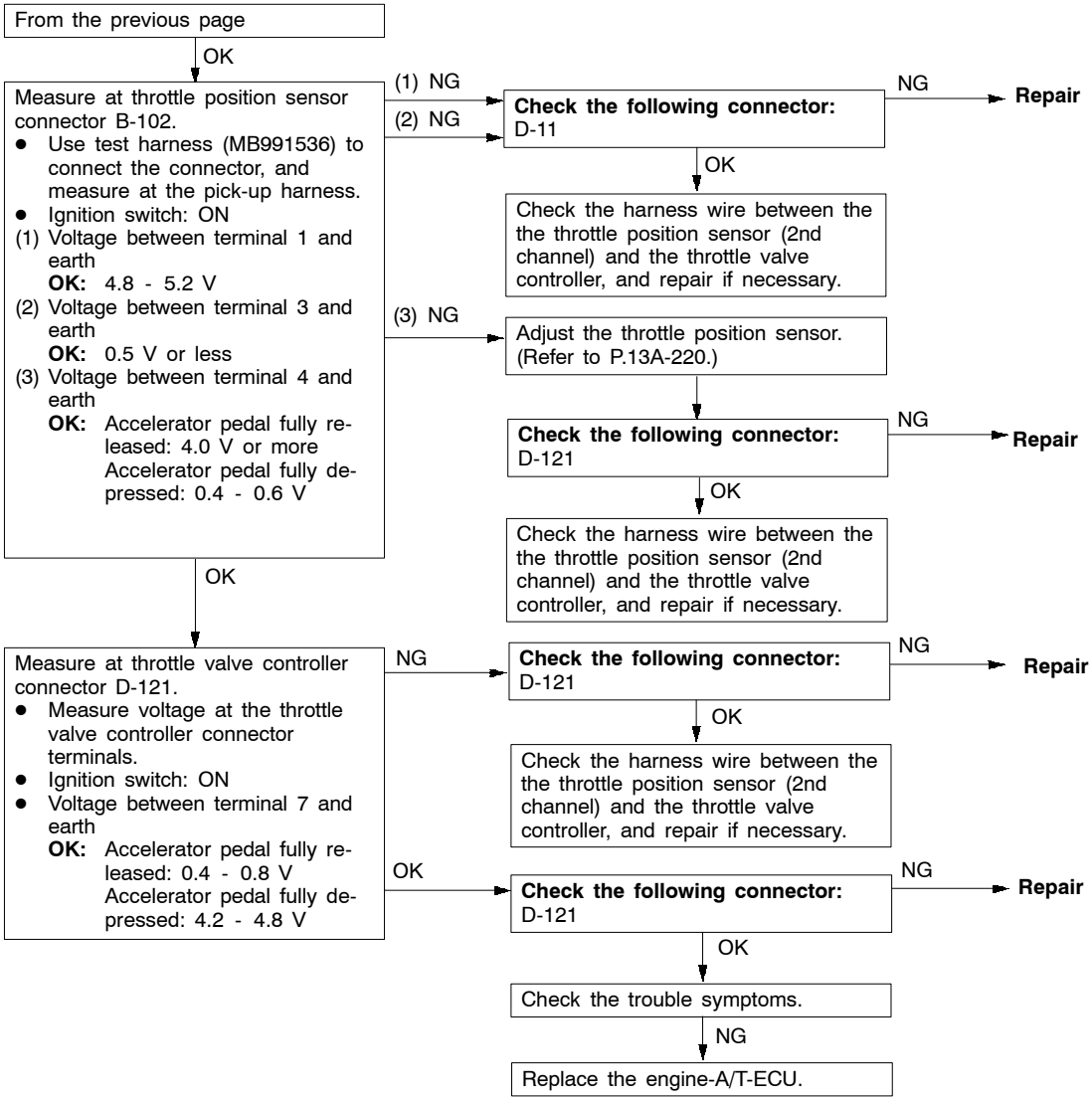
Code No.13 Intake air temperature sensor system	Probable cause
Range of Check • Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions • The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of intake air temperature) or • The sensor output voltage is 0.2 V or more for four seconds (equivalent to 125°C of intake air temperature)	• Malfunction of intake air temperature sensor • Open or short circuit in intake air temperature sensor or loose connector contact • Malfunction of engine-A/T-ECU



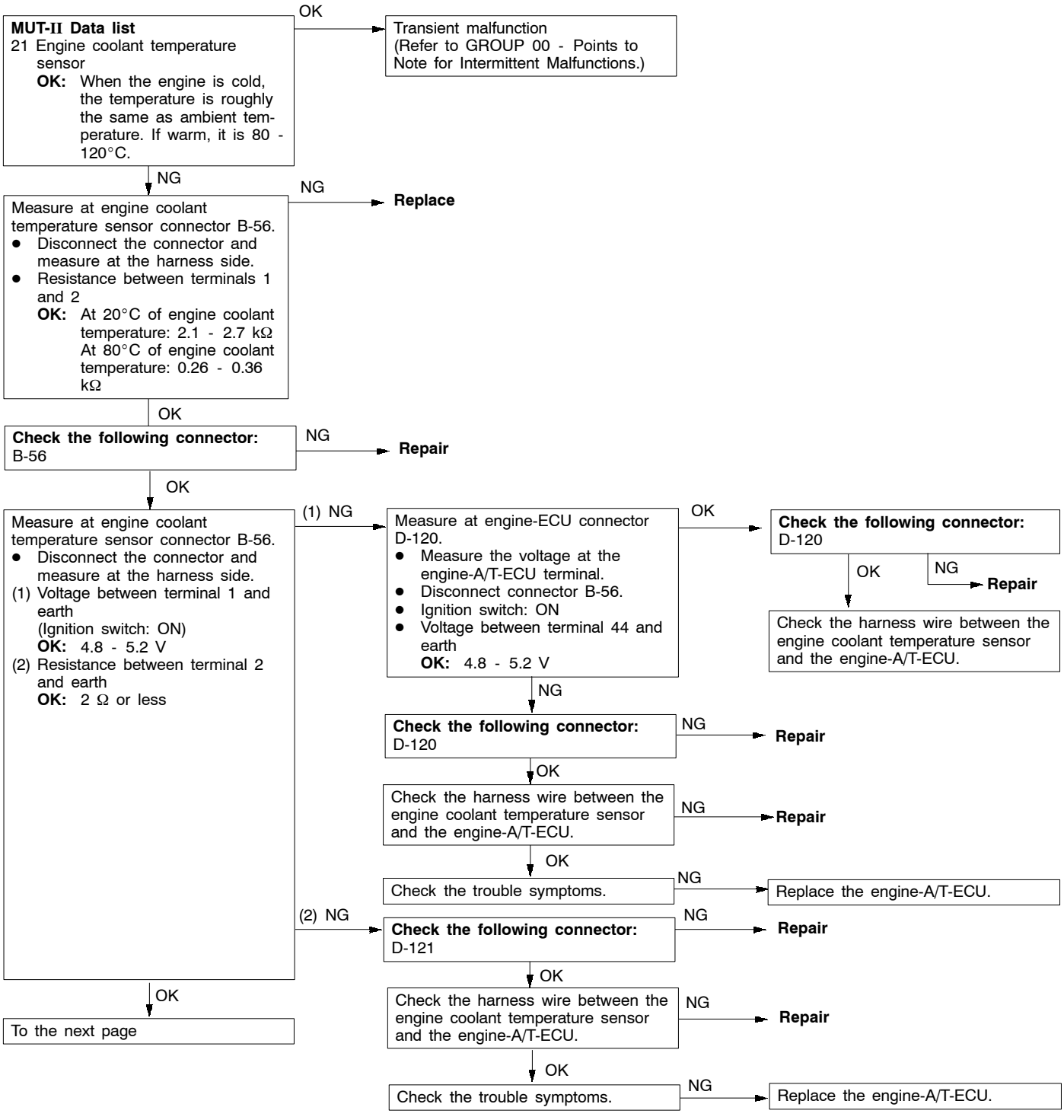

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OK
Measure at air flow sensor connector B-120.
● Use the test harness (MB991709) to connect only terminals 5 and 6, and then measure at the pickup harness.
● Ignition switch: ON
● Voltage between terminal 6 and earth
OK: Ambient temperature 0°C 3.2 - 3.8 V
Ambient temperature 20°C 2.3 - 2.9 V
Ambient temperature 40°C 1.5 - 2.1 V
Ambient temperature 80°C 0.4 - 1.0 V
NG
Check the following connectors: D-120, D-121
NG
Repair
OK
Check the harness between the air flow sensor and the engine-A/T-ECU, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.

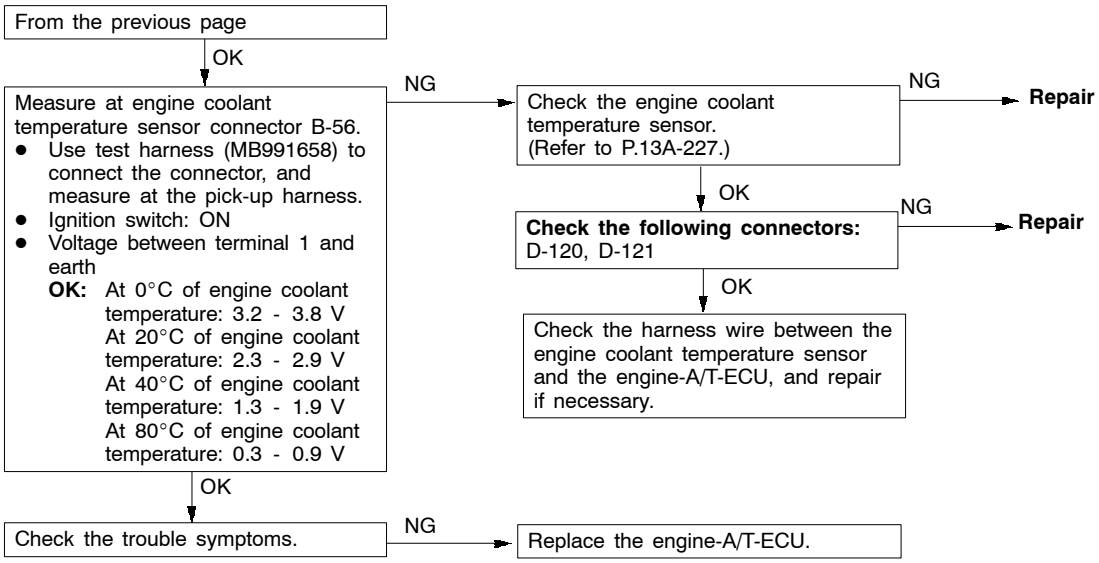
Code No.14 Throttle position sensor (2nd channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU. Range of Check ● Ignition switch: ON ● The throttle position sensor (1st channel) is normal. Set Conditions ● The sensor output voltage is 0.2 V or less for four seconds. or ● The sensor output voltage is 4.85 V or more and the throttle position sensor (1st channel) output voltage is 1.2 V or more for four seconds. or ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V.	● Malfunction of throttle position sensor (2nd channel) ● Open or short circuit in the throttle position sensor (2nd channel) circuit or loose connector contact ● Malfunction of throttle valve controller ● Malfunction of engine-A/T-ECU



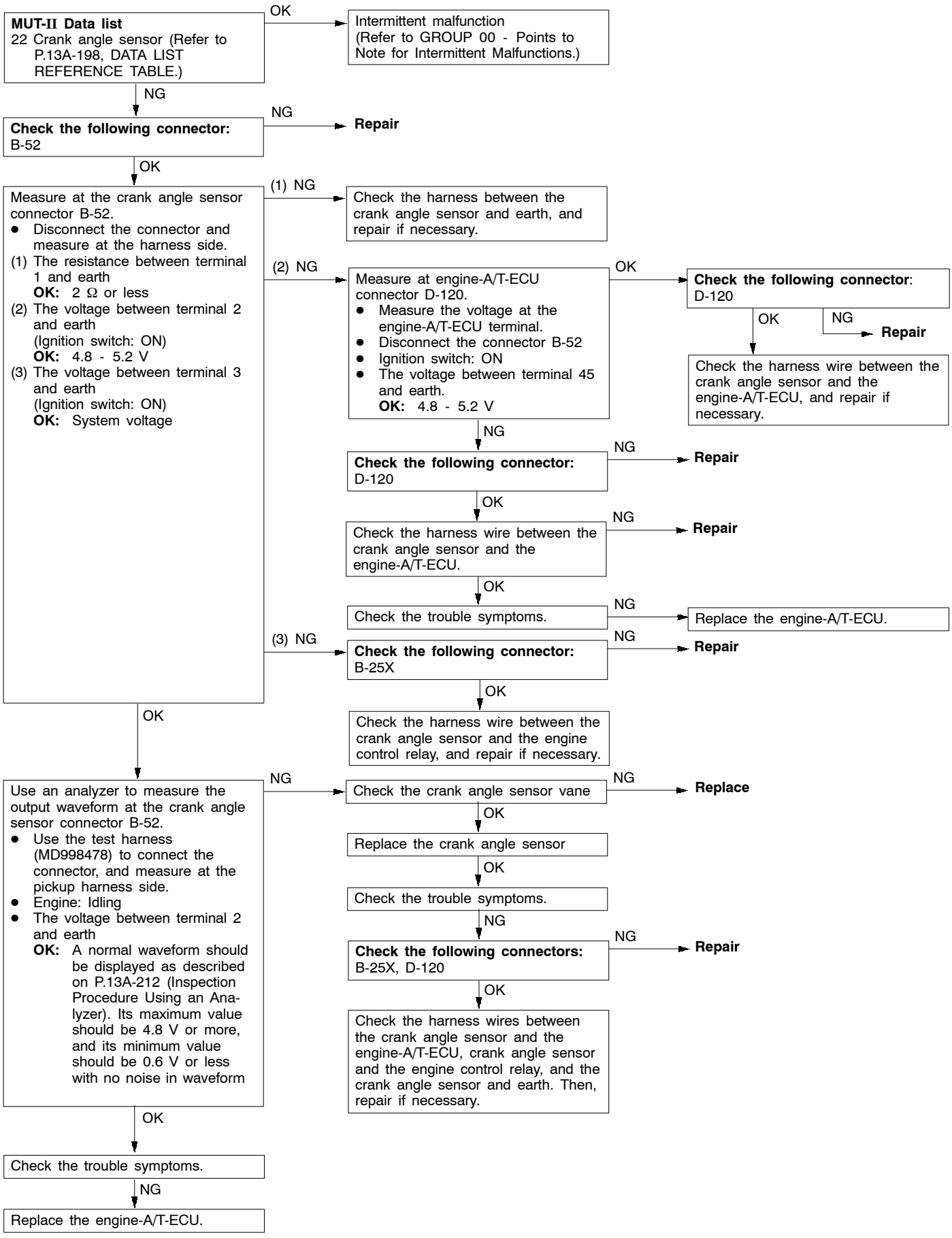


Code No.21 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of engine coolant temperature) or ● The sensor output voltage is 0.1 V or less for four seconds (equivalent to 140°C of engine coolant temperature)	● Malfunction of engine coolant temperature sensor ● Open or short circuit in the engine coolant temperature sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU
Range of Check ● Engine: After starting Set Conditions ● The engine coolant temperature has reduced from over 40°C to less than 40°C, and that condition has lasted for five minutes or more.	

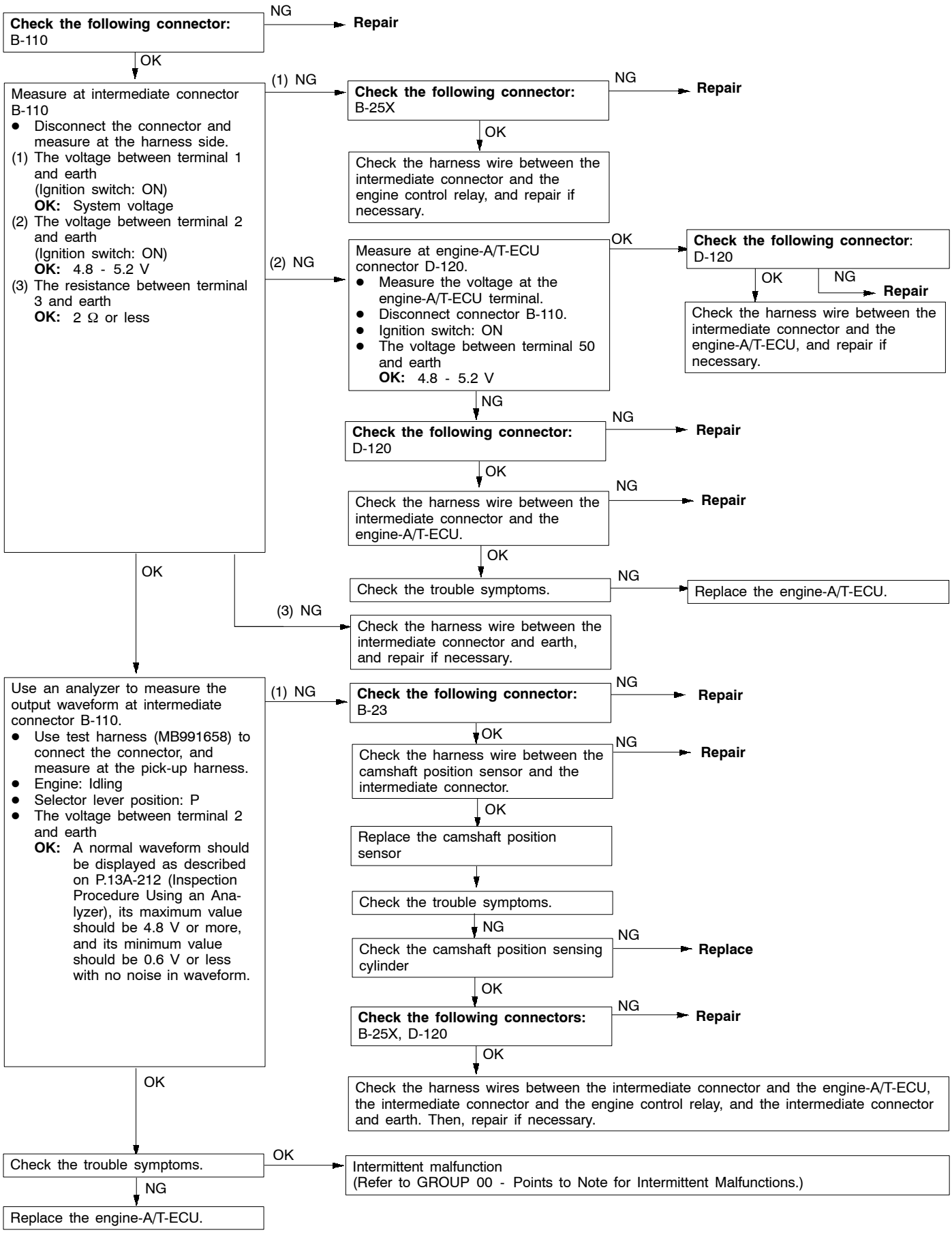

MUT-II Data list
21 Engine coolant temperature sensor
OK: When the engine is cold, the temperature is roughly the same as ambient temperature. If warm, it is 80 - 120°C.
OK
Transient malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Measure at engine coolant temperature sensor connector B-56.
Disconnect the connector and measure at the harness side.
Resistance between terminals 1 and 2
OK: At 20°C of engine coolant temperature: 2.1 - 2.7 kΩ
At 80°C of engine coolant temperature: 0.26 - 0.36 kΩ
NG
Replace
OK
Check the following connector: B-56
NG
Repair
OK
Measure at engine coolant temperature sensor connector B-56.
Disconnect the connector and measure at the harness side.
(1) Voltage between terminal 1 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less
(1) NG
Measure at engine-ECU connector D-120.
Measure the voltage at the engine-A/T-ECU terminal.
Disconnect connector B-56.
Ignition switch: ON
Voltage between terminal 44 and earth
OK: 4.8 - 5.2 V
OK
Check the following connector: D-120
OK
NG
Repair
Check the harness wire between the engine coolant temperature sensor and the engine-A/T-ECU.
NG
Check the following connector: D-120
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
(2) NG
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
OK
To the next page



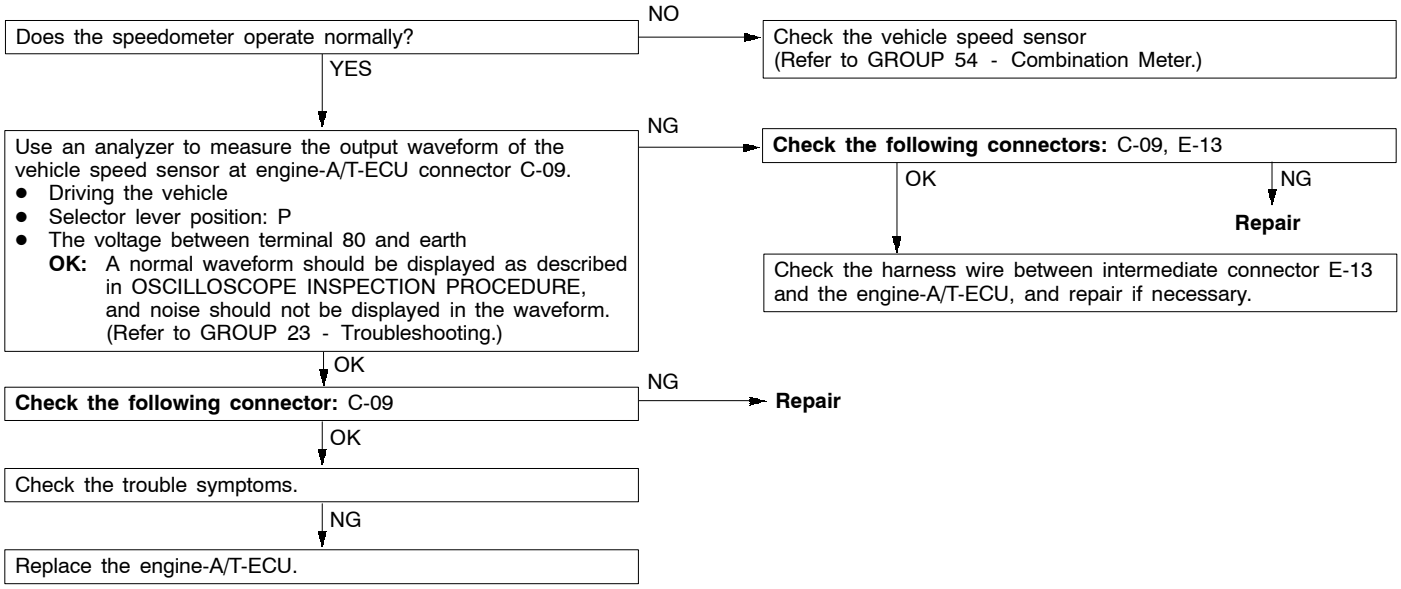
Code No.22 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking Set Conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the crank angle sensor. ● Open or short circuit in the crank angle sensor circuit or loose connector contact. ● Malfunction of engine-A/T-ECU


MUT-II Data list
22 Crank angle sensor (Refer to P.13A-198, DATA LIST REFERENCE TABLE.)
OK
Intermittent malfunction (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Check the following connector: B-52
NG
Repair
OK
Measure at the crank angle sensor connector B-52.
Disconnect the connector and measure at the harness side.
(1) The resistance between terminal 1 and earth
OK: 2 Ω or less
(2) The voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) The voltage between terminal 3 and earth
(Ignition switch: ON)
OK: System voltage
(1) NG
Check the harness between the crank angle sensor and earth, and repair if necessary.
(2) NG
Measure at engine-A/T-ECU connector D-120.
Measure the voltage at the engine-A/T-ECU terminal.
Disconnect the connector B-52
Ignition switch: ON
The voltage between terminal 45 and earth.
OK: 4.8 - 5.2 V
OK
Check the following connector: D-120
OK
NG
Repair
Check the harness wire between the crank angle sensor and the engine-A/T-ECU, and repair if necessary.
NG
Check the following connector: D-120
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
(3) NG
Check the following connector: B-25X
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine control relay, and repair if necessary.
OK
Use an analyzer to measure the output waveform at the crank angle sensor connector B-52.
Use the test harness (MD998478) to connect the connector, and measure at the pickup harness side.
Engine: Idling
The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-212 (Inspection Procedure Using an Analyzer). Its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform
NG
Check the crank angle sensor vane
NG
Replace
OK
Replace the crank angle sensor
OK
Check the trouble symptoms.
NG
Check the following connectors: B-25X, D-120
NG
Repair
OK
Check the harness wires between the crank angle sensor and the engine-A/T-ECU, crank angle sensor and the engine control relay, and the crank angle sensor and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.

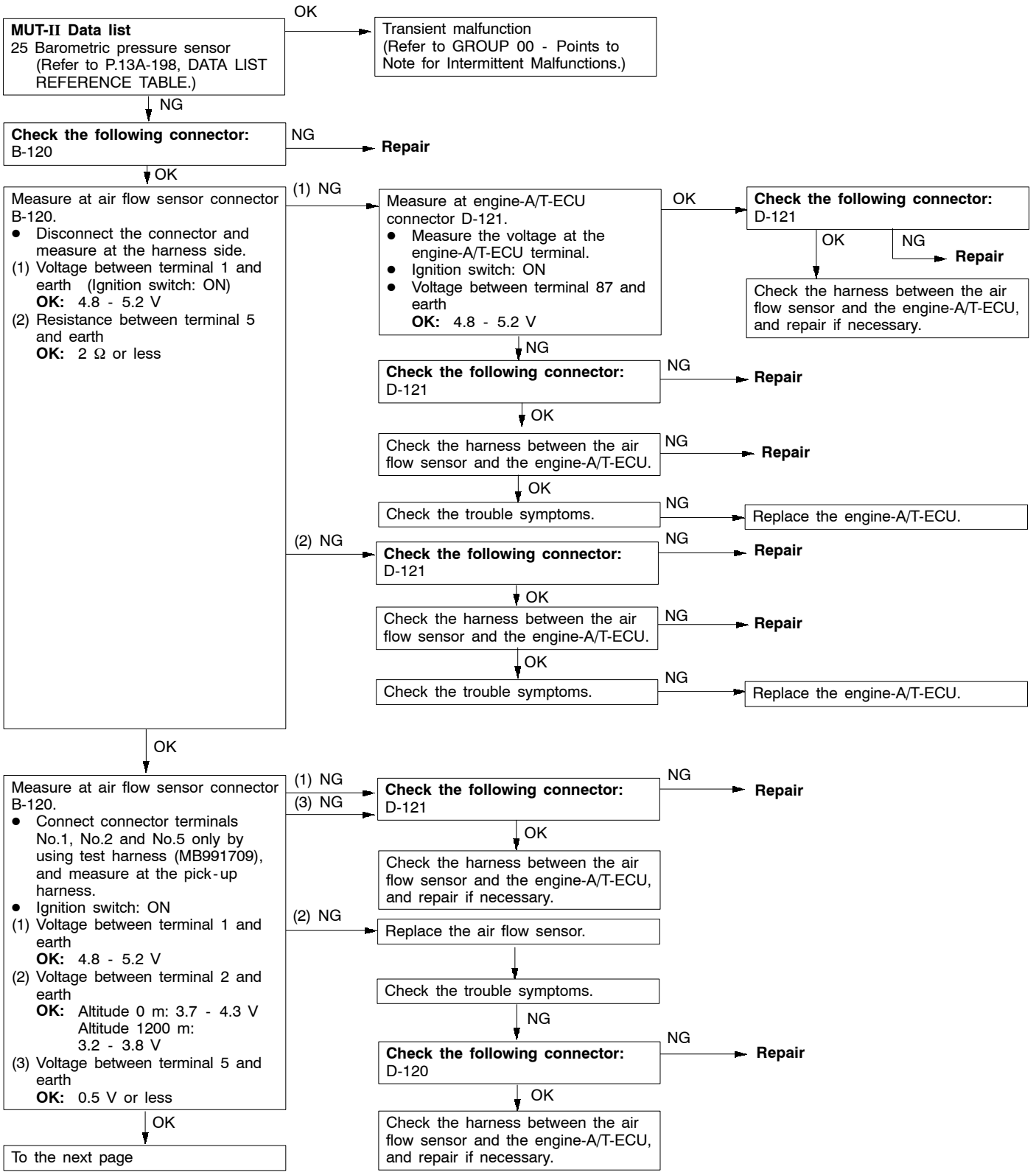
Code No.23 Camshaft position sensor system	Probable cause
Range of Check ● After the engine was started Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the camshaft position sensor ● Open or short circuit in the camshaft position sensor circuit or loose connector contact. ● Malfunction of engine-A/T-ECU

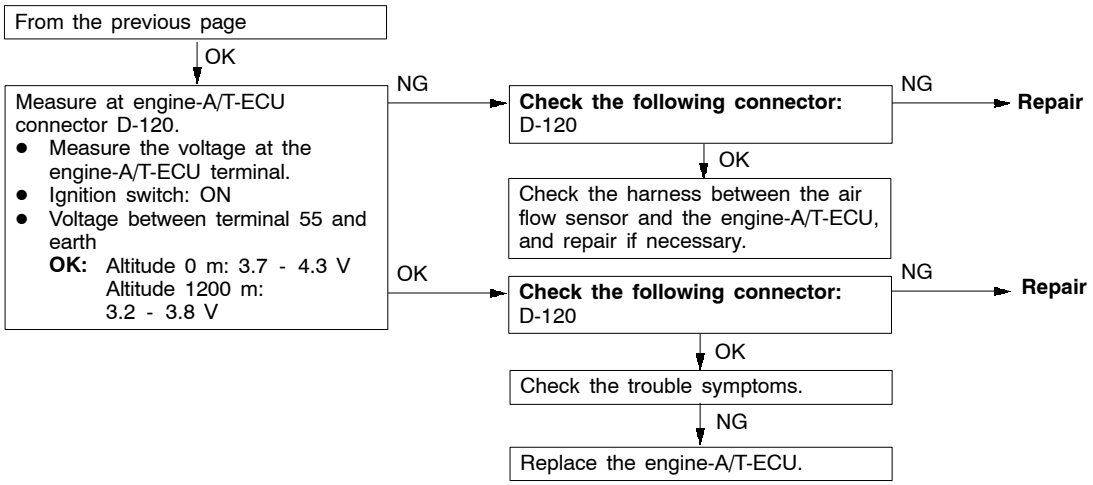

Check the following connector: B-110
NG
Repair
OK
Measure at intermediate connector B-110
● Disconnect the connector and measure at the harness side.
(1) The voltage between terminal 1 and earth (Ignition switch: ON)
OK: System voltage
(2) The voltage between terminal 2 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
(3) The resistance between terminal 3 and earth
OK: 2 Ω or less
(1) NG
Check the following connector: B-25X
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine control relay, and repair if necessary.
(2) NG
Measure at engine-A/T-ECU connector D-120.
● Measure the voltage at the engine-A/T-ECU terminal.
● Disconnect connector B-110.
● Ignition switch: ON
● The voltage between terminal 50 and earth
OK: 4.8 - 5.2 V
OK
Check the following connector: D-120
OK
NG
Repair
Check the harness wire between the intermediate connector and the engine-A/T-ECU, and repair if necessary.
NG
Check the following connector: D-120
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-A/T-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.
OK
(3) NG
Check the harness wire between the intermediate connector and earth, and repair if necessary.
Use an analyzer to measure the output waveform at intermediate connector B-110.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Selector lever position: P
● The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-212 (Inspection Procedure Using an Analyzer), its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
(1) NG
Check the following connector: B-23
NG
Repair
OK
Check the harness wire between the camshaft position sensor and the intermediate connector.
NG
Repair
OK
Replace the camshaft position sensor
Check the trouble symptoms.
NG
Check the camshaft position sensing cylinder
NG
Replace
OK
Check the following connectors: B-25X, D-120
NG
Repair
OK
Check the harness wires between the intermediate connector and the engine-A/T-ECU, the intermediate connector and the engine control relay, and the intermediate connector and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
OK
Intermittent malfunction
(Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-A/T-ECU.

Code No.24 Vehicle speed sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Open or short circuit in the vehicle speed sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU

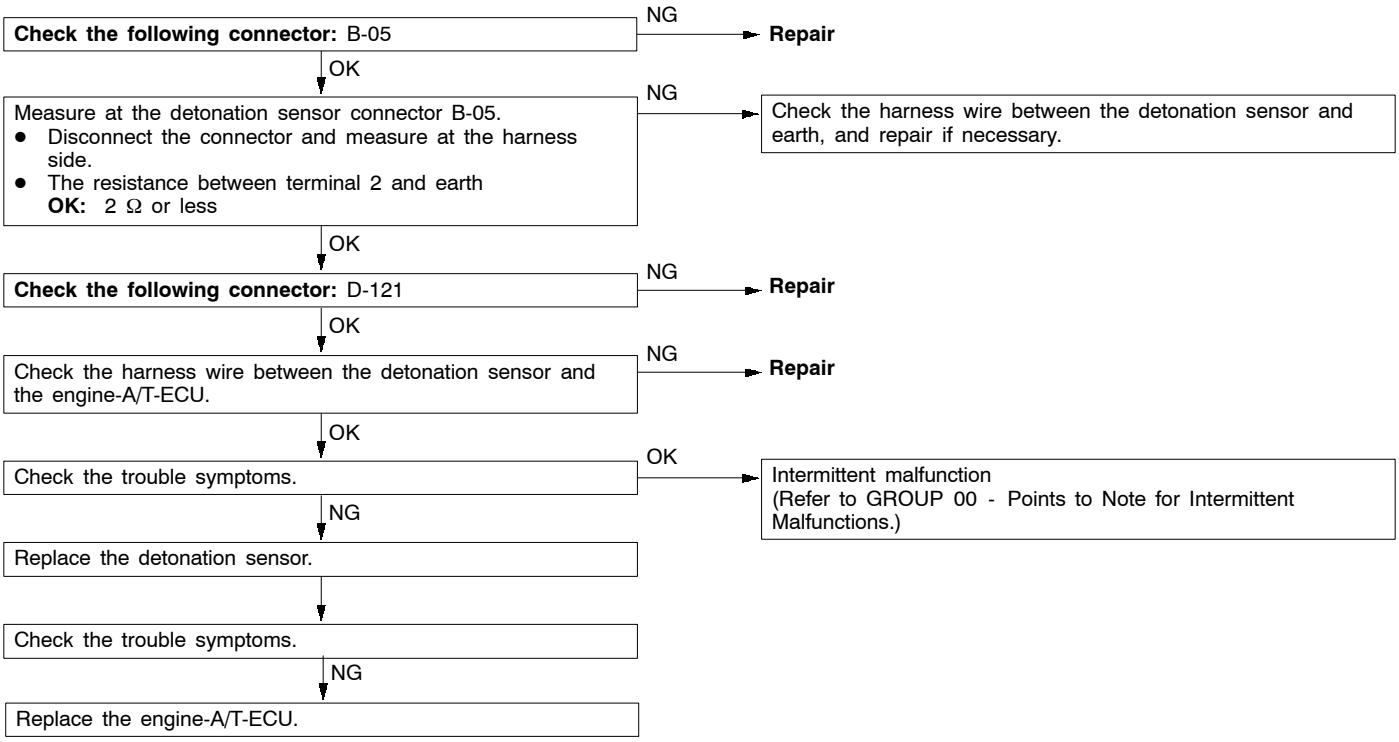


Code No.25 Barometric pressure sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. ● Battery voltage: 8 V or more Set Conditions ● The sensor output voltage is 4.5 V or more for four seconds (equivalent to 114 kPa of barometric pressure) or ● The sensor output voltage is 0.2 V or less (equivalent to 53 kPa of barometric pressure)	● Malfunction of barometric pressure sensor ● Open or short circuit in barometric pressure sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU

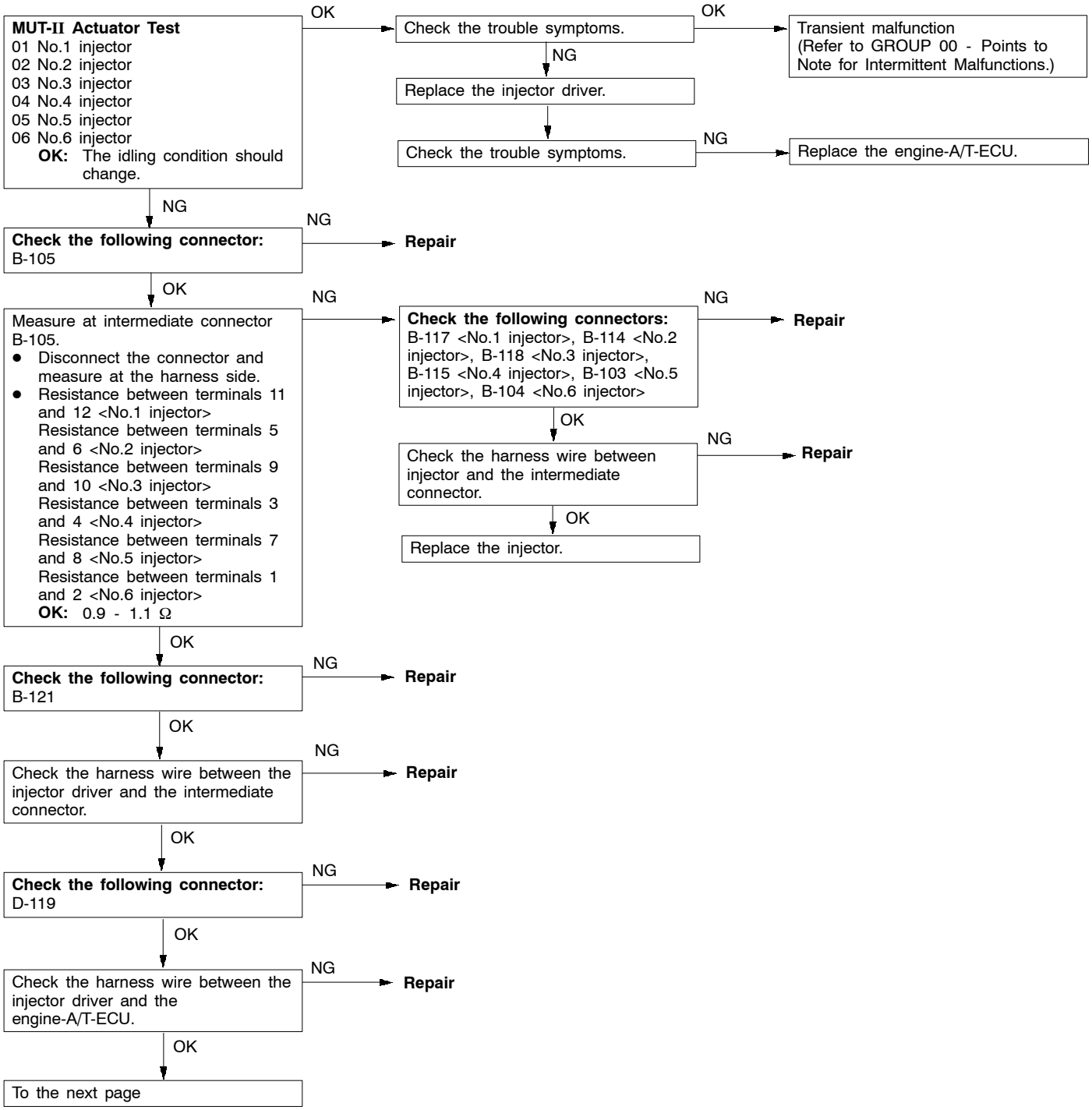


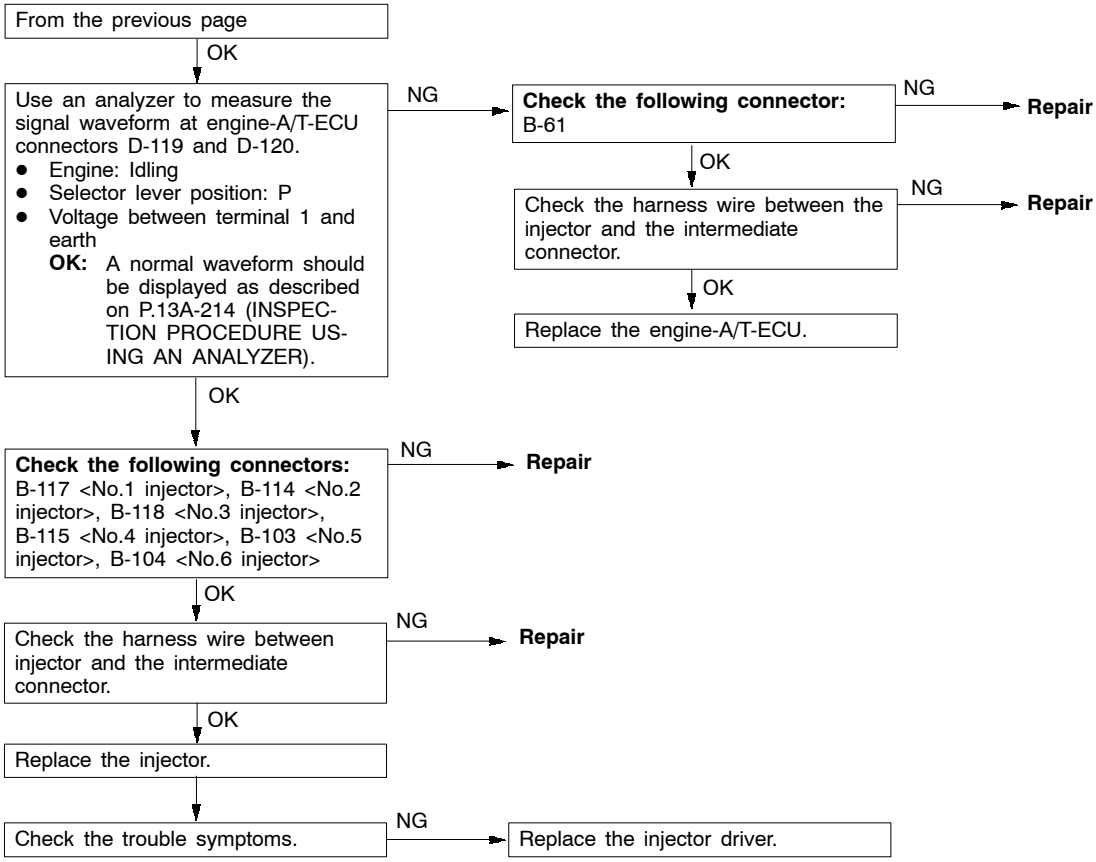


Code No.31 Detonation sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● Changes in sensor output voltage (detonation sensor peak voltage per 1/3 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	● Malfunction of the detonation sensor ● Open or short circuit in the detonation sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU



Code No.41 Injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting a injector open circuit check signal for four seconds.	● Malfunction of injector ● Open or short circuit in the injector circuit or loose connector contact ● Malfunction of engine-A/T-ECU



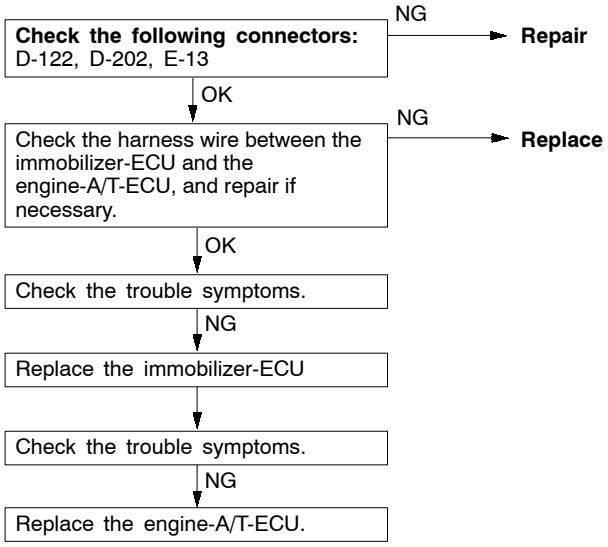


Code No.44, 52, 53 Ignition coil (incorporating power transistor) system	Probable cause
Range of Check ● Engine speed is approx. 50 - 4,000 r/min. ● Engine is not cranking. Set Conditions ● The ignition failure sensor does not send a signal about a certain cylinder for four seconds. However, except that the ignition failure sensor does not send a signal about all of cylinders.	● Malfunction of the ignition coil ● Malfunction of the ignition failure sensor ● Malfunction of spark plug ● Open or short circuit in the primary ignition circuit or loose connector contact ● Malfunction of engine-A/T-ECU

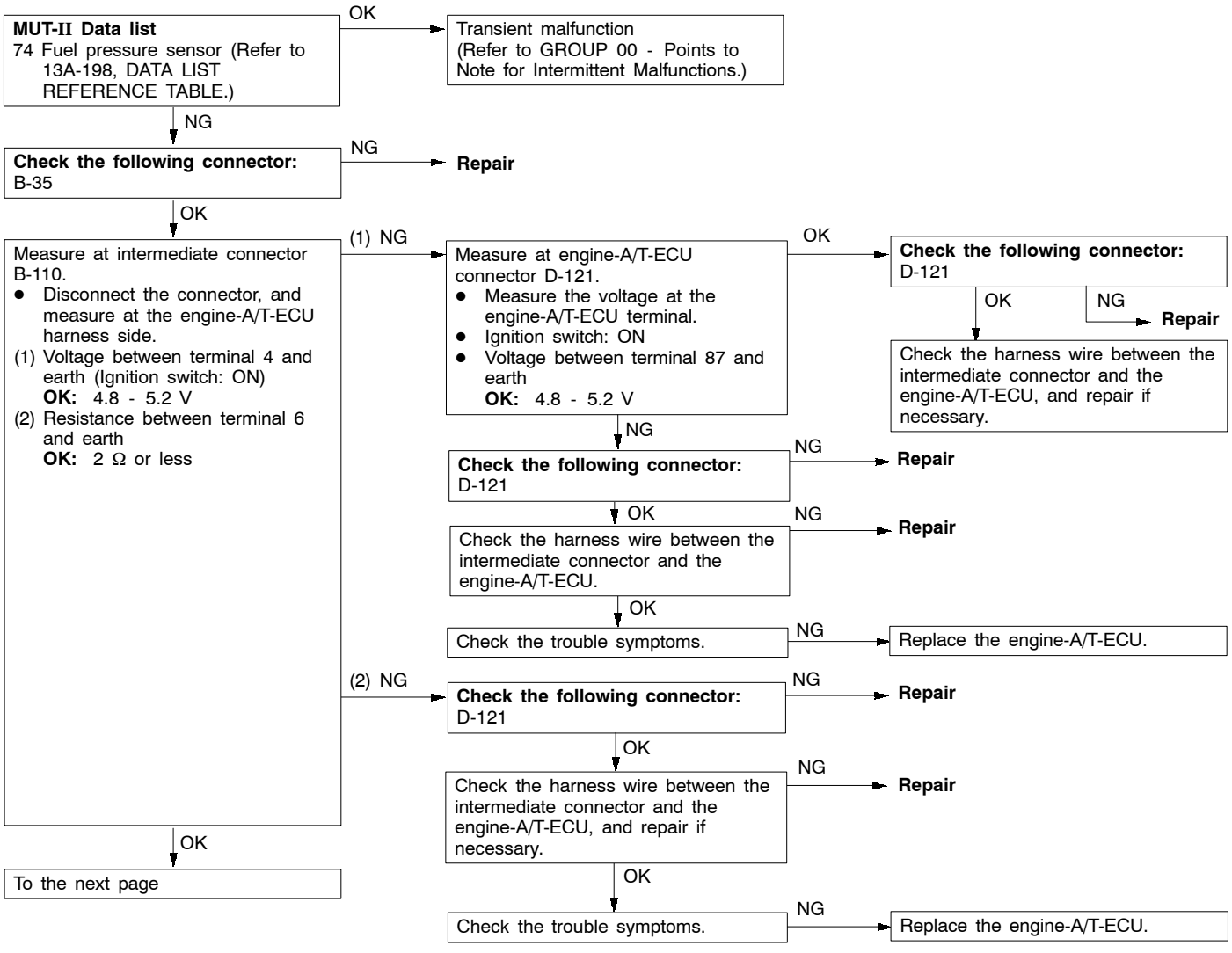

Check the ignition coil. (Refer to GROUP 16 - Ignition System.)
NG
Replace
OK
Check the ignition failure sensor. (Refer to GROUP 16 - Ignition System.)
NG
Replace
OK
Measure at the ignition coil connectors B-101, B-108, B-112, B-113, B-116, B-119.
● Disconnect the connector, and measure at the harness side.
(1) Voltage between 1 and earth (Ignition switch: ON)
OK: System voltage
(2) Voltage between 3 and earth (Engine: cranking)
OK: 0.5 - 4.0 V
(3) Continuity between 2 and earth
OK: Continuity
(1) NG
Check the following connectors: B-07, B-107, E-13, D-223 <LHD>
OK
NG
Repair
(2) NG
Check trouble symptom.
(3) NG
Check and repair the harness wire between the ignition coil and ignition failure sensor.
Check and repair the harness wire between the ignition failure sensor and ignition switch.
OK
Check the following connectors: B-101, B-108, B-112, B-113, B-116, B-119
OK
NG
Repair
Check the following connectors: B-107, D-119
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-A/T-ECU and the ignition coil.
OK
NG
Repair
Replace the engine-A/T-ECU.
Check and repair the harness wire between the ignition coil and earth.
Check trouble symptom.
NG
Measure at the ignition failure sensor connector B-04.
● Disconnect the connector, and measure at the harness side.
(1) Voltage between 2 and earth (Ignition switch: ON)
OK: 4 V or more
(2) Continuity between 1 and earth
OK: Continuity
(1) NG
There is short circuit or open circuit in the ignition signal output harness of the ignition failure sensor. Check and repair the harness.
(2) NG
Check and repair the harness wire between the ignition failure sensor and earth.
OK
Measure at the engine-A/T-ECU connector D-120.
● Connect the connector.
● Voltage between 45 and earth (Engine: 3,000 r/min)
OK: 0.3 - 3.0 V
NG
Check the following connectors: B-04, D-120
OK
NG
Repair
Check the harness wire between the engine-A/T-ECU and the ignition failure sensor.
OK
NG
Repair
OK
Replace the engine-A/T-ECU.
Replace the ignition failure sensor.

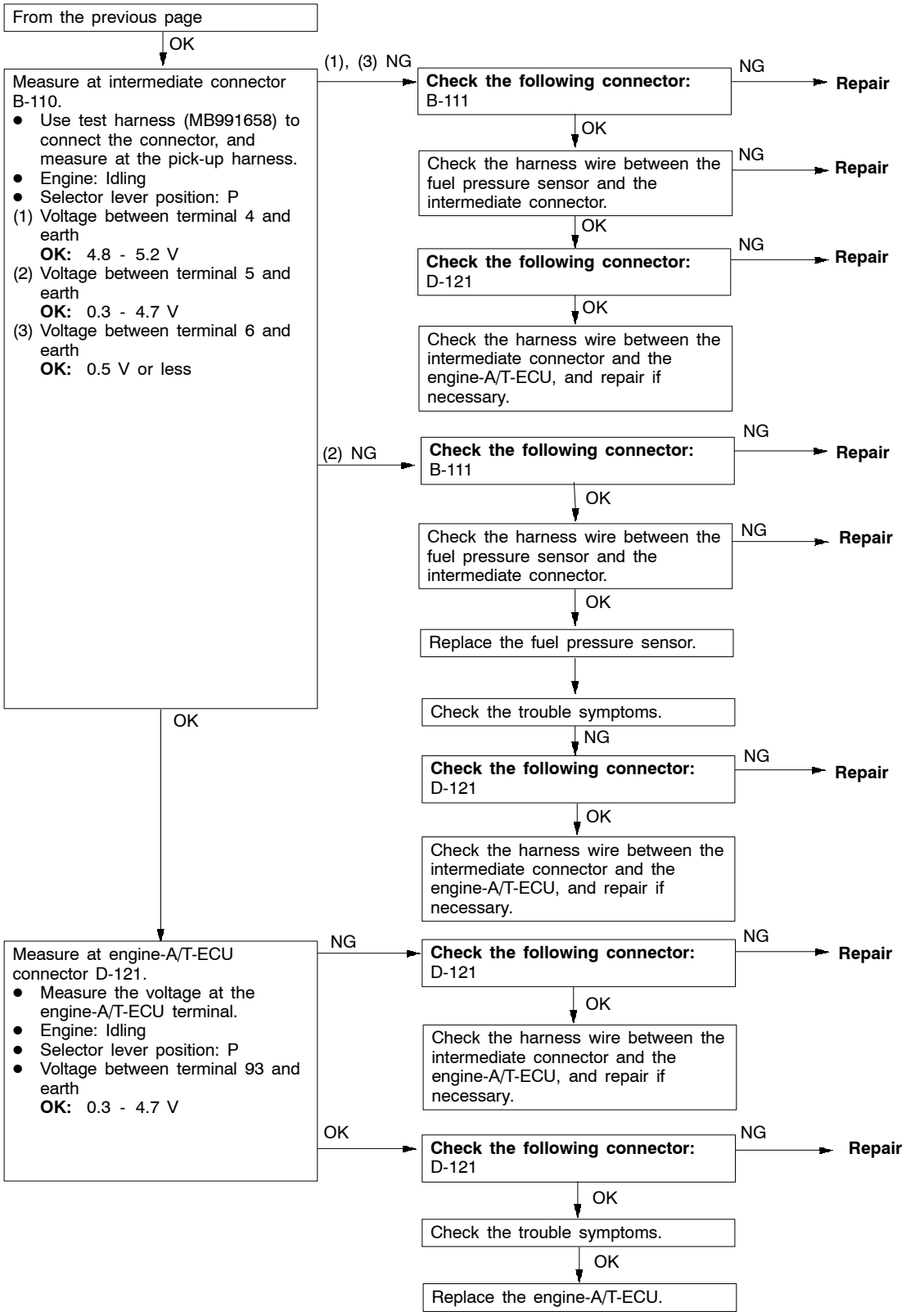
Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-A/T-ECU and the immobilizer-ECU	● Open or short circuit, or loose connector contact ● Malfunction of the immobilizer-ECU ● Malfunction of the engine-A/T-ECU

NOTE
(1) If the registered ignition keys are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.

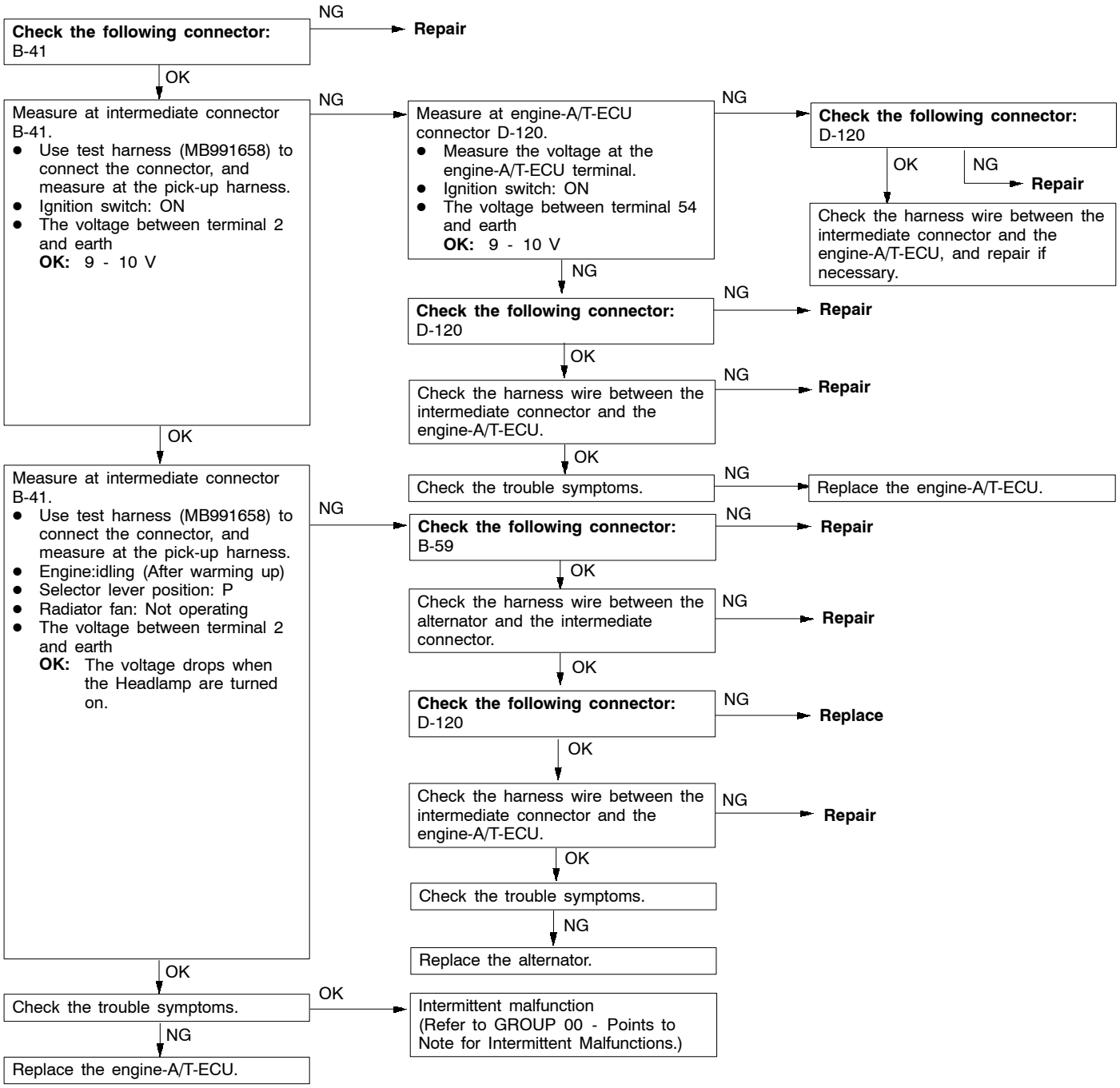


Code No.56 Abnormal fuel pressure	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 4.8V or more, or 0.2 V or less for four seconds.	● Malfunction of of fuel pressure sensor ● Open or short circuit in the fuel pressure sensor circuit or loose connector contact ● Malfunction of engine-A/T-ECU
Range of Check ● The following conditions are detected temporarily after the engine has been started. (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● Engine running Set Conditions ● The fuel pressure is 6.9 MPa or more, or 2 MPa or less for four seconds.	● Malfunction of high-pressure fuel pump ● Clogging of high-pressure fuel lines
This diagnosis code will also be output when air is trapped into the high-pressure fuel lines (such as poor fuel level). In that case, the air can be evacuated by operating the engine for at least 15 seconds at 2,000 r/min. After the repair, use the MUT-II to erase the diagnosis code.	● Air trapped due to poor fuel level

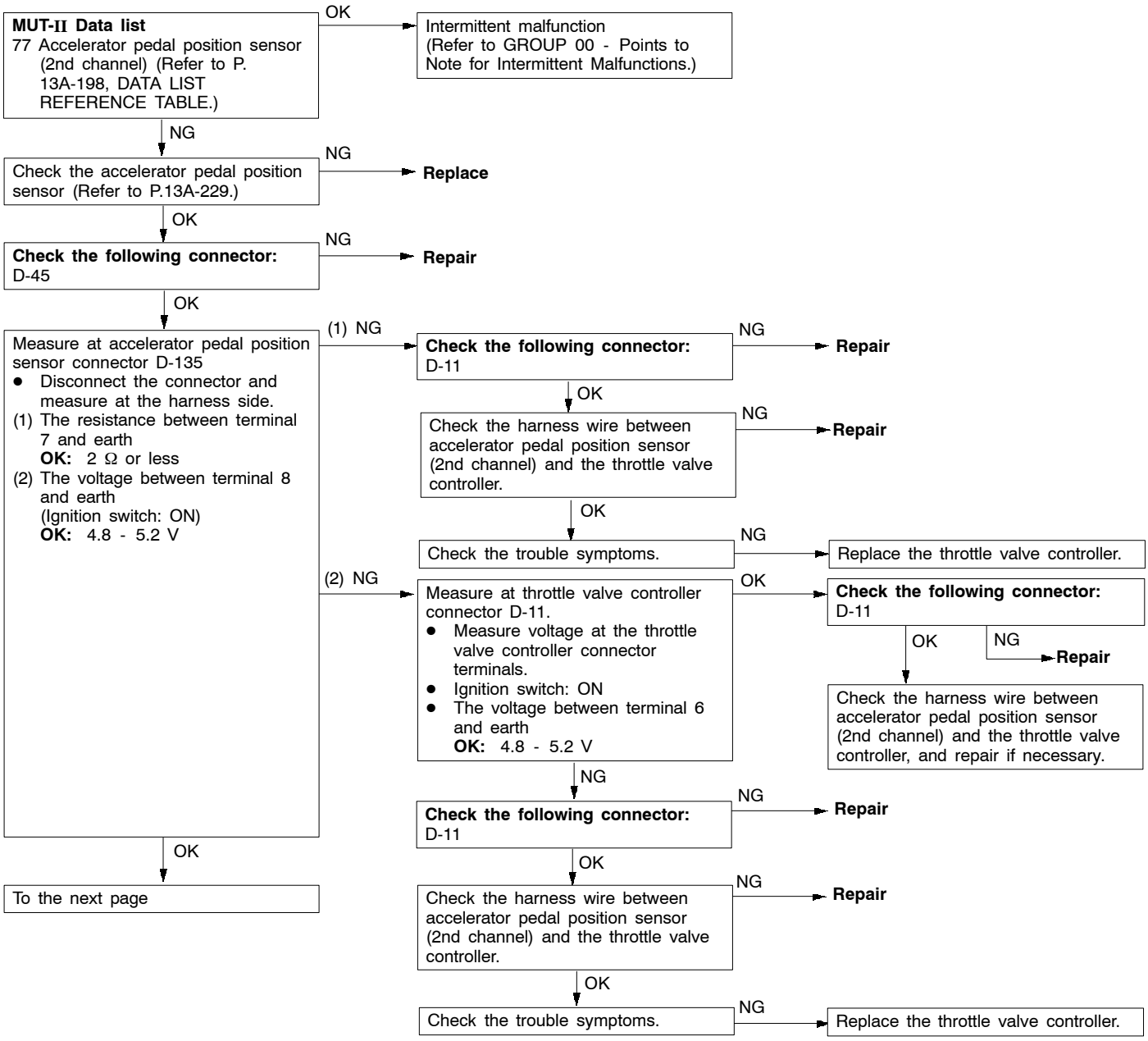


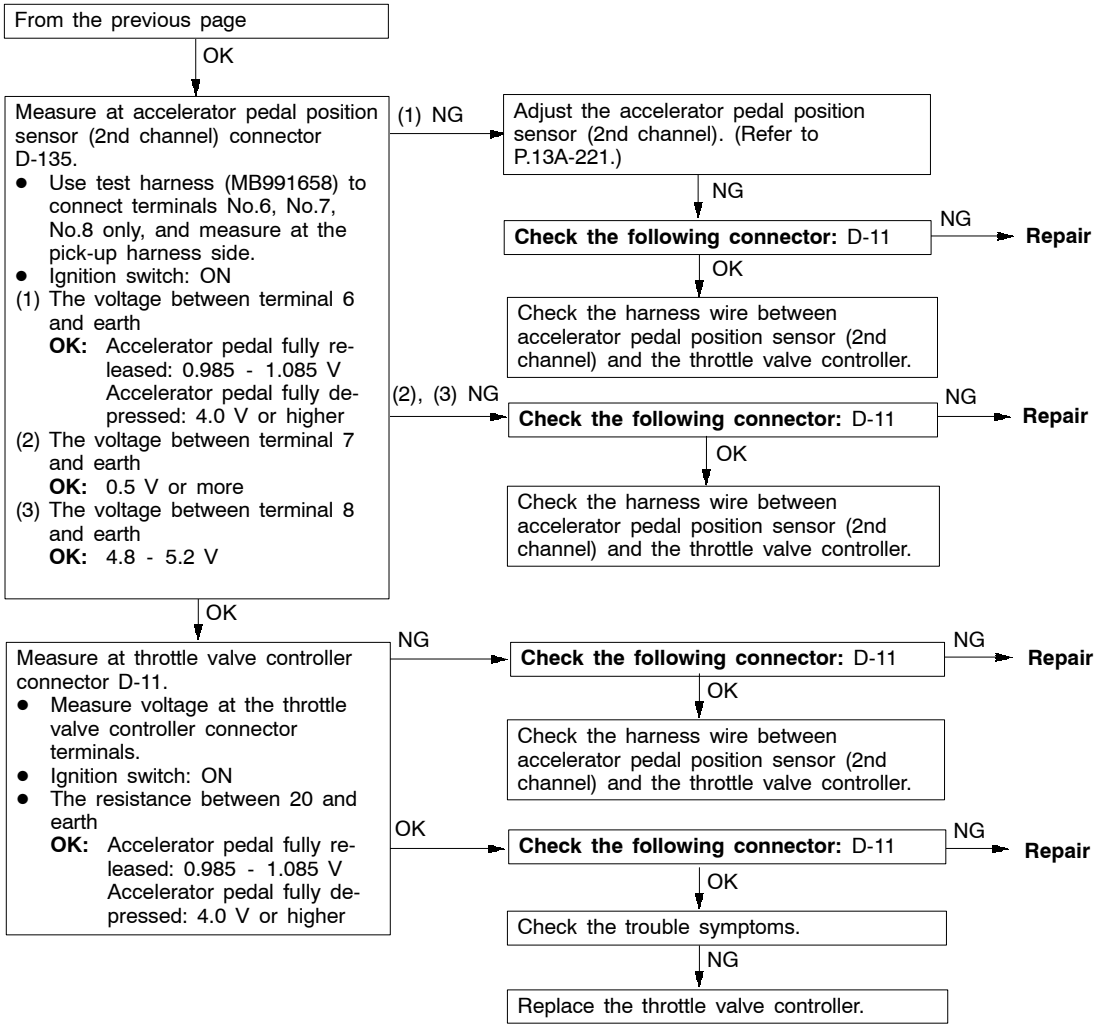

From the previous page
OK
Measure at intermediate connector B-110.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Selector lever position: P
(1) Voltage between terminal 4 and earth
OK: 4.8 - 5.2 V
(2) Voltage between terminal 5 and earth
OK: 0.3 - 4.7 V
(3) Voltage between terminal 6 and earth
OK: 0.5 V or less
(1), (3) NG
Check the following connector: B-111
NG
Repair
OK
Check the harness wire between the fuel pressure sensor and the intermediate connector.
NG
Repair
OK
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-A/T-ECU, and repair if necessary.
(2) NG
Check the following connector: B-111
NG
Repair
OK
Check the harness wire between the fuel pressure sensor and the intermediate connector.
NG
Repair
OK
Replace the fuel pressure sensor.
OK
Check the trouble symptoms.
NG
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-A/T-ECU, and repair if necessary.
Measure at engine-A/T-ECU connector D-121.
● Measure the voltage at the engine-A/T-ECU terminal.
● Engine: Idling
● Selector lever position: P
● Voltage between terminal 93 and earth
OK: 0.3 - 4.7 V
NG
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between the intermediate connector and the engine-A/T-ECU, and repair if necessary.
OK
Check the following connector: D-121
NG
Repair
OK
Check the trouble symptoms.
OK
Replace the engine-A/T-ECU.

Code No.64 Alternator FR terminal system	Probable cause
Range of Check ● Engine speed: 50 r/min or more Set Conditions ● Input voltage from the alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of engine-A/T-ECU

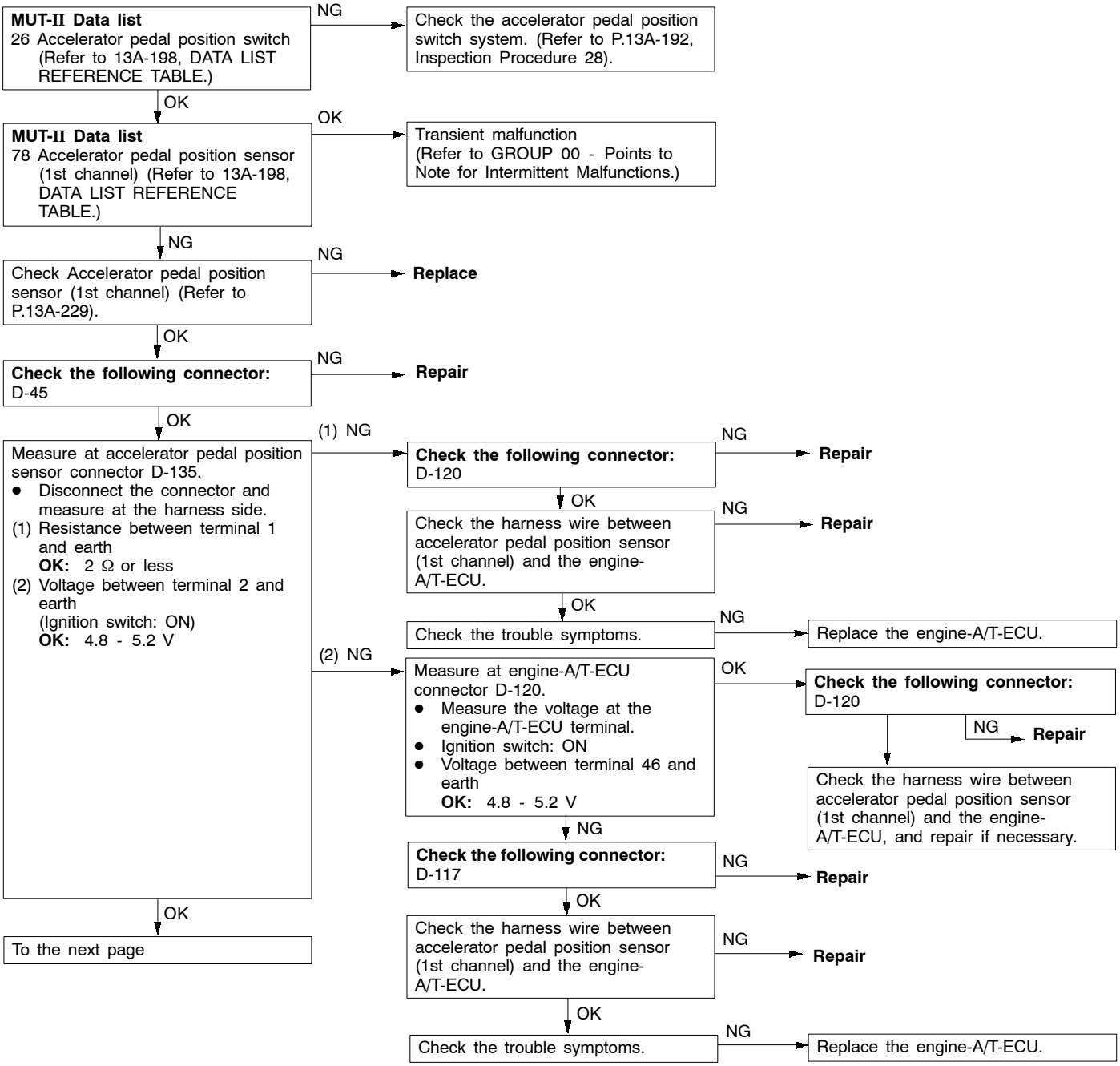


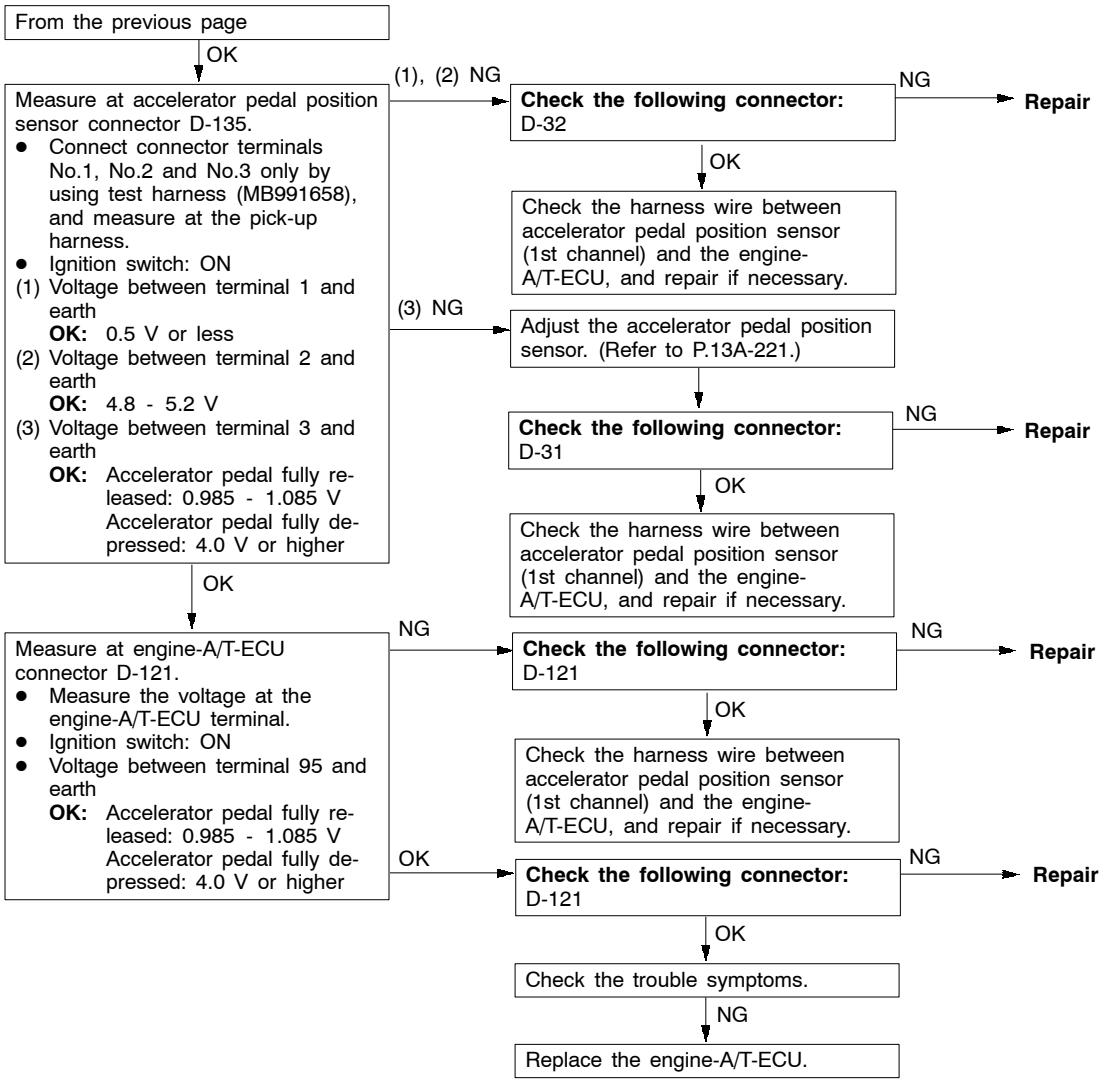
Code No.77 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of Check ● Accelerator pedal position sensor (1st channel) is normal. ● Communication between the engine-A/T-ECU and the throttle valve controller is normal. Set Conditions ● Output voltage of the accelerator pedal position sensor (2nd channel) is 0.2 V or less for one second or ● Output voltage of the accelerator pedal position sensor (1st channel) is 2.5 V or less, and output voltage of the accelerator pedal position sensor (2nd channel) is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor (1st and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly).	● Malfunction of accelerator pedal position sensor (2nd channel) ● Open or short circuit in accelerator pedal position sensor (2nd channel) circuit or loose connector contact ● Malfunction of the throttle valve controller ● Malfunction of engine-A/T-ECU



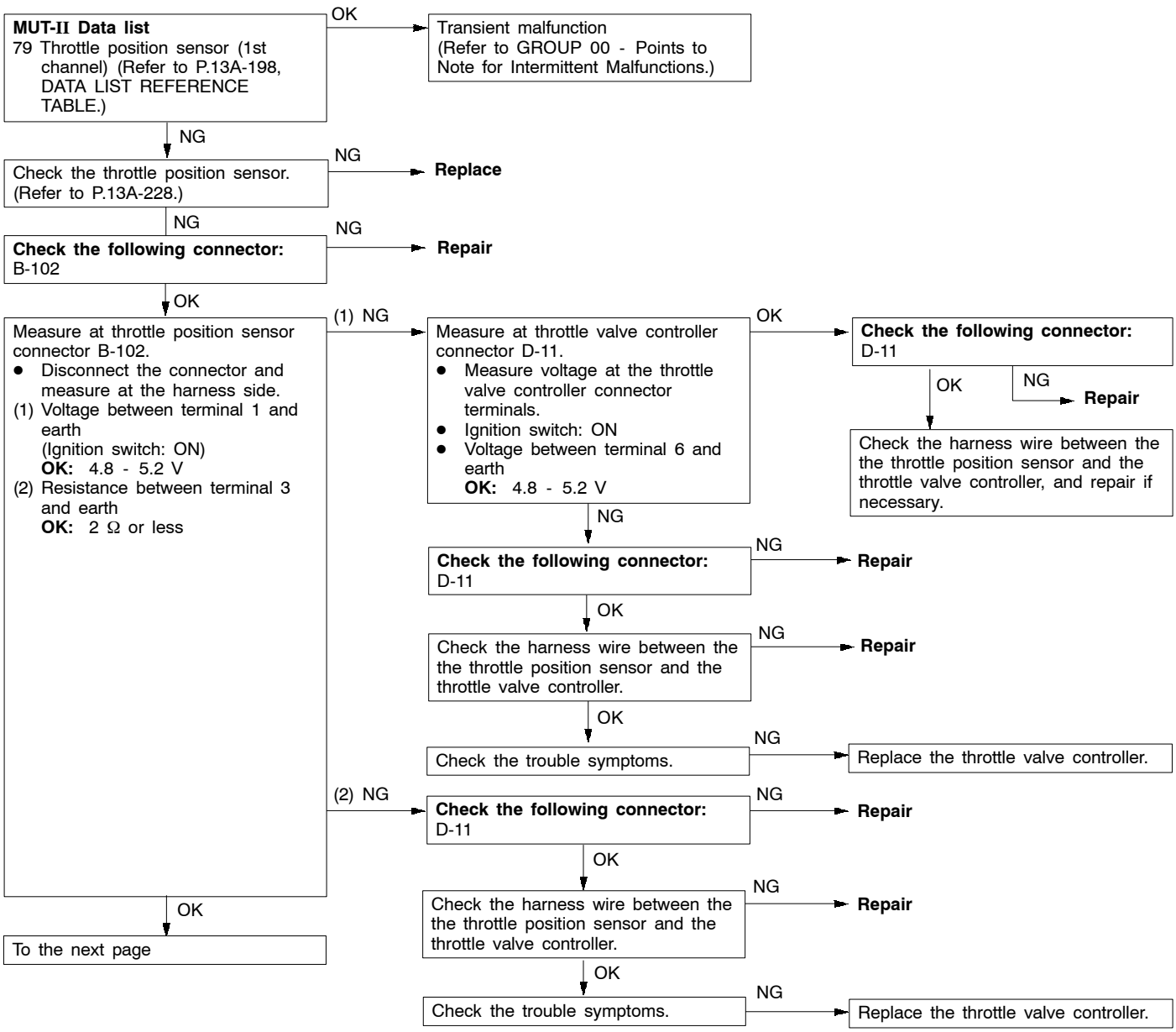

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OK
Measure at accelerator pedal position sensor (2nd channel) connector D-135.
● Use test harness (MB991658) to connect terminals No.6, No.7, No.8 only, and measure at the pick-up harness side.
● Ignition switch: ON
(1) The voltage between terminal 6 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
(2) The voltage between terminal 7 and earth
OK: 0.5 V or more
(3) The voltage between terminal 8 and earth
OK: 4.8 - 5.2 V
(1) NG
Adjust the accelerator pedal position sensor (2nd channel). (Refer to P.13A-221.)
NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller.
(2), (3) NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller.
OK
Measure at throttle valve controller connector D-11.
● Measure voltage at the throttle valve controller connector terminals.
● Ignition switch: ON
● The resistance between 20 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller.
OK
Check the following connector: D-11
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the throttle valve controller.

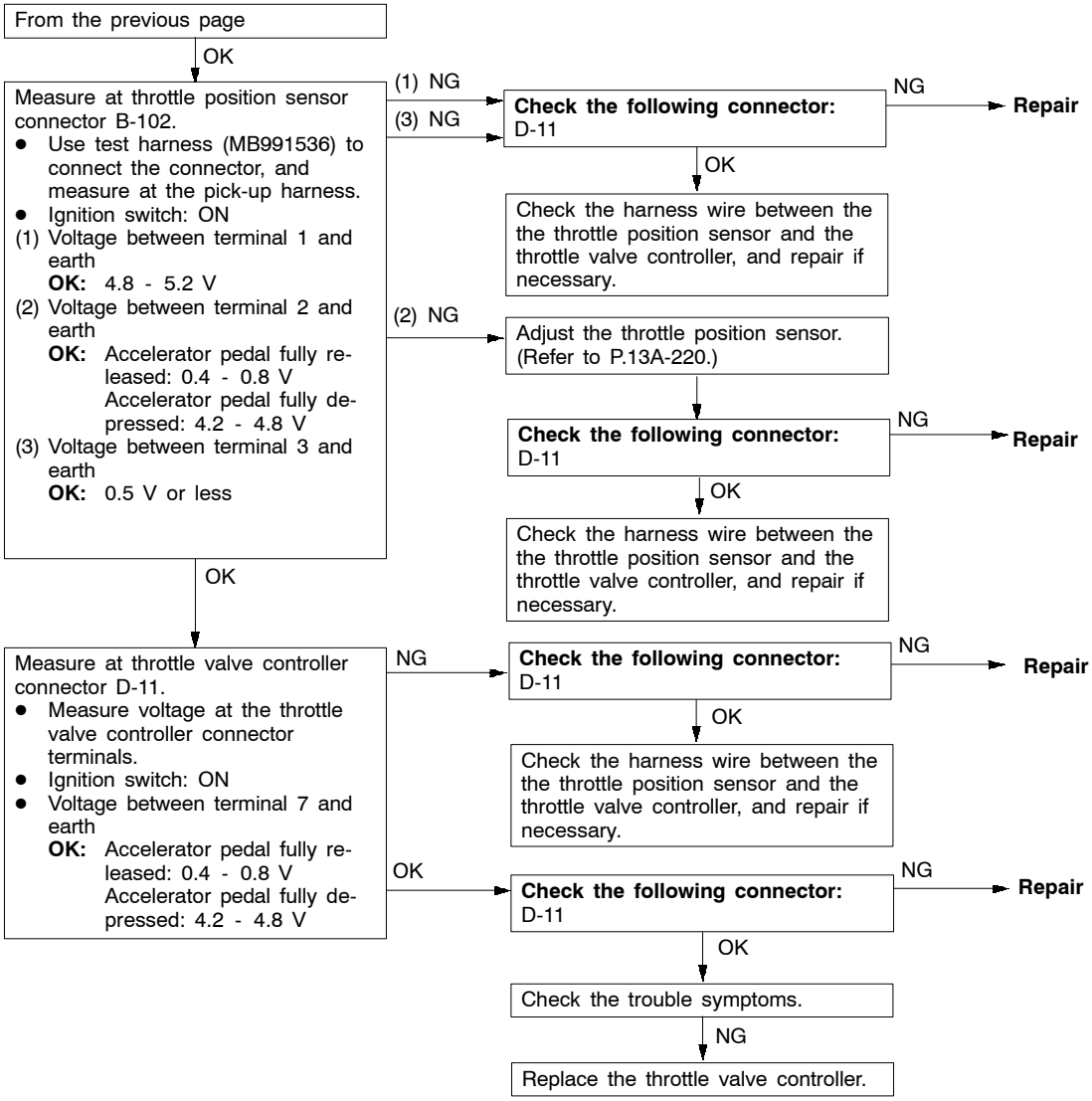
Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of Check • Accelerator pedal position sensor (2nd channel) is normal. • Communication between the engine-A/T-ECU and the throttle valve controller is normal. Set Conditions • The output voltage of accelerator pedal position sensor (1st channel) is 0.2 V or less for one second. or • The output voltage of accelerator pedal position sensor (2nd channel) is 2.5 V or less, and that of accelerator pedal position sensor (1st channel) is 4.5 V or more for one second or • The difference between accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) output voltages is 1.0 V or more (i.e. the throttle opening angle changes slightly). or • The output voltage of accelerator pedal position sensor (1st channel) is 1.1 V or more for one second when the accelerator pedal position switch is turned on.	• Malfunction of accelerator pedal position sensor (1st channel) • Open or short circuit in the accelerator pedal position sensor (1st channel) circuit or loose connector contact • Accelerator pedal position switch seized ON • Malfunction of throttle valve controller • Malfunction of engine-A/T-ECU



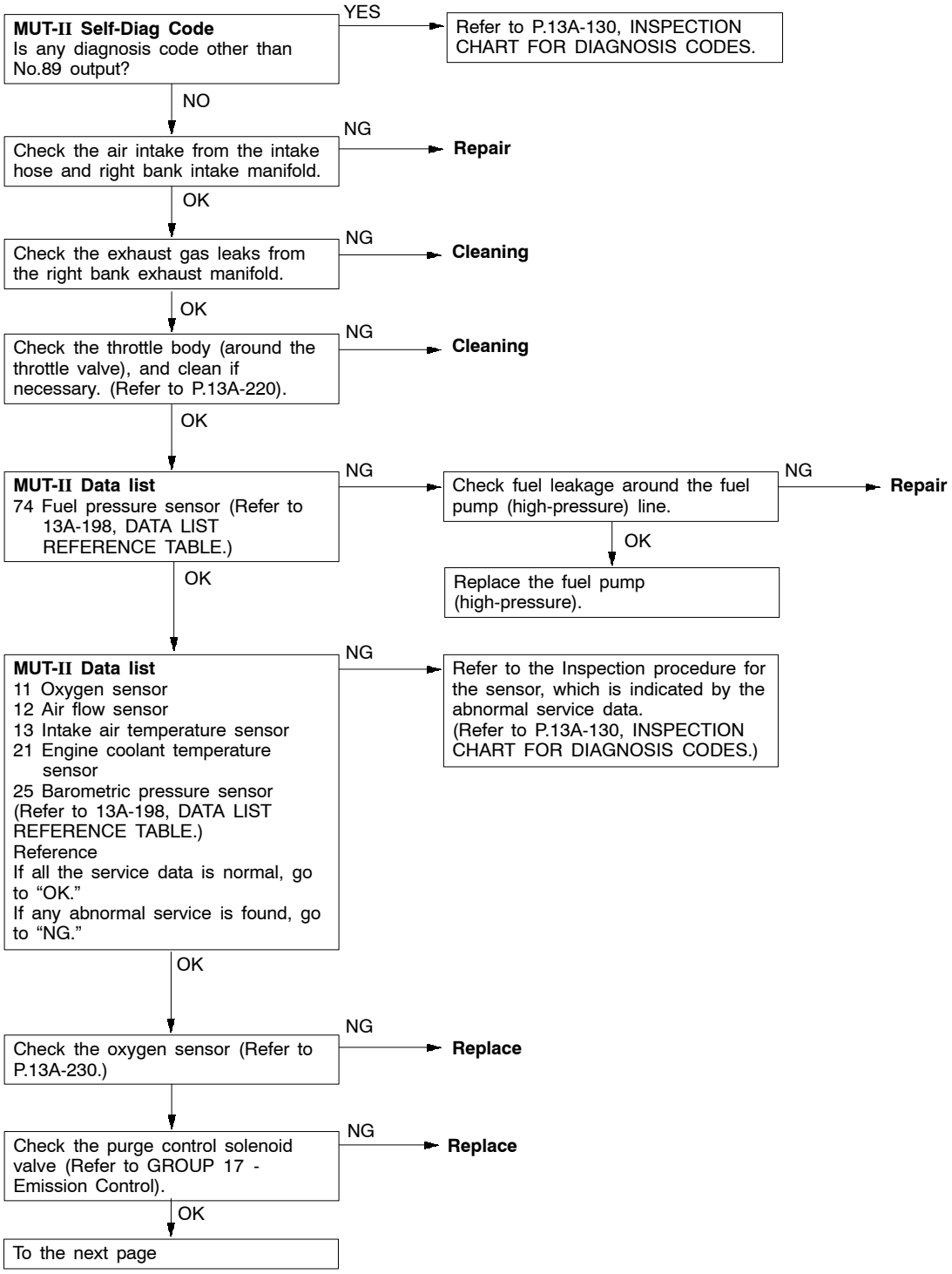

From the previous page
OK
Measure at accelerator pedal position sensor connector D-135.
● Connect connector terminals No.1, No.2 and No.3 only by using test harness (MB991658), and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 0.5 V or less
(2) Voltage between terminal 2 and earth
OK: 4.8 - 5.2 V
(3) Voltage between terminal 3 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
(1), (2) NG
Check the following connector: D-32
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-A/T-ECU, and repair if necessary.
(3) NG
Adjust the accelerator pedal position sensor. (Refer to P.13A-221.)
Check the following connector: D-31
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-A/T-ECU, and repair if necessary.
OK
Measure at engine-A/T-ECU connector D-121.
● Measure the voltage at the engine-A/T-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 95 and earth
OK: Accelerator pedal fully released: 0.985 - 1.085 V
Accelerator pedal fully depressed: 4.0 V or higher
NG
Check the following connector: D-121
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (1st channel) and the engine-A/T-ECU, and repair if necessary.
OK
Check the following connector: D-121
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-A/T-ECU.

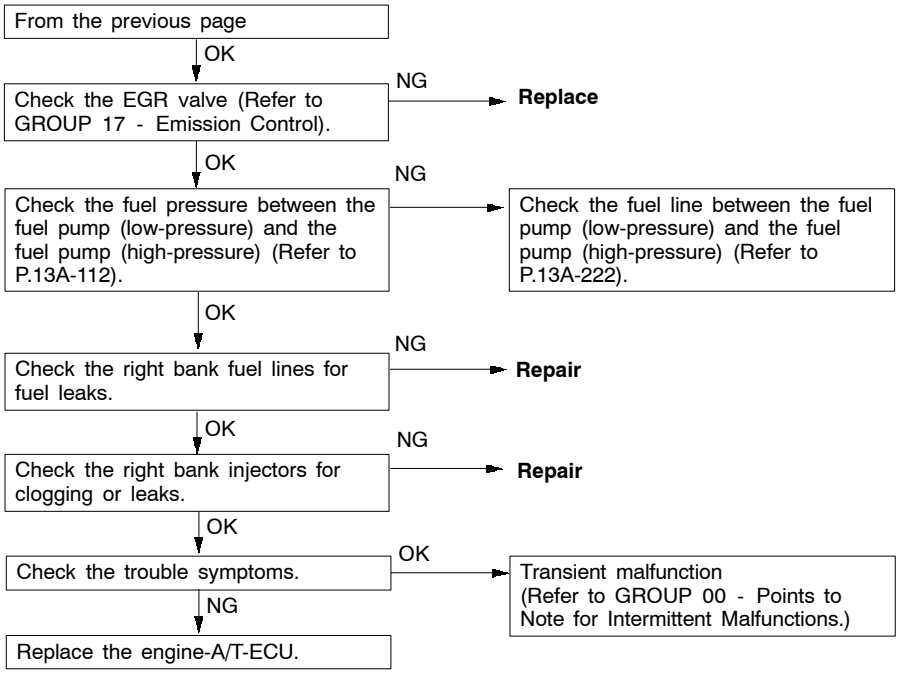
Code No.79 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU. Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 0.2 V or less. or ● The sensor output voltage is 4.85 V or more and the throttle position sensor (2nd channel) output voltage is 2.5V or more. or ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6V. or ● The opening angle of throttle position sensor (1st channel) is different from its target by 1V or more. or ● The throttle position sensor (1st channel) output changes within 25 mV when the throttle valve control servo moves one step.	● Malfunction of throttle position sensor ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of throttle valve controller ● Malfunction of engine-A/T-ECU



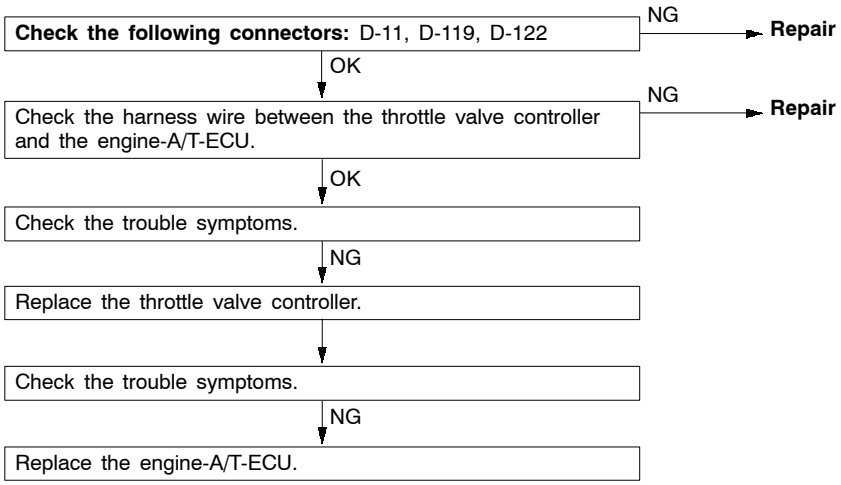

From the previous page
OK
Measure at throttle position sensor connector B-102.
● Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 4.8 - 5.2 V
(2) Voltage between terminal 2 and earth
OK: Accelerator pedal fully released: 0.4 - 0.8 V
Accelerator pedal fully depressed: 4.2 - 4.8 V
(3) Voltage between terminal 3 and earth
OK: 0.5 V or less
(1) NG
(3) NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
(2) NG
Adjust the throttle position sensor. (Refer to P.13A-220.)
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
OK
Measure at throttle valve controller connector D-11.
● Measure voltage at the throttle valve controller connector terminals.
● Ignition switch: ON
● Voltage between terminal 7 and earth
OK: Accelerator pedal fully released: 0.4 - 0.8 V
Accelerator pedal fully depressed: 4.2 - 4.8 V
NG
Check the following connector: D-11
NG
Repair
OK
Check the harness wire between the the throttle position sensor and the throttle valve controller, and repair if necessary.
OK
Check the following connector: D-11
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the throttle valve controller.

Code No.89 Abnormal fuel system	Probable cause
Range of Check • Engine: Being learning the air-fuel ratio Set Conditions • Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or • Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	• Malfunction of fuel supply system • Malfunction of oxygen sensor • Malfunction of intake air temperature sensor • Malfunction of barometric pressure sensor • Malfunction of air flow sensor • Malfunction of engine-A/T-ECU

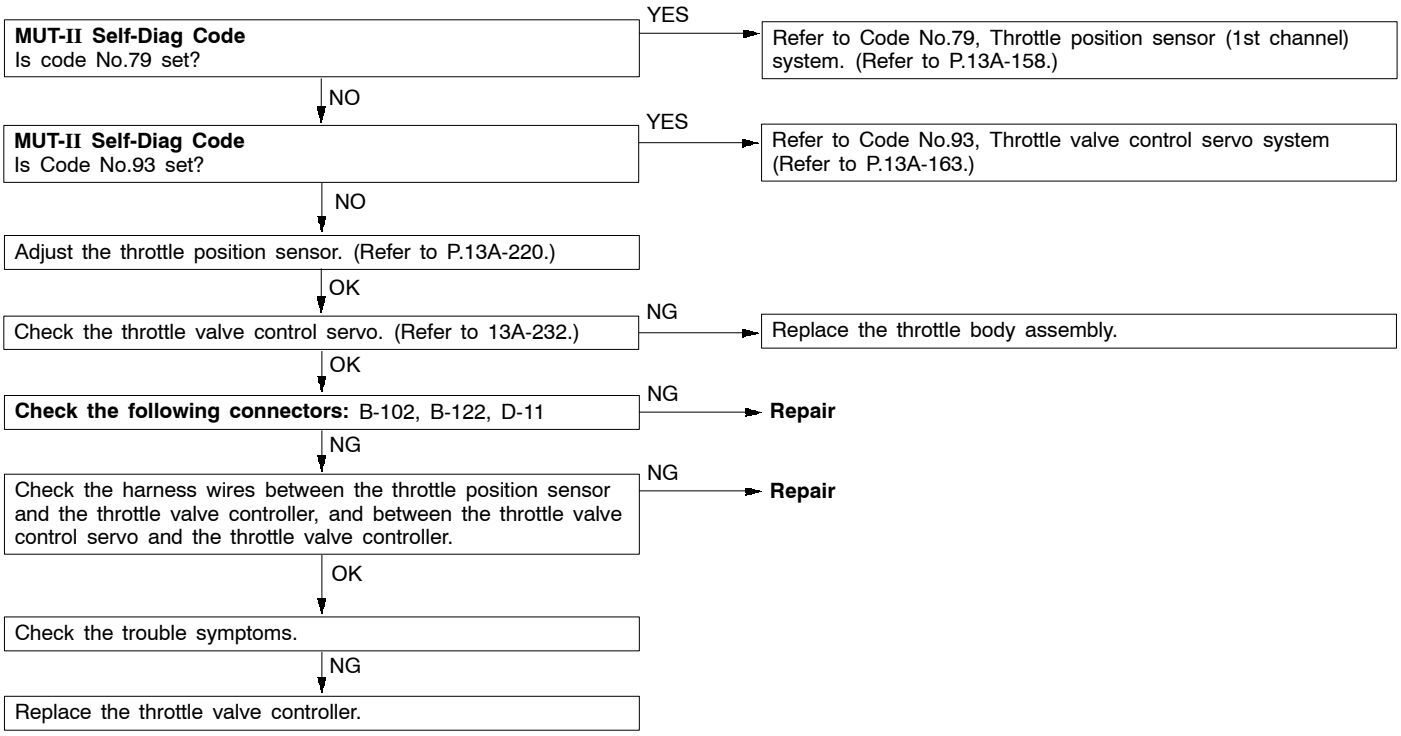




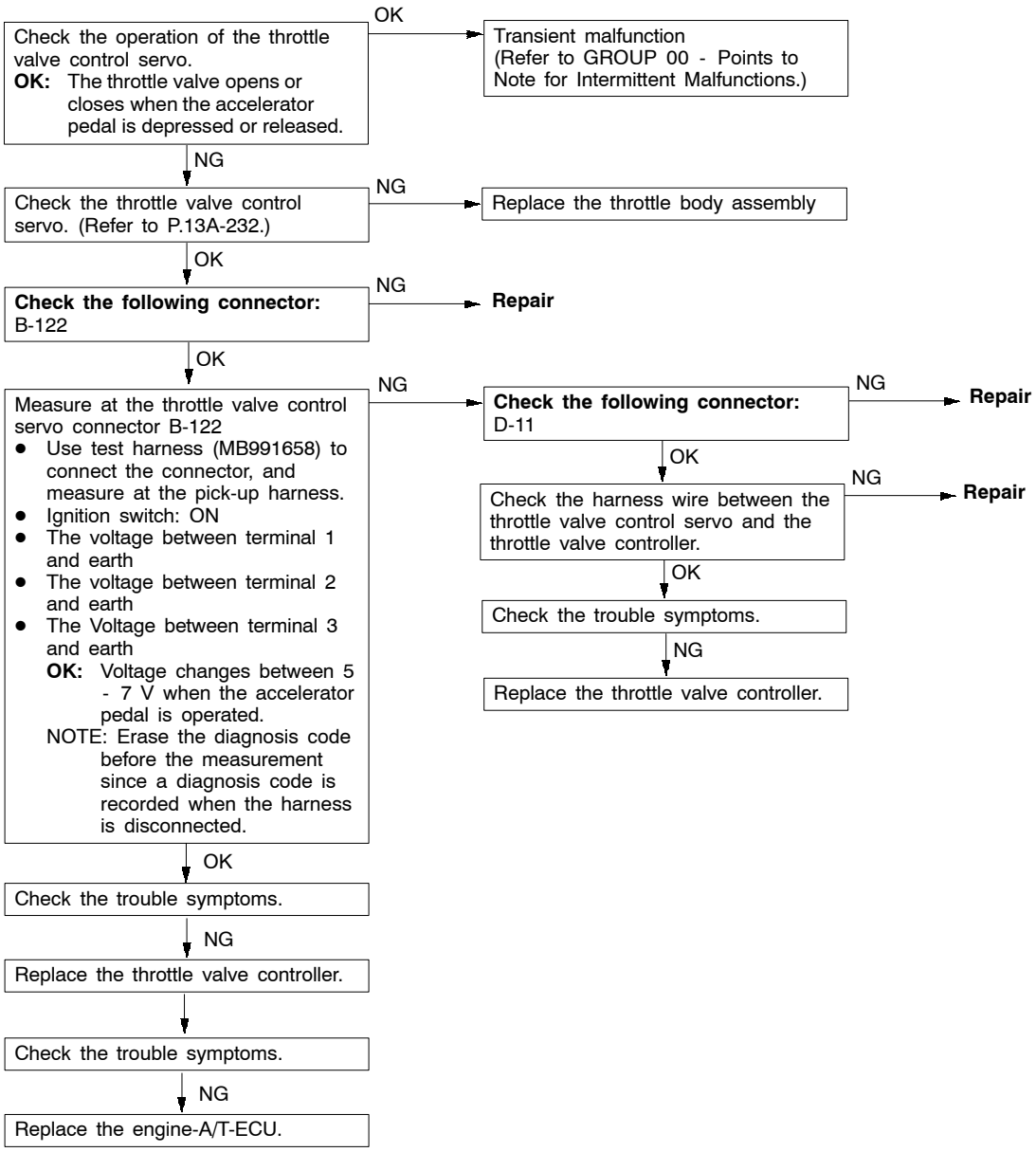
Code No.91 Electronic-controlled throttle valve system	Probable cause
Range of Check ● Ignition switch: ON ● Error in communication between the engine-A/T-ECU and the throttle valve controller Set Conditions ● Output voltage of throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value, based on that of the accelerator pedal position sensor (2nd channel). Range of Check ● Ignition switch: ON ● Error in communication between the throttle valve controller and the engine-A/T-ECU Set Conditions ● The output voltage of the throttle position sensor (2nd channel) is significantly different (approx. 1 V) from the the throttle valve opening angle (voltage), which the engine-A/T-ECU request the throttle valve controller.	● Short in communication line ● Malfunction of the engine-A/T-ECU ● Malfunction of the throttle valve controller



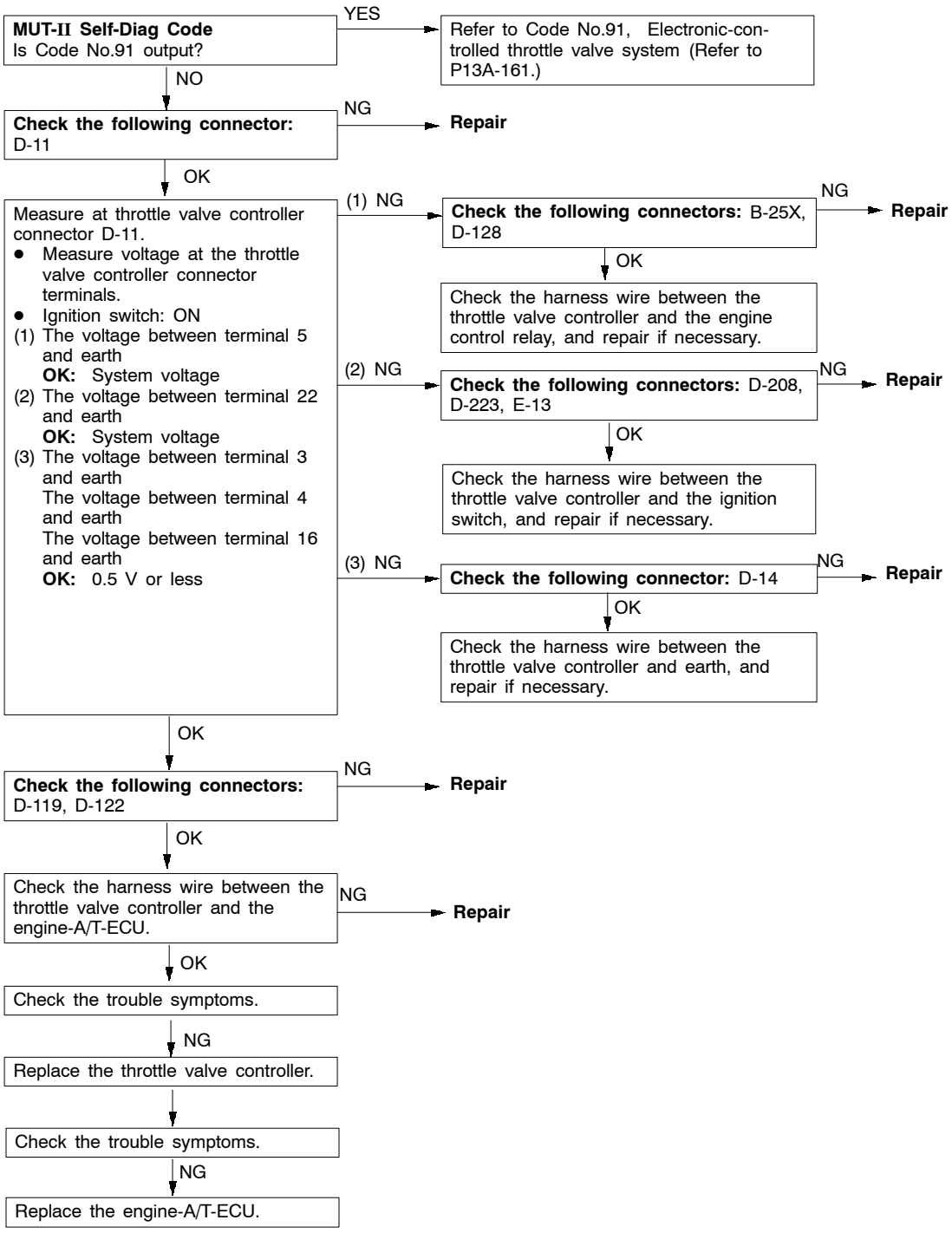
Code No.92 Throttle valve position feedback system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU. Range of Check ● Ignition switch: ON ● Battery voltage: 10 V or more Set Conditions ● Failure in the position feedback [The engine-A/T-ECU detects that the current in the motor is excessive and the opening angle difference between the target value of throttle position sensor (1st channel) and the actual value of throttle position sensor (1st channel) is 2.0V or more]	● Malfunction of throttle position sensor (1st channel) ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of the throttle valve controller



Code No.93 Throttle valve control servo system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU. Range of Check ● Throttle valve control servo relay: ON Set Conditions ● Short circuit of the throttle valve control servo drive circuit to earth ● Power is supplied to the throttle valve control servo circuit from other sources. ● Open circuit in the throttle valve control servo power supply circuit	● Malfunction of the throttle valve control servo ● Open circuit in the throttle valve control servo power supply circuit ● Open or short circuit in the throttle valve control servo circuit or loose connector contact ● Malfunction of throttle valve controller



Code No.94 Communication line system with the throttle valve controller	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage: 8 V or more. ● Engine: not cranking Set Conditions ● System detects an error in communication line between the engine-A/T-ECU and the throttle valve controller, and between the throttle valve controller and the engine-A/T-ECU.	● Short in communication line ● Malfunction of engine-A/T-ECU ● Malfunction of throttle valve controller



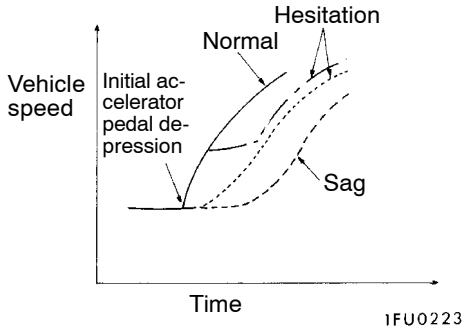
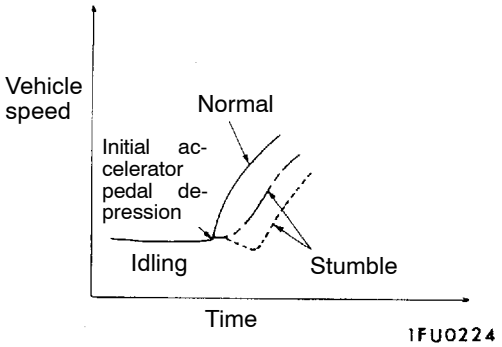
Code No.96 Throttle valve controller system	Probable cause
Set Conditions ● Errors in reading or writing to the throttle valve controller ROM.	● Malfunction of the throttle valve controller

Replace the throttle valve controller.

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-169
	Communication with engine-A/T-ECU only is not possible.	2	13A-169
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13A-170
	The engine warning lamp remains illuminating and never goes out.	4	13A-170
Starting	No initial combustion (starting impossible)	5	13A-171
	Initial combustion but no complete combustion (starting impossible)	6	13A-172
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-174
	Idling speed is high. (Improper idling speed)	8	13A-176
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-177
	When the engine is hot, it stalls at idling. (Die out)	10	13A-178
	The engine stalls when starting the car. (Pass out)	11	13A-180
	The engine stalls when decelerating.	12	13A-181
Driving	Hesitation, sag or stumble	13	13A-182
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-183
	The feeling of impact or vibration when decelerating	15	13A-184
	Knocking	16	13A-184
Dieseling		17	13A-184
Too high CO and HC concentration when idling		18	13A-185
Low alternator output voltage (approx. 12.3 V)		19	13A-186
Engine idle speed is incorrect while the A/C is on (A/C switch 2 signal).		20	13A-187
Fans (radiator fan, A/C condenser fan) are inoperative		21	13A-187
GDI ECO indicator lamp system	GDI ECO indicator lamp does not illuminate.	22	13A-188
	GDI ECO indicator lamp remains illuminated and does not go off.	23	13A-188

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

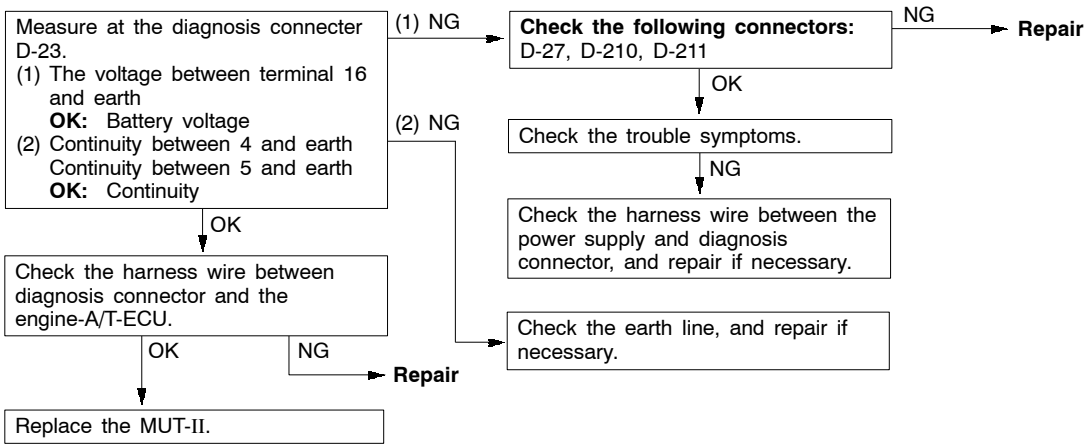
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicles is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation, Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. 

Items		Symptom
Driving	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run on (“Dieseling”)	The condition in which the engine continues to run after the ignition switch is turned to OFF. Also called “Dieseling”.

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

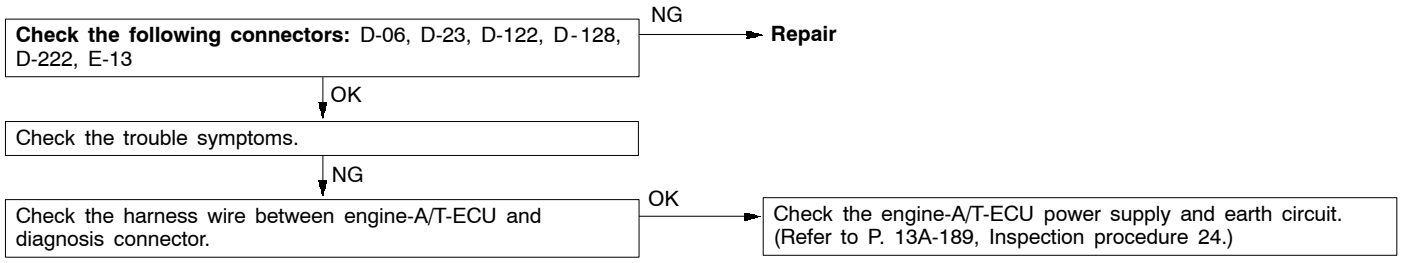
Inspection procedure 1

Communication with all systems is not possible.	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of the diagnosis connector • Open circuit or short-circuited between engine-A/T-ECU and diagnosis connector circuit • Malfunction of the MUT-II



Inspection procedure 2

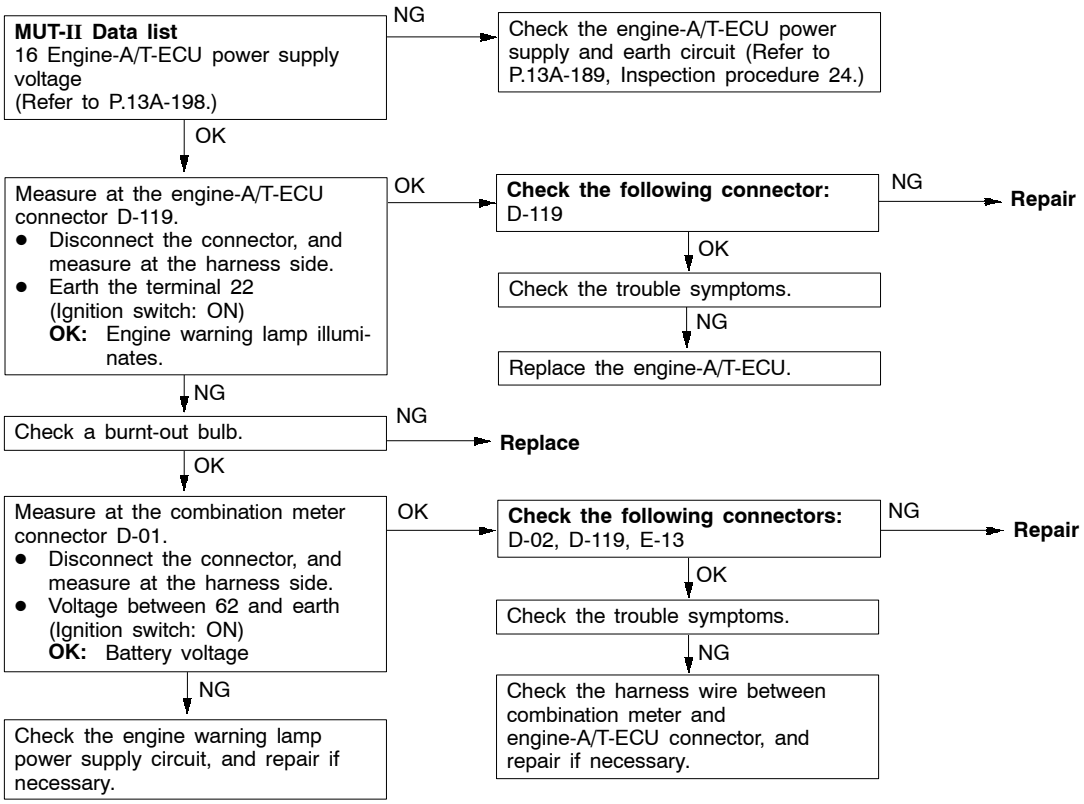
Communication with engine-A/T-ECU is not possible.	Probable cause
The cause is probably a defect in the engine-A/T-ECU power supply circuit (including earth).	• Open circuit or short-circuited harness wire in the engine-A/T-ECU power supply circuit. • Open circuit between engine-A/T-ECU and diagnosis connector • Malfunction of the engine-A/T-ECU



NOTE
On vehicles with multi communication system (MMCS) or RV meter, if a malfunction cannot be resolved after the procedure above, check the multi center display unit or RV meter and replace if necessary. (Refer to GROUP 54 - Clock, multi center display and RV meter.)

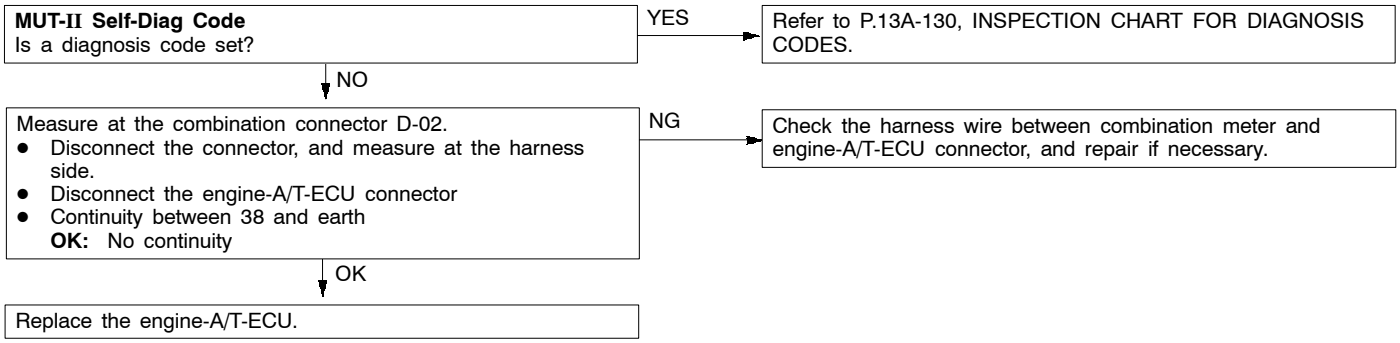
Inspection procedure 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
Because there is a burnt-out bulb, the engine-A/T-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunction listed at right has probably occurred.	• Burnt-out bulb • Open circuit or short-circuit between the engine warning lamp and engine-A/T-ECU. • Malfunction of the engine-A/T-ECU



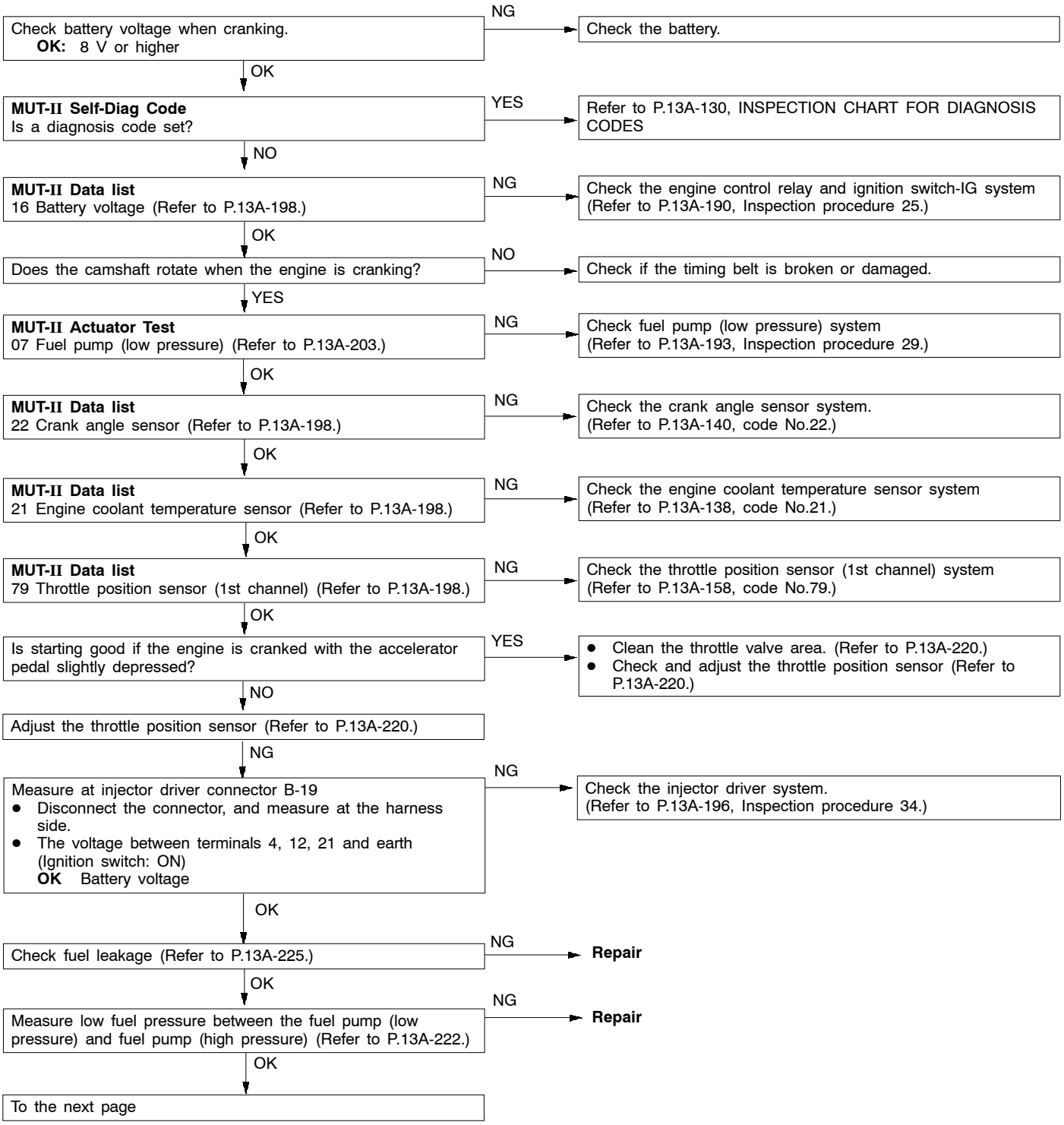
Inspection procedure 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-A/T-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning lamp and engine-A/T-ECU • Malfunction of the engine-A/T-ECU



Inspection procedure 5

No initial combustion (starting impossible)	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-A/T-ECU



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OK

Clamp the leads of the ignition coil No.1 terminal with a timing light pick-up in order. Does the timing light flash when the engine is cranked?

NO → Check the ignition coil (built-in power transistor) system (Refer to P.13A-148, code No.44.)

YES

Check the ignition timing when cranking.
OK: approx. 5 °BTDC

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.
3. Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the compression pressure
- Check if foreign materials (water, alcohol, etc.) got into fuel.

OK

Check the trouble symptoms.

NG

Replace the injector.

Inspection procedure 6

Initial combustion but no complete combustion (starting impossible), long time to start (hard starting)	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks by the spark are weak, or the initial mixture is not appropriate.	• Malfunction of fuel supply system • Malfunction of of fuel pressure control solenoid valve • Malfunction of the ignition system • Malfunction of the electronic-controlled throttle valve system • Malfunction of the engine-A/T-ECU

Check the battery voltage when cranking.
OK: 8 V or higher

NG → Check the battery.

OK

MUT-II Self-Diag Code
Is a diagnosis code set?

YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.

NO

MUT-II Actuator Test
07 Fuel pump (low pressure) (Refer to P.13A-203.)

NG → Check fuel pump system (low-pressure) (Refer to P.13A-193, Inspection procedure 29.)

OK

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)

NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)

OK

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OK

MUT-II Data list
18 Cranking signal (Refer to P.13A-198.)

NG → Check the ignition switch-ST system and inhibitor switch (Refer to 13A-191, Inspection procedure 27.)

OK

MUT-II Actuator Test
74 Fuel pressure sensor (Refer to P.13A-203.)

NG → Check abnormal fuel pressure. (Refer to P.13A-151, code No.56.)

OK

Check fuel leakage. (Refer to P.13A-225.)

NG → **Repair**

OK

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)

NG → Check the throttle valve position feedback system. (Refer to P.13A-162, code No.92.)

OK

Is starting good if the engine is cranked with the accelerator pedal slightly depressed?

YES →
- Clean the throttle valve area. (Refer to P.13A-220)
- Adjust the throttle position sensor (Refer to P.13A-220.)

NO

Adjust the throttle position sensor (Refer to P.13A-220.)

Check the ignition timing when cranking.
OK: Approx. 5 °BTDC

NG → Check that the crank angle sensor and timing belt cover are installed properly.

OK

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

3. Disconnect the injector intermediate connector.
4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the compression pressure
- Check the fuel lines for clogging.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

Check the trouble symptoms.

NG → Replace the injector.

Inspection procedure 7

Unstable idling (Rough idling, hunting)	Probable cause
The cause is probably a malfunction of the ignition system, air/fuel ratio control system, electronic controlled throttle valve system, compression pressure, etc. As many causes can be suspected, diagnose from easier items.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Poor compression • Air sucking into the air intake system

Has the battery been disconnected recently?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II Self-Diag Code
Is a diagnosis code set?
- YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
- NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)
- OK ↓

Does the idling speed fluctuate excessively?
- YES → • Clean around the throttle valve. (Refer to P.13A-220) • Adjust the throttle position sensor (Refer to P.13A-220.)
- NO ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-198.)
- NG → Check the accelerator pedal position switch system (Refer to P.13A-192, Inspection procedure 28.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-198.)
- NG → Check the intake air temperature sensor system (Refer to P.13A-135, code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-198.)
- NG → Check the barometric pressure sensor system (Refer to P.13A-145, code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
- NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)
- OK ↓

MUT-II Actuator Test
08 Purge control solenoid valve (Refer to P.13A-203.)
- NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 600 - 1,000 mV when the engine is suddenly raced
- NG → 11 Oxygen sensor system check (Refer to P. 13A-131, code No.11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for 2 minutes after the engine is started).
- NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)
  - OK ↓ Check that air is sucked in the air intake system.
    • Broken intake manifold gasket
    • Damaged vacuum hose
    • Damaged air intake hose
- OK ↓

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OK

MUT-II Data list
27 Power steering oil pressure switch (Refer to P.13A-198.)

NG → Check the power steering oil pressure switch system (Refer to P.13A-194, Inspection procedure 30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-198.)

NG → Check the A/C switch and A/C relay system (Refer to P.13A-194, Inspection procedure 31.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-198.)

NG → Check the stop lamp switch system (Refer to P.13A-195, Inspection procedure 32.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-198.)

NG → Check the small lamp switch system (Refer to P.13A-195, Inspection procedure 33.)

OK

MUT-II Data list
14 Throttle position sensor (2nd channel)
After warming-up, let the engine run at idling with no load.
OK: When idling, 3,900 - 4,800 mV

NG →
- Clean around the throttle valve. (Refer to P.13A-220)
- Adjust the throttle position sensor (Refer to P.13A-220.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)

NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)

OK

Check the ignition timing. (Refer to GROUP 11A - Engine Adjustment.)

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Clean around the throttle valve. (Refer to P.13A-220.)

OK

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.
3. Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the exhaust gas emission control system
- Check the EGR control system
- Check the compression pressure
- Check if foreign materials (water, kerosine,etc.) got into fuel.

→ Check the trouble symptoms.

NG →
Air is sucked in the air intake system, or EGR gas leaks.
- Broken intake manifold gasket
- Damaged air intake hose
- Damaged vacuum hose
- Faulty EGR valve seat

Inspection procedure 8

Idling speed is high or low (Improper idling speed)	Probable cause
The cause is probably that the intake air amount during idling is too great or too small.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body

MUT-II Self-Diag Code
Is a diagnosis code set?
- YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
- NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)
- OK ↓

MUT-II Actuator Test
08 Purge control solenoid valve (Refer to P.13A-203.)
- NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-198.)
- NG → Check the accelerator pedal position switch system (Refer to P.13A-192, Inspection procedure 28.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
- NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)
- OK ↓

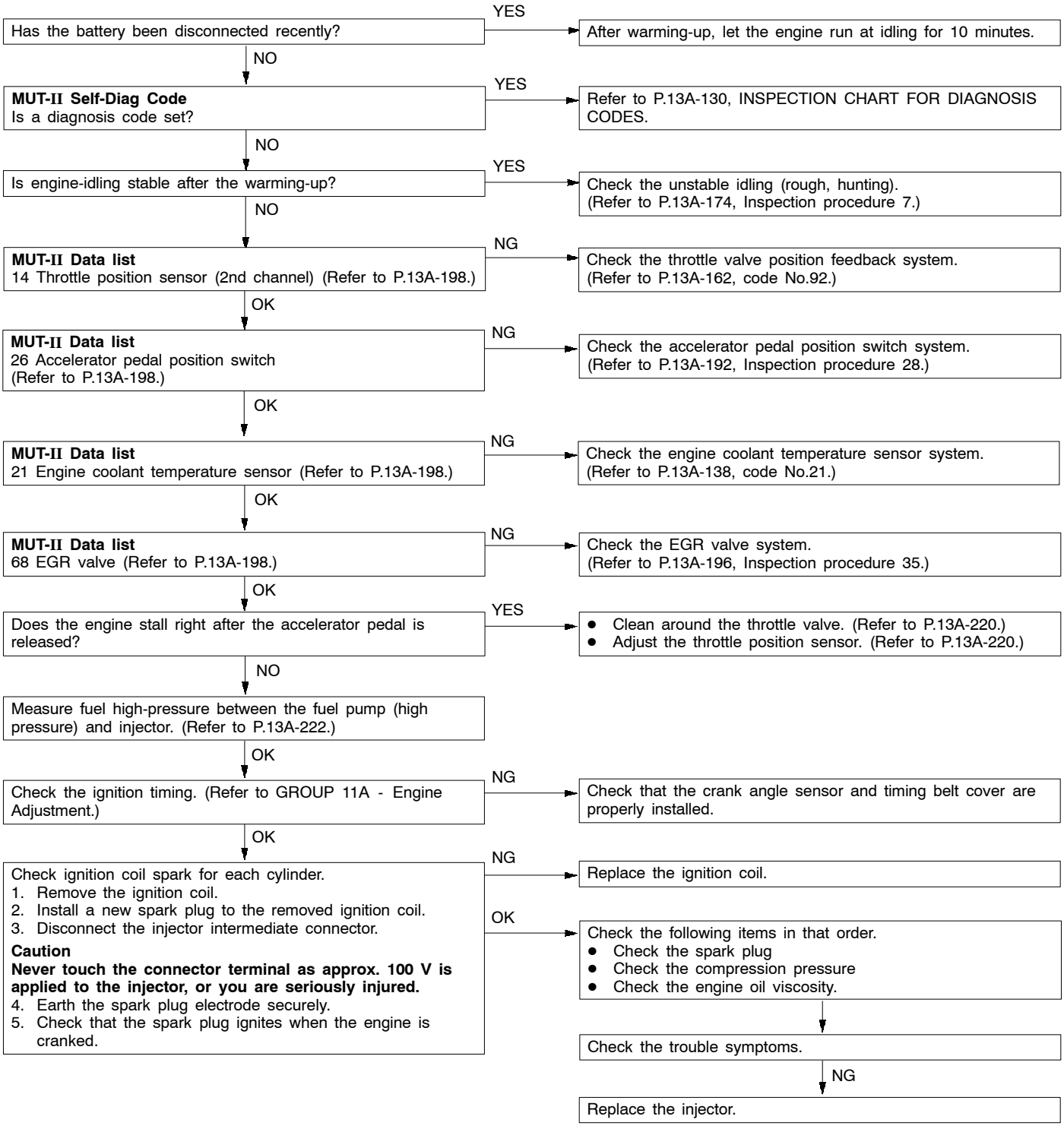
MUT-II Data list
28 A/C switch (Refer to P.13A-198.)
- NG → Check the A/C switch and A/C relay system (Refer to P.13A-194, Inspection procedure 31.)
- OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-198.)
- NG → Check the stop lamp switch system (Refer to P.13A-195, Inspection procedure 32.)
- OK ↓

- Clean around the throttle valve. (Refer to P.13A-220.)
- Adjust the throttle position sensor (Refer to P.13A-220.)

Inspection procedure 9

When the engine is cold, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body



Inspection procedure 10

When the engine becomes hot, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that ignition system, air/fuel mixture, electronic-controlled throttle valve system, compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body • Improper connector contact • Drawing air into intake system

Has the battery been disconnected recently?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II Self-Diag Code
Is a diagnosis code set?
- YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-162, code No.92.)
- OK ↓

Does the engine stall easily again?
- NO → While carrying out an intermittent malfunction simulation test (Refer to GROUP 00 - Points to Note for Intermittent Malfunctions.), check for sudden changes in the signals shown below.
  - Crank angle sensor signal
  - Injector activating signal
  - Low pressure fuel pump drive signal
  - Air flow sensor
  - Primary ignition signal
  - Engine-A/T-ECU power supply voltage
- YES ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-198.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-192, Inspection procedure 28.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-198.)
- NG → Check the intake air temperature sensor system. (Refer to P.13A-135, code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-198.)
- NG → Check the barometric pressure sensor system. (Refer to P.13A-145, code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13A-138, code No.21.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK 600 - 1,000 mV when the engine is suddenly raced.
- NG → Check Oxygen sensor system (Refer to P.13A-131, code No.11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for 2 minutes after the engine is started).
- NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)
  - OK ↓
  - Check that air is sucked in the air intake system.
    - Broken intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
- OK ↓

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OK

MUT-II Data list
27 Power steering oil pressure switch (Refer to P.13A-198.)

NG → Check the power steering oil pressure switch system (Refer to P.13A-194, Inspection procedure30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-198.)

NG → Check the A/C switch and A/C relay system (Refer to P.13A-194, Inspection procedure 31.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-198.)

NG → Check the small lamp switch system (Refer to P.13A-195, Inspection procedure 33.)

OK

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13A-198.)

NG → Check the air flow sensor system (Refer to P.13A-133, code No.12.)

OK

MUT-II Data list
14 Throttle position sensor (2nd channel)
After warming-up, let the engine run at idling with no load.
OK: 3,900 - 4,800 mV

NG →
- Clean around the throttle valve. (Refer to P.13A-220)
- Adjust the throttle position sensor (Refer to P.13A-220.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)

NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)

OK

Does the engine stall right after the accelerator pedal is released?

YES → Clean around the throttle valve. (Refer to P.13A-220.)

NO

Check the ignition timing. (Refer to GROUP 11A - Engine Adjustment.)

OK → Check that the crank angle sensor and timing belt cover are properly installed.

NG

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.
3. Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the compression pressure
- Check if foreign materials (water, kerosine,etc.) got into fuel.

Inspection procedure 11

The engine stalls when starting the car. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	• Malfunction of the ignition system • Malfunction of the EGR valve • Air stuck in the air intake system

MUT-II Self-Diag Code
Is a diagnosis code set?

YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.

NO ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198)

NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)

OK ↓

MUT-II Actuator Test
08 Purge control solenoid valve (Refer to P.13A-203.)

NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)

OK ↓

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.
3. Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 mV is applied to the injector, or you are seriously injured.

4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK ↓

Check the following items in that order.
- Check the spark plug
- Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged or disconnected vacuum hose
- Damaged air intake hose

Inspection procedure 12

The engine stalls when decelerating.	Probable cause
The cause is probably an improper air/fuel ratio due to a faulty EGR system, or poor intake air volume due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the EGR valve

Has the battery been disconnected recently?
- YES → After warming-up, let the engine run at idling for 10 minutes.
- NO ↓

MUT-II Self-Diag Code
Is a diagnosis code set?
- YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-198.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-192, Inspection procedure 28)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
- NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.P92)
- OK ↓

Check the vehicle speed sensor system (Refer to P.13A-144, code No.24.)
- NG → **Repair**
- NO ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)
- NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)
- OK ↓

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.
3. Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

- NG → Replace the ignition coil.
- OK ↓

Check the following items in that order.
- Check the spark plug
- Clean around the throttle valve. (Refer to P.13A-220.)
- Adjust the throttle position sensor (Refer to P.13A-220.)

Inspection procedure 13

Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, air/fuel ratio control system, electronic controlled throttle valve system, compression pressure, etc.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Improper compression pressure • Air stuck in the air intake system

MUT-II Self-Diag Code
Is a diagnosis code displayed?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Check the ignition timing. (Refer to GROUP11A - Engine Adjustment)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
26 Accelerator pedal position switch
(Refer to P.13A-198.)
NG → Check the accelerator pedal position switch system. (Refer to P.13A-192, Inspection procedure 28.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-198.)
NG → Check the intake air temperature sensor system (Refer to P.13A-135, code No.13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-198.)
NG → Check the barometric pressure sensor system (Refer to P.13A-145, code No.25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)
OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 600 - 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13A-131, code No.11.)
OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 0 - 400 mV and 600 - 1,000 mV alternates when the engine is idling (wait for 2 minutes after the engine is started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)
OK → Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)
NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)
OK ↓

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OK

MUT-II Actuator Test
08 Purge control solenoid valve
(Refer to P.13A-203.)

NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)

OK

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-222.)

NG → **Repair**

OK

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.
3. Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check the following items in that order.
- Check the spark plug
- Check the EGR control system
- Check the compression pressure
- Check the fuel filter or fuel line for clogging

Check the trouble symptoms.

NG → Replace the injector.

Inspection procedure 14

The feeling of impact or vibration when accelerating	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag Code
Is a diagnosis code displayed?

YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.

NO

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)

NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)

OK

Check the spark plug

NG → **Replace**

OK

Check the trouble symptoms.

NG

Replace the ignition coil.

Inspection procedure 15

The feeling of impact or vibration when decelerating	Probable cause
The cause is probably insufficient intake air due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system

MUT-II Self-Diag Code
Are diagnosis codes displayed?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-198.)
NG → Check the throttle valve position feedback system (Refer to P.13A-162, code No.92.)
OK ↓

MUT-II Data list
26 Accelerator pedal position switch
(Refer to P.13A-198.)
NG → Check the accelerator pedal position switch system (Refer to P.13A-192, Inspection procedure 28.)
OK ↓

Clean around the throttle valve. (Refer to P.13A-220.)

Inspection procedure 16

Knocking	Probable cause
In case as the above, the cause is probably that the heat value of the spark plug is inappropriate.	• Malfunction of the detonation sensor • Improper heat range of the spark plugs.

MUT-II Self-Diag Code
Is a diagnosis code set?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Does knocking occur when the vehicle is driven with the detonation sensor disconnected?
(At this time, use the MUT-II to check whether the ignition timing is retarded from when the detonation sensor connector is connected.)
NO → Check the detonation sensor system. (Refer to P.13A-146, code No.31.)
YES ↓

Check the following items in that order.
- Spark plugs
- Check if foreign materials (water, kerosine,etc.) got into fuel.

Inspection procedure 17

Run-on (Dieseling)	Probable cause
Fuel leakage from injectors is suspected.	• Malfunction of the injector

Replace the injector.

Inspection procedure 18

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	• Malfunction of the air/fuel ratio control system • Deteriorated catalyst

MUT-II Self-Diag Code
Are diagnosis codes displayed?
YES → Refer to P.13A-130, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Check the ignition timing. (Refer to GROUP 11A - Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-198.)
NG → Check the engine coolant temperature sensor system (Refer to P.13A-138, code No.21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-198.)
NG → Check the intake air temperature sensor system (Refer to P.13A-135, code No.13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-198.)
NG → Check the barometric pressure sensor system (Refer to P.13A-145, code No.25.)
OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-198.)
NG → Check the EGR valve system (Refer to P.13A-196, Inspection procedure 35.)
OK ↓

MUT-II Actuator Test
08 Purge control solenoid valve
(Refer to P.13A-203.)
NG → Check the purge control solenoid valve system (Refer to P.13A-197, Inspection procedure 36.)
OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: 600 - 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13A-131, code No.11.)
OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13A-198.)
OK: Repeat 0 - 400 mV and 600 - 1,000 mV alternately during idling (wait for at least 2 minutes after the engine started to run at idle).
OK → Replace the oxygen sensor.
Check the trouble symptoms.
NG ↓

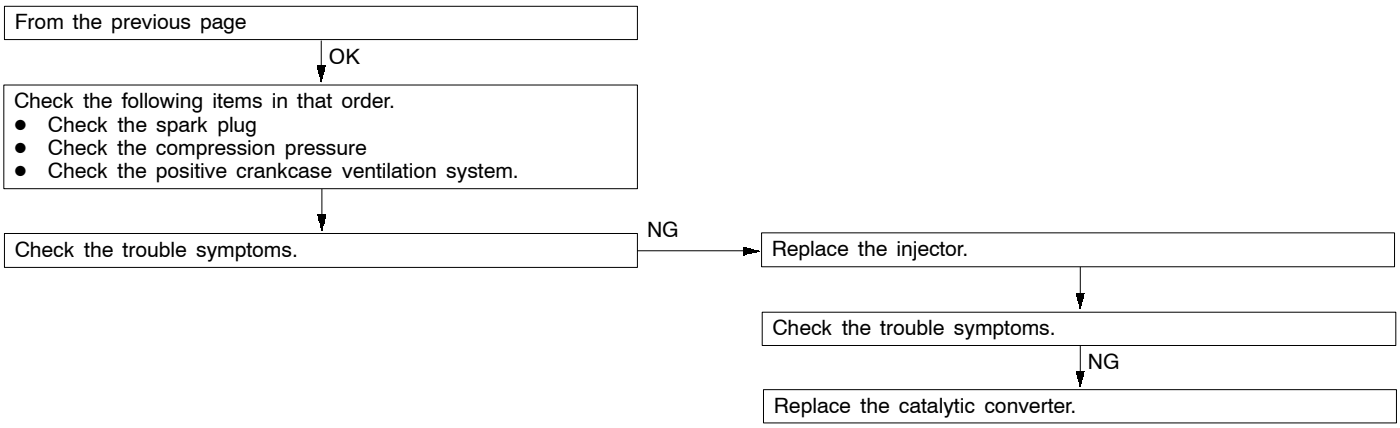
Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-223.)
OK ↓

Check ignition coil spark for each cylinder.
1. Remove the ignition coil.
2. Install a new spark plug to the removed ignition coil.
3. Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

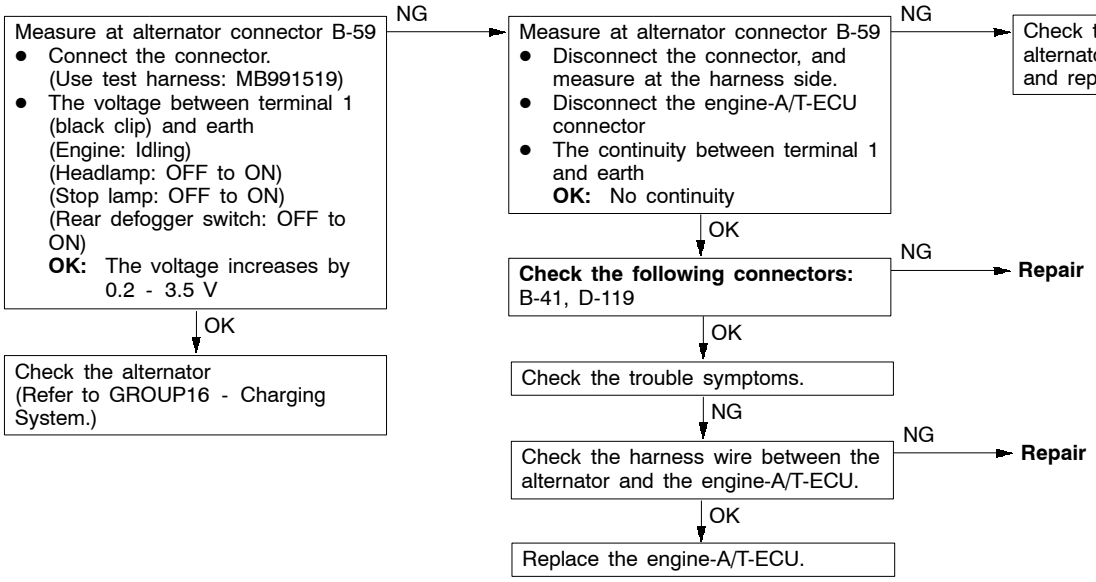
4. Earth the spark plug electrode securely.
5. Check that the spark plug ignites when the engine is cranked.

OK ↓ To the next page
NG → Replace the ignition coil.



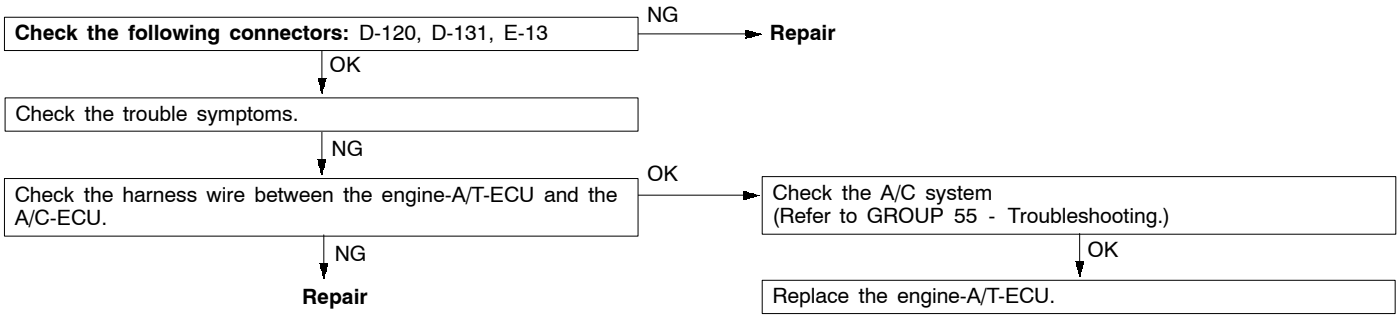
Inspection procedure 19

Low alternator output voltage (approx. 12.3 V)	Probable cause
The cause is probably a malfunction of the alternator or one of the problems listed at right.	● Malfunction of the charging system ● Open circuit between the alternator G terminal and the engine-A/T-ECU ● Malfunction of the engine-A/T-ECU



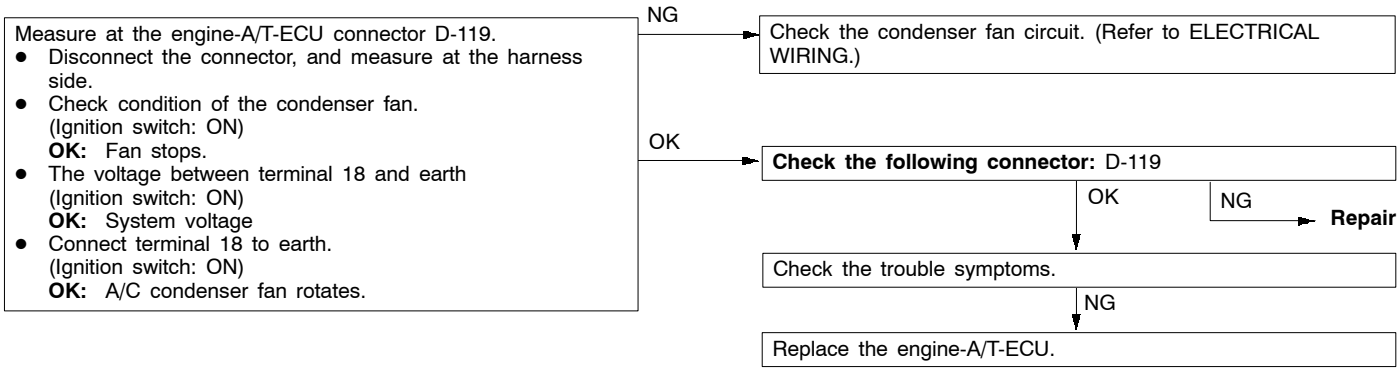
Inspection procedure 20

Idling speed is improper when A/C is operating (A/C switch 2 signal)	Probable cause
The A/C-ECU judges if load caused by air conditioner is high or low, and converts it to A/C switch 2 signal to send the engine-A/T-ECU it. Based on this signal, the engine-A/T-ECU operates the throttle control servo to control the idle-up speed.	• Malfunction of the A/C control system • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU



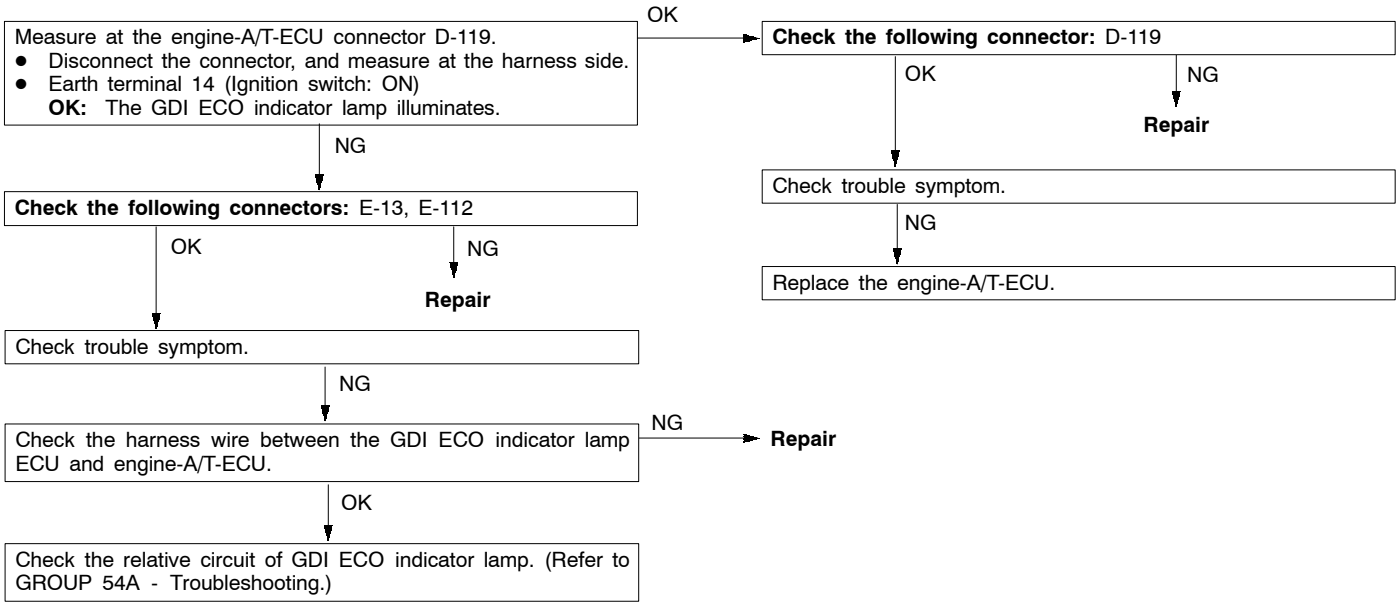
Inspection procedure 21

A/C condenser fan is inoperative	Probable cause
The fan motor relay is controlled by turning on and off the power transistor in the engine-A/T-ECU.	• Malfunction of the A/C condenser fan relay. • Malfunction of the A/C condenser fan motor. • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU



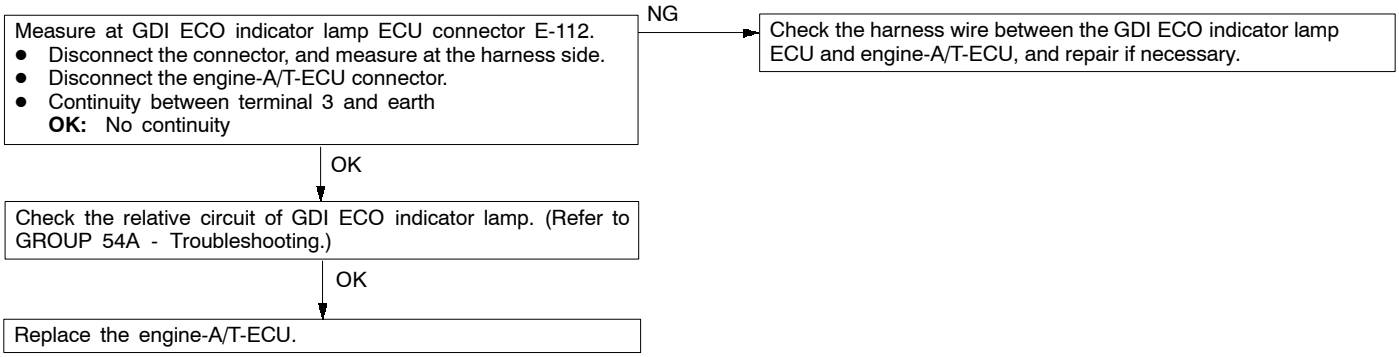
Inspection procedure 22

GDI ECO indicator lamp does not illuminate.	Probable cause
If the GDI ECO indicator lamp does not illuminate after turning switch, the causes listed in the right column are suspected.	• Burned-out GDI ECO indicator lamp bulb • Open circuit or short-circuited harness wire in the GDI ECO indicator lamp circuit • Malfunction of the engine-A/T-ECU • Malfunction of the GDI ECO indicator lamp ECU



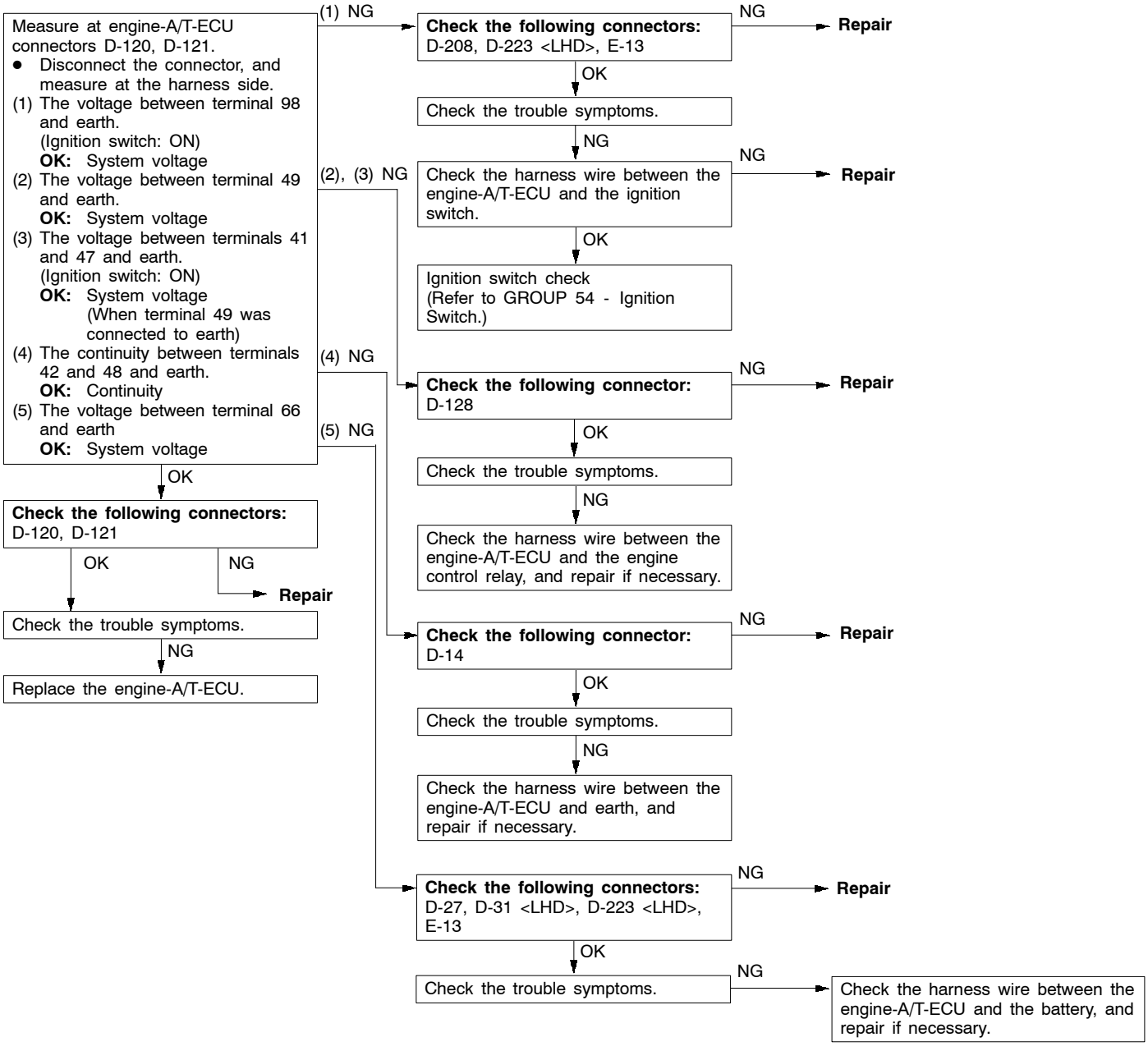
Inspection procedure 23

GDI ECO indicator lamp remains illuminated and does not go off.	Probable cause
If the GDI ECO indicator lamp does not go off during high load operation, the causes listed in the right column are suspected.	• Short circuit between the GDI ECO indicator lamp and engine-A/T-ECU • Malfunction of the engine-A/T-ECU • Malfunction of the GDI ECO indicator lamp ECU



Inspection procedure 24

Engine-A/T-ECU power supply and earth circuit system	Probable cause
The cause is probably the malfunction of the engine-A/T-ECU, or the malfunctions listed at right.	• Open circuit or short-circuited harness wire in the engine-A/T-ECU power supply circuit. • Open circuit or short-circuited harness wire to earth in the engine-A/T-ECU. • Malfunction of the engine-A/T-ECU



Inspection procedure 25

Engine control relay, ignition switch-IG system	Probable cause
When an ignition switch ON signal is input to the engine-A/T-ECU, the engine-A/T-ECU turns the control relay ON. This causes system voltage to be supplied to the engine-A/T-ECU, sensors, and actuators.	• Malfunction of the ignition switch • Malfunction of the control relay. • Open circuit or short-circuited harness wire in the engine control relay circuit. • Malfunction of the engine-A/T-ECU

Check the control relay. (Refer to P.13A-227.)
- NG → **Replace**
- OK ↓

Measure at control relay connector B-25X.
- Disconnect the connector, and measure at the harness side.
- The voltage between 2, 3 and earth
  OK: System voltage

- NG → Check the harness wire between the battery and the engine control relay, and repair if necessary.
- OK → Check the engine-A/T-ECU power supply and earth circuit. (Refer to P.13A-189, Inspection procedure 24.)

Inspection procedure 26

Injector driver relay system	Probable cause
When an ignition switch ON signal is input to the engine-A/T-ECU, the engine-A/T-ECU turns the injector driver relay ON. This causes system voltage to be supplied to the injector driver.	• Malfunction of the injector driver relay. • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU

Check the injector driver relay (Refer to P.13A-227.)
- NG → **Replace**
- OK ↓

Measure at the injector driver relay connector B-28X.
- Disconnect the connector, and measure at the harness side.

(1) The voltage between terminal 3 and earth
OK: System voltage

(2) The voltage between terminal 4 and earth (Ignition switch: ON)
OK: System voltage

- (1) NG → Check the harness wire between the injector driver relay and the battery, and repair if necessary.
- (2)NG → **Check the following connectors:** D-208, D-223 <LHD>, E-13
  - OK → Check the trouble symptoms.
    - NG → Check the harness wire between the injector driver relay and the ignition switch, and repair if necessary.
    - OK ↓
  - NG → **Repair**
- OK ↓

Measure at engine-A/T-ECU connector D-119.
- Disconnect the connector, and measure at the harness side.
- The voltage between terminal 6 and earth (Ignition switch: ON)
  OK: System voltage

- NG → **Check the following connector:** B-28X
  - OK → Check the trouble symptoms.
    - NG → Check the harness wire between the injector driver relay and the engine-A/T-ECU, and repair if necessary.
    - OK ↓
  - NG → **Repair**
- OK ↓

Check the following connector: D-119
- OK ↓
- NG → **Repair**

Check the trouble symptoms.
- NG ↓

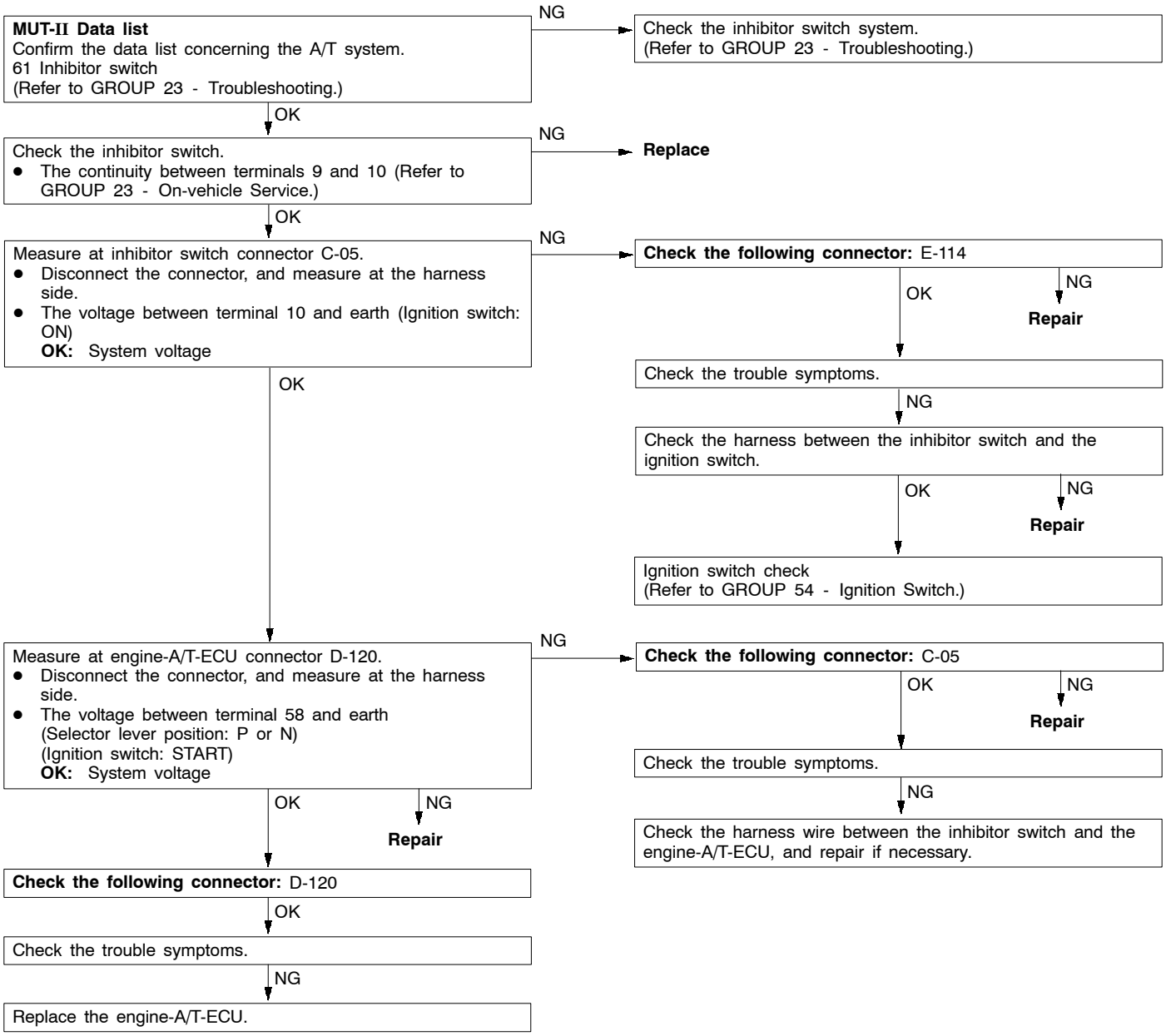
Measure at injector driver connector B-121.
- Connect the connector.
- The voltage between terminal 4, 12, 21 and earth (Ignition switch: ON)
  OK: System voltage

- NG → **Check the following connector:** B-28X
  - OK → Check the trouble symptoms.
    - NG → Check the harness wire between the injector driver relay and the injector driver, and repair if necessary.
    - OK ↓
  - NG → **Repair**
- OK ↓

Check the injector driver system. (Refer to P.13A-196, Inspection procedure 34.)

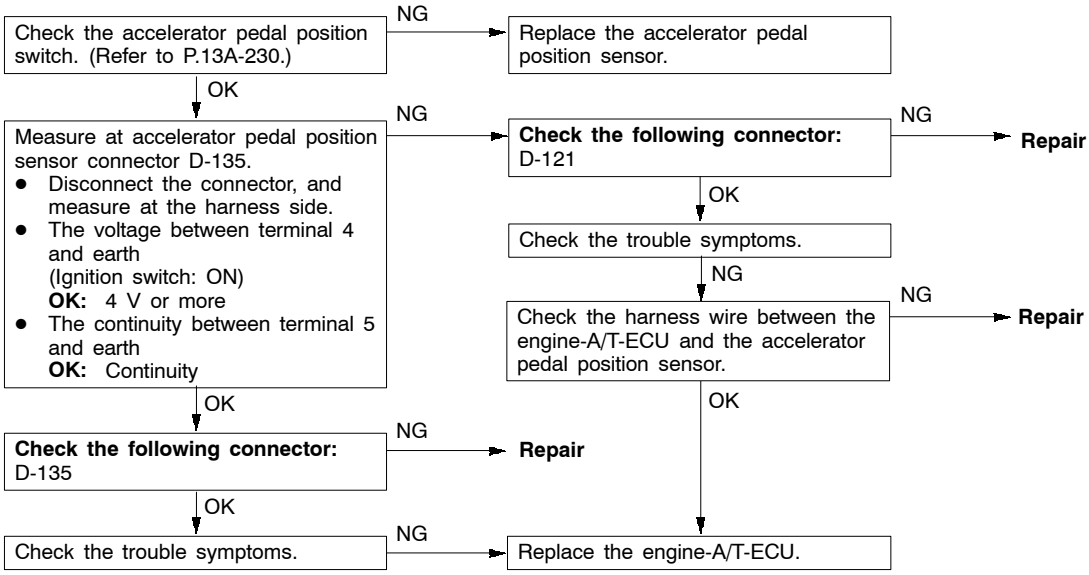
Inspection procedure 27

Ignition switch-ST and inhibitor switch system	Probable cause
The ignition switch-ST inputs a HIGH signal to the engine-A/T-ECU while the engine is cranking. The engine-A/T-ECU controls fuel injection, etc. during starting based on this input. The inhibitor switch inputs the position of the selector lever to the engine-A/T-ECU. The engine-A/T-ECU uses this signal to carry out idle speed control.	• Malfunction of the ignition switch • Malfunction of the inhibitor switch • Open circuit or short-circuited harness wire between the ignition switch and the inhibitor switch, or improper connector contact. • Malfunction of the engine-A/T-ECU



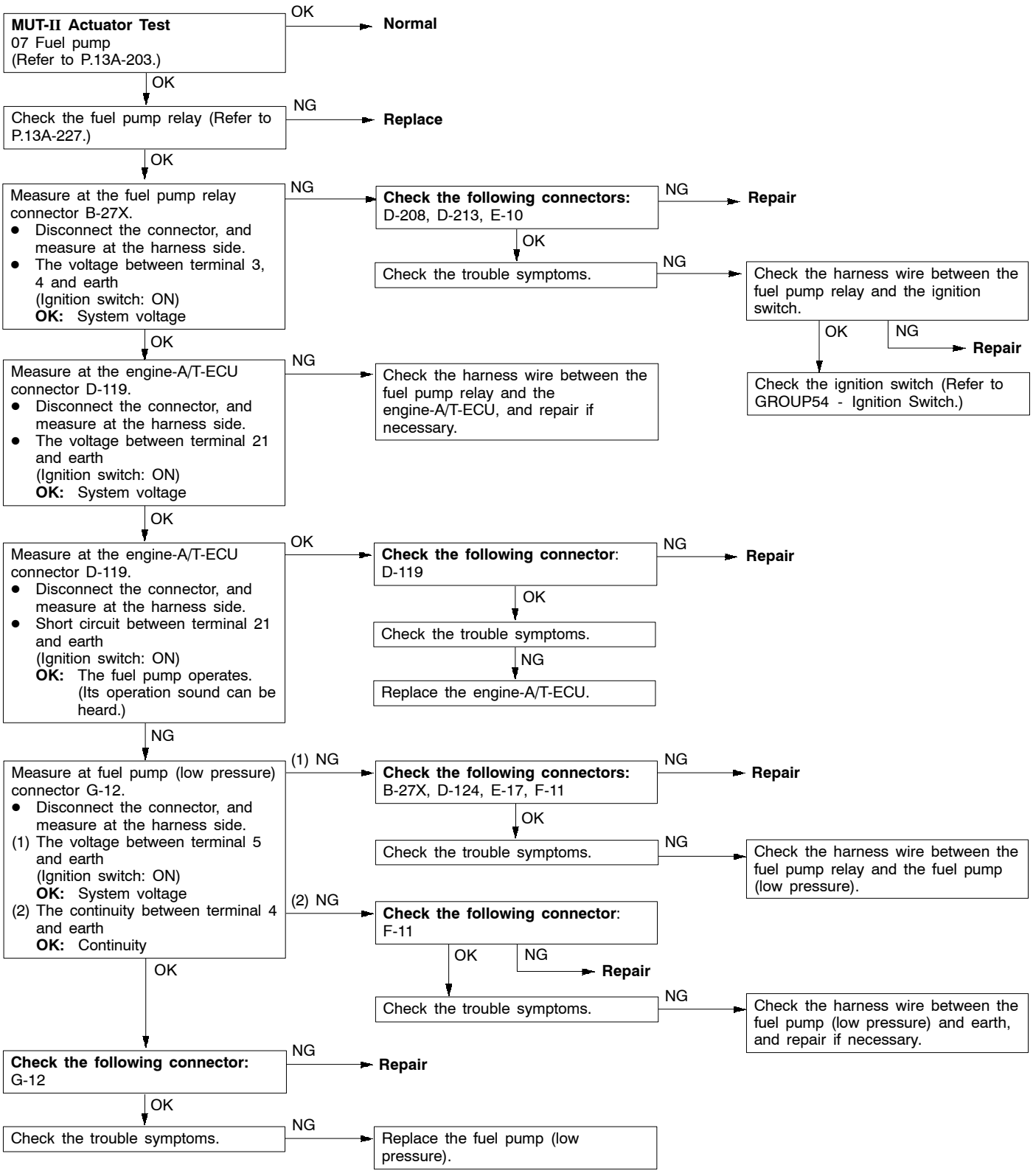
Inspection procedure 28

Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-A/T-ECU. The engine-A/T-ECU uses this signal to carry out idle speed control.	• Maladjustment of the accelerator pedal position switch and the accelerator pedal position sensor. • Open circuit or short-circuited harness wire in the accelerator pedal position switch system, or poor connector contact • Malfunction of the engine-A/T-ECU



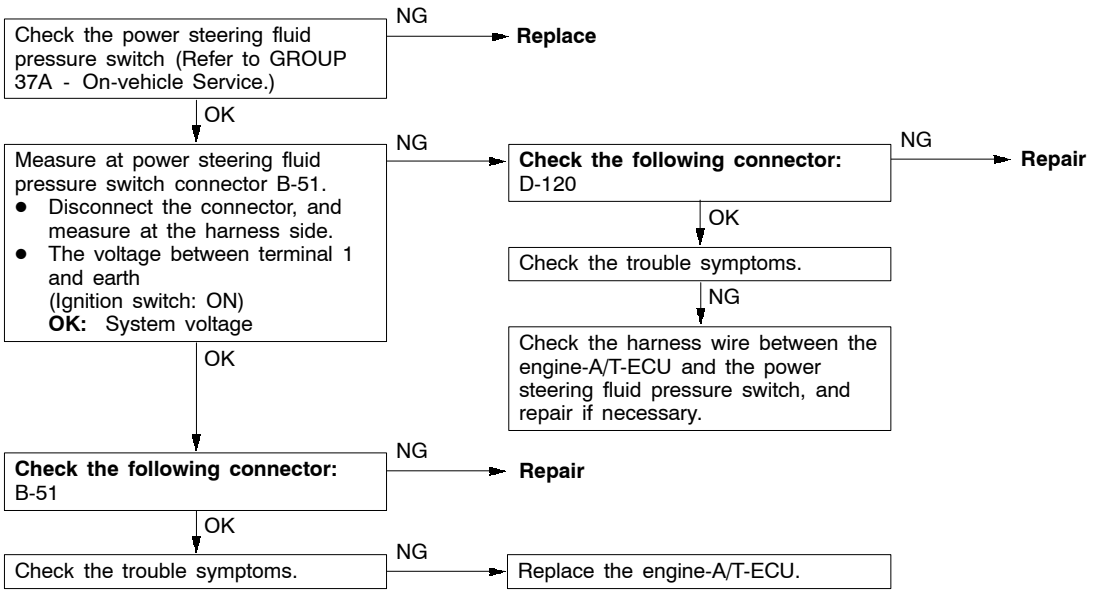
Inspection procedure 29

Fuel pump (low pressure) system	Probable cause
The engine-A/T-ECU turns on the fuel pump relay while the engine is cranking or running, and supplies power source to the fuel pump (low pressure).	• Malfunction of the fuel pump relay • Malfunction of the fuel pump (low pressure) • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



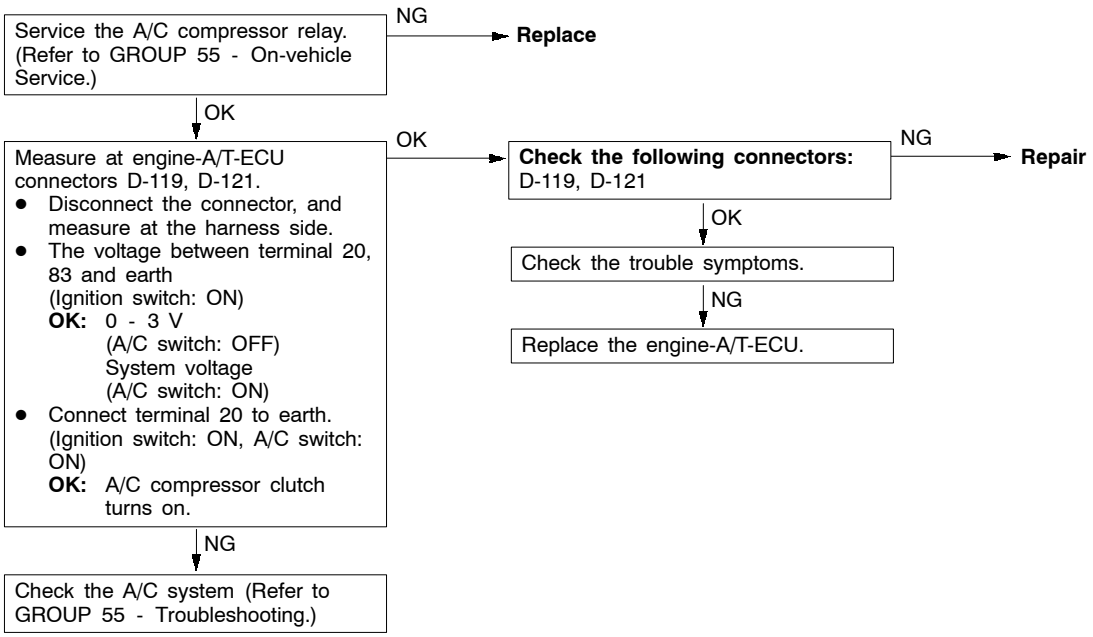
Inspection procedure 30

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-A/T-ECU. Based on this signal, the engine-A/T-ECU controls the throttle control servo so that idle speed increases when the power steering is in operation.	• Malfunction of the power steering fluid pressure switch. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



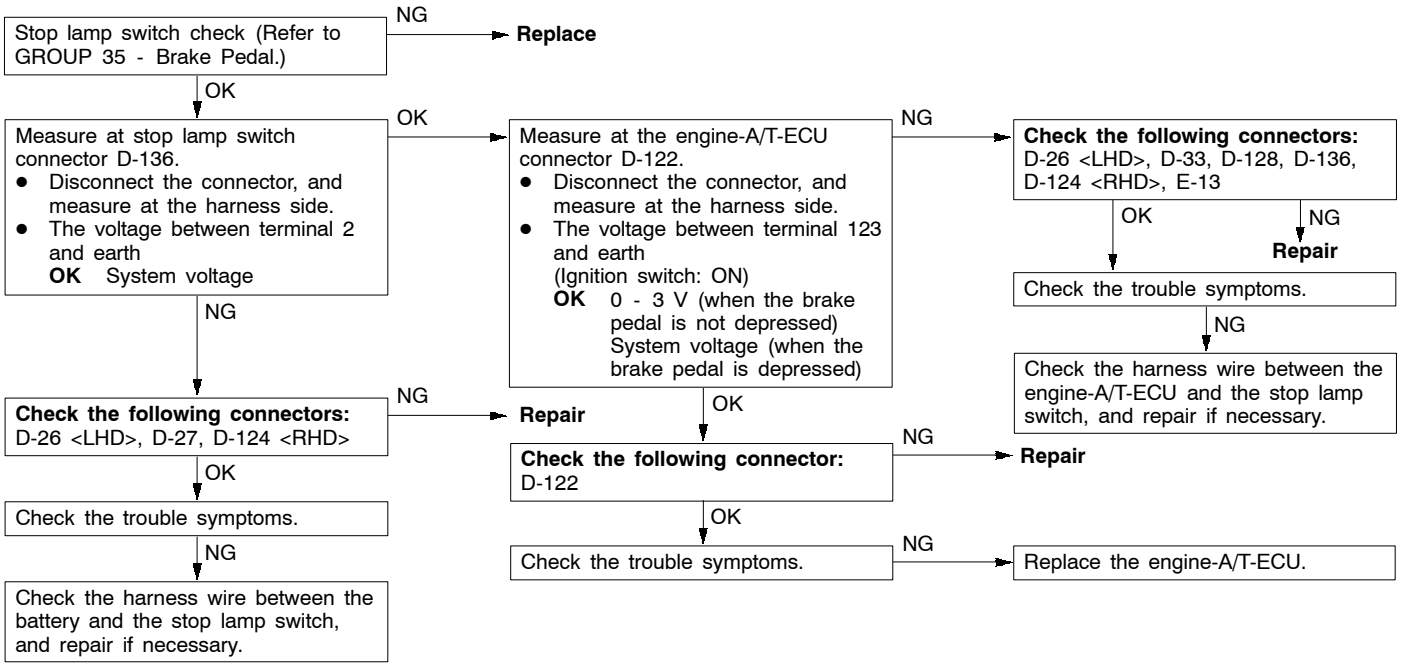
Inspection procedure 31

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-A/T-ECU, the engine-A/T-ECU controls the throttle control servo so that idle speed increases, and also operates the A/C compressor magnetic clutch.	• Malfunction of the A/C control system • Malfunction of the A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



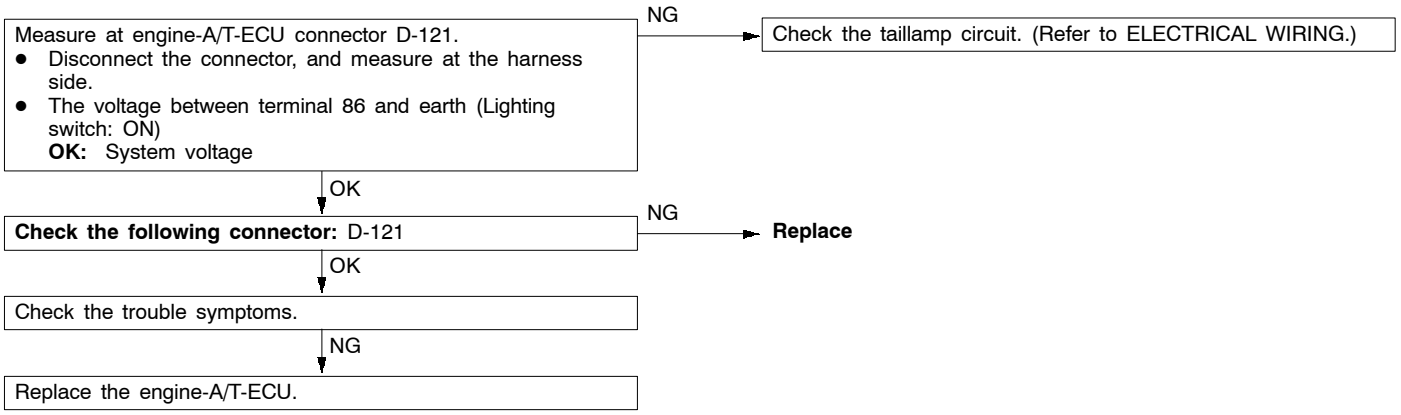
Inspection procedure 32

Stop lamp switch system	Probable cause
The engine-A/T-ECU determines whether the brake pedal is depressed or not. The engine-A/T-ECU selects a fuel injection mode by determining the brake operation according to this information.	• Malfunction of the stop lamp switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



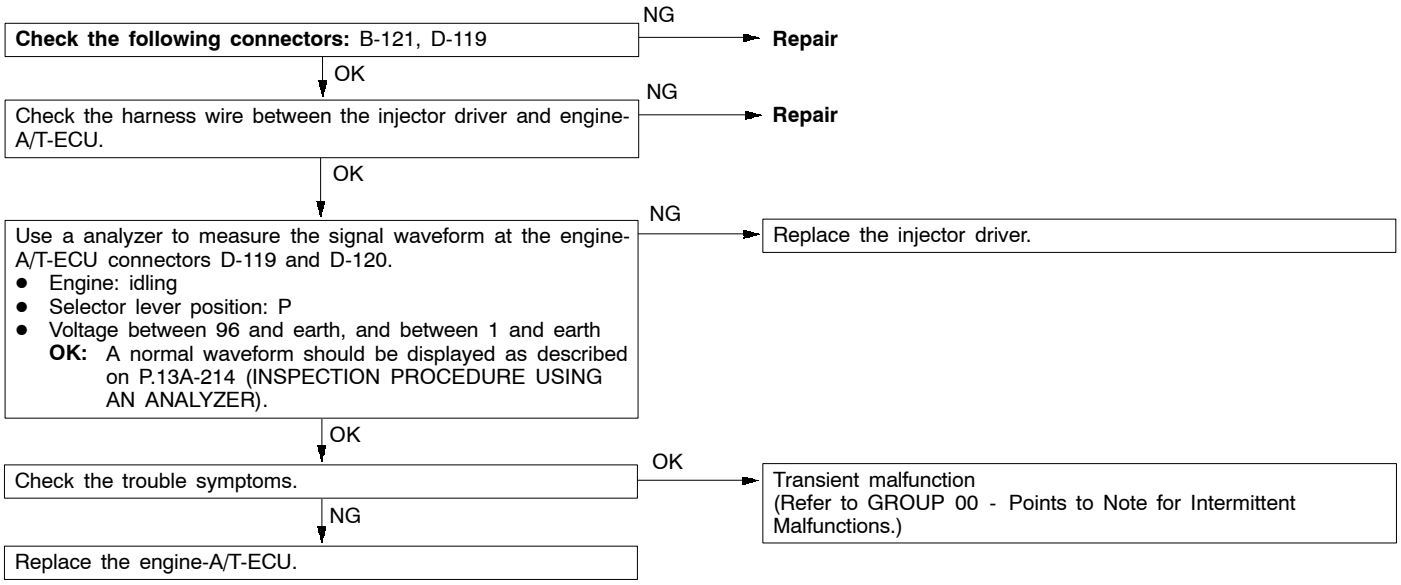
Inspection procedure 33

Small lamp switch system	Probable cause
The engine-A/T-ECU determines whether the small lamp switch is on or off. According to that information, the engine-A/T-ECU controls alternator output current when the vehicle is started.	• Improper connector contact, open circuit or short-circuited harness wire in the taillamp relay circuit. • Malfunction of the engine-A/T-ECU



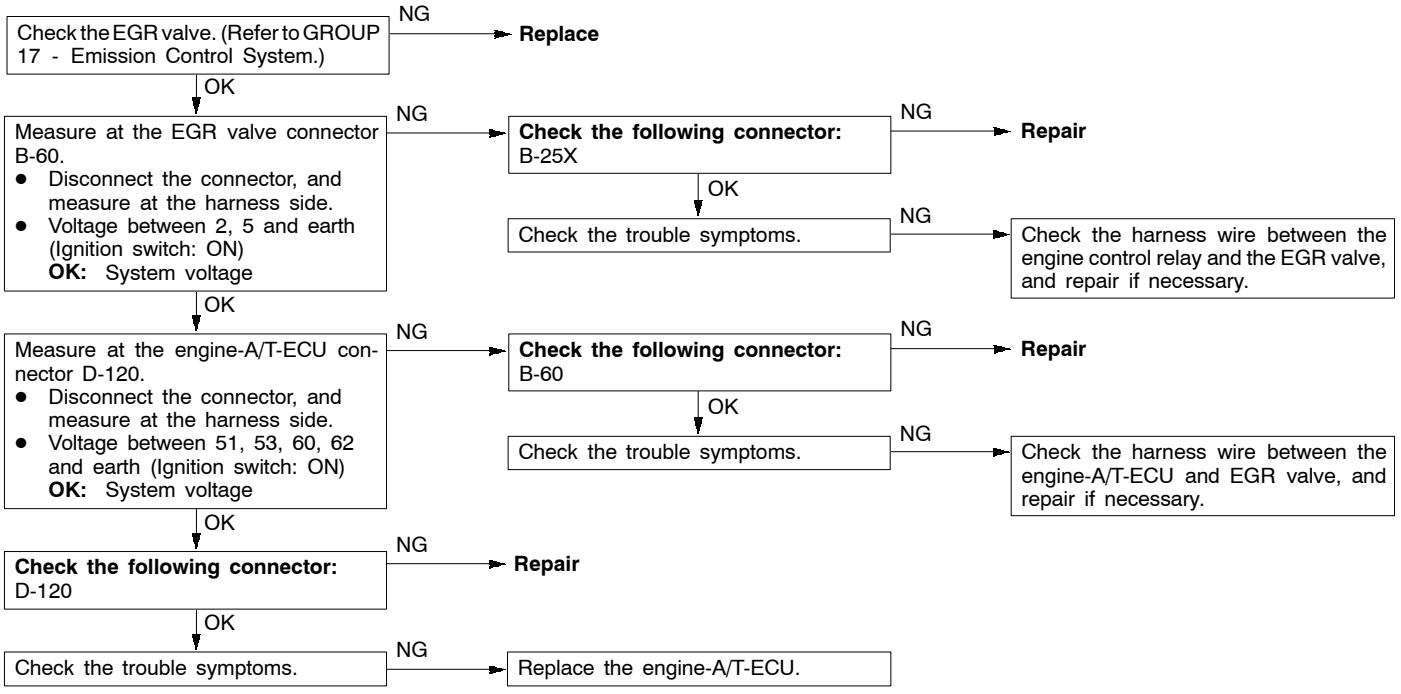
Inspection procedure 34

Injector driver	Probable cause
The engine-A/T-ECU drives the injector by the drive signal.	• Malfunction of the injector driver • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



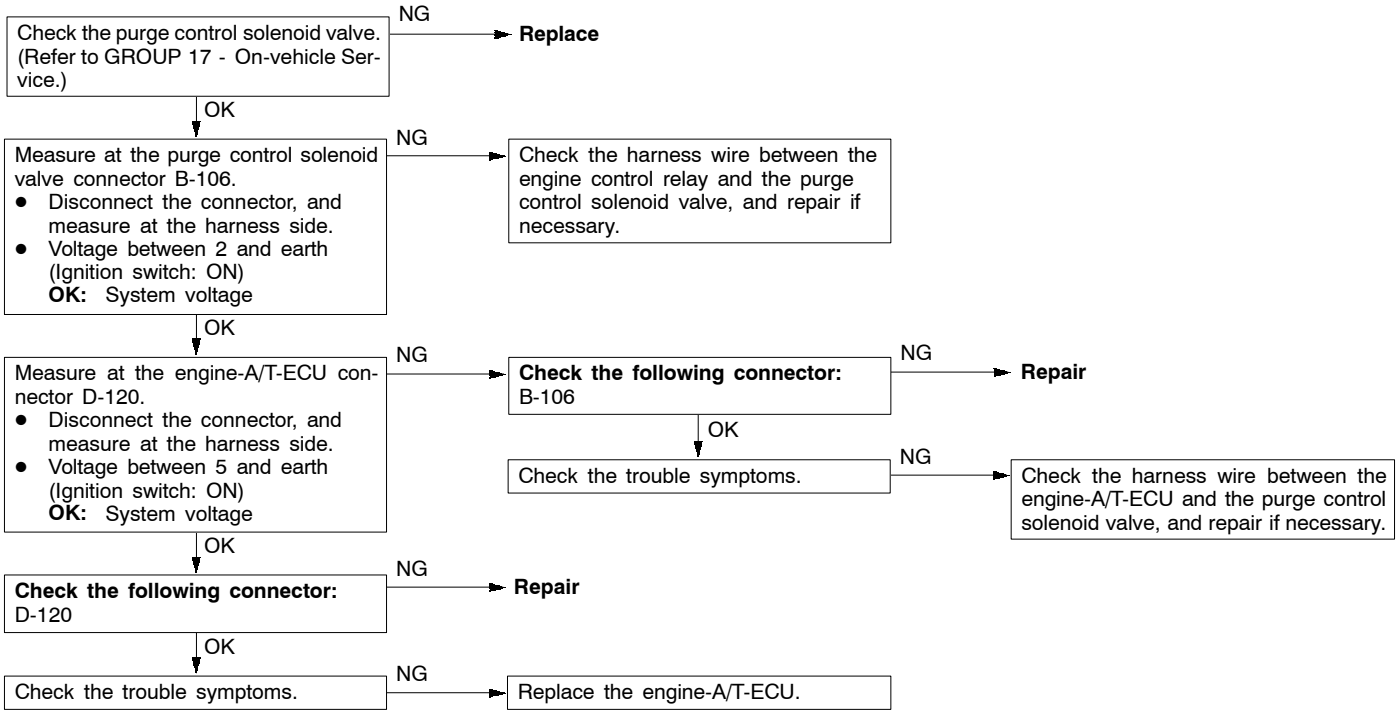
Inspection procedure 35

EGR valve (stepper motor) system	Probable cause
The engine-A/T-ECU controls the EGR valve (stepper motor) in order to control the amount of exhaust gas mixed in the intake air.	• Malfunction of the EGR valve • Open circuit or short-circuited harness wire in the EGR valve circuit • Malfunction of the engine-A/T-ECU



Inspection procedure 36

Purge control solenoid valve system	Probable cause
The engine-A/T-ECU controls the purge control solenoid valve in order to control the purge air coming from the canister.	• Malfunction of the purge control solenoid valve • Open circuit or short-circuited harness wire in the purge control solenoid valve circuit • Malfunction of the engine-A/T-ECU



DATA LIST REFERENCE TABLE

Caution
When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.

NOTE
*1: Injector running time indicates the time where the power voltage is 11 V and the cranking speed is 250 r/min or less. As the engine speed increases and the time passes by, the injector running time decreases.
*2: There may be occasions of taking the injector running time approximately 10% longer than usual when a vehicle has not been driven for a long time (mileage is no more than 500 km.)
*3: It is normal that the idle switch turns from ON to OFF when accelerator pedal position sensor (1st channel) voltage increases by 200 - 600 mV from the idling position. Moreover, adjust the idle switch and accelerator pedal position sesor if the idle switch keeps turning after the accelerator pedal is depressed.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	Engine: After having warmed up (Air/fuel mixture is made leaner when decelerating, and is made richer when racing.)	When at 4,000 r/min, engine is decelerated	200 mV or less	Code No. 11	13A-131
			Race the engine suddenly.	600 - 1,000 mV		
		Engine: After having warmed up (The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition by the engine-A/T-ECU.)	Idling (after six minutes)	400 mV or less 600 - 1,000 mV (changes)		
			2,500 r/min			
12	Air flow sensor	• Engine coolant temperature: 80 - 95°C • Lamps and all accessories: OFF • Transmission: P range	Idling	22 - 48 Hz	Code No. 12	13A-133
			2,500 r/min	60 - 100 Hz		
			Racing	Frequency increases in response to racing		
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is -20°C	-20°C	Code No. 13	13A-135
			When intake air temperature is 0°C	0°C		
			When intake air is 20°C	20°C		
			When intake air is 40°C	40°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (2nd channel)	• Engine: After having warmed up • Ignition switch: ON (Engine: Stopped)	Release the accelerator pedal.	4,000 mV or more	Code No. 14	13A-137
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	400 - 600 mV		
16	System voltage	Ignition switch: ON		System voltage	Procedure No. 25	13A-190
18	Cranking signal (ignition switch: ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No.27	13A-191
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is -20°C	-20°C	Code No. 21	13A-138
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the tachometer with the MUT-II reading.	Identical	Code No. 22	13A-140
		• Engine: Idling • Idle position switch: ON • Within six minutes after engine starting (Only when engine coolant temperature is 80°C)	When engine coolant temperature is -20°C	1,250 - 1,450 r/min		
			When engine coolant temperature is 0°C	1,100 - 1,300 r/min		
			When engine coolant temperature is 20°C	1,000 - 1,200 r/min		
			When engine coolant temperature is 40°C	900 - 1,100 r/min		
			When engine coolant temperature is 80°C	550 - 650 r/min		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25	13A-145
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No.28	13A-192
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	When steering wheel is turned	ON	Procedure No.30	13A-194
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No.31	13A-194
			A/C switch: ON	ON		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.33	13A-195
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Idling	ON	Code No. 12	13A-133
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 85 - 95°C • Lamps and all accessories: OFF • Transmission: P range	Idling	20 - 40%	-	-
			2,500 r/min	10 - 30%		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	• Engine: Cranking (reading is possible at 2,000 r/min or less) • Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	-	-

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time*1	• Engine: Cranking	When engine coolant temperature is 0°C	120 - 160 ms	Code No. 41	13A-147
			When engine coolant temperature is 20°C	70 - 90 ms		
			When engine coolant temperature is 80°C	20 - 35 ms		
	Injector drive time*2	• Engine coolant temperature: 85 - 95°C • Lamps and all accessories: OFF • Transmission: P range • Within six minutes after engine starting	Idling	0.3 - 0.8 ms		
			2,500 r/min	0.4 - 1.0 ms		
			When engine is suddenly raced	Increases		
44	Ignition advance value	• Engine: After having warmed up • Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.) • Within six minutes after engine starting	Idling	12 - 28° BTDC	Code No. 44	13A-148
			2,500 r/min	15 - 35° BTDC		
49	A/C relay	Engine: After having warmed up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.31	13A-194
			A/C switch: ON	ON (compressor clutch is operating)		
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.32	13A-195
			Brake pedal: Released	ON		
68	EGR valve	• Engine coolant temperature: 85 - 95°C • Lamps and all accessories: OFF • Transmission: P range	Idling	2 - 20 STEP	Procedure No.35	13A-196
			2,500 r/min	0 - 10 STEP		
74	Fuel pressure sensor	• Engine coolant temperature: 85 - 95°C • Lamps and all accessories: OFF • Transmission: P range	Engine: Cranking	2 MPa or more	Code No. 56	13A-151
			Engine: Idling	4.0 - 6.9 MPa		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	985 - 1,085 mV	Code No. 77	13A-154
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
78	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	985 - 1085 mV	Code No. 78	13A-156
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
79	Throttle position sensor (1st channel)	• Engine: After having warmed up • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	400 - 800 mV	Code No. 79	13A-158
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 - 4,800 mV		
		Engine: Idling after warming-up	No load	450 - 1,000 mV		
			A/C switch: OFF to ON	Increases by 100 - 600 mV		
			Transmission: P to D range	Increases by 0 - 200 mV.		
99	Combustion mode	Engine: After having warmed up	Idling (several minutes after starting)	Compression lean	-	-
			2,500 r/min	Stoichiometric feedback		
			Race the engine suddenly while the engine is idling.	Open loop		

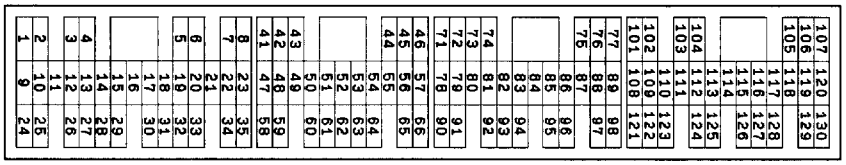
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive Contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injector	Cut fuel to the No.1 injector.	Engine: Idling after warming-up (Cut the fuel supply to each injector in turn and check cylinders which does not affect idling.)		Idling condition becomes different (becomes unstable, or the engine stalls).	Code No. 41	13A-147
02		Cut fuel to the No.2 injector.					
03		Cut fuel to the No.3 injector.					
04		Cut fuel to the No.4 injector.					
05		Cut fuel to the No.5 injector.					
06		Cut fuel to the No.6 injector.					
07	Fuel pump (low-pressure)	Operates the fuel pump (low-pressure) to circulate fuel.	Ignition switch: ON	Pinch the return hose with fingers to feel the pulse of the fuel being circulated.	Pulse is felt.	Procedure No.29	13A-193
				Operating sound can be heard around the fuel tank.	Sound of operation can be heard		
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No.36	13A-197
17	Basic ignition timing	Solenoid valve turns from OFF to ON.	● Engine: Idling ● Set a timing light.		5° BTDC	-	-
21	Condenser fan	Drive the fan motor	● Ignition switch: ON ● A/C switch: ON		Fan motor runs	Procedure No.21	13A-187
34	Electronic-controlled throttle valve system	Stop the throttle control servo	Ignition switch: ON		The throttle valve opens slightly	Code No. 91	13A-161

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-A/T-ECU Connector Terminal Arrangement



7FU1763

Terminal No.	Check item	Check condition (Engine condition)	Normal condition
1	No.1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 9 - 13 V, momentarily drops slightly
9	No.2 injector		
24	No.3 injector		
2	No.4 injector		
10	No.5 injector		
25	No.6 injector		
3	Oxygen sensor heater	Engine: Idling	0 - 3 V
		Engine: 5,000 r/min	System voltage
6	Injector driver relay	Ignition switch: OFF	0 - 0.1 V
		Ignition switch: ON	0.5 - 1.0 V
8	Alternator G terminal	• Engine: Idling after warming-up • Radiator fan: Not operating • Headlamp: off to on • Stop lamp: off to on • Defogger switch: OFF to ON	The voltage increases by 0.2 - 3.5 V
54	Alternator FR terminal	• Engine: Idling after warming-up • Radiator fan: Not operating • Headlamp: off to on • Stop lamp: off to on • Defogger switch: OFF to ON	The voltage drops
11	No.1 ignition coil	Engine speed: 3,000 r/min	0.3 - 3.0 V
31	No.2 ignition coil		
13	No.3 ignition coil		
30	No.4 ignition coil		
12	No.5 ignition coil		
32	No.6 ignition coil		
14	Throttle control servo relay	Ignition switch: OFF	0 - 0.1 V
		Ignition switch: ON	0.5 - 1.0 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
18	Condenser fan relay	Condenser fan not operating		System voltage
		Condenser fan operating		0 - 3 V or more
19	Air flow sensor reset signal	Engine: Idling		0 - 1 V
		Engine speed: 3,000 r/min		6 - 9 V
20	A/C relay	• Engine: Idling • A/C switch: OFF to ON (Compressor operating)		System voltage or changes momentarily 6 V or more to 0 - 3 V
21	Fuel pump relay	Ignition switch: ON		System voltage
		Engine: Idling		0 - 3 V
22	Engine warning lamp	Ignition switch: OFF to ON		System voltage
23	GDI ECO indication lamp	Ignition switch: OFF to ON		0 - 3 V (system voltage after five seconds)
		Rev the engine suddenly.		System voltage
34	Purge control solenoid valve	• Engine coolant temperature: 80 - 95 °C • Ignition switch: ON	Engine: stopped	System voltage
			Engine: After starting, increase the engine speed up to 3,500 r/min	The voltage drops
41	Power supply	Ignition switch: ON		System voltage
47				
43	Engine ignition signal	Engine speed: 3,000 r/min		0.3 - 3.0 V
44	Engine coolant temperature sensor	Ignition switch: ON	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 80°C	0.3 - 0.9 V
45	Crank angle sensor	Engine: Cranking		0.4 - 4.0 V
		Engine: Idling		1.5 - 2.5 V
46	Power supply voltage applied to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 - 5.5 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
49	Engine control relay	Ignition switch: OFF		0 - 3 V
		Ignition switch: ON		System voltage
51	EGR valve (A)	Ignition switch: OFF to ON		5 - 8 V (Repeatedly changes for approx. 3 seconds)
53	EGR valve (C)			
60	EGR valve (B)			
62	EGR valve (C)			
52	Power steering fluid pressure switch	Engine: Idling after warming-up	When steering wheel is stationary	System voltage
			When steering wheel is turned	0 - 3 V
55	Barometric pressure sensor	Ignition switch: ON	At an altitude of 0 m	3.7 - 4.3 V
			At an altitude of 1,200 m	3.2 - 3.8 V
56	Camshaft position sensor	Engine: Cranking		0.4 - 3.0 V
		Engine: Idling		0.5 - 2.0 V
58	Ignition switch-ST	Engine: Cranking		8 V or more
61	A/C switch 2	Refer to GROUP 55 - Troubleshooting (Check at A/C-ECU or Engine-ECU Terminal).		
63	Injector open circuit check signal	Engine: Increases from idling up to 4,000 r/min		The voltage decreases slightly (approx. 0.7 V) from 4.5 - 5.0 V.
64	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 - 3.8 V
			When intake air temperature is 20°C	2.3 - 2.9 V
			When intake air temperature is 40°C	1.5 - 2.1 V
			When intake air temperature is 80°C	0.4 - 1.0 V
65	Air flow sensor	Engine: Idling		2.2 - 3.2 V
		Engine speed: 2,500 r/min		
66	Backup power supply	Ignition switch: OFF		System voltage
71	Oxygen sensor	Engine: Running at 2,500 r/min after warming-up (Check by using a digital voltmeter.)		Voltages of 0 V and 0.8 V alternate

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.0 V or higher
			Depress the accelerator pedal fully.	0.4 - 0.6 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 - 1 V
			Depress the accelerator pedal slightly.	4 V or more
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		Voltages of 0 and 8 - 12 V alternate (changes repeatedly)
83	A/C switch 1	Engine: Idling	A/C switch: OFF	0 - 3 V
			A/C switch: ON (Compressor is operating)	System voltage
86	Small lamp switch	Lighting switch: OFF		0 - 3 V
		Lighting switch: Tail light position		System voltage
87	Sensor applied voltage	Ignition switch: ON		4.5 - 5.5 V
93	Fuel pressure sensor	Engine: Idling		0.3 - 4.7 V
95	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.985 - 1.085 V
			Depress the accelerator pedal fully.	4.0 V or higher
98	Ignition switch-IG	Ignition switch: ON		System voltage
123	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 - 3 V

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

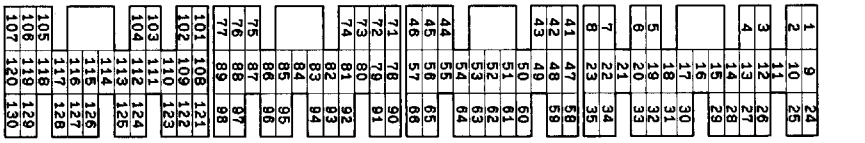
1. Turn the ignition switch to OFF.
2. Disconnect the engine-A/T-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-A/T-ECU harness-side connector while referring to the check chart.

   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.

   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-A/T-ECU and/or ohmmeter.
   Be careful to prevent this!

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-A/T-ECU Harness Side Connector Terminal Arrangement

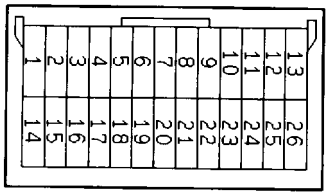


Terminal No.	Check item	Standard value, normal condition (check conditions)
3 - 41	Oxygen sensor heater	4.5 - 8.0 Ω (at 20°C)
34 - 41	Purge control solenoid valve	28 - 36 Ω (at 20°C)
42 - body earth	Earth	Continuity (0 Ω)
48 - body earth		
51 - 41	EGR valve (A)	15 - 20 Ω (at 20°C)
53 - 41	EGR valve (C)	
60 - 41	EGR valve (B)	
62 - 41	EGR valve (D)	
44 - 81	Engine coolant temperature sensor	5.1 - 6.5 kΩ (When coolant temperature is 0°C)
		2.1 - 2.7 kΩ (When coolant temperature is 20°C)
		0.9 - 1.3 kΩ (When coolant temperature is 40°C)
		0.26 - 0.36 kΩ (When coolant temperature is 80°C)
64 - 81	Intake air temperature sensor	5.3 - 6.7 kΩ (When intake air temperature is 0°C)
		2.3 - 3.0 kΩ (When intake air temperature is 20°C)
		1.0 - 1.5 kΩ (When intake air temperature is 40°C)
		0.30 - 0.42 kΩ (When intake air temperature is 80°C)
79 - 81	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is depressed slightly)

CHECK AT THROTTLE VALVE CONTROLLER TERMINALS

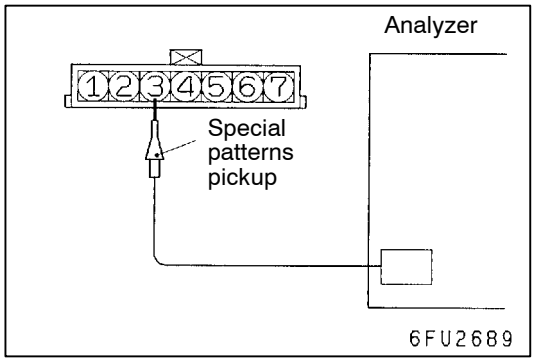
TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



7FU2290

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
1	Throttle control servo (U)	• Ignition switch: ON • Accelerator pedal: From released position to fully depressed position		Changes
14	Throttle control servo (V)			
15	Throttle control servo (W)			
2	Throttle control servo power supply	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor applied voltage	Ignition switch: ON		4.5 - 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.4 - 0.8 V
			Depress the accelerator pedal fully.	4.2 - 4.8 V
18	Backup power supply	Ignition switch: OFF		System voltage
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.985 - 1.085 V
			Depress the accelerator pedal fully.	4.0 V or higher
22	Ignition switch-IG	Ignition switch: ON		System voltage



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to air flow sensor connector terminal 3.

Alternate Method (Test harness not available)

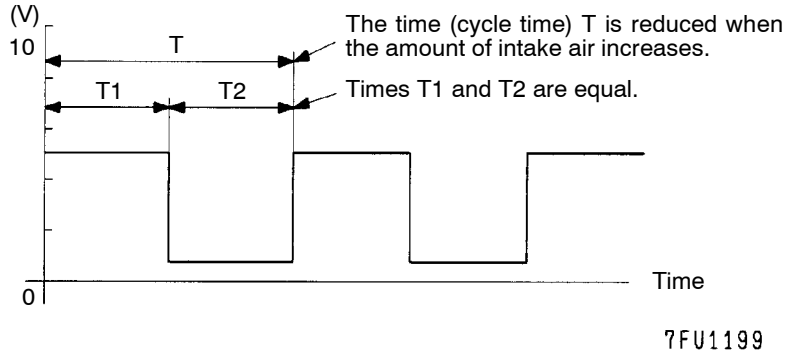
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 65.

Standard Wave Pattern

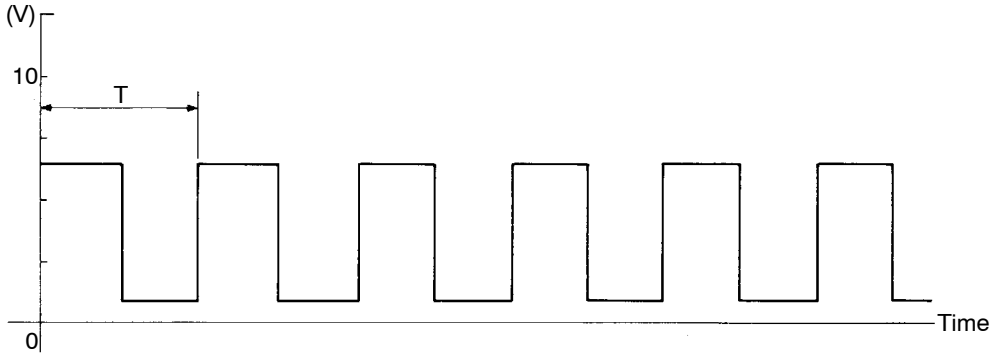
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

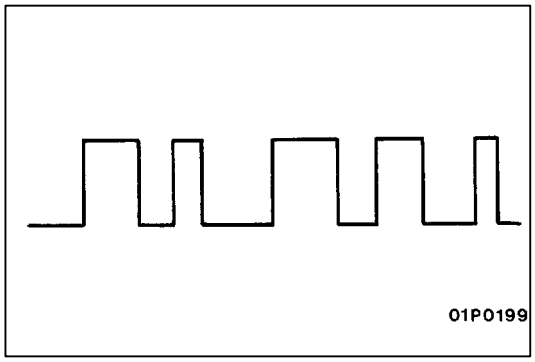


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

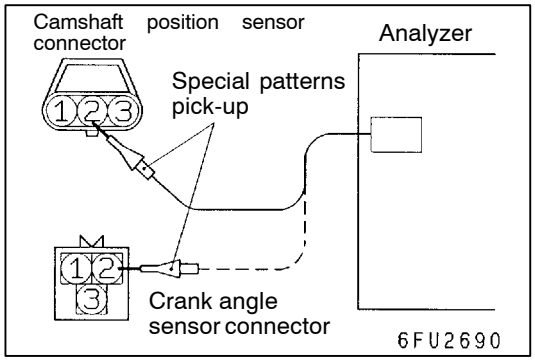
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

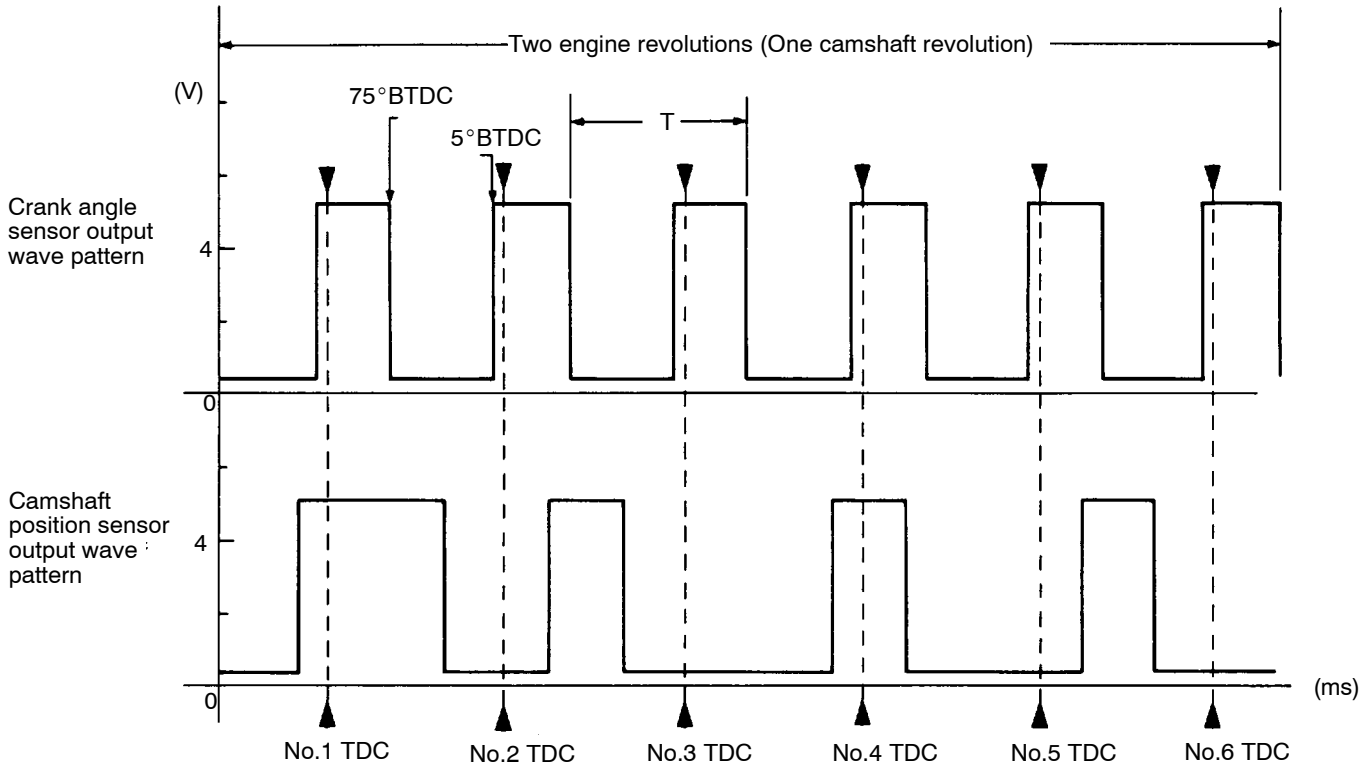
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 56. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 45. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

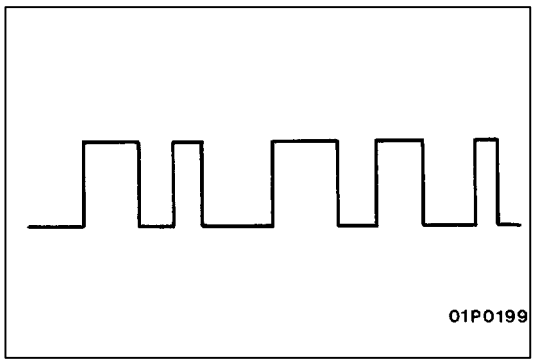
Standard wave pattern



7FU0887

Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

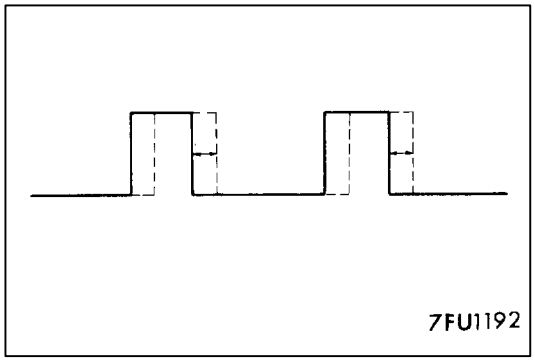
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



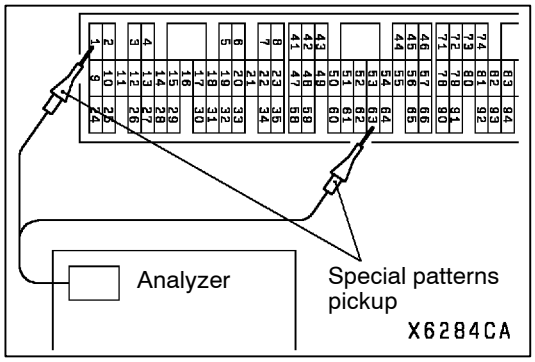
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTORS AND INJECTOR OPEN CIRCUIT CHECK SIGNAL

Measurement Method

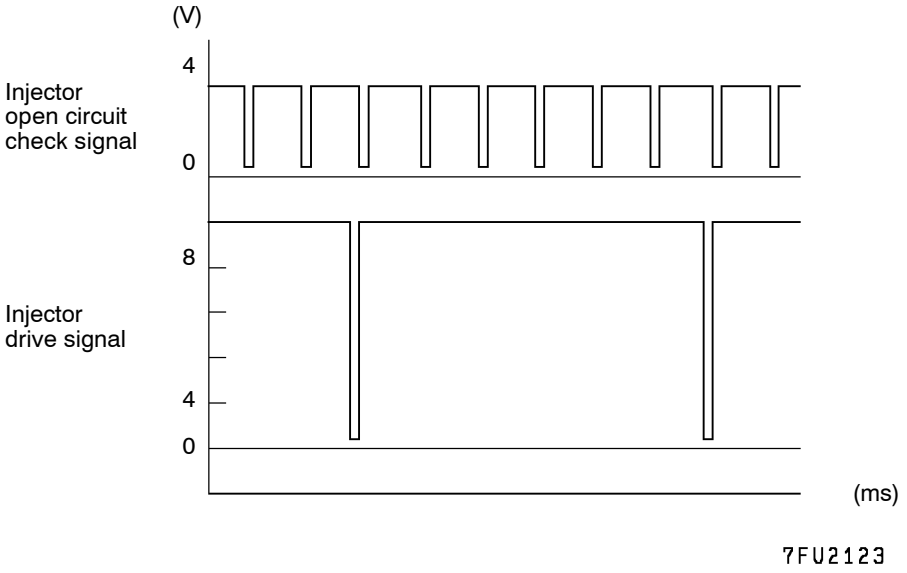
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-A/T-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 63 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 9 (No.2 injector), terminal 24 (No.3 injector), terminal 2 (No.4 injector), terminal 10 (No.5 injector) and terminal 25 (No.6 injector).

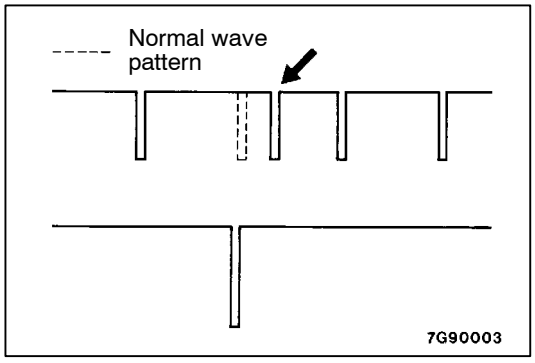
Standard Wave Pattern

Observation conditions

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

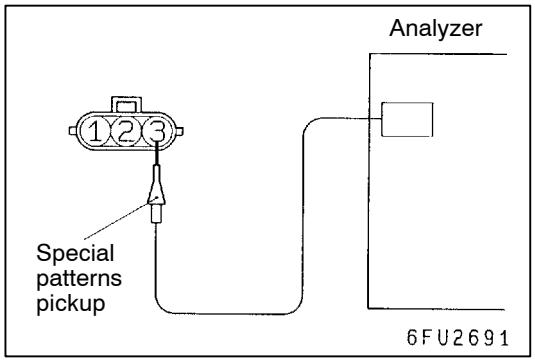
Standard wave pattern





Wave Pattern Observation Points

- Check that the injector drive time is identical to the time displayed on the MUT-II.
- Check that the injector signals become greatly extended but soon return to their normal wave length when the engine is suddenly raced.
- Check that the injector open circuit check signal is synchronized with each rising portion of the injector drive signal.



IGNITION COIL AND POWER TRANSISTOR

Power transistor control signal

Measurement Method

1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

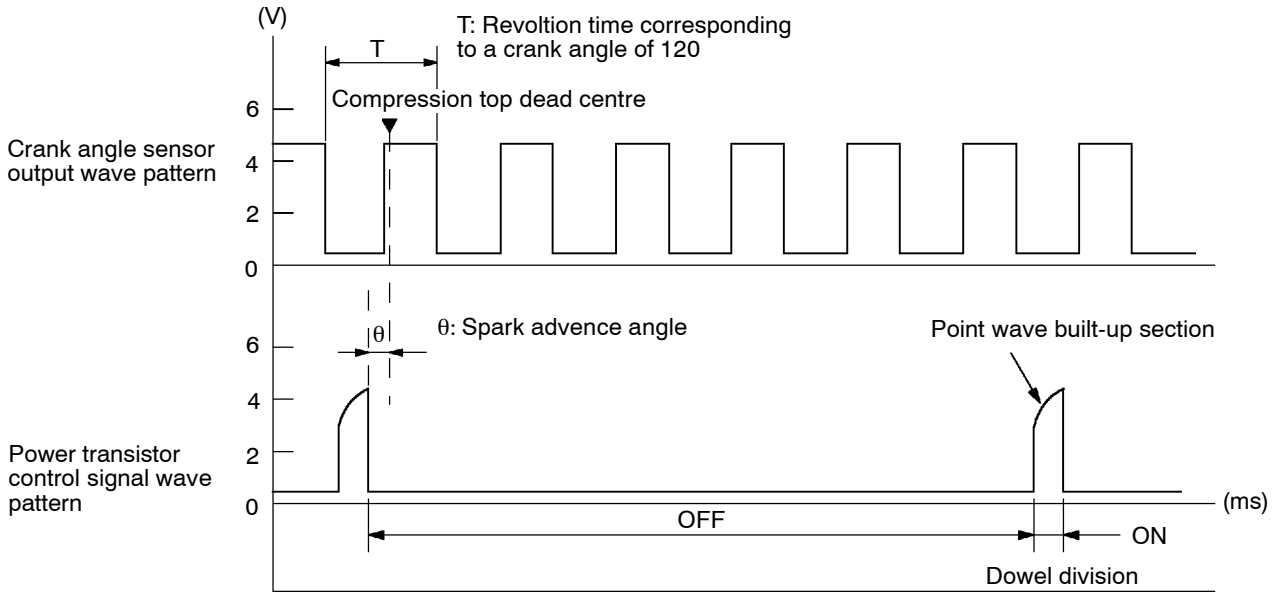
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 11 (No. 1 ignition coil), terminal 31 (No. 2 ignition coil), terminal 13 (No. 3 ignition coil), terminal 30 (No. 4 ignition coil), terminal 12 (No.5 ignition coil) and terminal 32 (No.6 ignition coil) respectively.

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approx. 1,200 r/min

Standard wave pattern

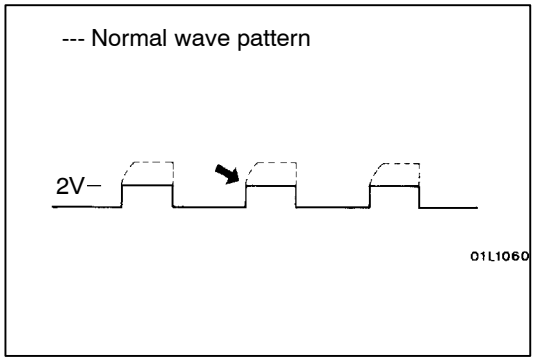


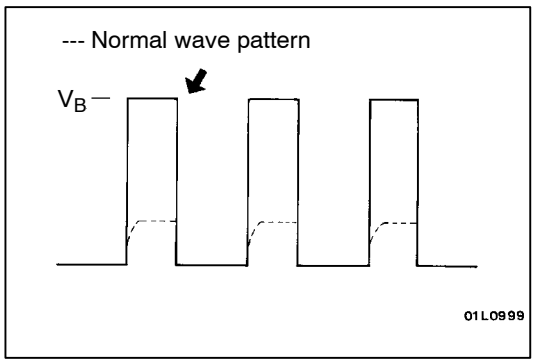
Y6007CA

Wave Pattern Observation Points

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

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction





Examples of Abnormal Wave Patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Open-circuit in ignition primary circuit

  Wave pattern characteristics

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

- Example 2

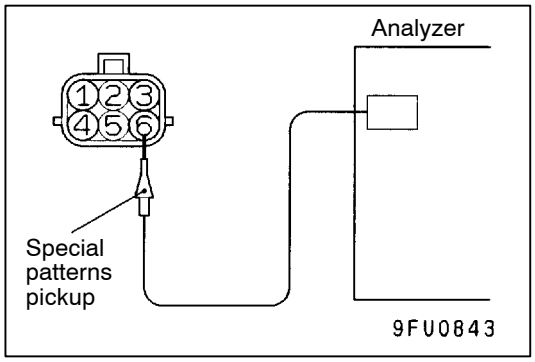
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.



EGR VALVE (STEPPER MOTOR)

Measurement Method

1. Disconnect the EGR valve connector, and connect the special tool (test harness: MB991658) in between.
2. Connect the analyzer special patterns pickup to the EGR valve-side connector terminal 1, terminal 3, terminal 4 and terminal 6 respectively.

Alternate Method (Test harness not available)

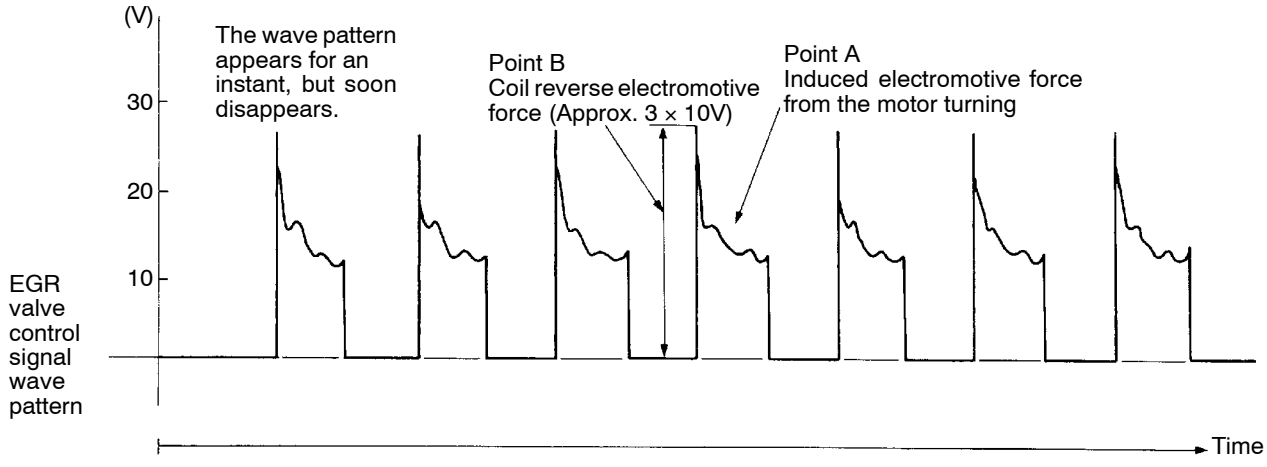
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 51, connection terminal 60, connection terminal 53, and connection terminal 62 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine

Standard wave pattern



7FU1204

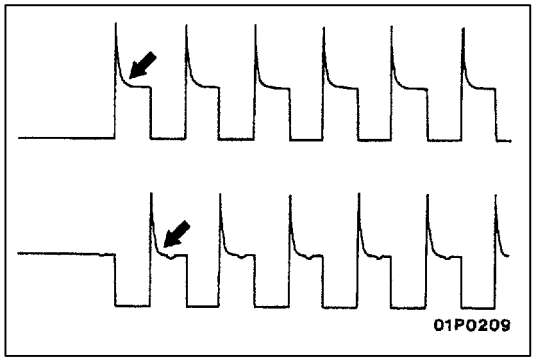
Wave Pattern Observation Points

Check that the standard wave pattern appears when the EGR control servo is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Motor is malfunctioning

Point B: Height of coil reverse electromotive force

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in the coil



Examples of Abnormal Wave Pattern

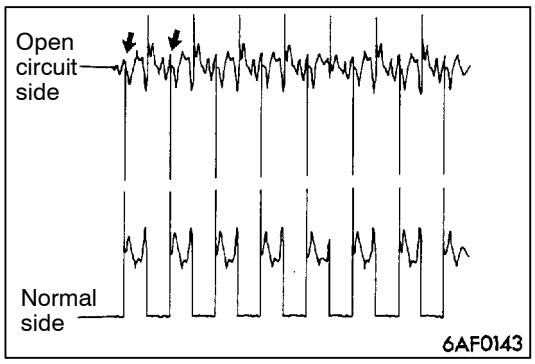
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



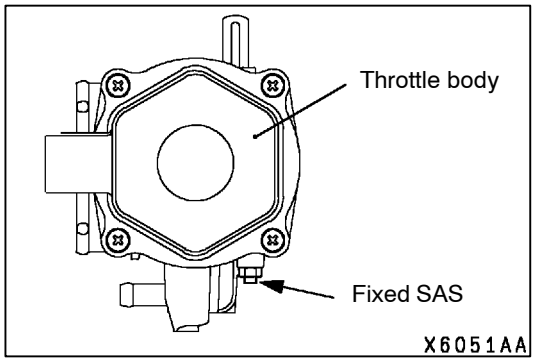
- Example 2

  Cause of problem

  Open circuit in the line between the EGR valve and the engine-A/T-ECU

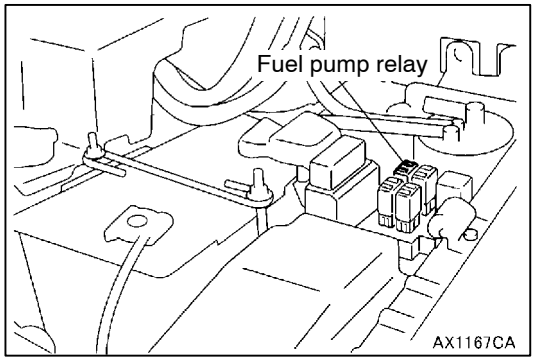
  Wave pattern characteristics

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



ON-VEHICLE SERVICE

Caution
(1) Never attempt to tamper the fixed SAS. The fixed SAS is precisely adjusted at factory.
(2) Should it be tampered, the full closed position of the throttle valve will be changed. This causes the engine-ECU to learn a wrong position of the throttle valve.



FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE FUEL PRESSURE)

When removing the fuel pipe, hose, etc., since fuel pressure in the fuel pipe line is high, do the following operation so as to release fuel pressure in the line and prevent fuel from running out.

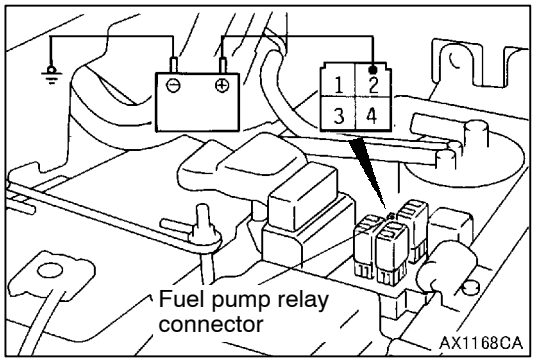
1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the fuel pump relay.
3. Connect the MUT-II to the diagnosis connector.

   Caution
   Turn off the ignition switch before disconnecting or connecting the MUT-II.

4. Turn off the ignition switch.
5. Select “Item No.74” from the MUT-II Data list.
6. Crank the engine for at least two seconds.
7. If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
8. If the engine is started, release fuel pressure by the following procedure:
   (1) Turn off the ignition switch, and then stop the engine.
   (2) Disconnect one of the ignition coil connectors.
   (3) Crank the engine for at least two seconds.
   (4) If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
   (5) If the engine is started, stop it by racing and use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
   (6) Reconnect the ignition coil connector.

   Caution
   Clean the spark plug which corresponds to the disconnected ignition coil connector.

9. Remove the MUT-II.
10. Install the fuel pump relay.



FUEL PUMP OPERATION (LOW PRESSURE) CHECK

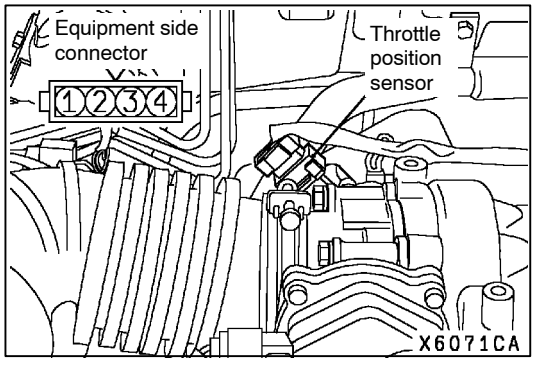
1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
   (1) Turn the ignition switch to the LOCK (OFF) position.
   (2) Remove the fuel pump relay. Connect the terminal No.2 of the harness-side connector to the battery. Check if the fuel pump operation sound can be heard at this time.

   NOTE
   As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel filler cap and check from the tank inlet.

   (3) Check the fuel pressure by pinching the fuel hose with the fingertips.

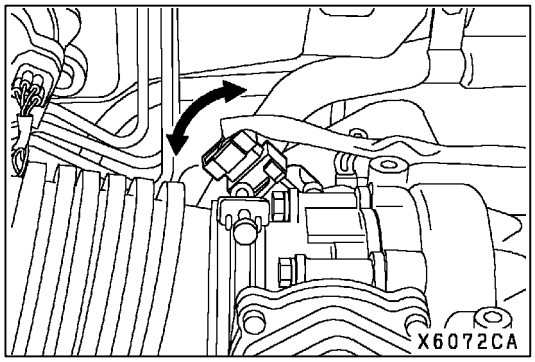
THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Start the engine, and warm it up until engine coolant temperature reaches 80°C. Then stop the engine.
2. Remove the air intake hose at the throttle body side.
3. Apply cleaning agent to the throttle valve through the intake port of the throttle valve, and then leave it for approx. five minutes.
4. Start the engine, race it several times, and then let it run at idle for approx. one minute.
5. If carbon deposits are not removed from the throttle vale area, repeat steps (3) and (4).
6. Install the air intake hose.
7. Use the MUT-II or disconnect the negative battery cable from the battery terminal in order to erase a diagnosis code. Wait for at least ten seconds, and then let the engine run at idle again for approx. ten minutes.



THROTTLE POSITION SENSOR (TPS) ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector.



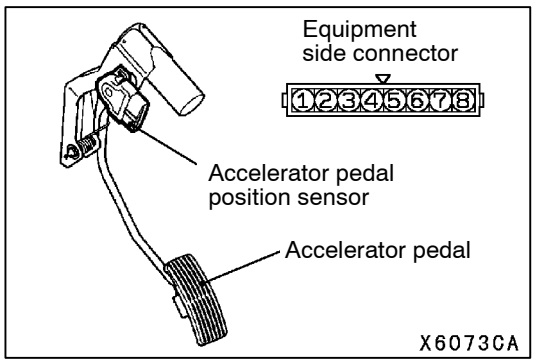
2. Check the output voltage of throttle position sensor (1st channel) while closing the throttle valve fully with your finger.

   Standard value: 0.4 - 0.6 V

3. If outside the standard value, loosen the throttle position sensor mounting bolts, and adjust the throttle position sensor by rotating it.
4. Check the output voltage of throttle position sensor (2nd channel) while closing the throttle valve fully with your finger.

   Standard value: 4.2 - 4.8 V

5. If outside the standard value, replace the throttle position sensor.
6. Turn the ignition switch to the LOCK (OFF) position.
7. Connect the throttle control servo connector.
8. Remove the MUT-II.
9. If a diagnosis code is set, erase it by using the MUT-II or by disconnecting the negative battery cable for ten seconds or more, reconnecting it.
10. Turn the ignition switch to the ON position, and then return it to the LOCK (OFF) position. Then maintain that condition for ten seconds or more.)
    If the negative battery cable is disconnected at step 11, let the engine run at idle for ten minutes.

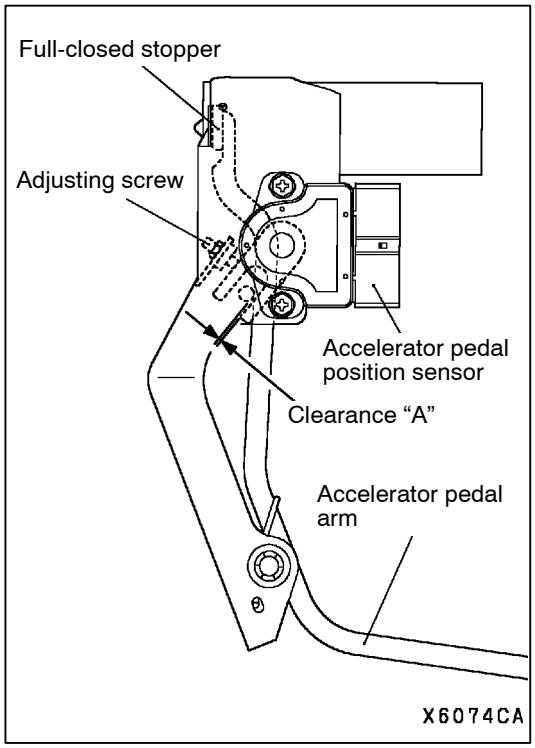


ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

Caution

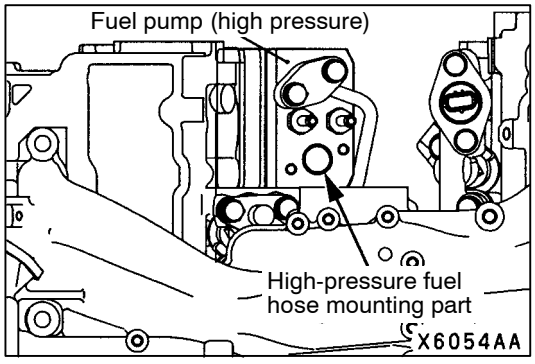
1. **The Accelerator pedal position sensor should not be moved unnecessarily; it has been precisely adjusted by the manufacturer.**
2. **If the adjustment is disturbed for any reason, readjust as follows.**

1. Remove the accelerator pedal complete.
2. Connect the MUT-II to the diagnosis connector.



3. Check that the accelerator pedal arm touches the full-closed stopper.
4. Adjust the pedal arm by the adjusting screw so that clearance “A” (see the illustration) is 0.5 - 0.93 mm.
5. Hold the adjusting screw with the lock nut.
6. Turn the ignition switch to the ON position. (but do not start the engine.)
7. Turn the accelerator pedal position sensor until the output from accelerator pedal position sensor (1st channel) satisfies the standard value.

   Standard value: 0.985 - 1.085 V
8. Tighten the accelerator pedal position sensor mounting bolts securely.
9. Install the accelerator pedal complete.

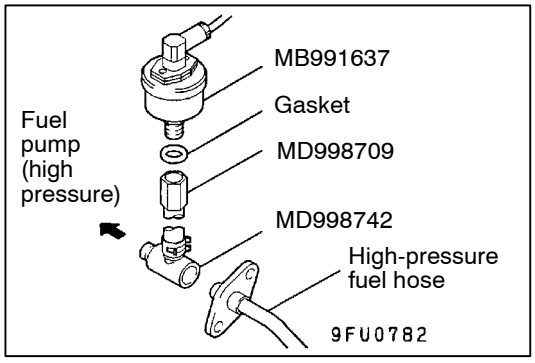


FUEL PRESSURE TEST

MEASUREMENT OF FUEL LOW PRESSURE BETWEEN FUEL PUMP (LOW PRESSURE) AND FUEL PUMP (HIGH PRESSURE)

1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13A-225.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

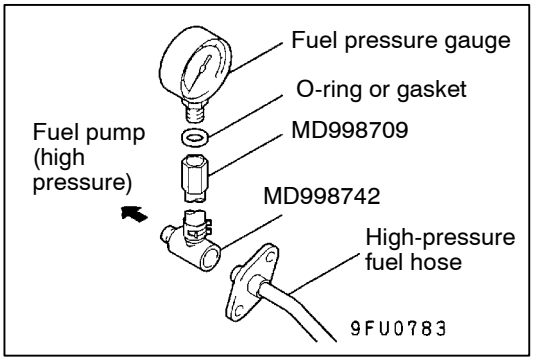
   Caution
   Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



3. Remove the union joint and bolt from the special tool (adapter hose) and instead attach the special tool (hose adapter) to the adapter hose.
4. Install the special tool (for measuring the fuel pressure) that was set up in step 3.

   <When using the fuel pressure gauge set (special tool)>
   (1) Install the special tool (for measuring the fuel pressure) between the high-pressure fuel hose and the fuel pump (high pressure).

(2) Install the fuel pressure gauge set (special tool) on the special tool (for measuring the fuel pressure) putting the gasket between them.
(3) Connect the lead wire of the fuel pressure gauge set (special tool) to the power supply (cigarette lighter socket) and to the MUT-II.



<When using the fuel pressure gauge>
(1) Install the fuel pressure gauge on the special tool (for measuring the fuel pressure) putting a suitable O-ring or gasket between them.
(2) Install the special tool which was set up in step (1) between the high-pressure fuel hose and the fuel pump (high pressure).

5. Connect the MUT-II to the diagnosis connector.

Caution
Turn off the ignition switch before disconnecting or connecting the MUT-II.

6. Turn the ignition switch to ON. (But do not start the engine.)
7. Select "Item No.07" from the MUT-II Actuator test to drive the fuel pump (low pressure) at the fuel tank side. Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to OFF.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

Standard value: approximately 329 kPa

11. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
12. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
● Fuel pressure too low ● Fuel pressure drops after racing	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel pressure regulator (low pressure) valve seating or settled spring	Replace fuel pressure regulator (low pressure)
	Low fuel pump (low pressure) delivery pressure	Replace the fuel pump (low pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (low pressure)	Replace fuel pressure regulator (low pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

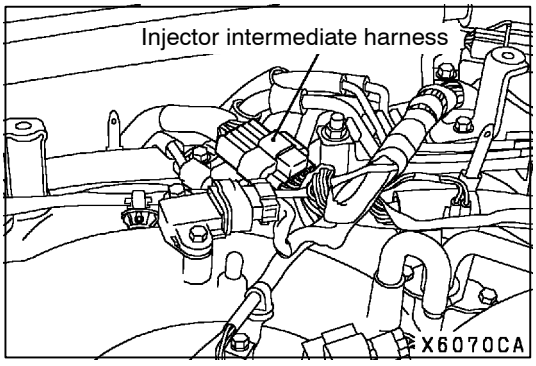
13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky fuel pressure regulator (low pressure) valve seat	Replace fuel pressure regulator (low pressure)
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump (low pressure) is held open	Replace the fuel pump (low pressure)

14. Release residual pressure from the fuel pipe line. (Refer to P.13A-225.)
15. Remove the fuel pressure gauge and special tools from the fuel pump (high pressure).

    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.

16. Replace the O-ring at the end of the high-pressure fuel hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
17. Fit the high-pressure fuel hose to the fuel pump (high pressure) and tighten the mounting bolt to specified torque.
18. Check for any fuel leaks by following the procedure in step 7.
19. Disconnect the MUT-II.



MEASUREMENT OF FUEL HIGH PRESSURE BETWEEN FUEL PUMP (HIGH PRESSURE) AND INJECTORS

NOTE
Measurement of the fuel pressure between the fuel pump (high pressure) and the injectors should be carried out after checking that the fuel pressure between the fuel pump (low pressure) and the fuel pump (high pressure) is normal.

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to ON.
4. Select “Item No.74” from the MUT-II Data list.
5. Crank the engine continuously for 2 seconds or more, and visually check that there are no fuel leaks from any parts.

   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

6. Check if the fuel pressure is more than 1 MPa immediately after 20 seconds have passed since cranking was finished.

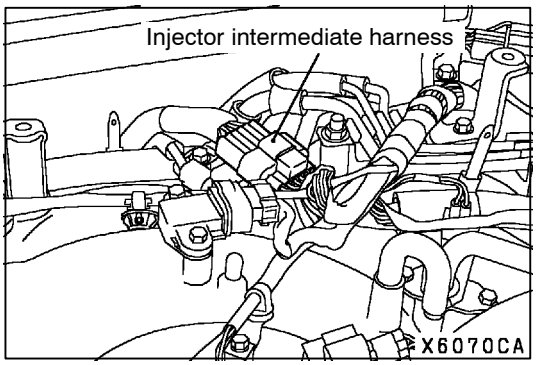
7. If the fuel pressure is lower than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.
8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.
11. Measure fuel pressure while the engine is running at idle.

    Standard value: 4 - 6.9 MPa

12. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
13. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Fuel leaking to return side due to poor fuel pressure regulator (high pressure) valve seating or settled spring	Replace fuel pressure regulator (high pressure)
	Low fuel pump (high pressure) delivery pressure	Replace the fuel pump (high pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (high pressure)	Replace fuel pressure regulator (high pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

14. Stop the engine and turn the ignition switch to OFF.
15. Disconnect the MUT-II.



FUEL LEAK CHECK

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to ON.
4. Select “Item No.74” from the MUT-II Data list.
5. Crank the engine continuously for two seconds or more, and visually check that there are no fuel leaks from any parts.

   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

6. Crank the engine, and then measure fuel pressure immediately after 20 seconds.

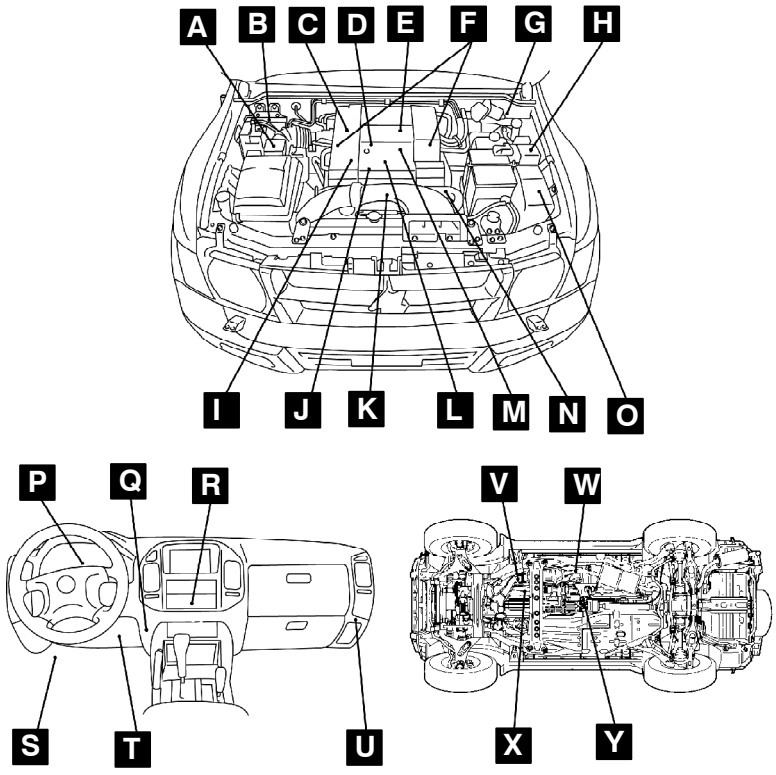
   Limit: Minimum 1 MPa

   Caution
   If the fuel pressure is less than 1 MPa, there may be a partial fuel leak in the high-pressure fuel system.

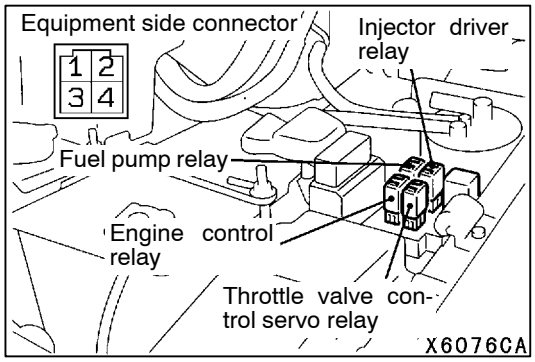
7. Turn off the ignition switch.
8. Reconnect the injector intermediate connector.
9. Remove the MUT-II.

COMPONENT LOCATION

Name	Symbol	Name	Symbol
A/C relay	O	Fuel pump relay	H
A/C switch	R	Ignition coil	F
Accelerator pedal position sensor (1st and 2nd channels)	T	Ignition failure sensor	D
		Inhibitor switch <A/T>	X
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	A	Injectors	F
		Injector driver (L.H.D)	B
Camshaft position sensor	E	Injector driver (R.H.D)	G
Clutch switch <M/T>	S	Injector driver relay	H
Crank angle sensor	K	Oxygen sensor (front)	V
Detonation sensor	L	Oxygen sensor (rear) <M/T>	W
Diagnosis connector	Q	Power steering fluid pressure switch	N
EGR valve	I	Purge control solenoid valve	M
Engine control relay	H	Throttle position sensor	C
Engine coolant temperature sensor	J	Throttle valve controller	U
Engine-A/T-ECU <A/T>	U	Throttle valve control servo	C
Engine-ECU <M/T>	U	Throttle valve control servo relay	H
Engine warning lamp (CHECK ENGINE lamp)	P	Vehicle speed sensor	Y
Fuel pressure sensor	E		

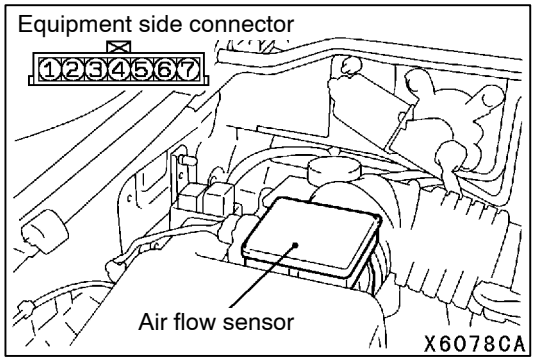


X6271CA



ENGINE CONTROL RELAY, FUEL PUMP RELAY, INJECTOR DRIVER CONTROL RELAY AND THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

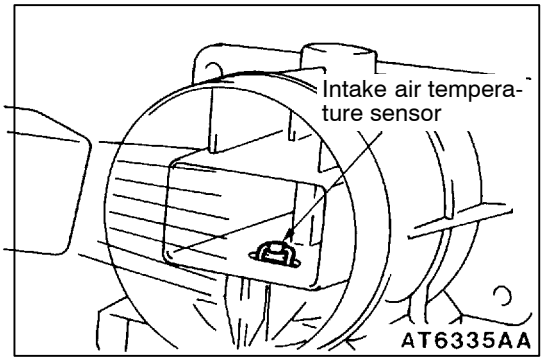
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕



INTAKE AIR TEMPERATURE SENSOR CHECK

1. Disconnect the air flow sensor connector.
2. Measure resistance between terminals 5 and 6.

   Standard value:
   2.3 - 3.0 kΩ (at 20°C)
   0.30 - 0.42 kΩ (at 80°C)

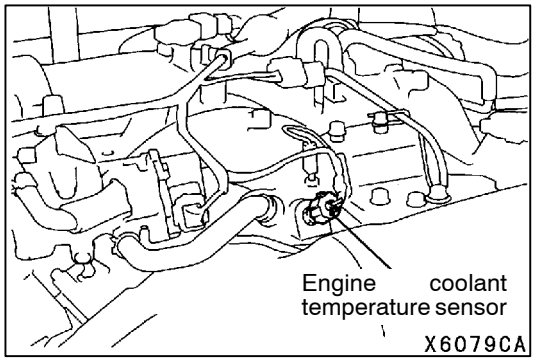


3. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

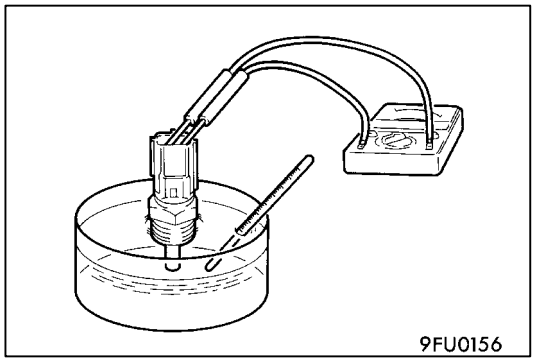
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution
Be careful not to touch the connector (resin section) with the tool when removing and installing.

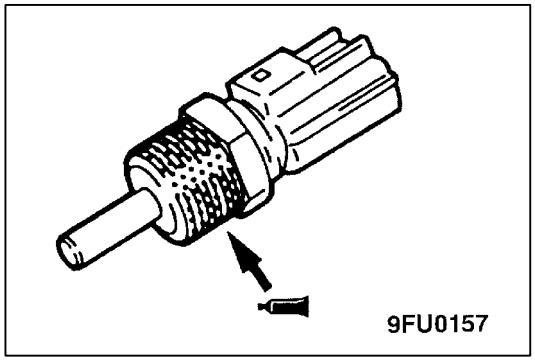
1. Remove the engine coolant temperature sensor.



2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

   Standard value:
   2.1 - 2.7 kΩ (at 20°C)
   0.26 - 0.36 kΩ (at 80°C)

3. If the resistance deviates from the standard value greatly, replace the sensor.

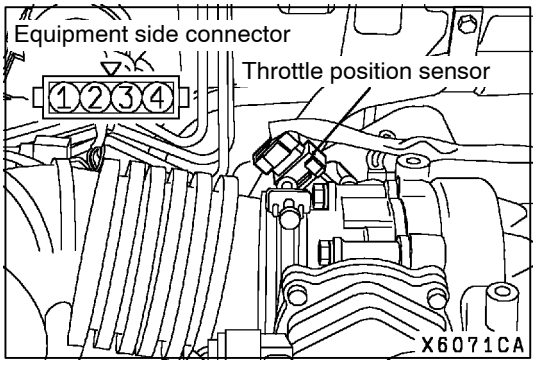


4. Apply sealant to threaded portion.

   Specified sealant:
   3M NUT Locking Part No.4171 or equivalent

5. Install the engine coolant temperature sensor and tighten it to the specified torque.

   Tightening torque: 29 N·m



THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between throttle position sensor side connector terminal 1 and terminal 3.

   Standard value: 0.9 - 2.5 kΩ

3. Measure resistance between terminal Nos. 1 and 2 as well as 1 and 4 of the throttle position sensor connector, respectively.

   Normal condition:

Throttle valve slowly open until fully open from the idle position	Changes smoothly in proportion to the opening angle of the throttle valve

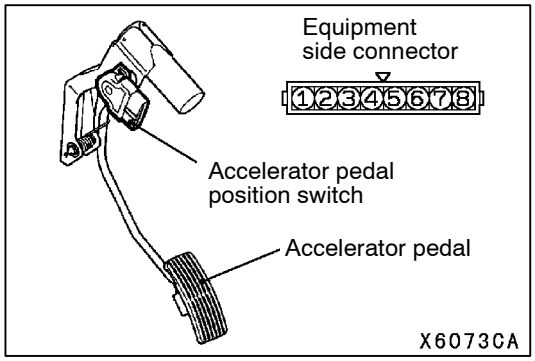
4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13A-220.

ACCELERATOR PEDAL POSITION SENSOR CHECK

1. Disconnect the accelerator pedal position sensor connector.
2. Measure the resistance between accelerator pedal position sensor connector terminal (1) [accelerator pedal position sensor (1st channel) earth] and terminal (2) [accelerator pedal position sensor (1st channel) power supply], and between terminal (7) [accelerator pedal position sensor (2nd channel) earth] and terminal (8) [accelerator pedal position sensor (2nd channel) power supply].

   Standard value: 3.5 - 6.5 kΩ



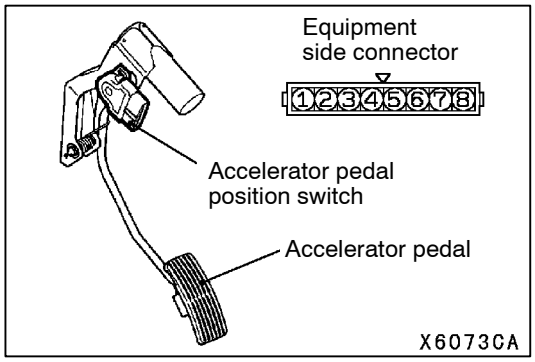
3. Measure the resistance between accelerator pedal position sensor connector terminal (2) [accelerator pedal position sensor (1st channel) power supply] and terminal (3) [accelerator pedal position sensor (1st channel) output]; and between terminal (8) [accelerator pedal position sensor (2nd channel) power supply] and terminal (6) [accelerator pedal position sensor (2nd channel) output].

   Normal condition:

When accelerator pedal is gently depressed	Changes comparatively smoothly in proportion to the accelerator pedal depression amount

4. If the measured values are outside the standard value range, or if the resistance does not change smoothly, replace the accelerator pedal position sensor.

   NOTE
   After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-221.)



ACCELERATOR PEDAL POSITION SWITCH CHECK

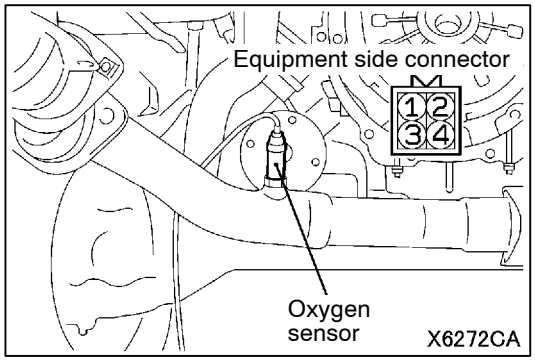
1. Disconnect the accelerator pedal position sensor (1st channel) connector.
2. Check continuity between terminal Nos. 4 (accelerator pedal position switch) and 5 (sensor earth) of the connector.

Normal condition

Accelerator pedal	Continuity
Depressed	No continuity
Released	Continuity (0 Ω)

3. If defective, replace the accelerator pedal position sensor assembly.

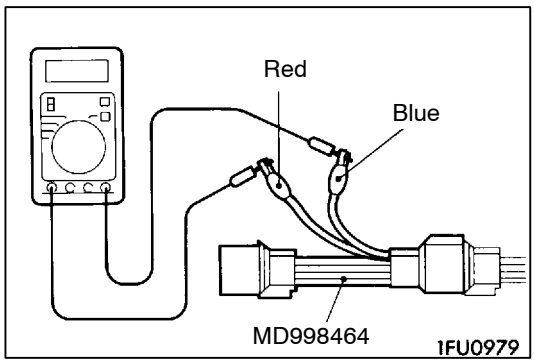
NOTE
After replacement, adjust the accelerator pedal position sensor and switch. (Refer to P.13A-221.)



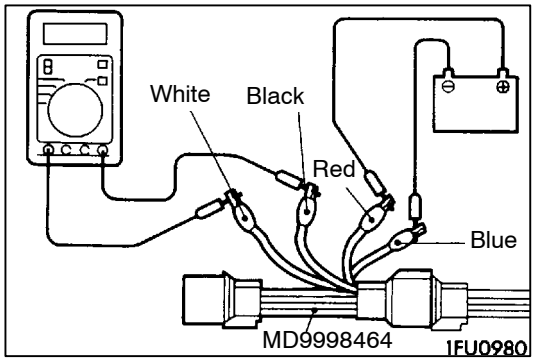
OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (4.5 - 8.0 Ω at 20°C) between terminal 2 (red clip of special tool) and terminal 4 (blue clip of special tool) on the oxygen sensor connector.



3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use a jumper wire to connect terminal 1 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 3 (blue clip) to the battery (-) terminal.

Caution
Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.

6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).

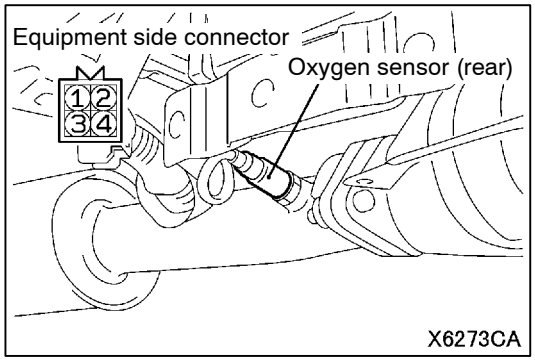
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

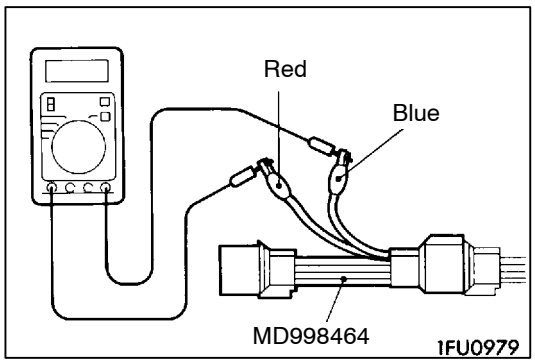
Standard value:

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.

8. If the sensor is defective, replace the oxygen sensor.

NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 - Exhaust Pipe and Main Muffler.

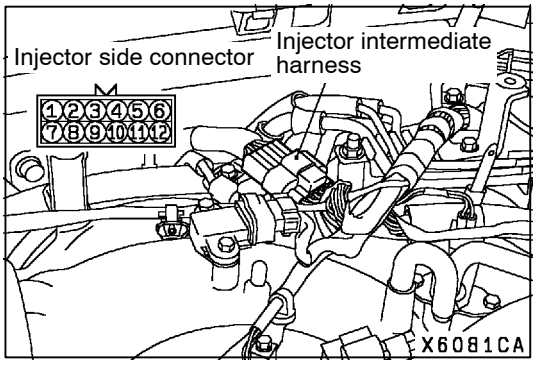




<Oxygen sensor (rear) M/T only>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness set) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (4.5 - 8.0 Ω at 20°C) between terminal 2 and terminal 4 on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.

NOTE
(1) If the MUT-II does not display the standard value although no abnormality is found by the above mentioned continuity test and harness check, replace the oxygen sensor (rear).
(2) For removal and installation of the oxygen sensor, refer to GROUP 15 - Exhaust Pipe and Main Muffler.



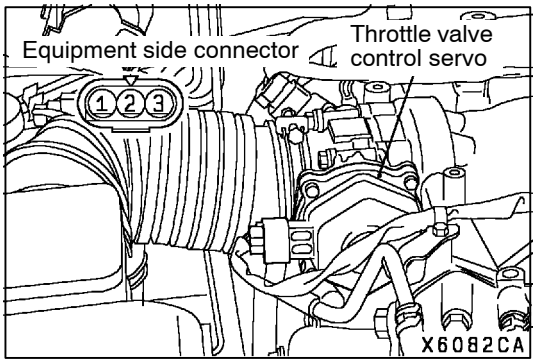
INJECTOR CHECK

1. Disconnect the injector intermediate harness connector.
2. Measure the resistance between each of the terminals.

Standard value: 0.9 - 1.1 Ω (at 20°C)

Injector	Measurement terminal
No.1 cylinder	11 - 12
No.2 cylinder	5 - 6
No.3 cylinder	9 - 10
No.4 cylinder	3 - 4
No.5 cylinder	7 - 8
No.6 cylinder	1 - 2

3. Connect the injector intermediate harness connector.



THROTTLE VALVE CONTROL SERVO CHECK

Operation Check

1. Disconnect the air intake hose from the throttle body.
2. Turn on the ignition switch.
3. Check that the throttle valve opens or closes in response to the accelerator pedal depression.

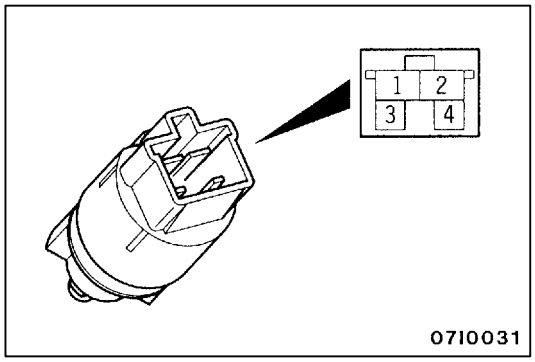
Check of Coil Resistance

1. Disconnect the throttle valve control servo connector.
2. Measure resistance between the throttle valve control servo connector terminals.

Standard value:

Terminals to be measured	Resistance value (Ω)
1 - 2	0.6 - 1.0 (at 20°C)
1 - 3	
2 - 3	

3. Check that there is no continuity between the terminals and body.



CLUTCH SWITCH CHECK

1. Disconnect the connector.
2. Check for continuity between the terminals of the switch.

Measurement conditions	Terminal No.	
	1	2
When clutch pedal is depressed.	○	○
When clutch pedal is not depressed.		

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 - Emission Control System.

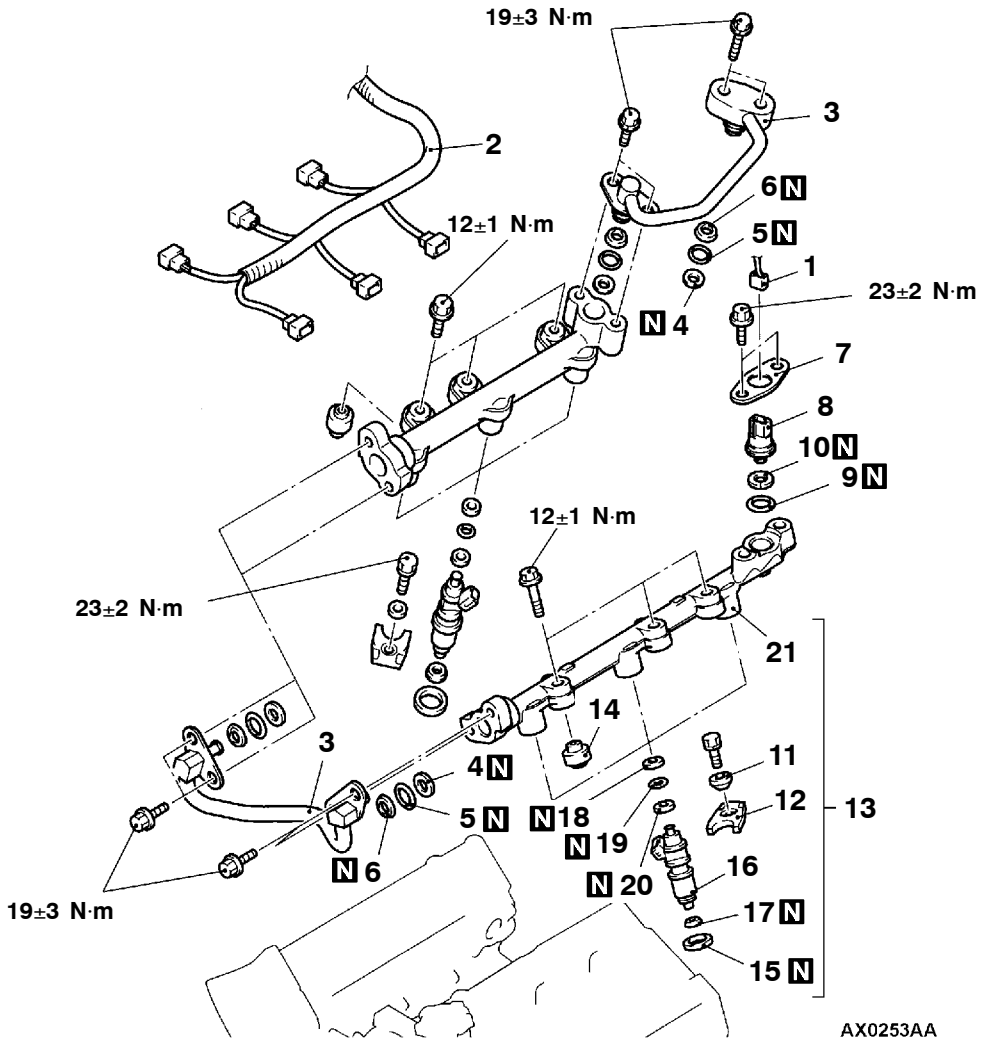
EGR VALVE CHECK

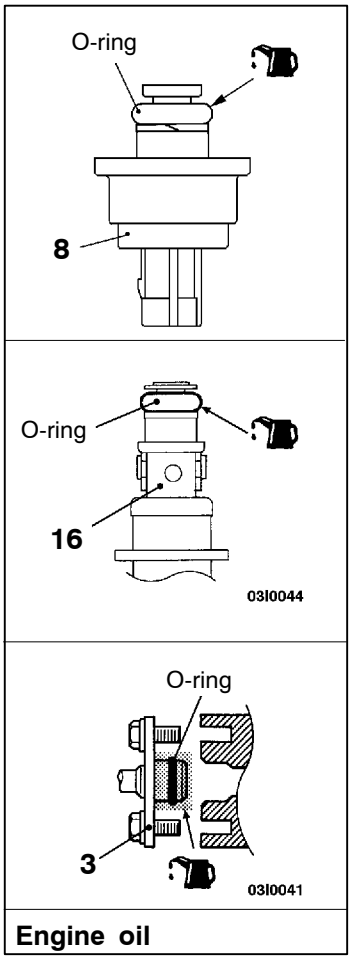
Refer to GROUP 17 - Emission Control System.

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Line Pressure Reduction <before removal only> (Refer to P.13A-219.)
- Engine Cover Removal and Installation
- Air Intake Hose Removal and Installation (Refer to GROUP 15 - Air Cleaner.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 - Intake Manifold.)
- Fuel Leak Check <after installation only> (Refer to P.13A-225.)





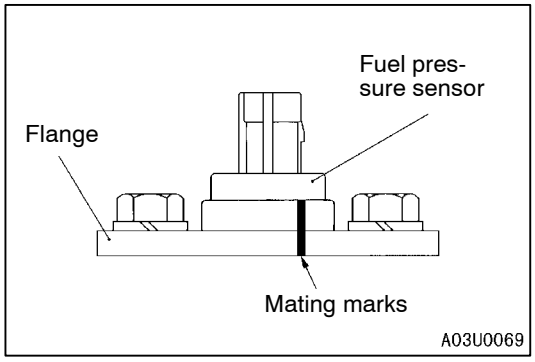
Removal steps

- ▶F◀ • Air bleeding from high-pressure fuel line
- 1. Fuel pressure sensor connector
- ◀A▶ 2. Injector harness
- ▶E◀ 3. Fuel feed pipe
- ▶E◀ 4. Back-up ring A
- ▶E◀ 5. O-ring
- ▶E◀ 6. Back-up ring B
- ◀B▶ ▶D◀ 7. Flange
- ▶D◀ 8. Fuel pressure sensor
- ▶C◀ 9. O-ring
- ▶C◀ 10. Back-up ring
- ▶B◀ 11. Injector washer
- ▶B◀ 12. Injector holder
- ◀C▶ ▶B◀ 13. Delivery pipe assembly and Fuel injector assembly
- ▶B◀ 14. Insulator
- ▶B◀ 15. Injector gasket
- 16. Fuel injector assembly
- ▶A◀ 17. Corrugated washer
- ▶A◀ 18. Back-up ring A
- ▶A◀ 19. O-ring
- ▶A◀ 20. Back-up ring B
- 21. Delivery pipe

REMOVAL SERVICE POINTS

◀A▶ INJECTOR HARNESS DISCONNECTION

Caution
Disconnect the negative battery cable from its terminal before carrying out this operation.



◀B▶ FLANGE REMOVAL

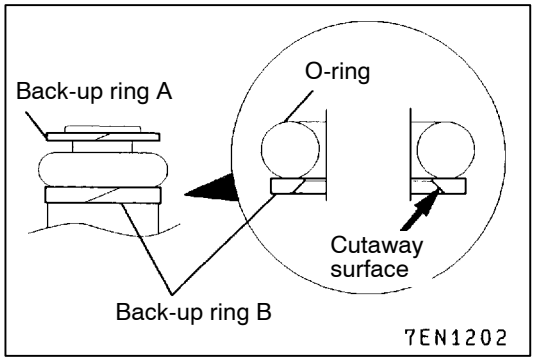
If the fuel pressure sensor is reused, make mating marks on the sensor and the flange.

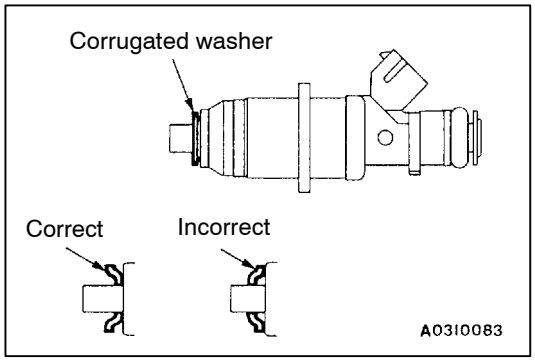
NOTE
The flange secures sealing performance of fuel pressure sensor and installation rigidity by bending to deform the shape at installation. Therefore, make mating marks to install the flange with the right phase and side. In addition, if the fuel pressure sensor is replaced with a new one, replace it together with the flange as a set.

◀C▶ DELIVERY PIPE ASSEMBLY/FUEL INJECTOR ASSEMBLY REMOVAL

Remove the delivery pipe assembly with the fuel injector assembly still attached.

Caution
Be careful not to drop the fuel injector assembly when removing the delivery pipe assembly.





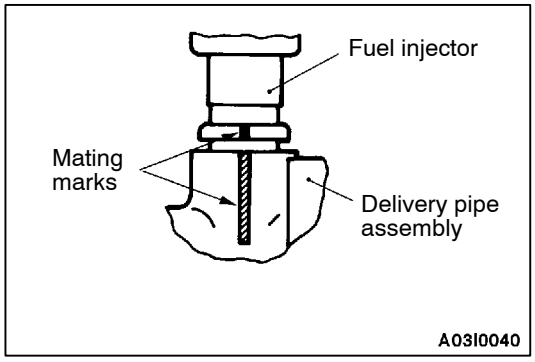
INSTALLATION SERVICE POINTS

▶A◀ BACK-UP RING B/O-RING/BACK-UP RING A/CORRUGATED WASHER INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.

   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Do not confuse back-up ring A with that for the fuel pressure sensor. (External diameter of back-up ring A: 14.8 mm)
2. Apply petroleum jelly to the corrugated washer to prevent it from dropping, and then install it to the direction shown.

   Caution
   The corrugated washer should always be replaced with a new part.



▶B◀ INJECTOR GASKET/INSULATOR/DELIVERY PIPE ASSEMBLY AND FUEL INJECTOR ASSEMBLY/INJECTOR HOLDER//INJECTOR WASHER INSTALLATION

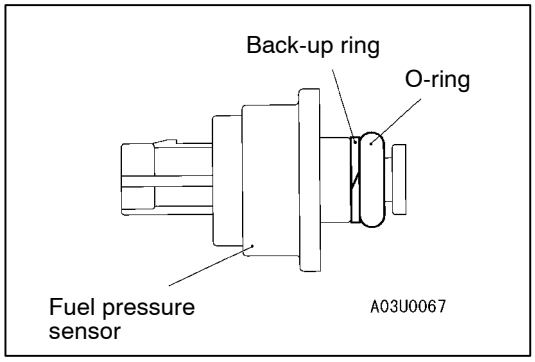
1. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the delivery pipe assembly.

2. While being careful not to damage the O-ring, turn the fuel injector assembly to the left and right and connect it to the delivery pipe assembly. After connecting, check that the fuel injector turns smoothly.
3. If the fuel injector does not turn smoothly, the cause may be that the O-ring is getting caught. Remove the fuel injector, check the O-ring for damage and re-connect the fuel injector to the delivery pipe assembly and then re-check.
4. Align the injector mating mark with the delivery pipe mating mark.
5. Install the injector gasket and the insulator to the cylinder head.
6. Install the delivery pipe and fuel injectors assembly to the cylinder head, and then tighten them provisionally.
7. Install the injector holders and washers, and then tighten them to the specified torque.

   Caution
   Observe the tightening torque.

8. Working from the centre mounting bolt, tighten the delivery pipe and injector assembly mounting bolts to the specified torque.



▶C◀ BACK-UP RING B/O-RING INSTALLATION

Install the back-up rings and the O-ring as shown in the illustration.

Caution
Be careful not to confuse this back-up ring with the back-up ring for the injector or back-up ring A for the fuel pipe. (External diameter of the back-up ring: 15.1 mm)

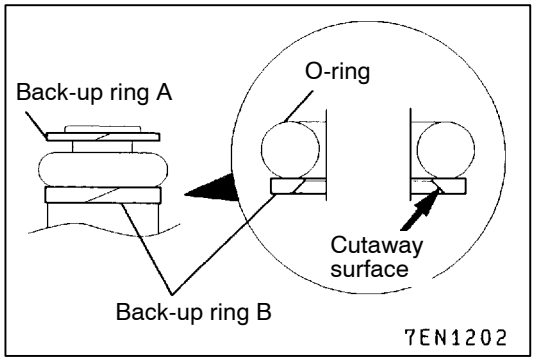
▶D◀ FUEL PRESSURE SENSOR/FLANGE INSTALLATION

1. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the delivery pipe.

2. Align the mating marks, and then install the sensor to the delivery pipe.

   Caution
   If the fuel pressure sensor is replaced, replace it together with the flange as a set.



▶E◀ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.

   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Do not confuse back-up ring A with that for the fuel pressure sensor. (External diameter of back-up ring A: 14.8 mm)

2. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high pressure) and delivery pipe.

3. Insert the fuel pipe into the fuel pump (high-pressure) and the delivery pipe ports squarely. Insert the pipe securely, being careful not to twisting it, and then tighten the mounting bolts to the specified torque.

▶F◀ AIR BLEEDING FROM THE HIGH-PRESSURE FUEL LINE

1. Run the engine at 2,000 r/min for 15 seconds or more in order to bleed the air.

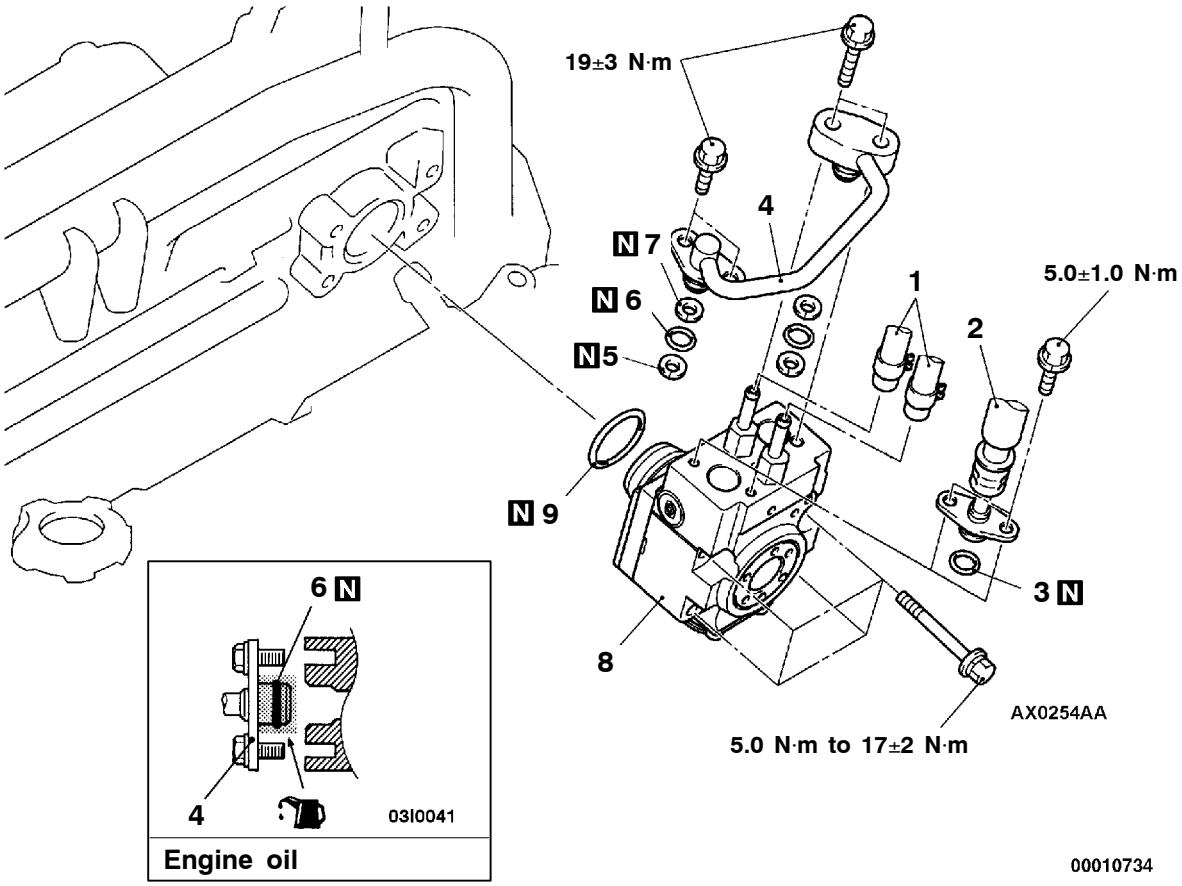
NOTE
When removing the fuel pump (high pressure), air may get into the fuel pump (high pressure). If air gets into the fuel pump (high pressure), diagnosis code No.56 for abnormal fuel pressure will be output.

2. Use the MUT-II to check the diagnosis code. If the diagnosis code No.56 for fuel pressure sensor system defect is output, erase it.

FUEL PUMP (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Line Pressure Reduction <before removal only> (Refer to P.13A-219.)
- Engine Cover Removal and Installation
- Air Intake Hose Removal and Installation (Refer to GROUP 15 - Air Cleaner.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 - Intake Manifold.)
- Fuel Leak Check <after installation only> (Refer to P.13A-225.)
- Air Bleeding from High Pressure Fuel Line (Refer to P.13A-237.)



Removal steps

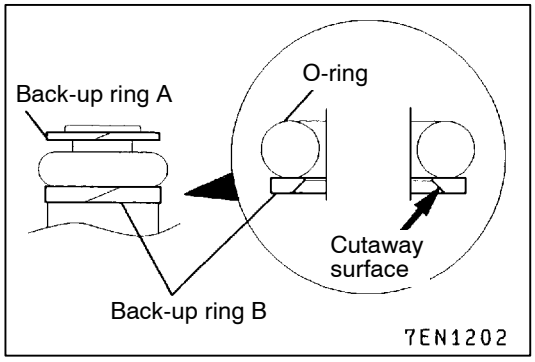
▶D◀ 1. Fuel return hose connection
▶C◀ 2. Fuel pressure hose connection
▶C◀ 3. O-ring
▶B◀ 4. Fuel feed pipe
▶B◀ 5. Back-up ring A
▶B◀ 6. O-ring
▶B◀ 7. Back-up ring B
▶A◀ 8. Fuel pump (high pressure)
9. O-ring

INSTALLATION SERVICE POINTS

▶A◀ FUEL PUMP (HIGH PRESSURE) INSTALLATION

1. Apply a small amount of fresh engine oil to the fuel pump (high pressure) roller and O-ring.
2. Install temporarily the fuel pump (high pressure) to the cylinder head.

3. Insert the fuel pump (high-pressure) to the cylinder head ports squarely, and then tighten the mounting bolts temporarily (a little more tightly than finger-tightening).Tightening them to the specified torque should be carried out in later step ▶B◀.



▶B◀ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

1. Install the back-up rings and the O-ring as shown in the illustration.

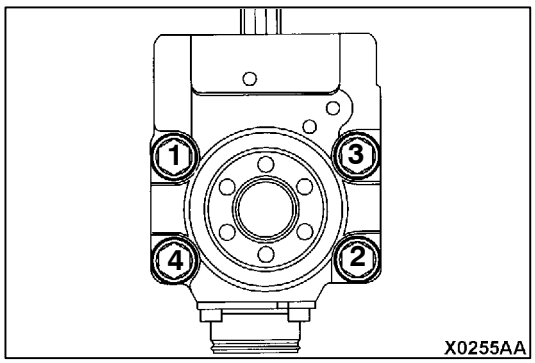
   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)

2. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high pressure) or the delivery pipe assembly.

3. Insert the fuel pipe into the fuel pump (high-pressure) and the delivery pipe ports squarely.
   Insert the pipe securely, being careful not to twisting it, and then tighten the mounting bolts to the specified torque.

   Tightening torque: 19 ± 3 N·m



4. Tighten the temporarily tightened mounting bolts of the fuel pump (high-pressure) in the shown order to 5.0 N·**m**.
5. Tighten the bolts to 17 N·m in the order shown in the illustration. The overall difference in tightening torque between the four bolts should be within 2 N·m.

▶C◀ O-RING/FUEL PRESSURE HOSE INSTALLATION

1. Apply a small amount of fresh engine oil to the O-ring.

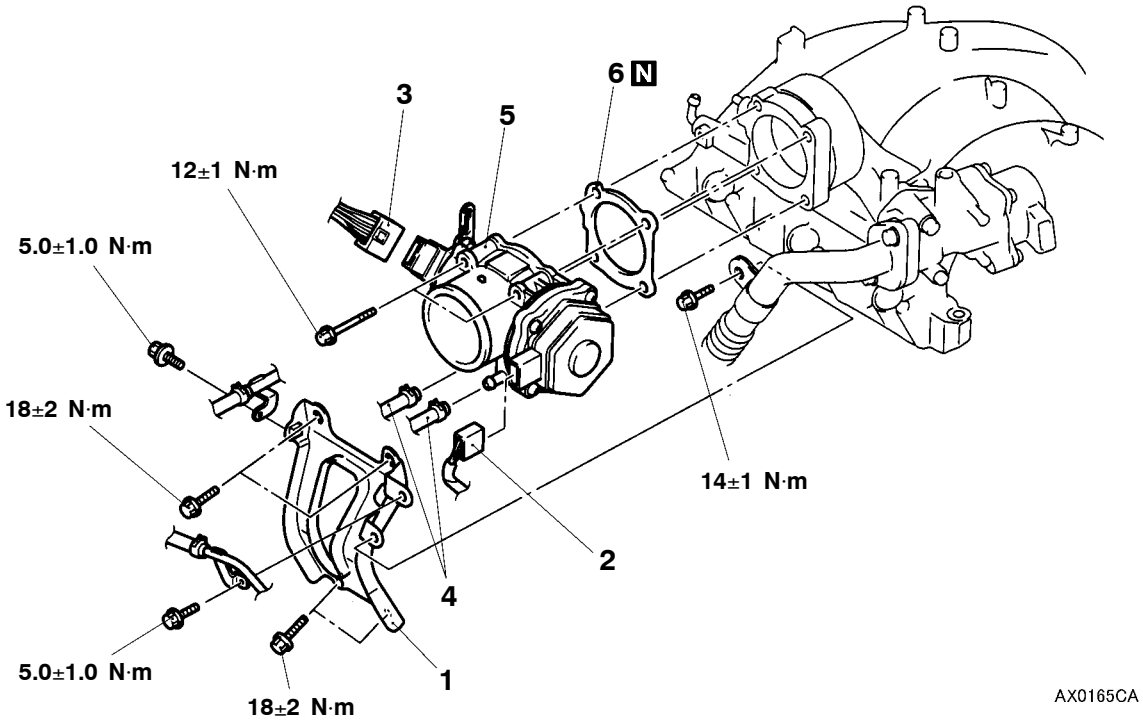
   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high pressure) or the delivery pipe assembly.

2. While being careful not to damage the O-ring, turn the fuel pressure hose to the left and right and connect it to the delivery pipe assembly. After connecting, check that the fuel injector turns smoothly.
3. If the fuel pressure hose does not turn smoothly, the cause may be that the O-ring is getting caught. Remove the fuel pressure hose, check the O-ring for damage and re-connect the fuel pressure hose to the delivery pipe assembly and then re-check.

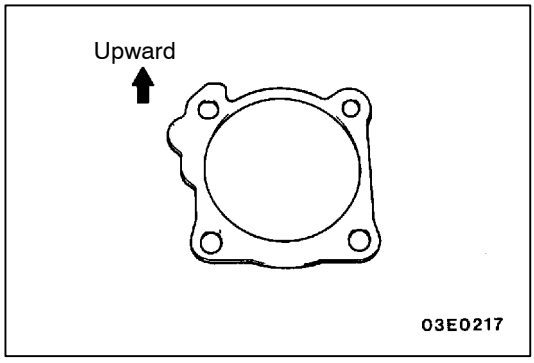
THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 - On-vehicle Service.)
- Engine Cover Removal and Installation
- Air Cleaner Removal and Installation (Refer to GROUP 15.)



Removal steps
1. Throttle body stay
2. Throttle control servo connector connection
3. Throttle position sensor connector connection
4. Water hose connection
- ▶B◀ 5. Throttle body assembly
- ▶A◀ 6. Throttle body gasket



INSTALLATION SERVICE POINTS

▶A◀ THROTTLE BODY GASKET INSTALLATION

The projection on the gasket should face upward.

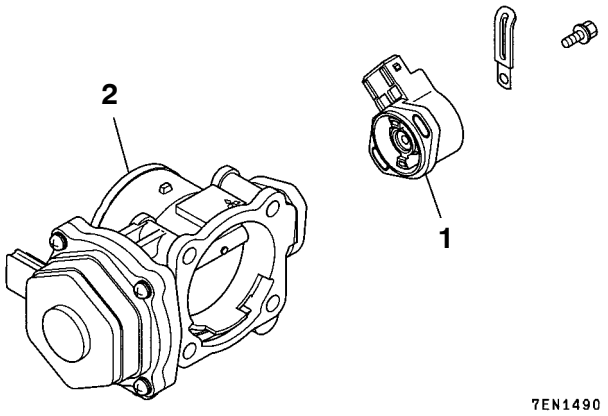
▶B◀ THROTTLE BODY INSTALLATION

If the throttle body is replaced, initialize the electronic-controlled throttle valve system.

Initialization

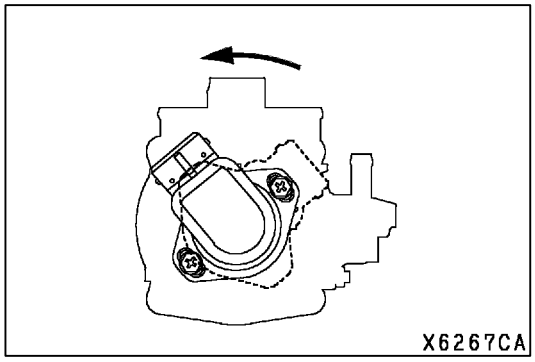
Turn on the ignition switch, and turn it to the LOCK (OFF) position within one second. Then leave it for at least ten seconds with the ignition switch in the LOCK (OFF) position.

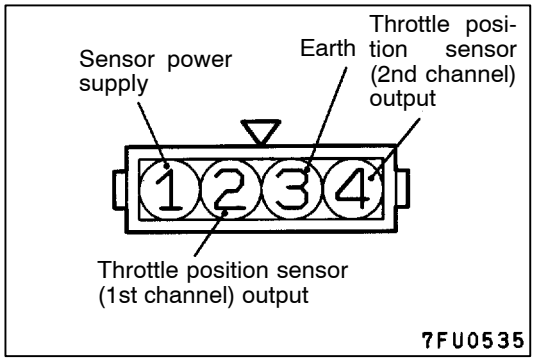
DISASSEMBLY AND REASSEMBLY



Disassembly steps

▶A◀ 1. Throttle position sensor
2. Throttle body





REASSEMBLY SERVICE POINTS

▶A◀ THROTTLE POSITION SENSOR

1. Position the throttle position sensor on the throttle body along the dotted line as shown in the illustration.
2. Rotate the throttle position sensor anticlockwise as shown in the illustration, and then tighten the screws.
3. Measure resistance value between terminal Nos. 1 (sensor power supply) and 2 (throttle position sensor 1st-channel output) as well as 1 (sensor power supply) and 4 (throttle position sensor 2nd channel output).

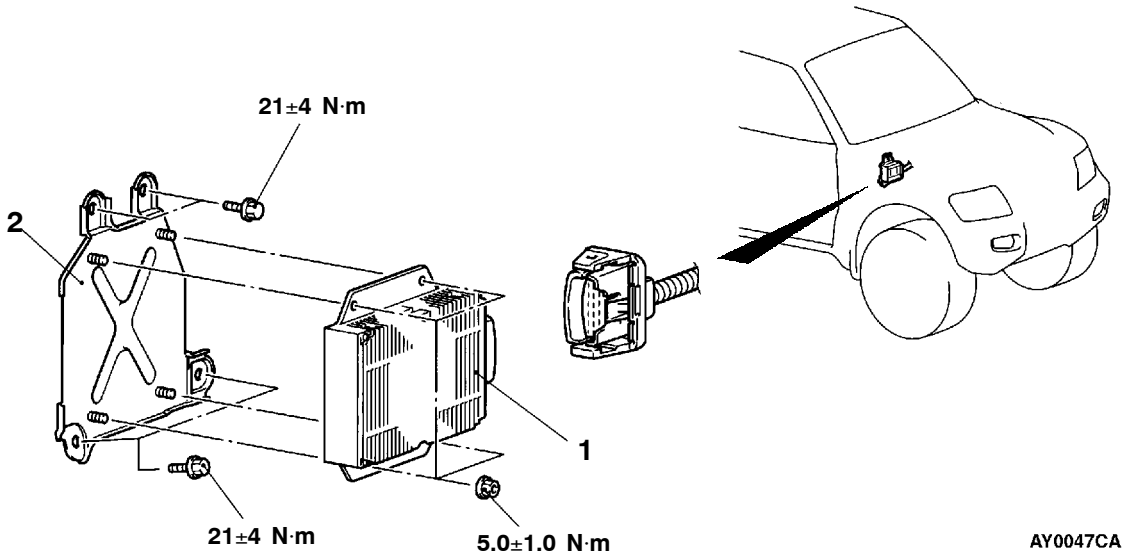
Normal condition

Open the throttle valve slowly from the idle position to full-open position.	Resistance value changes smoothly in response to throttle valve opening angle.

4. If the resistance value does not change smoothly, replace the throttle position sensor.

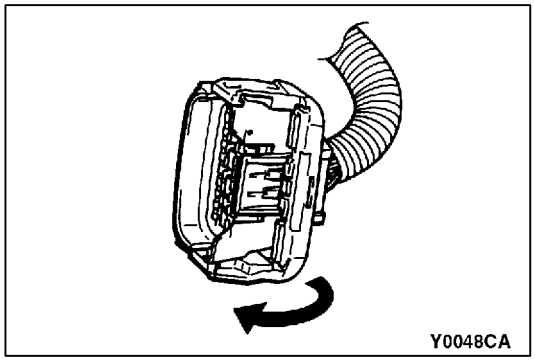
INJECTOR DRIVER

REMOVAL AND INSTALLATION



Removal steps

◀A▶ 1. Injector driver
2. Bracket



REMOVAL SERVICE POINT

◀A▶ INJECTOR DRIVER REMOVAL

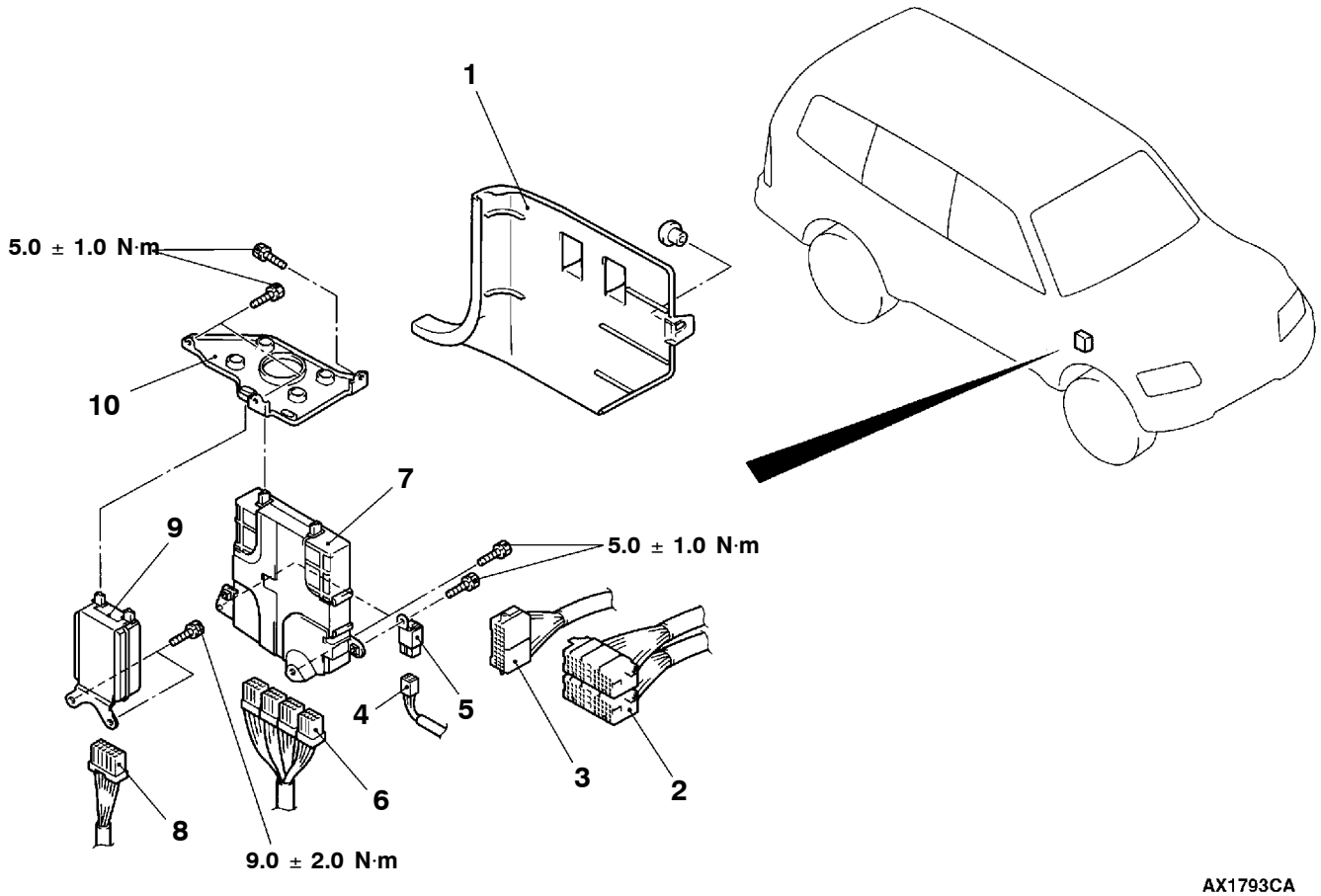
Press the injector driver connector in the place shown in the illustration to disconnect the injector driver connector.

Caution

1. **Disconnect the negative cable from its terminal before carrying out this operation.**
2. **High-tension current is flowing in the harness between the injector driver and the injector while engine is running, and the injector driver will become hot after the vehicle has been driven, so take care when handling it.**

ENGINE-ECU<M/T>, ENGINE-A/T-ECU<A/T>, THROTTLE VALVE CONTROLLER

REMOVAL AND INSTALLATION



Removal steps

1. Cowl side trim
2. Instrument panel harness and front door harness connection
3. Instrument panel harness and front floor harness connection
4. A/T control relay connector <A/T>
5. A/T control relay <A/T>
6. Engine-ECU <M/T>, Engine□A/T-ECU <A/T> connector
7. Engine-ECU <M/T>, Engine□A/T-ECU <A/T>
8. Throttle valve controller connector
- ▶A◀ 9. Throttle valve controller
  Instrument panel (Refer to GROUP 52A.)
10. Bracket

INSTALLATION SERVICE POINT

▶A◀ THROTTLE VALVE CONTROLLER INSTALLATION

If the throttle valve controller is replaced, initialize the electronic-controlled throttle valve system.

Initialization

Turn on the ignition switch, and turn it to the LOCK (OFF) position within one second. Then leave it for at least ten seconds with the ignition switch in the LOCK (OFF) position.

DIESEL FUEL <4D5>

CONTENTS

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SPECIAL TOOL 2

ON-VEHICLE SERVICE 2

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- Engine Idle Speed Check and Adjustment 2
- Evacuation of Water from Fuel Filter 2
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- Fuel Filter Cartridge Replacement 3
- Fuel Injection Pump Check 3
- Boost Compensator Check 4
- Injection Nozzle Check and Adjustment 4

INJECTION NOZZLE 6

INJECTION PUMP 10

GENERAL INFORMATION

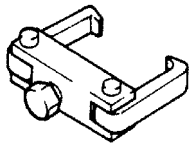
The fuel is drawn out of the fuel tank by means of the feed pump which is built into the fuel injection pump. It then passes through the fuel filter and is fed to the injection pump.
The fuel is pressurized by the feed pump, and this fuel pressure is controlled by the regulating valve which is built into the pump. Then, the fuel is compressed by the plunger and injected from the nozzles at high pressure in accordance with the injection sequence.

Engine speed (fuel injection amount) control is carried out by means of a centrifugal-type governor using a flyweight.
Fuel injection timing control is carried out by a hydraulic timer. The hydraulic timer operates by the fuel pressure inside the pump chamber. This pressure is controlled by the regulating valve.

SERVICE SPECIFICATIONS

Items	Standard value
Injection timing control solenoid coil resistance Ω	8 - 10
Fuel injection initial pressure kPa	14,710 - 15,690

SPECIAL TOOL

Tool	Number	Name	Use
	MD998388	Injection pump sprocket puller	Fuel injection pump sprocket removal

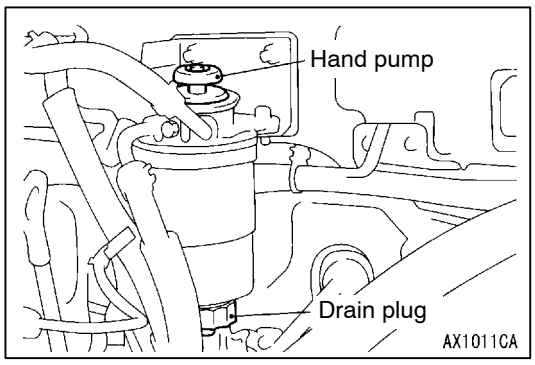
ON-VEHICLE SERVICE

FUEL INJECTION TIMING CHECK AND ADJUSTMENT

Refer to GROUP 11B - On-vehicle Service.

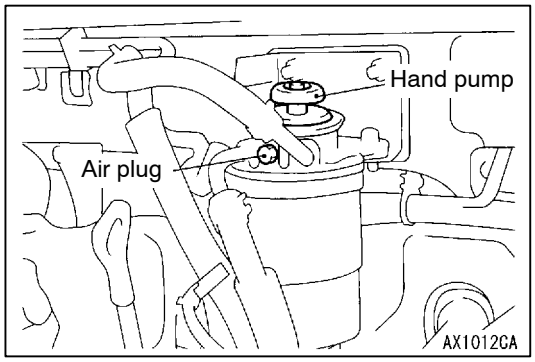
ENGINE IDLE SPEED CHECK AND ADJUSTMENT

Refer to GROUP 11B - On-vehicle Service.



EVACUATION OF WATER FROM FUEL FILTER

Water is in the filter when fuel filter warning lamp lights. Evacuate water by the following procedures.
1. Loosen drain plug.
2. Drain water with hand pump. Finger-tighten drain plug.



EVACUATION OF AIR FROM FUEL LINE

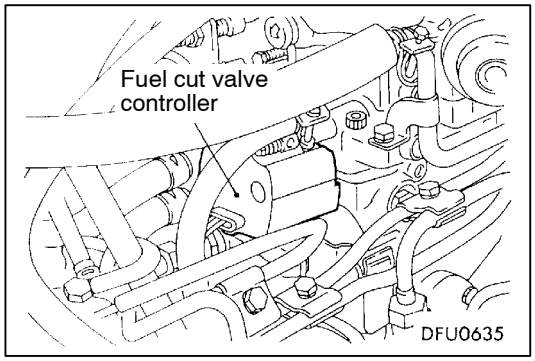
Bleed the air from the fuel line after refilling the fuel.

- When fuel is drained for service.
- When fuel filter is replaced.
- When main fuel line is removed.

1. Loosen fuel filter air plug.
2. Place rags around air plug hole. Operate hand pump repeatedly until no bubbles come from plug hole. Tighten air plug.
3. Repeat until hand pump operation becomes stiff.

FUEL FILTER CARTRIDGE REPLACEMENT

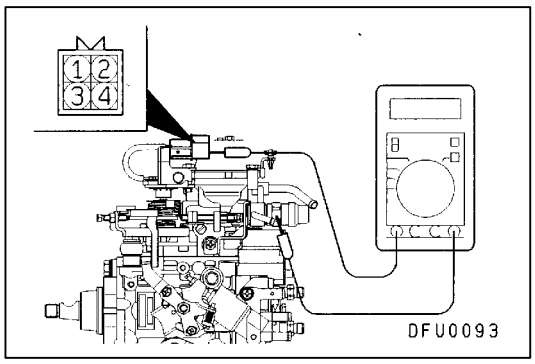
Refer to GROUP 13D.



FUEL INJECTION PUMP CHECK

FUEL CUT VALVE CONTROLLER OPERATION CHECK

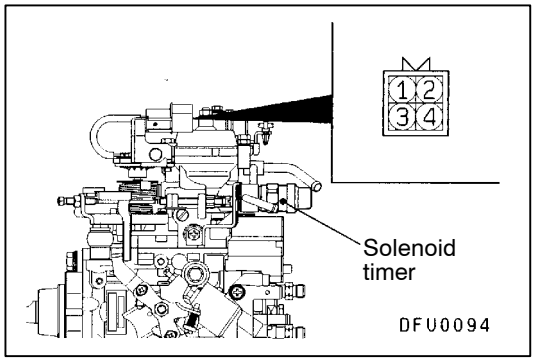
When a sound scope is held against the fuel cut valve controller and the ignition switch is turned to “ON”, check that the sound of the valve operating can be heard.
If no operating sound can be heard, check the immobilizer system while referring to GROUP 54.



INJECTION TIMING CONTROL SOLENOID COIL RESISTANCE CHECK

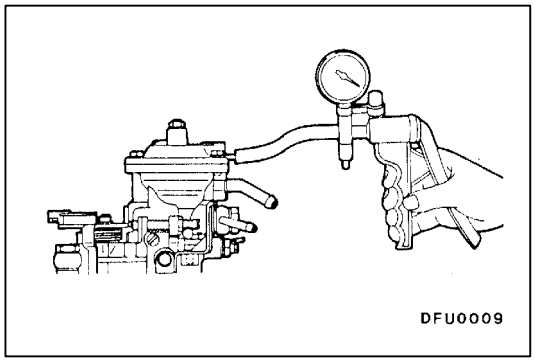
Measure the resistance between the injection pump connector terminal No.4 (injection timing control solenoid terminal) and the injection pump body.

Standard value: 8 - 10 Ω (at 20 °C)



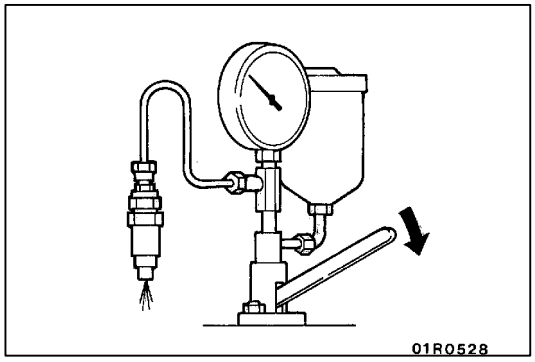
INJECTION TIMING CONTROL SOLENOID OPERATION CHECK

Check that operation sound of the injection timing control solenoid can be heard when connecting the injection pump connector terminal No.4 (injection timing control solenoid terminal) and the battery positive terminal.



BOOST COMPENSATOR CHECK

1. Connect a hand pump (pressurization type) to the nipple of the boost compensator.
2. Apply 30 kPa of pressure and check to be sure that the pressure is maintained.



INJECTION NOZZLE CHECK AND ADJUSTMENT

Caution
Never touch the injection spray that is injected from the nozzle.

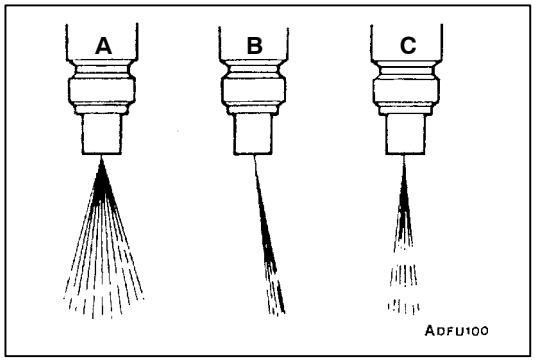
FUEL INJECTION INITIAL PRESSURE CHECK

1. Install the injection nozzle to a nozzle tester.
2. Move the lever of the nozzle tester 2 - 3 times to inject fuel and to bleed the air.
3. Gently press down the lever of the nozzle tester, and take a reading of the indication value on the pressure gauge at the point where the needle slowly rises and then suddenly drops.

   Standard value (Fuel injection initial pressure): 14,710 - 15,690 kPa

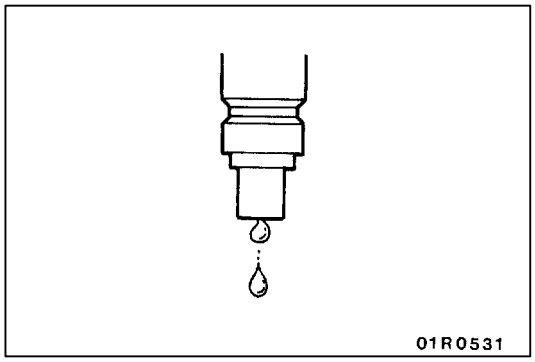
4. If the fuel injection initial pressure is outside the standard value, disassembly the nozzle holder to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

   NOTE
   (1) For disassembly, reassembly and adjustment of the nozzle holder, refer to P.13B-8.
   (2) There are 10 shims for adjustment, with thicknesses in the range of 0.10 - 0.80 mm.
   (3) When the shim thickness is increased by 0.1 mm, the fuel injection initial pressure increases by 2,350 kPa.

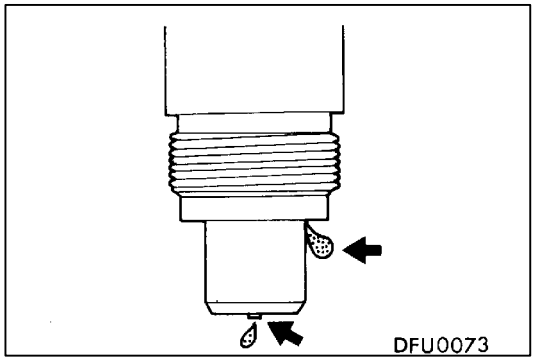


INJECTION SPRAY CONDITION CHECK

1. Move the lever of the nozzle tester rapidly (4 - 6 times per second) to eject the fuel continuously. Check to be sure that the injection spray comes out evenly in a cone shape (injection spray angle is 10 °). The injection spray patterns shown in the illustration at left are wrong.
   A. Injection angle is tool large
   B. Bias
   C. Intermittent fuel injection



2. Check to be sure that no fuel drips after injection is completed.
3. If there are any drips, disassemble the nozzle, clean it and reinspect, or replace the nozzle.



NOZZLE FUEL-TIGHT CHECK

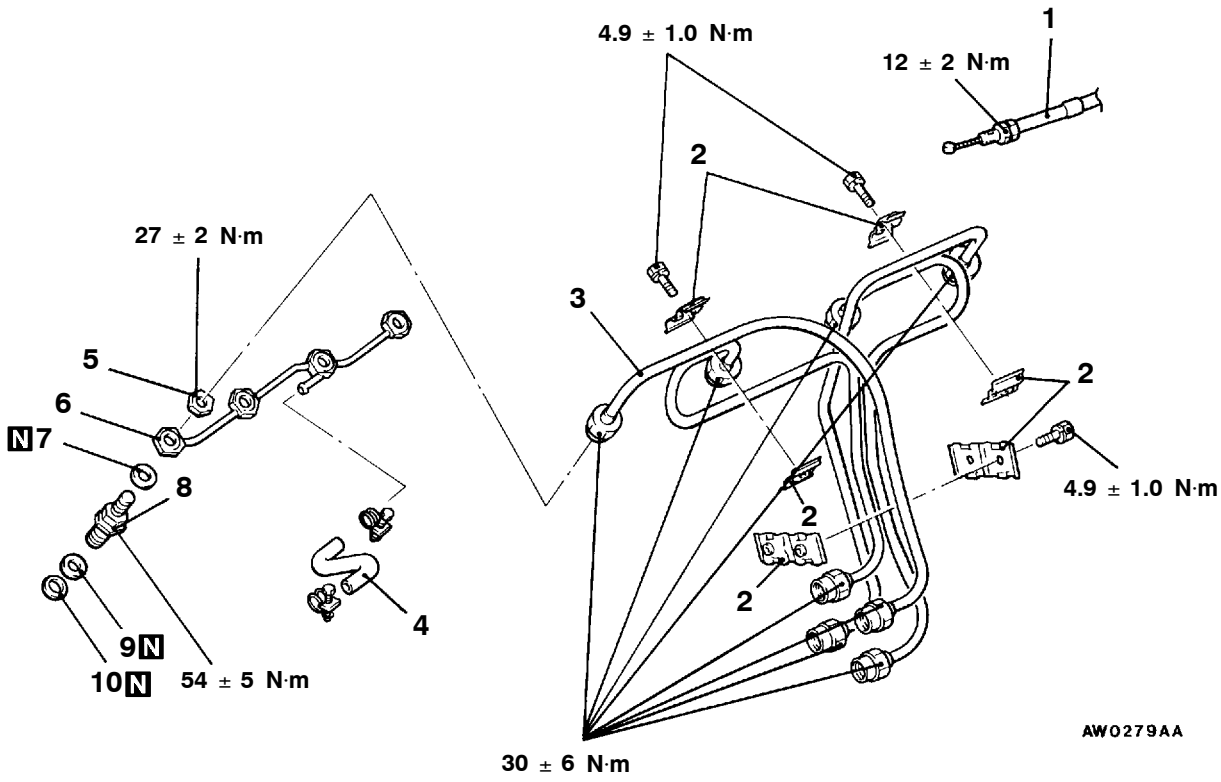
1. Gently raise the lever of the nozzle tester until the pressure inside the nozzle (value displayed on pressure gauge) becomes 12,750 - 13,730 kPa, and after holding this pressure for approximately 10 seconds, check to be sure that there are no fuel leaks from the nozzle.
2. If there are any leaks, disassemble the injection nozzle, clean it and re-inspect, or replace the nozzle.

INJECTION NOZZLE

REMOVAL AND INSTALLATION

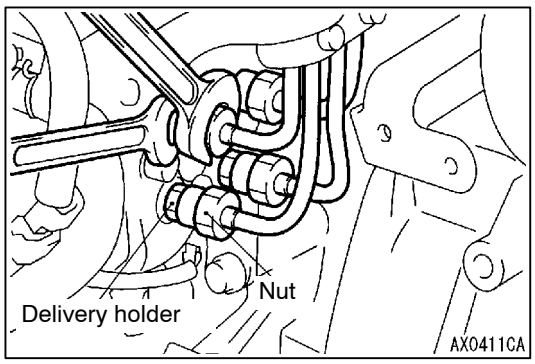
Pre-removal Operation
- Battery and Battery Tray Removal
- Air Pipe Removal (Refer to GROUP 15.)

Post-installation Operation
- Air Pipe Installation (Refer to GROUP 15.)
- Battery and Battery Tray Installation
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)



Removal steps

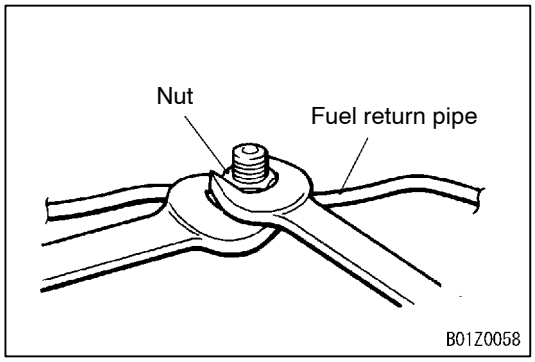
1. Accelerator cable connection
2. Injection pipe clamp
◀A▶ 3. Injection pipe
4. Fuel return hose
◀B▶ 5. Nut
◀B▶ 6. Fuel return pipe
7. Fuel return pipe gasket
◀C▶ 8. Injection nozzle assembly
▶A◀ 9. Holder gasket
▶A◀ 10. Nozzle gasket



REMOVAL SERVICE POINTS

◀A▶ INJECTION PIPE DISCONNECTION

When loosening nuts at both ends of injection pipe, hold the delivery holder (for pump side) and the injection nozzle assembly (for nozzle side) with wrench and loosen nut.

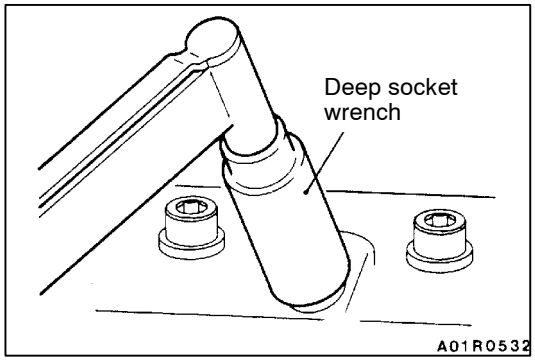


◀B▶ NUT/FUEL RETURN PIPE REMOVAL

1. While using a spanner or similar tool to hold the hexagonal nut of the fuel return pipe, remove the nut.

   Caution
   If an attempt is made to loosen the nut without first holding the fuel return pipe, the pipe may be broken or otherwise damaged.

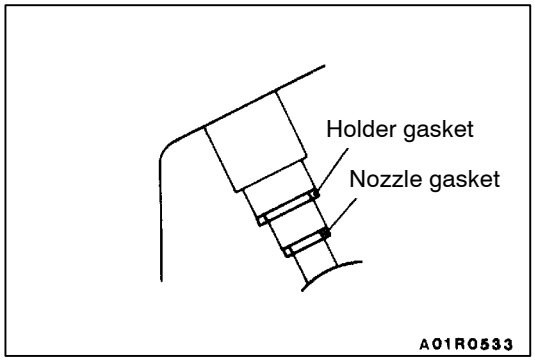
2. Disconnect the fuel return pipe.



◀C▶ INJECTION NOZZLE ASSEMBLY REMOVAL

Using a deep socket wrench, remove the injection nozzle assembly.

Caution
1. **Make a mark on the removed injection nozzle assembly (the cylinder No.).**
2. **Use a cap to prevent foreign material, etc. from entering the injection nozzle hole.**

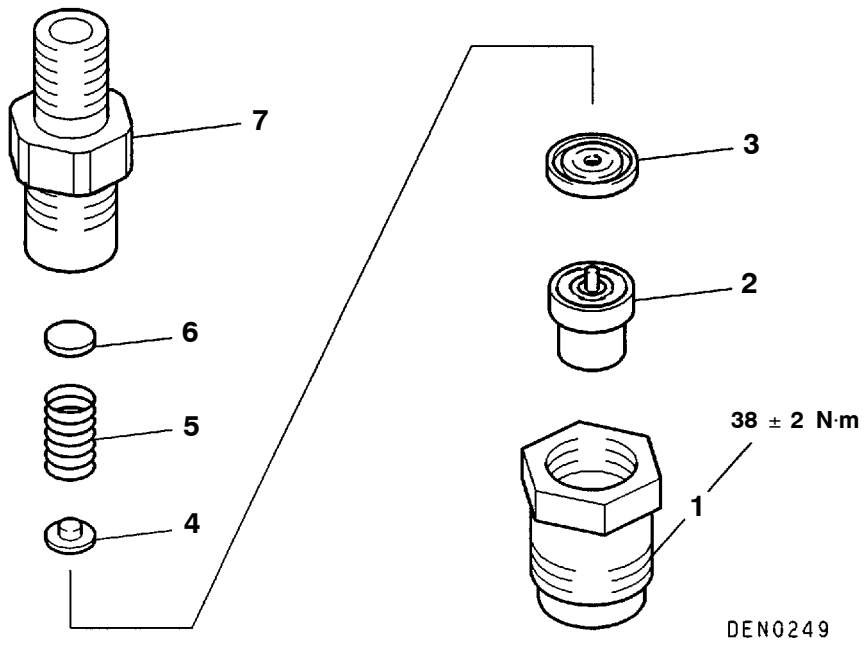


INSTALLATION SERVICE POINT

▶A◀ NOZZLE GASKET/HOLDER GASKET INSTALLATION

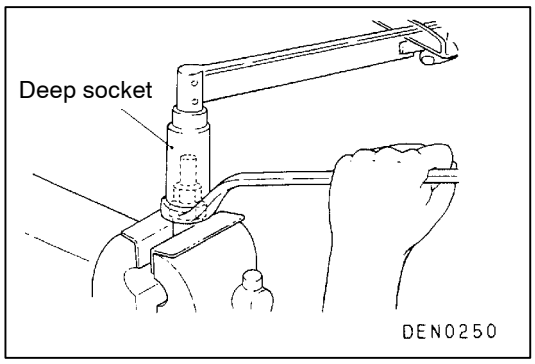
Clean the cylinder head's injection nozzle hole, and insert a new gasket.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

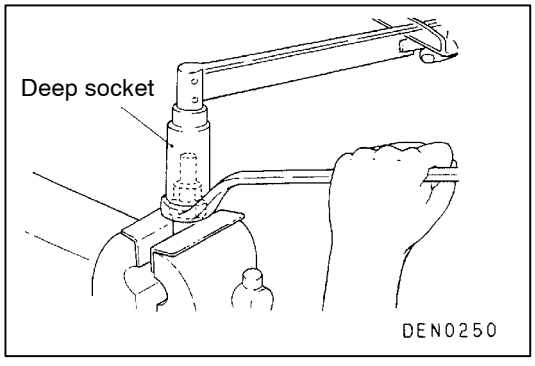
◀A▶ ▶A◀ 1. Retaining nut
2. Nozzle tip
3. Distance piece
4. Retaining pin
5. Pressure ring
6. Shim
7. Nozzle holder body



DISASSEMBLY SERVICE POINT

◀A▶ RETAINING NUT REMOVAL

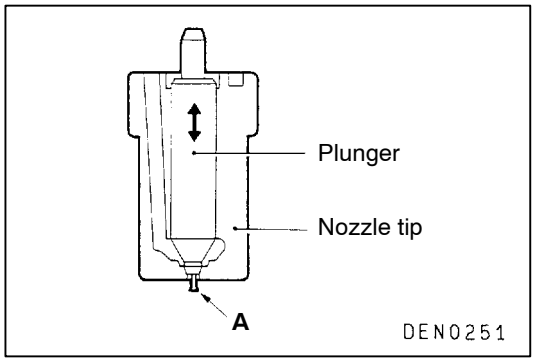
1. Lightly clamp the retaining nut in a vise with soft jaws.
2. Hold the retaining nut with a box wrench, and loosen the nozzle holder body using a deep socket.



REASSEMBLY SERVICE POINT

▶A◀ RETAINING NUT INSTALLATION

1. Finger-tighten the nozzle holder body.
2. Lightly clamp the retaining nut in a vise with soft jaws.
3. While holding the retaining nut with a box wrench, tighten the nozzle holder body to the specified torque with a deep socket.



INSPECTION

NOZZLE TIP

1. Check the nozzle tip for carbon deposits. Scape off carbon deposits with a piece of wood and clean each part with petrol. After cleaning, keep parts submerged in diesel fuel. Take particular care to protect the nozzle tip needle valve from damage.
2. While the nozzle tip is submerged in diesel fuel, check that the needle valve slides smoothly.
   If the needle valve does not slide smoothly, replace the nozzle tip.
   When replacing the nozzle tip, completely wash off the anticorrosive oil from the new nozzle tip with clean diesel fuel before using it.
3. Check plunger tip “A” for deformation and breakage. If “A” is damaged or broken, replace it.

DISTANCE PIECE

Check the surface in contact with the nozzle holder body by using minium.

PRESSURE SPRING

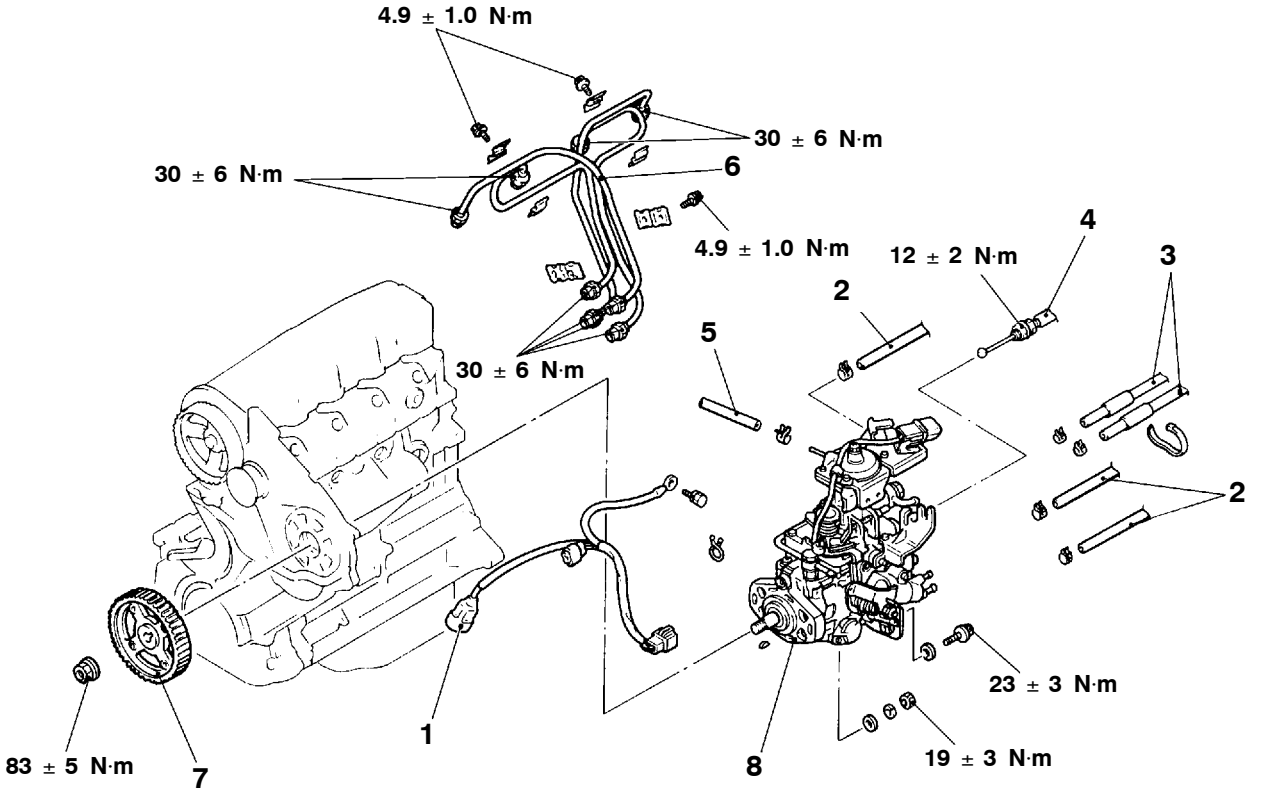
Check spring for weakness and breakage.

INJECTION PUMP

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining (Refer to GROUP 14 - On-vehicle Service.)
- Battery and Battery Tray Removal
- Timing Belt Removal (Refer to GROUP 11B.)
- Air Pipe Removal (Refer to GROUP 15.)

Post-installation Operation
- Air Pipe Installation (Refer to GROUP 15.)
- Timing Belt Installation (Refer to GROUP 11B.)
- Battery and Battery Tray Installation
- Engine Coolant Supplying (Refer to GROUP 14 - On-vehicle Service.)
- Injection Timing Adjustment (Refer to GROUP 11B - On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)

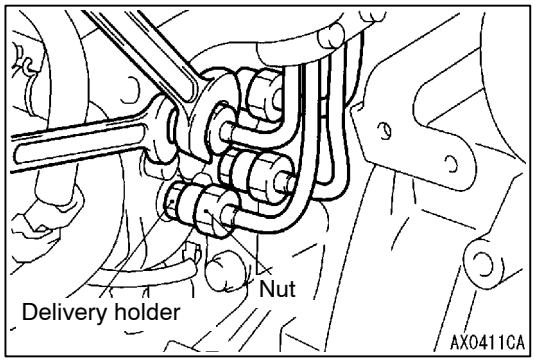


Removal steps

1. Fuel injection pump wiring harness
2. Water hoses connection
3. Fuel hoses connection
4. Accelerator cable connection

◀A▶
◀B▶

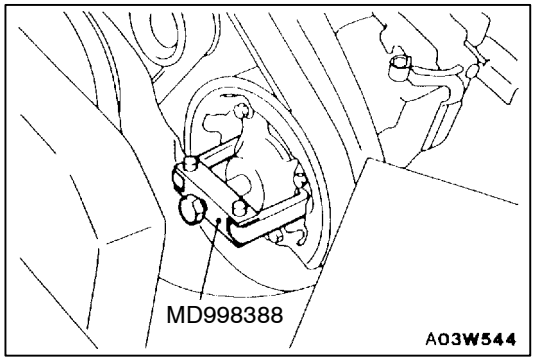
5. Boost hose connection
6. Fuel injection pipe
7. Fuel injection pump sprocket
8. Fuel injection pump



REMOVAL SERVICE POINTS

◀A▶ INJECTION PIPE REMOVAL

Loosen the nuts at the end of the injection pipe with the delivery holder (for pump side) and injection nozzle assembly (for nozzle side) retained by a spanner, etc.



◀B▶ FUEL INJECTION PUMP SPROCKET REMOVAL

Remove sprocket installing nut and remove sprocket from pump drive shaft with special tool.

Caution

1. **Do not hit pump drive shaft with hammer, etc.**
2. **When holding injection pump, do not allow to dangle by holding accelerator lever or fast idle lever. Do not remove these levers. Removal will cause injection pump malfunction.**

NOTES

DIESEL FUEL <4M4>

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GENERAL INFORMATION

The electronically-controlled fuel injection system consists of sensors which detect the condition of the diesel engine, an engine-ECU which controls the system based on signals from these sensors, and actuators which operate according to control commands from the engine-ECU.
The engine-ECU carries out operations such as fuel injection rate control, fuel injection timing control and idle up control. In addition, the engine-ECU is equipped with several self-diagnosis functions which make troubleshooting easier in the event that a problem develops.

FUEL INJECTION RATE CONTROL

The fuel injection completion timing is controlled by means of a solenoid-type spill valve to ensure that the optimum amount of fuel is supplied to the engine in accordance with gradual changes in the engine running condition.
Before fuel injection starts, the solenoid-type spill valve is on (energized), so that the valve is closed. As the plunger turns and rises, fuel is sent out under pressure, and when the fuel flow rate reaches the target value for fuel injection, the solenoid-type spill valve turns off. When the solenoid-type spill valve turns off, the fuel under high pressure inside the plunger is leaked out into the pump chamber and fuel injection is completed.

FUEL INJECTION TIMING CONTROL

The position of the injection pump timer piston is controlled so that fuel injection is carried out at the optimum timing in accordance with the engine running condition.
The timer piston position is determined by duty control of the timing control solenoid valve which is located in the line between the high-pressure chamber and the low-pressure chamber of the timer piston.
The fuel injection timing is advanced by increasing the control duty of the timing control solenoid valve.

IDLE SPEED CONTROL

Controlling the fuel injection rate in accordance with the engine running condition maintains the idle speed at the optimum condition.

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in any of the sensors or actuators, the engine warning lamp illuminates to warn the driver.
- When an abnormality is detected in any of the sensors or actuators, a diagnosis code number corresponding to the problem which occurred is output.
- The RAM data relating to the sensors and actuators which is stored in the engine-ECU can be read using the MUT-II. In addition, the actuators can be force-driven under certain conditions.

OTHER CONTROL FUNCTIONS

1. Power Supply Control
   When the ignition switch is turned to ON, the relay turns on and power is supplied to components such as the timing control solenoid valve.
2. Intake Air Throttle Control
   When the engine is idling after having warmed up, the throttle valve is half opened to restrict the amount of intake air in order to reduce vibration and noise.
3. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF
4. Fan motor relay control
   The radiator fan and condenser fan operating speeds are controlled in accordance with the engine coolant temperature and the vehicle speed.
5. Glow Control
   Refer to GROUP 16.
6. EGR Control
   Refer to GROUP 17.

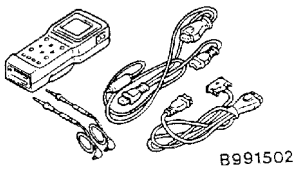
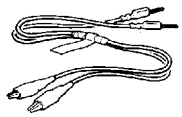
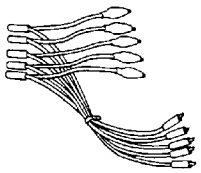
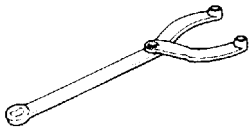
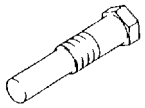
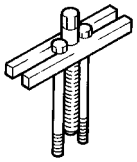
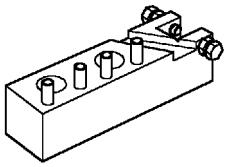
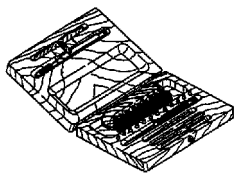
SERVICE SPECIFICATIONS

Item		Standard value
Accelerator pedal position sensor reference voltage V		0.985 - 1.085
Accelerator pedal position sensor resistance kΩ		3.5 - 6.5
Boost air temperature sensor (Intake air temperature sensor) resistance kΩ	When the temperature is 20°C	2.3 - 2.9
	When the temperature is 80°C	0.30 - 0.39
Engine coolant temperature sensor resistance kΩ	When the temperature is 20°C	2.3 - 2.6
	When the temperature is 80°C	0.30 - 0.34
Fuel cut solenoid valve resistance Ω		6.8 - 9.2
Timing control valve resistance Ω		10.8 - 11.2
Timer piston position sensor resistance Ω	Connector terminals No.1 - No.2	160 - 168
	Connector terminals No.1 - No.3	80 - 84
	Connector terminals No.2 - No.3	80 - 84
Control sleeve position sensor resistance Ω	Connector terminals No.4 - No.12	11.2 - 12.4
	Connector terminals No.4 - No.8	5.6 - 6.2
	Connector terminals No.8 - No.12	5.6 - 6.2
GE actuator (electronic governor) resistance Ω	Connector terminals No.6 - No.10	0.64 - 0.72
Fuel temperature sensor resistance kΩ	Connector terminals No.7 - No.11	1.4 - 2.6
Engine speed sensor resistance kΩ		2.15
Main/sub throttle solenoid valve resistance Ω		36 - 44

SEALANT

Item	Specified sealant
Engine coolant temperature sensor	3M Nut Locking Part No.4171 or equivalent

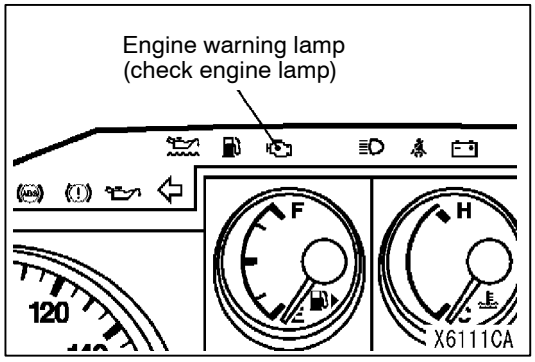
SPECIAL TOOLS

Tools	Number	Name	Application
 B991502	MB991502	MUT-II sub assembly	Electronically controlled fuel injection system check
	MB991529	Diagnosis code check harness	Diagnosis code reading
	MB991348, MB991658	Test harness set	• Boost pressure sensor check <MB991348> • APS adjustment <MB991658>
	MB990767	End yoke holder	Holding the crankshaft pulley
	MB998754	Crankshaft pulley holder pin	
 B990803	MH062567	Gear puller	Injection pump gear assembly removal
	157992-2820 (zexcel)	Plate	Retaining nut removal and installation
	105789-0010 (zexcel)	Nozzle cleaning tool	Cleaning of nozzle and needle valve

TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Engine warning lamp is lit when any abnormality takes place in the item related to electronically controlled fuel injection system shown in the following table.
If the malfunction indicator lamp has been on and/or is lit when the engine is in operation, check the diagnosis output.

Engine warning lamp check items

Accelerator pedal position sensor (main)
Accelerator pedal position sensor (sub)
Boost pressure sensor (Boost sensor)
Engine speed sensor
Control sleeve position sensor
Timer piston position sensor
Main throttle solenoid valve
GE actuator
Idle switch (built-in)
Engine-ECU

METHOD OF ERASING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 - How to Use Troubleshooting/Inspection Service Points.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function.
   If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II.
5. Start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE, BACKUP FUNCTIONS

When abnormalities in the major sensors are detected by diagnosis functions, pre-set control logic operates to maintain a safe driving condition for the vehicle.

Diagnosis item	Control features in malfunction
Accelerator pedal position sensor	● Accelerator pedal released (idle switch ON) Acceleration opening degree = 0% ● Accelerator pedal applied (idle switch OFF) Engine controlled at low speed Acceleration opening degree = 20% fixed
Idle switch	● Void idling speed control. ● Void cruise control.
Engine speed sensor	● Engine controlled at low speed ● Void cruise control.
Boost air temperature sensor	Maintain the intake air temperature at 50 °C.
Vehicle speed sensor	● Void idling speed control. ● Void cruise control.
Engine coolant temperature sensor	Maintain the engine coolant temperature at 80 °C.
Control sleeve position sensor	● Engine controlled at low speed ● Void cruise control.
Timer piston position sensor	● Injection timing stabilizing control ● Void cruise control.
Barometric pressure sensor (ECU built-in)	Keep the barometric pressure at 101 kPa.
Fuel temperature sensor	Maintain the fuel temperature at 50 °C.
Boost pressure sensor	Keep the boost pressure as barometric pressure (101 kPa).
Injection correction ROM	Void correction.
GE actuator	● Engine controlled at low speed ● Void cruise control.
Over boost	Void cruise control.
Timing control valve	● Injection timing stabilizing control ● Void cruise control.

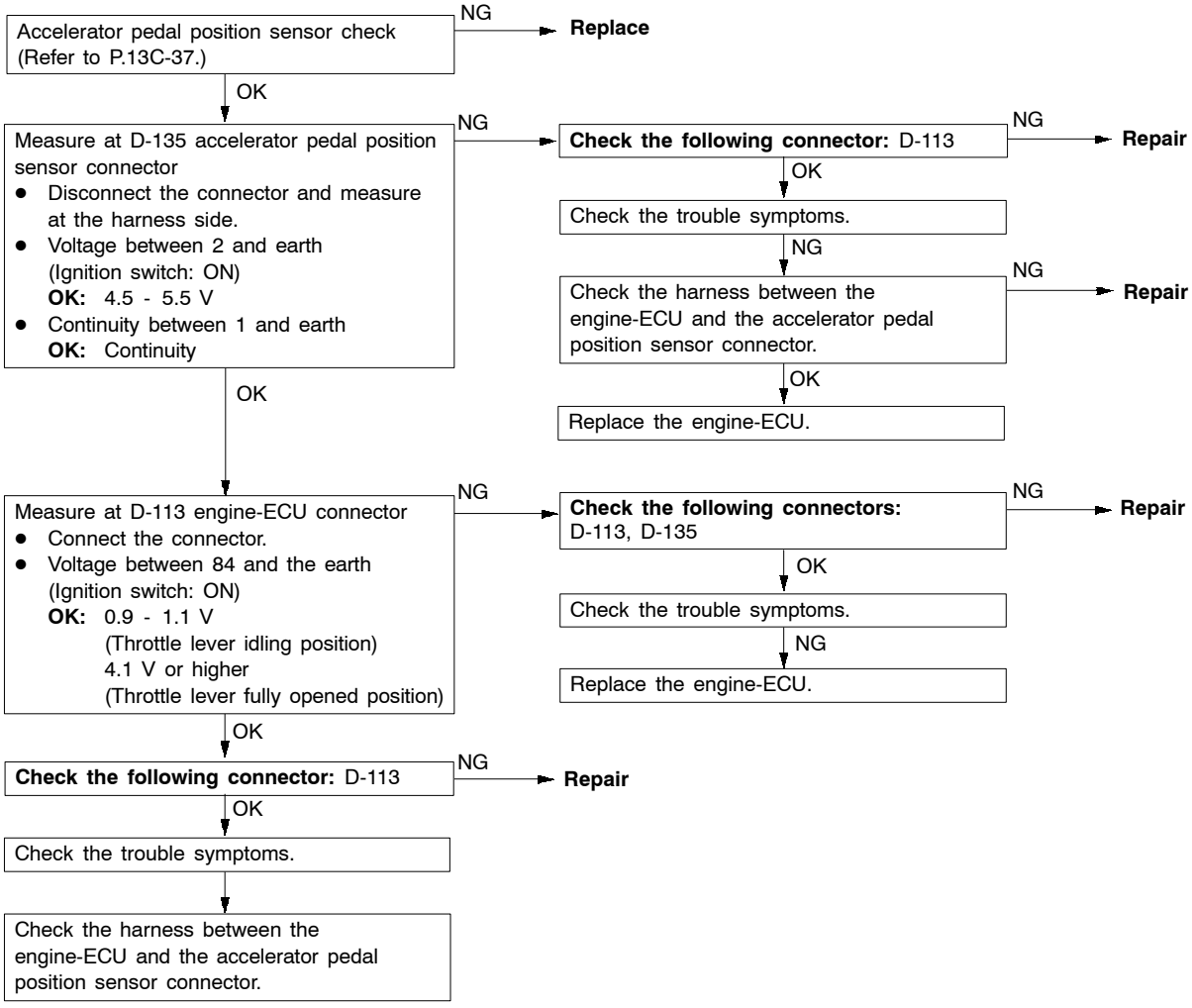
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Accelerator pedal position sensor (main) system	13C-8
12*	Boost pressure sensor system	13C-9
13	Barometric pressure sensor (ECU built-in) system	13C-10
14	Fuel temperature sensor system	13C-10
15	Engine coolant temperature sensor system	13C-11
16	Boost air temperature sensor system	13C-11
17	Vehicle speed sensor system	13C-12
18	Engine speed sensor (backup) system	13C-13
21	Engine speed sensor system	13C-14
23	Idle switch (accelerator pedal position sensor built-in) system	13C-15
25*	Timer piston position sensor system	13C-16
26*	Control sleeve position sensor system	13C-17
27	Accelerator pedal position sensor (sub) system	13C-18
41*	Main throttle solenoid valve system	13C-19
43	Timing control valve system	13C-20
46	Injection correction ROM system	13C-21
48*	GE actuator (in the middle of control sleeve position sensor inoperative) system	13C-21
49*	Over boost (turbocharger waste gate malfunction)	13C-22
54	Immobilizer system	13C-22

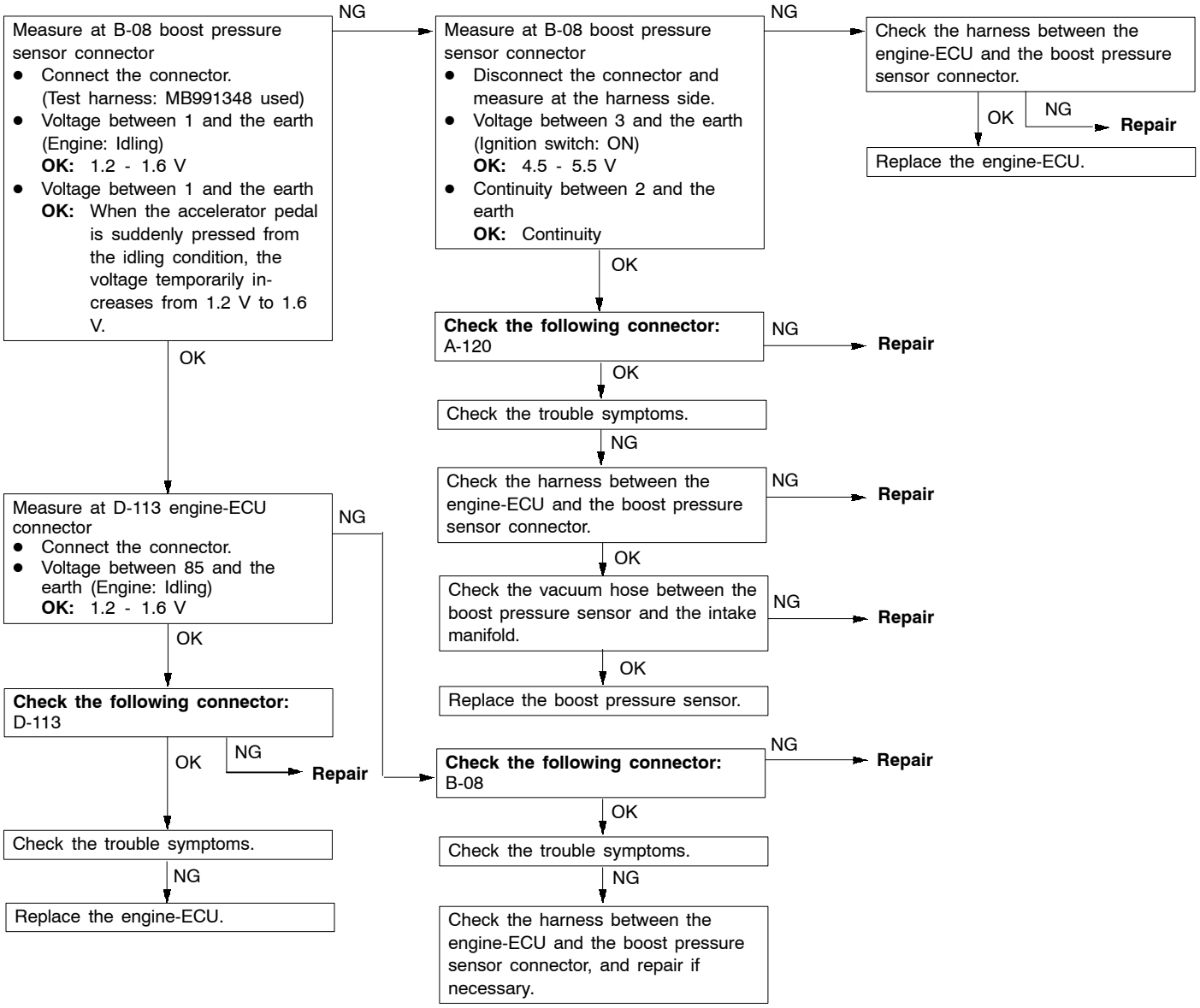
Caution
If the the above-mentioned diagnosis code number with the asterisks can be displayed along with another code number in parentheses simultaneously, check the other code number before replacing the engine-ECU.
12 (41, 49), 26 (48), 25 (43), 41 (12, 49), 48 (26), 49 (12, 41)

INSPECTION PROCEDURE FOR DIAGNOSIS CODE

Code No. 11 Accelerator pedal position sensor system	Probable cause
Range of Check ● Ignition switch: ON, accelerator pedal position sensor (sub) operative, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (sub) for one second is 0.2 V or higher and lower than 2.5V. Output voltage of accelerator pedal position sensor (main) for one second is 4.5V or higher, or lower than 0.2V. Range of Check ● Ignition switch:ON, except for during engine cranking Set Conditions ● The output voltage of accelerator pedal position sensor (main and sub) for 0.2 second is 0.2V or higher, or lower than 4.5V and the difference in sensor output voltage between the main and sub is 1V or higher, or idle switch:ON, and sensor main output voltage is 1.875V or higher.	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



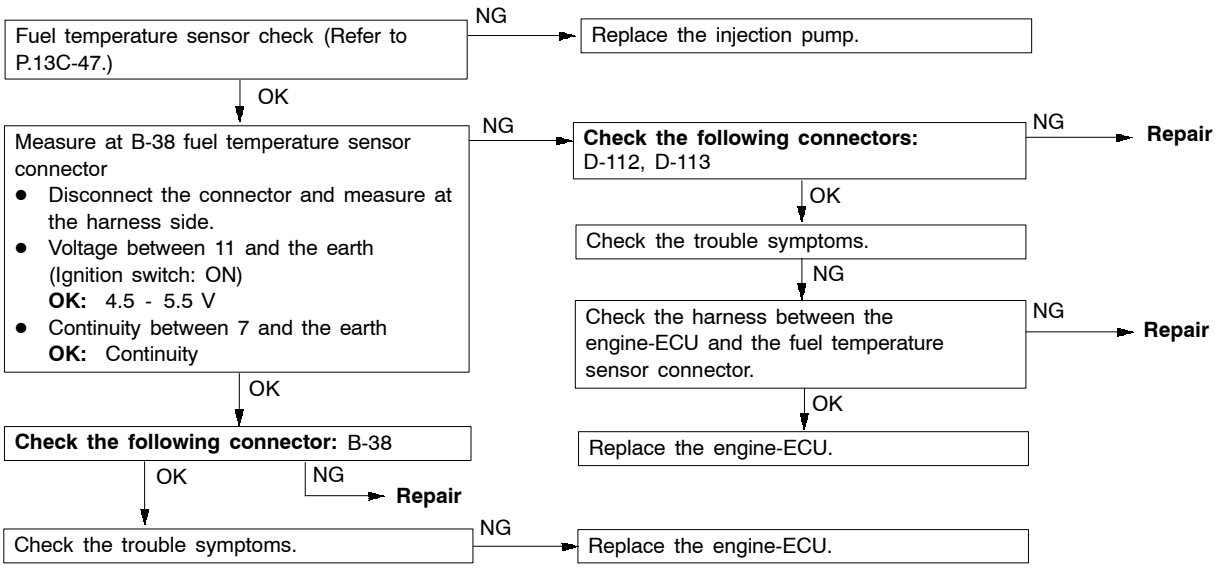
Code No. 12 Boost pressure sensor (boost sensor) system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● Sensor output voltage for one second is 4.5 Vor higher (boost pressure is approximately 306.7kPa). or ● Sensor output voltage for one second is 0.2 Vor lower (boost pressure is approximately 20kPa or lower) Range of Check ● Engine speed is 1600 r/min or higher and the acceleration opening degree is 60% or more. Set Conditions ● Boost pressure is lower than the barometric pressure + 13 kPa for two seconds.	● Boost pressure sensor inoperative ● Boost pressure sensor open circuit, short circuit, or connector contact inoperative ● Boost pressure sensor hose disconnected ● Engine-ECU inoperative



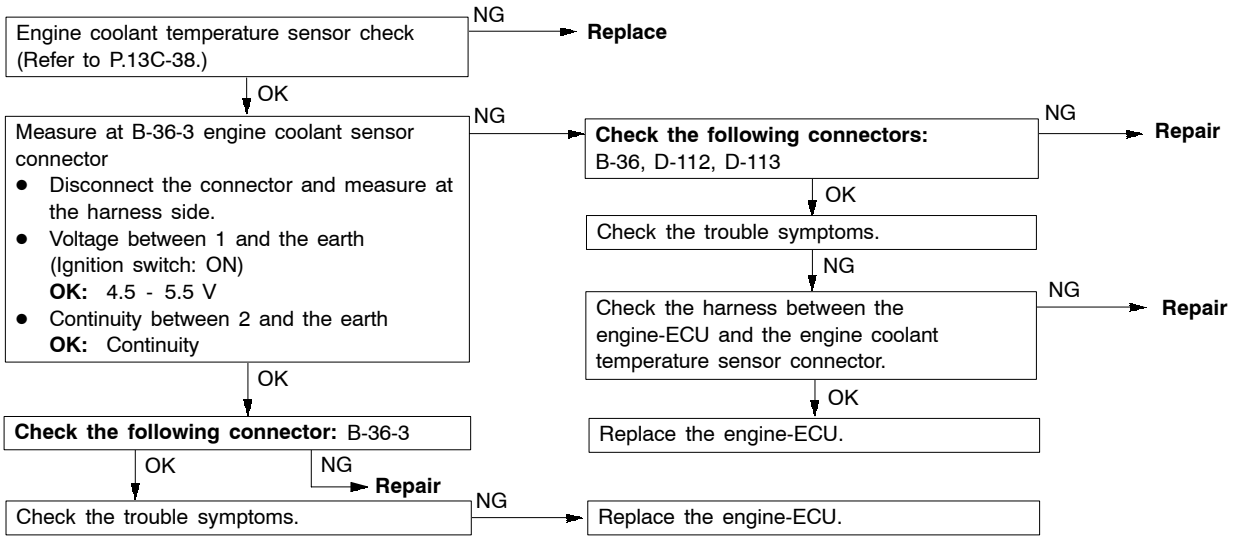
Code No. 13 Barometric pressure sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage is for 3 seconds is 4.5V or higher (the barometric pressure is approximately 120 kPa or over). or ● The sensor output voltage is for 3 seconds is 1.5V or lower (the barometric pressure is approximately 33 kPa or under).	Engine-ECU inoperative

Check the trouble symptoms. → NG → Replace the engine-ECU.

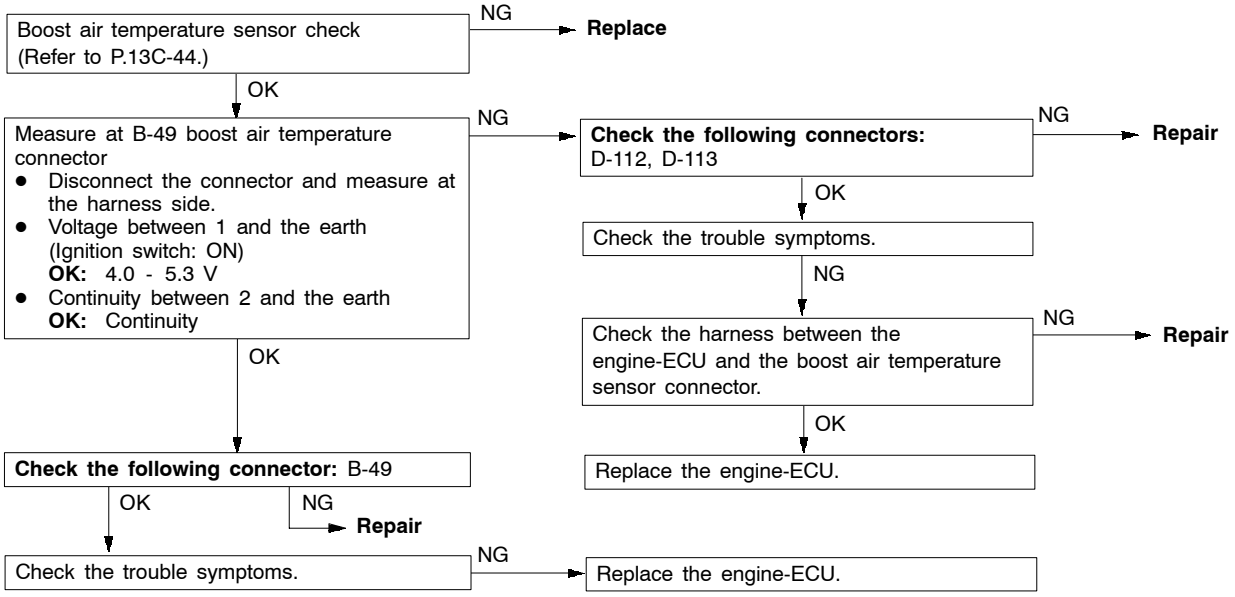
Code No. 14 Fuel temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage for 3 seconds is 0.2V or higher (the fuel temperature is approximately 120°C or higher). or ● The sensor output voltage for 3 seconds is 4.6V or lower (the fuel temperature is approximately 50°C or lower).	● Fuel temperature sensor inoperative ● Fuel temperature sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



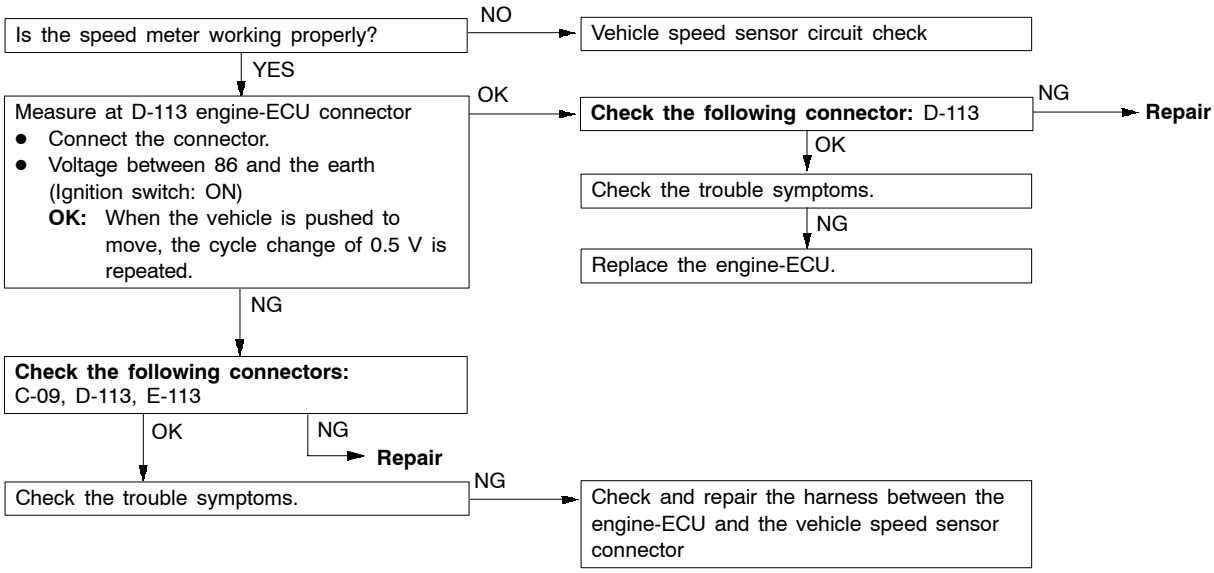
Code No. 15 Engine coolant temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● The sensor output voltage for 3 seconds is 4.9V or higher (the coolant temperature is approximately -45 °C or lower). or ● The sensor output voltage for 3 seconds is 0.2V or lower (the coolant temperature is approximately 140 °C or higher).	● Engine coolant temperature sensor inoperative ● Engine coolant temperature sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



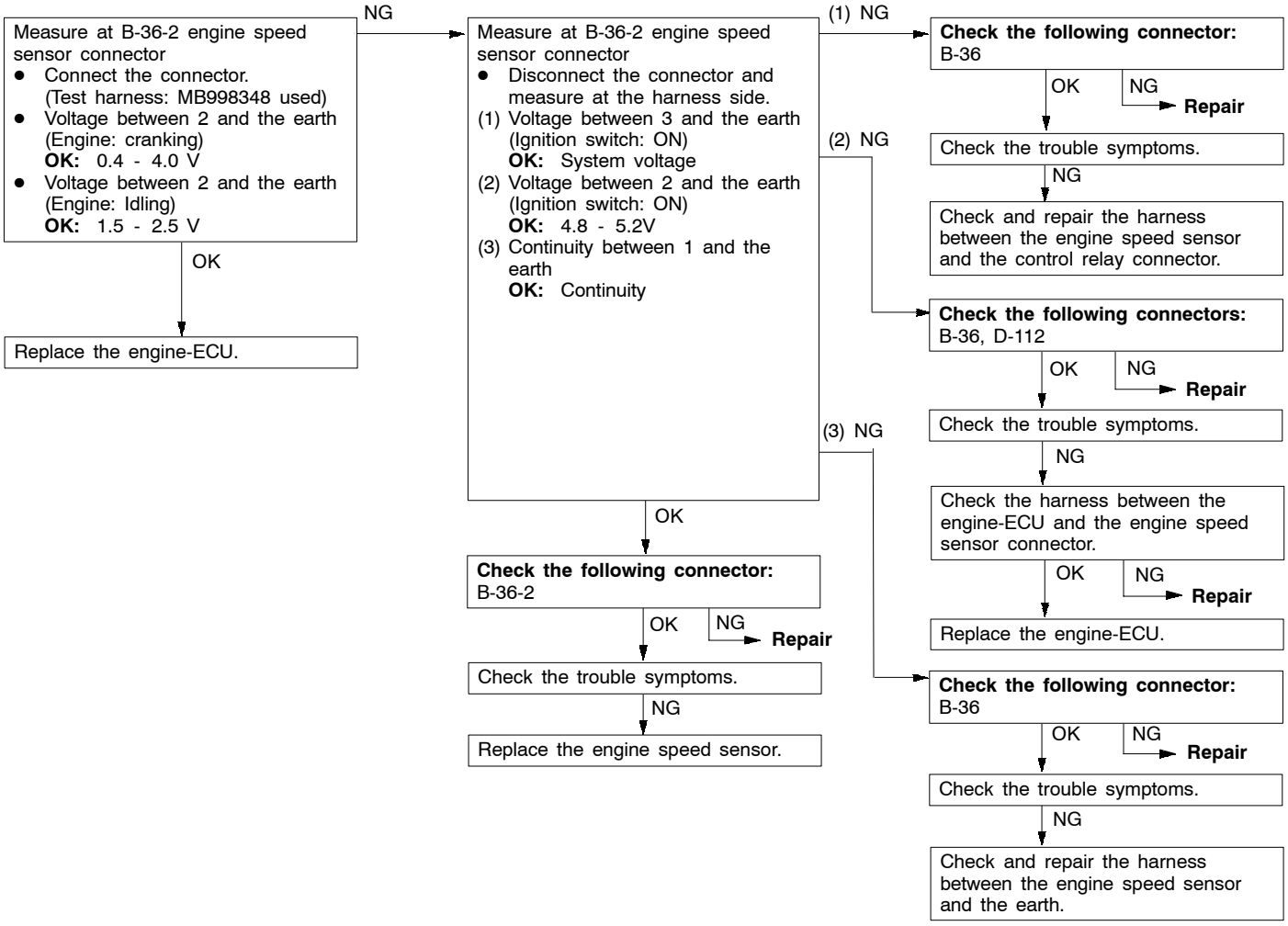
Code No. 16 Boost air temperature sensor (intake air sensor) system	Probable cause
Range of Check ● Ignition switch:ON, except for during engine cranking Set Conditions ● The sensor output voltage for 3 seconds is 4.6V or higher (the coolant temperature is approximately 45 °C or lower). or ● The sensor output voltage for 3 seconds is 0.3V or lower (the coolant temperature is approximately 110 °C or higher).	● Boost air temperature sensor inoperative ● Boost air temperature sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



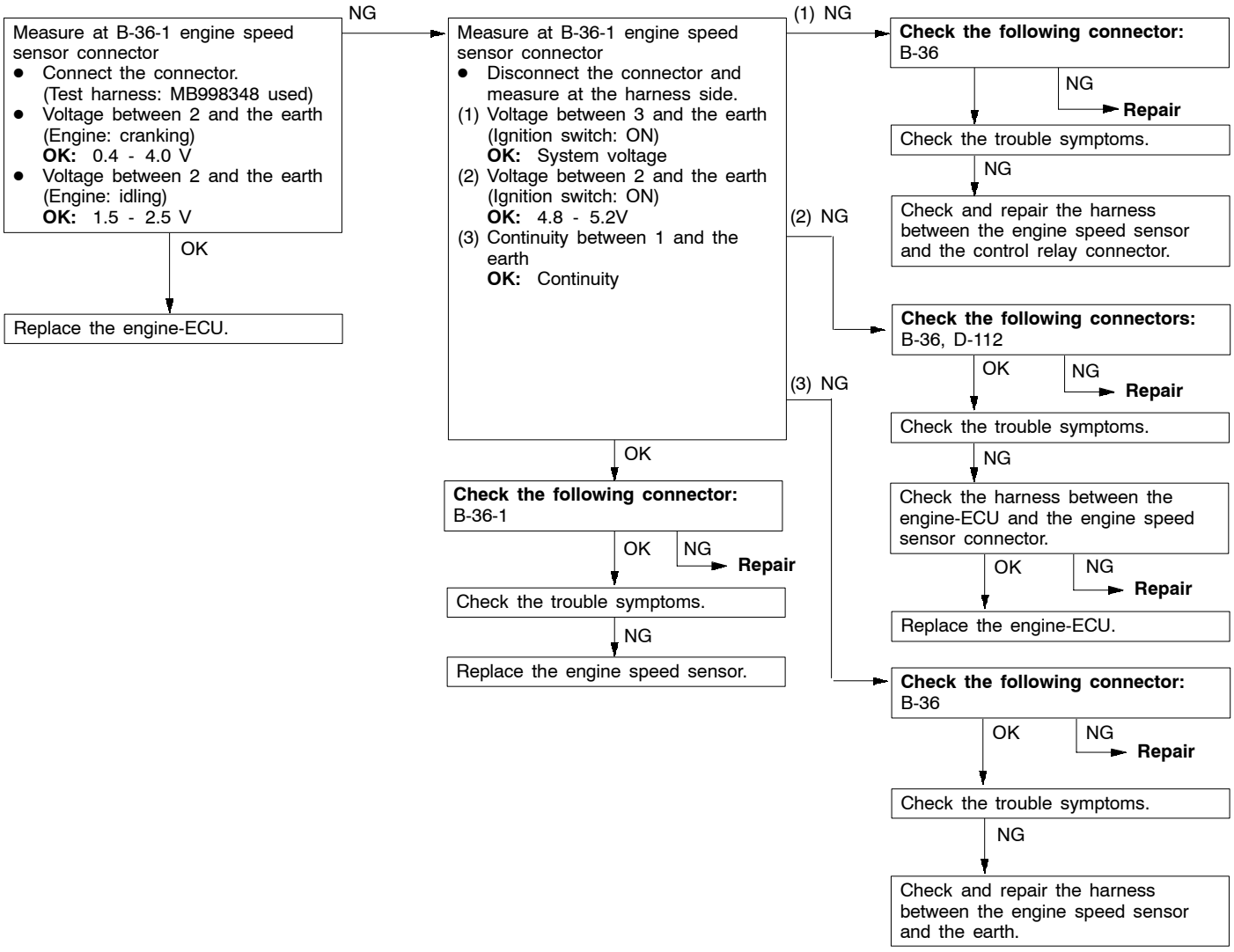
Code No. 17 Vehicle speed sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Engine speed: 2800 r/min or higher ● Driving with heavy load Set Conditions ● Slower than vehicle speed of 3 km/h	● Vehicle speed sensor inoperative ● Vehicle speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



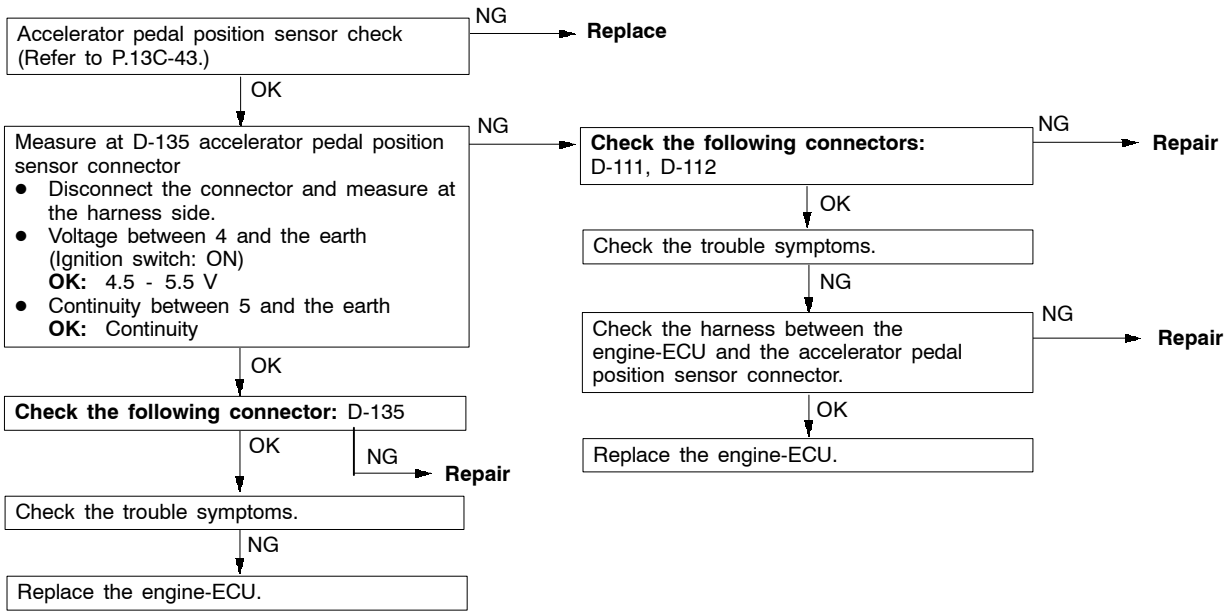
Code No. 18 Engine speed sensor (backup) system	Probable cause
Range of Check ● Except for during engine running and cranking Set Conditions ● The difference in the engine speed sensor output for 4 seconds: 325 r/min or more	● Engine speed sensor inoperative ● Engine speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



Code No. 21 Engine speed sensor system	Probable cause
Range of Check ● During engine cranking Or ● Except for during engine running and cranking Set Conditions ● No change in the sensor output voltage for 3 seconds (no pulse signal has been input). Or ● No change in the engine speed sensor output for 0.06 seconds (for backup), or in the sensor output for 0.3 seconds	● Engine speed sensor inoperative ● Engine speed sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

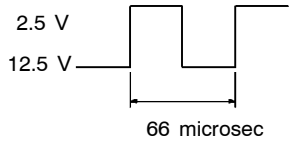


Code No. 23 Idle switch (accelerator pedal position sensor built-in) system	Probable cause
Range of Check Ignition switch: ON, accelerator pedal position sensor (main, sub) operative, except for during engine cranking Set Conditions • For 1 minute idle switch (built-in): ON, accelerator pedal position sensor (main, sub) output voltage 1.875V or higher or 10 minutes • Idle switch (built-in): OFF, accelerator pedal position sensor (main, sub) opening degrees less than 1%	• Accelerator pedal position sensor inoperative • Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative • Idle switch "ON" inoperative • Idle switch signal line short circuit • Engine-ECU inoperative

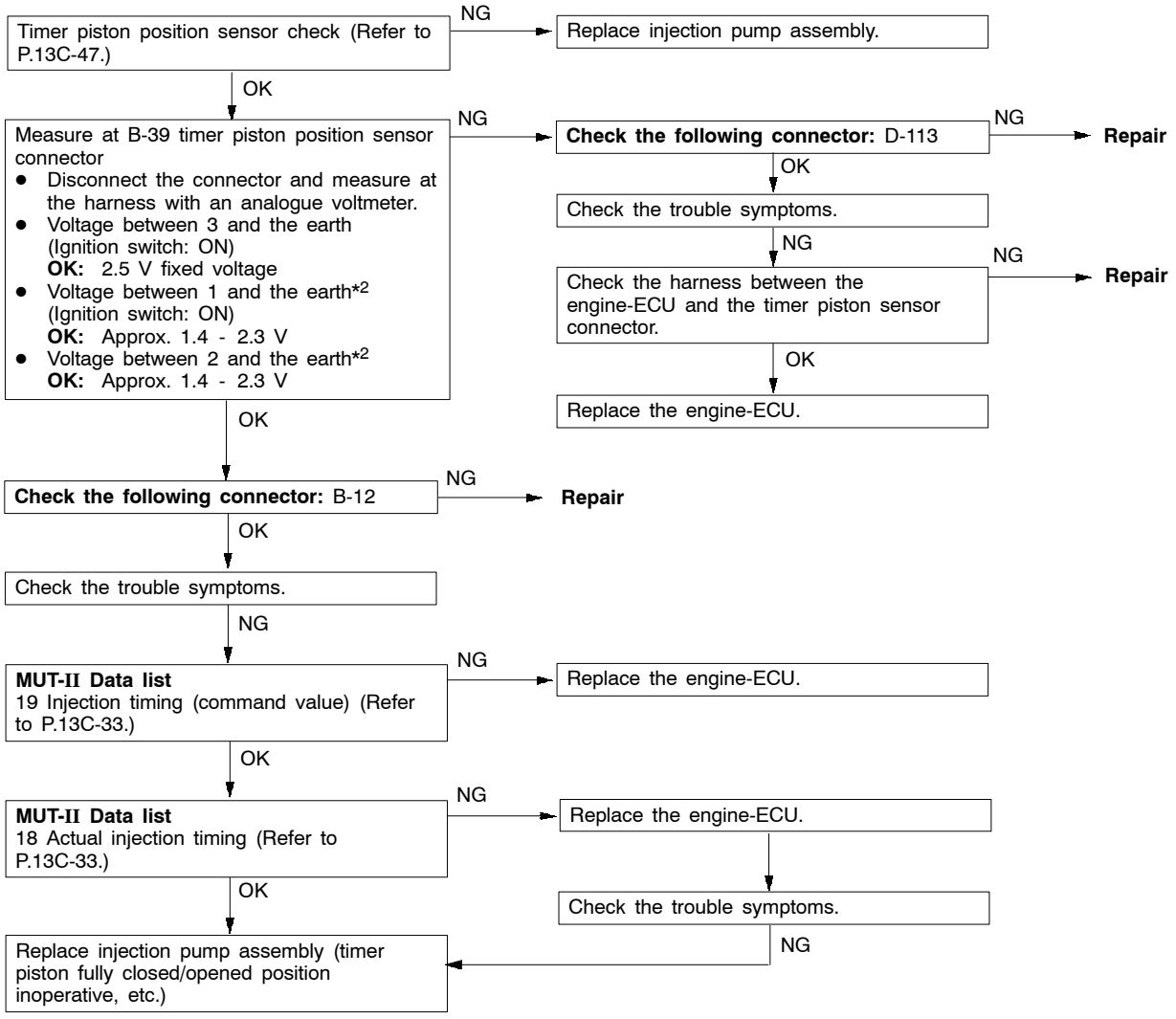


Code No. 25 Timer piston position sensor system	Probable cause
Range of Check ● Ignition switch: OK ● Not during the engine cranking Set Conditions ● The sensor output voltage for 1 second is 4.9V*1 or more or ● The sensor output voltage for 1 second is 0.25V*1 or less	● Timer piston position sensor inoperative ● Timer piston position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative

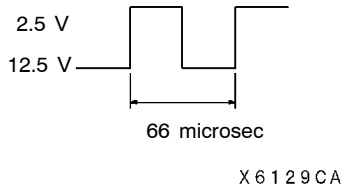
NOTE:
*1: This voltage is derived from the input pulse signal converted in the engine-ECU and cannot be measured.
*2: This voltage is shown as a square wave with a cycle of 66 mircosec (High: 2.5V, Low: 1.25V).



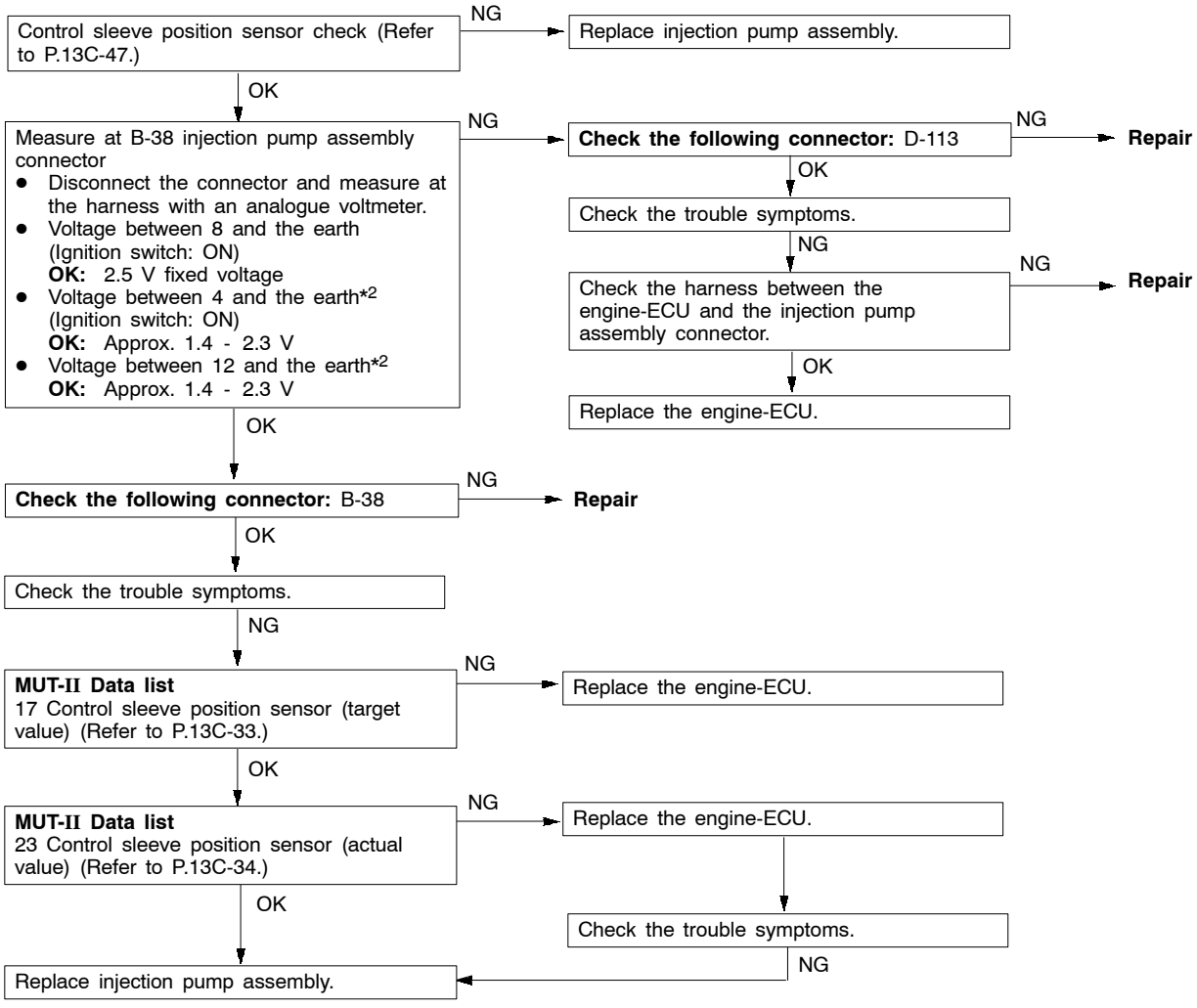
X6129CA



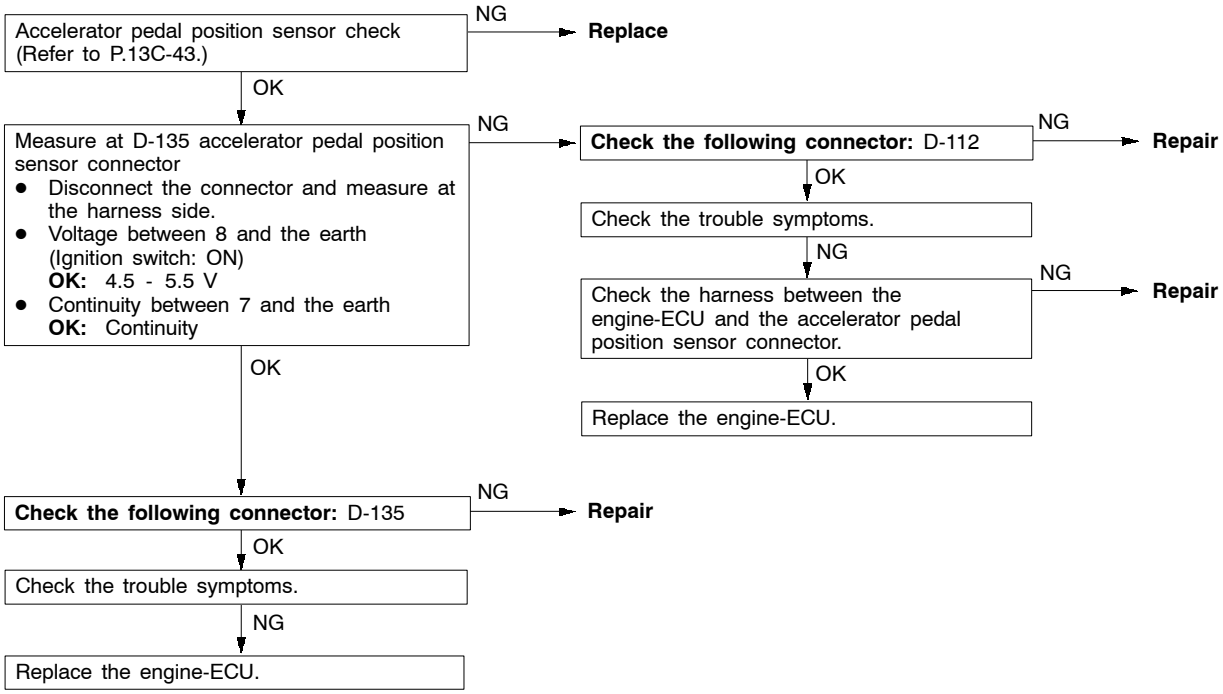
Code No. 26 Control sleeve position sensor system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage for 1 second is 4.7V*1 or more or ● The sensor output voltage for 1 second is 0.25V*1 or less	● Control sleeve position sensor inoperative ● Control sleeve position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



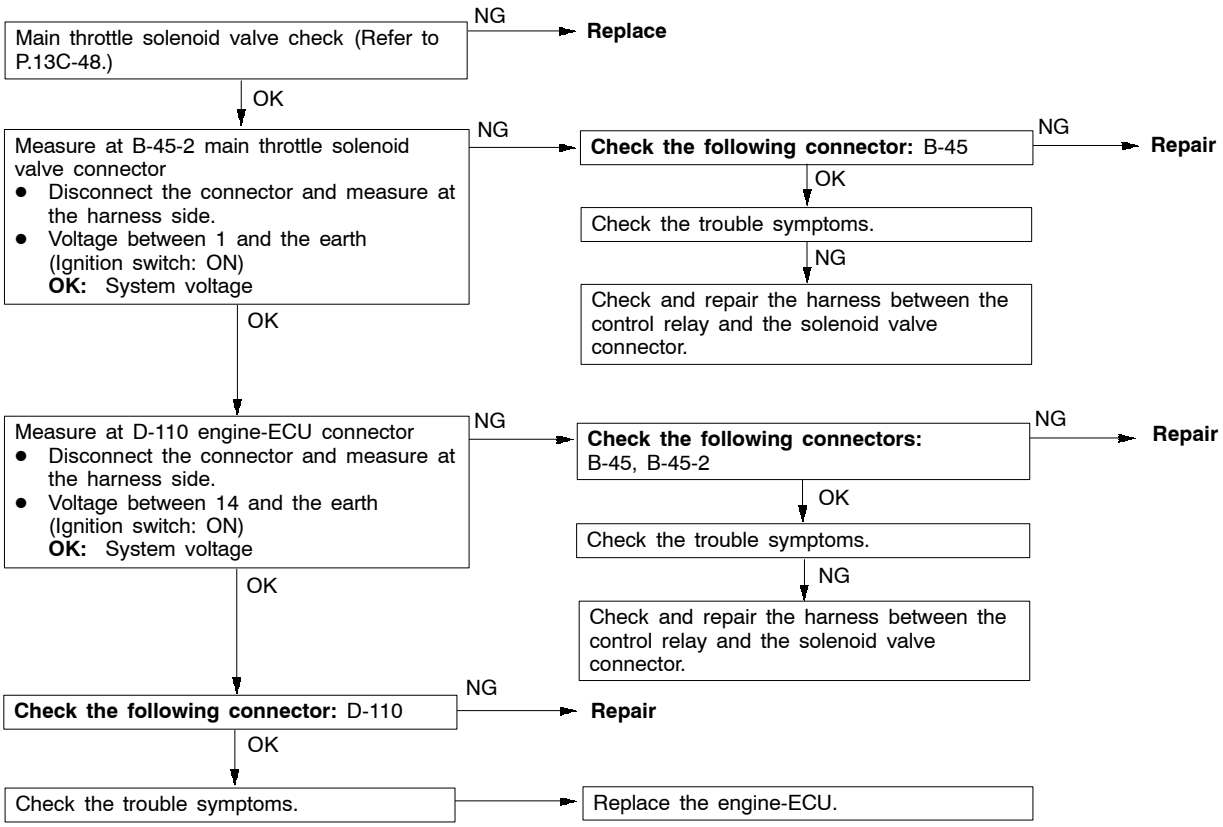
NOTE:
*1: This voltage is derived from the input pulse signal converted in the engine-ECU and cannot be measured.
*2: This voltage is shown as a square wave with a cycle of 16.7 microsec (High: 2.5V, Low: 1.25V.)



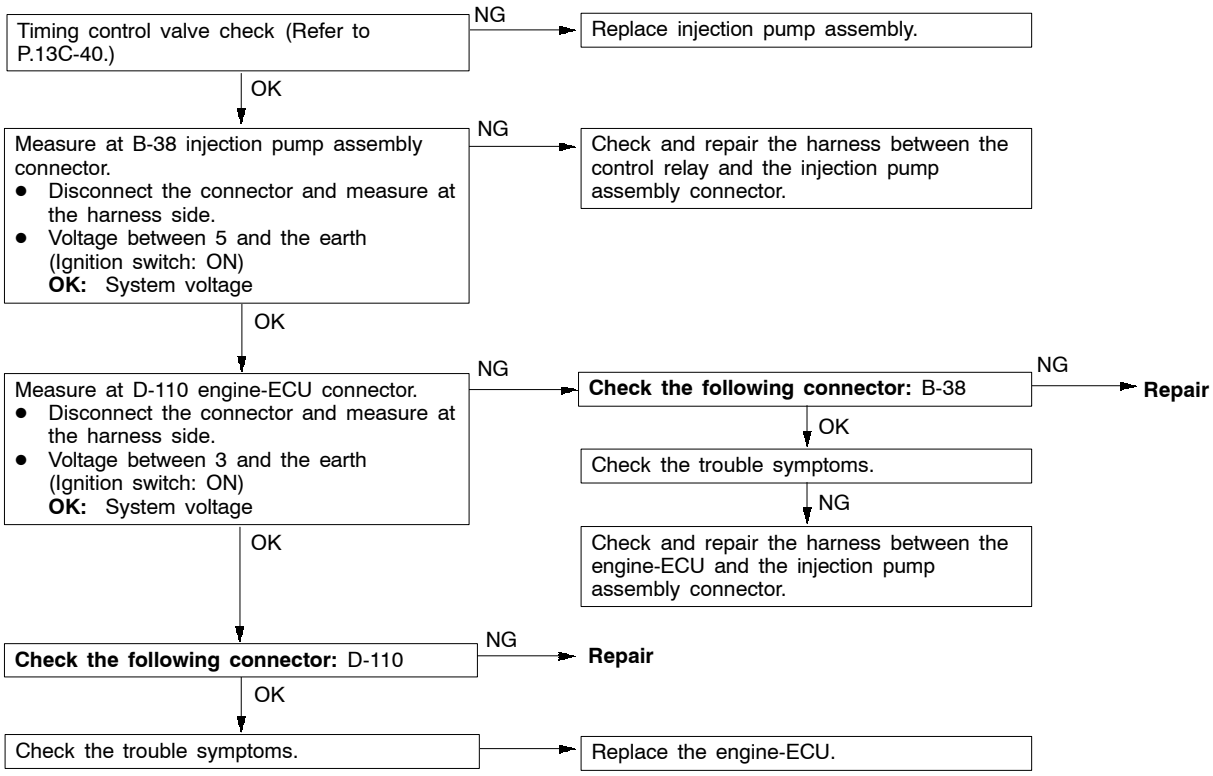
Code No. 27 Accelerator pedal position sensor (sub) system	Probable cause
Range of Check ● Ignition switch: ON, accelerator pedal position sensor (main) operative, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (main) for 1 second is 0.2V or higher and lower than 2.5V. Output voltage of accelerator pedal position sensor (sub) for 1 second is 4.5V or higher, or lower than 0.2V. Range of Check ● Ignition switch: ON, except for during engine cranking Set Conditions ● Output voltage of accelerator pedal position sensor (main, sub) for 1 second is 0.2 V or higher or lower than 4.5V. The difference in the output sensor voltage between the main and the sub sensor is 1V or higher, or the idle switch ON, and sensor main output voltage is 1.875V or higher.	● Accelerator pedal position sensor inoperative ● Accelerator pedal position sensor open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



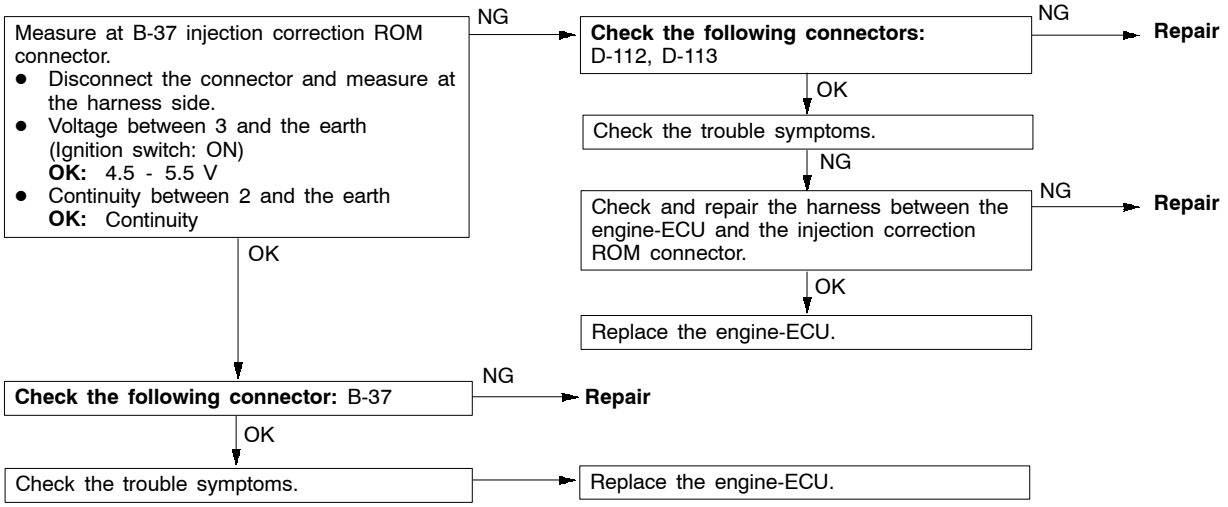
Code No. 41 Main throttle solenoid valve system	Probable cause
Range of Check ● Engine speed is 1600 r/min or higher and the acceleration opening degree is 60% or more. Set Conditions ● Boost pressure is lower than barometric pressure + 30 kPa for two seconds. Range of Check ● With the idling speed controlled, the engine warmed up, and no failure found Set Conditions ● Boost pressure is higher than barometric pressure - 2.7 kPa for 3 seconds.	● Main throttle solenoid valve inoperative ● Main throttle solenoid valve open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



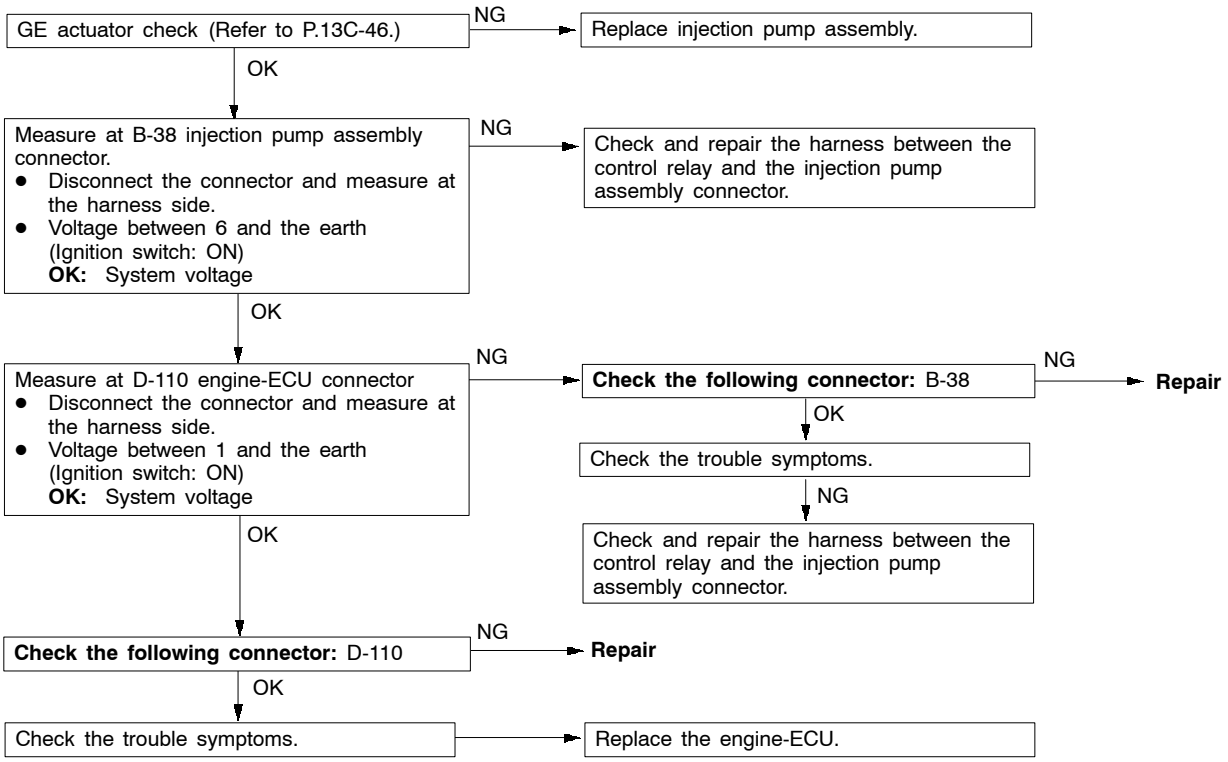
Code No. 43 Timing control valve system	Probable cause
Range of Check ● Engine coolant temperature 80 °C or higher and the engine running Set Conditions ● Target value minus actual value is 1 V or more.	● Timing control valve inoperative ● Timing control valve open circuit, short circuit, or connector contact inoperative ● Engine-ECU inoperative



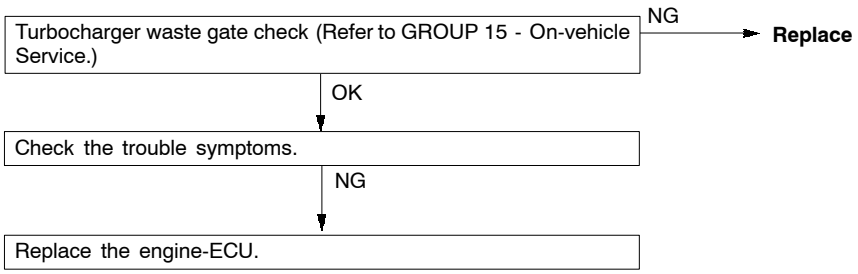
Code No. 46 Injection correction ROM system	Probable cause
Range of Check • Ignition switch: ON Set Conditions • When communication fails	• Injection correction ROM inoperative • Engine-ECU inoperative



Code No. 48 GE actuator (in the middle of control sleeve position sensor inoperative) system	Probable cause
Range of Check • Ignition switch: ON Set Conditions • Target value minus actual value is 1 V or more.	• Control sleeve position sensor inoperative • GE actuator inoperative • Control sleeve position sensor open circuit, short circuit, or connector contact inoperative • Engine-ECU inoperative

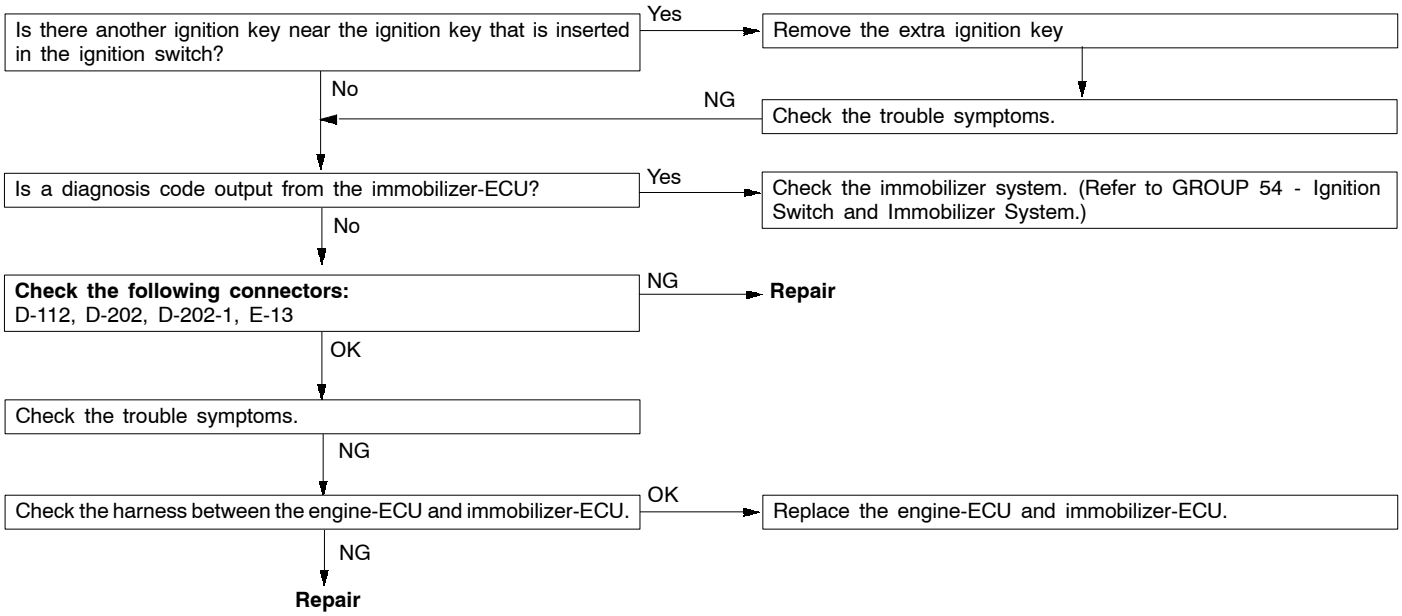


Code No. 49 Over boost	Probable cause
Range of Check ● Ignition switch: ON, except during engine cranking Set Conditions ● Boost pressure is higher than 305 kPa for 1 second.	● Malfunction of the turbocharger waste gate ● Engine-ECU inoperative



Code No. 54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of encrypted codes ● Incorrect encrypted code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Engine-ECU inoperative

NOTE
(1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.



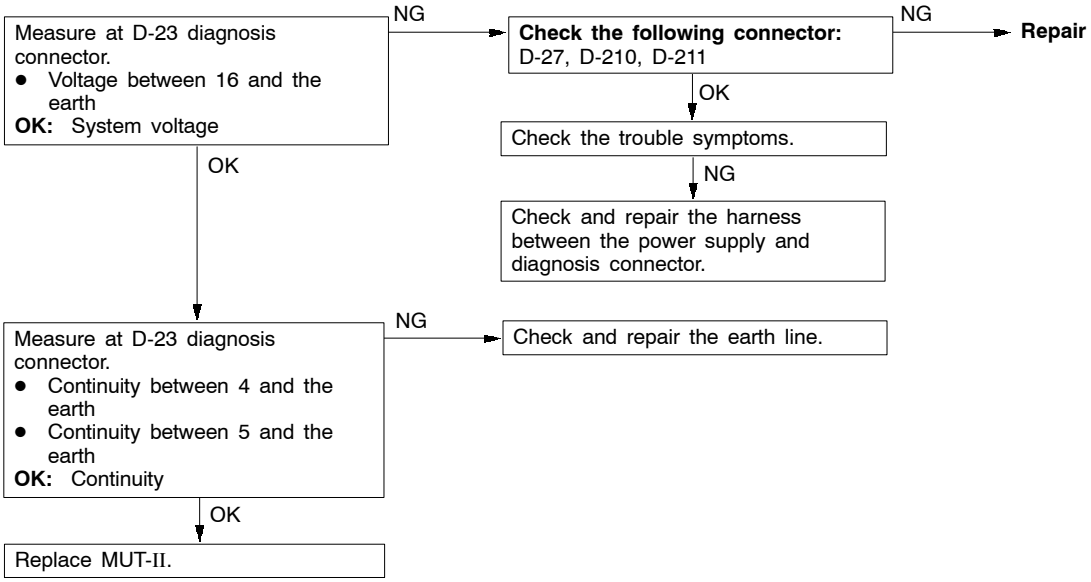
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble Symptom		Inspection procedure No.	Reference page
No communication can be established between MUT-II and the engine-ECU.	No communication can be established with all systems.	1	13C-24
	No communication can be established only with the engine-ECU.	2	13C-24
Engine warning lamp related	Immediately after the ignition switch is “ON”, the engine warning lamp does not turn on.	3	13C-25
	The engine warning lamp keeps on and does not turn off.	4	13C-25
Starting performance	No initial combustion (unable to start)	5	13C-26
	Starting performance is bad when the engine is cold (difficult to start)	6	13C-26
	Starting performance is bad regardless of when the engine is hot or cold (difficult to start)	7	13C-26
Idling stability (idling inoperative)	Low idling speed when the engine is cold (improper idling speed)	8	13C-27
	High idling speed (improper idling speed)	9	13C-27
	Low idling speed (improper idling speed)	10	13C-27
	Idling instable (rough idling, hunting)	11	13C-28
Idling stability (idling sustainment inoperative)	The engine halts after running for a while.	12	13C-28
	The engine halts during idling.	13	13C-29
Driveability	Lack of output power	14	13C-29
	Occurrence of abnormal knocking	15	13C-29
	Abnormal black smoke	16	13C-30
	Abnormal white smoke	17	13C-30
	Hunting during driving	18	13C-31

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

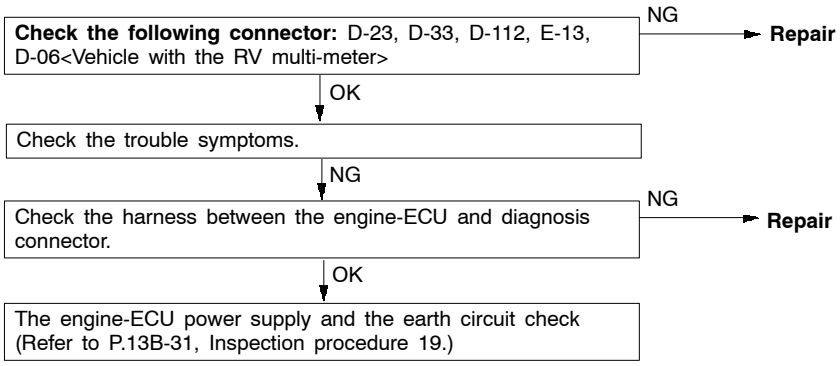
Inspection procedure 1

No communication can be established between MUT-II and all systems.	Probable cause
Probable cause can be found in troubles with the power supply circuit and the earth circuit to the diagnosis connector.	• Diagnosis connector inoperative • Harness inoperative



Inspection procedure 2

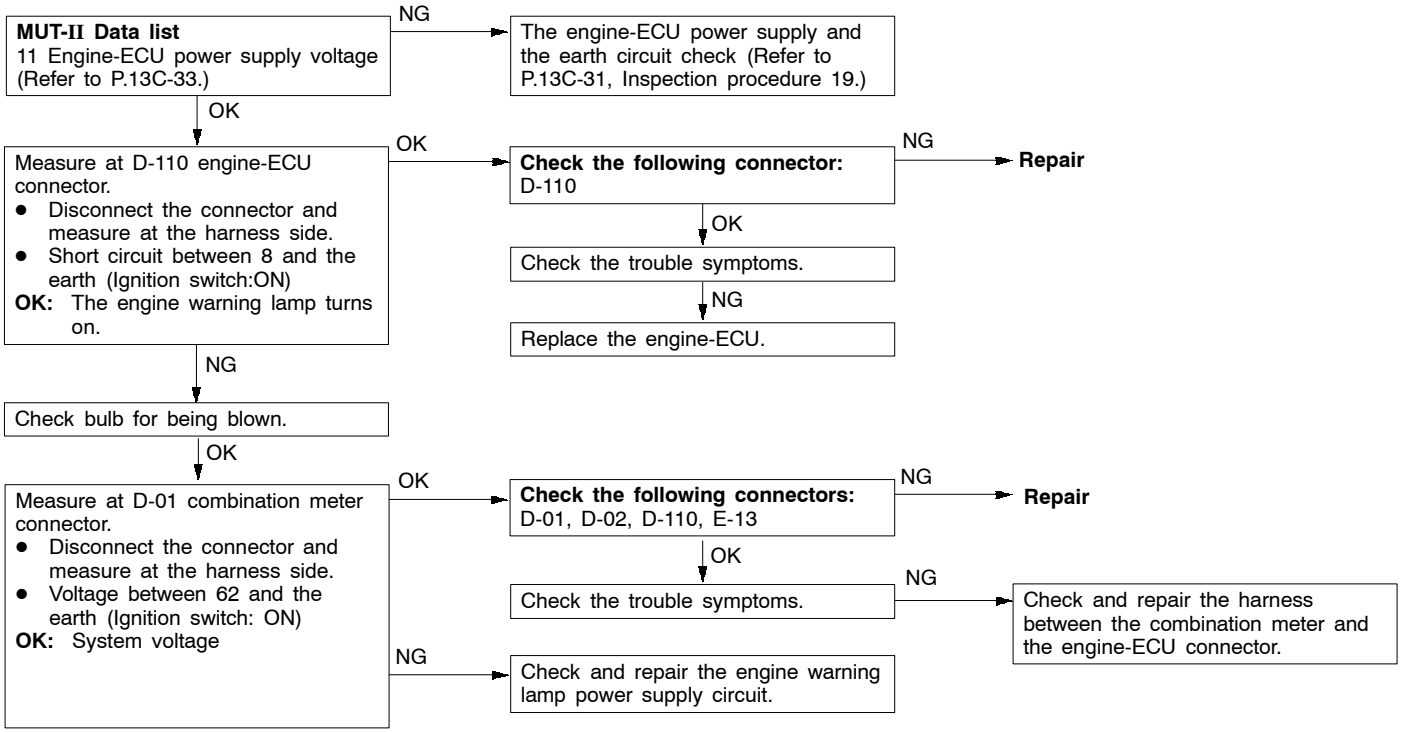
No communication can be established between MUT-II and the engine-ECU.	Probable cause
Probable causes are shown in the following: • The power is not supplied to the engine-ECU. • The earth circuit of the engine-ECU inoperative • The engine-ECU inoperative • Communication between the engine-ECU and MUT-II inoperative	• The power supply circuit of the engine-ECU inoperative • Engine-ECU inoperative • Open circuit at the harness between the engine-ECU and the diagnosis connector



NOTE
If the trouble symptoms persist even after implementing the above-mentioned inspection procedure to the vehicle with center display, check the center display and replace it if necessary. (Refer to GROUP 54A - Clock or Center display.)

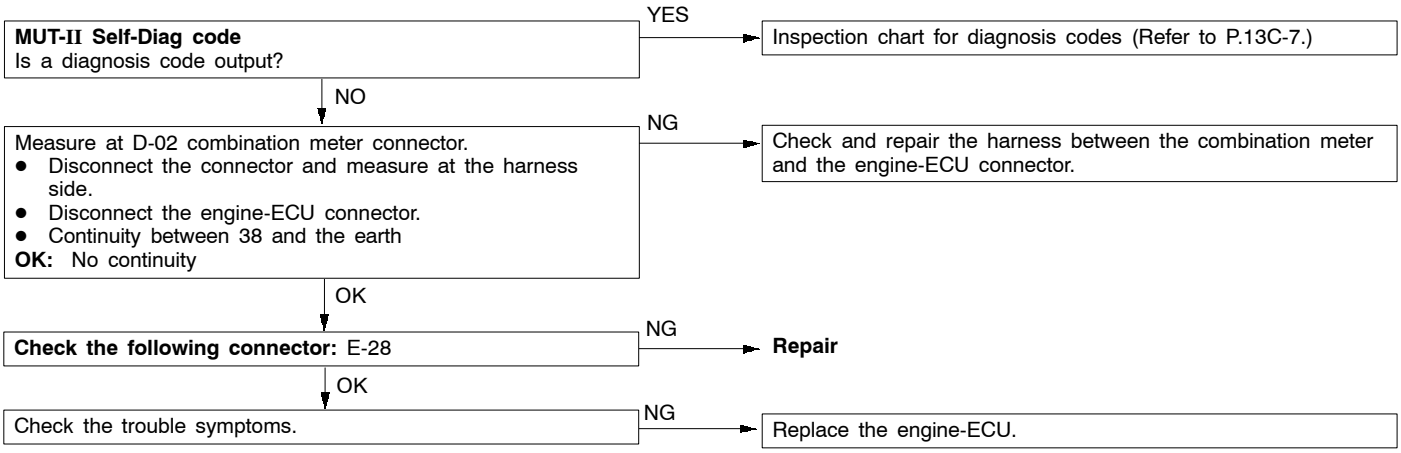
Inspection procedure 3

Immediately after the ignition switch is "ON", the engine warning lamp does not turn on.	Probable cause
The engine-ECU turns on the engine warning lamp for 5 seconds immediately after turning on the ignition switch to check the bulb for being blown. If the engine warning lamp does not turn on immediately after turning the ignition switch ON, problems shown in the right could exist.	• The engine warning lamp blown • The engine warning lamp circuit inoperative • Engine-ECU inoperative



Inspection procedure 4

The engine warning lamp keeps on and does not turn off.	Probable cause
The probable causes can be found in either the engine-ECU detecting the malfunction in the sensor and/or the actuator, or the problem shown in the right takes place.	• Short circuit at the harness between the engine warning lamp and the engine-ECU • Engine-ECU inoperative



Inspection procedure 5

No initial combustion (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, glow system, and power supply system.	• Control system inoperative • Injection pump inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-30, 37.)
OK → Check the following items in order:
- Glow plug, glow plug relay
- Battery
- Injection nozzle
- Injection pump
- Compression pressure
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

Inspection procedure 6

Starting performance is bad when the engine is cold (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and glow system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37)
OK → Inspect the following items in order:
- Glow plug, glow plug relay
- Injection nozzle, fuel filter
- Throttle body assembly
- Existence of starter switch signal input
- Engine oil
- Injection pump
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

Inspection procedure 7

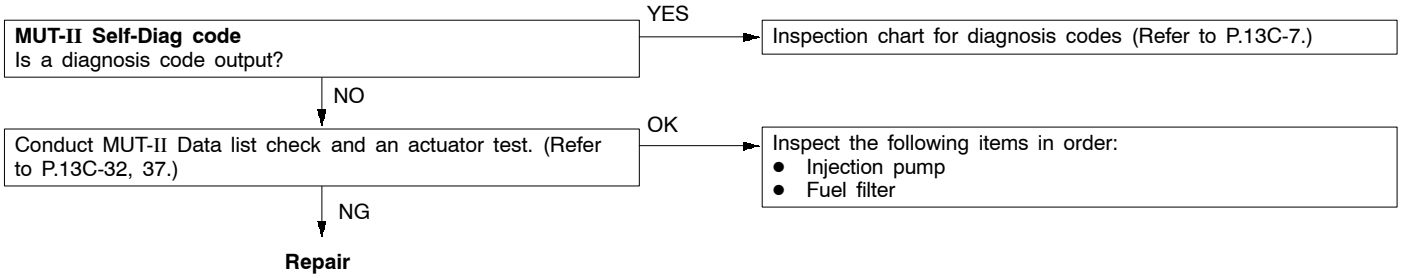
Starting performance is bad regardless of whether the engine is hot or cold (unable to start)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and intake system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Injection nozzle, fuel filter
- Throttle body
- Compression pressure
- Injection pump
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

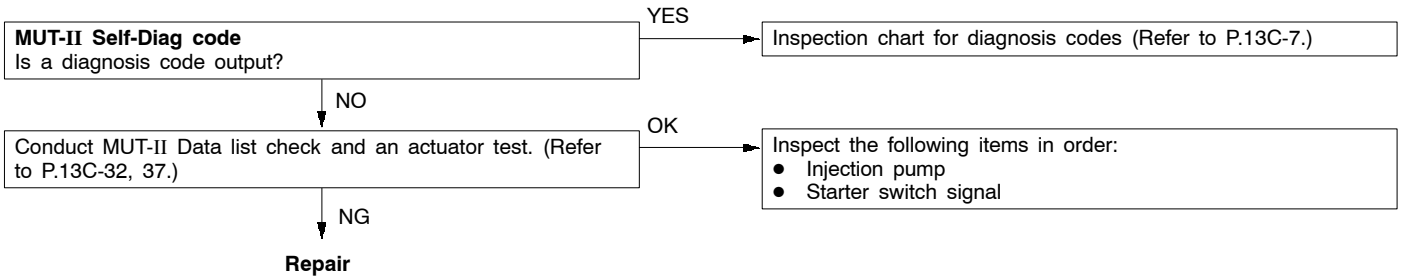
Inspection procedure 8

Low idling speed when the engine is cold (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative



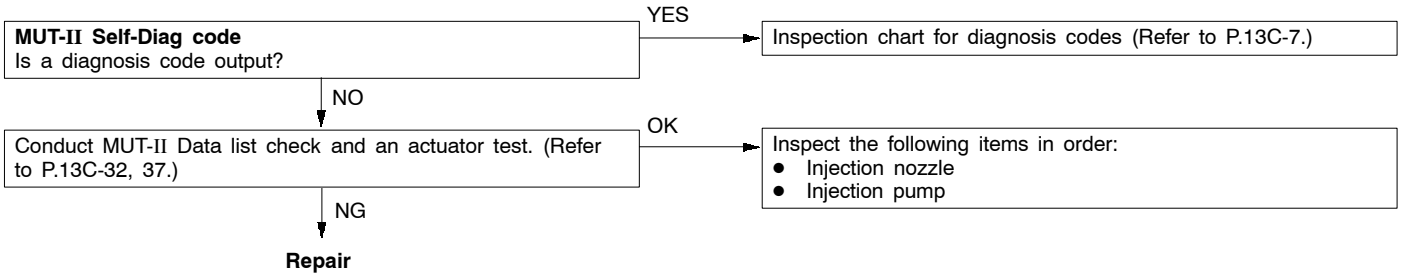
Inspection procedure 9

High idling speed (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system and injection pump.	• Control system inoperative • Injection pump inoperative • Engine-ECU inoperative



Inspection procedure 10

Low idling speed (improper idling speed)	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative



Inspection procedure 11

Idling instable (rough idling, hunting)	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, glow system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Glow system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
- YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
- NO ↓

Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
- OK → Inspect the following items in order:
  - Glow plug, glow plug relay
  - EGR system
  - Injection nozzle
  - Compression pressure
  - Valve clearance
  - Throttle body assembly
  - Injection timing
  - Fuel line bleeding
  - Injection pump
- NG ↓

Repair

Inspection procedure 12

The engine stalls after running for a while.	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and intake system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
- YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
- NO ↓

Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
- OK → Inspect the following items in order:
  - Throttle body assembly
  - Fuel filter
  - Injection pump
- NG ↓

Repair

Inspection procedure 13

The engine stalls during idling.	Probable cause
Probable causes can be found in troubles with control system, injection pump, intake system, EGR system, and power supply.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Power supply system
- Throttle body assembly
- EGR system
- Injection pump

NG ↓
Repair

Inspection procedure 14

Lack of output power	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Injection nozzle, fuel filter
- Throttle body assembly
- EGR system
- Turbocharger
- Compression pressure
- Injection timing
- Injection pump
- Existence of mixing foreign objects (water, kerosene) with the fuel

NG ↓
Repair

Inspection procedure 15

Occurrence of abnormal knocking	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Injection nozzle
- Injection timing
- EGR system
- Injection pump

NG ↓
Repair

Inspection procedure 16

Abnormal black smoke	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, and EGR system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Air cleaner
- Injection nozzle
- Throttle body assembly
- EGR system
- Turbocharger
- Injection pump

NG ↓
Repair

Inspection procedure 17

Abnormal white smoke	Probable cause
Probable causes can be found in troubles with control system, injection pump, fuel system, intake system, EGR system, and glow system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Intake system inoperative • EGR system inoperative • Glow system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Glow plug, glow plug relay
- Injection nozzle
- Throttle body assembly
- EGR system
- Turbocharger
- Injection pump

NG ↓
Repair

Inspection procedure 18

Hunting during driving	Probable cause
Probable causes can be found in troubles with control system, injection pump, and fuel system.	• Control system inoperative • Injection pump inoperative • Fuel system inoperative • Engine-ECU inoperative

MUT-II Self-Diag code
Is a diagnosis code output?
YES → Inspection chart for diagnosis codes (Refer to P.13C-7.)
NO ↓
Conduct MUT-II Data list check and an actuator test. (Refer to P.13C-32, 37.)
OK → Inspect the following items in order:
- Injection nozzle
- Injection pump

NG ↓
Repair

Inspection procedure 19

Engine-ECU power supply and earth circuit check

Measure at D-110, D-111, D-112 engine-ECU connectors.
- Disconnect the connector and measure at the harness side.

(1) Voltage between 82 and the earth (Ignition switch: ON)
OK: System voltage
(2) Voltage between 46 and the earth
OK: System voltage
(3) Voltage between 12, 25 and the earth (Ignition switch: ON)
OK: System voltage (When terminal 62 is short circuited to the earth)
(4) Continuity between 13, 26 and the earth
OK: Continuity
(5) Voltage 80 and the earth
OK: System voltage

(1) NG → **Check the following connector:** D-208, D-223, E-13 — NG → **Repair**
OK ↓
Check the trouble symptoms.
NG ↓
(2), (3) NG → Check the harness between the engine-ECU and the ignition switch. — NG → **Repair**
OK ↓
(4) NG → Ignition switch check
(5) NG → **Check the following connector:** D-21 — NG → **Repair**
OK ↓
Check the trouble symptoms. — NG → Check and repair the harness between the engine-ECU and the control relay connector.

OK ↓
Check the following connectors: D-110, D-111, D-112
OK ↓
Check the trouble symptoms.
NG ↓
Replace the engine-ECU.

NG → Check and repair the harness between the engine-ECU and the earth.
NG → **Check the following connectors:** D-27, E-13 — NG → **Repair**
OK ↓
Check the trouble symptoms. — NG → Check and repair the harness between the engine-ECU and the battery.

NG → **Repair**

DATA LIST REFERENCE TABLE

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
01	Boost air temperature sensor	Ignition switch: ON or the engine running	When the intake air temperature is -20°C	-20°C	Code No. 16	13C-11
			When the intake air temperature is 0°C	0°C		
			When the intake air temperature is 20°C	20°C		
			When the intake air temperature is 40°C	40°C		
			When the intake air temperature is 80°C	80°C		
02	Engine coolant temperature sensor	Ignition switch: ON or the engine running	When the engine coolant temperature is -20°C	-20°C	Code No. 15	13C-11
			When the engine coolant temperature is 0°C	0°C		
			When the engine coolant temperature is 20°C	20°C		
			When the engine coolant temperature is 40°C	40°C		
			When the engine coolant temperature is 80°C	80°C		
03	Barometric pressure sensor	Ignition switch: ON	Altitude 0 m	101 kPa	Code No. 13	13C-10
			Altitude 600 m	95 kPa		
			Altitude 1,200 m	88 kPa		
			Altitude 1,800 m	81 kPa		
04	Boost pressure sensor	• Engine coolant temperature: 80 - 95 °C • Lamps, electrical cooling fan, and accessories: OFF • Transmission: P range • Ignition switch: ON	Altitude 0 m	101 kPa	Code No. 12	13C-9
			Altitude 600 m	95 kPa		
			Altitude 1,200 m	88 kPa		
			Altitude 1,800 m	81 kPa		
			Idling	81 - 109 kPa		
			When sudden racing is done	Increased		
05	Fuel temperature sensor	Ignition switch: ON or the engine running	When the fuel temperature is -20°C	-20°C	Code No. 14	13C-10
			When the fuel temperature is 0°C	0°C		
			When the fuel temperature is 20°C	20°C		
			When the fuel temperature is 40°C	40°C		
			When the fuel temperature is 80°C	80°C		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
06	Vehicle speed sensor	When driving	Compare the engine speed displayed in the speed meter with that in MUT-II	Matched	Code No. 17	13C-12
07	Engine speed sensor (backup)	Engine: Cranking	Compare the engine speed displayed in the tachometer with that in MUT-II	Matched	Code No. 18	13C-13
		Engine: Idling				
08	Engine speed sensor	Engine: Cranking	Compare the engine speed displayed in the tachometer with that in MUT-II	Matched	Code No. 21	13C-14
		Engine: Idling				
09	Accelerator pedal position sensor (main)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1V	Code No. 11	13C-8
			Accelerator pedal: Fully opened position	4.1 V or higher		
10	Idle switch	Ignition switch: ON	Release the foot from the accelerator pedal.	0 - 1V	Code No. 23	13C-15
			Step on the accelerator pedal slightly	4V or higher		
11	System voltage	Ignition switch: ON		System voltage	Procedure No. 19	13C-31
13	Timing control valve*1	Engine: After warming up the engine	Idling	0%*1	Code No. 25 or No. 43	13C-16 13C-20
			2,500 r/min	35 - 45%*1		
			High idling	20 - 30%*1		
14	EGR command value	Engine: Idling		0 - 100%*2	–	-
		Engine: After warming up the engine				
17	Control sleeve position (target value)	Engine: After warming up the engine	Idling	1.535 - 1.735 V	Code No. 26	13C-17
			2,500 r/min	Slightly decreased.		
			High idling	1.884 - 2.084 V		
18	Actual injection timing	Engine: After warming up the engine	Idling	0.65 - 0.85 V	–	–
			2,500 r/min	2.325 - 2.525 V		
			High idling	3.814 - 4.014 V		
19	Injection timing command value	Engine: After warming up the engine	Idling	0.3 - 0.5 V	–	–
			2,500 r/min	2.325 - 2.525 V		
			High idling	3.814 - 4.014 V		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
21	GE actuator	Engine: After warming up the engine	Idling	20 - 30%	Code No. 26 or No. 48	13C-17 13C-21
			2,500 r/min	20 - 30%		
			High idling	20 - 29%		
22	EGR duty value	Engine: Idling		0 - 100%*2	–	–
		Engine: After warming up the engine				
23	Control sleeve position (actual value)	Engine: After warming up the engine	Idling	1.535 - 1.735 V	Code No. 26	13C-17
			2, 500 r/min	Slightly decreased.		
			High idling	1.884 - 2.084 V		
24	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1 V	Code No. 27	13C-18
			Accelerator pedal: Fully opened position	4.1V or higher		
25	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	0%	Code No. 27	13C-18
			Accelerator pedal: Fully opened position	99 - 100%		

NOTE
*1: The opening degree of the timing control valve is converted into percentage. (0%: timer non-advanced angle, 100%: timer maximum advanced angle)
*2: The opening degree of the EGR solenoid valve is converted into percentage.

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
41	Idle switch	Ignition switch: ON (check by repeated accelerator operation)	Release the foot from the accelerator pedal.	ON	–	–
			Step on the accelerator pedal slightly.	OFF		
43	A/C switch	Engine: Idling (The A/C compressor should be in operation when the A/C switch is "ON")	A/C switch: ON	ON	–	–
			A/C switch: OFF	OFF		
44	Ignition switch-ST	Ignition switch: ON	Engine: Stop	OFF	–	–
			Engine: Cranking	ON		
45	Ignition switch-IG	Ignition switch: ON		ON	–	–
46	Control relay	Ignition switch: ON		ON	–	–
47	A/C relay	Engine: Idling after warming up the engine	A/C switch: OFF	OFF (A/C compressor clutch not in operation)	–	–
			A/C switch: ON	ON (A/C compressor clutch in operation)		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
50	Condenser fan relay	Ignition switch: ON	A/C switch: OFF (engine coolant temperature at 109°C or higher) A/C switch: ON (engine coolant temperature at 109°C or higher or no higher than 109°C and the vehicle speed at 60 km/h or slower)	ON	–	–
			A/C switch: OFF (engine coolant temperature at 109°C or lower) A/C switch: ON (engine coolant temperature at 109°C or lower or no higher than 109°C and the vehicle speed at 60 km/h or faster)	OFF		
52	Glow plug relay	Ignition switch: OFF → ON	Engine coolant temperature at 60°C or lower	ON	–	–
			Engine coolant temperature at 60°C or higher	OFF		
53	Main throttle solenoid valve	Ignition switch: ON (Engine stops)		OFF	–	–
		Engine: Idling after warming up the engine		ON		
54	Sub throttle solenoid valve	Engine: Idling after warming up the engine		OFF	–	–
		Engine: Idling → Stop (within 3 seconds)		ON		
55	Engine warning lamp	Ignition switch: OFF → ON		ON (For 5 seconds)	Procedure No. 3	13C-25
56	Glow lamp	Ignition switch: OFF → ON	The engine coolant temperature at 60°C or lower	ON	–	–
			The engine coolant temperature at 60°C or higher	OFF		

Item No.	Check item	Inspection conditions		Value to be determined as normal	Code No. or inspection procedure No.	Reference page
58	Neutral switch	Ignition switch: ON	N, P range	N, P	–	–
			None of the above	D, R		
60	Fuel cut relay	Ignition switch: ON → OFF afterwards for a certain period of time		ON	–	–
		None of the above		OFF		
61	EGR control solenoid valve No. 2	Turning off EGR quickly		ON	–	–
		None of the above		OFF		
62	AT/MT switch	Ignition switch: ON	Vehicles with A/T	A/T	–	–
			Vehicles with M/T	M/T		
68	A/C switch 2	A/C: Under high load or low load		ON	–	–
		A/C: OFF or under medium load		OFF		
69	Warm up switch	● Warm up switch: ON ● Heater temperature setting: Maximum ● Engine coolant temperature: 90°C or lower ● Blower fan: ON		ON	–	–
		None of the above		OFF		
70	PTC heater	● Warm up switch: ON ● Heater temperature setting: Maximum ● Engine coolant temperature: 65°C to 75°C or lower ● Blower fan: ON		ON	–	–
		None of the above		OFF		
71	Power steering switch	Power steering switch: ON		ON	–	–
		Power steering switch: OFF		OFF		

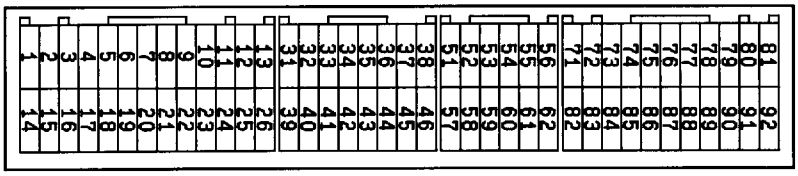
ACTUATOR TEST TABLE

Item No.	Check item	Drive Contents	Inspection conditions	Value to be determined as normal	Code No. or inspection procedure No.	Reference page
02	Glow plug relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	Battery charge is energized to the glow plug when the glow plug relay is ON.	–	–
03	A/C compressor relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	The A/C compressor clutch makes an audible sound.	–	–
11	Timing control valve	Turn the timing control valve to ON	• Ignition switch: ON • Engine: Idling • Timer piston position sensor: Normal	Makes an audible sound	Code No.43	13C-20
12		Turn the timing control valve to OFF				
15	Glow lamp	Turn the glow lamp on or off	Ignition switch: ON	The glow lamp turns on	–	–
16	Warning lamp	Turn the warning lamp on or off	Ignition switch: ON	The warning lamp turns on	Procedure No.3, 4	13C-25
22	Condenser fan relay	Turning the relay from OFF to ON or from ON to OFF	Ignition switch: ON	The condenser fan rotates.	–	–
23	Main throttle solenoid valve	Turn the solenoid valve from OFF to ON or from ON to OFF	• Ignition switch: ON • Vehicle speed: 0 km/h • Engine speed: 1,000 r/min or lower	Makes an audible sound	Code No.41	13C-19
24	Sub throttle solenoid valve	Turn the solenoid valve from OFF to ON or from ON to OFF	• Ignition switch: ON • Vehicle speed: 0 km/h • Engine speed: 1,000 r/min or lower	Makes an audible sound	–	–

Item No.	Check item	Drive Contents	Inspection conditions	Value to be determined as normal	Code No. or inspection procedure No.	Reference page
25	GE actuator	Turn the GE actuator to ON	● Ignition switch: ON ● Engine speed: 0 r/min or lower ● Control sleeve position sensor: Normal	Makes an audible sound	Code No.48	13C-21
26		Turn the GE actuator to OFF				
27	Fuel cut solenoid valve	Turn the solenoid valve to ON	● Ignition switch: ON ● Vehicle speed: 0 km/h	Makes an audible sound	–	–
28	EGR solenoid valve No.1	Turn the solenoid valve to ON	● Ignition switch: ON ● Vehicle speed: 0 km/h	Makes an audible sound	–	–
29		Turn the solenoid valve to ON				
30	EGR solenoid valve No.2	Turn the solenoid valve from OFF to ON or from ON to OFF	● Ignition switch: ON ● Vehicle speed: 0 km/h	Makes an audible sound	–	–
33	PTC heater	Switch the PTC heater relay ON/OFF.	● Ignition switch: ON	Voltage on the ECU terminal No.9: 0 - 1V	–	–
34	Middle position of GE actuator	Hold the injection governor in its middle position.	● Ignition switch: ON	When the crankshaft is turned clockwise during the adjustment of the injection timing, the injection pipes spray out fuel.	Code No.48	13C-21

ENGINE-ECU CHECK

TERMINAL VOLTAGE TABLE



W6106AQ

Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
1	GE actuator	Ignition switch: ON (Engine stops)		9 V or higher
2	Fuel cut solenoid valve	Ignition switch: OFF → ST		0 - 1 V
		Engine: Idling → Stop (in about 1 second)		System voltage
3	Timing control valve	Ignition switch: ON (Engine stops)		11 V or higher
4	Glow lamp	• Engine coolant temperature: 40°C or lower • Ignition switch: OFF → ON		0 - 1 V (In about 1 second: at 20°C) → System voltage
5	EGR control solenoid valve No. 2	Ignition switch: OFF → ON		System voltage
		Engine: After warming up the engine, conduct sudden racing from idling.		Decreased momentarily
7	Condenser fan relay	Condenser fan in operation		0 - 1 V
8	Engine warning lamp	Ignition switch: OFF → ON		0 -1 V (In few seconds) → System voltage
9	PTC heater relay	Heating switch: ON, outside temperature at 10°C or lower, and the engine coolant temperature at 65°C or lower		0 - 1 V
14	Main throttle solenoid valve	Ignition switch: ON (Engine stops)		System voltage
		Engine: After warming up the engine, conduct sudden racing from idling.		0 - 1 V
16	Glow plug relay	• Engine coolant temperature: 40°C or lower • Ignition switch: OFF → ON		System voltage (In about 8 seconds: at 20°C) → 0 - 1 V
18	Sub throttle solenoid valve	Engine: Idling		System voltage
		Engine: Idling → Stop (within approx. 3 seconds)		0 - 1 V
21	A/C relay	A/C switch: ON		0 - 1 V
31	Idle switch	Ignition switch: ON	Release the foot from the accelerator pedal.	0 - 1 V
			Step on the accelerator pedal slightly	4 V or higher
32	A/C switch	A/C in operation (compressor in operation)		System voltage
35	Power steering fluid pressure switch	Engine: Idling after warming up the engine	When turning steering wheel	0 - 1 V

Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
36	Selector switch between A/T and M/T	Ignition switch: ON		0 - 1 V
37	Inhibitor switch	Ignition switch: ON (Engine stops)	Set the selector lever to P or N	0 - 1 V
			Set the selector lever to D, 2, L, or R	System voltage
39	Stop lamp switch	Depress the brake pedal		System voltage
40	Brake switch	Depress the brake pedal		0 - 1 V
46	Control relay	Ignition switch: ON		0 - 1 V
		Ignition switch: ON → OFF (in about 8 seconds)		System voltage
51	Engine speed sensor (backup)	Engine: Idling		1.5 - 2.5 V
55	Accelerator pedal position sensor (sub)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1 V
			Accelerator pedal: Fully opened position	4.1 V or higher
71	Ignition switch-ST	Engine: Cranking		8 V or higher
74	Control sleeve position sensor	Ignition switch: ON (Engine stops)		2.2 - 2.7 V
73				2.0 - 4.0 V
75				2.0 - 4.0 V
76	Timer piston position sensor	Ignition switch: ON (Engine stops)		2.2 - 2.7 V
77				2.0 - 4.0 V
78				2.0 - 4.0 V
80	Back-up power supply	Ignition switch: OFF		System voltage
82	Ignition switch-IG	Ignition switch: ON		System voltage
83	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.4 - 4.5 V
			Engine coolant temperature: 20°C	2.6 - 3.6 V
			Engine coolant temperature: 40°C	1.8 - 2.5 V
			Engine coolant temperature: 80°C	0.7 - 1.1 V
84	Accelerator pedal position sensor (main)	Ignition switch: ON	Accelerator pedal: Idling position	0.9 - 1.1 V
			Accelerator pedal: Fully opened position	4.1 V or higher
85	Boost pressure sensor	Ignition switch: ON (760 mmHg)		1.2 - 1.6 V
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward slowly		0 V ↔ 5 V (repeat the change)

Terminal No.	Check item	Inspection conditions (engine status)		Normal condition:
87	Fuel temperature sensor	Ignition switch: ON	Fuel temperature: 0°C	3.2 - 3.6 V
			Fuel temperature: 20°C	2.3 - 2.7 V
			Fuel temperature: 40°C	1.4 - 1.8 V
			Fuel temperature: 80°C	0.4 - 0.8 V
88	Boost air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 - 3.8 V
			Intake air temperature: 20°C	2.3 - 2.9 V
			Intake air temperature: 40°C	1.5 - 2.1 V
			Intake air temperature: 80°C	0.4 - 1.0 V
89	Engine speed sensor	Engine: Idling		1.5 - 2.5 V
91	Neutral switch	Ignition switch: ON (Engine stops)	Set the selector lever to P or N	0 - 1 V
			Set the selector lever to D, 2, L, or R	System voltage

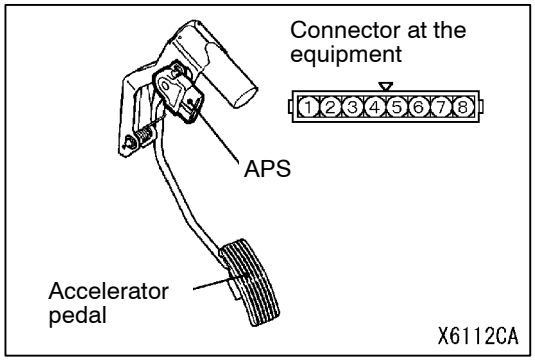
ON-VEHICLE SERVICE

INJECTION TIMING CHECK AND ADJUSTMENT

Refer to GROUP 11C - Engine Adjustment.

IDLE SPEED CHECK AND ADJUSTMENT

Refer to GROUP 11C - Engine Adjustment.



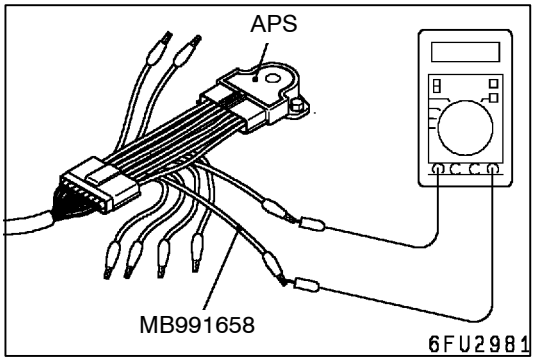
ACCELERATOR PEDAL POSITION SENSOR (APS) ADJUSTMENT

Caution

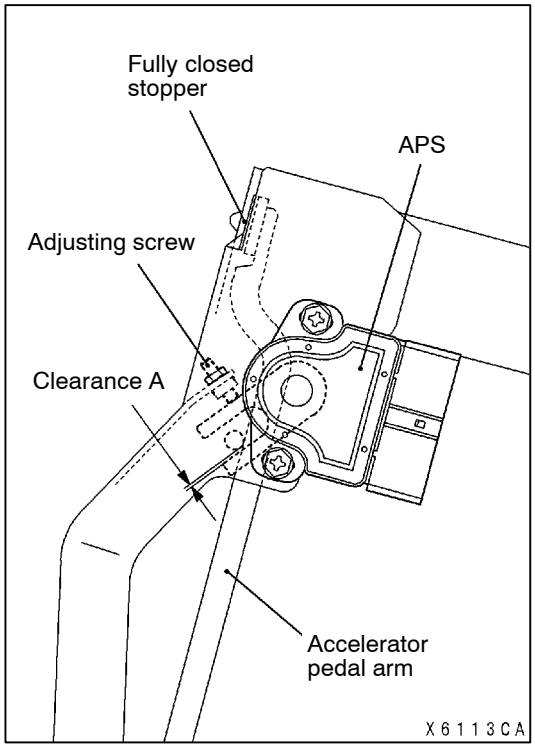
(1) APS is properly adjusted in the factory. Therefore, APS should not be moved carelessly.

(2) If the adjustment is not done correctly, carry out a new adjustment in the following procedure:

1. Remove accelerator pedal complete.



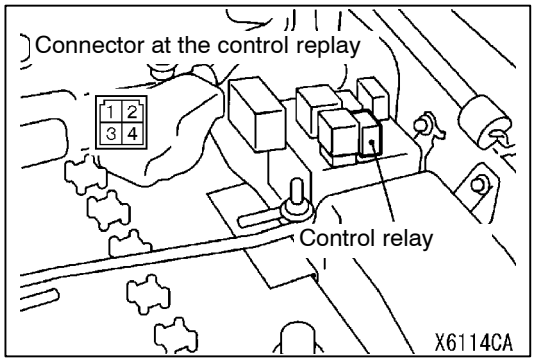
2. Connect MUT-II to the diagnosis connector. If MUT-II is not used, the following operation should be done:
   (1) Disconnect APS connector and connect the special tool (test harness: MB991658) between two connectors.
   (Be careful not to take a wrong terminal No.)
   (2) Connect a digital voltmeter between APS connector terminal No. 3 (APS1 output) and terminal No.1 (APS1 earth).
3. Loosen the APS mounting bolt to make it temporarily tightened.



4. Ensure that the accelerator pedal arm contacts the closing stopper.
5. Use the adjusting screw to make the clearance A (shown in the illustration) between 0.5 and 0.93 mm.
6. Secure the adjusting screw with the lock nut.
7. Turn on the ignition switch. (Engine does not start.)
8. Turn APS to make APS1 output the standard value.

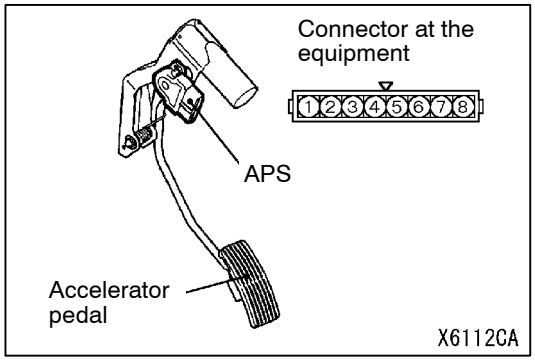
   Standard value: 0.985 - 1.085 V

9. Tighten the APS mounting bolt securely.
10. Install the accelerator pedal complete.



CONTROL RELAY CONTINUITY CHECK

System voltage	Terminal No.			
	1	2	3	4
When no current is supplied		○		○
When current is supplied	○		○	
		⊕		⊖



ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

1. Disconnect the APS connector.
2. Measure the resistance between APS connector terminal No.2 (APS1 power supply) and the terminal No.1 (APS1 earth) as well as the resistance between terminal No.8 (APS2 power supply) and terminal No.7 (APS2 output).

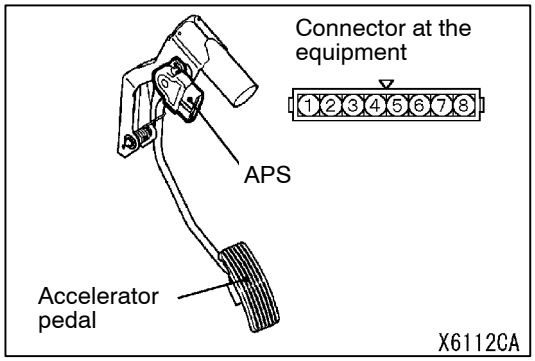
   Standard value: 3.5 - 6.5 kΩ
3. Measure the resistance between APS connector terminal No.2 (APS1 power supply) and the terminal No.3 (APS1 output) as well as the resistance between terminal No.8 (APS2 power supply) and terminal No.7 (APS2 earth).

   Normal condition:

Step on the accelerator pedal slowly.	Resistance smoothly changes in proportion to the travel of the accelerator pedal.

4. If the APS is out of the range of the standard value or the resistance does not change smoothly, replace APS.

   NOTE
   Make an adjustment on APS after replacement. (Refer to P.13C-42.)



IDLE SWITCH CHECK

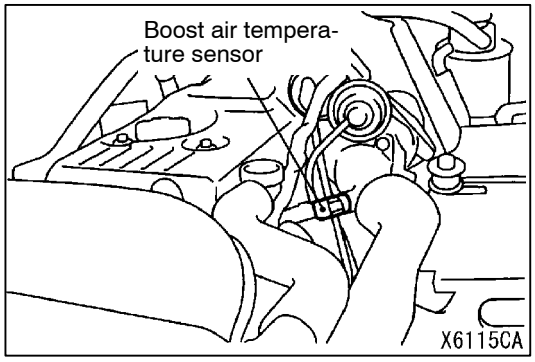
1. Disconnect the accelerator pedal position sensor (APS) connector.
2. Check the continuity between the idle switch connector terminal No.4 (idle switch) and terminal No.5 (earth).

Normal condition:

Accelerator pedal	Continuity
Step on	None
Release	Yes

3. Replace APS if it is inoperative.

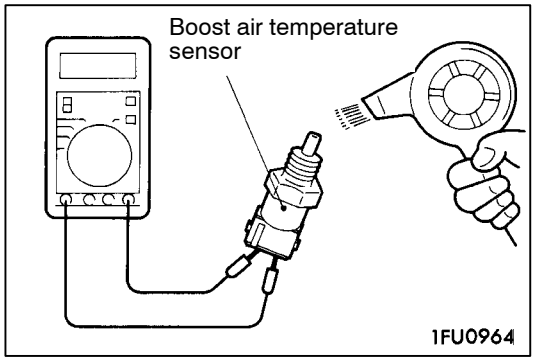
   NOTE
   Make an adjustment on APS after replacement.(Refer to P.13C-42.)



BOOST AIR TEMPERATURE SENSOR (INTAKE AIR TEMPERATURE SENSOR) CHECK

1. Remove the boost air temperature sensor.
2. Measure the resistance at the boost air temperature sensor connector terminal.

   Standard value:
   2.3 - 2.9 kΩ (at 20°C)
   0.3 - 0.39 kΩ (at 80°C)



3. Measure the resistance at the sensor part being warmed up by a hair dryer.

   Normal condition:

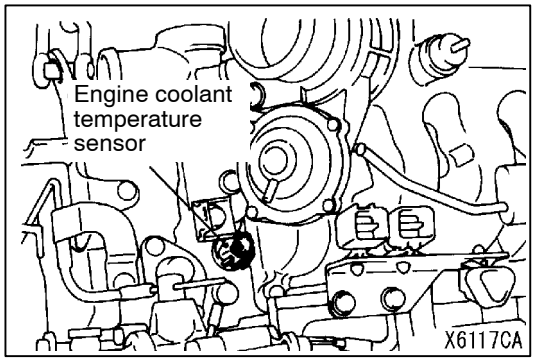
Temperature (°C)	Resistance value (kΩ)
Rising	Become smaller

4. If the resistance is not within the range of the standard value or does not change at all, replace the boost air temperature sensor.

   NOTE
   Replace the gasket as well.

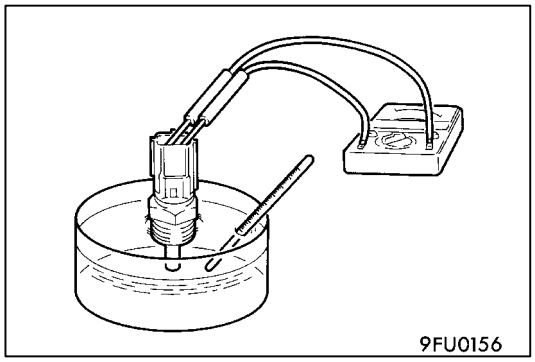
5. Tighten the boost air temperature sensor to the specified torque.

   Tightening torque: 15 ± 1 N·m



ENGINE COOLANT TEMPERATURE SENSOR CHECK

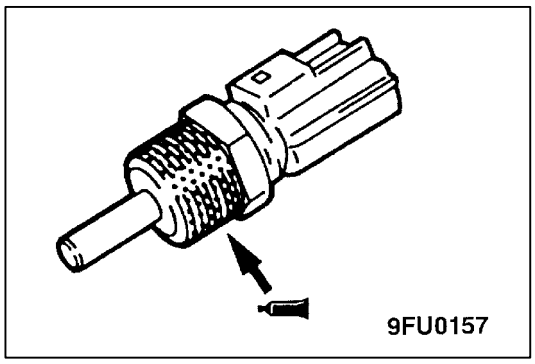
1. Remove the engine coolant temperature sensor.



2. Measure the resistance between the terminals of the connectors while immersing the sensor part of the engine coolant temperature sensor in the hot water.

   Standard value:
   2.3 - 2.6 kΩ (at 20°C)
   0.30 - 0.34 kΩ (at 80°C)

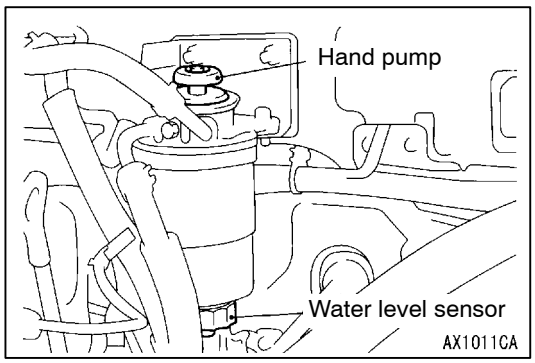
3. If the resistance is not within the range of the standard value, replace the engine coolant temperature sensor.



4. Apply the sealant to the thread of the engine coolant temperature sensor and tighten it to the specified torque.

   Sealant:
   3M Nut Locking Part No. 4171 or equivalent

   Tightening torque: 40 ± 4 N·m



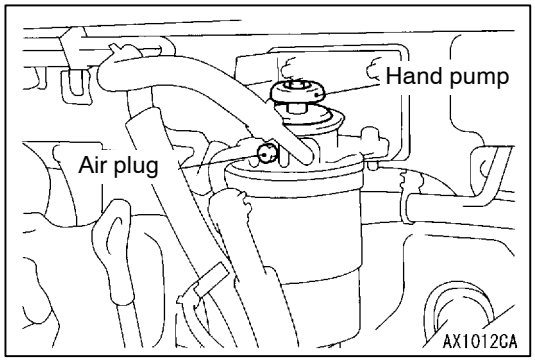
EVACUATION OF WATER FROM FUEL FILTER

Water is in the filter when fuel filter warning lamp illuminates. Evacuate water by the following procedure.

1. Loosen the water level sensor.
2. After water is evacuated by using a hand pump, tighten the water level sensor to the specified torque.
   Tightening torque: 2.5 ± 0.5 N·m

FUEL FILTER CARTRIDGE REPLACEMENT

Refer to GROUP 13D.



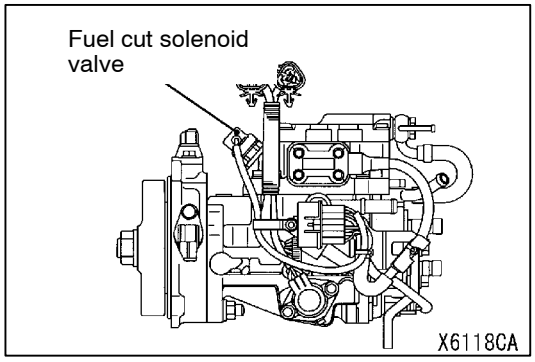
EVACUATION OF AIR FROM FUEL LINE

When the following service work(s) is done, refill the fuel tank and then evacuate air from the fuel line.

- Fuel hose is removed
- Fuel filter is replaced
- Fuel injection nozzle is removed
- If necessary for access, fuel is drained from the fuel tank.

1. Loosen the fuel filter air plug.

2. Cover the circumference of the air plug hole with cloth and use a manual pump repeatedly until no bubbles come out of the plug hole, then tighten the air plug to the specified torque.
   Tightening torque: 6.0 ± 1.0 N·m
3. Repeat until the hand pump operation becomes stiff.

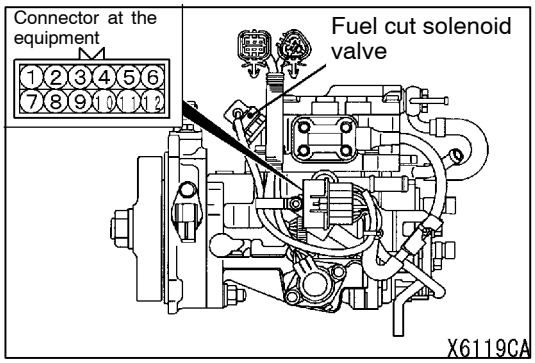


FUEL INJECTION PUMP CHECK

FUEL CUT SOLENOID VALVE CHECK

Operation noise check

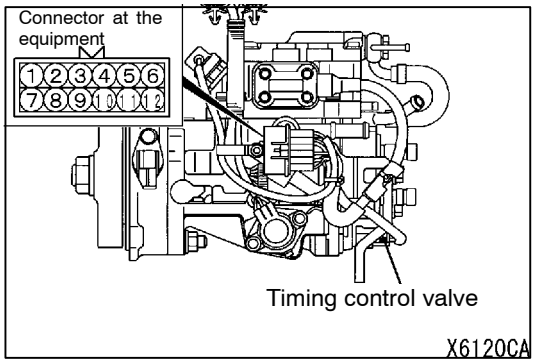
1. Attach the sound scope to the fuel cut solenoid valve to check for running noise when the ignition switch is "ON".



Coil resistance check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No.1 (fuel cut solenoid valve) and the injection pump body.

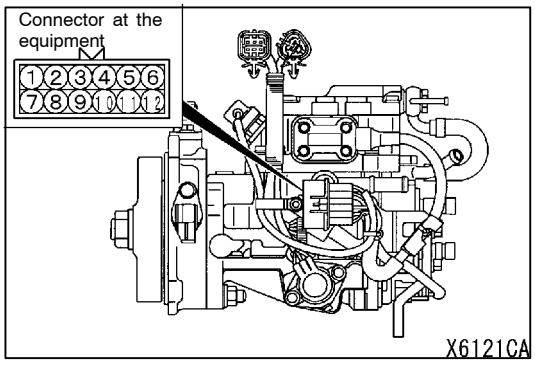
   Standard value: 6.8 - 9.2 Ω



Timing control valve check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No.5 and terminal No.9.

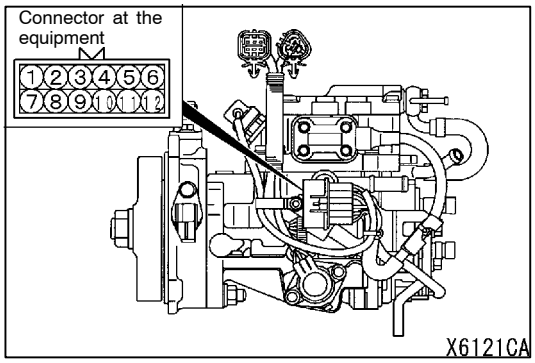
   Standard value: 10.8 - 11.2 Ω



GE actuator (electronic governor) check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No.6 and terminal No.10.

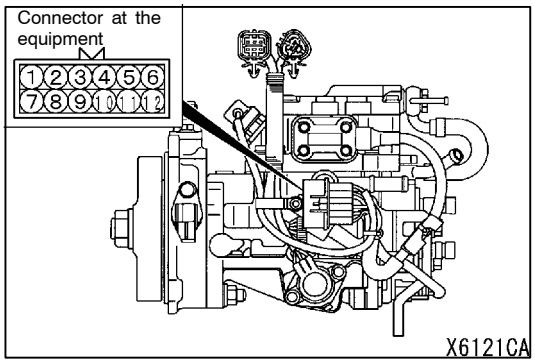
   Standard value: 0.64 - 0.72 Ω



Fuel temperature sensor check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between terminal No.7 and terminal No.11.

   Standard value: 1.4 - 2.6 Ω

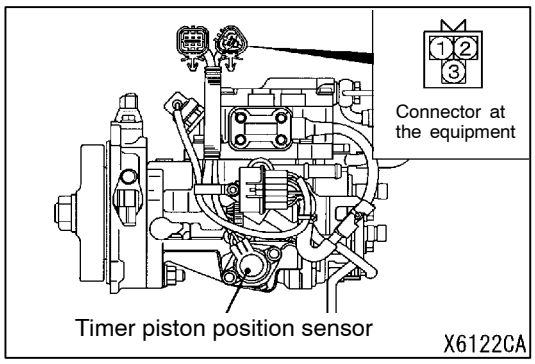


Control sleeve position sensor check

1. Disconnect the injection pump connector (12 pin).
2. Measure the resistance between the following terminals.

   Standard value:

Terminal No.4 - Terminal No.12	11.2 - 12.4 Ω
Terminal No.4 - Terminal No.8	5.6 - 6.2 Ω
Terminal No.8 - Terminal No.12	5.6 - 6.2 Ω

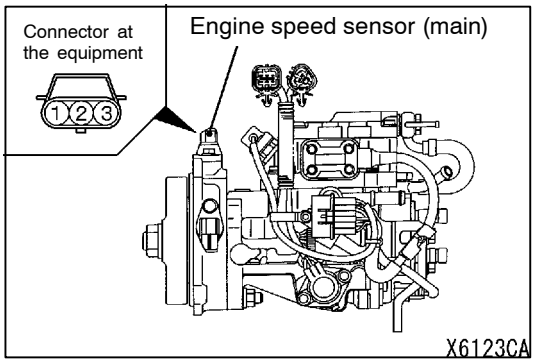


Timer piston position sensor check

1. Disconnect the timer piston position sensor connector.
2. Measure the resistance between the following terminals.

   Standard value:

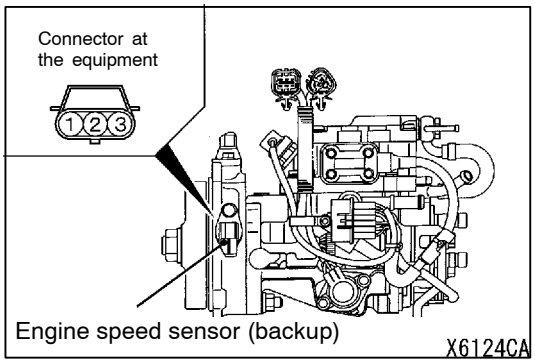
Terminal No.1 - Terminal No.2	160 - 168 Ω
Terminal No.1 - Terminal No.3	80 - 84 Ω
Terminal No.2 - Terminal No.3	80 - 84 Ω



Engine speed sensor (main) check

1. Disconnect the engine speed sensor connector.
2. Measure the resistance between terminal No.2 and terminal No.3.

   Standard value: 2.15 kΩ



Engine speed sensor (backup) check

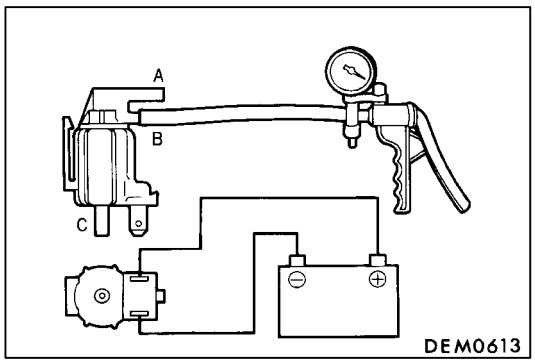
(1) Disconnect the engine speed sensor connector.
(2) Measure the resistance between terminal No.2 and terminal No.3.

   Standard value: 2.15 kΩ

INTAKE AIR RESTRICTION EQUIPMENT CHECK

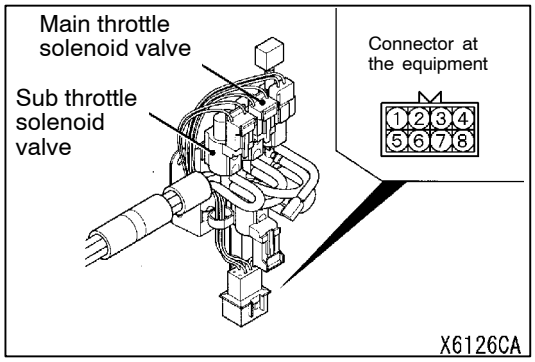
MAIN/SUB THROTTLE SOLENOID VALVE OPERATION CHECK

1. Remove the main/sub throttle solenoid valve connector and vacuum hose.
2. Apply negative pressure to each nipple of the main/sub throttle solenoid valve with a hand vacuum pump to check air density for applying electrical charge to each solenoid valve terminal or not.



Main/sub throttle solenoid valve

System voltage	Normal condition:
When current is supplied	Leak negative pressure (negative pressure maintained when nipple A is closed)
Cold	Leak negative pressure (negative pressure maintained when nipple C is closed)



MAIN/SUB THROTTLE SOLENOID VALVE RESISTANCE CHECK

1. Disconnect the main/sub throttle solenoid valve intermediate harness.
2. Main/sub throttle solenoid valve coil resistance.

Standard value:

Throttle solenoid valve	Terminal to be measured	Resistance value Ω
Main	2 - 6	36 - 44
Sub	1 - 5	36 - 44

INJECTION NOZZLE CHECK AND ADJUSTMENT

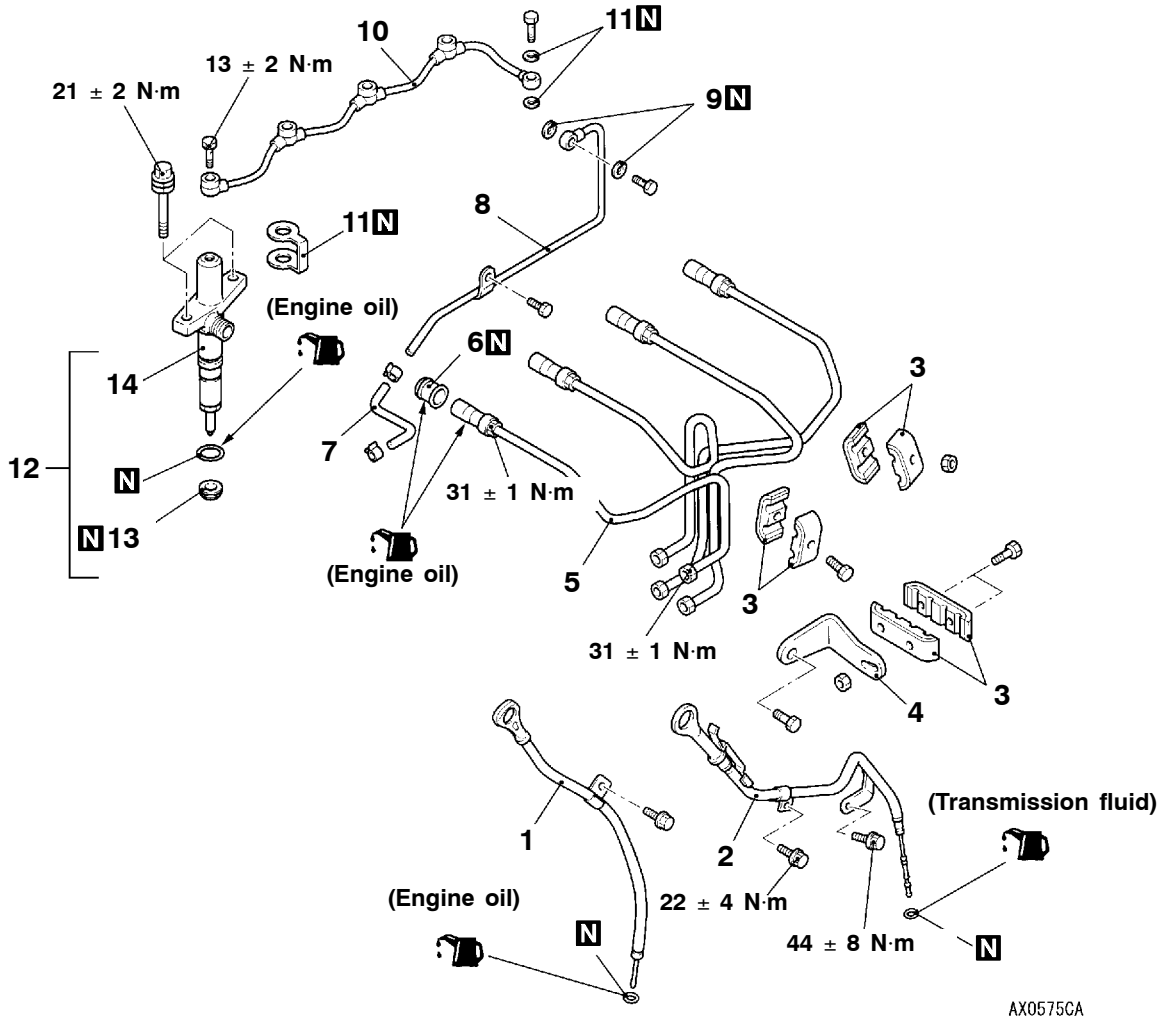
Refer to the Engine Workshop Manual.

INJECTION NOZZLE

REMOVAL AND INSTALLATION

Pre-removal Operations
- Engine Cover Removal (Refer to GROUP 11C - Camshaft.)
- Battery and Battery Tray Removal
- Fuel filter removal (Refer to GROUP 13D.)
- Skid Plate and Under Cover Removal

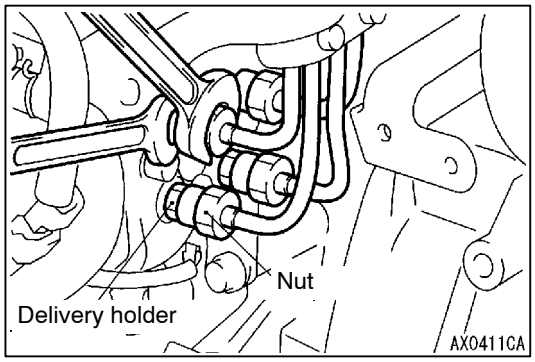
Post-installation Operations
- Skid Plate and Under Cover Installation
- Fuel Filter Installation (Refer to GROUP 13D.)
- Battery and Battery Tray Installation
- Fuel Line Bleeding (Refer to P.13C-45.)
- Engine Cover Installation (Refer to GROUP 11C - Camshaft.)



Removal steps

1. Engine oil level gauge and guide
2. A/T oil level gauge and guide
3. Clamp
4. Injection pipe stay
◀A▶ ▶C◀ 5. Injection pipe
▶C◀ 6. Injection pipe seal
▶B◀ 7. Fuel return hose
8. Fuel return pipe
9. Fuel return pipe gasket
- Rocker cover (Refer to GROUP 11C - Camshaft.)

10. Fuel leak off pipe
11. Fuel leak off pipe gasket
◀B▶ 12. Injection nozzle assembly
▶A◀ 13. Nozzle gasket
▶A◀ 14. Injection nozzle



REMOVAL SERVICE POINTS

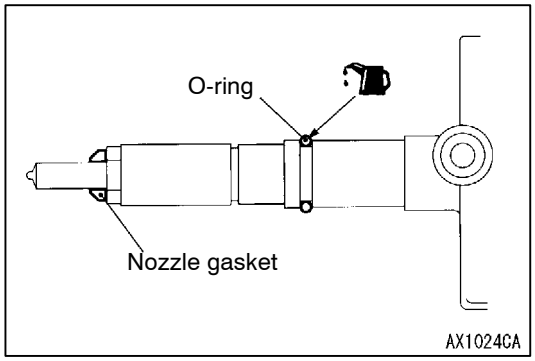
◀A▶ INJECTION PIPE REMOVAL

Hold the injection pump side delivery holder with a open-end wrench, and loosen the nut.

◀B▶ INJECTION NOZZLE ASSEMBLY REMOVAL

Caution

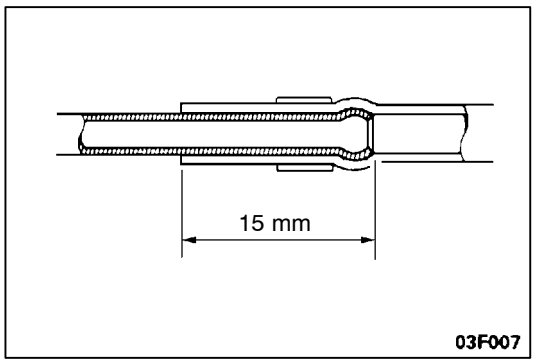
1. **Since the injection nozzle assembly is required to re-install to the same cylinder, paste a label of the cylinder number when it is removed.**
2. **Plug the injection nozzle holes to prevent foreign materials from entering the cylinders.**



INSTALLATION SERVICE POINTS

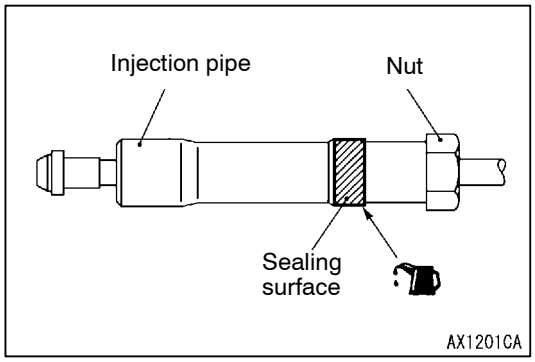
▶A◀ INJECTION NOZZLE/NOZZLE GASKET INSTALLATION

1. After cleaning the injection nozzle, apply a small amount of engine oil to a new O-ring, and install it, being careful not to damage it.
2. Install the nozzle gasket in the shown direction.



▶B◀ FUEL RETURN HOSE INSTALLATION

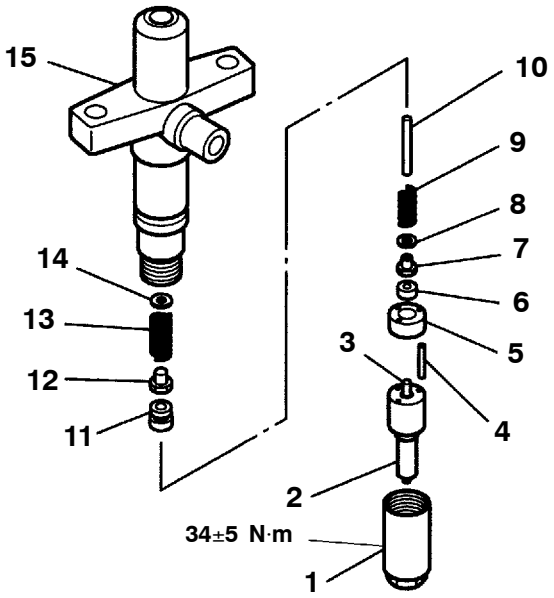
Insert the fuel return hose into the fuel pipe until the shown dimension is satisfied.



▶C◀ INJECTION PIPE SEAL/INJECTION PIPE INSTALLATION

1. Apply a small amount of engine oil to a new injection pipe seal, and install it, being careful not to damage it.
2. Apply a small amount of engine oil to the injection pipe sealing surface, and then connect the injection pipes.
3. Secure the delivery holder at the injection pump side with a spanner in the same way as the removal procedure, then install the injection pipe nut.
4. Tighten the injection pipe nut to the specified torque. **Tightening torque: 31 ± 1 N·m**

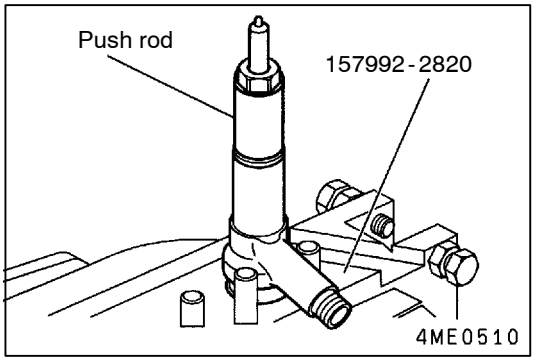
DISASSEMBLY AND REASSEMBLY



X6207CA

Disassembly steps

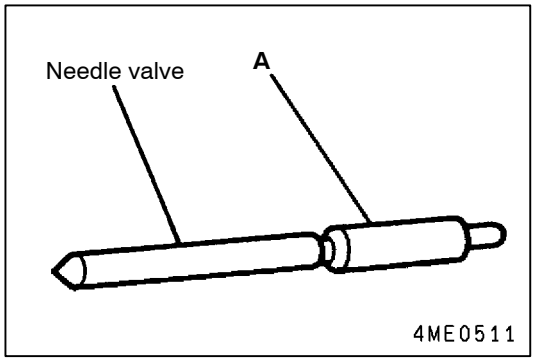
◀A▶ ▶A◀ 1. Retaining nut
2. Nozzle
3. Needle valve
4. Pin
5. Spacer
6. Lift piece
7. Spring seat
8. Shim
9. Second spring
10. Push rod
11. Collar
12. Spring seat
13. First spring
14. Shim
15. Nozzle holder



DISASSEMBLY SERVICE POINT

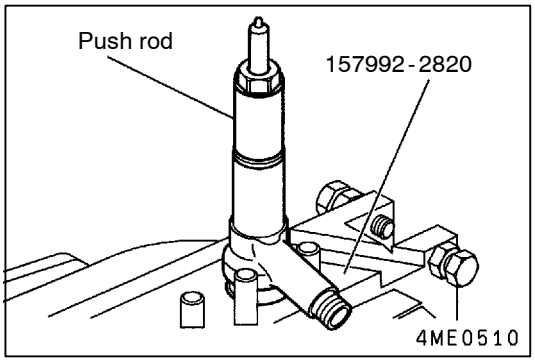
◀A▶ RETAINING NUT REMOVAL

Use the special tool to remove the retaining nut.



Caution

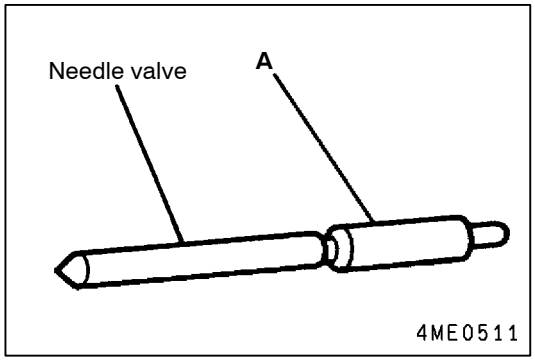
1. **Never touch the "A" part of the needle valve.**
2. **Always handle the needle valve and the nozzle as a set per cylinder.**



REASSEMBLY SERVICE POINT

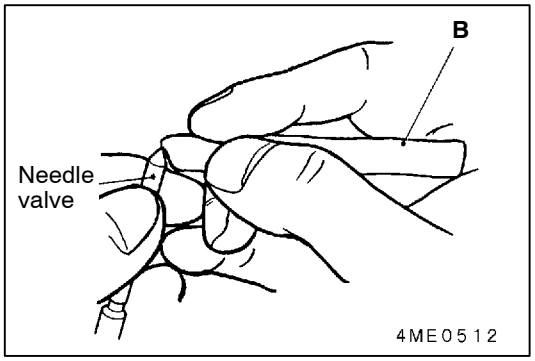
▶A◀ RETAINING NUT INSTALLATION

Use the special tool to install the retaining nut.



Caution

1. **Never touch the "A" part of the needle valve.**
2. **Always handle the needle valve and the nozzle as a set per cylinder.**



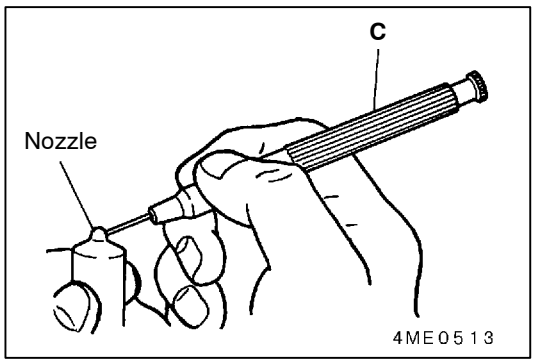
NOZZLE AND NEEDLE VALVE CLEANING

Clean the needle valve and nozzle with gas oil (cleaning solvant).

Remove carbon deposits with a cleaning tool in the following manner:

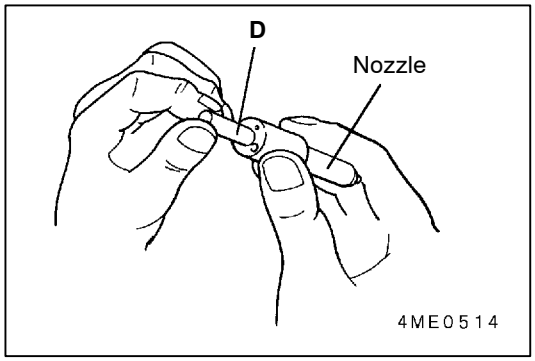
1. Clean the needle valve by removing carbon deposits from its tip using cleaning bar **B** of the cleaning tool.

   Never use a wire brush or hard steel for cleaning.

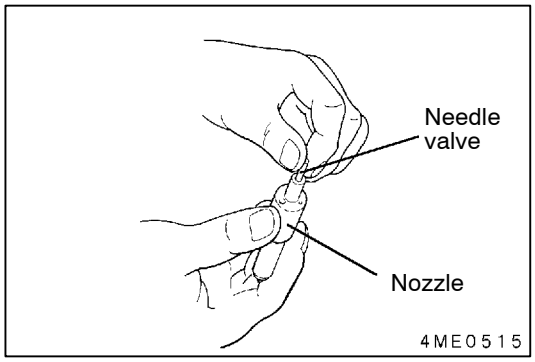


2. To clean the nozzle, remove carbon deposits from the orifices of the nozzle using needle cleaner **C** of the cleaning tool, by inserting it into the orifices and turning it.

   Needle cleaner diameter: ϕ0.21 mm or less.



3. Clean the seat of the nozzle using cleaning needle **D** of the cleaning tool.
4. Use carbon remover to remove hard-to-remove, burnt-on carbon deposits.



INSPECTION

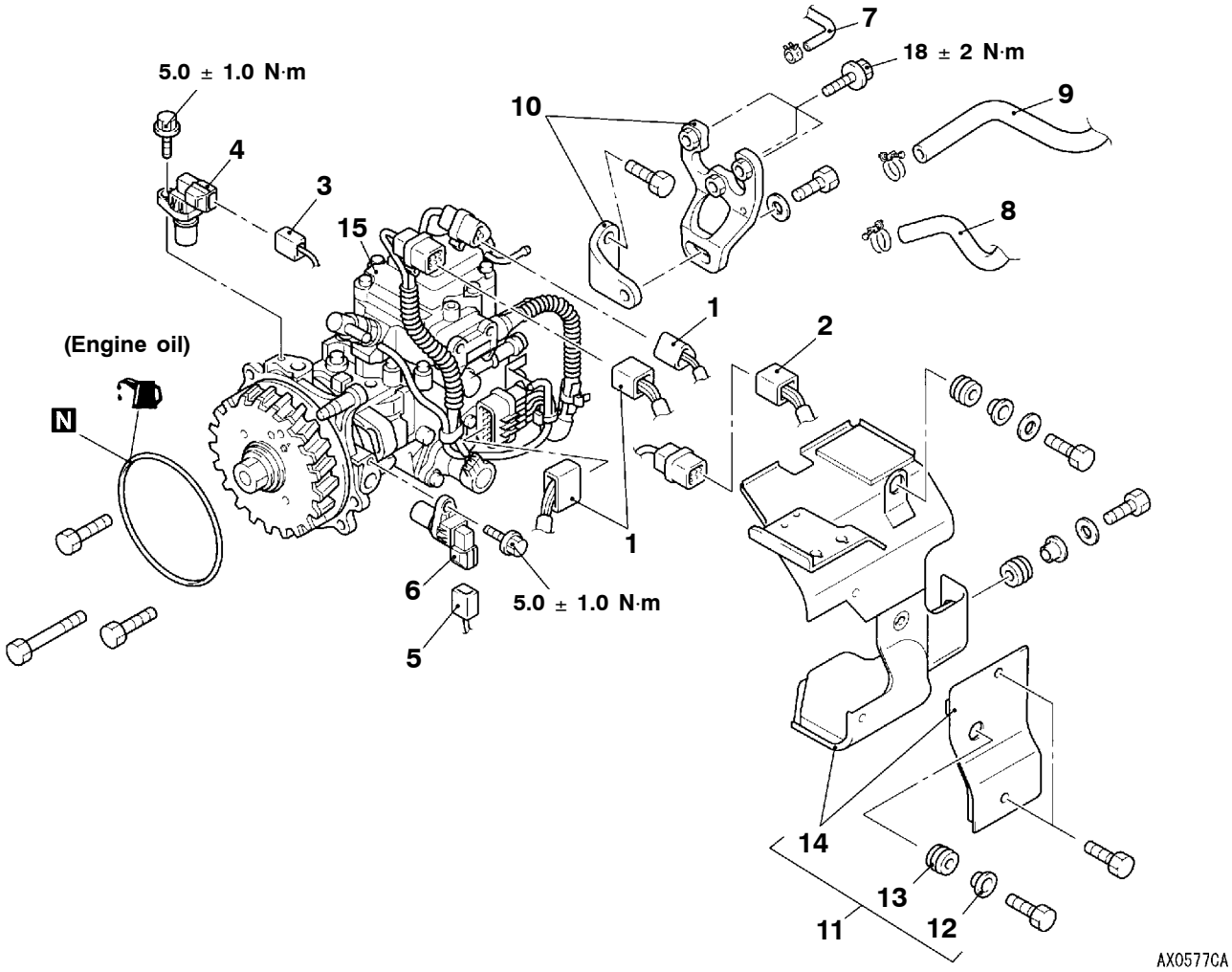
NOZZLE AND NEEDLE VALVE

1. Immerse the needle valve and nozzle in gas oil (cleaning solvent) and clean them thoroughly.
2. Check and see if the needle valve drops by its own weight into the nozzle from the position where a third of its length is pulled out. (Repeat this several times rotating the needle valve.)
3. If the needle valve does not drop smoothly, repeat cleaning and repeat the test. If any fault is still found, replace both the needle valve and nozzle together as a set.

INJECTION PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Removal and Installation Of Engine Cover (Refer to GROUP 11C - Camshaft.)
- Removal and Installation of Battery and Battery Tray
- Removal and Installation of Injection Pipe (Refer to P.13C-50.)
- Removal and Installation of Air Cleaner (Refer to GROUP 15.)
- Removal and Installation of Intercooler Hose (Refer to GROUP 15.)
- Removal and Installation of Glow Plug Relay and Solenoid Valve Assembly
- Removal and Installation of Vacuum Pump (Refer to GROUP 11C.)



Removal steps

1. Injection pump connector
2. Engine speed sensor connector
3. Engine speed sensor 1 connector
4. Engine speed sensor 1
5. Engine speed sensor 2 connector
6. Engine speed sensor 2

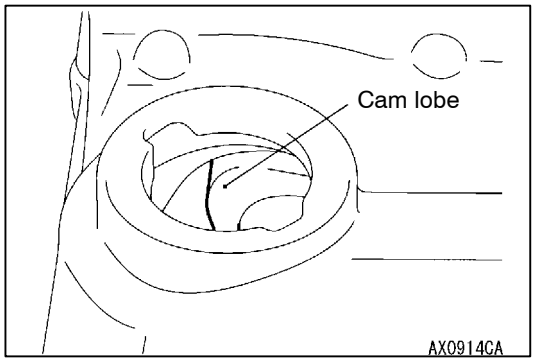
▶C◀ 7. Fuel return hose

▶B◀ 8. Fuel return hose

▶B◀ 9. Fuel main hose

10. Injection pump stay
11. Injection pump cover assembly
12. Insulator collar
13. Insulator
14. Injection pump cover

◀A▶ ▶A◀ 15. Injection pump assembly

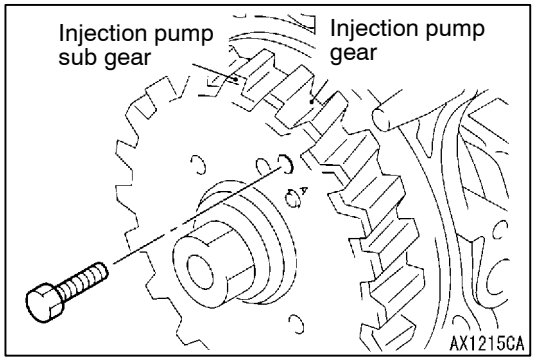


REMOVAL SERVICE POINT

◀A▶ INJECTION PUMP ASSEMBLY REMOVAL

Make the timing mark of "0" position on the crankshaft pulley with that of the timing case and set No.1 cylinder to compression stroke TDC.

NOTE
Remove the oil filler cap. If the camshaft cam lobe is at the shown position, the No.1 cylinder is on the compression stroke TDC.

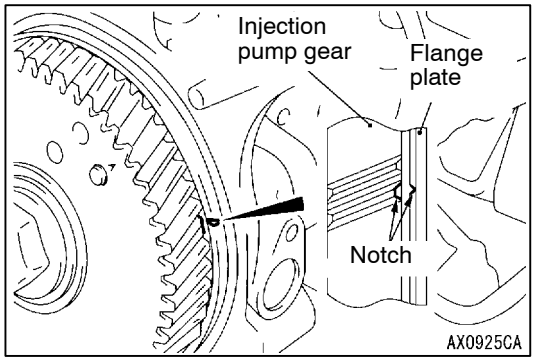


INSTALLATION SERVICE POINTS

▶A◀ INJECTION PUMP ASSEMBLY INSTALLATION

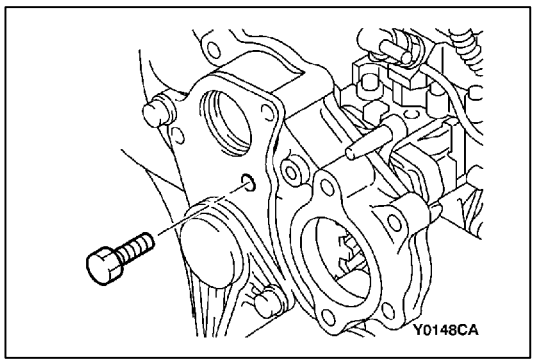
1. Install the bolt (M6 × 16) to the show position in order to hold the injection pump gear and the injection pump sub gear in position.

   NOTE
   If the injection pump assembly or the injection pump gear assembly is replaced, the bolt has been assembled beforehand.

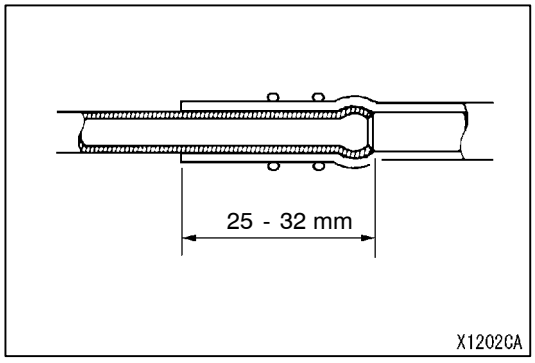


2. Make sure that No.1 cylinder is on the TDC of compression stroke.
3. Align the notch of the injection pump gear with the notch of the flange plate to install the injection pump assembly to the timing gear case.

   NOTE
   After installing the injection pump assembly, the characteristic of the gear makes the notch of the injection pump gear lag behind the notch of the flange plate by one tooth.

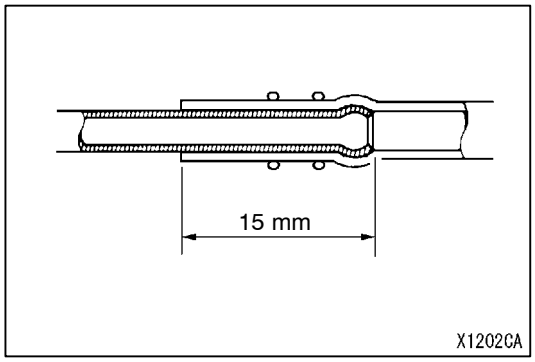


4. Remove the bolt, which has been assembled in Step 1.



▶B◀ FUEL MAIN HOSE/FUEL RETURN HOSE INSTALLATION

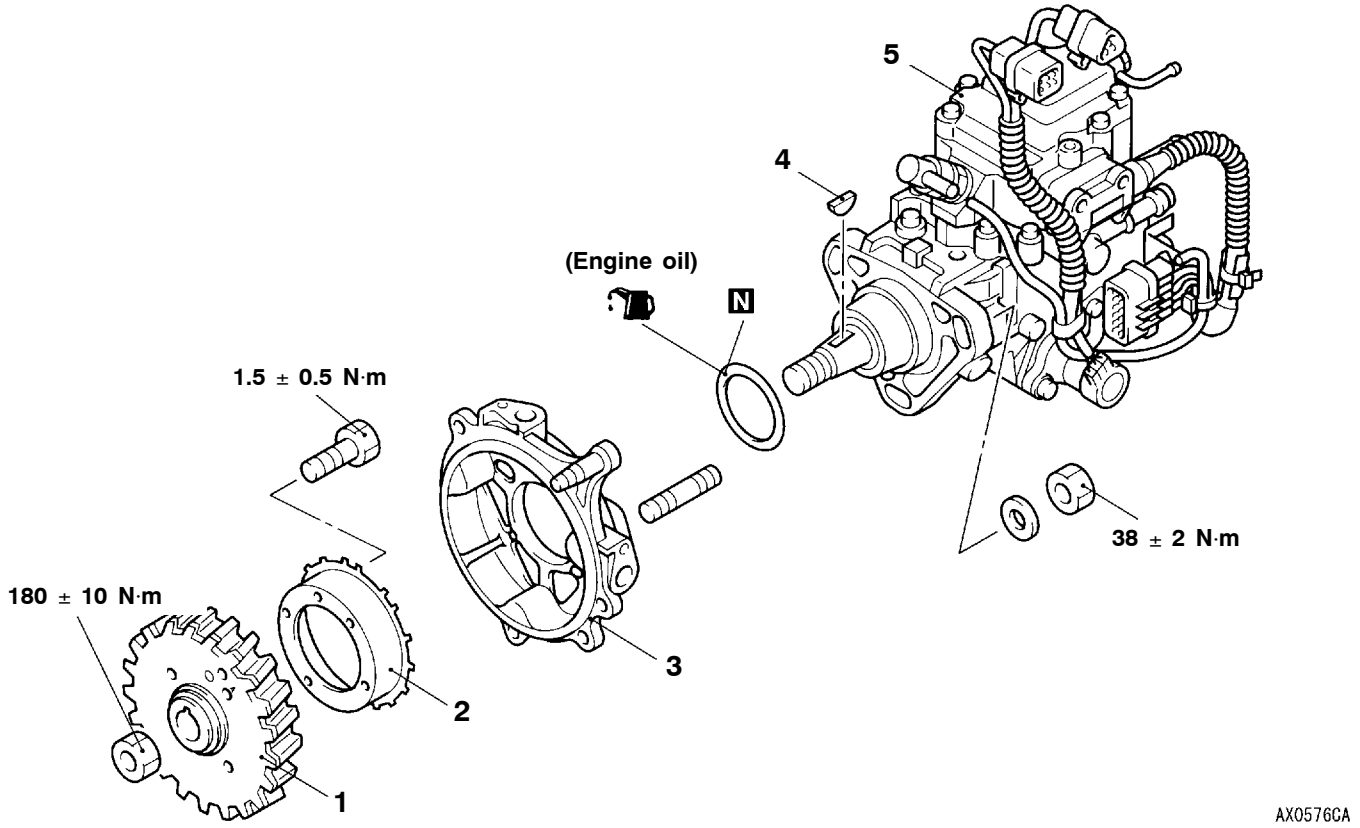
When connecting the fuel main hose or return hose to the fuel pipe, insert it up to the stepped part.



▶C◀ FUEL RETURN HOSE INSTALLATION

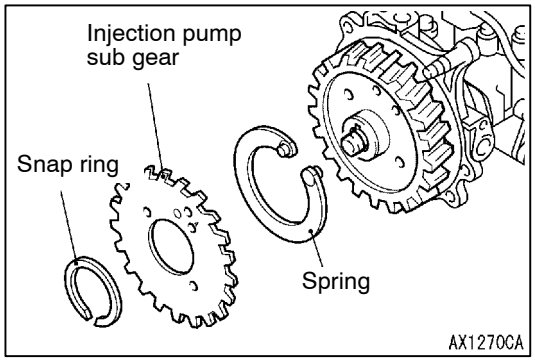
Insert the fuel return hose into the fuel pipe until the shown dimension is satisfied.

DISASSEMBLY AND ASSEMBLY



Disassembly steps

◀A▶ 1. Injection pump gear assembly
2. Sensor plate
3. Flange plate
4. Key
5. Injection pump

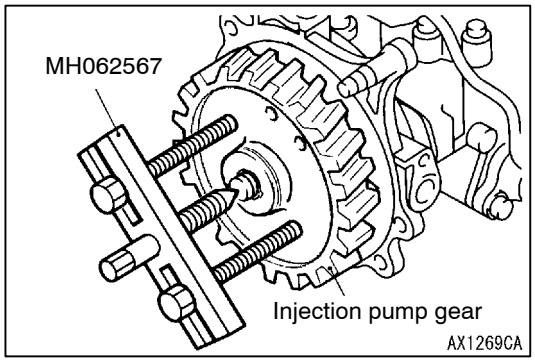


DISASSEMBLY SERVICE POINT

◀A▶ INJECTION PUMP GEAR ASSEMBLY REMOVAL

Remove the injection pump gear according to the following procedure.

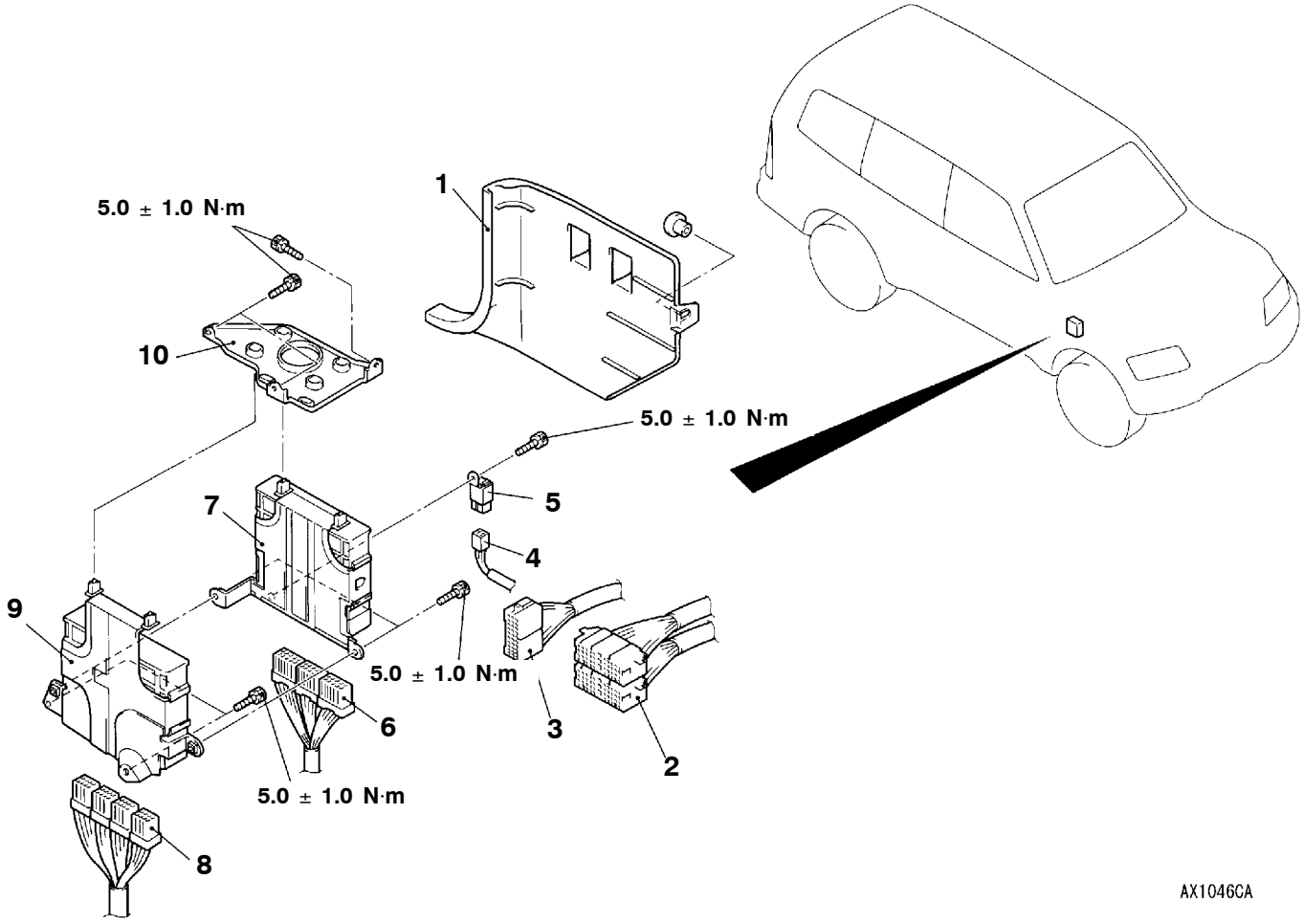
1. Remove the snap ring.
2. Remove the injection pump sub gear.
3. Remove the spring.



4. Remove the injection pump gear with special tools.

ENGINE-ECU

REMOVAL AND INSTALLATION



Removal steps

1. Cowl side trim (LH)
2. Joint of the instrument panel harness and front door harness (LH)
3. Joint of the instrument panel harness and floor harness (LH)
4. A/T control relay connector
5. A/T control relay
6. A/T-ECU connector
7. A/T-ECU
8. Engine-ECU connector
9. Engine-ECU
- Instrument panel (Refer to GROUP 52A.)
10. ECU bracket

NOTES

FUEL SUPPLY

CONTENTS

GENERAL INFORMATION 2
FUEL TANK <6G7> 2
FUEL TANK <4D5, 4M4> 8
FUEL FILTER 13

GENERAL INFORMATION

The fuel tank is located under the floor below the rear seats.
The fuel pump module contains a fuel pump (low-pressure), fuel filter and fuel pressure regulator (low-pressure).
The valve assembly contains a cut-off valve, which prevents fuel to flow out, and a two-way valve, which regulates the fuel pressure inside the fuel tank.

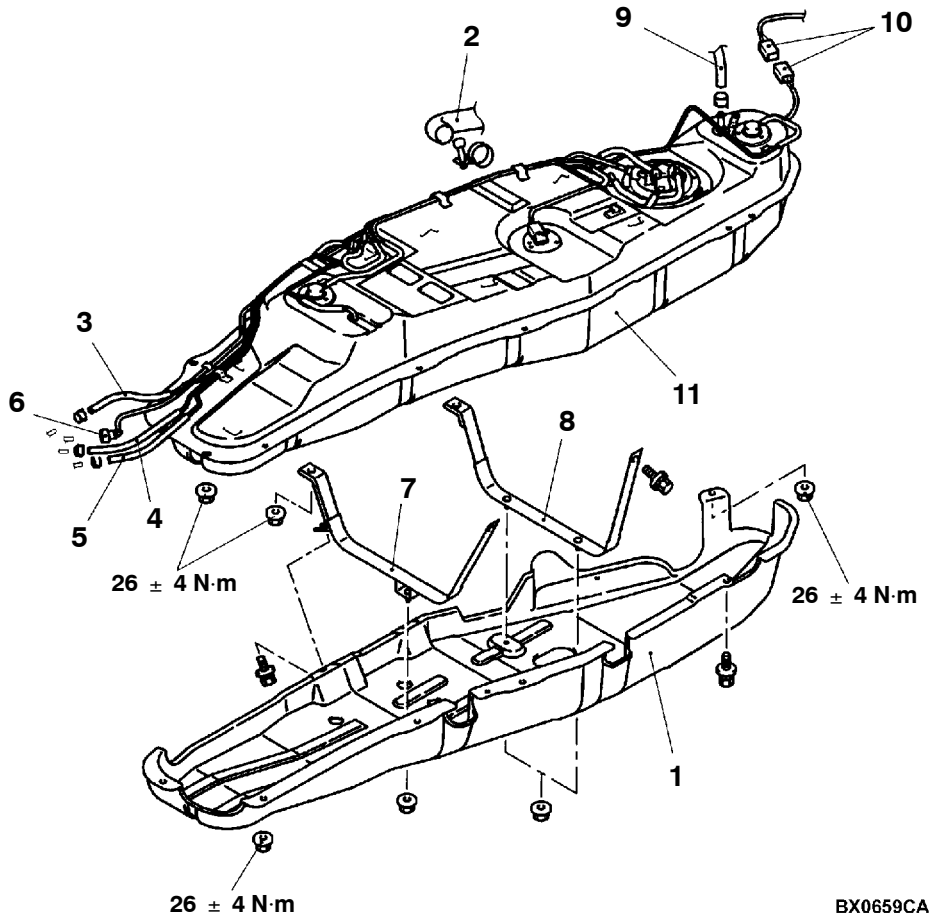
The high-pressure fuel hose is of an one-touch joint type.

FUEL TANK <6G7>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining Fuel
- Fuel Line Pressure Reduction (Refer to GROUP 13A - On-vehicle Service.)
- Transmission Mount Center Member Assembly (Refer to GROUP 32.)

Post-installation Operation
- Transmission Mount Center Member Assembly (Refer to GROUP 32.)
- Fuel Leakage Inspection
- Refilling Fuel



Removal steps

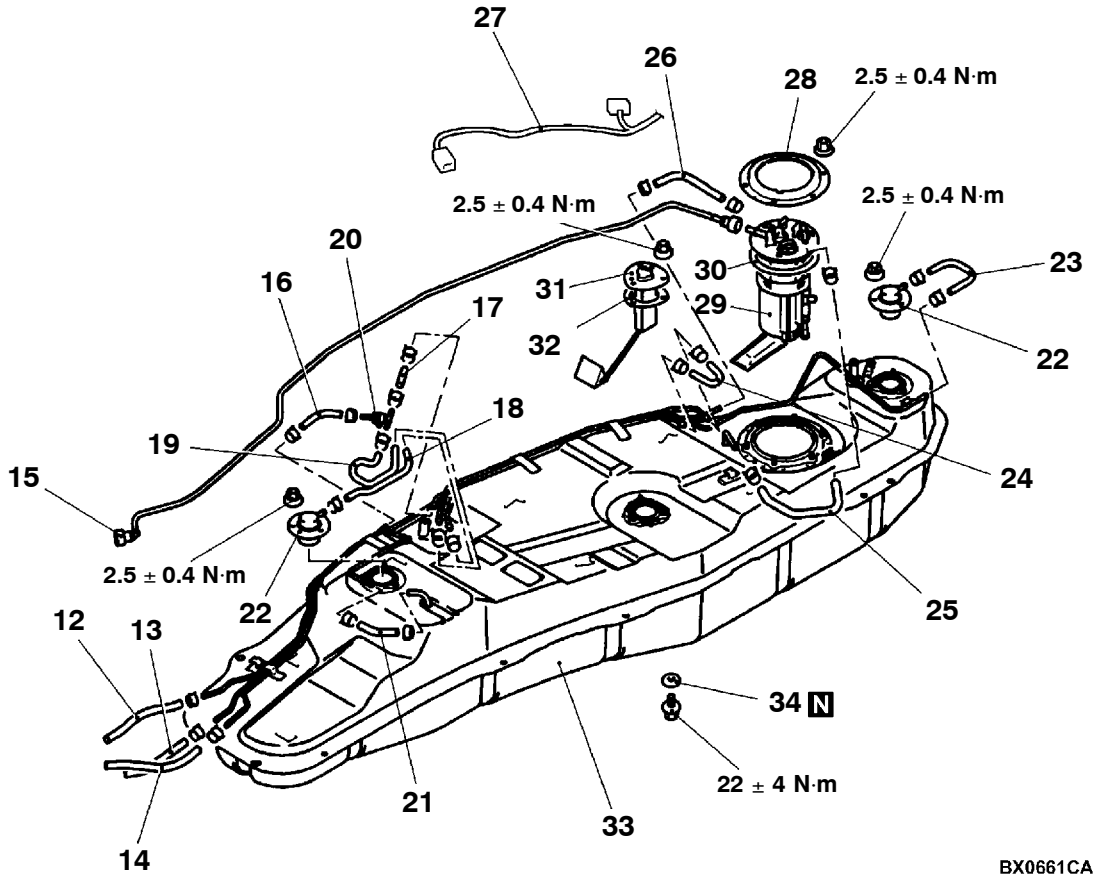
1. Fuel tank under protector
2. Fuel filler hose connection
3. Fuel return hose connection
4. Fuel vapor hose connection
5. Fuel return hose connection

▶A◀ 6. Fuel high-pressure hose connection

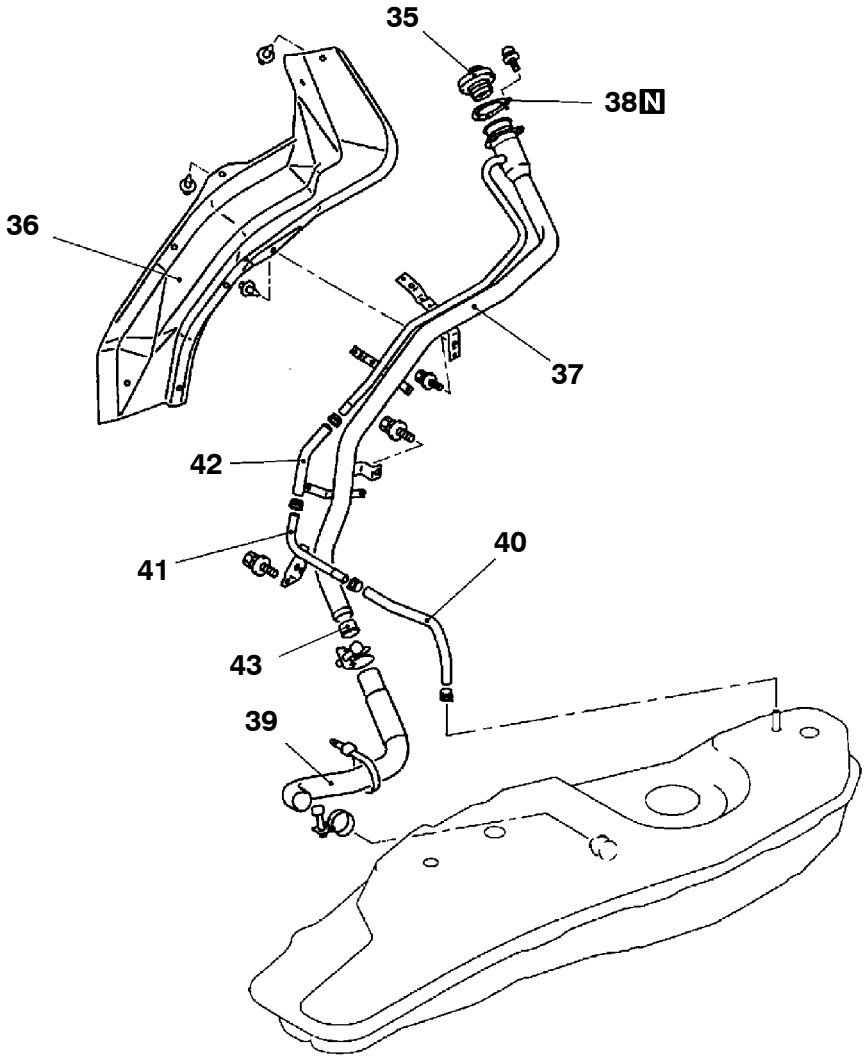
7. Fuel tank band, front
8. Fuel tank band, rear
9. Fuel tank breather hose connection

◀A▶ 10. Fuel tank harness connector connection

◀A▶ 11. Fuel tank assembly



12. Fuel return hose
13. Fuel vapor hose
14. Fuel return hose
15. Fuel high-pressure hose
16. Fuel tank vapor hose
17. Fuel tank vapor hose
18. Fuel tank vapor hose
19. Fuel tank vapor hose
20. Fuel check valve
21. Fuel tank hose
22. Valve assembly
23. Fuel tank vapor hose
24. Fuel tank vapor hose
25. Fuel tank suction hose
26. Fuel tank return hose
27. Fuel tank harness
28. Tapping plate
29. Fuel pump module assembly
30. Packing
31. Fuel gauge unit
32. Packing
33. Fuel tank
34. Gasket



AX0660CA

35. Fuel cap
36. Fuel filler neck protector
37. Fuel filler neck
38. Fuel filler neck gasket
39. Fuel filler hose
40. Fuel filler neck breather hose
41. Fuel filler pipe assembly
42. Fuel filler neck breather hose
43. Shut-off valve

REMOVAL SERVICE POINT

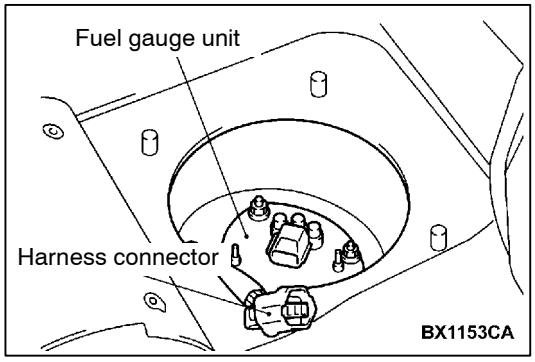
◀A▶ FUEL TANK BREATHER HOSE/FUEL TANK CONNECTOR DISCONNECTION

Lower the fuel tank until the fuel tank breather hose and the fuel tank harness connectors can be disconnected.

INSTALLATION SERVICE POINT

▶A◀ FUEL HIGH-PRESSURE HOSE INSTALLATION

Caution
Snap the high-pressure fuel hose one-touch joint into place, then pull back slightly on the hose to assure it is securely fitted. However, the connection should have a play of approx. 3 mm.



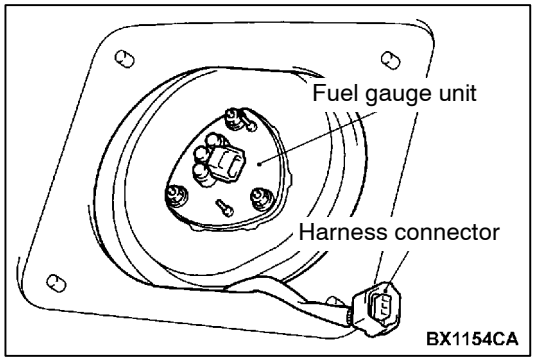
INSPECTION

FUEL GAUGE UNIT REPLACEMENT <SHORT WHEELBASE>

1. Slide the front seat (driver's side) forward and turn up the service hole notch on the carpet.
2. Remove the service hole cover and packing.
3. Disconnect the harness connector.
4. Unscrew the mounting nut to remove the fuel gauge unit.
5. Assemble the fuel gauge unit and tighten the mounting nut to the specified torque.

Tightening torque : 2.5 ± 0.4 N·m

6. Connect the harness connector.
7. Install the service hole cover and packing.
8. Return the floor carpet and slide the front seat (driver's side).



<LONG WHEELBASE>

1. Tumble the second seat.
2. Remove the service hole cover (upper side) and the packing located under the second seat.
3. Remove the second seat, the rear scuff plate, the anchor bolts for the outer seat belt (second) and mounting screws of the lower quarter trim. Tear off the carpet. (Refer to GROUP 52A.)
4. Remove the service hole cover and the packing located between the front seat and the second seat.
5. Disconnect the harness connector.
6. Unscrew the mounting nut to remove the fuel gauge unit.
7. Assemble the fuel gauge unit and tighten the mounting nut to the specified torque.

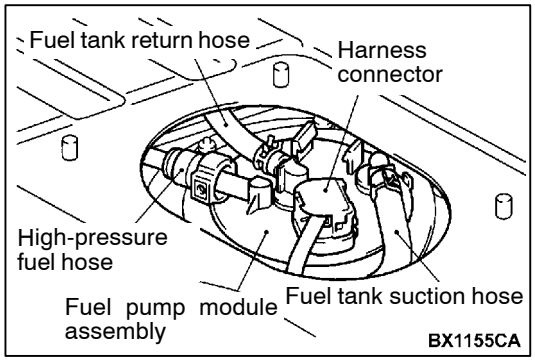
Tightening torque : 2.5 ± 0.4 N·m

8. Connect the harness connector.
9. Attach the service hole cover and the packing located between the front seat and the second seat.

10. Restore the carpet; attach the second seat, the rear scuff plate, anchor bolts for the outer seat belt (second) and mounting screws of the lower quarter trim. (Refer to GROUP 52A.)
11. Attach the service hole cover located under the second seat and the packing.
12. Restore the second seat.

FUEL GAUGE UNIT CHECK

Refer to GROUP 54 - Combination meter.

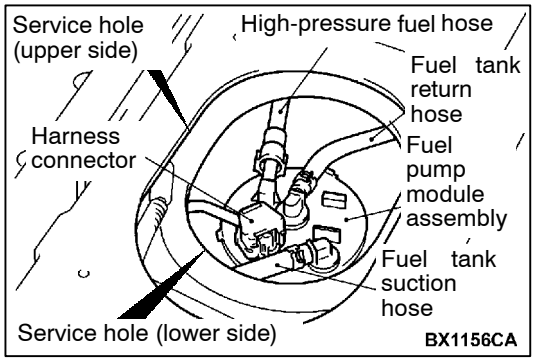


FUEL PUMP MODULE REPLACEMENT <SHORT WHEELBASE>

1. Remove the front scuff plate and outer seat belt (rear) anchor bolt, and then turn the carpet up. (Refer to GROUP 52A.)
2. Remove the service hole cover and packing.
3. Disconnect the harness connector.
4. Disconnect the high-pressure fuel hose and the fuel tank hose.
5. Remove the mounting nuts, and remove the fuel pump module.
6. Install the fuel pump module, and tighten the mounting nuts to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

7. Connect the high-pressure fuel hose and the fuel tank hose.
8. Connect the harness connector.
9. Install the service hole cover and packing.
10. Spread the carpet and then install the front scuff plate and outer seat belt (rear) anchor bolt. (Refer to GROUP 52A.)



<LONG WHEELBASE>

1. Tumble the second seat.
2. Remove the service hole cover (upper side) and the packing.
3. Remove the service hole cover (lower side) and the packing.
4. Disconnect the harness connector.
5. Disconnect the fuel high-pressure hose and the fuel tank hose.

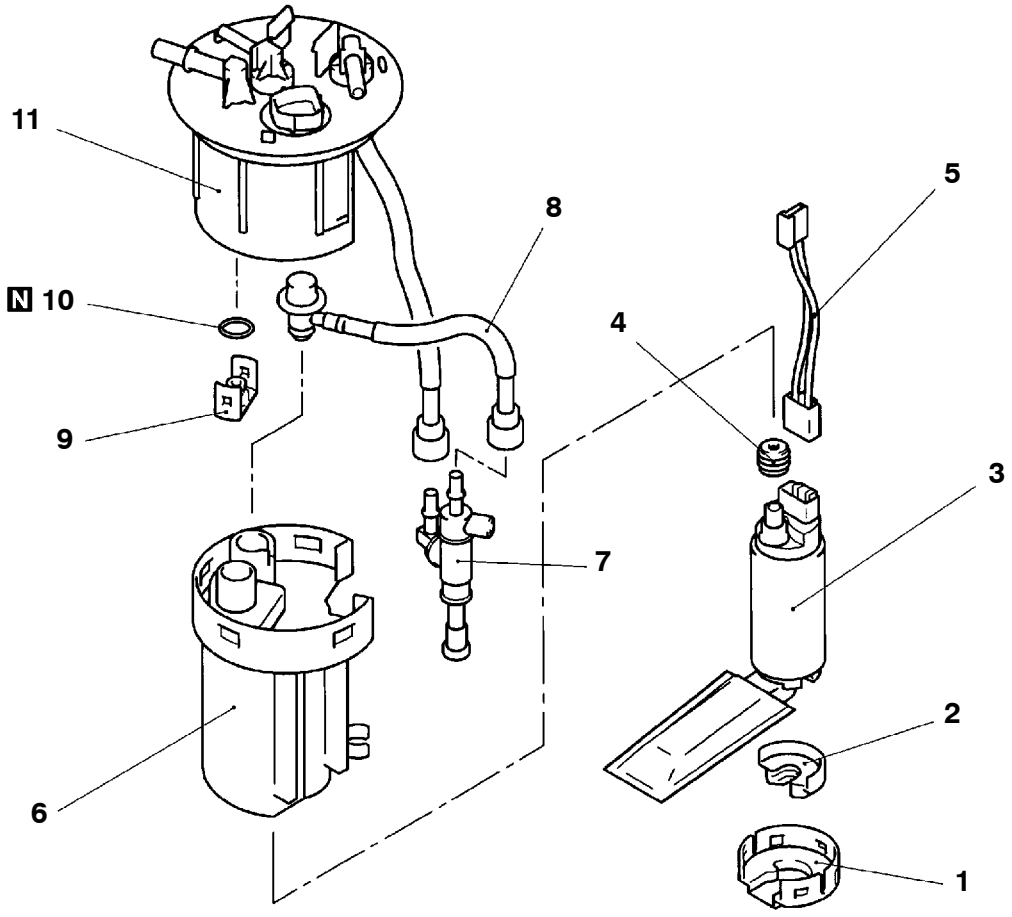
6. Unscrew the mounting nut to remove the fuel pump module.
7. Assemble the fuel pump module and tighten the mounting nut to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

8. Connect the fuel high-pressure hose and the fuel tank hose.
9. Connect the harness connector.
10. Attach the service hole cover (lower side) and the packing.
11. Attach the service hole cover (upper side) and the packing.
12. Restore the second seat.

DISASSEMBLY AND REASSEMBLY

FUEL PUMP MODULE



AX0962CA

Disassembly steps

1. Fuel pump bracket
2. Fuel pump cushion
3. Fuel pump (low-pressure)
▶A◀ 4. Grommet
5. Pump harness
6. Housing
7. Assist pump
8. Fuel pressure regulator (low-pressure)
9. Cap
▶A◀ 10. O-ring
11. Fuel high-pressure filter assembly

REASSEMBLY SERVICE POINTS

▶A◀ O-RING/GROMMET INSTALLATION

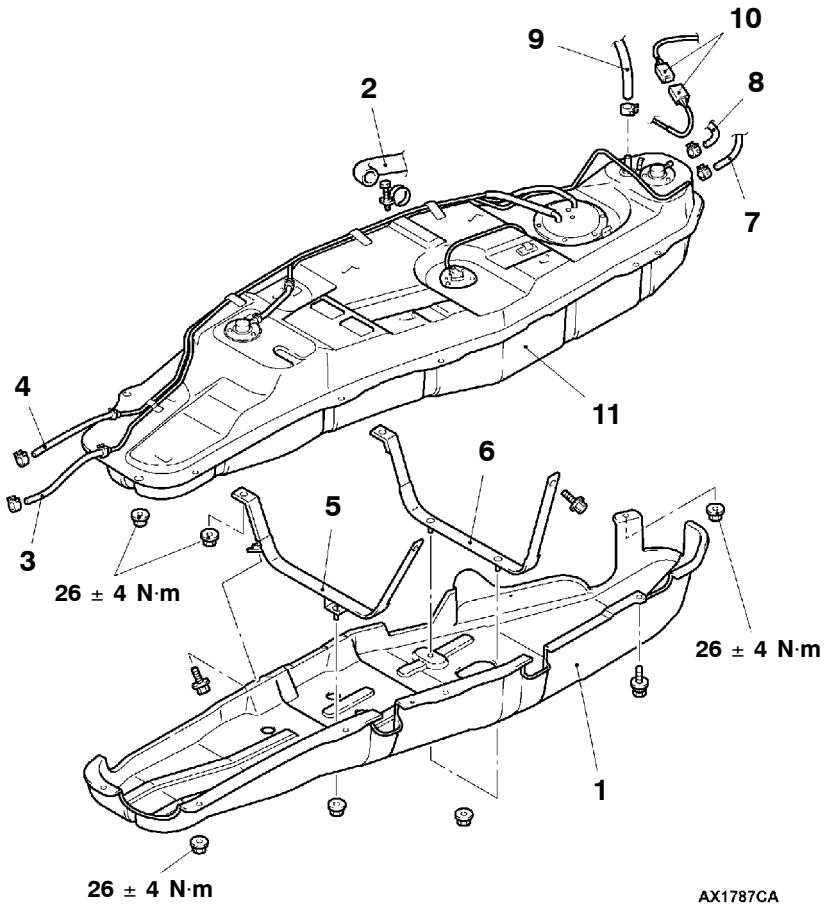
Apply a fuel to O-ring and grommet before installing them, to prevent them from being damaged or twisted.

FUEL TANK <4D5, 4M4>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining Fuel
- Fuel Line Pressure Reduction (Refer to GROUP 13A – On-vehicle Service.)
- Transmission Mount Center Member Assembly (Refer to GROUP 32.)

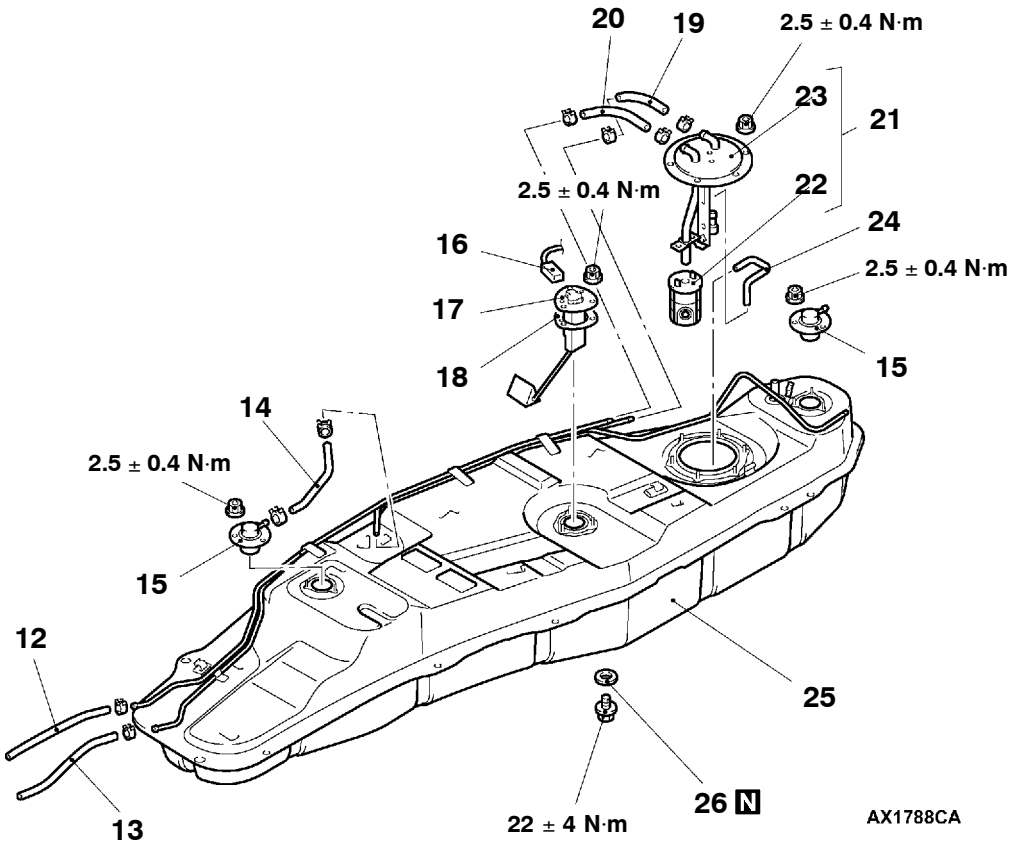
Post-installation Operation
- Transmission Mount Center Member Assembly (Refer to GROUP 32.)
- Fuel Leakage Inspection
- Refilling Fuel



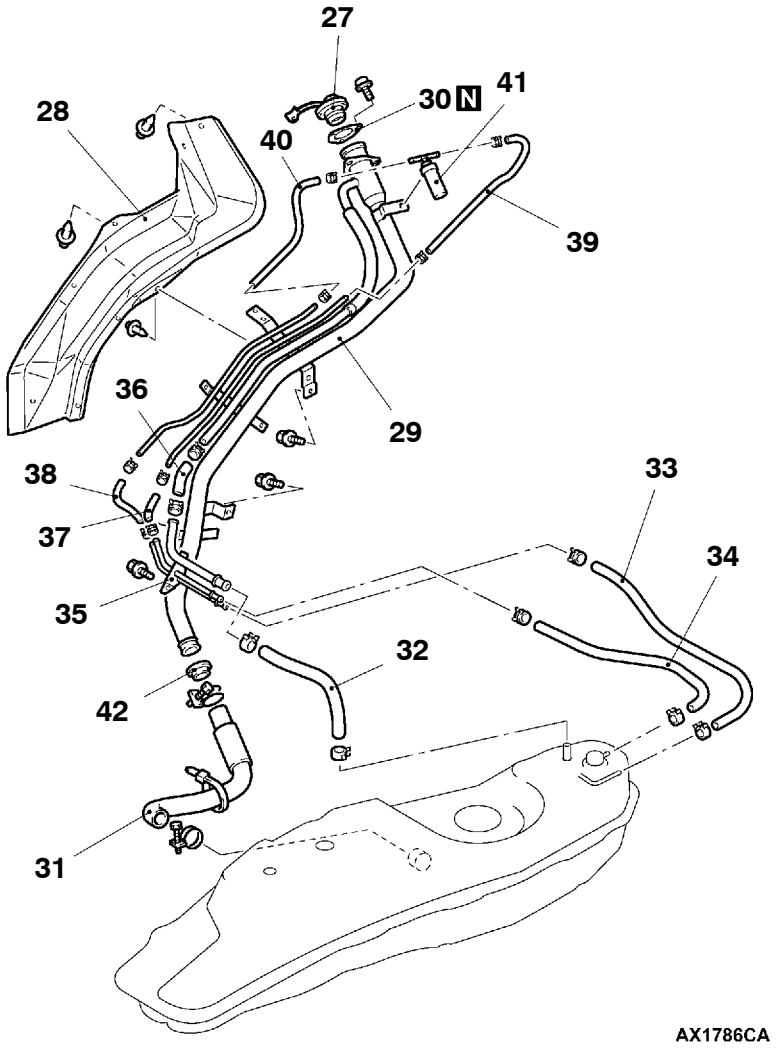
Removal steps
1. Fuel tank under protector
2. Fuel filler hose connection
3. Fuel return hose connection
4. Fuel main hose connection
5. Fuel tank band front
6. Fuel tank band rear

◀A▶
◀A▶

7. Fuel filler neck vapor hose (B) connection
8. Fuel filler neck vapor hose (A) connection
9. Fuel tank breather hose connection
10. Fuel tank harness connector connection
11. Fuel tank assembly



12. Fuel return hose
13. Fuel main hose
14. Fuel tank vapor hose
15. Valve assembly
16. Fuel tank harness
17. Fuel gauge unit
18. Packing
19. Fuel tank return hose
20. Fuel tank main hose
21. Fuel filter pipe assembly
22. Fuel filter
23. Pipe assembly
24. Fuel tank suction hose
25. Fuel tank
26. Gasket

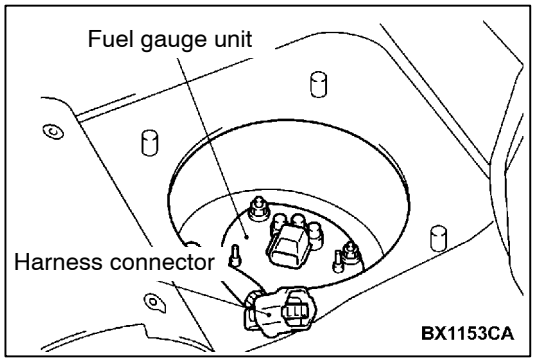


27. Fuel cap
28. Fuel filler neck protector
29. Fuel filler neck
30. Fuel filler neck gasket
31. Fuel filler hose
32. Fuel filler neck breather hose
33. Fuel filler neck vapor hose (B)
34. Fuel filler neck vapor hose (A)
35. Fuel filler pipe assembly
36. Fuel filler neck breather hose
37. Fuel filler neck vapor hose
38. Fuel filler neck vapor hose
39. Fuel filler neck vapor hose (B)
40. Fuel filler neck vapor hose (A)
41. Fuel filler neck check valve assembly
42. Shut-off valve

REMOVAL SERVICE POINT

◀A▶ FUEL TANK BREATHER HOSE/FUEL TANK CONNECTOR DISCONNECTION

Lower the fuel tank until the fuel tank breather hose and the fuel tank harness connectors can be disconnected.



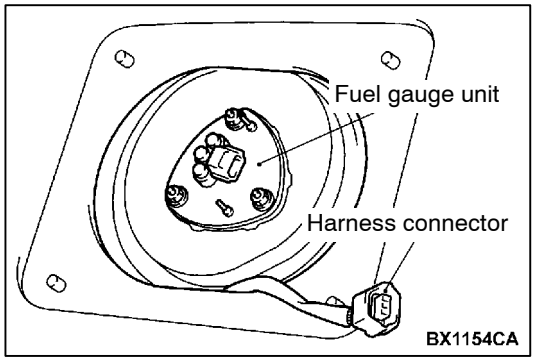
INSPECTION

FUEL GAUGE UNIT REPLACEMENT <SHORT WHEELBASE>

1. Slide the front seat (driver's side) forward and turn up the service hole notch on the carpet.
2. Remove the service hole cover and packing.
3. Disconnect the harness connector.
4. Unscrew the mounting nut to remove the fuel gauge unit.
5. Assemble the fuel gauge unit and tighten the mounting nut to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

6. Connect the harness connector.
7. Install the service hole cover and packing.
8. Return the floor carpet and slide the front seat (driver's side).



<LONG WHEELBASE>

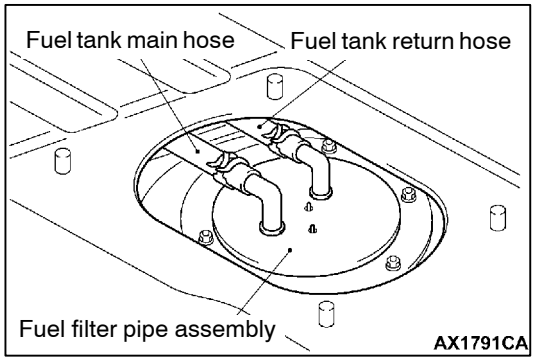
1. Tumble the second seat.
2. Remove the service hole cover (upper side) and the packing located under the second seat.
3. Remove the second seat, the rear scuff plate, the anchor bolts for the outer seat belt (second) and mounting screws of the lower quarter trim. Tear off the carpet. (Refer to GROUP 52A.)
4. Remove the service hole cover and the packing located between the front seat and the second seat.
5. Disconnect the harness connector.
6. Unscrew the mounting nut to remove the fuel gauge unit.
7. Assemble the fuel gauge unit and tighten the mounting nut to the specified torque.

Tightening torque : 2.5 ± 0.4 N·m

8. Connect the harness connector.
9. Attach the service hole cover and the packing located between the front seat and the second seat.
10. Restore the carpet; attach the second seat, the rear scuff plate, anchor bolts for the outer seat belt (second) and mounting screws of the lower quarter trim. (Refer to GROUP 52A.)
11. Attach the service hole cover located under the second seat and the packing.
12. Restore the second seat.

FUEL GAUGE UNIT CHECK

Refer to GROUP 54 - Combination Meter.

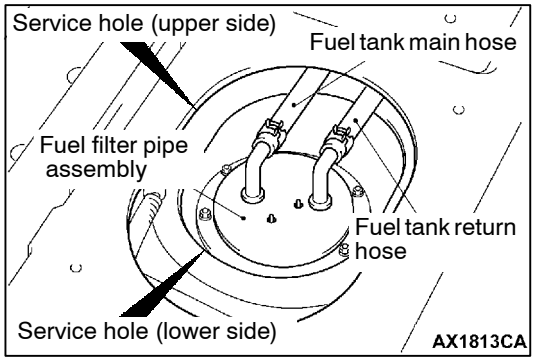


FUEL FILTER PIPE ASSEMBLY REPLACEMENT <SHORT WHEELBASE>

1. Remove the front scuff plate and outer seat belt (rear) anchor bolt, and then turn the carpet up. (Refer to GROUP 52A.)
2. Remove the service hole cover and packing.
3. Disconnect the fuel tank return hose and the fuel tank main hose.
4. Remove the mounting nuts, and remove the fuel filter pipe assembly.
5. Install the fuel filter pipe assembly, and tighten the mounting nuts to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

6. Connect the fuel tank return hose and the fuel tank main hose.
7. Install the service hole cover and packing.
8. Spread the carpet and then install the front scuff plate and outer seat belt (rear) anchor bolt. (Refer to GROUP 52A.)



<LONG WHEELBASE>

1. Tumble the second seat.
2. Remove the service hole cover (upper side) and the packing.
3. Remove the service hole cover (lower side) and the packing.
4. Disconnect the fuel tank return hose and the fuel tank main hose.
5. Unscrew the mounting nut to remove the fuel filter pipe assembly.
6. Assemble the fuel filter pipe assembly and tighten the mounting nut to the specified torque.

Tightening torque: 2.5 ± 0.4 N·m

7. Connect the fuel tank return hose and the fuel tank main hose.
8. Attach the service hole cover (lower side) and the packing.
9. Attach the service hole cover (upper side) and the packing.
10. Restore the second seat.

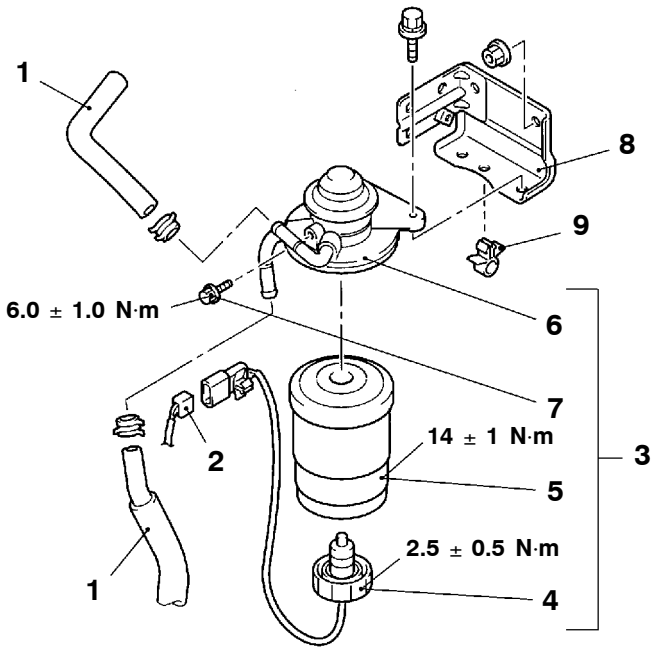
FUEL FILTER

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Cover Removal
  (Refer to GROUP 11B - Camshaft)
- Battery, Battery Tray Removal

Post-installation Operation
- Fuel Line Air-bleeding
  (Refer to GROUP 13B - On-vehicle Service.)
- Battery, Battery Tray Installation
- Engine Cover Installation
  (Refer to GROUP 11B - Camshaft.)

<4D5>

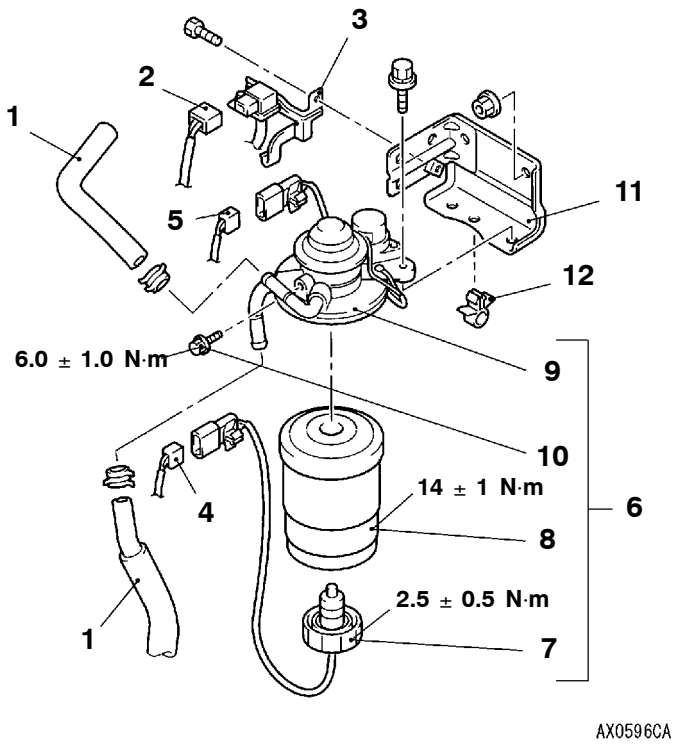


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Removal steps

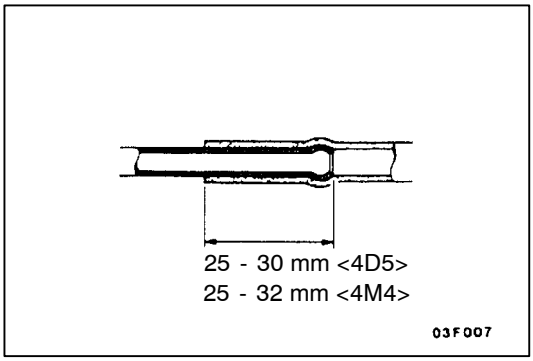
▶A◀ 1. Fuel hose
2. Water level sensor connector connection
3. Fuel filter assembly
4. Water level sensor
5. Fuel filter cartridge
6. Fuel filter pump
7. Air plug
8. Fuel filter bracket
9. Clip

<4M4>



Removal steps

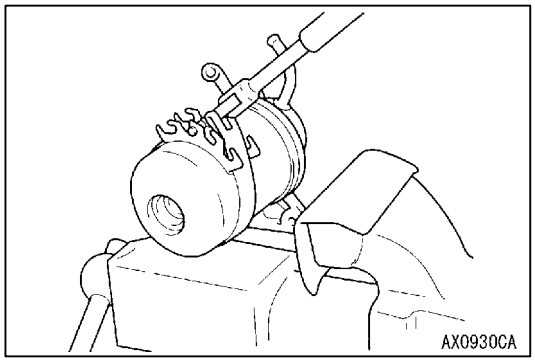
▶A◀ 1. Fuel hose
2. Boost sensor connector
3. Boost sensor bracket
4. Water level sensor connector connection
5. Fuel line heater connector <Vehicles for cold zone>
6. Fuel filter assembly
7. Water level sensor
8. Fuel filter cartridge
9. Fuel filter pump
10. Air plug
11. Fuel filter bracket
12. Clip



INSTALLATION SERVICE POINT

▶A◀ FUEL MAIN HOSE INSTALLATION

If the pipe has a stepped part, connect securely up to the stepped part. If the pipe has no stepped part, insert so that the inserted portion is 25 - 30 mm <4D5>, 25 - 32 mm <4M4> long.



INSPECTION

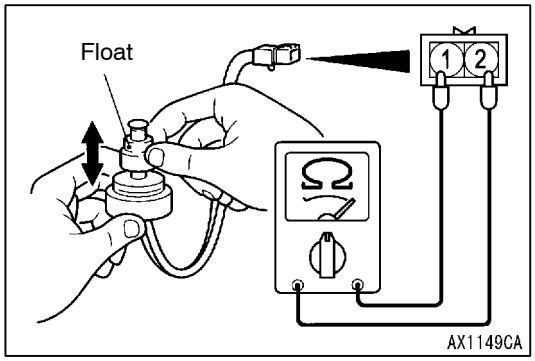
FUEL FILTER CARTRIDGE REPLACEMENT

1. Remove the fuel filler cap, and depressurise the fuel tank.
2. Disconnect the connector and the fuel hose.
3. Remove the boost sensor bracket from the fuel filter bracket. <4M4>
4. Remove the fuel filter assembly from the fuel filter bracket.
5. Remove the water level sensor from the fuel filter cartridge.
6. Use a filter wrench to remove the fuel filter cartridge from the fuel filter pump.

   Caution

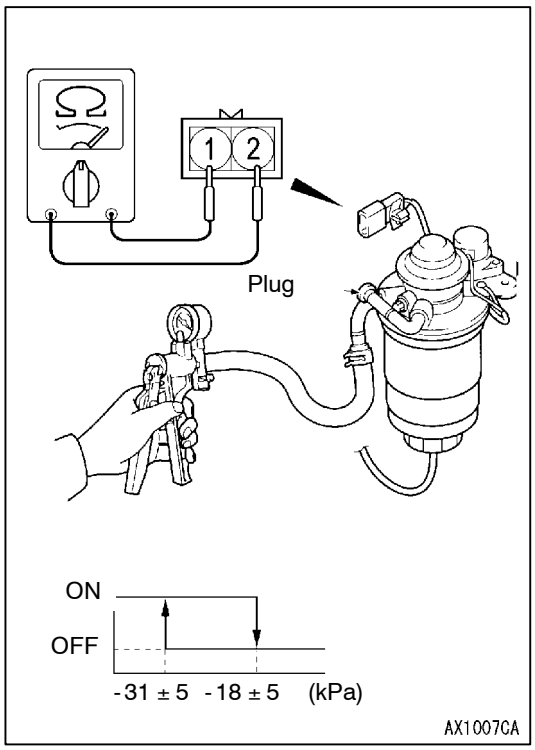
   Cover the cartridge port with rag to prevent fuel from flowing out.

7. Install a new filter, and bleed the air from fuel line. (Refer to GROUP 13B - On-vehicle Service.) <4D5> (Refer to GROUP 13C - On-vehicle Service.) <4M4>
8. Start the engine, and check that there is no fuel leakage.



WATER LEVEL SENSOR CHECK

1. Connect the circuit tester to the water level sensor.
2. There should be continuity when the float is raised, while there is no continuity when it is lowered.
3. Replace the water level sensor if it is faulty.



FUEL LINE HEATER CONTINUITY CHECK <4M4>

1. Connect a hand vacuum pump to the outlet port of the fuel filter pump, and plug the inlet port as shown.
2. Connect a circuit tester to the fuel line heater connector.
3. Using hand vacuum pump apply a vacuum to the fuel filter pump body, check that there is a continuity between terminals when the pressure becomes -31 ± 5 kPa or less.
4. Lower the load gradually and became -18 ± 5 kPa, check that there is no continuity.
5. The fuel line heater is normal if the conditions 3 and 4 above are satisfied.
6. Replace the fuel filter pump if defective.

NOTES