FUEL

CONTENTS

GASOLINE DIRECT INJECTION (GDI) <4G6>

CONTENTS

GENERAL INFORMATION

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

FUEL INJECTION CONTROL

The injector drive times and 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 1-3-4-2. 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 determines how deeply the accelerator pedal is depressed by means of the accelerator position sensor (APS). Then the engine-ECU 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 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 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 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 RAM data inside the engine-ECU 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. Fan Motor Control
   The revolutions of the radiator fan and condenser fan are controlled in response to the engine coolant temperature and vehicle speed.
4. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
5. EGR valve Control
   Refer to GROUP 17.

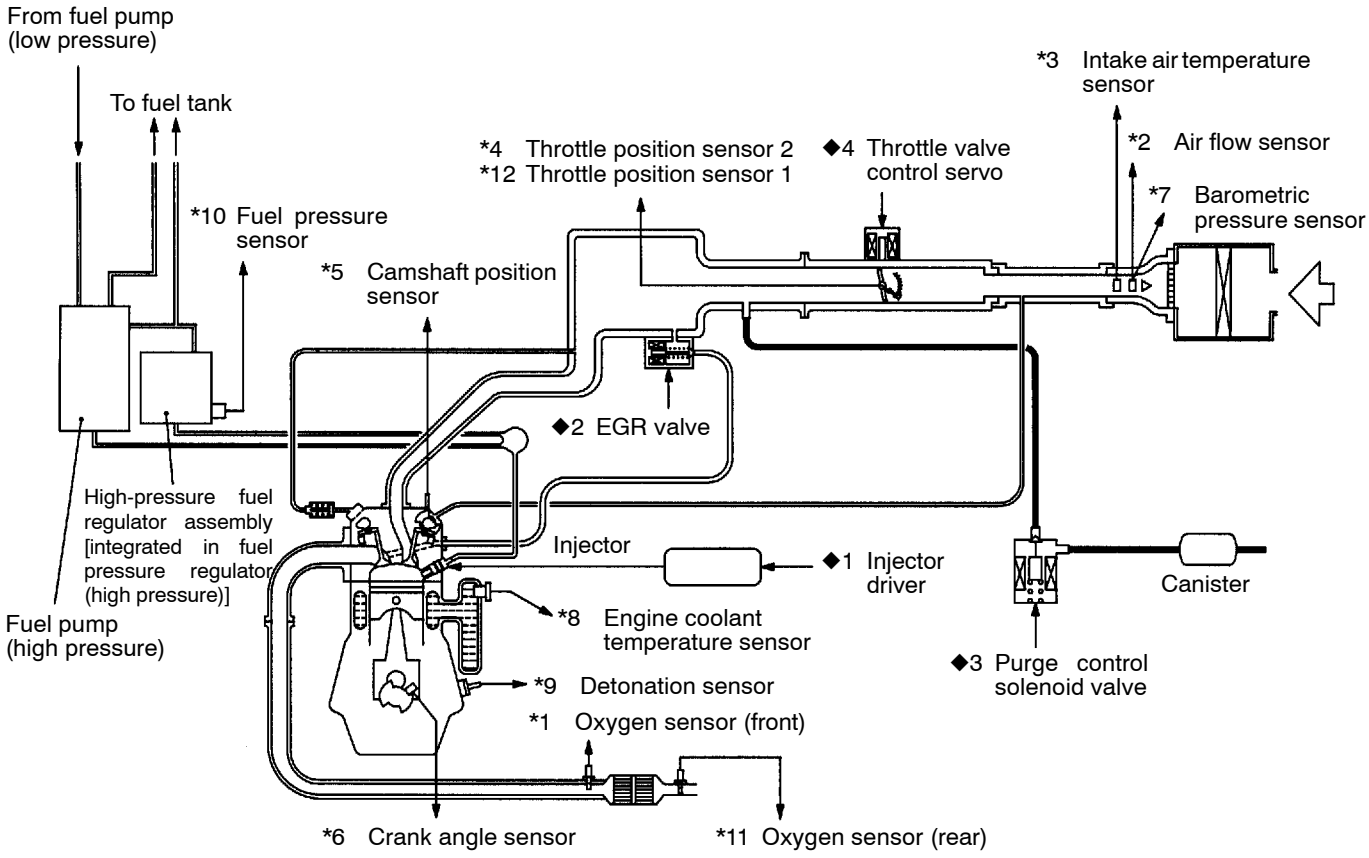
GENERAL SPECIFICATIONS

Items			Specifications
Throttle body	Throttle bore mm		65
	Throttle position sensor		Variable resistor type
	Throttle valve control servo		Torque motor type
Engine-ECU	Identification model No.	Except vehicles for Germany	E2T72571 <M/T> E2T72574 <A/T>
		Vehicles for Germany	E2T72575 <M/T> E2T73576 <A/T>

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, 4
	Injector identification mark	DIM 1100G
	Throttle valve control servo relay	Contact switch type
	Throttle valve control servo	Torque motor type
	EGR valve	Stepper motor type
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator (low pressure)	Regulator pressure kPa	324
Fuel pressure regulator (high pressure)	Regulator pressure MPa	5.5

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

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



W6058AE

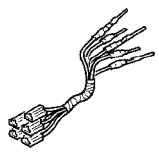
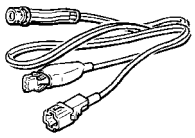
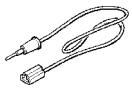
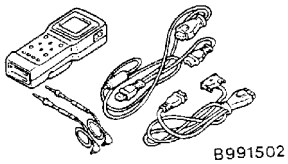
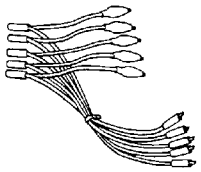
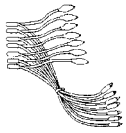
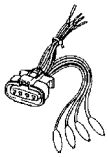
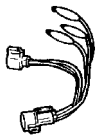
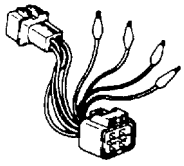
SERVICE SPECIFICATIONS

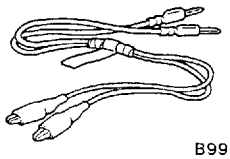
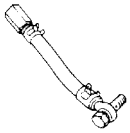
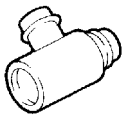
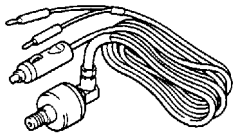
Item		Standard value
Adjustment voltage of throttle position sensor (1st channel) V		0.4 - 0.6
Adjustment voltage of throttle position sensor (2nd channel) V		4.2 - 4.8
Resistance of throttle position sensor kΩ		1.7 - 3.8
Adjustment voltages (1) and (2) of accelerator pedal position sensor V		0.4 - 1.0
Resistance (1) and (2) of throttle position sensor 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 - 7.5
	Low-pressure side kPa	Approximately 324
Injector coil resistance Ω		0.9 - 1.1
Oxygen sensor output voltage V		0.6 - 1.0
Oxygen sensor heater resistance Ω		11 - 18
Throttle valve control servo resistance Ω		1.35 - 1.65

SEALANT

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

SPECIAL TOOLS

Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	● Fuel gauge simple inspection A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	● Reading diagnosis code ● GDI system inspection
	MB991348, MB991658	Test harness set	● Measurement of voltage during trouble-shooting ● Inspection using an analyzer
 MB991709	MB991709	Test harness	
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
	MD998478	Test harness (3-pin, triangle)	● Measurement of voltage during trouble-shooting ● Inspection using an analyzer
	MD998464	Test harness (4-pin, square)	Inspection of oxygen sensor

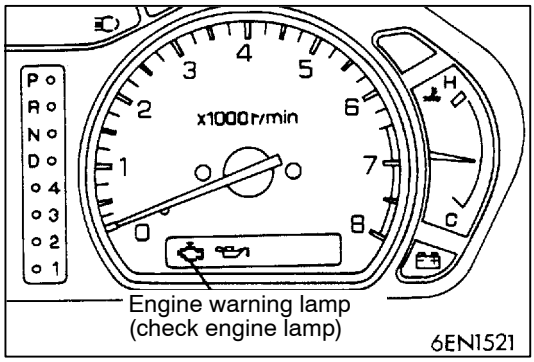
Tool	Number	Name	Use
 B991529	MB991529	Diagnosis code check harness	Reading diagnosis code
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE
If the engine-ECU is replaced, the steering lock cylinder and ignition key should be replaced together with it.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the Gasoline Direct Injection (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.

Engine warning lamp inspection items

Engine-ECU
Oxygen sensor
Air flow sensor
Intake air temperature sensor
Throttle position sensor (1st channel)
Throttle position sensor (2nd channel)
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Barometric pressure sensor
Detonation sensor
Injector
Abnormal combustion
Immobilizer system
Abnormal fuel pressure
Brake vacuum sensor
Fuel system malfunction
Accelerator pedal position sensor (1st channel)
Accelerator pedal position sensor (2nd channel)
Electronic-controlled throttle valve system
Throttle valve control servo
Throttle valve controller

METHOD OF READING 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 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.
5. Start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

If the diagnosis system detects any sensor malfunction, the vehicle can be driven safely by using a default control logic instead of the faulty sensors.

Defective part or function	What to do when a sensor is defective
Air flow sensor	(1) Disables lean-mixture combustion. (2) Determines injector basic operating time and basic ignition timing according to map value, which has been predetermined by throttle position sensor and crank angle sensor signals.
Intake air temperature sensor	Controls as the intake air temperature is 25°C.
Throttle position sensor (1st channel)	(1) Disables lean-mixture combustion. (2) Controls throttle valve opening angle by closed loop control by using the throttle position sensor (2nd channel) signal. (3) Disables the throttle valve opening angle control when the throttle position sensor (2nd channel) signal is also defective.
Throttle position sensor (2nd channel)	(1) Disables lean-mixture combustion. (2) Controls throttle valve opening angle by closed loop control by using the throttle position sensor (1st channel) signal. (3) Disables the throttle valve opening angle control when the throttle position sensor (1st channel) signal is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Note that this control will continue until the ignition switch is turned off even if the sensor signal return to normal.)
Camshaft position sensor	Controls according to the conditions before a failure is detected.
Vehicle speed sensor	(1) Disables lean-mixture combustion. However, if a predetermined time elapses at an engine speed of 1,500 r/min or more, the lean-mixture combustion will return to normal. (2) Disables lean-mixture combustion during engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Holds the ignition timing at that for regular gasoline.
Injector	(1) Disables lean-mixture combustion. (2) Shuts down exhaust gas recirculation.
Abnormal combustion	Disables lean-mixture combustion.
Communication line with A/T-ECU	Disables ignition timing retard control (engine and transmission total control) during shift change.
Alternator FR terminal	Disables inhibition control of the alternator output according to electrical load (treats the alternator as if it is conventional one).
Fuel pressure sensor	(1) Controls as if the fuel pressure is 5.5 MPa (if there is open or short circuit). (2) Turns off the fuel pump relay (if the fuel pressure is excessively high). (3) Shuts off the fuel injection (If an excessively low pressure is detected or the engine speed exceeds 3,000 r/min).

Defective part or function	What to do when a sensor is defective
Accelerator pedal position sensor (1st channel)	(1) Disables lean-mixture combustion. (2) Controls the throttle valve position by using the accelerator pedal position sensor (2nd channel) signal. (3) Disables the electronic-controlled throttle valve system if the accelerator pedal position sensor (2nd channel) signal is also defective, and holds the throttle valve at a predetermined angle where the vehicle can be driven safely although its performance is reduced.
Accelerator pedal position sensor (2nd channel)	(1) Disables lean-mixture combustion. (2) Controls the throttle valve position by using the accelerator pedal position sensor (1st channel) signal. (3) Disables the electronic-controlled throttle valve system if the accelerator pedal position sensor (1st channel) signal is also defective.
Electronic-controlled throttle valve system	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables idle engine speed feedback control.
Throttle valve position feedback	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables idle engine speed feedback control.
Throttle valve control servo motor malfunction (1st phase)	Disables lean-mixture combustion.
Throttle valve control servo motor malfunction (2nd phase)	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables idle engine speed feedback control.
Communication line with the throttle valve controller	(1) Error in communication between the throttle valve controller and engine-ECU ● Disables lean-mixture combustion. ● Shuts off fuel supply when engine speed exceeds 3,000 r/min. (1) Error in communication between the throttle valve controller and engine-ECU ● Disables lean-mixture combustion. ● Shuts off fuel supply when engine speed exceeds 3,000 r/min. ● The throttle valve controller controls the throttle valve opening angle by using the accelerator pedal position sensor (2nd channel) signal.

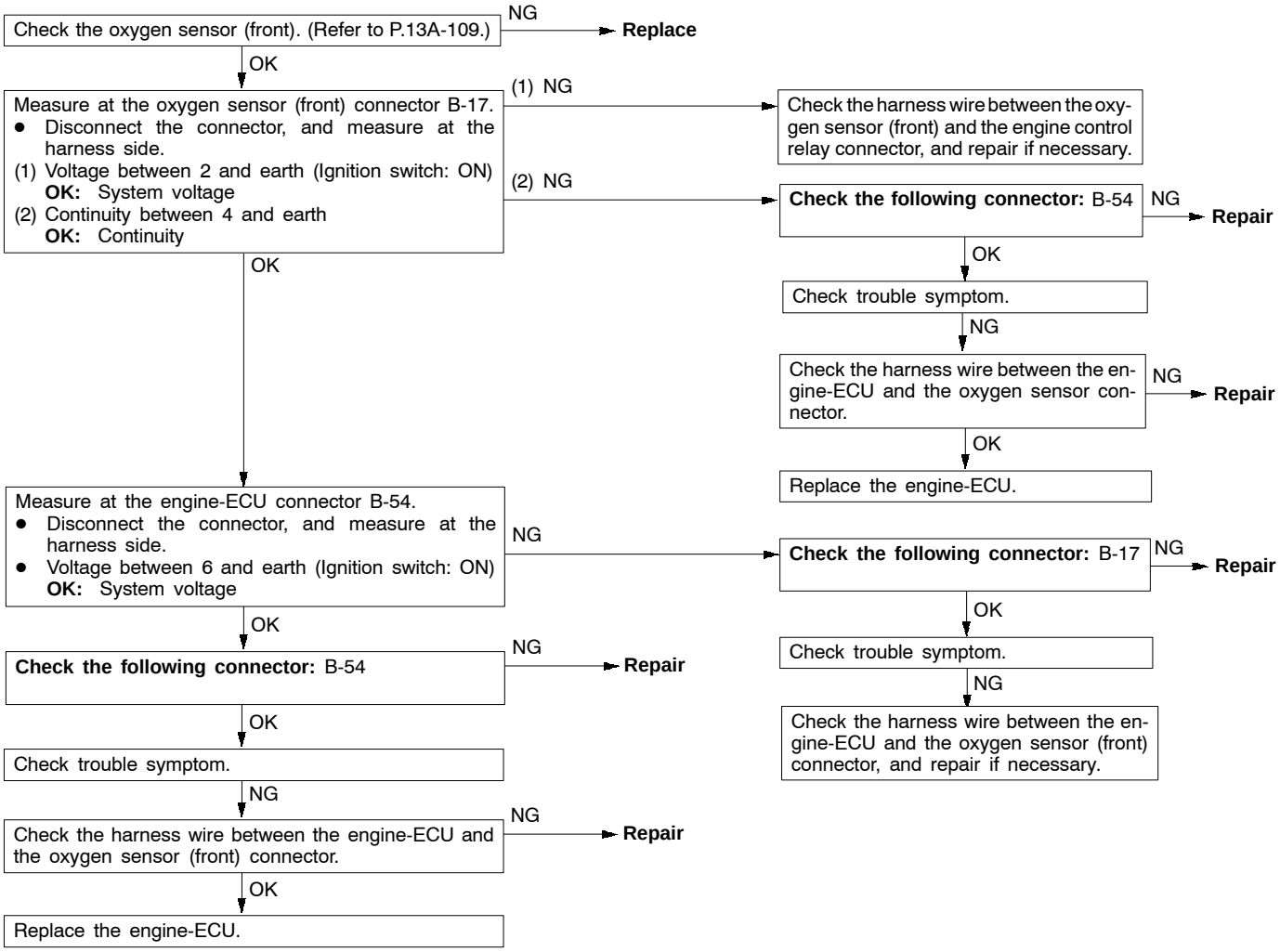
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Oxygen sensor (front) system	13A-14
12	Air flow sensor system	13A-15
13	Intake air temperature sensor system	13A-16
14	Throttle position sensor (2nd channel) system	13A-17
21	Engine coolant temperature sensor system	13A-18
22	Crank angle sensor system	13A-19
23	Camshaft position sensor system	13A-20
24	Vehicle speed sensor system	13A-21
25	Barometric pressure sensor system	13A-22
31	Detonation sensor system	13A-23
41	Injector system	13A-24
44	Abnormal combustion	13A-26
54	Immobilizer system	13A-27
56	Abnormal fuel pressure system	13A-28
59	Oxygen sensor (rear) system	13A-30
61	Communication line with A/T-ECU system	13A-31
64	Alternator FR terminal system	13A-31
66	Brake vacuum sensor system	13A-32
77	Accelerator pedal position sensor (2nd channel) system	13A-33
78	Accelerator pedal position sensor (1st channel) system	13A-34
79	Throttle position sensor (1st channel) system	13A-35
89	Abnormality in fuel pressure system	13A-36
91	Electronic-controlled throttle valve system	13A-36
92	Throttle valve position feedback system	13A-37
94	Communication line system with throttle valve controller	13A-37
95	Malfunction in throttle valve control servo motor system (1st phase)	13A-38
99	Malfunction in throttle valve control servo motor system (2nd phase)	13A-38

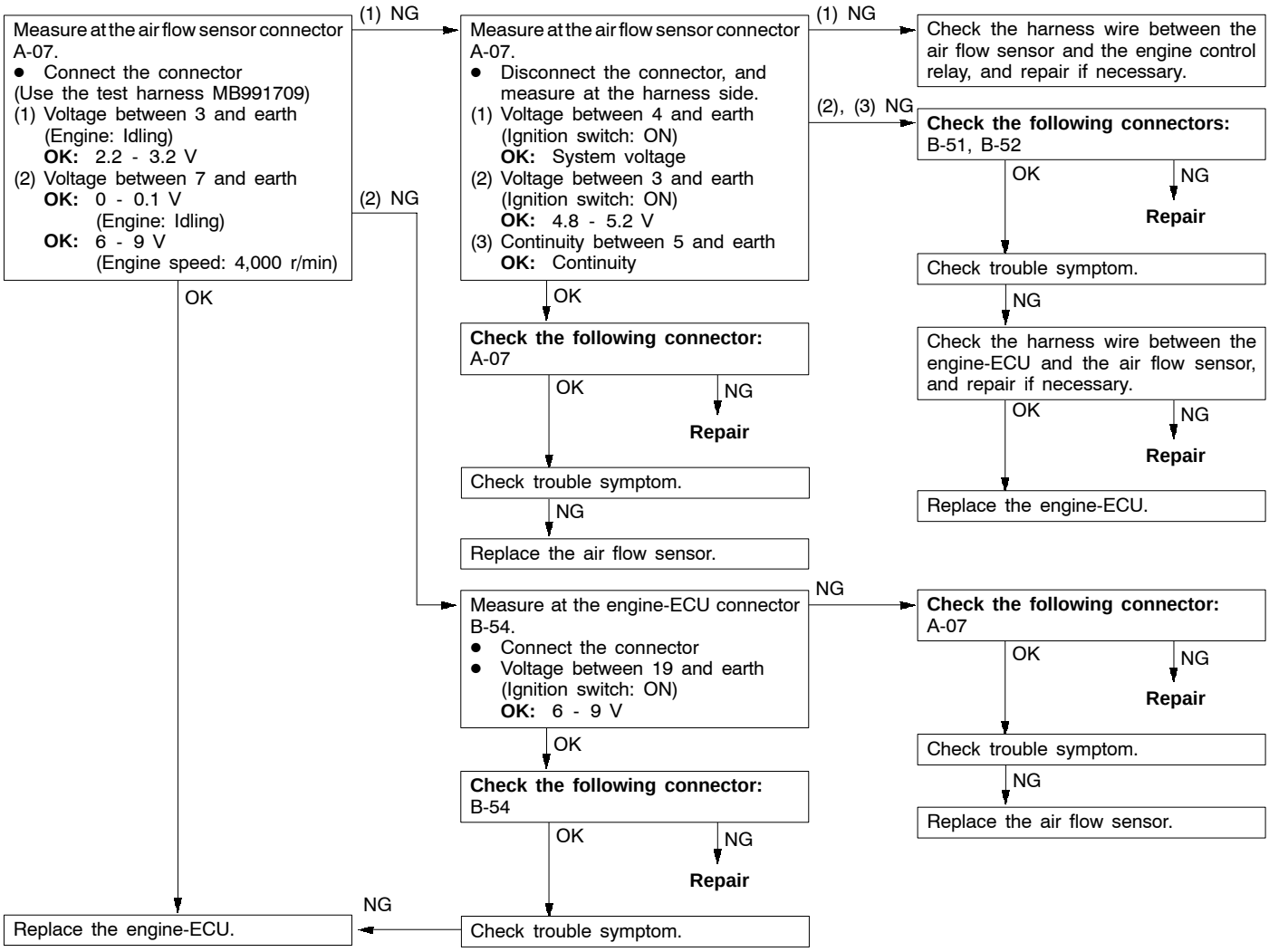
NOTE
Code No. 56 may be also output when air is sucked in high-pressure fuel line due to no fuel supply.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

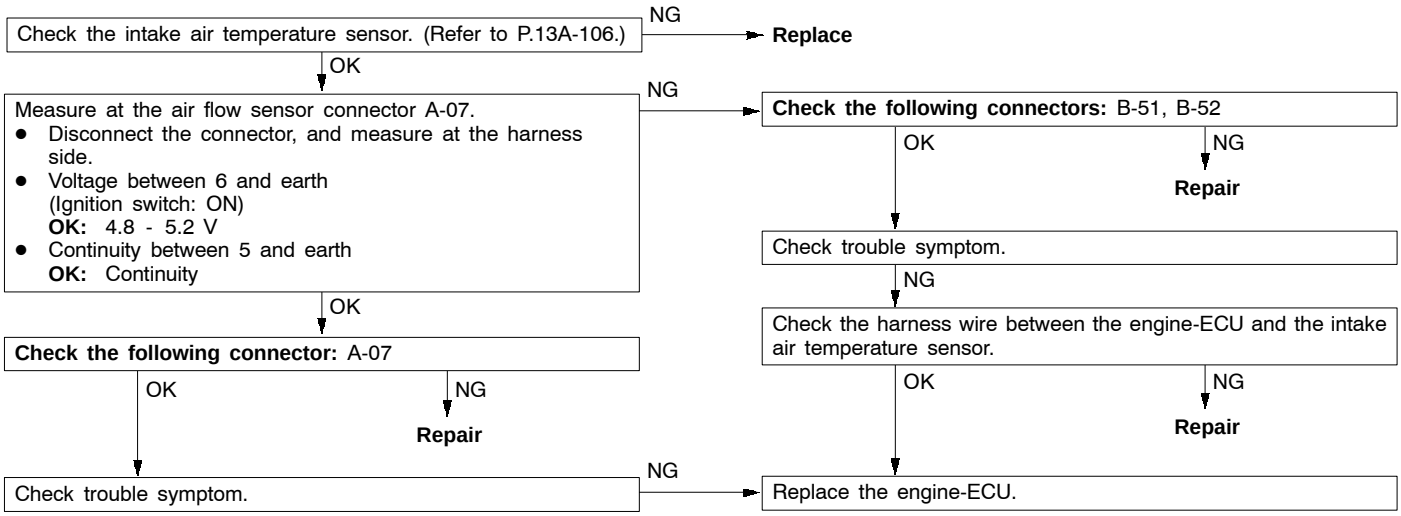
Code No. 11 Oxygen sensor (front) system	Probable cause
Range of check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 50°C. ● Engine speed is approx. 2,000 - 3,000 r/min ● Vehicle is moving at constant speed on a flat, level road surface Set conditions ● The oxygen sensor output voltage is around 0.6 V for 30 seconds (does not cross 0.6 V for 30 seconds). ● When the range of check operations given above which accompany starting of the engine are carried out four time in succession, a problem is detected after each operation.	● Malfunction of the oxygen sensor (front) ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU



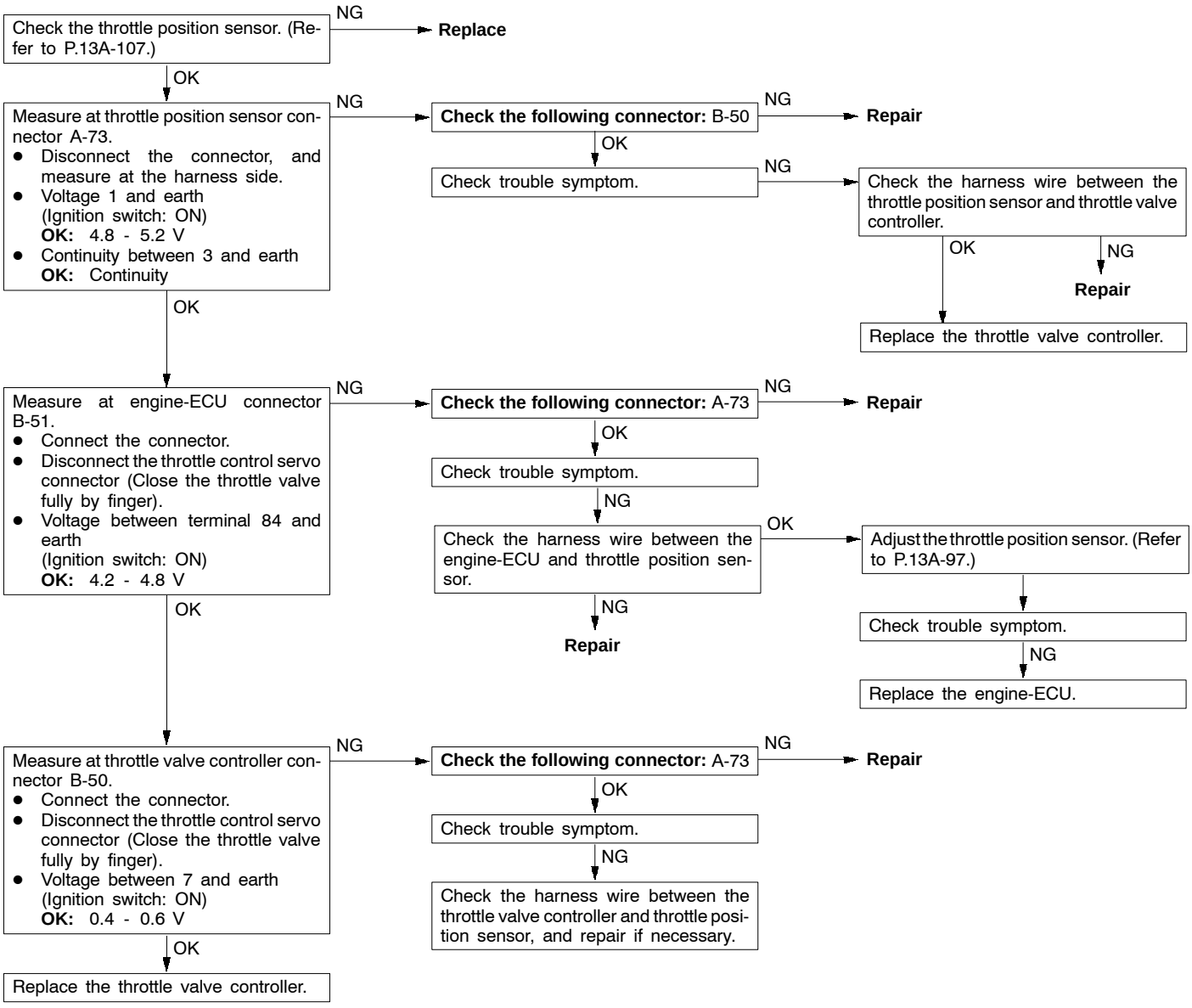
Code No.12 Air flow sensor system	Probable cause
Range of check ● Engine speed is 500 r/min or more. Set conditions ● Sensor output frequency is 3.3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Open circuit or short-circuited harness wire of air flow sensor circuit ● Malfunction of the engine-ECU



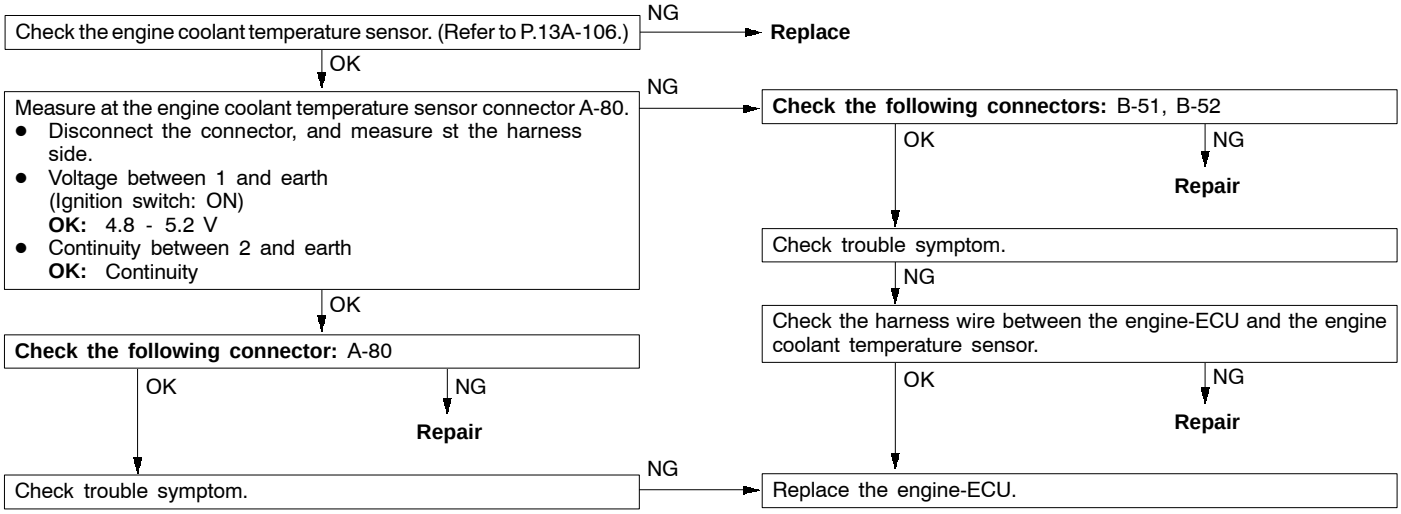
Code No.13 Intake air temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 0.14 kΩ or less for 4 seconds. or ● Sensor resistance is 50 kΩ or more for 4 seconds.	● Malfunction of the intake air temperature sensor ● Open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the engine-ECU



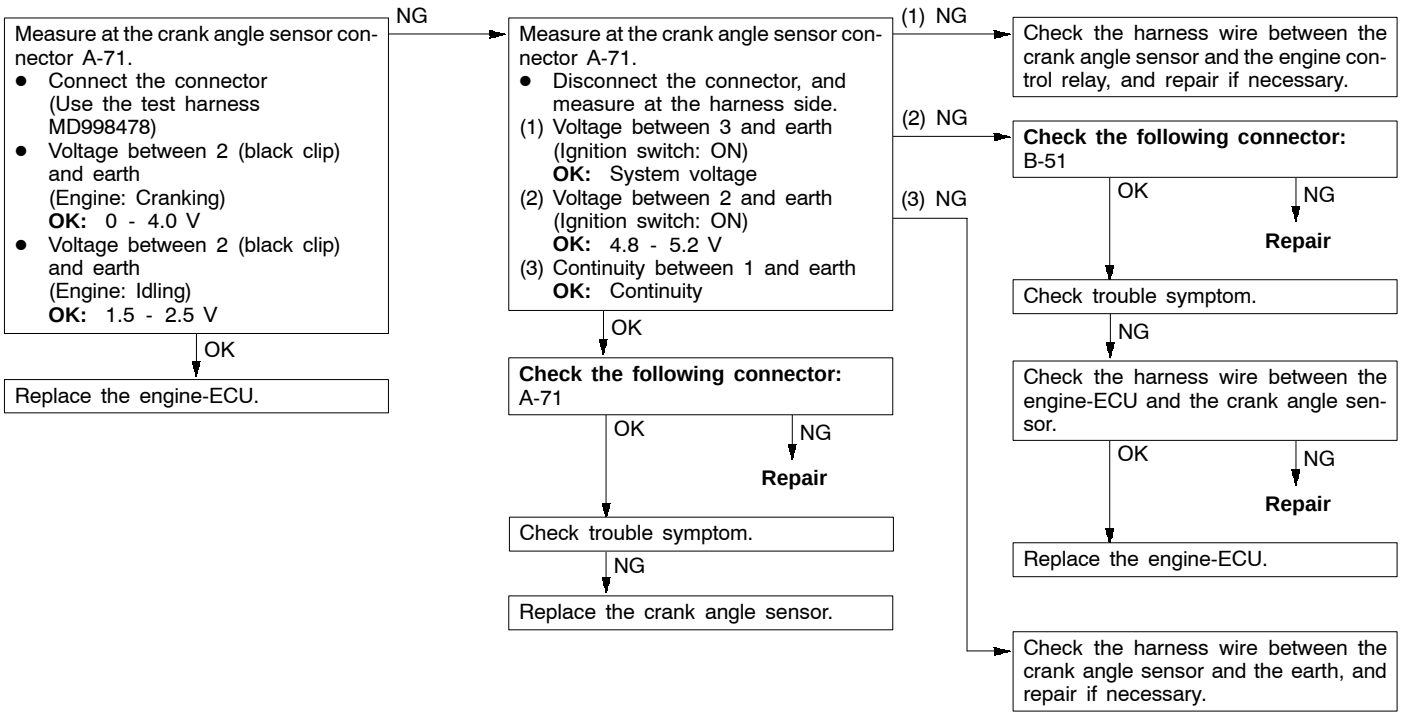
Code No.14 Throttle position sensor system (2nd channel)	Probable cause
The throttle valve controller determines whether a failure is present or not, and sends a signal indicating its result to the engine-ECU. Range of check ● Ignition switch: ON ● Throttle position sensor (1st channel) is normal Set conditions ● The throttle position sensor (1st channel) output voltage is 1.24 V or more, and the (2nd channel) output voltage is 4.6 V or more for one second. or ● The throttle position sensor (1st channel) output voltage is 3.53 V or less, and the (2nd channel) output voltage is 0.2 V or less for one second. or ● Throttle position sensor (1st and 2nd channels) output voltages are outside 4 to 6 V.	● Malfunction of throttle position sensor (2nd channel) ● Open circuit or short-circuited harness wire in throttle position sensor (2nd channel) or poor connector contact ● Faulty throttle valve controller ● Malfunction of the engine-ECU



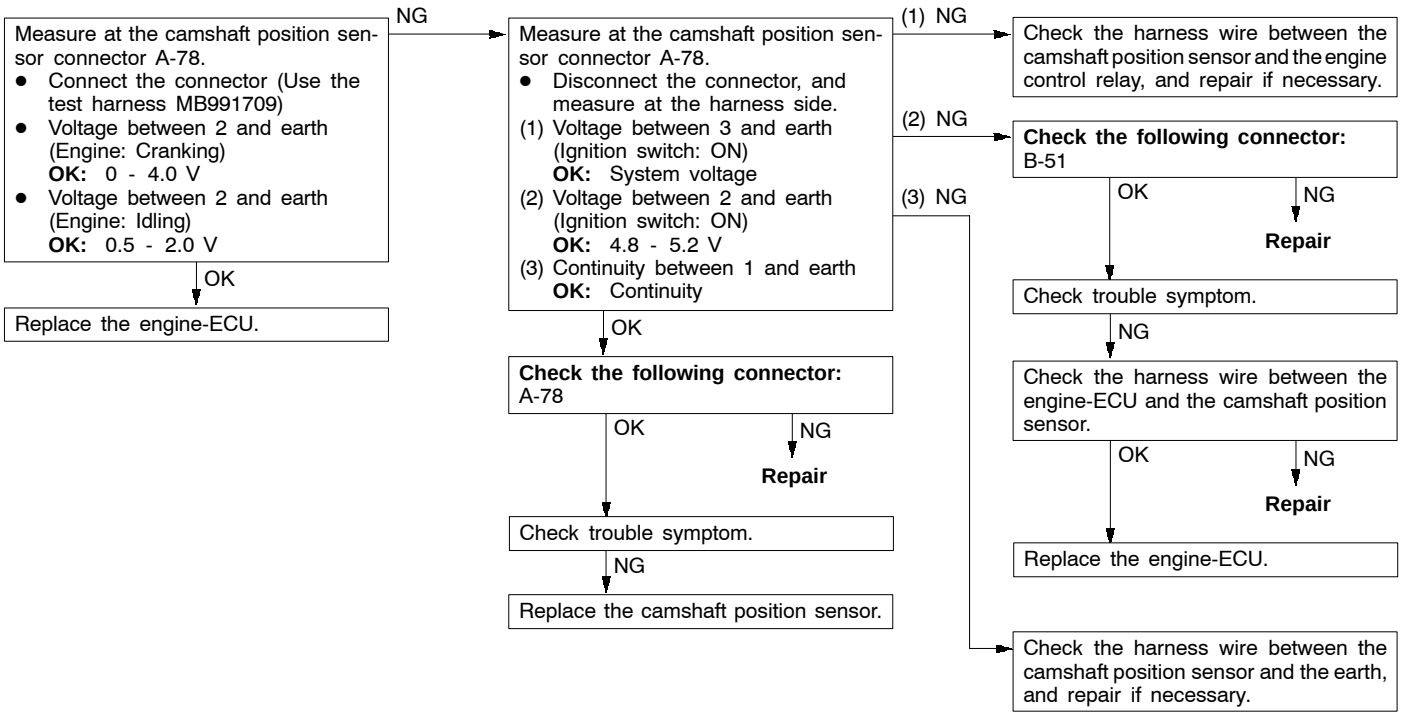
Code No.21 Engine coolant temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 50 Ω or less for 4 seconds. or ● Sensor resistance is 72 kΩ or more for 4 seconds.	● Malfunction of the engine coolant temperature sensor ● Open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit ● Malfunction of the engine-ECU
Range of check ● After engine starts Set conditions ● After 5 minutes or more have passed since the engine coolant temperature after filtering has dropped from 40°C or more to less than this temperature	



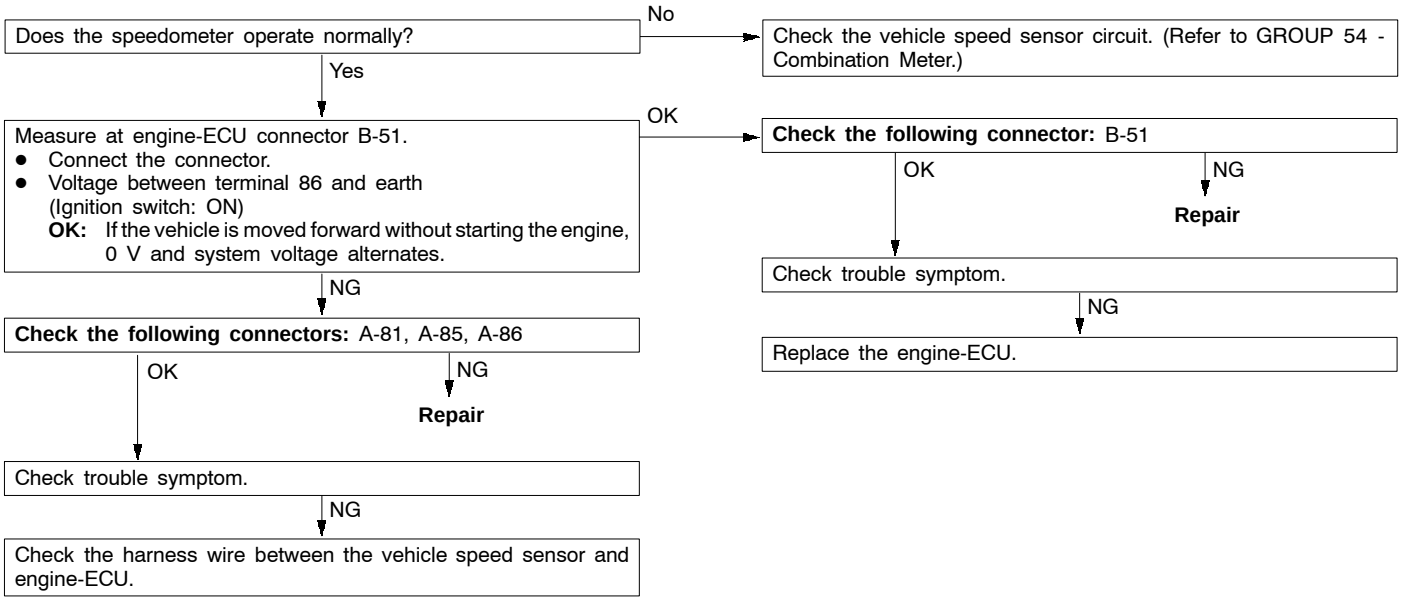
Code No.22 Crank angle sensor system	Probable cause
Range of check ● Engine: During cranking Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	● Malfunction of the crank angle sensor ● Open circuit or short-circuited harness wire of the crank angle sensor circuit ● Malfunction of the engine-ECU



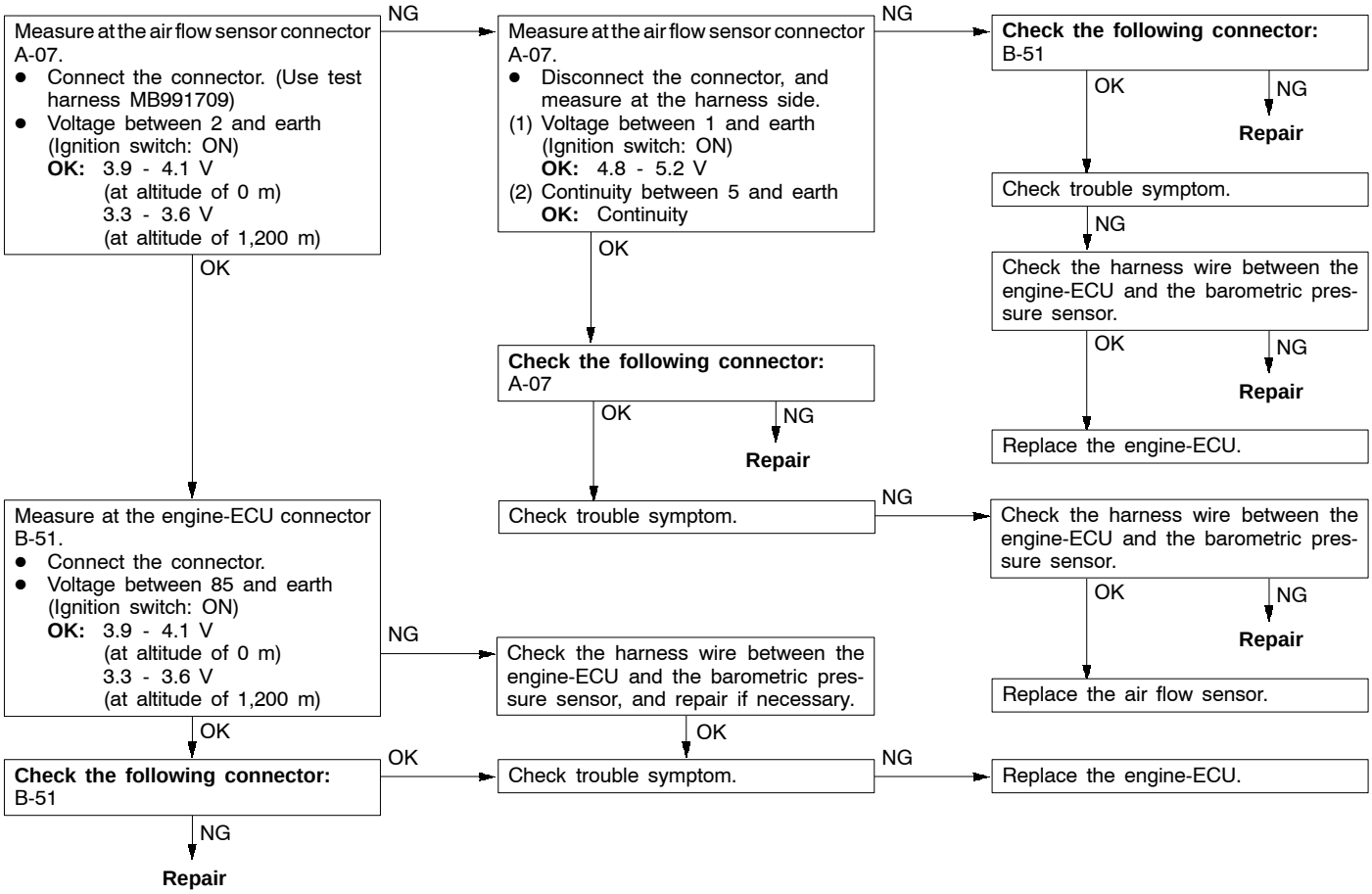
Code No.23 Camshaft position sensor system	Probable cause
Range of check ● While engine is cranking or running Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input). or ● Abnormal pulse signal pattern is output.	● Malfunction of the camshaft position sensor ● Open circuit or short-circuited harness wire of the camshaft position sensor ● Malfunction of the engine-ECU



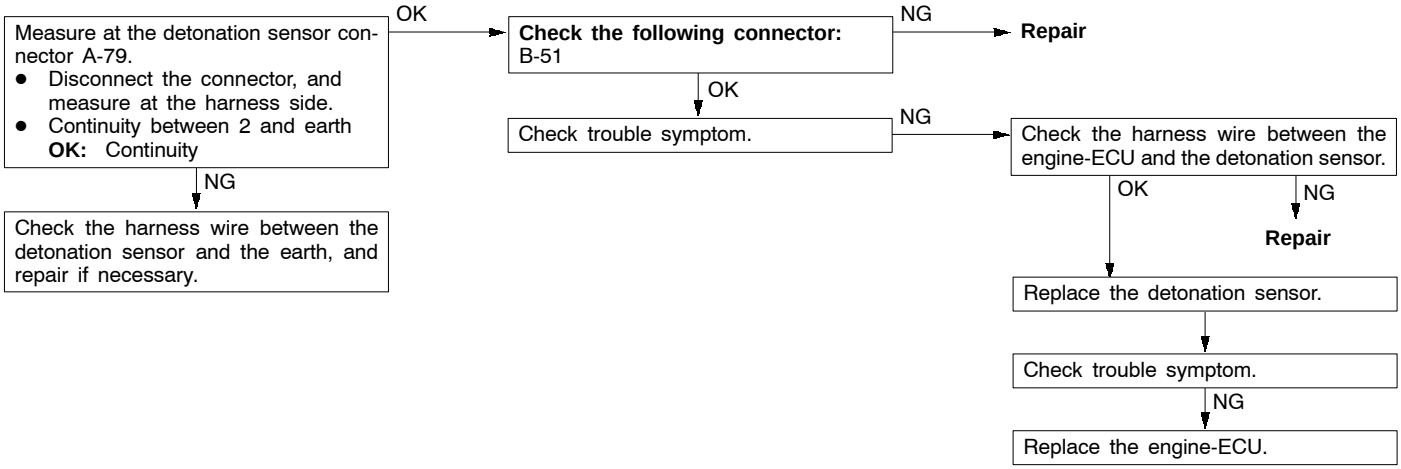
Code No. 24 Vehicles speed sensor system	Probable cause
Range of check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Engine speed is 3,000 r/min or more. ● Driving under high engine load conditions. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit ● Malfunction of the engine-ECU



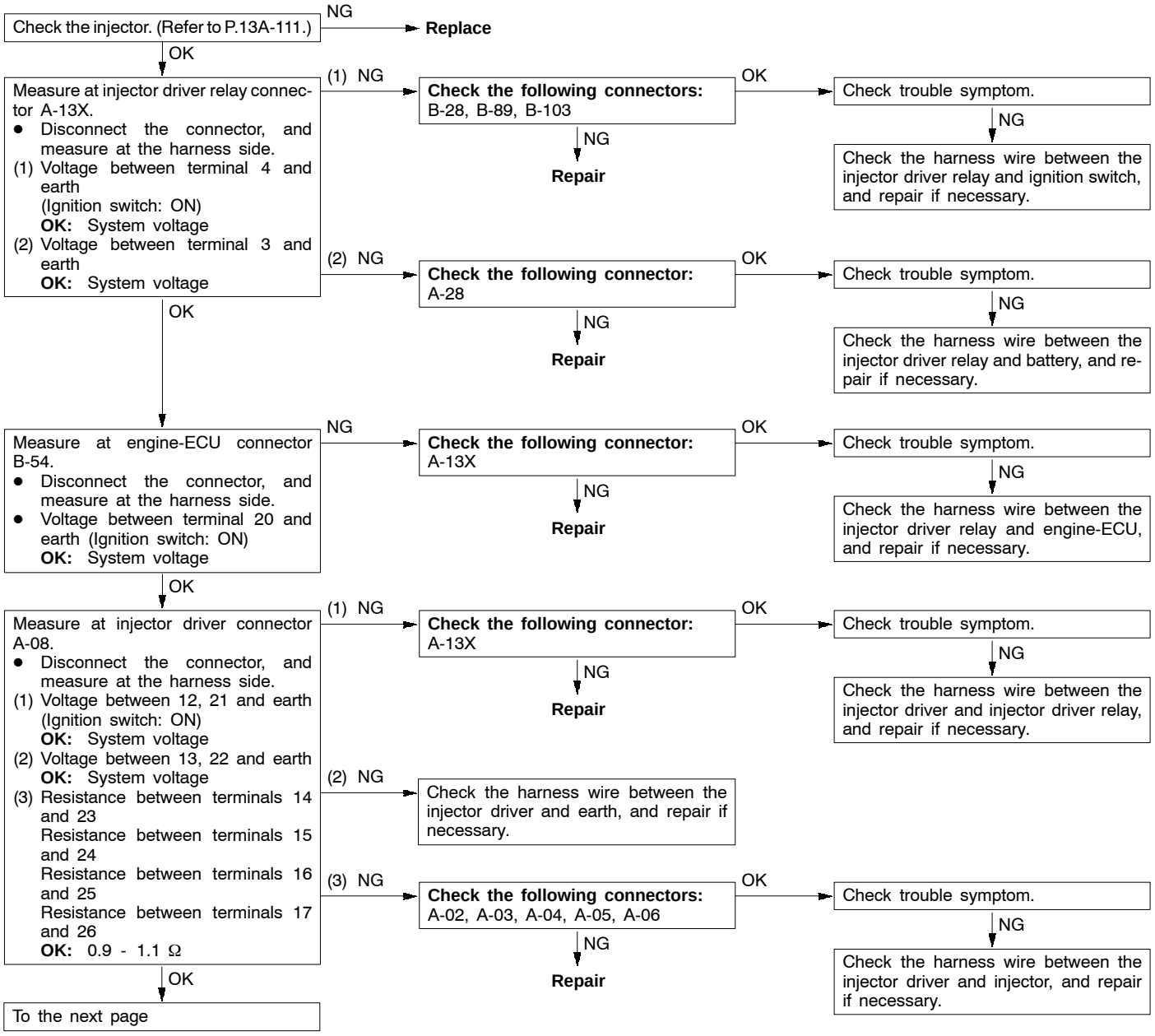
Code No.25 Barometric pressure sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 0.2 V or less for 4 seconds. or ● Sensor output voltage is 4.5 V or more for 4 seconds.	● Malfunction of the barometric pressure sensor ● Open circuit or short-circuited harness wire of the barometric pressure sensor ● Malfunction of the engine-ECU

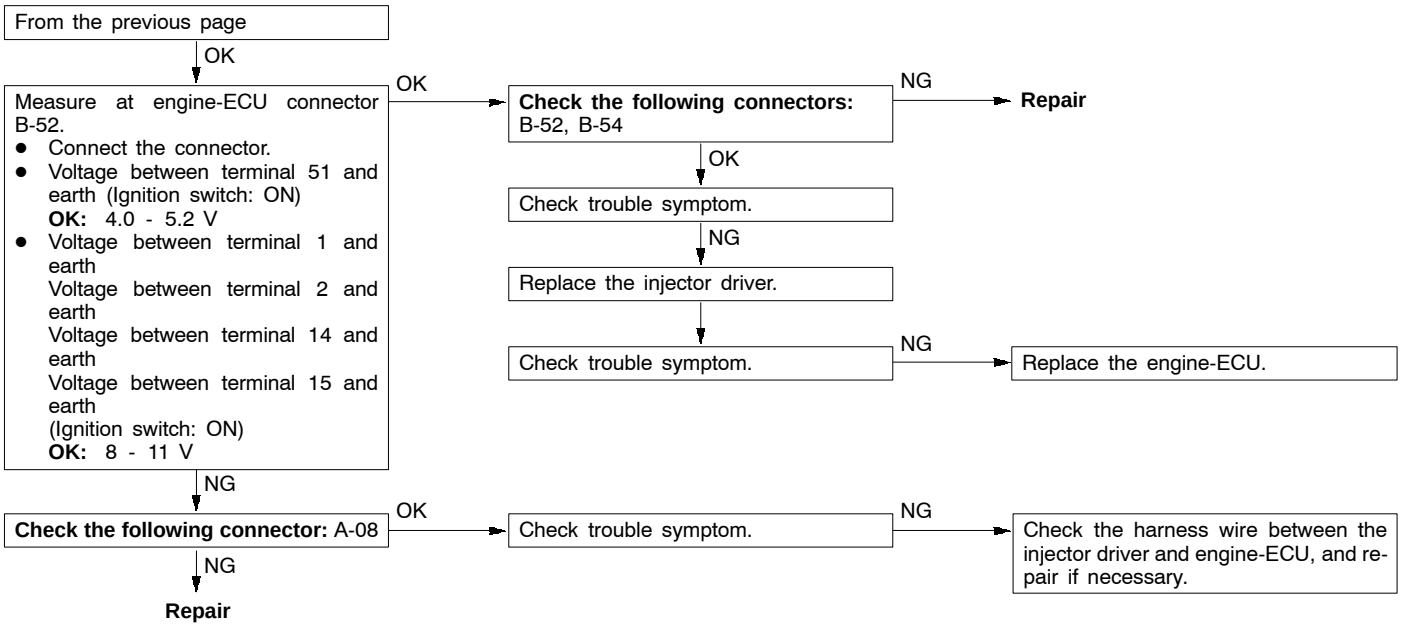


Code No.31 Detonation sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Amount of change in the sensor output voltage (detonation sensor peak voltage for each half rotation of the crankshaft) is 0.06 V or less for 200 continuous times.	● Malfunction of the detonation sensor ● Open circuit or short-circuited harness wire of the detonation sensor ● Malfunction of the engine-ECU

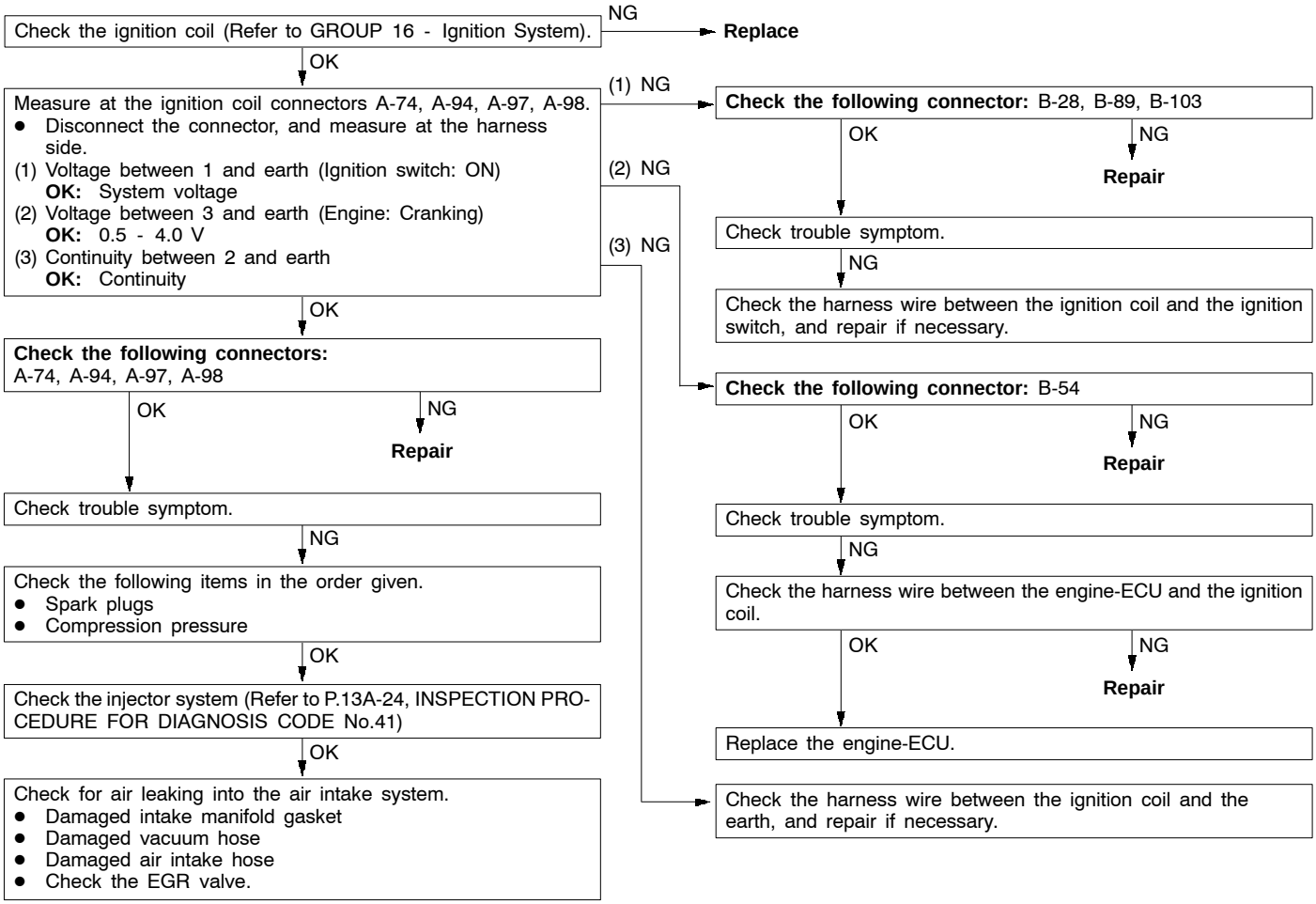


Code No.41 Injector system	Probable cause
Range of check ● Engine: while cranking, or running ● Engine speed: 4,000 r/min or less ● System voltage: 10 V or more ● Fuel shut off, or while forcible activating of injector (actuator test) is in operation. Set conditions ● Injector open circuit check signal is not output from the injector predetermined time(s).	● Malfunction of the injector ● Faulty injector driver relay ● Faulty injector driver ● Open circuit or short-circuited harness wire in the injector drive circuit, or poor connector contact ● Malfunction of the engine-ECU



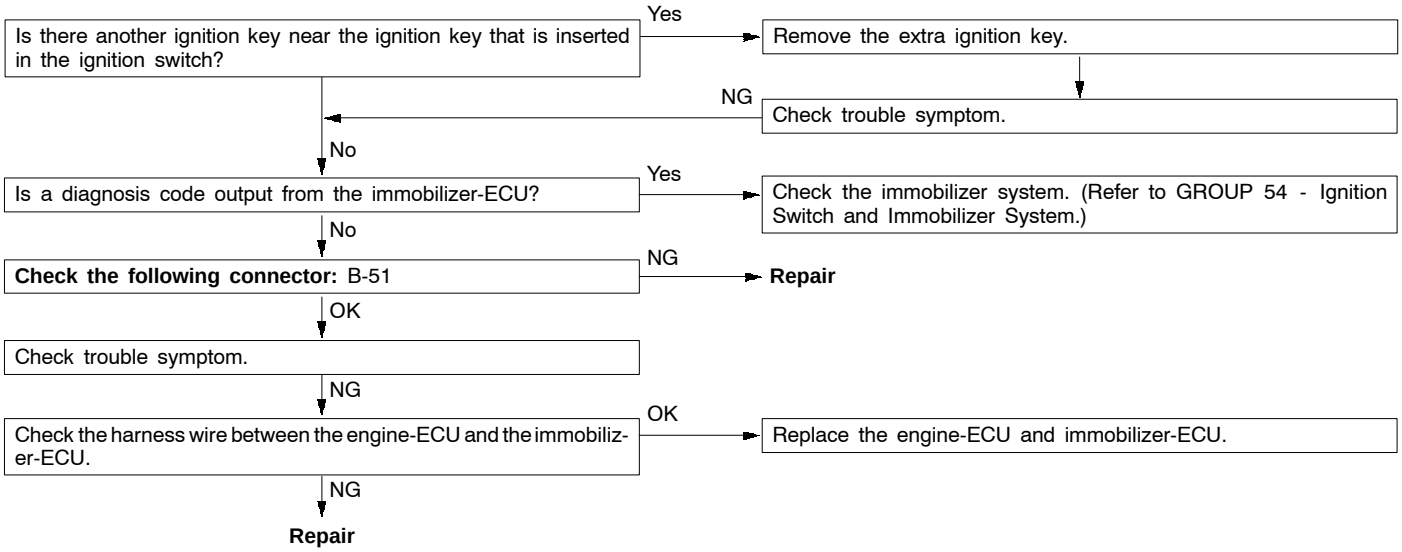

From the previous page
OK
Measure at engine-ECU connector B-52.
● Connect the connector.
● Voltage between terminal 51 and earth (Ignition switch: ON)
OK: 4.0 - 5.2 V
● Voltage between terminal 1 and earth
Voltage between terminal 2 and earth
Voltage between terminal 14 and earth
Voltage between terminal 15 and earth
(Ignition switch: ON)
OK: 8 - 11 V
OK
Check the following connectors: B-52, B-54
NG
Repair
OK
Check trouble symptom.
NG
Replace the injector driver.
Check trouble symptom.
NG
Replace the engine-ECU.
NG
Check the following connector: A-08
OK
Check trouble symptom.
NG
Check the harness wire between the injector driver and engine-ECU, and repair if necessary.
NG
Repair

Code No.44 Abnormal combustion	Probable cause
Range of check ● While engine is running during lean fuel combustion Set conditions ● Abnormal engine speed due to mis-firing is detected by the crank angle sensor	● Malfunction of the ignition coil ● Malfunction of the spark plug ● Malfunction of the EGR valve ● Open circuit or short-circuit in ignition primary circuit ● Malfunction of the injector system ● Malfunction of the engine-ECU

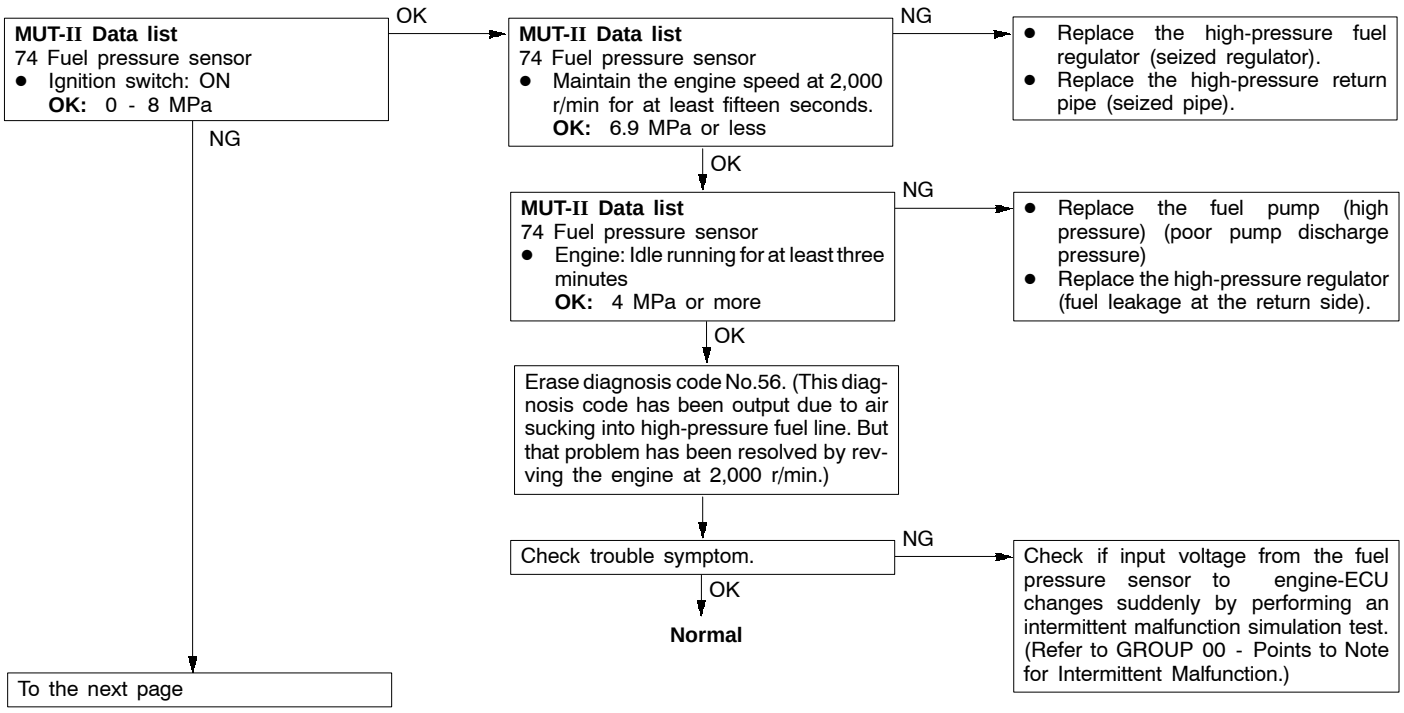


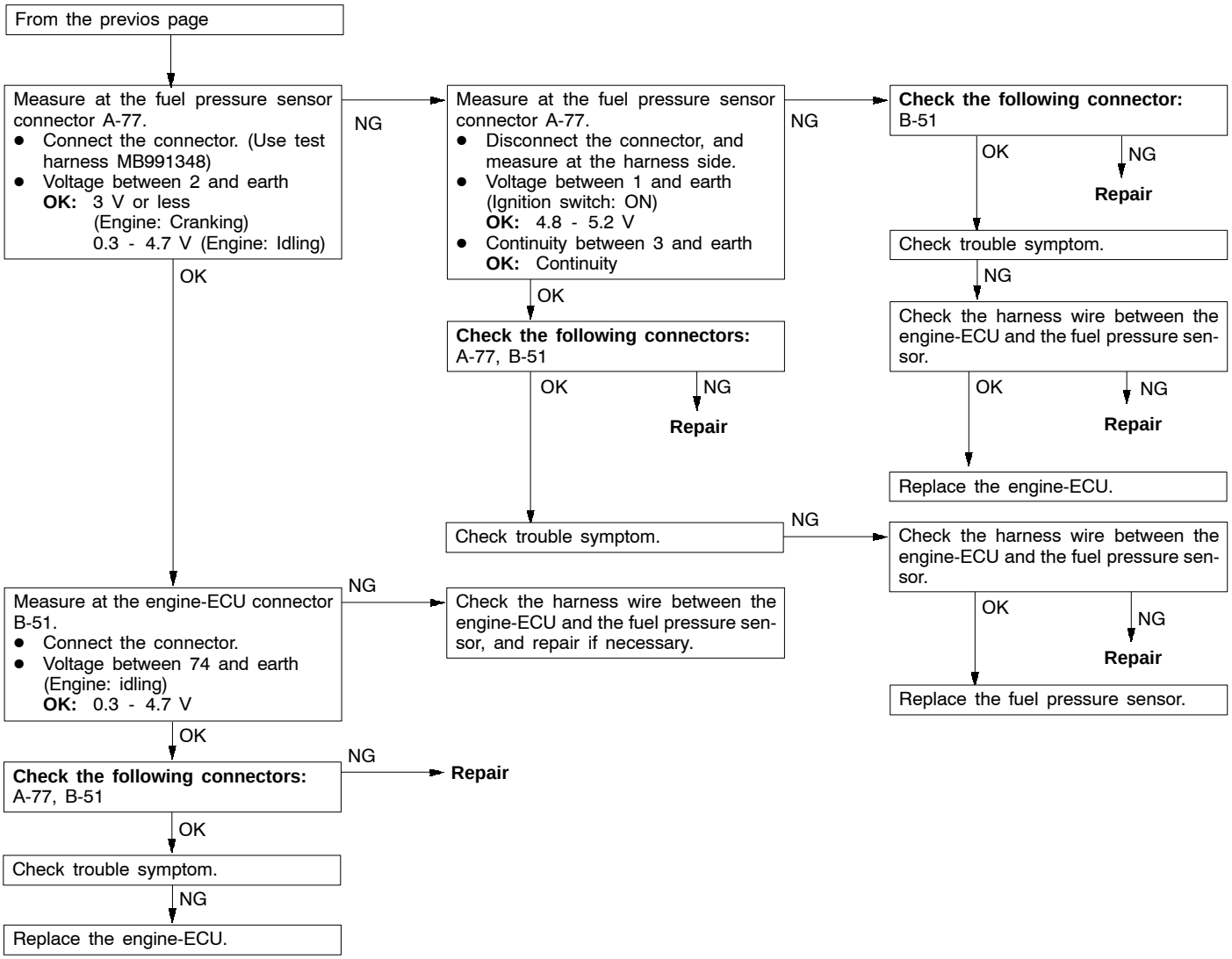
Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of encrypted codes ● Incorrect encrypted code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Malfunction of engine-ECU

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.

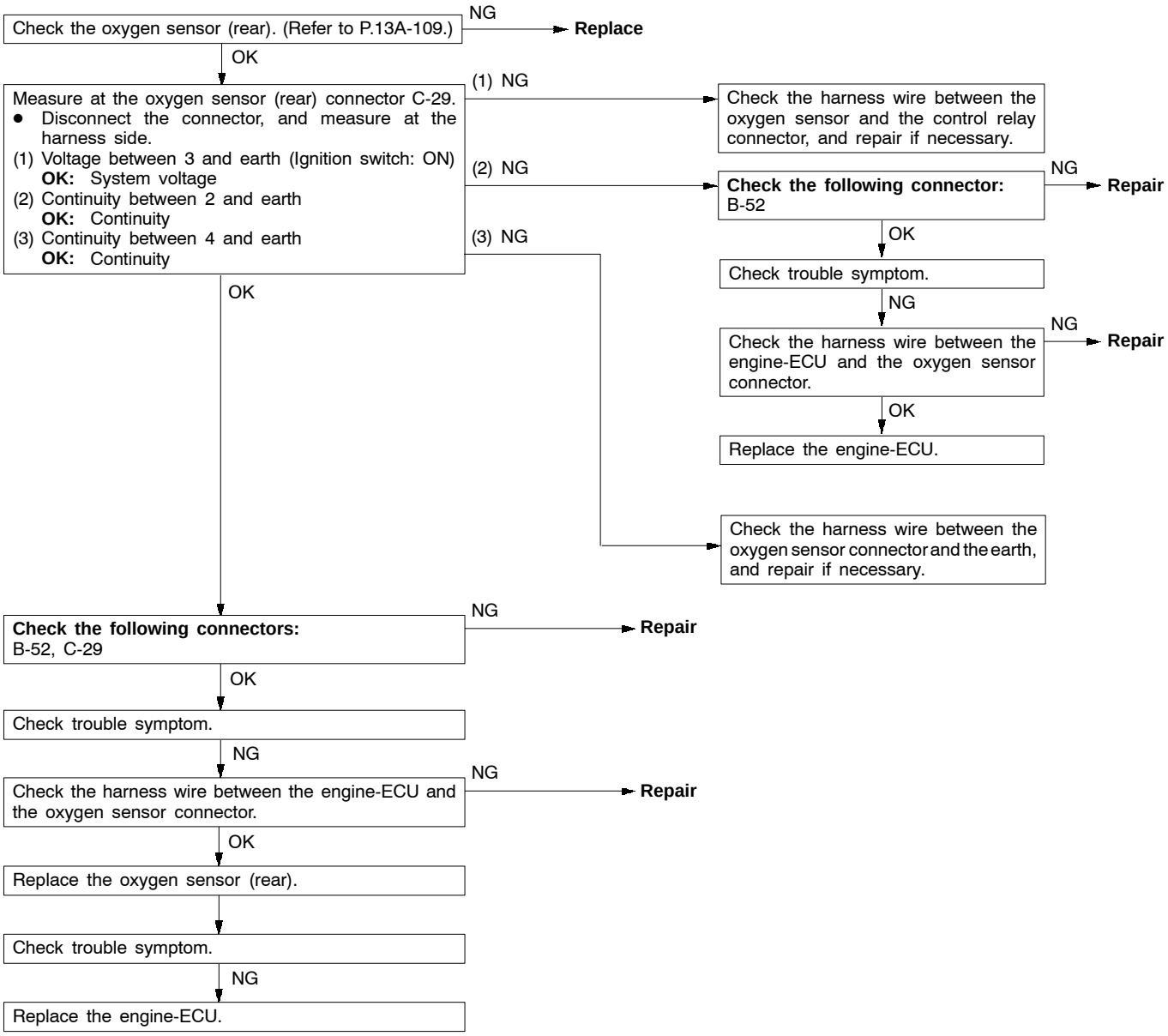


Code No.56 Abnormal fuel pressure	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more for four seconds. or ● Sensor output voltage is 0.2 V or less for four seconds. Range of check ● After the engine is started, the following condition has been detected: (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● While engine is running Set conditions ● Fuel pressure is 6.9 MPa or more for four seconds. or ● Fuel pressure is 2 MPa or less for four seconds.	● Malfunction of the fuel pressure sensor ● Open circuit or short-circuited harness wire of the fuel pressure sensor ● Malfunction of the engine-ECU ● Malfunction of the fuel pump (high pressure) ● Malfunction of the fuel pressure regulator (high pressure) ● Clogged high-pressure fuel line
This diagnosis code is also output when air is sucked in high-pressure fuel line due to no fuel supply. In this case, air can be bled by letting the engine run at 2,000 r/min for at least fifteen seconds. After the air bleeding, the diagnosis code must be erased by the MUT-II.	● Air sucking due to no fuel supply

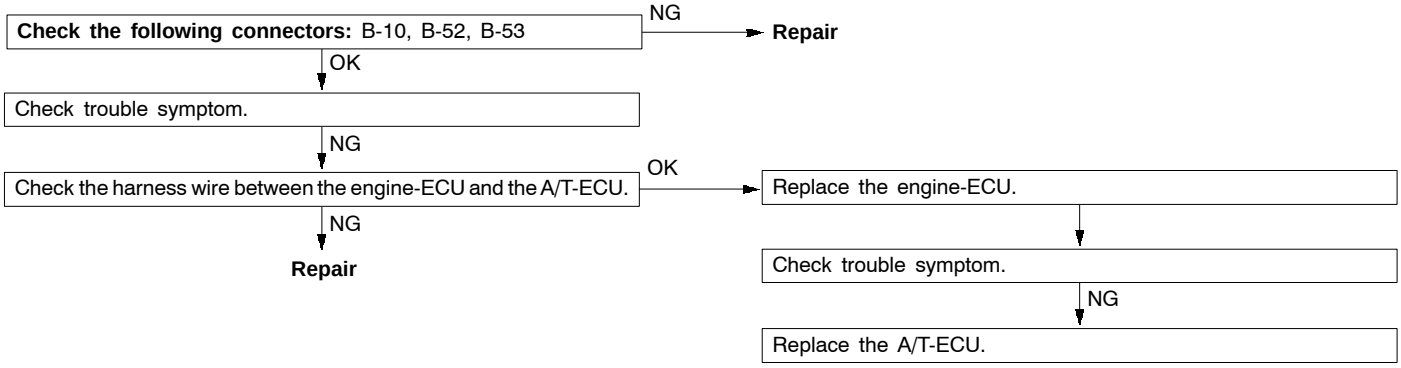



From the previos page
Measure at the fuel pressure sensor connector A-77.
● Connect the connector. (Use test harness MB991348)
● Voltage between 2 and earth
OK: 3 V or less (Engine: Cranking)
0.3 - 4.7 V (Engine: Idling)
NG
OK
Measure at the fuel pressure sensor connector A-77.
● Disconnect the connector, and measure at the harness side.
● Voltage between 1 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
● Continuity between 3 and earth
OK: Continuity
NG
OK
Check the following connectors: A-77, B-51
OK
NG
Repair
Check trouble symptom.
NG
Check the following connector: B-51
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the engine-ECU.
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the fuel pressure sensor.
Measure at the engine-ECU connector B-51.
● Connect the connector.
● Voltage between 74 and earth (Engine: idling)
OK: 0.3 - 4.7 V
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor, and repair if necessary.
OK
Check the following connectors: A-77, B-51
NG
Repair
OK
Check trouble symptom.
NG
Replace the engine-ECU.

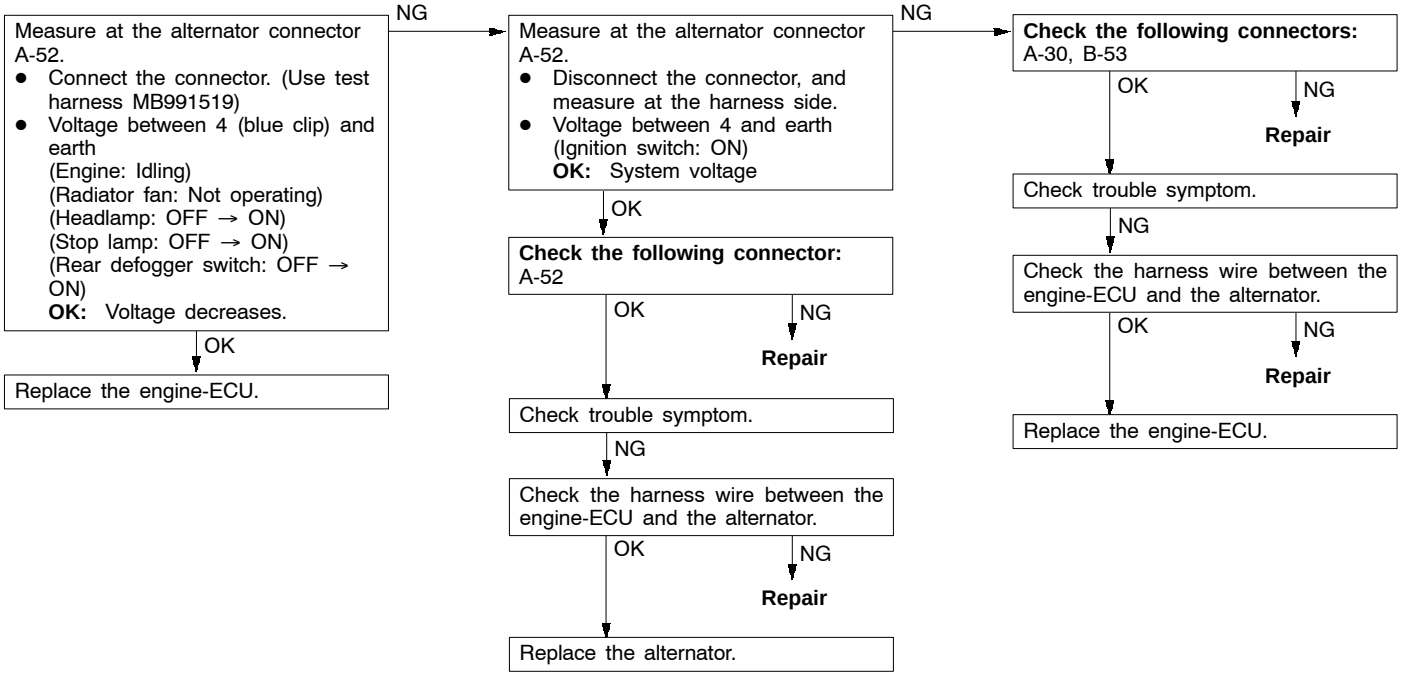
Code No. 59 Oxygen sensor (rear) system	Probable cause
Range of Check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Idle position switch: OFF ● The throttle position sensor output voltage is 4.1 V or more. ● Open loop control in operation ● 20 seconds have passed after deceleration finished. Set conditions ● The oxygen sensor (rear) output voltage is 0.1 V or less. ● The difference in the maximum and minimum values for the oxygen sensor (rear) output voltage is 0.08 V or less. ● The oxygen sensor (rear) output voltage is 0.5 V or more. ● The above conditions continue for a continuous period of 5 seconds.	● Malfunction of the oxygen sensor (rear) ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU



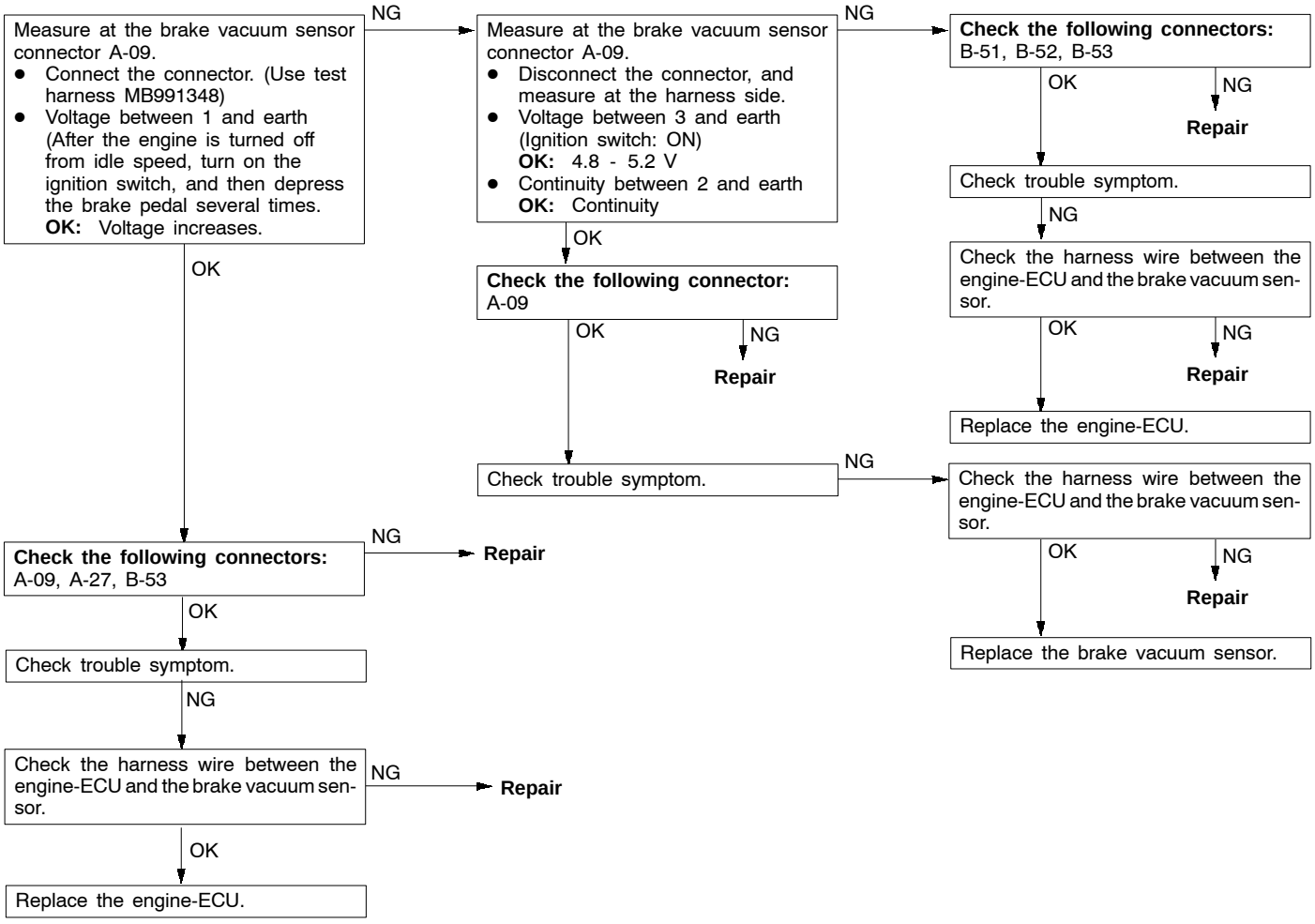
Code No.61 Communication wire with A/T-ECU system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	● Short circuit in ECU communication circuit ● Malfunction of the engine-ECU ● Malfunction of the A/T-ECU



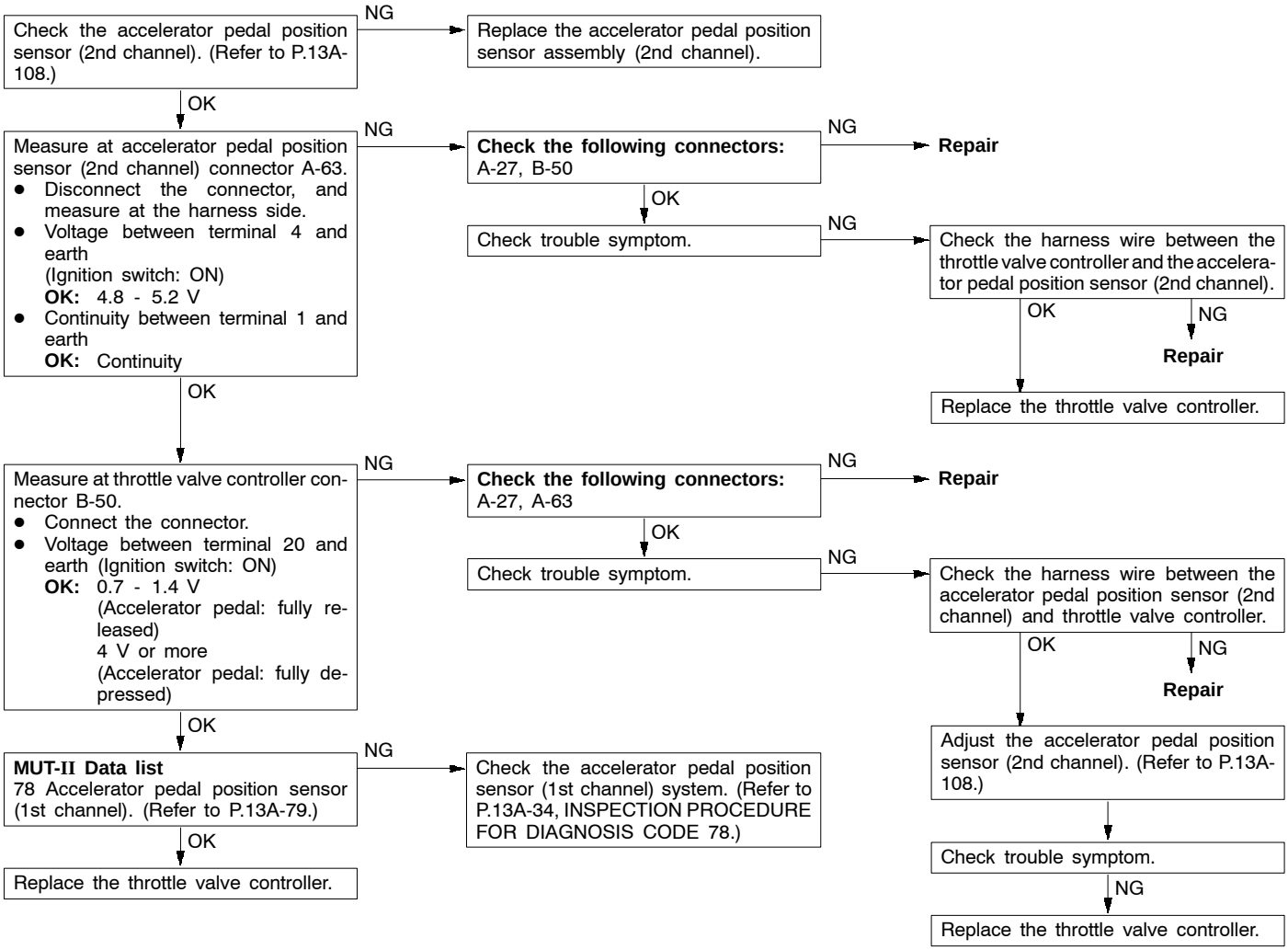
Code No.64 Alternator FR terminal system	Probable cause
Range of check ● Engine speed is 50 r/min or more. Set conditions ● Input voltage from the alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of the engine-ECU



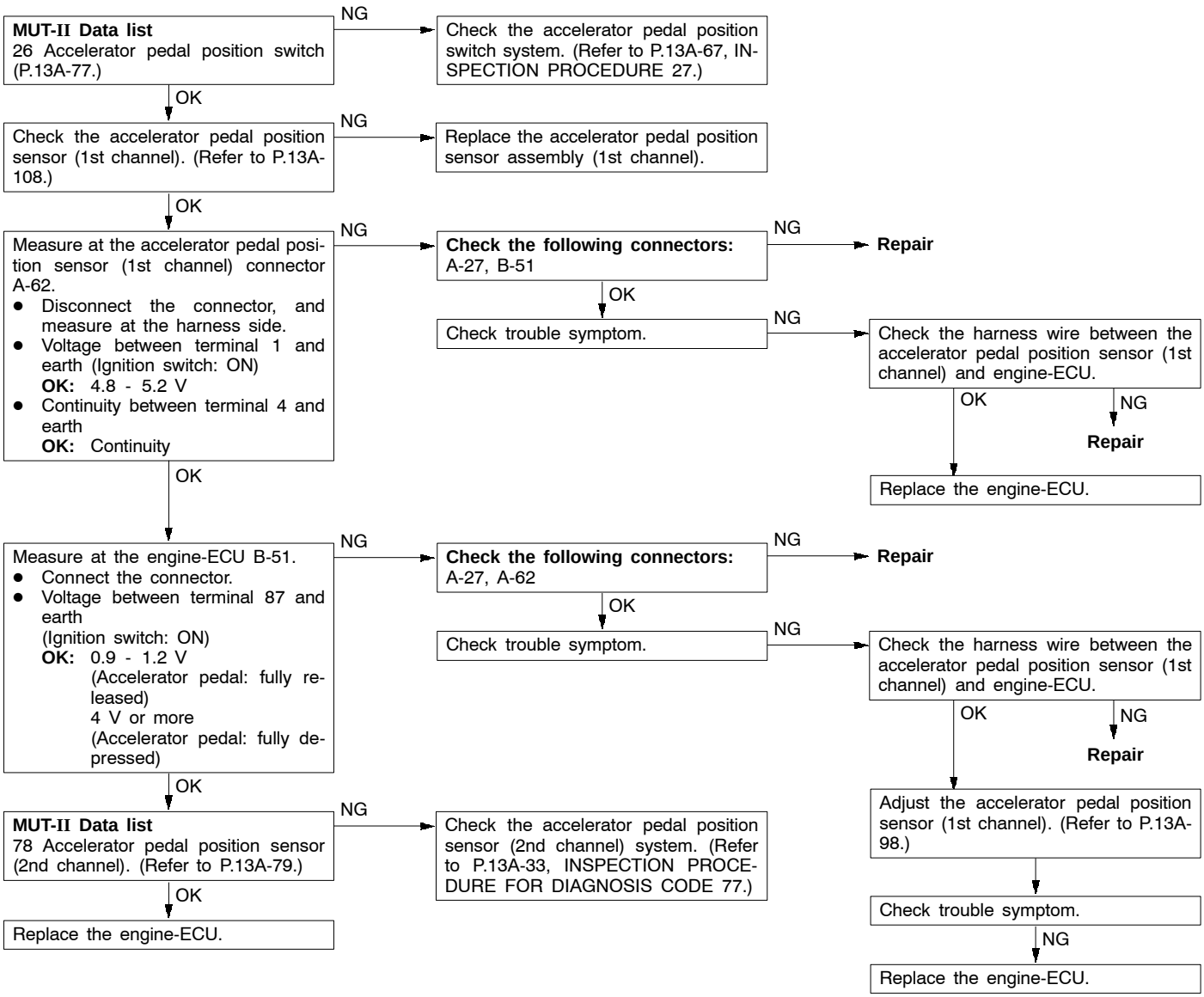
Code No.66 Brake vacuum sensor system	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more. or ● Sensor output voltage is 0.2 V or less.	● Malfunction of the brake vacuum sensor ● Improper connector contact, open circuit or short-circuited harness wire of the brake vacuum sensor ● Malfunction of the engine-ECU



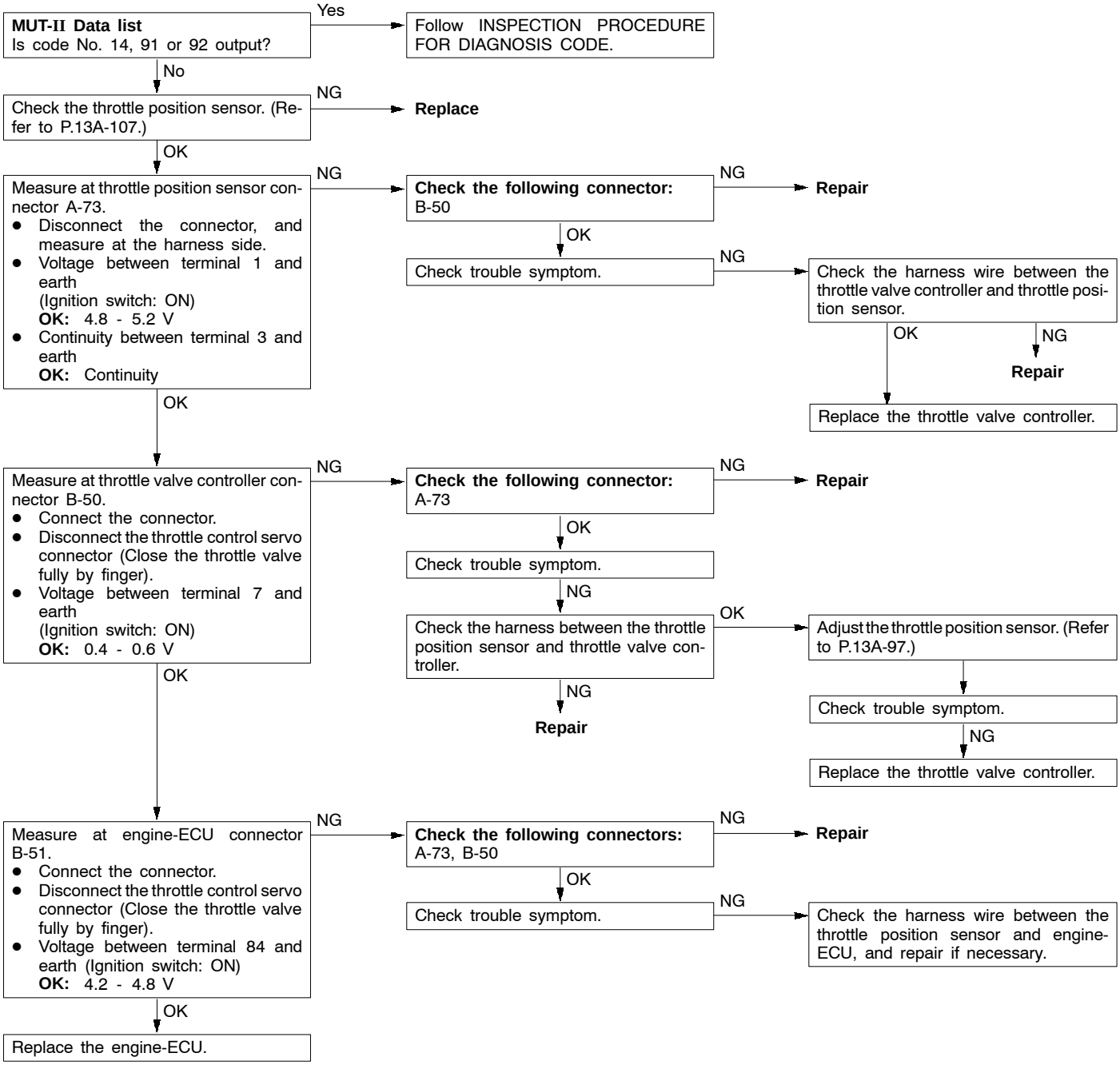
Code No.77 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (1st channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator position sensor (2nd channel) system 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 output voltages (1st and 2nd channels) exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly).	● Malfunction of the accelerator pedal position sensor (2nd channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (2nd channel) system, or poor connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (2nd channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator position sensor (1st channel) system is 0.2 V or less for one second. or ● Output voltage of the accelerator pedal position sensor (2nd channel) is 2.5 V or less, and (1st channel) output voltage of the accelerator pedal position sensor 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). or ● Although the accelerator pedal position switch is on, 1st-channel output voltage of the accelerator pedal position sensor exceeds 1.1 V for one second.	● Malfunction of the accelerator pedal position sensor (1st channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (1st channel) system, or poor connector contact ● ON-seizure of the accelerator pedal position switch ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



Code No.79 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller determines a failure, and sends it result to the engine-ECU. Range of check ● Ignition switch: ON ● System voltage: 8 V or more Set conditions ● Output voltage of the sensor remains 0.2 V for one second. or ● Output voltage of the sensor remains 4.9 V for one second. or ● Output voltage of the throttle position sensor (1st and 2nd channels) remains outside 4 - 6 V for four seconds.	● Malfunction of the throttle position sensor (1st channel) ● Open circuit or short-circuited harness wire in the throttle position sensor (1st channel), or poor connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



Code No.89 Abnormal fuel pressure system	Probable cause
Range of check ● Engine: Idling (during stoichio-feedback operation) Set conditions ● Fuel injection correction value remains excessively low for ten seconds or more. or ● Fuel injection correction value remains excessively high for ten seconds or more.	● Malfunction of the fuel pump (high pressure) ● Malfunction of the intake air temperature sensor ● Malfunction of the barometric pressure sensor ● Malfunction of the air flow sensor ● Malfunction of the engine-ECU

MUT-II Data list
13 Intake air temperature sensor. (Refer to P.13A-75.)
→ NG → Check the intake air temperature sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE No.13.)
↓ OK

MUT-II Data list
25 Barometric air temperature sensor. (Refer to P.13A-77.)
→ NG → Check the barometric air temperature sensor system. (Refer to P.13A-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE No.25.)
↓ OK

MUT-II Data list
12 Air flow sensor. (Refer to P.13A-75.)
→ NG → Check the air flow sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE No.12.)
↓ OK

Replace the fuel pump (high pressure).

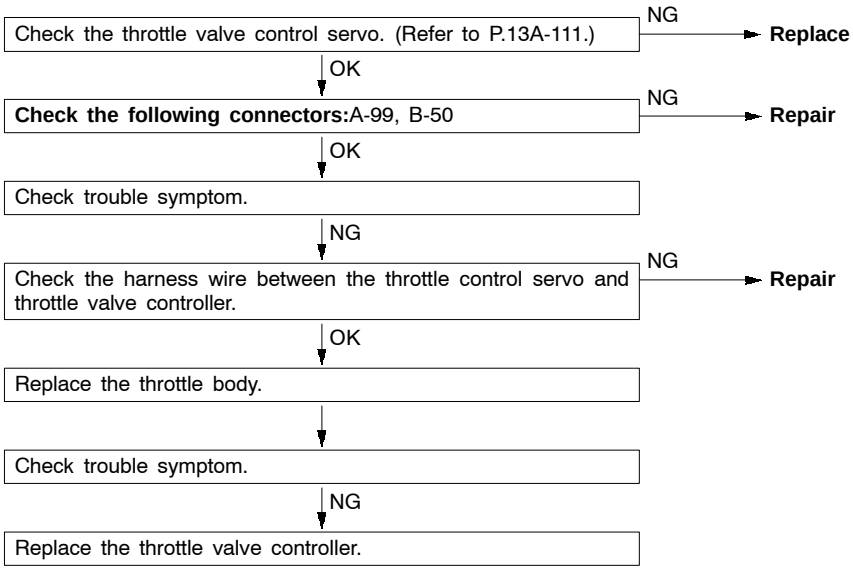
Code No.91 Electronic-controlled throttle valve system	Probable cause
Range of check ● Ignition switch: ON ● Error in communication between the engine-ECU and throttle valve controller Set conditions ● Output voltage of the throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value. Range of check ● Ignition switch: ON ● Error in communication between the throttle valve controller and engine-ECU Set conditions ● The throttle valve opening angle (voltage) which the engine-ECU requested of the throttle valve controller is significantly different from output voltage of the (2nd channel) throttle position sensor (approx. one volt).	● Short in communication line ● Malfunction of the engine-ECU ● Malfunction of the throttle valve controller

MUT-II Self-Diag code
Is any other diagnosis code than No.94 output?
→ Yes → Follow INSPECTION PROCEDURE FOR DIAGNOSIS CODE.
↓ No

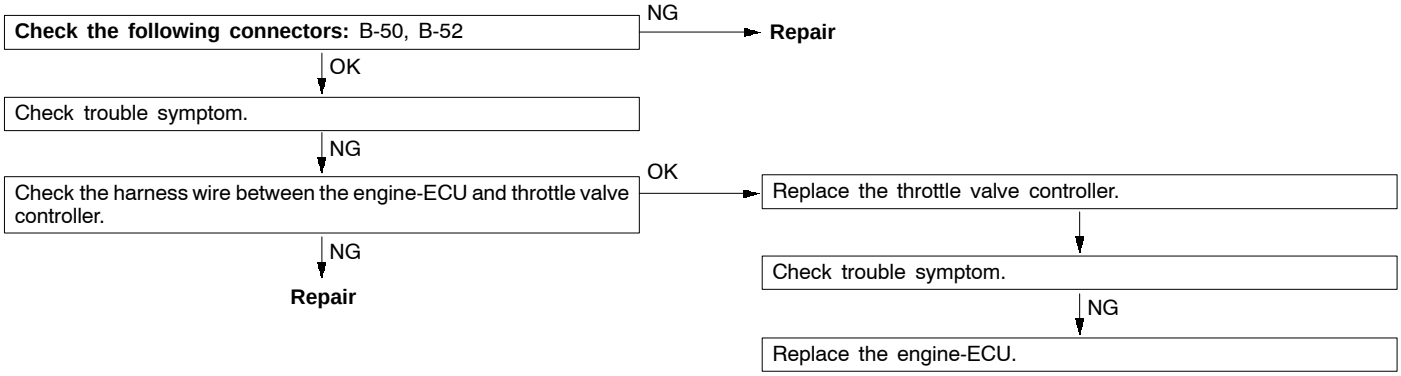
Check the harness wire between the throttle valve controller and engine-ECU.
→ NG → **Repair**
↓ OK

Replace the throttle valve controller.

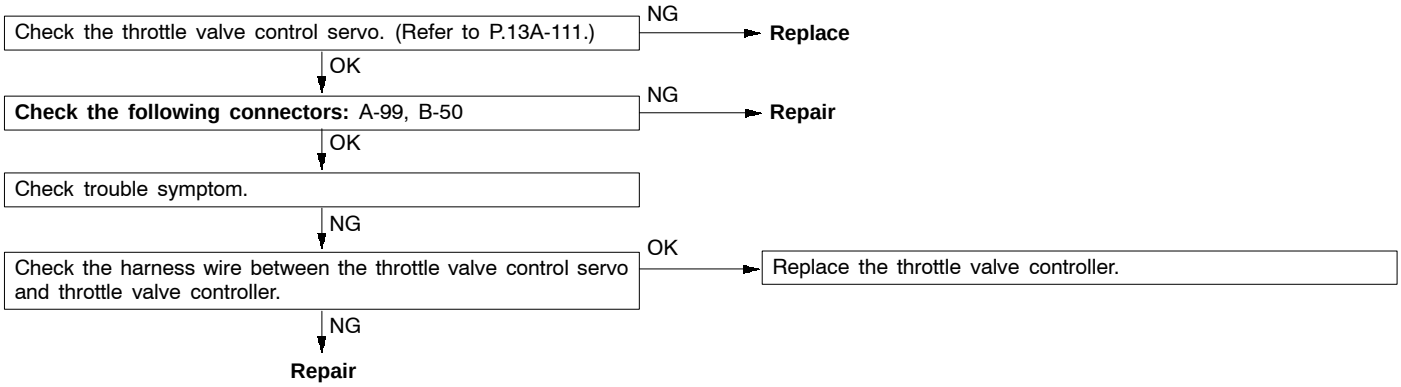
Code No.92 Throttle valve position feedback system	Probable cause
The throttle valve controller determines if a failure is present, and sends its result to the engine-ECU. Range of check ● Ignition switch: ON ● System voltage: 8 V or more Set condition ● Motor position feedback system is defective (System detects a motor overcurrent, or that actual and projected opening angles of the throttle position sensor (1st channel) are different by 1.0 V or more.	● Malfunction of the throttle position sensor (1st channel) ● Open circuit or short-circuited harness wire in the throttle position sensor system (1st channel), or poor connector contact ● Malfunction of the throttle valve controller



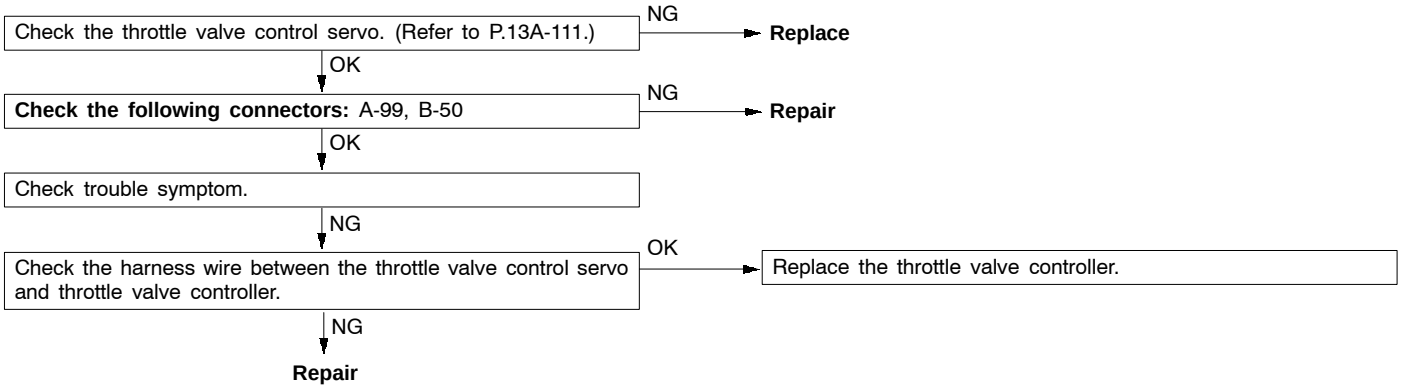
Code No.94 Communication line system with throttle valve controller	Probable cause
Range of check ● Ignition switch: ON ● System voltage: 8 V or more ● Engine: not cranking Set condition ● System detects an error in communication line between the engine-ECU and throttle valve controller.	● Short circuit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



Code No.95 Malfunction in throttle valve control servo motor system (1st phase)	Probable cause
Range of check ● Throttle valve control servo relay: ON ● System voltage: 8 V or more Set conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferences with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open circuit.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller



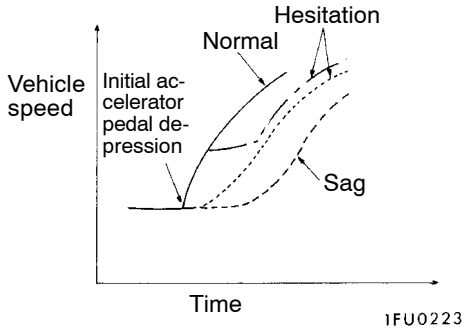
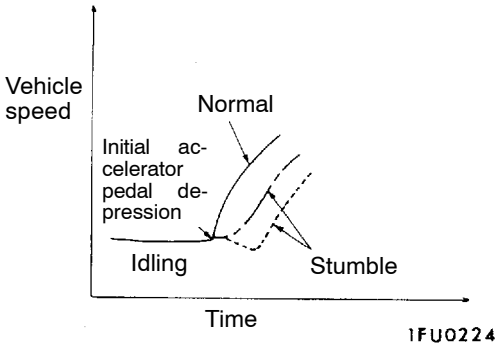
Code No.99 Malfunction in throttle valve control servo motor system (2nd phase)	Probable cause
Range of check ● Throttle valve control servo relay: ON ● System voltage: 8V or more Set conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferes with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open-circuited.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in the throttle valve control servo system, or poor connector contact ● Malfunction of 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-41
	Communication with engine-ECU only is not possible.	2	13A-42
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-43
	The engine warning lamp remains illuminating and never goes out.	4	13A-43
Starting	No initial combustion (starting impossible)	5	13A-44
	Initial combustion but no complete combustion (starting impossible)	6	13A-46
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-48
	Idling speed is high. (Improper idling speed)	8	13A-50
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-51
	When the engine is hot, it stalls at idling. (Die out)	10	13A-52
	The engine stalls when starting the car. (Pass out)	11	13A-54
	The engine stalls when decelerating.	12	13A-55
Driving	Hesitation, sag or stumble	13	13A-56
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-57
	The feeling of impact or vibration when decelerating	15	13A-58
	Knocking	16	13A-58
Dieseling		17	13A-58
Too high CO and HC concentration when idling		18	13A-59
Low alternator output voltage (approx. 12.3 V)		19	13A-61
Engine idle speed is incorrect while the A/C is on.		20	13A-61
Fans (radiator fan, A/C condenser fan) are inoperative		21	13A-62
Clutch switch system malfunction <M/T>		22	13A-63

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

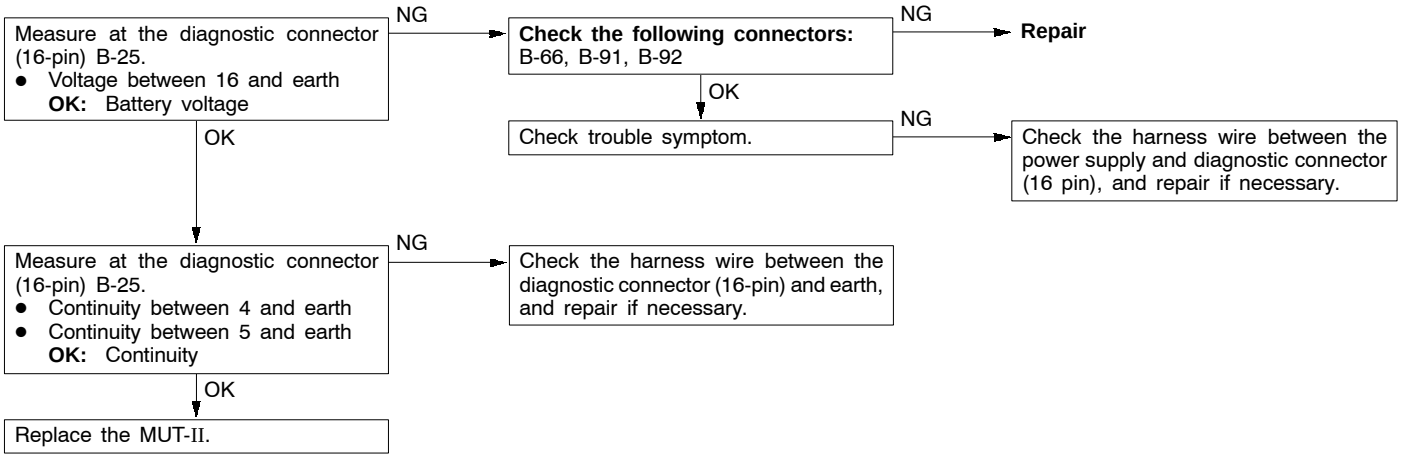
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
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

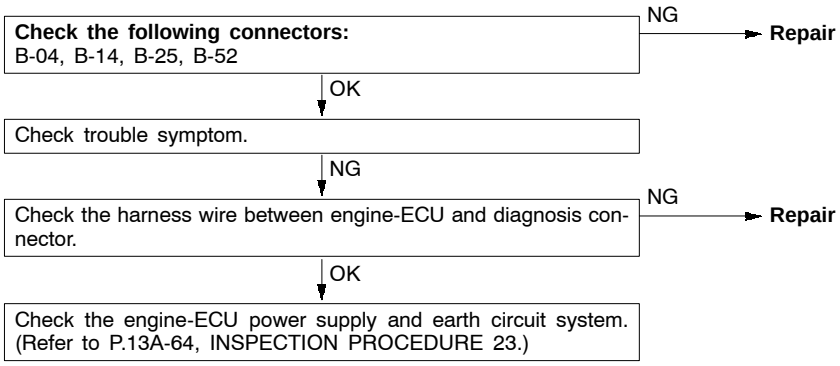
INSPECTION PROCEDURE 1

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



INSPECTION PROCEDURE 2

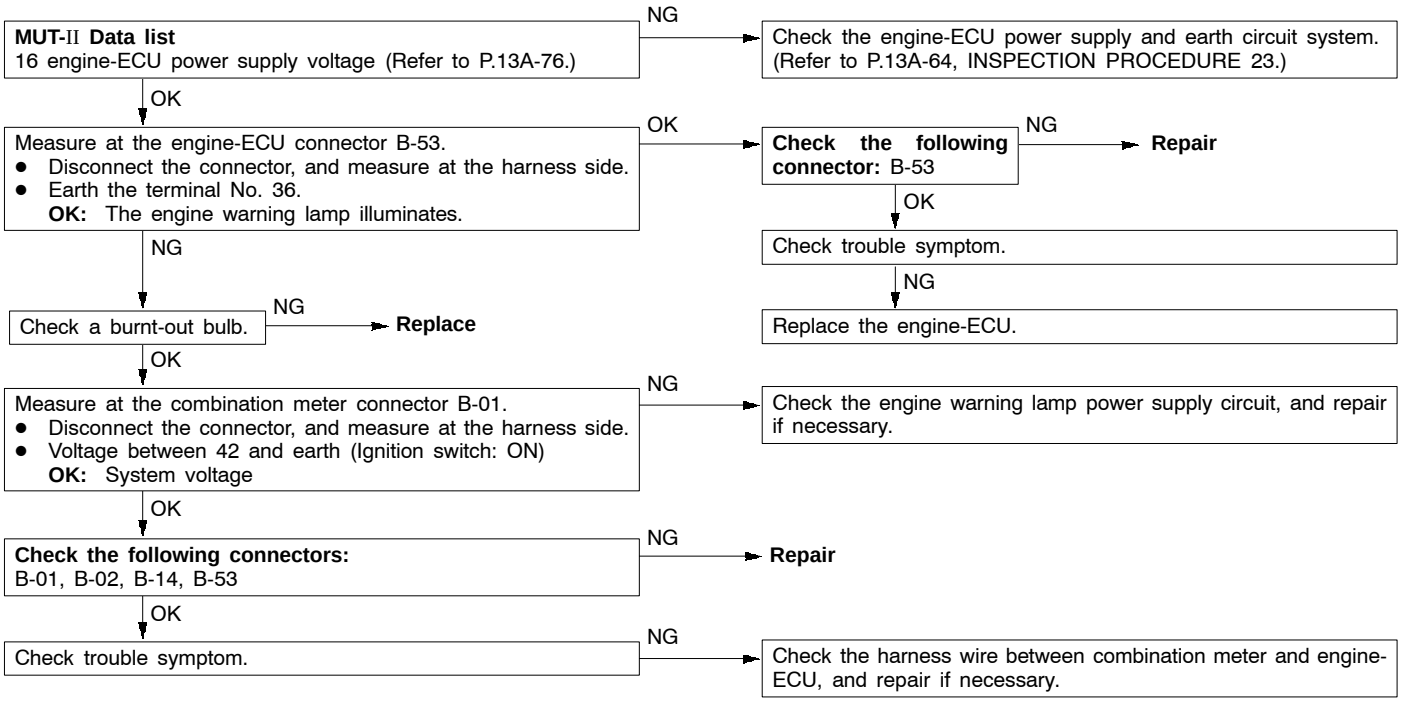
MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. ● No power supply to engine-ECU. ● Defective earth circuit of engine-ECU. ● Defective engine-ECU. ● Improper communication line between engine-ECU and MUT-II	● Malfunction of engine-ECU power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



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

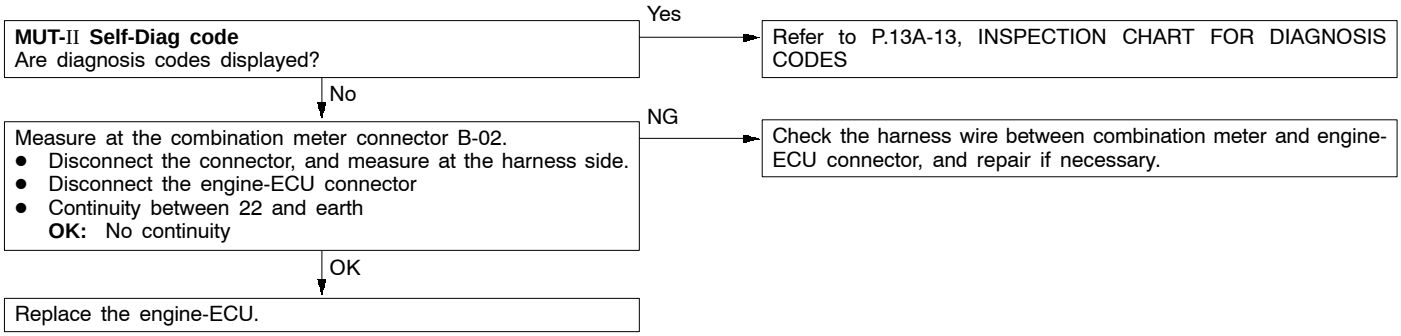
INSPECTION PROCEDURE 3

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-13, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Data list
16 System voltage (Refer to P.13A-76.)
NG → Check the engine control relay and ignition switch-IG system. (Refer to P.13A-65, INSPECTION PROCEDURE 24.)
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-81.)
NG → Check the fuel pump (low pressure) system. (Refer to P.13A-68, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
22 Crank angle sensor (Refer to P.13A-76.)
NG → Check the crank angle sensor system. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 22.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-76.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-76.)
NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
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-97.)
NG ↓

Check fuel leakage. (Refer to P.13A-103.)
NG → **Repair**
OK ↓

Measure low fuel pressure between the fuel pump (low pressure) and fuel pump (high pressure). (Refer to P.13A-99.)
NG → **Repair**
OK ↓

Measure at ignition coil connectors A-74, A-94, A-97, A-98.
- 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 abnormal fuel combustion system. (Refer to P.13A-26, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 44.)
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 ↓

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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

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-13, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13A-81.)
- NG → Check the fuel pump (low pressure) system. (Refer to P.13A-68, INSPECTION PROCEDURE 28.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-76.)
- NG → Check the engine coolant temperature system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
18 Cranking signal (Refer to P.13A-76.)
- NG → Check the ignition switch-ST system <M/T>. (Refer to P.13A-65, INSPECTION PROCEDURE 25.)
  Check the ignition switch-ST system and inhibitor switch <A/T>. (Refer to P.13A-66, INSPECTION PROCEDURE 26.)
- OK ↓

MUT-II Data list
74 Fuel pressure sensor (Refer to P.13A-79.)
- NG → Check an abnormal fuel pressure system. (Refer to P.13A-28, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 56.)
- OK ↓

Check fuel leakage. (Refer to P.13A-103.)
- NG → **Repair**
- OK ↓

Is the engine started normally when it is cranked with the accelerator pedal depressed slightly?
- Yes → Clean around the throttle valve. (Refer to P.13A-97.)
- No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-76.)
- NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

Check ignition timing when the engine is cranked.
OK: approx. 5° BTDC
- NG → Check that the crank angle sensor and timing belt cover are properly installed.
- OK ↓

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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

Has the battery 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-13, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does the engine idle speed fluctuates excessively (excessive hunting)?
- Yes → Clean around the throttle valve. (Refer to P.13A-97.)
- No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-76.)
- NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-80.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-77.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-67, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-75.)
- NG → Check the intake air temperature sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-77.)
- NG → Check the barometric pressure sensor system. (Refer to P.13A-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-76.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-81.)
- NG → Check the purge control solenoid valve system. (Refer to P.13A-70, INSPECTION PROCEDURE 30.)
- OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A-79.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 - 1,000 mV
- NG → Check the oxygen sensor (rear) system. (Refer to P.13A-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
- 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-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
- OK ↓

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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-99.)

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-77.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-71, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-77.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-71, INSPECTION PROCEDURE 32.)

OK

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13A-78.)

NG → Check the M/T oil temperature sensor system. (Refer to P.13A-72, INSPECTION PROCEDURE 33.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-77.)

NG → Check the ignition switch-ST and inhibitor switch. <A/T> (Refer to P.13A-68, INSPECTION PROCEDURE 28.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-78.)

NG → Check the stop lamp switch. (Refer to P.13A-73, INSPECTION PROCEDURE 34.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-77.)

NG → Check the small lamp switch system. (Refer to P.13A-74, INSPECTION PROCEDURE 35.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-79.)

NG → Check the EGR valve. (Refer to P.13A-69, INSPECTION PROCEDURE 29.)

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

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

Clean around the throttle valve. (Refer to P.13A-97.)

Check trouble symptom.

NG

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-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-76.)
NG → Check the throttle position sensor (2nd channel). (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODES 14.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-81.)
NG → Check the purge control solenoid valve. (Refer to P.13A-70, INSPECTION PROCEDURE 30.)
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-77.)
NG → Check the accelerator pedal position switch system. (Refer to P.13A-67, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-76.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13A-77.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13A-71, INSPECTION PROCEDURE 32.)
OK ↓

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13A-78.)
NG → Check the M/T oil temperature sensor. (Refer to P.13A-72, INSPECTION PROCEDURE 33.)
OK ↓

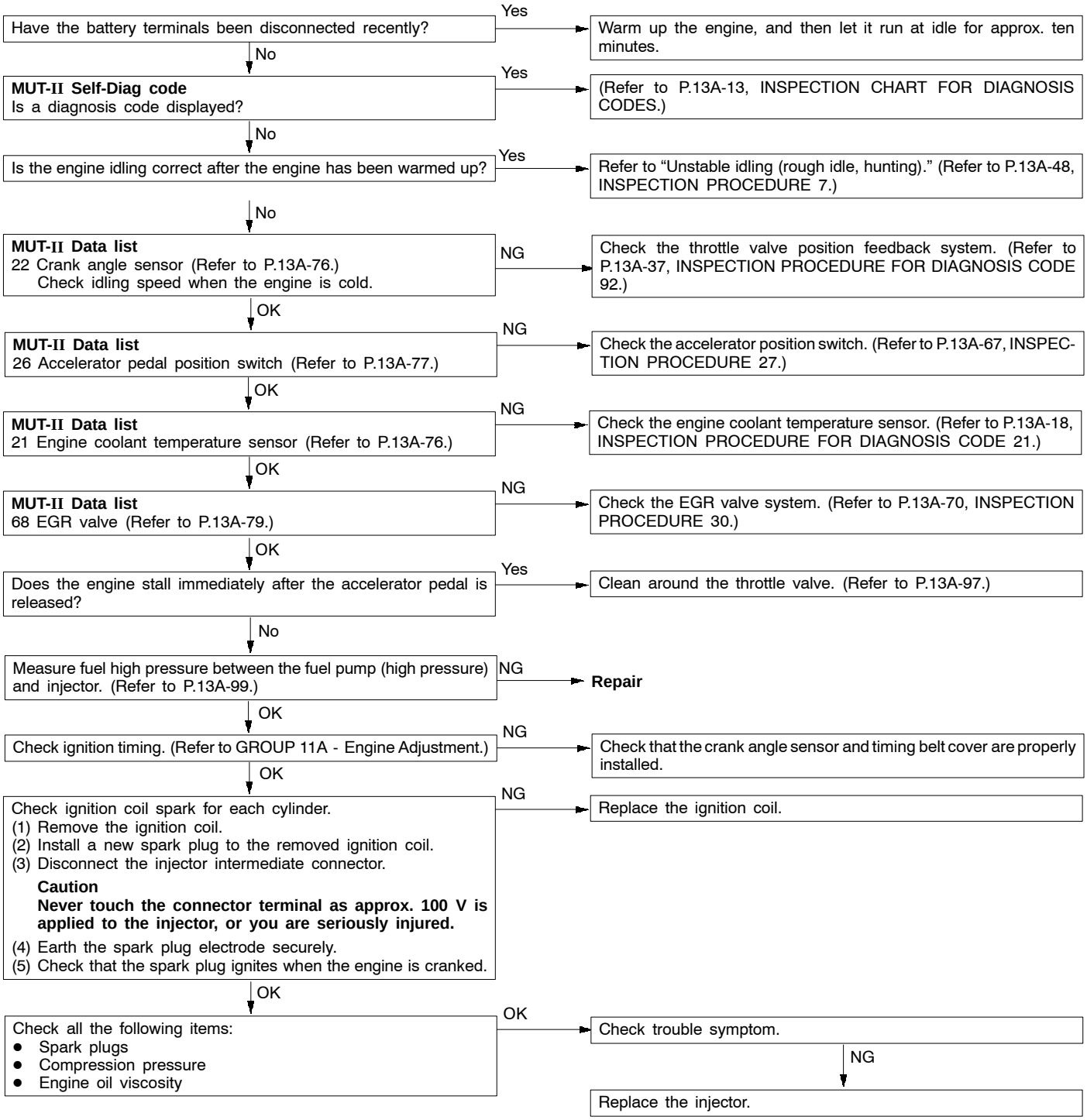
MUT-II Data list
29 Inhibitor switch (Refer to P.13A-77.)
→ Check the ignition switch-ST and inhibitor switch. <A/T> (Refer to P.13A-68, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-78.)
NG → Check the stop lamp switch system. (Refer to P.13A-73, INSPECTION PROCEDURE 34.)
OK ↓

- Clean around the throttle valve. (Refer to P.13A-97.)
- Adjust the throttle position sensor. (Refer to P.13A-97.)

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

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-13, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-80.)
- NG → Check the throttle position sensor (1st channel) system. (Refer to P.13A-35, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 79.)
- OK ↓

Is it easy to reproduce the engine stall?
- No → While carrying out an intermittent malfunction simulation test. (Refer to GROUP 00 - Points to Note for Intermittent Malfunction.), check for sudden changes in the following signals.
  - Crank angle sensor signal
  - Injector drive signal
  - Fuel pump (low pressure) drive signal
  - Air flow sensor
  - Primary ignition signal
  - Power supply to the engine-ECU
- Yes ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-77.)
- NG → Check the accelerator pedal position switch. (Refer to P.13A-67, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-75.)
- NG → Check the intake air temperature sensor. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-77.)
- NG → Check the barometric pressure sensor. (Refer to P.13A-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-76.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A-78.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open
  OK: 600 - 1,000 mV
- NG → Check the oxygen sensor (rear) system. (Refer to P.13A-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
- 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-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
- 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-99.)
  - 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 ↓

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OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-77.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-71, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-77.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-71, INSPECTION PROCEDURE 32.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-77.)

NG → Check the small lamp switch system. (Refer to P.13A-74, INSPECTION PROCEDURE 35.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-77.)

NG → Check the ignition switch-ST and inhibitor switch. <A/T> (Refer to P.13A-68, INSPECTION PROCEDURE 28.)

OK

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13A-77.)

NG → Check the air flow sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 12.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-79.)

NG → Check the EGR valve. (Refer to P.13A-69, INSPECTION PROCEDURE 29.)

OK

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

Yes → Clean around the throttle valve. (Refer to P.13A-97.)

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-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-79.)
- NG → Check the EGR valve. (Refer to P.13A-69, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-81.)
- NG → Check the purge control solenoid valve system. (Refer to P.13A-70, INSPECTION PROCEDURE 30.)
- 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-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-77.)
- NG → Check the accelerator pedal position switch. (Refer to P.13A-67, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-80.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-79.)
- NG → Check the EGR valve system. (Refer to P.13A-69, INSPECTION PROCEDURE 29.)
- 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-97.)

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-13, 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-77.)
NG → Check the accelerator pedal position switch. (Refer to P.13A-67, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-75.)
NG → Check the intake air temperature sensor. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-77.)
NG → Check the barometric pressure sensor. (Refer to P.13A-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-76.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-80.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-38, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 99.)
OK ↓

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

NG → Check the oxygen sensor (rear) system. (Refer to P.13A-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
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-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
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-99.)
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-79.)
NG → Check the EGR valve. (Refer to P.13A-69, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-81.)
NG → Check the purge control solenoid valve. (Refer to P.13A-70, INSPECTION PROCEDURE 30.)
OK ↓

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From the previous page

OK

Measure high fuel pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-99.)

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-13, INSPECTION CHART FOR DIAGNOSIS CODES.)

No

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-80.)

NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)

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-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-80.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-77.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-67, INSPECTION PROCEDURE 27.)
- OK ↓

Clean around the throttle valve. (Refer to P.13A-97.)

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-13, 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-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 31.)
- 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-13, 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-76.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-75.)
NG → Check the intake air temperature sensor. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-77.)
NG → Check the barometric pressure sensor. (Refer to P.13A-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A-78.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 - 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13A-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
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-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
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).
NG ↓

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-99.)
NG → **Repair**
OK ↓

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.

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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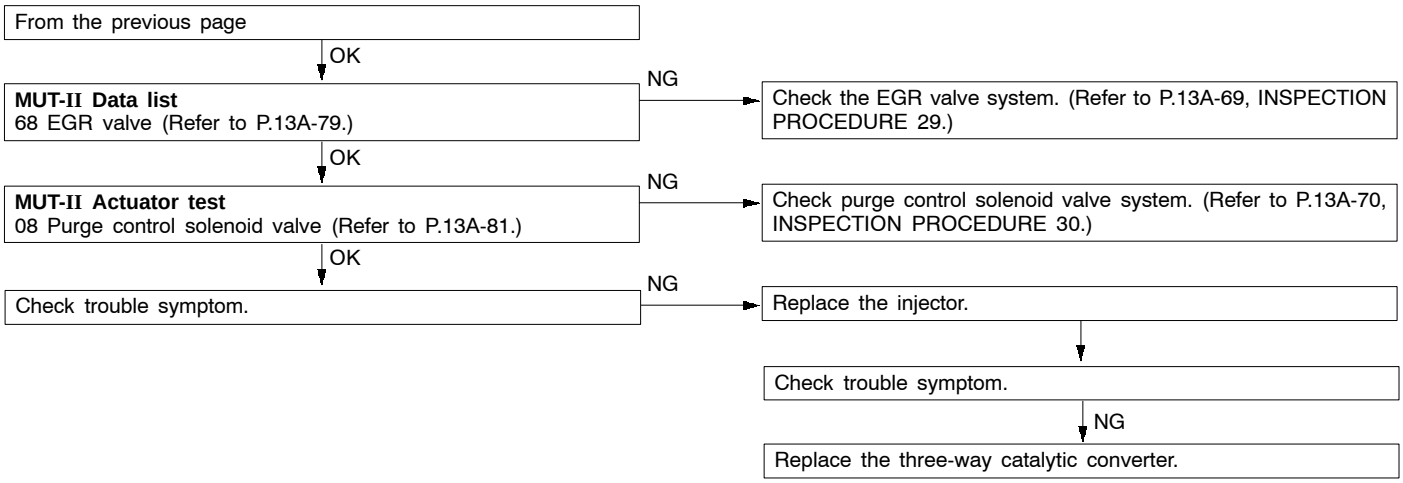
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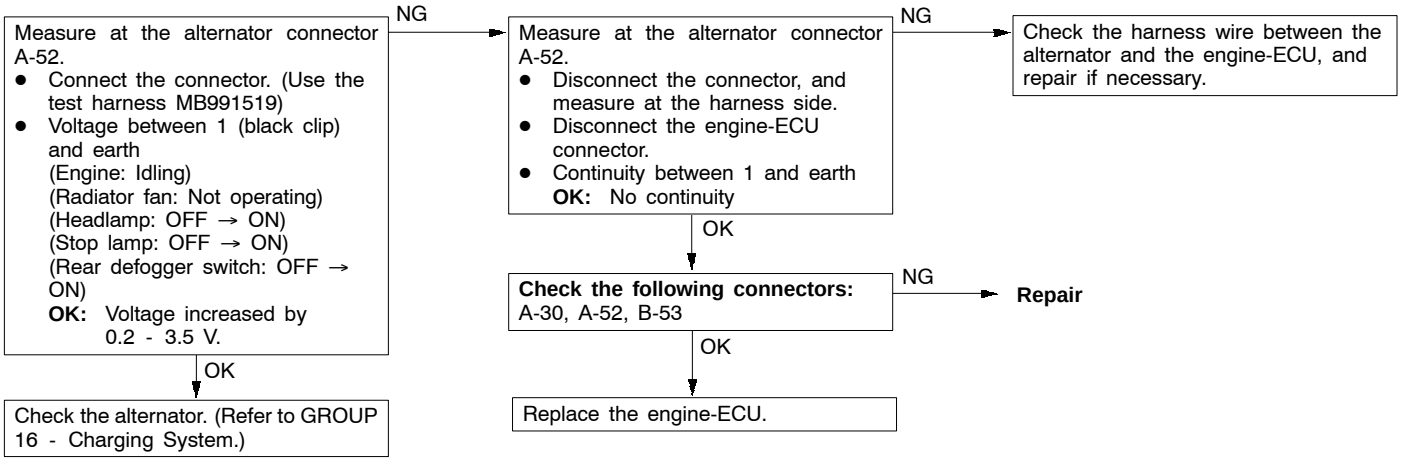
OK
MUT-II Data list
68 EGR valve (Refer to P.13A-79.)
NG
Check the EGR valve system. (Refer to P.13A-69, INSPECTION PROCEDURE 29.)
OK
MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-81.)
NG
Check purge control solenoid valve system. (Refer to P.13A-70, INSPECTION PROCEDURE 30.)
OK
Check trouble symptom.
NG
Replace the injector.
Check trouble symptom.
NG
Replace the three-way catalytic converter.

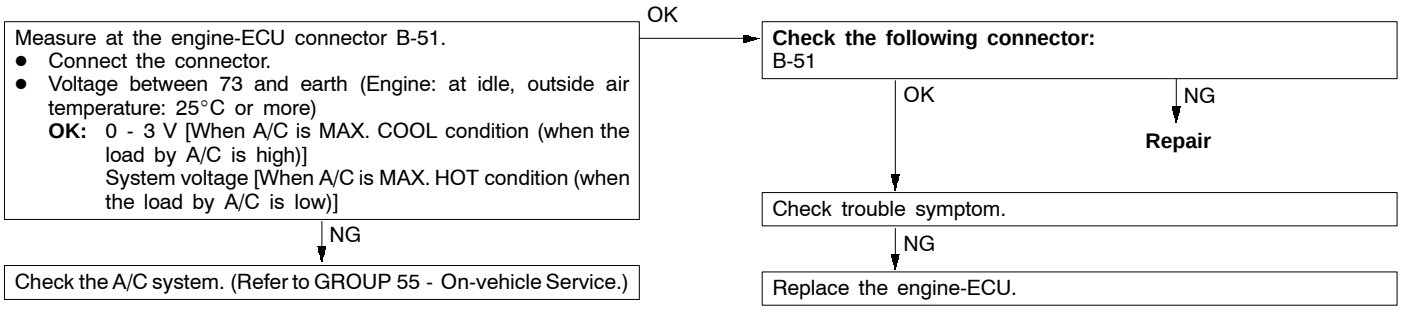
INSPECTION PROCEDURE 19

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



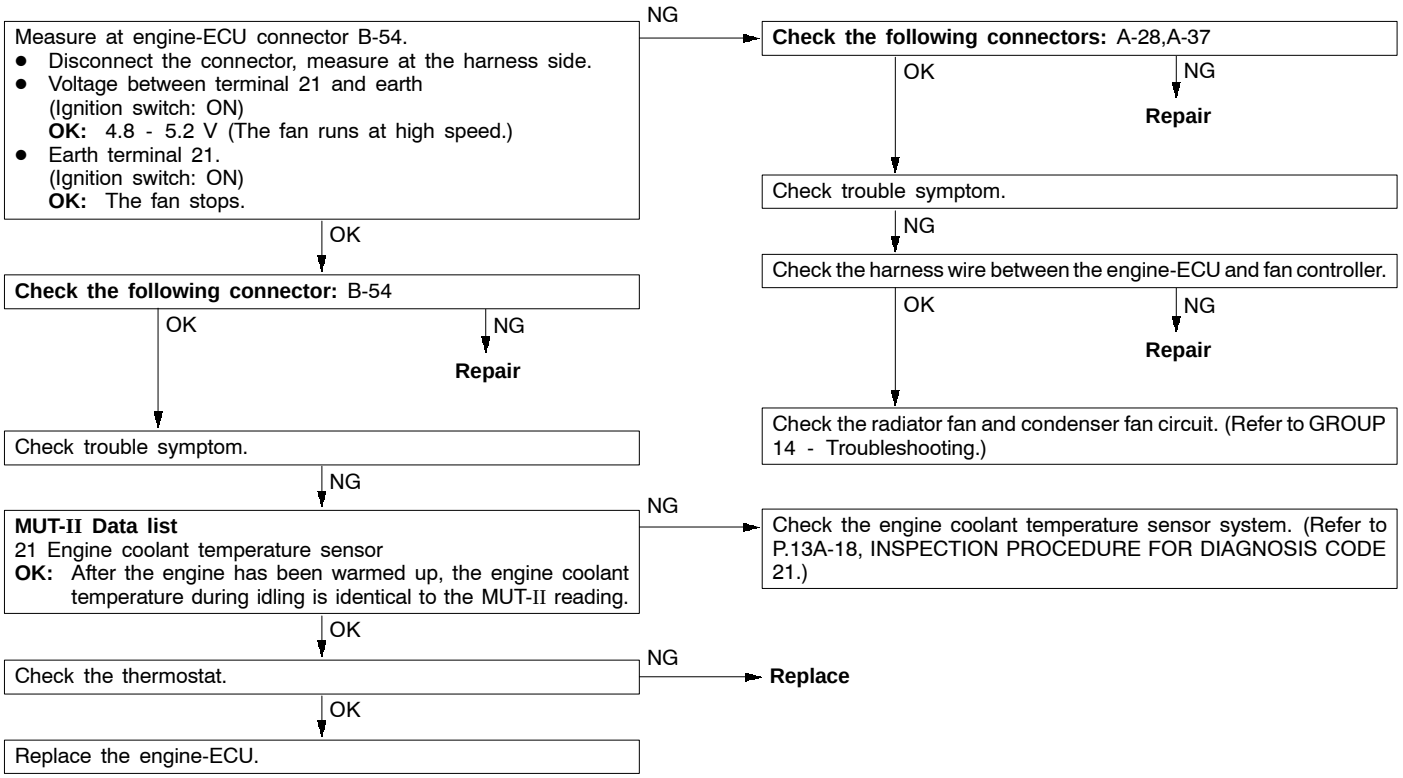
INSPECTION PROCEDURE 20

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 idle speed control (ISC) 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



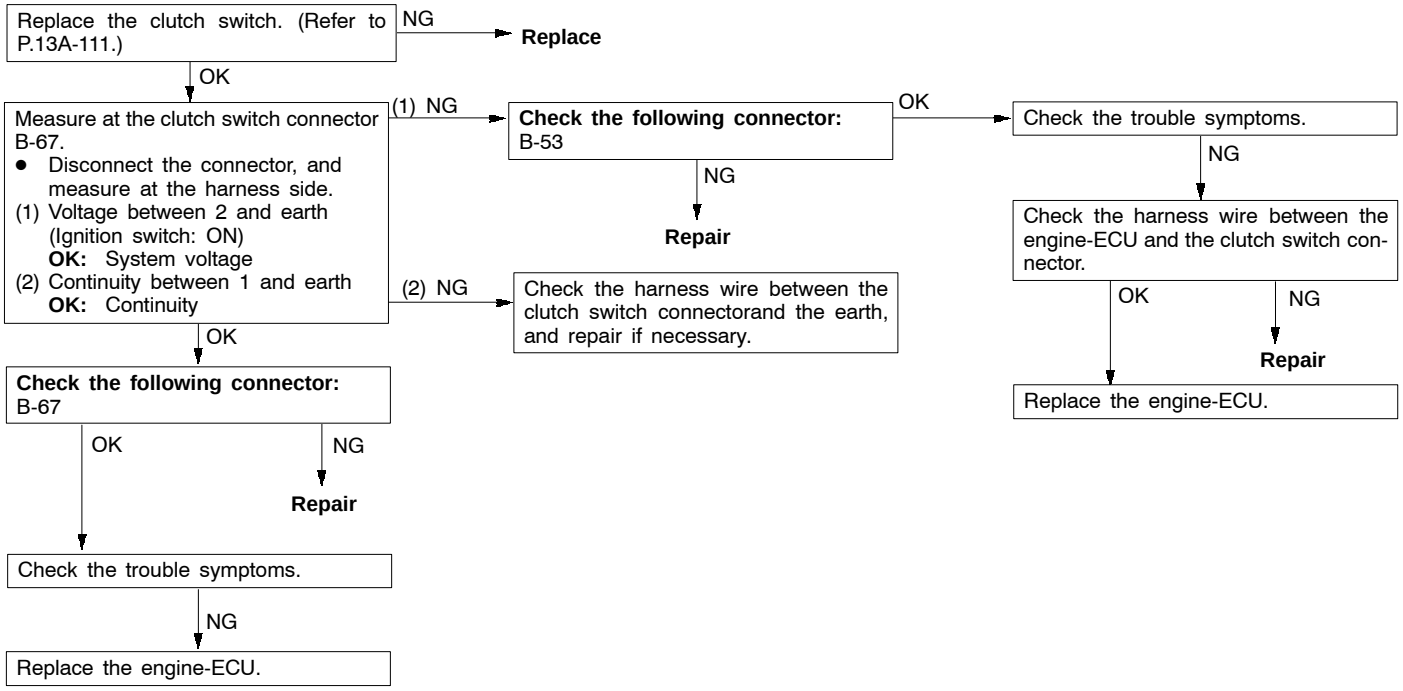
INSPECTION PROCEDURE 21

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
The engine-ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch. The fan controller controls radiator fan and condenser fan speeds, based on this signal. (The closer the terminal voltage comes to 5 V, the higher the fan speed becomes.)	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the fan controller • Open or short circuit, or poor connector contact • Malfunction of the engine-ECU



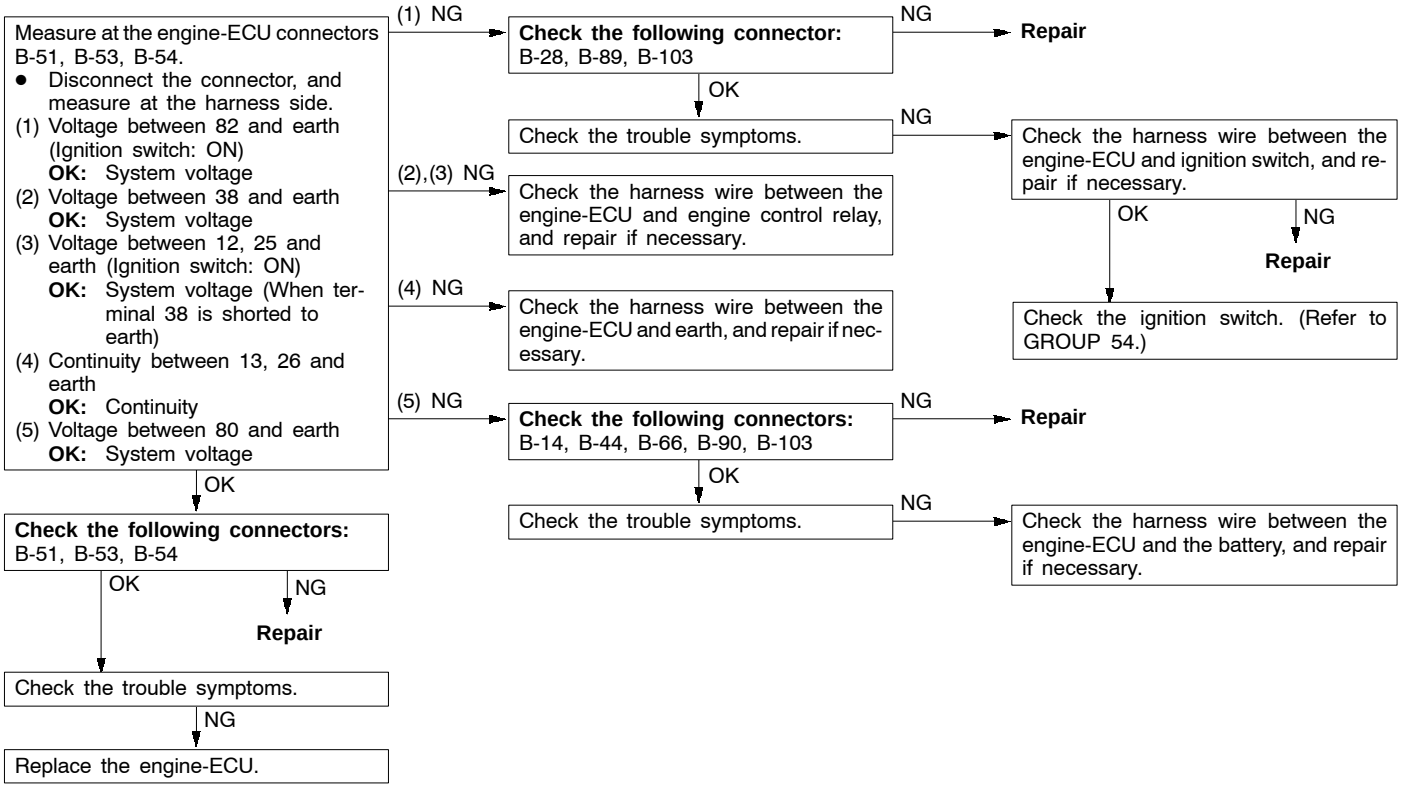
INSPECTION PROCEDURE 22

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



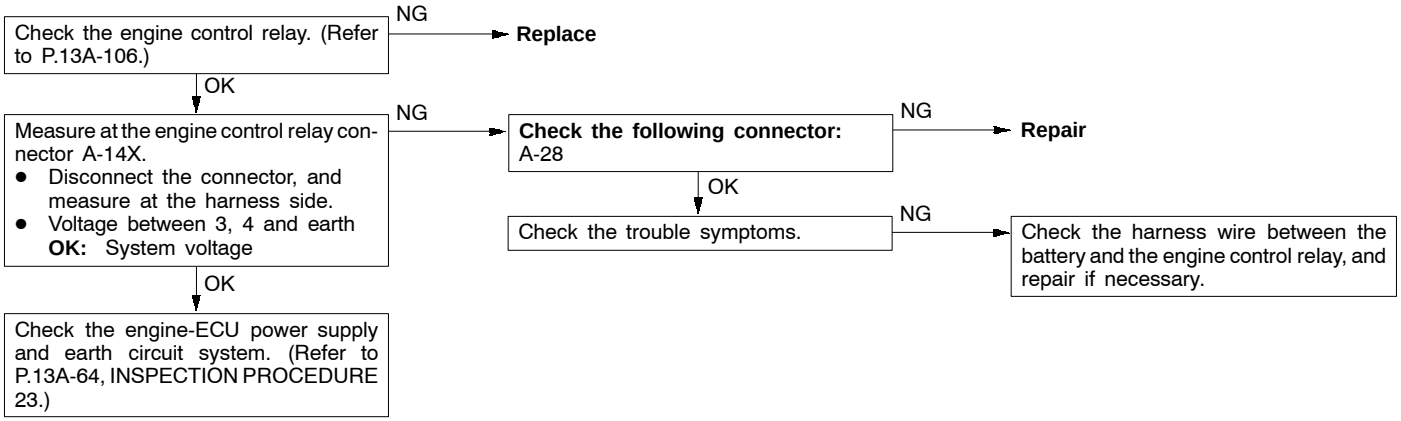
INSPECTION PROCEDURE 23

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



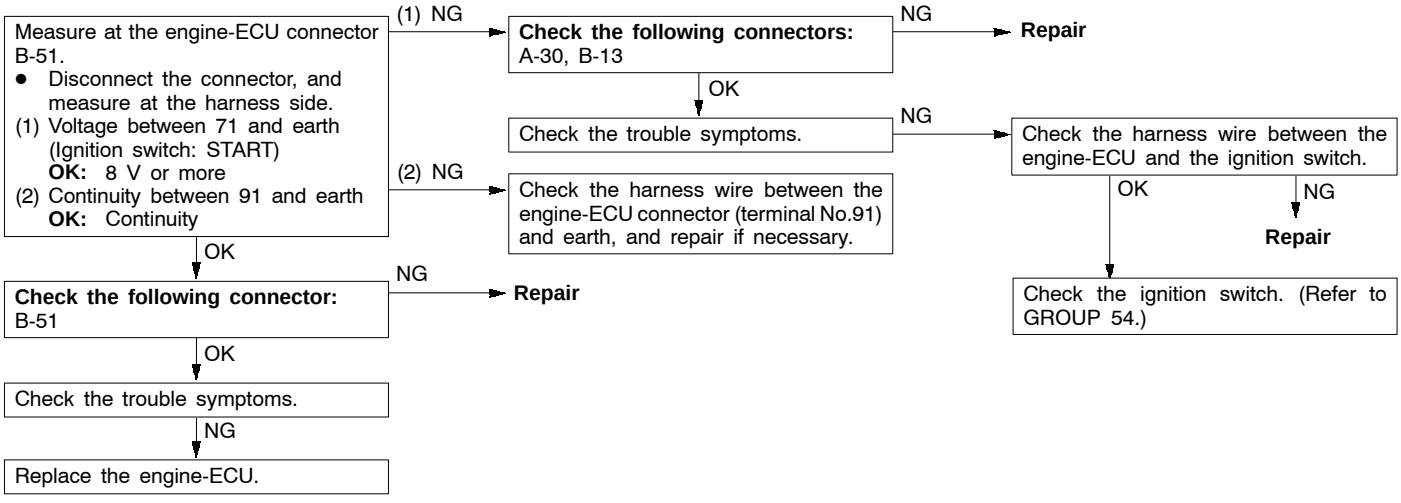
INSPECTION PROCEDURE 24

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



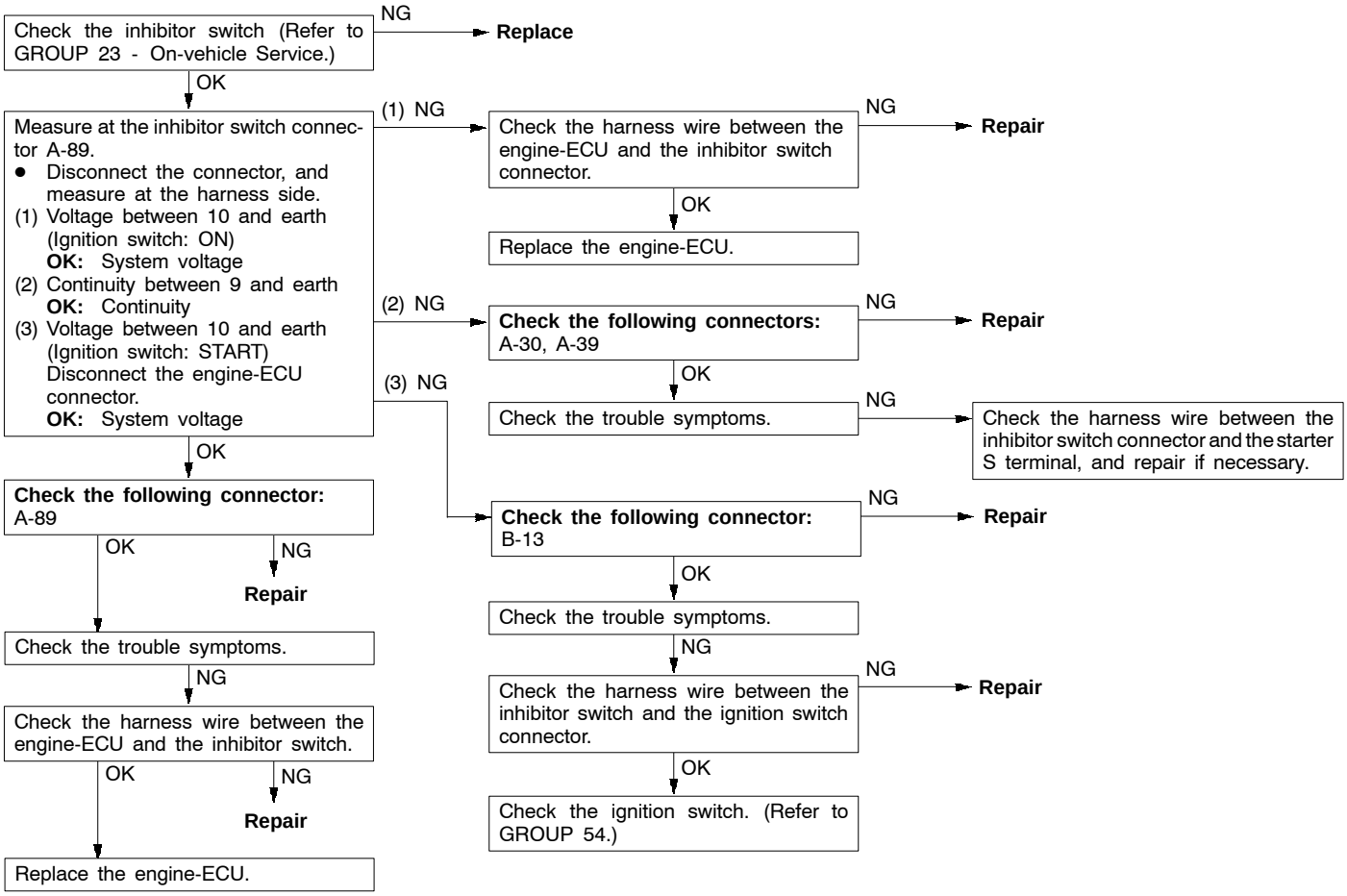
INSPECTION PROCEDURE 25

Ignition switch-ST system <M/T>	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



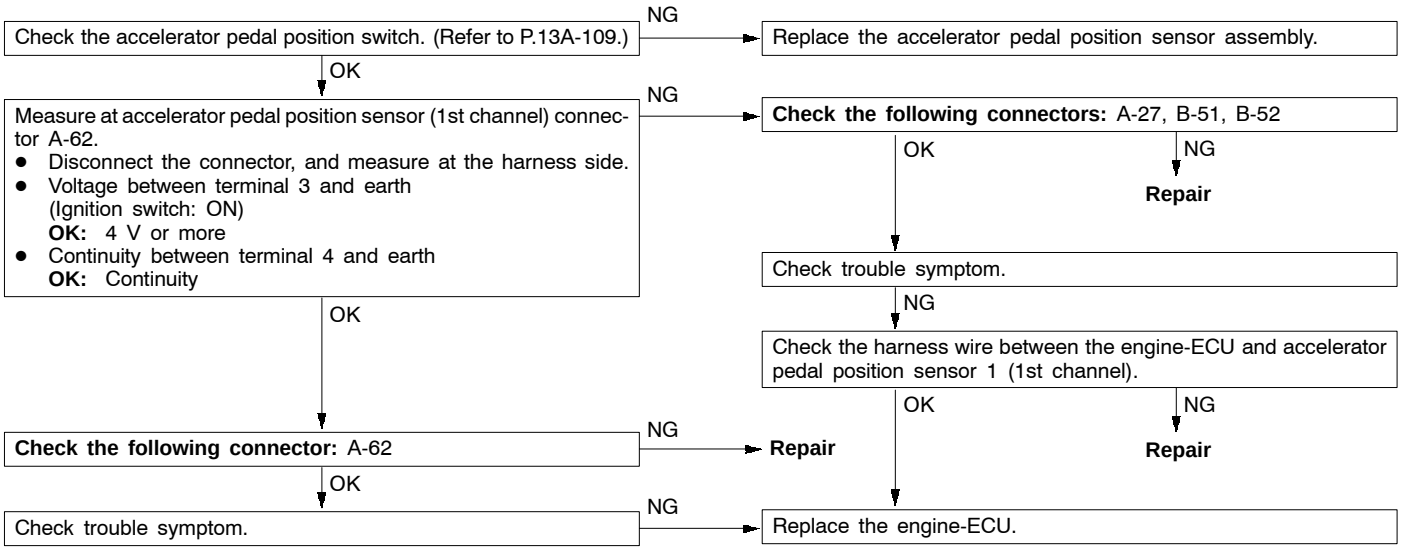
INSPECTION PROCEDURE 26

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking, and the engine-ECU uses this signal to carry out functions such as fuel injection control during starting. The inhibitor switch inputs the position of the selector lever to the engine-ECU. The engine-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 ignition switch and inhibitor switch • Malfunction of the engine-ECU



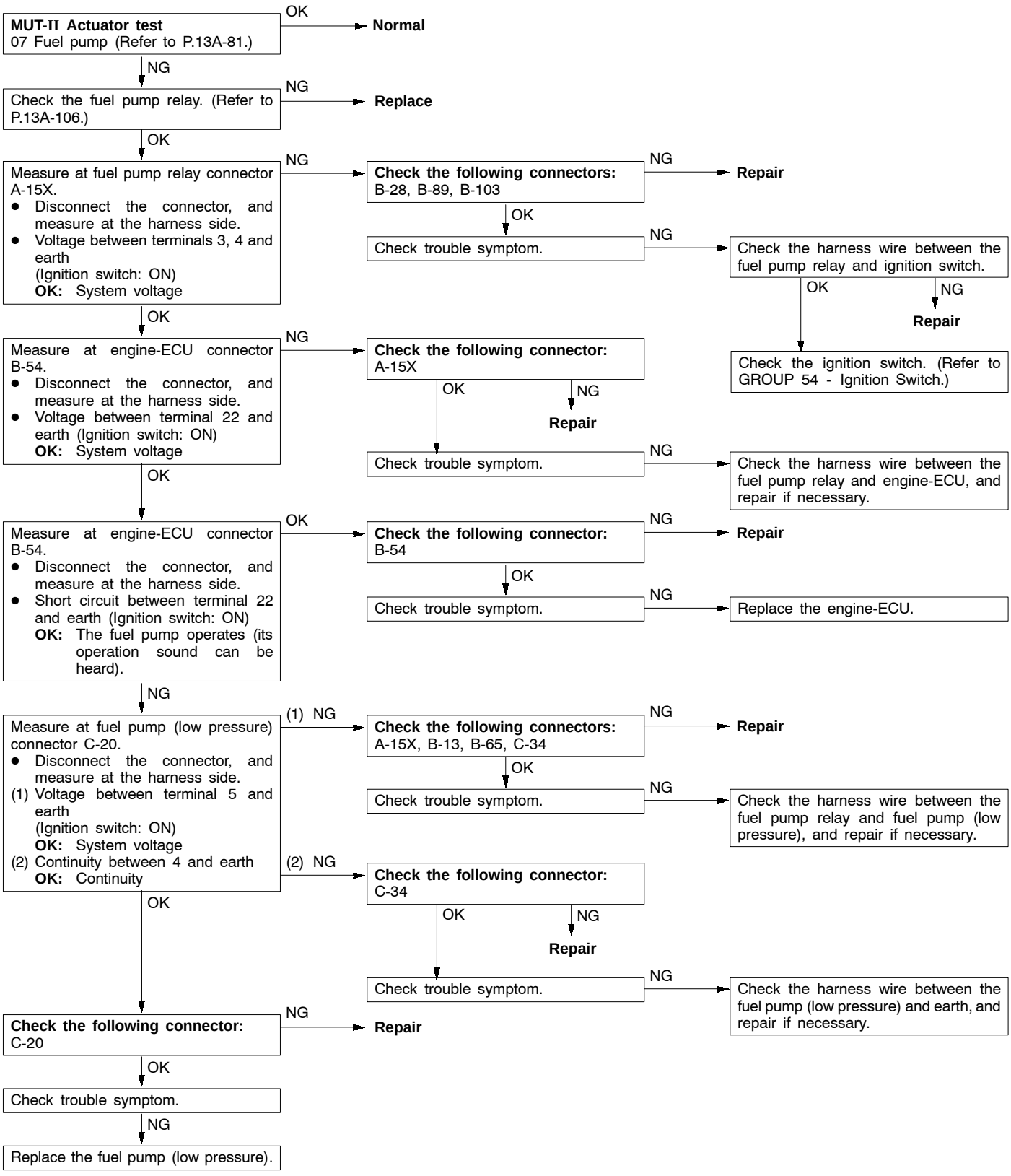
INSPECTION PROCEDURE 27

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



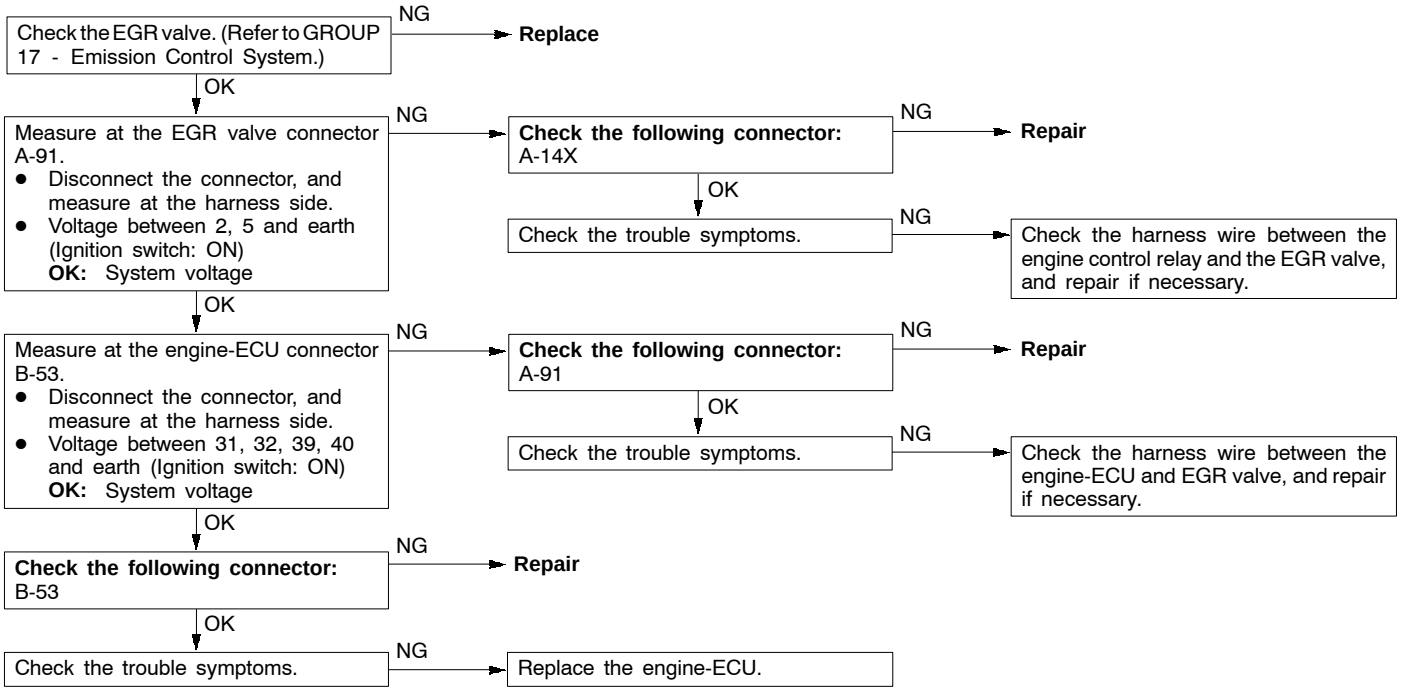
INSPECTION PROCEDURE 28

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



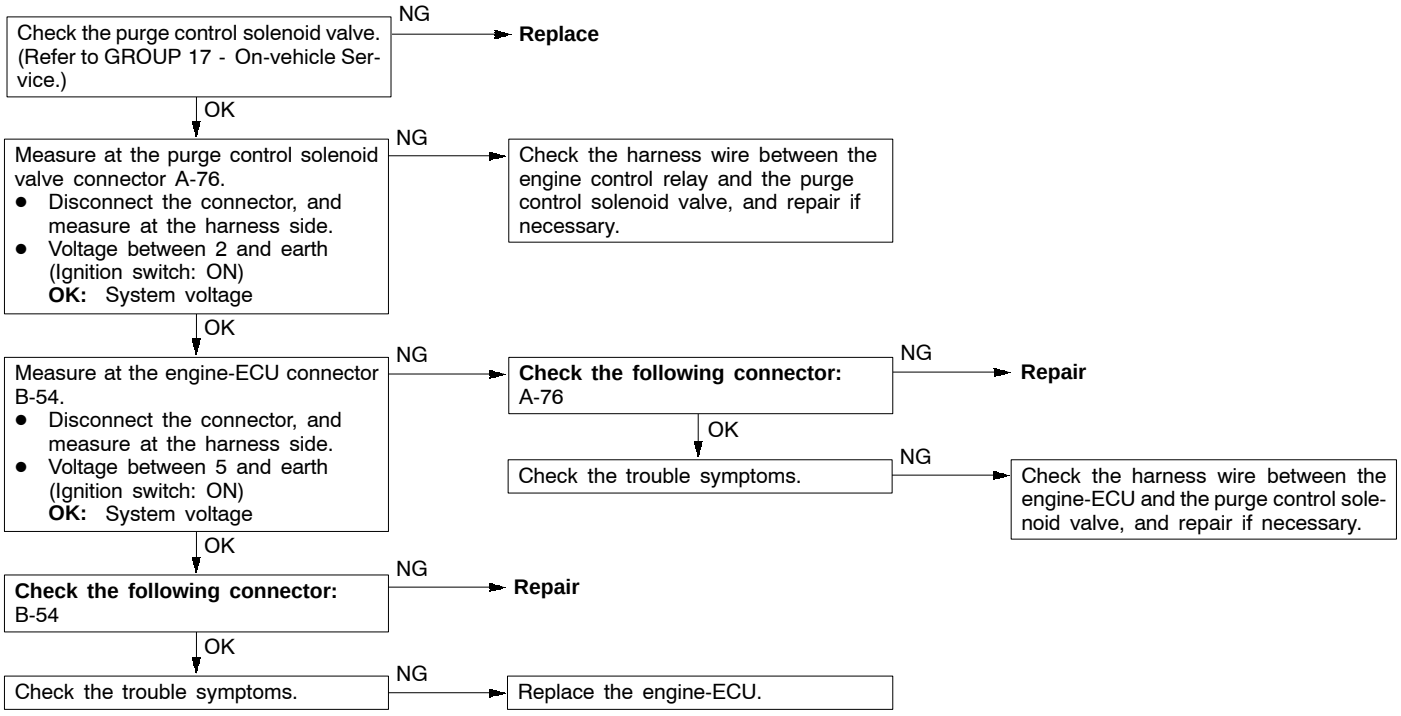
INSPECTION PROCEDURE 29

EGR valve (stepper motor) system	Probable cause
The engine-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-ECU



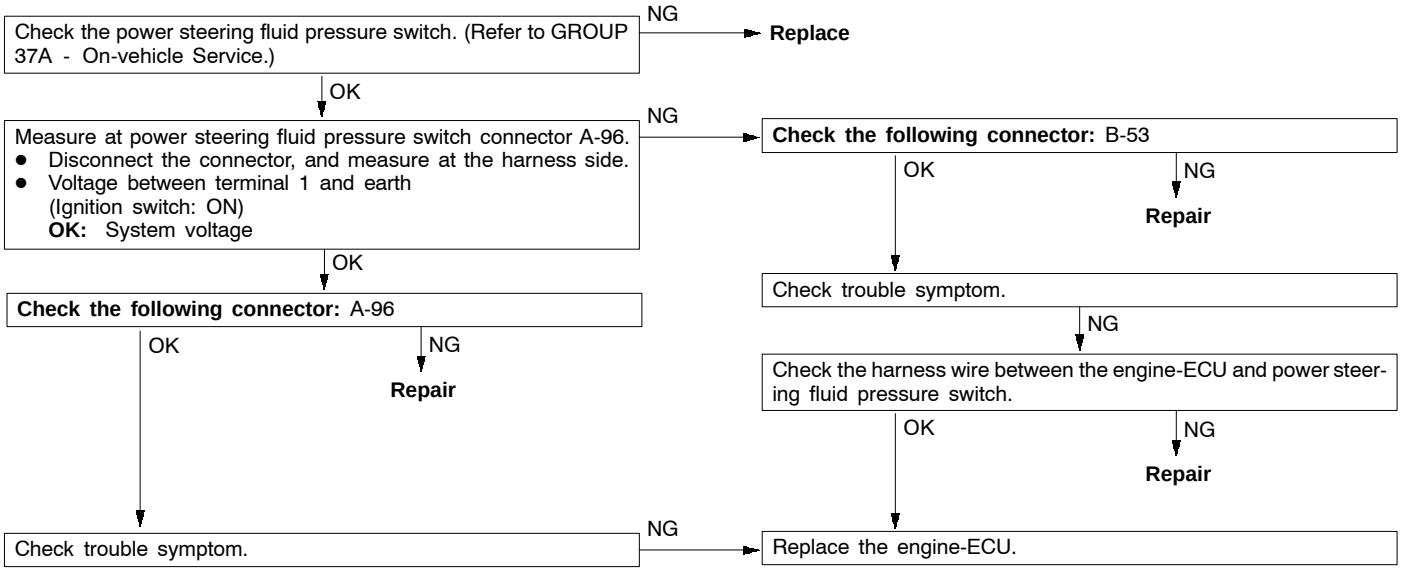
INSPECTION PROCEDURE 30

Purge control solenoid valve system	Probable cause
The engine-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-ECU



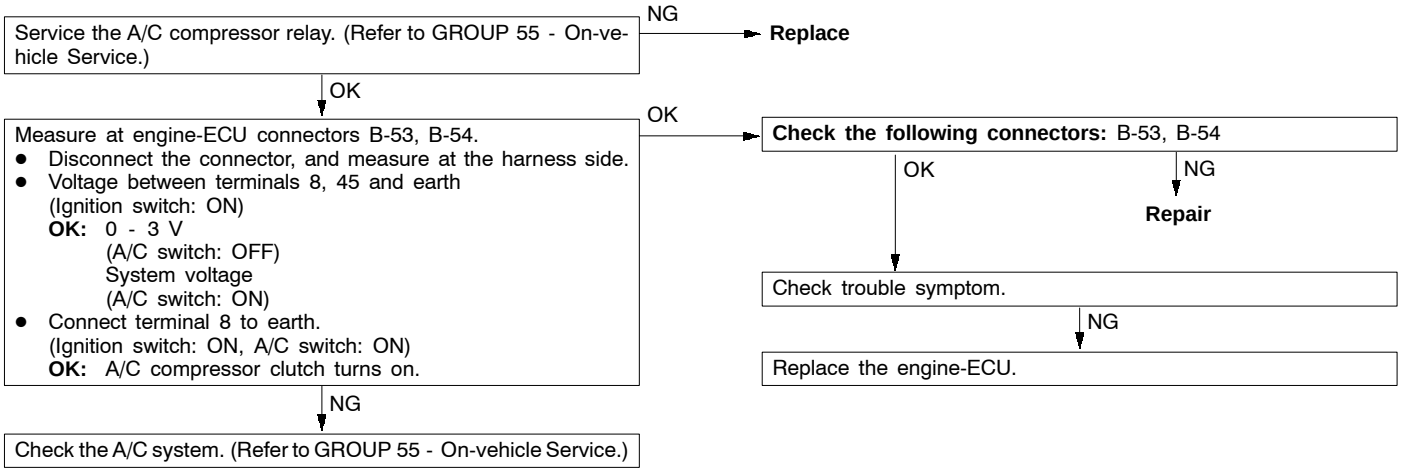
INSPECTION PROCEDURE 31

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



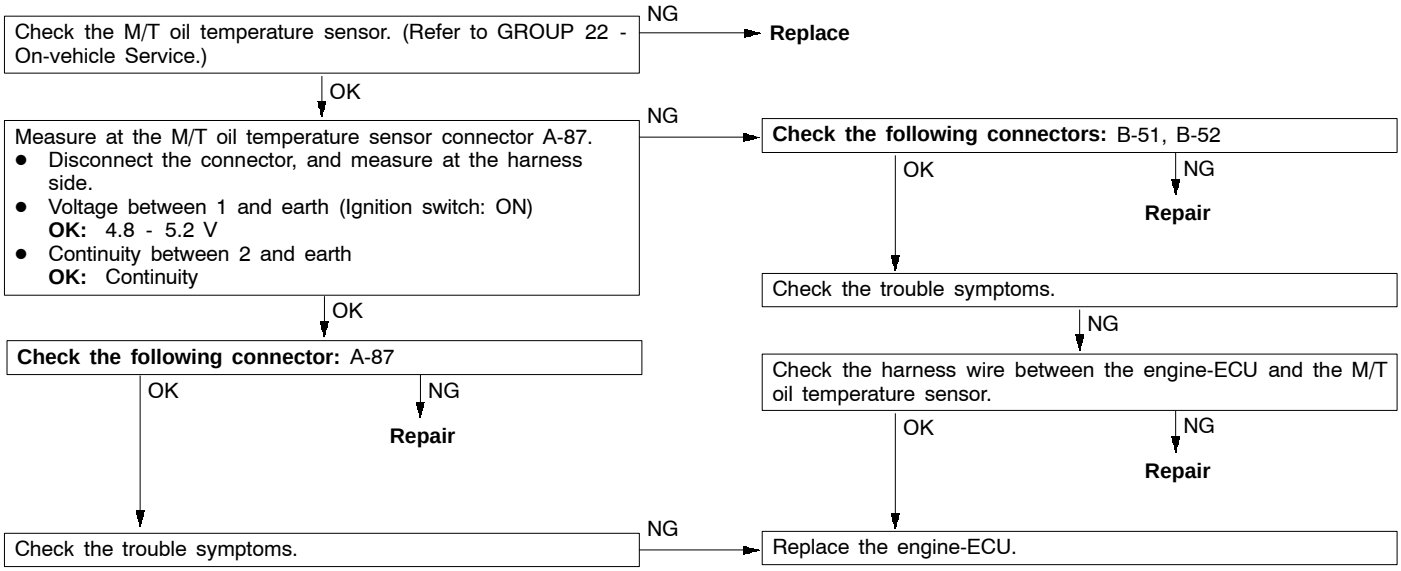
INSPECTION PROCEDURE 32

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



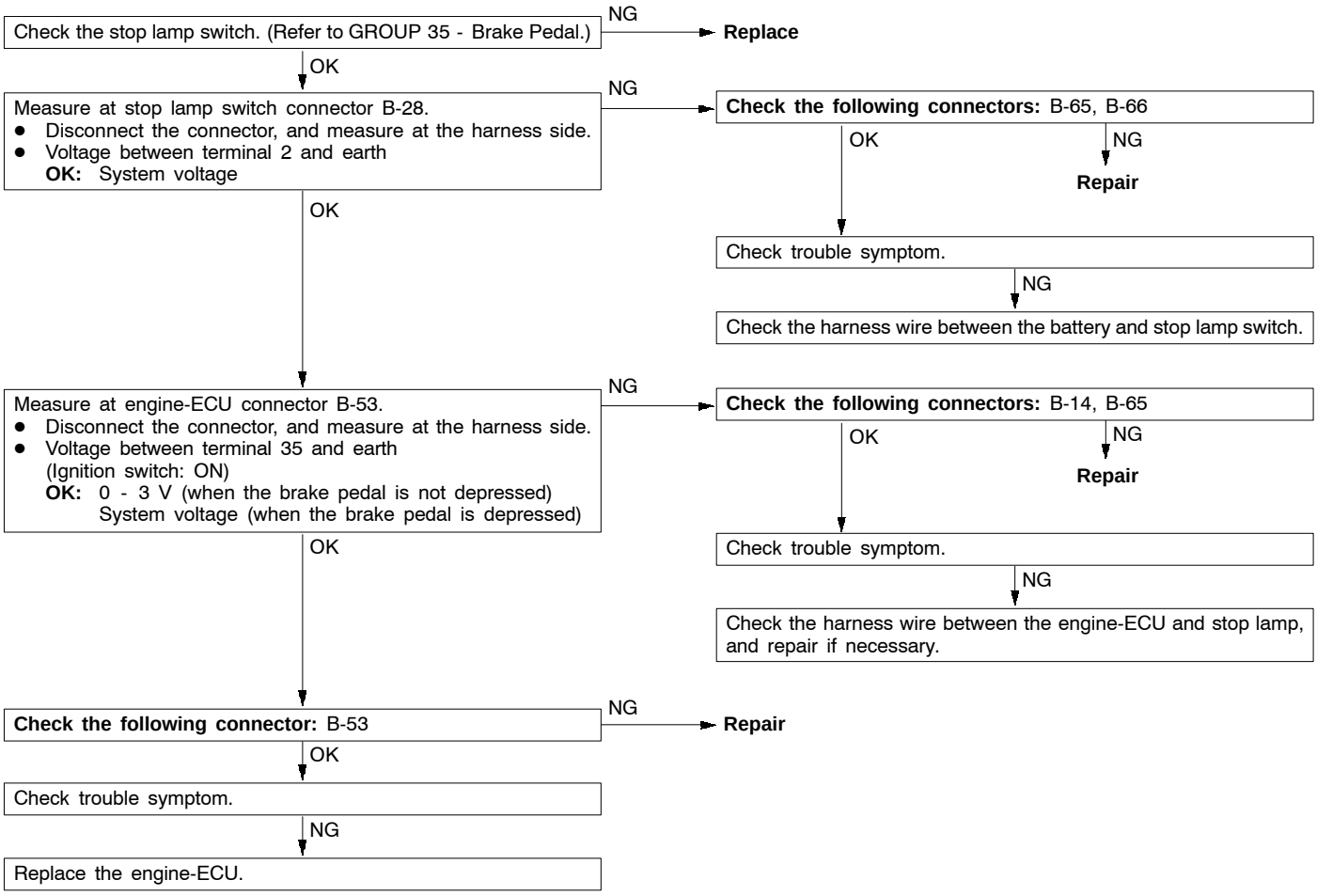
INSPECTION PROCEDURE 33

M/T oil temperature sensor system	Probable cause
This sensor inputs the manual transmission oil temperature to the engine-ECU. The engine-ECU uses this input to control the idle speed control servo so that the idle speed is increased when the manual transmission oil temperature becomes low.	• Malfunction of the M/T oil temperature sensor • Open circuit or short-circuited harness wire in the M/T oil temperature sensor circuit • Malfunction of the engine-ECU



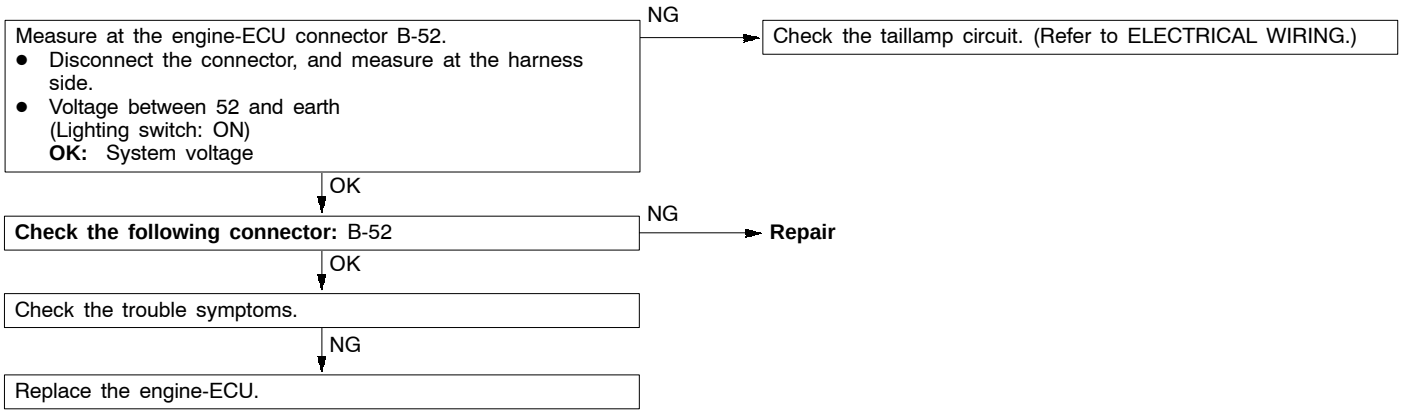
INSPECTION PROCEDURE 34

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 35

Small lamp switch	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



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 50 - 100 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	Engine: After warm-up	Idling	0 mV	Code No.11	13A-14
			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 (A/T: P range)	Idling	20 - 55 Hz	Code No.12	13A-15
			2,500 r/min	70 - 90 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.13	13A-16
			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 - 4,900 mV	Code No.14	13A-17
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	100 - 1,100 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No.24	13A-65
18	Cranking signal (Ignition switch - ST)	Transmission: Neutral (A/T: P range)	Engine: Stopped	OFF	Procedure No.25 <M/T> Procedure No.26 <A/T>	13A-65 <M/T> 13A-66 <A/T>
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: -20°C	-20°C	Code No.21	13A-18
			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.22	13A-19
		• Engine: Idling • Accelerator pedal position switch: ON	Engine coolant temperature: -20°C	1,300 - 1,500 r/min		
			Engine coolant temperature: 0°C	1,200 - 1,400 r/min		
			Engine coolant temperature: 20°C	1,050 - 1,250 r/min		
			Engine coolant temperature: 40°C	850 - 1,050 r/min		
			Engine coolant temperature: 80°C	550 - 750 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.25	13A-22
			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.27	13A-67
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No.31	13A-71
			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.32	13A-71
			A/C switch: ON	ON		
29	Inhibitor switch	Ignition switch: ON	Selector lever: P or N	P, N	Procedure No.26	13A-66
			Selector lever: D, 2, L or R	D, 2, L, R		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.35	13A-74
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No.12	13A-15
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	15 - 35%	-	-
			2,500 r/min	15 - 35%		
			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 (A/T: P range)	Idling	0.4 - 0.6 ms*1	-	-
			2,500 r/min	0.4 - 0.8 ms		
			Sudden racing	Increases		
44	Ignition advance	• Engine: After warm-up • Set a timing light.	Idling	15 - 25°BTDC *2	Code No.44	13A-26
			2,500 r/min	25 - 35°BTDC		
48	M/T oil temperature sensor	Drive after the engine has warmed up.	Drive for 15 minutes or more.	Gradually increases to 50 - 90°C.	Procedure No.33	13A-72
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.32	13A-71
			A/C switch: ON	ON (compressor clutch is operating)		
59	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Drive with throttle widely open	3,500 r/min	600 - 1,000 mV	Code No.59	13A-30
66	Brake vacuum sensor	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Stop the engine from idling speed, and then depress the brake pedal several times with the ignition switch on.	Displayed pressure increases.	Code No.66	13A-32
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.32	13A-71
			Brake pedal: Released	ON		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
68	EGR valve	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idling	0 - 15 STEP	Procedure No.29	13A-69
			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 (A/T: P range)	Engine: Idling	4 - 7.5 MPa	-	-
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	300 - 1,000 mV	Code No.77	13A-33
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,600 - 5,200 mV		
78	Accelerator pedal position sensor *3	Ignition switch: ON	Release the accelerator pedal.	300 - 1,000 mV	Code No.78	13A-34
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,600 - 5,200 mV		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
79	Throttle position sensor (1st channel)	• Engine coolant temperature: 80 - 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	450 - 800 mV	Code No.79	13A-35
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			4,600 - 5,200 mV	3,900 - 4,900 mV		
		Engine: After warm-up, idling	No load	450 - 1,000 mV		
			A/C switch: OFF → ON	Increases by 100 - 600 mV.		
			Selector lever: N → D range	Increases by 0 - 200 mV.		
99	Fuel injection mode	Engine: After warm up	Idling (for several minutes after engine start)	Lean compression	-	-
			2,500 r/min	Stoichio metric feedback		
			Sudden racing after idle position	Open loop		

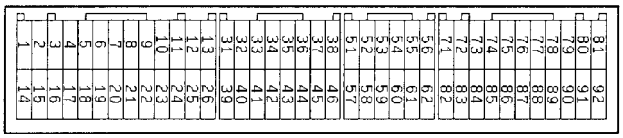
ACTUATOR TEST REFERENCE TABLE

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. 41	13A-24
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 28	13A-68
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. 30	13A-70
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Idling after engine warm up	5°BTDC	-	-
21	Fan controller	Drive the fan motor	Ignition switch: ON	The fan motor operates	Procedure No.21	13A-62
34	Electronic-controlled throttle valve system	Close the throttle valve fully	Ignition switch: ON	Operation sound can be heard	Code No.91	13A-36

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



9FU0393

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.
14	No.2 injector			
2	No.3 injector			
15	No.4 injector			
5	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.
6	Oxygen sensor heater	Engine: idling		0 - 3 V
		Engine: 3,500 r/min		System voltage
8	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
10	No.1 ignition coil	Engine: 3,000 r/min		0.1 - 2.0 V
11	No.2 ignition coil			
23	No.3 ignition coil			
24	No.4 ignition coil			
12	Power supply	Ignition switch: ON		System voltage
25				
16	Throttle valve control servo relay	Ignition switch: OFF		0 - 0.3 V
		Ignition switch: ON		0.5 - 1.0 V
19	Air flow sensor reset signal	Engine: idling		0 - 1 V
		Engine: 3,000 r/min		6 - 9 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
20	Injector driver relay	Ignition switch: OFF		0 - 0.1 V
		Ignition switch: ON		0.5 - 1.0 V
21	Fan controller	Radiator and condenser fans are not operating.		0 - 0.3 V
		Radiator and condenser fans are operating.		0.7 V or more
22	Fuel pump relay	Ignition switch: ON	Engine: stopped	System voltage
			Engine: Idling	0 - 3 V
31	EGR valve (C)	Ignition switch: Immediately after turning ON		5 - 8 V (fluctuates for approx. three seconds)
32	EGR valve (D)			
39	EGR valve (A)			
40	EGR valve (B)			
33	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
41	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
34	Oxygen sensor (rear)	● Transmission: 2nd gear <M/T>, L range <A/T> ● Engine speed: 3,500 r/min or more ● Driving with the throttle valve widely open		0.6 - 1.0 V
35	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 - 3 V
36	Engine warning lamp	Ignition switch: OFF → ON		0 - 3 V → System voltage (after several seconds)
37	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 - 3 V
38	Engine control relay	Ignition switch: OFF		0 - 3 V
		Ignition switch: ON		System voltage

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
42	Brake vacuum sensor	Engine: Stop the engine from idle speed, turn the ignition switch ON, and then depress the brake pedal several times.		Voltage increases
44	Clutch switch <M/T>	Depress the clutch pedal		0 - 3 V
		Release the clutch pedal		System voltage
45	A/C switch (1st channel)	Engine: idling	A/C switch: OFF	0 - 3 V
			A/C switch: ON (Compressor is operating)	System voltage
51	Injector open circuit check signal	Engine: Increase engine speed from idle speed to 4,000 r/min.		Decreases slightly (approx.0.7 V) from 4.5 V - 5.0 V.
52	Small lamp switch	Lighting switch: OFF		0 - 3 V
		Lighting switch: ON (Taillamp: ON)		System voltage
57	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 - 1 V
			Depress the accelerator pedal slightly.	4 V or more
58	Tachometer output	Engine: 3,000 r/min		2.0 - 9.0 V
71	Ignition switch - ST	Engine: Cranking		8 V or more
72	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
73	A/C switch (2nd channel)	Refer to GROUP 55 - Troubleshooting “Check at the A/C-ECU terminal, engine-ECU output terminals.”		
74	Fuel pressure sensor	Engine: Idling		0.3 - 4.7 V
75	M/T oil temperature sensor <M/T>	M/T oil temperature: 25°C		2.4 - 2.7 V
		M/T oil temperature: 80°C		0.5 - 0.8 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
76	Oxygen sensor (front)	Engine: Warm up, and then hold the engine speed at 2,500 r/min (Use a digital voltmeter).		0 ↔ 0.8 V alternates.
77	Sensor power supply	Ignition switch: ON		4.5 - 5.5 V
81	Power supply to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 - 5.5 V
80	Back-up power source	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	3.2 - 3.8 V
			Engine coolant temperature: 20°C	2.3 - 2.9 V
			Engine coolant temperature: 40°C	1.3 - 1.9 V
			Engine coolant temperature: 80°C	0.3 - 0.9 V
84	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.0 - 4.9 V
			Depress the accelerator pedal fully.	0.1 - 1.1 V
85	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 - 4.3 V
			Altitude: 1,200 m	3.2 - 3.8 V
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward.		0 V ↔ system voltage alternates.
87	Accelerator pedal position sensor 1	Ignition switch: ON	Release the accelerator pedal.	0.9 - 1.2 V
			Depress the accelerator pedal fully.	4 V or more
88	Camshaft position sensor	Engine: Cranking		0.3 - 3.0 V
		Engine: Idling		0.5 - 3.5 V
89	Crank angle sensor	Engine: Cranking		0.4 - 4.0 V
		Engine: Idling		1.5 - 2.5 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
90	Air flow sensor	Engine: Idling		2.2 - 3.2 V
		Engine: 2,500 r/min		
91	Inhibitor switch <A/T>	Ignition switch: ON	Selector lever: P or N range	0 - 3 V
			Selector lever: Other than P or N range	8 - 14 V

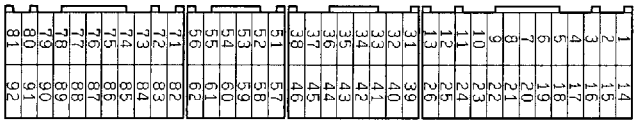
CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

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



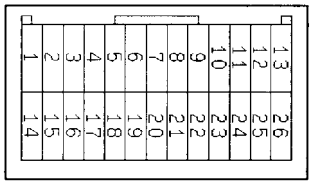
9FU0392

Terminal No.	Check item	Standard value, normal condition (check requirements)
5 - 12	Purge control solenoid valve	36 - 44 Ω (at 20°C)
6 - 12	Oxygen sensor heater control	11 - 18 Ω (at 20°C)
13 - Body earth	Earth	Continuity (0 Ω)
26 - Body earth		
31 - 12	EGR valve (C)	15 - 20 Ω (at 20°C)
32 - 12	EGR valve (D)	
39 - 12	EGR valve (A)	
40 - 12	EGR valve (B)	
57 - 92	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
72 - 53	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)
83 - 53	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)
91 - Body earth	Inhibitor switch <A/T>	Continuity (when the selector lever is at P or N range)
		No continuity (when the selector lever is at a range other than P or N)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

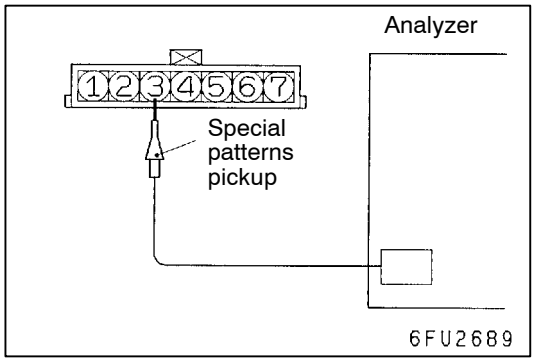
TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



7FU2121

Terminal No.	Check items	Requirements		Normal value
1	Throttle valve control servo (A+)	● Ignition switch: ON ● Accelerator pedal: Fully opened → fully closed		Decreases slightly from system voltage.
9	Throttle valve control servo (B+)			
14	Throttle valve control servo (A-)	● Ignition switch: ON ● Accelerator pedal: Fully closed → fully opened		Decreases slightly (approx. 2 V) from system voltage.
15	Throttle valve control servo (B-)			
2	Power supply to throttle valve control servo	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor 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.	3.9 - 4.9 V
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.7 - 1.4 V
			Depress the accelerator pedal fully.	4 V or more
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)

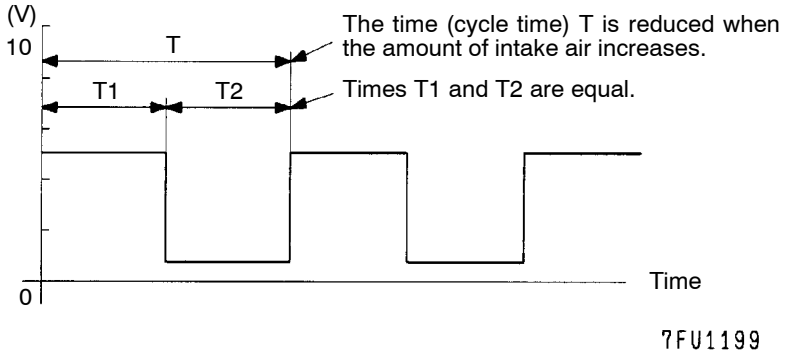
1. Connect the analyzer special patterns pickup to engine-ECU terminal 90.

Standard Wave Pattern

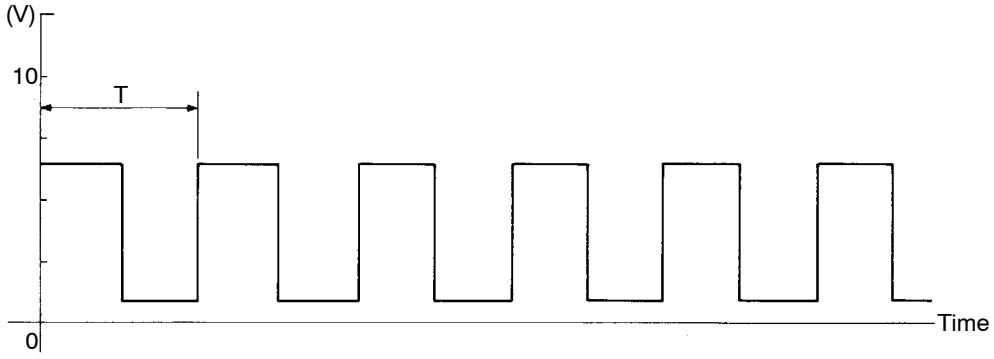
Observation conditions

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

Standard wave pattern

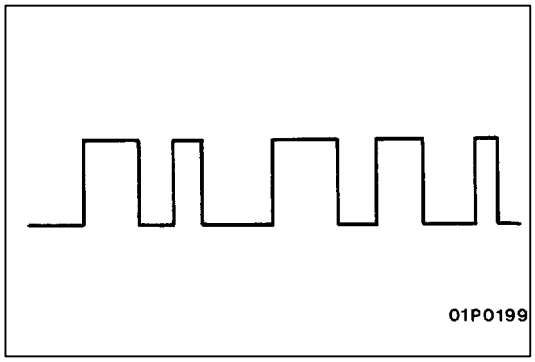


Observation conditions (from conditions above engine speed is increased by racing.)



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.

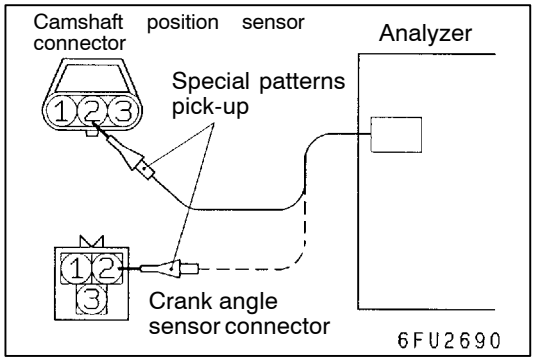
- Example 2

  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)

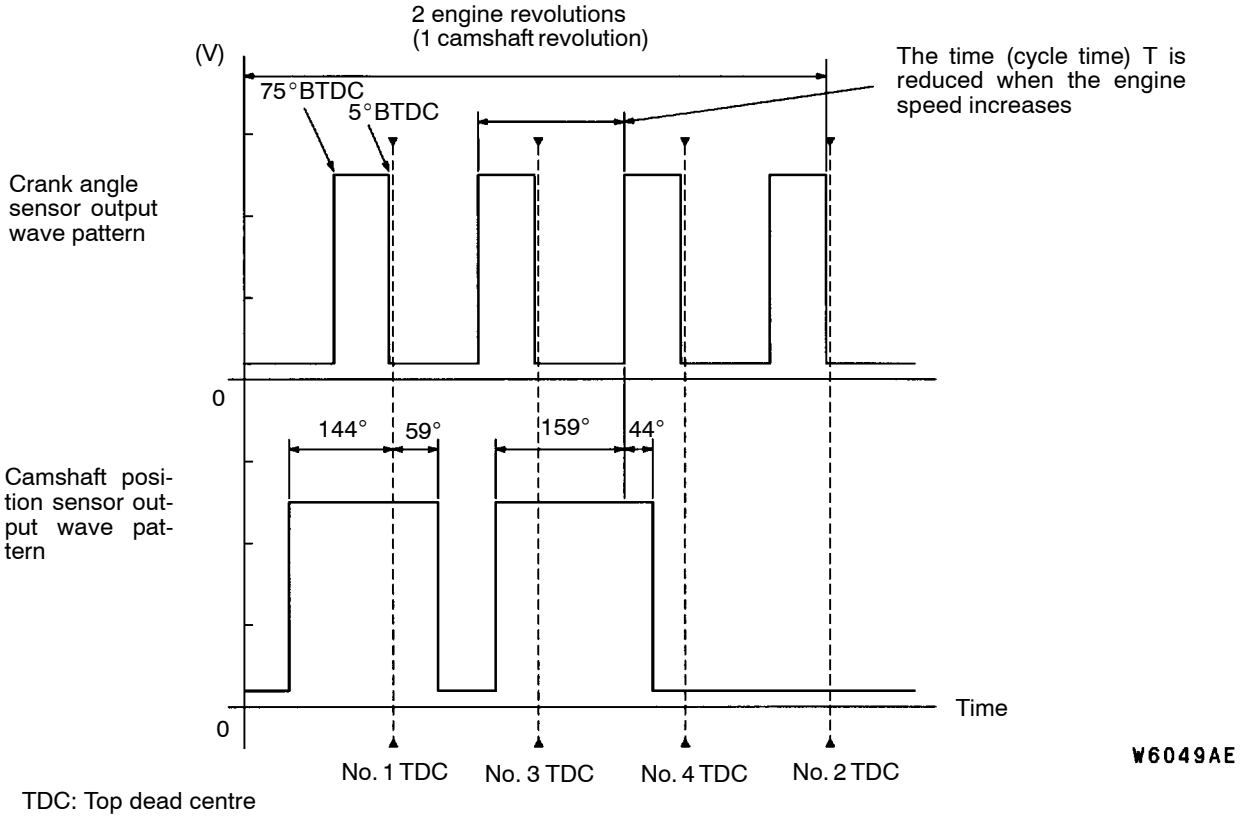
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

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

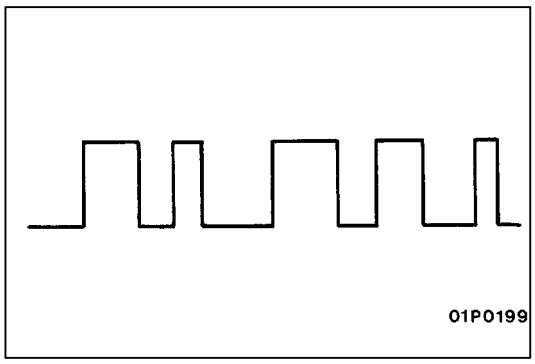
Standard wave pattern



TDC: Top dead centre

Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

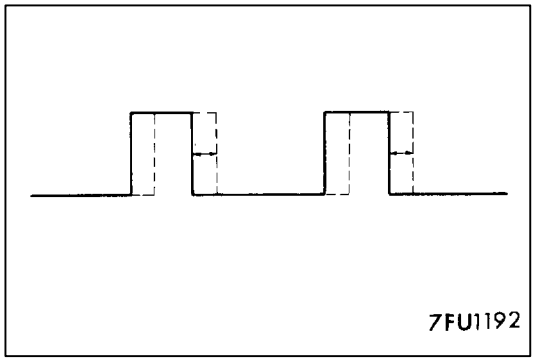
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



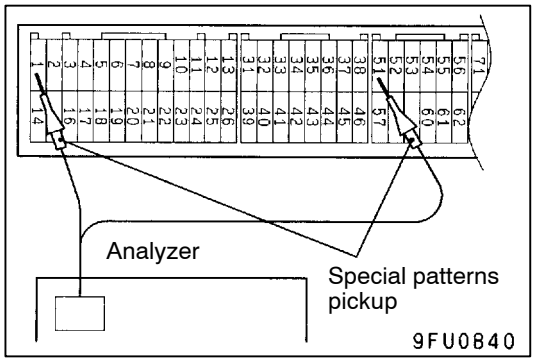
- Example 2

  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

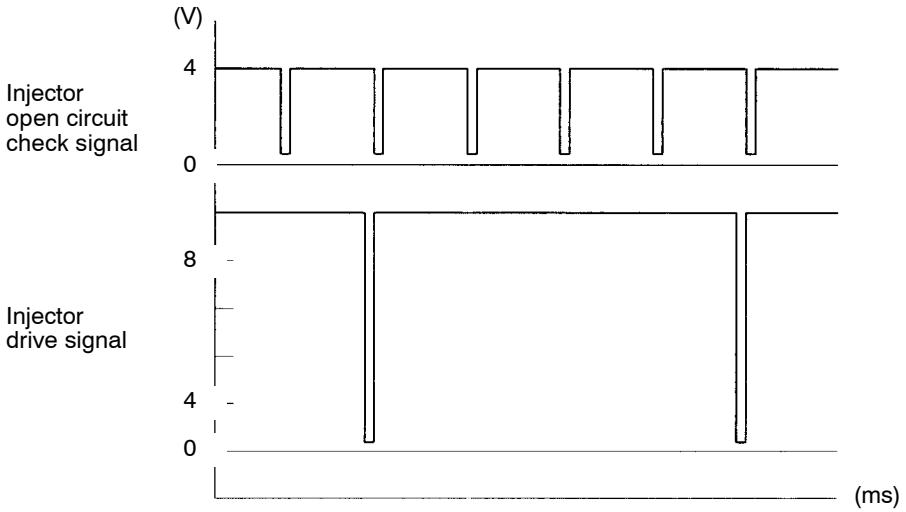
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 51 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 14 (No.2 injector), terminal 2 (No.3 injector) and terminal 15 (No.4 injector).

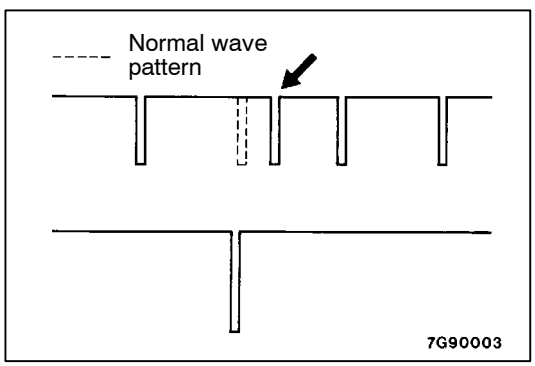
Standard Wave Pattern

Observation conditions

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

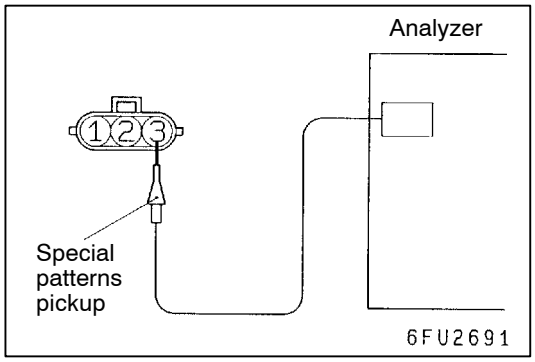
Standard wave pattern





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)

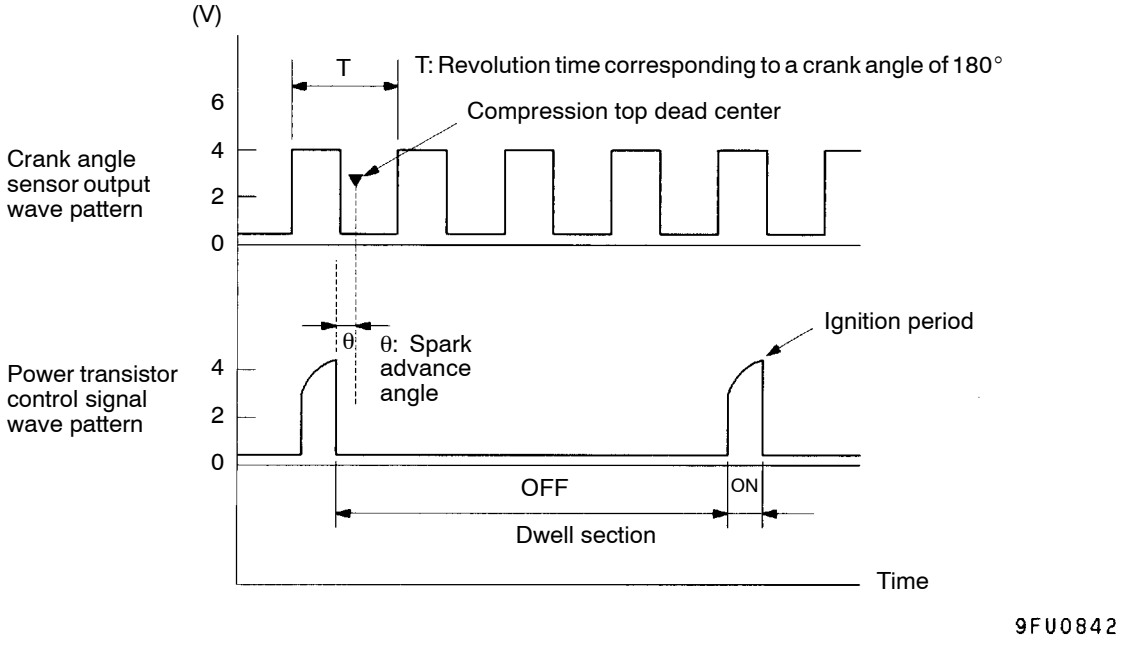
1. Connect the analyzer special patterns pickup to engine-ECU terminal 10 (No. 1 ignition coil), terminal 11 (No. 2 ignition coil), terminal 23 (No. 2 ignition coil), terminal 24 (No. 4 ignition coil) respectively.

Standard Wave Pattern

Observation condition

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

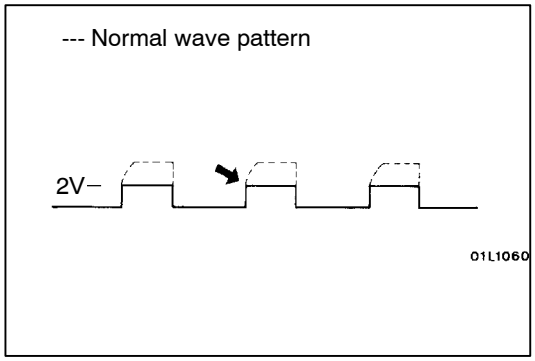
Standard wave pattern

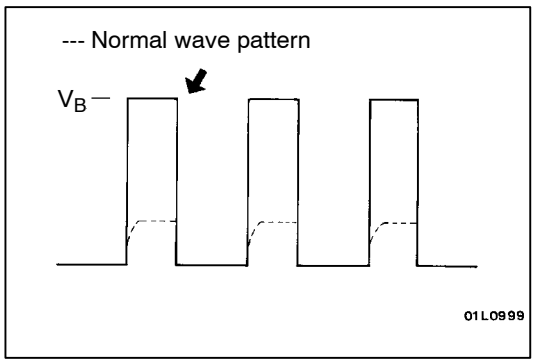


Wave Pattern Observation Points

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

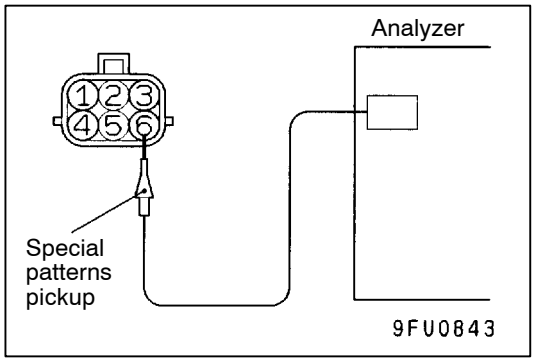
  Wave pattern during engine cranking

  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)

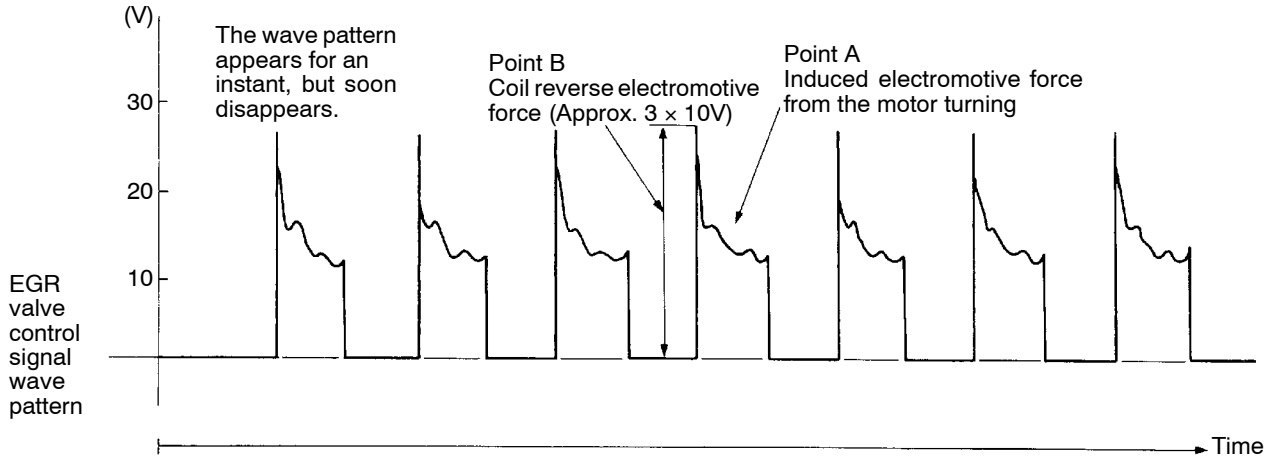
1. Connect the analyzer special patterns pickup to engine-ECU terminal 39, connection terminal 40, connection terminal 31, and connection terminal 32 respectively.

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

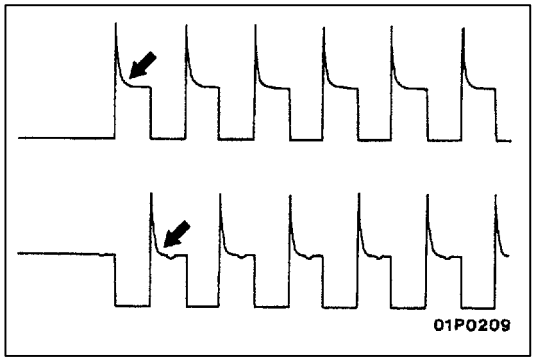
Wave Pattern Observation Points

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

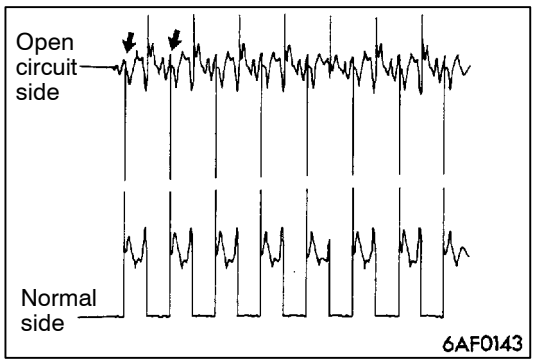
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



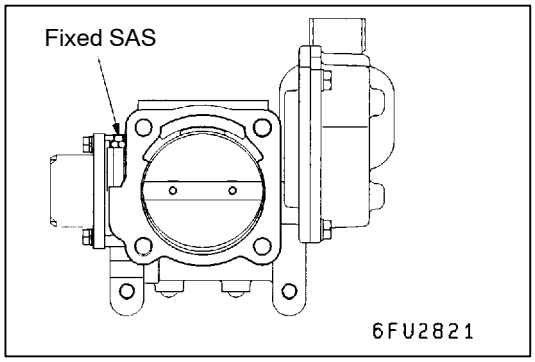
- Example 2

  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.



ON-VEHICLE SERVICE

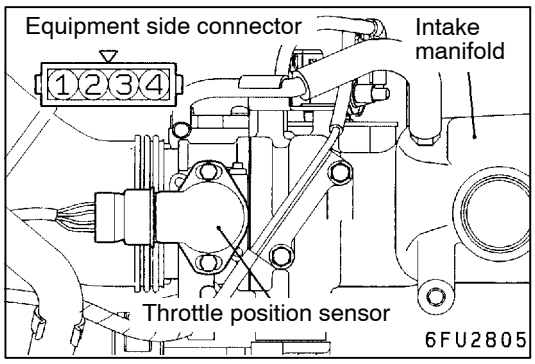
Caution

(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.

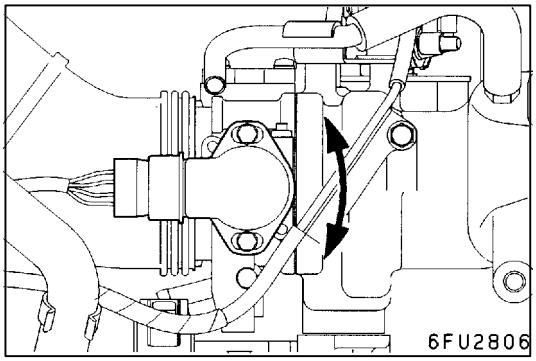
THROTTLE BODY (THROTTLE VALVE ARE) CLEANING

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 ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the throttle valve control servo connector.
3. Turn the ignition switch to ON (but do not start the engine).



4. Check the output voltage of the throttle position sensor (1st channel) when the throttle valve is fully closed by your finger.

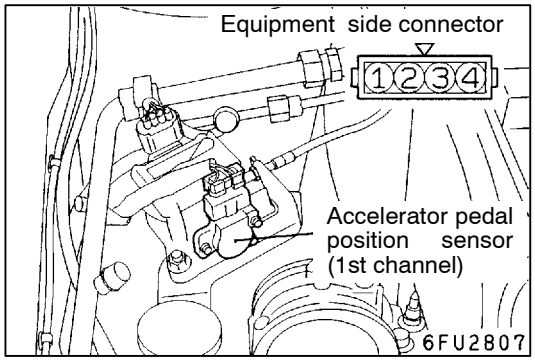
   Standard value: 0.4 - 0.6 V

5. If not within the standard value, loosen the throttle position sensor mounting bolts. Then rotate the sensor body to adjust.

6. Check the output voltage of the throttle position sensor (2nd channel) when the throttle valve is fully closed by your finger.

   Standard value: 4.2 - 4.8 V

7. If not within the standard value, replace the throttle position sensor.
8. Turn the ignition switch to OFF.
9. Reconnect the throttle valve control servo connector.
10. Remove the MUT-II.
11. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II or disconnect the negative battery cable from the battery terminal and then leave it for at least ten seconds. After that, reconnect the battery cable.
12. Turn the ignition switch to ON and return it to OFF, and then leave it for at least ten seconds. In addition, if the battery cable is disconnected at step (11), let the engine run at idle for approx. ten minutes.



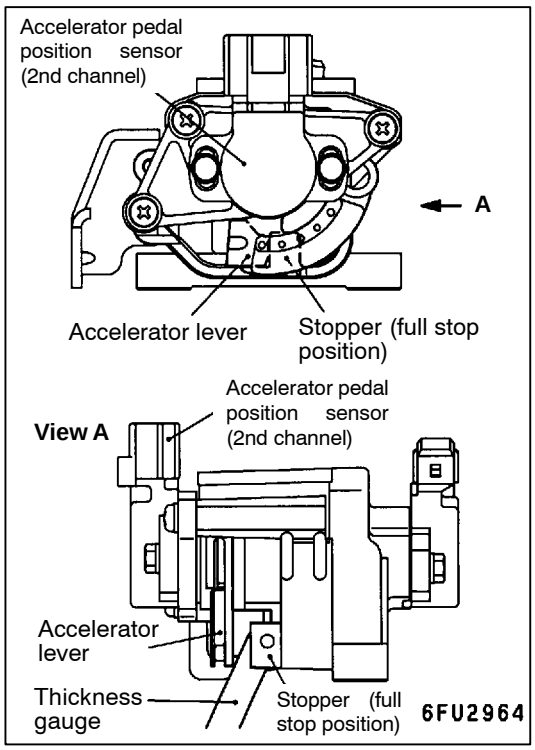
ACCELERATOR PEDAL POSITION SWITCH AND ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

Caution

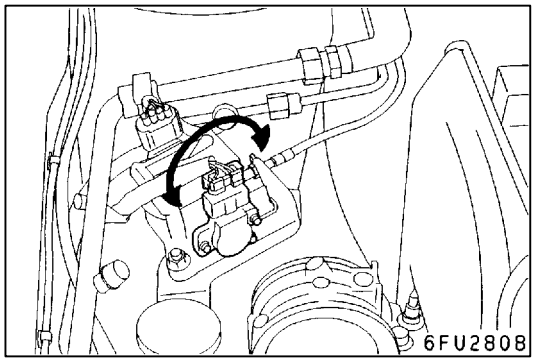
(1) Never attempt to tamper the accelerator pedal position sensor. The sensor position is precisely adjusted at factory.

(2) Should it be tampered, follow the procedure below:

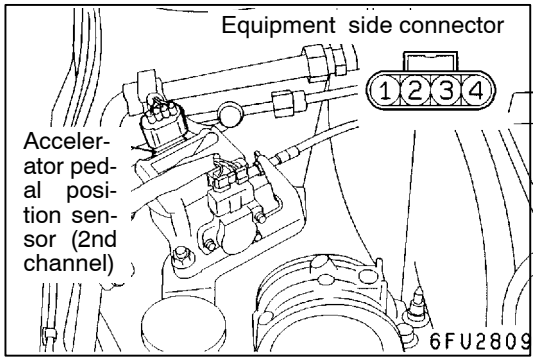
1. Connect the MUT-II to the diagnosis connector.



2. Remove the two accelerator pedal position sensor assembly mounting bolts, and then insert a 0.60 mm of thickness gauge blade between the accelerator lever and stopper.
3. Turn the ignition switch to ON (but do not start the engine).

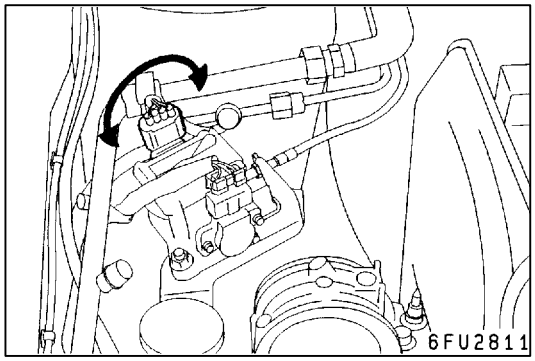


4. Loosen the accelerator pedal position sensor (1st channel) mounting bolts, and then rotate it fully anticlockwise.
5. Check that the accelerator pedal position switch is on (there is continuity between terminals).
6. Slowly rotate the accelerator pedal position sensor (1st channel) clockwise, and find the pint where the accelerator pedal position switch is turned off (there will be no continuity). At this point, tighten the accelerator pedal position sensor (1st channel) mounting bolts securely.

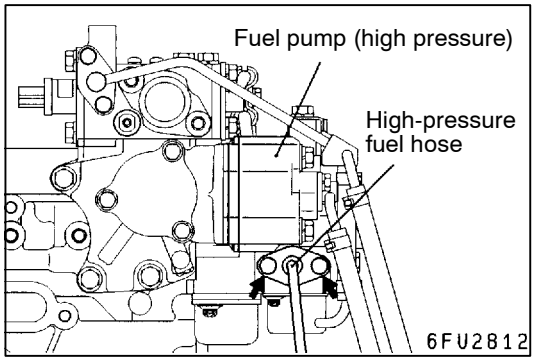


7. Check output voltage of the accelerator pedal position sensor (1st channel).

   Standard value: 0.4 - 1.0 V
8. If not within the standard value, check the accelerator pedal position sensor (1st channel) and its related wiring harness.
9. After the adjustment of the accelerator pedal position sensor (1st channel), check that the output voltage of the accelerator pedal position sensor (2nd channel) is identical to that of the sensor (1st channel).



10. Loosen the mounting bolts of the accelerator pedal position sensor (2nd channel) if there is a difference between these output voltages, and rotate the sensor body to adjust.
11. Turn the ignition switch to OFF.
12. Remove the thickness gauge blade, and then install the accelerator pedal position sensor assembly.
13. Remove the MUT-II.

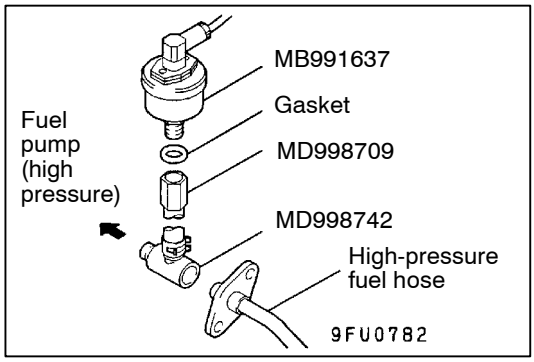


FUEL PRESSURE TEST

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

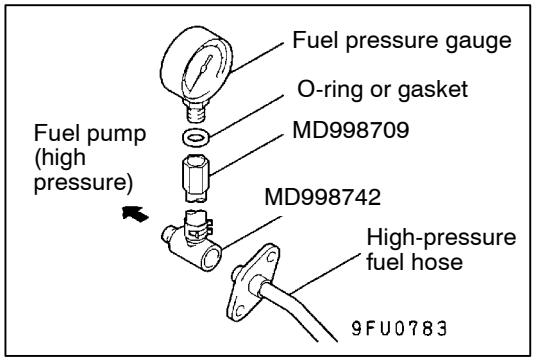
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13A-103.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

   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.
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 324 kPa
11. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
12. If 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

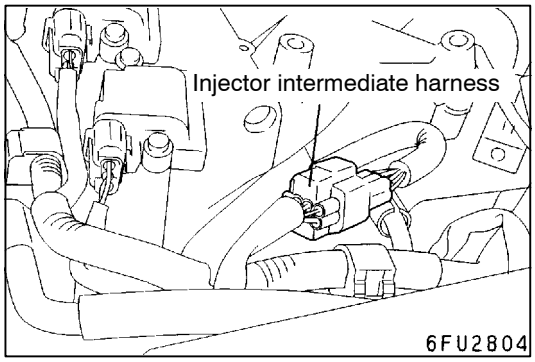
13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

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-103.)
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.

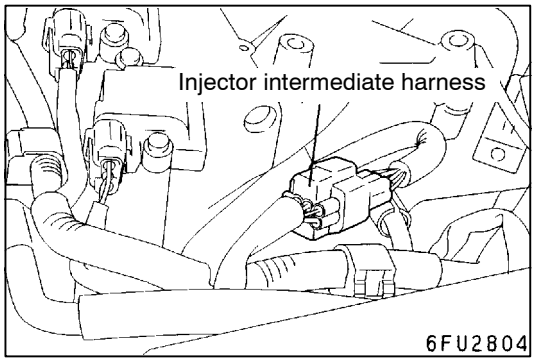
6. Check if the fuel pressure is more than 1 MPa immediately after 20 seconds have passed since cranking was finished.
7. If the fuel pressure is lower than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.
8. Turn the ignition switch 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 - 7.5 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.

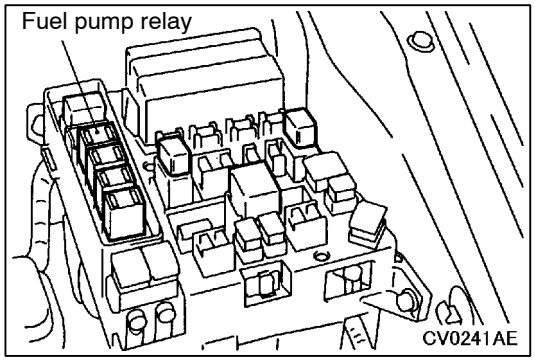
   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

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.



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.

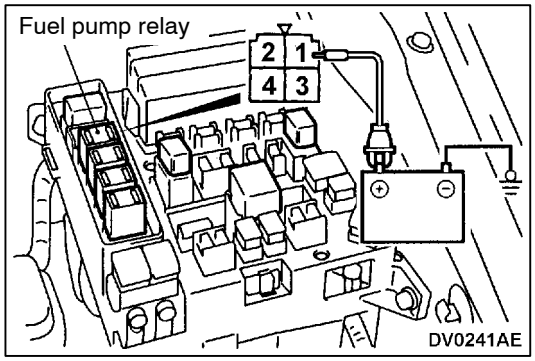
1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the fuel pump relay.
3. Connect the MUT-II to the diagnosis connector.

   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 CHECK

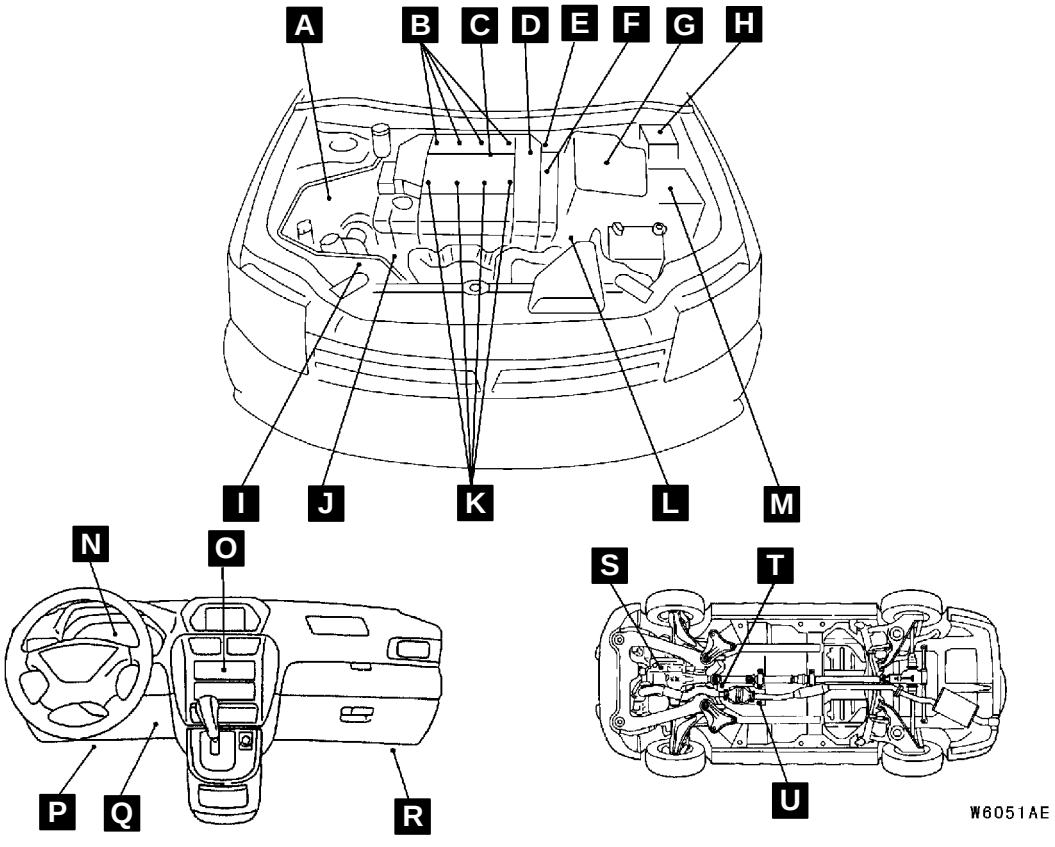
1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
   (1) Turn off the ignition switch.
   (2) Remove the fuel pump relay. Connect the terminal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

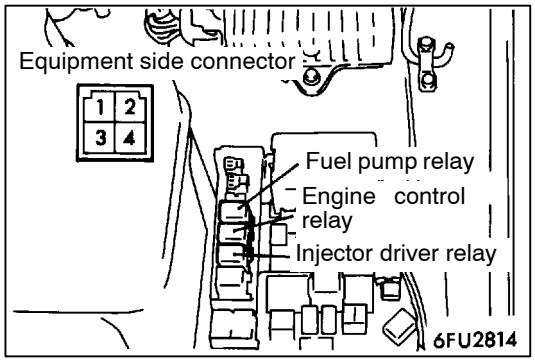
   NOTE
   As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel filler cap and check from the tank inlet.

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

COMPONENT LOCATION

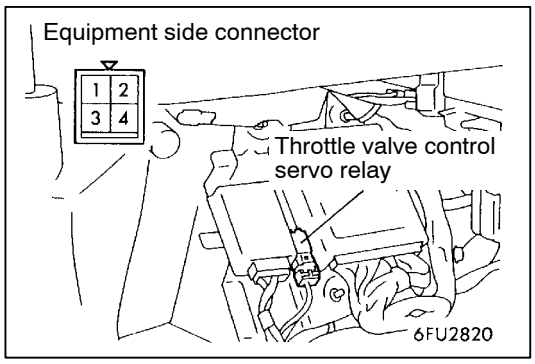
Name	Symbol	Name	Symbol
A/C relay	M	Fuel pressure sensor	F
A/C switch	O	Fuel pump relay	M
Accelerator pedal position sensor (1st and 2nd channels)	A	Ignition coil	K
		Inhibitor switch <A/T>	L
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	G	Injectors	B
		Injector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

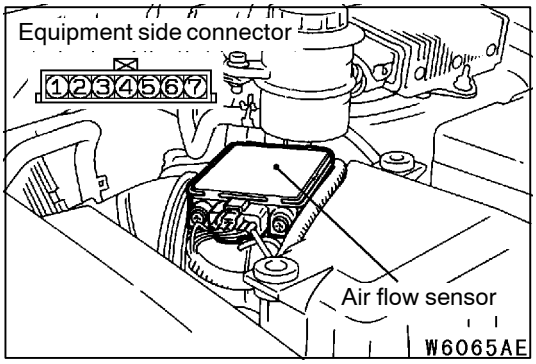




ENGINE CONTROL RELAY, FUEL PUMP RELAY, INJECTOR DRIVER CONTROL RELAY AND THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

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

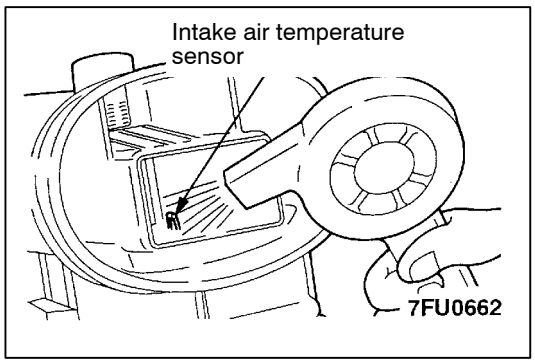




INTAKE AIR TEMPERATURE SENSOR CHECK

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)

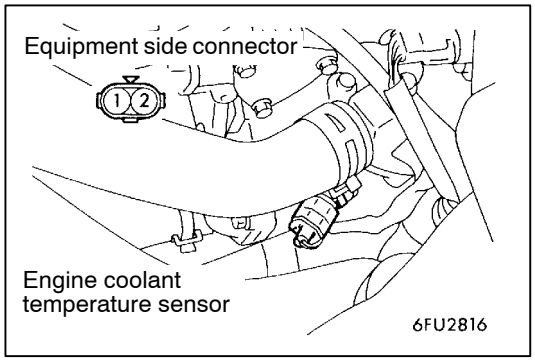


3. Measure resistance while heating the sensor using a hair drier.

Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

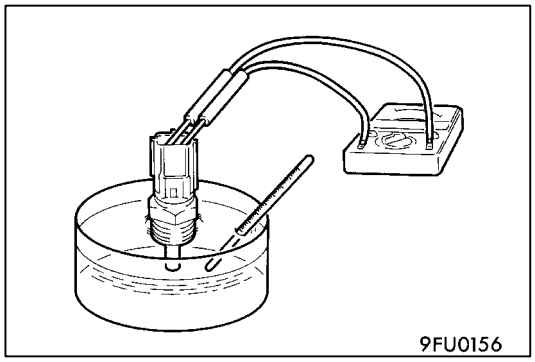
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

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

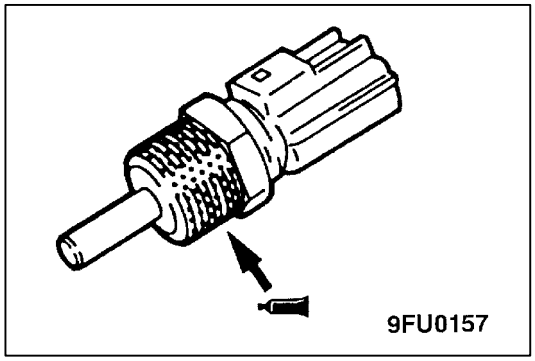
1. Remove the engine coolant temperature sensor.



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.

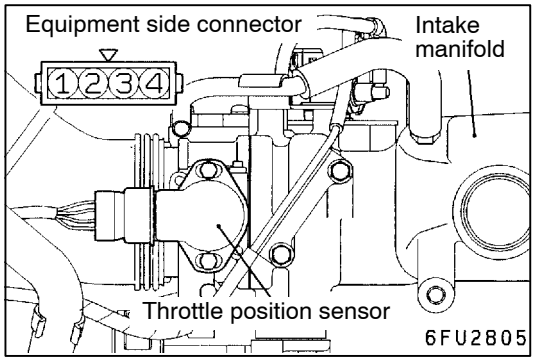


4. Apply sealant to threaded portion.

   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 Nm



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: 1.7 - 3.3 kΩ

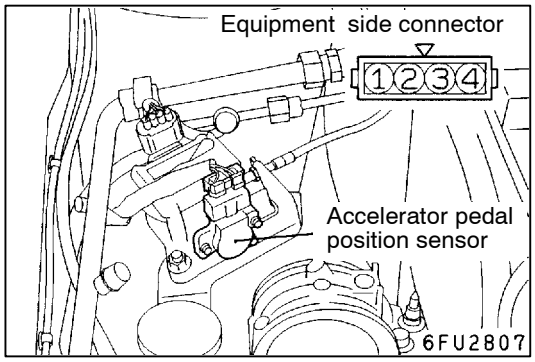
3. Measure resistance between terminal Nos. 1 and 2 as well as 1 and 4 of the throttle position sensor connector, respectively.

   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-97.



ACCELERATOR PEDAL POSITION SENSOR (1ST CHANNEL) CHECK

1. Disconnect the accelerator pedal position sensor (1st channel) connector.
2. Measure resistance between terminal Nos.1 and 4 of the sensor connector.

   Standard value: 3.5 - 6.5 kΩ

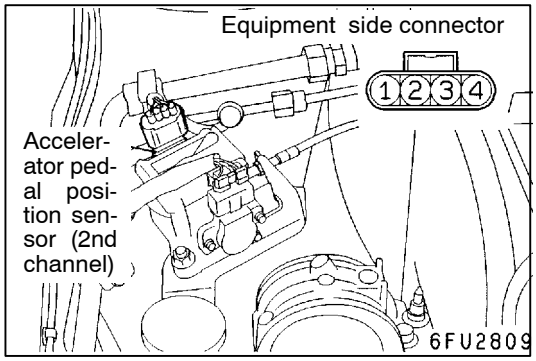
3. Measure resistance between terminal Nos.1 and 2 of the connector.

   Normal condition:

Depress the accelerator pedal slowly.	Resistance value changes in accordance with the accelerator pedal depression smoothly.

4. If not within the standard value, or resistance value does not change smoothly, replace the accelerator pedal position sensor assembly.

   NOTE
   After replacement, adjust the accelerator pedal position sensor (1st channel). (Refer to P.13A-98.)



ACCELERATOR PEDAL POSITION SENSOR (2ND CHANNEL) CHECK

1. Disconnect the accelerator pedal position sensor (2nd channel) connector.
2. Measure resistance between terminal Nos.1 and 4 of the connector.

   Standard value: 3.5 - 6.5 kΩ

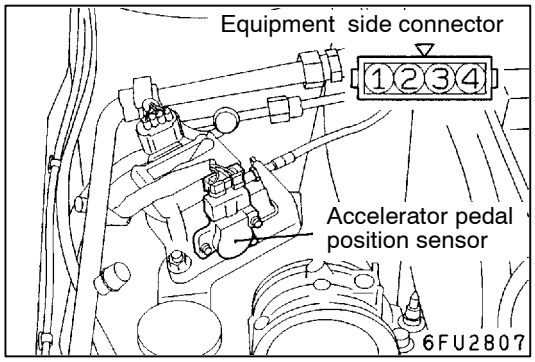
3. Measure resistance between terminal Nos.4 and 3 of the connector.

   Normal condition:

Depress the accelerator pedal slowly.	Resistance value changes in accordance with the accelerator pedal depression smoothly.

4. If not within the standard value, or resistance value does not change smoothly, replace the accelerator pedal position sensor assembly.

   NOTE
   After replacement, adjust the accelerator pedal position sensor (2nd channel). (Refer to P.13A-98.)



ACCELERATOR PEDAL POSITION SWITCH CHECK

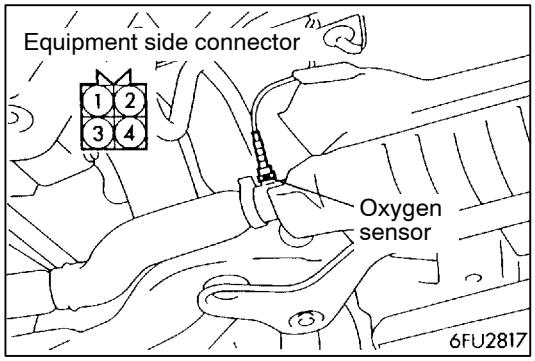
1. Disconnect the accelerator pedal position sensor (1st channel) connector.
2. Check continuity between terminal Nos. 3 (accelerator pedal position switch) and 4 (sensor earth) of the connector.

Normal condition

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

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

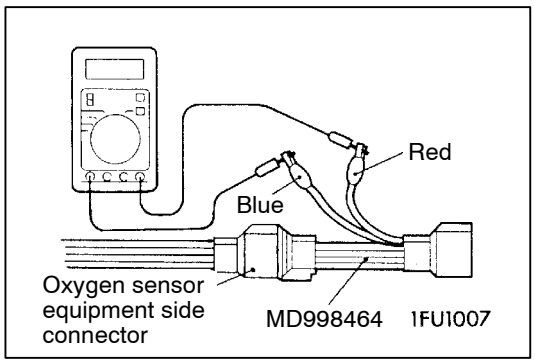
NOTE
After replacement, adjust the accelerator pedal position sensor and switch. (Refer to P.13A-98.)



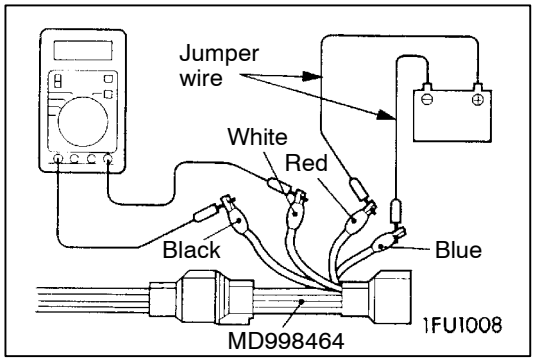
OXYGEN SENSOR CHECK

<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 (11 - 18 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 2 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 4 (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 1 (black clip) and terminal 3 (white clip).

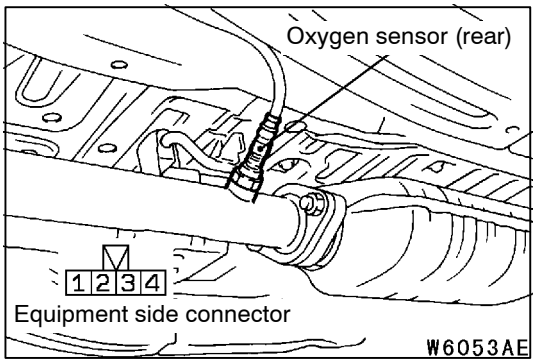
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

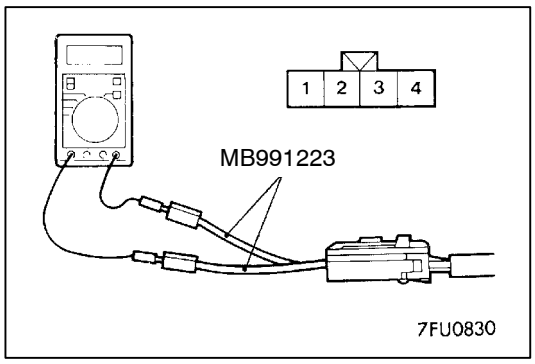
Standard value:

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.

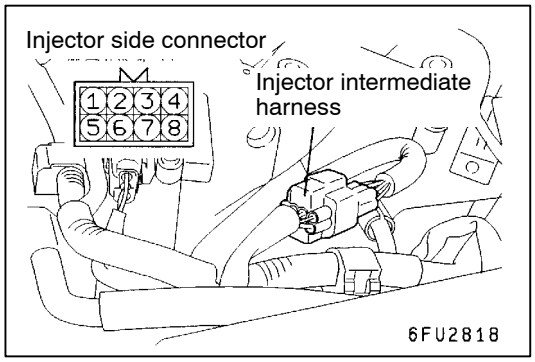




<Oxygen sensor (rear)>

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 (11 - 18 Ω at 20°C) between terminal 3 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.



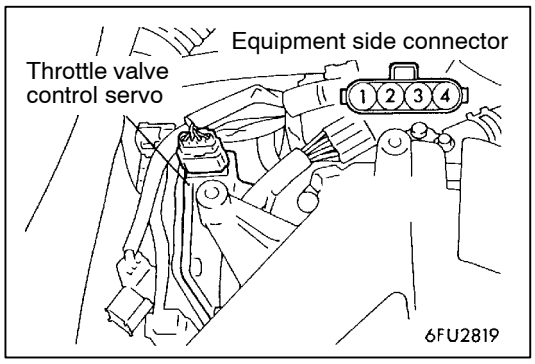
INJECTOR CHECK

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	1 - 2
No.2 cylinder	3 - 4
No.3 cylinder	5 - 6
No.4 cylinder	7 - 8

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.

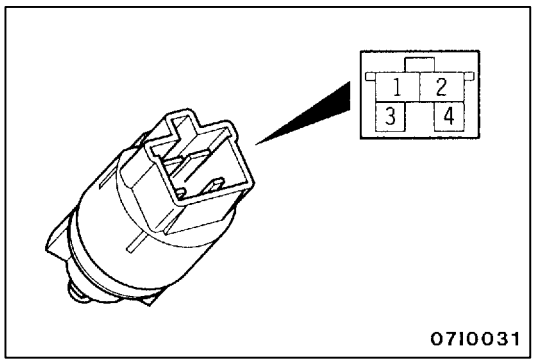
Check of Coil Resistance

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 - 3	1.35 - 1.65 (at 20°C)
2 - 4	

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.

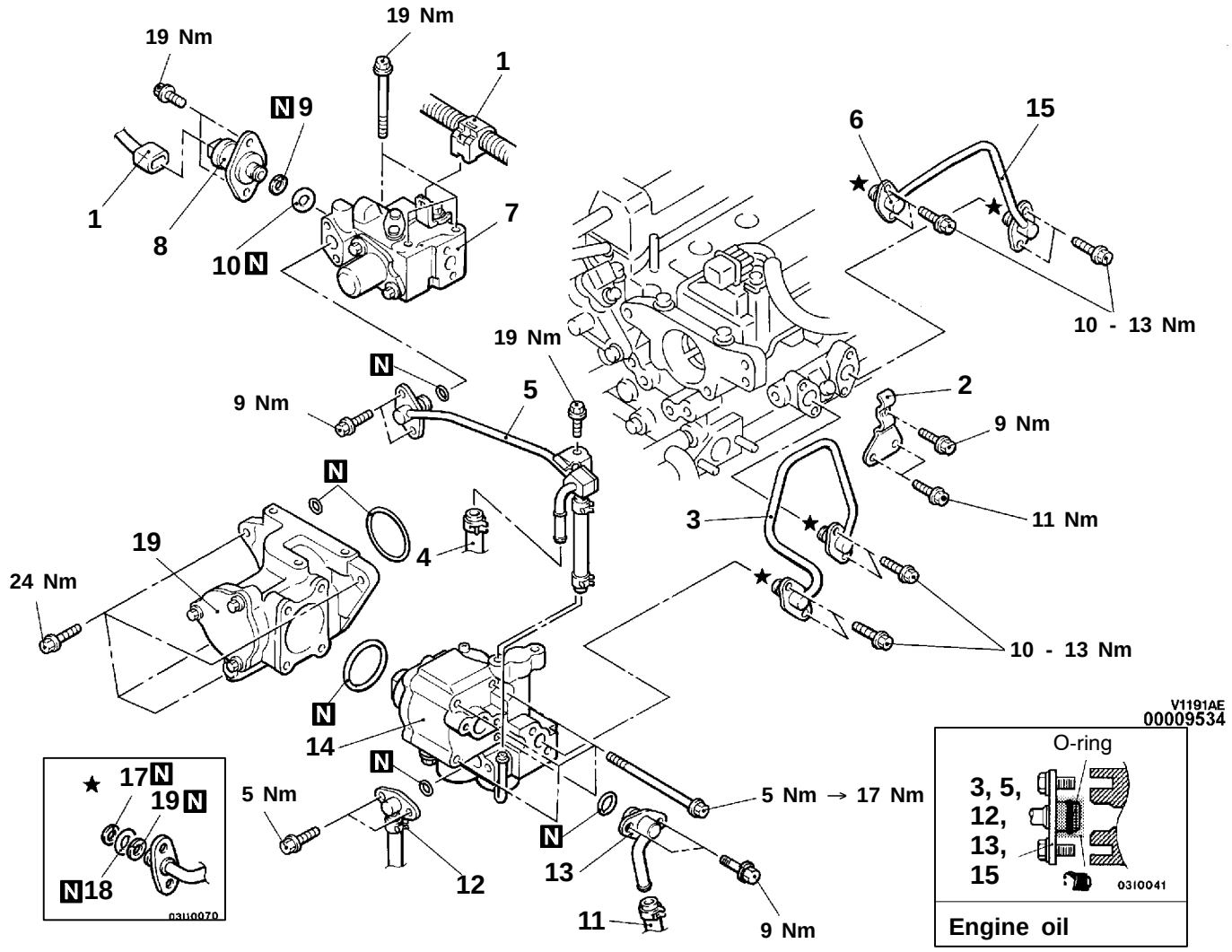
EGR VALVE CHECK

Refer to GROUP 17 - Emission Control System.

FUEL PUMP (HIGH PRESSURE) AND FUEL PRESSURE REGULATOR (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of fuel discharge <before removal only> (Refer to P.13A-103.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Fuel Leak Check <after installation only> (Refer to P.13A-103.)



Fuel pressure regulator (High pressure) removal steps

1. Harness connector and clamp
4. Fuel return hose connection
▶C◀ 5. Low-pressure fuel pipe
▶C◀ 6. Fuel return pipe connection
7. Fuel pressure regulator (high pressure) assembly
8. Fuel pressure sensor assembly
▶F◀ 9. O-ring
▶F◀ 10. Back-up ring
▶B◀ 16. Back-up ring A
▶B◀ 17. O-ring
▶B◀ 18. Back-up ring

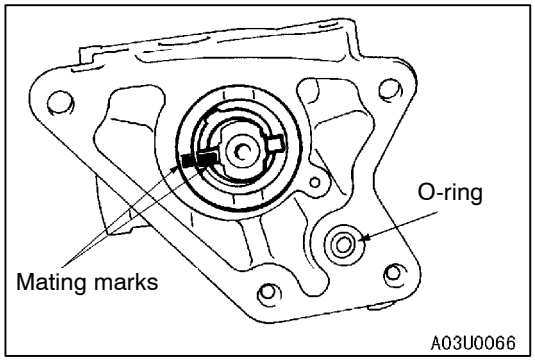
Fuel pump (High pressure) removal steps

- Intake manifold removal (Refer to GROUP 15.)

2. Fuel pipe clamp
▶C◀ 3. Fuel feed pipe
▶C◀ 5. Low-pressure fuel pipe
11. Fuel return hose connection
▶E◀ 12. Fuel pressure hose connection
13. Fuel nipple assembly
▶D◀ 14. Fuel pump (high pressure)
▶B◀ 16. Back-up ring A
▶B◀ 17. O-ring
▶B◀ 18. Back-up ring

Pump camshaft case removal steps

7. Fuel pressure regulator (high pressure) assembly
▶D◀ 14. Fuel pump (high pressure)
▶C◀ 15. Fuel return pipe
▶B◀ 16. Back-up ring A
▶B◀ 17. O-ring
▶B◀ 18. Back-up ring
▶A◀ 19. Pump camshaft case

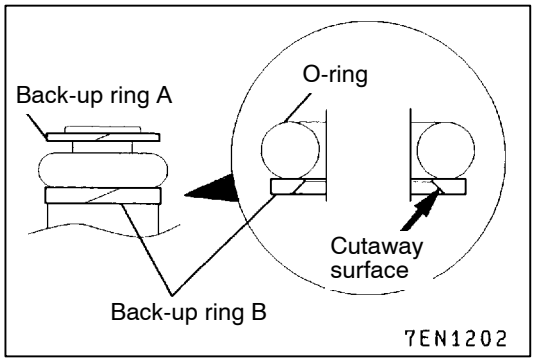


INSTALLATION SERVICE POINTS

▶A◀ PUMP CAMSHAFT CASE ASSEMBLY INSTALLATION

1. Set the No.1 cylinder to the compression top dead centre position.
2. Align the mating mark on the housing of the pump camshaft case assembly with the mating mark on the coupling, and then install the pump camshaft case assembly to the engine.

Caution
Take care not to drop the O-ring.



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

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

Caution

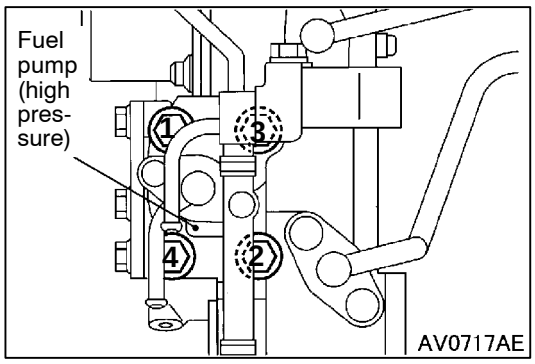
1. **Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.**
2. **Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring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

▶C◀ FUEL RETURN PIPE/LOW-PRESSURE FUEL PIPE/FUEL FEED PIPE INSTALLATION

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), fuel pressure regulator (high pressure) or the delivery pipe assembly.



▶D◀ FUEL PUMP (HIGH PRESSURE) INSTALLATION

Use a torque wrench with a precision of 0.5 Nm to tighten the fuel pump mounting bolts according to the following procedure.

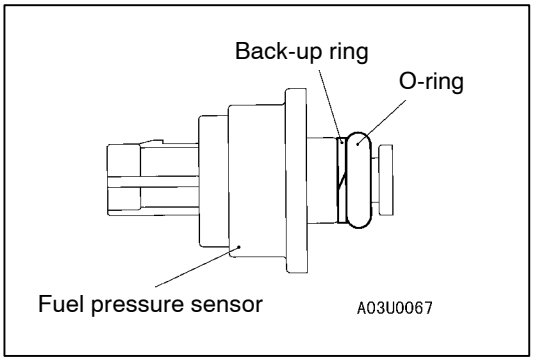
1. Tighten the bolts to 5 Nm in the order shown in the illustration.
2. Tighten the bolts to 17 Nm in the order shown in the illustration. The overall difference in tightening torque between the four bolts should be within 2 Nm.

▶E◀ HIGH-PRESSURE FUEL 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).

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



▶F◀ BACK-UP RING/O-RING INSTALLATION

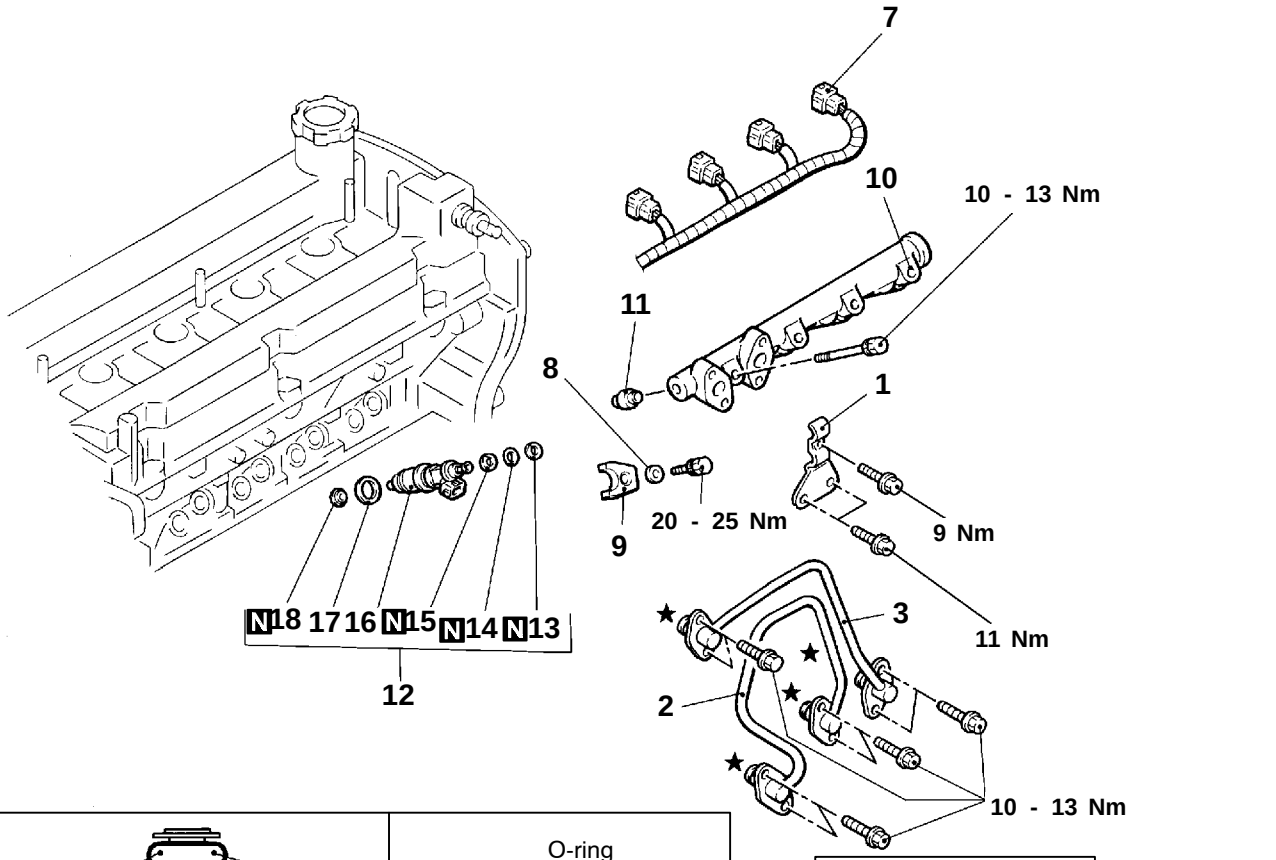
Install the back-up ring and the O-ring as shown in the illustration.

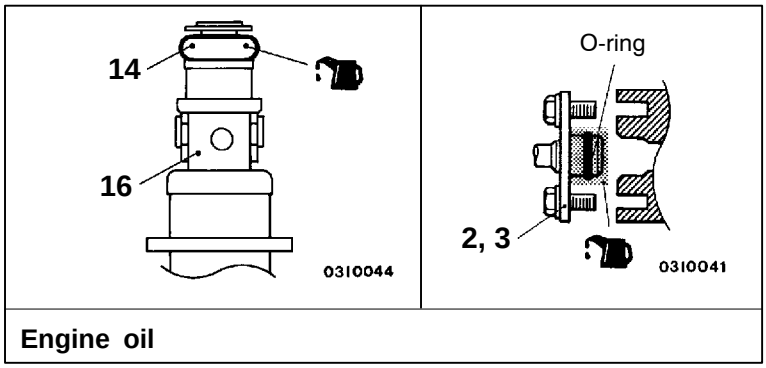
Caution
Take care not to install the back-up ring A for the injector, fuel feed pipe or fuel return pipe by mistake. (Outer diameter of the back-up ring for the fuel pressure sensor: 15.1 mm)

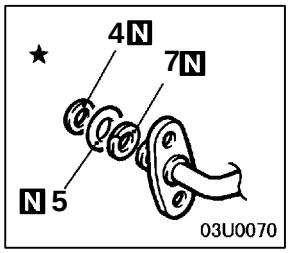
INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of fuel discharge <before removal only> (Refer to P.13A-103.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Leak Check <after installation only> (Refer to P.13A-103.)







Removal steps

1. Fuel pipe clamp
▶D◀ 2. Fuel feed pipe
▶D◀ 3. Fuel return pipe
▶C◀ 4. Back-up ring A
▶C◀ 5. O-ring
▶C◀ 6. Back-up ring B
◀A▶ 7. Injector harness connector
8. Washer
9. Injector holder
◀B▶ ▶B◀ 10. Delivery pipe assembly
11. Insulator
◀B▶ ▶B◀ 12. Fuel injector assembly
13. Back-up ring
14. O-ring
15. Back-up ring
16. Fuel injector
17. Gasket
▶A◀ 18. Corrugated washer

REMOVAL SERVICE POINTS

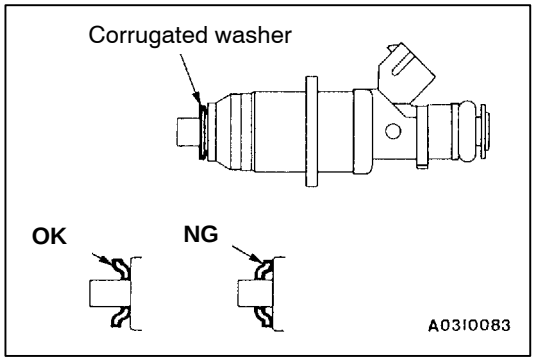
◀A▶ INJECTOR HARNESS CONNECTOR DISCONNECTION

Caution
Disconnect the battery (-) cable from its terminal before carrying out this operation.

◀B▶ 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◀ CORRUGATED WASHER INSTALLATION

Caution
1. **The corrugated washer should always be replaced with a new part.**
2. **There should be no scratches or foreign particles on the corrugated washer mounting surface of the injector.**
3. **Be careful not to mistake the corrugated washer installation direction.**

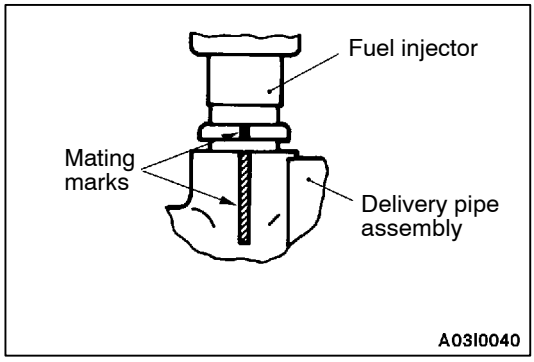
▶B◀ FUEL INJECTOR ASSEMBLY/DELIVERY PIPE ASSEMBLY INSTALLATION

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

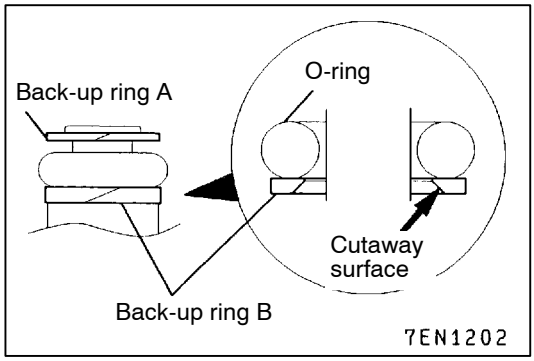
   Caution
   Take care not to let any of the engine oil get inside the delivery pipe assembly.

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 mating marks on the delivery pipe assembly and the fuel injector, and then install the delivery pipe assembly with the injector assembly still attached.



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

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)**

▶D◀ FUEL RETURN PIPE/FUEL FEED PIPE INSTALLATION

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

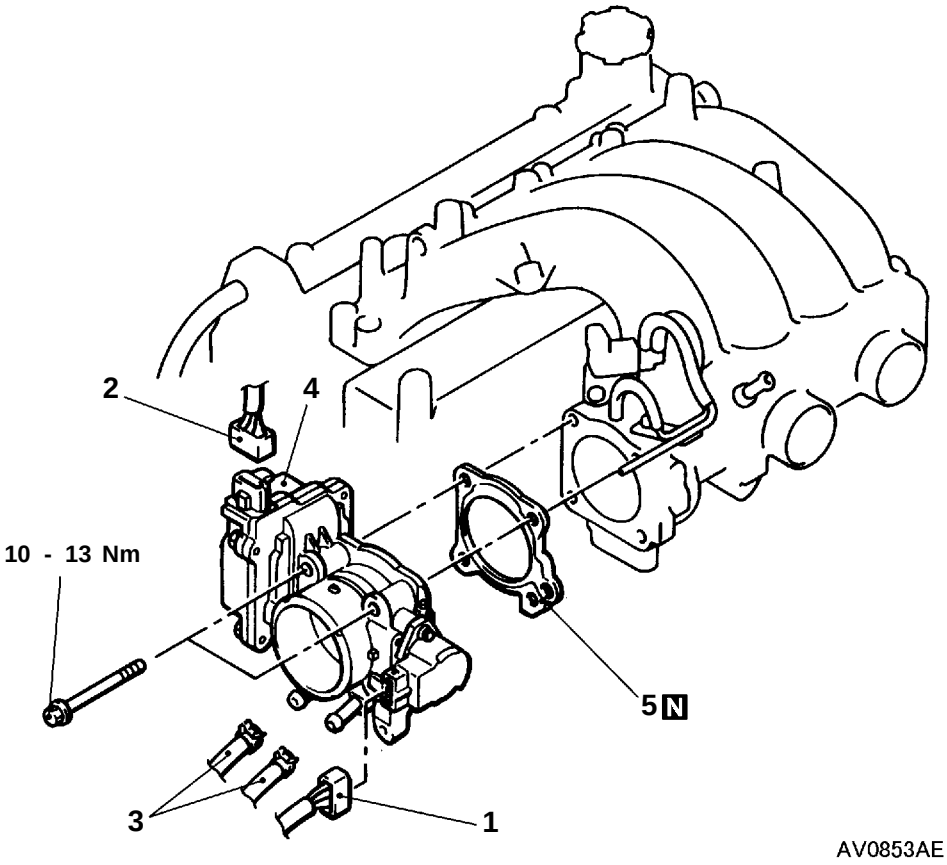
Caution

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

THROTTLE BODY

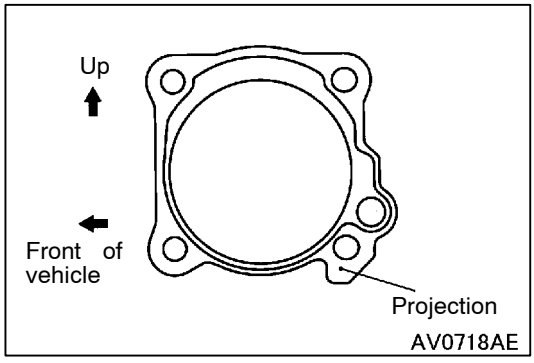
REMOVAL AND INSTALLATION

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 Assembly Removal and Installation



Removal steps

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



INSTALLATION SERVICE POINT

▶A◀ THROTTLE BODY GASKET INSTALLATION

Position the projection as shown in the illustration.

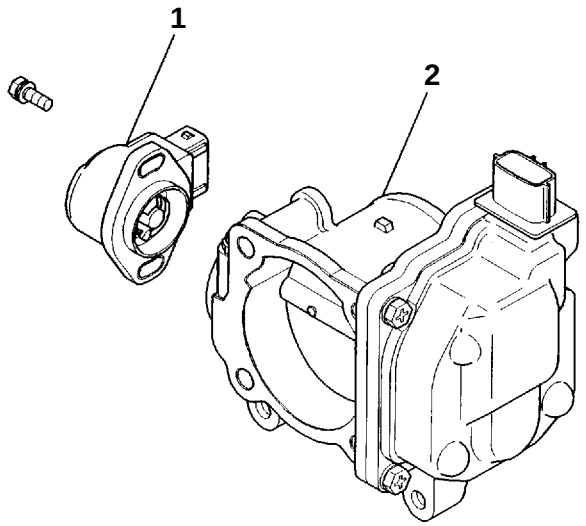
▶B◀ THROTTLE BODY INSTALLATION

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

Initialization

Turn on the ignition switch, and turn off it within one second. Then leave it for at least ten seconds with the ignition switch off.

DISASSEMBLY AND REASSEMBLY



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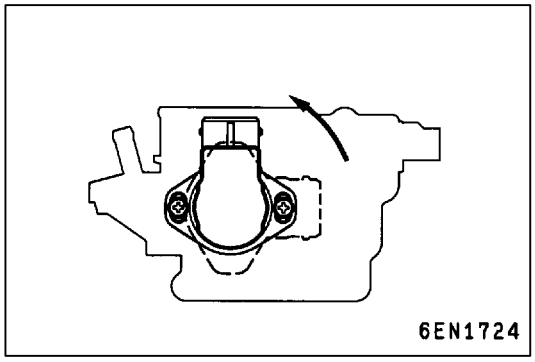
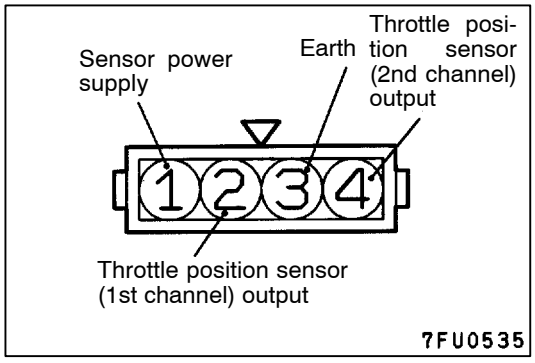
Disassembly steps

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



6EN1724



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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).

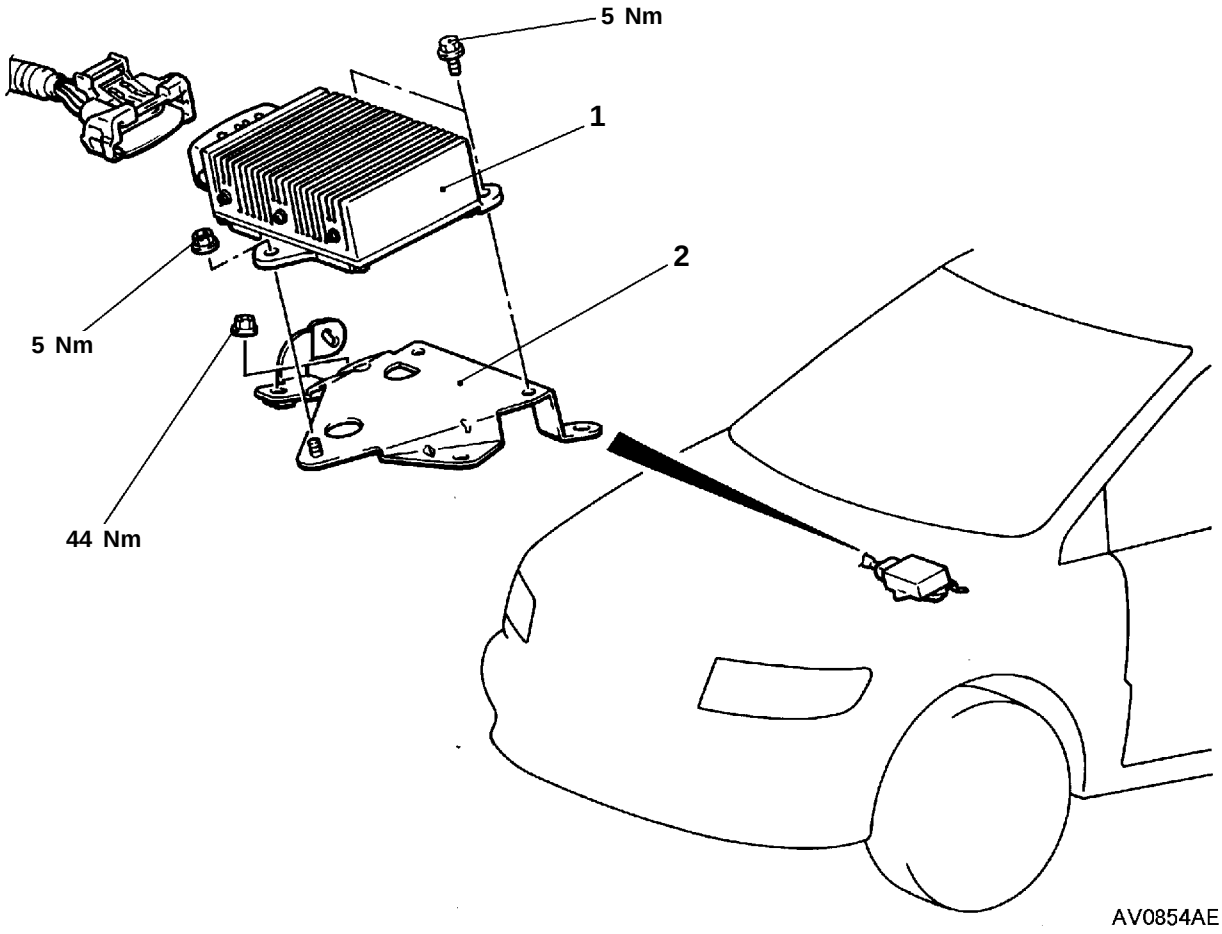
Normal condition

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.

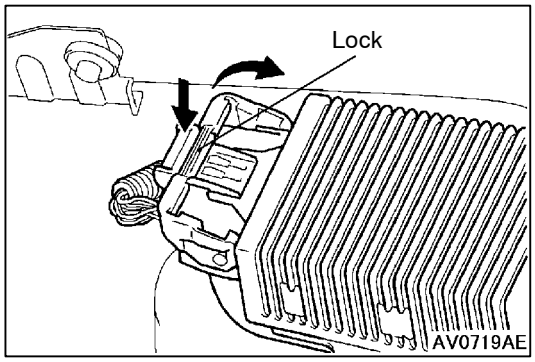
INJECTOR DRIVER

REMOVAL AND INSTALLATION



Removal steps

◀A▶ 1. Injector driver
2. Bracket



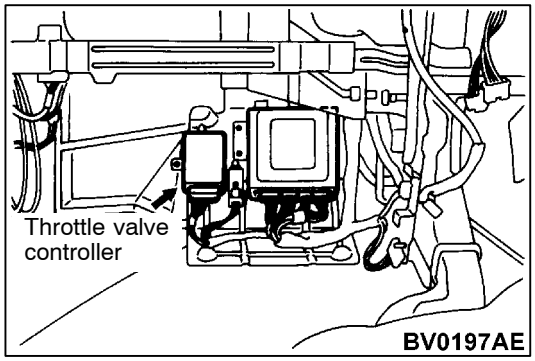
REMOVAL SERVICE POINT

◀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 battery (-) 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.**



THROTTLE VALVE CONTROLLER

INSTALLATION SERVICE POINT

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

Initialization

Turn on the ignition switch, and turn off it within one second. Then leave it for at least ten seconds with the ignition switch off.

GASOLINE DIRECT INJECTION (GDI) <4G9>

CONTENTS

GENERAL INFORMATION

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

FUEL INJECTION CONTROL

The injector drive times and 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 1-3-4-2. 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.

IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The engine-ECU drives the idle speed control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and air conditioner load. In addition, when the air conditioner switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the engine-ECU from the engine speed, intake air volume, engine coolant temperature, 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 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 RAM data inside the engine-ECU 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. Fan Relay Control
   The revolutions of the radiator fan and condenser fan are controlled in response to the engine coolant temperature and vehicle speed.
4. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
5. EGR Control Servo Control
   Refer to GROUP 17.

GENERAL SPECIFICATIONS

Items			Specifications
Throttle body	Throttle bore mm		54
	Throttle position sensor		Variable resistor type
	Idle speed control servo		Stepper motor type (Stepper motor type by-pass air control system)
Engine-ECU	Identification model No.	Except vehicles for Germany	E2T72572 <M/T>, E2T72577 <A/T>
		Vehicles for Germany	E2T72573 <M/T>, E2T72578 <A/T>
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
	Vehicle speed sensor		Magnetic resistive element type
	Inhibitor switch		Contact switch type
	Camshaft position sensor		Magnetic resistive 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

Items		Specifications
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, 4
	Injector identification mark	DIM 1000G
	Air by-pass control solenoid valve (ON/OFF)	ON/OFF type solenoid valve
	Air by-pass control solenoid valve (DUTY)	Duty cycle type solenoid valve
	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

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

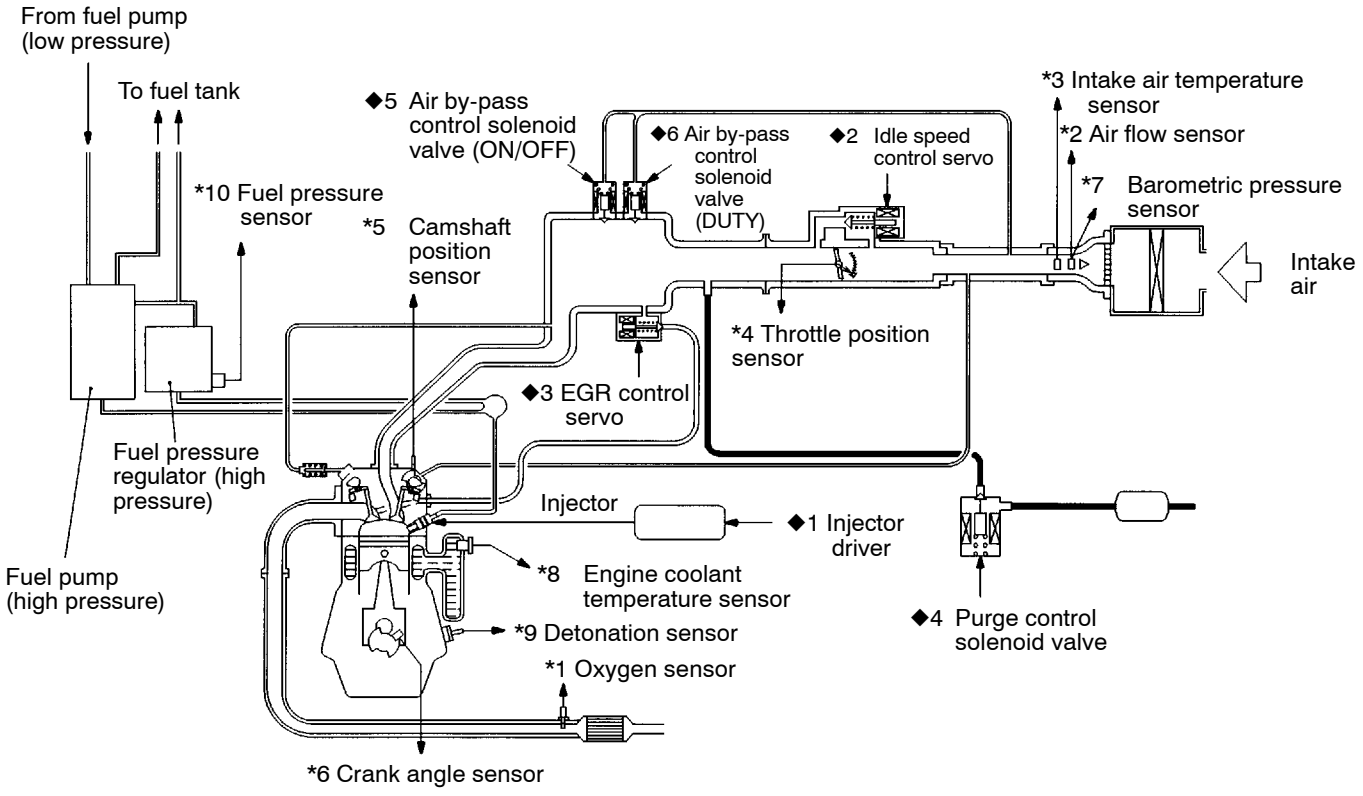
*1 Oxygen sensor
*2 Air flow sensor
*3 Intake air temperature sensor
*4 Throttle position sensor
*5 Camshaft position sensor
*6 Crank angle sensor
*7 Barometric pressure sensor
*8 Engine coolant temperature sensor
*9 Detonation sensor
*10 Fuel pressure sensor

- Power supply
- Ignition switch - ST
- Ignition switch - IG
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering fluid pressure switch
- Alternator FR terminal
- M/T oil temperature sensor
- Small lamp switch
- Brake vacuum sensor
- Stop lamp switch
- Injector open circuit check signal
- A/T-ECU

⇨ Engine-ECU ⇨

◆1 Injector driver (injector)
◆2 Idle speed control servo
◆3 EGR valve (stepper motor)
◆4 Purge control solenoid valve
◆5 Air by-pass control solenoid valve (ON/OFF)
◆6 Air by-pass control solenoid valve (DUTY)

- Fuel pump relay
- Engine control relay
- Injector driver relay
- A/C relay
- Engine warning lamp
- Diagnosis output
- Ignition coil
- Fan controller
- Alternator G terminal
- A/T-ECU



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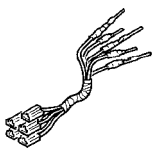
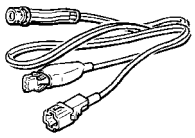
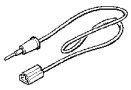
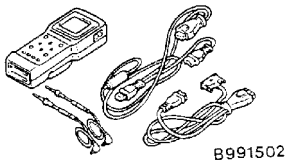
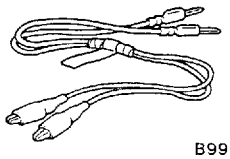
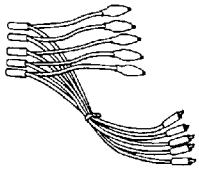
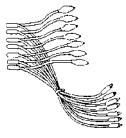
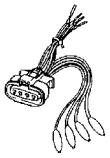
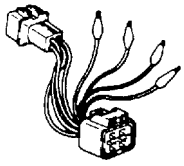
SERVICE SPECIFICATIONS

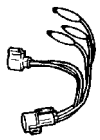
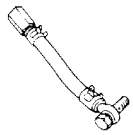
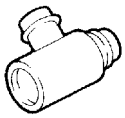
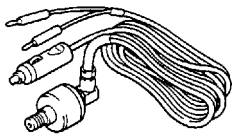
Items		Specifications
Basic idle speed r/min		750 ± 50
Throttle position sensor adjusting voltage mV		535 - 735
Throttle position sensor resistance kΩ		3.5 - 6.5
Idle speed control servo coil resistance Ω		28 - 33 (at 20°C)
Intake air temperature sensor resistance kΩ	20°C	2.3 - 3.0
	80°C	0.30 - 0.44
Engine coolant temperature sensor resistance kΩ	20°C	2.1 - 2.7
	80°C	0.26 - 0.36
Oxygen sensor output voltage V		0.6 - 1.0
Fuel pressure	High pressure MPa	4 - 7
	Low pressure kPa	324 - 343
Injector coil resistance Ω		0.9 - 1.1 (at 20°C)
Air by-pass control solenoid valve coil resistance Ω	ON/OFF	7.7 - 9.3 (at 20°C)
	DUTY	7.7 - 9.3 (at 20°C)

SEALANT

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

SPECIAL TOOLS

Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	● Fuel gauge simple inspection A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	● Reading diagnosis code ● GDI system inspection
 B991529	MB991529	Diagnosis code check harness	Reading diagnosis code
	MB991348, MB991658	Test harness set	● Measurement of voltage during trouble-shooting ● Inspection using an analyzer
 MB991709	MB991709	Test harness	
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
	MD998464	Test harness (4-pin, square)	Inspection of oxygen sensor

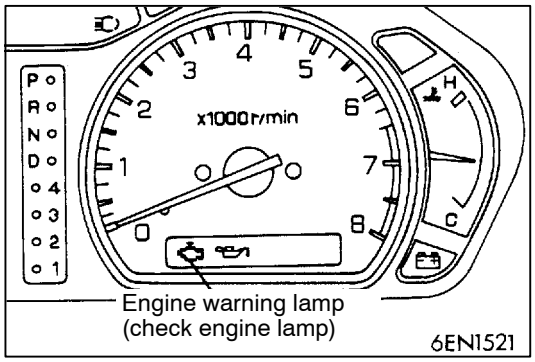
Tool	Number	Name	Use
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE
If the engine-ECU is replaced, the steering lock cylinder should be replaced together with it.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the Gasoline Direct Injection (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.

Engine warning lamp inspection items

Engine-ECU
Oxygen sensor
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Barometric pressure sensor
Detonation sensor
Injector
Abnormal combustion
Immobilizer system
Abnormal fuel pressure
Excessive intake air amount
Brake vacuum sensor
Fuel system malfunction

METHOD OF READING 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 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.
5. 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.

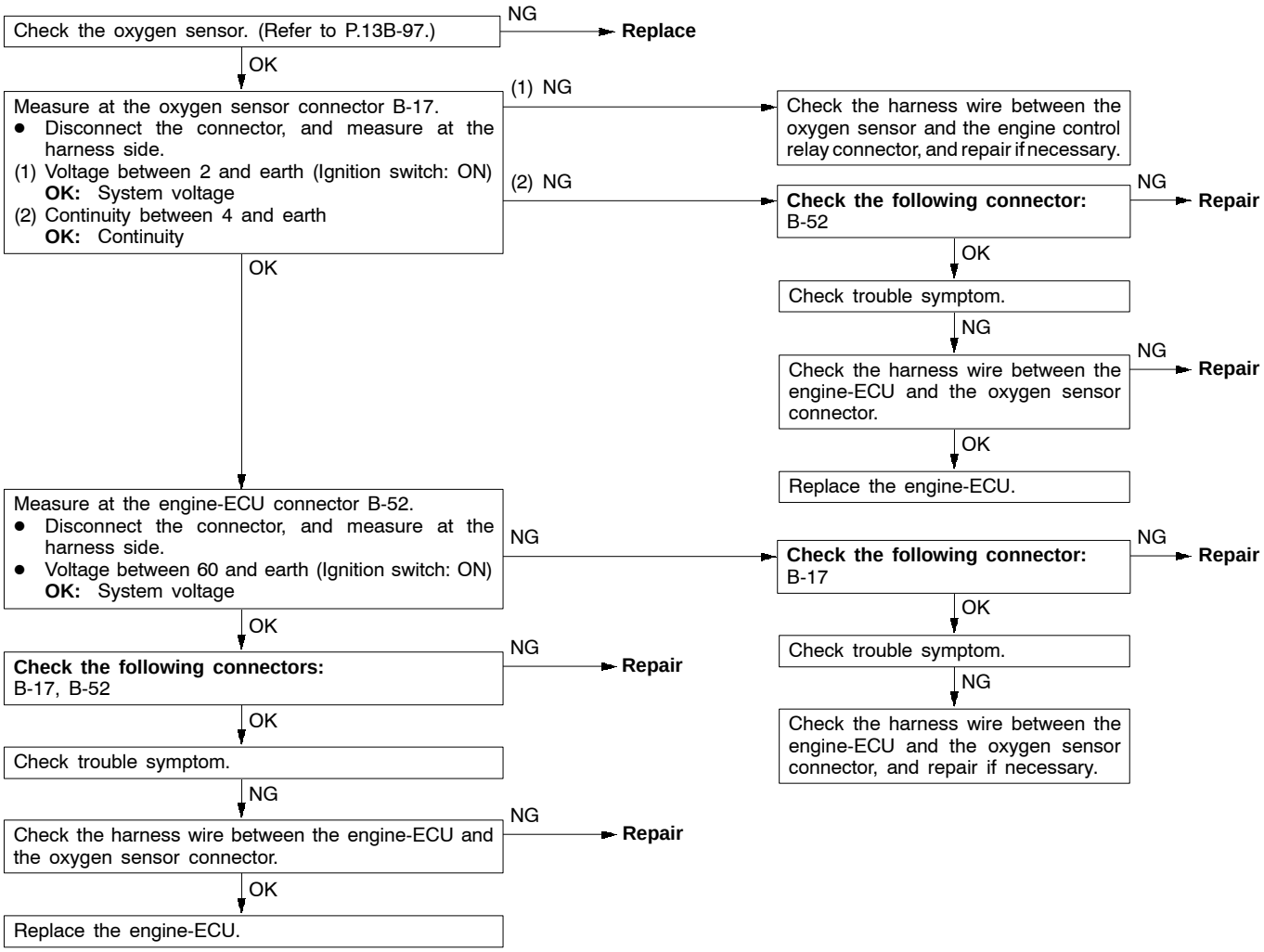
Malfunctioning item	Control contents during malfunction
Air flow sensor	(1) Lean fuel combustion driving and feedback control driving are prevented. (2) Basic injection drive timing and basic ignition timing are set by means of the mapping values from the throttle position sensor signal and the crank angle sensor signal.
Intake air temperature sensor	Control is carried out as if the intake air temperature is 25°C.
Throttle position sensor	(1) Lean fuel combustion driving is prevented. (2) Dashpot compensation for the idle speed control is prevented.
Engine coolant temperature sensor	Control is carried out as if the engine coolant temperature is 80°C. Furthermore, this control will continue until the ignition switch is turned to OFF, even if the sensor signal returns to normal.
Camshaft position sensor	Control is carried out as if the conditions before the failure judgement occurred are continuing.
Vehicle speed sensor	(1) Lean fuel combustion driving is prevented. However, this condition is cleared if the engine speed is continuously at 1,500 r/min or more for a certain length of time. (2) Lean fuel combustion during idling is prevented.
Barometric pressure sensor	Control is carried out as if the barometric pressure is 101 kPa (760 mmHg).
Detonation sensor	Ignition timing is fixed to the timing for standard petrol.
Injector	(1) Lean fuel combustion driving is prevented. (2) EGR operation is cut.
Abnormal combustion	Lean fuel combustion driving is prevented.
Excessive intake air amount	When the air flow sensor output is compared with the throttle position sensor output and the air amount is judged to be excessive, compression stroke fuel injection and lean fuel combustion driving are set.
Communication line with A/T-ECU	Ignition timing retarding control (engine and transmission total control) during transmission gear shifting is prevented.
Alternator FR terminal	Alternator output suppression control under high electrical loads is prevented. (Alternator works as a normal alternator.)
Fuel pressure sensor	(1) Control is carried out as if the fuel pressure is 5 MPa (if there is open or short circuit). (2) Turns off the fuel pump relay (if the fuel pressure is excessively high). (3) Shuts off the fuel injection (If an excessively low pressure is detected or the engine speed exceeds 3,000 r/min).

INSPECTION CHART FOR DIAGNOSIS CODES

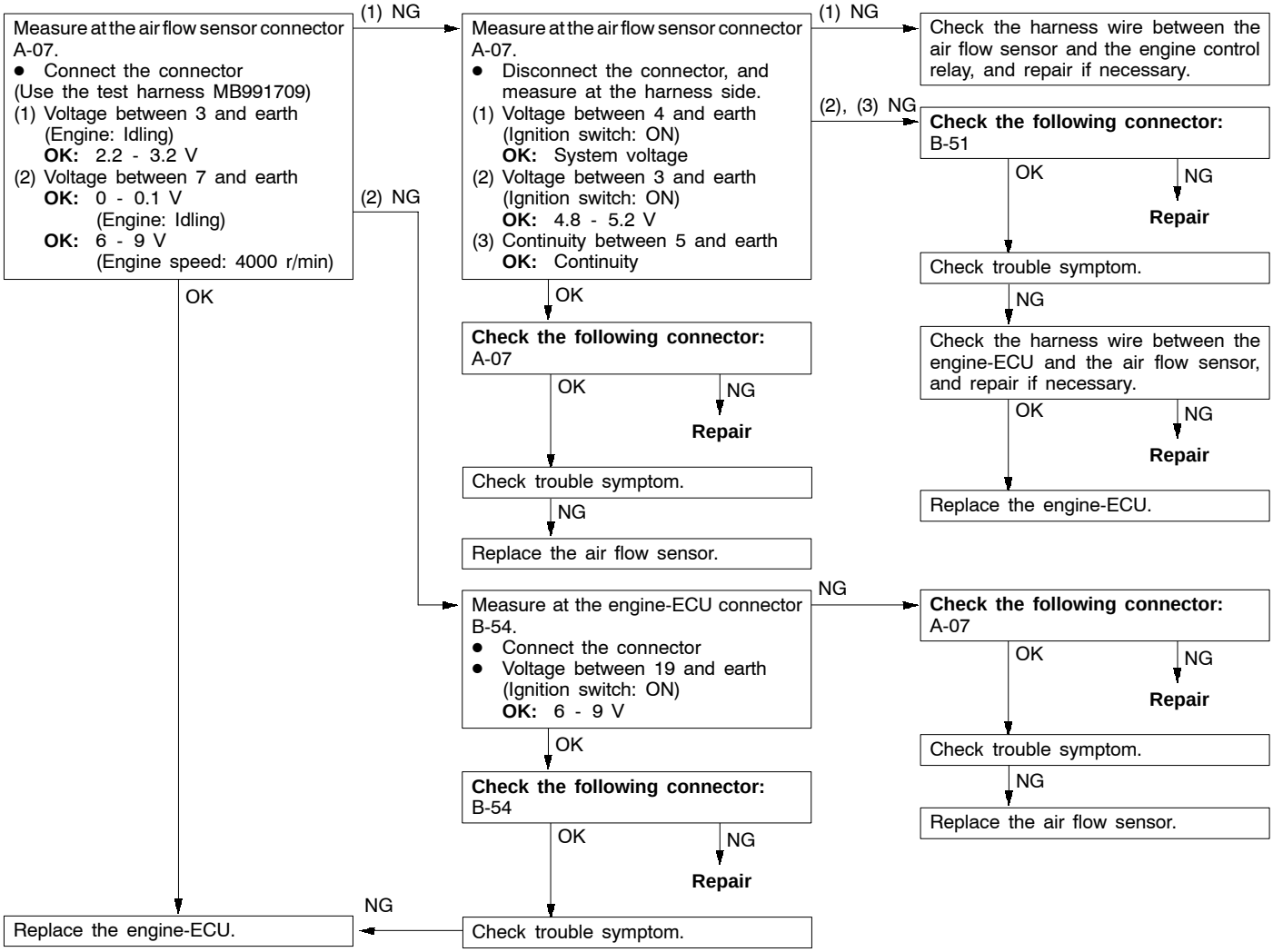
Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13B-12
12	Air flow sensor system	13B-13
13	Intake air temperature sensor system	13B-14
14	Throttle position sensor system	13B-15
21	Engine coolant temperature sensor system	13B-16
22	Crank angle sensor system	13B-17
23	Camshaft position sensor system	13B-18
24	Vehicle speed sensor system	13B-19
25	Barometric pressure sensor system	13B-20
31	Detonation sensor system	13B-21
41	Injector system	13B-22
44	Abnormal combustion	13B-23
54	Immobilizer system	13B-24
56	Abnormal fuel pressure	13B-24
58	Excessive intake air amount	13B-26
61	Communication wire with A/T-ECU system	13B-26
64	Alternator FR terminal system	13B-27
66	Brake vacuum sensor system	13B-28
89	Abnormality in fuel pressure system	13B-29

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

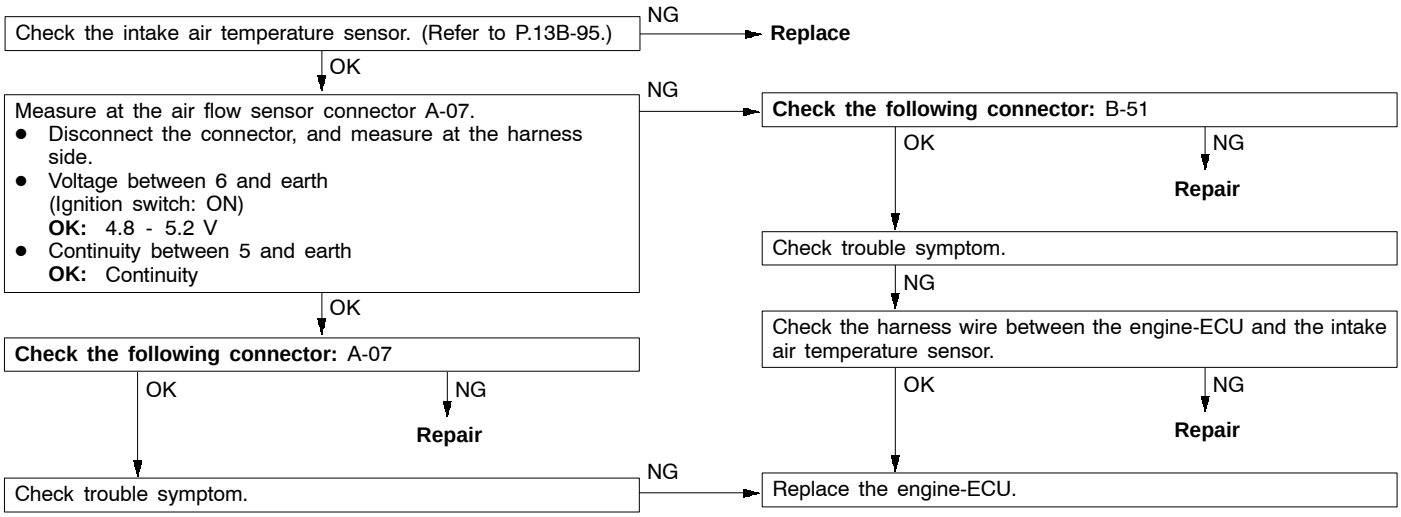
Code No. 11 Oxygen sensor system	Probable cause
Range of check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 50°C. ● Engine speed is approx. 2,000 - 3,500 r/min ● Vehicle is moving at constant speed on a flat, level road surface Set conditions ● When the engine-ECU has detected that the oxygen sensor output voltage is around 0.6 V for 30 seconds (does not cross 0.6 V for 30 seconds) four times. ● When the range of check operations given above which accompany starting of the engine are carried out four times in succession, a problem is detected after each operation.	● Malfunction of the oxygen sensor ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU



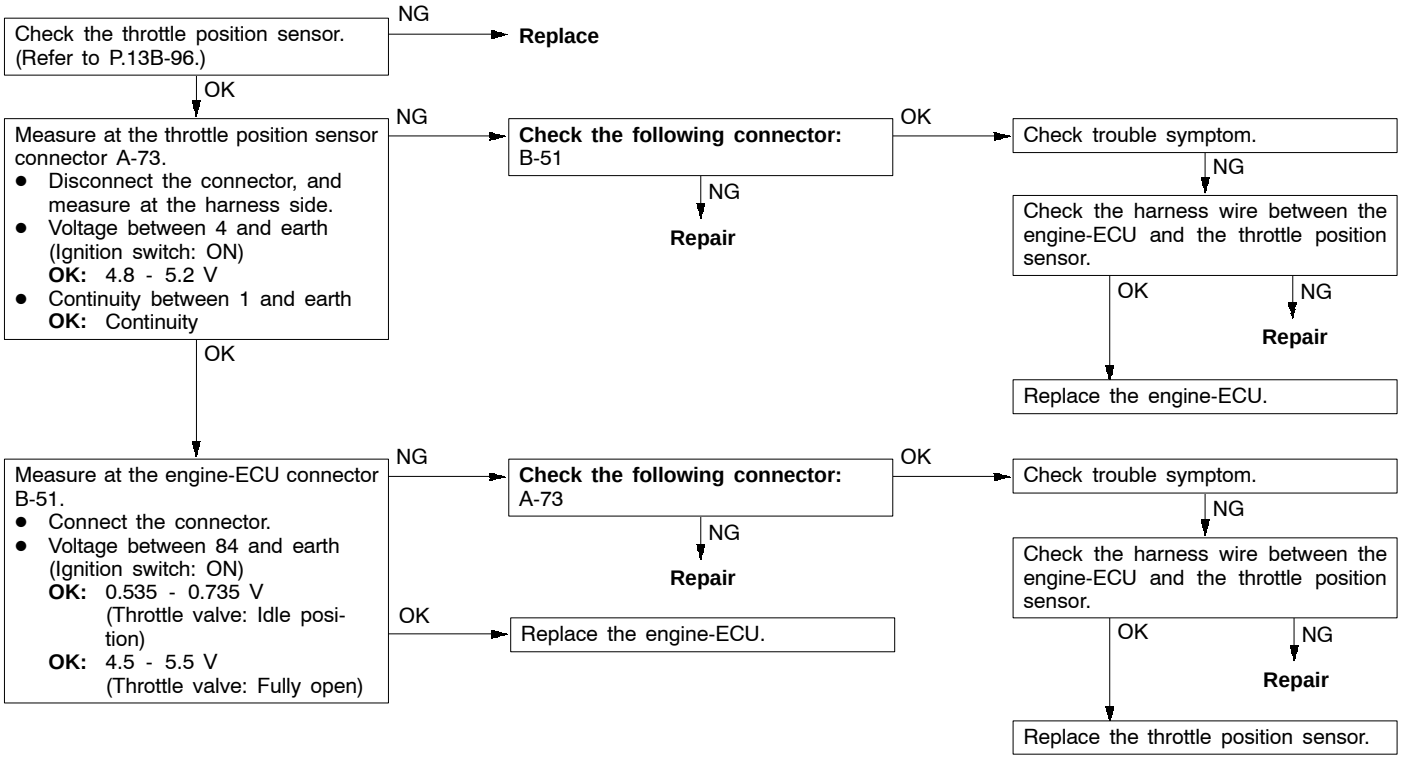
Code No.12 Air flow sensor system	Probable cause
Range of check ● Engine speed is 500 r/min or more. Set conditions ● Sensor output frequency is 3.3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Open circuit or short-circuited harness wire of air flow sensor circuit ● Malfunction of the engine-ECU



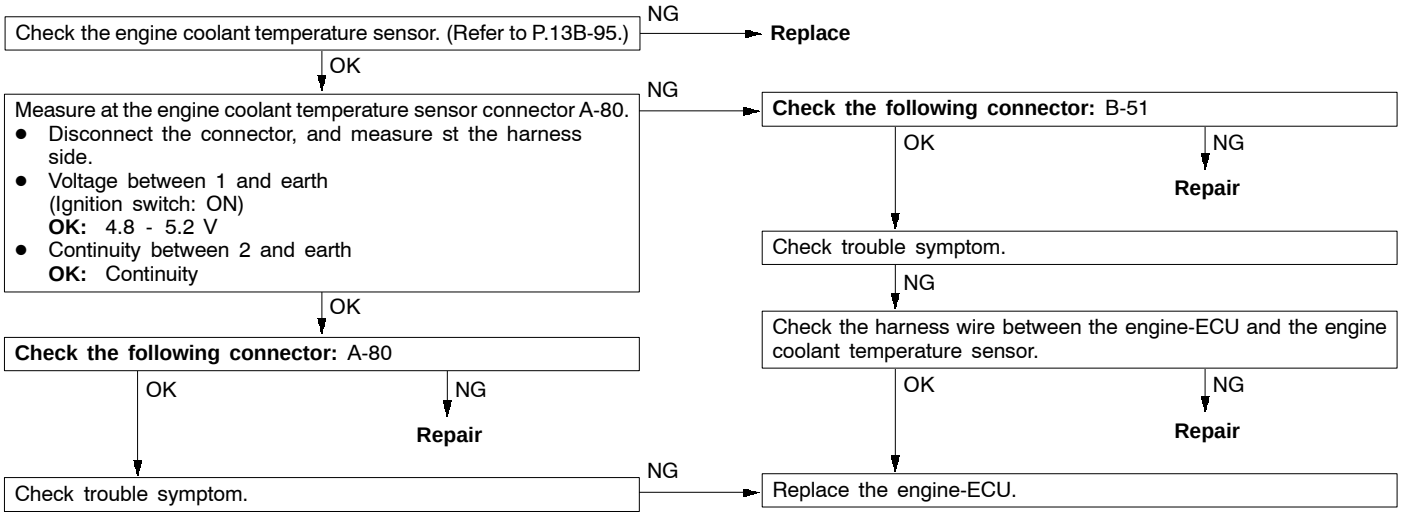
Code No.13 Intake air temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 0.14 kΩ or less for 4 seconds. or ● Sensor resistance is 50 kΩ or more for 4 seconds.	● Malfunction of the intake air temperature sensor ● Open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the engine-ECU



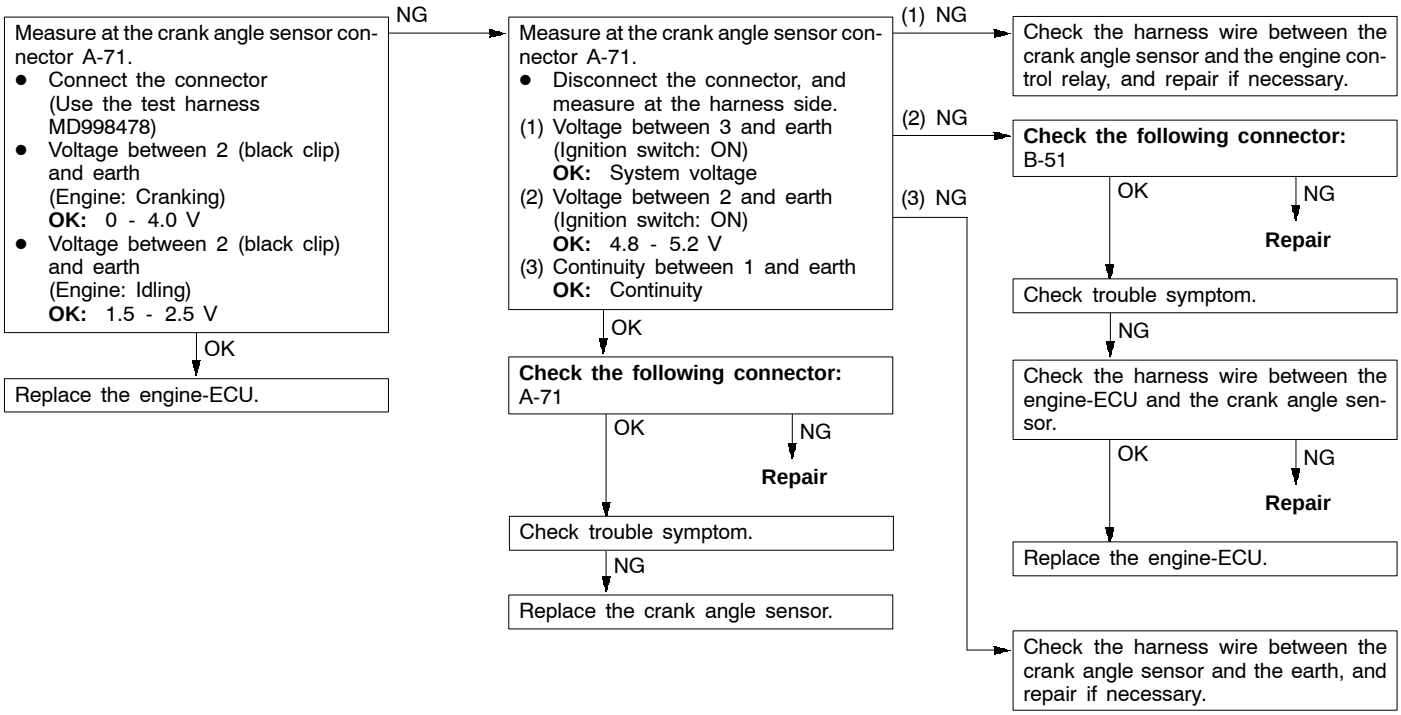
Code No.14 Throttle position sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor output voltage is 0.2 V or less for 4 seconds. or ● Idle position switch is ON and sensor output voltage is 2.0 V or more for 4 seconds.	● Malfunction of the throttle position sensor ● Open circuit or short-circuited harness wire of the throttle position sensor circuit ● Malfunction of the engine-ECU



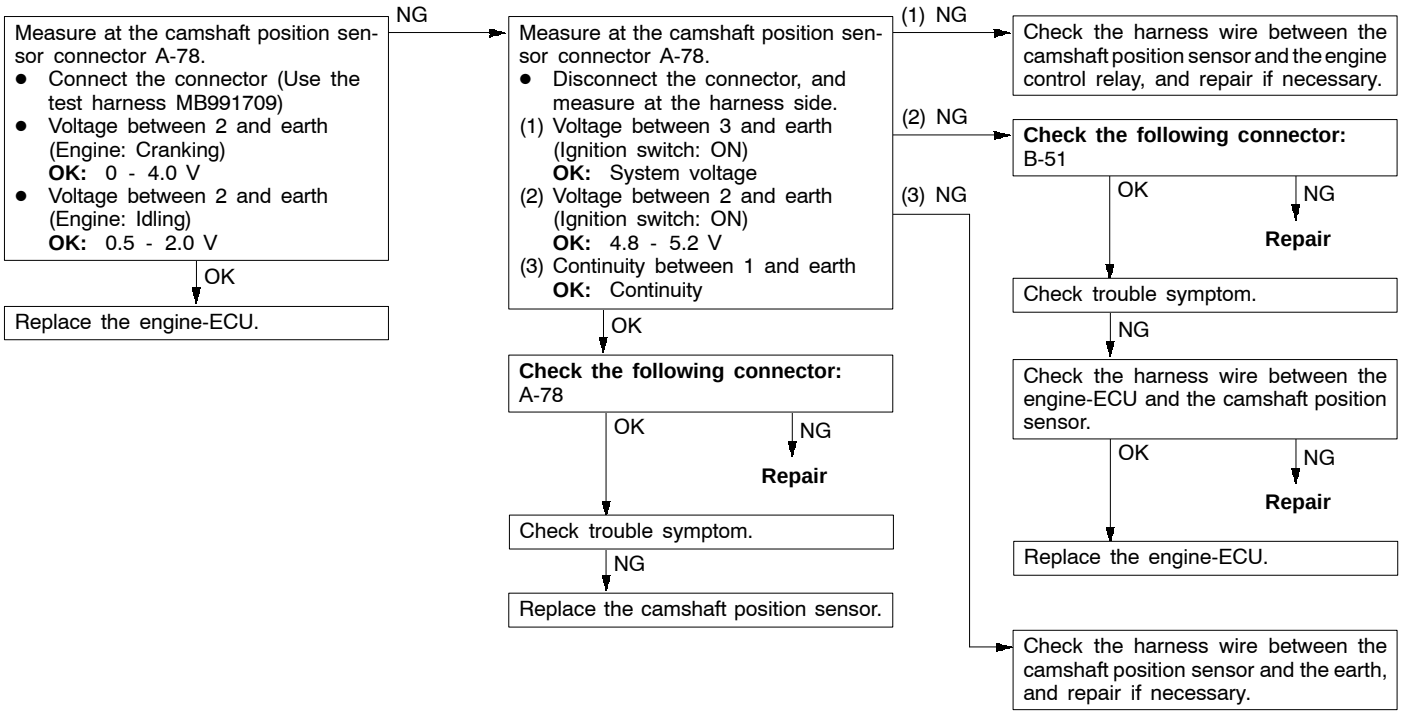
Code No.21 Engine coolant temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 50 Ω or less for 4 seconds. or ● Sensor resistance is 72 kΩ or more for 4 seconds.	● Malfunction of the engine coolant temperature sensor ● Open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit ● Malfunction of the engine-ECU
Range of check ● After engine starts Set conditions ● After 5 minutes or more have passed since the engine coolant temperature after filtering has dropped from 40°C or more to less than this temperature	



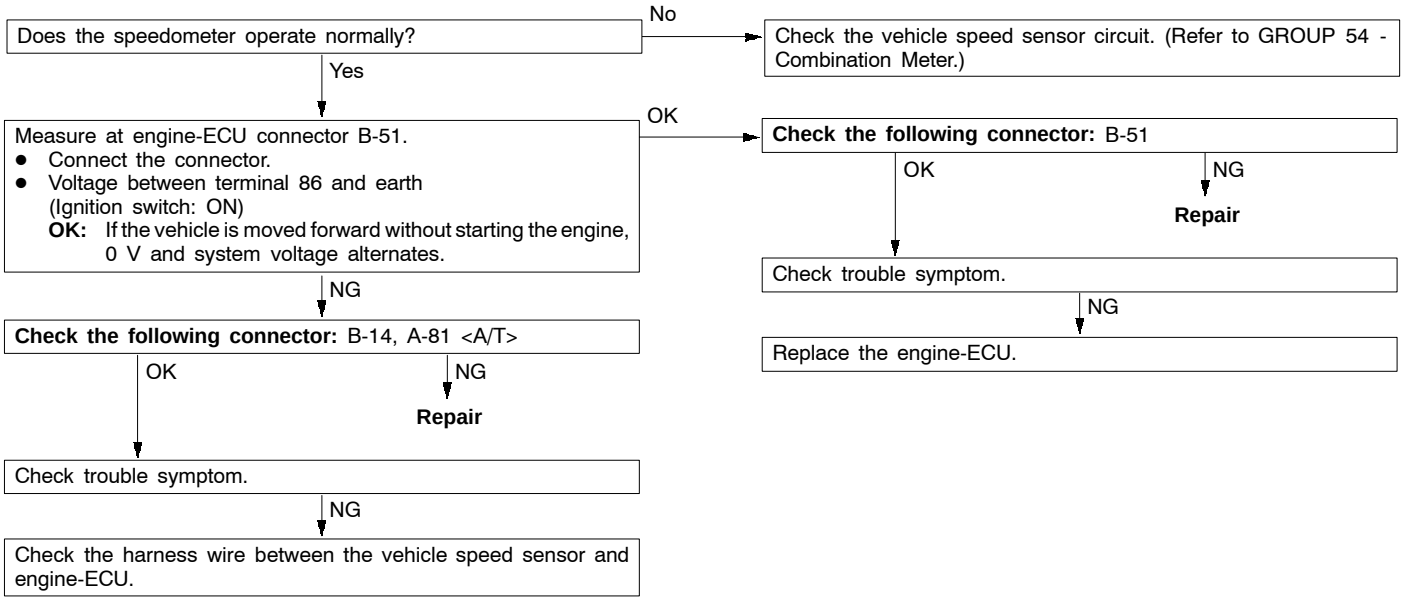
Code No.22 Crank angle sensor system	Probable cause
Range of check ● Engine: During cranking Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	● Malfunction of the crank angle sensor ● Open circuit or short-circuited harness wire of the crank angle sensor circuit ● Malfunction of the engine-ECU



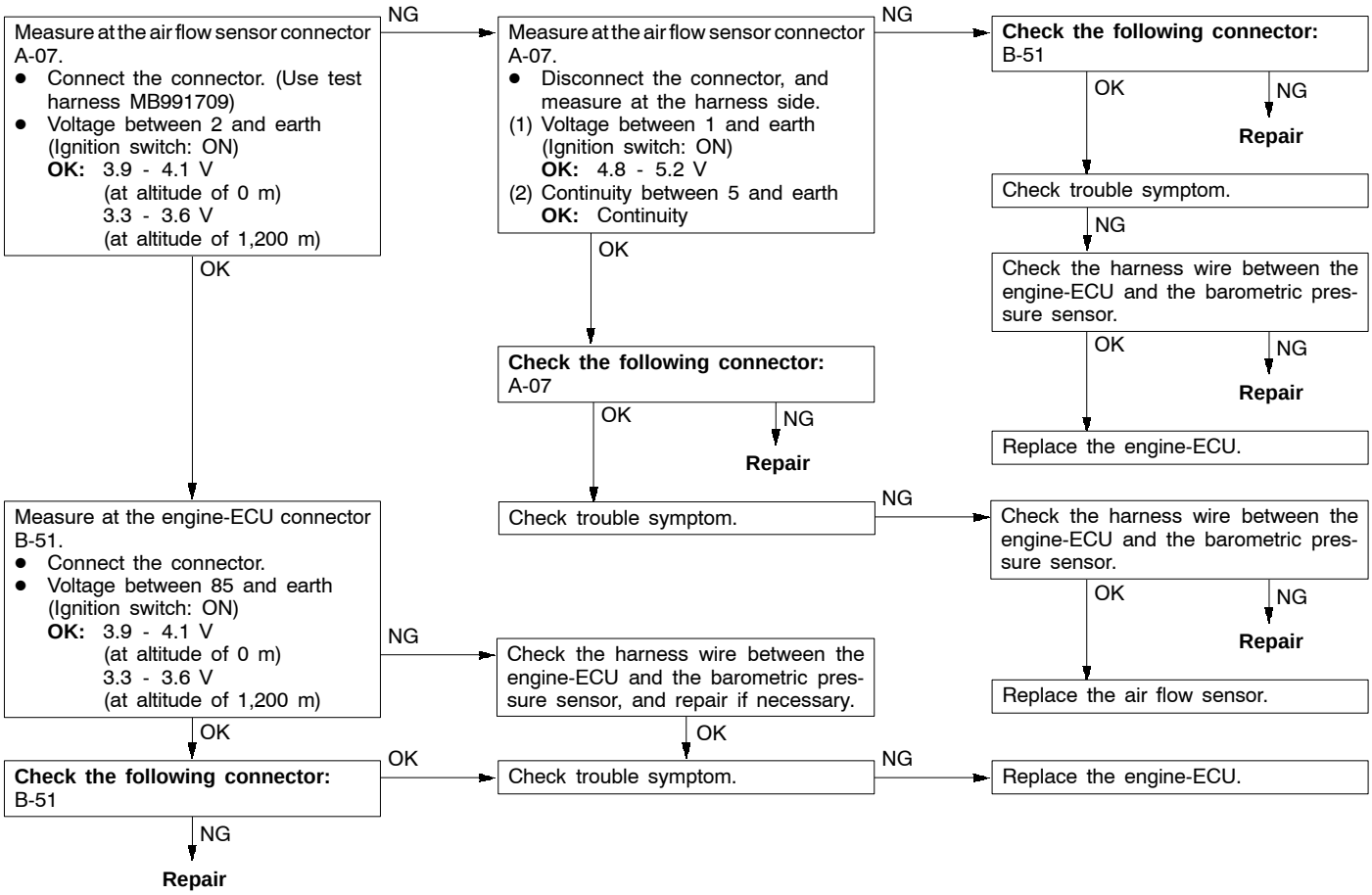
Code No.23 Camshaft position sensor system	Probable cause
Range of check ● While engine is cranking or running Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input). or ● Abnormal pulse signal pattern is output.	● Malfunction of the camshaft position sensor ● Open circuit or short-circuited harness wire of the camshaft position sensor ● Malfunction of the engine-ECU



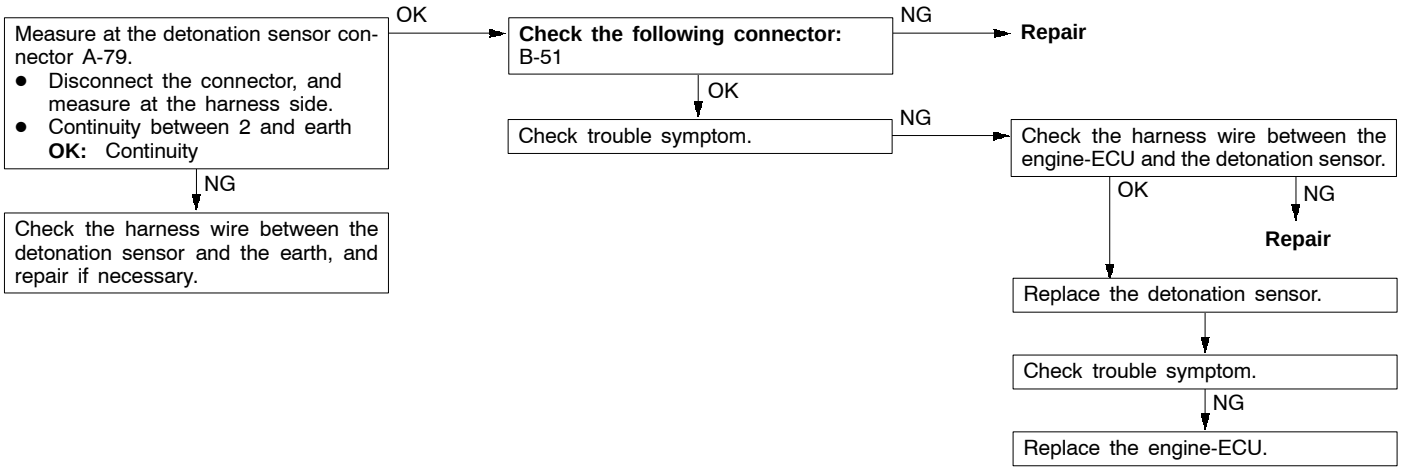
Code No. 24 Vehicle speed sensor system	Probable cause
Range of check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Engine speed is 3,000 r/min or more. ● Driving under high engine load conditions. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit ● Malfunction of the engine-ECU



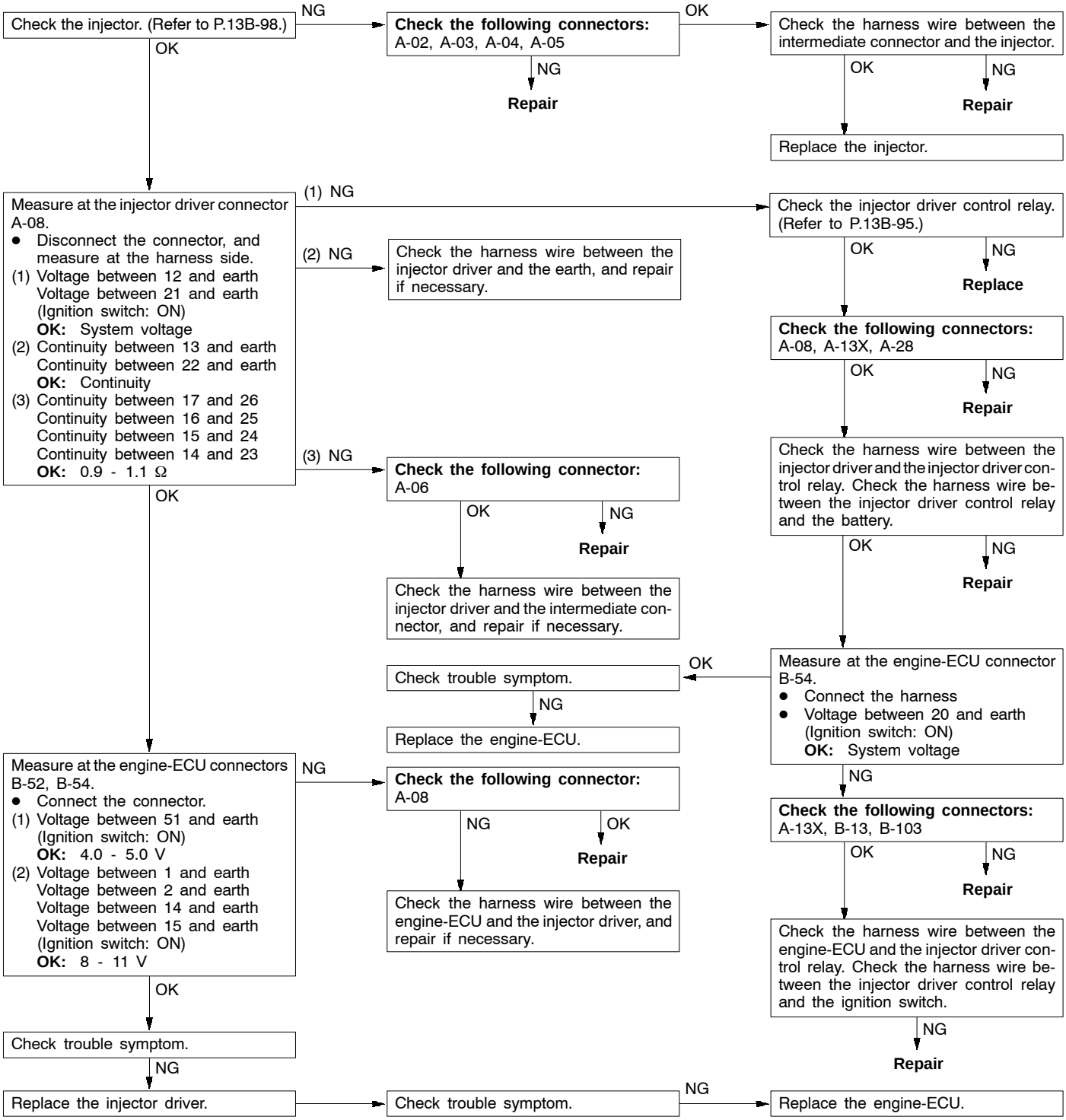
Code No.25 Barometric pressure sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 0.2 V or less for 4 seconds. or ● Sensor output voltage is 4.5 V or more for 4 seconds.	● Malfunction of the barometric pressure sensor ● Open circuit or short-circuited harness wire of the barometric pressure sensor ● Malfunction of the engine-ECU



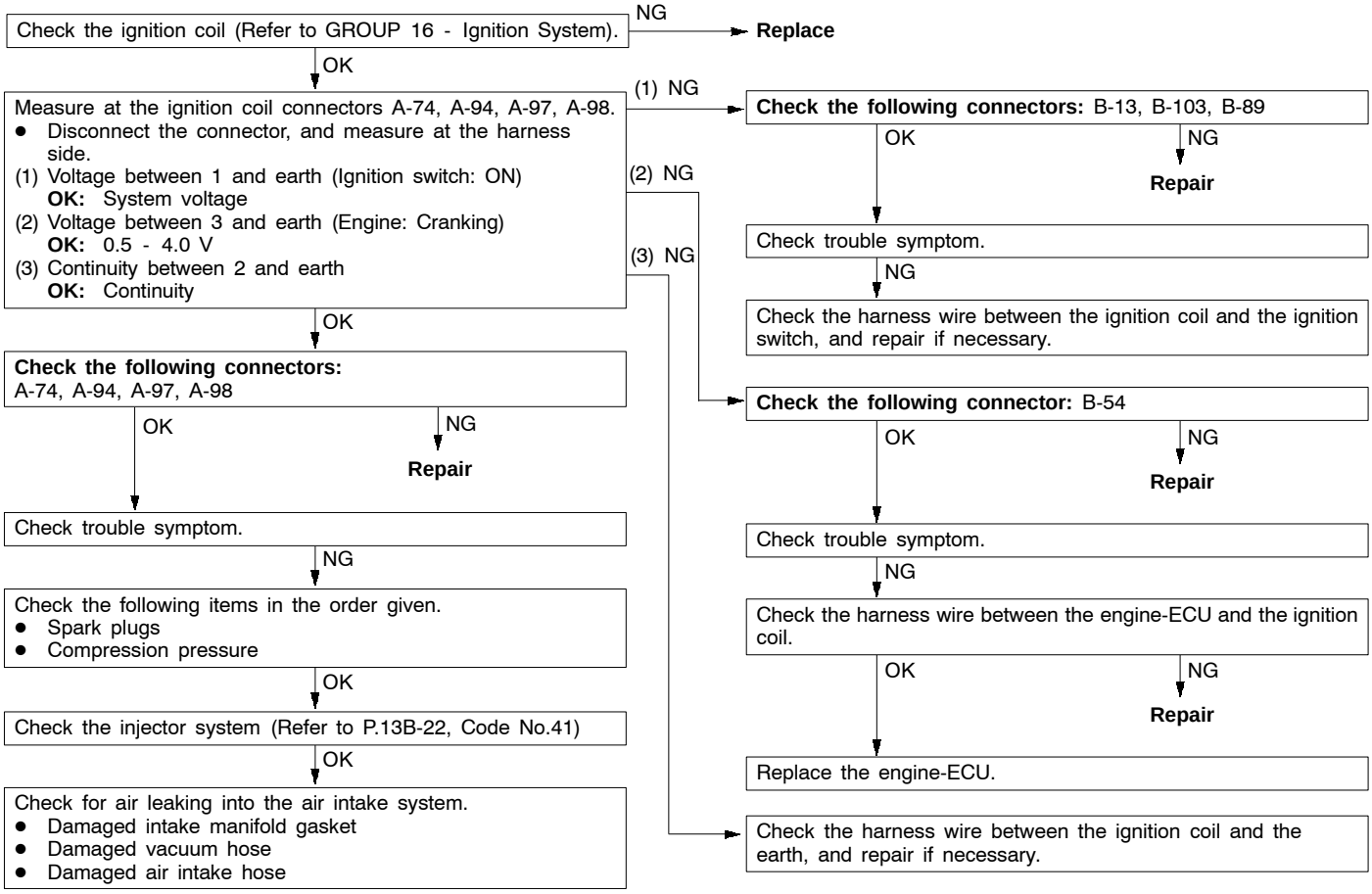
Code No.31 Detonation sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Amount of change in the sensor output voltage (detonation sensor peak voltage for each half rotation of the crankshaft) is 0.06 V or less for 200 continuous times.	● Malfunction of the detonation sensor ● Open circuit or short-circuited harness wire of the detonation sensor ● Malfunction of the engine-ECU



Code No.41 Injector system	Probable cause
Range of check ● While engine is cranking or running ● Engine speed is 4,000 r/min or less. ● System voltage is 10 V or more. ● While fuel cut and injector forced drive (actuator test) are not being carried out Set conditions ● Injector open circuit check signal is not output by the injector driver for a set number of times.	● Malfunction of the injector ● Malfunction of the injector driver control relay ● Malfunction of the injector driver ● Open circuit or short-circuited harness wire of the injector drive circuit ● Malfunction of the engine-ECU

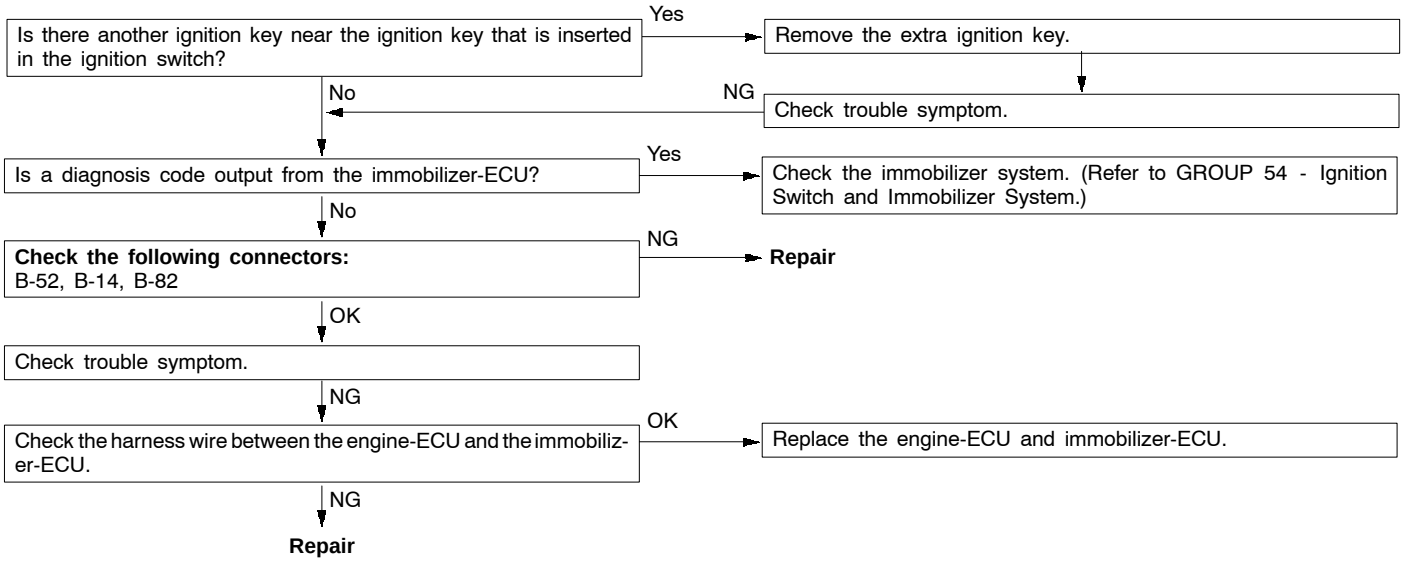


Code No.44 Abnormal combustion	Probable cause
Range of check ● While engine is running during lean fuel combustion Set conditions ● Abnormal engine speed due to mis-firing is detected by the crank angle sensor	● Malfunction of the ignition coil ● Malfunction of the spark plug ● Open circuit or short-circuit in ignition primary circuit ● Malfunction of the injector system ● Malfunction of the engine-ECU

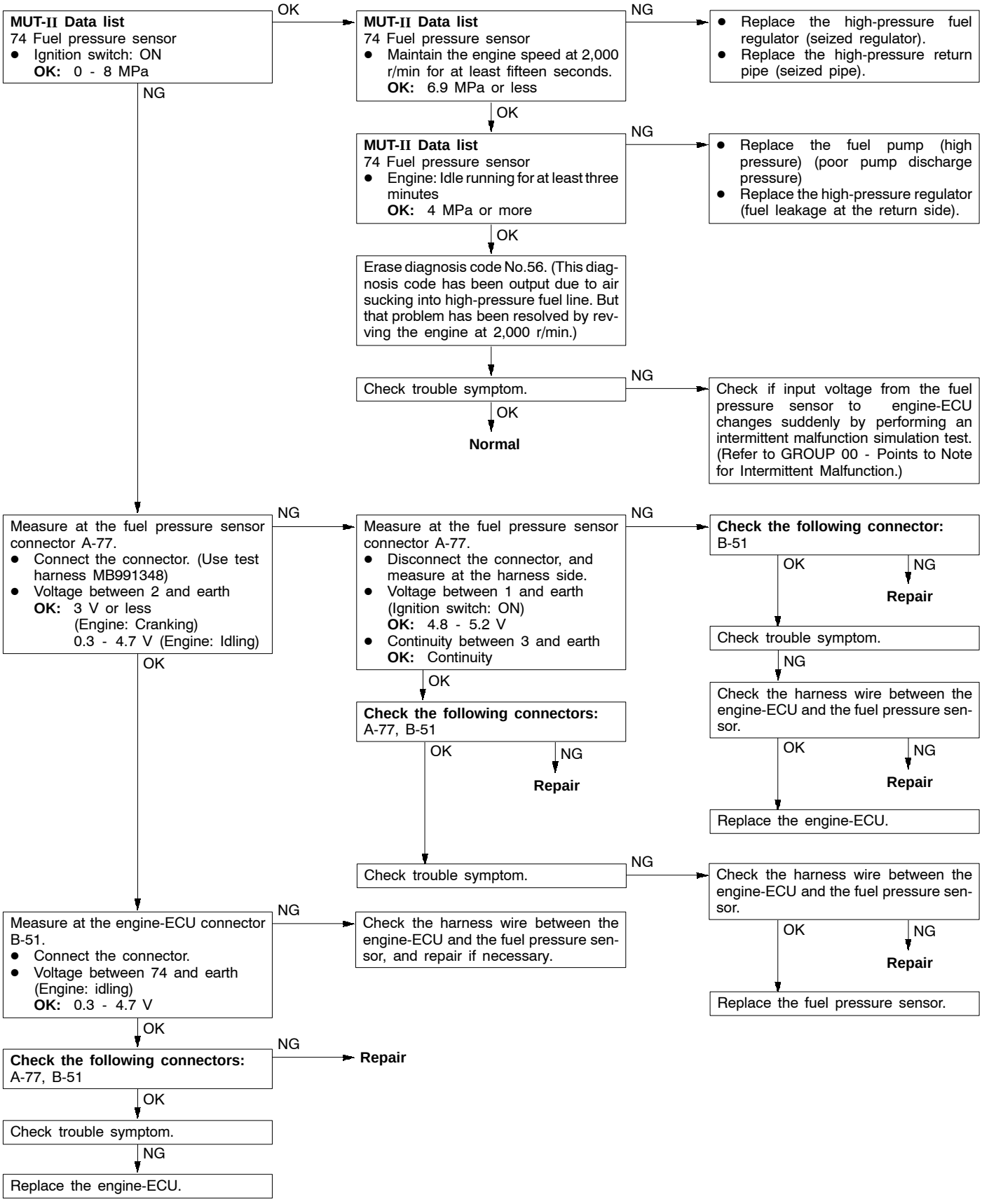


Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of encrypted codes ● Incorrect encrypted code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Malfunction of engine-ECU

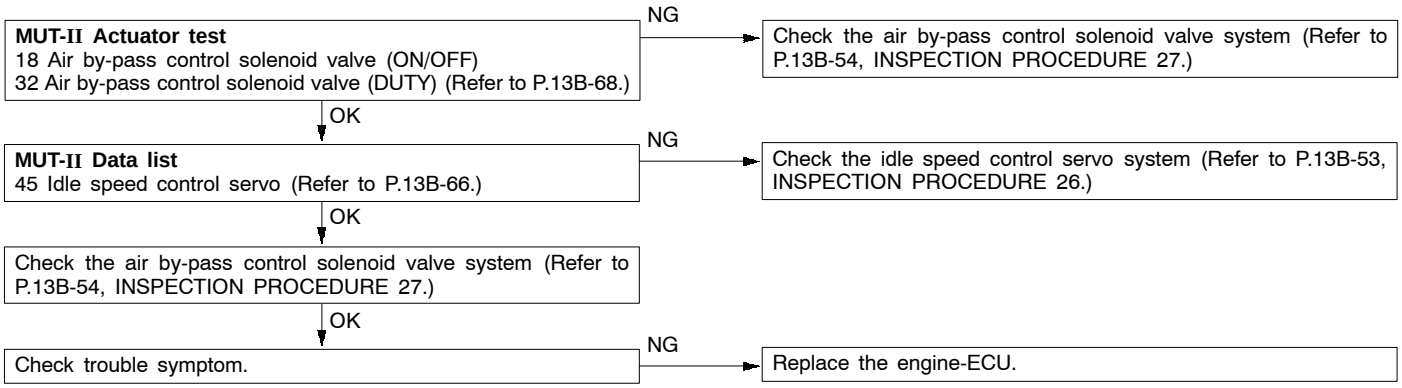
NOTE
(1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.



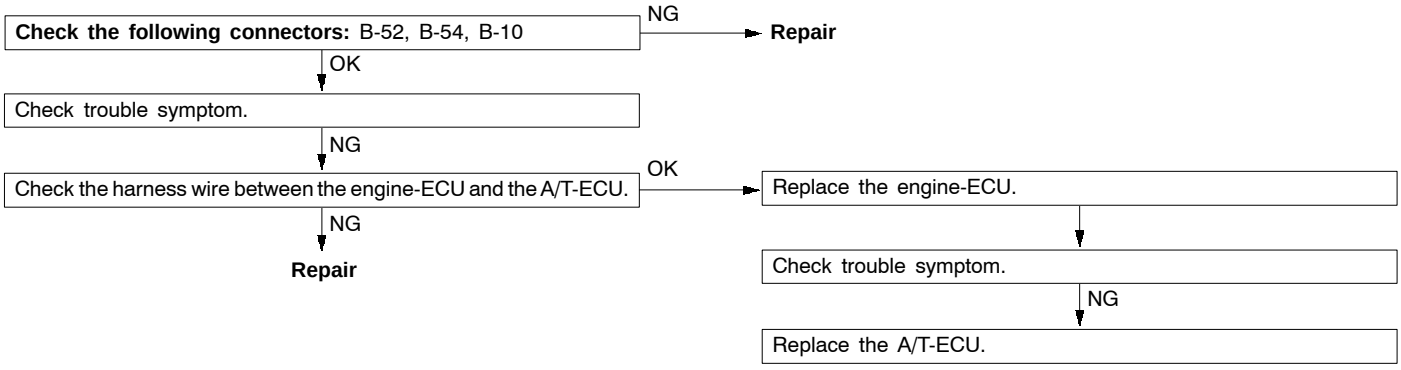
Code No.56 Abnormal fuel pressure	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more for four seconds. or ● Sensor output voltage is 0.2 V or less for four seconds. Range of check ● After the engine is started, the following condition has been detected: (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● While engine is running Set conditions ● Fuel pressure is 6.9 MPa or more for four seconds. or ● Fuel pressure is 2 MPa or less for four seconds.	● Malfunction of the fuel pressure sensor ● Open circuit or short-circuited harness wire of the fuel pressure sensor ● Malfunction of the engine-ECU ● Malfunction of the fuel pump (high pressure) ● Malfunction of the fuel pressure regulator (high pressure) ● Clogged high-pressure fuel line
This diagnosis code is also output when air is sucked in high-pressure fuel line due to no fuel supply. In this case, air can be bled by letting the engine run at 2,000 r/min for at least fifteen seconds. After the air bleeding, the diagnosis code must be erased by the MUT-II.	● Air sucking due to no fuel supply


MUT-II Data list
74 Fuel pressure sensor
● Ignition switch: ON
OK: 0 - 8 MPa
OK
MUT-II Data list
74 Fuel pressure sensor
● Maintain the engine speed at 2,000 r/min for at least fifteen seconds.
OK: 6.9 MPa or less
NG
● Replace the high-pressure fuel regulator (seized regulator).
● Replace the high-pressure return pipe (seized pipe).
OK
MUT-II Data list
74 Fuel pressure sensor
● Engine: Idle running for at least three minutes
OK: 4 MPa or more
NG
● Replace the fuel pump (high pressure) (poor pump discharge pressure)
● Replace the high-pressure regulator (fuel leakage at the return side).
OK
Erase diagnosis code No.56. (This diagnosis code has been output due to air sucking into high-pressure fuel line. But that problem has been resolved by revving the engine at 2,000 r/min.)
Check trouble symptom.
NG
Check if input voltage from the fuel pressure sensor to engine-ECU changes suddenly by performing an intermittent malfunction simulation test. (Refer to GROUP 00 - Points to Note for Intermittent Malfunction.)
OK
Normal
NG
Measure at the fuel pressure sensor connector A-77.
● Connect the connector. (Use test harness MB991348)
● Voltage between 2 and earth
OK: 3 V or less (Engine: Cranking)
0.3 - 4.7 V (Engine: Idling)
OK
Measure at the fuel pressure sensor connector A-77.
● Disconnect the connector, and measure at the harness side.
● Voltage between 1 and earth (Ignition switch: ON)
OK: 4.8 - 5.2 V
● Continuity between 3 and earth
OK: Continuity
NG
Check the following connector: B-51
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the engine-ECU.
OK
Check the following connectors: A-77, B-51
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the fuel pressure sensor.
NG
Measure at the engine-ECU connector B-51.
● Connect the connector.
● Voltage between 74 and earth (Engine: idling)
OK: 0.3 - 4.7 V
OK
Check the harness wire between the engine-ECU and the fuel pressure sensor, and repair if necessary.
NG
Check the following connectors: A-77, B-51
OK
Repair
Check trouble symptom.
NG
Replace the engine-ECU.

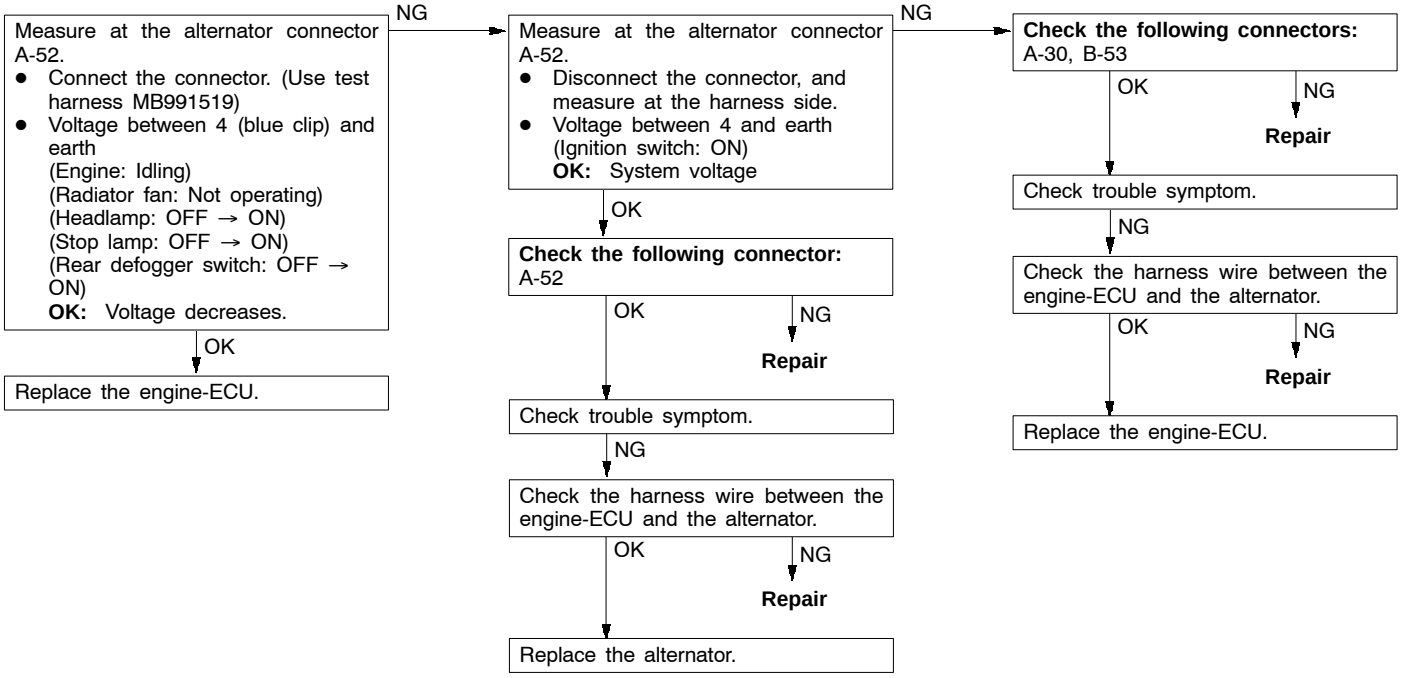
Code No.58 Excessive intake air amount	Probable cause
Range of check ● While engine is running in lean compression mode ● Engine speed is 3,000 r/min or less. ● Throttle position sensor output voltage is 1 V or less. Set conditions ● Air flow sensor output frequency is 100 Hz or more for 1 second.	● Malfunction of the idle speed control servo ● Open circuit or short-circuited harness wire of the idle speed control servo ● Malfunction of the air by-pass control solenoid valve (ON/OFF, DUTY) ● Short-circuited harness wire of the air by-pass control solenoid valve (ON/OFF, DUTY) ● Malfunction of the engine-ECU
Range of check ● While engine is not running in lean compression mode Set conditions ● Air flow sensor output frequency is higher than the map value specified by the engine speed for 1 second.	



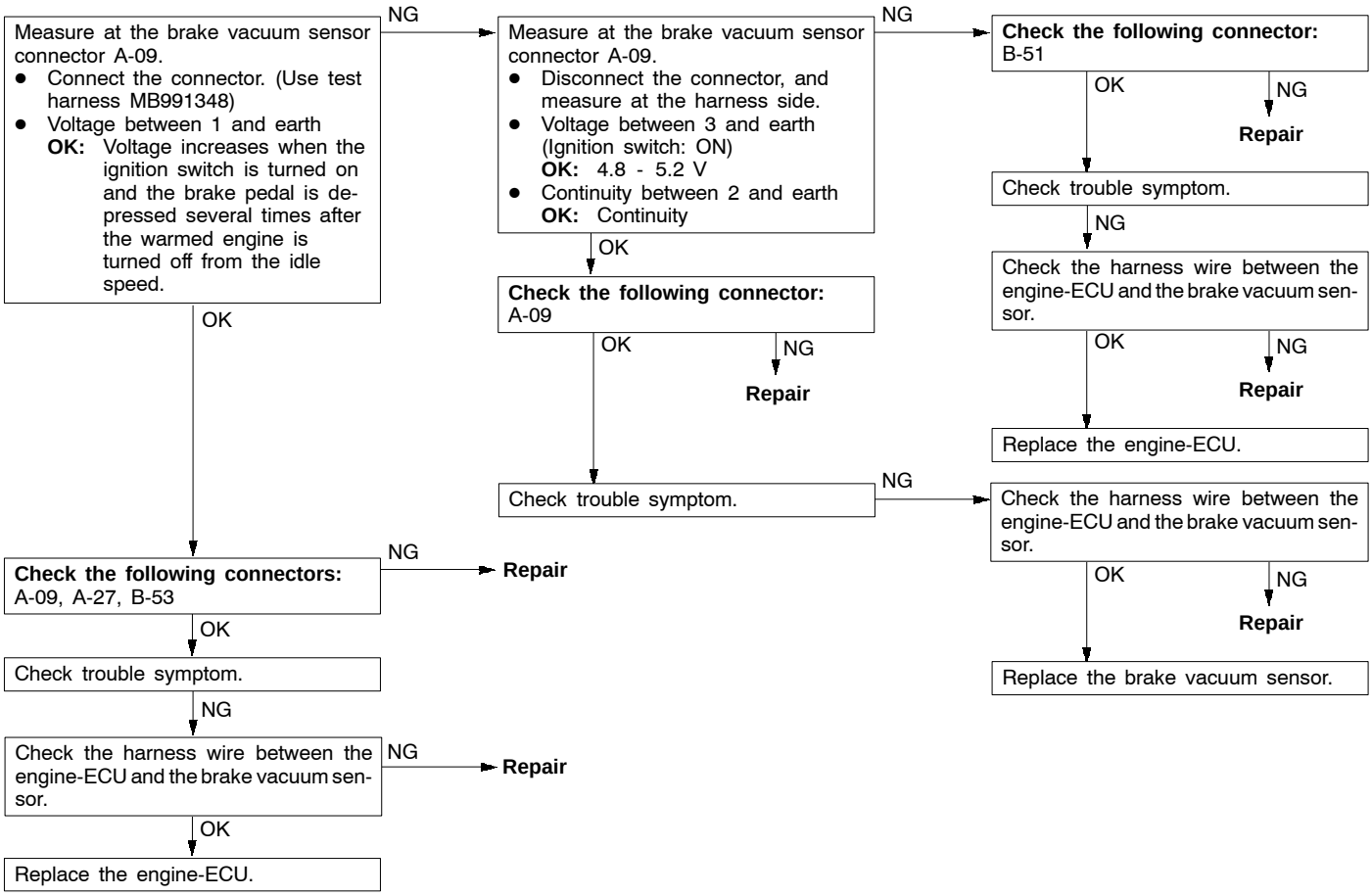
Code No.61 Communication wire with A/T-ECU system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	● Short circuit in ECU communication circuit ● Malfunction of the engine-ECU ● Malfunction of the A/T-ECU



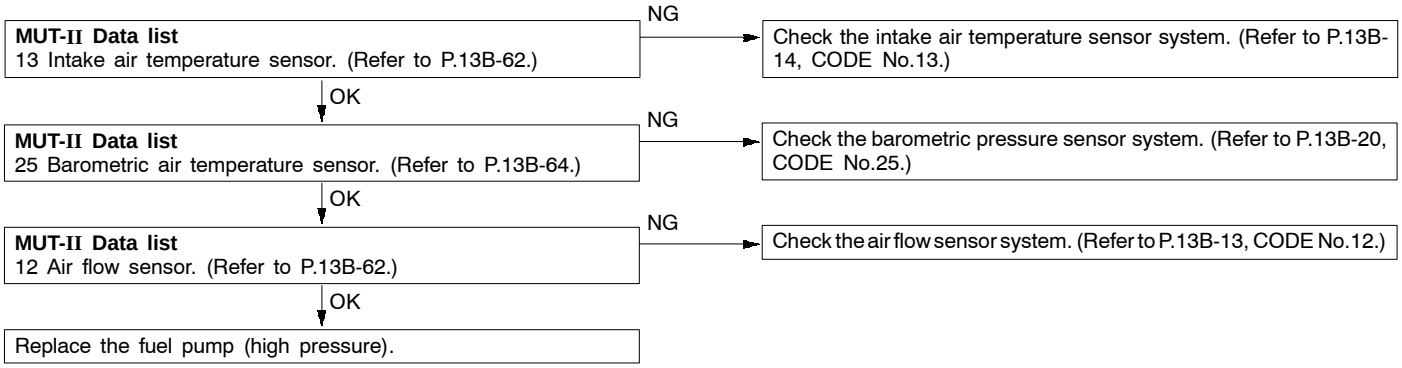
Code No.64 Alternator FR terminal system	Probable cause
Range of check ● Engine speed is 50 r/min or more. Set conditions ● Input voltage from alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of the engine-ECU



Code No.66 Brake vacuum sensor system	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more. or ● Sensor output voltage is 0.2 V or less.	● Malfunction of the brake vacuum sensor ● Improper connector contact, open circuit or short-circuited harness wire of the brake vacuum sensor ● Malfunction of the engine-ECU



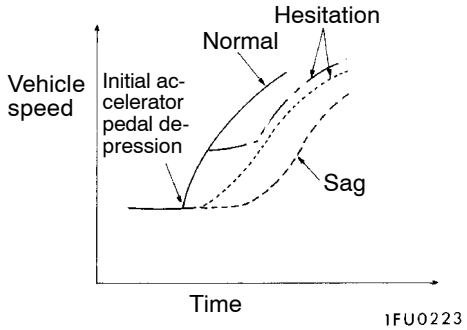
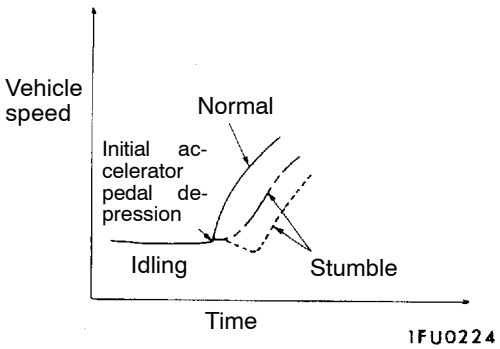
Code No.89 Abnormal fuel pressure	Probable cause
Range of check ● Engine: Idling (during stoichio-feedback operation) Set conditions ● Fuel injection correction value remains excessively low for ten seconds or more. or ● Fuel injection correction value remains excessively high for ten seconds or more.	● Malfunction of the fuel pump (high pressure) ● Malfunction of the intake air temperature sensor ● Malfunction of the barometric pressure sensor ● Malfunction of the air flow sensor ● Malfunction of the engine-ECU



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	13B-32
	Communication with engine-ECU only is not possible.	2	13B-33
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	13B-34
	The engine warning lamp remains illuminating and never goes out.	4	13B-34
Starting	No initial combustion (starting impossible)	5	13B-35
	Initial combustion but no complete combustion (starting impossible)	6	13B-36
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13B-37
	Idling speed is high. (Improper idling speed)	8	13B-39
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13B-40
	When the engine is hot, it stalls at idling. (Die out)	10	13B-41
	The engine stalls when starting the car. (Pass out)	11	13B-43
	The engine stalls when decelerating.	12	13B-44
Driving	Hesitation, sag or stumble	13	13B-44
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13B-46
	The feeling of impact or vibration when decelerating	15	13B-46
	Knocking	16	13B-46
Dieseling		17	13B-47
Too high CO and HC concentration when idling		18	13B-47
Low alternator output voltage (approx. 12.3 V)		19	13B-48
Idling speed is improper when A/C is operating		20	13B-48
Fans (radiator fan, A/C condenser fan) are inoperative		21	13B-49

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

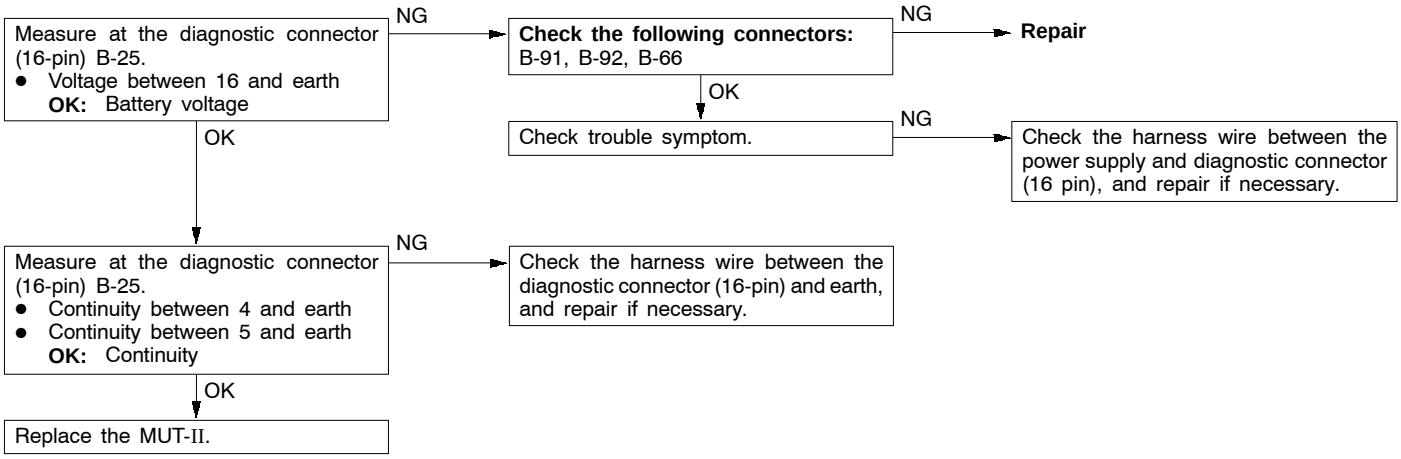
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
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

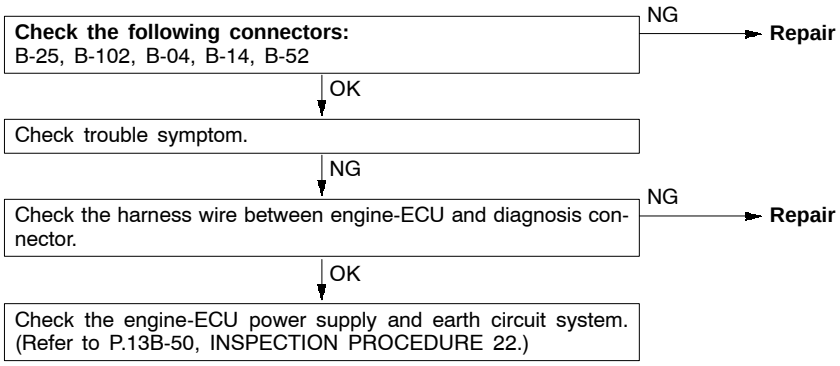
INSPECTION PROCEDURE 1

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



INSPECTION PROCEDURE 2

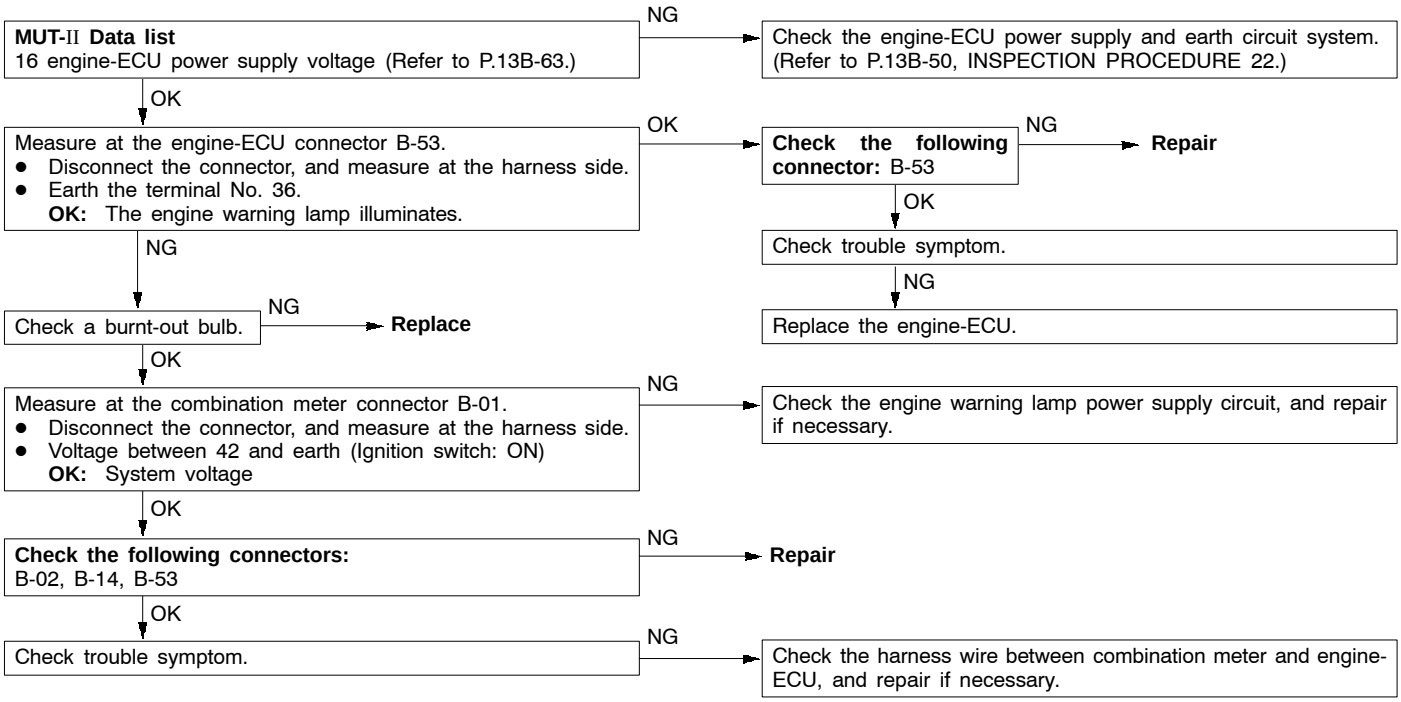
MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. ● No power supply to engine-ECU. ● Defective earth circuit of engine-ECU. ● Defective engine-ECU. ● Improper communication line between engine-ECU and MUT-II	● Malfunction of engine-ECU power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



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

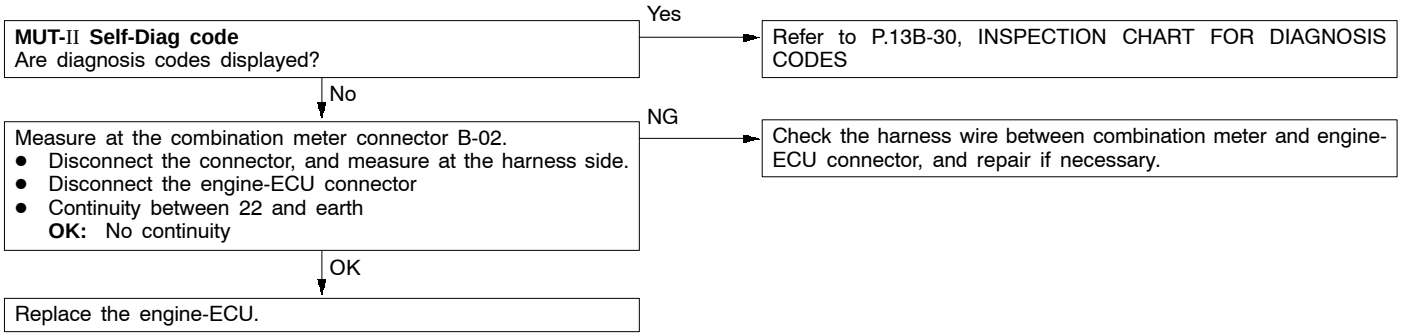
INSPECTION PROCEDURE 3

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
The cause is probably a problem with the supply of fuel to the combustion chambers or a malfunction of the ignition circuit. Furthermore, there is a slight possibility that the fuel is contaminated.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-ECU

Check the battery voltage during cranking.
OK: 8 V or more
NG → Check the battery. (Refer to GROUP 54.)
OK ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13B-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

MUT-II Data list
16 System voltage (Refer to P.13B-63.)
NG → Check the engine control relay and ignition switch-IG system. (Refer to P.13B-51, INSPECTION PROCEDURE 23.)
OK ↓

Is the camshaft rotating while the engine is cranking?
NO → Check for a broken timing belt.
YES ↓

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13B-68.)
NG → Check the fuel pump (low pressure) system. (Refer to P.13B-55, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
22 Crank angle sensor (Refer to P.13B-64.)
NG → Check the crank angle sensor system. (Refer to P.13B-17, Code No.22.)
OK ↓

Can the sound of the injectors operating be heard while the engine is cranking? (Using a soundscope)
NG → Check the injector system. (Refer to P.13B-22, Code No.41.)
OK ↓

Check for fuel leaks. (Refer to P.13B-92.)
NG → Replace the fuel pump (high pressure).
OK ↓

Measure the fuel pressure between the fuel pump (low pressure) and the fuel pump (high pressure). (Refer to P.13B-89.)
OK ↓

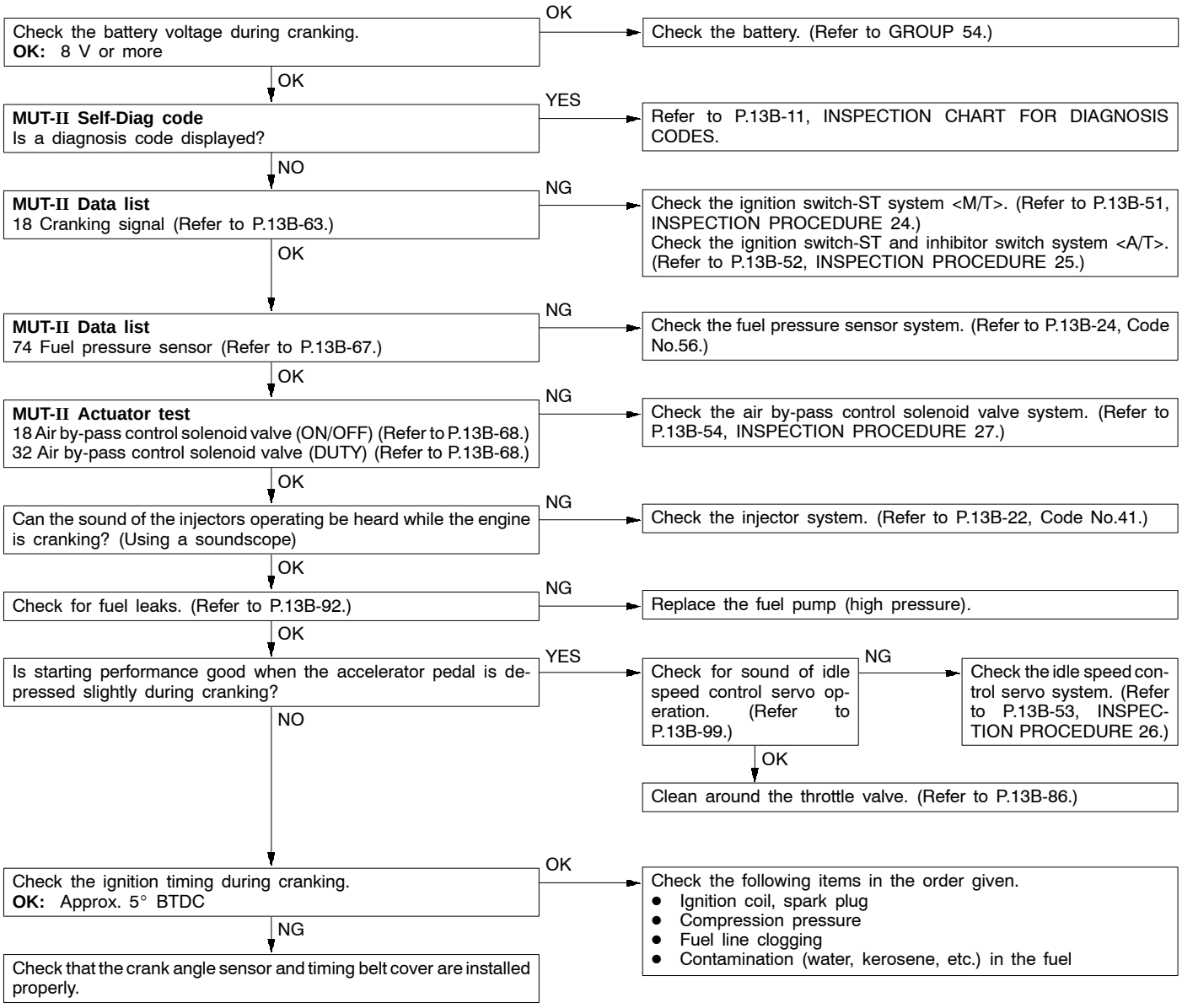
Check the ignition timing during cranking.
OK: Approx. 5° BTDC
NG → Check that the crank angle sensor and timing belt cover are installed properly.
OK ↓

Measure at the ignition coil connectors A-74, A-94, A-97, A-98.
- Connect the connector. (Use test harness MB991658)
- Check while connecting a primary voltage detection-type tachometer to terminal 1 of each connector.
  OK: For all terminals, the engine tachometer indication is 1/2 of the cranking speed.

NG → Check the abnormal combustion. (Refer to P.13B-23, Code No.44.)
OK → Contamination (water, kerosene, etc.) in the fuel

INSPECTION PROCEDURE 6

Initial combustion but no complete combustion (starting impossible) Long time to start (improper starting)	Probable cause
The cause is probably poor ignition due to a malfunctioning spark plug (weak spark), an incorrect air/fuel ratio when starting or incorrect fuel pressure switching.	• Malfunction of the fuel supply system • Malfunction of the fuel pressure sensor • Malfunction of the ignition system • Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Malfunction of the engine-ECU



INSPECTION PROCEDURE 7

Unstable idling (Rough idling, hunting)	Probable cause
The cause is probably a malfunction of the ignition system, or incorrect air/fuel ratio, idle speed control, air by-pass control or compression pressure. Because the probable range of causes is so wide, checking starts from those items which are most likely to be the cause.	• Malfunction of the ignition system • Malfunction of air/fuel ratio control system • Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Incorrect compression pressure • Air leaking into air intake system

Have the battery terminals been disconnected recently?
- YES → After the engine has warmed up, run it at idle for approximately 10 minutes.
- NO ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- YES → Refer to P.13B-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check for sound of idle speed control servo operation. (Refer to P.13B-99.)
- NG → Check the idle speed control servo system. (Refer to P.13B-53, INSPECTION PROCEDURE 26.)
- OK ↓

Check the injector operation sound.
- NG → Check the injector system. (Refer to P.13B-22, Code No.41.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13B-63.)
- NG → Check the throttle position sensor system. (Refer to P.13B-15, Code No.14.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13B-62.)
- NG → Check the intake air temperature sensor system. (Refer to P.13B-14, Code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13B-64.)
- NG → Check the barometric pressure sensor system. (Refer to P.13B-20, Code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13B-63.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13B-16, Code No.21.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13B-68.)
- NG → Check the purge control solenoid valve. (Refer to P.13B-57, INSPECTION PROCEDURE 30.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13B-62.)
OK: 700 - 900 mV when the engine is suddenly raced
- NG → Check the oxygen sensor system. (Refer to P.13B-12, Code No.11)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13B-62.)
OK: Changes between 0 mV and 700 - 900 mV at 2,500 r/min.
- NG → Check the fuel pressure. (Refer to P.13B-89.)
  - OK → Check for air leaking into the air intake system.
    - Damaged intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
- OK ↓

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13B-64.)
- NG → Check the power steering fluid pressure switch system. (Refer to P.13B-58, INSPECTION PROCEDURE 31.)
- OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13B-64.)
- NG → Check the A/C switch and A/C relay system. (Refer to P.13B-58, INSPECTION PROCEDURE 32.)
- OK ↓

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MUT-II Data list
29 Inhibitor switch (Refer to P.13B-64.)
NG → Check the ignition switch-ST and inhibitor switch system. <A/T> (Refer to P.13B-52, INSPECTION PROCEDURE 25.)
OK

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13B-66.)
NG → Check the M/T oil temperature sensor system. (Refer to P.13B-59, INSPECTION PROCEDURE 33.)
OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13B-66.)
NG → Check the stop lamp switch system. (Refer to P.13B-60, INSPECTION PROCEDURE 34.)
OK

MUT-II Data list
31 Small lamp switch (Refer to P.13B-64.)
NG → Check the small lamp switch system. (Refer to P.13B-61, INSPECTION PROCEDURE 35.)
OK

MUT-II Data list
45 Idle speed control servo (Refer to P.13B-66.)
NG → Adjust the basic idle speed. (Refer to P.13B-87.)
OK

MUT-II Data list
68 EGR valve (Refer to P.13B-66.)
NG → Check the EGR valve system. (Refer to P.13B-56, INSPECTION PROCEDURE 29.)
OK

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13B-68.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13B-68.)
NG → Check the air by-pass control solenoid valve system. (Refer to P.13B-54, INSPECTION PROCEDURE 27.)
OK

Check the ignition timing. (Refer to GROUP 11A - On-vehicle Service)
OK → Check the following items in the order given.
- Ignition coil, spark plug
- Evaporative Emission Control System
- EGR system
- Compression pressure
- Contamination (water, kerosene, etc.) in the fuel

NG

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

Clean the throttle body. (Refer to P.13B-86.)

Check the trouble symptoms.
NG → Check for air leaking into the air intake system.
- Damaged intake manifold gasket
- Damaged air intake hose
- Damaged vacuum hose

INSPECTION PROCEDURE 8

Idling speed is high, Idling speed is 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 idle speed control system • Malfunction of the air by-pass control system • Malfunction of the throttle body

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13B-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Check for sound of idle speed control servo operation. (Refer to P.13B-97.)
NG → Check the idle speed control servo system. (Refer to P.13B-53, INSPECTION PROCEDURE 26.)
OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13B-68.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13B-68.)
NG → Check the air by-pass control solenoid valve system. (Refer to P.13B-54, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13B-68.)
NG → Check the purge control solenoid valve system. (Refer to P.13B-57, INSPECTION PROCEDURE 30.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13B-63.)
NG → Check the throttle position sensor system. (Refer to P.13B-15, Code No.14.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13B-63.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13B-16, Code No.21.)
OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13B-64.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13B-58, INSPECTION PROCEDURE 32.)
OK ↓

MUT-II Data list
29 Inhibitor switch (Refer to P.13B-64.)
NG → Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer to P.13B-52, INSPECTION PROCEDURE 25.)
OK ↓

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13B-66.)
NG → Check the M/T oil temperature sensor system. (Refer to P.13B-59, INSPECTION PROCEDURE 33.)
OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13B-66.)
NG → Check the stop lamp switch system. (Refer to P.13B-60, INSPECTION PROCEDURE 34.)

↓

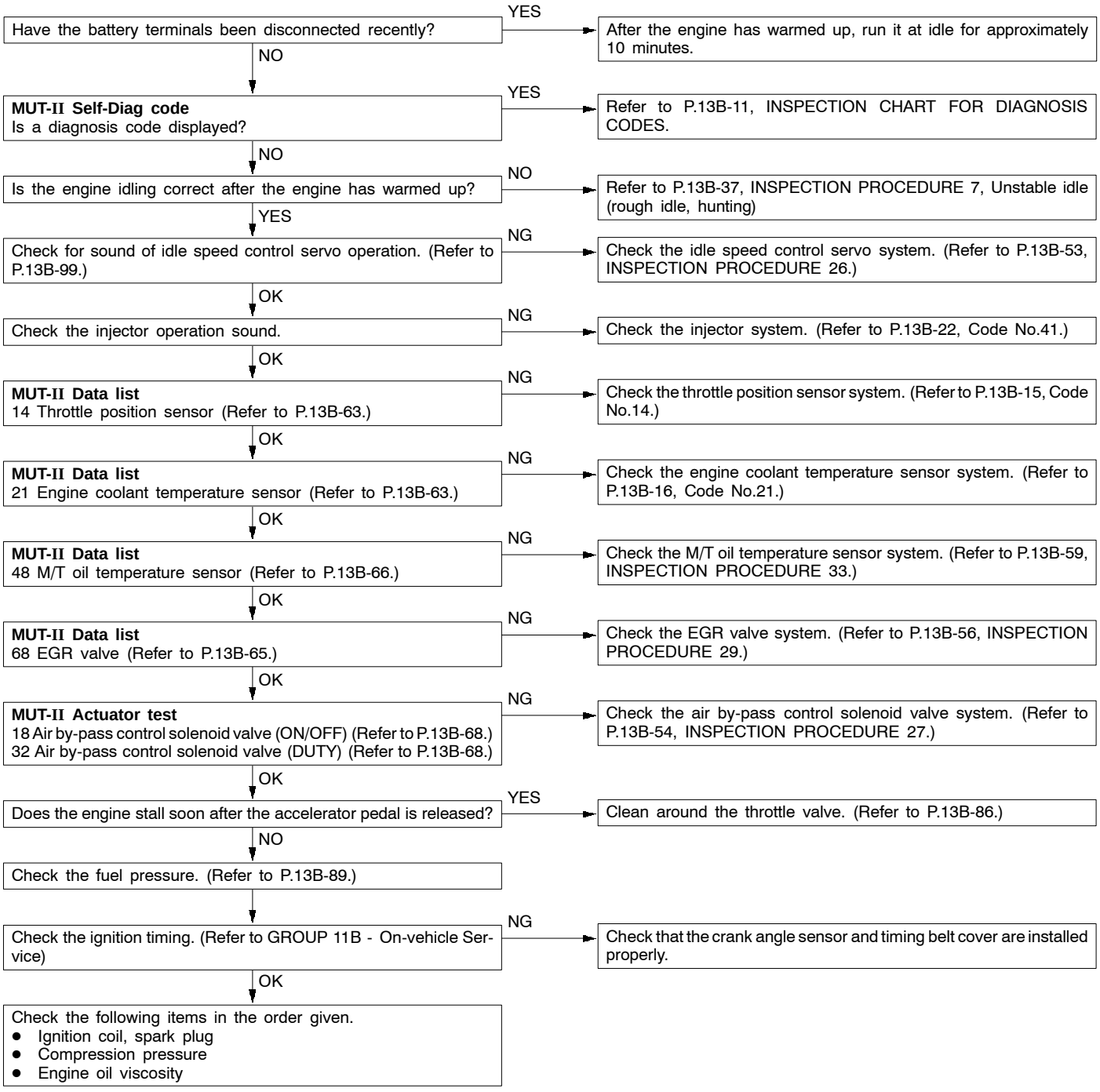
Adjust the basic idle speed. (Refer to P.13B-87.)

↓

Check the trouble symptoms.
NG → Clean around the throttle valve. (Refer to P.13B-86.)

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 when the engine is cold, or insufficient intake air.	• Malfunction of the idle speed control system • Malfunction of the air by-pass control 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 a malfunction of the ignition system, or incorrect air/fuel ratio, idle speed control, air by-pass control or compression pressure. In addition, if the engine suddenly stalls, another possible cause might be a poor connector contact.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Malfunction of the throttle body • Poor connector contact • Air leaking into air intake system

Have the battery terminals been disconnected recently?
- YES → After the engine has warmed up, run it at idle for approximately 10 minutes.
- NO ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- YES → Refer to P.13B-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check for sound of idle speed control servo operation. (Refer to P.13B-99.)
- NG → Check the idle speed control servo system. (Refer to P.13B-53, INSPECTION PROCEDURE 26.)
- OK ↓

Check the injector operation sound.
- NG → Check the injector system. (Refer to P.13B-22, Code No.41.)
- OK ↓

Is it easy to reproduce the stalling?
- 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 following signals.
  - Crank angle sensor signal
  - Injector drive signal
  - Fuel pump (low pressure) drive signal
  - Air flow sensor signal
  - Engine-ECU power supply voltage
- YES ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13B-63.)
- NG → Check the throttle position sensor system. (Refer to P.13B-15, Code No.14.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13B-62.)
- NG → Check the intake air temperature sensor system. (Refer to P.13B-14, Code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13B-64.)
- NG → Check the barometric pressure sensor system. (Refer to P.13B-20, Code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13B-63.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13B-16, Code No.21.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13B-62.)
OK: 700 - 900 mV when the engine is suddenly raced
- NG → Check the oxygen sensor system. (Refer to P.13B-12, Code No.11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13B-62.)
OK: Changes between 0 mV and 700 - 900 mV at 2,500 r/min.
- NG → Check the fuel pressure. (Refer to P.13B-89.)
  - OK → Check for air leaking into the air intake system.
    - Damaged intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
- OK ↓

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MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13B-64.)
- NG → Check the power steering fluid pressure switch. (Refer to P.13B-58, INSPECTION PROCEDURE 31.)
- OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13B-64.)
- NG → Check the A/C switch. (Refer to P.13B-58, INSPECTION PROCEDURE 32.)
- OK ↓

MUT-II Data list
29 Inhibitor switch (Refer to P.13B-64.)
- NG → Check the ignition switch-ST and inhibitor switch system. <A/T> (Refer to P.13B-52, INSPECTION PROCEDURE 25.)
- OK ↓

MUT-II Data list
31 Small lamp switch (Refer to P.13B-64.)
- NG → Check the small lamp switch system. (Refer to P.13B-61, INSPECTION PROCEDURE 35.)
- OK ↓

MUT-II Data list
12 Air flow sensor (Refer to P.13B-62.)
- NG → Check the air flow sensor system. (Refer to P.13B-13, Code No.12)
- OK ↓

MUT-II Data list
45 Idle speed control servo (Refer to P.13B-66.)
- NG → Adjust the basic idle speed. (Refer to P.13B-87.)
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13B-66.)
- NG → Check the EGR valve system. (Refer to P.13B-56, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13B-68.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13B-68.)
- NG → Check the air by-pass control solenoid valve system. (Refer to P.13B-54, INSPECTION PROCEDURE 27.)
- OK ↓

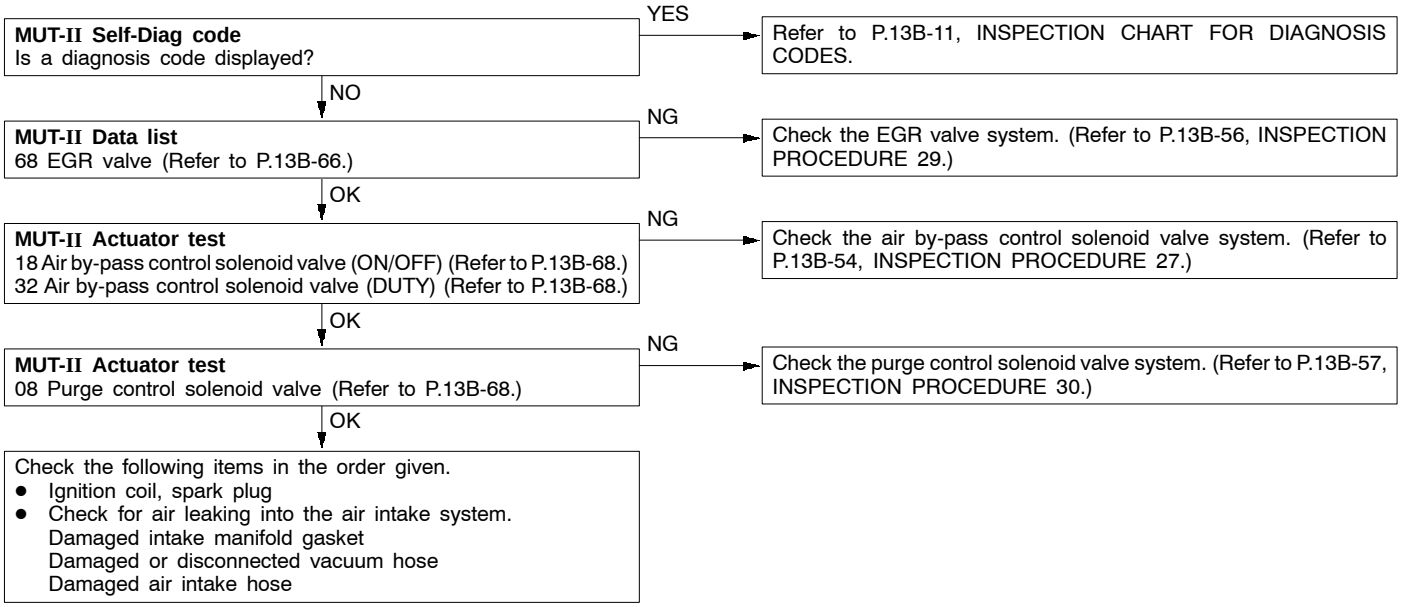
Does the engine stall soon after the accelerator pedal is released?
- YES → Clean around the throttle valve. (Refer to P.13B-86.)
- NO ↓

Check the ignition timing. (Refer to GROUP 11B - On-vehicle Service.)
- OK → Check the following items in the order given.
  - Ignition coil, spark plug
  - Compression pressure
  - Contamination (water, kerosene, etc.) in the fuel
- NG ↓

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

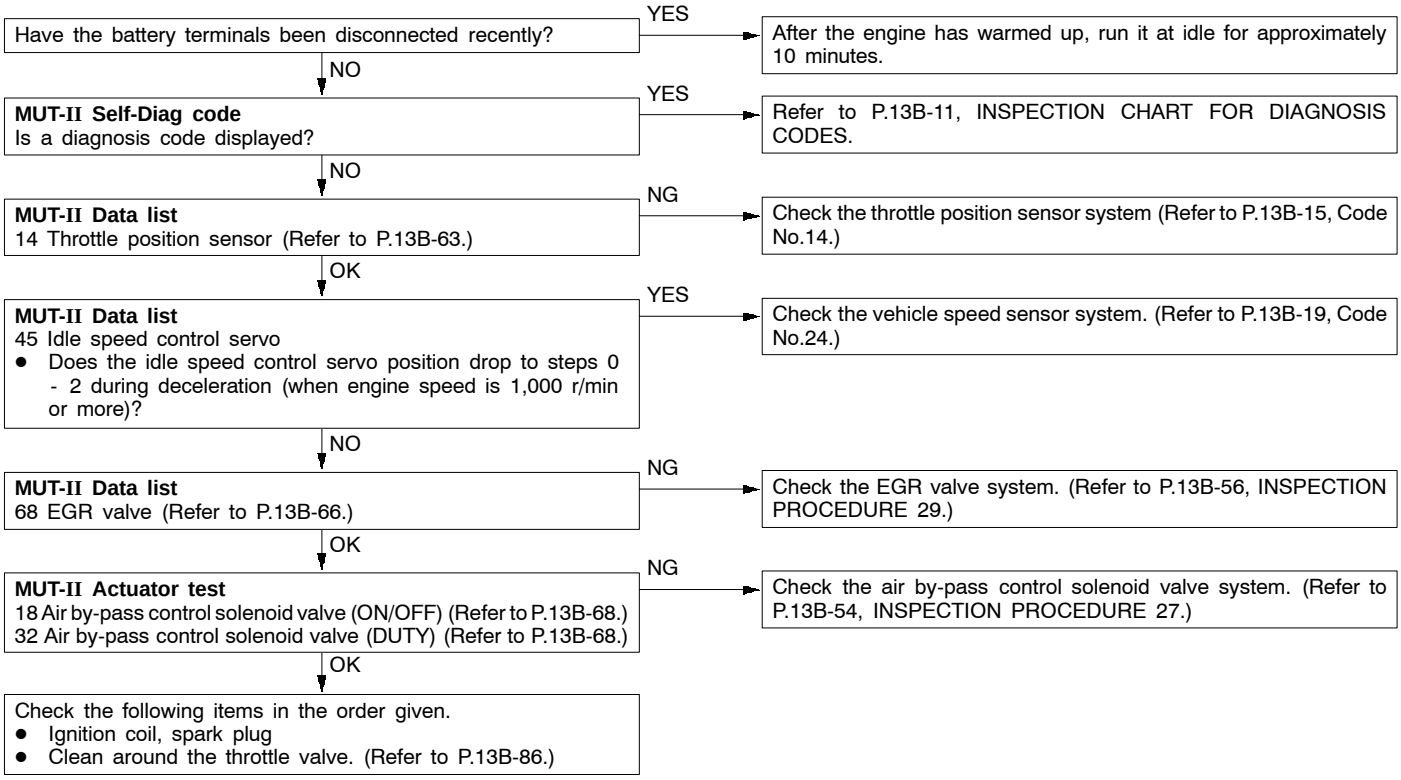
INSPECTION PROCEDURE 11

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 air by-pass control system • Malfunction of the EGR valve • Air leaking into air intake system



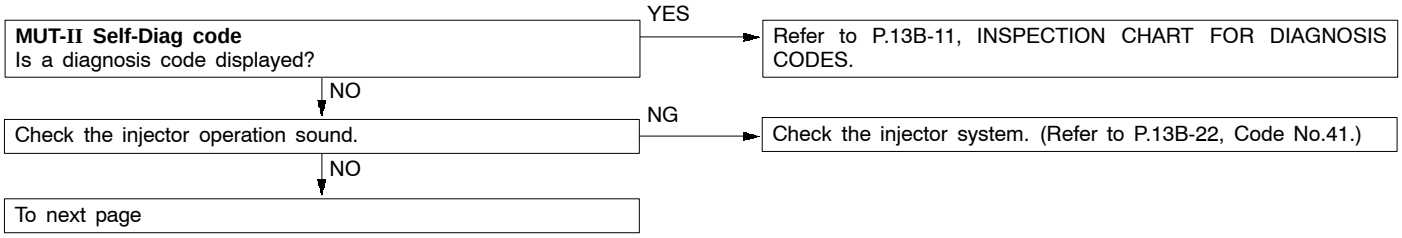
INSPECTION PROCEDURE 12

The engine stalls when decelerating	Probable cause
The cause is probably insufficient intake air due to an idle speed control malfunction, or incorrect air/fuel ratio due to an air by-pass control or EGR malfunction.	• Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Malfunction of the EGR valve



INSPECTION PROCEDURE 13

Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, or incorrect air/fuel ratio, air by-pass control or compression pressure.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the air by-pass control system • Poor compression pressure • Air leaking into air intake system



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Check the ignition timing. (Refer to GROUP 11B - On-vehicle Service)
- NG → Check that the crank angle sensor and timing belt cover are installed properly.
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13B-62.)
- NG → Check the intake air temperature sensor system. (Refer to P.13B-14, Code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13B-64.)
- NG → Check the barometric pressure sensor system. (Refer to P.13B-20, Code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13B-63.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13B-16, Code No.21.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13B-63.)
- NG → Check the throttle position sensor system. (Refer to P.13B-15, Code No.14.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 700 - 900 mV when the engine is suddenly raced
- NG → Check the oxygen sensor system. (Refer to P.13B-12, Code No.11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 mV and 700 - 900 mV at 2,500 r/min.
- NG → Check the fuel pressure. (Refer to P.13B-89.)
  - OK ↓
  - Check for air leaking into the air intake system.
    - Damaged intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13B-66.)
- NG → Check the EGR valve system. (Refer to P.13B-56, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13B-68.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13B-68.)
- NG → Check the air by-pass control solenoid valve system. (Refer to P.13B-54, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13B-68.)
- NG → Check the purge control solenoid valve system. (Refer to P.13B-57, INSPECTION PROCEDURE 30.)
- OK ↓

Check the fuel pressure. (Refer to P.13B-89.)
- OK → Check the following items in the order given.
  - Ignition coil, spark plug
  - EGR system
  - Compression pressure
  - Fuel filter and fuel line clogging

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 demand voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13B-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓
Check the following items in the order given.
- Ignition coil, spark plug
- Ignition leak.

INSPECTION PROCEDURE 15

The feeling of impact when decelerating	Probable cause
The cause is probably insufficient intake air due to an idle speed control malfunction.	• Malfunction of the idle speed control system

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13B-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓
Check for sound of idle speed control servo operation. (Refer to P.13B-99.)
NG → Check the idle speed control servo system. (Refer to P.13B-53, INSPECTION PROCEDURE 26.)
OK ↓
MUT-II Data list
14 Throttle position sensor (Refer to P.13B-63.)
NG → Check the throttle position sensor system. (Refer to P.13B-15, Code No.14.)
OK ↓
Clean around the throttle valve. (Refer to P.13B-86.)

INSPECTION PROCEDURE 16

Knocking	Probable cause
The cause is probably incorrect detonation control or an incorrect heating value for the spark plugs.	• Malfunction of the detonation sensor • Incorrect heat value of the spark plug

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13B-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓
Does knocking occur when driving while the detonation sensor connector is 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 idle speed control servo system. (Refer to P.13B-53, INSPECTION PROCEDURE 26.)
YES ↓
Check the following items in the order given.
- Spark plug
- Contamination (water, kerosene, etc.) in the fuel

INSPECTION PROCEDURE 17

Run-on (Dieseling)	Probable cause
The cause is probably a leaking injector.	• 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 the air/fuel ration control system • Deterioration of the catalyst

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13B-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

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

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13B-63.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13B-16, Code No.21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13B-62.)
NG → Check the intake air temperature sensor system. (Refer to P.13B-14, Code No.13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13B-64.)
NG → Check the barometric pressure sensor system. (Refer to P.13B-20, Code No.25.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 700 - 900 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13B-12, Code No.11.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 mV and 700 - 900 mV at 2,500 r/min.
OK → Replace the oxygen sensor.
Check the trouble symptoms.
NG → Check the following items in the order given.
NG ↓
Check the fuel pressure. (Refer to P.13B-87.)
OK ↓

Check the following items in the order given.
- Ignition coil, spark plug
- Compression pressure
- Positive crankcase ventilation system

OK ↓

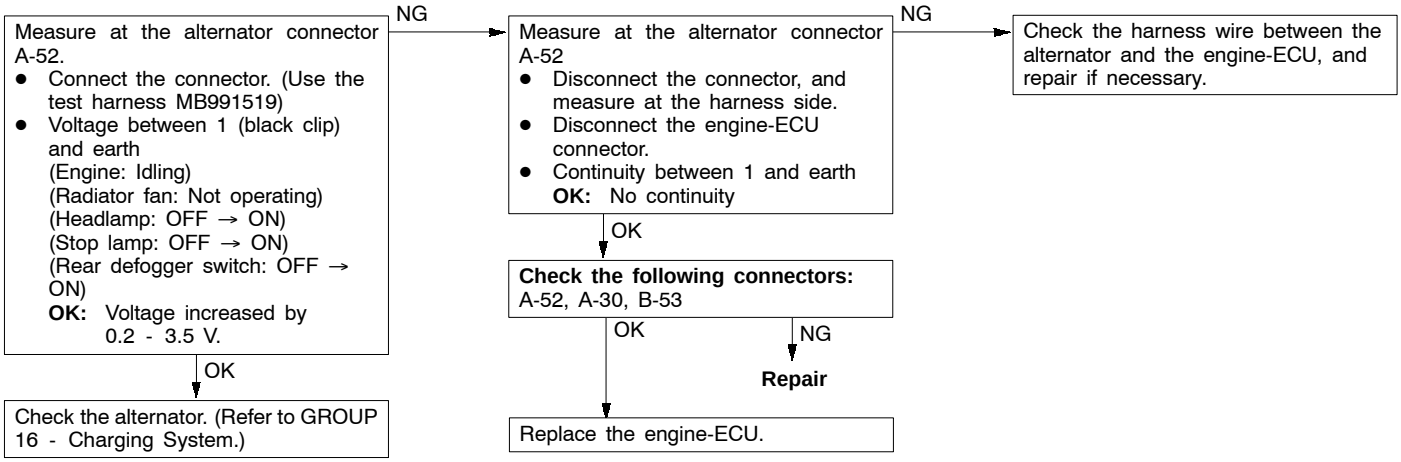
MUT-II Data list
68 EGR valve (Refer to P.13B-66.)
NG → Check the EGR valve system. (Refer to P.13B-56, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13B-68.)
NG → Check the purge control solenoid valve system. (Refer to P.13B-57, INSPECTION PROCEDURE 30.)
OK ↓

Check the trouble symptoms.
NG ↓
Replace the three-way catalytic converter.

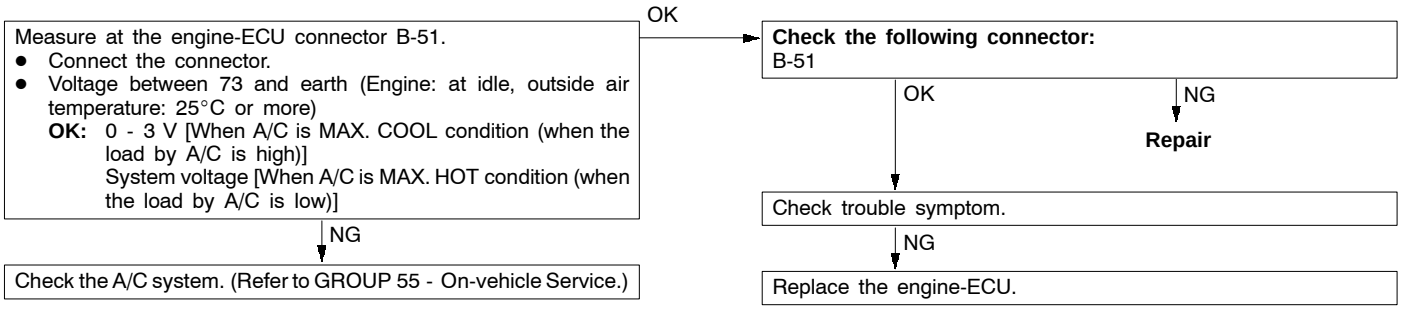
INSPECTION PROCEDURE 19

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



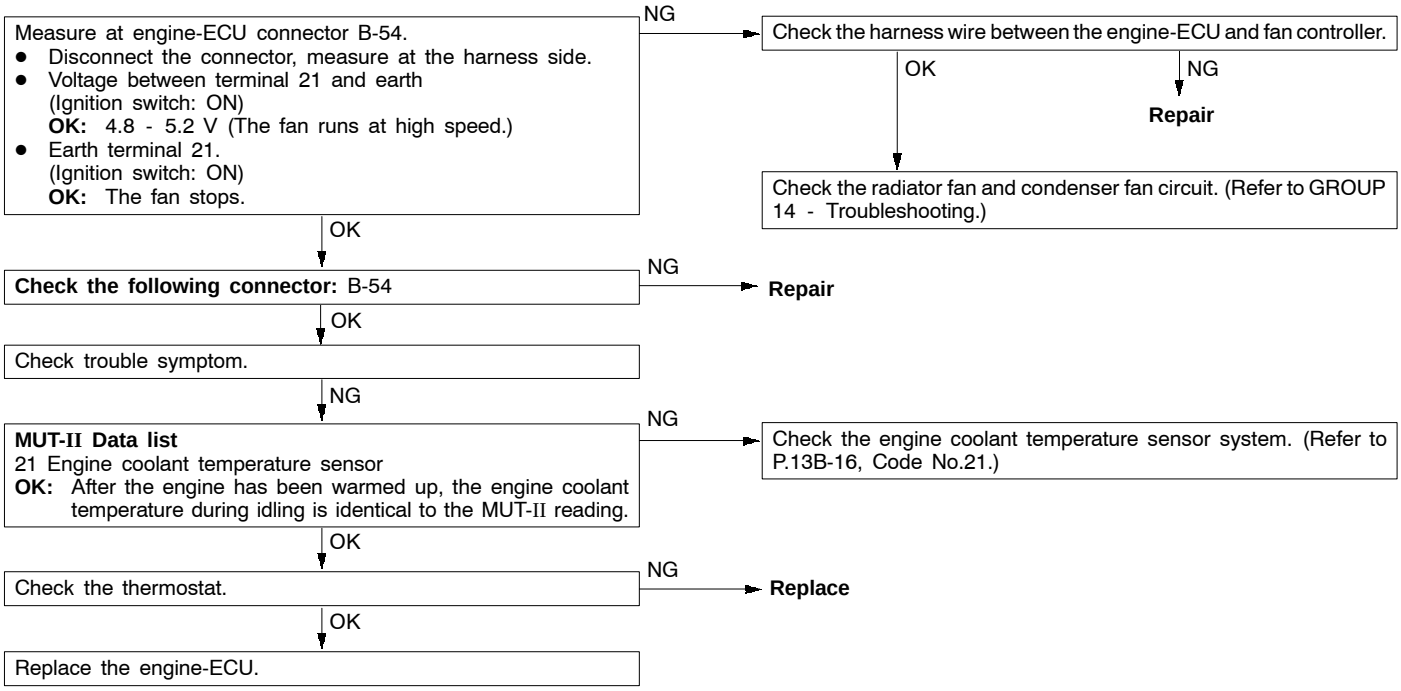
INSPECTION PROCEDURE 20

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 idle speed control (ISC) 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



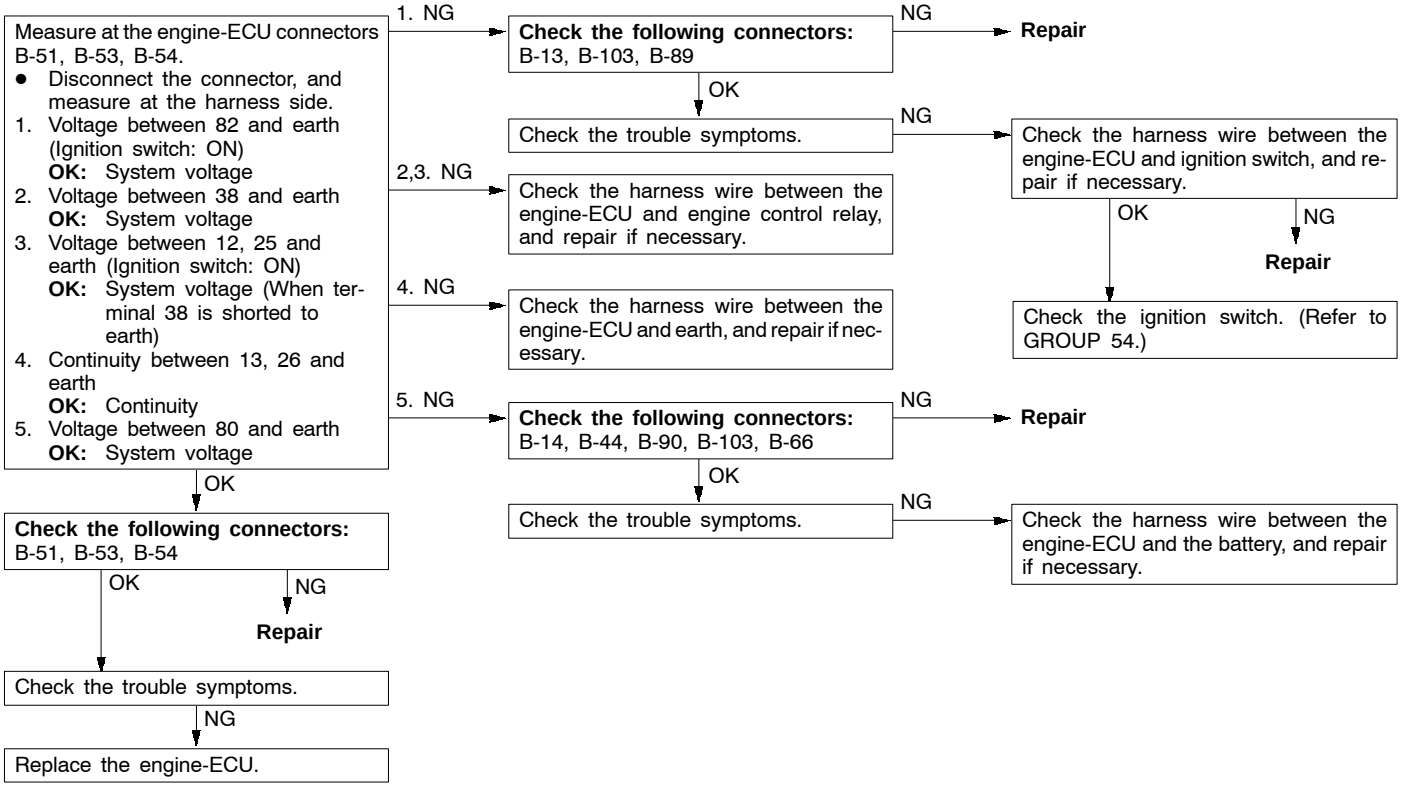
INSPECTION PROCEDURE 21

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
The engine-ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch. The fan controller controls radiator fan and condenser fan speeds, based on this signal. (The closer the terminal voltage comes to 5 V, the higher the fan speed becomes.)	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the fan controller • Open or short circuit, or poor connector contact • Malfunction of the engine-ECU



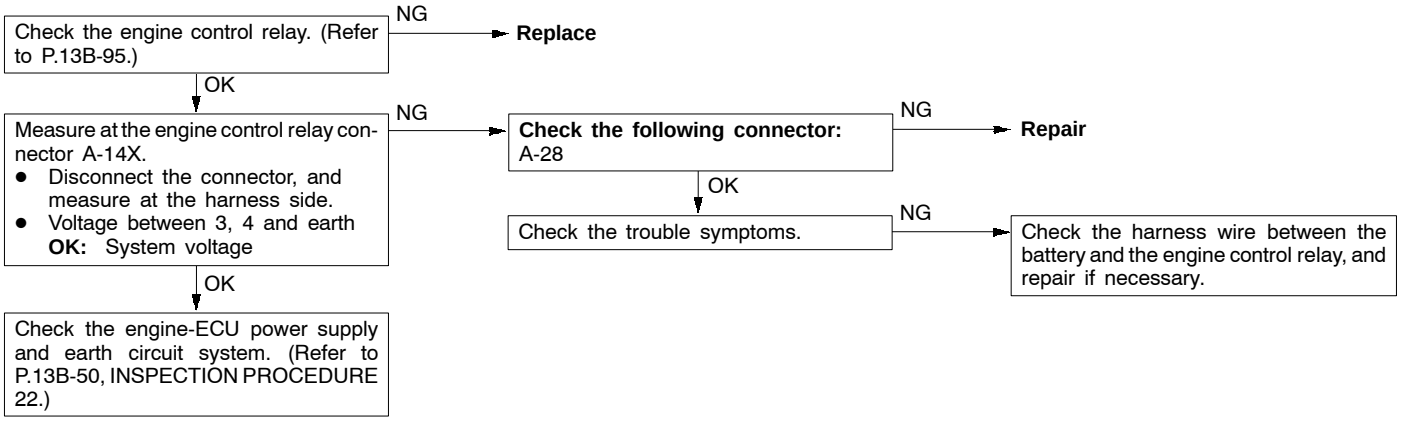
INSPECTION PROCEDURE 22

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



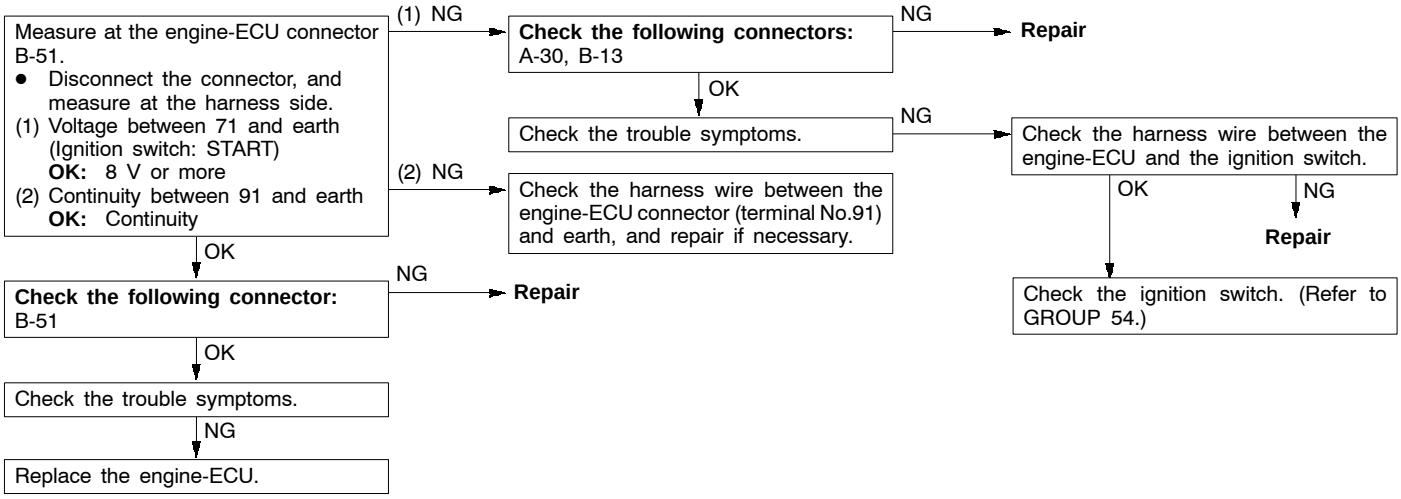
INSPECTION PROCEDURE 23

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



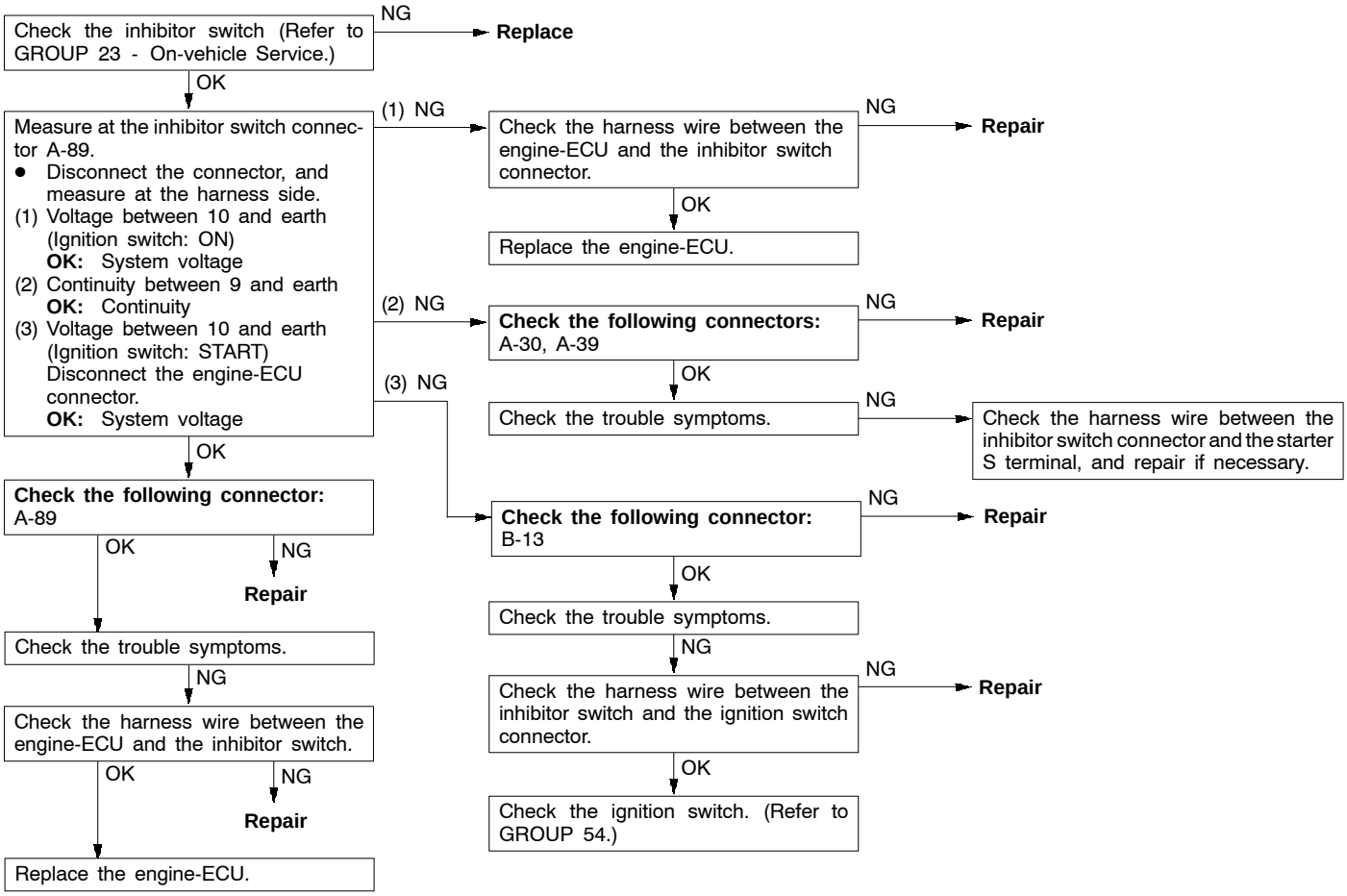
INSPECTION PROCEDURE 24

Ignition switch-ST system <M/T>	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



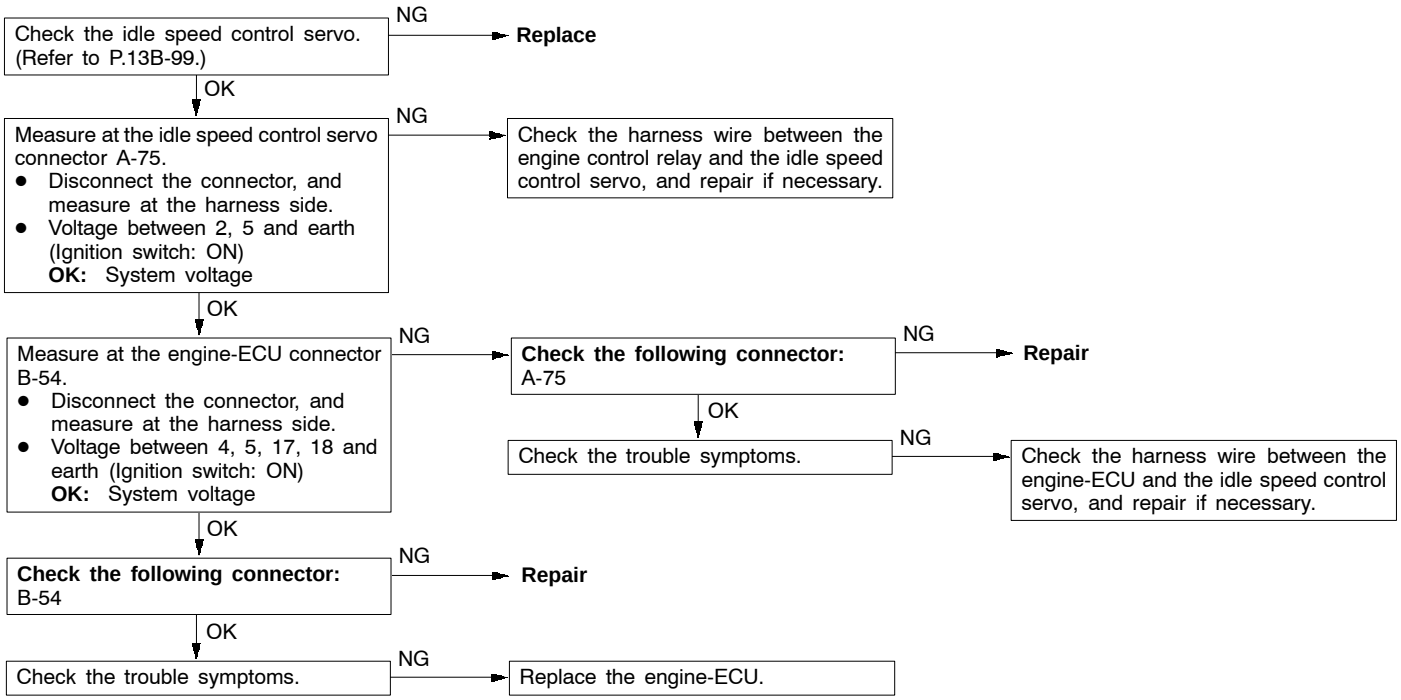
INSPECTION PROCEDURE 25

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking, and the engine-ECU uses this signal to carry out functions such as fuel injection control during starting. The inhibitor switch inputs the position of the selector lever to the engine-ECU. The engine-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 ignition switch and inhibitor switch • Malfunction of the engine-ECU



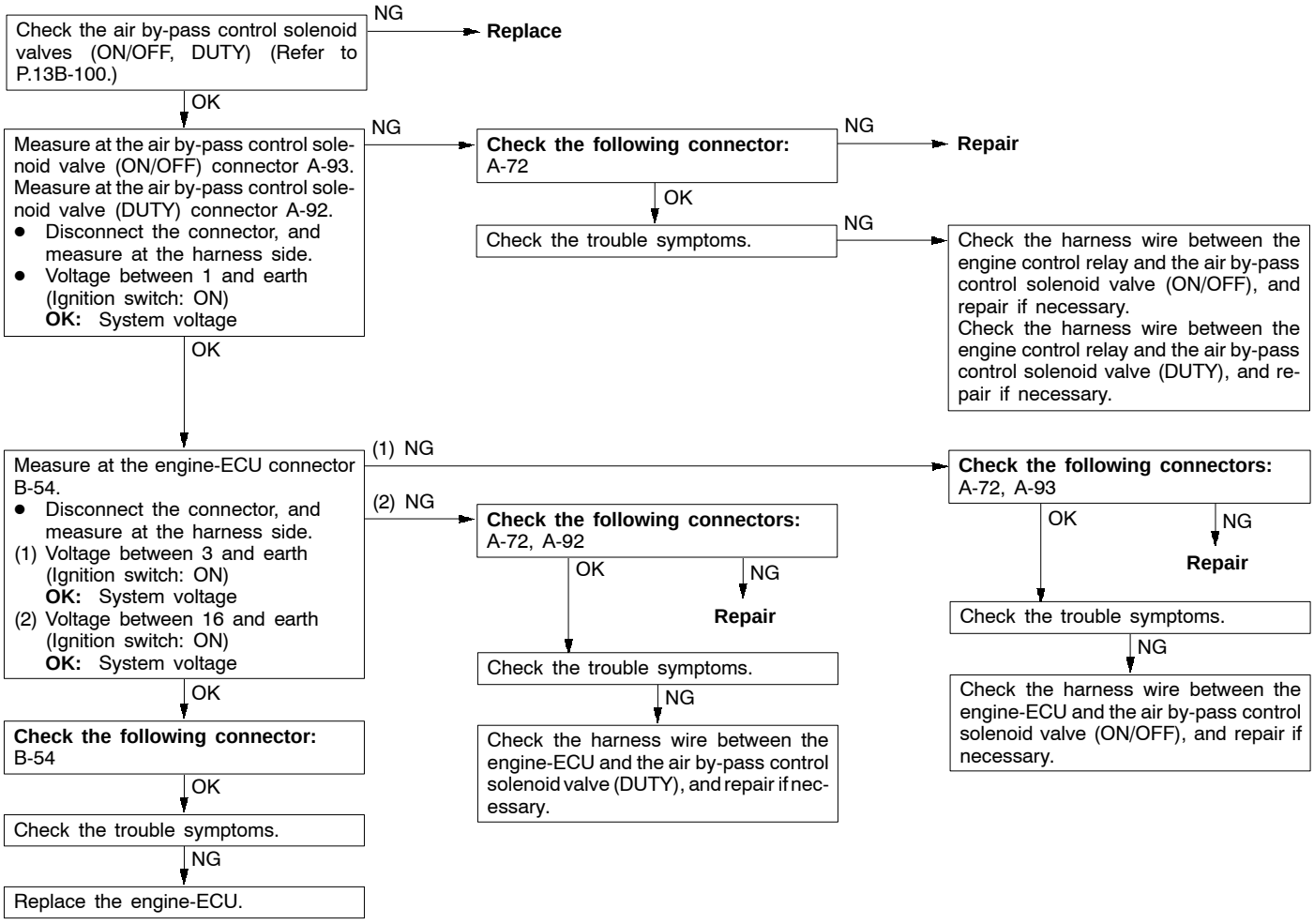
INSPECTION PROCEDURE 26

Idle speed control servo (ISC) system	Probable cause
The engine-ECU controls the amount of intake air during idling by opening and closing the servo valve which is located in the air by-pass passage.	• Malfunction of the idle speed control servo • Open circuit or short-circuited harness wire in the idle speed control servo circuit • Malfunction of the engine-ECU



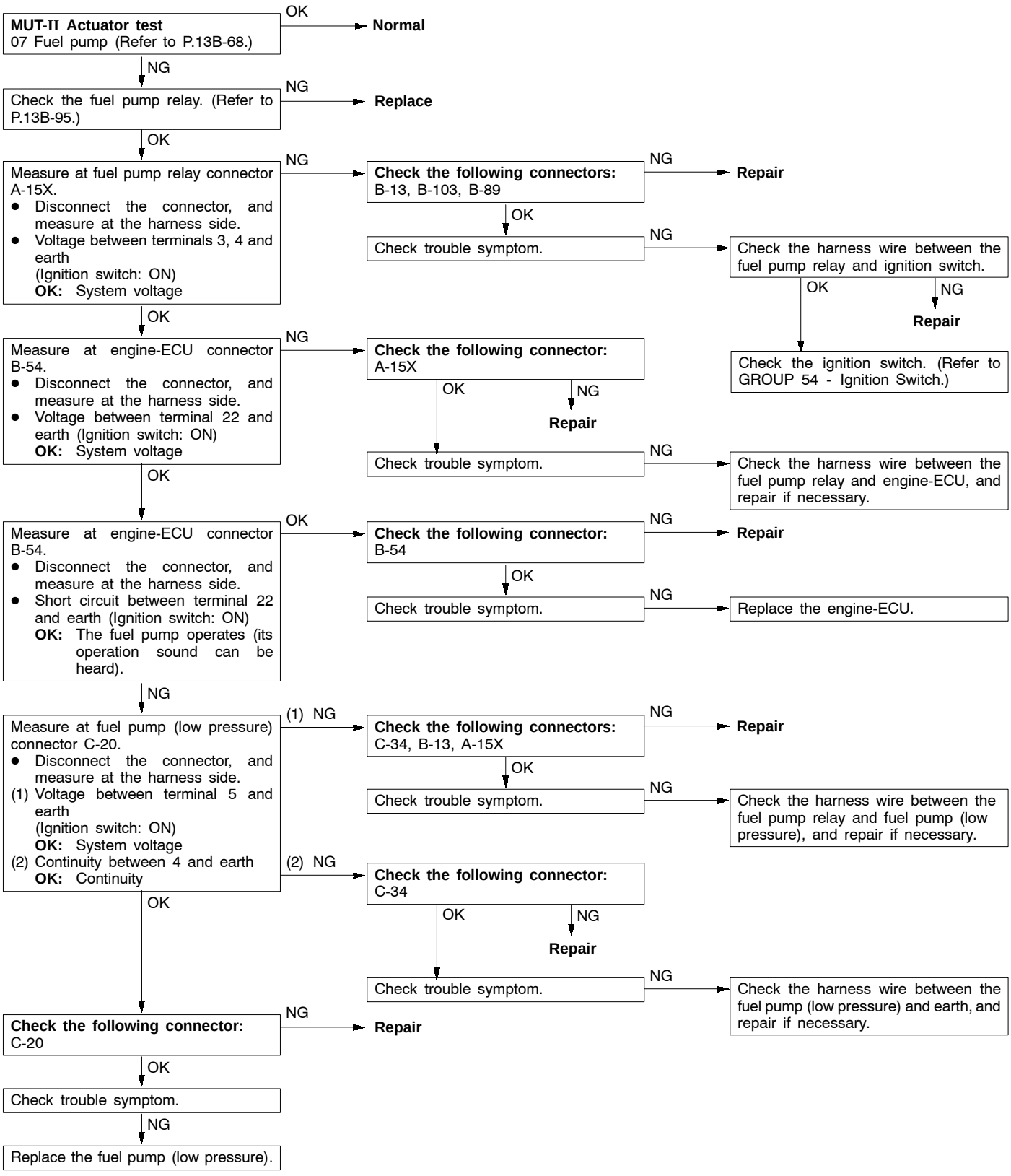
INSPECTION PROCEDURE 27

Air by-pass control solenoid valve system	Probable cause
The engine-ECU controls the two ON/OFF and DUTY solenoid valves in order to adjust the by-pass air amount.	• Malfunction of the air by-pass control solenoid valves (ON/OFF, DUTY) • Open circuit or short-circuited harness wire in the air by-pass control solenoid valves (ON/OFF, DUTY) • Malfunction of the engine-ECU



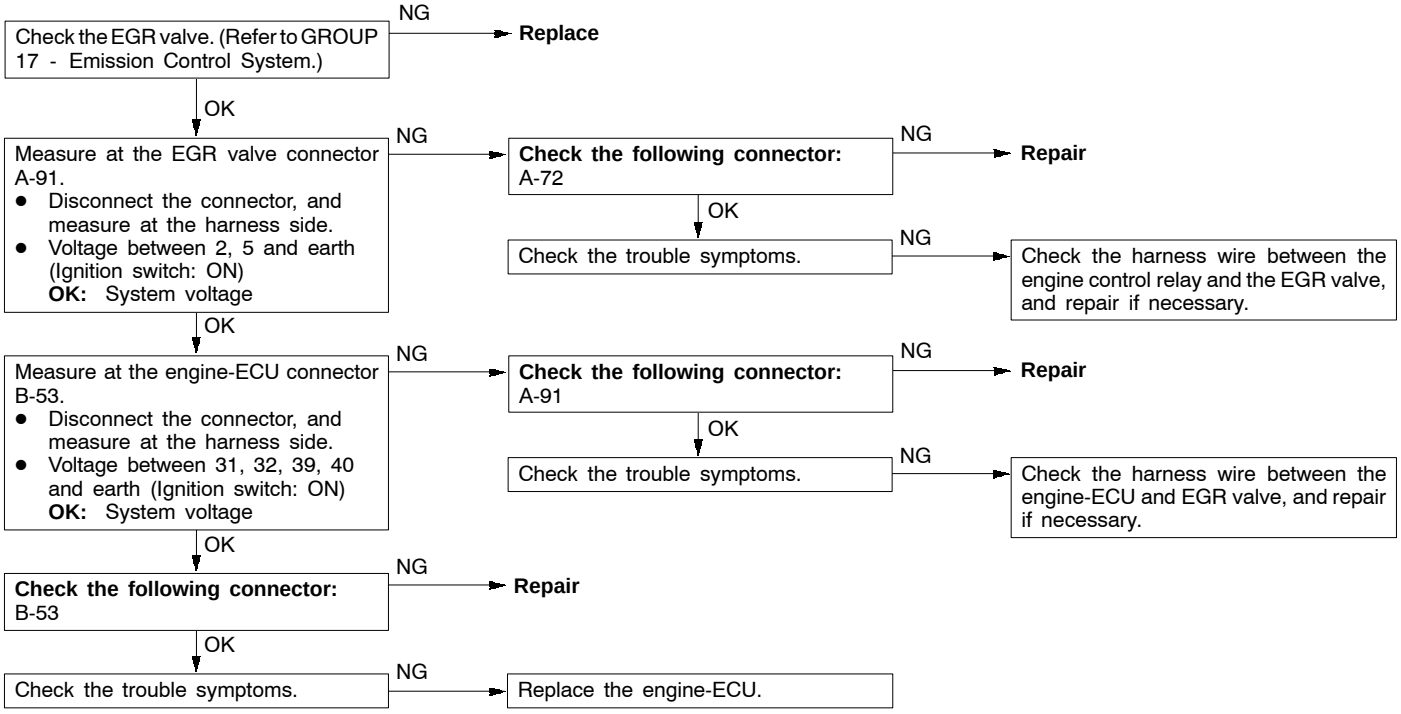
INSPECTION PROCEDURE 28

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



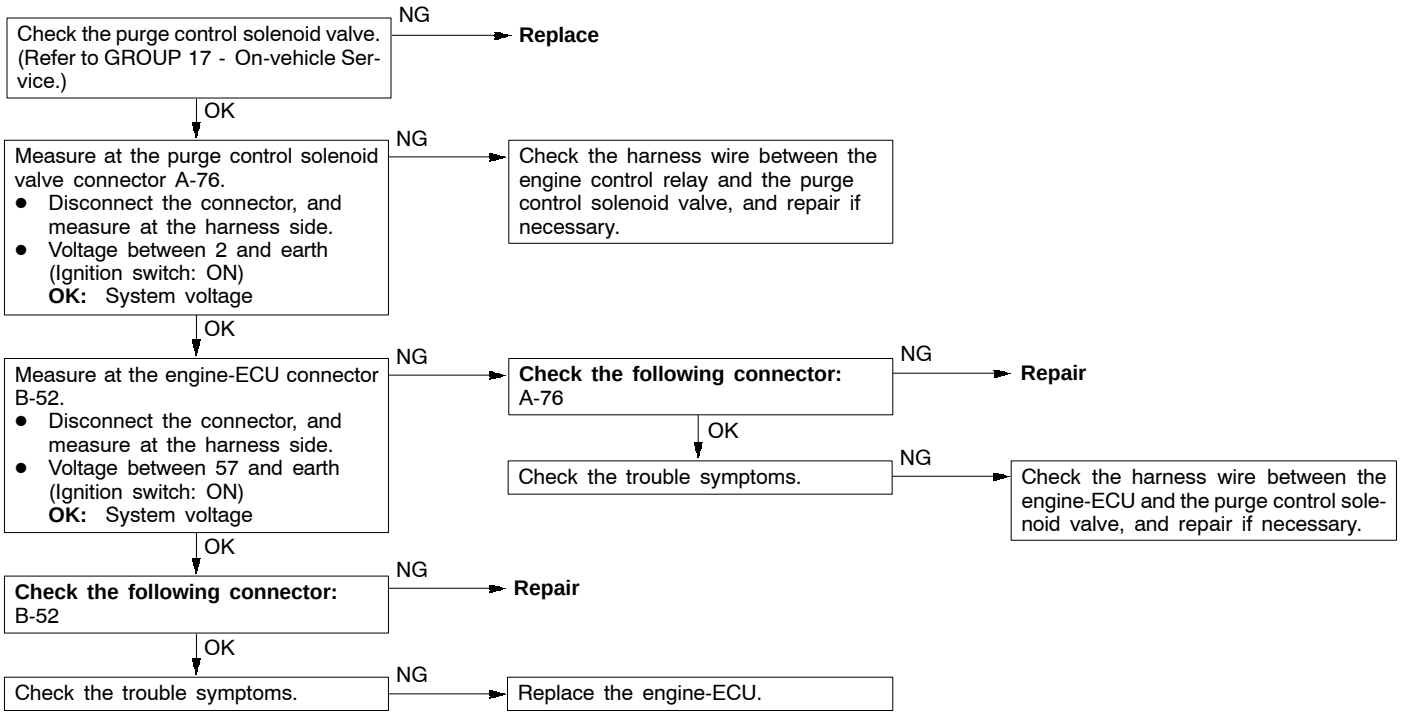
INSPECTION PROCEDURE 29

EGR valve (stepper motor) system	Probable cause
The engine-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-ECU



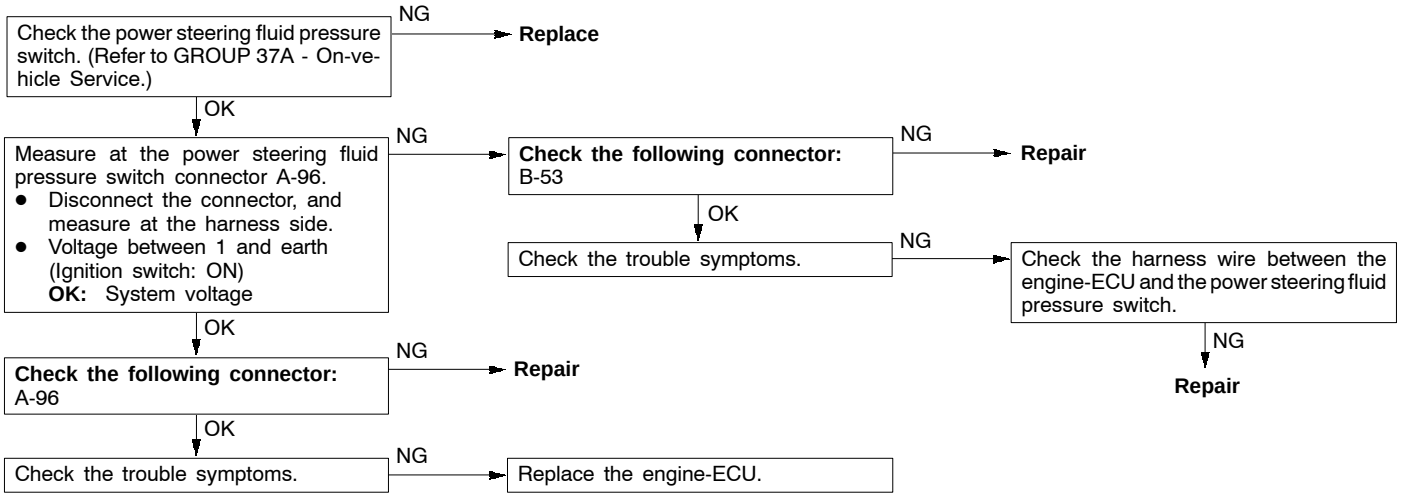
INSPECTION PROCEDURE 30

Purge control solenoid valve system	Probable cause
The engine-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-ECU



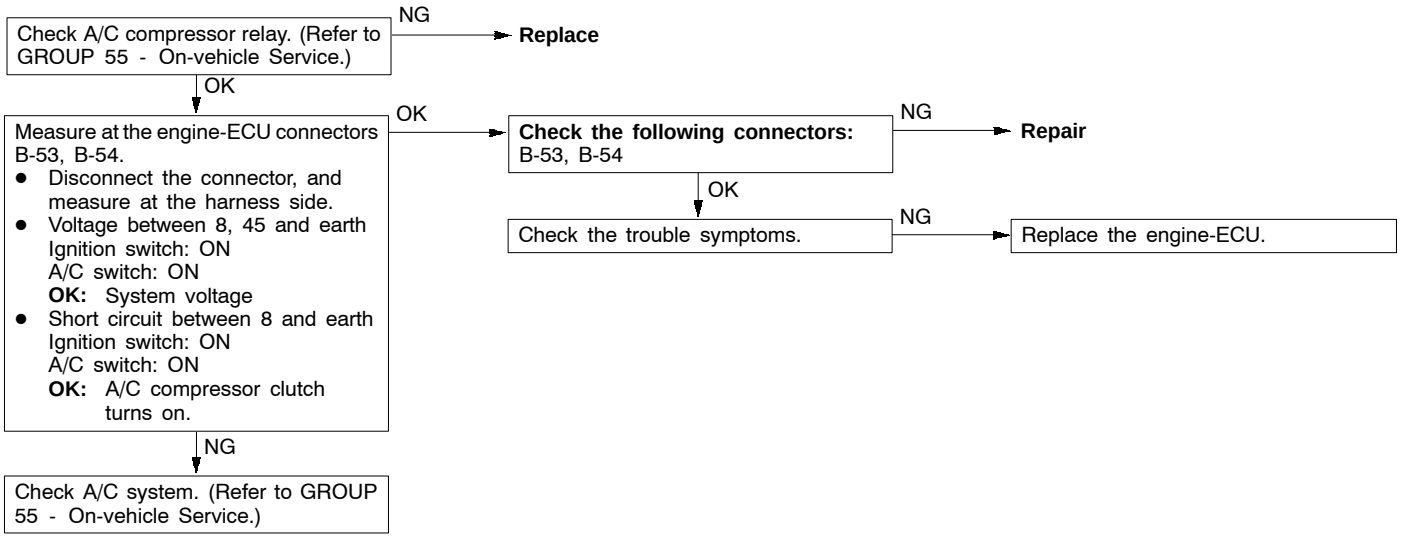
INSPECTION PROCEDURE 31

Power steering fluid pressure switch system	Probable cause
This switch inputs the amount of power steering load to the engine-ECU. The engine-ECU uses this input to control the idle speed control servo so that the idle speed is increased when the power steering is operating.	• Malfunction of the power steering fluid pressure switch • Open circuit or short-circuited harness wire in the power steering fluid pressure switch circuit • Malfunction of the engine-ECU



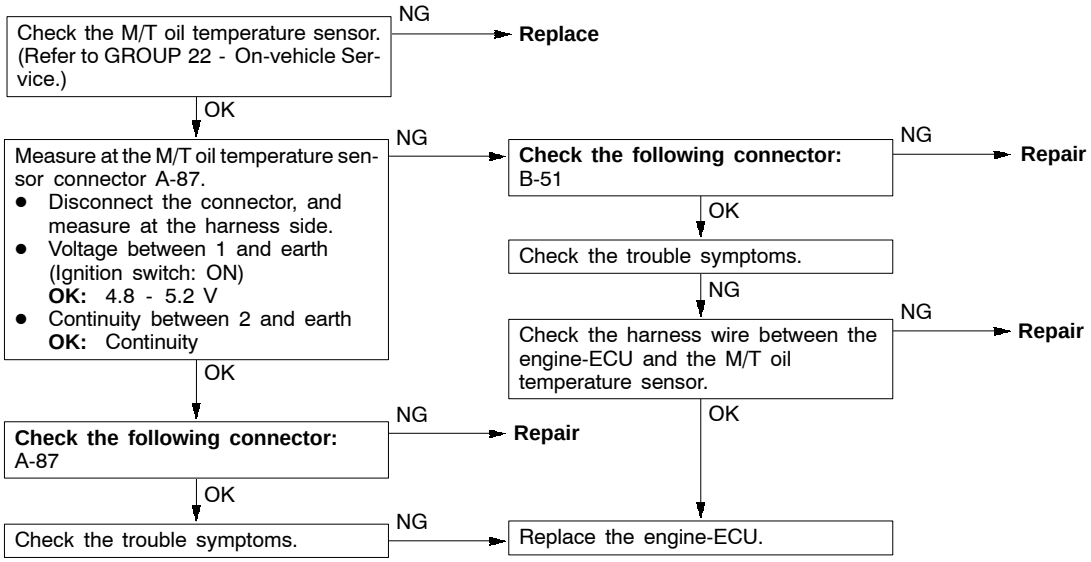
INSPECTION PROCEDURE 32

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-ECU, the engine-ECU controls the idle speed control servo to increase the idle speed, and also operates the A/C compressor magnetic clutch.	• 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 • Malfunction of the engine-ECU



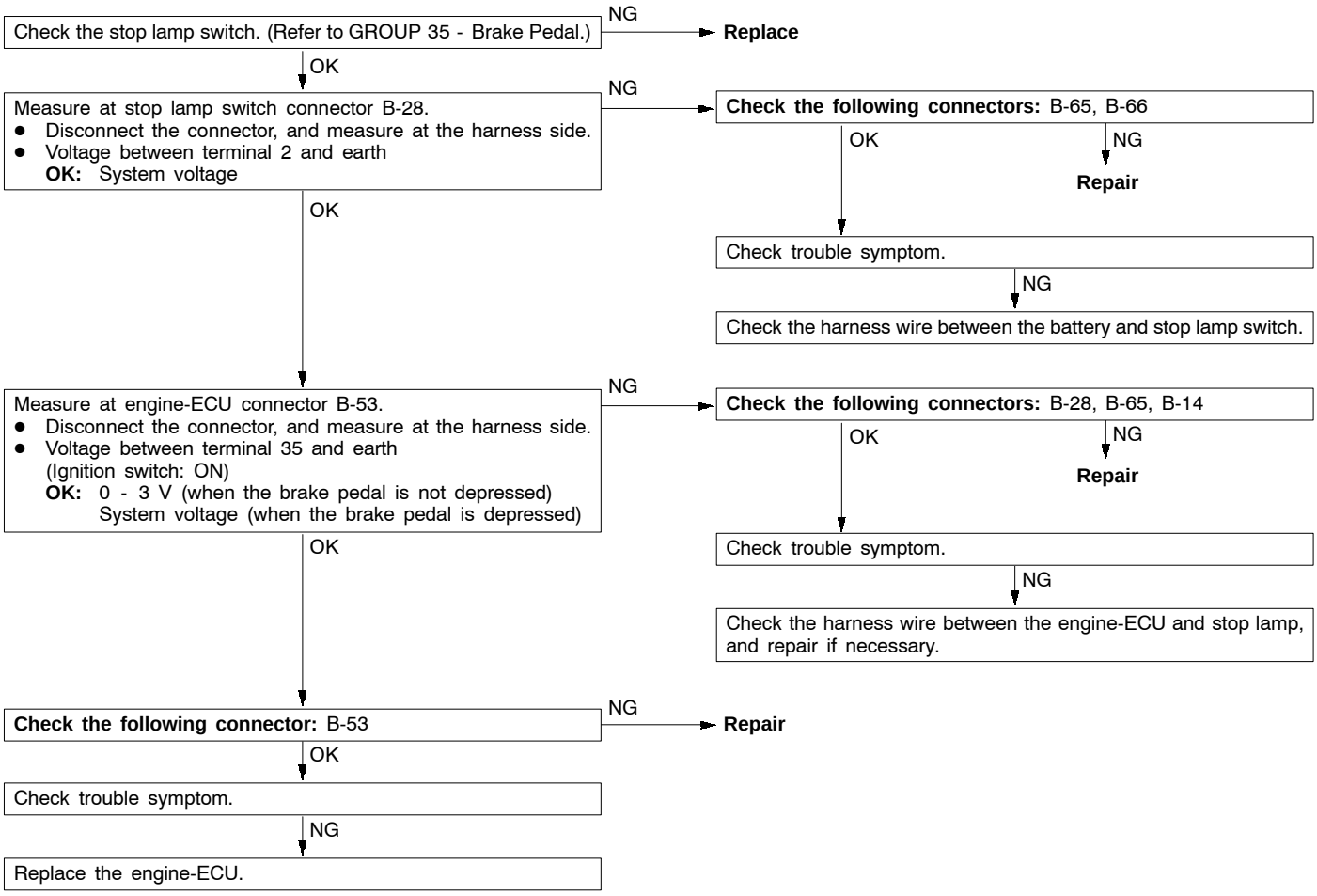
INSPECTION PROCEDURE 33

M/T oil temperature sensor system	Probable cause
This sensor inputs the manual transmission oil temperature to the engine-ECU. The engine-ECU uses this input to control the idle speed control servo so that the idle speed is increased when the manual transmission oil temperature becomes low.	• Malfunction of the M/T oil temperature sensor • Open circuit or short-circuited harness wire in the M/T oil temperature sensor circuit • Malfunction of the engine-ECU



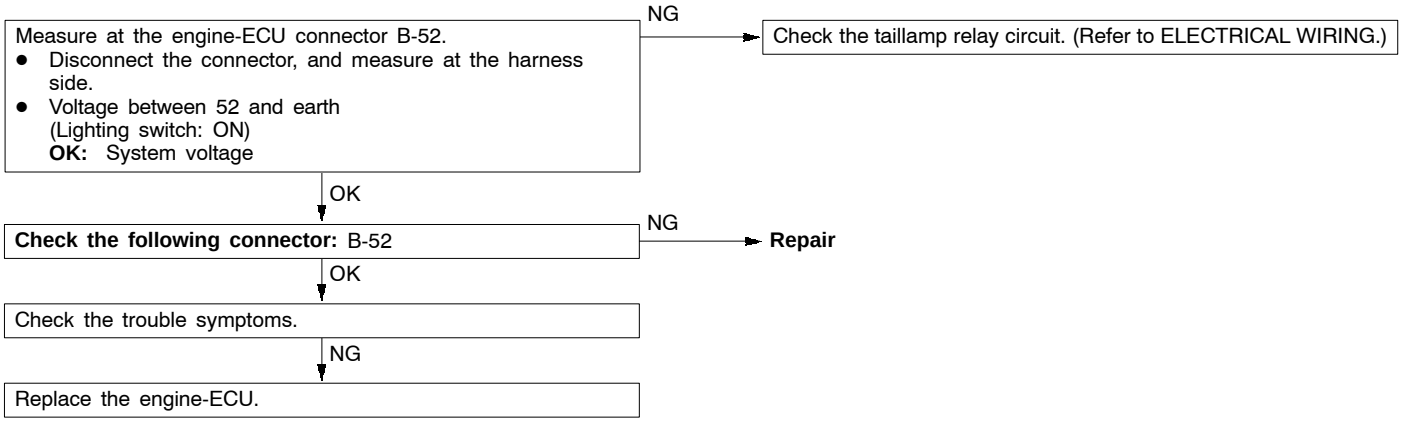
INSPECTION PROCEDURE 34

Stop lamp switch system	Probable cause
This switch inputs the brake pedal depression amount to the engine-ECU. The engine-ECU uses this input to detect brake operation in order to switch the fuel injection mode.	• Malfunction of the stop lamp switch • Open circuit or short-circuited harness wire in the stop lamp switch circuit • Malfunction of the engine-ECU



INSPECTION PROCEDURE 35

Small lamp switch	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



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. In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10% higher than the standard frequency.
*2. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
*3. In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	Engine: After having warmed up	Engine is idling (within 4 minutes after engine start)	0 mV	Code No.11	13B-12
			When engine is suddenly raced	600 - 1,000 mV		
			2,500 r/min	0 mV and 600 - 1,000 mV alternates.		
12	Air flow sensor*1	● Engine coolant temperature: 80 - 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Engine is idling	20 - 55 Hz	-	-
			2,500 r/min	65 - 85 Hz		
			Engine is raced	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	13B-15
			When intake air temperature is 0°C	0°C		
			When intake air temperature is 20°C	20°C		
			When intake air temperature is 40°C	40°C		
			When intake air temperature is 80°C	80°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor	Ignition switch: ON	Release the accelerator pedal.	535 - 735 mV	Code No. 14	13B-15
			Depress the accelerator pedal gradually.	Increases in proportion to throttle opening angle		
			Depress the accelerator pedal fully.	4,500 - 5,500 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 22	13B-50
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 24 <M/T> Procedure No. 25 <A/T>	13B-51 <M/T> 13B-52 <A/T>
			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	13B-16
			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		
			When engine coolant temperature is 80°C	80°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	● Engine: Cranking ● Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. 22	13B-17
		● Engine: Idling ● Idle position switch: ON	When engine coolant temperature is -20°C	1,200 - 1,400 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 - 850 r/min		
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25	13B-20
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 31	13B-58
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (when A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 32	13B-58
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 25	13B-52
			D, 2, L or R	D, 2, L or R		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.35	13B-61
			Lighting switch: ON	ON		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No.12	13B-13
			3,000 r/min	OFF		
37	Volumetric efficiency	● Engine coolant temperature: 80 - 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Engine is idling	15 - 35%	-	-
			2,500 r/min	15 - 35%		
			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.	-	-
41	Injectors	● Engine: Idling ● Transmission: Neutral (A/T: P range)	When engine coolant temperature is 0°C	0.9 - 1.1 ms	-	-
			When engine coolant temperature is 20°C	0.8 - 1.0 ms		
			When engine coolant temperature is 50°C	0.7 - 0.9 ms		
			When engine coolant temperature is 80°C	0.5 - 0.7 ms		
	Injectors*2	● Engine coolant temperature: 80–95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T : P range)	Engine is idling (within 4 minutes after engine start)	0.5 - 0.7 ms	-	-
			2,500 r/min	0.6 - 0.8 ms		
			When engine is suddenly raced	Increases		
44	Ignition coils and power transistors	● Engine: After having warmed up ● Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	12 - 20°BTDC	-	-
			2,500 r/min	20 - 40°BTDC		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
45	ISC (stepper) motor position *3	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T : P range) • Engine: Idling • When A/C switch is ON, A/C compressor should be operating	A/C switch: OFF	10 - 55 STEP	-	-
			A/C switch: OFF → ON	Increases by 15 - 55 steps		
			• A/C switch: OFF • Select lever: N range → D range	Increases by 10 - 40 steps		
48	M/T oil temperature sensor	Drive after the engine has warmed up.	Drive for 15 minutes or more.	Gradually increases to 50° - 90°C.	Procedure No. 33	13B-59
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 32	13B-58
			A/C switch: ON	ON (Compressor clutch is operating)		
66	Brake vacuum sensor	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	When the engine is running at idle, stop the engine, and then turn the ignition switch to ON and depress the brake pedal several times.	Displayed pressure increases.	Code No. 66	13B-28
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No. 34	13B-60
			Brake pedal: Released	ON		
68	EGR valve	• Engine coolant temperature: 80 - 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	5 - 15 STEP	Procedure No. 29	13B-56
			2,500 r/min	0 - 5 STEP		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
74	Fuel pressure sensor	● Engine coolant temperature: 80 - 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Engine; Idling	4 - 7 MPa	Code No. 56	13B-24
99	Fuel injection mode	Engine: After warmed-up	Engine: Idling (several minutes after engine starts)	Lean compression	-	-
			2,500 r/min	Stoichiometric feedback		
			When engine is idling and then suddenly raced	Open-loop		

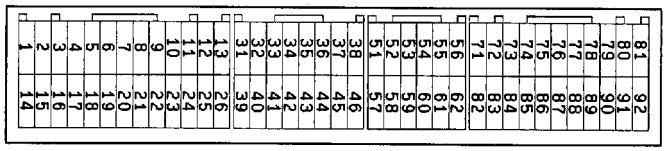
ACTUATOR TEST REFERENCE TABLE

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. 41	13B-22
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 28	13B-55
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. 30	13B-57
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Idling after engine warm up	5°BTDC	-	-
18	Air by-pass control solenoid valve (ON/OFF)	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Procedure No. 27	13B-54
21	Fan controller	Drive the fan motor	Ignition switch: ON	Fan motor operates at low speed.	Procedure No.21	13B-49
30	SAS adjustment mode	Set the engine-ECU to SAS adjustment mode	Engine: Idling	Idle speed control (ISC) servo is fixed at step 6.	-	-
32	Air by-pass control solenoid valve (DUTY)	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Procedure No. 27	13B-54

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



9FU0393

Terminal No.	Check item	Check condition (Engine condition)	Normal condition
1	No.1 injector	Engine: Warm up the engine, and then depress the accelerator pedal suddenly from the idle speed.	Decreases slightly for short time from 9 - 13 V.
14	No.2 injector		
2	No.3 injector		
15	No.4 injector		
3	Air by-pass control solenoid valve (ON/OFF)	Engine: Idling after having warmed up	System voltage
		Engine: 2,500 r/min	System voltage
16	Air by-pass control solenoid valve (DUTY)	Engine: Idling after having warmed up	System voltage
		Engine: 2,500 r/min	System voltage
4	Idle speed control servo (A)	Engine: Immediately after the warm engine has been started	System voltage ↔ 0 - 0.5 V (changes repeatedly)
17	Idle speed control servo (B)		
5	Idle speed control servo (C)		
18	Idle speed control servo (D)		
8	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
10	No.1 ignition coil	Engine: 3,000 r/min	0.1 - 2.0 V
11	No.2 ignition coil		
23	No.3 ignition coil		
24	No.4 ignition coil		
12	Power supply	Ignition switch: ON	System voltage
25			

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
19	Air flow sensor reset signal	Engine: Idling		0 - 0.1 V
		Engine: 3,000 r/min		6 - 9 V
90	Air flow sensor	Engine: Idling		2.2 - 3.2 V
		Engine: 2,500 r/min		
20	Injector driver control relay	Ignition switch: OFF		0 - 0.1 V
		Ignition switch: ON		0.5 - 1 V
21	Fan controller	Radiator fan is not operating (Engine coolant temperature is 80°C or less)		0 - 0.1 V
		Radiator fan is operating (Engine coolant temperature is 80°C or more)		1 V
22	Fuel pump relay	Ignition switch: ON	Engine: Stopped	System voltage
			Engine: Idling	0 - 3 V
39	EGR valve (A)	Ignition switch: Immediately after turning ON		5 - 8 V (fluctuates for approx. three seconds)
40	EGR valve (B)			
31	EGR valve (C)			
32	EGR valve (D)			
33	Alternator G terminal	Engine: Idling after having warmed up Radiator fan: Not operating Headlamp: OFF → ON Stop lamp: OFF → ON Rear defogger switch: OFF → ON		Voltage increases by 0.2 - 3.5 V
41	Alternator FR terminal	Engine: Idling after having warmed up Radiator fan: Not operating Headlamp: OFF → ON Stop lamp: OFF → ON Rear defogger switch: OFF → ON		Voltage decreases
35	Stop lamp switch	Brake pedal: Depressed		System voltage
		Brake pedal: Released		0 - 0.1 V
36	Engine warning lamp	Ignition switch: OFF → ON		0 - 3 V → System voltage (after several seconds have passed)
37	Power steering fluid pressure switch	Engine: Idling after having warmed up	Steering wheel: Neutral position	System voltage
			Steering wheel: Turned	0 - 3 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
38	Engine control relay	Ignition switch: OFF		0 - 3 V
		Ignition switch: ON		System voltage
42	Brake vacuum sensor	When the engine is running at idle, stop the engine, and then turn the ignition switch to ON and depress the brake pedal several times.		Voltage increases
45	A/C switch 1	Engine: Idling	A/C switch: OFF	0 - 3 V
			A/C switch: ON (Compressor is operating)	System voltage
51	Injector open circuit check signal	Engine: Increase engine speed from idle speed to 4,000 r/min.		Decreases slightly (approx.0.7 V) from 4.5 V - 5.0 V.
52	Small lamp switch	Engine: Idling	Lighting switch: OFF	0 - 3 V
			Lighting switch: ON	System voltage
57	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 to 3,500 r/min.	Voltage decreases.
58	Tachometer	Engine: 3,000 r/min		0.3 - 3.0 V
60	Oxygen sensor heater control	Engine: Idling		0 - 3 V
		Engine: 5,000 r/min		System voltage
76	Oxygen sensor	Engine: Running at 2,500 r/min after having warmed up		0 ↔ 1 V (changes repeatedly)
71	Ignition switch-ST	Engine: Cranking		8 V or more

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
72	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 - 2.0 V
			Intake air temperature: 80°C	0.4 - 1.0 V
73	A/C switch 2	Refer to GROUP 55 - Troubleshooting "Check at the A/C-ECU terminal, engine-ECU output terminals."		
74	Fuel pressure sensor	Engine: Idling		0.3 - 4.7 V
75	M/T oil temperature sensor	M/T oil temperature: 25°C		2.4 - 2.7 V
		M/T oil temperature: 80°C		0.5 - 0.8 V
77	Sensor power supply (5 V)	Ignition switch: ON		4.5 - 5.5 V
81				
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	3.2 - 3.8 V
			Engine coolant temperature: 20°C	2.3 - 2.9 V
			Engine coolant temperature: 40°C	1.3 - 1.9 V
			Engine coolant temperature: 80°C	0.3 - 0.9 V
84	Throttle position sensor	Ignition switch: ON	Release the accelerator pedal.	0.535 - 0.735 V
			Depress the accelerator pedal fully.	4.5 - 5.5 V
85	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 - 4.3 V
			Altitude: 1,200 m	3.2 - 3.8 V
86	Vehicle speed sensor	Ignition switch: ON Move the vehicle slowly forward		0 ⇔ 5 V (changes repeatedly)

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
88	Camshaft position sensor	Engine: Cranking		0.4 - 3.0 V
		Engine: Idling		0.5 - 2.0 V
89	Crank angle sensor	Engine: Cranking		0.4 - 4.0 V
		Engine: Idling		1.5 - 2.5 V
91	Inhibitor switch	Ignition switch: ON	Selector lever position: N or P	0 - 3 V
			Selector lever position: Except N and P	System voltage

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

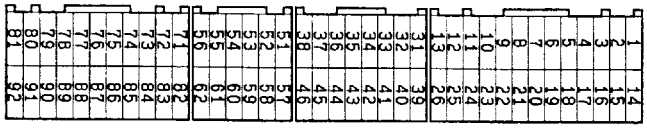
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   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



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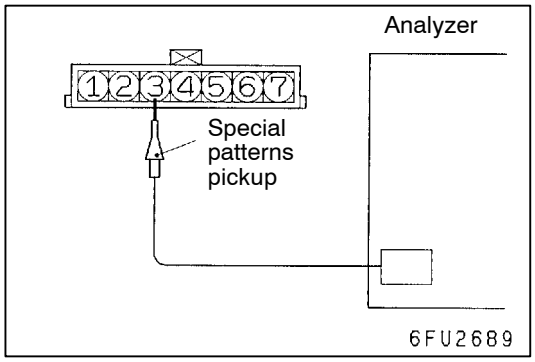
Terminal No.	Check item	Standard value, normal value (Check condition)
3 - 12	Air by-pass control solenoid valve (ON/OFF)	8 - 11 Ω (At 20°C)
16 - 12	Air by-pass control solenoid valve (DUTY)	8 - 11 Ω (At 20°C)
4 - 12	Idle speed control servo (A)	28 - 33 Ω (At 20°C)
17 - 12	Idle speed control servo (B)	
5 - 12	Idle speed control servo (C)	
18 - 12	Idle speed control servo (D)	
13 - Body earth	Engine-ECU earth	Continuity (0 Ω)
26 - Body earth	Engine-ECU earth	
39 - 12	EGR valve (A)	15 - 20 Ω (At 20°C)
40 - 12	EGR valve (B)	
31 - 12	EGR valve (C)	
32 - 12	EGR valve (D)	
57 - 12	Purge control solenoid valve	36 - 44 Ω (At 20°C)
60 - 12	Oxygen sensor heater	11 - 18 Ω (At 20°C)
72 - 92	Intake air temperature sensor	5.3 - 6.7 Ω (When intake air temperature is 0°C)
		2.3 - 3.0 Ω (When intake air temperature is 20°C)
		1.0 - 1.5 Ω (When intake air temperature is 40°C)
		0.26 - 0.36 kΩ (When intake air temperature is 80°C)

Terminal No.	Check item	Standard value, normal value (Check condition)
83 - 92	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)
91 - Body earth	Inhibitor switch	Continuity (0 Ω) (When selector lever position is N or P)
		No continuity (When selector lever position is except N and P)



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)

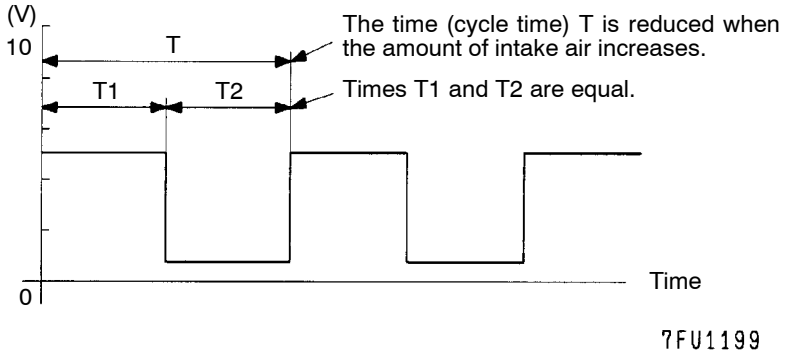
1. Connect the analyzer special patterns pickup to engine-ECU terminal 90.

Standard Wave Pattern

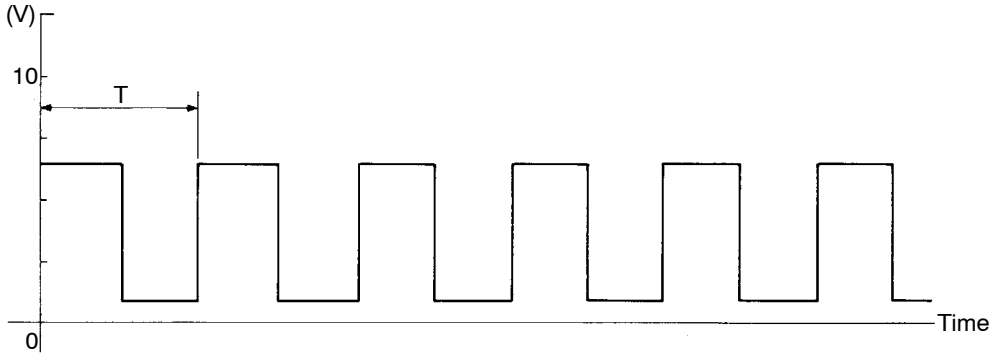
Observation conditions

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

Standard wave pattern

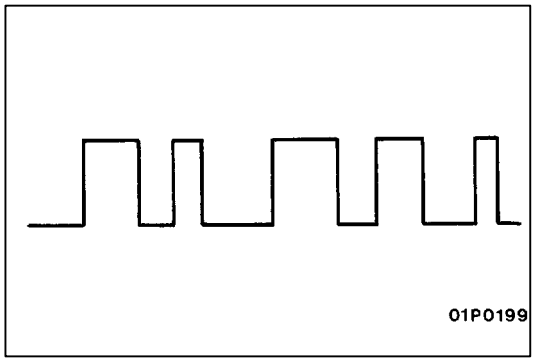


Observation conditions (from conditions above engine speed is increased by racing.)



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.

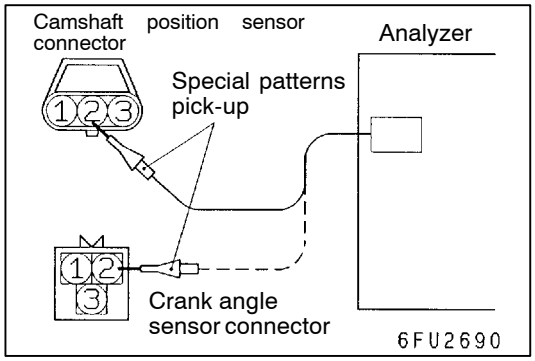
- Example 2

  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)

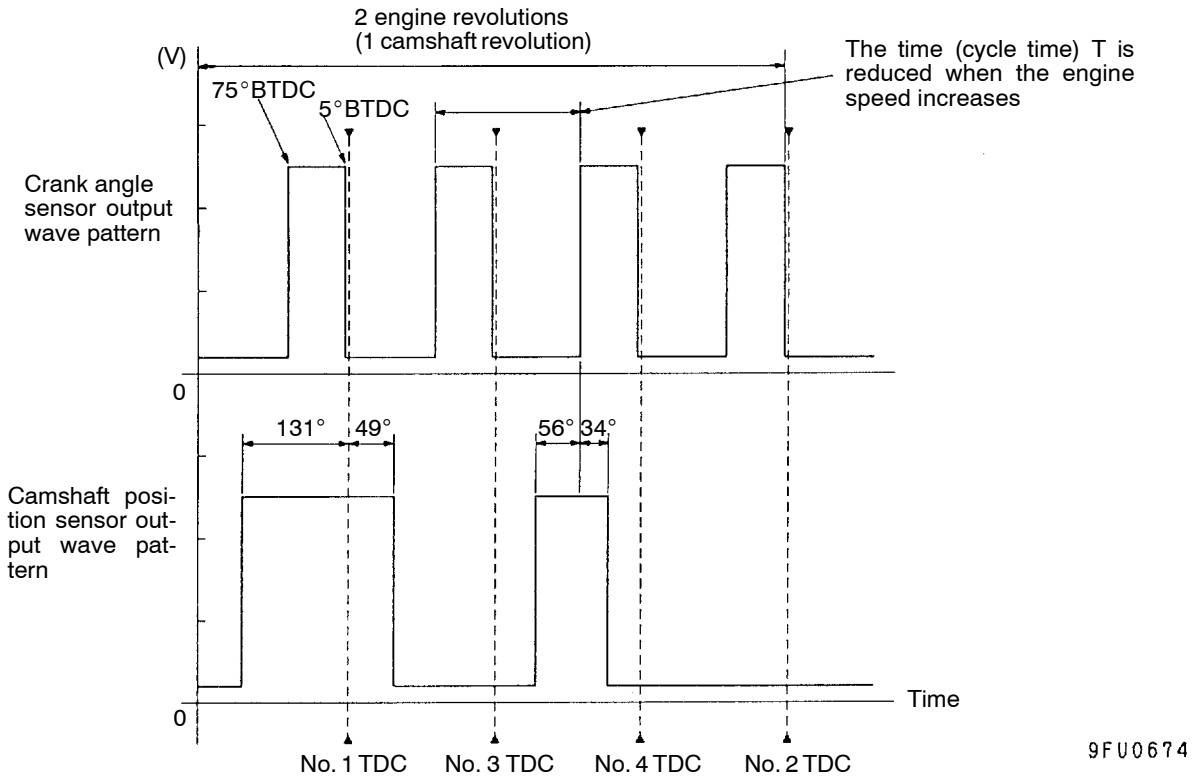
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

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

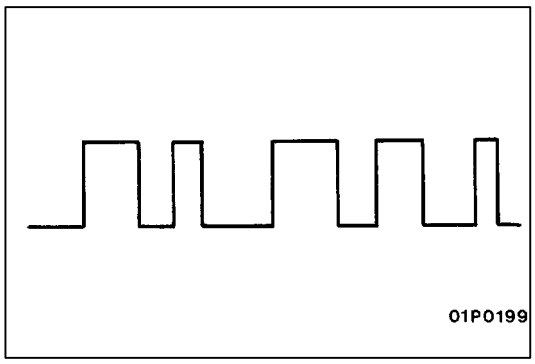
Standard wave pattern



TDC: Top dead centre

Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

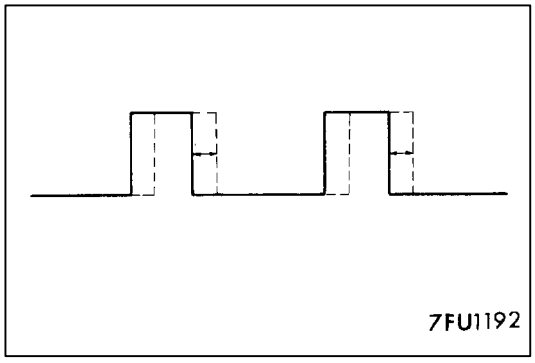
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



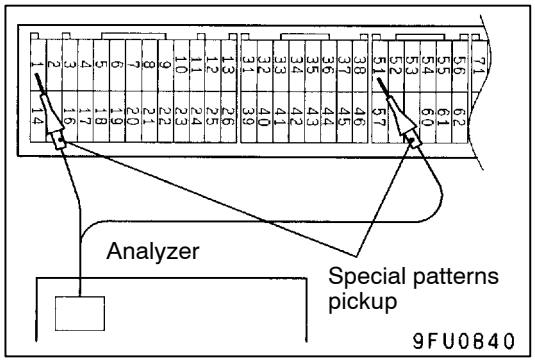
- Example 2

  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

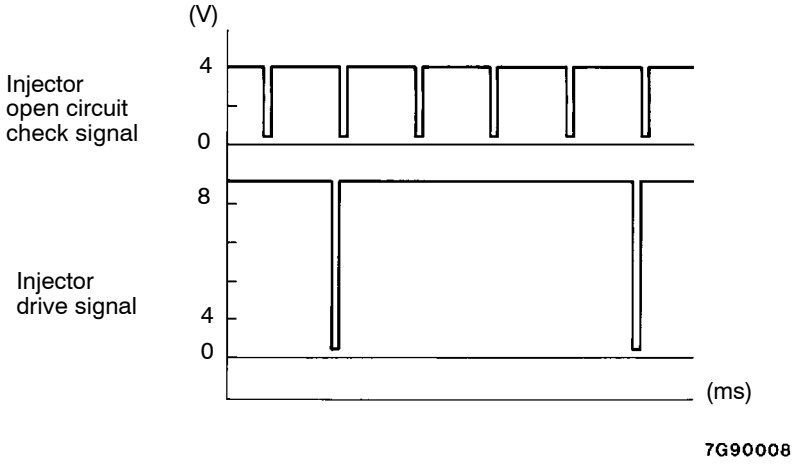
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 51 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 14 (No.2 injector), terminal 2 (No.3 injector) and terminal 15 (No.4 injector).

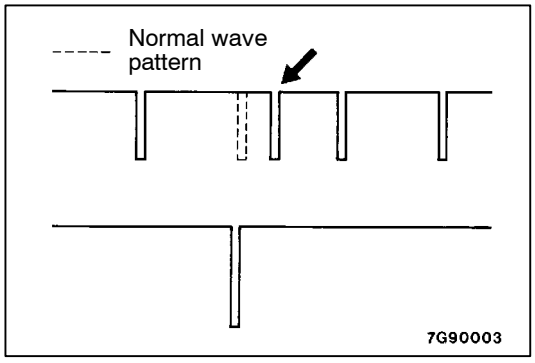
Standard Wave Pattern

Observation conditions

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

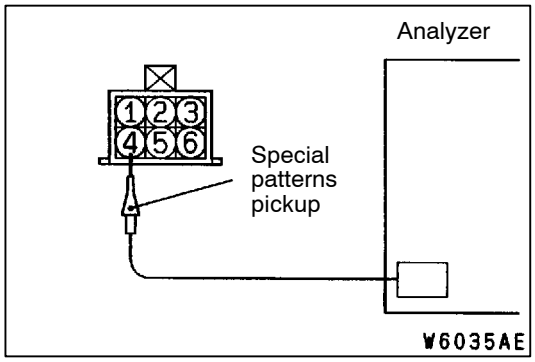
Standard wave pattern





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.



IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR)

Measurement Method

1. Disconnect the ISC servo connector and connect the special tool (test harness: MB991709) in between.
2. Connect the analyzer special patterns pickup to the ISC servo-side connector terminal 1, terminal 3, terminal 4 and terminal 6 respectively.

Alternate Method (Test harness not available)

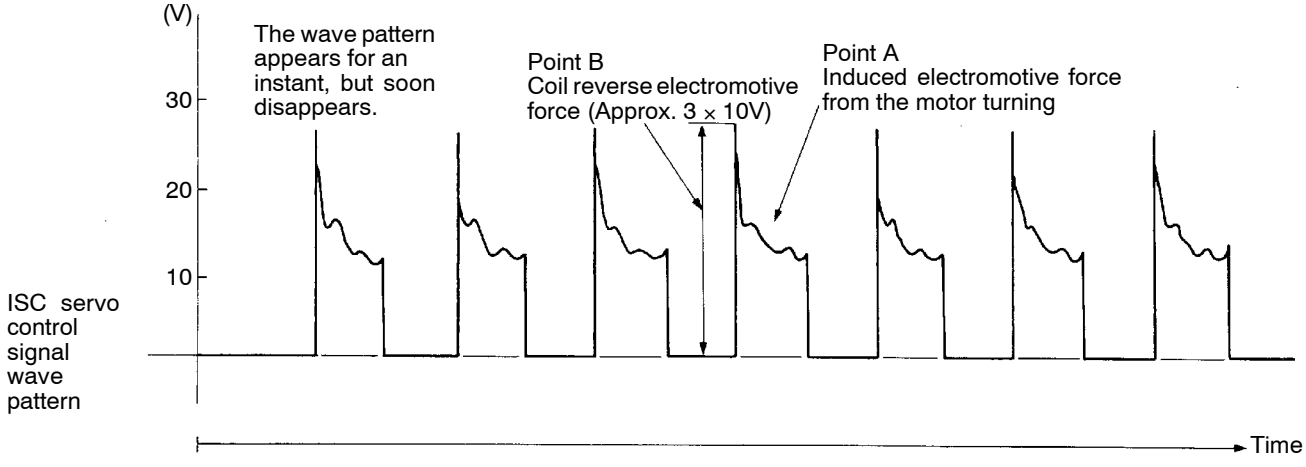
1. Connect the analyzer special patterns pickup to engine-ECU terminal 4, connection terminal 5, connection terminal 17, and connection terminal 18 respectively.

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



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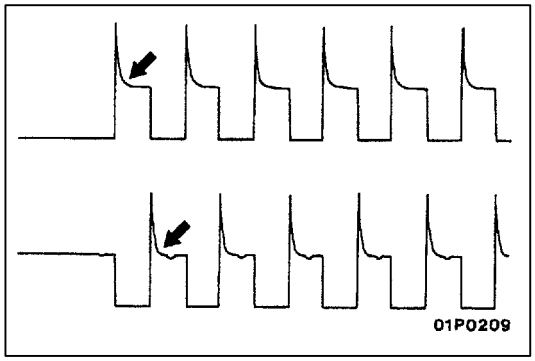
Wave Pattern Observation Points

Check that the standard wave pattern appears when the ISC 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

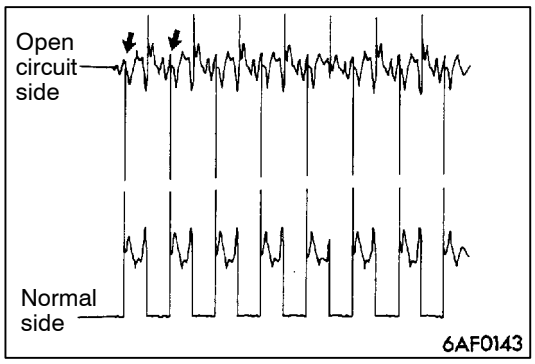
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



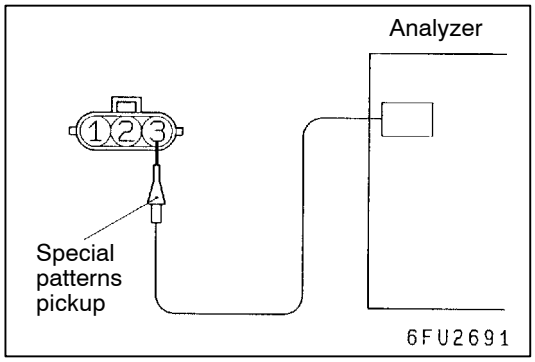
- Example 2

  Cause of problem

  Open circuit in the line between the ISC servo 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.



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)

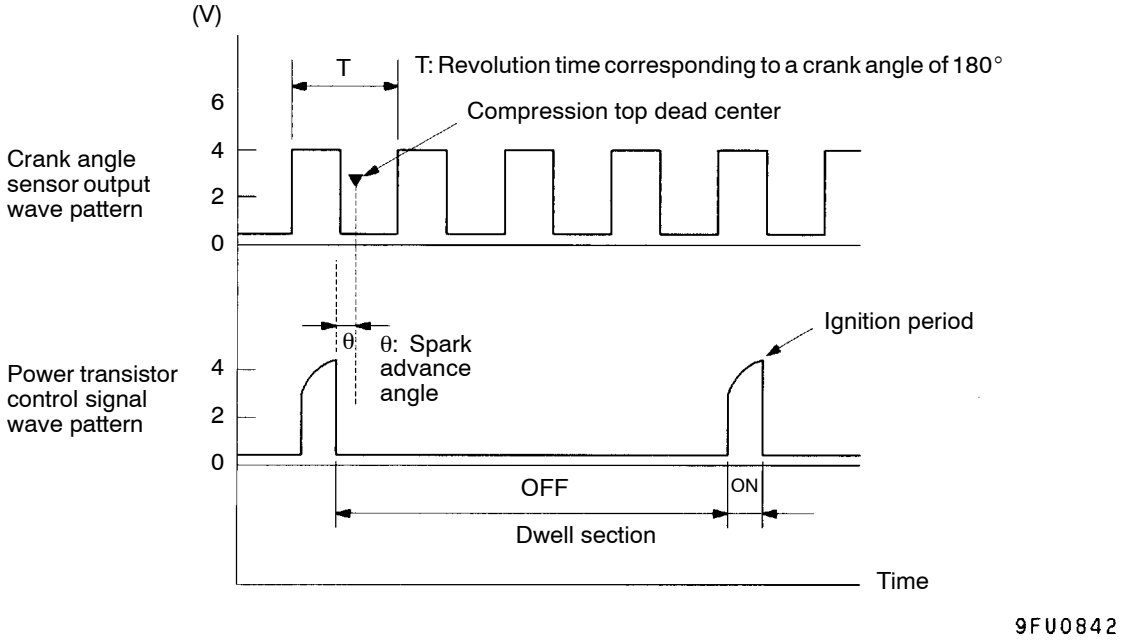
1. Connect the analyzer special patterns pickup to engine-ECU terminal 10 (No. 1 ignition coil), terminal 11 (No. 2 ignition coil), terminal 23 (No. 2 ignition coil), terminal 24 (No. 4 ignition coil) respectively.

Standard Wave Pattern

Observation condition

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

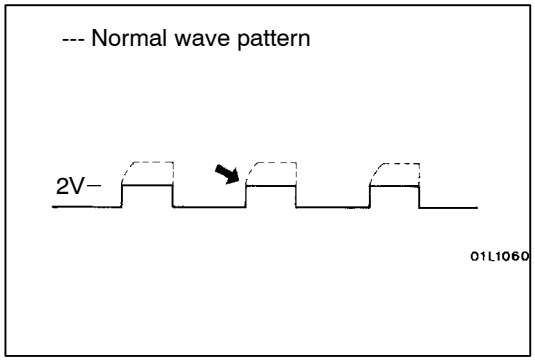
Standard wave pattern

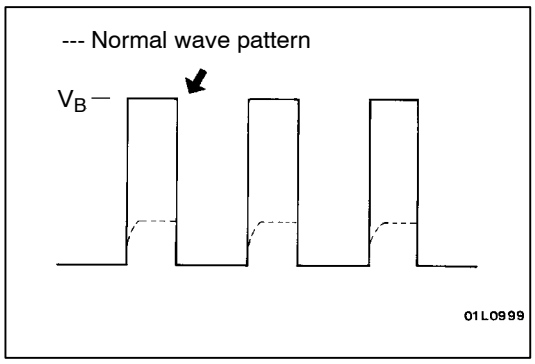


Wave Pattern Observation Points

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

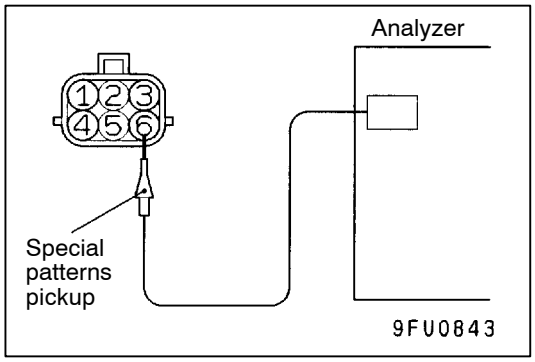
  Wave pattern during engine cranking

  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)

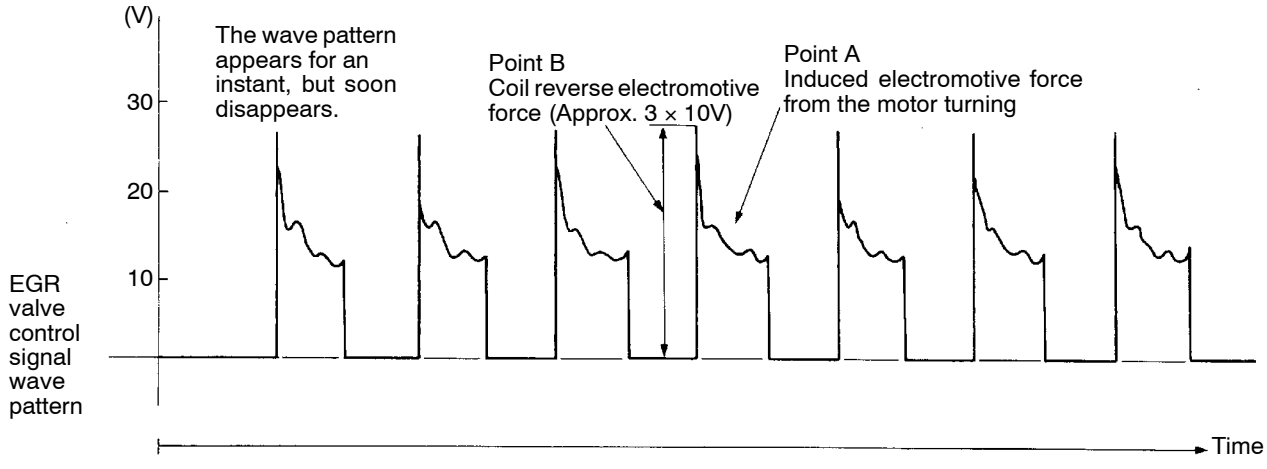
1. Connect the analyzer special patterns pickup to engine-ECU terminal 39, connection terminal 40, connection terminal 31, and connection terminal 32 respectively.

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



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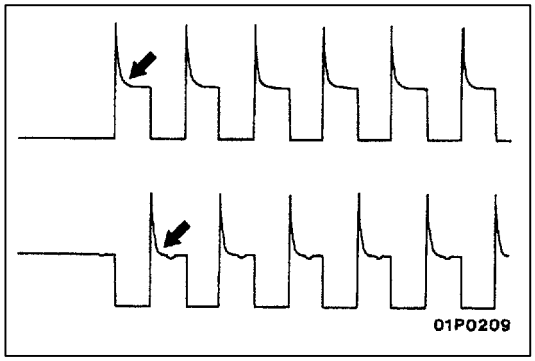
Wave Pattern Observation Points

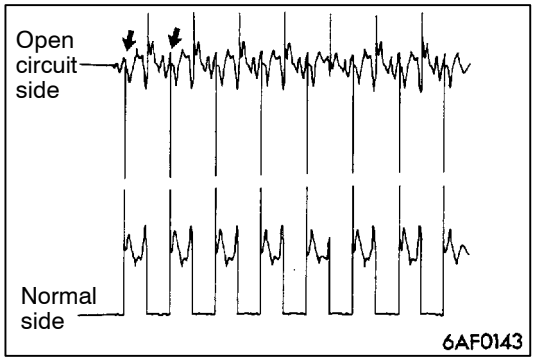
Check that the standard wave pattern appears when the EGR valve is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

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

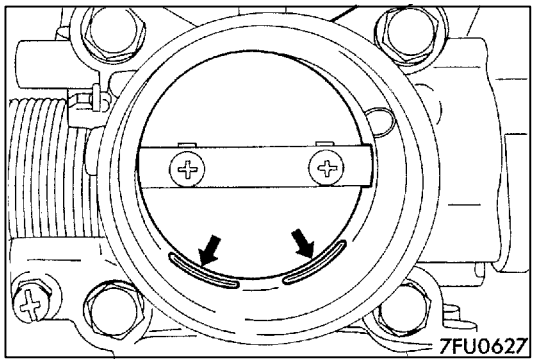
  Wave pattern characteristics

  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.

ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Start the engine and warm it up until the coolant is heated to 80°C or higher and then stop the engine.
2. Remove the air intake hose from the throttle body.



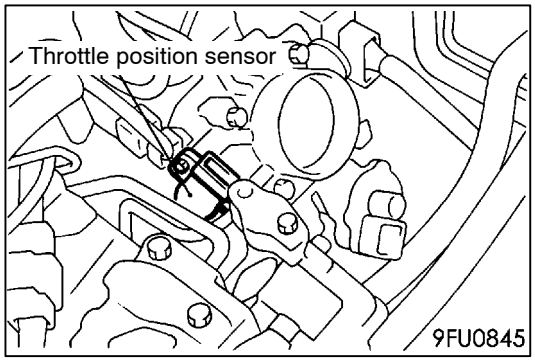
3. Plug the bypass passage inlet of the throttle body.

   Caution
   Do not allow cleaning solvent to enter the bypass passage.

4. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.
5. Start the engine, race it several times and idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
6. If the throttle valve deposits are not removed, repeat steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the air intake hose.
9. Use the MUT-II to erase the self-diagnosis code.
10. Adjust the basic idle speed. (Refer to P.13B-87.)

    NOTE
    If the engine hunts while idling after adjustment of the basic idle speed, disconnect the (–) cable from the battery for 10 seconds or more, and then reconnect it and run the engine at idle for about 10 minutes.

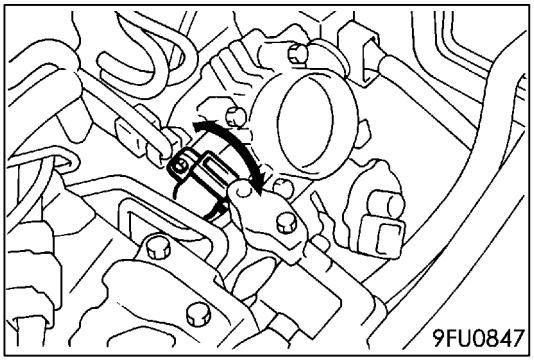
THROTTLE POSITION SENSOR ADJUSTMENT



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

2. Turn the ignition switch to ON (but do not start the engine).
3. Check the throttle position sensor output voltage.

   Standard value: 535 - 735 mV



4. If not within the standard value, loosen the throttle position sensor mounting bolts, and then rotate the sensor body to adjust the output voltage.
5. Turn the ignition switch to OFF.
6. Remove the MUT-II.
7. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II or disconnect the negative battery cable from the battery terminal and then leave it for at least ten seconds. After that, reconnect the battery cable, and then let the engine run at idle for approx. 10 minutes.

BASIC IDLE SPEED ADJUSTMENT

Caution

(1) The standard idling speed has been adjusted by the speed adjusting screw (SAS) by the manufacturer, and there should usually be no need for readjustment.

(2) If the adjustment has been changed by mistake, the idle speed may become too high or the idle speed may drop too low when loads from components such as the A/C are placed on the engine. If this occurs, adjust by the following procedure.

(3) The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the idle speed control servo, the compression pressure, etc., are all normal.

1. Before inspection and adjustment, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector.

   NOTE
   When the MUT-II is connected, the diagnosis control terminal should be earthed.

3. Start the engine and run it at idle.

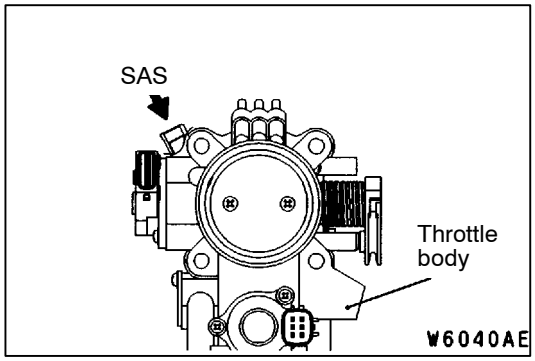
4. Select the item No.30 of the MUT-II Actuator test.

   NOTE
   This holds the idle speed control servo at the basic step to adjust the basic idle speed.

5. Check the basic idle speed.

   Standard value: 750 ± 50 r/min

   NOTE
   (1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
   (2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it.



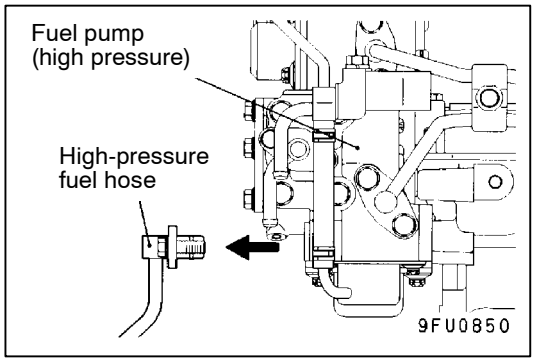
6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

   NOTE
   (1) Use a screwdriver which is shorter than 30 mm to turn the SAS.
   (2) If the idling speed is higher than the standard value range even when the SAS is fully closed, check whether or not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS.

7. Press the MUT-II clear key, and release the idle speed control servo from the Actuator test mode.

   NOTE
   Unless the idle speed control servo is released, the Actuator test mode will continue 27 minutes.

8. Turn the ignition switch to OFF.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.

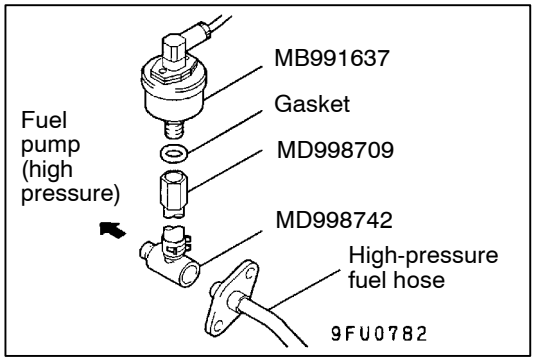


FUEL PRESSURE TEST

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

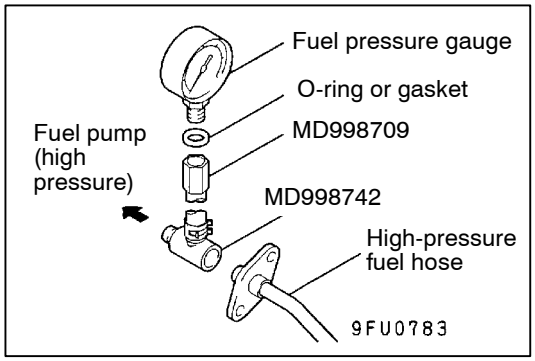
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13B-93.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

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.
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:
    324 - 343 kPa at kerb idle

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

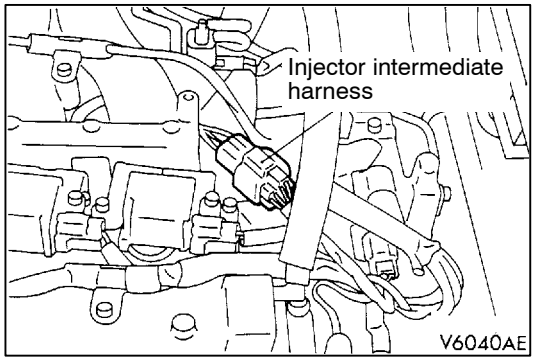
13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

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.13B-93.)
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.

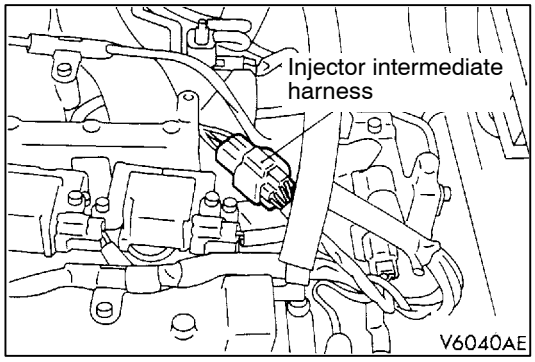
11. Measure fuel pressure while the engine is running at idle.

    Standard value: 4 - 7 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 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. Stop cranking and 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. Check this system.

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

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE)

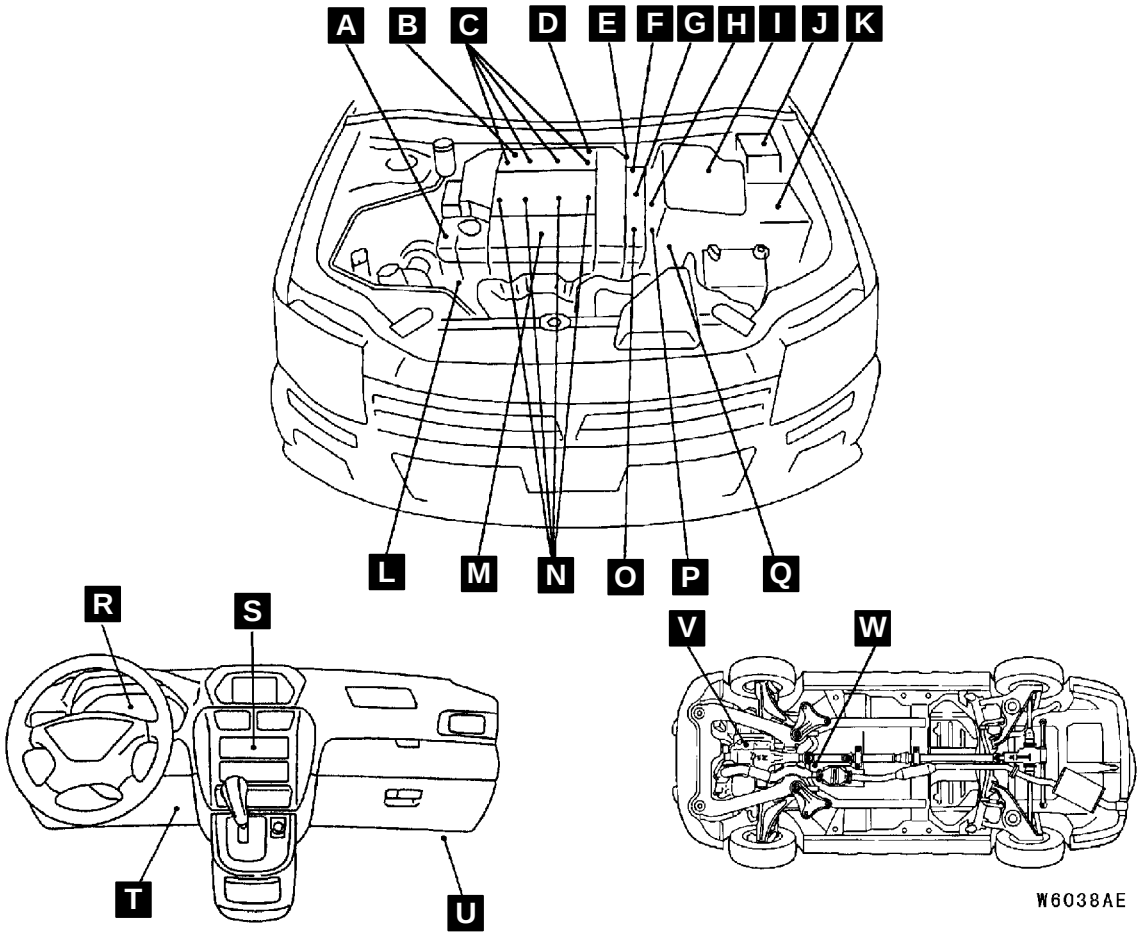
Refer to GROUP 13A - On-vehicle Service.

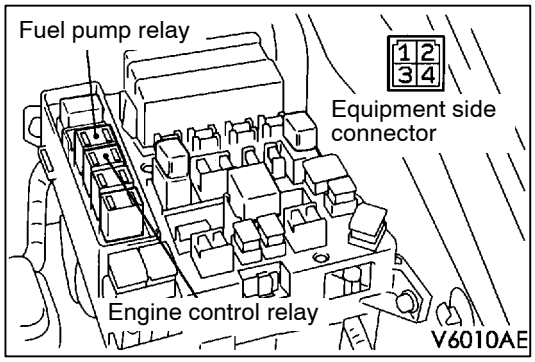
FUEL PUMP OPERATION CHECK

Refer to GROUP 13A - On-vehicle Service.

COMPONENT LOCATION

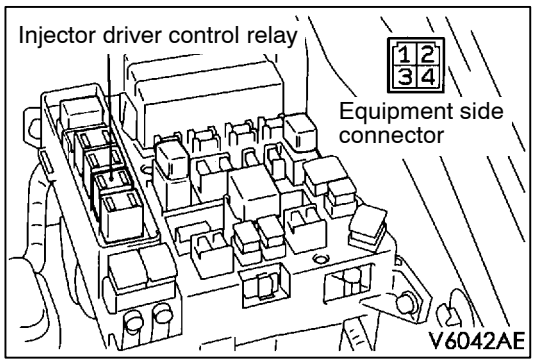
Name	Symbol	Name	Symbol
A/C relay	K	Engine warning lamp (check engine lamp)	R
A/C switch	S	Fuel pressure sensor	H
Air by-pass control solenoid valve (DUTY)	B	Idle speed control (ISC) servo	F
Air by-pass control solenoid valve (ON/OFF)	B	Ignition coil	N
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	I	Inhibitor switch <A/T>	Q
		Injectors	C
Camshaft position sensor	G	Injector driver	J
Control relay and fuel pump relay	K	Injector driver control relay	K
Crank angle sensor	A	M/T oil temperature sensor	V
Detonation sensor	M	Oxygen sensor	W
Diagnosis connector	T	Power steering fluid pressure switch	L
EGR valve	D	Purge control solenoid valve	D
Engine coolant temperature sensor	O	Throttle position sensor	E
Engine-ECU	U	Vehicle speed sensor	P

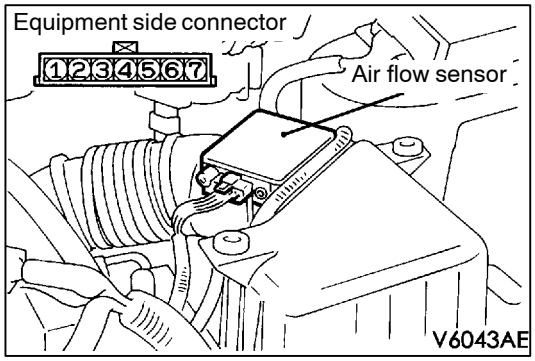




ENGINE CONTROL RELAY, FUEL PUMP RELAY AND INJECTOR DRIVER CONTROL RELAY CONTINUITY CHECK

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

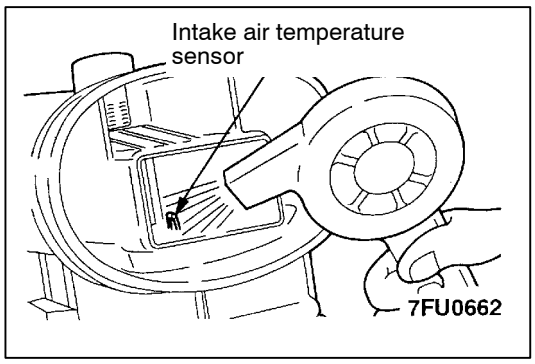




INTAKE AIR TEMPERATURE SENSOR CHECK

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)
0.26 - 0.36 kΩ (at 80°C)

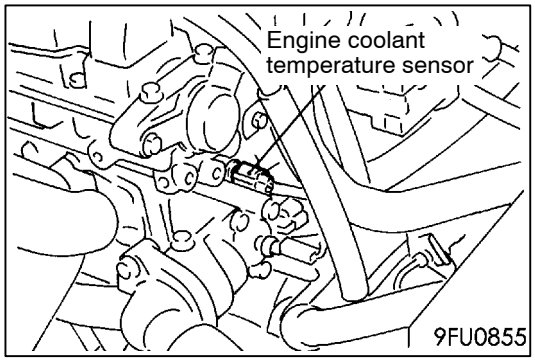


3. Measure resistance while heating the sensor using a hair drier.

Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

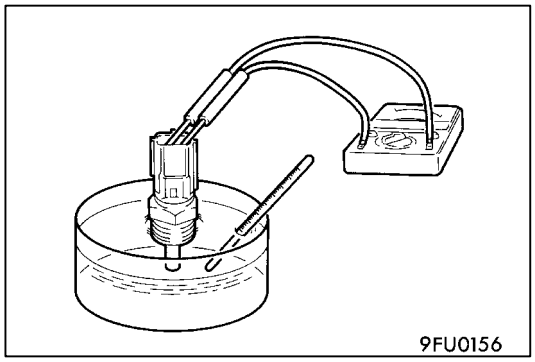
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

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

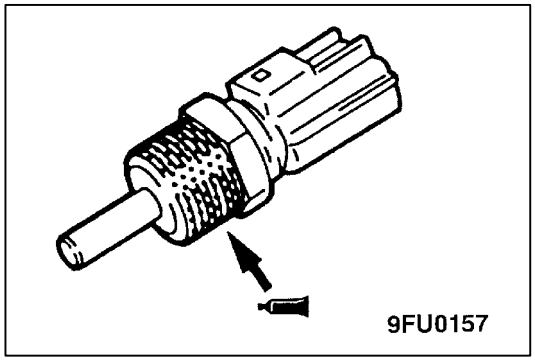
1. Remove the engine coolant temperature sensor.



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.

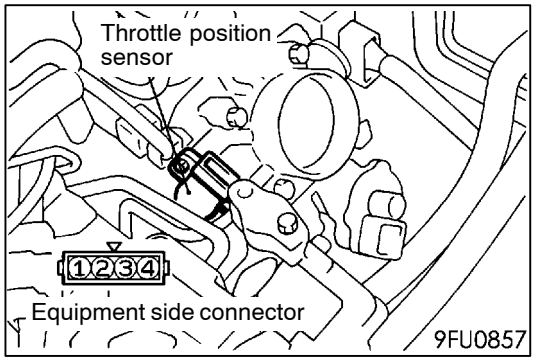


4. Apply sealant to threaded portion.

   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 Nm



THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between the throttle position sensor side connector terminal 1 and terminal 4.

   Standard value: 3.5 - 6.5 kΩ

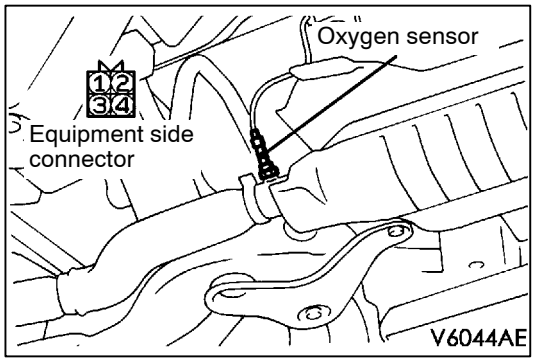
3. Measure the resistance between the throttle position sensor side connector terminal 3 and terminal 4.

   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

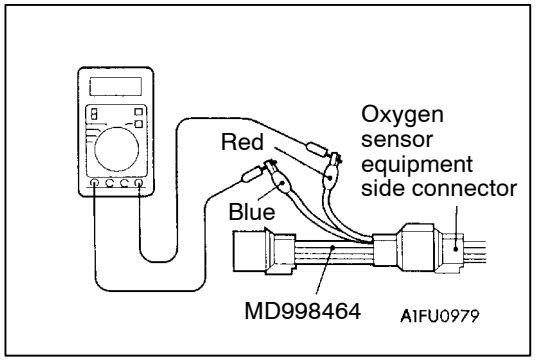
4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13B-86.

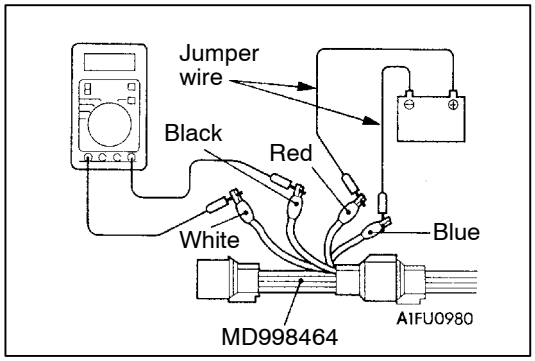


OXYGEN SENSOR CHECK

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 (11 - 18 Ω at 20°C) between terminal 2 (red clip) and terminal 4 (blue clip) 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 2 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 4 (blue clip) to the battery (-) terminal.

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

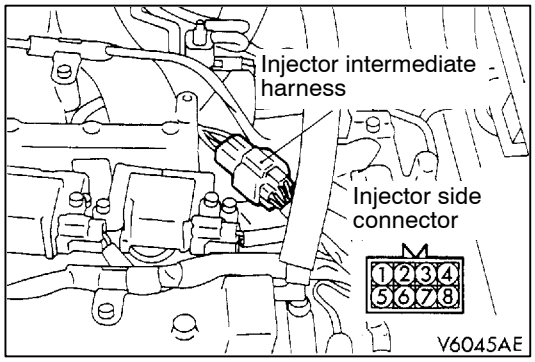
6. Connect a digital voltage meter between terminal 1 (black clip) and terminal 3 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   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.



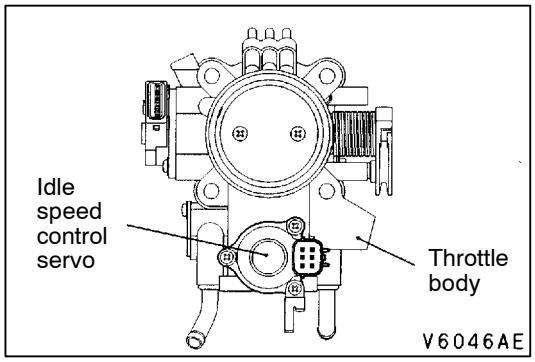
INJECTOR CHECK

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	1 - 2
No.2 cylinder	3 - 4
No.3 cylinder	5 - 6
No.4 cylinder	7 - 8

3. Connect the injector intermediate harness connector.

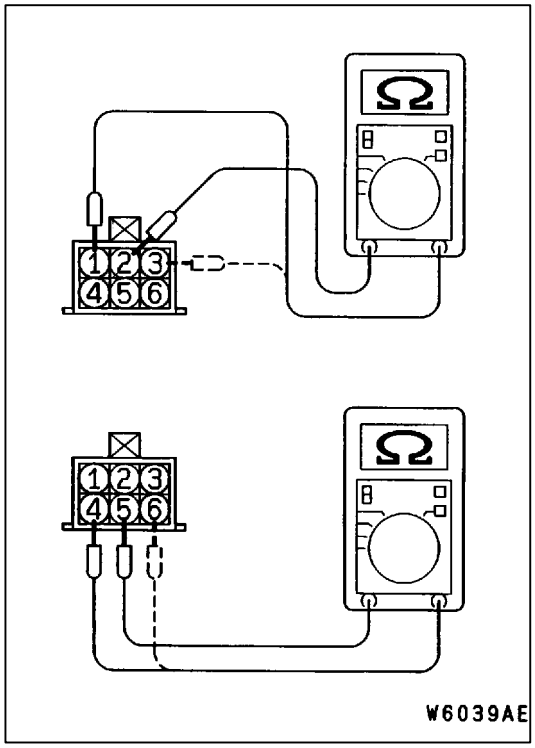


IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

Checking the Operation Sound

1. Check that the engine coolant temperature is 20°C or below.

   NOTE
   Disconnecting the engine coolant temperature sensor connector and connecting the harness-side of the connector to another engine coolant temperature sensor that is at 20°C or below is also okay.
2. Check that the operation sound of the stepper motor can be heard after the ignition is switched ON. (but without starting the motor.)
3. If the operation sound cannot be heard, check the stepper motor's activation circuit.
   If the circuit is normal, it is probable that there is a malfunction of the stepper motor or of the engine control unit.

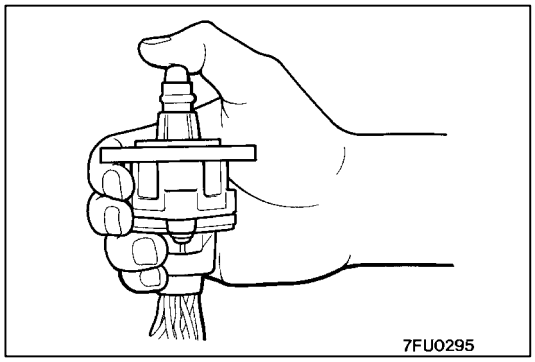


Checking the Coil Resistance

1. Disconnect the idle speed control servo connector.
2. Measure the resistance between terminal 2 and either terminal 1 or terminal 3 of the connector at the idle speed control servo side.

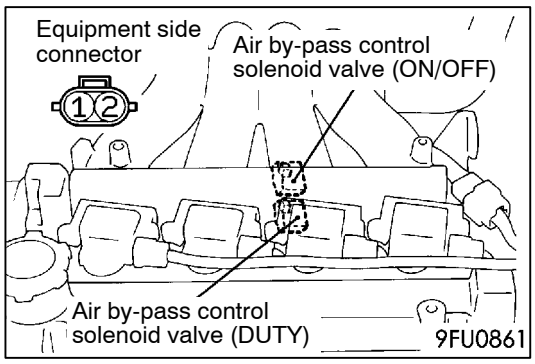
   Standard value: 28 - 33 Ω (at 20°C)
3. Measure the resistance between terminal 5 and either terminal 6 or terminal 4 of the connector at the idle speed control servo side.

   Standard value: 28 - 33 Ω (at 20°C)



Operation Check

1. Remove the throttle body.
2. Remove the stepper motor.
3. Connect the special tool (test harness: MB991709) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approx. 6 V) to the terminals 2 and 5.
5. With the idle speed control servo as shown in the illustration, connect the negative (-) terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.
   (1) Connect the negative (-) terminal of the power supply to the red and black clip.
   (2) Connect the negative (-) terminal of the power supply to the blue and black clip.
   (3) Connect the negative (-) terminal of the power supply to the blue and yellow clip.
   (4) Connect the negative (-) terminal of the power supply to the red and yellow clip.
   (5) Connect the negative (-) terminal of the power supply to the red and black clip.
   (6) Repeat the tests in sequence from (5) to (1).
6. If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.



AIR BY-PASS CONTROL SOLENOID VALVE CHECK

1. Measure the resistance between the terminals of the air by-pass control solenoid valve (DUTY).

   Standard value: 7.7 - 9.3 Ω (at 20°C)

2. Measure the resistance between the terminals of the air by-pass control solenoid valve (ON/OFF).

   Standard value: 7.7 - 9.3 Ω (at 20°C)

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 - Emission Control System.

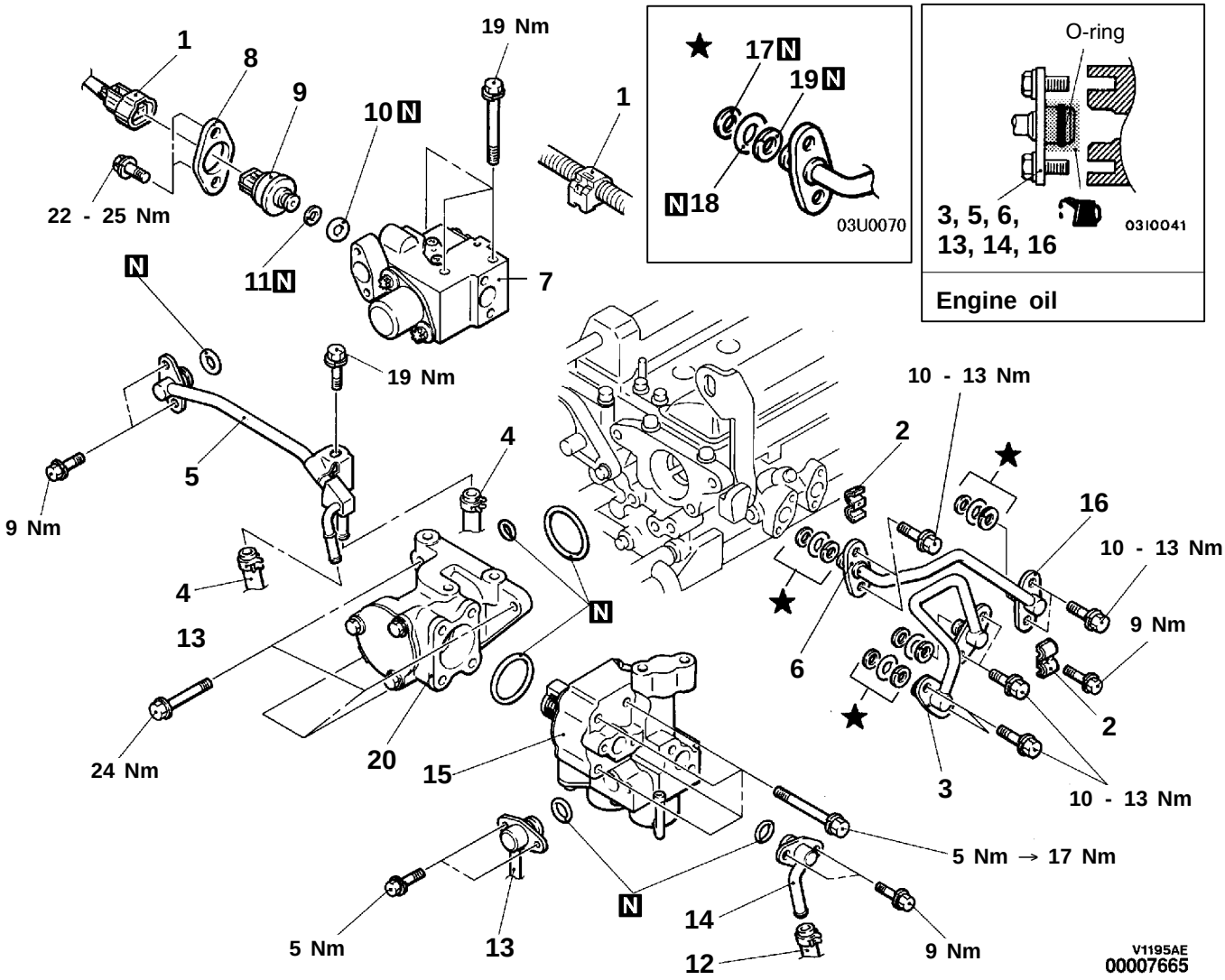
EGR VALVE CHECK

Refer to GROUP 17 - Emission Control System.

FUEL PUMP (HIGH PRESSURE) AND FUEL PRESSURE REGULATOR (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of fuel discharge <before removal only> (Refer to P.13B-93.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Fuel Leak Check <after installation only> (Refer to P.13B-92.)



Fuel pressure regulator (High pressure) removal steps

1. Harness connector and clamp
4. Fuel return hose connection
▶C◀ 5. Low-pressure fuel pipe
▶C◀ 6. Fuel return pipe connection
7. Fuel pressure regulator (high pressure) assembly
◀A▶ ▶G◀ 8. Flange
▶G◀ 9. Fuel pressure sensor
▶F◀ 10. O-ring
▶F◀ 11. Back-up ring
▶B◀ 17. Back-up ring A
▶B◀ 18. O-ring
▶B◀ 19. Back-up ring B

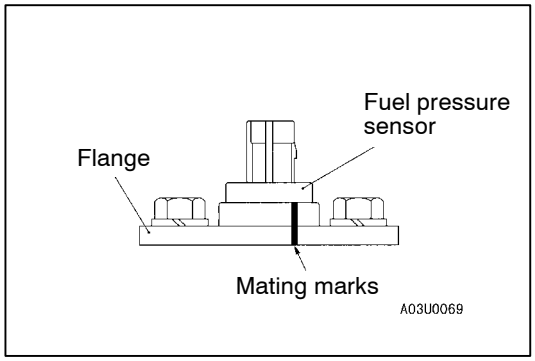
Fuel pump (High pressure) removal steps

- Throttle body removal (Refer to P.13B-109.)

2. Fuel pipe clamp
▶C◀ 3. Fuel feed pipe
▶C◀ 5. Low-pressure fuel pipe
12. Fuel return hose connection
▶E◀ 13. Fuel pressure hose connection
▶C◀ 14. Fuel nipple assembly
▶D◀ 15. Fuel pump (high pressure)
▶B◀ 17. Back-up ring A
▶B◀ 18. O-ring
▶B◀ 19. Back-up ring

Pump camshaft case removal steps

7. Fuel pressure regulator (high pressure) assembly
▶D◀ 15. Fuel pump (high pressure)
▶C◀ 16. Fuel return pipe
▶B◀ 17. Back-up ring A
▶B◀ 18. O-ring
▶B◀ 19. Back-up ring B
▶A◀ 20. Pump camshaft case

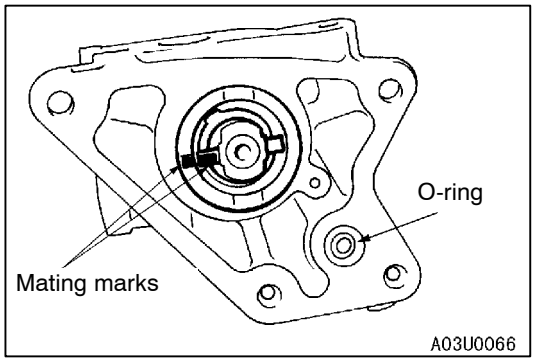


REMOVAL SERVICE POINT

◀A▶ FLANGE REMOVAL

If reusing the fuel pressure sensor, make the mating marks on the sensor and the flange before removing the flange.

NOTE
The flange will be bent when it is installed to the engine. Because of this, the sealing condition and installation condition of the fuel pressure sensor will be maintained in good condition. Therefore, the mating marks should be made in order to install the flange in the original condition. If replacing the fuel pressure sensor with a new part, the sensor and flange should be replaced together.

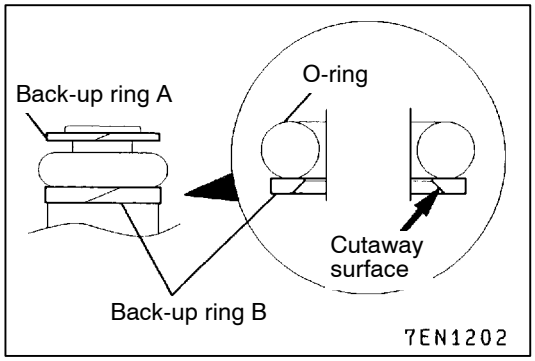


INSTALLATION SERVICE POINTS

▶A◀ PUMP CAMSHAFT CASE ASSEMBLY INSTALLATION

1. Set the No.1 cylinder to the compression top dead centre position.
2. Align the mating mark on the housing of the pump camshaft case assembly with the mating mark on the coupling, and then install the pump camshaft case assembly to the engine.

Caution
Take care not to drop the O-ring.



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

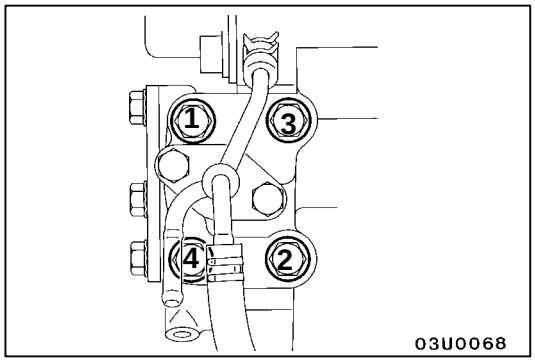
Install the back-up rings and the O-ring as shown in the illustration.

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)**

▶C◀ FUEL RETURN PIPE/LOW-PRESSURE FUEL PIPE/FUEL FEED PIPE INSTALLATION

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), fuel pressure regulator (high pressure) or the delivery pipe assembly.



▶D◀ FUEL PUMP (HIGH PRESSURE) INSTALLATION

Use a torque wrench with a precision of 0.5 Nm to tighten the fuel pump mounting bolts according to the following procedure.

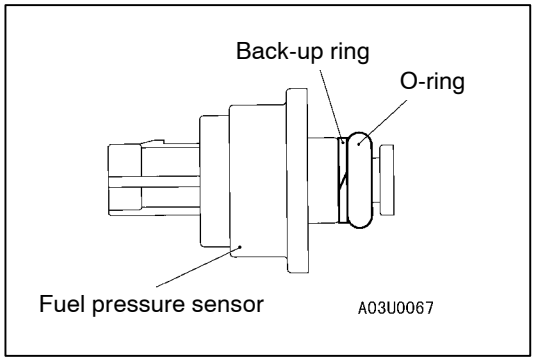
1. Tighten the bolts to 5 Nm in the order shown in the illustration.
2. Tighten the bolts to 17 Nm in the order shown in the illustration. The overall difference in tightening torque between the four bolts should be within 2 Nm.

▶E◀ HIGH-PRESSURE FUEL 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).

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



▶F◀ BACK-UP RING/O-RING INSTALLATION

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

Caution
Take care not to install the back-up ring A for the injector, fuel feed pipe or fuel return pipe by mistake. (Outer diameter of the back-up ring for the fuel pressure sensor: 15.1 mm)

▶G◀ 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 fuel pressure regulator (high pressure) assembly.

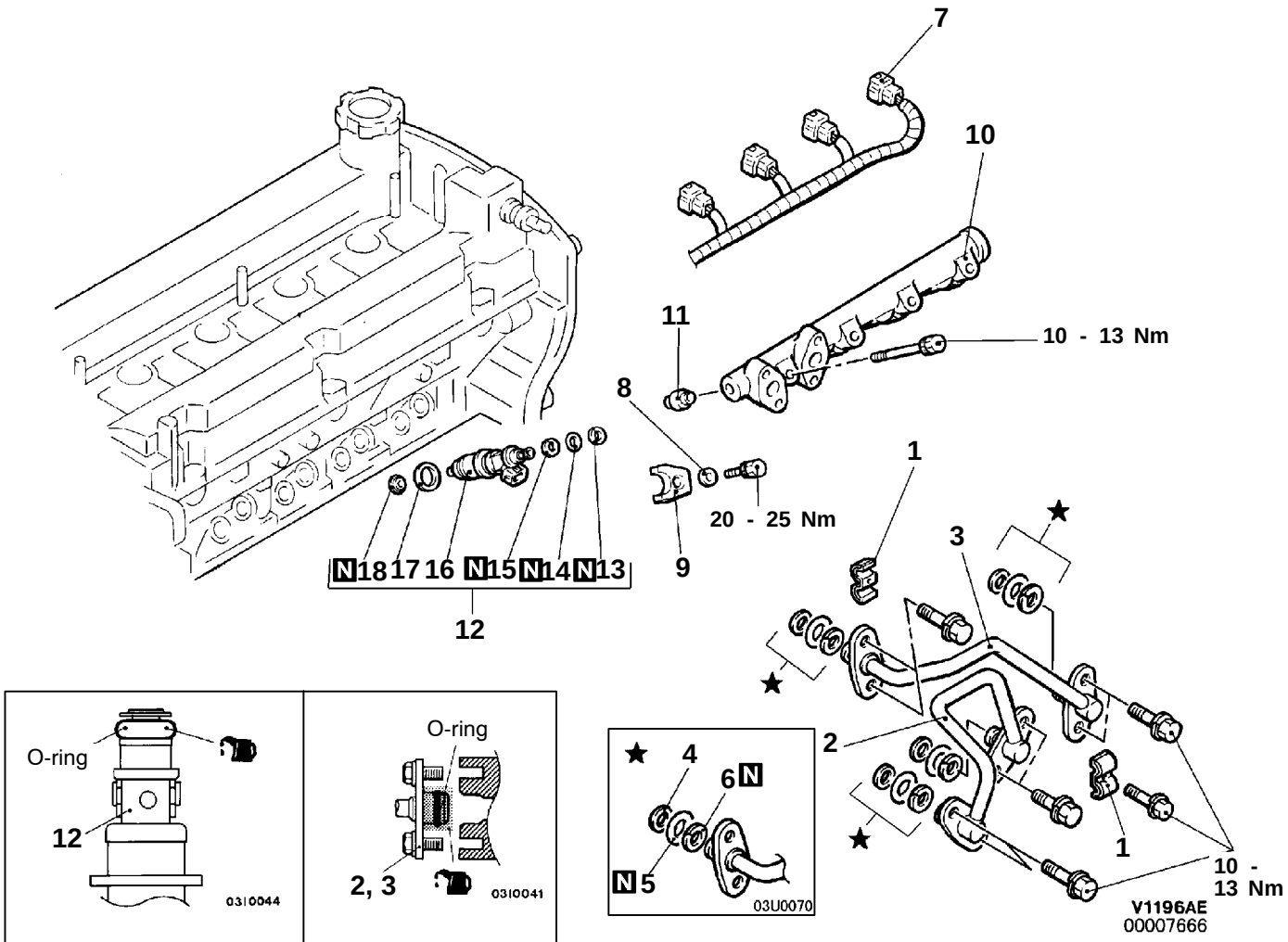
2. Align the mating marks which were made at the time of removal, and then install the fuel pressure sensor and flange to the fuel pressure regulator (high pressure) assembly.

   Caution
   If replacing the fuel pressure sensor with a new part, the sensor and flange should be replaced together.

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of fuel discharge <before removal only> (Refer to P.13B-93.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Leak Check <after installation only> (Refer to P.13B-92.)



Removal steps

1. Fuel pipe clamp
▶D◀ 2. Fuel feed pipe
▶D◀ 3. Fuel return pipe
▶C◀ 4. Back-up ring A
▶C◀ 5. O-ring
▶C◀ 6. Back-up ring B
◀A▶ 7. Injector harness connector
8. Washer
9. Injector holder
◀B▶ ▶B◀ 10. Delivery pipe assembly
11. Insulator
◀B▶ ▶B◀ 12. Fuel injector assembly
13. Back-up ring
14. O-ring
15. Back-up ring
16. Fuel injector
17. Gasket
▶A◀ 18. Corrugated washer

REMOVAL SERVICE POINTS

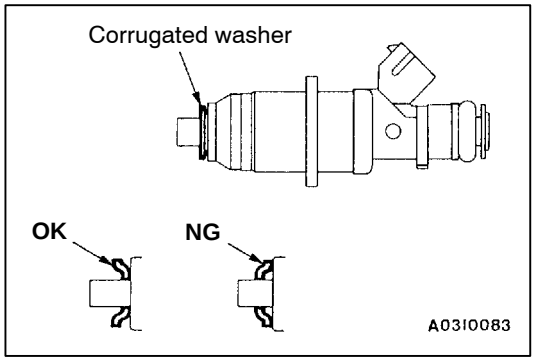
◀A▶ INJECTOR HARNESS CONNECTOR DISCONNECTION

Caution
Disconnect the battery (-) cable from its terminal before carrying out this operation.

◀B▶ 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◀ CORRUGATED WASHER INSTALLATION

Caution
1. **The corrugated washer should always be replaced with a new part.**
2. **There should be no scratches or foreign particles on the corrugated washer mounting surface of the injector.**
3. **Be careful not to mistake the corrugated washer installation direction.**

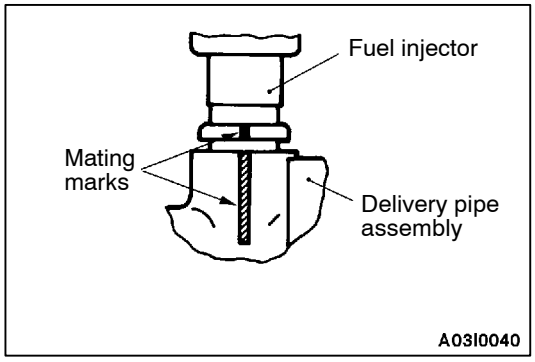
▶B◀ FUEL INJECTOR ASSEMBLY/DELIVERY PIPE ASSEMBLY INSTALLATION

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

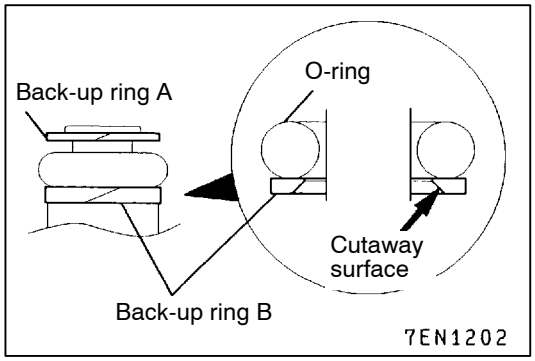
   Caution
   Take care not to let any of the engine oil get inside the delivery pipe assembly.

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 mating marks on the delivery pipe assembly and the fuel injector, and then install the delivery pipe assembly with the injector assembly still attached.



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

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)**

▶D◀ FUEL RETURN PIPE/FUEL FEED PIPE INSTALLATION

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

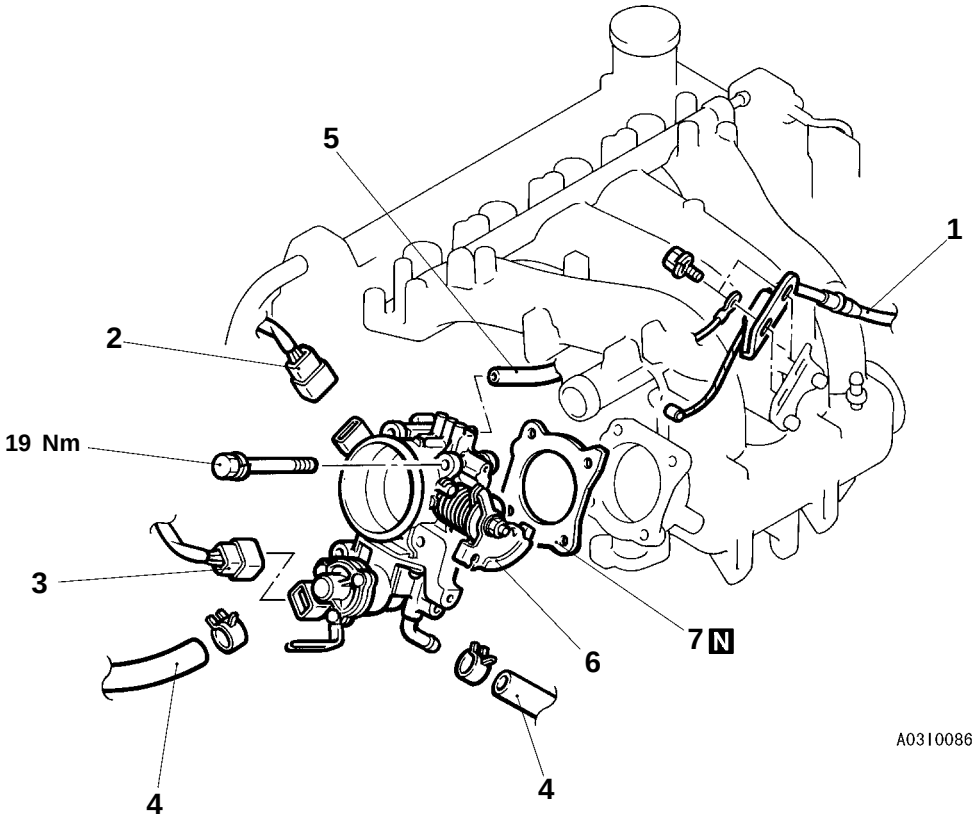
Caution

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

THROTTLE BODY

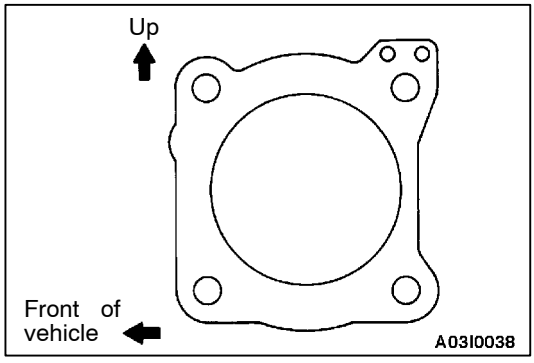
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 - On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 - On-vehicle Service.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation



Removal steps

1. Accelerator cable
2. Throttle position sensor connector
3. Idle speed control servo connector
4. Water hose connection
5. Vacuum hose connection
6. Throttle body assembly
▶A◀ 7. Throttle body gasket

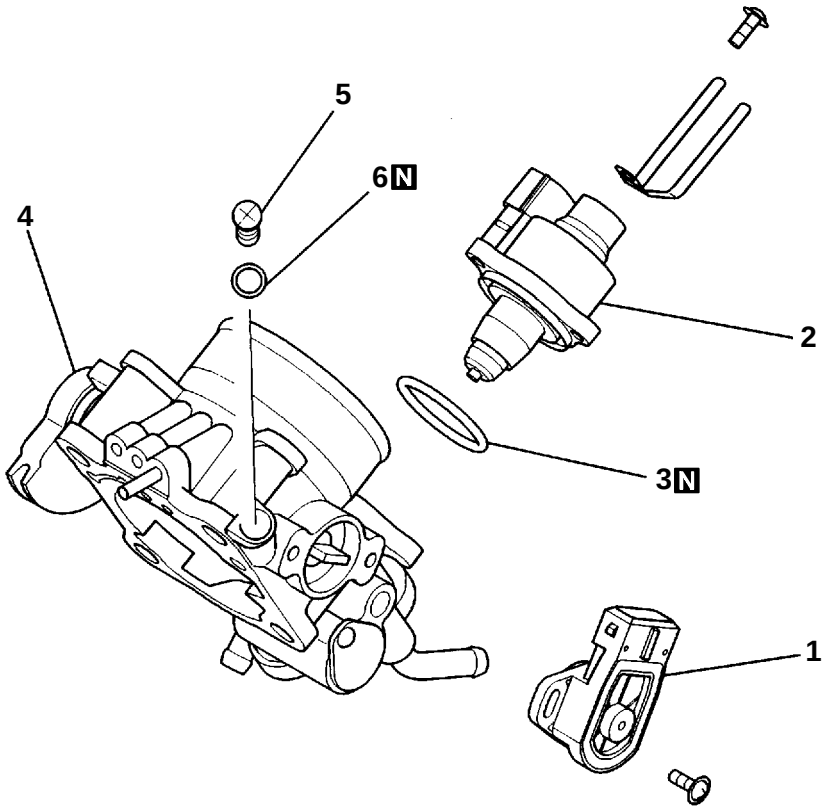


INSTALLATION SERVICE POINT

▶A◀ THROTTLE BODY GASKET INSTALLATION

Position the projection as shown in the illustration.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

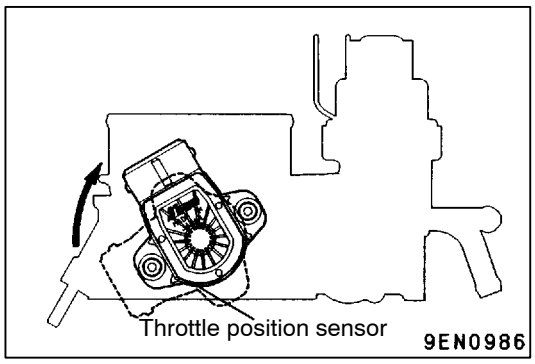
▶A◀ 1. Throttle position sensor
2. Idle speed control servo
3. O-ring
4. Throttle body
5. Speed adjusting screw
6. O-ring

NOTE
1. The speed adjusting screw is correctly adjusted at the factory and should not be removed.
2. If the speed adjusting screw has been removed, carry out fixed SAS adjustment.
3. If the speed adjusting screw should happen to have been removed, carry out speed adjusting screw adjustment.

CLEANING THROTTLE BODY PARTS

1. Clean all throttle body parts.
   Do not use solvent to clean the following parts:
   - Throttle position sensor
   - Accelerator pedal position sensor
   - Idle speed control body assembly

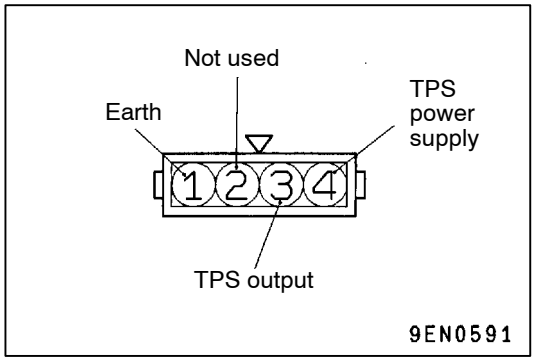
   If these parts are immersed in solvent, their insulation will deteriorate.
   Wipe them with cloth only.
2. Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.



REASSEMBLY SERVICE POINT

▶A◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

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 clockwise as shown in the illustration, and then tighten the screws.



3. Connect a multimeter between terminal (4) (TPS power supply) and terminal (3) (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
4. If there is an abnormality, replace the TPS.

INJECTOR DRIVER

Refer to GROUP 13A.

NOTES

FUEL SUPPLY

CONTENTS

13509000197

GENERAL INFORMATION

13500010120

- The steel fuel tank is located under the floor of the rear seats to provide increased safety and increase the amount of luggage compartment space.
- The fuel tank has been equipped with a valve assembly which incorporates a fuel cut-off valve to prevent fuel from leaking out in the event of a collision and a two-way valve for adjusting the pressure inside the fuel tank.
- A plastic snap-fitting hose (high-pressure fuel hose) has been adopted between the fuel pump assembly and the fuel filter assembly in petrol-powered vehicles in order to improve ease of maintenance.
- A fuel pump module with an electric fuel pump (low-pressure), fuel gauge unit, fuel filter and fuel pressure regulator (low-pressure) integrated has been used to reduce the weight and enhance the collision safety.

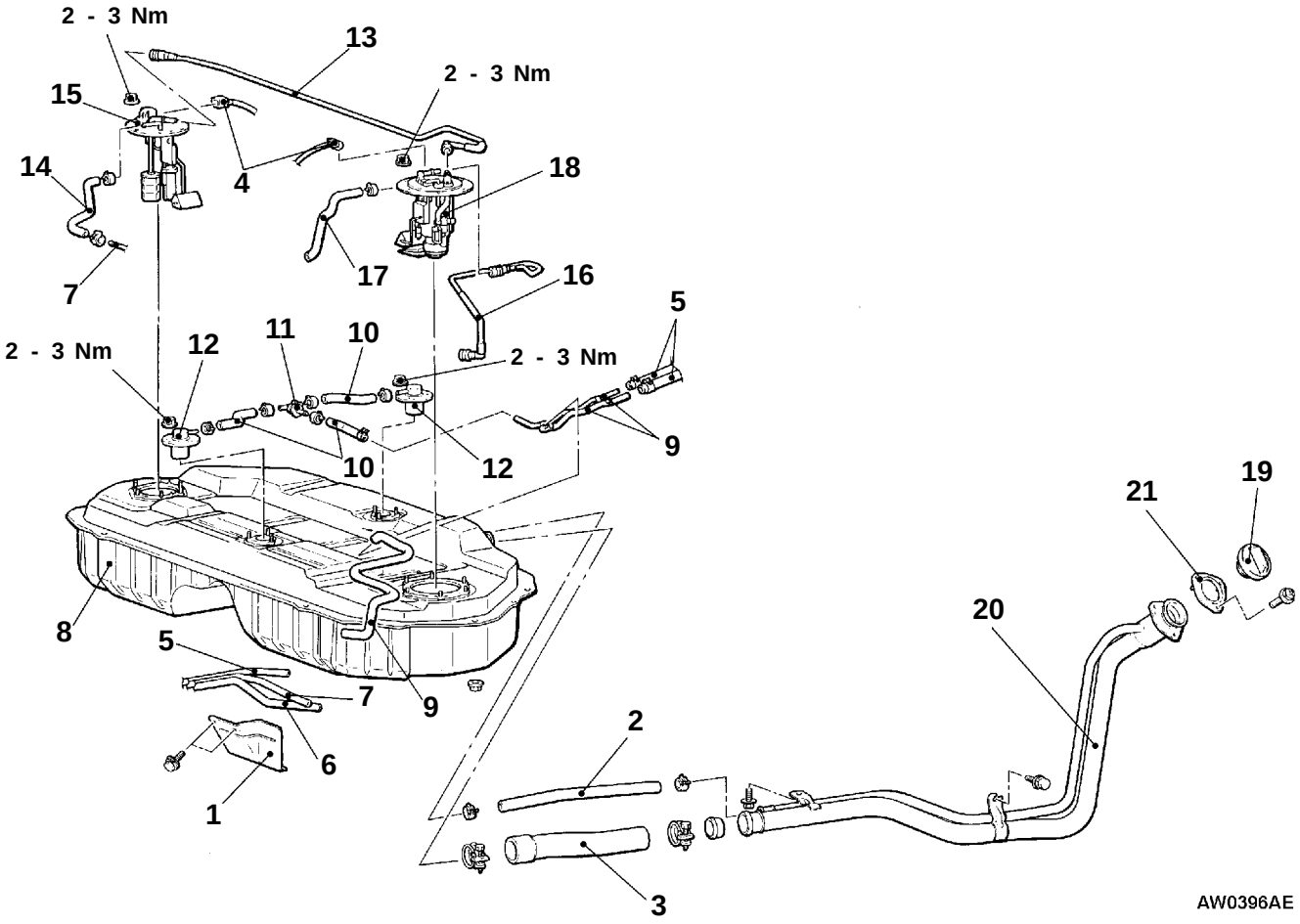
FUEL TANK

13500190244

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Draining
- Reduce the Inner Pressure of Fuel Line and Hose (Refer to GROUP 13A - On-vehicle Service.)
- Center Exhaust Pipe Removal (Refer to GROUP 15.)
- Propeller Shaft Removal <4WD> (Refer to GROUP 25.)

Post-installation Operation
- Fuel Supplying.
- Checking for Fuel Leaks
- Propeller Shaft Installation <4WD> (Refer to GROUP 25.)
- Center Exhaust Pipe Installation (Refer to GROUP 15.)



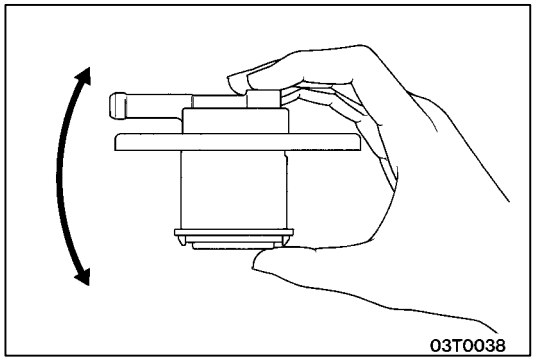
Removal steps

1. Fuel hose protector
2. Vapour hose
3. Filler hose
4. Harness connector connection
5. Vapour hose connection
▶A◀ 6. Pressure tube connectionlink=IA
7. Return hose connection
8. Fuel tank assembly
9. Vapour tube
10. Vapour hose
11. Fuel check valve assembly
12. Valve assembly
▶A◀ 13. Suction tube
14. Return hose
15. Pipe and gauge assembly
▶A◀ 16. Pressure tube
17. Return hose
18. Fuel pump module
19. Fuel filler cap
20. Filler neck assembly
21. Packing

INSTALLATION SERVICE POINT

spot=IA ▶A◀ **PRESSURE TUBE/SUCTION TUBE CONNECTION**

Caution
After the connection, pull the pressure tube and suction tube gently in the direction of removal to check that they are firmly connected.



INSPECTION

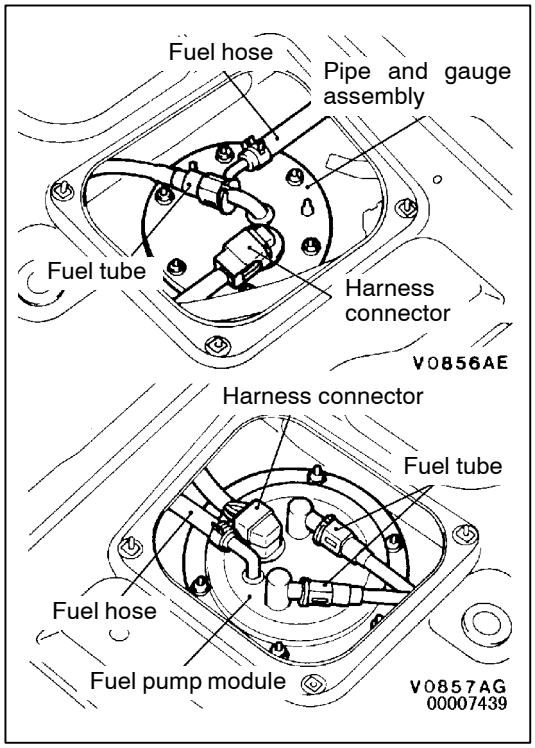
13500300104

VALVE CHECK

If the sound of the float valve moving (knocking sound) can be heard when the valve assembly is gently shaken up and down, then the valve is okay.

FUEL GAUGE UNIT CHECK

Refer to GROUP 54 - Combination Meter.



FUEL GAUGE UNIT REPLACEMENT

1. Remove the rear seat, rear seat rail cover, rear scuff plate and center pillar lower trim and turn over the carpet.
2. Remove the service hose cover.
3. Disconnect the harness connector, fuel hose and fuel tube.
4. Unscrew the mounting nuts to remove the pipe and gauge assembly and fuel pump module.
5. Install the pipe and gauge assembly and fuel pump module. Tighten the mounting nuts to the specified torque.

   Specified torque: 2 - 3 Nm

6. Connect the fuel hose, fuel tube and harness connector.

   Caution
   After the connection, pull the pressure tube and suction tube gently in the direction of removal to check that they are firmly connected.

7. Install the service hole cover.
8. Turn back the carpet and install the rear seat, rear seat rail cover, rear scuff plate and center pillar lower trim.