
FUEL

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MULTIPOINT FUEL INJECTION (MPI)

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MULTIPOINT FUEL INJECTION (MPI) <4G6>

GENERAL

OUTLINE OF CHANGES

Service procedures have been added for the following modifications:

- Modification of immobilizer system
- Modification of body harness

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

NOTE

If the engine-ECU is replaced, the immobilizer-ECU and ignition key should be replaced together with it.

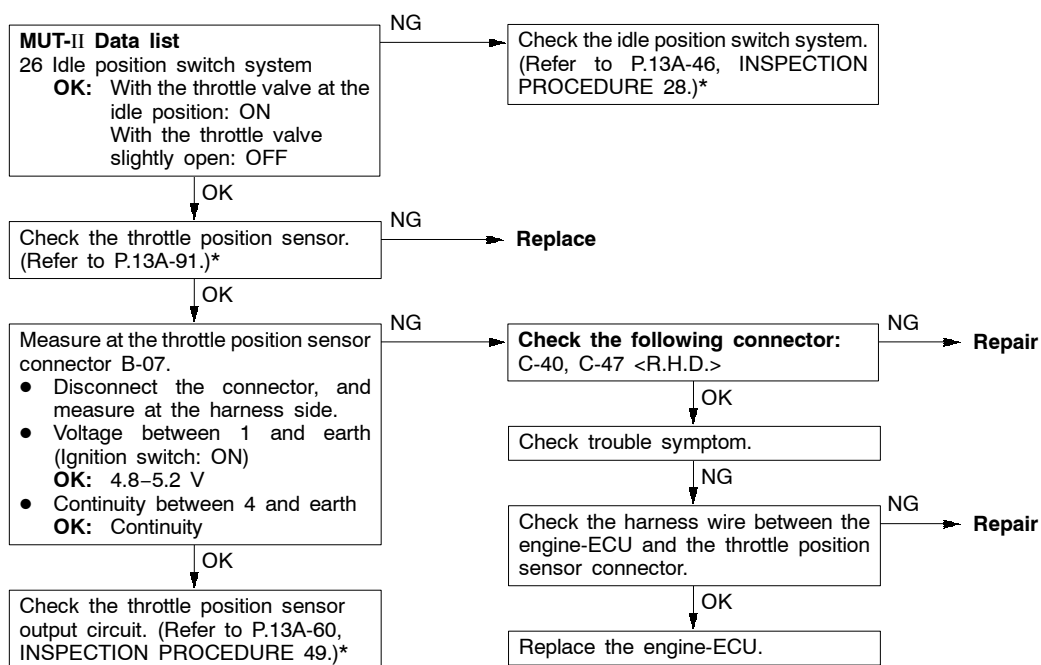
INSPECTION CHART FOR DIAGNOSIS CODES

The troubleshootings of code Nos.14, 22, 25 and 54 have been revised. The other items are the same as before.

Code No.	Diagnosis item	Reference page
14	Throttle position sensor system	13A-4
22	Crank angle sensor system	13A-5
25	Barometric pressure sensor system	13A-6
54	Immobilizer system	13A-7

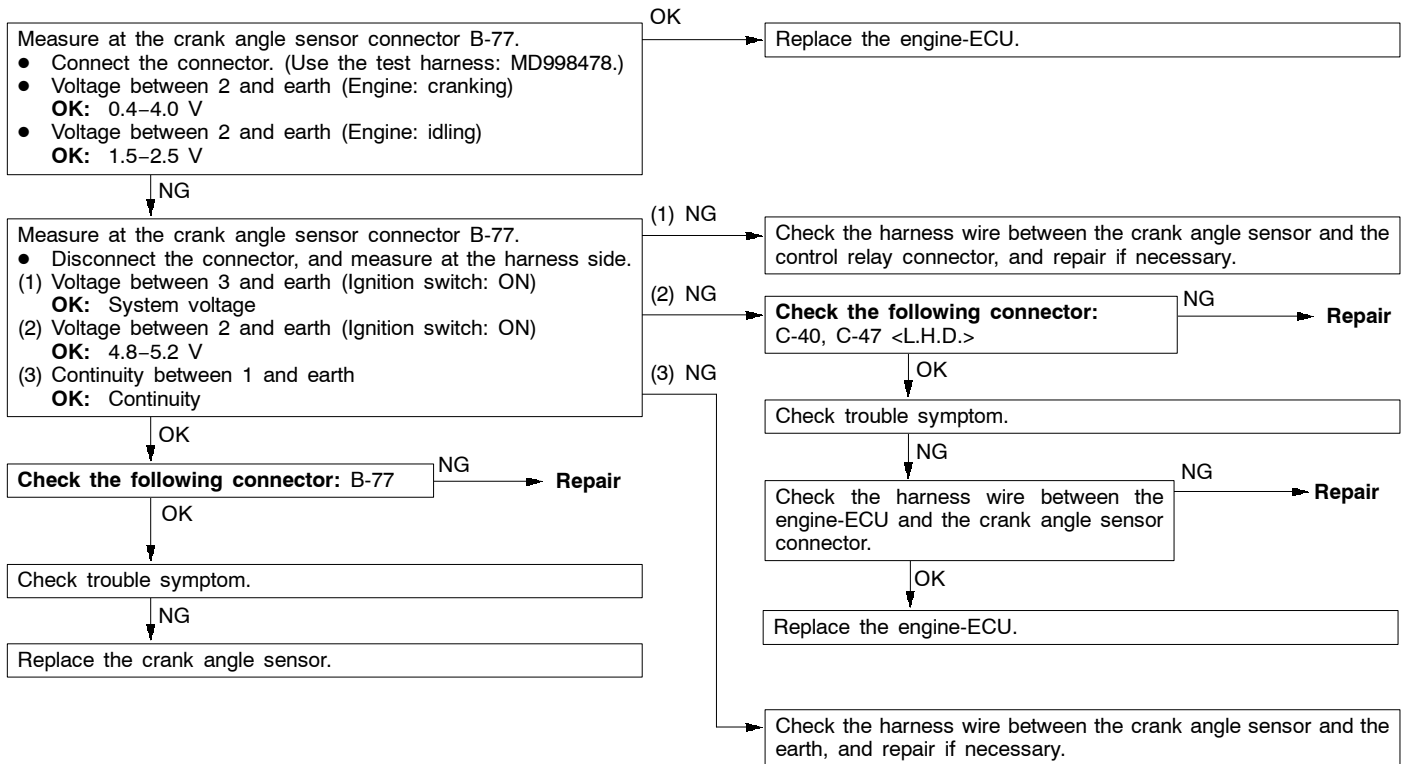
INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 14 Throttle position sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> When the idle position switch is ON, the sensor output voltage is 2 V or more for 4 seconds. <p>or</p> <ul style="list-style-type: none"> The sensor output voltage is 0.2 V or less for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the throttle position sensor or maladjustment Improper connector contact, open circuit or short-circuited harness wire of the throttle position sensor circuit Improper "ON" state of idle position switch Short circuit of the idle position switch signal line Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611)

Code No. 22 Crank angle sensor system	Probable cause
Range of Check • Engine is cranking. Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input.)	• Malfunction of the crank angle sensor • Improper connector contact, open circuit or short-circuited harness wire of the crank angle sensor • Malfunction of the engine-ECU



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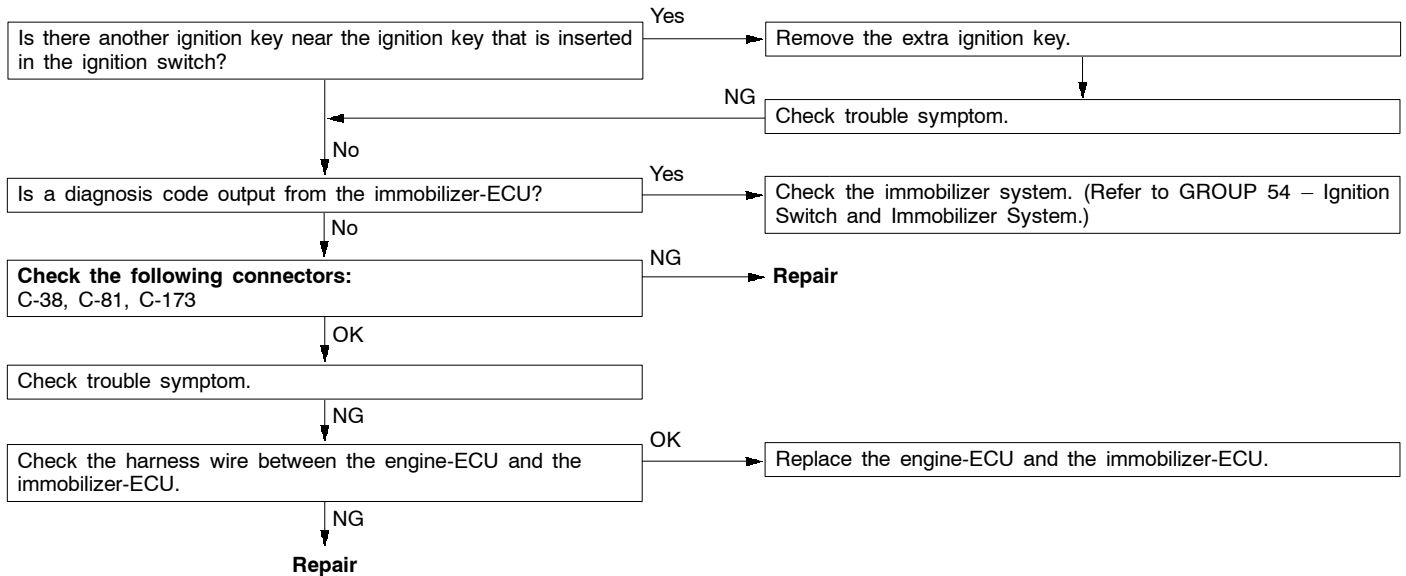
graph TD
    Start([Start]) --> Step1[Measure at the air flow sensor connector B-12.  
• Connect the connector. (Use the test harness: MB991709)  
• Voltage between 2 and earth (Ignition switch: ON)  
OK: 3.7-4.3 V (Altitude: 0 m)  
3.2-3.8 V (Altitude: 1,200 m)]
    Step1 -- OK --> Step2[Measure at the engine-ECU connector C-40.  
• Connect the connector.  
• Voltage between 85 and earth (Ignition switch: ON)  
OK: 3.7-4.3 V (Altitude: 0 m)  
3.2-3.8 V (Altitude: 1,200 m)]
    Step1 -- NG --> Step1a[Check the following connector: B-12  
• 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 5 and earth  
OK: Continuity]
    Step2 -- OK --> Step3[Check trouble symptom.]
    Step2 -- NG --> Step2a[Check the harness wire between the engine-ECU and the barometric pressure sensor connector, and repair if necessary.]
    Step3 -- OK --> Step4[Check trouble symptom.]
    Step3 -- NG --> Step3a[Check the harness wire between the engine-ECU and the barometric pressure sensor connector.]
    Step4 -- OK --> End([End])
    Step4 -- NG --> Step4a[Replace the engine-ECU.]
    Step2a --> End
    Step3a -- OK --> Step3b[Replace the air flow sensor.]
    Step3a -- NG --> Step3c[Check the following connector: C-40, C-47 <R.H.D.>]
    Step3c -- OK --> Step3d[Check trouble symptom.]
    Step3c -- NG --> Step3e[Check the harness wire between the engine-ECU and the barometric pressure sensor connector.]
    Step3d -- OK --> End
    Step3d -- NG --> Step3f[Repair]
    Step3e -- OK --> End
    Step3e -- NG --> Step3f
    Step3f -- OK --> End
    Step3f -- NG --> Step3g[Repair]

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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.



INSPECTION CHART FOR TROUBLE SYMPTOMS

The troubleshootings of inspection procedures Nos. 2, 28, 34 and 45 have been revised. The other items are the same as before.

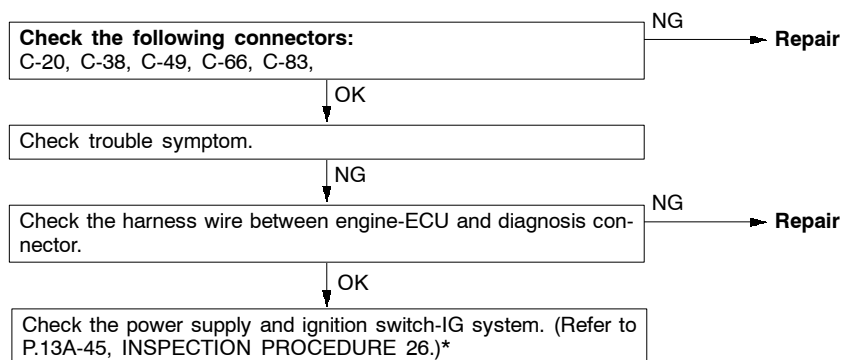
Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-28*
	Communication with engine-ECU only is not possible.	2	13A-8

*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 2

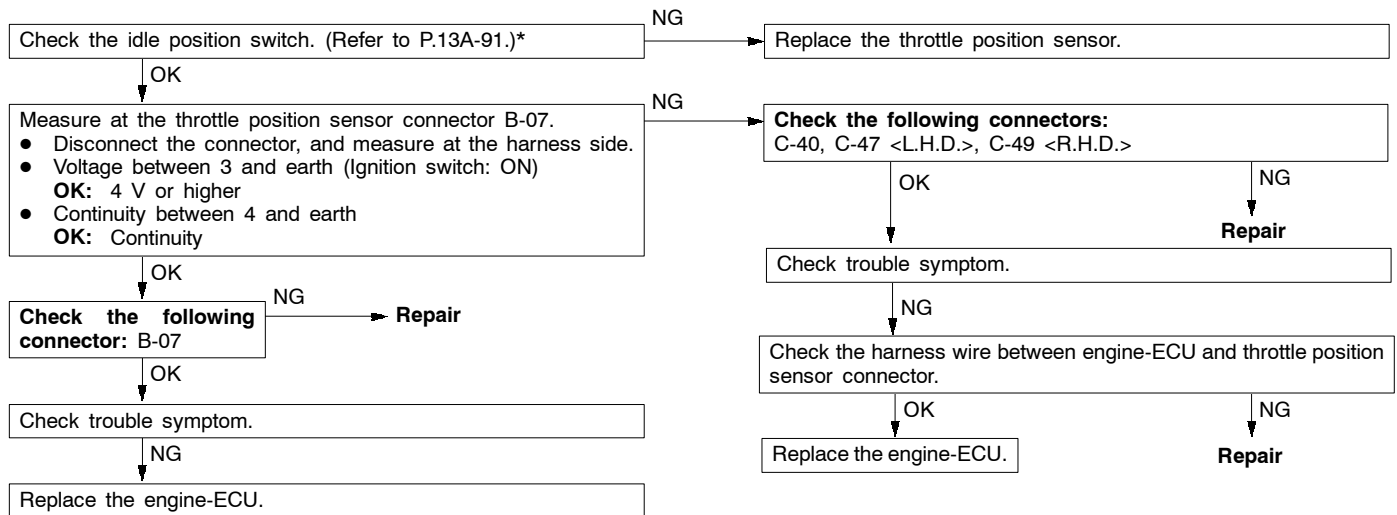
MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. <ul style="list-style-type: none"> • No power supply to engine-ECU. • Defective earth circuit of engine-ECU. • Defective engine-ECU. • Improper communication line between engine-ECU and MUT-II 	<ul style="list-style-type: none"> • Malfunction of engine-ECU power supply circuit • Malfunction of engine-ECU • Open circuit between engine-ECU and diagnosis connector



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 28

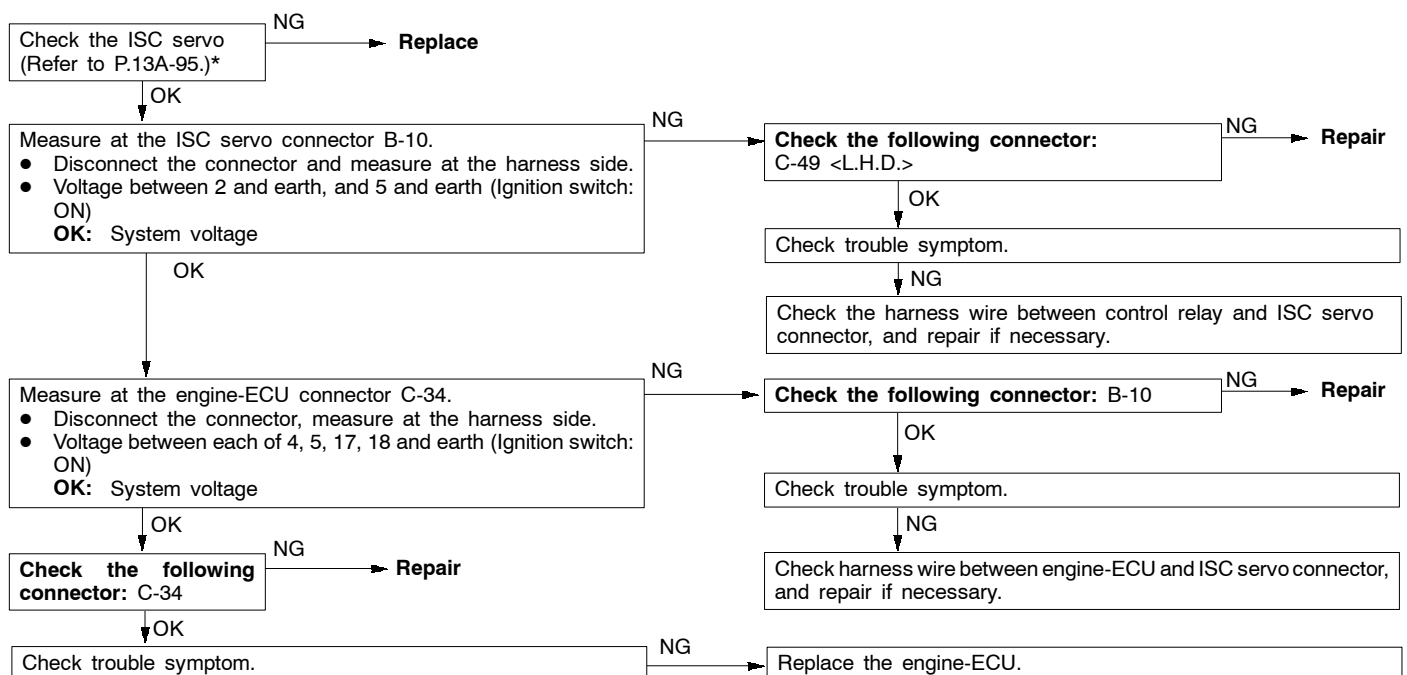
Idle position switch system	Probable cause
The idle position switch inputs the condition of the accelerator pedal, i.e. whether it is depressed or released (HIGH/LOW), to the engine-ECU. The engine-ECU controls the idle speed control servo based on this input.	<ul style="list-style-type: none"> Maladjustment of the accelerator pedal Maladjustment of the fixed SAS Maladjustment of the idle position switch and throttle position sensor Improper connector contact, open circuit or short-circuited harness wire Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 34

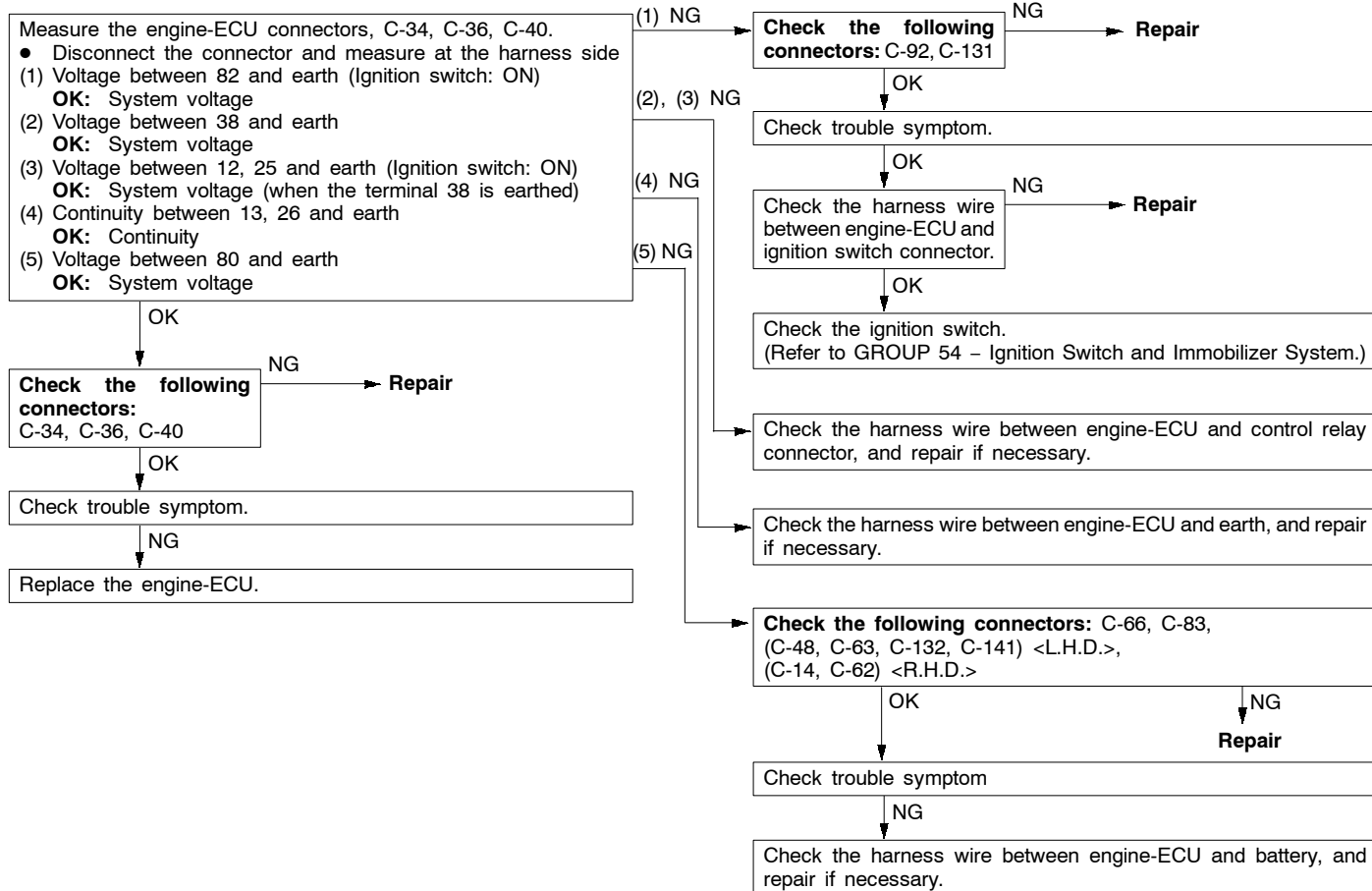
Idle speed control (ISC) servo (Stepper motor) system	Probable cause
The engine-ECU controls the intake air volume during idling by opening and closing the servo valve located in the bypass air passage.	<ul style="list-style-type: none"> Malfunction of ISC servo Improper connector contact, open circuit or short-circuited harness wire Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 45

Check the engine-ECU power supply and earth circuit.



MULTIPOINT FUEL INJECTION (MPI) <6A1>

GENERAL

OUTLINE OF CHANGES

Service procedures have been added for the following modifications:

- Modification of immobilizer
- Modification of body harness

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

NOTE

If the engine-ECU is replaced, the immobilizer-ECU and ignition key should be replaced together with it.

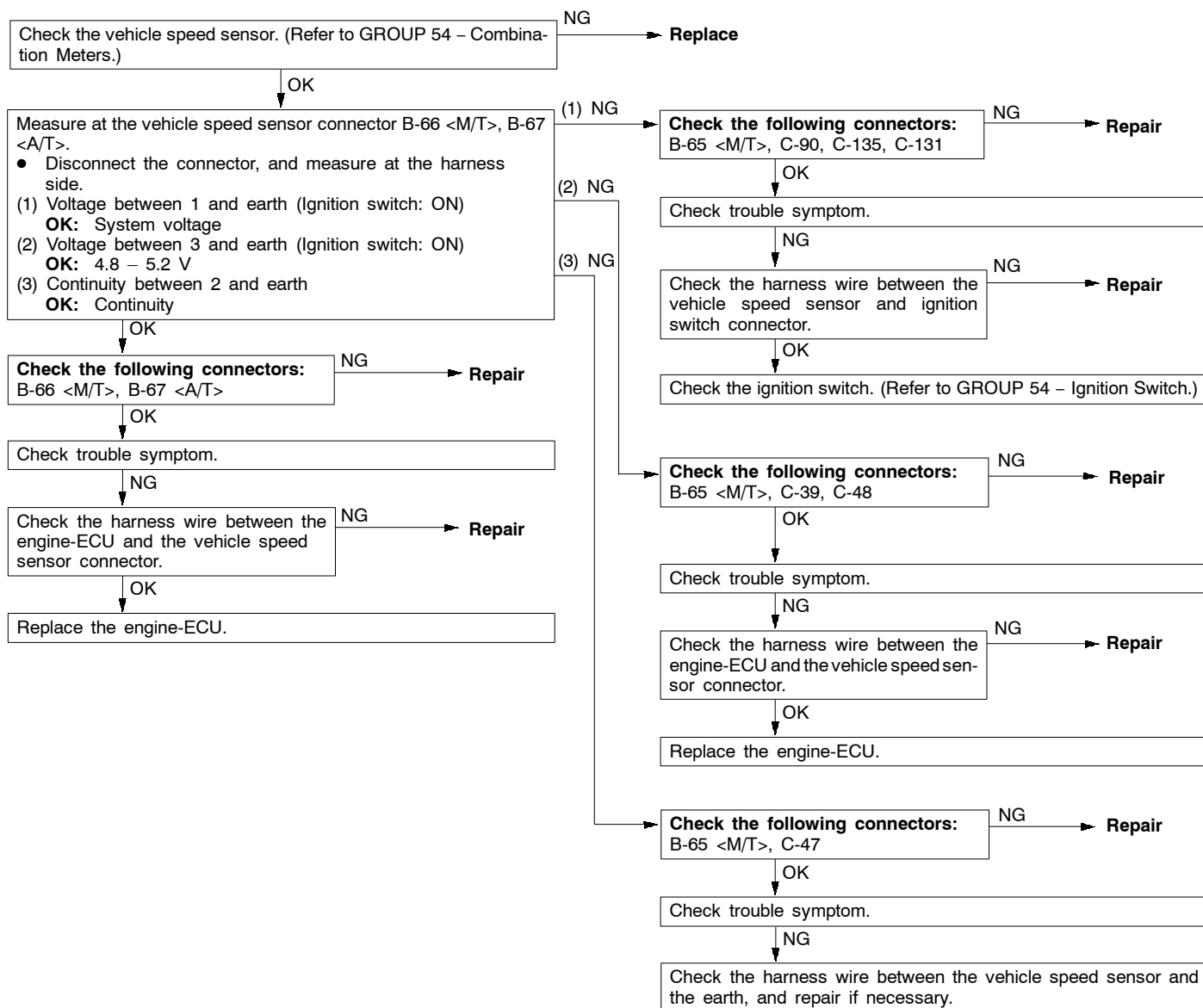
INSPECTION CHART FOR DIAGNOSIS CODES

The troubleshootings of code Nos.24, 54, 71 and 72 have been revised. The other items are the same as before.

Code No.	Diagnosis item	Reference page
24	Vehicle speed sensor system	13A-12
54	Immobilizer system	13A-13
71	Vacuum control solenoid valve system <Vehicles with TCL>	13A-14
72	Ventilation control solenoid valve system <Vehicles with TCL>	13A-15

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

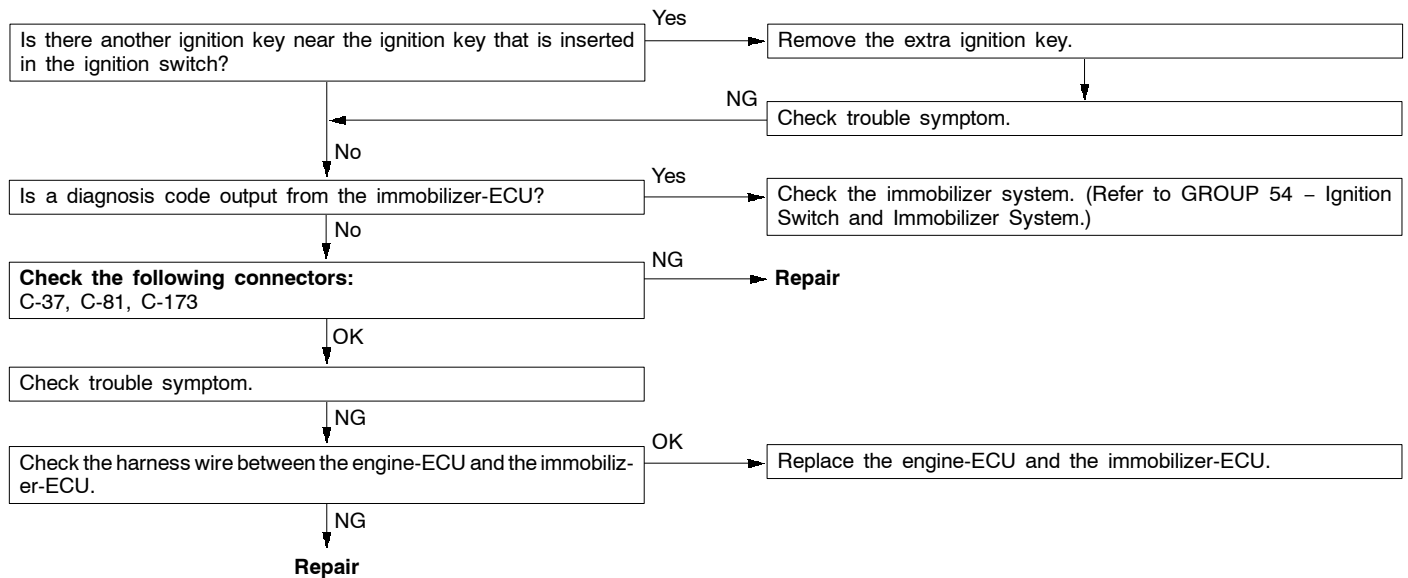
Code No. 24 Vehicles speed sensor system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Idle position switch: OFF Engine speed is 3,000 r/min or more. Driving under high engine load conditions. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> 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



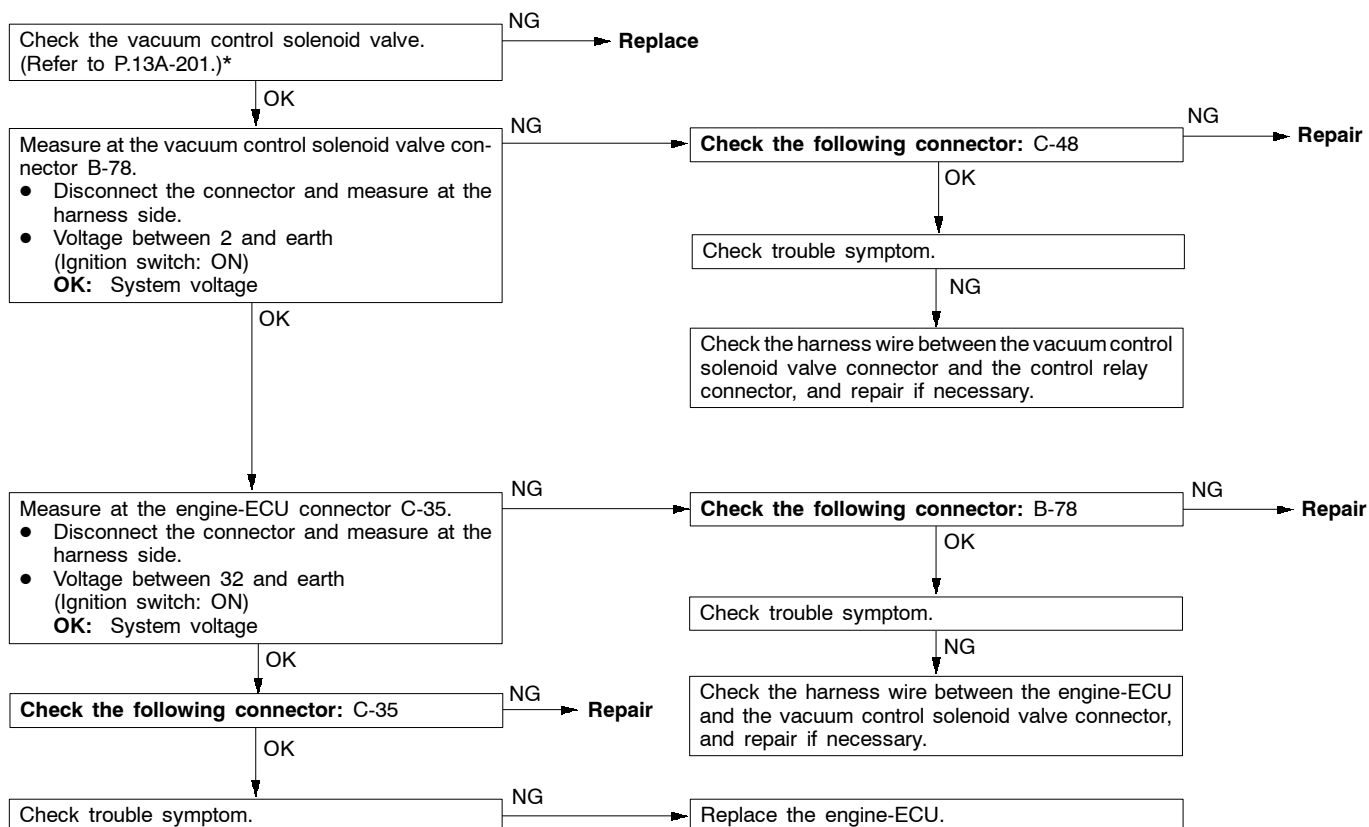
Code No.54 Immobilizer system	Probable cause
Range of Check • Ignition switch: ON Set Conditions • Improper communication between the engine-ECU and immobilizer-ECU	• Radio interference of encrypted codes • Incorrect encrypted code • Malfunction of harness or connector • Malfunction of immobilizer-ECU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

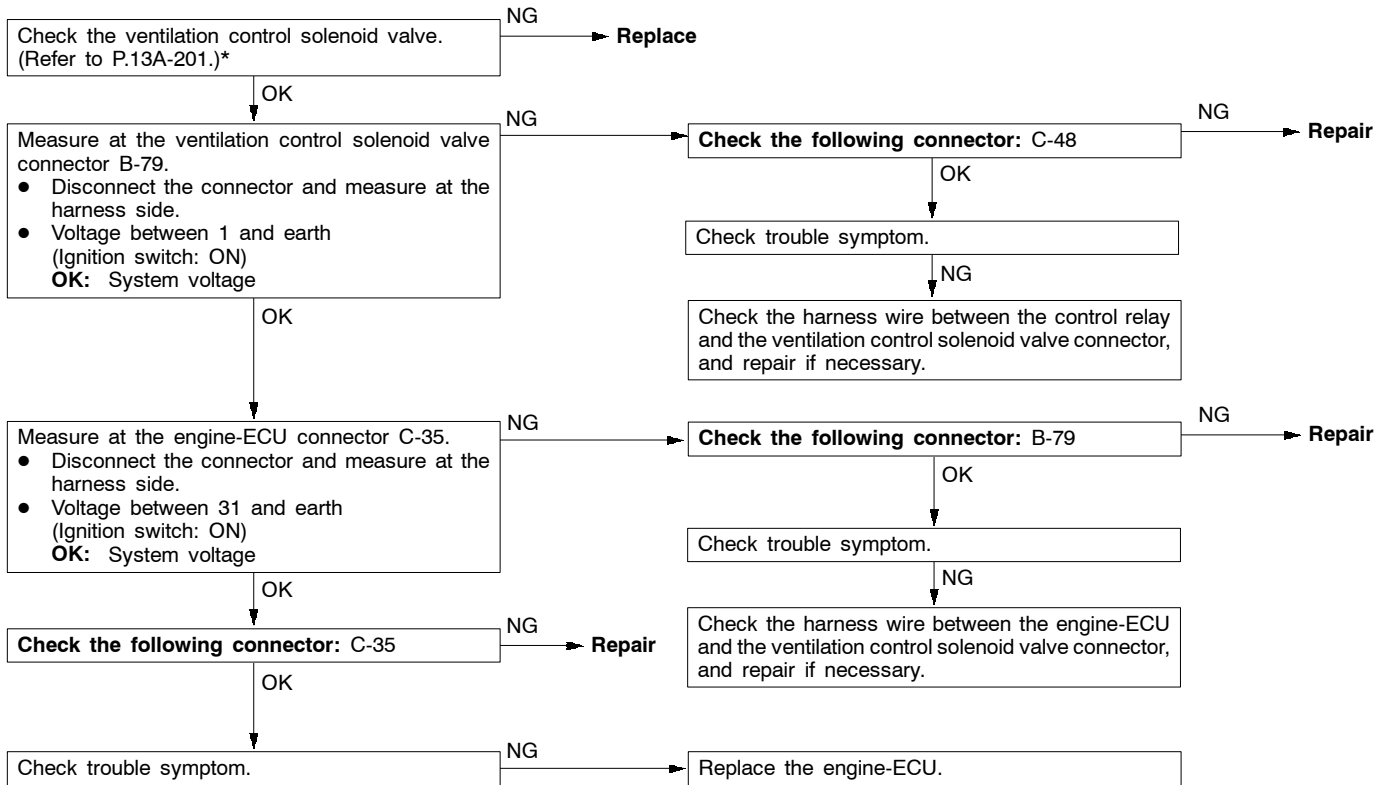


Code No. 71 Vacuum control solenoid valve system <Vehicles with TCL>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • Ignition switch: ON • Excluding 60 seconds immediately after the engine starts. • Battery voltage is 10 V or more. • Forced actuation by means of MUT-II is not being carried out. <p>Set condition</p> <p>Solenoid valve drive or non-drive instruction and energized condition of solenoid coil are different.</p>	<ul style="list-style-type: none"> • Malfunction of the vacuum control solenoid valve • Improper connector contact, open circuit or short-circuited harness wire of the vacuum control solenoid valve • Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

Code No. 72 Ventilation control solenoid valve system <Vehicles with TCL>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • Ignition switch: ON • Excluding 60 seconds immediately after the engine starts. • Battery voltage is 10 V or more. • Forced actuation by means of MUT-II is not being carried out. <p>Set condition</p> <p>Solenoid valve drive or non-drive instruction and energized condition of solenoid coil are different.</p>	<ul style="list-style-type: none"> • Malfunction of the ventilation control solenoid valve • Improper connector contact, open circuit or short-circuited harness wire of the ventilation control solenoid valve • Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION CHART FOR TROUBLE SYMPTOMS

The troubleshootings of inspection procedures Nos. 2, 31 and 48 have been revised. The other items are the same as before.

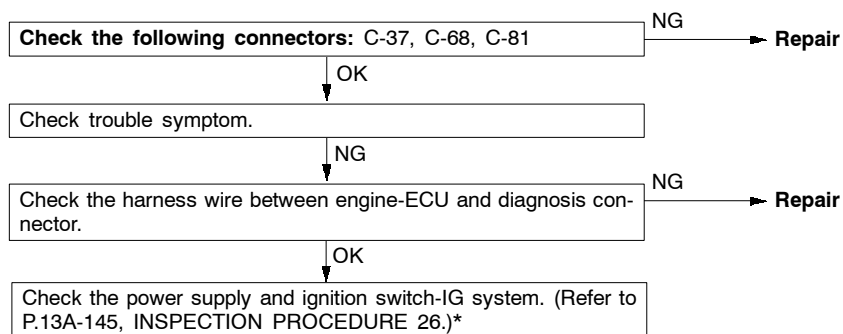
Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-128*
	Communication with engine-ECU only is not possible.	2	13A-16

*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 2

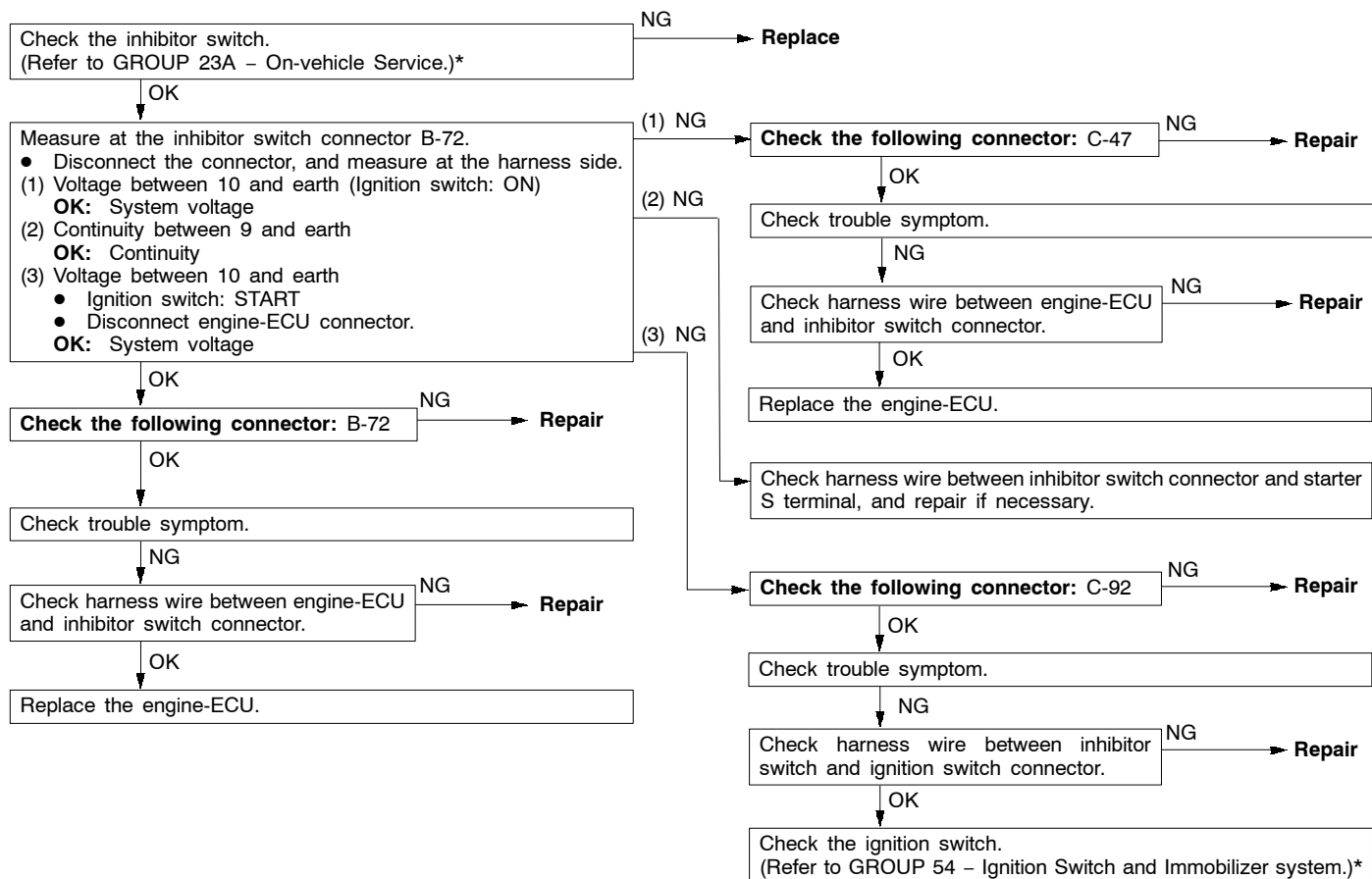
MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. <ul style="list-style-type: none"> • No power supply to engine-ECU. • Defective earth circuit of engine-ECU. • Defective engine-ECU. • Improper communication line between engine-ECU and MUT-II 	<ul style="list-style-type: none"> • Malfunction of engine-ECU power supply circuit • Malfunction of engine-ECU • Open circuit between engine-ECU and diagnosis connector



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 31

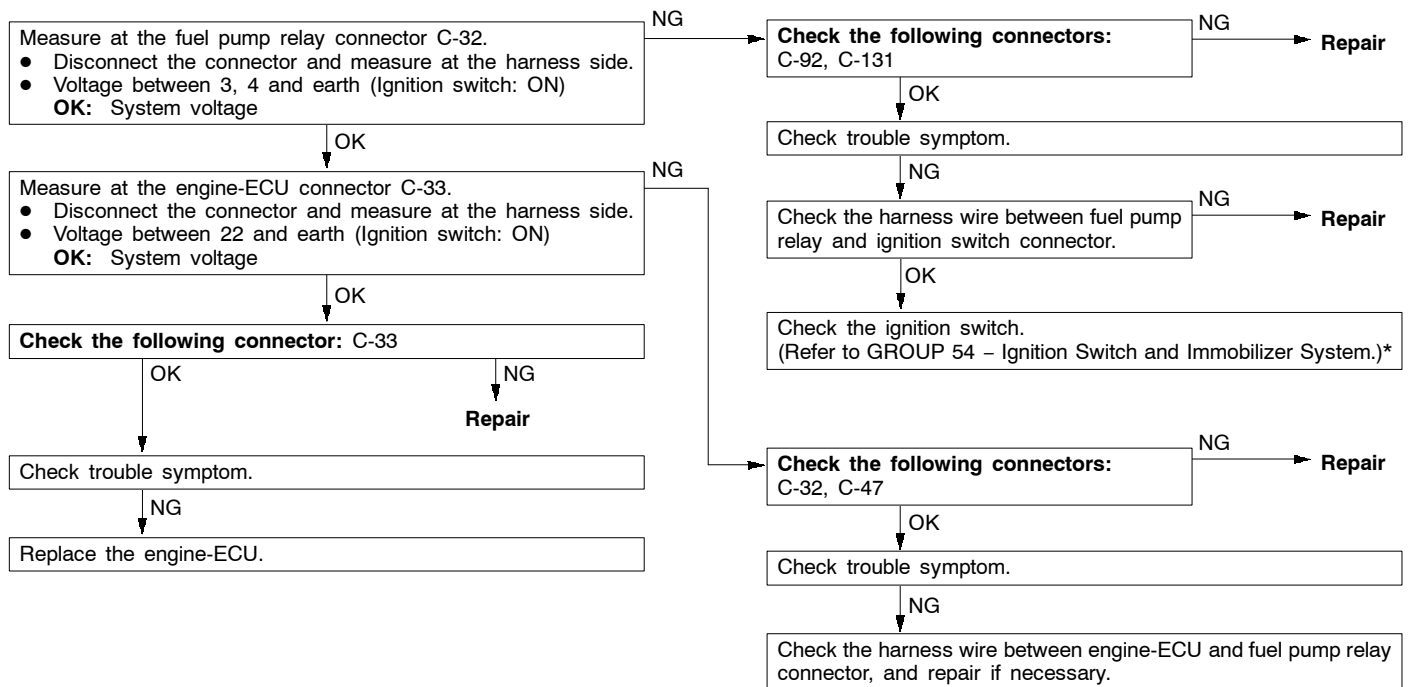
Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
<ul style="list-style-type: none"> The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU controls fuel injection, etc. during starting based on this input. The inhibitor switch inputs the condition of the select lever, i.e. whether it is in P or N range or in some other range, to the engine-ECU. The engine-ECU controls the idle speed control (ISC) servo based on this input. 	<ul style="list-style-type: none"> Malfunction of ignition switch Malfunction of inhibitor switch Improper connector contact, open circuit or short-circuited harness wire Malfunction of the engine-ECU.



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 48

Check the fuel pump drive control circuit.



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

GROUP 13E

DIESEL FUEL

GENERAL

OUTLINE OF CHANGE

- Troubleshooting regarding diagnosis code No.17 has been changed to correspond to the change of the body wiring harness.

TROUBLESHOOTING

INSPECTION CHART FOR DIAGNOSIS CODES

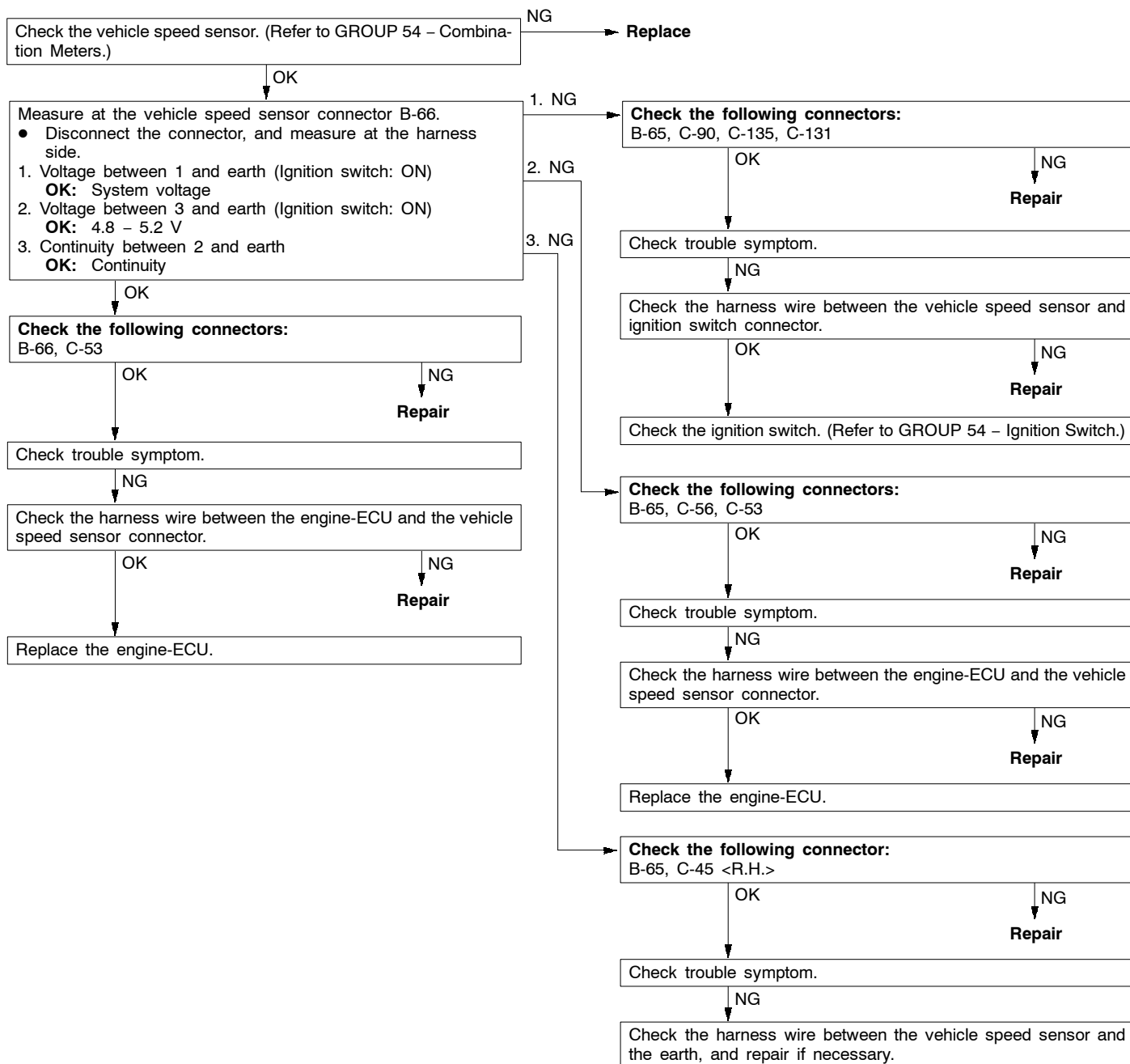
Caution

Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.

Code No.	Diagnosis item	Reference page
17	Vehicle speed sensor system	13E-2

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No.17 Vehicle speed sensor system	Probable cause
Range of Check <ul style="list-style-type: none"> Engine speed: 2,400 r/min or more Accelerator pedal opening amount: 50 % or more Engine coolant temperature: 60 °C or higher Set Conditions <ul style="list-style-type: none"> Vehicle speed signal is 0 km/h for 10 seconds or more. 	<ul style="list-style-type: none"> Malfunction of the vehicle speed sensor Open or short circuit in vehicle speed sensor circuit or poor connector contact Malfunction of the engine-ECU



GROUP 13H

TRACTION CONTROL SYSTEM (TCL)

GENERAL

OUTLINE OF CHANGE

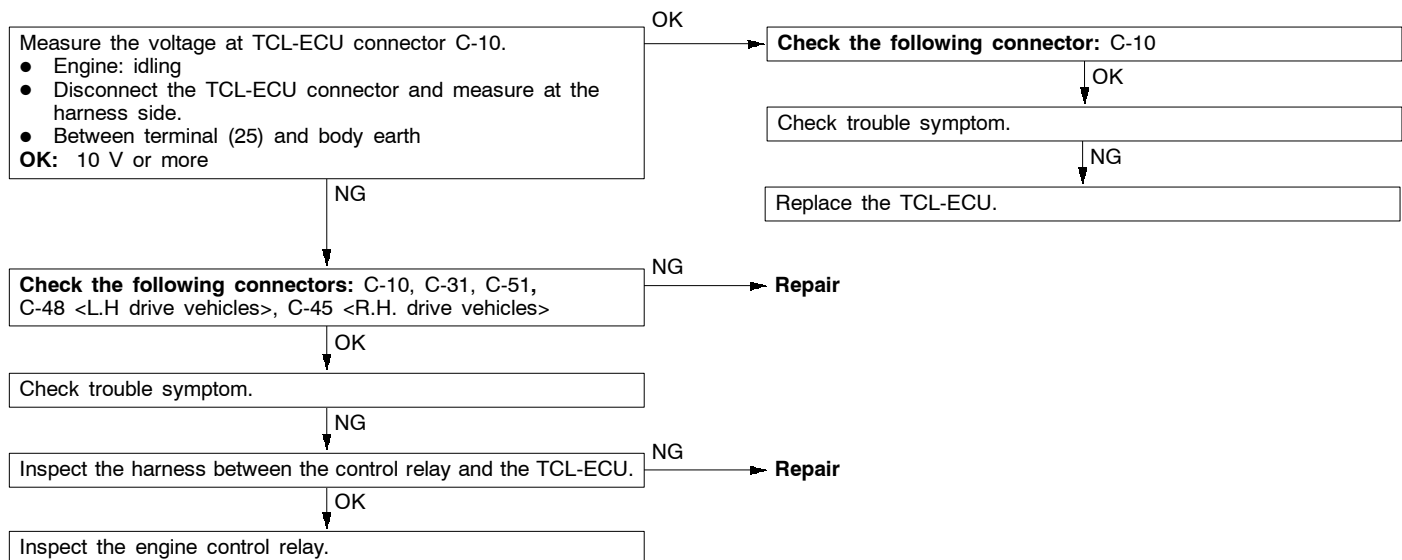
Troubleshootings have been revised for the modification of the traction control system (TCL) circuit.

TROUBLESHOOTING

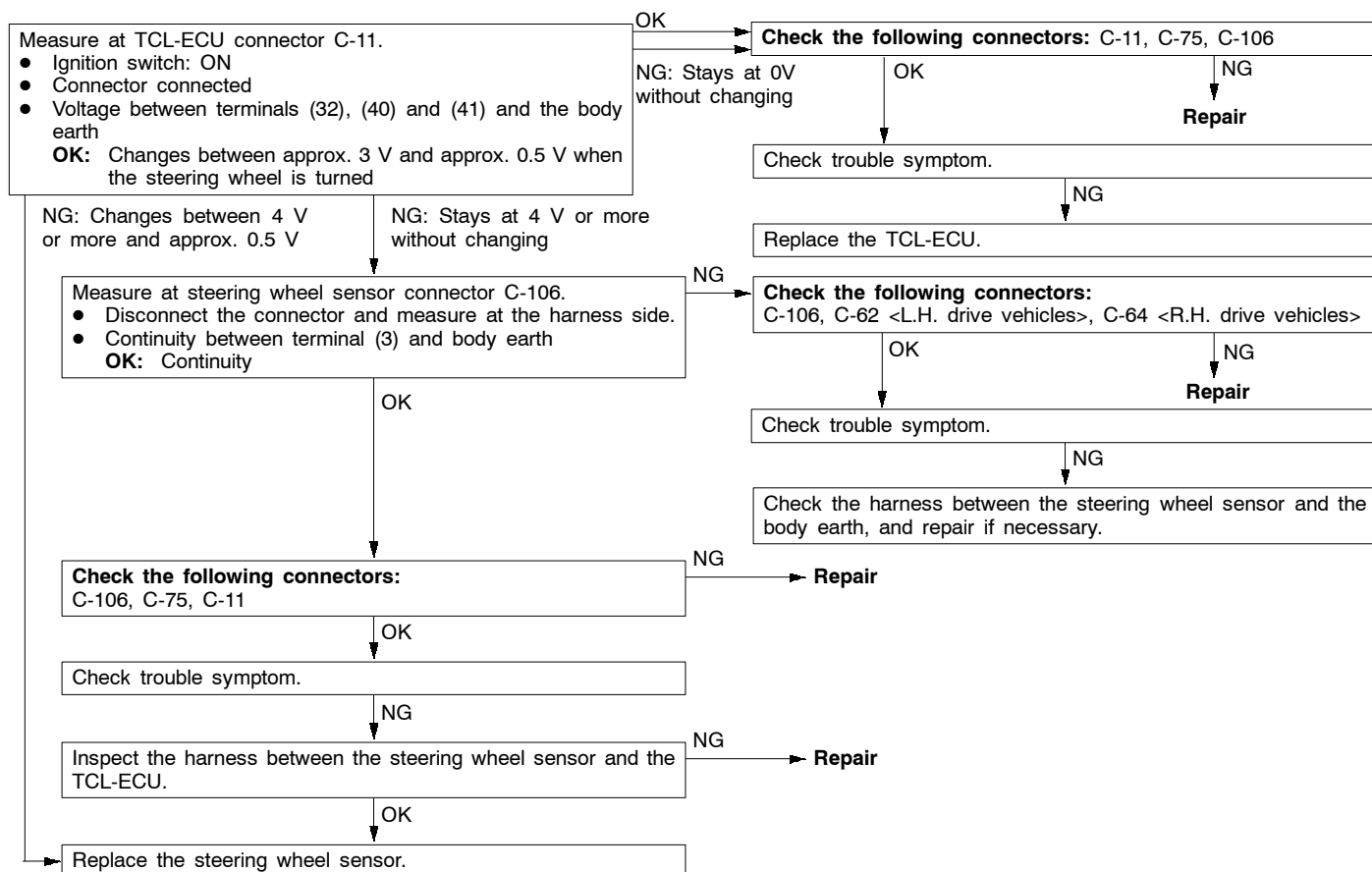
The other items than the following are the same as before.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 27 TCL-ECU power supply voltage circuit (engine control relay circuit) system	Probable cause
This diagnosis code is output if the TCL-ECU power supply voltage (engine control relay supply voltage) is lower than the specified value. If the voltage returns to the specified value or greater, the diagnosis code is erased.	<ul style="list-style-type: none"> • Malfunction of control relay • Malfunction of harness or connector • Malfunction of TCL-ECU



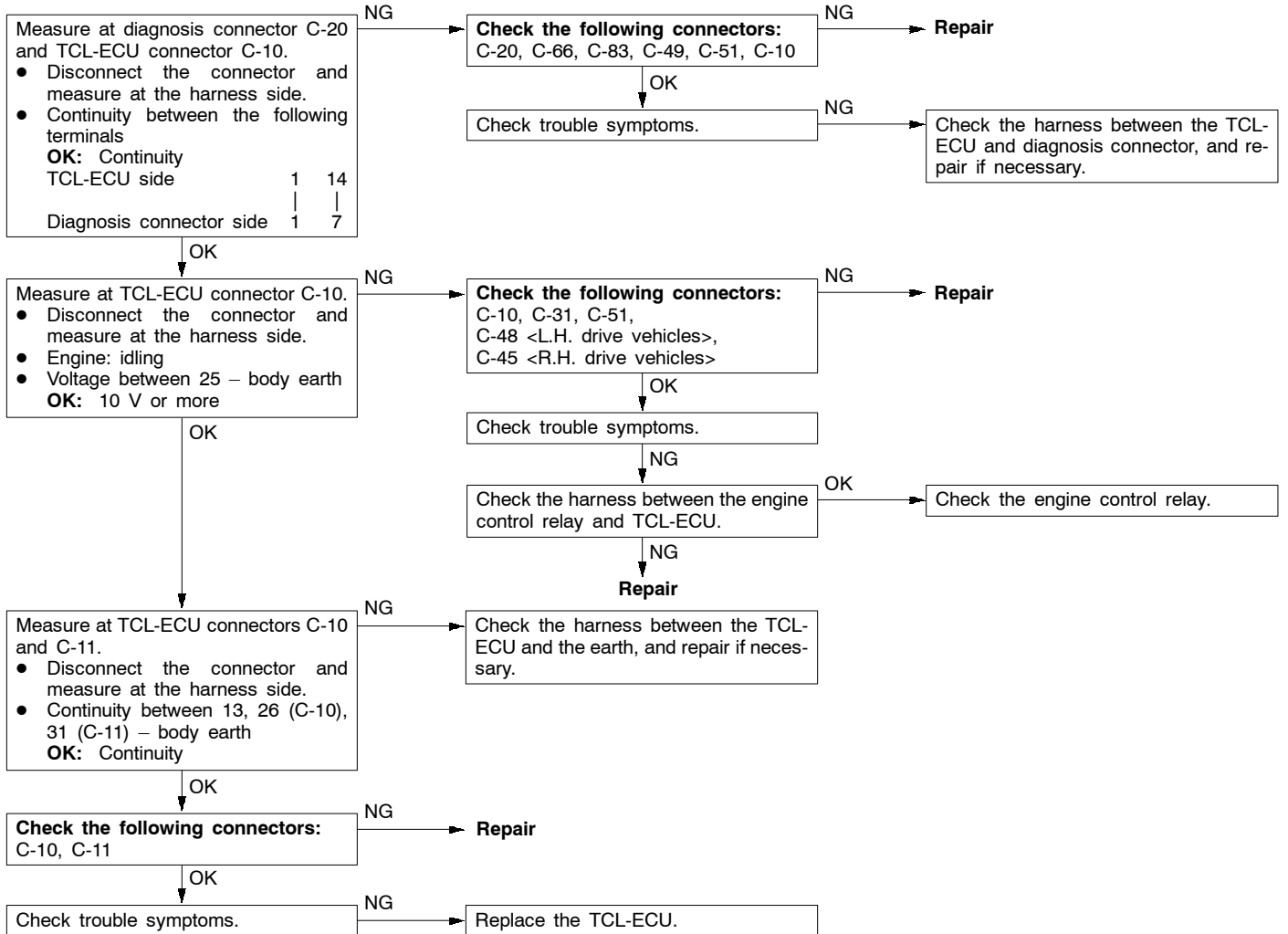
Code No. 41 Steering wheel sensor (ST-1) circuit system (open circuit)	Probable cause
Code No. 42 Steering wheel sensor (ST-2) circuit system (open circuit)	
Code No. 43 Steering wheel sensor (ST-N) circuit system (open circuit)	
These diagnosis codes are output if there is an open circuit in the output wire of the steering wheel sensor circuit.	<ul style="list-style-type: none"> • Malfunction of harness or connector • Malfunction of steering wheel sensor • Malfunction of TCL-ECU



INSPECTION PROCEDURE FOR TROUBLE SYMPTOM

Inspection Procedure 2

Communication with the MUT-II is not possible. (Communication with TCL-ECU only is not possible.)	Probable cause
If the MUT-II cannot communicate with the TCL-ECU only, the cause is probably an abnormality in the TCL diagnosis line or in the TCL-ECU power supply line or earth line.	<ul style="list-style-type: none"> • Malfunction of harness or connector • Malfunction of engine control relay • Malfunction of TCL-ECU



NOTES

GASOLINE DIRECT INJECTION (GDI) <4G6>

CONTENTS

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Fuel Leak Check	104	FUEL PUMP (HIGH PRESSURE) AND FUEL PRESSURE REGULATOR (HIGH PRESSURE)	114
Fuel Pump Connector Disconnection (How to Reduce the Fuel Pressure)	104	INJECTOR	118
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Engine Control Relay, Fuel Pump Relay, and Throttle Valve Control Servo Relay Continuity Check	107	THROTTLE VALVE CONTROLLER	125

GENERAL

OUTLINE OF CHANGE

- A 4G64-GDI engine has been added. To correspond to this, maintenance service procedures are given below:

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.

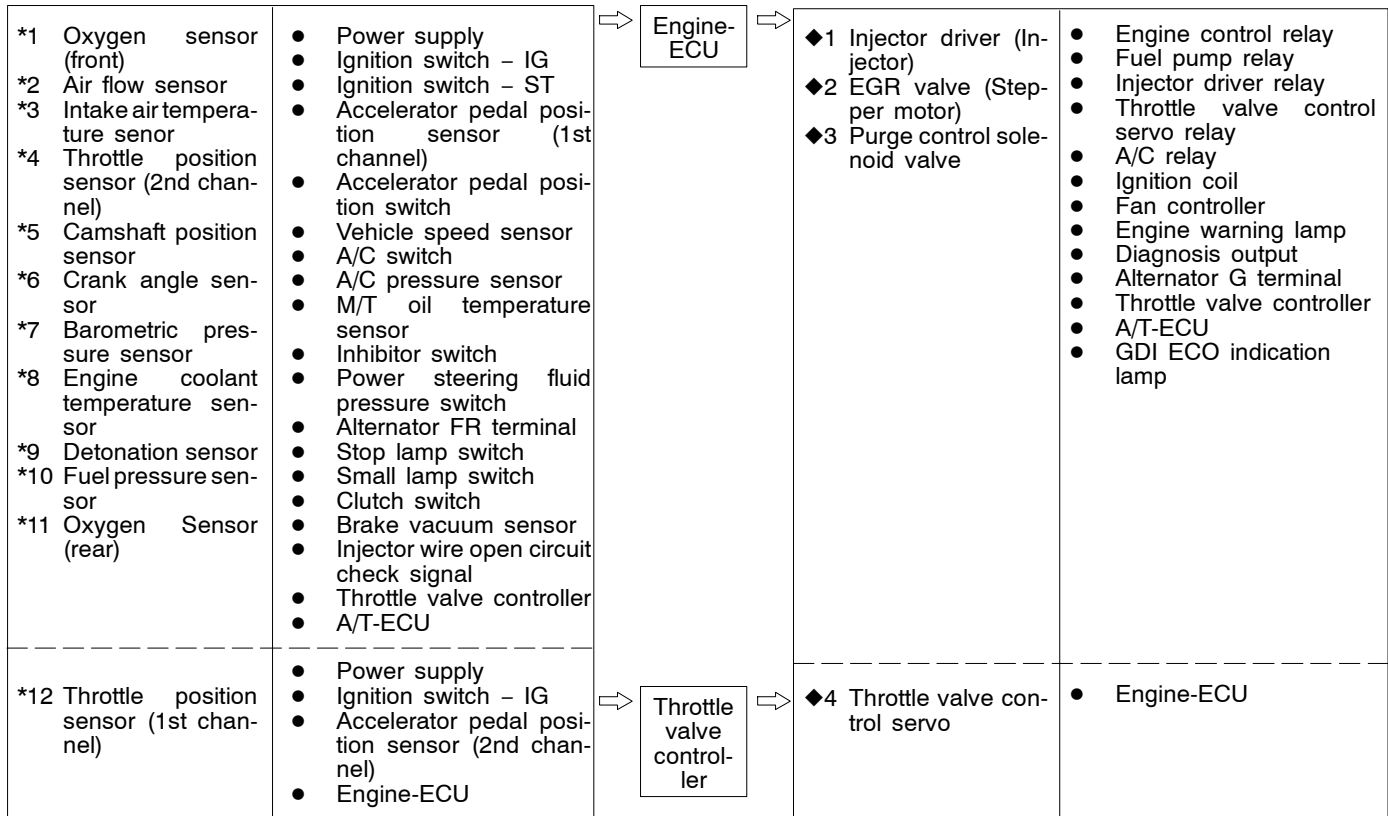
4. Purge Control Solenoid Valve Control
Refer to GROUP 17.
5. EGR valve Control
Refer to GROUP 17.

GENERAL SPECIFICATIONS

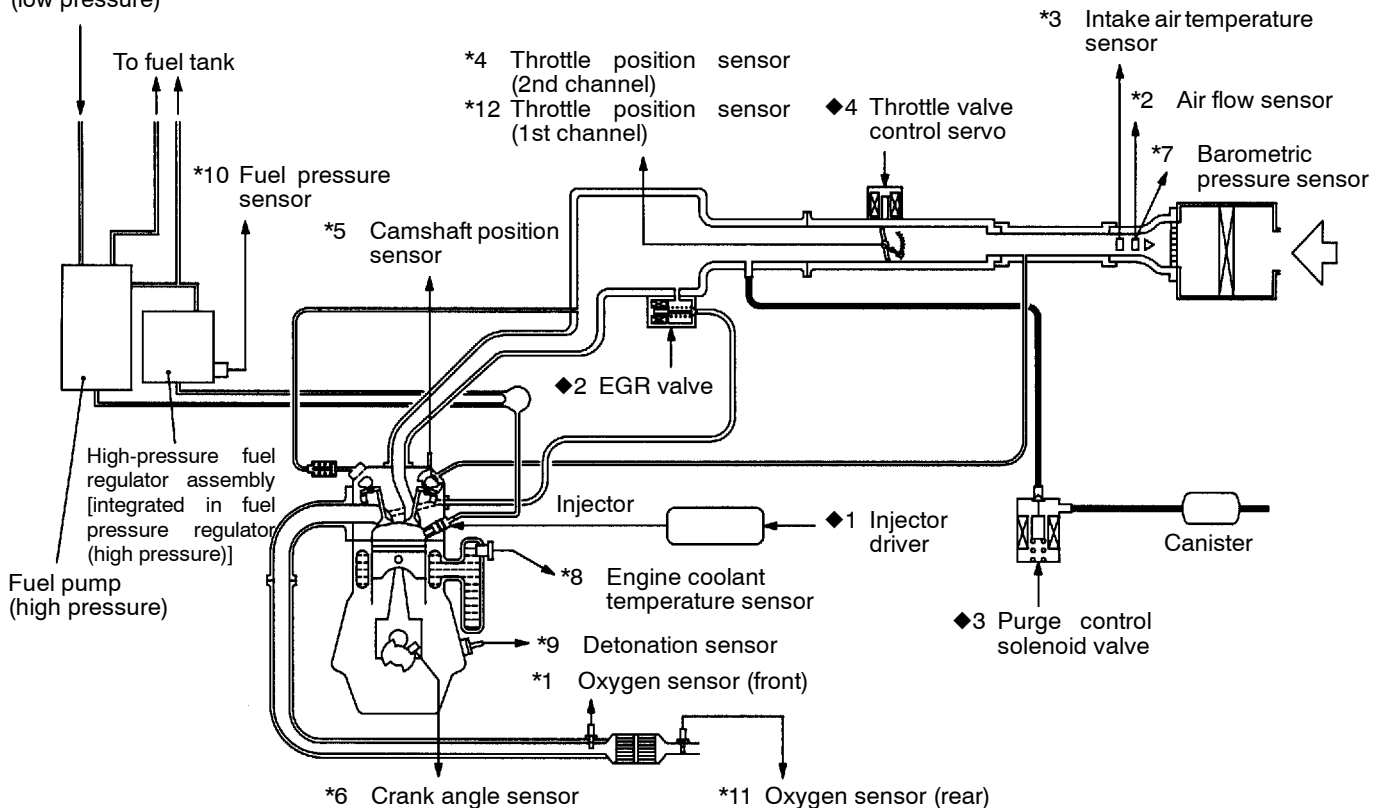
Items			Specifications
Throttle body	Throttle bore mm		65
	Throttle position sensor		Variable resistor type (Dual system type)
	Throttle valve control servo		Torque motor type
Engine-ECU	Identification model No.	Except vehicles for Germany	E2T72880
		Vehicles for Germany	E2T72881
Sensors	Air flow sensor		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		Variable resistor type (Dual system type)
	Accelerator pedal position switch		Rotary contact type, within accelerator pedal position sensor
	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

Items		Specifications
Actuators	Engine control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector driver relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	DIM 1100G
	Throttle valve control servo relay	Contact switch 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



From fuel pump
(low pressure)



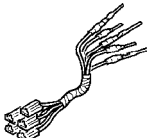
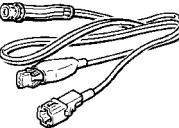
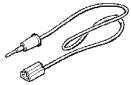

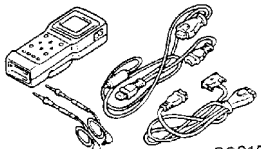
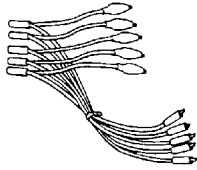
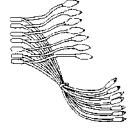
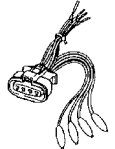

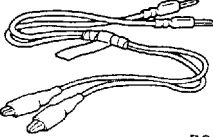
SERVICE SPECIFICATIONS

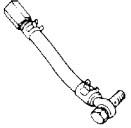
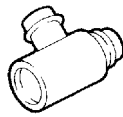
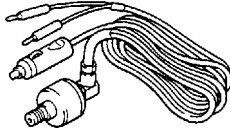
Item		Standard value
Adjustment voltage of throttle position sensor (1st channel) V		0.4 – 0.6
Adjustment voltage of throttle position sensor (2nd channel) V		4.2 – 4.8
Resistance of throttle position sensor (1st and 2nd channels) kΩ		1.7 – 3.3
Adjustment voltages of accelerator pedal position sensor (1st and 2nd channels) V		0.985 – 1.085
Resistance of accelerator pedal position sensor (1st and 2nd channels) kΩ		3.5 – 6.5
Intake air temperature sensor resistance kΩ	at 20°C	2.3 – 3.0
	at 80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	at 20°C	2.1 – 2.7
	at 80°C	0.26 – 0.36
Fuel pressure	High-pressure side MPa	4 – 6.9
	Low-pressure side kPa	Approximately 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
<p>A</p>  <p>B</p>  <p>C</p>  <p>D</p>  <p>C991223</p>	<p>MB991223</p> <p>A: MB991219</p> <p>B: MB991220</p> <p>C: MB991221</p> <p>D: MB991222</p>	<p>Harness set</p> <p>A: Test harness</p> <p>B: LED harness</p> <p>C: LED harness adapter</p> <p>D: Probe</p>	<ul style="list-style-type: none"> Inspection of oxygen sensor A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 <p>B991502</p>	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> Reading diagnosis code GDI system inspection
	MB991348, MB991658	Test harness set	<ul style="list-style-type: none"> Measurement of voltage during troubleshooting Inspection using an analyzer
 <p>MB991709</p>	MB991709	Test harness	
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
	MD998478	Test harness (3-pin, triangle)	<ul style="list-style-type: none"> Measurement of voltage during troubleshooting Inspection using an analyzer
 <p>B991529</p>	MB991529	Diagnosis code check harness	Reading diagnosis code

Tool	Number	Name	Use
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	

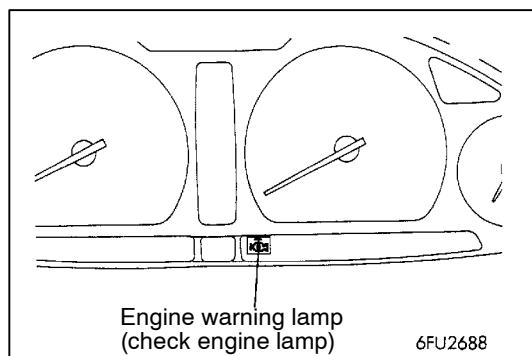
TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE

If the engine-ECU is replaced, the immobilizer-ECU 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.

Diagnosis items indicated by the engine warning lamp flashing

Engine-ECU
Oxygen sensor (front)
Oxygen sensor (rear)
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 position feedback
Throttle valve control servo motor (Motor 1st phase malfunction)
Throttle valve control servo motor (Motor 2nd phase malfunction)
Communication line system with throttle valve controller

NOTE

The engine warning lamp flashes when the electronic-controlled throttle valve system is disabled.

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.)

Defective part or function	What to do when a sensor is defective
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).
Oxygen sensor (front)	Air/fuel ratio closed loop control is not performed.
Oxygen sensor (rear)	Performs the closed loop control of the air/fuel ratio by using only the signal of oxygen sensor (front).
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).
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.

Defective part or function	What to do when a sensor is defective
Accelerator pedal position sensor (2nd channel)	<ol style="list-style-type: none"> (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	<ol style="list-style-type: none"> (1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables idle engine speed feedback control.
Throttle valve position feedback	<ol style="list-style-type: none"> (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 (Motor 1st phase malfunction)	Disables lean-mixture combustion.
Throttle valve control servo motor (Motor 2nd phase malfunction)	<ol style="list-style-type: none"> (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	<ol style="list-style-type: none"> (1) Error in communication from the throttle valve controller to the engine-ECU <ul style="list-style-type: none"> ● Disables lean-mixture combustion. ● Shuts off fuel supply when engine speed exceeds 3,000 r/min. (2) Error in communication from the engine-ECU to the throttle valve controller <ul style="list-style-type: none"> ● 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.

NOTE

The engine warning lamp illuminates when the electronic-controlled throttle valve system is disabled.

INSPECTION CHART FOR DIAGNOSIS CODES

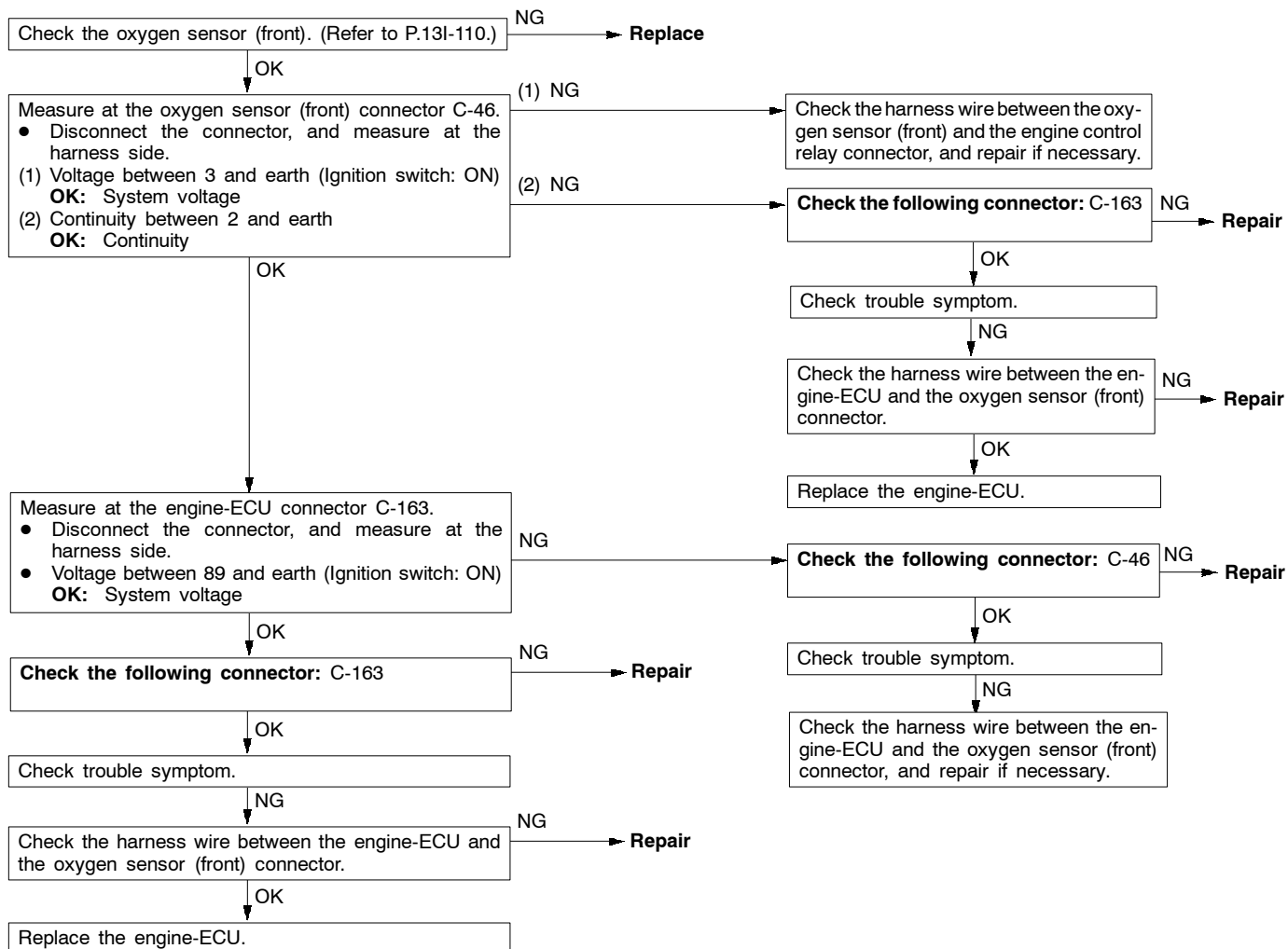
Code No.	Diagnosis item	Reference page
11	Oxygen sensor (front) system	13I-14
12	Air flow sensor system	13I-15
13	Intake air temperature sensor system	13I-16
14	Throttle position sensor (2nd channel) system	13I-17
21	Engine coolant temperature sensor system	13I-18
22	Crank angle sensor system	13I-19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

NOTE

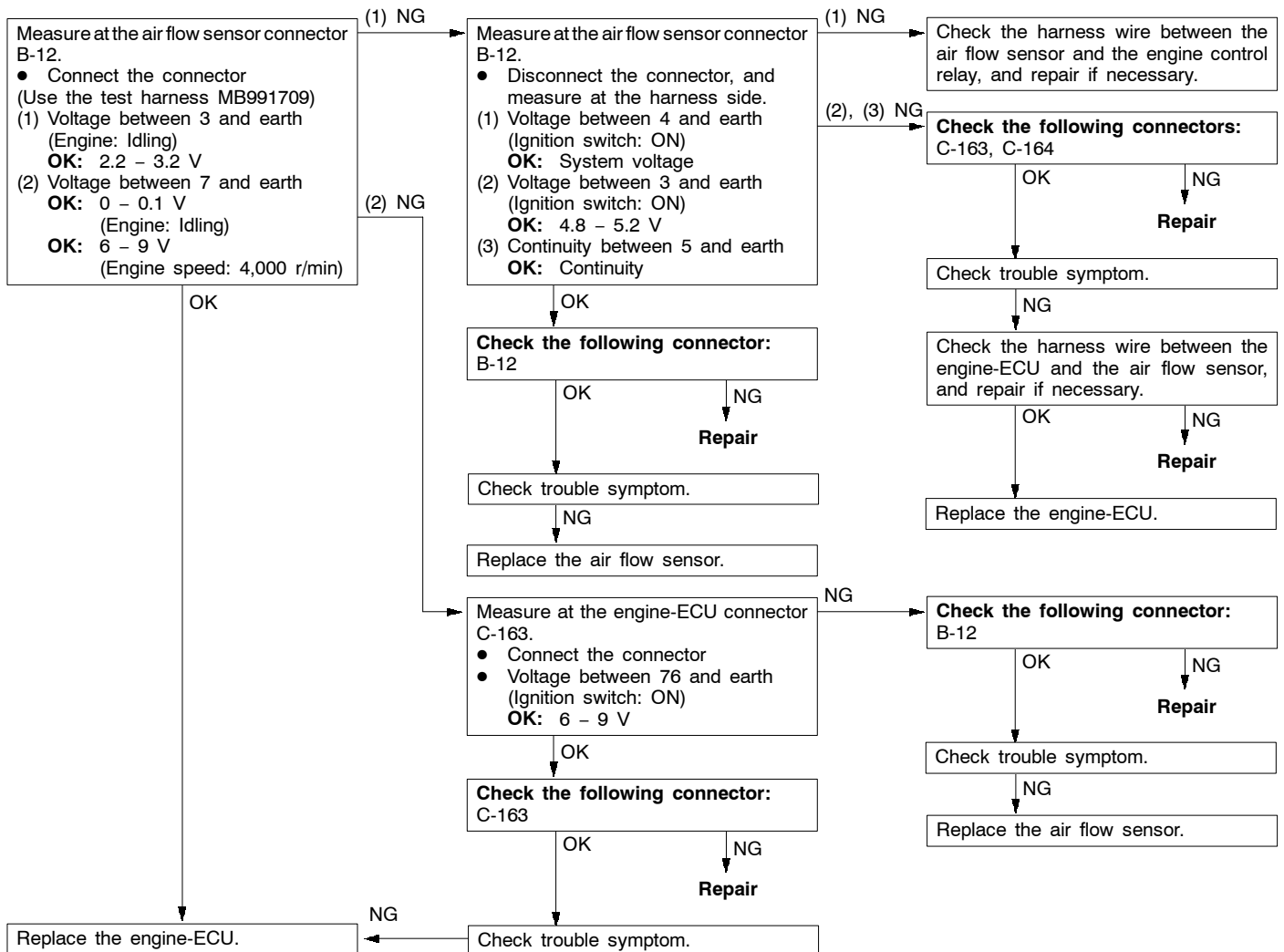
Code No. 56 may be also output when air is sucked in high-pressure fuel line due to no fuel supply.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

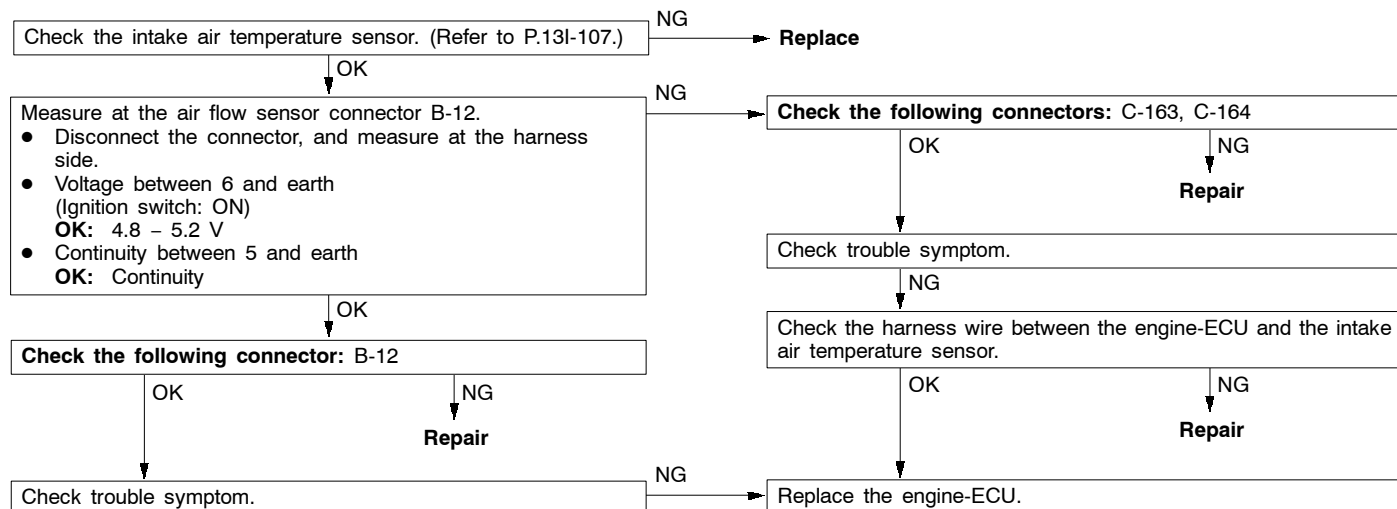
Code No. 11 Oxygen sensor (front) system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> 3 minutes have passed after engine was started. Engine coolant temperature is approx. 80°C or more. Intake air temperature is 20–50°C. Engine speed is approx. 2,000–3,000 r/min Vehicle is moving at constant speed on a flat, level road surface <p>Set conditions</p> <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Malfunction of the oxygen sensor (front) Improper connector contact, open circuit or short-circuited harness wire Malfunction of the engine-ECU



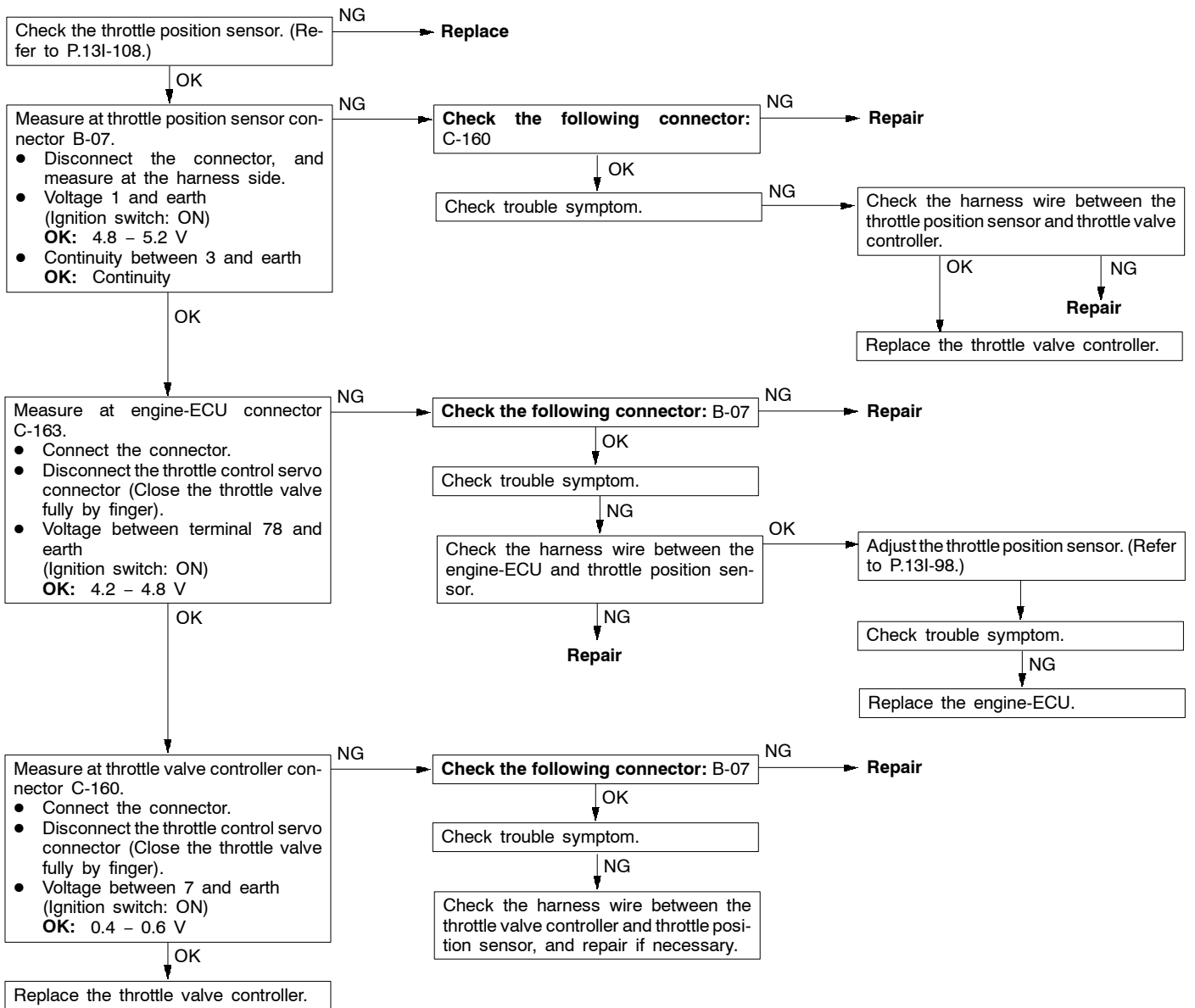
Code No.12 Air flow sensor system	Probable cause
Range of check • Engine speed is 500 r/min or more. Set conditions • Sensor output frequency is 3.3 Hz or less for 4 seconds.	• Malfunction of the air flow sensor • Open circuit or short-circuited harness wire of air flow sensor circuit • Malfunction of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



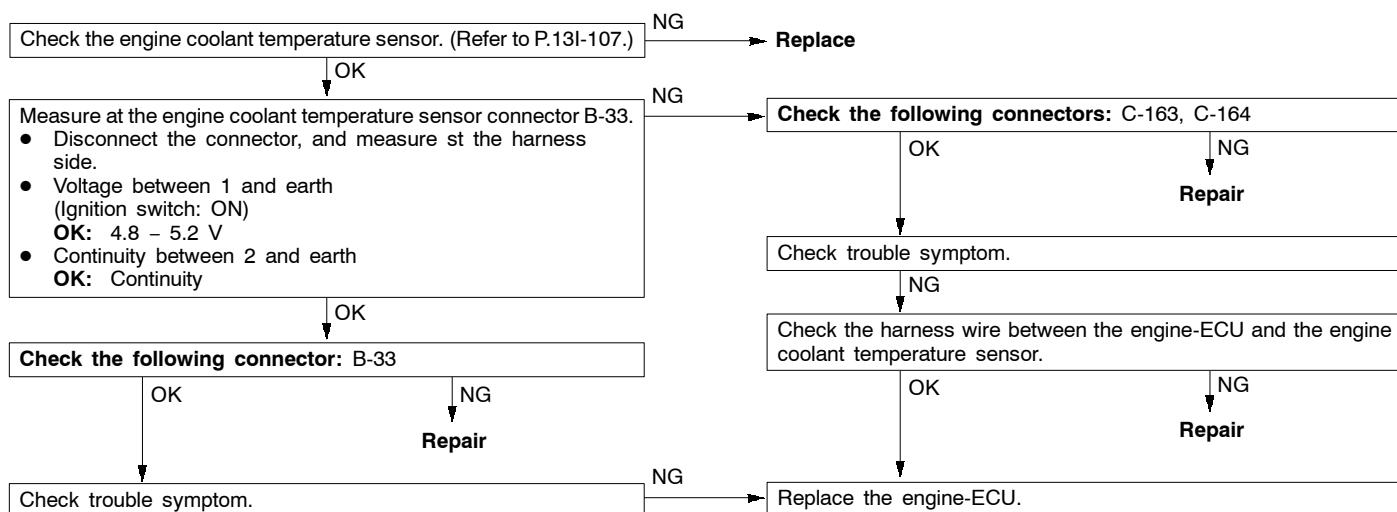
Code No.13 Intake air temperature sensor system	Probable cause
Range of check <ul style="list-style-type: none"> After 60 seconds have passed since the engine have started Set conditions <ul style="list-style-type: none"> Sensor resistance is 0.14 kΩ or less for 4 seconds. or <ul style="list-style-type: none"> Sensor resistance is 50 kΩ or more for 4 seconds. 	<ul style="list-style-type: none"> 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



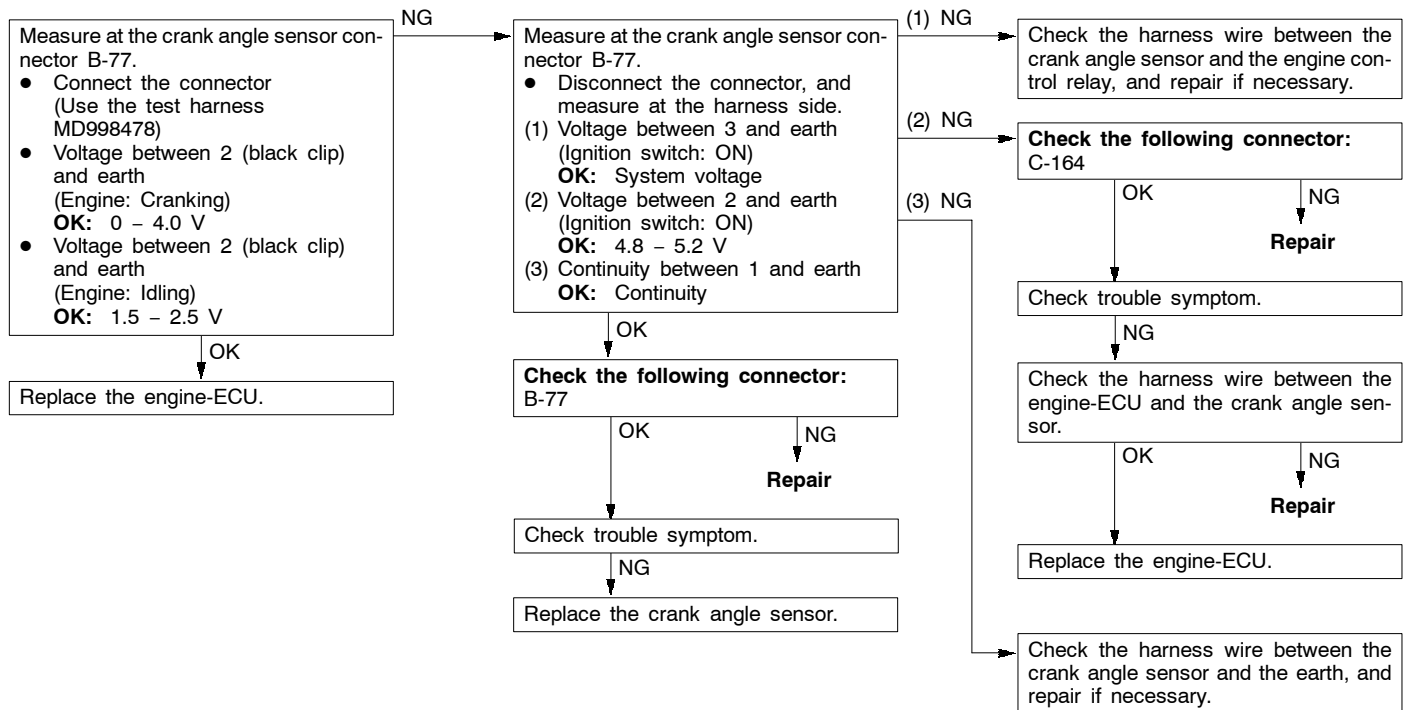
Code No.14 Throttle position sensor system (2nd channel)	Probable cause
<p>The throttle valve controller determines whether a failure is present or not, and sends a signal indicating its result to the engine-ECU.</p> <p>Range of check</p> <ul style="list-style-type: none"> Ignition switch: ON Throttle position sensor (1st channel) is normal <p>Set conditions</p> <ul style="list-style-type: none"> 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. <p>or</p> <ul style="list-style-type: none"> 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. <p>or</p> <ul style="list-style-type: none"> Throttle position sensor (1st and 2nd channels) output voltages are outside 4 to 6 V. 	<ul style="list-style-type: none"> 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



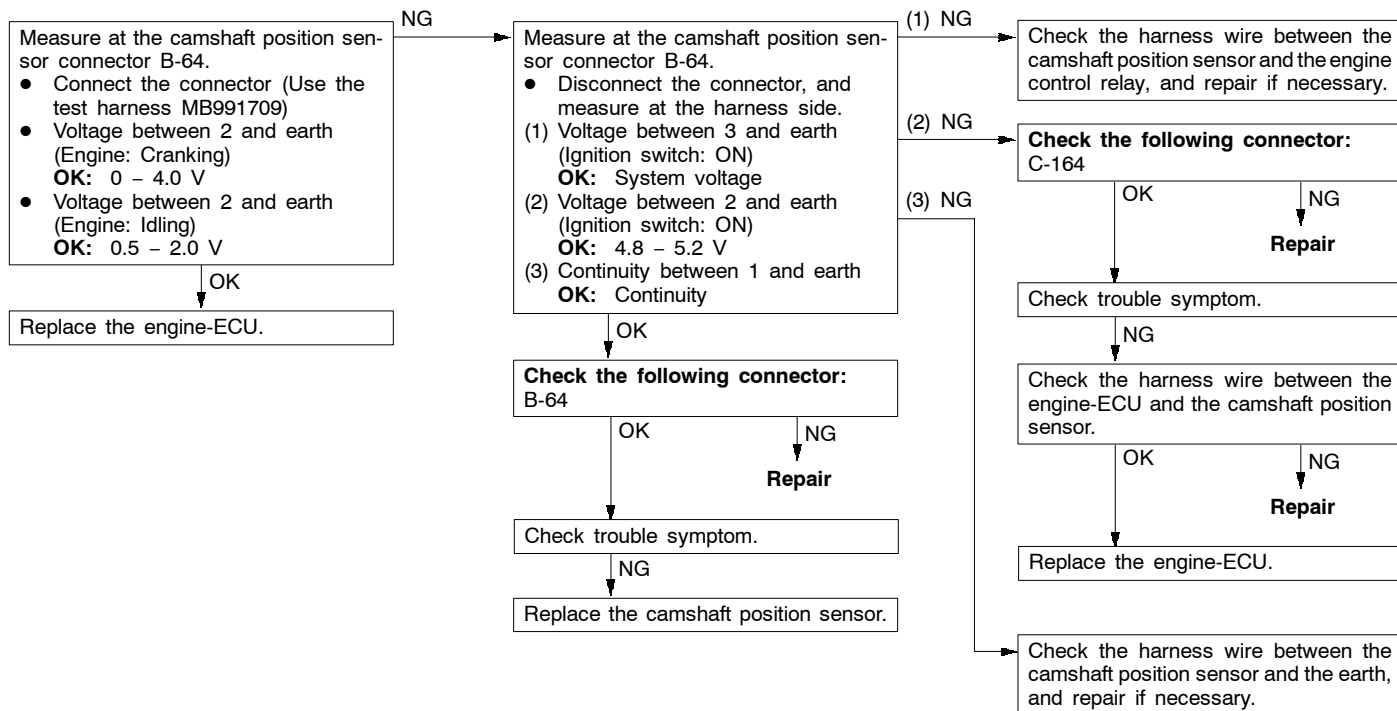
Code No.21 Engine coolant temperature sensor system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> After 60 seconds have passed since the engine have started <p>Set conditions</p> <ul style="list-style-type: none"> Sensor resistance is 50 Ω or less for 4 seconds. <p>or</p> <ul style="list-style-type: none"> Sensor resistance is 72 kΩ or more for 4 seconds. <p>Range of check</p> <ul style="list-style-type: none"> After engine starts <p>Set conditions</p> <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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



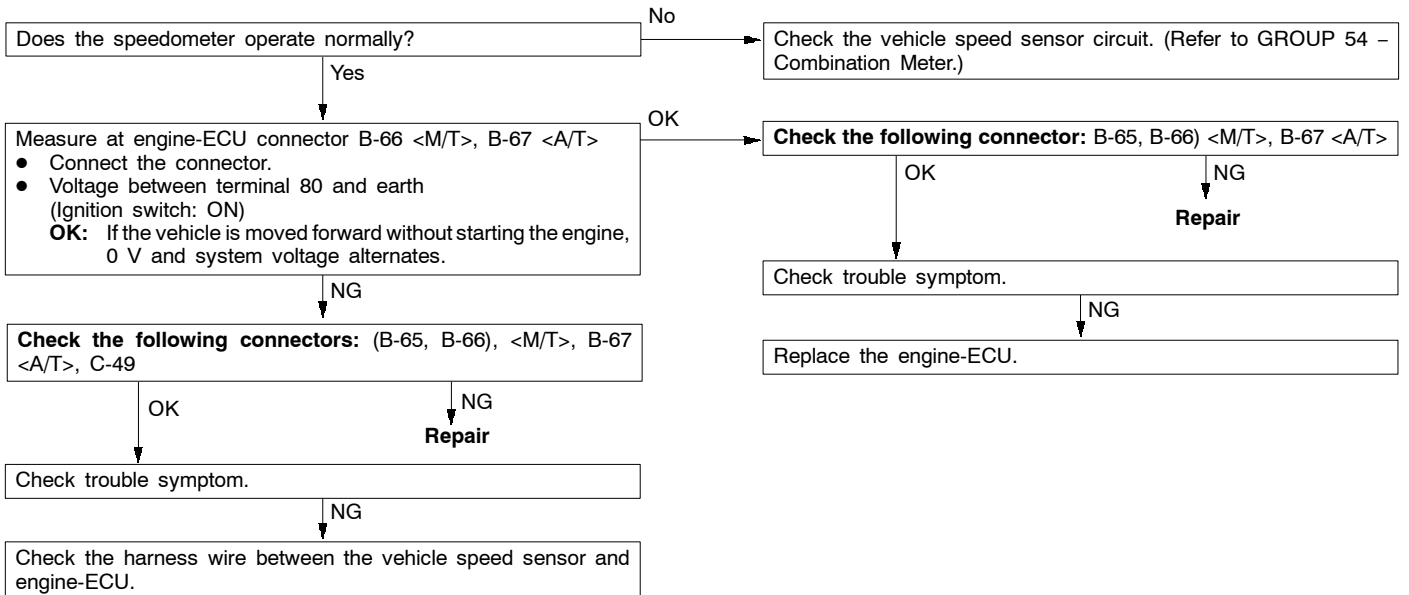
Code No.22 Crank angle sensor system	Probable cause
Range of check • Engine: During cranking Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	• Malfunction of the crank angle sensor • Open circuit or short-circuited harness wire of the crank angle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



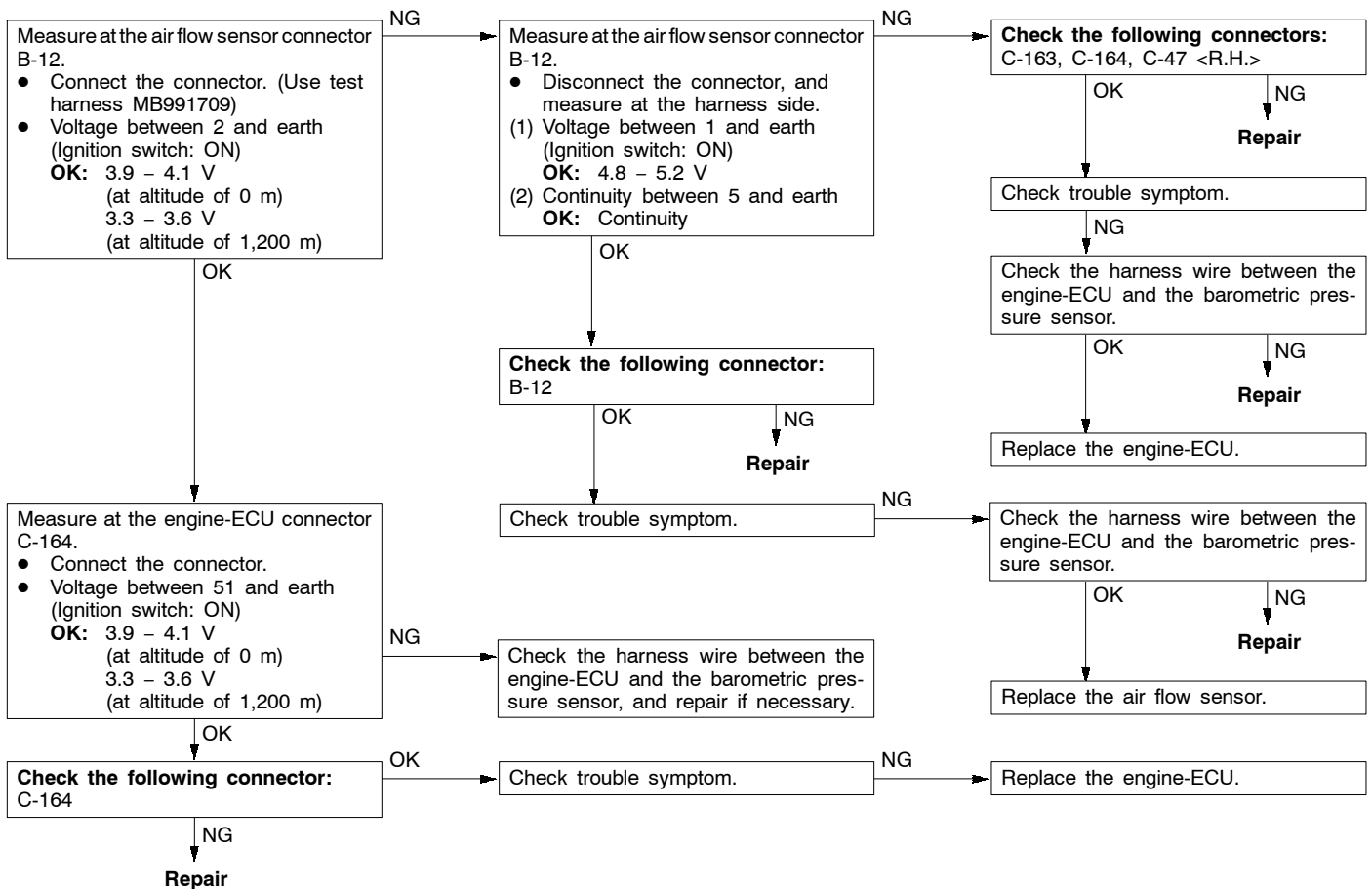
Code No.23 Camshaft position sensor system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> While engine is cranking or running <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal is being input). <p>or</p> <ul style="list-style-type: none"> Abnormal pulse signal pattern is output. 	<ul style="list-style-type: none"> Malfunction of the camshaft position sensor Open circuit or short-circuited harness wire of the camshaft position sensor Malfunction of the engine-ECU



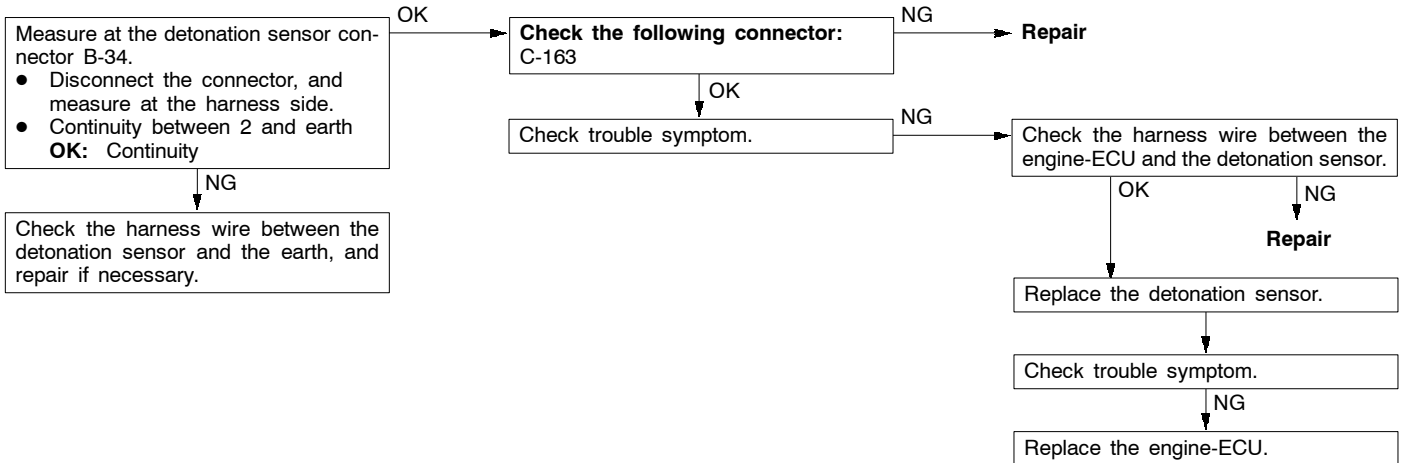
Code No. 24 Vehicles speed sensor system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Engine speed is 3,000 r/min or more. Driving under high engine load conditions. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> 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



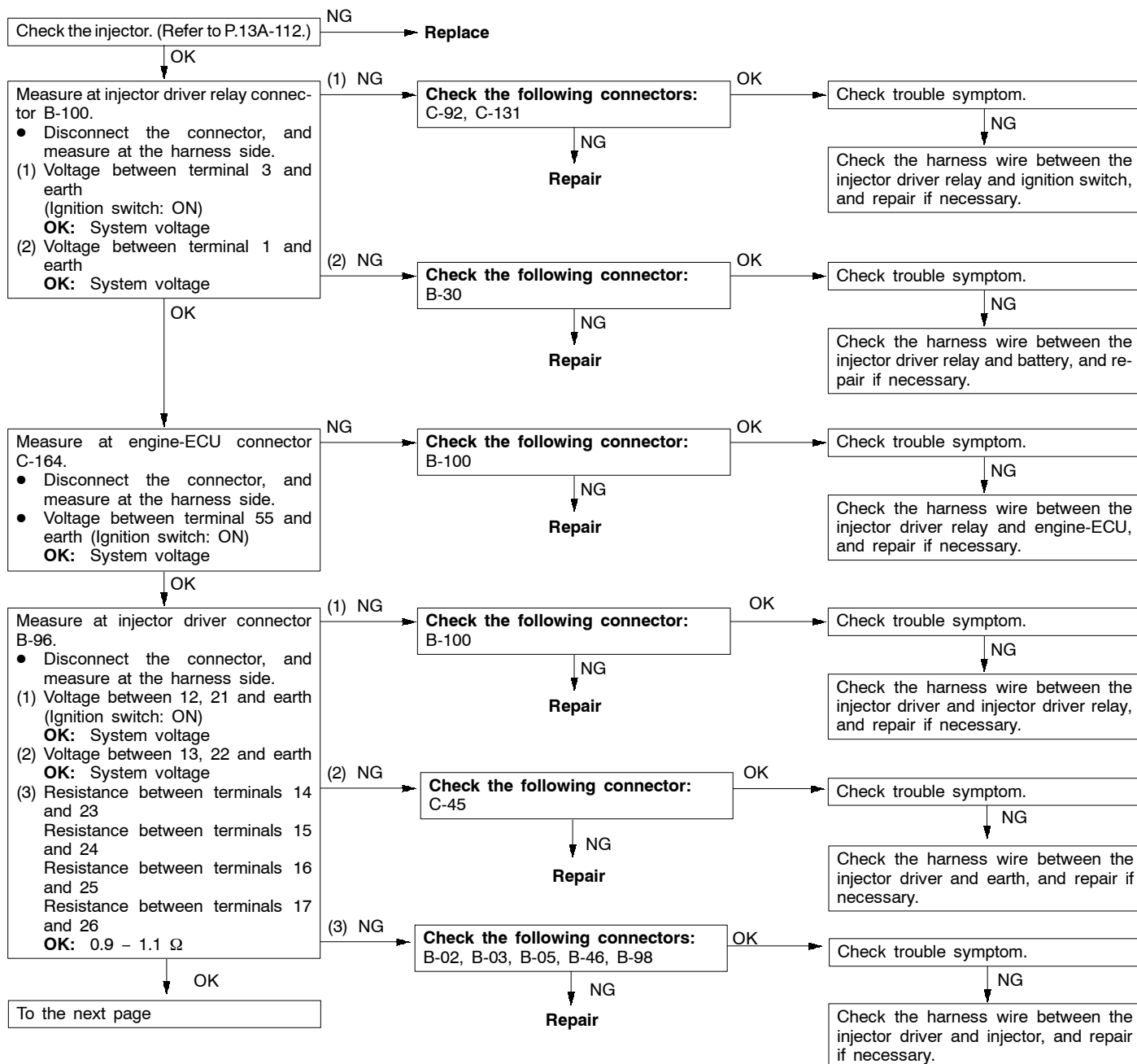
Code No.25 Barometric pressure sensor system	Probable cause
Range of check <ul style="list-style-type: none"> After 60 seconds have passed since the engine have started Battery voltage is 8 V or more. Set conditions <ul style="list-style-type: none"> Sensor output voltage is 0.2 V or less for 4 seconds. or <ul style="list-style-type: none"> Sensor output voltage is 4.5 V or more for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the barometric pressure sensor Open circuit or short-circuited harness wire of the barometric pressure sensor Malfunction of the engine-ECU

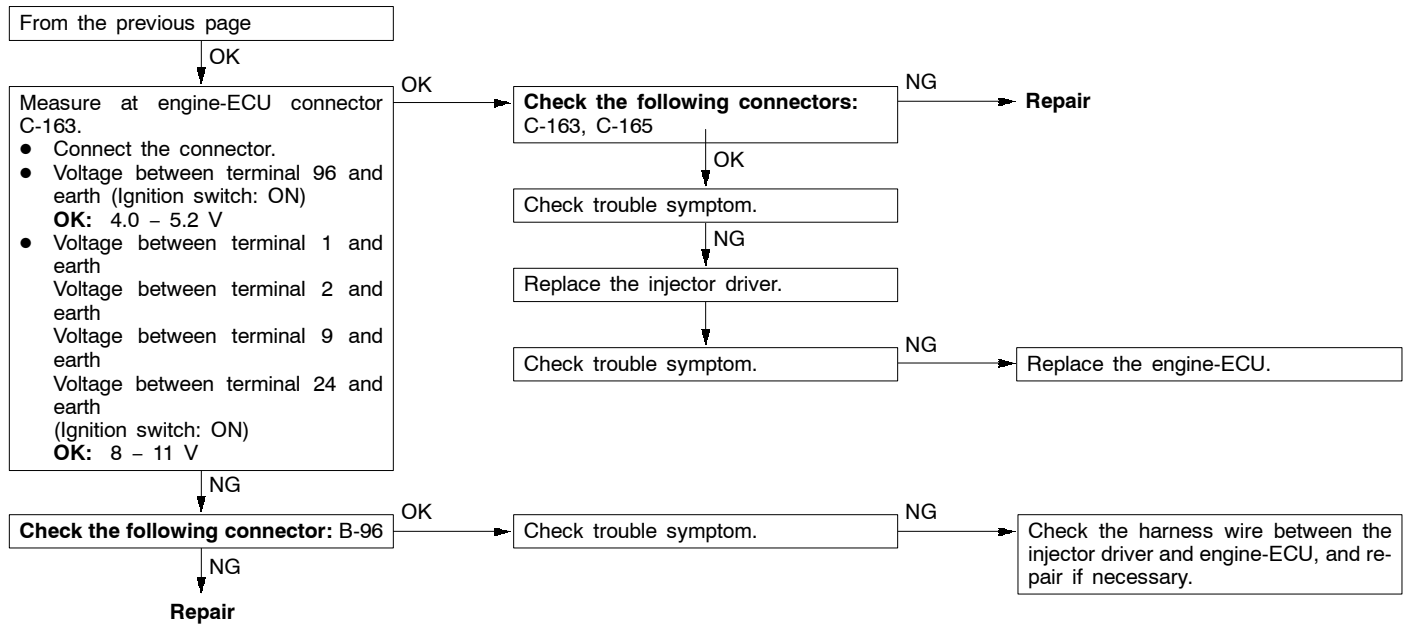


Code No.31 Detonation sensor system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> After 60 seconds have passed since the engine have started <p>Set conditions</p> <ul style="list-style-type: none"> Amount of change in the sensor output voltage (detonation sensor peak voltage for each half rotation of the crankshaft) is 0.06 V or less for 200 continuous times. 	<ul style="list-style-type: none"> Malfunction of the detonation sensor Open circuit or short-circuited harness wire of the detonation sensor Malfunction of the engine-ECU

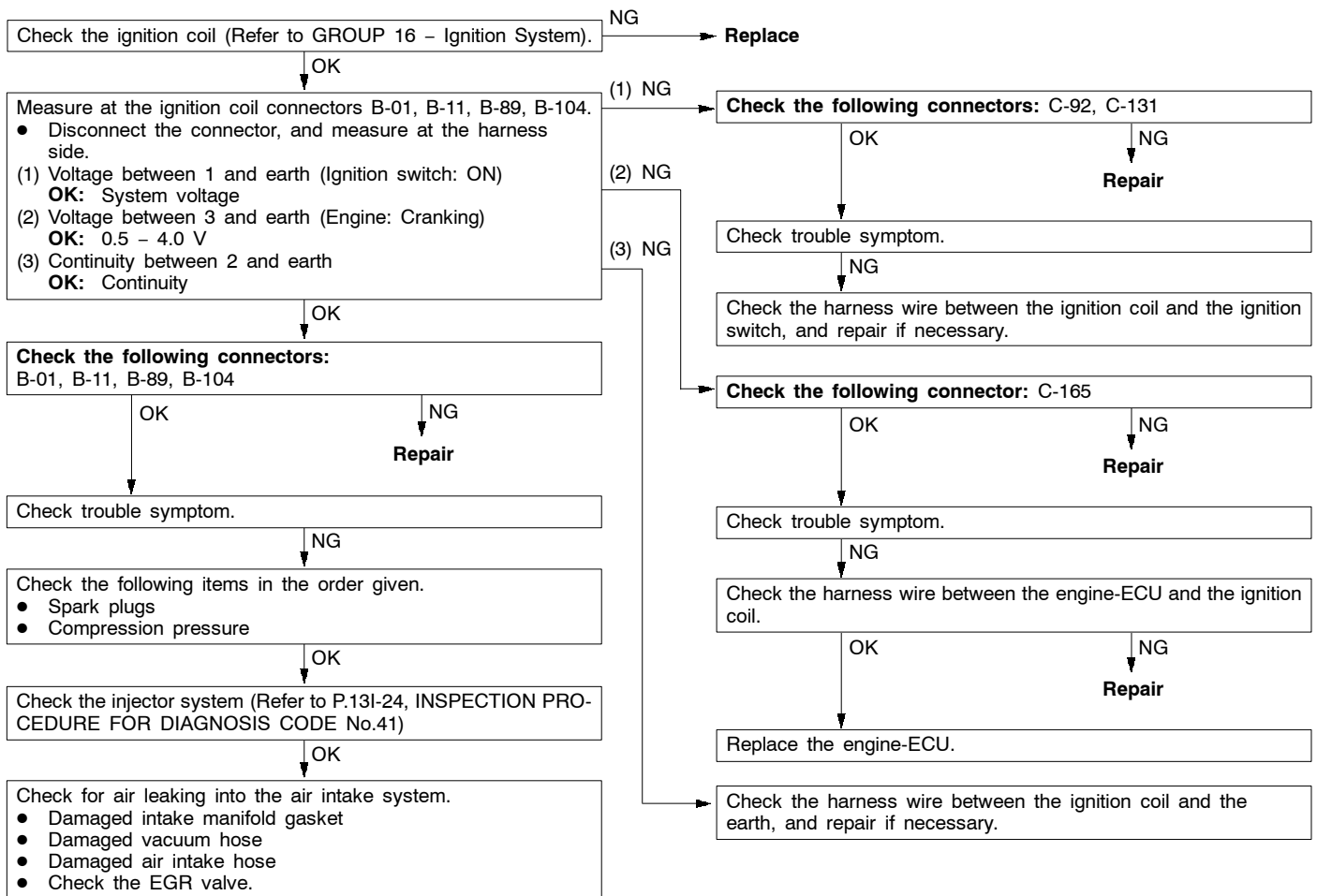


Code No.41 Injector system	Probable cause
Range of check <ul style="list-style-type: none"> Engine: while cranking, or running Engine speed: 4,000 r/min or less System voltage: 10 V or more Fuel shut off, or while forcible activating of injector (actuator test) is in operation. Set conditions <ul style="list-style-type: none"> Injector open circuit check signal is not output from the injector predetermined time(s). 	<ul style="list-style-type: none"> 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





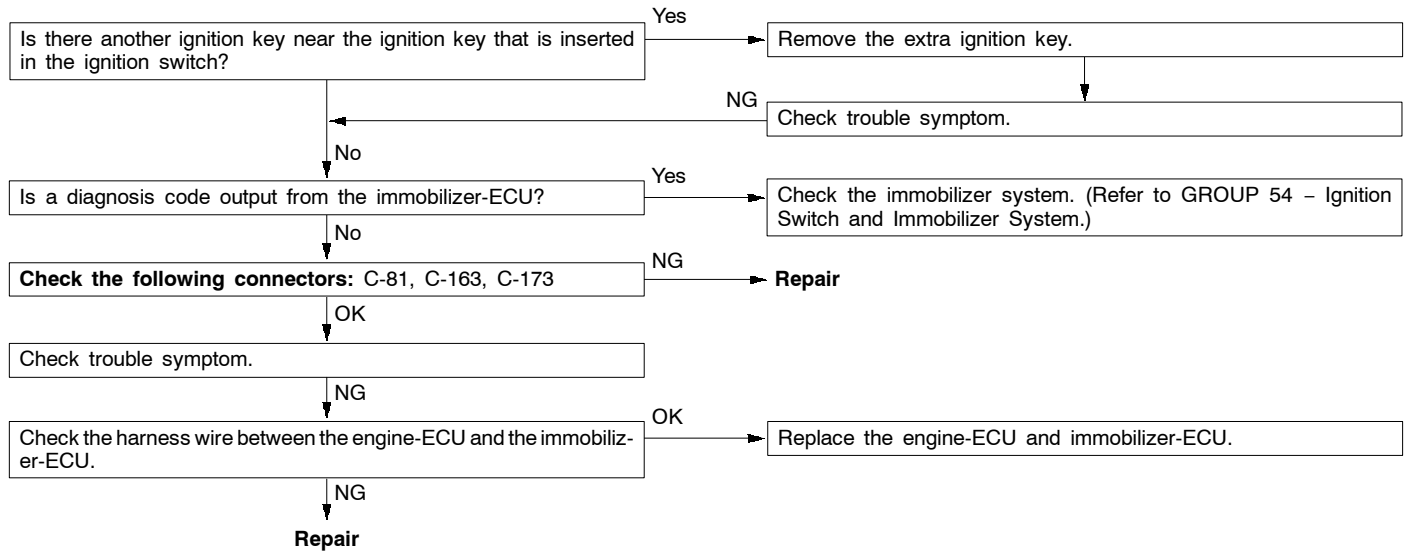
Code No.44 Abnormal combustion	Probable cause
Range of check • While engine is running during lean fuel combustion Set conditions • Abnormal engine speed due to mis-firing is detected by the crank angle sensor	• Malfunction of the ignition coil • Malfunction of the spark plug • Malfunction of the EGR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



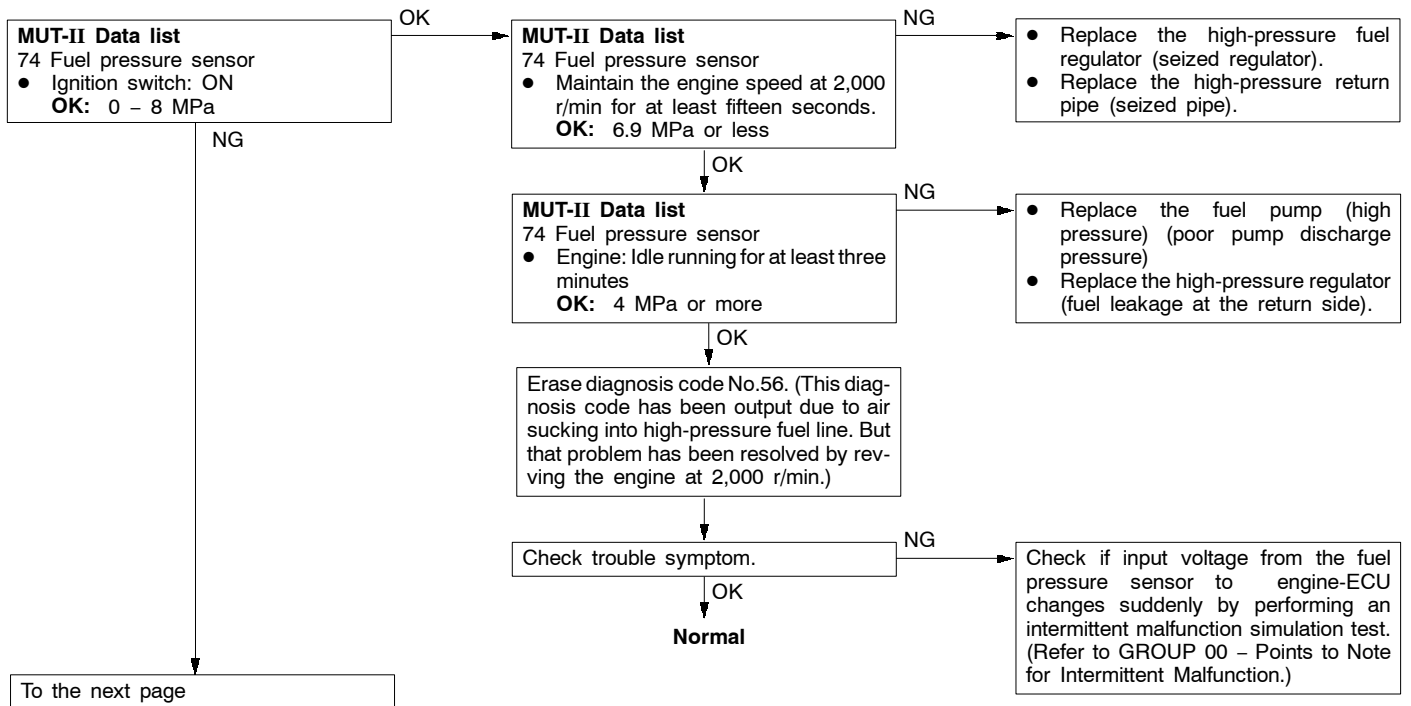
Code No.54 Immobilizer system	Probable cause
Range of Check • Ignition switch: ON Set Conditions • Improper communication between the engine-ECU and immobilizer-ECU	• Radio interference of encrypted codes • Incorrect encrypted code • Malfunction of harness or connector • Malfunction of immobilizer-ECU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

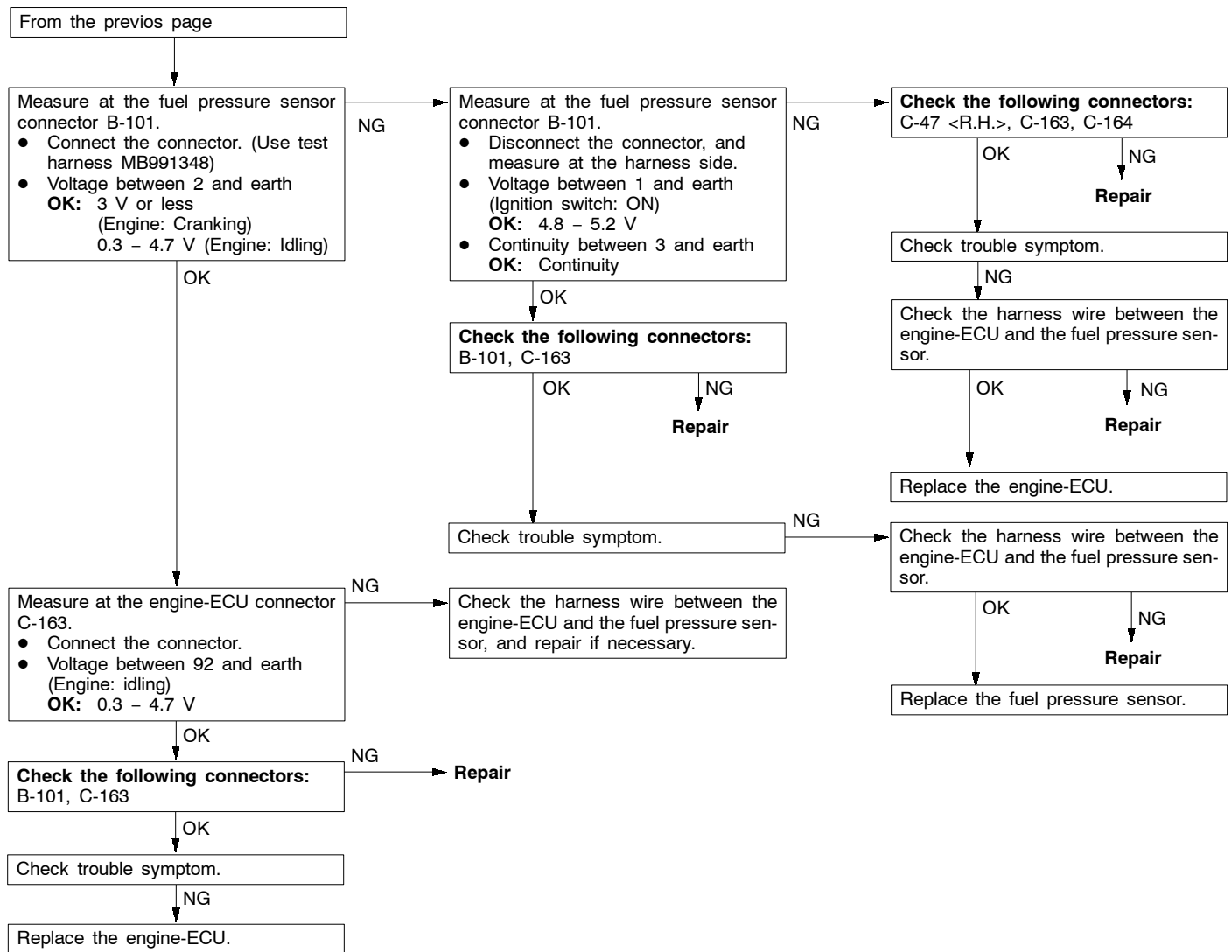
NOTE

- (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.

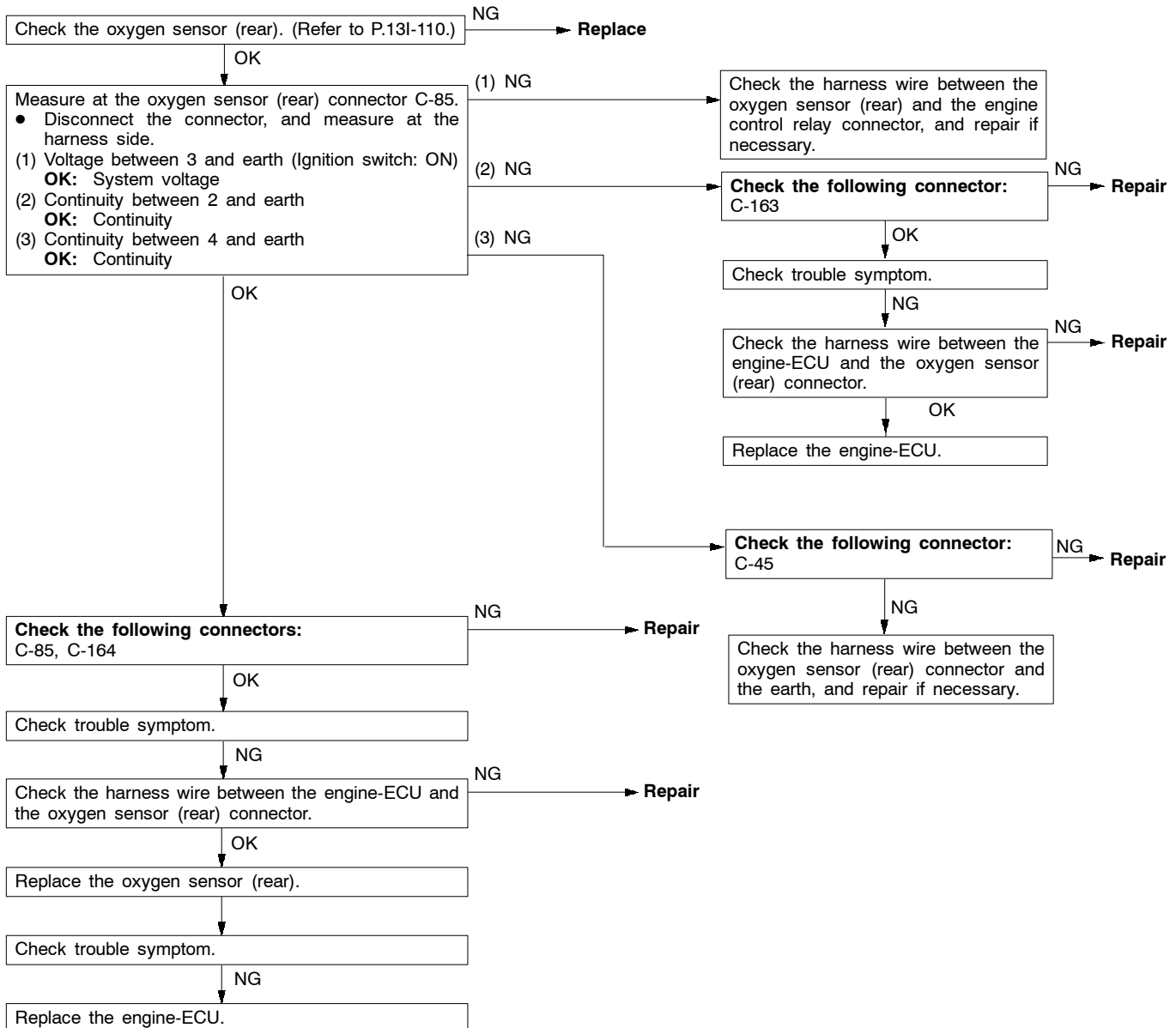


Code No.56 Abnormal fuel pressure	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> Ignition switch: ON <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.8 V or more for four seconds. <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.2 V or less for four seconds. <p>Range of check</p> <ul style="list-style-type: none"> After the engine is started, the following condition has been detected: <ol style="list-style-type: none"> Engine speed: 1,000 r/min or more Fuel pressure: 2 MPa or more While engine is running <p>Set conditions</p> <ul style="list-style-type: none"> Fuel pressure is 6.9 MPa or more for four seconds. <p>or</p> <ul style="list-style-type: none"> Fuel pressure is 2 MPa or less for four seconds. 	<ul style="list-style-type: none"> 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
<p>This diagnosis code is also output when air is sucked in high-pressure fuel line due to no fuel supply.</p> <p>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.</p>	<ul style="list-style-type: none"> Air sucking due to no fuel supply

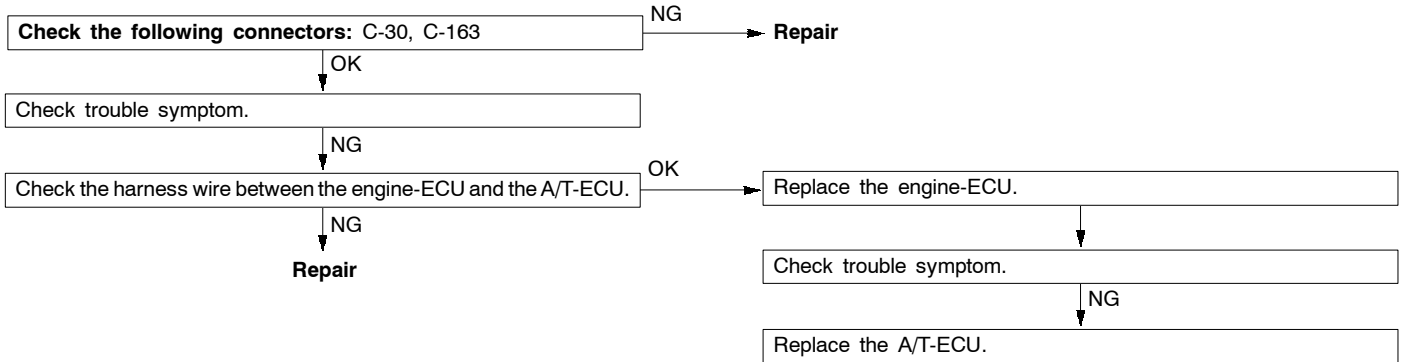




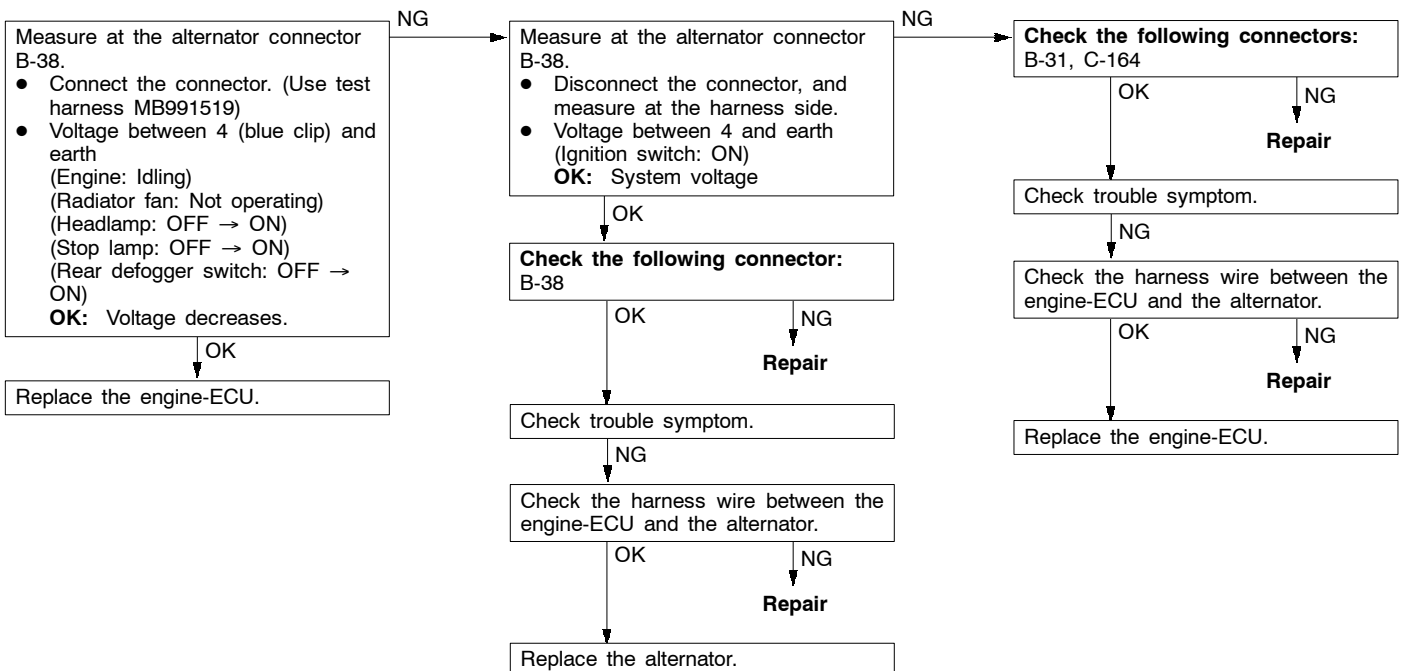
Code No. 59 Oxygen sensor (rear) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • 3 minutes have passed after engine was started. • Engine coolant temperature is approx. 80°C or more. • Idle position switch: OFF • The throttle position sensor output voltage is 4.1 V or more. • Open loop control in operation • 20 seconds have passed after deceleration finished. <p>Set conditions</p> <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Malfunction of the oxygen sensor (rear) • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



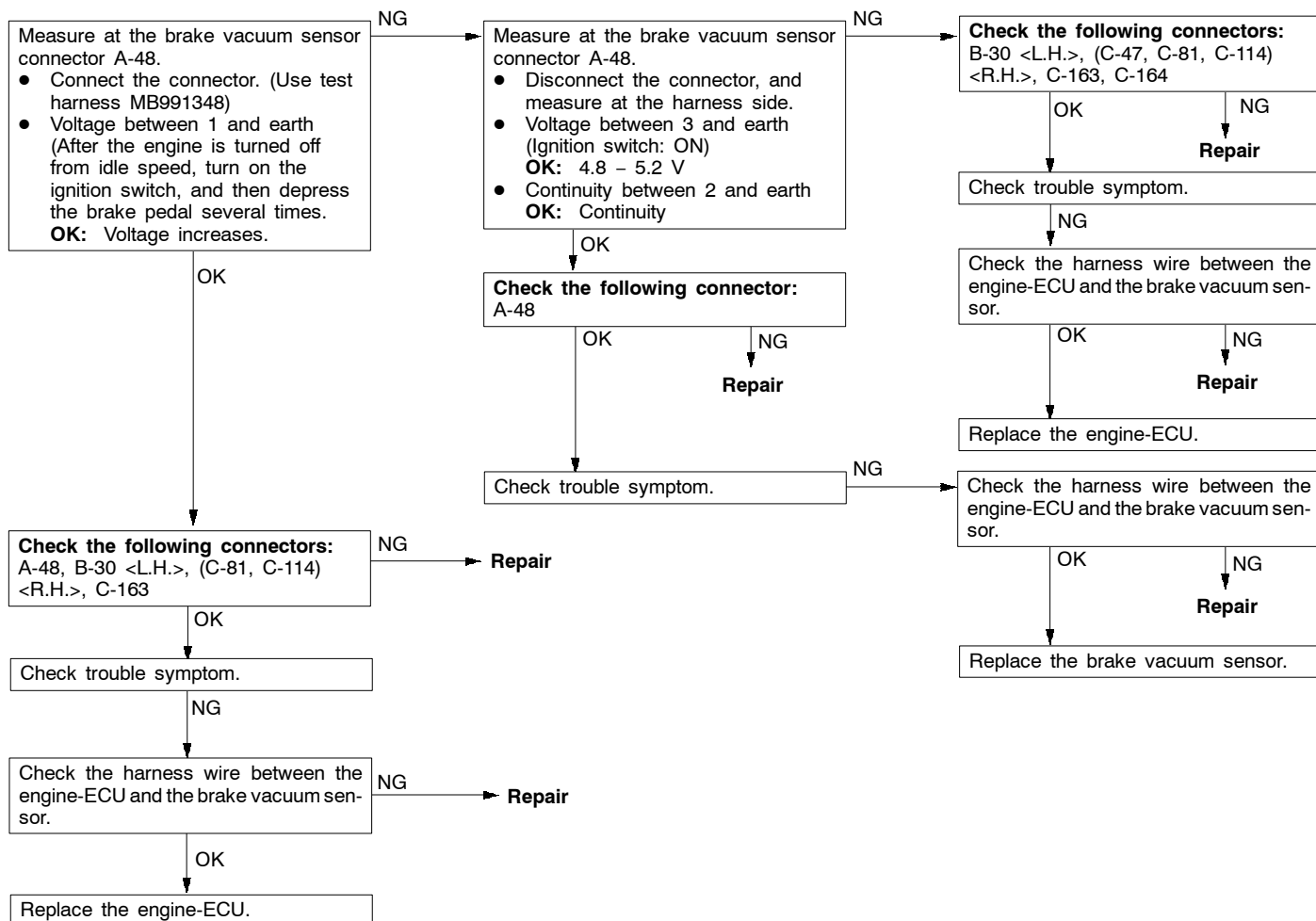
Code No.61 Communication wire with A/T-ECU system	Probable cause
Range of check • After 60 seconds have passed since the engine have started Set conditions • Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	• Short circuit in ECU communication circuit • Malfunction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



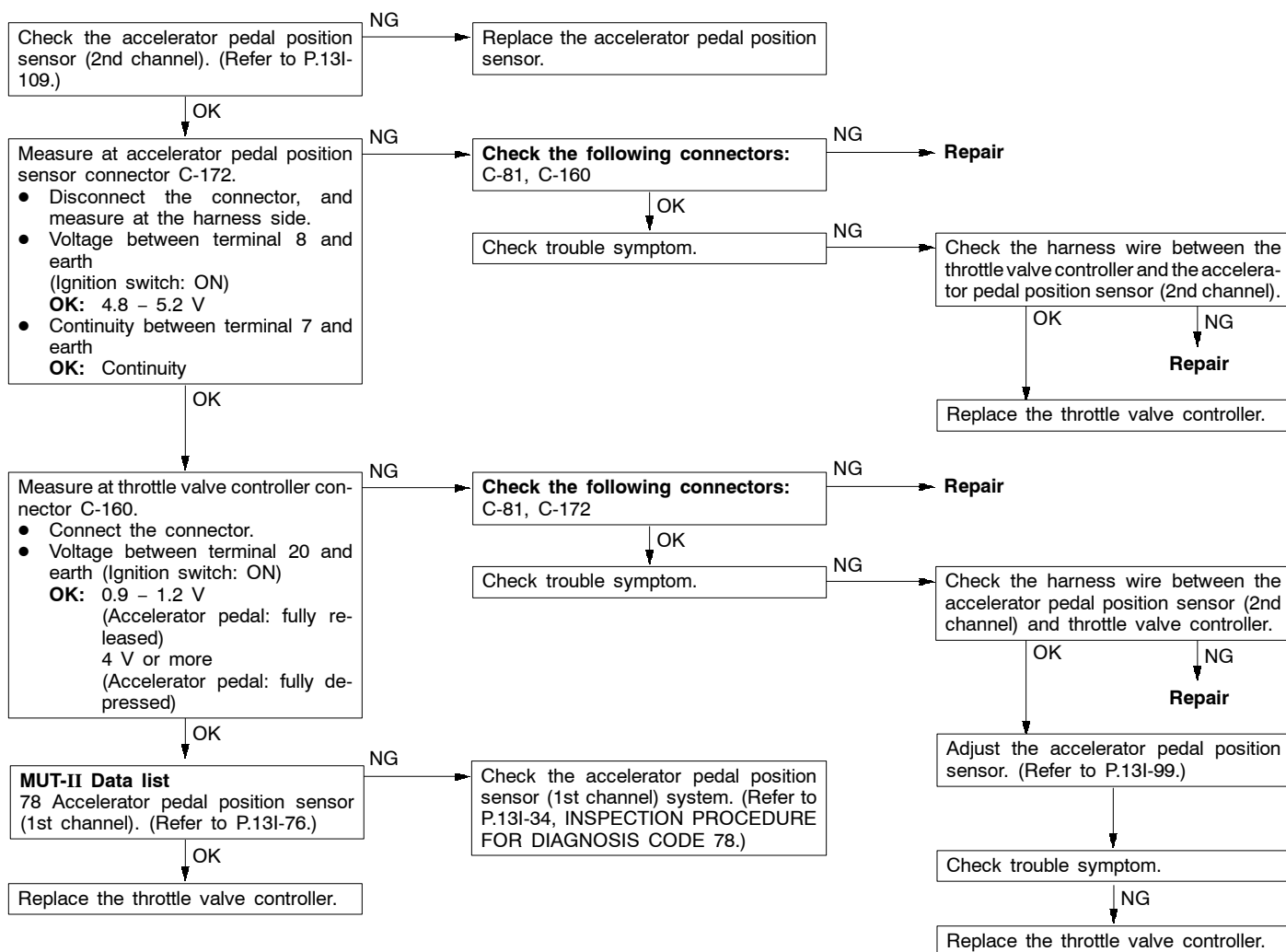
Code No.64 Alternator FR terminal system	Probable cause
Range of check • Engine speed is 50 r/min or more. Set conditions • Input voltage from the alternator FR terminal is system voltage for 20 seconds.	• Open circuit in alternator FR terminal circuit • Malfunction of the engine-ECU



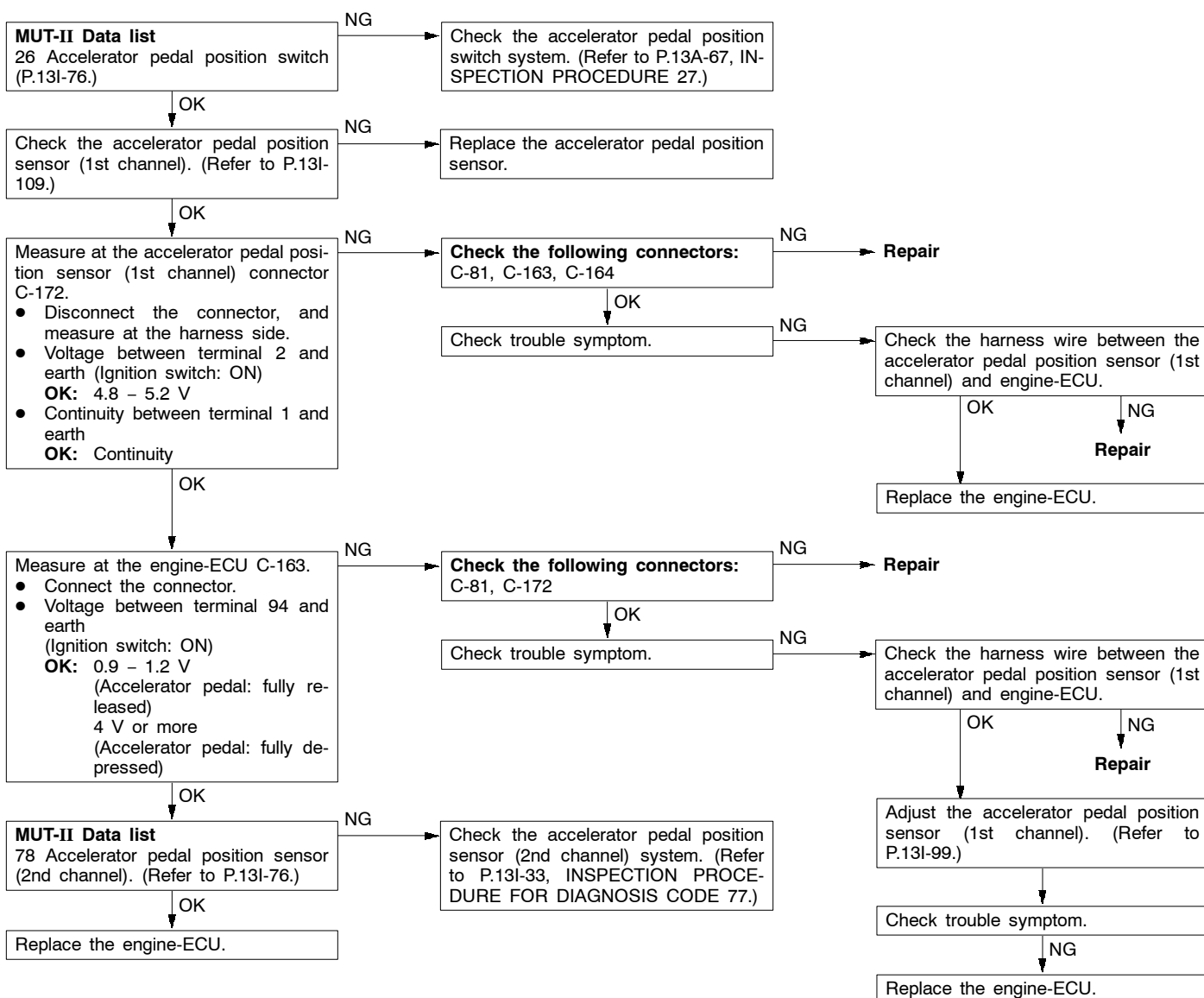
Code No.66 Brake vacuum sensor system	Probable cause
Range of check • Ignition switch: ON Set conditions • Sensor output voltage is 4.8 V or more. or • Sensor output voltage is 0.2 V or less.	• Malfunction of the brake vacuum sensor • Improper connector contact, open circuit or short-circuited harness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



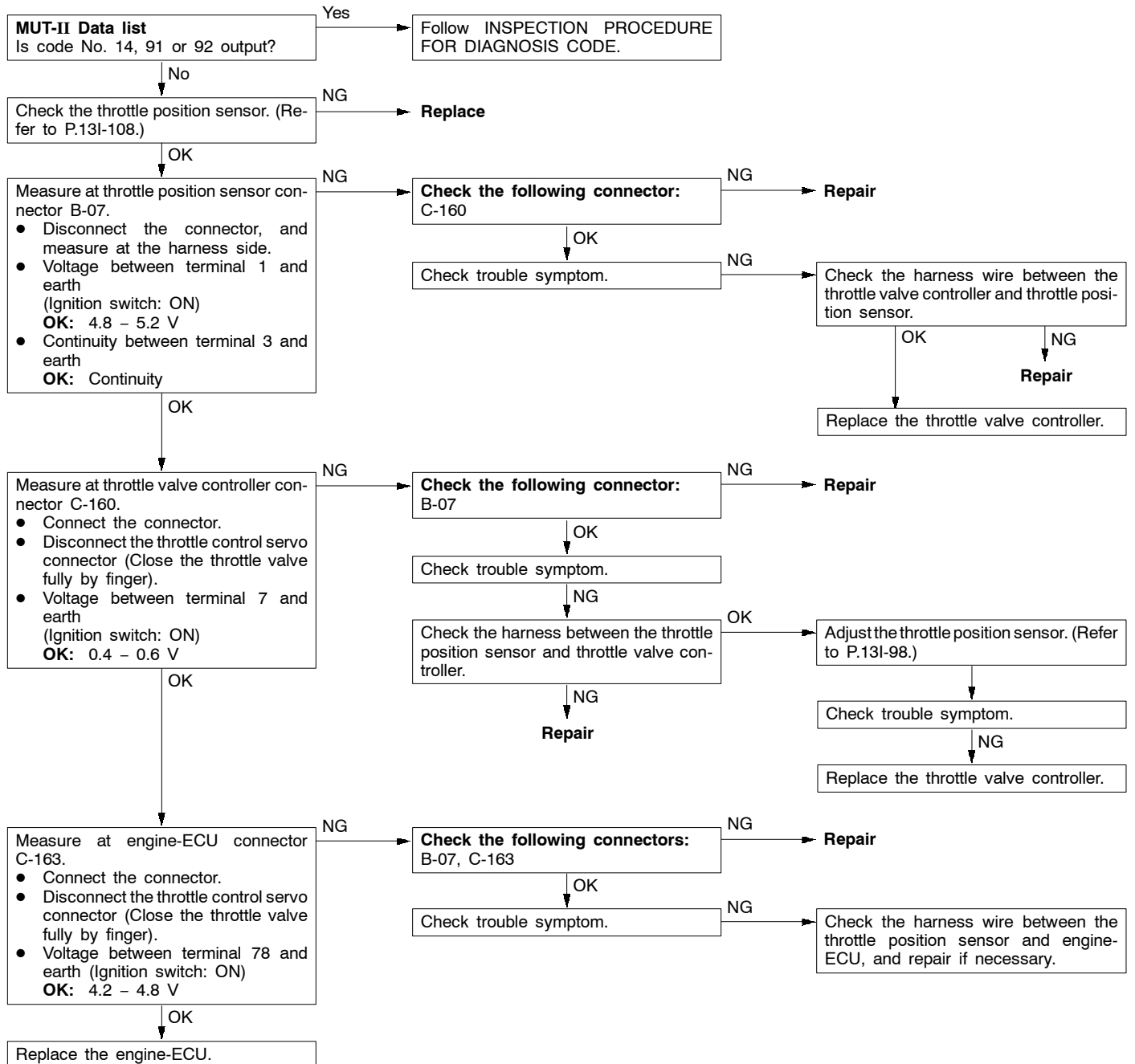
Code No.77 Accelerator pedal position sensor (2nd channel) system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> Accelerator pedal position sensor (1st channel) system is normal. Communication between the engine-ECU and throttle valve controller is normal. <p>Set conditions</p> <ul style="list-style-type: none"> Output voltage of accelerator position sensor (2nd channel) system is 0.2 V or less for one second. <p>or</p> <ul style="list-style-type: none"> 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. <p>or</p> <ul style="list-style-type: none"> 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). 	<ul style="list-style-type: none"> 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



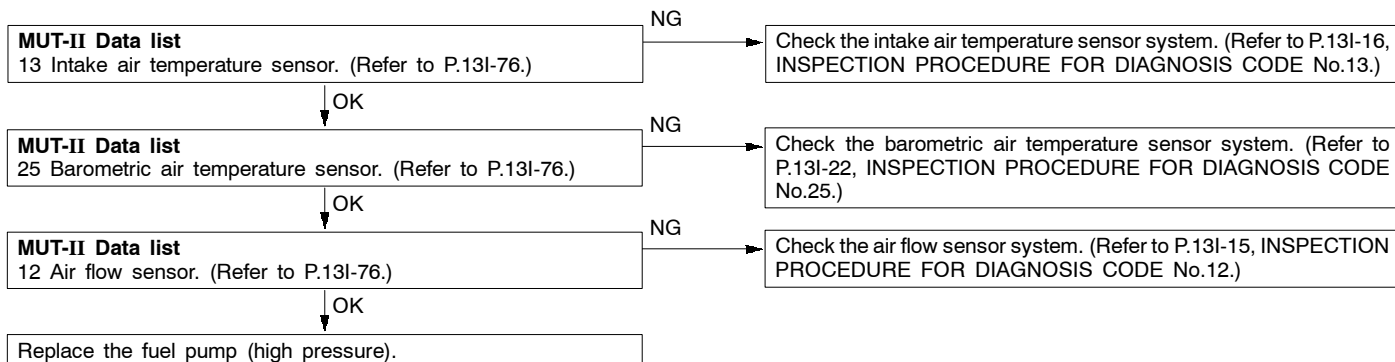
Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> Accelerator pedal position sensor (2nd channel) system is normal. Communication between the engine-ECU and throttle valve controller is normal. <p>Set conditions</p> <ul style="list-style-type: none"> Output voltage of accelerator position sensor (1st channel) system is 0.2 V or less for one second. <p>or</p> <ul style="list-style-type: none"> 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. <p>or</p> <ul style="list-style-type: none"> 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). <p>or</p> <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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



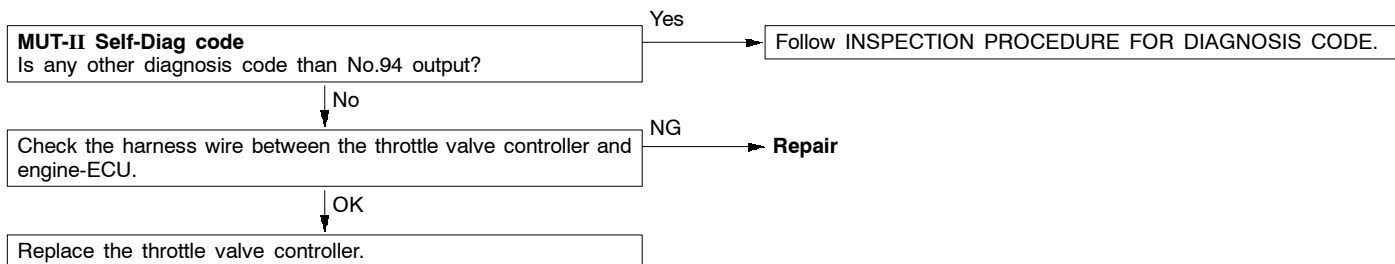
Code No.79 Throttle position sensor (1st channel) system	Probable cause
<p>The throttle valve controller determines a failure, and sends it result to the engine-ECU.</p> <p>Range of check</p> <ul style="list-style-type: none"> Ignition switch: ON System voltage: 8 V or more <p>Set conditions</p> <ul style="list-style-type: none"> Output voltage of the sensor remains 0.2 V for one second. <p>or</p> <ul style="list-style-type: none"> Output voltage of the sensor remains 4.9 V for one second. <p>or</p> <ul style="list-style-type: none"> Output voltage of the throttle position sensor (1st and 2nd channels) remains outside 4 – 6 V for four seconds. 	<ul style="list-style-type: none"> 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



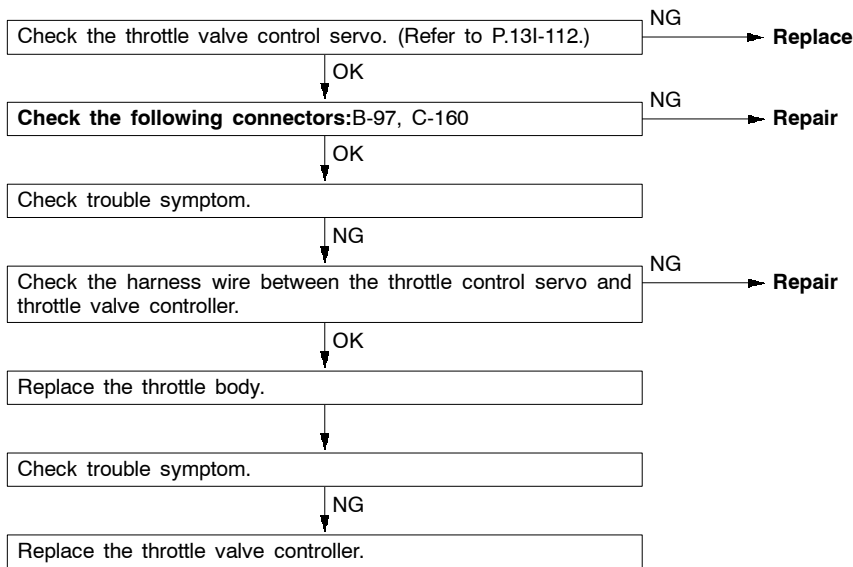
Code No.89 Abnormal fuel pressure system	Probable cause
Range of check • Engine: Idling (during stoichio-feedback operation) Set conditions • Fuel injection correction value remains excessively low for ten seconds or more. or • Fuel injection correction value remains excessively high for ten seconds 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



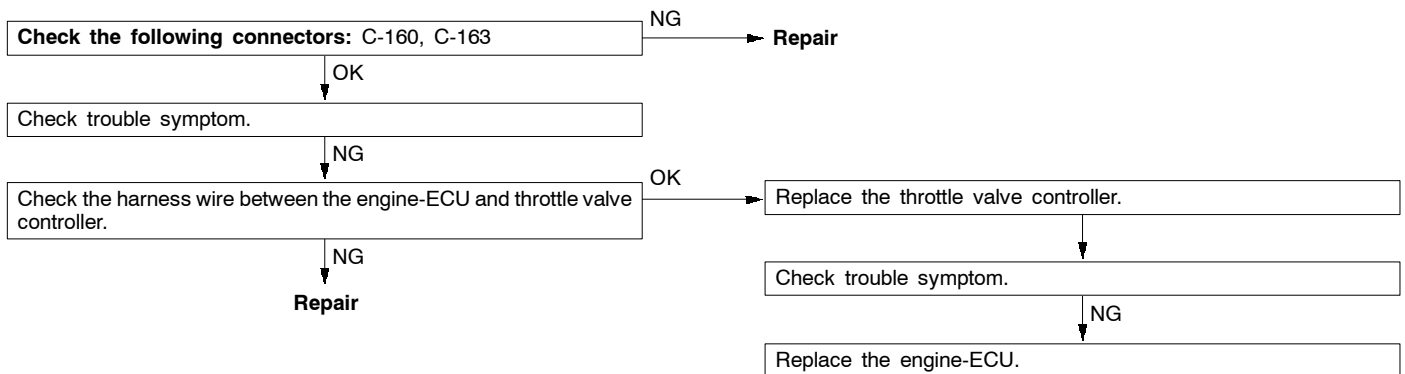
Code No.91 Electronic-controlled throttle valve system	Probable cause
Range of check • Ignition switch: ON • Error in communication from the engine-ECU to throttle valve controller Set conditions • Output voltage of the throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value. Range of check • Ignition switch: ON • Error in communication from the throttle valve controller to 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



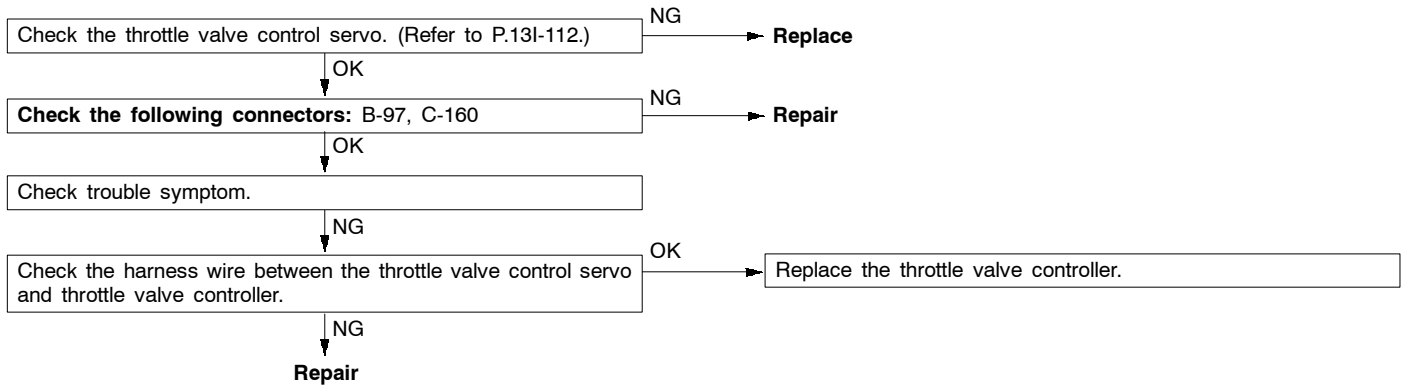
Code No.92 Throttle valve position feedback system	Probable cause
<p>The throttle valve controller determines if a failure is present, and sends its result to the engine-ECU.</p> <p>Range of check</p> <ul style="list-style-type: none"> Ignition switch: ON System voltage: 8 V or more <p>Set condition</p> <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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



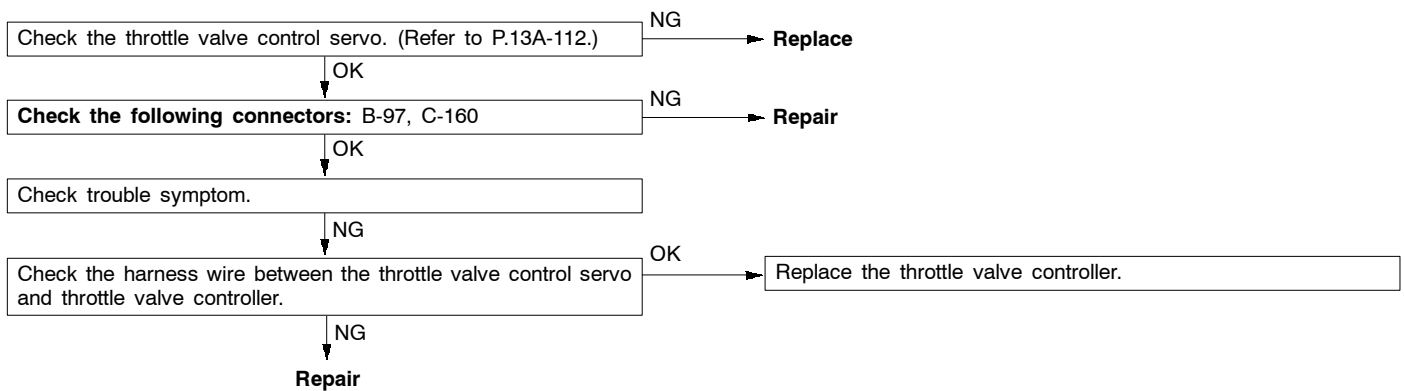
Code No.94 Communication line system with throttle valve controller	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> Ignition switch: ON System voltage: 8 V or more Engine: not cranking <p>Set condition</p> <ul style="list-style-type: none"> System detects an error in communication line between the engine-ECU and throttle valve controller. 	<ul style="list-style-type: none"> Short circuit in communication line Malfunction of the engine-ECU Malfunction of the throttle valve controller



Code No.95 Throttle valve control servo motor (Motor 1st phase malfunction) system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> Throttle valve control servo relay: ON System voltage: 8 V or more <p>Set conditions</p> <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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



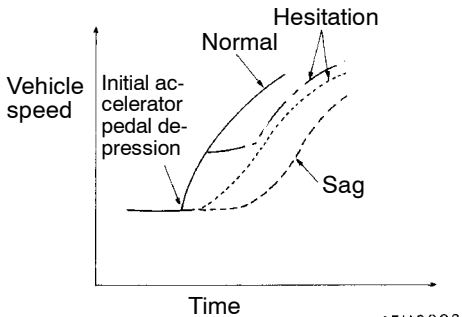
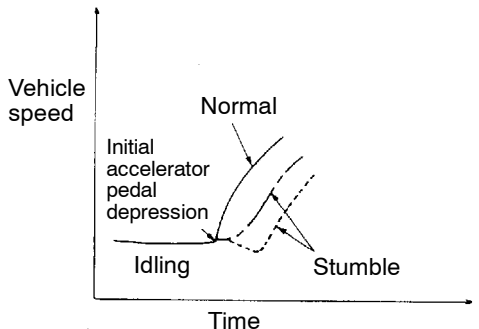
Code No.99 Throttle valve control servo motor (Motor 2nd phase malfunction) system	Probable cause
<p>Range of check</p> <ul style="list-style-type: none"> Throttle valve control servo relay: ON System voltage: 8V or more <p>Set conditions</p> <ul style="list-style-type: none"> Throttle valve control 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. 	<ul style="list-style-type: none"> 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	13I-41
	Communication with engine-ECU only is not possible.	2	13I-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	13I-43
	The engine warning lamp remains illuminating and never goes out.	4	13I-43
Starting	No initial combustion (starting impossible)	5	13I-44
	Initial combustion but no complete combustion (starting impossible)	6	13I-46
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13I-48
	Idling speed is high. (Improper idling speed)	8	13I-50
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13I-51
	When the engine is hot, it stalls at idling. (Die out)	10	13I-52
	The engine stalls when starting the car. (Pass out)	11	13I-54
	The engine stalls when decelerating.	12	13I-55
Driving	Hesitation, sag or stumble	13	13I-56
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13I-57
	The feeling of impact or vibration when decelerating	15	13I-58
	Knocking	16	13I-58
Dieseling		17	13I-58
Too high CO and HC concentration when idling		18	13I-59
Low alternator output voltage (approx. 12.3 V)		19	13I-61
Engine idle speed is incorrect while the A/C is on.		20	13I-61
Fans (radiator fan, A/C condenser fan) are inoperative		21	13I-62
Clutch switch system malfunction <M/T>		22	13I-63
GDI ECO indication lamp system	The GDI ECO indication lamp does not illuminate.	23	13I-64
	The GDI ECO indication lamp remains on (does not extinguish).	24	13I-64

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

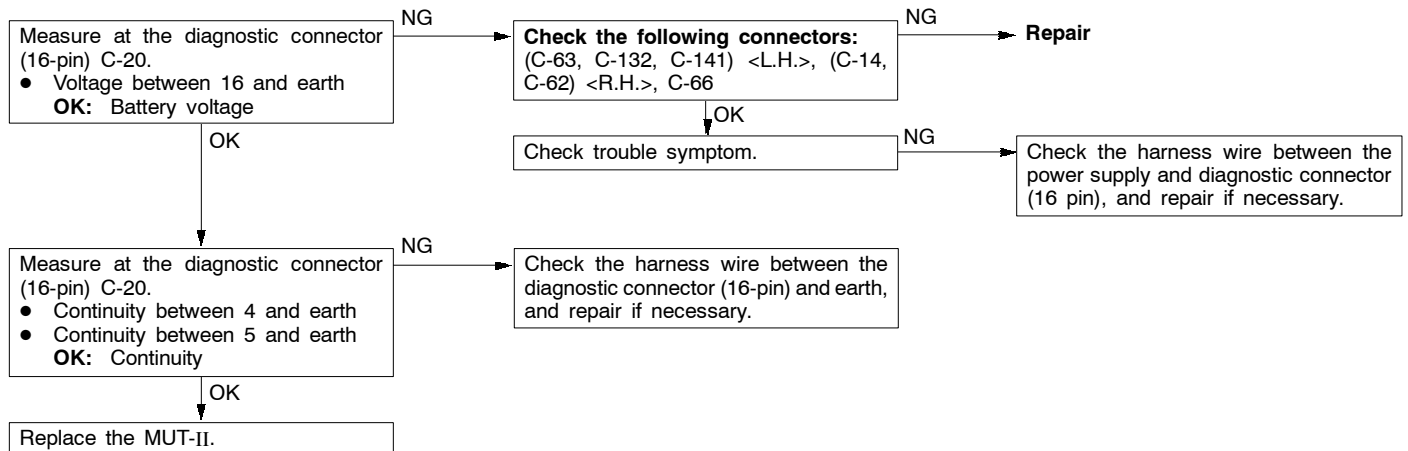
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
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	<p>"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".</p>  <p style="text-align: right;">1FU0223</p>
	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	<p>Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration.</p>  <p style="text-align: right;">1FU0224</p>

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

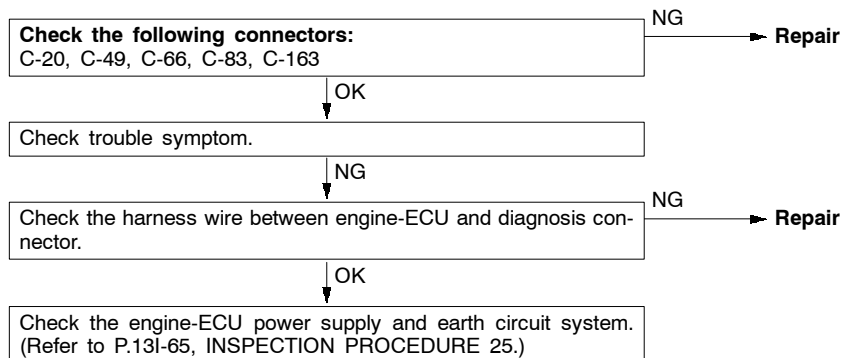
INSPECTION PROCEDURE 1

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.	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness wire



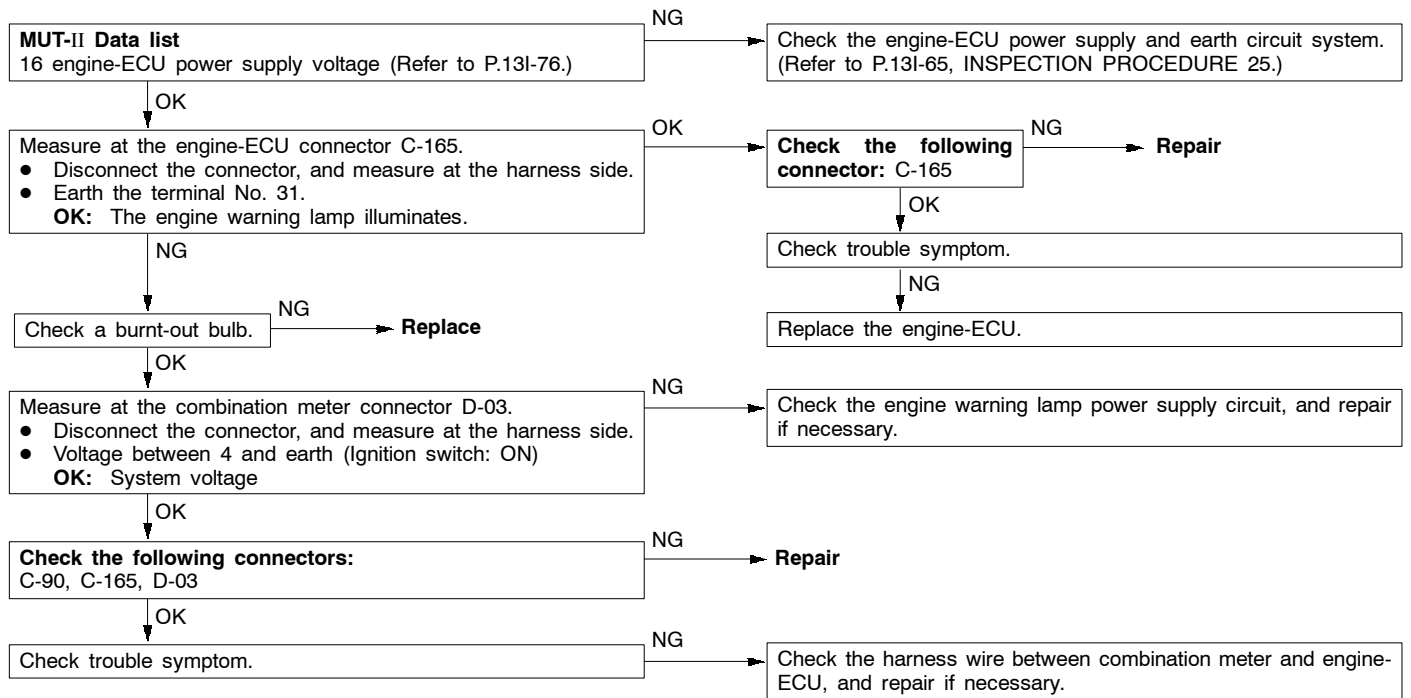
INSPECTION PROCEDURE 2

MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. <ul style="list-style-type: none"> • No power supply to engine-ECU. • Defective earth circuit of engine-ECU. • Defective engine-ECU. • Improper communication line between engine-ECU and MUT-II 	<ul style="list-style-type: none"> • Malfunction of engine-ECU power supply circuit • Malfunction of engine-ECU • Open circuit between the engine-ECU and diagnosis connector



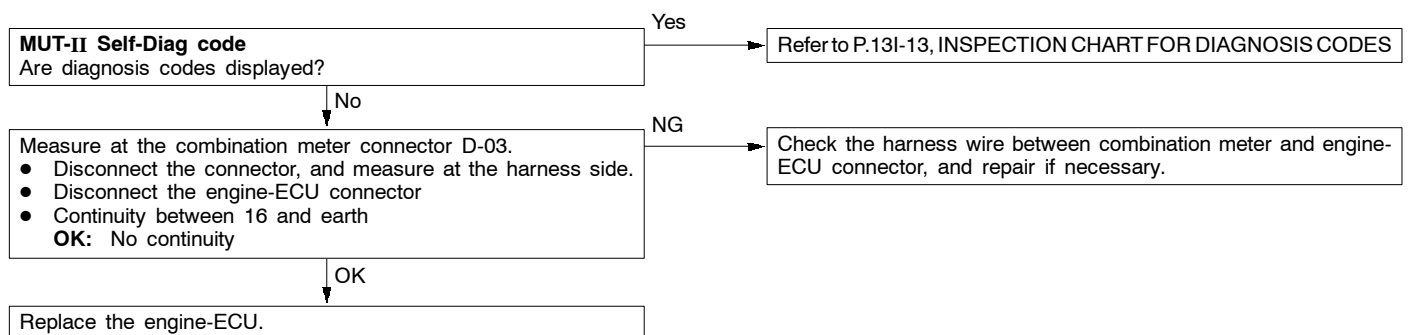
INSPECTION PROCEDURE 3

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.	<ul style="list-style-type: none"> Burnt-out bulb Defective warning lamp circuit Malfunction of the engine-ECU



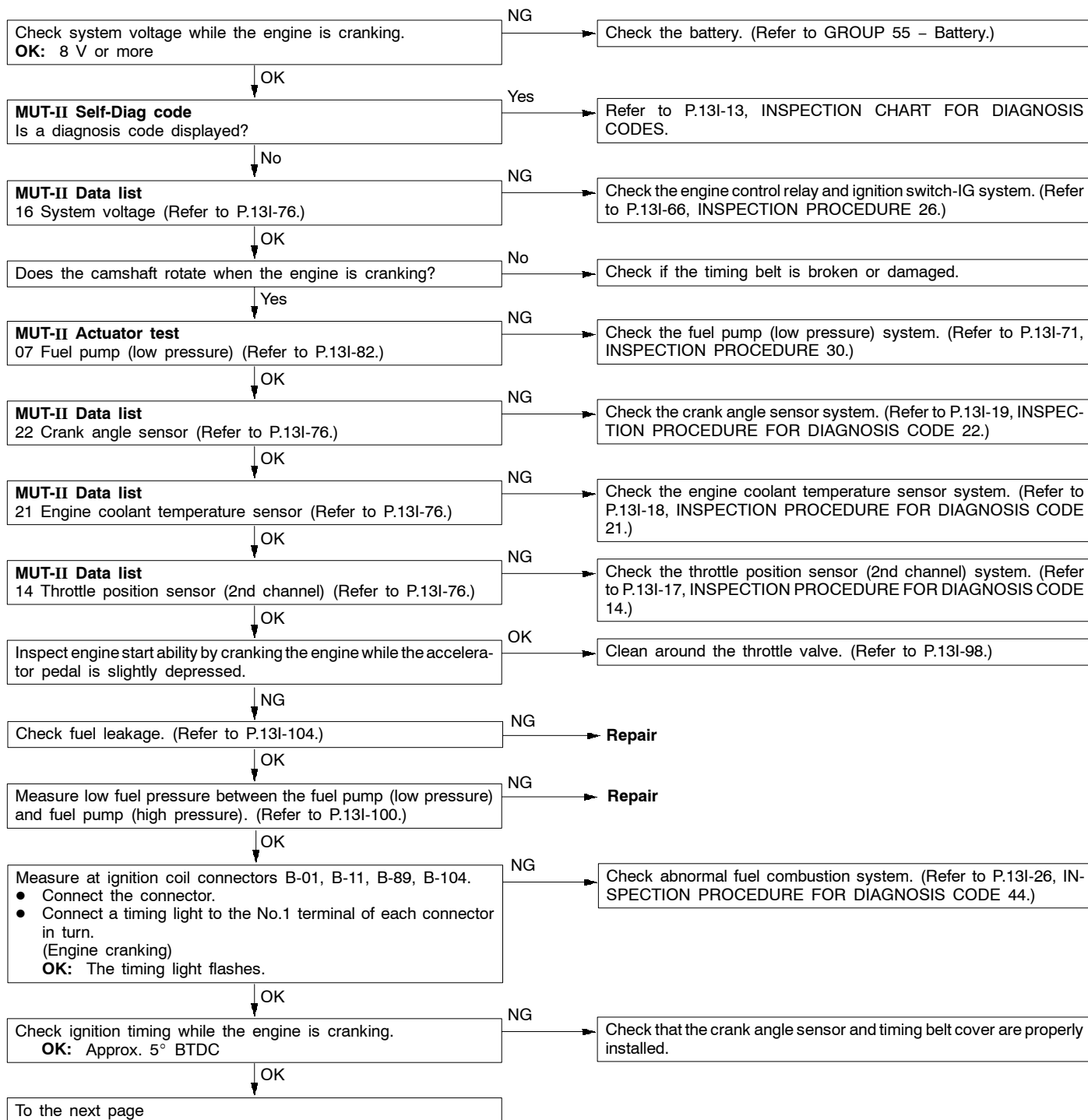
INSPECTION PROCEDURE 4

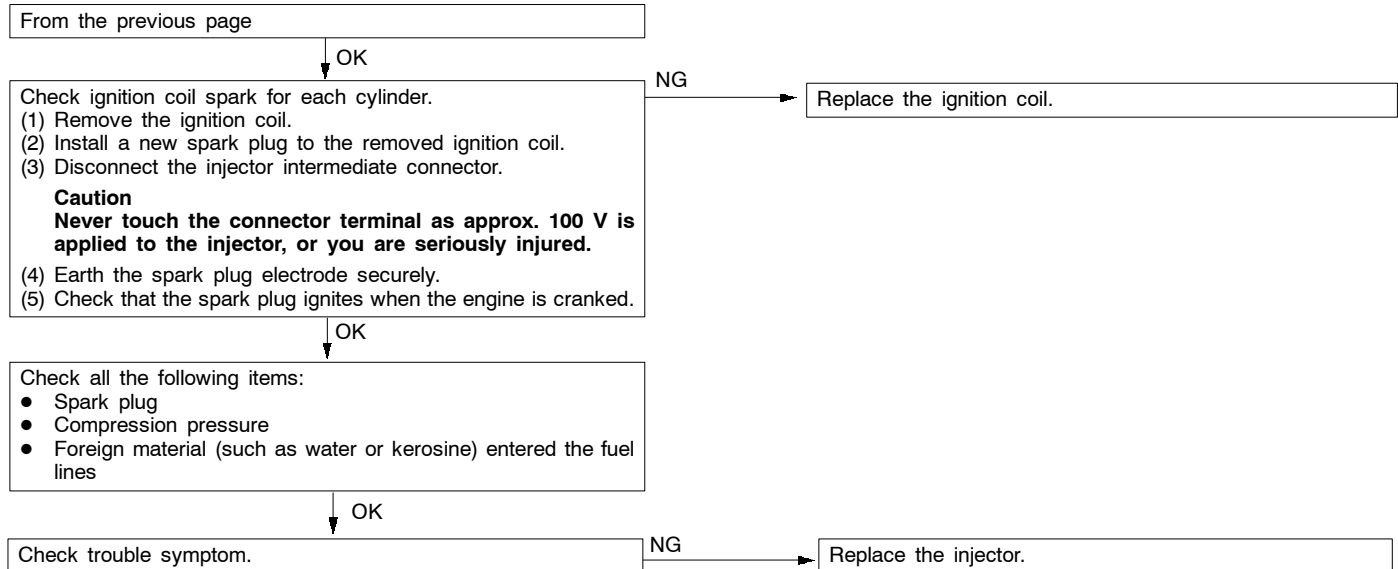
The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	<ul style="list-style-type: none"> Short-circuit between the engine warning lamp and engine-ECU Malfunction of the engine-ECU



INSPECTION PROCEDURE 5

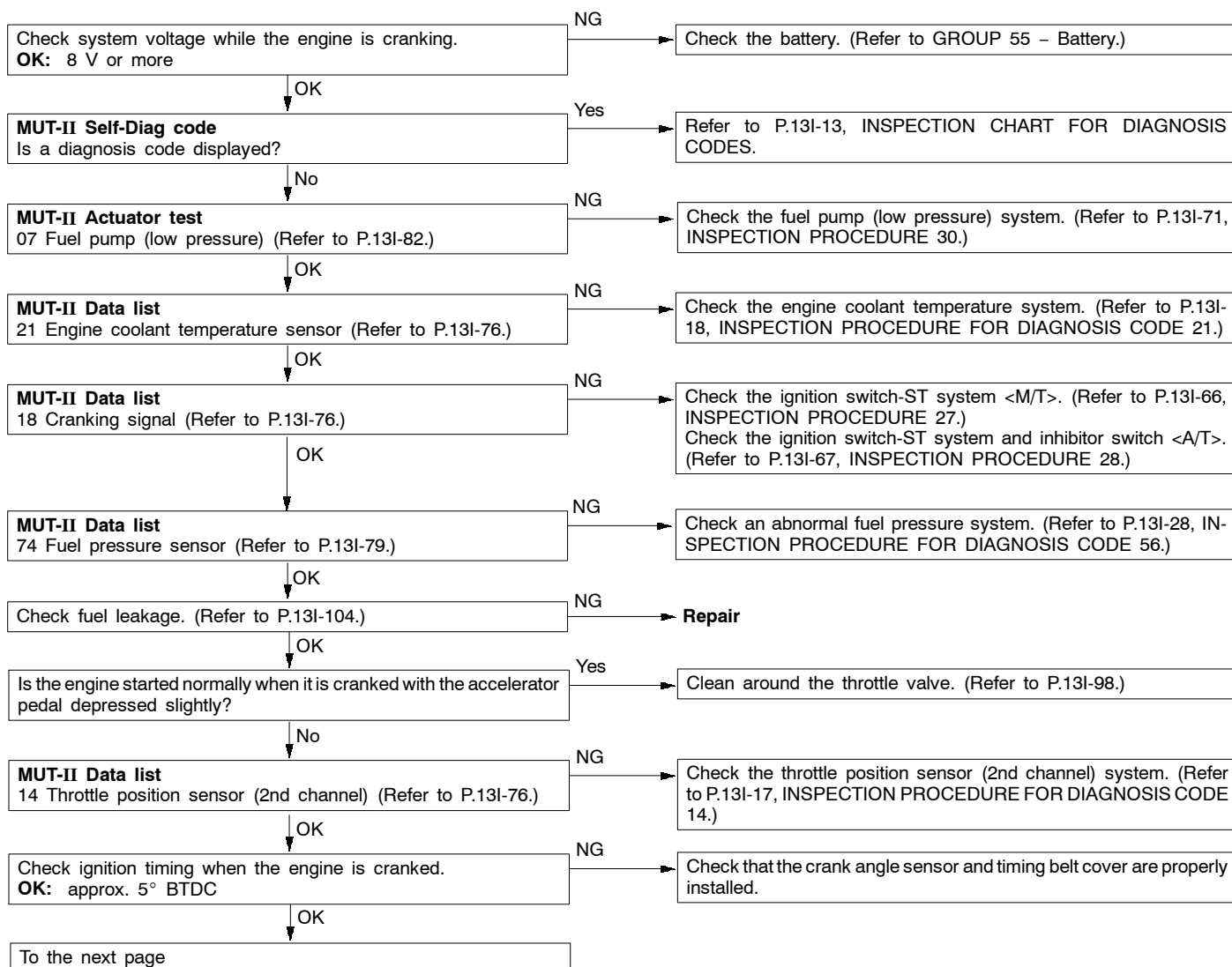
No initial combustion (starting impossible)	Probable cause
This is caused by incorrect fuel supply into the combustion chamber, and improper ignition circuit. Besides that, foreign material may be contaminated in fuel.	<ul style="list-style-type: none"> • Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-ECU





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.	<ul style="list-style-type: none"> • Malfunction of the fuel supply system • Malfunction of the fuel pressure sensor • Malfunction of the ignition system • Malfunction of the electronic-controlled throttle valve system • Malfunction of the engine-ECU



From the previous page

↓ OK

Check ignition coil spark for each cylinder.

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

Caution

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

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

↓ 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

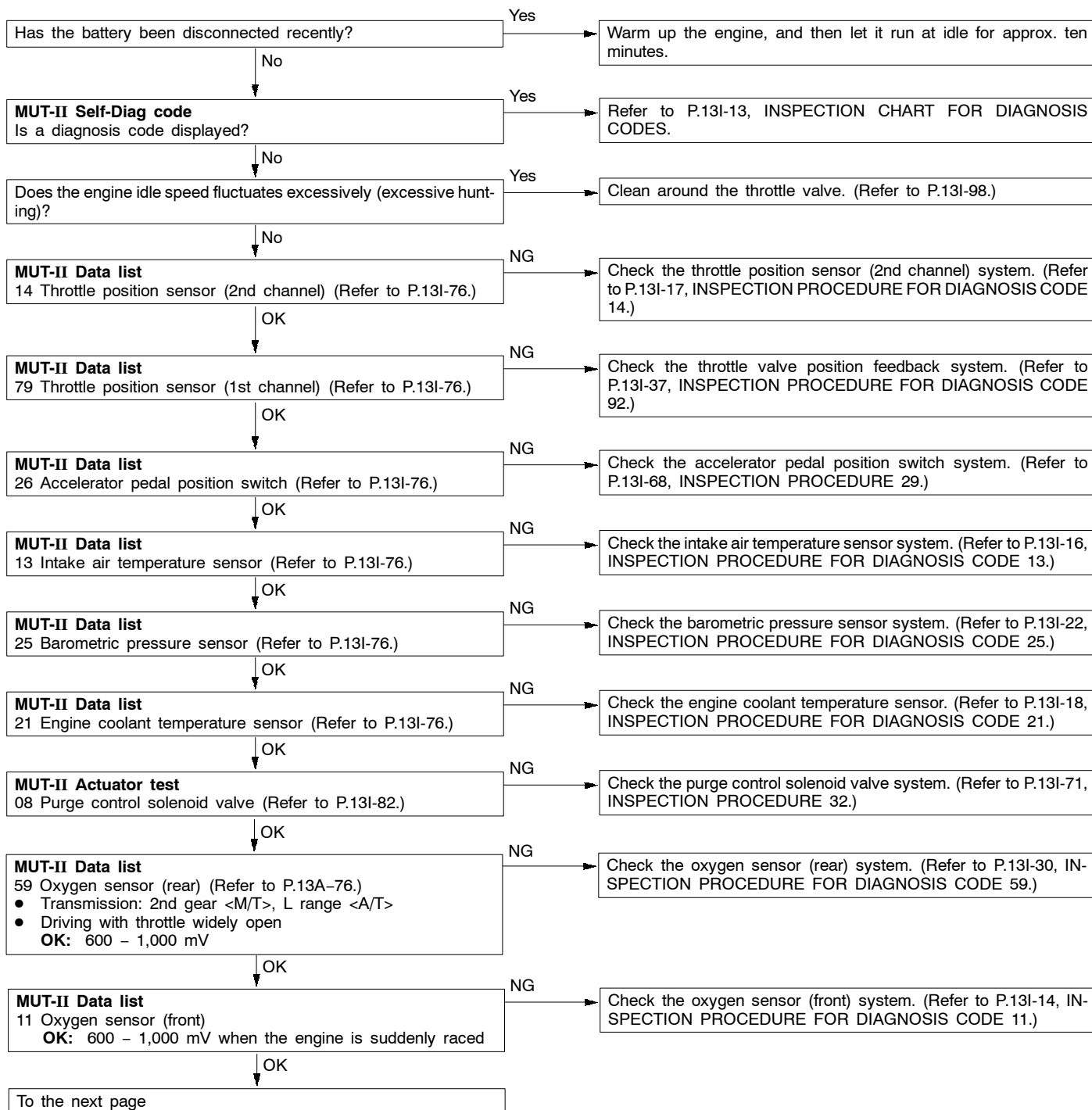
Replace the injector.

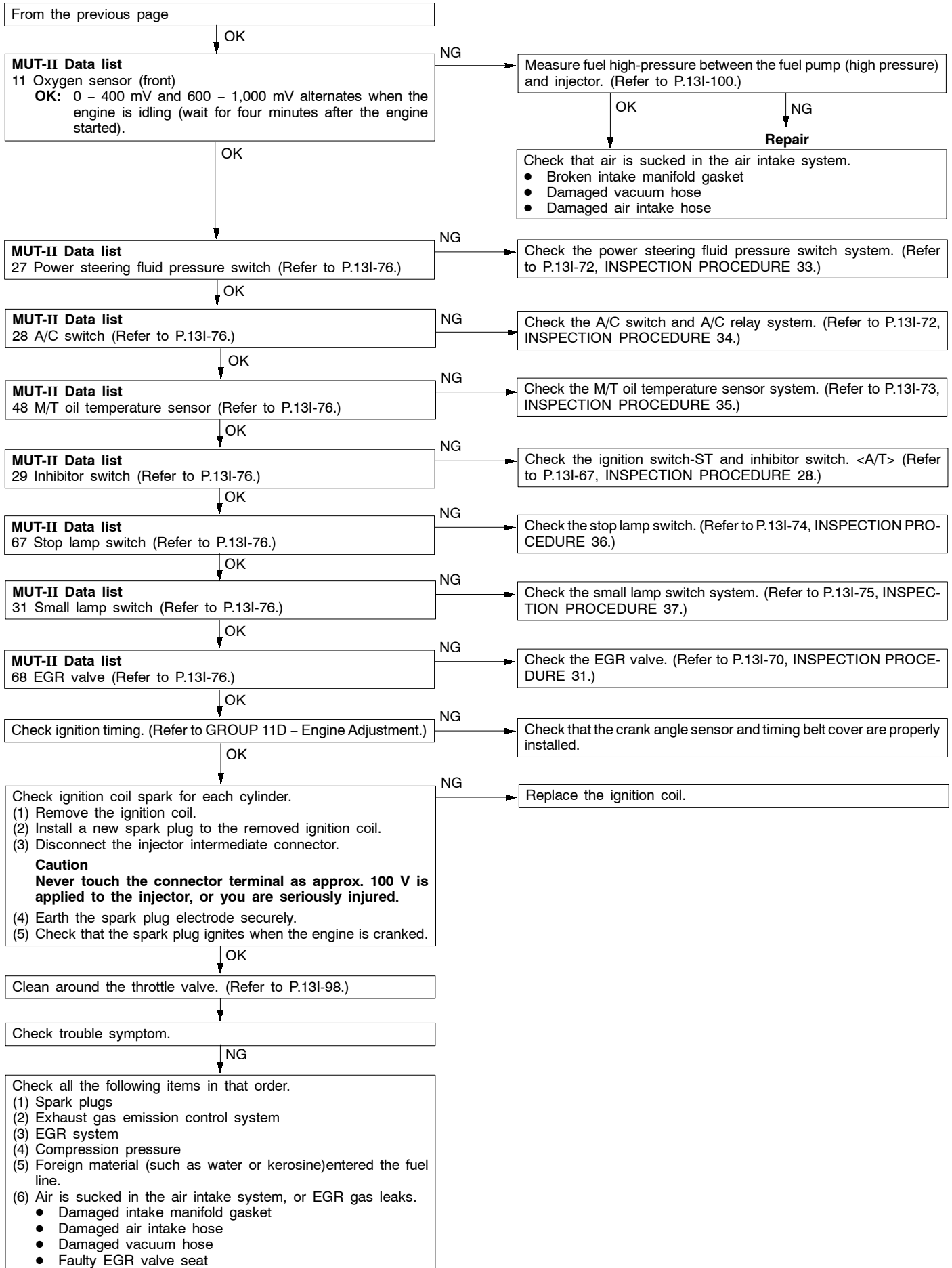
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Replace the ignition coil.

INSPECTION PROCEDURE 7

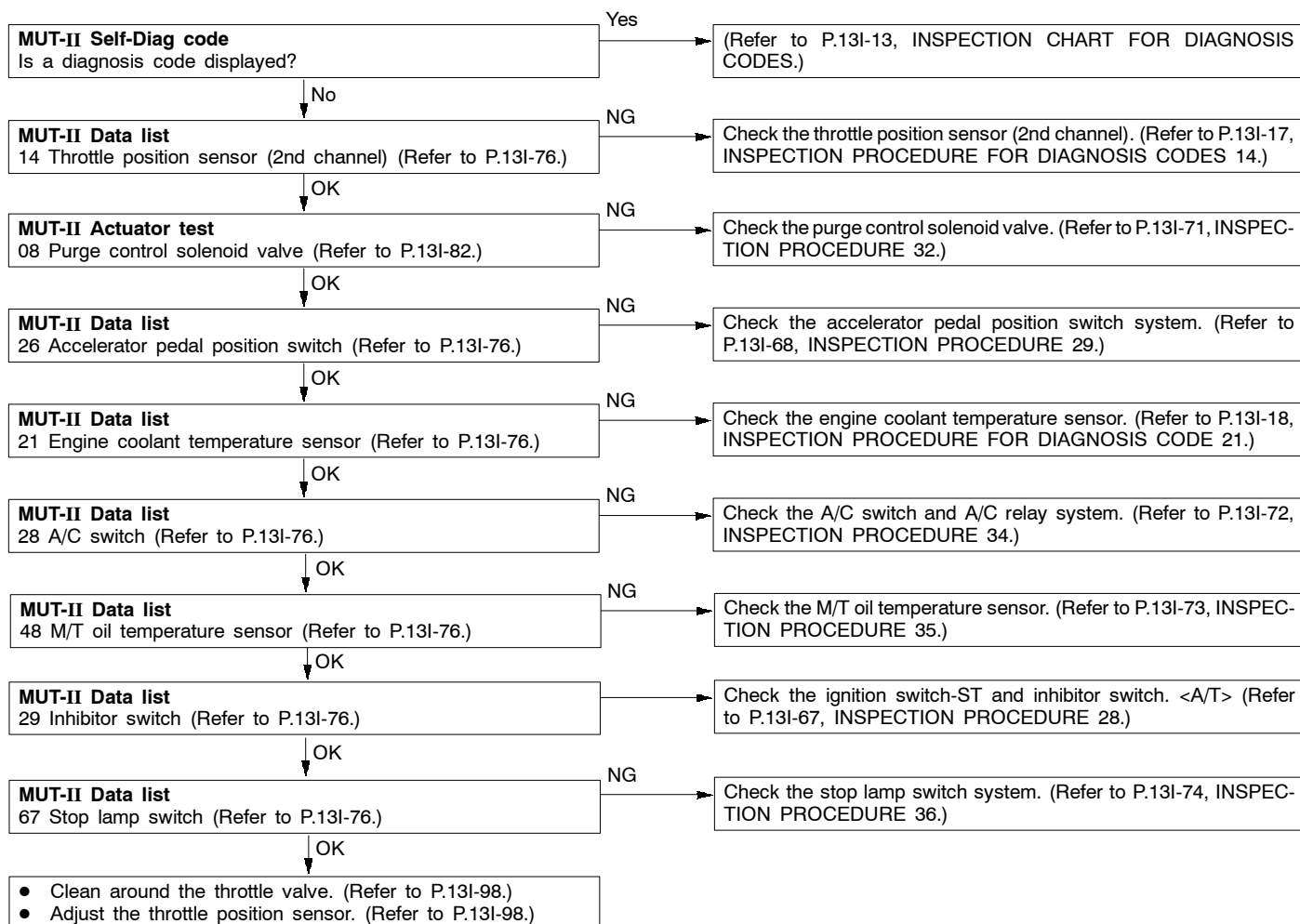
Unstable idling (rough idle, hunting)	Probable cause
This malfunction is probably caused by a faulty ignition system, improper air/fuel ratio, a faulty electronic-controlled throttle valve system, improper compression pressure, etc. As many causes can be suspected, diagnose from easier items.	<ul style="list-style-type: none"> • 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





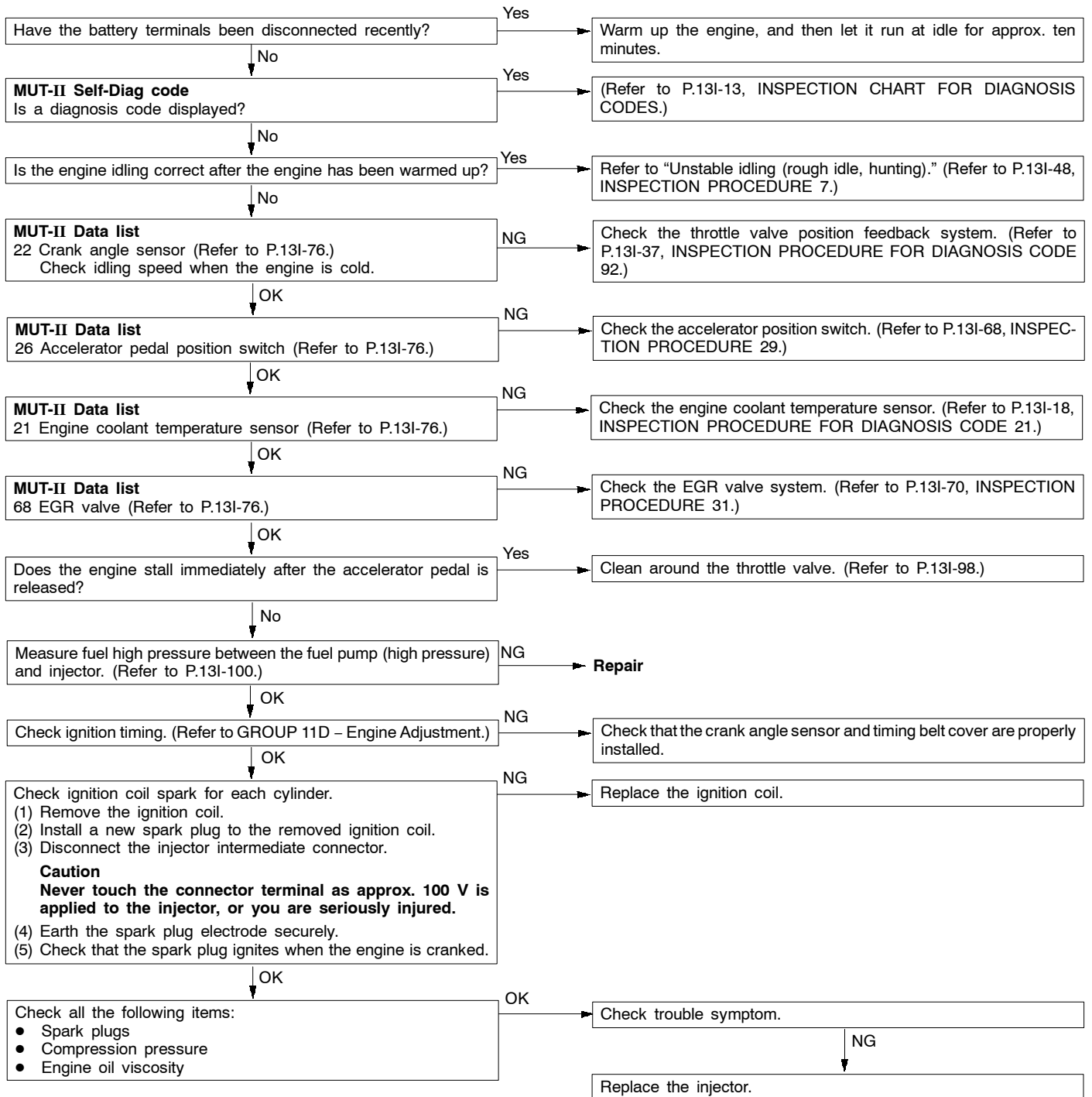
INSPECTION PROCEDURE 8

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.	<ul style="list-style-type: none"> Malfunction of the electronic-controlled throttle valve system Malfunction of the throttle body



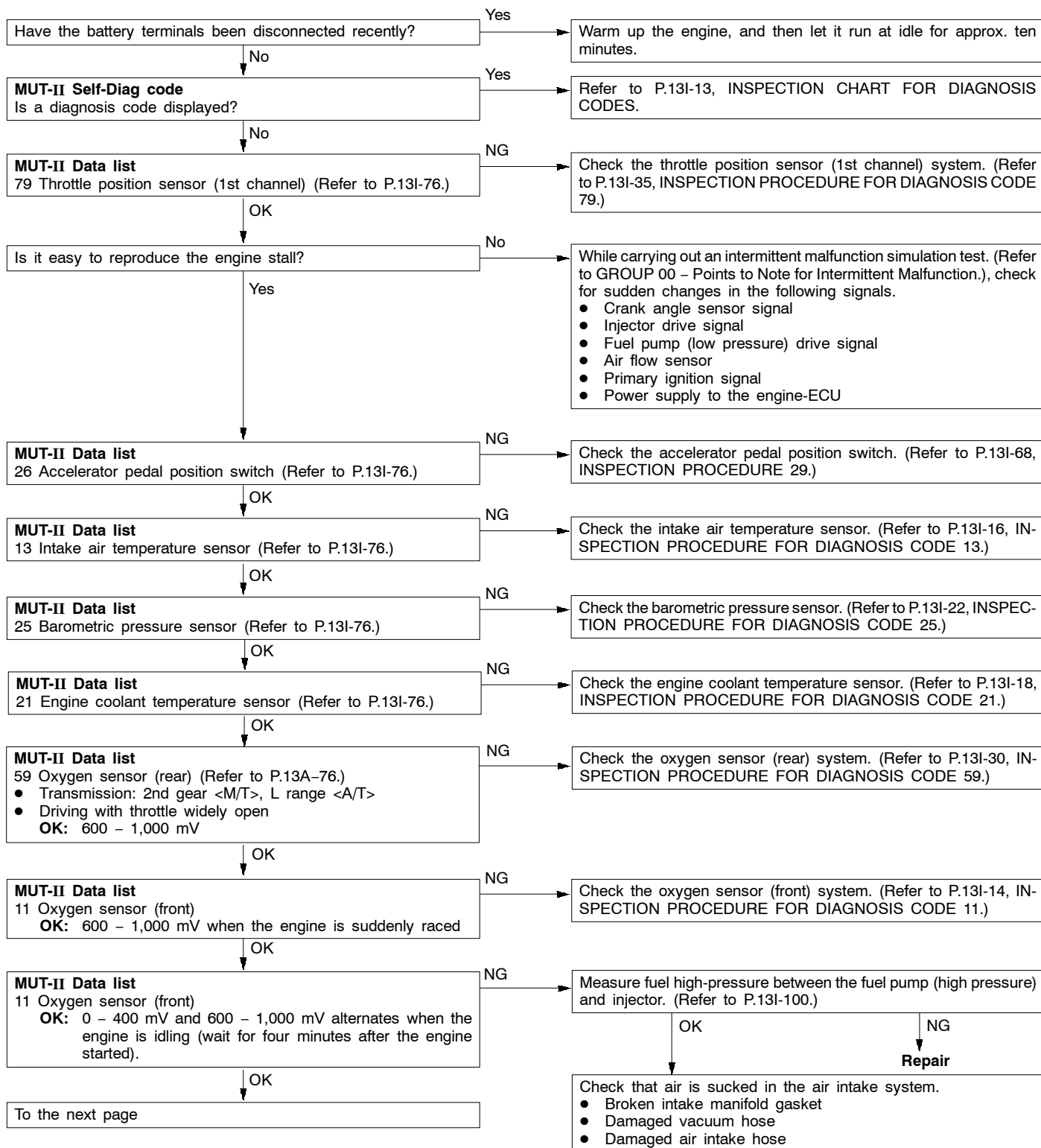
INSPECTION PROCEDURE 9

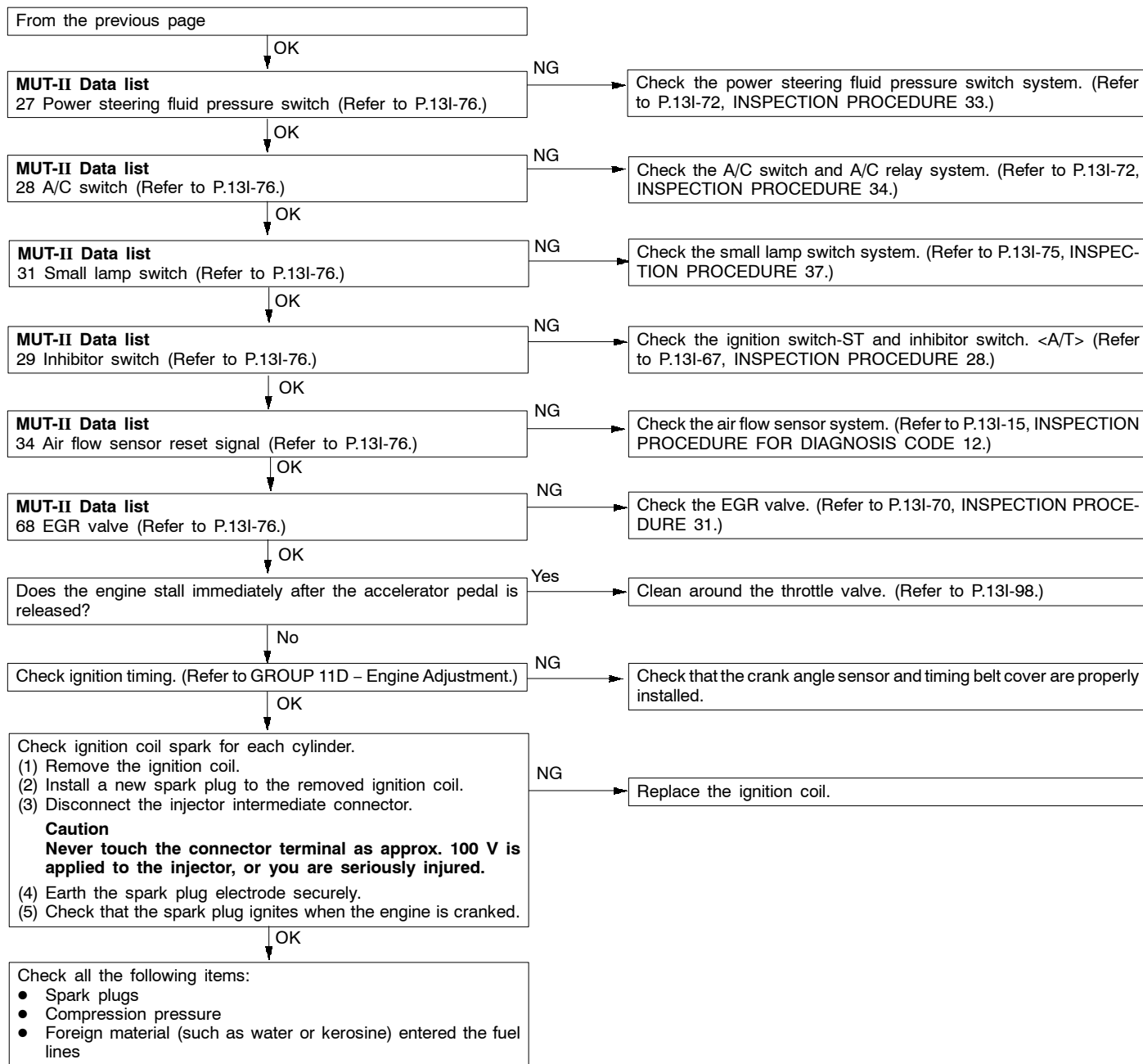
When the engine is cold, it stalls at idling. (Die out)	Probable cause
The cause is probably an incorrect air/fuel ratio or poor intake air amount when the engine is cold.	<ul style="list-style-type: none"> Malfunction of the electronic-control throttle valve system Malfunction of the throttle body



INSPECTION PROCEDURE 10

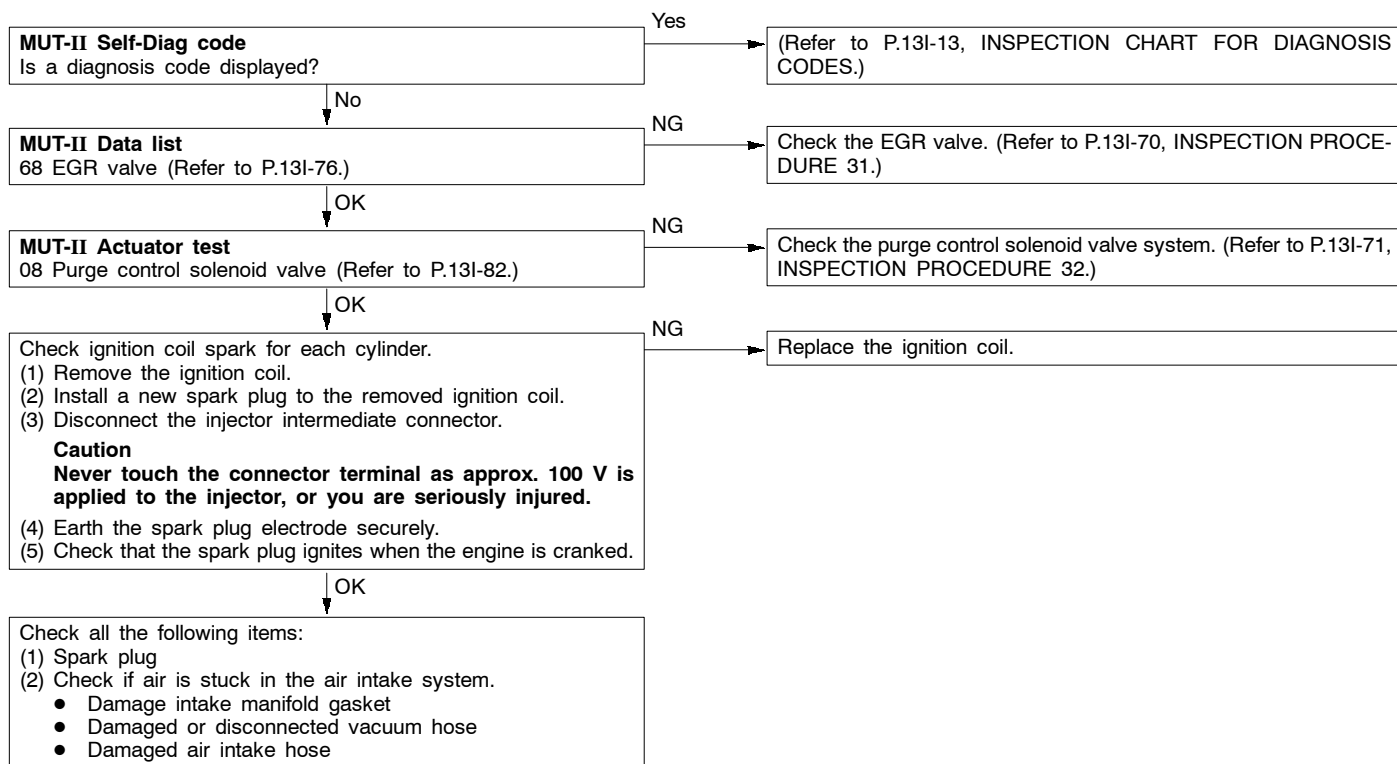
When the engine is hot, it stalls at idling. (Die out)	Probable cause
The cause is probably an improper air/fuel ratio, faulty electronic-controlled throttle valve system, compression pressure. In addition, if the engine stalls suddenly, another possible cause might be a poor connector contact.	<ul style="list-style-type: none"> • 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





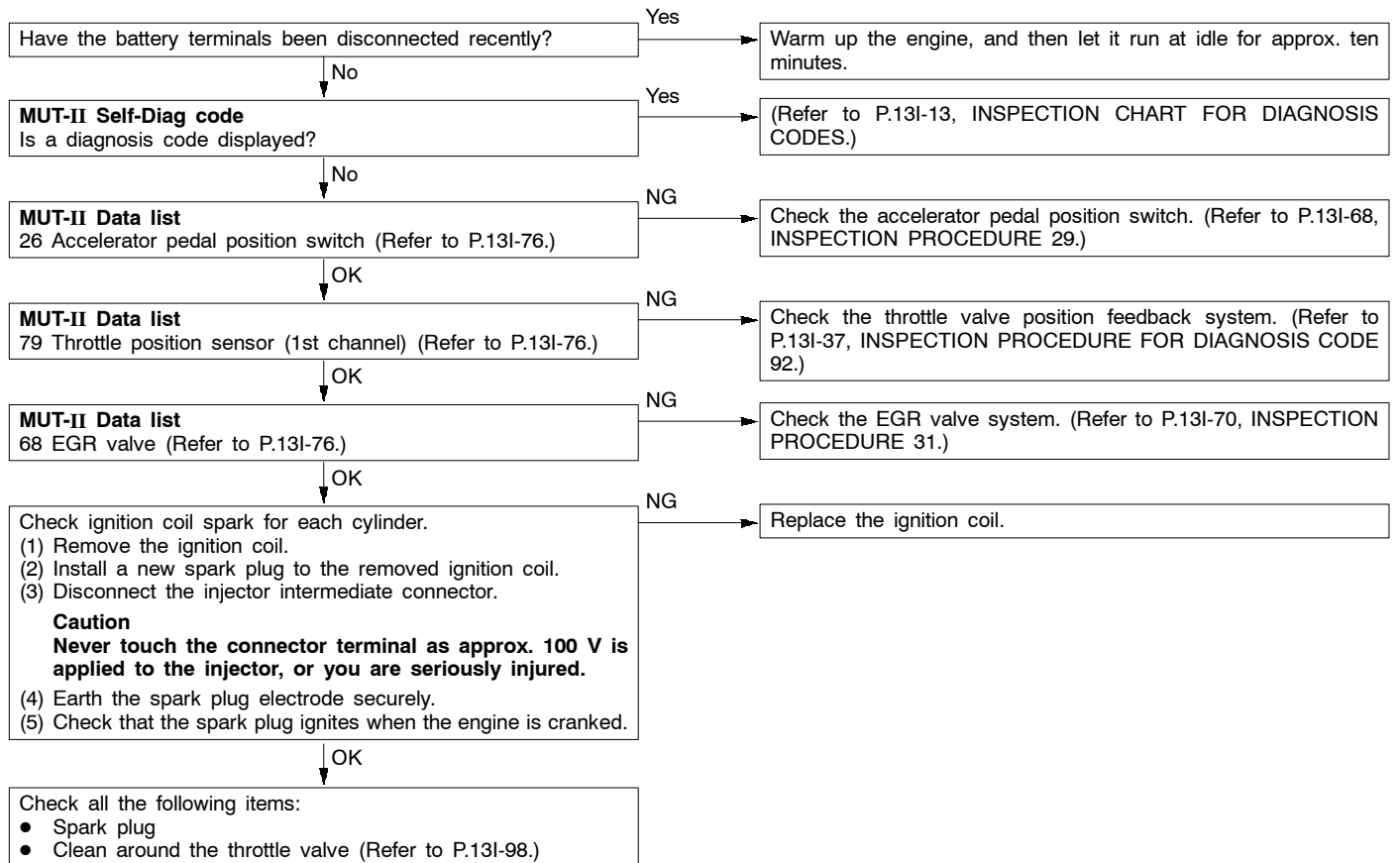
INSPECTION PROCEDURE 11

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.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the EGR valve • Air stuck in the air intake system



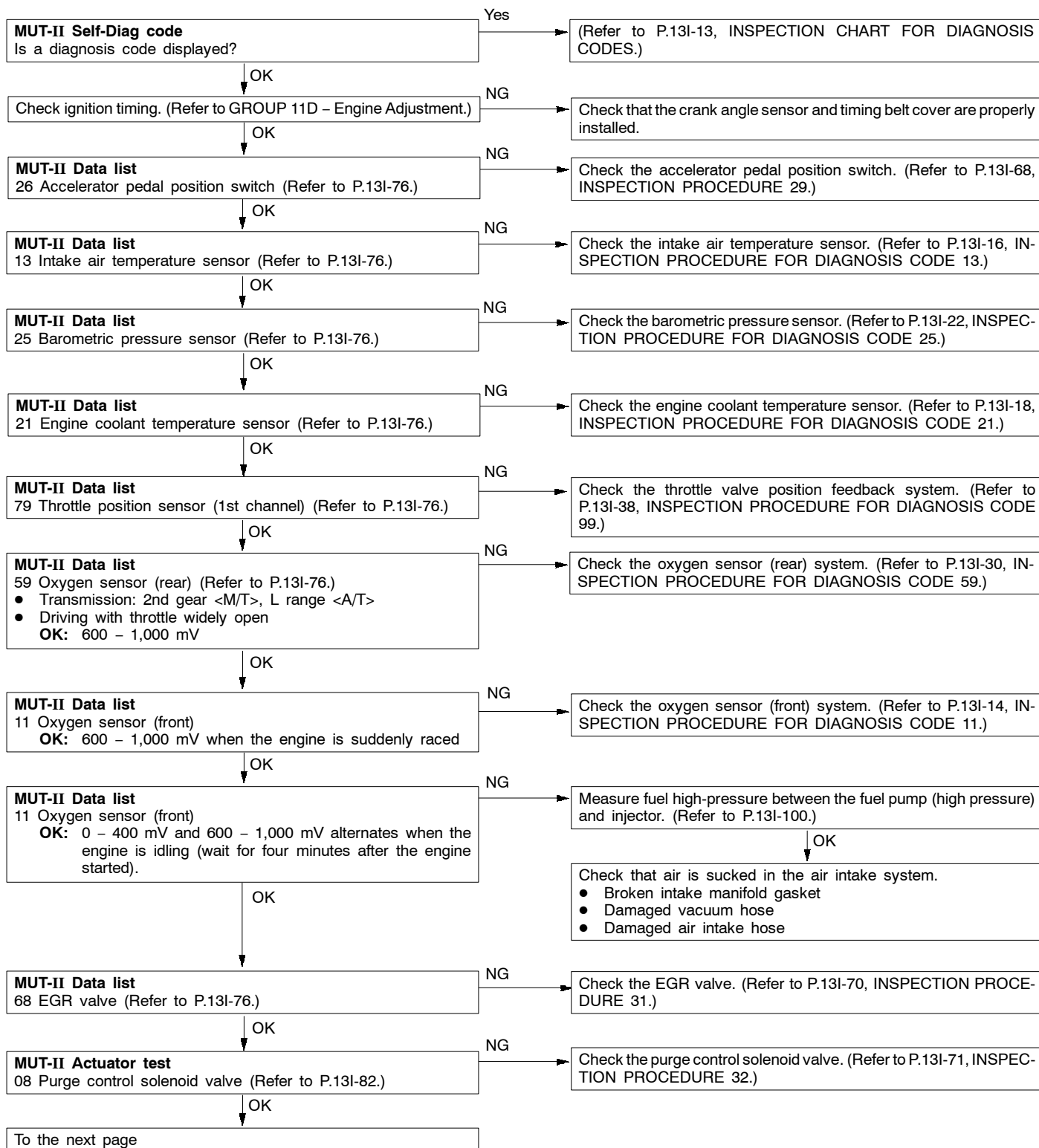
INSPECTION PROCEDURE 12

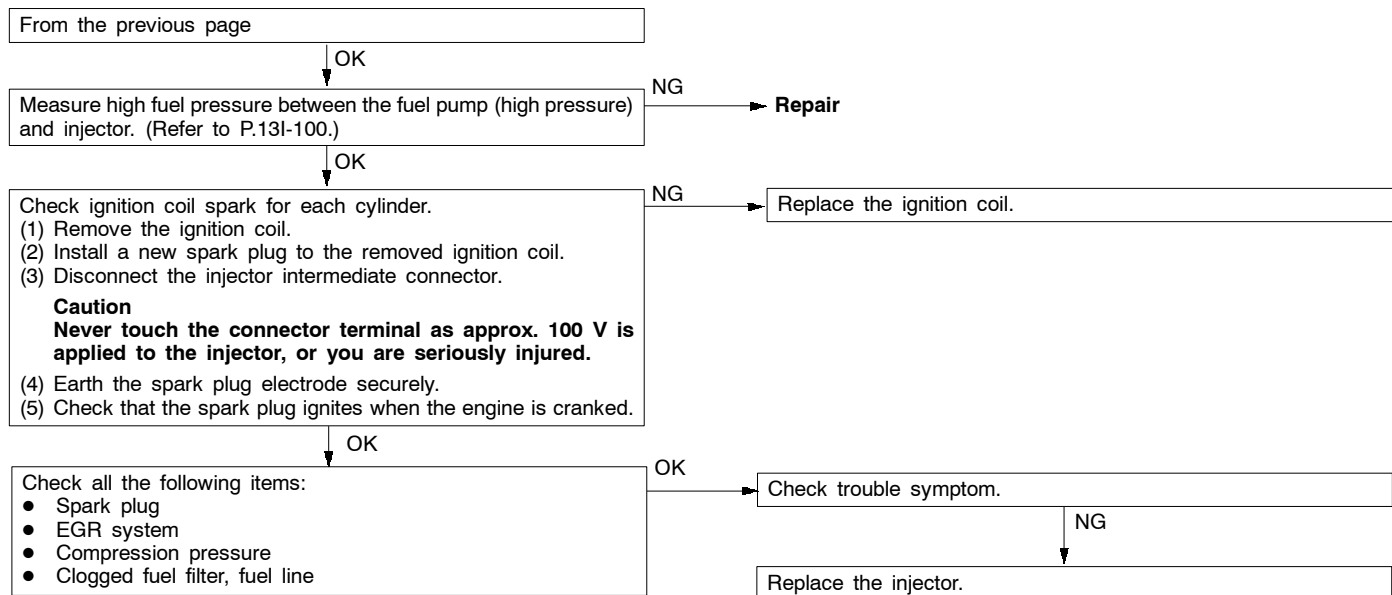
The engine stalls when decelerating.	Probable cause
The cause is probably an improper air/fuel ratio due to a faulty EGR system, or poor intake air volume due to a faulty electronic-controlled throttle valve system.	<ul style="list-style-type: none"> Malfunction of the electronic-controlled throttle valve system Malfunction of the EGR valve



INSPECTION PROCEDURE 13

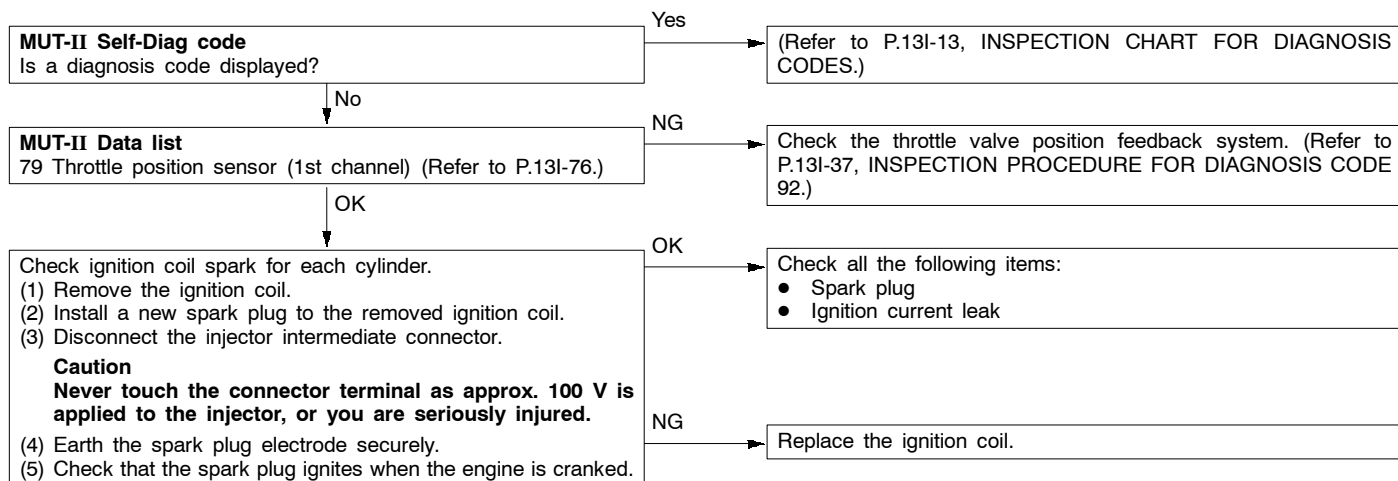
Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, electronic-controlled throttle valve system, compression pressure, etc.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of the air/fuel ratio control system Malfunction of the electronic-controlled throttle valve system Improper compression pressure Air stuck in the air intake system





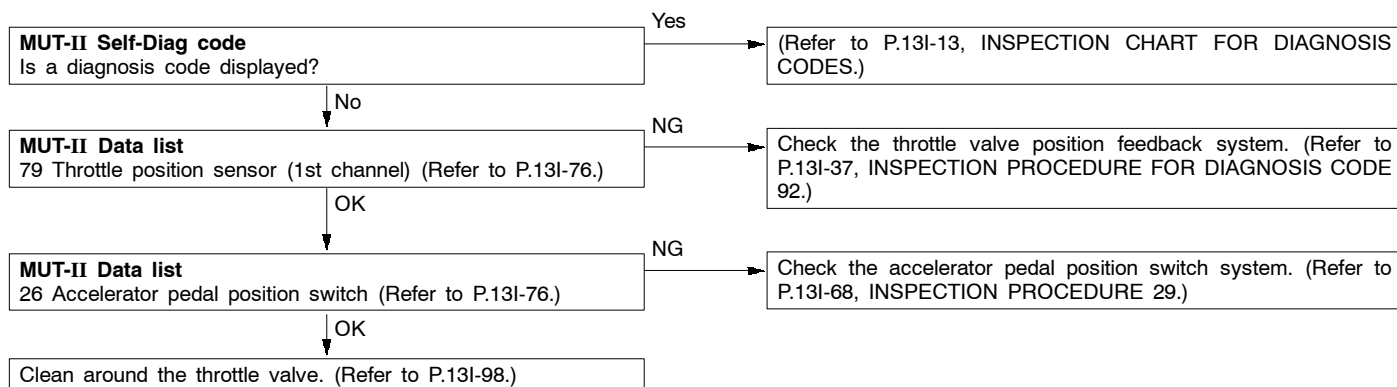
INSPECTION PROCEDURE 14

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.	<ul style="list-style-type: none"> • Malfunction of the ignition system



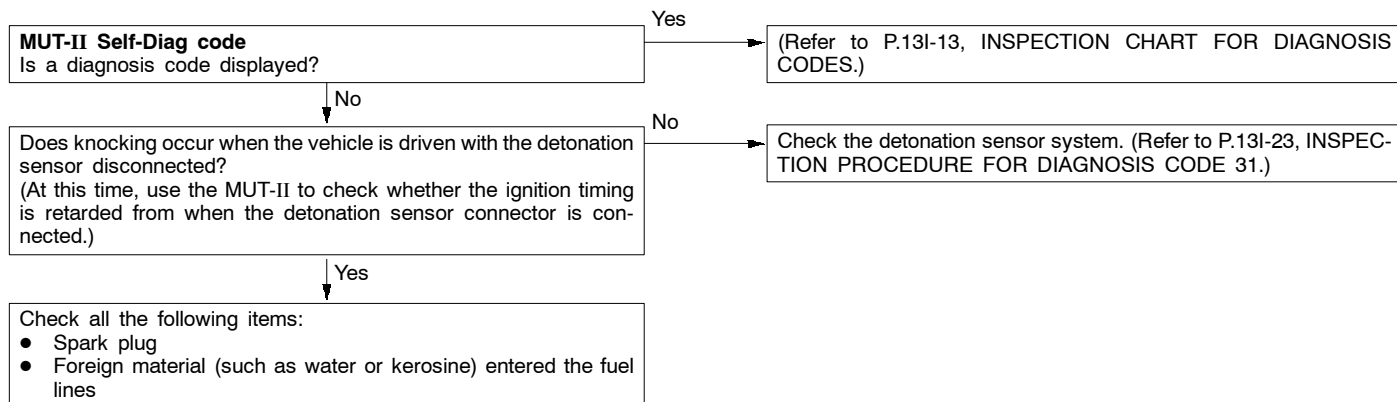
INSPECTION PROCEDURE 15

The feeling of impact when decelerating	Probable cause
The cause is probably insufficient intake air due to a faulty electronic-controlled throttle valve system.	<ul style="list-style-type: none"> Malfunction of the electronic-controlled throttle valve system



INSPECTION PROCEDURE 16

Knocking	Probable cause
The cause is probably incorrect detonation control or improper heat range of the spark plugs.	<ul style="list-style-type: none"> Malfunction of the detonation sensor Improper heat range of the spark plugs



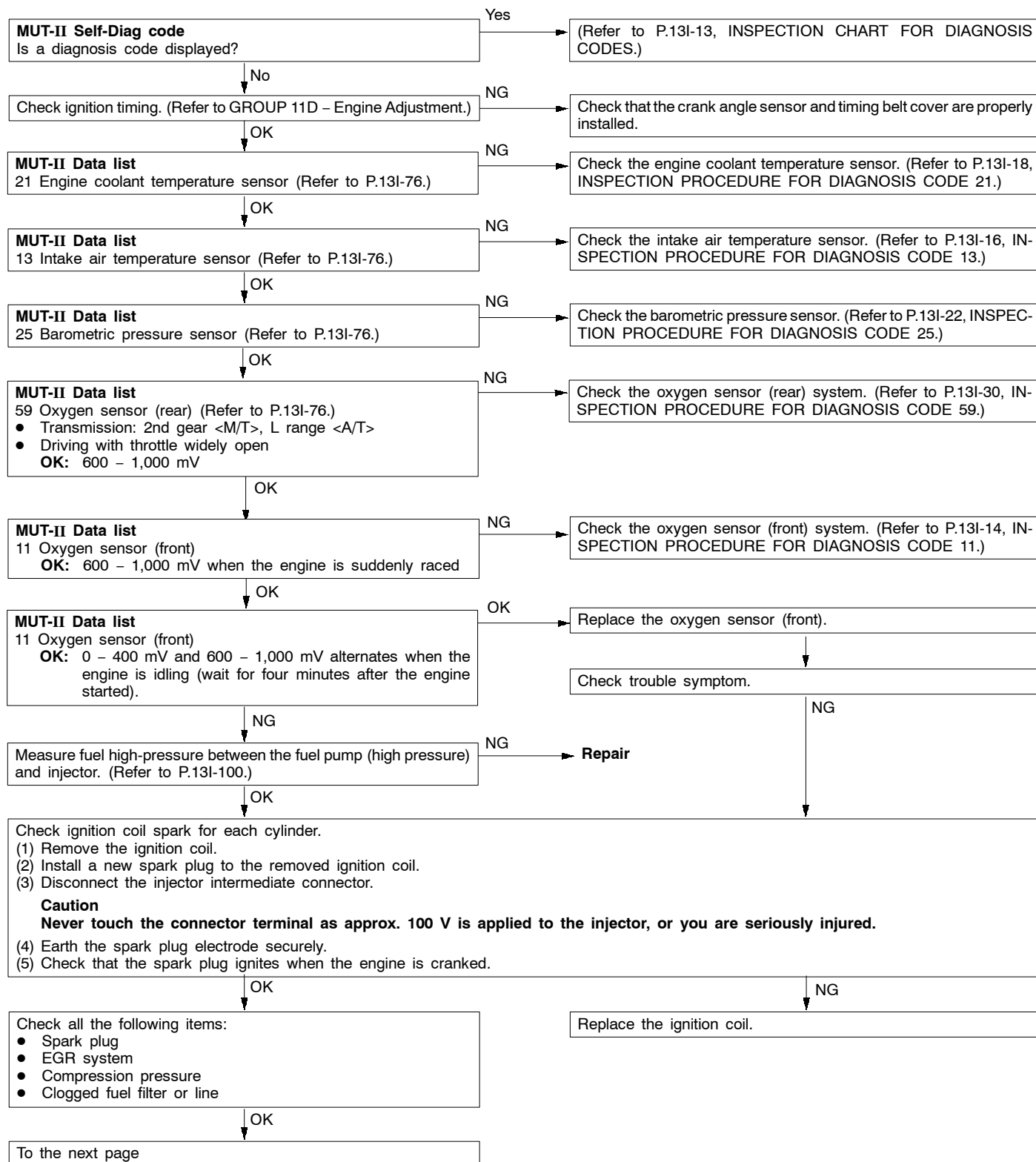
INSPECTION PROCEDURE 17

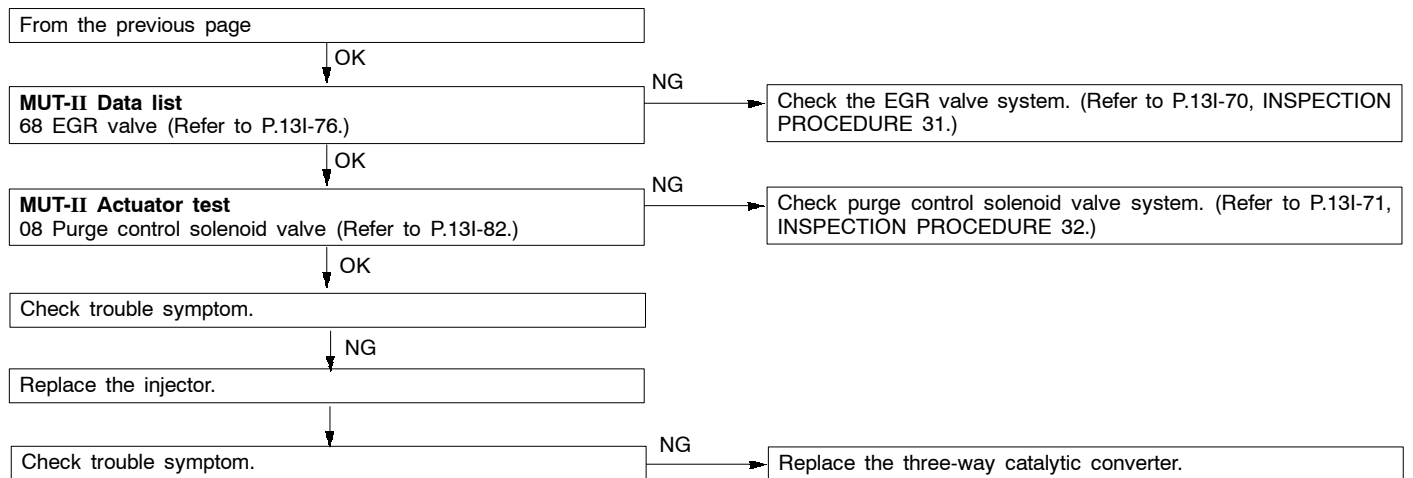
Run-on (dieseling)	Probable cause
The cause is probably fuel leak from injector(s)	<ul style="list-style-type: none"> Malfunction of the injector

Replace the injector.

INSPECTION PROCEDURE 18

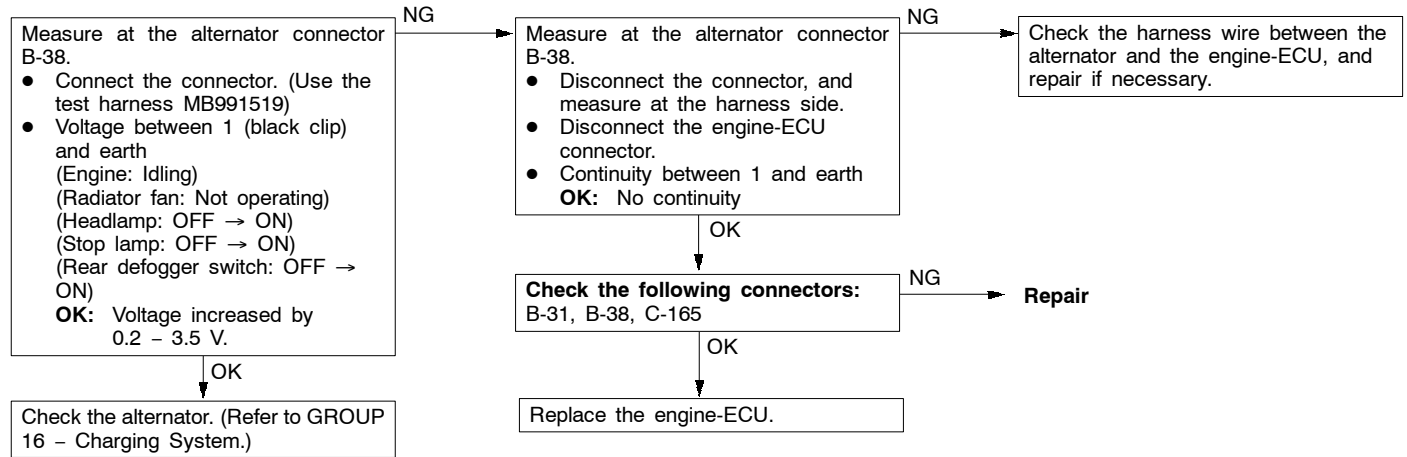
Too high CO and HC concentration when idling	Probable cause
The cause is probably an incorrect air/fuel ratio	<ul style="list-style-type: none"> Malfunction of air/fuel ratio control system Deterioration of the catalyst





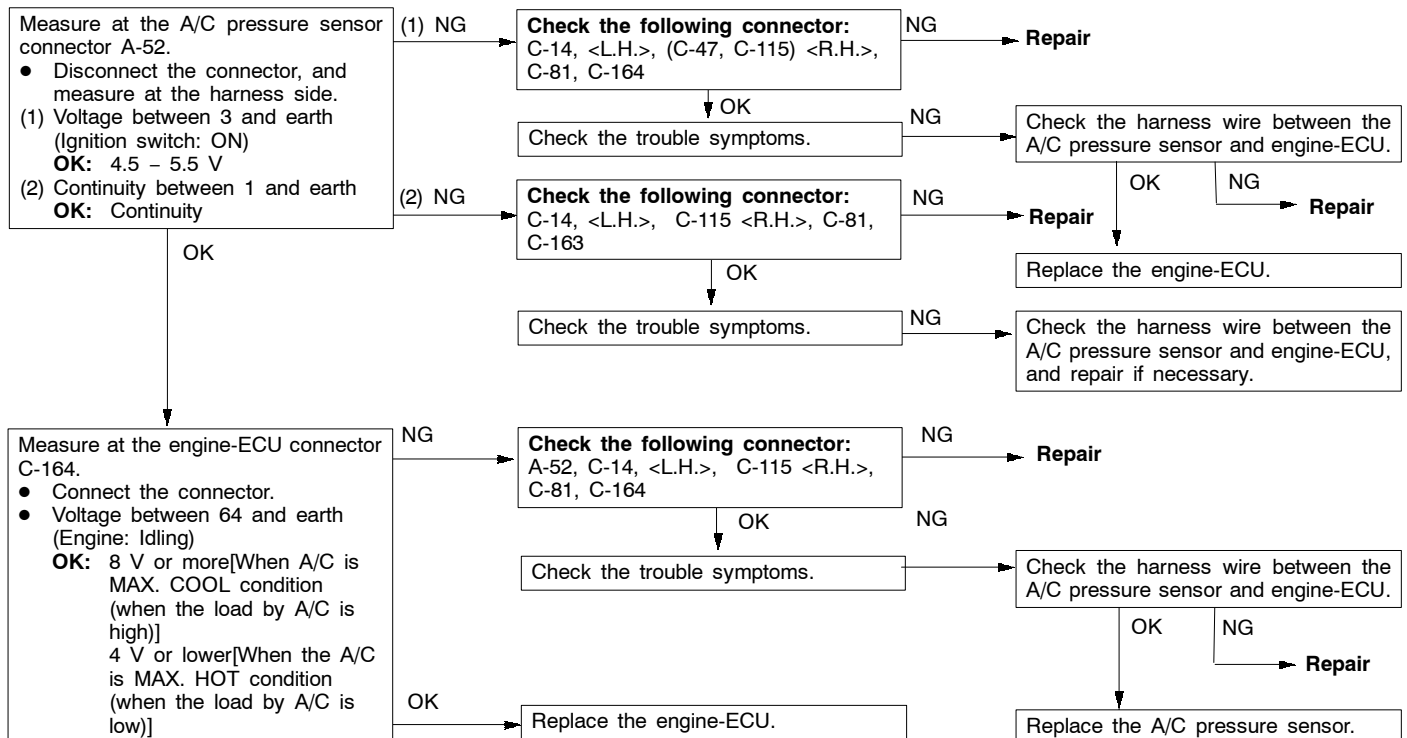
INSPECTION PROCEDURE 19

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.	<ul style="list-style-type: none"> Malfunction of the charging system Open circuit between the alternator G terminal and the engine-ECU Malfunction of the engine-ECU



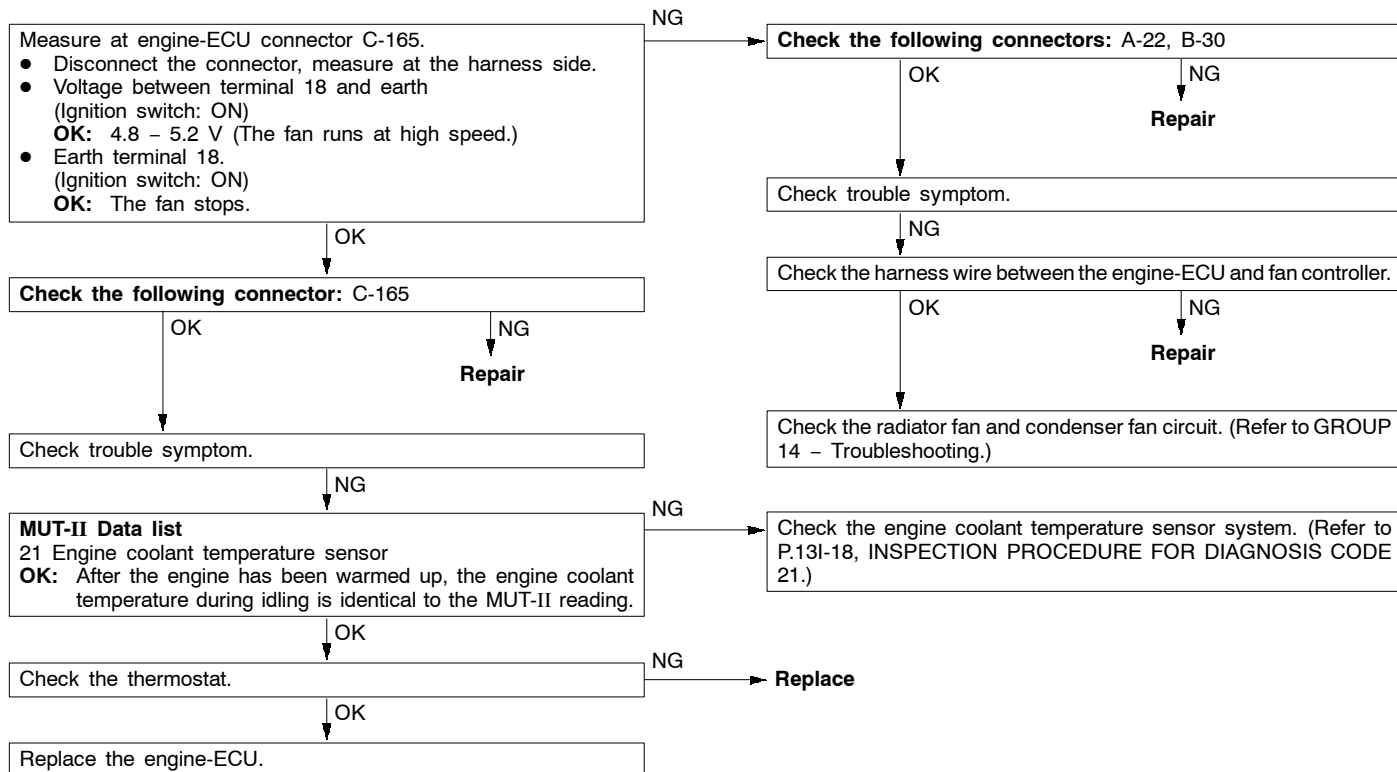
INSPECTION PROCEDURE 20

Idling speed is improper when A/C is operating	Probable cause
<p>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).</p>	<ul style="list-style-type: none"> Malfunction of the A/C control system Improper connector contact, open circuit or short-circuited harness wire Malfunction of the A/C pressure sensor Malfunction of the engine-ECU



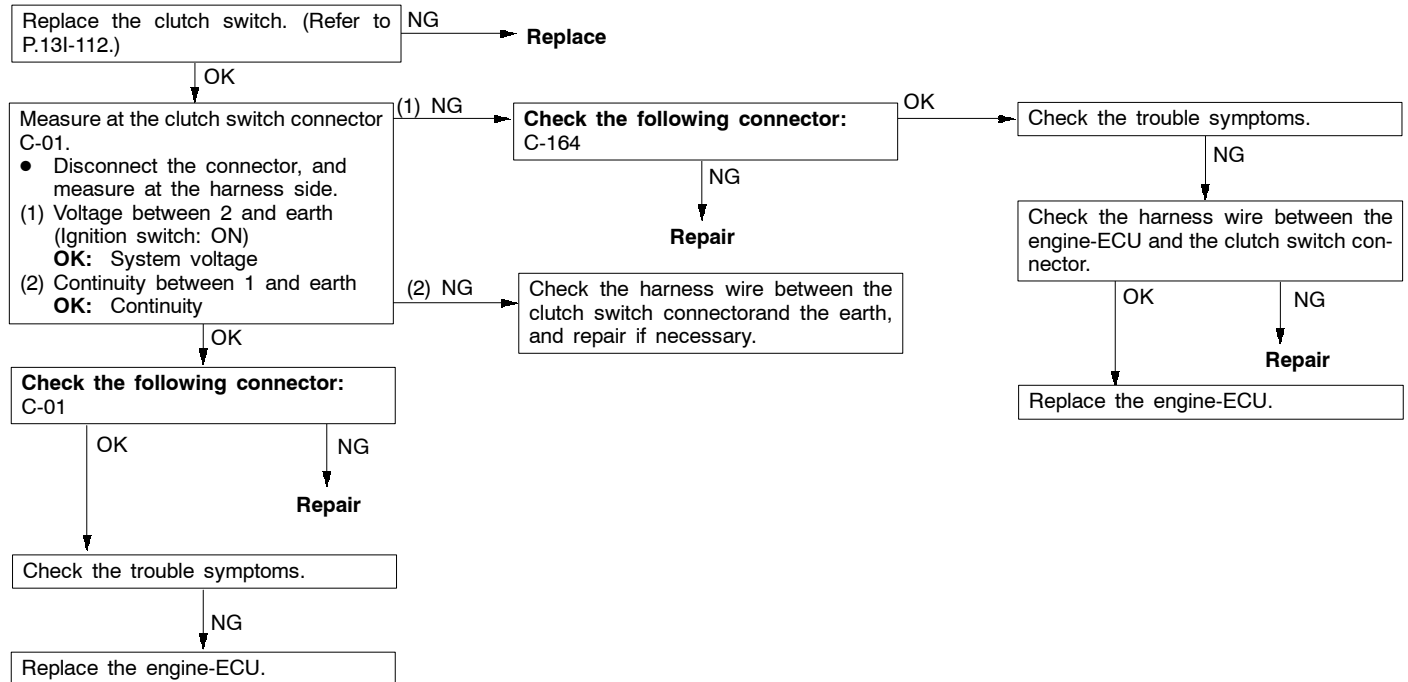
INSPECTION PROCEDURE 21

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
<p>The engine-ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch.</p> <p>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.)</p>	<ul style="list-style-type: none"> • 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



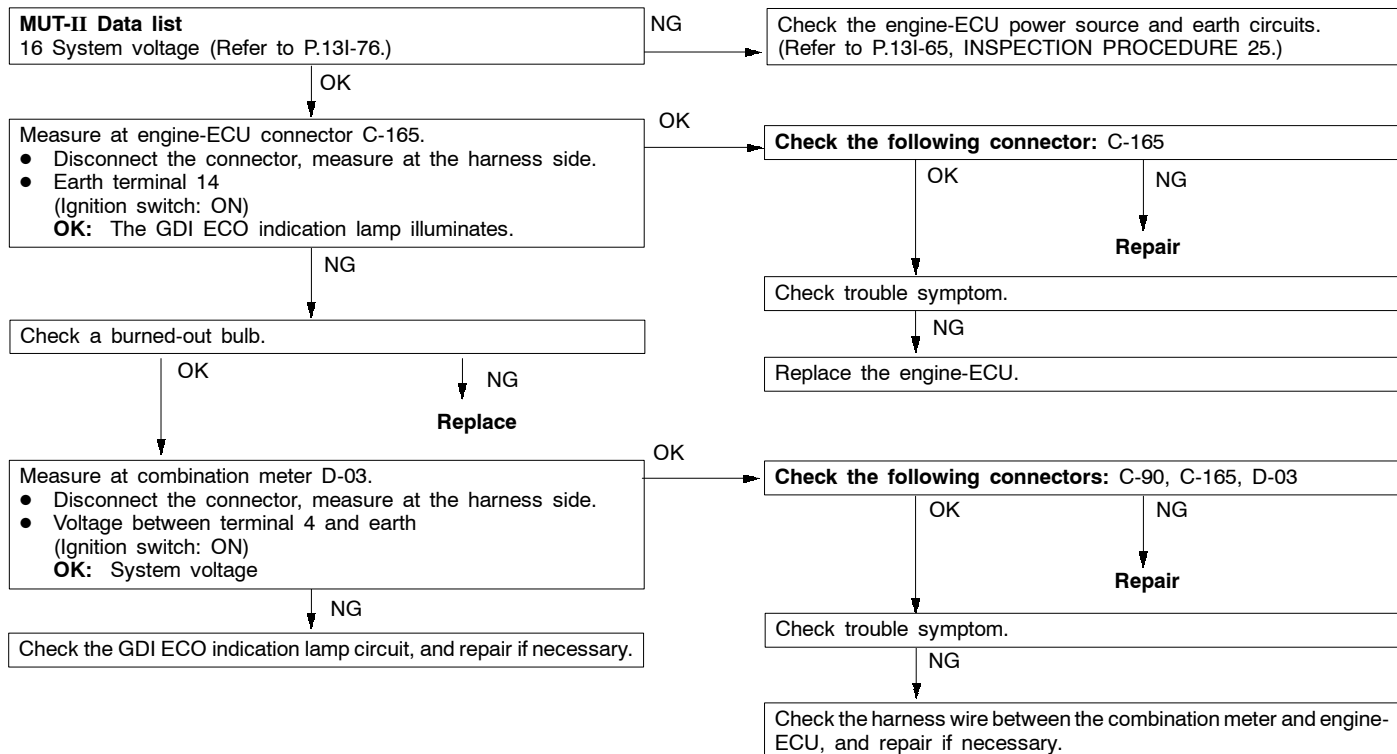
INSPECTION PROCEDURE 22

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.	<ul style="list-style-type: none"> Malfunction of the clutch switch Open circuit or short-circuited harness wire in the clutch switch circuit Malfunction of the engine-ECU



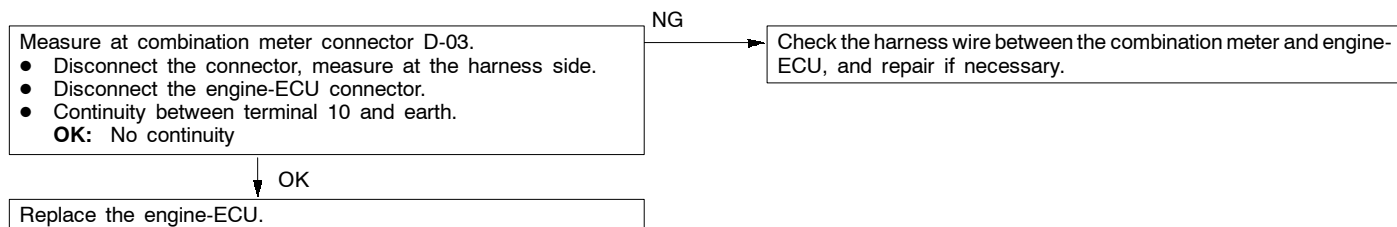
INSPECTION PROCEDURE 23

The GDI ECO indication lamp does not illuminate.	Probable cause
If the GDI ECO indication lamp does not illuminate after turning on the ignition switch, the causes listed in the right column are suspected.	<ul style="list-style-type: none"> Burned-out GDI ECO indication lamp bulb Open circuit or short -circuited harness wire in the GDI ECO indication lamp circuit Malfunction of the engine-ECU



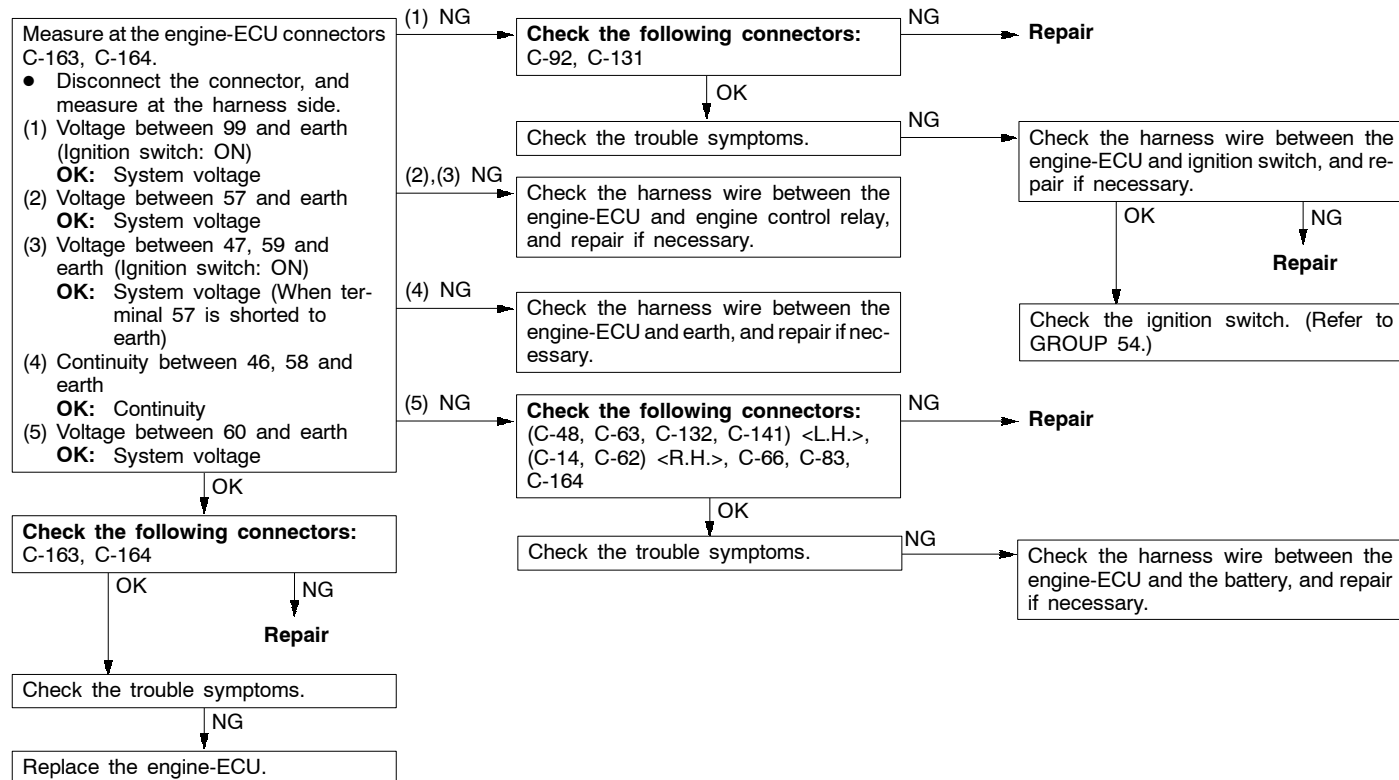
INSPECTION PROCEDURE 24

The GDI ECO indication lamp remains on (does not extinguish).	Probable cause
If the GDI ECO indication lamp does not extinguish during high load operation, the causes listed in the right column are suspected.	<ul style="list-style-type: none"> Short circuit between the GDI ECO indication lamp and engine-ECU Malfunction of the engine-ECU



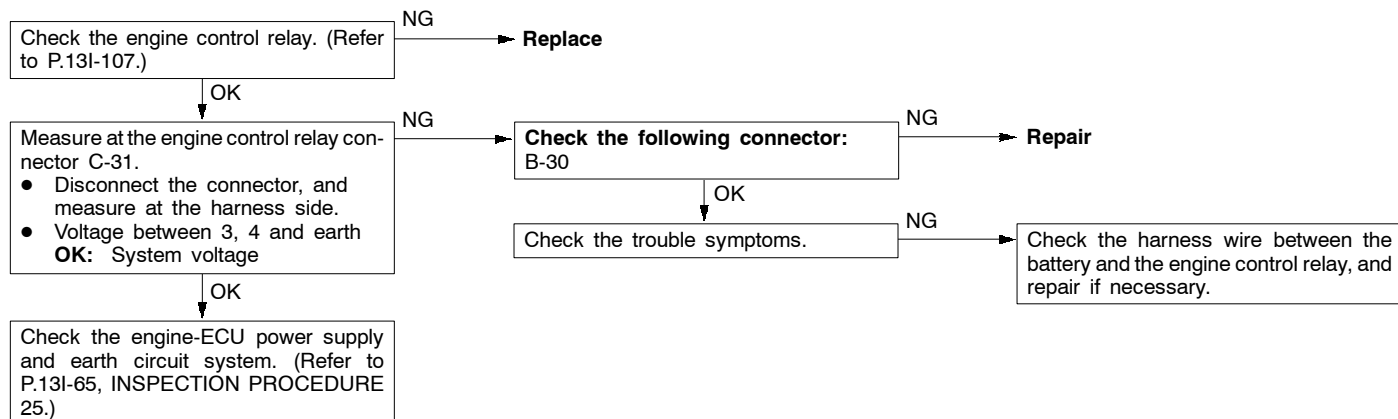
INSPECTION PROCEDURE 25

Engine-ECU power supply and earth circuit system	Probable cause
The cause is probably a malfunction of the engine-ECU or one of the problems listed at right.	<ul style="list-style-type: none"> Open circuit or short-circuited harness wire in the engine-ECU power supply circuit Open circuit or short-circuited harness wire in the engine-ECU earth circuit Malfunction of the engine-ECU



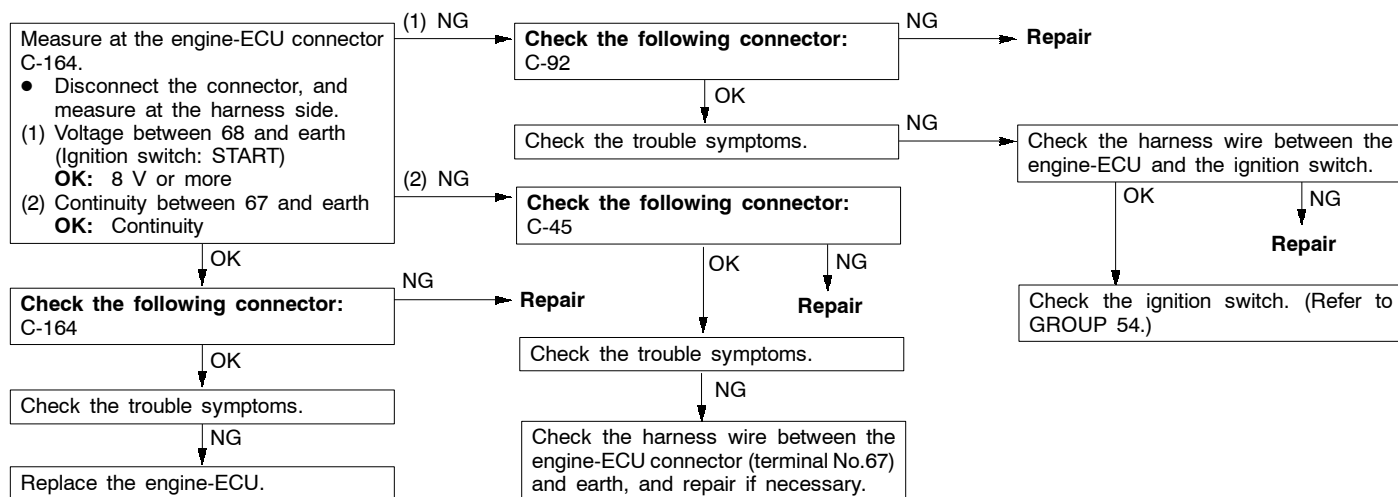
INSPECTION PROCEDURE 26

Engine control relay and ignition switch-IG system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, the engine-ECU turns on the engine control relay. This causes system voltage to be supplied to the engine-ECU and to the sensors and actuators.	<ul style="list-style-type: none"> Malfunction of the ignition switch Malfunction of the engine control relay Open circuit or short-circuited harness wire of the engine control relay circuit Malfunction of the engine-ECU



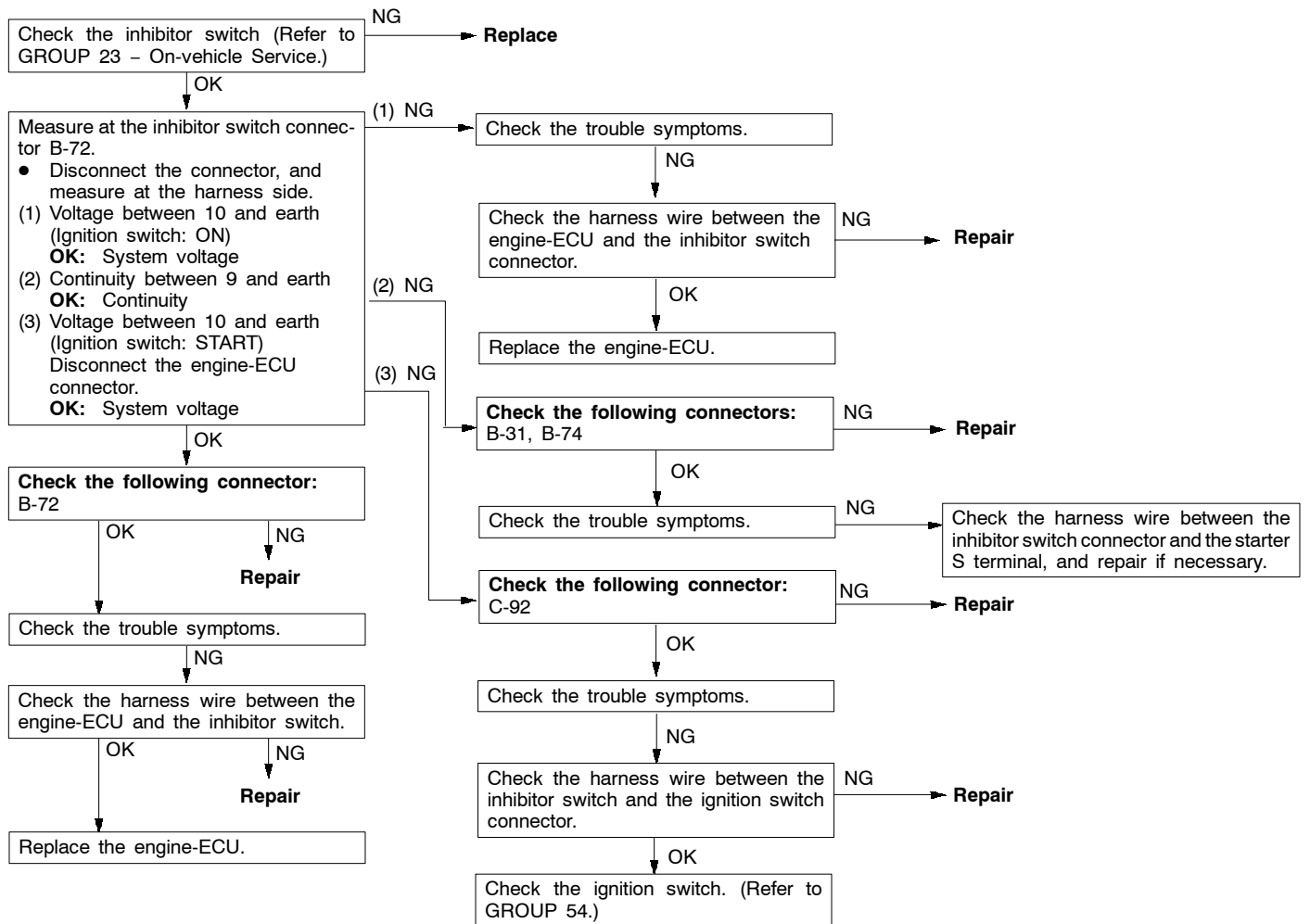
INSPECTION PROCEDURE 27

Ignition switch-ST system <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.	<ul style="list-style-type: none"> Malfunction of the ignition switch Open circuit or short-circuited harness wire of the ignition switch circuit Malfunction of the engine-ECU



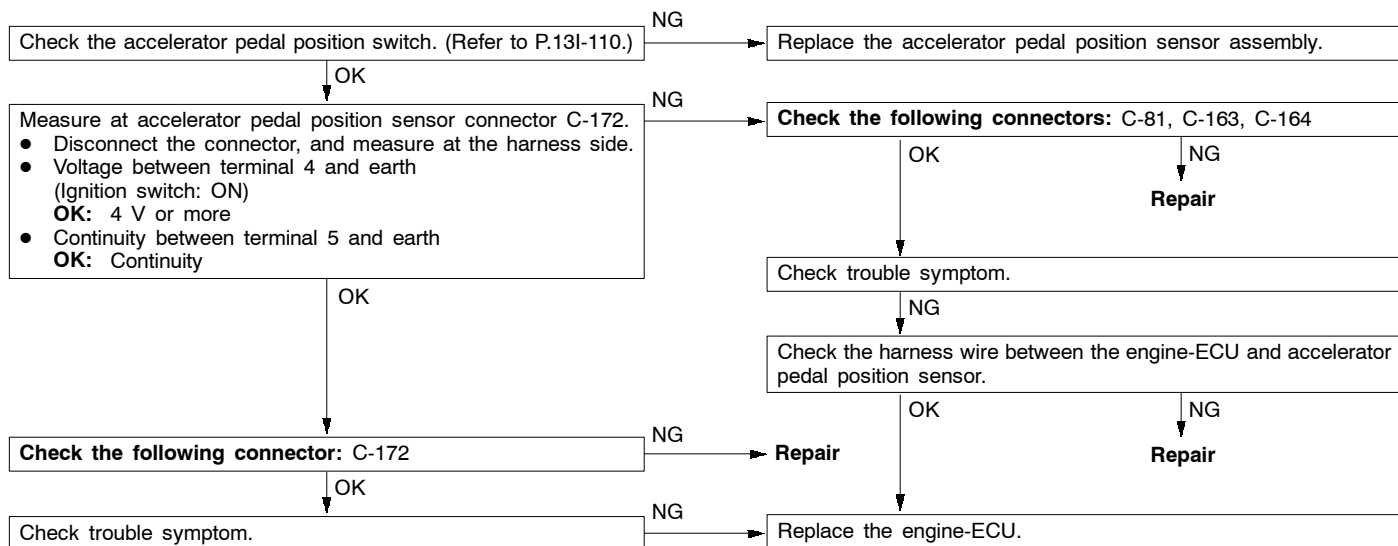
INSPECTION PROCEDURE 28

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
<p>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.</p> <p>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.</p>	<ul style="list-style-type: none"> • 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



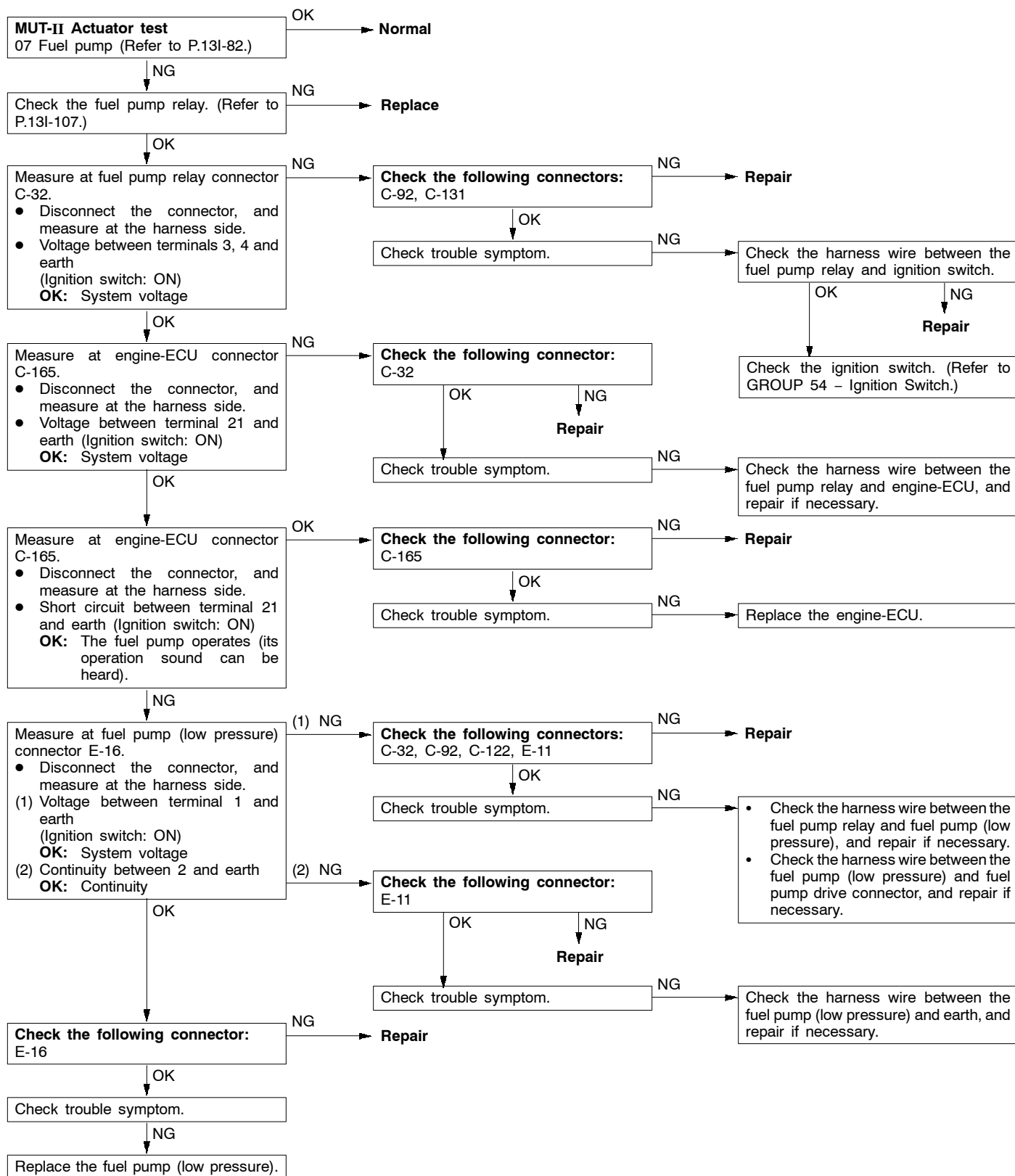
INSPECTION PROCEDURE 29

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.	<ul style="list-style-type: none"> • 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



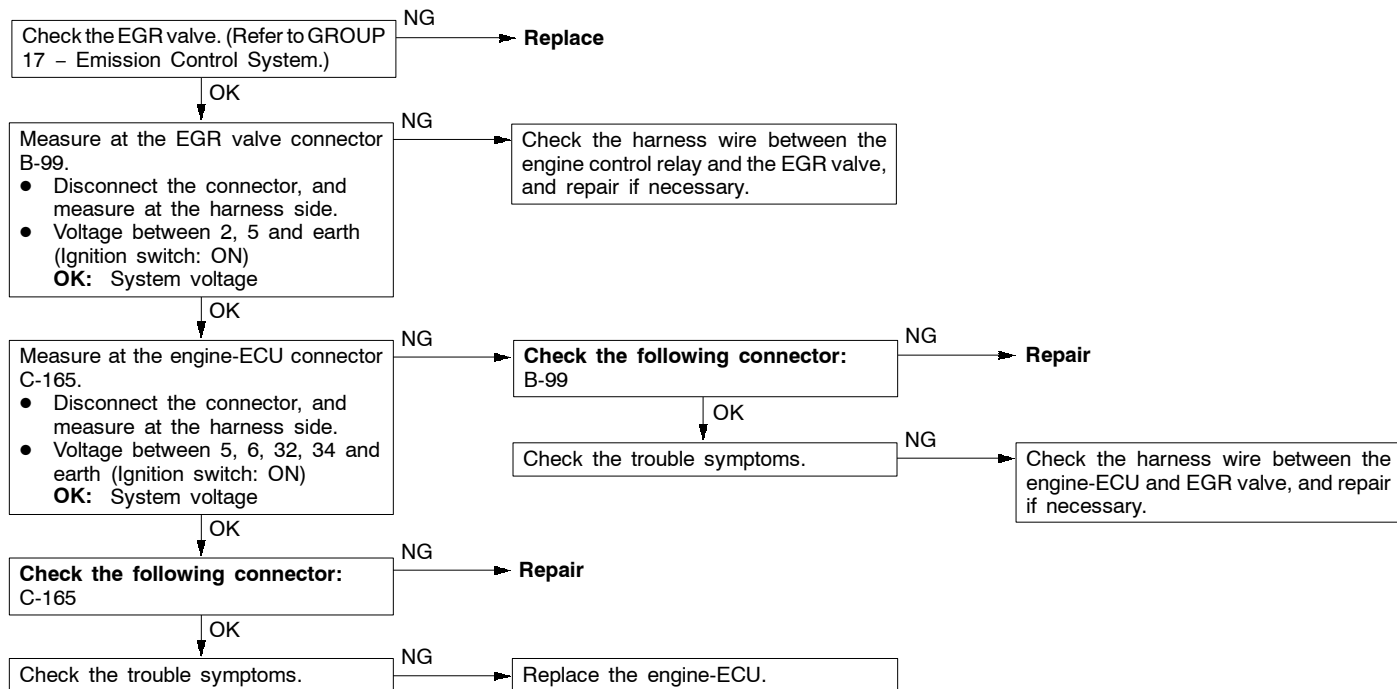
INSPECTION PROCEDURE 30

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).	<ul style="list-style-type: none"> • 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



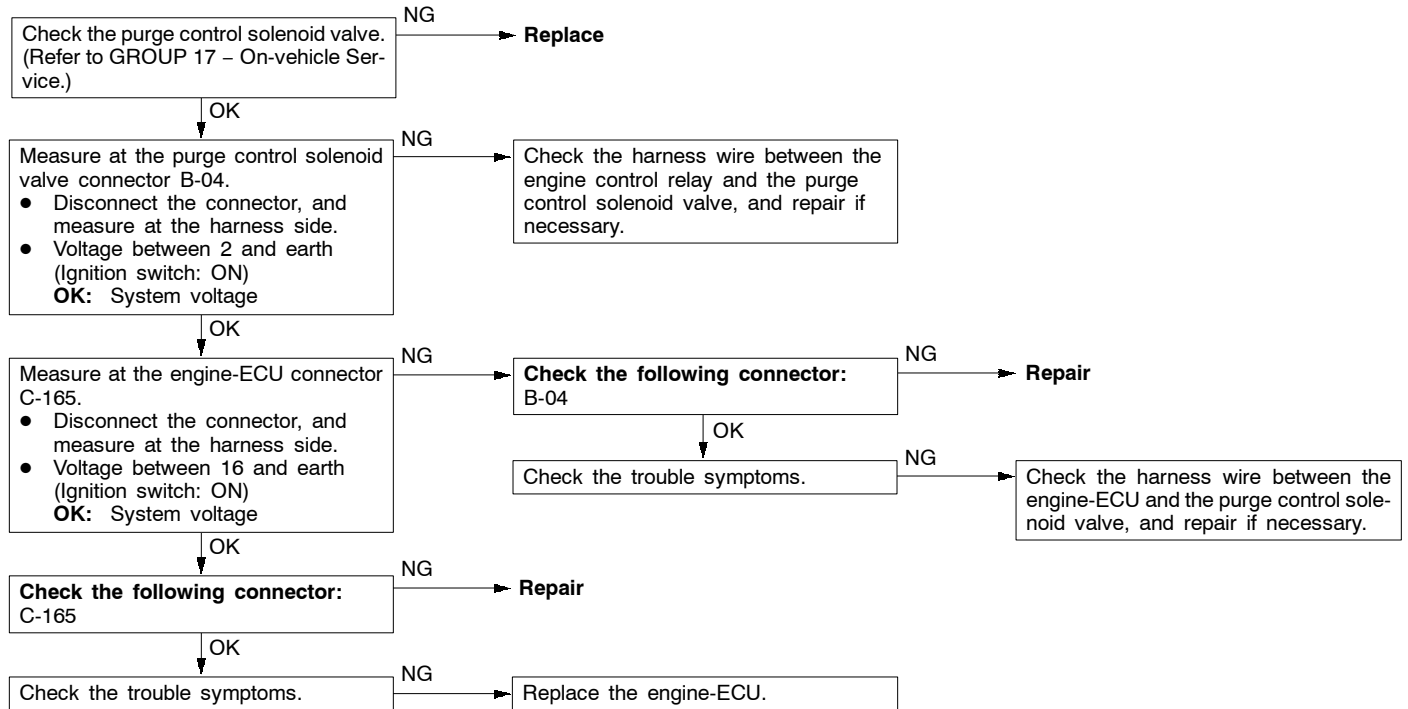
INSPECTION PROCEDURE 31

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.	<ul style="list-style-type: none"> • Malfunction of the EGR valve • Open circuit or short-circuited harness wire in the EGR valve circuit • Malfunction of the engine-ECU



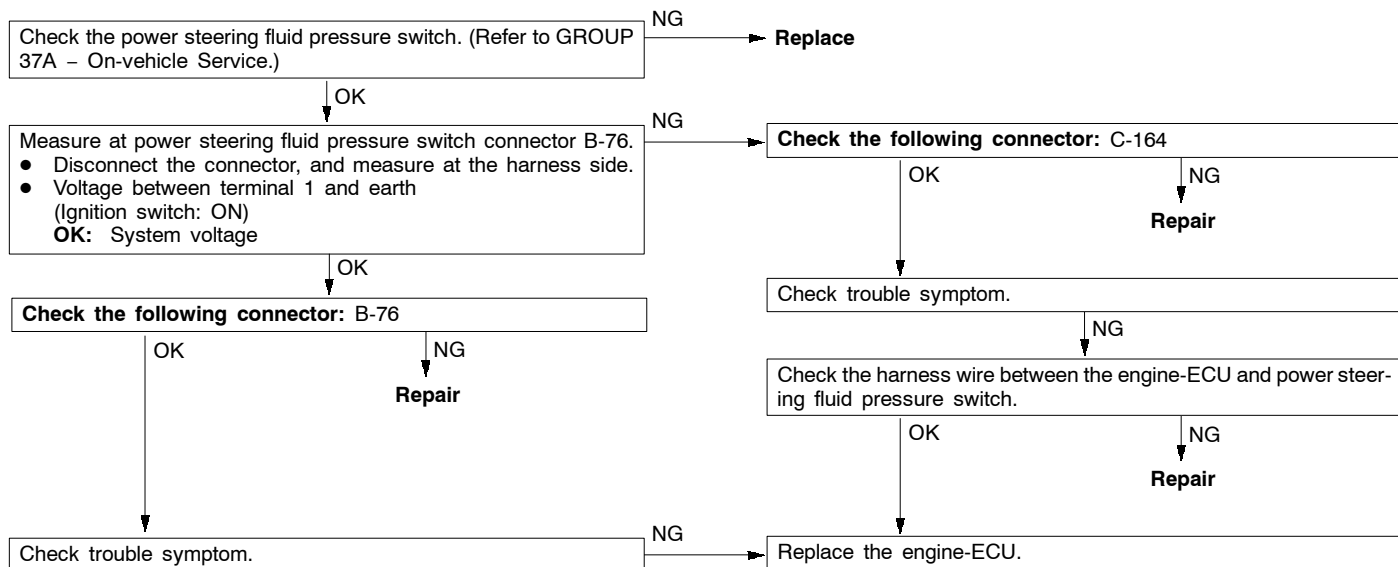
INSPECTION PROCEDURE 32

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.	<ul style="list-style-type: none"> 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



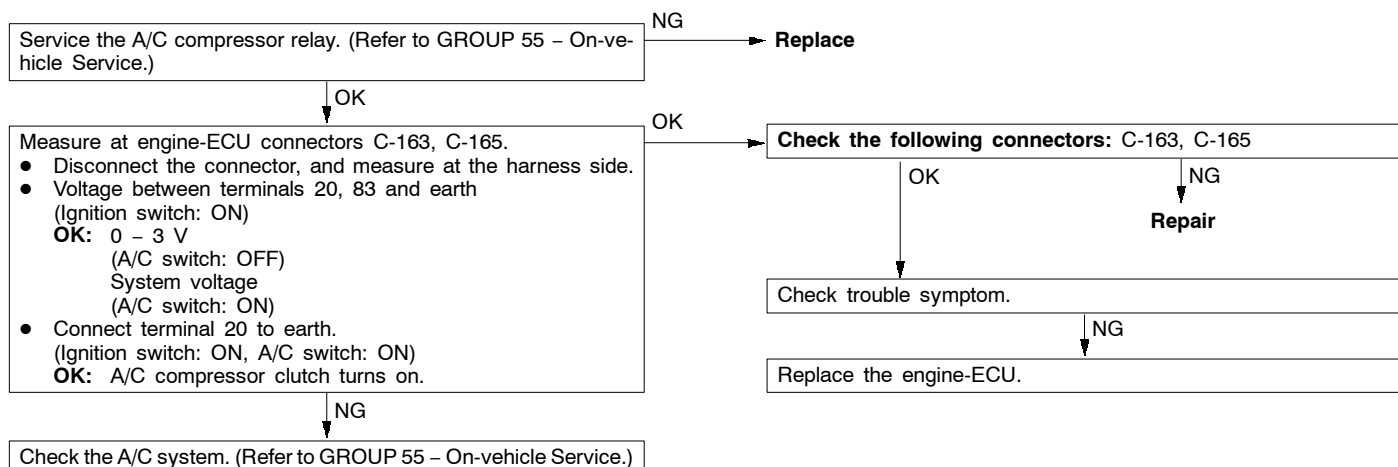
INSPECTION PROCEDURE 33

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.	<ul style="list-style-type: none"> 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



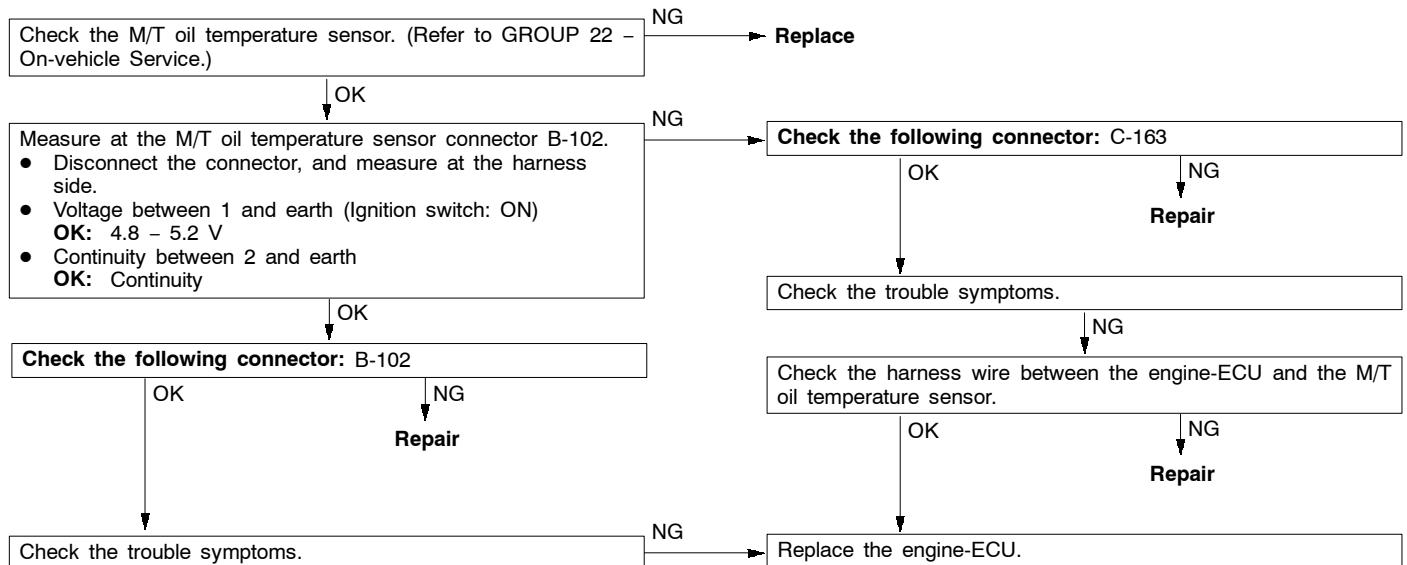
INSPECTION PROCEDURE 34

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.	<ul style="list-style-type: none"> 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



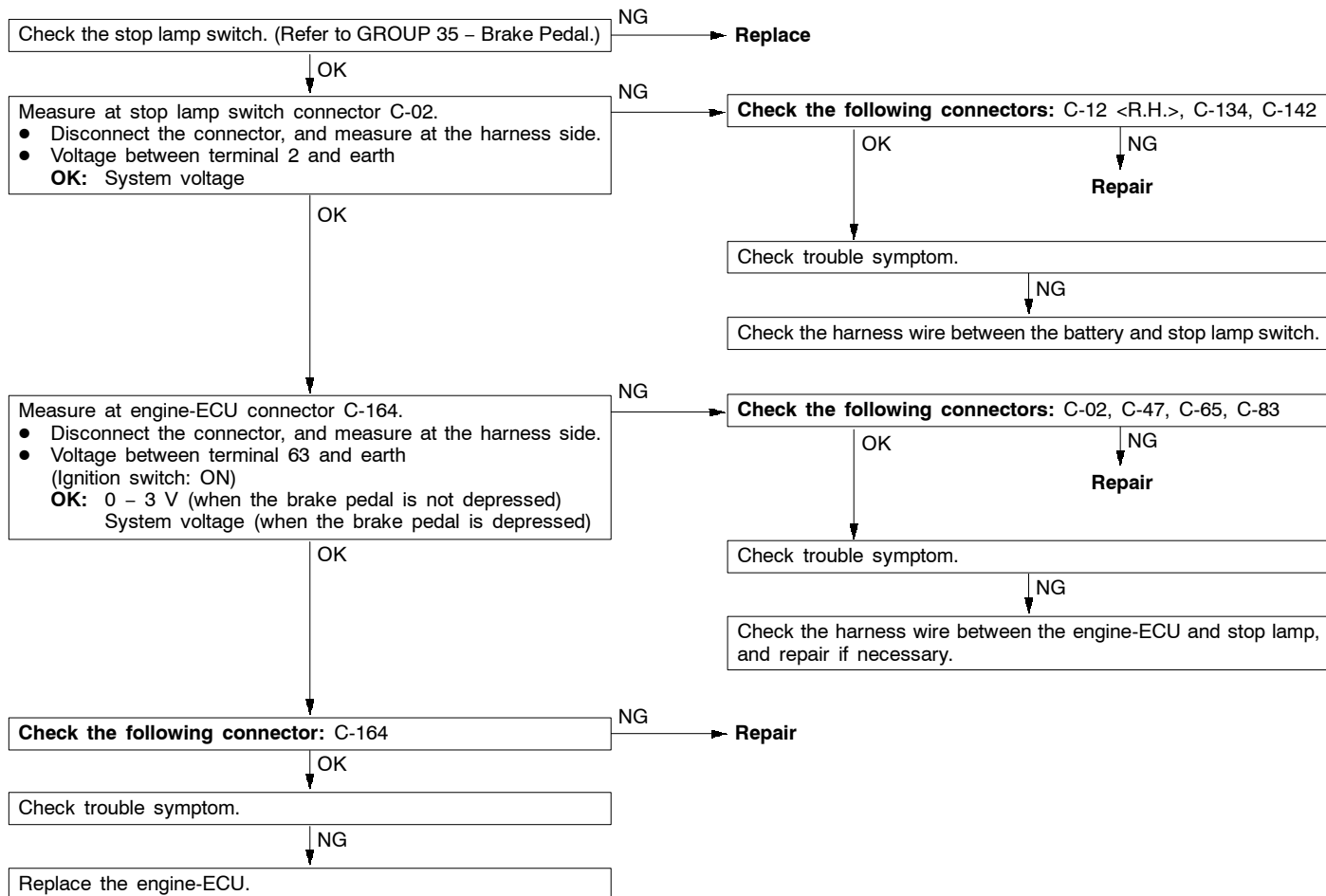
INSPECTION PROCEDURE 35

M/T oil temperature sensor system	Probable cause
<p>This sensor inputs the manual transmission oil temperature to the engine-ECU. The engine-ECU uses this input to control the throttle valve control servo so that the idle speed is increased when the manual transmission oil temperature becomes low.</p>	<ul style="list-style-type: none"> • 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



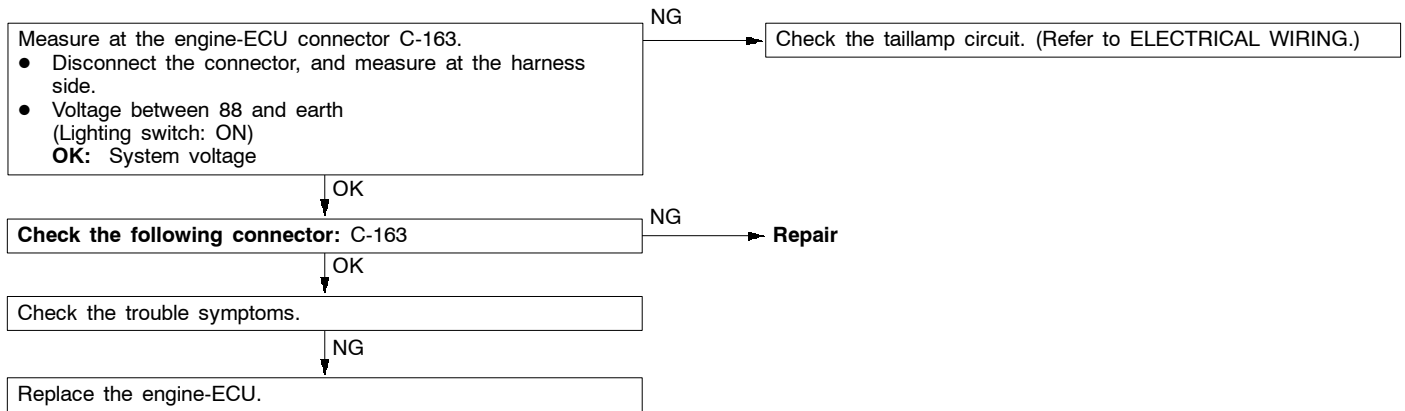
INSPECTION PROCEDURE 36

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.	<ul style="list-style-type: none"> 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 37

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.	<ul style="list-style-type: none"> 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: Transmission oil temperature is 50 °C or more

*3: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.

*4: The accelerator pedal position switch normally turns off when the voltage of the accelerator pedal position sensor (1st channel) is 300 – 500 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 500 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 *1	Code No.11 13I-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	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Lamps, electric cooling fan and all accessories: OFF Transmission: Neutral (A/T: P range) 	Idling	20 – 55 Hz	–
			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 13I-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)	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Ignition switch: ON (Engine stopped) 	Release the accelerator pedal.	4,500 – 5,500 mV	Code No.14	13I-17
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	400 – 600 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No.25	13I-65
18	Cranking signal (Ignition switch – ST)	Transmission: Neutral (A/T: P range)	Engine: Stopped	OFF	Procedure No.27 <M/T>	13I-66 <M/T> 13I-67 <A/T>
			Engine: Cranking	ON	Procedure No.28 <A/T>	
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: –20°C	–20°C	Code No.21	13I-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	<ul style="list-style-type: none"> Engine: cranking Tachometer: Connected 	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	–	–
		<ul style="list-style-type: none"> 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	500 – 700 r/min <M/T>*1,*2 550 – 750 r/min <A/T>*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	13I-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.29	13I-68
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No.33	13I-72
			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.34	13I-72
			A/C switch: ON	ON		
29	Inhibitor switch	Ignition switch: ON	Selector lever: P or N	P, N	Procedure No.28	13I-67
			Selector lever: D, 2, L or R	D, 2, L, R		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.37	13I-75
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No.12	13I-15
			3,000 r/min	OFF		
37	Volumetric efficiency	<ul style="list-style-type: none">Engine coolant temperature: 80 – 95°CLamps, electric cooling fan and all accessories: OFFTransmission: 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	<ul style="list-style-type: none">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	<ul style="list-style-type: none">Engine coolant temperature: 80 – 95°CLamps, electric cooling fan and all accessories: OFFTransmission: 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	<ul style="list-style-type: none">Engine: After warm-upSet a timing light.	Idling	15 – 25° BTDC *1	Code No.44	13I-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.35	13I-73
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.34	13I-72
			A/C switch: ON	ON (compressor clutch is operating)		
59	Oxygen sensor (rear)	<ul style="list-style-type: none">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	13I-30
66	Brake vacuum sensor	<ul style="list-style-type: none">Engine coolant temperature: 80 – 95°CLamps, electric cooling fan and all accessories: OFFTransmission: 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	13I-32
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.36	13I-74
			Brake pedal: Released	ON		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
68	EGR valve	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Lamps, electric cooling fan and all accessories: OFF Transmission: Neutral 	Idling	0 – 15 STEP	Procedure No.31	13I-70
			2,500 r/min	0 – 10 STEP		
74	Fuel pressure sensor	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Lamps, electric cooling fan and all accessories: OFF Transmission: Neutral (A/T: P range) 	Leave the engine running at the idle speed for more than three minutes	4 – 6.9 MPa	Code No.56	13I-28
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	935 – 1,135 mV	Code No.77	13I-33
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
78	Accelerator pedal position sensor (1st channel*3)	Ignition switch: ON	Release the accelerator pedal.	935 – 1,135 mV	Code No.78	13I-34
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
79	Throttle position sensor (1st channel)	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Ignition switch: ON (Engine stopped) 	Release the accelerator pedal.	450 – 800 mV	Code No.79	13I-35
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully	4,200 – 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	13I-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. 30	13I-69
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. 32	13I-71
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	13I-62
34	Electronic-controlled throttle valve system	Close the throttle valve fully	Ignition switch: ON	Operation sound can be heard	Code No. 91	13I-36

CHECK AT THE ENGINE-ECU TERMINALS**TERMINAL VOLTAGE CHECK CHART****Engine-ECU Connector Terminal Arrangement**

77	90	100
76	89	99
75	88	98
	87	97
	86	96
	85	95
	84	94
74	83	93
73	82	92
	81	91
72	80	90
71	79	89
70	78	88
69	77	87
68	76	86
67	75	85
66	74	84
65	73	83
64	72	82
63	71	81
62	70	80
61	69	79
60	68	78
59	67	77
58	66	76
57	65	75
56	64	74
55	63	73
54	62	72
53	61	71
52	60	70
51	59	69
50	58	68
49	57	67
48	56	66
47	55	65
46	54	64
45	53	63
44	52	62
43	51	61
42	50	60
41	49	59
40	48	58
39	47	57
38	46	56
37	45	55
36	44	54
35	43	53
34	42	52
33	41	51
32	40	50
31	39	49
30	38	48
29	37	47
28	36	46
27	35	45
26	34	44
25	33	43
24	32	42
23	31	41
22	30	40
21	29	39
20	28	38
19	27	37
18	26	36
17	25	35
16	24	34
15	23	33
14	22	32
13	21	31
12	20	30
11	19	29
10	18	28
9	17	27
8	16	26
7	15	25
6	14	24
5	13	23
4	12	22
3	11	21
2	10	20
1	9	19

7FU2119

Terminal No.	Check item	Check requirements (engine condition)	Normal condition
1	No.1 injector	Engine: Warm up, and then depress the accelerator pedal suddenly from the idle speed.	Decreases slightly for short time from 9 – 13 V.
9	No.2 injector		
24	No.3 injector		
2	No.4 injector		
3	No.1 ignition coil	Engine: 3,000 r/min	0.1 – 2.0 V
13	No.2 ignition coil		
12	No.3 ignition coil		
4	No.4 ignition coil		
5	EGR valve (D)	Ignition switch: Immediately after turning ON	5 – 8 V (fluctuates for approx. three seconds)
6	EGR valve (C)		
32	EGR valve (B)		
34	EGR valve (A)		
8	Alternator G terminal	<ul style="list-style-type: none"> 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
52	Alternator FR terminal	<ul style="list-style-type: none"> Engine: Warm up, and then idling Radiator fan: not operating Headlamp: OFF → ON Stop lamp: OFF → ON Rear defogger: OFF → ON 	Voltage decreases
14	GDI ECO indication lamp	Constant speed driving at 40 km/h	0 – 3 V
		Engine: Depress the accelerator pedal suddenly from the idle speed.	System voltage

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
16	Purge control solenoid valve	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Ignition switch: ON 	Engine: stopped	System voltage
			Engine: Start the engine, and then increase engine speed up to 3,500 r/min.	Voltage decreases.
18	Fan controller	Radiator and condenser fans are not operating.		0 – 0.3 V
		Radiator and condenser fans are operating.		0.7 V or more
20	A/C relay	<ul style="list-style-type: none"> Engine: idling A/C switch: OFF → ON (Compressor is operating) 		System voltage, or changes from momentarily 6 V or more to 0 → 3 V
21	Fuel pump relay	Ignition switch: ON	Engine: stopped	System voltage
			Engine: Idling	0 – 3 V
31	Engine warning lamp	Ignition switch: OFF → ON		0 – 3 V → System voltage (after several seconds)
41	Sensor power supply	Ignition switch: ON		4.5 – 5.5 V
42	Power supply to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 – 5.5 V
43	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idling		1.5 – 2.5 V
44	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.2 – 3.8 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
45	Tachometer output	Engine: 3,000 r/min		2.0 – 9.0 V
47	Power supply	Ignition switch: ON		System voltage
59				
50	Camshaft position sensor	Engine: Cranking		0.3 – 3.0 V
		Engine: Idling		0.5 – 3.5 V
51	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 – 4.3 V
			Altitude: 1,200 m	3.2 – 3.8 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
53	Oxygen sensor (rear)	<ul style="list-style-type: none">Transmission: 2nd gear <M/T>, L range <A/T>Engine speed: 3,500 r/min or moreDriving with the throttle valve widely open		0.6 – 1.0 V
54	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 – 3 V
55	Injector driver relay	Ignition switch: OFF		0 – 0.1 V
		Ignition switch: ON		0.5 – 1.0 V
56	Throttle valve control servo relay	Ignition switch: OFF		0 – 0.3 V
		Ignition switch: ON		0.5 – 1.0 V
57	Engine control relay	Ignition switch: OFF		0 – 3 V
		Ignition switch: ON		System voltage
60	Back-up power source	Ignition switch: OFF		System voltage
61	Air flow sensor	Engine: Idling		2.2 – 3.2 V
		Engine: 2,500 r/min		
62	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 – 3.8 V
			Intake air temperature: 20°C	2.3 – 2.9 V
			Intake air temperature: 40°C	1.5 – 2.1 V
			Intake air temperature: 80°C	0.4 – 1.0 V
63	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 – 3 V
64	A/C pressure sensor	Engine: Idling	Set the A/C switch to MAX. COOL (under high load)	8 V or more
			Set the A/C switch to MAX. HOT (under low load)	4 V or less
66	Clutch switch <M/T>	Depress the clutch pedal		0 – 3 V
		Release the clutch pedal		System voltage

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
67	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
68	Ignition switch – ST	Engine: Cranking		8 V or more
71	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.
73	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
74	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
76	Air flow sensor reset signal	Engine: idling		0 – 1 V
		Engine: 3,000 r/min		6 – 9 V
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.5 – 5.5 V
			Depress the accelerator pedal fully.	0.4 – 0.6 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 – 1 V
			Depress the accelerator pedal slightly.	4 V or more
80	Vehicle speed sensor	<ul style="list-style-type: none"> Ignition switch: ON Move the vehicle forward. 		0 V ↔ system voltage alternates.
83	A/C switch	Engine: idling	A/C switch: OFF	0 – 3 V
			A/C switch: ON (Compressor is operating)	System voltage
88	Small lamp switch	Lighting switch: OFF		0 – 3 V
		Lighting switch: ON (Taillamp: ON)		System voltage
89	Oxygen sensor (front) heater	Engine: idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
94	Accelerator pedal position sensor 1	Ignition switch: ON	Release the accelerator pedal.	0.9 – 1.2 V
			Depress the accelerator pedal fully.	4 V or more
96	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.
99	Ignition switch – IG	Ignition switch: ON		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!

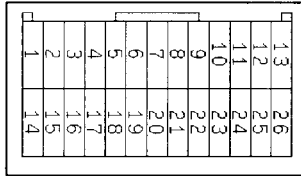
4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector Terminal Arrangement

1	9	24
2	10	25
3	11	26
4	12	27
5	13	28
6	14	29
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59	67	82
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62	70	85
63	71	86
64	72	87
65	73	88
66	74	89
67	75	90
68	76	91
69	77	92
70	78	93
71	79	94
72	80	95
73	81	96
74	82	97
75	83	98
76	84	99
77	85	100

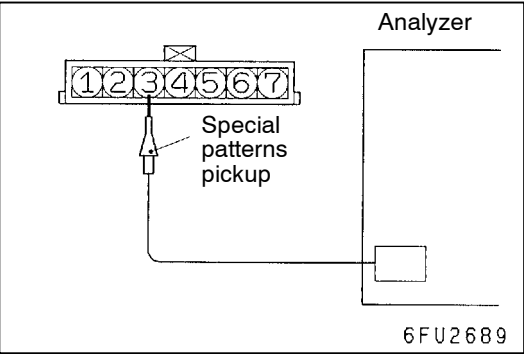
7FU2120

Terminal No.	Check item	Standard value, normal condition (check requirements)
16 – 47	Purge control solenoid valve	36 – 44 Ω (at 20°C)
89 – 47	Oxygen sensor (front) heater	11 – 18 Ω (at 20°C)
46 – Body earth	Earth	Continuity (0 Ω)
58 – Body earth		
5 – 47	EGR valve (B)	15 – 20 Ω (at 20°C)
6 – 47	EGR valve (C)	
32 – 47	EGR valve (B)	
34 – 47	EGR valve (A)	
72 – 79	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
62 – 72	Intake air temperature sensor	5.3 – 6.7 kΩ (when intake air temperature is 0°C)
		2.3 – 3.0 kΩ (when intake air temperature is 20°C)
		1.0 – 1.5 kΩ (when intake air temperature is 40°C)
		0.30 – 0.42 kΩ (when intake air temperature is 80°C)
44 – 72	Engine coolant temperature sensor	5.1 – 6.5 kΩ (when engine coolant temperature is 0°C)
		2.1 – 2.7 kΩ (when engine coolant temperature is 20°C)
		0.9 – 1.3 kΩ (when engine coolant temperature is 40°C)
		0.26 – 0.36 kΩ (when engine coolant temperature is 80°C)
67 – 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+)	<ul style="list-style-type: none">Ignition switch: ONAccelerator pedal: Fully opened → fully closed		Decreases slightly from system voltage.
9	Throttle valve control servo (B+)			
14	Throttle valve control servo (A−)	<ul style="list-style-type: none">Ignition switch: ONAccelerator 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.	4.2 – 4.9 V
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.9 – 1.2 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)

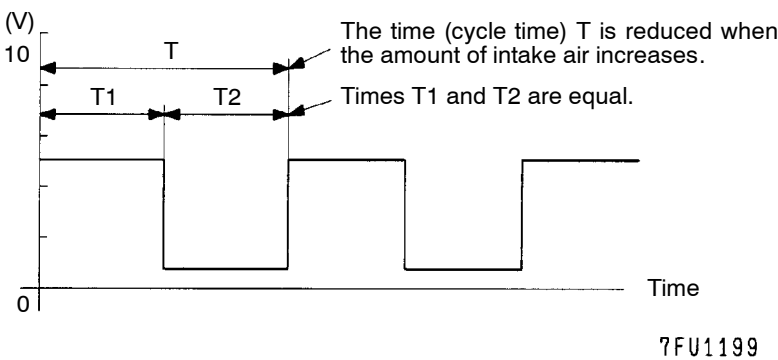
1. Connect the analyzer special patterns pickup to engine-ECU terminal 61.

Standard Wave Pattern

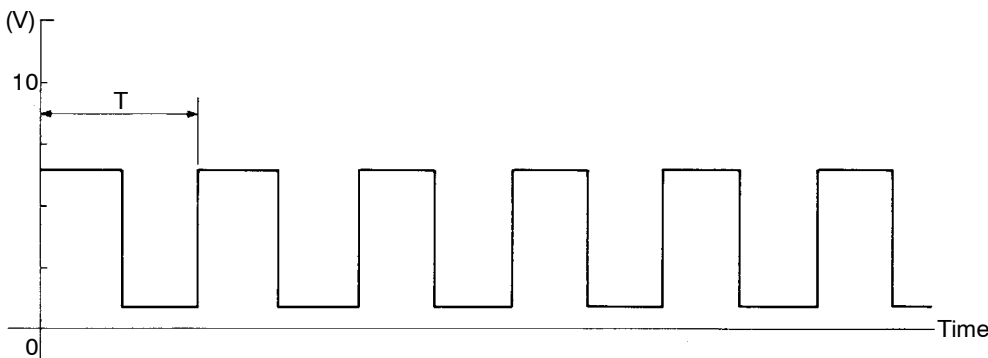
Observation conditions

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

Standard wave pattern

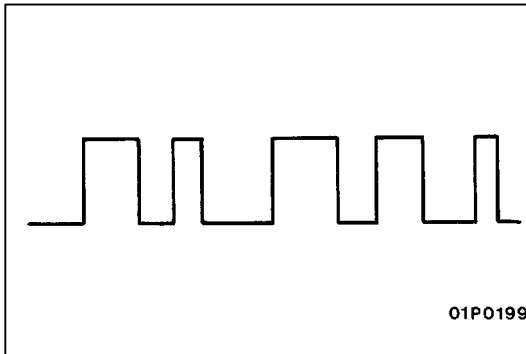


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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

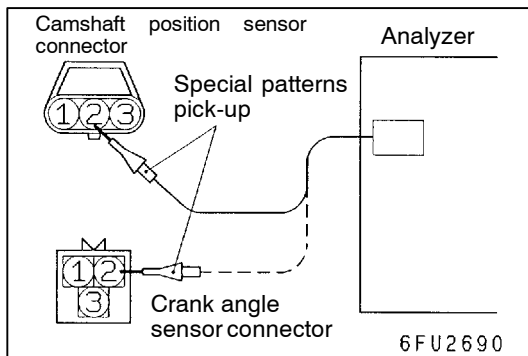
- Example 2

Cause of problem

Damaged rectifier or vortex generation column

Wave pattern characteristics

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



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

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

Alternate Method (Test harness not available)

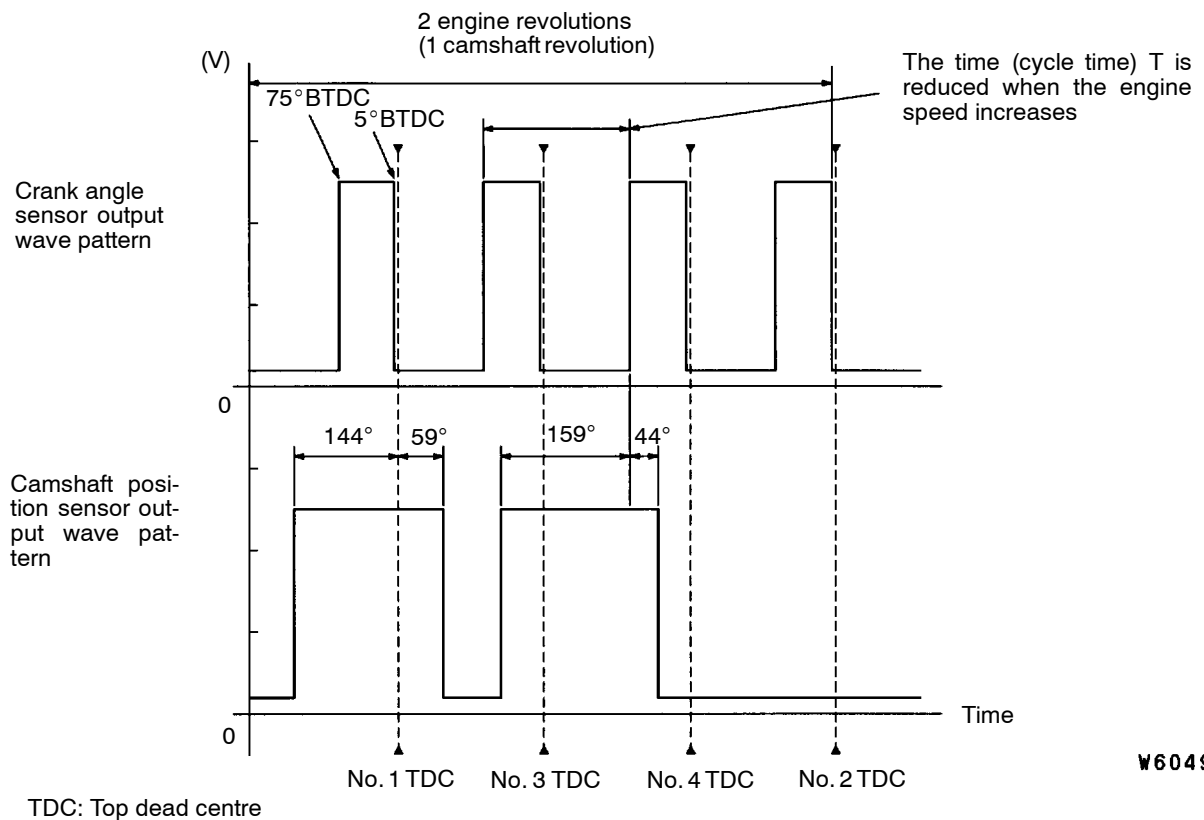
1. Connect the analyzer special patterns pickup to engine-ECU terminal 50. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 43. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

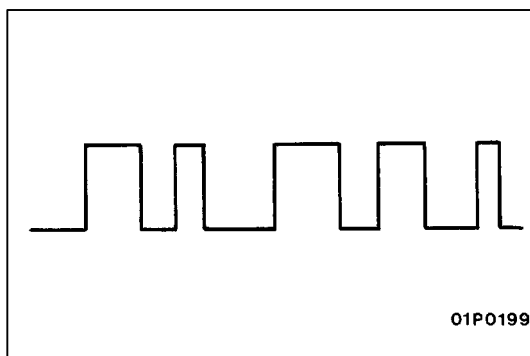
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

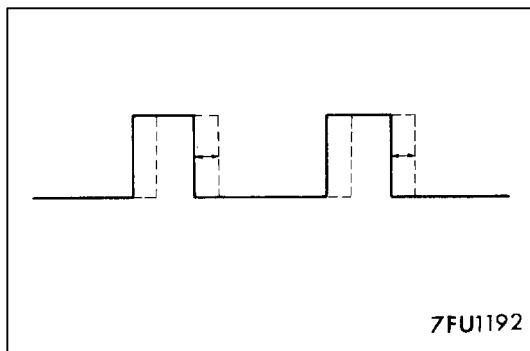
- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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



- Example 2

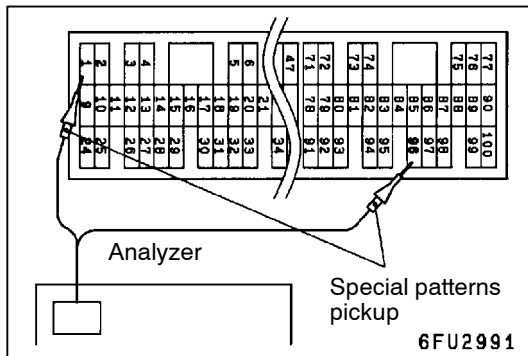
Cause of problem

Loose timing belt

Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.



INJECTORS AND INJECTOR OPEN CIRCUIT CHECK SIGNAL

Measurement Method

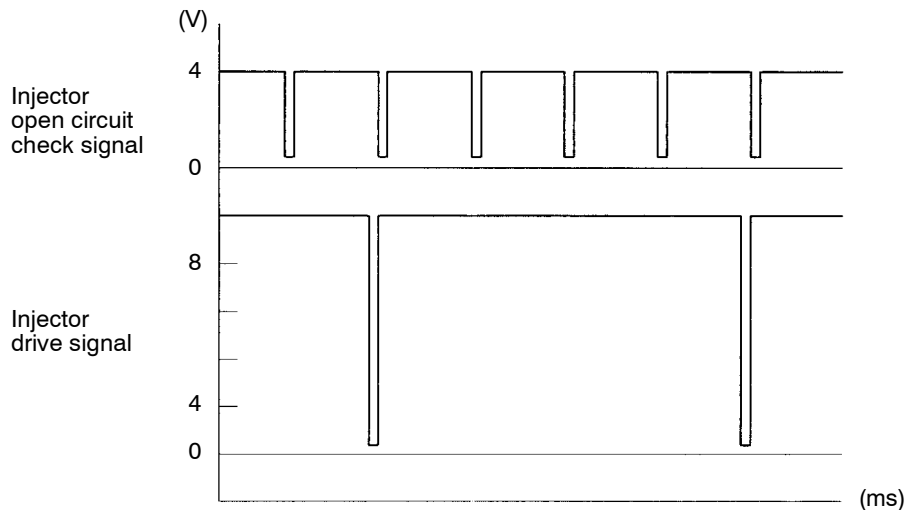
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 96 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1 (No.1 injector), check terminal 9 (No.2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

Standard Wave Pattern

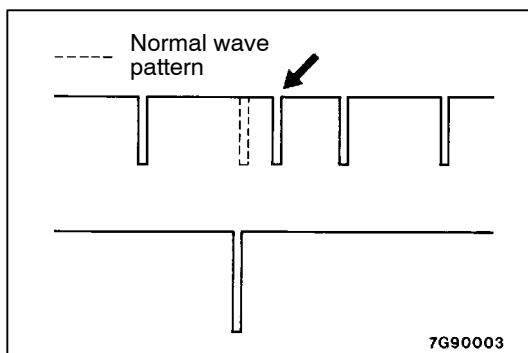
Observation conditions

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

Standard wave pattern

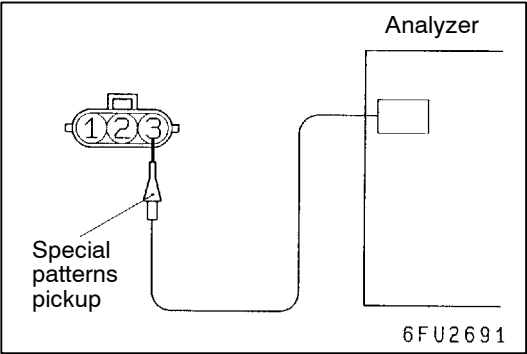


9FU0841



Wave Pattern Observation Points

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



IGNITION COIL AND POWER TRANSISTOR

Power transistor control signal

Measurement Method

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

Alternate Method (Test harness not available)

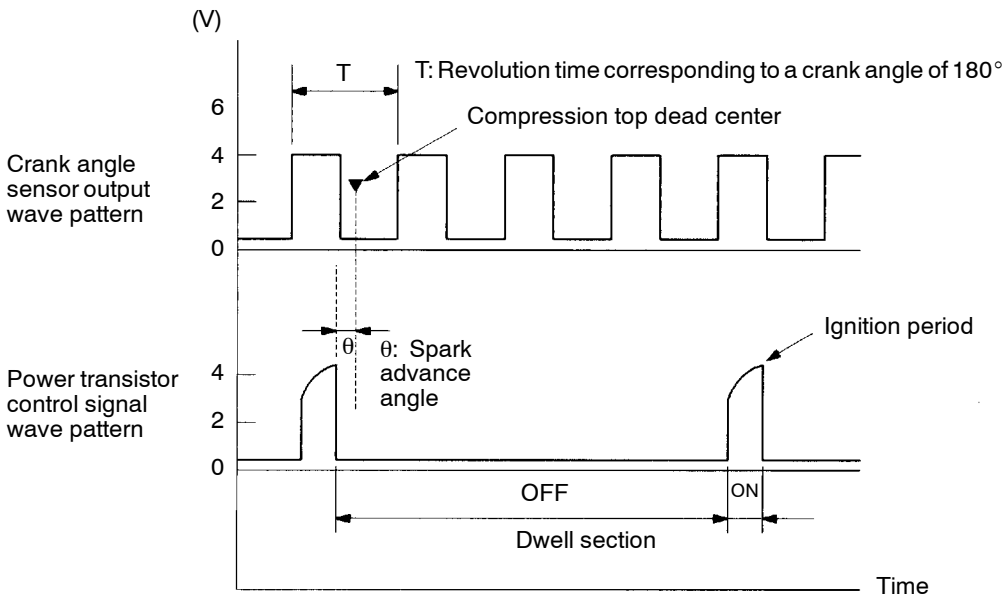
1. Connect the analyzer special patterns pickup to engine-ECU terminal 3 (No. 1 ignition coil), terminal 13 (No. 2 ignition coil), terminal 12 (No. 3 ignition coil), terminal 4 (No. 4 ignition coil) respectively.

Standard Wave Pattern

Observation condition

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

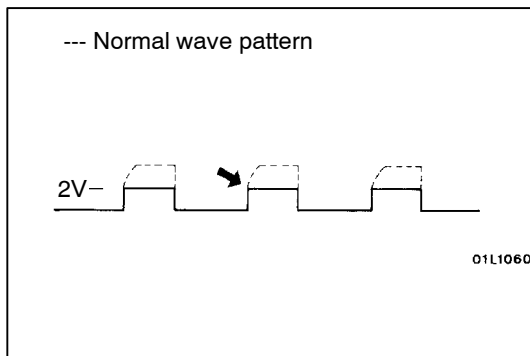
Standard wave pattern



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

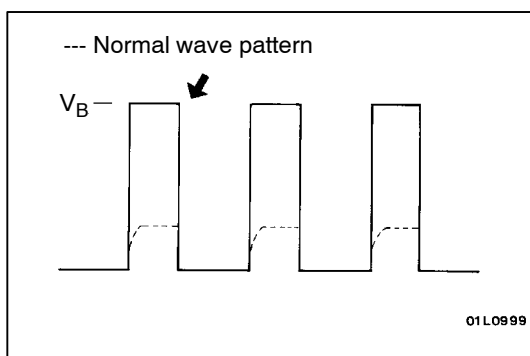
Wave pattern during engine cranking

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

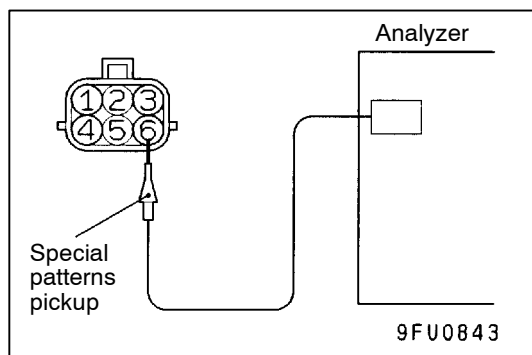
Wave pattern during engine cranking

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)

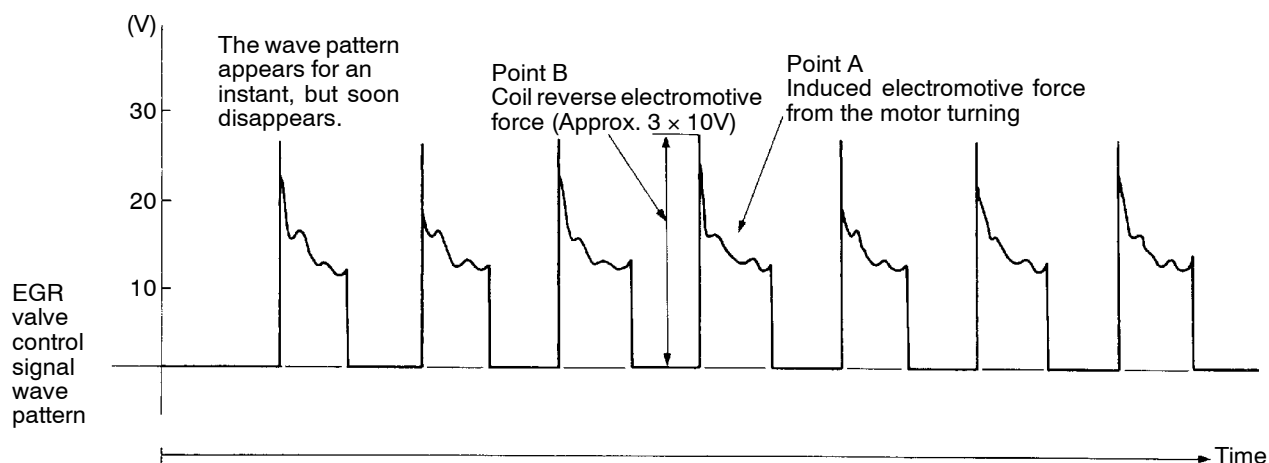
1. Connect the analyzer special patterns pickup to engine-ECU terminal 5, connection terminal 6, connection terminal 32, and connection terminal 34 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine r/min	Racing

Standard wave pattern



Wave Pattern Observation Points

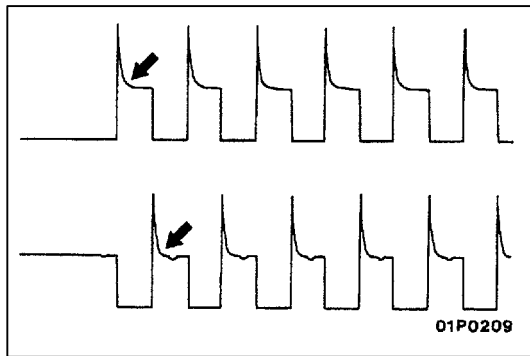
Check that the standard wave pattern appears when the EGR control servo is operating.

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

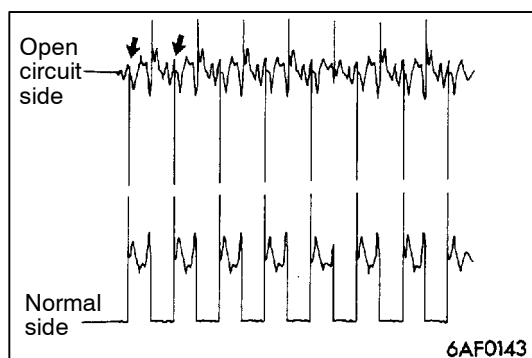
Cause of problem

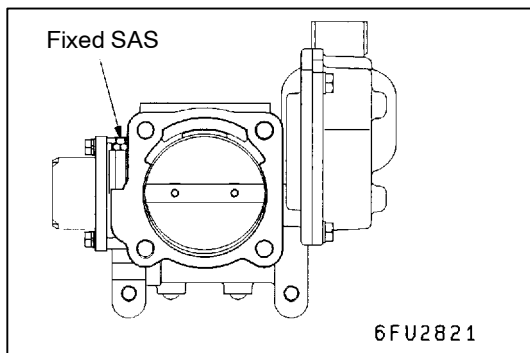
Open circuit in the line between the EGR valve and the engine-ECU

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.





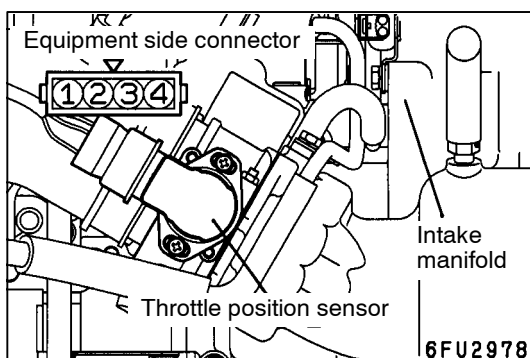
ON-VEHICLE SERVICE

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.**

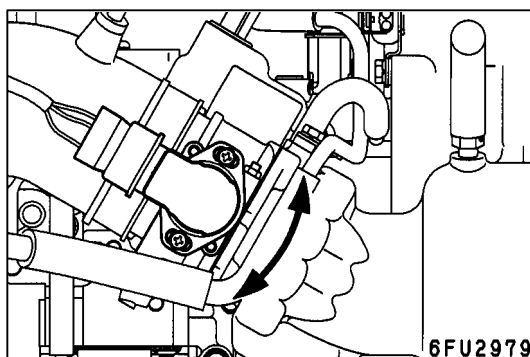
THROTTLE BODY (THROTTLE VALVE ARE) CLEANING

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 valve 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.

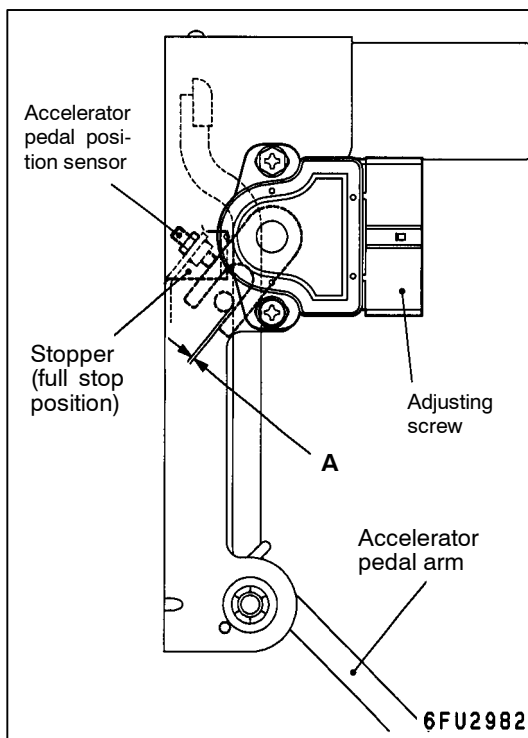
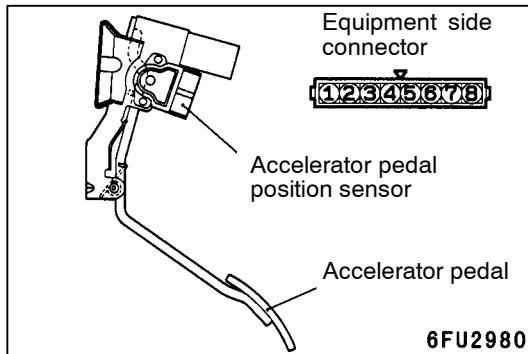
Standard value: 4.2 – 4.8 V

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. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II.
11. Remove the MUT-II.

ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

Caution

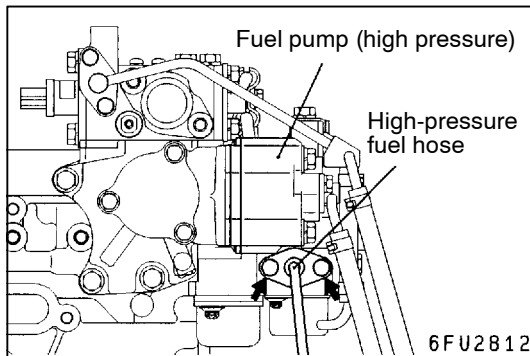
- (1) **Never attempt to tamper the accelerator pedal position sensor. The sensor position is precisely adjusted at factory.**
- (2) **Should it be tampered, follow the procedure below:**
 1. Remove the accelerator pedal complete.
 2. Connect the MUT-II to the diagnosis connector.
 3. Loosen the accelerator pedal position sensor attaching bolts to allow it to be loosely fitted.



4. Ensure that the accelerator pedal arm contacts the full-stop position stopper.
5. Turn the adjusting screw so that clearance "A" is 0.5 – 0.93 mm (Refer to the left figure).
6. Secure the adjusting screw with the lock nut.
7. Turn the ignition switch to the ON position (but do not start the engine).
8. Rotate the accelerator pedal position sensor to adjust sensor output voltage to the standard value.

Standard value: 0.985 – 1.085 V

9. Tighten the sensor mounting bolts securely.
10. Install the accelerator pedal complete.



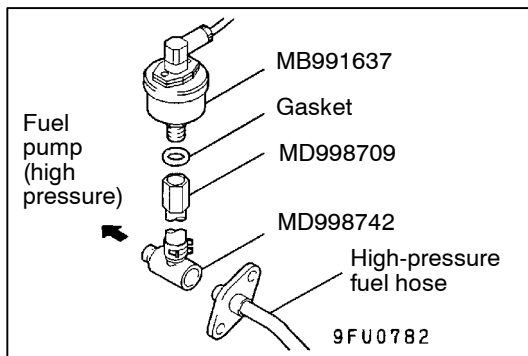
FUEL PRESSURE TEST

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

1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13I-104.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

Caution

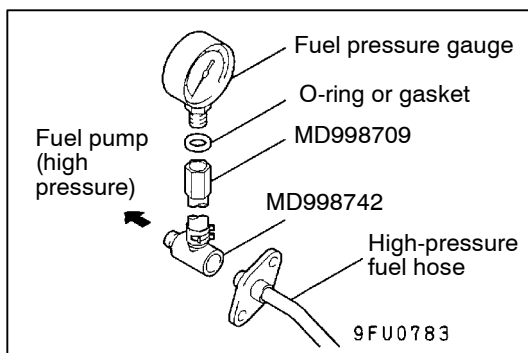
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



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
<ul style="list-style-type: none"> ● 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.13I-104.)

15. Remove the fuel pressure gauge and special tools from the fuel pump (high pressure).

Caution

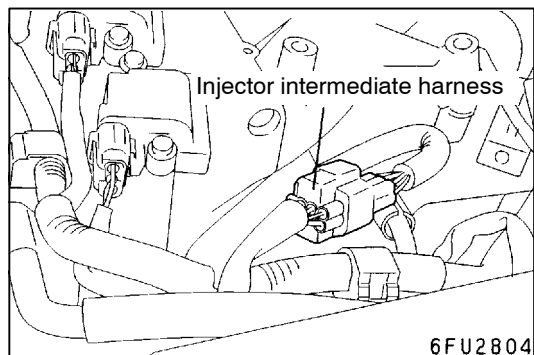
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

16. Replace the O-ring at the end of the high-pressure fuel hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.

17. Fit the high-pressure fuel hose to the fuel pump (high pressure) and tighten the mounting bolt to specified torque.

18. Check for any fuel leaks by following the procedure in step 7.

19. Disconnect the MUT-II.



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

NOTE

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

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

Caution

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

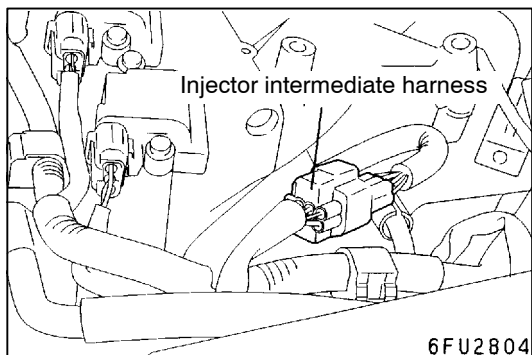
6. Check if the fuel pressure is more than 1 MPa immediately after 20 seconds have passed since cranking was finished.
7. If the fuel pressure is lower than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.
8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.
11. Measure fuel pressure while the engine is running at idle.

Standard value: 4 – 6.9 MPa

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

Symptom	Probable cause	Remedy
<ul style="list-style-type: none"> • 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.

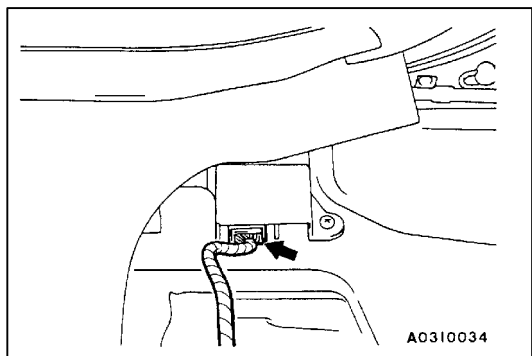
6. Crank the engine, and then measure fuel pressure immediately after 20 seconds.

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 rear seat cushion.
3. Disconnect the fuel wiring harness from the floor wiring harness (RH), which is located under the floor carpet.
4. Connect the MUT-II to the diagnosis connector.

Caution

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

5. Turn off the ignition switch.
6. Select "Item No.74" from the MUT-II Data list.
7. Crank the engine for at least two seconds.
8. 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.

9. 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.

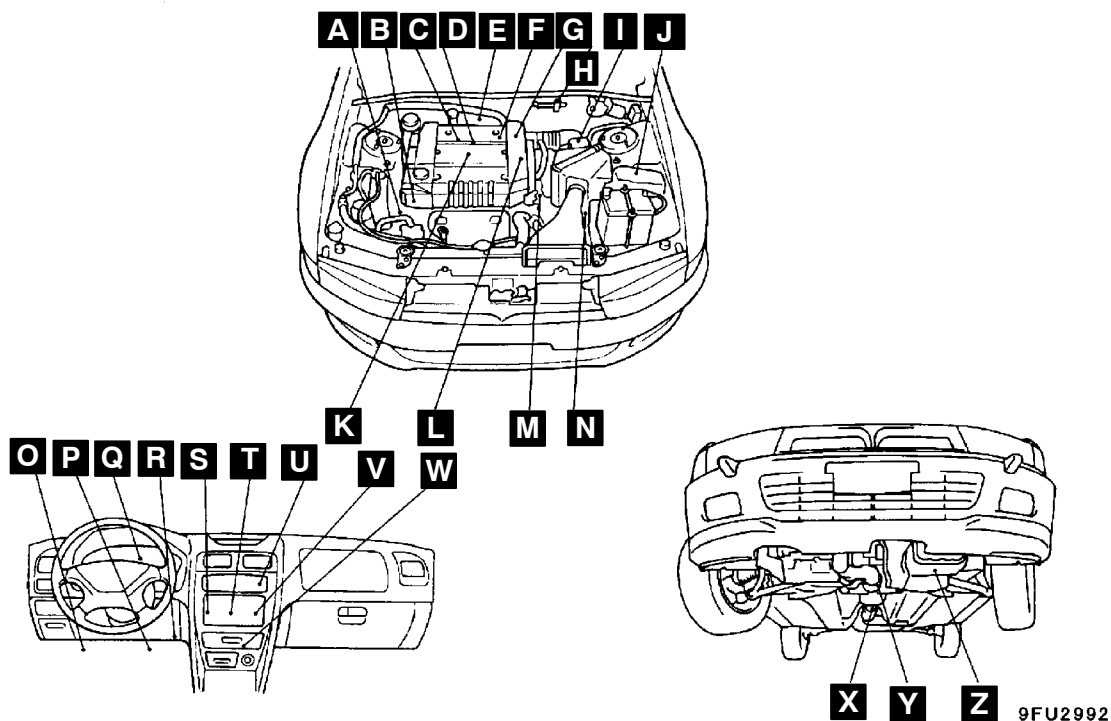
10. Remove the MUT-II.
11. Connect the fuel wiring harness to the floor wiring harness (RH).
12. Install the rear seat cushion.

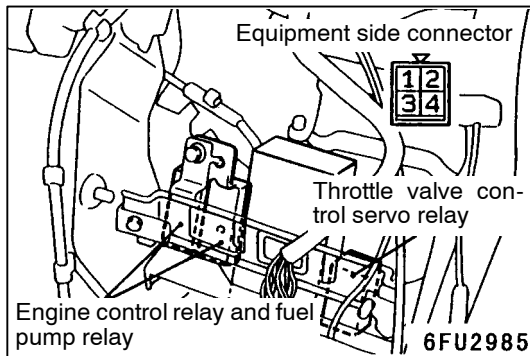
FUEL PUMP OPERATION CHECK

This procedure is the same as for the 4G6-MPI engine.

COMPONENT LOCATION

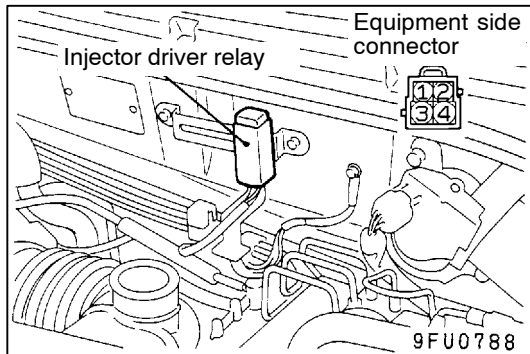
Name	Symbol	Name	Symbol
A/C relay	J	Fuel pressure sensor	L
A/C switch	U	Fuel pump relay	S
		GDI ECO indication lamp	Q
Accelerator pedal position sensor (1st and 2nd channels)	P	Ignition coil	K
		Inhibitor switch <A/T>	N
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)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





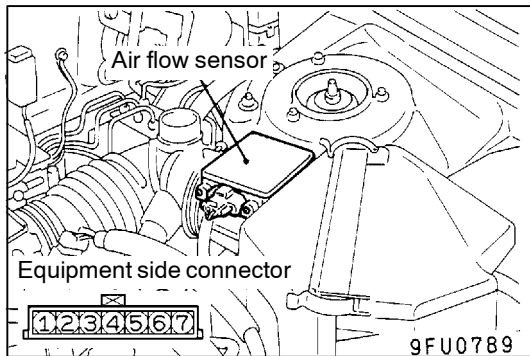
ENGINE CONTROL RELAY, FUEL PUMP RELAY AND THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

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



INJECTOR DRIVER RELAY CONTINUITY CHECK

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



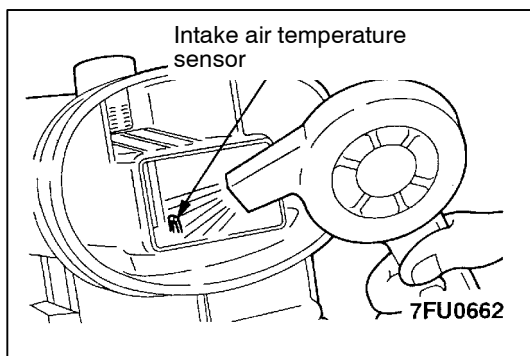
INTAKE AIR TEMPERATURE SENSOR CHECK

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)

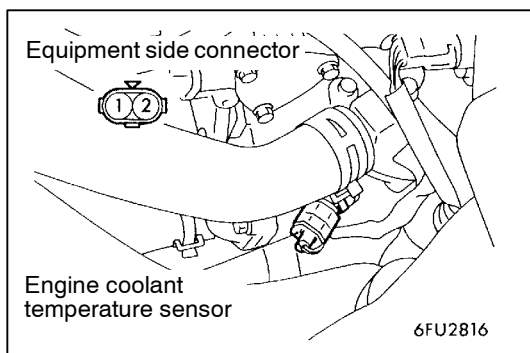


3. Measure resistance while heating the sensor using a hair drier.

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.

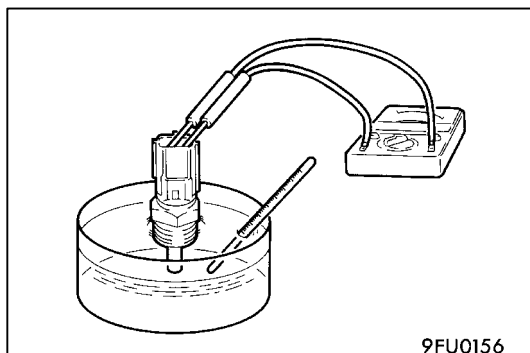


ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution

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

1. Remove the engine coolant temperature sensor.



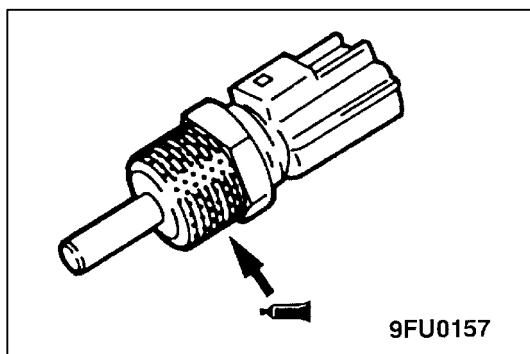
2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:

2.1 – 2.7 k Ω (at 20°C)

0.26 – 0.36 k Ω (at 80°C)

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



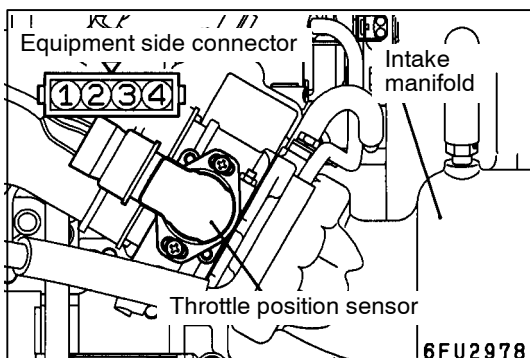
4. Apply sealant to threaded portion.

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 k Ω

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

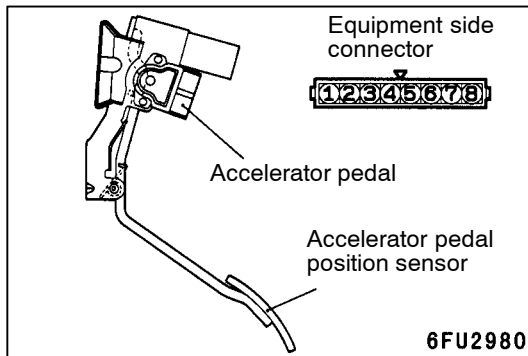
Normal condition:

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.13I-98.



ACCELERATOR PEDAL POSITION SENSOR (1ST AND 2ND CHANNELS) CHECK

1. Disconnect the accelerator pedal position sensor connector.
2. Measure resistance between terminal Nos.2 (1st channel power supply) and 1 (1st channel earth) as well as between terminal Nos.8 (2nd channel power supply) and terminal No.7 (2nd channel earth) of the sensor connector.

Standard value: 3.5 – 6.5 k Ω

3. Measure resistance between terminal Nos.2 (1st channel power supply) and 3 (1st channel output) as well as between terminal Nos.8 (2nd channel power supply) and terminal No.6 (2nd channel output) of the sensor connector.

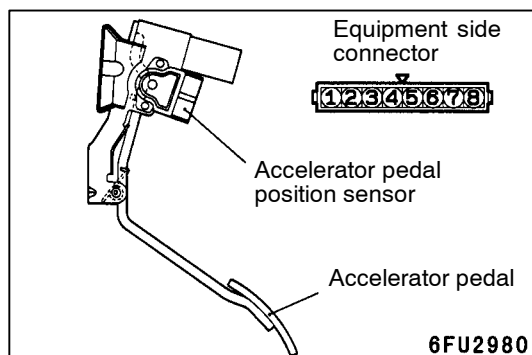
Normal condition:

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.

NOTE

After replacement, adjust the accelerator pedal position sensor. (Refer to P.13I-99.)



ACCELERATOR PEDAL POSITION SWITCH CHECK

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

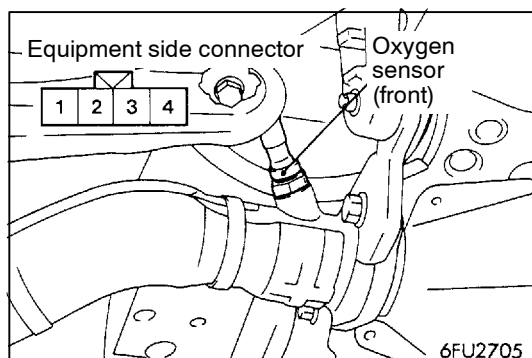
Normal condition

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

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

NOTE

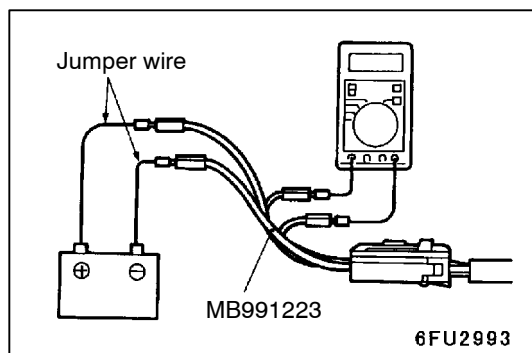
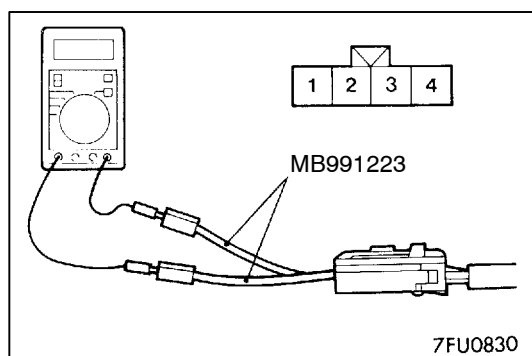
After replacement, adjust the accelerator pedal position sensor. (Refer to P.13I-99.)



OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (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.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use a jumper wire to connect terminal 3 of the oxygen sensor connector to the battery (+) terminal and terminal 4 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 and terminal 2.

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

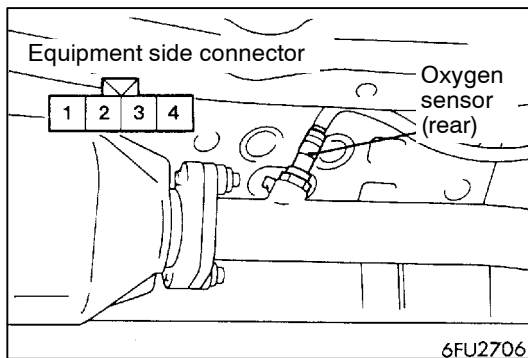
Standard value:

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

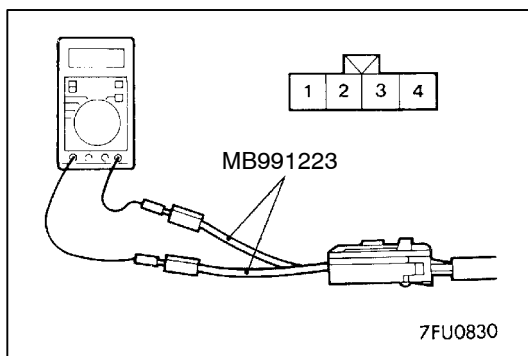
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.

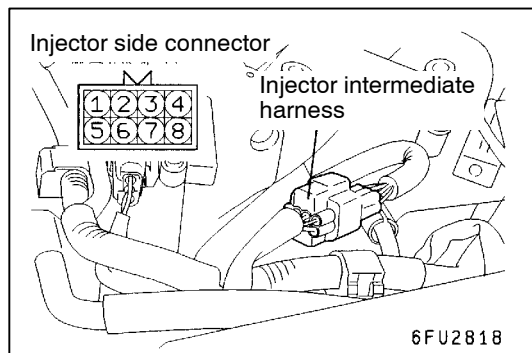
**<Oxygen sensor (rear)>**

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 ($11 - 18 \Omega$ 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.





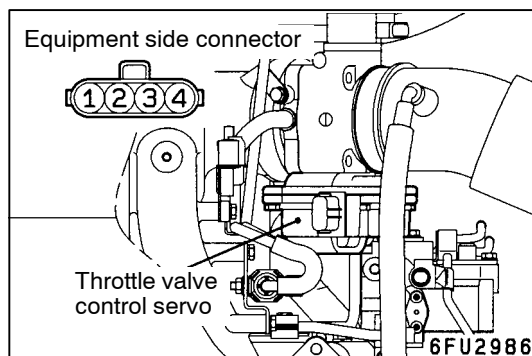
INJECTOR CHECK

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.

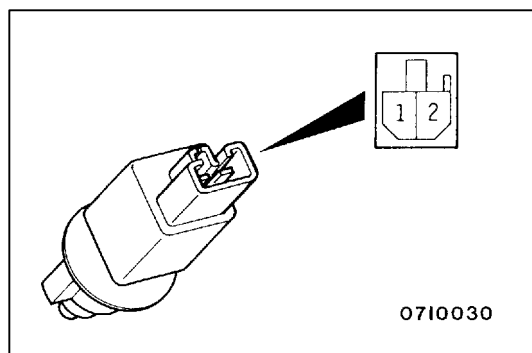
Check of Coil Resistance

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

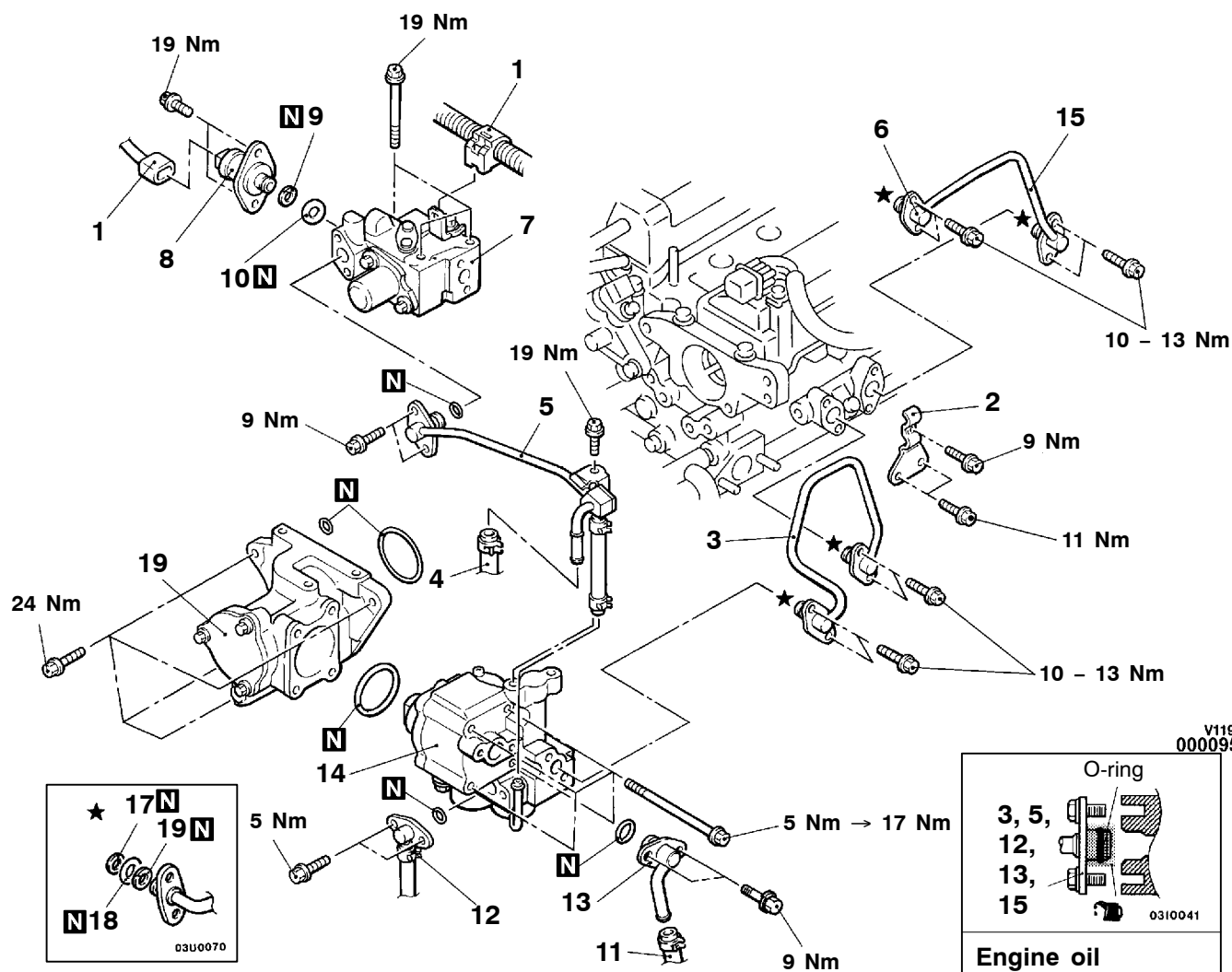
Refer to GROUP 17 – Emission Control System.

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.13I-104.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Fuel Leak Check <after installation only> (Refer to P.13I-104.)



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

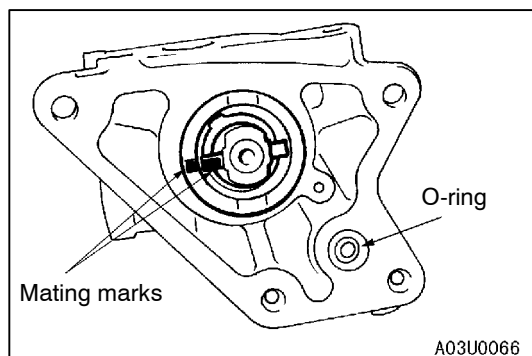
Fuel pump (High pressure) removal steps

- 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

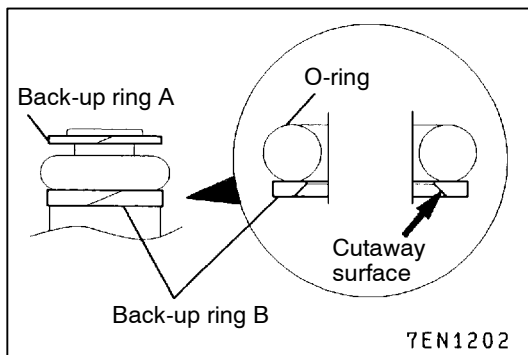
- 7. Fuel pressure regulator (high pressure) assembly
- ▶D◀ 14. Fuel pump (high pressure)
- ▶C◀ 15. Fuel return pipe
- ▶B◀ 16. Back-up ring A
- ▶B◀ 17. O-ring
- ▶B◀ 18. Back-up ring
- ▶A◀ 19. Pump camshaft case

**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

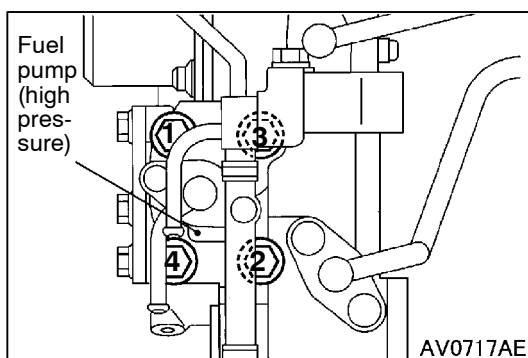
1. Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
2. Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: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

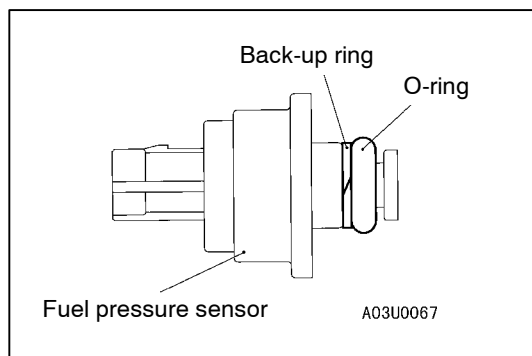
►E◄ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

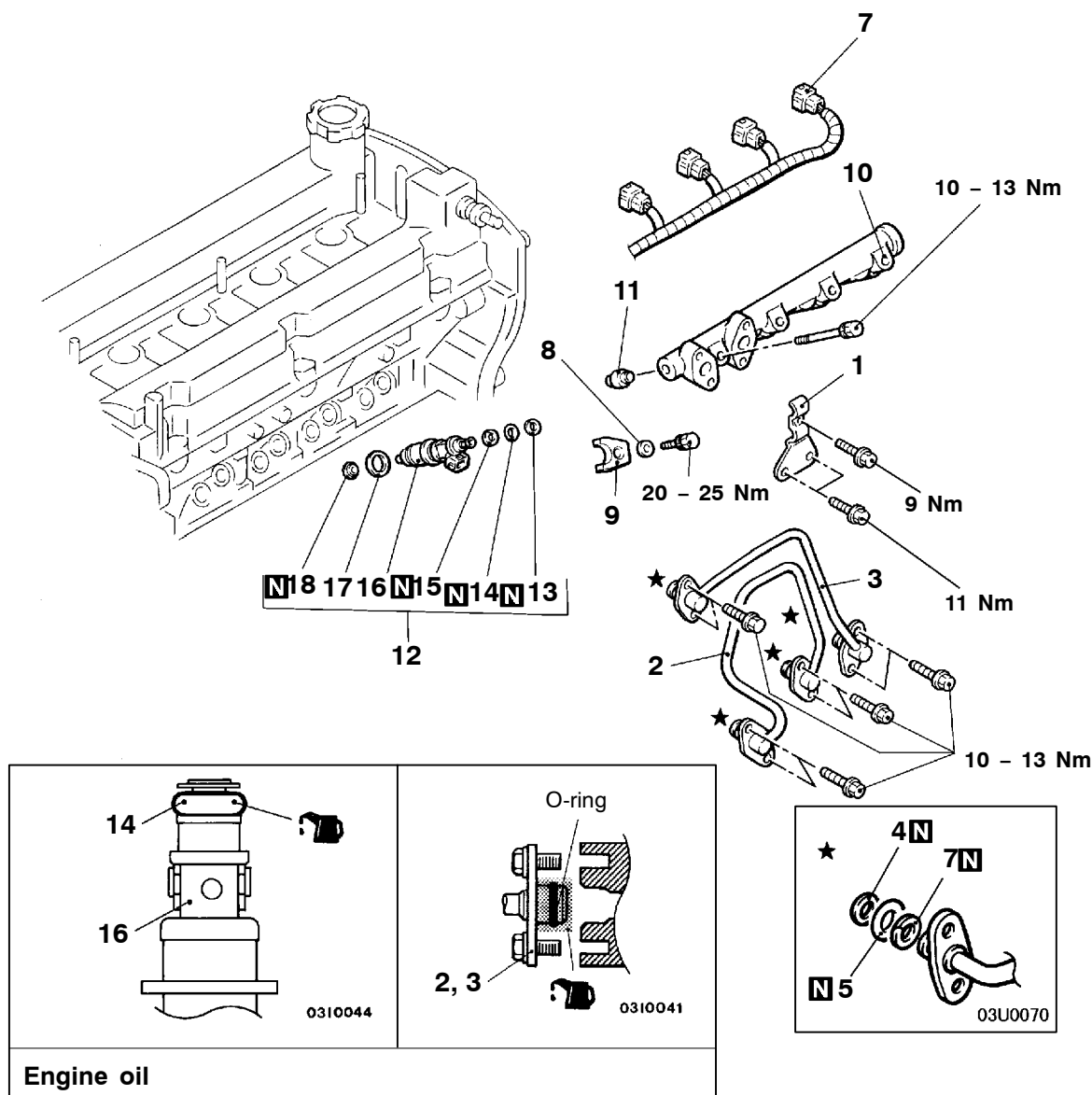
Take care not to install the back-up ring A for the injector, fuel feed pipe or fuel return pipe by mistake. (Outer diameter of the back-up ring for the fuel pressure sensor: 15.1 mm)

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Prevention of fuel discharge <before removal only> (Refer to P.13I-104.)
- 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.13I-104.)



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Removal steps

1. Fuel pipe clamp
2. Fuel feed pipe
3. Fuel return pipe
4. Back-up ring A
5. O-ring
6. Back-up ring B
7. Injector harness connector
8. Washer
9. Injector holder

10. Delivery pipe assembly
11. Insulator
12. Fuel injector assembly
13. Back-up ring
14. O-ring
15. Back-up ring
16. Fuel injector
17. Gasket
18. Corrugated washer

REMOVAL SERVICE POINTS**◀A▶ INJECTOR HARNESS CONNECTOR
DISCONNECTION****Caution**

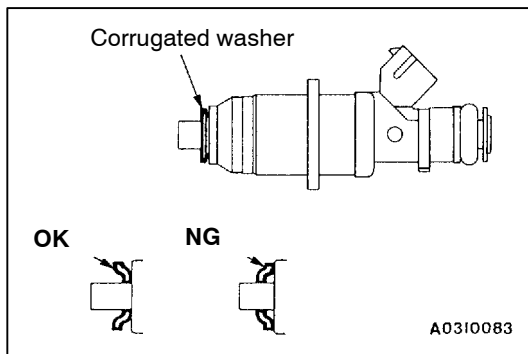
Disconnect the battery (–) cable from its terminal before carrying out this operation.

**◀B▶ DELIVERY PIPE ASSEMBLY/FUEL INJECTOR
ASSEMBLY REMOVAL**

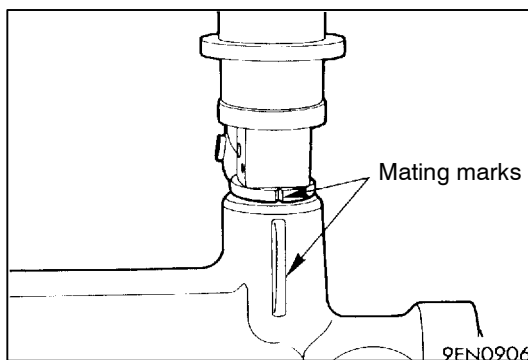
Remove the delivery pipe assembly with the fuel injector assembly still attached.

Caution

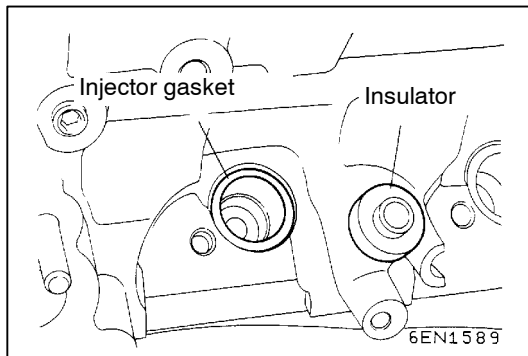
Be careful not to drop the fuel injector assembly when removing the delivery pipe assembly.

**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**

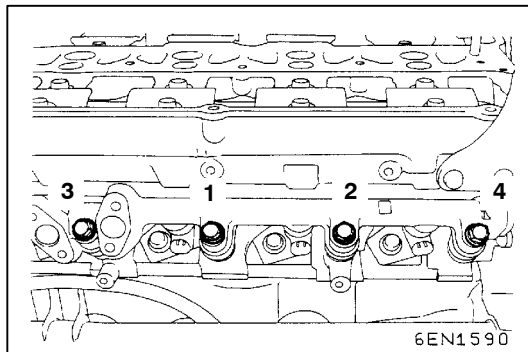
1. Apply machine oil or gasoline to the O-ring of the injector.
2. Insert the injector assemblies straight into the injector mounting holes on the delivery pipe assembly.
3. Rotate the injector. If it does not rotate freely, remove the injector to check the O-ring for damage. If the O-ring is damaged, replace the O-ring. Then assemble the injector again and confirm that it rotates freely.
4. Align the mating marks on the injector and the delivery pipe.



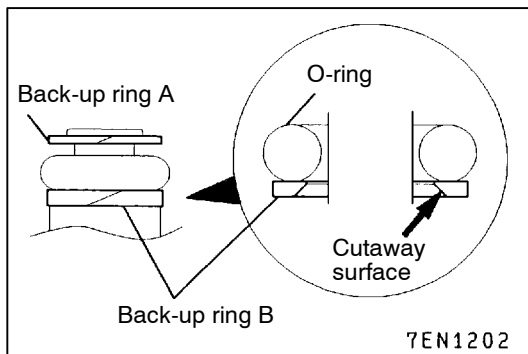
5. Install the injector gasket and the insulator. As the insulator is likely to drop off, apply Vaseline or equivalent before installing to the cylinder head.
6. Install the delivery pipe and injector assembly to the cylinder head, and tighten it loosely.
7. Install the injector holder and the washer, and then tighten them to the specified torque.

Caution

Observe the specified torque strictly.



8. Tighten the delivery pipe and injector assembly in the shown order to the specified torque.



►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

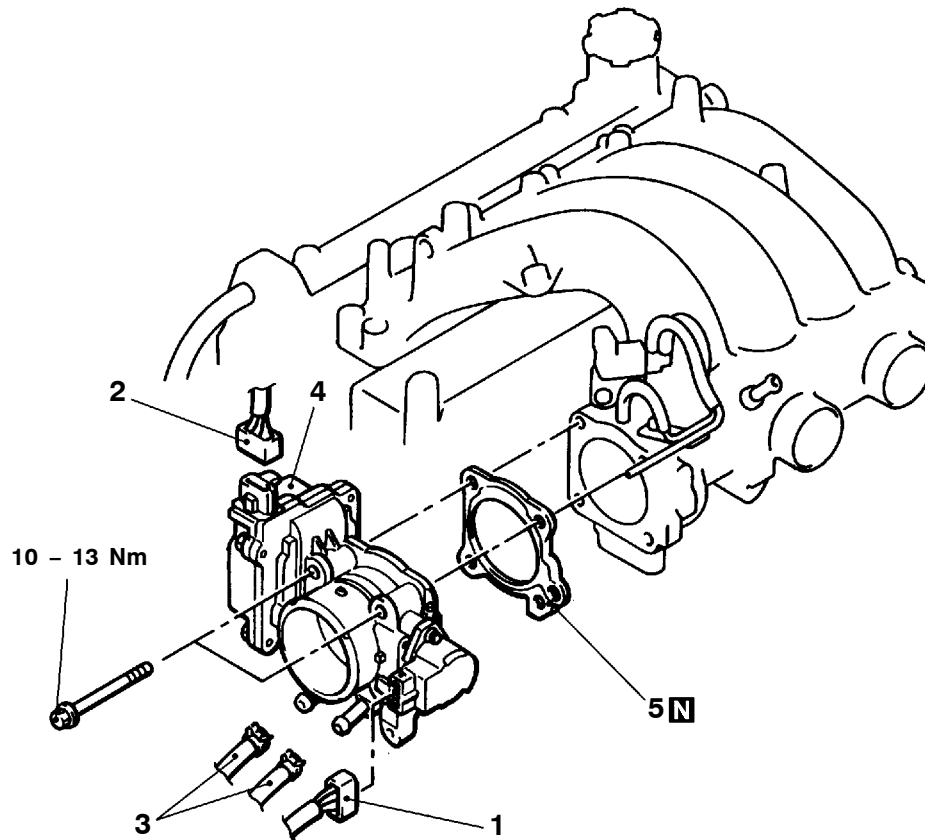
Take care not to let any of the engine oil get inside the fuel pump (high pressure), fuel pressure regulator (high pressure) and delivery pipe.

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

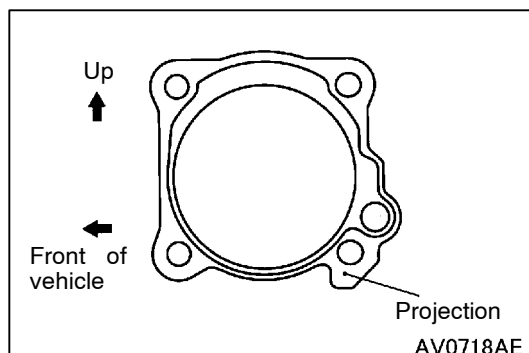


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Removal steps

1. Throttle position sensor connector
2. Throttle control servo connector
3. Water hose connection

- B◄ 4. Throttle body assembly
 ►A◄ 5. Throttle body gasket



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INSTALLATION SERVICE POINT

►A◄ THROTTLE BODY GASKET INSTALLATION

Position the projection as shown in the illustration.

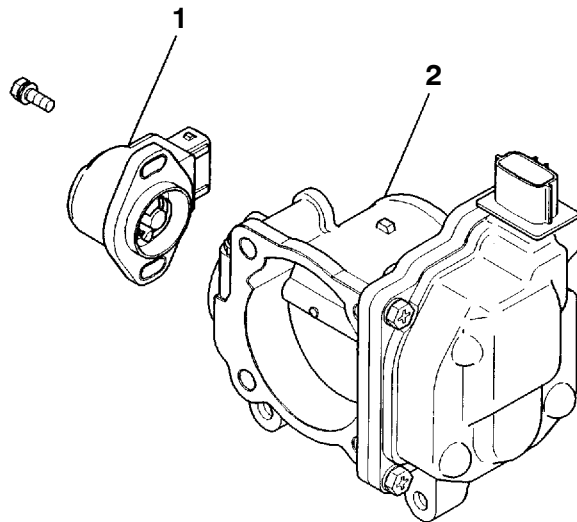
►B◄ THROTTLE BODY INSTALLATION

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.

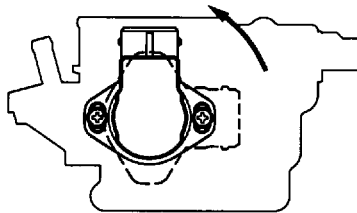
DISASSEMBLY AND REASSEMBLY



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Disassembly steps

- A◄
1. Throttle position sensor
 2. Throttle body



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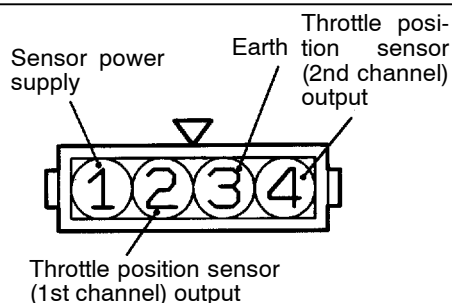
REASSEMBLY SERVICE POINTS**►A◄ THROTTLE POSITION SENSOR**

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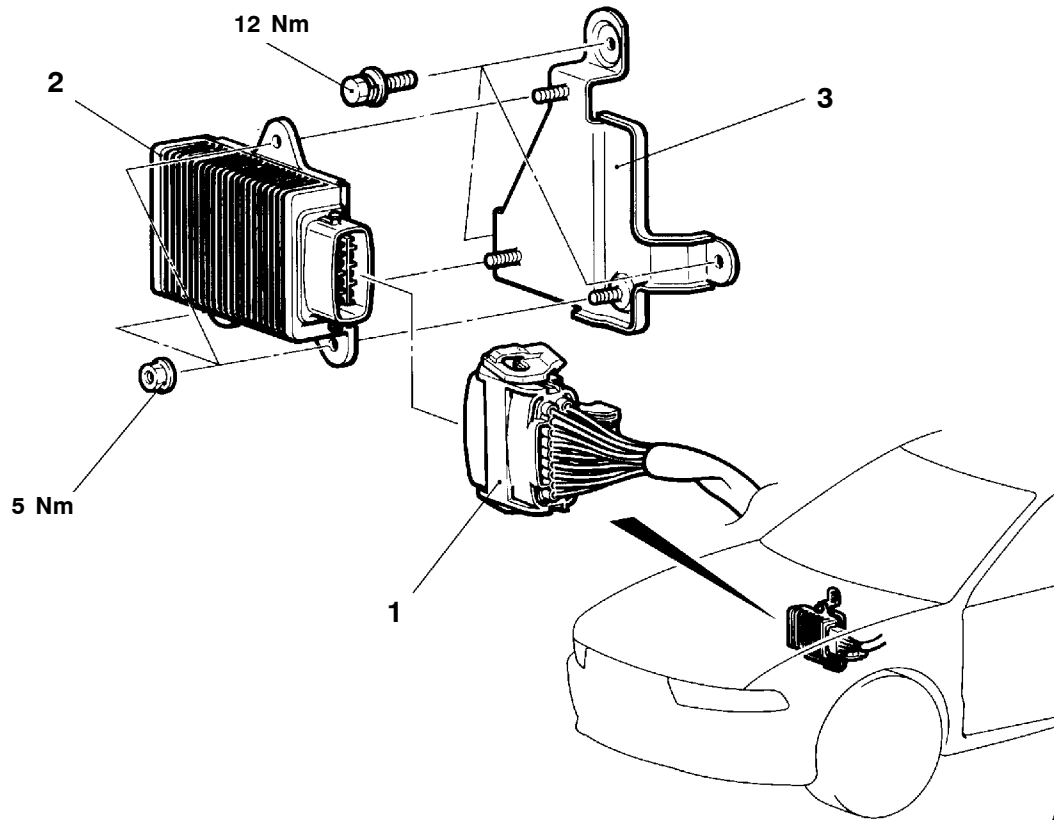
4. If the resistance value does not change smoothly, replace the throttle position sensor.



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INJECTOR DRIVER

REMOVAL AND INSTALLATION

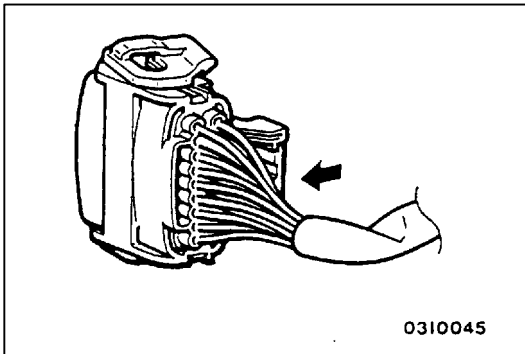


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Removal steps

1. Injector driver connector
2. Injector driver
3. Bracket

**REMOVAL SERVICE POINT****◀A▶ INJECTOR DRIVER CONNECTOR
DISCONNECTION**

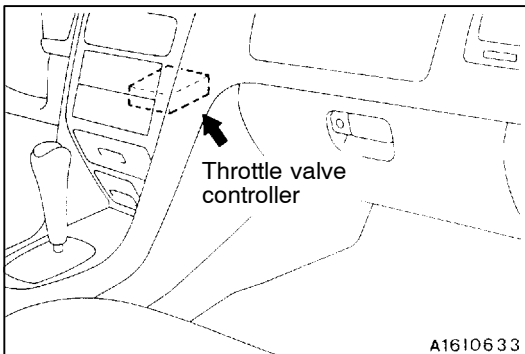
Press the injector driver connector in the place shown in the illustration to disconnect the injector driver connector.

Caution

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

◀B▶ INJECTOR DRIVER REMOVAL**Caution**

Care must be taken when handling the injector driver as it is hot after driving.

**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.

NOTES