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GENERAL

OUTLINE OF CHANGES

The following service procedures have been established to correspond to the addition of vehicle with 6G7-MPI engine for Hong Kong. The other service procedures are the same as for the 6G7-MPI engine for General Export.

GENERAL INFORMATION

GENERAL SPECIFICATIONS

Items		Standard value
Engine-ECU	Identification model No.	E2T79488 <M/T>
Engine-A/T-ECU	Identification model No.	E6T36380 <A/T>

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SYSTEM DIAGRAM

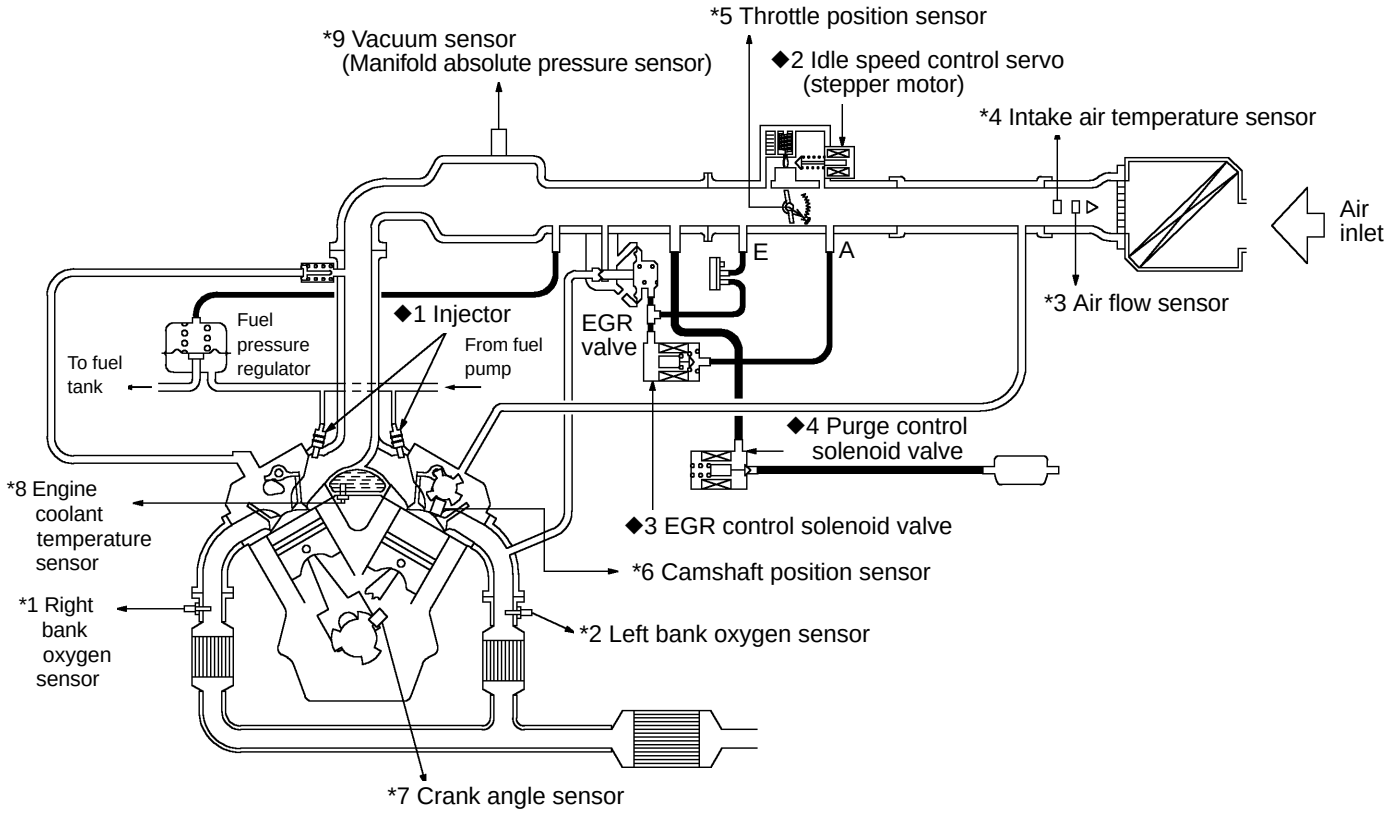
*1. Right bank oxygen sensor
*2. Left bank oxygen sensor
*3. Air flow sensor
*4. Intake air temperature sensor
*5. Throttle position sensor
*6. Camshaft position sensor
*7. Crank angle sensor
*8. Engine coolant temperature sensor
*9. Vacuum sensor (Manifold absolute pressure sensor)

- Power supply
- Vehicle speed sensor
- A/C switch
- Inhibitor switch <A/T>
- Power steering fluid pressure switch
- Ignition switch-ST
- Ignition switch-IG
- Knock sensor

⇨ Engine-ECU <M/T> or Engine-A/T-ECU <A/T> ⇨

◆1 Injector
◆2 Idle speed control servo
◆3 EGR control solenoid valve
◆4 Purge control solenoid valve

- Fuel pump relay
- Control relay
- A/C power relay
- Condenser fan relay
- Engine warning lamp
- Diagnosis signal
- Ignition coil, power transistor
- Right bank oxygen sensor heater
- Left bank oxygen sensor heater



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SERVICE SPECIFICATION

Item	Specification
Oxygen sensor heater coil resistance (at 20°C) Ω	4.5 – 8.0

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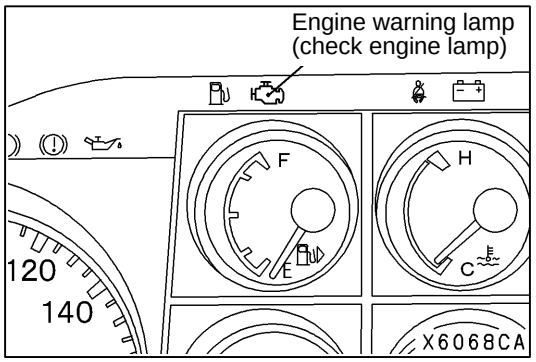

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points of 2001 PAJERO Workshop Manual [Pub. No. PWJE0005 (1/2)].

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the Multipoint Fuel Injection (MPI) 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

Air flow sensor	Ignition coil, power transistor
Intake air temperature sensor	Knock sensor
Engine coolant temperature sensor	Crank angle sensor
Oxygen sensor	Camshaft position sensor
Oxygen sensor heater	EGR valve
Abnormal fuel system	EGR control solenoid valve
Injector	Engine-ECU <M/T> or engine-A/T-ECU <A/T>
Throttle position sensor	

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points of 2001 PAJERO Workshop Manual [Pub. No. PWJE0005 (1/2)].

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 <M/T> or ENGINE-A/T-ECU <A/T> will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.
5. Erase the diagnosis codes.

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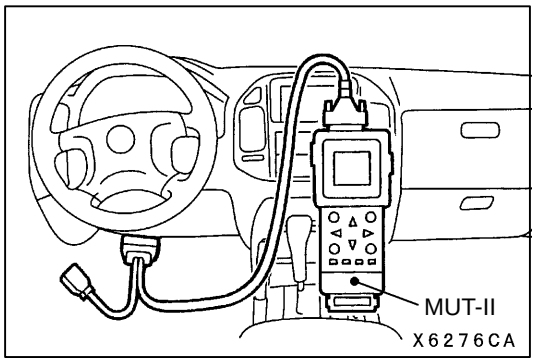

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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.

FREEZE FRAME DATA

When the engine-ECU <M/T> or engine-A/T-ECU <A/T> 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.

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READINESS TEST STATUS

The engine-ECU <M/T> or engine-A/T-ECU <A/T> 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).

- Oxygen sensor: P0130, P0150
- Oxygen sensor heater: P0135, P0155

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. 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. 2. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Camshaft position sensor	Injects fuel to all cylinders simultaneously. (However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.)
Ignition coil, power transistor unit	Cut off the fuel supply to cylinders with an abnormal ignition signal.
Detonation sensor	Hold the ignition timing programmed for regular petrol.

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INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13B-8
P0110	Intake air temperature sensor system	13B-10
P0115	Engine coolant temperature sensor system	13B-11
P0120	Throttle position sensor 1 system	13B-14
P0130	Oxygen sensor system <Bank 1 sensor 1>	13B-16
P0135	Oxygen sensor heater system <Bank 1 sensor 1>	13B-18
P0150	Oxygen sensor system <Bank 2 sensor 1>	13B-19
P0155	Oxygen sensor heater system <Bank 2 sensor 1>	13B-21
P0170	Abnormal fuel system (Bank 1)	13B-22
P0173	Abnormal fuel system (Bank 2)	13B-24
P0201	No. 1 injector system	13B-25
P0202	No. 2 injector system	13B-25
P0203	No. 3 injector system	13B-25
P0204	No. 4 injector system	13B-25
P0205	No. 5 injector system	13B-25
P0206	No. 6 injector system	13B-25
P0300	Ignition coil and power transistor unit	13B-26
P0325	Detonation sensor system	13B-28
P0335	Crank angle sensor system	13B-28
P0340	Camshaft position sensor system	13B-30
P0400	EGR system	13B-31
P0403	EGR control solenoid valve system	13B-32
P0500	Vehicle speed sensor system	13B-33

NOTE
1. Bank 1: Indicates the right bank.
2. Bank 2: Indicates the left bank.
3. Sensor 1: Indicates that the sensor is mounted on the engine side beyond the catalyst.

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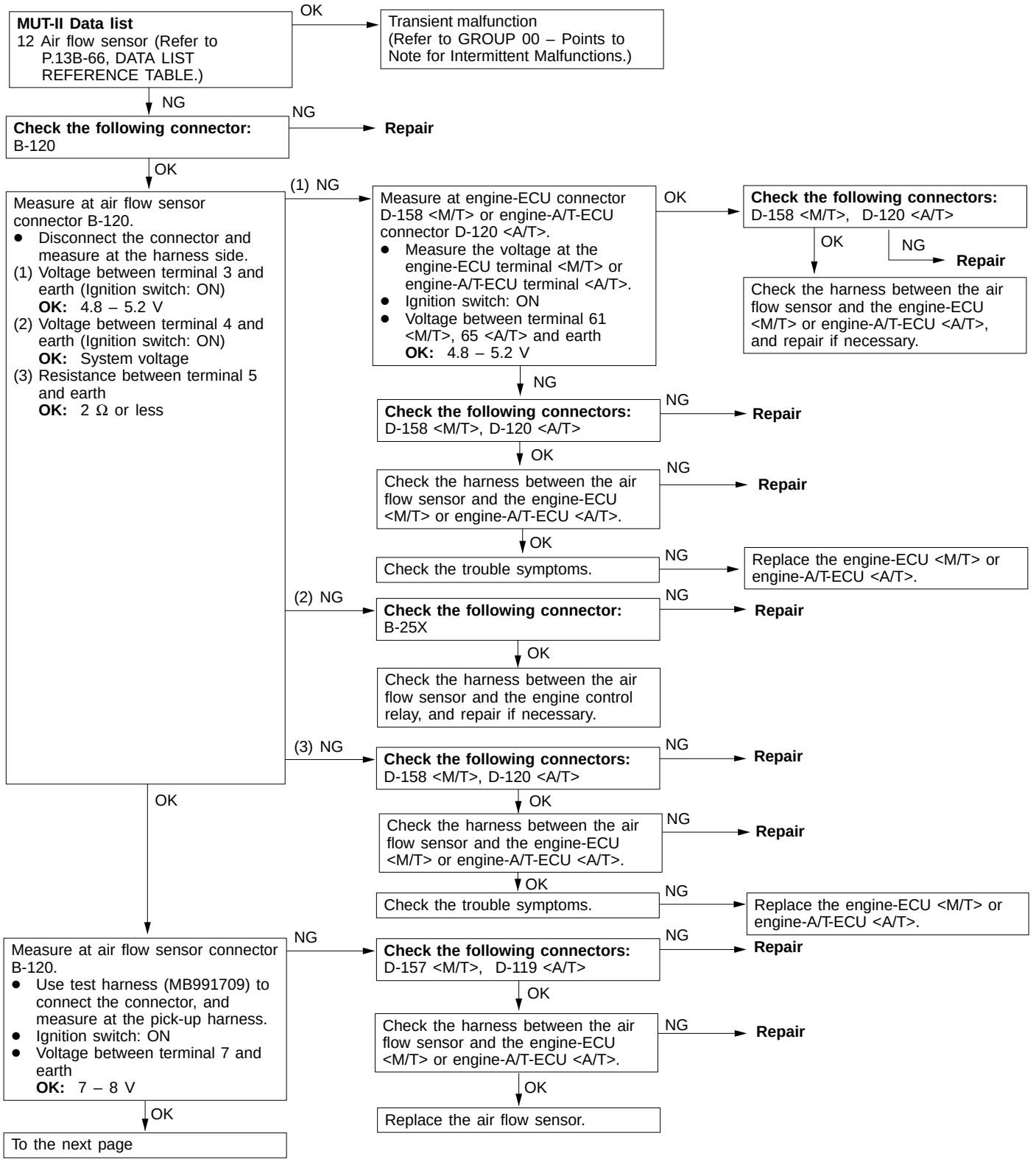
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

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 the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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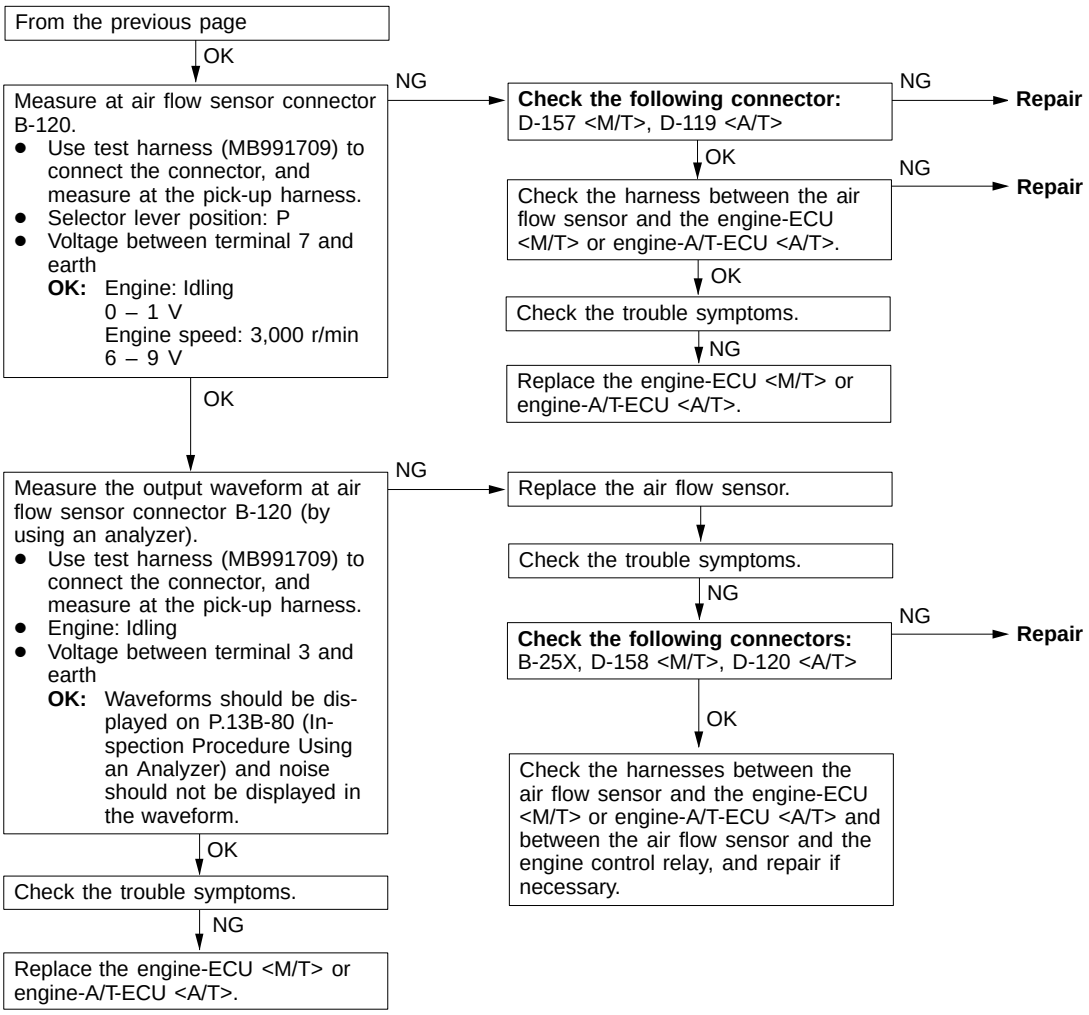

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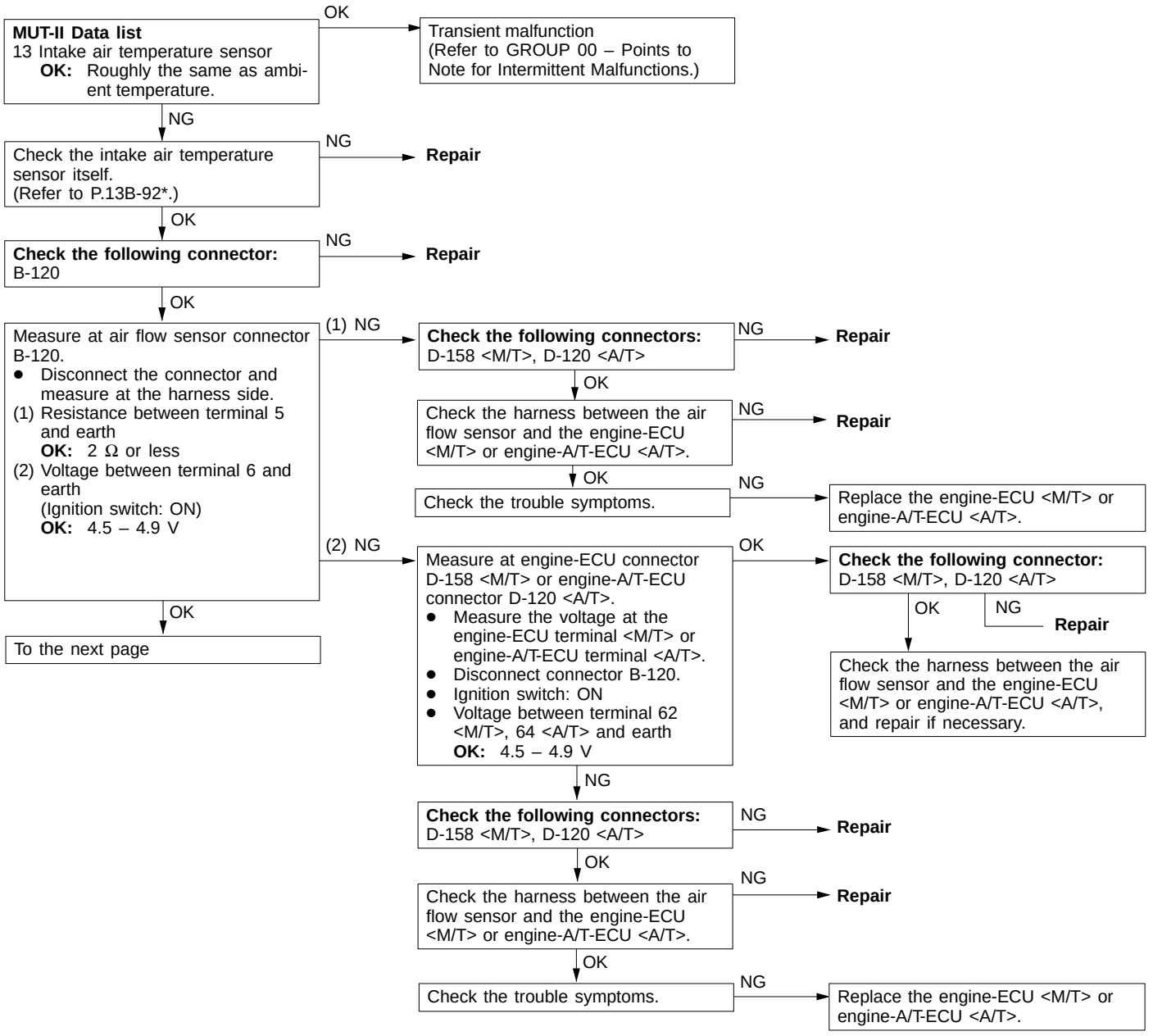
Code No. P0110 Intake air temperature sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to –40°C of intake air temperature) or ● The sensor output voltage is 0.2 V or less for four seconds (equivalent to 120°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 the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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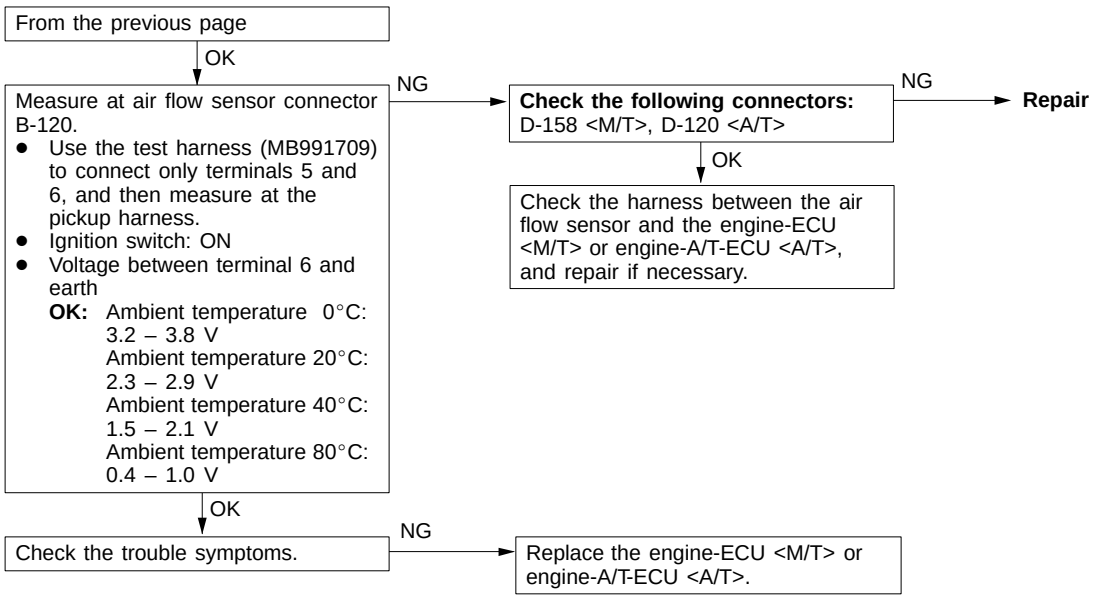

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

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 the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>
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.	

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MUT-II Data list
21 Engine coolant temperature sensor
OK: When the engine is cold, the temperature is roughly the same as ambient temperature. If warm, it is 80 – 120°C.

OK → Transient malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)

NG ↓

Measure at engine coolant temperature sensor connector B-56.
- Disconnect the connector and measure at the harness side.
- Resistance between terminals 1 and 2
OK: At 20°C of engine coolant temperature: 2.1 – 2.7 kΩ
At 80°C of engine coolant temperature: 0.26 – 0.36 kΩ

NG → **Replace**

OK ↓

Check the following connector:
B-56

NG → **Repair**

OK ↓

Measure at engine coolant temperature sensor connector B-56.
- Disconnect the connector and measure at the harness side.

(1) Voltage between terminal 1 and earth
(Ignition switch: ON)
OK: 4.5 – 4.9 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less

(1) NG → Measure at engine-ECU connector D-158 <M/T> or engine-A/T-ECU connector D-120 <A/T>.
- Measure the voltage at the engine-ECU terminal <M/T> or engine-A/T-ECU terminal <A/T>.
- Disconnect connector B-56.
- Ignition switch: ON
- Voltage between terminal 44 and earth
OK: 4.5 – 4.9 V

OK → **Check the following connectors:** D-158 <M/T>, D-120 <A/T>
OK → Check the harness wire between the engine coolant temperature sensor and the engine-ECU <M/T> or engine-A/T-ECU <A/T>, and repair if necessary.
NG → **Repair**

NG ↓

Check the following connectors: D-158 <M/T>, D-120 <A/T>

NG → **Repair**

OK ↓

Check the harness wire between the engine coolant temperature sensor and the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

NG → **Repair**

OK ↓

Check the trouble symptoms.

NG → Replace the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

OK ↓

To the next page

(2) NG → **Check the following connectors:** D-158 <M/T>, D-120 <A/T>

NG → **Repair**

OK ↓

Check the harness wire between the engine coolant temperature sensor and the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

NG → **Repair**

OK ↓

Check the trouble symptoms.

NG → Replace the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

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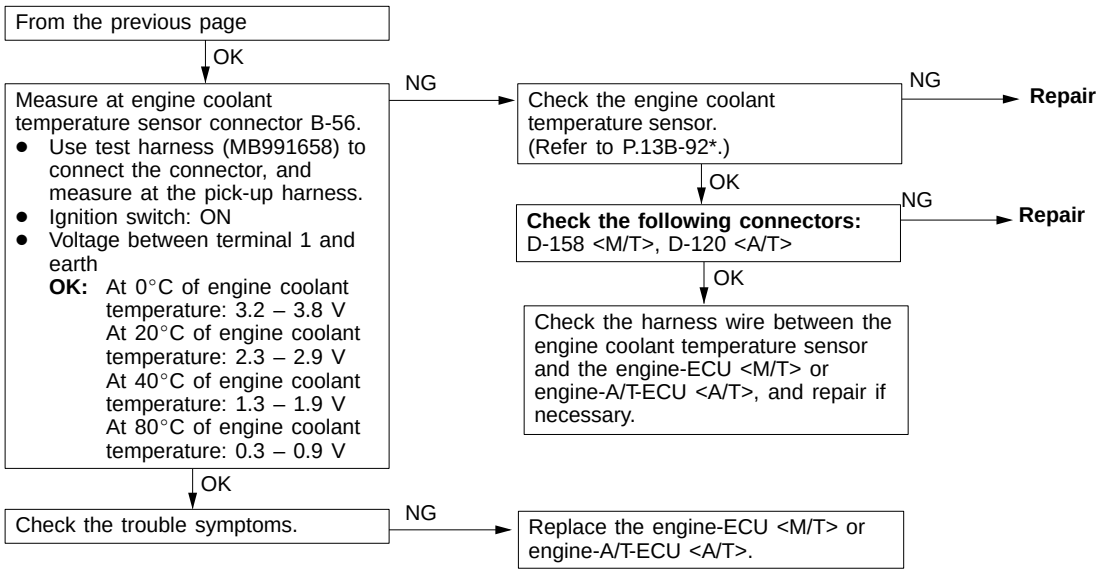

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

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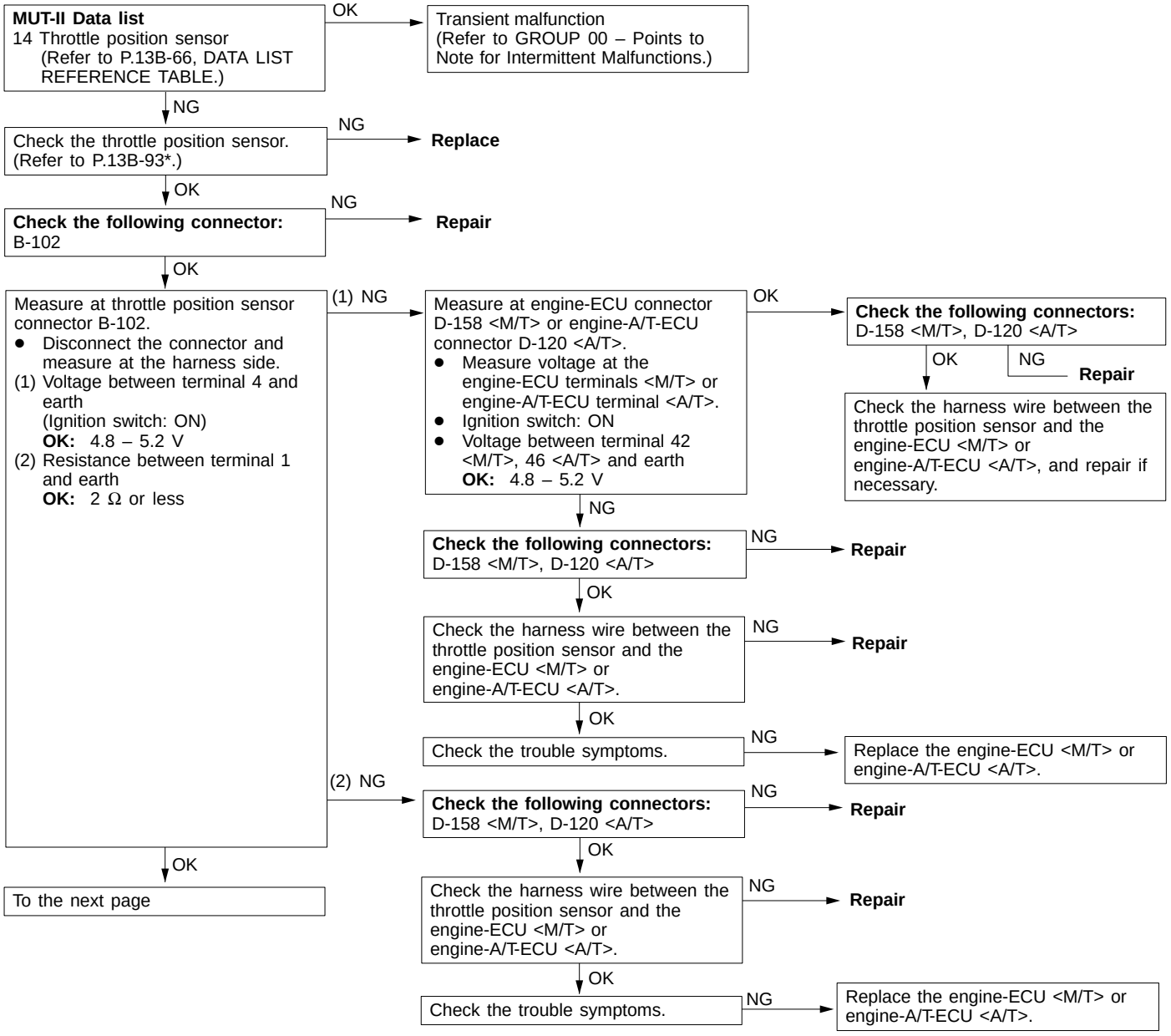
Code No. P0120 Throttle position sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 2 seconds after the ignition switch is turned ON or immediately after the engine starts. Set Conditions ● The sensor output voltage is 2V or more for 2 seconds, the volume efficiency is 60% or less, and the engine speed is 1000 r/min. or less or ● The sensor output voltage is 0.2 V or less for 2 seconds	● Malfunction of throttle position sensor ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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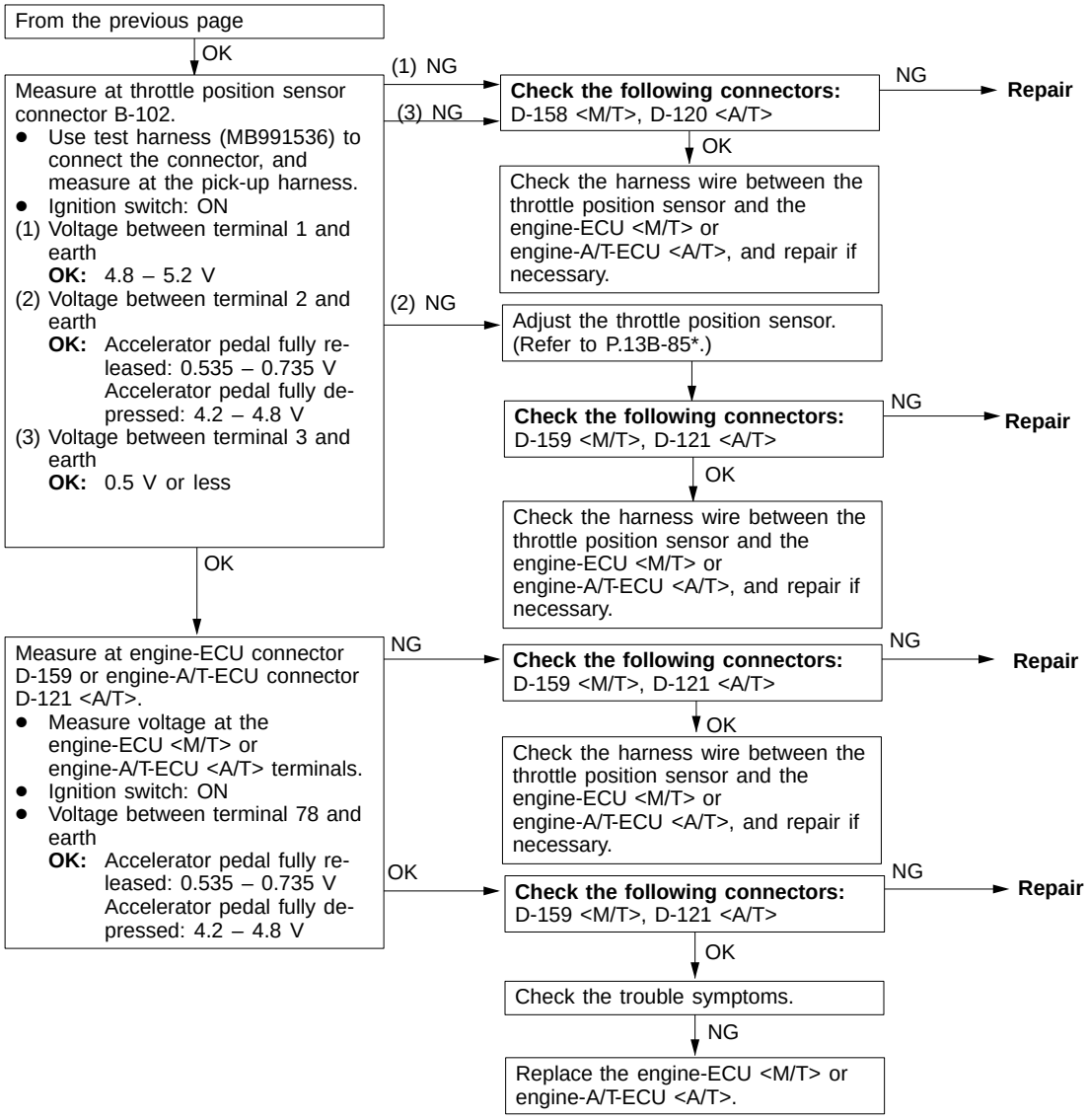

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

Code No. P0130 Oxygen sensor system <Bank 1 sensor 1>	Probable cause
Range of Check ● 3 minutes or more has passed since the engine started. ● Engine coolant temperature is higher than approximately 80°C. ● Engine speed is higher than 1,200 r/min. ● Volumetric efficiency is higher than 25 percent. ● The car is running at the constant speed on a flat road. Set Conditions ● Input voltage supplied to the engine-ECU<M/T> or engine-A/T-ECU <A/T> interface circuit is higher than 4.5 volts when 5 volts is applied to the right bank oxygen sensor output line.	● Malfunction of right bank oxygen sensor ● Open or short circuit in the right bank oxygen sensor circuit or loose connector contact ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

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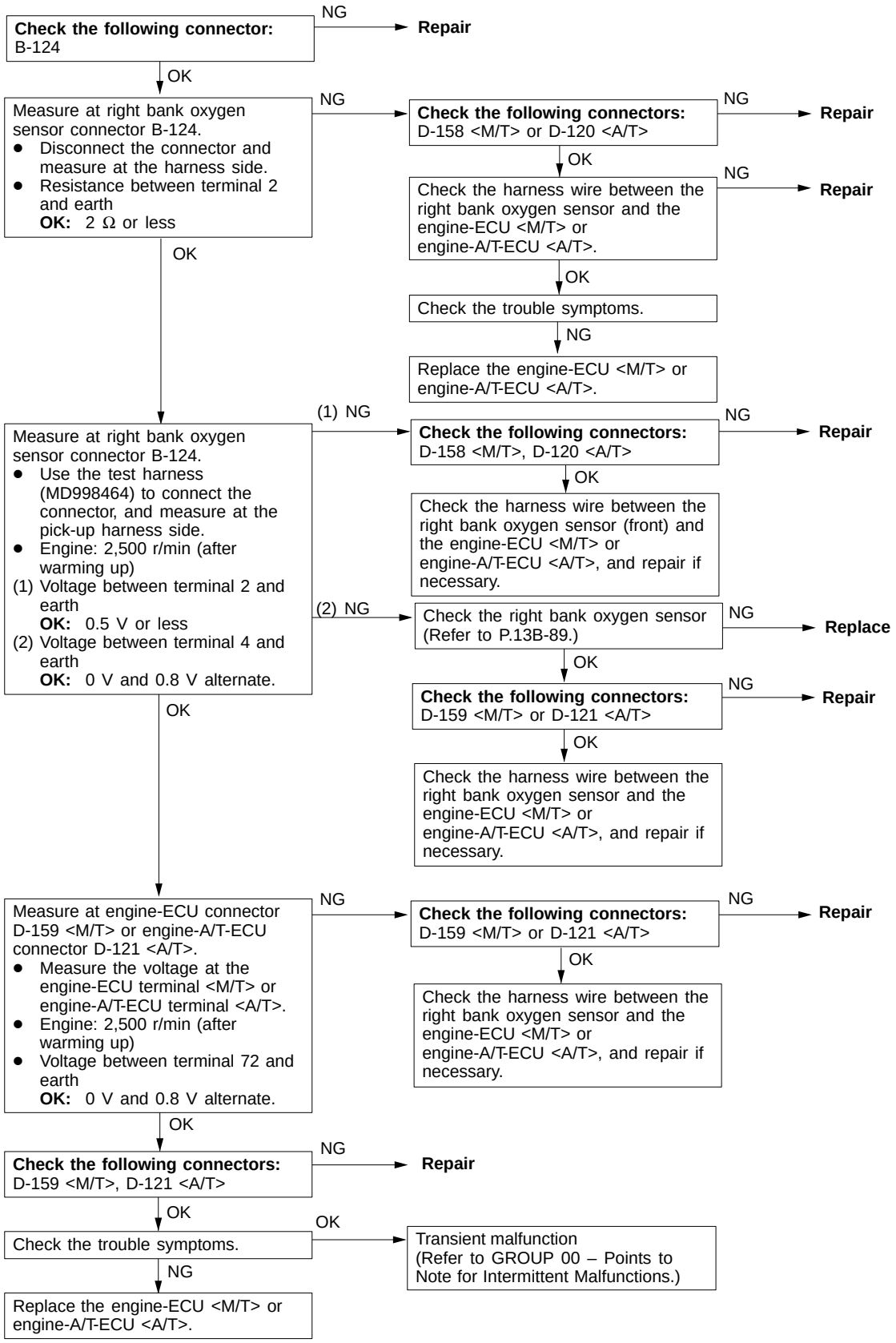

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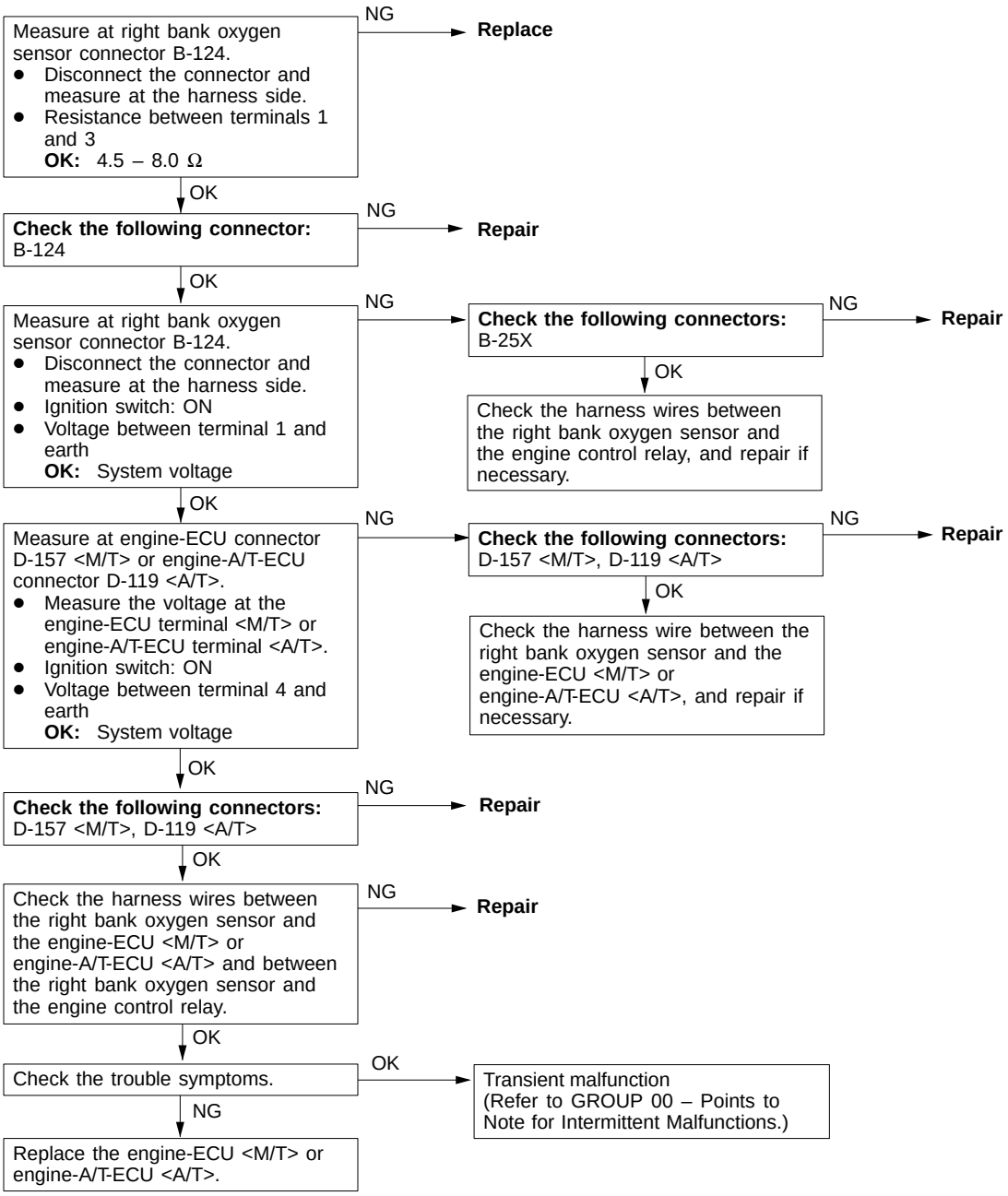
Code No. P0135 Oxygen sensor heater front system <Bank 1 sensor 1>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The right bank oxygen sensor heater remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current,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



Code No. P0150 Oxygen sensor system <Bank 2 sensor 1>	Probable cause
Range of Check ● 3 minutes or more has passed since the engine started. ● The engine coolant temperature is higher than approximately 80°C. ● Engine speed is higher than 1,200 r/min. ● Volumetric efficiency is higher than 25 percent. ● The car is running at the constant speed on a flat road. Set Conditions ● Input voltage supplied to the engine-ECU <M/T> or engine-A/T-ECU <A/T> interface circuit is higher than 4.5 volts when 5 volts are applied to the left bank heated oxygen sensor output line.	● Malfunction of left bank oxygen sensor ● Open or short circuit in the left bank oxygen sensor circuit or loose connector contact ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

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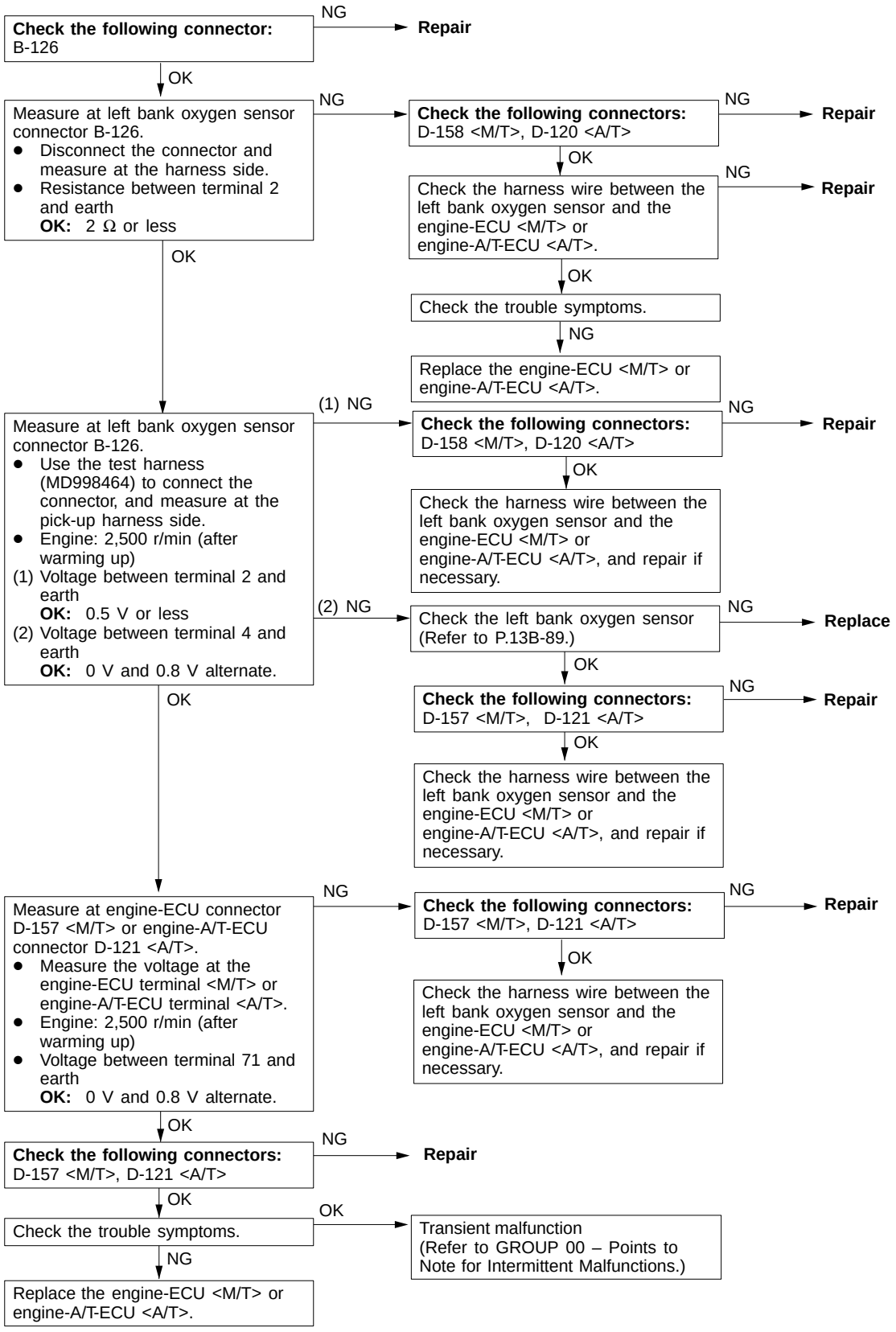

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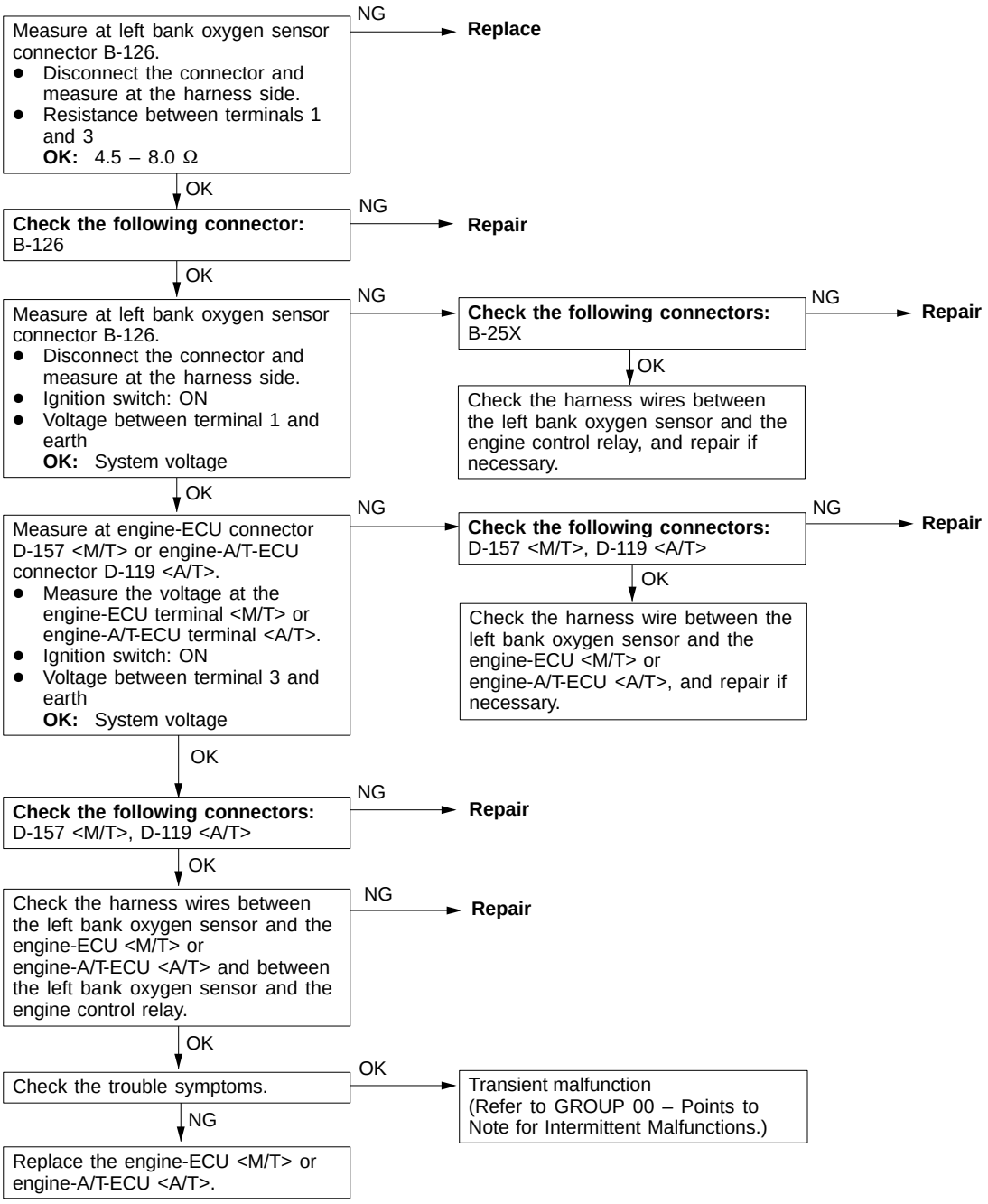
Code No. P0155 Oxygen sensor heater system <Bank 2 sensor 1>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The left bank oxygen sensor heater remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current, which flows through the left bank oxygen sensor heater, is 0.2 A or less or 3.5 A or more for four seconds.	● Malfunction of left bank oxygen sensor heater ● Open or short circuit in the left bank oxygen sensor heater circuit or loose connector contact ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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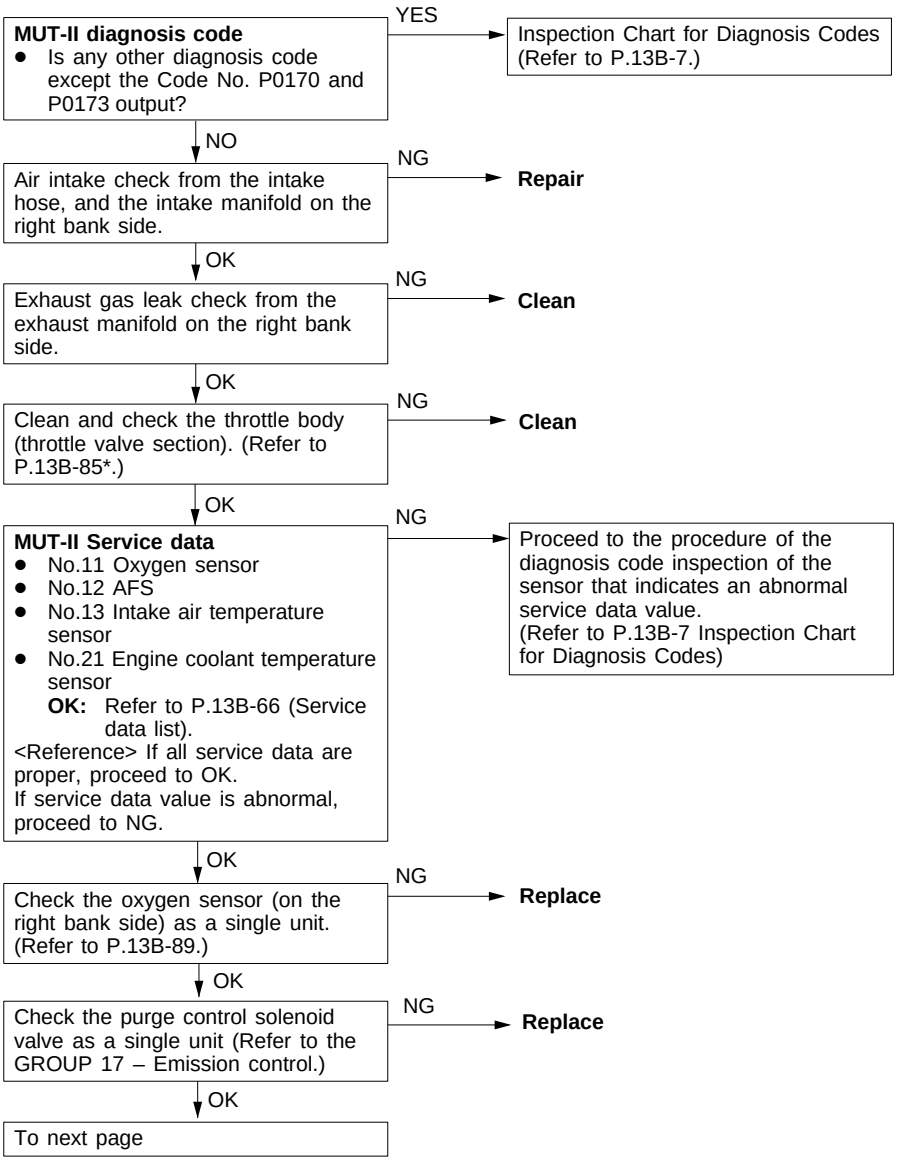
Code No. P0170 Abnormal fuel system (Bank 1)	Probable cause
Range of Check ● Engine: Being learning the air-fuel ratio Set Conditions ● Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or ● Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	● Incorrect fuel pressure ● Malfunction of fuel supply system ● Malfunction of right bank oxygen sensor ● Malfunction of intake air temperature sensor ● Malfunction of vacuum sensor ● Malfunction of air flow sensor ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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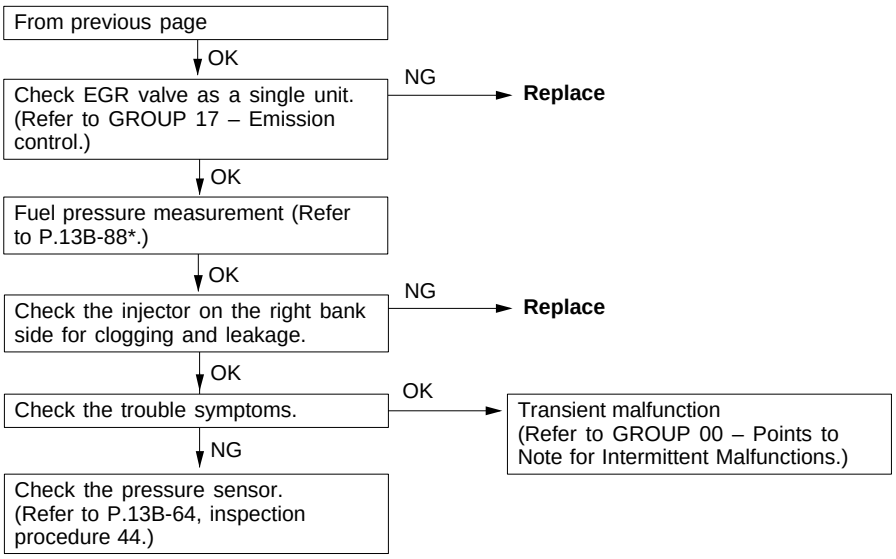

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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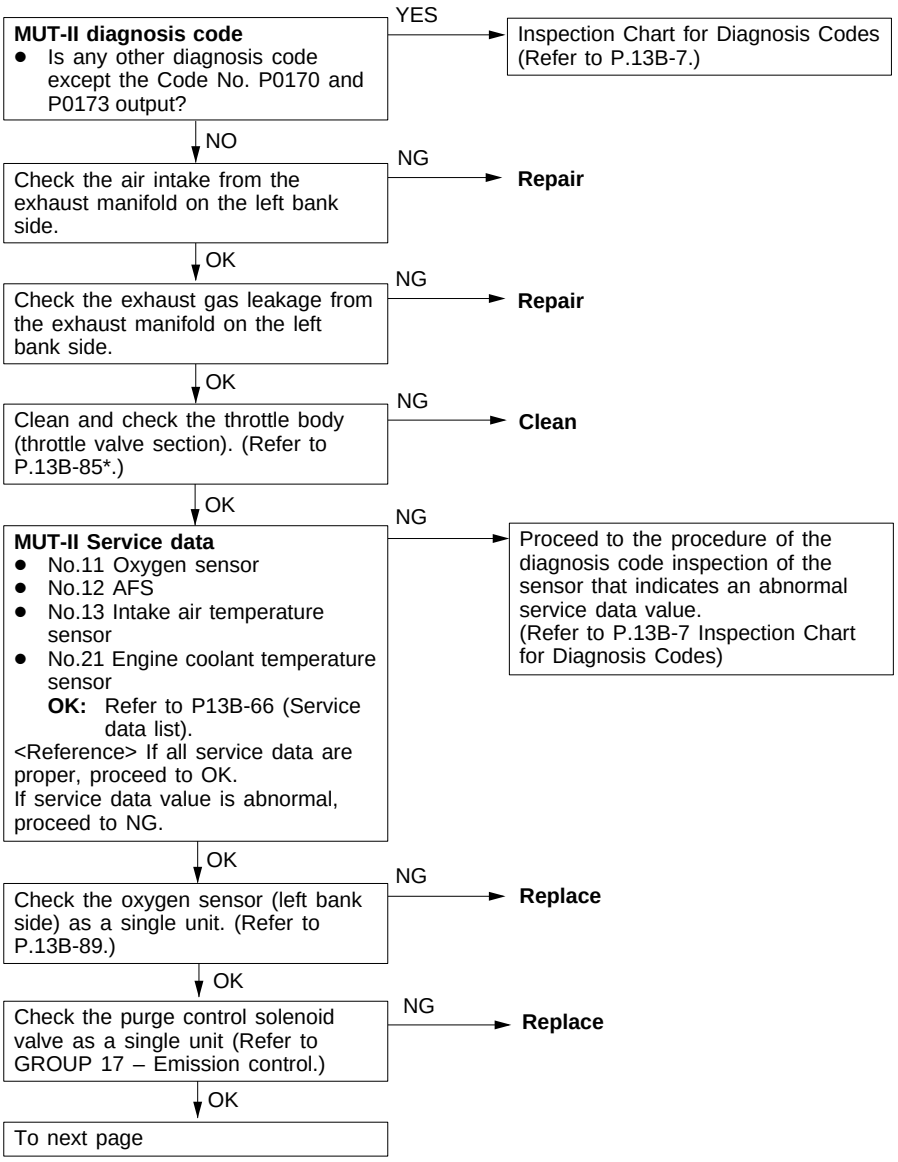
Code No. P0173 Abnormal fuel system (Bank 2)	Probable cause
Range of Check ● Engine: Being learning the air-fuel ratio Set Conditions ● Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or ● Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	● Incorrect fuel pressure ● Malfunction of fuel supply system ● Malfunction of left bank oxygen sensor ● Malfunction of intake air temperature sensor ● Malfunction of vacuum sensor ● Malfunction of air flow sensor ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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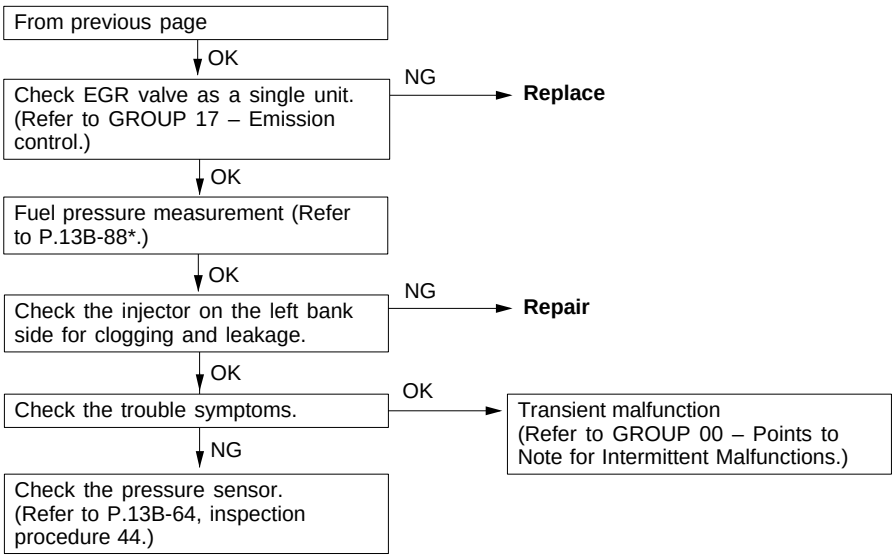
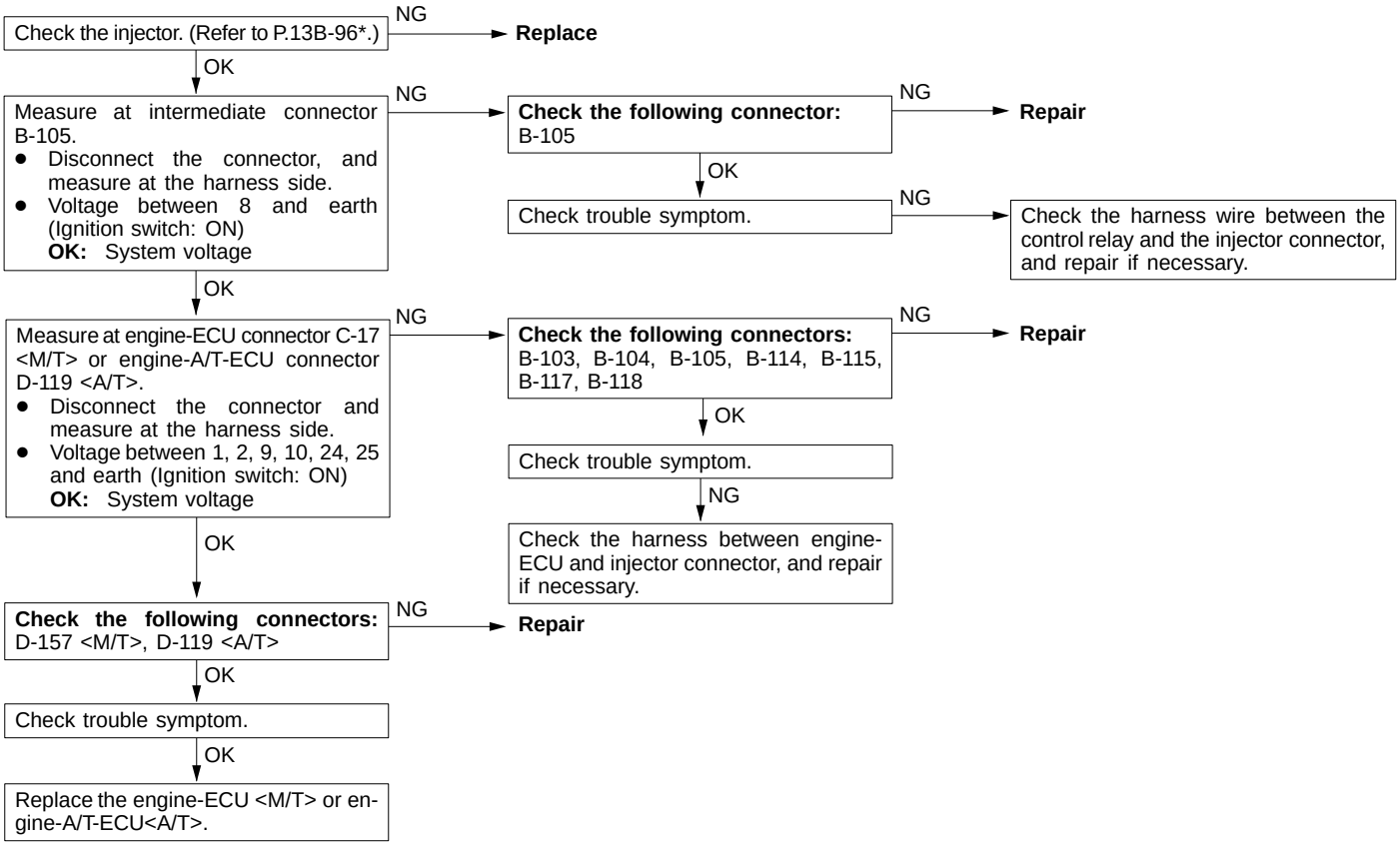


NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

Code No. P0201 No.1 – P0206 No.6 Injector system	Probable cause
Range of Check ● Engine speed is approx. 50 – 1,000 r/min ● The throttle position sensor output voltage is 1.15 V or less. ● Actuator test by MUT-II is not carried out. Set conditions ● Surge voltage of injector coil is not detected for 4 seconds.	● Malfunction of the injector ● Improper connector contact, open circuit or short-circuited harness wire of the injector circuit ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

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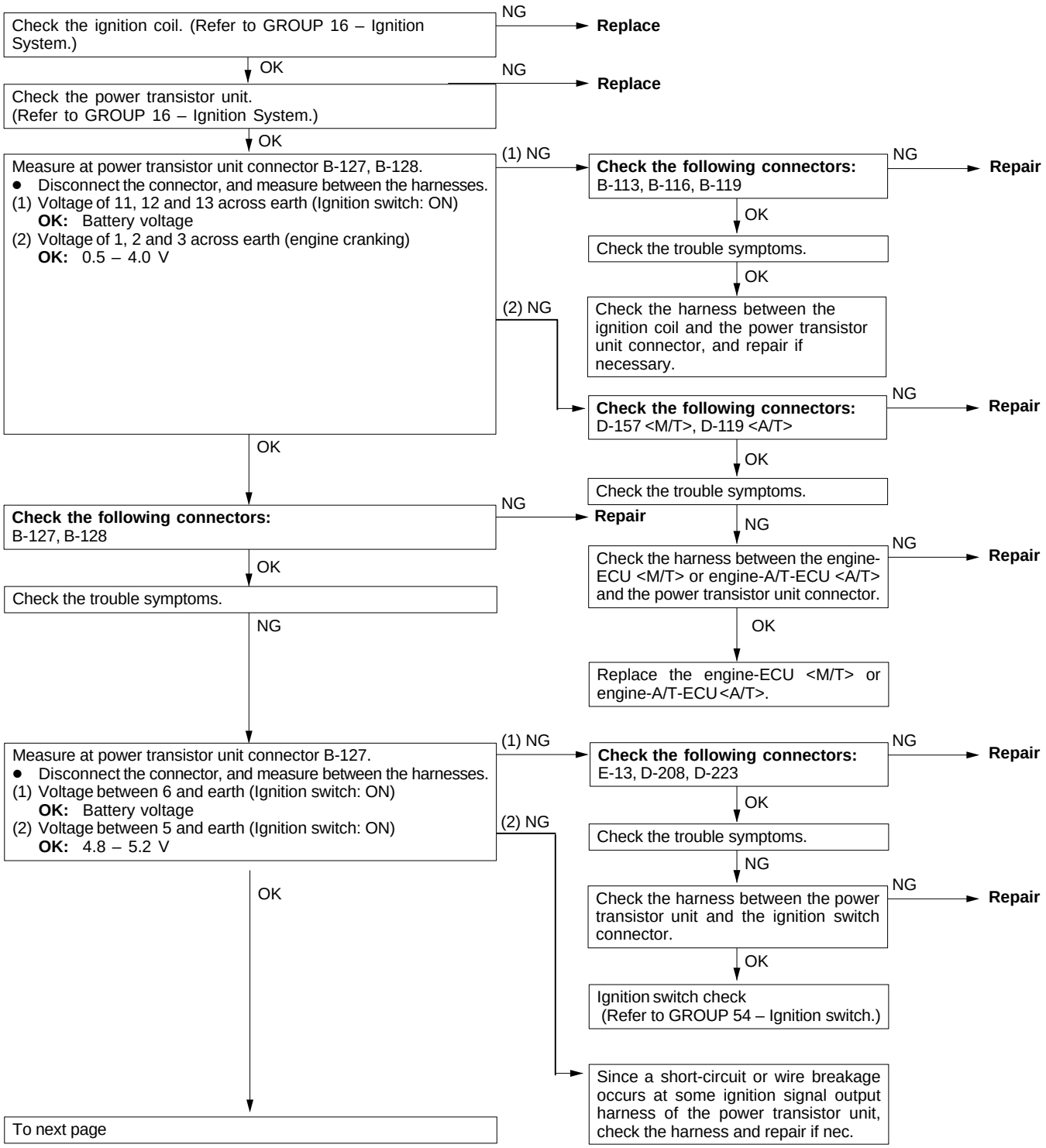
Code No. P0300 Ignition coil and power transistor unit system	Probable cause
Range of Check ● Engine speed is approx. 50 to 4,000 rpm ● The engine is not cranking Set Conditions ● Ignition signal of the same coil is not input between the interval of 48-point ignitions. However, such a case as the ignition signals of all coils are not input is excluded.	● Malfunction of ignition coil ● Wire breakage or short circuit of ignition primary circuit, or defective contact of connector ● Malfunction of power transistor unit ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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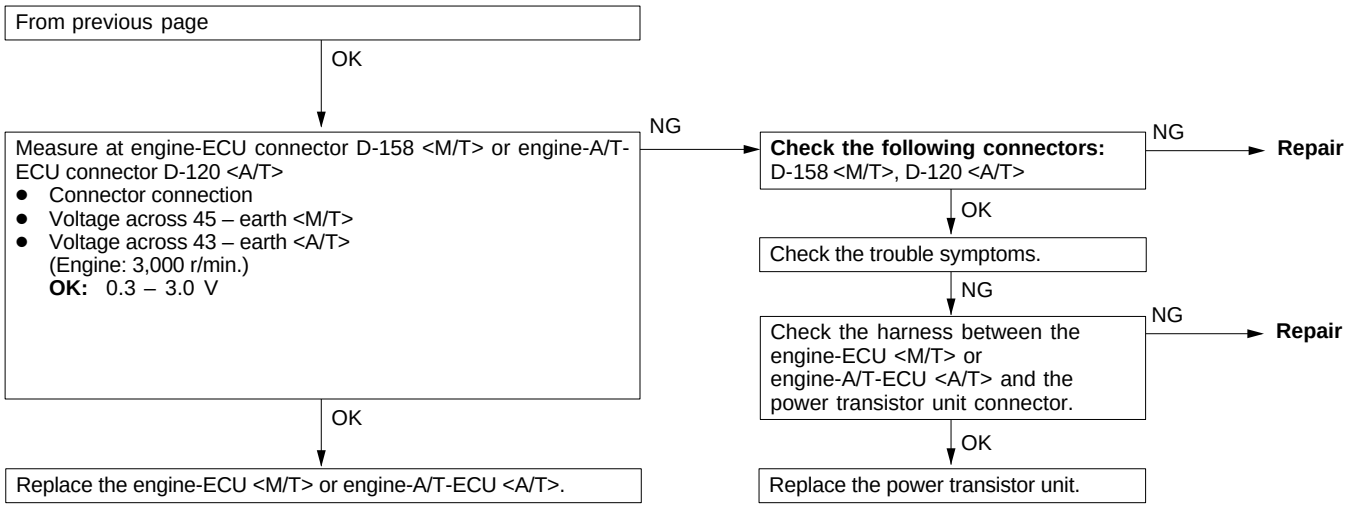

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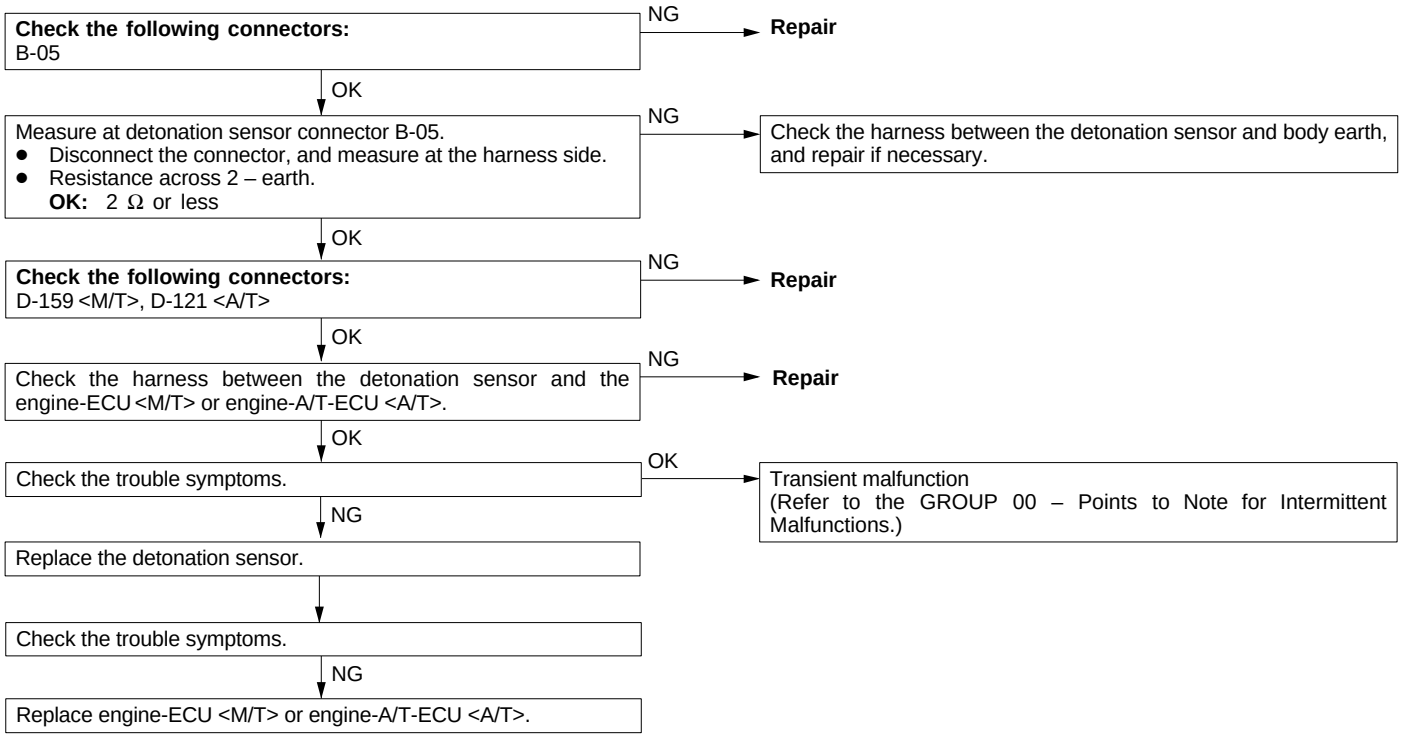
Code No. P0325 Detonation sensor system	Probable cause
Range of Check ● Engine: 2 seconds after completion of start Set Conditions ● Continuous 200 times, the varying rate of sensor output voltage (detonation sensor peak voltage every 1/3 revolution of crankshaft) is 0.06V or less.	● Malfunction of the detonation sensor ● Wire breakage or short circuit of the detonation sensor circuit or defective contact of connector ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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 the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

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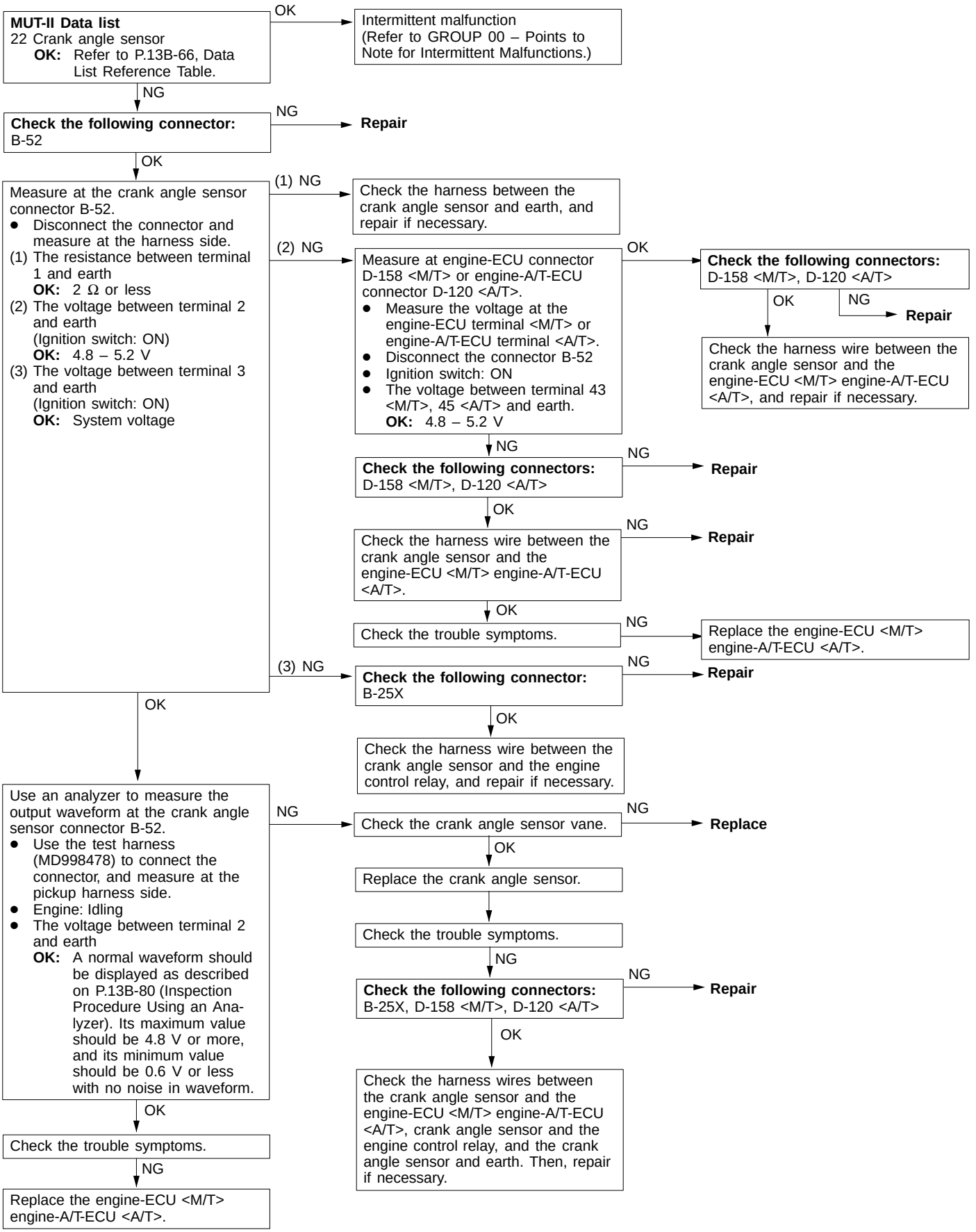

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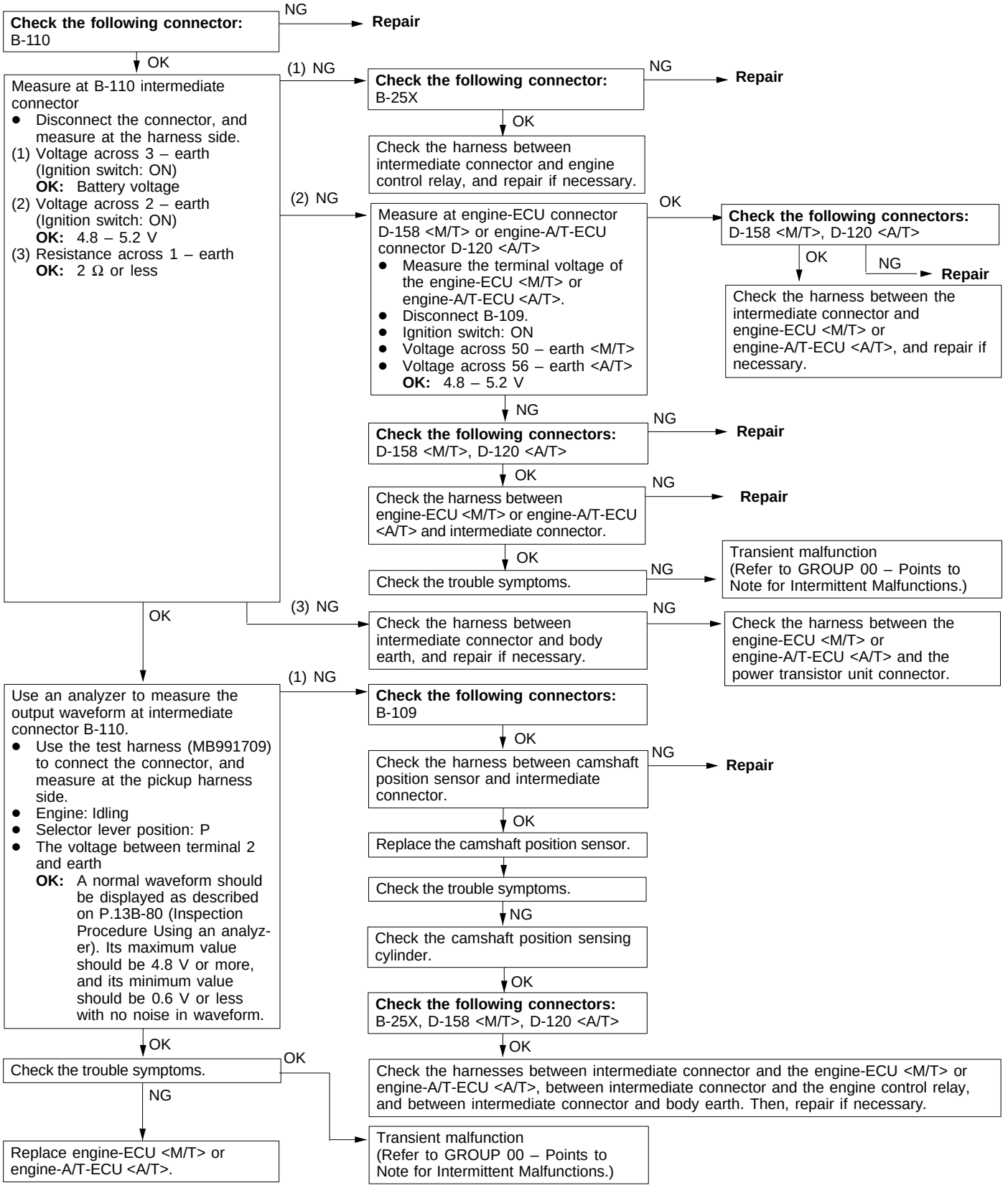
Code No. P0340 Camshaft position sensor system	Probable cause
Range of Check ● After the engine was started Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the camshaft position sensor ● Open or short circuit in the camshaft position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



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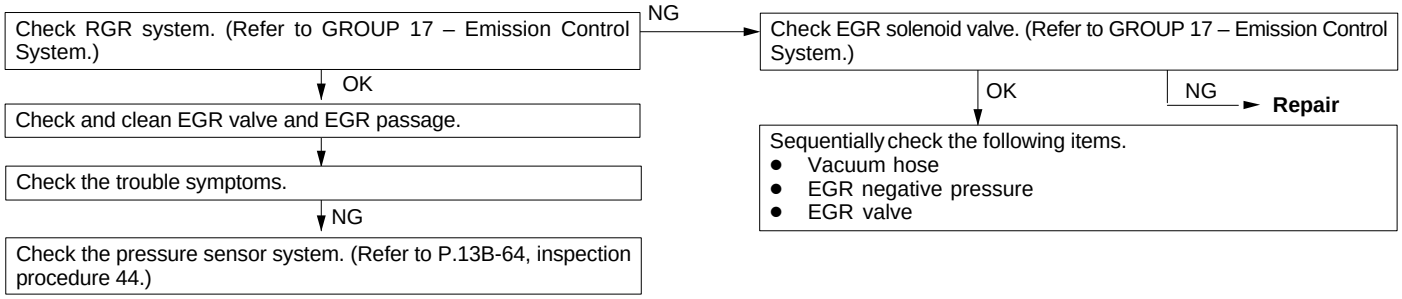
Code No. P0400 EGR system	Probable cause
Range of Check ● The temperature of engine cooling water is approx. 80°C or more. ● The engine revolution speed is 1,000 to 1,650 <M/T> or 910 – 1,650 <A/T> r/min. ● The intake air temperature is 5°C or higher. ● The atmospheric pressure is 76 kPa or more. ● The car speed is 1.5 km/h <M/T>, 30 km/h <A/T> or more. ● The fuel is cut. <M/T> ● The volume efficiency is 18 % <M/T>, 28 % <A/T> or less. Set Conditions ● When EGR solenoid valve is turned on, the state of the intake system varies slightly.	● Malfunction of EGR valve ● Low EGR control negative pressure ● Malfunction of EGR solenoid valve ● Wire breakage and short circuit of EGR solenoid valve circuit, or defective contact of connector ● Malfunction of pressure sensor ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



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Code No. P0403 EGR 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 EGR control solenoid valve ● Open or short circuit in the EGR control solenoid valve circuit or loose connector contact ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

MUT-II Actuator Test
10 EGR control solenoid valve
OK: Operating sound can be heard and the valve vibrates.
OK → Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG ↓

Measure at the EGR control solenoid valve connector B-123.
- Disconnect the connector, and measure at the solenoid valve side.
- The resistance between terminals 1 and 2
OK: 28 – 35 Ω (at 20°C)
NG → **Replace**
OK ↓

Check the following connector:
B-123
NG → **Repair**
OK ↓

Measure at the EGR control solenoid valve connector B-123.
- Disconnect the connector and measure at the harness side.
- Ignition switch: ON
- The voltage between terminal 1 and earth
OK: System voltage
NG → **Check the following connector:** B-25X
NG → **Repair**
NG ↓ Check the harness wire between the EGR control solenoid valve and the engine control relay, and repair if necessary.
OK ↓

Measure at engine-ECU connector D-157 <M/T> or engine-A/T-ECU connector D-119 <A/T>.
- Measure the voltage at the engine-ECU terminal <M/T> or engine-A/T-ECU terminal <A/T>.
- Ignition switch: ON
- The voltage between terminal 6 and earth
OK: System voltage
NG → **Check the following connectors:** D-157 <M/T>, D-119 <A/T>
NG → **Repair**
OK ↓ Check the harness wire between the EGR control solenoid valve and the engine-ECU <M/T> engine-A/T-ECU <A/T>.
NG → **Repair**
OK ↓ Replace the engine-ECU <M/T> engine-A/T-ECU <A/T>.
OK ↓

Check the following connectors:
D-157 <M/T>, D-119 <A/T>
NG → **Repair**
OK ↓

Check the harness wires between the EGR control solenoid valve and the engine control relay, and between the purge control solenoid valve and the engine-ECU <M/T> engine-A/T-ECU <A/T>.
NG → **Repair**
OK ↓

Check the trouble symptoms.
NG ↓

Replace the engine-ECU <M/T> engine-A/T-ECU <A/T>.

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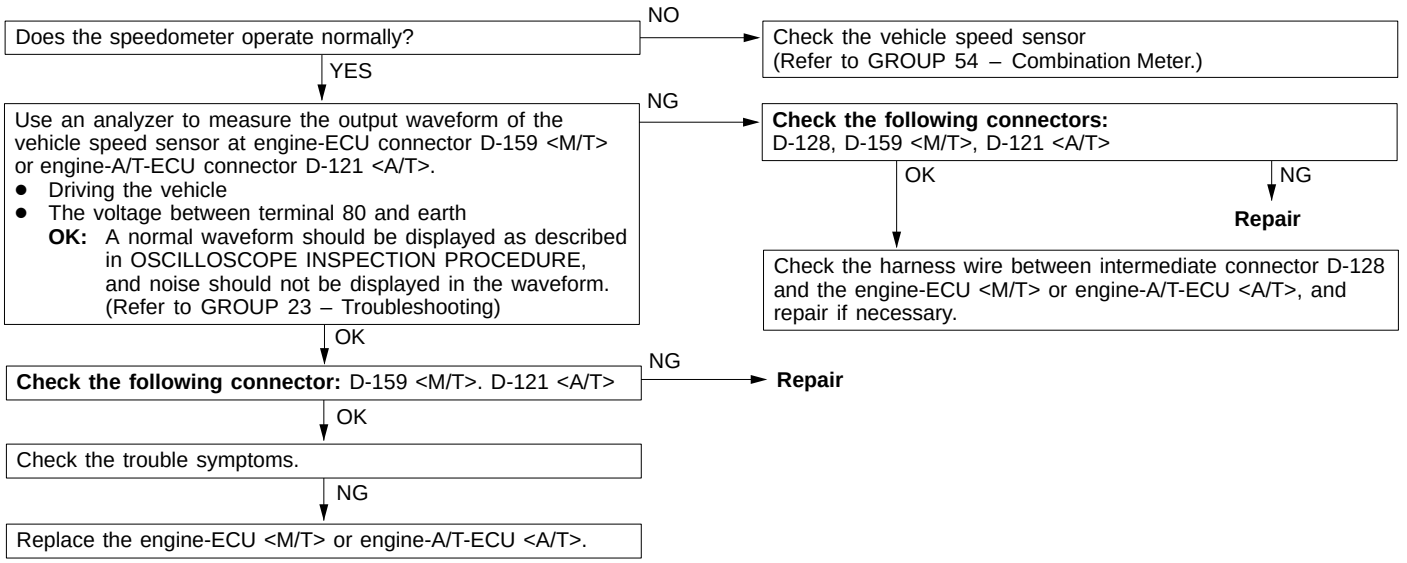
Code No. P0500 Vehicle speed sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).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



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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-35
	Communication with engine-ECU <M/T> or engine-A/T-ECU <A/T> only is not possible.	2	13A-35
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-36
	The engine warning lamp remains illuminating and never goes out.	4	13A-36
Starting	No initial combustion (starting impossible)	5	13A-37
	Initial combustion but no complete combustion (starting impossible)	6	13A-38
	Long time to start (improper starting)	7	13A-39
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13A-40
	Idling speed is high. (Improper idling speed)	9	13A-41
	Idling speed is low. (Improper idling speed)	10	13A-41
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13A-42
	When the engine becomes hot, it stalls at idling. (Die out)	12	13A-43
	The engine stalls when starting the car. (Pass out)	13	13A-44
	The engine stalls when decelerating.	14	13A-44
Driving	Hesitation, sag or stumble	15	13A-45
	The feeling of impact or vibration when accelerating	16	13A-45
	The feeling of impact or vibration when decelerating	17	13A-46
	Poor acceleration	18	13A-46
	Surge	19	13A-47
	Knocking	20	13A-47
Dieseling		21	13A-48
Too high CO and HC concentration when idling		22	13A-48
Idling speed is improper when A/C is operating		23	13A-49
Fans (radiator fan, A/C condenser fan) are inoperative		24	13A-49

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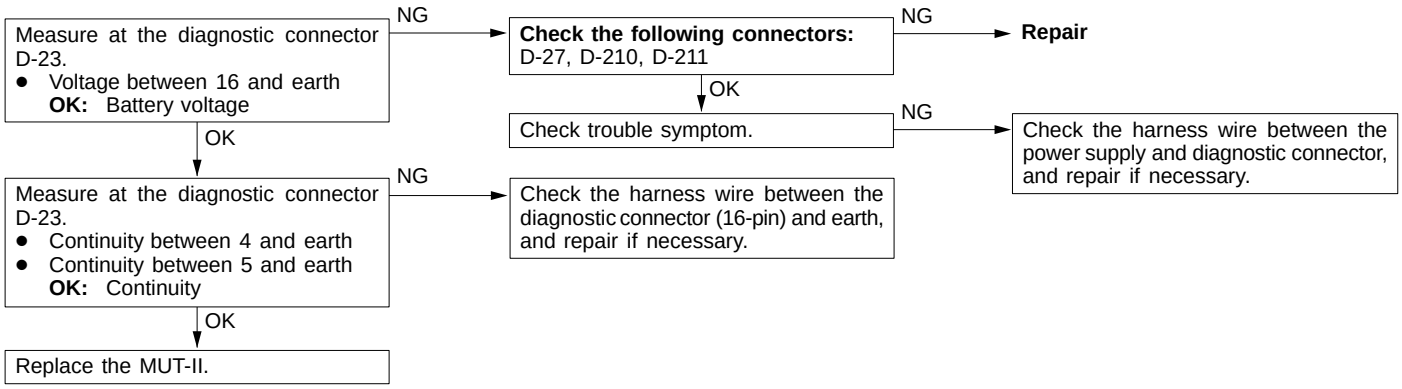
INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

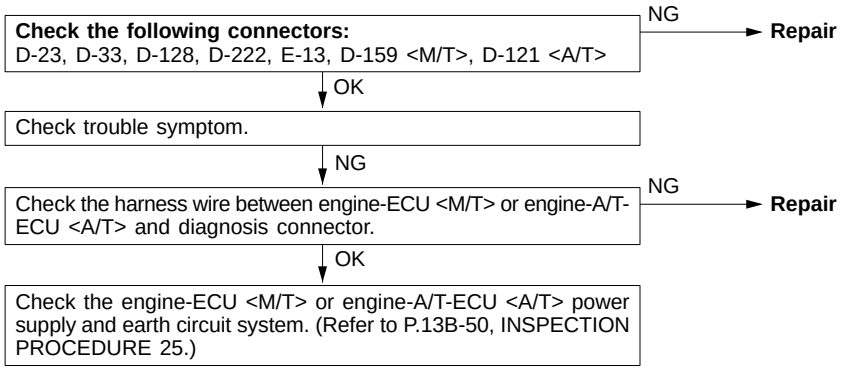
INSPECTION PROCEDURE 1

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



INSPECTION PROCEDURE 2

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



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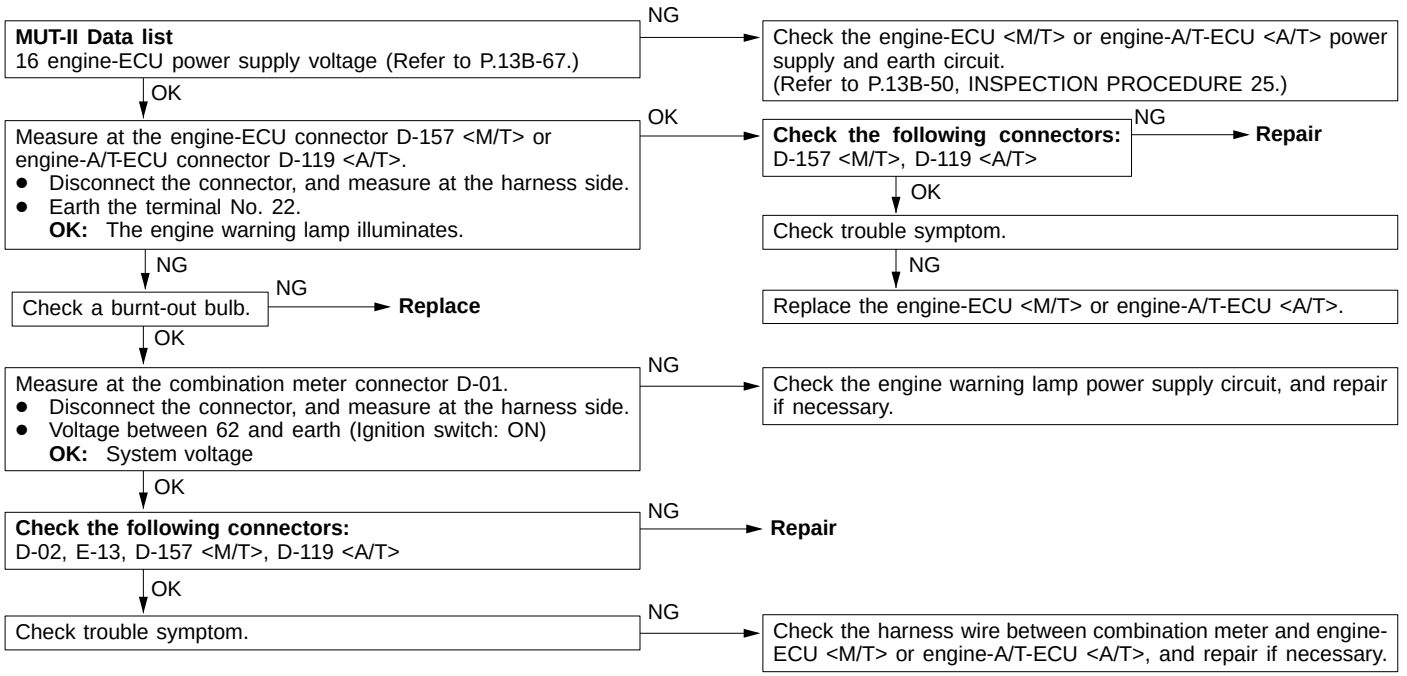
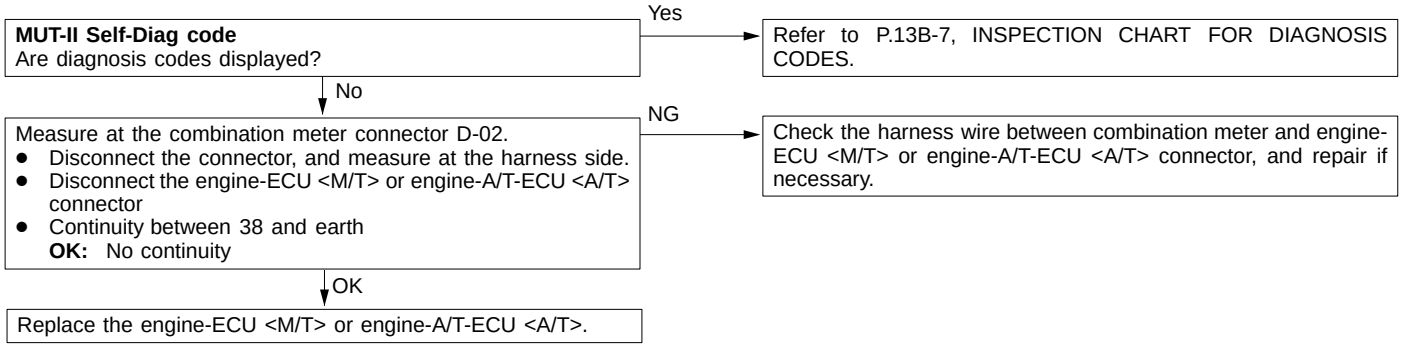
INSPECTION PROCEDURE 3

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 <M/T> or engine-A/T-ECU <A/T> 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 <M/T> or engine-A/T-ECU <A/T> • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



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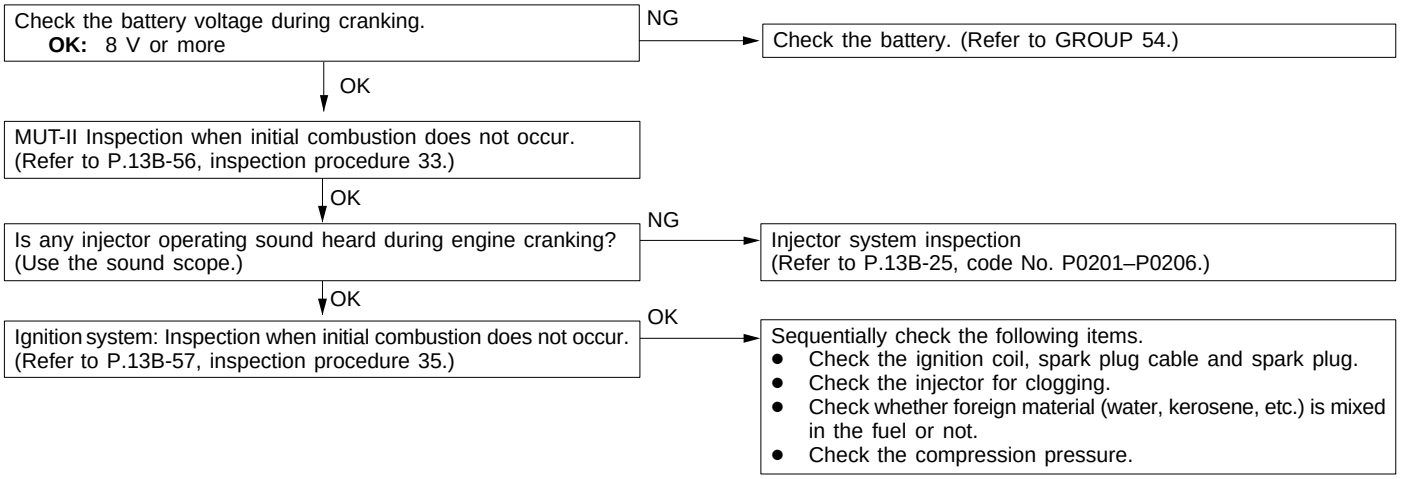
INSPECTION PROCEDURE 5

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



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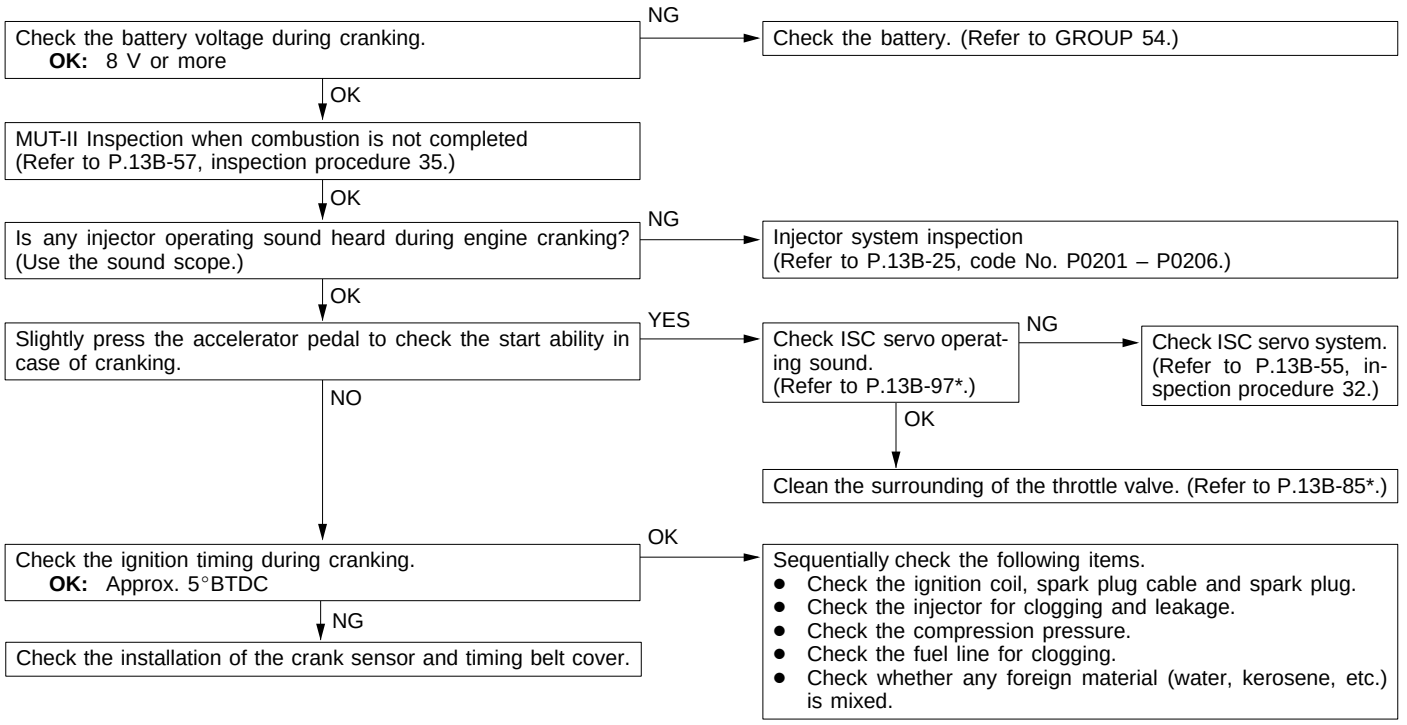
INSPECTION PROCEDURE 6

Initial combustion but no complete combustion (starting impossible)	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks but the sparks are weak, or the initial mixture for starting is not appropriate.	• Malfunction of the ignition system • Malfunction of the injector system • Foreign materials in fuel • Poor compression • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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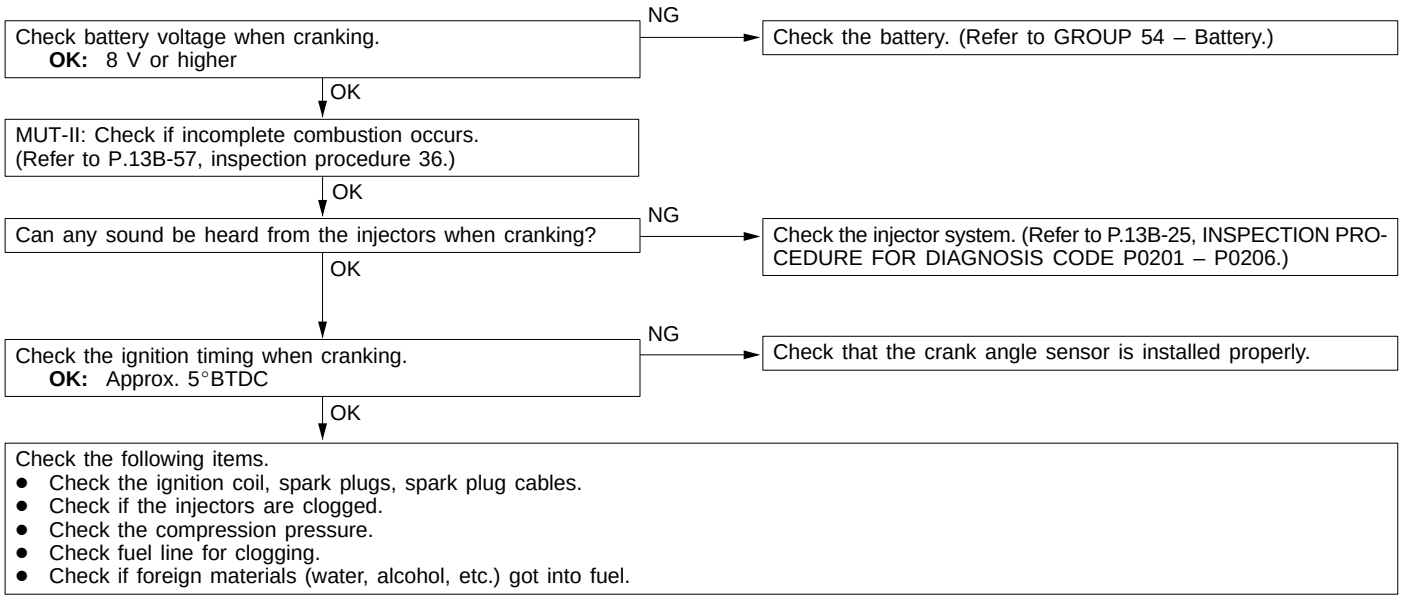
INSPECTION PROCEDURE 7

It takes too long time to start. (Incorrect starting)	Probable cause
In cases such as the above, the cause is probably that the spark is weak and ignition is difficult, the initial mixture for starting is not appropriate, or sufficient compression pressure is not being obtained.	• Malfunction of the ignition system • Malfunction of the injector system • Inappropriate gasoline use • Poor compression



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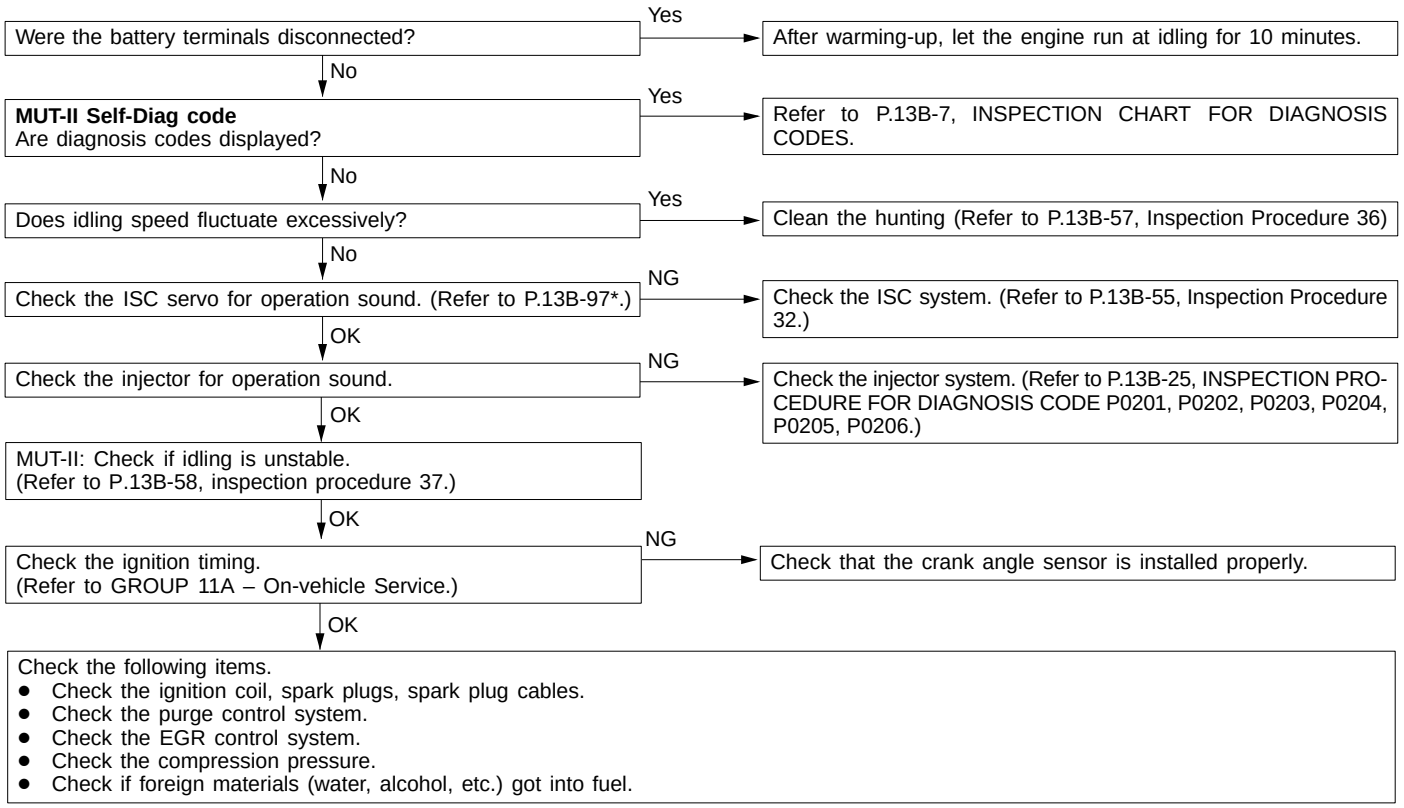
INSPECTION PROCEDURE 8

Unstable idling (Rough idling, hunting)	Probable cause
In cases as the above, the cause is probably that the ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. Because the range of possible causes is broad, inspection is narrowed down to simple items.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Poor compression • Drawing air into exhaust system



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

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INSPECTION PROCEDURE 9

Idling speed is high. (Improper idling speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idling is too great.	• Malfunction of the ISC servo system • Malfunction of the throttle body

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the ISC servo for operation sound. (Refer to P.13B-97*.)
NG → Check the ISC system. (Refer to P.13B-55, Inspection Procedure 32.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13B-67.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13B-11, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13B-68.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13B-53, INSPECTION PROCEDURE 30.)
OK ↓

Basic idle adjustment (Refer to P.13B-86*.) ↓

Check trouble symptom.
NG → Clean the throttle valve area. (Refer to P.13B-84*.)

INSPECTION PROCEDURE 10

Idling speed is low. (Improper idling speed)	Probable cause
In cases such as the above, the cause is probably that the intake air volume during idling is too small.	• Malfunction of the ISC servo system • Malfunction of the throttle body

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the ISC servo for operation sound. (Refer to P.13B-97*.)
NG → Check the ISC system. (Refer to P.13B-55, Inspection Procedure 32.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13B-67.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13B-11, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

Basic idle adjustment (Refer to P.13B-86*.) ↓

Check trouble symptom.
NG → Clean the throttle valve area. (Refer to P.13B-84*.)

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

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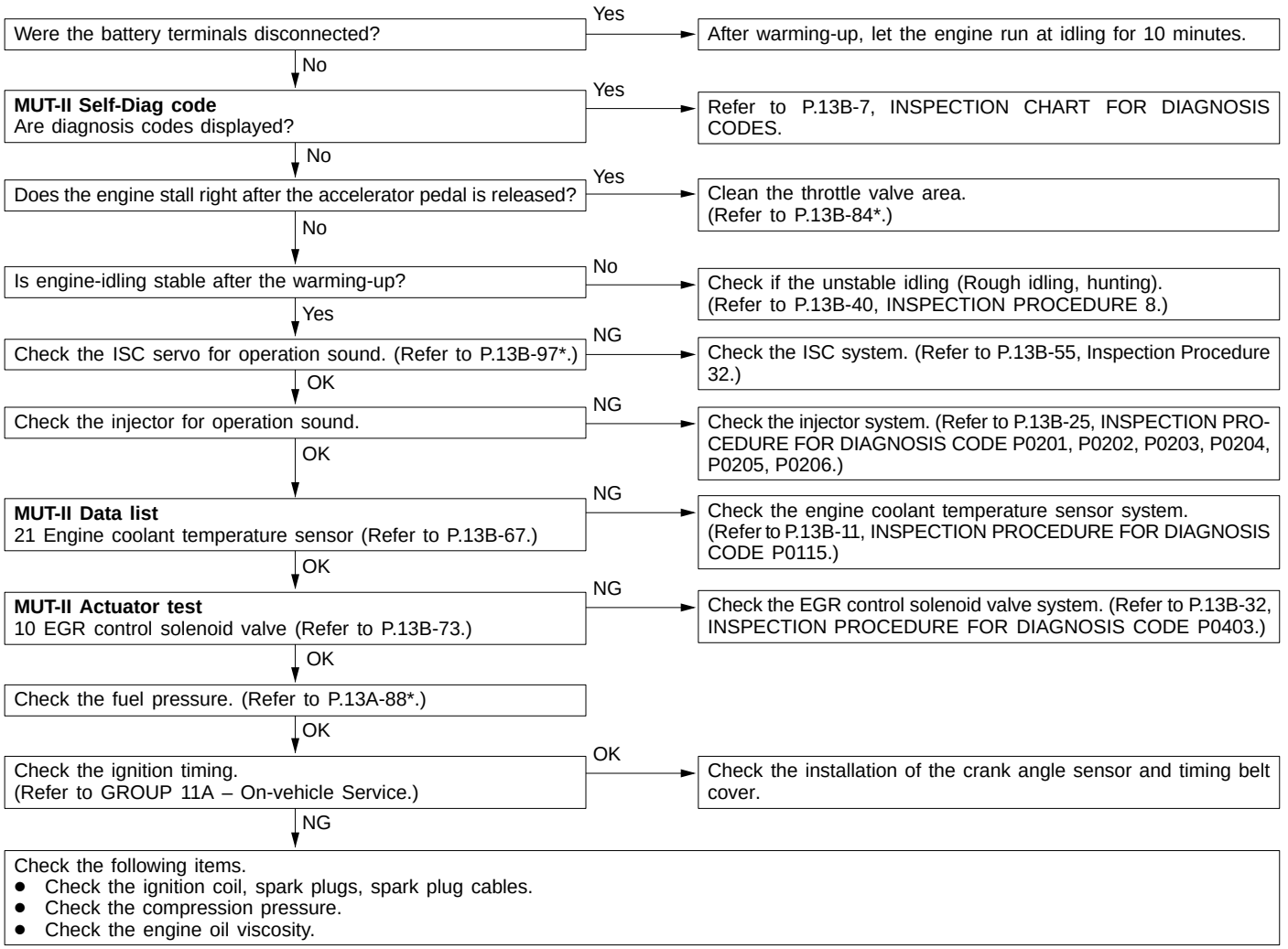
INSPECTION PROCEDURE 11

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



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

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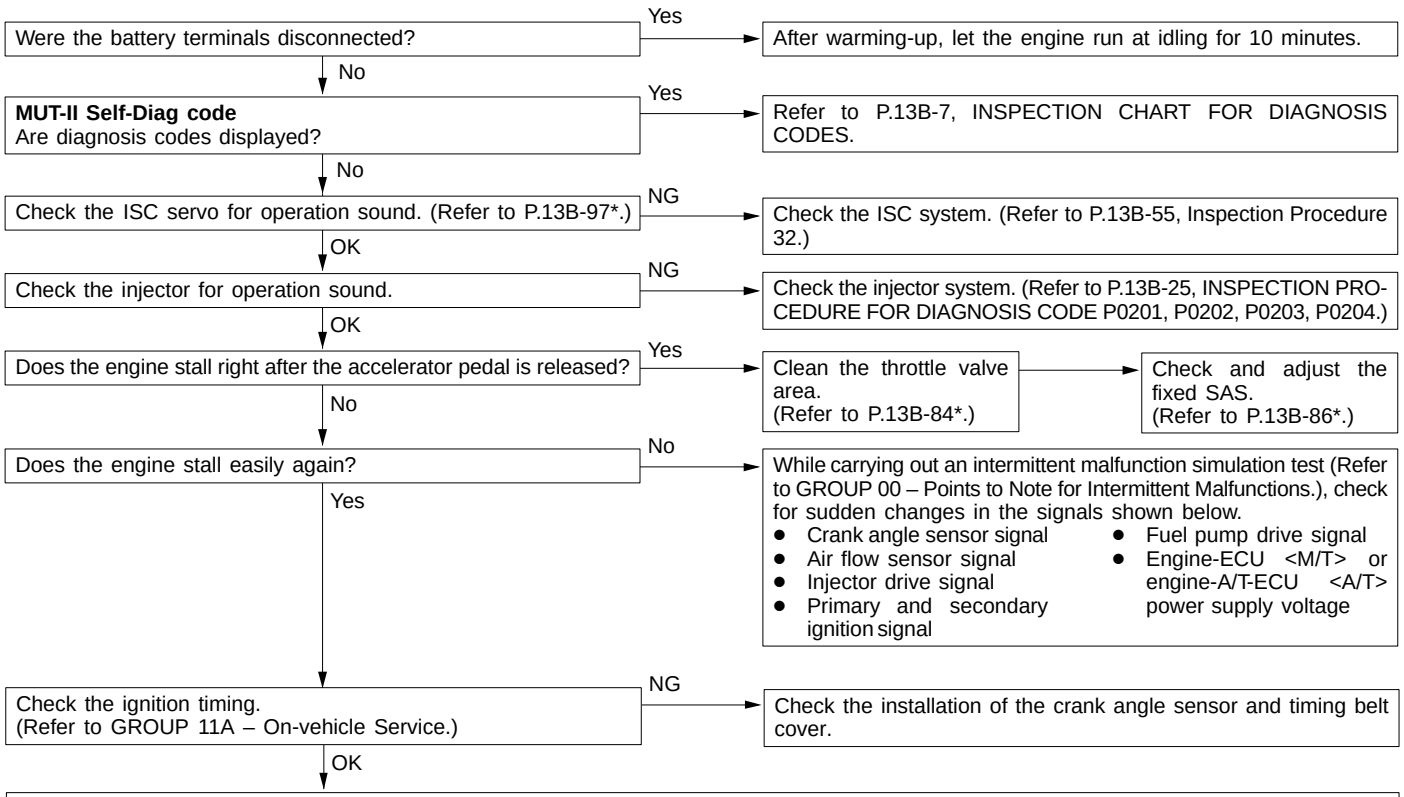
INSPECTION PROCEDURE 12

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



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

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INSPECTION PROCEDURE 13

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13B-73.)
NG → Check the EGR control solenoid valve system. (Refer to P.13B-32, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if air was drawn into the intake system.
  - Broken intake manifold gasket
  - Broken or disconnected vacuum hose
  - Improper operation of the PCV valve
  - Broken air intake hose

INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective idle speed control (ISC) servo system.	• Malfunction of the ISC system

Were the battery terminals disconnected?
Yes → After warming-up, let the engine run at idling for 10 minutes.
No ↓

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13B-67.)
NG → Check the throttle position sensor system. (Refer to P.13B-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

MUT-II Data list
45 ISC servo position
- Is the idle speed control (ISC) servo position drops to 0 – 2 steps when decelerating (engine r/min less than 1,000)?

Yes → Check the vehicle speed sensor system. (Refer to P.13B-55, Inspection Procedure 32.)
No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13B-73.)
NG → Check the EGR control solenoid valve system. (Refer to P.13B-32, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Clean the throttle valve area.

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INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Poor compression

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13B-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204, P0205, P0206.)
OK ↓

Check the ignition timing.
(Refer to GROUP 11A – On-vehicle Service.)
NG → Check the installation of the crank angle sensor and timing belt cover.
OK ↓

MUT-II Check breathing, poor running, and defective acceleration.
(Refer to P.13B-60, inspection procedure 39.)
OK ↓

Check the fuel pressure. (Refer to P.13B-88*.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR control system.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

INSPECTION PROCEDURE 16

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check for occurrence of ignition leak.

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INSPECTION PROCEDURE 17

The feeling of impact or vibration when decelerating.	Probable cause
Malfunction of the ISC system is suspected.	• Malfunction of the ISC system

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓
Check the ISC servo for operation sound. (Refer to P.13B-97*.)
NG → Check the ISC system. (Refer to P.13B-55, Inspection Procedure 32.)
OK ↓
MUT-II Data list
14 Throttle position sensor (Refer to P.13B-67.)
NG → Check the throttle position sensor system. (Refer to P.13B-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓
Clean the throttle valve area. (Refer to P.13B-84*.)

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005).

INSPECTION PROCEDURE 18

Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the fuel supply system • Poor compression pressure • Clogged exhaust system

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓
Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13B-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204, P0205, P0206.)
OK ↓
Check the ignition timing.
(Refer to GROUP 11A – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓
MUT-II Check breathing, poor running, and defective acceleration.
(Refer to P.13B-60, Inspection procedure 39.)
OK ↓
Check the fuel pressure. (Refer to P.13B-88*.)
OK ↓
Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.
- Broken air intake hose
- Clogged air cleaner
- Clogged exhaust system

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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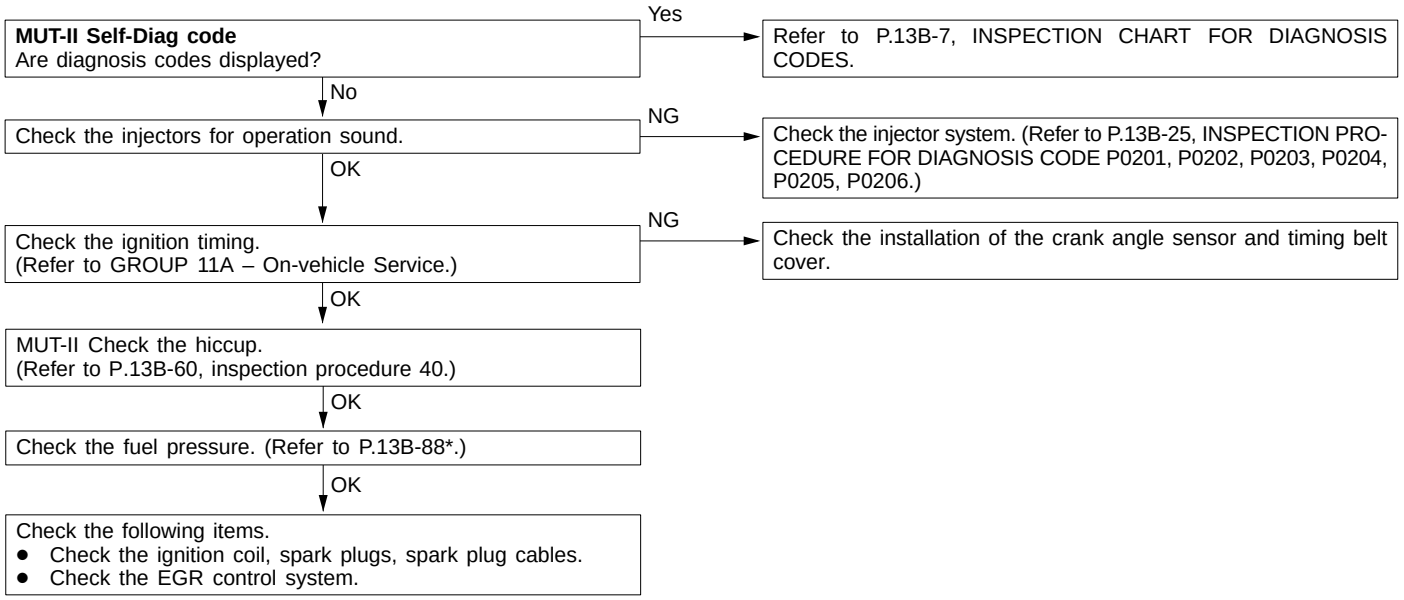
INSPECTION PROCEDURE 19

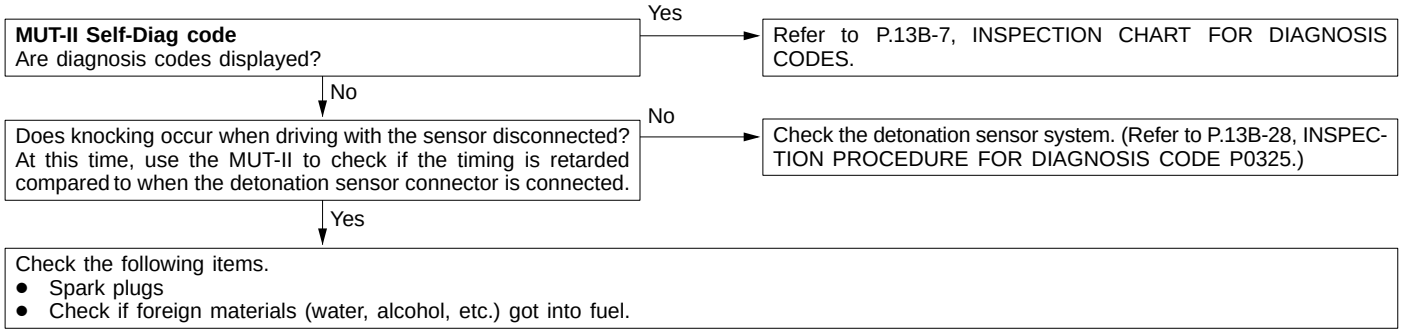
Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio, etc. are suspected.	• Malfunction of the ignition system • Malfunction of air-fuel ratio control system



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases as the above, the cause is probably that the detonation control is defective or the heat value of the spark plug is inappropriate.	• Defective detonation sensor • Inappropriate heat value of the spark plug



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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INSPECTION PROCEDURE 21

Dieseling	Probable cause
Fuel leakage from injectors is suspected.	• Fuel leakage from injectors

Check the injectors for fuel leakage.

INSPECTION PROCEDURE 22

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13B-7, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the ignition timing.
(Refer to GROUP 11A – On-vehicle Service.)
NG → Check the installation of the crank angle sensor and timing belt cover.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor. (Refer to P.13B-67.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13B-11, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13B-67.)
NG → Check the intake air temperature sensor system. (Refer to P.13B-10, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
11 Right bank oxygen sensor
OK: Repeat 0 – 400 mV and 600 – 1,000 mV alternately when idling
NG → Replace the oxygen sensor. ↓
Check trouble symptom.
NG →
NG ↓

Check the fuel pressure. (Refer to P.13B-88*.)
OK ↓

Check the following items.
- Check the injectors for operation sound.
- Check the injectors for fuel leakage.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the positive crankcase ventilation system.
- Check the purge control system.
- Check the EGR control system.

↓
Check the trouble symptom.
NG ↓
Replace the catalytic converter.

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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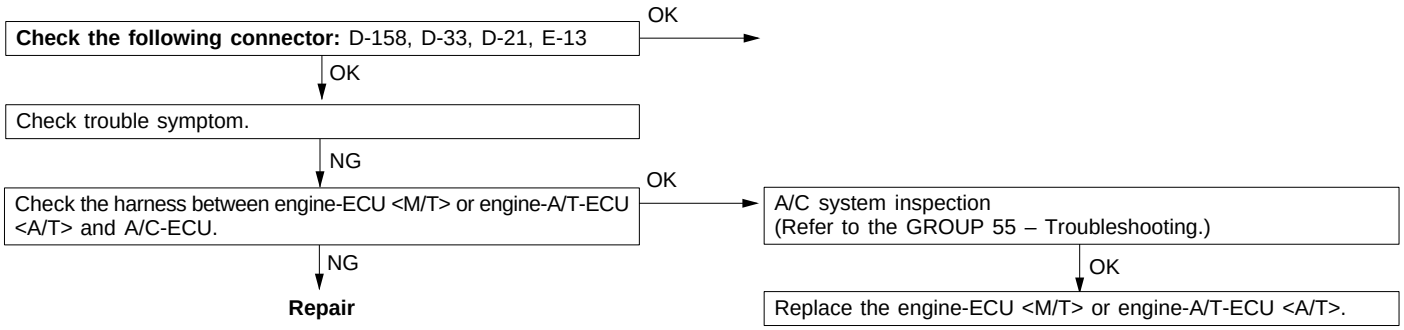
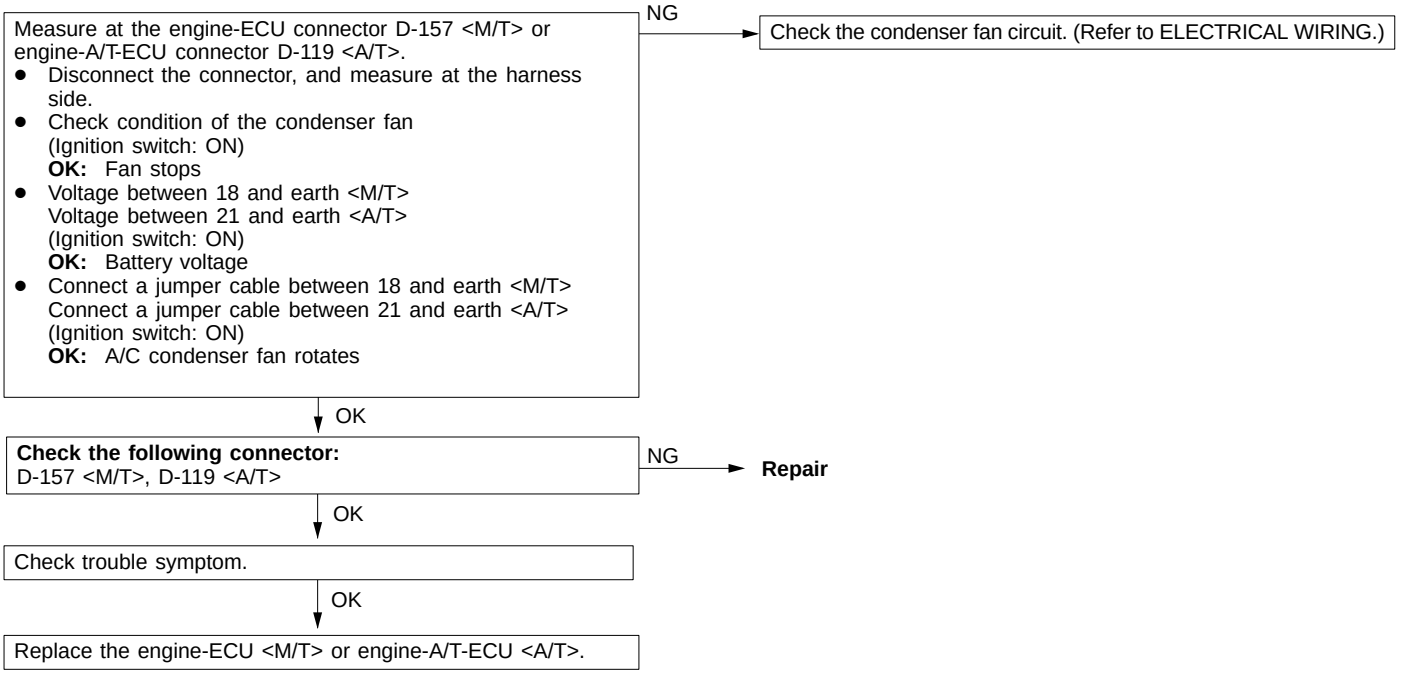
INSPECTION PROCEDURE 23

Improper idling revolution speed during A/C activation (A/C load signal)	Probable cause
A/C-ECU detects A/C load state, and inputs it to engine-ECU <M/T> or engine-A/T-ECU <A/T> as the A/C load signal. When the signal is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, it will drive the throttle control servo to control the idling revolution speed.	• Malfunction of the A/C control system • Wire breakage and short circuit of circuit, and poor contact of connector • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



INSPECTION PROCEDURE 24

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



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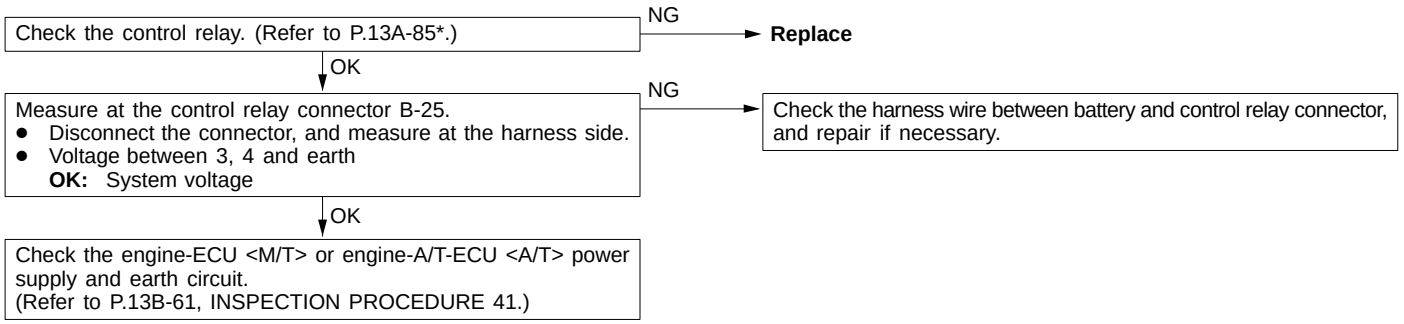
INSPECTION PROCEDURE 25

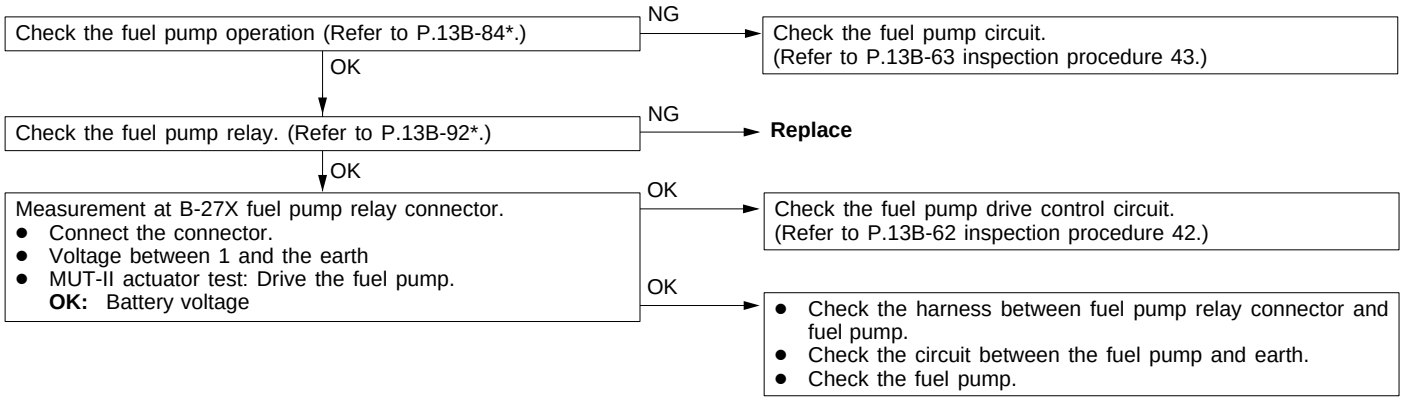
Power supply system and ignition switch-IG system	Probable cause
When an ignition switch ON signal is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, the engine-ECU <M/T> or engine-A/T-ECU <A/T> turns the control relay ON. This causes battery voltage to be supplied to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, injectors and air flow sensor.	• Malfunction of the ignition switch • Malfunction of the control relay • Improper connector contact, open circuit or short-circuited harness wire • Disconnected engine-ECU <M/T> or engine-A/T-ECU <A/T> earth wire • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

INSPECTION PROCEDURE 26

Fuel pump system	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> turns the control relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.	• Malfunction of the fuel pump relay • Malfunction of the fuel pump • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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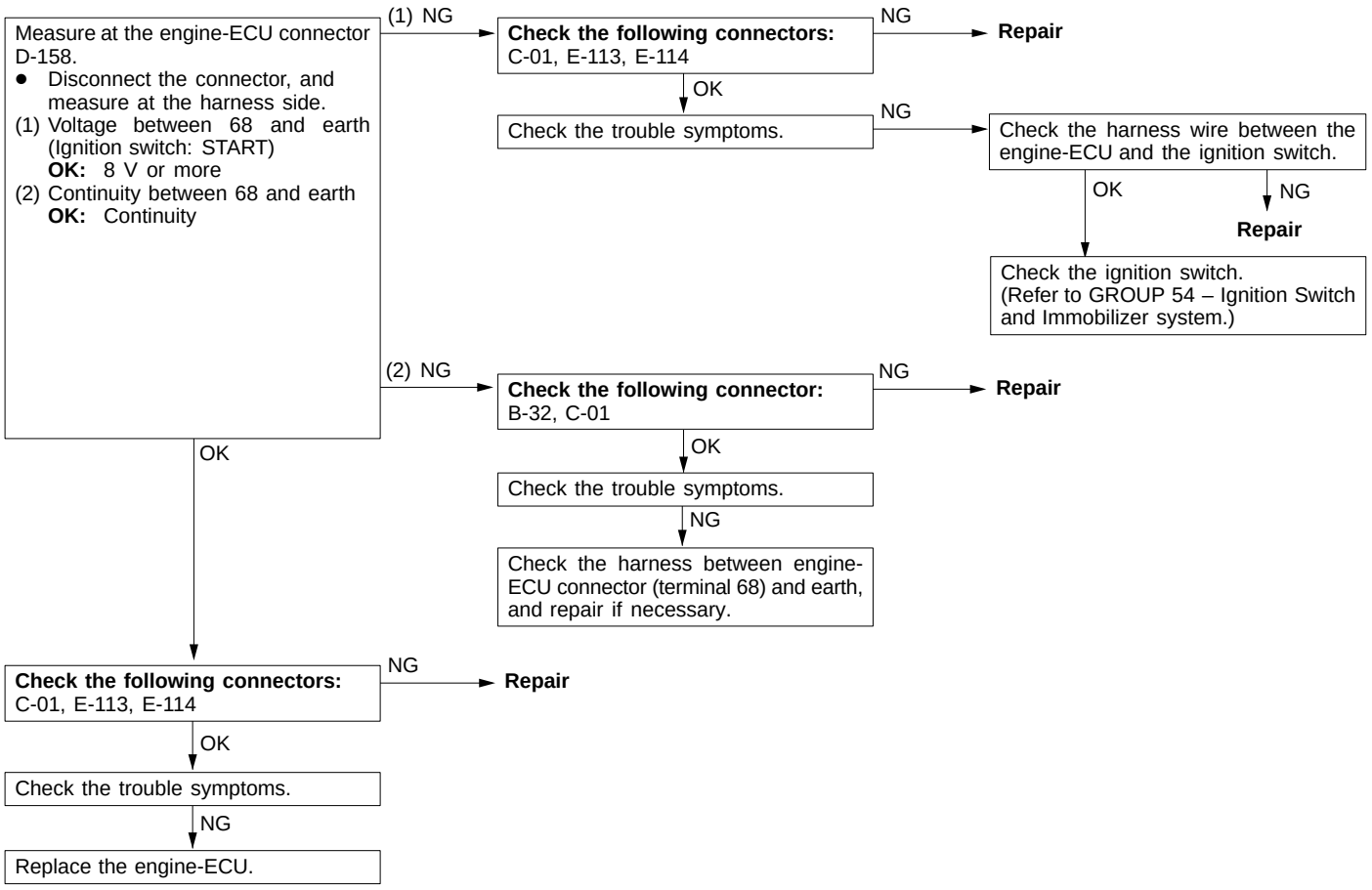
INSPECTION PROCEDURE 27

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU <M/T> while the engine is cranking. The engine-ECU <M/T> 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



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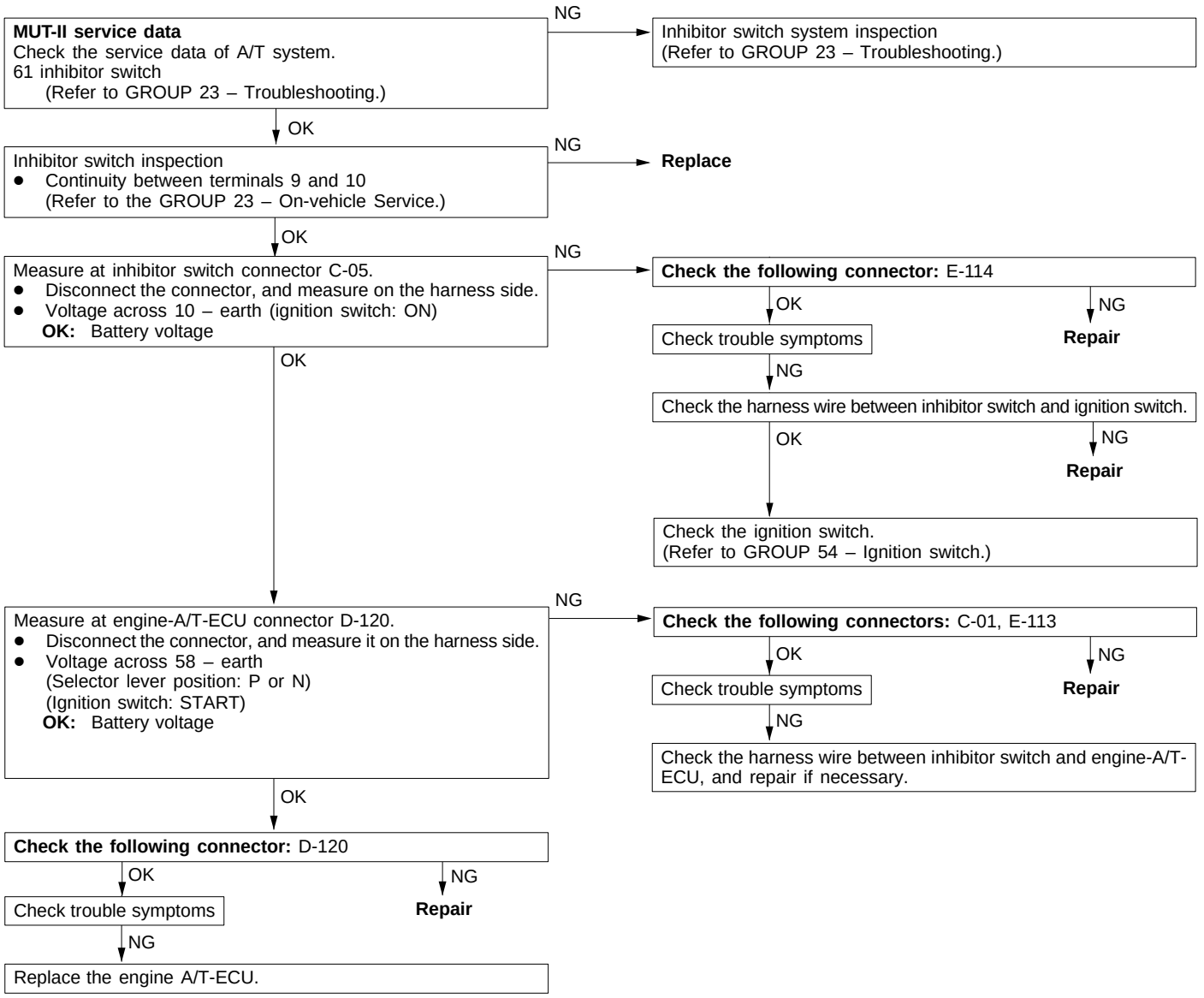
INSPECTION PROCEDURE 28

Ignition switch – ST, inhibitor switch system <A/T>	Probable cause
The ignition switch – ST inputs the High signal to the engine-A/T-ECU during engine cranking. The engine-A/T-ECU controls the fuel injection and others according to the signal during starting. The inhibitor switch inputs the position of the selector lever to the engine-A/T-ECU. The engine-A/T-ECU applies ISC control according to the input.	• Malfunction of the ignition switch • Malfunction of the inhibitor switch • Wire breakage, short-circuit or poor connector contact in the circuit between the ignition switch and inhibitor switch • Malfunction of the engine-A/T-ECU



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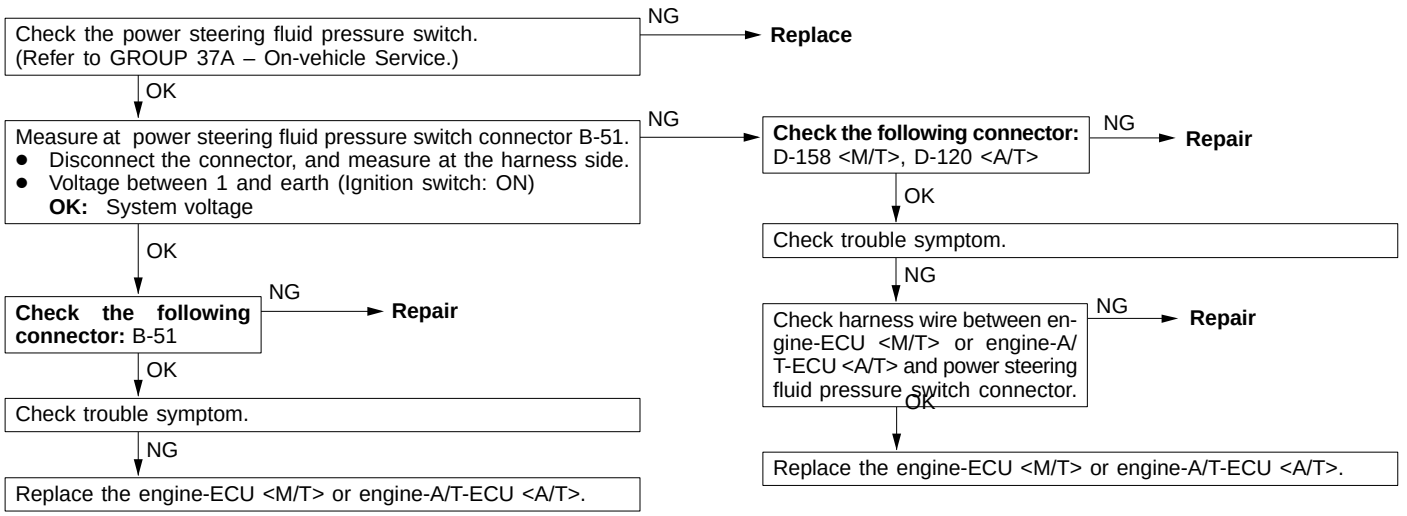
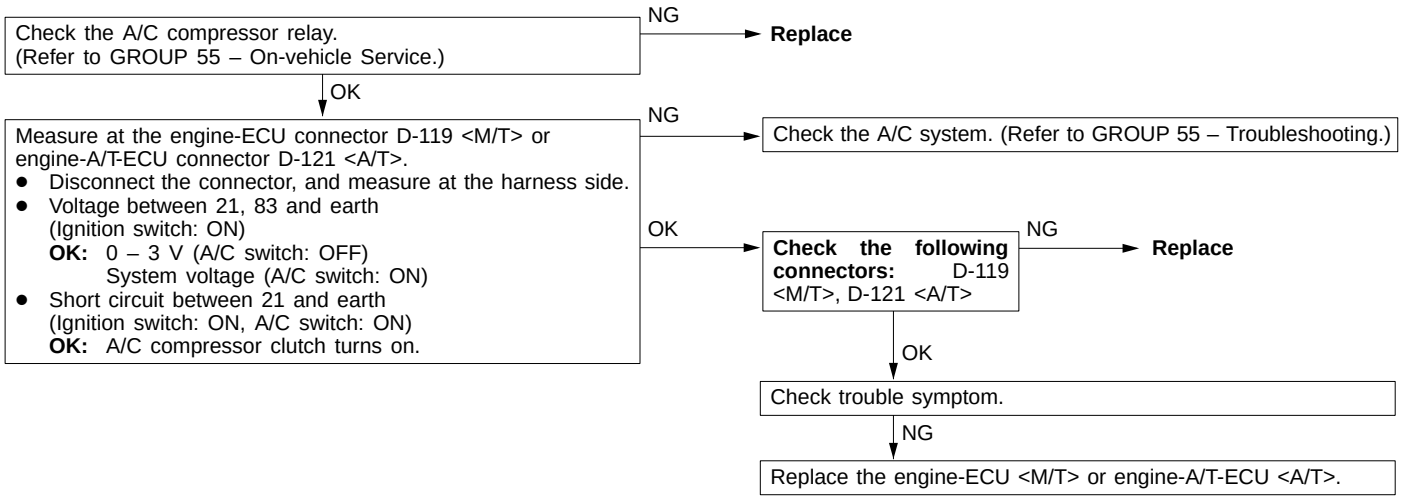
INSPECTION PROCEDURE 29

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-ECU. The engine-ECU controls the idle speed control (ISC) servo based on this input.	• Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



INSPECTION PROCEDURE 30

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, the engine-ECU <M/T> or engine-A/T-ECU <A/T> carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	• Malfunction of A/C control system • Malfunction of A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



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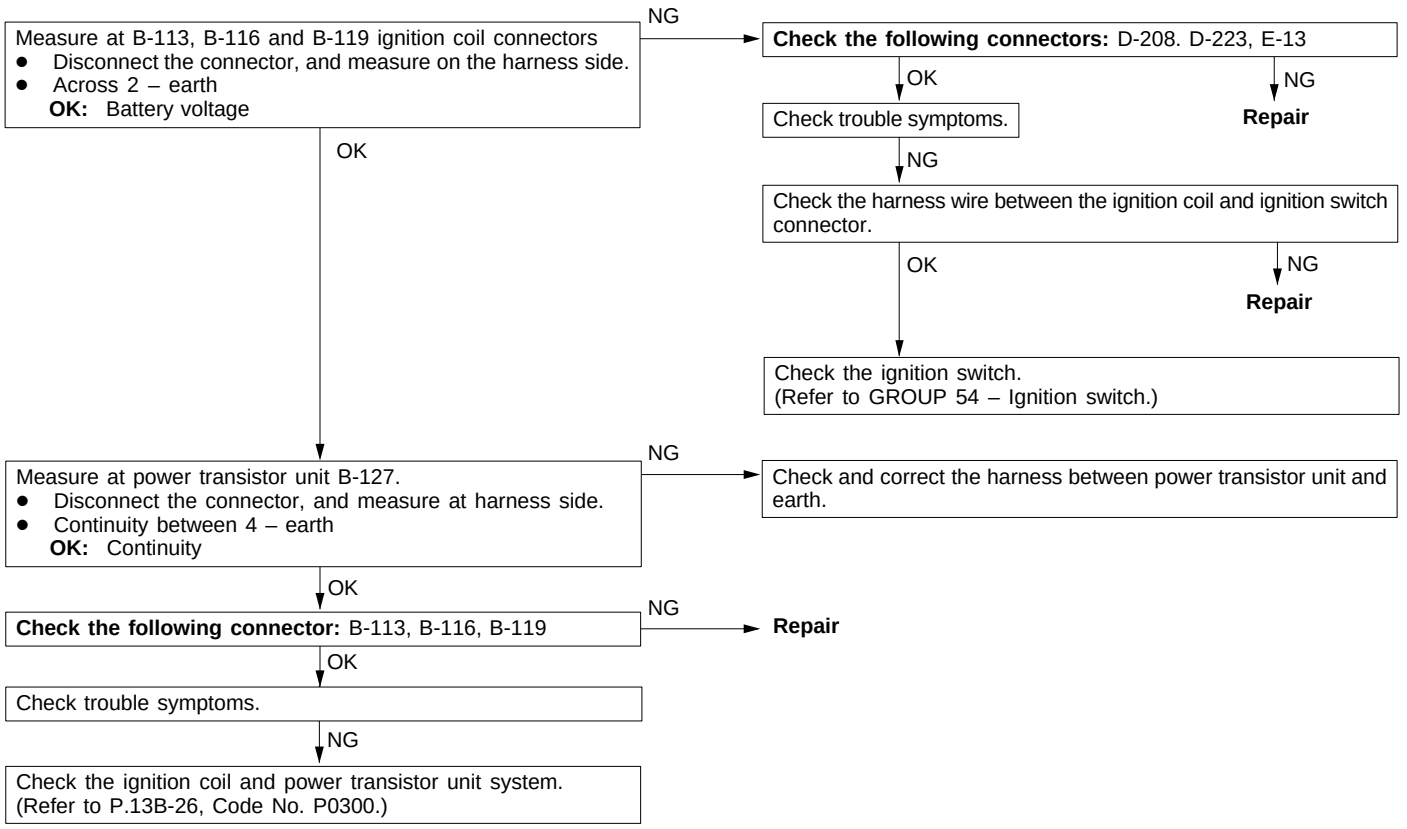
INSPECTION PROCEDURE 31

Ignition circuit system	Probable cause
The engine-ECU <M/T> turns on and off the primary current of the ignition coil by turning on and off the power transistor in the unit.	• Malfunction of ignition coil • Wire breakage and short circuit in the circuit, or poor connector contact • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



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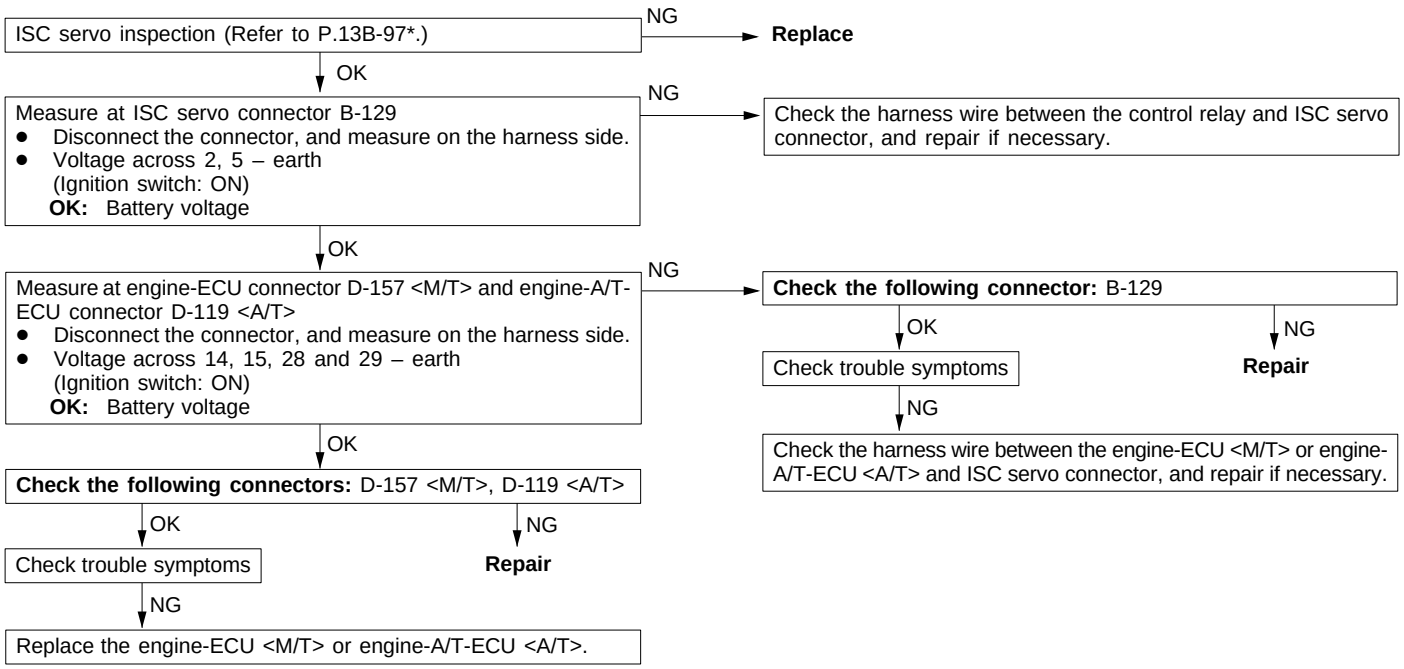
INSPECTION PROCEDURE 32

Idle speed control (ISC) servo (stepper motor) system	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the intake air flow rate during idling by opening and closing the servo valve which is provided on the bypass passage.	• Malfunction of the ISC servo • Wire breakage and short circuit in the circuit, or poor connector contact • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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INSPECTION PROCEDURE 33

MUT-II: Inspection when initial combustion does not occur

MUT-II Service data
16 battery voltage (Refer to P.13B-67.)
→ NG: Check the power supply and ignition switch IG system. (Refer to P.13B-50, inspection procedure 25.)
→ OK:

Does the camshaft revolve during engine cranking.
→ NO: Check the timing belt breakage.
→ YES:

MUT-II Diagnosis code
Is the diagnosis code output?
→ YES: Inspection Chart for Diagnosis codes (Refer to P.13B-7.)
→ NO:

MUT-II Service data
22 crank angle sensor
OK: Cranking revolution speed is indicated.
→ NG: Check the crank angle sensor system. (Refer to P.13B-28, code No. P0335.)
→ OK:

MUT-II Actuator test
07 fuel pump (Refer to P.13B-72.)
→ NG: Check the fuel pump system. (Refer to P13B-50, inspection procedure 26.)
→ OK:

MUT-II Service data
21 Engine coolant temperature sensor (Refer to P.13B-67.)
→ NG: Check the engine coolant temperature sensor. (Refer to P.13B-11, code No. P0115.)

INSPECTION PROCEDURE 34

Ignition system: Inspection when any initial ignition does not occur

Measure at B-113, B-116 and B-119 ignition connectors
- Connector connection (Test harness: Use of MB991348)
- Sequentially connect the tachometer of the primary voltage detection type to the terminal 1 of each connector.

OK: At all terminals, the engine tachometer indicates one third of the cranking revolution speed.
→ NG: Check the ignition circuit system. (Refer to P.13B-53, inspection procedure 30.)
→ OK:

Check the ignition timing during cranking.
OK Approx. 5°BTDC
→ NG: Check the installation of the crank angle sensor and timing belt cover.

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INSPECTION PROCEDURE 35

MUT-II: Check if incomplete combustion occurs

MUT-II Diagnosis code
Is the diagnosis code output?
→ YES → Inspection Chart for Diagnosis Codes (Refer to P.13B-7.)
↓ NO

MUT-II Actuator test
07 fuel pump (Refer to P.13B-72.)
→ NO → Check the fuel pump system. (Refer to P13B-50, inspection procedure 26.)
↓ OK

MUT-II Service data
21 Engine coolant temperature sensor (Refer to P.13B-67.)
→ NG → Check the engine coolant temperature sensor. (Refer to P.13B-11, code No. P0115.)
↓ OK

MUT-II Service data
18 ignition switch – ST (Refer to P.13B-67.)
→ NG → Check the ignition switch ST system <M/T> (Refer to P13B-51, inspection procedure 27.)
Check the ignition switch – ST and inhibitor switch system <A/T> (Refer to P.13B-52, inspection procedure 28.)

INSPECTION PROCEDURE 36

Hunting inspection

Clean the throttle body. (Refer to P.13B-84*.)
↓

Check trouble symptoms
→ NG →
- The intake manifold gasket is broken.
- The air intake hose is broken.
- The vacuum hose is broken.
- The positive crankcase ventilation (PCV) valve malfunctions.

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INSPECTION PROCEDURE 37

MUT-II: Check if idling is unstable

MUT-II Service data
13 intake air temperature sensor (Refer to P.13B-67.)
NG → Check the intake air temperature sensor. (Refer to P.13B-10, code No. P0110.)
OK ↓

MUT-II Service data
21 Engine coolant temperature sensor (Refer to P.13B-67.)
NG → Check the engine coolant temperature sensor. (Refer to P.13B-11, code No. P0115.)
OK ↓

MUT-II Service data
11 Oxygen sensor
OK 600 to 1,000mV during rapid racing
NG → Check the oxygen sensor (right) system. (Refer to P.13B-16, code No.P0130.) Check the oxygen sensor (left) system. (Refer to P.13B-19, code No.P0150.)
OK ↓

MUT-II Service data
11 Oxygen sensor
OK It varies in the range of 0 to 400mV and 600 to 1,000mV.
NG → Measure the combustion pressure. (Refer to P.13B-88*.)
OK ↓

1. Check the air intake to the intake system.
   - The intake manifold gasket is broken.
   - The vacuum hose is broken.
   - PCV valve malfunctions.
   - The air intake hose is broken.
2. Check the injector for clogging.

OK ↓

MUT-II Service data
27 Power steering fluid pressure switch (Refer to P.13B-68.)
NG → Check the power steering fluid pressure switch. (Refer to P.13B-53, inspection procedure 29.)
OK ↓

MUT-II Service data
28 A/C switch (Refer to P.13B-68.)
NG → Check A/C switch and A/C relay system. (Refer to P.13B-53, inspection procedure 30.)
OK ↓

MUT-II Service data
45 ISC servo position (Refer to P.13B-70.)
NG → Adjust the standard idling revolution speed. (Refer to P.13B-86*.)

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INSPECTION PROCEDURE 38

MUT-II: Inspection when the engine stops during idling in the warm state

MUT-II Service data
13 intake air temperature sensor (Refer to P.13B-67.)
NG → Check the intake air temperature sensor. (Refer to P.13B-10, code No. P0110.)
OK ↓

MUT-II Service data
21 Engine coolant temperature sensor (Refer to P.13B-67.)
NG → Check the Engine coolant temperature sensor. (Refer to P.13B-11, code No. P0115.)
OK ↓

MUT-II Service data
11 Oxygen sensor
OK 600 to 1,000mV during rapid racing
NG → Check the oxygen sensor (right) system. (Refer to P.13B-16, code No. P0130.) Check the oxygen sensor (left) system. (Refer to P.13B-19, code No. P0150.)
OK ↓

MUT-II Service data
11 Oxygen sensor
OK It varies in the range of 0 to 400mV and 600 to 1000mV.
NG → Measure the combustion pressure. (Refer to P.13B-88*.)
OK ↓
OK ↓

1. Check the air intake to the intake system.
   - The intake manifold gasket is broken.
   - The vacuum hose is broken.
   - PCV valve malfunctions.
   - The air intake hose is broken.
2. Check the injector for clogging.

MUT-II Service data
27 Power steering fluid pressure switch (Refer to P.13B-68.)
NO → Check the power steering fluid pressure switch. (Refer to P.13B-53, inspection procedure 29.)
OK ↓

MUT-II Service data
28 A/C switch (Refer to P.13B-68.)
NG → Check A/C switch and A/C relay system. (Refer to P.13B-53, inspection procedure 30.)
OK ↓

MUT-II Service data
34 Air flow sensor resetting signal (Refer to P.13B-68.)
NG → Check the air flow sensor system. (Refer to P.13B-8, code No. P0100.)
OK ↓

MUT-II Service data
45 ISC servo position (Refer to P.13B-70.)
NG → Adjust the standard idling revolution speed. (Refer to P.13B-86*.)

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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INSPECTION PROCEDURE 39

MUT-II: Inspection of breathing, slow progression and poor acceleration

MUT-II Service data
13 intake air temperature sensor (Refer to P.13B-67.)
NG → Check the intake air temperature sensor. (Refer to P.13B-10, code No. P0110.)
OK ↓

MUT-II Service data
21 Engine coolant temperature sensor (Refer to P.13B-67.)
NG → Check the Engine coolant temperature sensor. (Refer to P.13B-11, code No. P0115.)
OK ↓

MUT-II Service data
14 Throttle position sensor (Refer to P.13B-67.)
NG → Check the throttle position sensor (TPS) system. (Refer to P.13B-14, Code No. P0120.)
OK ↓

MUT-II Service data
11 Oxygen sensor
OK 600 to 1,000mV during rapid racing
NG → Check the oxygen sensor (right) system. (Refer to P.13B-16, code No.P0130.) Check the oxygen sensor (left) system. (Refer to P.13B-19, code No.P0150.)
OK ↓

MUT-II Service data
11 Oxygen sensor
OK It varies in the range of 0 to 400mV and 600 to 1000mV.
NG → Measure the combustion pressure. (Refer to P.13D-86.)
OK ↓

1. Check the air intake to the intake system.
   - The intake manifold gasket is broken.
   - The vacuum hose is broken.
   - PCV valve malfunctions.
   - The air intake hose is broken.
2. Check the injector for clogging.

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

INSPECTION PROCEDURE 40

MUT-II: Inspection of singulation

MUT-II Service data
13 intake air temperature sensor (Refer to P.13B-67.)
NG → Check the intake air temperature sensor. (Refer to P.13B-10, code No. P0110.)
OK ↓

MUT-II Service data
21 Engine coolant temperature sensor (Refer to P.13B-67.)
NG → Check the Engine coolant temperature sensor. (Refer to P.13B-11, code No. P0115.)
OK ↓

MUT-II Service data
14 Throttle position sensor (Refer to P.13B-67.)
NG → Check the throttle position sensor (TPS) system. (Refer to P.13B-14, Code No. P0120.)
OK ↓

MUT-II Service data
11 Oxygen sensor
OK 600 to 1,000mV during rapid racing
NG → Check the oxygen sensor (right) system. (Refer to P.13B-16, code No.P0130.) Check the oxygen sensor (left) system. (Refer to P.13B-19, code No.P0150.)
OK ↓

MUT-II Service data
11 Oxygen sensor
OK It varies in the range of 0 to 400mV and 600 to 1000mV.
NG → Measure the combustion pressure. (Refer to P.13D-86.)
OK ↓

1. Check the air intake to the intake system.
   - The intake manifold gasket is broken.
   - The vacuum hose is broken.
   - PCV valve malfunctions.
   - The air intake hose is broken.
2. Check the injector for clogging.

NOTE:
*: Refer to the 2001 PAJERO Workshop Manual (Pub. No. PWJE0005)

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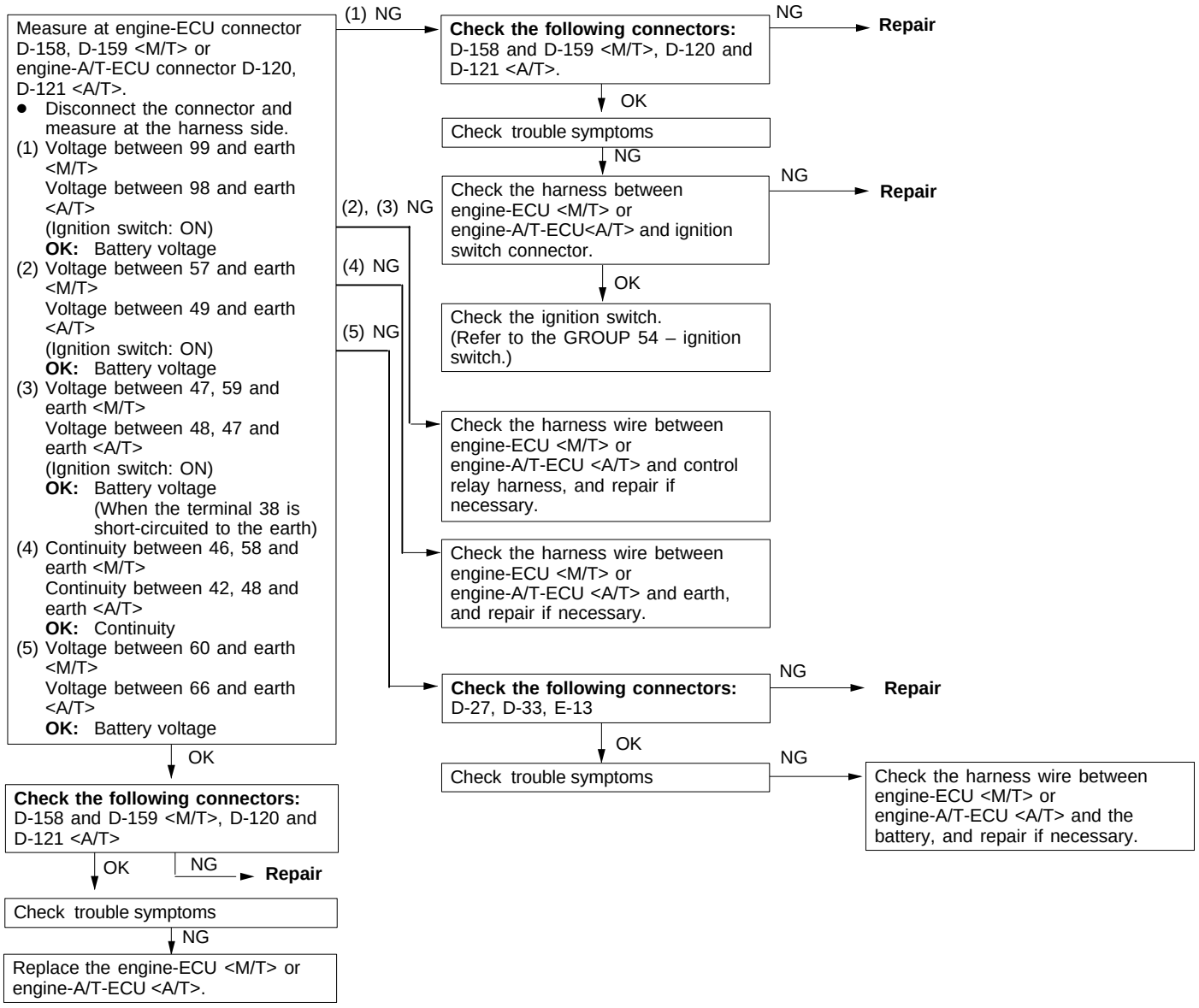
INSPECTION PROCEDURE 41

Engine-ECU<M/T> or engine-A/T-ECU<A/T> power supply and earth circuit system



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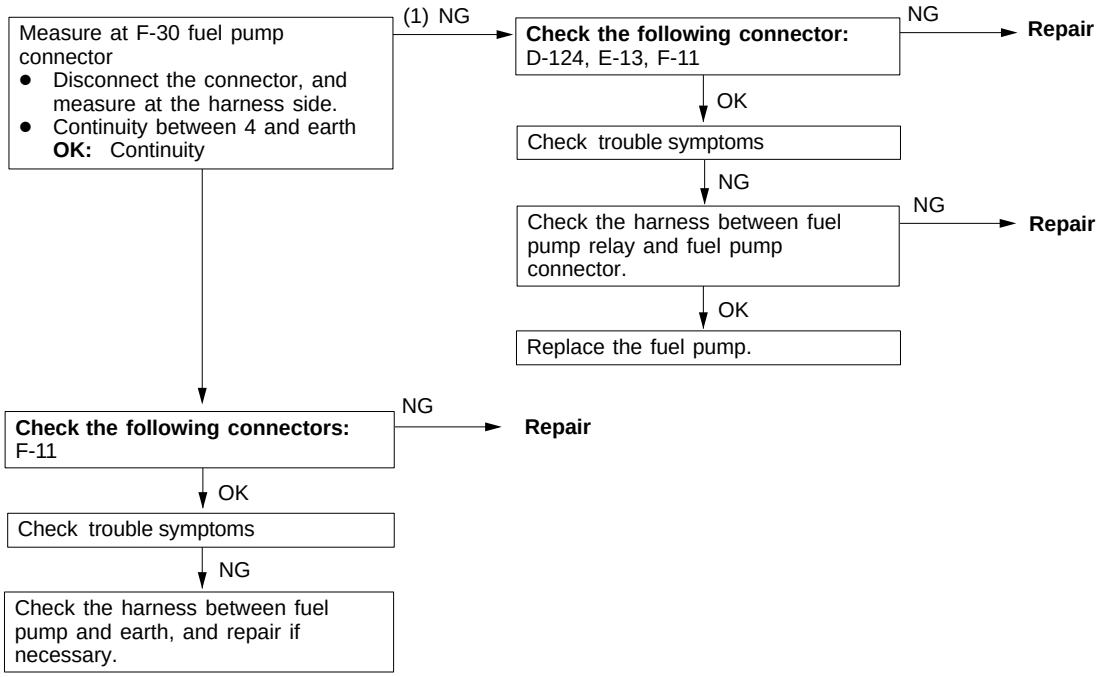
INSPECTION PROCEDURE 42

Fuel pump circuit inspection



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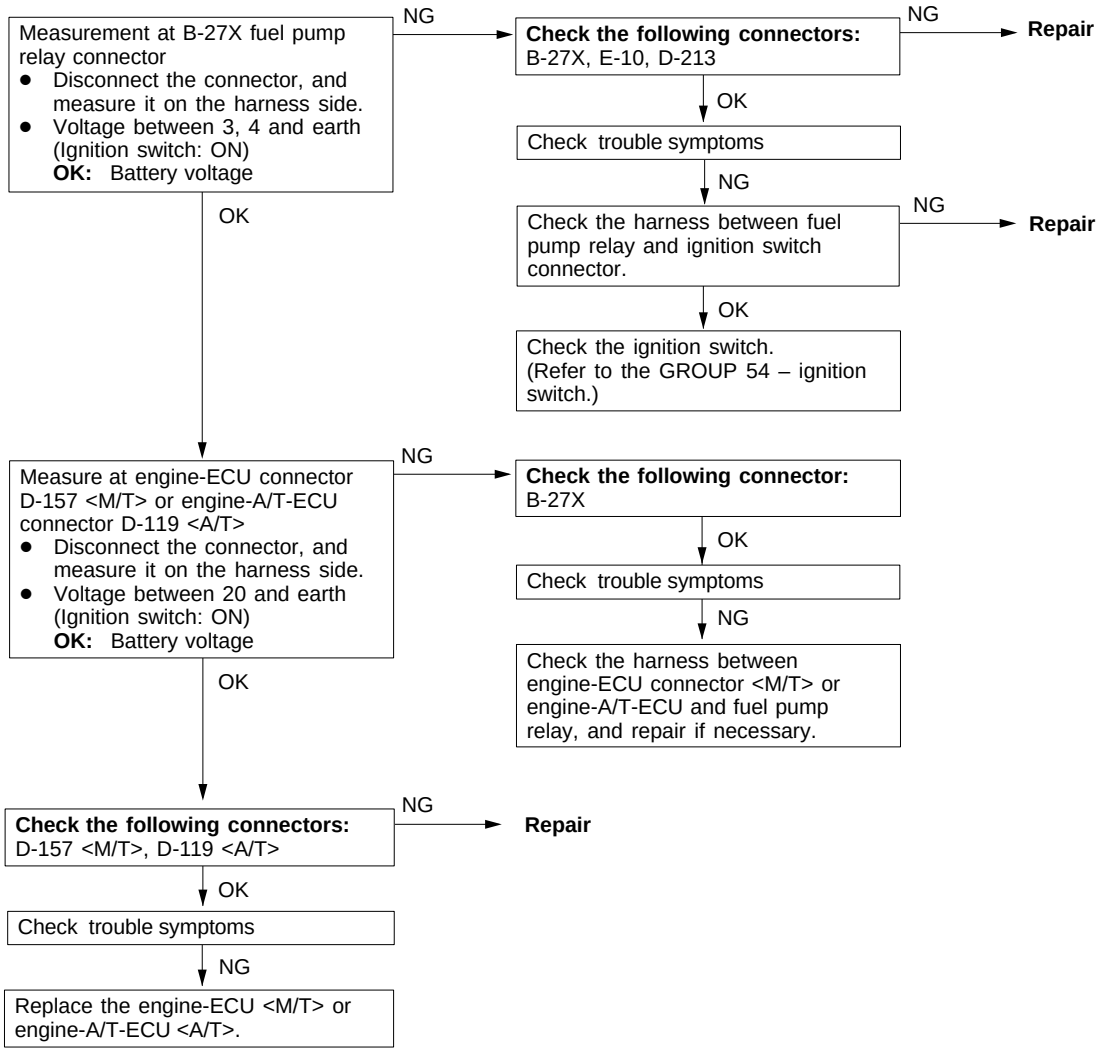
INSPECTION PROCEDURE 43

Fuel pump drive control circuit inspection



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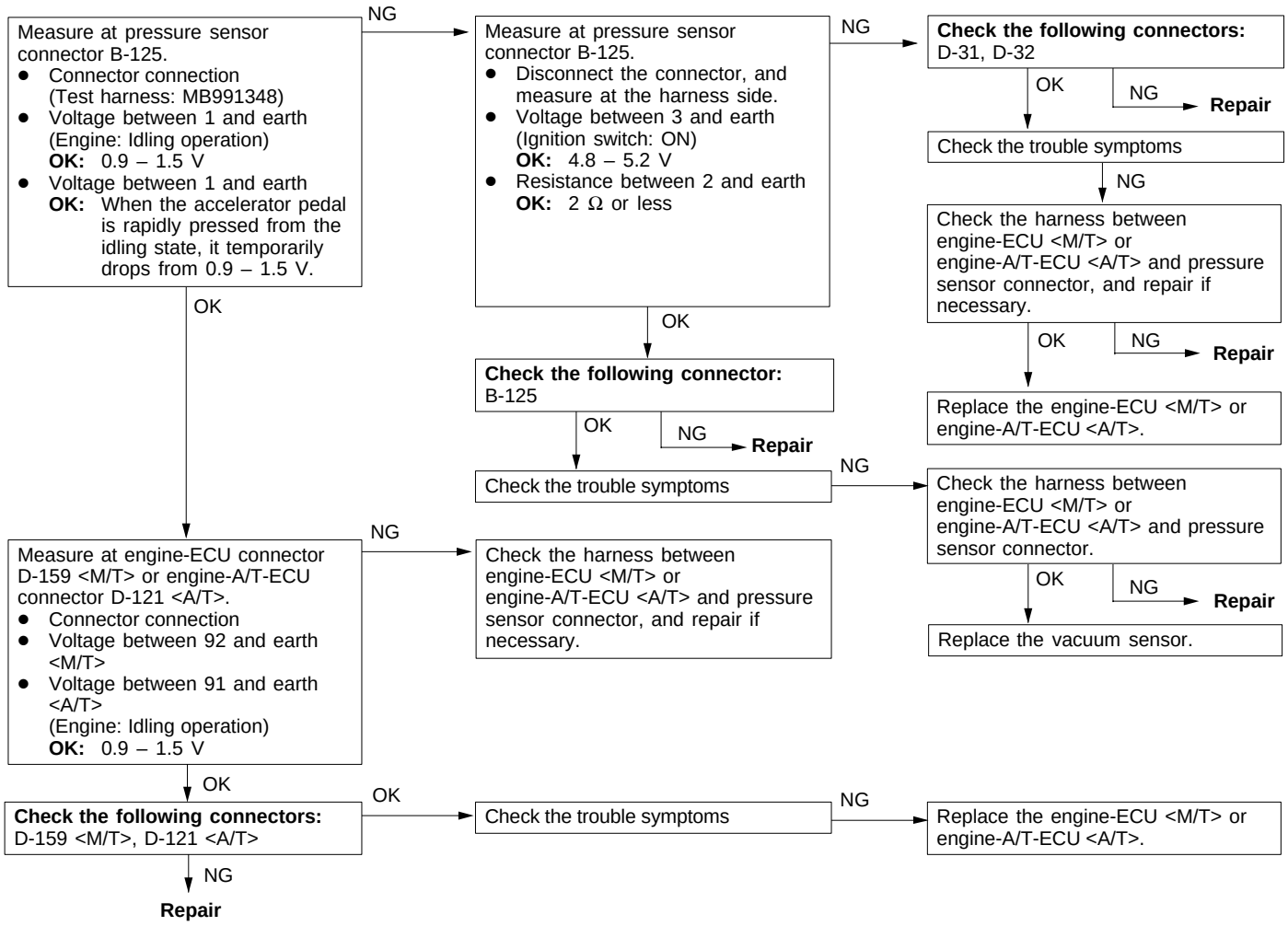
INSPECTION PROCEDURE 44

Pressure sensor system	Probable cause
The pressure sensor is used to estimate the atmospheric pressure from the intake pipe pressure during starting and in the fully open state of the throttle and to detect the pressure variation during EGR activation.	• Malfunction of pressure sensor. • Wire breakage or short circuit in the pressure sensor • Poor contact of connector • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



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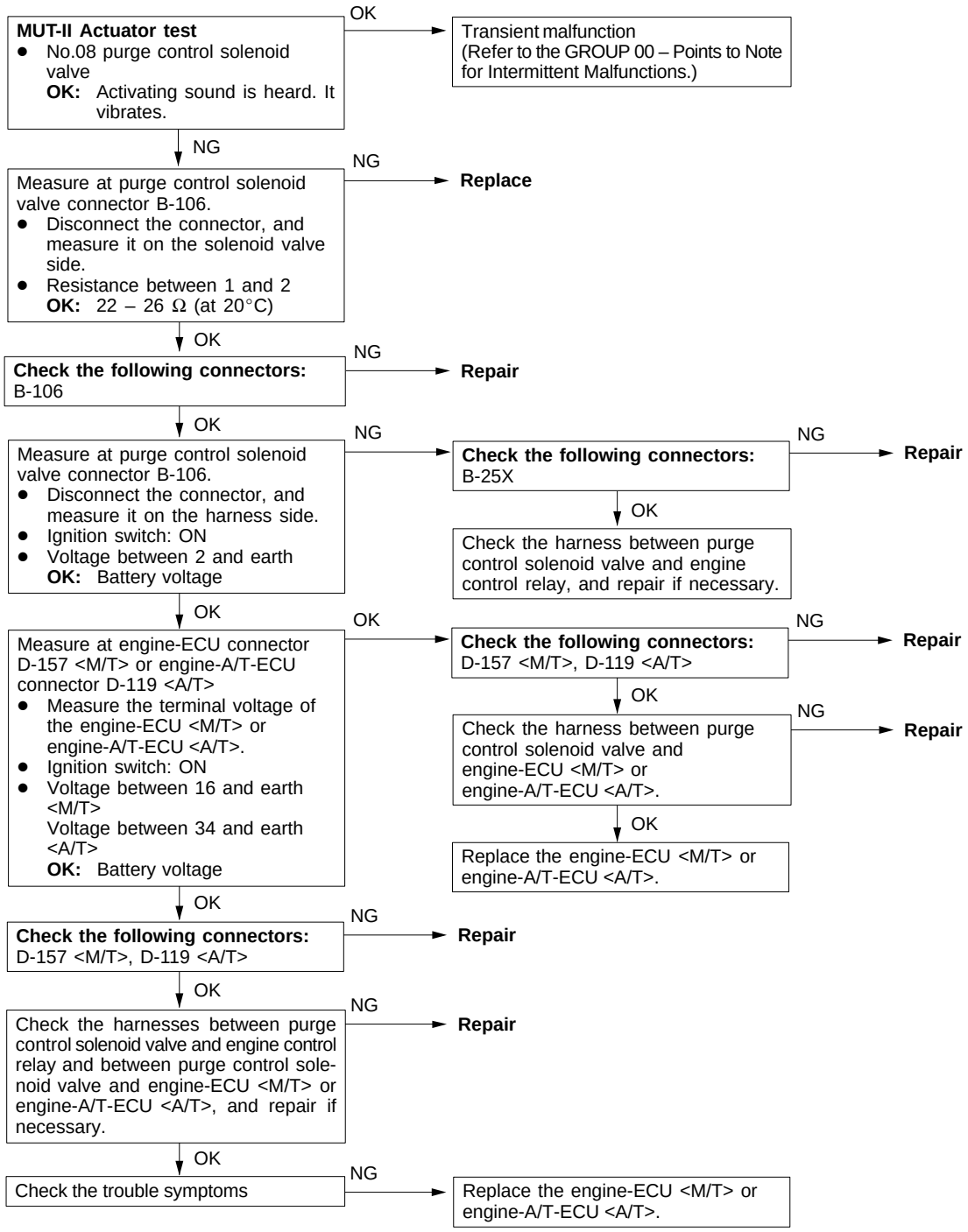
INSPECTION PROCEDURE 45

Purge control solenoid valve system	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the purge air from the canister by controlling the purge control solenoid valve.	• Malfunction of purge control solenoid valve • Wire breakage and short circuit in the purge control solenoid valve circuit, or poor contact of connector • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



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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. The injector drive time represents the time when the cranking speed is at 250 r/min or below when the power supply voltage is 11 V.
*2. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10 % longer than the standard time.
*3. In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.
*4. The bank 1 indicates the right bank, and the bank 2 indicates the left bank.
*:★ It is not indicated when the service data of the check mode is selected.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Right bank oxygen sensor	Engine:After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Code No. P0130	13B-16
			When engine is suddenly raced	600 – 1,000 mV		
		Engine:After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the engine-ECU <M/T> or engine-A/T-ECU <A/T>	Engine is idling	400 mV or less (Changes) 600 – 1,000 mV		
			2,500 r/min			
12	Air flow sensor	● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range)	Engine is idling	17 – 43 Hz	Code No. P0100	13B-8
			2,500 r/min	60 – 100 Hz		
			Engine is raced	Frequency increases in response to racing		

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. P0110	13B-10
			When intake air temperature is 0°C	0°C		
			When intake air temperature is 20°C	20°C		
			When intake air temperature is 40°C	40°C		
			When intake air temperature is 80°C	80°C		
14	Throttle position sensor	• After having warmed up • Ignition switch: ON (Engine:stopped)	Release the acelerator pedal	535 – 735 mV or more	Code No. P0120	13B-14
			Depress the accelerator pedal gradully	Decrease in response to accelerator pedal depression stroke		
			Depress the accelerator pedal fully	4,500 – 5,500 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 25	13B-50
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 28	13B-52
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is –20°C	–20°C	Code No. P0115	13B-11
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			When engine coolant temperature is 80°C	80°C		

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13B-28
		• Engine: Idling	When engine coolant temperature is –20°C	1,300 – 1,500 rpm		
			When engine coolant temperature is 0°C	1,300 – 1,500 rpm		
			When engine coolant temperature is 20°C	1,300 – 1,500 rpm		
			When engine coolant temperature is 40°C	1,000 – 1,200 rpm		
			When engine coolant temperature is 80°C	650 – 750 rpm		
24★	Vehicle speed sensor	Drive at 40 km/h		Approximately 40 km/h	Code No. P0500	13B-33
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No.29	13B-53
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (when A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 30	13B-53
			A/C switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No. P0100	13B-8
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 85 – 95°C • Lights, power cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	15 – 35 %	–	–
			2,500 r/min	15 – 35 %		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
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.	Code No. P0335	13B-28
39	Left bank oxygen sensor	Engine: After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Code No. P0150	13B-19
			When engine is suddenly raced	600 – 1,000 mV		
		Engine: After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the engine-ECU <M/T> or engine-A/T-ECU <A/T>	Engine is idling	400 mV or less (Changes) 600 – 1,000 mV		
			2,500 r/min			
41	Injectors*1	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)	15.6 – 16.8 ms	–	–
			When engine coolant temperature is 20°C	40.6 – 41.8 ms		
			When engine coolant temperature is 80°C	9.4 – 10.6 ms		
	Injectors*2	• Engine coolant temperature: 85 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	2.2 – 3.4 ms		
			2,500 r/min	2.0 – 3.2 ms		
			When engine is suddenly raced	Increases		

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
44	Ignition coils and power transistors	• Engine: After having warmed up • Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	2 – 18°BTDC	Code No.P0300	13B-26
			2,500 r/min	28 – 48°BTDC		
45	ISC (stepper) motor position*3	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range) • Engine: Idling (When A/C switch is ON, A/C compressor should be operating)	A/C switch: OFF	2 – 25 STEP	–	–
			A/C switch: OFF → ON	Increases by 10 – 70 steps		
			• A/C switch: OFF • Select lever: N range → D range	Increases by 5 – 50 steps		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 30	13B-53
			A/C switch: ON	ON (Compressor clutch is operating)		
81★	Long-term fuel compensation (bank 1)*4	Engine: Warm, 2,500 r/min without any load (during closed loop)		–12.5 – 12.5 %	Code No. P0170	13B-22
82★	Short-term fuel compensation (bank 1)*4	Engine: Warm, 2,500 r/min without any load (during closed loop)		–30 – 25 %	Code No. P0170	13B-22

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
83★	Long-term fuel compensation (bank 2)*4	Engine: Warm, 2,500 r/min without any load (during closed loop)		–12.5 – 12.5 %	Code No. P0173	13B-24
84★	Short-term fuel compensation (bank 2)*4	Engine: Warm, 2,500 r/min without any load (during closed loop)		–30 – 25 %	Code No. P0173	13B-24
87★	Calculation load value	Engine: Warm	Engine: Idling	15 – 35 %	–	–
			2,500 r/min	15 – 35 %		
A1★	Oxygen sensor (Bank 1)	Engine: After warm-up	Idling	0 V	Code No. P0130	13B-16
			Sudden racing	0.6 – 1.0 V		
			2,500 r/min	0.4 V or less and 0.6 – 1.0 V alternates		
A3★	Oxygen sensor (Bank 2)	Engine: After warm-up	Idling	0 V	Code No. P0130	13B-16
			Sudden racing	0.6 – 1.0 V		
			2,500 r/min	0.4 V or less and 0.6 – 1.0 V alternates		
8A★	Throttle position sensor (throttle valve opening angle)	• Engine: Warm • Ignition switch: ON (Engine: Stopped)	Release the accelerator pedal	8 – 16 %	Code No. P0120	13B-14
			Depress the accelerator pedal gradually	Increase in response to accelerator pedal depression stroke		
			Depress the accelerator pedal fully	80 – 100 %		

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ACTUATOR TEST REFERENCE TABLE

NOTE
*** At the same time when the engine alarm lamp is lit during setting, the engine state of the time is memorized as the freeze frame data. (The freeze frame data with MUT-II can not be checked.) Though the engine alarm lamp goes out when it is released, the freeze frame data will remain memorized. Using MUT-II, erase the freeze frame data using MUT-II, or disconnect the negative battery cable from the battery terminal 10 seconds or more, reconnect it and idle the engine approx. 10 minutes.**

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, P0202, P0203, P0204, P0205, P0206	13B-25
02		Cut fuel to No. 2 injector					
03		Cut fuel to No. 3 injector					
04		Cut fuel to No. 4 injector					
05		Cut fuel to No. 5 injector					
06		Cut fuel to No. 6 injector					
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 27	13B-51
				Listen near the fuel tank for the sound of fuel pump operation.	Sound of operation is heard.		
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No. 45	13B-64

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Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
10	EGR 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. P0403	13B-32
17	Basic ignition timing*	Set to ignition timing adjustment mode	● Engine: Idling ● Timing light is set	5°BTDC	–	–
21	Fan controller	Drive the fan motor	● Engine: Idling ● Timing light is set	Radiator fan and condenser fan rotate at high speed	Procedure No. 24	13B-49
30	SAS adjustment mode	Bring Engine-ECU <M/T> or engine-A/T-ECU <A/T> into the SAS adjustment mode.	Engine: Idling	6 STEP	–	–

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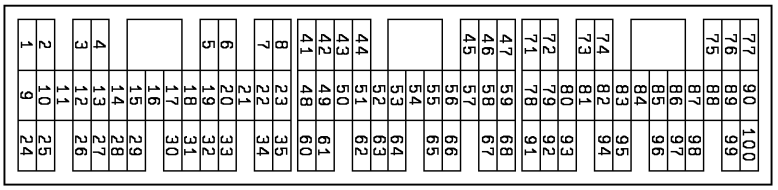
CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU <M/T> or Engine-A/T-ECU <A/T> Connector Terminal Arrangement

<M/T>



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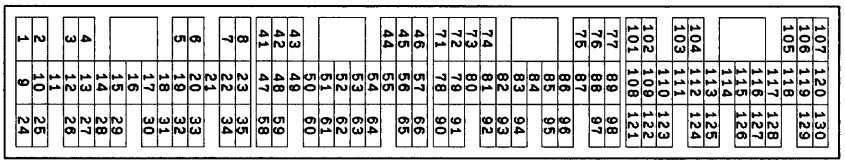
<A/T>



7FU1763

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)	Normal condition
1	1	No. 1 injector	Engine: After warm-up, rapidly press the accelerator pedal from the idling state.	The voltage temporarily and slightly drops from 11 to 14V.
9	9	No. 2 injector		
24	24	No. 3 injector		
2	2	No. 4 injector		
10	10	No. 5 injector		
25	25	No. 6 injector		
3	3	Oxygen sensor heater (left)	Engine: Idling operation	0 – 3 V
			Engine: 5000 r/min	Battery voltage
4	4	Oxygen sensor heater (right)	Engine: Idling operation	0 – 3 V
			Engine: 5000 r/min	Battery voltage
6	6	EGR control solenoid valve	Ignition switch: ON	Battery voltage
			Engine: Rapidly press the accelerator pedal from the idling state.	The voltage temporarily drops from the battery voltage.

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Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
11	11	Ignition coil – No. 1, No. 4 (Power transistor)	Engine: 3000 r/min		0.3 – 3.0 V
12	12	Ignition coil – No. 2, No. 5 (Power transistor)			
13	13	Ignition coil – No. 3, No. 6 (Power transistor)			
14	14	Stepper motor coil (A1)	Engine: Soon after the warmed-up engine is ready for starting		Battery voltage ⇔ 0 – 6V (Variation is repeated.)
28	28	Stepper motor coil (A1)			
15	15	Stepper motor coil (B1)			
29	29	Stepper motor coil (B2)			
16	34	Purge control solenoid valve	● Engine cooling water temperature: 80 to 95°C ● Ignition switch: ON	Engine: Stop	Battery voltage
				Engine: Soon after starting the engine, raise it to 3500 r/min.	The voltage drops.
18	18	Condenser fan relay	The condenser fan is not operated.		Battery voltage
			The condenser fan is operated.		0 – 3 V or more
19	19	Air flow sensor reset signal	Engine: Idling operation		0 – 1 V
			Engine: 3000 r/min		6 – 9 V
20	20	Fuel pump relay	Ignition switch: ON		Battery voltage
			Engine: Idling operation		0 – 3 V
21	21	A/C relay	● Engine: Idling operation ● A/C switch: OFF → ON (The compressor is driven.)		Battery voltage or temporary 6V or more → 0 – 3V
22	22	Engine alarm lamp	Ignition switch: OFF → ON		0 – 3 V → Battery voltage (after several seconds)
42	46	Sensor applied voltage	Ignition switch: ON		4.5 – 5.5 V
43	45	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
			Engine: Idling operation		1.5 – 2.5 V

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Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
44	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	43	Engine ignition signal	Engine: 3000 r/min		0.3 – 3.0 V
47	41	Power supply	Ignition switch: ON		Battery voltage
59	47				
50	56	Camshaft position sensor	Engine: Cranking		0.4 – 3.0 V
			Engine: Idling operation		0.5 – 2.0 V
54	52	Power steering fluid pressure switch	Engine: Idling operation after warm-up	The steering wheel is stopped.	Battery voltage
				The steering wheel is operated.	0 – 3 V
57	49	Control relay	Ignition switch: OFF		Battery voltage
			Ignition switch: ON		0 – 3 V
60	66	Backup power supply	Ignition switch: OFF		Battery voltage
61	65	Air flow sensor	Engine: Idling operation		2.2 – 3.2 V
			Engine: 2000 r/min		
62	64	Intake air temperature sensor	Ignition switch: ON	Intake air temperature of 0°C	3.2 – 3.8 V
				Intake air temperature of 20°C	2.3 – 2.9 V
				Intake air temperature of 40°C	1.5 – 2.1 V
				Intake air temperature of 80°C	0.4 – 1.0 V

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Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
65	61	A/C load signal	Refer to the GROUP 55 – troubleshooting (Inspection at A/C-ECU <M/T> or engine-A/T-ECU <A/T> output terminal).		
68	58	Ignition switch – ST	Engine: Cranking		8 V or more
71	71	Oxygen sensor (left)	Engine: After warm-up, 2500 r/min is held. (Use the digital type voltmeter for inspection.)		0 ⇔ 0.8 V (Variation is repeated.)
72	72	Oxygen sensor (right)	Engine: After warm-up, 2500 r/min is held. (Use the digital type voltmeter for inspection.)		0 ⇔ 0.8 V (Variation is repeated.)
78	78	Throttle position sensor	Ignition switch: ON	Set the throttle valve at the idling position.	0.3 – 1.0 V
				Fully open the throttle valve.	4.5 – 5.5 V
80	–	Vehicle speed sensor	• Ignition switch: ON • Slowly drive the car forward.		0 ⇔ 5 V (Variation is repeated.)
83	83	A/C switch	Engine: Idling operation	A/C switch: OFF	1 V or more
				A/C switch: ON (The compressor is running.)	Battery voltage
92	91	Pressure sensor	Ignition switch: ON	Altitude of 0 m	3.7 – 4.3 V
				Altitude of 1200 m	3.2 – 3.8 V
99	98	Ignition switch – IG	Ignition switch: ON		Battery voltage

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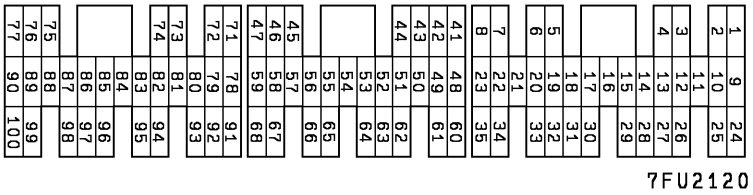
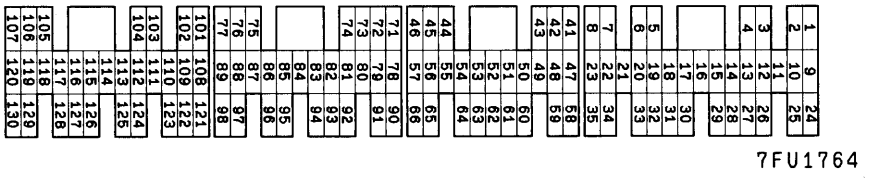
CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

Engine-ECU <M/T> or Engine-A/T-ECU <A/T> Harness Side Connector Terminal Arrangement

<M/T>



<A/T>



Terminal No. <M/T>	Terminal No. <A/T>	Inspection item	Normal condition (Check condition)
1 – 47	1 – 41	No. 1 injector	13 – 16 Ω (At 20°C)
9 – 47	9 – 41	No. 2 injector	
24 – 47	24 – 41	No. 3 injector	
2 – 47	2 – 41	No. 4 injector	
10 – 47	10 – 41	No. 5 injector	
25 – 47	25 – 41	No. 6 injector	
3 – 47	3 – 41	Oxygen sensor heater (left)	4.5 – 8.0 Ω (At 20°C)
4 – 47	4 – 41	Oxygen sensor heater (right)	4.5 – 8.0 Ω (At 20°C)
6 – 47	6 – 41	EGR control solenoid valve	36 – 44 Ω (At 20°C)
14 – 47	14 – 41	Stepper motor coil (A1)	28 – 33 Ω (At 20°C)
28 – 47	28 – 41	Stepper motor coil (A2)	
15 – 47	15 – 41	Stepper motor coil (B1)	
29 – 47	29 – 41	Stepper motor coil (B2)	

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Terminal No. <M/T>	Terminal No. <A/T>	Inspection item	Normal condition (Check condition)
15 – 47	34 – 41	Purge control solenoid valve	22 – 26 Ω (At 20°C)
44 – 49	44 – 57	Engine coolant temperature sensor	5.1 – 6.5 kΩ (At 0°C)
			2.1 – 2.7 kΩ (At 20°C)
			0.9 – 1.3 kΩ (At 40°C)
			0.26 – 0.36 kΩ (At 80°C)
46 – Body earth	42 – Body earth	Earth	Continuity is present. (0 Ω)
58 – Body earth	48 – Body earth		
62 – 49	64 – 57	Intake air temperature sensor	5.3 – 6.7 kΩ (At 0°C)
			2.3 – 3.0 kΩ (At 20°C)
			1.0 – 1.5 kΩ (At 40°C)
			0.30 – 0.42 kΩ (At 80°C)

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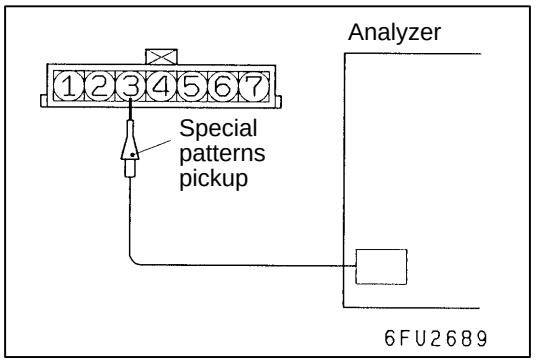


INSPECTION PROCEDURE USING AN ANALYZER

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)

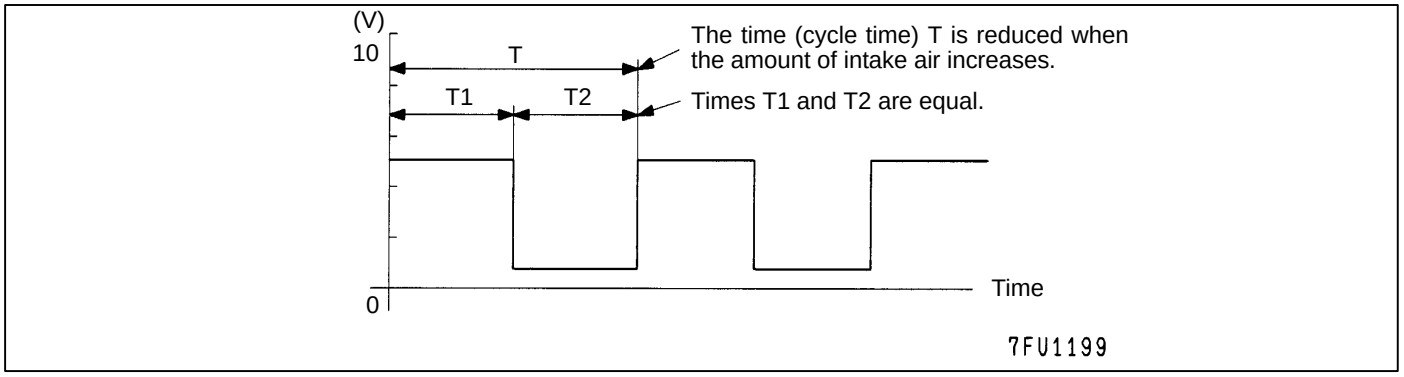
1. Connect the analyzer special patterns pickup to engine-ECU terminal 61 <M/T> or engine-A/T-ECU terminal 65 <A/T>.

Standard Wave Pattern

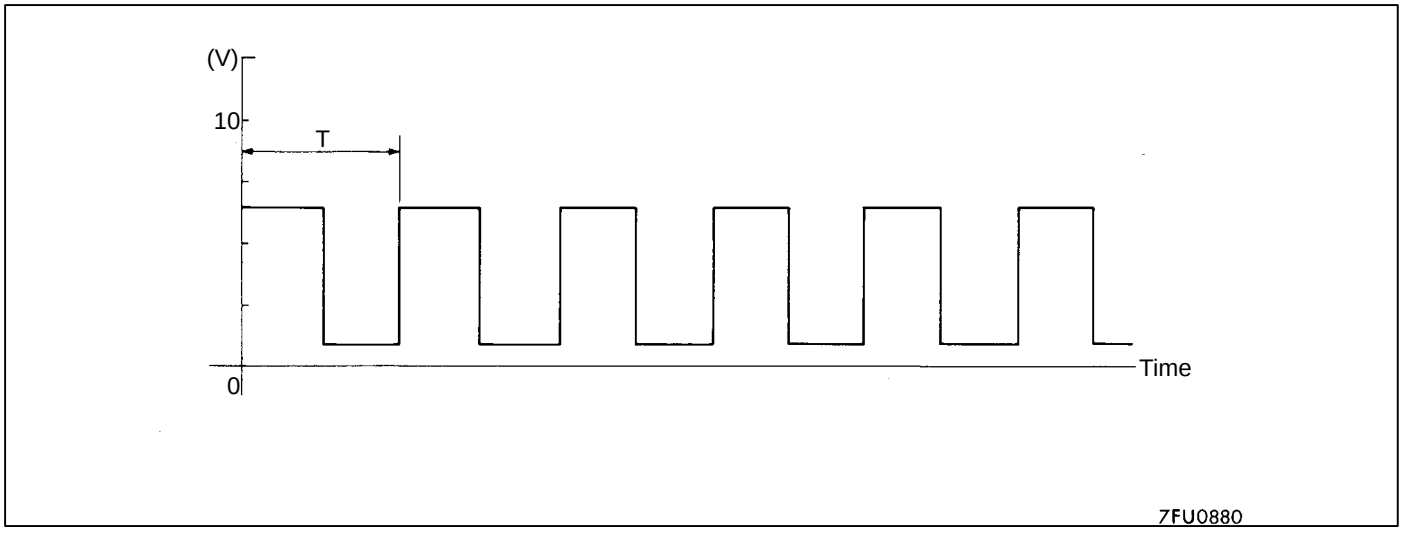
Observation conditions

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

Standard wave pattern

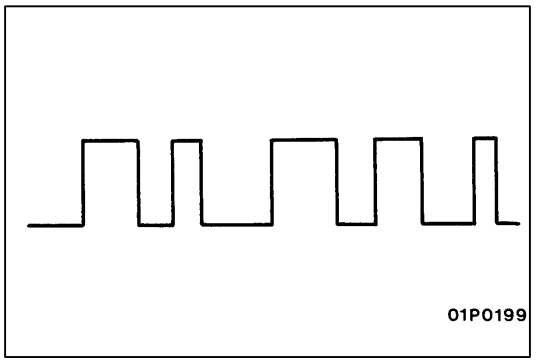


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

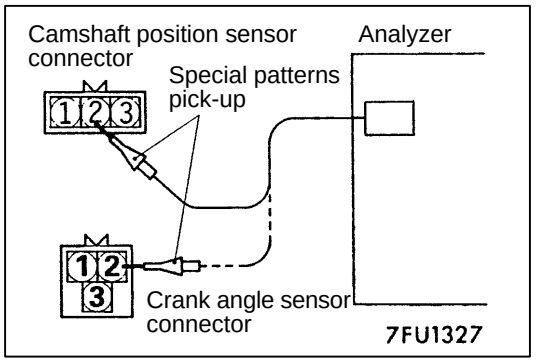
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

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



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

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

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to engine-ECU terminal 50 <M/T> or engine-A/T-ECU terminal 56 <A/T>. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 43 <M/T> or engine-A/T-ECU terminal 45. (When checking the crank angle sensor signal wave pattern.)

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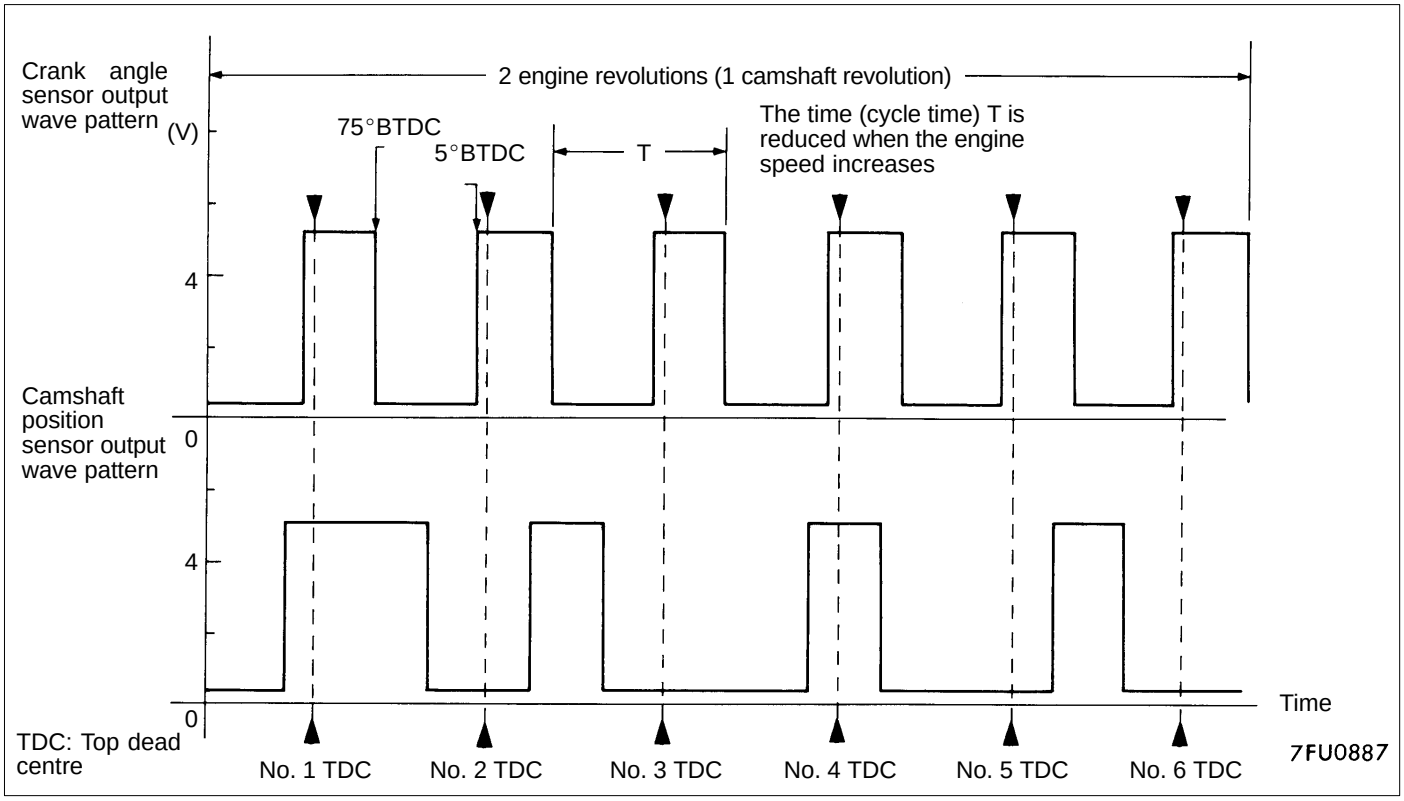
Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min.	Idle speed

Standard wave pattern



Wave Pattern Observation Points

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

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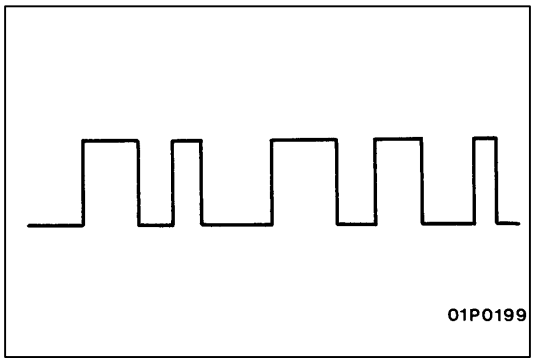


Examples of Abnormal Wave Patterns

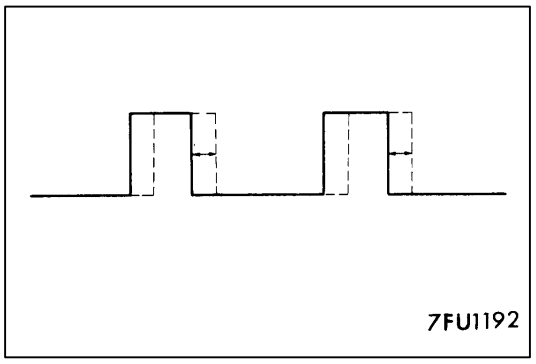
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



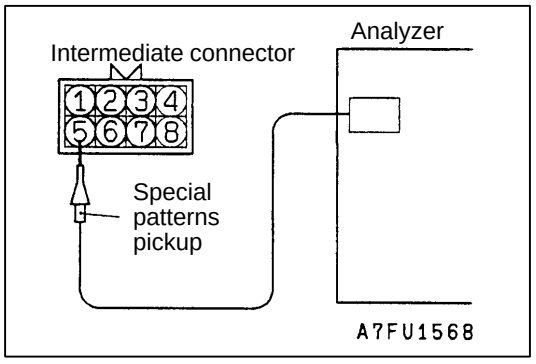
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTOR

Measurement Method

1. Disconnect the injector intermediate harness connector, and then connect the special tool (test harness: MD998474) in between. (Both the power supply side and engine-ECU <M/T> or engine-A/T-ECU <A/T> side should be connected.)
2. To measure cylinder No. 1, connect the analyzer special patterns pickup to terminal 3 (red clip [red lead wire] of the special tool). For cylinder No. 2, connect to terminal 2 (yellow clip [yellow lead wire]). For cylinder No. 3, connect to terminal 1 (green clip [green lead wire]). For cylinder No. 4, connect to terminal 7 (white clip [white lead wire]). For cylinder No. 5, connect to terminal 6 (green clip [green and black lead wire]). For cylinder No. 6, connect to terminal 5 (yellow clip [red and yellow lead wire]).

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal 1. (When checking the No. 1 cylinder.)
2. Connect the analyzer special patterns pickup to engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal 9. (When checking the No. 2 cylinder.)
3. Connect the analyzer special patterns pickup to engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal 24. (When checking the No. 3 cylinder.)
4. Connect the analyzer special patterns pickup to engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal 2. (When checking the No. 4 cylinder.)
5. Connect the analyzer special patterns pickup to engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal 10. (When checking the No. 5 cylinder.)

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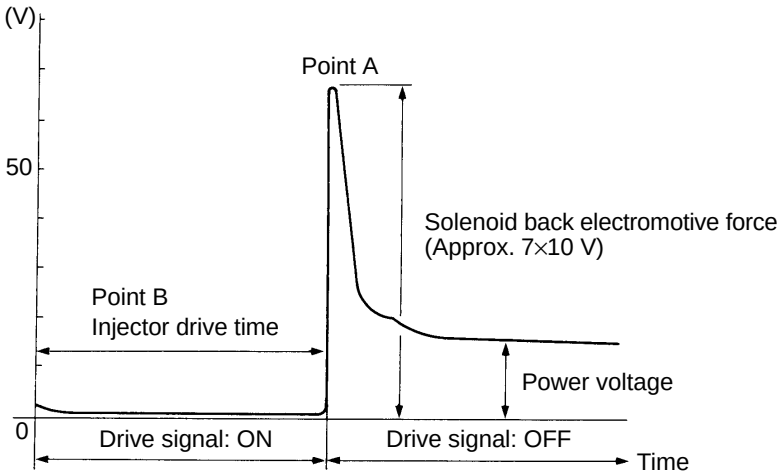
6. Connect the analyzer special patterns pickup to engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal 25. (When checking the No. 6 cylinder.)

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



7FU1202

Wave Pattern Observation Points

Explanation of Wave Pattern

Point A: Height of solenoid back electromotive force

Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or doesn't appear at all.	Short in the injector solenoid

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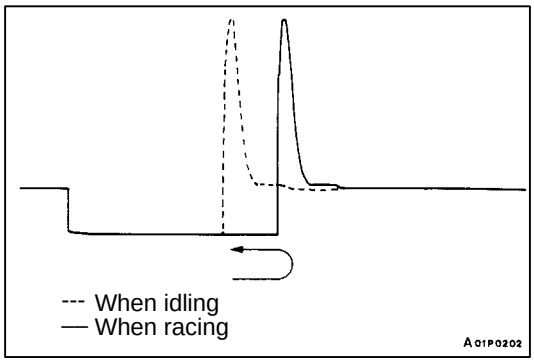
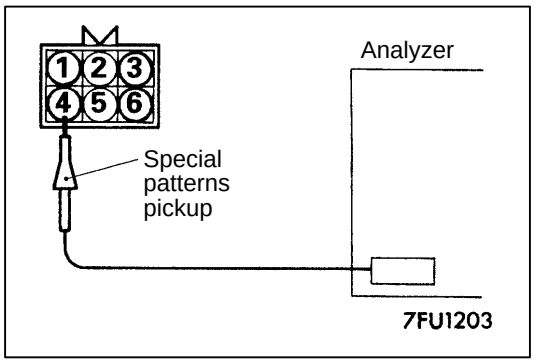


Point B: Injector drive time

- The injector drive time will be synchronized with the MUT-II tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.



STEPPER MOTOR

Measurement Method

1. Disconnect the stepper motor connector, and connect the special tool (test harness: MD998463) in between.
2. Connect the analyzer special patterns pickup to the stepper motor-side connector terminal 1 (red clip of special tool), terminal 3 (blue clip), terminal 4 (black clip) and terminal 6 (yellow clip) respectively.

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal 14, 15, 28, 29 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine (approx. 1 minute)

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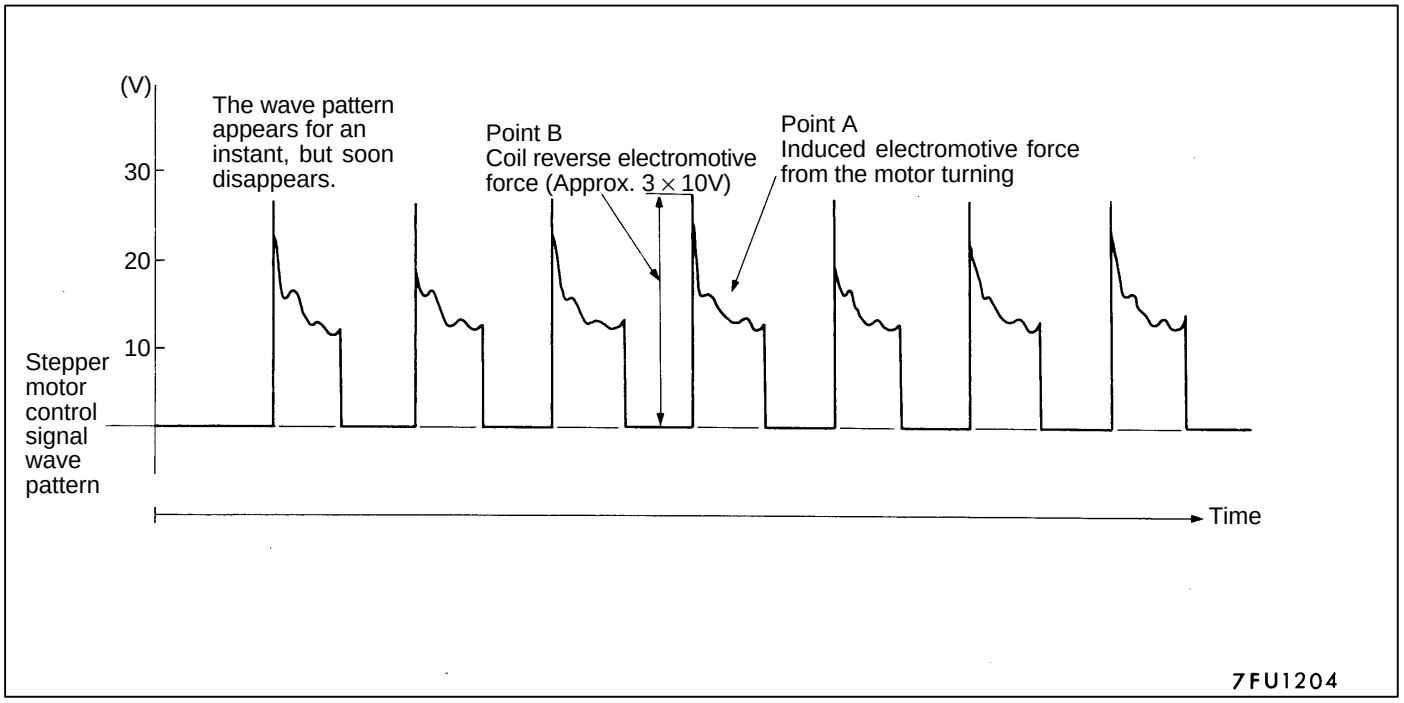
Standard wave pattern



Wave Pattern Observation Points

Check that the standard wave pattern appears when the stepper motor 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

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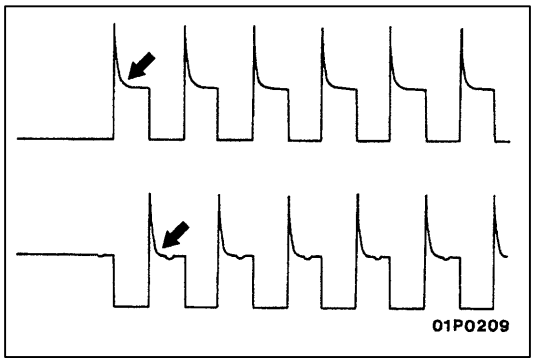


Examples of Abnormal Wave Pattern

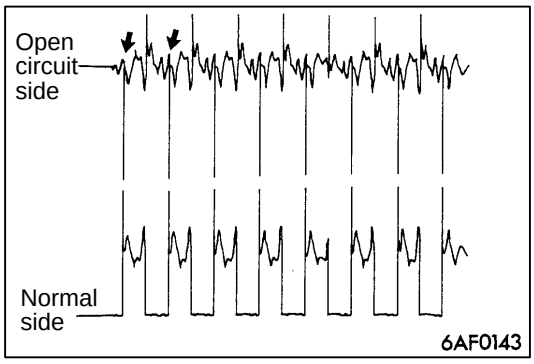
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



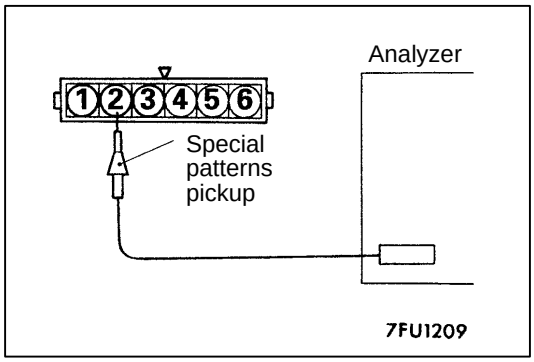
- Example 2

  Cause of problem

  Open circuit in the line between the stepper motor and the engine-ECU.

  Wave pattern characteristics

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



IGNITION COIL AND POWER TRANSISTOR

- Ignition coil primary signal
  Refer to GROUP 16 – Ignition System
- Power transistor control signal

Measurement Method

1. Disconnect the power transistor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to the power transistor connector terminal 1 (No. 3 – No. 6), terminal 2 (No. 2 – No. 5) and terminal 3 (No. 1 – No. 4) respectively.

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to the engine ECU <M/T> or engine-A/T-ECU <A/T> terminal 11 (No.1 – No.4), terminal 13 (No.3 – No.6), terminal 12 (No.2 – No.5) respectively.

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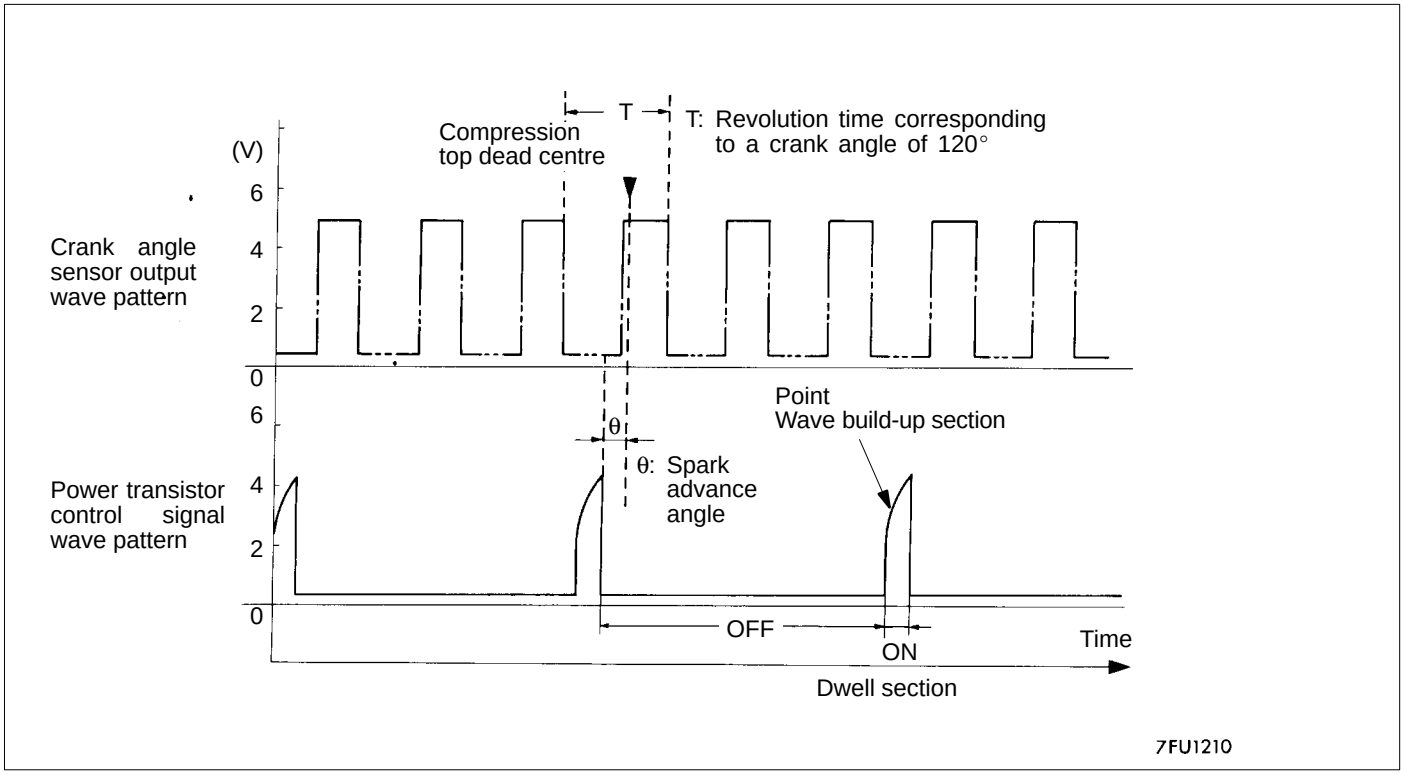
Standard Wave Pattern

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

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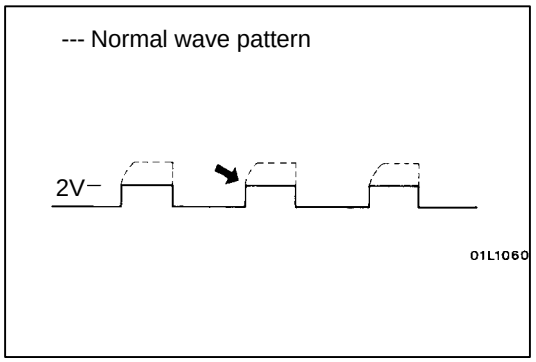


Examples of Abnormal Wave Patterns

- Example 1

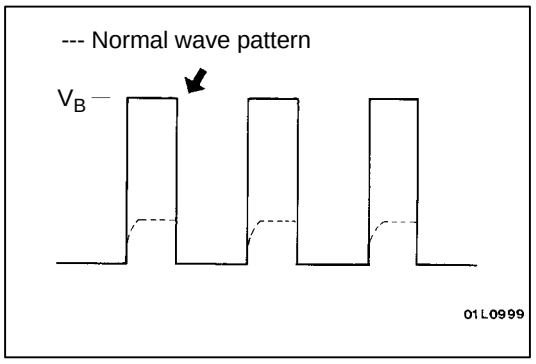
  Wave pattern during engine cranking

  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 2 V too low.



- Example 2

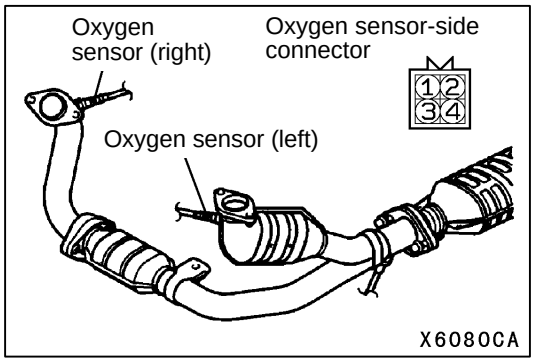
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

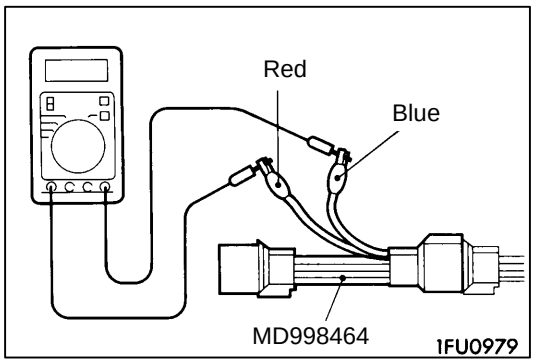
  Power voltage results when the power transistor is ON.



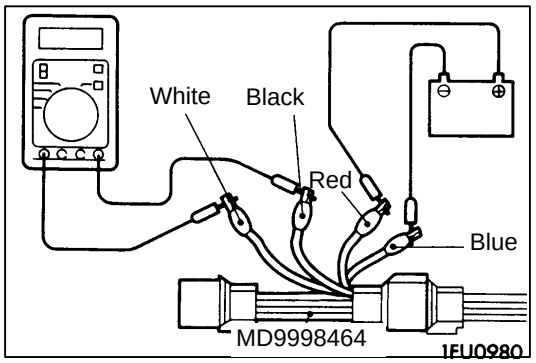
ON-VEHICLE SERVICE

OXYGEN SENSOR CHECK

1. Disconnect the oxygen sensor connector, and connect the special tool (test harness) to that connector.



2. Check that the continuity (4.5 – 8.0 Ω at 20 °C) exists between the oxygen sensor connector terminal 1 (red clip of the special tool) and terminal 3 (blue clip of the special tool).
3. If no continuity, replace the oxygen sensor.
4. Warm up the engine until the engine coolant temperature reaches 80°C or more.



5. Use the jumper wire to connect terminal 1 (red clip) of the oxygen sensor connector to the positive battery terminal and terminal 3 (blue clip) to the negative 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	NOTE
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.

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

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