

GENERAL INFORMATION

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

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

FUEL INJECTION CONTROL

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

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

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

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

THROTTLE VALVE OPENING ANGLE CONTROL

This system controls throttle valve opening angle electronically. The engine-A/T-ECU determines how deeply the accelerator pedal is depressed by means of the accelerator position sensor (APS). Then the engine-

A/T-ECU sends a target value of the throttle valve opening angle to the throttle valve controller. The throttle valve control servo operates the throttle valve so that it reaches the target opening angle.

IDLE SPEED CONTROL

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

The engine-A/T-ECU operates the throttle valve control servo so that engine speed is

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

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing

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

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-A/T-ECU that is related to the sensors and actuators can be read by means of the MUT-II. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

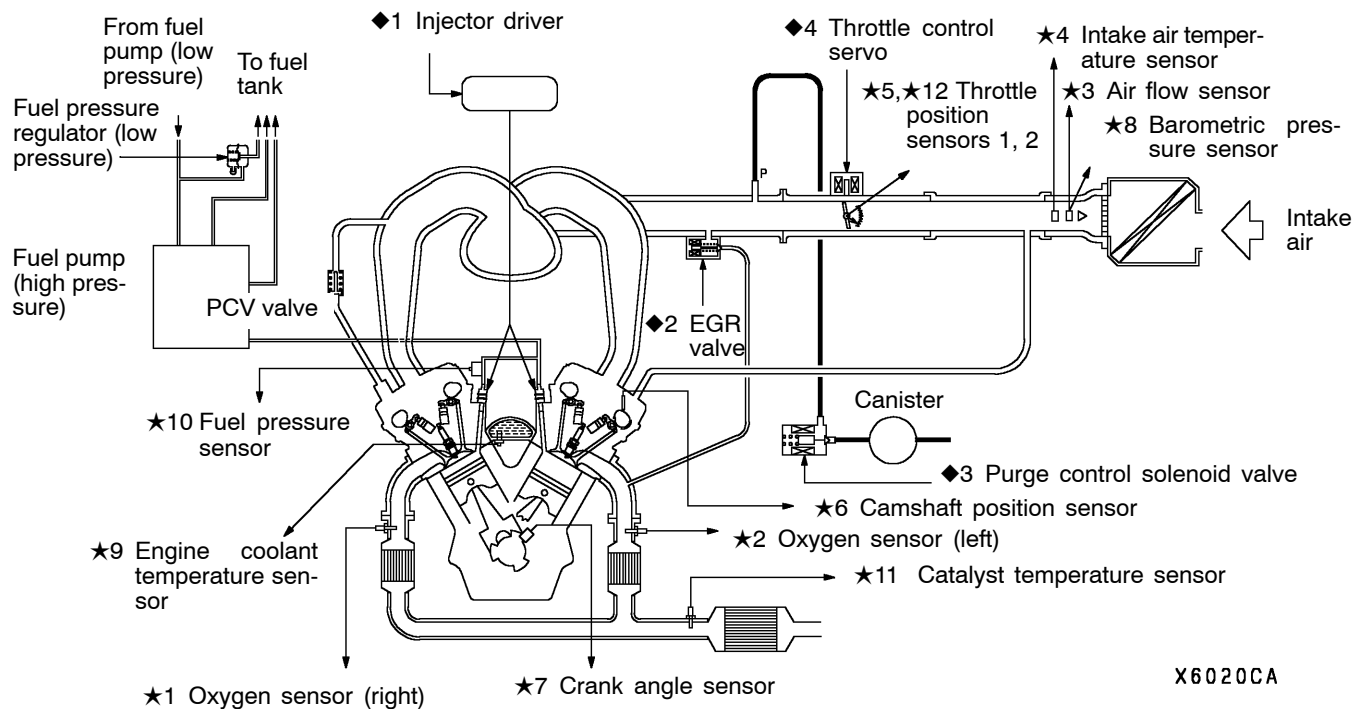
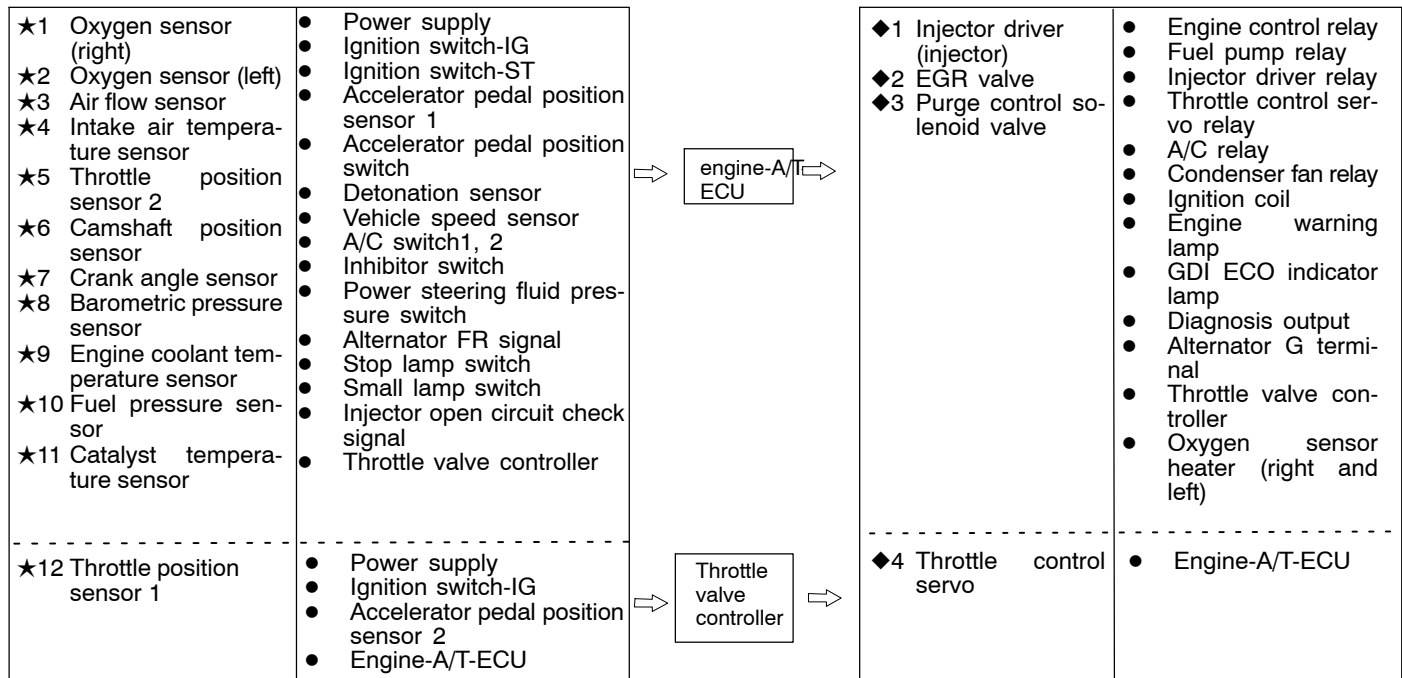
1. Fuel Pump Control
Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
Turns the compressor clutch of the A/C ON and OFF.
3. Purge Control Solenoid Valve Control
Refer to GROUP 17.
4. EGR Control Servo Control
Refer to GROUP 17.

GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	65
	Throttle position sensor	Variable resistor type
	Throttle valve control servo	Torque motor type
Engine-A/T-ECU	Identification model No.	E2T76284
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Accelerator pedal position sensor (1st and 2nd channels)	Variable resistor type
	Accelerator pedal position switch	Rotary contact type, within accelerator pedal position sensor (1st channel)
	Vehicle speed sensor	Magnetic resistive element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Fuel pressure sensor	Metallic membrane type
	Power steering fluid pressure switch	Contact switch type

Items		Specifications
Actuators	Engine control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector driver control relay	Contact switch type
	Injector type and number	Electromagnetic type, 6
	Injector identification mark	DIM 1070G
	Throttle valve control servo relay	Contact switch type
	Throttle valve control servo	DC brushless motor type
	EGR control servo	Stepper motor type
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator (low pressure)	Regulator pressure kPa	324
Fuel pressure regulator (high pressure)	Regulator pressure MPa	5.5

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM



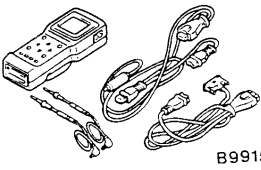
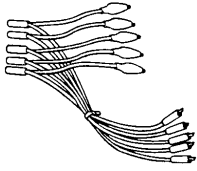
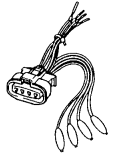
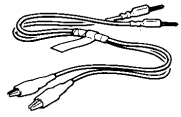
SERVICE SPECIFICATIONS

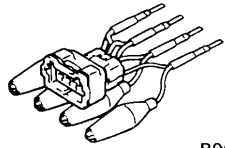
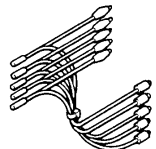
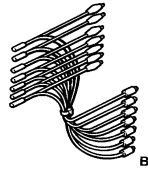
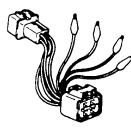

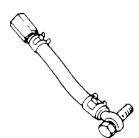

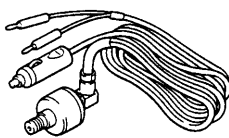
Item		Standard value
Adjustment voltage of throttle position sensor 1 V		0.4 – 0.6
Adjustment voltage of throttle position sensor 2 V		4.2 – 4.8
Throttle position sensor resistance k Ω		0.9 – 2.5
Adjustment voltage of accelerator pedal position sensors 1 and 2 V		0.985 – 1.085
Resistance of accelerator pedal position sensors 1 and 2 k Ω		3.5 – 6.5
Intake air temperature sensor resistance k Ω	at 20 °C	2.3 – 3.0
	at 80 °C	0.30 – 0.43
Engine coolant temperature sensor resistance k Ω	at 20 °C	2.1 – 2.7
	at 80 °C	0.26 – 0.36
Fuel pressure	High-pressure side MPa	4 – 6.9
	Low-pressure side kPa	Approx. 329
Injector coil resistance (at 20 °C) Ω		0.9 – 1.1
Oxygen sensor output voltage V (during revving)		0.6 – 1.0
Oxygen sensor heater resistance (at 20 °C) Ω		4.5 – 8.0
Throttle control servo coil resistance (at 20 °C) Ω		0.6 – 1.0

SEALANT

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

SPECIAL TOOLS

Tools	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> GDI system check Fuel pressure measurement
	MB991348	Test harness set	<ul style="list-style-type: none"> Troubleshooting – voltage measurement Inspection using an analyzer
	MB991519	Alternator harness connector	Troubleshooting – voltage measurement
	MB991529	Diagnosis code checking harness	Take a reading of the diagnosis codes

Tools	Number	Name	Use
 B991536	MB991536	Check harness for TPS adjustment	Throttle position sensor (TPS) adjustment
 B991658	MB991658	Test harness	<ul style="list-style-type: none"> • Troubleshooting – voltage measurement • Inspection using an analyzer • Accelerator pedal position sensor (APS) adjustment
 B991709	MB991709	Test harness	<ul style="list-style-type: none"> • Troubleshooting – voltage measurement • Inspection using an analyzer
	MD998464	Test harness (4-pin, square)	Oxygen sensor check
	MD998478	Test harness (3-pin, square)	<ul style="list-style-type: none"> • Troubleshooting – voltage measurement • Inspection using an analyzer
	MD998709	Adaptor hose	Fuel pressure measurement
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	

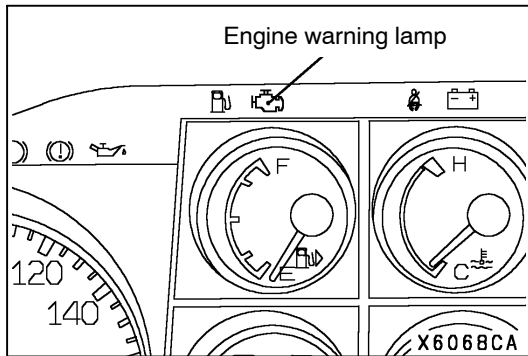
TROUBLESHOOTING

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

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

NOTE

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



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

Engine warning lamp inspection items

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

Caution

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

NOTE

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

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

DIAGNOSIS USING DIAGNOSIS 2 MODE

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

NOTE

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

4. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

CONFIRMING FREEZE FRAME DATA

When the engine-ECU detects a malfunction and stores a diagnosis code, it also stores a current status of the engine. This function is called “Freeze frame data.” By analyzing this “freeze frame” data with the MUT-II, an effective troubleshooting can be performed.

Item No.	Data item	Unit	Item No.	Data item	Unit
12	Air flow sensor	Hz	82	Feedback (right bank)	%
13	Intake air temperature sensor	°C	83	Learning value (left bank)	%
21	Engine coolant temperature sensor	°C	84	Feedback (left bank)	%
22	Crank angle sensor	r/min	87	Engine load (left bank)	%
24	Vehicle speed	km/h	8A	TPS1 (throttle valve opening angle)	%
44	Ignition advance value	°BTDC	A1	Oxygen sensor (right bank)	mV
81	Learning value (right bank)	%	A2	Oxygen sensor (left bank)	mV

NOTE

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

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	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor 2 (TPS2)	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Controls the throttle opening angle feedback (half as much as the opening rate in the normal condition) by using signals from the TPS1. However, this controlling system is not applied if the TPS1 and TPS2 combination output voltage is outside 4 – 6 V. 3. Refrains from controlling the throttle opening angle feedback if the TPS1 is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Moreover, the control system is working until the ignition switch is turned OFF if the sensor signal returns to normal.)
Camshaft position sensor	Cuts the fuel supply once a malfunction is detected. (Only when there has been no occasion of detecting No.1 cylinder TDC after the ignition switch is turned ON.)
Vehicle speed sensor	<ol style="list-style-type: none"> 1. Suspends lean burn operation. However, the control is cancelled as a certain time passes by with the engine speed of 1500 r/min or more. 2. Suspends lean burn operation during the engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Fixes the ignition timing as that for regular gasoline.
Injector	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Suspends the exhaust gas recirculation.
Ignition coil (incorporating power transistor)	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Cuts off the fuel supply to cylinders with an abnormal ignition signal.
Fuel pressure sensor	<ol style="list-style-type: none"> 1. Controls as if the fuel pressure is 5MPa. 2. Suspends fuel injection.(when the low pressure is detected and the engine speed is more than 3000r/min)
Alternator FR terminal	Refrains from controlling to suppress the alternator output to electrical load. (Operated as a normal alternator)
Accelerator pedal position sensor 2 (APS2)	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the APS1. (However, the control system is not applicable if the difference from the APS1 output voltage is 1.0V or higher.) 3. Suspends the electronic controlled throttle valve system if APS1 is also defective.
Accelerator pedal position sensor 1 (APS1)	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the APS2. (However, this control is not applicable if the voltage difference between the APS1 and APS2 is 1.0 V or higher.) 3. Also suspends the electronic-controlled throttle valve system when the APS2 is defective.
Throttle position sensor 1 (TPS)	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Controls throttle opening angle feedback by using signals from TPS2. (However, the controlling system is not applied when the TPS1 and TPS2 combination output voltage is outside 4 – 6 V.) 3. Refrains from controlling the throttle opening angle feedback when TPS2 is also defective.

Malfunctioning item	Control contents during malfunction
Electronic-controlled throttle valve system	<ol style="list-style-type: none"> 1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the idle speed feedback control.
Throttle valve position feedback	<ol style="list-style-type: none"> 1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control. <p>However, if the throttle valve opening angle is significantly wide, this system carries out the following controls.</p> <ol style="list-style-type: none"> 1. Always cuts the fuel supply to three cylinders. 2. Cuts the fuel supply when the engine speed reaches 3,000 r/min or more.
Throttle control servo	<ol style="list-style-type: none"> 1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.
Communication line between the throttle valve controller and the ECU	<ol style="list-style-type: none"> 1. Communication error between the throttle valve controller and the engine-A/T-ECU: <ul style="list-style-type: none"> • Suspends lean burn operation. • Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. • Suspends the cruise-control. 2. Communication error between the throttle valve controller and the engine-A/T-ECU: <ul style="list-style-type: none"> • Suspends lean burn operation. • Cuts the fuel supply when the engine speed reaches 3,000 r/min or more. • Suspends the cruise-control. • The throttle valve controller controls the throttle valve opening angle by using signals from APS2.
Throttle valve controller	<ol style="list-style-type: none"> 1. Suspends the electronic-controlled throttle valve system. 2. Suspends lean burn operation. 3. Suspends the engine speed feedback control.

NOTE

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

INSPECTION CHART FOR DIAGNOSIS CODES

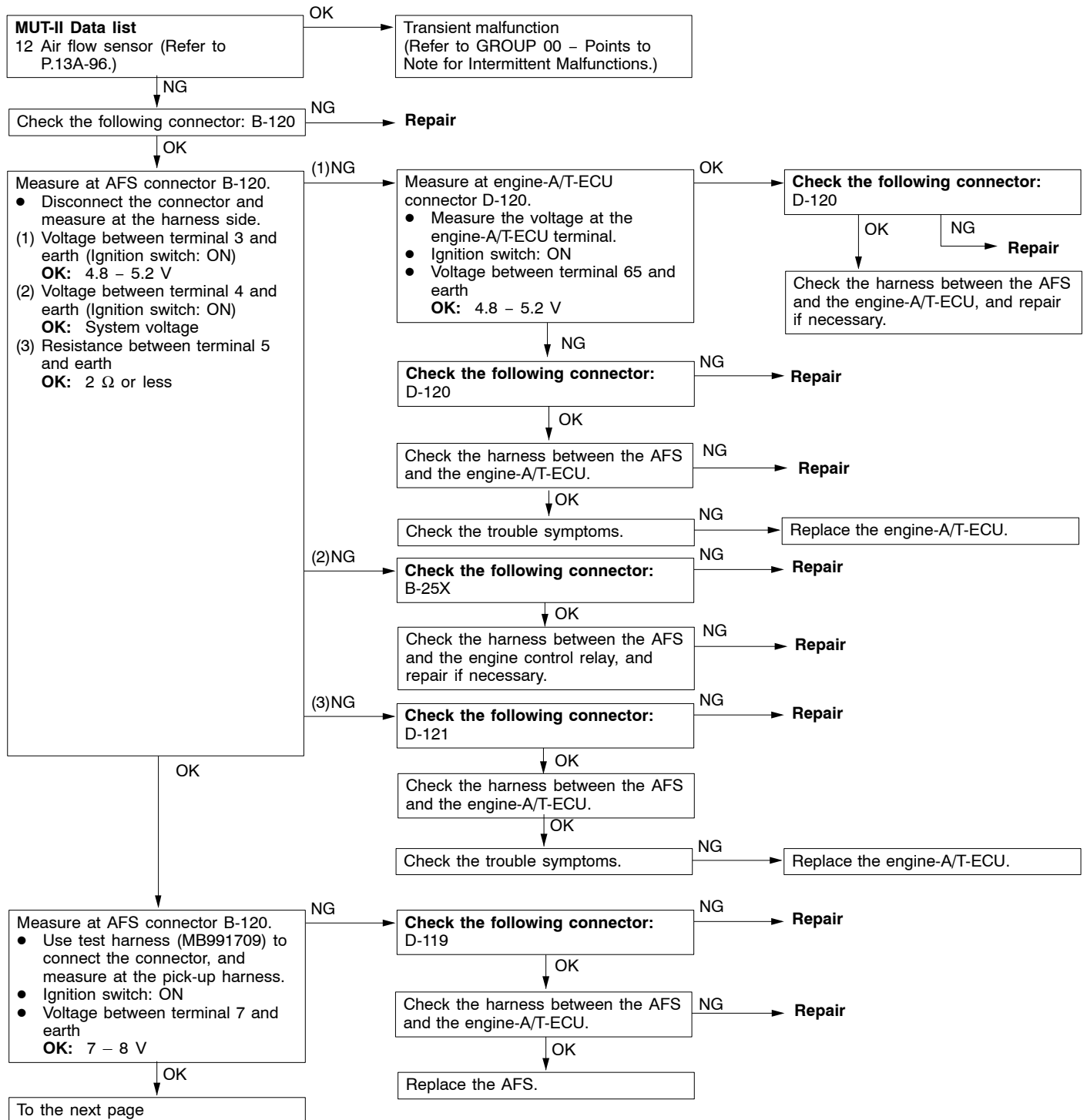
Code No.	Diagnosis item	Reference page
P0100	Air flow sensor (AFS) system	13B-14
P0105	Barometric pressure sensor system	13B-16
P0110	Intake air temperature sensor system	13B-18
P0115	Engine coolant temperature sensor system	13B-19
P0120	Throttle position sensor 1(TPS1) system	13B-22
P0130	Oxygen sensor (right bank) system	13B-24
P0135	Oxygen sensor heater (right bank) system	13B-25
P0150	Oxygen sensor (left bank) system	13B-26
P0155	Oxygen sensor heater (left bank) system	13B-27
P0170	Abnormal fuel system (right bank) system	13B-28
P0173	Abnormal fuel system (left bank) system	13B-30
P0190	Abnormal fuel system	13B-32
P0201	No.1 injector system	13B-34
P0202	No.2 injector system	13B-36
P0203	No.3 injector system	13B-38
P0204	No.4 injector system	13B-40
P0205	No.5 injector system	13B-42
P0206	No.6 injector system	13B-44
P0220	Accelerator pedal position sensor 1 (APS1) system	13B-46
P0225	Throttle position sensor 2 (TPS2) system	13B-48
P0300	Ignition coil (power transistor) system	13B-49
P0325	Detonation sensor system	13B-51
P0335	Crank angle sensor system	13B-51
P0340	Camshaft position sensor system	13B-53
P0403	EGR valve system	13B-55
P0425	Catalyst temperature sensor system	13B-56
P0443	Purge control solenoid valve system	13B-57
P0500	Vehicle speed sensor system	13B-58
P1200	Injector driver system	13B-58
P1220	electronic-controlled throttle valve system	13B-59
P1221	Throttle valve position feedback system	13B-60
P1222	Throttle control servo system	13B-61
P1223	Communication line with throttle valve controller	13B-62
P1225	Accelerator pedal position sensor 2 (APS2) system	13B-63
P1226	Throttle valve controller system	13B-64
P1500	Alternator FR terminal system	13B-65
P1610	Immobilizer system	13B-66

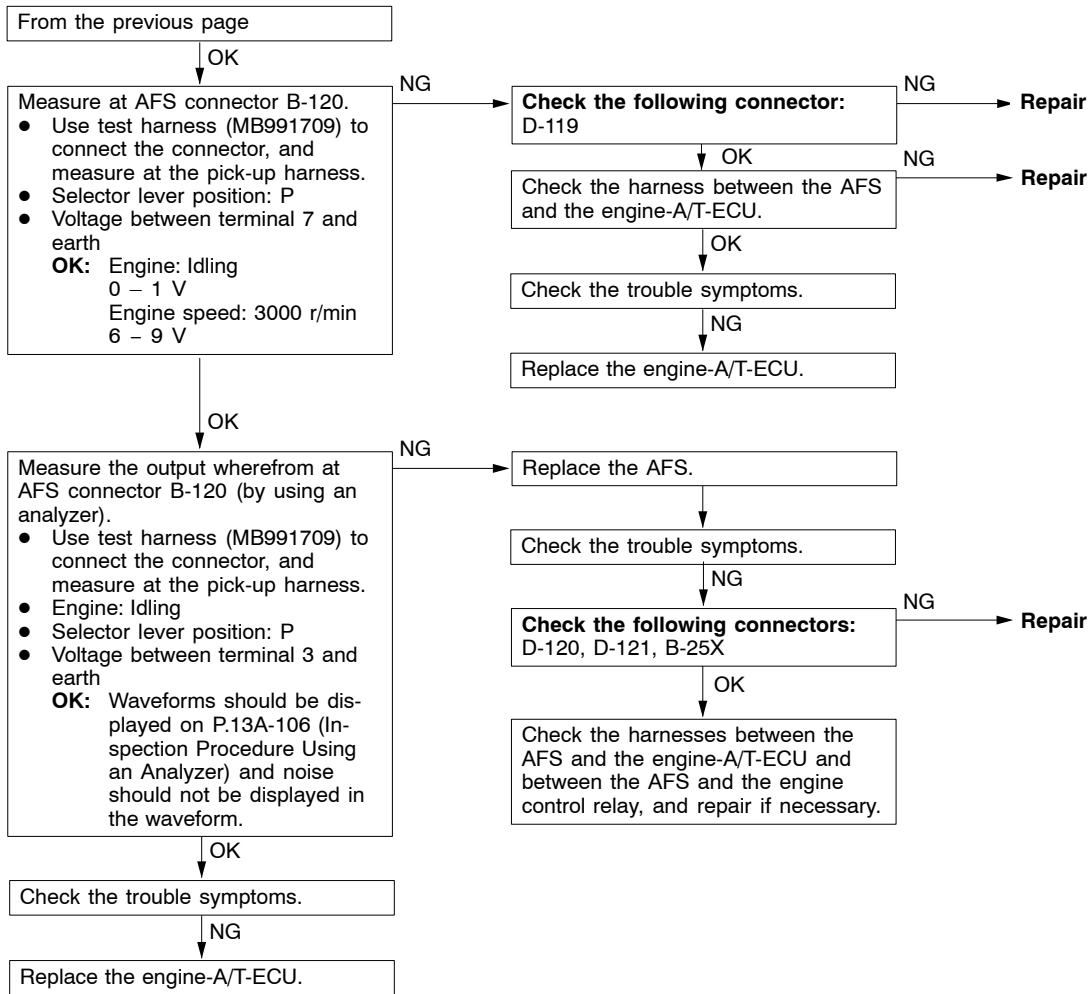
NOTE

Code No.P0190 will also be output when air is trapped into the high-pressure fuel line such as poor fuel supply.

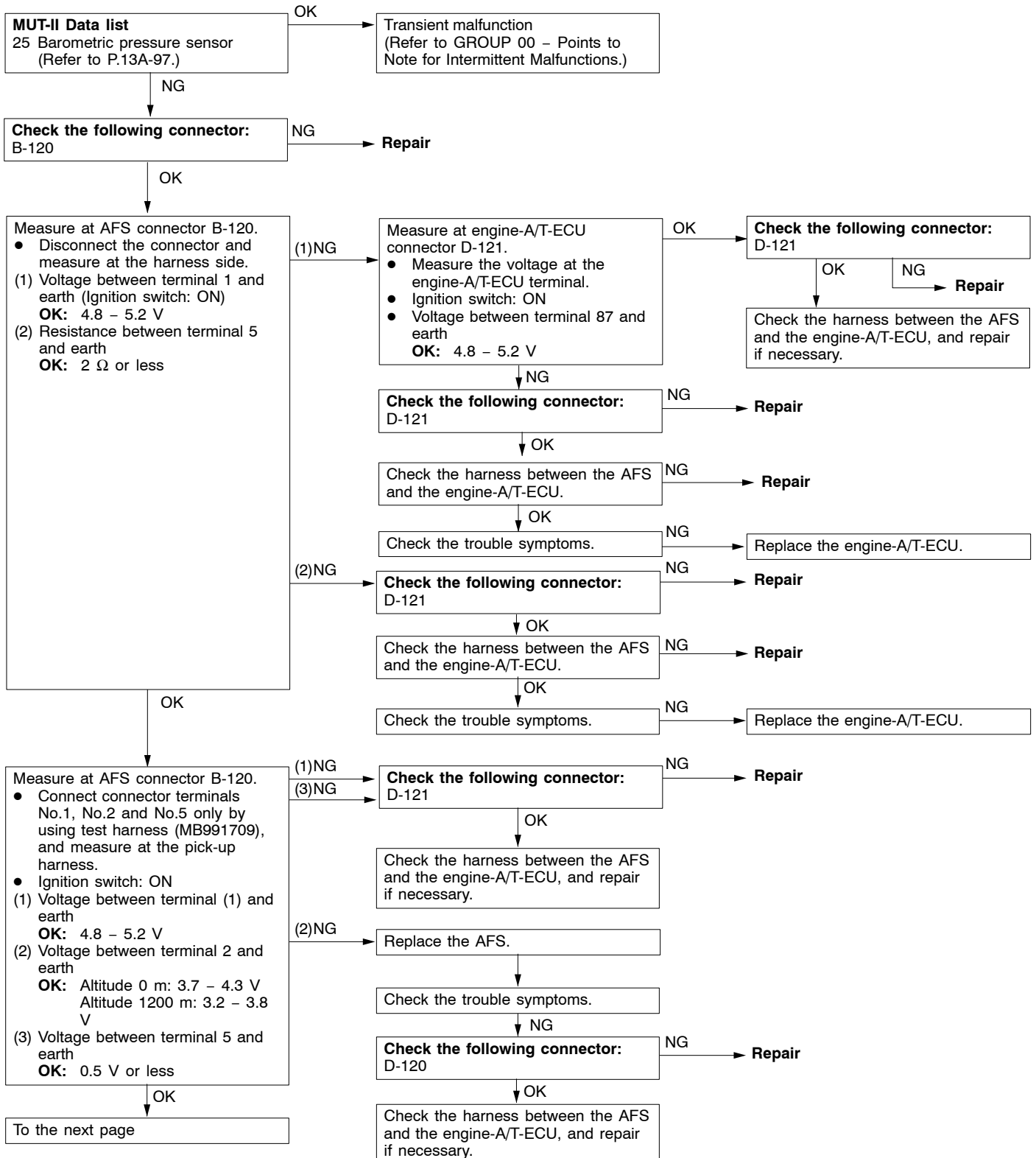
INSPECTION PROCEDURE FOR DIAGNOSIS CODE

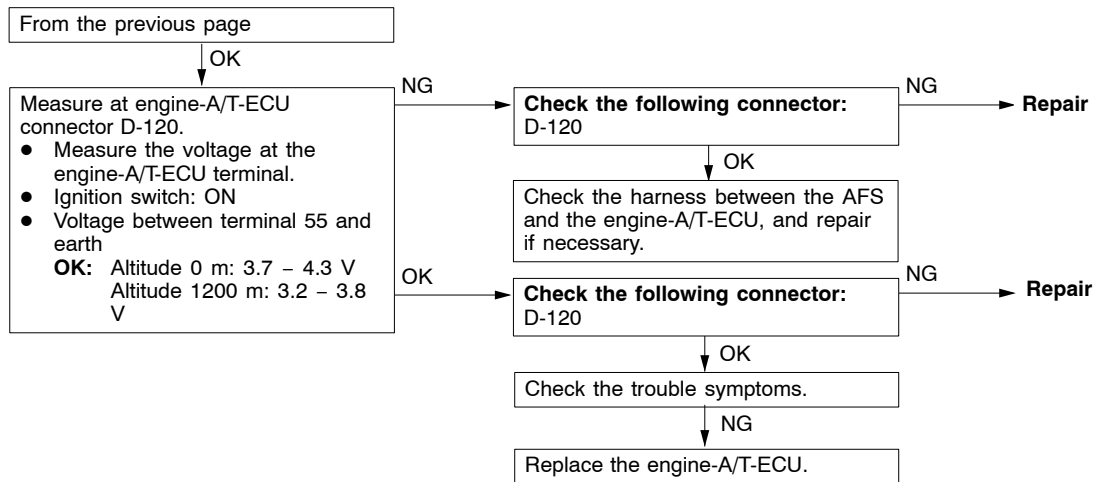
Code No. P0100 Air flow sensor (AFS) system	Probable cause
Range of Check • Engine speed: 500 r/min or more Set Conditions • The sensor output frequency is 3.3 Hz or less for four seconds.	• Malfunction of AFS • Open or short circuit in AFS circuit or loose connector contact • Malfunction of engine-A/T-ECU



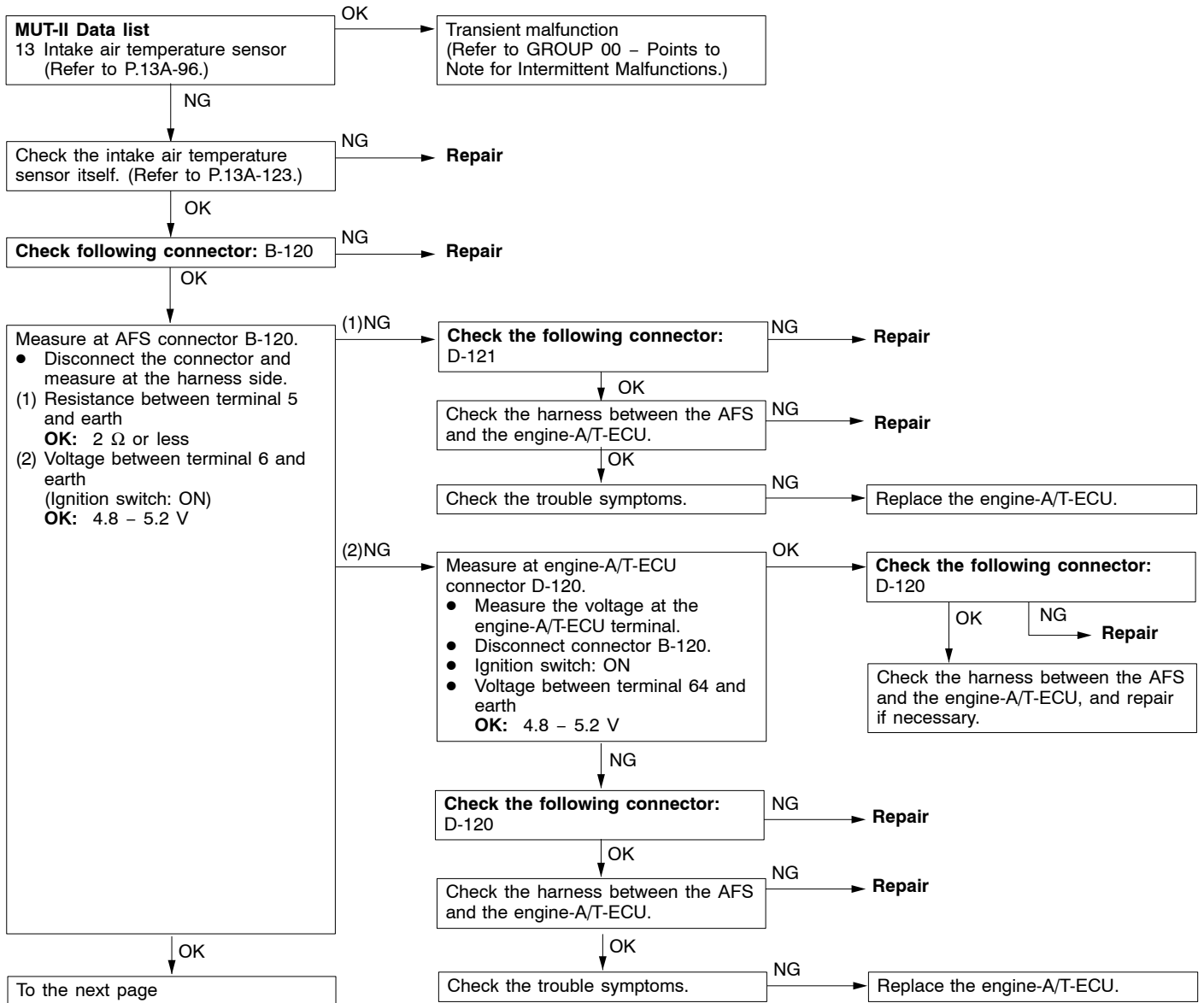


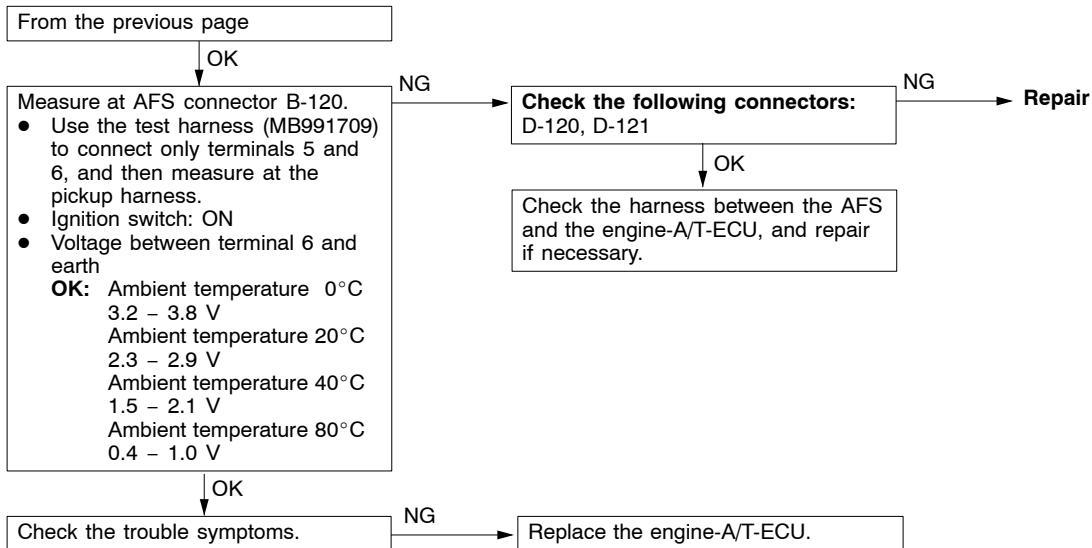
Code No.P0105 Barometric pressure sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Battery voltage: 8 V or more <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage is 4.5 V or more for four seconds (equivalent to 114 kPa of barometric pressure) <p>or</p> <ul style="list-style-type: none"> The sensor output voltage is 0.2 V or less (equivalent to 53 kPa of barometric pressure) 	<ul style="list-style-type: none"> Malfunction of barometric pressure sensor Open or short circuit in barometric pressure sensor circuit or loose connector contact Malfunction of engine-A/T-ECU



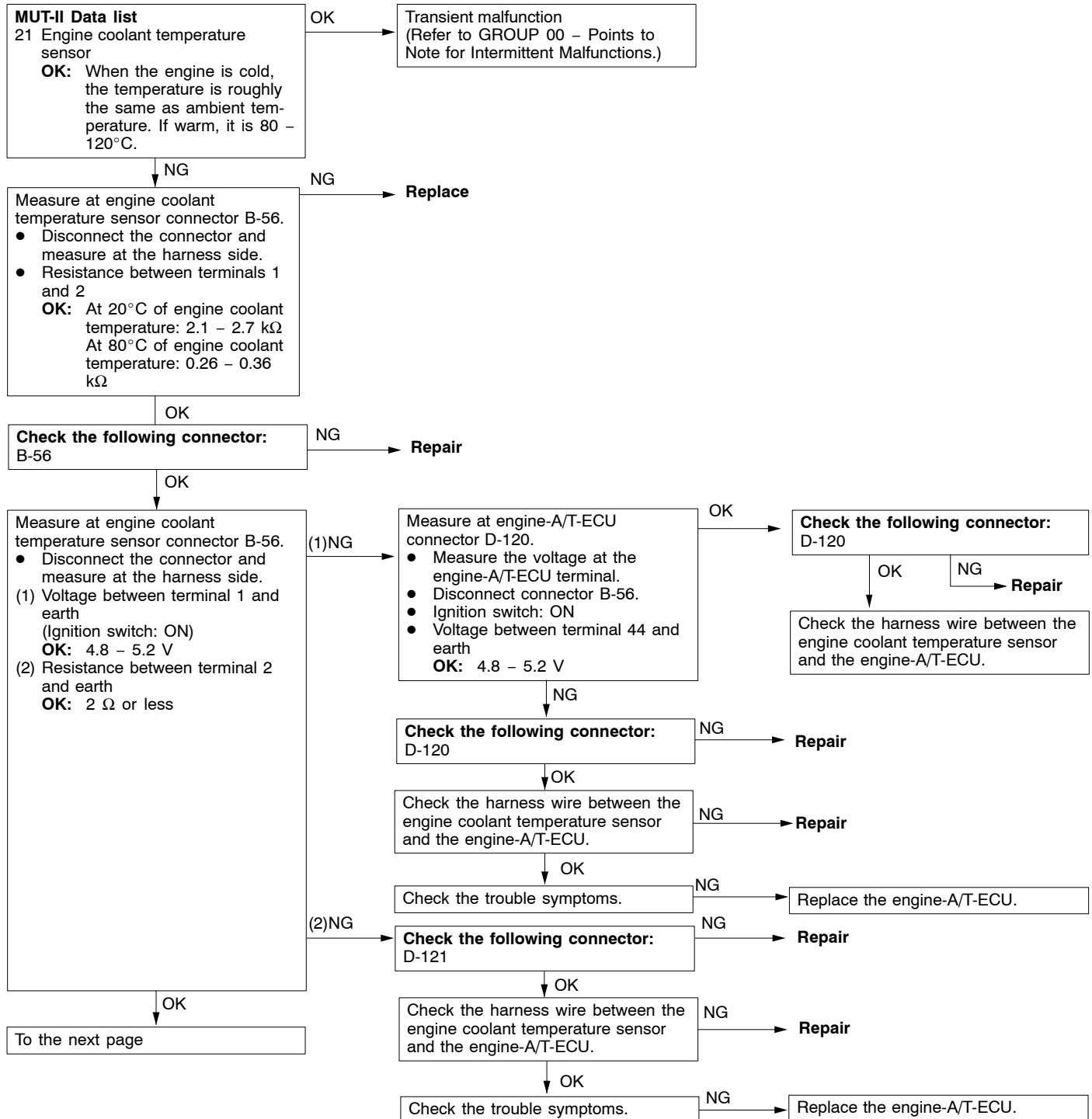


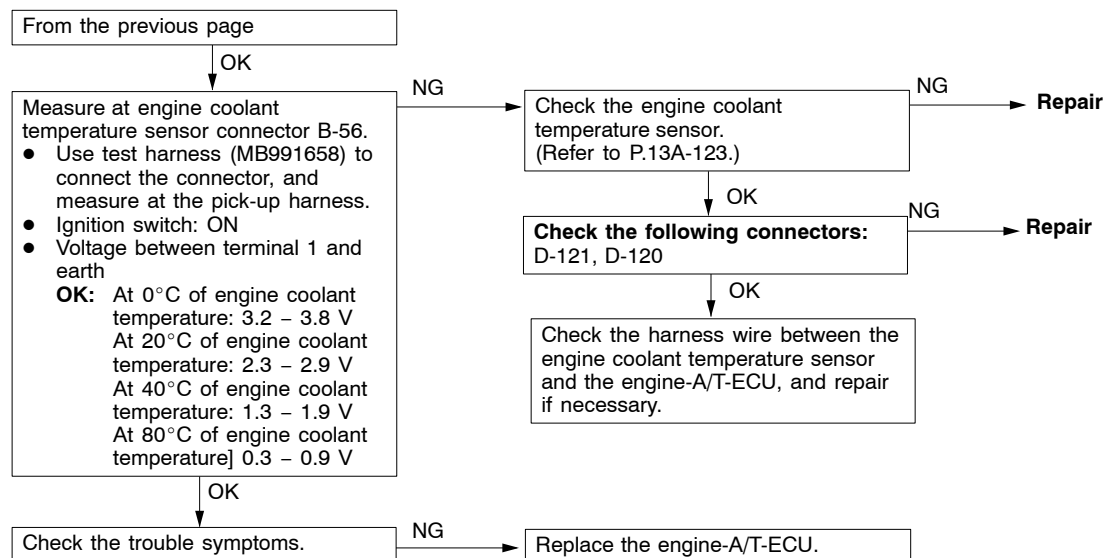
Code No.P0110 Intake air temperature sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage is 4.6V or more for four seconds (equivalent to -45°C of intake air temperature) <p>or</p> <ul style="list-style-type: none"> The sensor output voltage is 0.2V or more for four seconds (equivalent to 125°C of intake air temperature) 	<ul style="list-style-type: none"> Malfunction of intake air temperature sensor Open or short circuit in intake air temperature sensor or loose connector contact Malfunction of engine-A/T-ECU



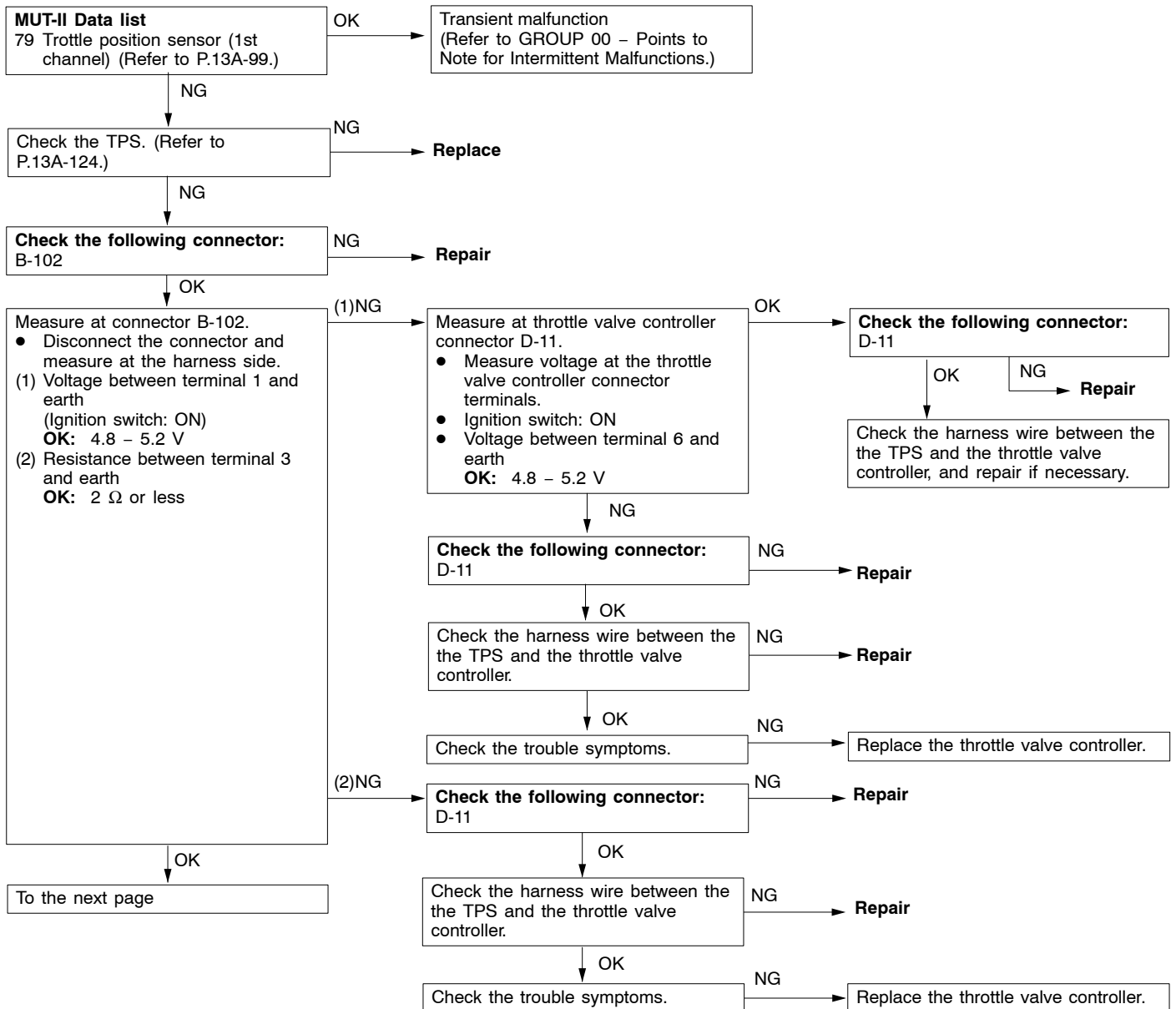


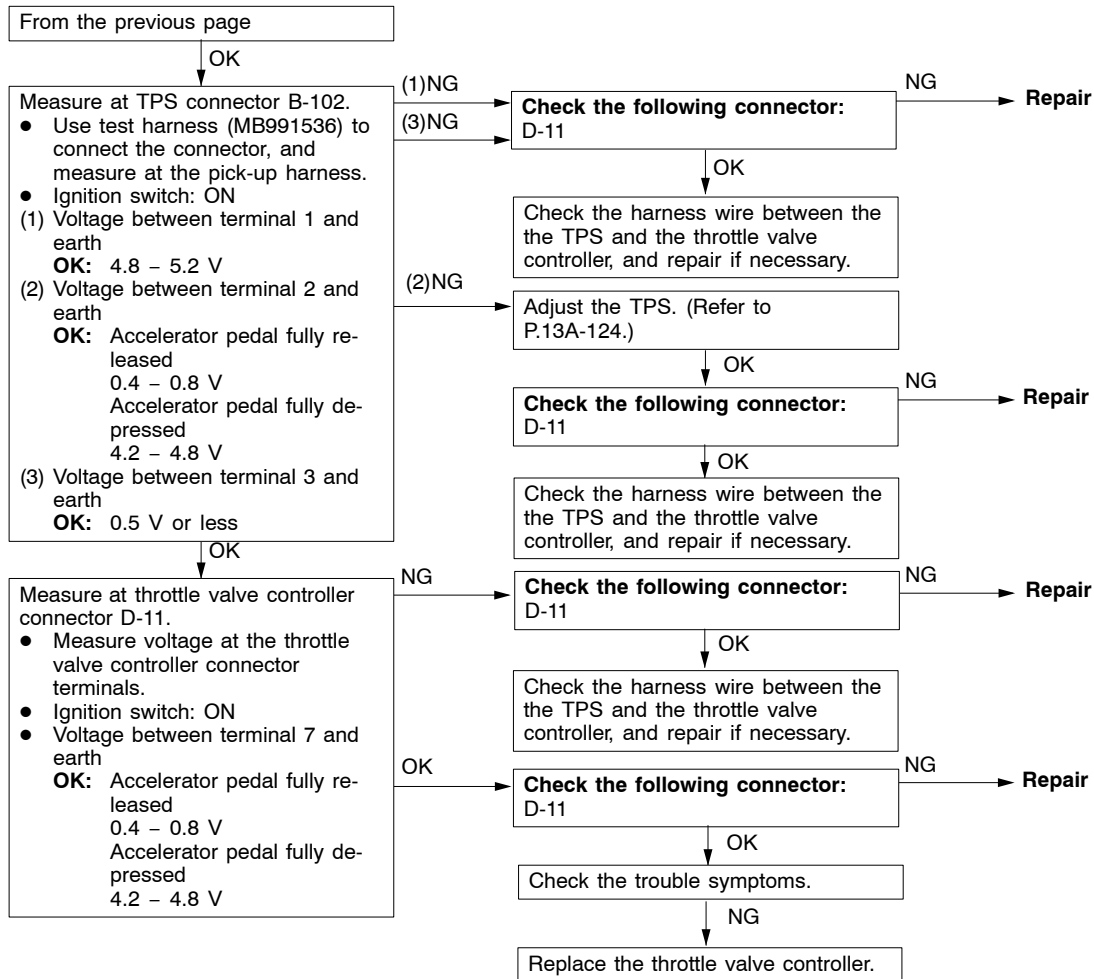
Code No.P0115 Engine coolant temperature sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • Engine: Two seconds after the engine has been started <p>Set Conditions</p> <ul style="list-style-type: none"> • The sensor output voltage is 4.6V or more for four seconds (equivalent to -45°C of engine coolant temperature) <p>or</p> <ul style="list-style-type: none"> • The sensor output voltage is 0.1V or more for four seconds (equivalent to 140°C of engine coolant temperature) <p>Range of Check</p> <ul style="list-style-type: none"> • Engine: After starting <p>Set Conditions</p> <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Malfunction of engine coolant temperature sensor • Open or short circuit in the engine coolant temperature sensor circuit or loose connector contact • Malfunction of engine-A/T-ECU



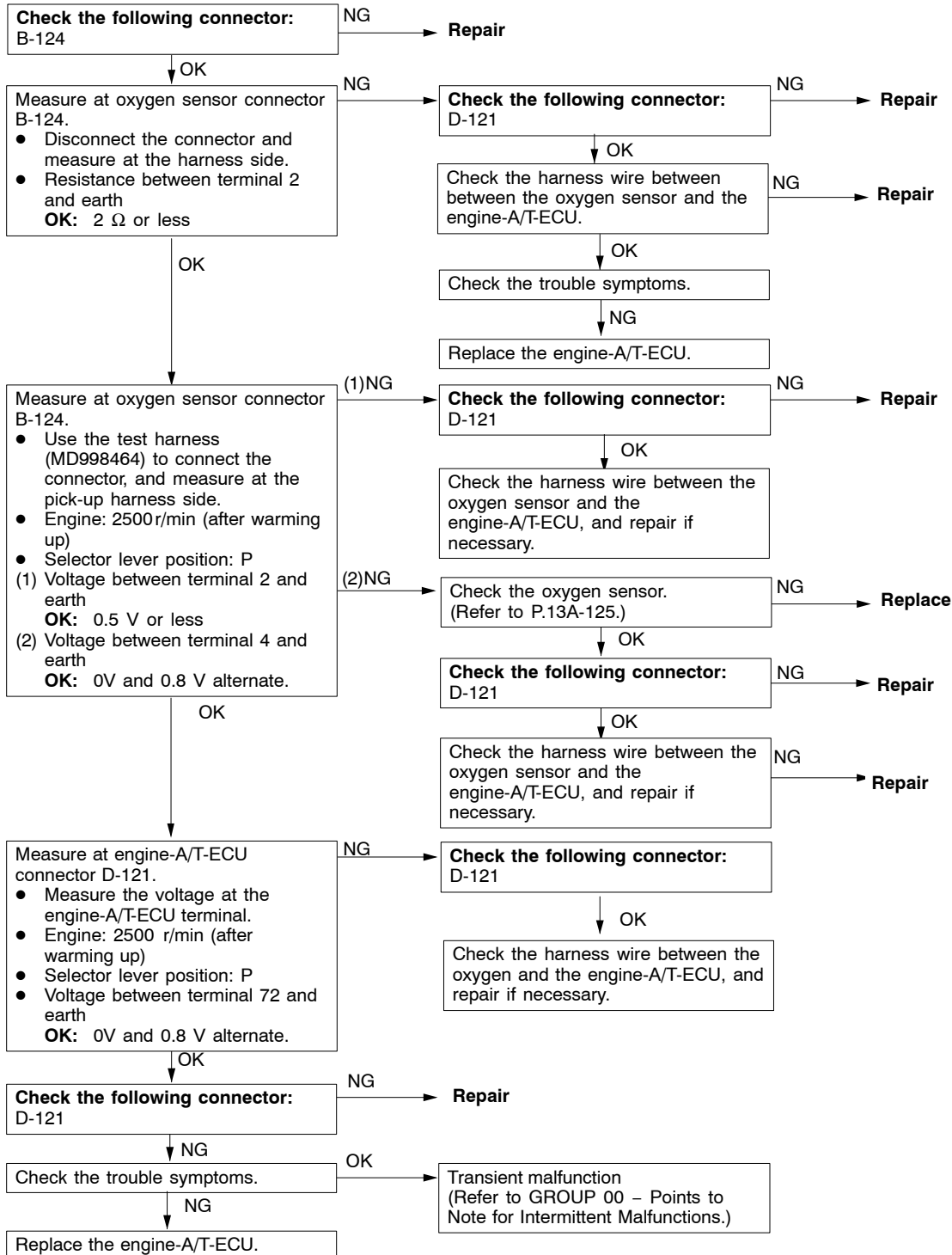


Code No.P0120 Throttle position sensor 1 (TPS1) system	Probable cause
<p>The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU.</p> <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage is 0.2 V or less. <p>or</p> <ul style="list-style-type: none"> The sensor output voltage is 4.85 V or more and the TPS2 output voltage is 2.5V or more. <p>or</p> <ul style="list-style-type: none"> The TPS and TPS2 combination output voltage is outside 4 – 6 V. <p>or</p> <ul style="list-style-type: none"> The opening angle of TPS1 is different from its target by 1 V or more. <p>or</p> <ul style="list-style-type: none"> The TPS output changes within 25 mV when the throttle control servo moves one step. 	<ul style="list-style-type: none"> Malfunction of TPS Open or short circuit in the TPS1 circuit or loose connector contact Malfunction of throttle valve controller Malfunction of engine-A/T-ECU

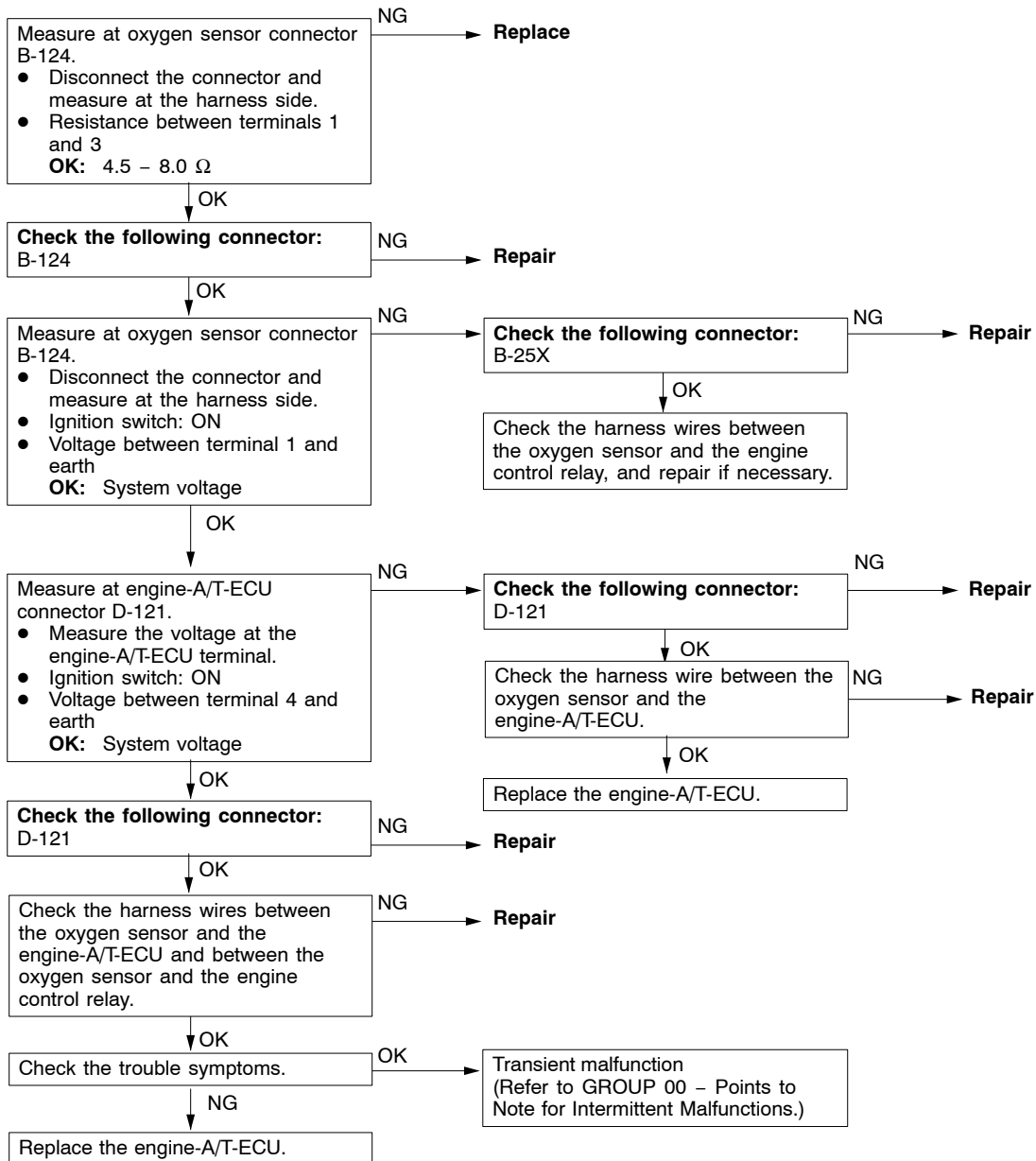




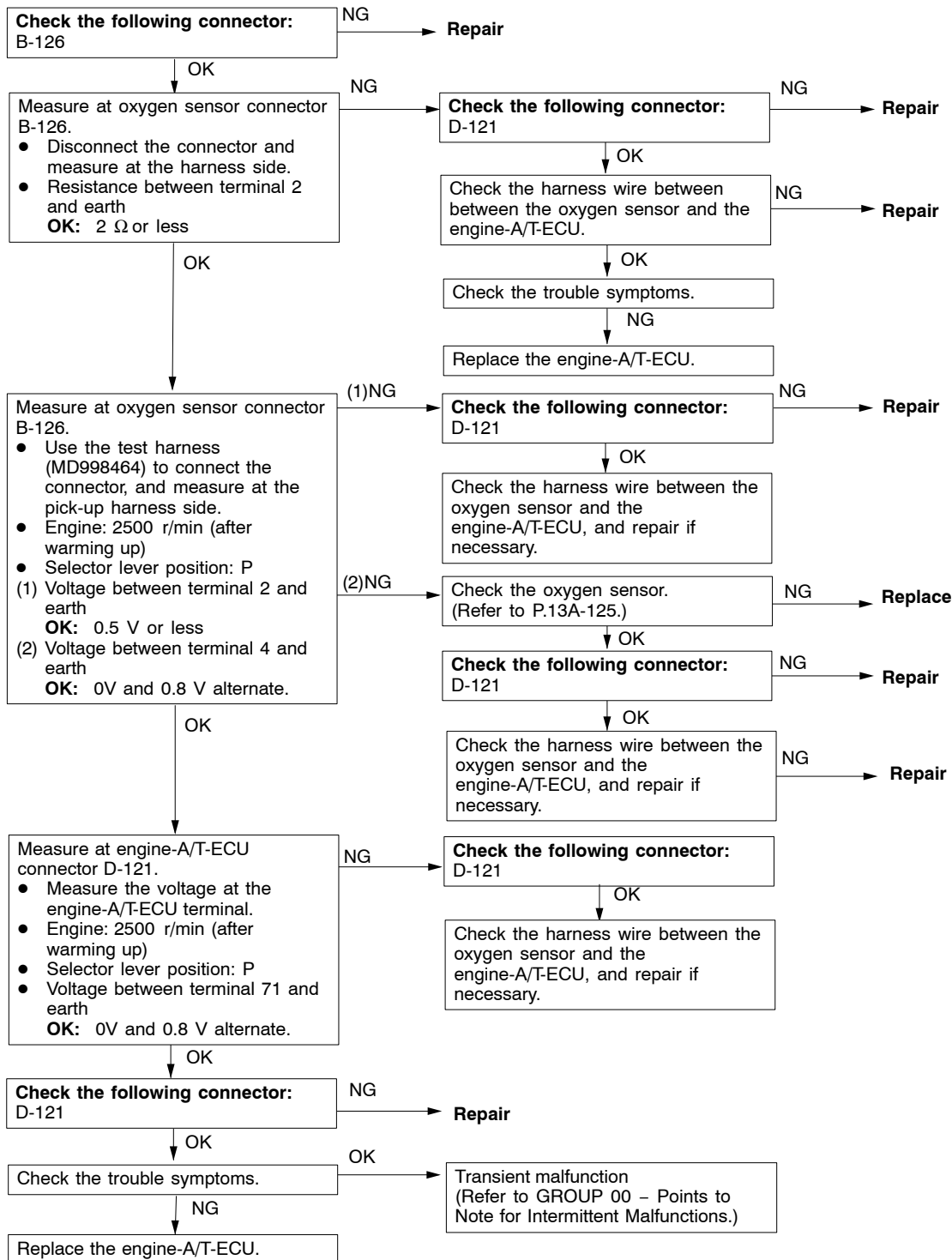
Code No.P0130 Oxygen sensor (right bank) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Three minutes have been passed since the engine has been started. The engine coolant temperature is approx. 80°C or more. Intake air temperature is 20 – 30°C Engine speed is 1200 r/min or more Driving on a level surface at constant speed. <p>Set Conditions</p> <ul style="list-style-type: none"> The oxygen sensor output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor inside the engine-A/T-ECU. 	<ul style="list-style-type: none"> Malfunction of of right bank oxygen sensor Open or short circuit in the right bank oxygen sensor circuit or loose connector contact Malfunction of engine-A/T-ECU



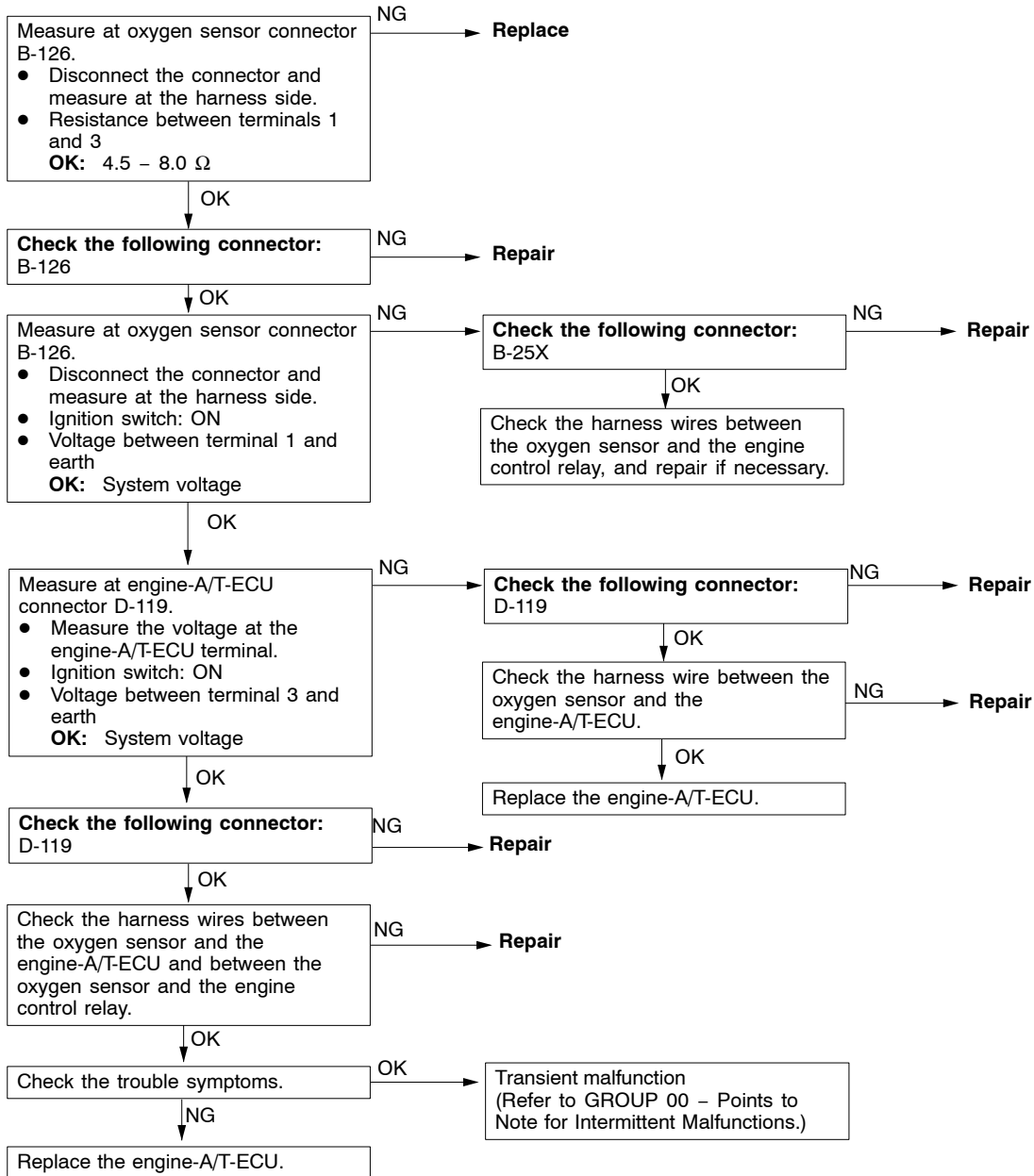
Code No.P0135 Oxygen sensor heater (right bank) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine coolant temperature is approx. 20°C or more. • The right bank oxygen sensor heater remains on. • The engine speed is 50 r/min or more. • Battery voltage is 11 – 16 V. <p>Set Conditions</p> <ul style="list-style-type: none"> • The current, which flows through the right bank oxygen sensor heater, is 0.2 A or less or 3.5 A or more for four seconds. 	<ul style="list-style-type: none"> • Malfunction of right bank oxygen sensor heater • Open or short circuit in the right bank oxygen sensor circuit or loose connector contact • Malfunction of engine-A/T-ECU



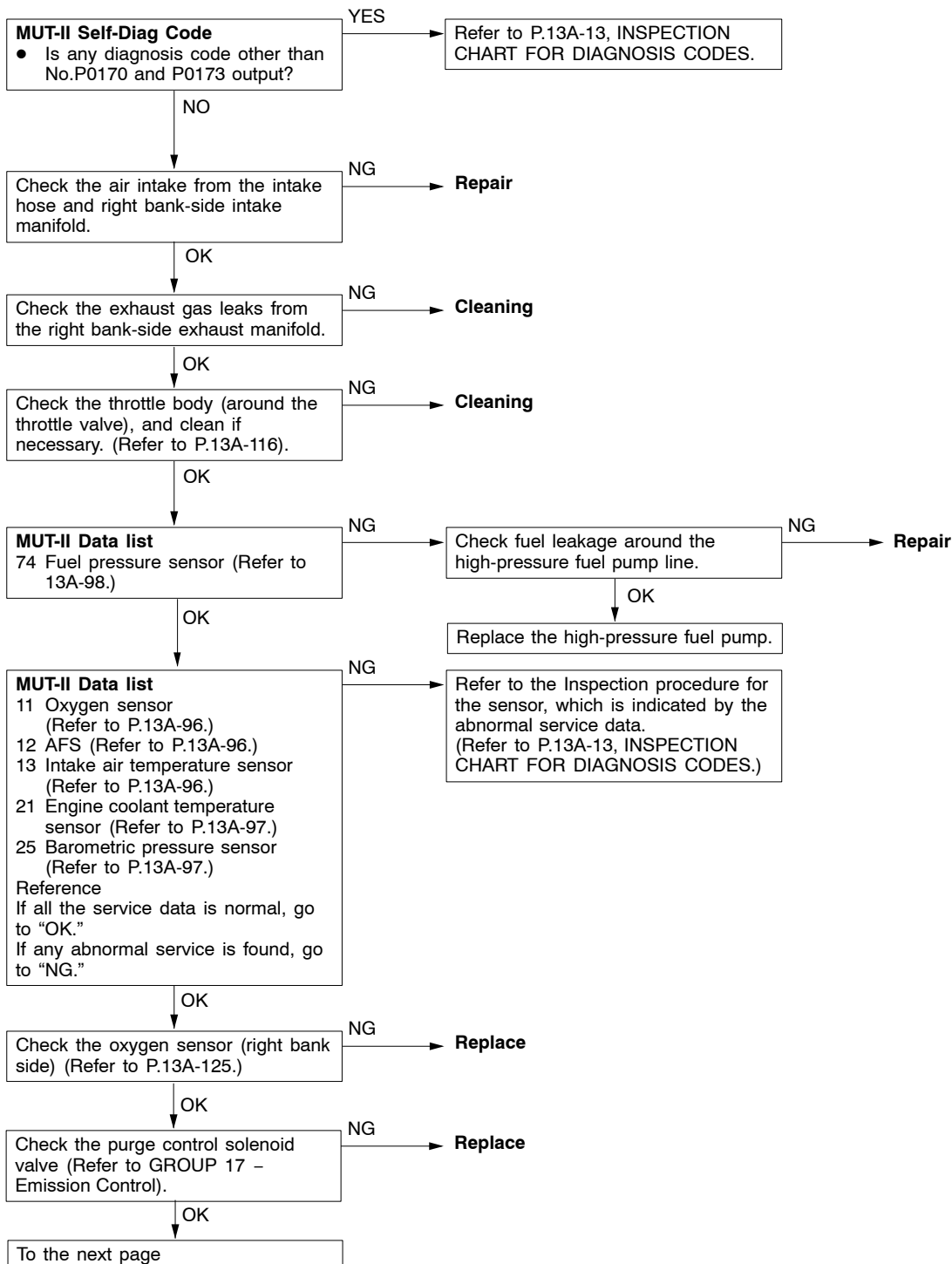
Code No.P0150 Oxygen sensor (left bank) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Three minutes have been passed since the engine has been started. The engine coolant temperature is approx. 80°C or more. Intake air temperature is 20 – 50°C. Engine speed is 1200 r/min or more Driving on a level surface at constant speed. <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage is 4.5 V or more when the oxygen sensor output voltage is 0.2 V or less and a voltage of 5 V is applied inside the engine-A/T-ECU. 	<ul style="list-style-type: none"> Malfunction of left bank oxygen sensor Open or short circuit in the left bank oxygen sensor circuit or loose connector contact Malfunction of engine-A/T-ECU

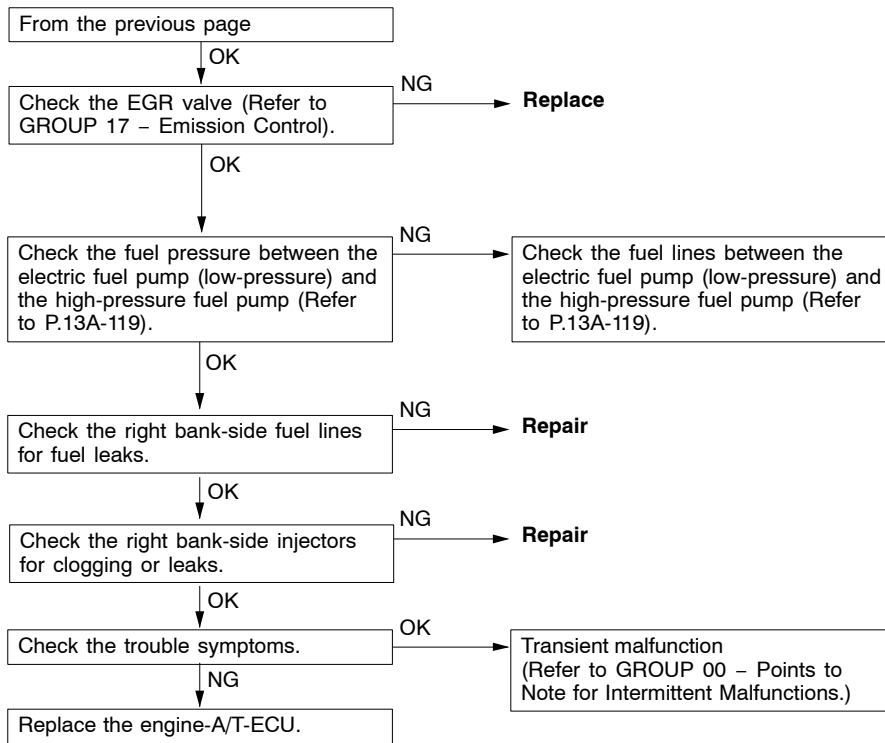


Code No.P0155 Oxygen sensor heater (left bank) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine coolant temperature is approx. 20°C or more. • The left bank oxygen sensor heater remains on. • The engine speed is 50 r/min or more. • Battery voltage is 11 – 16 V. <p>Set Conditions</p> <ul style="list-style-type: none"> • The current, which flows through the left bank oxygen sensor heater, does not change to 0.2 A or less, or 3.5 A or more for four seconds. 	<ul style="list-style-type: none"> • 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 engine-A/T-ECU

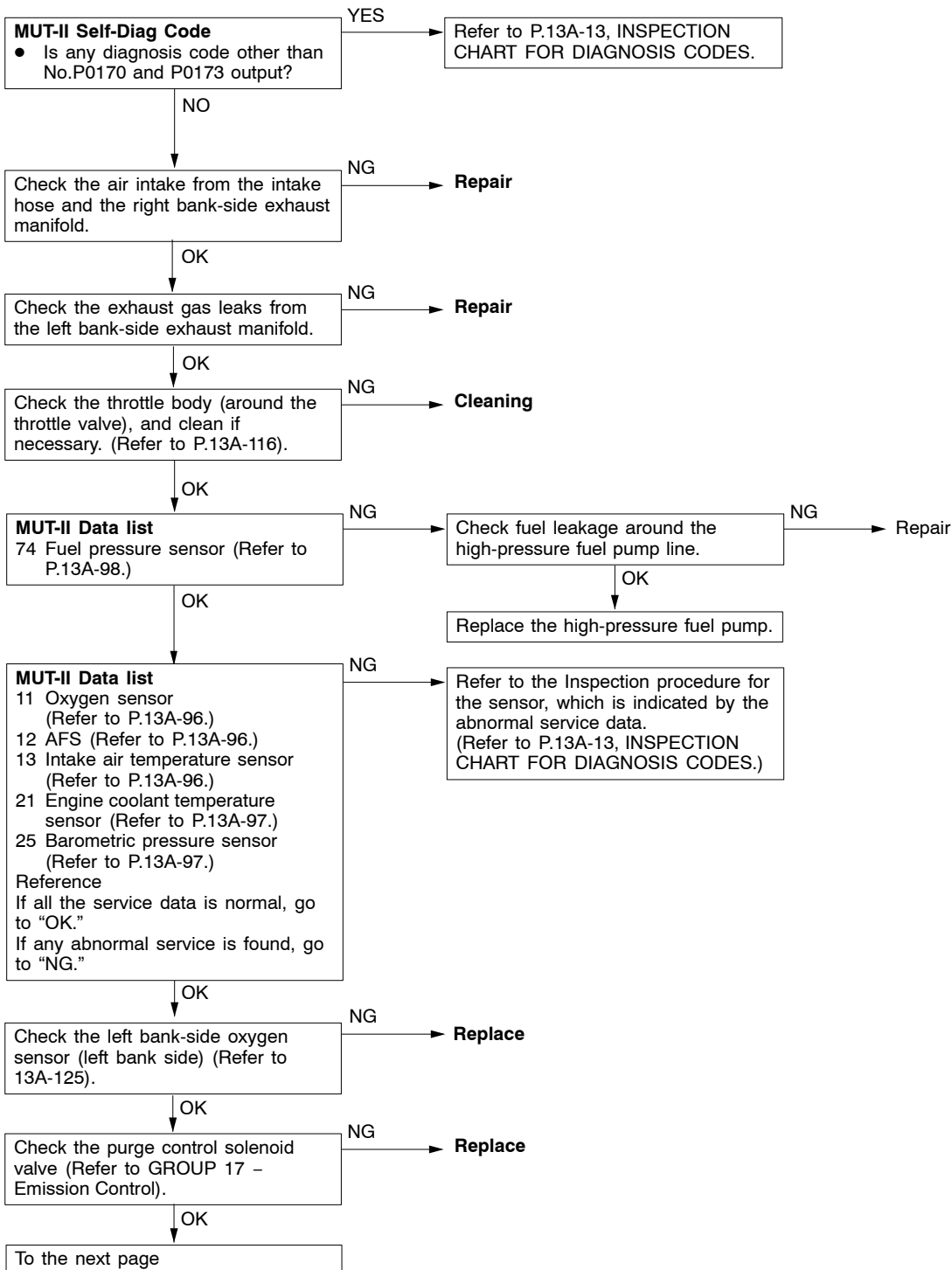


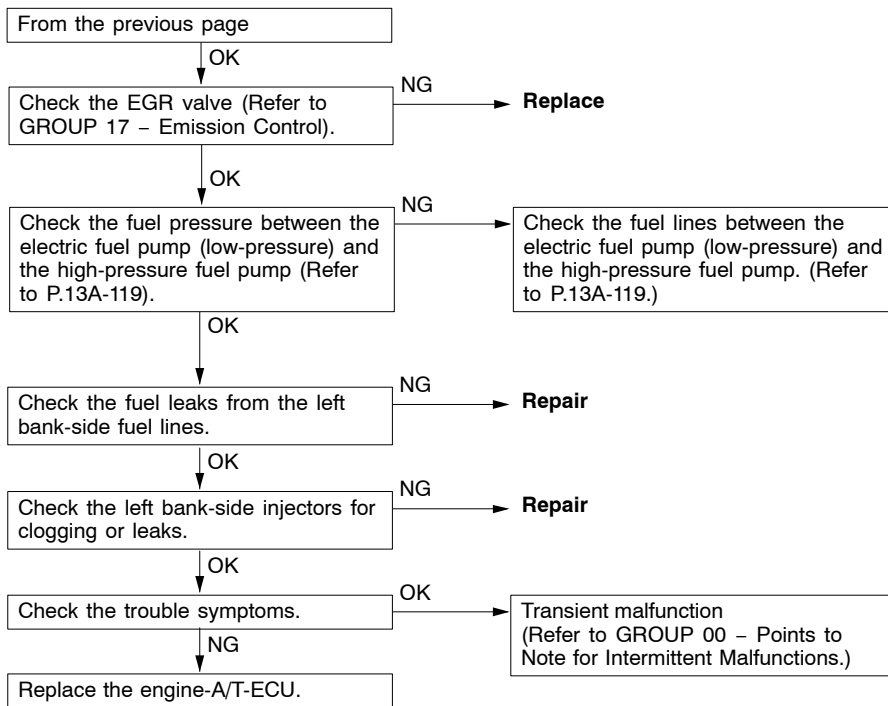
Code No.P0170 Abnormal fuel system <right bank> system	Probable cause
Range of Check • Engine: Being learning the air-fuel ratio Set Conditions • Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or • Ten seconds or more have been passed while the fuel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



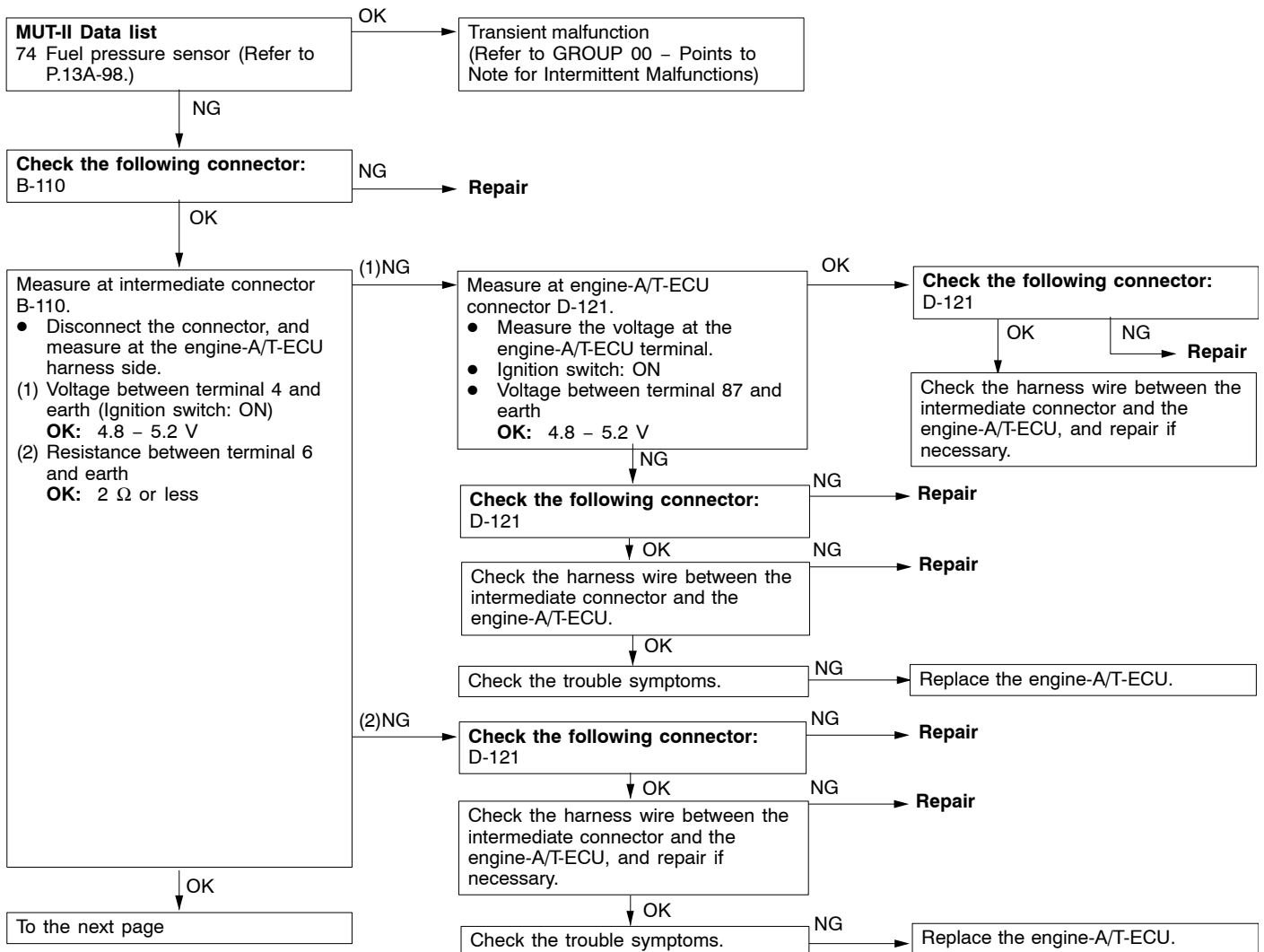


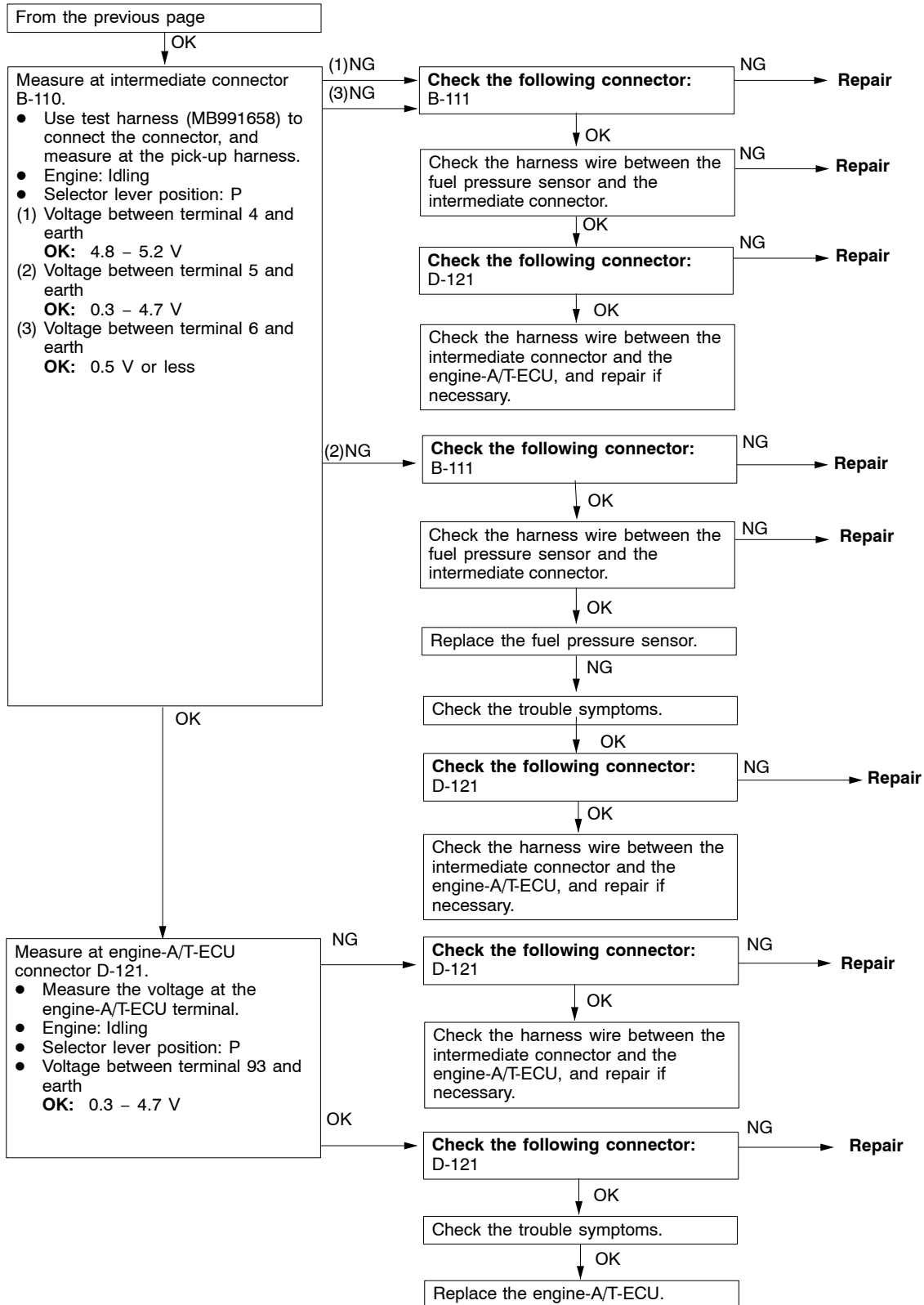
Code No.P0173 Abnormal fuel system (left bank)	Probable cause
Range of Check <ul style="list-style-type: none"> Engine: Being learning the air-fuel ratio Set Conditions <ul style="list-style-type: none"> Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or <ul style="list-style-type: none"> Ten seconds or more have been passed while the fuel injection amount compensation value is too high. 	<ul style="list-style-type: none"> Malfunction of fuel supply system Malfunction of oxygen sensor Malfunction of intake air temperature sensor Malfunction of barometric pressure sensor Malfunction of air flow sensor Malfunction of engine-A/T-ECU



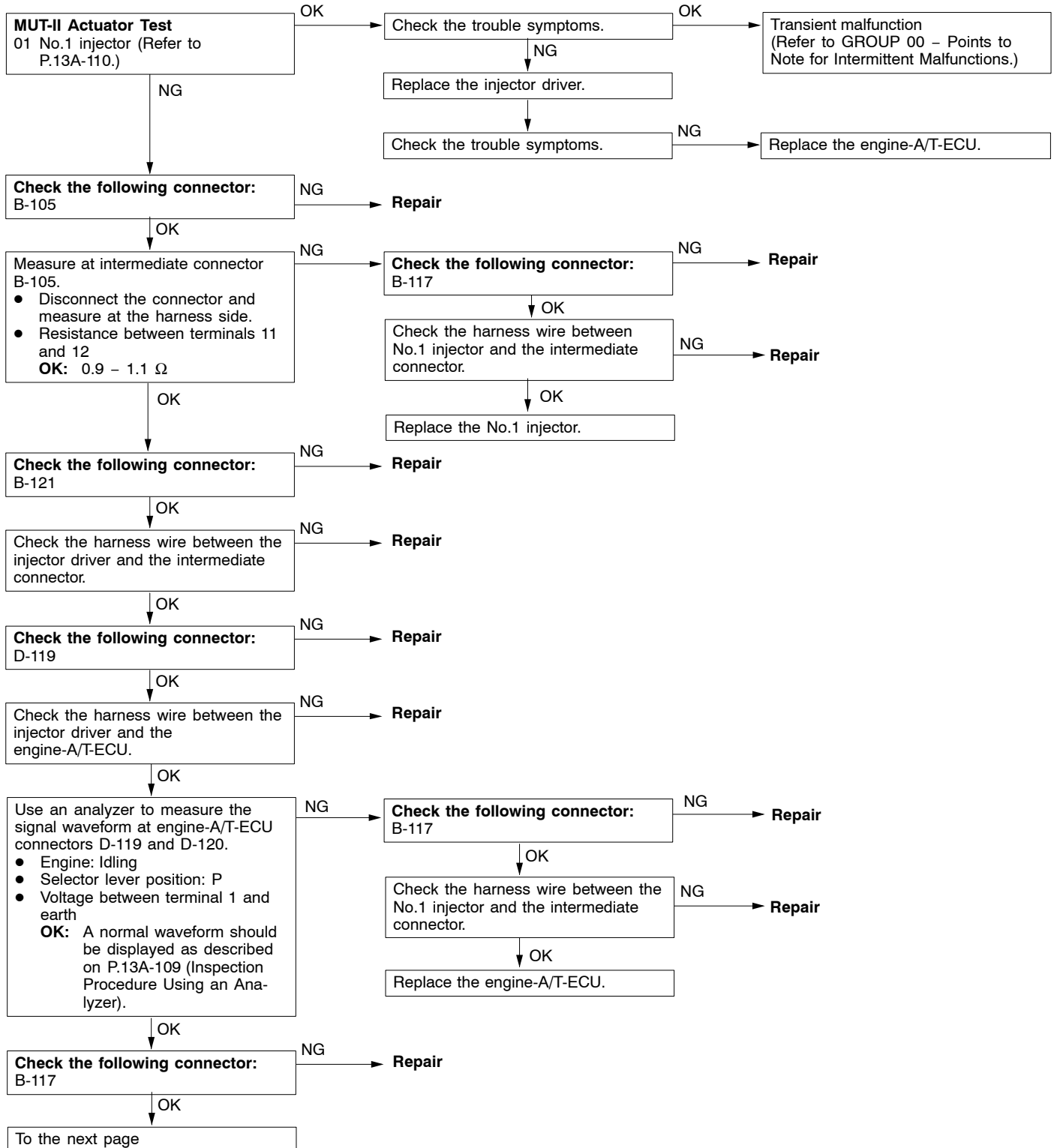


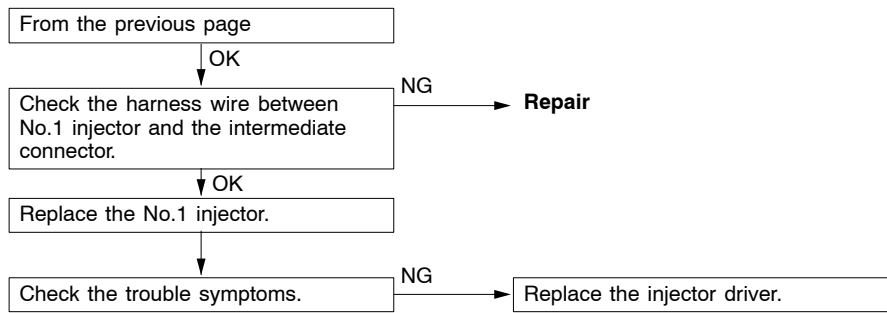
Code No.P0190 Abnormal fuel system	Probable cause
Range of Check <ul style="list-style-type: none"> Ignition switch: ON Set Conditions <ul style="list-style-type: none"> The sensor output voltage is 4.8V or more, or 0.2 V or less for four seconds. 	<ul style="list-style-type: none"> Malfunction of fuel pressure sensor Open or short circuit in the fuel pressure sensor circuit or loose connector contact Malfunction of engine-A/T-ECU
Range of Check <ul style="list-style-type: none"> The following conditions are detected temporarily after the engine has been started. <ul style="list-style-type: none"> (1)Engine speed: 1,000 r/min or more (2)Fuel pressure: 2 MPa or more Engine running Set Conditions <ul style="list-style-type: none"> The fuel pressure is 6.9 MPa or more, or 2 MPa or less for four seconds. 	<ul style="list-style-type: none"> Malfunction of high-pressure fuel pump Clogging of high-pressure fuel lines
This diagnosis code will also be output when air is trapped into the high-pressure fuel lines(such as poor fuel level).In that case, the air can be evacuated by operating the engine for at least 15 seconds at 2000r/min. After the repair, use the MUT-II to erase the diagnosis code.	<ul style="list-style-type: none"> Air trapped due to poor fuel level



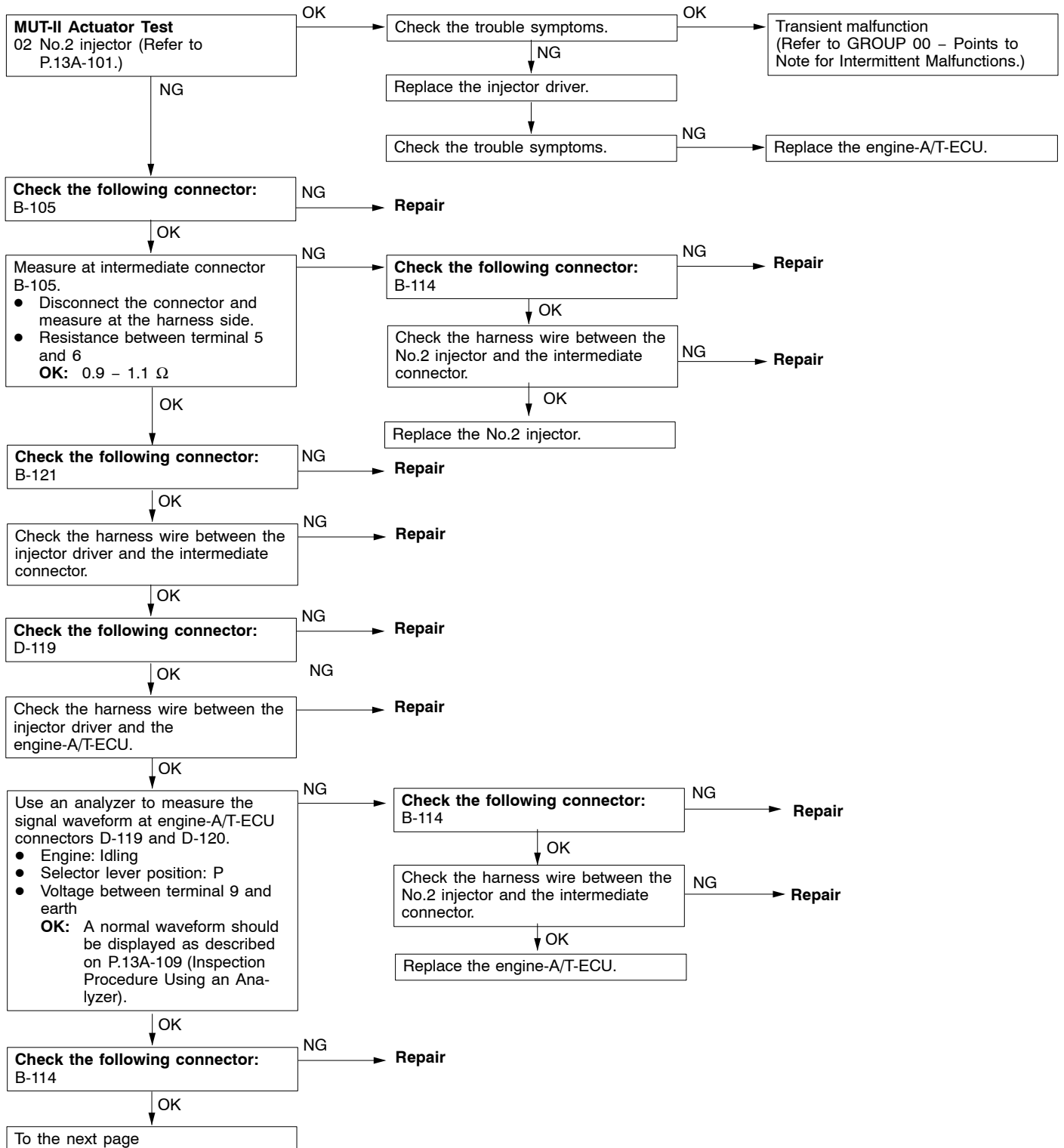


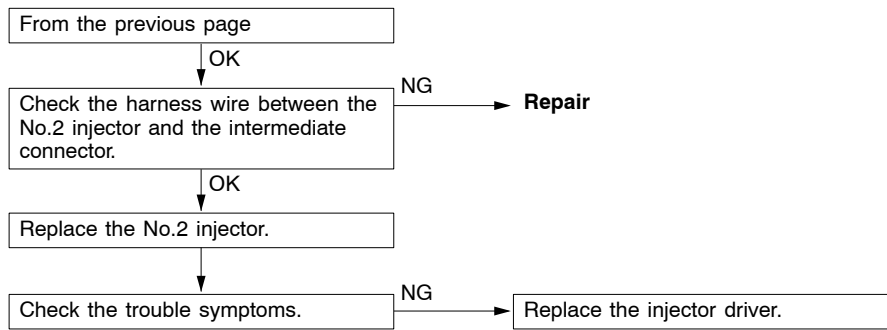
Code No.P0201 No.1 injector system	Probable cause
Range of Check <ul style="list-style-type: none"> • The engine speed is 4,000 r/min or less. • The battery voltage is 10 V or more. • The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions <ul style="list-style-type: none"> • The injector driver is not transmitting a injector open circuit check signal for four seconds. 	<ul style="list-style-type: none"> • Malfunction of No.1 injector • Open or short circuit in the No.1 injector circuit or loose connector contact • Malfunction of engine-A/T-ECU



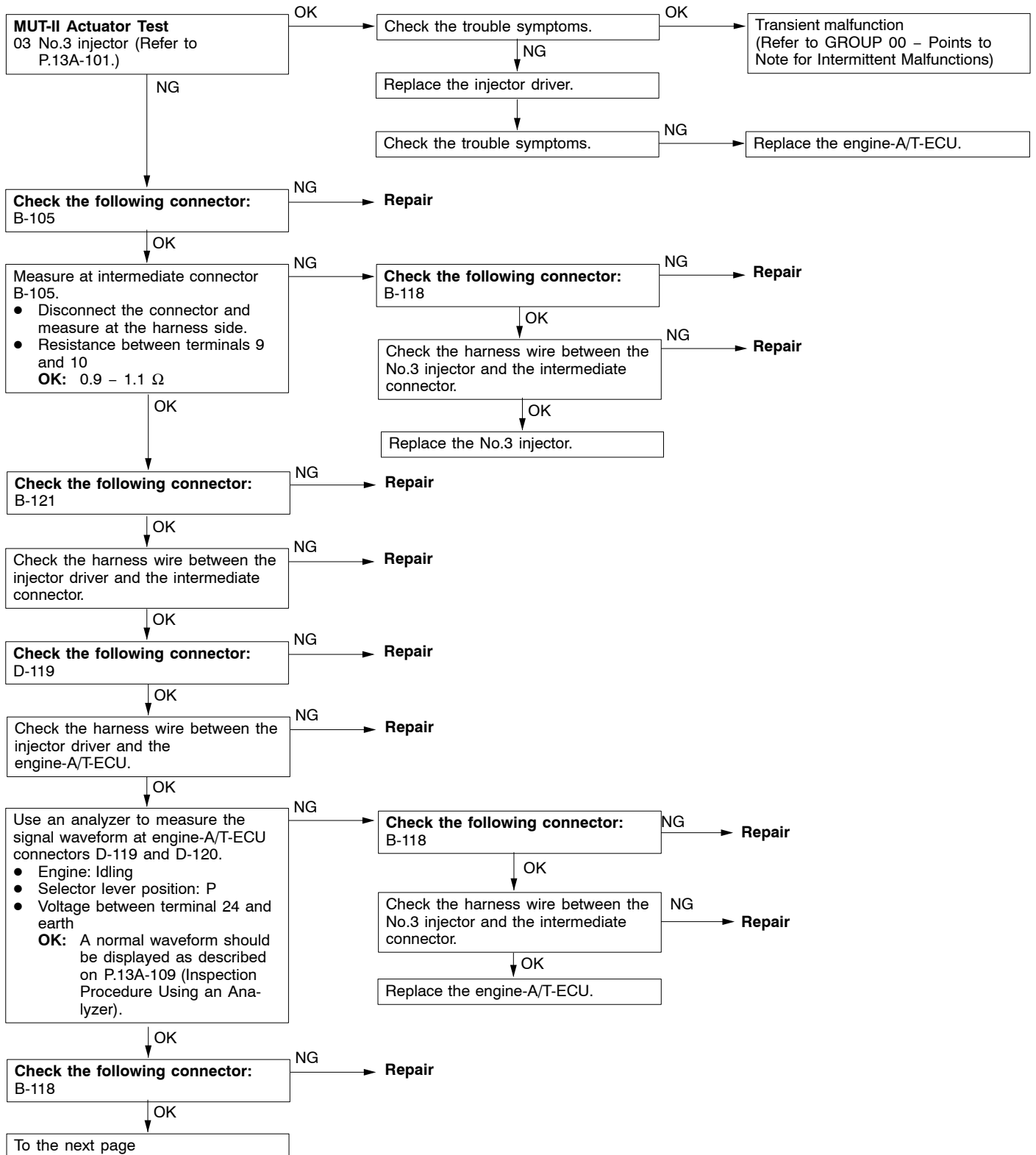


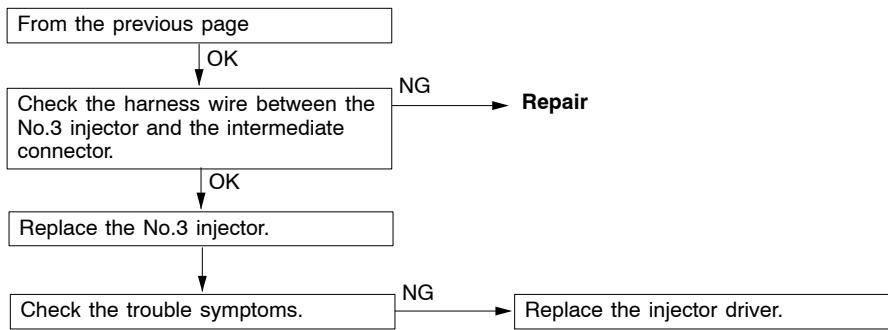
Code No.P0202 No.2 injector system	Probable cause
Range of Check <ul style="list-style-type: none"> • The engine speed is 4,000 r/min or less. • The battery voltage is 10 V or more. • The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions <ul style="list-style-type: none"> • The injector driver is not transmitting a injector open circuit check signal for four seconds. 	<ul style="list-style-type: none"> • Malfunction of No.2 injector • Open or short circuit in the No.2 injector circuit or loose connector contact • Malfunction of engine-A/T-ECU



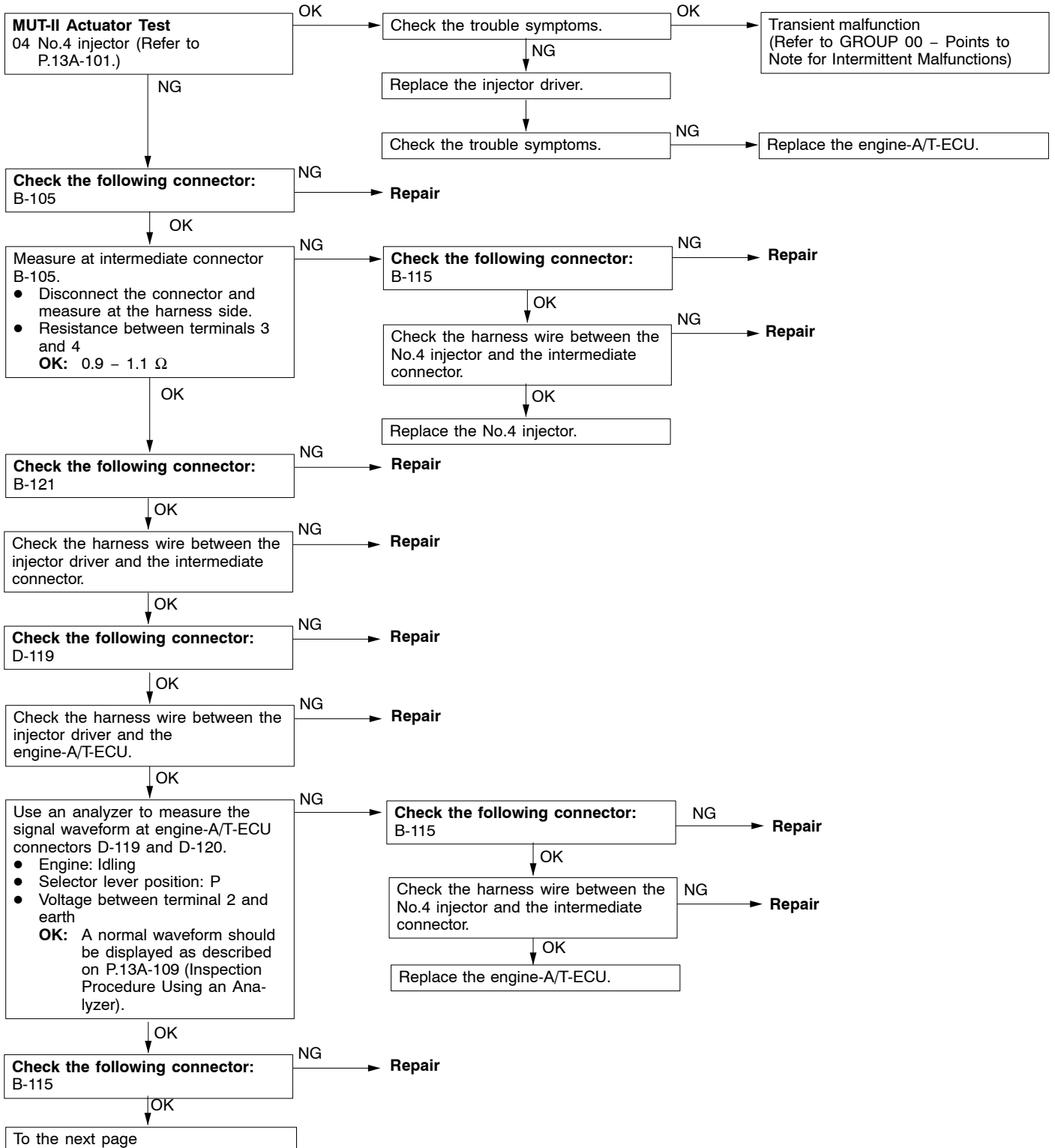


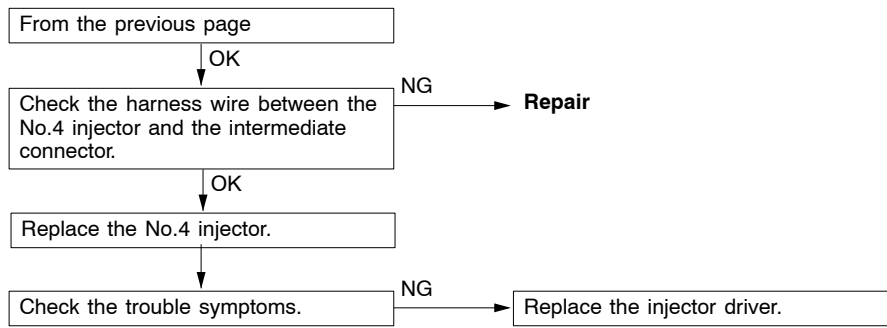
Code No.P0203 No.3 injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> The engine speed is 4,000 r/min or less. The battery voltage is 10 V or more. The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. <p>Set Conditions</p> <ul style="list-style-type: none"> The injector driver is not transmitting a injector open circuit check signal for four seconds. 	<ul style="list-style-type: none"> Malfunction of No.3 injector Open or short circuit in the No.3 injector circuit or loose connector contact Malfunction of engine-A/T-ECU



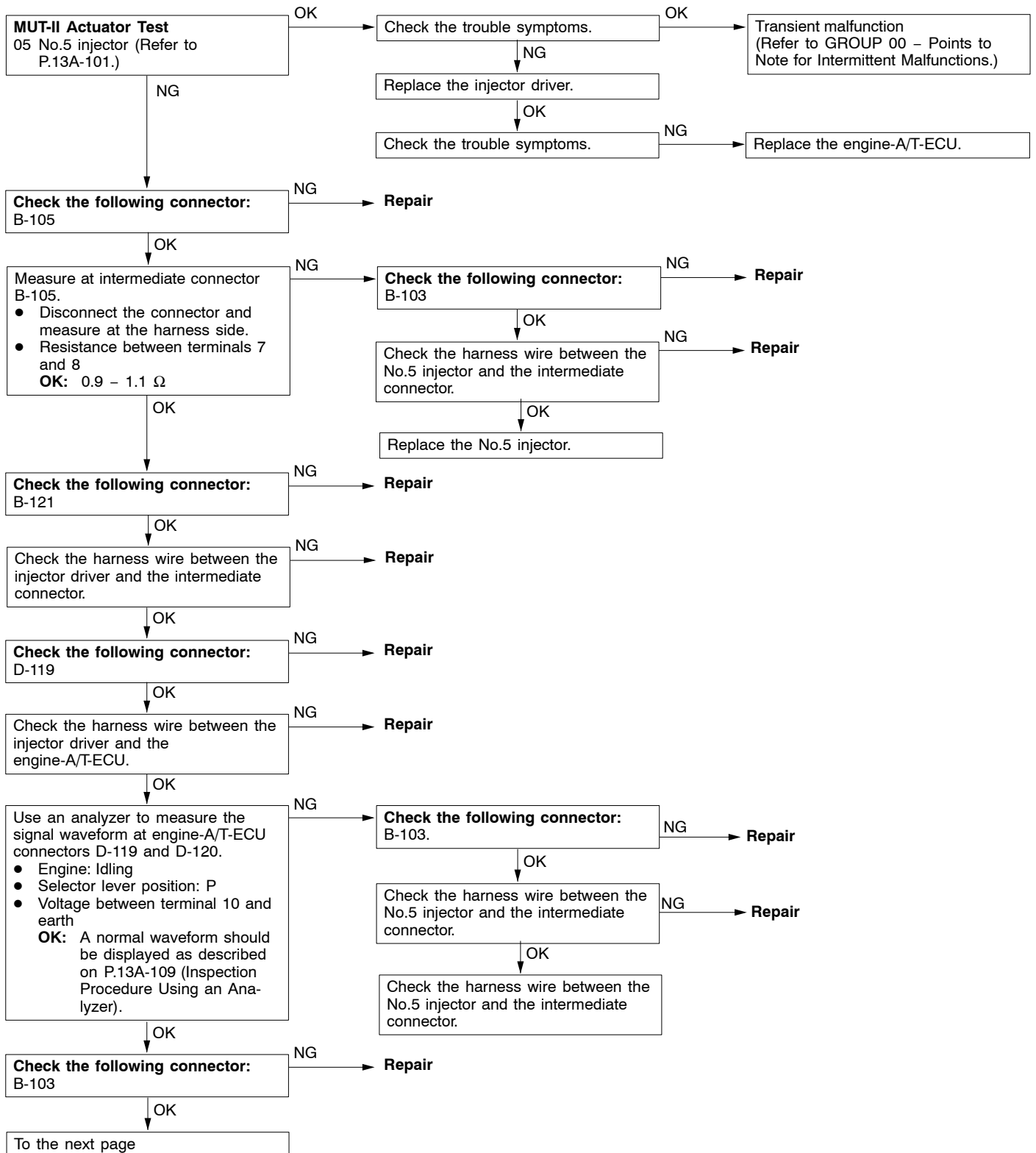


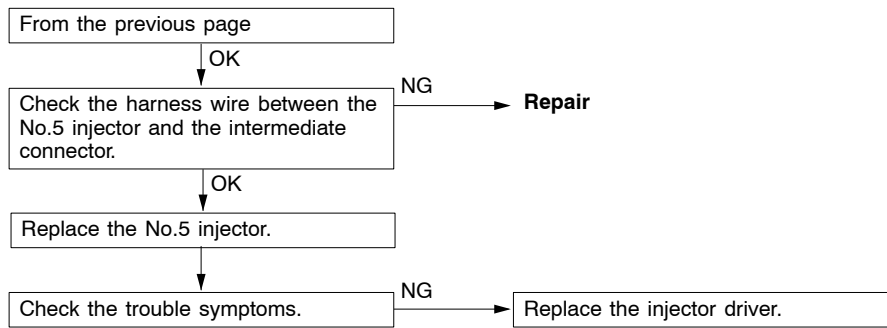
Code No.P0204 No.4 injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> The engine speed is 4,000 r/min or less. The battery voltage is 10 V or more. The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. <p>Set Conditions</p> <ul style="list-style-type: none"> The injector driver is not transmitting a injector open circuit check signal for four seconds. 	<ul style="list-style-type: none"> Malfunction of No.4 injector Open or short circuit in the No.4 injector circuit or loose connector contact Malfunction of engine-A/T-ECU



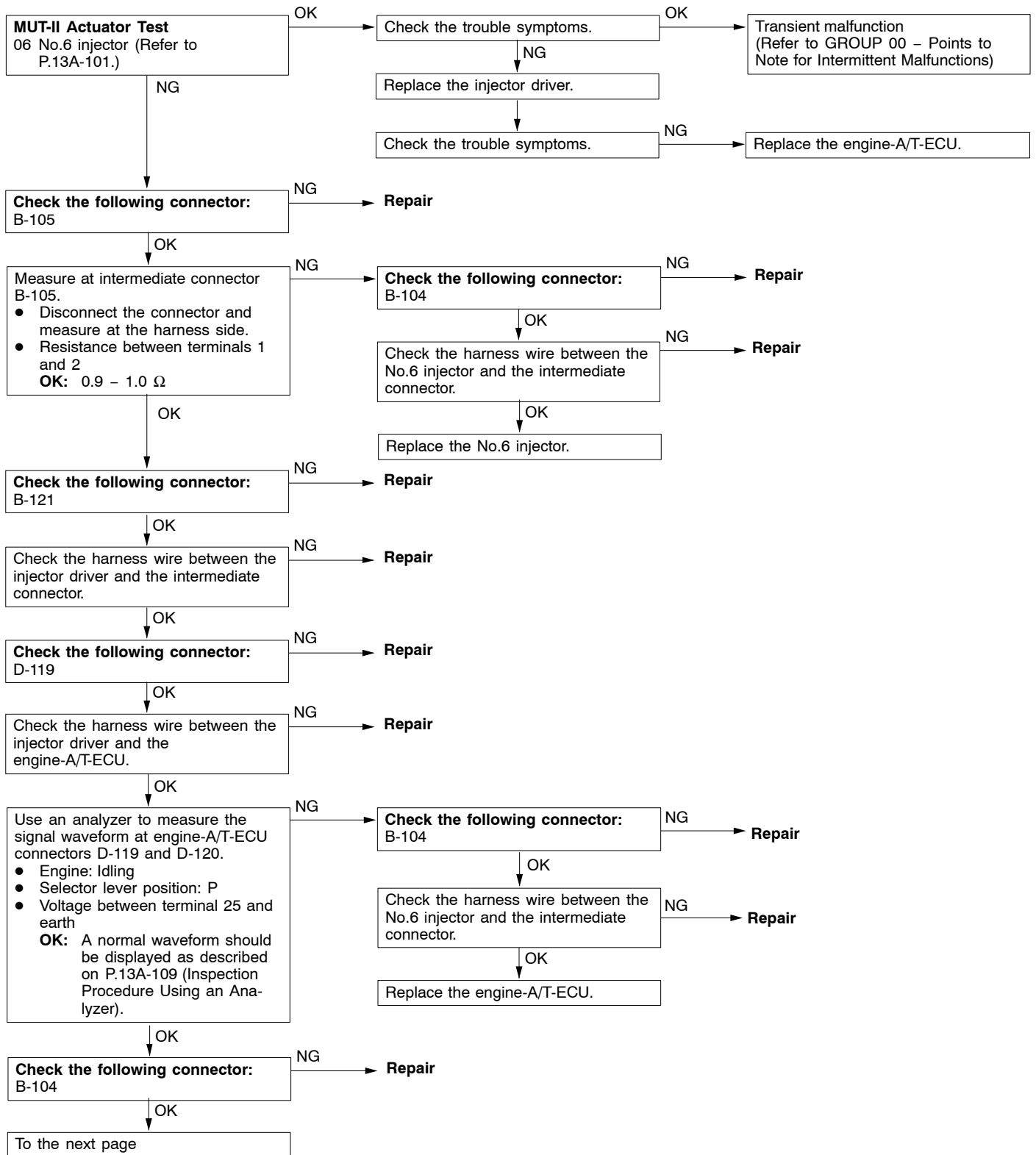


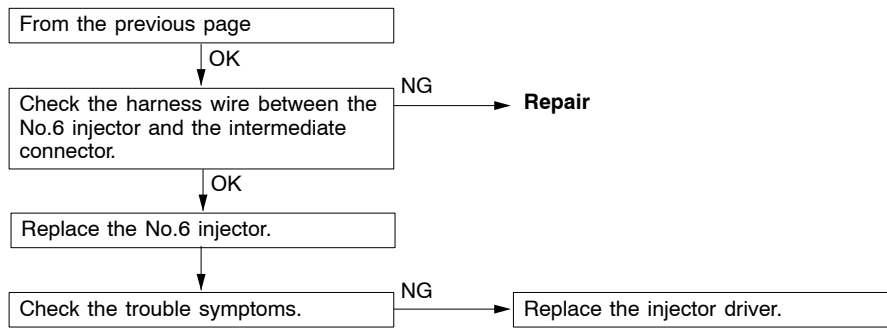
Code No.P0205 No.5 injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> The engine speed is 4,000 r/min or less. The battery voltage is 10 V or more. The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. <p>Set Conditions</p> <ul style="list-style-type: none"> The injector driver is not transmitting a injector open circuit check signal for four seconds. 	<ul style="list-style-type: none"> Malfunction of No.5 injector Open or short circuit in the No.5 injector circuit or loose connector contact Malfunction of engine-A/T-ECU



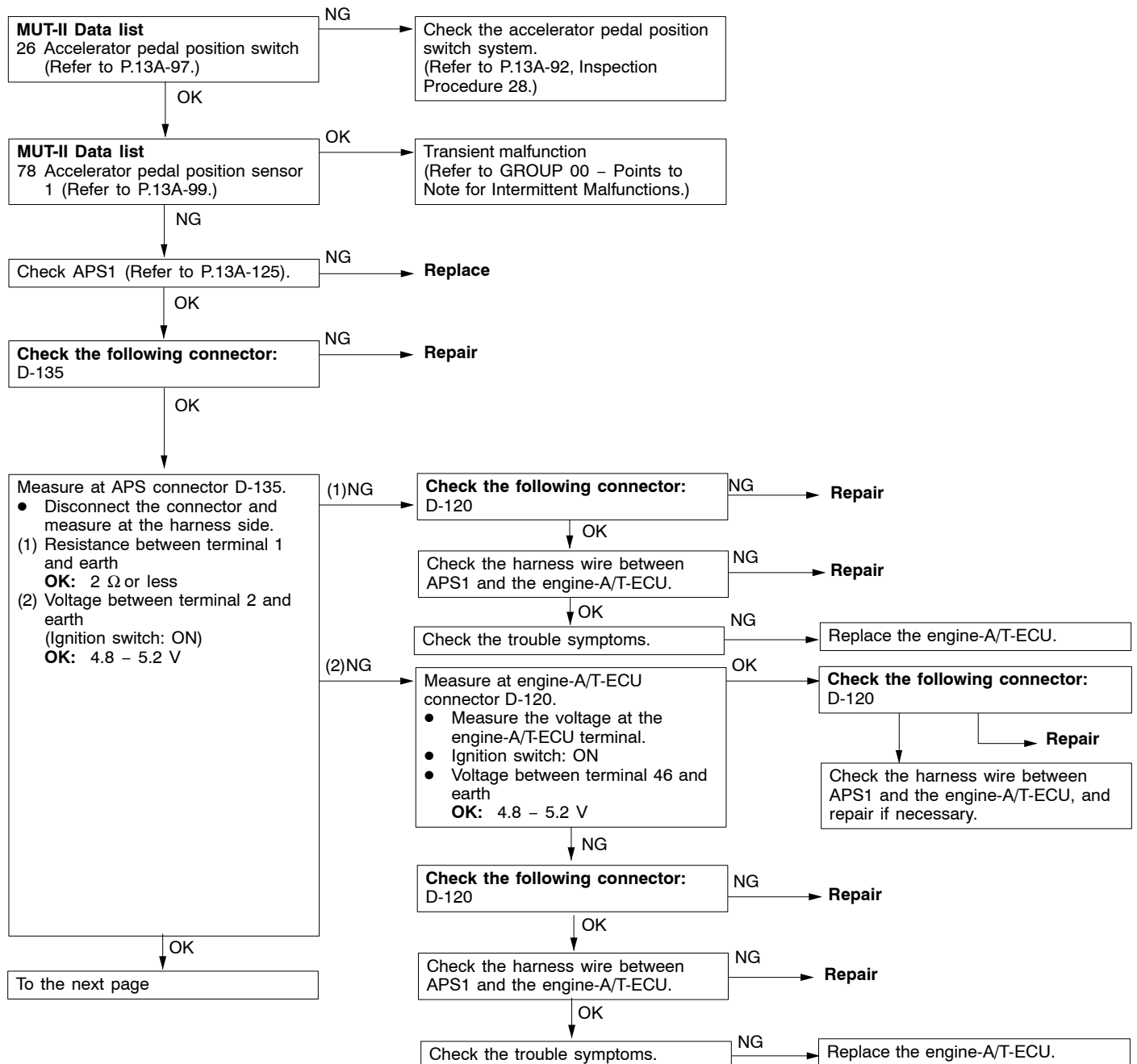


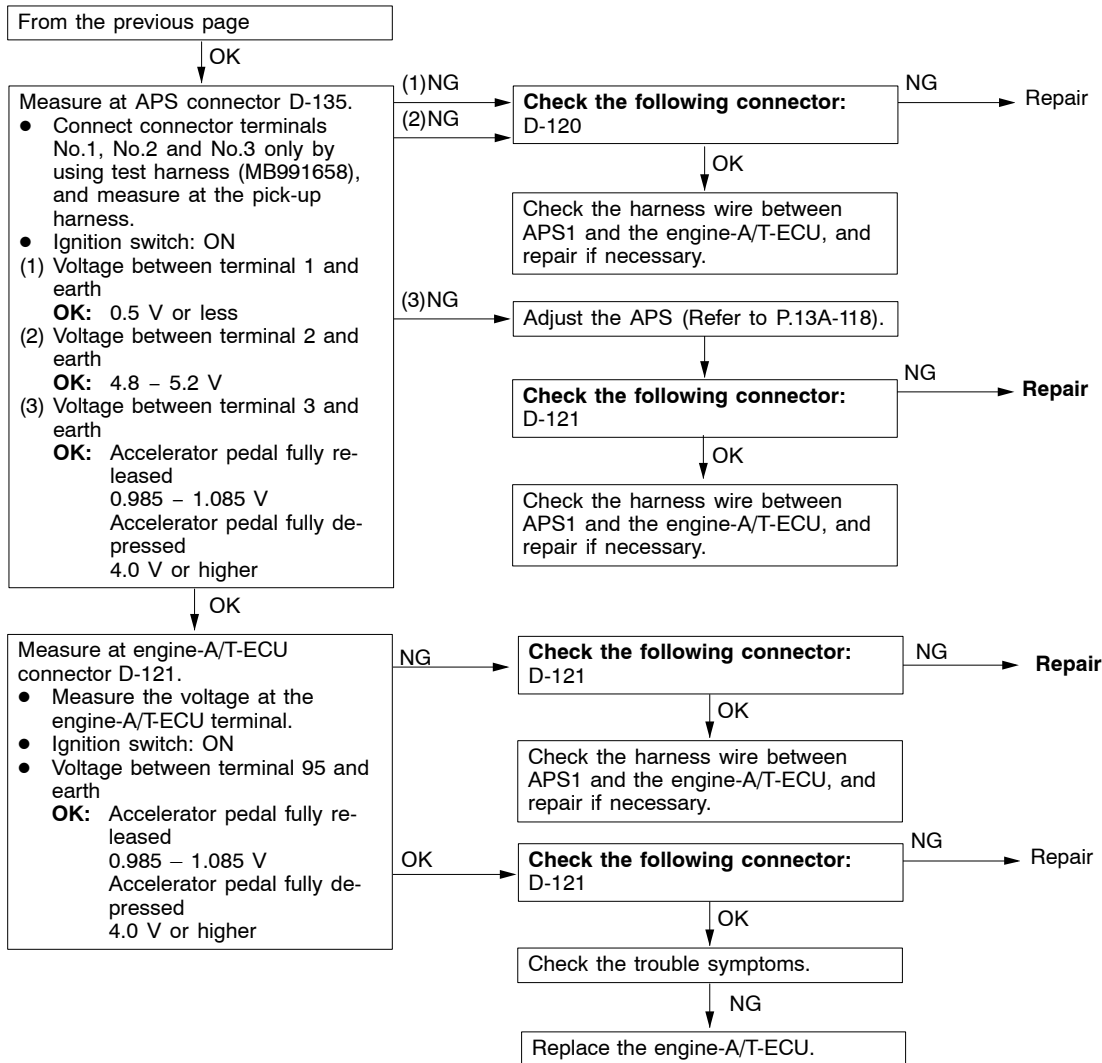
Code No.P0206 No.6 injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> The engine speed is 4000 r/min or less. The battery voltage is 10 V or more. The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. <p>Set Conditions</p> <ul style="list-style-type: none"> The injector driver is not transmitting a injector open circuit check signal for four seconds. 	<ul style="list-style-type: none"> Malfunction of No.6 injector Open or short circuit in the No.6 injector circuit or loose connector contact Malfunction of engine-A/T-ECU



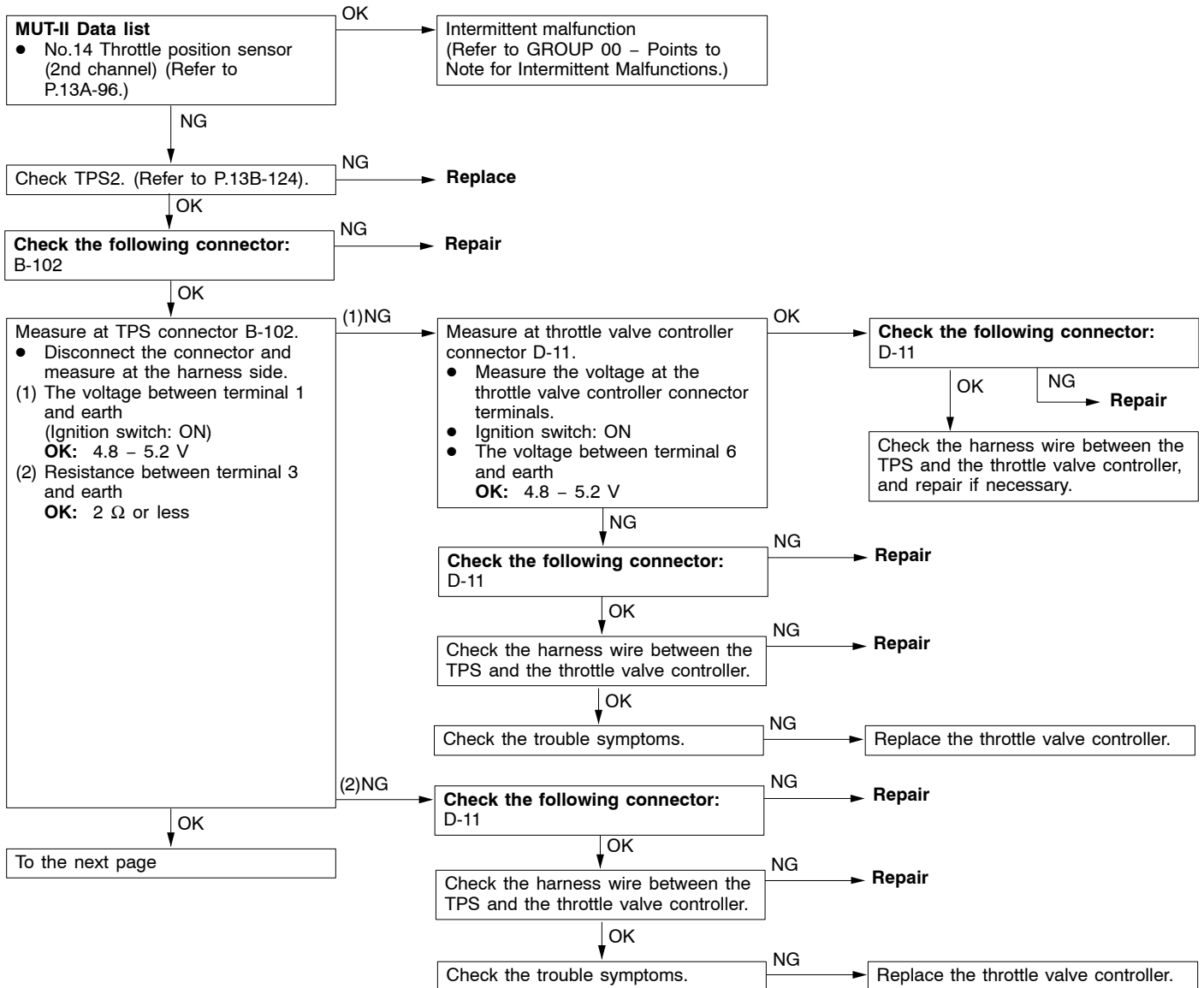


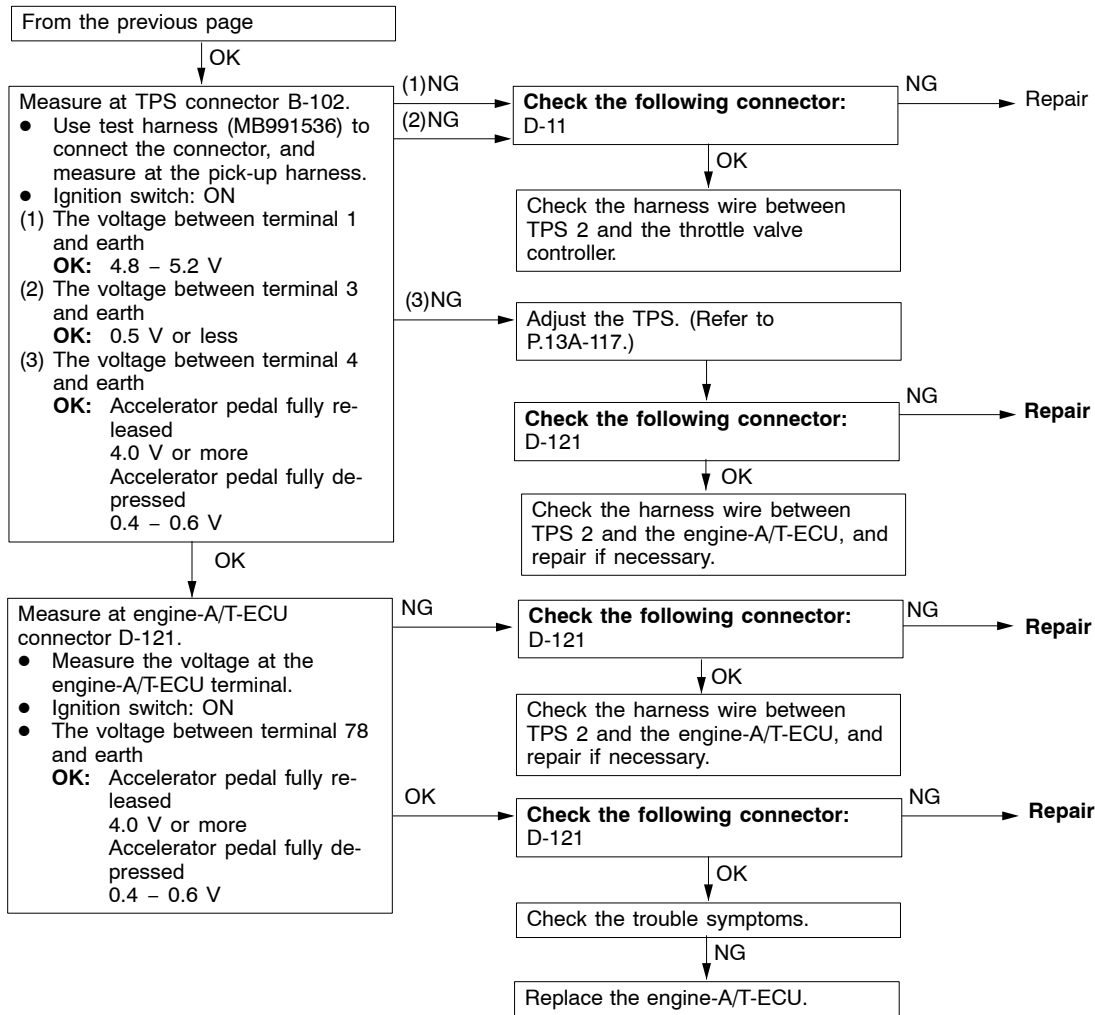
Code No.P0220 Accelerator pedal position sensor 1 (APS1) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Accelerator pedal position sensor 2 (APS2) is normal. Communication between the engine-A/T-ECU and the throttle valve controller is normal. <p>Set Conditions</p> <ul style="list-style-type: none"> The output voltage of APS1 is 0.2 V or less for one second. <p>or</p> <ul style="list-style-type: none"> The output voltage of APS2 is 2.5 V or less, and that of APS1 is 4.5 V or more for one second <p>or</p> <ul style="list-style-type: none"> The difference between APS1 and APS2 output voltages is 1.0 V or more (i.e. the throttle opening angle changes slightly). <p>or</p> <ul style="list-style-type: none"> The output voltage of APS1 is 1.1 V or more for one second when the accelerator pedal position switch is turned on. 	<ul style="list-style-type: none"> Malfunction of APS1 Open or short circuit in the APS1 circuit or loose connector contact Accelerator pedal position switch seized ON Malfunction of throttle valve controller Malfunction of engine-A/T-ECU



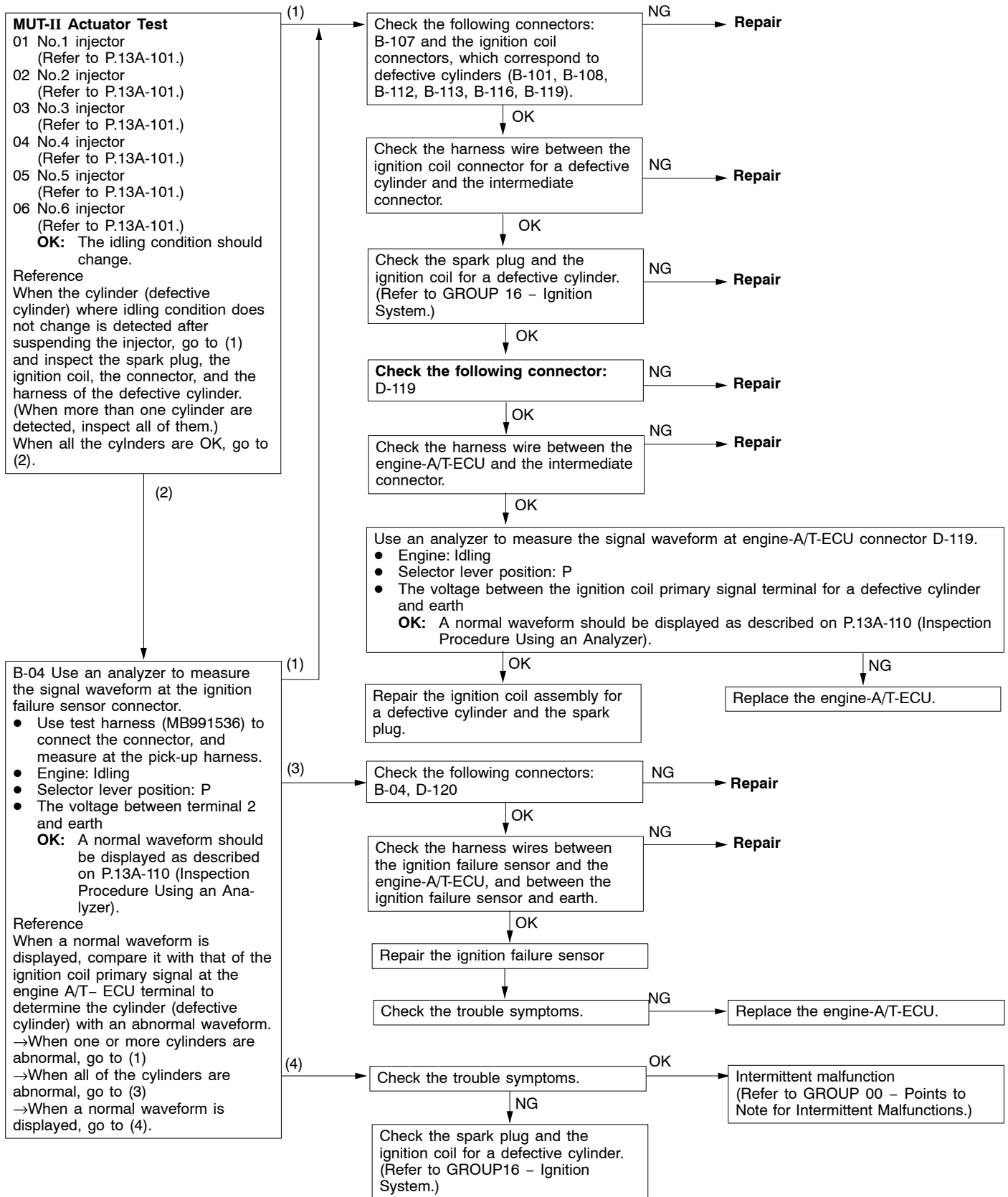


Code No. 0225 Throttle position sensor 2 (TPS2) system	Probable cause
<p>The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU.</p> <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON The throttle position sensor (TPS1) is normal. <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage is 0.2V or less for four seconds. <p>or</p> <ul style="list-style-type: none"> The sensor output voltage is 4.85V or more for four seconds, and the output voltage of the TPS1 is 1.2 V or more. <p>or</p> <ul style="list-style-type: none"> The TPS1 and TPS2 combination output voltage is outside 4 – 6 V. 	<ul style="list-style-type: none"> Malfunction of TPS2 Open or short circuit in the TPS2 circuit or loose connector contact Malfunction of the throttle valve controller Malfunction of the engine-A/T-ECU

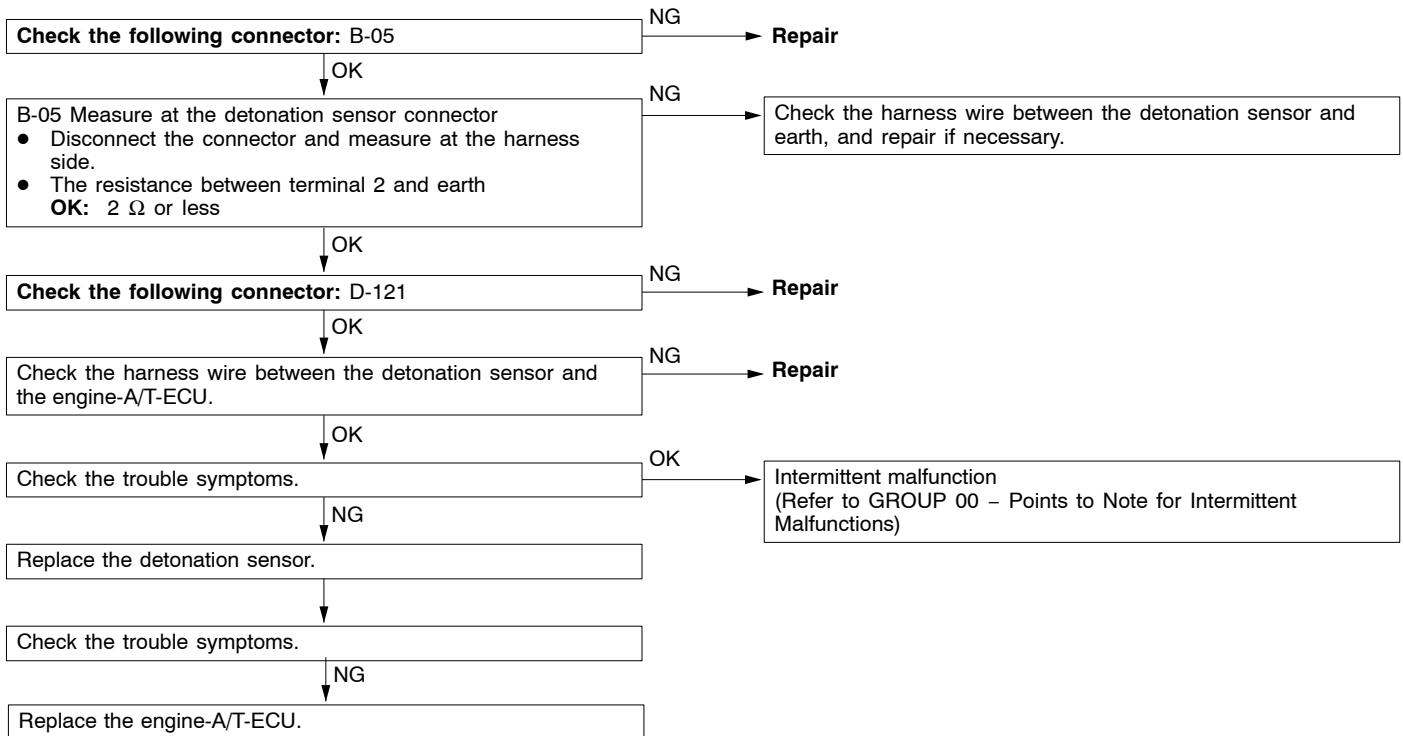




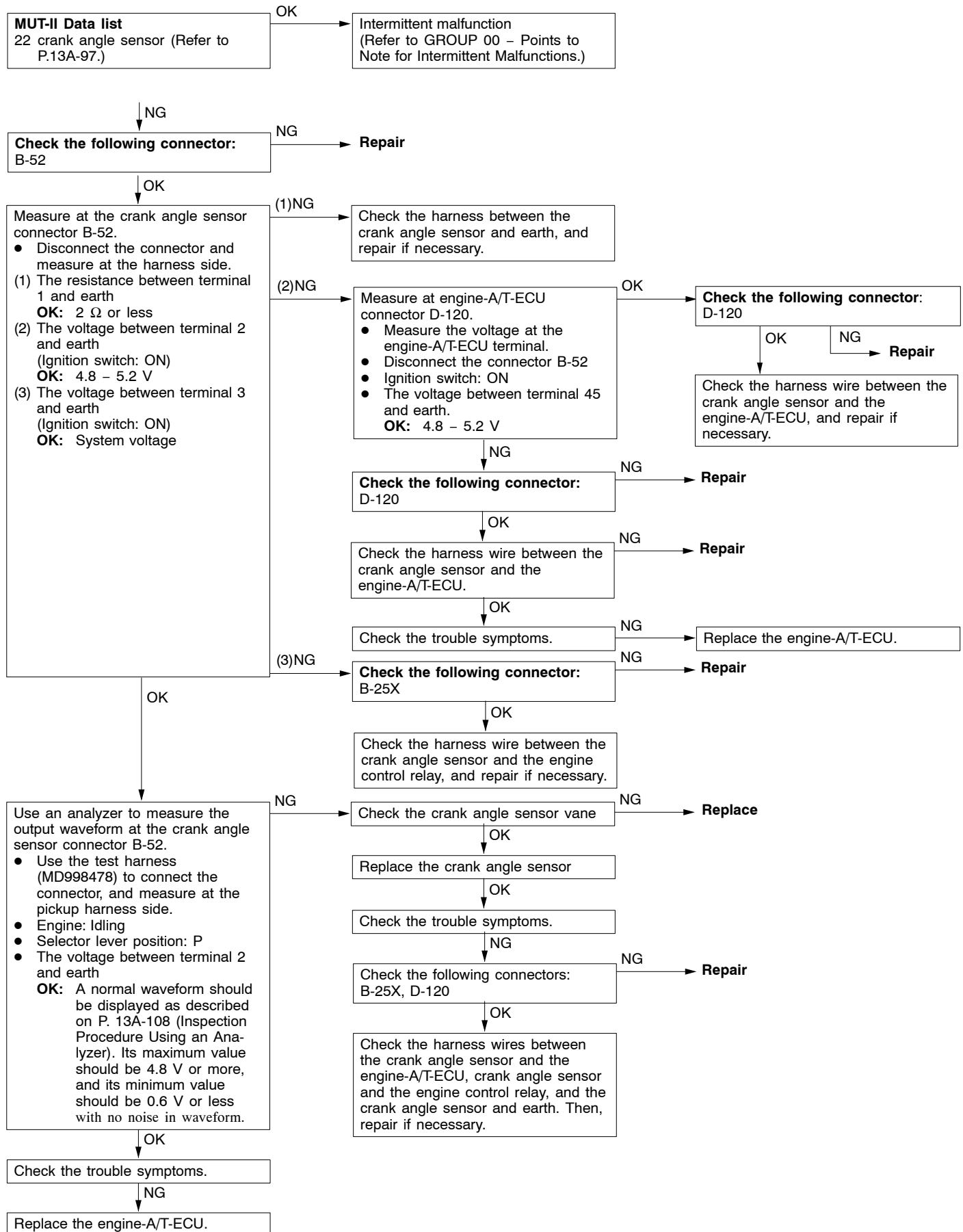
Code No.P0300 Ignition coil (power transistor) system	Probable cause
Range of Check <ul style="list-style-type: none"> • Engine speed is approx. 50 – 4,000 r/min. • Engine is not cranking. Set Conditions <ul style="list-style-type: none"> • The ignition failure sensor does not send a signal about a certain cylinder for four seconds. 	<ul style="list-style-type: none"> • Malfunction of the ignition coil • Malfunction of the ignition failure sensor • Malfunction of spark plug • Open or short circuit in the primary ignition circuit or loose connector contact • Malfunction of engine-A/T-ECU



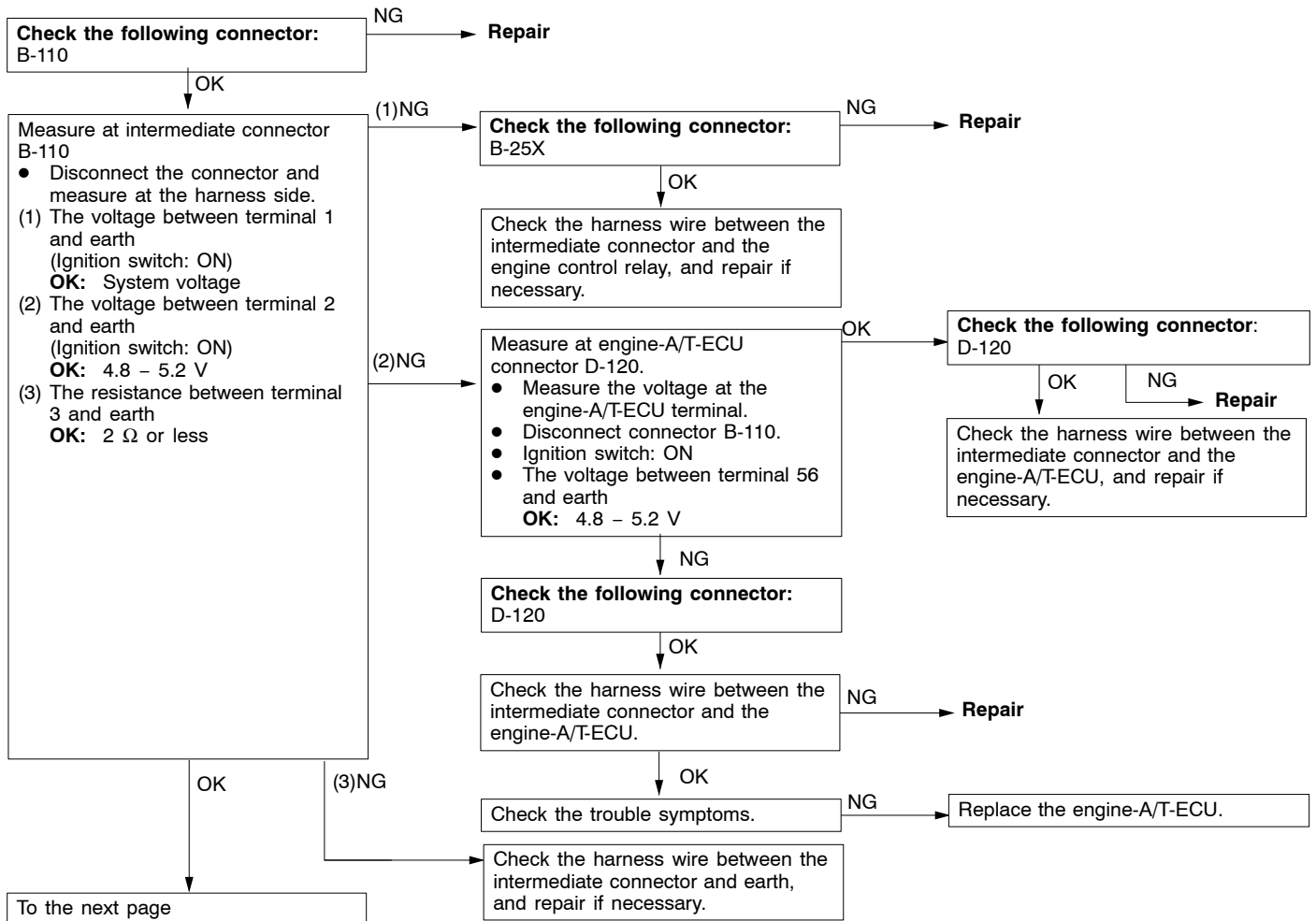
Code No.P0325 Detonation sensor system	Probable cause
Range of Check • Engine: Two seconds after the engine has been started Set Conditions • Changes in sensor output voltage (detonation sensor peak voltage per 1/3 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	• Malfunction of the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

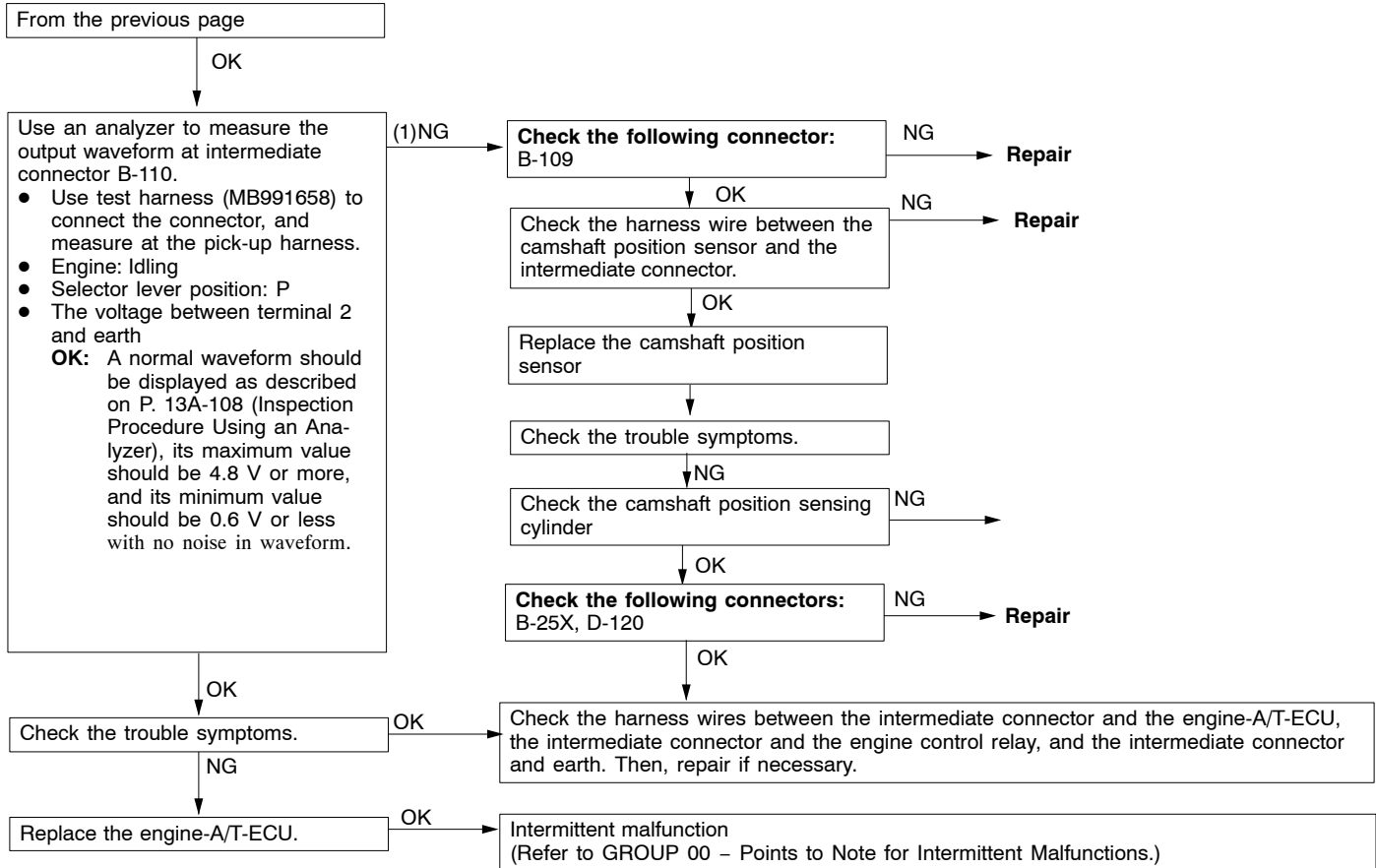


Code No.P0335 Crank angle sensor system	Probable cause
Range of Check • Engine is cranking Set Conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input).	• Malfunction of the crank angle sensor. • Open or short circuit in the crank angle sensor circuit or loose connector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

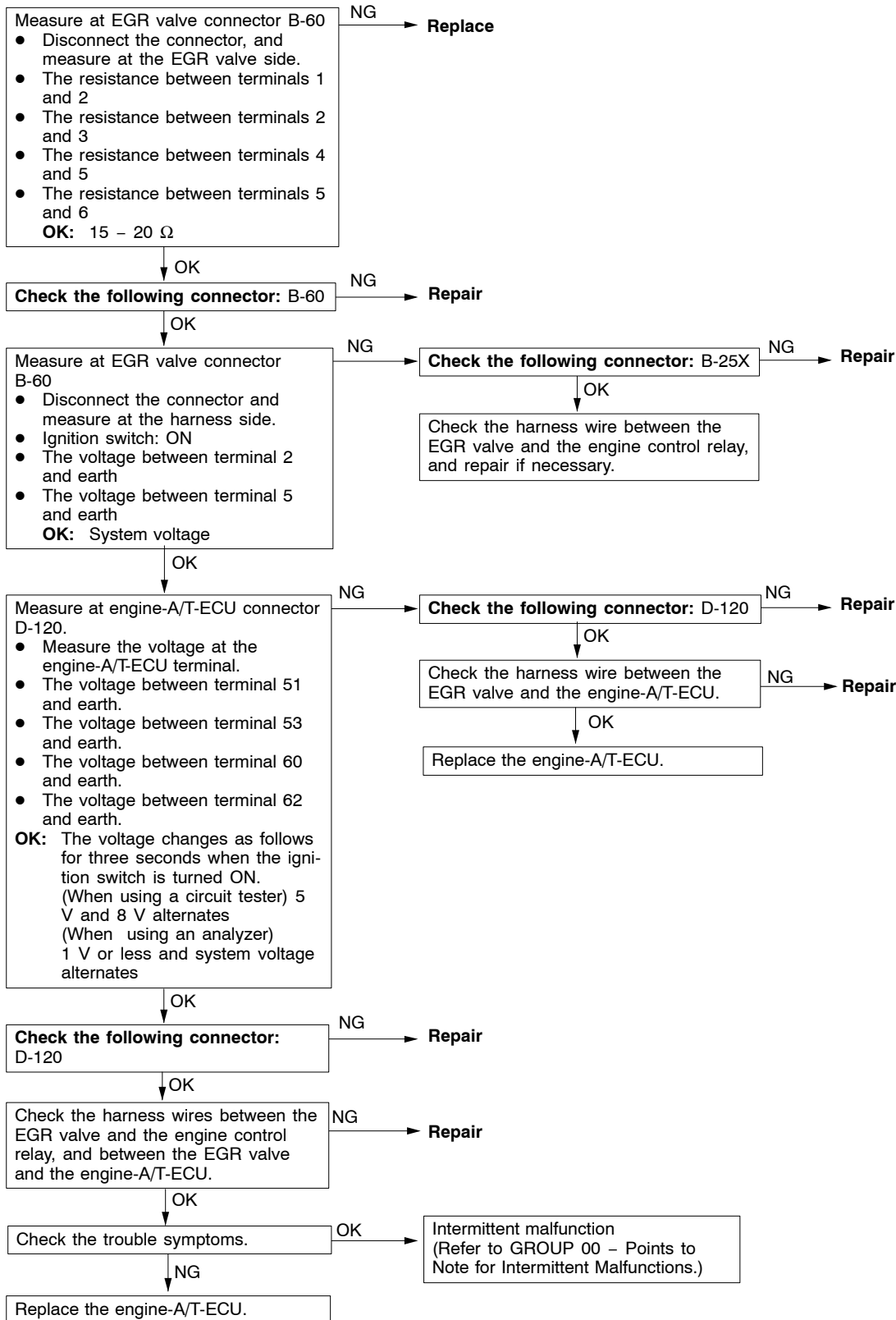


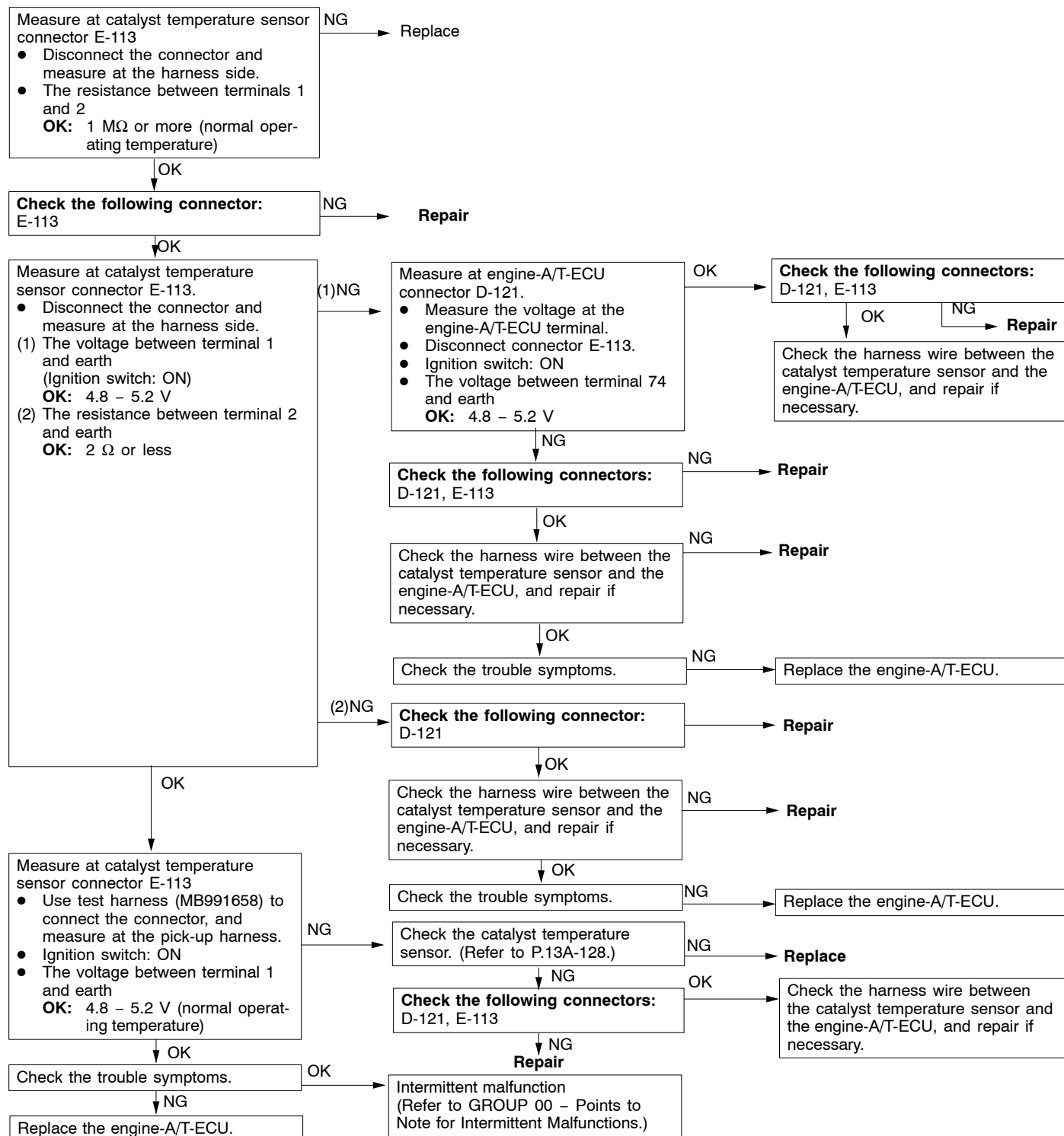
Code No.P0340 Camshaft position sensor system	Probable cause
Range of Check <ul style="list-style-type: none"> After the engine was started Set Conditions <ul style="list-style-type: none"> The sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> Malfunction of the camshaft position sensor Open or short circuit in the camshaft position sensor circuit or loose connector contact. Malfunction of engine-A/T-ECU



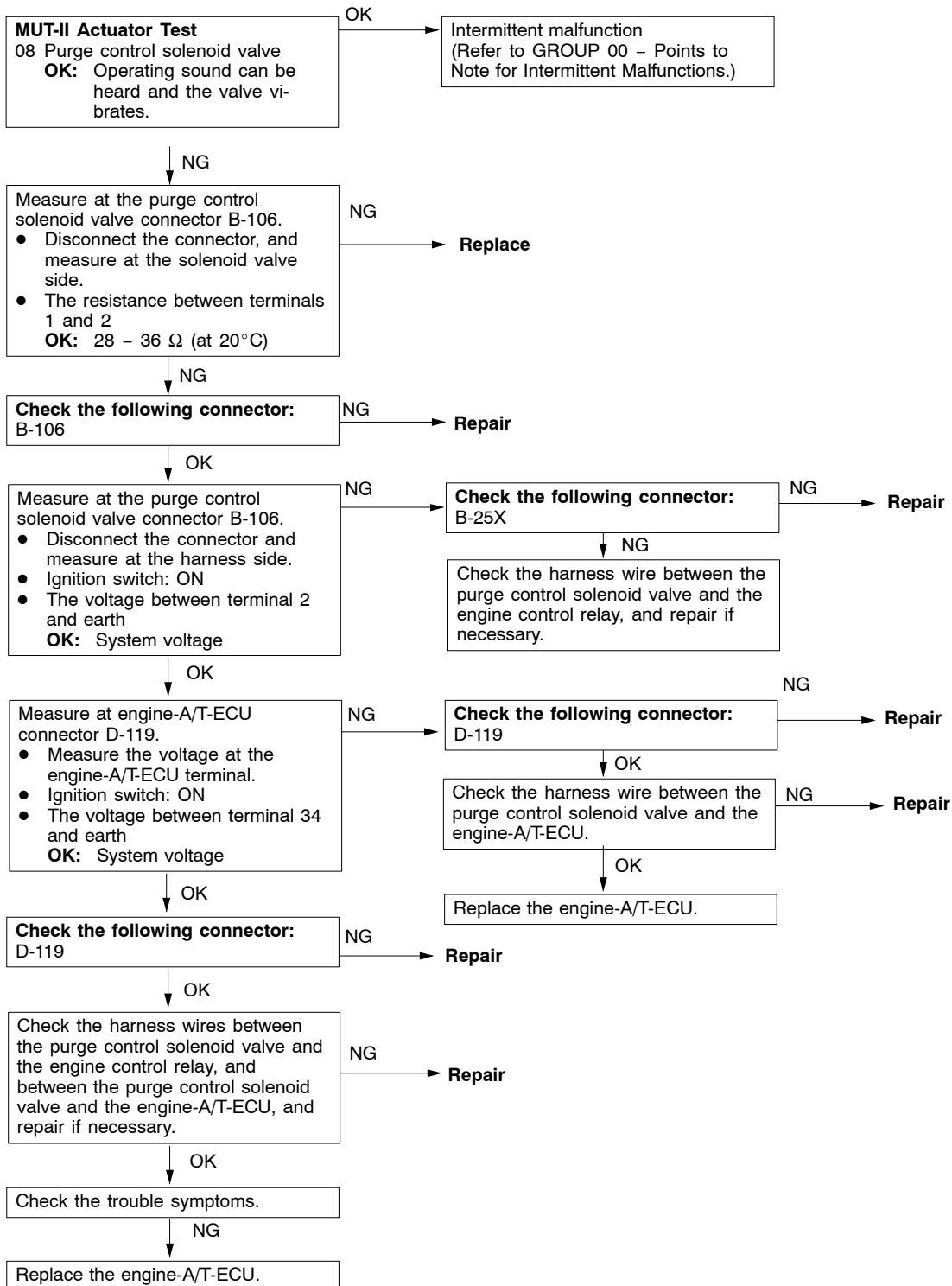


Code No.P0403 EGR valve system	Probable cause
Range of Check <ul style="list-style-type: none"> Ignition switch OFF to ON EGR valve is in operation after the engine starting process is complete. Set Conditions <ul style="list-style-type: none"> Off-surge voltage is not generated from the motor coil while the EGR valve control motor is running. 	<ul style="list-style-type: none"> Malfunction of the EGR valve Open or short circuit in the EGR valve circuit or loose connector contact Malfunction of engine-A/T-ECU

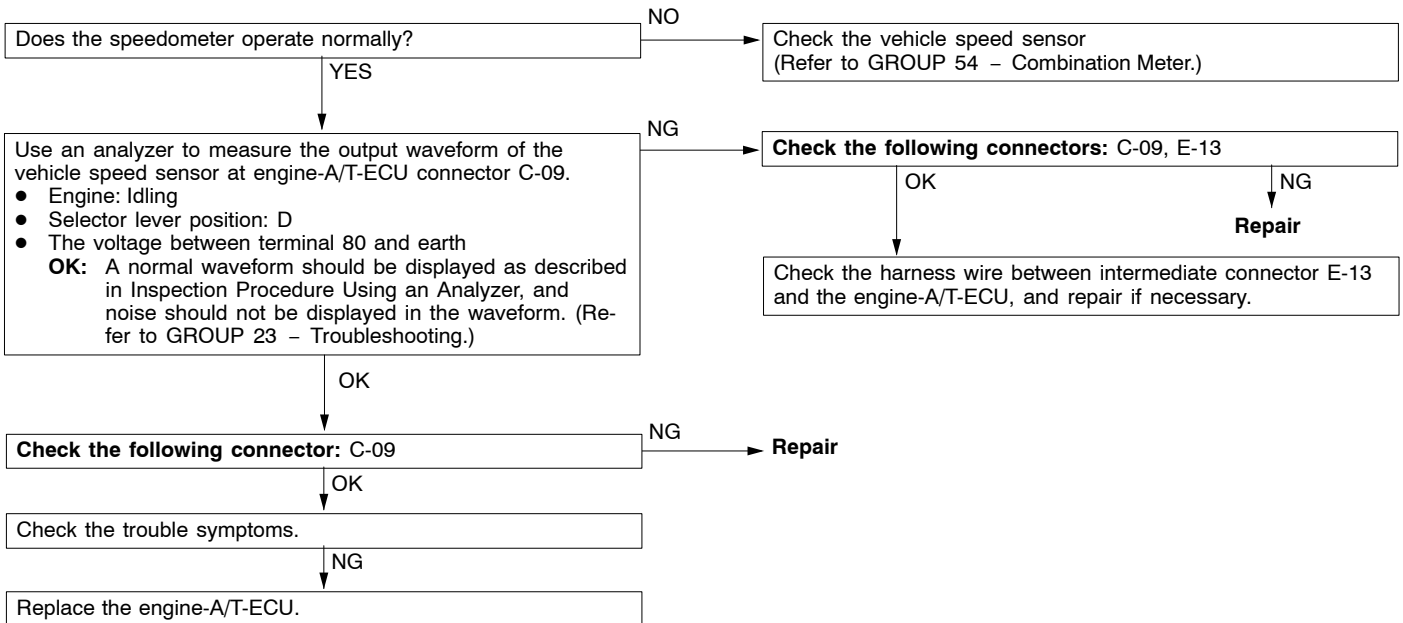




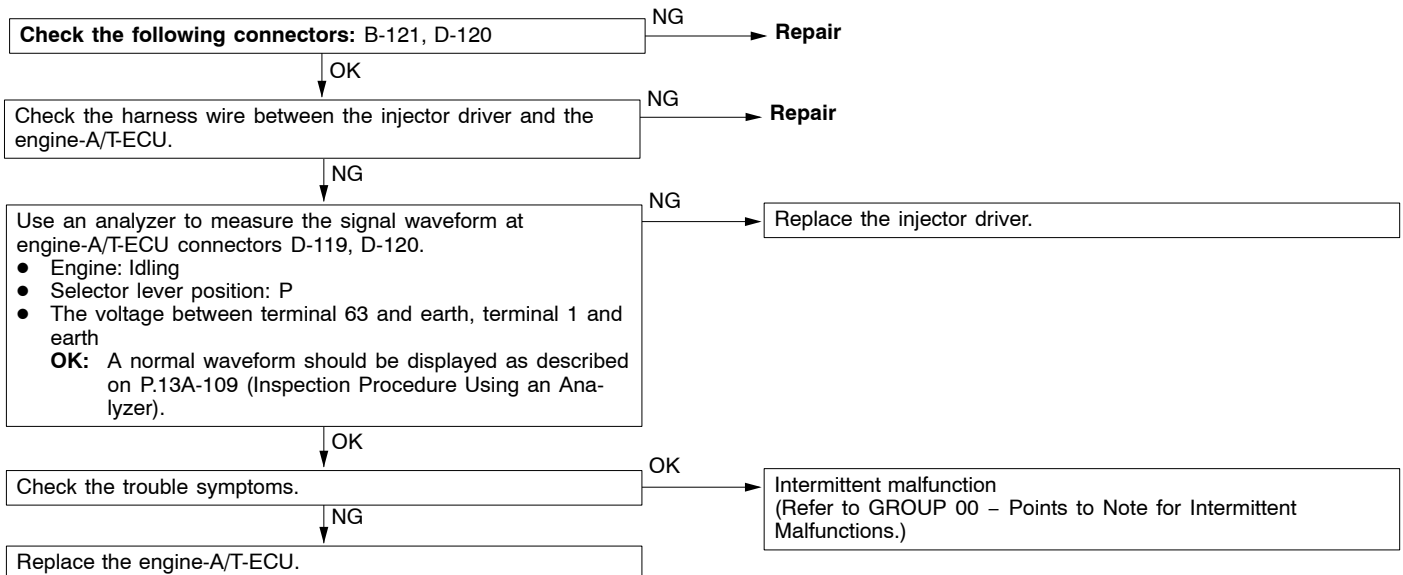
Code No.P0443 Purge control solenoid valve system	Probable cause
Range of Check <ul style="list-style-type: none"> Ignition switch: ON System voltage is 10 V or more. Set Conditions <ul style="list-style-type: none"> The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off. 	<ul style="list-style-type: none"> Malfunction of the purge control solenoid valve Open or short circuit in the purge control solenoid valve circuit or loose connector contact Malfunction of engine-A/T-ECU



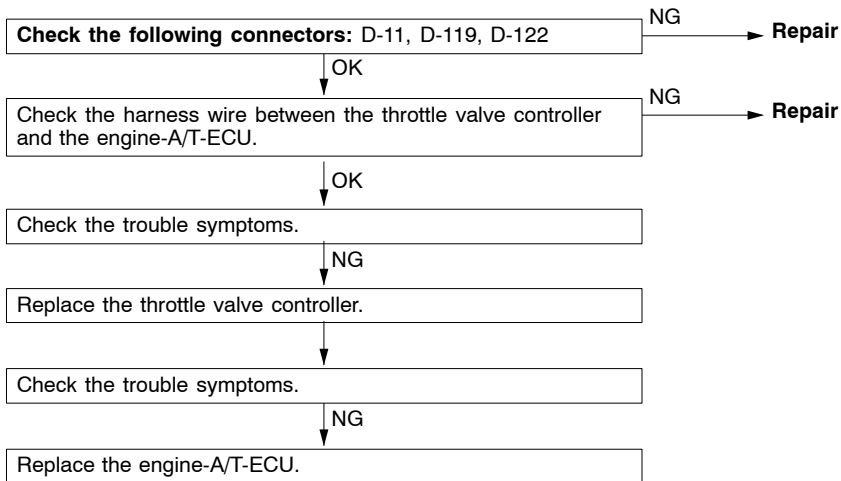
Code No.P0500 Vehicle speed sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Engine: Two seconds after the engine was started Idle switch: OFF Engine speed: 2,500 r/min or more During high engine load <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> Malfunction of the vehicle speed sensor Open or short circuit in the vehicle speed sensor circuit or loose connector contact Malfunction of engine-A/T-ECU



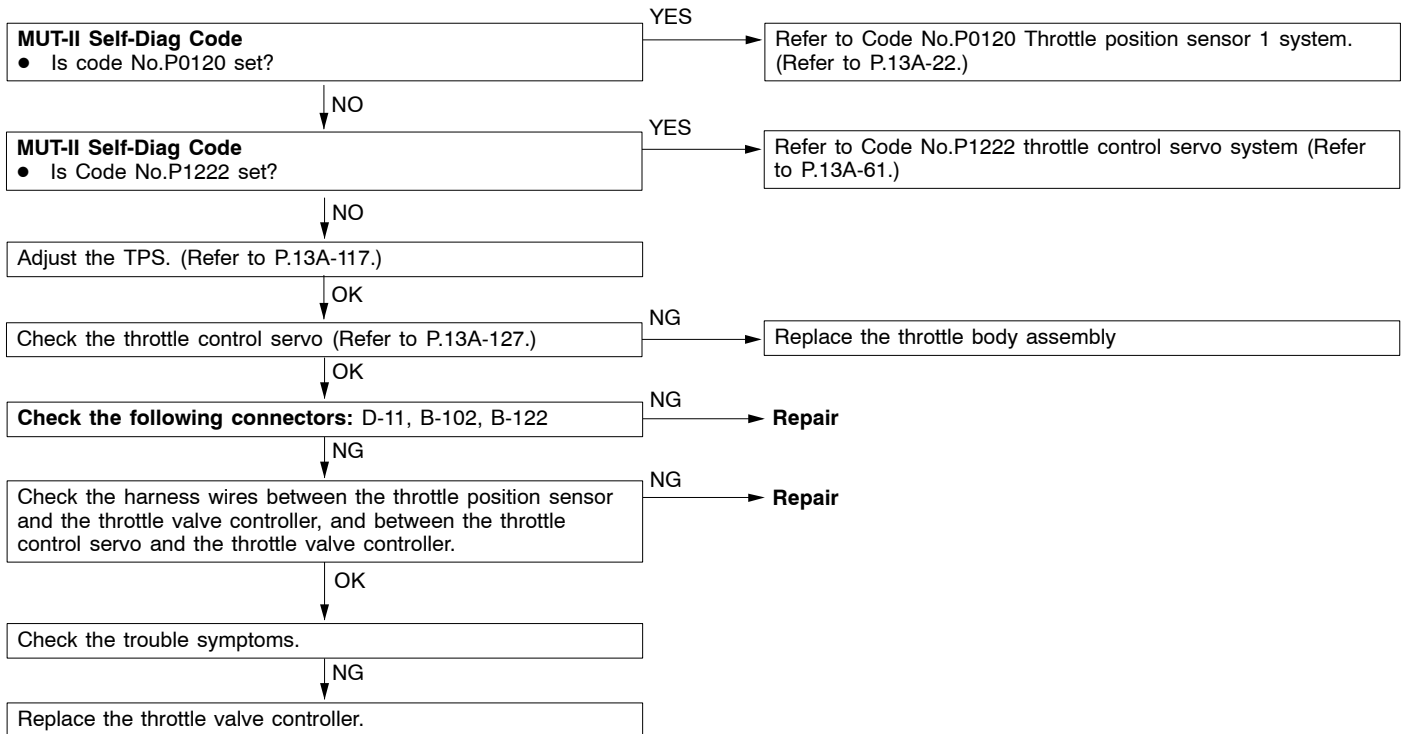
Code No.P1200 Injector driver system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Engine speed: 4,000 r/m or less System voltage: 10 V or more The fuel cut operation and the injector operation (by carrying out the Actuator test) are not in progress. During high engine load <p>Set Conditions</p> <ul style="list-style-type: none"> Injector open circuit check signal is not output from the injector driver. 	<ul style="list-style-type: none"> Malfunction of the injector driver Open or short circuit, or loose connector contact Malfunction of engine-A/T-ECU



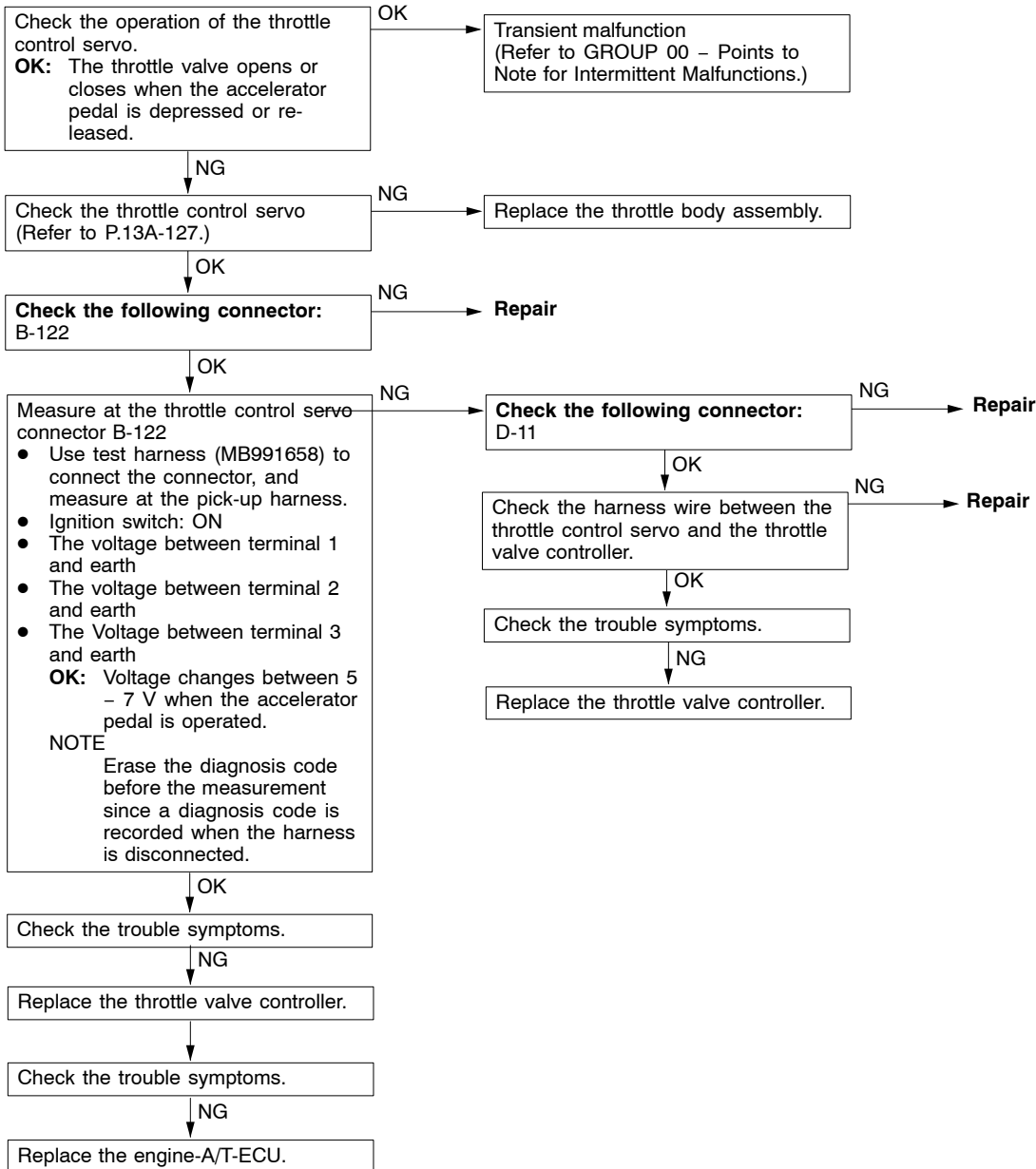
Code No.P1220 Electronic-controlled throttle valve system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Error in communication between the engine-A/T-ECU and the throttle valve controller <p>Set Conditions</p> <ul style="list-style-type: none"> Output voltage of TPS2 fluctuates significantly (approx. 1 V or more) from an expected value, based on that of the APS2. <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Error in communication between the throttle valve controller and the engine-A/T-ECU <p>Set Conditions</p> <ul style="list-style-type: none"> The output voltage of the TPS2 is significantly different (approx. 1 V) from the throttle valve opening angle (voltage), which the engine-A/T-ECU request the throttle valve controller. 	<ul style="list-style-type: none"> Short in communication line Malfunction of the engine-A/T-ECU Malfunction of the throttle valve controller



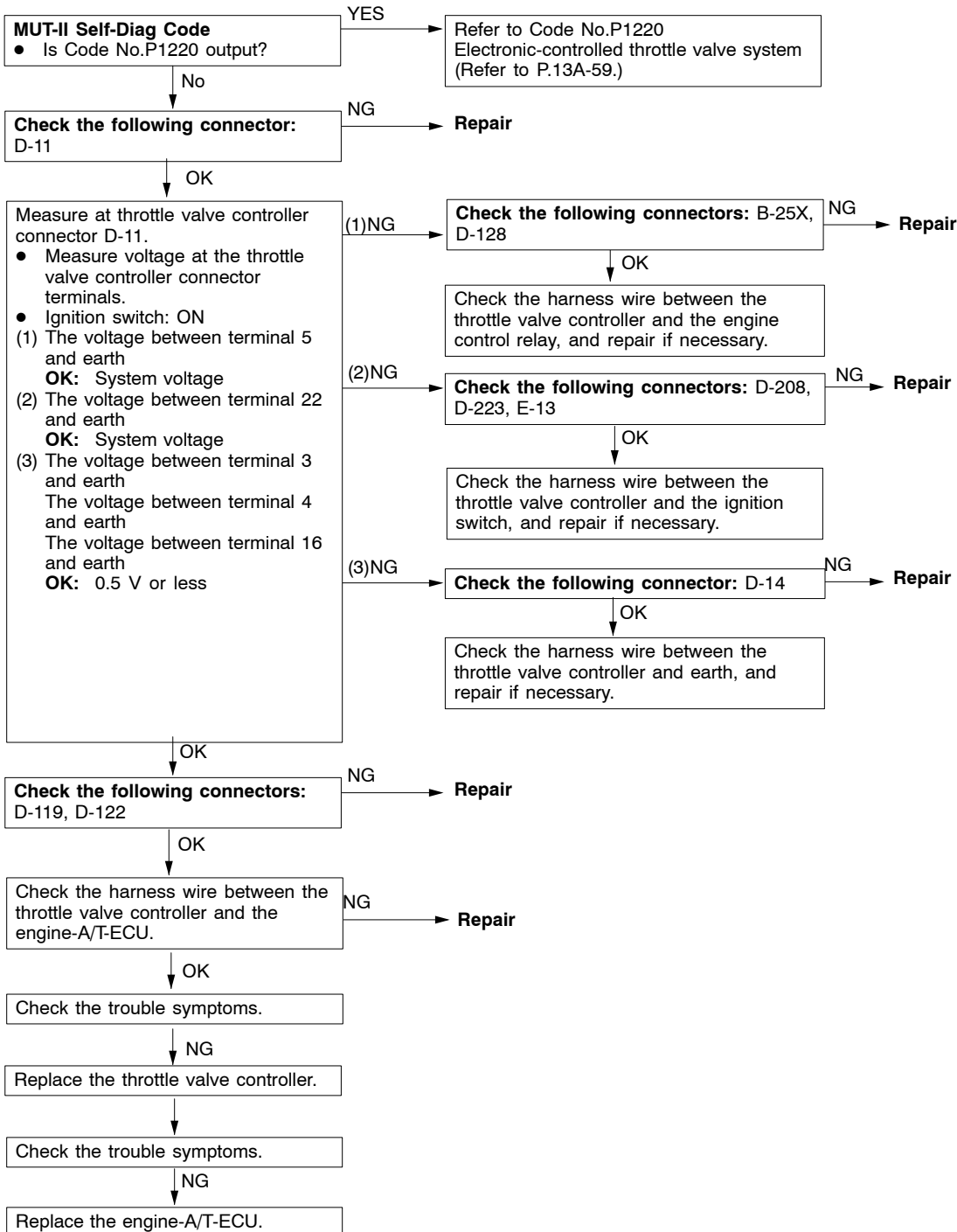
Code No.P1221 Throttle valve position feedback system	Probable cause
<p>The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU.</p> <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON System voltage: 10 V or more <p>Set Conditions</p> <ul style="list-style-type: none"> Failure in the position feedback (The ECU detects that the current in the motor is excessive and the opening angle difference between the target value of TPS1 and the actual value of TPS1 is 2.0V or more) 	<ul style="list-style-type: none"> Malfunction of TPS 1 Open or short circuit in the TPS1 circuit or loose connector contact Malfunction of the throttle valve controller



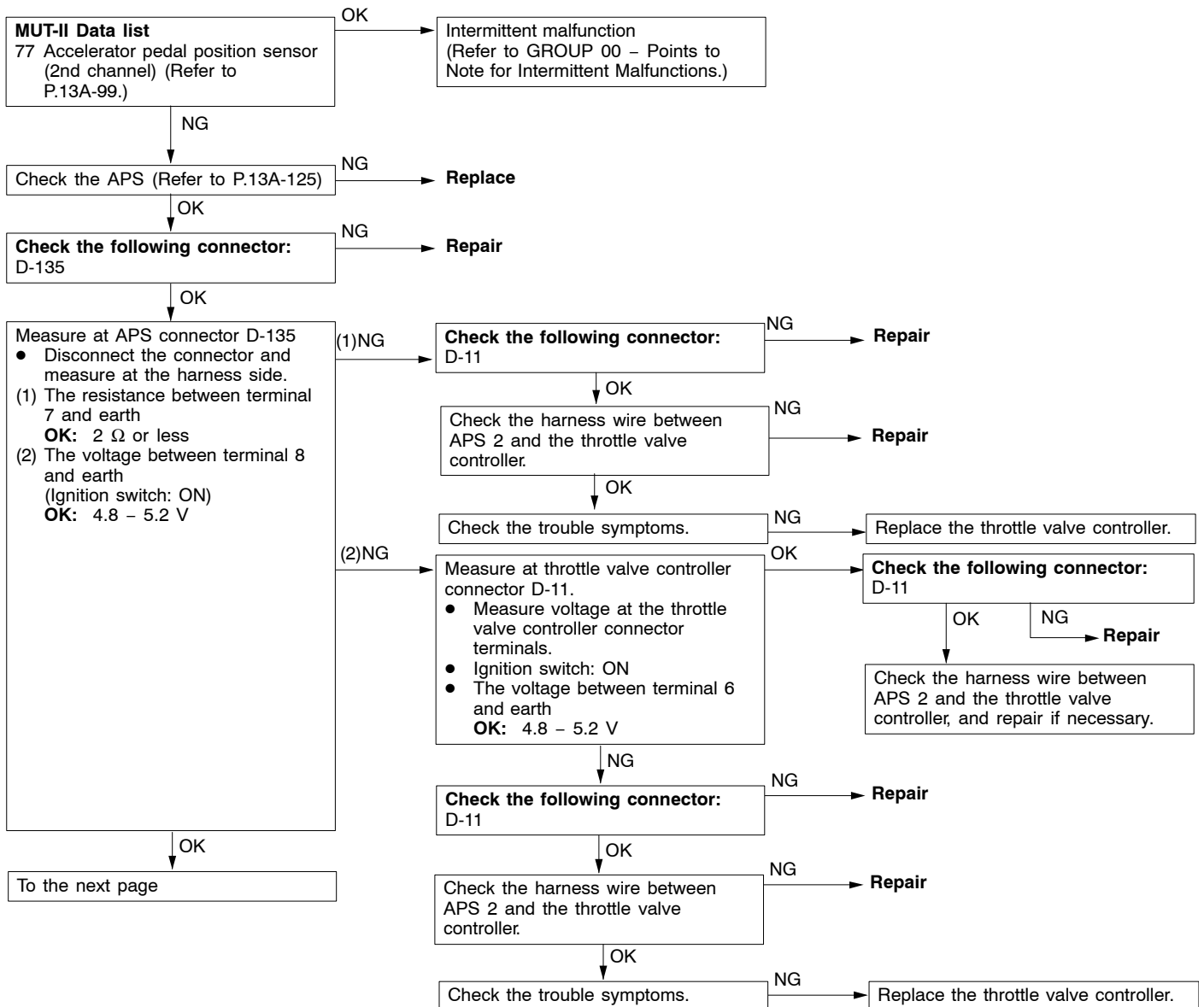
Code No.P1222 Throttle control servo system.	Probable cause
<p>The throttle valve controller judges a malfunction, and then transmit the result to the engine-A/T-ECU.</p> <p>Range of Check</p> <ul style="list-style-type: none"> Throttle control servo relay: ON <p>Set Conditions</p> <ul style="list-style-type: none"> Short circuit of the throttle control servo drive circuit to earth Power is supplied to the throttle control servo circuit from other sources. Open circuit in the throttle control servo power supply circuit 	<ul style="list-style-type: none"> Malfunction of the throttle control servo Open circuit in the throttle control servo power supply circuit Open or short circuit in the throttle control servo circuit or loose connector contact Malfunction of throttle valve controller

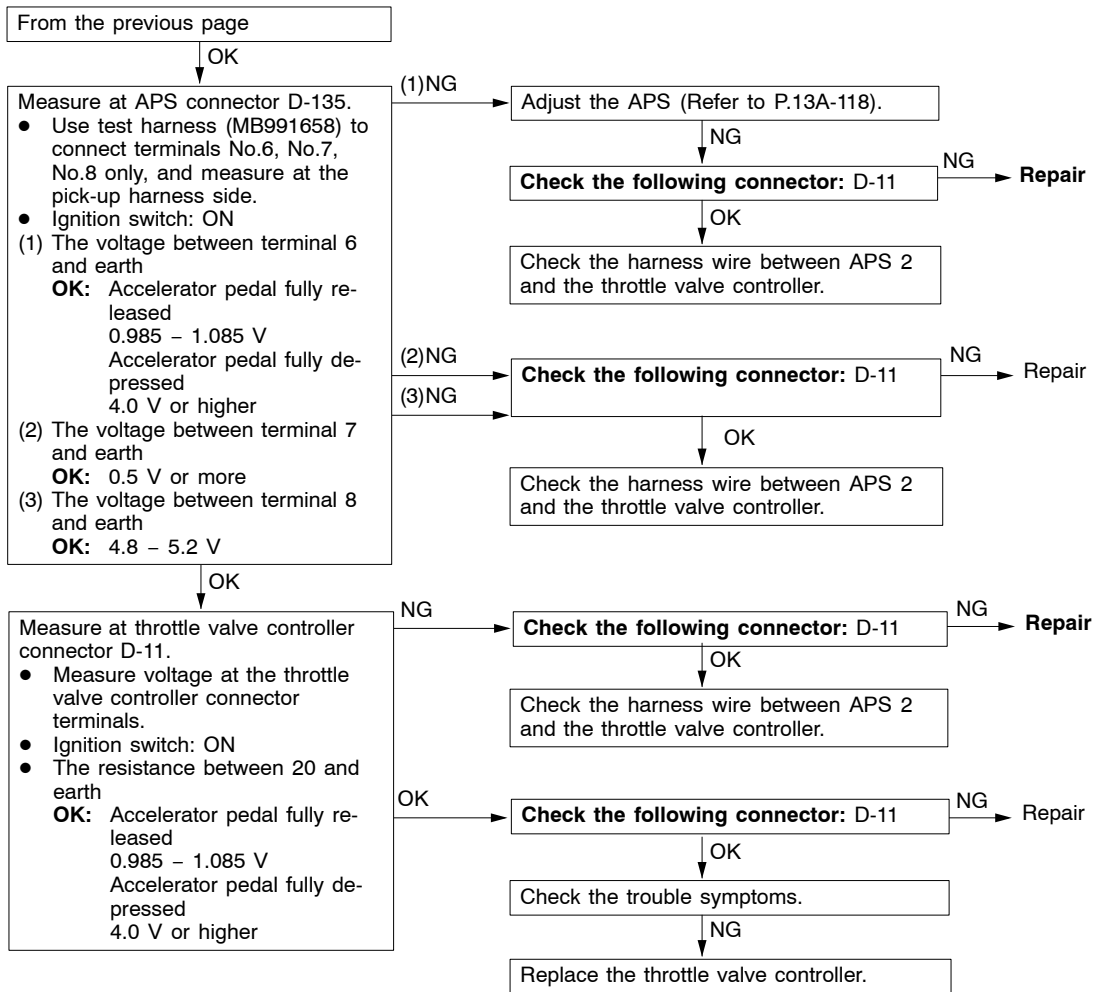


Code No.P1223 Communication line system with the throttle valve controller.	Probable cause
Range of Check <ul style="list-style-type: none"> Ignition switch: ON Battery voltage: 8 V or more. Engine: not cranking Set Conditions <ul style="list-style-type: none"> System detects an error in communication line between the engine-A/T-ECU and the throttle valve controller, and between the throttle valve controller and the engine-A/T-ECU. 	<ul style="list-style-type: none"> Short in communication line Malfunction of engine-A/T-ECU Malfunction of throttle valve controller



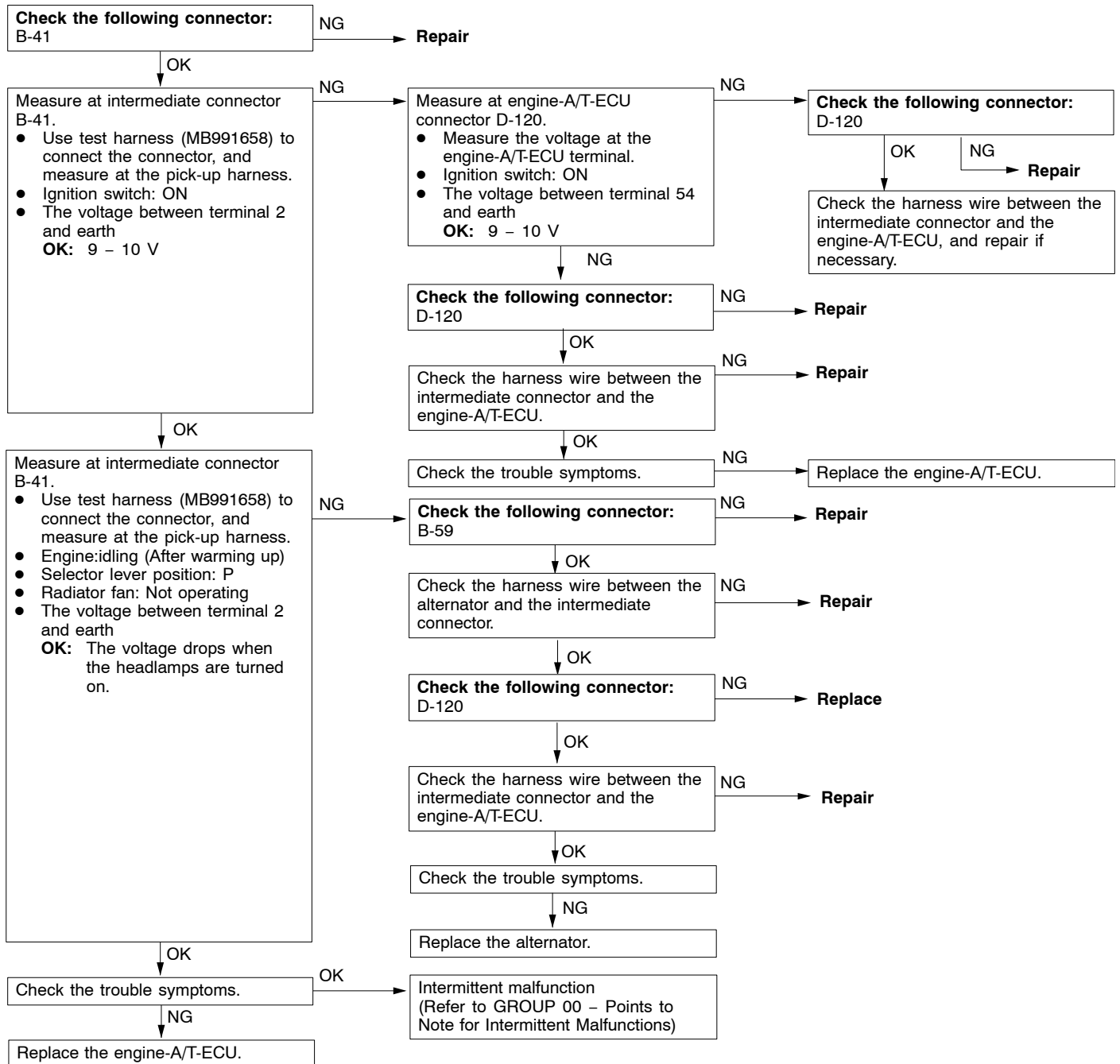
Code No.P1225 Accelerator pedal position sensor 2 (APS2) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Accelerator pedal position sensor 1 (APS1) is normal. Communication between the engine-A/T-ECU and the throttle valve controller is normal. <p>Set Conditions</p> <ul style="list-style-type: none"> Output voltage of the accelerator pedal position sensor 2 is 0.2 V or less for one second <p>or</p> <ul style="list-style-type: none"> Output voltage of the accelerator pedal position sensor 1 is 2.5 V or less, and output voltage of the accelerator pedal position sensor 2 is 4.5 V or more for one second. <p>or</p> <ul style="list-style-type: none"> Difference between the accelerator pedal position sensor(1st. and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly). 	<ul style="list-style-type: none"> Malfunction of accelerator pedal position sensor 2 Open or short circuit in accelerator pedal position sensor 2 circuit or loose connector contact Malfunction of the throttle valve controller Malfunction of engine-A/T-ECU





Code No.P1226 Throttle valve controller system	Probable cause
Set Conditions <ul style="list-style-type: none"> • Errors in reading or writing to the throttle valve controller ROM. 	<ul style="list-style-type: none"> • Malfunction of the throttle valve controller
Replace the throttle valve controller.	

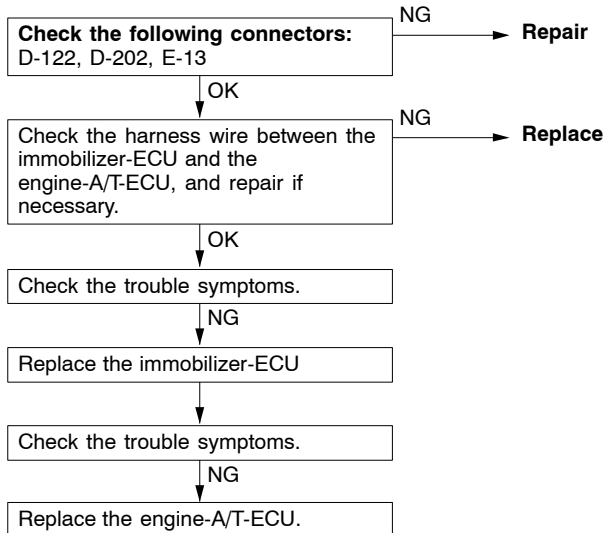
Code No.P1500 Alternator FR terminal system	Probable cause
Range of Check <ul style="list-style-type: none"> Engine speed: 50 r/min or more Set Conditions <ul style="list-style-type: none"> Input voltage from the alternator FR terminal is system voltage for 20 seconds. 	<ul style="list-style-type: none"> Open circuit in alternator FR terminal circuit Malfunction of engine-A/T-ECU



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

NOTE

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

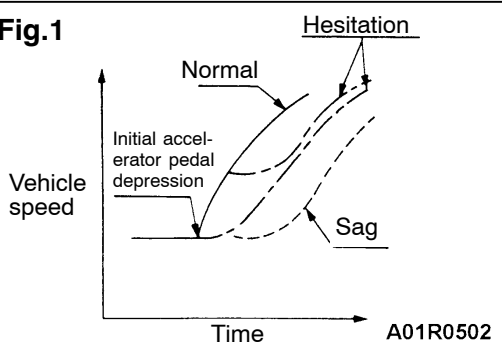
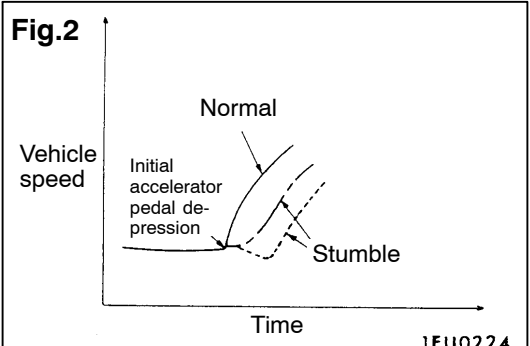


INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble Symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-69
	Communication with engine-A/T-ECU only is not possible.	2	13A-69
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-70
	The engine warning lamp remains illuminating and never goes out.	4	13A-70
Starting	No initial combustion (starting impossible)	5	13A-71
	Initial combustion but no complete combustion (starting impossible)	6	13A-72
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-74
	Idling speed is high. (Improper idling speed)	8	13A-76
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-77
	When the engine becomes hot, it stalls at idling. (Die out)	10	13A-78
	The engine stalls when starting the car. (Pass out)	11	13A-80
	The engine stalls when decelerating.	12	13A-81
Driving	Hesitation, sag or stumble	13	13A-82
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-83
	The feeling of impact or vibration when decelerating	15	13A-84
	Knocking	16	13A-84
Run on (Dieseling)		17	13A-84
Too high CO and HC concentration when idling		18	13A-85
Low alternator output voltage (approx. 12.3 V)		19	13A-86
Idling speed is improper when A/C is operating (A/C switch 2 signal)		20	13A-87
A/C condenser fan is inoperative		21	13A-87
GDI ECO indicator lamp	GDI ECO indicator lamp does not illuminate.	22	13A-88
	GDI ECO indicator lamp remains illuminated and does not go off.	23	13A-88

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

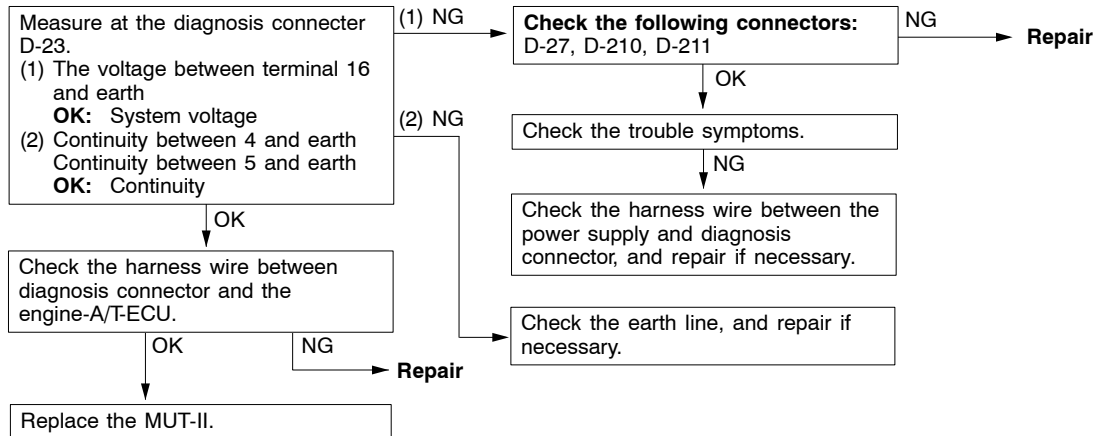
Items		Symptom
Starting	Won't start (No initial combustion)	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Hard starting (Fires up and dies)	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting (Long time to start)	Engine starts after cranking a while.
Idling stability	Unstable idling (Rough idling, hunting)	Engine speed doesn't remain constant; changes at idle. Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Engine speed doesn't increase.	The engine speed doesn't increase when the accelerator pedal is depressed.
	Hesitation, sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now travelling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". (See figure 1.)
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. (See figure 2.)
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run on ("Dieseling")	The condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".

Fig.1**Fig.2**

INSPECTION PROCEDURES FOR TROUBLE SYMPTOMS

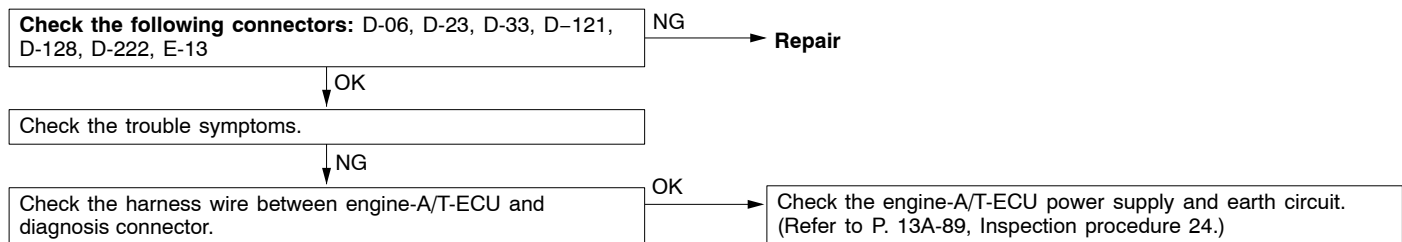
Inspection procedure 1

MUT-II Communication with all systems is not possible.	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	<ul style="list-style-type: none"> • Malfunction of the diagnosis connector • Open circuit or short-circuited between engine-A/T-ECU and diagnosis connector circuit • Malfunction of the MUT-II



Inspection procedure 2

MUT-II Communication with engine-A/T-ECU is not possible.	Probable cause
The cause is probably a defect in the engine-A/T-ECU power supply circuit (including earth).	<ul style="list-style-type: none"> • Open circuit or short-circuited harness wire in the engine-A/T-ECU power supply circuit. • Open circuit between engine-A/T-ECU and diagnosis connector • Malfunction of the engine-A/T-ECU

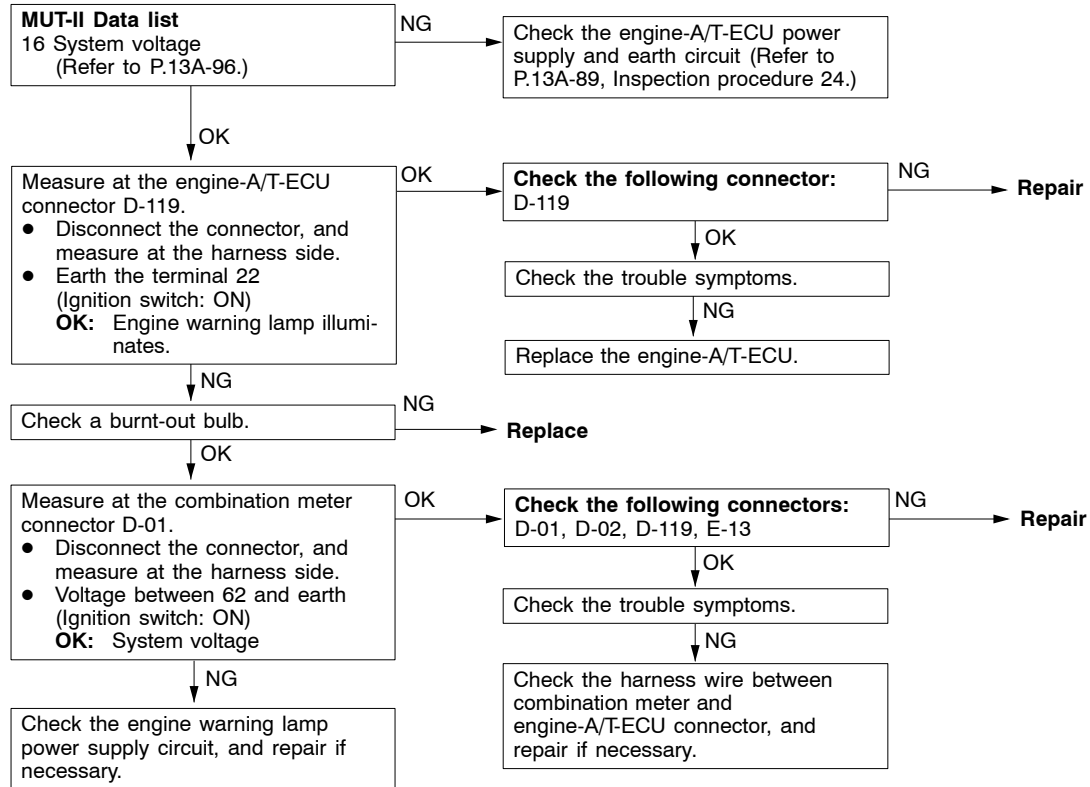


NOTE

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

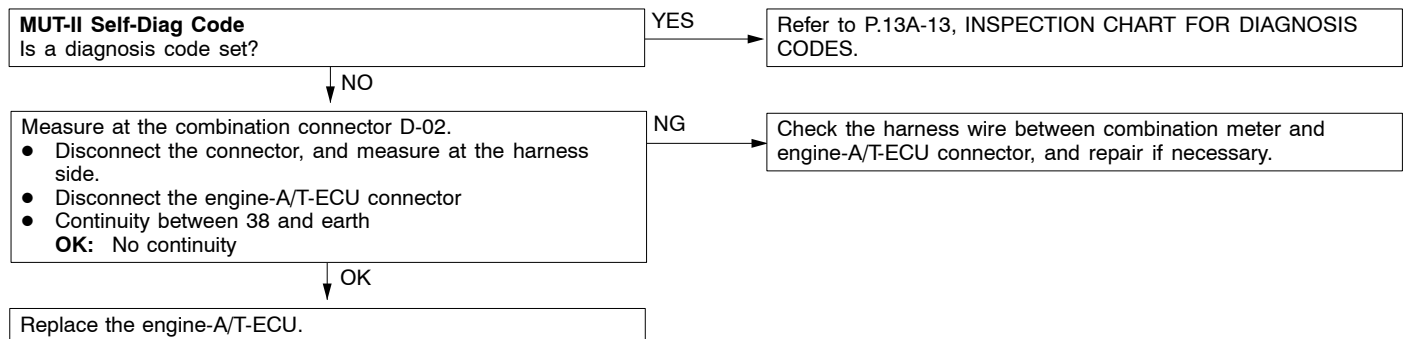
Inspection procedure 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
<p>Because there is a burnt-out bulb, the engine-A/T-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON.</p> <p>If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunction listed at right has probably occurred.</p>	<ul style="list-style-type: none"> • Burnt-out bulb • Open circuit or short-circuit between the engine warning lamp and engine-A/T-ECU. • Malfunction of the engine-A/T-ECU



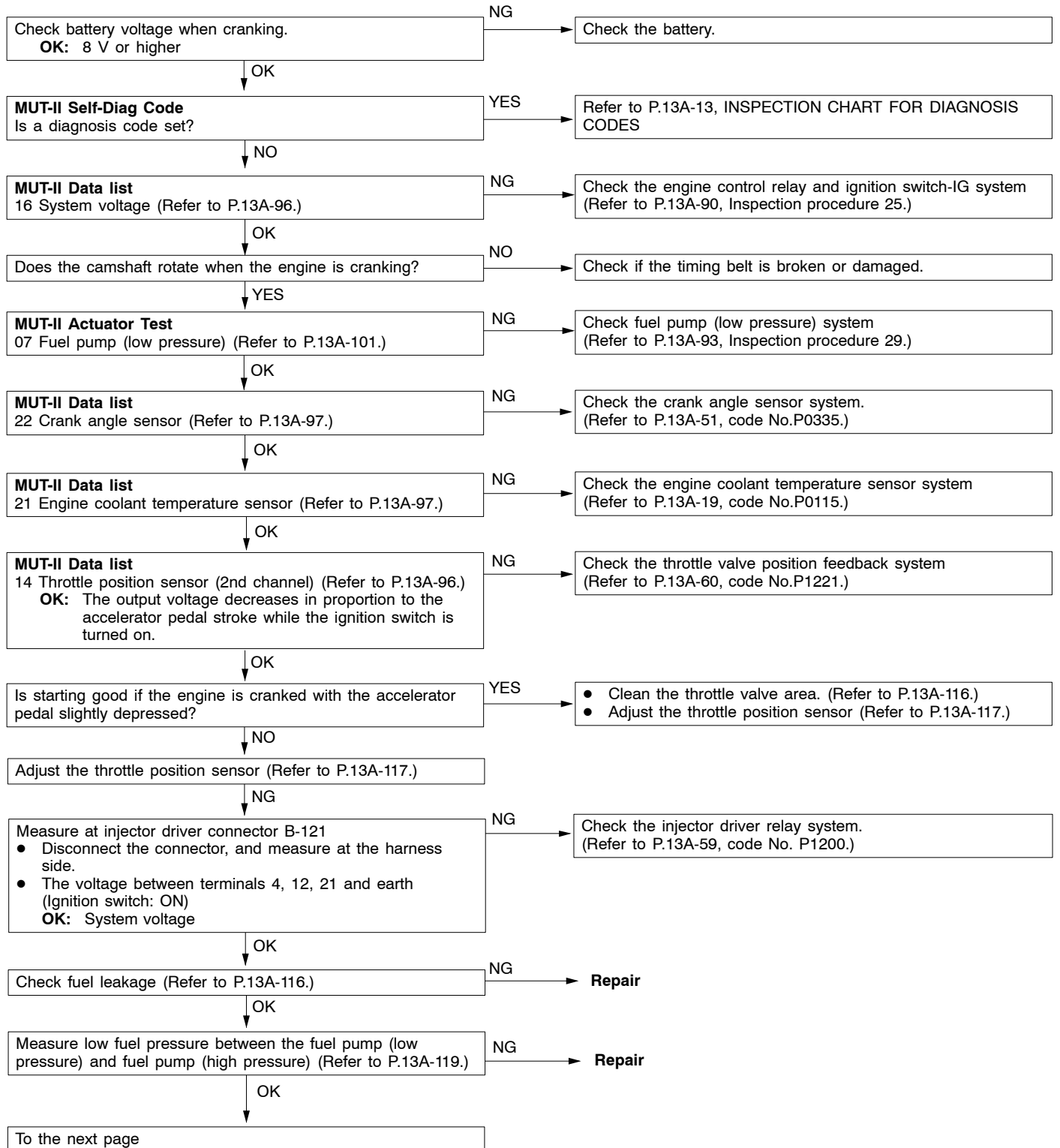
Inspection procedure 4

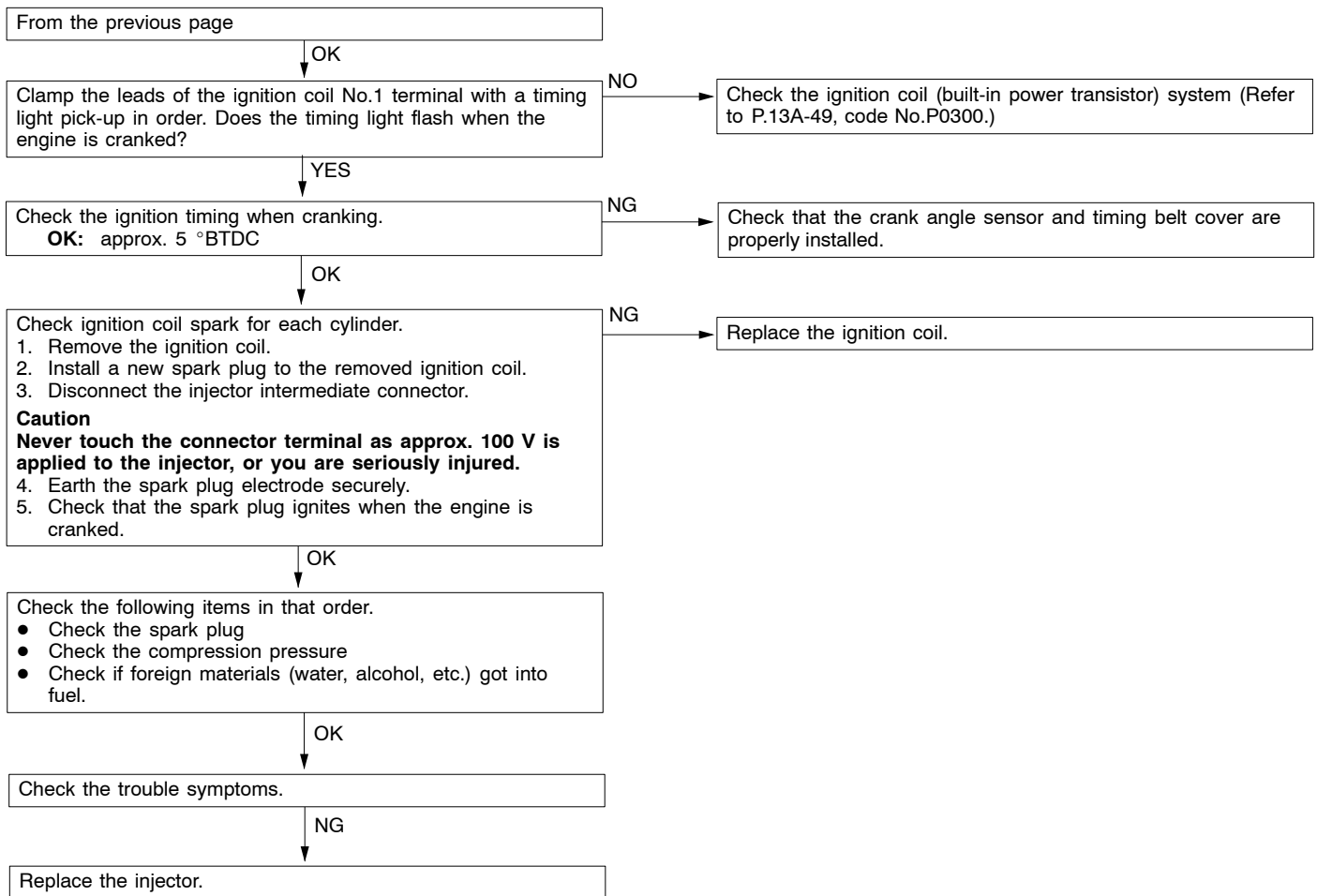
The engine warning lamp remains illuminating and never goes out.	Probable cause
<p>In cases such as the above, the cause is probably that the engine-A/T-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.</p>	<ul style="list-style-type: none">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



Inspection procedure 5

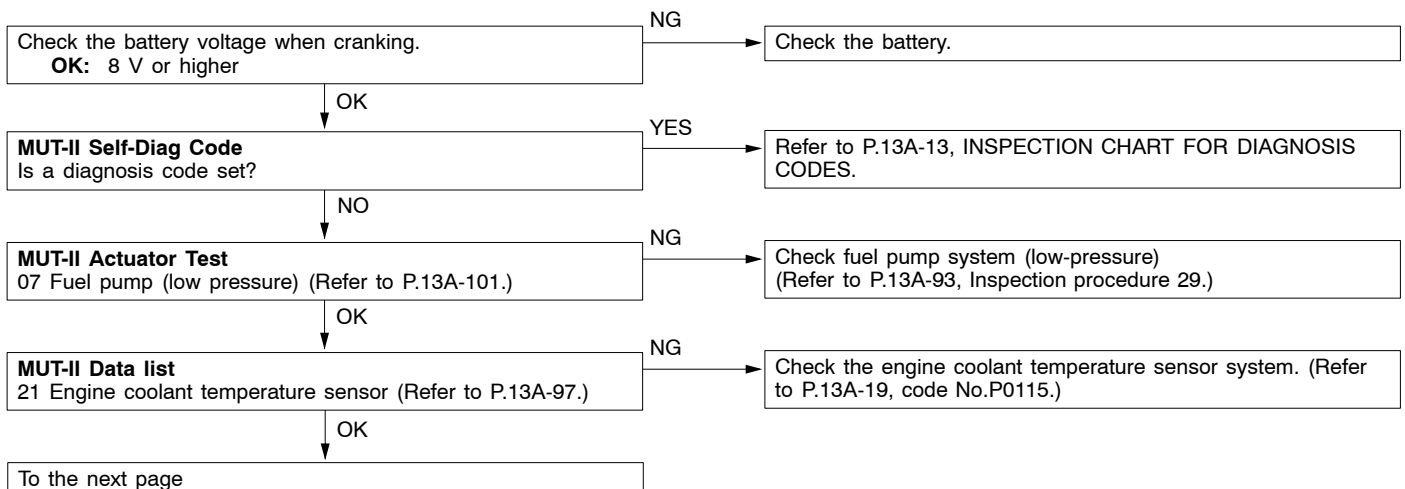
No initial combustion (starting impossible)	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	<ul style="list-style-type: none"> • Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-A/T-ECU

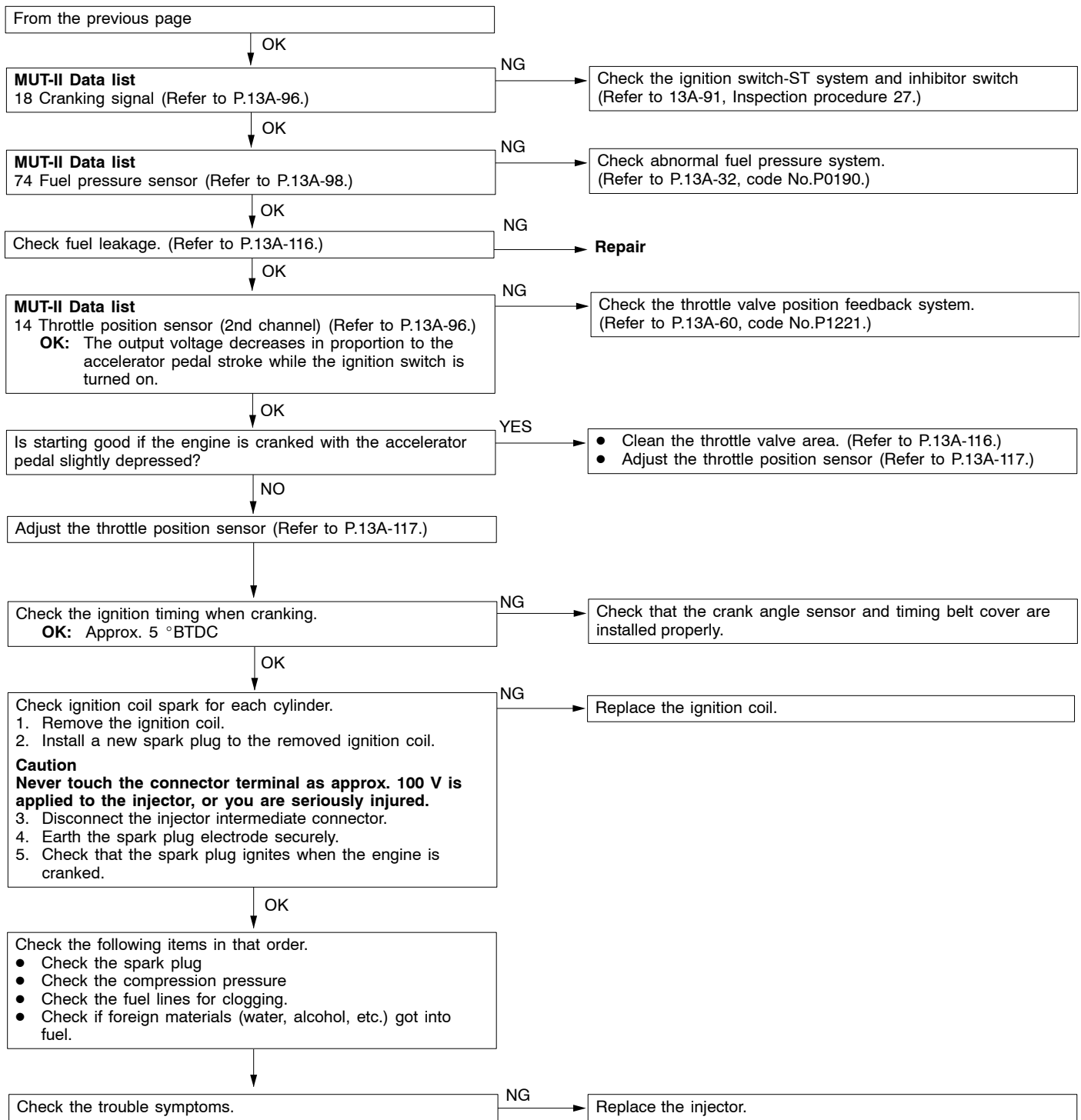




Inspection procedure 6

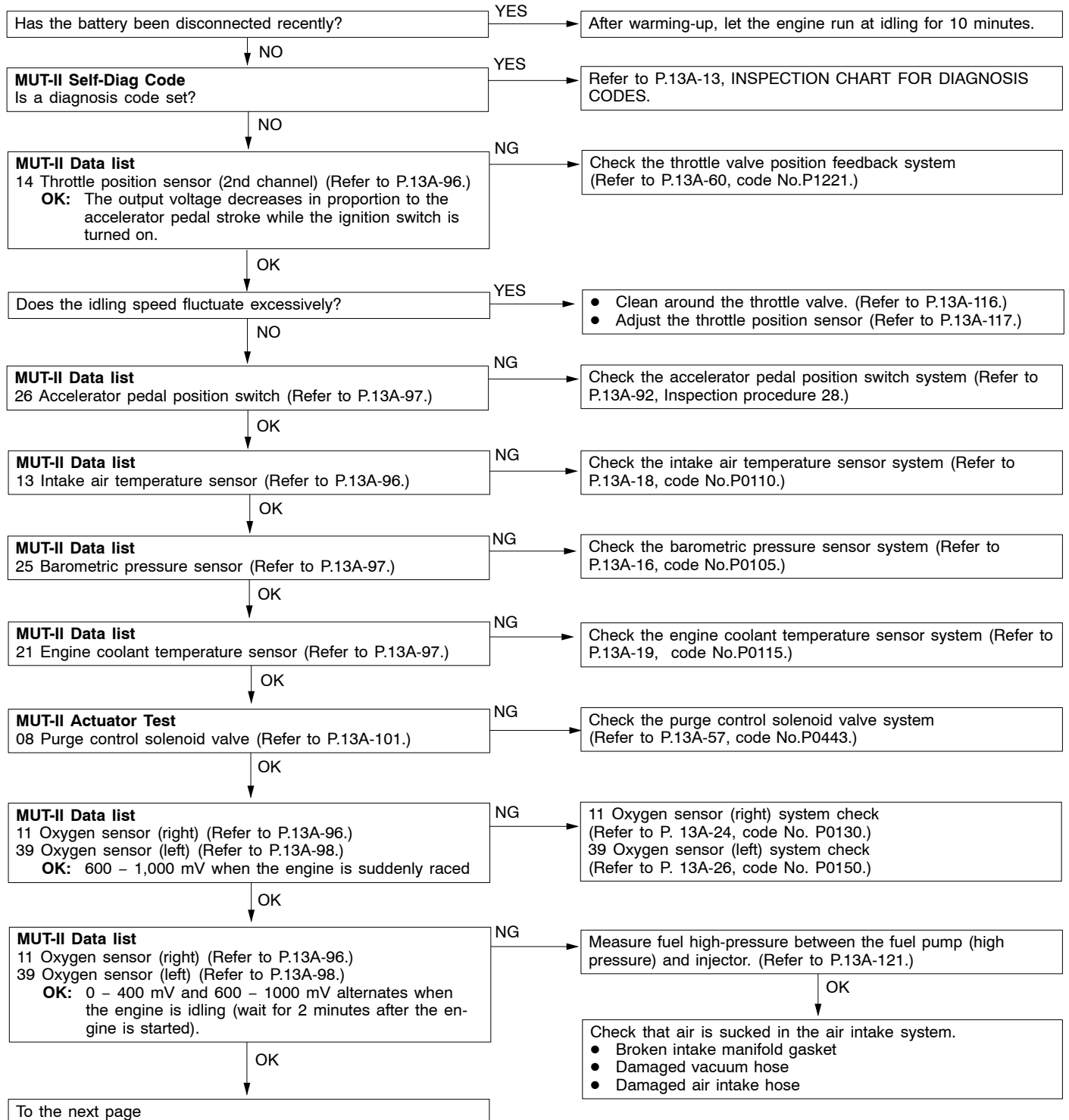
Initial combustion but no complete combustion (starting impossible), long time to start (hard starting)	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks by the spark are weak, or the initial mixture is not appropriate.	<ul style="list-style-type: none"> • Malfunction of fuel supply system • Malfunction of of fuel pressure control solenoid valve • Malfunction of the ignition system • Malfunction of the electronic-controlled throttle valve system • Malfunction of the engine-A/T-ECU

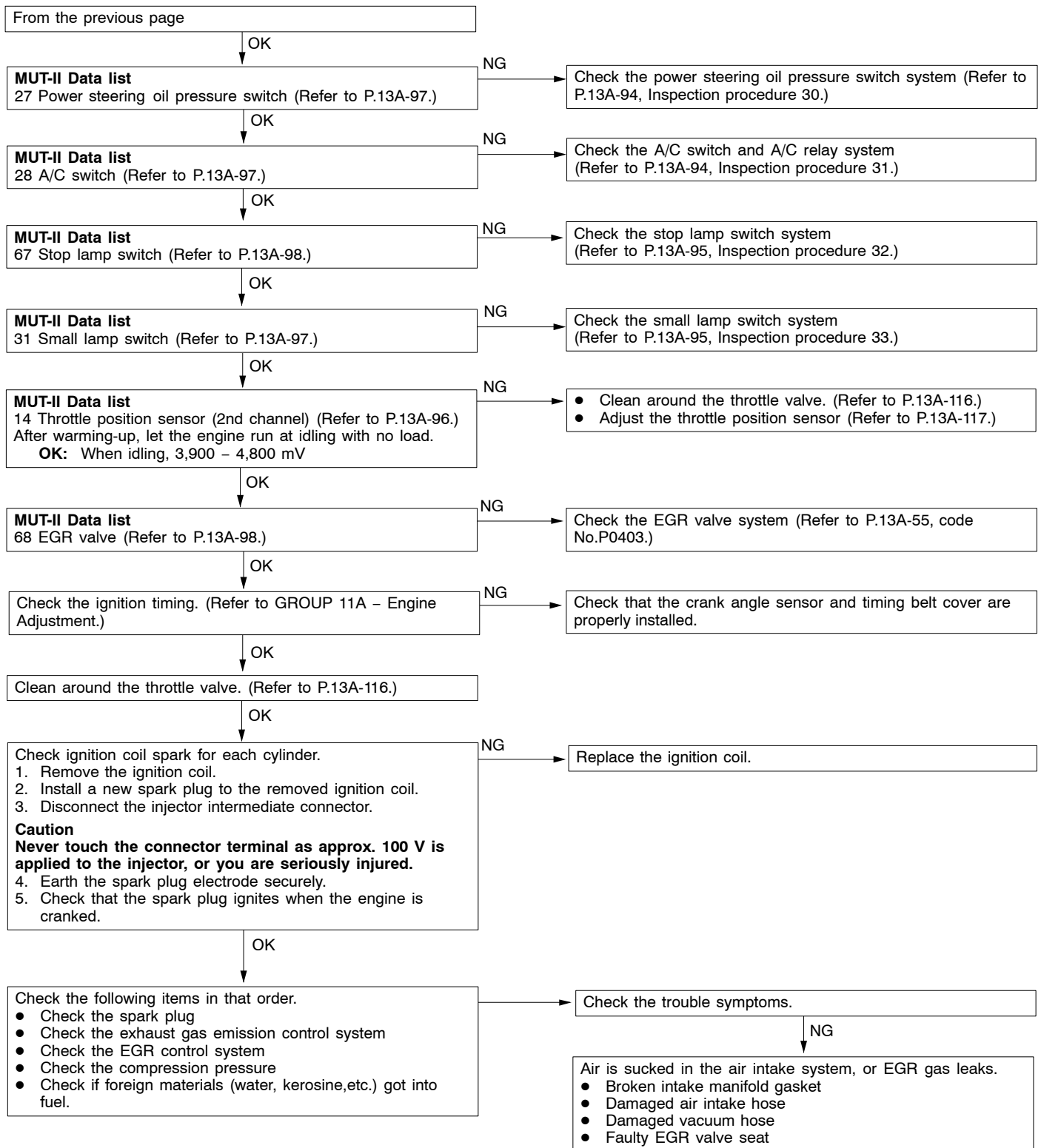




Inspection procedure 7

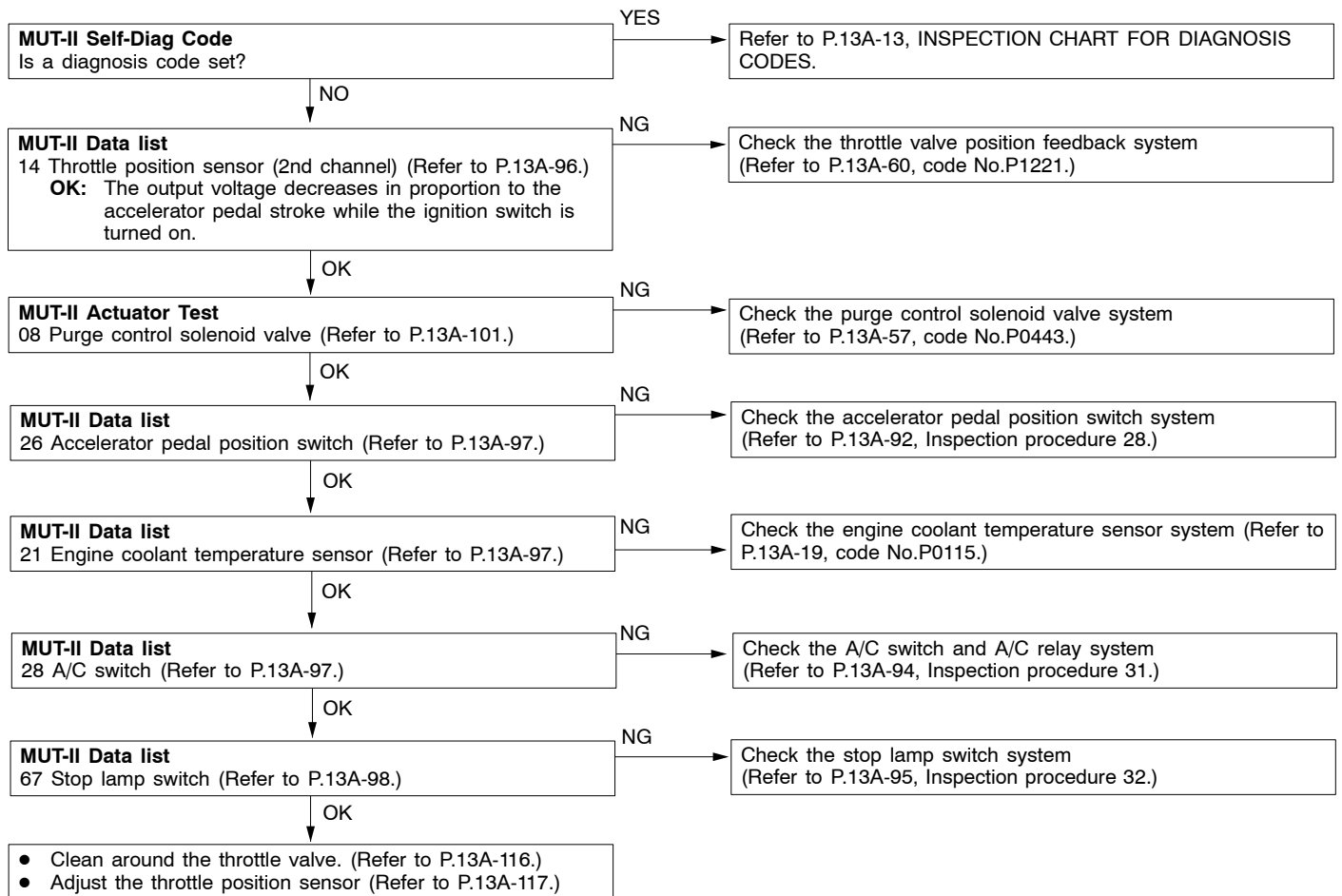
Unstable idling (Rough idling, hunting)	Probable cause
The cause is probably a malfunction of the ignition system, air/fuel ratio control system, electronic controlled throttle valve system, compression pressure, etc. As many causes can be suspected, diagnose from easier items.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Poor compression • Air sucking into the air intake system





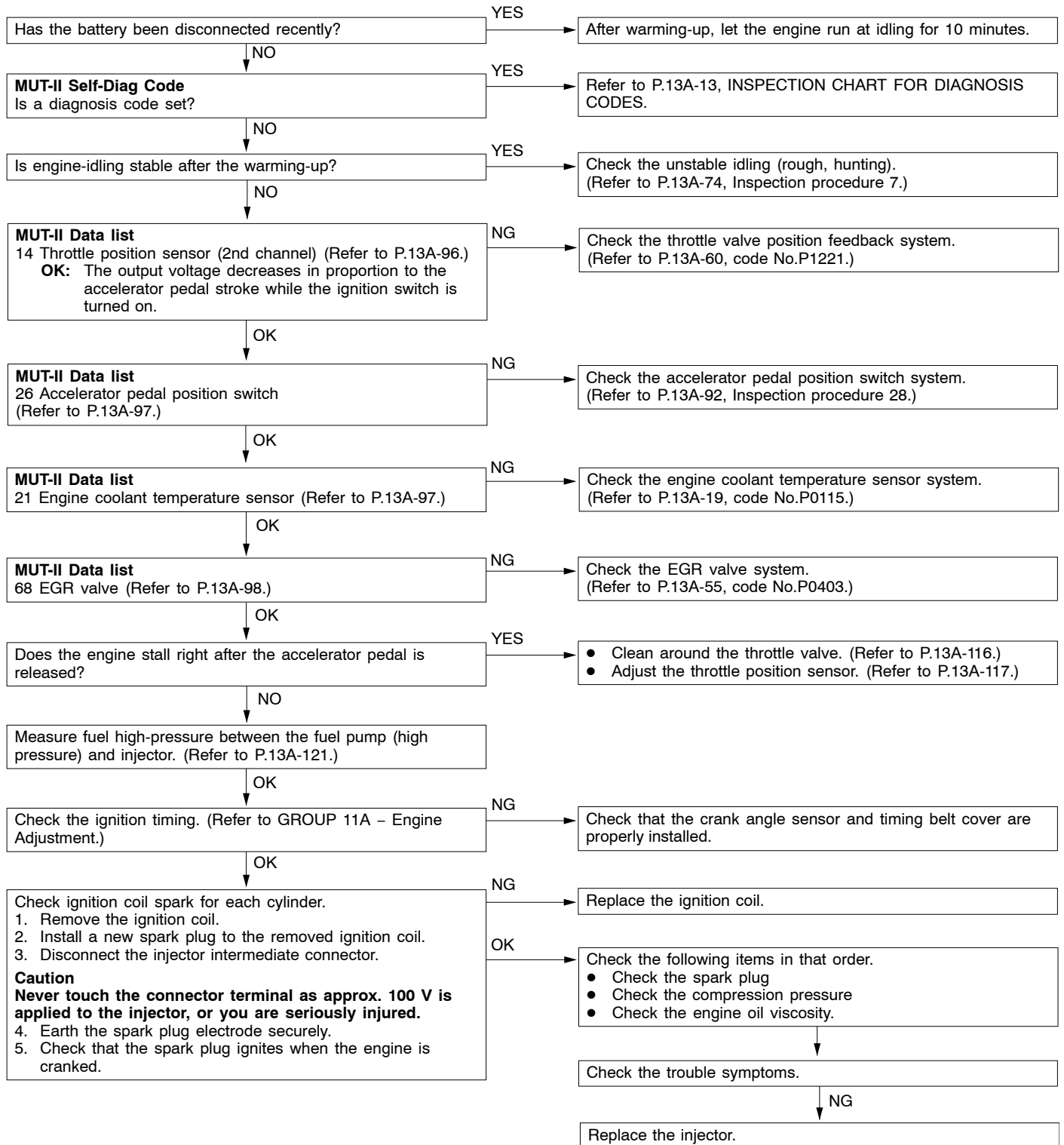
Inspection procedure 8

Idling speed is high or low (Improper idling speed)	Probable cause
The cause is probably that the intake air amount during idling is too great or too small.	<ul style="list-style-type: none"> • Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body



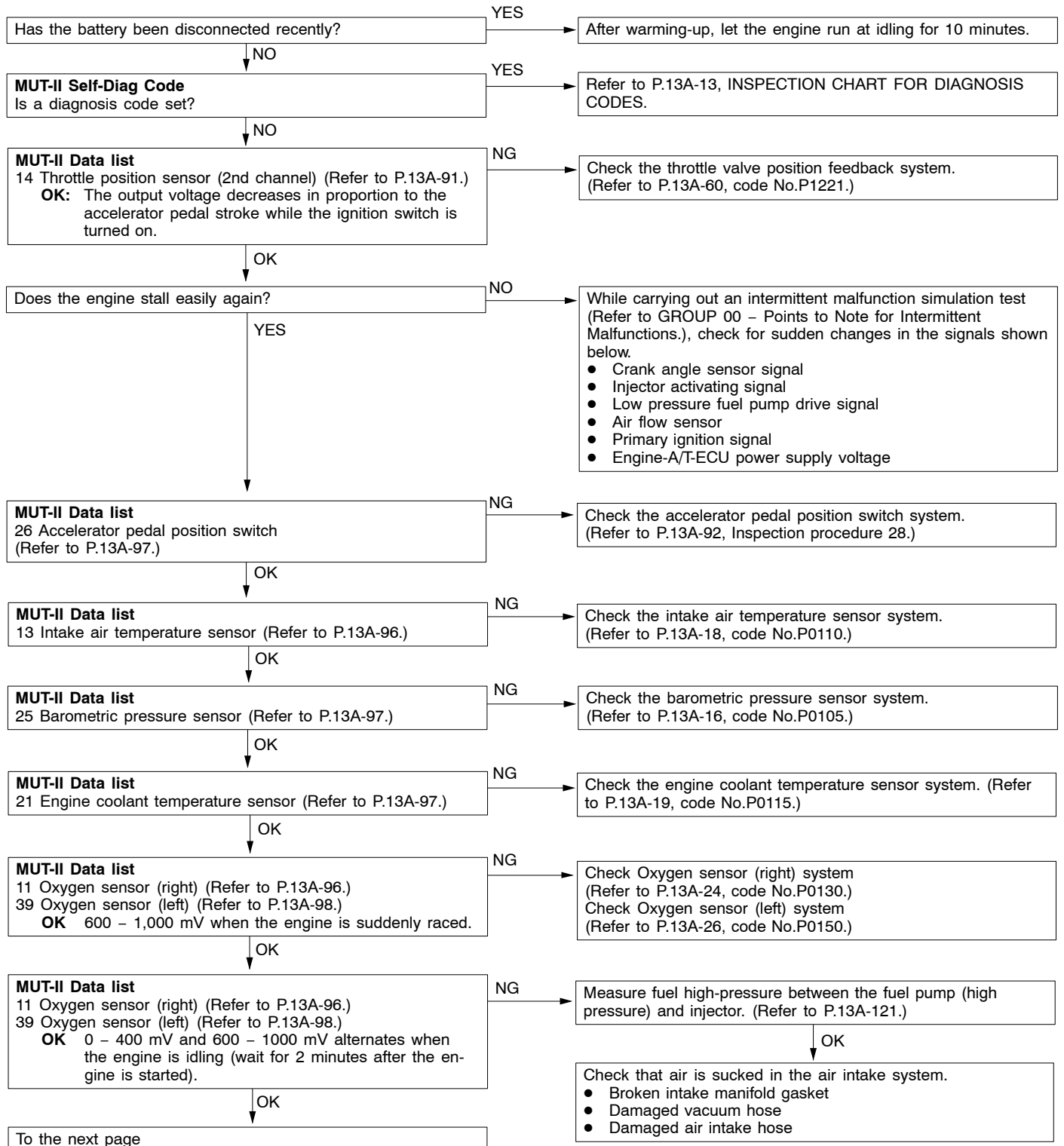
Inspection procedure 9

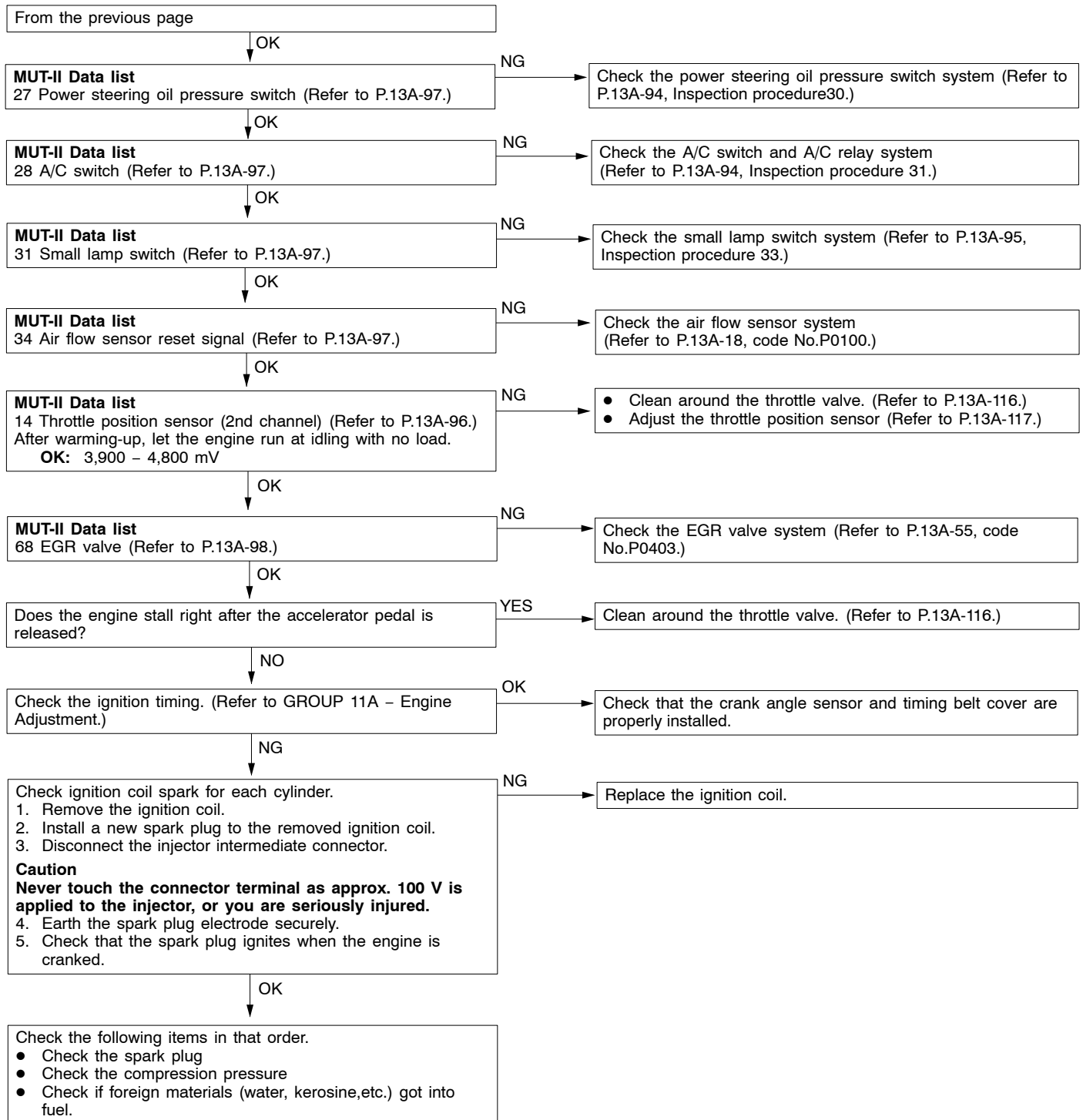
When the engine is cold, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	<ul style="list-style-type: none"> Malfunction of the electronic-controlled throttle valve system Malfunction of the throttle body



Inspection procedure 10

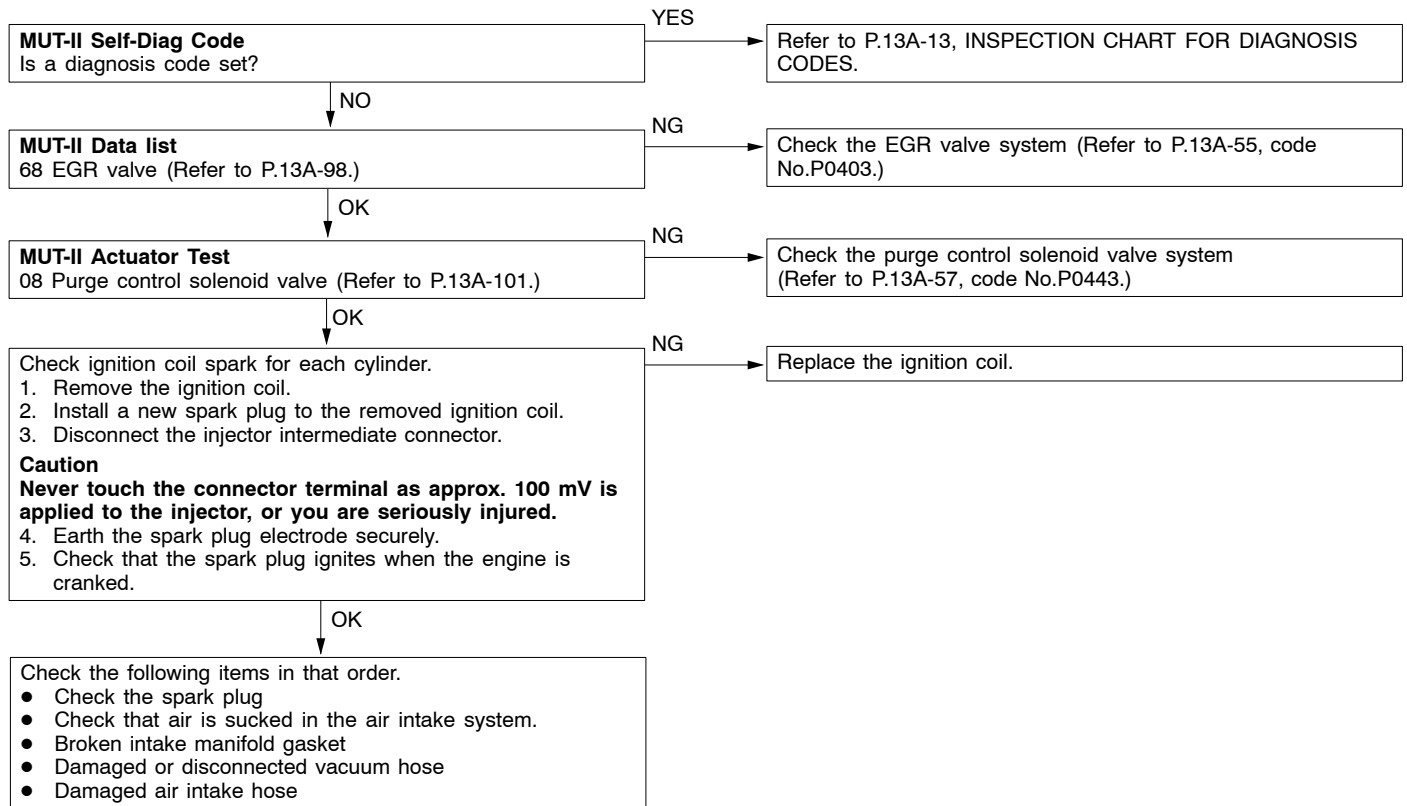
When the engine becomes hot, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that ignition system, air/fuel mixture, electronic-controlled throttle valve system, compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body • Improper connector contact • Drawing air into intake system





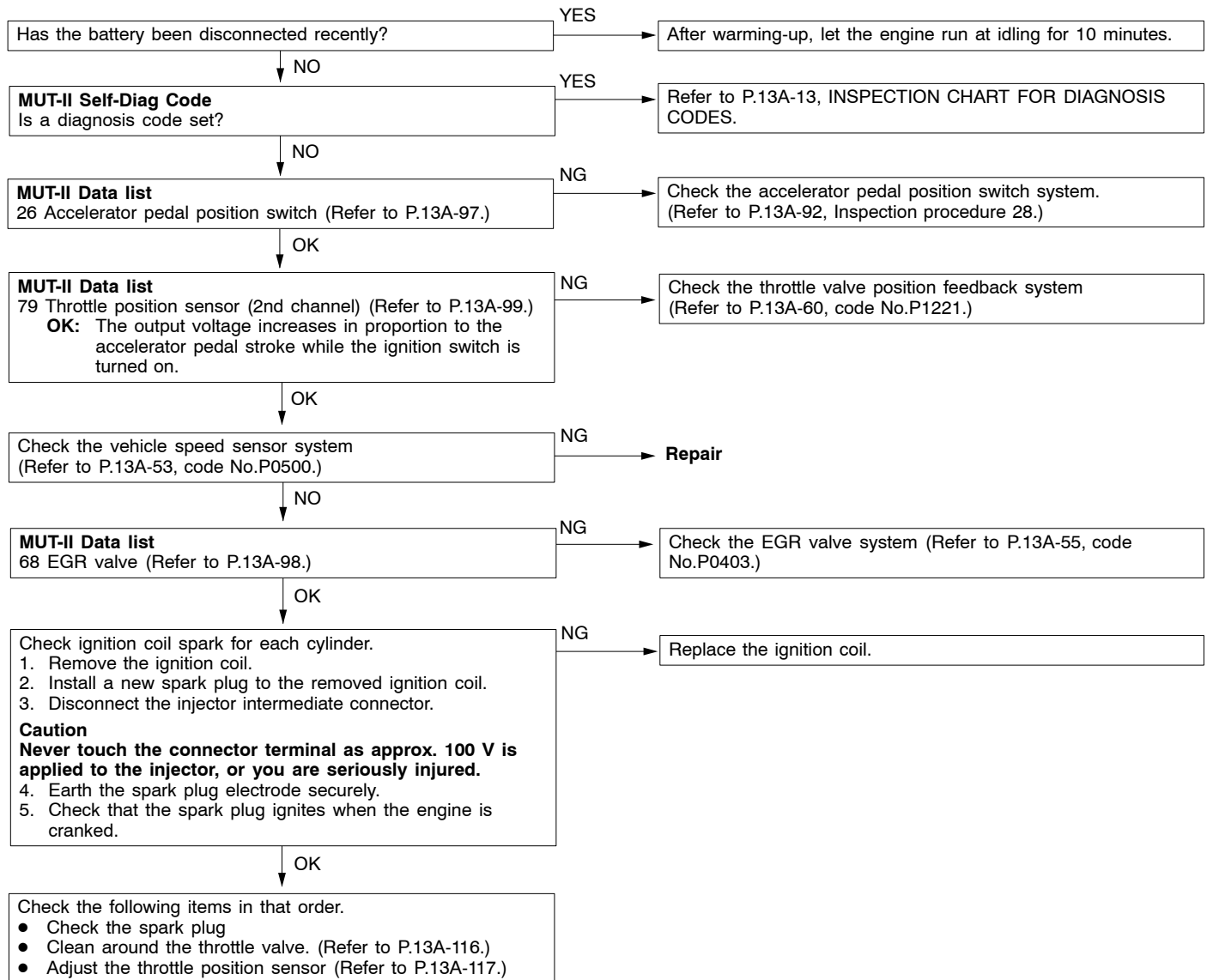
Inspection procedure 11

The engine stalls when starting the car. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the EGR valve • Air stuck in the air intake system



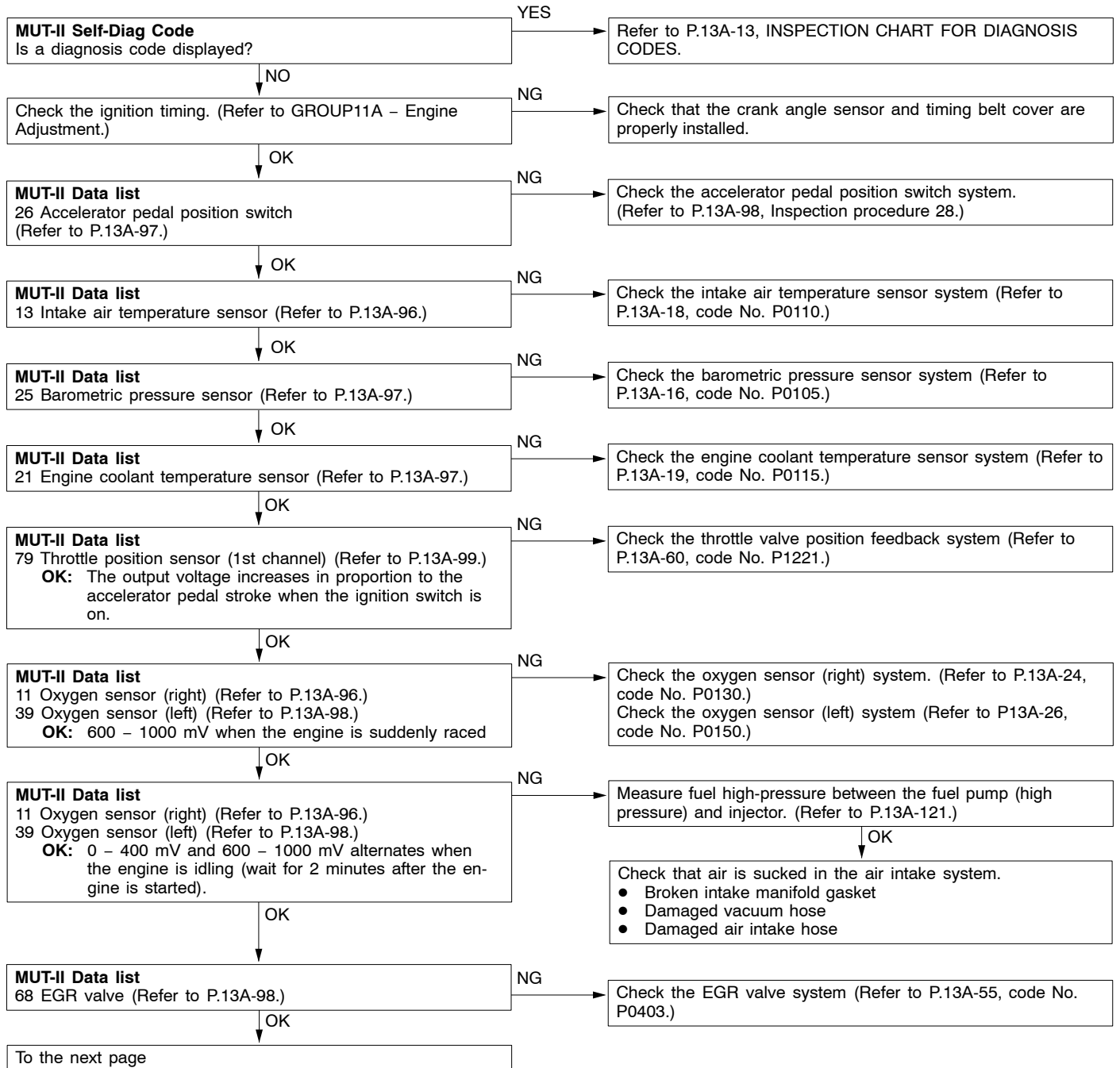
Inspection procedure 12

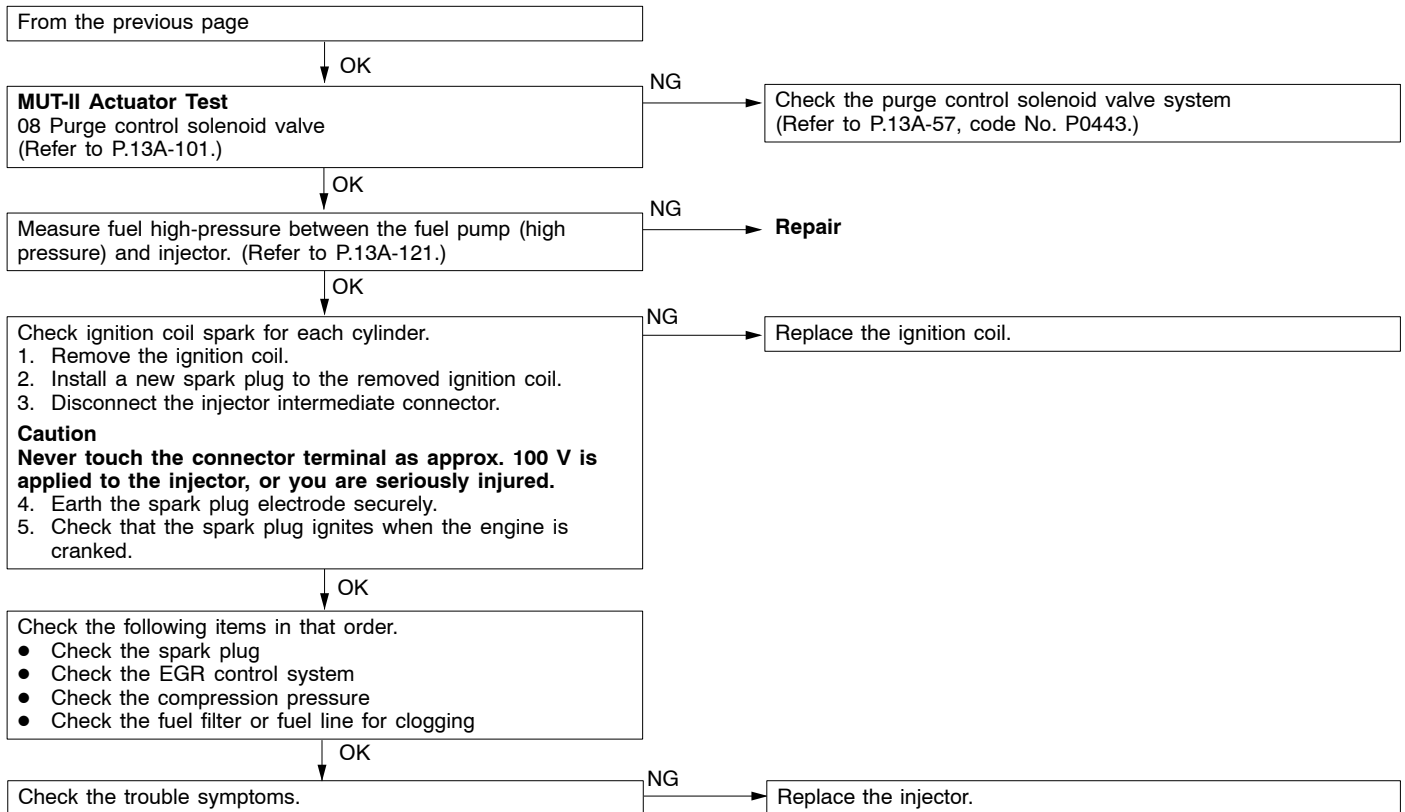
The engine stalls when decelerating.	Probable cause
The cause is probably an improper air/fuel ratio due to a faulty EGR system, or poor intake air volume due to a faulty electronic-controlled throttle valve system.	<ul style="list-style-type: none"> • Malfunction of the electronic-controlled throttle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



Inspection procedure 13

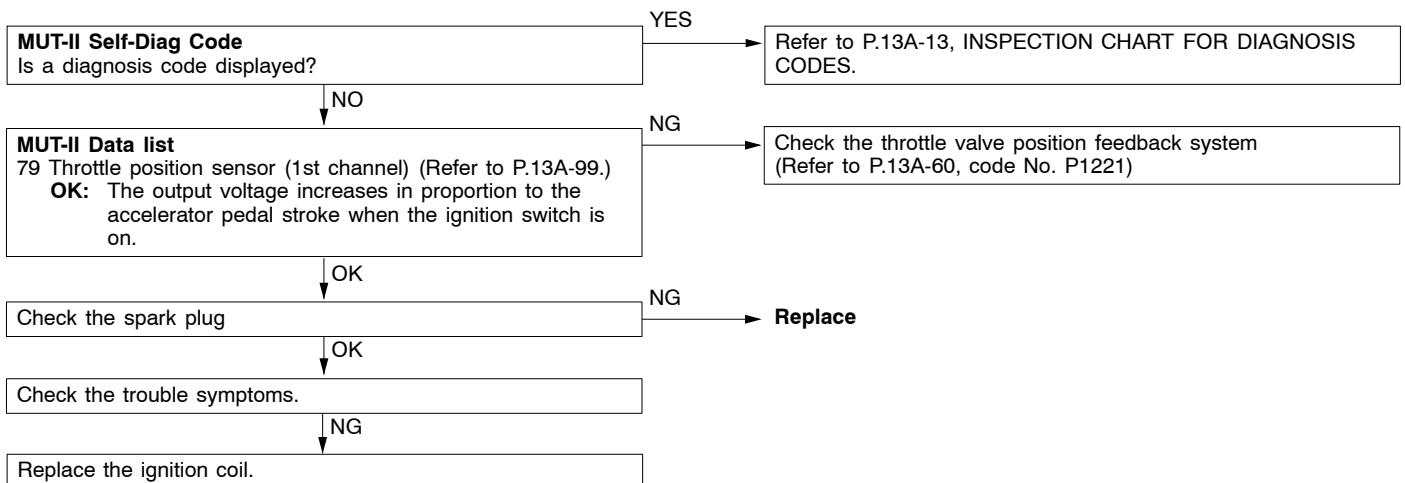
Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, air/fuel ratio control system, electronic controlled throttle valve system, compression pressure, etc.	<ul style="list-style-type: none"> • Malfunction of the ignition system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





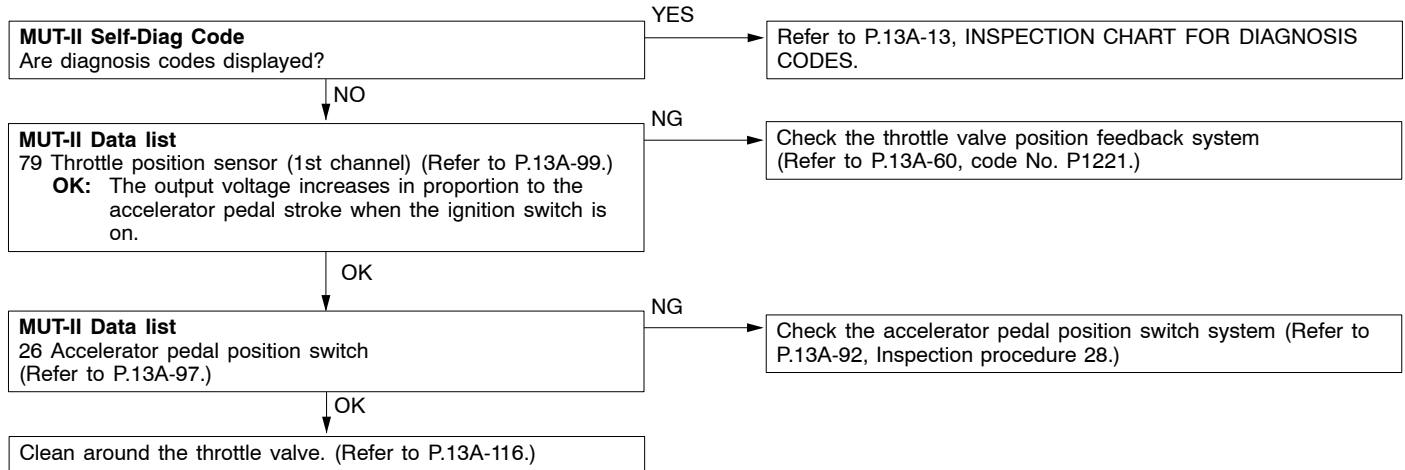
Inspection procedure 14

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



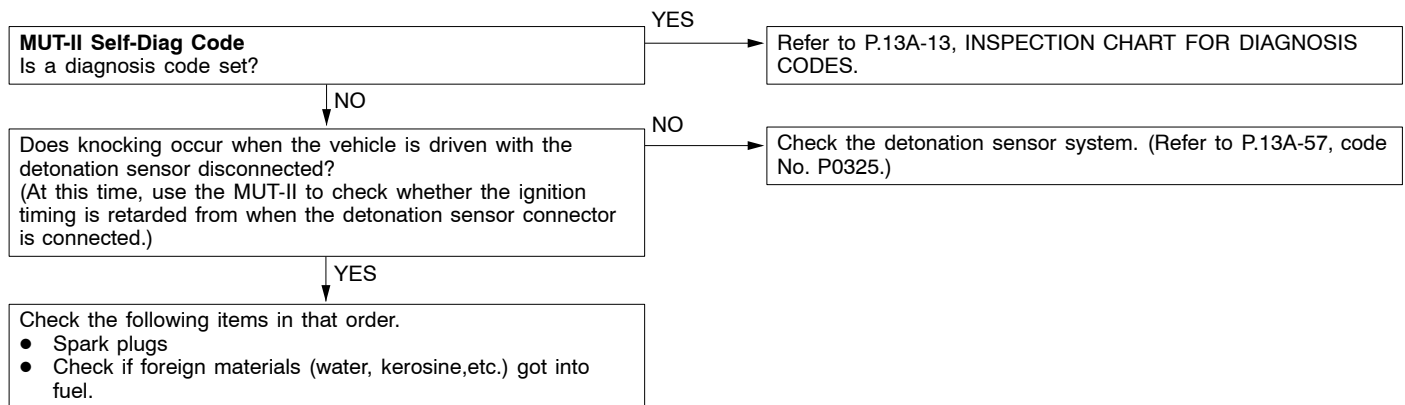
Inspection procedure 15

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



Inspection procedure 16

Knocking	Probable cause
In case as the above, the cause is probably that the heat value of the spark plug is inappropriate.	<ul style="list-style-type: none"> Malfunction of the knock sensor Improper heat range of the spark plugs.



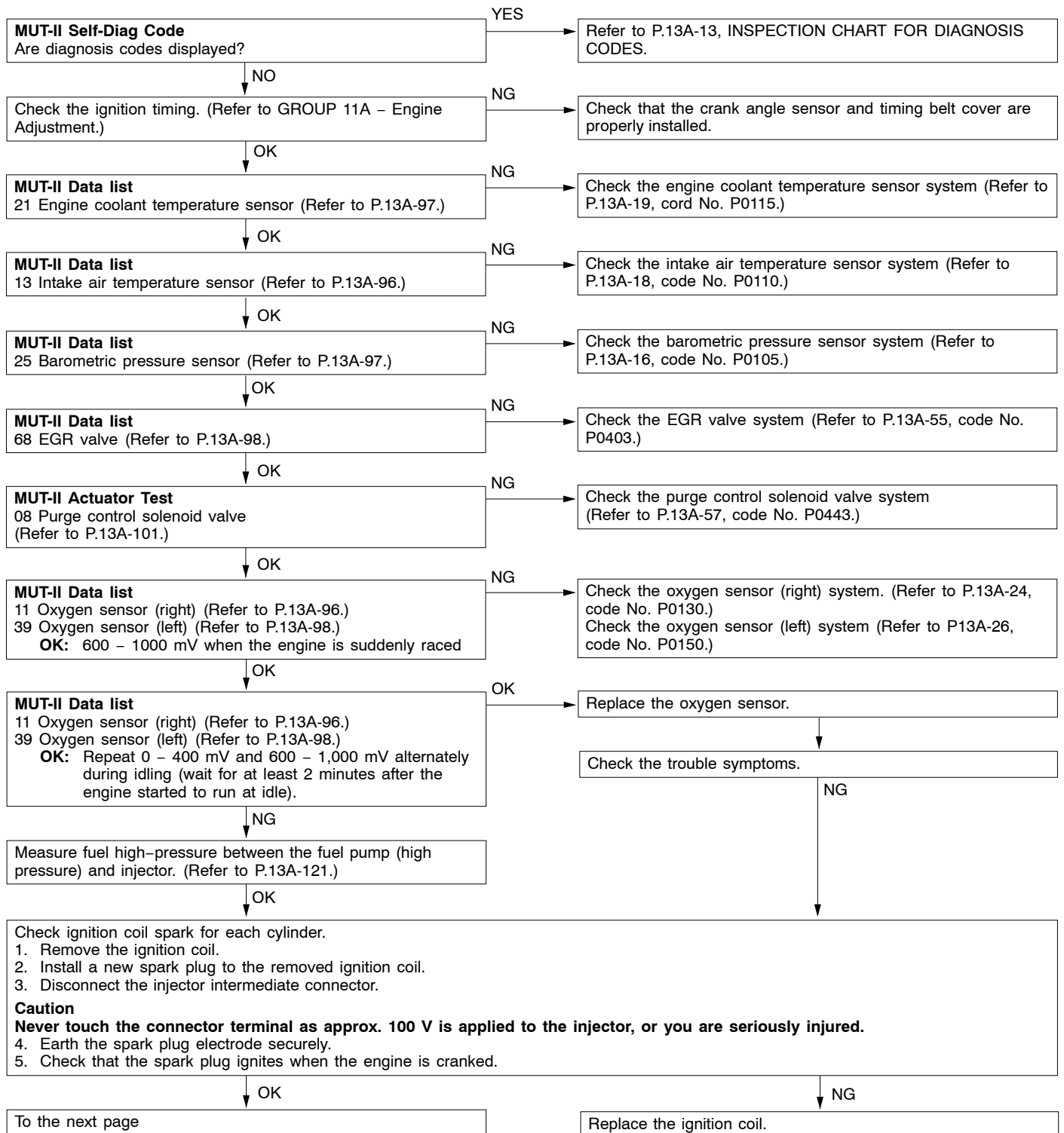
Inspection procedure 17

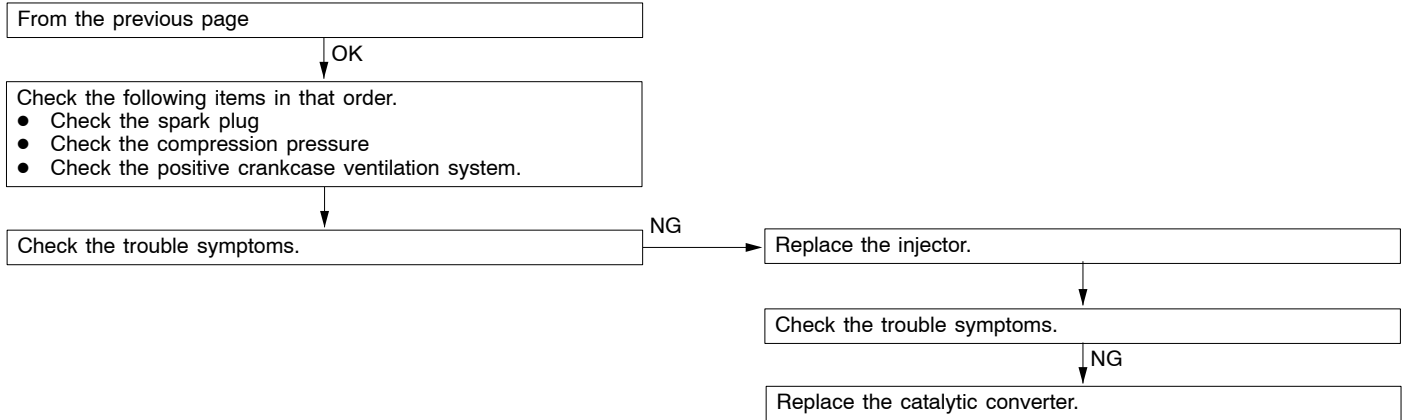
Run-on (Dieseling)	Probable cause
Fuel leakage from injectors is suspected.	<ul style="list-style-type: none"> Malfunction of the injector

Replace the injector.

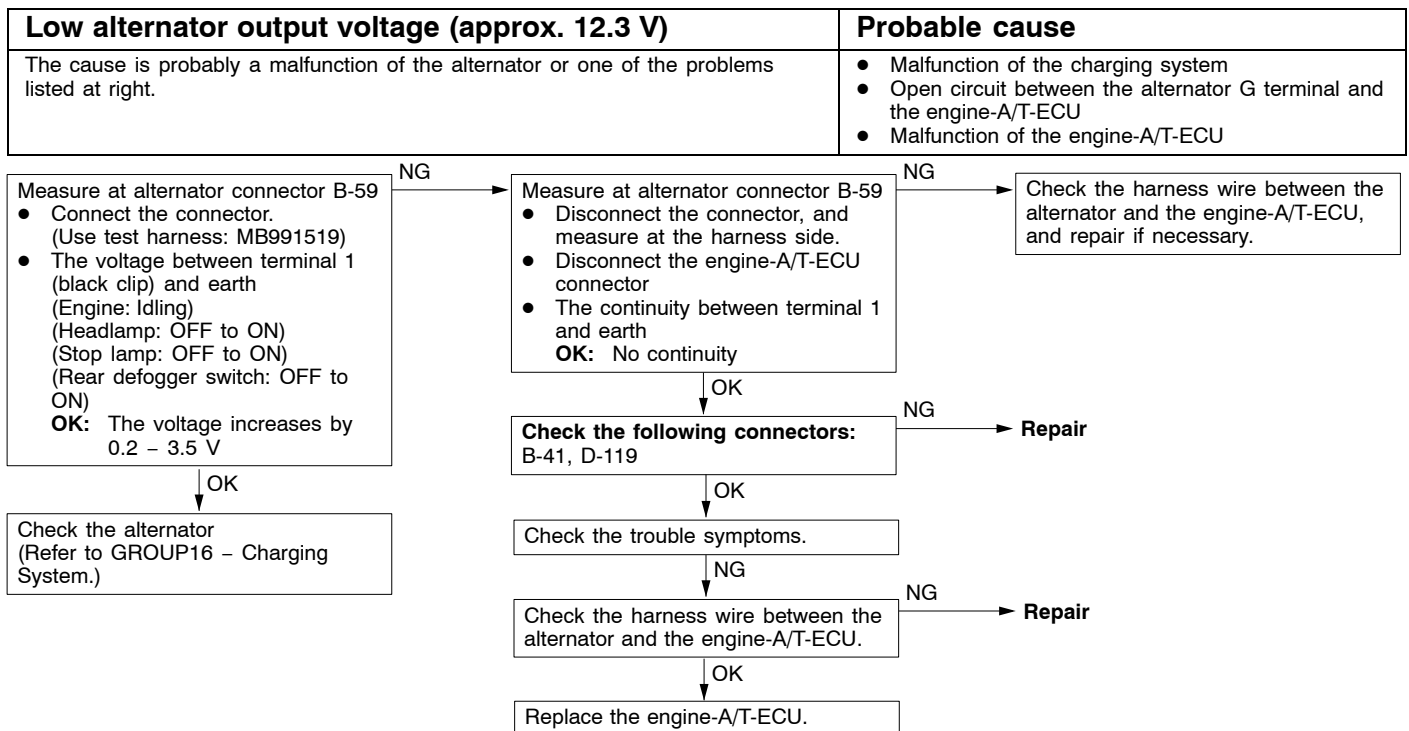
Inspection procedure 18

Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	<ul style="list-style-type: none"> Malfunction of the air/fuel ratio control system Deteriorated catalyst



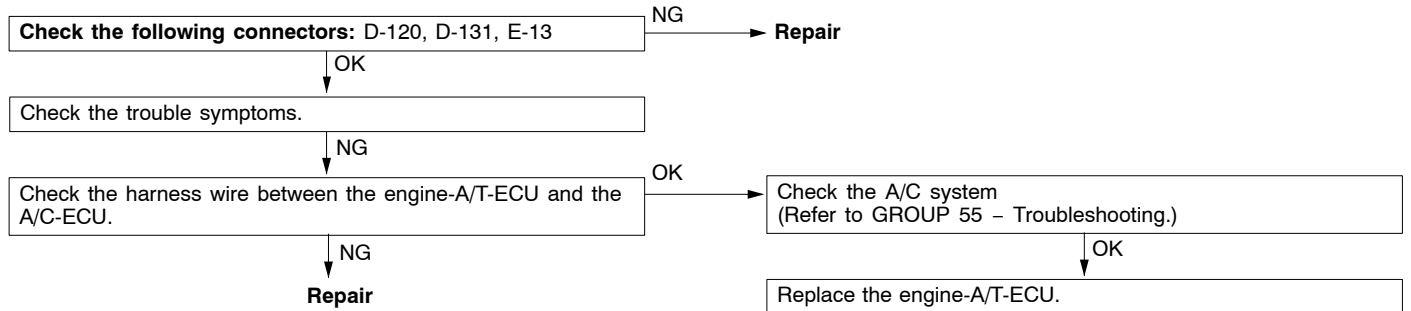


Inspection procedure 19



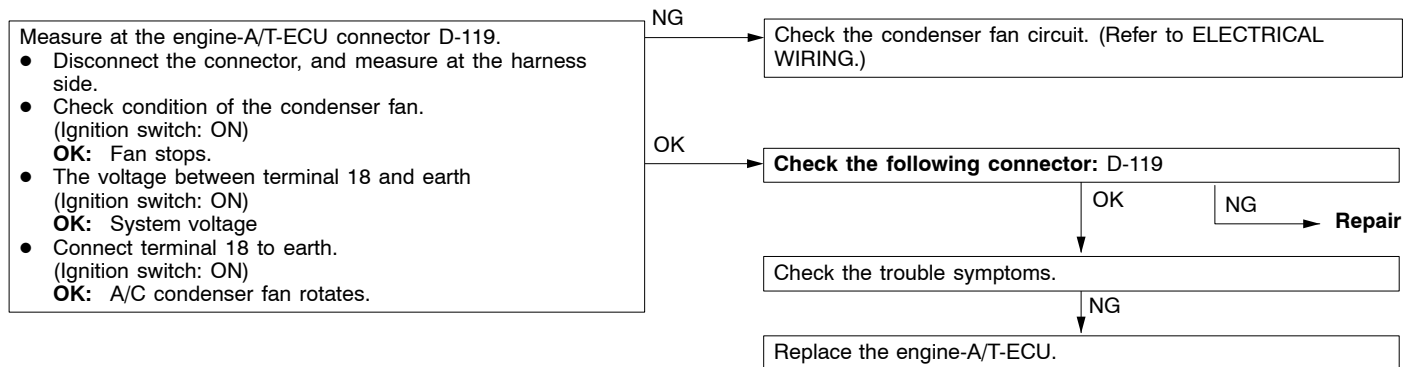
Inspection procedure 20

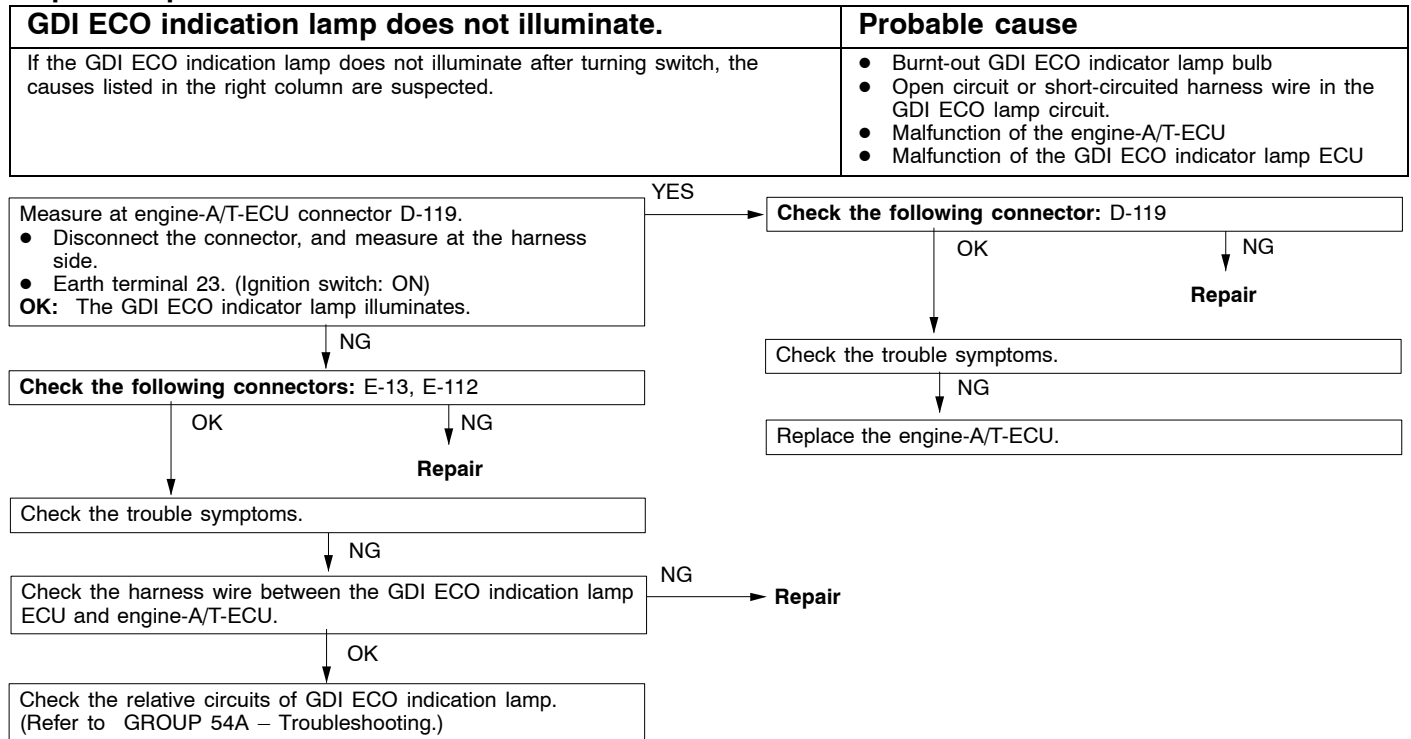
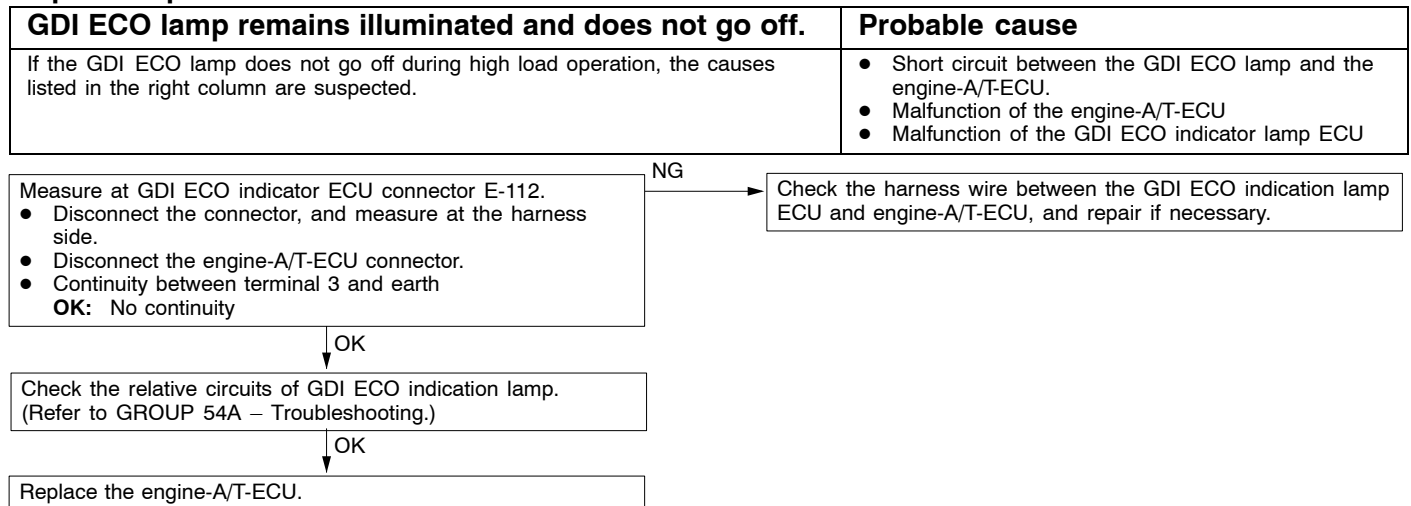
Idling speed is improper when A/C is operating (A/C switch 2 signal)	Probable cause
The A/C-ECU judges if load caused by air conditioner is high or low, and converts it to A/C switch 2 signal to send the engine-A/T-ECU it. Based on this signal, the engine-A/T-ECU operates the throttle control servo to control the idle-up speed.	<ul style="list-style-type: none"> • Malfunction of the A/C control system • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU



Inspection procedure 21

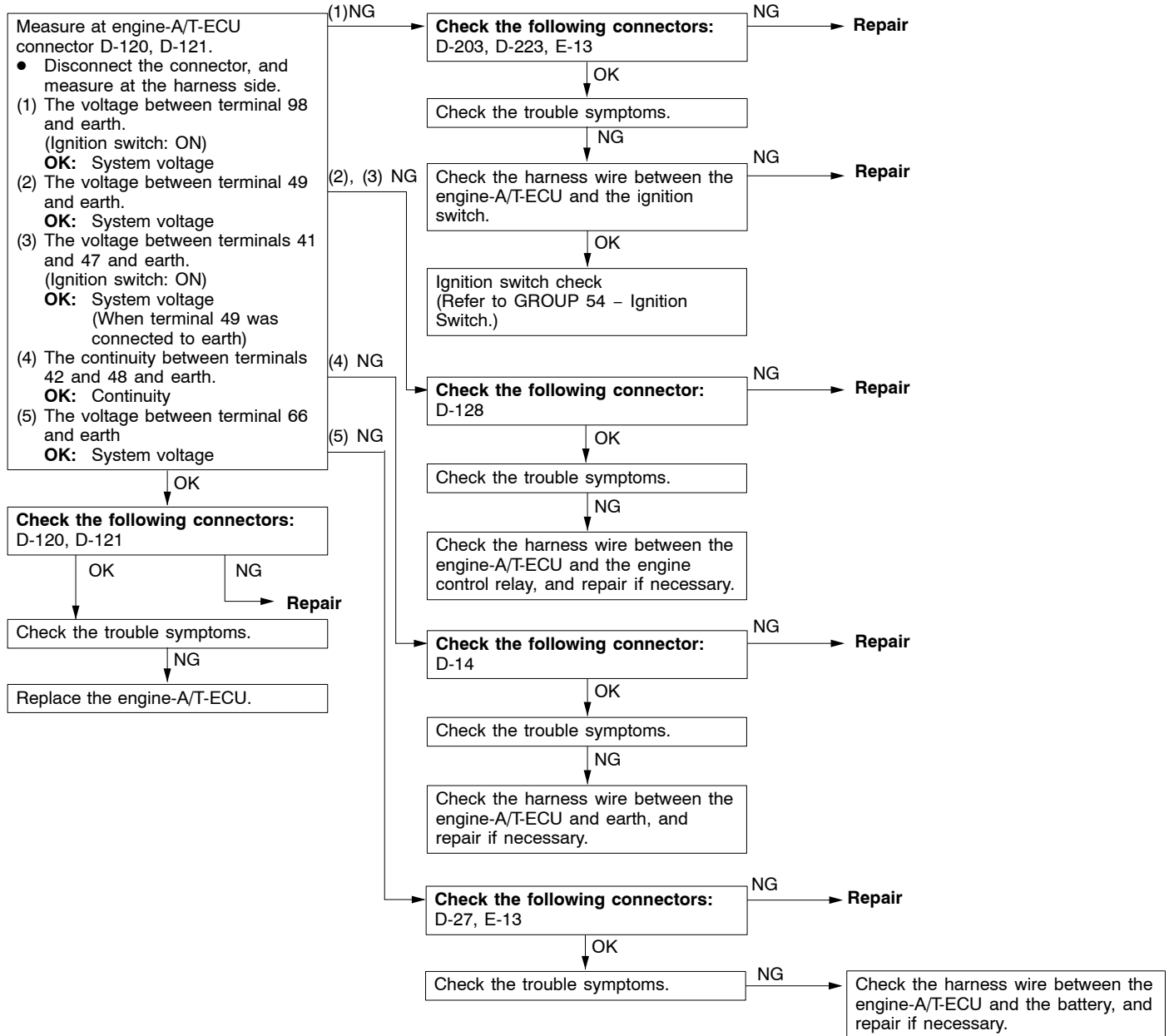
A/C condenser fan is inoperative	Probable cause
The fan motor relay is controlled by turning on and off the power transistor in the engine-A/T-ECU.	<ul style="list-style-type: none"> • Malfunction of the A/C condenser fan relay. • Malfunction of the condenser fan motor. • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU



Inspection procedure 22**Inspection procedure 23**

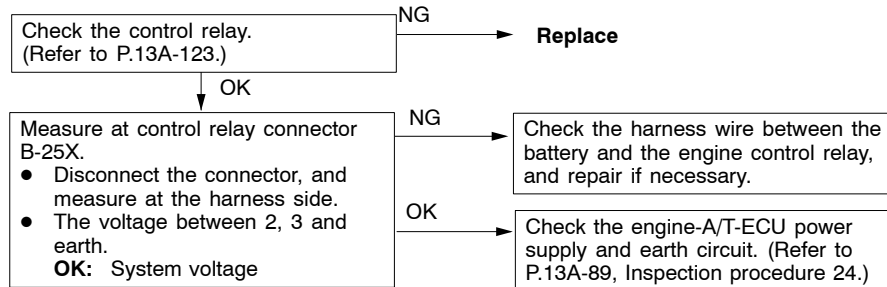
Inspection procedure 24

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



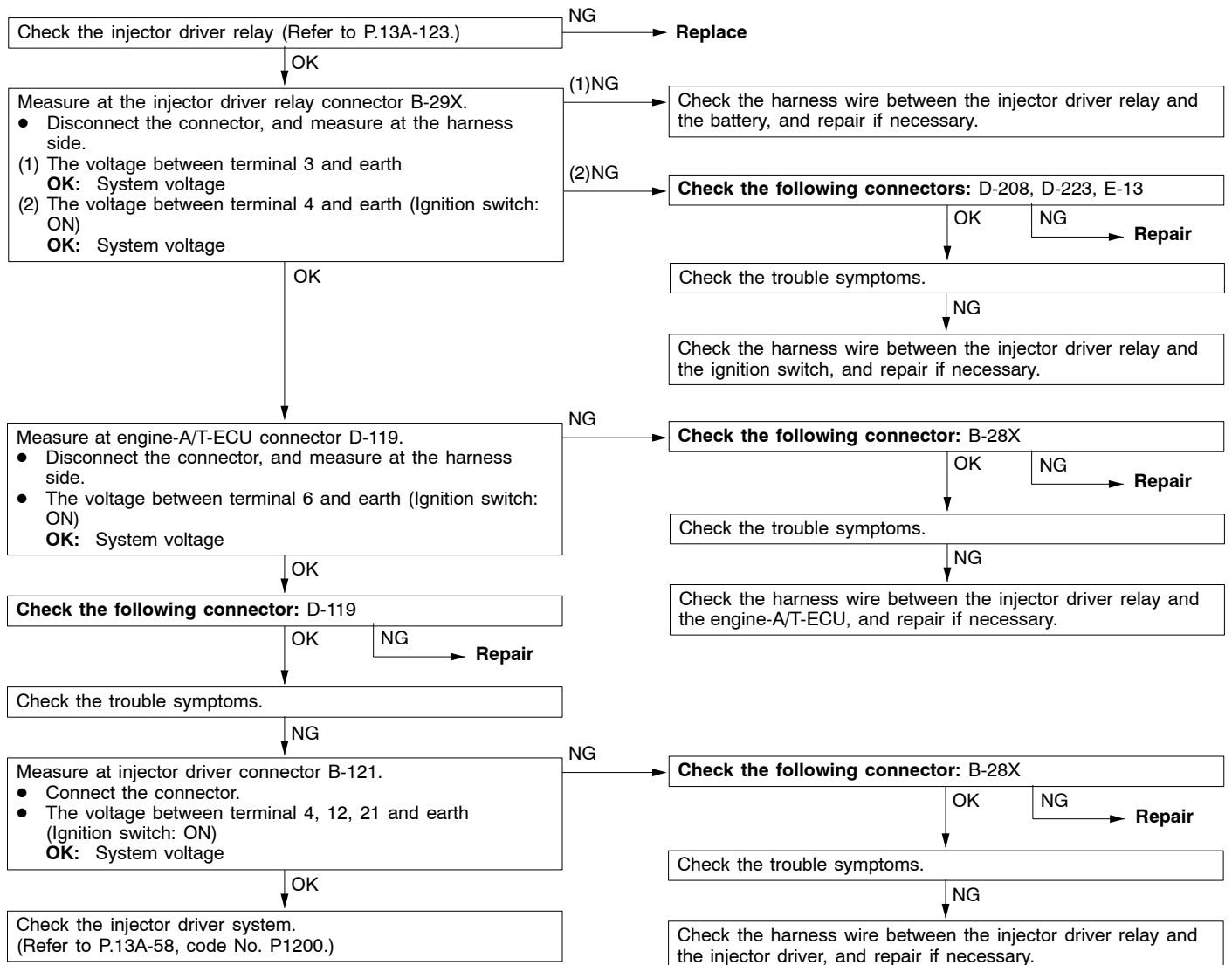
Inspection procedure 25

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



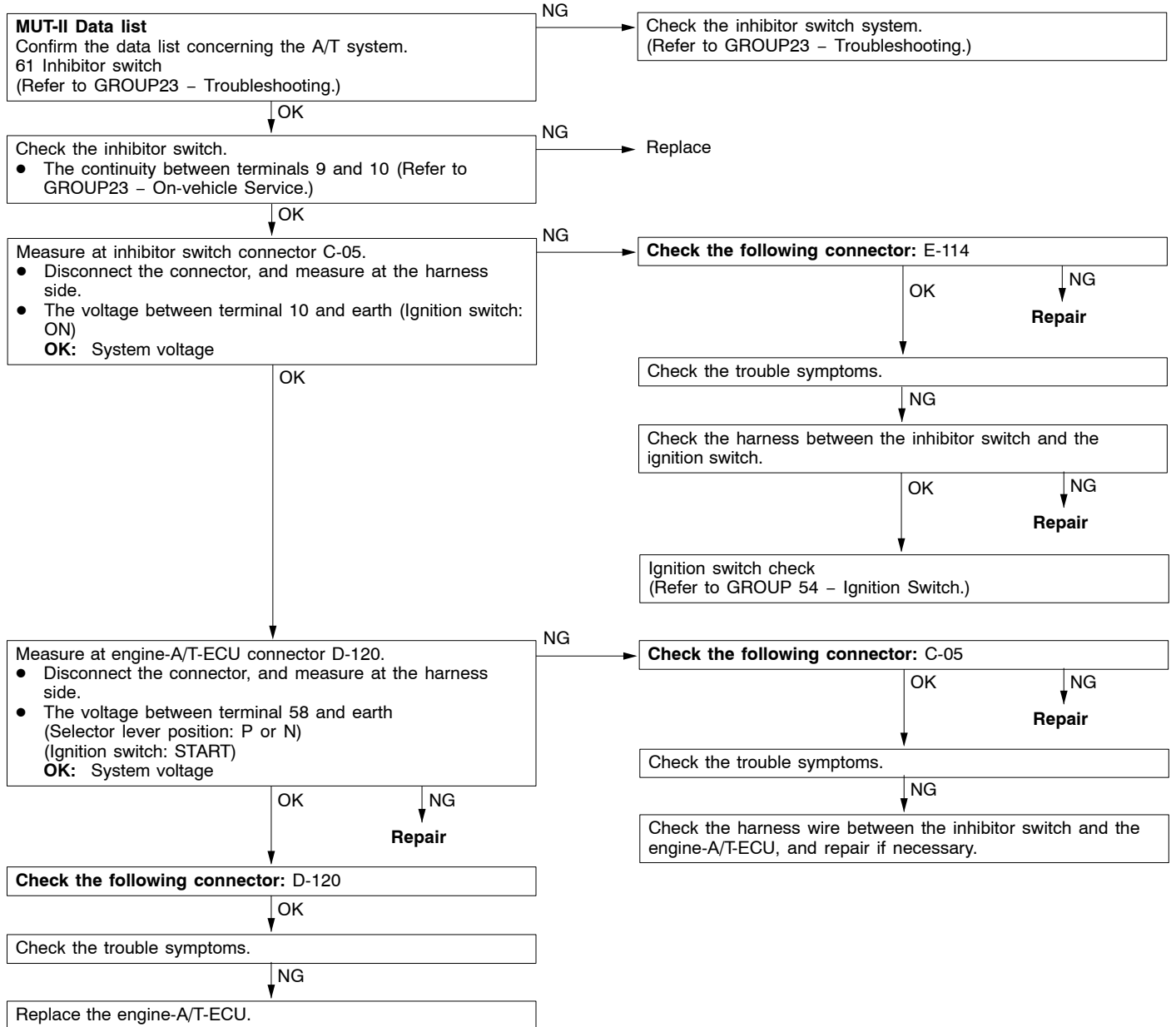
Inspection procedure 26

Injector driver relay system	Probable cause
When an ignition switch ON signal is input to the engine-A/T-ECU, the engine-A/T-ECU turns the injector driver relay ON. This causes system voltage to be supplied to the injector driver.	<ul style="list-style-type: none"> • Malfunction of the injector driver relay. • Open or short circuit, or loose connector contact • Malfunction of the engine-A/T-ECU



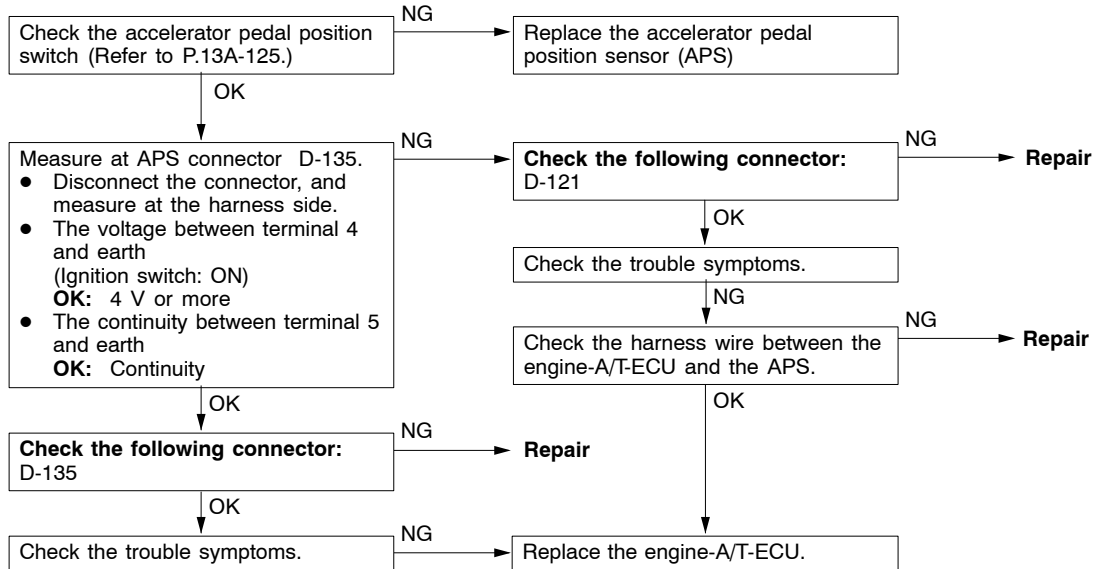
Inspection procedure 27

Ignition switch-ST and inhibitor switch system	Probable cause
<p>The ignition switch-ST inputs a HIGH signal to the engine-A/T-ECU while the engine is cranking. The engine-A/T-ECU controls fuel injection, etc. during starting based on this input.</p> <p>The inhibitor switch inputs the position of the selector lever to the engine-A/T-ECU. The engine-A/T-ECU uses this signal to carry out idle speed control.</p>	<ul style="list-style-type: none"> • Malfunction of the ignition switch • Malfunction of the inhibitor switch • Open circuit or short-circuited harness wire between the ignition switch and the inhibitor switch, or improper connector contact. • Malfunction of the engine-A/T-ECU



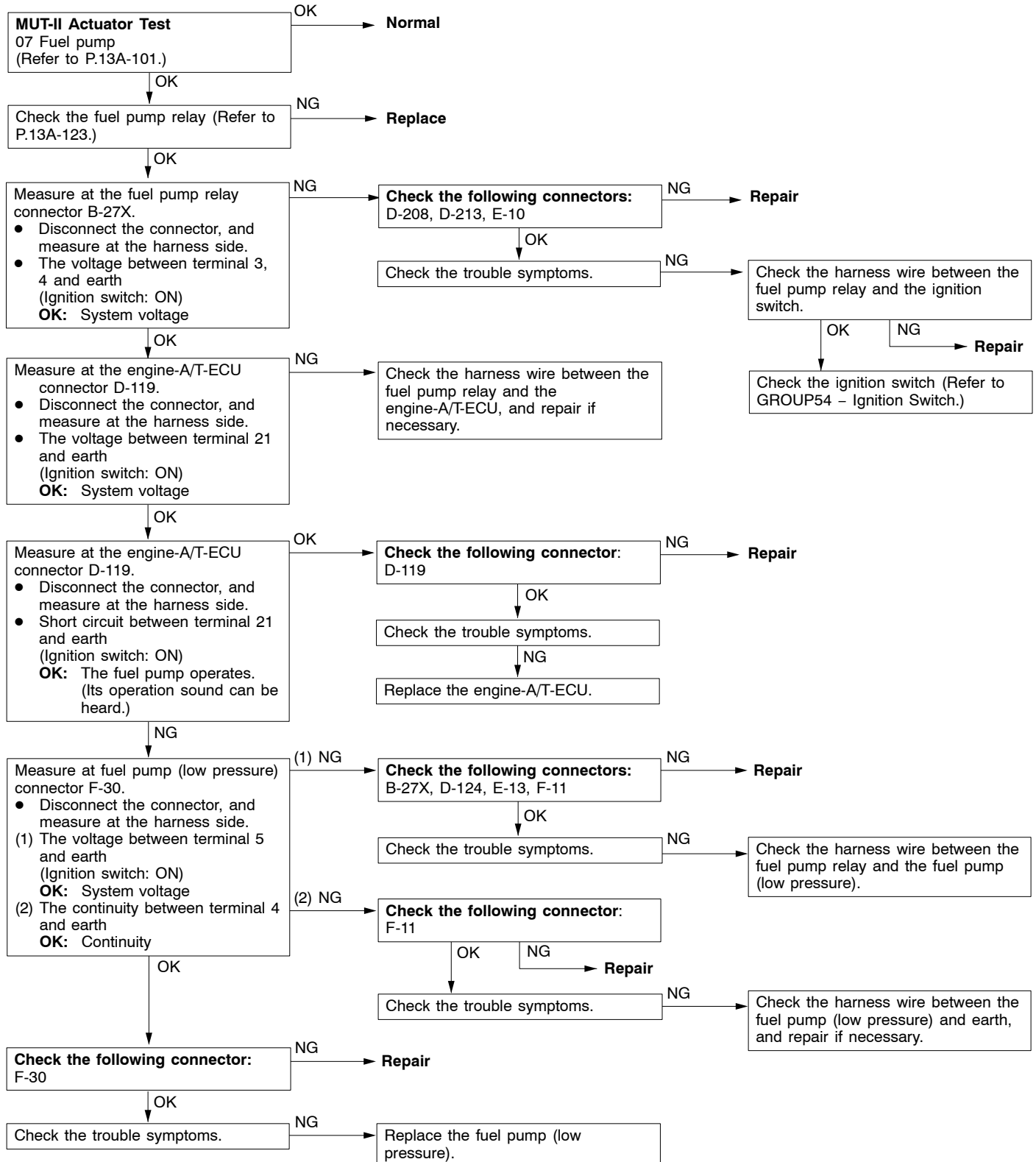
Inspection procedure 28

Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-A/T-ECU. The engine-A/T-ECU uses this signal to carry out idle speed control.	<ul style="list-style-type: none"> Maladjustment of the accelerator pedal position switch and the accelerator pedal position sensor. Open circuit or short-circuited harness wire in the accelerator pedal position switch system, or poor connector contact Malfunction of the engine-A/T-ECU



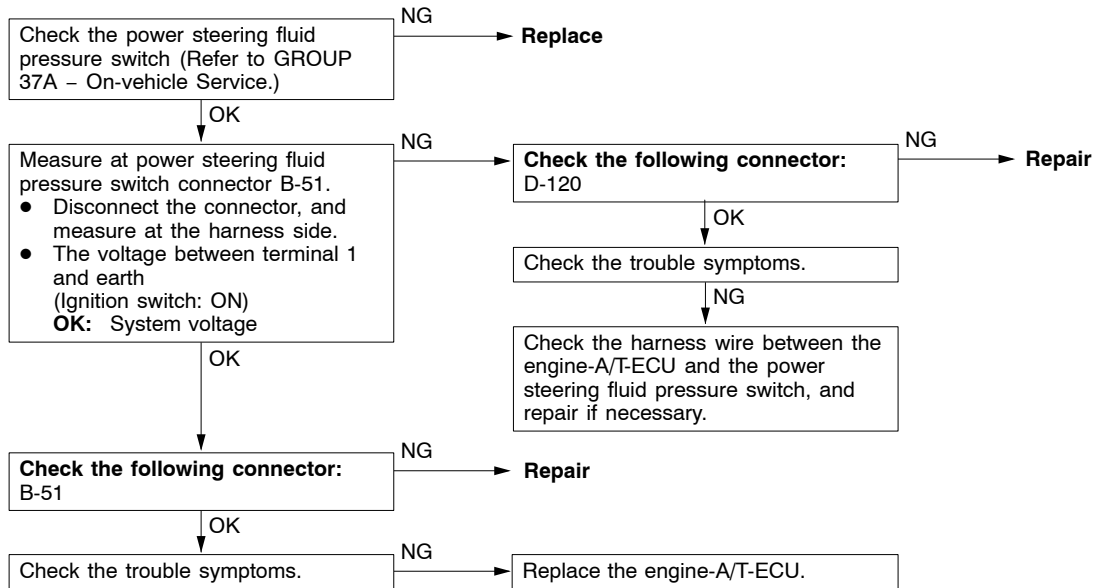
Inspection procedure 29

Fuel pump (low pressure) system	Probable cause
The engine-A/T-ECU turns on the fuel pump relay while the engine is cranking or running, and supplies power source to the fuel pump (low pressure).	<ul style="list-style-type: none"> • Malfunction of the fuel pump relay • Malfunction of the fuel pump (low pressure) • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



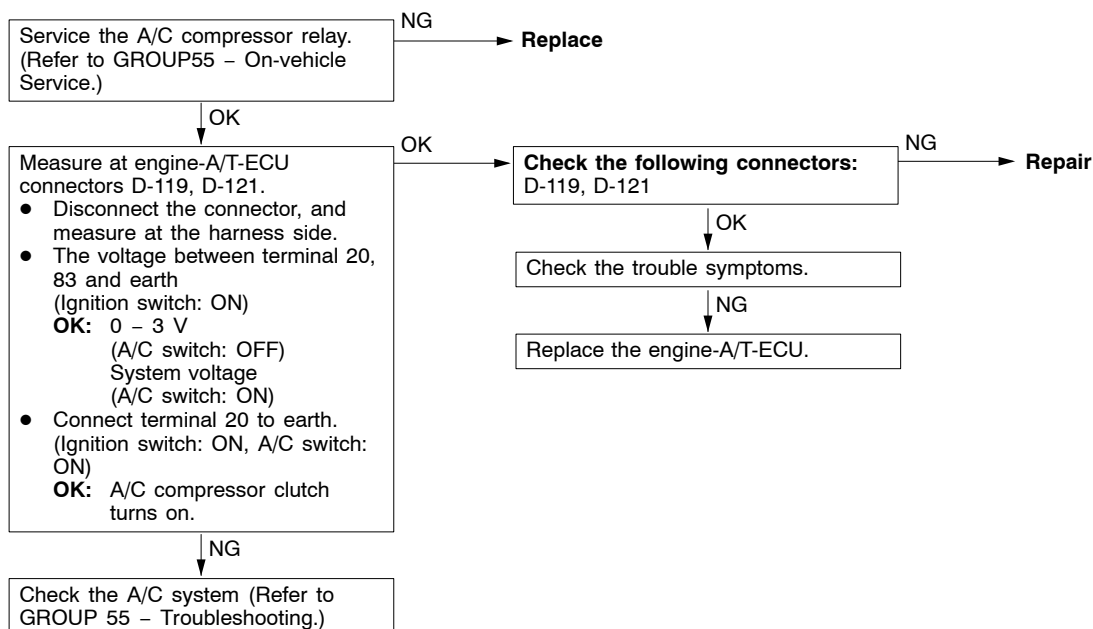
Inspection procedure 30

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-A/T-ECU. Based on this signal, the engine-A/T-ECU controls the throttle control servo so that idle speed increases when the power steering is in operation.	<ul style="list-style-type: none"> • Malfunction of the power steering fluid pressure switch. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



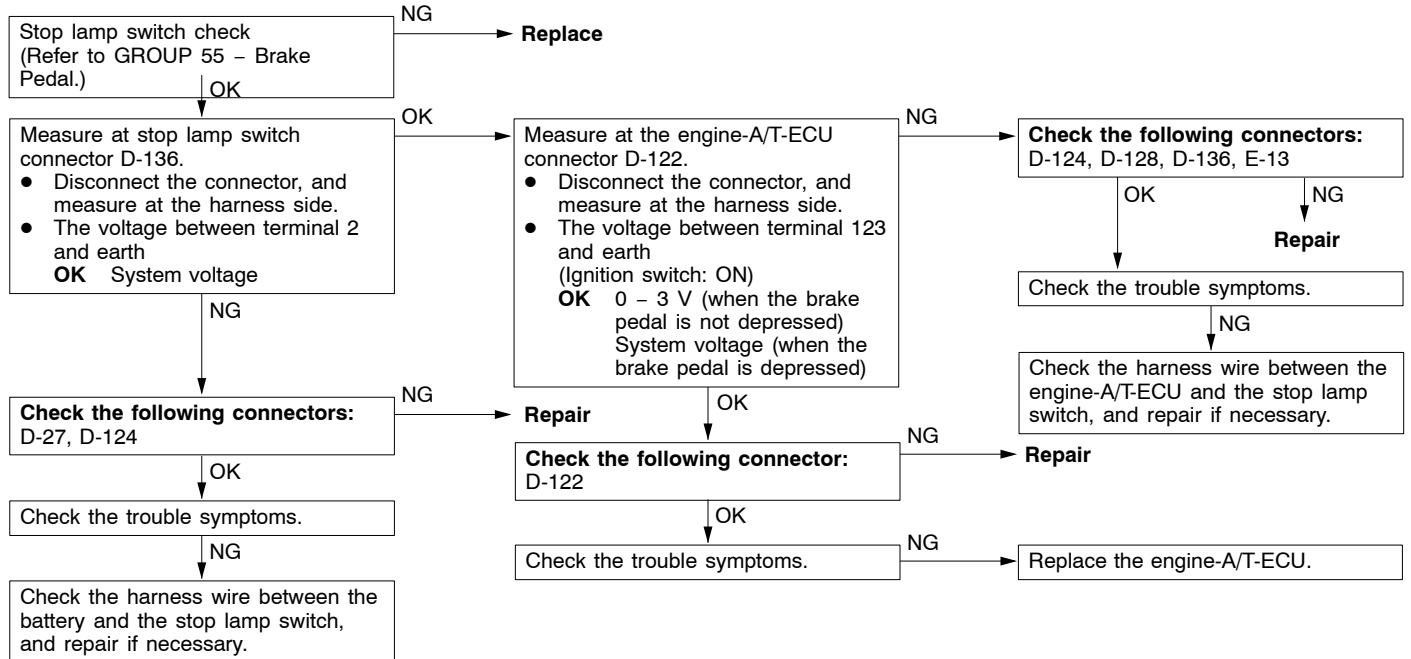
Inspection procedure 31

Check the A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-A/T-ECU, the engine-A/T-ECU carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	<ul style="list-style-type: none"> • Malfunction of the A/C control system • Malfunction of the A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



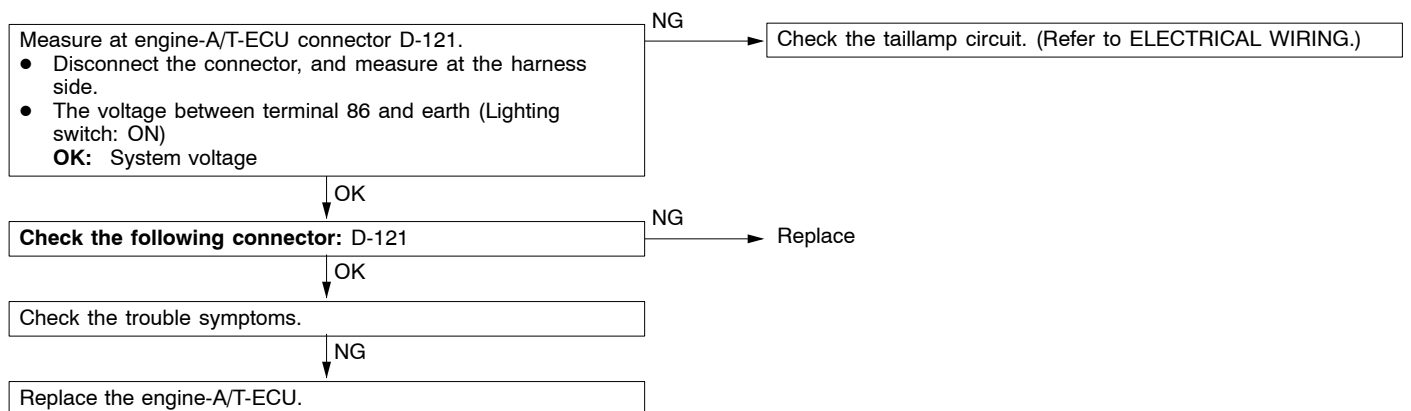
Inspection procedure 32

Stop lamp switch system	Probable cause
The engine-A/T-ECU determines whether the brake pedal is depressed or not. The engine-A/T-ECU selects a fuel combustion mode by determining the brake operation according to this information.	<ul style="list-style-type: none"> • Malfunction of the stop lamp switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU



Inspection procedure 33

Small lamp switch system	Probable cause
The engine-A/T-ECU determines whether the small lamp switch is on or off. According to that information, the engine-A/T-ECU controls alternator output current when the vehicle is started.	<ul style="list-style-type: none"> • Improper connector contact, open circuit or short-circuited harness wire in the taillamp relay circuit. • Malfunction of the engine-A/T-ECU



DATA LIST REFERENCE TABLE

Caution

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

NOTE

- *1: Injector running time indicates the time where the power voltage is 11V and the cranking speed is 250 r/min or less. As the engine speed increases and the time passes by, the injector running time decreases.
- *2: There may be occasions of taking the injector running time approximately 10% longer than usual when a vehicle has not been driven for a long time (mileage is no more than 500 km.)
- *3: It is normal that the idle switch turns from ON to OFF when APS1 voltage increases by 50 – 100 mV from the idling position. Moreover, adjust the idle switch and APS if the idle switch keeps turning after the accelerator pedal is depressed.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (right)	Engine: After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is decelerated	200 mV or less	Code No. P0130	13A-24
			Rev the engine suddenly.	600 – 1,000 mV		
		Engine: After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition by the engine-A/T-ECU.	Idling (after six minutes)	400 mV or less 600 – 1,000 mV (changes)		
			2,500 r/min			
12	Air flow sensor	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Lamps and all accessories: OFF Transmission: P range 	Idling	22 – 48 Hz	Code No. P0100	13A-14
			2,500 r/min	60 – 100 Hz		
			Racing	Frequency increases in response to racing		
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. P0110	13A-18
			When intake air temperature is 0°C	0°C		
			When intake air is 20°C	20°C		
			When intake air is 40°C	40°C		
14	Throttle position sensor (2nd channel)	<ul style="list-style-type: none"> Engine: After having warmed up Ignition switch: ON (Engine Stopped) 	Release the accelerator pedal.	4,000 mV or more	Code No. P0225	13A-48
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	400 – 600 mV		
16	System voltage	Ignition switch: ON		System voltage	Procedure No. 24	13A-89
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 27	13A-91
			Engine: Cranking	ON		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is -20°C	-20°C	Code No. P0115	13A-19
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
22	Crank angle sensor	<ul style="list-style-type: none"> Engine: Cranking Tachometer: Connected 	Compare the tachometer with the MUT-II reading.	Identical	Code No. P0335	13A-51
		<ul style="list-style-type: none"> Engine: Idling Idle position switch: ON Within six minutes after engine starting Only when engine coolant temperature is 80°C 	When engine coolant temperature is -20°C	1,250 – 1,450 r/min		
			When engine coolant temperature is 0°C	1,100 – 1,300 r/min		
			When engine coolant temperature is 20°C	1,000 – 1,200 r/min		
			When engine coolant temperature is 40°C	900 – 1,100 r/min		
			When engine coolant temperature is 80°C	550 – 650 r/min		
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. P0105	13A-16
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No.28	13A-92
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	When steering wheel is turned	ON	Procedure No.30	13A-94
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No.31	13A-94
			A/C switch: ON	ON		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.33	13A-95
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Idling	ON	Code No. P0100	13A-14
			3,000 r/min	OFF		
37	Volumetric efficiency	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Lamps and all accessories: OFF Transmission: P 	Idling	20 – 40%	–	–
			2,500 r/min	10 – 30%		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	<ul style="list-style-type: none"> Engine: Cranking (reading is possible at 2,000 r/min or less) Tachometer: Connected 	Engine speeds displayed on the MUT-II and tachometer are identical.	–	–	–

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
39	Oxygen sensor (left)	Engine: After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is decelerated	200 mV or less	Code No. P0150	13A-26
			Rev the engine suddenly.	600 – 1,000 mV		
		Engine: After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition by the engine-A/T-ECU.	Idling (after six minutes)	400 mV or less 600 – 1,000 mV (changes)		
			2,500 r/min			
41	Injector drive time*1	● Engine: Cranking	When engine coolant temperature is 0°C	120 – 160ms	Code No. P1200	13A-58
			When engine coolant temperature is 20°C	70 – 90 ms		
			When engine coolant temperature is 80°C	20 – 35 ms		
	Injector drive time*2	● Engine coolant temperature: 80 – 95°C ● Lamps and all accessories: OFF ● Transmission: P range ● Within six minutes after engine starting	Idling	0.3 – 0.8 ms		
			2,500 r/min	0.4 – 1.0 ms		
			When engine is suddenly raced	Increases		
44	Ignition advance value	● Engine: After having warmed up ● Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.) ● Within six minutes after engine starting	Idling	7 – 23° BTDC	Code No. P0300	13A-49
			2,500 r/min	15 – 35° BTDC		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.31	13A-94
			A/C switch: ON	ON (compressor clutch is operating)		
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.32	13A-95
			Brake pedal: Released	ON		
68	EGR valve	● Engine coolant temperature: 80 – 95°C ● Lamps and all accessories: OFF ● Transmission: P range	Idling	2 – 20 STEP	Code No. P0403	13A-55
			2,500 r/min	0 – 10 STEP		
74	Fuel pressure sensor	● Engine coolant temperature: 80 – 95°C ● Lamps and all accessories: OFF ● Transmission: P range	Engine: Cranking	2 MPa or more	Code No. P0190	13A-32
			Engine: Idling	4.0 – 6.9 MPa		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	985 – 1,085 mV	Code No. P1225	13A-63
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
78	Accelerator pedal position sensor 1*3	Ignition switch: ON	Release the accelerator pedal.	985 – 1085 mV	Code No. P0220	13A-46
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
79	Throttle position sensor (1st channel)	<ul style="list-style-type: none">Engine: After having warmed upIgnition switch: ON (Engine stopped)	Release the accelerator pedal.	400 – 800 mV	Code No. P0120	13A-22
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 – 4,800 mV		
		Engine: Idling after warming-up	No load	450 – 1,000 mV		
		A/C switch: OFF – ON	Increases by 100 – 600 mV			
		Transmission: P to D range	Increases by 0 – 200 mV.			
99	Combustion mode	Engine: After having warmed up	Idling (several minutes after starting)	Compression lean	–	–
			2,500 r/min	Stoichiometric feedback		
			Race the engine suddenly while the engine is idling.	Open loop		
A1★	Oxygen sensor (right bank)	Engine: After having warmed up (makes the mixture lean by deceleration, and rich by revving)	Suddenly decelerating from 4000 r/min	200 mV or less	Code No. P0130	13A-24
			When the engine is revved suddenly	600 – 1000 mV		
		Engine: After having warmed up (checks air-to-fuel ratio according to oxygen sensor signals and the control condition of the engine-A/T-ECU.	Idling (after six minutes)	400 mV or less and 600 – 1000 mV alternate		
			2500 r/min			

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
A3★	Oxygen sensor (left bank)	Engine: After having warmed up (makes the mixture lean by deceleration, and rich by revving)	Suddenly decelerating from 4000 r/min	200 mV or less	Code No. P0150	13A-26
			When the engine is revved suddenly	600 – 1000 mV		
		Engine: After having warmed up (checks air-to-fuel ratio according to oxygen sensor signals and the control condition of the engine-A/T-ECU.	Idling (after six minutes)	400 mV or less and 600 – 1000 mV alternate		
			2500 r/min			
24★	Vehicle speed sensor	Driving at 40 km/h		Approx. 40km/h	Code No. P0500	13A-58
81★	Learned value (right bank)	Engine: After having warmed-up, running with no load at 2500 r/min		–10 – 10%	Code No. P0170	13A-28
82★	Feedback (right bank)	Engine: After having warmed-up, running with no load at 2500 r/min		–25 – 25%	Code No. P0170	13A-28
83★	Learned value (left bank)	Engine: After having warmed-up, running with no load at 2500 r/min		–10 – 10%	Code No. P0173	13A-30
84★	Feedback (left bank)	Engine: after having warmed-up, running with no load at 2500 r/min		–25 – 25%	Code No. P0173	13A-30
87★	Engine load	Engine: After having warmed-up	Idling	15 – 35%	–	–
			2500 r/min	15 – 35%	–	–
8A★	Throttle position sensor (1st channel) (Throttle valve opening angle)	<ul style="list-style-type: none">Engine: After having warmed upIgnition switch: ON (Engine stopped)	Release the accelerator pedal.	8 – 16%	Code No. P0120	13A-22
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	80 – 100%		

NOTE

Items marked by ★ will not displayed if service data is selected on the check mode.

ACTUATOR TEST TABLE

Item No.	Inspection item	Drive Contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injector	Cut fuel to the No.1 injector.	Engine: Idling after warming-up (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idling condition becomes different (becomes unstable, or the engine stalls).	Code No. P0201	13A-34
02		Cut fuel to the No.2 injector.				Code No. P0202	13A-36
03		Cut fuel to the No.3 injector.				Code No. P0203	13A-38
04		Cut fuel to the No.4 injector.				Code No. P0204	13A-40
05		Cut fuel to the No.5 injector.				Code No. P0205	13A-42
06		Cut fuel to the No.6 injector.				Code No. P0206	13A-44
07	Fuel pump (low-pressure)	Operates the fuel pump (low-pressure) to circulate fuel.	Ignition switch: ON	Pinch the return hose with fingers to feel the pulse of the fuel being circulated.	Pulse is felt.	Procedure No.29	13A-93
				Operating sound can be heard around the fuel tank.	Sound of operation can be heard		
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Code No. P0443	13A-57
17	Basic ignition timing	Solenoid valve turns from OFF to ON.	<ul style="list-style-type: none"> ● Engine: Idling ● Set a timing light. 		5° BTDC	–	–
21	Condenser fan	Drive the fan motor.	<ul style="list-style-type: none"> ● Ignition switch: ON ● A/C switch: ON 		Fan motor runs.	Procedure No.21	13A-87
34	Electronic-controlled throttle valve system	Stop the throttle control servo.	Ignition switch: ON		The throttle valve opens slightly.	Code No. P1220	13A-59

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-A/T-ECU Connector

107	130	130
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7FU1763

Terminal No.	Check item	Check condition (Engine condition)	Normal condition
1	No.1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 9 – 13 V, momentarily drops slightly
9	No.2 injector		
24	No.3 injector		
2	No.4 injector		
10	No.5 injector		
25	No.6 injector		
3	Oxygen sensor heater (left)	Engine: Idling	0 – 3 V
		Engine: 5000 r/min	System voltage
4	Oxygen sensor heater (right)	Engine: Idling	0 – 3 V
		Engine: 5000 r/min	System voltage
6	Injector driver relay	Ignition switch: OFF	0 – 0.1 V
		Ignition switch: ON	0.5 – 1.0 V
8	Alternator G terminal	<ul style="list-style-type: none"> Engine: Idling after warming-up Radiator fan: Not operating Headlamp: off to on Stop lamp: off to on Defogger switch: OFF to ON 	The voltage increases by 0.2 – 3.5 V
54	Alternator FR terminal	<ul style="list-style-type: none"> Engine: Idling after warming-up Radiator fan: Not operating Headlamp: off to on Stop lamp: off to on Defogger switch: OFF to ON 	The voltage drops
11	No.1 ignition coil	Engine speed: 3000 r/min	0.3 – 3.0 V
31	No.2 ignition coil		
13	No.3 ignition coil		
30	No.4 ignition coil		
12	No.5 ignition coil		
32	No.6 ignition coil		
14	Throttle control servo relay	Ignition switch: OFF	0 – 0.1 V
		Ignition switch: ON	0.5 – 1.0 V
18	Condenser fan relay	Condenser fan not operating	System voltage
		Condenser fan operating	0 – 3 V or more
19	Air flow sensor reset signal	Engine: Idling	0 – 1 V
		Engine speed: 3000 r/min	6 – 9 V
20	A/C relay	<ul style="list-style-type: none"> Engine: Idling A/C switch: OFF to ON (Compressor operating) 	System voltage or changes momentarily 6 V or more to 0 – 3 V
21	Fuel pump relay	Ignition switch: ON	System voltage
		Engine: Idling	0 – 3 V
22	Engine warning lamp	Ignition switch: OFF to ON	System voltage

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
23	GDI ECO indication lamp	Engine: Idling		0 – 3 V
		Rev the engine suddenly.		System voltage
34	Purge control solenoid valve	<ul style="list-style-type: none">Engine coolant temperature: 80 – 95 °CIgnition switch: ON	Engine: stopped	System voltage
			Engine: After starting, increase the engine speed up to 3500 r/min	The voltage drops
41	Power supply	Ignition switch: ON		System voltage
47				
43	Engine ignition signal	Engine speed: 3000 r/min		0.3 – 3.0 V
44	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2 – 3.8 V
			When engine coolant temperature is 20°C	2.3 – 2.9 V
			When engine coolant temperature is 40°C	1.3 – 1.9 V
			When engine coolant temperature is 80°C	0.3 – 0.9 V
45	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idling		1.5 – 2.5 V
46	Power supply voltage applied to accelerator pedal position sensor 1	Ignition switch: ON		4.5 – 5.5 V
49	Engine control relay	Ignition switch: OFF		0 – 3 V
		Ignition switch: ON		System voltage
51	EGR valve (A)	Ignition switch: OFF to ON		5 – 8 V (Repeatedly changes for approx. 3 seconds)
53	EGR valve (C)			
60	EGR valve (B)			
62	EGR valve (D)			
52	Power steering fluid pressure switch	Engine: Idling after warming-up	When steering wheel is stationary	System voltage
			When steering wheel is turned	0 – 3 V
55	Barometric pressure sensor	Ignition switch: ON	At an altitude of 0 m	3.7 – 4.3 V
			At an altitude of 1200 m	3.2 – 3.8 V
56	Camshaft position sensor	Engine: Cranking		0.4 – 3.0 V
		Engine: Idling		0.5 – 2.0 V
58	Ignition switch-ST	Engine: Cranking		8 V or more
61	A/C switch 2	Refer to GROUP 55 – Troubleshooting (Check at A/C-ECU or Engine-ECU Terminal).		
63	Injector open circuit check signal	Engine: Increases from idling up to 4000 r/min		The voltage decreases slightly (approx. 0.7 V) from 4.5 – 5.0 V.
64	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 – 3.8 V
			When intake air temperature is 20°C	2.3 – 2.9 V
			When intake air temperature is 40°C	1.5 – 2.1 V
			When intake air temperature is 80°C	0.4 – 1.0 V
65	Air flow sensor	Engine: Idling		2.2 – 3.2 V
		Engine speed: 2500 r/min		
66	Backup power supply	Ignition switch: OFF		System voltage

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
71	Oxygen sensor (left)	Engine: Running at 2500 r/min after warming-up (Check by using a digital voltmeter.)		Voltages of 0 V and 0.8 V alternate (changes repeatedly)
72	Oxygen sensor (right)	Engine: Running at 2500 r/min after warming-up (Check by using a digital voltmeter.)		Voltages of 0 V and 0.8 V alternate (changes repeatedly)
78	Throttle position sensor 2	Ignition switch: ON	Release the accelerator pedal.	4.0 V or higher
			Depress the accelerator pedal fully.	0.4 – 0.6 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 – 1 V
			Depress the accelerator pedal slightly.	4 V or more
80	Vehicle speed sensor	<ul style="list-style-type: none"> Ignition switch: ON Move the vehicle slowly forward 		Voltages of 0 and 8 – 12 V alternate (changes repeatedly)
83	A/C switch 1	Engine: Idling	A/C switch: OFF	0 – 3 V
			A/C switch: ON (Compressor is operating)	System voltage
86	Small lamp switch	Lighting switch: OFF		0 – 3 V
		Lighting switch: Tail light position		System voltage
87	Sensor applied voltage	Ignition switch: ON		4.5 – 5.5 V
93	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V
95	Accelerator pedal position sensor 1	Ignition switch: ON	Release the accelerator pedal.	0.985 – 1.085 V
			Depress the accelerator pedal fully.	4.0 V or higher
98	Ignition switch-IG	Ignition switch: ON		System voltage
123	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 – 3 V

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

Engine-A/T-ECU harness-side connector

107	106	105	104	103	102	101	77	76	75	74	73	72	71	46	45	44	43	42	41	8	7	6	5	4	3	2	1
120	119	118	117	116	115	114	89	88	87	86	85	84	83	82	81	80	79	78	77	23	22	21	20	19	18	17	16
130	129	128	127	126	125	124	98	97	96	95	94	93	92	91	90	89	88	87	86	35	34	33	32	31	30	29	28
														66	65	64	63	62	61	60	59	58	57	56	55	54	53
														66	65	64	63	62	61	60	59	58	57	56	55	54	53

7FU1764

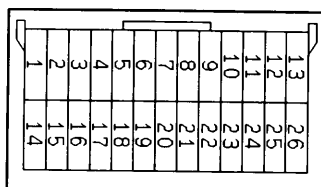
Terminal No.	Check item	Standard value, normal condition (check conditions)
3–41	Oxygen sensor heater (left)	4.5 – 8.0 Ω (at 20°C)
4–41	Oxygen sensor heater (right)	4.5 – 8.0 Ω (at 20°C)
34–41	Purge control solenoid valve	28 – 36 Ω (at 20°C)
Between terminal 42 and body earth	Earth	Continuity (0 Ω)
Between 48 and body earth		
51–41	EGR valve (A)	15 – 20 Ω (at 20°C)
53–41	EGR valve (C)	
60–41	EGR valve (B)	
62–41	EGR valve (D)	

Terminal No.	Check item	Standard value, normal condition (check conditions)
44–81	Engine coolant temperature sensor	5.1 – 6.5 k Ω (When coolant temperature is 0°C)
		2.1 – 2.7 k Ω (When coolant temperature is 20°C)
		0.9 – 1.3 k Ω (When coolant temperature is 40°C)
		0.26 – 0.36 k Ω (When coolant temperature is 80°C)
64–81	Intake air temperature sensor	5.3 – 6.7 k Ω (When intake air temperature is 0°C)
		2.3 – 3.0 k Ω (When intake air temperature is 20°C)
		1.0 – 1.5 k Ω (When intake air temperature is 40°C)
		0.30 – 0.42 k Ω (When intake air temperature is 80°C)
74–81	Catalyst temperature sensor	1 M Ω or more (at 20°C)
79–81	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is depressed slightly)

CHECK AT THROTTLE VALVE CONTROLLER

TERMINAL VOLTAGE CHECK CHART

Throttle valve controller connector

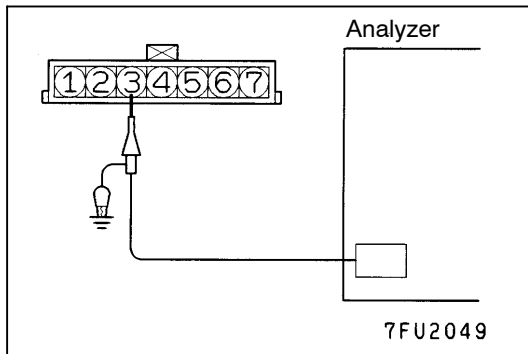


7FU2290

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
1	Throttle control servo (U)	<ul style="list-style-type: none">● Ignition switch: ON● Accelerator pedal: From released position to fully depressed position		Changes
14	Throttle control servo (V)			
15	Throttle control servo (W)			
2	Throttle control servo power supply	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor applied voltage	Ignition switch: ON		4.5 – 5.5 V
7	Throttle position sensor 1	Ignition switch: ON	Release the accelerator pedal.	0.4 – 0.8 V
			Depress the accelerator pedal fully.	4.2 – 4.8 V
18	Backup power supply	Ignition switch: OFF		System voltage
20	Accelerator pedal position sensor 2	Ignition switch: ON	Release the accelerator pedal.	0.985 – 1.085 V
			Depress the accelerator pedal fully.	4.0 V or higher
22	Ignition switch-IG	Ignition switch: ON		System voltage

INSPECTION PROCEDURE USING AN ANALYZER

Sensor output signals and actuator signals can be checked visually by observing wave patterns with an analyzer.



AIR FLOW SENSOR

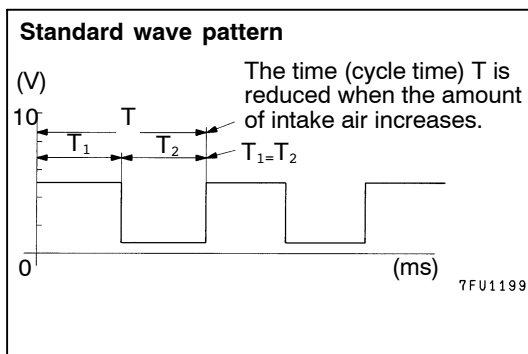
Measurement Method

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.

NOTE

If measuring at the engine-A/T-ECU connector, connect the pickup to terminal 65.

Standard wave pattern



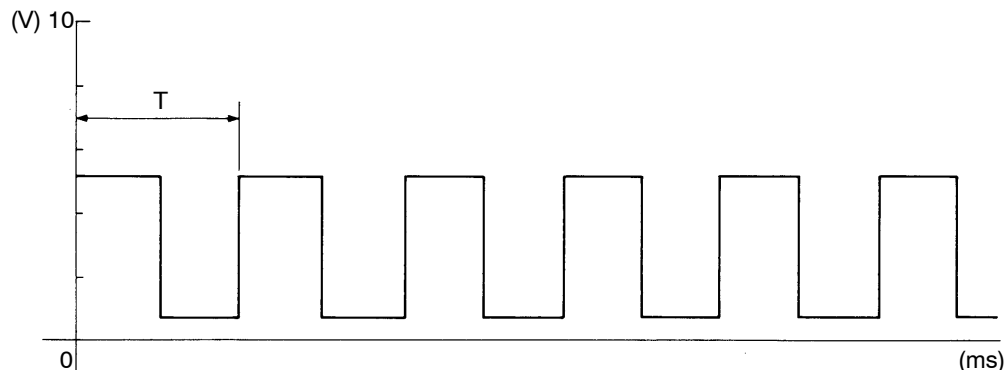
Observation conditions

Pickup changeover switch	1
AC-GND-DC	DC
TIME/DIV.	5 ms
VOLTS/DIV.	2 V
Others	–
Engine	Idling

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

Engine speed	2,000 r/min
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Standard wave pattern

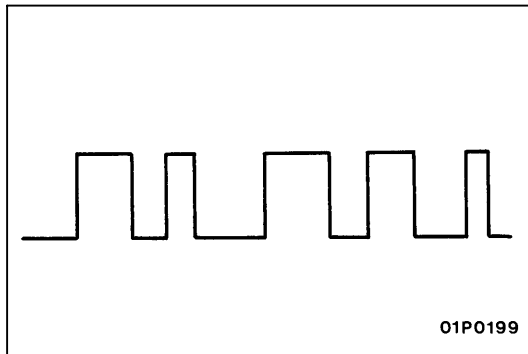


Explanation of Wave Pattern

- The air flow sensor transmits a pulse signal to the engine-A/T-ECU in proportion to the air intake amount. The output signal frequency can be calculated by the following formula by measuring the pulse signal frequency “T” (second).
Frequency (Hz) = 1/T (second)

Wave Pattern Observation Points

- The interval “T” should be shortened and its frequency should increase as the engine speed increases.



Examples of Abnormal Wave Patterns

- Example 1

Wave pattern characteristics

Wave pattern is displayed although the engine is not started.

Cause of problem

Sensor interface malfunction

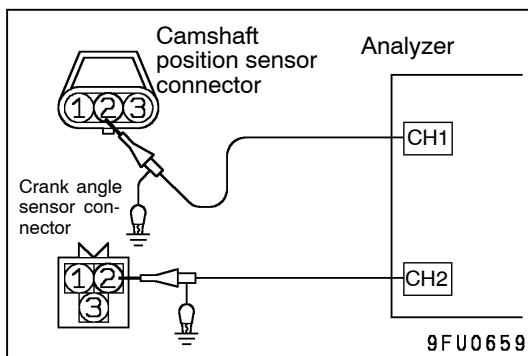
- Example 2

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.

Cause of problem

Damaged rectifier or vortex generation column



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

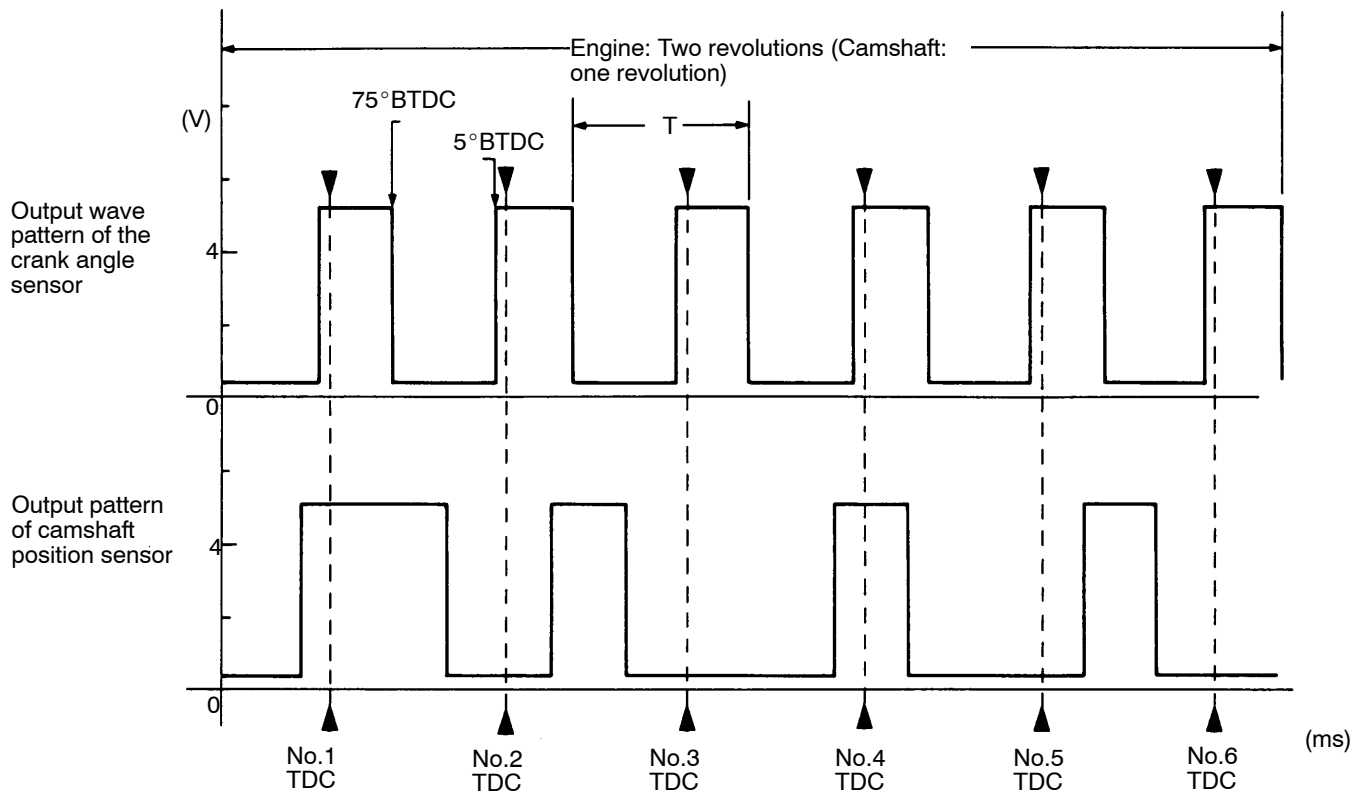
1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
3. Connect the respective pickups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

NOTE

If measuring at the engine-A/T-ECU connector, connect the respective pickups to terminal 56 (camshaft position sensor) and terminal 45 (crank angle sensor).

Standard wave pattern**Observation conditions**

	Camshaft position sensor and crank angle sensor
Pickup changeover switch	×1
AC-GND-DC	DC
TIME/DIV.	10 ms
VOLTS/DIV.	2 V
Others	–
Engine	Idling

Standard wave pattern

7FU0887

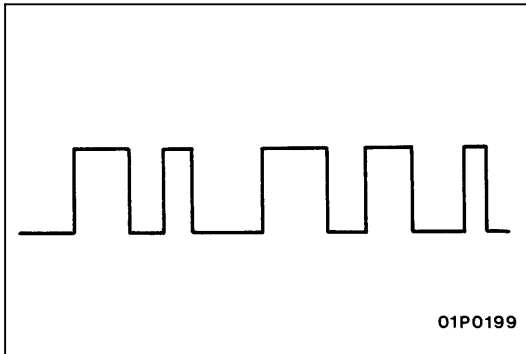
Explanation of Wave Pattern

- The cam position sensor detects the TDC of each cylinder. Identifying each cylinder is possible by observing this signal and other control signals at the same time.
- Crank angle sensor detects the crank angle of each cylinder. Six crank angle sensor high signals per two engine revolutions are output at intervals. Therefore, the engine speed can be calculated by measuring the cycle T (second) as shown below.

$$\text{Engine speed } 2/6T \text{ (second)} \times 60 = 30/T \text{ (second)}$$

Wave Pattern Observation Points

- The interval "T" should be shortened as the engine speed increases.



Examples of Abnormal Wave Patterns

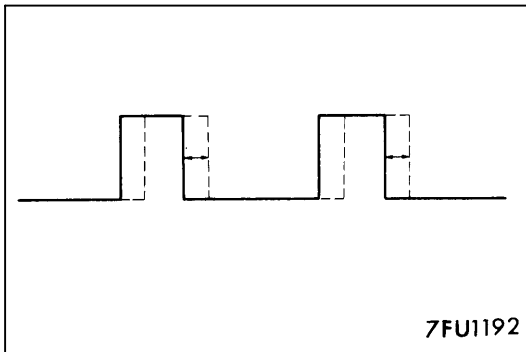
• Example 1

Wave pattern characteristics

Wave pattern is displayed although the engine is not started.

Cause of problem

Sensor interface malfunction



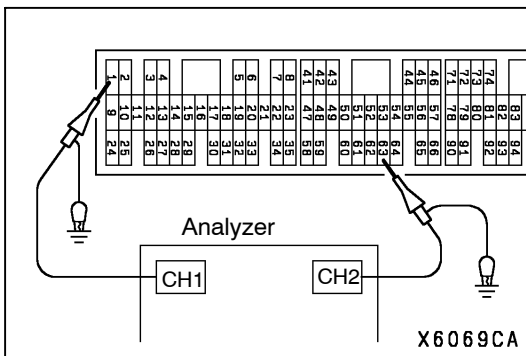
• Example 2

Wave pattern characteristics

The wave pattern fluctuates back and forth.

Cause of problem

Loose timing belt
Defective sensor disc



Injector and its open circuit check signal

Measurement Method

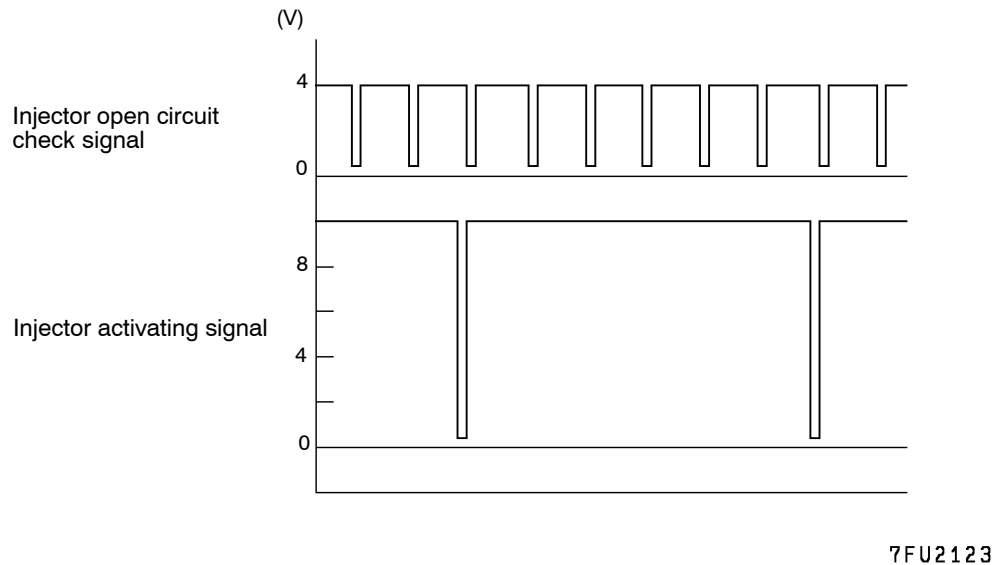
1. Connect the respective pickups to the engine-A/T-ECU connector terminal 1 (No.1injector) and terminal 63 (injector open circuit check signal).
2. After checking terminal 1, then check terminal 9 (No.2 injector), terminal 24 (No.3 injector), terminal 2 (No.4 injector), terminal 10 (No.5 injector) and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

Standard wave pattern

Observation conditions

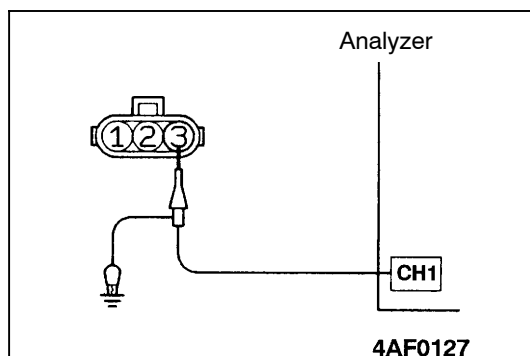
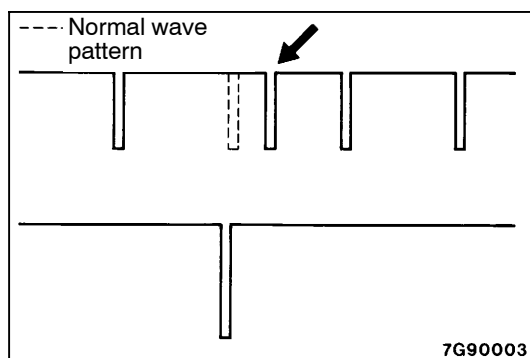
	Injector and its open circuit check signal
Pickup changeover switch	× 1
AC-GND-DC	DC
TIME/DIV.	25 ms
VOLTS/DIV.	2 V
Others	–
Engine	Idling

Standard wave pattern



Explanation of Wave Pattern

- Only high signals (approximately 9 V) are displayed when the injector is not running, but low signals (approximately 0 V) are displayed when signals are detected from the engine-A/T-ECU.
 - Injector open circuit detection signals are output corresponding to the changes from low to high signals in the injector.
- Since injector open circuit detection signals are output whenever each injector is in operation, 6 pulses of injector open circuit signal is output for one pulse of one injector signal from one cylinder.



Wave Pattern Observation Points

- Ensure that the injector running time matches the time displayed on MUT-II.
- Ensure that the injector signal drastically increases but returns to normal quickly when the rapid racing is conducted.
- Ensure that the injector open circuit detection signal synchronizes with the rise of each injector signal.

IGNITION COIL (POWER TRANSISTOR CONTROL SIGNAL)

Measurement Method

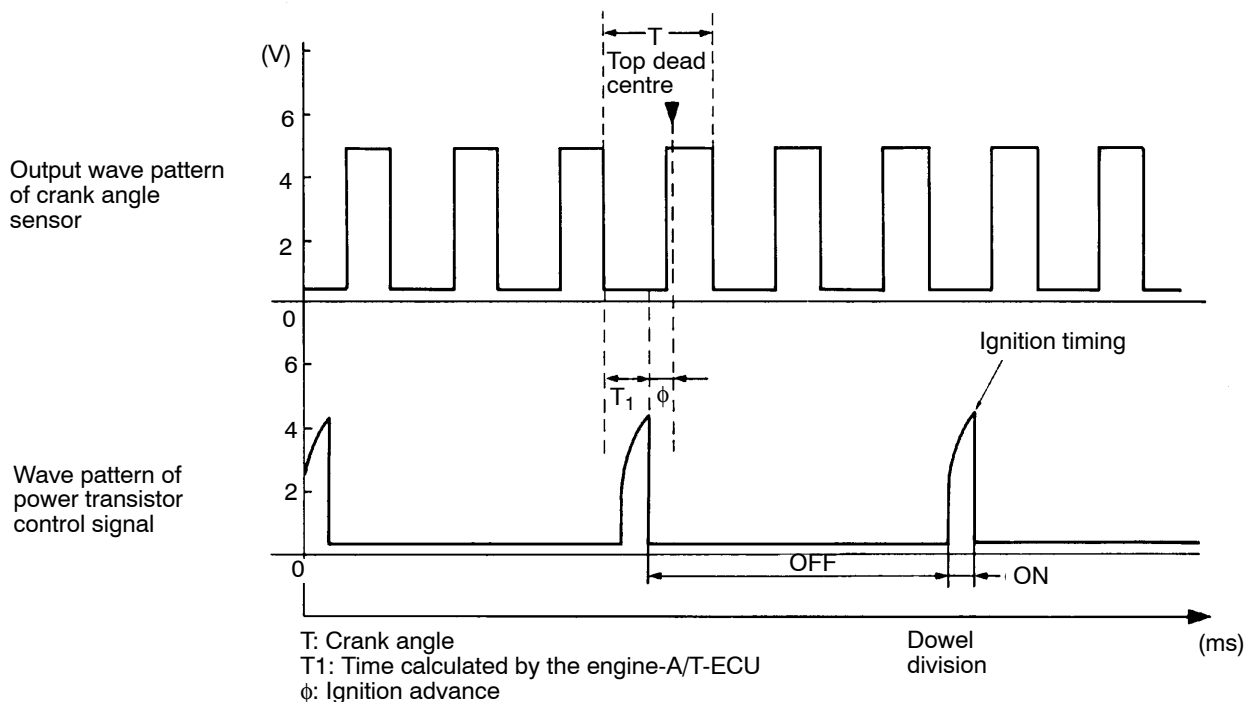
1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to ignition coil connector terminal 3.
3. Measure along with the crank angle sensor output signals at the same time to check the advanced angle status in the ignition.

NOTE

If measuring at the engine-A/T-ECU connector, connect the respective pickups to terminal 11 (No.1 ignition coil), terminal 31 (No.2 ignition coil), terminal 13 (No.3 ignition coil), terminal 30 (No.4 ignition coil), terminal 12 (No.5 ignition coil) and terminal 32 (No.6 ignition coil).

Standard wave pattern**Observation conditions**

	Power transistor control signal and crank angle sensor
Pickup changeover switch	× 1
AC-GND-DC	DC
VOLTS/DIV.	2 V
TIME/DIV.	10 ms
Others	–
Engine speed	Approx. 1200 r/min

Standard wave pattern

7FU0896

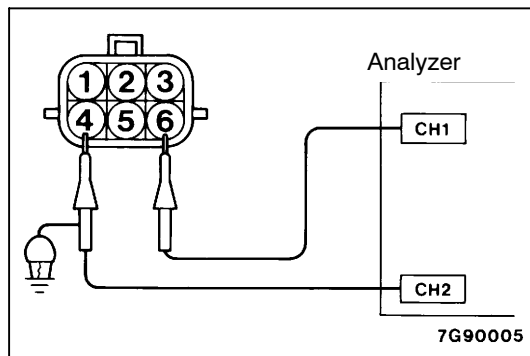
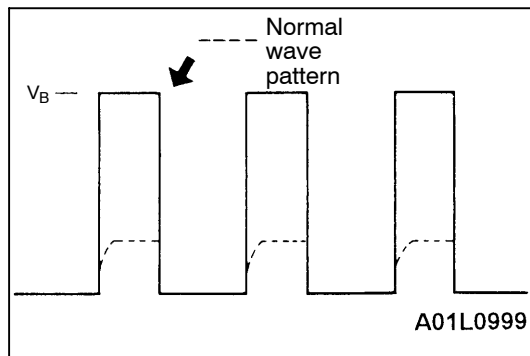
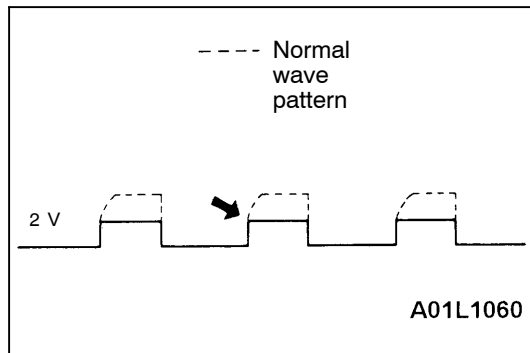
Explanation of Wave Pattern

- As the engine speed increases, the angle advances as illustrated above.
Ignition advanced angle value $\theta = 75^\circ - T_1/T \times 120^\circ$
- When the power transistor is ON:
The power transistor is ON and the ignition primary circuit is energized (Dowel division.) The energized time is controlled to keep the primary current constant (approximately 6A) during the firing sequence by making it longer when the battery voltage is low and making it shorter when the battery voltage is high. (The waveform of this part moves upward.)
- When the power transistor is OFF:
The power transistor is OFF and no signal to drive the power transistor is received from the engine-A/T-ECU.

Wave Pattern Observation Points

- Point: Wave pattern rise conditions and the peak voltage (Refer to the examples of abnormal wave pattern 1 and 2.)

Wave pattern rise conditions and the peak voltage	Probable cause
The wave moves upward from the vicinity of approximately 2 V to approximately 4.5 V.	Normal
It is a square wave of approximately 2 V.	Open-circuit in the ignition primary circuit
It is a square wave of power voltage.	Defective power transistor



Examples of Abnormal Wave Patterns

- Example 1

Wave pattern characteristics

No upward movement in the rise part is shown, and the voltage remains low at approximately 2 V.

Cause of problem

Open circuit in the primary ignition circuit

- Example 2

Wave pattern characteristics

When the power transistor is ON, power voltage is applied. (Square wave of power voltage)

Cause of problem

Defective power transistor

EGR VALVE (STEPPER MOTOR)

Measurement method

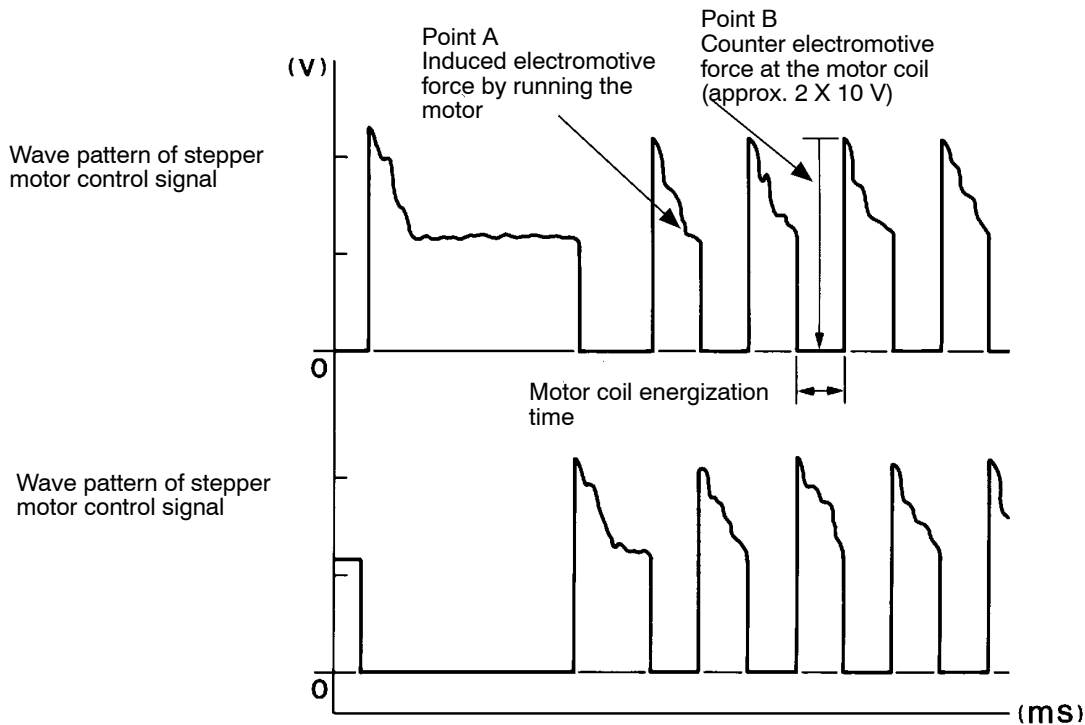
1. Disconnect the EGR valve connector, and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the probe of each channel of the oscilloscope to either combination of terminal No.1 and No.3 or terminal No.4 and No.6 of EGR valve connector.

NOTE

When measured at engine-A/T-ECU connector, connect the probe of each channel of oscilloscope to either combination of terminal No.51 and No.60 or terminal No.13 and No.62.

Standard wave pattern**Observation conditions**

Pickup changeover switch	×10
AC-GND-DC	DC
VOLTS/DIV.	1 V
TIME/DIV.	25 ms
Others	–
Engine speed	Racing

Standard wave pattern

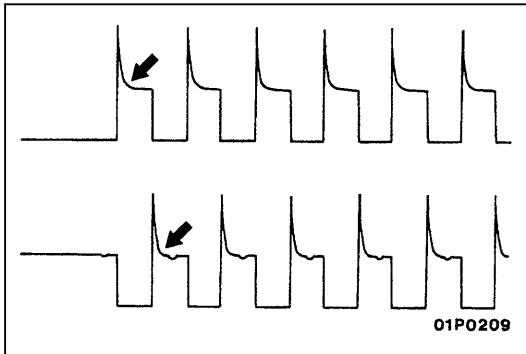
7G90012

Explanation of Wave Pattern

- A wave is displayed momentarily when racing.
- When the signal from the engine-A/T-ECU is cut, counter electromotive force at the motor coil causes the peak voltage. Moreover, a wave pattern is distorted when induced electromotive force is generated by running the motor.

Wave Pattern Observation Points

- Observe that the standard wave pattern is displayed when the stepper motor is in operation.



Examples of Abnormal Wave Patterns

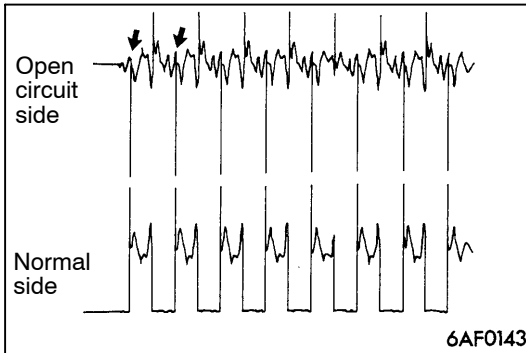
- Example 1

Wave pattern characteristics

1. Induced electromotive force by running the motor is not generated or very small.
2. Counter electromotive force at the motor coil is not generated or very small.

Cause of problem

1. Malfunction of motor (The motor does not run)
2. Short in coil



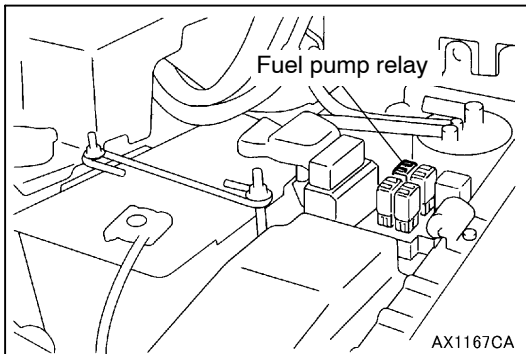
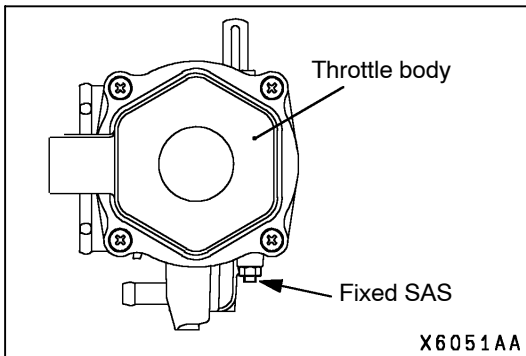
- Example 2

Wave pattern characteristics

The motor coil is not energized (the voltage does not decrease to 0 V) or the wave pattern of induced electromotive force is slightly different from the standard wave pattern.

Cause of problem

Open circuit in the line between the stepper motor and engine-A/T-ECU



ON-VEHICLE SERVICE

Caution

1. The fixed SAS is correctly adjusted at the factory and should not be moved.
2. If the fixed SAS should happen to have been moved, the fully closed position of the throttle valve may be out of adjustment. In this case, the ECU may not be able to learn the fully closed or open position of the throttle valve.

FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE FUEL PRESSURE)

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

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

Caution

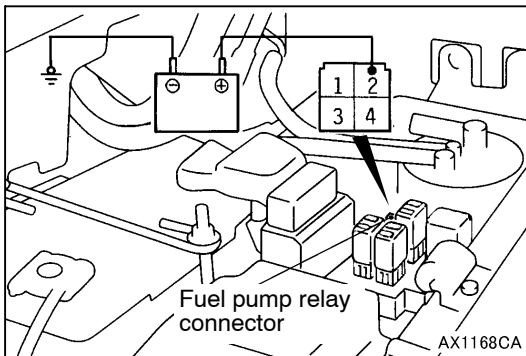
Turn off the ignition switch before disconnecting or connecting the MUT-II.

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

Caution

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

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



FUEL PUMP OPERATION (LOW PRESSURE) CHECK

1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.

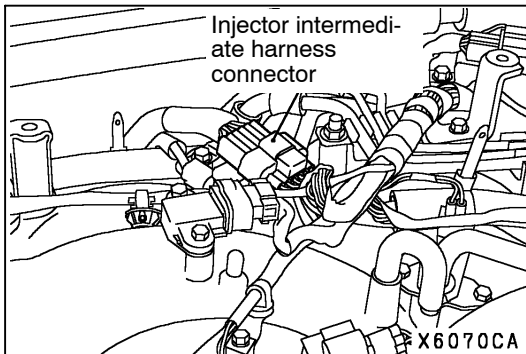
(1) Turn off the ignition switch.

(2) Remove the fuel pump relay. Connect the terminal No.2 of the harness-side connector to the battery. Check if the fuel pump operation sound can be heard at this time.

NOTE

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

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



FUEL LEAK TEST

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition key to the ON position.
4. Select item No. 74 on the MUT-II Data list.
5. Crank the engine for at least two seconds, and check for fuel leak while the fuel is pressurized.

Caution

If fuel leaks, stop the cranking immediately, and correct.

6. Wait for just 20 seconds after the engine cranking, and measure the fuel pressure.

Limit: min.1 MPa

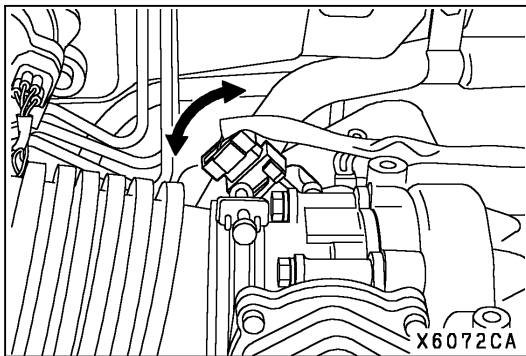
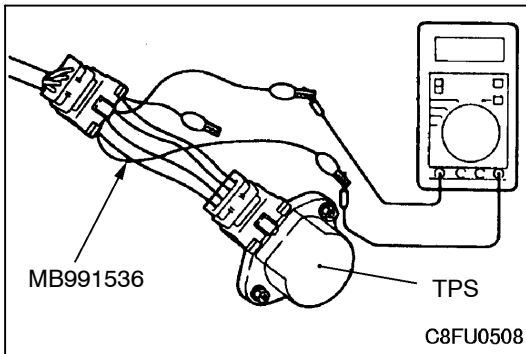
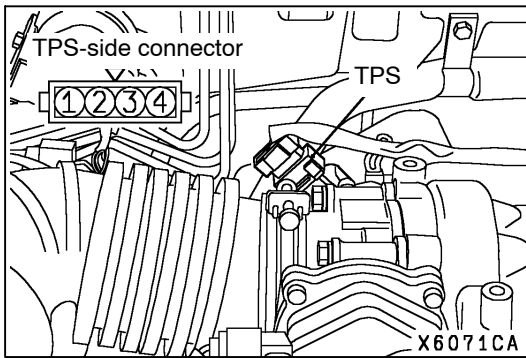
Caution

If less than 1 MPa, leaks may be present around the high-pressure fuel system. Check the system for fuel leaks.

7. Turn the ignition switch to the LOCK (OFF) position.
8. Connect the injector intermediate harness connector.
9. Remove the MUT-II.

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Start the engine and warm it up until the coolant is heated to 80°C or higher and then stop the engine.
2. Remove the air intake hose from the throttle body.
3. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.
4. Start the engine, race it several times and idle it for about 1 minute.
5. If the throttle valve deposits are not removed, repeat steps 3 and 4.
6. Attach the air intake hose.
7. Erase the self-diagnosis code by using the MUT-II or by disconnecting the negative battery cable for ten seconds or more, reconnecting it and then letting the engine run at idle for ten minutes.



THROTTLE POSITION SENSOR (TPS) ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector.
If the MUT-II is not used, carry out the following steps.

- (1) Disconnect the TPS connector, and connect the special tool (test harness: MB991536) to that connector.
(Be careful to not confuse the terminal numbers.)
- (2) Connect a digital voltmeter between TPS connector terminal 2 (sensor output: blue clip of the special tool) and terminal 3 (sensor earth: white clip of the special tool).

2. Disconnect the throttle control servo connector.
3. Turn the ignition switch to the ON position. (but do not start the engine)

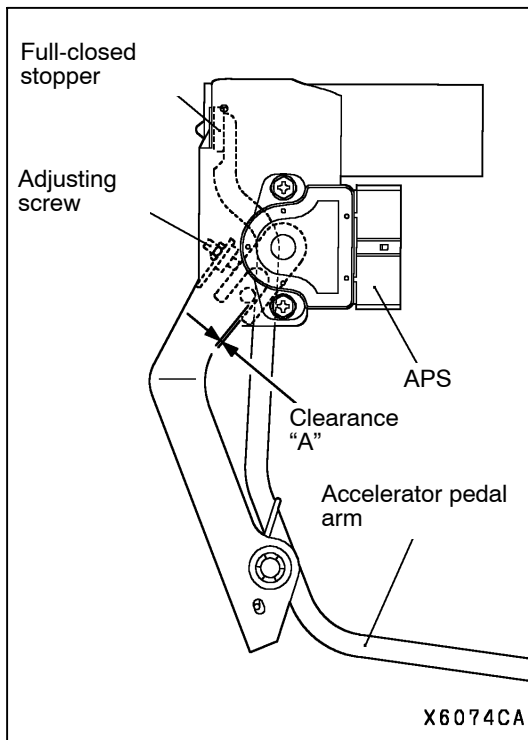
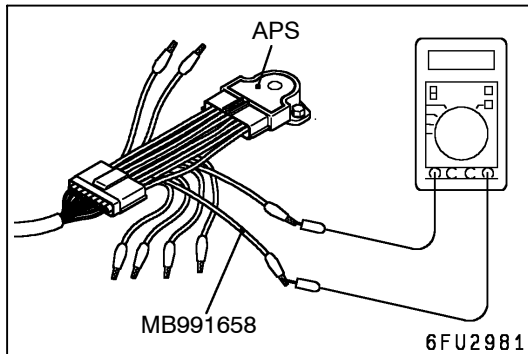
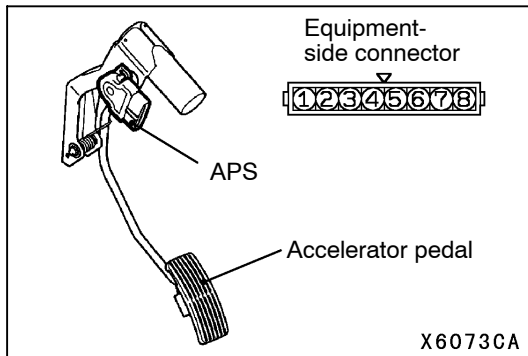
4. Check the output voltage of TPS1 while closing the throttle valve fully with your finger.

Standard value: 0.4 – 0.6 V

5. If outside the standard value, loosen the TPS mounting bolts, and adjust the TPS by rotating it.
6. Check the output voltage of TPS2 while closing the throttle valve fully with your finger. If the MUT-II is not used, connect a digital voltmeter between TPS connector terminal 4 (sensor output: black clip of the special tool) and terminal 3 (sensor earth: white clip of the special tool).

Standard value: 4.2 – 4.8 V

7. If outside the standard value, replace the TPS.
8. Turn the ignition switch to the LOCK (OFF) position.
9. Connect the throttle control servo connector.
10. Remove the MUT-II. If the MUT-II is not used, remove the special tool, and then reconnect the TPS connector.
11. If a diagnosis code is set, erase it by using the MUT-II or by disconnecting the negative battery cable for ten seconds or more, reconnecting it.
12. Turn the ignition switch to the ON position, and then return it to the LOCK (OFF) position. Then maintain that condition for ten seconds or more.)
If the negative battery cable is disconnected at step 11, let the engine run at idle for ten minutes.



ACCELERATOR PEDAL POSITION SENSOR (APS) ADJUSTMENT

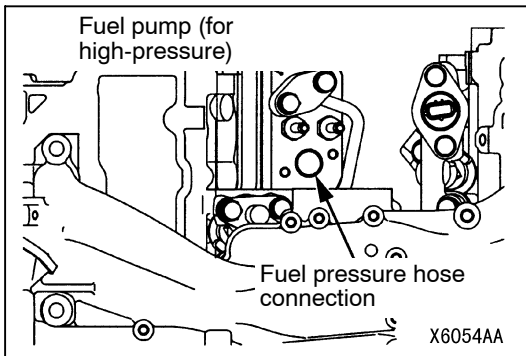
Caution

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

1. Remove the accelerator pedal complete.
2. Connect the MUT-II to the diagnosis connector. If the MUT-II is not used, carry out the following steps.
 - (1) Disconnect the APS connector, and connect the special tool (test harness: MB991658) to that connector.
(Be careful not to confuse the terminal numbers.)
 - (2) Connect a digital voltmeter between APS connector terminal 3 (output of APS1) and terminal 3 (earth of APS1).
3. Loosen the APS mounting bolts, and hold the APS temporarily.
4. Check that the accelerator pedal arm touches the full-closed stopper.
5. Adjust the pedal arm by the adjusting screw so that clearance "A" (see the illustration) is 0.5 – 0.93 mm.
6. Hold the adjusting screw with the lock nut.
7. Turn the ignition switch to the ON position. (but do not start the engine.)
8. Turn the APS until the output from APS1 satisfies the standard value.

Standard value: 0.985 – 1.085 V

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



FUEL PRESSURE MEASUREMENT

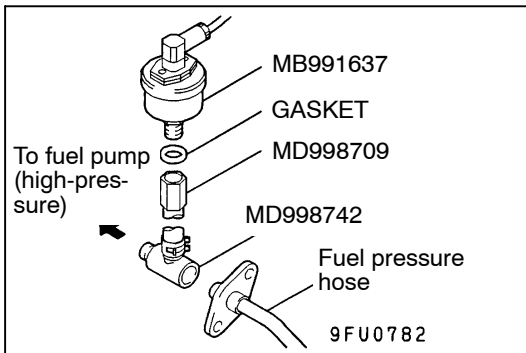
FUEL PRESSURE MEASUREMENT IN THE LINE BETWEEN ECLECTIC FUEL PUMP (LOW-PRESSURE) AND FUEL PUMP (HIGH-PRESSURE)

1. Release residual pressure from the fuel pipe line to prevent fuel from gushing out.(Refer to P.13A-116.)
2. Remove the fuel pressure hose from the fuel pump (high-pressure).

Caution

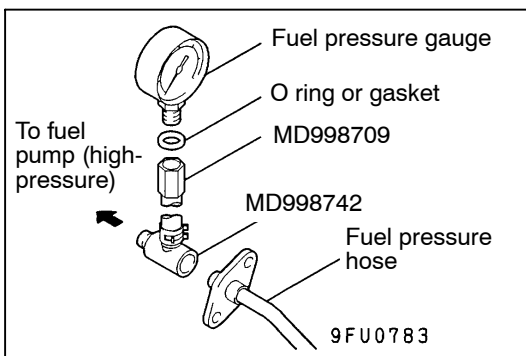
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

3. Change the fuel pressure measurement special tool adapter.
4. Attach the fuel pressure measurement special tool.



When the fuel pressure gauge set is used

- (1) Connect the fuel pressure measurement special tool between the fuel pressure hose and the fuel pump (high-pressure).
- (2) Use a gasket and connect the fuel pressure gauge set (special tool) to the fuel pressure measurement special tool.
- (3) Connect the lead wire of the fuel pressure gauge set to a power supply (cigarette lighter socket) and the MUT-II.



When a fuel pressure gauge is used

- (1) Use the O ring or gasket and connect a fuel pressure gauge to the fuel pressure measurement special tool.
- (2) Install the special tool (assembled at step 1) between the fuel pressure hose and the fuel pump (high-pressure).

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

Caution

Turn the ignition switch to the LOCK (OFF) position when connecting and disconnecting the MUT-II.

6. Turn the ignition switch to the ON position. (but do not start the engine)
7. Select item No.7 from the MUT-II Actuator test, and activate the fuel pump (low-pressure) at the fuel tank. Check that there are not fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to the LOCK (OFF) position.

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

Standard value: Approx. 329 kPa

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

State	Cause	Remedy
<ul style="list-style-type: none"> ● Fuel pressure too low ● Fuel pressure drops after racing 	Clogged fuel filter	FUEL FILTER REPLACEMENT
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator (low-pressure).
	Low fuel pump (low-pressure) delivery pressure	Replace the fuel pump (low-pressure) (Refer to GROUP 13E.)
Fuel pressure too high	Binding valve in fuel pressure regulator (low-pressure)	Replace fuel pressure regulator (low-pressure). (Refer to GROUP 13E.)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe.

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

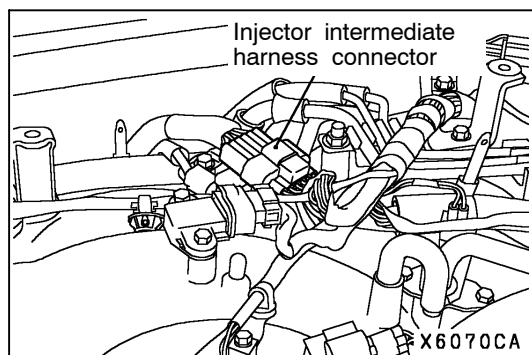
State	Cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky fuel regulator (low-pressure) valve seat	Replace fuel pressure regulator (low-pressure).
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump (low-pressure) is held open	Replace the fuel pump (low-pressure).

14. Release residual pressure from the fuel pipe line to prevent fuel from gushing out.(Refer to P.13A-116.)
15. Remove the fuel pressure gauge and special tool.

Caution

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

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



MEASUREMENT OF HIGH FUEL PRESSURE BETWEEN FUEL PUMP (HIGH-PRESSURE) AND INJECTOR

NOTE

This measurement assumes that the fuel pressure between the fuel pumps (low-pressure and high-pressure) is normal.

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

Caution

Turn the ignition switch to the LOCK (OFF) position before connecting or disconnecting the MUT-II.

2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to the ON position.
4. Select item No. 74 on the MUT-II Data list.
5. Crank the engine for about two seconds (but do not start the engine), and then check any fuel leaks visually.

Caution

If any fuel leak is found, stop the engine cranking, and repair.

6. Wait for just 20 seconds after the engine cranking, and then confirm that the fuel pressure is 1 MPa or more.
7. If less than 1 MPa, leaks may be present around the high-pressure fuel system. Check the fuel system for leaks.
8. Turn the ignition switch to the LOCK (OFF) position.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.
11. Measure fuel pressure while the engine is running at idle.

Standard value: 4 – 6.9 MPa

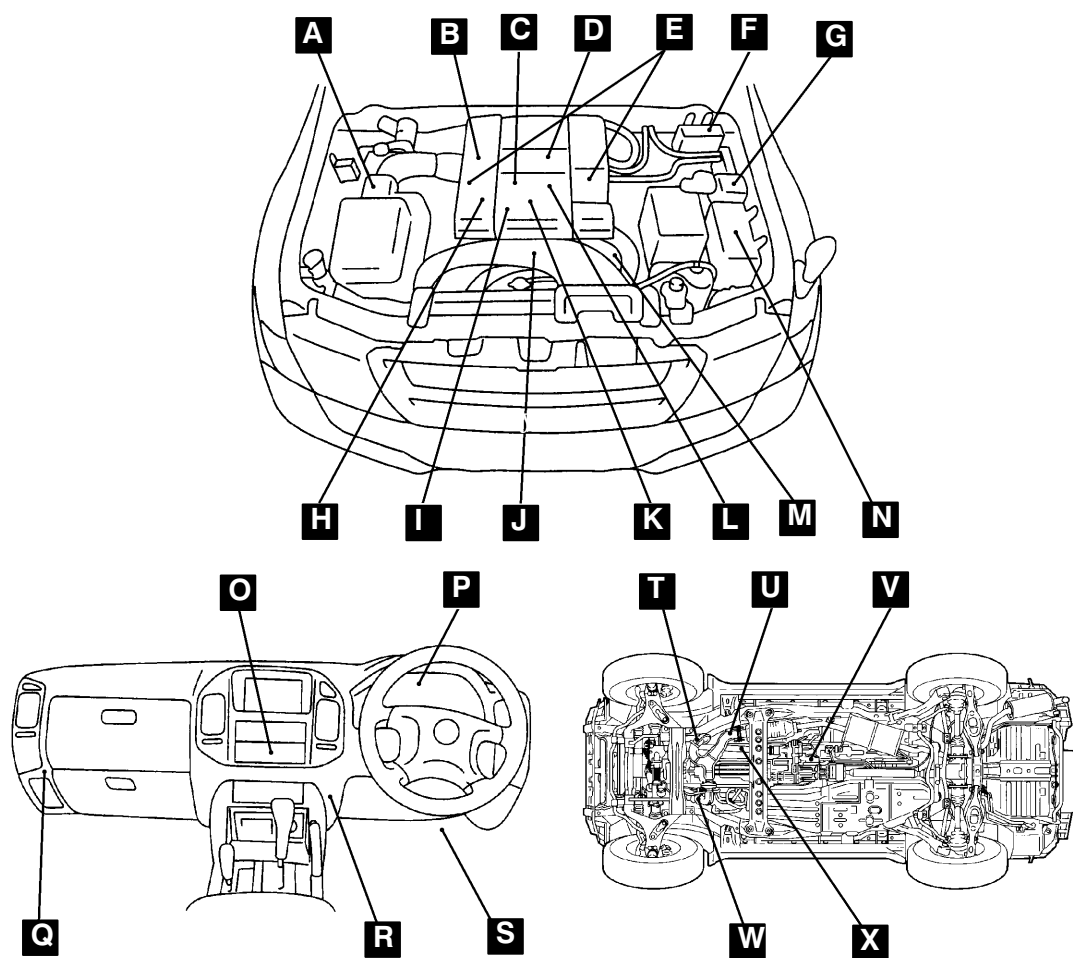
12. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
13. If the fuel pressure is out of specification, troubleshoot and repair according to the table.

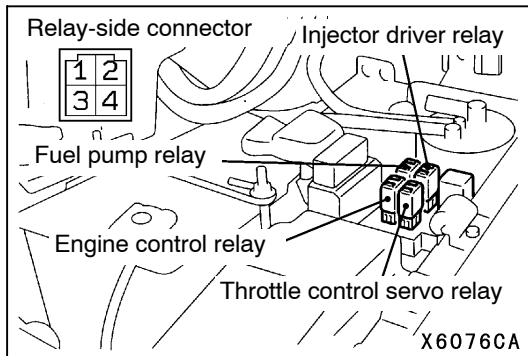
State	Cause	Remedy
<ul style="list-style-type: none"> Fuel pressure too low Fuel pressure drops after racing 	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace the fuel pump (for high-pressure).
	Low fuel pump (high-pressure) delivery pressure	Replace the fuel pump (for high-pressure).
Fuel pressure too high	Binding valve in fuel pressure regulator (high-pressure)	Replace the fuel pump (for high-pressure).
	Clogged fuel return hose or pipe	Clean or replace hose or pipe.

14. Stop the engine, and turn the ignition switch to the LOCK (OFF) position.
15. Remove the MUT-II.

COMPONENT LOCATION

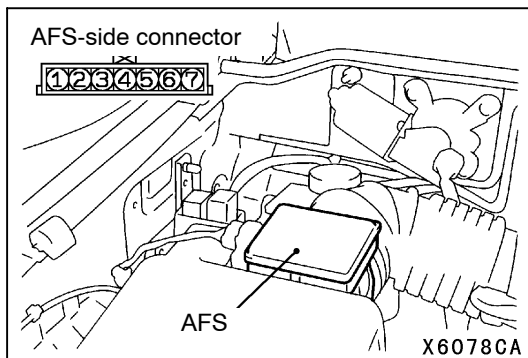
Name	Symbol	Name	Symbol
Accelerator pedal position sensor	S	Fuel pump relay	G
A/C relay	N	Ignition coil and power transistor unit	E
A/C switch	O	Injector	E
Air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor)	A	Injector driver	F
Camshaft position sensor	D	Injector driver relay	G
Catalyst temperature sensor	U	Inhibitor switch	X
Crank angle sensor	J	Oxygen sensor (left)	T
Detonation sensor	K	Oxygen sensor (right)	W
Diagnosis connector	R	Power steering fluid pressure switch	M
EGR valve	H	Purge control solenoid valve	L
Engine-AT-ECU	Q	Throttle control servo	B
Engine control relay	G	Throttle control servo relay	G
Engine coolant temperature sensor	I	Throttle position sensor	B
Engine warning lamp	P	Throttle valve controller	Q
Fuel pressure sensor	D	Vehicle speed sensor	V





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

System voltage	Terminal No.			
	1	2	3	4
When no current is supplied		○		○
When current is supplied	○	⊖	○	⊕



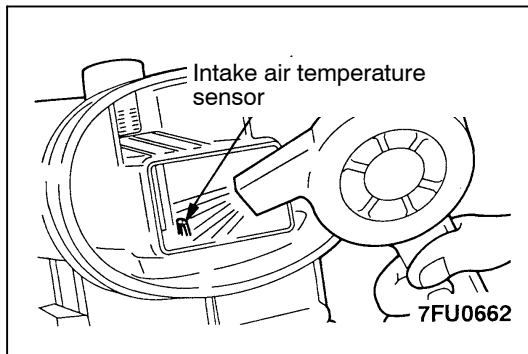
INTAKE AIR TEMPERATURE SENSOR CHECK

1. Disconnect the air flow sensor (AFS) connector.
2. Measure the resistance between AFS connector terminals No.5 and No.6.

Standard value:

2.3 – 3.0 kΩ (at 20°C)

0.30 – 0.42 kΩ (80°C)

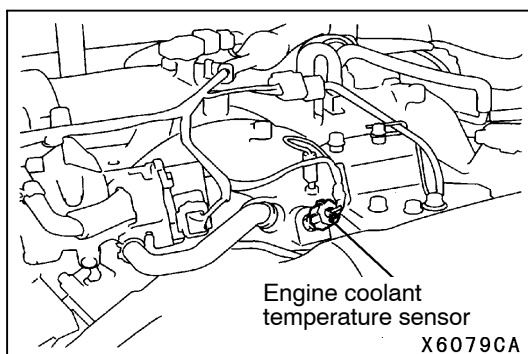


3. Measure the resistance while heating the sensor using a hair drier.

Normal condition:

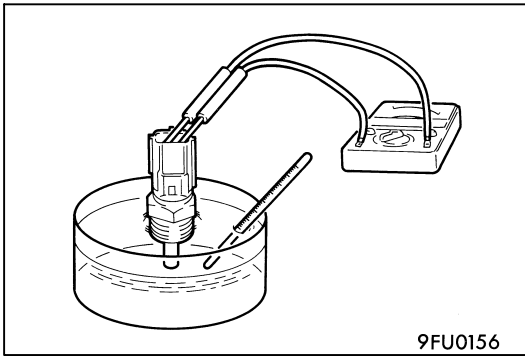
Temperature (°C)	Resistance (kΩ)
Higher	Smaller

4. If the value divides from the standard value or the resistance remains unchanged, replace the airflow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

1. Remove the engine coolant temperature sensor.



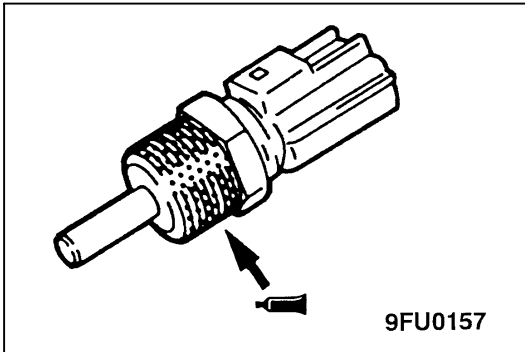
2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:

2.1 – 2.7 k Ω (at 20°C)

0.26 – 0.36 k Ω (at 80°C)

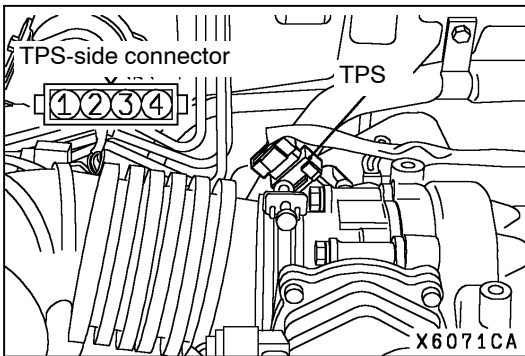
3. If outside the standard value, replace the engine coolant temperature sensor.



4. Apply the specified sealant to the sensor threaded portion, and tighten it to the specified torque.

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

Tightening torque: 30 \pm 9 N·m



THROTTLE POSITION SENSOR (TPS) CHECK

1. Disconnect the TPS connector.
2. Measure the resistance between TPS connector terminal No.1 (sensor power supply) and terminal No.3(sensor earth).

Standard value: 0.9 – 2.5 k Ω

3. Measure the resistances between TPS connector terminal No.1 (sensor power supply) and terminal No.2(output of TPS1) and between terminal No.1 (sensor power supply) and terminal No. 4 (output of TPS2).

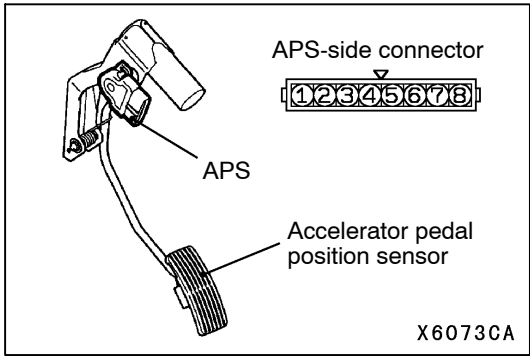
Normal condition

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

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

NOTE

For the throttle position sensor adjustment procedure, refer to P.13A-117.



ACCELERATOR PEDAL POSITION SENSOR (APS) CHECK

1. Disconnect the APS connector.
2. Measure the resistances between APS connector terminal 2 (power supply of APS1) and terminal 1 (earth of APS1) and between terminal 8 (power supply of APS2) and terminal 7 (earth of APS2).

Standard value: 3.5 – 6.5 kΩ

3. Measure the resistances between APS connector terminal 2 (power supply of APS1) and terminal 3 (output of APS1) and between terminal 8 (power supply of APS2) and terminal 6 (output of APS2).

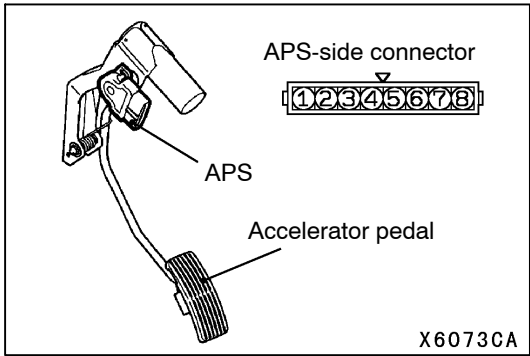
Normal condition:

Depress the accelerator pedal slowly.	Changes smoothly in proportion to the pedal stroke.
---------------------------------------	---

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

NOTE

For the accelerator pedal position sensor adjustment procedure, refer to P.13A-118.



ACCELERATOR PEDAL POSITION SWITCH CHECK

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

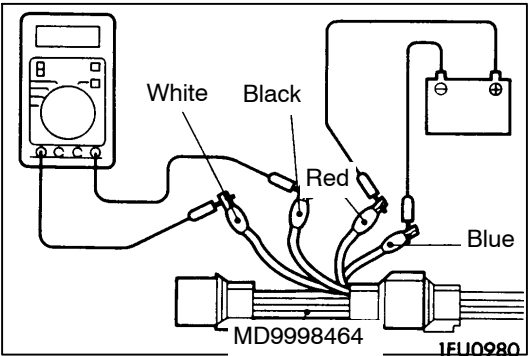
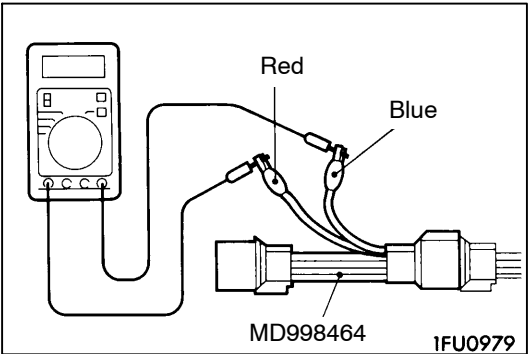
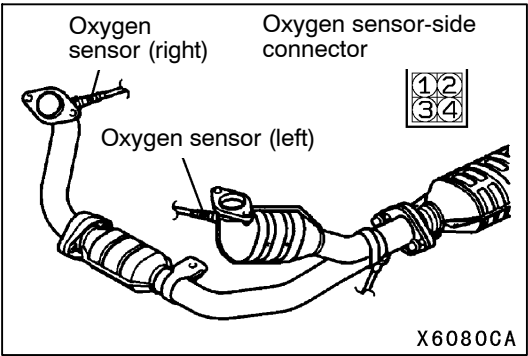
Normal condition:

Accelerator pedal	Continuity
Depress	No continuity
Release	Continuity

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

NOTE

For the accelerator pedal position sensor adjustment procedure, refer to P.13A-118.



OXYGEN SENSOR CHECK

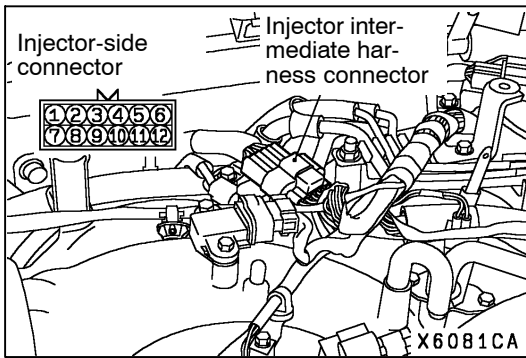
1. Disconnect the oxygen sensor connector, and connect the special tool (test harness) to that connector.
 2. Check that the continuity ($4.5 - 8.0 \Omega$ at 20°C) exists between the oxygen sensor connector terminal 1 (red clip of the special tool) and terminal 3 (blue clip of the special tool).
 3. 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.



INJECTOR CHECK

Measurement of Resistance between Terminals

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

Standard value: 0.9 – 1.1 Ω (at 20°C)

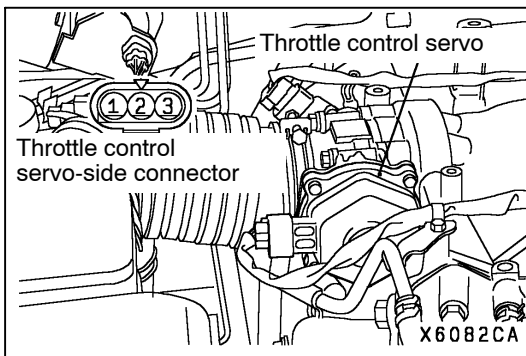
Injector	Terminal to be measured
No.1 cylinder	11–12
No.2 cylinder	5–6
No.3 cylinder	9–10
No.4 cylinder	3–4
No.5 cylinder	7–8
No.6 cylinder	1–2

3. Connect the injector intermediate harness connector.

THROTTLE CONTROL SERVO CHECK

Operation check

1. Remove the air intake hose from the throttle body.
2. Turn the ignition switch to the ON position.
3. The throttle valve should open or close in proportion to the accelerator pedal stroke.



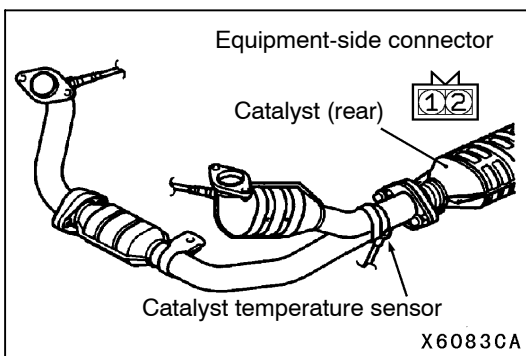
COIL RESISTANCE CHECK

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

Standard value:

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

3. Check that no continuity exists between each terminal and the vehicle body.



CATALYST TEMPERATURE SENSOR CHECK

1. Disconnect the catalyst temperature sensor connector.
2. Measure the resistance between the catalyst temperature sensor connector terminals.

Standard value: 1M Ω (at 20°C)

NOTE

If the catalyst surface temperature is 400°C, the resistance will be approx. 77 k Ω .

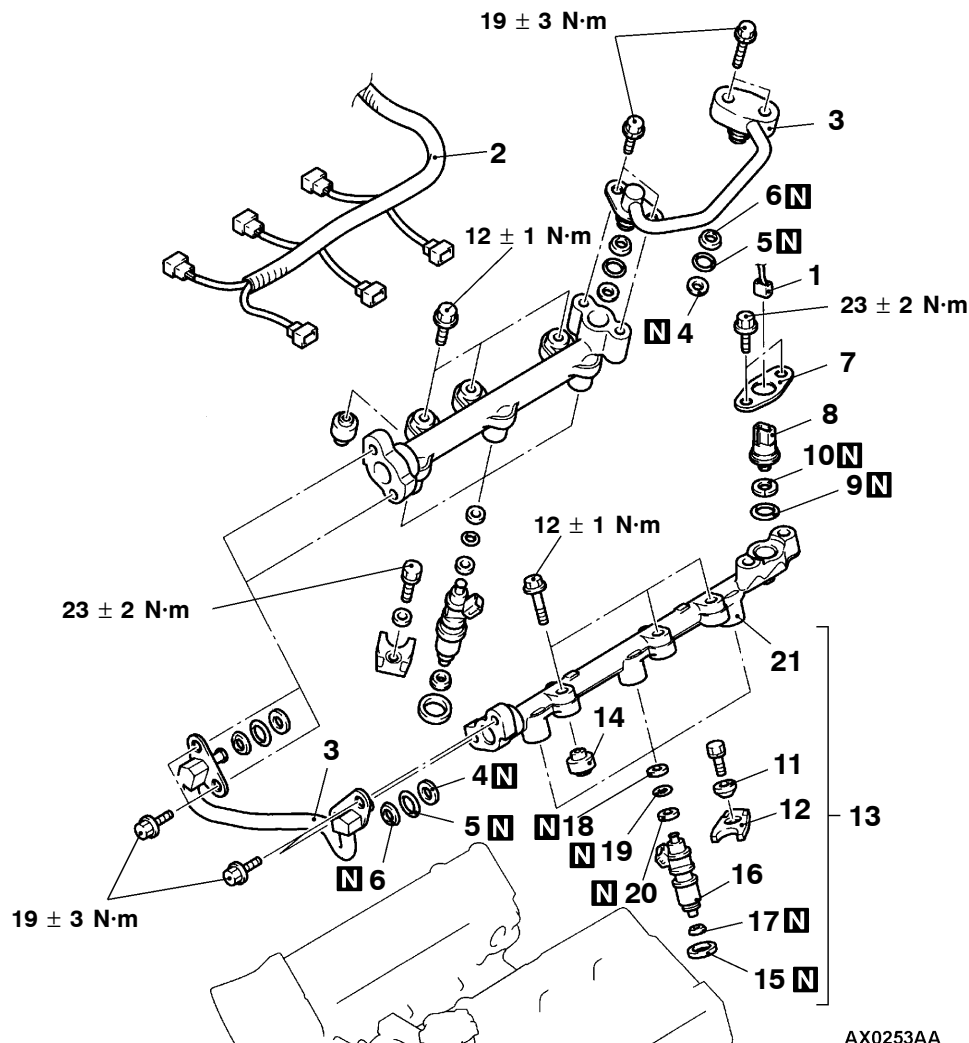
3. If out of specification, replace the catalyst temperature sensor.

INJECTOR

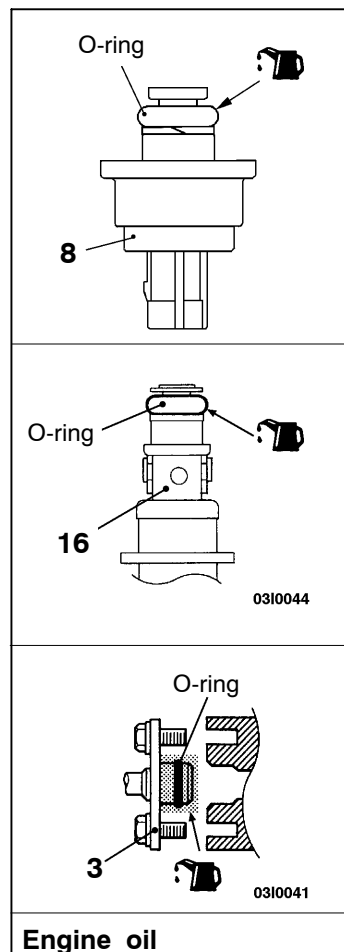
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Fuel Line Pressure Reduction <before removal only> (Refer to P.13A-115.)
- Engine Cover Removal and Installation
- Air Intake Hose Removal and Installation (Refer to GROUP 15 – Air Cleaner.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 – Intake Manifold.)
- Fuel Leak Check <after installation only> (Refer to P.13A-116.)



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Removal steps

- F◀ • Air bleeding from high-pressure fuel line

◀A▶

1. Fuel pressure sensor connector
2. Injector harness
3. Fuel feed pipe
4. Back-up ring A
5. O-ring
6. Back-up ring B
7. Flange
8. Fuel pressure sensor
9. O-ring
10. Back-up ring

◀C▶

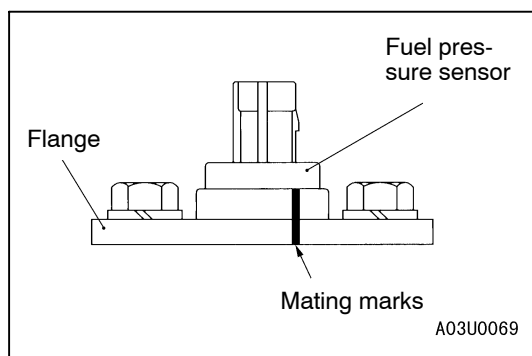
11. Injector washer
12. Injector holder
13. Delivery pipe assembly and Fuel injector assembly
14. Insulator
15. Injector gasket
16. Fuel injector assembly
17. Corrugated washer
18. Back-up ring A
19. O-ring
20. Back-up ring B
21. Delivery pipe

REMOVAL SERVICE POINTS

◀A▶ INJECTOR HARNESS DISCONNECTION

Caution

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



◀B▶ FLANGE REMOVAL

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

NOTE

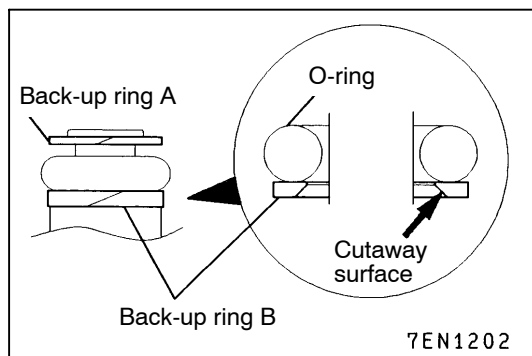
The flange secures sealing performance of fuel pressure sensor and installation rigidity by bending to deform the shape at installation. Therefore, make mating marks to install the flange with the right phase and side. In addition, if the fuel pressure sensor is replaced with a new one, replace it together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

◀C▶ DELIVERY PIPE ASSEMBLY/FUEL INJECTOR ASSEMBLY REMOVAL

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

Caution

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



INSTALLATION SERVICE POINTS

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

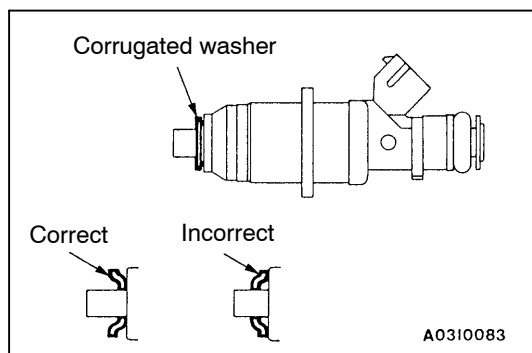
1. Install the back-up rings and the O-ring as shown in the illustration.

Caution

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

Caution

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



►B◄ INJECTOR GASKET/INSULATOR/DELIVERY PIPE ASSEMBLY AND FUEL INJECTOR ASSEMBLY/INJECTOR HOLDER//INJECTOR WASHER INSTALLATION

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

Caution

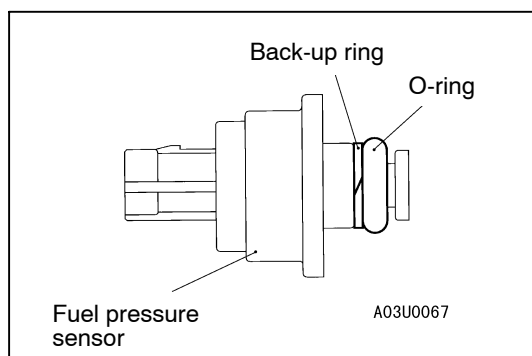
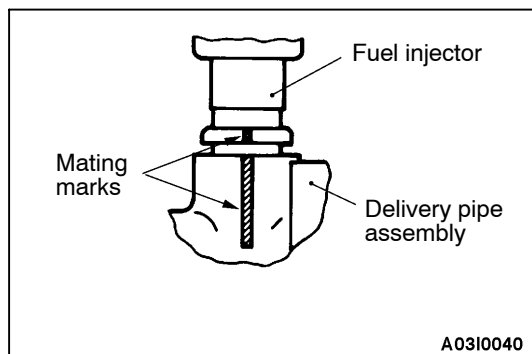
Take care not to let any of the engine oil get inside the delivery pipe assembly.

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

Caution

Observe the tightening torque.

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



►C◄ BACK-UP RING B/O-RING INSTALLATION

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

Caution

Be careful not to confuse this back-up ring with the back-up ring for the injector or back-up ring A for the fuel pipe.

(External diameter of the back-up ring: 15.1 mm)

►D◄ FUEL PRESSURE SENSOR/FLANGE INSTALLATION

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

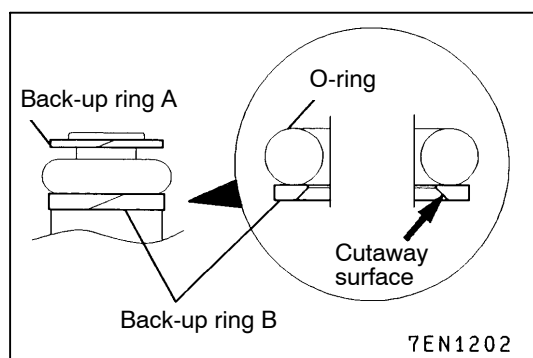
Caution

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

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

Caution

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



►E◄ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

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

Caution

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

(2) Do not confuse back-up ring A with that for the fuel pressure sensor. (External diameter of back-up ring A: 14.8 mm)

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

Caution

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

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

►F◄ AIR BLEEDING FROM THE HIGH-PRESSURE FUEL LINE

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

NOTE

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

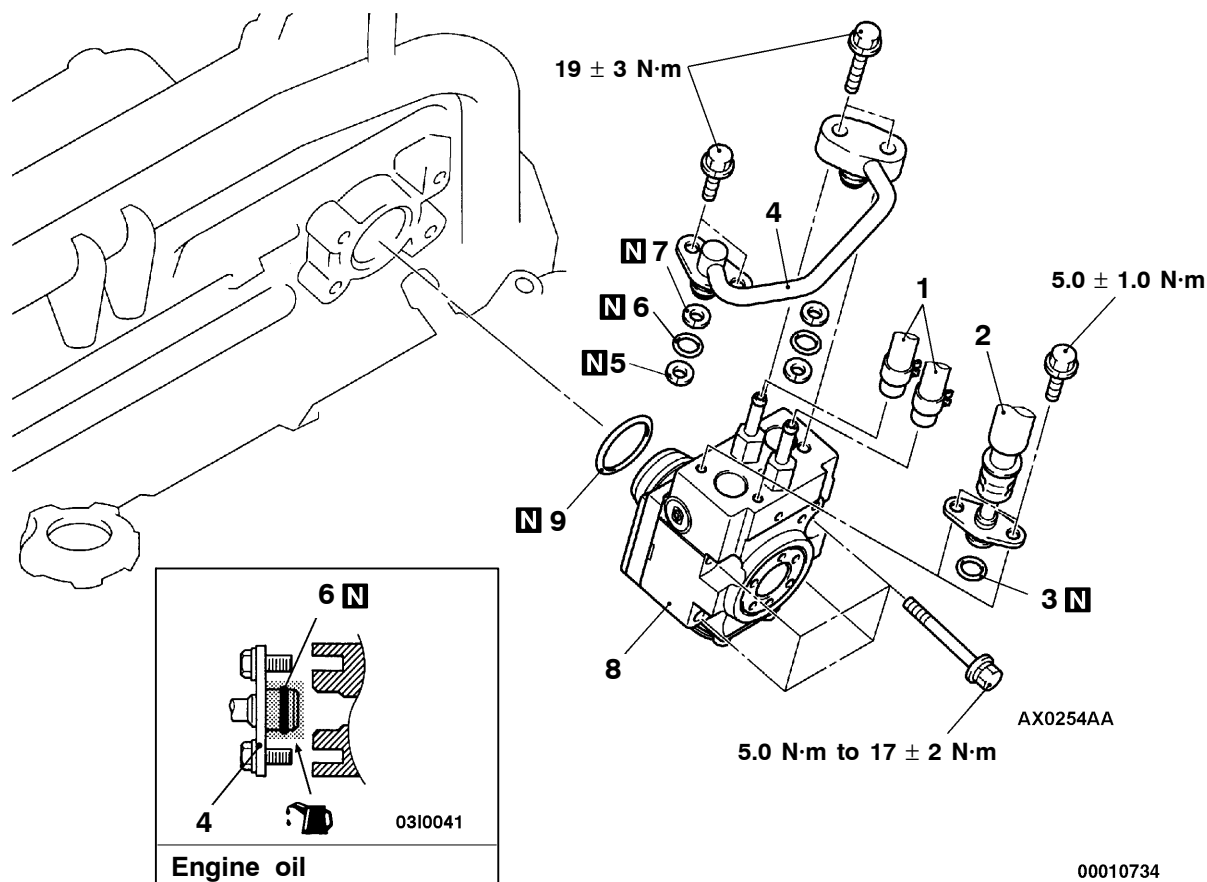
2. Use the MUT-II to check the diagnosis code. If the diagnosis code No.56 for fuel pressure sensor system defect is output, erase it.

FUEL PUMP (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Fuel Line Pressure Reduction <before removal only> (Refer to P.13A-115.)
- Engine Cover Removal and Installation
- Air Intake Hose Removal and Installation (Refer to GROUP 15 – Air Cleaner.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 – Intake Manifold.)
- Fuel Leak Check <after installation only> (Refer to P.13A-116.)
- Air Bleeding from High Pressure Fuel Line (Refer to P.13A-132.)



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Removal steps

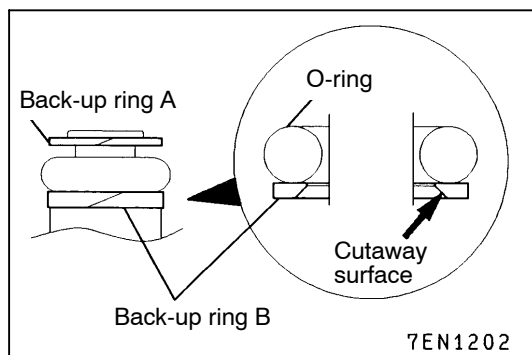
- D◄ 1. Fuel return hose connection
 ►C◄ 2. Fuel pressure hose connection
 ►C◄ 3. O-ring
 ►B◄ 4. Fuel feed pipe
 ►B◄ 5. Back-up ring A

- B◄ 6. O-ring
 ►B◄ 7. Back-up ring B
 ►A◄ 8. Fuel pump (high pressure)
 9. O-ring

INSTALLATION SERVICE POINTS

►A◄ FUEL PUMP (HIGH PRESSURE) INSTALLATION

1. Apply a small amount of fresh engine oil to the fuel pump (high pressure) roller and O-ring.
2. Install temporarily the fuel pump (high pressure) to the cylinder head.
3. Insert the fuel pump (high-pressure) to the cylinder head ports squarely, and then tighten the mounting bolts temporarily (a little more tightly than finger-tightening). Tightening them to the specified torque should be carried out in later step ►B◄.



►B◄ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL PIPE INSTALLATION

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

Caution

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

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

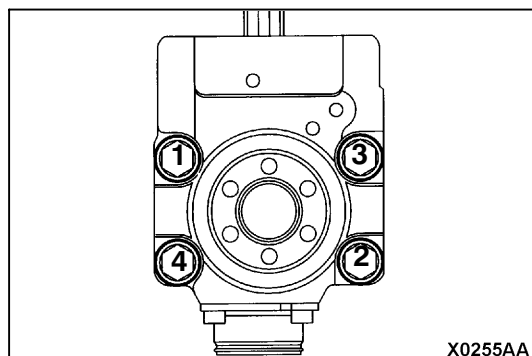
Caution

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

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

Tightening torque: 19 ± 3 N·m

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



►C◄ O-RING/FUEL PRESSURE HOSE INSTALLATION

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

Caution

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

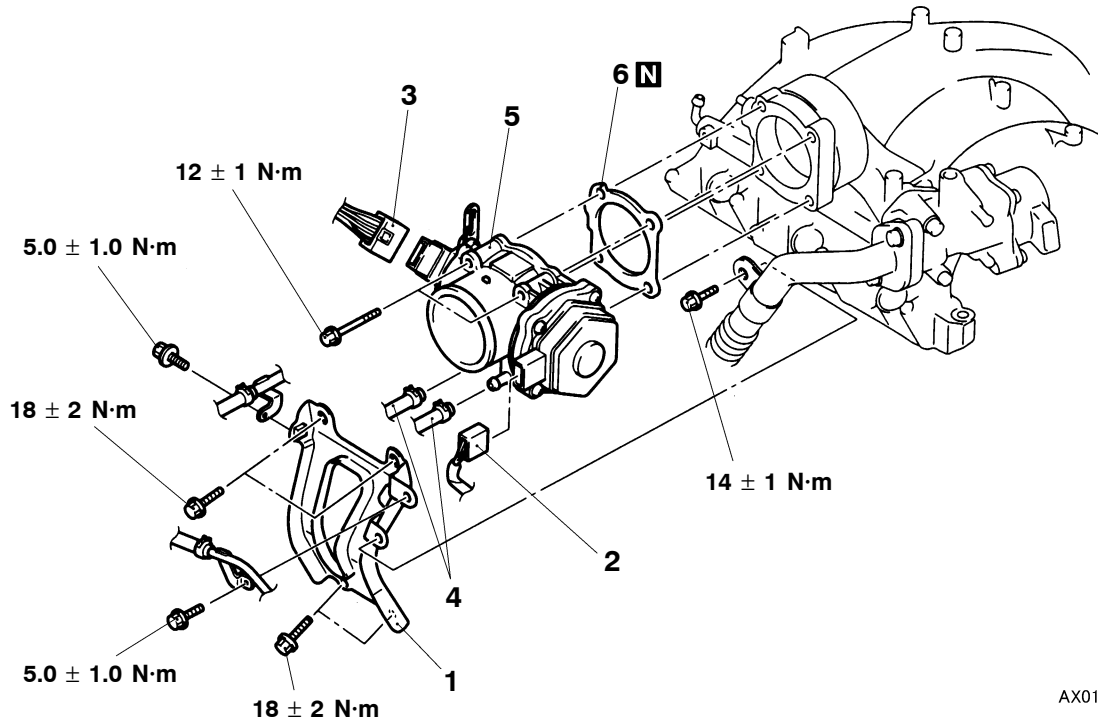
2. While being careful not to damage the O-ring, turn the fuel pressure hose to the left and right and connect it to the delivery pipe assembly. After connecting, check that the fuel injector turns smoothly.
3. If the fuel pressure hose does not turn smoothly, the cause may be that the O-ring is getting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

THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Cover Removal and Installation
- Air Cleaner Removal and Installation (Refer to GROUP 15.)



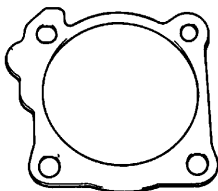
AX0165CA

Removal steps

1. Throttle body stay
2. Throttle control servo connector connection
3. Throttle position sensor connector connection

- ▶B◀ 4. Water hose connection
 ▶A◀ 5. Throttle body assembly
 ▶A◀ 6. Throttle body gasket

Upward
↑



03E0217

INSTALLATION SERVICE POINTS

▶A◀ THROTTLE BODY GASKET INSTALLATION

The projection on the gasket should face upward.

▶B◀ THROTTLE BODY INSTALLATION

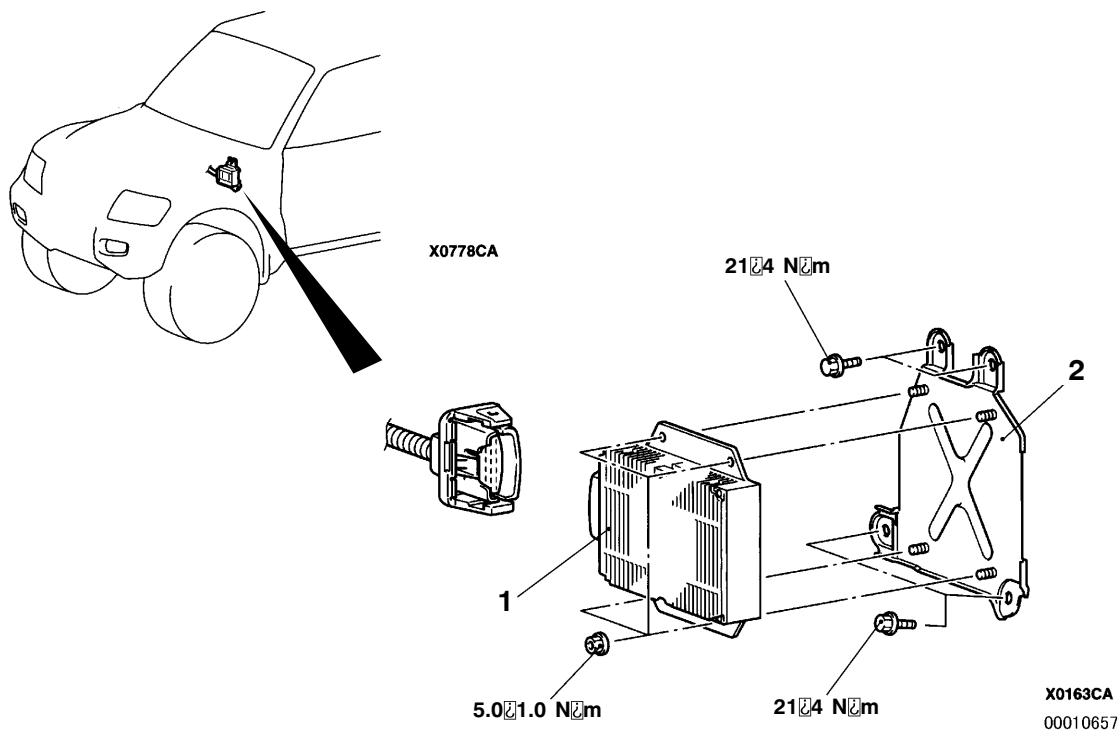
If the throttle body is replaced, initialize the electronic-controlled throttle valve system.

Initialization

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

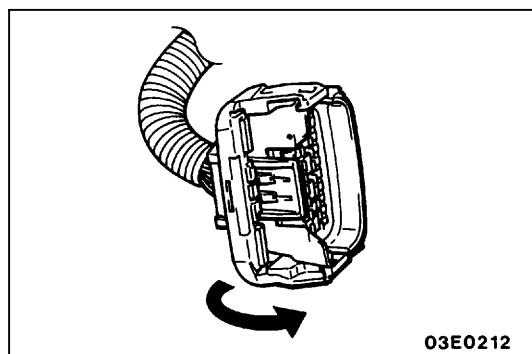
INJECTOR DRIVER

REMOVAL AND INSTALLATION



Removal steps

1. Injector driver
2. Bracket



REMOVAL SERVICE POINT

INJECTOR DRIVER REMOVAL

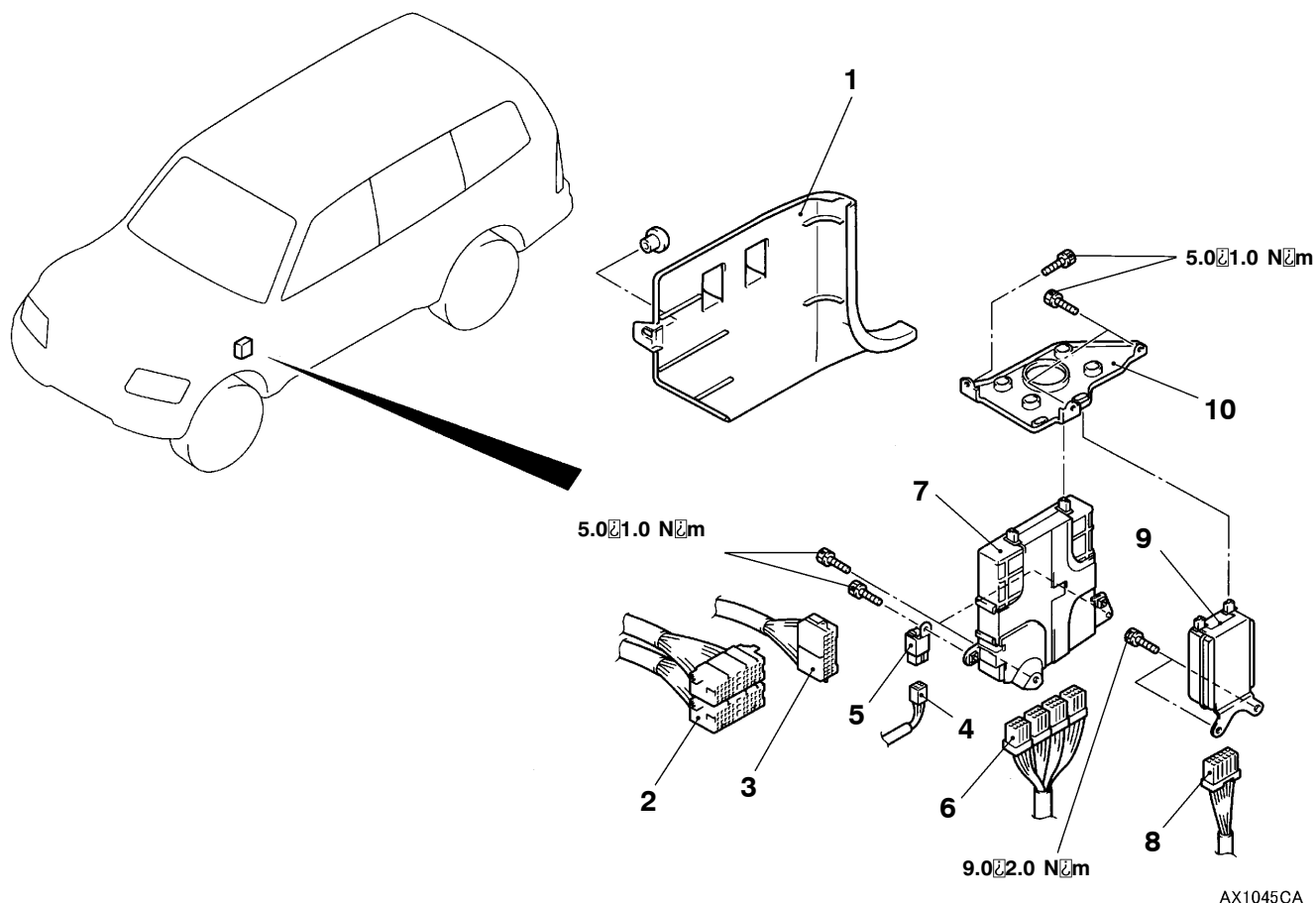
Press the injector driver connector in the place shown in the illustration to disconnect the injector driver connector.

Caution

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

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

REMOVAL AND INSTALLATION



AX1045CA

Removal steps

1. Cowl side trim
2. Instrument panel harness and front door harness connection
3. Instrument panel harness and front floor harness connection
4. A/T control relay connector
5. A/T control relay

6. Engine-A/T-ECU connector
7. Engine-A/T-ECU
8. Throttle valve controller connector
9. Throttle valve controller
 - Instrument panel (Refer to GROUP 52A)
10. Bracket

INSTALLATION SERVICE POINT

►A◄ THROTTLE VALVE CONTROLLER INSTALLATION

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

Initialization

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