GASOLINE DIRECT INJECTION (GDI)

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GASOLINE DIRECT INJECTION (GDI)

CONTENTS

GENERAL INFORMATION

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

FUEL INJECTION CONTROL

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

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

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

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

THROTTLE VALVE OPENING ANGLE CONTROL

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

IDLE SPEED CONTROL

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

The engine-ECU operates the throttle valve control servo so that engine speed is maintained within a map value. The map value is predetermined according to engine coolant temperature and air-conditioning load. In addition, if the A/C switch is turned on or off during engine idling, the engine-ECU compensates the engine speed by operating the throttle valve control servo as necessary.

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 Control Servo Control
   Refer to GROUP 17.

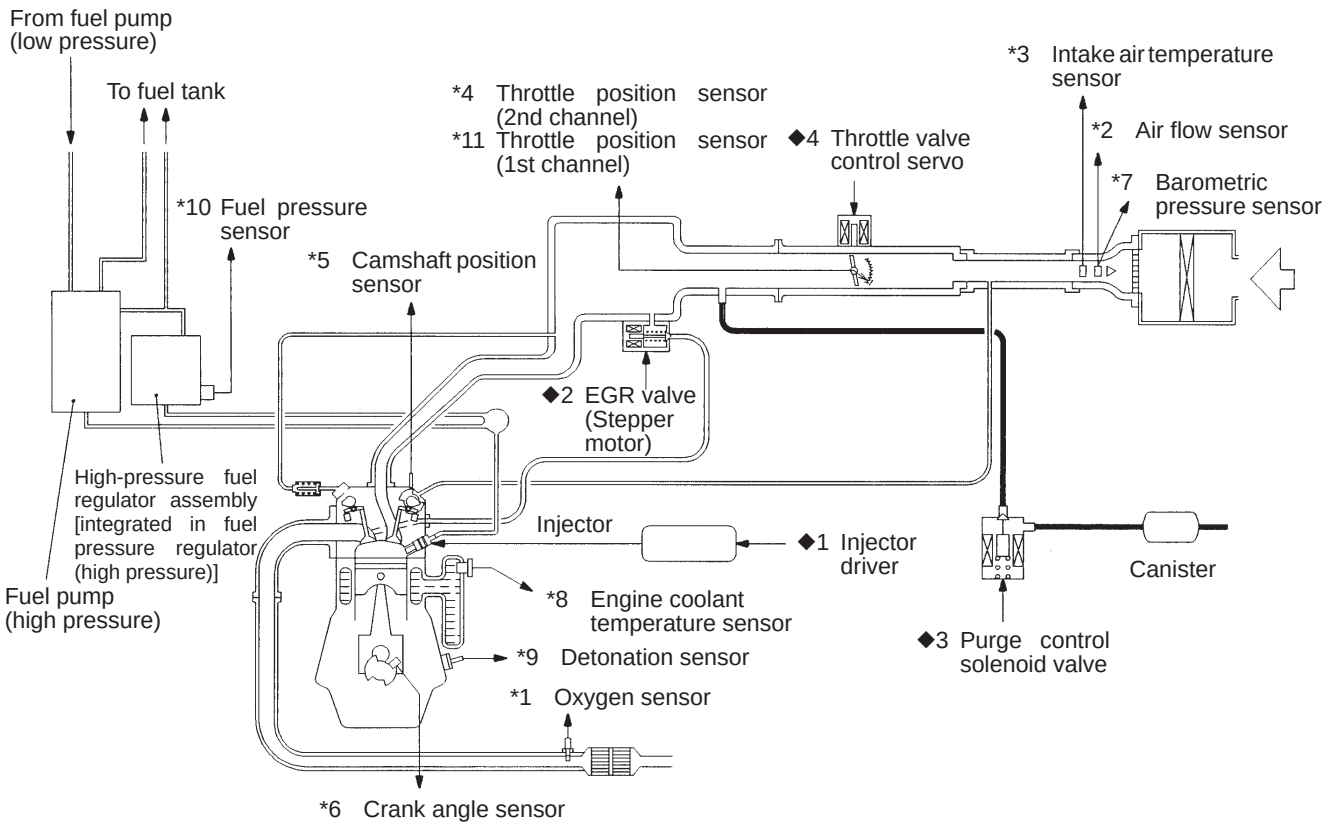
GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	60
	Throttle position sensor	Variable resistor type
	Throttle valve control servo	Torque motor type
Engine-ECU	Identification model No.	E2T71575
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
	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	Magnetic resistive element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Fuel pressure sensor	Metallic membrane type
	Power steering fluid pressure switch	Contact switch type

Items		Specifications
Actuators	Engine control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector driver control relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	DIM 100G
	Throttle valve control servo relay	Contact switch type
	Throttle valve control servo	Torque motor type
	EGR control servo	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

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

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



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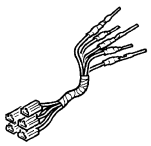
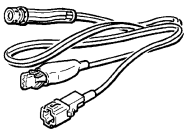
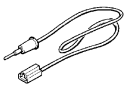
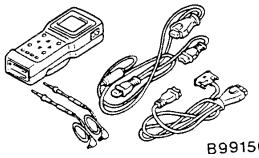
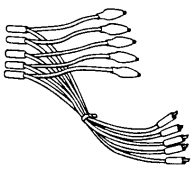
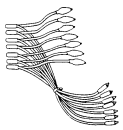
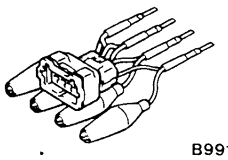
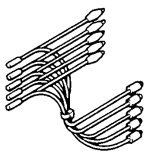
SERVICE SPECIFICATIONS

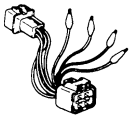
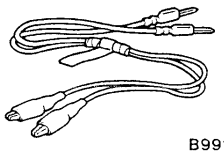
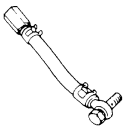
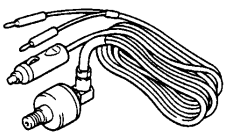
Item		Standard value
Adjustment voltage of throttle position sensor (1st channel) V		0.4 – 0.6
Adjustment voltage of throttle position sensor (2nd channel) V		4.2 – 4.8
Resistance of throttle position sensor kΩ		3.5 – 6.5
Adjustment voltages (1st channel) and (2nd channel) of accelerator pedal position sensor V		0.935 – 1.135
Resistance (1st channel) and (2nd channel) of accelerator pedal position sensor kΩ		3.5 – 6.5
Intake air temperature sensor resistance kΩ	at 20°C	2.3 – 3.0
	at 80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	at 20°C	2.1 – 2.7
	at 80°C	0.26 – 0.36
Fuel pressure	High-pressure side MPa	4 – 6.9
	Low-pressure side kPa	Approximately 324
Injector coil resistance Ω		0.9 – 1.1
Oxygen sensor output voltage (at racing) V		0.6 – 1.0
Oxygen sensor heater resistance Ω		11 – 18
Throttle valve control servo resistance Ω		1.35 – 1.65

SEALANT

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

SPECIAL TOOLS

Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	● Fuel gauge simple inspection A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	● Reading diagnosis code ● GDI system inspection
	MB991348	Test harness set	● Measurement of voltage during trouble-shooting ● Inspection using an analyzer
 MB991709	MB991709	Test harness	
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
 B991536	MB991536	TPS adjustment harness	Adjustment of throttle position sensor
 B991658	MB991658	Test harness	● Measurement of voltage during troubleshooting ● Inspection using an analyzer ● Adjustment of accelerator pedal position sensor

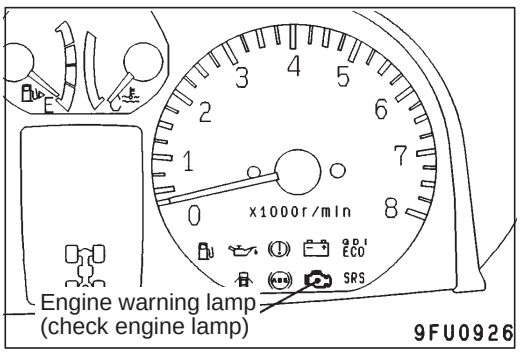
Tool	Number	Name	Use
	MD998464	Test harness (4-pin, square)	Oxygen sensor inspection
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
 B991529	MB991529	Diagnosis code check harness	Reading diagnosis code
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE
If the ECU is replaced, the immobilizer-ECU and ignition key should replaced together with it. Each ECU has an individual information for immobilizer-ECU, and the individual information is registered in the immobilizer-ECU.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

Engine warning lamp inspection items

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

Throttle valve position feedback
Throttle valve control servo motor (1st motor)
Throttle valve control servo motor (2nd motor)
Communication line system with throttle valve controller
Engine-ECU

NOTE
When the electronic-controlled throttle valve system is stopped, the engine warning lamp flashes.

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

FAIL-SAFE FUNCTION REFERENCE TABLE

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

Defective part or function	What to do when a sensor is defective
Air flow sensor	(1) Disables lean-mixture combustion. (2) Determines injector basic operating time and basic ignition timing according to map value, which has been predetermined by throttle position sensor and crank angle sensor signals.
Intake air temperature sensor	Controls as the intake air temperature is 25°C.
Throttle position sensor (1st channel)	(1) Disables lean-mixture combustion. (2) Controls throttle valve opening angle by closed loop control by using the throttle position sensor (2nd channel) signal. (3) Disables the throttle valve opening angle control when the throttle position sensor (2nd channel) signal is also defective.
Throttle position sensor (2nd channel)	(1) Disables lean-mixture combustion. (2) Controls throttle valve opening angle by closed loop control by using the throttle position sensor (1st channel) signal. (3) Disables the throttle valve opening angle control when the throttle position sensor (1st channel) signal is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Note that this control will continue until the ignition switch is turned off even if the sensor signal return to normal.)
Camshaft position sensor	Controls according to the conditions before a failure is detected.
Vehicle speed sensor	(1) Disables lean-mixture combustion. However, if a predetermined time elapses at an engine speed of 1,500 r/min or more, the lean-mixture combustion will return to normal. (2) Disables lean-mixture combustion during engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Holds the ignition timing at that for standard petrol.
Injector	(1) Disables lean-mixture combustion. (2) Shuts down exhaust gas recirculation.
Abnormal combustion	Disables lean-mixture combustion.
Communication line with A/T-ECU	Disables ignition timing retard control (engine and transmission total control) during shift change.
Alternator FR terminal	Disables inhibition control of the alternator output according to electrical load (treats the alternator as if it is conventional one).
Fuel pressure sensor	(1) Controls as if the fuel pressure is 5 MPa (if there is open or short circuit). (2) Turns off the fuel pump relay (if the fuel pressure is excessively high). (3) Shuts off the fuel injection (If an excessively low pressure is detected or the engine speed exceeds 3,000 r/min).

Defective part or function	What to do when a sensor is defective
Accelerator pedal position sensor (1st channel)	(1) Disables lean-mixture combustion. (2) Controls the throttle valve position by using the accelerator pedal position sensor (2nd channel) signal. (3) Disables the electronic-controlled throttle valve system if the accelerator pedal position sensor (2nd channel) signal is also defective.
Accelerator pedal position sensor (2nd channel)	(1) Disables lean-mixture combustion. (2) Controls the throttle valve position by using the accelerator pedal position sensor (1st channel) signal. (3) Disables the electronic-controlled throttle valve system if the accelerator pedal position sensor (1st channel) signal is also defective.
Electronic-controlled throttle valve system	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables engine speed feedback control.
Throttle valve position feedback	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables engine speed feedback control. However, if the throttle valve opening is great, controls as follows: (1) Carries out lean-mixture combustion continuously. (2) Shuts off fuel supply for 2 cylinders continuously. (3) Shuts off fuel supply when engine speed exceeds 3,000 r/min.
Throttle valve control servo motor (1st motor) malfunction	Disables lean-mixture combustion.
Throttle valve control servo motor (2nd motor) malfunction	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables engine speed feedback control.
Communication line with the throttle valve controller	(1) Error in communication from the throttle valve controller to engine-ECU ● 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 throttle valve controller ● 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
When the electronic-controlled throttle valve system is stopped, the engine warning lamp flashes.

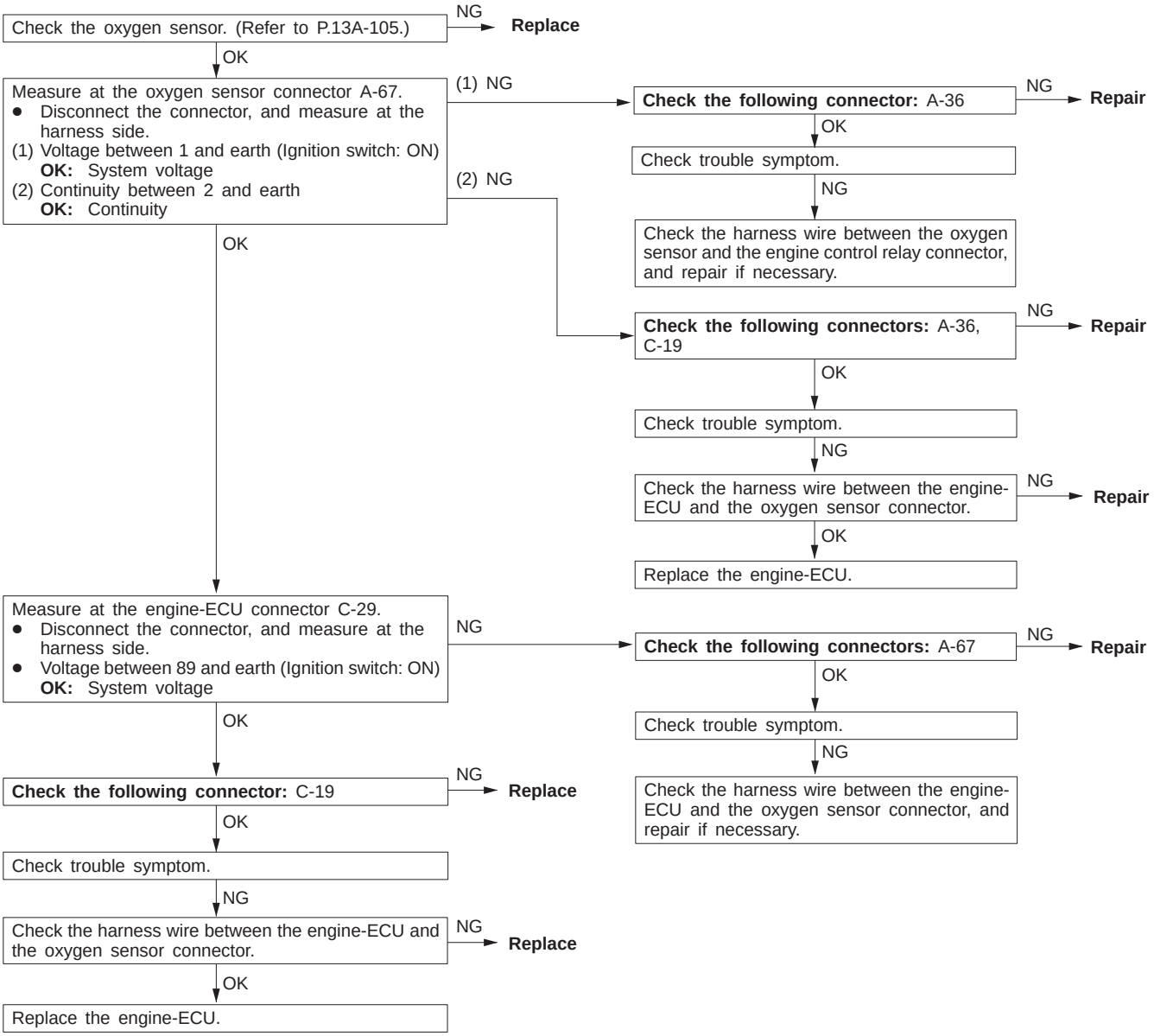
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13A-15
12	Air flow sensor system	13A-16
13	Intake air temperature sensor system	13A-17
14	Throttle position sensor (2nd channel) system	13A-18
21	Engine coolant temperature sensor system	13A-19
22	Crank angle sensor system	13A-20
23	Camshaft position sensor system	13A-21
24	Vehicle speed sensor system	13A-22
25	Barometric pressure sensor system	13A-23
31	Detonation sensor system	13A-24
41	Injector system	13A-25
44	Abnormal combustion	13A-27
54	Immobilizer system	13A-28
56	Abnormal fuel pressure system	13A-29
61	Communication line with A/T-ECU system	13A-31
64	Alternator FR terminal system	13A-31
66	Brake vacuum sensor system	13A-32
77	Accelerator pedal position sensor (2nd channel) system	13A-33
78	Accelerator pedal position sensor (1st channel) system	13A-34
79	Throttle position sensor (1st channel) system	13A-35
89	Abnormality in fuel pressure system	13A-36
91	Electronic-controlled throttle valve system	13A-36
92	Throttle valve position feedback system	13A-37
94	Communication line system with throttle valve controller	13A-37
95	Malfunction in throttle valve control servo motor (1st motor) system	13A-38
99	Malfunction in throttle valve control servo motor (2nd motor) system	13A-38

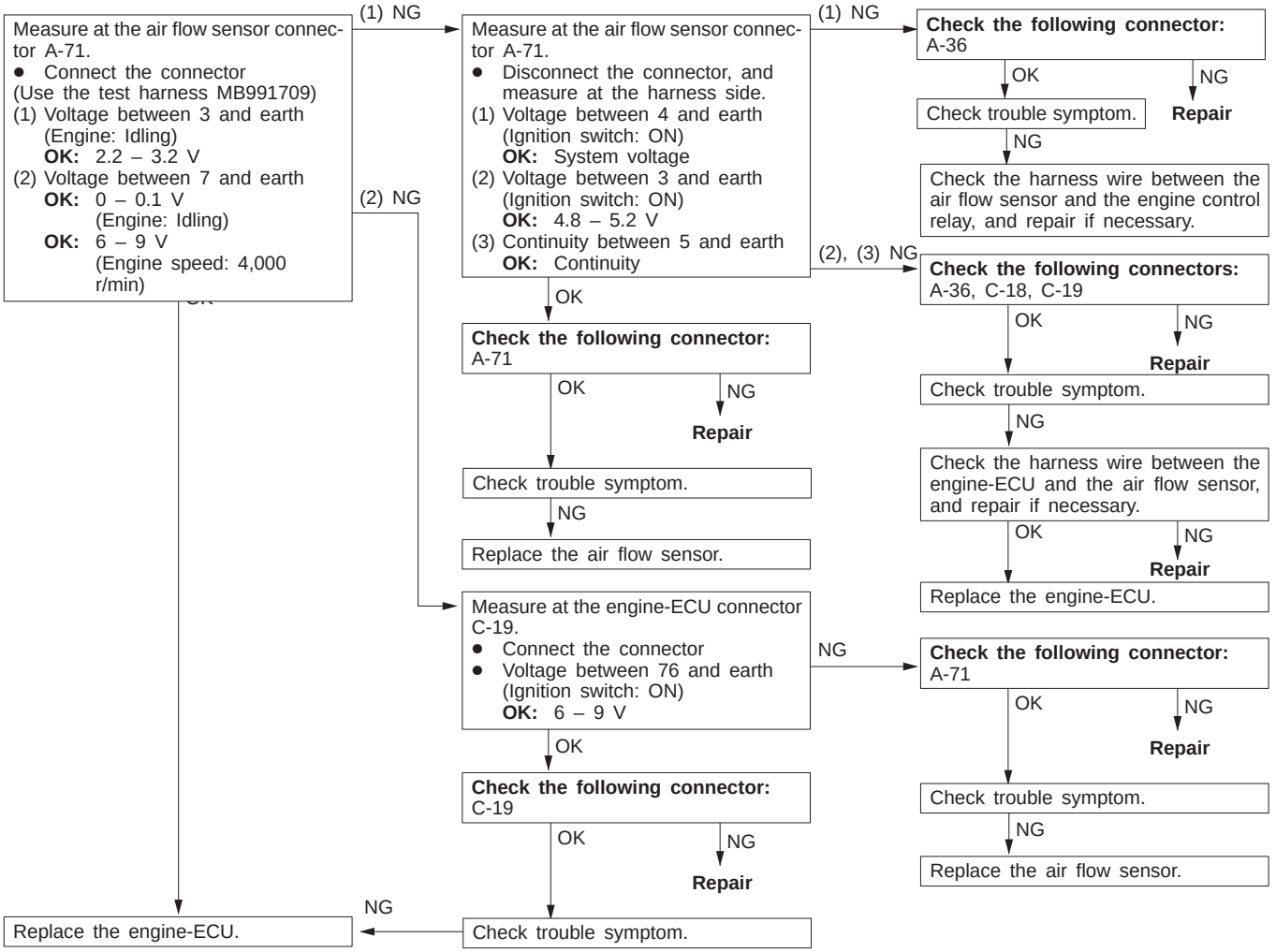
NOTE
Code No. 56 may be also output when air is sucked in high-pressure fuel line due to no fuel supply.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

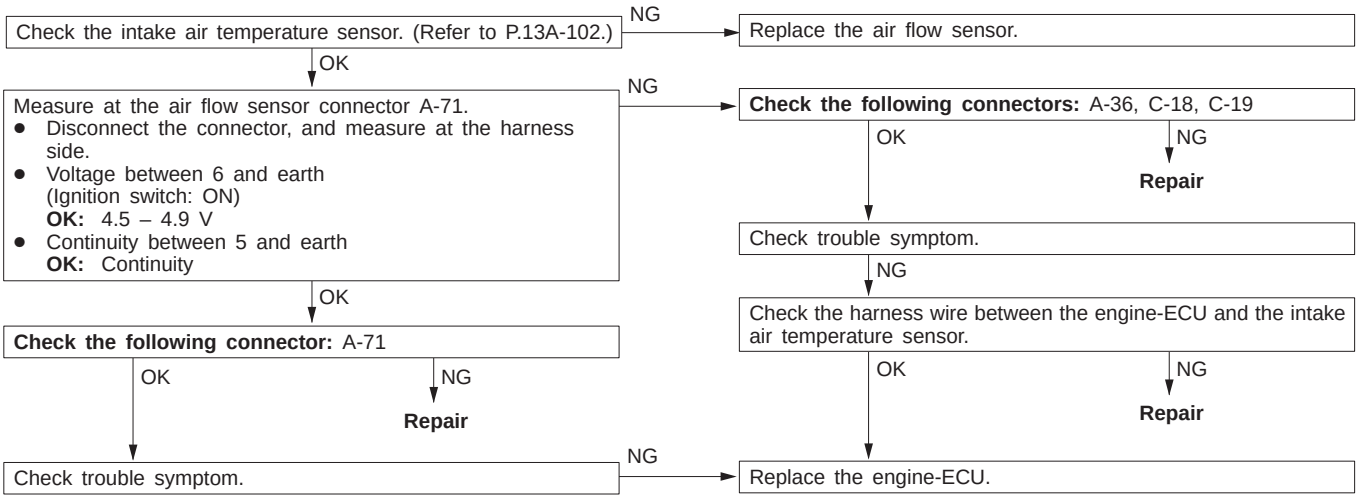
Code No.11 Oxygen sensor system	Probable cause
Range of check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C. ● Engine speed is approx. 2,000 – 3,000 r/min. ● Vehicle is moving at constant speed on a flat,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



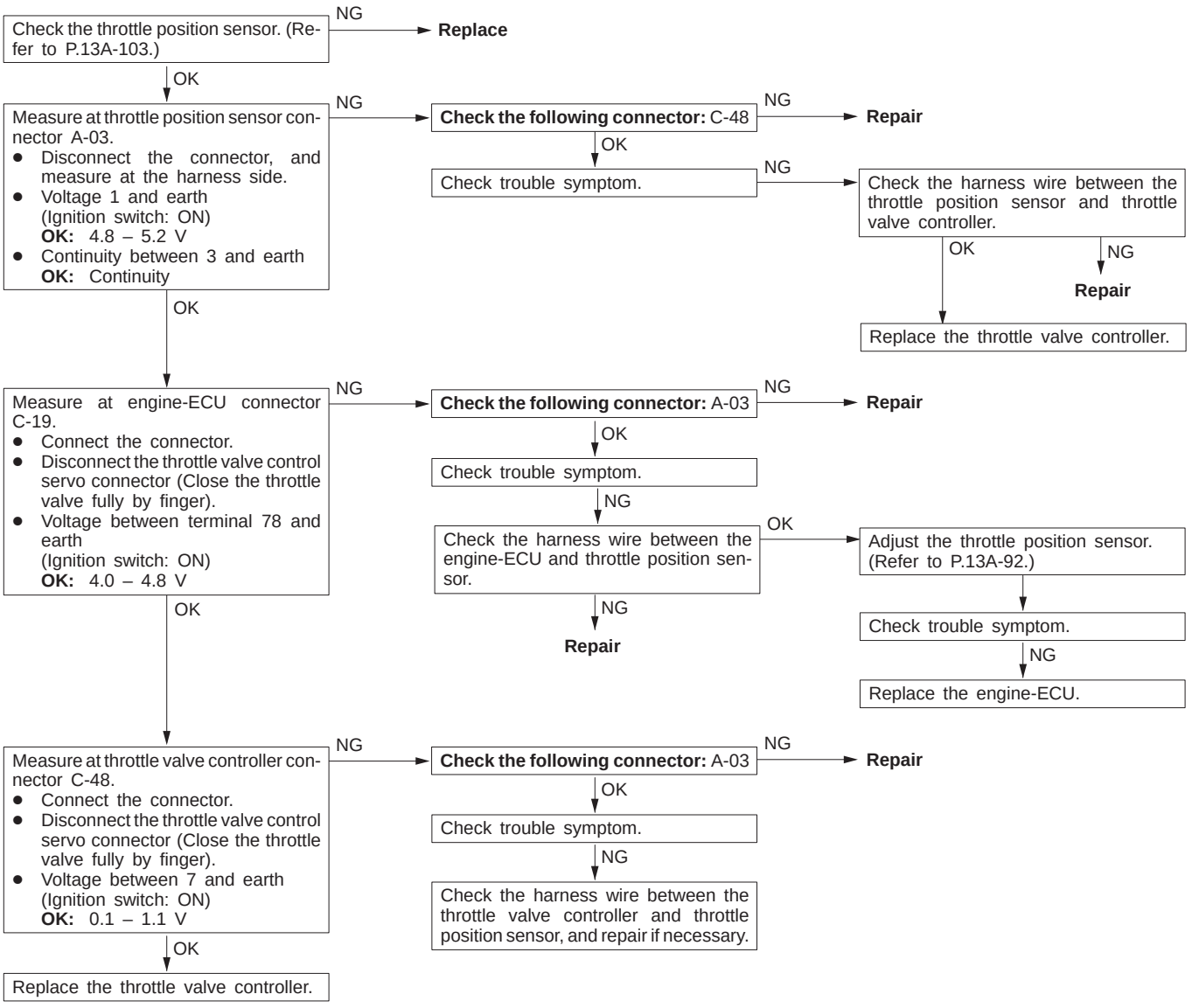
Code No.12 Air flow sensor system	Probable cause
Range of check ● Engine speed is 500 r/min or more. Set conditions ● Sensor output frequency is 3.3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Open circuit or short-circuited harness wire of air flow sensor circuit ● Malfunction of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



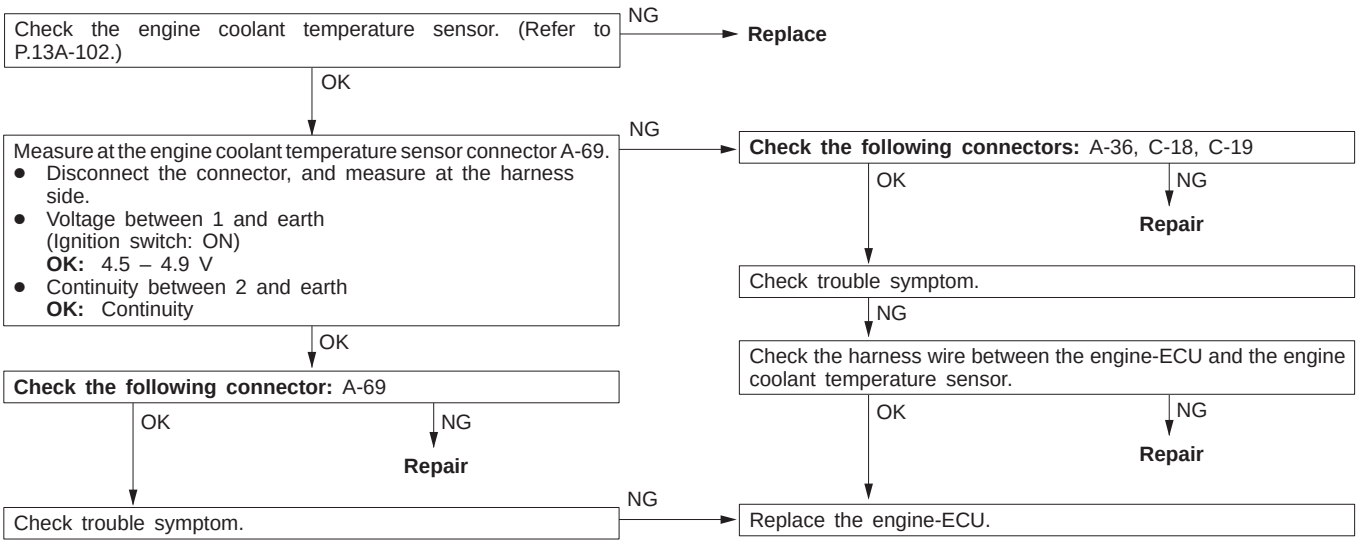
Code No.13 Intake air temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 0.14 kΩ or less for 4 seconds. or ● Sensor resistance is 50 kΩ or more for 4 seconds.	● Malfunction of the intake air temperature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



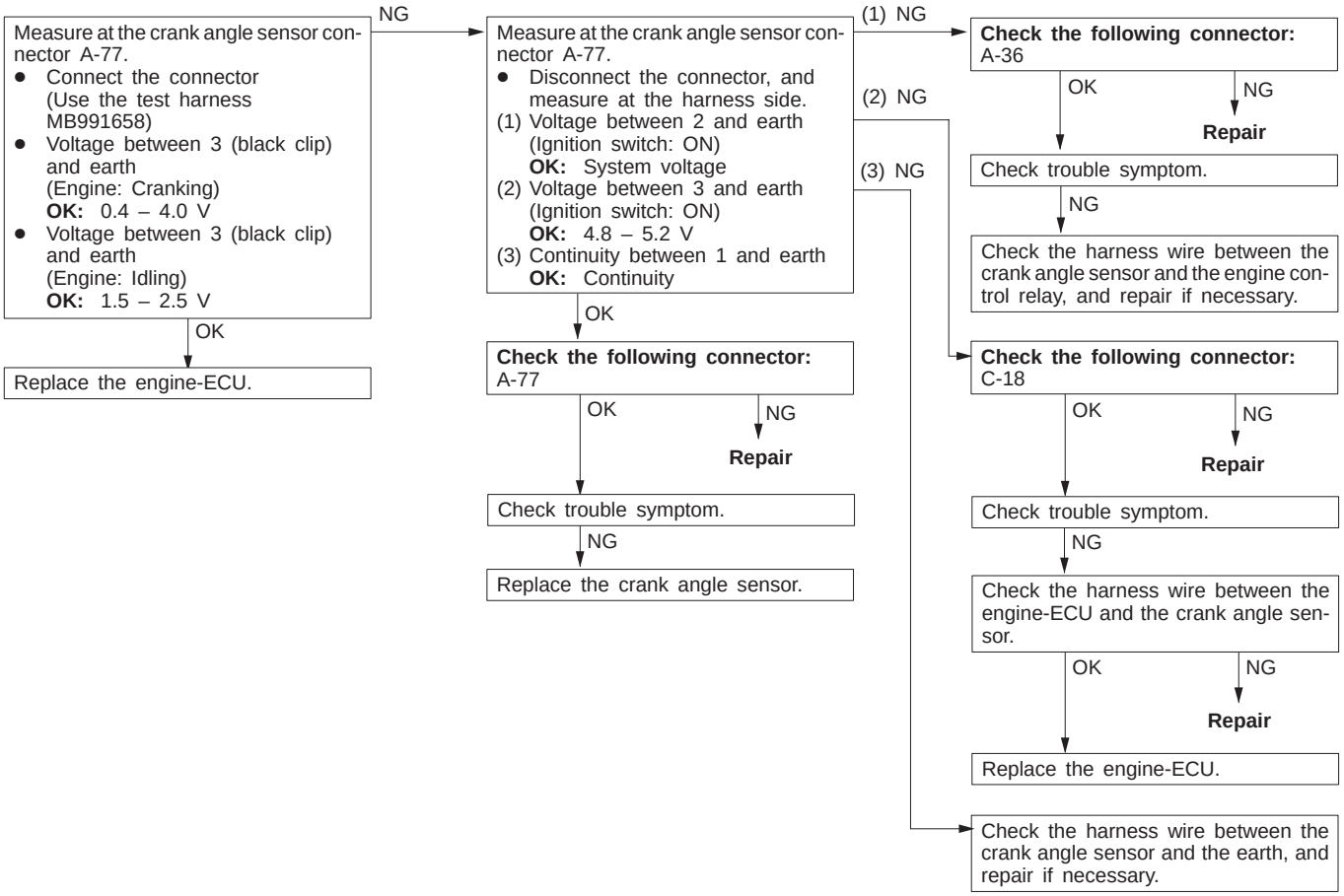
Code No.14 Throttle position sensor system (2nd channel)	Probable cause
The throttle valve controller determines whether a failure is present or not, and sends a signal indicating its result to the engine-ECU. Range of check ● Ignition switch: ON ● Throttle position sensor (1st channel) is normal Set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



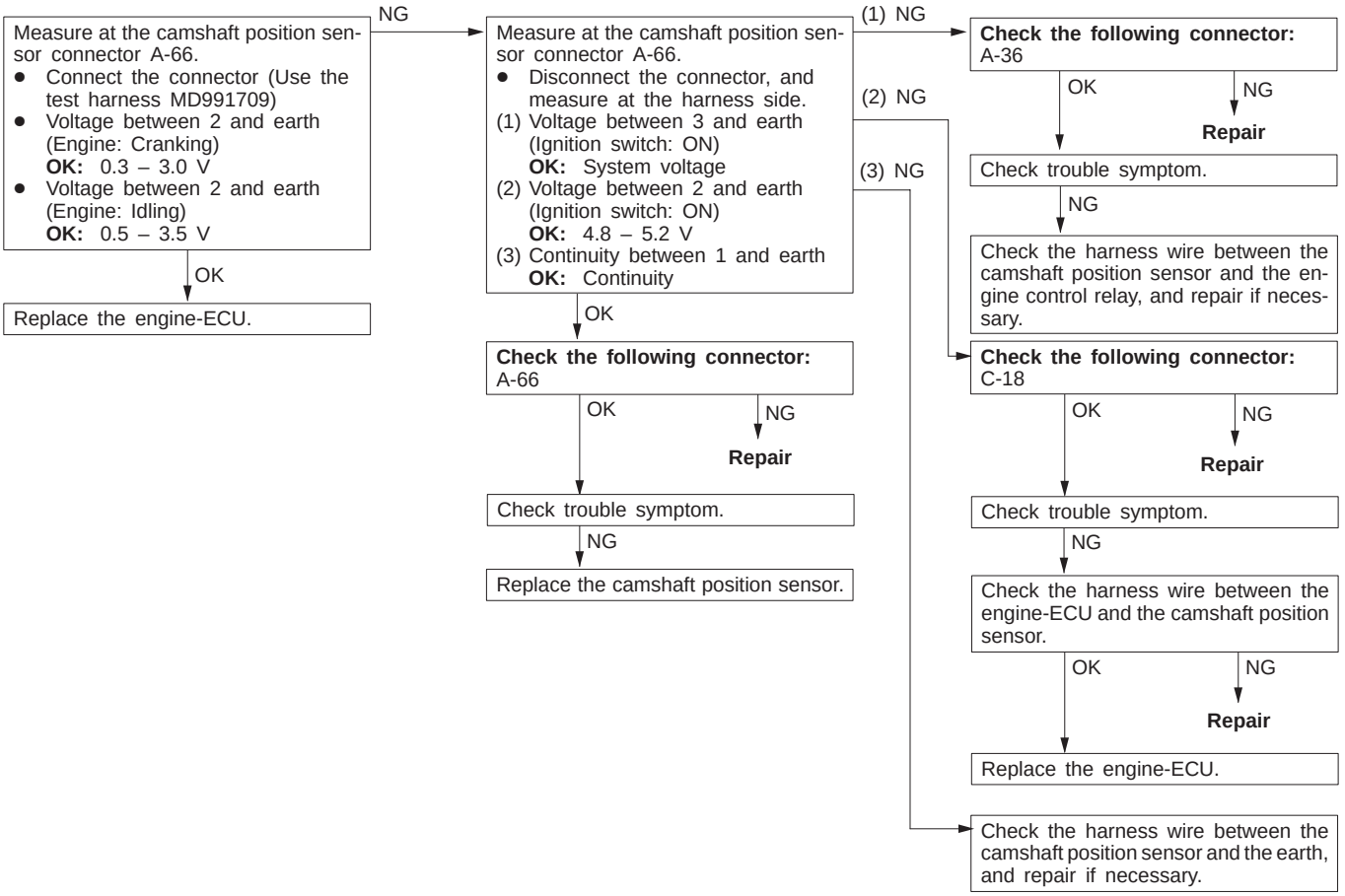
Code No.21 Engine coolant temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 50 Ω or less for 4 seconds. or ● Sensor resistance is 72 kΩ or more for 4 seconds.	● Malfunction of the engine coolant temperature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



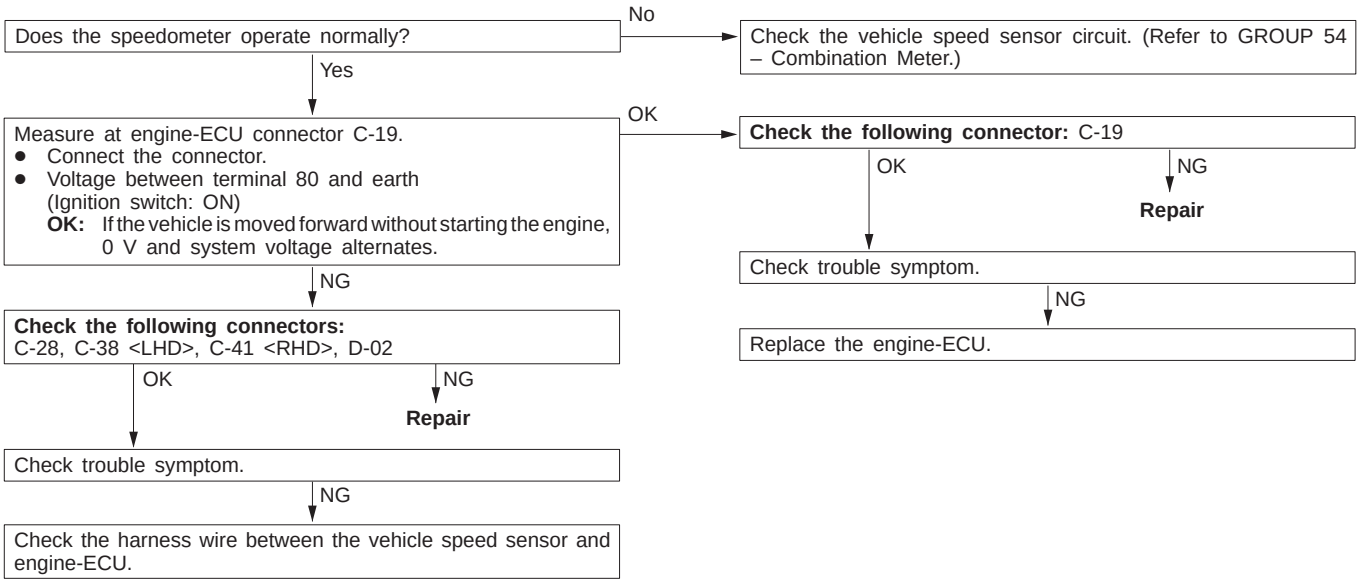
Code No.22 Crank angle sensor system	Probable cause
Range of check ● Engine: During cranking Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	● Malfunction of the crank angle sensor ● Open circuit or short-circuited harness wire of the crank angle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



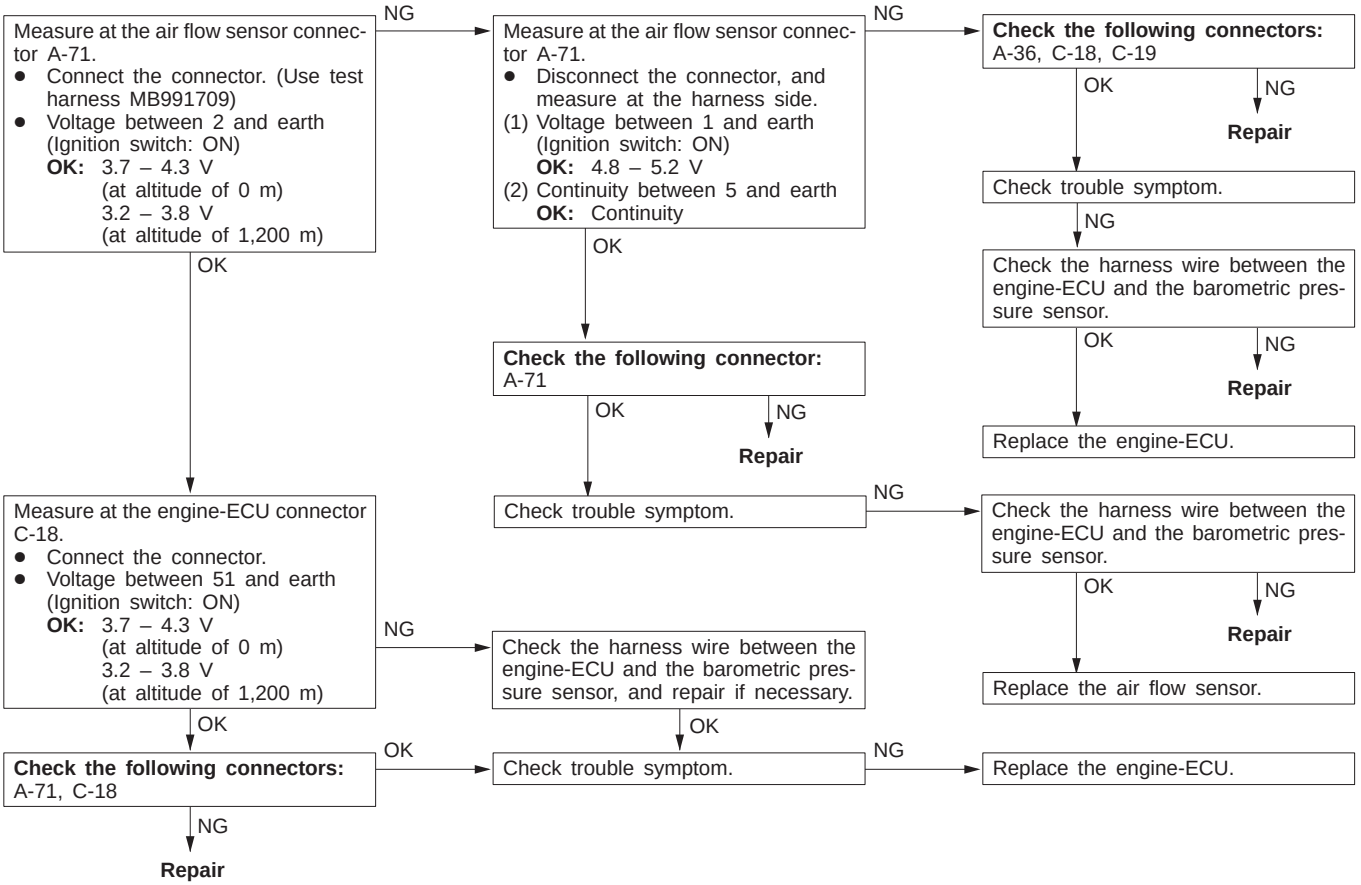
Code No.23 Camshaft position sensor system	Probable cause
Range of check ● While engine is cranking or running Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	● Malfunction of the camshaft position sensor ● Open circuit or short-circuited harness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



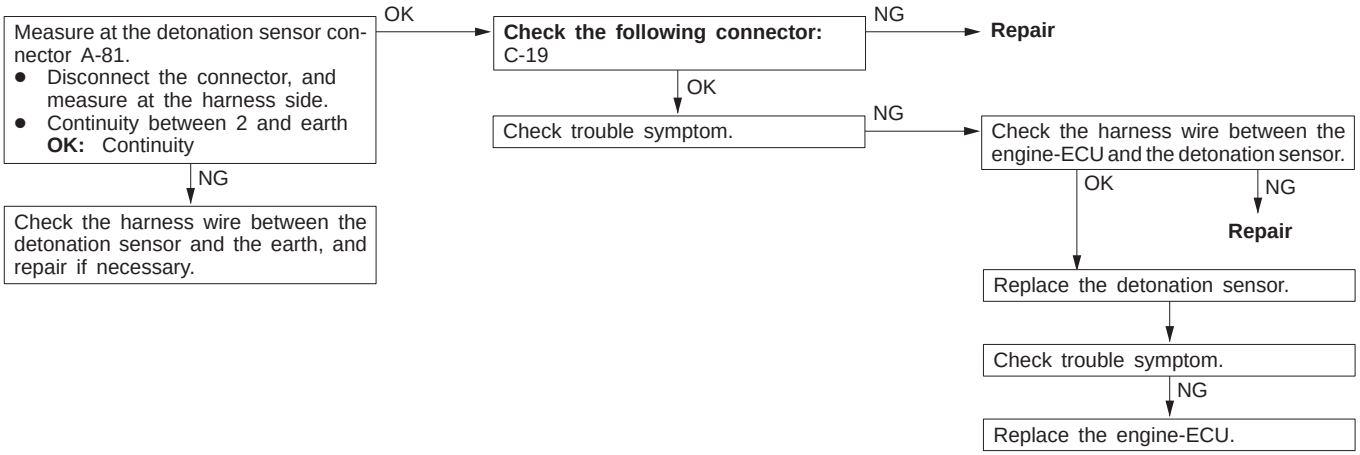
Code No. 24 Vehicles speed sensor system	Probable cause
Range of check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Engine speed is 3,000 r/min or more. ● Driving under high engine load conditions. Set conditions ● Sensor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



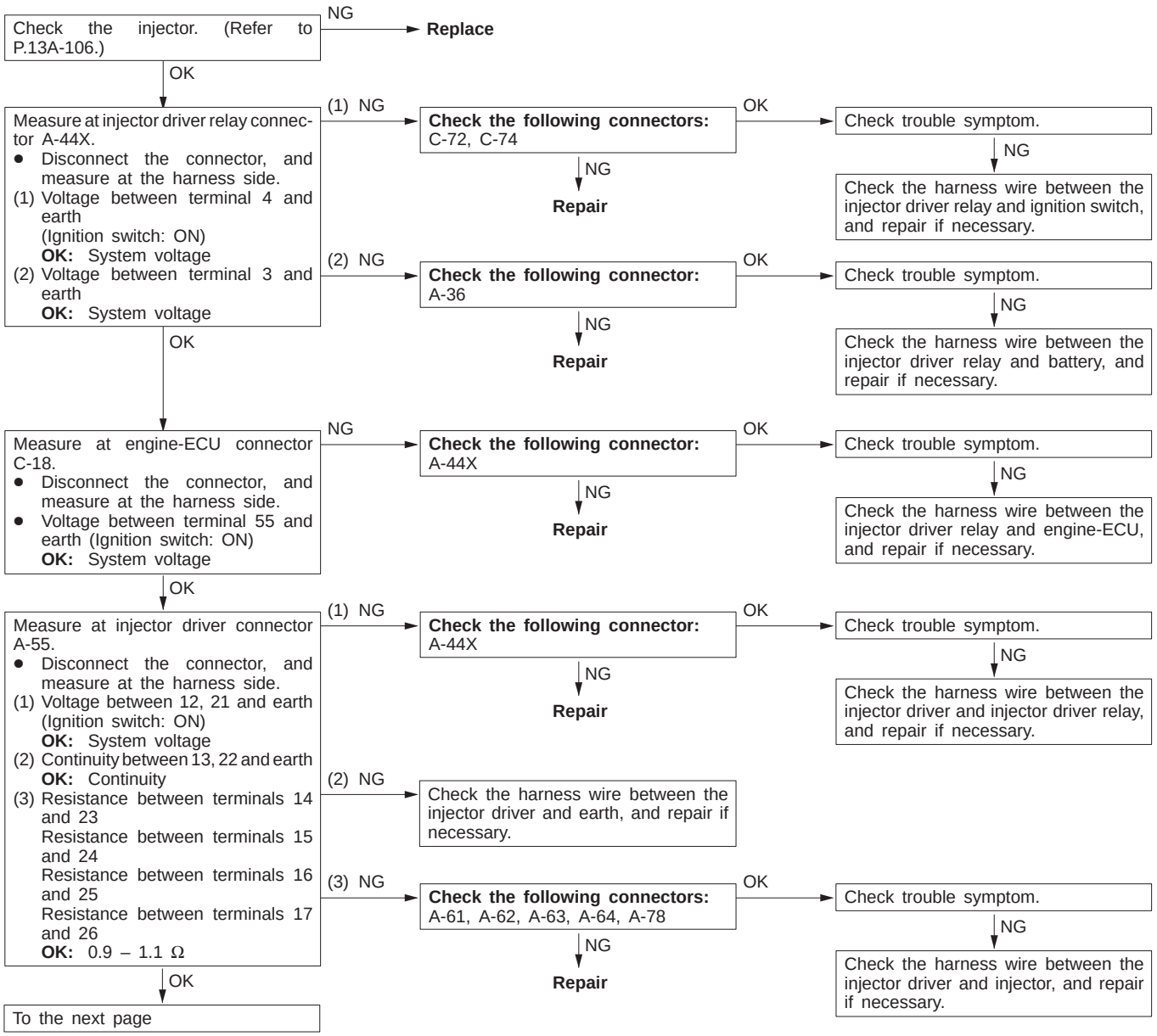
Code No.25 Barometric pressure sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 0.2 V or less for 4 seconds. (This condition corresponds to that the barometric pressure is 53 kPa or less.) or ● Sensor output voltage is 4.5 V or more for 4 seconds. (This condition corresponds to that the barometric pressure is 114 kPa or more.)	● Malfunction of the barometric pressure sensor ● Open circuit or short-circuited harness wire of the barometric pressure sensor ● Malfunction of the engine-ECU

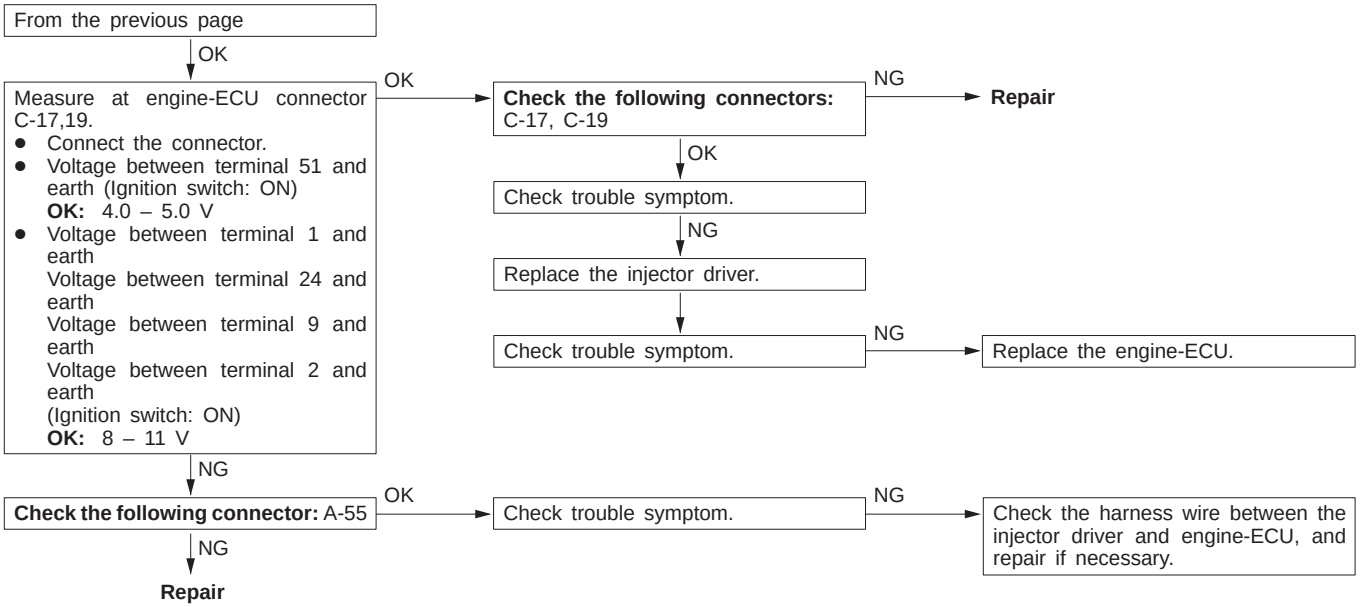


Code No.31 Detonation sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Amount of change in the sensor output voltage (detonation sensor peak voltage for each half rotation of the crankshaft) is 0.06 V or less for 200 continuous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

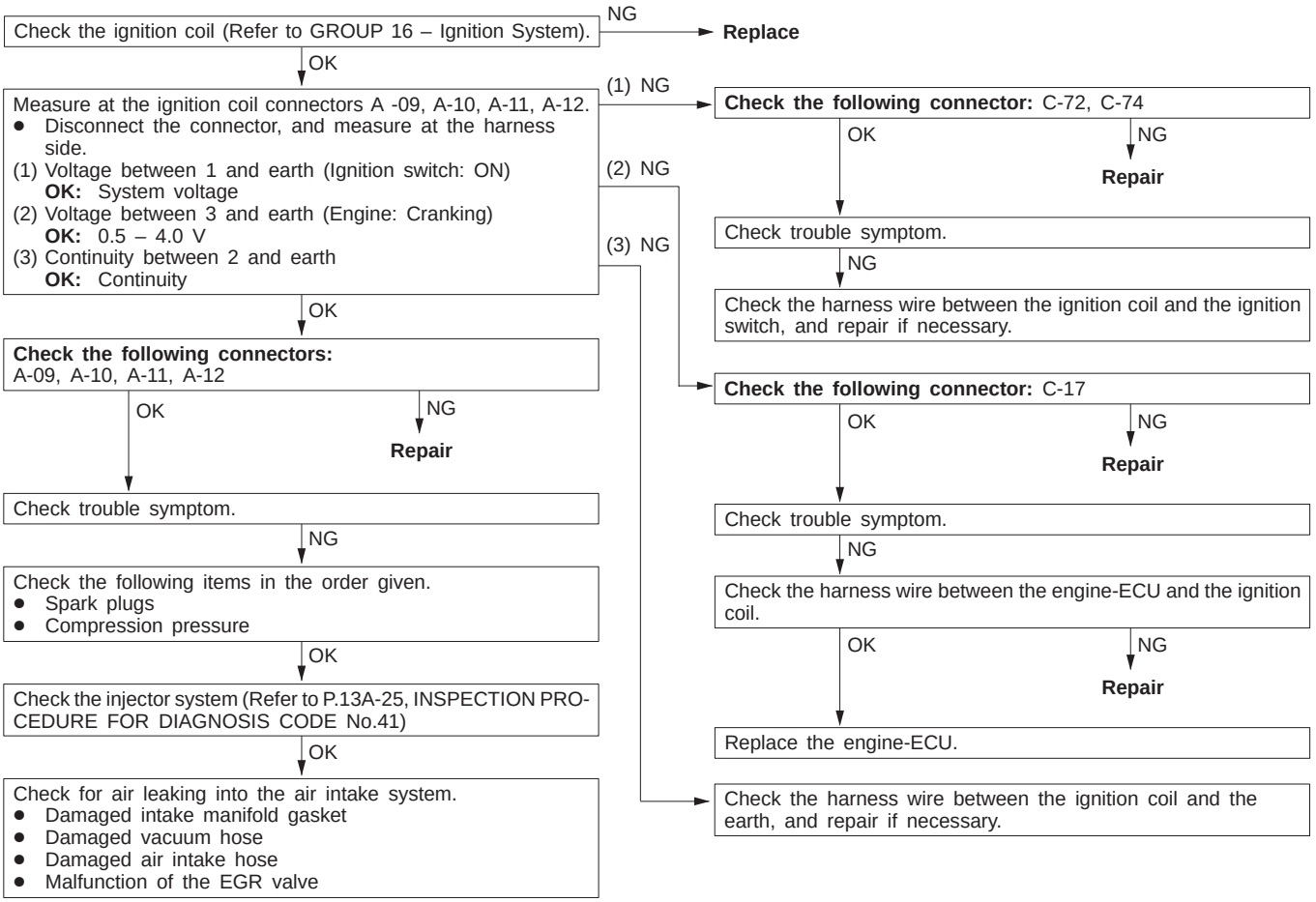


Code No.41 Injector system	Probable cause
Range of check ● Engine: while cranking, or running ● Engine speed: 4,000 r/min or less ● System voltage: 10 V or more ● Fuel shut off, or while forcible activating of injector (actuator test) is in operation. Set conditions ● Injector open circuit check signal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



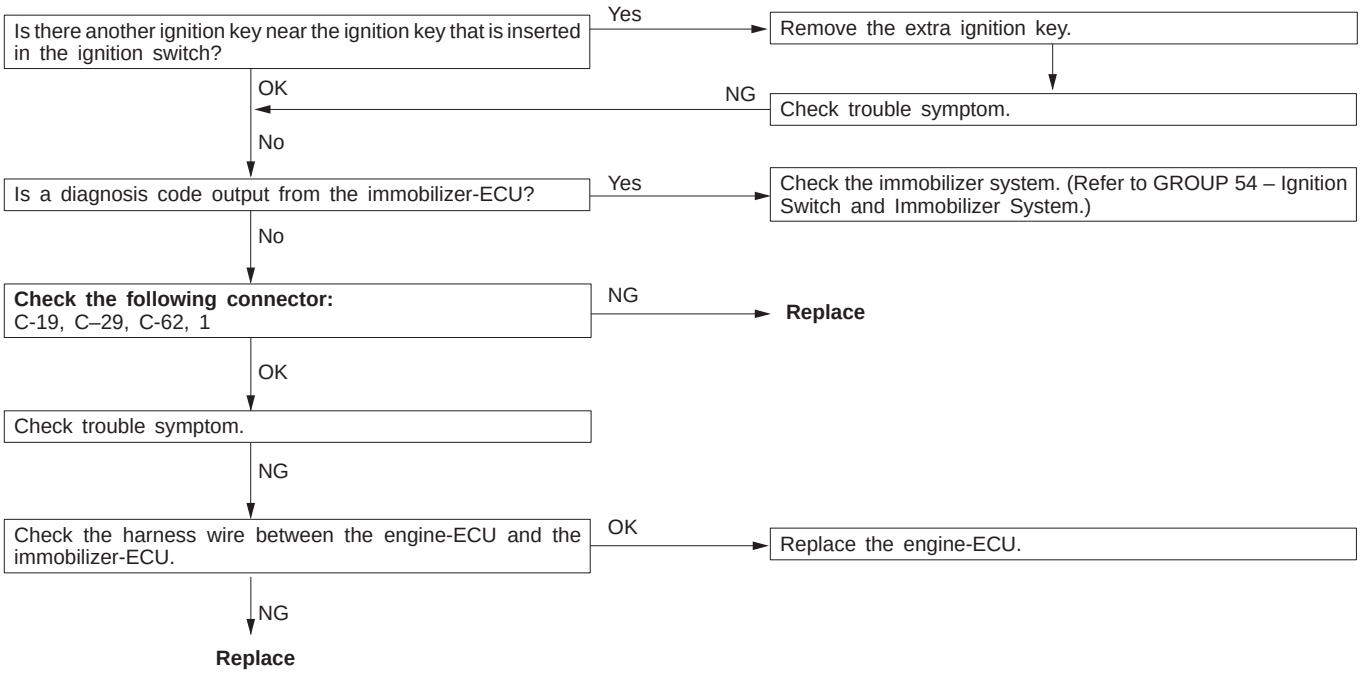

From the previous page
OK
Measure at engine-ECU connector C-17,19.
● Connect the connector.
● Voltage between terminal 51 and earth (Ignition switch: ON)
OK: 4.0 – 5.0 V
● Voltage between terminal 1 and earth
Voltage between terminal 24 and earth
Voltage between terminal 9 and earth
Voltage between terminal 2 and earth
(Ignition switch: ON)
OK: 8 – 11 V
OK
Check the following connectors: C-17, C-19
NG
Repair
OK
Check trouble symptom.
NG
Replace the injector driver.
Check trouble symptom.
NG
Replace the engine-ECU.
NG
Check the following connector: A-55
OK
Check trouble symptom.
NG
Check the harness wire between the injector driver and engine-ECU, and repair if necessary.
NG
Repair

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

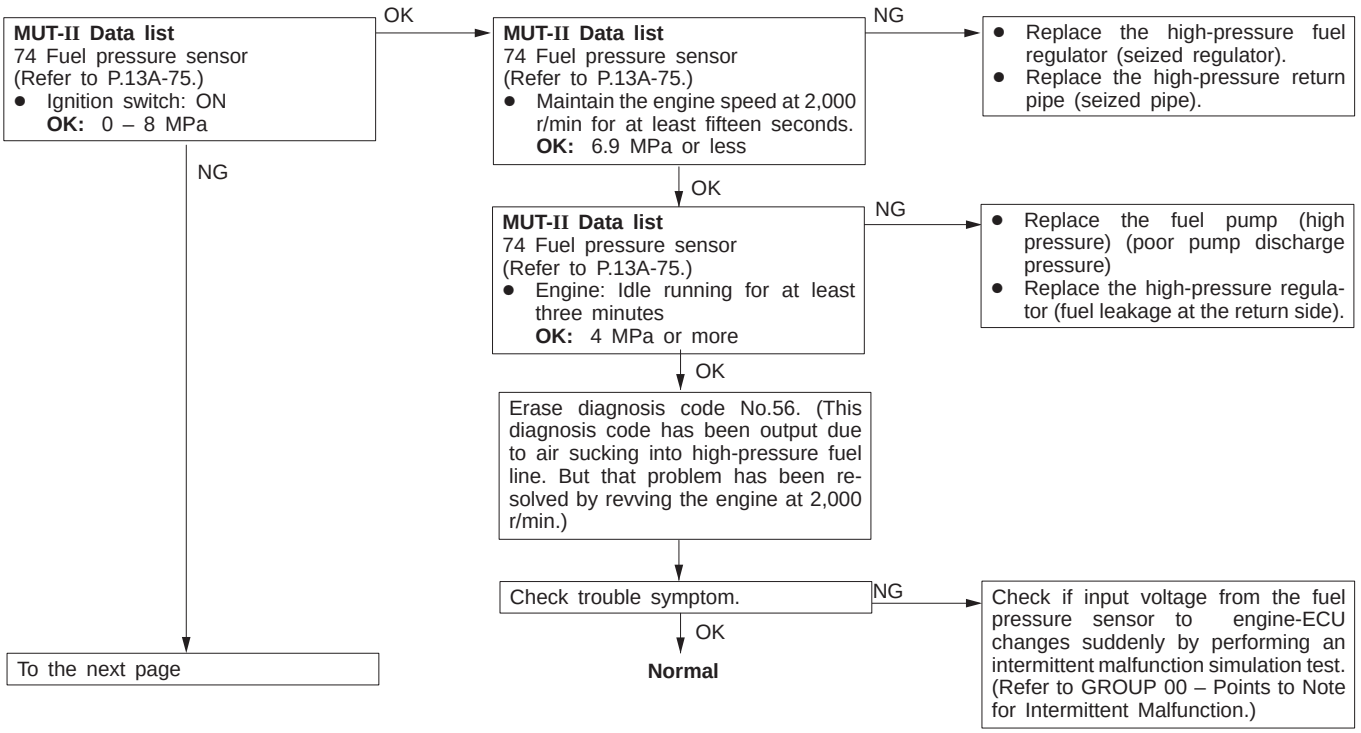


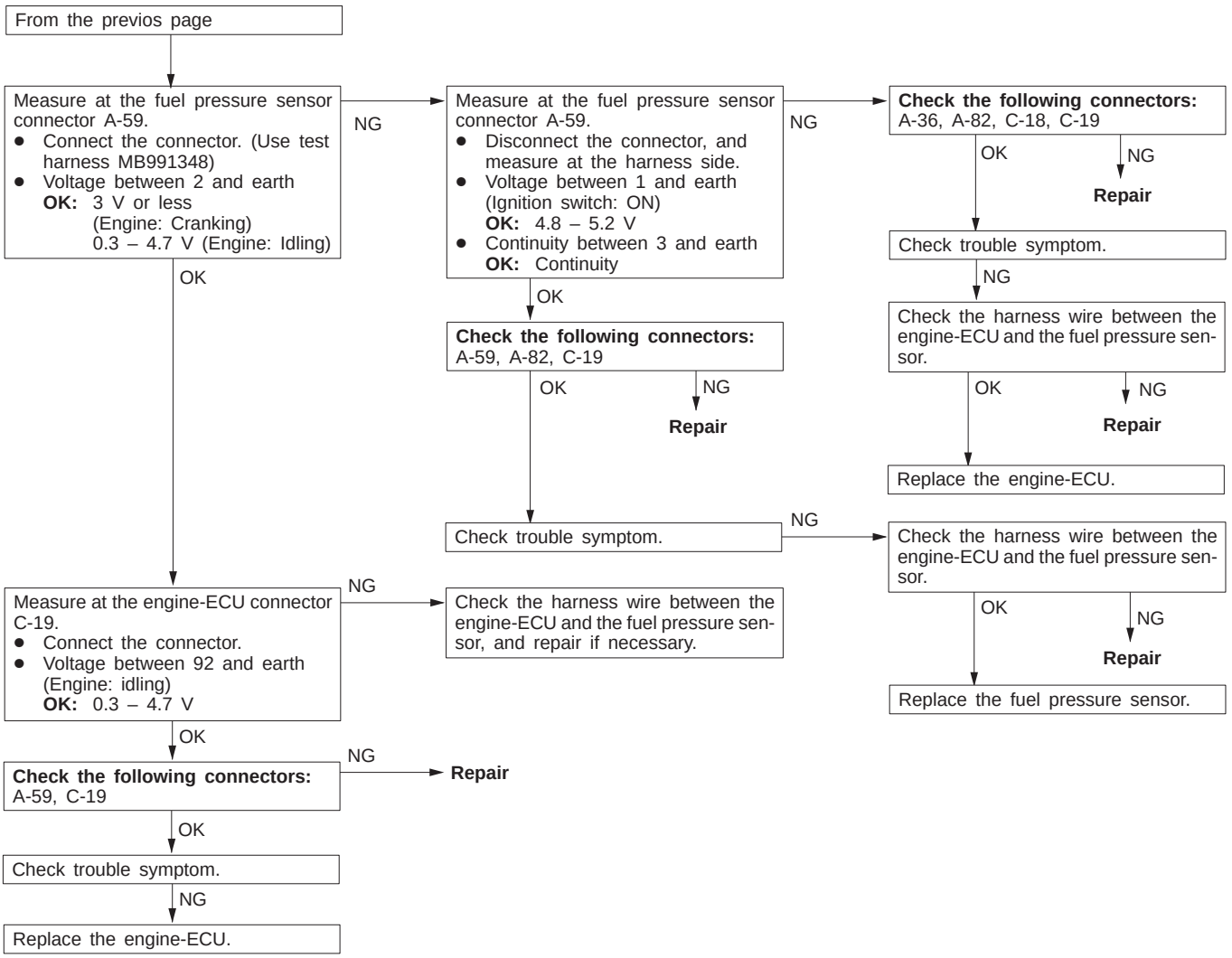
Code No.54 Immobilizer system	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of ID codes ● Incorrect ID code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Malfunction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

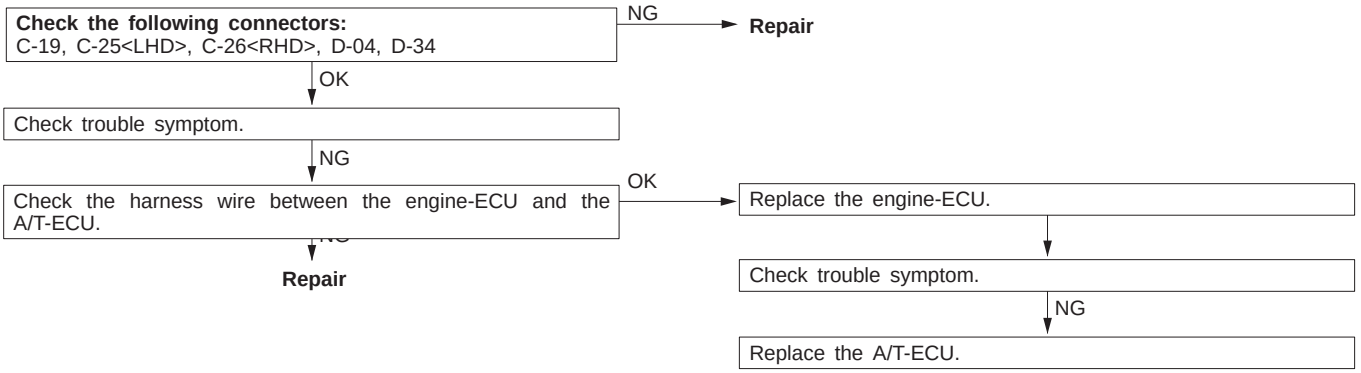


Code No.56 Abnormal fuel pressure	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more for four seconds. or ● Sensor output voltage is 0.2 V or less for four seconds. Range of check ● After the engine is started, the following condition has been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

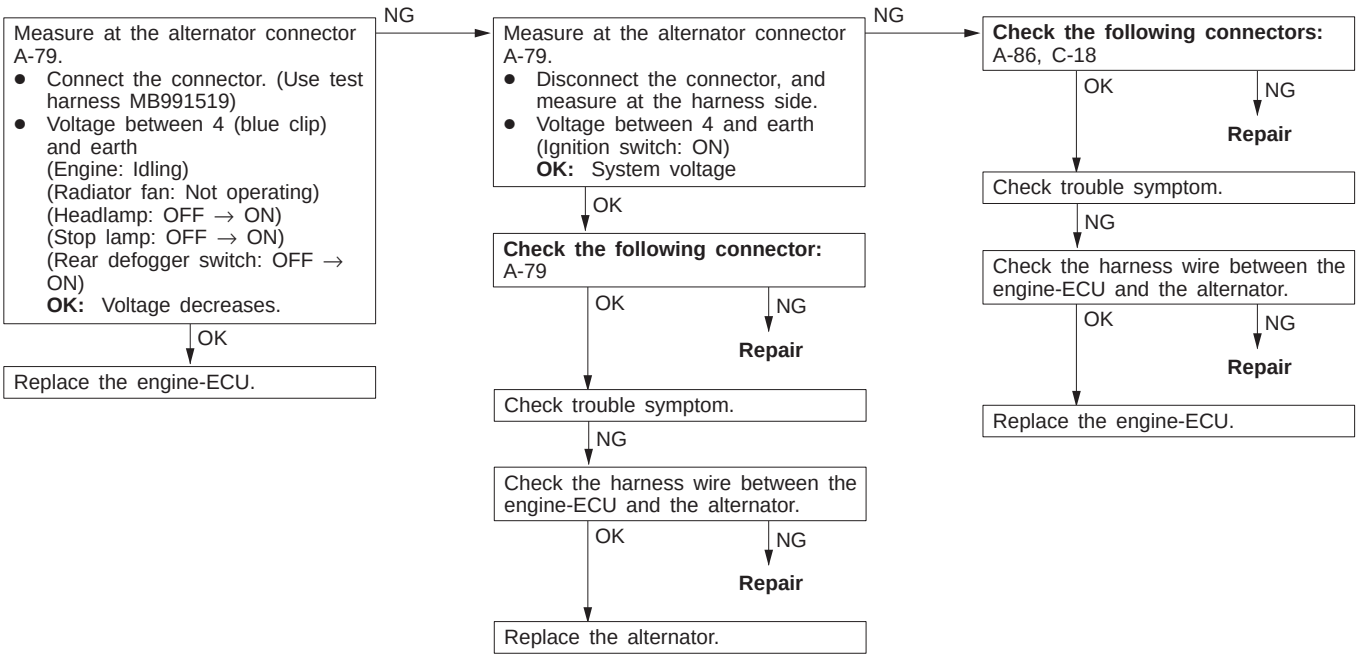



From the previos page
Measure at the fuel pressure sensor connector A-59.
● Connect the connector. (Use test harness MB991348)
● Voltage between 2 and earth
OK: 3 V or less
(Engine: Cranking)
0.3 – 4.7 V (Engine: Idling)
NG
Measure at the fuel pressure sensor connector A-59.
● Disconnect the connector, and measure at the harness side.
● Voltage between 1 and earth
(Ignition switch: ON)
OK: 4.8 – 5.2 V
● Continuity between 3 and earth
OK: Continuity
NG
Check the following connectors:
A-36, A-82, C-18, C-19
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the engine-ECU.
OK
Check the following connectors:
A-59, A-82, C-19
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the fuel pressure sensor.
Measure at the engine-ECU connector C-19.
● Connect the connector.
● Voltage between 92 and earth
(Engine: idling)
OK: 0.3 – 4.7 V
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor, and repair if necessary.
OK
Check the following connectors:
A-59, C-19
NG
Repair
OK
Check trouble symptom.
NG
Replace the engine-ECU.

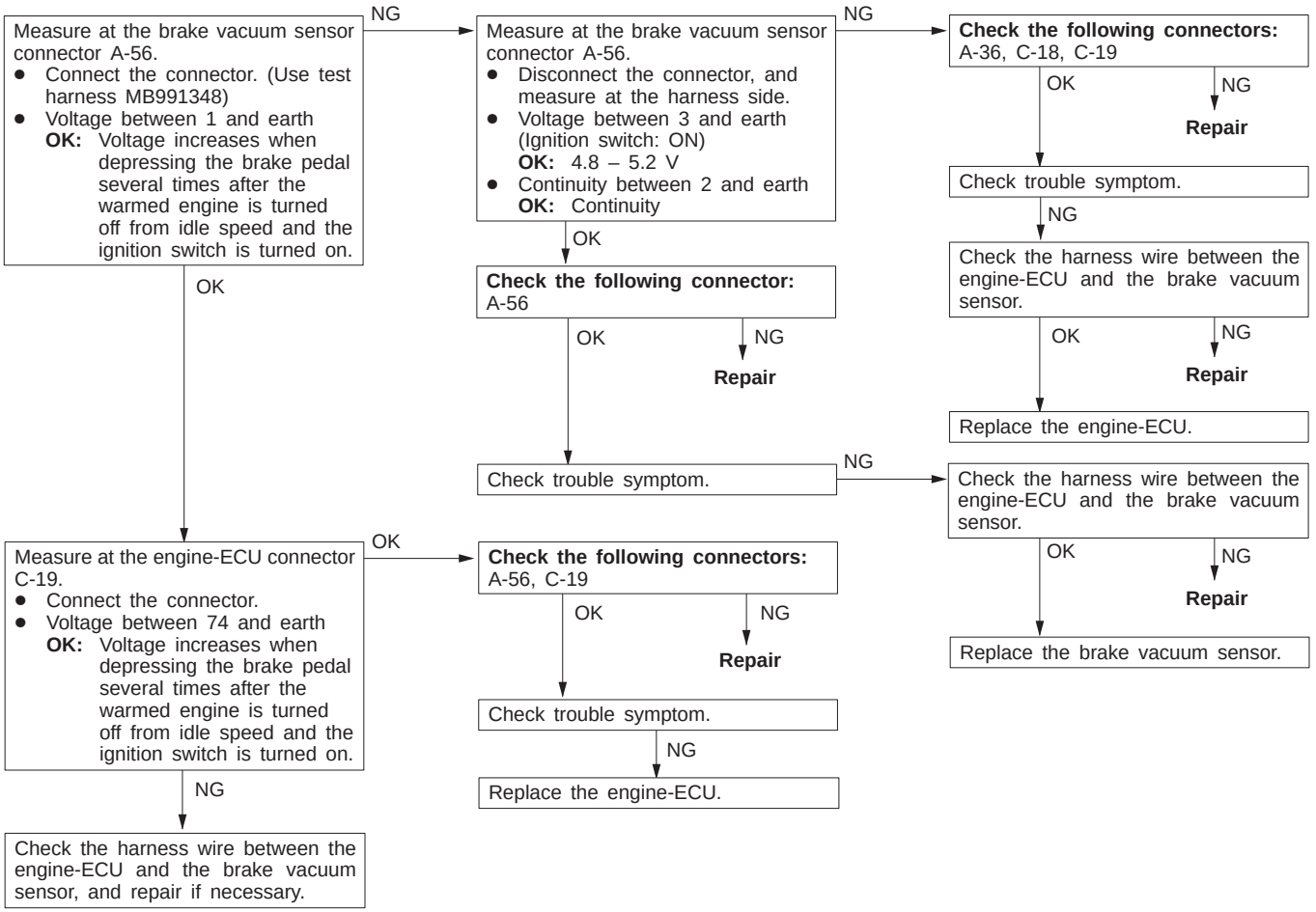
Code No.61 Communication wire with A/T-ECU system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	● Short circuit in ECU communication circuit ● Malfunction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



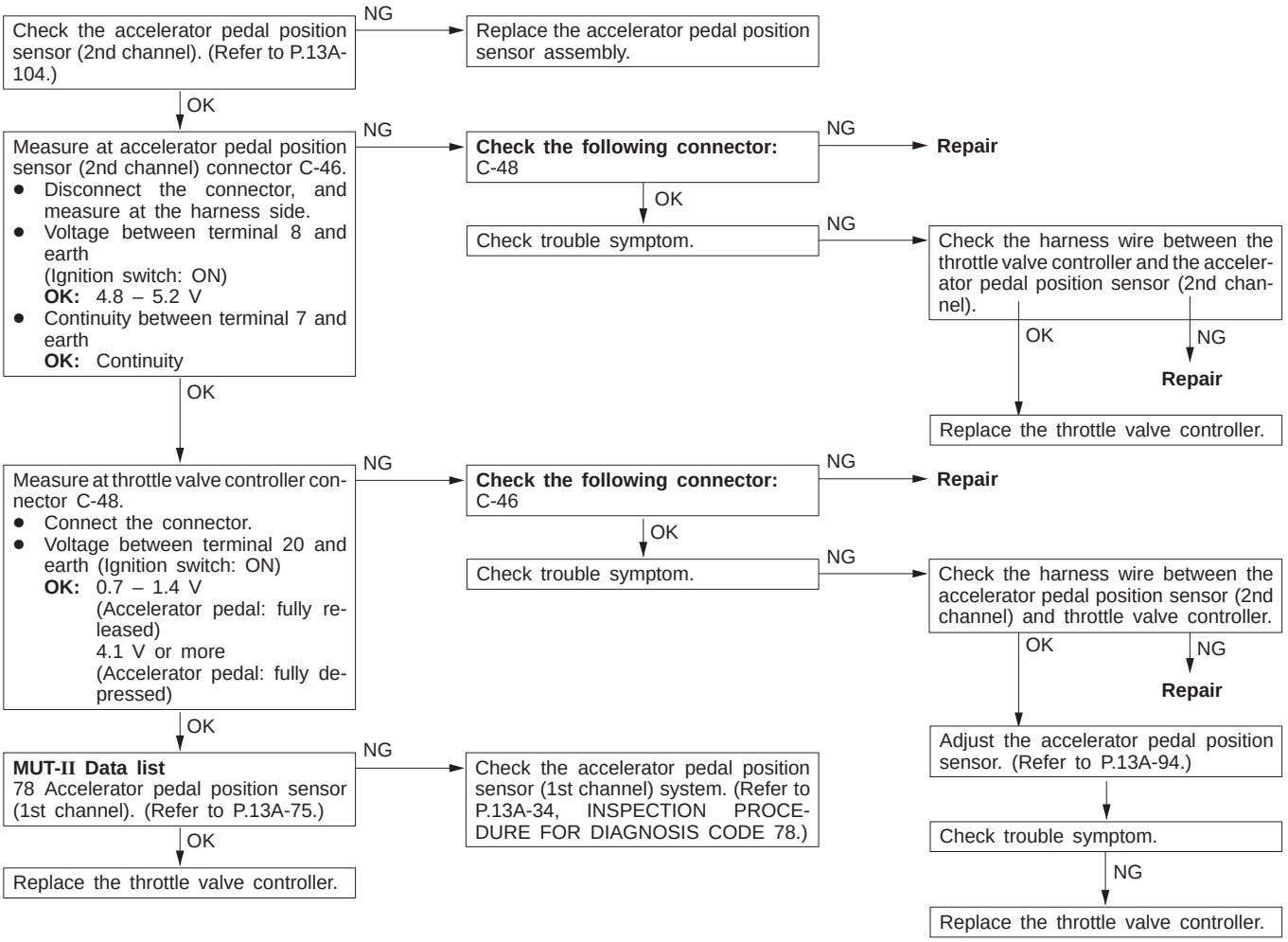
Code No.64 Alternator FR terminal system	Probable cause
Range of check ● Engine speed is 50 r/min or more. Set conditions ● Input voltage from the alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of the engine-ECU



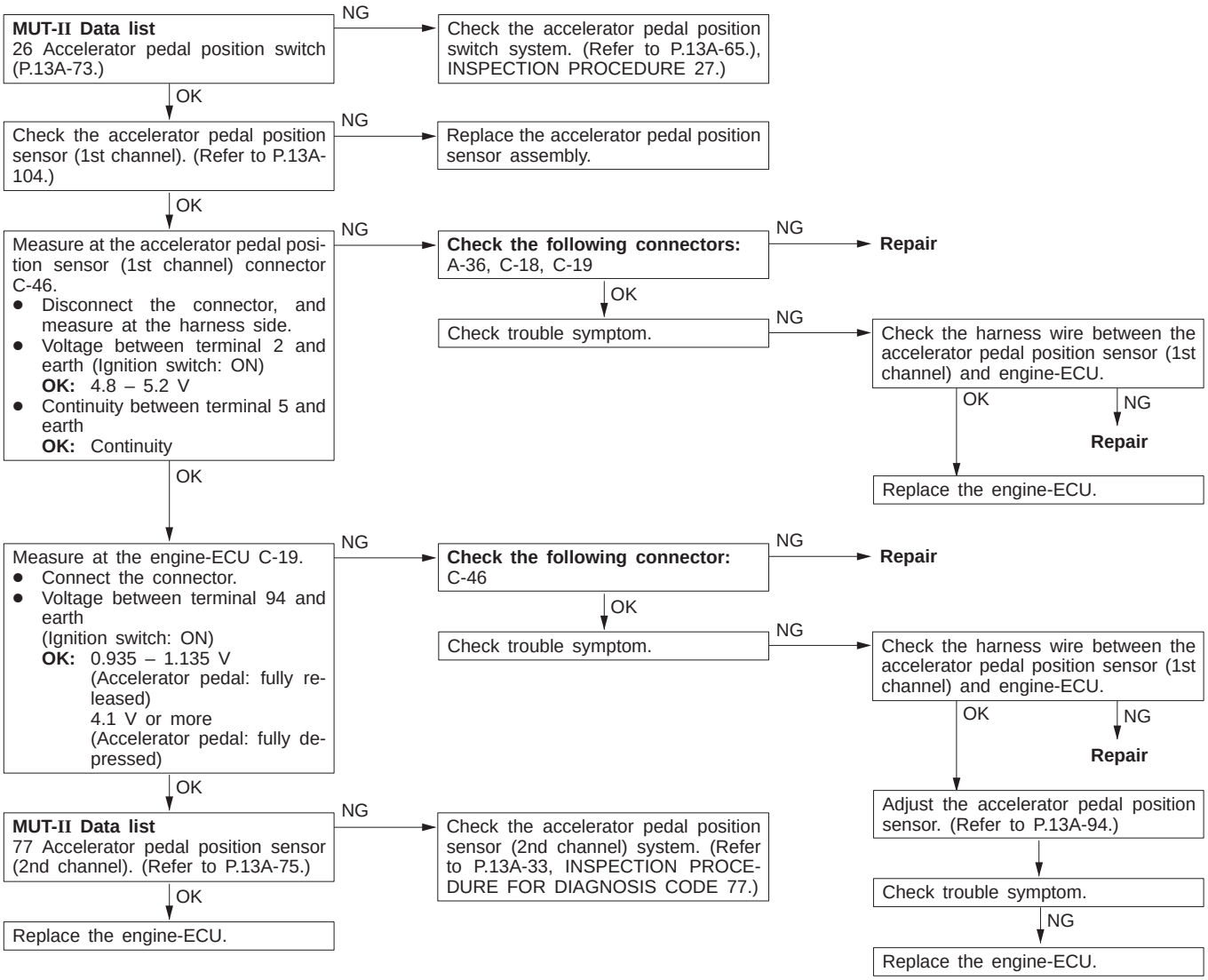
Code No.66 Brake vacuum sensor system	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more. or ● Sensor output voltage is 0.2 V or less.	● Malfunction of the brake vacuum sensor ● Improper connector contact, open circuit or short-circuited harness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



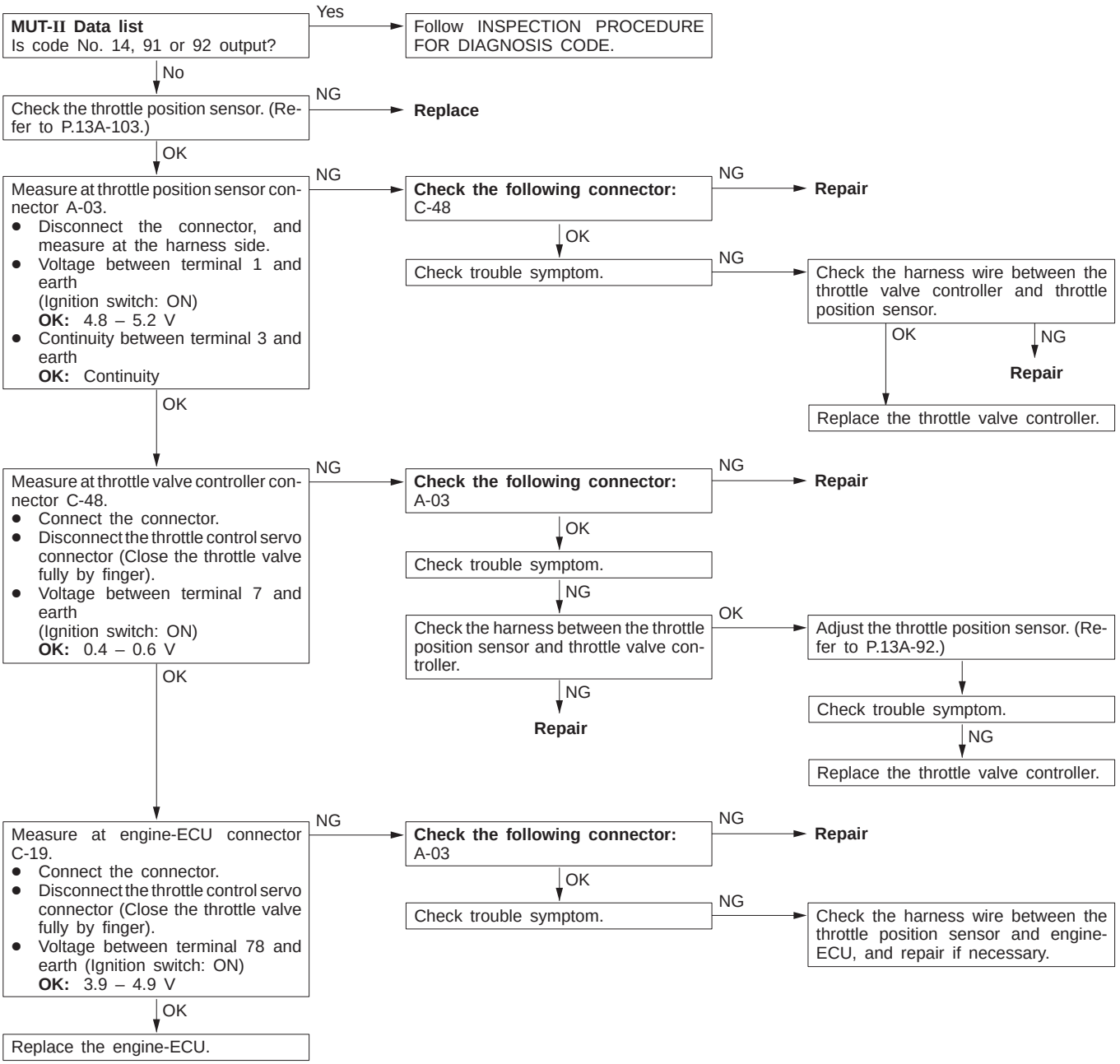
Code No.77 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (1st channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator pedal position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



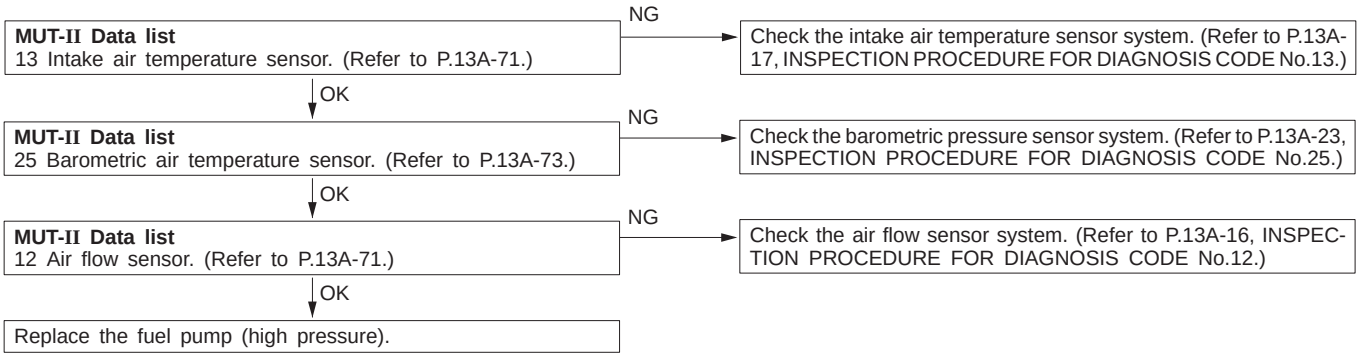
Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (2nd channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator position sensor (1st channel) system is 0.2 V or less for one second. or ● Output voltage of the accelerator pedal position sensor (2nd channel) is 2.5 V or less, and (1st channel) output voltage of the accelerator pedal position sensor is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor (1st and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly). or ● Although the accelerator pedal position switch is on, 1st-channel output voltage of the accelerator pedal position sensor exceeds 1.1 V for one second.	● Malfunction of the accelerator pedal position sensor (1st channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (1st channel) system, or poor connector contact ● ON-seizure of the accelerator pedal position switch ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



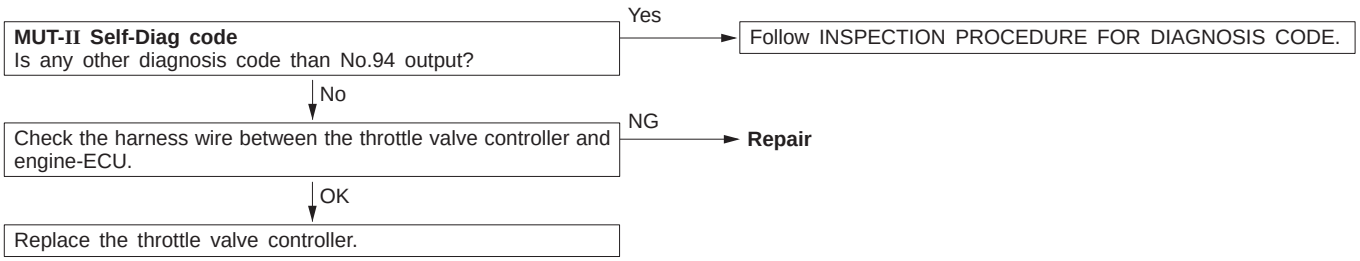
Code No.79 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller determines a failure, and sends it result to the engine-ECU. Range of check ● Ignition switch: ON ● System voltage: 8 V or more Set conditions ● Output voltage of the sensor remains 0.2 V for one second.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



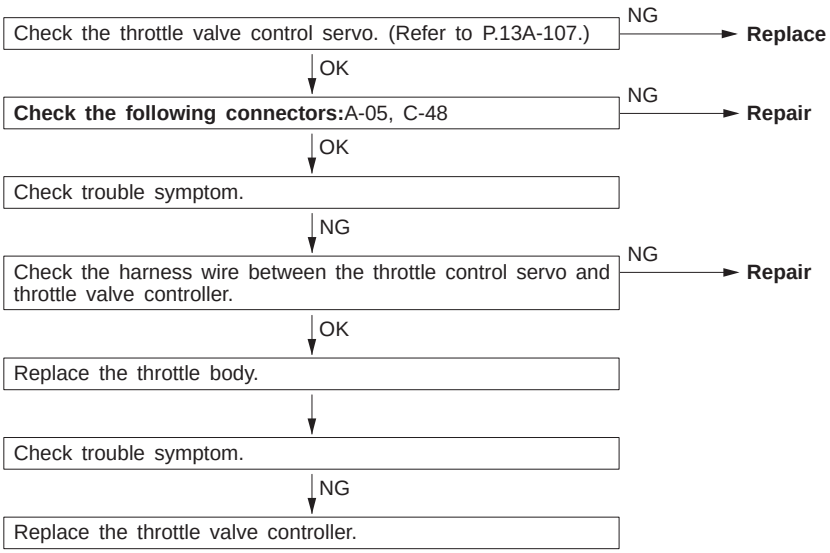
Code No.89 Abnormal fuel pressure system	Probable cause
Range of check ● Engine: Idling (during stoichio-feedback operation) Set conditions ● Fuel injection correction value remains excessively low for ten seconds or more. or ● Fuel injection correction value remains excessively high for ten seconds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



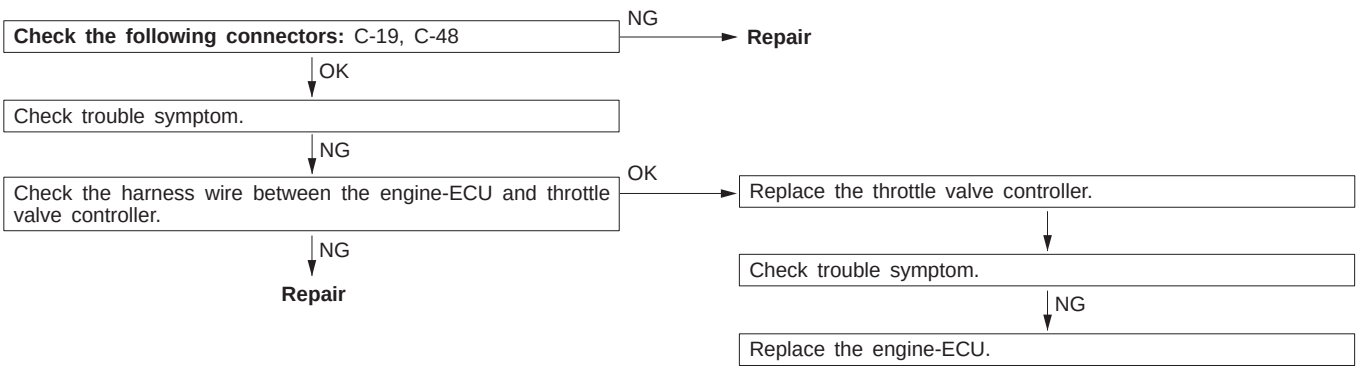
Code No.91 Electronic-controlled throttle valve system	Probable cause
Range of check ● Ignition switch: ON ● Error in communication from the engine-ECU to throttle valve controller Set conditions ● Output voltage of the throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more)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



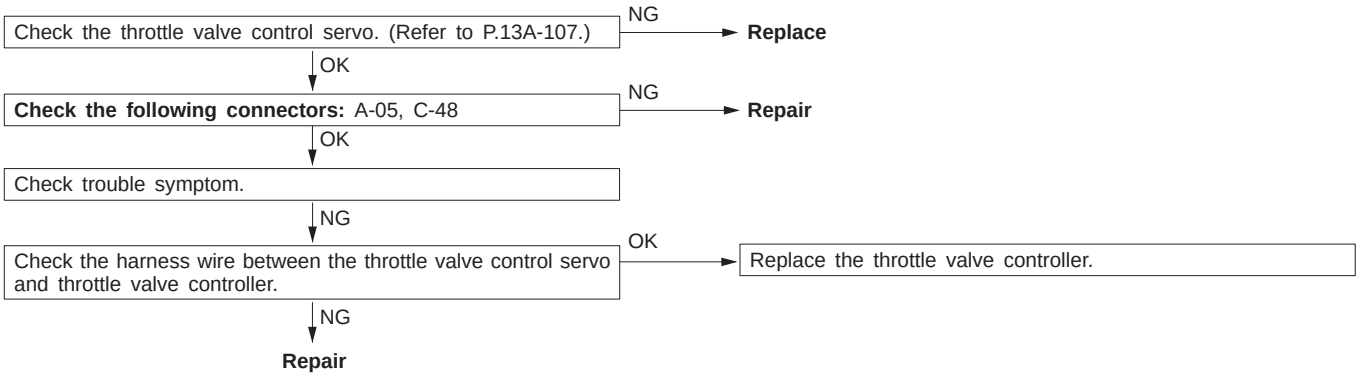
Code No.92 Throttle valve position feedback system	Probable cause
The throttle valve controller determines if a failure is present, and sends its result to the engine-ECU. Range of check ● Ignition switch: ON ● System voltage: 8 V or more Set condition ● Motor position feedback system is defective (System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



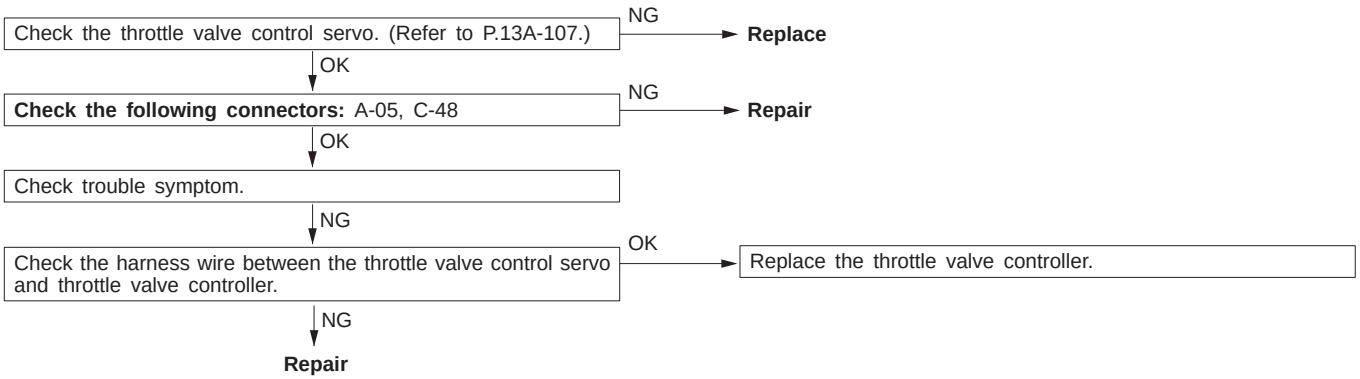
Code No.94 Communication line system with throttle valve controller	Probable cause
Range of check ● Ignition switch: ON ● System voltage: 8 V or more ● Engine: not cranking Set condition ● System detects an error in communication line between the engine-ECU and throttle valve controller.	● Short circuit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



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



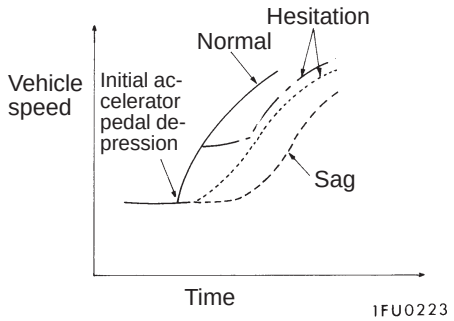
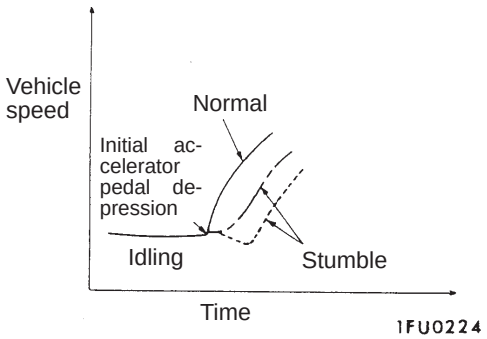
Code No.99 Malfunction in throttle valve control servo motor (2nd motor) system	Probable cause
Range of check ● Throttle valve control servo relay: ON ● System voltage: 8V or more Set conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferes with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open-circuited.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in the throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-41
	Communication with engine-ECU only is not possible.	2	13A-42
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13A-42
	The engine warning lamp remains illuminating and never goes out.	4	13A-43
Starting	No initial combustion (starting impossible)	5	13A-43
	Initial combustion but no complete combustion (starting impossible)	6	13A-45
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-47
	Idling speed is high. (Improper idling speed)	8	13A-49
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-50
	When the engine is hot, it stalls at idling. (Die out)	10	13A-51
	The engine stalls when starting the car. (Pass out)	11	13A-53
	The engine stalls when decelerating.	12	13A-54
Driving	Hesitation, sag or stumble	13	13A-55
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-56
	The feeling of impact or vibration when decelerating	15	13A-57
	Knocking	16	13A-57
Dieseling		17	13A-57
Too high CO and HC concentration when idling		18	13A-58
Low alternator output voltage (approx. 12.3 V)		19	13A-59
Fans (radiator fan, A/C condenser fan) are inoperative		20	13A-60
GDI ECO indicator lamp	GDI ECO indicator lamp does not illuminate.	21	13A-61
	GDI ECO indicator lamp remains illuminated and does not go off.	22	13A-61

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

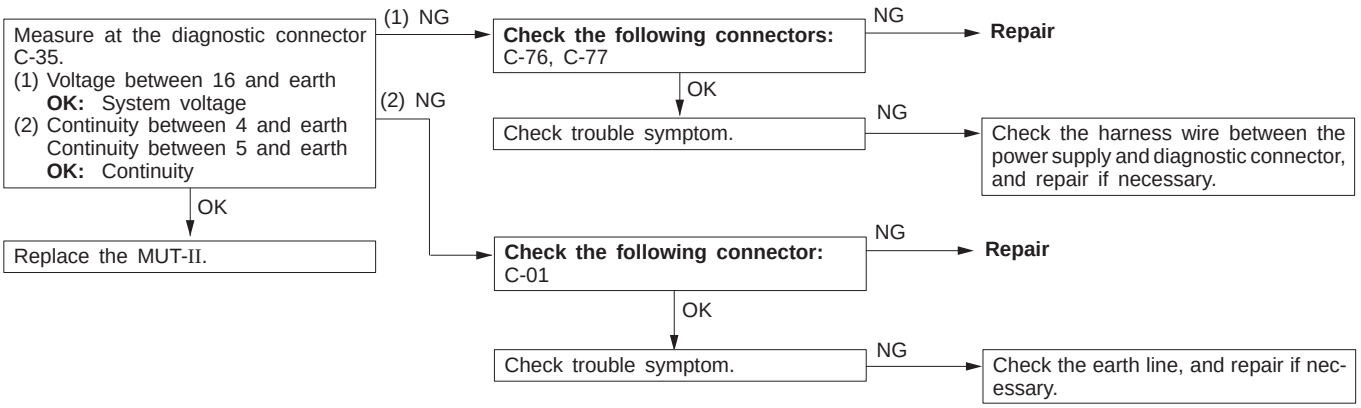
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.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

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

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

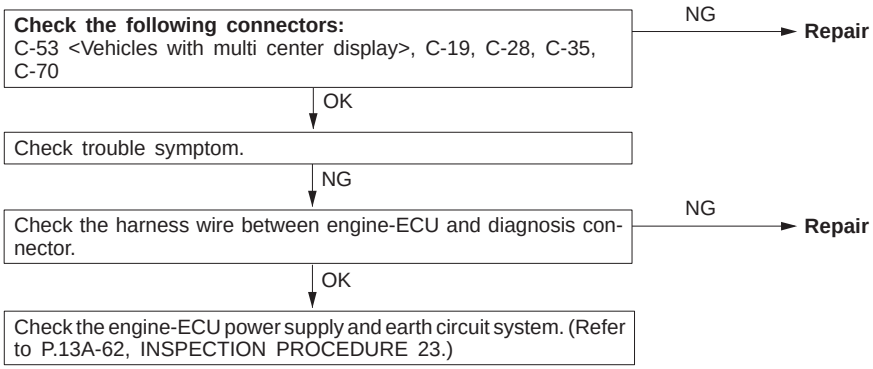
INSPECTION PROCEDURE 1

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



INSPECTION PROCEDURE 2

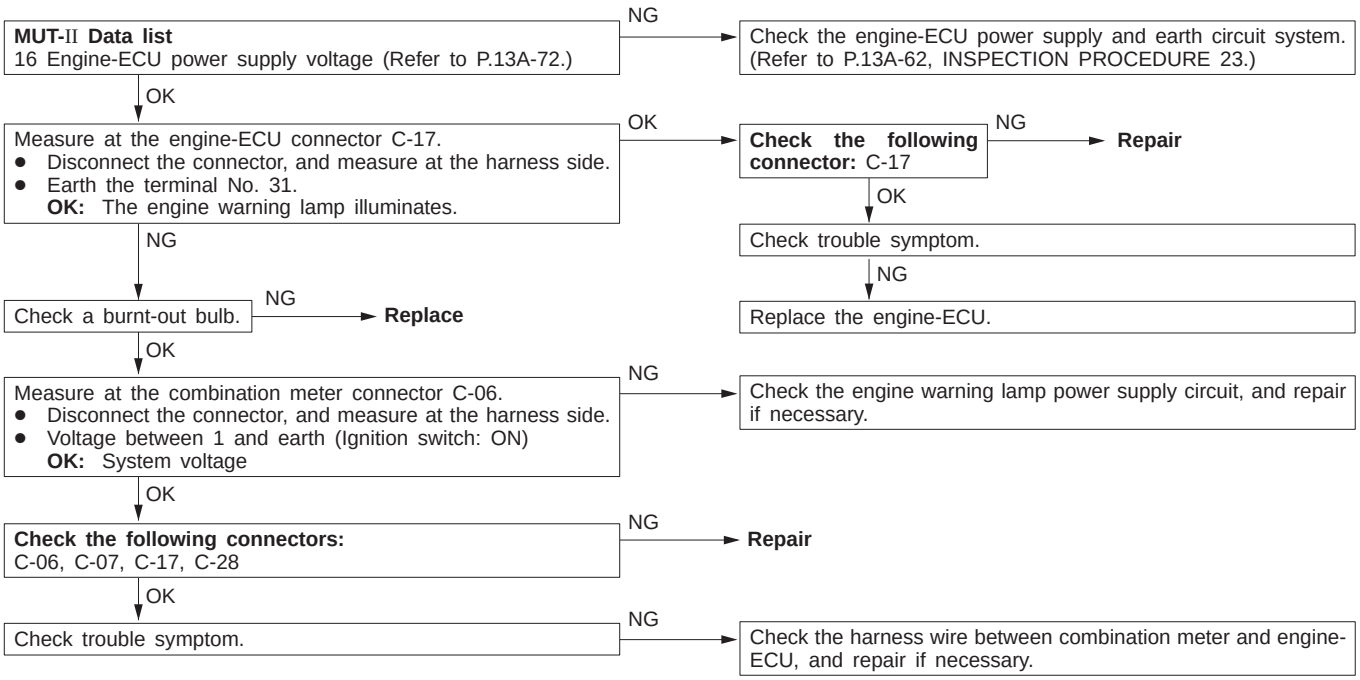
MUT-II communication with engine-ECU is impossible.	Probable cause
This may be caused by malfunction of engine-ECU power supply circuit and earth circuit.	• Malfunction of engine-ECU power supply circuit • Malfunction of engine-ECU • Open circuit between the engine-ECU and diagnosis connector



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

INSPECTION PROCEDURE 3

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



INSPECTION PROCEDURE 4

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES
- No ↓

Measure at the combination meter connector C-07.
- Disconnect the connector, and measure at the harness side.
- Disconnect the engine-ECU connector
- Continuity between 46 and earth
  OK: No continuity

- NG → Check the harness wire between combination meter and engine-ECU connector, and repair if necessary.
- OK ↓

Replace the engine-ECU.

INSPECTION PROCEDURE 5

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

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
16 System voltage (Refer to P.13A-72.)
- NG → Check the engine control relay and ignition switch-IG system. (Refer to P.13A-62, INSPECTION PROCEDURE 24.)
- OK ↓

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

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13A-76.)
- NG → Check the fuel pump (low pressure) system. (Refer to P.13A-66, INSPECTION PROCEDURE 28.)
- OK ↓

MUT-II Data list
22 Crank angle sensor (Refer to P.13A-72.)
- NG → Check the crank angle sensor system. (Refer to P.13A-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 22.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

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OK

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-72.)

NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)

OK

Inspect engine start ability by cranking the engine while the accelerator pedal is slightly depressed.

OK → Clean around the throttle valve. (Refer to P.13A-92.)

NG

Check fuel leakage. (Refer to P.13A-99.)

NG → **Repair**

OK

Measure low fuel pressure between the fuel pump (low pressure) and fuel pump (high pressure). (Refer to P.13A-95.)

NG → **Repair**

OK

Measure at ignition coil connectors A-09, A-10, A-11, A-12.
- Connect the connector.
- Connect a timing light to the No.1 terminal of each connector in turn.
  (Engine cranking)
  OK: The timing light flashes.

NG → Check abnormal fuel combustion system. (Refer to P.13A-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 44.)

OK

Check ignition timing while the engine is cranking.
OK: Approx. 5° BTDC

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

OK

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

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

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

NG → Replace the ignition coil.

OK

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

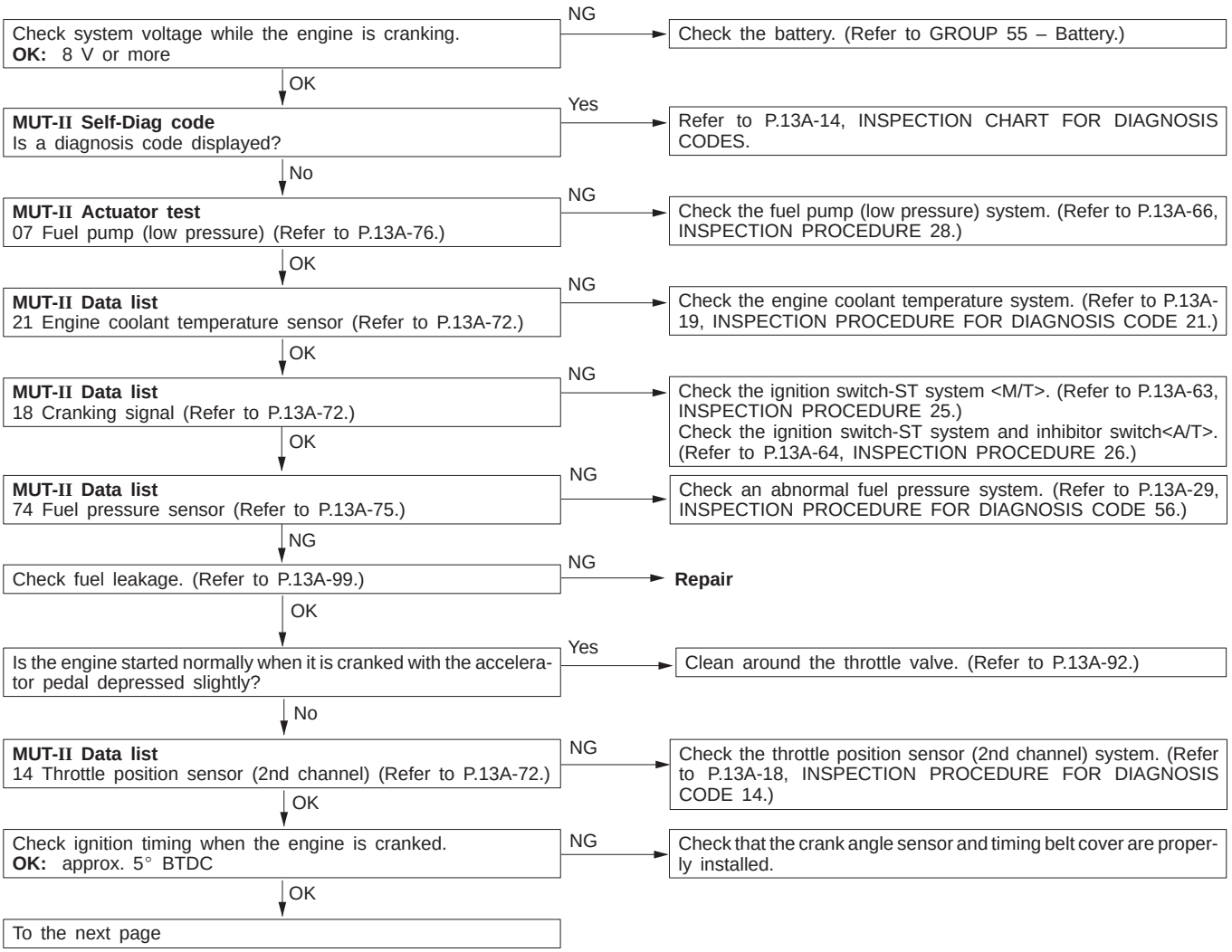
OK

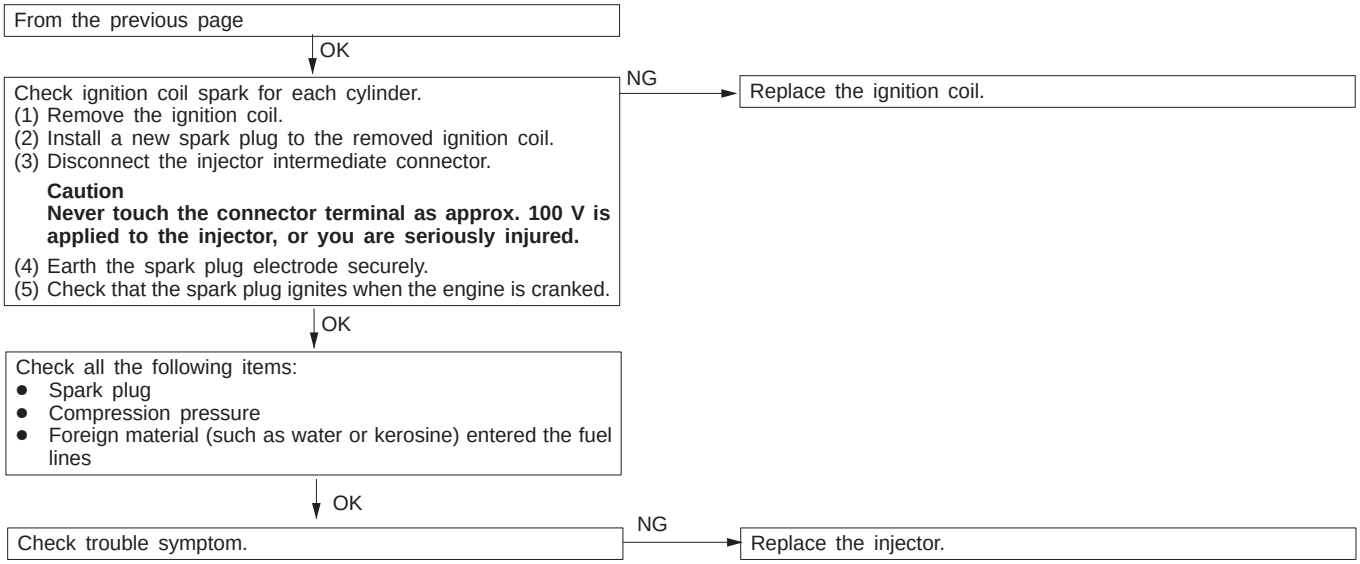
Check trouble symptom.

NG → Replace the injector.

INSPECTION PROCEDURE 6

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

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OK
Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.
Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
NG
Replace the ignition coil.
OK
Check all the following items:
● Spark plug
● Compression pressure
● Foreign material (such as water or kerosine) entered the fuel lines
OK
Check trouble symptom.
NG
Replace the injector.

INSPECTION PROCEDURE 7

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

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does the engine idle speed fluctuates excessively (excessive hunting)?
- Yes → Clean around the throttle valve. (Refer to P.13A-92.)
- No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-72.)
- NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-71.)
- NG → Check the intake air temperature sensor system. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-73.)
- NG → Check the barometric pressure sensor system. (Refer to P.13A-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-76.)
- NG → Check the purge control solenoid valve system. (Refer to P.13A-68, INSPECTION PROCEDURE 30.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV when the engine is suddenly raced
- NG → Check the oxygen sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
- OK ↓

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OK

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

NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-97.)

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

NG → **Repair**

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-73.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-69, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-73.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-69, INSPECTION PROCEDURE 32.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-73.)

NG → Check the ignition switch-ST and inhibitor switch. <A/T> (Refer to P.13A-64, INSPECTION PROCEDURE 26.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-74.)

NG → Check the stop lamp switch. (Refer to P.13A-70, INSPECTION PROCEDURE 33.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-73.)

NG → Check the small lamp switch system. (Refer to P.13A-70, INSPECTION PROCEDURE 34.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)

NG → Check the EGR valve. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)

OK

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

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

OK

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

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

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

NG → Replace the ignition coil.

OK

Clean around the throttle valve. (Refer to P.13A-92.)

Check trouble symptom.

NG

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

INSPECTION PROCEDURE 8

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13A-72.)
- NG → Check the throttle position sensor (2nd channel). (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-76.)
- NG → Check the purge control solenoid valve. (Refer to P.13A-68, INSPECTION PROCEDURE 30.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13A-73.)
- NG → Check the A/C switch and A/C relay system. (Refer to P.13A-69, INSPECTION PROCEDURE 32.)
- OK ↓

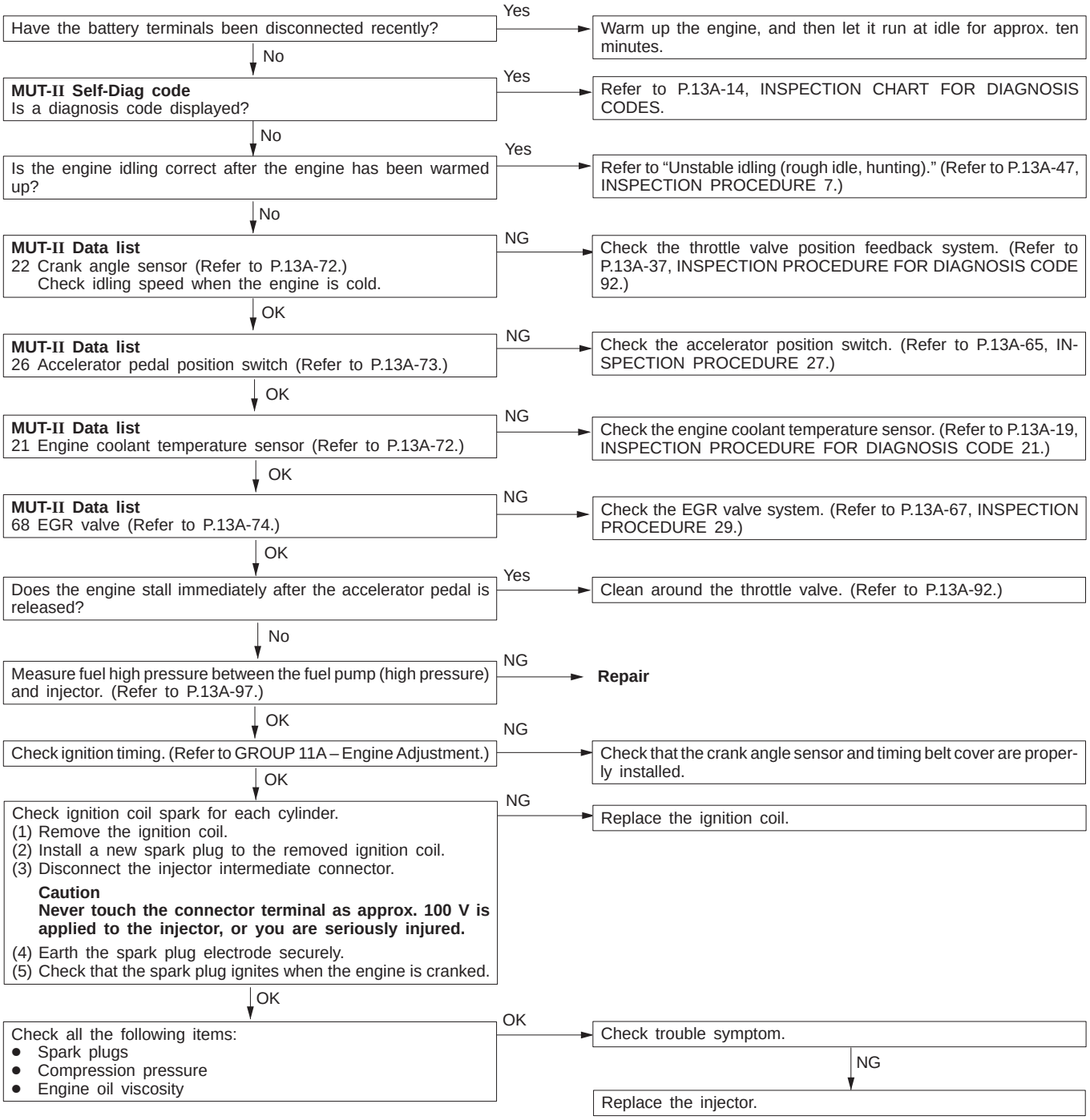
MUT-II Data list
29 Inhibitor switch (Refer to P.13A-73.)
- NG → Check the ignition switch-ST and inhibitor switch <A/T>. (Refer to P.13A-64, INSPECTION PROCEDURE 26.)
- OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-74.)
- NG → Check the stop lamp switch system. (Refer to P.13A-70, INSPECTION PROCEDURE 33.)
- OK ↓

- Clean around the throttle valve. (Refer to P.13A-92.)
- Adjust the throttle position sensor. (Refer to P.13A-92.)

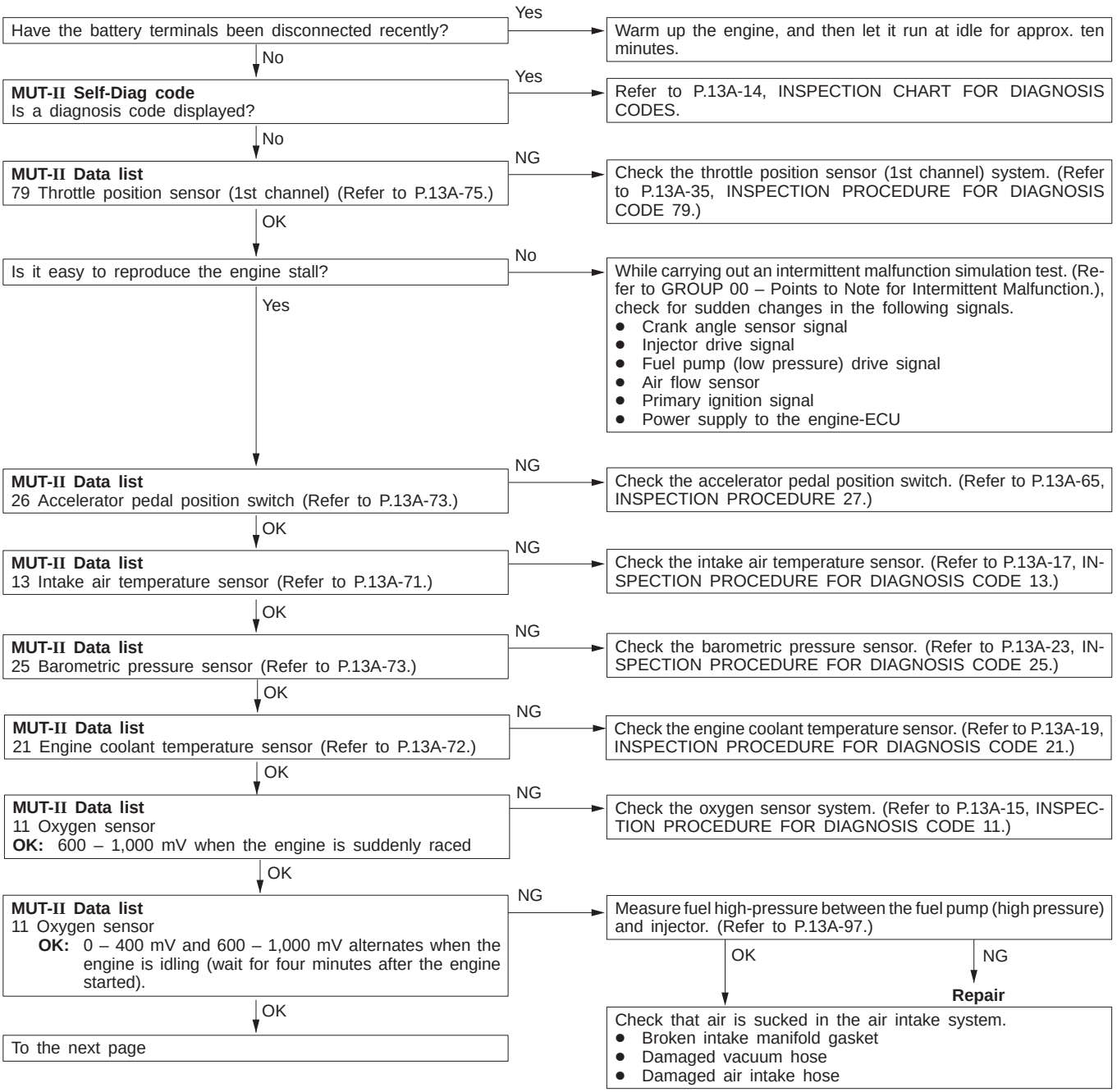
INSPECTION PROCEDURE 9

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



INSPECTION PROCEDURE 10

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



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↓ OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-73.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-69, INSPECTION PROCEDURE 31.)

↓ OK

MUT-II Data list
28 A/C switch (Refer to P.13A-73.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-69, INSPECTION PROCEDURE 32.)

↓ OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13A-73.)

NG → Check the ignition switch-ST and inhibitor switch <A/T>. (Refer to P.13A-64, INSPECTION PROCEDURE 26.)

↓ OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-73.)

NG → Check the small lamp switch system. (Refer to P.13A-70, INSPECTION PROCEDURE 34.)

↓ OK

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13A-73.)

NG → Check the air flow sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 12.)

↓ OK

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)

NG → Check the EGR valve system. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)

↓ OK

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

Yes → Clean around the throttle valve. (Refer to P.13A-92.)

↓ No

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

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

↓ OK

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

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

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

NG → Replace the ignition coil.

↓ OK

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

INSPECTION PROCEDURE 11

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
→ Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
↓ No

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)
→ NG → Check the EGR valve system. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)
↓ OK

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-76.)
→ NG → Check the purge control solenoid valve system. (Refer to P.13A-68, INSPECTION PROCEDURE 30.)
↓ OK

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

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

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

→ NG → Replace the ignition coil.
↓ OK

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

INSPECTION PROCEDURE 12

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

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
- NG → Check the accelerator pedal position switch. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)
- NG → Check the EGR valve system. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)
- OK ↓

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

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

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

Check all the following items:
- Spark plug
- Clean around the throttle valve (Refer to P.13A-92.)

INSPECTION PROCEDURE 13

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

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

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
NG → Check the accelerator pedal position switch. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-71.)
NG → Check the intake air temperature sensor. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-73.)
NG → Check the barometric pressure sensor. (Refer to P.13A-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-38, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 99.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-97.)
OK ↓

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

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-74.)
NG → Check the EGR valve system. (Refer to P.13A-67, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-76.)
NG → Check the purge control solenoid valve. (Refer to P.13A-68, INSPECTION PROCEDURE 30.)
OK ↓

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OK

Measure high fuel pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-97.)

NG → **Repair**

OK

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

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

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

NG → Replace the ignition coil.

OK

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

OK → Check trouble symptom.

NG → Replace the injector.

INSPECTION PROCEDURE 14

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

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

Yes → (Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.)

No

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)

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

OK

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

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

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

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

NG → Replace the ignition coil.

INSPECTION PROCEDURE 15

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-75.)
- NG → Check the throttle valve position feedback system. (Refer to P.13A-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-73.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13A-65, INSPECTION PROCEDURE 27.)
- OK ↓

Clean around the throttle valve. (Refer to P.13A-92.)

INSPECTION PROCEDURE 16

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does knocking occur when the vehicle is driven with the detonation sensor disconnected?
(At this time, use the MUT-II to check whether the ignition timing is retarded from when the detonation sensor connector is connected.)
- No → Check the detonation sensor system. (Refer to P.13A-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 31.)
- Yes ↓

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

INSPECTION PROCEDURE 17

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

Replace the injector.

INSPECTION PROCEDURE 18

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13A-14, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

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

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-72.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-71.)
NG → Check the intake air temperature sensor. (Refer to P.13A-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-73.)
NG → Check the barometric pressure sensor. (Refer to P.13A-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

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

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-97.)
NG → **Repair**
OK ↓

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

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

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

OK ↓
NG → Replace the ignition coil.

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

OK ↓

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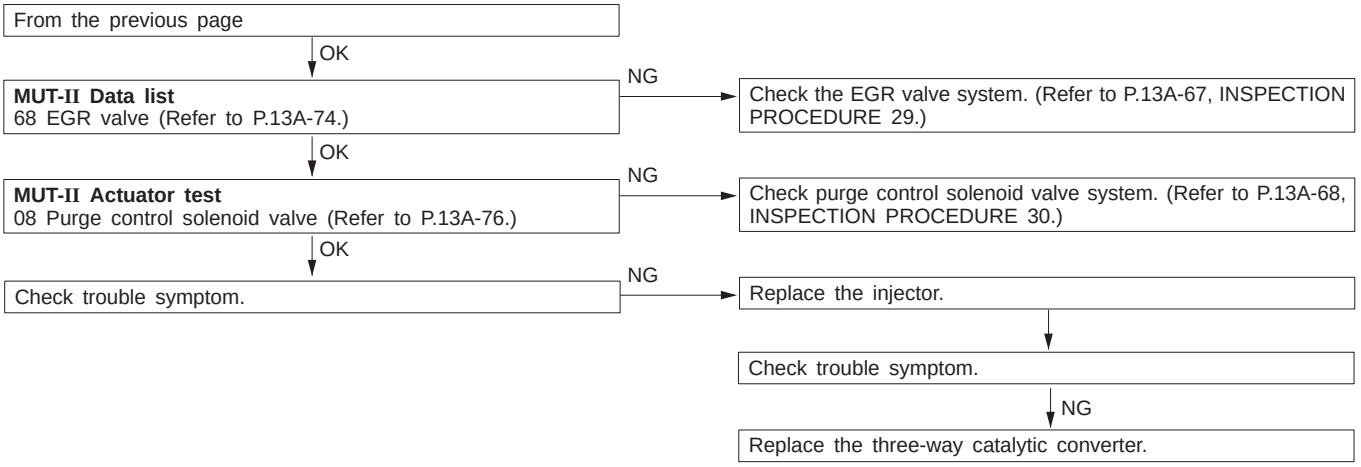
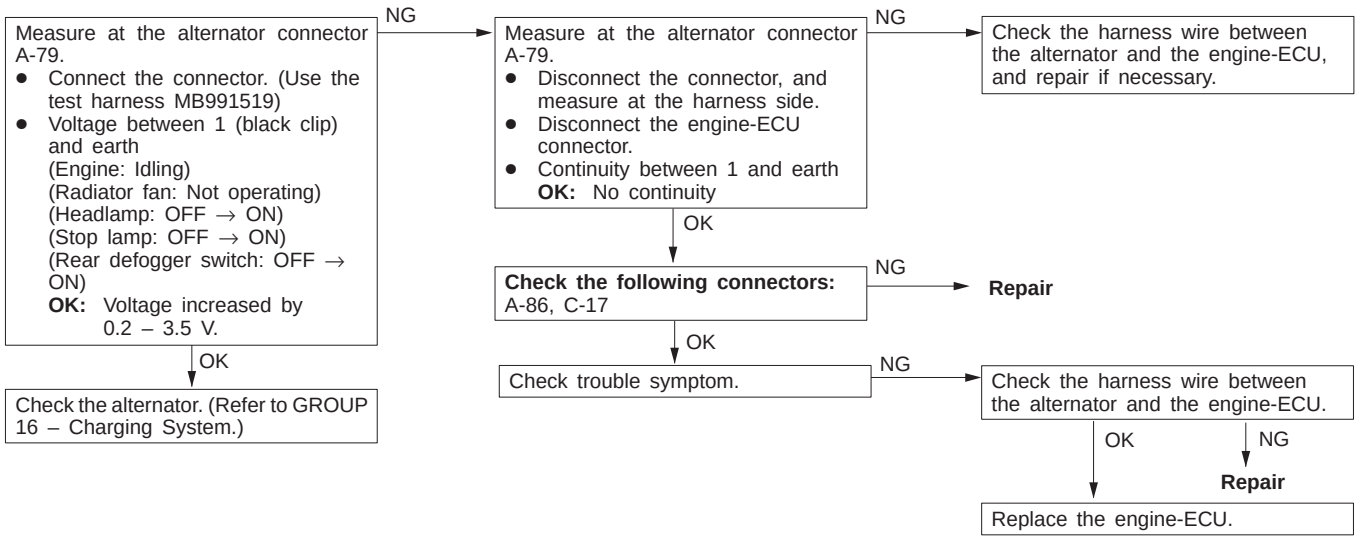


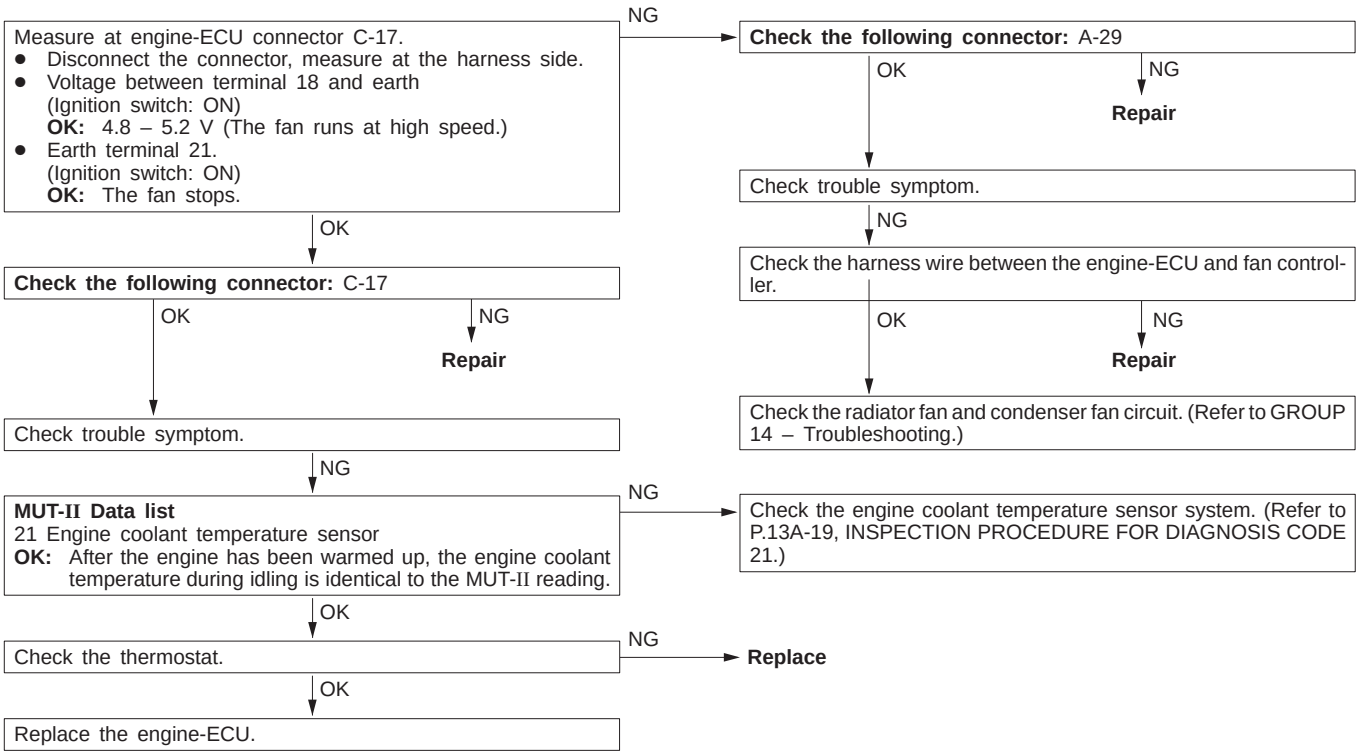
INSPECTION PROCEDURE 19

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



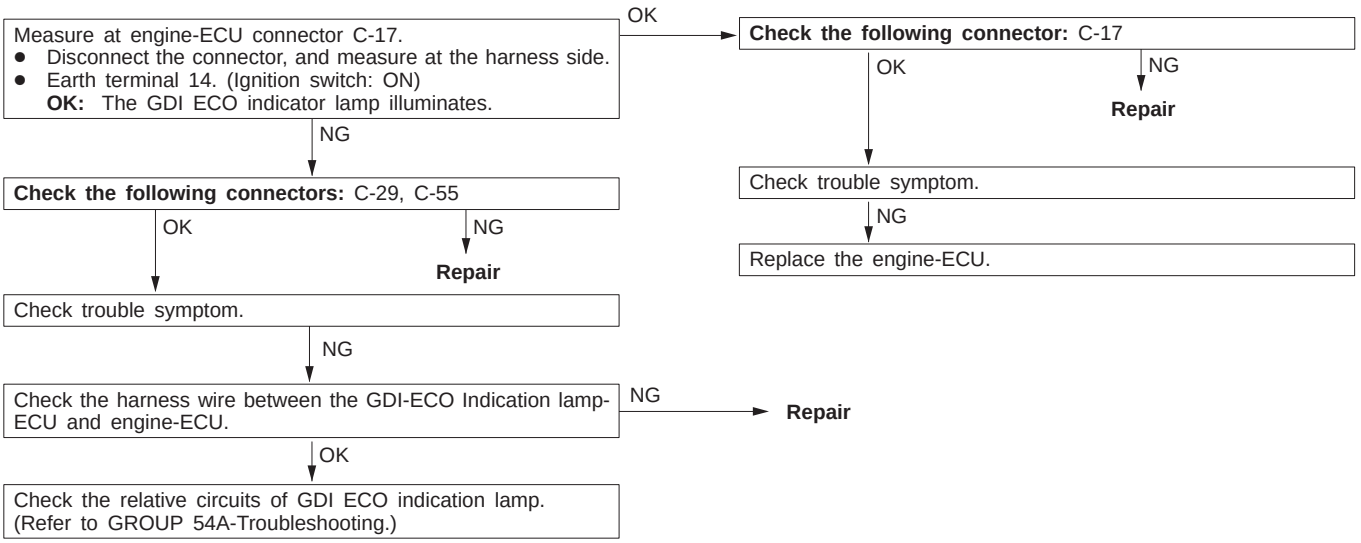
INSPECTION PROCEDURE 20

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



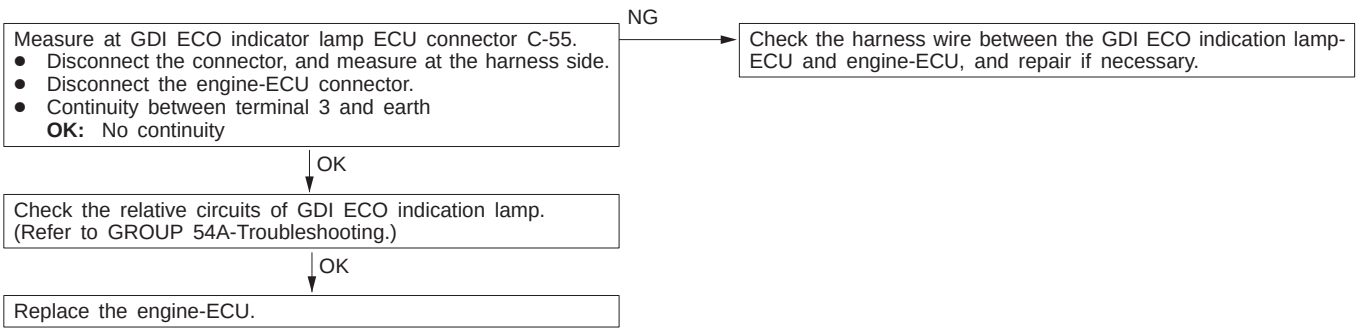
INSPECTION PROCEDURE 21

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



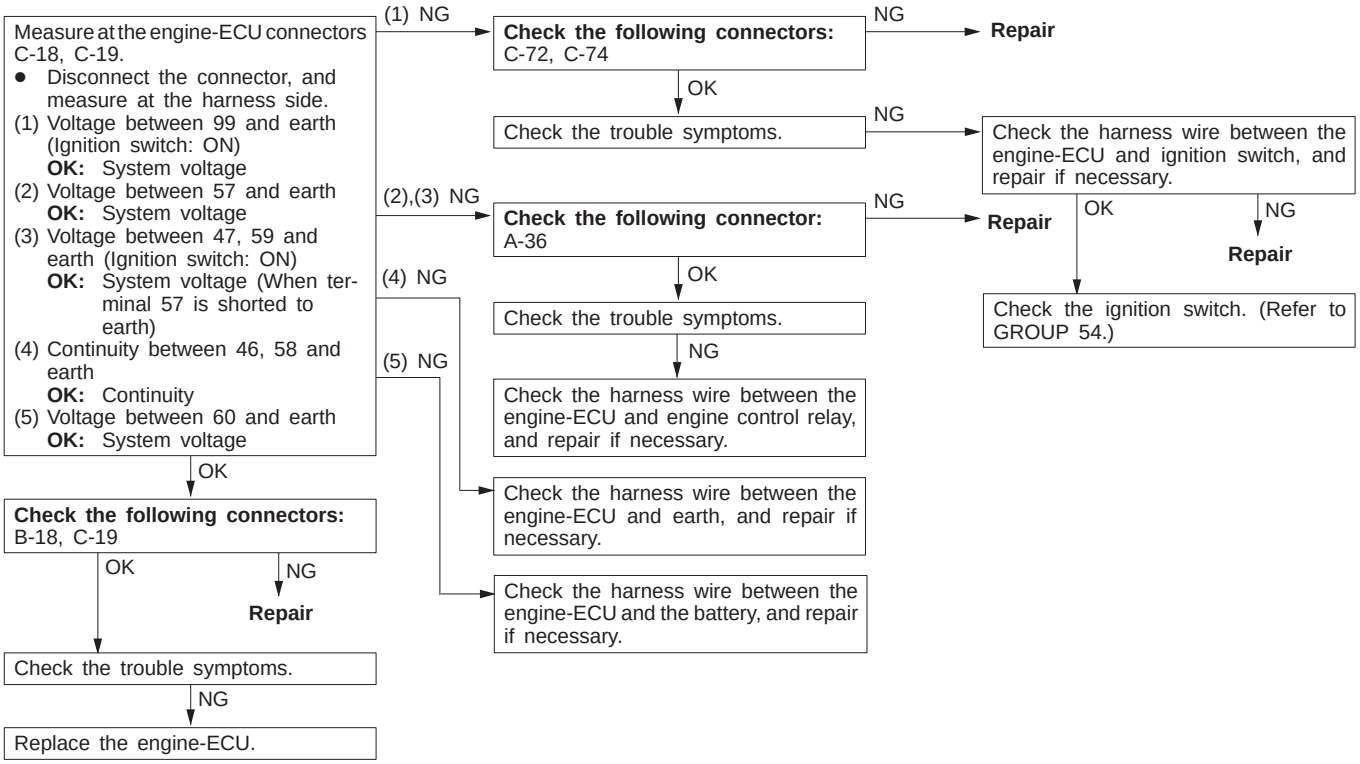
INSPECTION PROCEDURE 22

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



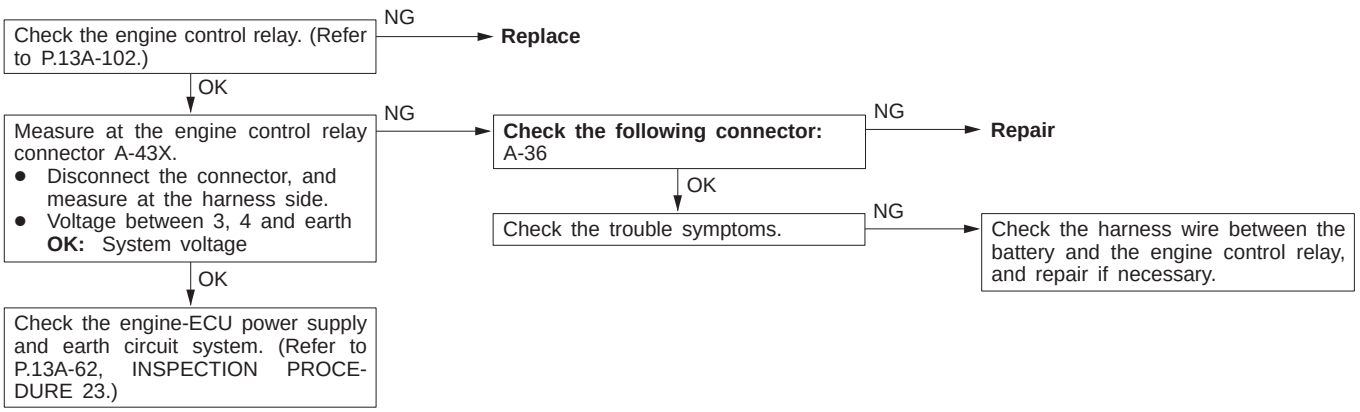
INSPECTION PROCEDURE 23

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



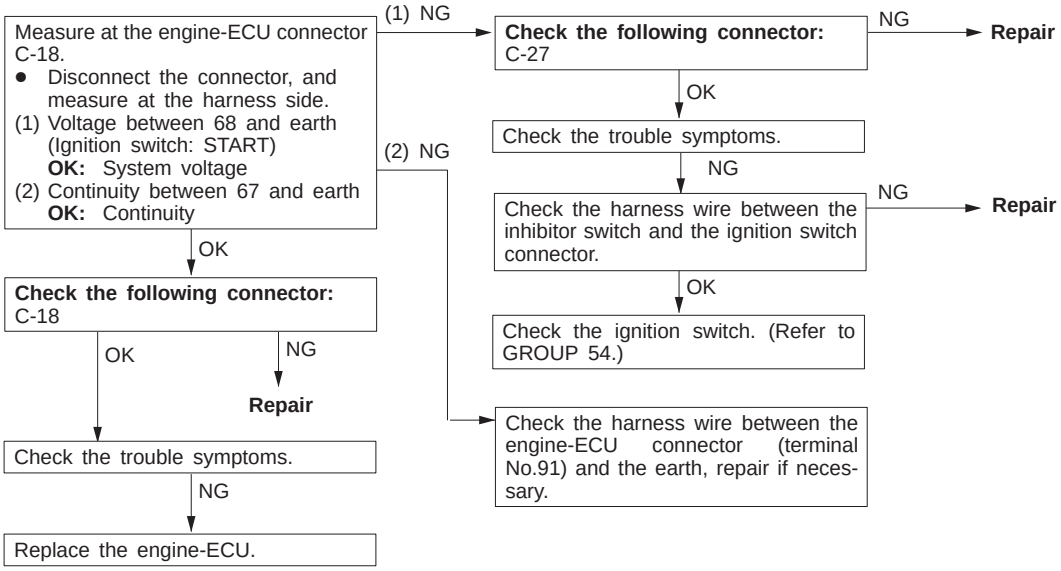
INSPECTION PROCEDURE 24

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



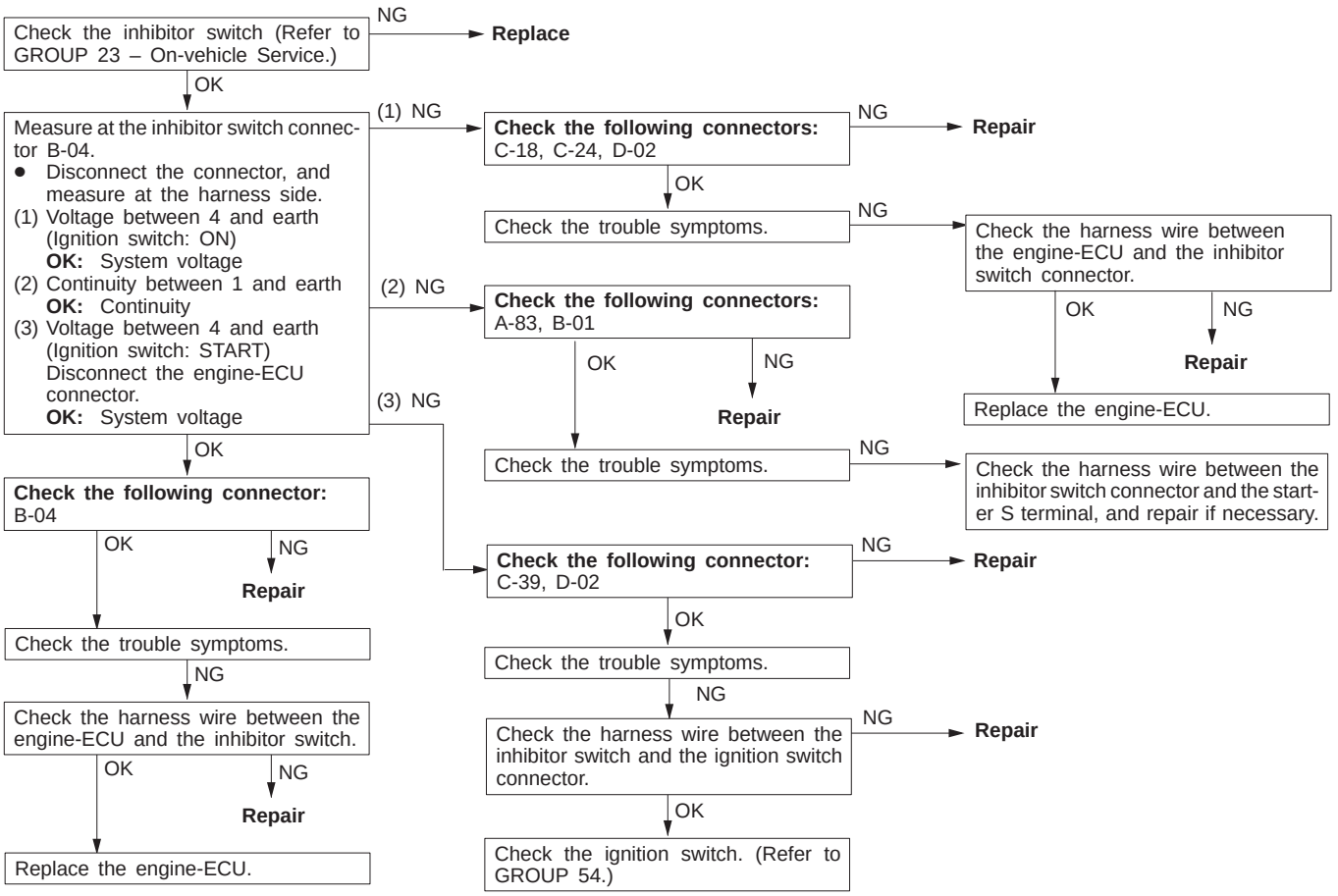
INSPECTION PROCEDURE 25

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



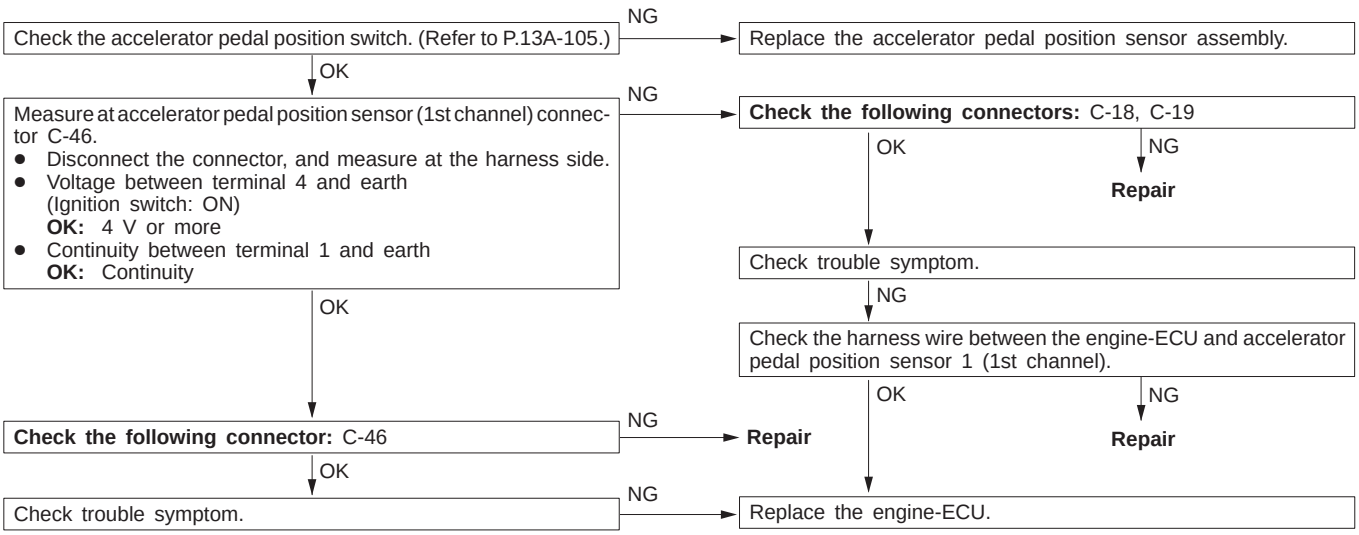
INSPECTION PROCEDURE 26

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



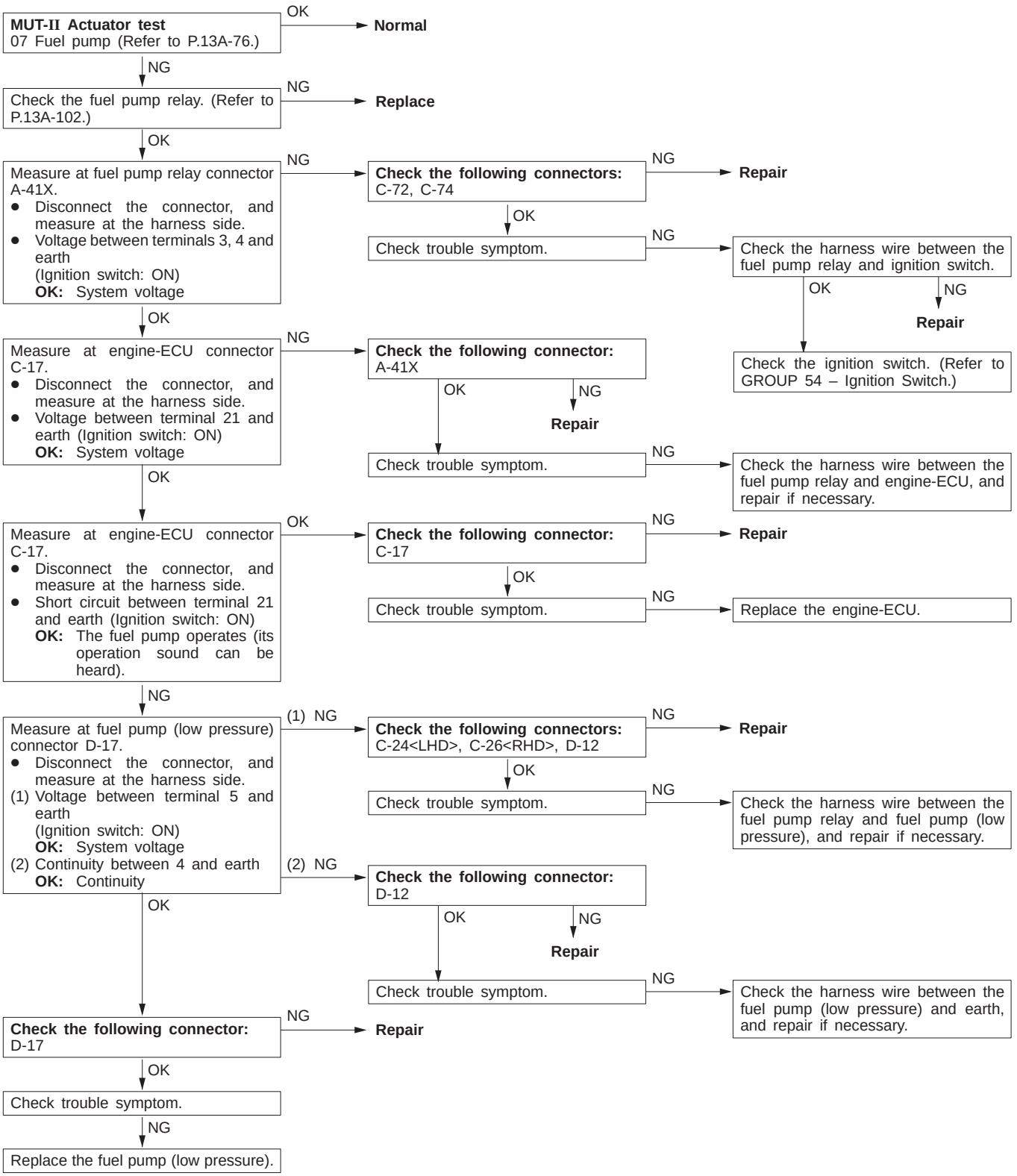
INSPECTION PROCEDURE 27

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



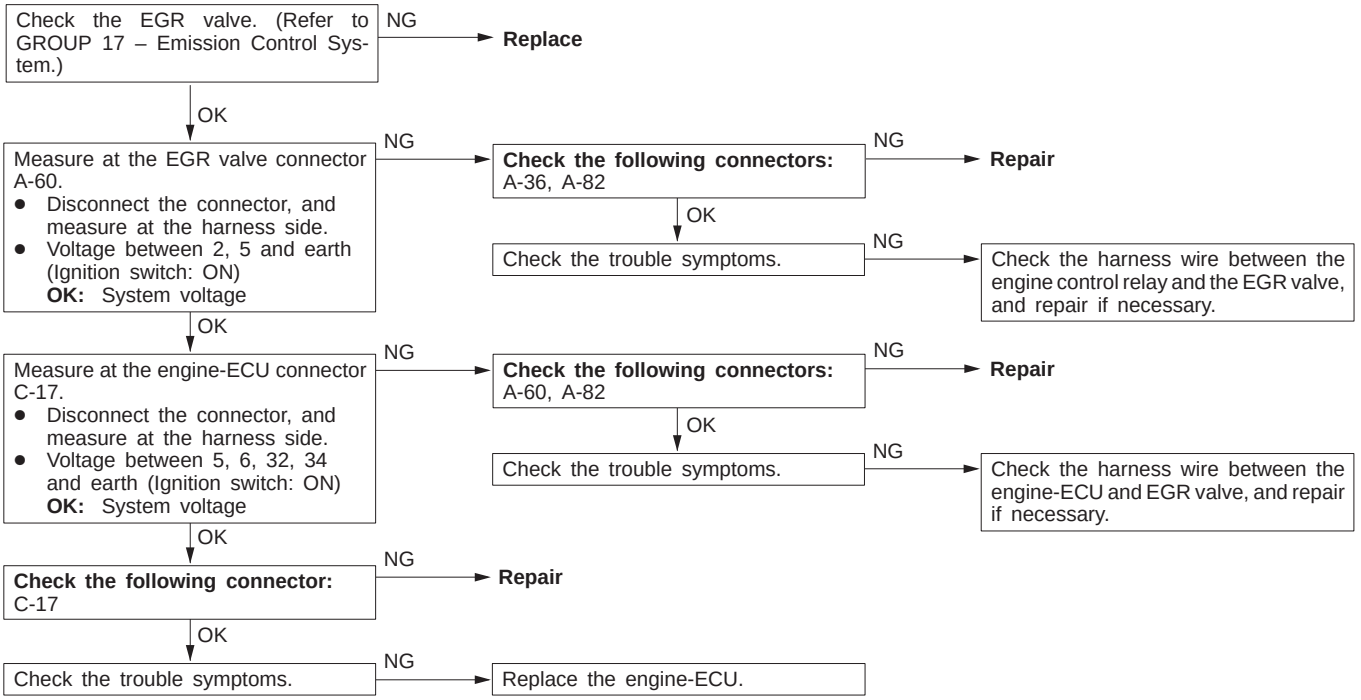
INSPECTION PROCEDURE 28

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



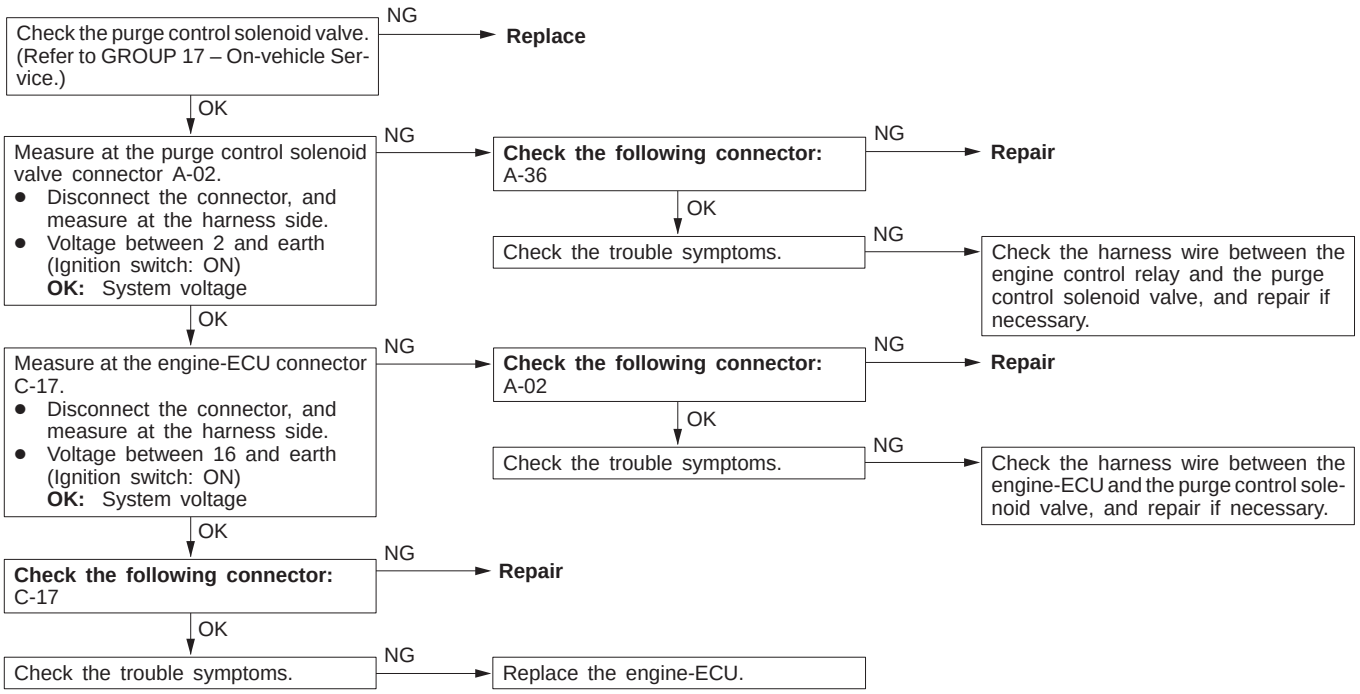
INSPECTION PROCEDURE 29

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



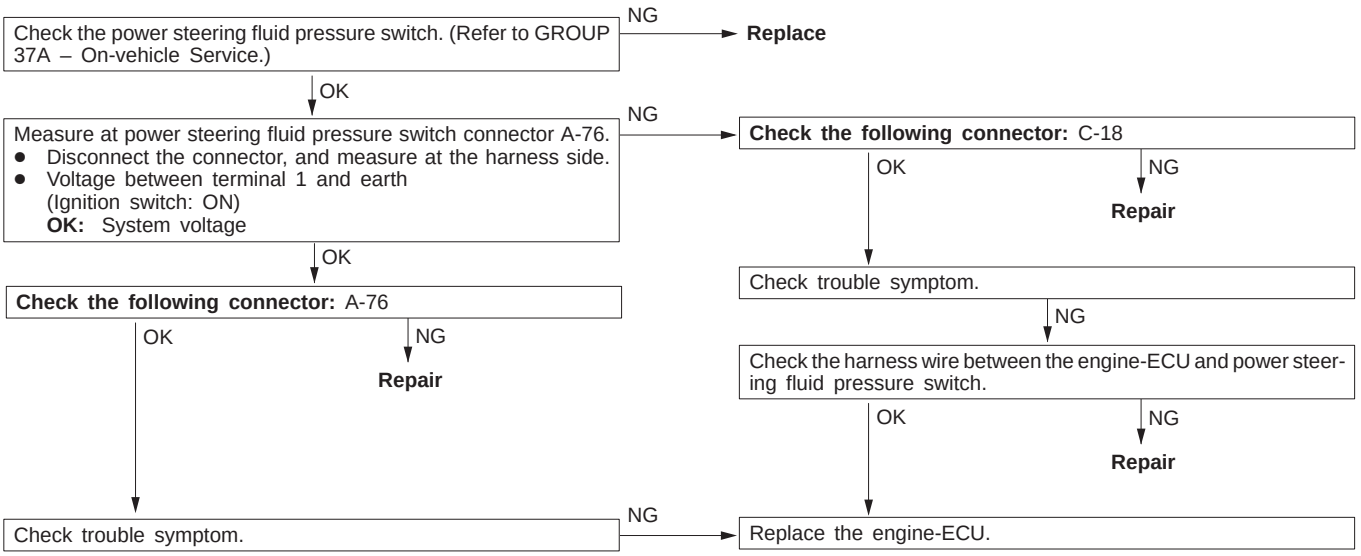
INSPECTION PROCEDURE 30

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



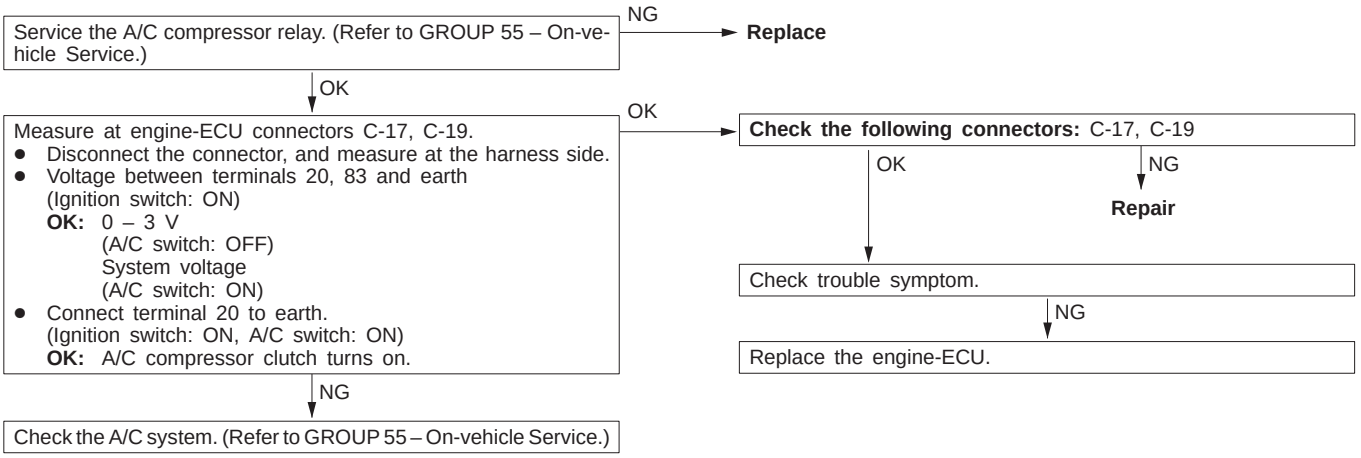
INSPECTION PROCEDURE 31

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



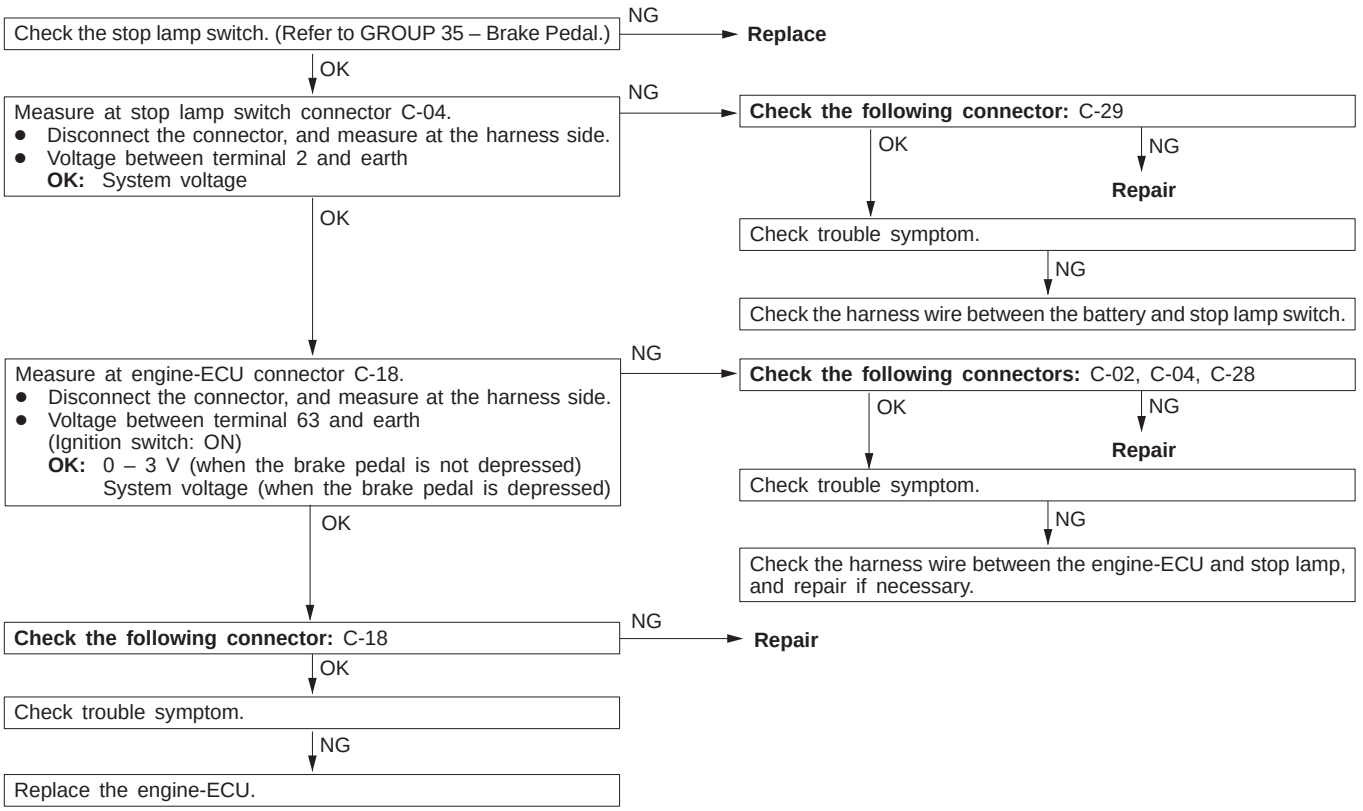
INSPECTION PROCEDURE 32

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



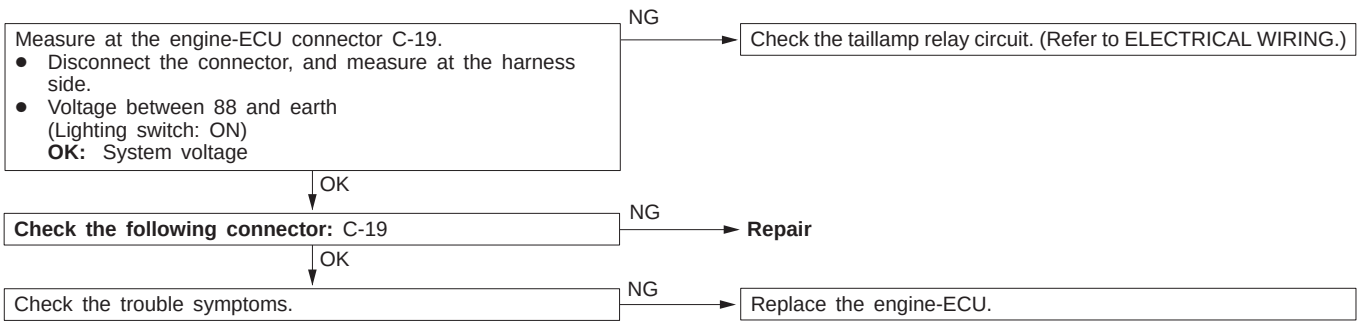
INSPECTION PROCEDURE 33

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



INSPECTION PROCEDURE 34

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



DATA LIST REFERENCE TABLE

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

NOTE
*1: Within four minutes after starting the engine
*2: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
*3: The accelerator pedal position switch normally turns off when the voltage of the accelerator pedal position sensor (1st channel) is 250 – 550 mV higher than the voltage at the idle position. If the accelerator pedal position switch turns back on after the accelerator pedal position sensor voltage has risen by 100 mV and the throttle valve has opened, the accelerator pedal position switch and the accelerator pedal position sensor (1st channel) need to be adjusted.

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	Engine: After warm-up	Idling	0 mV*1	Code No.11	13A-15
			Sudden racing	600 – 1,000 mV		
			2,500 r/min	400 mV or less ↔ 600 – 1,000 mV (alternates)		
12	Air flow sensor	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Idling	20 – 55 Hz	Code No.12	13A-16
			2,500 r/min	65 – 85 Hz		
			Racing	Frequency increases in response to racing.		
13	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: –20°C	–20°C	Code No.13	13A-17
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (2nd channel)	● Engine coolant temperature: 80 – 95°C ● Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	4,000 – 4,800 mV	Code No.14	13A-18
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	100 – 1,100 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No.23	13A-62
18	Cranking signal (Ignition switch – ST)	Transmission: Neutral (A/T: P range)	Engine: Stopped	OFF	Procedure No.25 <M/T> Procedure No.26 <A/T>	13A-63 <M/T> 13A-64 <A/T>
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: –20°C	–20°C	Code No.21	13A-19
			Engine coolant temperature: 0°C	0°C		
			Engine coolant temperature: 20°C	20°C		
			Engine coolant temperature: 40°C	40°C		
			Engine coolant temperature: 80°C	80°C		
22	Crank angle sensor	● Engine: cranking ● Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No.22	13A-20
		● Engine: Idling ● Accelerator pedal position switch: ON ● Transmission: Neutral (A/T: P range)	Engine coolant temperature: –20°C	1,200 – 1,400 r/min		
			Engine coolant temperature: 0°C	1,100 – 1,300 r/min		
			Engine coolant temperature: 20°C	1,000 – 1,200 r/min		
			Engine coolant temperature: 50°C	750 – 950 r/min		
			Engine coolant temperature: 80°C	550 – 850 r/min*1		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No.25	13A-23
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No.27	13A-65
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No.31	13A-69
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No.32	13A-69
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	Selector lever: P or N	P, N	Procedure No.26	13A-64
			Selector lever: D, 2, L or R	D, 2, L, R		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.34	13A-70
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No.12	13A-16
			3,000 r/min	OFF		
37	Volumetric efficiency	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Engine is idling	30 – 50%	–	–
			2,500 r/min	30 – 50%		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	● Engine: Cranking [reading is possible at 2,000 r/min or less] ● Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	–	–

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time *2	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Idling	0.5 – 0.7 ms*1	Code No.41	13A-25
			2,500 r/min	0.4 – 0.8 ms		
			Sudden racing	Increases		
44	Ignition advance	● Engine: After warm-up ● Set a timing light.	Idling	12 – 20°BTDC *2	Code No.44	13A-27
			2,500 r/min	20 – 40°BTDC		
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.32	13A-69
			A/C switch: ON	ON (compressor clutch is operating)		
66	Brake vacuum sensor	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Stop the engine from idling speed, and then depress the brake pedal several times with the ignition switch on.	Displayed pressure increases.	Code No.66	13A-32
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.33	13A-70
			Brake pedal: Released	ON		
68	EGR valve	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Idling	0 – 15 STEP	Procedure No.29	13A-67
			2,500 r/min	0 – 10 STEP		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
74	Fuel pressure sensor	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	After 3 minutes have passed at idling condition	4 – 6.9 MPa	Code No.56	13A-29
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	700 – 1,400 mV	Code No.77	13A-33
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,100 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	13A-34
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,100 mV or more		
79	Throttle position sensor (1st channel)	● Engine coolant temperature: 80 – 95°C ● Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	450 – 800 mV	Code No.79	13A-35
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	3,900 – 4,900 mV		
		Engine: After warm-up, idling	No load	450 – 1,000 mV		
			A/C switch: OFF → ON	Increases by 100 – 600 mV.		
			Selector lever: N → D range	Increases by 0 – 200 mV.		
99	Fuel injection mode	Engine: After warm up	Idling (for several minutes after engine start)	Lean compression	–	–
			2,500 r/min	Stoichio metric feedback		
			Sudden racing after idle position	Open loop		

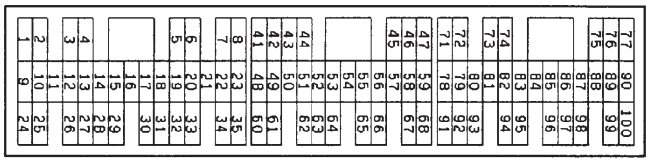
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. 41	13A-25
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 28	13A-66
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Procedure No. 30	13A-68
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Engine: Idling Timing light is set	5°BTDC	–	–
21	Fan controller	Drive the fan motor	Ignition switch: ON	The fan motor operates	Procedure No.20	13A-60
34	Electronic-controlled throttle valve system	Close the throttle valve fully	Ignition switch: ON	Operation sound can be heard	Code No.91	13A-36

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



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			
6	EGR valve (C)	Ignition switch: Immediately after turning ON		5 – 8 V (fluctuates for approx. three seconds)
5	EGR valve (D)			
34	EGR valve (A)			
32	EGR valve (B)			
8	Alternator G terminal	• Engine: Warm up, and then idling • Radiator fan: not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage increases by 0.2 – 3.5 V
14	GDI ECO indicator lamp	Engine: idling		0 – 3 V
		Engine: Depress the accelerator pedal suddenly from the idle speed.		System voltage
16	Purge control solenoid valve	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON	Engine: stopped	System voltage
			Engine: Start the engine, and then increase engine speed up to 3,500 r/min.	Voltage decreases.
18	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	• Engine: idling • A/C switch: OFF → ON (Compressor is operating)		System voltage, or changes from momentarily 6 V or more to 0 – 3 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
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	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
52	Alternator FR terminal	• Engine: Warm up, and then idling • Radiator fan: not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage decrease
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

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
57	Engine control relay	Ignition switch: OFF		System voltage
		Ignition switch: ON		0 – 3 V
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
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	Engine: Warm up, and then hold the engine speed at 2,500 r/min (Use a digital voltmeter).		0 V ↔ 0.8 V alternates
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.	4.0 – 4.8 V
			Depress the accelerator pedal fully.	0.1 – 1.1 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 – 1 V
			Depress the accelerator pedal slightly.	4 V or more
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward.		0 V ↔ Battery voltage (alternates repeatedly)

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
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 heater	Engine: Idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V
94	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.935 – 1.135 V
			Depress the accelerator pedal fully.	4.1 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.
97	A/C thermo sensor	● Temperature at sensing portion: Approx. 25°C ● Ignition switch: ON		2.0 – 2.9 V
99	Ignition switch – IG	Ignition switch: ON		System voltage

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

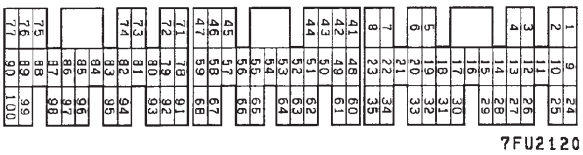
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   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

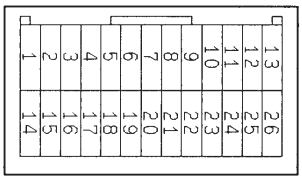


Terminal No.	Check item	Standard value, normal condition (check requirements)
6 – 47	EGR valve (C)	15 – 20 Ω (at 20°C)
5 – 47	EGR valve (D)	
34 – 47	EGR valve (A)	
32 – 47	EGR valve (B)	
16 – 47	Purge control solenoid valve	36 – 44 Ω (at 20°C)
44 – 72	Engine coolant temperature sensor	5.1 – 6.5 kΩ (when engine coolant temperature is 0°C)
		2.1 – 2.7 kΩ (when engine coolant temperature is 20°C)
		0.9 – 1.3 kΩ (when engine coolant temperature is 40°C)
		0.26 – 0.36 kΩ (when engine coolant temperature is 80°C)
46 – Body earth	Earth	Continuity (0 Ω)
58 – Body earth		
62 – 72	Intake air temperature sensor	5.3 – 6.7 kΩ (when intake air temperature is 0°C)
		2.3 – 3.0 kΩ (when intake air temperature is 20°C)
		1.0 – 1.5 kΩ (when intake air temperature is 40°C)
		0.30 – 0.42 kΩ (when intake air temperature is 80°C)
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)
79 – 72	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
89 – 47	Oxygen sensor heater control	11 – 18 Ω (at 20°C)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



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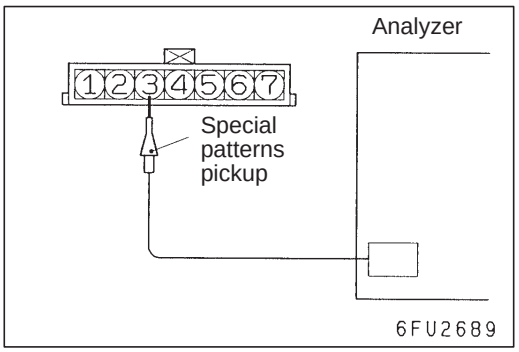
Terminal No.	Check items	Requirements		Normal value
1	Throttle valve control servo (A+)	• Ignition switch: ON • Accelerator pedal: Fully opened → fully closed		Decreases slightly from system voltage.
9	Throttle valve control servo (B+)			
14	Throttle valve control servo (A–)	• Ignition switch: ON • Accelerator pedal: Fully closed → fully opened		Decreases slightly (approx. 2 V) from system voltage.
15	Throttle valve control servo (B–)			
2	Power supply to throttle valve control servo	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor voltage	Ignition switch: ON		4.5 – 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.45 – 0.8 V
			Depress the accelerator pedal fully.	3.9 – 4.9 V
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.7 – 1.4 V
			Depress the accelerator pedal fully.	4 V or more
22	Ignition switch – IG	Ignition switch: ON		System voltage



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

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

Alternate Method (Test harness not available)

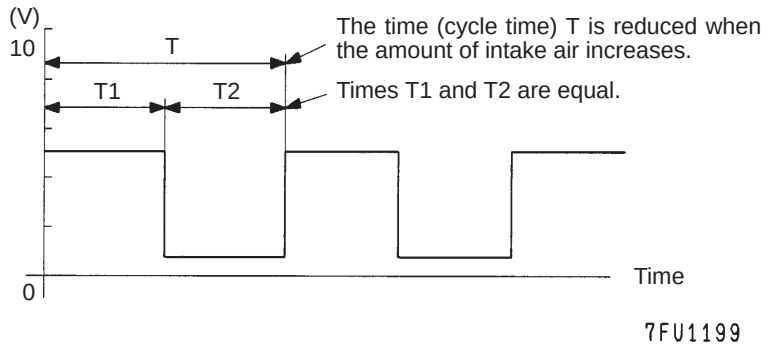
1. Connect the analyzer special patterns pickup to engine-ECU terminal 61.

Standard Wave Pattern

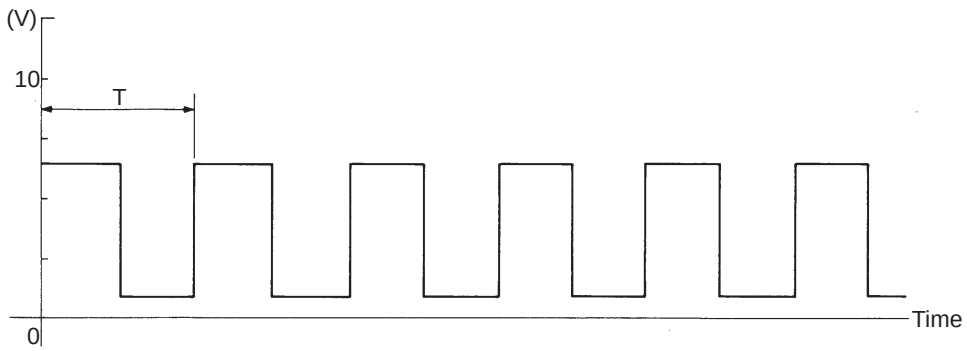
Observation conditions

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

Standard wave pattern

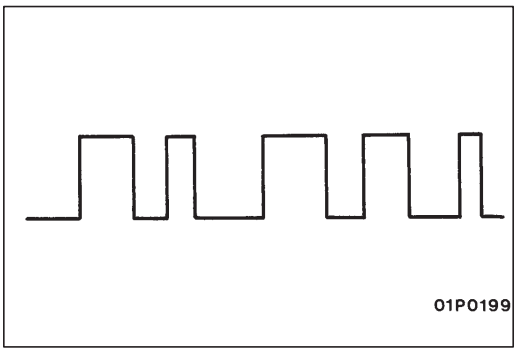


Observation conditions (from conditions above engine speed is increased by racing.)



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.

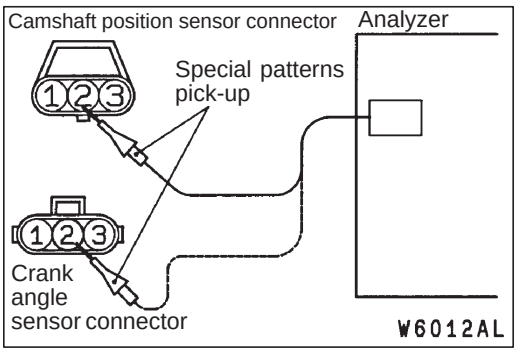
- Example 2

  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: MB991658) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

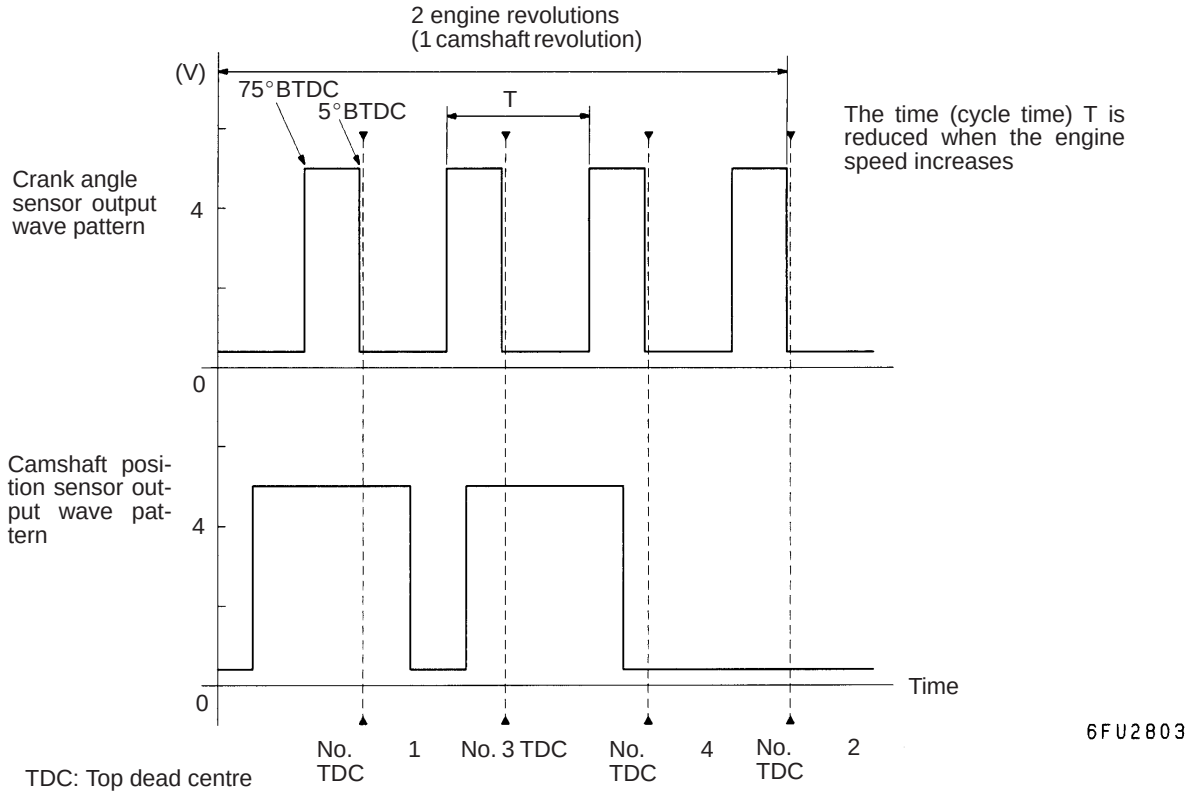
1. Connect the analyzer special patterns pickup to engine-ECU terminal 50. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 43. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

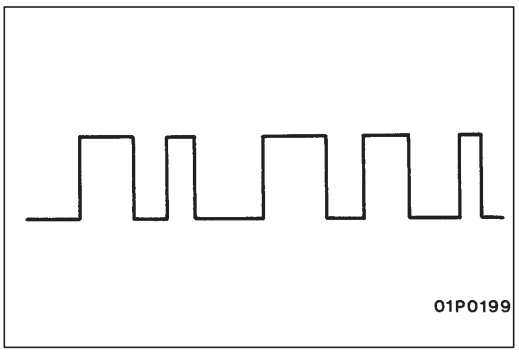
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

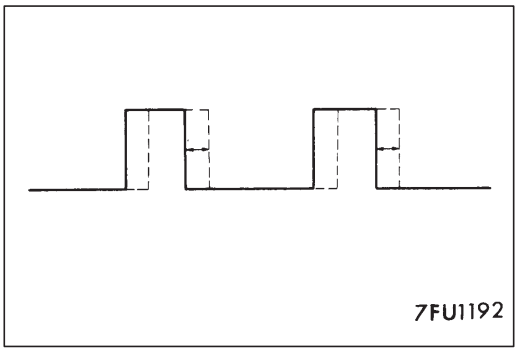
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



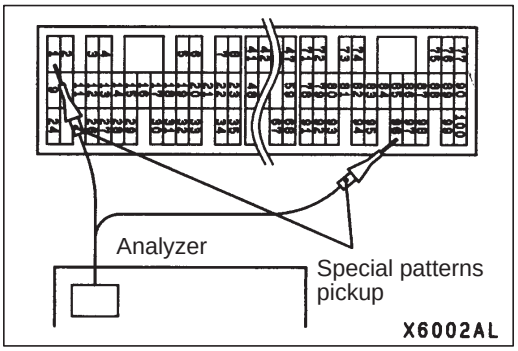
- Example 2

  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

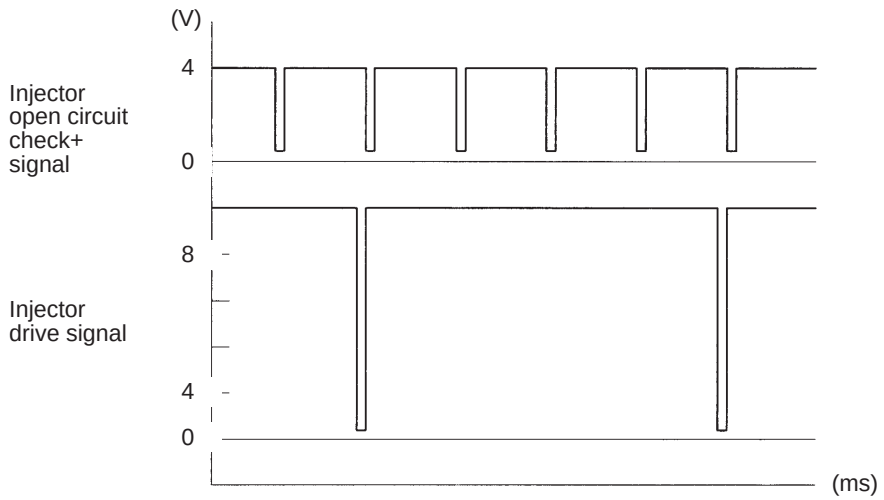
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 96 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 9 (No.2 injector), terminal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



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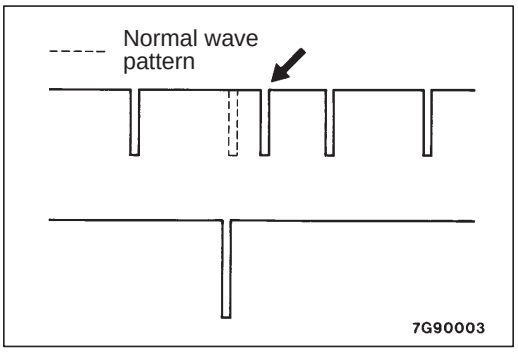
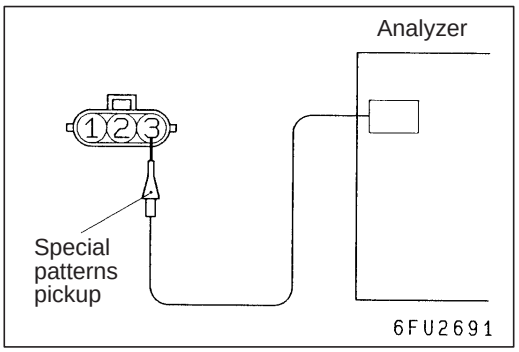


Wave Pattern Observation Points

- 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)

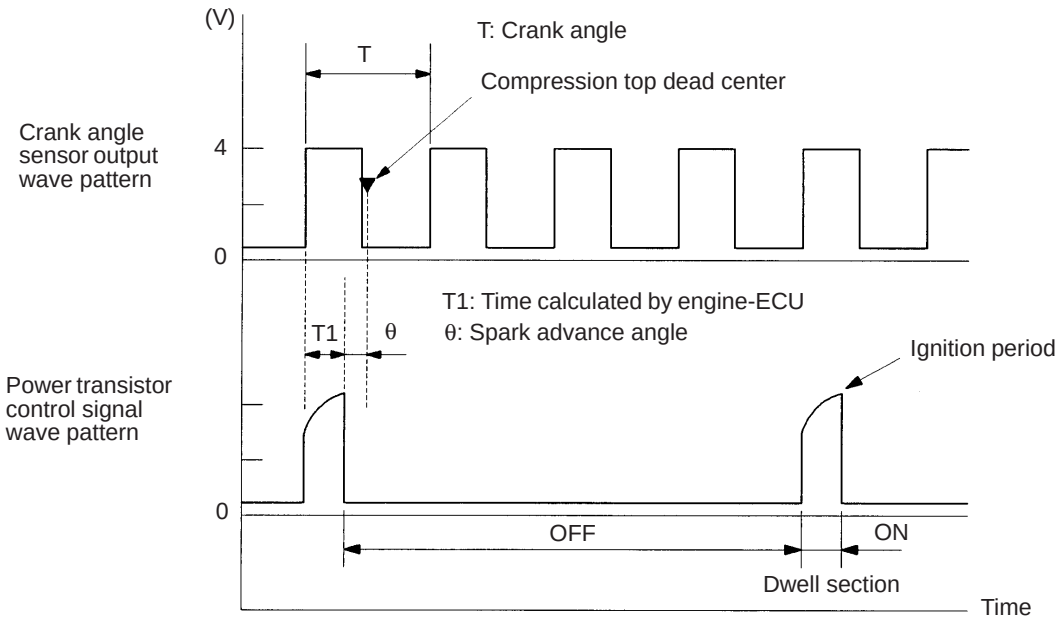
1. Connect the analyzer special patterns pickup to engine-ECU terminal 3 (No. 1 ignition coil), terminal 13 (No. 2 ignition coil), terminal 12(No. 3 ignition coil), terminal 4 (No. 4 ignition coil) respectively.

Standard Wave Pattern

Observation condition

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

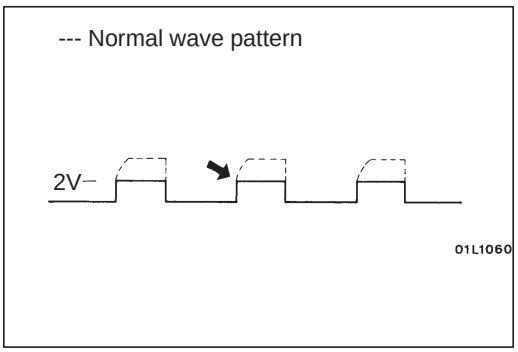
Standard wave pattern

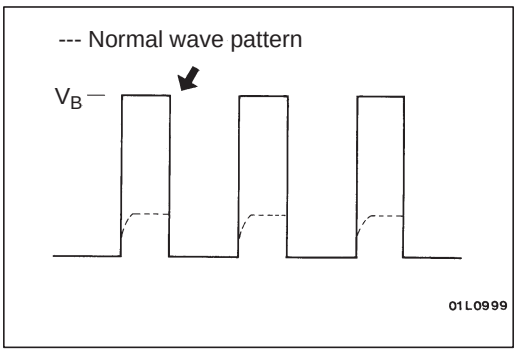


Wave Pattern Observation Points

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

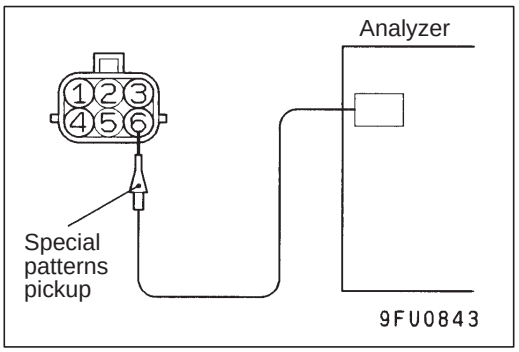
  Wave pattern during engine cranking

  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)

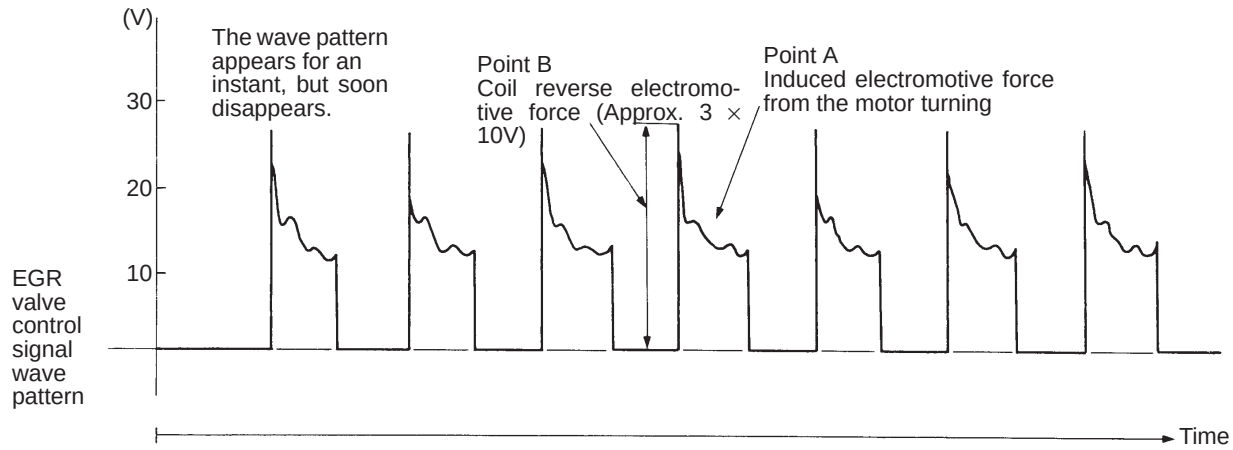
1. Connect the analyzer special patterns pickup to engine-ECU terminal 34, connection terminal 32, connection terminal 6, and connection terminal 5 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	Racing

Standard wave pattern



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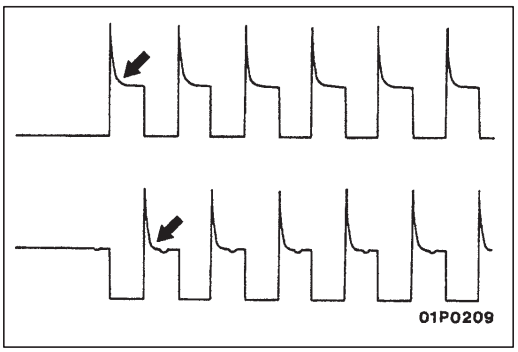
Wave Pattern Observation Points

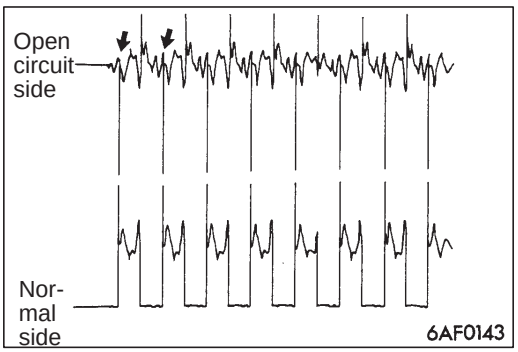
Check that the standard wave pattern appears when the EGR control servo is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

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

Point B: Height of coil reverse electromotive force

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





Examples of Abnormal Wave Pattern

- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.

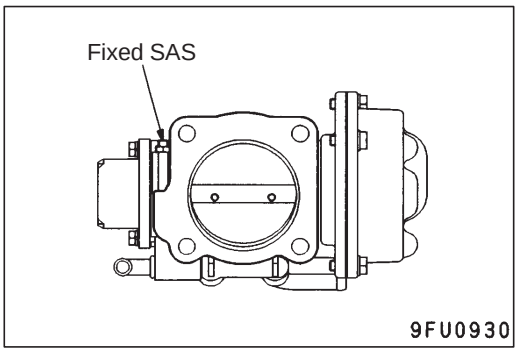
- Example 2

  Cause of problem

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

  Wave pattern characteristics

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



ON-VEHICLE SERVICE

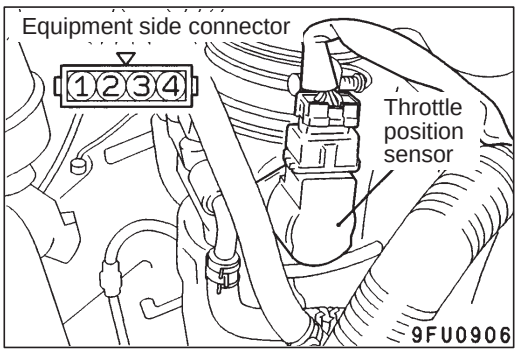
Caution

(1) Never attempt to tamper the fixed SAS. The fixed SAS is precisely adjusted at factory.

(2) Should it be tampered, the full closed position of the throttle valve will be changed. This causes the engine-ECU to learn a wrong position of the throttle valve.

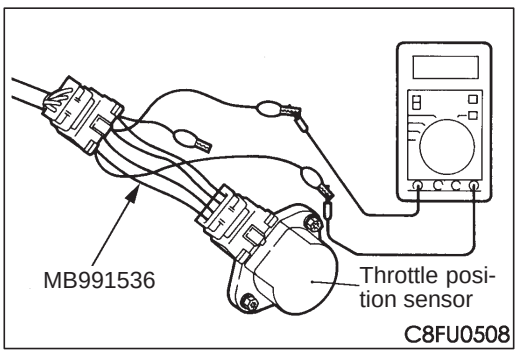
THROTTLE BODY (THROTTLE VALVE ARE) CLEANING

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



THROTTLE POSITION SENSOR ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector.
   When not using the MUT-II, proceed as follows:

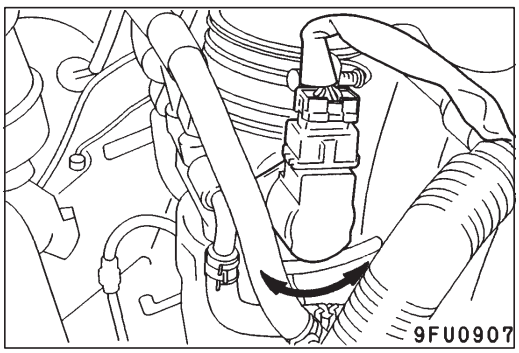


(1) Disconnect the throttle position sensor connector, and connect the special tool (test harness: MB991536) between the disconnected connector taking care not to confuse the terminal to be connected.

(2) Connect digital voltmeter between the terminal No.2 (sensor output: blue clip of special tool) and the terminal No.3 (sensor earth: white clip of special tool) of the throttle position sensor 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.

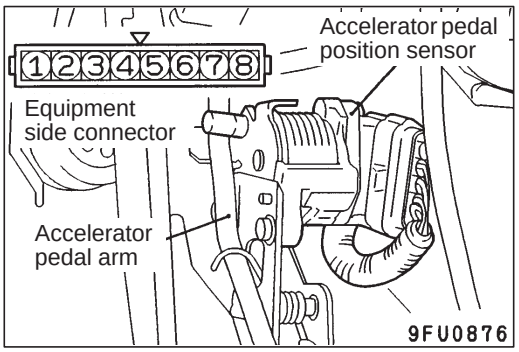
   Standard value: 0.4 – 0.6 V



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. When not using the MUT-II, connect digital voltmeter between the terminal No.4 (sensor output: black clip of special tool) and the terminal No.3 (sensor earth: white clip of special tool) of the throttle position sensor connector.

   Standard value: 4.2 – 4.8 V

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

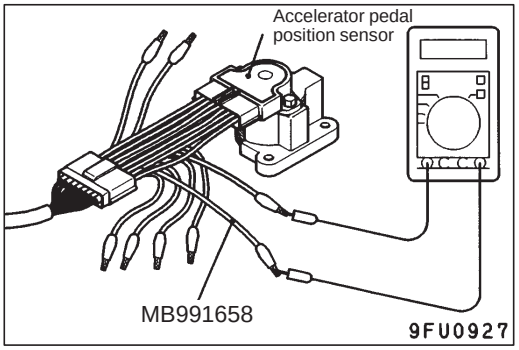


ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

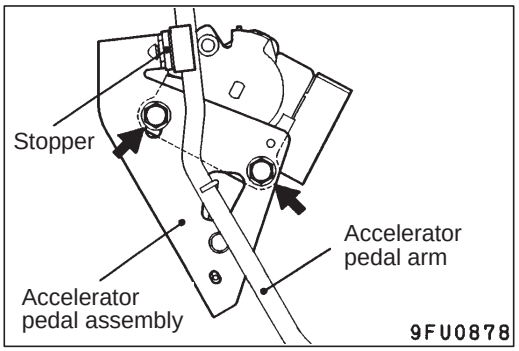
Caution

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

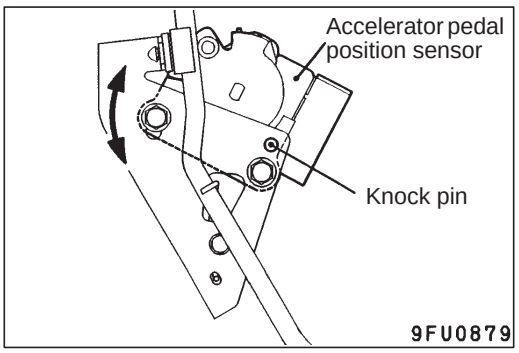
(2) Should it be tampered, follow the procedure below:



1. Connect the MUT-II to the diagnosis connector.
   When not using the MUT-II, proceed as follows:
   (1) Disconnect the accelerator pedal position sensor connector. Connect the special tool (test harness: MB991658) between the disconnected connectors, and then connect the digital voltmeter to the terminal No.3 [output terminal of accelerator pedal position sensor (1st channel)] and to the terminal No.1 [earth terminal of accelerator pedal position sensor (1st channel)].



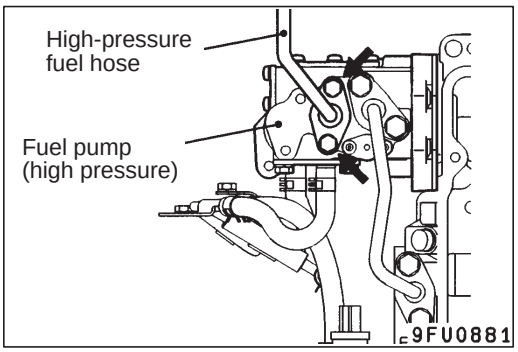
2. Loosen the accelerator pedal position sensor installation bolts.
3. Contact the accelerator pedal arm to the stopper.
4. Turn the ignition switch to the ON position (but do not start the engine).



5. Rotate the accelerator pedal position sensor with the knock pin as the centre, and adjust the output voltage of the accelerator pedal position sensor (1st channel) to the standard value.

   Standard value: 0.935 – 1.135 V

6. Tighten the accelerator pedal position sensor installation bolts fully.

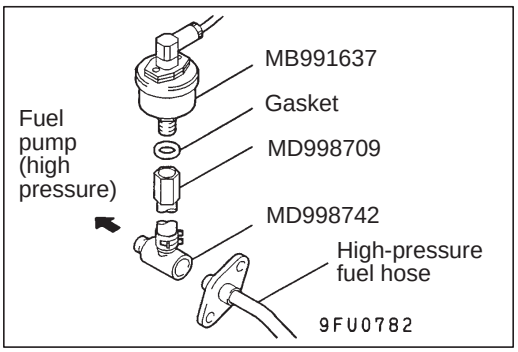


FUEL PRESSURE TEST

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

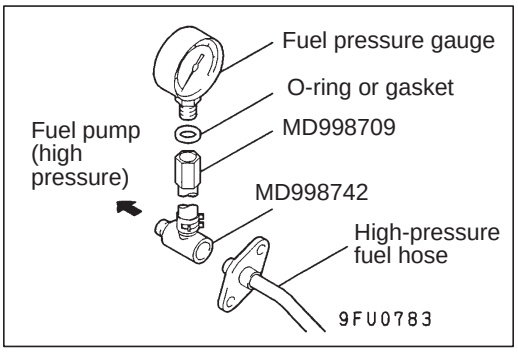
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13A-99.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

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 328 kPa

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

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

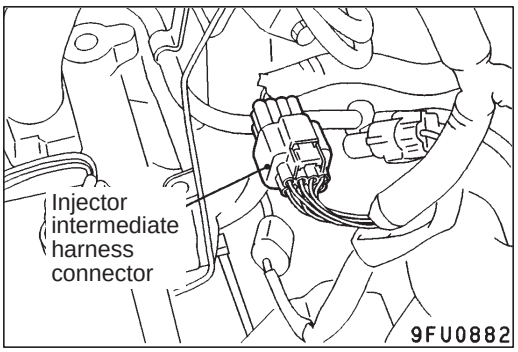
13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

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

14. Release residual pressure from the fuel pipe line. (Refer to P.13A-99.)
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. Crank the engine, and then measure the 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 the ignition switch to OFF.
8. Connect the injector intermediate harness connector.

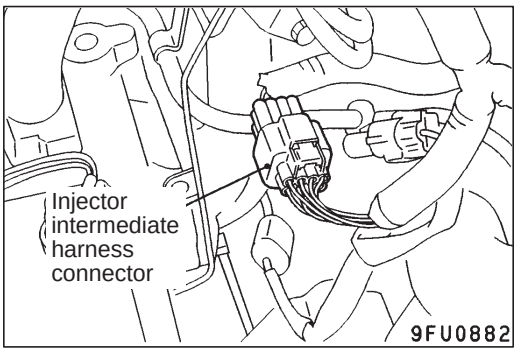
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

    Standard value: approximately 4 – 6.9 MPa

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

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	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

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



FUEL LEAK CHECK

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

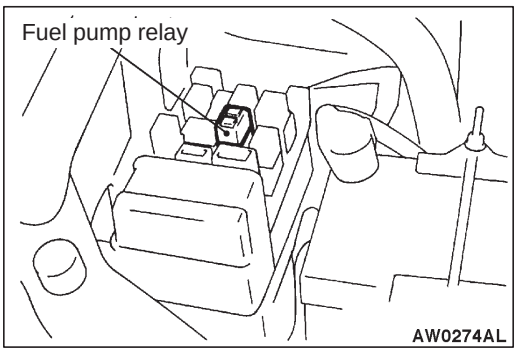
   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

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

   Limit: Minimum 1 MPa

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

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



FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE FUEL PRESSURE)

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

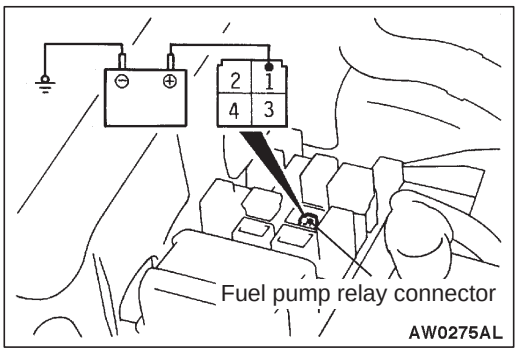
1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the fuel pump relay.
3. Connect the MUT-II to the diagnosis connector.

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

4. Turn off the ignition switch.
5. Select “Item No.74” from the MUT-II Data list.
6. Crank the engine for at least two seconds.
7. If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.

8. If the engine is started, release fuel pressure by the following procedure:
   (1) Turn off the ignition switch, and then stop the engine.
   (2) Disconnect one of the ignition coil connectors.
   (3) Crank the engine for at least two seconds.
   (4) If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
   (5) If the engine is started, stop it by racing and use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
   (6) Reconnect the ignition coil connector.

   Caution
   Clean the spark plug which corresponds to the disconnected ignition coil connector.
9. Remove the MUT-II.
10. Install the fuel pump relay.



FUEL PUMP OPERATION CHECK

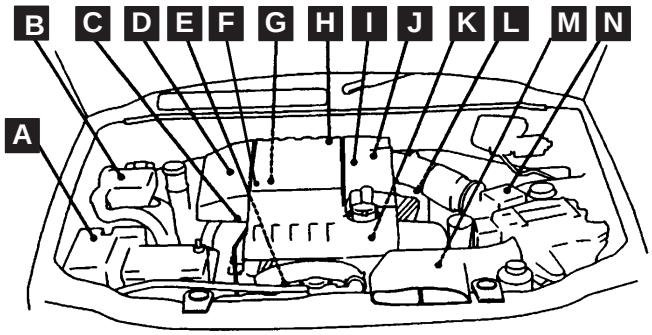
1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
   (1) Turn off the ignition switch.
   (2) Remove the fuel pump relay. Connect the terminal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

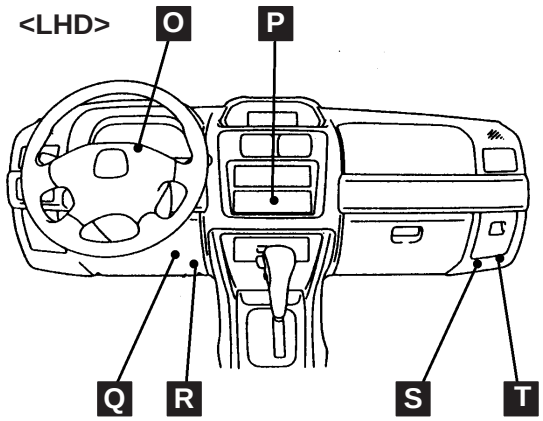
   NOTE
   As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel filler cap and check from the tank inlet.

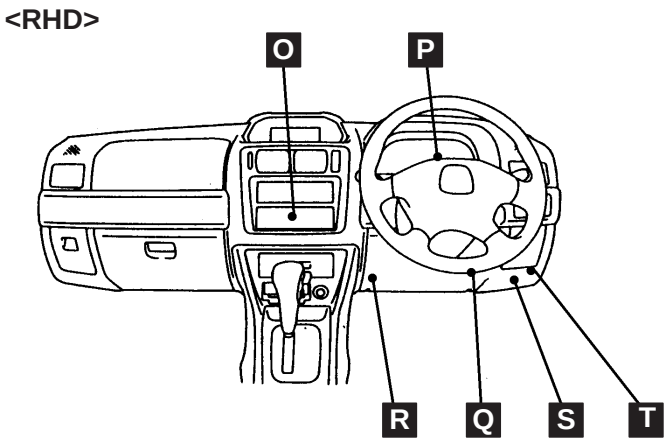
   (3) Check the fuel pressure by pinching the fuel hose with the fingertips.

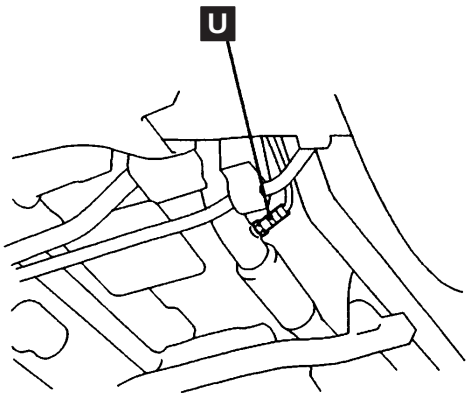
COMPONENT LOCATION

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









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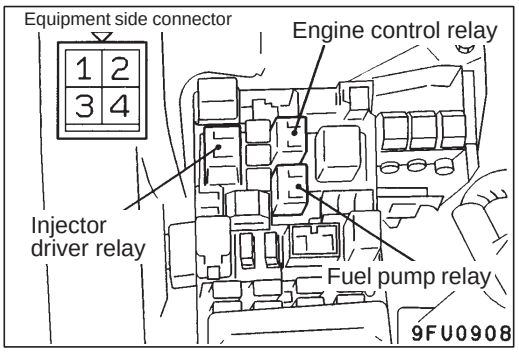
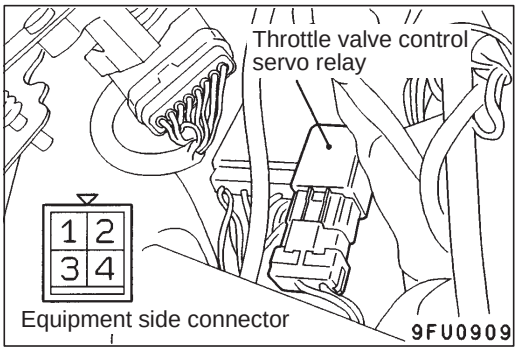
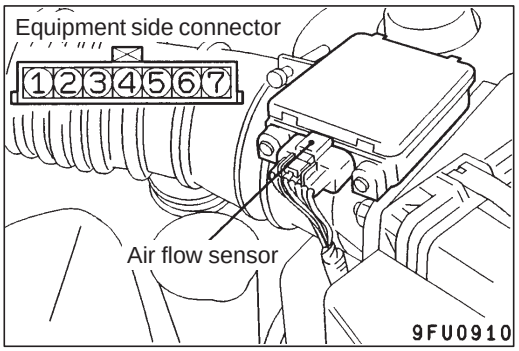


ENGINE CONTROL RELAY, FUEL PUMP RELAY, INJECTOR DRIVER RELAY AND THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

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

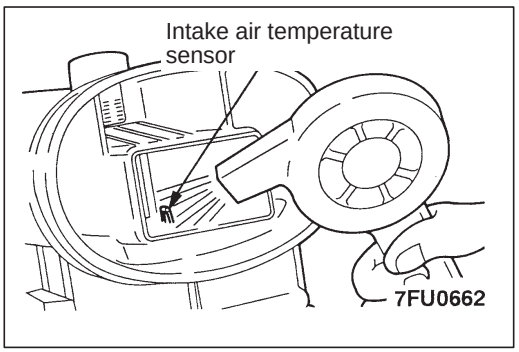




INTAKE AIR TEMPERATURE SENSOR CHECK

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

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

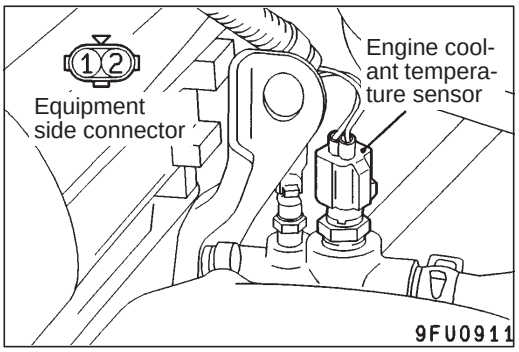


3. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

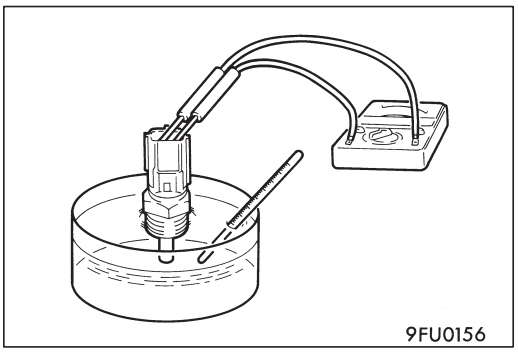
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

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

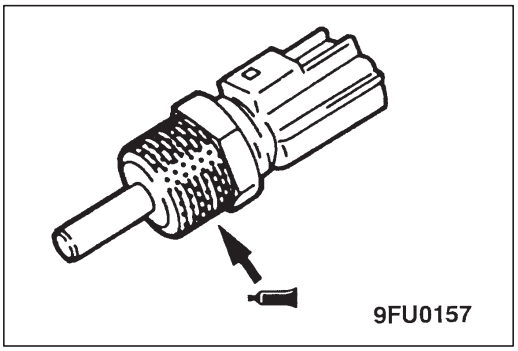
1. Remove the engine coolant temperature sensor.



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

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

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

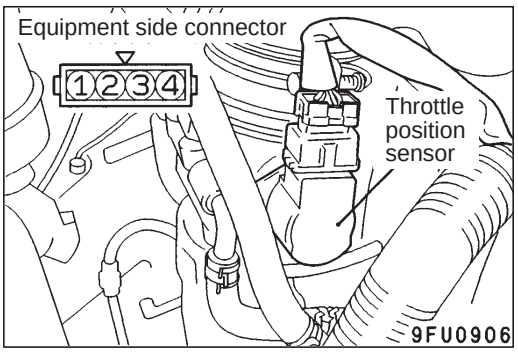


4. Apply sealant to threaded portion.

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

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

   Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

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

   Standard value: 3.5 – 6.5 kΩ

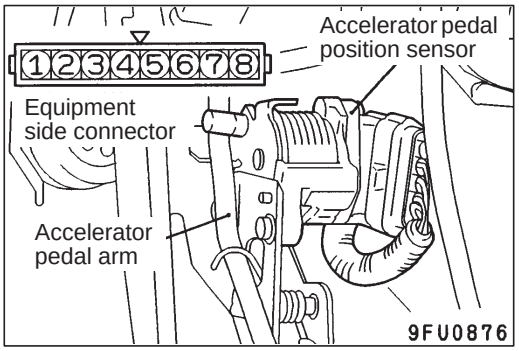
3. Measure resistance between terminal Nos. 1 and 2 as well as 1 and 4 of the throttle position sensor connector, respectively.

   Normal condition:

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

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

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13A-92.



ACCELERATOR PEDAL POSITION SENSOR (1ST CHANNEL) CHECK

1. Disconnect the accelerator pedal position sensor connector.
2. Measure resistance between terminal No.2 (sensor power supply) and 1 (sensor earth) of the sensor connector.

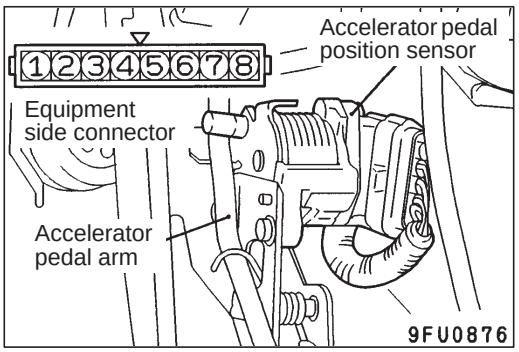
   Standard value: 3.5 – 6.5 kΩ
3. Measure resistance between terminal No.2 (sensor power supply) and 3 (sensor output) of the connector.

   Normal condition:

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

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

   NOTE
   After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-94.)



ACCELERATOR PEDAL POSITION SENSOR (2ND CHANNEL) CHECK

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

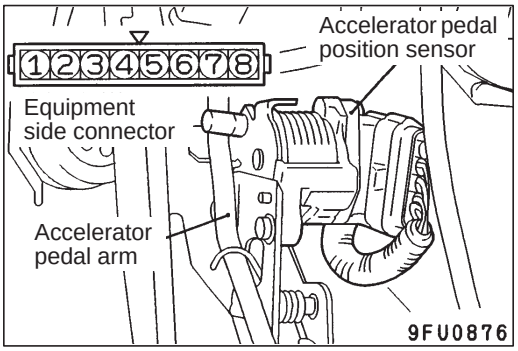
   Standard value: 3.5 – 6.5 kΩ
3. Measure resistance between terminal No.8 (sensor power supply) and 6 (sensor output) of the connector.

   Normal condition:

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

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

   NOTE
   After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-94.)



ACCELERATOR PEDAL POSITION SWITCH CHECK

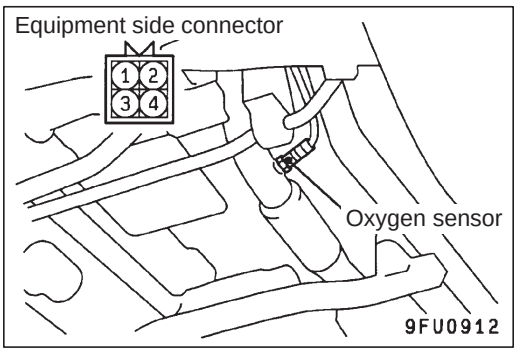
1. Disconnect the accelerator pedal position sensor connector.
2. Check continuity between terminal No.4 (accelerator pedal position switch) and 5 (sensor earth) of the connector.

Normal condition

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

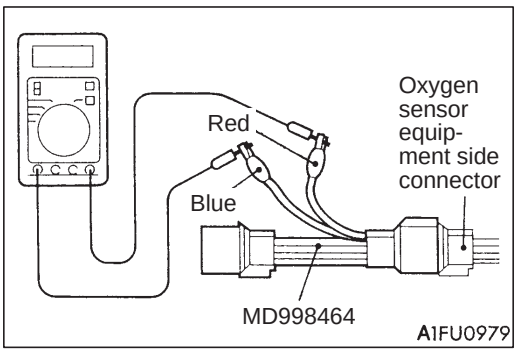
3. If defective, replace the accelerator pedal position sensor assembly.

NOTE
After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A-94.)

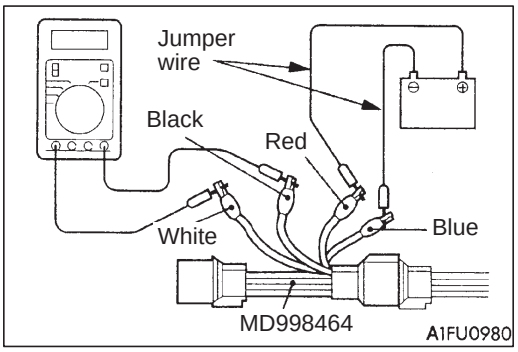


OXYGEN SENSOR CHECK

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (11 – 18 Ω at 20°C) between terminal 1 (red cip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.



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



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

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

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

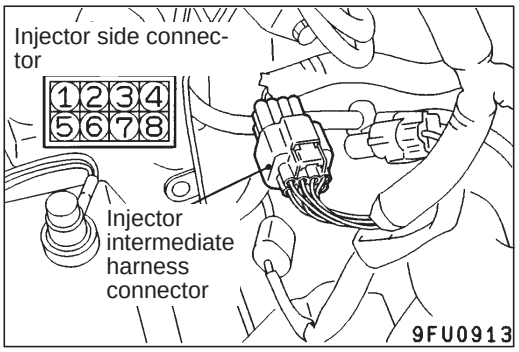
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

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

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



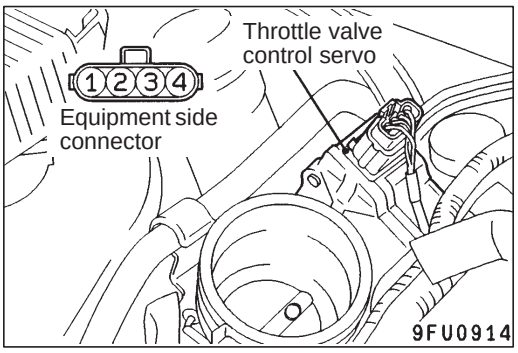
INJECTOR CHECK

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.

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 – Emission Control System.

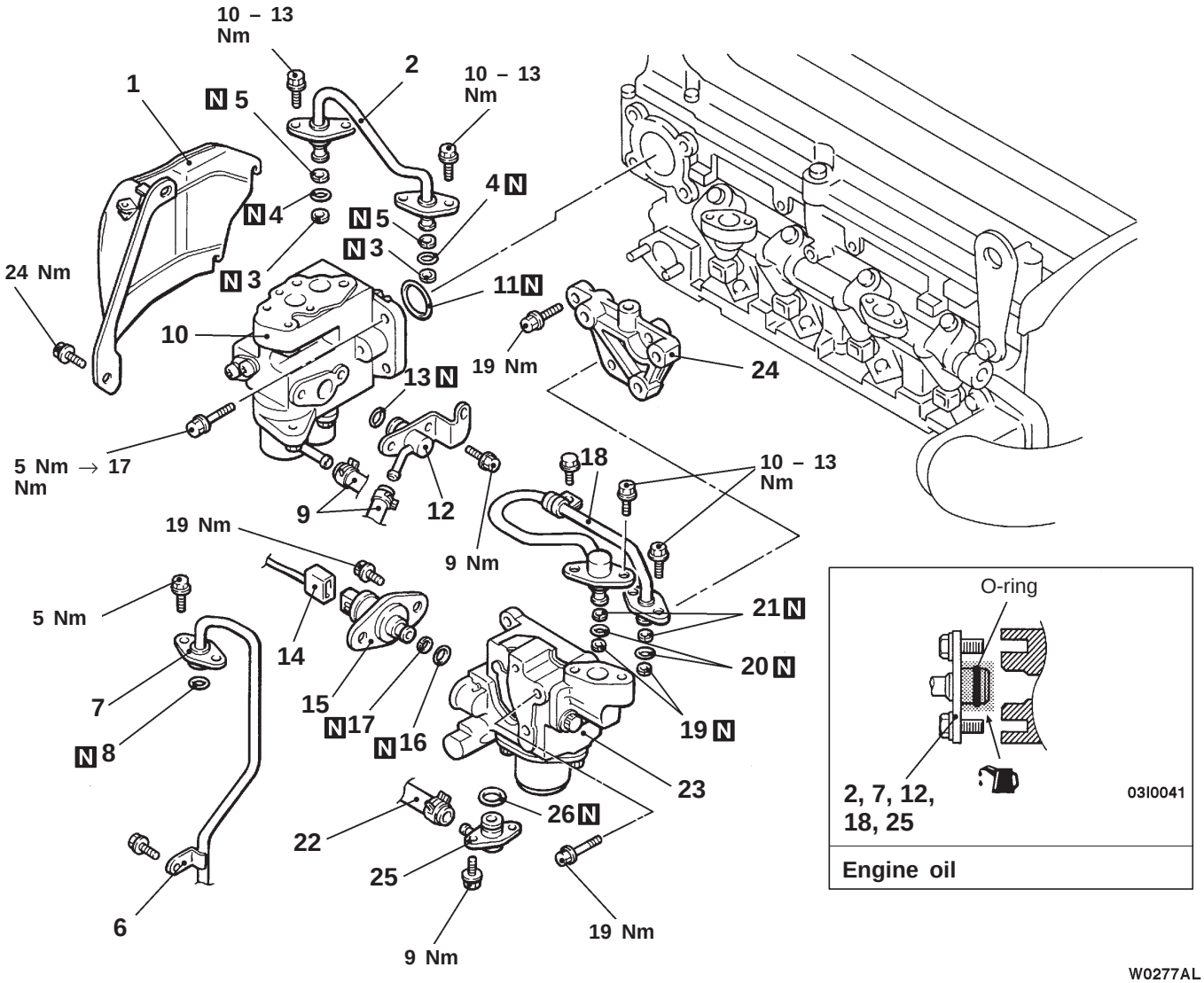
EGR VALVE CHECK

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
- Fuel Discharge Prevention <before removal only> (Refer to P.13A-98.)
- Engine Cover Removal and Installation
- Resonance Tank Removal and Installation (Refer to GROUP 15.)
- Fuel Leak Check <after installation only> (Refer to P.13A-98.)



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Fuel pump (High pressure) removal steps

- ▶F◀ ● Fuel pump (high pressure) air bleeding
- ● Throttle body removal (Refer to P.13A-113.)
- ◀A▶ 1. Fuel pump protector
- ▶C◀ 2. Fuel feed pipe
- ▶B◀ 3. Back-up ring A
- ▶B◀ 4. O-ring
- ▶B◀ 5. Back-up ring B
- 6. Fuel pressure hose clamp
- ▶C◀ 7. Fuel pressure hose connection
- 8. O-ring
- 9. Fuel return hose connection
- ▶E◀ 10. Fuel pump (high pressure)
- 11. O-ring
- 12. Fuel pump return nipple
- 13. O-ring

Fuel pressure regulator (High pressure) removal steps

- ● Intake manifold assembly removal (Refer to GROUP 15.)
- 14. Fuel pressure sensor connector connection
- 15. Fuel pressure sensor
- ▶D◀ 16. O-ring
- ▶D◀ 17. Back-up ring
- ▶C◀ 18. Fuel return pipe
- ▶B◀ 19. Back-up ring A
- ▶B◀ 20. O-ring
- ▶B◀ 21. Back-up ring B
- 22. Fuel return hose connection
- ▶A◀ 23. Fuel pressure regulator (high pressure)
- 24. Spacer
- 25. Fuel nipple
- 26. O-ring

REMOVAL SERVICE POINT

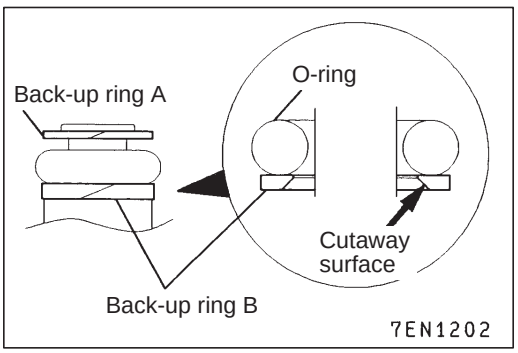
◀A▶ FUEL PUMP PROTECTOR REMOVAL

Lift up the transmission with a jack to create clearance between the engine and front deck, and then remove the fuel pump protector.

INSTALLATION SERVICE POINTS

▶A◀ FUEL PRESSURE REGULATOR (HIGH PRESSURE) INSTALLATION

1. Install provisionally the fuel pressure regulator (high pressure) to the spacer.
2. Install the fuel return pipe, and then tighten the fuel pressure regulator (high pressure) to the specified torque.



▶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.

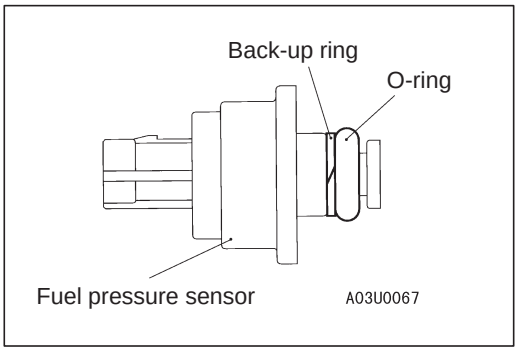
Caution

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/FUEL PRESSURE HOSE/FUEL FEED PIPE INSTALLATION

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

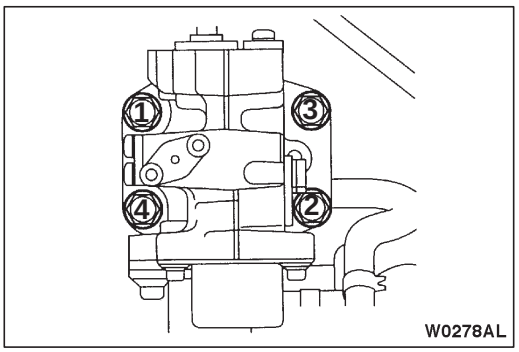
Caution
Take care not to let any of the engine oil get inside the fuel pump (high pressure), fuel pressure regulator (high pressure) or the delivery pipe assembly.



▶D◀ 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)



▶E◀ FUEL PUMP (HIGH PRESSURE) INSTALLATION

1. Apply a small amount of fresh engine oil to the fuel pump (high pressure) roller and O-ring.
2. Install temporarily the fuel pump (high pressure) to the cylinder head.
3. Install the fuel feed pipe, and then tighten the fuel pump (high pressure) mounting bolts to 5 Nm in the order shown in the illustration.
4. 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.

▶F◀ FUEL PUMP (HIGH PRESSURE) AIR BLEEDING

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

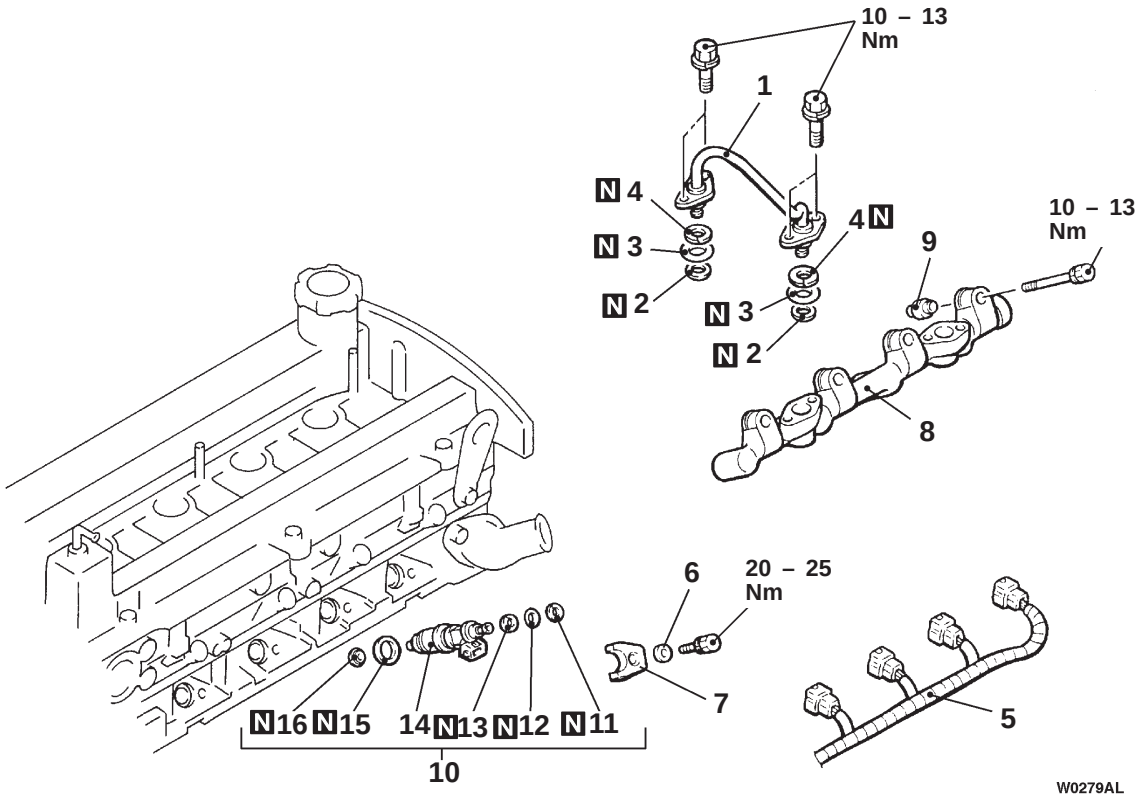
   NOTE
   When removing the fuel pump (high pressure), air may get into the fuel pump (high pressure). If air gets into the fuel pump (high pressure), diagnosis code No.56 for abnormal fuel pressure will be output.

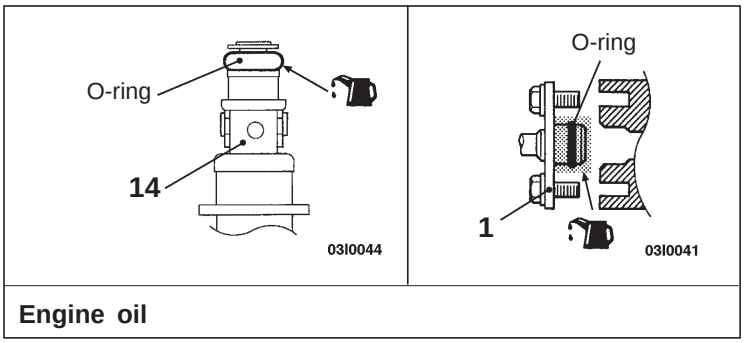
2. Use the MUT-II to check the diagnosis code. If the diagnosis code No.56 for fuel pressure sensor system defect is output, erase it.

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Fuel Pressure Regulator (High Pressure) Removal and Installation (Refer to P.13A-107.)





Engine oil

Removal steps

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

REMOVAL SERVICE POINTS

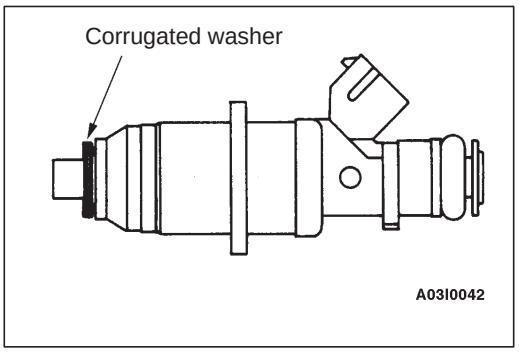
◀A▶ INJECTOR HARNESS CONNECTOR DISCONNECTION

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

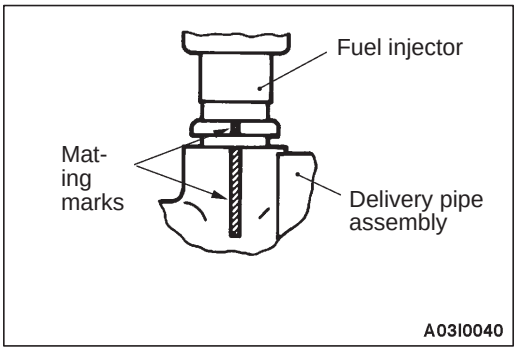
▶A◀ CORRUGATED WASHER INSTALLATION

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

▶B◀ FUEL INJECTOR ASSEMBLY/DELIVERY PIPE ASSEMBLY INSTALLATION

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

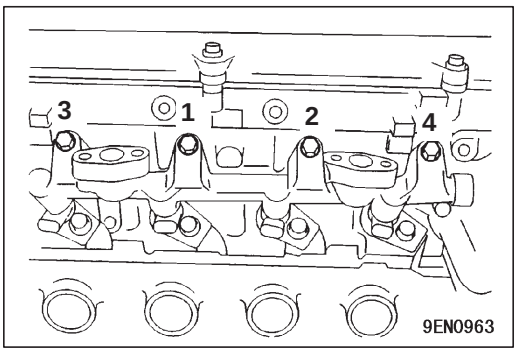
   Caution
   Take care not to let any of the engine oil get inside the delivery pipe assembly.
2. While being careful not to damage the O-ring, turn the fuel injector assembly to the left and right and connect it to the delivery pipe assembly. After connecting, check that the fuel injector turns smoothly.
3. If the fuel injector does not turn smoothly, the cause may be that the O-ring is getting caught. Remove the fuel injector, check the O-ring for damage and re-connect the fuel injector to the delivery pipe assembly and then re-check.



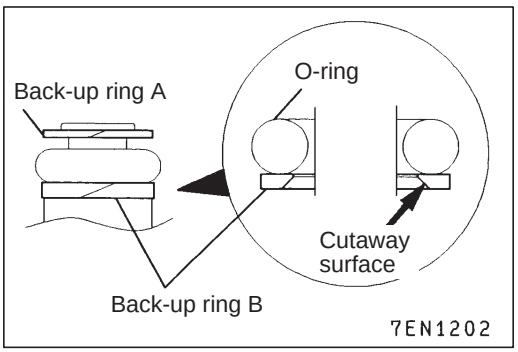
4. Align the mating marks on the delivery pipe assembly and the fuel injector, and then install the delivery pipe assembly with the injector assembly still attached.

5. Install the delivery pipe and fuel injectors to the cylinder head, and then tighten them provisionally.
6. Install the injector holders and washers, and then tighten them to the specified torque.

Caution
Observe the tightening torque.



7. Tighten the delivery pipe and fuel injectors to the specified torque in the order shown in the illustration.



▶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
Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.

▶D◀ FUEL FEED PIPE INSTALLATION

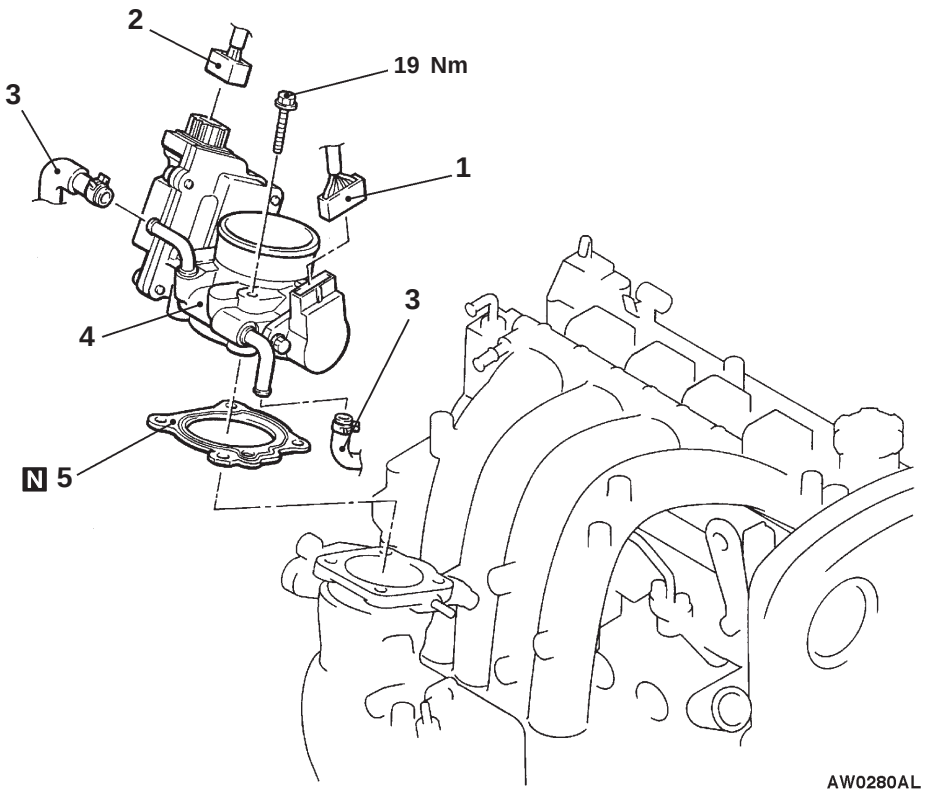
Apply a small amount of fresh engine oil to the O-ring.

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.)
- Resonance Tank Removal and Installation (Refer to GROUP 15.)



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

INSTALLATION SERVICE POINT

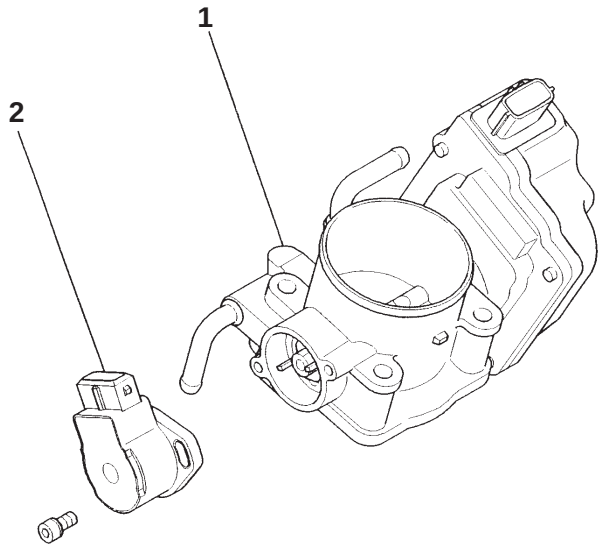
▶A◀ THROTTLE BODY INSTALLATION

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

Initialization

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

DISASSEMBLY AND REASSEMBLY



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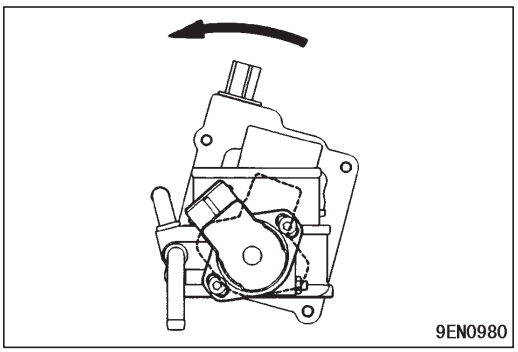
Disassembly steps

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



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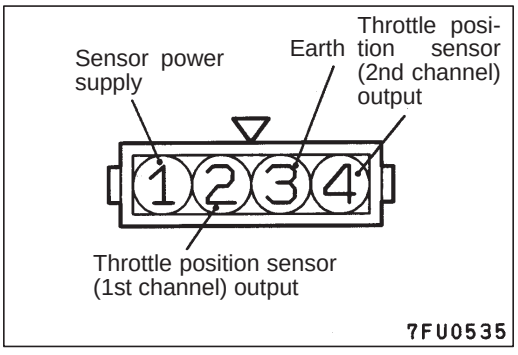

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REASSEMBLY SERVICE POINTS

▶A◀ THROTTLE POSITION SENSOR

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

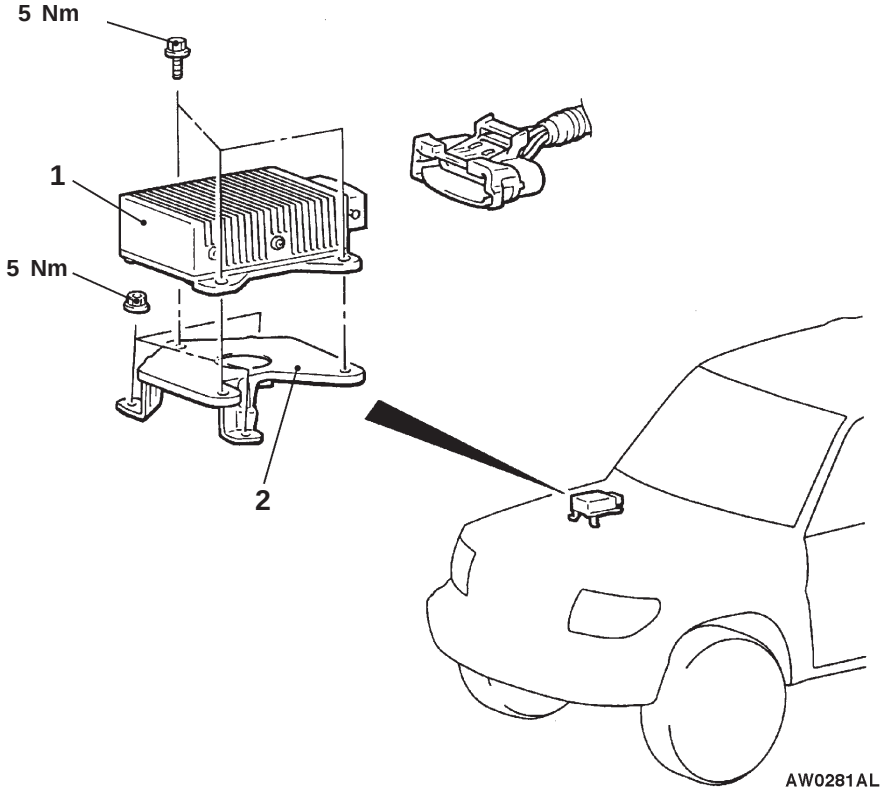
Normal condition

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

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

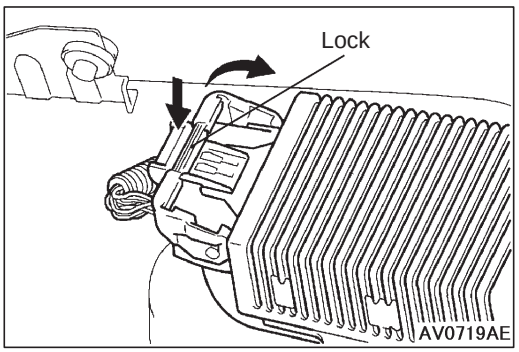
INJECTOR DRIVER

REMOVAL AND INSTALLATION



Removal steps

◀A▶ 1. Injector driver
2. Bracket



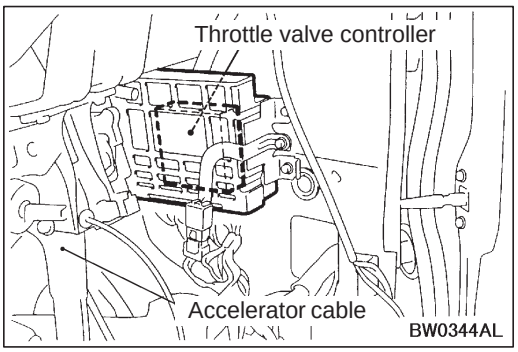
REMOVAL SERVICE POINT

◀A▶ INJECTOR DRIVER REMOVAL

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

Caution

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



THROTTLE VALVE CONTROLLER

INSTALLATION SERVICE POINT

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

Initialization

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

NOTES

GASOLINE DIRECT INJECTION (GDI)

CONTENTS

GENERAL

OUTLINE OF CHANGES

Due to the changes shown below, the service procedures regarding the different description from the previous version have been established.

- On-board Diagnostics System has been adopted to expand the diagnostic items and to change diagnosis code numbering system.
- Fuel pressure regulator (high-pressure) incorporate fuel pump (high-pressure) has been adopted.
- An oxygen sensor (rear) has been added.
- A ignition failure sensor has been added.

GENERAL INFORMATION

SELF-DIAGNOSIS FUNCTION

Following functions have been added.

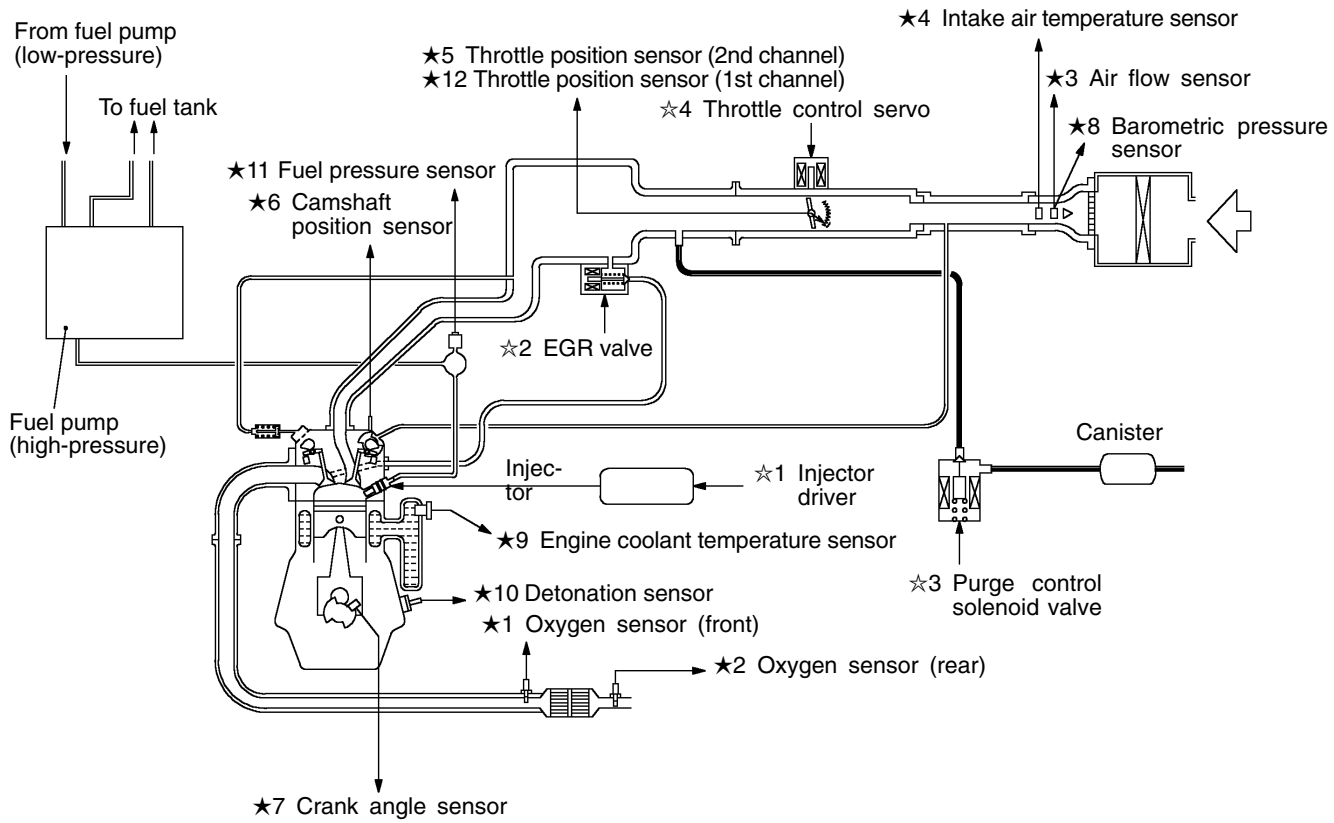
- The engine-ECU records the engine operating condition when the diagnosis code is set.
  This data is called “freeze frame” data.
  This data can be read by using the MUT-II, are can then be used in simulation tests for troubleshooting.

GENERAL SPECIFICATION

Items		Specification
Engine-ECU	Identification No.	E2T71582

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

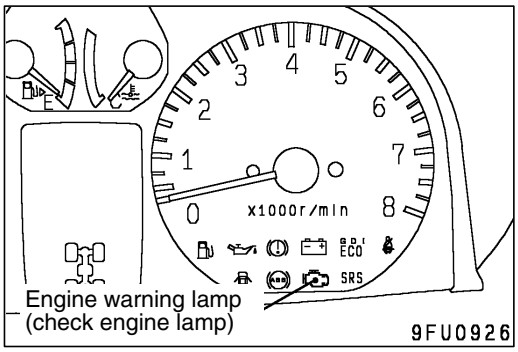
★1 Oxygen sensor (front) ★2 Oxygen sensor (rear) ★3 Air flow sensor ★4 Intake air temperature sensor ★5 Throttle position sensor (2nd channel) ★6 Camshaft position sensor ★7 Crank angle sensor ★8 Barometric pressure sensor ★9 Engine coolant temperature sensor ★10 Detonation sensor ★11 Fuel pressure sensor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



Y6061AJ

SERVICE SPECIFICATIONS

Items			Standard value
Fuel pressure	High-pressure side MPa		4 – 6.9
	Low-pressure side kPa		Approximately 324
Oxygen sensor output voltage (during revving) V			0.6 – 1.0
Oxygen sensor heater resistance (at 20°C) Ω		Front	4.5 – 8.0
		Rear	11 – 18



TROUBLESHOOTING

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

Engine warning lamp inspection items

Code No.	Diagnosis item
–	Engine-ECU
P0100	Air flow sensor system
P0105	Barometric pressure sensor system
P0110	Intake air temperature sensor system
P0115	Engine coolant temperature sensor system
P0120★	Throttle position sensor (1st channel) system
P0125	Feedback system
P0130	Oxygen sensor (front) system <sensor 1>
P0135	Oxygen sensor heater (front) system <sensor 1>
P0136	Oxygen sensor (rear) system <sensor 2>
P0141	Oxygen sensor heater (rear) system <sensor 2>
P0170	Abnormal fuel system
P0190★	Abnormal fuel pressure
P0201	No. 1 injector system
P0202	No. 2 injector system
P0203	No. 3 injector system
P0204	No. 4 injector system
P0220★	Accelerator pedal position sensor (1st channel) system
P0225★	Throttle position sensor (2nd channel) system
P0300★	Ignition coil (power transistor) system
P0301	No. 1 cylinder misfire detected
P0302	No. 2 cylinder misfire detected
P0303	No. 3 cylinder misfire detected
P0304	No. 4 cylinder misfire detected

Code No.	Diagnosis item
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0403	EGR valve system
P0420	Catalyst malfunction
P0443	Purge control solenoid valve system
P1200	Injector driver system
P1220★	Electronic-controlled throttle valve system
P1221★	Throttle valve position feedback system
P1223★	Communication line with throttle valve controller
P1224★	Throttle valve control servo motor (motor 1st phase malfunction) system
P1225★	Accelerator pedal position sensor (2nd channel) system
P1228★	Throttle valve control servo motor (motor 2nd phase malfunction) system
P1515	Brake vacuum sensor system

NOTE
1. If the engine warning lamp illuminates because of a malfunction of the engine-ECU, communication between MUT-II and the engine-ECU is impossible. In this case, the diagnosis code cannot be read.
2. After the engine-ECU has detected a malfunction, the engine warning lamp illuminates when the engine is next turned on and the same malfunction is re-detected. However, for items marked with a "★" in the diagnosis code number column, the engine warning lamp illuminates only on the first detection of the malfunction.
   As for P1220, P1221, P1223, P1224, and P1228, the engine warning lamp flashes. If malfunctions are detected at the throttle position sensor (1st channel) and the throttle position sensor (2nd channel) at the same time, or malfunctions are detected at the accelerator pedal position sensor (1st channel) and the accelerator pedal position sensor (2nd channel) at the same time, the engine warning lamp will flash.
3. After the engine warning lamp illuminates, it will be switched off under the following conditions.
   (1) When the engine-ECU monitored the power train malfunction three times* and met set condition requirements, it detected no malfunction.
      *: In this case, "one time" indicates from engine start to stop.
   (2) For misfiring malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.
4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

DIAGNOSIS USING DIAGNOSIS 2 MODE

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

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

5. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

FREEZE FRAME DATA

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

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

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

READINESS TEST STATUS

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

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

FAIL-SAFE FUNCTION REFERENCE TABLE

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

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Suspends lean burn operation. 2. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle opening angle feedback (half as much as the opening rate in the normal condition) by using signals from the throttle position sensor (1st channel). However, this controlling system is not applied if the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V. 3. Refrains from controlling the throttle opening angle feedback if the throttle position sensor (1st channel) is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Moreover, the control system is working until the ignition switch is turned OFF if the sensor signal returns to normal.)
Camshaft position sensor	Controls maintaining the condition before determined as failure. Fuel will be cut-off 4 seconds after a malfunction is detected. (However, only if No. 1 cylinder TDC has never been detected after the ignition switch is turned to the ON position)
Vehicle speed sensor	1. Suspends lean burn operation. However, the control is cancelled as a certain time passes by with the engine speed of 1,500 r/min or more. 2. Suspends lean burn operation during the engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Fixes the ignition timing as that for standard petrol.
Injector	1. Suspends lean burn operation. 2. Suspends the exhaust gas recirculation.
Communication line with A/T-ECU	Disable ignition timing retard control (engine and transmission total control) during shift change.
Ignition coil (incorporating power transistor)	1. Suspends lean burn operation. 2. Cuts off the fuel supply to cylinders with an abnormal ignition signal.
Fuel pressure sensor	1. Controls as if the fuel pressure is 5 MPa. (In case of open/short circuit) 2. Turns the fuel pump relay off. (In case of abnomality in high pressure) 3. Suspends fuel injection. (when the low pressure is detected and the engine speed is more than 3,000 r/min)
Alternator FR terminal	Refrains from controlling to suppress the alternator output to electrical load. (Operated as a normal alternator)
Accelerator pedal position sensor (2nd channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (1st channel). (However, the control system is not applicable if the difference from the accelerator pedal position sensor (1st channel) output voltage is 1.0 V or higher.) 3. Suspends the electronic controlled throttle valve system if accelerator pedal position sensor (1st channel) is also defective.

Malfunctioning item	Control contents during malfunction
Accelerator pedal position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (2nd channel). (However, this control is not applicable if the voltage difference between the accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) is 1.0 V or higher.) 3. Also suspends the electronic-controlled throttle valve system when the accelerator pedal position sensor (2nd channel) is defective.
Throttle position sensor (1st channel)	1. Suspends lean burn operation. 2. Controls throttle opening angle feedback by using signals from throttle position sensor (2nd channel). (However, the controlling system is not applied when the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V.) 3. Refrains from controlling the throttle opening angle feedback when throttle position sensor (2nd channel) is also defective.
Electronic-controlled throttle valve system	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the idle speed feedback control.
Throttle valve position feedback	1. Suspends the electronic controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.
Communication line between the throttle valve controller and the engine-ECU	1. Communication error between the throttle valve controller and the engine-ECU ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. 2. Communication error between the throttle valve controller and the engine-ECU ● Suspends lean burn operation. ● Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. ● Suspends the cruise-control. ● The throttle valve controller controls the throttle valve opening angle by using signals from accelerator pedal position sensor (2nd channel).
Throttle control servo motor 1st phase malfunction	Bans lean burn operation.
Throttle control servo motor 2nd phase malfunction	1. Suspends electronic control throttle valve system. 2. Bans lean burn operation. 3. Bans engine speed feed back control.
Misfiring	If the detected misfiring causes damage to the catalyst, the misfiring cylinder will be shut down.

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

INSPECTION CHART FOR DIAGNOSIS CODES

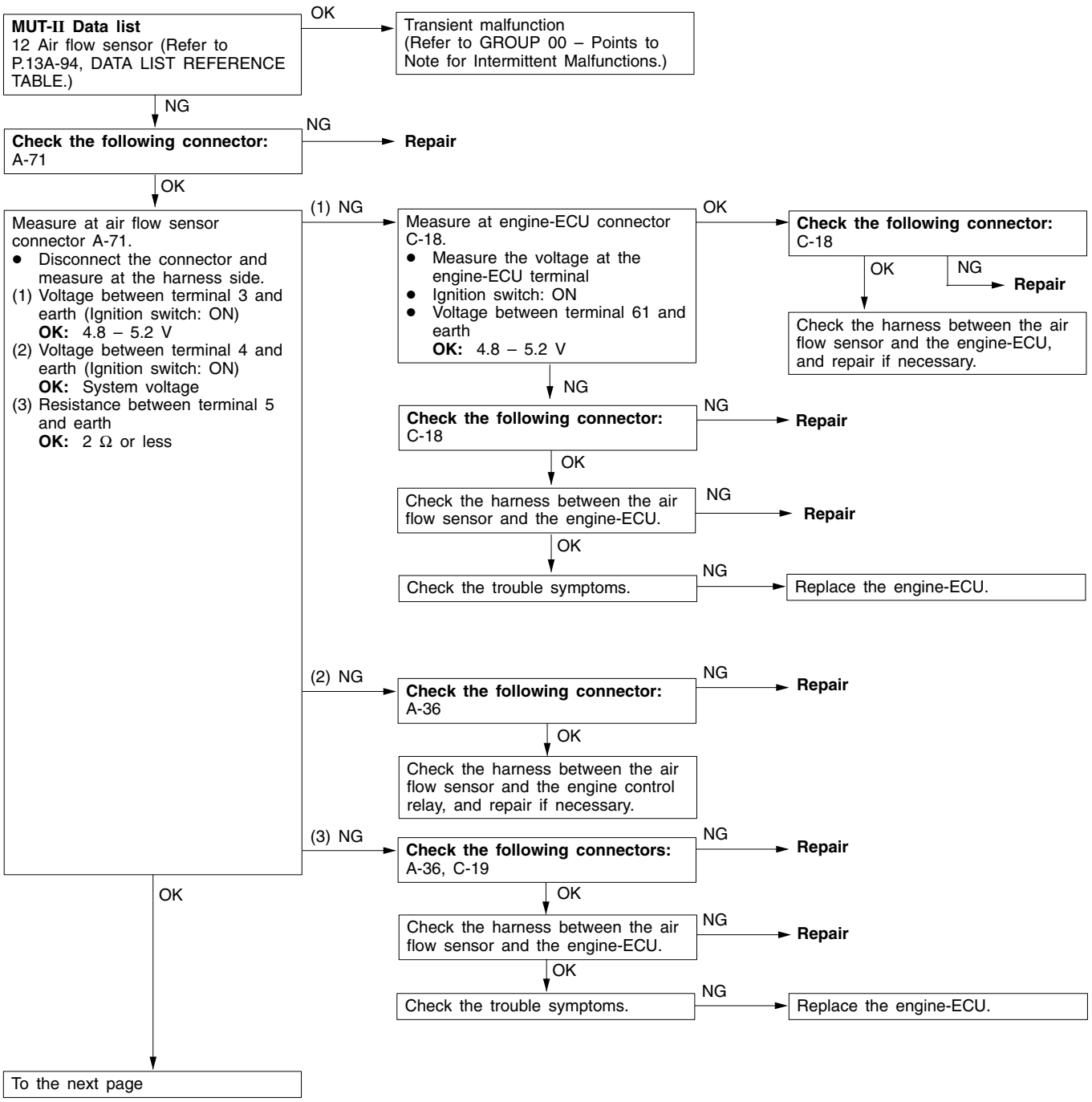
Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13A-14
P0105	Barometric pressure sensor system	13A-16
P0110	Intake air temperature sensor system	13A-18
P0115	Engine coolant temperature sensor system	13A-19
P0120★	Throttle position sensor 1 (1st channel) system	13A-22
P0125	Feedback system	13A-24
P0130	Oxygen sensor (front) system <sensor 1>	13A-25
P0135	Oxygen sensor heater (front) system <sensor 1>	13A-27
P0136	Oxygen sensor (rear) system <sensor 2>	13A-28
P0141	Oxygen sensor heater (rear) system <sensor 2>	13A-30
P0170	Abnormal fuel system	13A-31
P0190★	Abnormal fuel pressure	13A-33
P0201	No. 1 injector system	13A-34
P0202	No. 2 injector system	13A-36
P0203	No. 3 injector system	13A-37
P0204	No. 4 injector system	13A-38
P0220★	Accelerator pedal position sensor (1st channel) system	13A-40
P0225★	Throttle position sensor (2nd channel) system	13A-43
P0300★	Ignition coil (power transistor) system	13A-44
P0301	No. 1 cylinder misfire detected	13A-46
P0302	No. 2 cylinder misfire detected	13A-46
P0303	No. 3 cylinder misfire detected	13A-46
P0304	No. 4 cylinder misfire detected	13A-46
P0325	Detonation sensor system	13A-47
P0335	Crank angle sensor system	13A-47
P0340	Camshaft position sensor system	13A-59
P0403	EGR valve system	13A-50
P0420	Catalyst malfunction	13A-51
P0443	Purge control solenoid valve system	13A-52
P0500	Vehicle speed sensor system	13A-53
P1200	Injector driver system	13A-53
P1220★	Electronic-controlled throttle valve system	13A-54

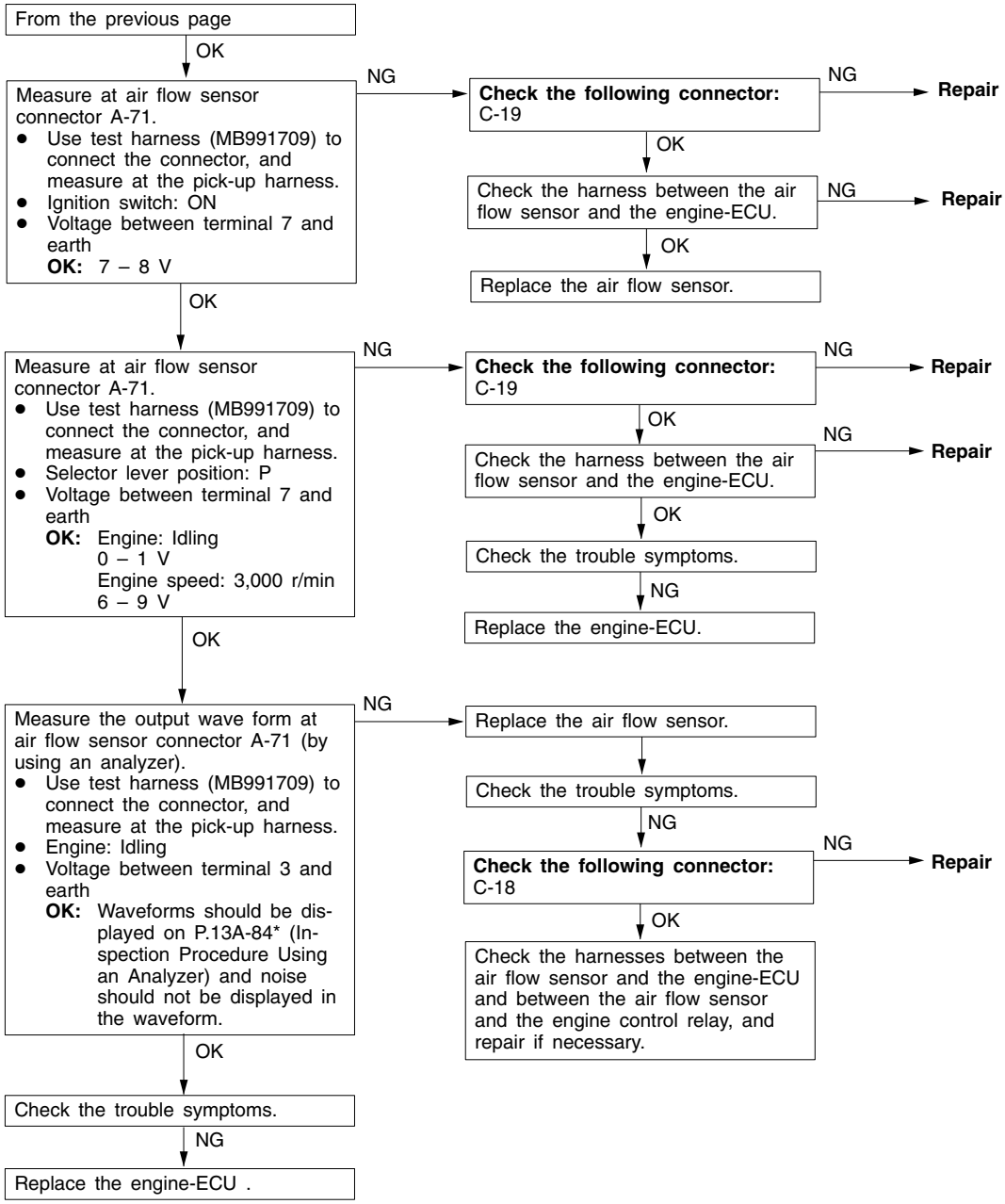
Code No.	Diagnosis item	Reference page
P1221★	Throttle valve position feedback system	13A-55
P1223★	Communication line with throttle valve controller	13A-56
P1224★	Throttle valve control servo motor (motor 1st phase malfunction) system	13A-57
P1225★	Accelerator pedal position sensor (2nd channel) system	13A-58
P1228★	Throttle valve control servo motor (motor 2nd phase malfunction) system	13A-60
P1500	Alternator FR terminal system	13A-61
P1515	Brake vacuum sensor system	13A-62
P1600	Communication wire with A/T-ECU system	13A-64
P1610	Immobilizer system	13A-64

NOTE
1. Do not replace the engine-ECU until a through terminal check reveals there are no short/open circuit.
2. Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.
3. After the engine-ECU has detected a malfunction, a diagnosis code is recorded the next time the engine is started and the same malfunction is re-detected. However, for items marked with a "★", the diagnosis code is recorded on the first detection of the malfunction.
4. Sensor 1 indicates the sensor mounted at a position closest to the engine, and sensor 2 indicates the sensor mounted at the position second closest to the engine.

INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

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

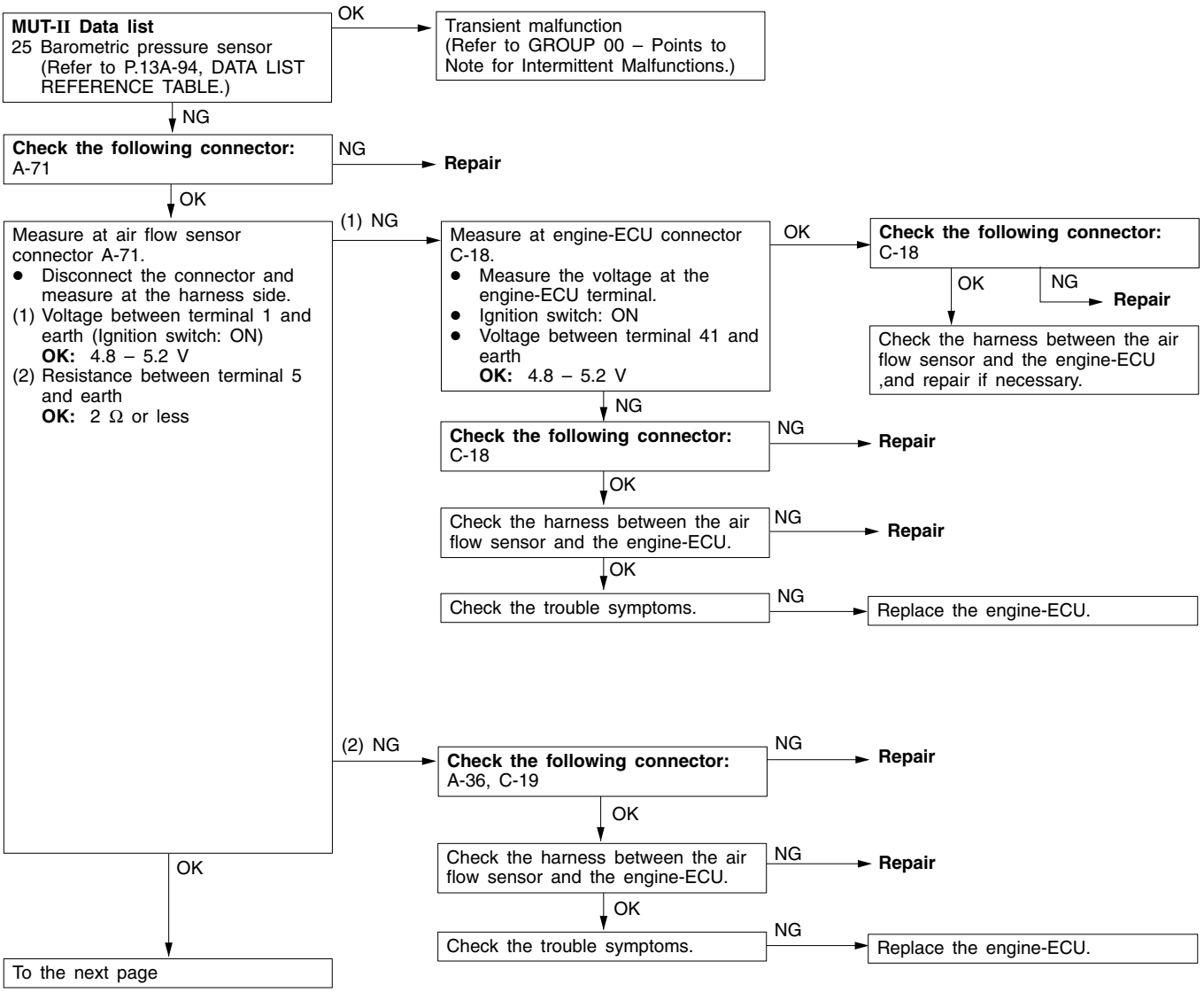


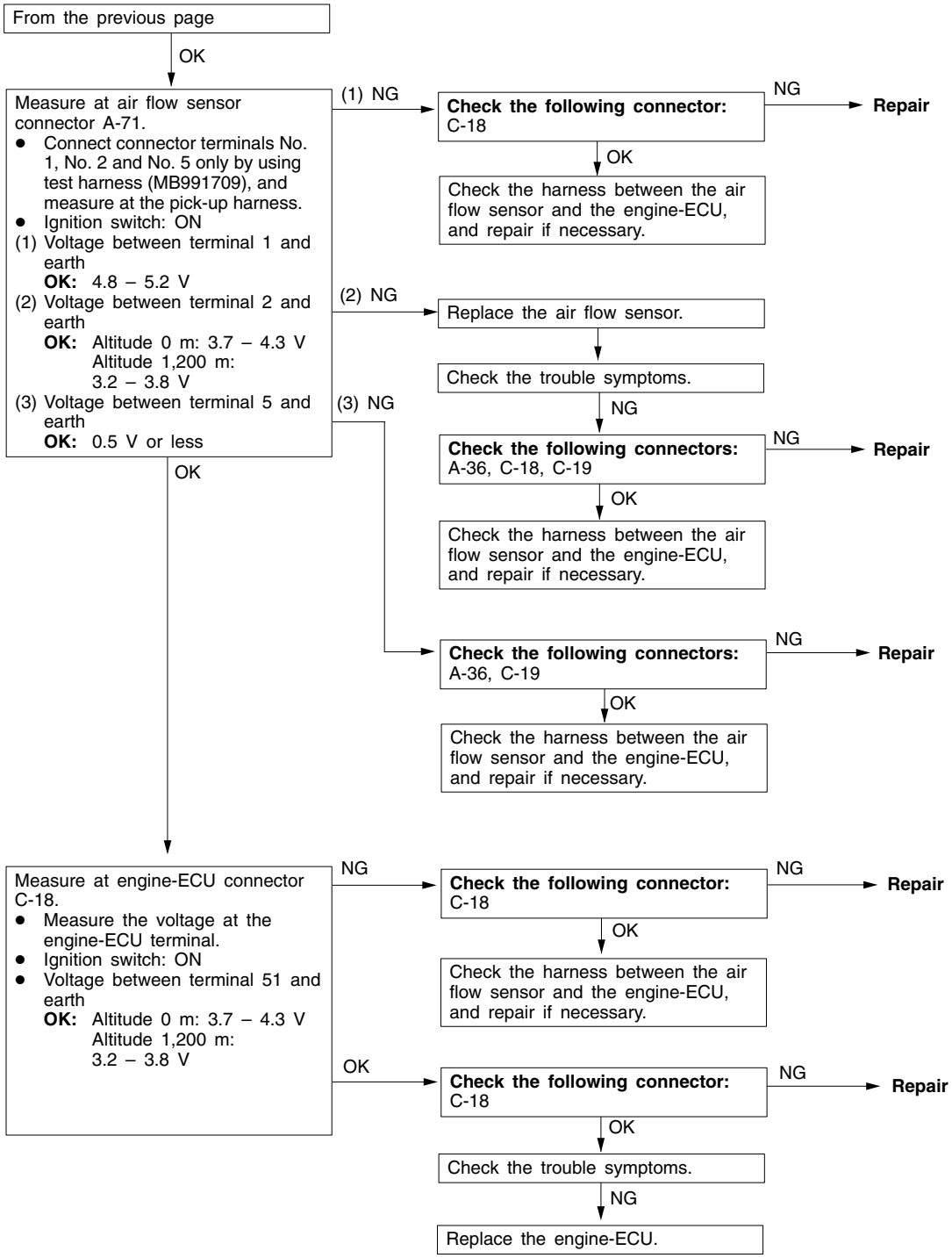


NOTE

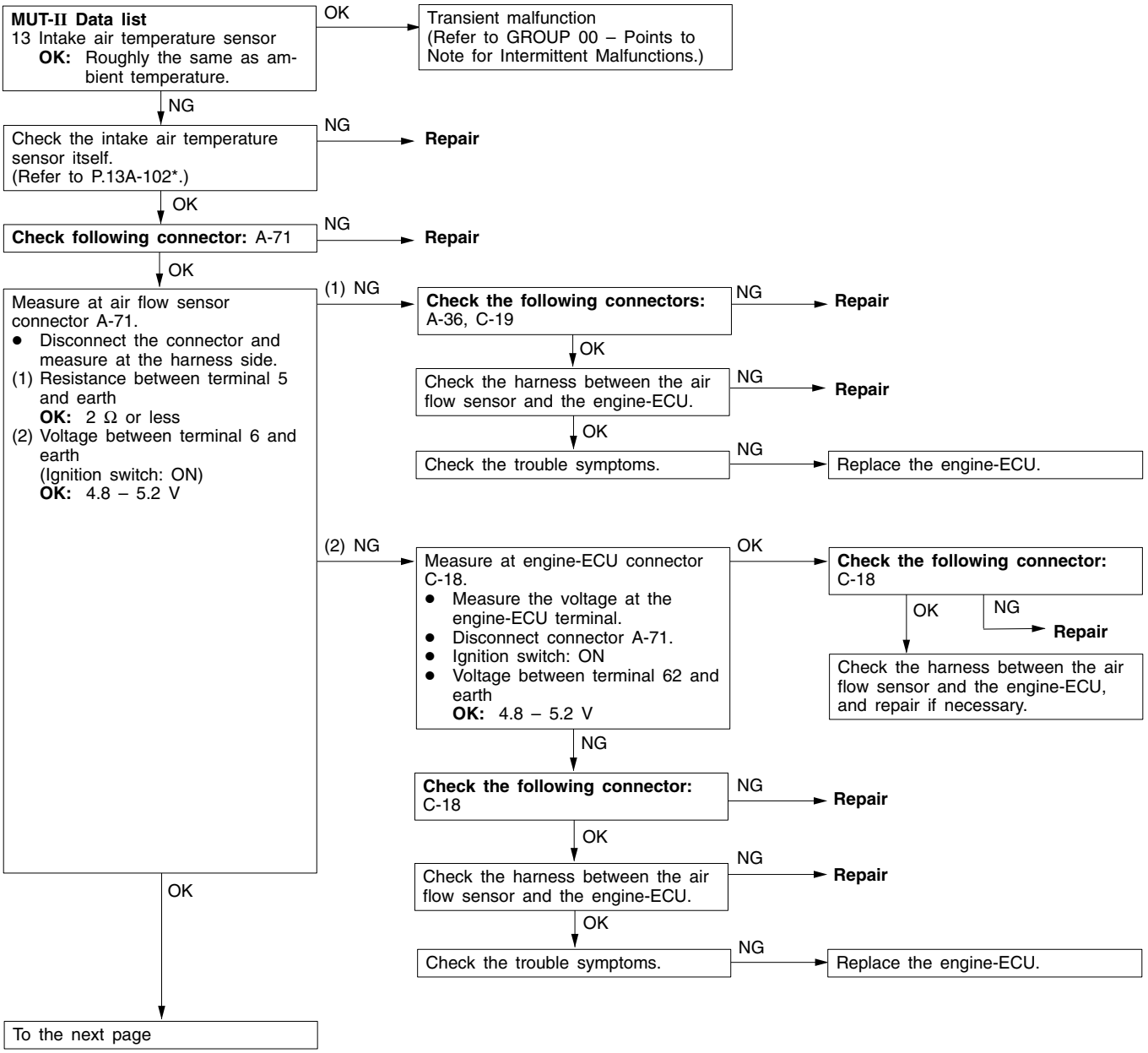
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).

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

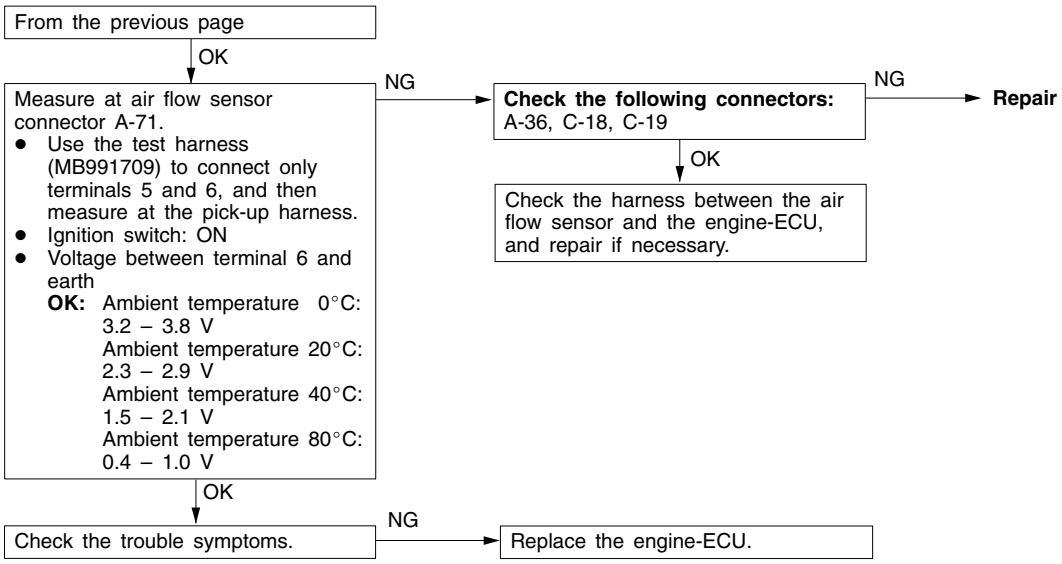



From the previous page
OK
Measure at air flow sensor connector A-71.
● Connect connector terminals No. 1, No. 2 and No. 5 only by using test harness (MB991709), and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 4.8 – 5.2 V
(2) Voltage between terminal 2 and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V
(3) Voltage between terminal 5 and earth
OK: 0.5 V or less
(1) NG
Check the following connector: C-18
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
(2) NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connectors: A-36, C-18, C-19
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
(3) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-18.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 51 and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V
NG
Check the following connector: C-18
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Check the following connector: C-18
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

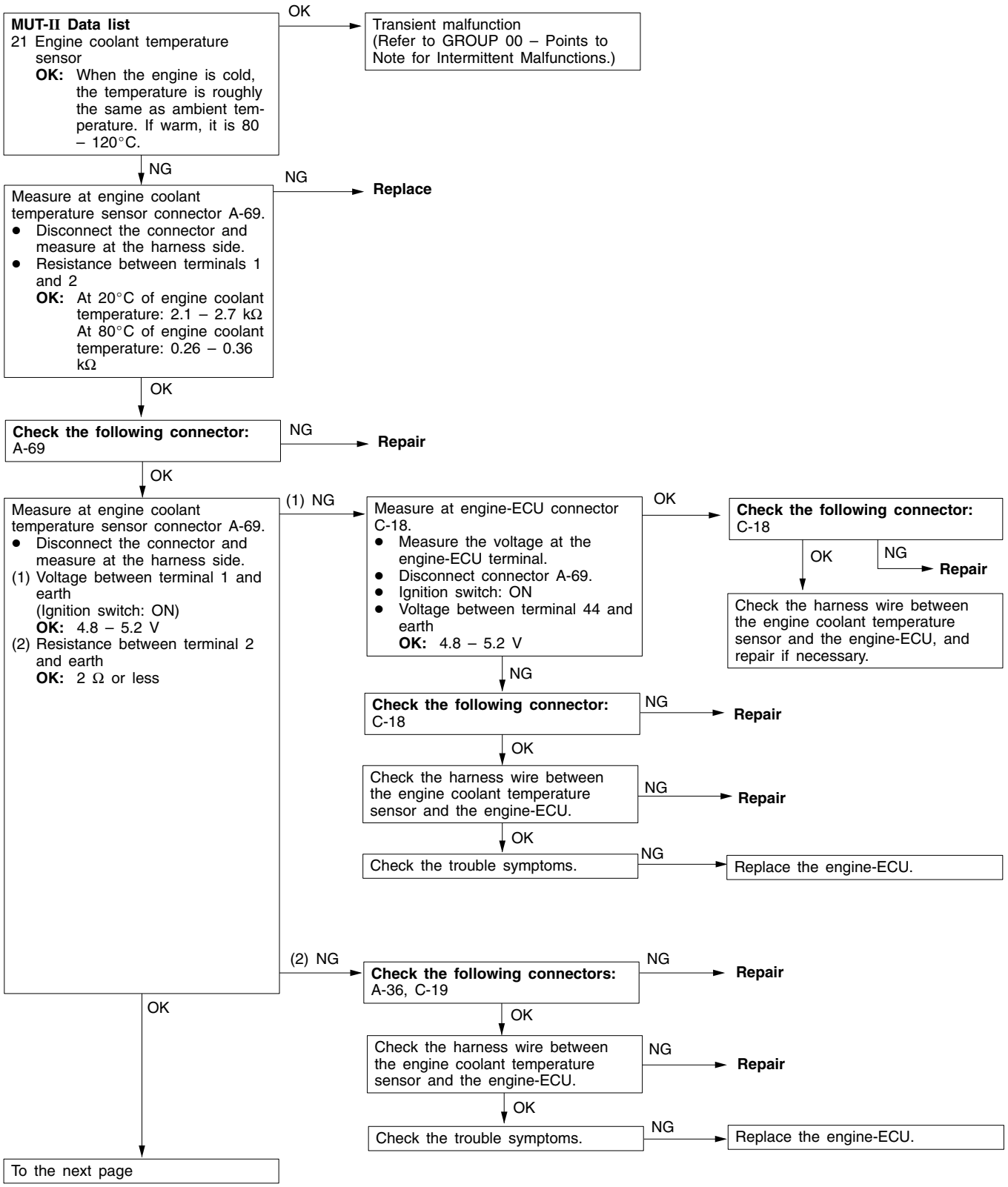
Code No. P0110 Intake air temperature sensor system	Probable cause
Range of Check • Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions • The sensor output voltage is 4.6 V or more for four seconds (equivalent to –45°C of intake air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

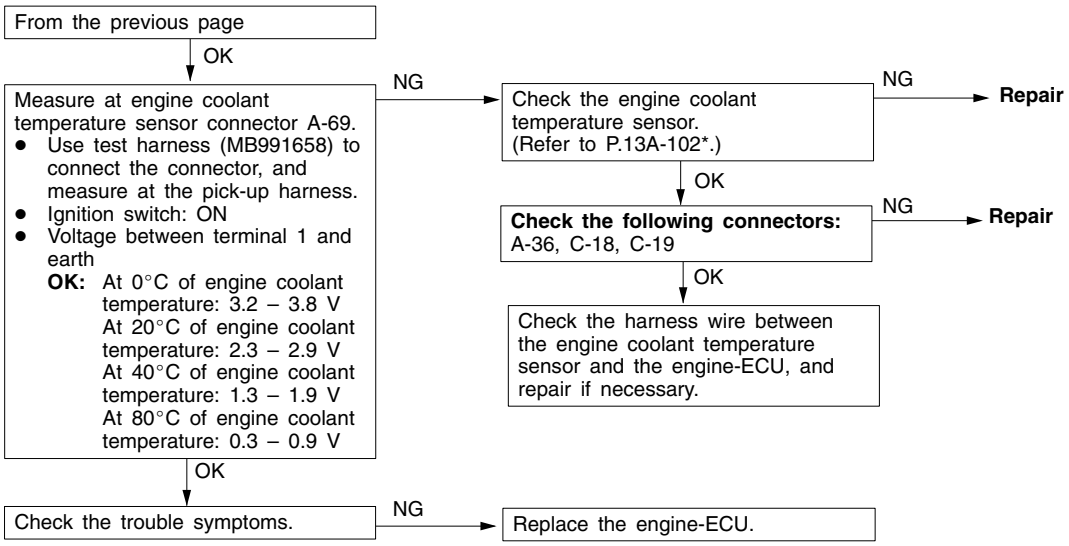


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).



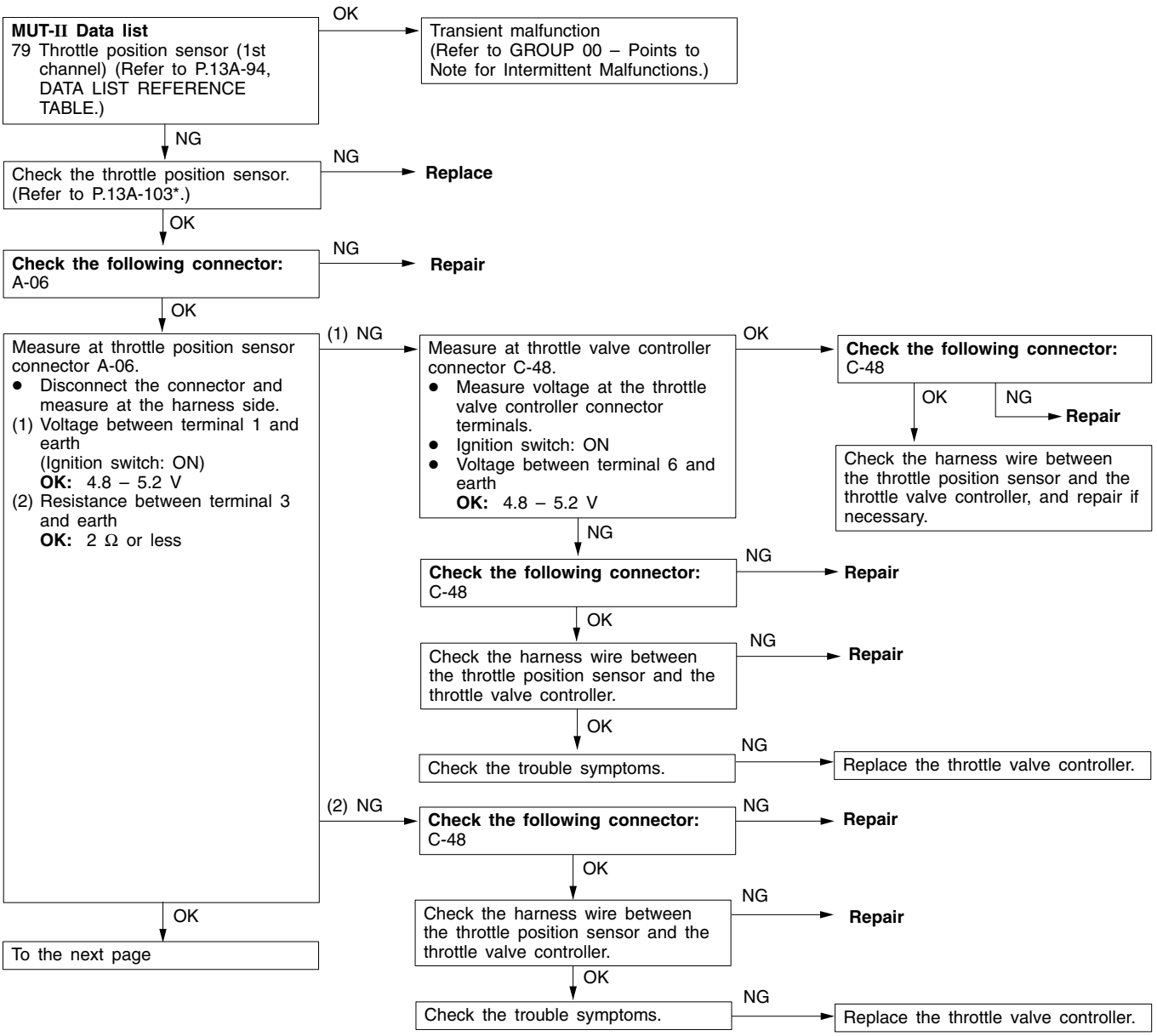
Code No. P0115 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to –45°C of engine coolant temperature) or ● The sensor output voltage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


MUT-II Data list
21 Engine coolant temperature sensor
OK: When the engine is cold, the temperature is roughly the same as ambient temperature. If warm, it is 80 – 120°C.
OK
Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Measure at engine coolant temperature sensor connector A-69.
• Disconnect the connector and measure at the harness side.
• Resistance between terminals 1 and 2
OK: At 20°C of engine coolant temperature: 2.1 – 2.7 kΩ
At 80°C of engine coolant temperature: 0.26 – 0.36 kΩ
NG
Replace
OK
Check the following connector: A-69
NG
Repair
OK
Measure at engine coolant temperature sensor connector A-69.
• Disconnect the connector and measure at the harness side.
(1) Voltage between terminal 1 and earth (Ignition switch: ON)
OK: 4.8 – 5.2 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less
(1) NG
Measure at engine-ECU connector C-18.
• Measure the voltage at the engine-ECU terminal.
• Disconnect connector A-69.
• Ignition switch: ON
• Voltage between terminal 44 and earth
OK: 4.8 – 5.2 V
OK
Check the following connector: C-18
OK
NG
Repair
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(2) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
To the next page

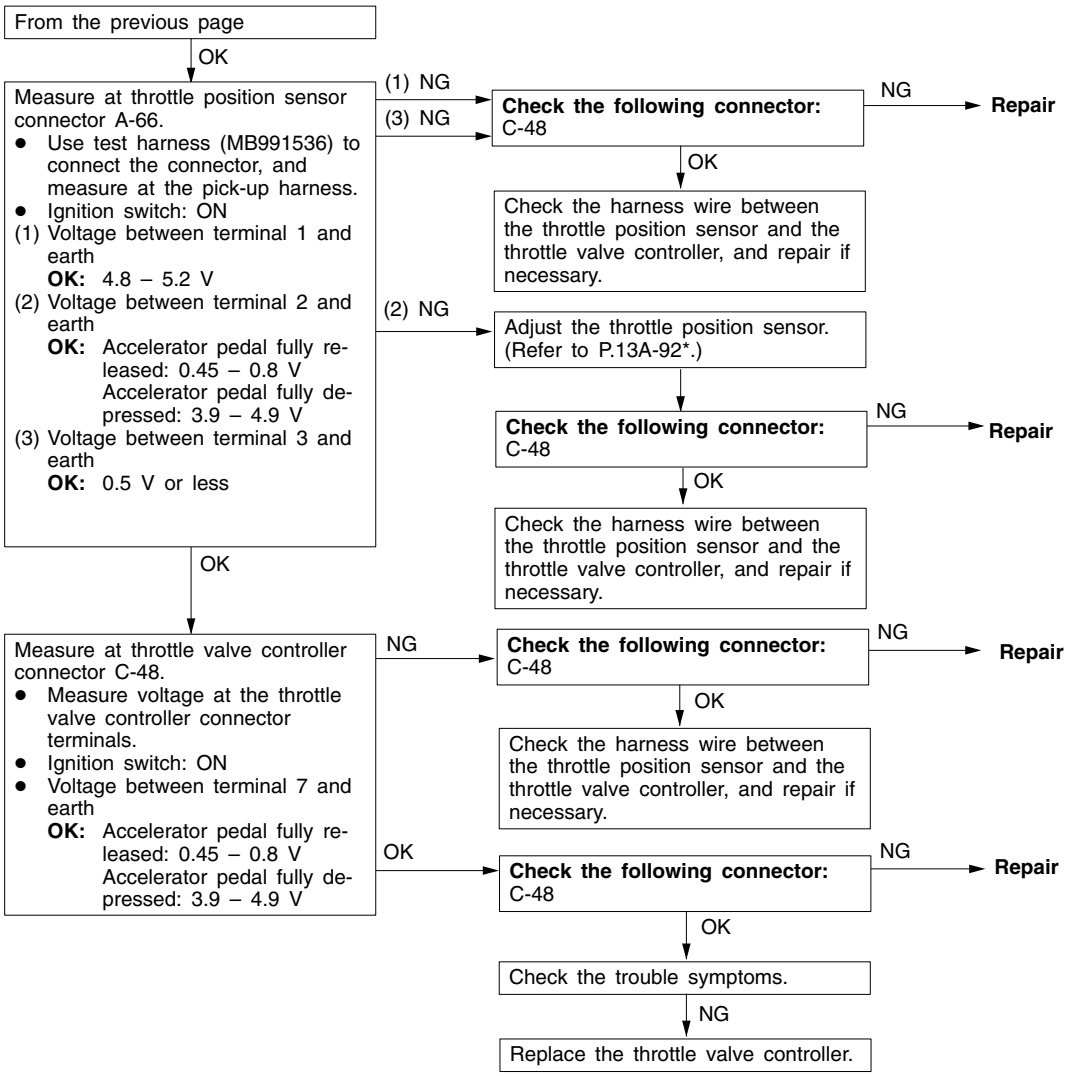


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1).

Code No. P0120 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check • Ignition switch: ON Set Conditions • The sensor output voltage is 0.2 V or less. or • The sensor output voltage is 4.9 V or more. or • The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V. or • The output voltage of the throttle position sensor (1st channel) is significantly different (approx. 1V) from the throttle valve opening angle (voltage), which the engine-ECU request the throttle valve controller.	• Malfunction of throttle position sensor • Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact • Malfunction of throttle valve controller • Malfunction of engine-ECU

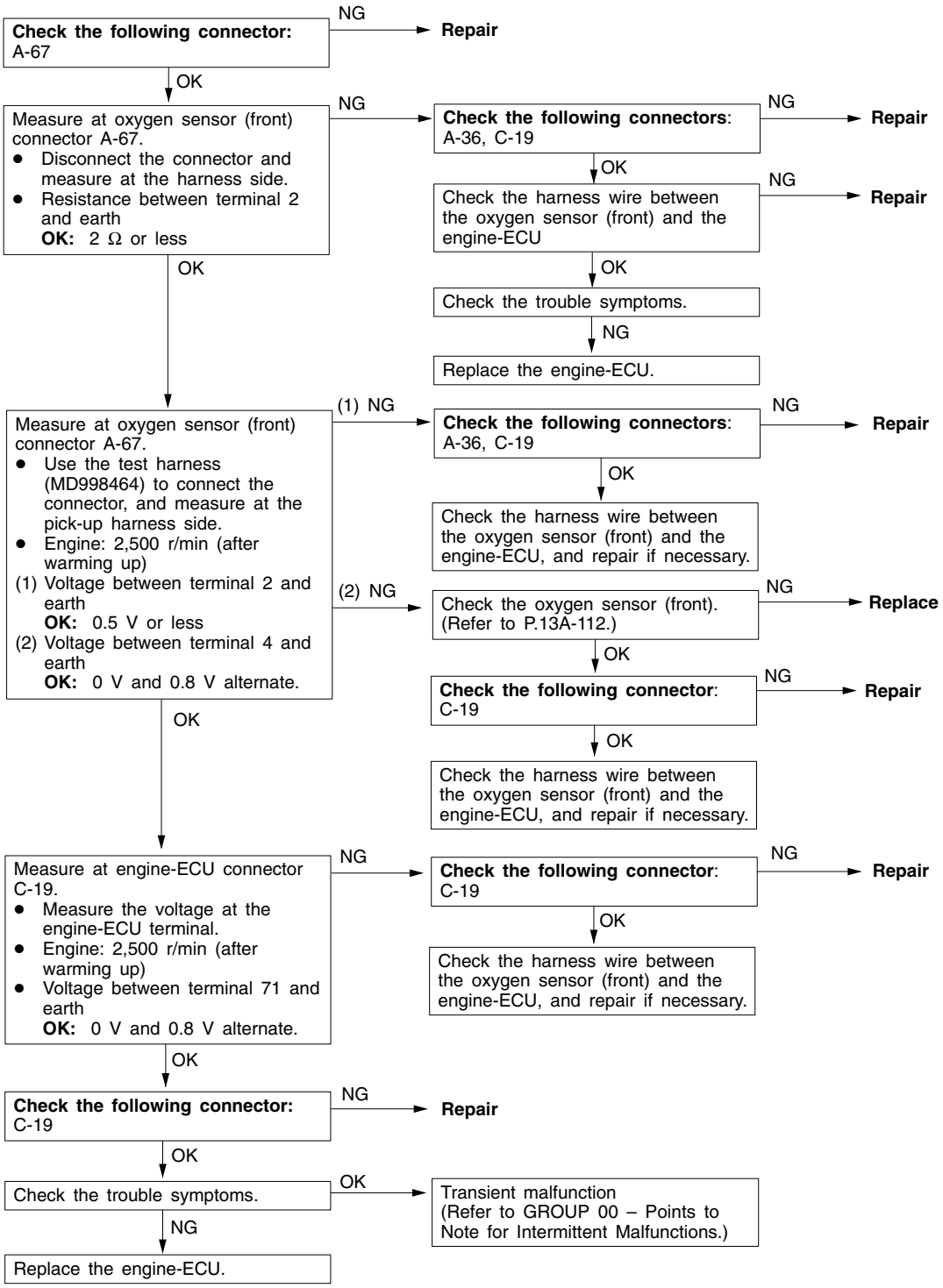


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKPE00E1)

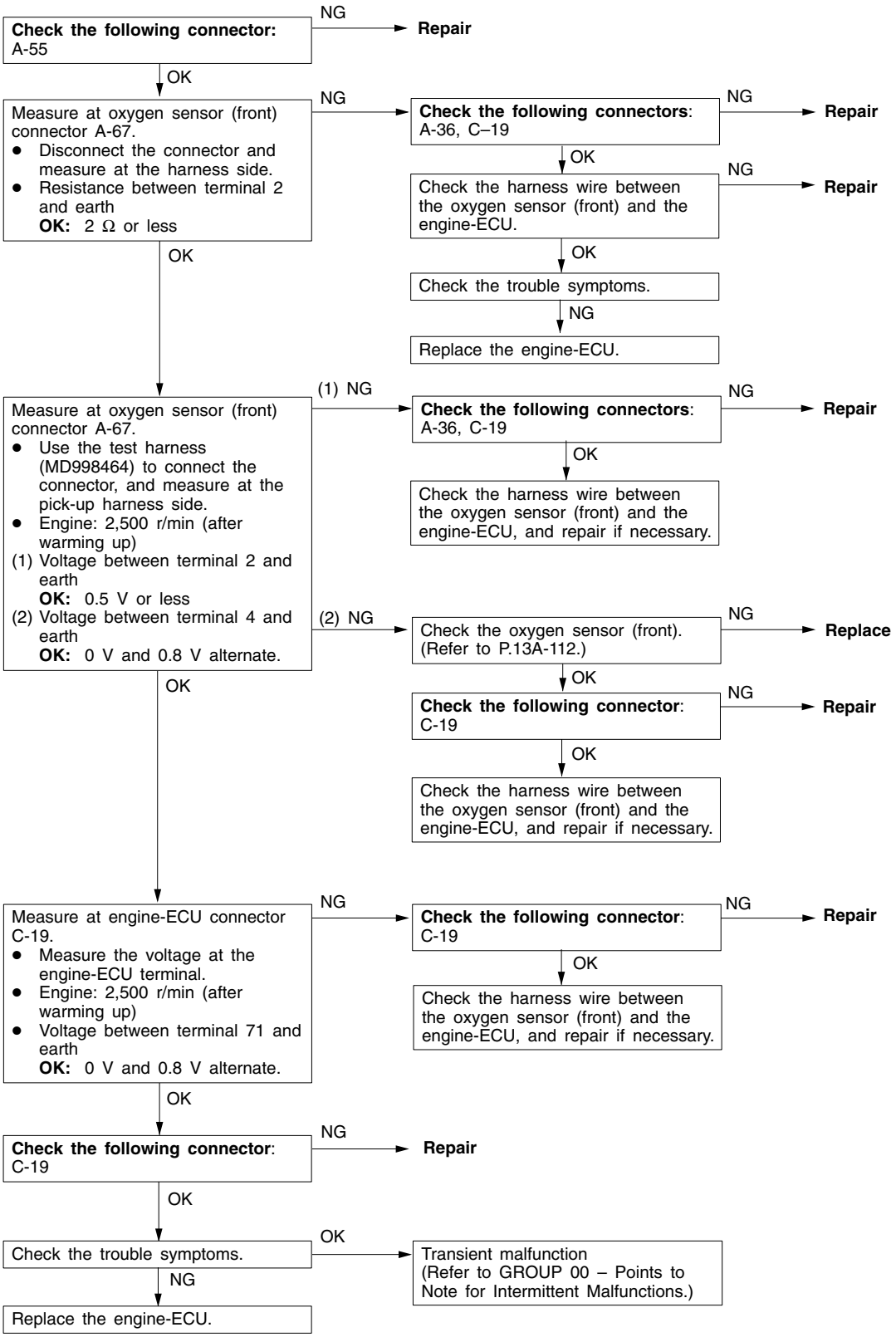


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

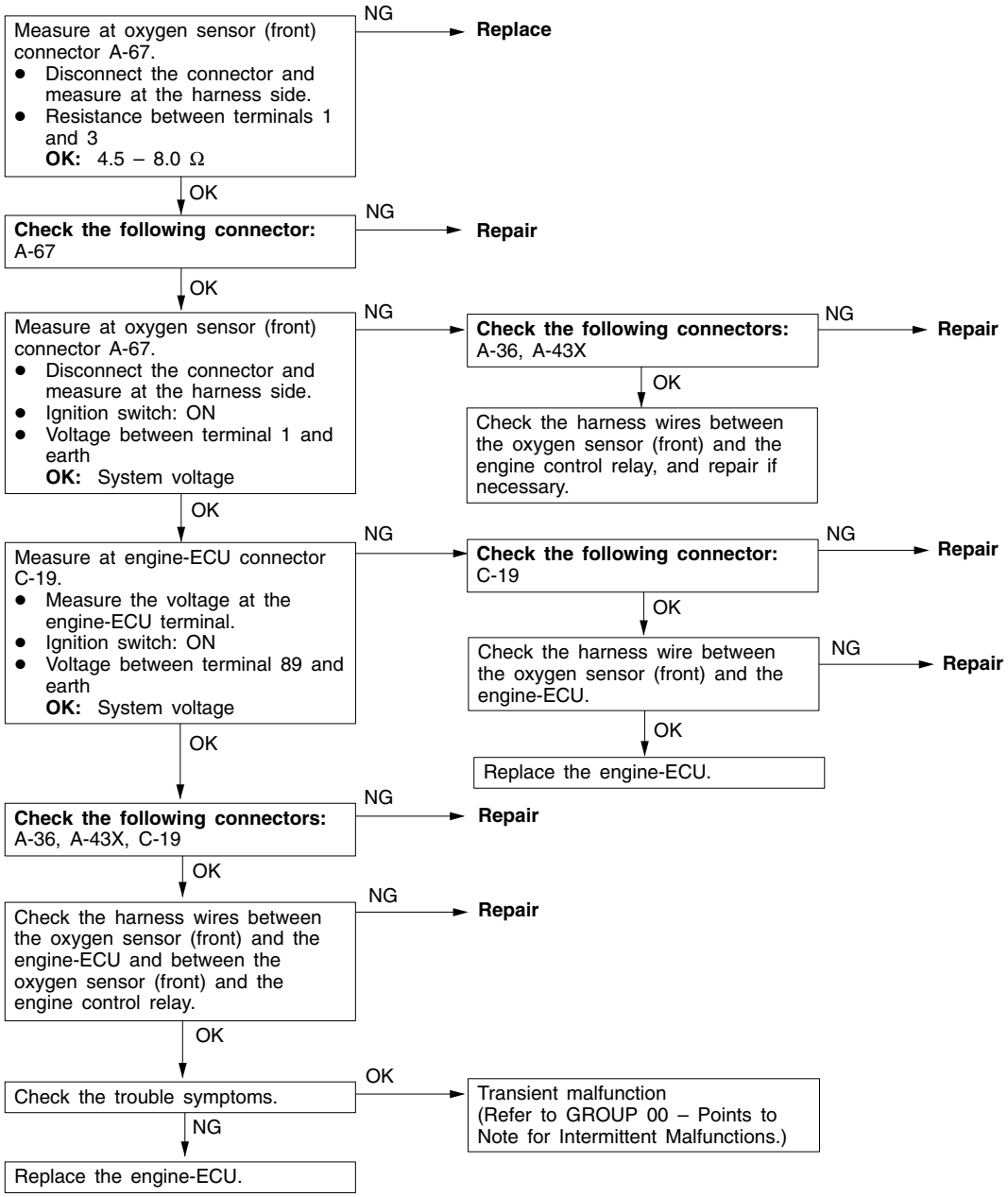
Code No. P0125 Feedback system	Probable cause
Range of Check ● The engine coolant temperature is approx. 80°C or more. ● During stoichiometric feedback control ● The vehicle is not being decelerated. Set Conditions ● Oxygen sensor (front) output voltage has been higher or lower than 0.5 V for at least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



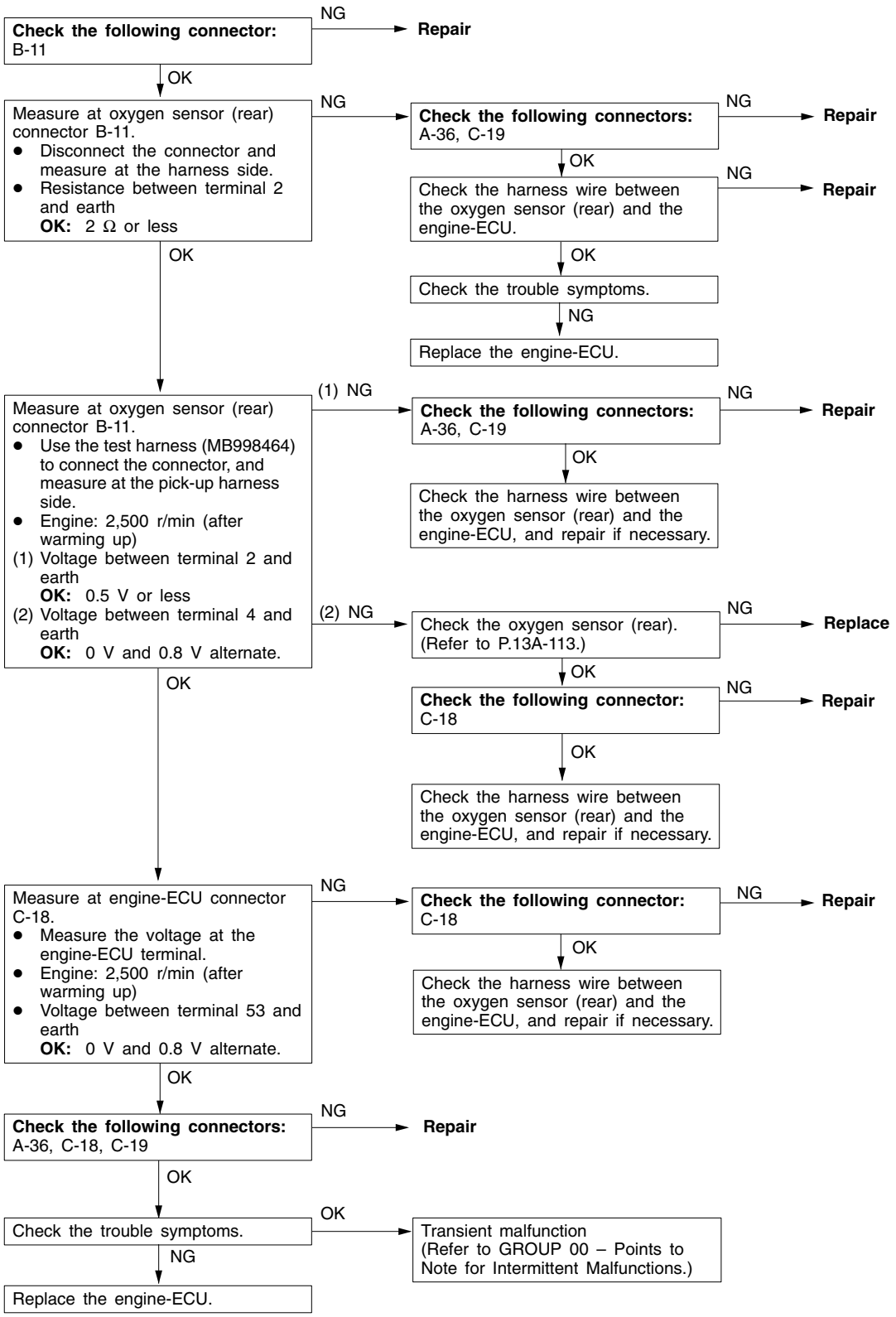
Code No. P0130 Oxygen sensor (front) system <sensor 1>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 r/min or more ● Driving on a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


Check the following connector: A-55
NG
Repair
OK
Measure at oxygen sensor (front) connector A-67.
• Disconnect the connector and measure at the harness side.
• Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: A-36, C–19
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at oxygen sensor (front) connector A-67.
• Use the test harness (MD998464) to connect the connector, and measure at the pick-up harness side.
• Engine: 2,500 r/min (after warming up)
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal 4 and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor (front). (Refer to P.13A-112.)
NG
Replace
OK
Check the following connector: C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-19.
• Measure the voltage at the engine-ECU terminal.
• Engine: 2,500 r/min (after warming up)
• Voltage between terminal 71 and earth
OK: 0 V and 0.8 V alternate.
NG
Check the following connector: C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (front) and the engine-ECU, and repair if necessary.
OK
Check the following connector: C-19
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

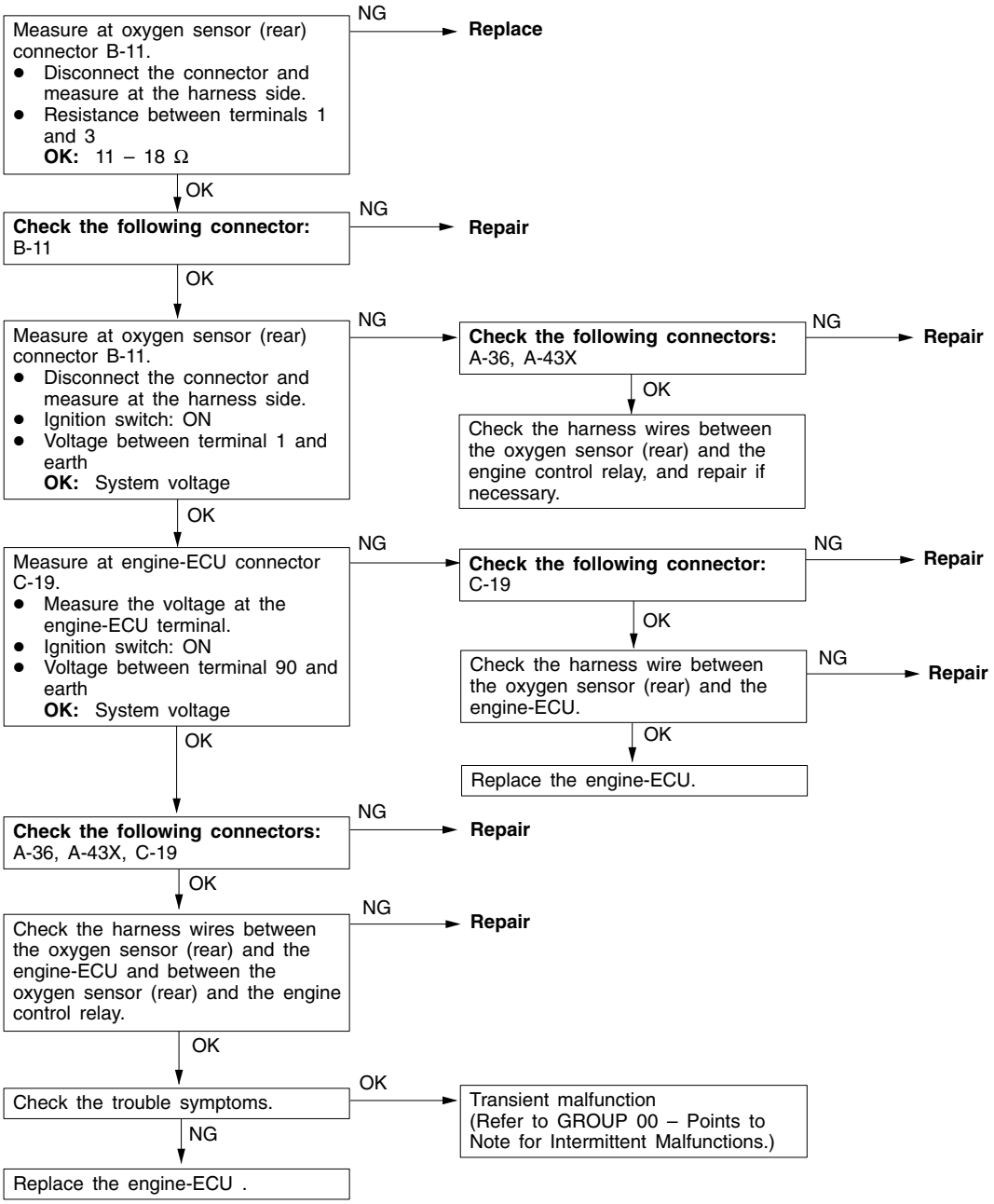
Code No. P0135 Oxygen sensor heater (front) system <sensor 1>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (front) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current, which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



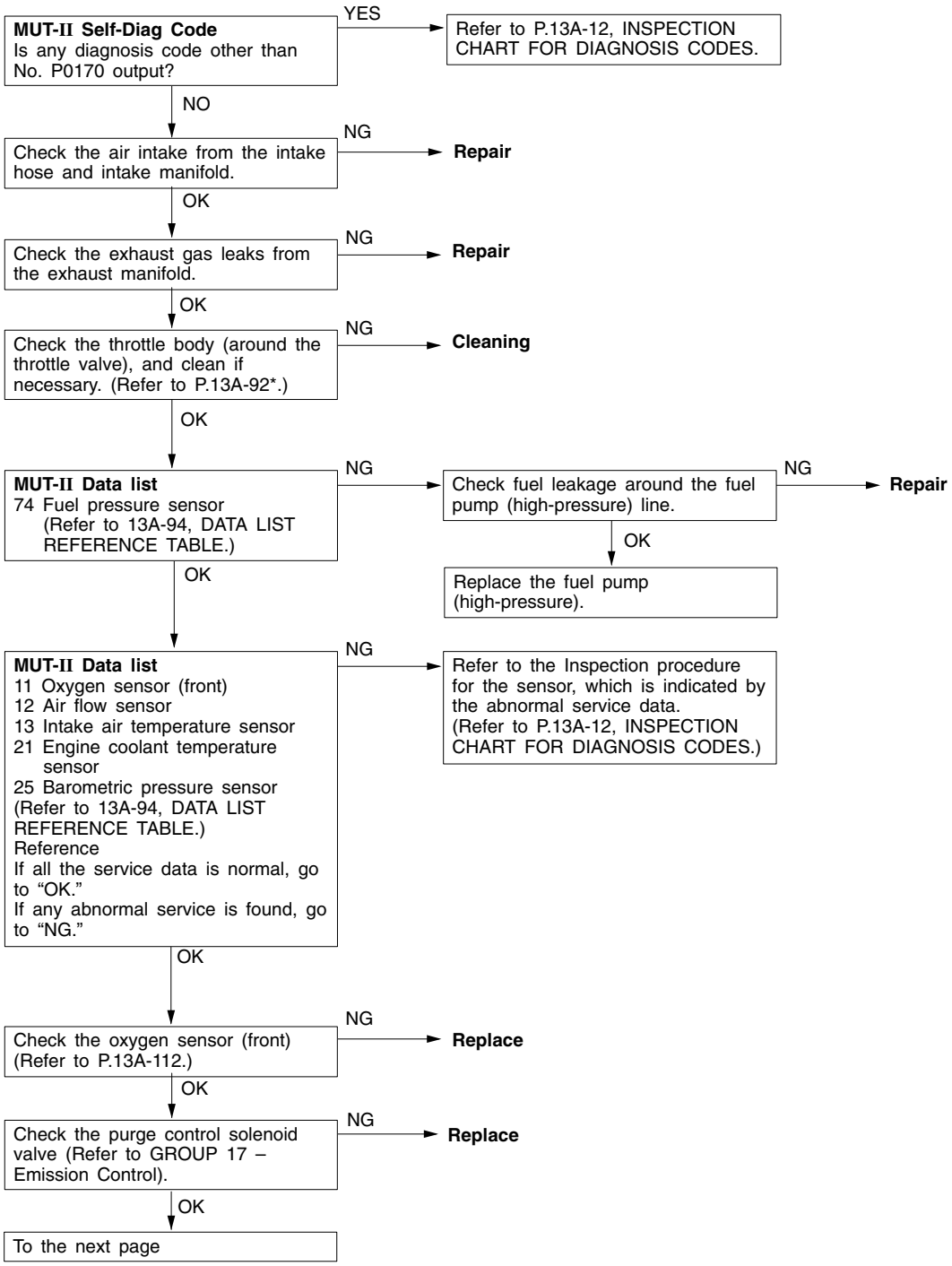
Code No. P0136 Oxygen sensor (rear) system <sensor 2>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 r/min or more ● Driving on a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


Check the following connector: B-11
NG
Repair
OK
Measure at oxygen sensor (rear) connector B-11.
• Disconnect the connector and measure at the harness side.
• Resistance between terminal 2 and earth
OK: 2 Ω or less
NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at oxygen sensor (rear) connector B-11.
• Use the test harness (MB998464) to connect the connector, and measure at the pick-up harness side.
• Engine: 2,500 r/min (after warming up)
(1) Voltage between terminal 2 and earth
OK: 0.5 V or less
(2) Voltage between terminal 4 and earth
OK: 0 V and 0.8 V alternate.
(1) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
(2) NG
Check the oxygen sensor (rear). (Refer to P.13A-113.)
NG
Replace
OK
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-18.
• Measure the voltage at the engine-ECU terminal.
• Engine: 2,500 r/min (after warming up)
• Voltage between terminal 53 and earth
OK: 0 V and 0.8 V alternate.
NG
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the oxygen sensor (rear) and the engine-ECU, and repair if necessary.
OK
Check the following connectors: A-36, C-18, C-19
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

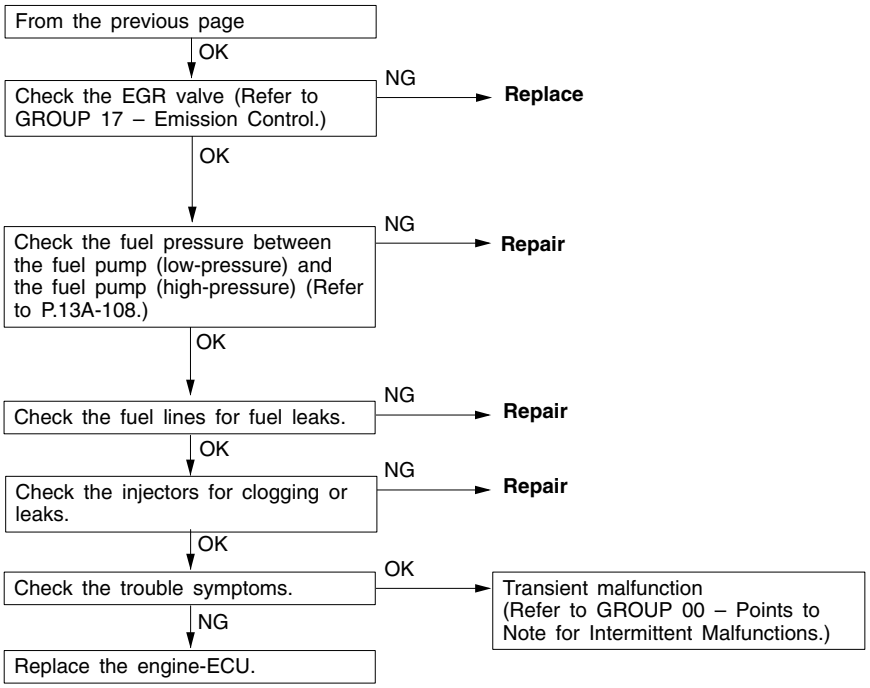
Code No. P0141 Oxygen sensor heater (rear) system <sensor 2>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (rear) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current, which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



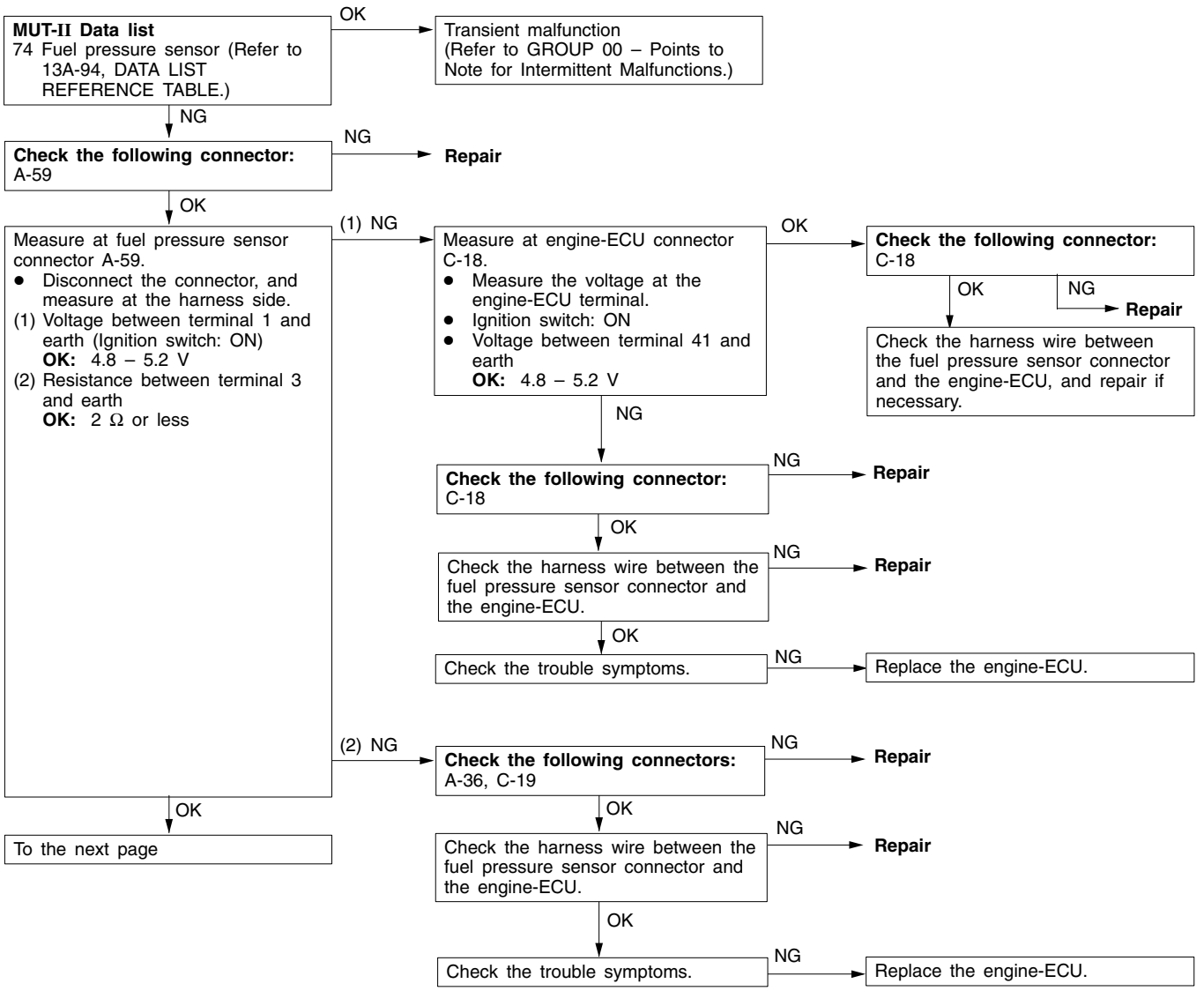
Code No. P0170 Abnormal fuel system	Probable cause
Range of Check ● Engine: Being learning the air-fuel ratio Set Conditions ● Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or ● Ten seconds or more have been passed while the fuel injection amount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

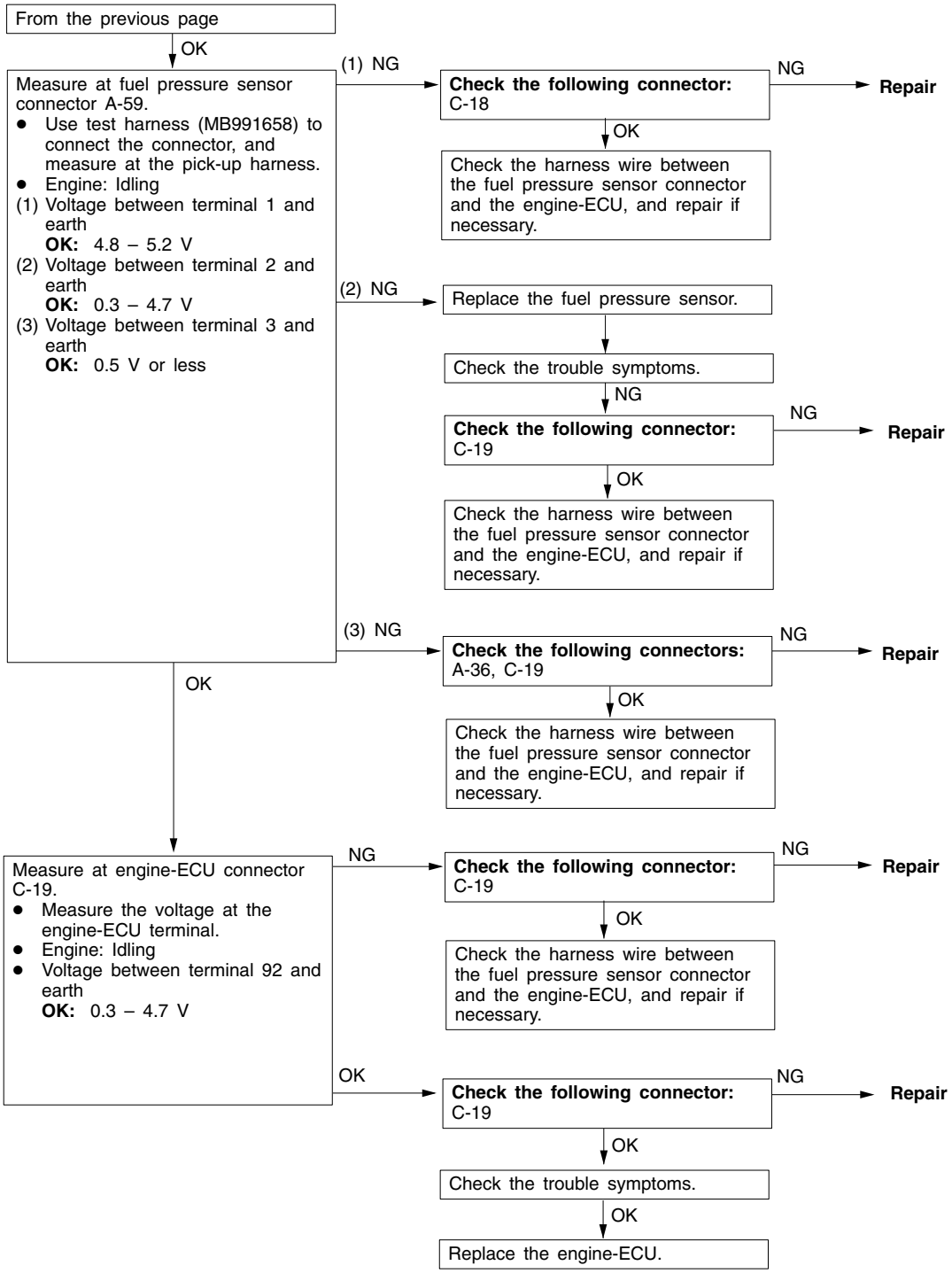


NOTE
*: Refer to the ’00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

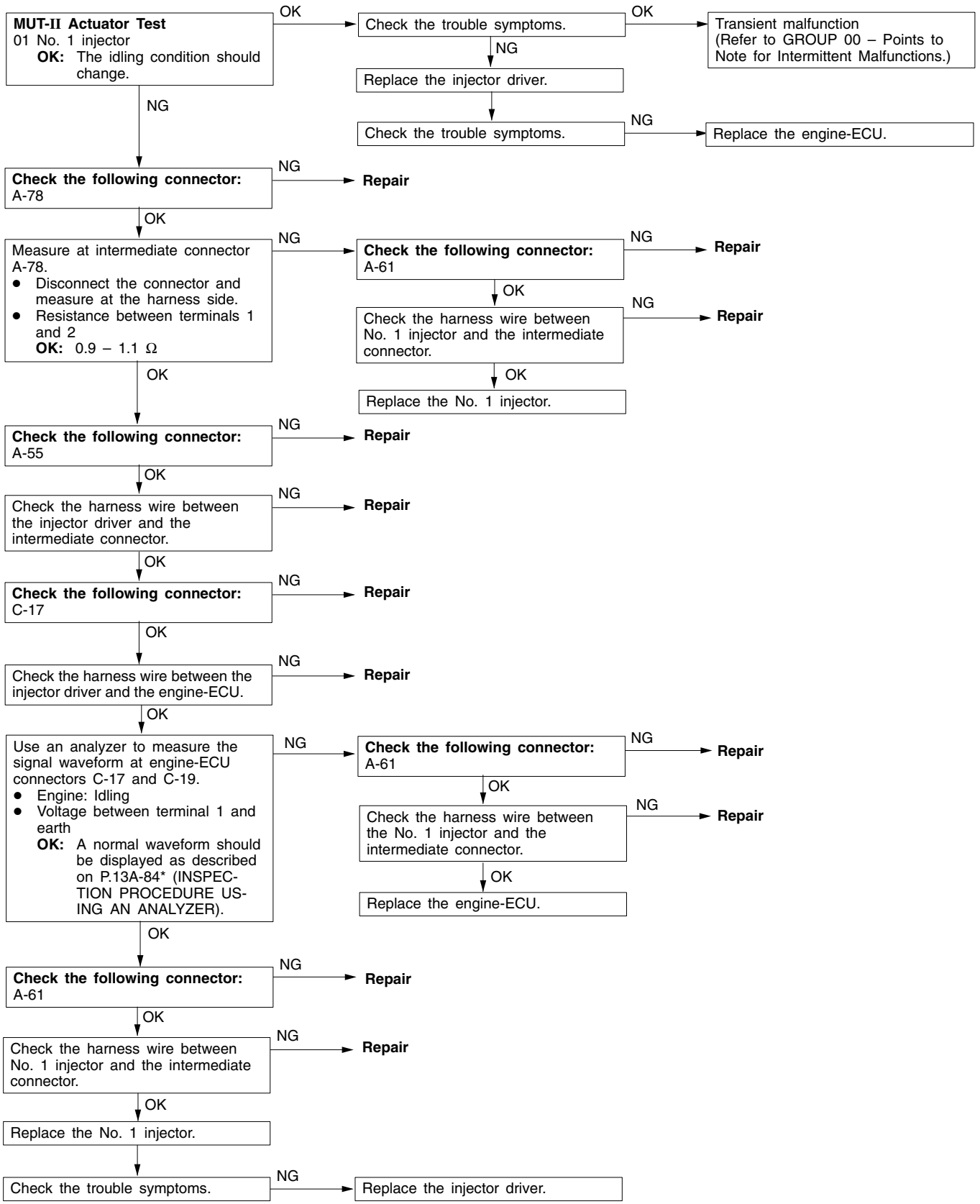

From the previous page
OK
Check the EGR valve (Refer to GROUP 17 – Emission Control.)
NG
Replace
OK
Check the fuel pressure between the fuel pump (low-pressure) and the fuel pump (high-pressure) (Refer to P.13A-108.)
NG
Repair
OK
Check the fuel lines for fuel leaks.
NG
Repair
OK
Check the injectors for clogging or leaks.
NG
Repair
OK
Check the trouble symptoms.
OK
Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

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





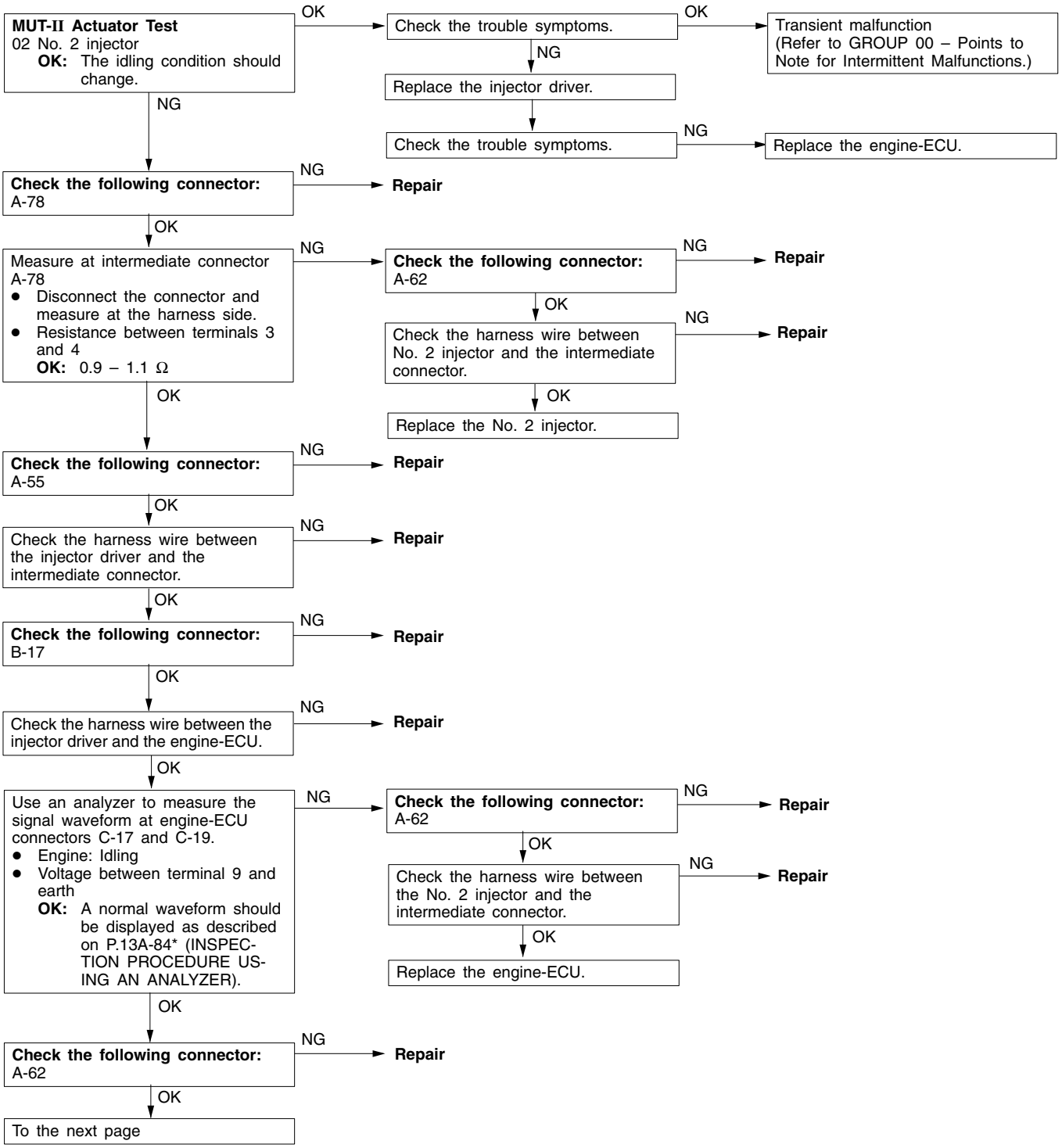
Code No. P0201 No. 1 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting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



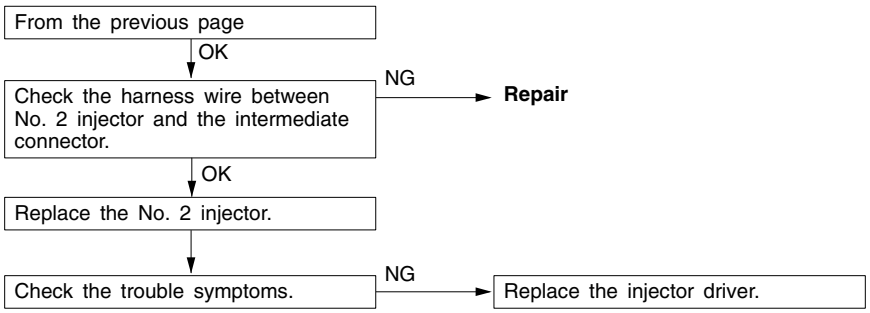
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

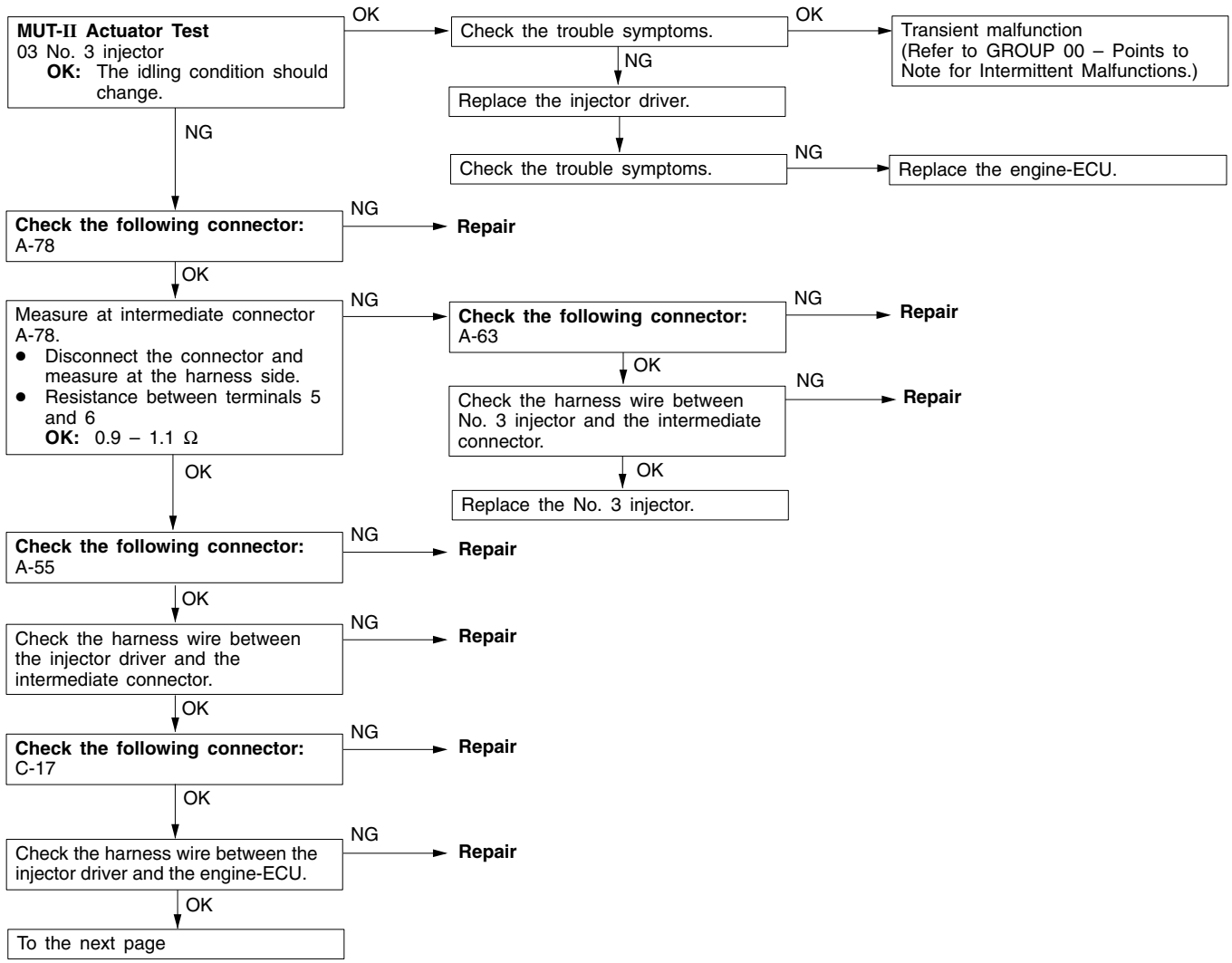
Code No. P0202 No. 2 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting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

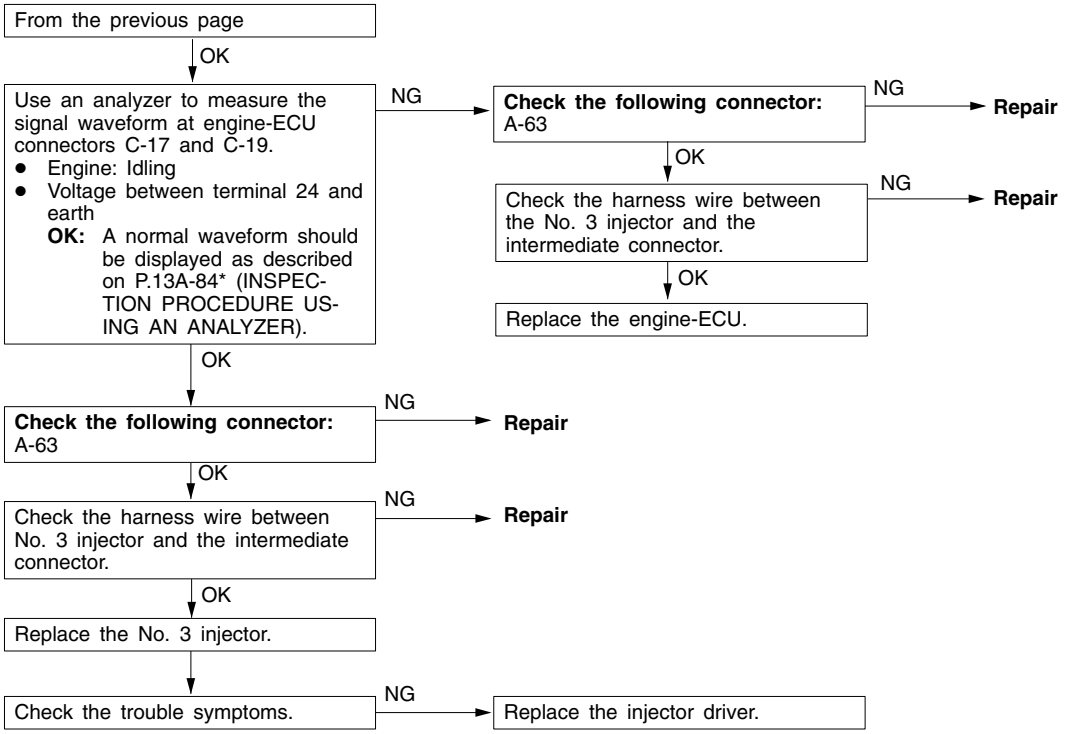


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)



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

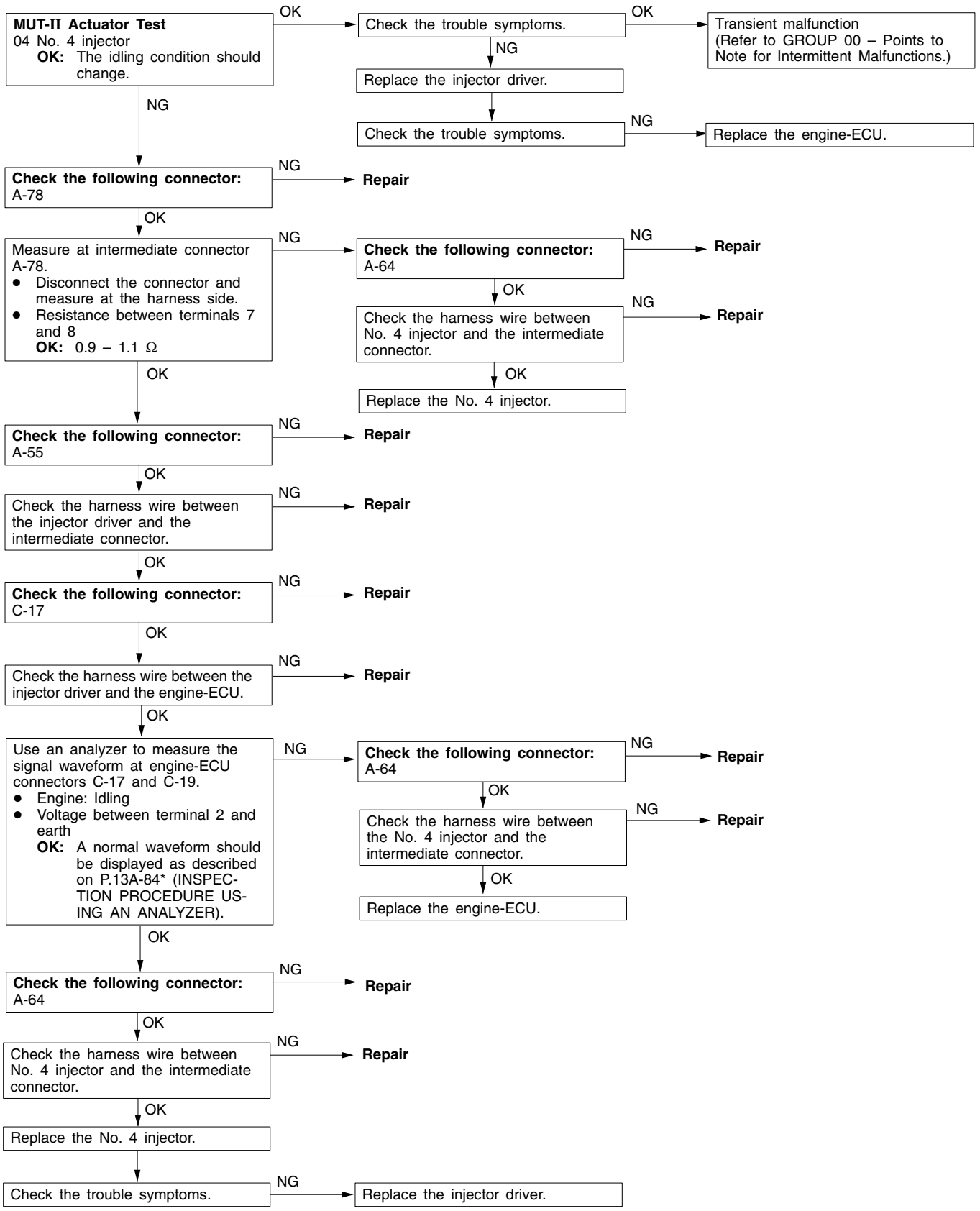




NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

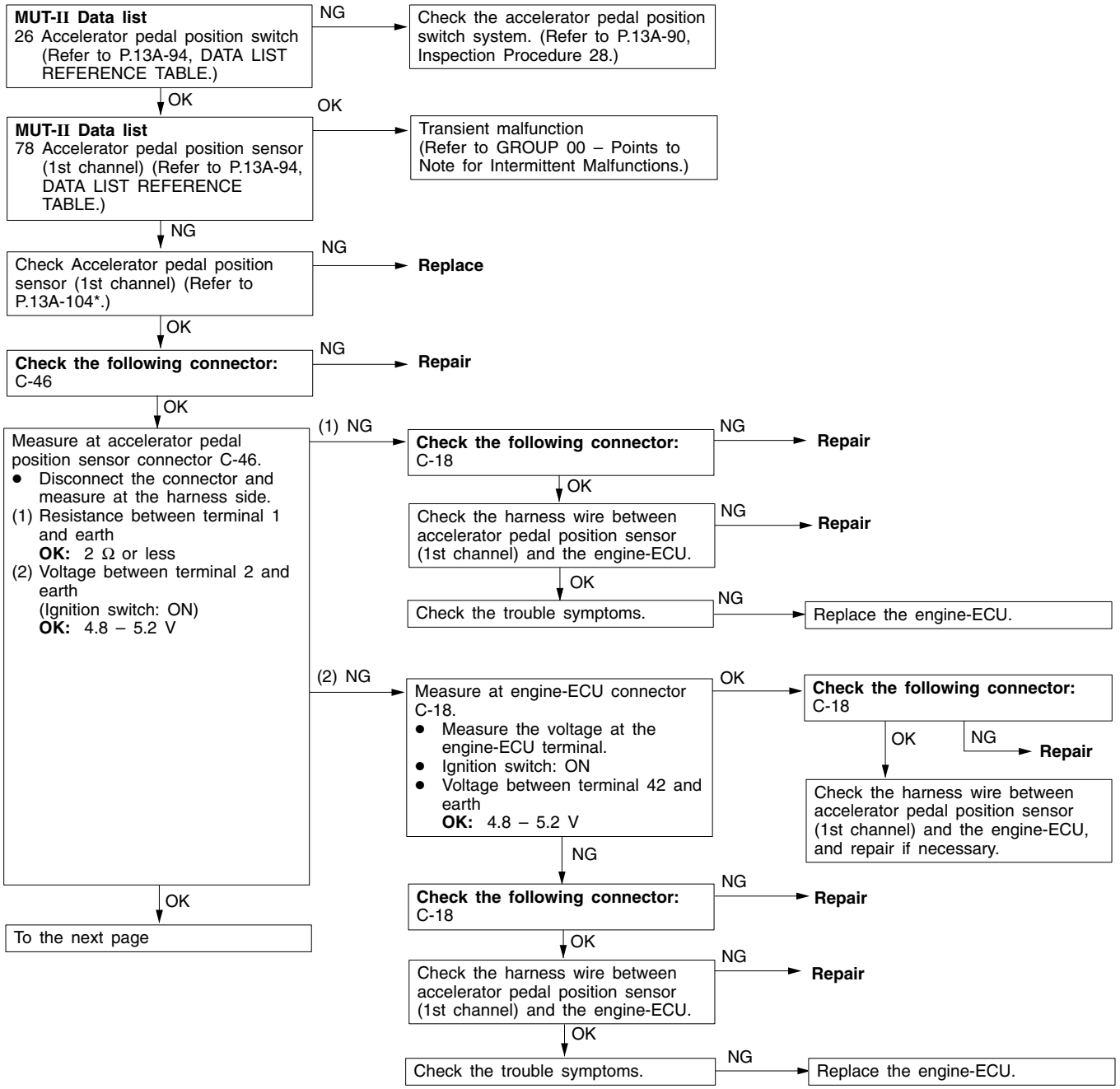
Code No. P0204 No. 4 injector system	Probable cause
Range of Check ● The engine speed is 4,000 r/min or less. ● The battery voltage is 10 V or more. ● The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions ● The injector driver is not transmitting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



NOTE

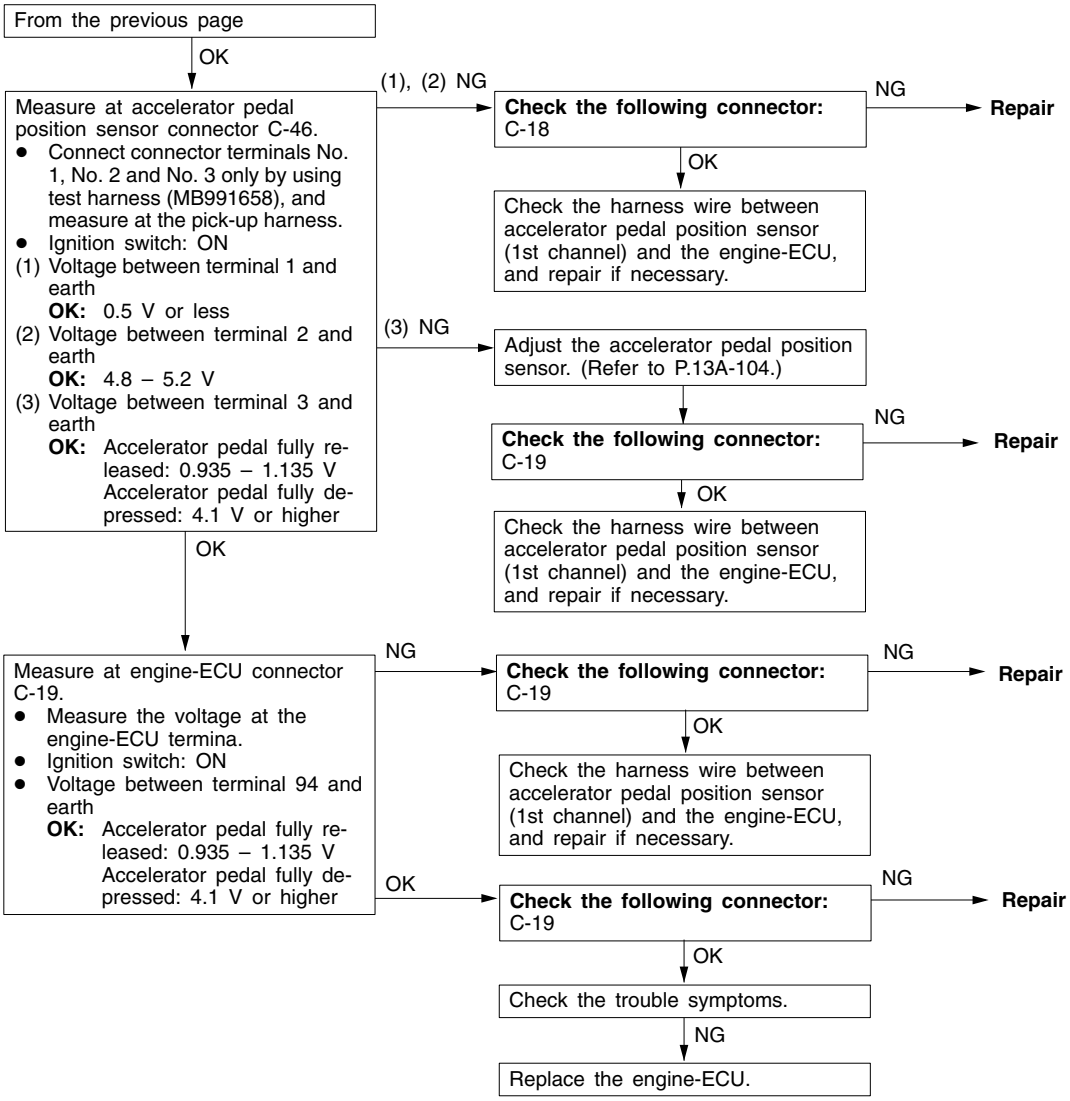
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

Code No. P0220 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of Check ● Accelerator pedal position sensor (2nd channel) is normal. ● Communication between the engine-ECU and the throttle valve controller is normal. Set Conditions ● The output voltage of accelerator pedal position sensor (1st channel) is 0.2 V or less for one second. or ● The output voltage of accelerator pedal position sensor (2nd channel) is 2.5 V or less, and that of accelerator pedal position sensor (1st channel) is 4.5 V or more for one second or ● The difference between accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) output voltages is 1.0 V or more (i.e. the throttle opening angle changes slightly). or ● The output voltage of accelerator pedal position sensor (1st channel) is 1.875 V or more for one second when the accelerator pedal position switch is turned on.	● Malfunction of accelerator pedal position sensor (1st channel) ● Open or short circuit in the accelerator pedal position sensor (1st channel) circuit or loose connector contact ● Accelerator pedal position switch seized ON ● Malfunction of throttle valve controller ● Malfunction of engine-ECU



NOTE

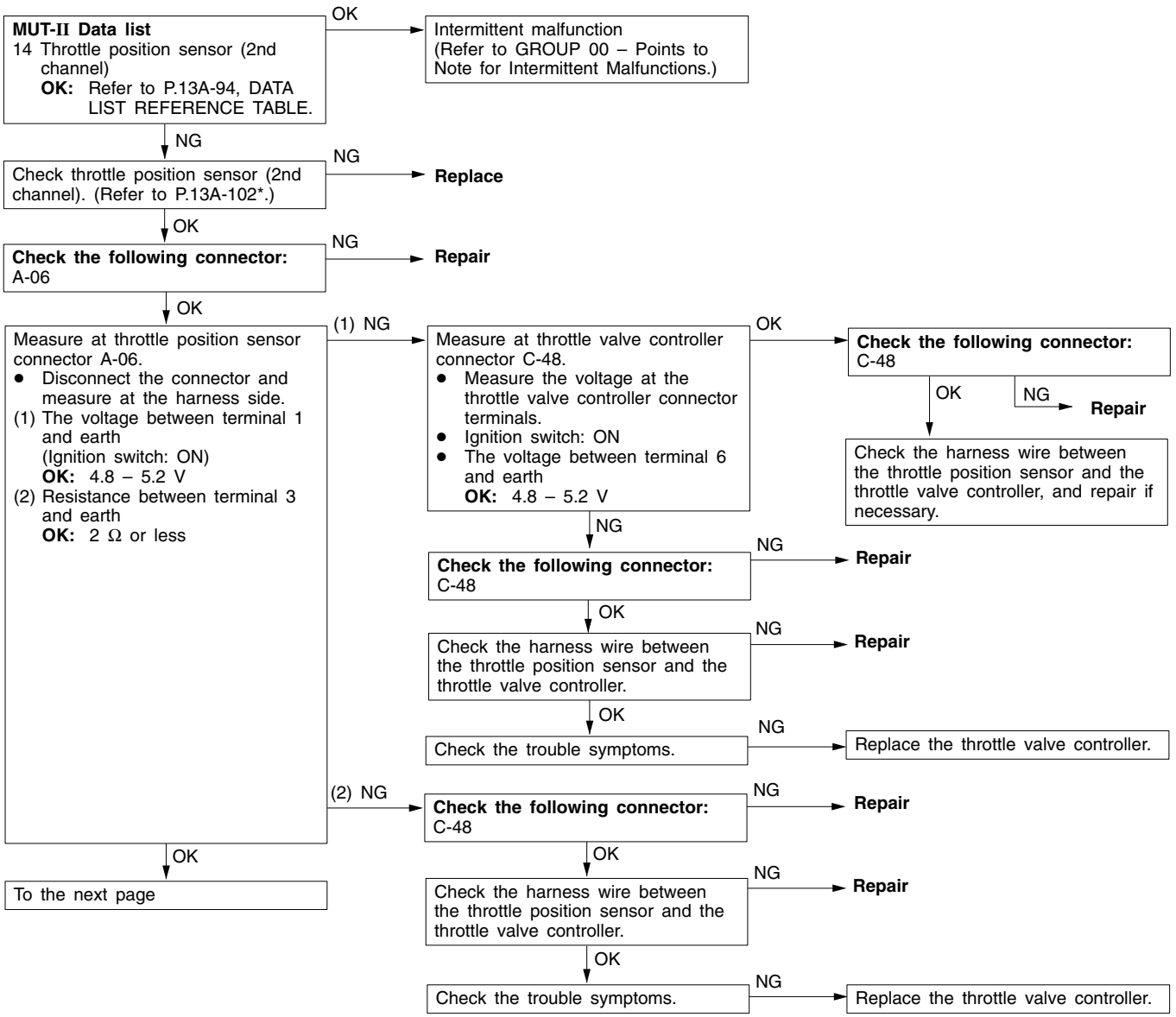
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)



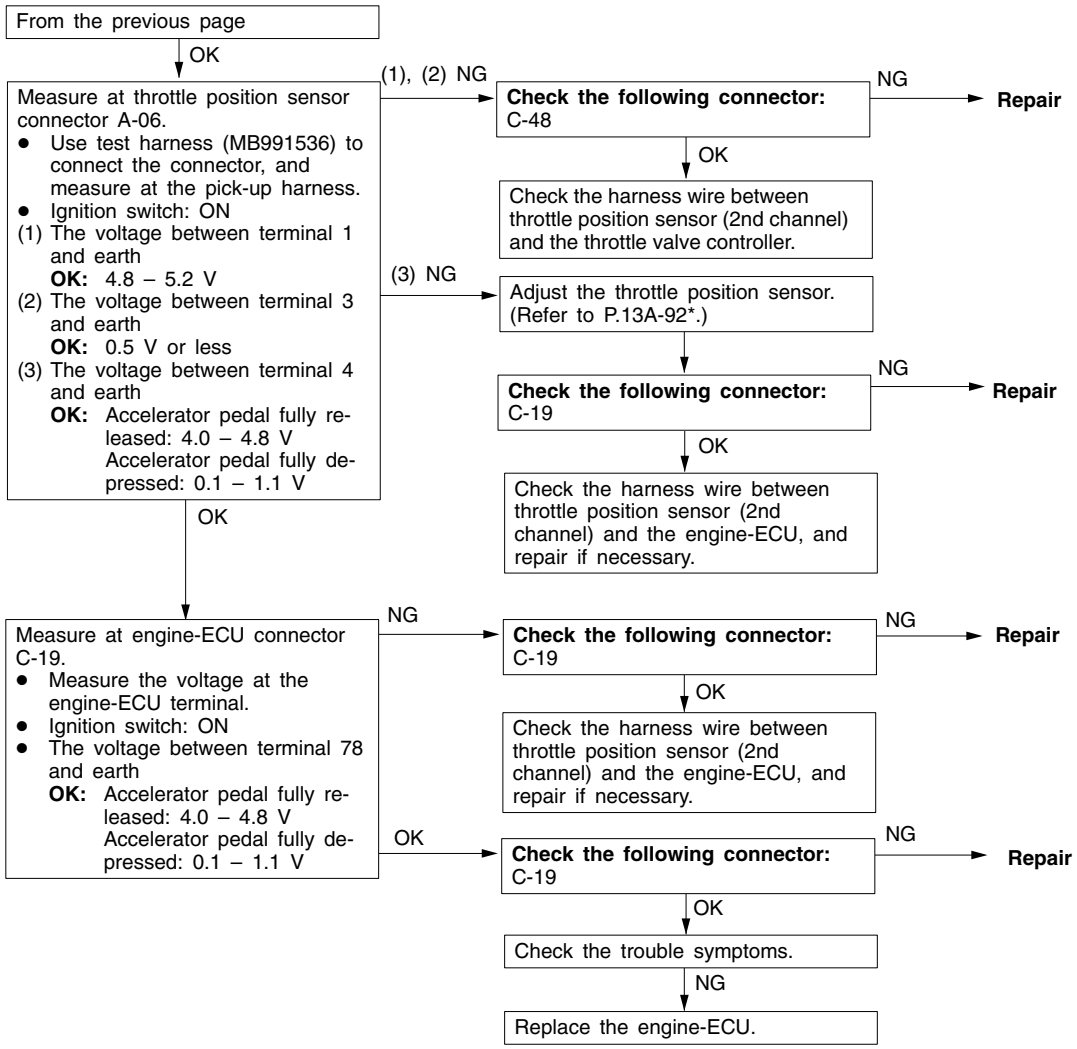
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

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

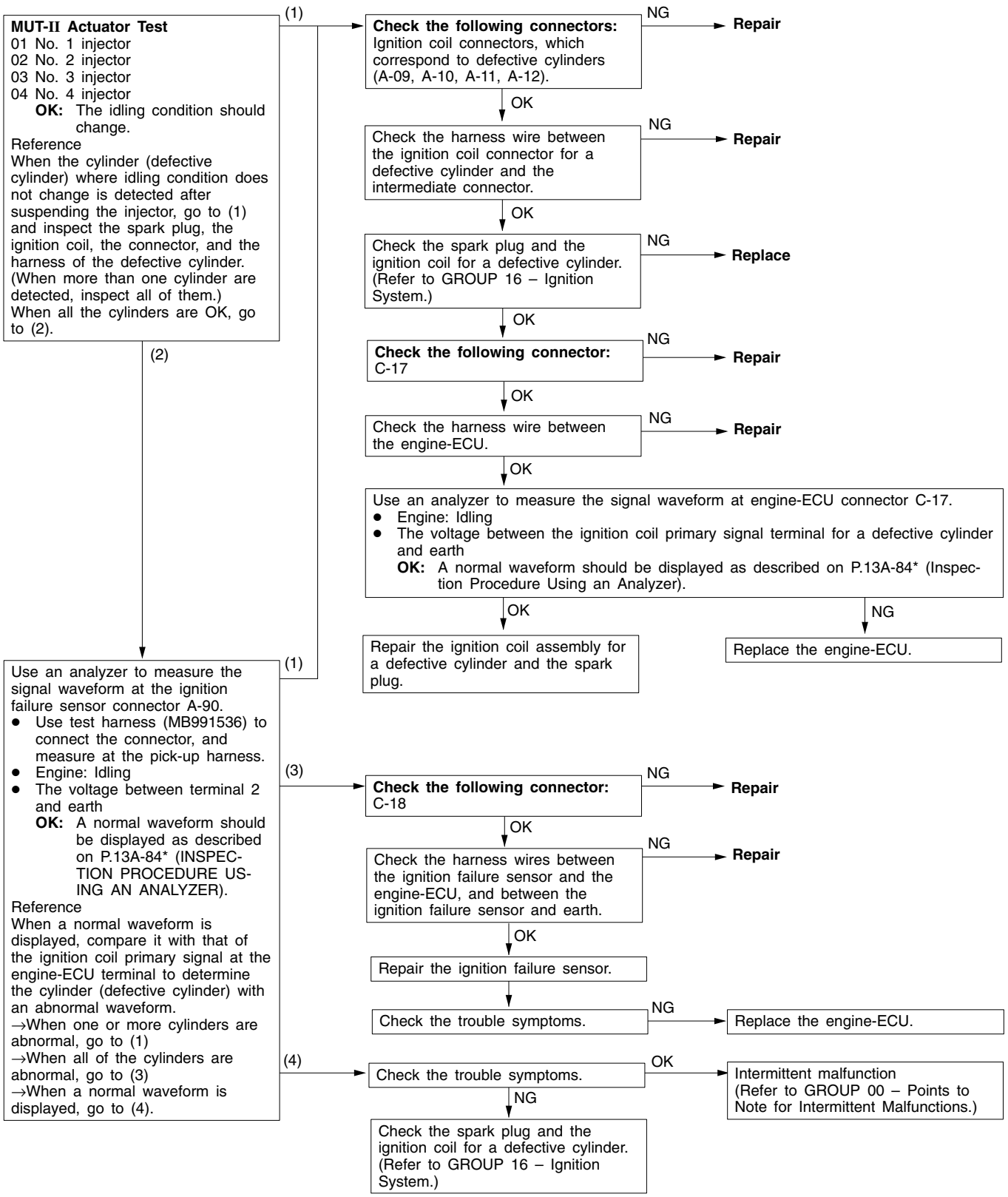


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

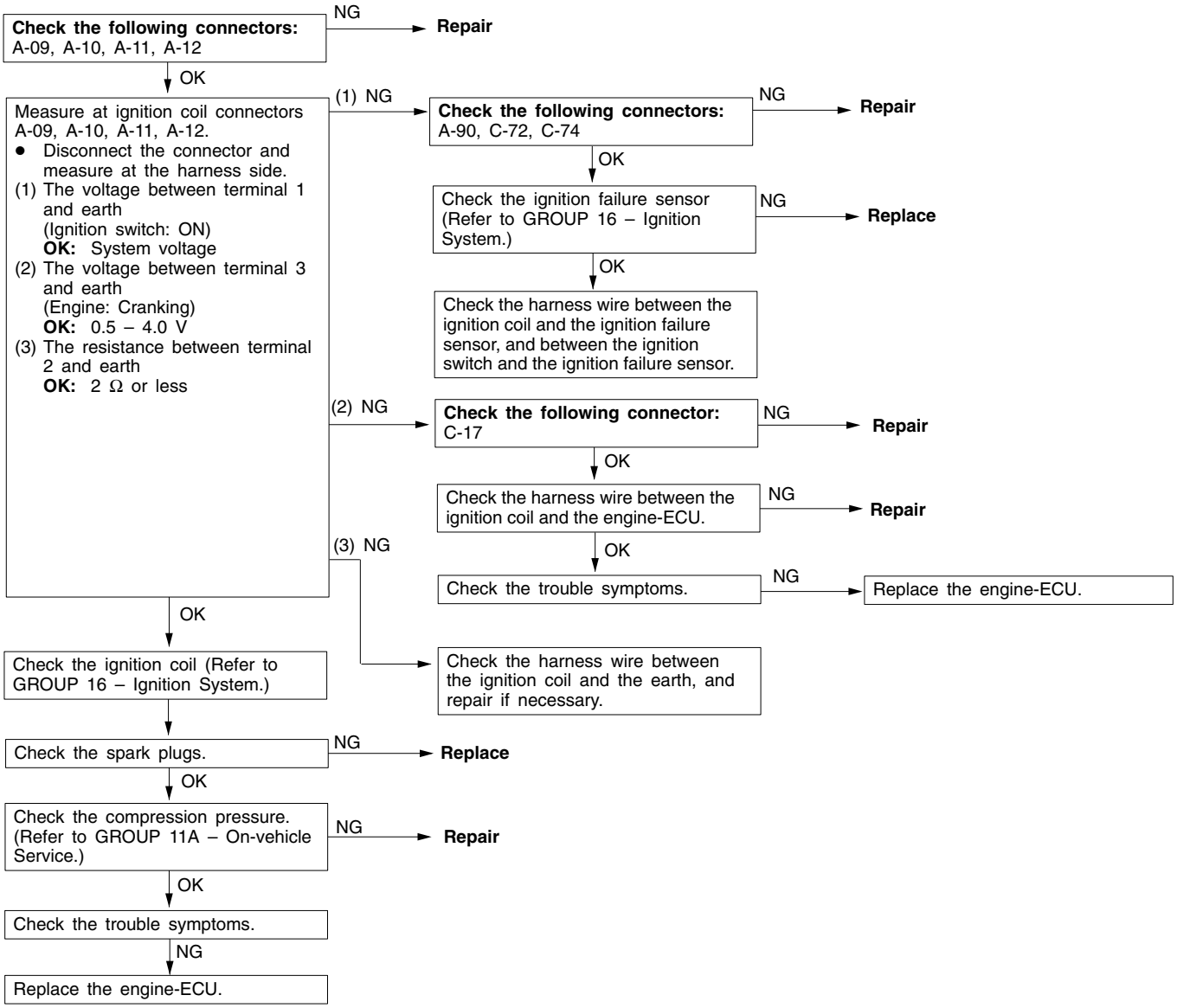
Code No. P0300 Ignition coil (power transistor) system	Probable cause
Range of Check ● Engine speed is approx. 50 – 4,000 r/min. ● Engine is not cranking. Set Conditions ● The ignition failure sensor does not send a signal about a certain cylinder for four seconds.	● Malfunction of the ignition coil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



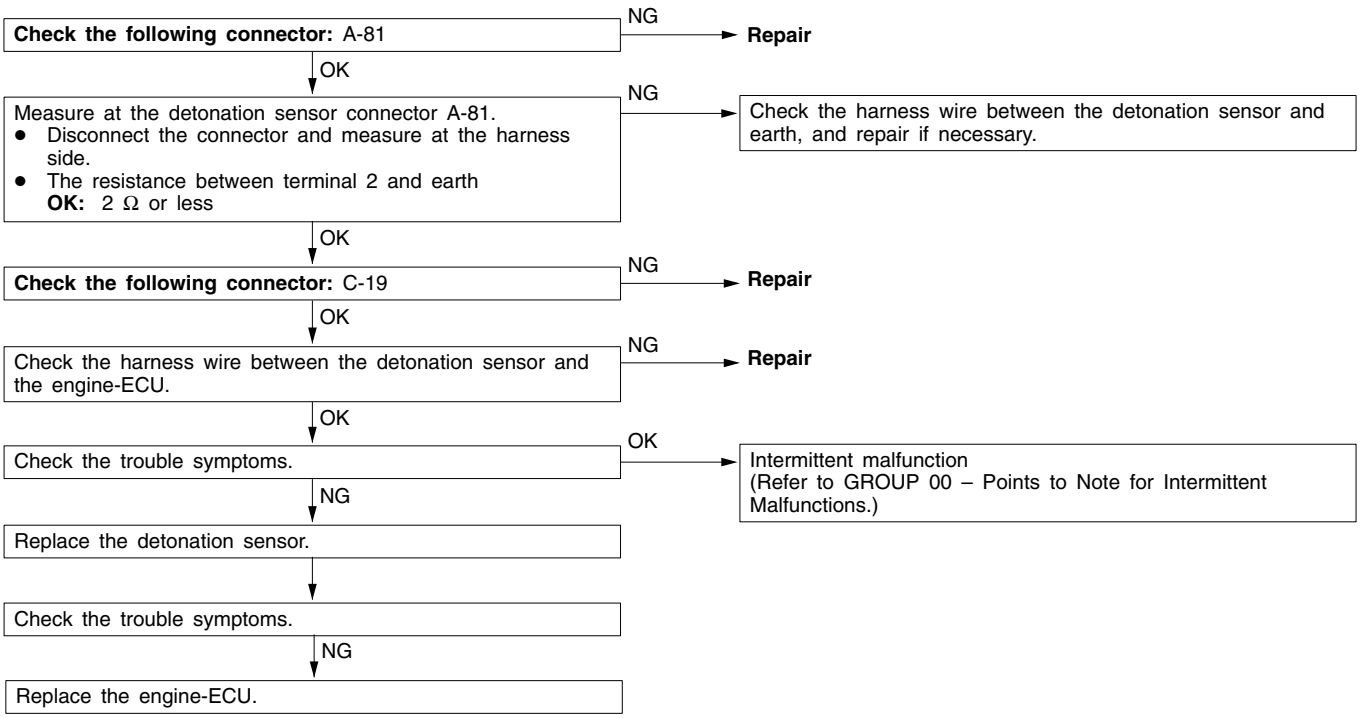
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

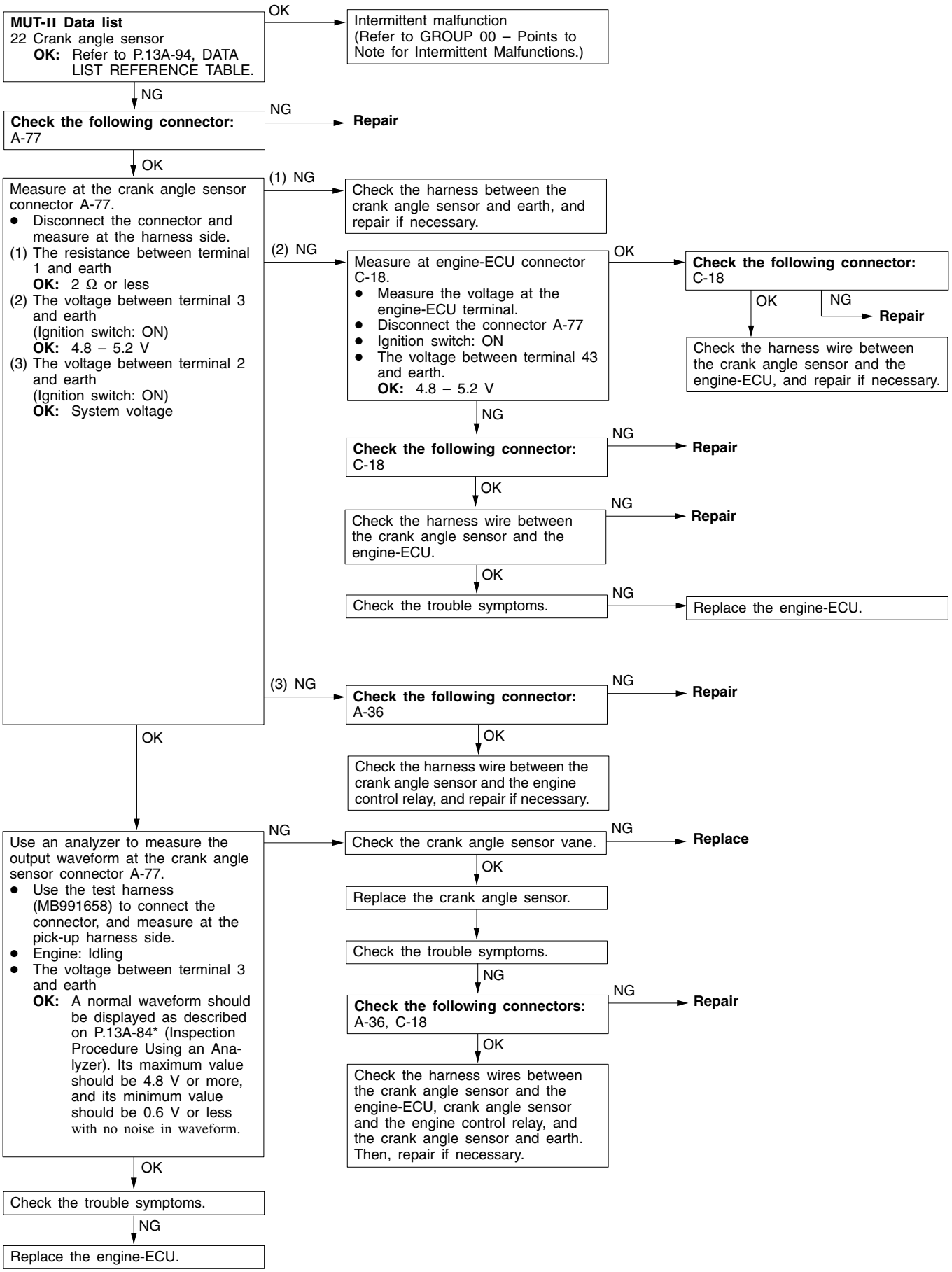
Code No. P0301 No. 1 cylinder misfire detected **Code No. P0302 No. 2 cylinder misfire detected** **Code No. P0303 No. 3 cylinder misfire detected** **Code No. P0304 No. 4 cylinder misfire detected**	**Probable cause**
Range of Check ● The engine speed is 500 – 4,500 r/min. ● While the engine is running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



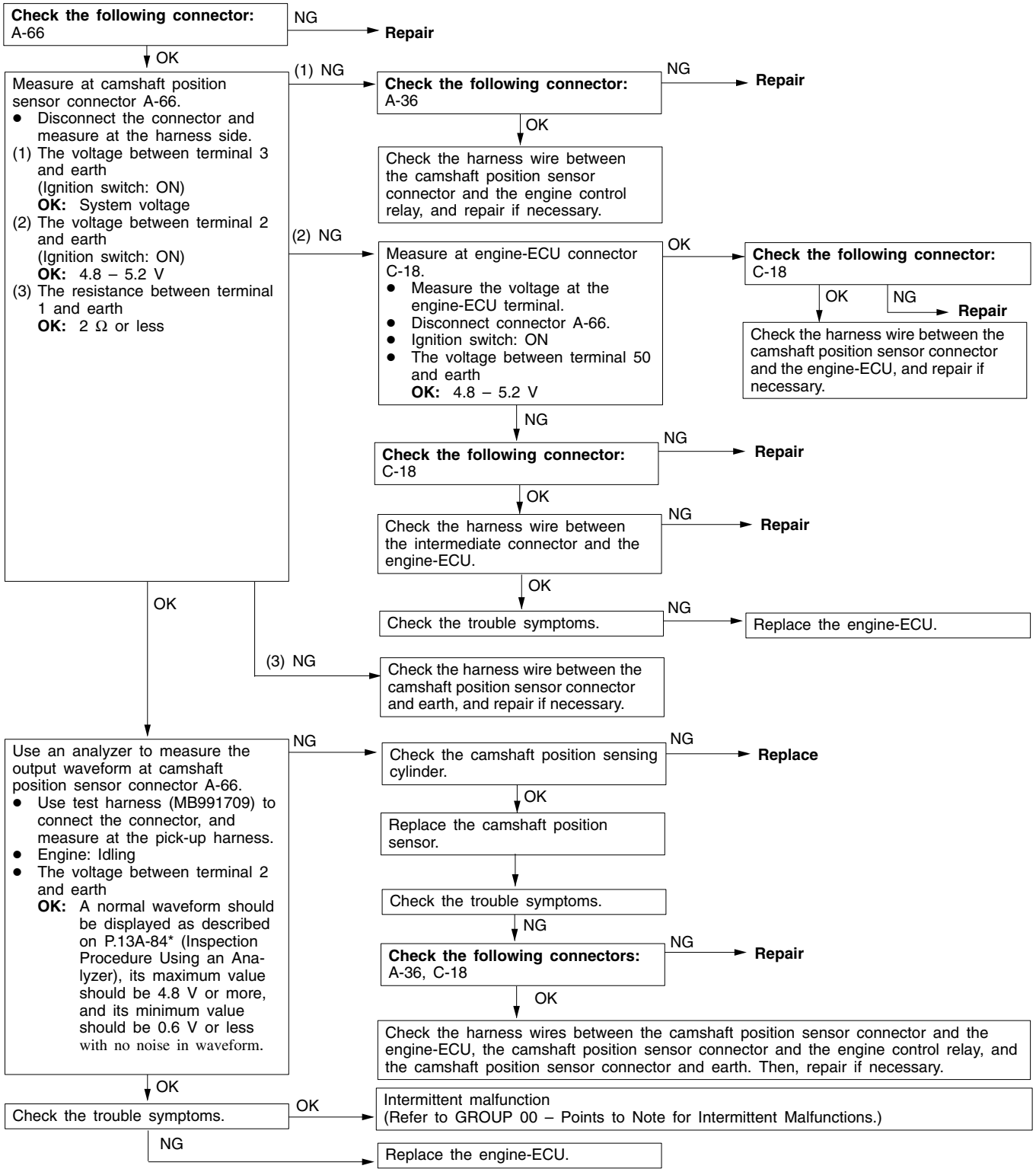
Code No. P0325 Detonation sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● Changes in sensor output voltage (detonation sensor peak voltage per 1/3 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	● Malfunction of the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



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

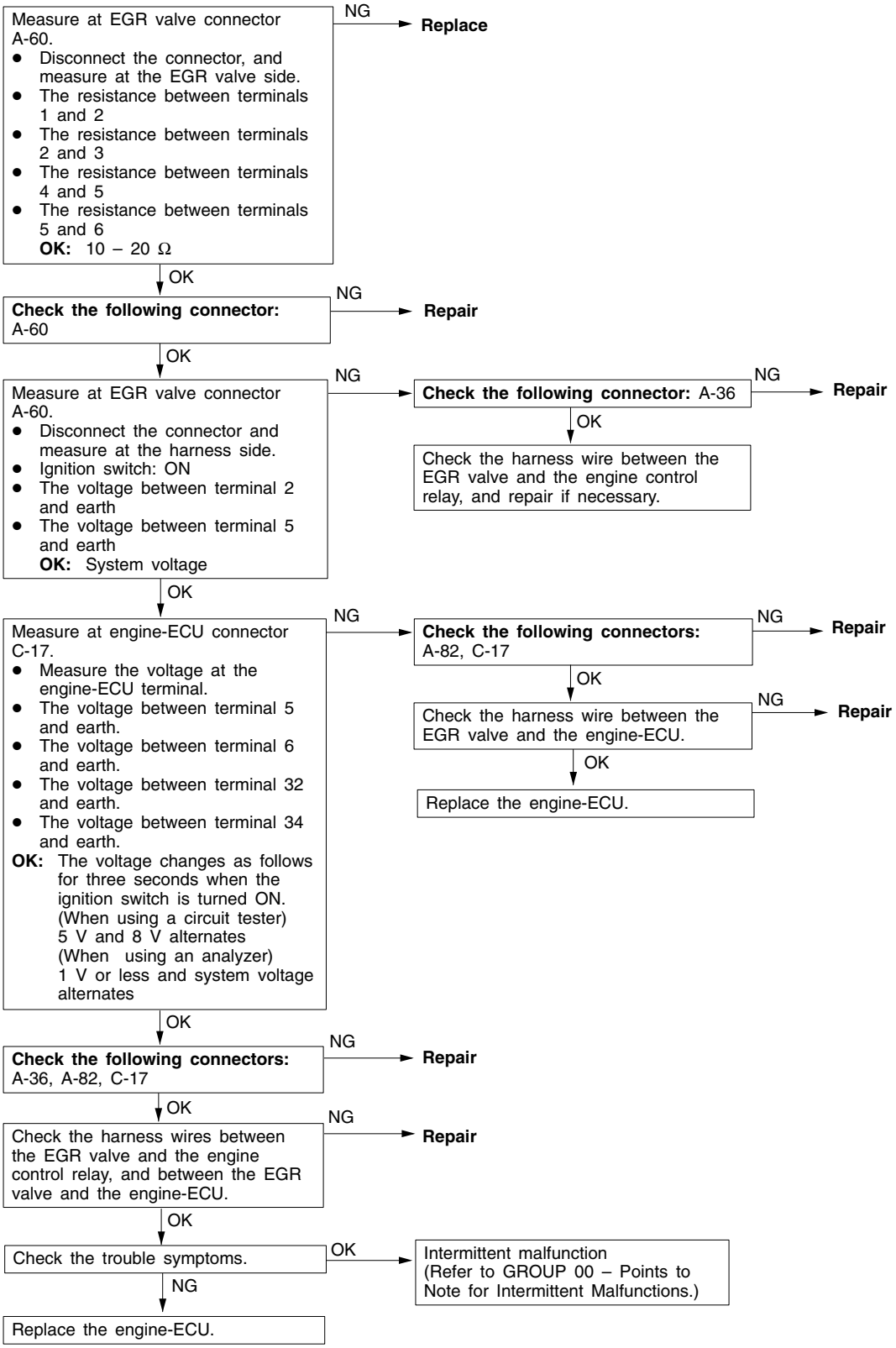

MUT-II Data list
22 Crank angle sensor
OK: Refer to P.13A-94, DATA LIST REFERENCE TABLE.
OK
Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Check the following connector: A-77
NG
Repair
OK
Measure at the crank angle sensor connector A-77.
• Disconnect the connector and measure at the harness side.
(1) The resistance between terminal 1 and earth
OK: 2 Ω or less
(2) The voltage between terminal 3 and earth
(Ignition switch: ON)
OK: 4.8 – 5.2 V
(3) The voltage between terminal 2 and earth
(Ignition switch: ON)
OK: System voltage
(1) NG
Check the harness between the crank angle sensor and earth, and repair if necessary.
(2) NG
Measure at engine-ECU connector C-18.
• Measure the voltage at the engine-ECU terminal.
• Disconnect the connector A-77
• Ignition switch: ON
• The voltage between terminal 43 and earth.
OK: 4.8 – 5.2 V
OK
Check the following connector: C-18
OK
NG
Repair
Check the harness wire between the crank angle sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(3) NG
Check the following connector: A-36
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine control relay, and repair if necessary.
OK
Use an analyzer to measure the output waveform at the crank angle sensor connector A-77.
• Use the test harness (MB991658) to connect the connector, and measure at the pick-up harness side.
• Engine: Idling
• The voltage between terminal 3 and earth
OK: A normal waveform should be displayed as described on P.13A-84* (Inspection Procedure Using an Analyzer). Its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
NG
Check the crank angle sensor vane.
NG
Replace
OK
Replace the crank angle sensor.
Check the trouble symptoms.
NG
Check the following connectors: A-36, C-18
NG
Repair
OK
Check the harness wires between the crank angle sensor and the engine-ECU, crank angle sensor and the engine control relay, and the crank angle sensor and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

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

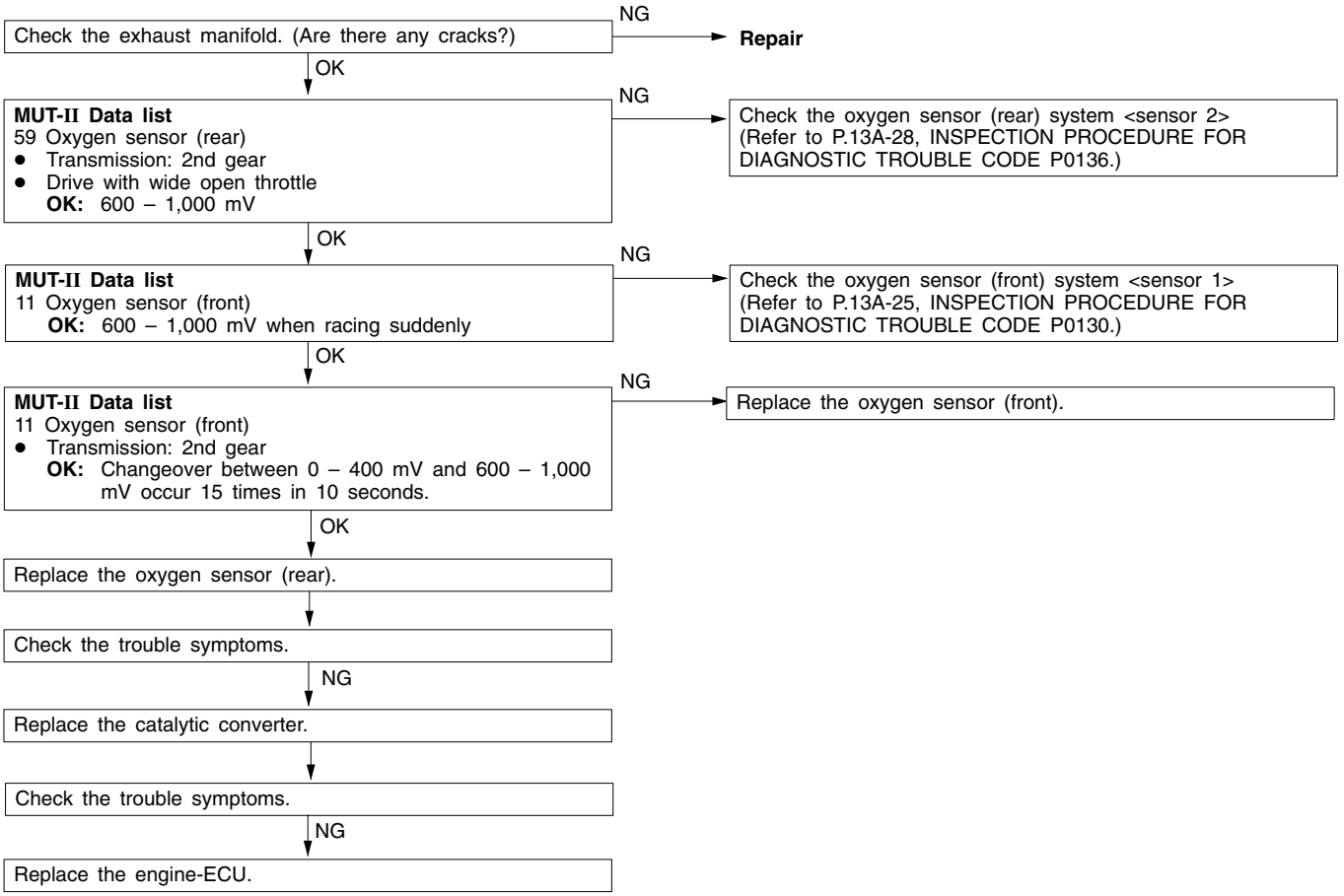


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

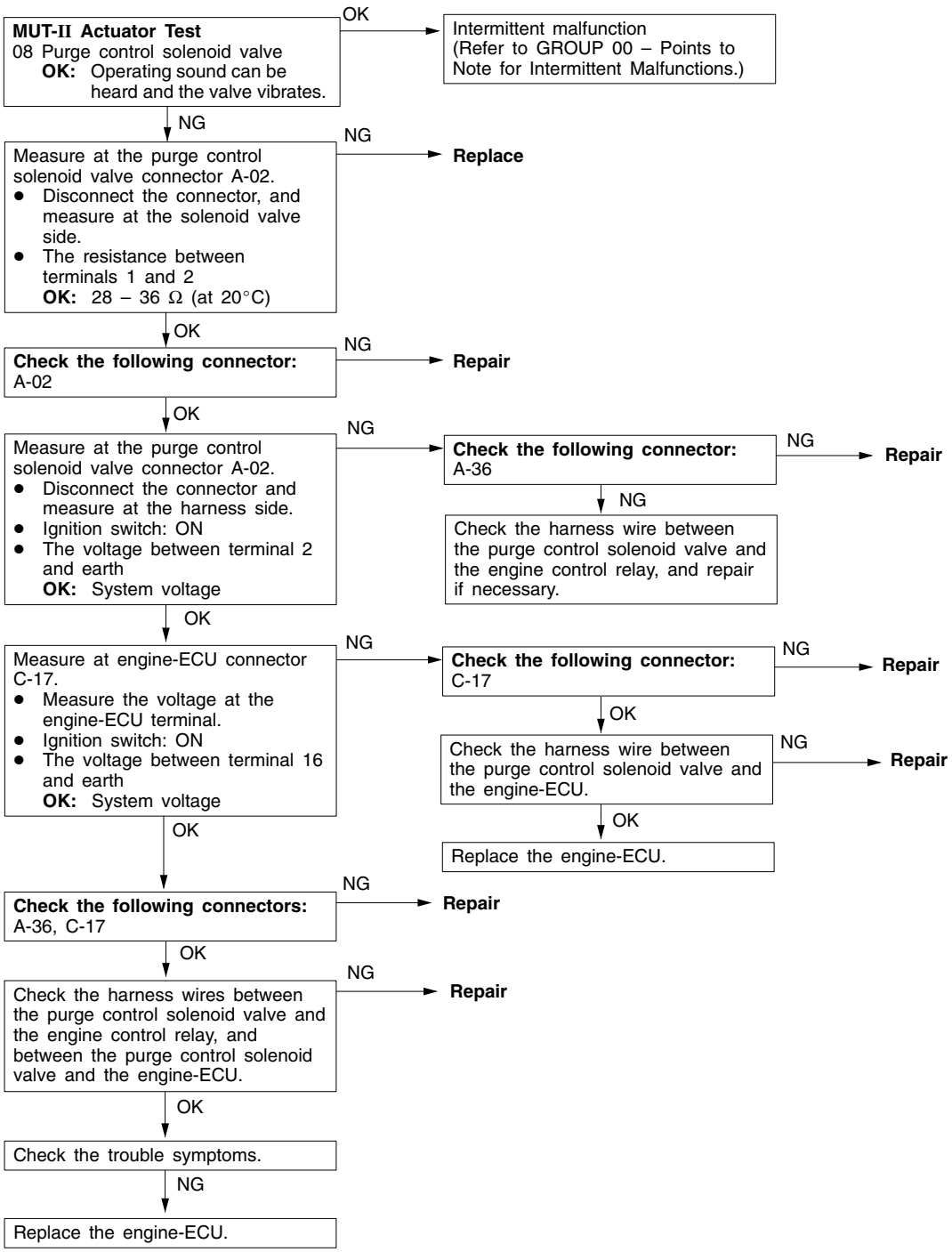
Code No. P0403 EGR valve system	Probable cause
Range of Check • Ignition switch: OFF to ON • EGR valve is in operation after the engine starting process is complete. Set Conditions • Off–surge voltage is not generated from the motor coil while the EGR valve control motor is running.	• Malfunction of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



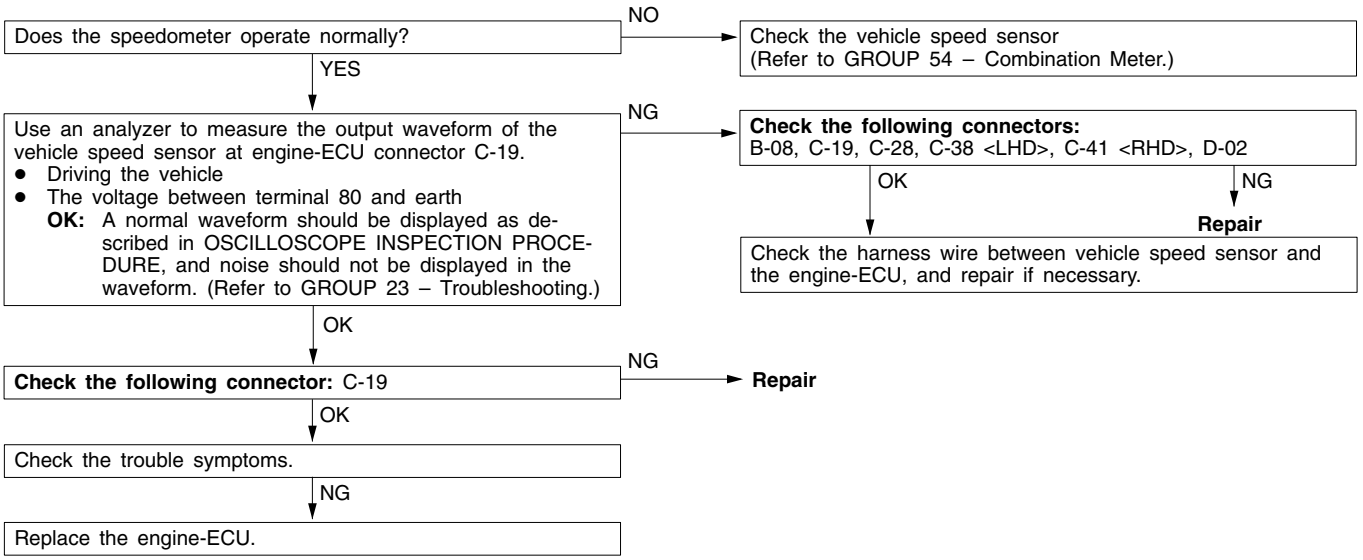
Code No. P0420 Catalyst malfunction	Probable cause
Range of Check • The engine speed is 3,000 r/min or less. • During driving • During air/fuel ratio feedback control Set Conditions • The ratio between the oxygen sensor (rear) and the oxygen sensor (front) output frequencies reaches 0.8 per 12 seconds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



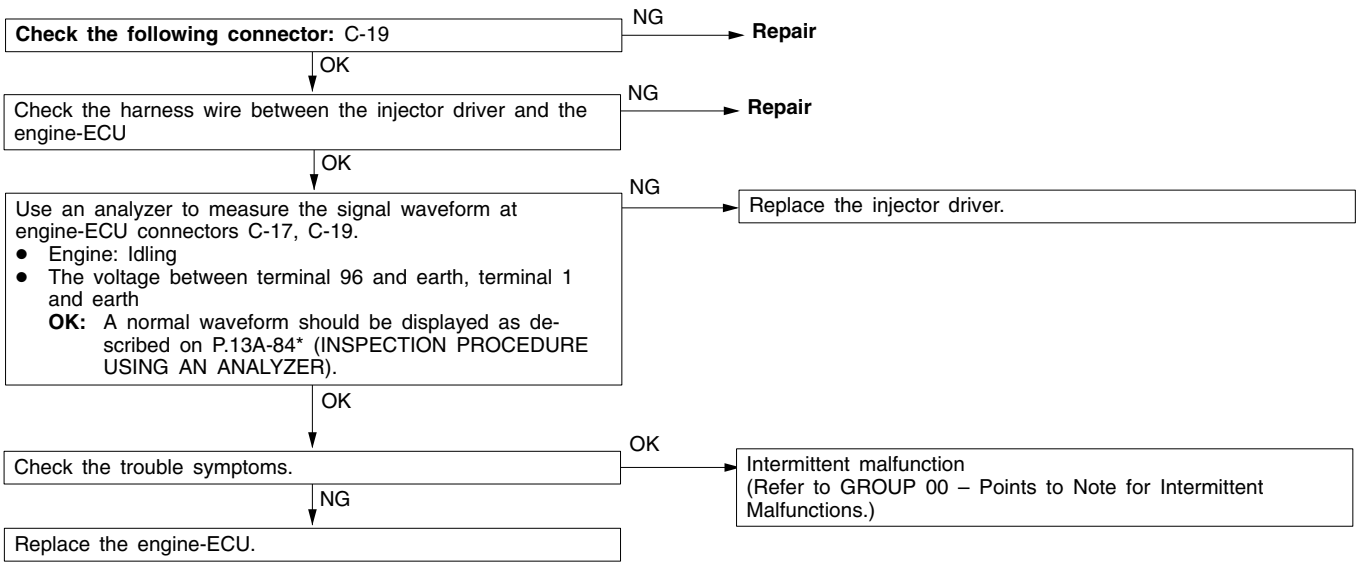
Code No. P0443 Purge control solenoid valve system	Probable cause
Range of Check • Ignition switch: ON • Battery voltage is 10 V or more. Set Conditions • The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off.	• Malfunction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



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

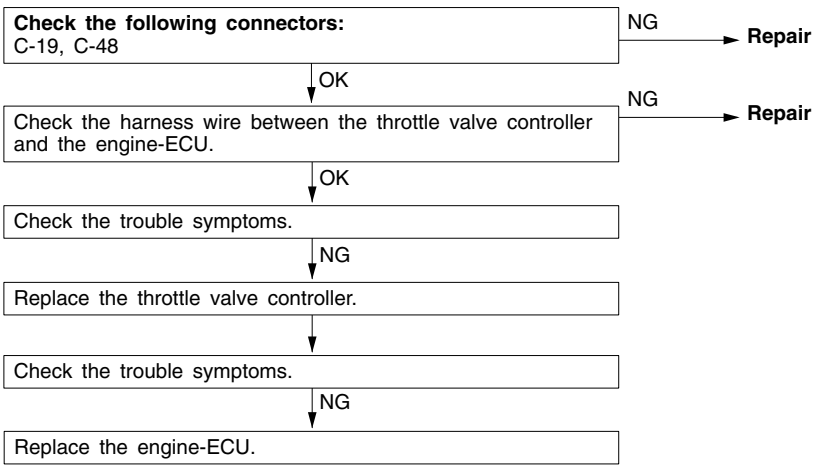


Code No. P1200 Injector driver system	Probable cause
Range of Check ● Engine speed: 4,000 r/mimn or less ● Battery voltage: 10 V or more ● The fuel cut operation and the injector operation (by carrying out the Actuator test) are not in progress. ● During high engine load Set Conditions ● Injector open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

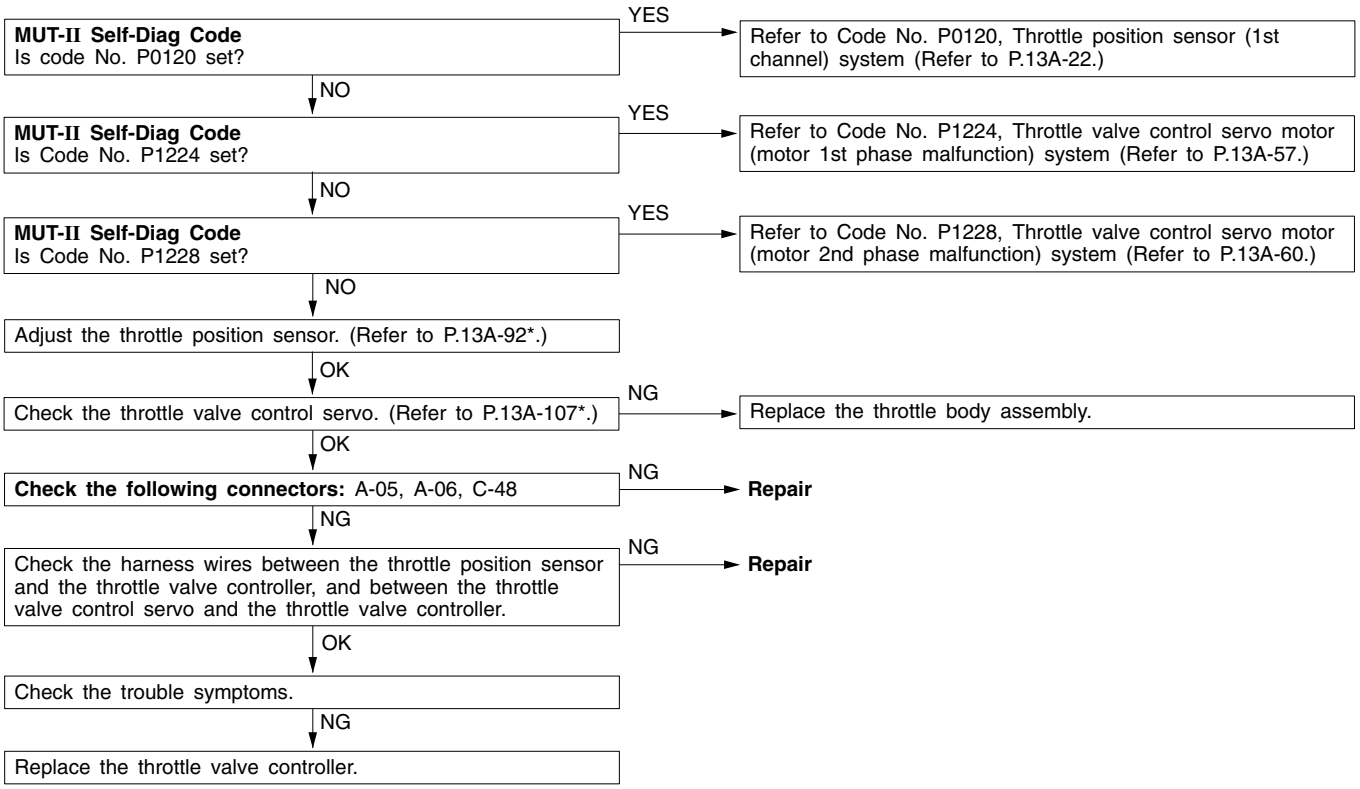


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

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



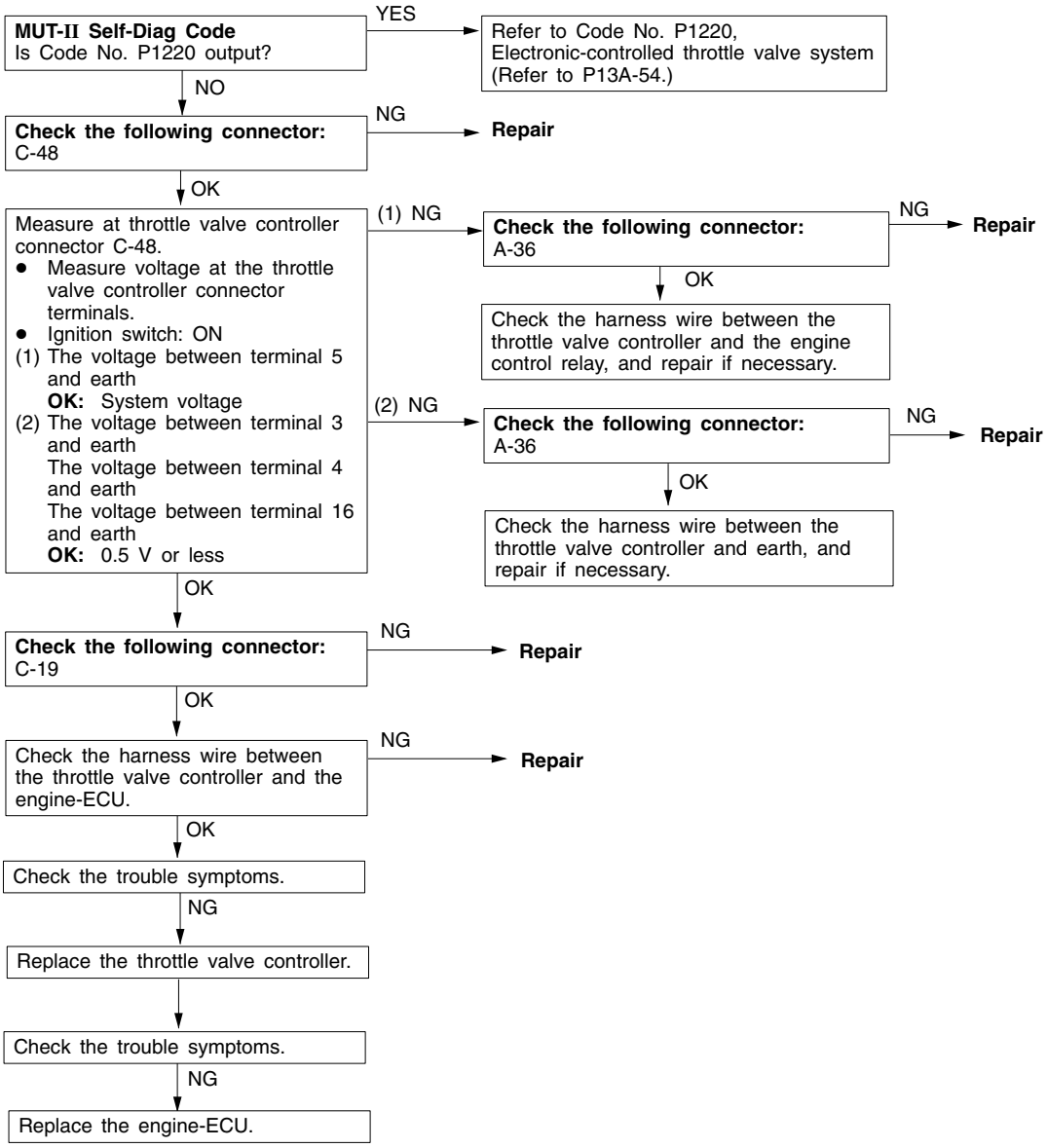
Code No. P1221 Throttle valve position feedback system	Probable cause
The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU. Range of Check • Ignition switch: ON • Battery voltage: 10 V or more Set Conditions • Failure in the motor position feedback (The engine-ECU detects that the current in the motor is excessive and the opening angle difference between the target value of throttle position sensor (1st channel) and the actual value of throttle position sensor (1st channel) is 1.0 V or more)	• Malfunction of throttle position sensor (1st channel) • Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact • Malfunction of the throttle valve controller



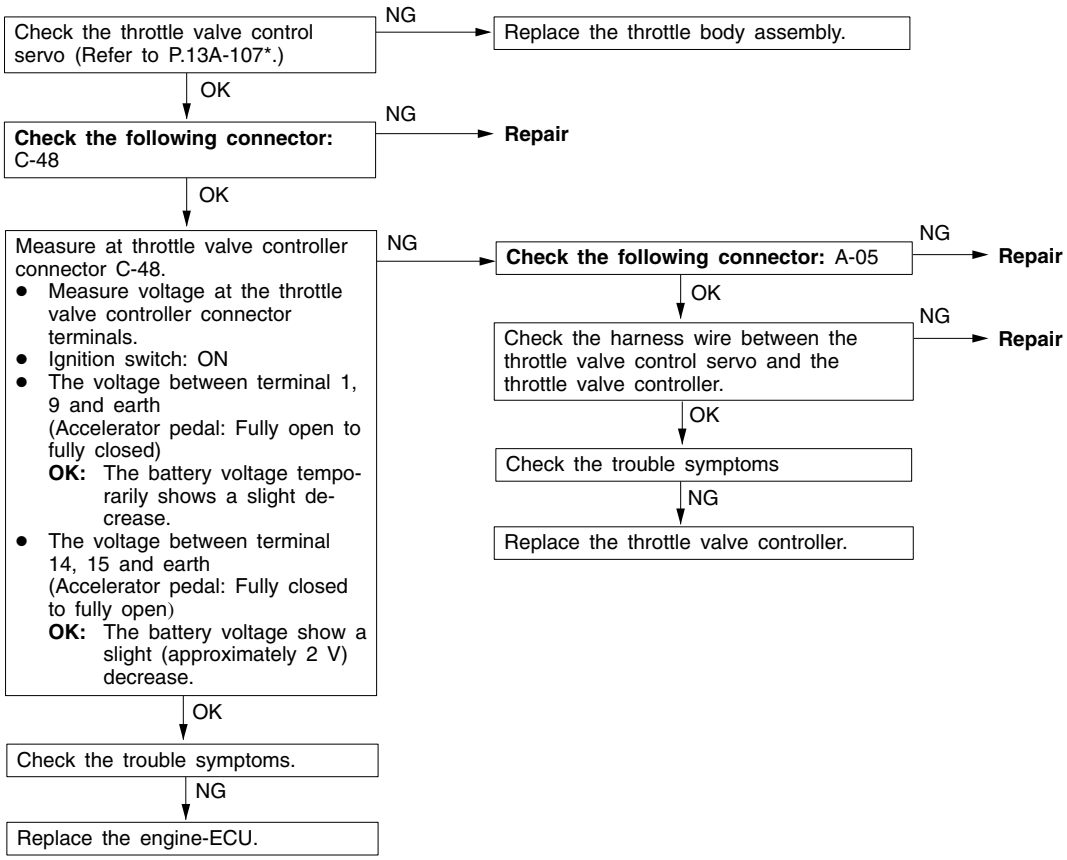
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

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



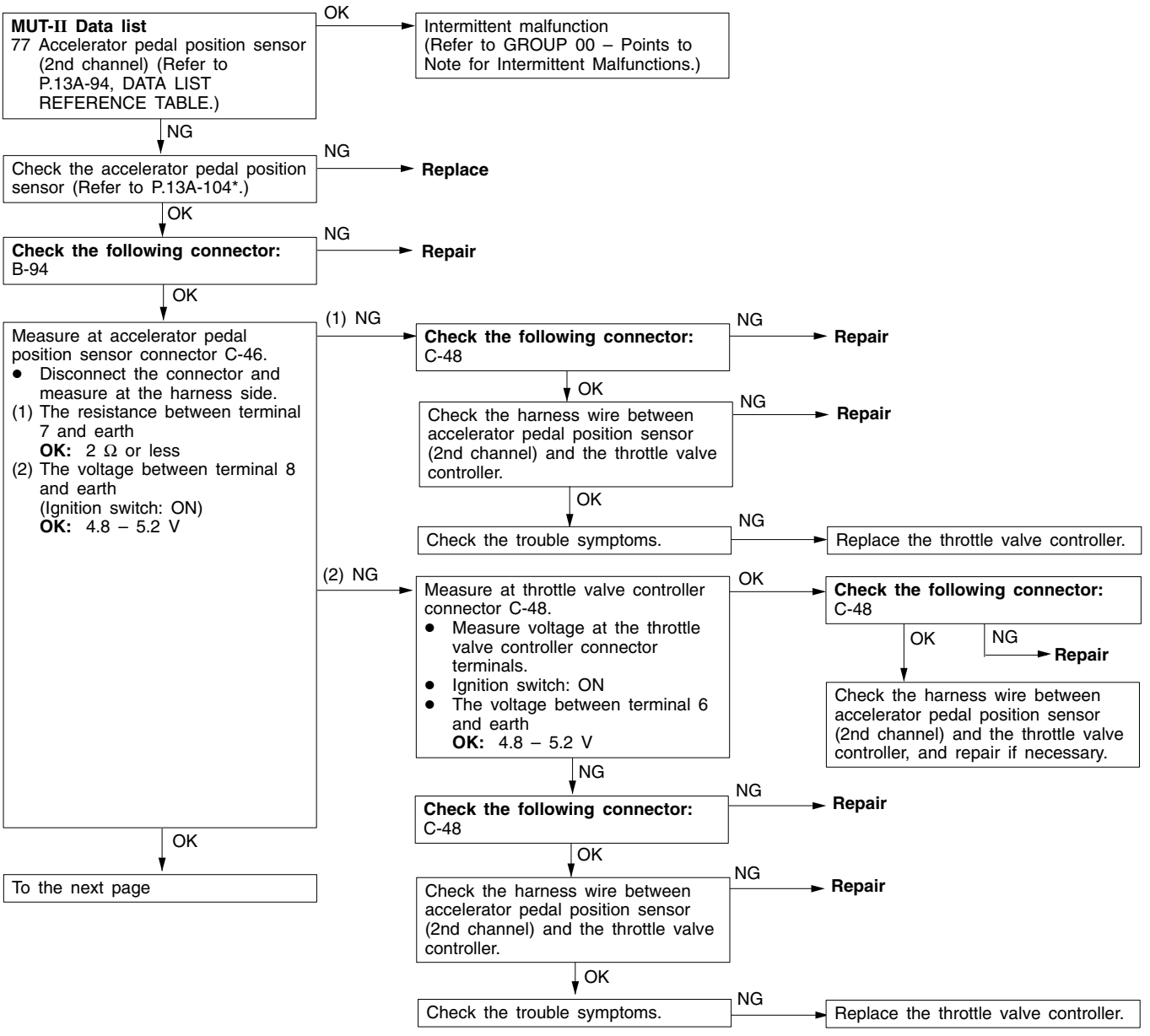
Code No. P1224 Throttle valve control servo motor (Motor 1st phase malfunction) system	Probable cause
Range of Check ● Throttle valve control servo relay: ON ● System voltage: 8 V or more. Set Conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferences with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open circuit.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller



NOTE

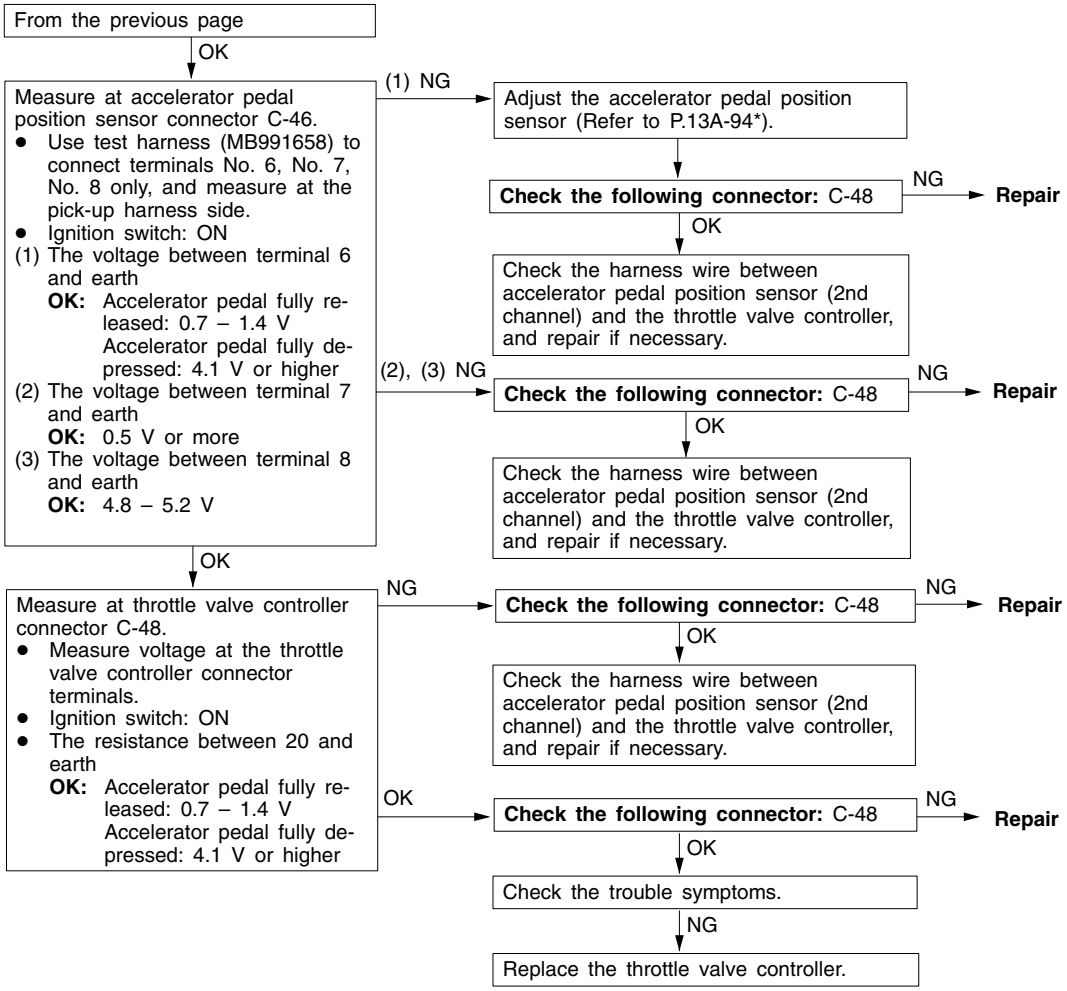
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

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

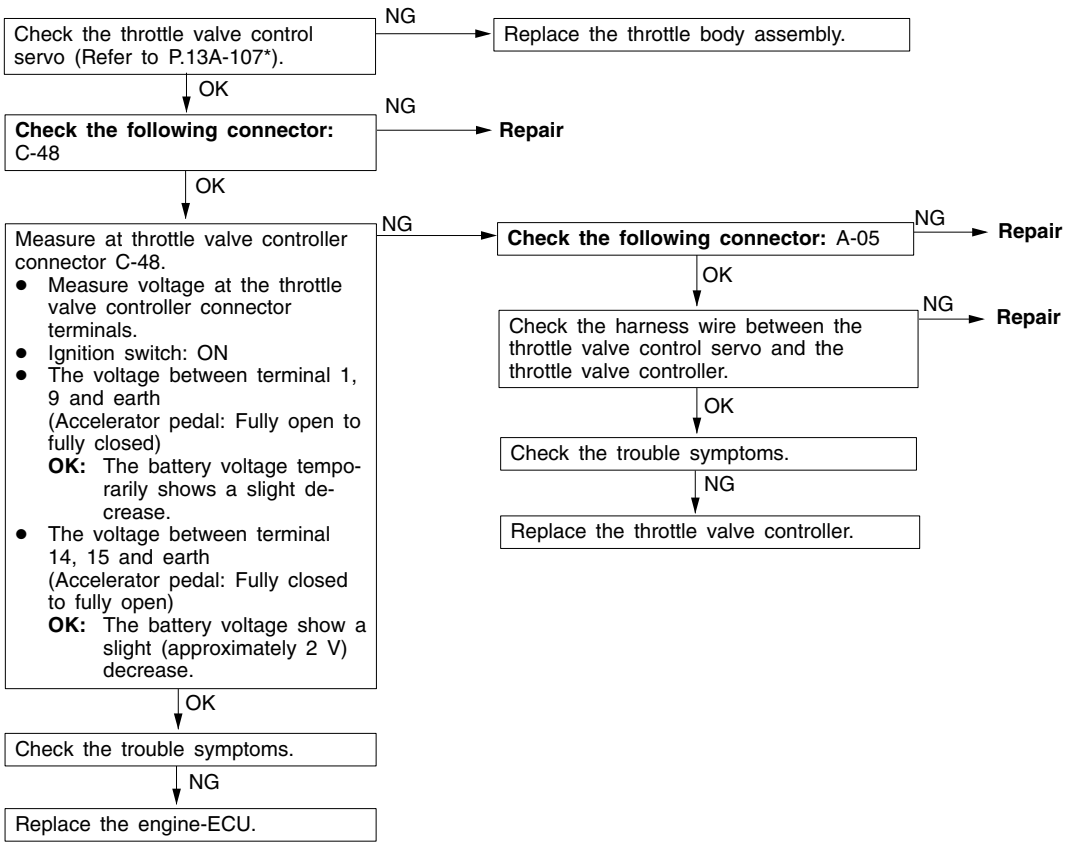


NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

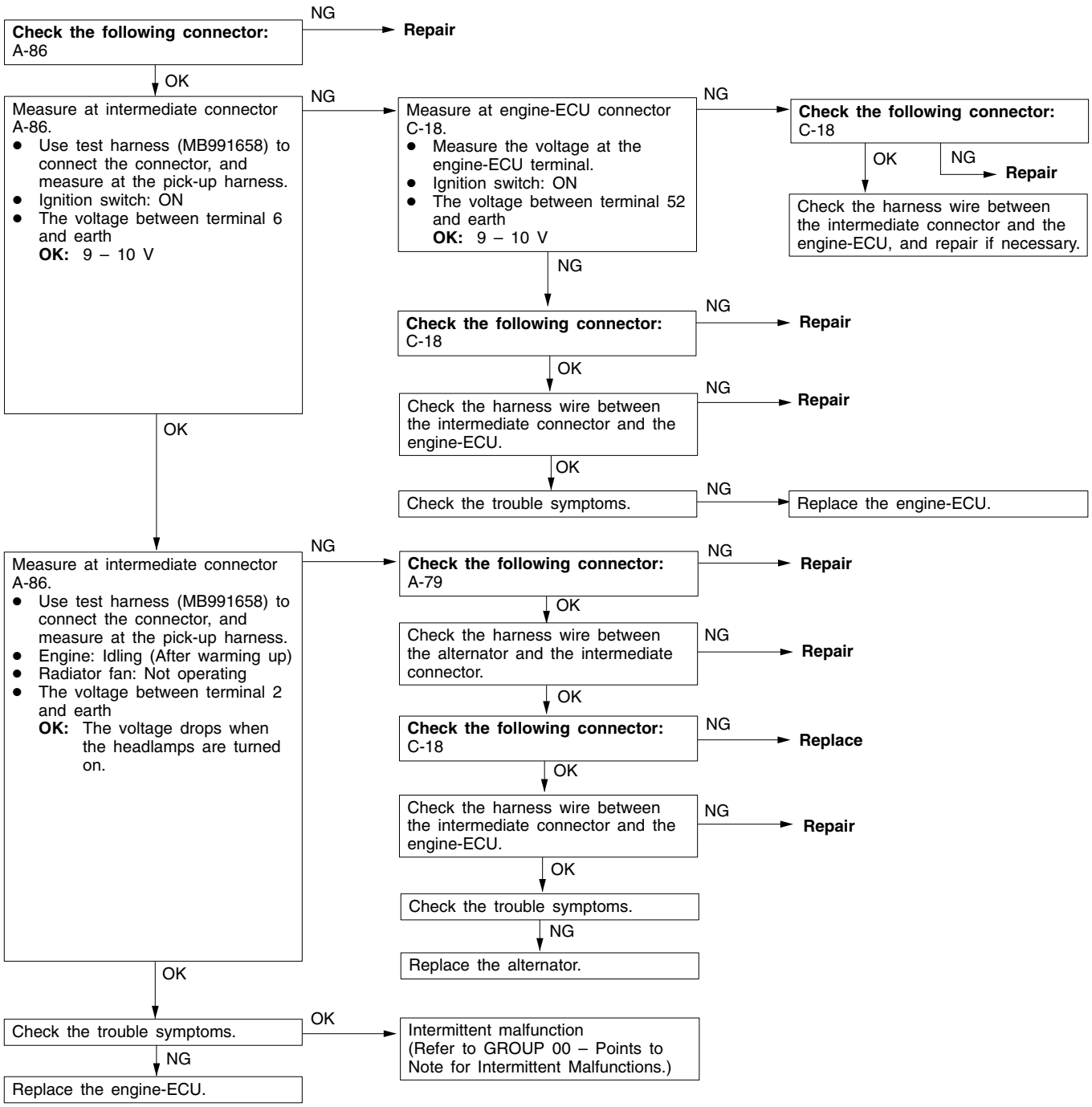

From the previous page
OK
Measure at accelerator pedal position sensor connector C-46.
● Use test harness (MB991658) to connect terminals No. 6, No. 7, No. 8 only, and measure at the pick-up harness side.
● Ignition switch: ON
(1) The voltage between terminal 6 and earth
OK: Accelerator pedal fully released: 0.7 – 1.4 V
Accelerator pedal fully depressed: 4.1 V or higher
(2) The voltage between terminal 7 and earth
OK: 0.5 V or more
(3) The voltage between terminal 8 and earth
OK: 4.8 – 5.2 V
(1) NG
Adjust the accelerator pedal position sensor (Refer to P.13A-94*).
Check the following connector: C-48
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller, and repair if necessary.
(2), (3) NG
Check the following connector: C-48
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller, and repair if necessary.
OK
Measure at throttle valve controller connector C-48.
● Measure voltage at the throttle valve controller connector terminals.
● Ignition switch: ON
● The resistance between 20 and earth
OK: Accelerator pedal fully released: 0.7 – 1.4 V
Accelerator pedal fully depressed: 4.1 V or higher
NG
Check the following connector: C-48
NG
Repair
OK
Check the harness wire between accelerator pedal position sensor (2nd channel) and the throttle valve controller, and repair if necessary.
OK
Check the following connector: C-48
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the throttle valve controller.

Code No. P1228 Throttle valve control servo motor (Motor 2nd phase malfunction) system	Probable cause
Range of Check ● Throttle valve control servo relay: ON ● System voltage: 8 V or more Set Conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferes with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open-circuit.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller

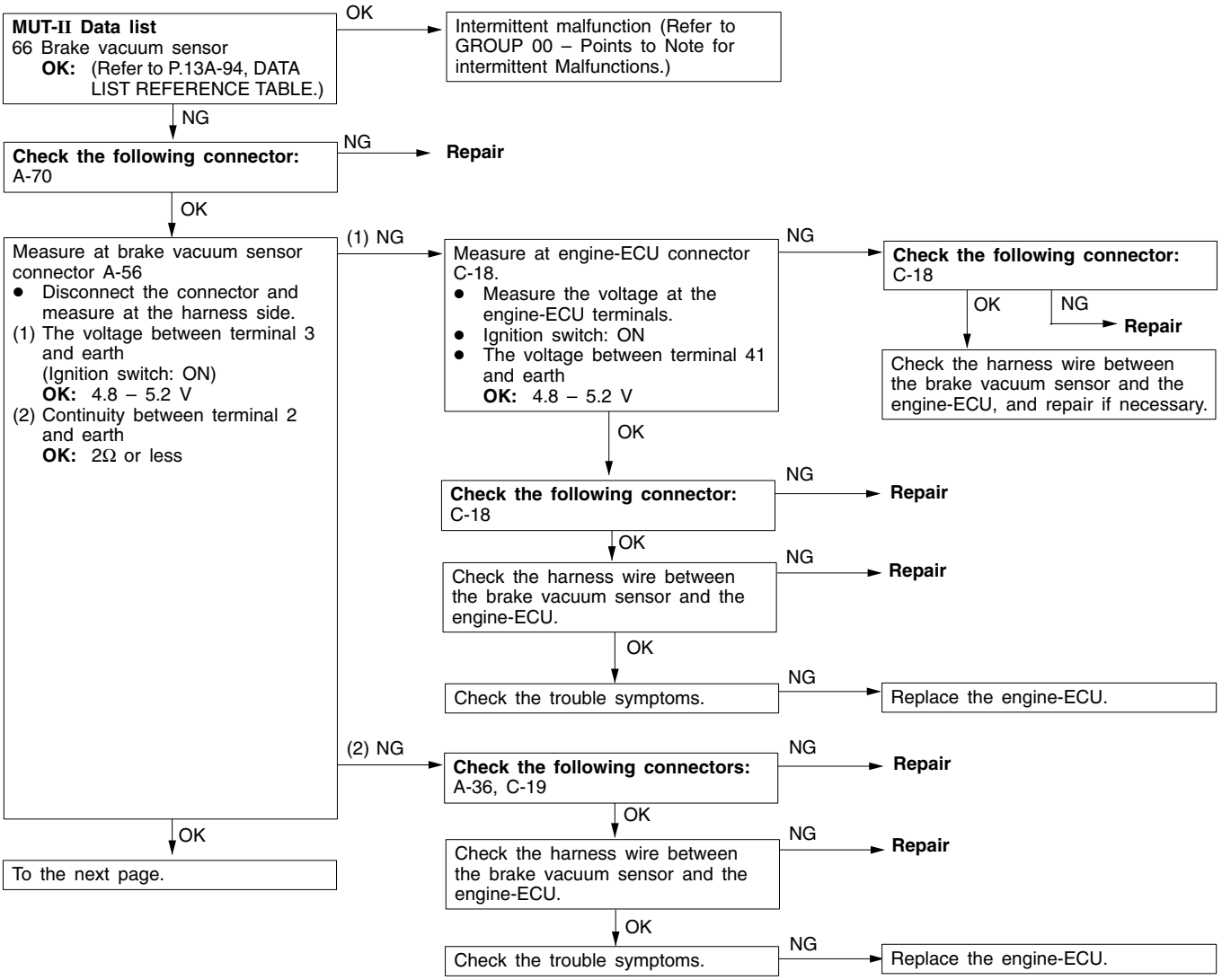


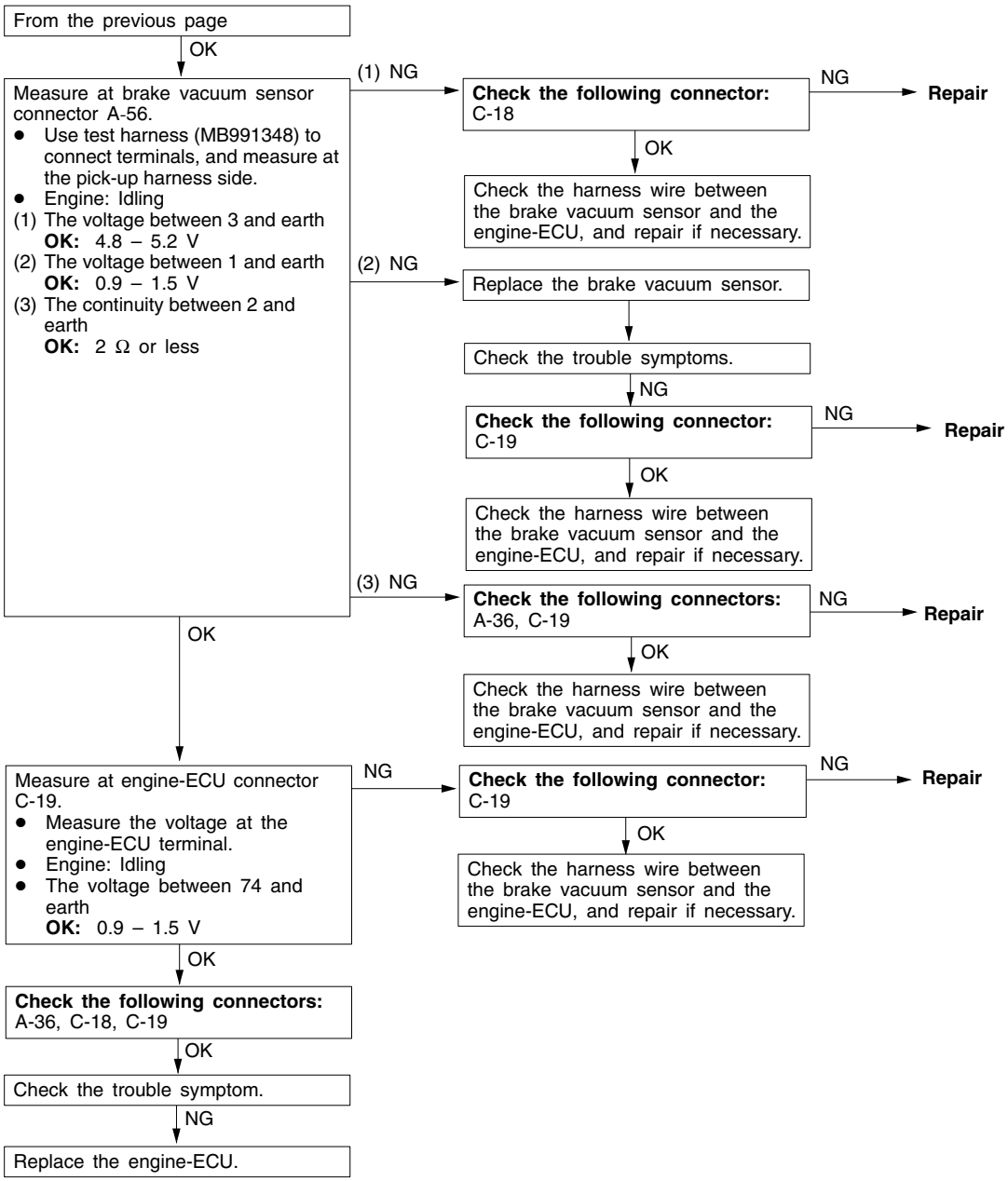
NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

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

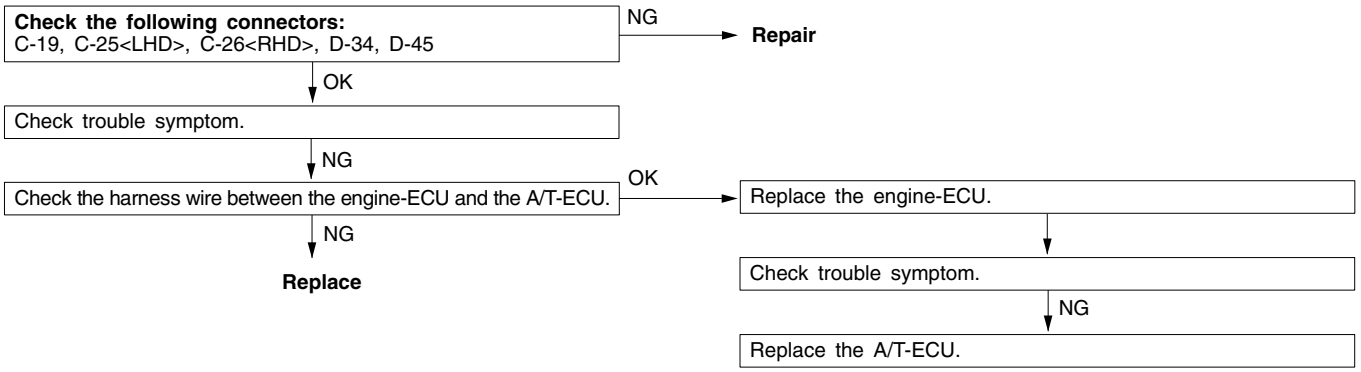


Code No. P1515 Brake vacuum sensor system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Sensor output voltage is 4.8 V or more. or ● Sensor output voltage is 0.2 V or less.	● Malfunction of the brake vacuum sensor ● Improper connector contact, open circuit or short-circuited harness wire of the brake vacuum sensor ● Malfunction of the engine-ECU



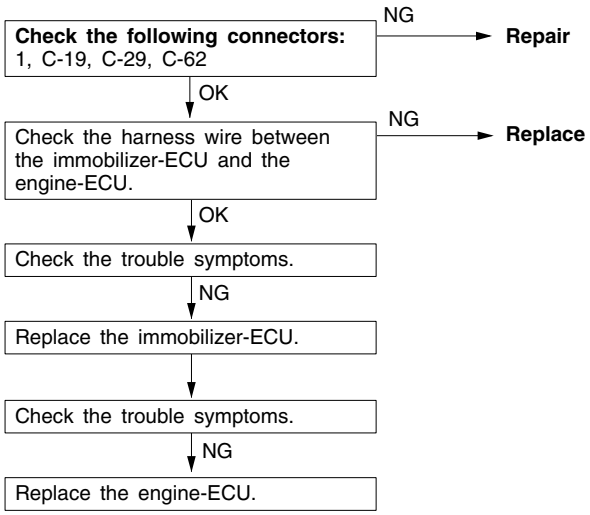

From the previous page
OK
Measure at brake vacuum sensor connector A-56.
● Use test harness (MB991348) to connect terminals, and measure at the pick-up harness side.
● Engine: Idling
(1) The voltage between 3 and earth
OK: 4.8 – 5.2 V
(2) The voltage between 1 and earth
OK: 0.9 – 1.5 V
(3) The continuity between 2 and earth
OK: 2 Ω or less
(1) NG
Check the following connector: C-18
NG
Repair
OK
Check the harness wire between the brake vacuum sensor and the engine-ECU, and repair if necessary.
(2) NG
Replace the brake vacuum sensor.
Check the trouble symptoms.
NG
Check the following connector: C-19
NG
Repair
OK
Check the harness wire between the brake vacuum sensor and the engine-ECU, and repair if necessary.
(3) NG
Check the following connectors: A-36, C-19
NG
Repair
OK
Check the harness wire between the brake vacuum sensor and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-19.
● Measure the voltage at the engine-ECU terminal.
● Engine: Idling
● The voltage between 74 and earth
OK: 0.9 – 1.5 V
NG
Check the following connector: C-19
NG
Repair
OK
Check the harness wire between the brake vacuum sensor and the engine-ECU, and repair if necessary.
OK
Check the following connectors: A-36, C-18, C-19
OK
Check the trouble symptom.
NG
Replace the engine-ECU.

Cord No. P1600 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



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

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



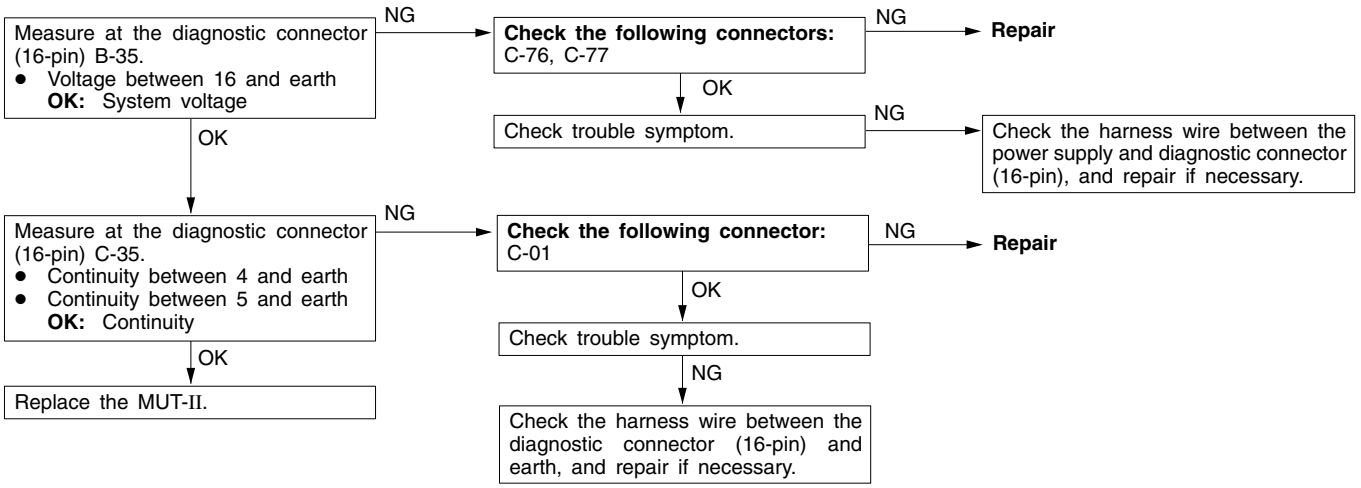
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-66
	Communication with engine-ECU only is not possible.	2	13A-66
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13A-67
	The engine warning lamp remains illuminating and never goes out.	4	13A-67
Starting	No initial combustion (starting impossible)	5	13A-78
	Initial combustion but no complete combustion (starting impossible)	6	13A-70
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-71
	Idling speed is high. (Improper idling speed)	8	13A-73
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-74
	When the engine is hot, it stalls at idling. (Die out)	10	13A-75
	The engine stalls when starting the car. (Pass out)	11	13A-77
	The engine stalls when decelerating.	12	13A-78
Driving	Hesitation, sag or stumble	13	13A-79
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-80
	The feeling of impact or vibration when decelerating	15	13A-81
	Knocking	16	13A-81
Dieseling		17	13A-81
Too high CO and HC concentration when idling		18	13A-82
Low alternator output voltage (approx. 12.3 V)		19	13A-83
Fans (radiator fan, A/C condenser fan) are inoperative		20	13A-84
GDI ECO indicator lamp system	GDI ECO indicator lamp does not illuminate.	21	13A-85
	GDI ECO indicator lamp remains illuminated and does not go off.	22	13A-85

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

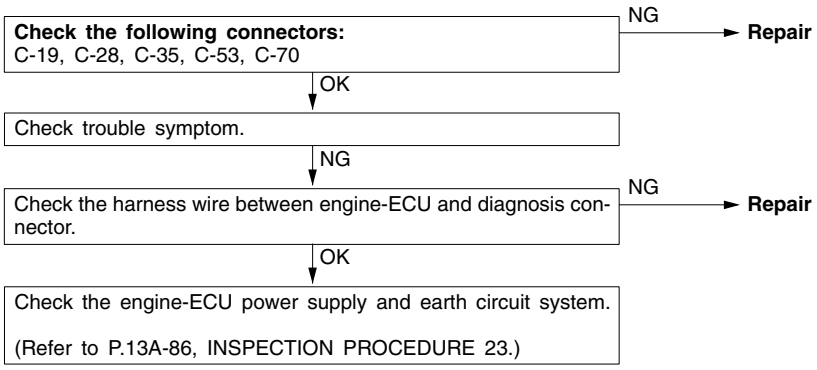
INSPECTION PROCEDURE 1

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



INSPECTION PROCEDURE 2

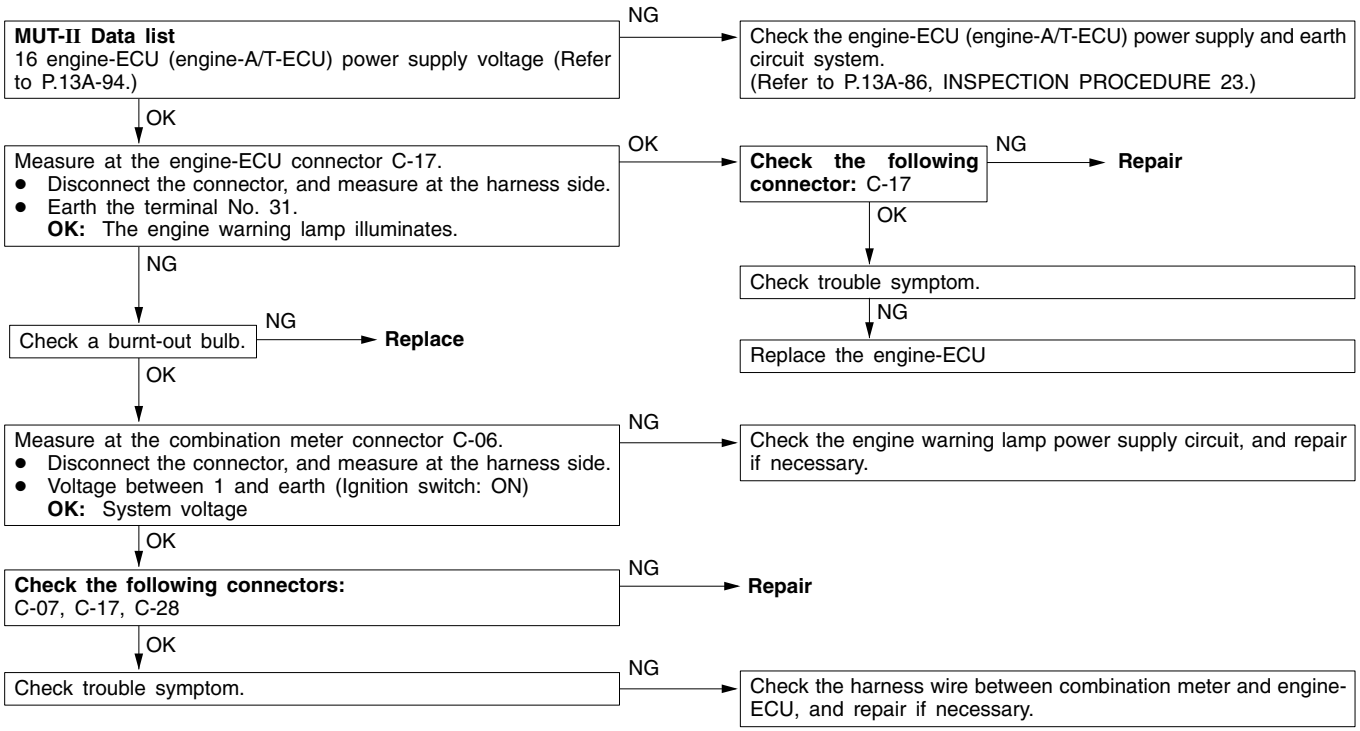
MUT-II communication with engine-ECU (engine-A/T-ECU) is impossible.	Probable cause
One of the following causes may be suspected. • No power supply to engine-ECU • Defective earth circuit of engine-ECU • Defective engine-ECU • Improper communication line between engine-ECU and MUT-II	• Malfunction of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



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

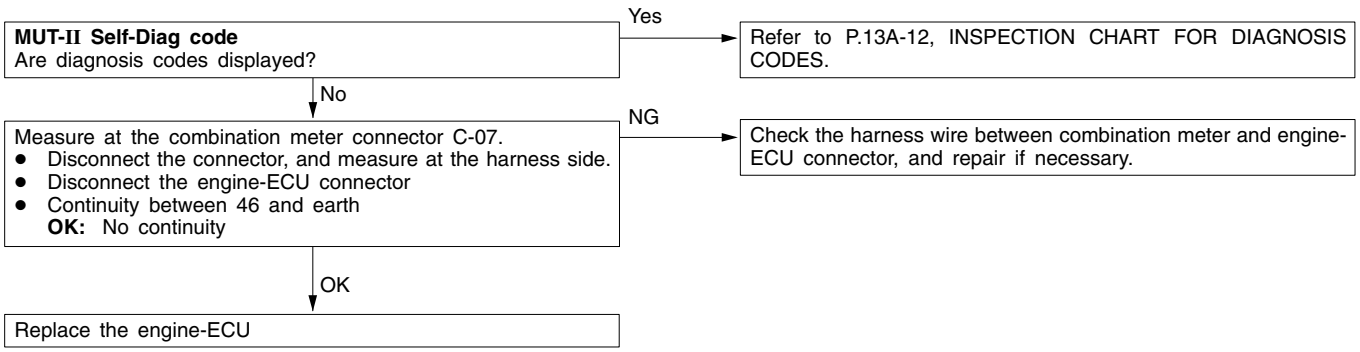
INSPECTION PROCEDURE 3

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



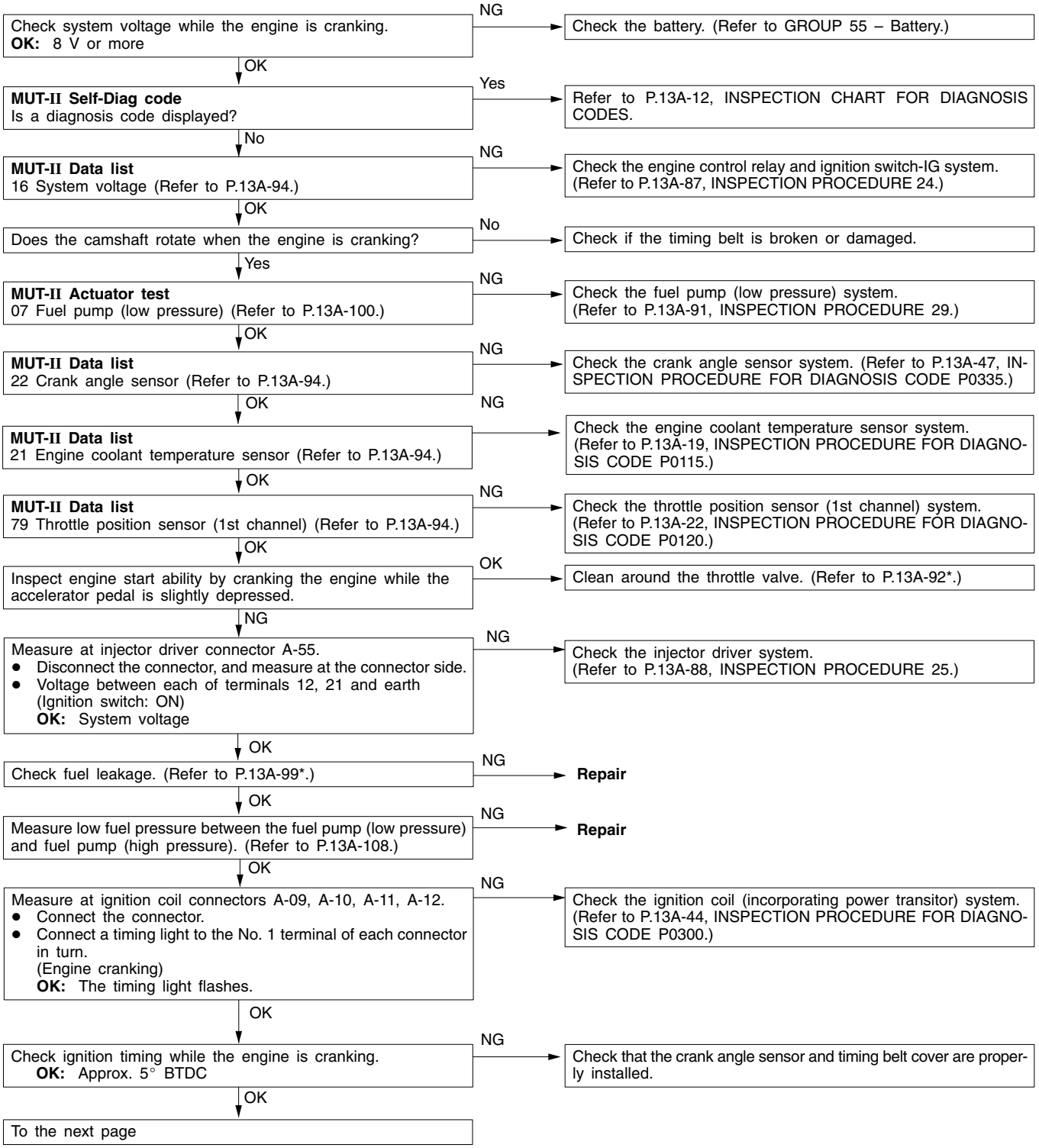
INSPECTION PROCEDURE 4

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



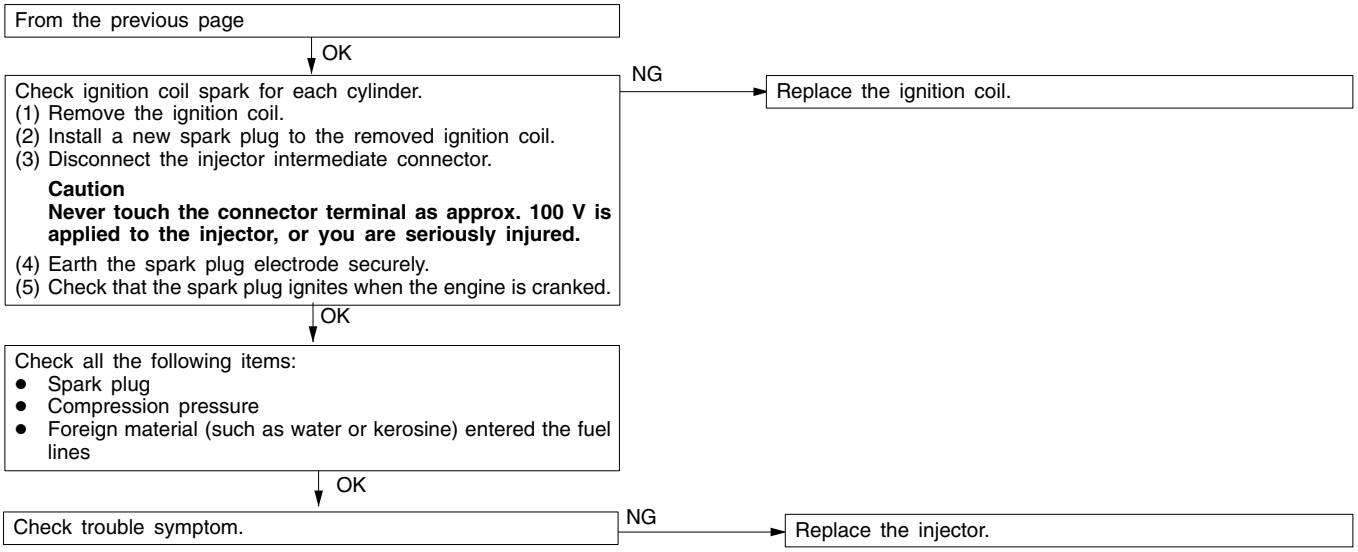
INSPECTION PROCEDURE 5

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



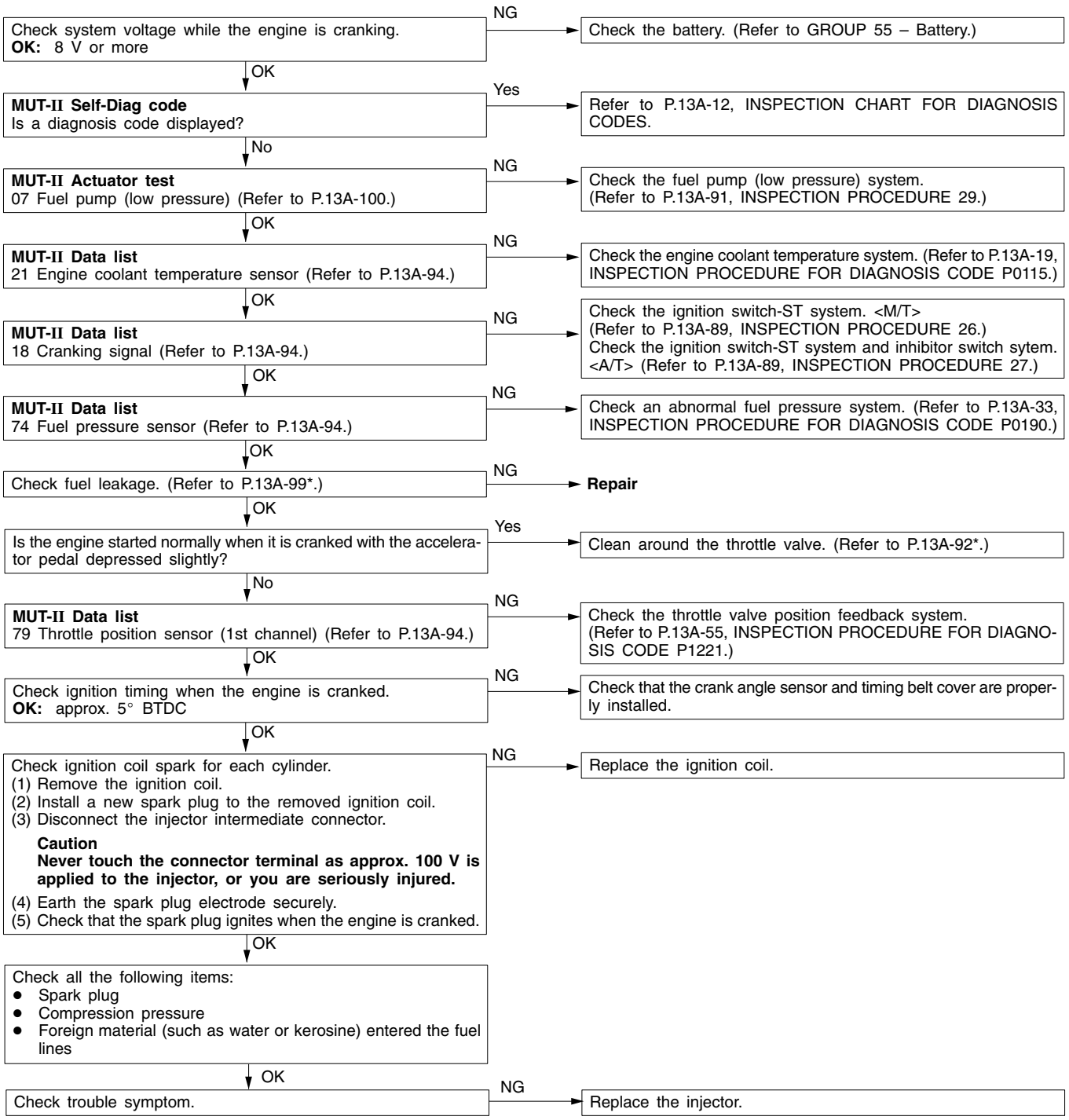
NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)


From the previous page
OK
Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.
Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
NG
Replace the ignition coil.
OK
Check all the following items:
• Spark plug
• Compression pressure
• Foreign material (such as water or kerosine) entered the fuel lines
OK
Check trouble symptom.
NG
Replace the injector.

INSPECTION PROCEDURE 6

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

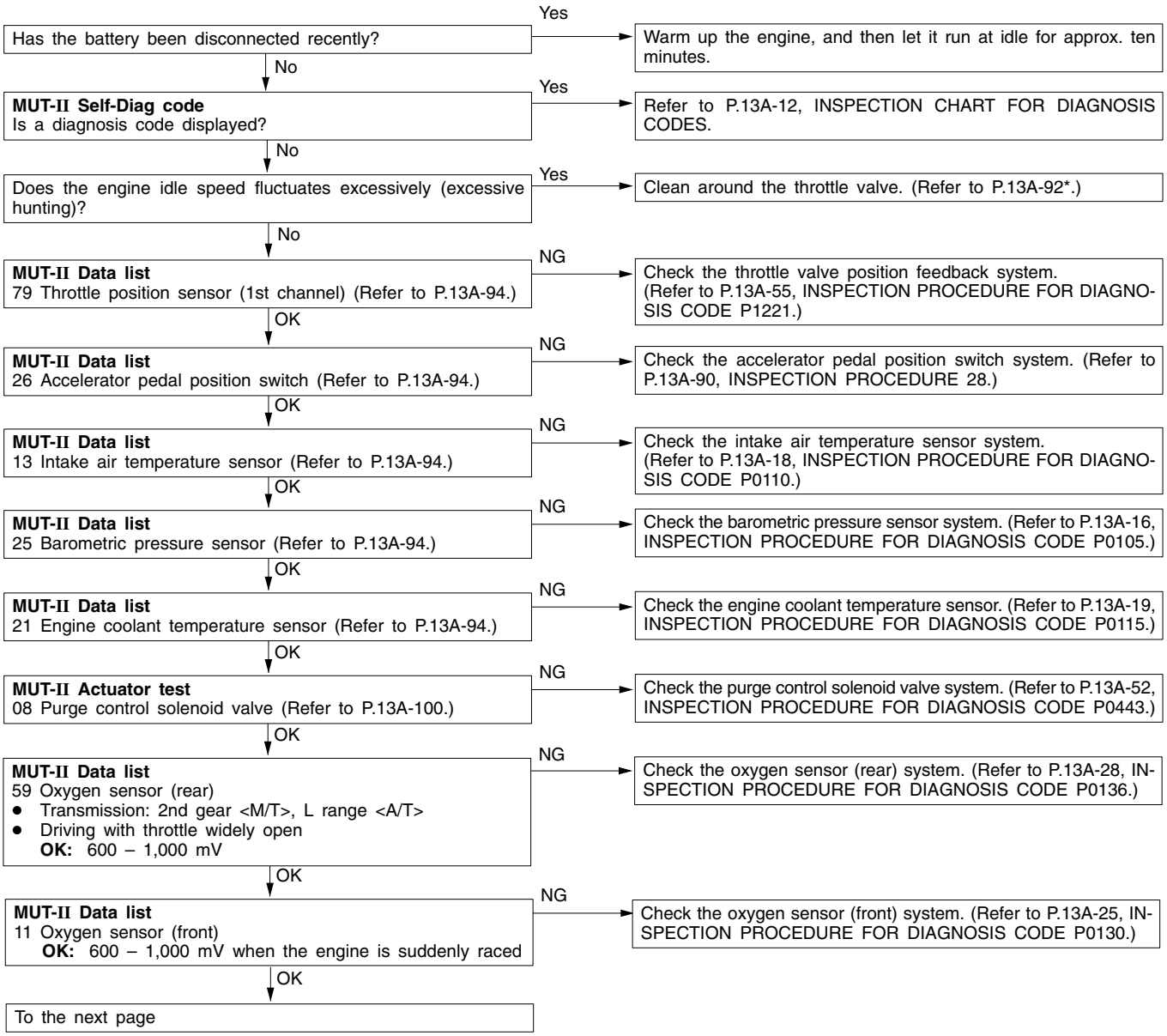


NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 7

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



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

From the previous page

OK

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

NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-108.)

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

NG → **Repair**

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-94.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13A-92, INSPECTION PROCEDURE 30.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13A-94.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13A-92, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13A-94.)

NG → Check the stop lamp switch. (Refer to P.13A-93, INSPECTION PROCEDURE 32.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13A-94.)

NG → Check the small lamp switch system. (Refer to P.13A-93, INSPECTION PROCEDURE 33.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13A-94.)

NG → Check the EGR valve. (Refer to P.13A-50, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)

OK

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

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

OK

Clean around the throttle valve. (Refer to P.13A-92*.)

Check trouble symptom.

NG

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

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

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

NG → Replace the ignition coil.

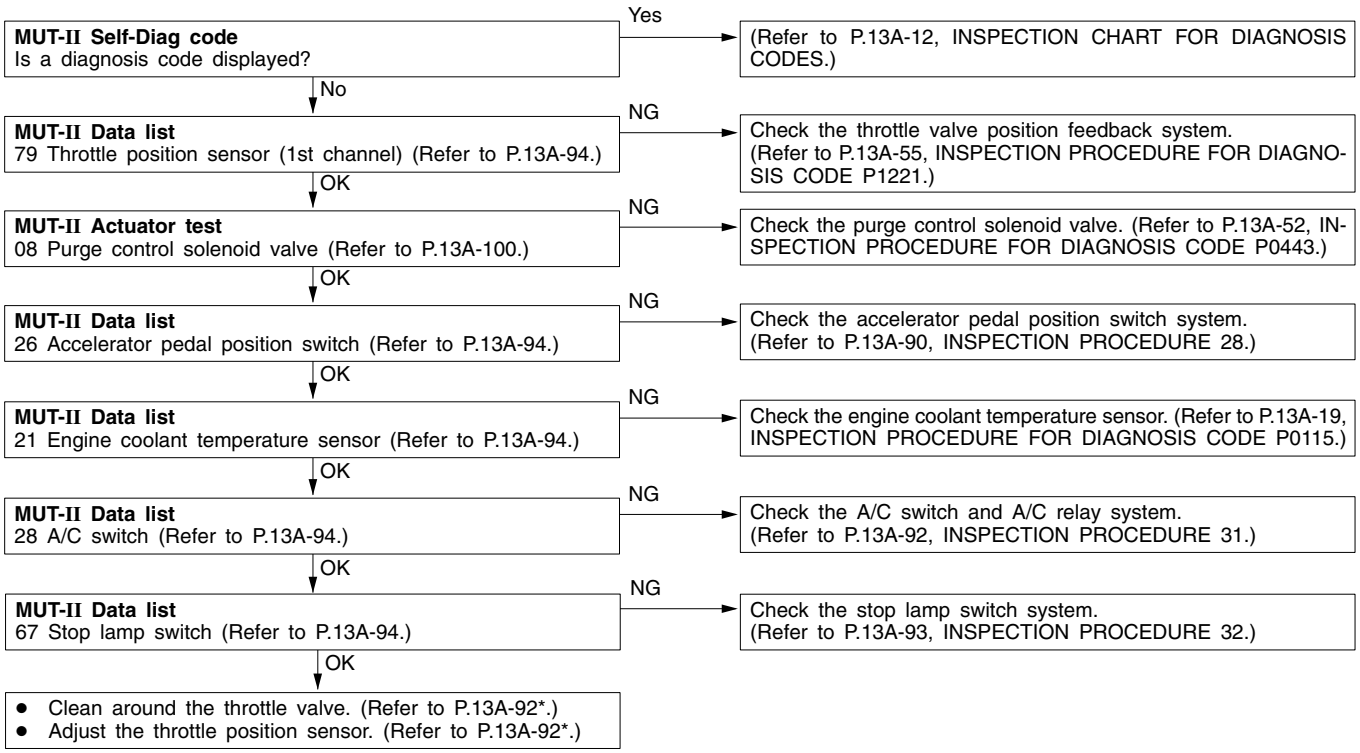
OK

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

NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 8

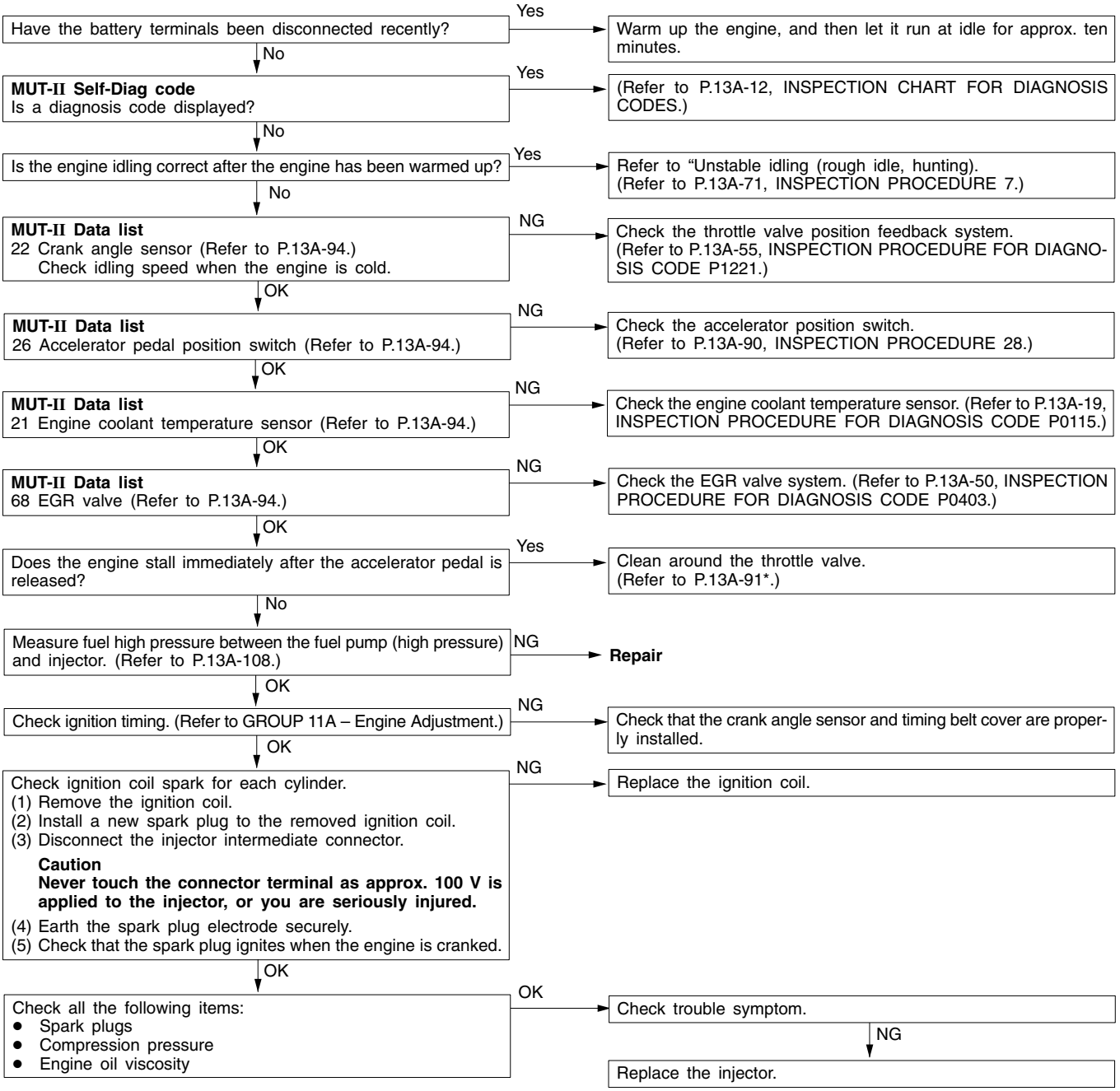
Idle speed is high or low (Improper idling)	Probable cause
The cause is probably that the intake air amount during idling is too great or too small.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 9

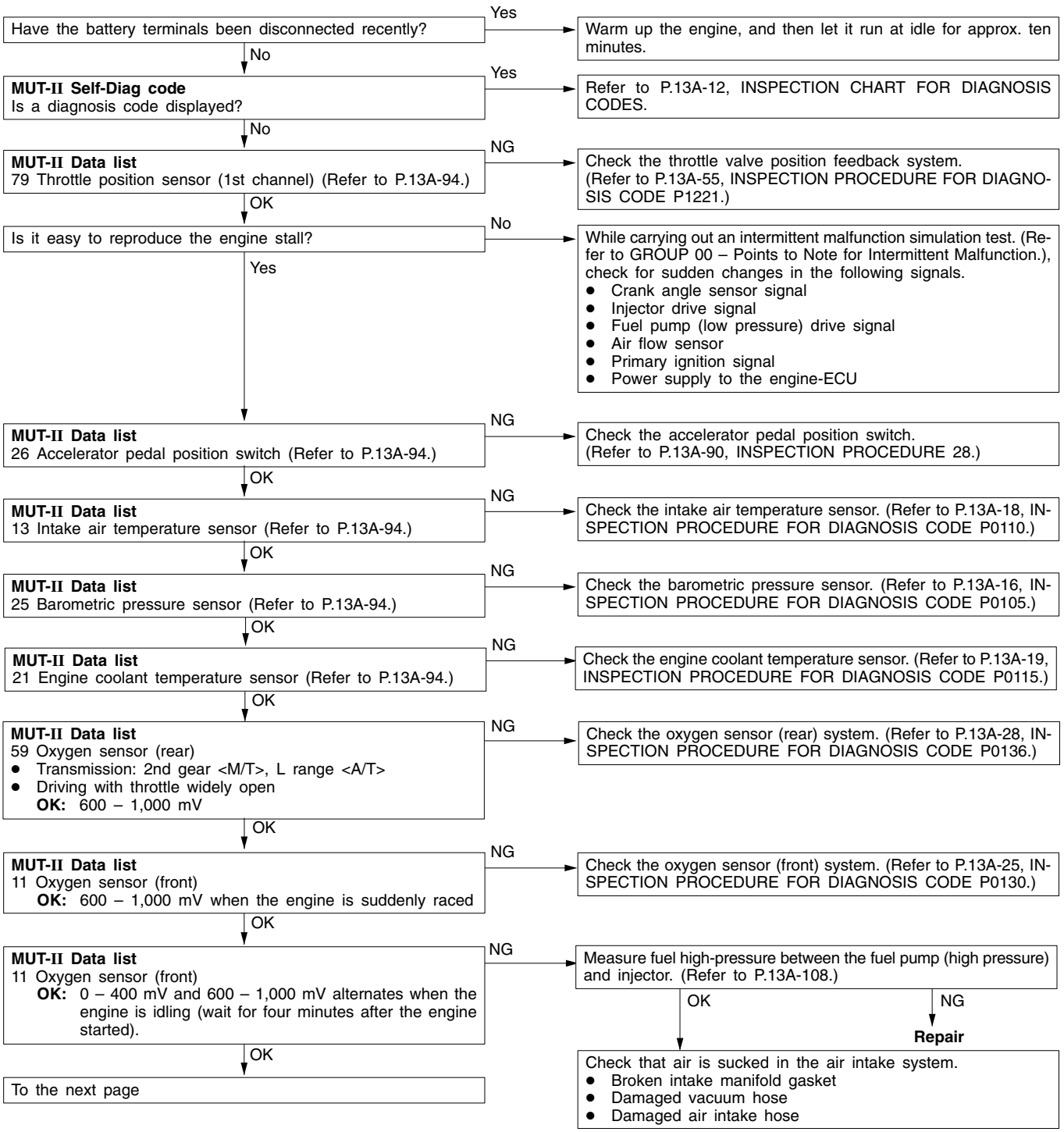
When the engine is cold, it stalls at idling. (Die out)	Probable cause
The cause is probably an incorrect air/fuel ratio or poor intake air amount when the engine is cold.	• Malfunction of the electronic-control throttle valve system • Malfunction of the throttle body

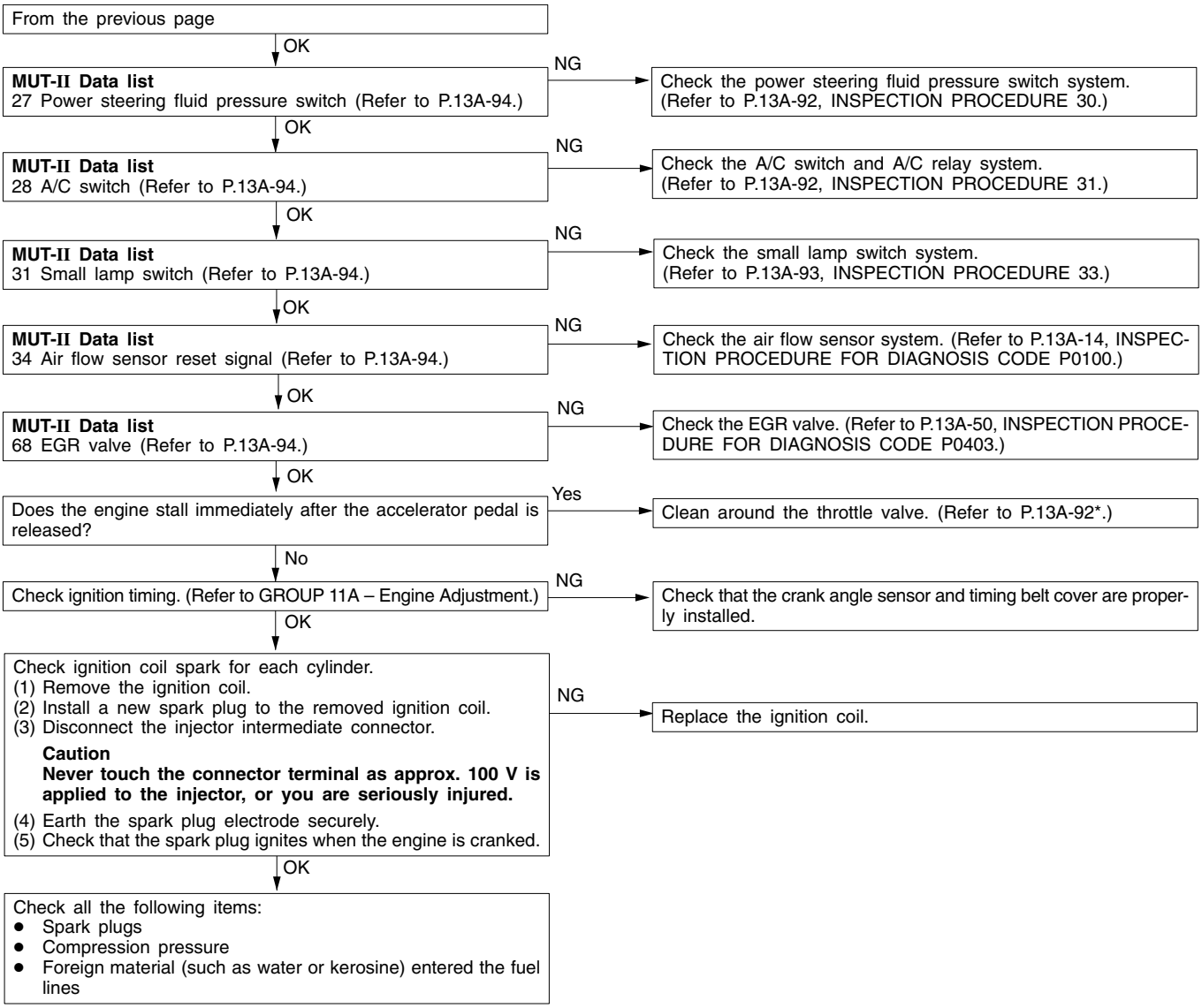


NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 10

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





NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 11

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
→ Yes → (Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.)
↓ No

MUT-II Data list
68 EGR valve (Refer to P.13A-94.)
→ NG → Check the EGR valve. (Refer to P.13A-50, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
↓ OK

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-100.)
→ NG → Check the purge control solenoid valve system. (Refer to P.13A-52, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0443.)
↓ OK

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

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

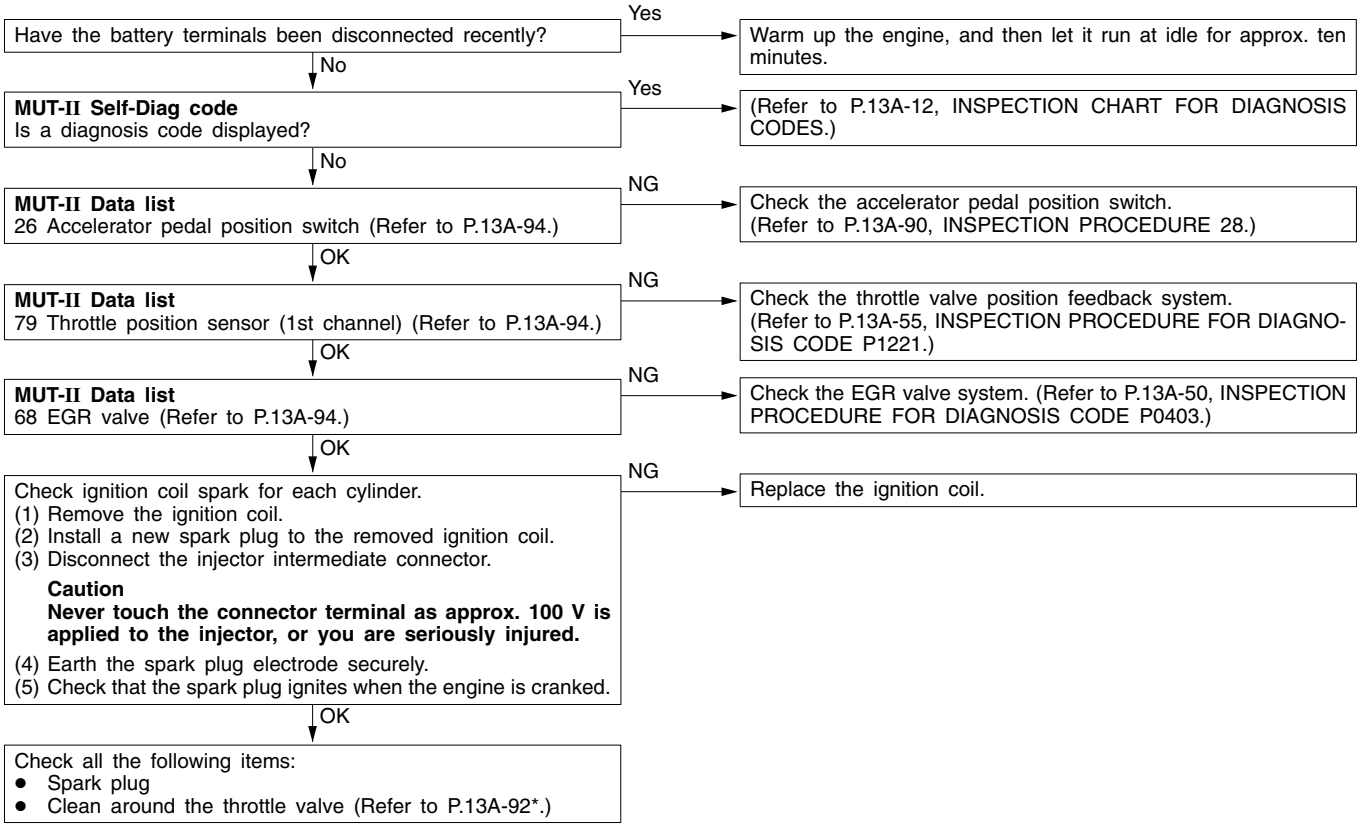
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

→ NG → Replace the ignition coil.
↓ OK

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

INSPECTION PROCEDURE 12

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



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 13

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

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

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13A-94.)
NG → Check the accelerator pedal position switch. (Refer to P.13A-90, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-94.)
NG → Check the intake air temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-94.)
NG → Check the barometric pressure sensor. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-94.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-94.)
NG → Check the throttle valve position feedback system. (Refer to P.13A-55, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P1221.)
OK ↓

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

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13A-28, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13A-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-108.)
OK ↓

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

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13A-94.)
NG → Check the EGR valve. (Refer to P.13A-50, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-100.)
NG → Check the purge control solenoid valve. (Refer to P.13A-52, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0443.)
OK ↓

To the next page

From the previous page

OK

Measure high fuel pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-108.)

NG → **Repair**

OK

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

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

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

NG → Replace the ignition coil.

OK

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

OK → Check trouble symptom.

NG → Replace the injector.

INSPECTION PROCEDURE 14

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

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

Yes → (Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.)

No

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13A-94.)

NG → Check the throttle valve position feedback system. (Refer to P.13A-55, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P1221.)

OK

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

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

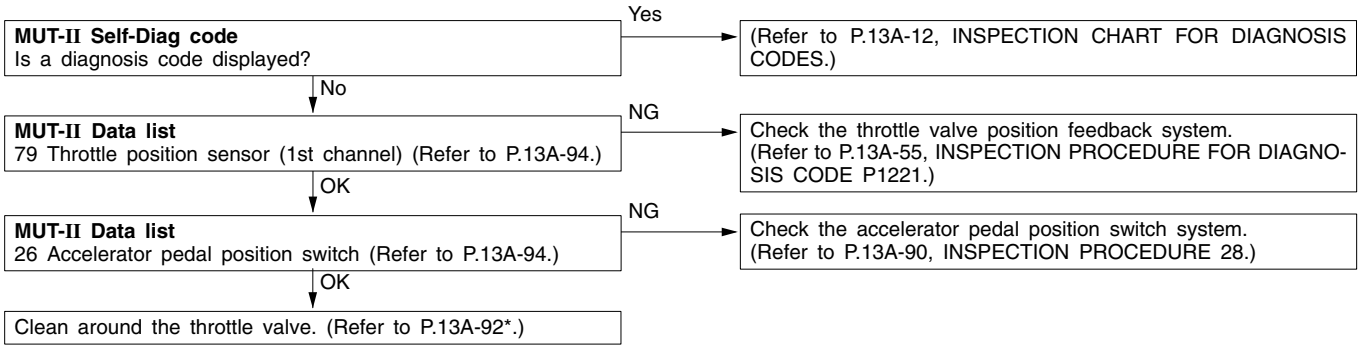
(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

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

NG → Replace the ignition coil.

INSPECTION PROCEDURE 15

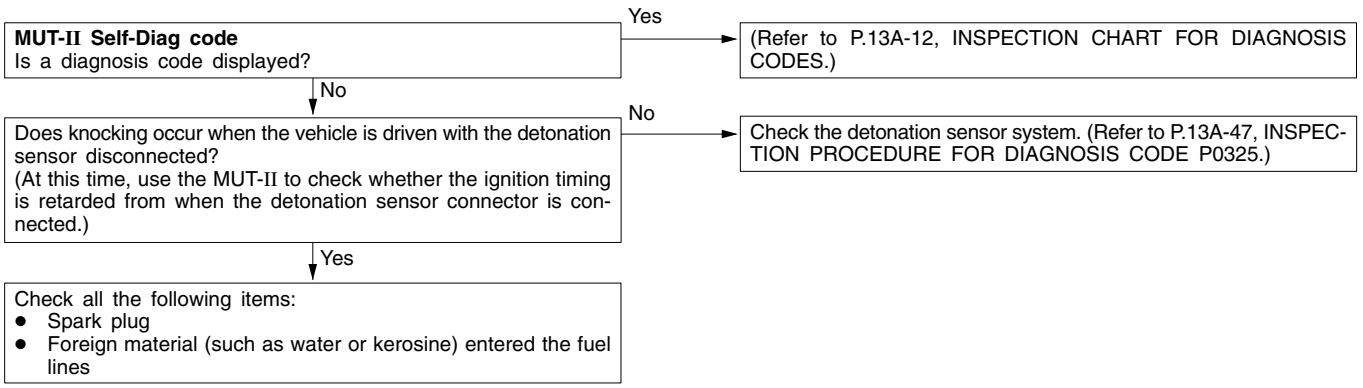
The feeling of impact when decelerating	Probable cause
The cause is probably insufficient intake air due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 16

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



INSPECTION PROCEDURE 17

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

Replace the injector.

INSPECTION PROCEDURE 18

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

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

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

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-94.)
NG → Check the engine coolant temperature sensor. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-94.)
NG → Check the intake air temperature sensor. (Refer to P.13A-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-94.)
NG → Check the barometric pressure sensor. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

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

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13A-28, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13A-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

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

NG ↓

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13A-108.)
NG → **Repair**
OK ↓

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

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

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

OK ↓
NG ↓

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

Replace the ignition coil.

OK ↓

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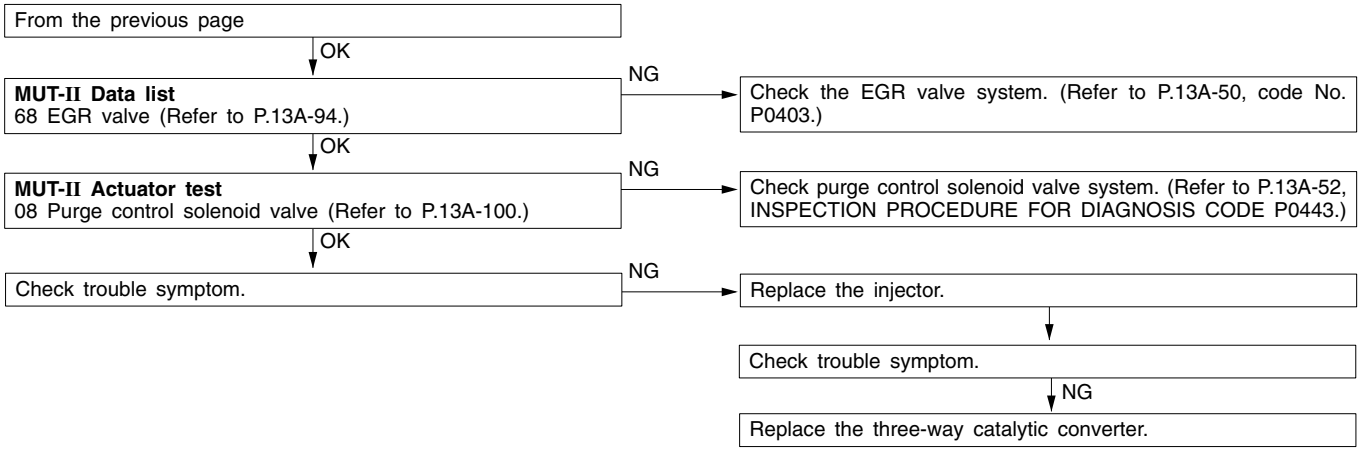
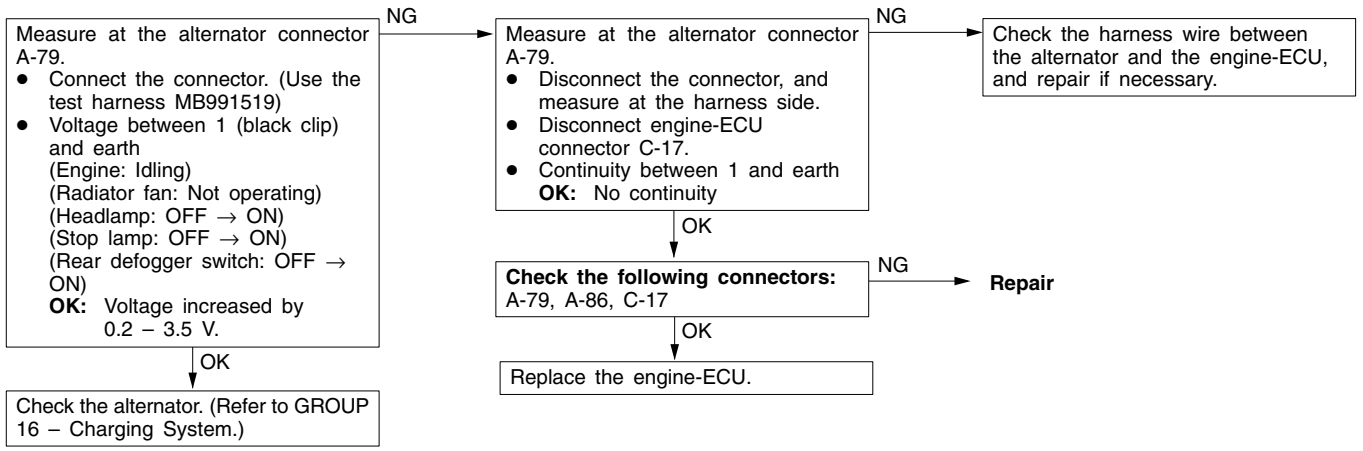


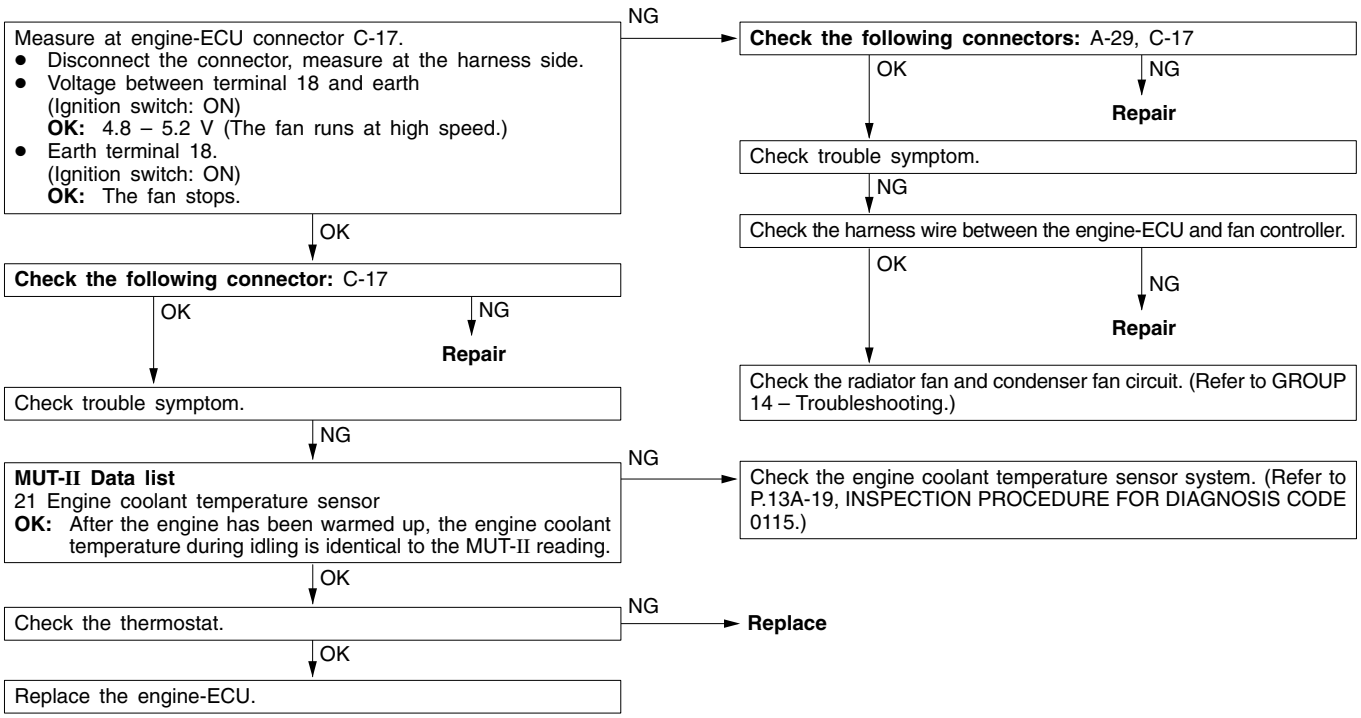
INSPECTION PROCEDURE 19

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



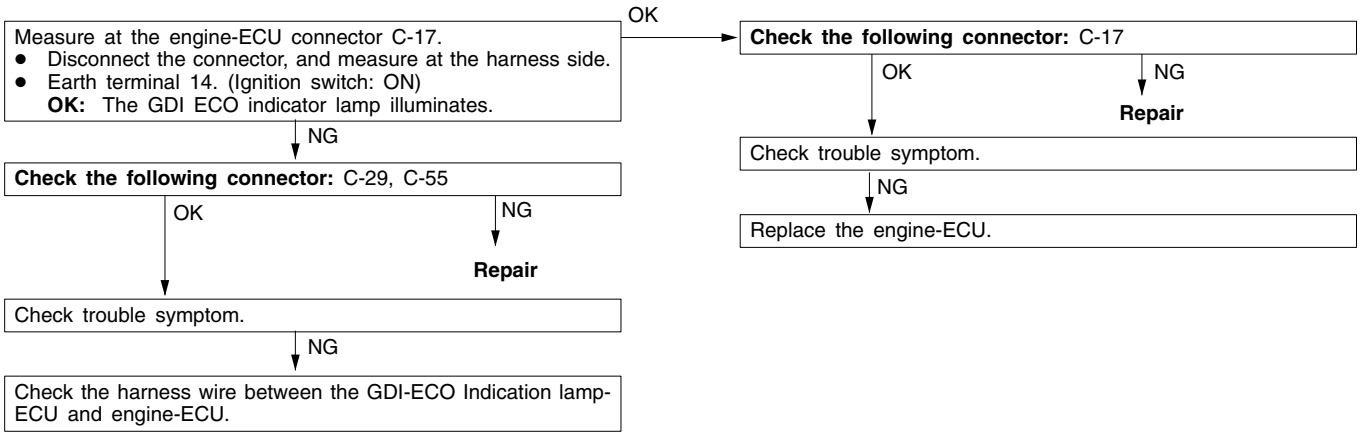
INSPECTION PROCEDURE 20

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



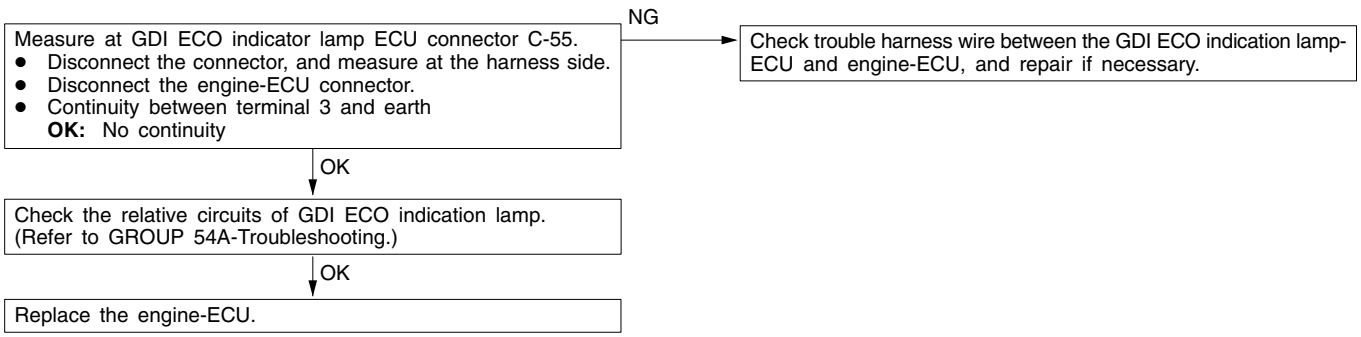
INSPECTION PROCEDURE 21

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



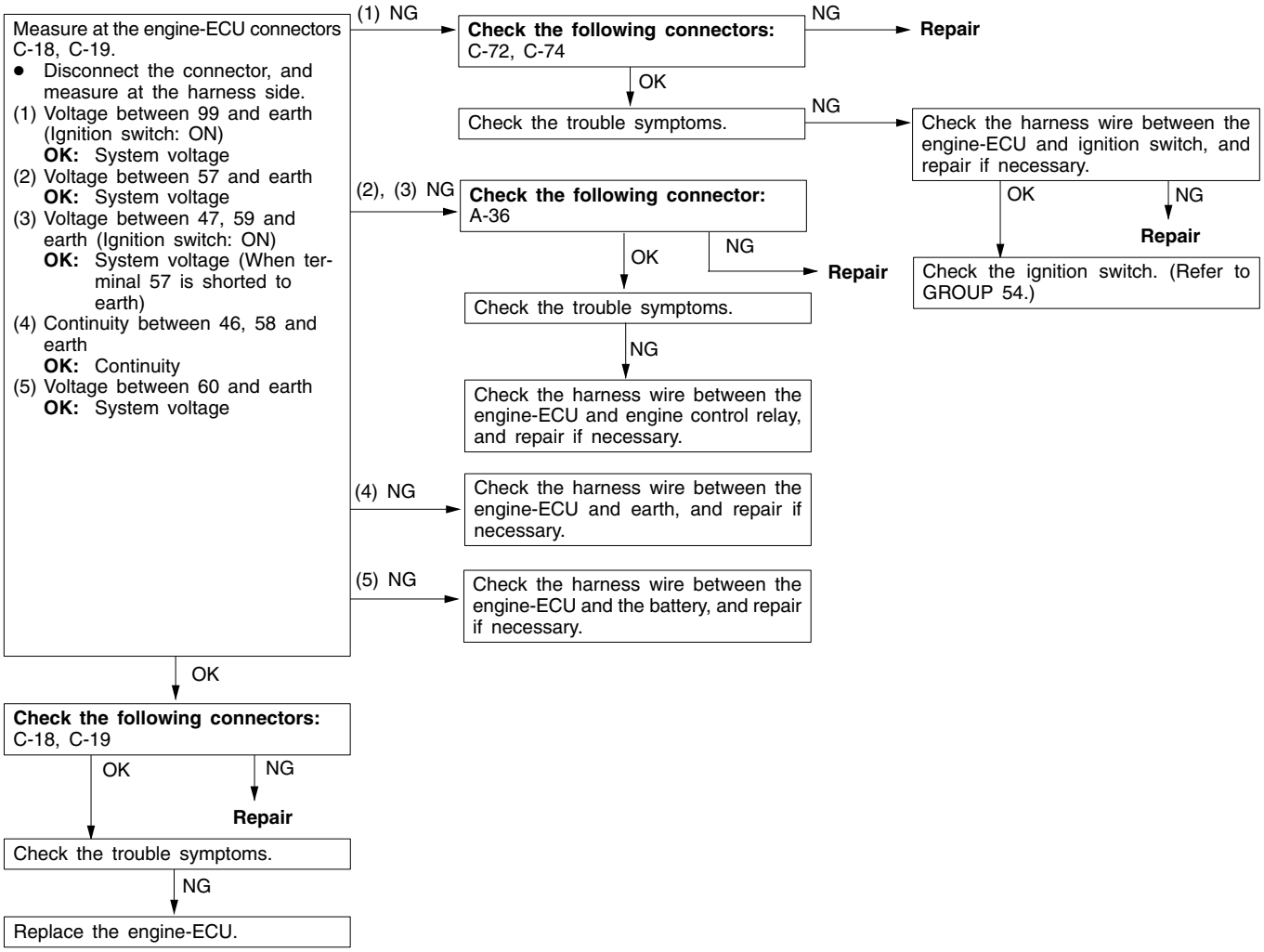
INSPECTION PROCEDURE 22

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



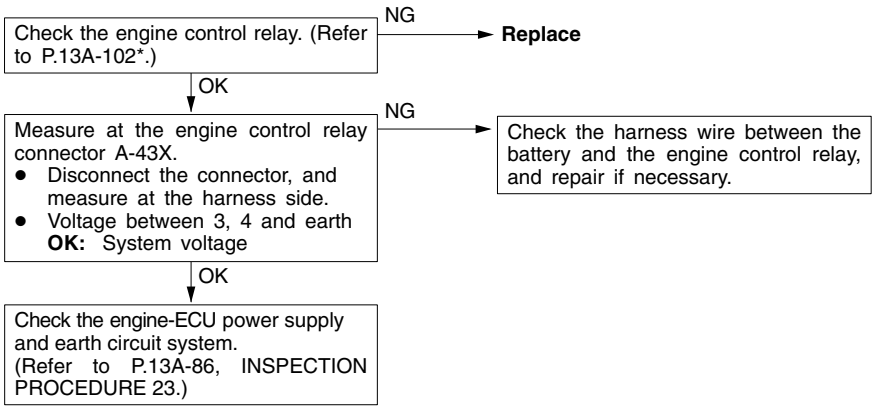
INSPECTION PROCEDURE 23

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



INSPECTION PROCEDURE 24

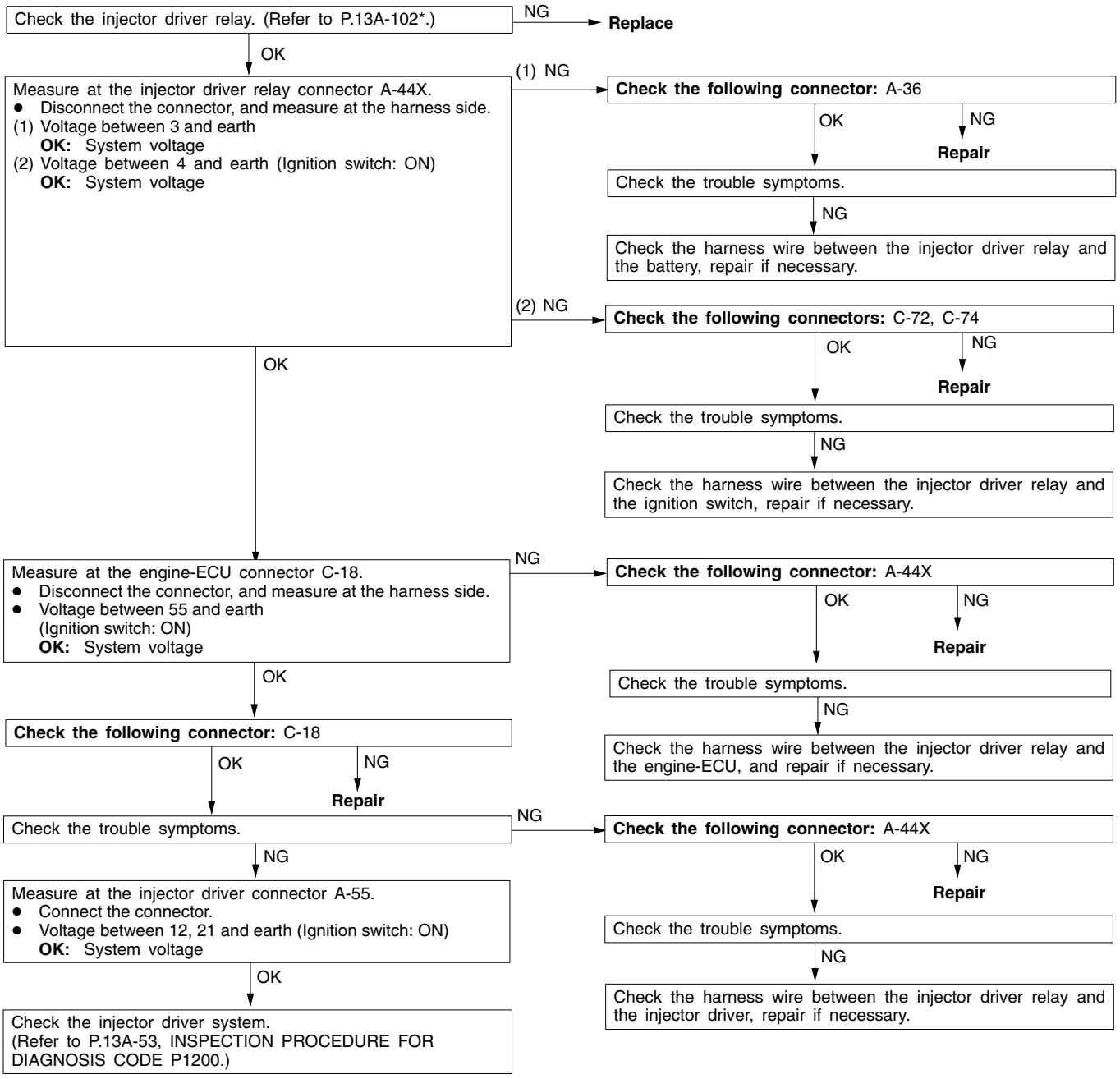
Engine control relay and ignition switch-IG system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, the engine-ECU turns on the engine control relay. This causes system voltage to be supplied to the engine-ECU and to the sensors and actuators.	• Malfunction of the ignition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



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

INSPECTION PROCEDURE 25

Injector driver relay system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, engine-ECU turns on the injector driver relay. This causes system voltage to be supplied to the injector driver.	• Malfunction of the injector driver relay • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU

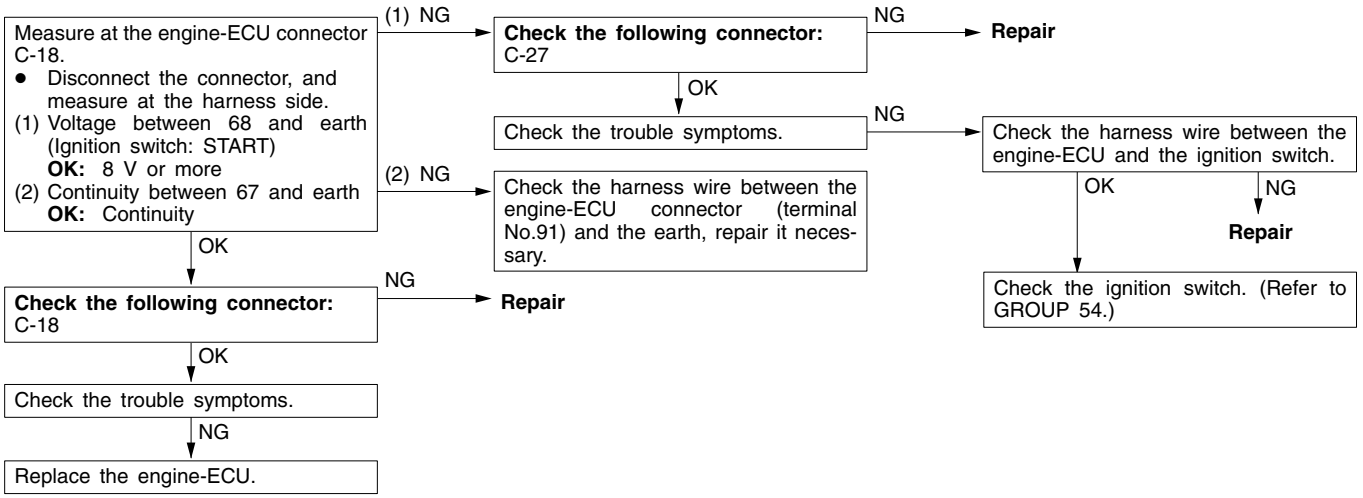


NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE99E1)

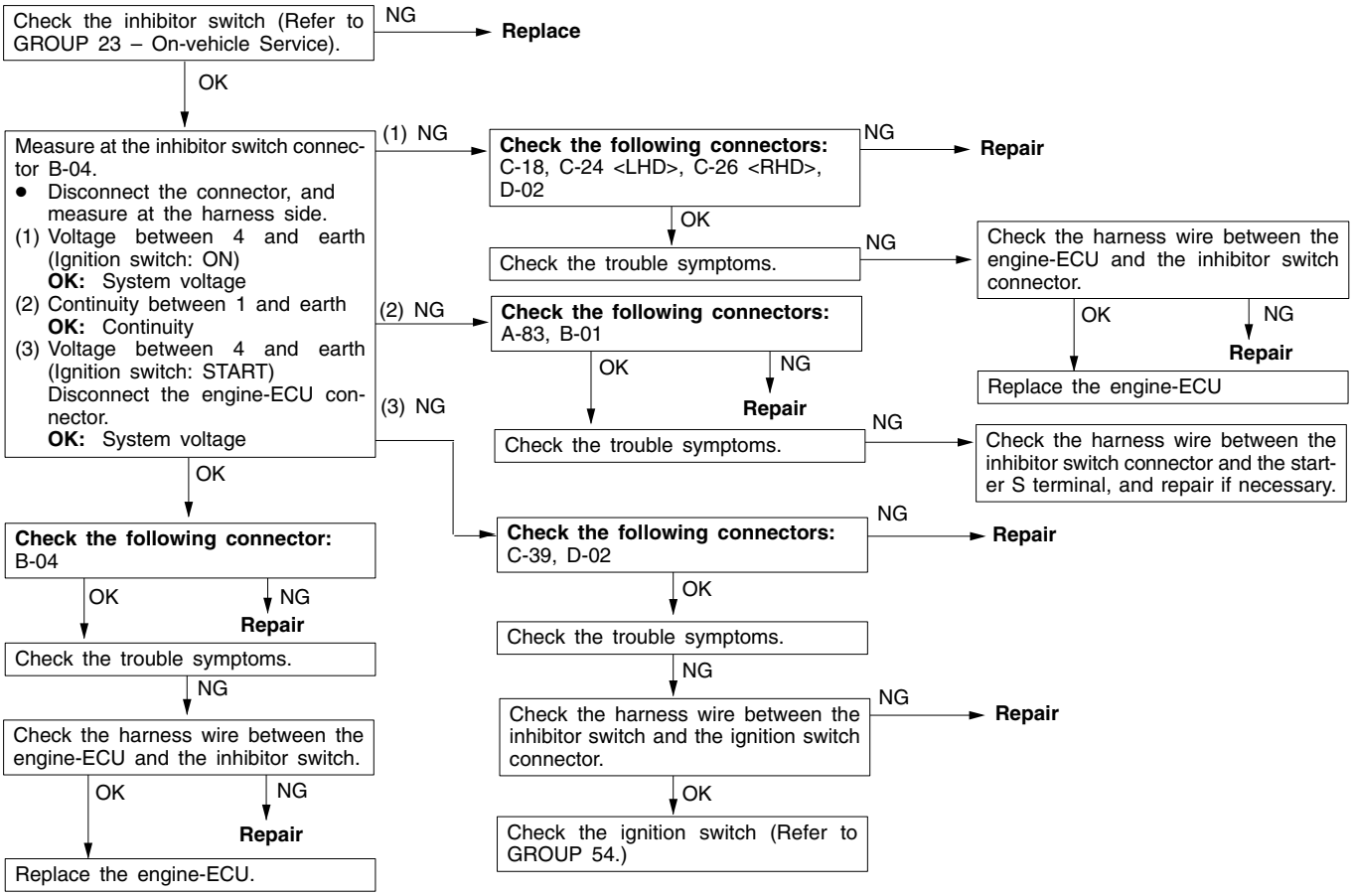
INSPECTION PROCEDURE 26

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



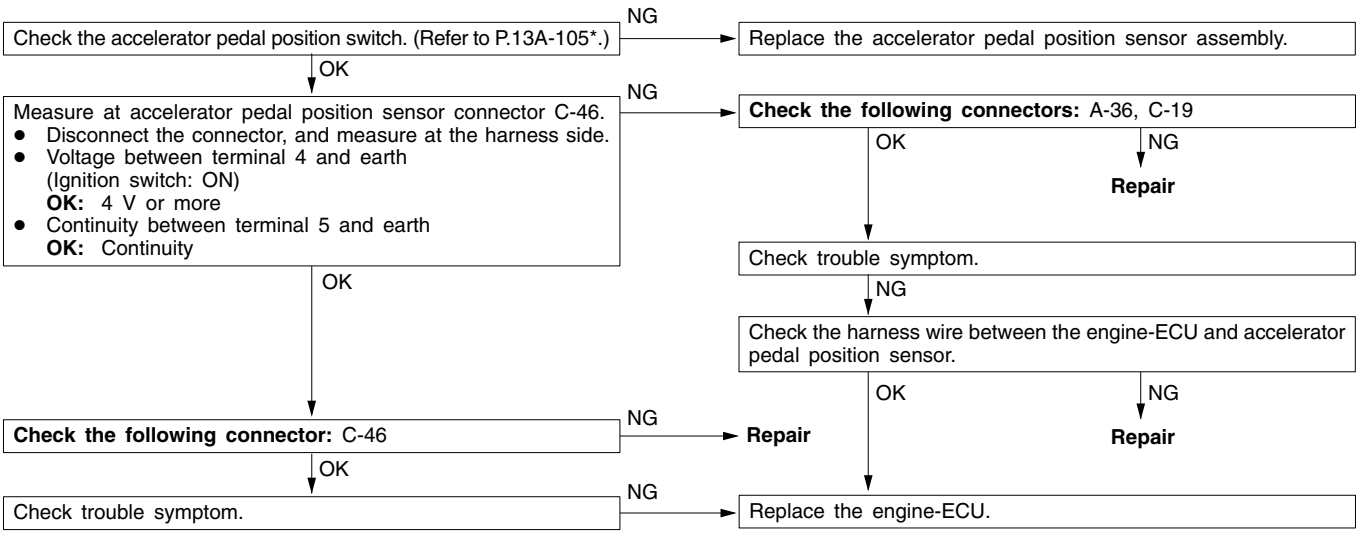
INSPECTION PROCEDURE 27

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



INSPECTION PROCEDURE 28

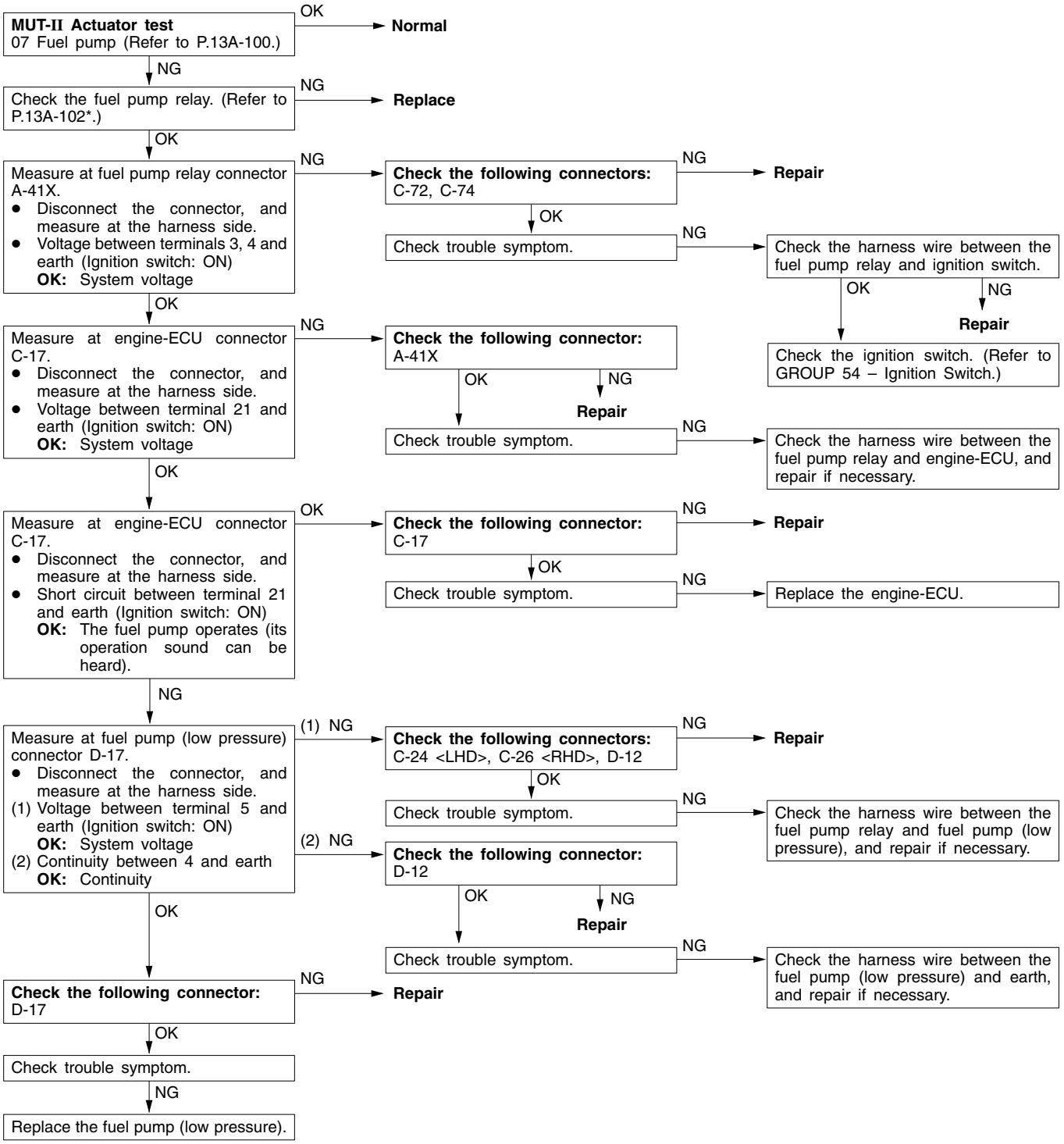
Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-ECU. The engine-ECU controls idle speed, based on this signal.	● Maladjustment of the accelerator cable ● Maladjustment of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



NOTE
*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE99E1)

INSPECTION PROCEDURE 29

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

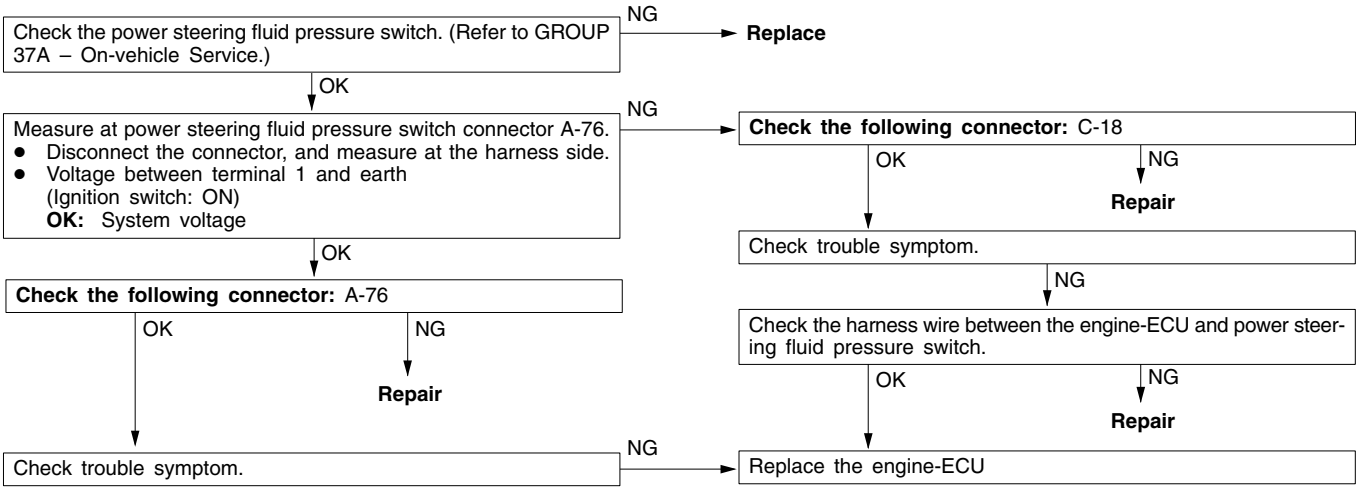


NOTE

*: Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1)

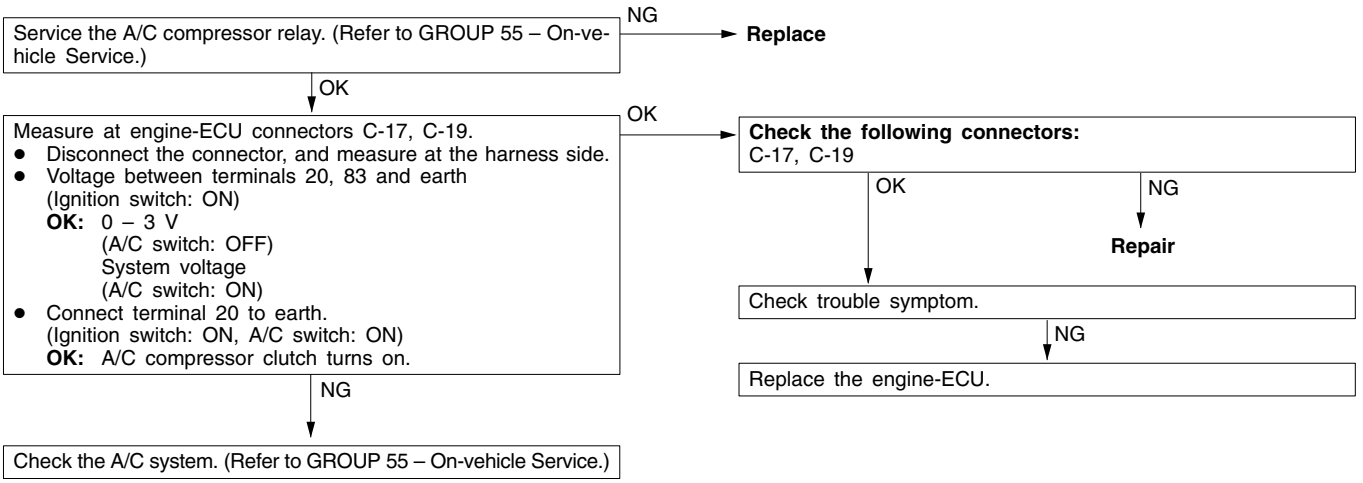
INSPECTION PROCEDURE 30

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



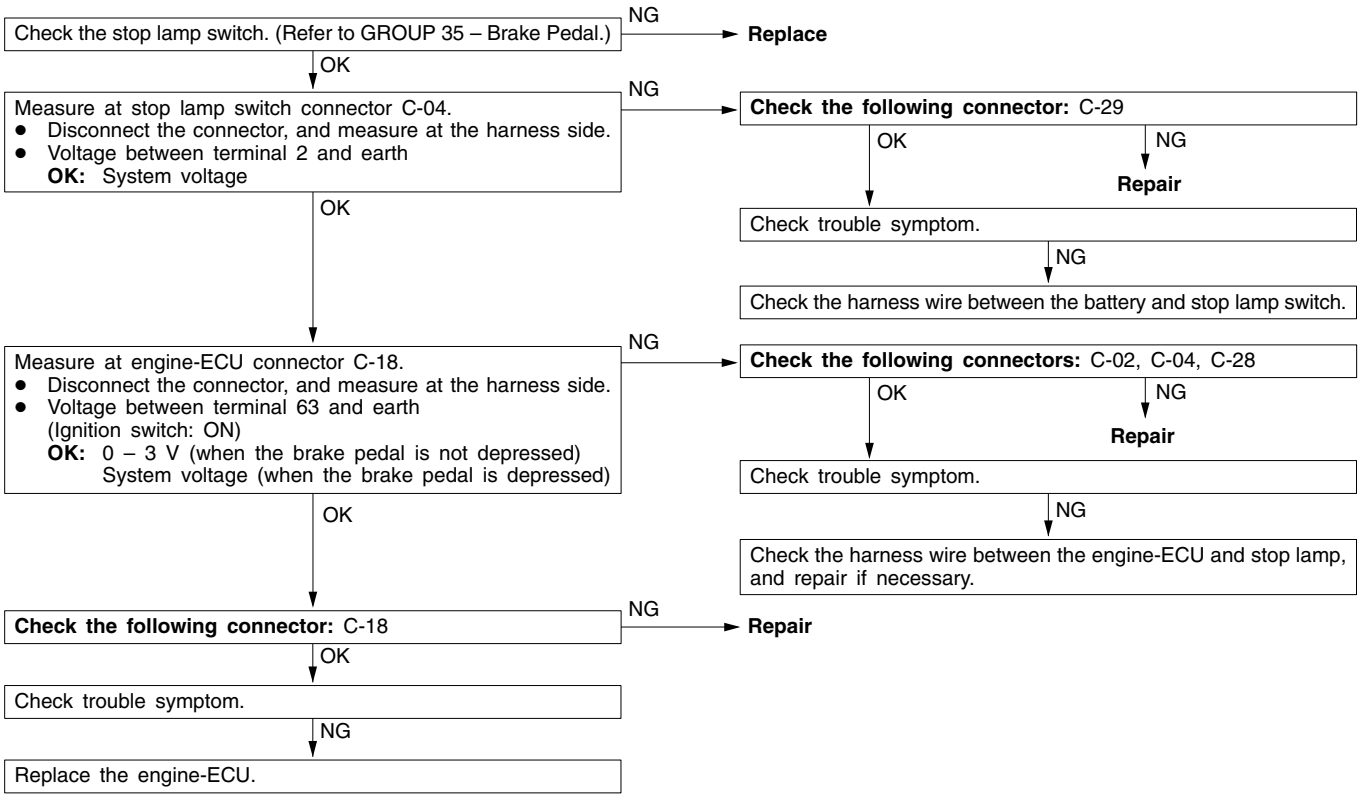
INSPECTION PROCEDURE 31

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



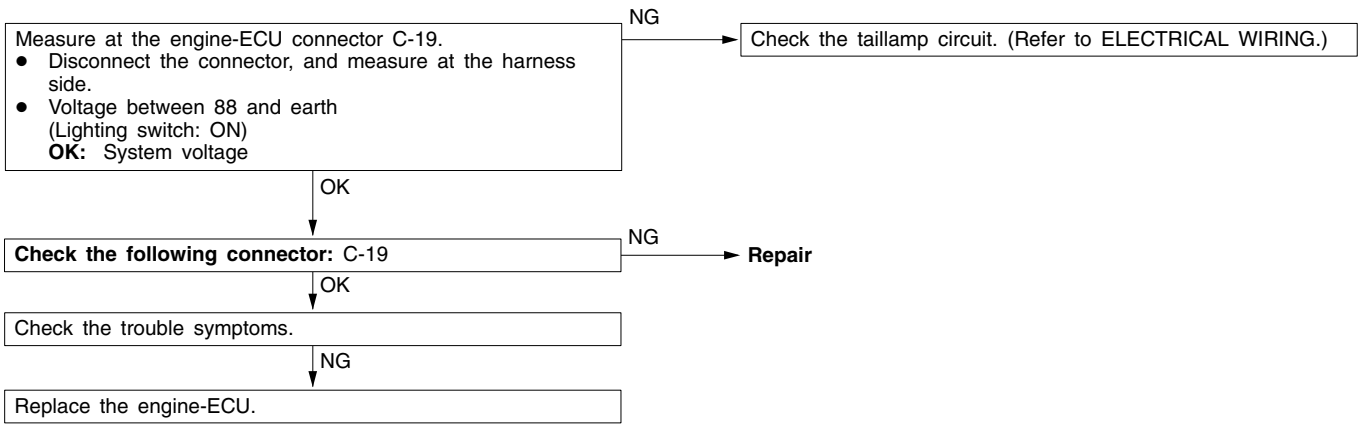
INSPECTION PROCEDURE 32

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



INSPECTION PROCEDURE 33

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



DATA LIST REFERENCE TABLE

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

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

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front)	Engine: After warm-up	Idling	0 mV*1	Code No. P0130	13A-25
			Sudden racing	600 – 1,000 mV		
			2,500 r/min	400 mV or less and 600 – 1,000 mV alternates.		
12	Air flow sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Idling	24 – 50 Hz	Code No. P0100	13A-14
			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. P0110	13A-18
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (2nd channel)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	4,000 – 4,800	Code No. P0225	13A-43
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	100 – 1,100 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 23	13A-86
18	Cranking signal (Ignition switch – ST)	Transmission: Neutral (A/T: P range)	Engine: Stopped	OFF	Procedure No.26 <M/T> Procedure No.27 <A/T>	13A-89 <M/T> 13A-89 <A/T>
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: –20°C	–20°C	Code No. P0115	13A-19
			Engine coolant temperature: 0°C	0°C		
			Engine coolant temperature: 20°C	20°C		
			Engine coolant temperature: 40°C	40°C		
			Engine coolant temperature: 80°C	80°C		
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13A-47
		• Engine: Idling • Accelerator pedal position switch: ON	Engine coolant temperature: –20°C	1,200 – 1,400 r/min		
			Engine coolant temperature: 0°C	1,100 – 1,300 r/min		
			Engine coolant temperature: 20°C	1,000 – 1,200 r/min		
			Engine coolant temperature: 40°C	850 – 1,050 r/min		
			Engine coolant temperature: 80°C	550 – 750 r/min*1		
24	Vehicle speed sensor	Drive at 40 km/h		Approximately 40 km/h	Code No. P0500	13A-53

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No. P0105	13A-16
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No. 28	13A-90
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 30	13A-92
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No. 31	13A-92
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	Selector lever: P or N	P, N	Procedure No. 27	13A-89
			Selector lever: D, 2, L or R	D, 2, L, R		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No. 33	13A-93
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No. P0100	13A-14
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	30 – 50 %	–	–
			2,500 r/min	10 – 30 %		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	• Engine: Cranking [reading is possible at 2,000 r/min or less] • Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	–	–

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time*2	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Idling	0.35 – 0.55 ms*1	–	–
			2,500 r/min	0.4 – 0.6 ms		
			Sudden racing	Increases		
44	Ignition advance	• Engine: After warm-up • Set a timing light.	Idling	8 – 24°BTDC*1	Code No. P0300	13A-44
			2,500 r/min	15 – 35°BTDC		
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No. 31	13A-92
			A/C switch: ON	ON (compressor clutch is operating)		
59	Oxygen sensor (rear)	• Transmission: 2nd gear (A/T: L range) • Drive with throttle widely open	3,500 r/min	600 – 1,000 mV	Code No. P0136	13A-28
66	Brake vacuum sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Stop the engine from idling speed, and then depress the brake pedal several times with the ignition switch on.	Displayed pressure increases.	Code No. P1515	13A-62
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No. 32	13A-93
			Brake pedal: Released	ON		
68	EGR valve	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Idling	2 – 17 STEP	Code No. P0403	13A-50
			2,500 r/min	0 – 9 STEP		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
74	Fuel pressure sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine: Idling	4 – 6.9 MPa	Code No. P0190	13A-33
77	Accelerator pedal position sensor (2nd channel)*3	Ignition switch: ON	Release the accelerator pedal.	700 – 1,400 mV	Code No. P1225	13A-58
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,100 mV or more		
78	Accelerator pedal position sensor (1st channel)*3	Ignition switch: ON	Release the accelerator pedal.	985 – 1,135 mV	Code No. P0220	13A-40
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,100 mV or more		
79	Throttle position sensor (1st channel)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	450 – 800 mV	Code No. P0120	13A-22
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	3,900 – 4,900 mV		
		Engine: After warm-up, idling	No load	450 – 1,000 mV		
			A/C switch: OFF → ON	Increases by 100 – 600 mV.		
			Selector lever: N → D range	Increases by 0 – 200 mV.		
81	Long-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		–10 – 10 %	Code No. P0170	13A-31
82	Short-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		–25 – 25 %	Code No. P0170	13A-31

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
85	Fuel pressure sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine: Idling	4,000 – 6,900 kPa	Code No.P0190	13A-33
87	Calculation load value	Engine: Warm	Engine: Idling	15 – 35 %	–	–
			2,500 r/min	15 – 35 %		
88	Fuel control condition	Engine: Warm	2,500 r/min	Closed loop	Code No. P0125	13A-24
			When engine is suddenly raced	Open loop – drive condition		
99	Fuel injection mode	Engine: After warm up	Idling (after four minutes or more have passed since engine start)	Lean compression	–	–
			2,500 r/min	Stoichiometric metric feedback		
			Sudden racing after idle position	Open loop		
A1	Oxygen sensor (front)	Engine: After warm-up	Idling	0 V	Code No. P0130	13A-25
			Sudden racing	0.6 – 1.0 V		
			2,500 r/min	0.4 V or less and 0.6 – 1.0 V alternates		
A2	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Drive with throttle widely open	3,500 r/min	0.6 – 1.0 V	Code No. P0136	13A-28
8A	Throttle position sensor (1st channel) (Throttle valve opening angle)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine: stopped)	Release the accelerator pedal.	8 – 16 %	Code No. P0120	13A-22
			Depress the accelerator pedal gradually.	Increase in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	80 – 100 %		
		Engine: After warm-up, idling	No load	8 – 18 %		
			A/C switch: OFF → ON	Rises by 2 – 10 %		

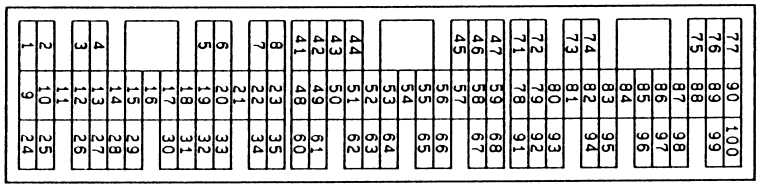
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. P0201	13A-34
02		Cut fuel to No. 2 injector			Code No. P0202	13A-36
03		Cut fuel to No. 3 injector			Code No. P0203	13A-37
04		Cut fuel to No. 4 injector			Code No. P0204	13A-38
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 29	13A-91
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Code No. P0443	13A-52
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. 20	13A-84
34	Electronic-controlled throttle valve system	Stop the throttle control servo.	Ignition switch: ON	Throttle valve is opened slightly.	Code No. P1220	13A-54

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



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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		0.3 – 3.0 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	• Engine: Warm up, and then idling • Radiator fan: Not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON		Voltage increases by 0.2 – 3.5 V
14	GDI ECO indication lamp	Ignition switch: OFF → ON		0 – 3 V (System voltage after five seconds)
		Engine: When the accelerator pedal is suddenly depressed while the engine is idling		System voltage
16	Purge control solenoid valve	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON	Engine: Stopped	System voltage
			Engine: Start the engine, and then increase engine speed up to 3,500 r/min.	Voltage decreases

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
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	• 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 – 3.5 V
			Engine coolant temperature: 20°C	2.3 – 2.9 V
			Engine coolant temperature: 40°C	1.5 – 2.1 V
			Engine coolant temperature: 80°C	0.4 – 1.0 V
45	Engine ignition signal	Engine: 3,000 r/min		0.3 – 3.0 V
47	Power supply	Ignition switch: ON		System voltage
59				
50	Camshaft position sensor	Engine: Cranking		0.4 – 3.0 V
		Engine: Idling		0.5 – 2.0 V
51	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 – 4.3 V
			Altitude: 1,200 m	3.2 – 3.8 V
52	Alternator FR terminal	• Engine: Warm up, and then idling • Radiator fan: Not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger: OFF → ON		Voltage decreases

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
53	Oxygen sensor (rear)	• Transmission: 2nd gear • Engine speed: 3,500 r/min or more • Driving with the throttle valve widely open		0.6 – 1.0 V
54	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 – 3 V
55	Injector driver relay	Ignition switch: OFF		0 – 0.1 V
		Ignition switch: ON		0.5 – 1.0 V
56	Throttle valve control servo relay	Ignition switch: OFF		0 – 0.3 V
		Ignition switch: ON		0.5 – 1.0 V
57	Engine control relay	Ignition switch: OFF		0 – 3 V
		Ignition switch: ON		System voltage
60	Back-up power source	Ignition switch: OFF		System voltage
61	Air flow sensor	Engine: Idling		2.2 – 3.2 V
		Engine: 2,500 r/min		
62	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 – 3.8 V
			Intake air temperature: 20°C	2.3 – 2.9 V
			Intake air temperature: 40°C	1.5 – 2.1 V
			Intake air temperature: 80°C	0.4 – 1.0 V
63	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 – 3 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.
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

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.0 – 4.8 V
			Depress the accelerator pedal fully.	0.1 – 1.1 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 – 1 V
			Depress the accelerator pedal fully.	4 V or more
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward.		0 ↔ 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 heater (front)	Engine: Idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
90	Oxygen sensor heater (rear)	Engine: Idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V
94	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.935 – 1.135 V*1
			Depress the accelerator pedal fully.	4.1 V or more*2
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.
97	A/C thermo sensor	• Temperature at sensing portion: Approx 25°C • Ignition switch: ON		2.0 – 2.9 V
99	Ignition switch-IG	Ignition switch: ON		System voltage

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

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

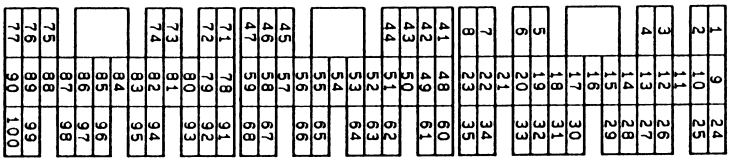
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   NOTE
   (1) When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   (2) Checking need not be carried out in the order given in the chart.

   Caution
   If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter.
   Be careful to prevent this!

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

Engine-ECU Harness Side Connector Terminal Arrangement

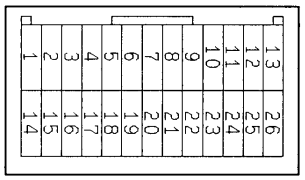


Terminal No.	Check item	Standard value, normal condition (check requirements)
5 – 47	EGR valve (D)	15 – 20 Ω (at 20°C)
6 – 47	EGR valve (C)	
32 – 47	EGR valve (B)	
34 – 47	EGR valve (A)	
16 – 47	Purge control solenoid valve	30 – 34 Ω (at 20°C)
44 – 72	Engine coolant temperature sensor	5.1 – 6.5 kΩ (when engine coolant temperature is 0°C)
		2.1 – 2.7 kΩ (when engine coolant temperature is 20°C)
		0.9 – 1.3 kΩ (when engine coolant temperature is 40°C)
		0.26 – 0.36 kΩ (when engine coolant temperature is 80°C)
46 – Body earth	Earth	Continuity (0 Ω)
58 – Body earth		
62 – 72	Intake air temperature sensor	5.3 – 6.7 kΩ (when intake air temperature is 0°C)
		2.3 – 3.0 kΩ (when intake air temperature is 20°C)
		1.0 – 1.5 kΩ (when intake air temperature is 40°C)
		0.30 – 0.42 kΩ (when intake air temperature is 80°C)
79 – 49	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
89 – 47	Oxygen sensor heater control (front)	4.5 – 8.0 Ω (at 20°C)
90 – 47	Oxygen sensor heater (rear)	11 – 18 Ω (at 20°C)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



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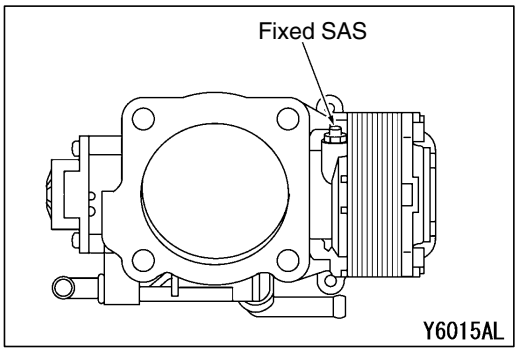
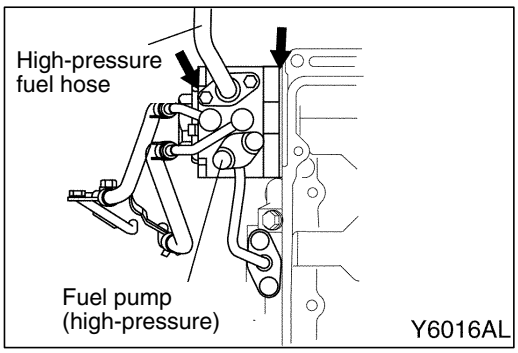
Terminal No.	Check items	Requirements		Normal value
1	Throttle valve control servo (A+)	• Ignition switch: ON • Accelerator pedal: Fully opened → fully closed		Decreases slightly from system voltage.
9	Throttle valve control servo (B+)			
14	Throttle valve control servo (A–)	• Ignition switch: ON • Accelerator pedal: Fully closed → fully opened		Decreases slightly (approx. 2 V) from system voltage.
15	Throttle valve control servo (B–)			
2	Power supply to throttle valve control servo	Ignition switch: ON		System voltage
19				
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.	0.45 – 0.8 V
			Depress the accelerator pedal fully.	3.9 – 4.9 V
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.7 – 1.4 V*1
			Depress the accelerator pedal fully.	4.1 V or more*1

NOTE:
Check that the voltage difference between *1 and *2 is 4 V or more.



ON-VEHICLE SERVICE

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



FUEL PRESSURE TEST

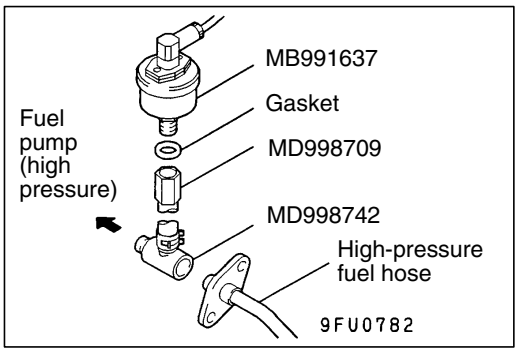
MEASUREMENT OF FUEL LOW PRESSURE BETWEEN FUEL PUMP (LOW PRESSURE) AND FUEL PUMP (HIGH PRESSURE)

1. Release residual pressure from the fuel pipe line to prevent fuel gush out.

   NOTE
   Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1) GROUP 13A – On-vehicle Service.

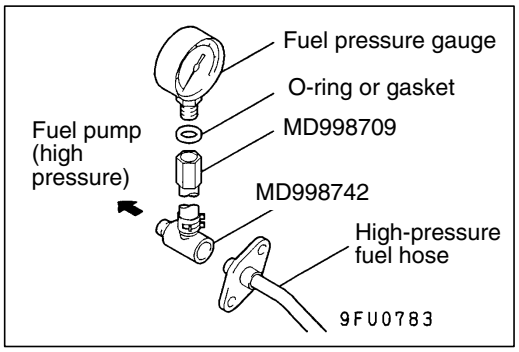
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

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



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

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



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

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

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

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

Standard value: approximately 324 kPa

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

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

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

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

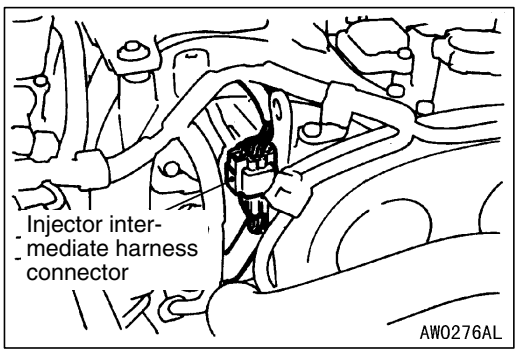
14. Release residual pressure from the fuel pipe line.

    NOTE
    Refer to the '00 PAJERO PININ Workshop Manual (Pub. No. CKRE00E1) GROUP 13A – On-vehicle Service.

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

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

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



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

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

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

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

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

8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.
11. Measure fuel pressure while the engine is running at idle.

    Standard value: 4 – 6.9 MPa

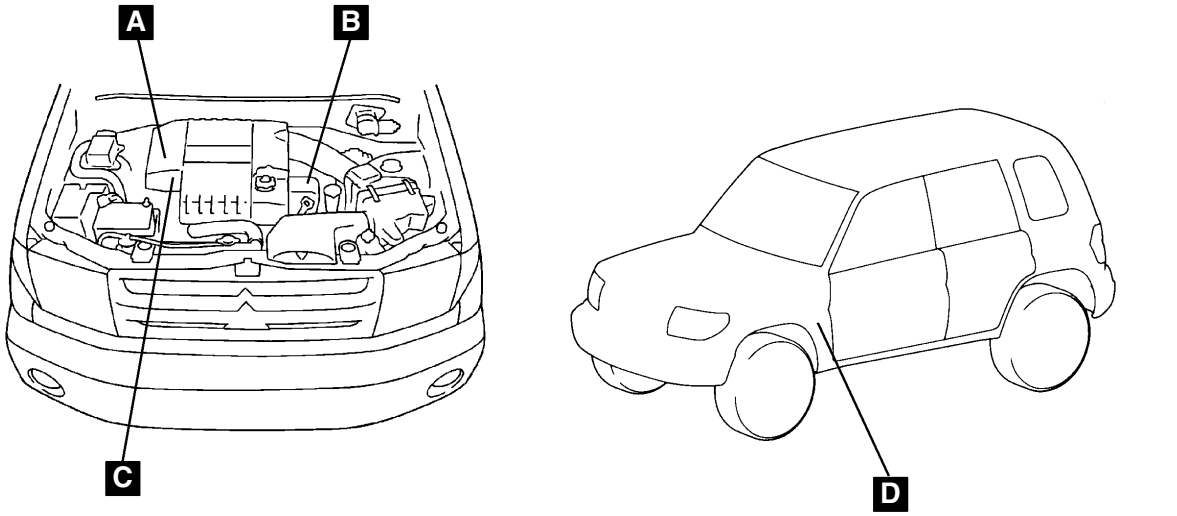
12. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
13. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

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

COMPONENT LOCATION

Name	Symbol	Name	Symbol
Fuel pressure sensor	C	Oxygen sensor (front)	B
Ignition failure sensor	A	Oxygen sensor (rear)	D



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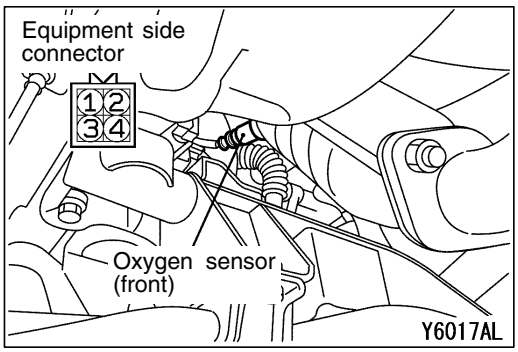

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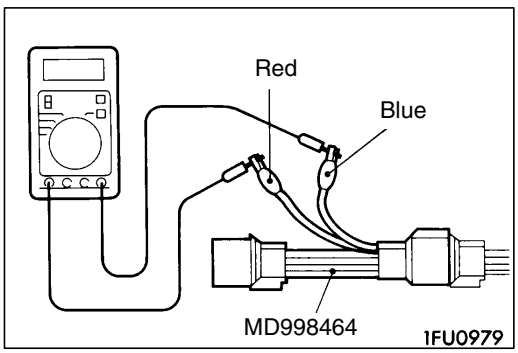

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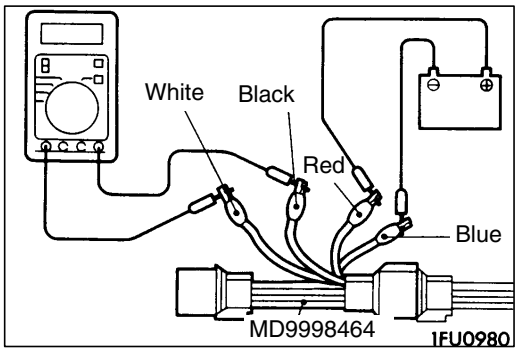
OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (4.5 – 8.0 Ω at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



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

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

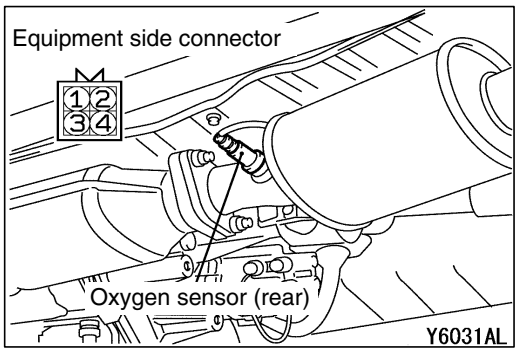
6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

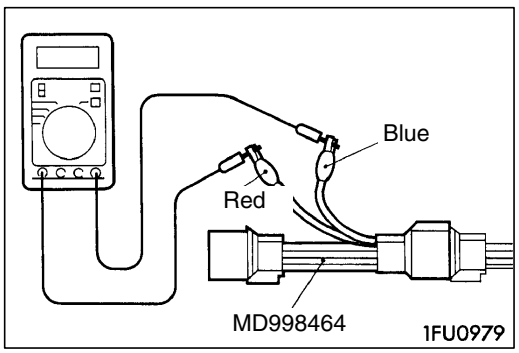
   Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

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

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





<Oxygen sensor (rear)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness set) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (11 – 18 Ω at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.

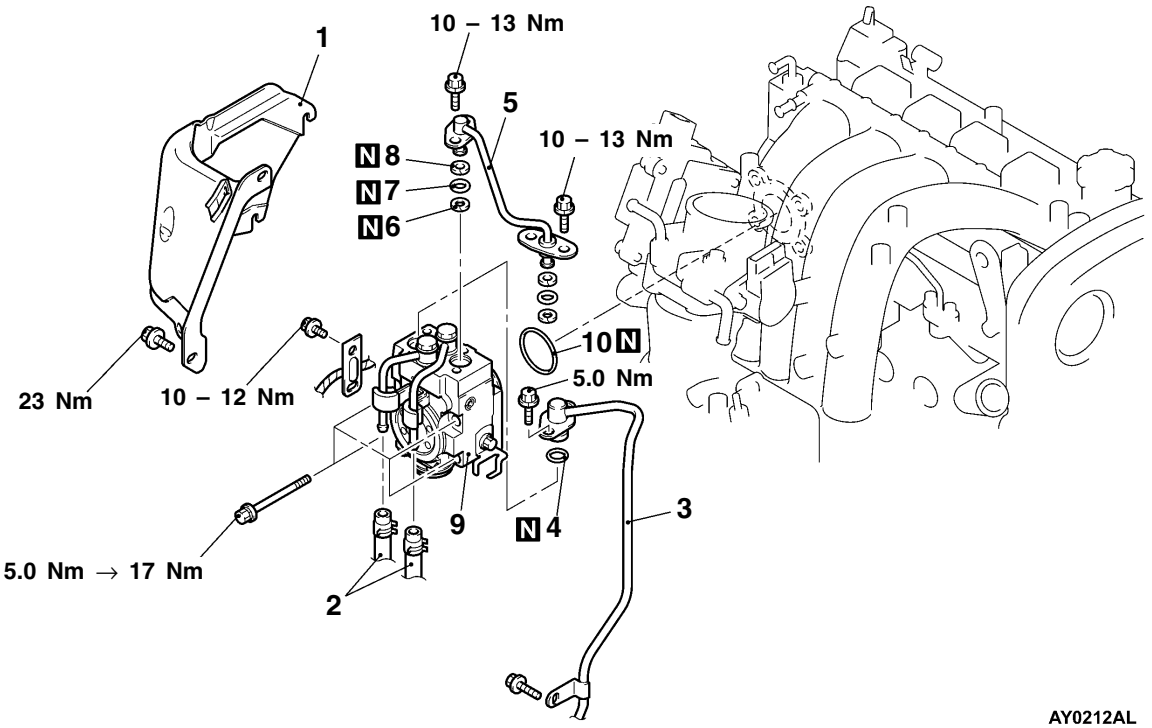
   NOTE
   (1) If the MUT-II does not display the standard value although no abnormality is found by the above mentioned continuity test and harness check, replace the oxygen sensor (rear).
   (2) For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.

FUEL PUMP (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation (Refer to GROUP 11A – Camshaft and Camshaft Oil Seal.)
- Prevention of Fuel Discharge <before removal only>
- Fuel Leak Check <after installation only>
- High-pressure Fuel Line Air Bleeding <after installation only> (P.13A-116.)
- Resonance Tank Removal and Installation

Apply engine oil to all O-rings during installation.



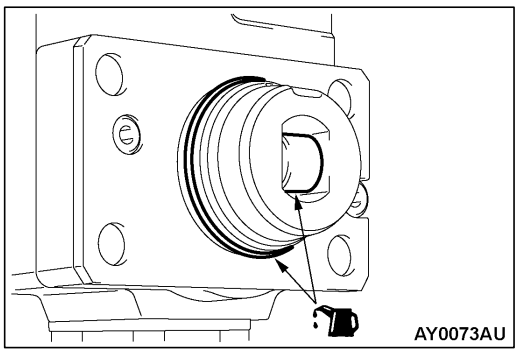
Removal steps

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

REMOVAL SERVICE POINT

◀A▶ FUEL PUMP PROTECTOR REMOVAL

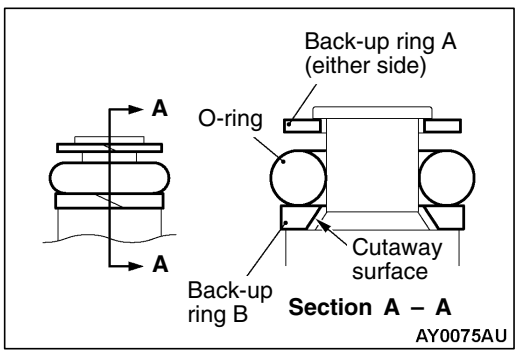
Jack up the transmission, and create sufficient clearance between the engine and the front deck. Then remove the fuel pump protector.



INSTALLATION SERVICE POINTS

▶A◀ FUEL PUMP (HIGH-PRESSURE) INSTALLATION

1. Apply clean engine oil to the O-ring and the roller of the fuel pump (high-pressure).
2. Insert the fuel pump (high-pressure) into the cylinder head mounting hole squarely, and finger-tighten the mounting bolts. The mounting bolts should be tightened securely at step ▶B◀.



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

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

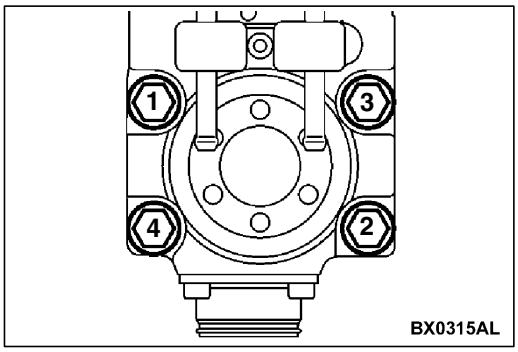
   Caution
   (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
   (2) Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the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

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

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

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

   Tightening torque: 10 – 13 Nm



4. Tighten the fuel pump (high-pressure) mounting bolts to 5.0 Nm in the order shown.
5. Tighten the mounting bolts to 17 Nm in the sequence shown as second stage. The final tightening torques should not vary more than 2.0 Nm.

▶C◀ O-RING/FUEL PRESSURE HOSE INSTALLATION

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

   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high pressure).
2. While being careful not to damage the O-ring, turn the fuel pressure hose to the left and right and connect it to the 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.
4. Tighten the fuel pressure hose mounting bolts to the specified toque.

   Tightening torque: 5.0 Nm

AIR-BLEEDING HIGH-PRESSURE FUEL LINE

1. Run the engine at 2000 r/min for at least 15 seconds in order to bleed air from the high-pressure fuel line.

   NOTE
   If air is trapped in the high-pressure fuel line due to the removal of fuel pipe, diagnosis code No. P.0190 will be set as abnormal fuel pressure.
2. Finally confirm diagnosis code by using the MUT-II. If diagnosis code, which indicates defective fuel pressure sensor system, has been set, erase the code.

INJECTOR

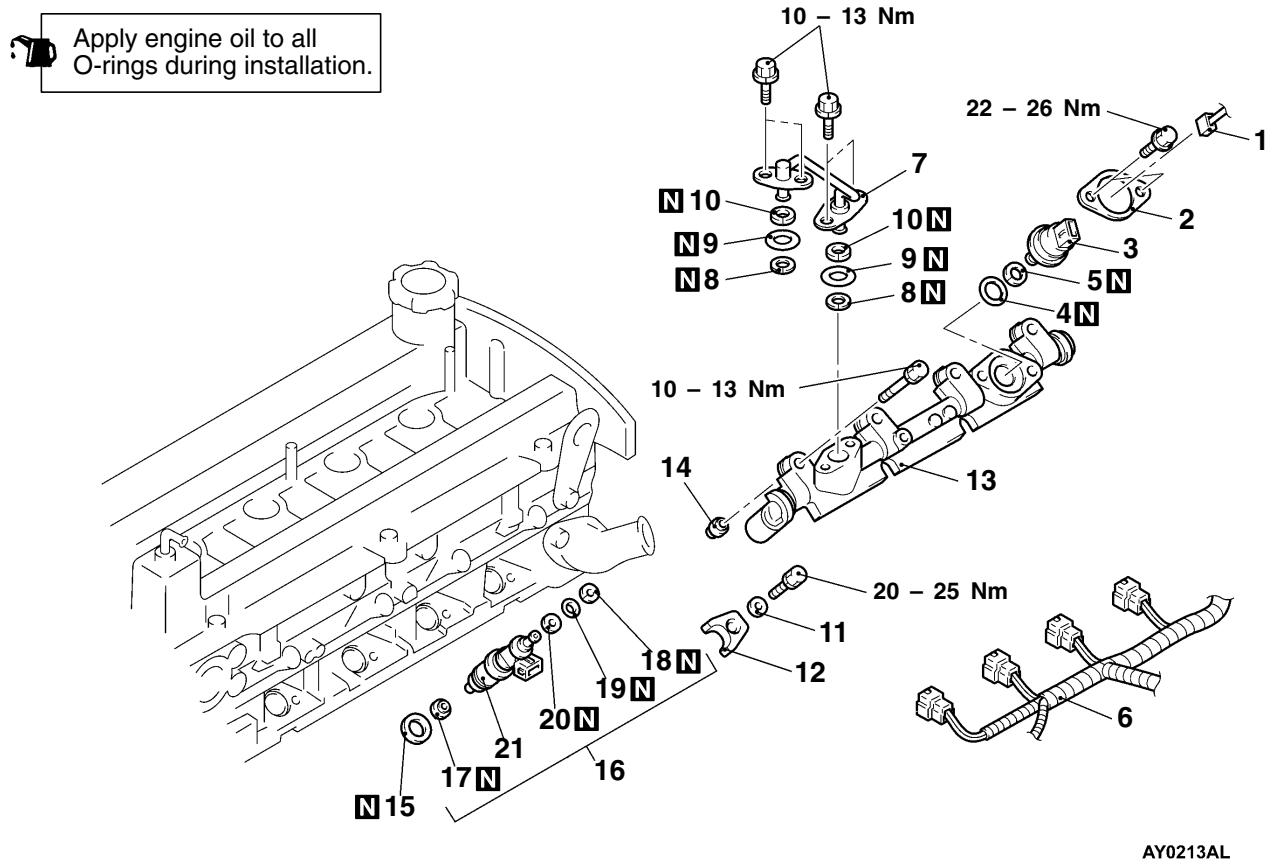
REMOVAL AND INSTALLATION

Caution

1. **Disconnect the negative battery cable prior to the service work.**
2. **The injector driver may be hot immediately after each operation, and high voltage and current flows between the injector driver and the injectors while the engine is running. Handle the injector driver carefully.**

Pre-removal and Post-installation Operation

- Engine Cover Removal and Installation (Refer to GROUP 11A – Camshaft and Camshaft Oil Seal.)
- Prevention of Fuel Discharge <before removal only>
- Fuel Leak Check <after installation only>
- High-pressure Fuel Line Air Bleeding <after installation only> (P.13A-116.)



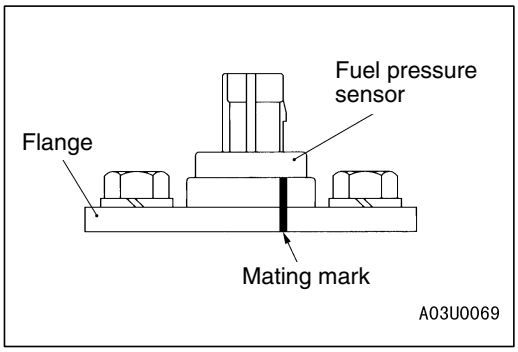
Fuel pressure sensor removal steps

◀A▶ ▶E◀ 1. Fuel pressure sensor connector
◀A▶ ▶E◀ 2. Flange
▶E◀ 3. Fuel pressure sensor
▶D◀ 4. O-ring
▶D◀ 5. Back-up ring

Injector removal steps

- Intake manifold (Refer to GROUP 15.)

6. Injector connector
▶C◀ 7. Fuel pipe
▶C◀ 8. Back-up ring A
▶C◀ 9. O-ring
▶C◀ 10. Back-up ring B
▶B◀ 11. Injector washer
▶B◀ 12. Injector holder
◀B▶ ▶B◀ 13. Delivery pipe assembly
▶B◀ 14. Insulator
▶B◀ 15. Injector gasket
◀B▶ ▶B◀ 16. Injector assembly
▶A◀ 17. Corrugated washer
▶A◀ 18. Back-up ring A
▶A◀ 19. O-ring
▶A◀ 20. Back-up ring B
21. Injector



REMOVAL SERVICE POINT

◀A▶ FLANGE REMOVAL

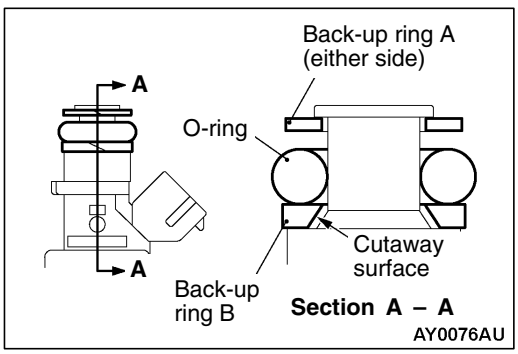
If the fuel pressure sensor is reused, make mating marks on the sensor and the flange before removal.

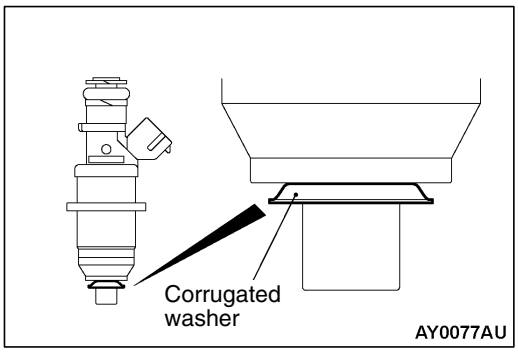
NOTE
The sealing performance and the installation rigidity of the fuel pressure sensor can be secured by deforming the flange when the sensor is installed. Therefore, the flange must be reinstalled on the same side and phase as it is removed. In addition, if the fuel pressure sensor is replaced, it should be always replaced together with the flange.

◀B▶ DELIVERY PIPE ASSEMBLY/INJECTOR ASSEMBLY REMOVAL

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

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





INSTALLATION SERVICE POINTS

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

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

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

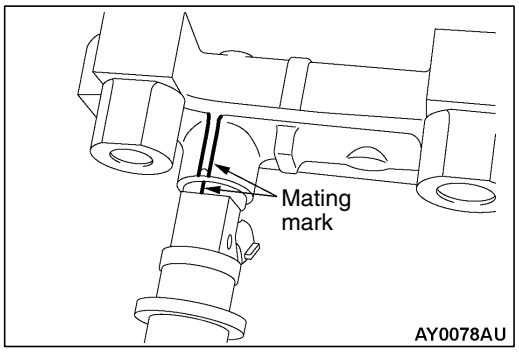
2. Apply petroleum jelly to the corrugated washer to prevent it from falling off, and install it in the direction shown.

   Caution
   The corrugated washer should always be replaced with a new part. If the corrugated washer is reused, fuel or gas leak may occur.

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

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

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

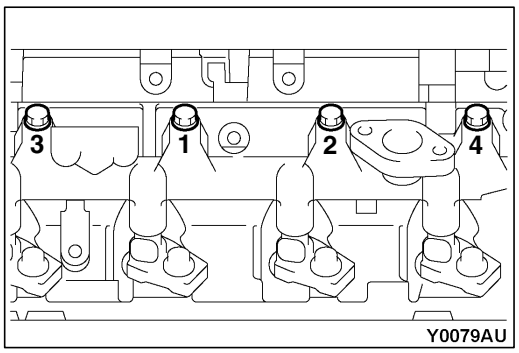


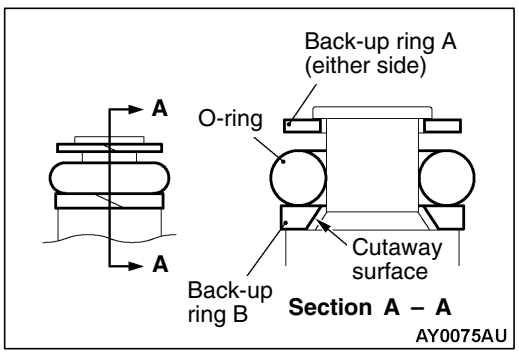
2. Insert the injector assembly into the mounting hole on the delivery pipe squarely. Then check that the fuel injector turns smoothly.
3. If the injector does not turn smoothly, the cause may be that the O-ring is getting caught. Remove the fuel injector, check the O-ring for damage and re-connect the injector to the delivery pipe assembly and then re-check.
4. Align the injector assembly mating mark with the delivery pipe mating mark.
5. Install the injector gasket and the insulator to the cylinder head.
6. Assemble the delivery pipe and injector assembly to the cylinder head, then finger-tighten the mounting bolts.
7. Assemble the injector holder and the injector washer, then tighten the mounting bolts to the specified torque.

   Tightening torque: 20 – 25 Nm

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

   Tightening torque: 10 – 13 Nm





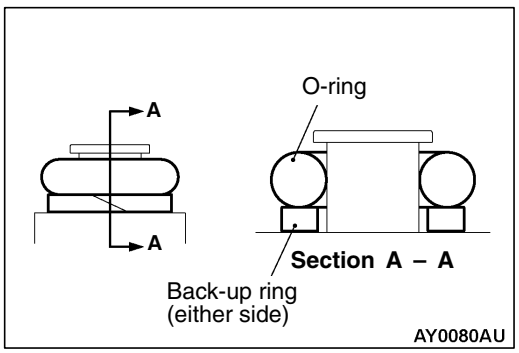
▶C◀ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

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

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

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

   Tightening torque: 10 – 13 Nm



▶D◀ BACK-UP RING/O-RING INSTALLATION

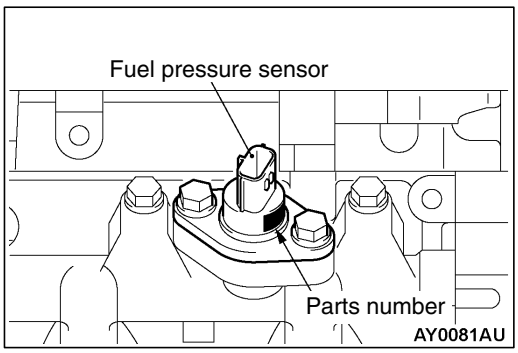
Assemble the back-up ring and the O-ring as shown.

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

▶E◀ FUEL PRESSURE SENSOR/FLANGE INSTALLATION

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

   Caution
   Be careful not to allow the engine oil to enter the delivery pipe.



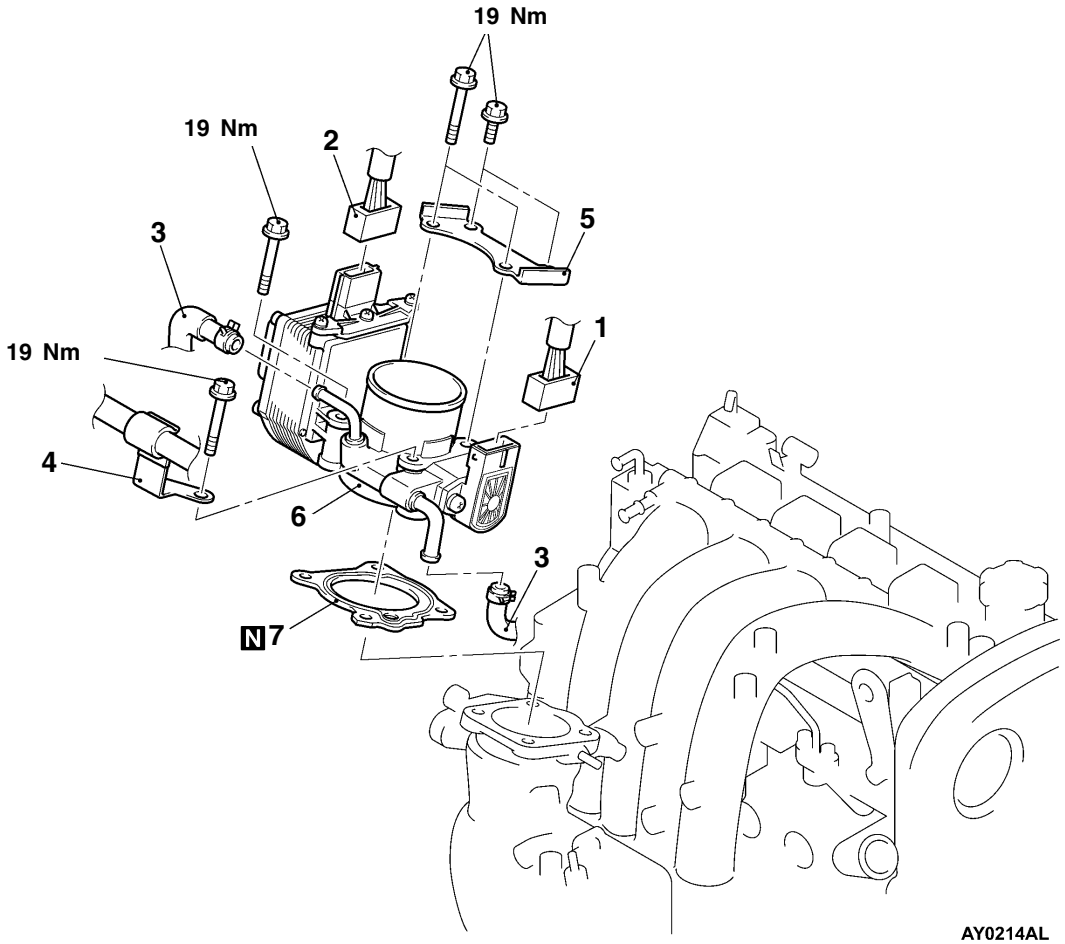
2. Make the part number on the fuel pressure sensor face as shown.
   If the fuel pressure sensor is reused, align the mating marks to install it to the delivery pipe.

   Caution
   If the fuel pressure sensor is replaced, always replace it together with the flange.

THROTTLE BODY

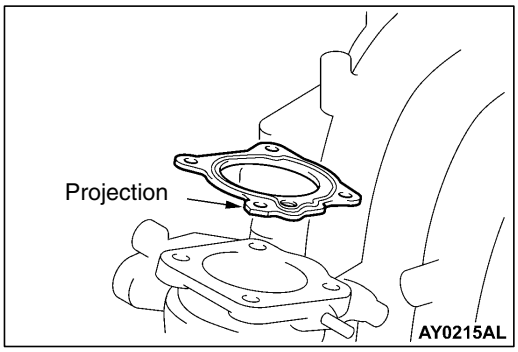
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying
- Resonance Tank Removal and Installation



Removal steps

1. Throttle position sensor connector
2. Throttle control servo connector
3. Water hose connection
4. Brake booster vacuum hose connection
5. Throttle body stay
▶B◀ 6. Throttle body assembly
▶A◀ 7. Throttle body gasket



INSTALLATION SERVICE POINTS

▶A◀ THROTTLE BODY GASKET INSTALLATION

Install the throttle body gasket with its projection facing as shown in the illustration.

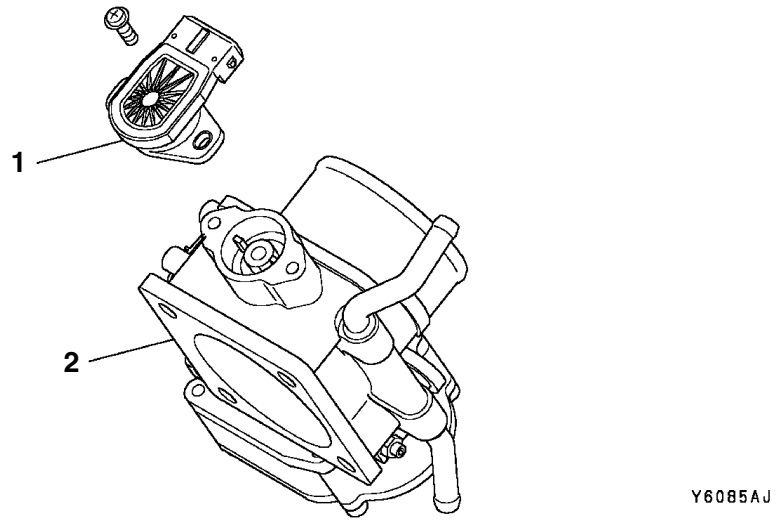
▶B◀ THROTTLE BODY ASSEMBLY INSTALLATION

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

Initialization

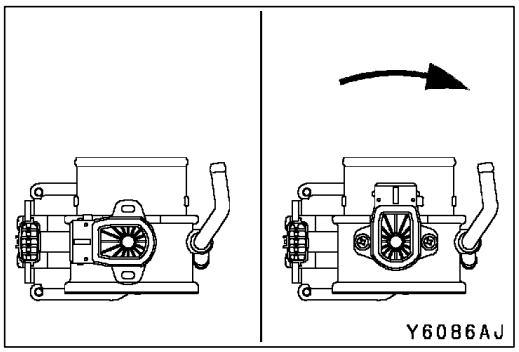
Turn on the ignition switch, and turn it to LOCK (OFF) position within one second. Then leave it for at least ten seconds with the ignition switch in LOCK (OFF) position.

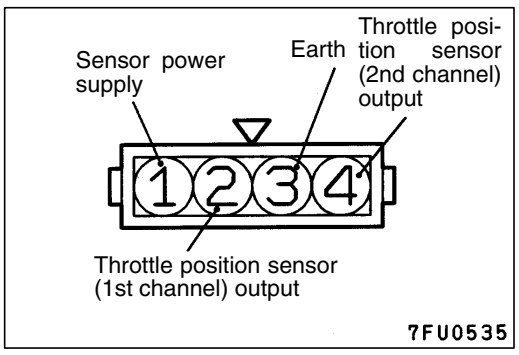
DISASSEMBLY AND REASSEMBLY



Disassembly steps

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





REASSEMBLY SERVICE POINT

▶A◀ THROTTLE POSITION SENSOR INSTALLATION

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

Normal condition

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

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

SERVICE BULLETIN

MITSUBISHI MOTORS

QUALITY INFORMATION ANALYSIS
OVERSEAS SERVICE DEPT. MITSUBISHI MOTORS CORPORATION

SERVICE BULLETIN	**No.:** MSB-00E13-001	
	Date: 2001-06-03	**<Model>** / **<M/Y>**

Subject: AVAILABILITY OF DRIVE CYCLE PATTERNS FOR 2001 MODEL CARS

Group: FUEL

Draft No.: 00AL602317

INFORMATION

INTERNATIONAL CAR ADMINISTRATION OFFICE

T.MASAKI-MANAGER
TECHNICAL SERVICE PLANNING

<Model>	<M/Y>
(EC)GALANT(EA0)	01-10
(EC)SPACE STAR	
(EC) SPACE RUNNER/SPACE WAGON(N80, N90)	
(EC)PAJERO SPORT (K80W,K90W)	
(EC)PAJERO/ MONTERO (V60, V70)	
(EC)CARISMA	
(EC)PAJERO PININ (H60,H70)	

1. Description:

On the 2001 model cars equipped with the on-board diagnostics system, the drive cycle patterns have been made available.
Performing the running test of the car using these drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.

2. Applicable Manuals:

Manual	Pub. No.	Language	Page(s)
2001 GALANT Workshop Manual Supplement	PWDE9611-B	(English)	4G64-GDI:13I-8 4G63-MPI:13A-7 6A13-MPI:13A-97
	PWDS9612-B	(Spanish)	
	PWDF9613-B	(French)	
	PWDG9614-B	(German)	
	PWDD9615-B	(Dutch)	
	PWDW9616-B	(Swedish)	
2001 SPACE RUNNER/ SPACE WAGON Workshop Manual Supplement	PWDE9803-C	(English)	4G64-GDI:13A-9 4G63-MPI:13D-12
	PWDS9804-C	(Spanish)	
	PWDF9805-C	(French)	
	PWDG9806-C	(German)	
	PWDD9807-C	(Dutch)	
	PWDW9808-C	(Swedish)	
2001 CARISMA Workshop Manual Supplement	PWDE9502-E	(English)	4G93-GDI:13J-8 4G92-MPI:13A-7
	PWDS9503-E	(Spanish)	
	PWDF9504-E	(French)	
	PWDG9505-E	(German)	
	PWDD9506-E	(Dutch)	
	PWDW9507-E	(Swedish)	
2001 SPACE STAR Workshop Manual Supplement	CMXE99E1-A	(English)	4G93-GDI:13A-9 4G13-MPI:13B-7
2001 COLT Workshop Manual Supplement	PWME9511-C	(English)	4G13-MPI:13A-7 4G93-MPI:13A-88
	PWMS9512-C	(Spanish)	
	PWMF9513-C	(French)	
	PWMG9514-C	(German)	
	PWMD9515-C	(Dutch)	
	PWMW9516-C	(Swedish)	
2001 PAJERO Workshop Manual VOL1	PWJE0001(1/2)	(English)	6G74-GDI:13A-12
2001 MONTERO Workshop Manual VOL1	PWJS0002(1/2)	(Spanish)	
2001 PAJERO/MONTERO Workshop Manual CD-ROM	PWJT0008R	(English)	
		(Spanish)	
		(French)	
		(German)	
2001 PAJERO SPORT Workshop Manual Supplement	PWJE9812-B	(English)	6G72-MPI:13A-8
	PWJS9813-B	(Spanish)	
	PWJF9814-B	(French)	
	PWJG9815-B	(German)	
2001 PAJERO PININ Workshop Manual Supplement	CKRE99E1-A	(English)	4G93-GDI: 13A-9

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

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

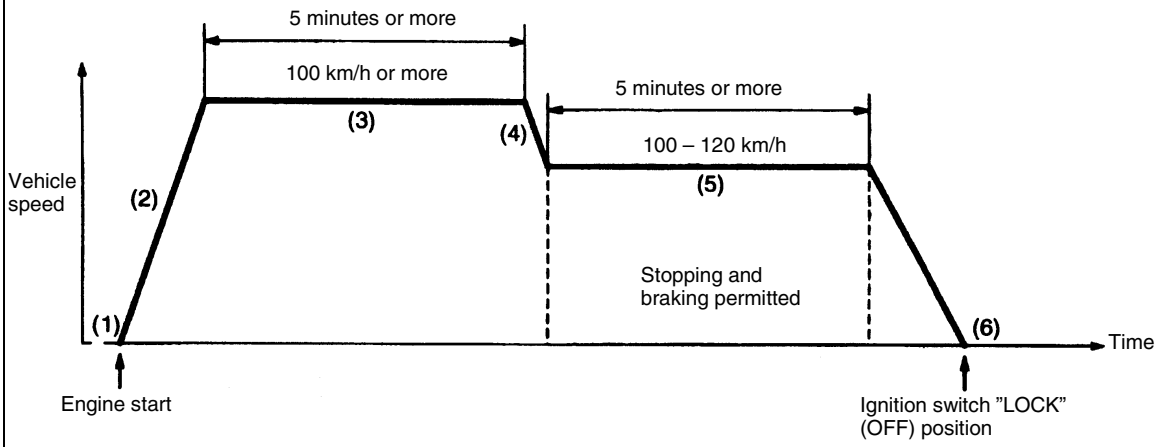
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

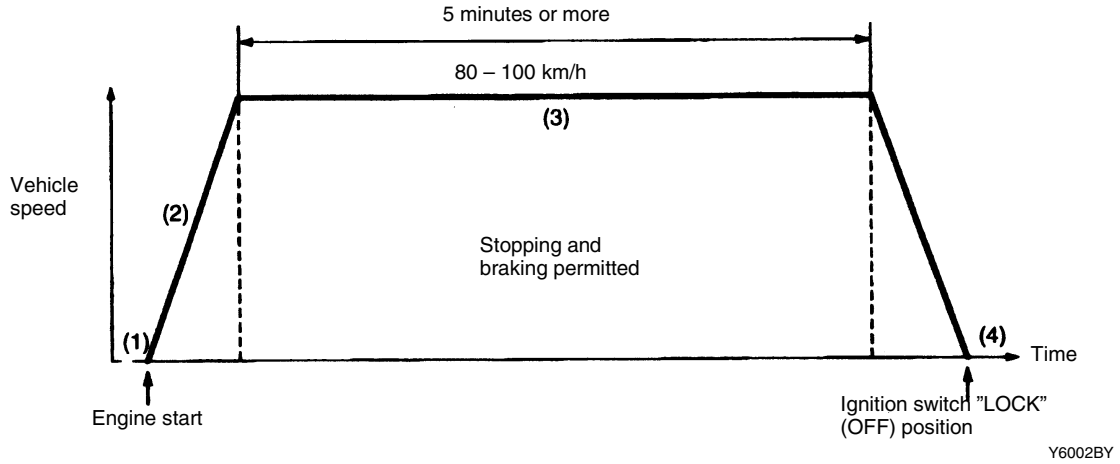
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
2	Heated oxygen sensor <front> monitor	P0130
3	Fuel trim monitor	P0170
4	Feed back monitor	P0125
5	Other monitor	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

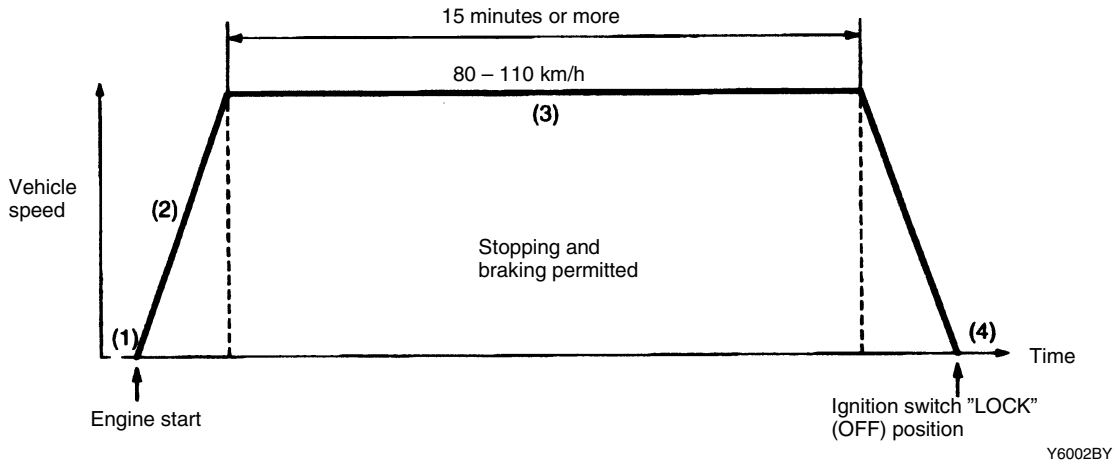
PROCEDURE 1

Monitor item	**CATALYTIC CONVERTER MONITOR (P0420)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes or more. 
Inspection conditions	• Atmospheric temperature :-10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h or more. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 100 – 120 km/h or less. 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. 6. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

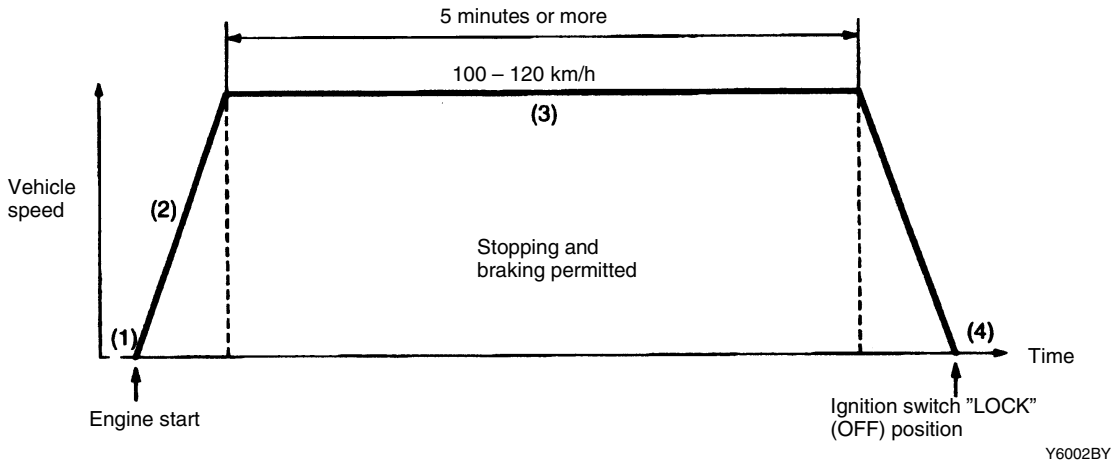
PROCEDURE 2

OXYGEN SENSOR <FRONT> MONITOR (P0130)	
Drive cycle pattern	One trip monitor [from start to ignition switch to "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch "ON" position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 100 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 100 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. Keep the accelerator pedal opening degree constant for 1 minute or more after each acceleration. 4. Return the vehicle to the shop, then turn the ignition switch "LOCK" (OFF) position.

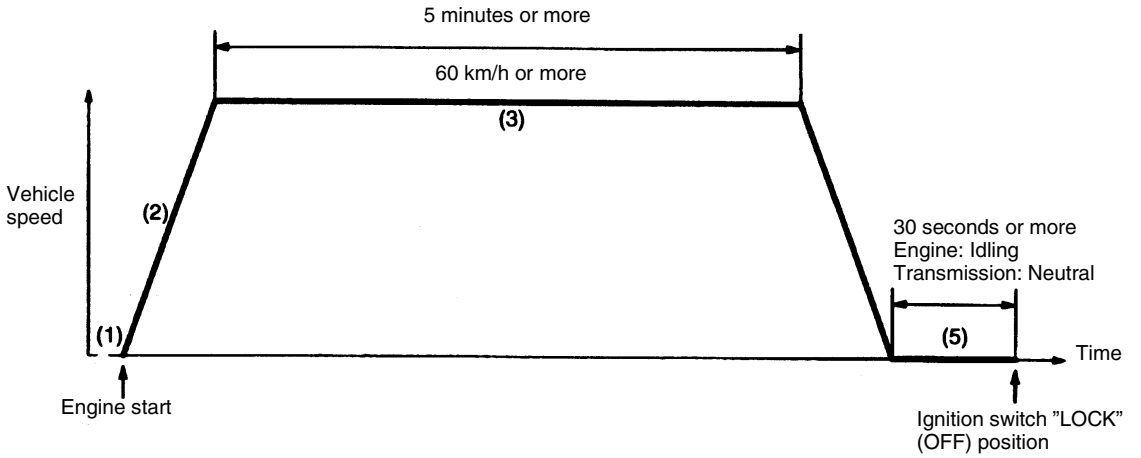
PROCEDURE 3

monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 15 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 110 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 110 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

monitor item	**FEED BACK MONITOR (PO125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 5 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 5

monitor item	**OTHER MONITOR**
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to "LOCK" (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch "ON" position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to "LOCK" (OFF) position. • A/C switch : OFF • Light and all accessories : OFF • Transmission : Neutral

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

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

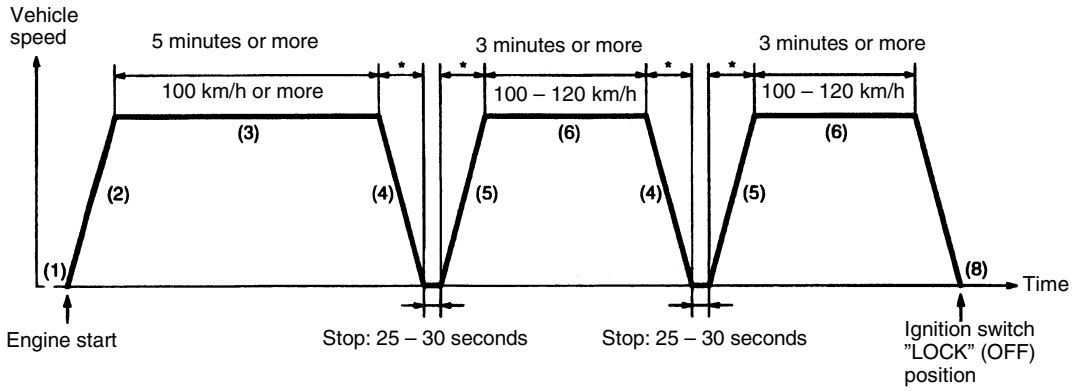
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

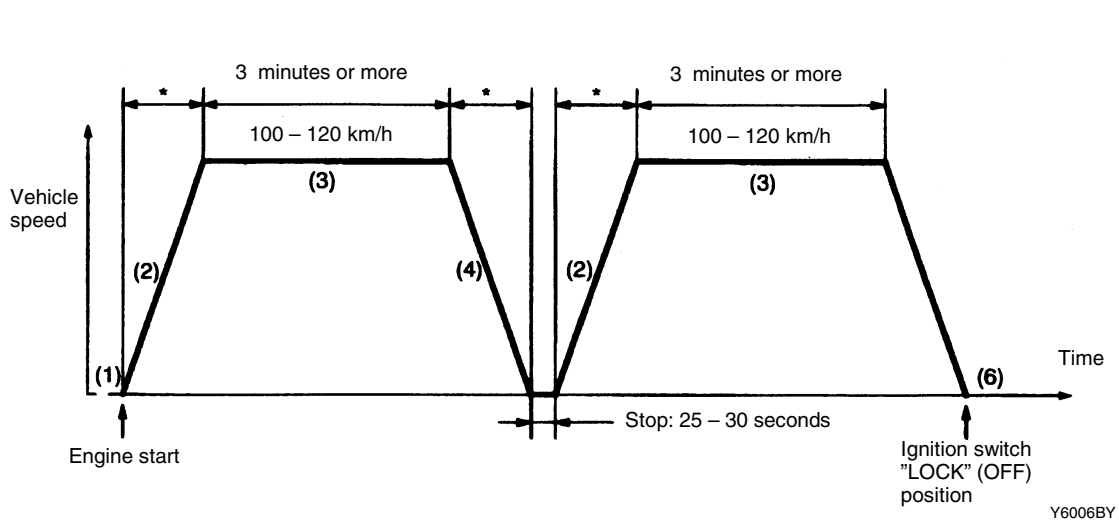
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
	Catalyst temperature sensor <M/T> monitor (DX only)	P0425
2	Heated oxygen sensor <front> monitor	P0130
3	Fuel trim monitor	P0170
4	Feed back monitor	P0125
5	Other monitor	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

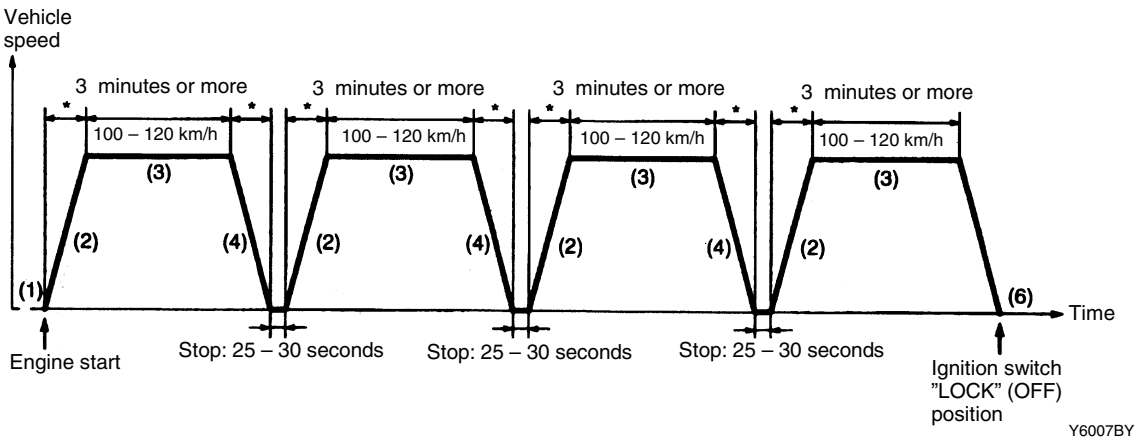
PROCEDURE 1

monitor item	**CATALYTIC CONVERTER MONITOR (P0420)** **CATALYTIC TEMPERATURE SENSOR <M/T> MONITOR (P0425)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 12 minutes or more. *: 1 minute or less  Y6004BY
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 0 km/h within 1 minute and stop for 25 – 30 seconds. 5. Accelerate until the vehicle speed at 100 – 120 km/h within 1 minute. 6. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 - 120 km/h and travel for 3 minutes or more. 7. Repeat the above procedure 4 – 6. 8. Return the vehicle to the shop, then turn the ignition switch ”LOCK” (OFF) position.

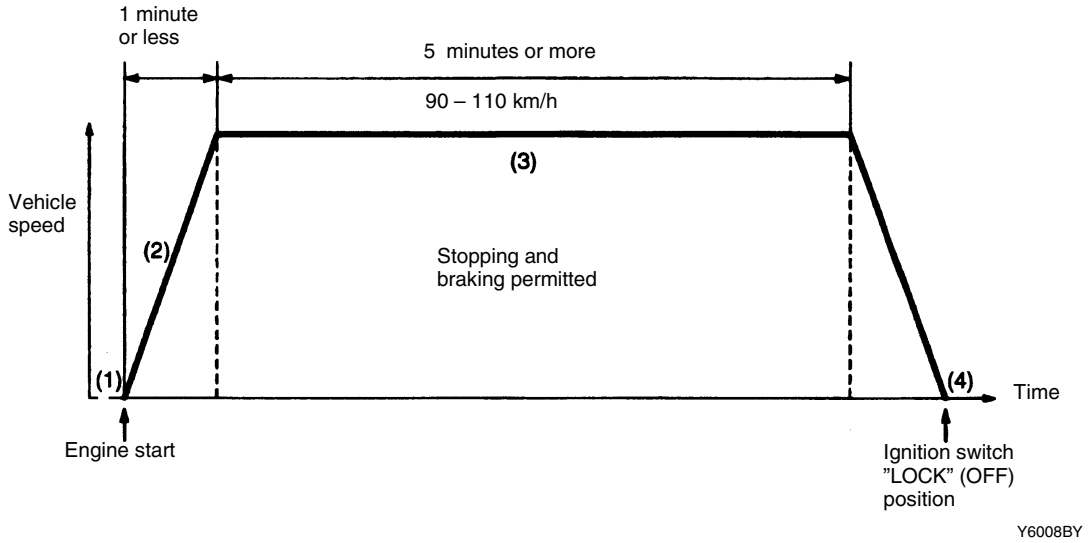
PROCEDURE 2

monitor item	**OXYGEN SENSOR <FRONT> MONITOR (P0130)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 7 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h within 1 minute. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 3 minutes or more. 4. Decelerate until the vehicle speed is 0 km/h within 1 minute and stop for 25 – 30 seconds. 5. Repeat the above procedure 2 – 3. 6. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

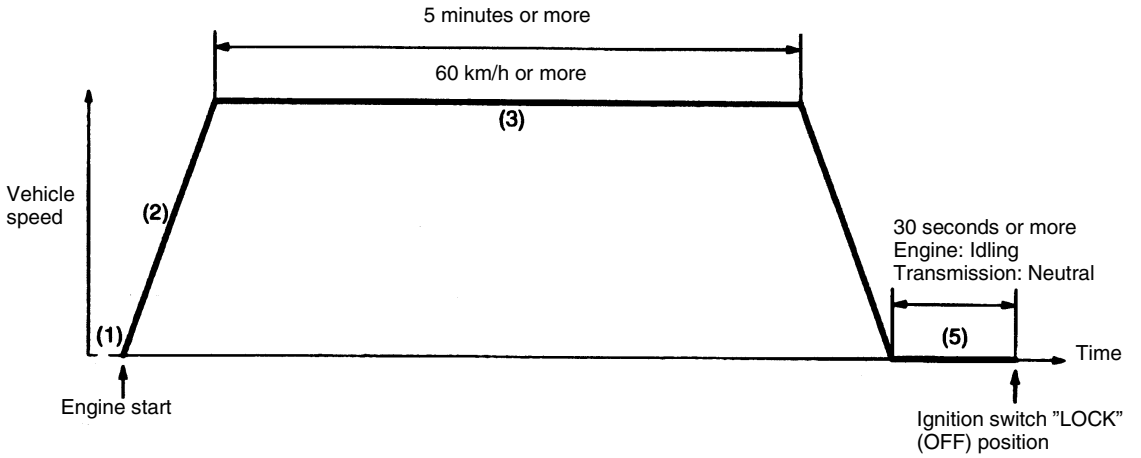
PROCEDURE 3

monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 13 minutes or more. *: 1 minute or less 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h within 1 minute. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 3 minutes or more. 4. Decelerate until the vehicle speed is 0 km/h within 1 minute and stop for 25 – 30 seconds. 5. Repeat the above procedure 2 - 4 two times and 2 - 3 one time. 6. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

monitor item	**FEED BACK MONITOR (P0125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 90 – 110 km/h within 1 minute. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 90 – 110 km/h and travel for 5 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 5

OTHER MONITOR	
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to ”LOCK” (OFF) position. • A/C switch : OFF • Light and all accessories : OFF • Transmission : Neutral

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

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

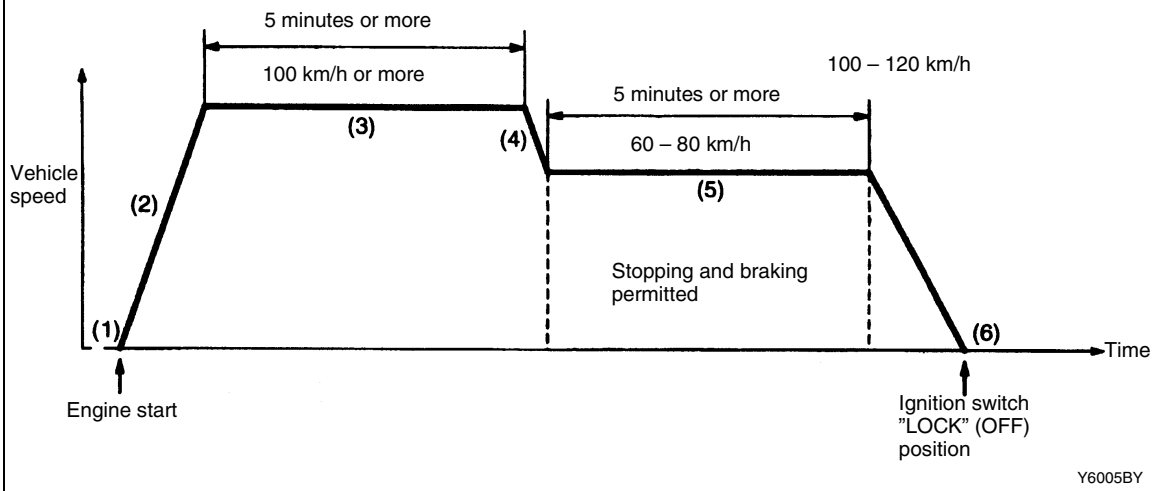
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

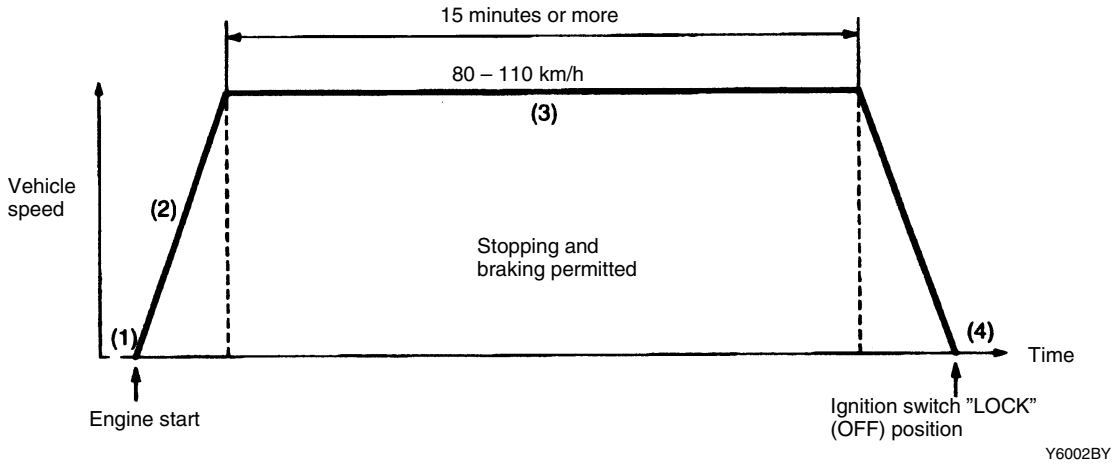
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
	Heated oxygen sensor <front> monitor	P0130
2	Fuel trim monitor	P0170
3	Feed back monitor	P0125
4	Other monitor	P0136, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

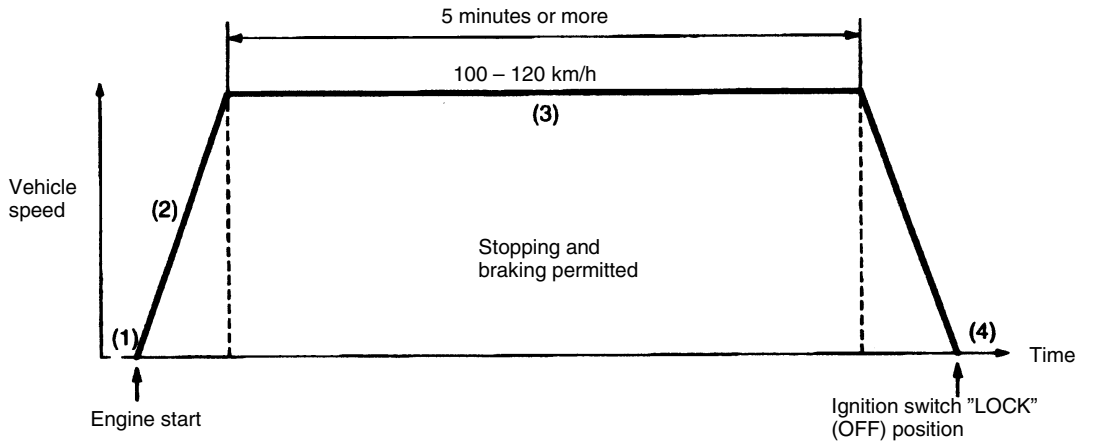
PROCEDURE 1

monitor item	**CATALYTIC CONVERTER MONITOR (P0420)** **OXYGEN SENSOR <FRONT> MONITOR (P0130)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes or more. 
Inspection conditions	• Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h or more. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 60 - 80 km/h or less. 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60 - 80 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. 6. Return the vehicle to the shop, then turn the ignition switch ”LOCK” (OFF) position.

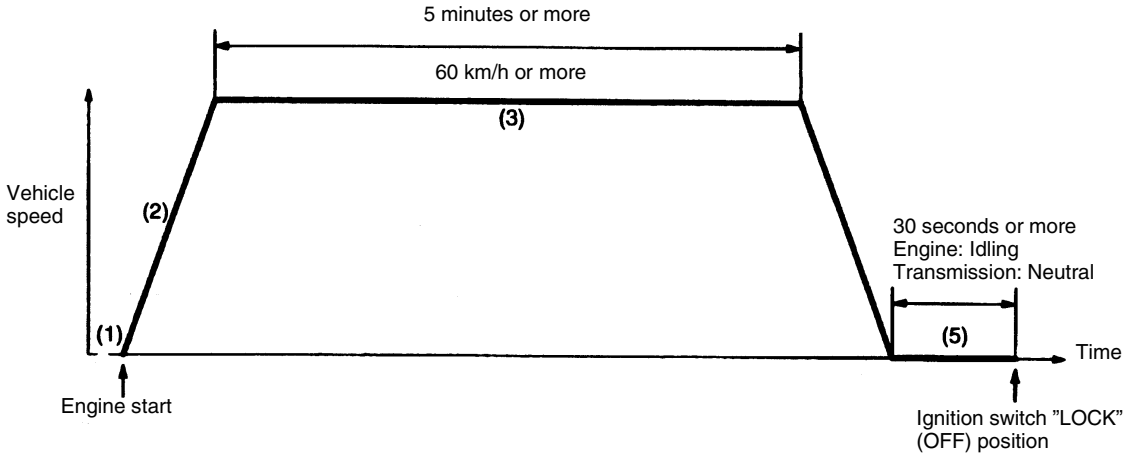
PROCEDURE 2

monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 15 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 110 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 110 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 3

monitor item	**FEED BACKK MONITOR (P0125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 5 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

monitor item	**OTHER MONITOR**
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more.  Y6009BY
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60 km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to ”LOCK” (OFF) position. • A/C switch : OFF • Light and all accessories: OFF • Transmission : Neutral

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

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

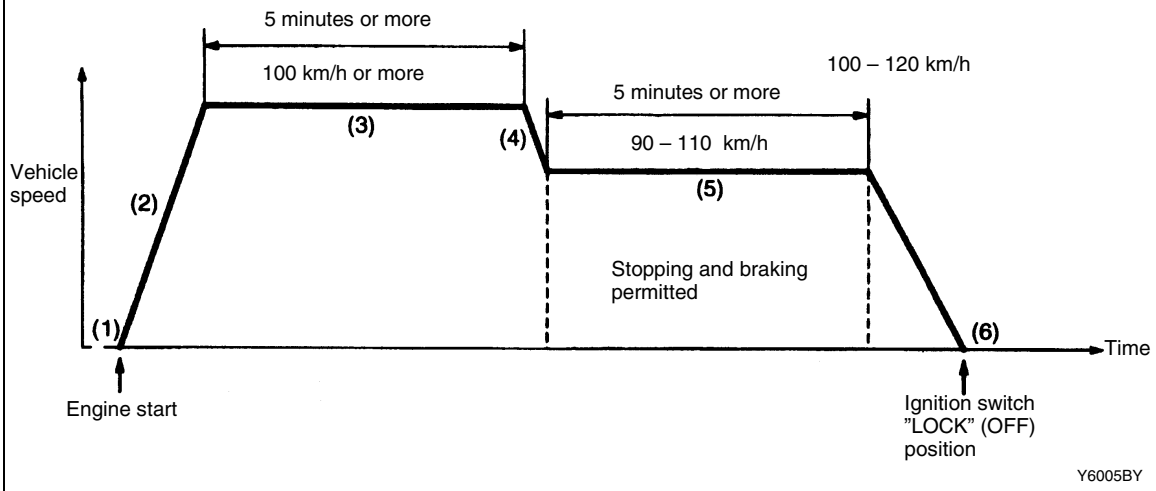
NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

DRIVE CYCLE PATTERN LIST

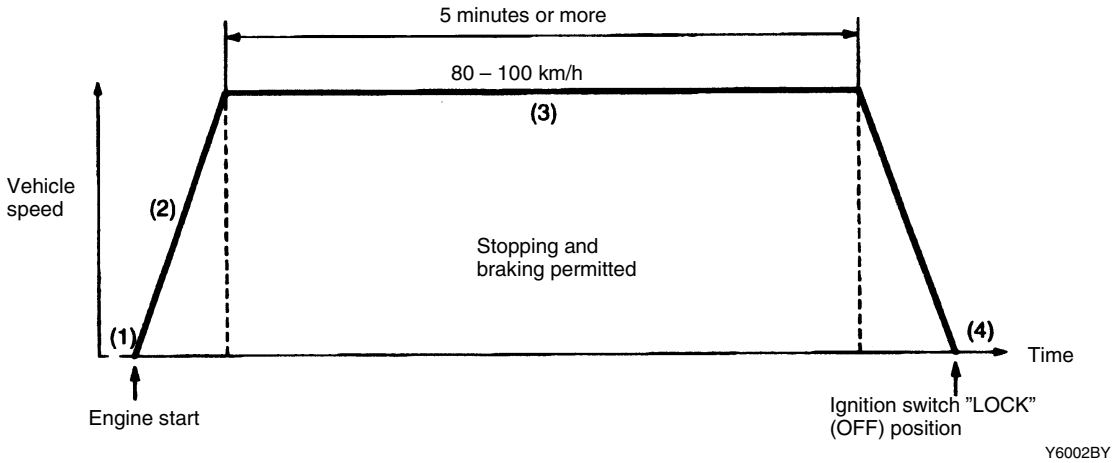
PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE
1	Catalytic converter monitor	P0420
2	Heated oxygen sensor <front> monitor	P0130
3	Fuel trim monitor	P0170
4	Feed back monitor	P0125
5	Other monitor	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325

NOTE
The vehicle speed sensor (P0500) and the power steering fluid pressure switch (P0551) are used to determine if the system is operating properly or not through use of the Data List function of the MUT-II.

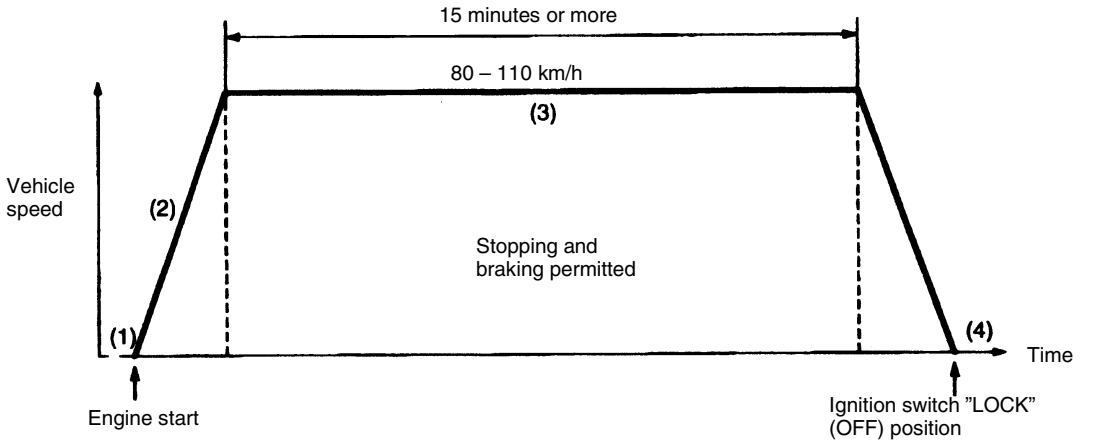
PROCEDURE 1

monitor item	**CATALYTIC CONVERTER MONITOR (P0420)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 10 minutes or more. 
Inspection conditions	• Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 km/h or more. 3. Travel for 5 minutes or more while keeping the vehicle speed is 100 km/h or more. 4. Decelerate until the vehicle speed is 90 –110 km/h or less. 5. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 90 - 110 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. 6. Return the vehicle to the shop, then turn the ignition switch ”LOCK” (OFF) position.

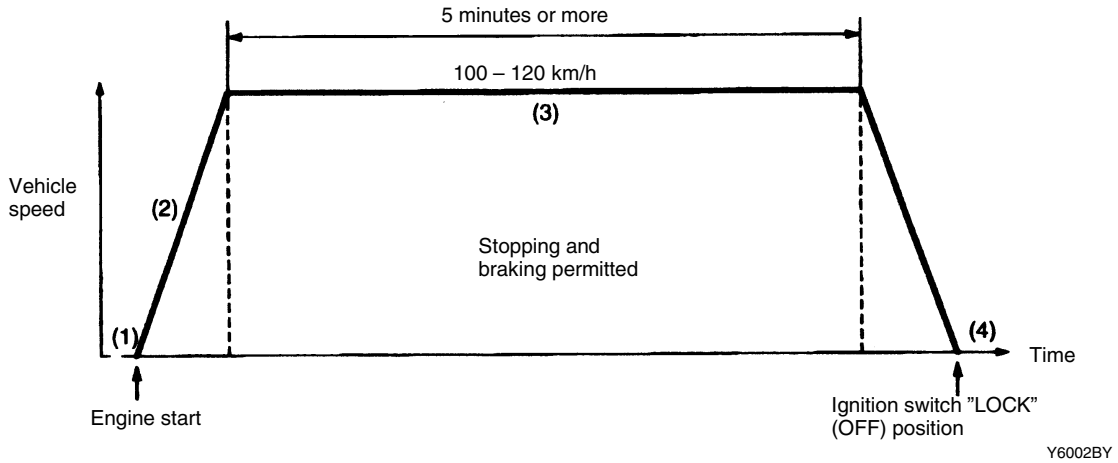
PROCEDURE 2

OXYGEN SENSOR <FRONT> MONITOR (P0130)	
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 100 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 100 km/h and travel for 5 minutes or more. • Stopping and braking during this operation are permitted. Keep the accelerator pedal opening degree constant for 1 minute or more after each acceleration. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

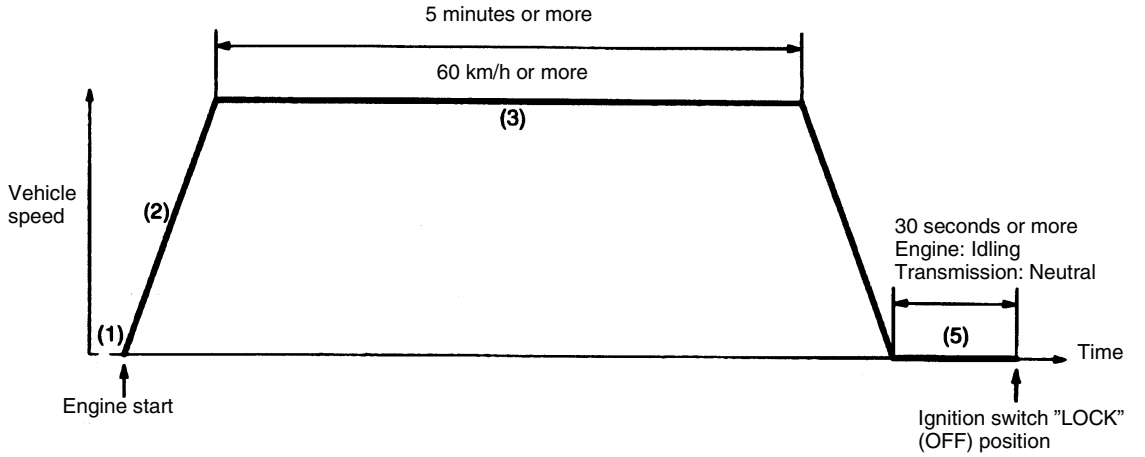
PROCEDURE 3

Monitor item	**FUEL TRIM MONITOR (P0170)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 15 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 80 – 100 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 80 – 110 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 4

Monitor item	**FEED BACK MONITOR (P0125)**
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 5 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 100 – 120 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 100 – 120 km/h and travel for 15 minutes or more. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 5

monitor item	**OTHER MONITOR**
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0300, P0301, P0302, P0303, P0304, P0325
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 6 minutes or more. 
Inspection conditions	• Engine coolant temperature : 85 °C or more • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 60 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 60 km/h or more and travel for 5 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 30 seconds, and then turn the ignition switch to ”LOCK” (OFF) position. • A/C switch : OFF • Light and all accessories: OFF • Transmission : Neutral

DRIVE CYCLE

Performing the running test of the car using the following five drive cycle patterns makes it possible to monitor all the diagnosis codes that are required for operation of the car in order to determine if the applicable system is operating properly or not.
In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Engine Warning Lamp (Check Engine Lamp) and to verify the repair procedure has eliminated the trouble [the Engine Warning Lamp (Check Engine Lamp) is no longer illuminated].

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

NOTE
Check that the diagnosis code is not output before traveling in the Drive cycle pattern. Erase the diagnosis code if it has been output.

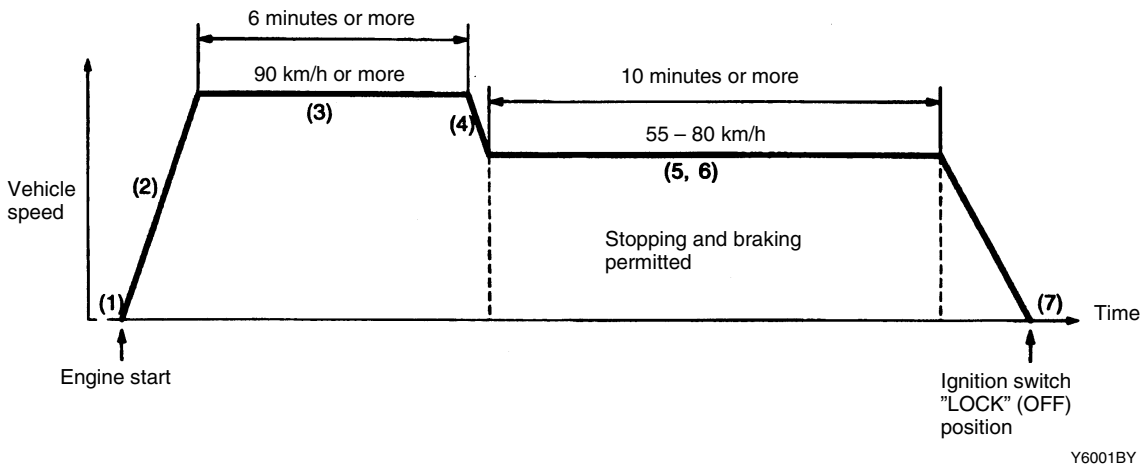
DRIVE CYCLE PATTERN LIST

PROCEDURE	MONITOR ITEM	DIAGNOSIS CODE (DTC)
1	Catalytic converter monitor	P0420*[1], P0421*[2], P0431*[3],
2	Heated oxygen sensor <front> monitor	P0130
3	Other monitor	P0136, P0201, P0202, P0203, P0204, P0205*[3], P0300, P0301, P0302, P0303, P0304, P0305*[3], P0306*[3], P0325*[4]

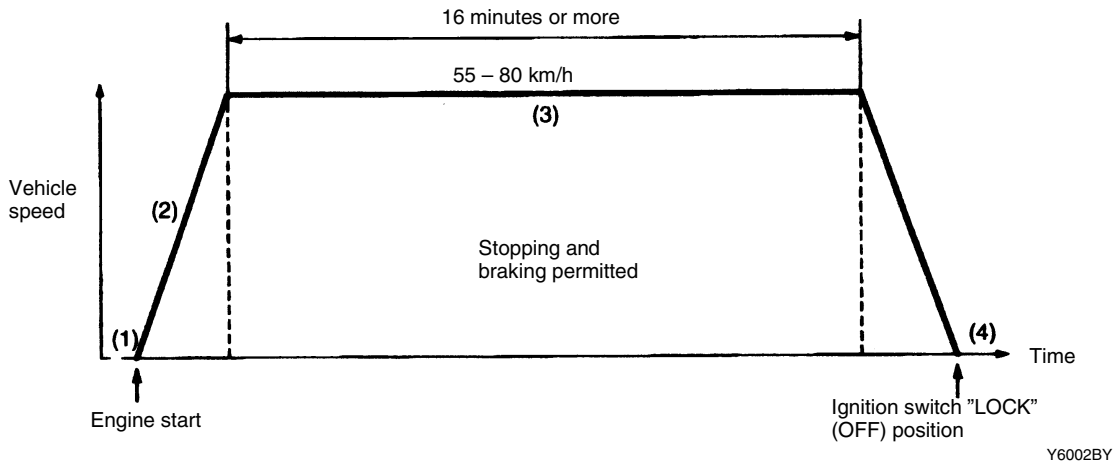
NOTE
*1: 4G63
*2: 4G13, 4G92, 4G93, 6A13, 6G72
*3: 6A13, 6G72
*4: 4G13, 4G63, 4G92, 4G93, 6A13

GDI - Troubleshooting

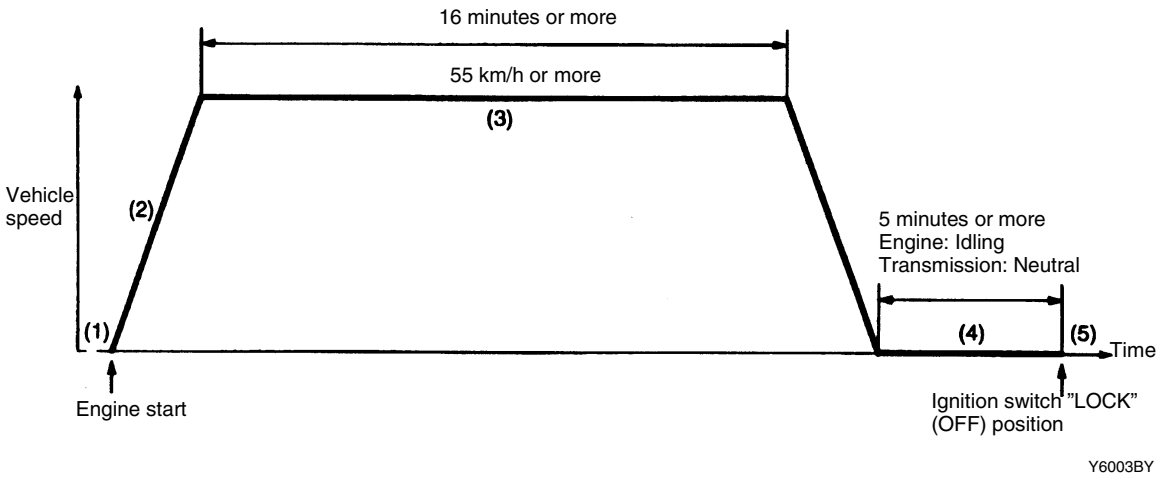
PROCEDURE 1

CATALYTIC CONVERTER MONITOR	
Diagnosis code No.	P0420, P0421, P0431
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 16 minutes or more. 
Inspection conditions	• Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 90 km/h or more. 3. Travel for 6 minutes or more while keeping the vehicle speed is 90 km/h or more. 4. Decelerate until the vehicle speed is 80 km/h or less. 5. While traveling at 55 – 80 km/h for 10 minutes or more, fully close the throttle at least once in 2 minutes and decelerate for 10 seconds or more. • Do not repeat deceleration too often. • Vehicle speed may go below 55 km/h after the deceleration. • Stopping and braking during this operation are permitted. (If stopped or drive at 55 km/h or less for more than 5 minutes the monitoring may be stopped. In this case please restart monitoring from the beginning.) 6. After completing the above deceleration, bring the vehicle speed back to 55 – 80 km/h and keep it in the range until starting the deceleration again. • Repeat the above deceleration at least 5 times. 7. Return the vehicle to the shop, the turn the ignition switch ”LOCK” (OFF) position.

PROCEDURE 2

OXYGEN SENSOR <FRONT> MONITOR	
Diagnosis code No.	P0130
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 16 minutes or more. 
Inspection conditions	• Engine coolant temperature : After engine warm up. • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 55 – 80 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 55 –80 km/h and travel for 16 minutes or more. • Stopping and braking during this operation are permitted. 4. Return the vehicle to the shop, then turn the ignition switch “LOCK” (OFF) position.

PROCEDURE 3

OTHER MONITOR	
Diagnosis code No.	P0136, P0201, P0202, P0203, P0204, P0205, P0206, P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0325, P0500, P0551
Drive cycle pattern	One trip monitor [from start to ignition switch to “LOCK” (OFF) position] will be completed while traveling with the following drive cycle pattern. It will take 21 minutes or more. 
Inspection conditions	• Engine coolant temperature : After engine warm up. • Atmospheric temperature : -10 °C or more • Condition of A/T :Selector lever D range, overdrive switch “ON” position
Test procedure	1. Engine : start 2. Accelerate until the vehicle speed is 55 km/h. 3. While keeping the accelerator pedal opening degree constant, keep the vehicle speed at 55 km/h or more and travel for 16 minutes or more. 4. Return the vehicle to the shop 5. After stopping the vehicle, continue idling for 5 minutes, and then turn the ignition switch to ”LOCK” (OFF) position.