

FUEL

CONTENTS

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GASOLINE DIRECT INJECTION (GDI) <4G6>

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GENERAL

OUTLINE OF CHANGES

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

- On-board Diagnostics System has been adopted to expand the diagnostic items and to change diagnosis code numbering system.
- Fuel pressure regulator (high-pressure) incorporate fuel pump (high-pressure) has been adopted.
- An ignition failure sensor has been adopted.
- The engine-ECU has been changed. <Vehicles with M/T>
- An engine-A/T-ECU has been adopted. <Vehicles with A/T>

GENERAL INFORMATION

SELF-DIAGNOSIS FUNCTION

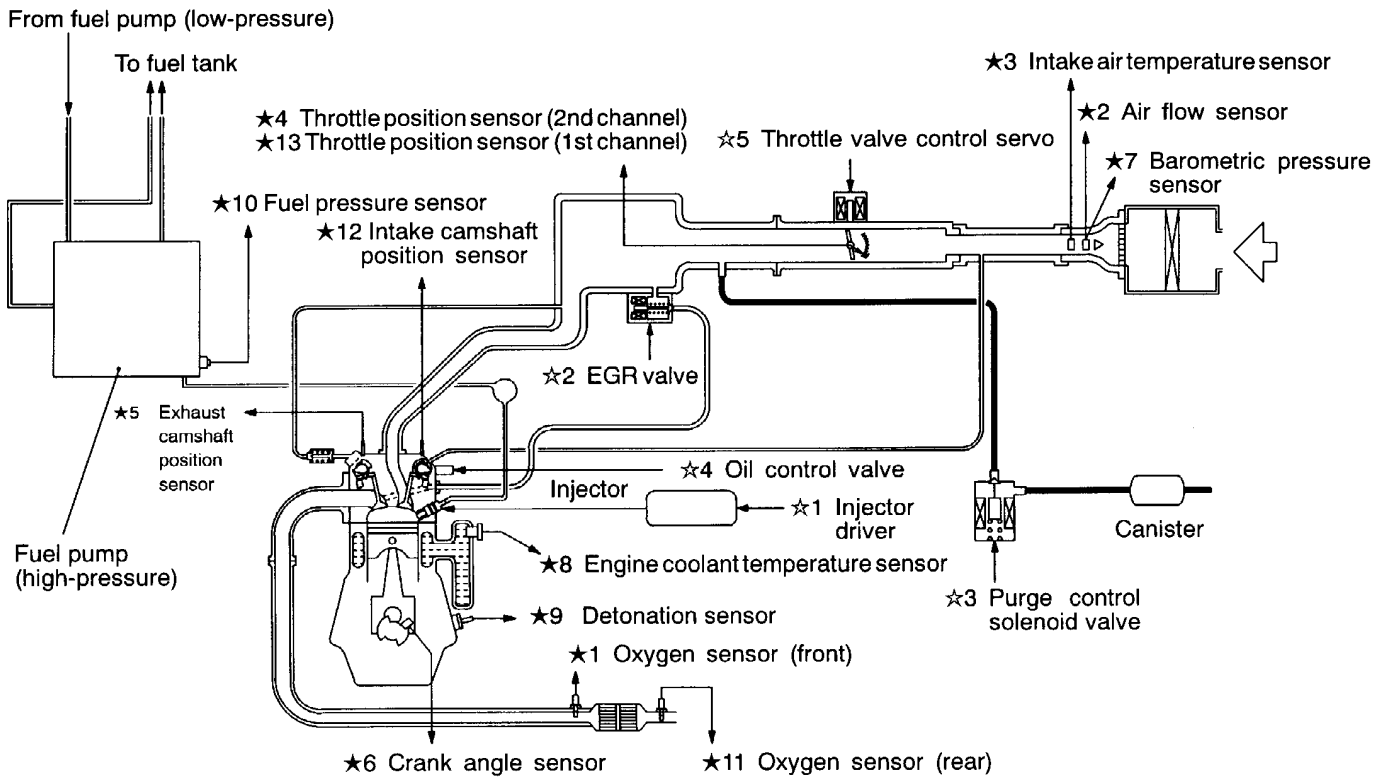
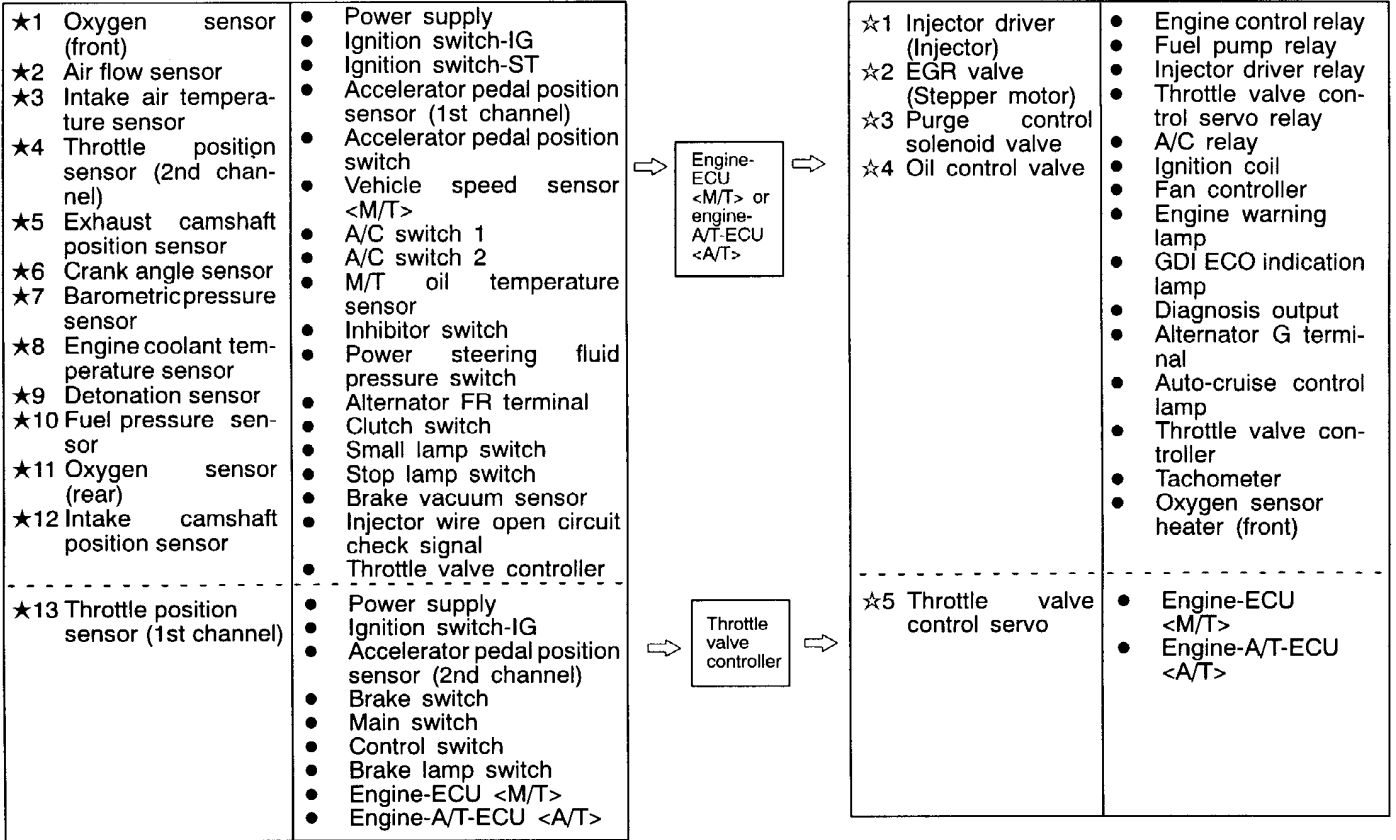
Following functions have been added.

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

GENERAL SPECIFICATIONS

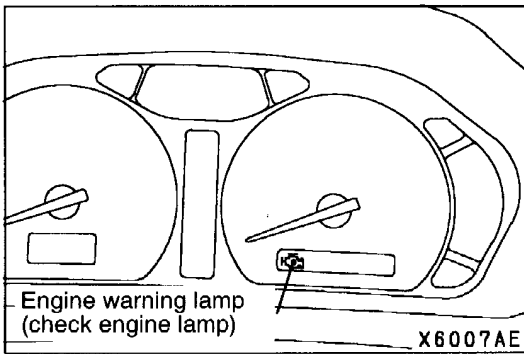
Items		Specifications
Engine-ECU <M/T>	Identification No.	E2T72590
Engine-A/T-ECU <A/T>	Identification No.	E2T77481

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM



SERVICE SPECIFICATIONS

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



TROUBLESHOOTING

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

However, the warning lamp will illuminate as bulb check for five seconds whenever the ignition switch is turned to the ON position.

Engine warning lamp inspection items

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

Code No.	Diagnosis item
P0304	No. 4 cylinder misfire detected
P0335	Crank angle sensor system
P0340	Exhaust camshaft position sensor system
P0403	EGR valve system
P0420	Catalyst malfunction
P0443	Purge control solenoid valve system
P1010	Oil control valve (OCV) system
P1012	Intake camshaft position sensor system
P1200	Injector driver system
P1220★	Electronic-controlled throttle valve system
P1221★	Throttle valve position feedback system
P1223★	Communication line with throttle valve controller
P1224★	Throttle valve control servo motor (motor 1st phase malfunction) system
P1225★	Accelerator pedal position sensor (2nd channel) system
P1228★	Throttle valve control servo motor (motor 2nd phase malfunction) system
P1515	Brake vacuum sensor system

NOTE

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

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

DIAGNOSIS USING DIAGNOSIS 2 MODE

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

NOTE

By turning the ignition switch to OFF, the engine-ECU <M/T> or engine-A/T-ECU <A/T> will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.

5. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

FREEZE FRAME DATA

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

The display items of freeze frame data are shown below.

Display item list

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

NOTE

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

READINESS TEST STATUS

The engine-ECU <M/T> or engine-A/T-ECU <A/T> monitors the following main diagnosis items, judges if these items are in good condition or not, and stores its history. This history can be read out by using MUT-II. (If the ECU has judged a item before, the MUT-II displays “Complete.”)

In addition, if diagnosis codes are erased or the battery cable is disconnected, this history will also be erased (the memory will be reset).

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

FAIL-SAFE FUNCTION REFERENCE TABLE

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

Malfunctioning item	Control contents during malfunction
Air flow sensor	<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 (2nd channel)	<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 throttle position sensor (1st channel). However, this controlling system is not applied if the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V. 3. Refrains from controlling the throttle opening angle feedback if the throttle position sensor (1st channel) is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Moreover, the control system is working until the ignition switch is turned OFF if the sensor signal returns to normal.)
Exhaust camshaft position sensor	Controls maintaining the condition before determined as failure. Fuel will be cut-off 4 seconds after a malfunction is detected. (However, only if No. 1 cylinder TDC has never been detected after the ignition switch is turned to the ON position)
Vehicle speed sensor	<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 1,500 r/min or more. 2. Suspends lean burn operation during the engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Fixes the ignition timing as that for standard petrol.
Injector	<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 5 MPa. (If there is open or short circuit). 2. Turns off the fuel pump relay (If the fuel pressure is excessively high). 3. Suspends fuel injection. (when the low pressure is detected and the engine speed is more than 3,000 r/min)
Alternator FR terminal	Refrains from controlling to suppress the alternator output to electrical load. (Operated as a normal alternator)
Accelerator pedal position sensor (2nd channel)	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (1st channel). (However, the control system is not applicable if the difference from the accelerator pedal position sensor (1st channel) output voltage is 1.0 V or higher.) 3. Suspends the electronic controlled throttle valve system if accelerator pedal position sensor (1st channel) is also defective.

Malfunctioning item	Control contents during malfunction
Accelerator pedal position sensor (1st channel)	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Controls the throttle valve position by using signals from the accelerator pedal position sensor (2nd channel). (However, this control is not applicable if the voltage difference between the accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) is 1.0 V or higher.) 3. Also suspends the electronic-controlled throttle valve system when the accelerator pedal position sensor (2nd channel) is defective.
Throttle position sensor (1st channel)	<ol style="list-style-type: none"> 1. Suspends lean burn operation. 2. Controls throttle opening angle feedback by using signals from throttle position sensor (2nd channel). (However, the controlling system is not applied when the throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V.) 3. Refrains from controlling the throttle opening angle feedback when throttle position sensor (2nd channel) is also defective.
Electronic-controlled throttle valve system	<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.
Communication line between the throttle valve controller and the engine-ECU <M/T> or engine-A/T-ECU <A/T>	<ol style="list-style-type: none"> 1. Communication error between the throttle valve controller and the engine-ECU <M/T> or engine-A/T-ECU <A/T>: <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-ECU <M/T> or engine-A/T-ECU <A/T>: <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 accelerator pedal position sensor (2nd channel).
Throttle valve control servo motor (Motor 1st phase malfunction)	Disables lean-mixture combustion.
Throttle valve control servo motor (Motor 2nd phase malfunction)	<ol style="list-style-type: none"> 1. Disables the electronic-controlled throttle valve system. 2. Disables lean-mixture combustion. 3. Disables idle engine speed feedback control.
Misfiring	If the detected misfiring causes damage to the catalyst, the misfiring cylinder will be shut down.
Intake camshaft position sensor	Turns off the oil control valve, and retard the ignition timing to a maximum degree.

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
P0011	Variable valve timing (V.T.T.) system	13A-14
P0100	Air flow sensor system	13A-15
P0105	Barometric pressure sensor system	13A-17
P0110	Intake air temperature sensor system	13A-19
P0115	Engine coolant temperature sensor system	13A-20
P0120★	Throttle position sensor 1 (1st channel) system	13A-23
P0125	Feedback system	13A-25
P0130	Oxygen sensor (front) system <sensor 1>	13A-27
P0135	Oxygen sensor heater (front) system <sensor 1>	13A-29
P0136	Oxygen sensor (rear) system <sensor 2>	13A-30
P0141	Oxygen sensor heater (rear) system <sensor 2>	13A-32
P0170	Abnormal fuel system	13A-33
P0190★	Abnormal fuel pressure	13A-35
P0201	No. 1 injector system	13A-36
P0202	No. 2 injector system	13A-38
P0203	No. 3 injector system	13A-39
P0204	No. 4 injector system	13A-40
P0220★	Accelerator pedal position sensor (1st channel) system	13A-42
P0225★	Throttle position sensor (2nd channel) system	13A-45
P0300★	Ignition coil (power transistor) system	13A-46
P0301	No. 1 cylinder misfire detected	13A-48
P0302	No. 2 cylinder misfire detected	13A-48
P0303	No. 3 cylinder misfire detected	13A-48
P0304	No. 4 cylinder misfire detected	13A-48
P0325	Detonation sensor system	13A-49
P0335	Crank angle sensor system	13A-49
P0340	Exhasut camshaft position sensor system	13A-51
P0403	EGR valve system	13A-53
P0420	Catalyst malfunction	13A-55
P0443	Purge control solenoid valve system	13A-56
P0500	Vehicle speed sensor system <M/T>	13A-57
P1010	Oil control valve (OCV) system	13A-57

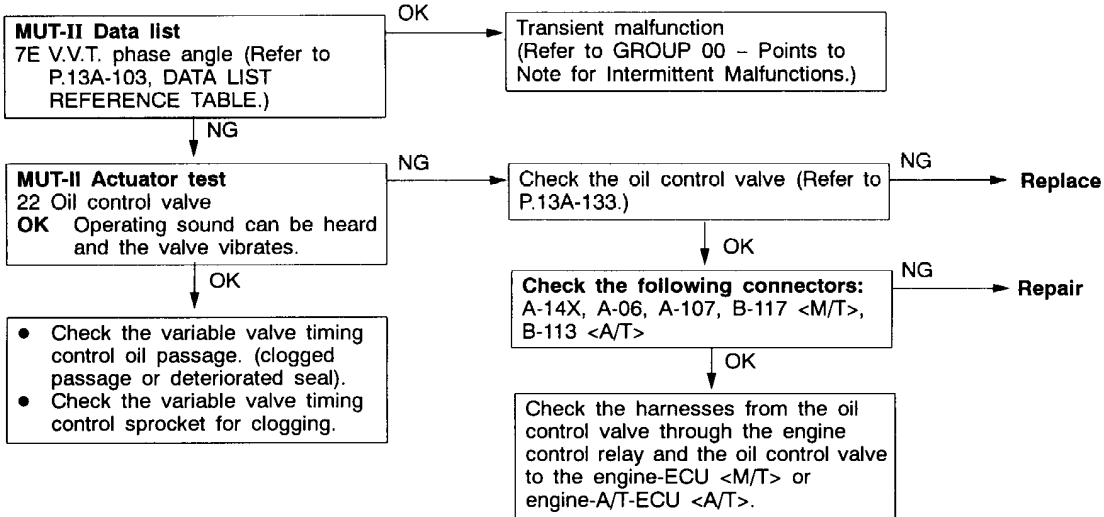
Code No.	Diagnosis item	Reference page
P1012	Intake camshaft position sensor system	13A-58
P1200	Injector driver system	13A-60
P1220★	Electronic-controlled throttle valve system	13A-61
P1221★	Throttle valve position feedback system	13A-62
P1223★	Communication line with throttle valve controller	13A-63
P1224★	Throttle valve control servo motor (motor 1st phase malfunction) system	13A-64
P1225★	Accelerator pedal position sensor (2nd channel) system	13A-65
P1228★	Throttle valve control servo motor (motor 2nd phase malfunction) system	13A-67
P1500	Alternator FR terminal system	13A-68
P1515	Brake vacuum sensor system	13A-69
P1610	Immobilizer system	13A-71

NOTE

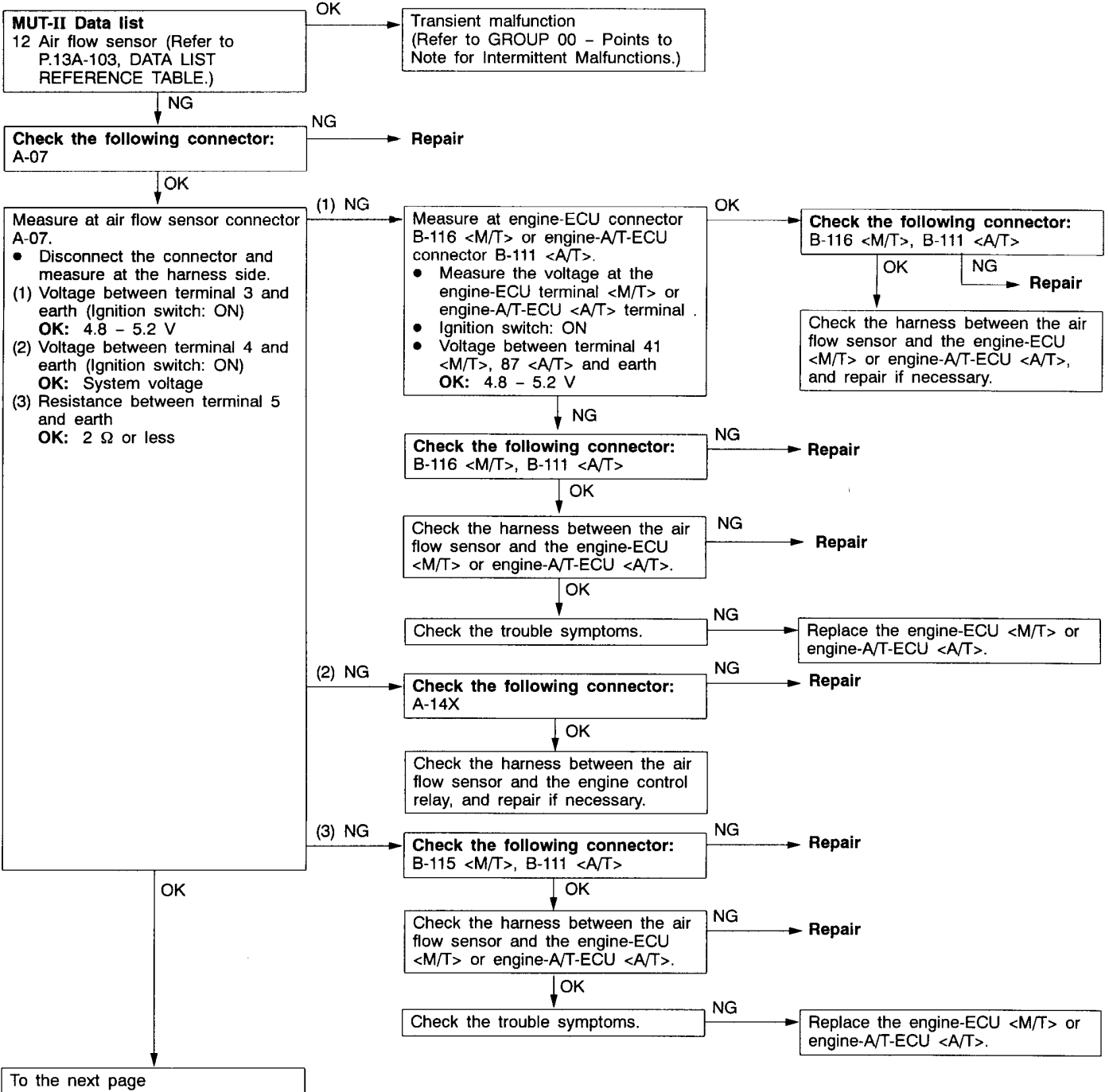
1. Do not replace the engine-ECU <M/T> or engine-A/T-ECU <A/T> until a through terminal check reveals there are no short/open circuit.
2. Check that the engine-ECU <M/T> or engine-A/T-ECU <A/T> earth circuit is normal before checking for the cause of the problem.
3. After the engine-ECU <M/T> or engine-A/T-ECU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

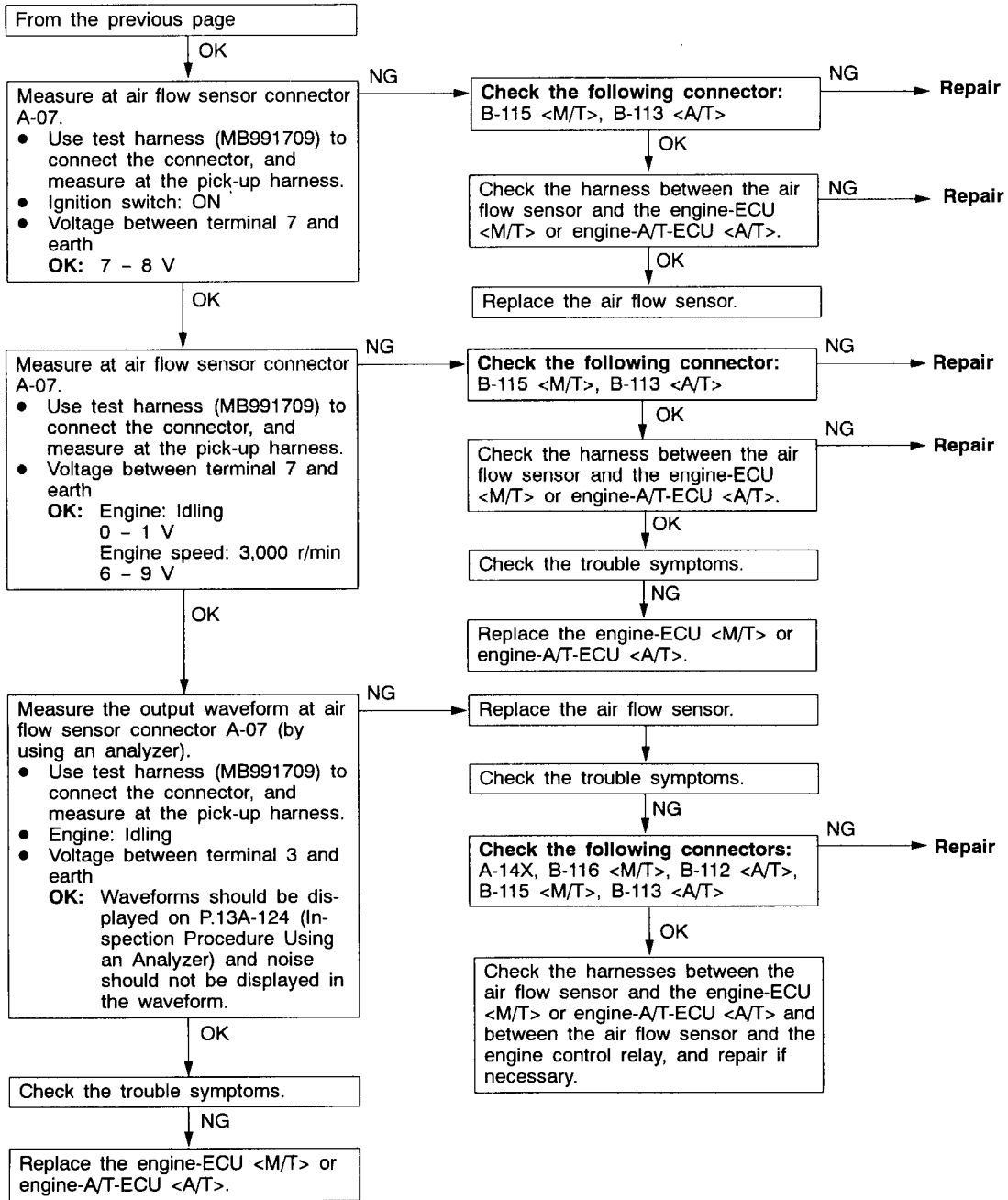
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

Code No. P0011 Variable valve timing (V.V.T.) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • Engine is running • Oil control valve (OCV): OFF <p>Set Conditions</p> <ul style="list-style-type: none"> • The intake cam phase angle remains approx. 15° or more for 10 seconds. <p>or</p> <ul style="list-style-type: none"> • The intake cam phase angle is approx. 8° or more during the engine idling. 	<ul style="list-style-type: none"> • Malfunction (eg. sticking or leaks) of oil control valve (OCV) • Malfunction (clogging) of variable valve timing (V.V.T.) control oil passage • Sticked variable valve timing (V.V.T) sprocket

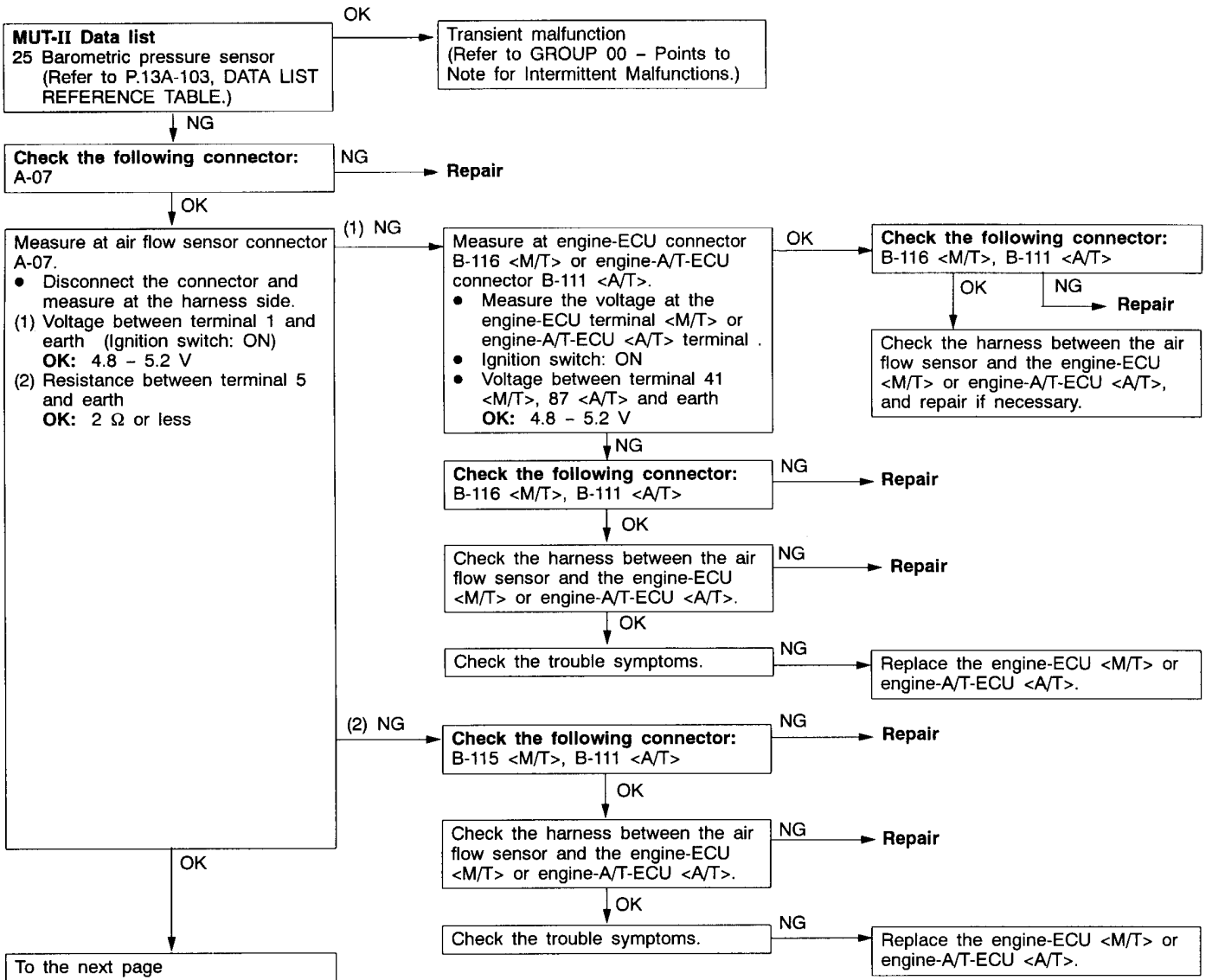


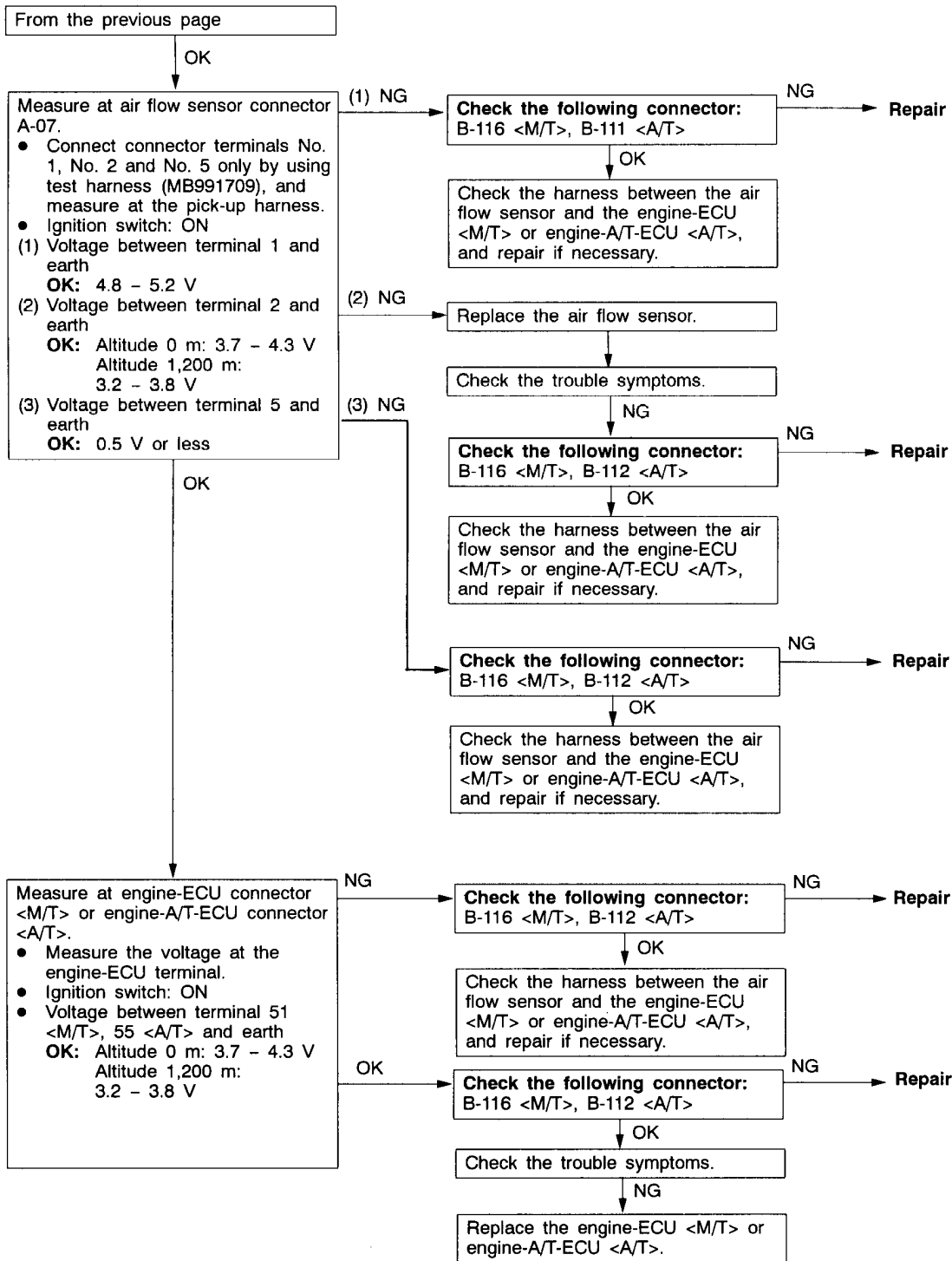
Code No. P0100 Air flow sensor system	Probable cause
Range of Check • Engine speed: 500 r/min or more Set Conditions • The sensor output frequency is 3.3 Hz or less for four seconds.	<ul style="list-style-type: none"> • Malfunction of air flow sensor • Open or short circuit in air flow sensor circuit or loose connector contact • Malfunction of engine-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>



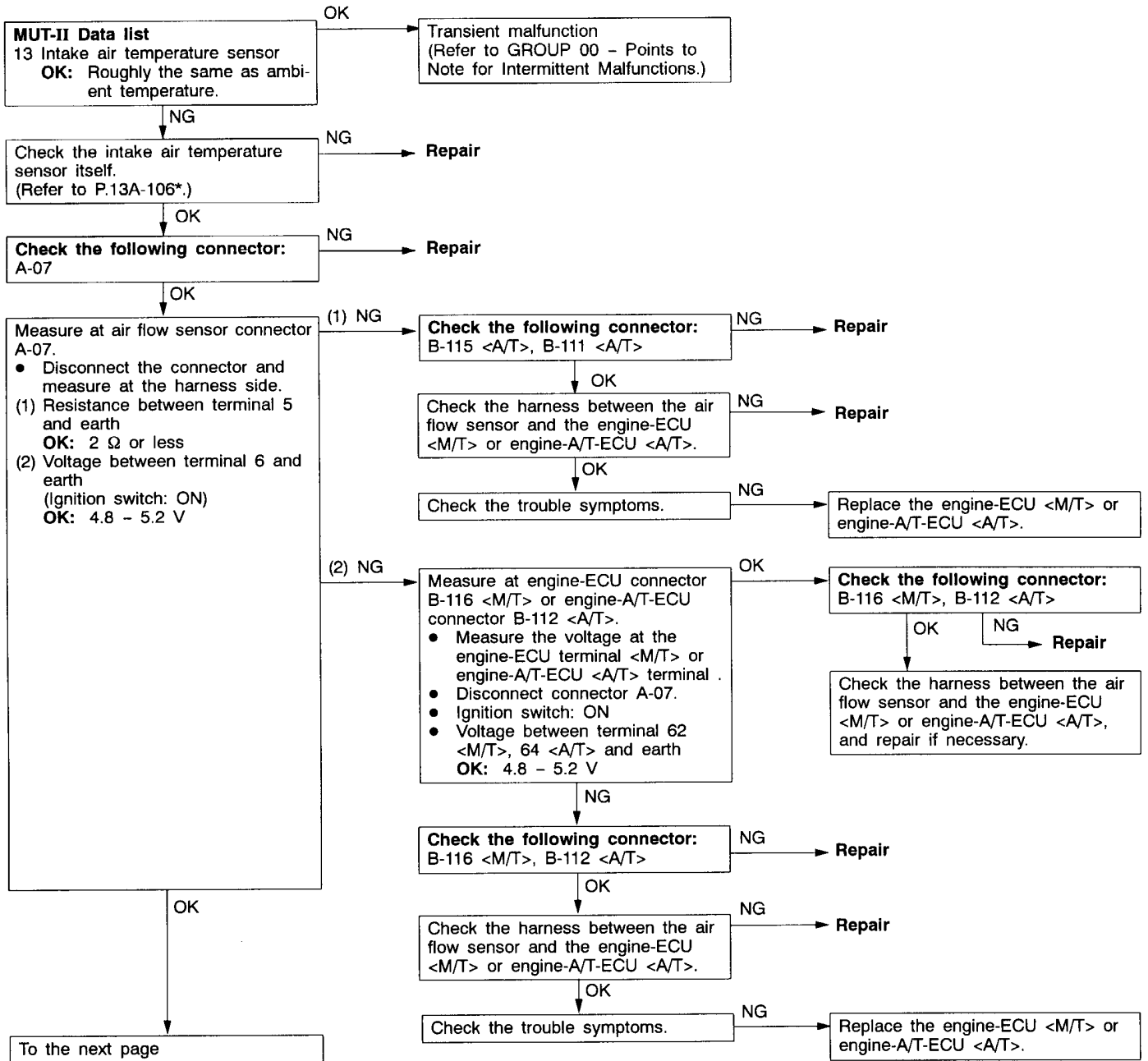


Code No. P0105 Barometric pressure sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Battery voltage: 8 V or more <p>Set Conditions</p> <ul style="list-style-type: 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-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>

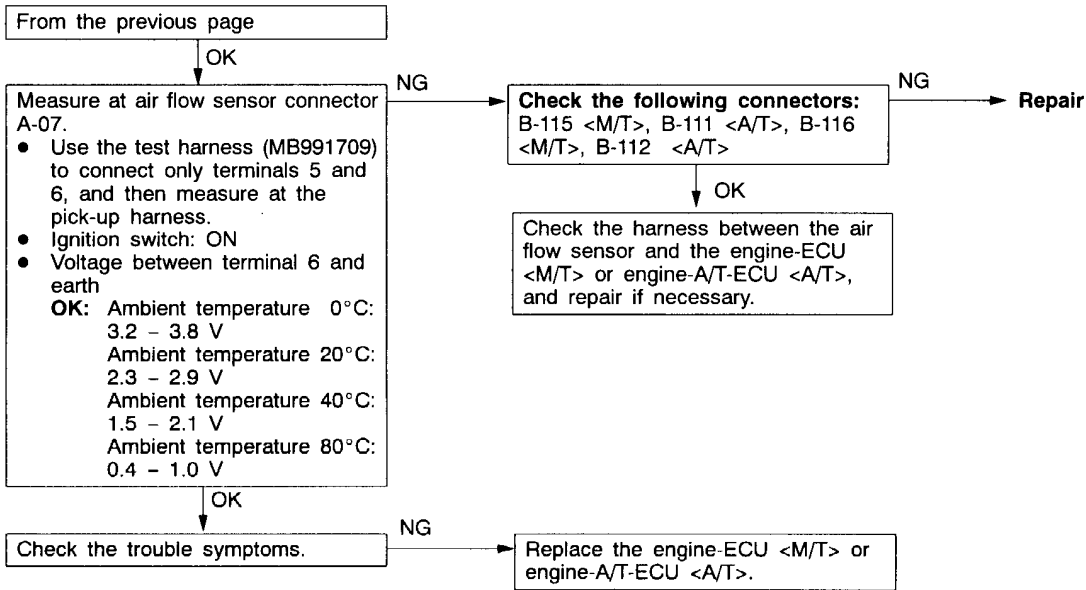




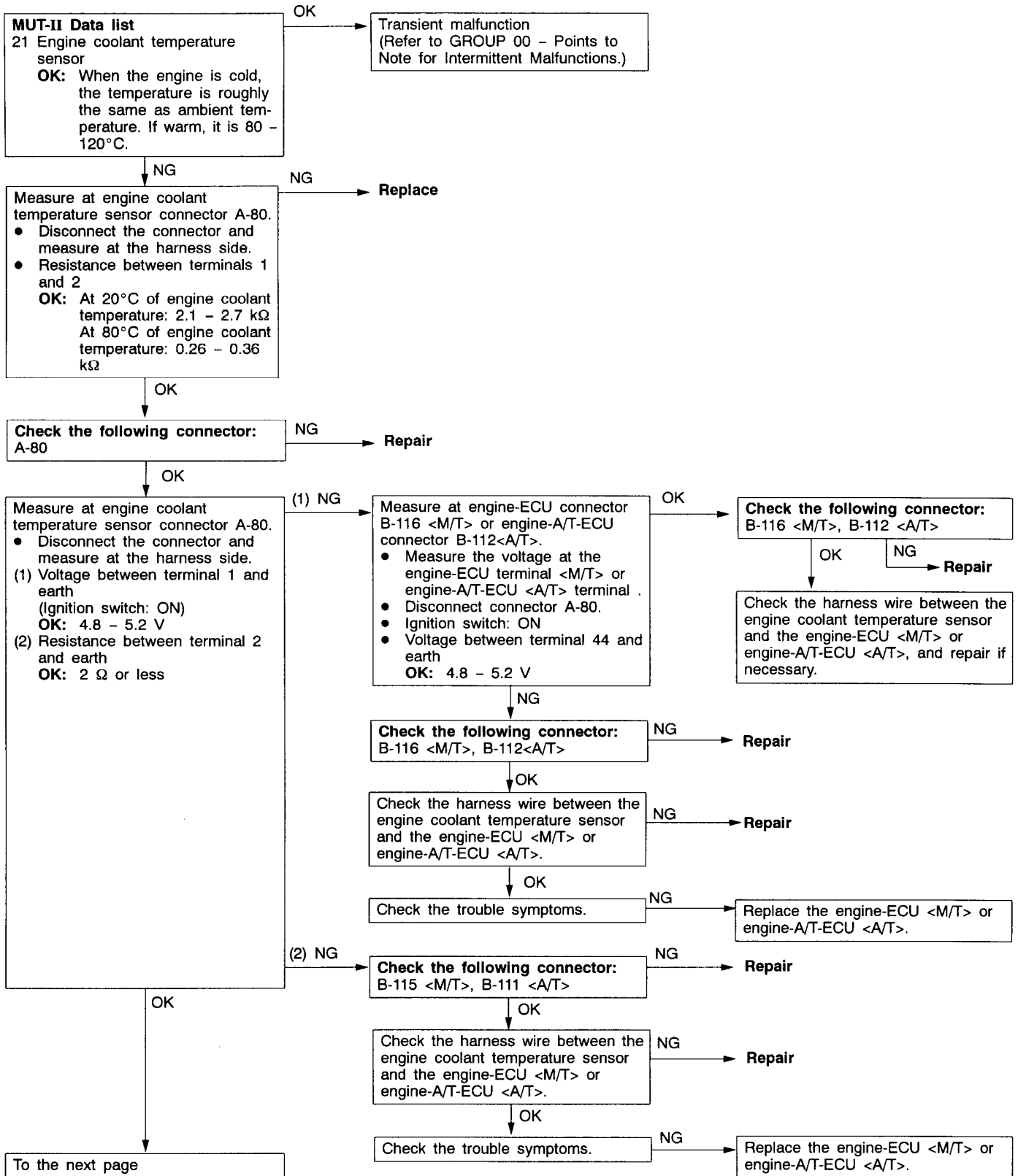
Code No. P0110 Intake air temperature sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage is 4.6 V 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 0.2 V 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-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>

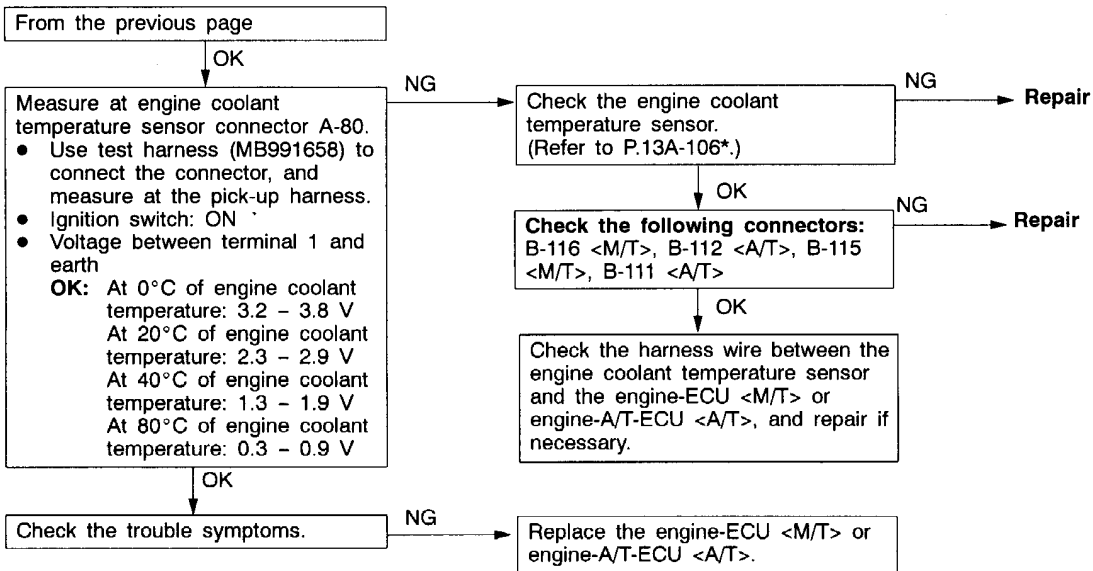


NOTE:
 *: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).



Code No. P0115 Engine coolant temperature sensor system	Probable cause
Range of Check • Engine: Two seconds after the engine has been started Set Conditions • The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of engine coolant temperature) or • The sensor output voltage is 0.1 V or less for four seconds (equivalent to 140°C of engine coolant temperature)	<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-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>
Range of Check • Engine: After starting Set Conditions • The engine coolant temperature has reduced from over 40°C to less than 40°C, and that condition has lasted for five minutes or more.	

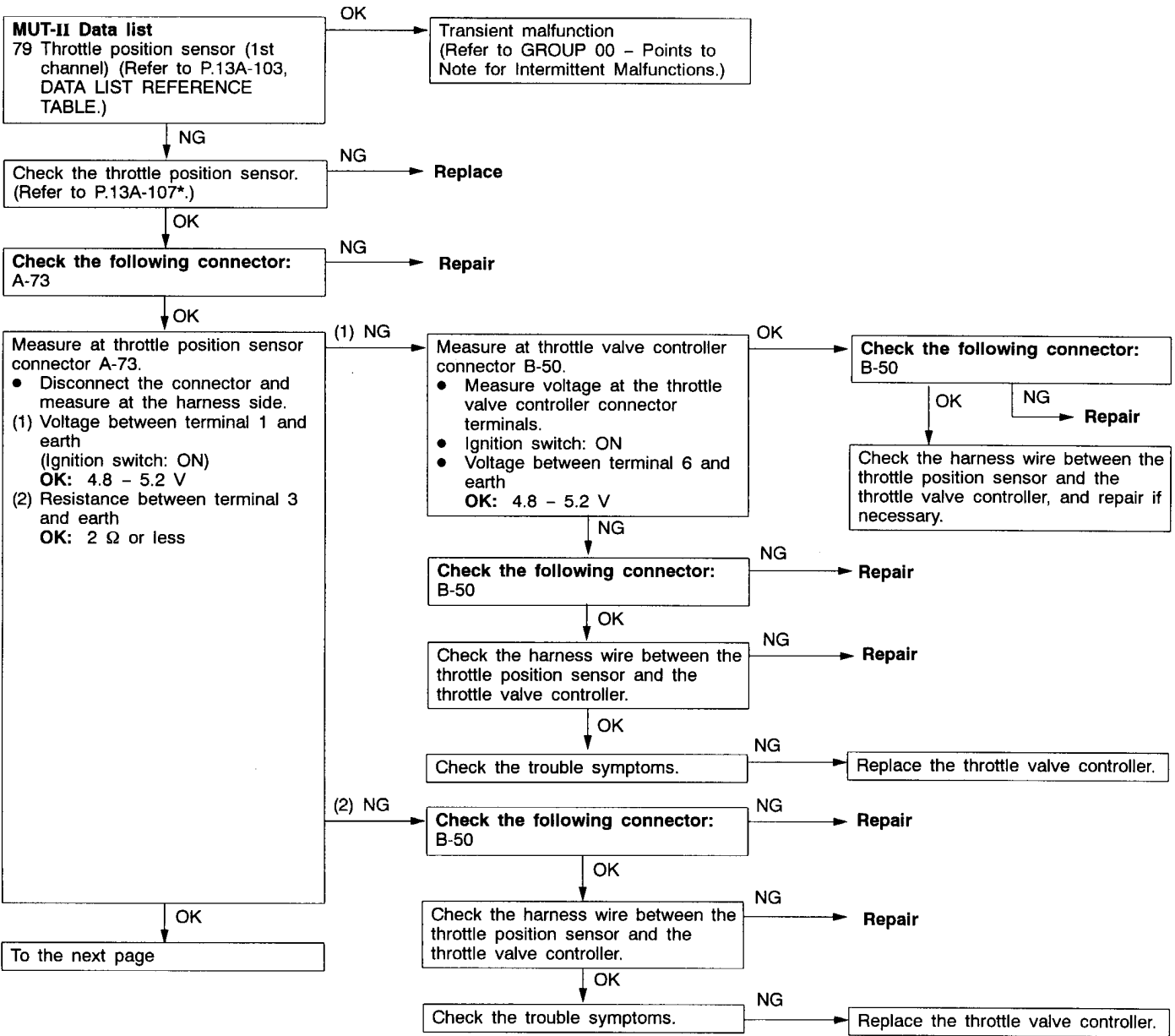




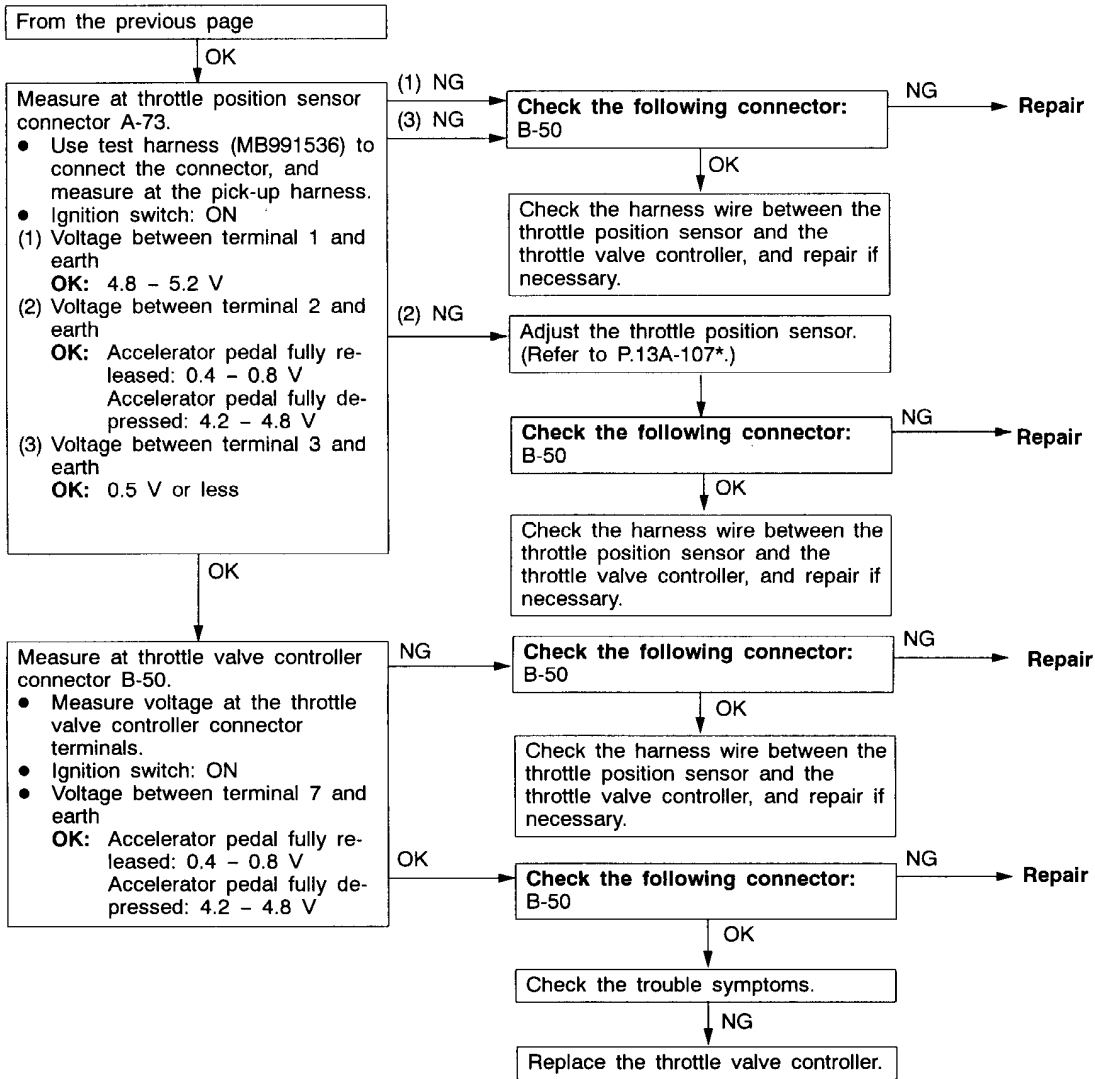
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

Code No. P0120 Throttle position sensor (1st channel) system	Probable cause
<p>The throttle valve controller judges a malfunction, and then transmit the result to the engine-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 throttle position sensor (2nd channel) output voltage is 2.5 V or more. <p>or</p> <ul style="list-style-type: none"> The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 - 6 V. <p>or</p> <ul style="list-style-type: none"> The opening angle of throttle position sensor (1st channel) is different from its target by 1 V or more. <p>or</p> <ul style="list-style-type: none"> The throttle position sensor (1st channel) output changes within 25 mV when the throttle control servo moves one step. 	<ul style="list-style-type: none"> Malfunction of throttle position sensor Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact Malfunction of throttle valve controller Malfunction of engine-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>



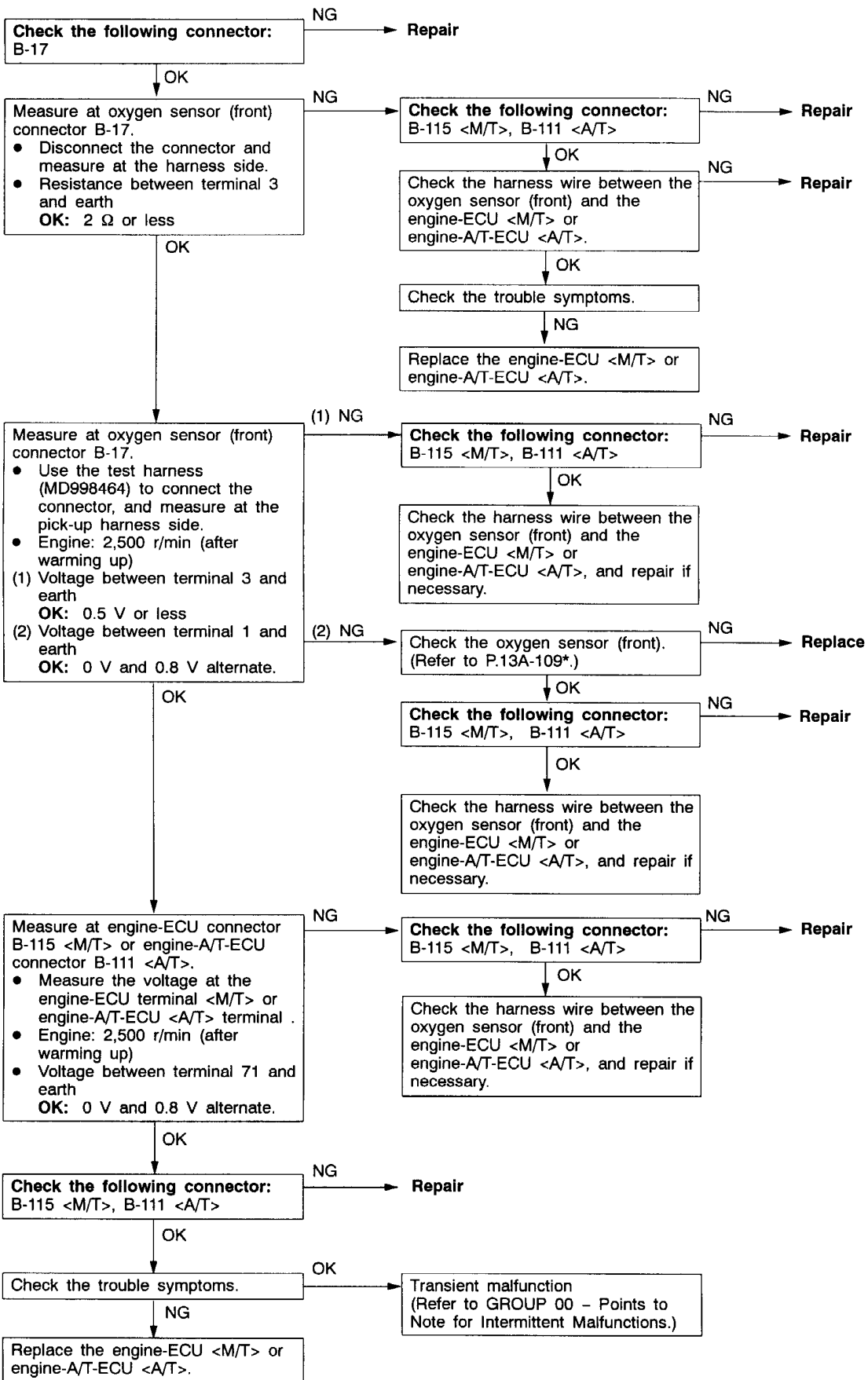
NOTE:
*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).



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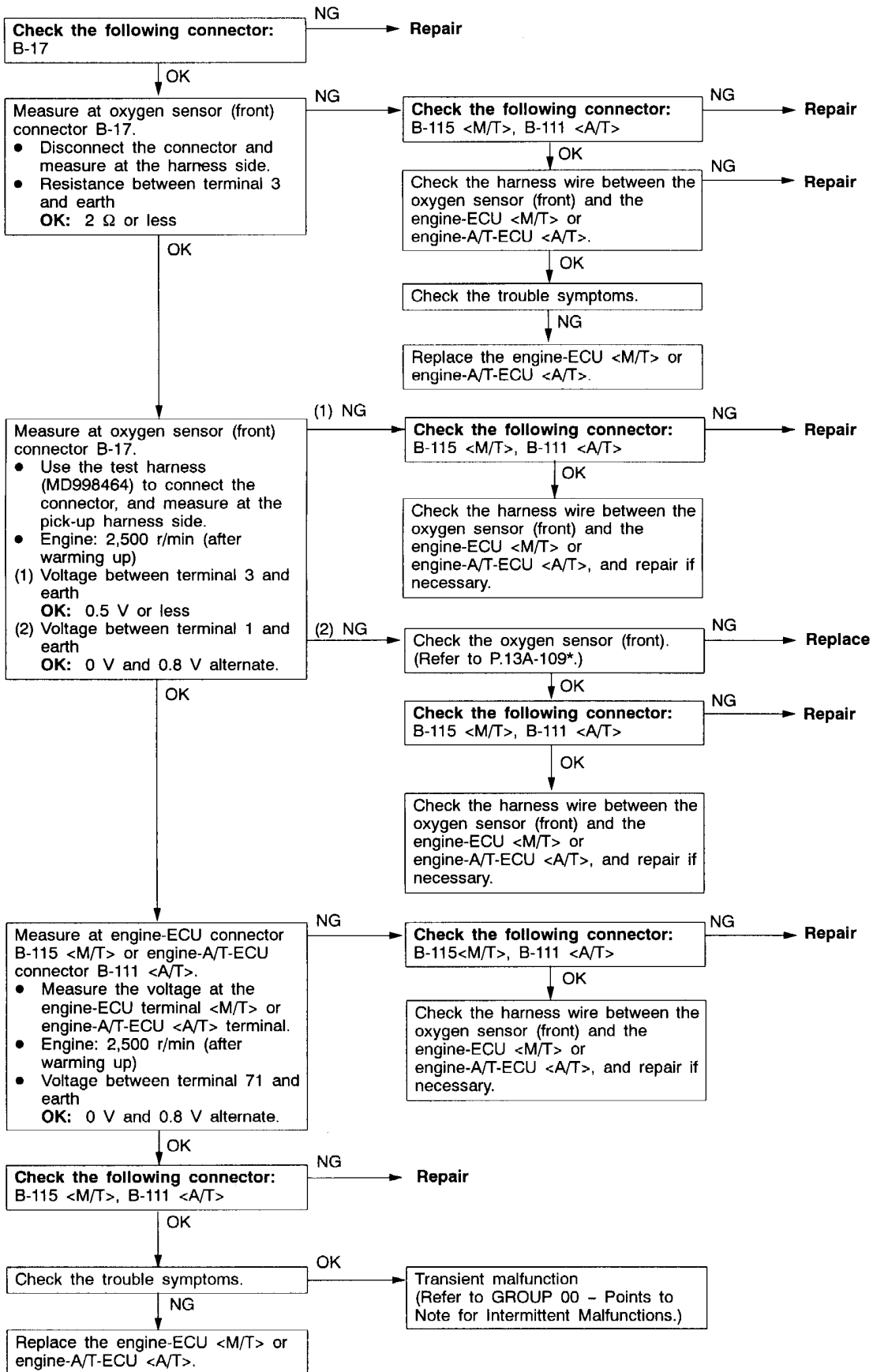
Code No. P0125 Feedback system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none">• The engine coolant temperature is approx. 80°C or more.• During stoichiometric feedback control• The vehicle is not being decelerated. <p>Set Conditions</p> <ul style="list-style-type: none">• Oxygen sensor (front) output voltage has been higher or lower than 0.5 V for at least thirty seconds.	<ul style="list-style-type: none">• Malfunction of oxygen sensor (front)• Open or short circuit in the oxygen sensor (front) circuit or loose connector contact• Malfunction of engine-ECU <M/T>• Malfunction of engine-A/T-ECU <A/T>



NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

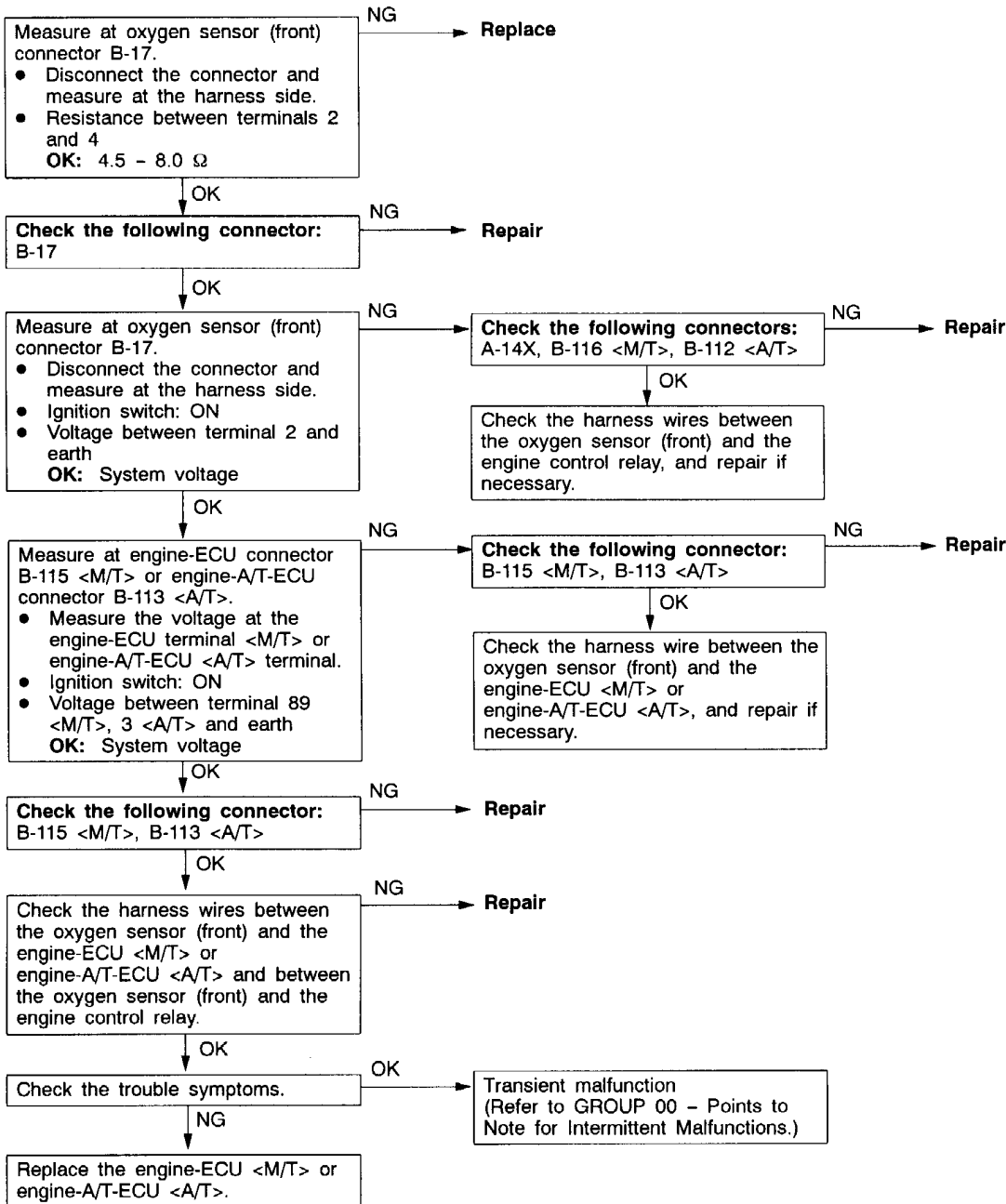
Code No. P0130 Oxygen sensor (front) system <sensor 1>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 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 (front) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (front) inside the engine-ECU. 	<ul style="list-style-type: none"> ● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>
<p>Range of Check</p> <ul style="list-style-type: none"> ● Engine speed is 3,000 r/min or less ● During driving ● During air/fuel ratio feedback control <p>Set Conditions</p> <ul style="list-style-type: none"> ● The oxygen sensor (front) output frequency is five or less per 12 seconds on average. 	



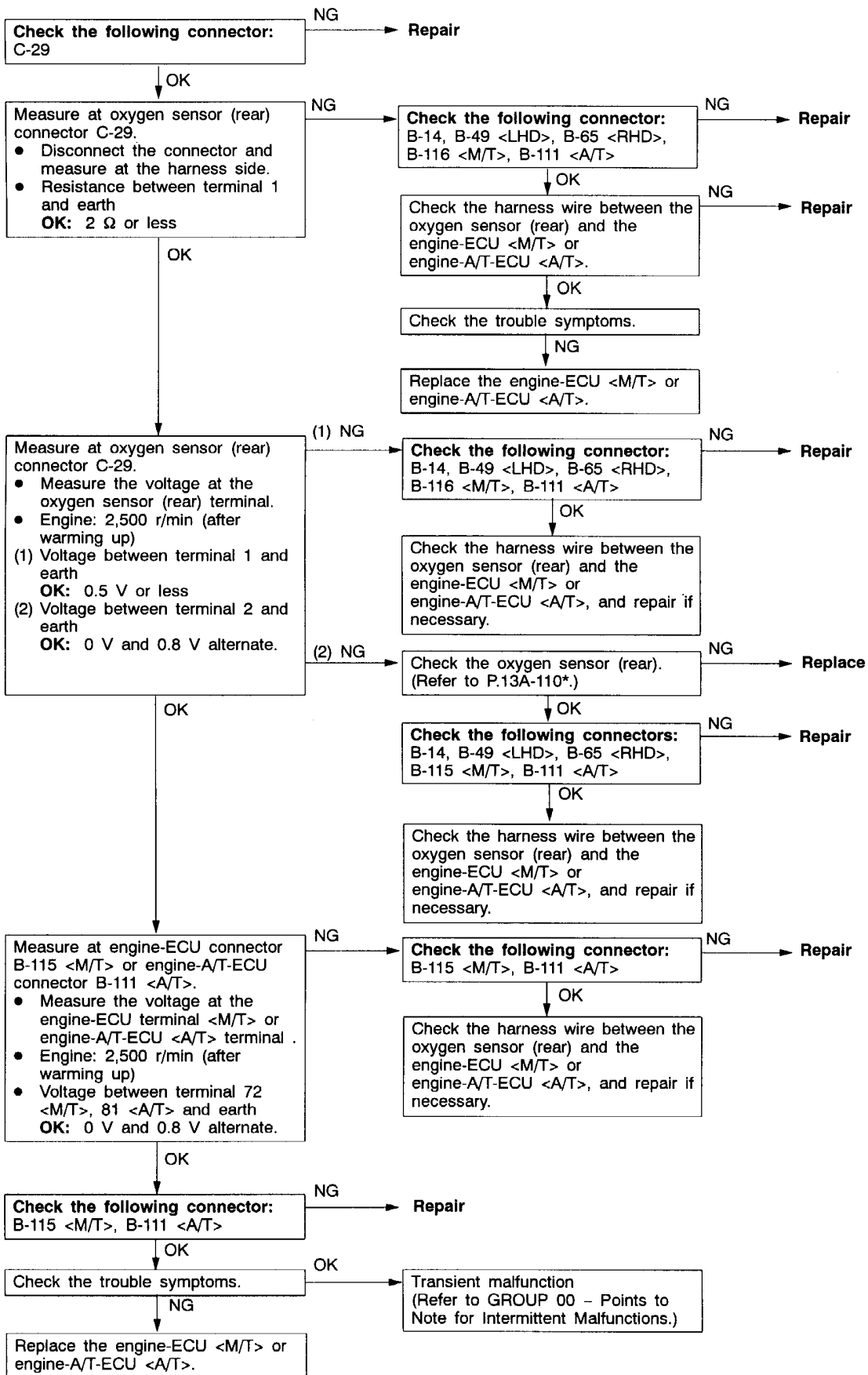
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

Code No. P0135 Oxygen sensor heater (front) system <sensor 1>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine coolant temperature is approx. 20°C or more. • The oxygen sensor heater (front) remains on. • The engine speed is 50 r/min or more. • Battery voltage is 11 – 16 V. <p>Set Conditions</p> <ul style="list-style-type: none"> • The current, which flows through the oxygen sensor heater (front), is 0.2 A or less or 3.5 A or more for six seconds. 	<ul style="list-style-type: none"> • Malfunction of oxygen sensor heater (front) • Open or short circuit in the oxygen sensor heater (front) circuit or loose connector contact • Malfunction of engine-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>



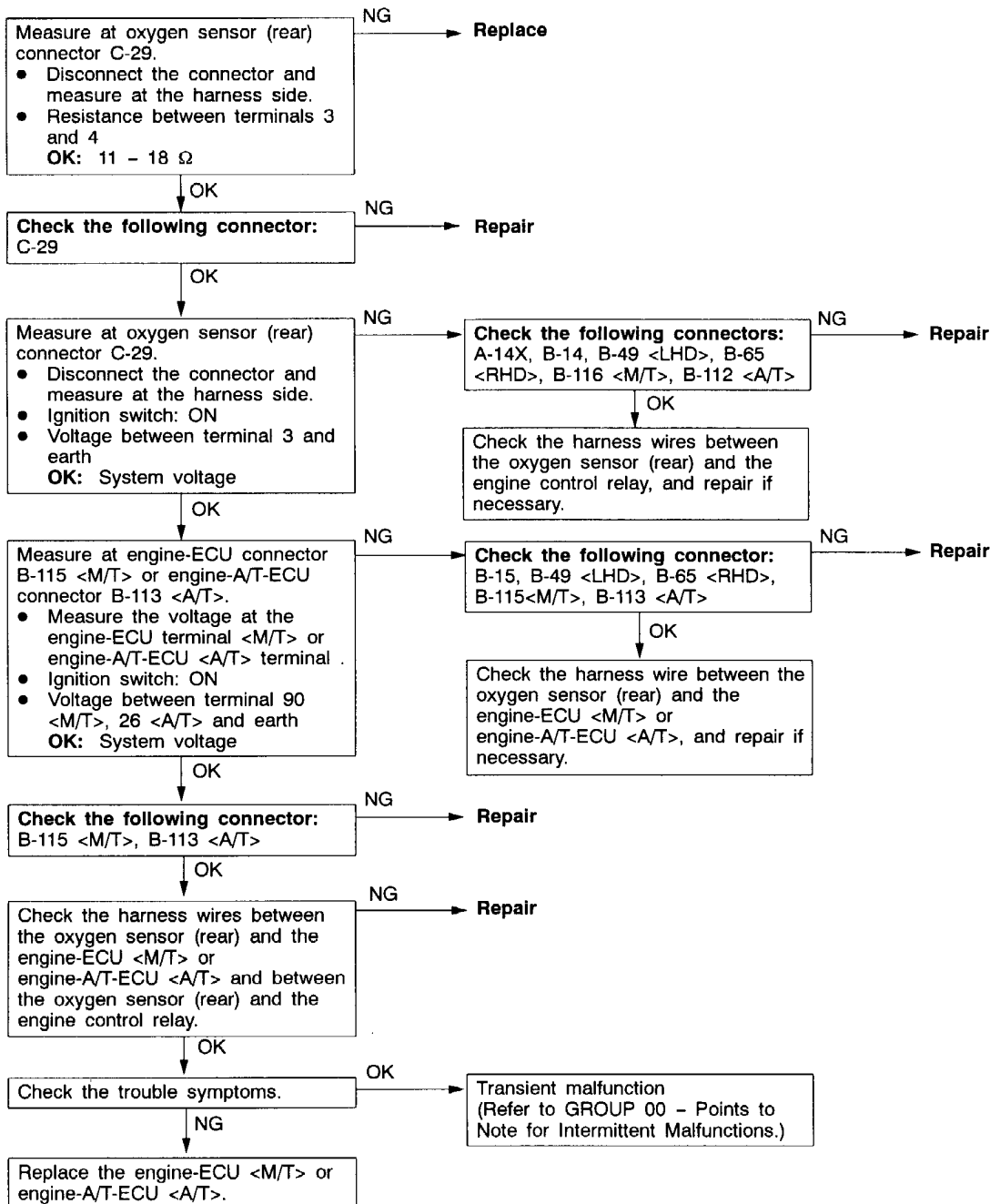
Code No. P0136 Oxygen sensor (rear) system <sensor 2>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 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 (rear) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (rear) inside the engine-ECU <M/T> or engine-A/T-ECU <A/T>. 	<ul style="list-style-type: none"> ● Malfunction of oxygen sensor (rear) ● Open or short circuit in the oxygen sensor (rear) circuit or loose connector contact ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>
<p>Range of Check</p> <ul style="list-style-type: none"> ● Two seconds have passed after the engine-ECU <M/T> or engine-A/T-ECU <A/T> detected an open circuit. ● When the oxygen sensor (front) is in good condition. <p>Set Conditions</p> <ul style="list-style-type: none"> ● When the air/fuel ratio is rich, the oxygen sensor (front) output voltage is 0.5 V or more, the oxygen sensor (rear) output voltage is less than 0.1 V, and the oxygen sensor (rear) output voltage fluctuates within 0.078 V. 	



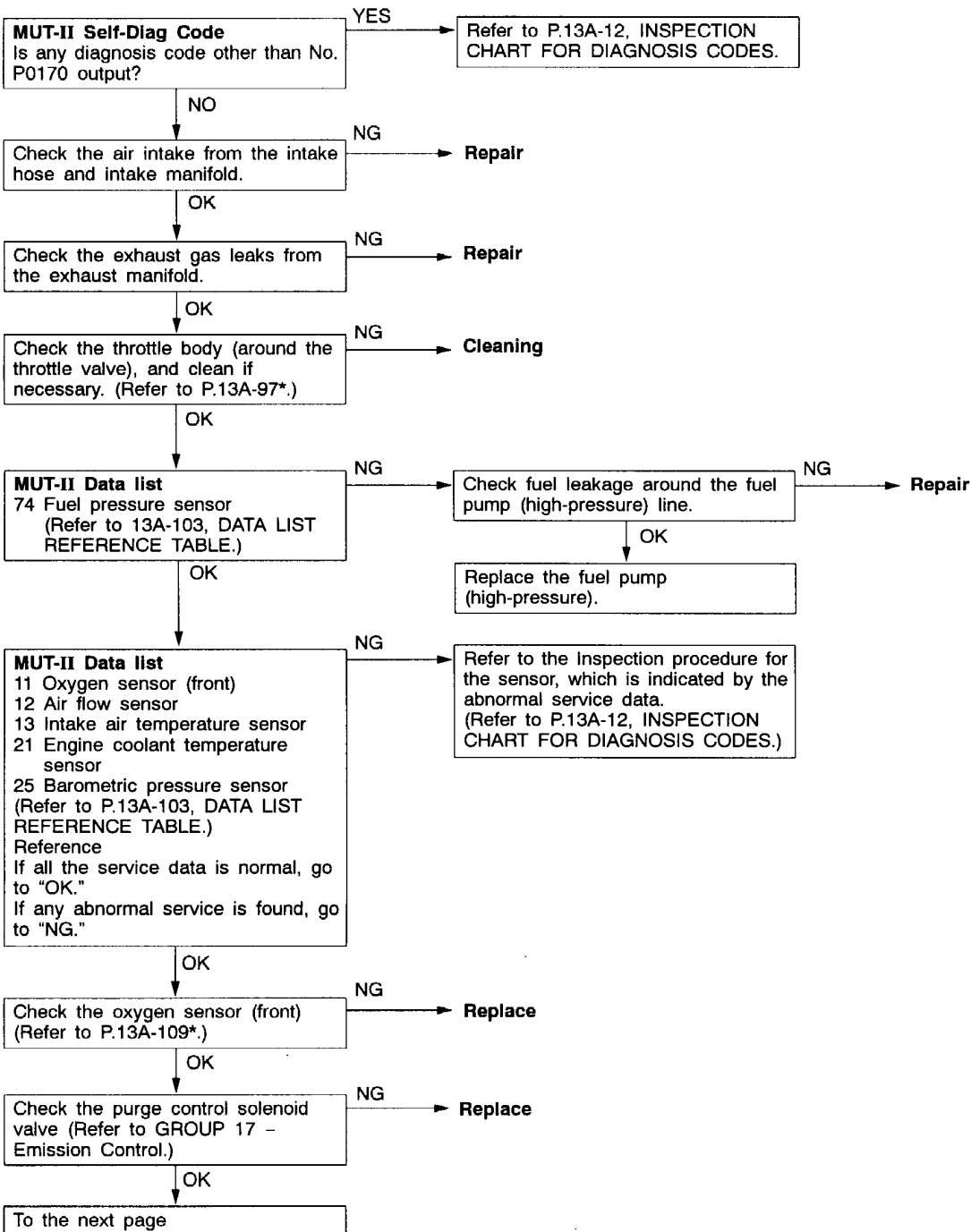
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

Code No. P0141 Oxygen sensor heater (rear) system <sensor 2>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine coolant temperature is approx. 20°C or more. • The oxygen sensor heater (rear) remains on. • The engine speed is 50 r/min or more. • Battery voltage is 11 - 16 V. <p>Set Conditions</p> <ul style="list-style-type: none"> • The current, which flows through the oxygen sensor heater (rear), is 0.2 A or less or 3.5 A or more for six seconds. 	<ul style="list-style-type: none"> • Malfunction of oxygen sensor heater (rear) • Open or short circuit in the oxygen sensor heater (rear) circuit or loose connector contact • Malfunction of engine-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>

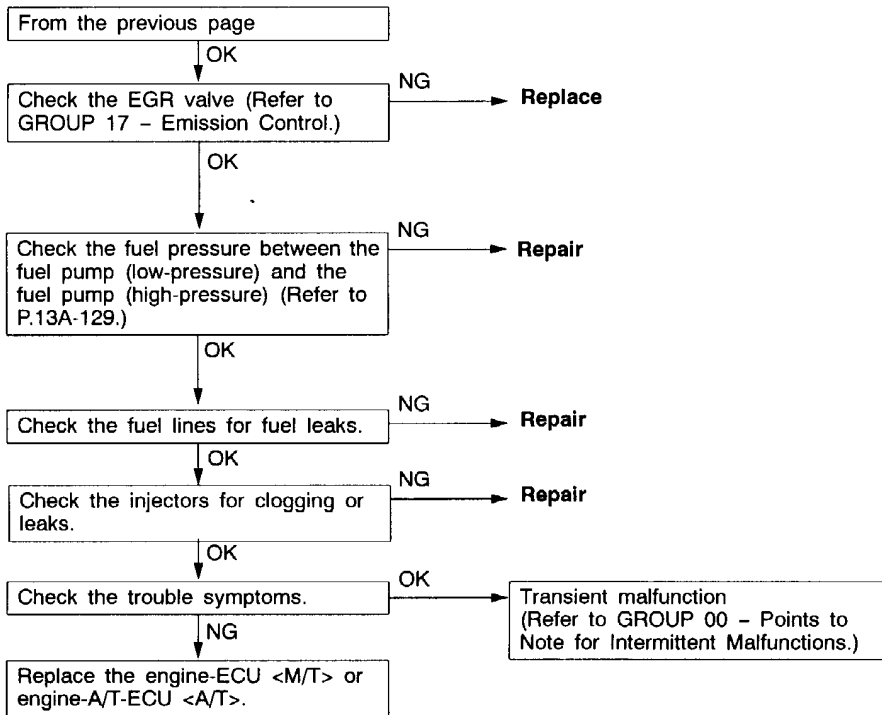


Code No. P0170 Abnormal fuel system	Probable cause
Range of Check ● Engine: Being learning the air-fuel ratio Set Conditions ● Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or ● Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	<ul style="list-style-type: none"> ● Malfunction of fuel supply system ● Malfunction of oxygen sensor (front) ● Malfunction of intake air temperature sensor ● Malfunction of barometric pressure sensor ● Malfunction of air flow sensor ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>

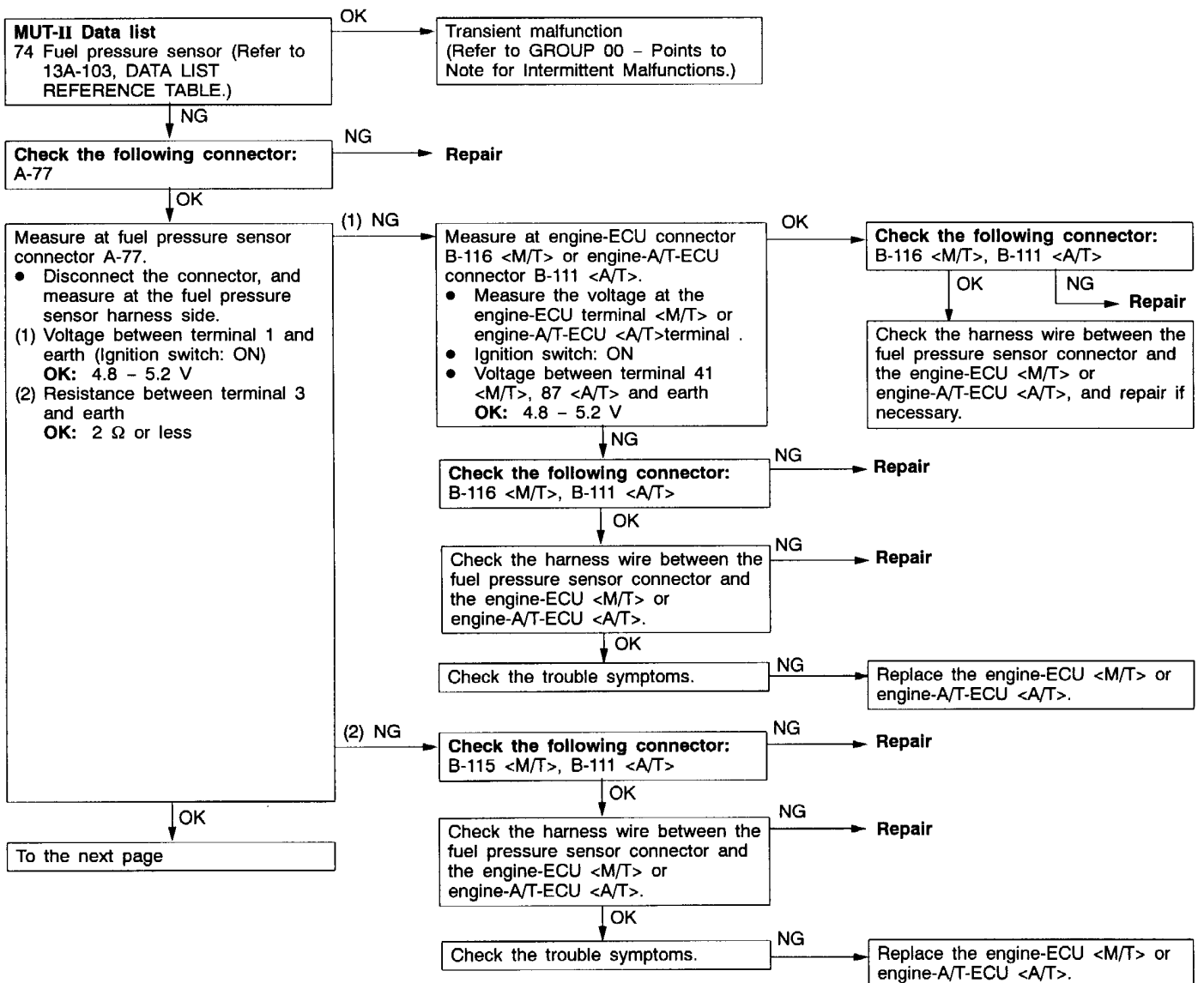


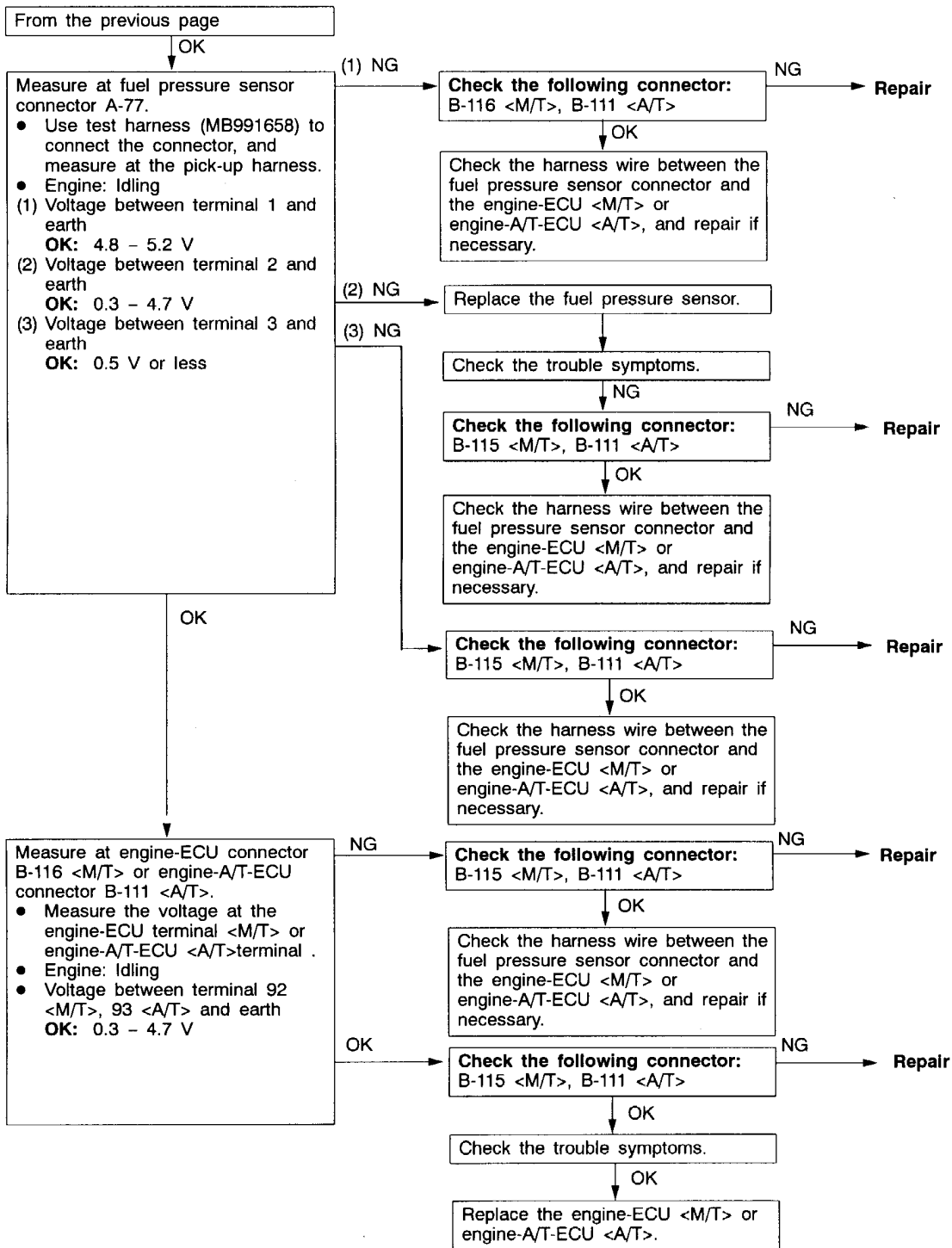
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

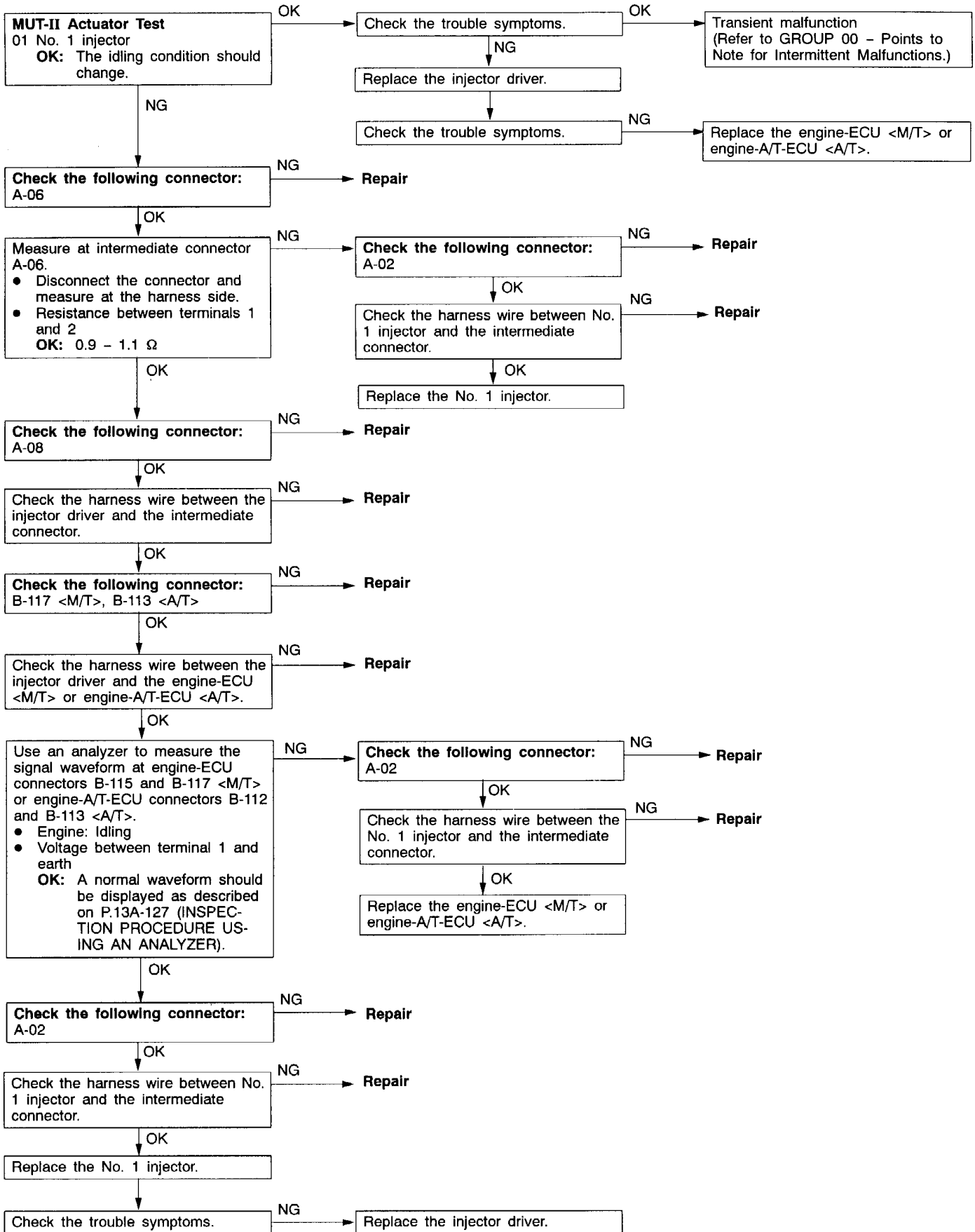


Code No. P0190 Abnormal fuel pressure	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● The sensor output voltage is 4.8 V or more, or 0.2 V or less for four seconds.	● Malfunction of fuel pressure sensor ● Open or short circuit in the fuel pressure sensor circuit or loose connector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

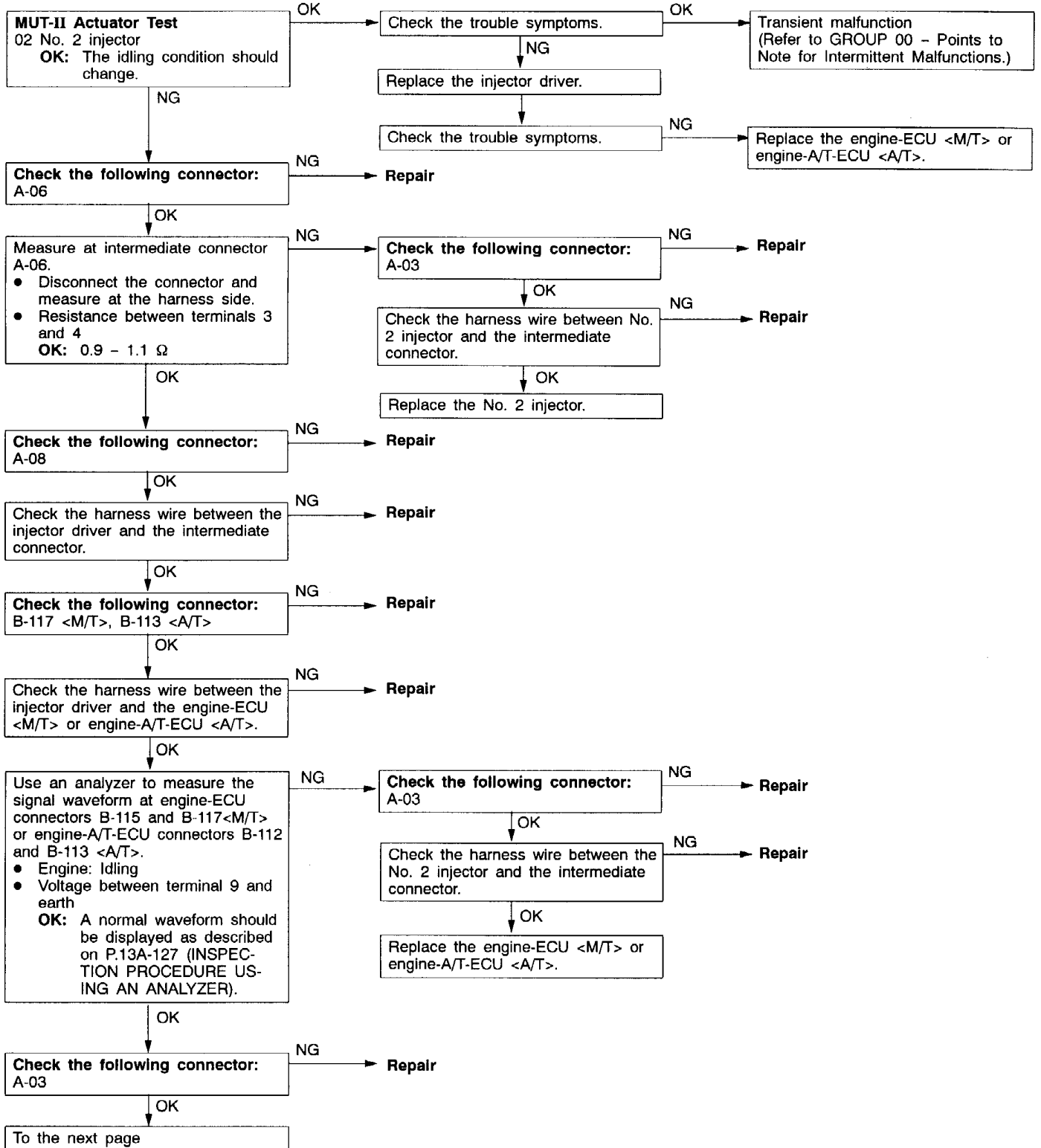


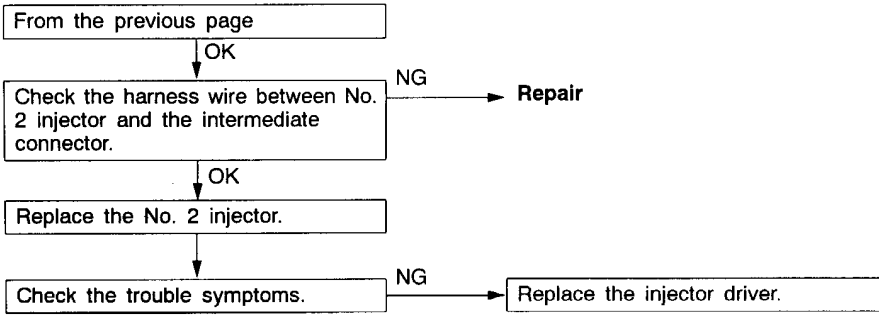


Code No. P0201 No. 1 injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine speed is 4,000 r/min or less. • The battery voltage is 10 V or more. • The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. <p>Set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

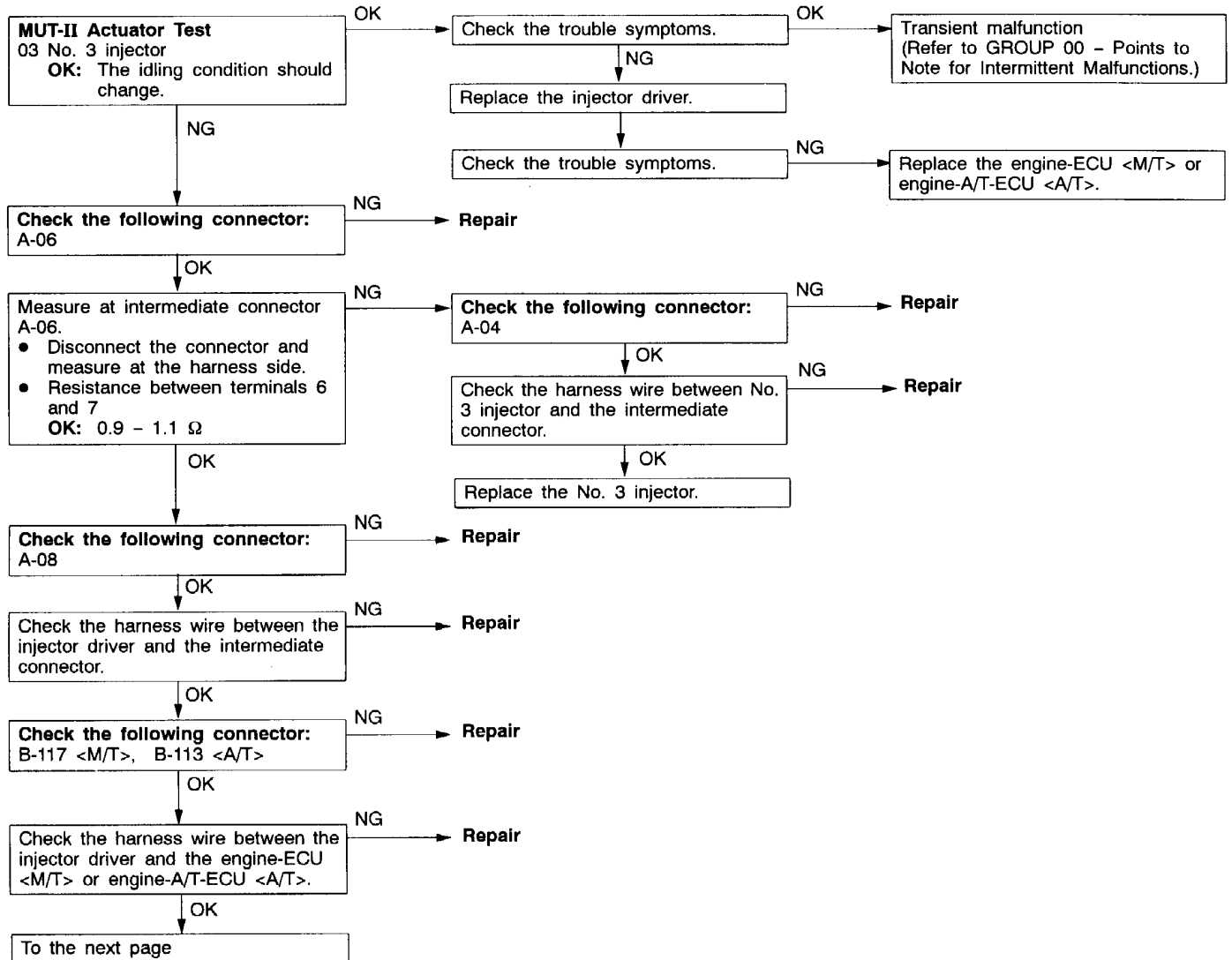


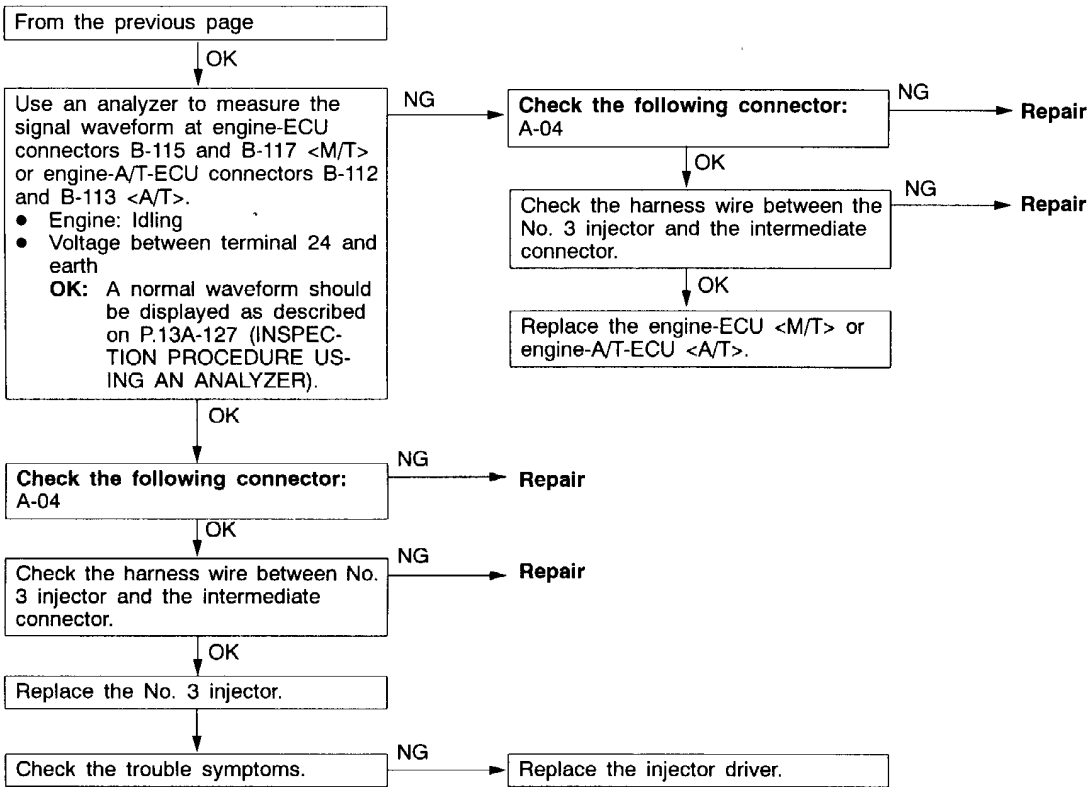
Code No. P0202 No. 2 injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine speed is 4,000 r/min or less. • The battery voltage is 10 V or more. • The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. <p>Set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



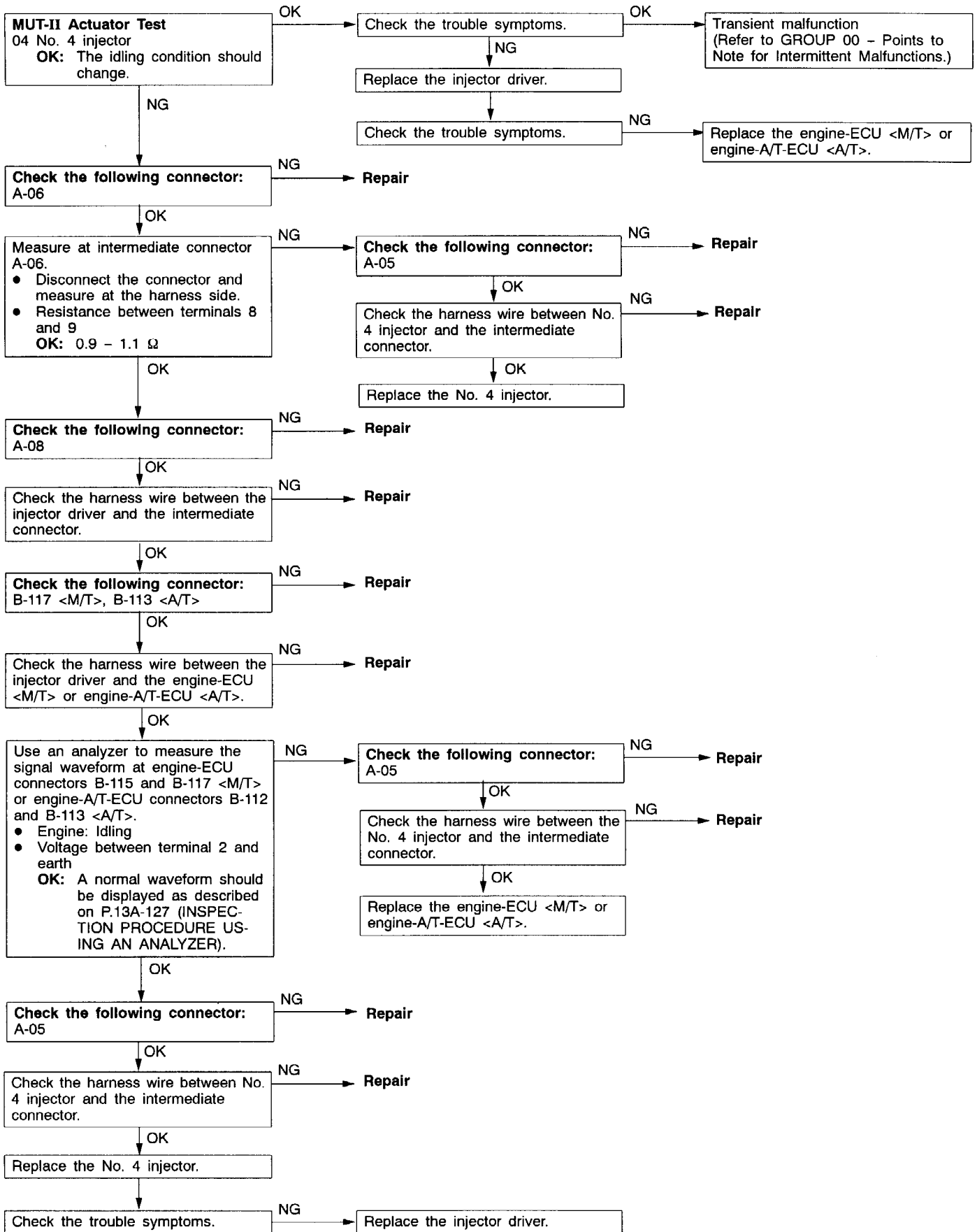


Code No. P0203 No. 3 injector system	Probable cause
Range of Check <ul style="list-style-type: none"> The engine speed is 4,000 r/min or less. The battery voltage is 10 V or more. The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. Set Conditions 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

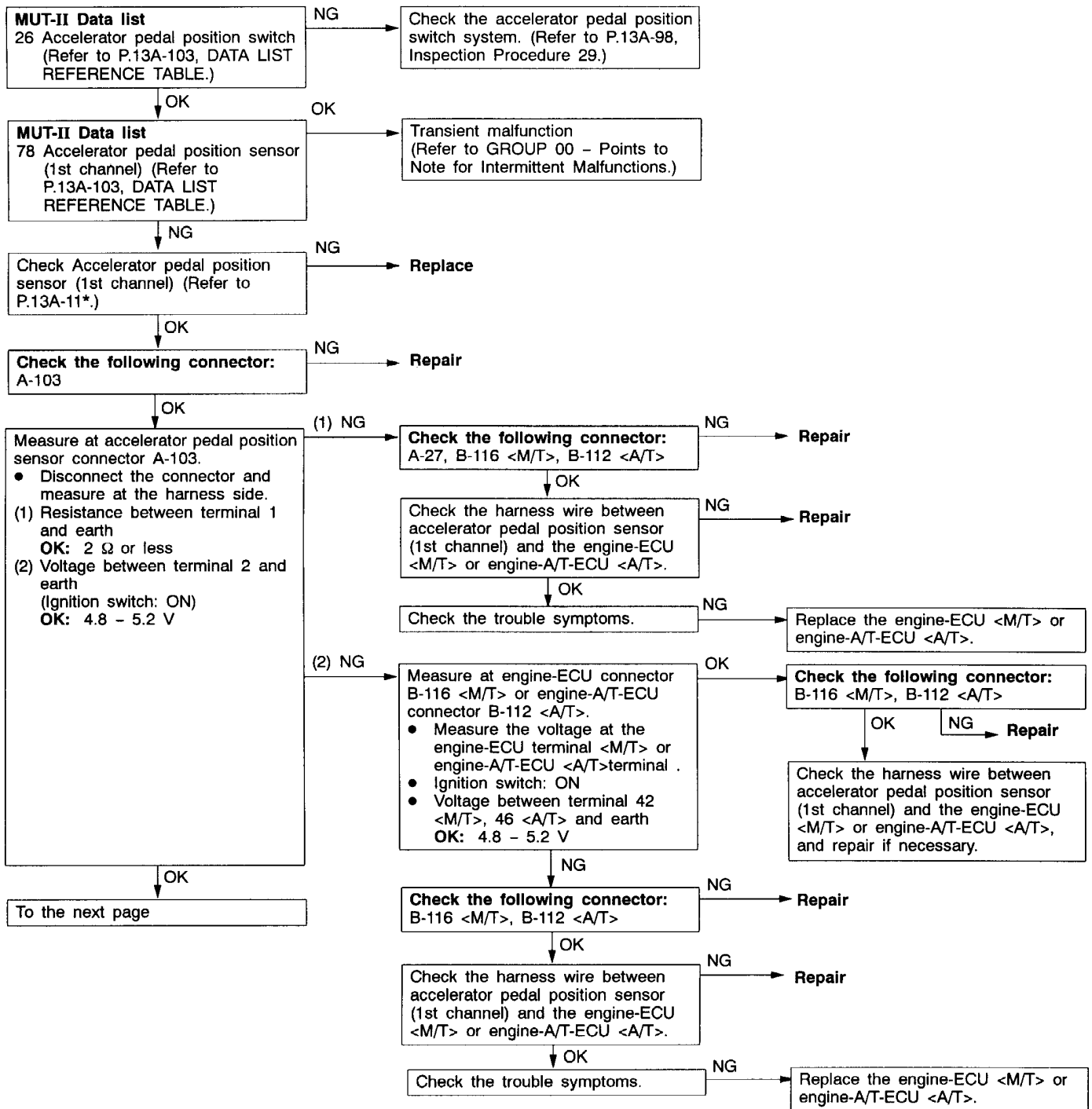




Code No. P0204 No. 4 injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine speed is 4,000 r/min or less. • The battery voltage is 10 V or more. • The fuel cut operation or the injector operation (by carrying out the Actuator Test) is not in progress. <p>Set 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-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>

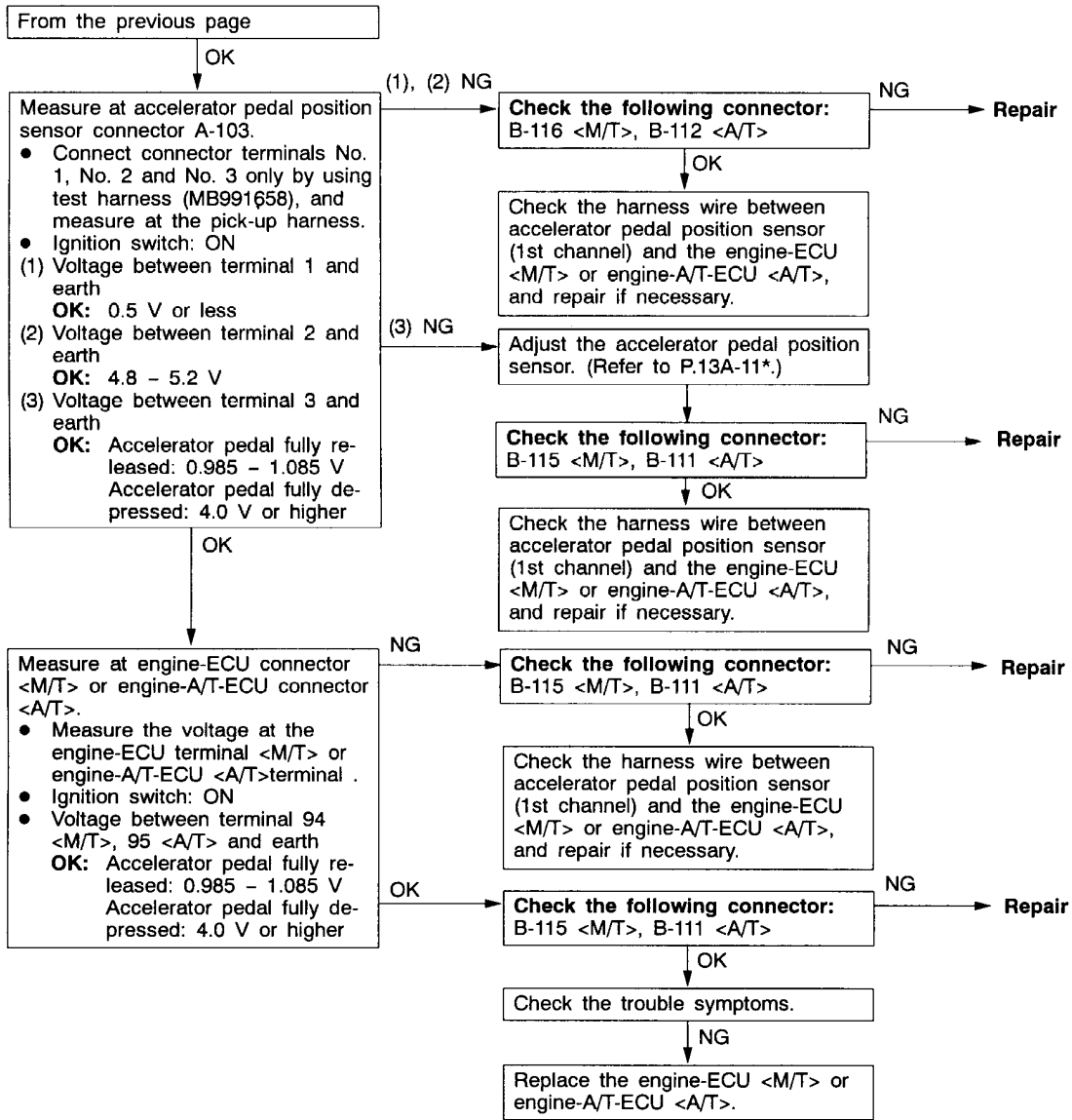


Code No. P0220 Accelerator pedal position sensor (1st channel) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● Accelerator pedal position sensor (2nd channel) is normal. ● Communication between the engine-ECU <M/T> or engine-A/T-ECU <A/T> and the throttle valve controller is normal. <p>Set Conditions</p> <ul style="list-style-type: none"> ● The output voltage of accelerator pedal position sensor (1st channel) is 0.2 V or less for one second. <p>or</p> <ul style="list-style-type: none"> ● The output voltage of accelerator pedal position sensor (2nd channel) is 2.5 V or less, and that of accelerator pedal position sensor (1st channel) is 4.5 V or more for one second <p>or</p> <ul style="list-style-type: none"> ● The difference between accelerator pedal position sensor (1st channel) and accelerator pedal position sensor (2nd channel) output voltages is 1.0 V or more (i.e. the throttle opening angle changes slightly). <p>or</p> <ul style="list-style-type: none"> ● The output voltage of accelerator pedal position sensor (1st channel) is 1.875 V or more for one second when the accelerator pedal position switch is turned on. 	<ul style="list-style-type: none"> ● Malfunction of accelerator pedal position sensor (1st channel) ● Open or short circuit in the accelerator pedal position sensor (1st channel) circuit or loose connector contact ● Accelerator pedal position switch seized ON ● Malfunction of throttle valve controller ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>



NOTE:

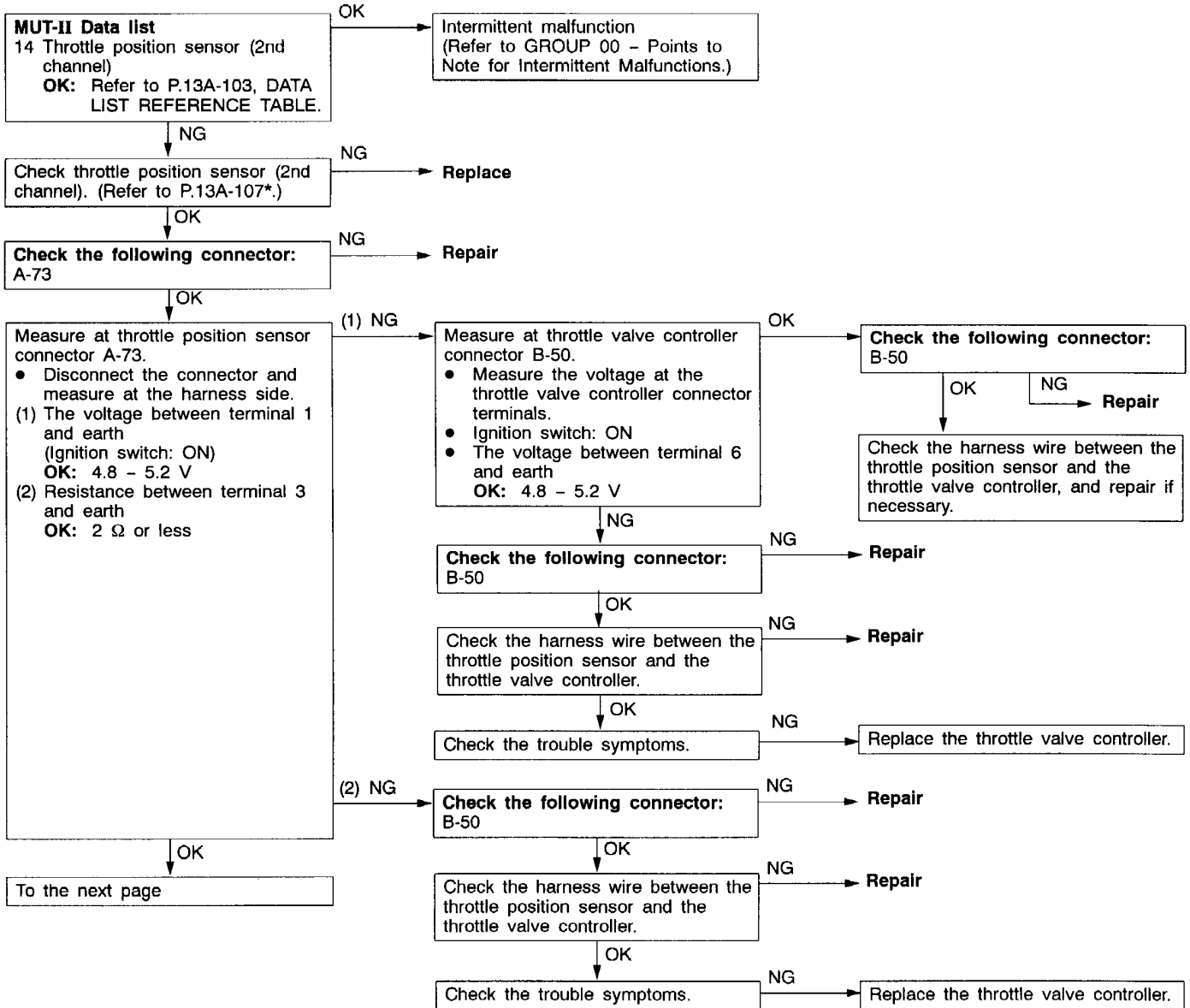
*: Refer to the '00 SPACE RUNNER Workshop Manual (Pub. No. PWDE9803-A).



NOTE:

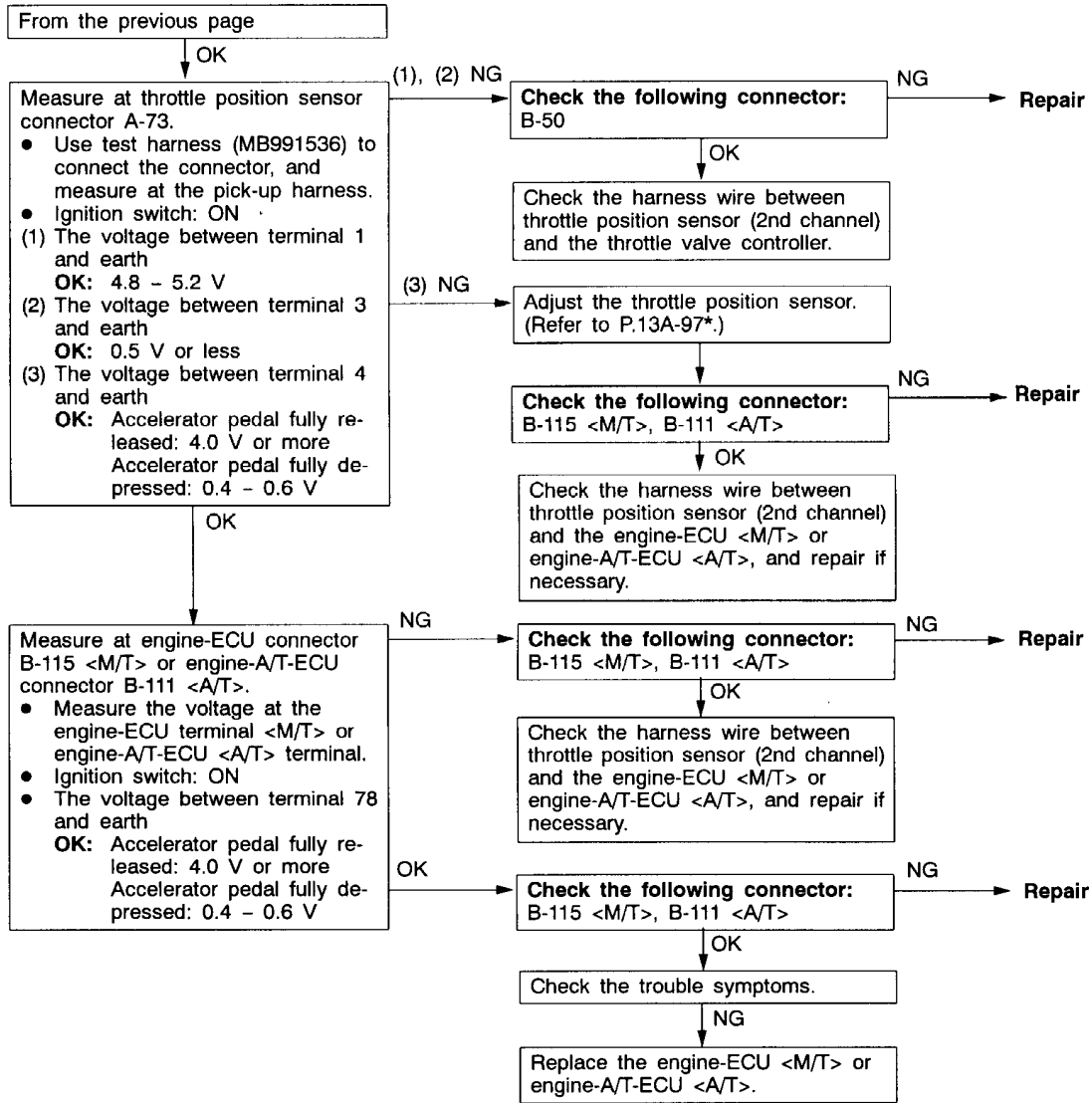
*: Refer to the '00 SPACE RUNNER Workshop Manual (Pub. No. PWDE9803-A).

Code No. 0225 Throttle position sensor (2nd channel) system	Probable cause
<p>The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU <M/T> or engine-A/T-ECU <A/T>.</p> <p>Range of Check</p> <ul style="list-style-type: none"> ● Ignition switch: ON ● The throttle position sensor (1st channel) is normal. <p>Set Conditions</p> <ul style="list-style-type: none"> ● The sensor output voltage is 0.2 V or less for four seconds. <p>or</p> <ul style="list-style-type: none"> ● The sensor output voltage is 4.85 V or more for four seconds, and the output voltage of the throttle position sensor (1st channel) is 1.2 V or more. <p>or</p> <ul style="list-style-type: none"> ● The throttle position sensor (1st channel) and throttle position sensor (2nd channel) combination output voltage is outside 4 – 6 V. 	<ul style="list-style-type: none"> ● Malfunction of throttle position sensor (2nd channel) ● Open or short circuit in the throttle position sensor (2nd channel) circuit or loose connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).



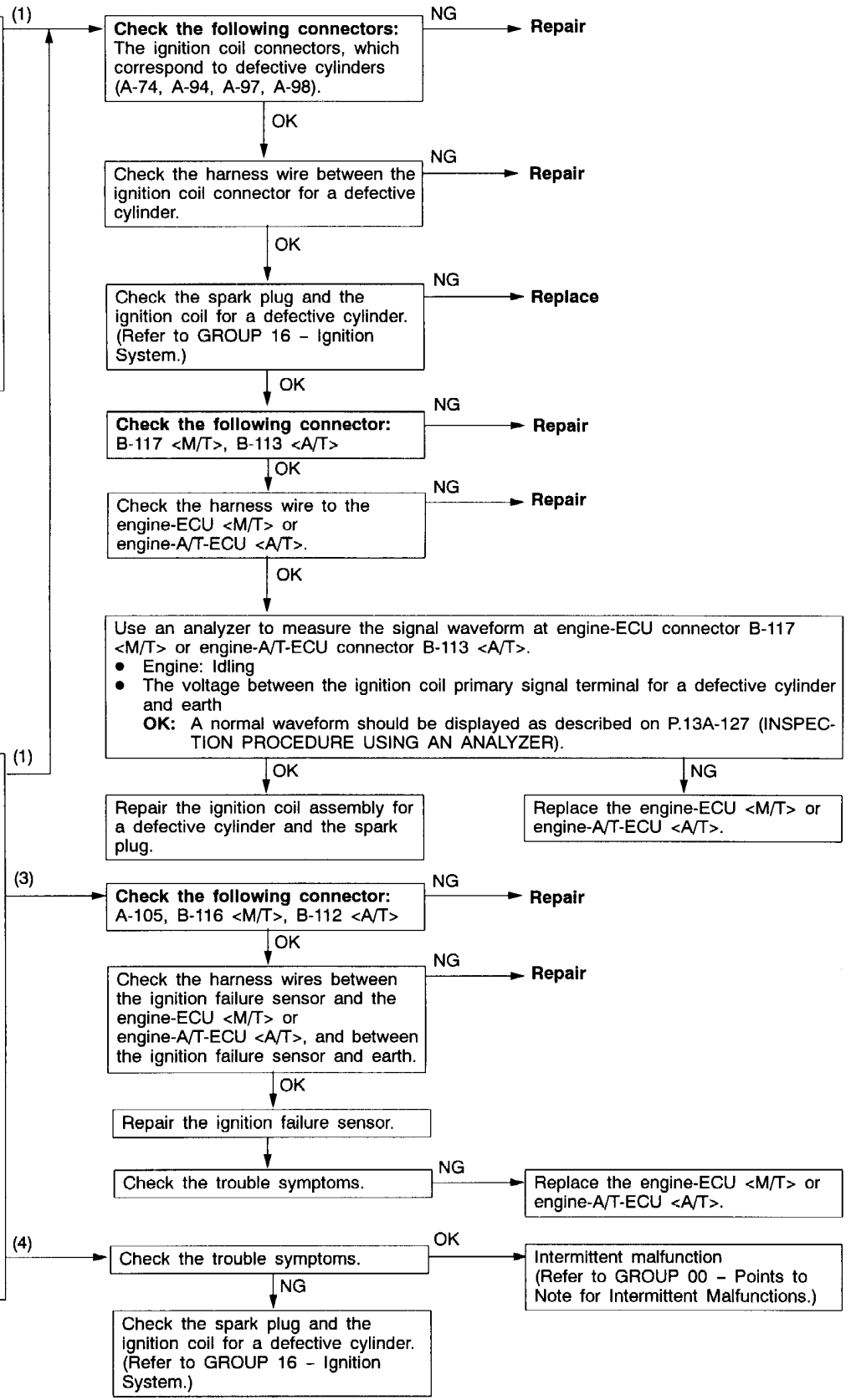
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

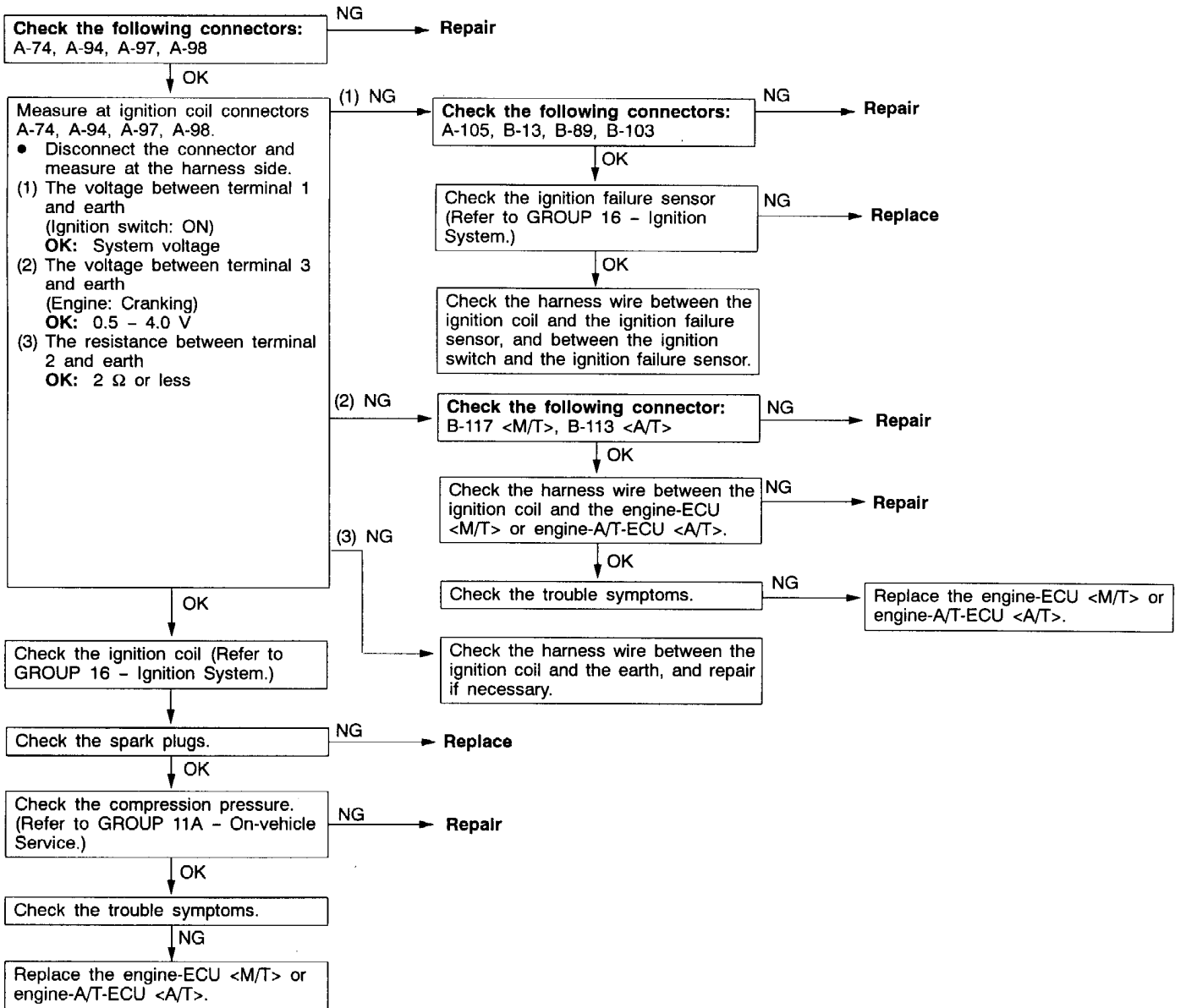
Code No. P0300 Ignition coil (power transistor) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • Engine speed is approx. 50 - 4,000 r/min. • Engine is not cranking. <p>Set Conditions</p> <ul style="list-style-type: none"> • The ignition failure sensor does not send a signal 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-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>

MUT-II Actuator Test
 01 No. 1 injector
 02 No. 2 injector
 03 No. 3 injector
 04 No. 4 injector
OK: The idling condition should change.
Reference
 When the cylinder (defective cylinder) where idling condition does not change is detected after suspending the injector, go to (1) and inspect the spark plug, the ignition coil, the connector, and the harness of the defective cylinder. (When more than one cylinder are detected, inspect all of them.) When all the cylinders are OK, go to (2).

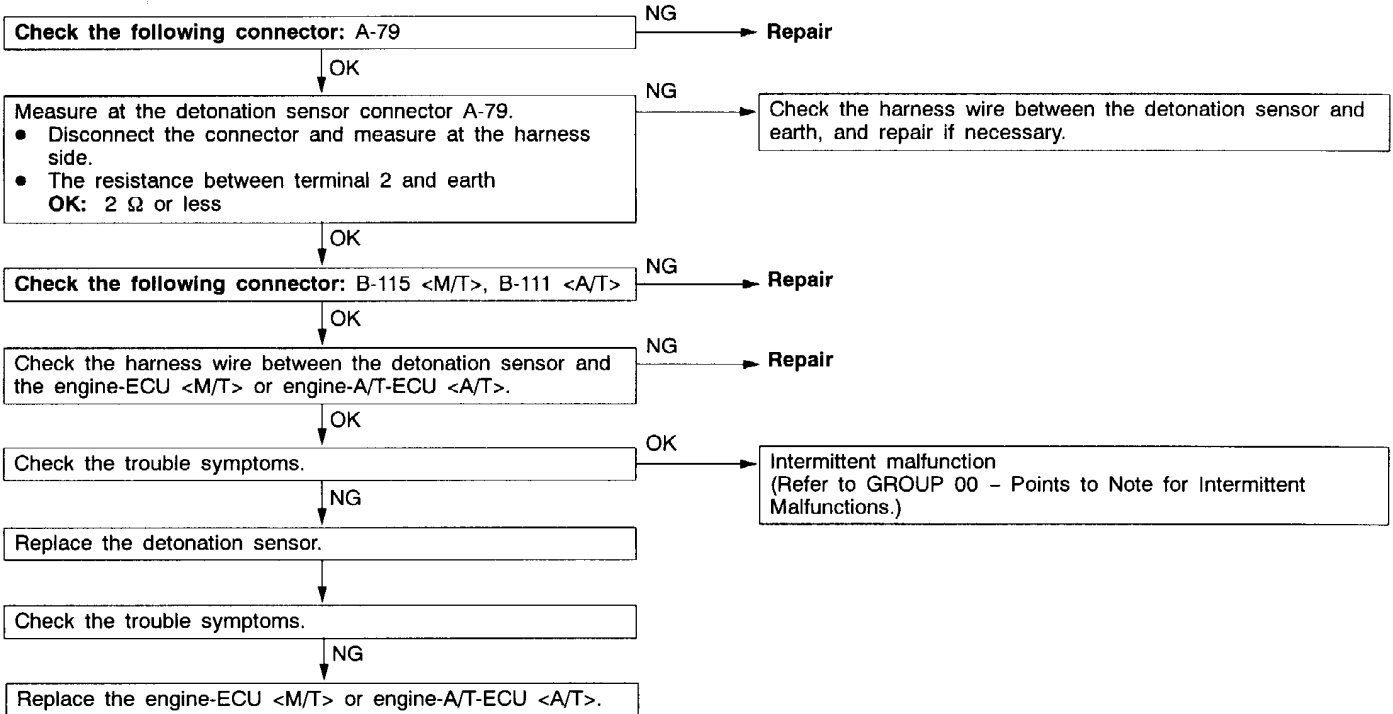
Use an analyzer to measure the signal waveform at the ignition failure sensor connector A-105.
 • Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
 • Engine: Idling
 • The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13A-127 (INSPECTION PROCEDURE USING AN ANALYZER).
Reference
 When a normal waveform is displayed, compare it with that of the ignition coil primary signal at the engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal to determine the cylinder (defective cylinder) with an abnormal waveform.
 →When one or more cylinders are abnormal, go to (1)
 →When all of the cylinders are abnormal, go to (3)
 →When a normal waveform is displayed, go to (4).



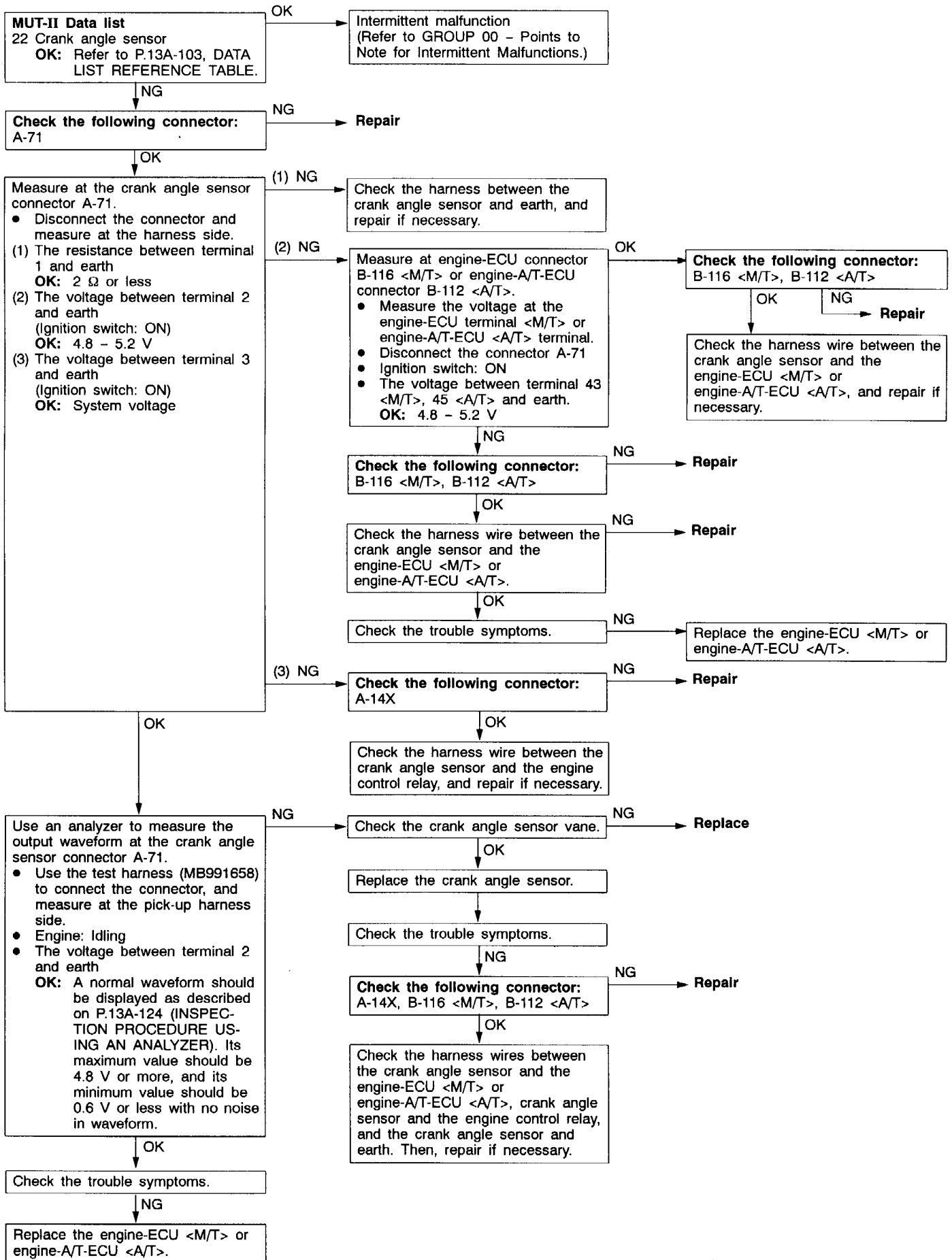
<p>Code No. P0301 No. 1 cylinder misfire detected Code No. P0302 No. 2 cylinder misfire detected Code No. P0303 No. 3 cylinder misfire detected Code No. P0304 No. 4 cylinder misfire detected</p>	<p>Probable cause</p>
<p>Range of Check</p> <ul style="list-style-type: none"> The engine speed is 500 - 4,500 r/min. While the engine is running except deceleration and sudden acceleration. <p>Set Conditions</p> <ul style="list-style-type: none"> The number of misfires exceeds a predetermined number per 200 engine revolutions (Misfire has occurred in only one cylinder). <p>or</p> <ul style="list-style-type: none"> The number of misfires exceeds a predetermined number per 100 engine revolutions (Misfire has occurred in only one cylinder). 	<ul style="list-style-type: none"> Malfunction of the ignition system Abnormal compression Malfunction of injector Malfunction of engine-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>



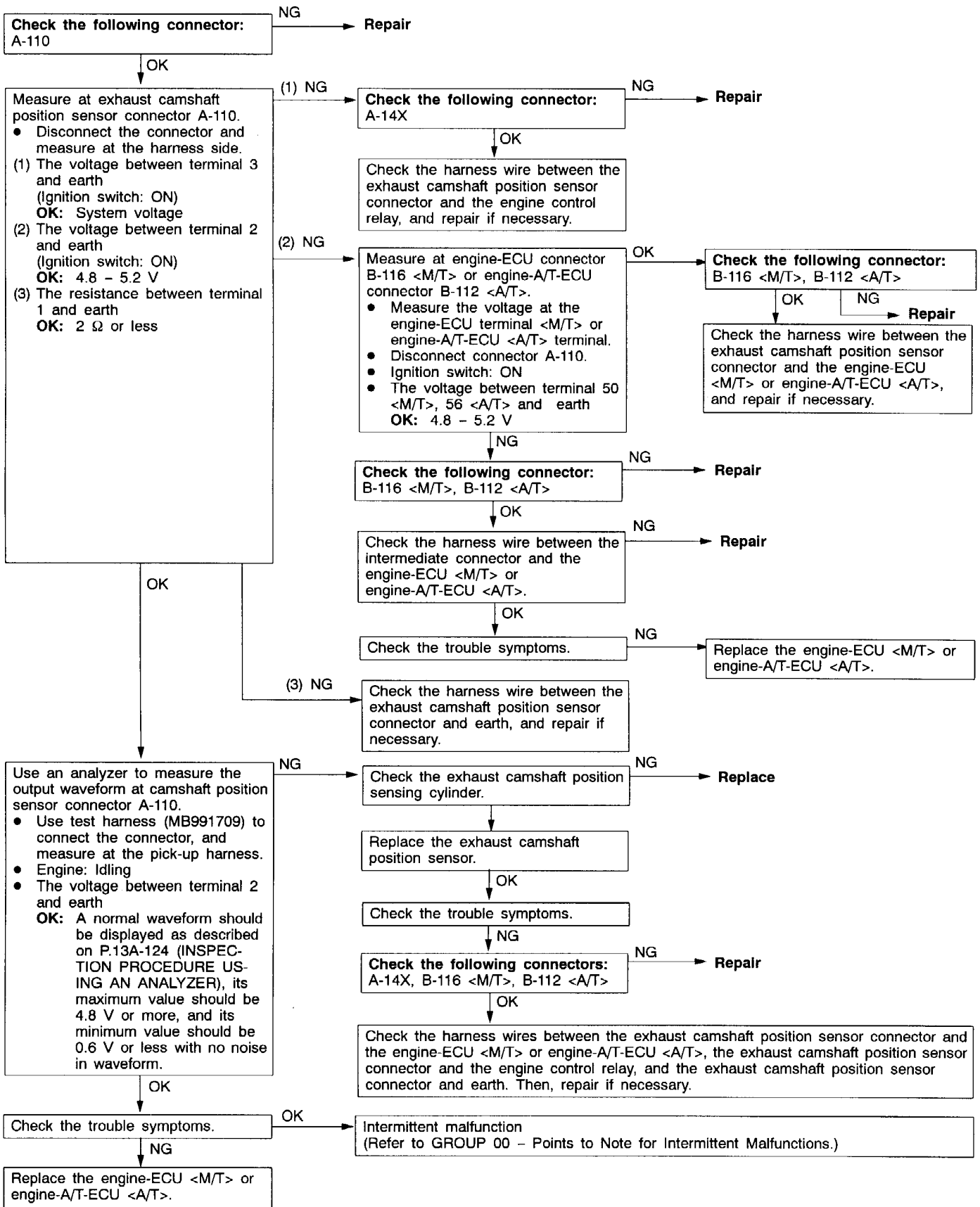
Code No. P0325 Detonation sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● Changes in sensor output voltage (detonation sensor peak voltage per 1/3 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	● Malfunction of the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



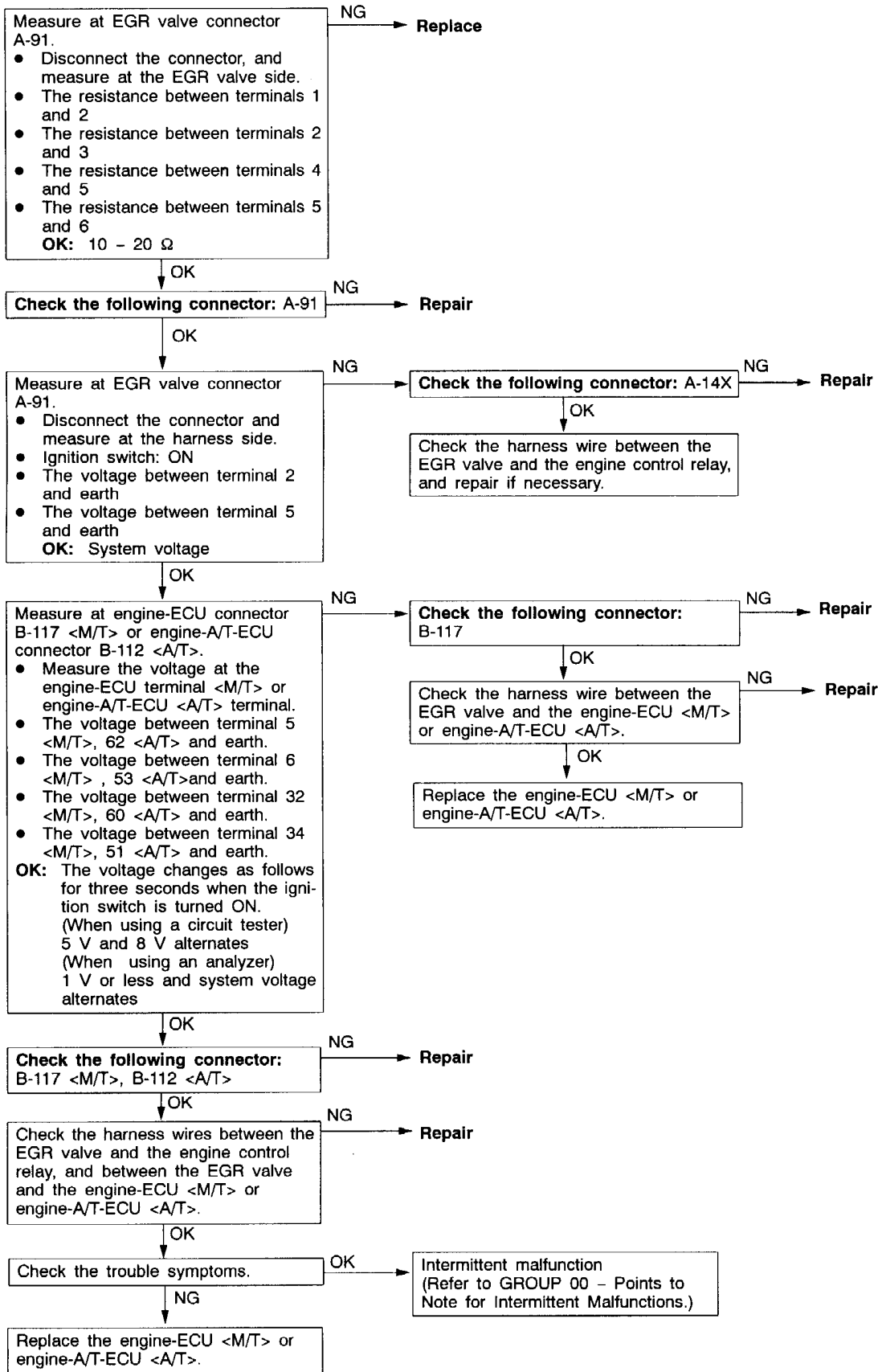
Code No. P0335 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking Set Conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the crank angle sensor. ● Open or short circuit in the crank angle sensor circuit or loose connector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



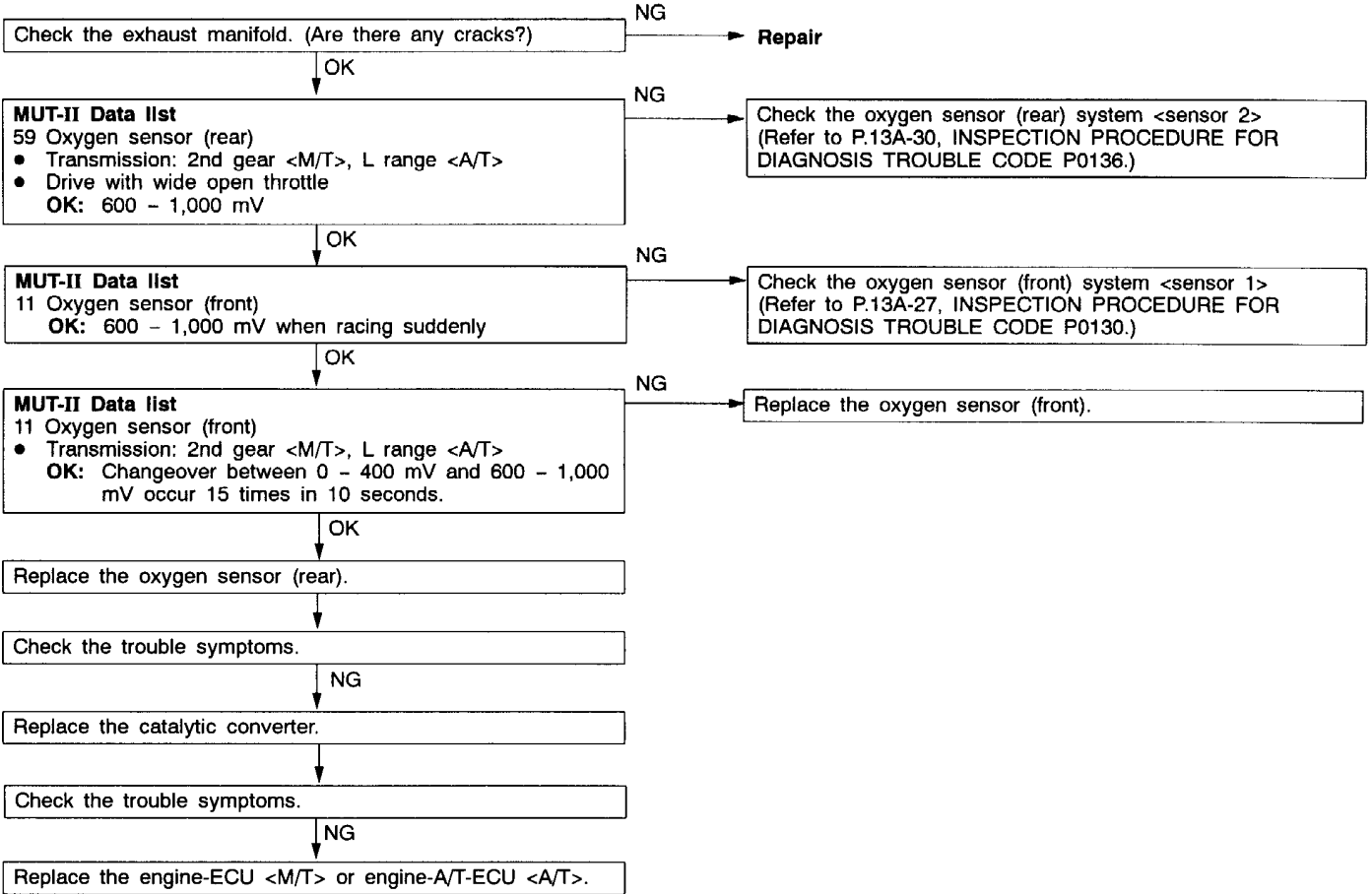
Code No. P0340 Exhaust camshaft position sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none">● After the engine was started <p>Set Conditions</p> <ul style="list-style-type: none">● The sensor output voltage does not change for 4 seconds (no pulse signal input).	<ul style="list-style-type: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



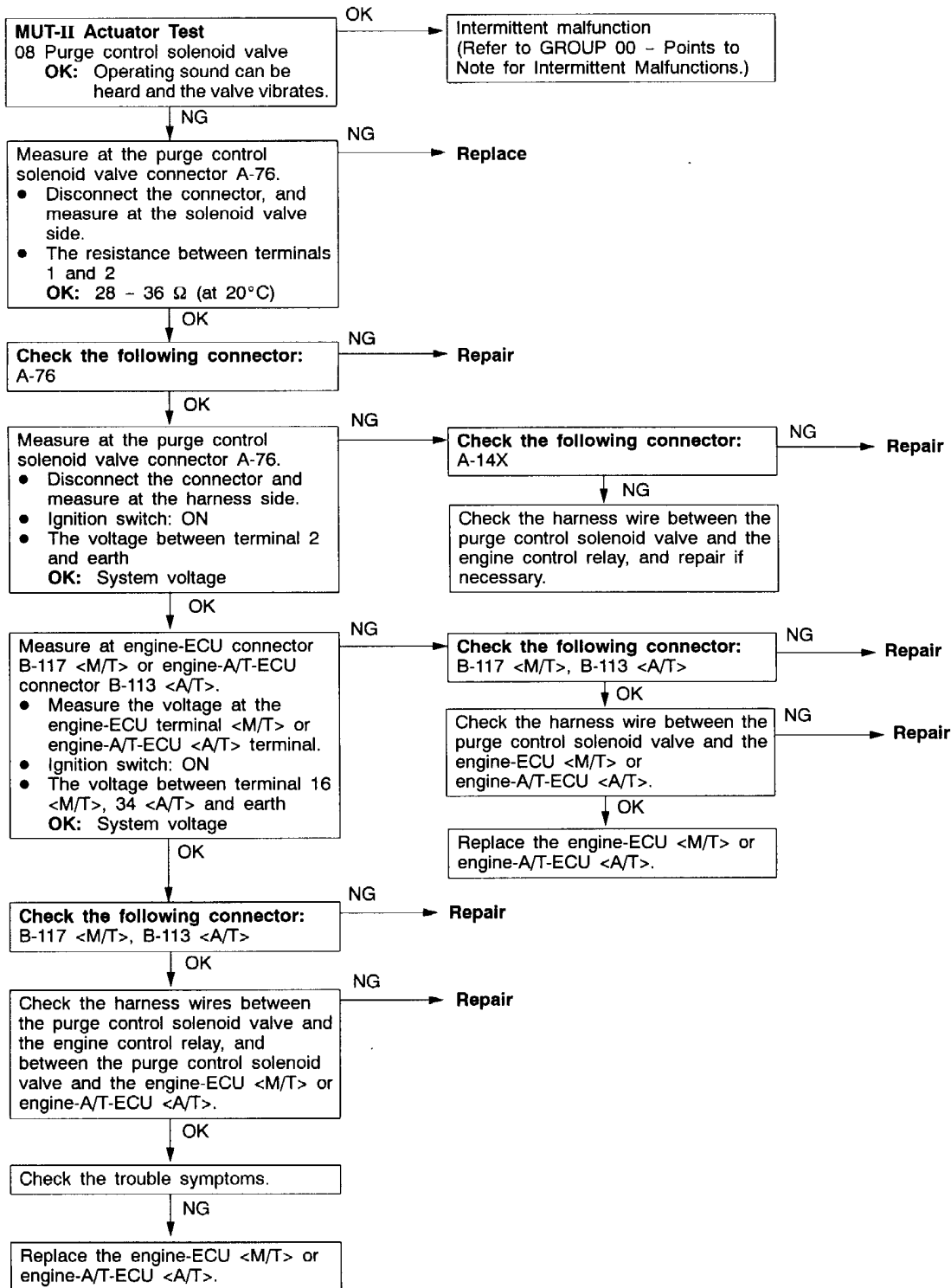
Code No. P0403 EGR valve system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none">● Ignition switch: OFF to ON● EGR valve is in operation after the engine starting process is complete. <p>Set Conditions</p> <ul style="list-style-type: none">● Off-surge voltage is not generated from 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-ECU <M/T>● Malfunction of engine-A/T-ECU <A/T>



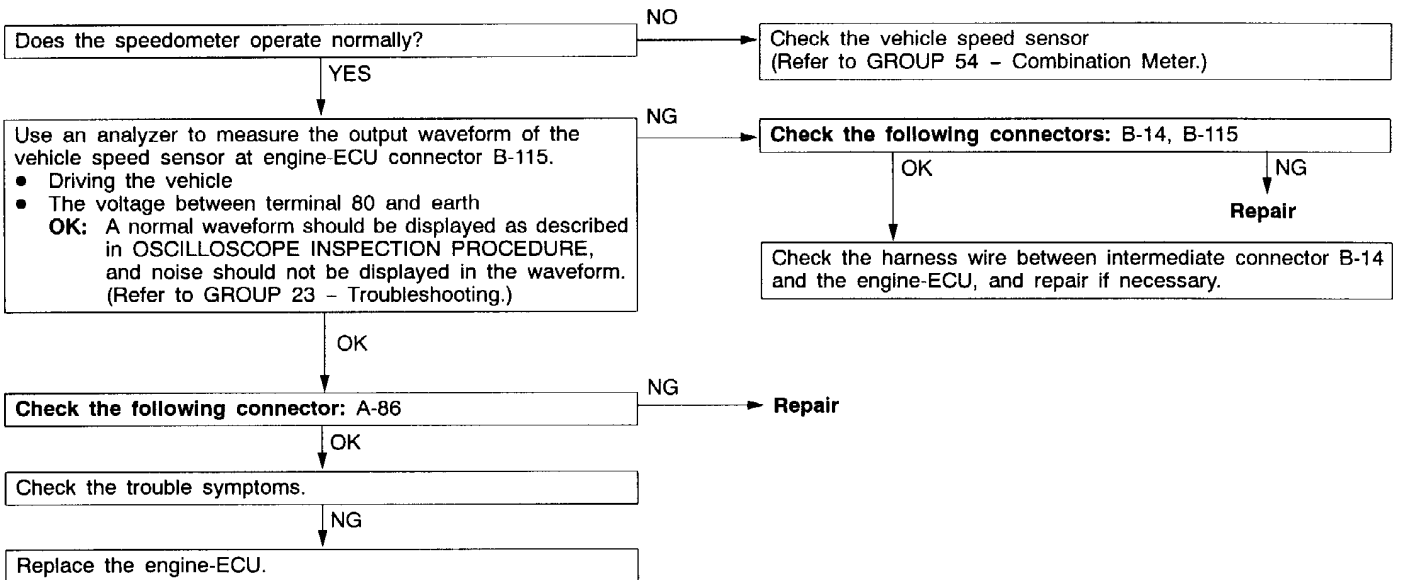
Code No. P0420 Catalyst malfunction	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine speed is 3,000 r/min or less. • During driving • During air/fuel ratio feedback control <p>Set Conditions</p> <ul style="list-style-type: none"> • The ratio between the oxygen sensor (rear) and the oxygen sensor (front) output frequencies reaches 0.8 per 12 seconds on average. 	<ul style="list-style-type: none"> • Malfunction of catalyst • Malfunction of the oxygen sensor (front) • Malfunction of the oxygen sensor (rear) • Malfunction of engine-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>



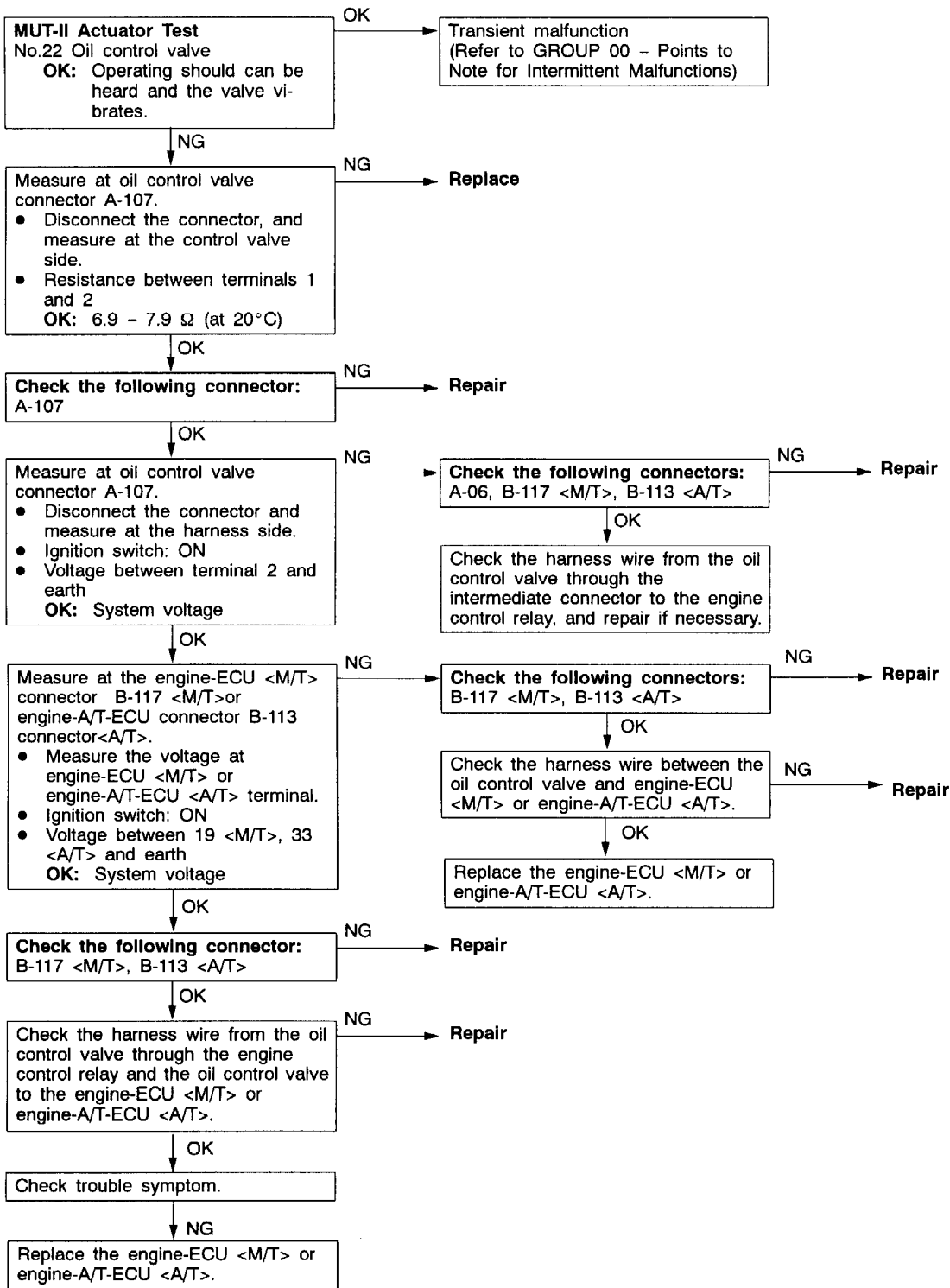
Code No. P0443 Purge control solenoid valve system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Battery voltage is 10 V or more. <p>Set Conditions</p> <ul style="list-style-type: none"> The solenoid coil surge voltage (battery voltage + 2 V) is not detected 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-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>



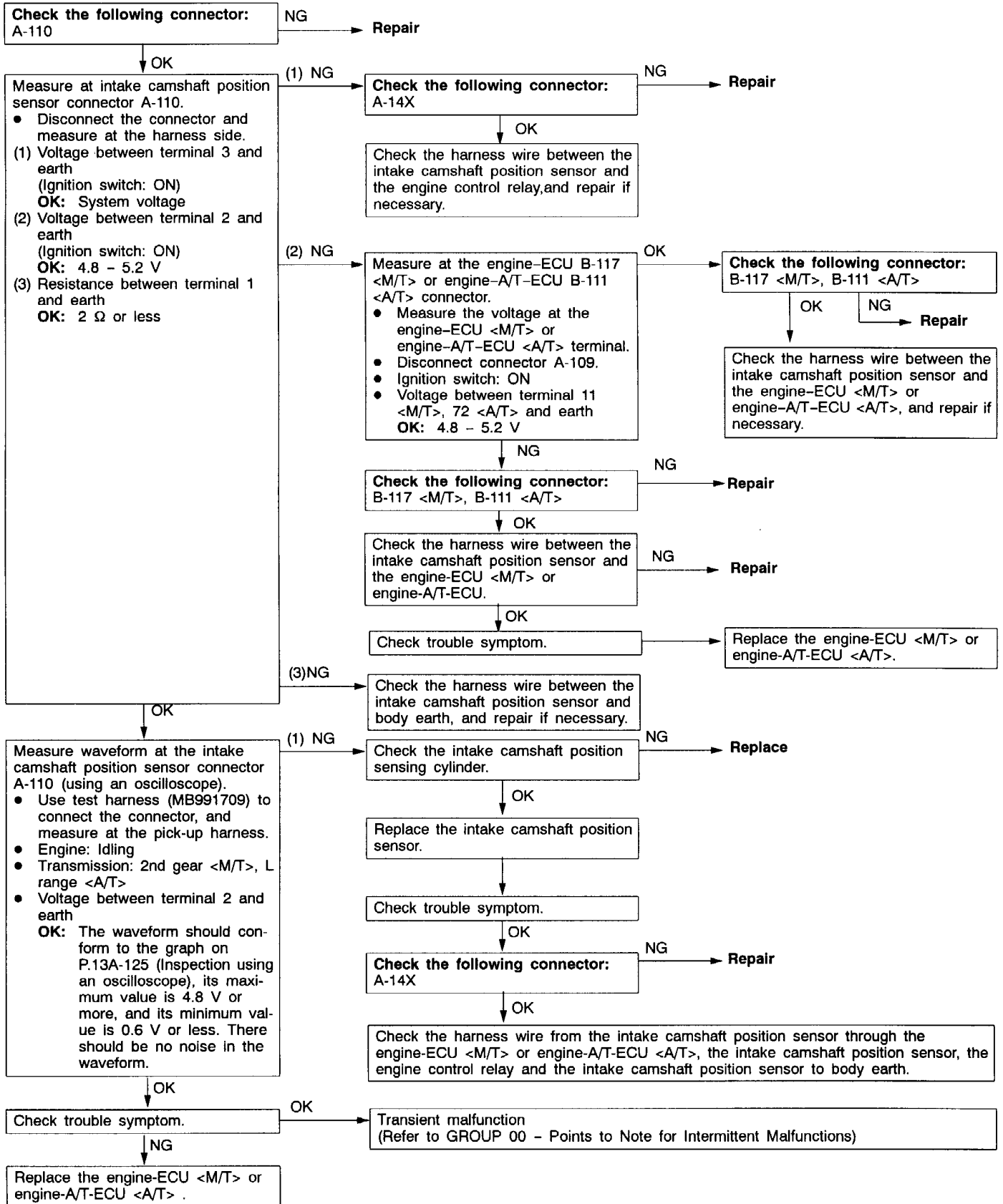
Code No. P0500 Vehicle speed sensor system <M/T>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load <p>Set Conditions</p> <ul style="list-style-type: 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-ECU



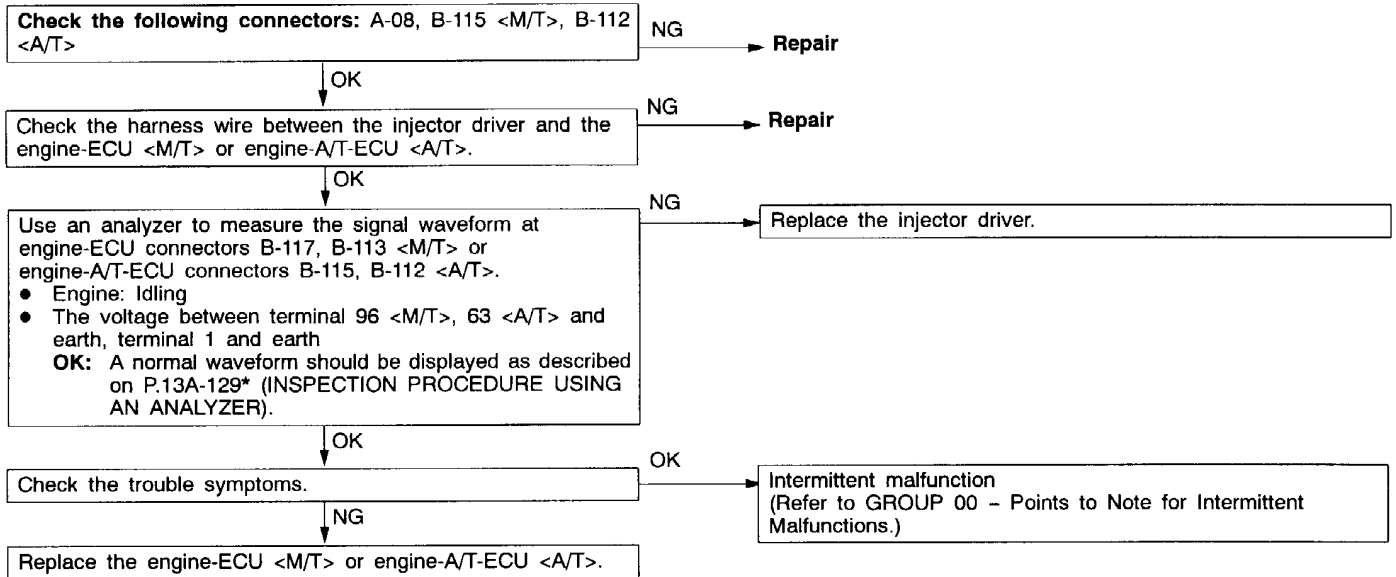
Code No. P1010 Oil control valve system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● When the oil control valve is off (for example, when the ignition switch is on or the engine is idling) <p>Set Conditions</p> <ul style="list-style-type: none"> ● The voltage at the oil control valve activating terminal of the engine-A/T-ECU is abnormal for more than 4 seconds. 	<ul style="list-style-type: none"> ● The oil control valve is defective. ● The oil control valve circuit is short or open, or connector contact is loose ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



Code No. P1012 Intake camshaft position sensor system	Probable cause
Range of Check • Engine: During cranking and running Set Conditions • The sensor output voltage does not change for 4 seconds (no pulse signal input).	• Malfunction of intake camshaft position sensor • Intake camshaft position sensor circuit short or open, or loose connector contact • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



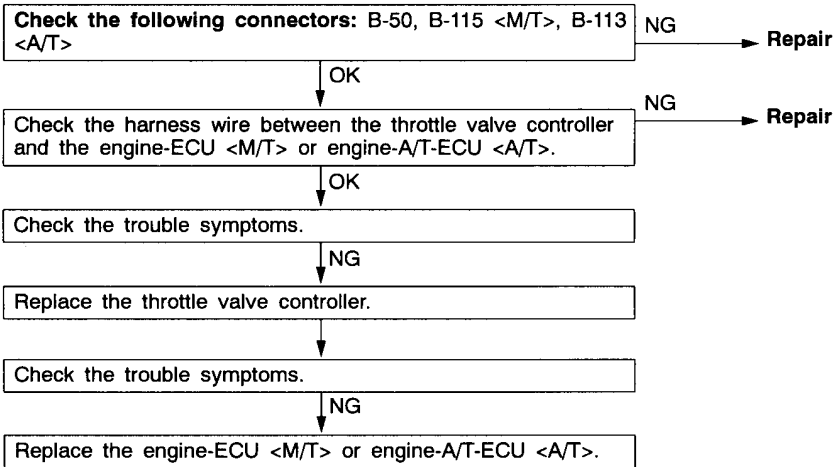
Code No. P1200 Injector driver system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● Engine speed: 4,000 r/m or less ● Battery voltage: 10 V or more ● The fuel cut operation and the injector operation (by carrying out the Actuator test) are not in progress. ● During high engine load <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-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>



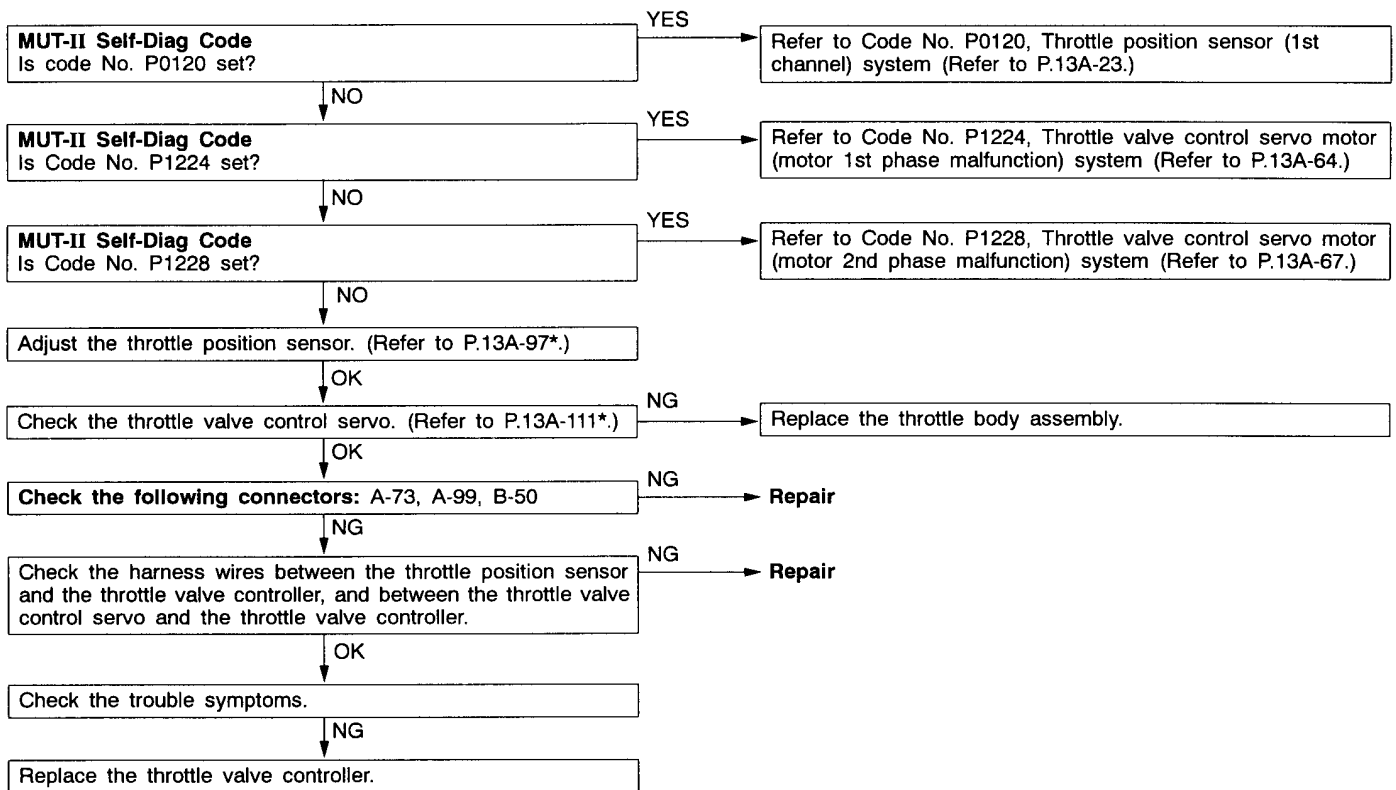
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

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-ECU <M/T> or engine-A/T-ECU <A/T> and the throttle valve controller <p>Set Conditions</p> <ul style="list-style-type: none"> Output voltage of throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value, based on that of the accelerator pedal position sensor (2nd channel). <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-ECU <M/T> or engine-A/T-ECU <A/T> <p>Set Conditions</p> <ul style="list-style-type: none"> The output voltage of the throttle position sensor (2nd channel) is significantly different (approx. 1 V) from the throttle valve opening angle (voltage), which the engine-ECU <M/T> or engine-A/T-ECU <A/T> request the throttle valve controller. 	<ul style="list-style-type: none"> Short in communication line Malfunction of the engine-ECU <M/T> Malfunction of the engine-A/T-ECU <A/T> Malfunction of the throttle valve controller



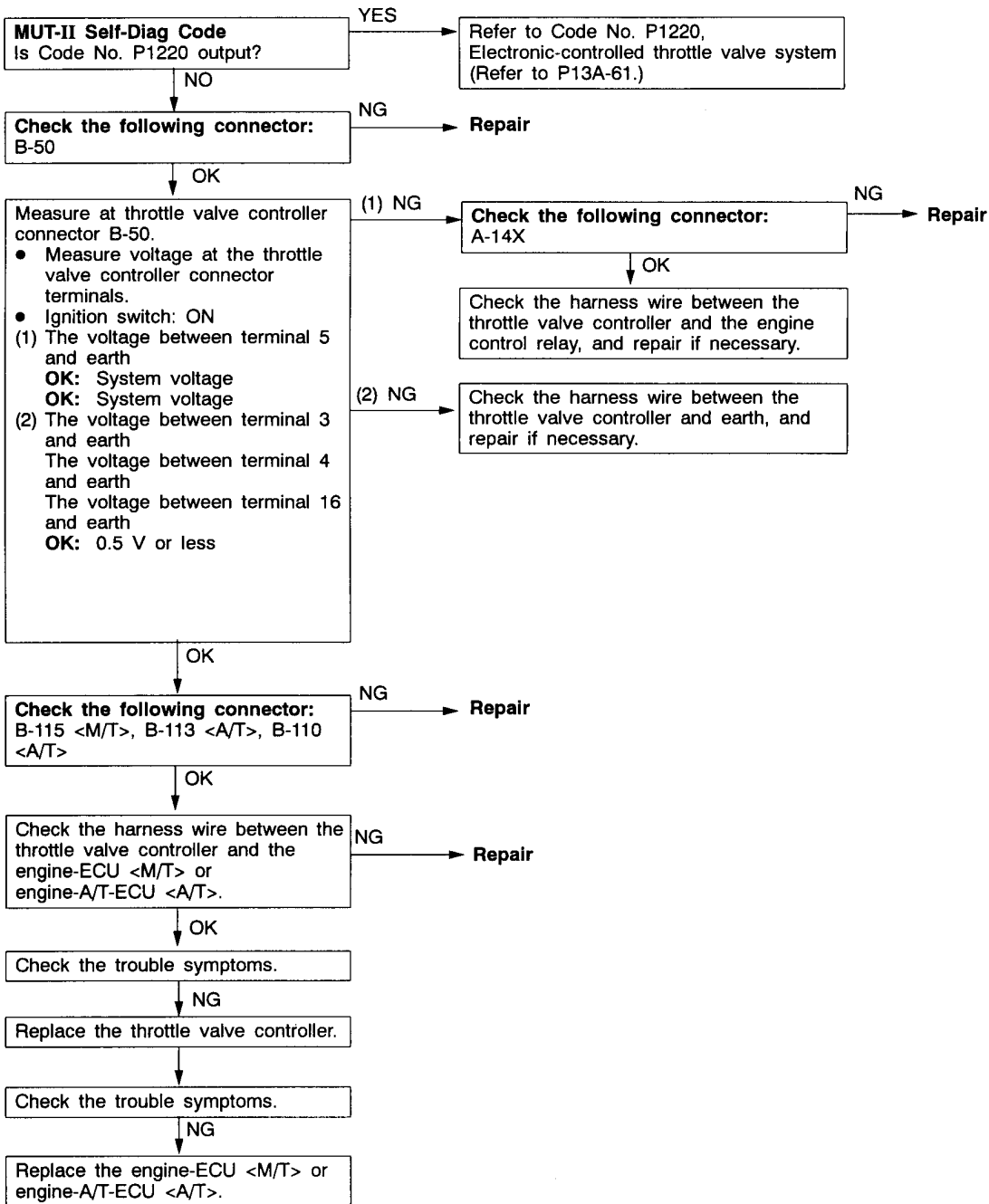
Code No. P1221 Throttle valve position feedback system	Probable cause
<p>The throttle valve controller judges a malfunction, and then transmit the result to the engine-ECU <M/T> or engine-A/T-ECU <A/T>.</p> <p>Range of Check</p> <ul style="list-style-type: none"> ● Ignition switch: ON ● Battery voltage: 10 V or more <p>Set Conditions</p> <ul style="list-style-type: none"> ● Failure in the motor position feedback (The engine-ECU <M/T> or engine-A/T-ECU <A/T> detects that the current in the motor is excessive and the opening angle difference between the target value of throttle position sensor (1st channel) and the actual value of throttle position sensor (1st channel) is 1.0 V or more) 	<ul style="list-style-type: none"> ● Malfunction of throttle position sensor (1st channel) ● Open or short circuit in the throttle position sensor (1st channel) circuit or loose connector contact ● Malfunction of the throttle valve controller



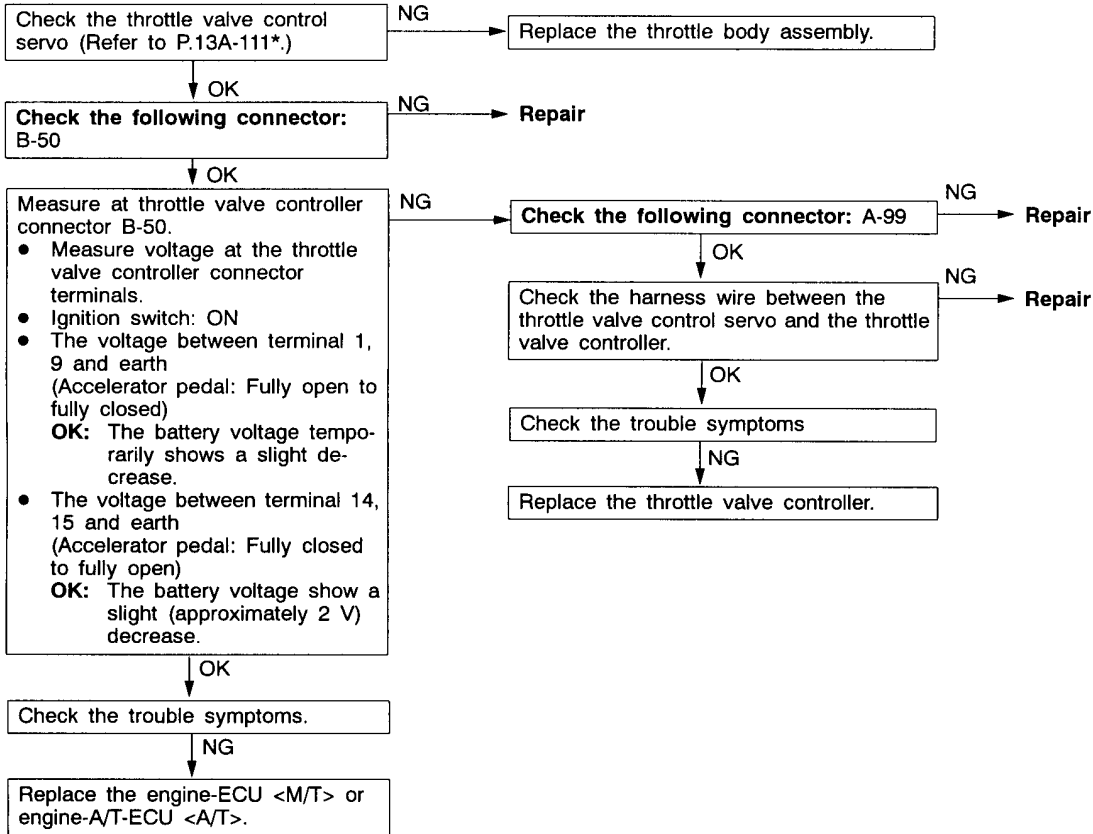
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

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



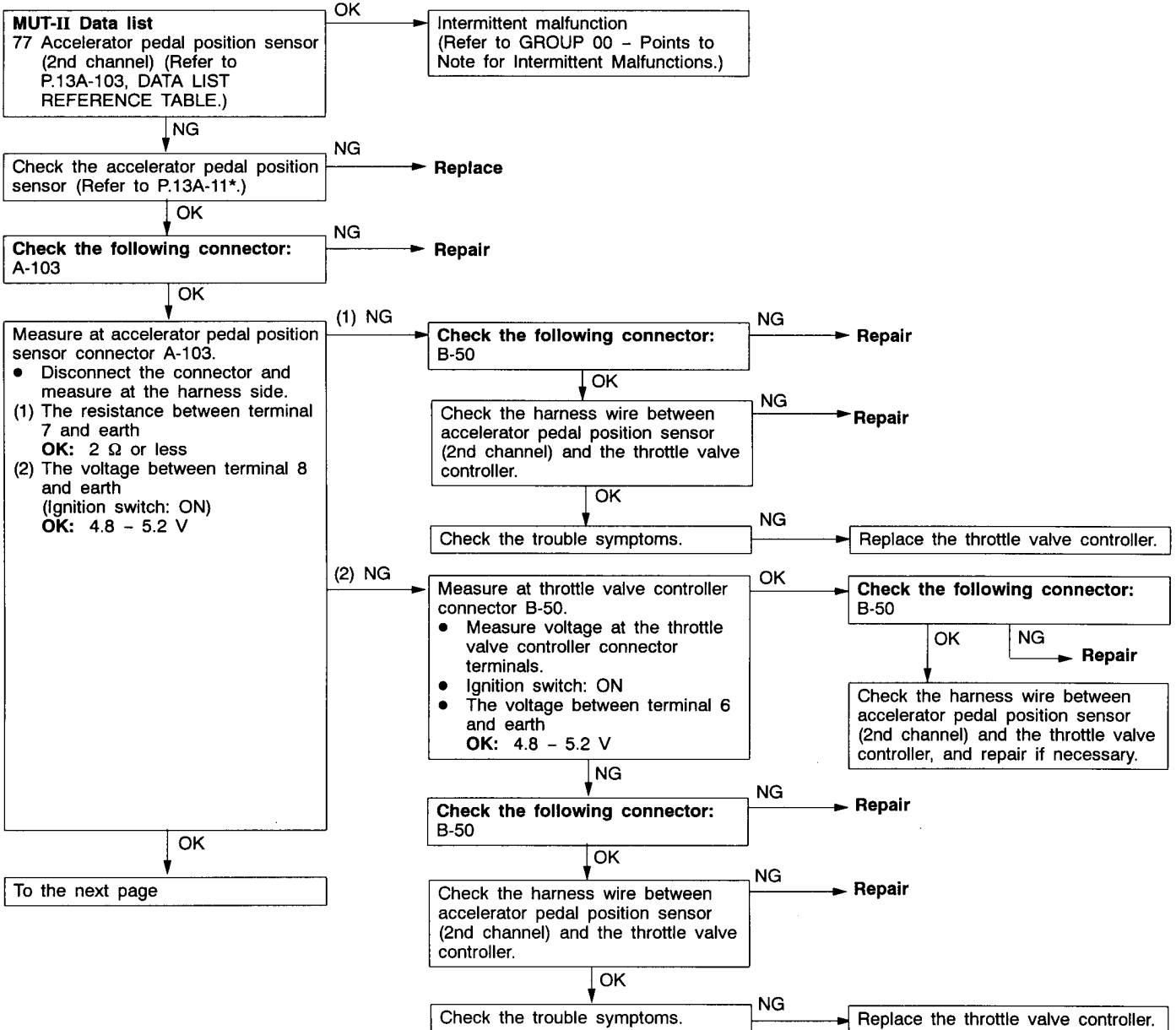
Code No. P1224 Throttle valve control servo motor (Motor 1st phase malfunction) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • Throttle valve control servo relay: ON • System voltage: 8 V or more. <p>Set Conditions</p> <ul style="list-style-type: none"> • Throttle valve control servo drive circuit is shorted to earth. • Other power source interferences with throttle valve control servo drive circuit. • Throttle valve control servo drive circuit is open circuit. 	<ul style="list-style-type: none"> • Malfunction of the throttle valve control servo • Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact • Malfunction of the throttle valve controller



NOTE:

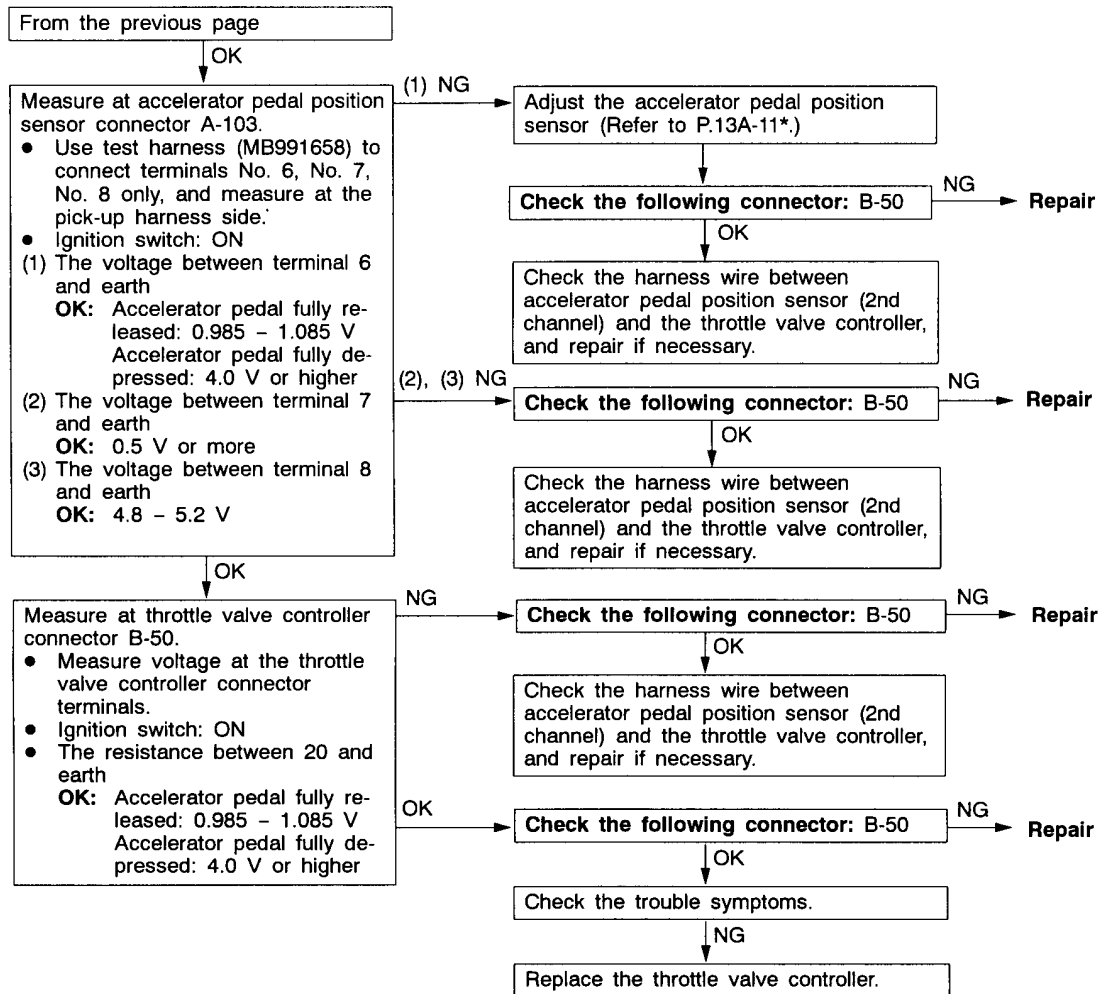
*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

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



NOTE:

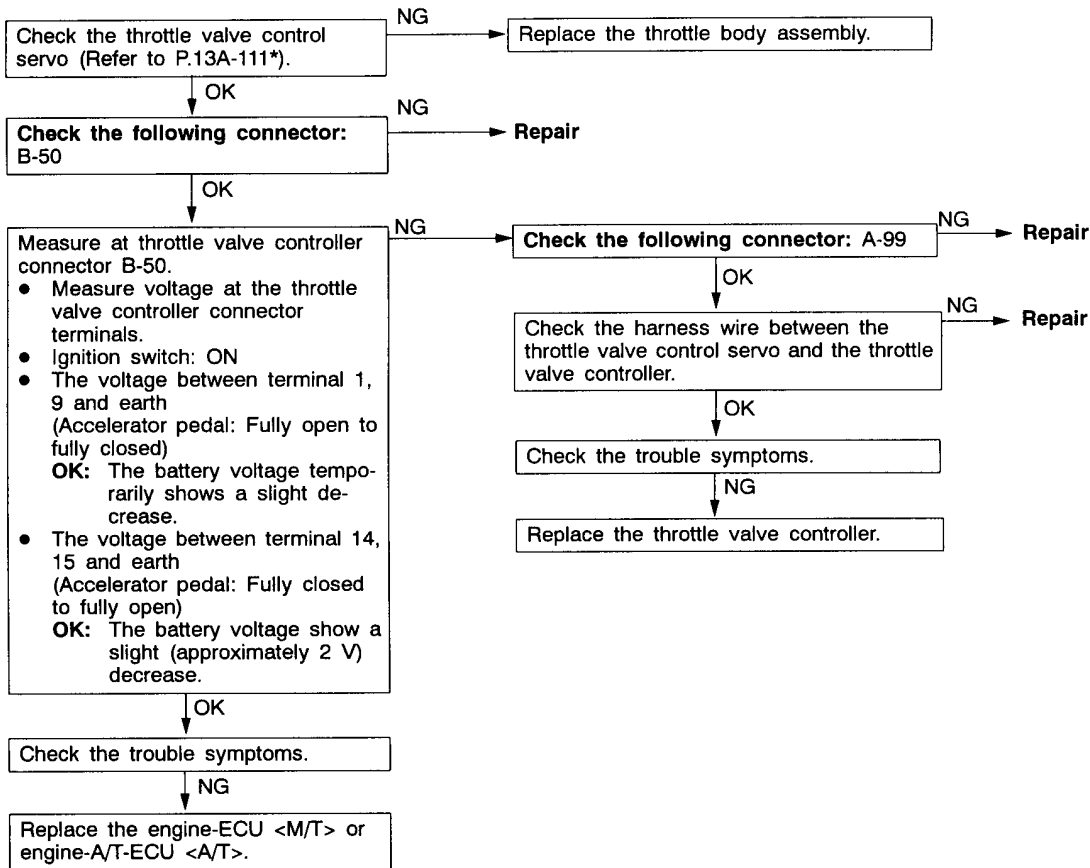
*: Refer to the '00 SPACE RUNNER Workshop Manual (Pub. No. PWDE9803-A).



NOTE:

*: Refer to the '00 SPACE RUNNER Workshop Manual (Pub. No. PWDE9803-A).

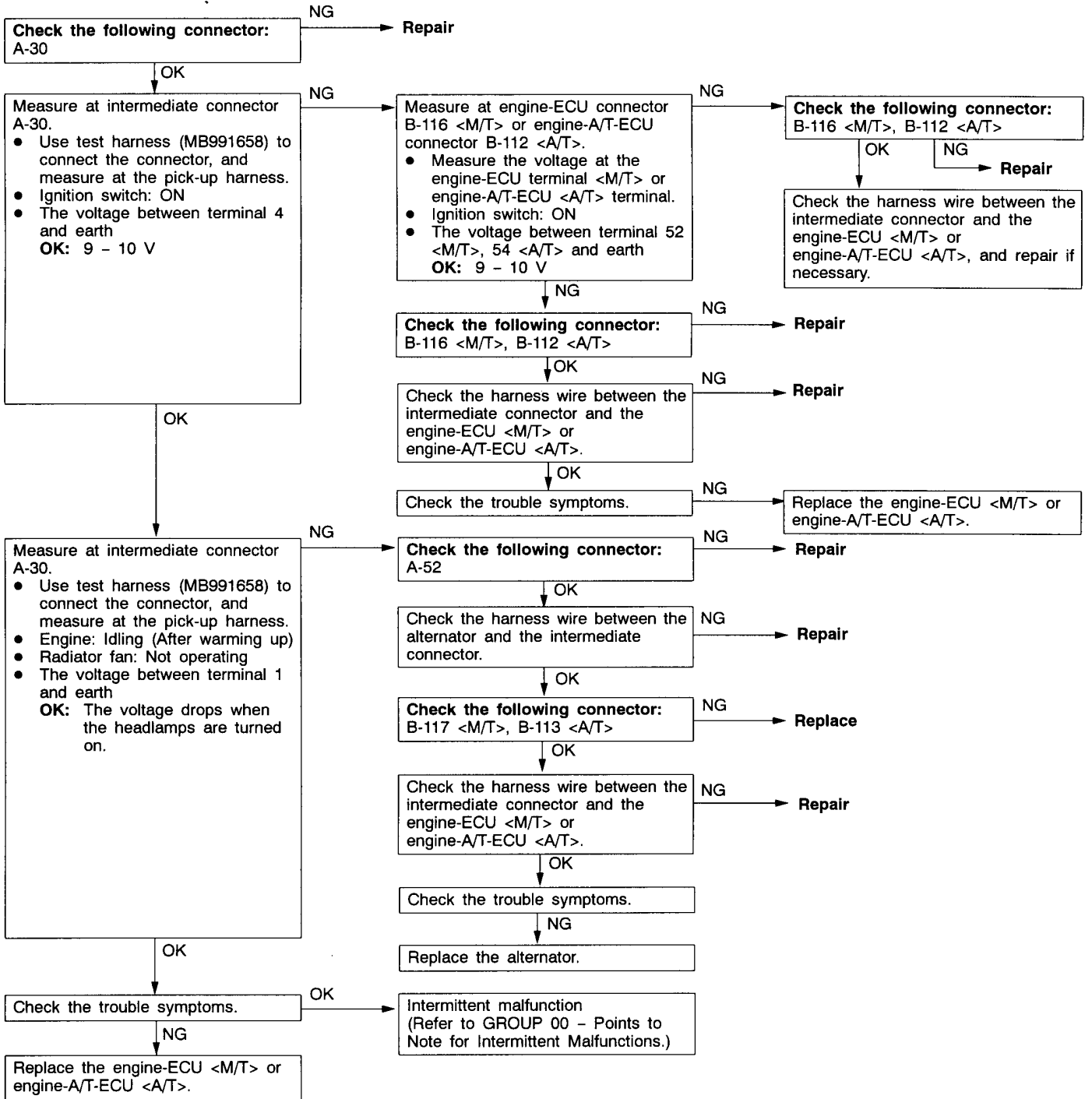
Code No. P1228 Throttle valve control servo motor (Motor 2nd phase malfunction) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • Throttle valve control servo relay: ON • System voltage: 8 V or more <p>Set Conditions</p> <ul style="list-style-type: none"> • Throttle valve control servo drive circuit is shorted to earth. • Other power source interferes with throttle valve control servo drive circuit. • Throttle valve control servo drive circuit is open-circuit. 	<ul style="list-style-type: none"> • Malfunction of the throttle valve control servo • Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact • Malfunction of the throttle valve controller



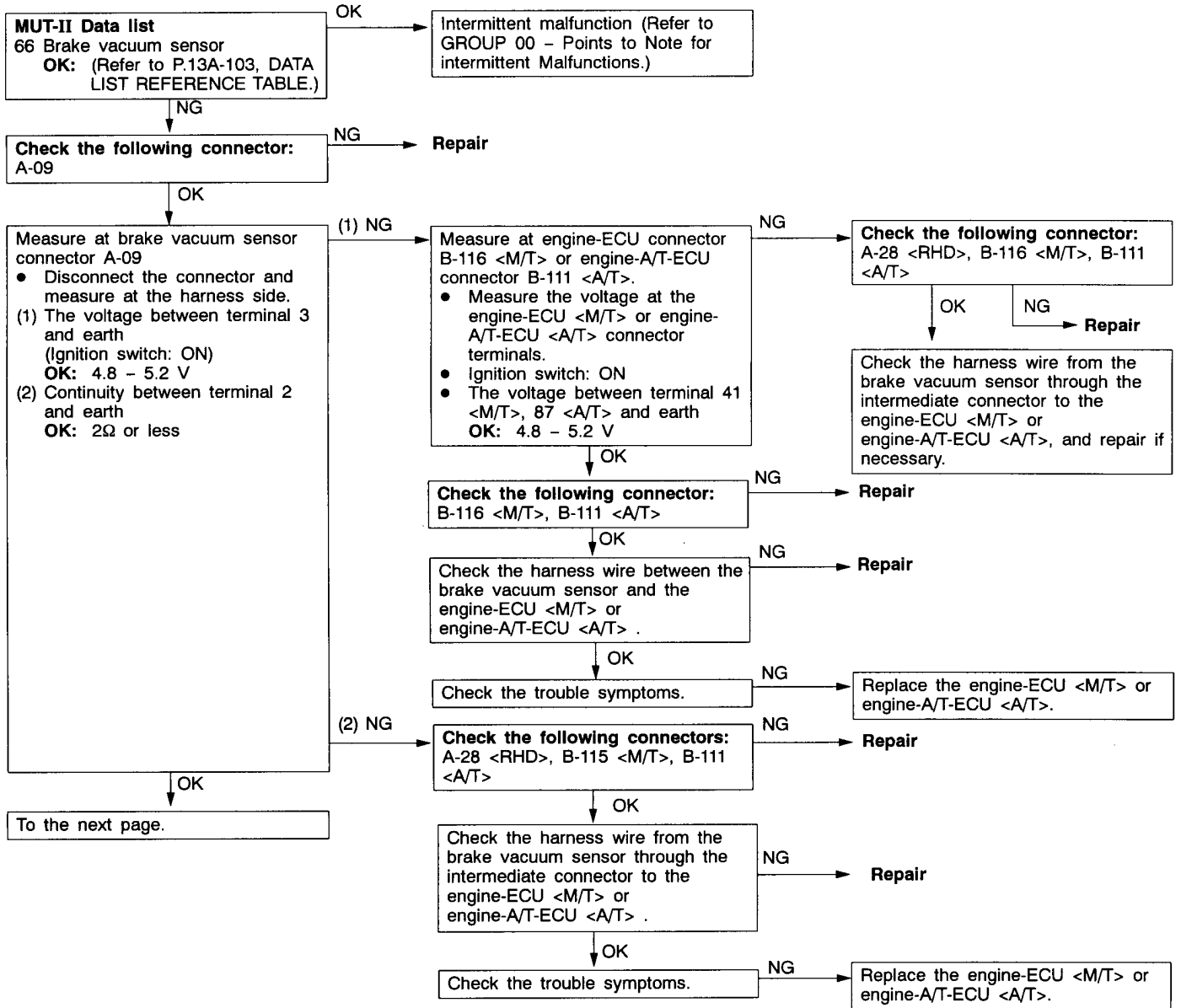
NOTE:

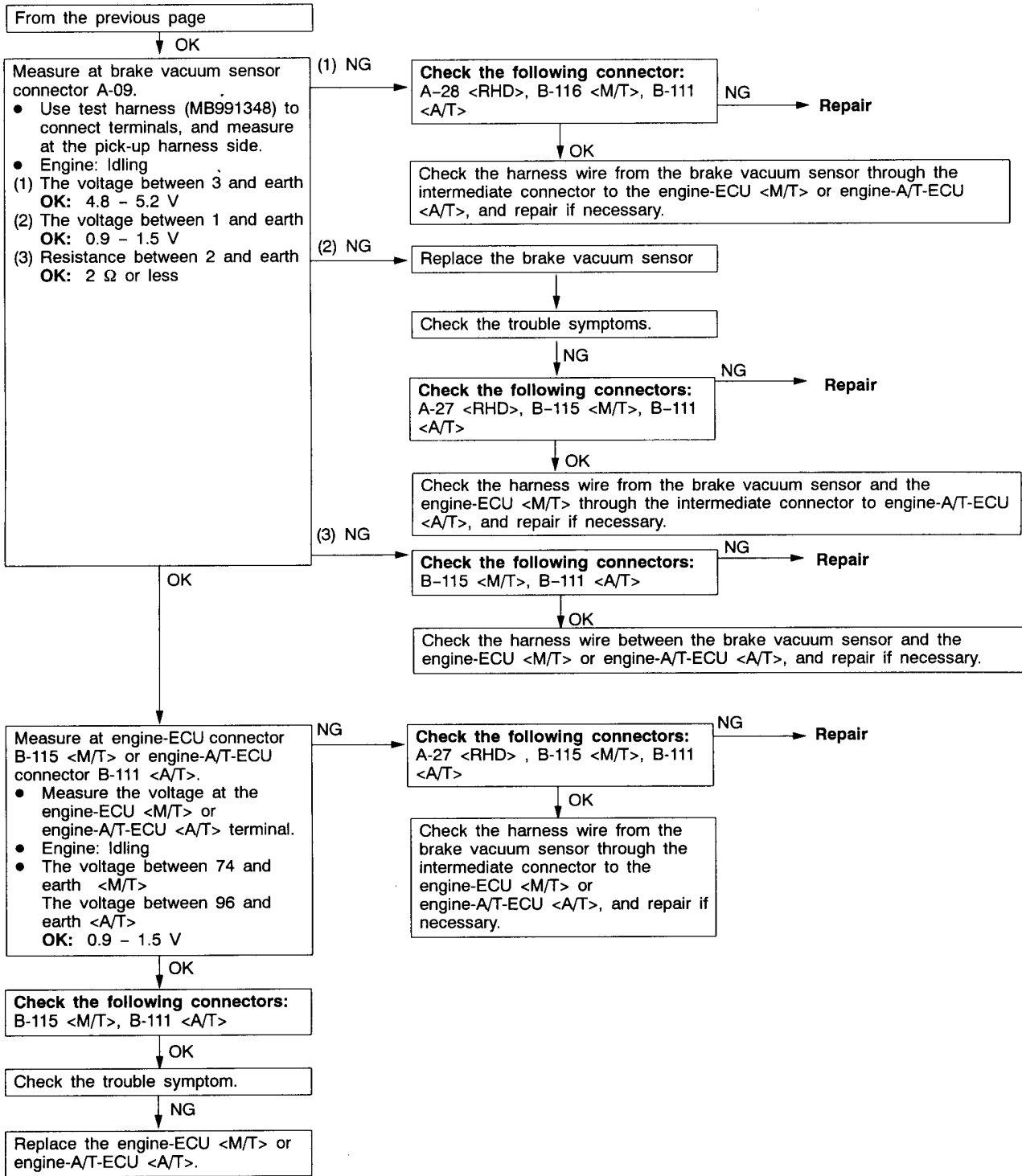
*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

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



Code No. P1515 Brake vacuum sensor system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Sensor output voltage is 4.8 V or more. or ● Sensor output voltage is 0.2 V or less.	<ul style="list-style-type: none"> ● Malfunction of the brake vacuum sensor ● Improper connector contact, open circuit or short-circuited harness wire of the brake vacuum sensor ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

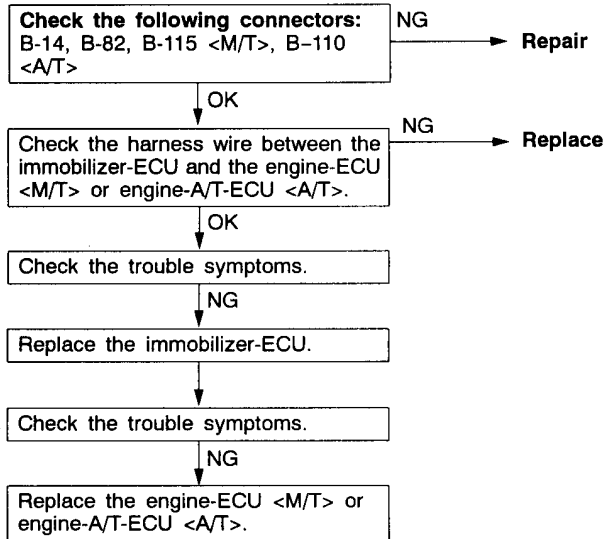




Cord No. P1610 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU <M/T> or engine-A/T-ECU <A/T> and the immobilizer-ECU	<ul style="list-style-type: none"> ● Open or short circuit, or loose connector contact ● Malfunction of the immobilizer-ECU ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

NOTE

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



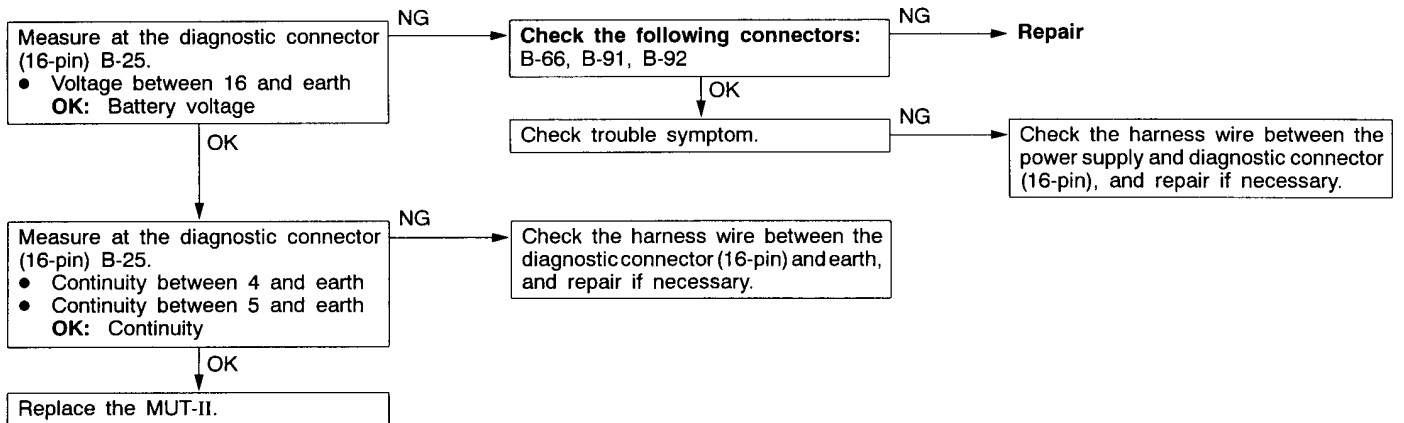
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-73
	Communication with engine-ECU only is not possible.	2	13A-73
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-74
	The engine warning lamp remains illuminating and never goes out.	4	13A-74
Starting	No initial combustion (starting impossible)	5	13A-75
	Initial combustion but no complete combustion (starting impossible)	6	13A-77
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13A-78
	Idling speed is high. (Improper idling speed)	8	13A-80
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13A-81
	When the engine is hot, it stalls at idling. (Die out)	10	13A-82
	The engine stalls when starting the car. (Pass out)	11	13A-84
	The engine stalls when decelerating.	12	13A-85
Driving	Hesitation, sag or stumble	13	13A-86
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13A-87
	The feeling of impact or vibration when decelerating	15	13A-88
	Knocking	16	13A-88
Dieseling		17	13A-88
Too high CO and HC concentration when idling		18	13A-89
Low alternator output voltage (approx. 12.3 V)		19	13A-90
Engine idle speed is incorrect while the A/C is on.		20	13A-91
Fans (radiator fan, A/C condenser fan) are inoperative		21	13A-91
Clutch switch system malfunction <M/T>		22	13A-92
GDI ECO indicator lamp system	GDI ECO indicator lamp does not illuminate.	23	13A-92
	GDI ECO indicator lamp remains illuminated and does not go off.	24	13A-93

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

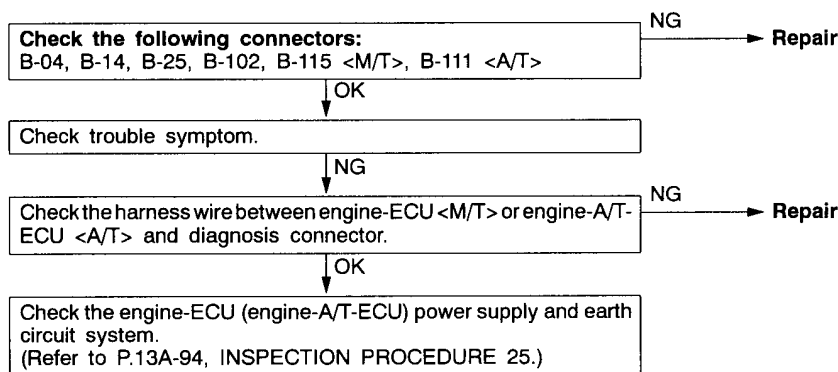
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	<ul style="list-style-type: none"> ● Malfunction of the connector ● Malfunction of the harness wire ● Malfunction of MUT-II



INSPECTION PROCEDURE 2

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

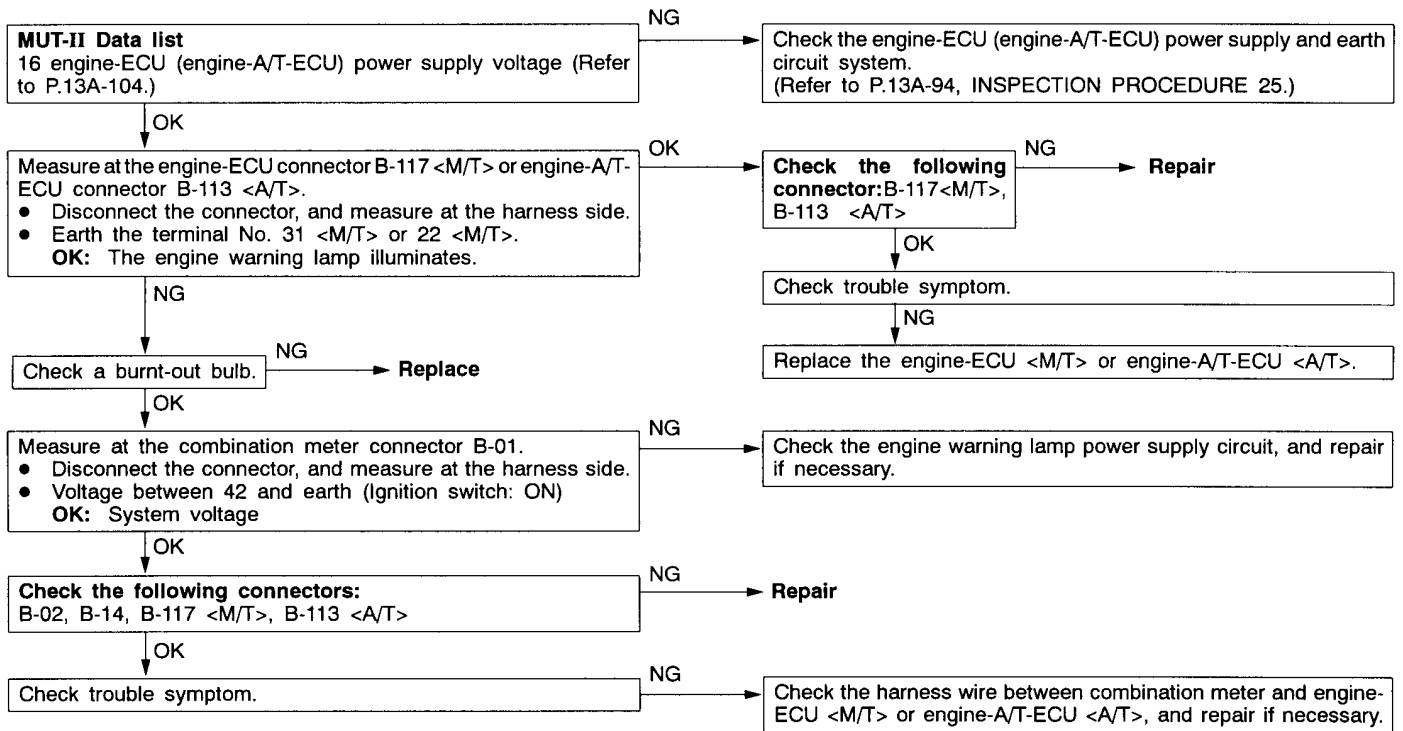


NOTE

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

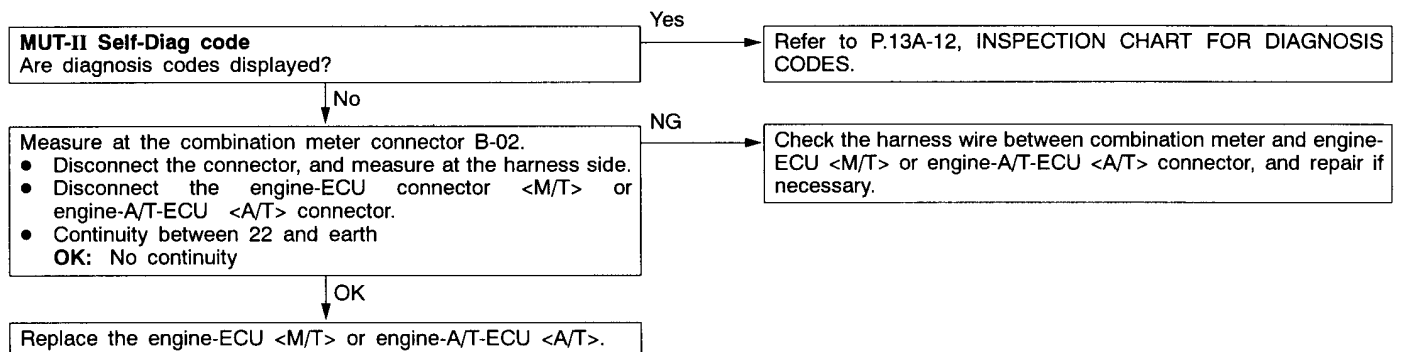
INSPECTION PROCEDURE 3

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



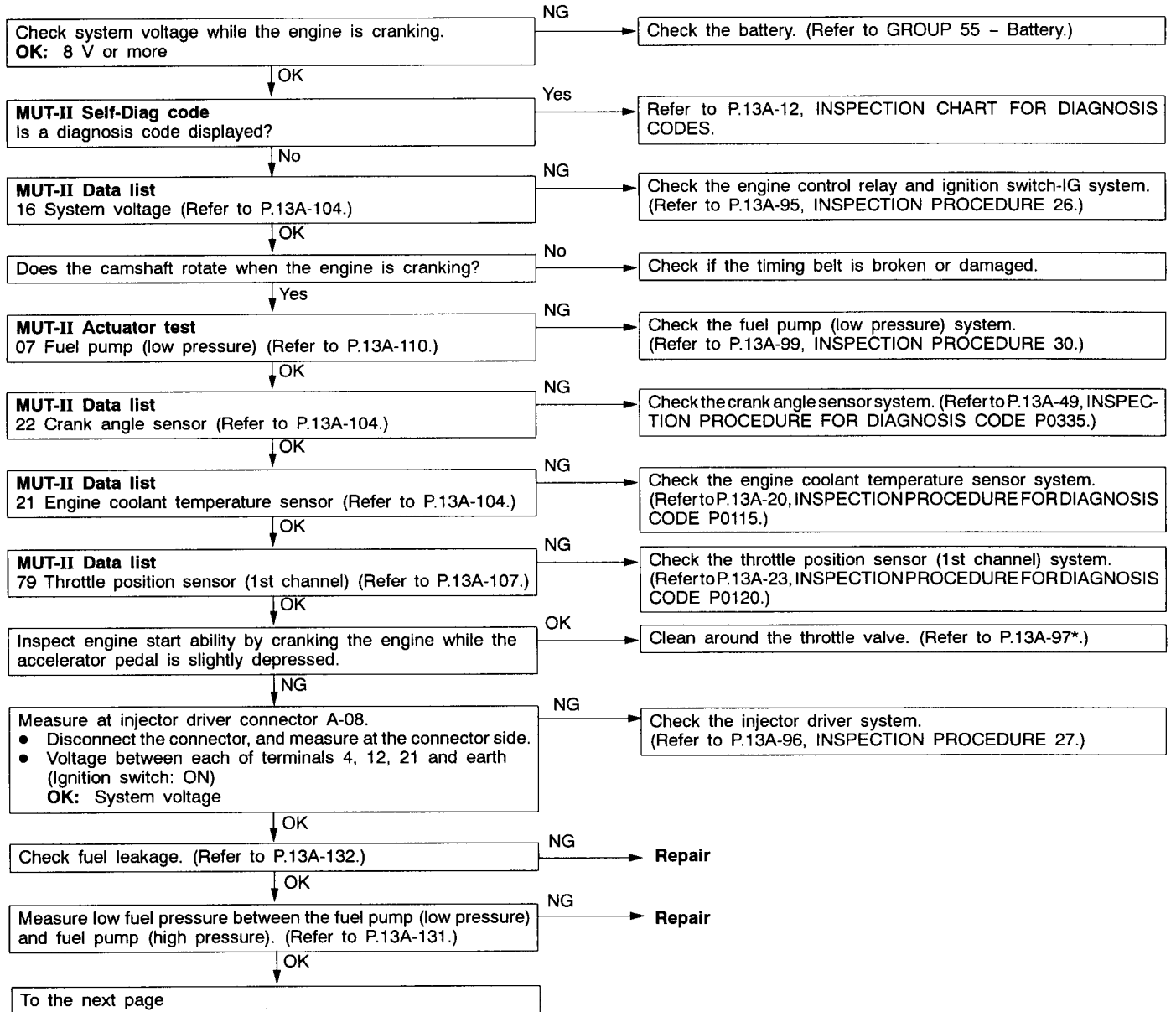
INSPECTION PROCEDURE 4

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



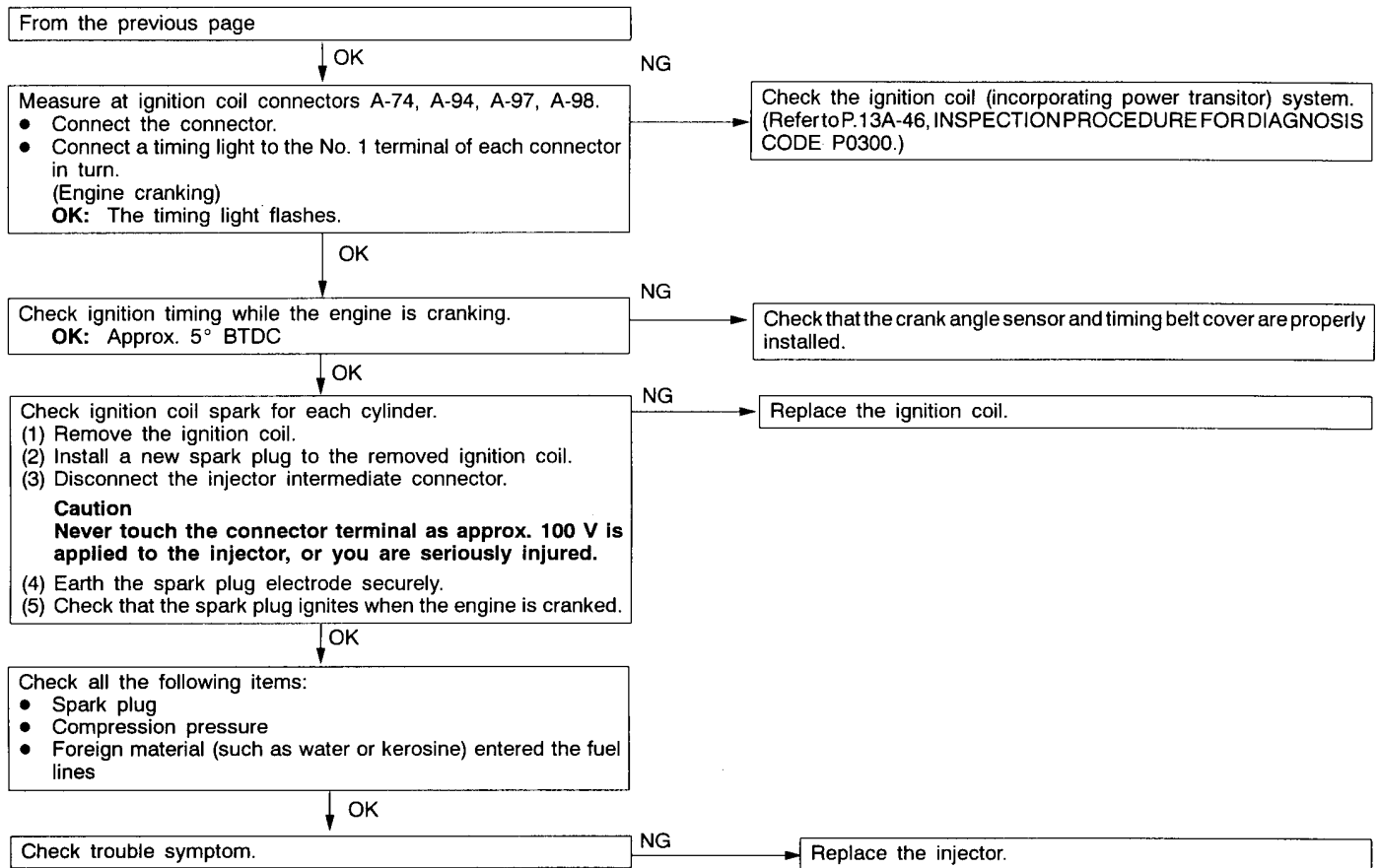
INSPECTION PROCEDURE 5

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



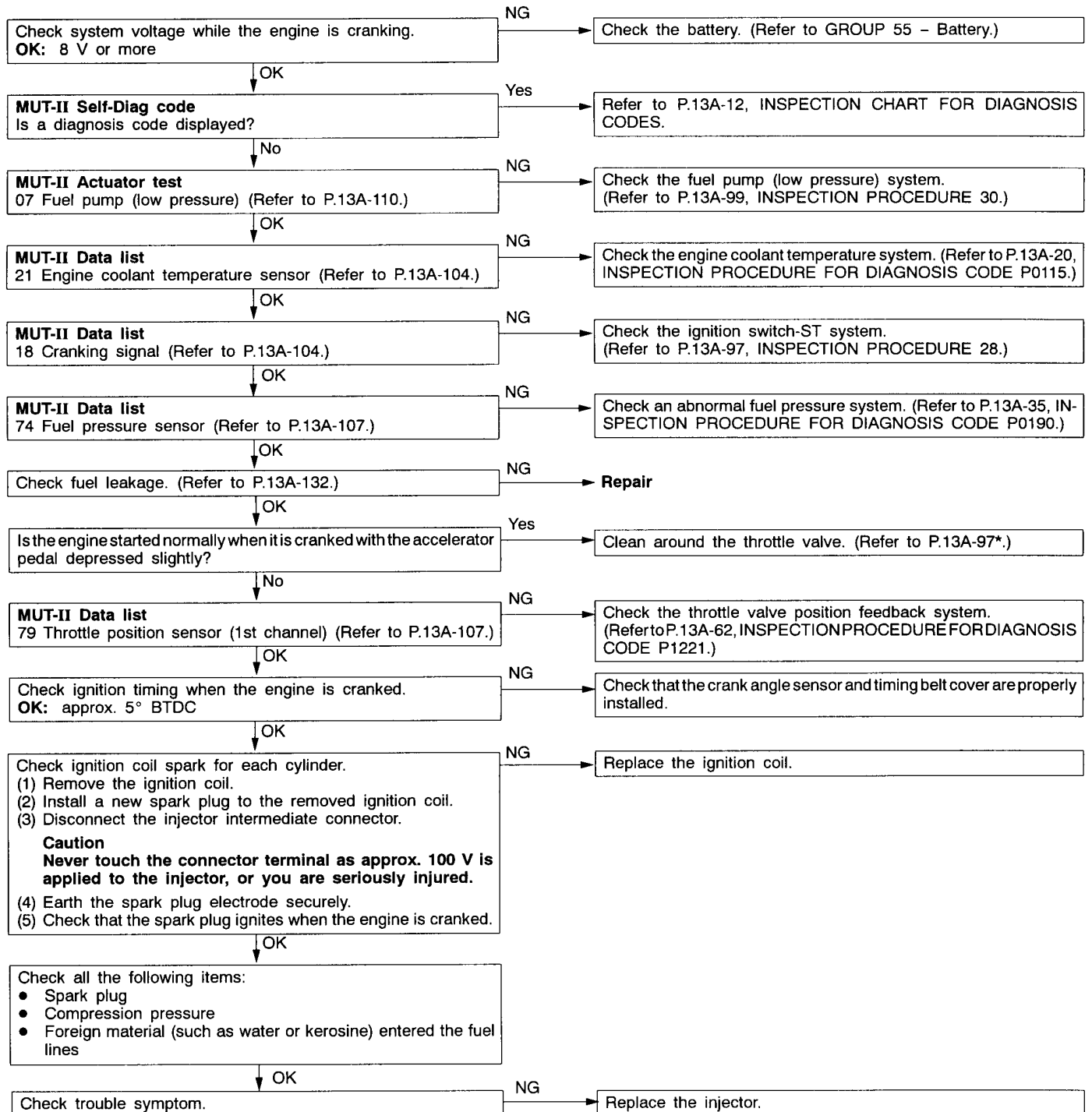
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).



INSPECTION PROCEDURE 6

Initial combustion takes place, but does not complete (start impossible), too long time to start (poor start)	Probable cause
This may be caused by improper spark plug ignition (poor spark), improper mixture during engine cranking, improper fuel pressure.	<ul style="list-style-type: none"> ● Malfunction of the fuel supply system ● Malfunction of the fuel pressure sensor ● Malfunction of the ignition system ● Malfunction of the electronic-controlled throttle valve system ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

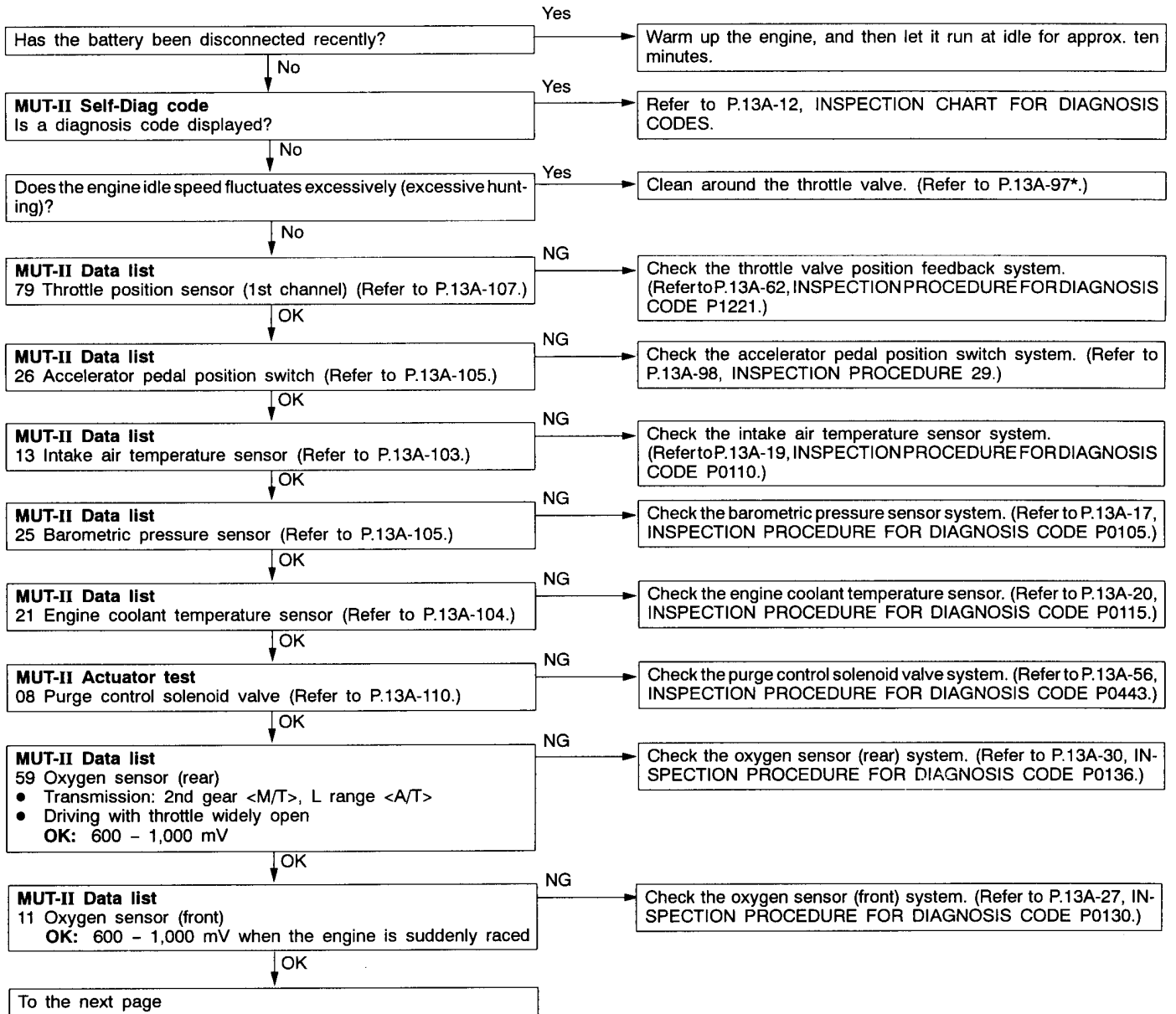


NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

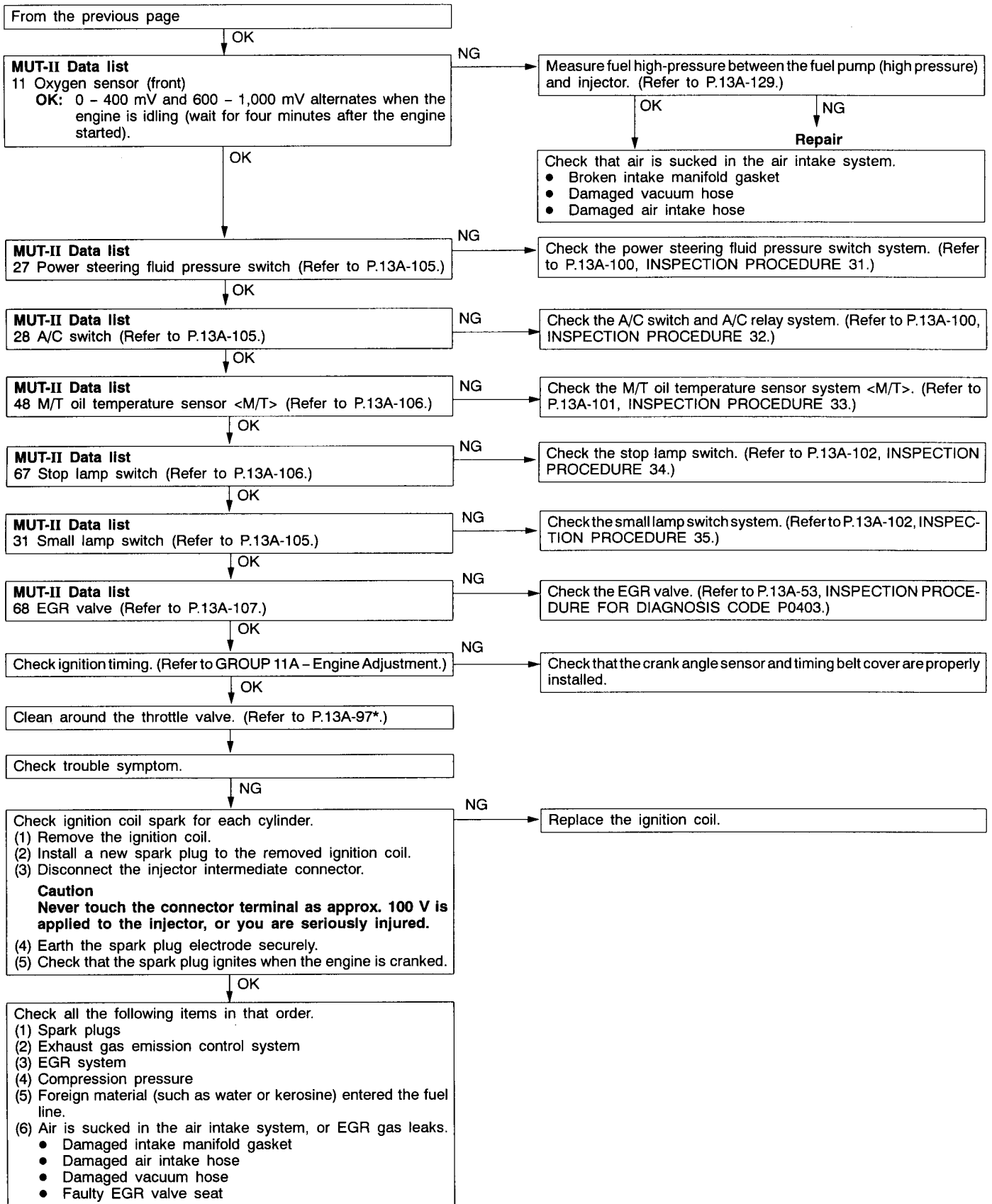
INSPECTION PROCEDURE 7

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



NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

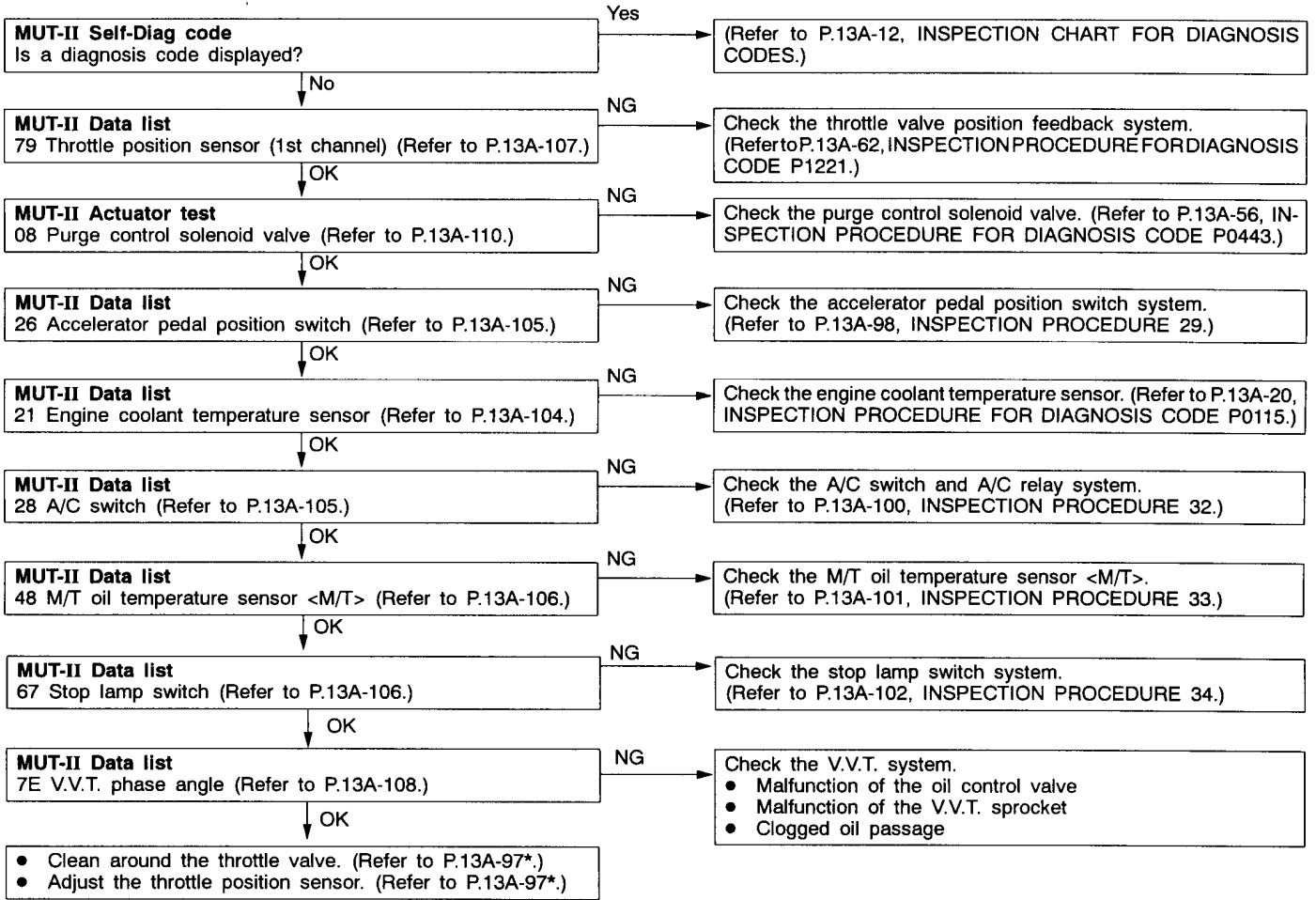


NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

INSPECTION PROCEDURE 8

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

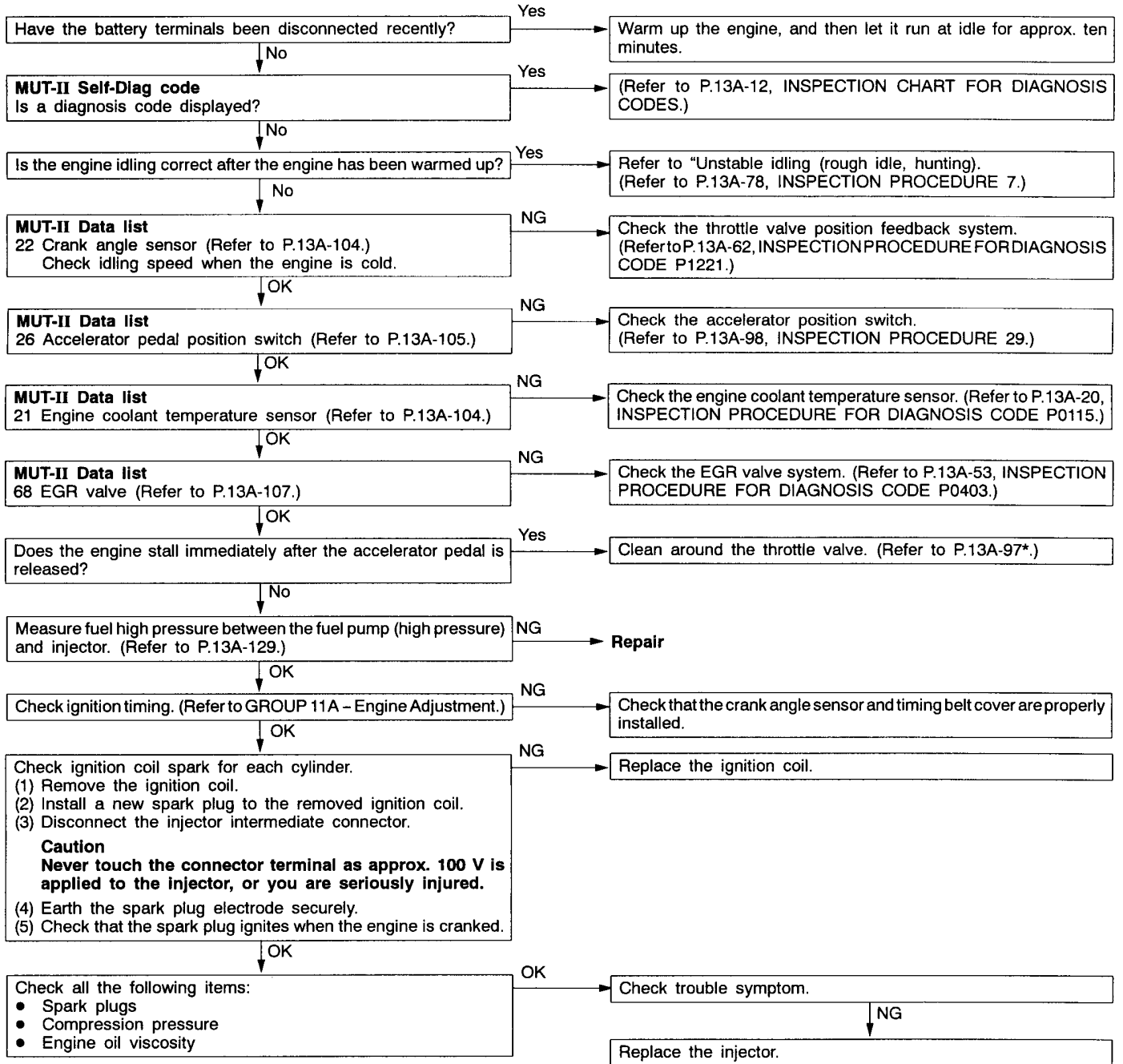


NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

INSPECTION PROCEDURE 9

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

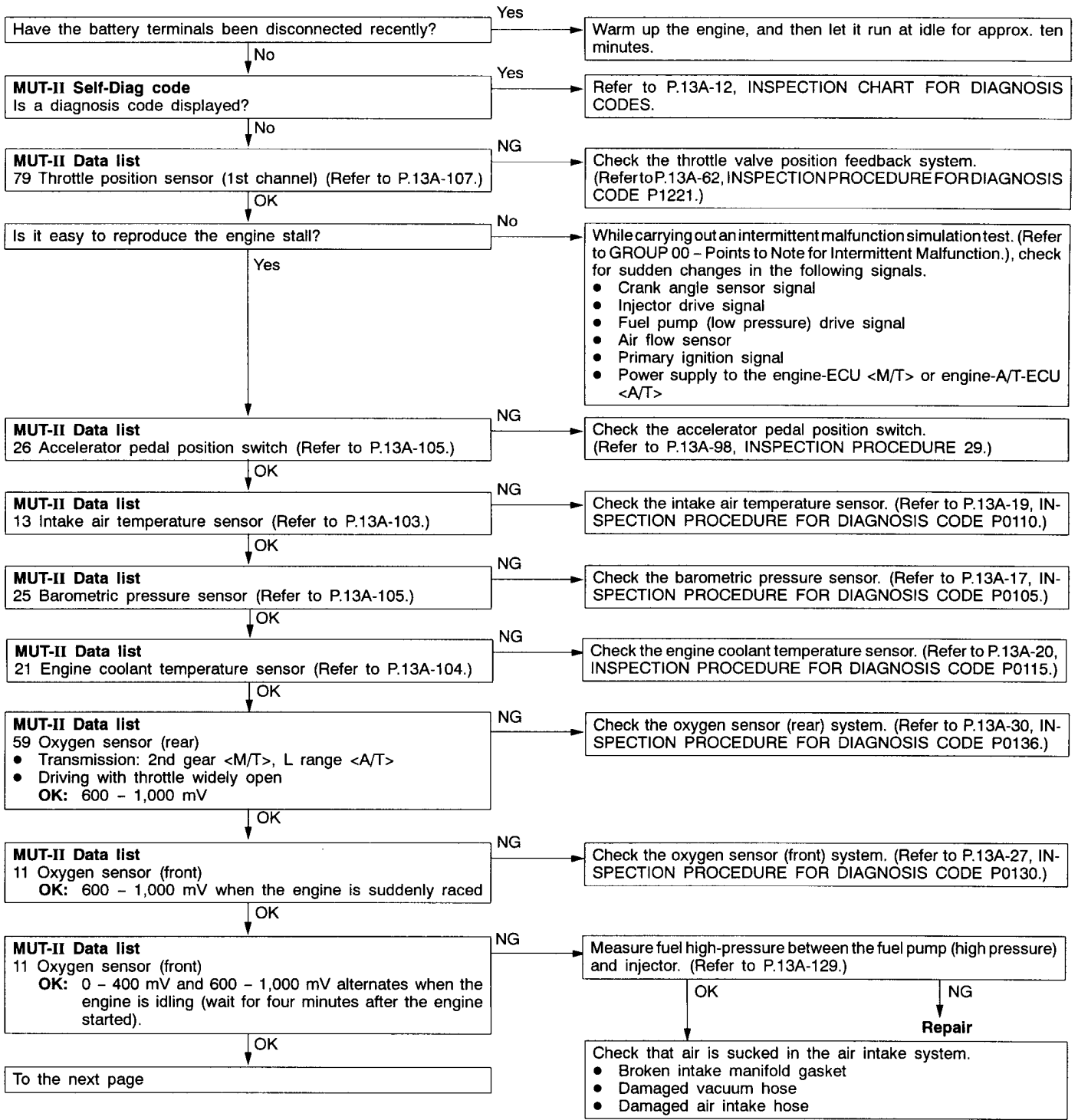


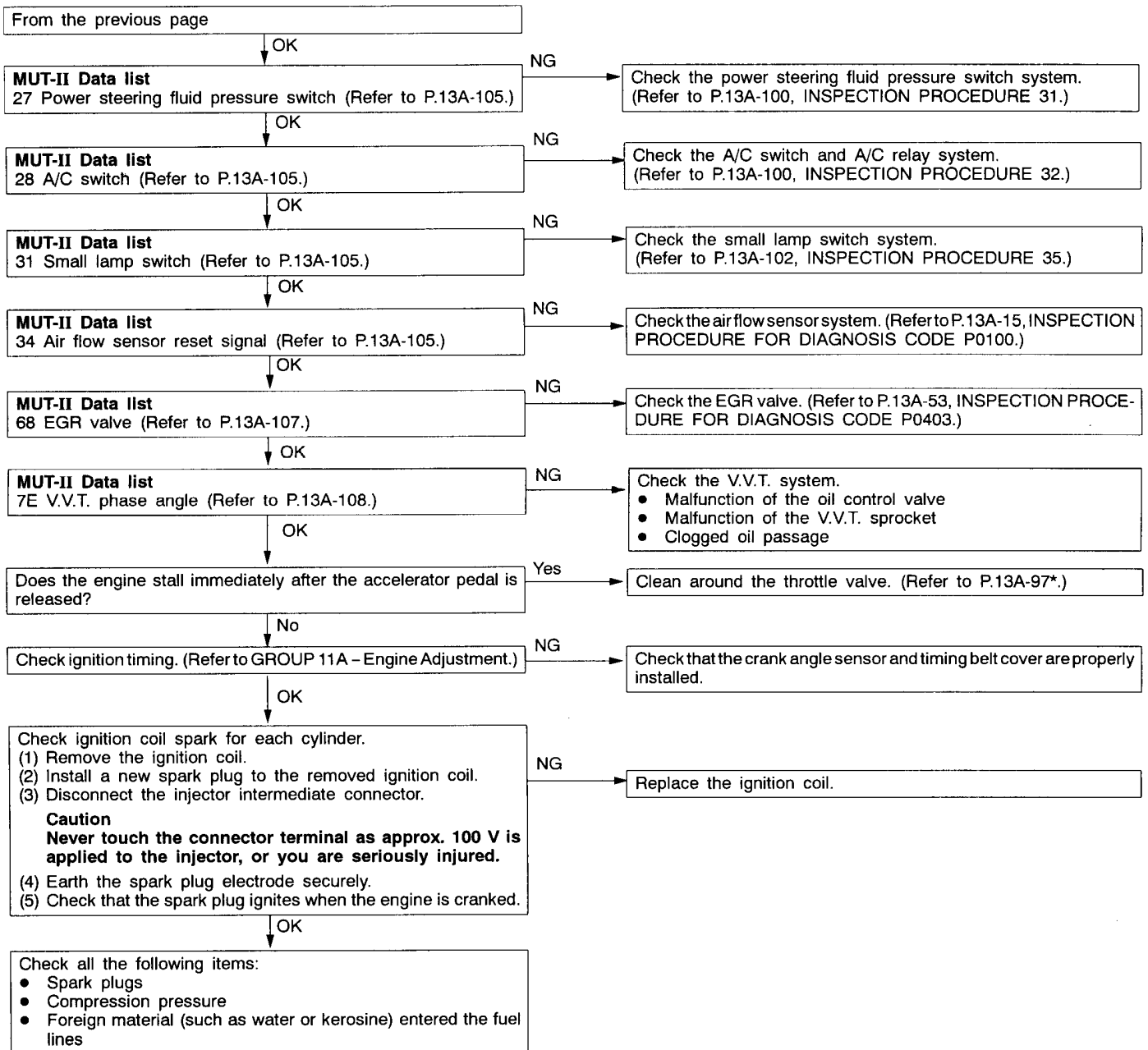
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

INSPECTION PROCEDURE 10

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



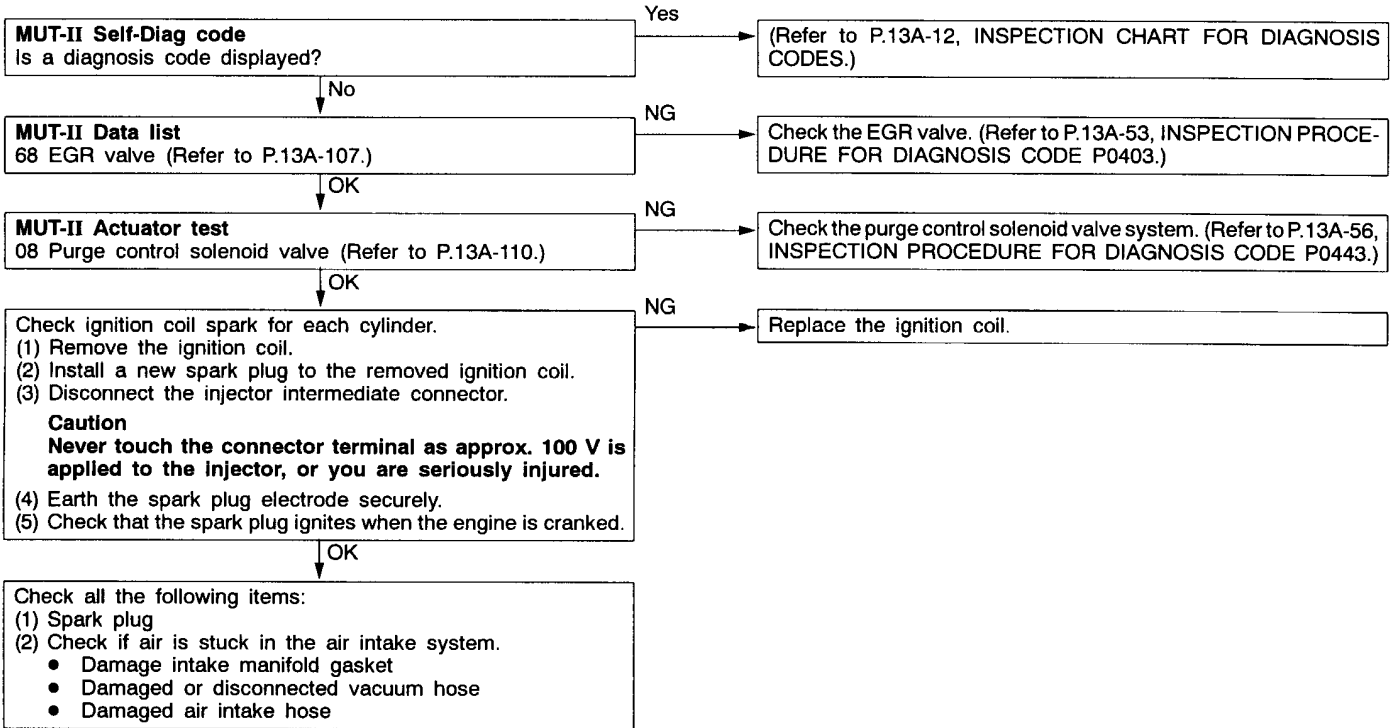


NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

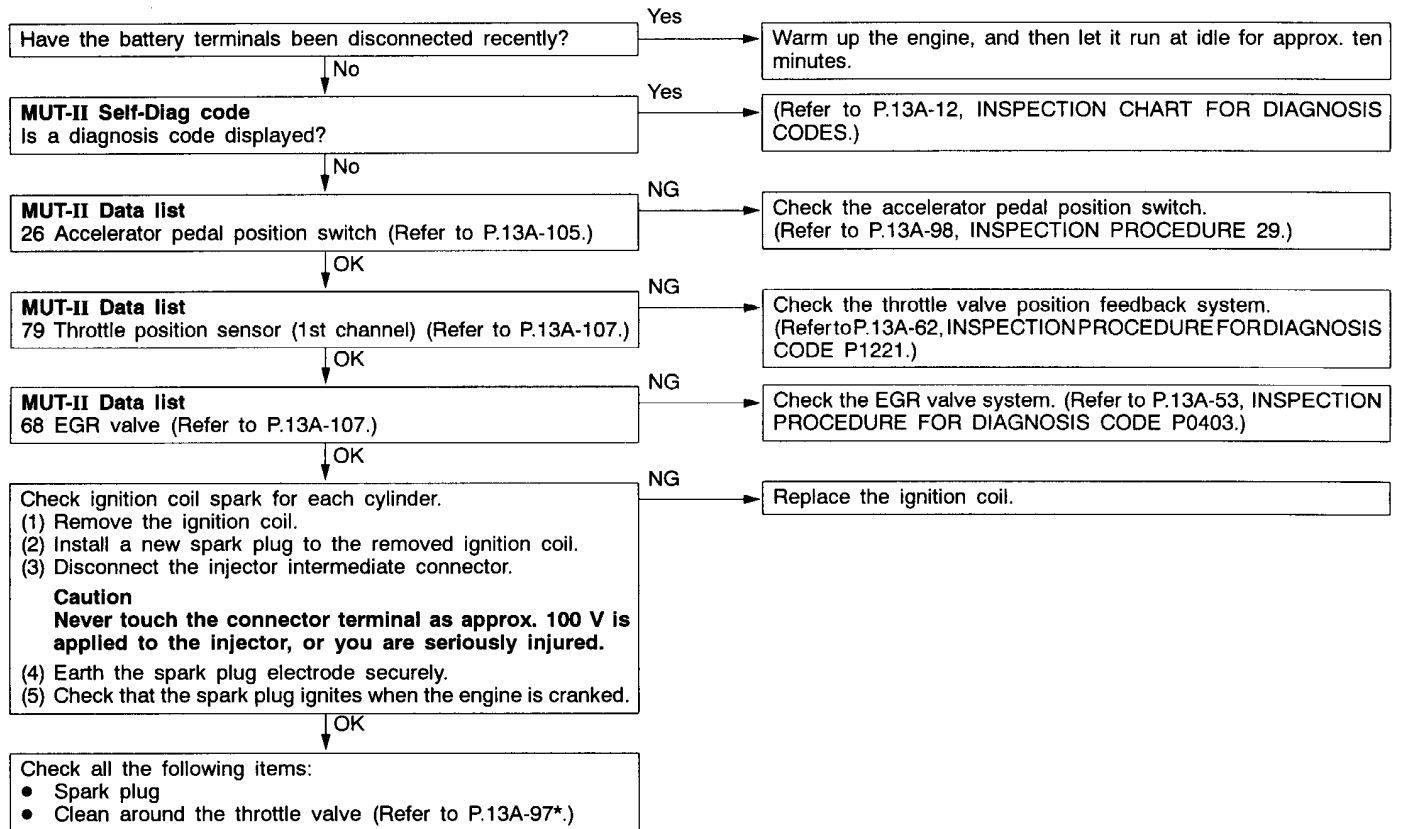
INSPECTION PROCEDURE 11

The engine stalls when starting the car. (Pass out)	Probable cause
The cause is probably poor ignition due to a malfunctioning spark plug (weak spark), or an incorrect air/fuel ratio when the accelerator is depressed.	<ul style="list-style-type: none"> ● Malfunction of the ignition system ● Malfunction of the EGR valve ● Air stuck in the air intake system



INSPECTION PROCEDURE 12

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

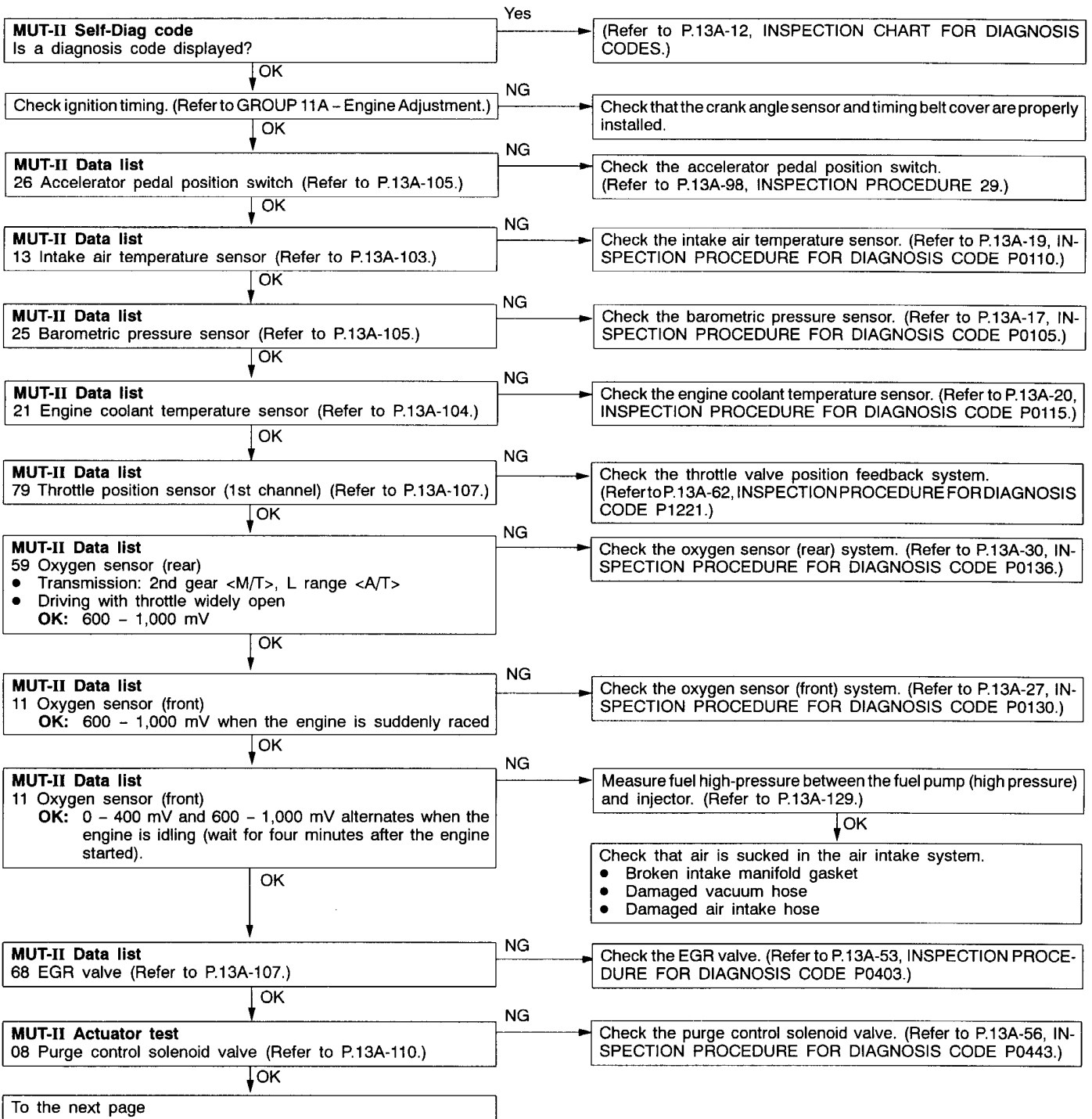


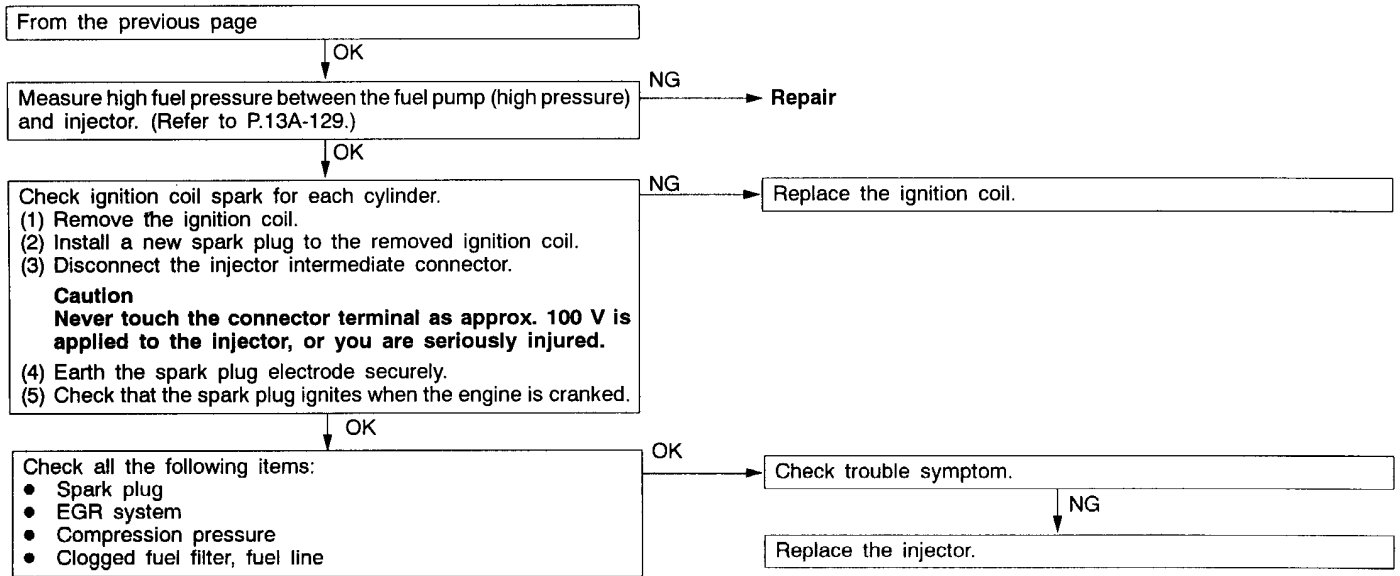
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

INSPECTION PROCEDURE 13

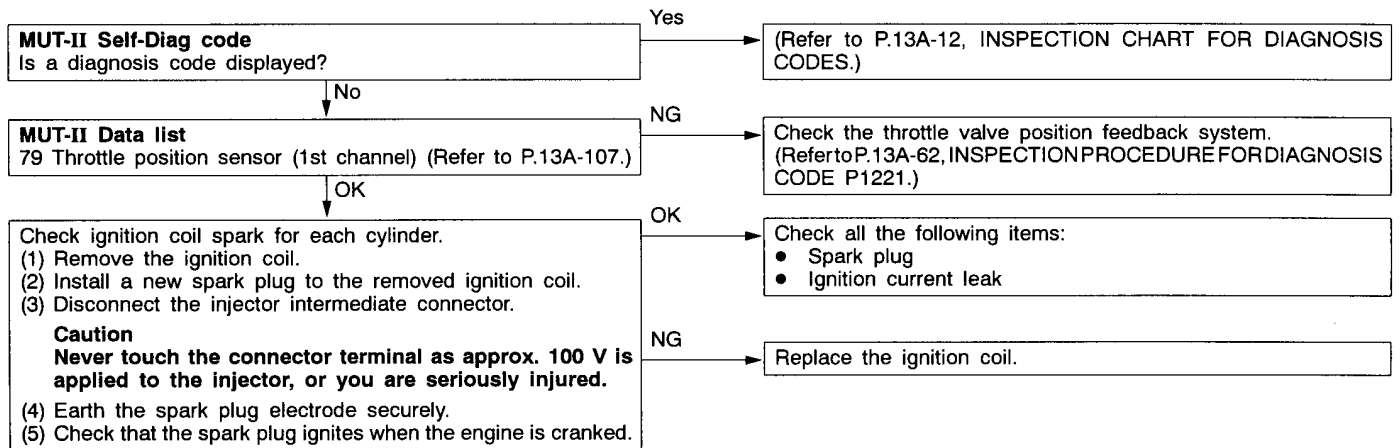
Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, electronic-controlled throttle valve system, compression pressure, etc.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of the air/fuel ratio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





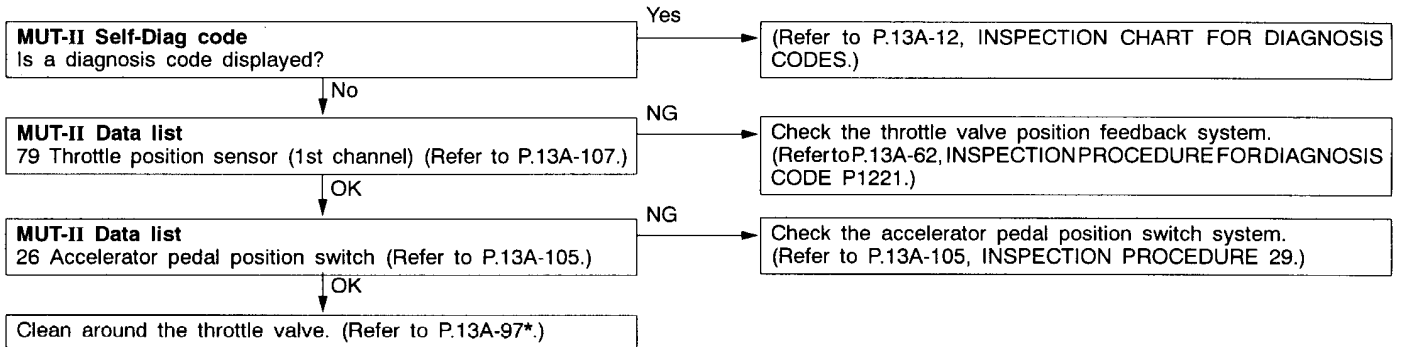
INSPECTION PROCEDURE 14

The feeling of impact when accelerating	Probable cause
The cause is probably an ignition leak being generated in line with an increase in the spark plug request voltage during acceleration.	<ul style="list-style-type: none"> Malfunction of the ignition system



INSPECTION PROCEDURE 15

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

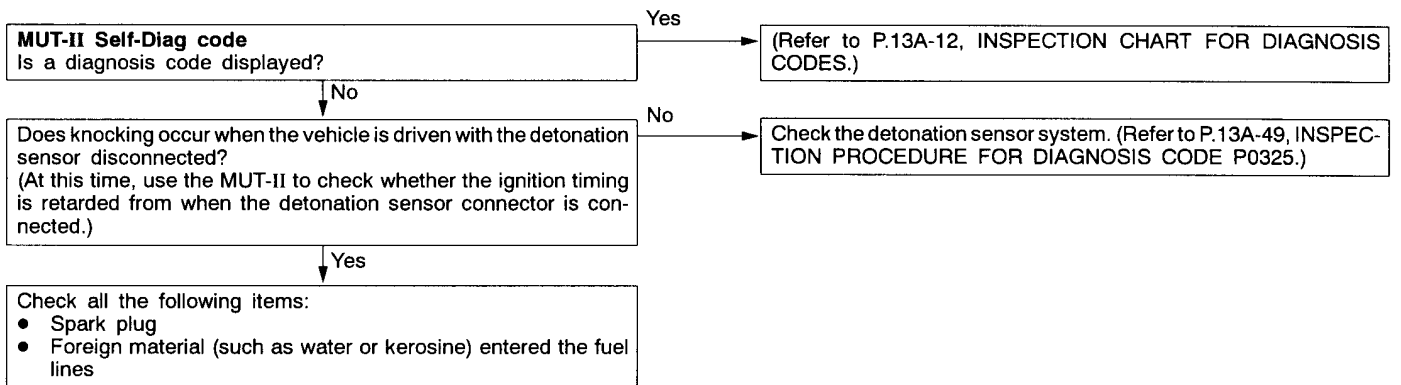


NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

INSPECTION PROCEDURE 16

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



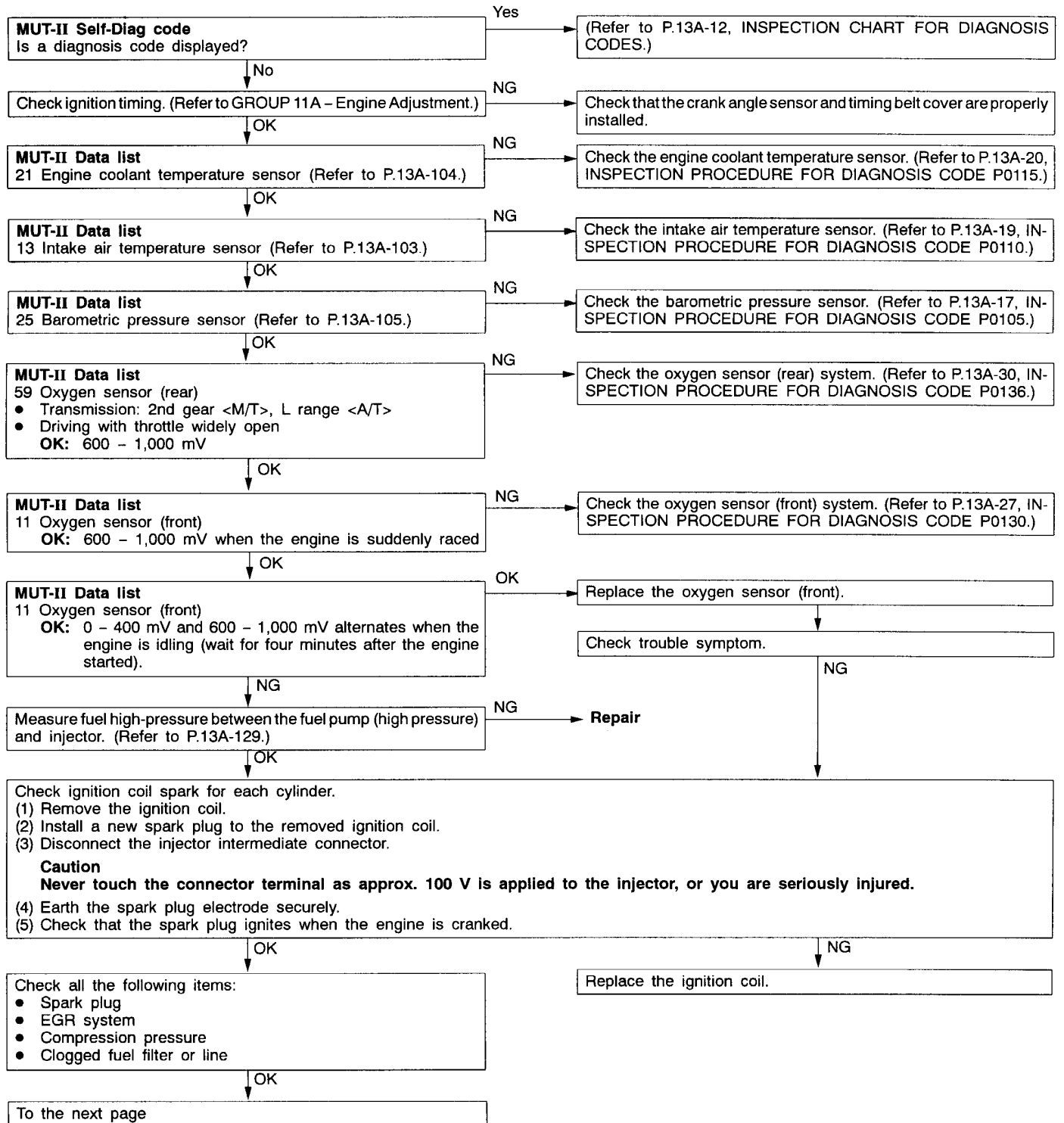
INSPECTION PROCEDURE 17

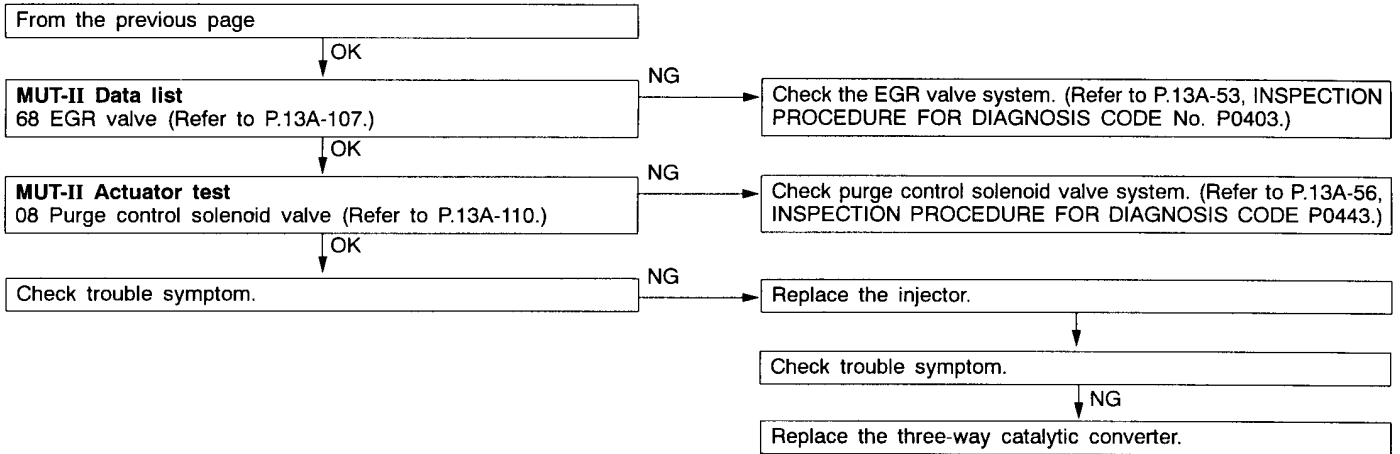
Run-on (dieseling)	Probable cause
The cause is probably fuel leak from injector(s)	<ul style="list-style-type: none"> Malfunction of the injector

Replace the injector.

INSPECTION PROCEDURE 18

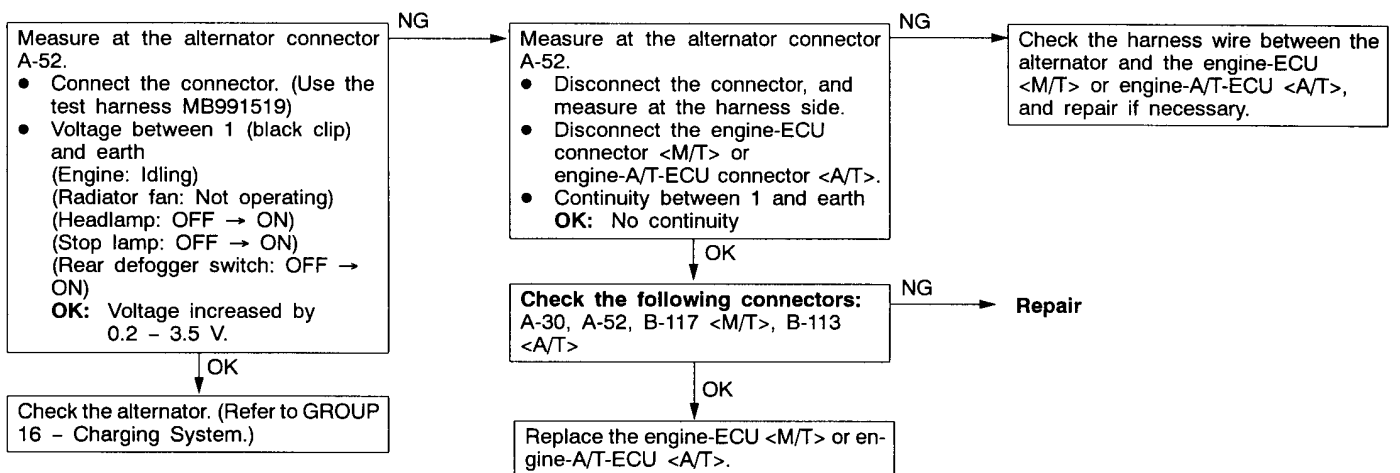
Too high CO and HC concentration when idling	Probable cause
The cause is probably an incorrect air/fuel ratio	<ul style="list-style-type: none"> • Malfunction of air/fuel ratio control system • Deterioration of the catalyst





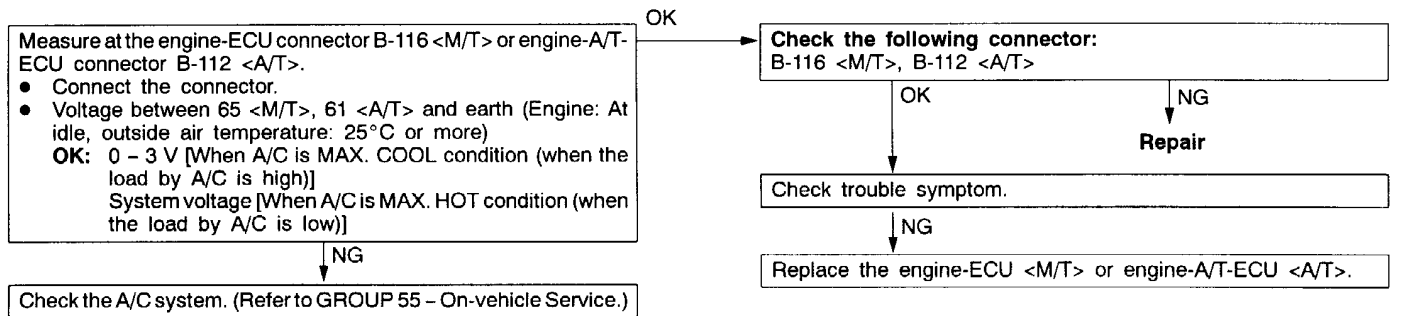
INSPECTION PROCEDURE 19

Low alternator output voltage (approx. 12.3 V)	Probable cause
The cause is probably a malfunction of the alternator or one of the problems listed at right.	<ul style="list-style-type: none"> • Malfunction of the charging system • Open circuit between the alternator G terminal and the engine-ECU <M/T> or engine-A/T-ECU <A/T> • Malfunction of the engine-ECU <M/T> • Malfunction of the engine-A/T-ECU <A/T>



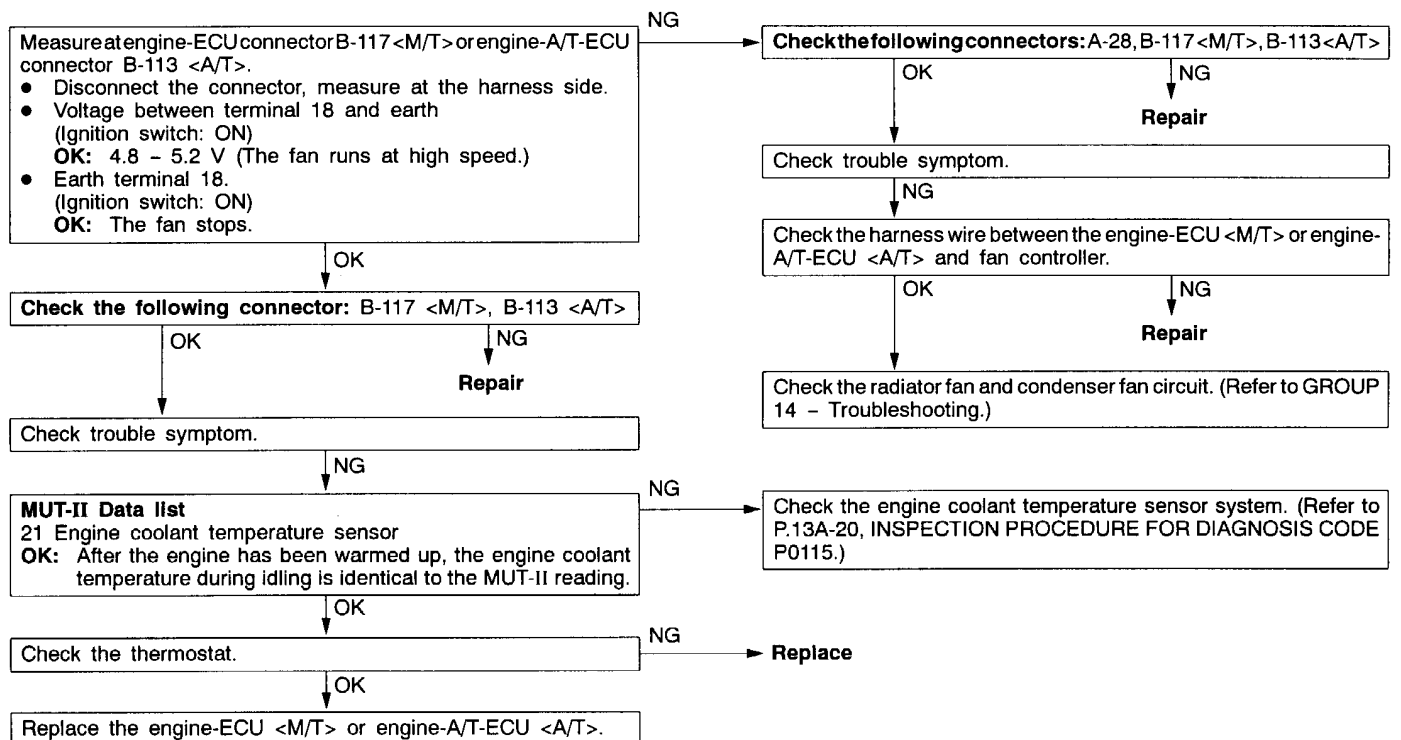
INSPECTION PROCEDURE 20

Idling speed is improper when A/C is operating	Probable cause
<p>If the engine-ECU <M/T> or engine-A/T-ECU <A/T> detects that the air conditioner is on, it activates the throttle control servo to control idle-up operation. The A/C-ECU judges if the load caused by air conditioner operation is high or low, and converts it to voltage signal (high or low voltage) and inputs the signal to the engine-ECU <M/T> or engine-A/T-ECU <A/T>. Based on this voltage signal, the engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the idle-up speed (for high or low load).</p>	<ul style="list-style-type: none"> ● Malfunction of the A/C control system ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



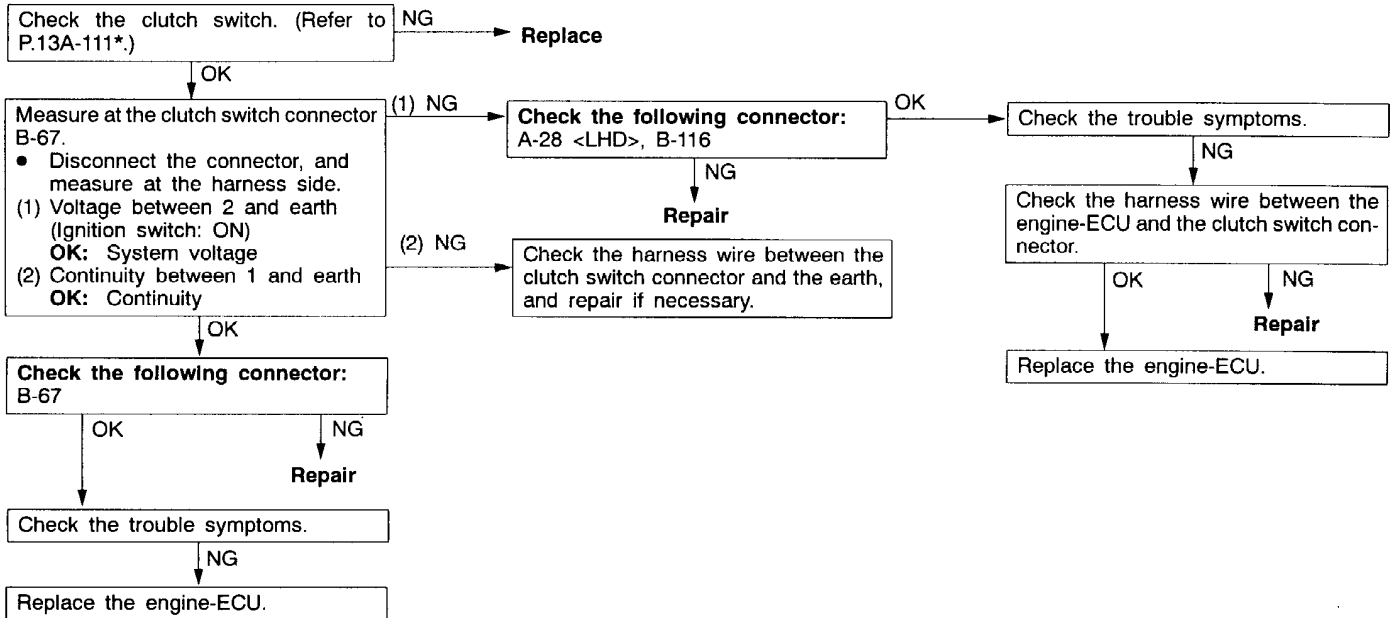
INSPECTION PROCEDURE 21

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
<p>The engine-ECU <M/T> or engine-A/T-ECU <A/T> sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch load. The fan controller controls radiator fan and condenser fan speeds, based on this signal. (The closer the terminal voltage comes to 5 V, the higher the fan speed becomes.)</p>	<ul style="list-style-type: none"> ● Malfunction of the fan motor relay ● Malfunction of the fan motor ● Malfunction of the fan controller ● Open or short circuit, or poor connector contact ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



INSPECTION PROCEDURE 22

Clutch switch system malfunction <M/T>	Probable cause
The clutch pedal switch sends a signal indicating clutch pedal depression to the engine-ECU. The engine-ECU controls the fuel injection properly according to this signal, thus prevents the fluctuation of the engine speed during shift change.	<ul style="list-style-type: none"> • Malfunction of the clutch switch • Open circuit or short-circuited harness wire in the clutch switch circuit • Malfunction of the engine-ECU

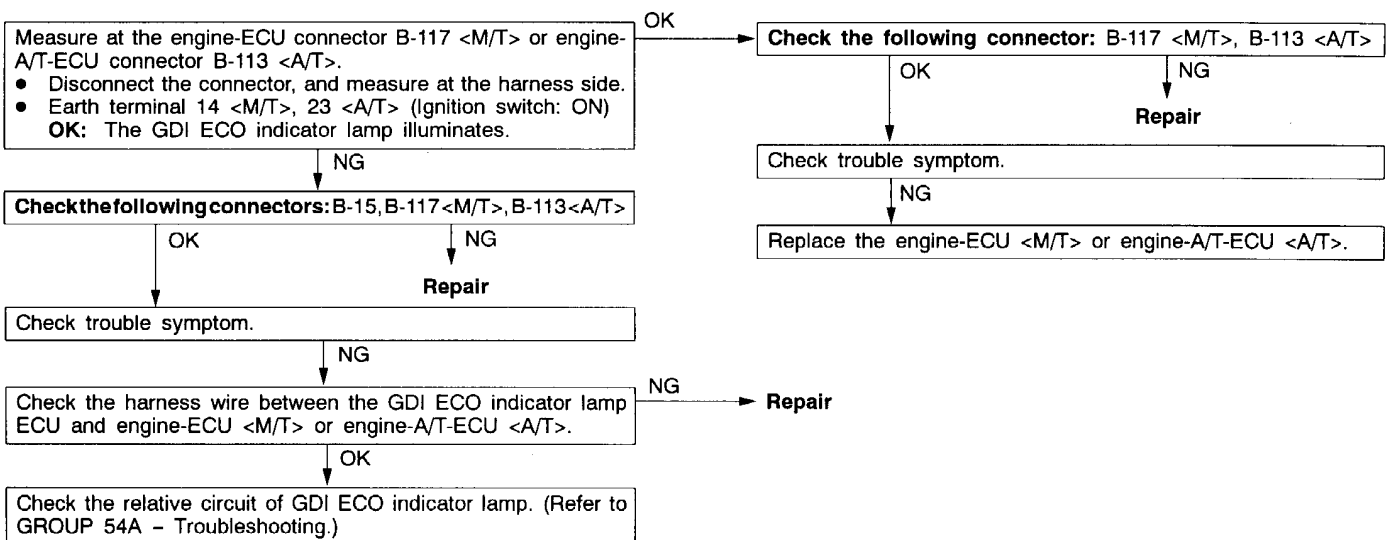


NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

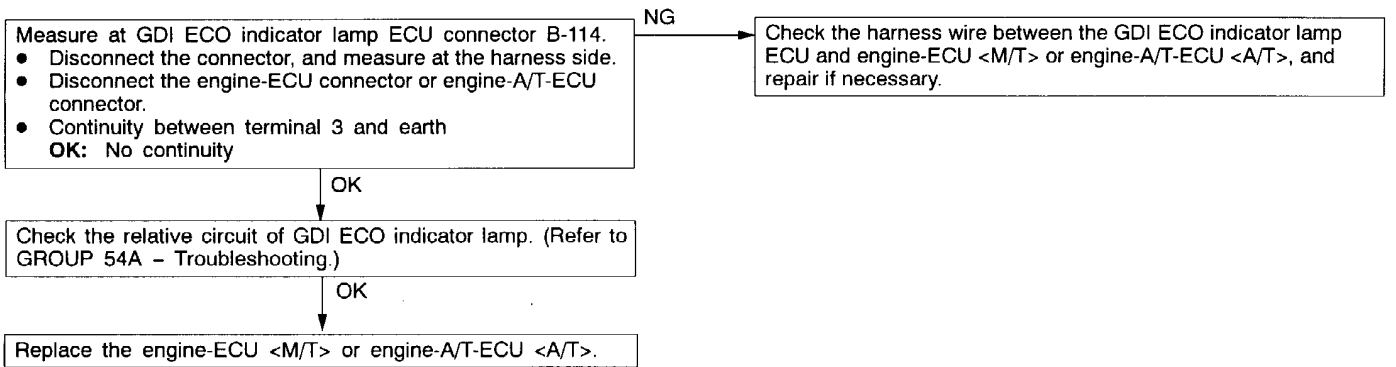
INSPECTION PROCEDURE 23

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



INSPECTION PROCEDURE 24

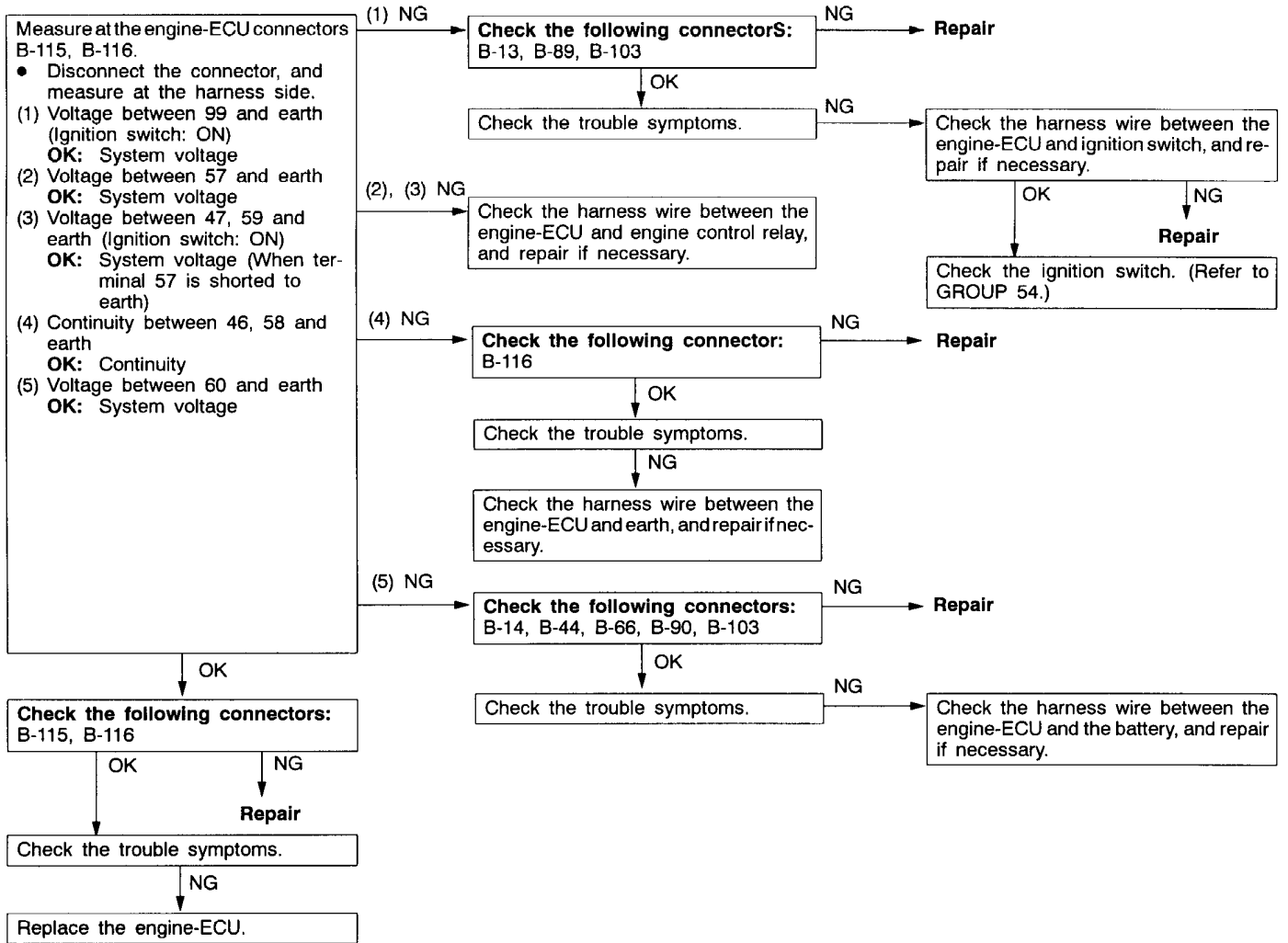
GDI ECO indicator lamp remains illuminated and does not go off.	Probable cause
If the GDI ECO indicator lamp does not go off during high load operation, the causes listed in the right column are suspected.	<ul style="list-style-type: none"> ● Short circuit between the GDI ECO indicator lamp and engine-ECU ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T> ● Malfunction of the GDI ECO indicator lamp ECU



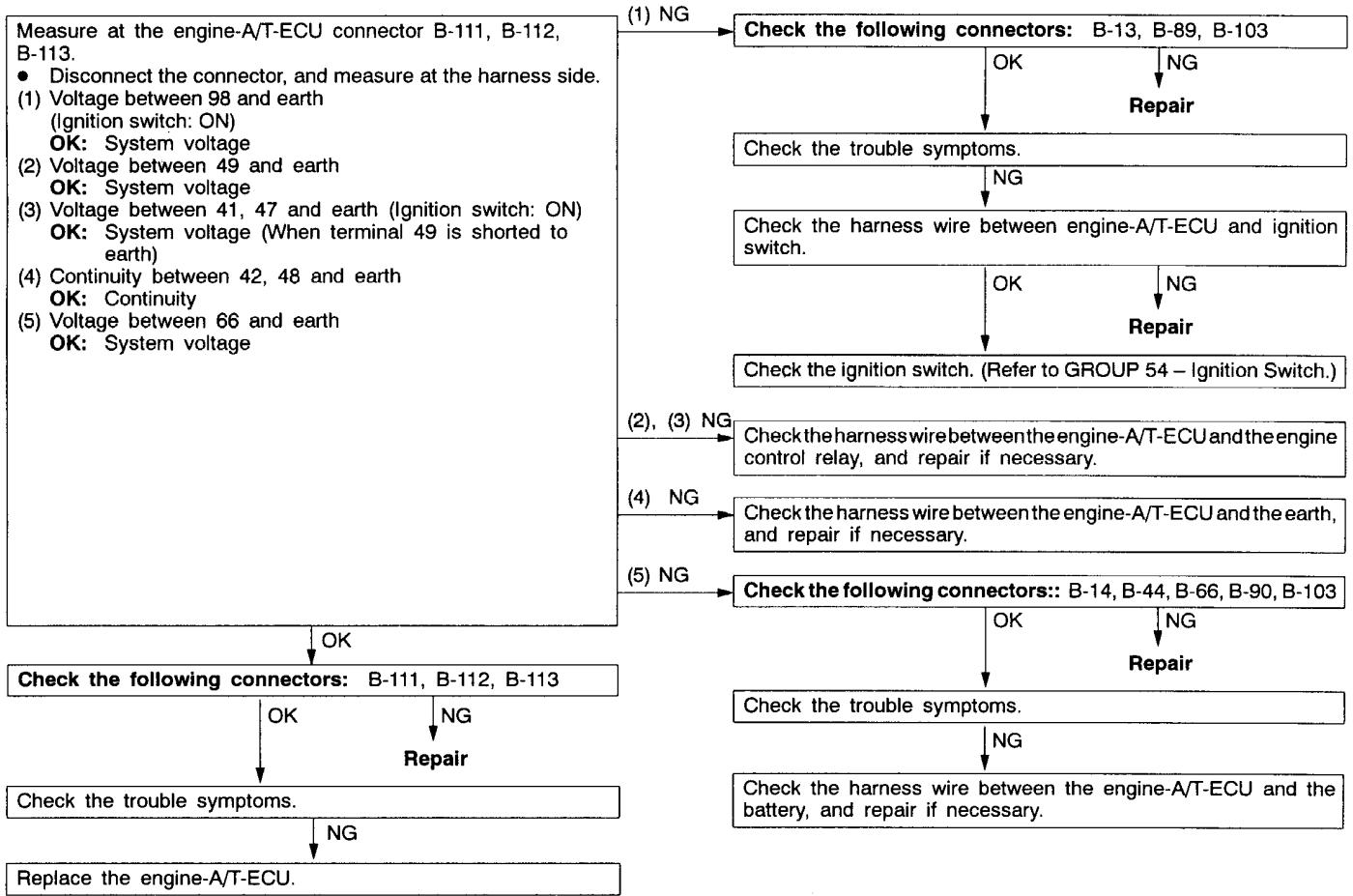
INSPECTION PROCEDURE 25

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

<M/T>

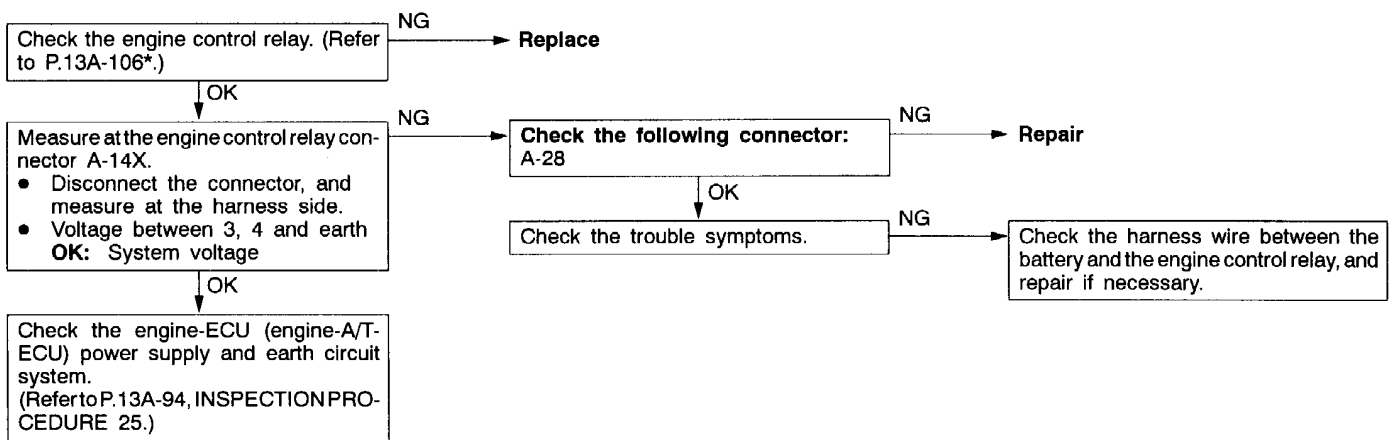


<A/T>



INSPECTION PROCEDURE 26

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

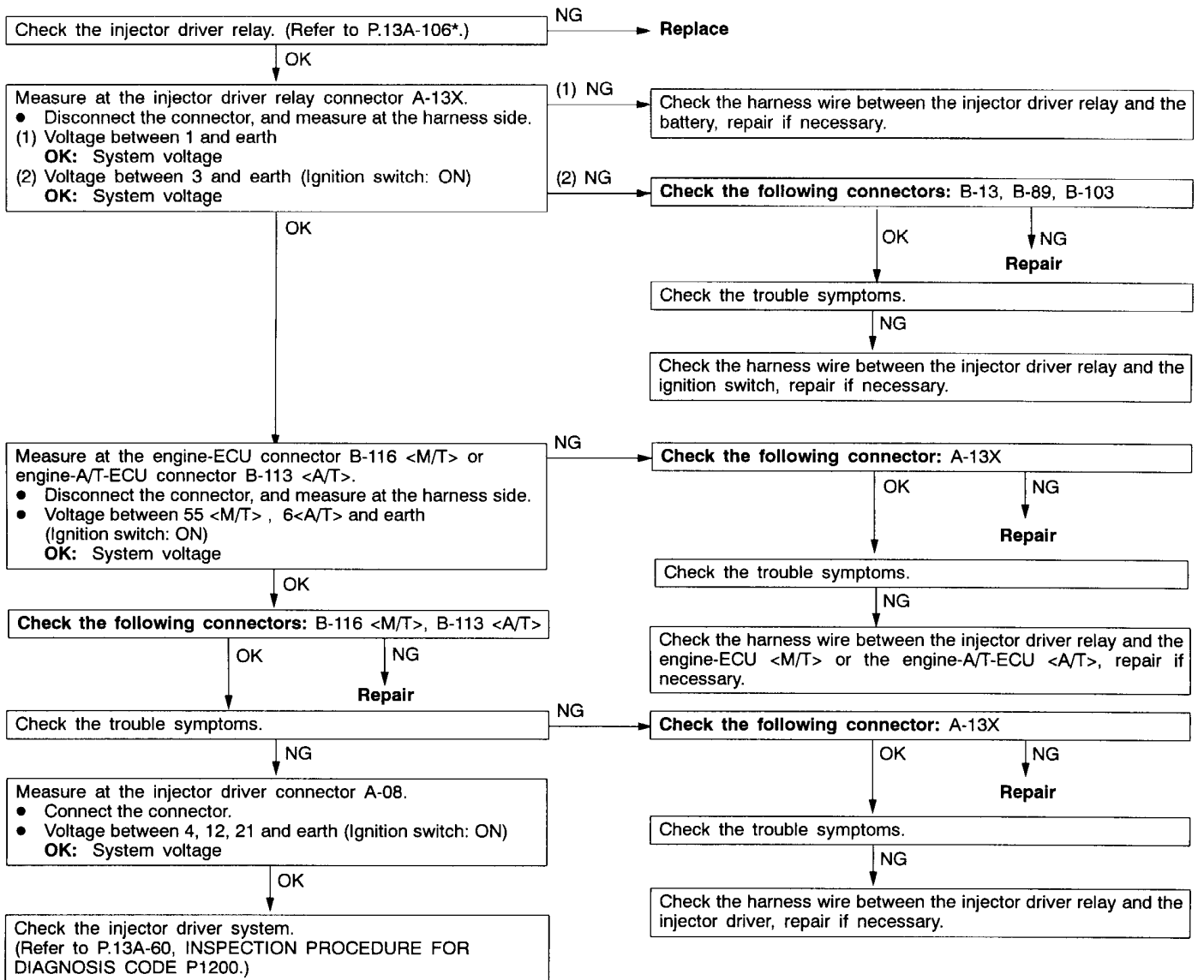


NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

INSPECTION PROCEDURE 27

Injector driver relay system	Probable cause
When the ignition switch ON signal is input to the engine-ECU <M/T> or the engine -A/T-ECU <A/T>, engine-ECU <M/T> or the engine -A/T-ECU <A/T> turns on the injector driver relay. This causes system voltage to be supplied to the injector driver.	<ul style="list-style-type: none"> ● Malfunction of the injector driver relay ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



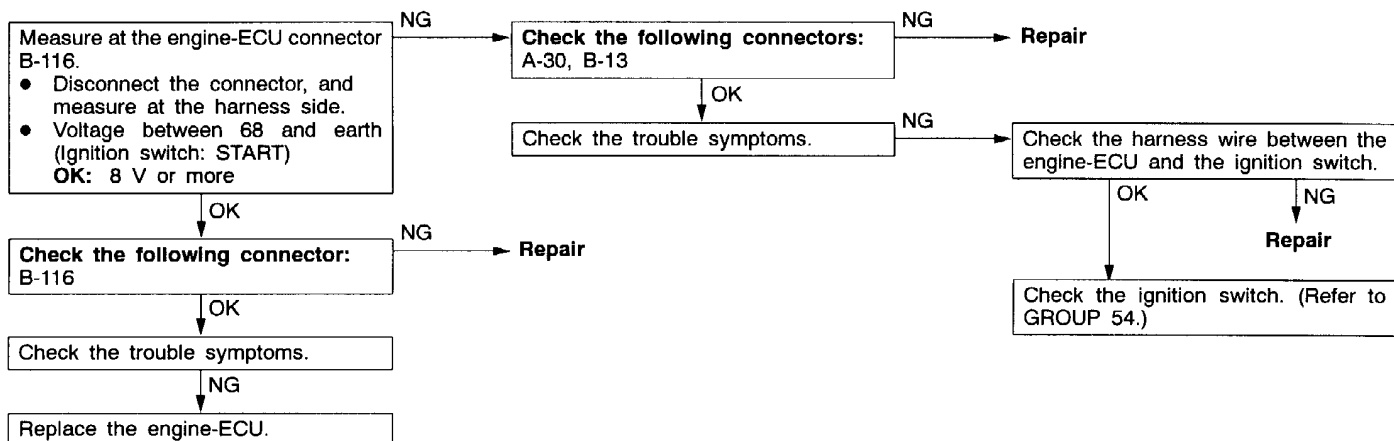
NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

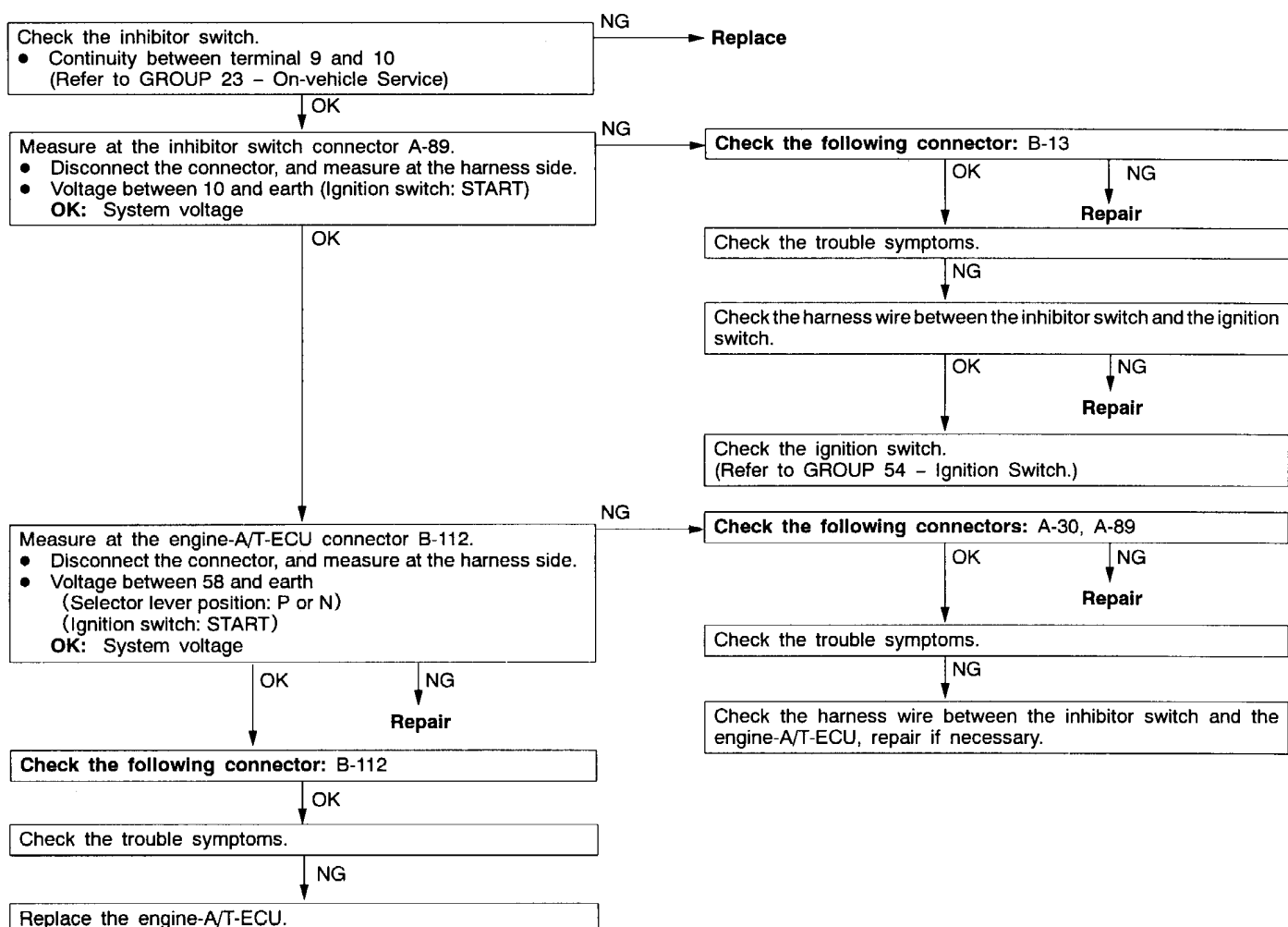
INSPECTION PROCEDURE 28

Ignition switch-ST system	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU <M/T> or engine-A/T-ECU <A/T> while the engine is cranking. The engine-ECU <M/T> or engine-A/T-ECU <A/T> uses this signal to carry out functions such as fuel injection control during starting.	<ul style="list-style-type: none"> ● Malfunction of the ignition switch <M/T> ● Malfunction of the inhibitor switch <A/T> ● Open circuit or short-circuited harness wire of the ignition switch circuit ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

<M/T>

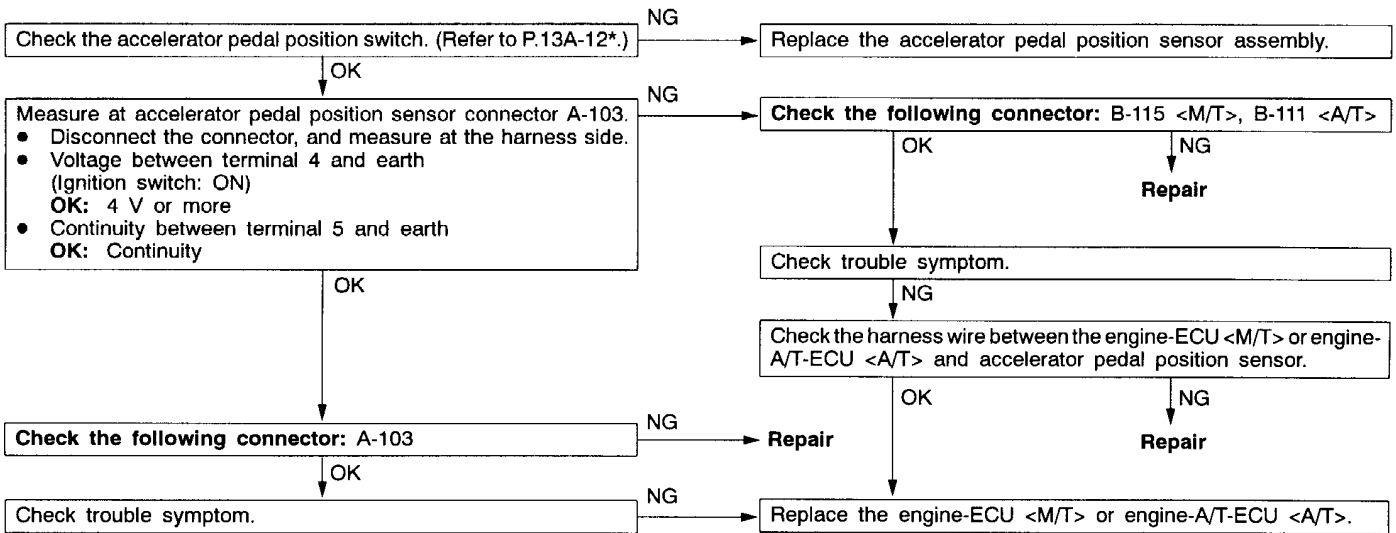


<A/T>



INSPECTION PROCEDURE 29

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

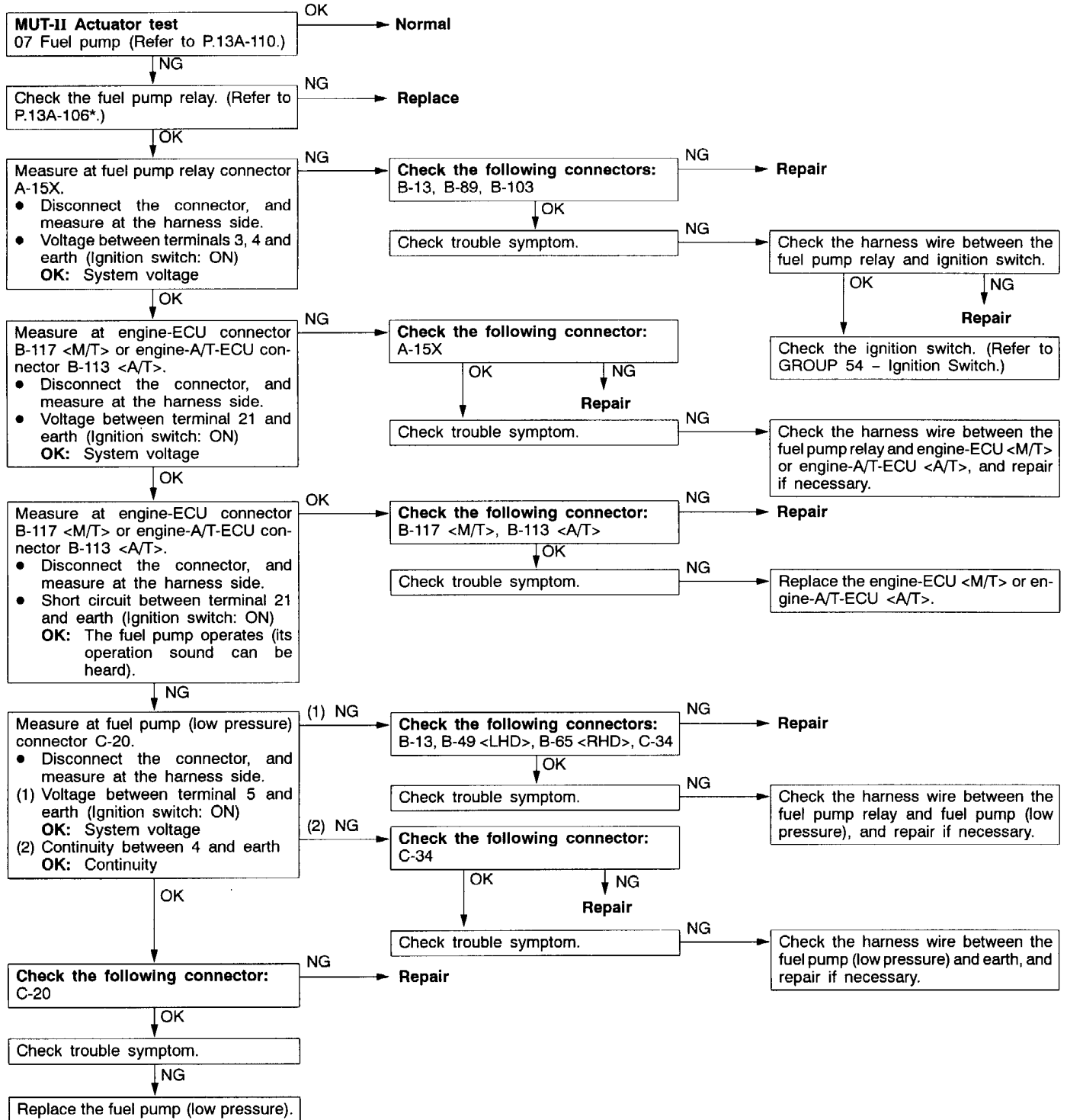


NOTE:

*: Refer to the '00 SPACE RUNNER Workshop Manual (Pub. No. PWDE9803-A).

INSPECTION PROCEDURE 30

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

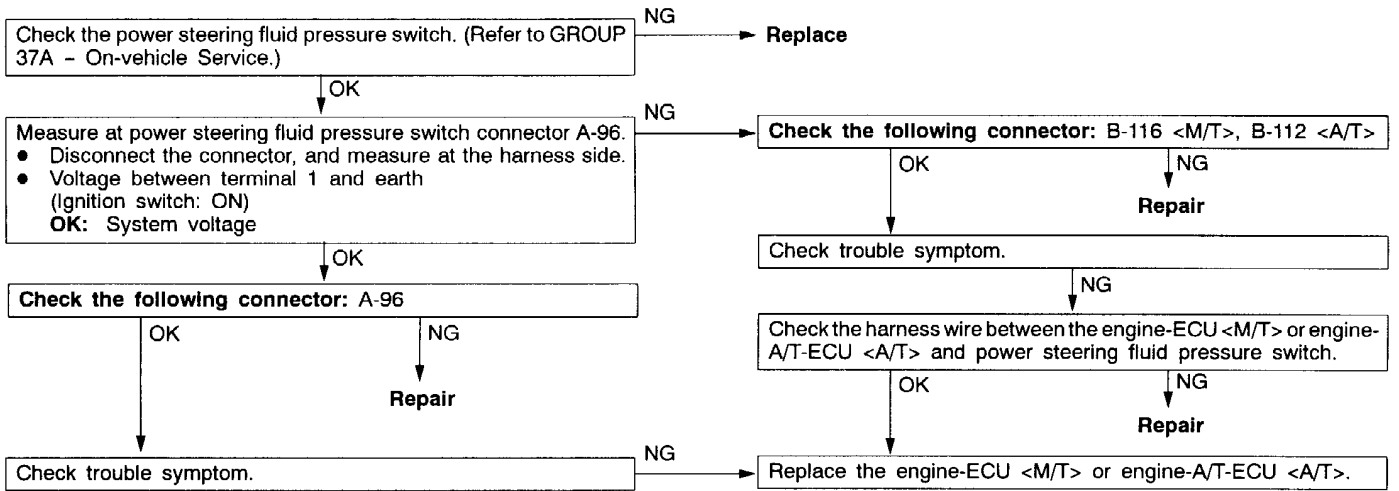


NOTE:

*: Refer to the '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803).

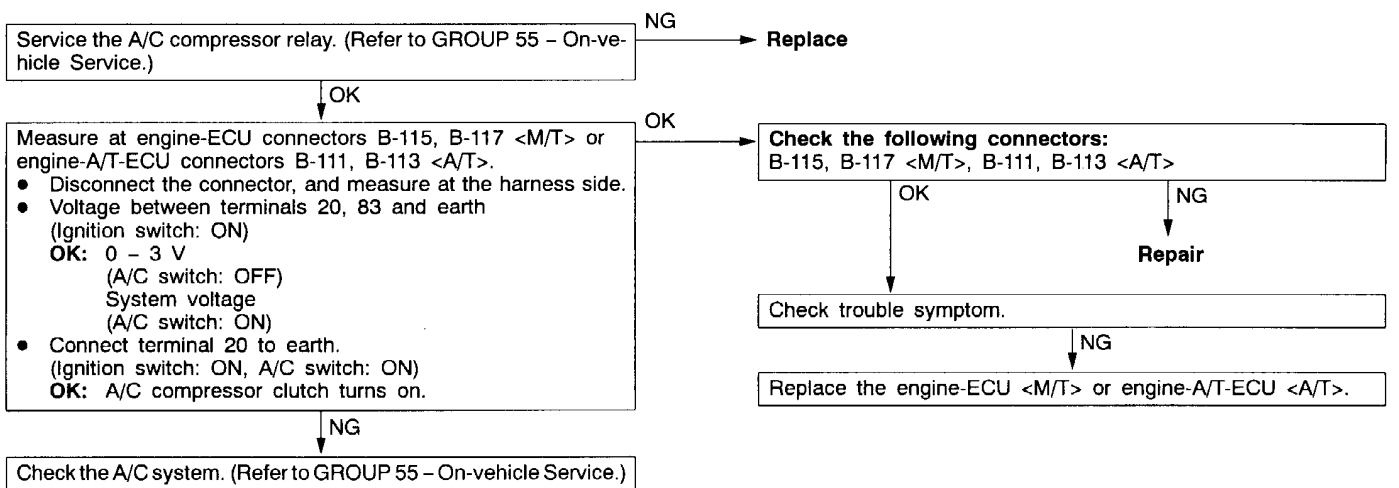
INSPECTION PROCEDURE 31

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



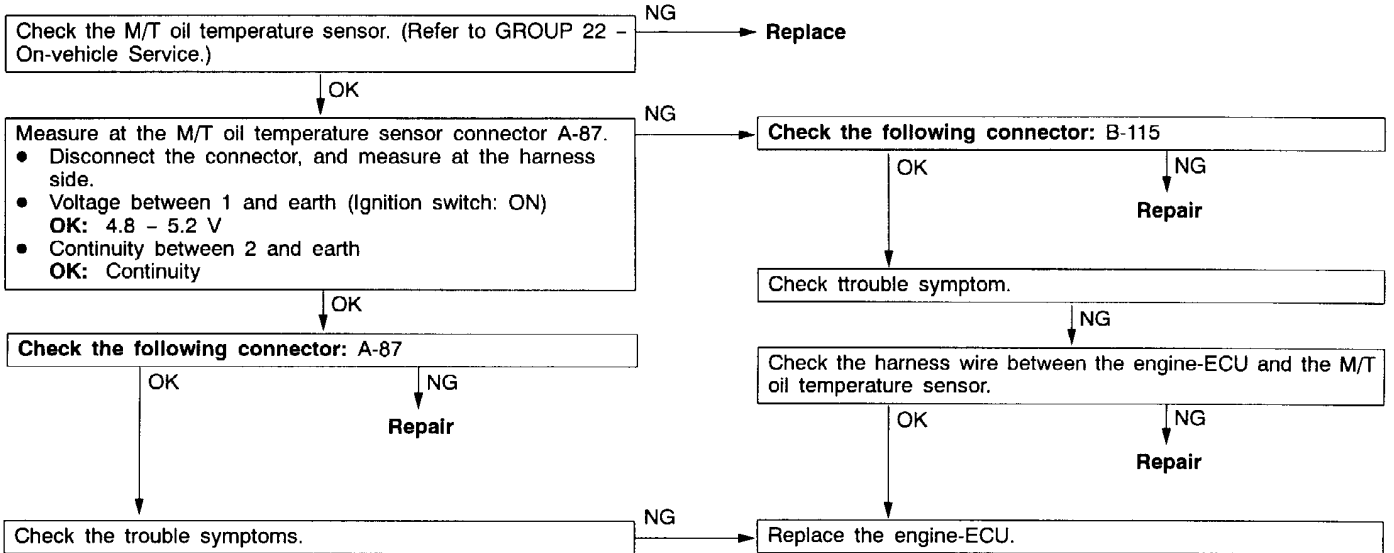
INSPECTION PROCEDURE 32

A/C switch and A/C relay system	Probable cause
<p>If the engine-ECU receives a 'A/C on' signal, it operates the throttle control servo and A/C compressor magnetic clutch so that idle speed increases.</p>	<ul style="list-style-type: none"> Malfunction of the A/C control system Malfunction of the A/C switch Open circuit or short-circuited harness wire in the A/C switch circuit, or poor connector contact Malfunction of the engine-ECU <M/T> Malfunction of the engine-A/T-ECU <A/T>



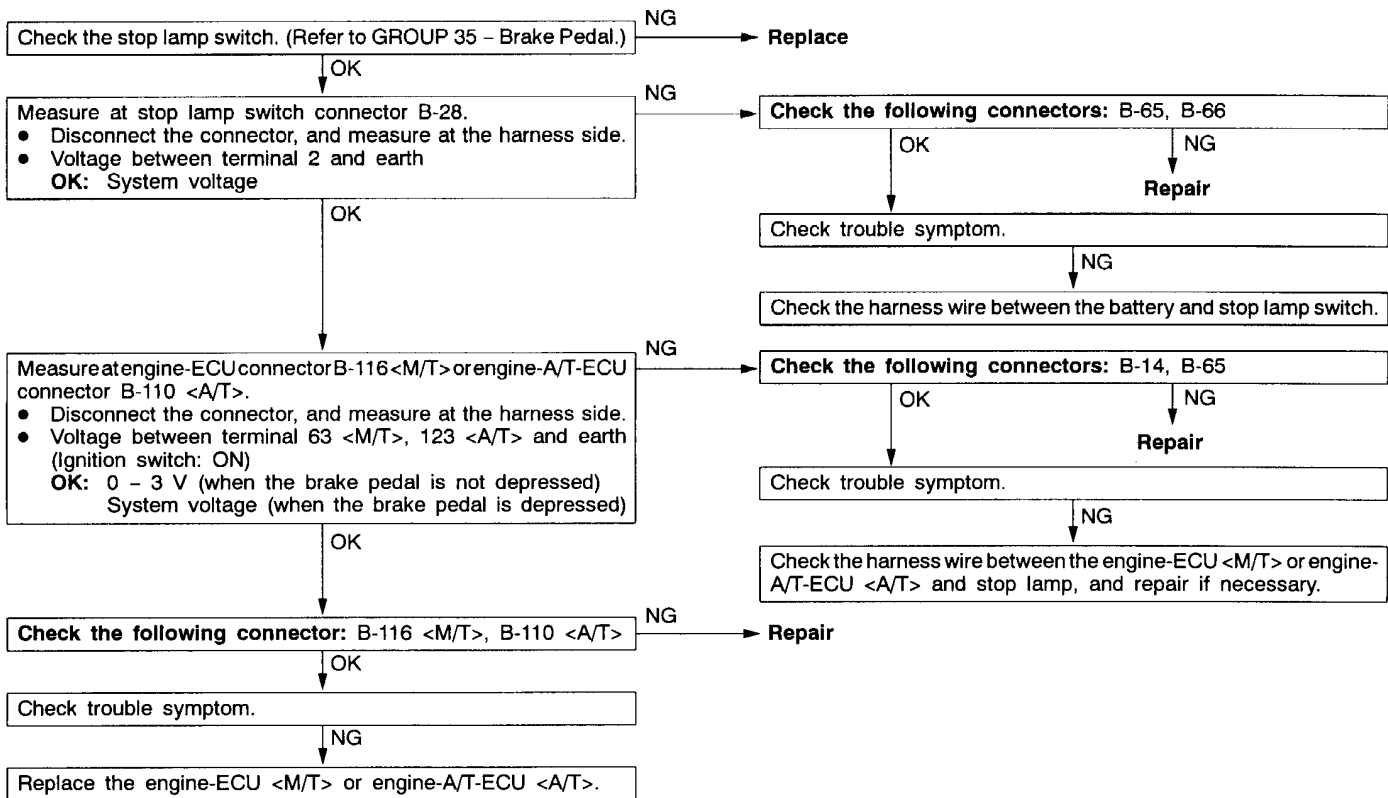
INSPECTION PROCEDURE 33

M/T oil temperature sensor system <M/T>	Probable cause
This sensor inputs the manual transmission oil temperature to the engine-ECU. The engine-ECU uses this input to control the idle speed control servo so that the idle speed is increased when the manual transmission oil temperature becomes low.	<ul style="list-style-type: none"> ● Malfunction of the M/T oil temperature sensor ● Open circuit or short-circuited harness wire in the M/T oil temperature sensor circuit ● Malfunction of the engine-ECU



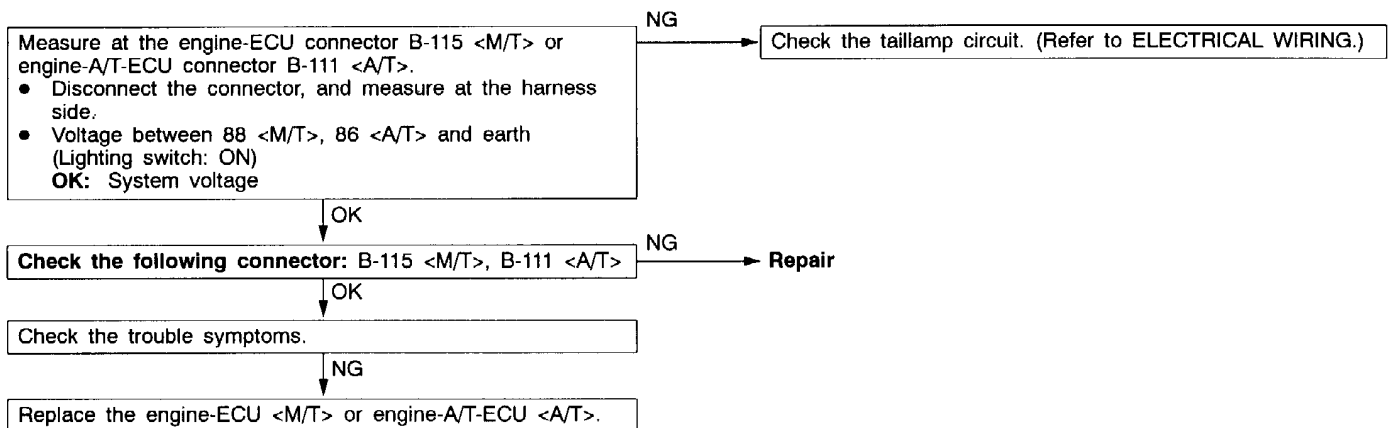
INSPECTION PROCEDURE 34

Stop lamp switch system	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> determines whether the brake pedal is depressed or not, by means of the stop lamp switch input signal.	<ul style="list-style-type: none"> ● Malfunction of the stop lamp switch ● Open circuit or short-circuited harness wire in the stop lamp circuit, or poor connector contact ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>



INSPECTION PROCEDURE 35

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



DATA LIST REFERENCE TABLE

Caution

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

NOTE

*1: Within four minutes after starting the engine

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

*3: The accelerator pedal position switch normally turns off when the voltage of the accelerator pedal position sensor (1st channel) is 300 – 500 mV higher than the voltage at the idle position. If the accelerator pedal position switch turns back on after the accelerator pedal position sensor voltage has risen by 100 mV and the throttle valve has opened, the accelerator pedal position switch and the accelerator pedal position sensor (1st channel) need to be adjusted.

*4: Terminal oil temperature is 50°C or more.

NOTE

*: If the battery is removed or the engine-ECU <M/T> or engine-A/T-ECU <A/T> is replaced, start the the engine when the engine coolant temperature is 70°C or less and let it run at a speed of at least 2,000 r/min for a while prior to each check.

Item No.	Check items	Requirements	Normal condition	Inspection procedure No.	Reference page	
11	Oxygen sensor (front)	Engine: After warm-up	Idling	200 mV or less*1	Code No. P0130	13A-27
			Sudden racing	600 – 1,000 mV		
			2,500 r/min	400 mV or less and 600 – 1,000 mV alternates.		
12	Air flow sensor	<ul style="list-style-type: none"> ● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range) 	Idling	17 – 43 Hz	Code No. P0100	13A-15
			2,500 r/min	50 – 90 Hz		
			Racing	Frequency increases in response to racing.		
13	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: -20°C	-20°C	Code No. P0110	13A-19
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		

Item No.	Check items	Requirements	Normal condition	Inspection procedure No.	Reference page	
14	Throttle position sensor (2nd channel)	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Ignition switch: ON (Engine stopped) 	Release the accelerator pedal.	4,500 – 5,500 mV	Code No. P0225	13A-45
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	400 – 600 mV		
16	Power supply voltage	Ignition switch: ON	System voltage	Procedure No. 25	13A-105	
18	Cranking signal (Ignition switch-ST)	Transmission: Neutral (A/T: P range)	Engine: Stopped	OFF	Procedure No. 28	13A-105
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: -20°C	-20°C	Code No. P0115	13A-20
			Engine coolant temperature: 0°C	0°C		
			Engine coolant temperature: 20°C	20°C		
			Engine coolant temperature: 40°C	40°C		
			Engine coolant temperature: 80°C	80°C		
22	Crank angle sensor	<ul style="list-style-type: none"> Engine: Cranking Tachometer: Connected 	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13A-49
			<ul style="list-style-type: none"> Engine: Idling Accelerator pedal position switch: ON 	Engine coolant temperature: -20°C		
		Engine coolant temperature: 0°C		1,200 – 1,400 r/min		
		Engine coolant temperature: 20°C		1,050 – 1,250 r/min		
		Engine coolant temperature: 40°C		850 – 1,050 r/min		
		Engine coolant temperature: 80°C	500 – 700 r/min <M/T>*1, *4 550 – 750 <A/T> r/min*1			

Item No.	Check items	Requirements	Normal condition	Inspection procedure No.	Reference page	
24	Vehicle speed sensor <M/T>	Drive at 40 km/h	Approximately 40 km/h	Code No. P0500	13A-57	
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No. P0105	13A-17
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No. 29	13A-105
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 31	13A-105
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No. 32	13A-105
			A/C switch: ON	ON		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No. 35	13A-105
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No. P0100	13A-19
			3,000 r/min	OFF		
37	Volumetric efficiency	<ul style="list-style-type: none"> Engine coolant temperature: 80 - 95°C Lamps, electric cooling fan and all accessories: OFF Transmission: Neutral (A/T: P range) 	Engine is idling	15 - 35 %	-	-
			2,500 r/min	15 - 35 %		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	<ul style="list-style-type: none"> Engine: Cranking [reading is possible at 2,000 r/min or less] Tachometer: Connected 	Engine speeds displayed on the MUT-II and tachometer are identical.	-	-	

Item No.	Check items	Requirements	Normal condition	Inspection procedure No.	Reference page	
41	Injector drive time*2	<ul style="list-style-type: none"> • Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range) 	Idling	0.3 – 0.8 ms*1	–	–
			2,500 r/min	0.5 – 1.0 ms		
			Sudden racing	Increases		
44	Ignition advance	<ul style="list-style-type: none"> • Engine: After warm-up • Set a timing light. 	Idling	15 – 25° BTDC*1	Code No. P0300	13A-46
			2,500 r/min	25 – 35° BTDC		
48	M/T oil temperature sensor <M/T>	Drive after the engine has warmed up.	Drive for 15 minutes or more	Gradually increases to 50 – 90°C	Procedure No. 33	13A-105
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No. 32	13A-105
			A/C switch: ON	ON (compressor clutch is operating)		
59	Oxygen sensor (rear)	<ul style="list-style-type: none"> • Transmission: 2nd gear (A/T: L range) • Drive with throttle widely open 	3,500 r/min	600 – 1,000 mV	Code No. P0136	13A-30
66	Brake vacuum sensor	<ul style="list-style-type: none"> • Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range) 	Stop the engine from idling speed, and then depress the brake pedal several times with the ignition switch on.	Displayed pressure increases.	Code No. P1515	13A-69
67	Stop switch lamp	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No. 34	13A-105
			Brake pedal: Released	ON		

Item No.	Check items	Requirements	Normal condition	Inspection procedure No.	Reference page	
68	EGR valve	<ul style="list-style-type: none"> • Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range) 	Idling	0 – 15 STEP	Code No. P0403	13A-53
			2,500 r/min	0 – 5 STEP		
74	Fuel pressure sensor	<ul style="list-style-type: none"> • Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range) 	Engine: Idling	4 – 6.9 MPa	Code No. P0190	13A-35
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	300 – 1,000 mV	Code No. P1225	13A-65
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
78	Accelerator pedal position sensor (1st channel)*3	Ignition switch: ON	Release the accelerator pedal.	300 – 1,000 mV	Code No. P0220	13A-42
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 mV or more		
79	Throttle position sensor (1st channel)	<ul style="list-style-type: none"> • Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine stopped) 	Release the accelerator pedal.	450 – 800 mV	Code No. P0120	13A-23
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 – 4,900 mV		
		Engine: After warm-up, idling	No load	450 – 1,000 mV		
		A/C switch: OFF → ON	Increases by 100 – 600 mV.			
		Selector lever: N → D range	Increases by 0 – 200 mV.			

Item No.	Check items	Requirements	Normal condition	Inspection procedure No.	Reference page	
7E	V.V.T. phase angle	Engine: Idling	0° CA	-	-	
		Engine: 2,500 r/min	approx. 25° CA*5			
81	Long-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)	-12.5 - 12.5 %	Code No. P0170	13A-33	
82	Short-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)	-30 - 25 %	Code No. P0170	13A-33	
85	Fuel pressure sensor	<ul style="list-style-type: none"> Engine coolant temperature: 80 - 95°C Lamps, electric cooling fan and all accessories: OFF Transmission: Neutral (A/T: P range) 	Engine: Idling	4,000 - 6,900 kPa	-	-
87	Calculation load value	Engine: Warm	Engine: Idling	15 - 35 %	-	-
			2,500 r/min	15 - 35 %		
88	Fuel control condition	Engine: Warm	2,500 r/min	Closed loop	Code No. P0125	13A-25
			When engine is suddenly raced	Open loop - drive condition		
99	Fuel injection mode	Engine: After warm up	Idling (after four minutes or more have passed since engine start)	Lean compression	-	-
			2,500 r/min	Stoichiometric metric feedback		
			Sudden racing after idle position	Open loop		
A1	Oxygen sensor (front)	Engine: After warm-up	Idling	0 V	Code No. P0130	13A-27
			Sudden racing	0.6 - 1.0 V		
			2,500 r/min	0.4 V or less and 0.6 - 1.0 V alternates		
A2	Oxygen sensor (rear)	<ul style="list-style-type: none"> Transmission: 2nd gear <M/T>, L range <A/T> Drive with throttle widely open 	3,500 r/min	0.6 - 1.0 V	Code No. P0136	13A-30

Item No.	Check items	Requirements	Normal condition	Inspection procedure No.	Reference page	
8A	Throttle position sensor (1st channel) (Throttle valve opening angle)	<ul style="list-style-type: none"> Engine coolant temperature: 80 - 95°C Ignition switch: ON (Engine: stopped) 	Release the accelerator pedal.	8 - 16 %	Code No. P0120	13A-23
			Depress the accelerator pedal gradually.	Increase in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	80 - 100 %		
		Engine: After warm-up, idling	No load	8 - 18 %		
		A/C switch: OFF → ON	Rises by 2 - 10 %			

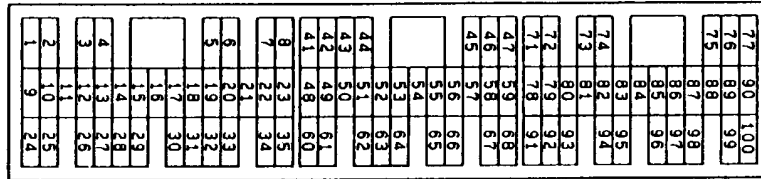
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. P0201	13A-36
02		Cut fuel to No. 2 injector			Code No. P0202	13A-38
03		Cut fuel to No. 3 injector			Code No. P0203	13A-39
04		Cut fuel to No. 4 injector			Code No. P0204	13A-40
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 30	13A-105
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-56
17	Basic ignition timing	Set the engine-ECU <M/T> or engine-A/T-ECU <A/T> to ignition timing adjustment mode	Idling after engine warm up	5° BTDC	-	-
21	Fan controller	Drive the fan motor	Ignition switch: ON	The fan motor operates	Procedure No. 21	13A-104
34	Electronic-controlled throttle valve system	Stop the throttle control servo.	Ignition switch: ON	Throttle valve is opened slightly.	Code No. P1220	13A-61

CHECK AT THE ENGINE-ECU TERMINALS <M/T>

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



7FU2119

Terminal No.	Check item	Check requirements (engine condition)	Normal condition	
1	No. 1 injector	Engine: Warm up, and then depress the accelerator pedal suddenly from the idle speed.	Decreases slightly for short time from 9 – 13 V	
9	No. 2 injector			
24	No. 3 injector			
2	No. 4 injector			
3	No. 1 ignition coil	Engine: 3,000 r/min	0.3 – 3.0 V	
13	No. 2 ignition coil			
12	No. 3 ignition coil			
4	No. 4 ignition coil			
5	EGR valve (D)	Ignition switch: Immediately after turning ON	5 – 8 V (fluctuates for approx. three seconds)	
6	EGR valve (C)			
32	EGR valve (B)			
34	EGR valve (A)			
8	Alternator G terminal	<ul style="list-style-type: none"> • Engine: Warm up, and then idling • Radiator fan: Not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON 	Voltage increases by 0.2 – 3.5 V	
11	Intake camshaft position sensor	Engine: Cranking	0.4 – 3.0 V	
		Engine: Idling	0.5 – 2.0 V	
14	GDI ECO indication lamp	Ignition switch: OFF → ON	0 – 3 V (System voltage after five seconds)	
		Engine: When the accelerator pedal is suddenly depressed while the engine is idling	System voltage	
16	Purge control solenoid valve	<ul style="list-style-type: none"> • Engine coolant temperature: 80 – 95°C • Ignition switch: ON 	Engine: Stopped	System voltage
			Engine: Start the engine, and then increase engine speed up to 3,500 r/min.	Voltage decreases

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
18	Fan controller	Radiator and condenser fans are not operating.		0 – 0.3 V
		Radiator and condenser fans are operating.		0.7 V or more
19	Oil control valve	Ignition switch: ON		System voltage
		Maintain at least 2,500 r/min after checking the idling speed.		4 – 10 V*
20	A/C relay	<ul style="list-style-type: none"> ● Engine: Idling ● A/C switch: OFF → ON (Compressor is operating) 		System voltage, or changes from momentarily 6 V or more to 0 → 3 V
21	Fuel pump relay	Ignition switch: ON	Engine: Stopped	System voltage
			Engine: Idling	0 – 3 V
31	Engine warning lamp	Ignition switch: OFF → ON		0 – 3 V → System voltage (after several seconds)
41	Sensor power supply	Ignition switch: ON		4.5 – 5.5 V
42	Power supply to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 – 5.5 V
43	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idling		1.5 – 2.5 V
44	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.2 – 3.5 V
			Engine coolant temperature: 20°C	2.3 – 2.9 V
			Engine coolant temperature: 40°C	1.5 – 2.1 V
			Engine coolant temperature: 80°C	0.4 – 1.0 V
45	Engine ignition signal	Engine: 3,000 r/min		0.3 – 3.0 V
47	Power supply	Ignition switch: ON		System voltage
59				

NOTE

*: If the battery is removed or the engine-ECU is replaced, start the the engine when the engine coolant temperature is 70°C or less and let it run at a speed of at least 2,000 r/min for a while prior to each check.

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
50	Exhaust camshaft position sensor	Engine: Cranking		0.3 - 3.0 V
		Engine: Idling		0.5 - 3.5 V
51	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 - 4.3 V
			Altitude: 1,200 m	3.2 - 3.8 V
52	Alternator FR terminal	<ul style="list-style-type: none"> ● Engine: Warm up, and then idling ● Radiator fan: Not operating ● Headlamp: OFF → ON ● Stop lamp: OFF → ON ● Rear defogger: OFF → ON 		Voltage decreases
53	Oxygen sensor (rear)	<ul style="list-style-type: none"> ● Transmission: 2nd gear ● Engine speed: 3,500 r/min or more ● Driving with the throttle valve widely open 		0.6 - 1.0 V
54	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 - 3 V
55	Injector driver relay	Ignition switch: OFF		0 - 0.1 V
		Ignition switch: ON		0.5 - 1.0 V
56	Throttle valve control servo relay	Ignition switch: OFF		0 - 0.3 V
		Ignition switch: ON		0.5 - 1.0 V
57	Engine control relay	Ignition switch: OFF		0 - 3 V
		Ignition switch: ON		System voltage
60	Back-up power source	Ignition switch: OFF		System voltage
61	Air flow sensor	Engine: Idling		2.2 - 3.2 V
		Engine: 2,500 r/min		
62	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 - 3.8 V
			Intake air temperature: 20°C	2.3 - 2.9 V
			Intake air temperature: 40°C	1.5 - 2.1 V
			Intake air temperature: 80°C	0.4 - 1.0 V
63	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 - 3 V
66	Clutch switch	Depress the clutch pedal.		0 - 3 V
		Release the clutch pedal.		System voltage
68	Ignition switch-ST	Engine: Cranking		8 V or more

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
71	Oxygen sensor (front)	Engine: Warm up, and then hold the engine speed at 2,500 r/min (Use a digital voltmeter).		0 ↔ 0.8 V alternates.
73	M/T oil temperature sensor	M/T oil temperature: 25°C		2.4 – 2.7 V
		M/T oil temperature: 80°C		0.5 – 0.8 V
74	Brake vacuum sensor	Engine: Stop the engine from idle speed, turn the ignition switch ON, and then depress the brake pedal several times.		Voltage increases
76	Air flow sensor reset signal	Engine: Idling		0 – 1 V
		Engine: 3,000 r/min		6 – 9 V
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.5 – 5.5 V
			Depress the accelerator pedal fully.	0.4 – 0.6 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 – 1 V
			Depress the accelerator pedal fully.	4 V or more
80	Vehicle speed sensor	<ul style="list-style-type: none"> ● Ignition switch: ON ● Move the vehicle forward. 		0 ↔ system voltage alternates.
83	A/C switch	Engine: Idling	A/C switch: OFF	0 – 3 V
			A/C switch: ON (Compressor is operating)	System voltage
88	Small lamp switch	Lighting switch: OFF		0 – 3 V
		Lighting switch: ON (Taillamp: ON)		System voltage
89	Oxygen sensor heater (front)	Engine: Idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
90	Oxygen sensor heater (rear)	Engine: Idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V
94	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.9 – 1.2 V
			Depress the accelerator pedal fully.	4 V or more

Terminal No.	Check item	Check requirements (engine condition)	Normal condition
96	Injector open circuit check signal	Engine: Increase engine speed from idle speed to 4,000 r/min.	Decreases slightly (approx. 0.7 V) from 4.5 V – 5.0 V.
99	Ignition switch-IG	Ignition switch: ON	System voltage

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

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

NOTE

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

Caution

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

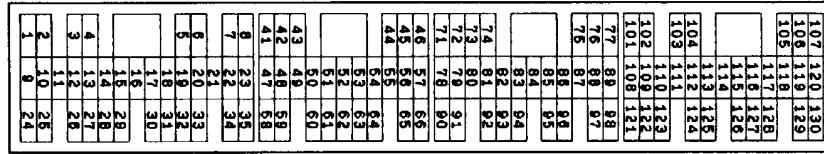
Be careful to prevent this!

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

CHECK AT THE ENGINE-A/T-ECU TERMINALS <A/T>

TERMINAL VOLTAGE CHECK CHART

Engine-A/T-ECU Connector Terminal Arrangement



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		
3	Oxygen sensor heater (front)	Engine: Idling	0 – 3 V
		Engine: 3,500 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: 3,000 r/min	0.3 – 3.0 V
12	No. 2 ignition coil		
31	No. 3 ignition coil		
30	No. 4 ignition coil		
14	Throttle control servo relay	Ignition switch: OFF	0 – 0.1 V
		Ignition switch: ON	0.5 – 1.0 V
18	Fan controller	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: 3,000 r/min	6 – 9 V

Terminal No.	Check item	Check condition (Engine condition)	Normal condition	
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	
23	GDI ECO indication lamp	Ignition switch: OFF → ON	0 - 3 V (System voltage after five seconds)	
		Rev the engine suddenly.	System voltage	
26	Oxygen sensor heater (rear)	Engine: Idling	0 - 3 V	
		Engine: 3,500 r/min	System voltage	
33	Oil control valve	Ignition switch: ON	System voltage	
		Maintain at least 2,500 r/min after checking the idling speed.	4 - 10 V*	
34	Purge control solenoid valve	<ul style="list-style-type: none"> Engine coolant temperature: 80 - 95°C Ignition switch: ON 	Engine: Stopped	System voltage
			Engine: After starting, increase the engine speed up to 3,500 r/min	The voltage drops
41	Power supply	Ignition switch: ON	System voltage	
47				
43	Engine ignition signal	Engine speed: 3,000 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 (1st channel)	Ignition switch: ON	4.5 - 5.5 V	
49	Engine control relay	Ignition switch: OFF	0 - 3 V	
		Ignition switch: ON	System voltage	

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
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 1,200 m	3.2 – 3.8 V
56	Exhaust camshaft position sensor	Engine: Cranking		0.3 – 3.0 V
		Engine: Idling		0.5 – 3.5 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, engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal.)		
63	Injector open circuit check signal	Engine: Increases from idling up to 4,000 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: 2,500 r/min		
66	Backup power supply	Ignition switch: OFF		System voltage
71	Oxygen sensor (front)	Engine: Running at 2,500 r/min after warming-up (Check by using a digital voltmeter.)		Voltages of 0 V and 0.8 V alternate
72	Intake camshaft position sensor	Engine: Cranking		0.4 – 3.0 V
		Engine: Idling		0.5 – 2.0 V
73	Oxygen sensor (rear)	<ul style="list-style-type: none"> ● Transmission: L range ● Engine speed: 3,500 r/min or more ● Driving with the throttle valve widely open 		0.6 – 1.0 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
78	Throttle position sensor (2nd channel)	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 <M/T>	<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 (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.9 – 1.2 V
			Depress the accelerator pedal fully.	4.0 V or higher
96	Brake vacuum sensor	Engine: Stop the engine from idle speed, turn the ignition switch ON, and then depress the brake pedal several times.		Voltage increases
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

NOTE

*: If the battery is removed or the engine-A/T-ECU is replaced, start the the engine when the engine coolant temperature is 70°C or less and let it run at a speed of at least 2,000 r/min for a while prior to each check.

**CHECK CHART FOR RESISTANCE AND CONTINUITY
BETWEEN TERMINALS**

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

NOTE

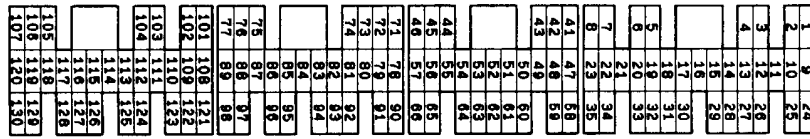
- (1) When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
- (2) Checking need not be carried out in the order given in the chart.

Caution

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

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

Engine-A/T-ECU Harness Side Connector Terminal Arrangement



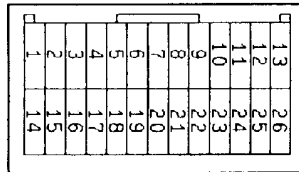
7FU1764

Terminal No.	Check item	Standard value, normal condition (check conditions)
3 – 41	Oxygen sensor heater (front)	4.5 – 8.0 Ω (at 20°C)
26 – 41	Oxygen sensor heater (rear)	11 – 18 Ω (at 20°C)
33 – 41	Oil control valve	6.9 – 7.9 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 terminal 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)	
44 – 81	Engine coolant temperature sensor	5.1 – 6.5 kΩ (When coolant temperature is 0°C)
		2.1 – 2.7 kΩ (When coolant temperature is 20°C)
		0.9 – 1.3 kΩ (When coolant temperature is 40°C)
		0.26 – 0.36 kΩ (When coolant temperature is 80°C)
64 – 81	Intake air temperature sensor	5.3 – 6.7 kΩ (When intake air temperature is 0°C)
		2.3 – 3.0 kΩ (When intake air temperature is 20°C)
		1.0 – 1.5 kΩ (When intake air temperature is 40°C)
		0.30 – 0.42 kΩ (When intake air temperature is 80°C)
79 – 81	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is depressed slightly)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

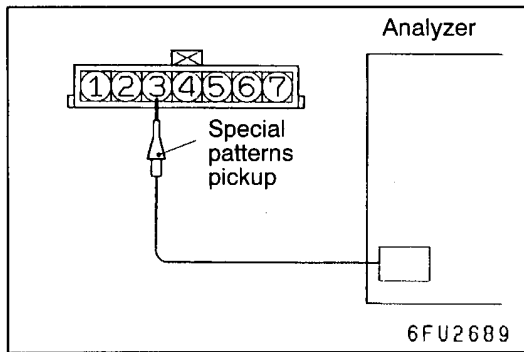
TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



7FU2121

Terminal No.	Check items	Requirements		Normal value
1	Throttle valve control servo (A+)	<ul style="list-style-type: none"> Ignition switch: ON Accelerator pedal: Fully opened → fully closed 		Decreases slightly from system voltage.
9	Throttle valve control servo (B+)			
14	Throttle valve control servo (A-)	<ul style="list-style-type: none"> Ignition switch: ON Accelerator pedal: Fully closed → fully opened 		Decreases slightly (approx. 2 V) from system voltage.
15	Throttle valve control servo (B-)			
2	Power supply to throttle valve control servo	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor voltage	Ignition switch: ON		4.5 – 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.4 – 0.8 V
			Depress the accelerator pedal fully.	4.2 – 4.9 V
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.9 – 1.2 V
			Depress the accelerator pedal fully.	4 V or more



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

The followings have been changed from the previous description.

Alternate Method (Test harness not available)

<Vehicles with M/T>

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

<Vehicles with A/T>

1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 65.

EXHAUST CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

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

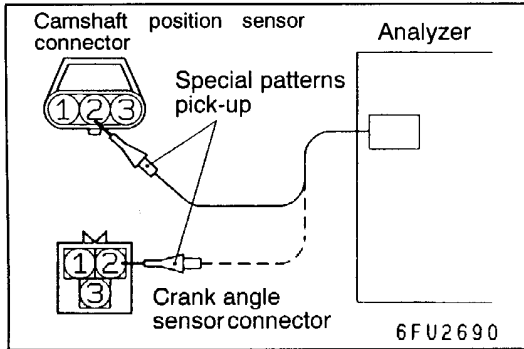
Alternate Method (Test harness not available)

<Vehicles with M/T>

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

<Vehicles with A/T>

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



INTAKE CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the intake camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to intake camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD9988478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

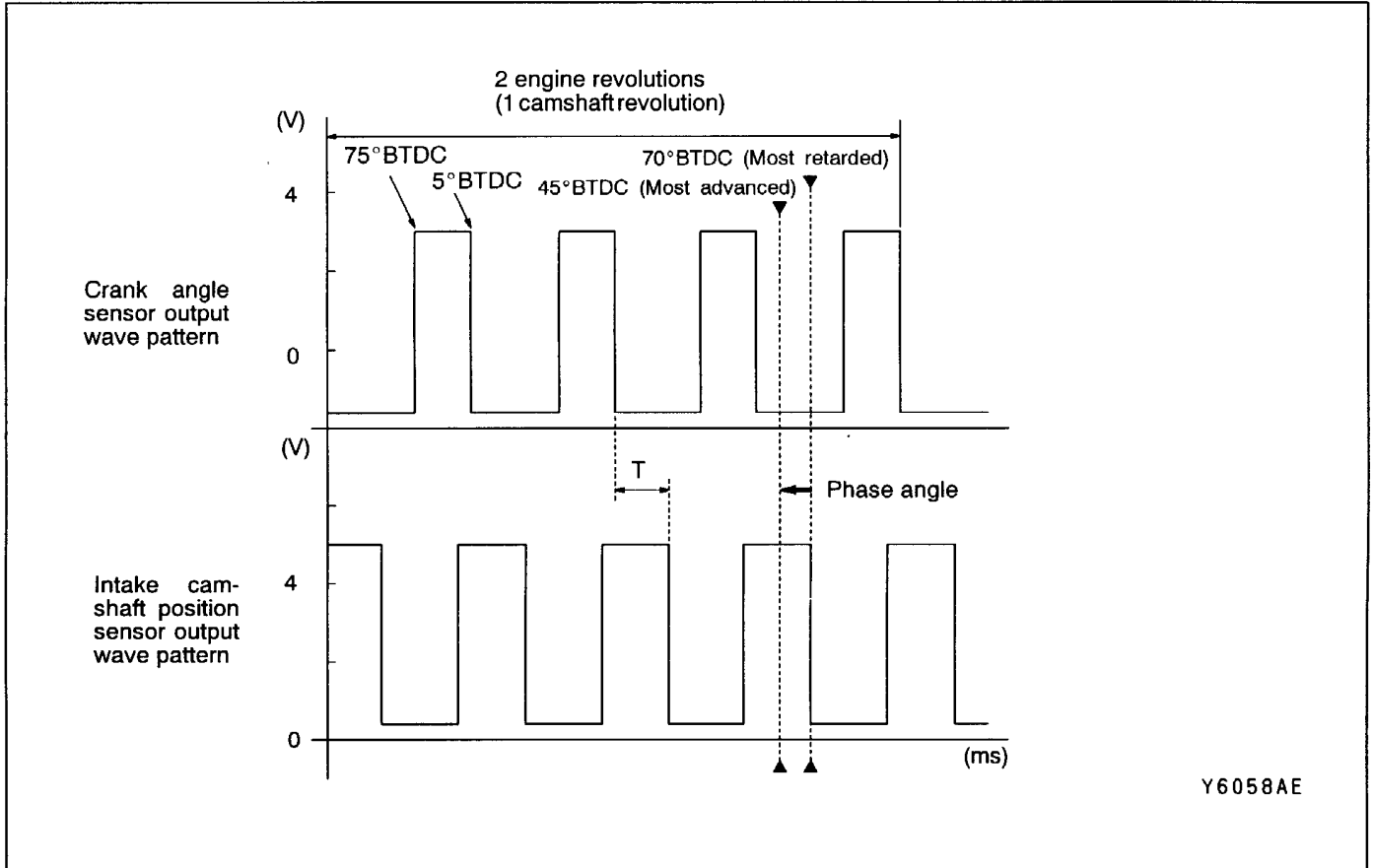
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 11 or engine-A/T-ECU <A/T> terminal 72. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 43 or engine-A/T-ECU <A/T> terminal 45. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

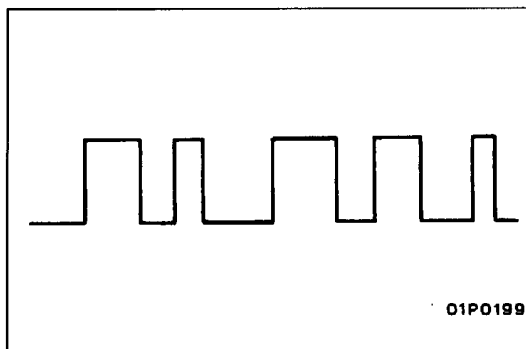
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

As the intake camshaft position sensor sends signal for longer time, time duration T should become the shorter. Meanwhile, as the sensor sends signal for shorter time, time duration T should become the longer.



Examples of Abnormal Wave Patterns

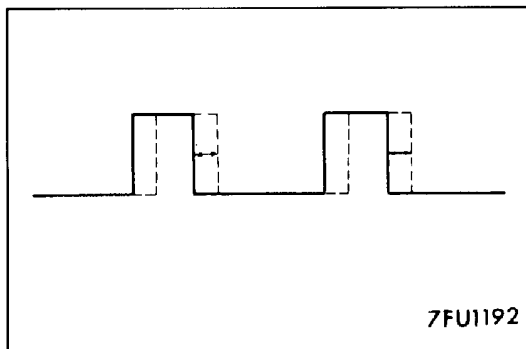
- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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



- Example 2

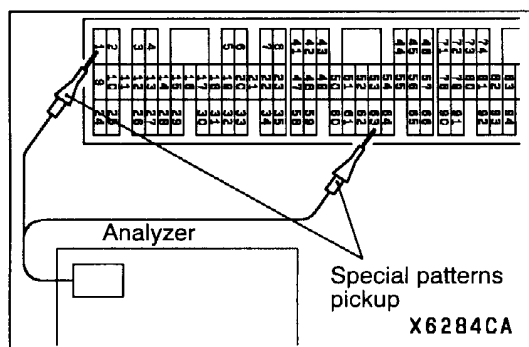
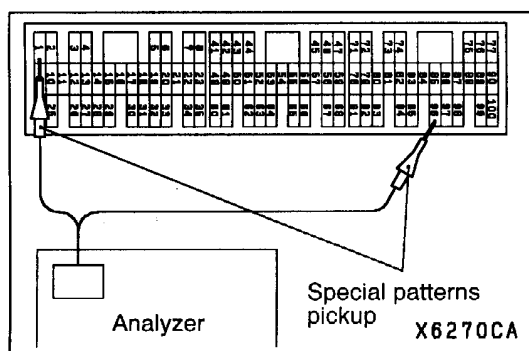
Cause of problem

Loose timing belt

Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.



INJECTORS AND INJECTOR OPEN CIRCUIT CHECK SIGNAL

Measurement Method

<Vehicles with M/T>

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

<Vehicles with A/T>

1. Connect the analyzer special patterns pickup to terminal 1 (No. 1 injector) of the engine-A/T-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 63 (injector open circuit check signal) of the engine-A/T-ECU connector.
3. After checking terminal 1, check terminal 9 (No. 2 injector), terminal 24 (No. 3 injector) and terminal 2 (No. 4 injector).

IGNITION COIL AND POWER TRANSISTOR (Power transistor control signal)

The followings have been changed from the previous description.

Alternate Method (Test harness not available)

<Vehicles with M/T>

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

<Vehicles with A/T>

1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 11 (No. 1 ignition coil), terminal 12 (No. 2 ignition coil), terminal 31 (No. 3 ignition coil) and terminal 30 (No. 4 ignition coil) respectively.

EGR VALVE (STEPPER MOTOR)

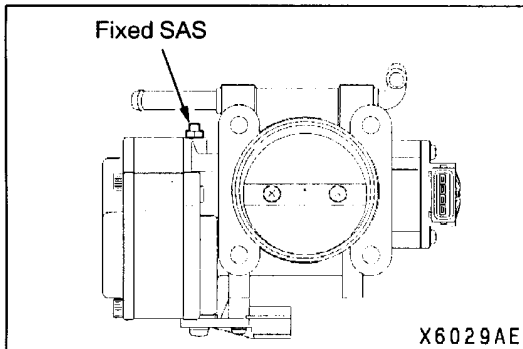
The followings have been changed from the previous description.

Alternate Method (Test harness not available)**<Vehicles with M/T>**

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

<Vehicles with A/T>

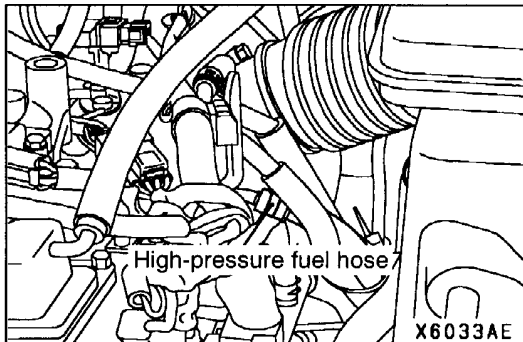
1. Connect the analyzer special patterns pickup to engine-A/T-ECU terminal 51, connection terminal 60, connection terminal 53, and connection terminal 62 respectively.



ON-VEHICLE SERVICE

Caution

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



FUEL PRESSURE TEST

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

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

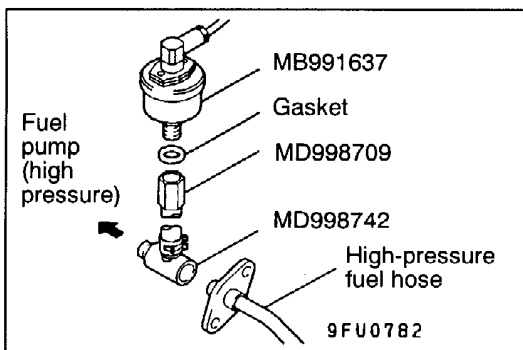
NOTE

Refer to '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803) GROUP 13A - On-vehicle Service.

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

Caution

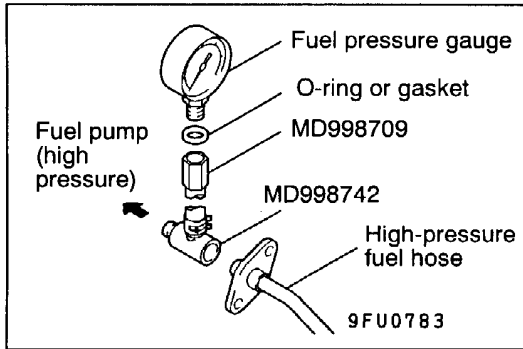
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



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

<When using the fuel pressure gauge set (special tool)>

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



<When using the fuel pressure gauge>

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

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

Caution

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

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

Standard value: approximately 324 kPa

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

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

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

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

14. Release residual pressure from the fuel pipe line.

NOTE

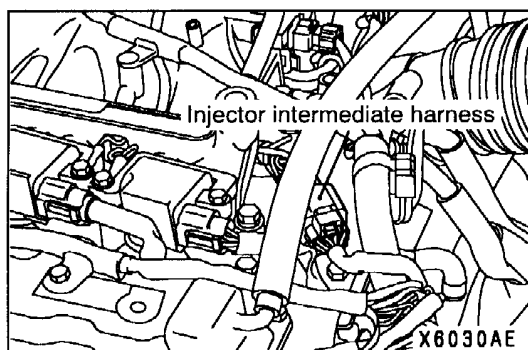
Refer to '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803) GROUP 13A – On-vehicle Service.

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

Caution

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

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



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

NOTE

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

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

Caution

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

6. Check if the fuel pressure is more than 1 MPa immediately after 20 seconds have passed since cranking was finished.

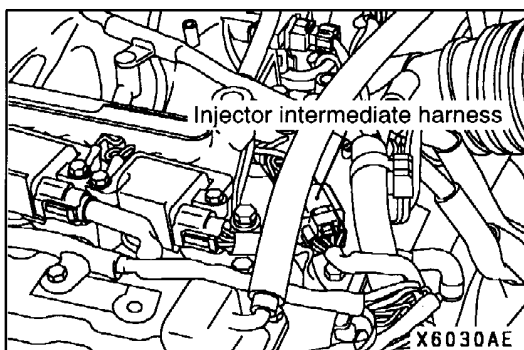
7. If the fuel pressure is lower than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.
8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.
11. Measure fuel pressure while the engine is running at idle.

Standard value: 4 – 6.9 MPa

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

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

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



FUEL LEAK CHECK

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

Caution

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

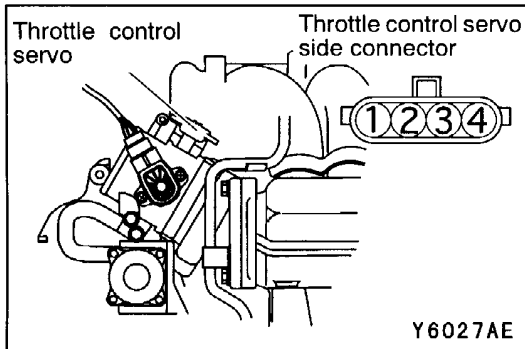
6. Crank the engine, and then measure fuel pressure immediately after 20 seconds.

Limit: Minimum 1 MPa

Caution

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

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



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. Operate the accelerator pedal to confirm that the throttle valve opens and closes.

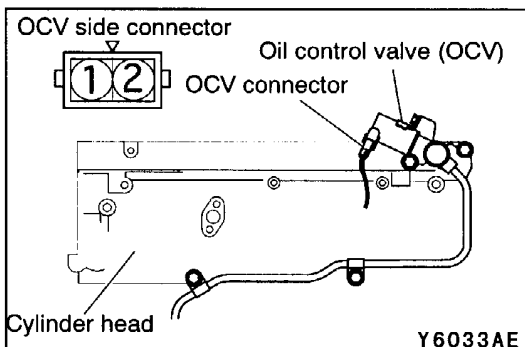
Coil resistance check

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

Standard value:

Terminals	Resistance (Ω)
1 - 3	1.35 - 1.65 (at 20°C)
2 - 4	

3. Confirm that there is no continuity between the terminals.



OIL CONTROL VALVE (OCV) CHECK

Operating sound check

1. Disconnect the OCV connector.
2. When battery voltage is applied to the OCV side connector terminals, operating sound should be heard from the OCV.

Caution

Never apply battery voltage for long time, or the coil may be burned out.

Measuring resistance between terminals

1. Disconnect the OCV connector.
2. Measure the resistance between the OCV connector terminals.

Standard value:

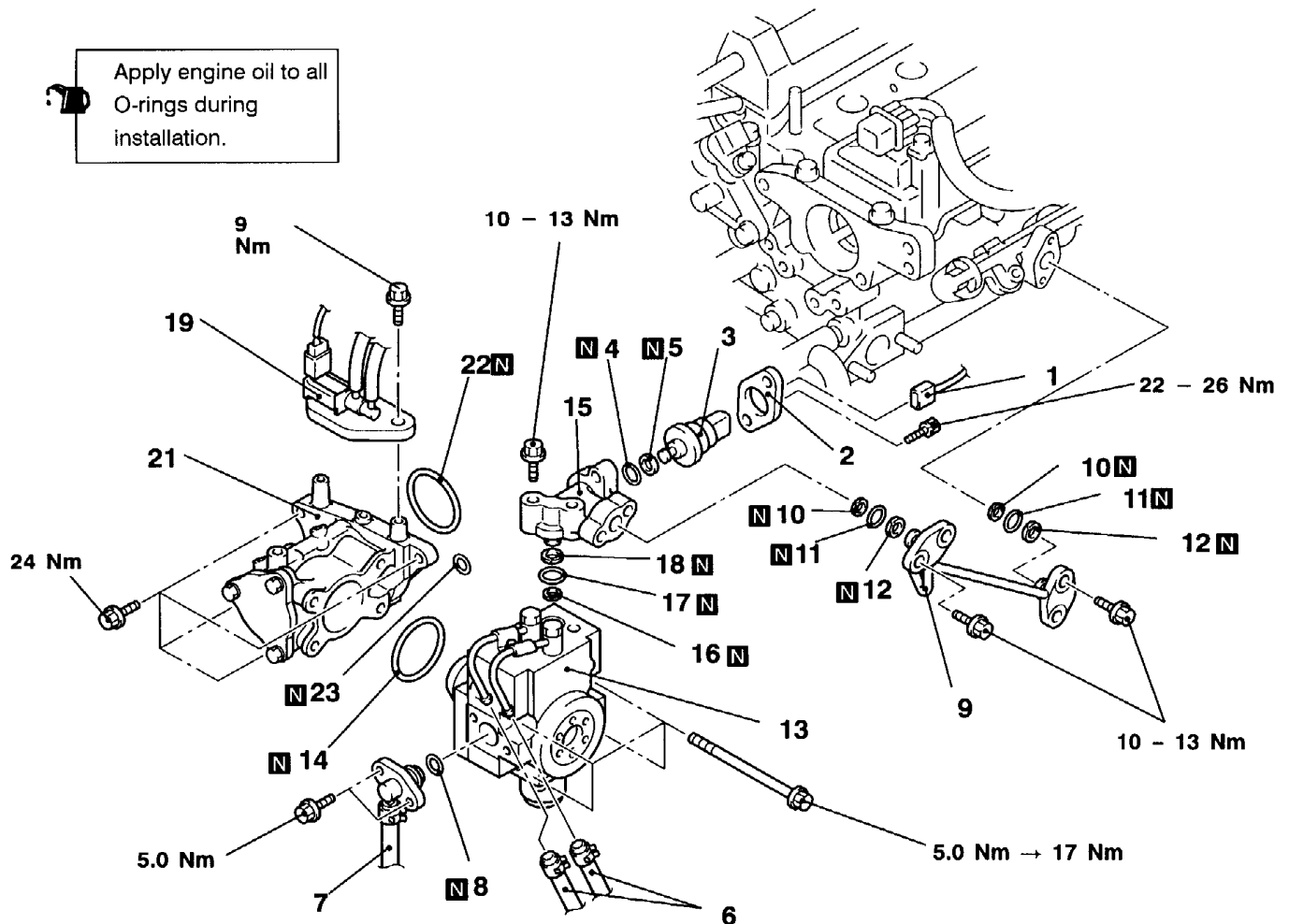
6.9 - 7.9 Ω (at 20°C)

FUEL PUMP (HIGH PRESSURE)**REMOVAL AND INSTALLATION****Pre-removal and Post-Installation Operation**

- Prevention of fuel discharge <before removal only>
- Throttle Body Removal and Installation (P.13A-142.)
- Fuel Leak Check <after installation only> (Refer to P.13A-132.)



Apply engine oil to all O-rings during installation.

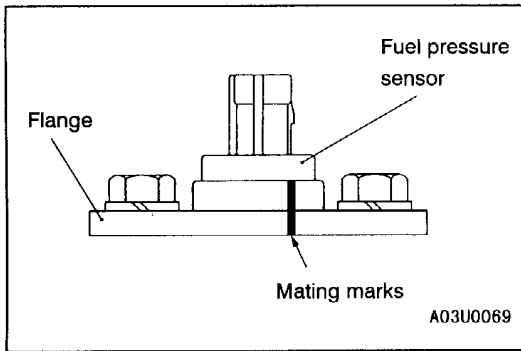


AX0528AU

Removal steps

- ▶H◀ • Air-bleeding high-pressure fuel line
- ▶A◀ ▶G◀ 1. Fuel pressure sensor connector
- ▶G◀ ▶G◀ 2. Flange
- ▶F◀ ▶F◀ 3. Fuel pressure sensor
- ▶F◀ ▶F◀ 4. O-ring
- ▶E◀ ▶E◀ 5. Back-up ring
- ▶E◀ ▶E◀ 6. Fuel return hose connection
- ▶E◀ ▶E◀ 7. Fuel pressure hose connection
- ▶D◀ ▶D◀ 8. O-ring
- ▶D◀ ▶D◀ 9. Fuel pipe
- ▶D◀ ▶D◀ 10. Back-up ring A
- ▶D◀ ▶D◀ 11. O-ring

- ▶D◀ ▶D◀ 12. Back-up ring B
- ▶C◀ ▶C◀ 13. Fuel pump (high pressure) assembly
- ▶B◀ ▶B◀ 14. O-ring
- ▶B◀ ▶B◀ 15. Fuel fitting
- ▶B◀ ▶B◀ 16. Back-up ring A
- ▶B◀ ▶B◀ 17. O-ring
- ▶B◀ ▶B◀ 18. Back-up ring B
- ▶A◀ ▶A◀ 19. Purge control solenoid valve assembly
- ▶A◀ ▶A◀ 20. Camshaft position sensor
- ▶A◀ ▶A◀ 21. Pump camshaft case assembly
- ▶A◀ ▶A◀ 22. O-ring
- ▶A◀ ▶A◀ 23. O-ring



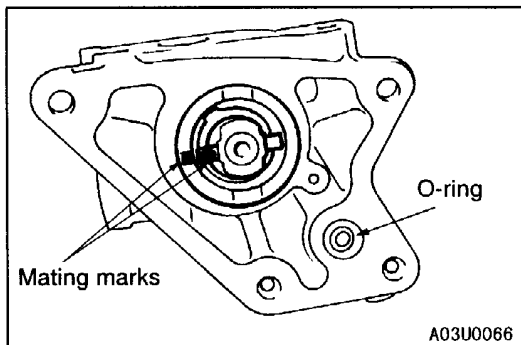
REMOVAL SERVICE POINTS

◀A▶ 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.



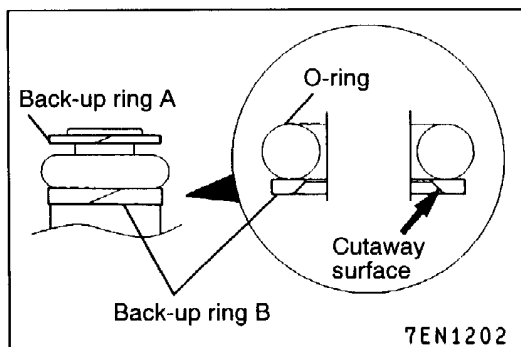
INSTALLATION SERVICE POINTS

▶A◀ PUMP CAMSHAFT CASE ASSEMBLY INSTALLATION

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

Caution

Take care not to drop the O-ring.



▶B◀ BACK-UP RING B/O-RING/BACK-UP RING A/FUEL FITTING 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

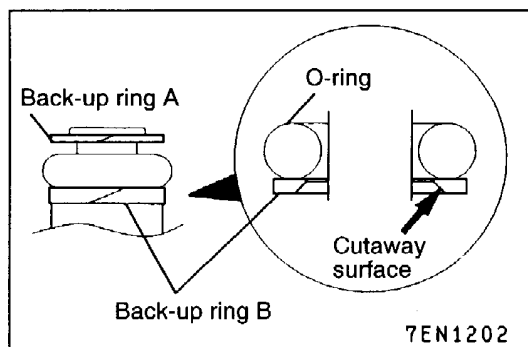
Be careful not to allow the engine oil to enter the fuel pump (high pressure) and the delivery pipe.

3. Insert the fuel fitting into the fuel pump (high pressure) bore squarely and securely while being careful not to twist the fitting. Tighten the mounting bolts to the specified torque.

Tightening torque: 10 – 13 Nm

►C◄ FUEL PUMP (HIGH PRESSURE) INSTALLATION

1. Apply fresh engine oil to the O-ring and the fuel pump (high pressure) roller.
2. Insert the fuel pump (high pressure) to the pump camshaft case bore squarely, and loosely install the mounting bolts at this stage (a bit tighter than finger-tightening). Tightening the bolts to the specified torque should be carried out at step ►D◄ below .

**►D◄ 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

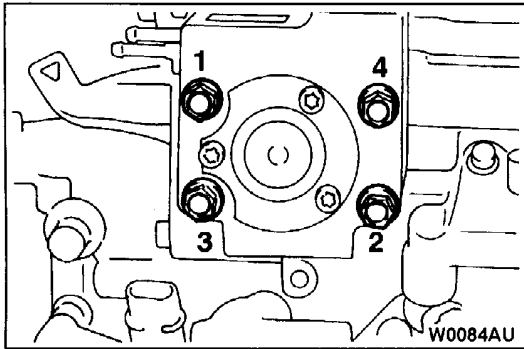
- (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
- (2) Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring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

Caution

Be careful not to allow the engine oil to enter the fuel pump (high pressure) and the delivery pipe.

3. Insert the fuel pipe into the fuel pump (high pressure) and the delivery pipe bores squarely and securely while being careful not to twist the pipe. Tighten the mounting bolts to the specified torque.

Tightening torque: 10 – 13 Nm



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

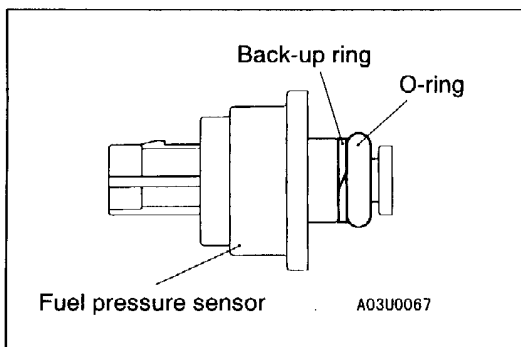
►E◄ FUEL PRESSURE HOSE INSTALLATION

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

Caution

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

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



►F◄ BACK-UP RING/O-RING INSTALLATION

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

Caution

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

**►G◄ FUEL PRESSURE SENSOR/FLANGE
INSTALLATION**

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

Caution

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

2. Install the fuel fitting according to the mating marks made during removal.

Caution

If the fuel pressure sensor is replaced with new one, always replace the sensor and the flange as a set.

►H◄ AIR-BLEEDING HIGH-PRESSURE FUEL LINE

1. After installing the fuel pump (high pressure), run the engine at 2000 r/min for at least 15 seconds in order to bleed air from the high-pressure fuel line.

NOTE

If air is trapped in the high-pressure fuel line due to the removal of fuel pipe, diagnosis code No.56 will be set as abnormal fuel pressure.

2. Finally confirm diagnosis code by using the MUT-II. If diagnosis code, which indicates defective fuel pressure sensor system, has been set, erase the code.

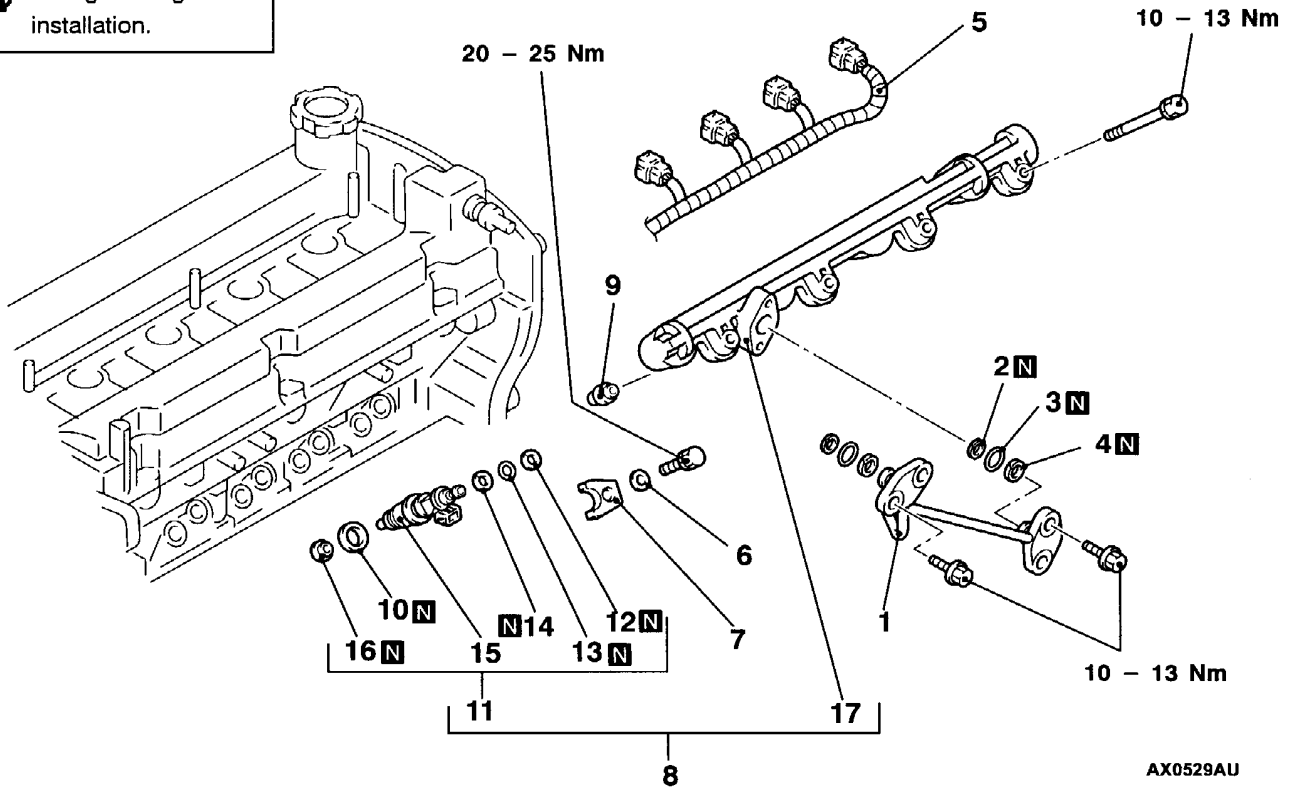
INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Prevention of fuel discharge <before removal only>
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Leak Check <after installation only> (Refer to P.13A-132.)

Apply engine oil to all O-rings during installation.



AX0529AU

Removal steps

- | | | | | | |
|-----|-----|---|-----|-----|----------------------------|
| | ▶E◀ | • Air-bleeding high-pressure fuel line | | ▶C◀ | 9. Insulator |
| | ▶D◀ | 1. Fuel pipe | | ▶C◀ | 10. Gasket |
| | ▶D◀ | 2. Back-up ring A | ◀B▶ | ▶B◀ | 11. Fuel injector assembly |
| | ▶D◀ | 3. O-ring | | ▶A◀ | 12. Back-up ring A |
| ◀A▶ | ▶D◀ | 4. Back-up ring B | | ▶A◀ | 13. O-ring |
| | | 5. Injector harness connector | | ▶A◀ | 14. Back-up ring B |
| | ▶C◀ | 6. Washer | | ▶A◀ | 15. Fuel injector |
| ◀B▶ | ▶C◀ | 7. Injector holder | | ▶A◀ | 16. Corrugated washer |
| | ▶C◀ | 8. Delivery pipe and fuel injector assembly | | | 17. Delivery pipe |

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

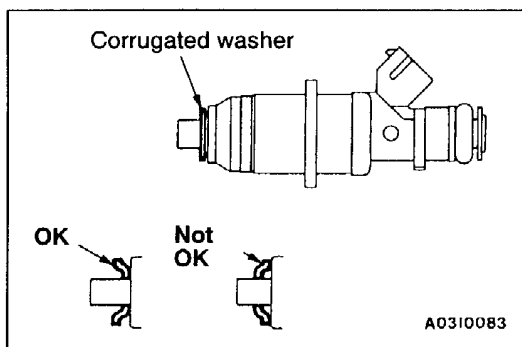
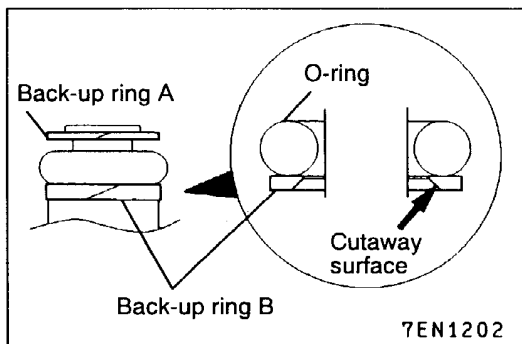
Disconnect the negative battery cable from its terminal before carrying out this operation.

◀B▶ DELIVERY PIPE AND FUEL INJECTOR ASSEMBLY REMOVAL

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

Caution

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

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

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

Caution

- (1) Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.
- (2) Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)
2. Apply petroleum jelly to the corrugated washer to prevent it from falling off, and install it in the direction shown.

Caution

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

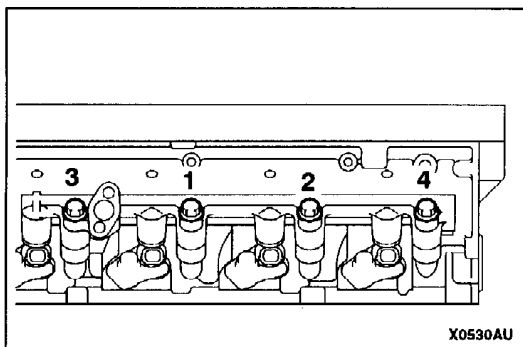
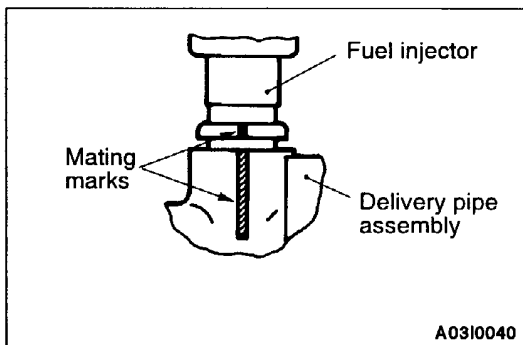
►B◄ FUEL INJECTOR ASSEMBLY INSTALLATION

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.

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

1. Align the mating marks on the delivery pipe and fuel injector assembly, and then install the delivery pipe assembly with the injector assembly still attached.
2. Install the gasket and insulator to the cylinder head.
3. Install the delivery pipe and fuel injector assembly to the cylinder head, and loosely install the mounting bolts.
4. Install the injector holder and washer, and tighten the mounting bolts to the specified torque.

Tightening torque: 20 – 25 Nm

5. Tighten the loosely installed delivery pipe and fuel injector assembly mounting bolts to the specified torque in the sequence shown.

Tightening torque: 10 – 13 Nm

►H◄ AIR-BLEEDING HIGH-PRESSURE FUEL LINE

1. After installing the fuel pump (high pressure), run the engine at 2000 r/min for at least 15 seconds in order to bleed air from the high-pressure fuel line.

NOTE

If air is trapped in the high-pressure fuel line due to the removal of fuel pipe, diagnosis code No.56 will be set as abnormal fuel pressure.

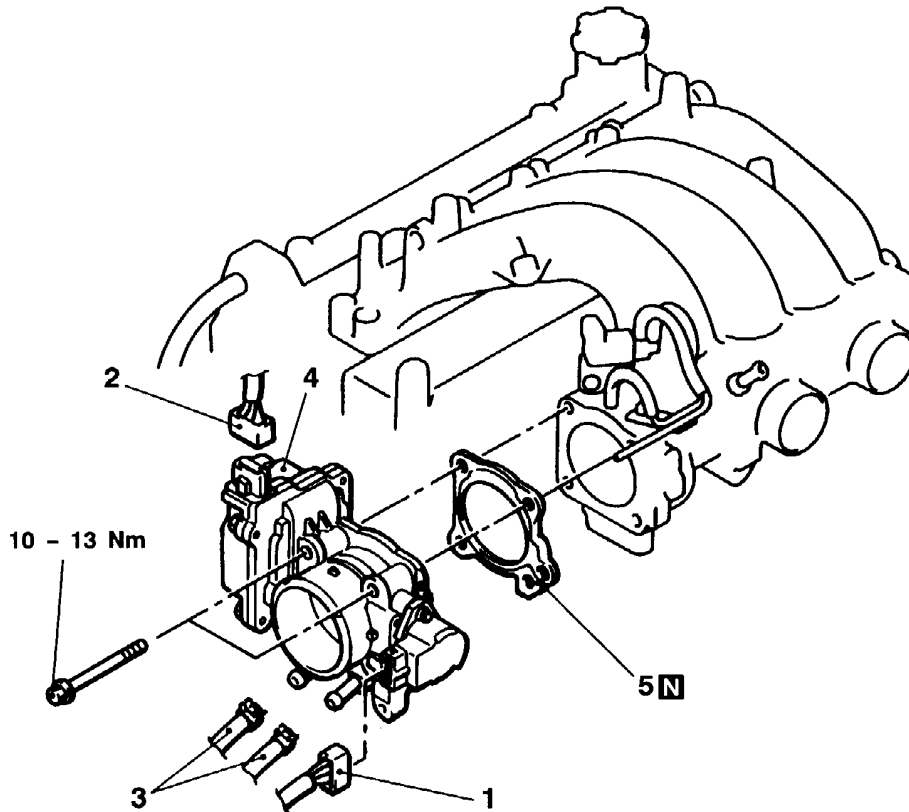
2. Finally confirm diagnosis code by using the MUT-II. If diagnosis code, which indicates defective fuel pressure sensor system, has been set, erase the code.

THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying
- Air Cleaner Assembly Removal and Installation

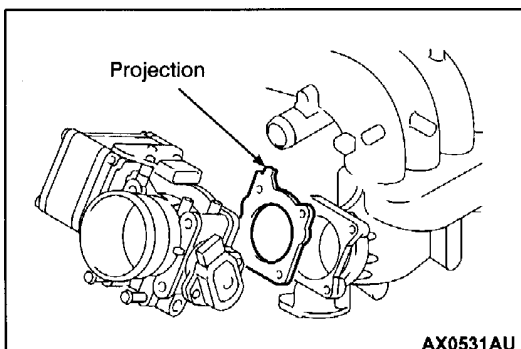


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Removal steps

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

- ▶B◀ 4. Throttle body assembly
- ▶A◀ 5. Throttle body gasket



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INSTALLATION SERVICE POINT

▶A◀ **THROTTLE BODY GASKET INSTALLATION**

Position the projection as shown in the illustration.

▶B◀ THROTTLE BODY INSTALLATION

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

Initialization

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

MULTIPOINT FUEL INJECTION (MPI)

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GENERAL

OUTLINE OF CHANGE

The new 4G6-MPI engine is basically the same as the previous one, which is mounted on the SPACE RUNNER and SPACE WAGON, but some changes have been made as follows:

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

- On-board Diagnostics System has been adopted to expand the diagnostic items and to change diagnosis code numbering system.
- The engine-ECU has been changed. <Vehicles with M/T>
- An engine-A/T-ECU has been adopted. <Vehicles with A/T>
- An ignition failure sensor has been adopted.
- The injector has been changed.
- The oxygen sensor has been changed.

GENERAL INFORMATION

The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the engine-ECU <M/T> or engine-A/T-ECU <A/T> which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

The engine-ECU <M/T> or engine-A/T-ECU <A/T> carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU <M/T> or engine-A/T-ECU <A/T> 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 is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors.

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

The engine-ECU <M/T> or engine-A/T-ECU <A/T> provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the air/fuel mixture by using the oxygen sensor signal to carry out "closed-loop" control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst.

IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The engine-ECU <M/T> or engine-A/T-ECU <A/T> drives the idle speed control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with

the engine coolant temperature and air conditioner load. In addition, when the air conditioner switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

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

engine operating conditions. The ignition timing is determined by the engine-ECU <M/T> or engine-A/T-ECU <A/T> from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-ECU <M/T> or engine-A/T-ECU <A/T> 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.

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

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control
Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
Turns the compressor clutch of the A/C ON and OFF.
3. Fan Controller
The revolutions of the radiator fan and

condenser fan are controlled in response to the engine coolant temperature and vehicle speed.

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

GENERAL SPECIFICATIONS

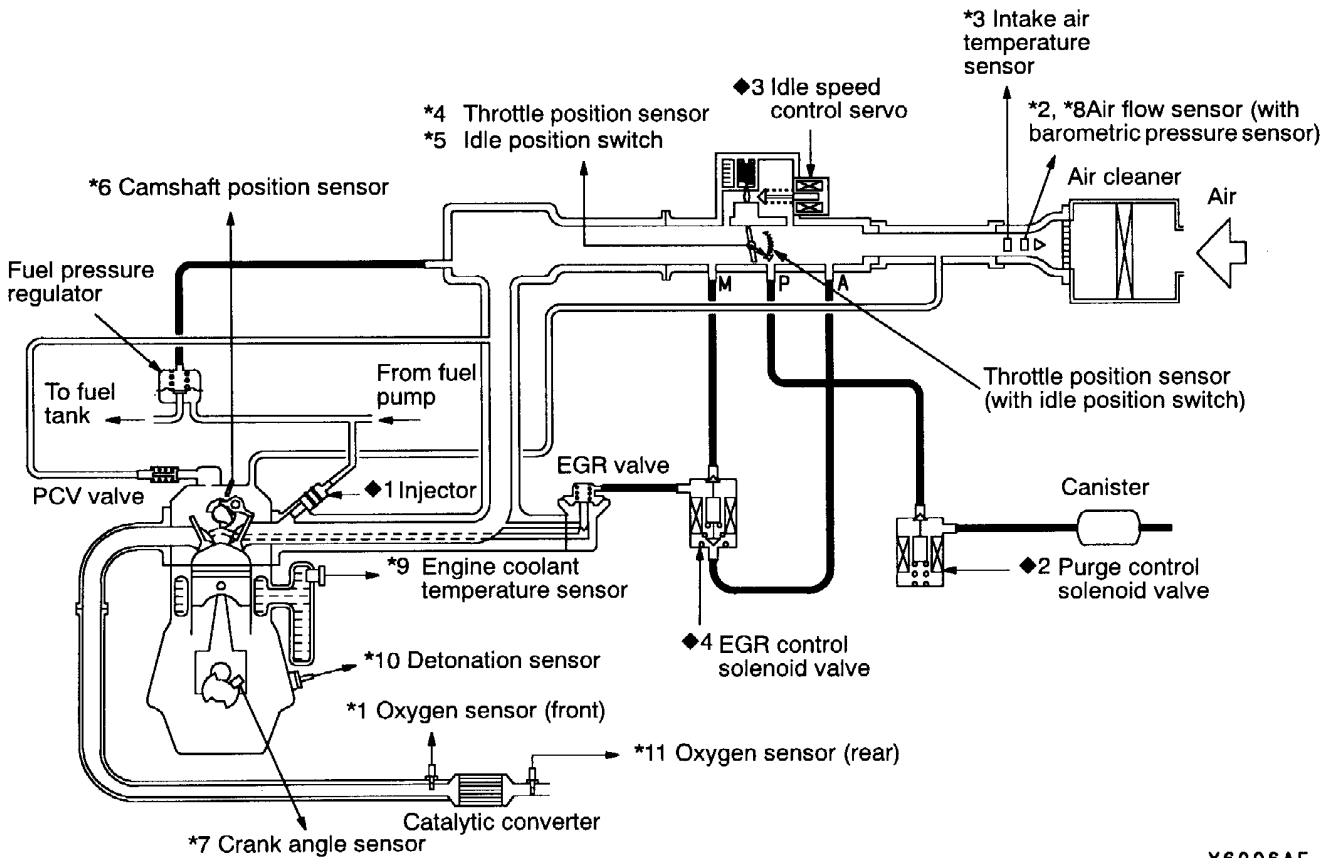
Items		Specifications
Throttle body	Throttle bore mm	54
	Throttle position sensor	Variable resistor type
	Idle speed control servo	Stepper motor type (Stepper motor type by-pass air control system with the air volume limiter)
	Idle position switch	Rotary contact type, within throttle position sensor
Engine-ECU	Identification model No.	E2T73678
Engine-A/T-ECU	Identification model No.	E2T76374
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Vehicle speed sensor	Magnetic resistive element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Power steering fluid pressure switch	Contact switch type
Actuators	Control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	CDH240
	EGR control solenoid valve	Duty cycle type solenoid valve
	Purge control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	329

MULTIPOINT FUEL INJECTION SYSTEM DIAGRAM

- *1 Oxygen sensor (front)
 - *2 Air flow sensor
 - *3 Intake air temperature sensor
 - *4 Throttle position sensor
 - *5 Idle position switch
 - *6 Camshaft position sensor
 - *7 Crank angle sensor
 - *8 Barometric pressure sensor
 - *9 Engine coolant temperature sensor
 - *10 Detonation sensor
 - *11 Oxygen sensor (rear)
-
- Power supply voltage
 - Vehicle speed sensor
 - A/C switch 1, 2
 - Inhibitor switch
 - Power steering fluid pressure switch
 - Ignition switch – ST
 - Ignition switch – IG
 - Alternator FR terminal
 - A/T-ECU

⇒ engine-ECU <M/T> or engine-A/T-ECU <A/T> <M/T> and Engine-A/T-ECU <A/T>

- ◆1 Injector
 - ◆2 Purge control solenoid valve
 - ◆3 Idle speed control servo
 - ◆4 EGR control solenoid valve
-
- Fuel pump relay
 - Control relay
 - A/C power relay
 - Engine warning lamp
 - Diagnosis signal
 - Ignition coil, power transistor
 - Fan controller
 - Alternator G terminal



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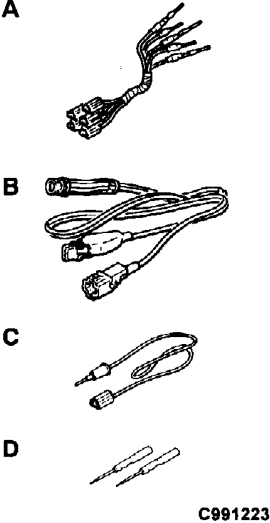
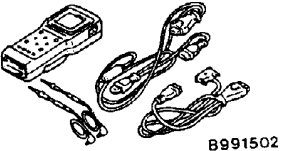
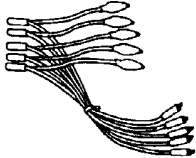
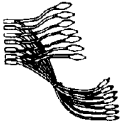

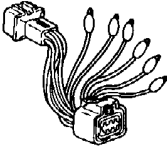
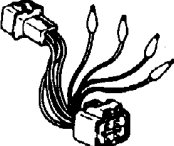
SERVICE SPECIFICATIONS


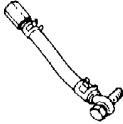
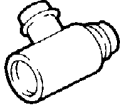
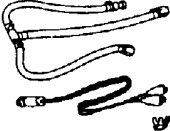
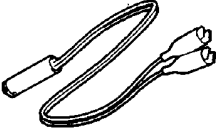
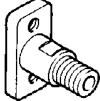
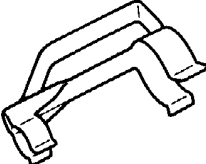
Items		Specifications
Basic idle speed r/min		750±50
Throttle position sensor adjusting voltage mV		400 – 1,000
Throttle position sensor resistance kΩ		3.5 – 6.5
Idle speed control servo coil resistance Ω		28 – 33 (at 20°C)
Intake air temperature sensor resistance kΩ	20°C	2.3 – 3.0
	80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	20°C	2.1 – 2.7
	80°C	0.26 – 0.36
Oxygen sensor output voltage (when engine is racing) V		0.6 – 1.0
Oxygen sensor heater coil resistance (at 20°C) Ω	Front	4.5 – 8.0
	Rear	11 – 18
Fuel pressure kPa	Vacuum hose disconnection	324 – 343 at kerb idle
	Vacuum hose connection	Approx. 265 at kerb idle
Injector coil resistance Ω		13 – 16 (at 20°C)

SEALANT

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

SPECIAL TOOLS

Tool	Number	Name	Use
 <p>A B C D</p> <p>C991223</p>	<p>MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222</p>	<p>Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe</p>	<ul style="list-style-type: none"> ● Fuel gauge simple inspection A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 <p>B991502</p>	<p>MB991502</p>	<p>MUT-II sub assembly</p>	<ul style="list-style-type: none"> ● Reading diagnosis code ● MPI system inspection
	<p>MB991348</p>	<p>Test harness set</p>	<ul style="list-style-type: none"> ● Measurement of voltage during troubleshooting ● Inspection using an analyzer
 <p>MB991709</p>	<p>MB991709</p>	<p>Test harness</p>	
	<p>MB991519</p>	<p>Alternator harness connector</p>	<p>Measurement of voltage during troubleshooting</p>
	<p>MD998463</p>	<p>Test harness (6-pin, square)</p>	<ul style="list-style-type: none"> ● Inspection of idle speed control servo ● Inspection using an analyzer
	<p>MD998464</p>	<p>Test harness (4-pin, square)</p>	<p>Inspection of oxygen sensor (front)</p>

Tool	Number	Name	Use
	MD998478	Test harness (3-pin, triangle)	<ul style="list-style-type: none"> • Measurement of voltage during troubleshooting • Inspection using an analyzer
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
	MD998706	Injector test set	
 MB991607	MB991607	Injector test harness	
 MD998741	MD998741	Injector test adaptor	
	MB991608	Clip	

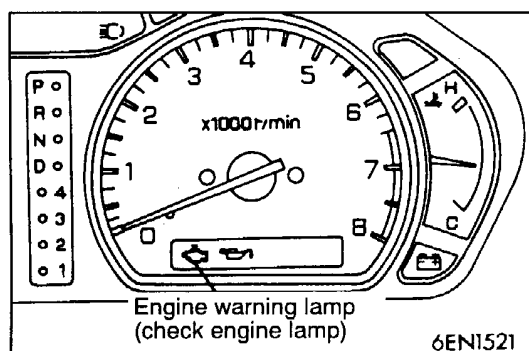
TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE

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



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

However, the warning lamp will illuminate as bulb check for five seconds whenever the ignition switch is turned to the ON position.

Engine warning lamp inspection items

Code No.	Diagnosis item
-	Engine-ECU <M/T> or engine-A/T-ECU <A/T>
P0100	Air flow sensor system
P0105	Barometric pressure sensor system
P0110	Intake air temperature sensor system
P0115	Engine coolant temperature sensor system
P0120★	Throttle position sensor system
P0125	Feedback system
P0130	Oxygen sensor (front) system <sensor 1>
P0135	Oxygen sensor heater (front) system <sensor 1>
P0136	Oxygen sensor (rear) system <sensor 2>
P0141	Oxygen sensor heater (rear) system <sensor 2>
P0170	Abnormal fuel system
P0201	No. 1 injector system
P0202	No. 2 injector system
P0203	No. 3 injector system
P0204	No. 4 injector system
P0300★	Ignition coil (power transistor) system
P0301	No. 1 cylinder misfire detected
P0302	No. 2 cylinder misfire detected
P0303	No. 3 cylinder misfire detected
P0304	No. 4 cylinder misfire detected
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0403	EGR valve system

Code No.	Diagnosis item
P0420	Catalyst malfunction
P0443	Purge control solenoid valve system
P0505	Idle speed control system
P0510	Idle position switch system
P0551	Power steering fluid pressure switch system

NOTE

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

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

DIAGNOSIS USING DIAGNOSIS 2 MODE

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

NOTE

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

5. Erase the diagnosis codes.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

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

FREEZE FRAME DATA

When the engine-ECU <M/T> or engine-A/T-ECU <A/T> detects a malfunction and stores a diagnosis code, it also stores a current status of the engine. This function is called "Freeze frame data." By analyzing this "freeze frame" data with the MUT-II, an effective troubleshooting can be performed.

The display items of freeze frame data are shown below.

Display item list

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

NOTE

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

READINESS TEST STATUS

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

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

FAIL-SAFE FUNCTION REFERENCE TABLE

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

Malfunctioning item	Control contents during malfunction
Air flow sensor	<ol style="list-style-type: none"> 1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Camshaft position sensor	Injects fuel to all cylinders simultaneously. (However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Switches the ignition timing from ignition timing for super petrol to ignition timing for standard petrol.
Ignition coil, power transistor	Cuts off the fuel supply to cylinders with an abnormal ignition.
Oxygen sensor (front)	Air/fuel ratio feedback control (closed loop control) is not performed.
Oxygen sensor (rear)	Performs the feedback control (closed loop control) of the air/fuel ratio by using only the signal of the oxygen sensor (front) installed on the front of the catalytic converter.
Alternator FR terminal	Does not control the output of the alternator according to an electrical load. (works as a normal alternator)
Misfiring	If the detected misfiring causes damage to the catalyst, the misfiring cylinder will be shut down.

INSPECTION CHART FOR DIAGNOSIS CODES

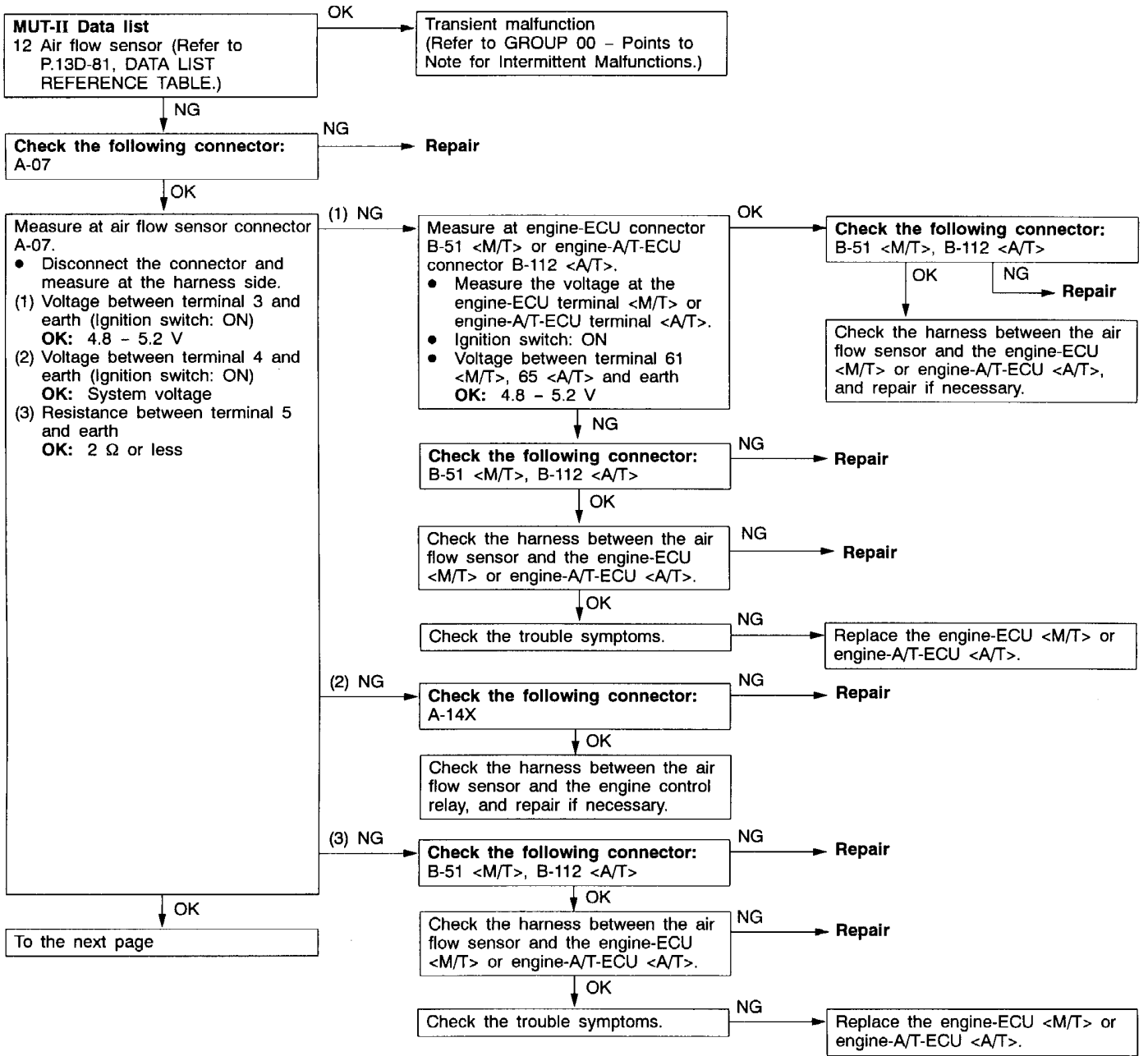
Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13D-16
P0105	Barometric pressure sensor system	13D-18
P0110	Intake air temperature sensor system	13D-20
P0115	Engine coolant temperature sensor system	13D-22
P0120★	Throttle position sensor 1 system	13D-24
P0125	Feedback system	13D-26
P0130	Oxygen sensor (front) system <sensor 1>	13D-27
P0135	Oxygen sensor heater (front) system <sensor 1>	13D-29
P0136	Oxygen sensor (rear) system <sensor 2>	13D-30
P0141	Oxygen sensor heater (rear) system <sensor 2>	13D-32
P0170	Abnormal fuel system	13D-33
P0201	No. 1 injector system	13D-34
P0202	No. 2 injector system	13D-34
P0203	No. 3 injector system	13D-34
P0204	No. 4 injector system	13D-34
P0300★	Ignition coil (power transistor) system	13D-35
P0301	No. 1 cylinder misfire detected	13D-37
P0302	No. 2 cylinder misfire detected	13D-37
P0303	No. 3 cylinder misfire detected	13D-37
P0304	No. 4 cylinder misfire detected	13D-37
P0325	Detonation sensor system	13D-38
P0335	Crank angle sensor system	13D-38
P0340	Camshaft position sensor system	13D-40
P0403	EGR valve system	13D-42
P0420	Catalyst malfunction	13D-43
P0443	Purge control solenoid valve system	13D-44
P0500	Vehicle speed sensor system	13D-45
P0505	Idle speed control system	13D-45
P0510	Idle position switch system	13D-47
P0551	Power steering fluid pressure switch system	13D-48
P1500	Alternator FR terminal system	13D-49
P1610	Immobilizer system	13D-50

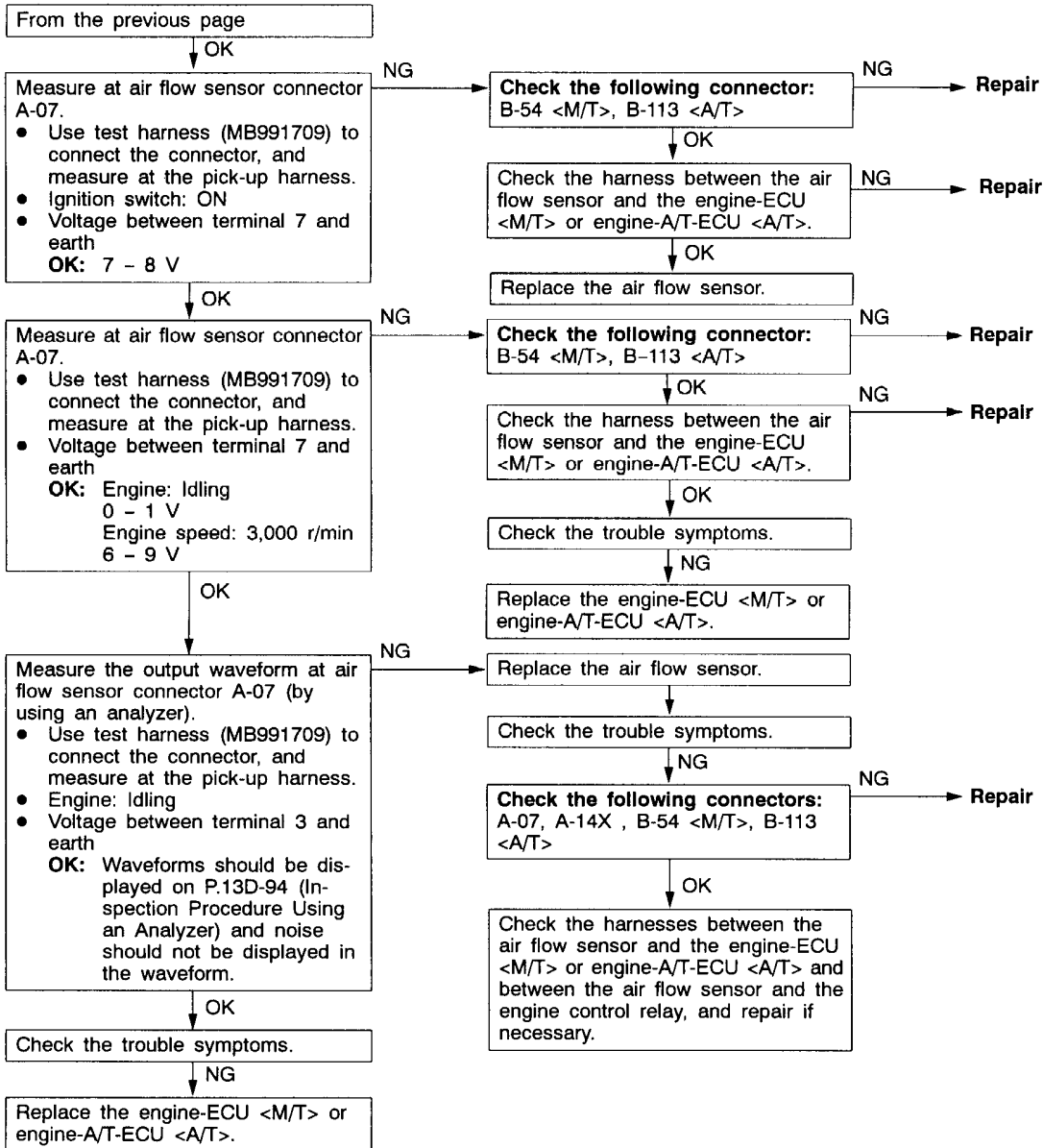
NOTE

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

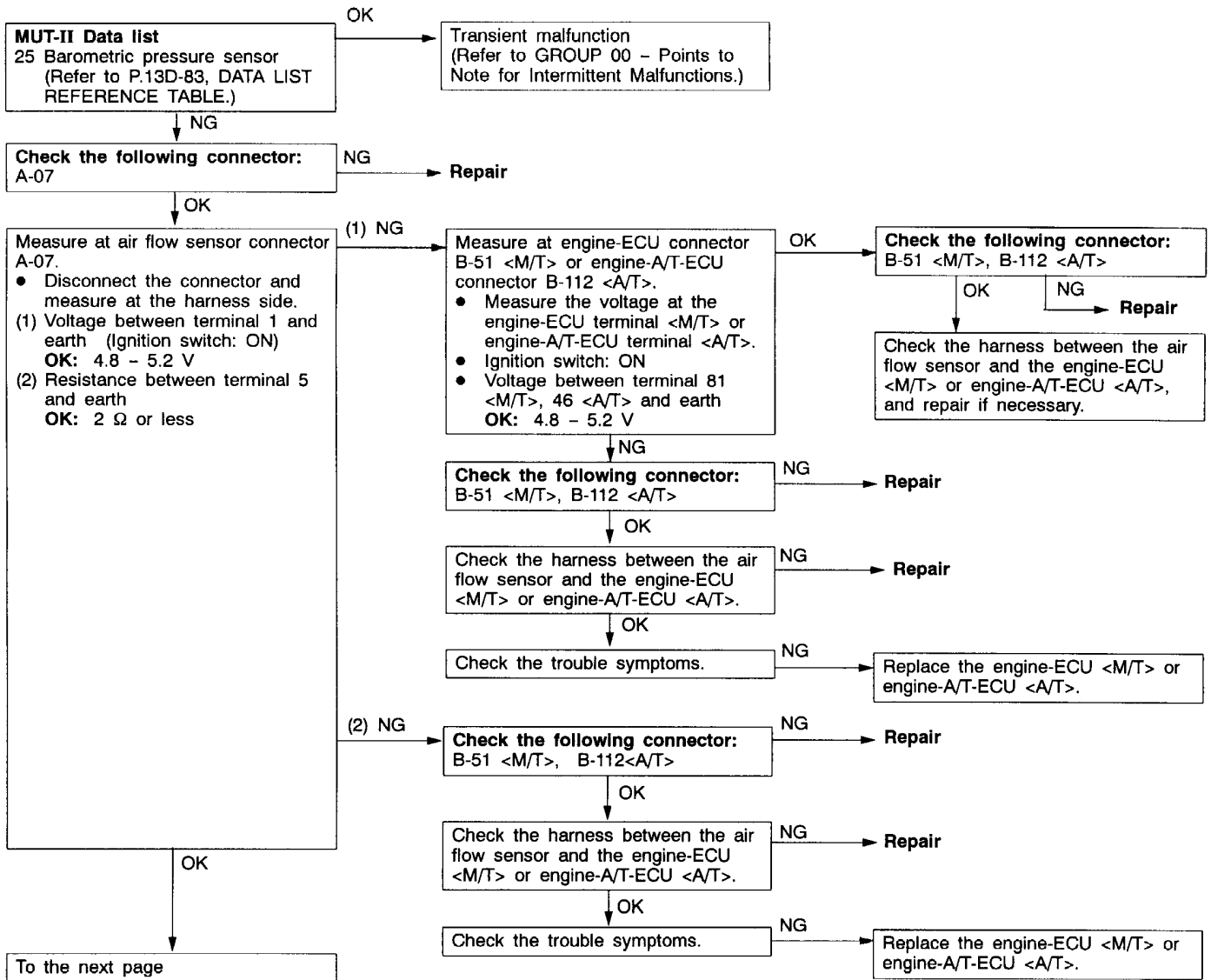
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

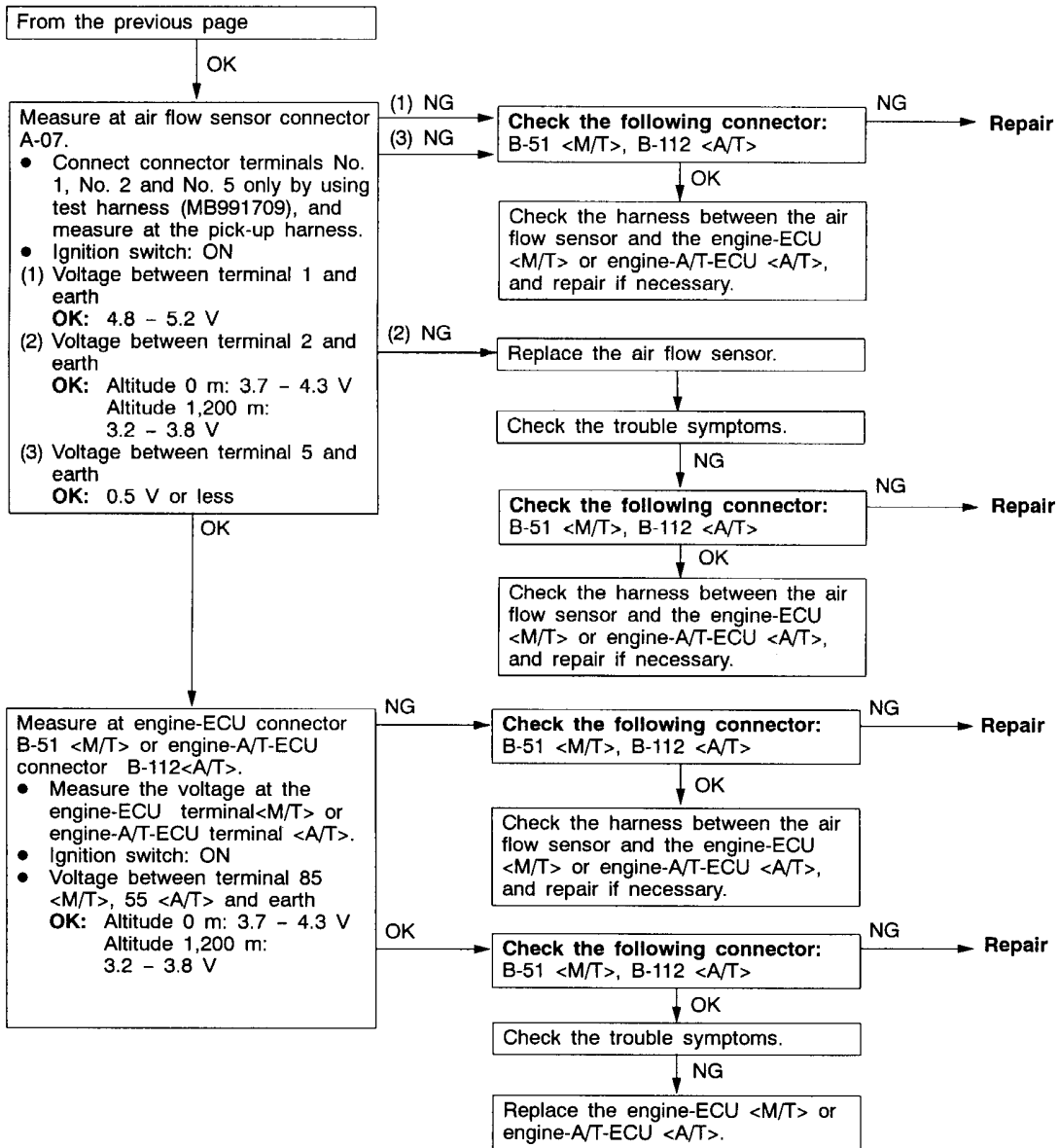
Code No. P0100 Air flow sensor system	Probable cause
Range of Check ● Engine speed: 500 r/min or more Set Conditions ● The sensor output frequency is 3.3 Hz or less for four seconds.	● Malfunction of air flow sensor ● Open or short circuit in air flow sensor circuit or loose connector contact ● Malfunction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





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





NG

OK

Measure at engine-ECU connector B-51 <M/T> or engine-A/T-ECU connector B-112<A/T>.

- Measure the voltage at the engine-ECU terminal<M/T> or engine-A/T-ECU terminal <A/T>.
- Ignition switch: ON
- Voltage between terminal 85 <M/T>, 55 <A/T> and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V

NG

Check the following connector:
B-51 <M/T>, B-112 <A/T>

NG → **Repair**

OK

Check the harness between the air flow sensor and the engine-ECU <M/T> or engine-A/T-ECU <A/T>, and repair if necessary.

NG

Check the following connector:
B-51 <M/T>, B-112 <A/T>

NG → **Repair**

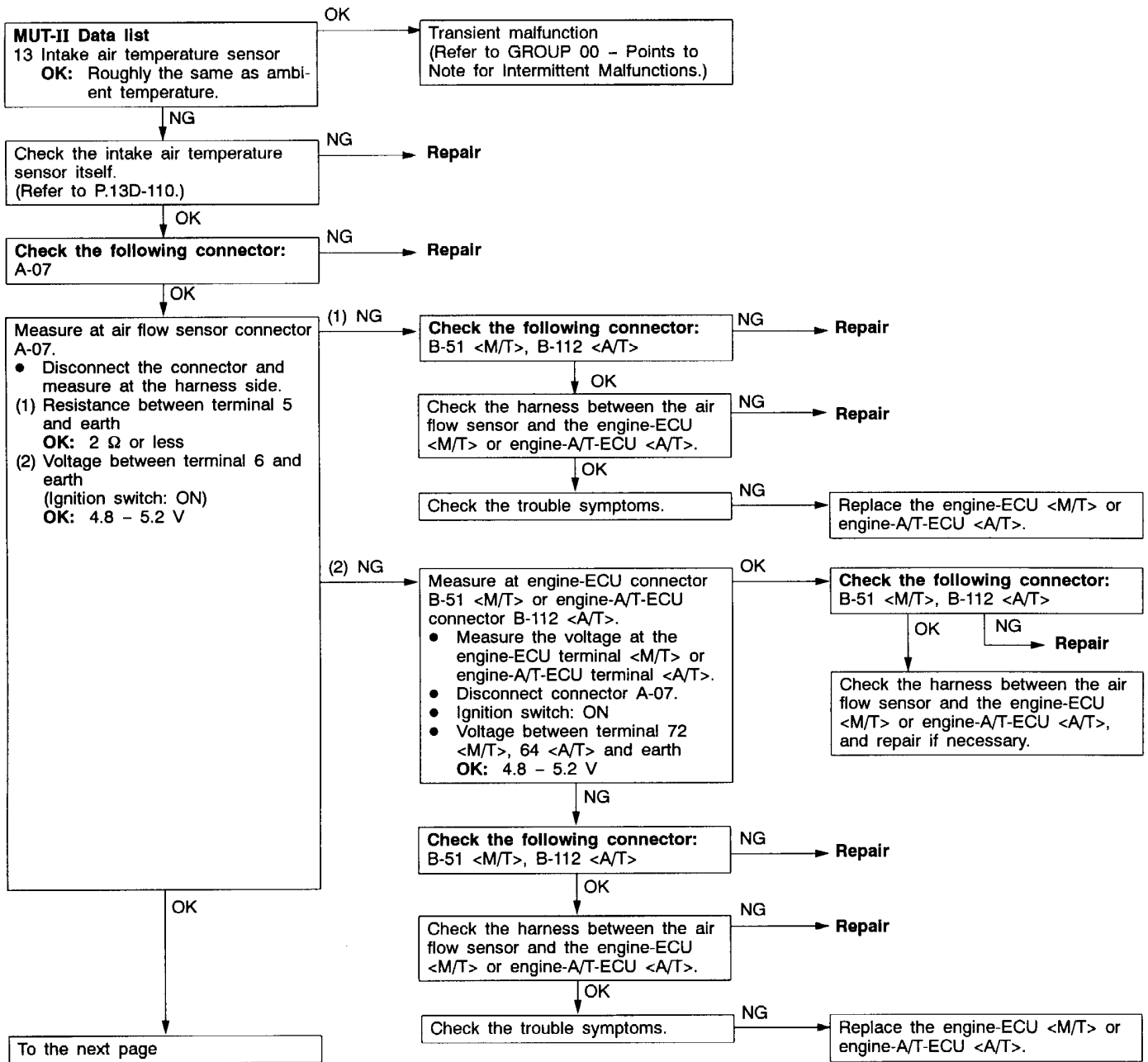
OK

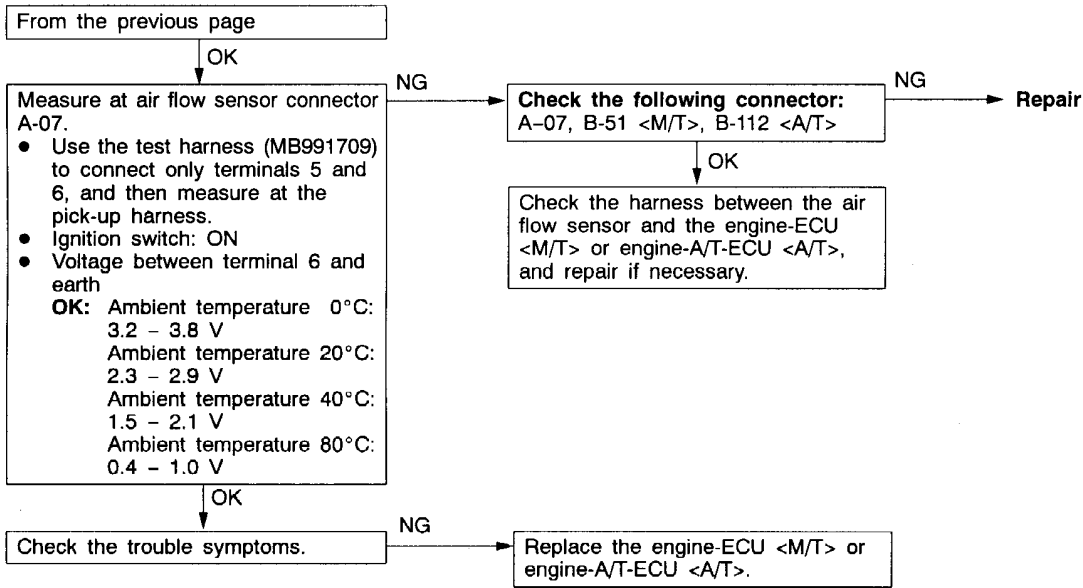
Check the trouble symptoms.

NG

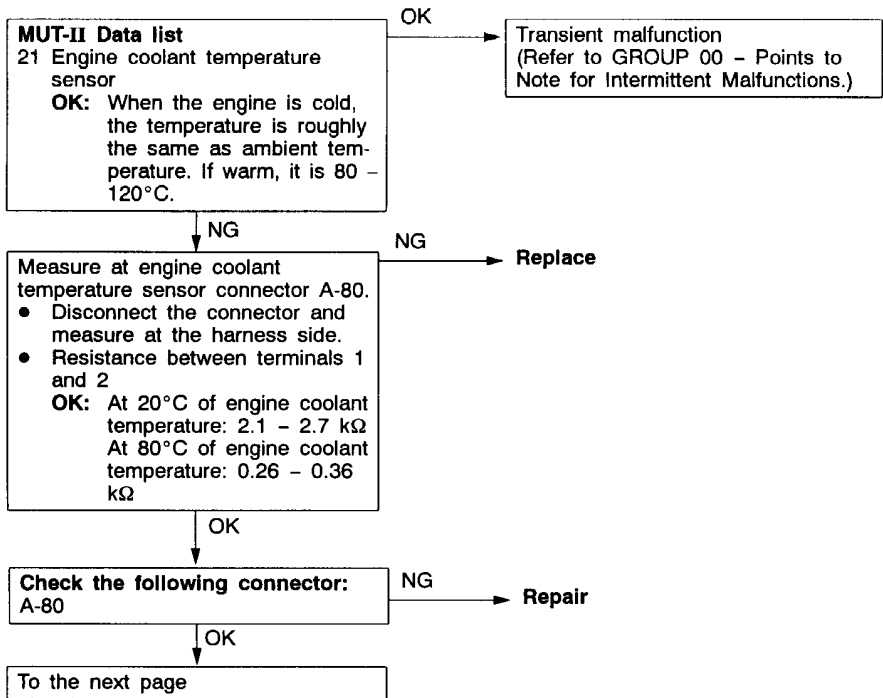
Replace the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

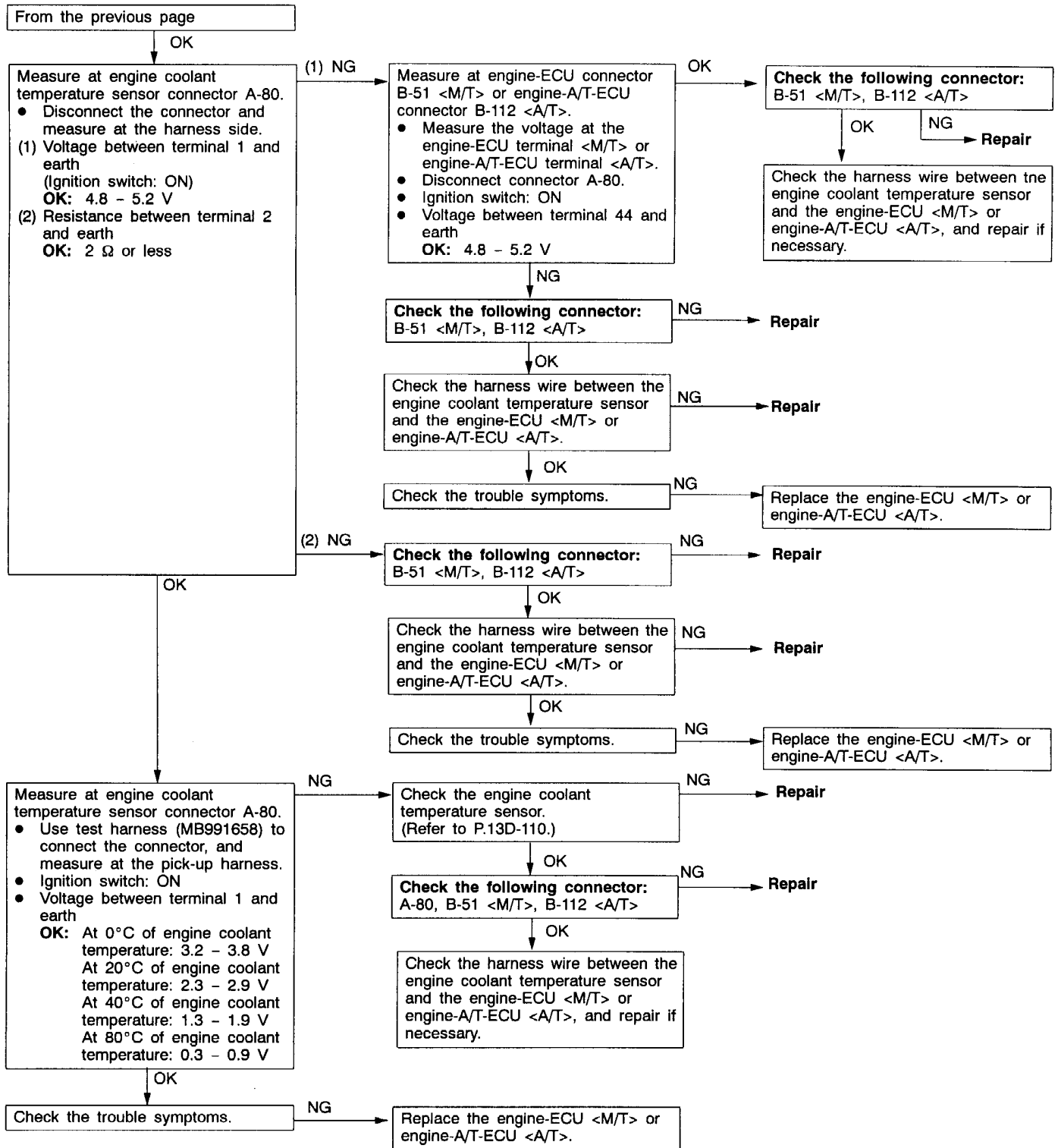
Code No. P0110 Intake air temperature sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage is 4.6 V 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 0.2 V 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-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>



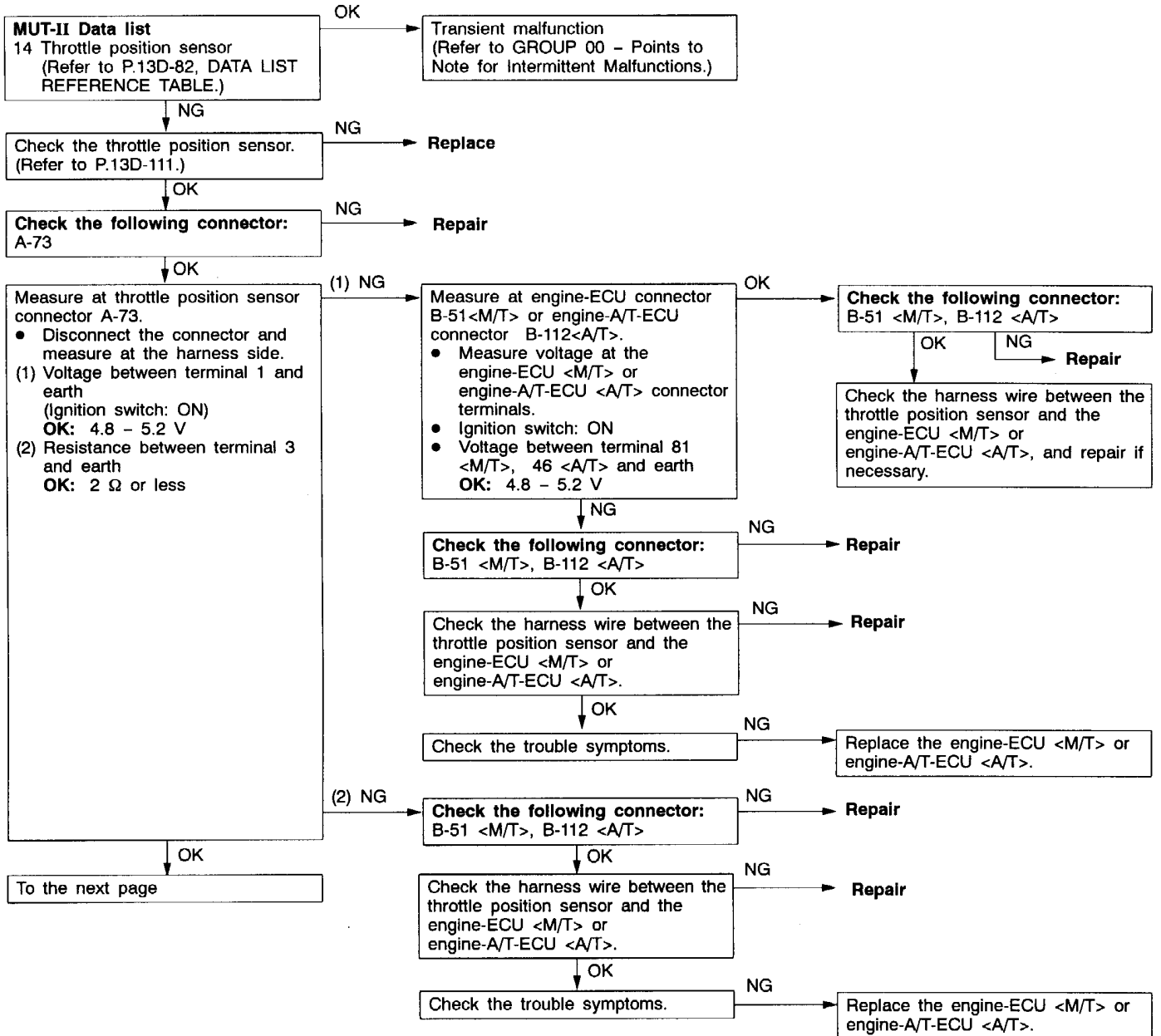


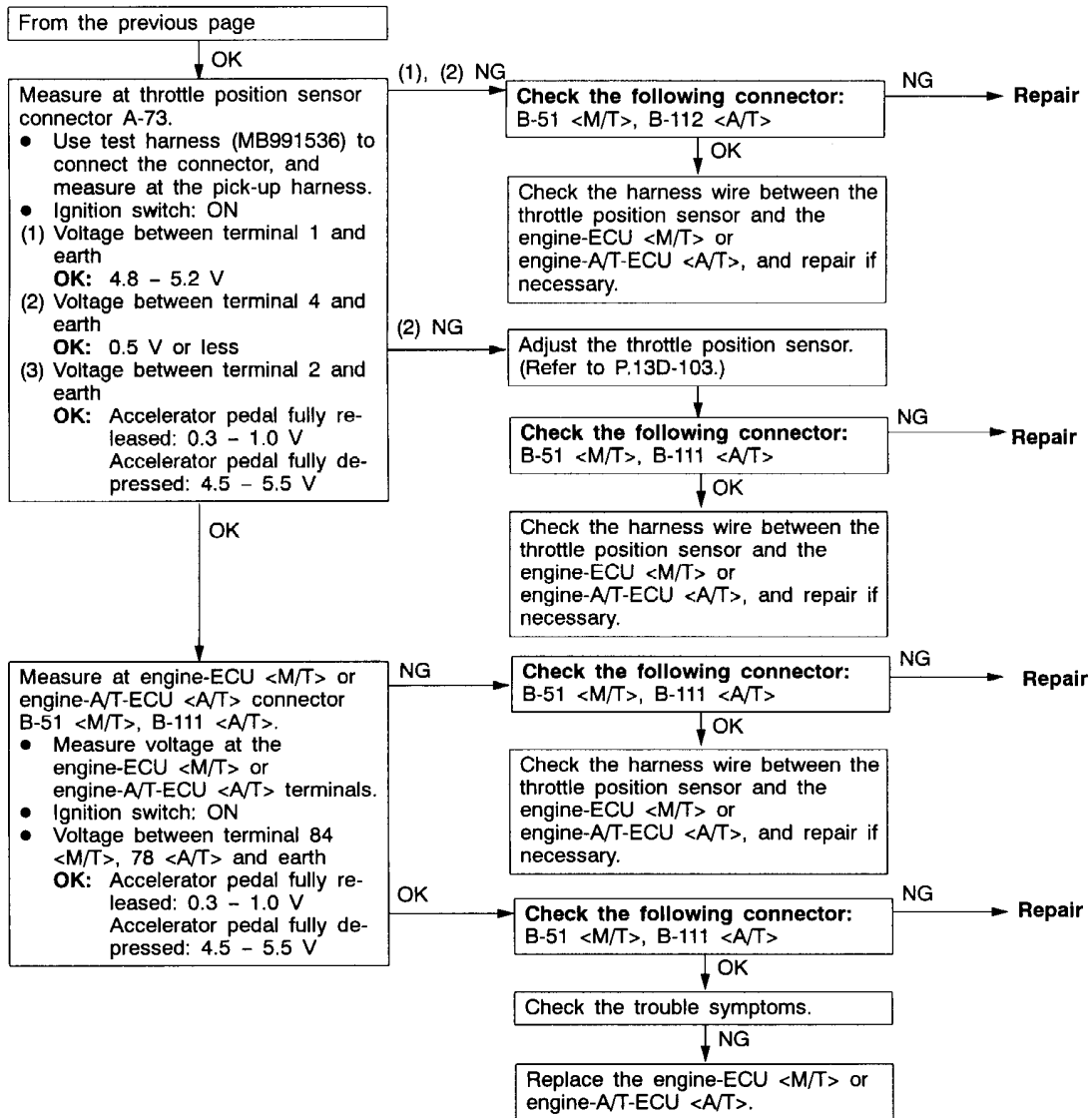
Code No. P0115 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to -45°C of engine coolant temperature) or ● The sensor output voltage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



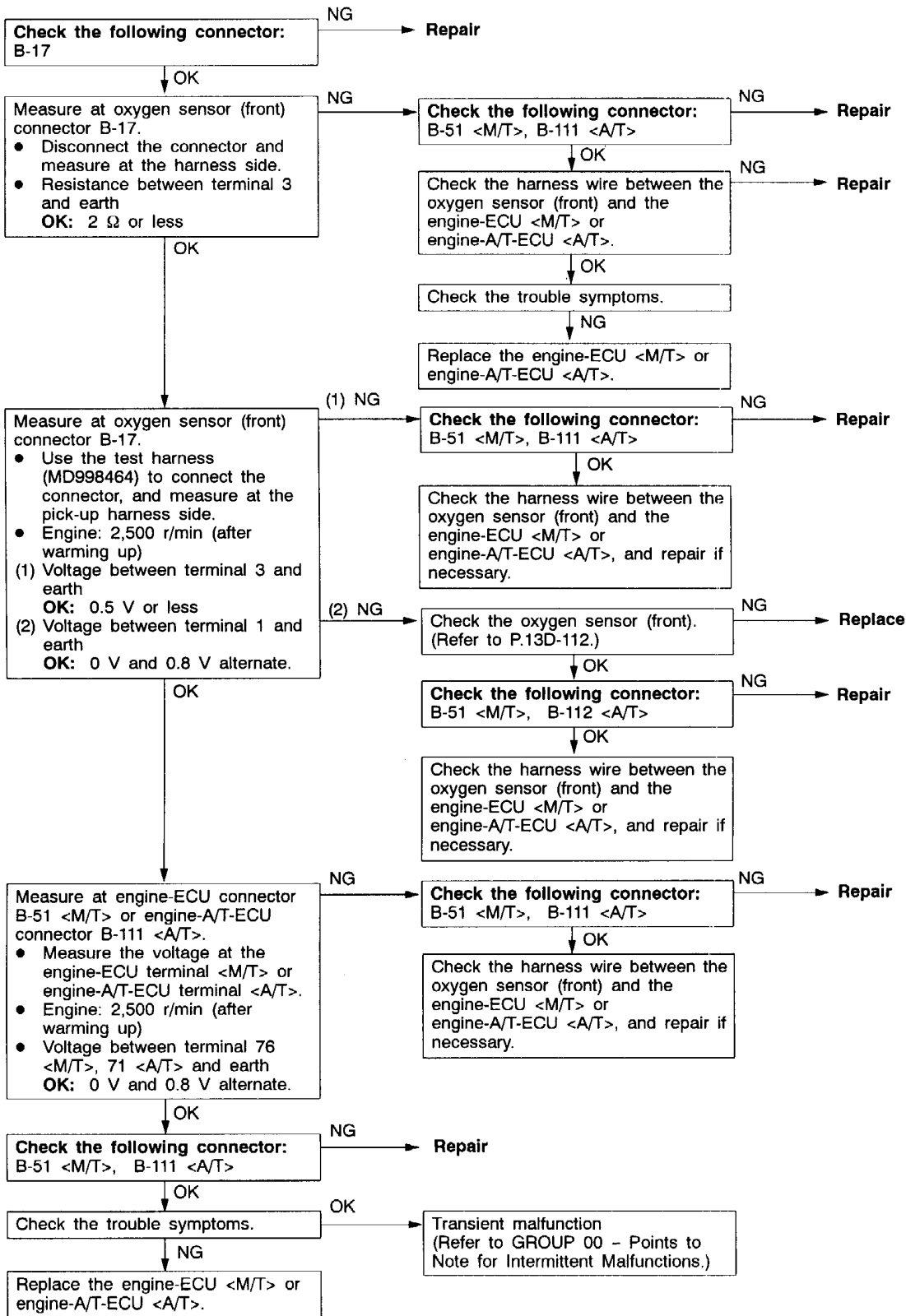


Code No. P0120 Throttle position sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON The throttle position sensor is normal. <p>Set Conditions</p> <ul style="list-style-type: none"> The sensor output voltage is 0.2 V or less for four seconds. <p>or</p> <ul style="list-style-type: none"> The sensor output voltage is 4.85 V or more for four seconds, and the output voltage of the throttle position sensor is 1.2 V or more. <p>or</p> <ul style="list-style-type: none"> The throttle position sensor and combination output voltage is outside 4 – 6V. 	<ul style="list-style-type: none"> Malfunction of throttle position sensor Open or short circuit in the throttle position sensor circuit or loose connector contact Malfunction of engine-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>

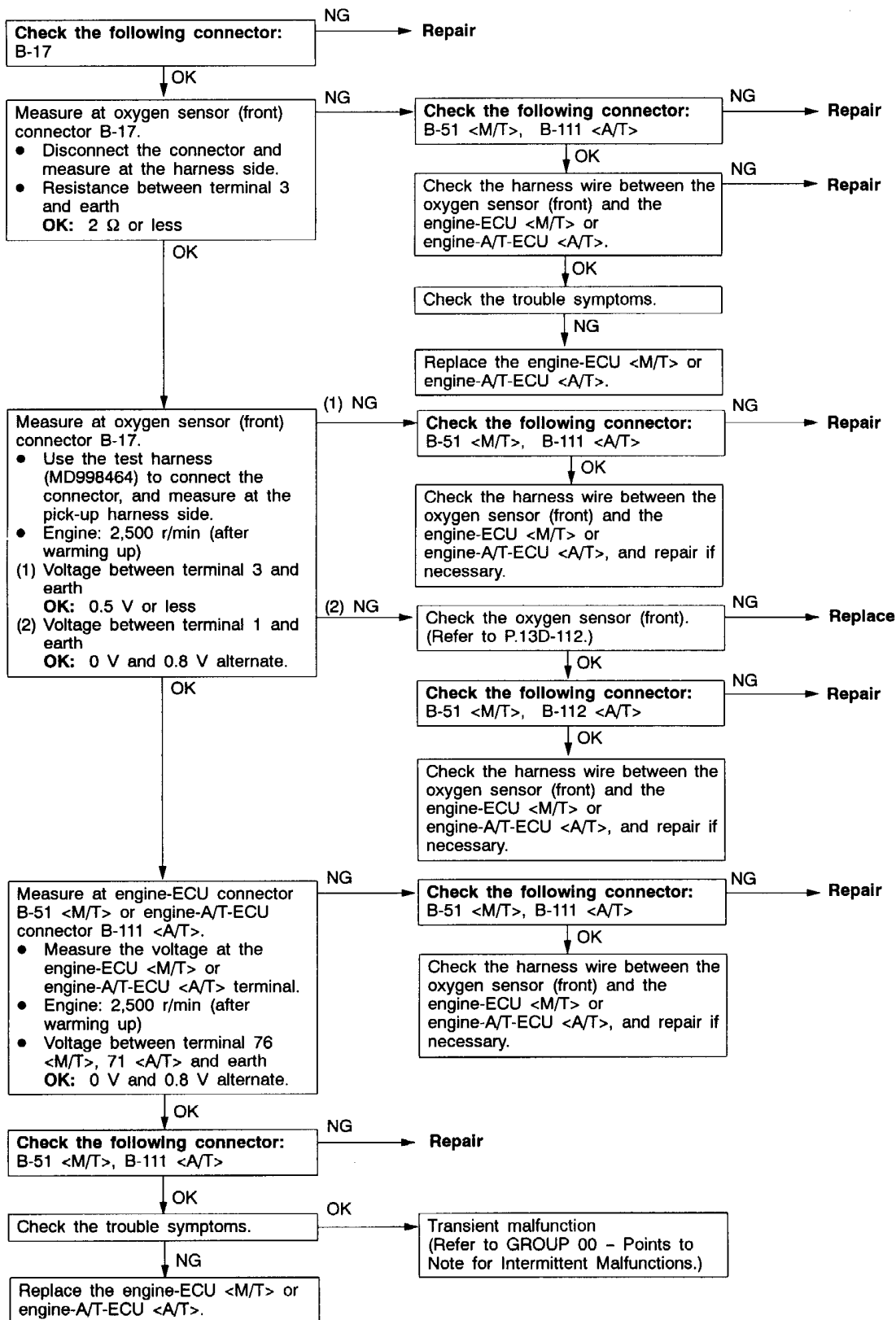




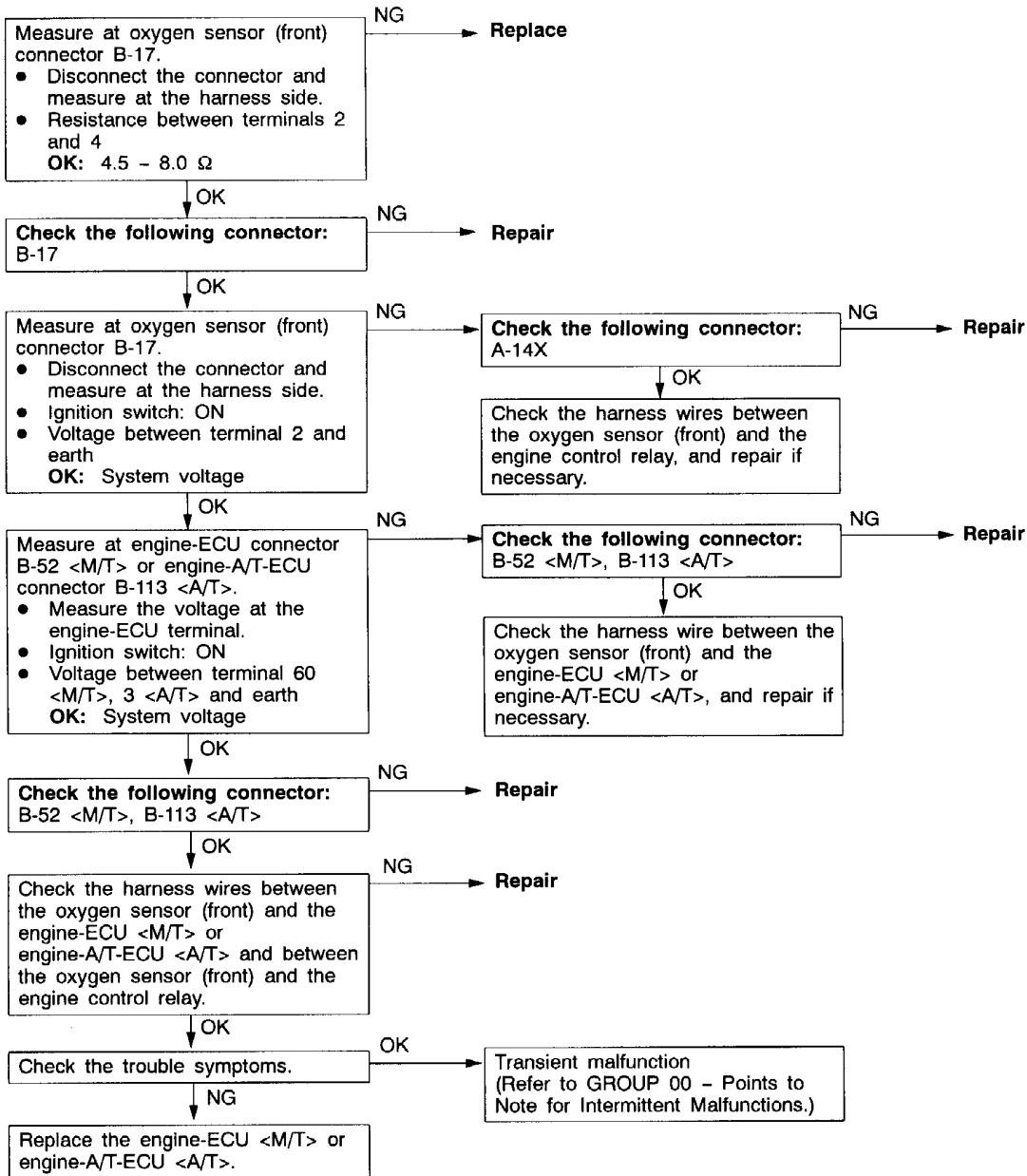
Code No. P0125 Feedback system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> The engine coolant temperature is approx. 80°C or more. During stoichiometric feedback control The vehicle is not being decelerated. <p>Set Conditions</p> <ul style="list-style-type: none"> Oxygen sensor (front) output voltage has been higher or lower than 0.5 V for at least thirty seconds. 	<ul style="list-style-type: none"> Malfunction of oxygen sensor (front) Open or short circuit in the oxygen sensor (front) circuit or loose connector contact Malfunction of engine-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>



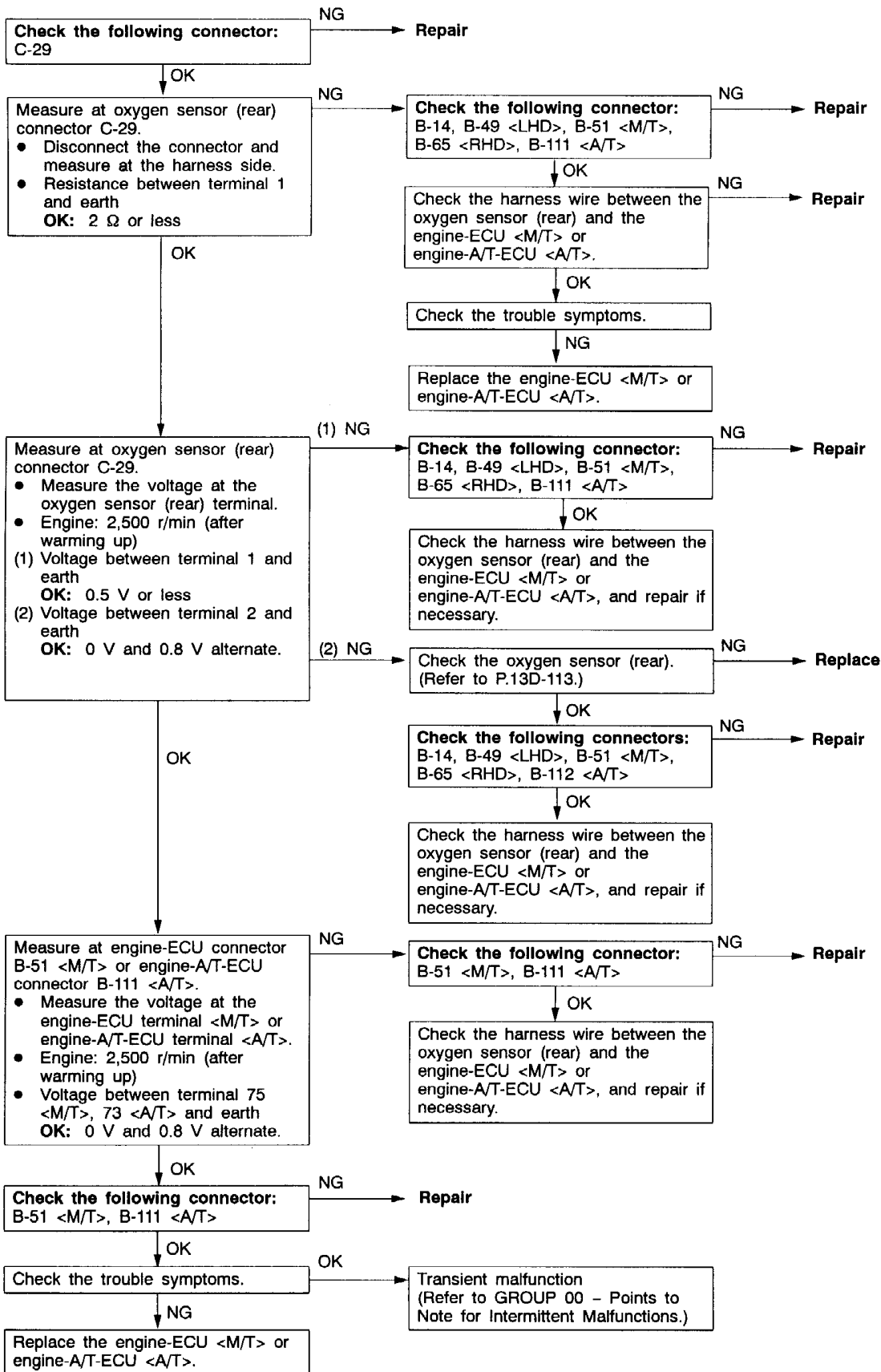
Code No. P0130 Oxygen sensor (front) system <sensor 1>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 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 (front) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (front) inside the engine-ECU <M/T> or engine-A/T-ECU <A/T>. 	<ul style="list-style-type: none"> ● Malfunction of oxygen sensor (front) ● Open or short circuit in the oxygen sensor (front) circuit or loose connector contact ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>
<p>Range of Check</p> <ul style="list-style-type: none"> ● Engine speed is 3,000 r/min or less ● During driving ● During air/fuel ratio feedback control <p>Set Conditions</p> <ul style="list-style-type: none"> ● The oxygen sensor (front) output frequency is five or less per 12 seconds on average. 	



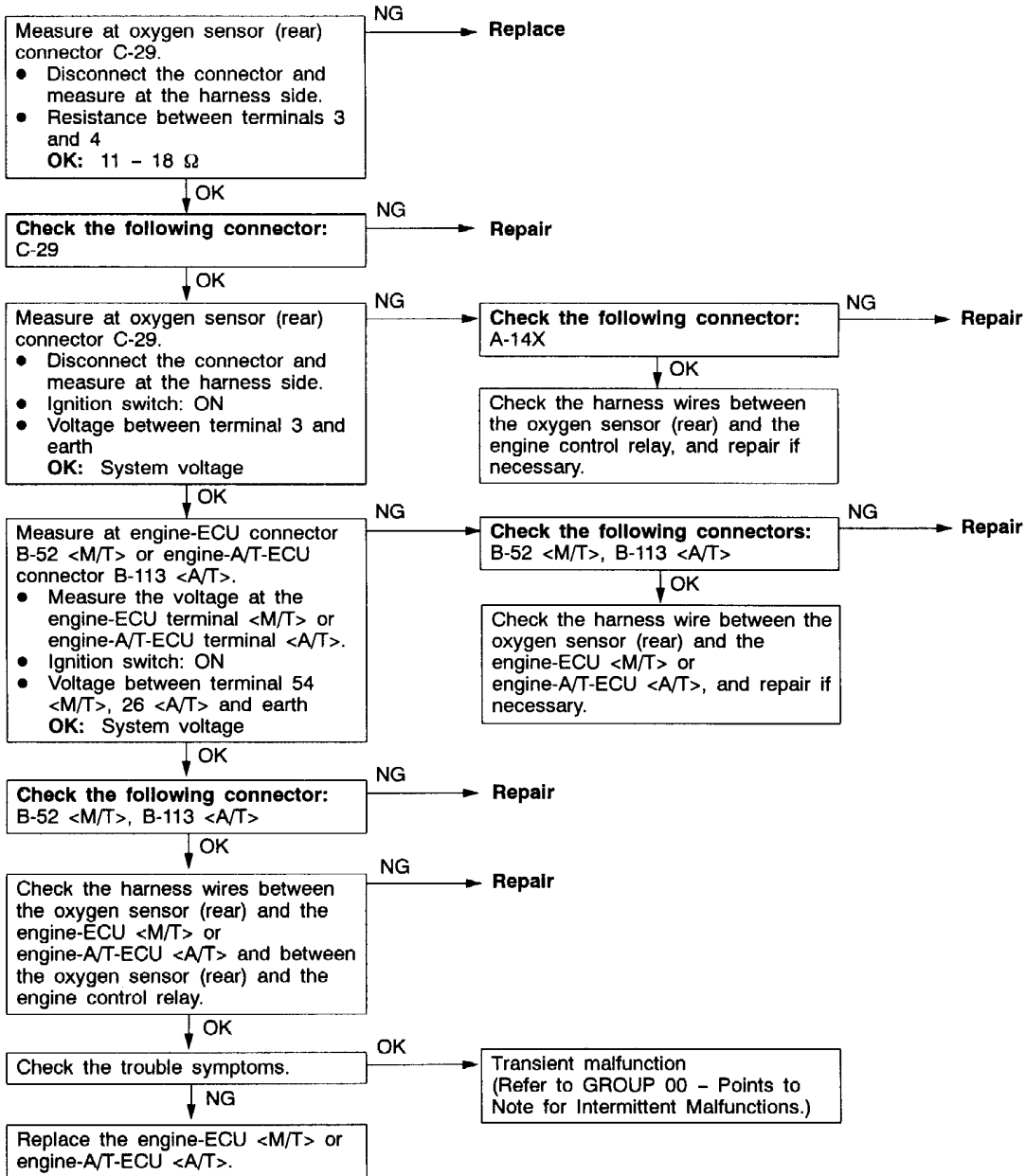
Code No. P0135 Oxygen sensor heater (front) system <sensor 1>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine coolant temperature is approx. 20°C or more. • The oxygen sensor heater (front) remains on. • The engine speed is 50 r/min or more. • Battery voltage is 11 – 16 V. <p>Set Conditions</p> <ul style="list-style-type: none"> • The current, which flows through the oxygen sensor heater (front), is 0.2 A or less or 3.5 A or more for six seconds. 	<ul style="list-style-type: none"> • Malfunction of oxygen sensor heater (front) • Open or short circuit in the oxygen sensor heater (front) circuit or loose connector contact • Malfunction of engine-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>



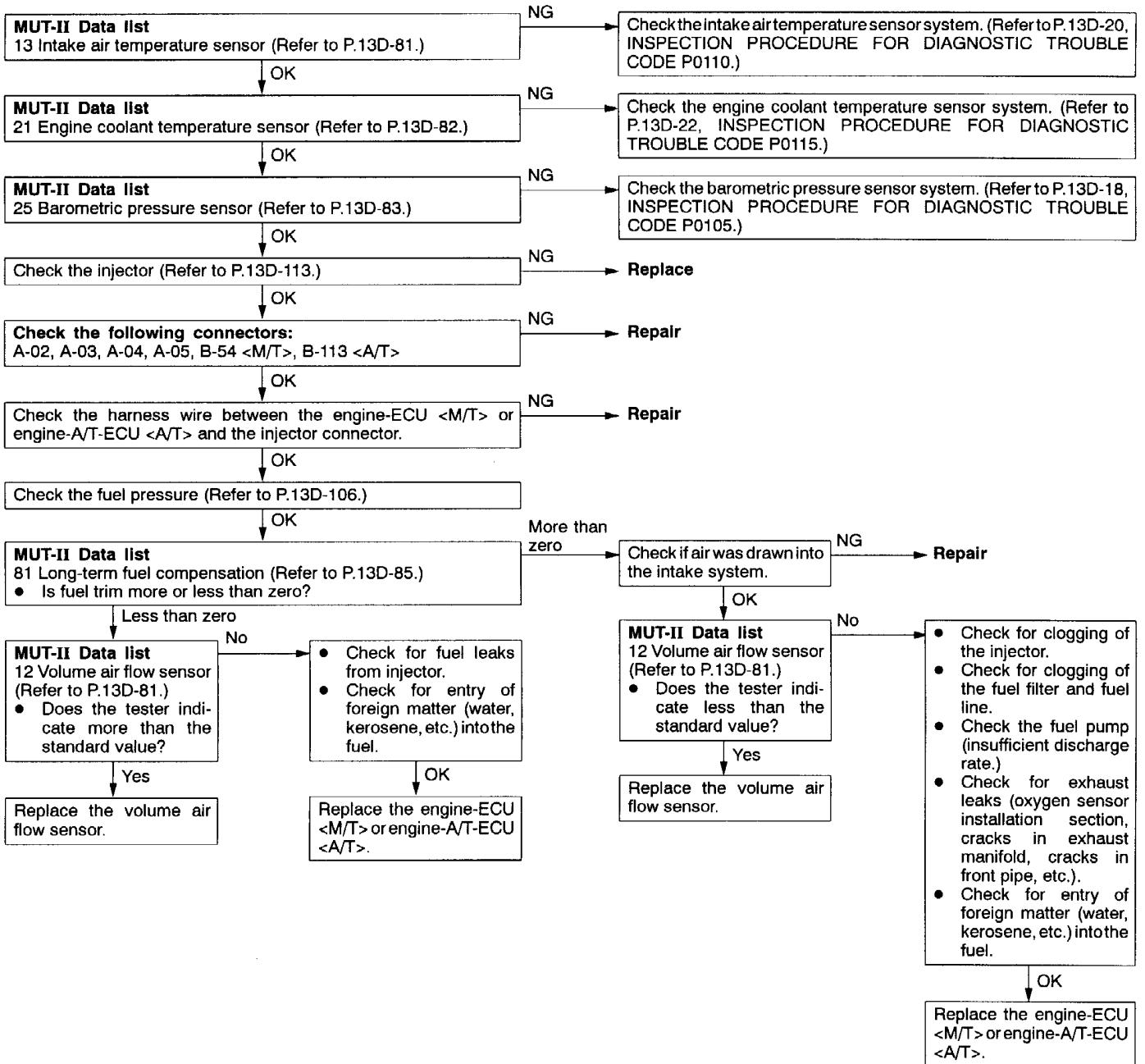
Code No. P0136 Oxygen sensor (rear) system <sensor 2>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 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 (rear) output voltage is 4.5 V or more when the sensor output voltage is 0.2 V or less and a voltage of 5 V is applied to the oxygen sensor (rear) inside the engine-ECU <M/T> or engine-A/T-ECU <A/T>. 	<ul style="list-style-type: none"> ● Malfunction of oxygen sensor (rear) ● Open or short circuit in the oxygen sensor (rear) circuit or loose connector contact ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>
<p>Range of Check</p> <ul style="list-style-type: none"> ● Two seconds have passed after the engine-ECU <M/T> or engine-A/T-ECU <A/T> detected an open circuit. ● When the oxygen sensor (front) is in good condition. <p>Set Conditions</p> <ul style="list-style-type: none"> ● When the air/fuel ratio is rich, the oxygen sensor (front) output voltage is 0.5 V or more, the oxygen sensor (rear) output voltage is less than 0.1 V, and the oxygen sensor (rear) output voltage fluctuates within 0.078 V. 	



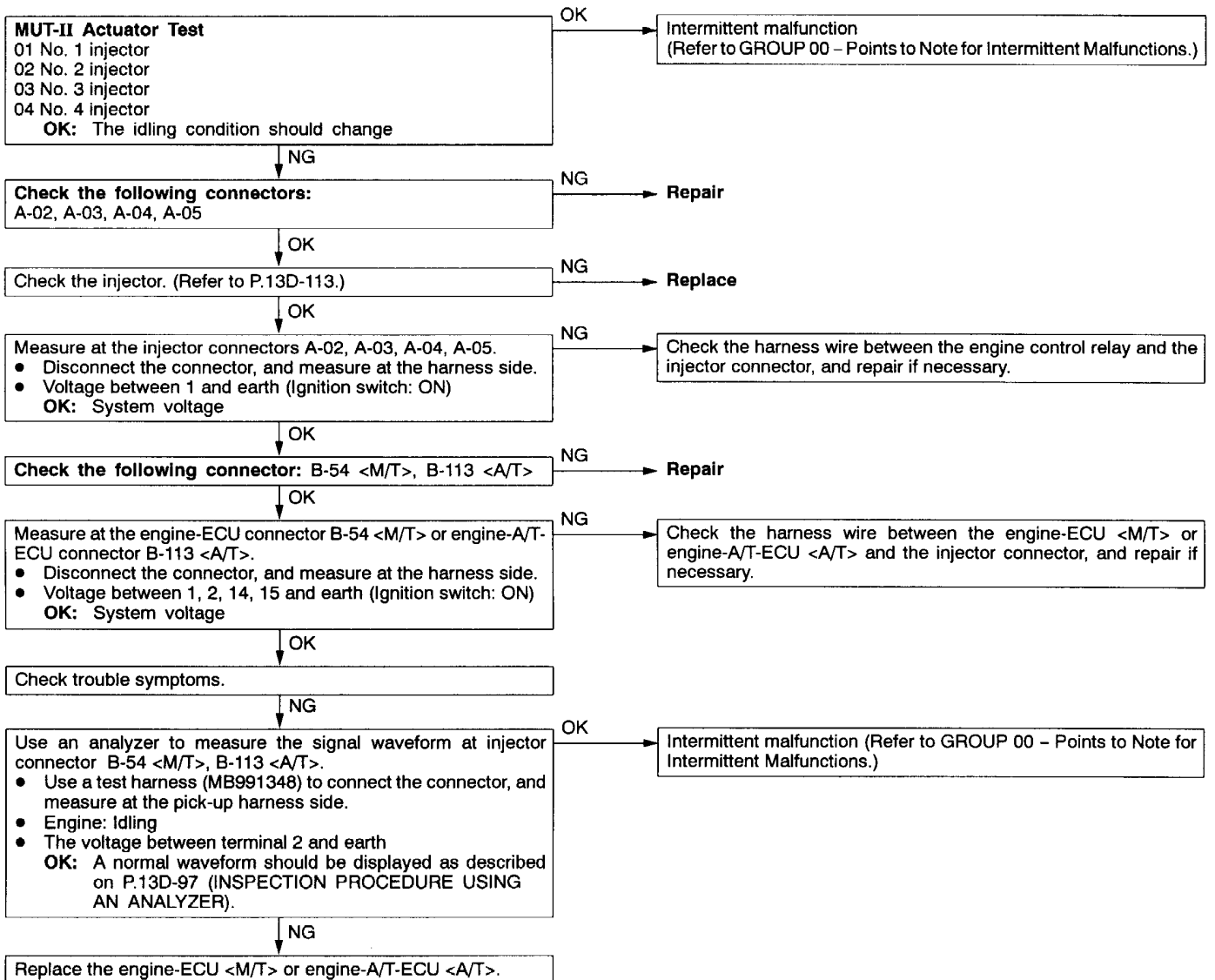
Code No. P0141 Oxygen sensor heater (rear) system <sensor 2>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • The engine coolant temperature is approx. 20°C or more. • The oxygen sensor heater (rear) remains on. • The engine speed is 50 r/min or more. • Battery voltage is 11 – 16 V. <p>Set Conditions</p> <ul style="list-style-type: none"> • The current, which flows through the oxygen sensor heater (rear), is 0.2 A or less or 3.5 A or more for six seconds. 	<ul style="list-style-type: none"> • Malfunction of oxygen sensor heater (rear) • Open or short circuit in the oxygen sensor heater (rear) circuit or loose connector contact • Malfunction of engine-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>



Code No. P0170 Abnormal fuel system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Engine: Being learning the air-fuel ratio <p>Set Conditions</p> <ul style="list-style-type: none"> Ten seconds or more have been passed while the fuel injection amount compensation value is too low. <p>or</p> <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"> Incorrect fuel pressure Malfuction of fuel supply system Malfuction of oxygen sensor (front) Malfuction of intake air temperature sensor Malfuction of barometric pressure sensor Malfuction of air flow sensor Malfuction of engine-ECU <M/T> Malfuction of engine-A/T-ECU <A/T>



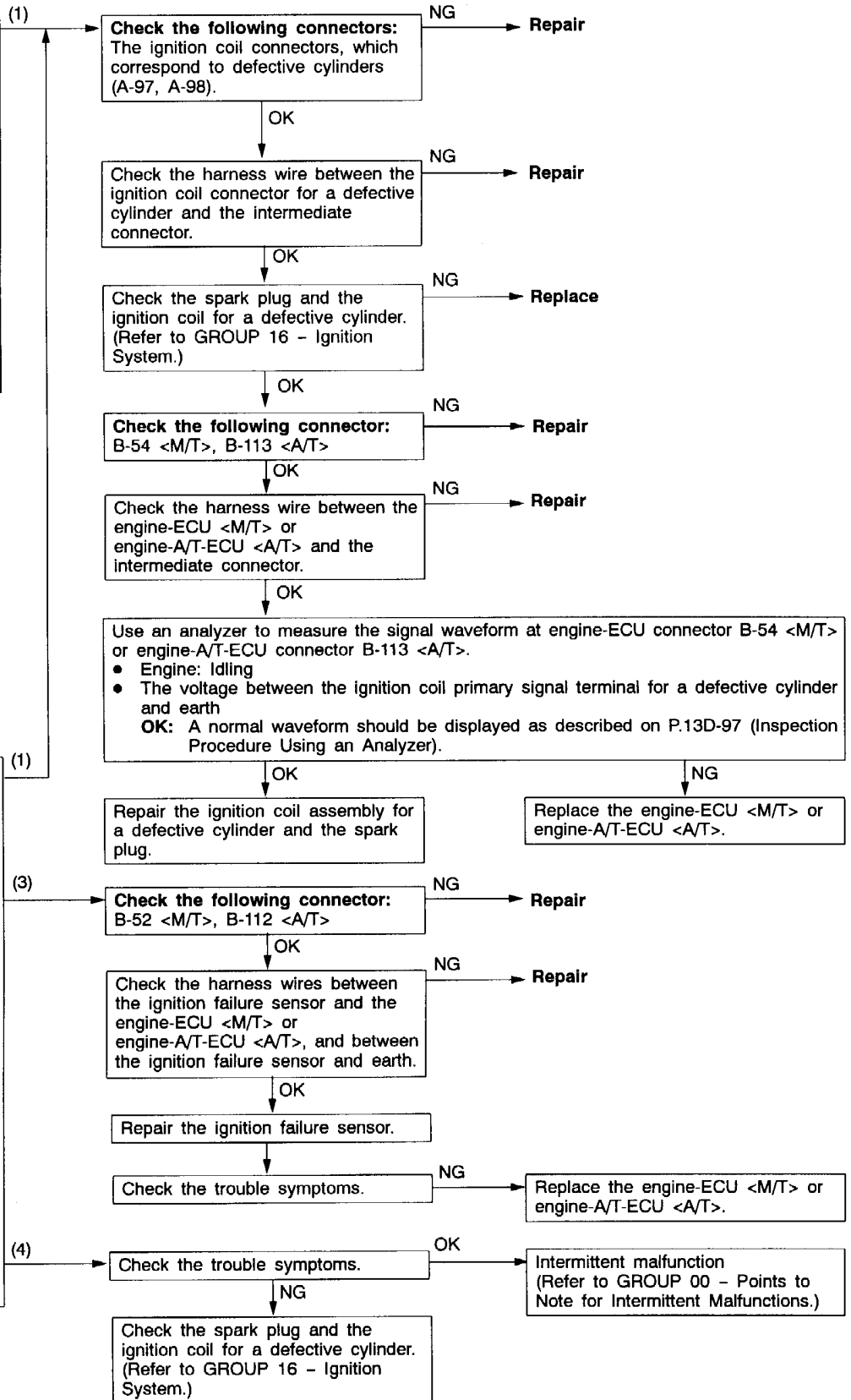
Code No. P0201 No. 1 injector system Code No. P0202 No. 2 injector system Code No. P0203 No. 3 injector system Code No. P0204 No. 4 injector system	Probable cause
Range of Check <ul style="list-style-type: none"> ● Engine speed is approx. 50 – 1,000 r/min ● The throttle position sensor output voltage is 1.15 V or less. ● Actuator test by MUT-II is not carried out. Set Conditions <ul style="list-style-type: none"> ● Surge voltage of injector coil is not detected for 4 seconds. 	<ul style="list-style-type: none"> ● Malfunction of the injector ● Improper connector contact, open circuit or short-circuited harness wire of the injector circuit ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>



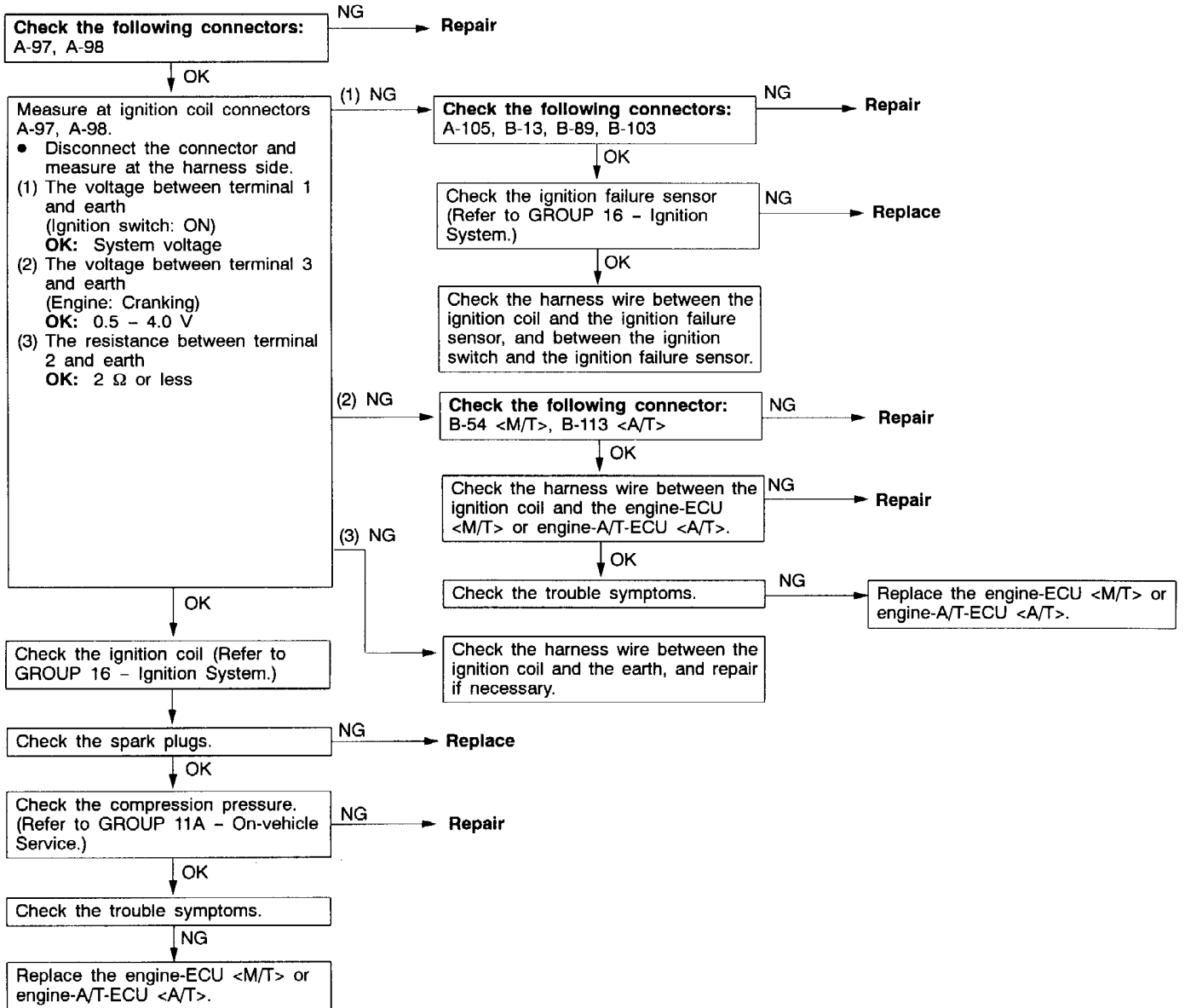
Code No. P0300 Ignition coil (power transistor) system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none">● Engine speed is approx. 50 – 4,000 r/min.● Engine is not cranking. <p>Set Conditions</p> <ul style="list-style-type: none">● The ignition failure sensor does not send a signal 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-ECU <M/T>● Malfunction of engine-A/T-ECU <A/T>

MUT-II Actuator Test
 01 No. 1 injector
 02 No. 2 injector
 03 No. 3 injector
 04 No. 4 injector
OK: The idling condition should change.
Reference
 When the cylinder (defective cylinder) where idling condition does not change is detected after suspending the injector, go to (1) and inspect the spark plug, the ignition coil, the connector, and the harness of the defective cylinder. (When more than one cylinder are detected, inspect all of them.) When all the cylinders are OK, go to (2).

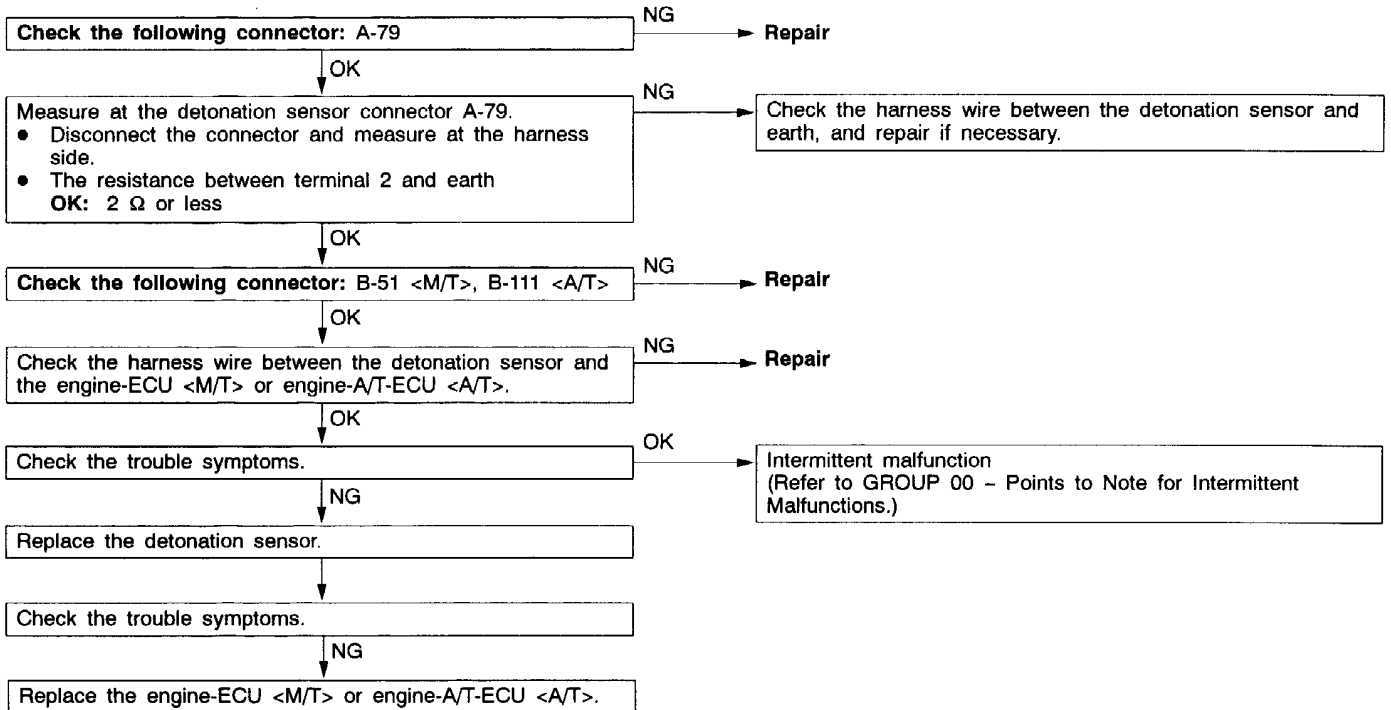
Use an analyzer to measure the signal waveform at the ignition failure sensor connector A-105.
 • Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
 • Engine: Idling
 • The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13D-97 (INSPECTION PROCEDURE USING AN ANALYZER).
Reference
 When a normal waveform is displayed, compare it with that of the ignition coil primary signal at the engine-ECU <M/T> or engine-A/T-ECU <A/T> terminal to determine the cylinder (defective cylinder) with an abnormal waveform.
 →When one or more cylinders are abnormal, go to (1)
 →When all of the cylinders are abnormal, go to (3)
 →When a normal waveform is displayed, go to (4).



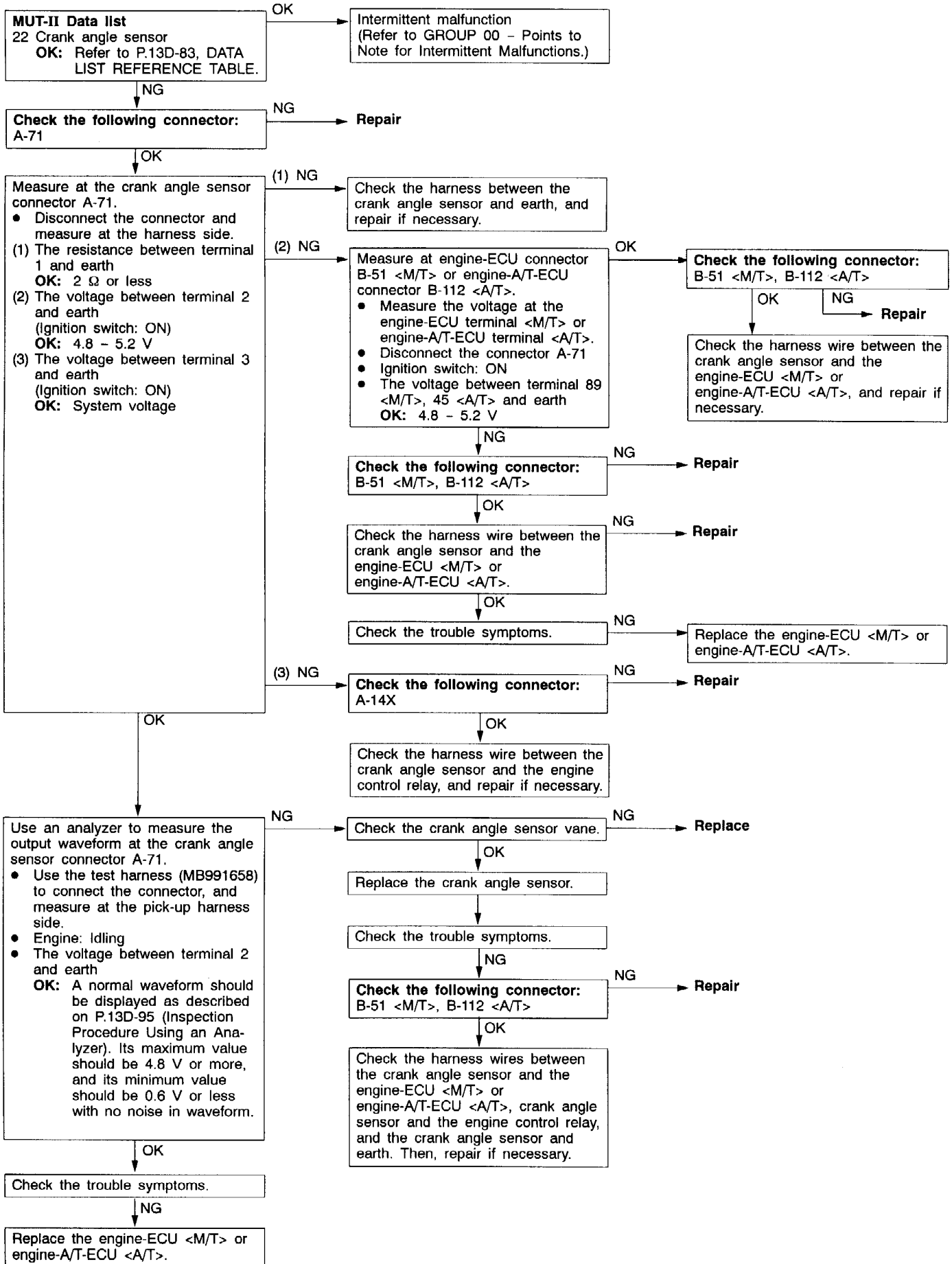
Code No. P0301 No. 1 cylinder misfire detected Code No. P0302 No. 2 cylinder misfire detected Code No. P0303 No. 3 cylinder misfire detected Code No. P0304 No. 4 cylinder misfire detected	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> The engine speed is 500 – 4,500 r/min. While the engine is running except deceleration and sudden acceleration. <p>Set Conditions</p> <ul style="list-style-type: none"> The number of misfires exceeds a predetermined number per 200 engine revolutions (Misfire has occurred in only one cylinder). <p>or</p> <ul style="list-style-type: none"> The number of misfires exceeds a predetermined number per 100 engine revolutions (Misfire has occurred in only one cylinder). 	<ul style="list-style-type: none"> Malfunction of the ignition system Abnormal compression Malfunction of injector Malfunction of engine-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>



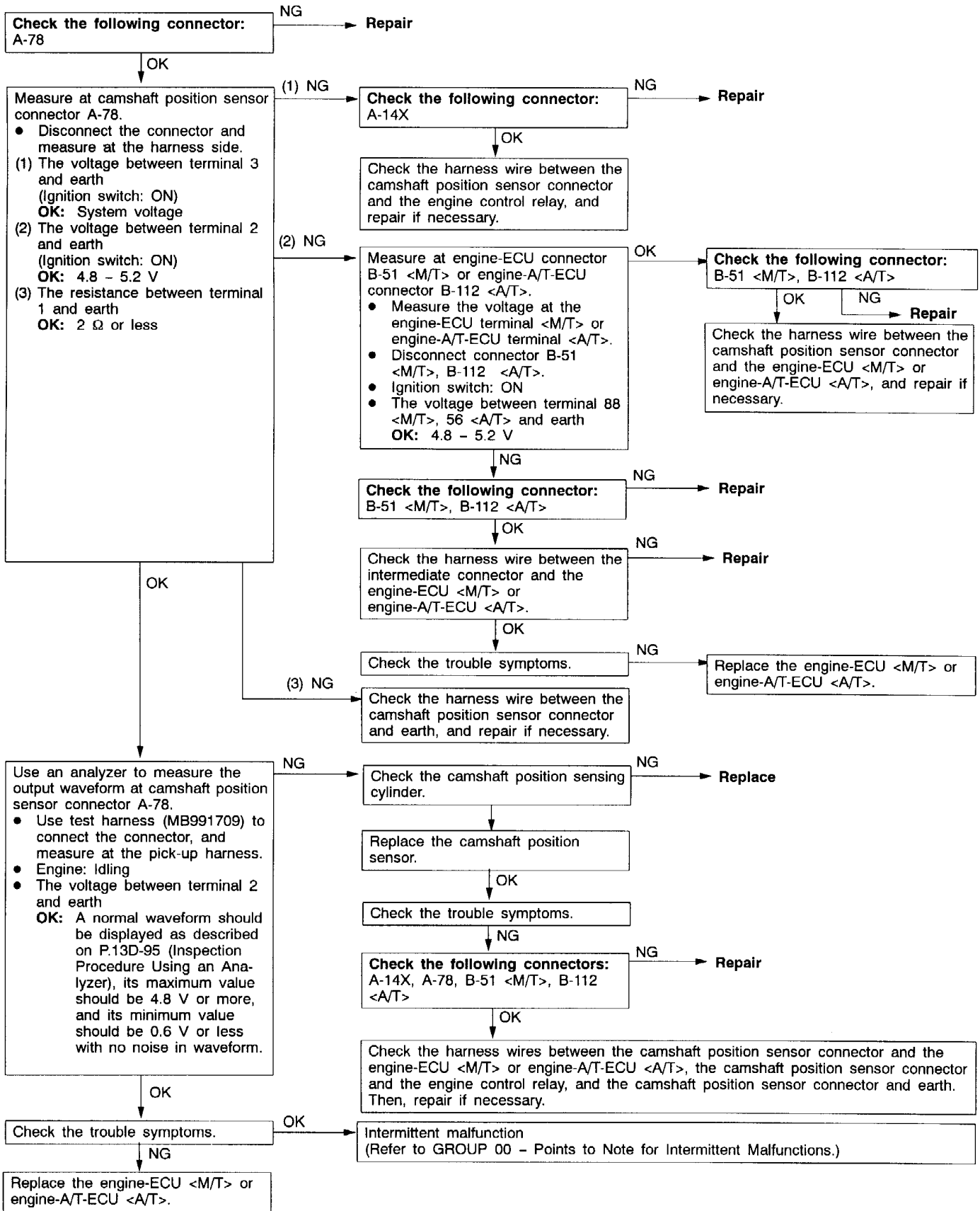
Code No. P0325 Detonation sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● Changes in sensor output voltage (detonation sensor peak voltage per 1/2 crankshaft rotation) in 200 consecutive cycles are 0.08 V or less.	● Malfunction of the detonation sensor ● Open or short circuit in the detonation sensor circuit or loose connector contact ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/T-ECU <A/T>



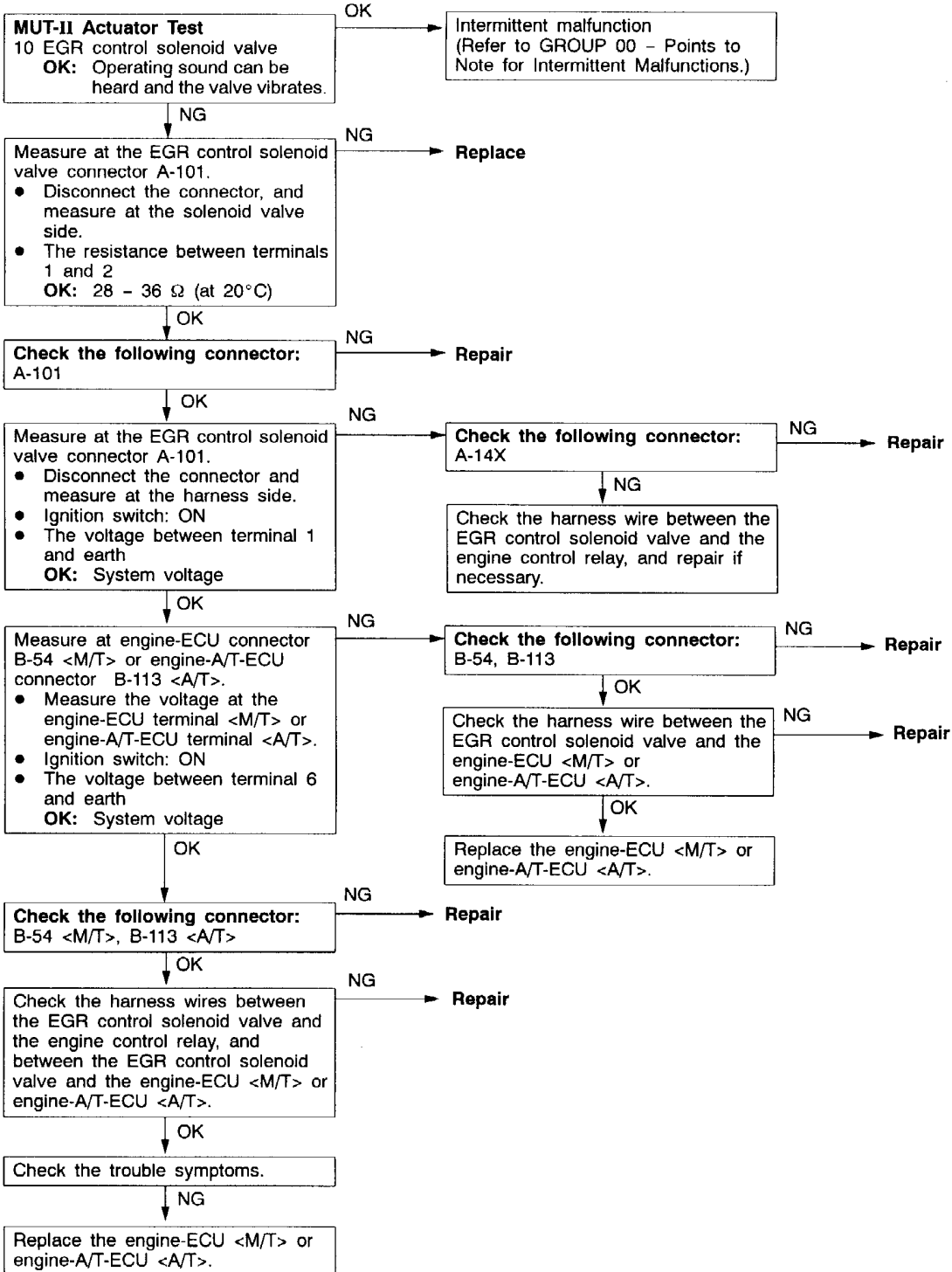
Code No. P0335 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking Set Conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the crank angle sensor. ● Open or short circuit in the crank angle sensor circuit or loose connector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



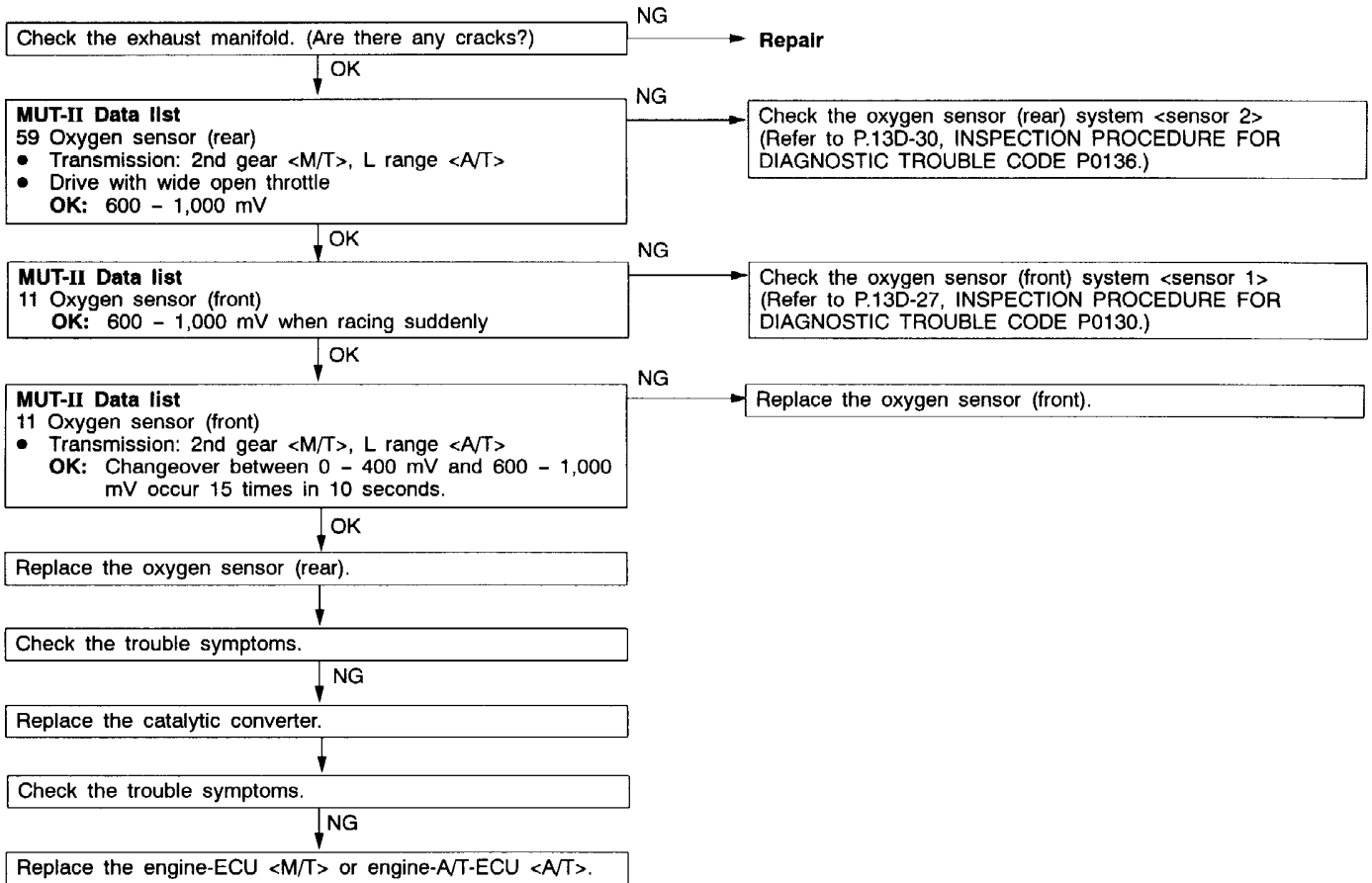
Code No. P0340 Camshaft position sensor system	Probable cause
Range of Check ● After the engine was started Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the camshaft position sensor ● Open or short circuit in the camshaft position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



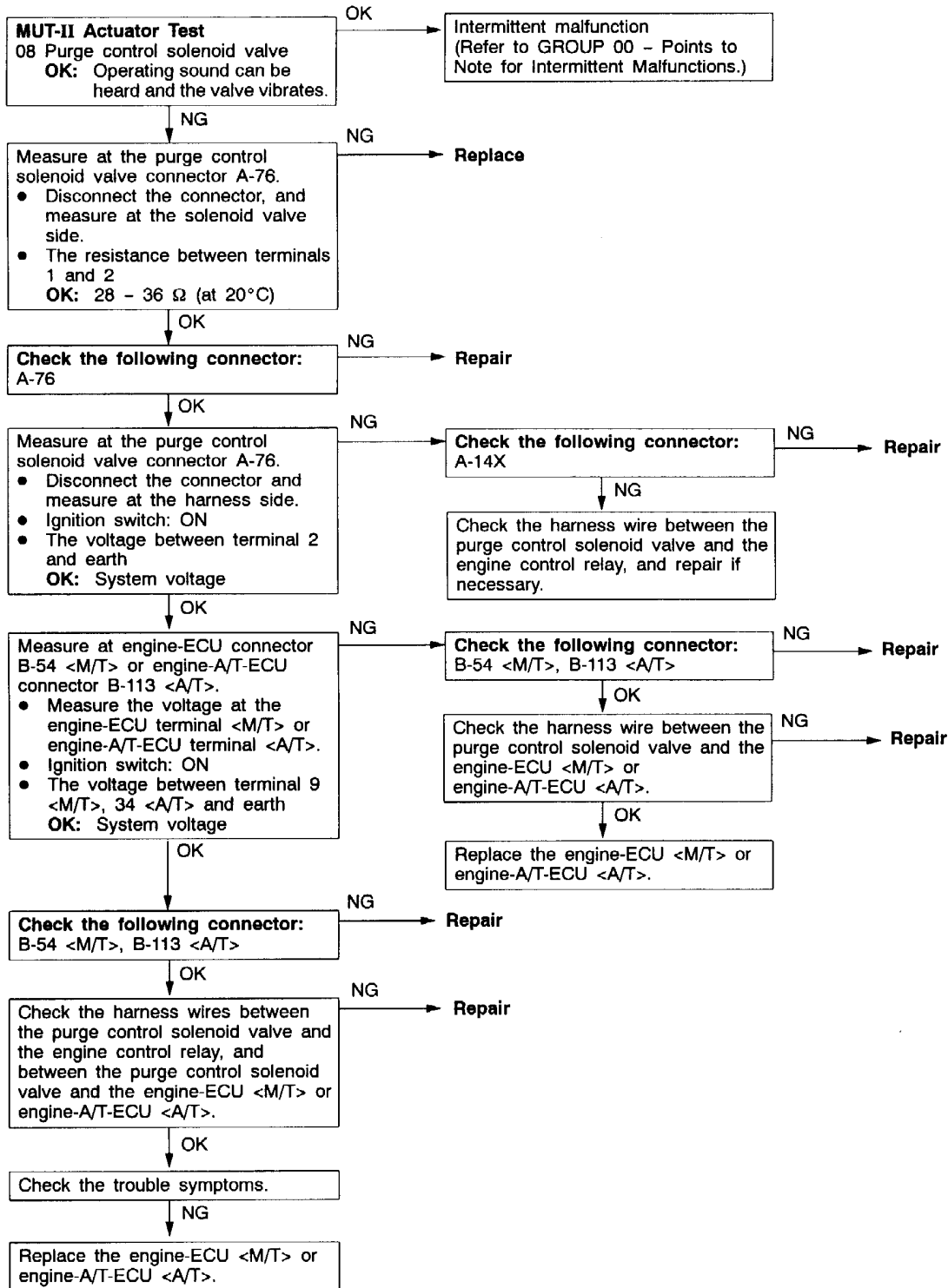
Code No. P0403 EGR control solenoid valve system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> • Ignition switch: ON • Battery voltage is 10 V or more. <p>Set Conditions</p> <ul style="list-style-type: none"> • The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off. 	<ul style="list-style-type: none"> • Malfunction of the EGR control solenoid valve • Open or short circuit in the EGR control solenoid valve circuit or loose connector contact • Malfunction of engine-ECU <M/T> • Malfunction of engine-A/T-ECU <A/T>



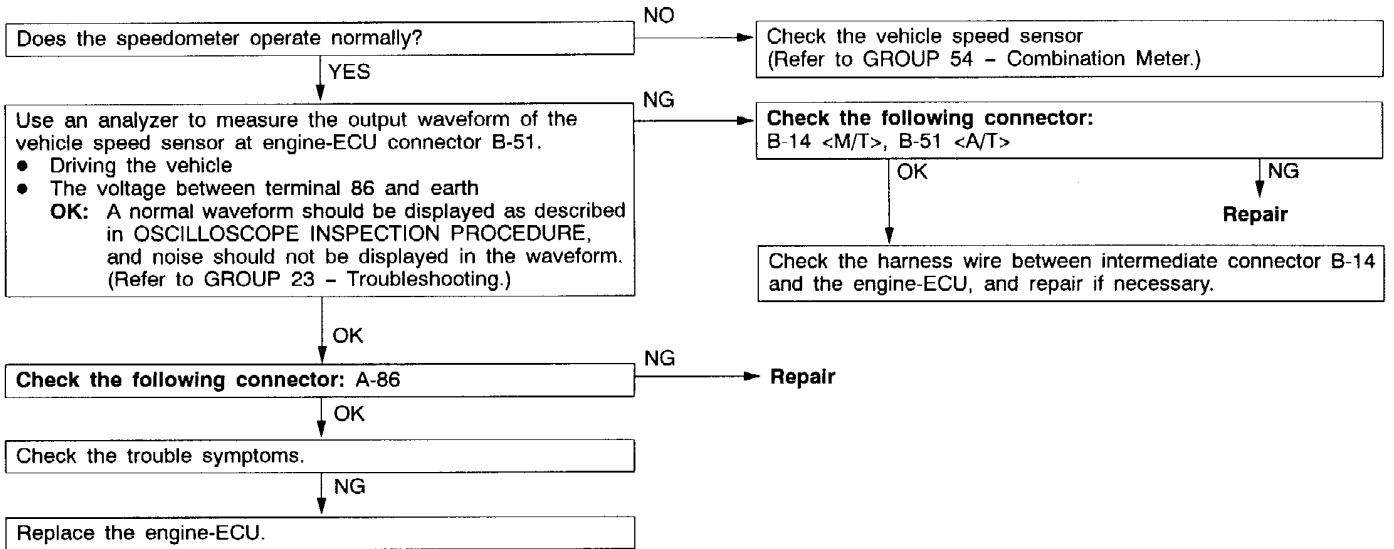
Code No. P0420 Catalyst malfunction	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> The engine speed is 3,000 r/min or less. During driving During air/fuel ratio feedback control <p>Set Conditions</p> <ul style="list-style-type: none"> The ratio between the oxygen sensor (rear) and the oxygen sensor (front) output frequencies reaches 0.8 per 12 seconds on average. 	<ul style="list-style-type: none"> Malfunction of catalyst Malfunction of the oxygen sensor (front) Malfunction of the oxygen sensor (rear) Malfunction of engine-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>



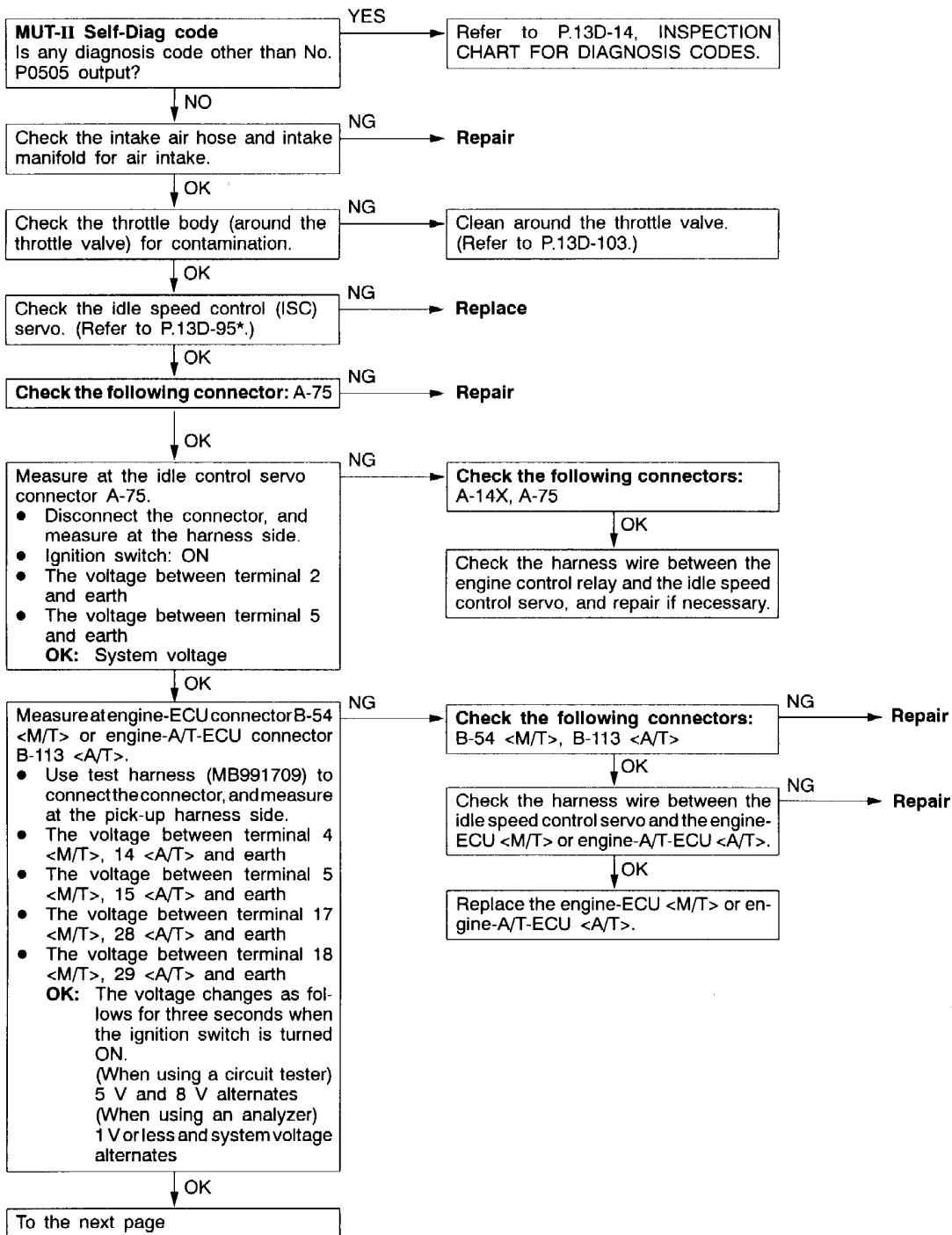
Code No. P0443 Purge control solenoid valve system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Battery voltage is 10 V or more. <p>Set Conditions</p> <ul style="list-style-type: none"> The solenoid coil surge voltage (battery voltage + 2 V) is not detected 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-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>

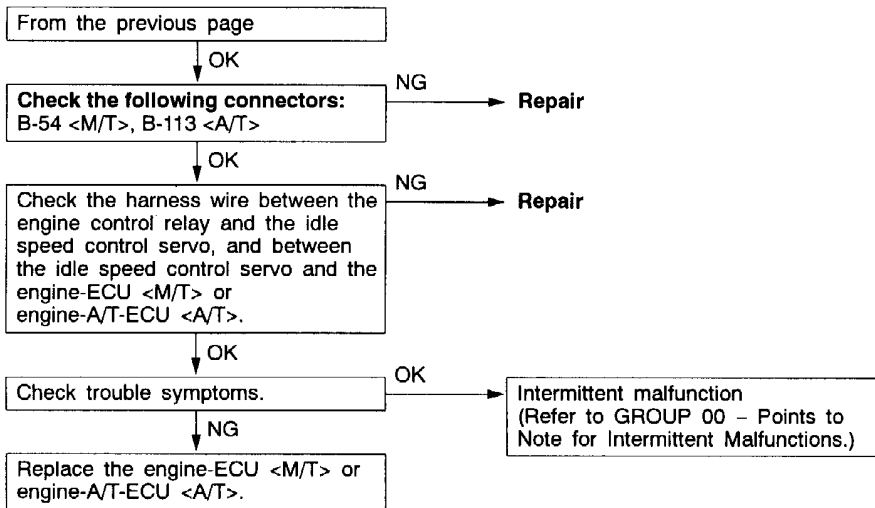


Code No. P0500 Vehicle speed sensor system <M/T>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load <p>Set Conditions</p> <ul style="list-style-type: 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-ECU

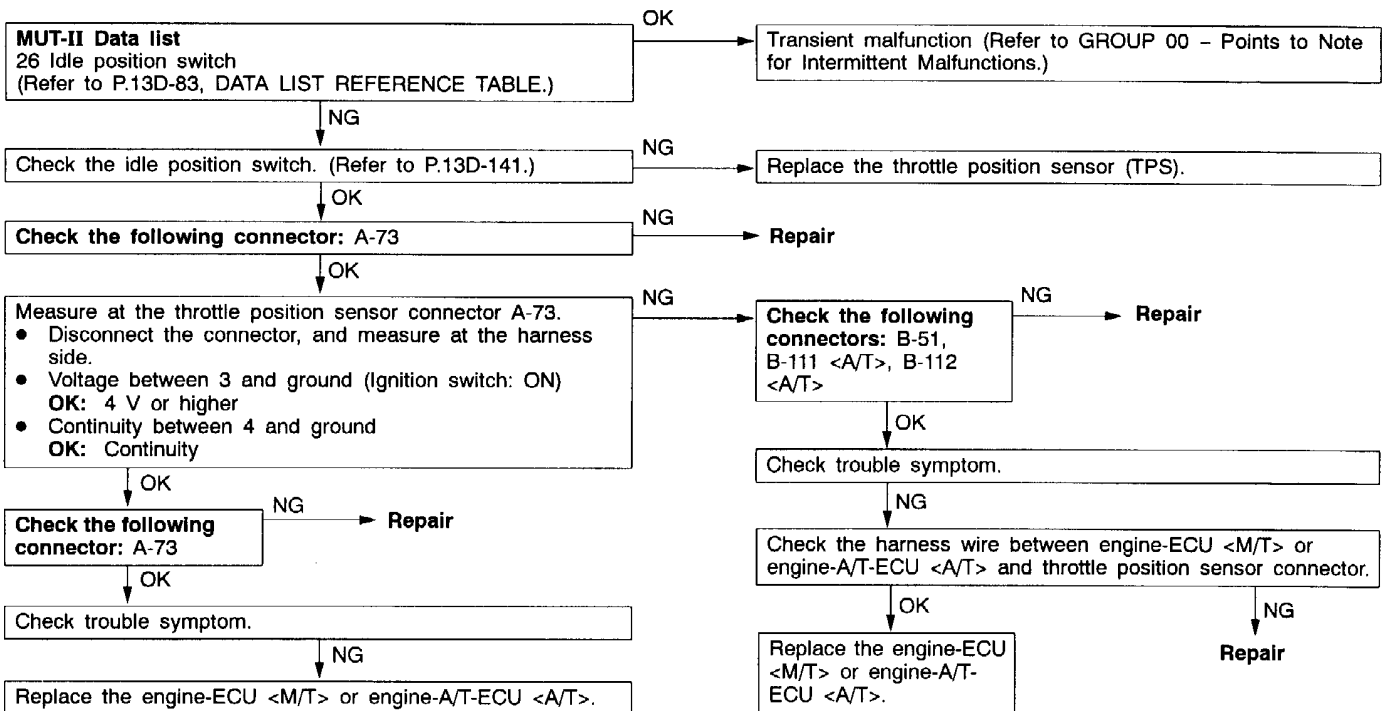


Code No. P0505 Idle speed control (ISC) system	Probable cause
<p>Check Area</p> <ul style="list-style-type: none"> ● Vehicle speed has reached 1.5 km/h at least once. ● Under the closed loop idle speed control. <p>Judgment Criteria</p> <ul style="list-style-type: none"> ● Actual idle speed has continued to be higher than the target idle speed by 300 r/min or more for 10 sec. <p>Check Area</p> <ul style="list-style-type: none"> ● Vehicle speed has reached 1.5 km/h at least once. ● During idle speed closed loop control. ● The highest temperature at the last drive is 45°C or less. ● Engine coolant temperature is approx. 80°C or more. ● Battery voltage is 10 V or more. ● Intake air temperature is -10°C (14°F) or more. <p>Judgment Criteria</p> <ul style="list-style-type: none"> ● Actual idle speed has been minimum 200 r/min higher than the target idle speed for ten seconds. <p>Check Area</p> <ul style="list-style-type: none"> ● During idle speed closed loop control. ● Engine coolant temperature is about 80°C or higher. ● Battery voltage is 10 V or higher. ● Power steering switch is off. ● Intake air pipe pressure is 53 kPa or less. ● Intake air temperature is -10°C or more. <p>Judgment Criteria</p> <ul style="list-style-type: none"> ● Actual idle speed has been minimum 100 r/min higher than the target idle speed for ten seconds. 	<ul style="list-style-type: none"> ● Malfunction of idle speed control (ISC) servo ● Improper connector contact, open circuit or short-circuit harness wire ● Malfunction of engine-ECU <M/T> ● Malfunction of engine-A/C-ECU <A/T>

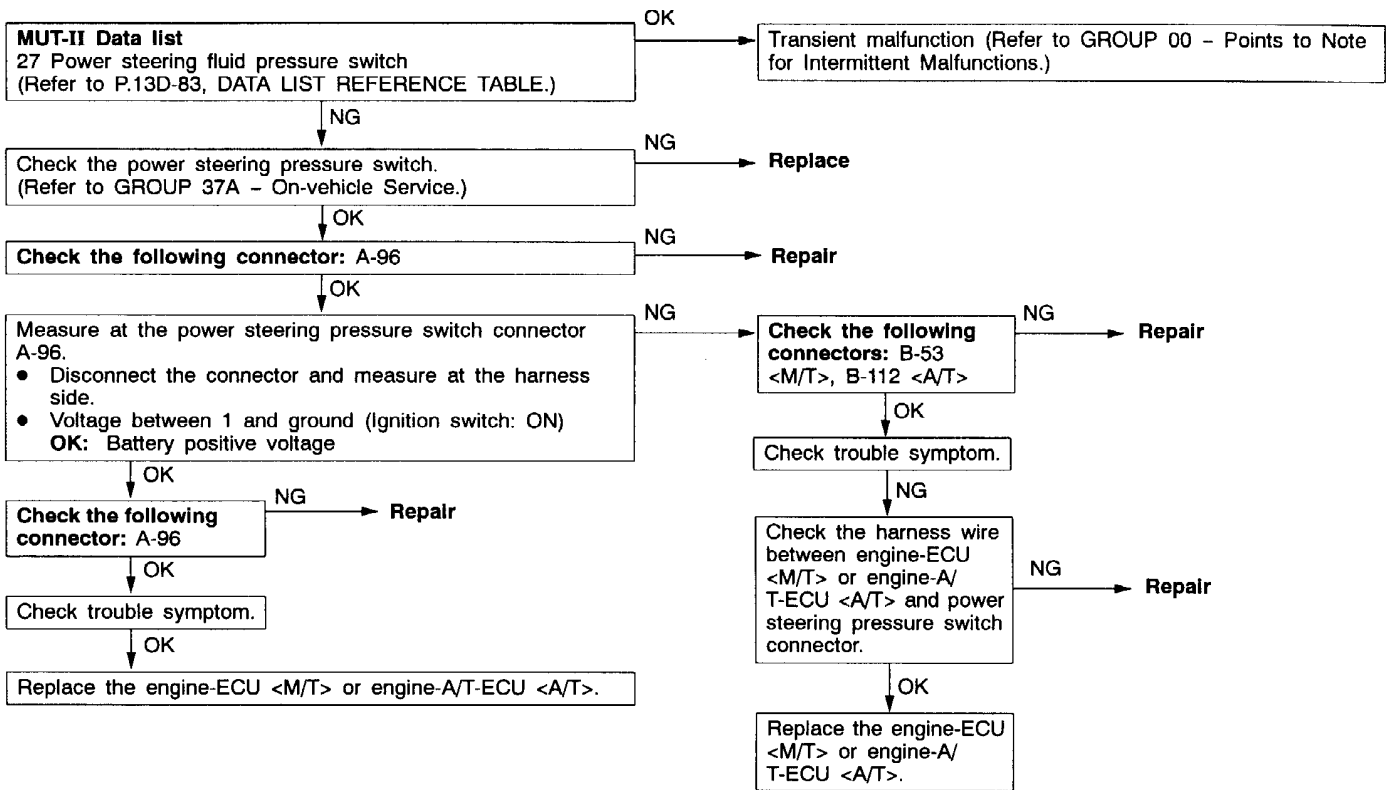




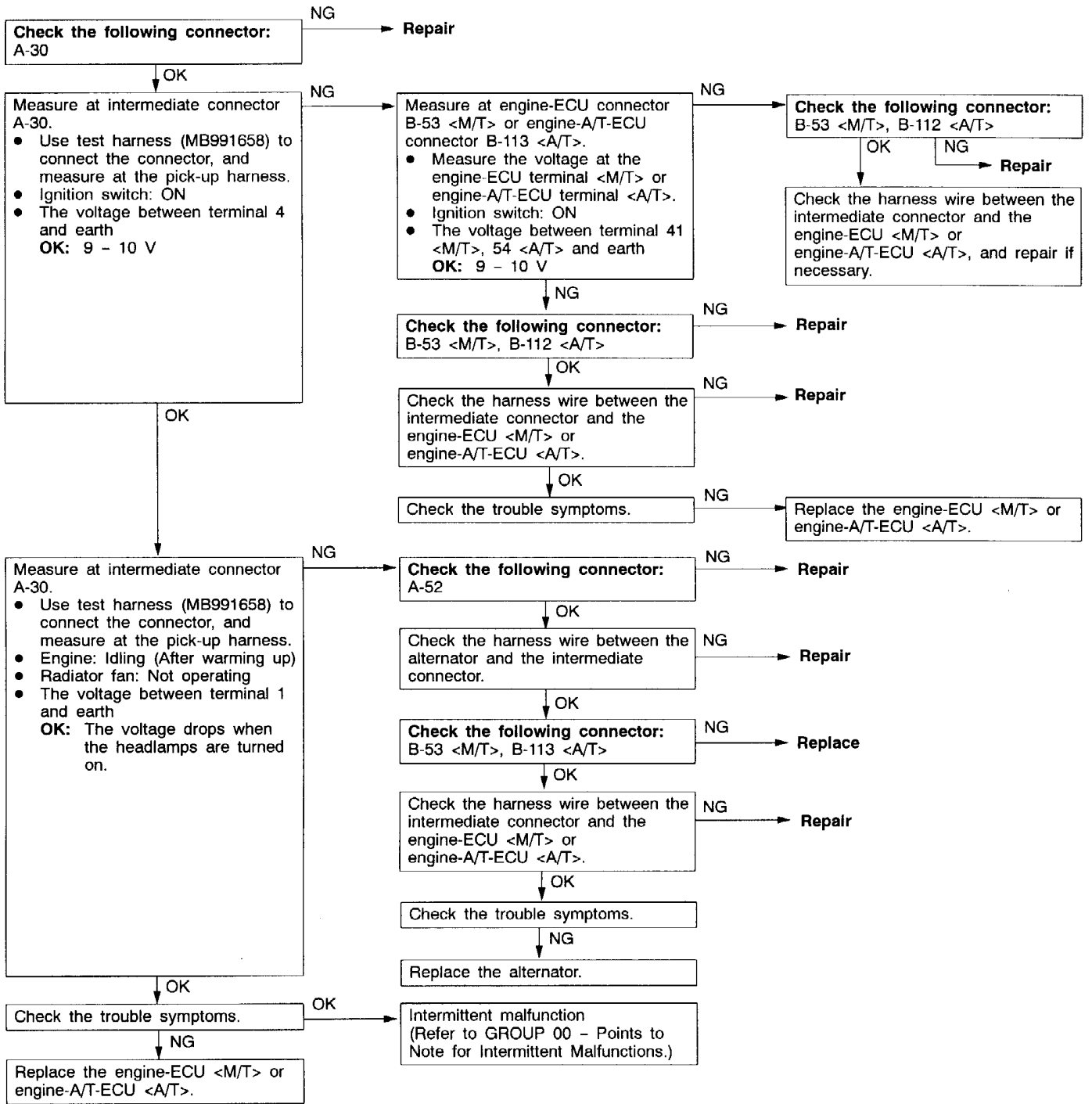
Code No. P0510 Idle Position Switch System	Probable cause
<p>Check Area</p> <ul style="list-style-type: none"> Throttle position sensor output voltage is 2.0 V or more. <p>Judgment Criteria</p> <ul style="list-style-type: none"> Idle position switch has been turned on. <p>Check Area</p> <ul style="list-style-type: none"> Repeat the *1 drive and *2 stop 15 times. <p>*1 drive: Vehicle speed is more than 30 km/h (19 mph) for two seconds or more.</p> <p>*2 stop: Vehicle speed is more than 1.5 km/h (0.93 mph).</p> <p>Judgment Criteria</p> <ul style="list-style-type: none"> Idle position switch remains off. 	<ul style="list-style-type: none"> Malfunction of idle position switch Open or shorted idle position switch circuit, or loose connector. Malfunction of engine-ECU <M/T> Malfunction of engine-A/T-ECU <A/T>



Code No. P0551 Power Steering fluid Pressure Switch System	Probable cause
<p>Check Area</p> <ul style="list-style-type: none"> ● Intake air temperature is -10°C (14°F) or higher. ● Barometric pressure is 76 kPa (11 psi) or higher. ● Engine coolant temperature is 30°C (86°F) or more. ● Repeat the *1 drive and *2 stop ten times or more. <p>*1: Engine speed is 2,500 r/min or higher, volumetric efficiency is 55 % or higher and vehicle speed is 5 km/h (3.1 mph) or higher for 4 seconds or more.</p> <p>*2: Vehicle speed is 1.5 km/h (0.93 mph) or lower.</p> <p>Judgment Criteria</p> <ul style="list-style-type: none"> ● Power steering pressure switch remains on. 	<ul style="list-style-type: none"> ● Power steering fluid pressure switch failed. ● Open or shorted power steering fluid pressure switch circuit or loose connector ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/C-ECU <A/T>



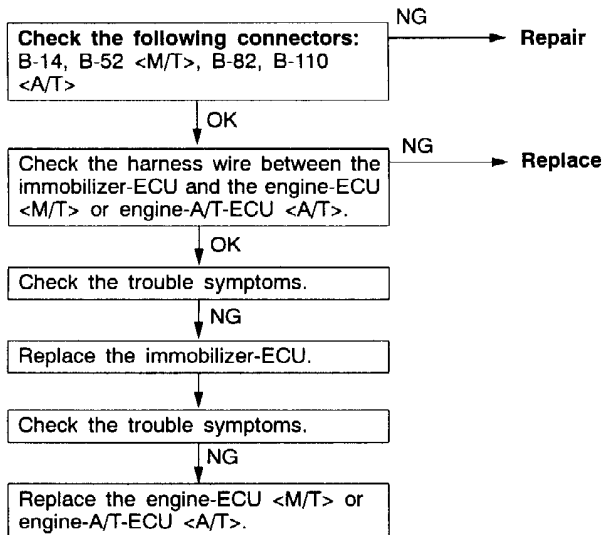
Code No. P1500 Alternator FR terminal system	Probable cause
Range of Check ● Engine speed: 50 r/min or more Set Conditions ● Input voltage from the alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of engine-ECU <M/T> ● Malfunction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



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

NOTE

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



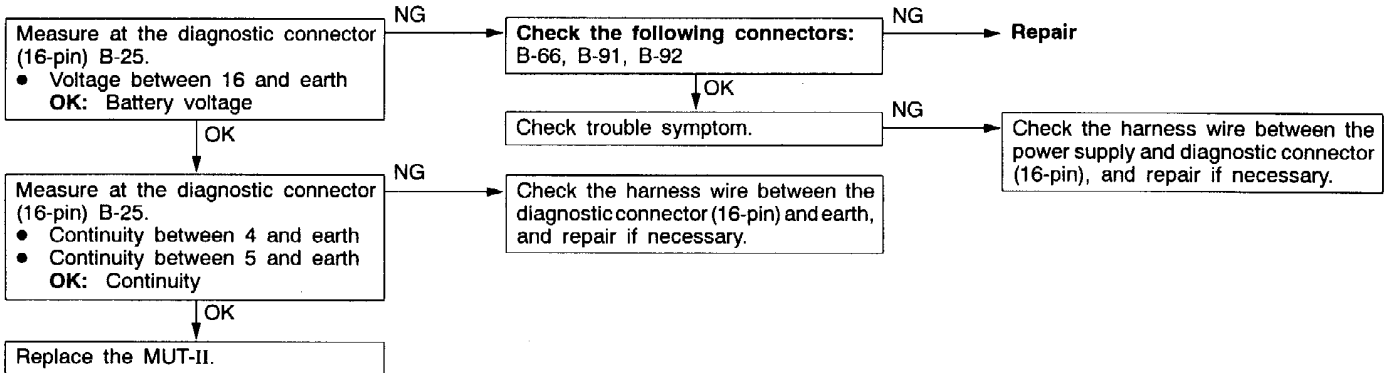
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13D-77
	Communication with engine-ECU <M/T> or engine-A/T-ECU <A/T> only is not possible.	2	13D-77
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	13D-53
	The engine warning lamp remains illuminating and never goes out.	4	13D-53
Starting	No initial combustion (starting impossible)	5	13D-54
	Initial combustion but no complete combustion (starting impossible)	6	13D-45
	Long time to start (improper starting)	7	13D-56
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13D-57
	Idling speed is high. (Improper idling speed)	9	13D-82
	Idling speed is low. (Improper idling speed)	10	13D-60
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13D-61
	When the engine becomes hot, it stalls at idling. (Die out)	12	13D-86
	The engine stalls when starting the car. (Pass out)	13	13D-64
	The engine stalls when decelerating.	14	13D-64
Driving	Hesitation, sag or stumble	15	13D-65
	The feeling of impact or vibration when accelerating	16	13D-66
	The feeling of impact or vibration when decelerating	17	13D-66
	Poor acceleration	18	13D-67
	Surge	19	13D-69
	Knocking	20	13D-70
Dieseling		21	13D-70
Too high CO and HC concentration when idling		22	13D-71
Low alternator output voltage (approx. 12.3 V)		23	13D-72
Idling speed is improper when A/C is operating		24	13D-72
Fans (radiator fan, A/C condensor fan) are inoperative		25	13D-73

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

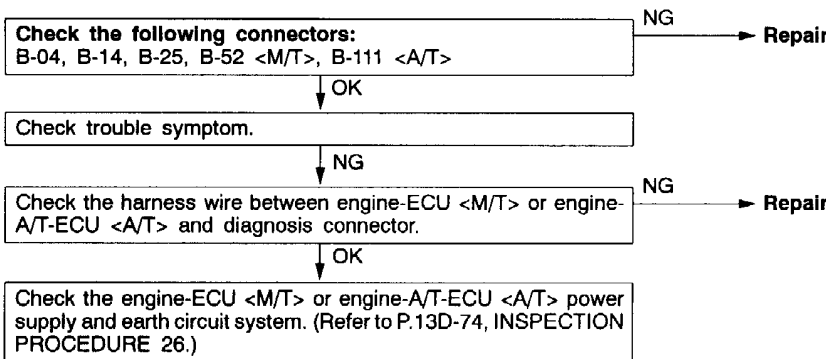
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness wire



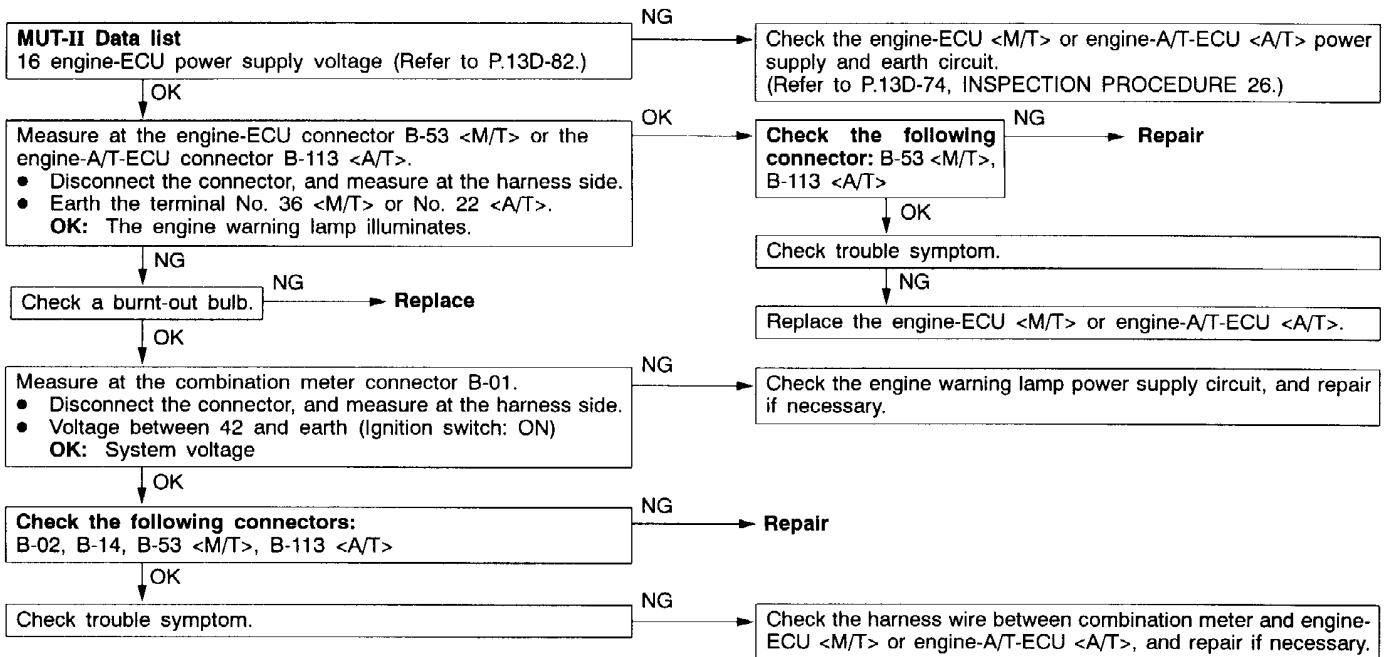
INSPECTION PROCEDURE 2

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



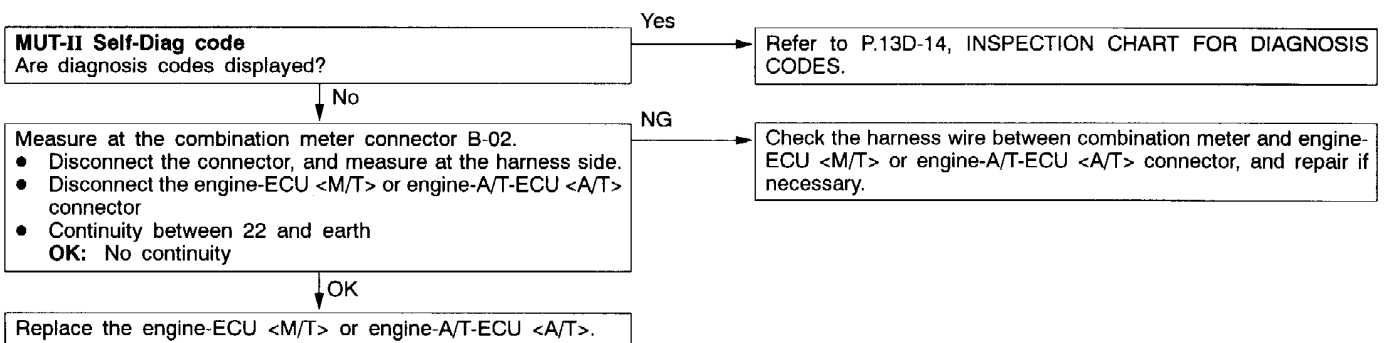
INSPECTION PROCEDURE 3

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



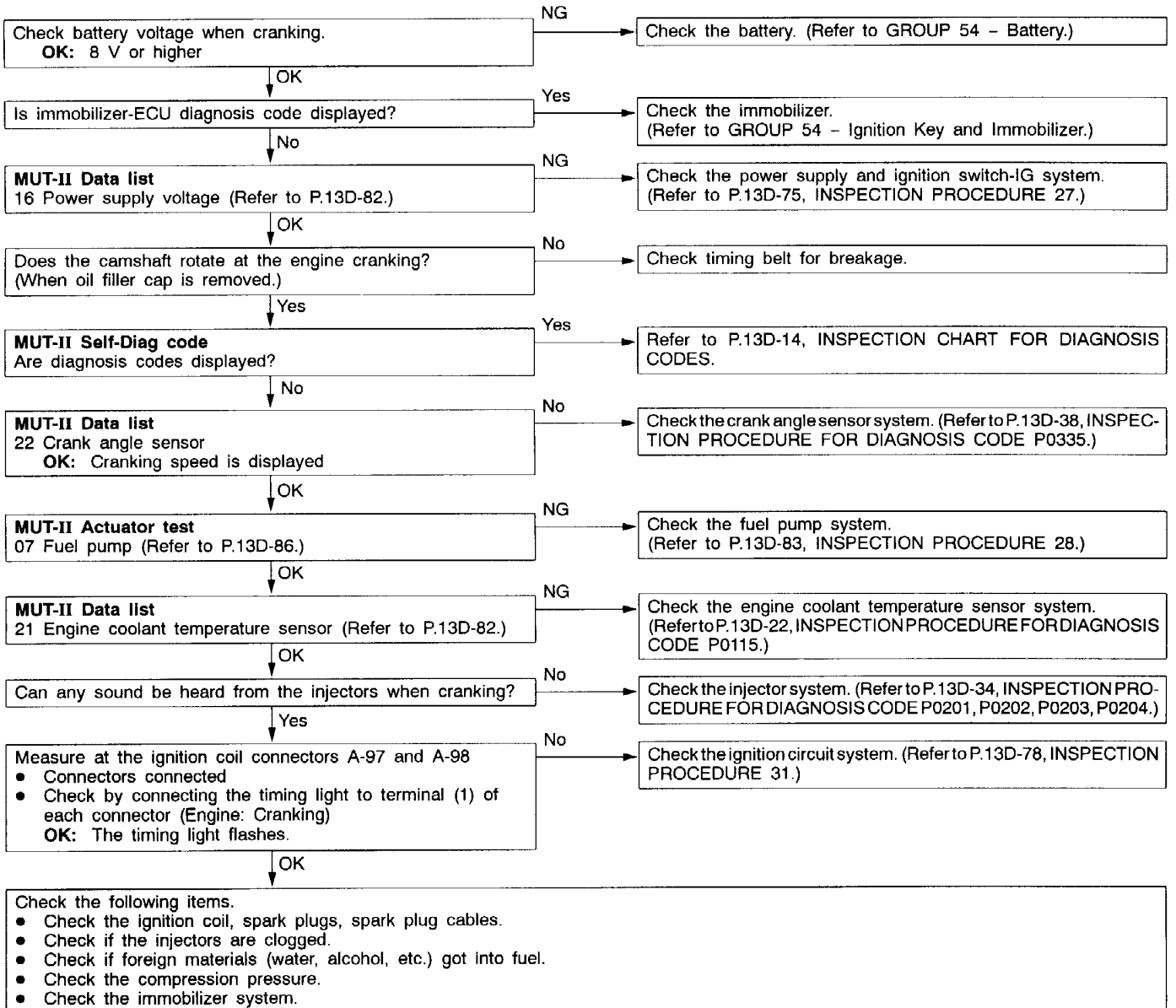
INSPECTION PROCEDURE 4

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



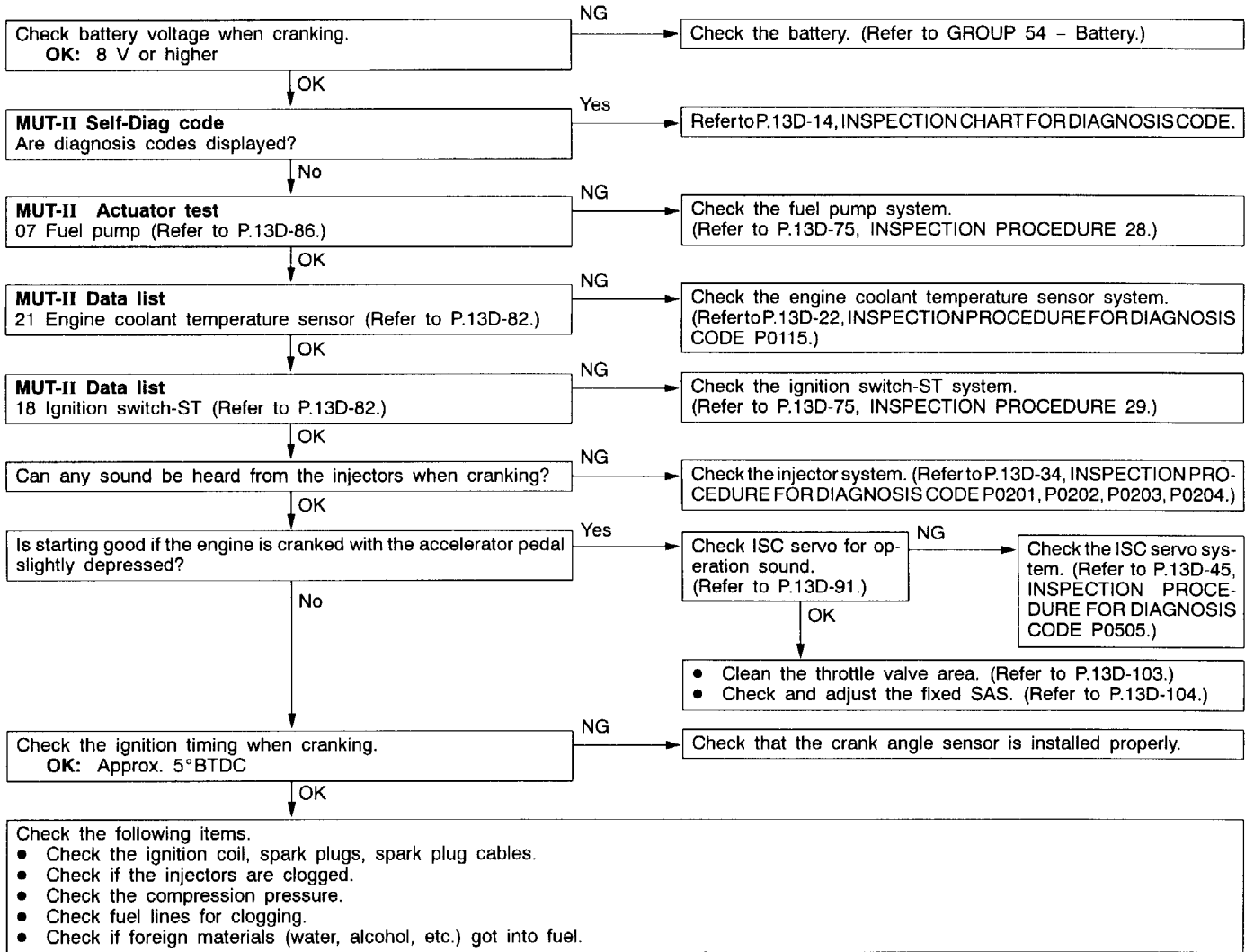
INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
<p>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.</p>	<ul style="list-style-type: none"> ● Malfunction of the ignition system ● Malfunction of the fuel pump system ● Malfunction of the injectors ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T> ● Malfunction of the immobilizer system ● Foreign materials in fuel



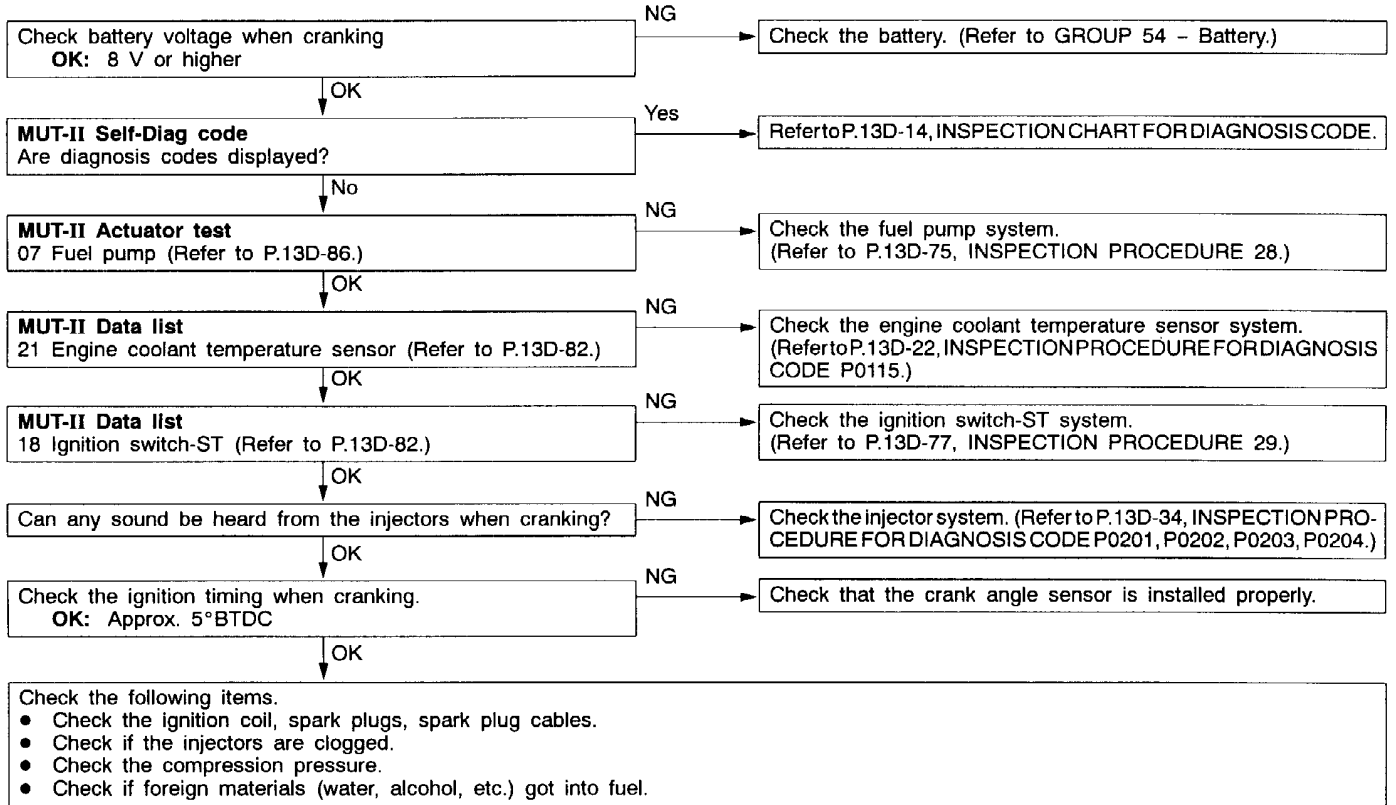
INSPECTION PROCEDURE 6

Initial combustion but no complete combustion (starting impossible)	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks but the sparks are weak, or the initial mixture for starting is not appropriate.	<ul style="list-style-type: none"> ● Malfunction of the ignition system ● Malfunction of the injector system ● Foreign materials in fuel ● Poor compression ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



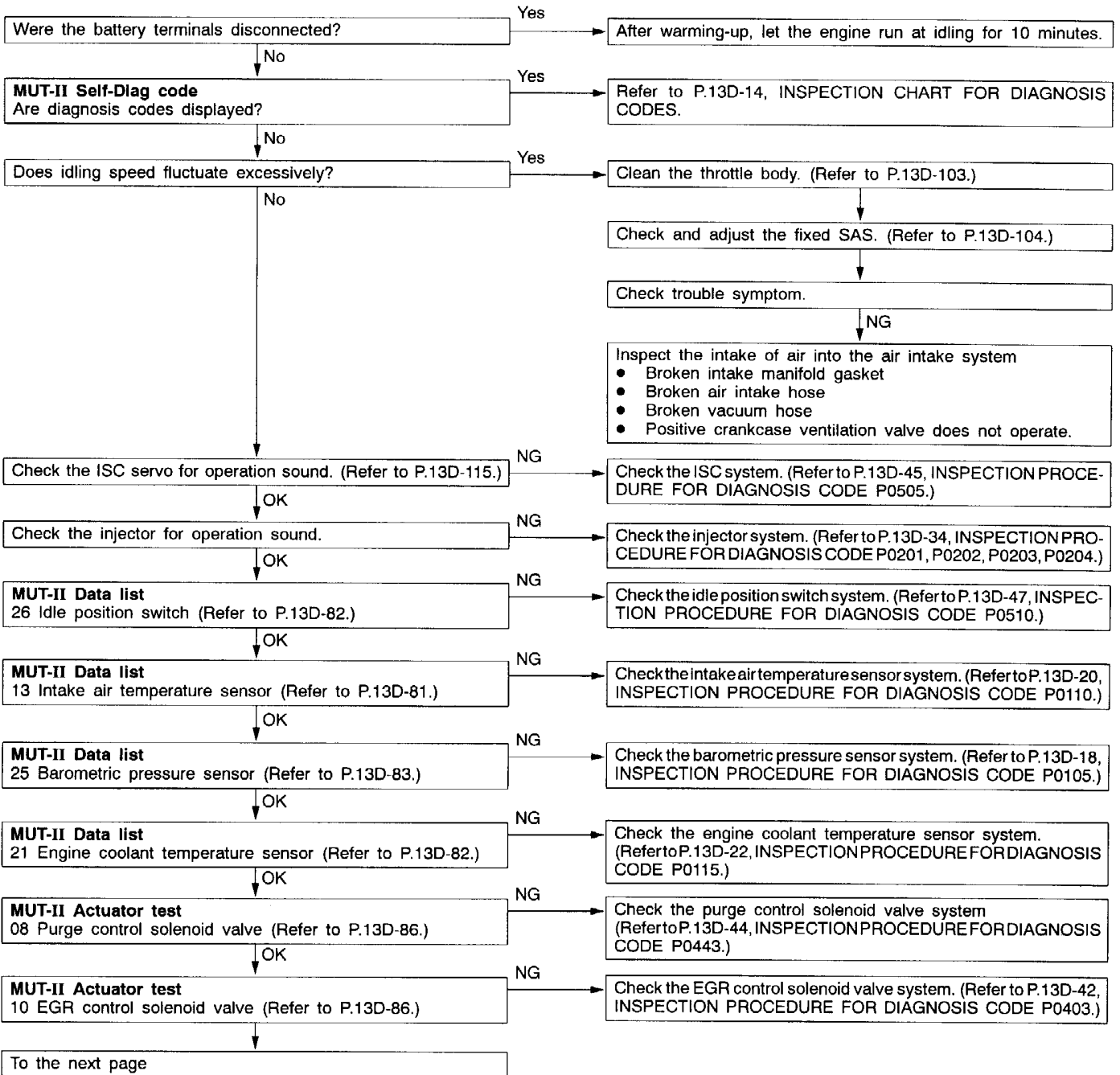
INSPECTION PROCEDURE 7

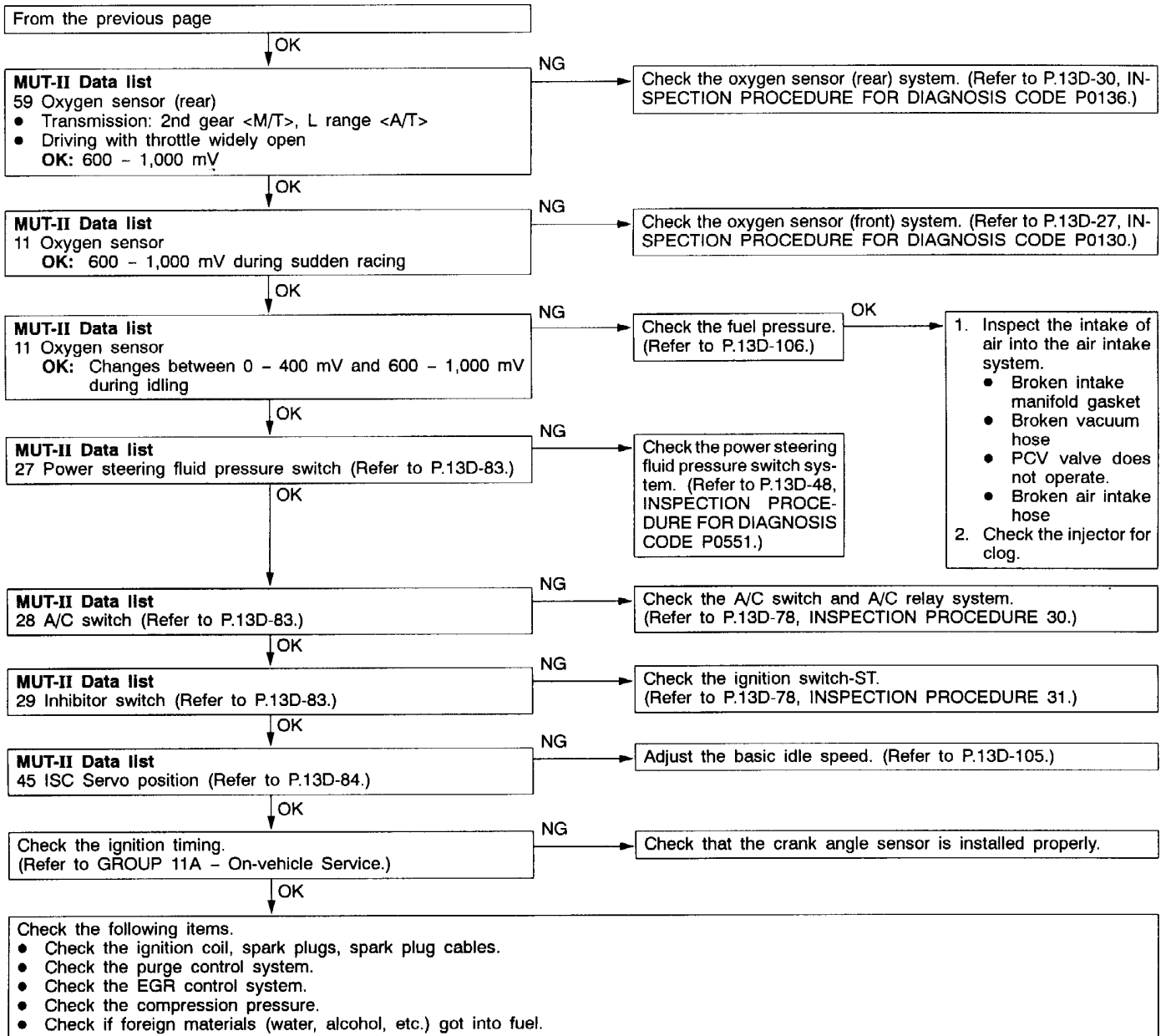
It takes too long time to start. (Incorrect starting)	Probable cause
In cases such as the above, the cause is probably that the spark is weak and ignition is difficult, the initial mixture for starting is not appropriate, or sufficient compression pressure is not being obtained.	<ul style="list-style-type: none"> ● Malfunction of the ignition system ● Malfunction of the injector system ● Inappropriate gasoline use ● Poor compression



INSPECTION PROCEDURE 8

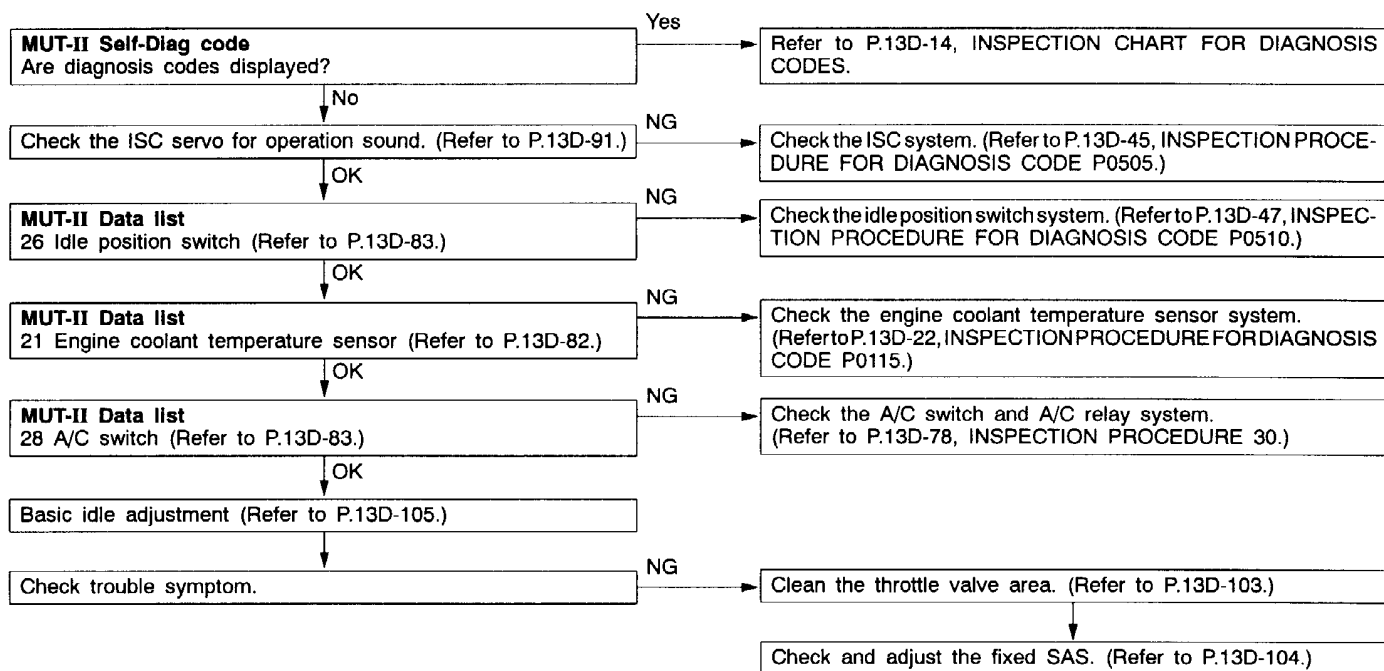
Unstable idling (Rough idling, hunting)	Probable cause
In cases as the above, the cause is probably that the ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. Because the range of possible causes is broad, inspection is narrowed down to simple items.	<ul style="list-style-type: none"> ● Malfunction of the ignition system ● Malfunction of air-fuel ratio control system ● Malfunction of the ISC system ● Malfunction of the purge control solenoid valve system ● Malfunction of the EGR solenoid valve system ● Poor compression ● Drawing air into exhaust system





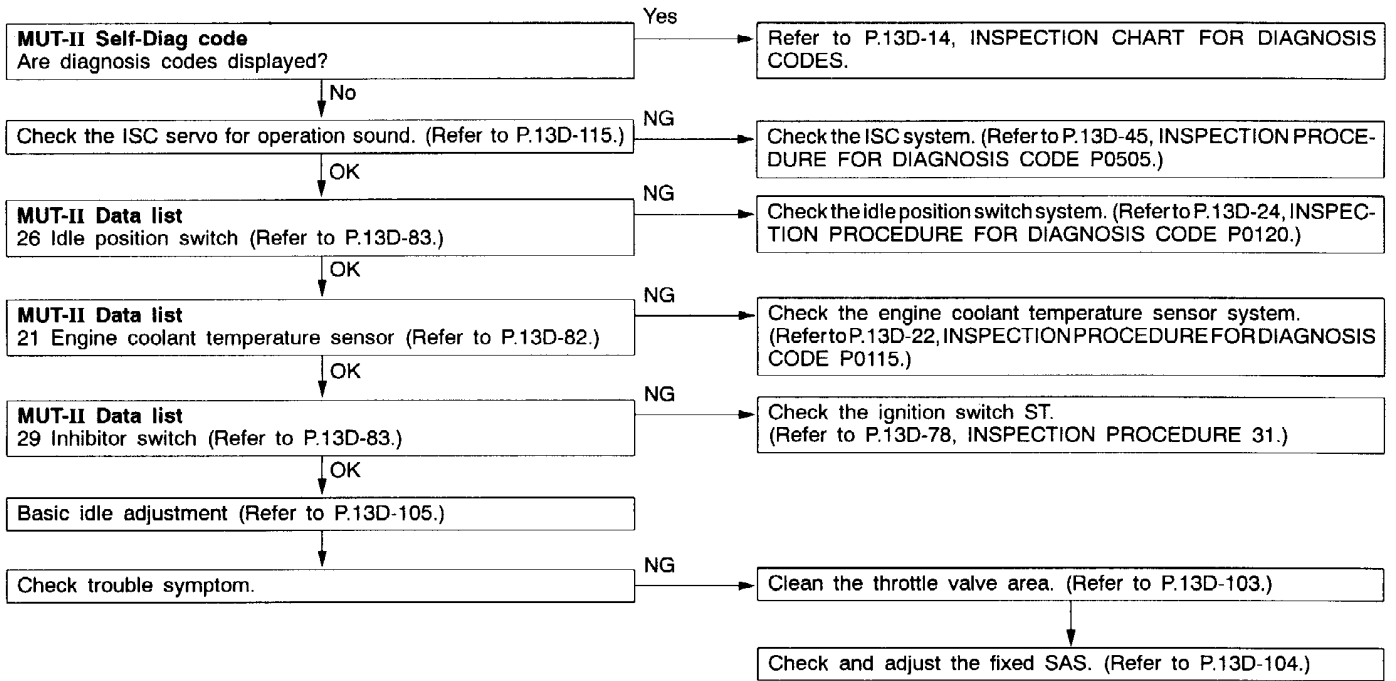
INSPECTION PROCEDURE 9

Idling speed is high. (Improper idling speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idling is too great.	<ul style="list-style-type: none"> ● Malfunction of the ISC servo system ● Malfunction of the throttle body



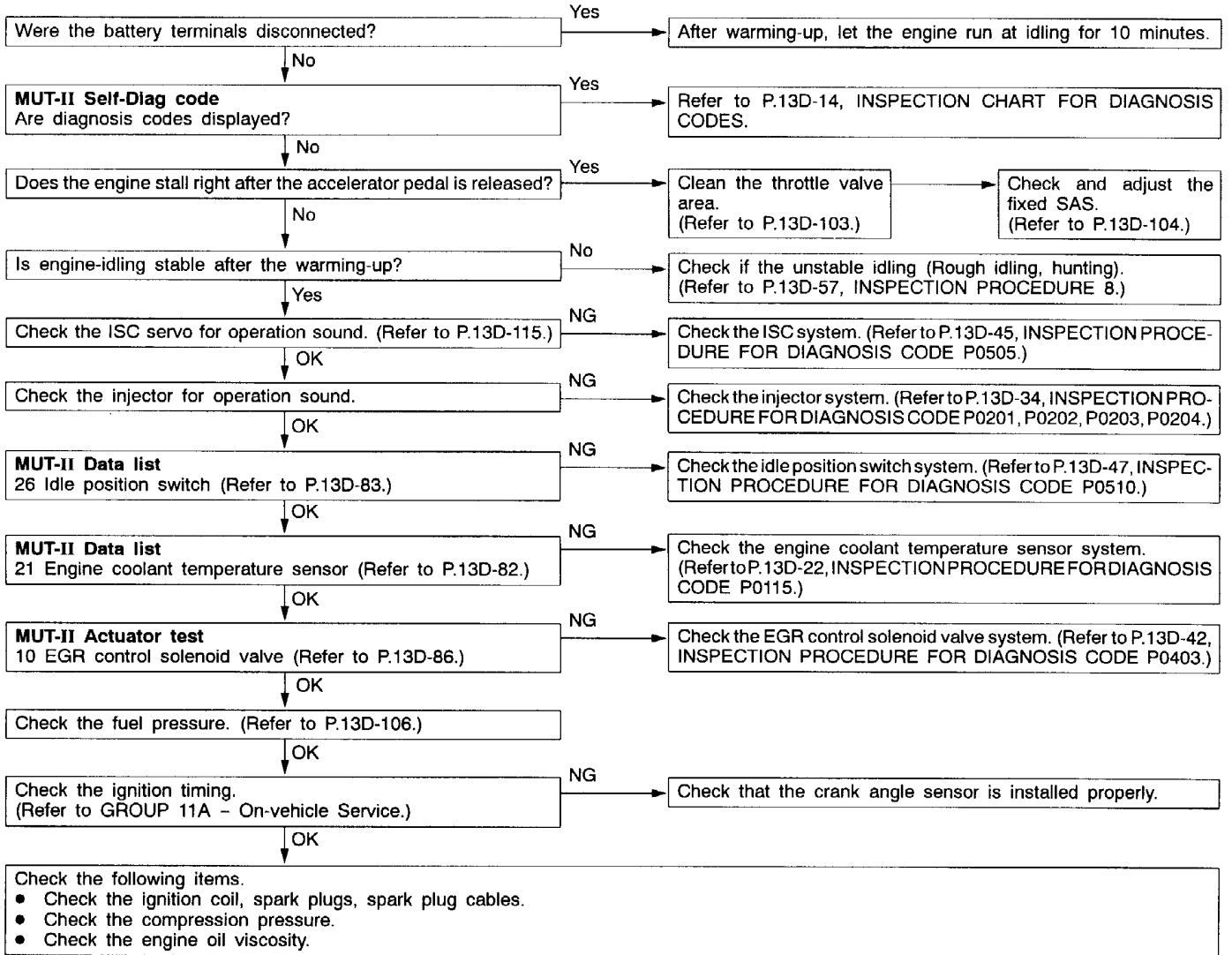
INSPECTION PROCEDURE 10

Idling speed is low. (Improper idling speed)	Probable cause
In cases such as the above, the cause is probably that the intake air volume during idling is too small.	<ul style="list-style-type: none"> ● Malfunction of the ISC servo system ● Malfunction of the throttle body



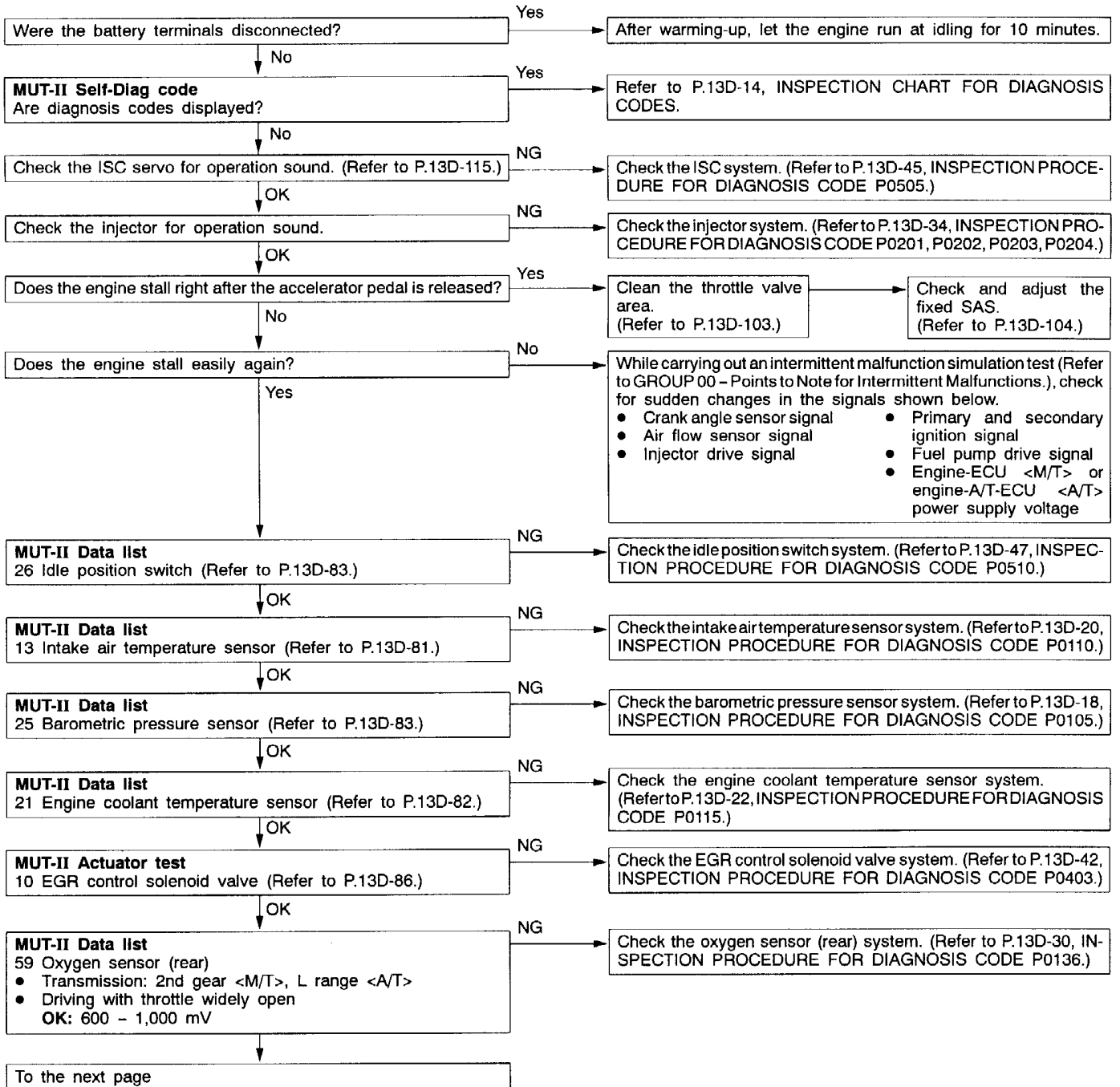
INSPECTION PROCEDURE 11

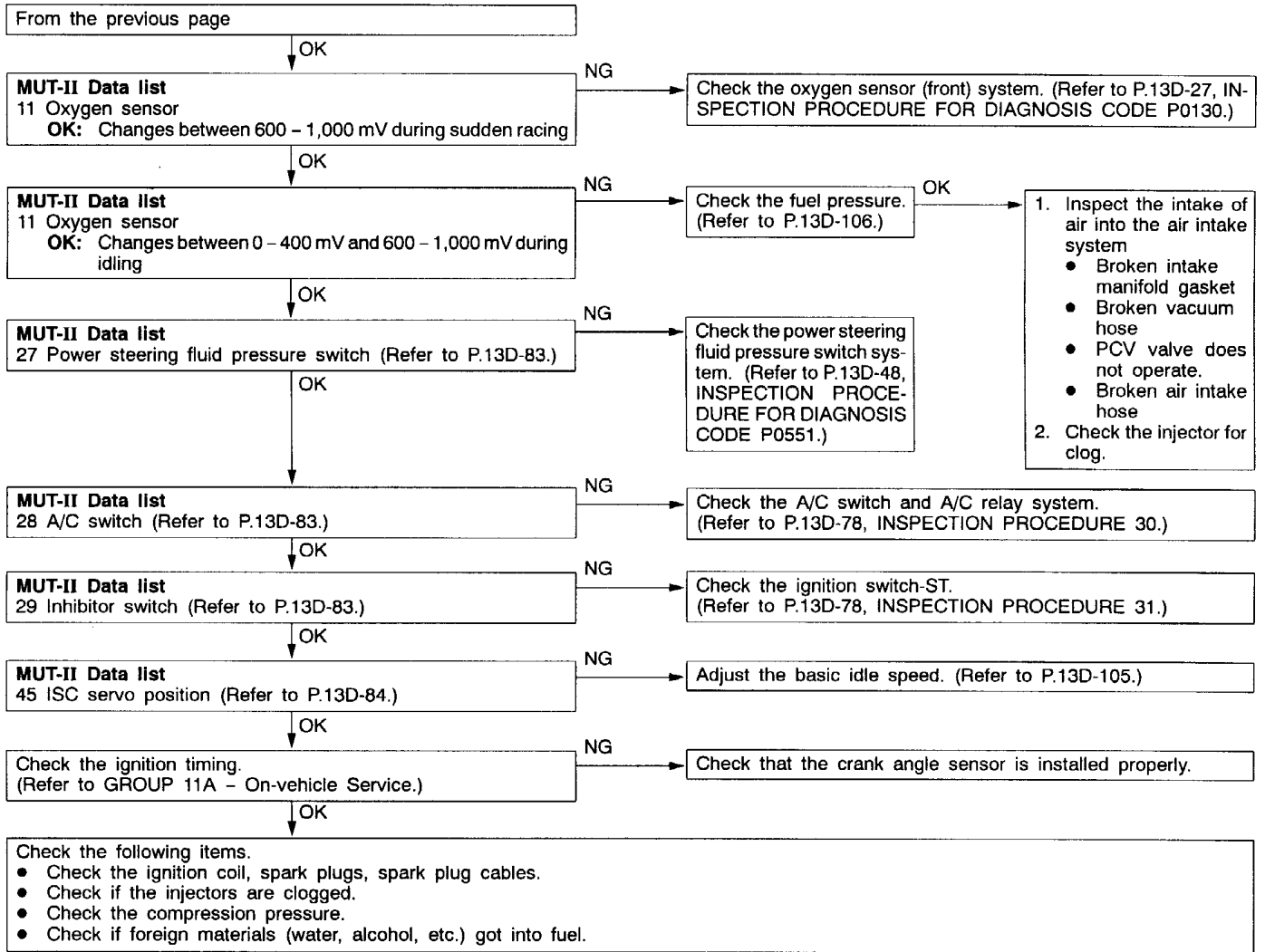
When the engine is cold, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	<ul style="list-style-type: none"> ● Malfunction of the ISC servo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



INSPECTION PROCEDURE 12

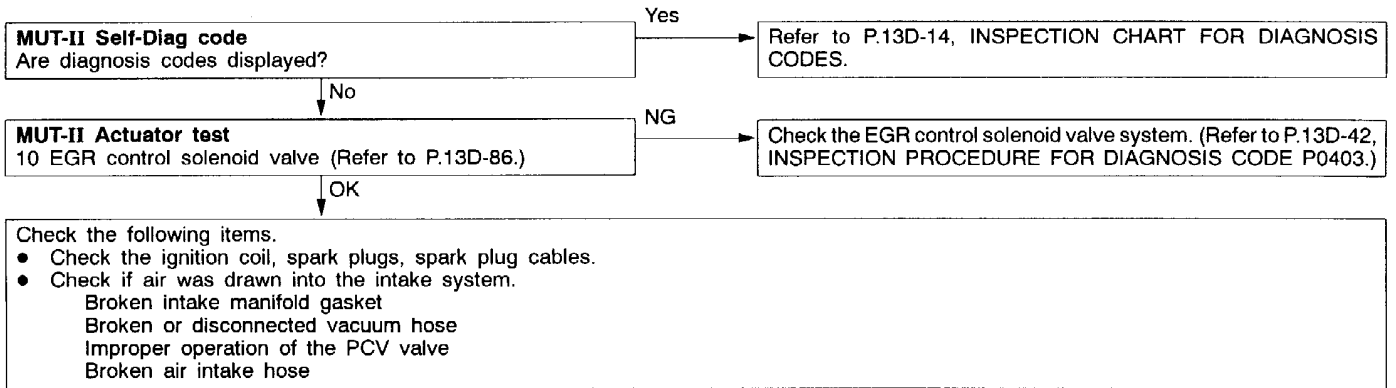
When the engine is hot, it stalls at idling. (Die out)	Probable cause
In such cases as the above, the cause is probably that ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective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





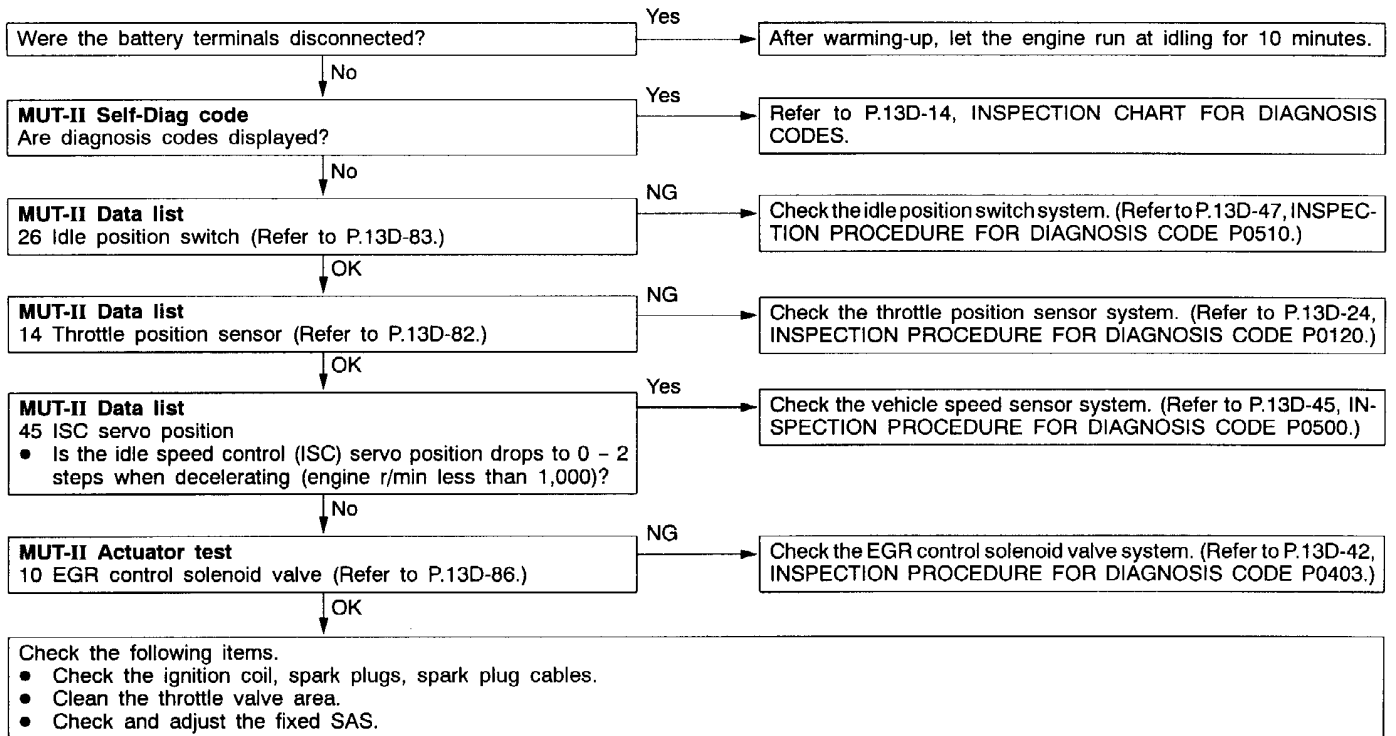
INSPECTION PROCEDURE 13

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



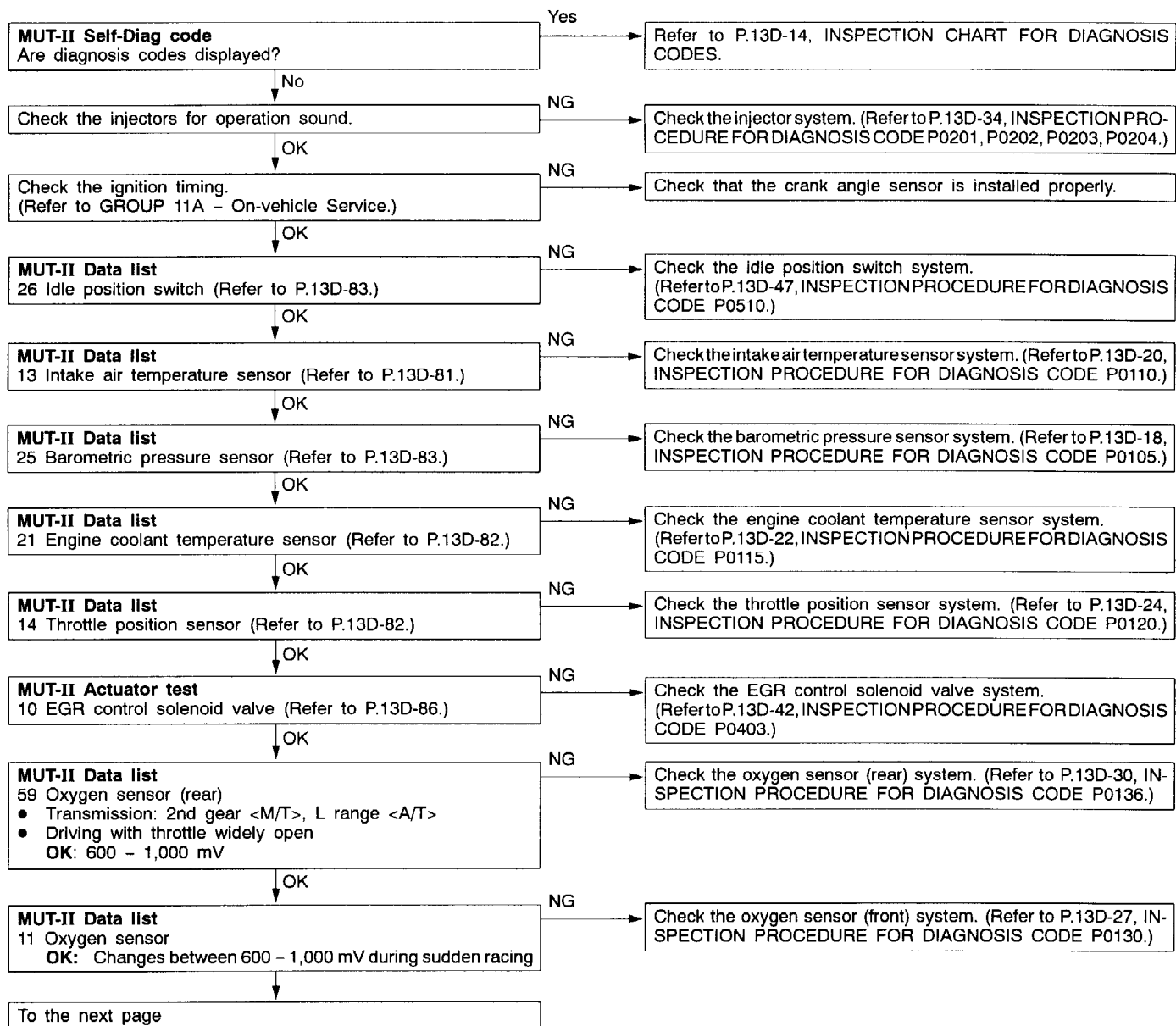
INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective idle speed control (ISC) servo system.	<ul style="list-style-type: none"> • Malfunction of the ISC system



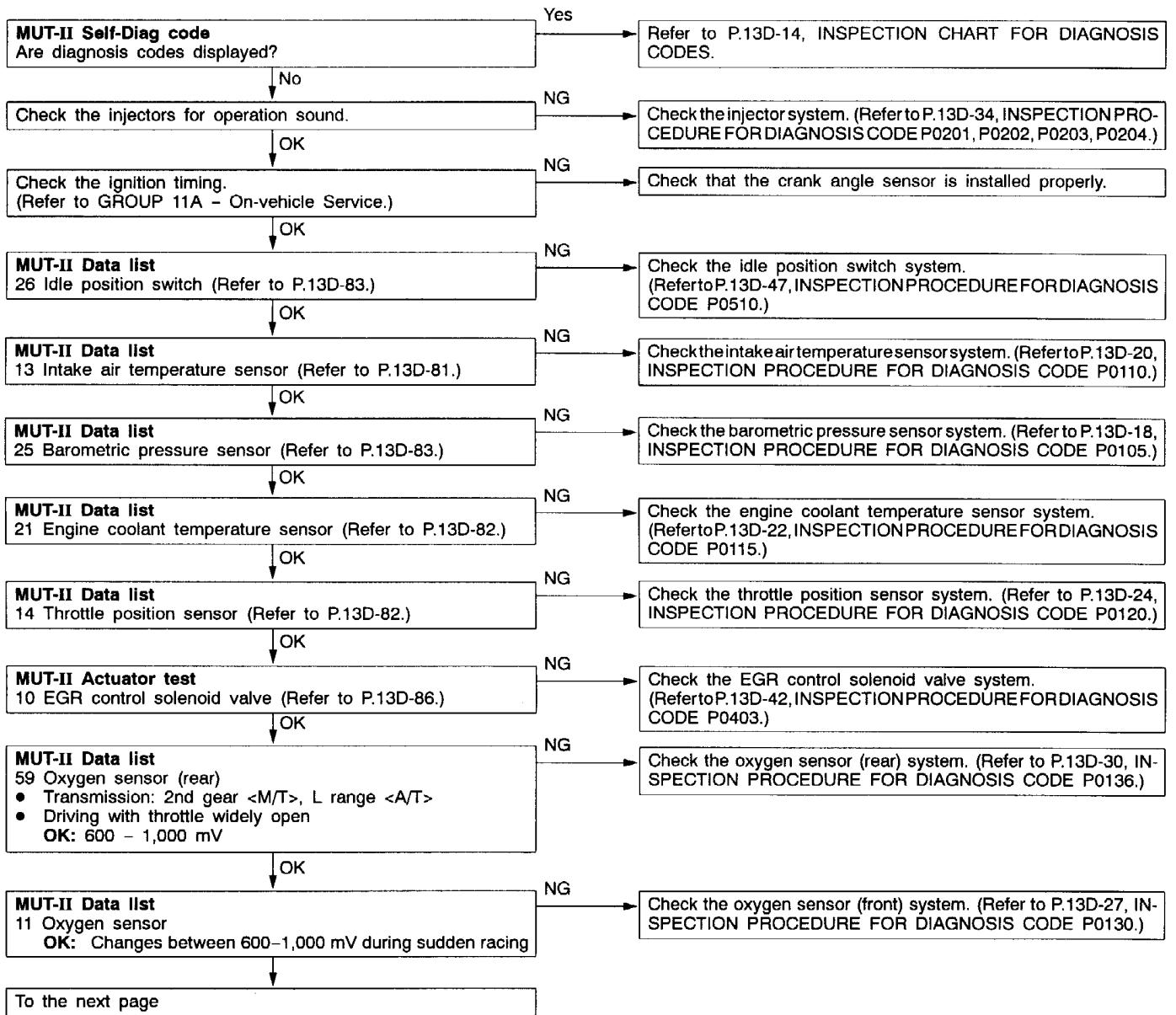
INSPECTION PROCEDURE 15

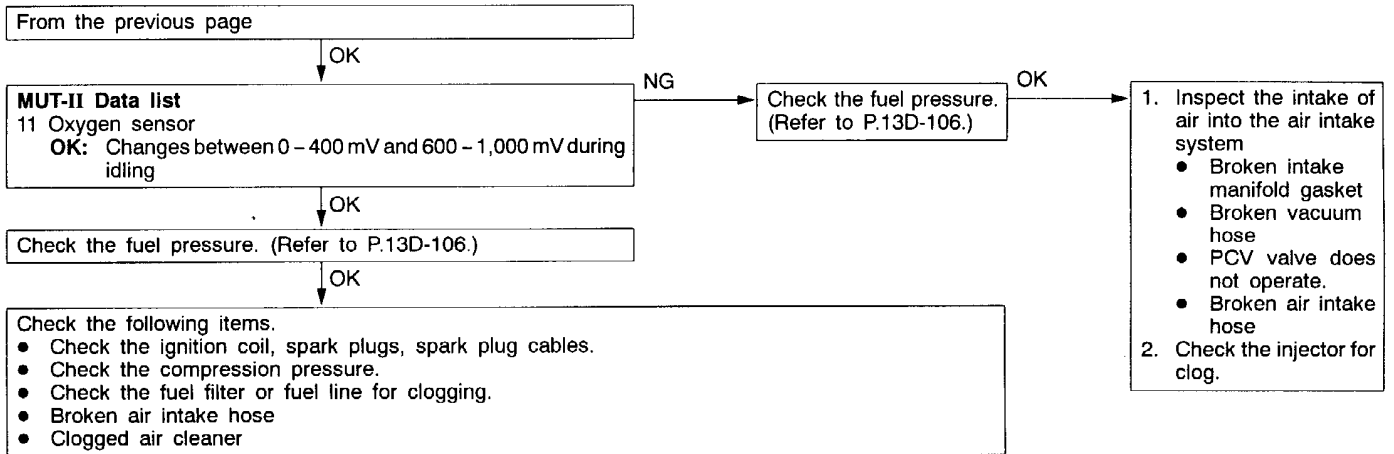
Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	<ul style="list-style-type: none"> ● Malfunction of the ignition system ● Malfunction of air-fuel ratio control system ● Malfunction of the fuel supply system ● Malfunction of the EGR control solenoid valve system ● Poor compression



INSPECTION PROCEDURE 18

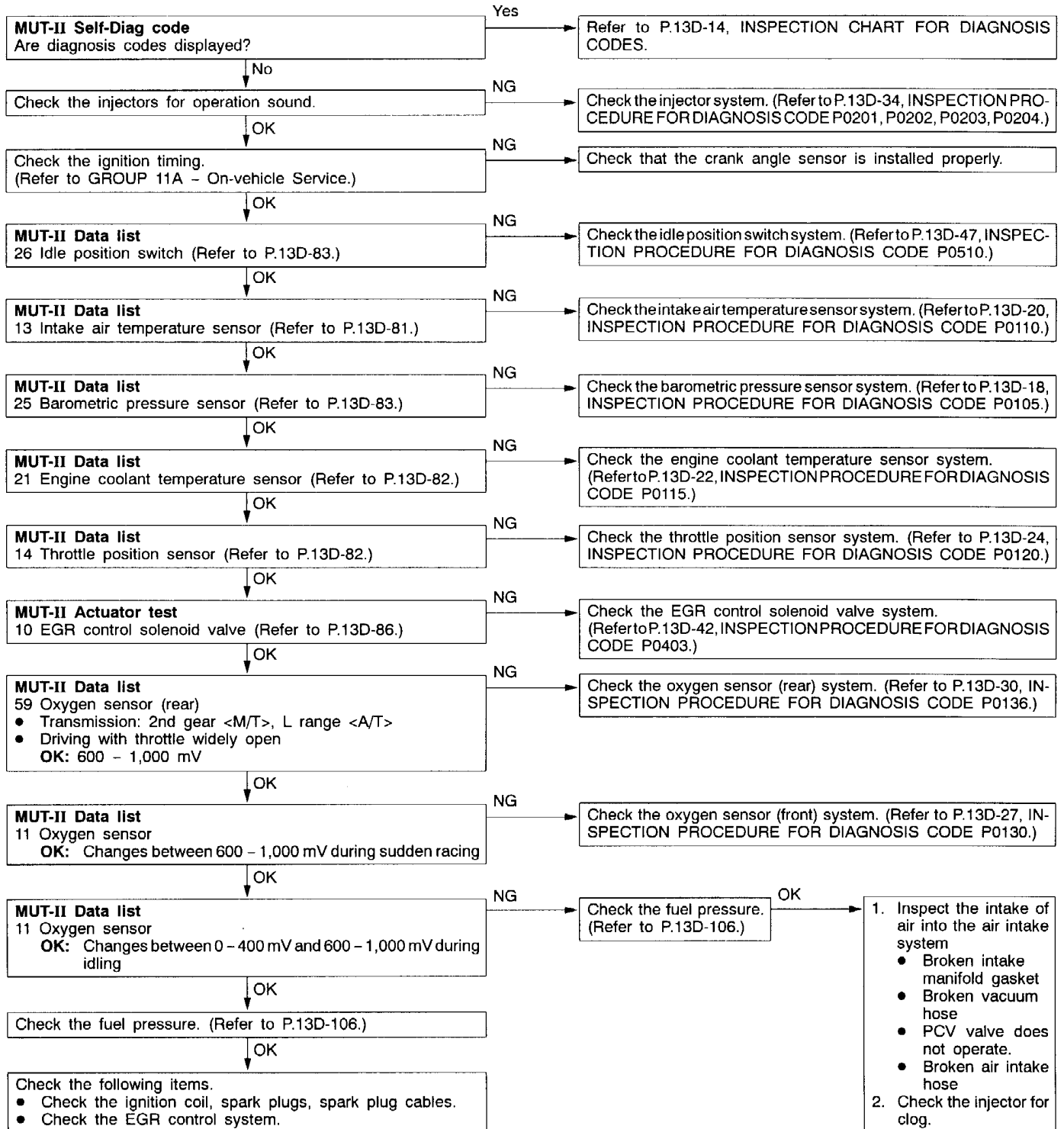
Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	<ul style="list-style-type: none"> ● Malfunction of the ignition system ● Malfunction of air-fuel ratio control system ● Malfunction of the fuel supply system ● Poor compression pressure ● Clogged exhaust system





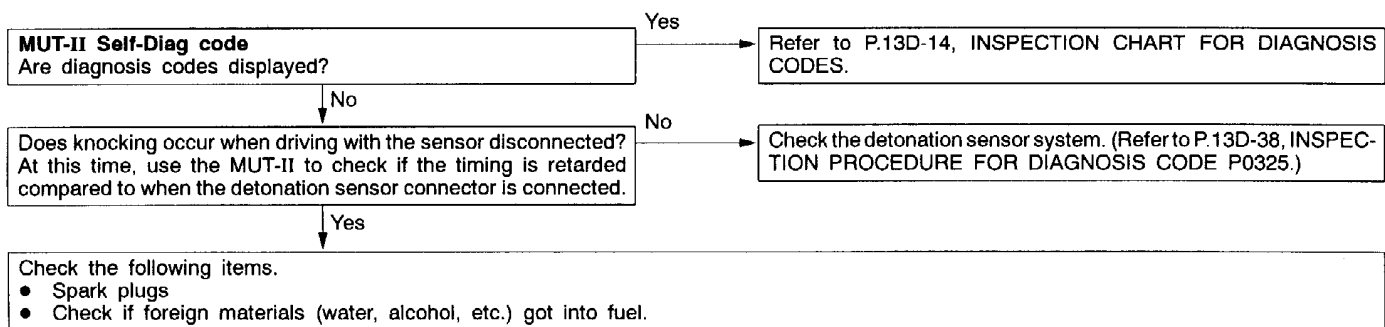
INSPECTION PROCEDURE 19

Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio, etc. are suspected.	<ul style="list-style-type: none"> ● Malfunction of the ignition system ● Malfunction of air-fuel ratio control system ● Malfunction of the EGR control solenoid valve system



INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases as the above, the cause is probably that the detonation control is defective or the heat value of the spark plug is inappropriate.	<ul style="list-style-type: none"> ● Defective detonation sensor ● Inappropriate heat value of the spark plug



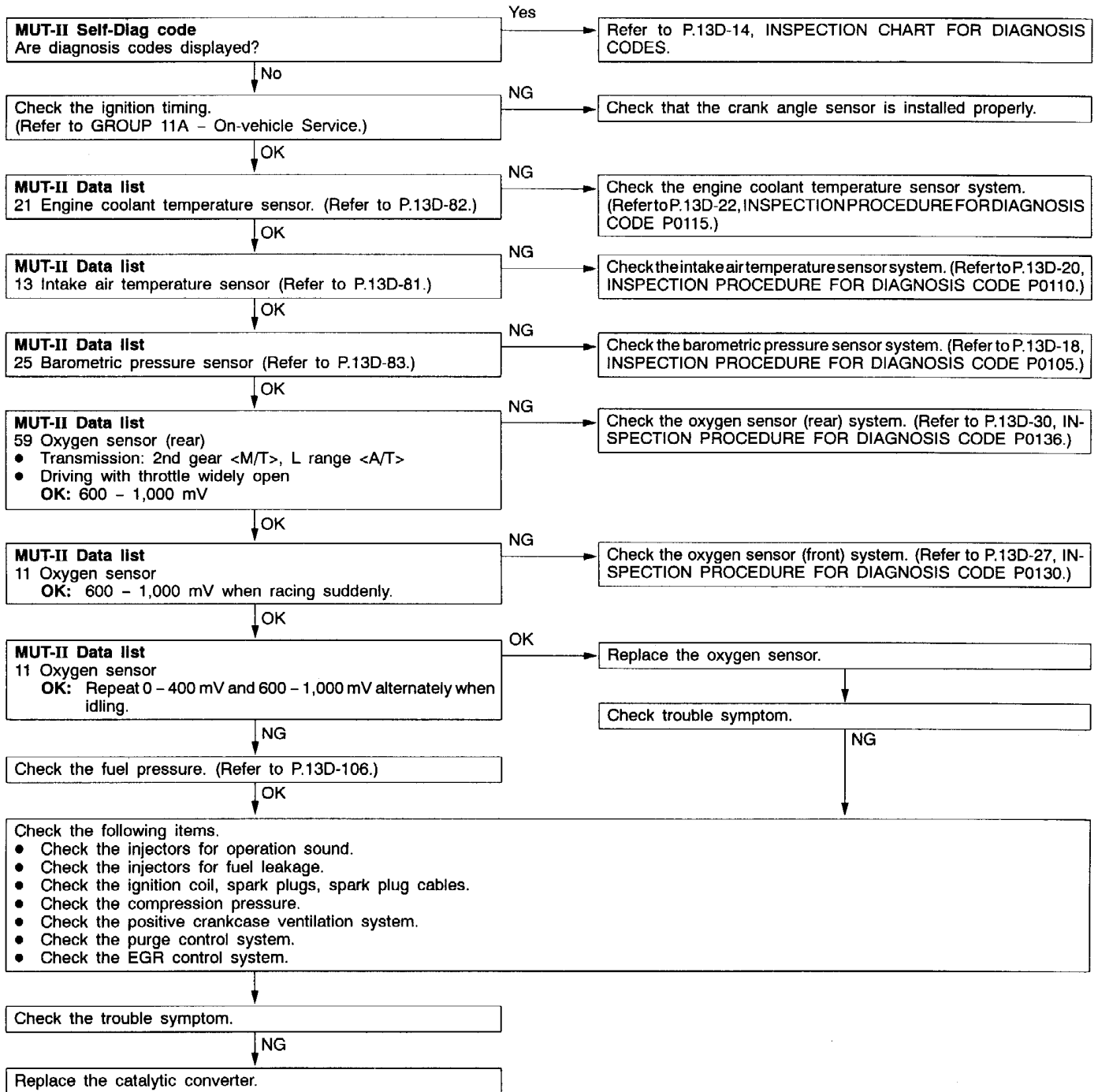
INSPECTION PROCEDURE 21

Dieseling	Probable cause
Fuel leakage from injectors is suspected.	<ul style="list-style-type: none"> ● Fuel leakage from injectors

Check the injectors for fuel leakage.

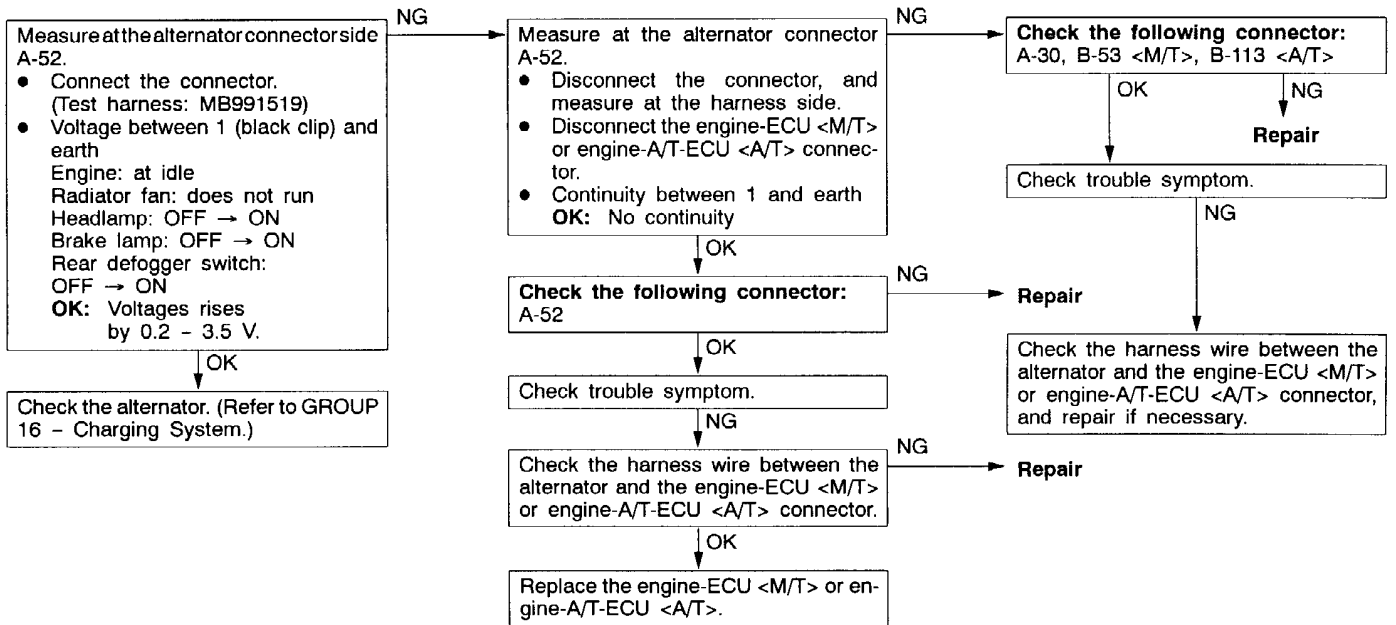
INSPECTION PROCEDURE 22

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



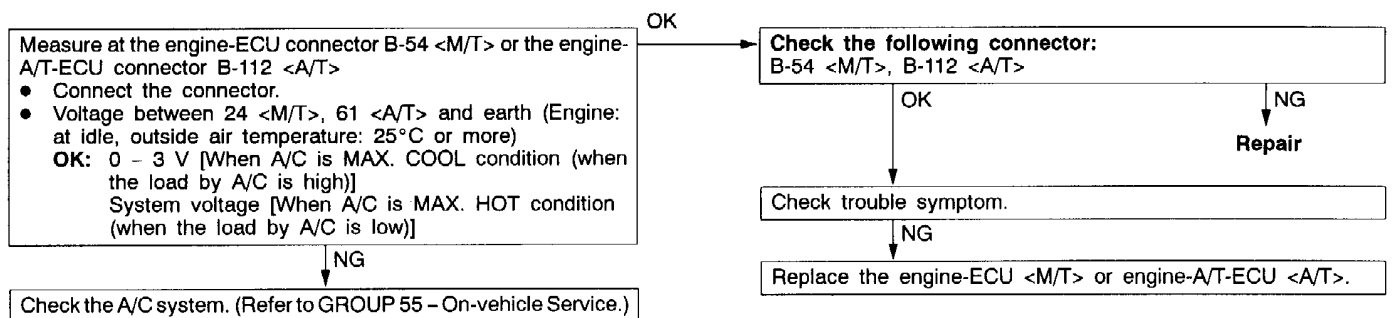
INSPECTION PROCEDURE 23

Low alternator output voltage (approx. 12.3 V)	Probable cause
<p>The alternator may be defective, or malfunctions, which are listed in the right column, may be suspected.</p>	<ul style="list-style-type: none"> ● Malfunction of charging system ● Short circuit in harness between alternator G terminal and engine-ECU <M/T> or engine-A/T-ECU <A/T> ● Malfunction of engine-ECU <M/T> or engine-A/T-ECU <A/T>



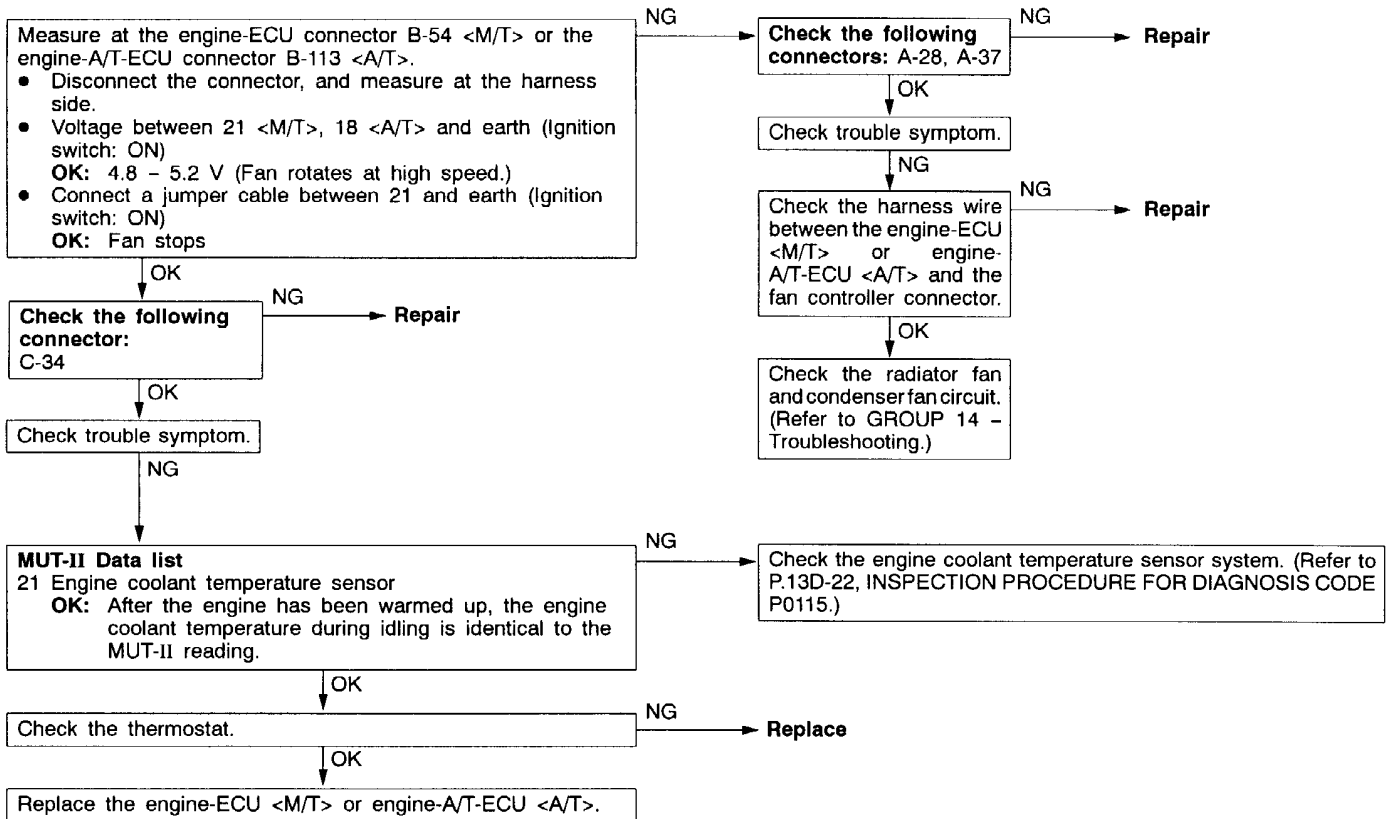
INSPECTION PROCEDURE 24

Idling speed is improper when A/C is operating	Probable cause
<p>If the engine-ECU <M/T> or engine-A/T-ECU <A/T> detects that the air conditioner is on, it activates the idle speed control (ISC) servo to control idle-up operation. The A/C-ECU judges if the load caused by air conditioner operation is high or low, and converts it to voltage signal (high or low voltage) and inputs the signal to the engine-ECU <M/T> or engine-A/T-ECU <A/T>. Based on this voltage signal, the engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the idle-up speed (for high or low load).</p>	<ul style="list-style-type: none"> ● Malfunction of the A/C control system ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



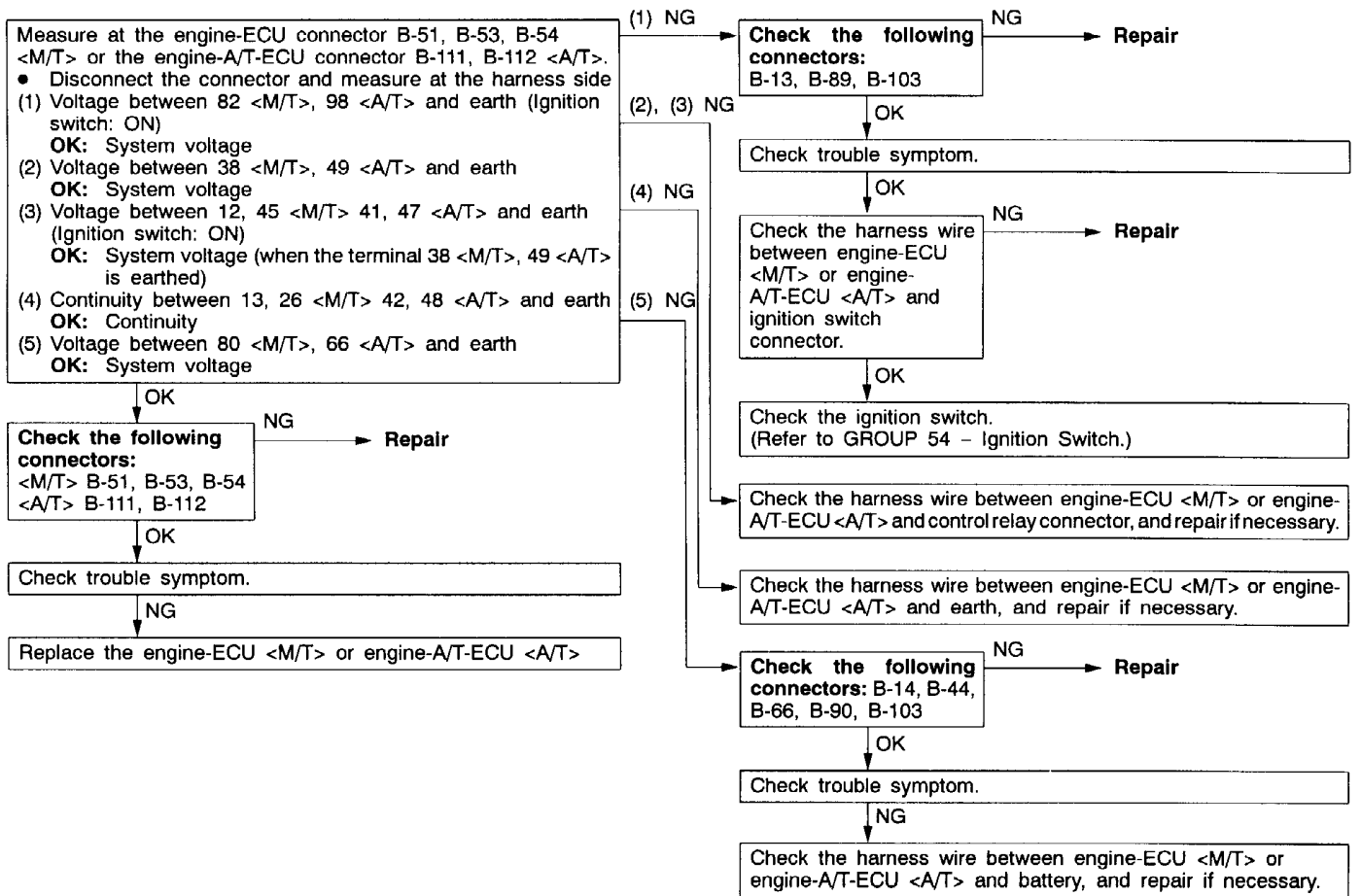
INSPECTION PROCEDURE 25

Fans (radiator fan, A/C condenser fan) are inoperative	Probable cause
<p>The engine-ECU <M/T> or engine-A/T-ECU <A/T> outputs a duty signal to the fan controller depending on the engine coolant temperature, vehicle speed, and air conditioner switch condition. Based on this signal, the fan controller controls the radiator fan and condenser fan speeds (The more the average voltage at the terminal approaches 5 V, the higher the fan speed become.)</p>	<ul style="list-style-type: none"> ● Malfunction of the fan motor relay ● Malfunction of the fan motor ● Malfunction of the fan controller ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



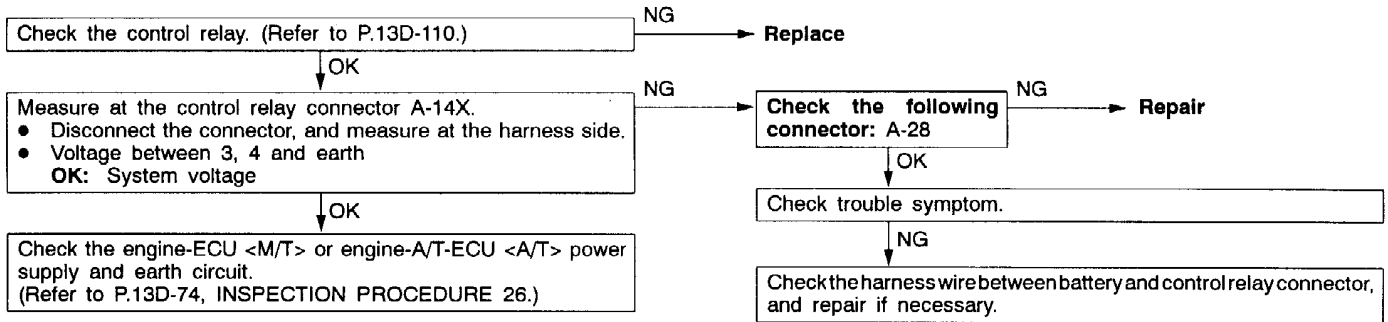
INSPECTION PROCEDURE 26

Engine-ECU <M/T> or Engine-A/T-ECU <A/T> power supply and earth circuit system	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> may be defective, or that one of the malfunctions listed at right has occurred.	<ul style="list-style-type: none"> Improper connector contact, open circuit or short-circuited harness wire in the engine-ECU <M/T> or engine-A/T-ECU <A/T> power supply circuit. Open circuit or short-circuited harness wire in the engine-ECU <M/T> or engine-A/T-ECU <A/T> earth circuit Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



INSPECTION PROCEDURE 27

Power supply system and ignition switch-IG system	Probable cause
<p>When an ignition switch ON signal is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, the engine-ECU <M/T> or engine-A/T-ECU <A/T> turns the control relay ON. This causes battery voltage to be supplied to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, injectors and air flow sensor.</p>	<ul style="list-style-type: none"> ● Malfunction of the ignition switch ● Malfunction of the control relay ● Improper connector contact, open circuit or short-circuited harness wire ● Disconnected engine-ECU <M/T> or engine-A/T-ECU <A/T> earth wire ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



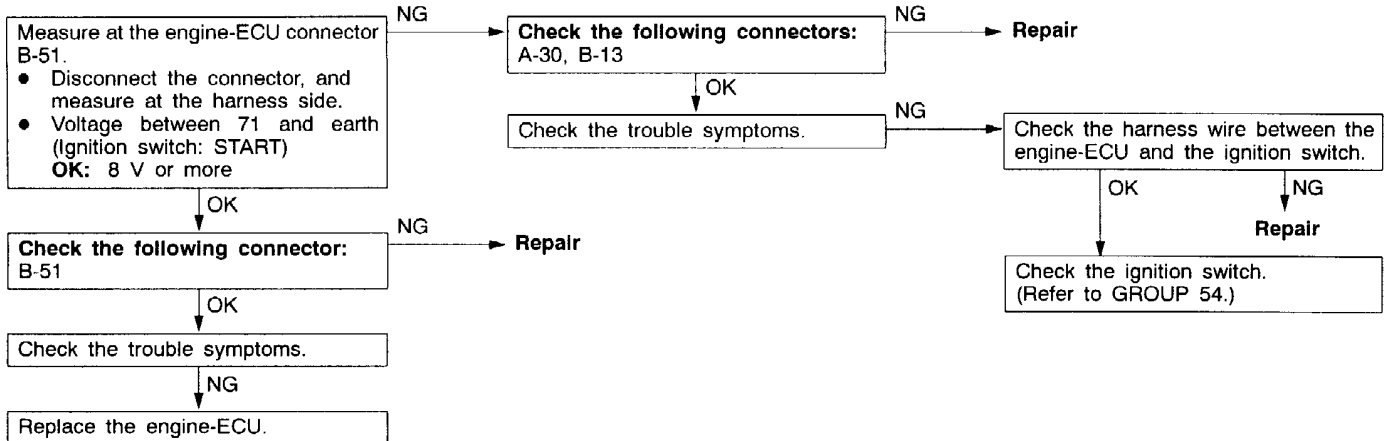
INSPECTION PROCEDURE 28

Fuel pump system	Probable cause
<p>The engine-ECU <M/T> or engine-A/T-ECU <A/T> turns the control relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.</p>	<ul style="list-style-type: none"> ● Malfunction of the fuel pump relay ● Malfunction of the fuel pump ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>

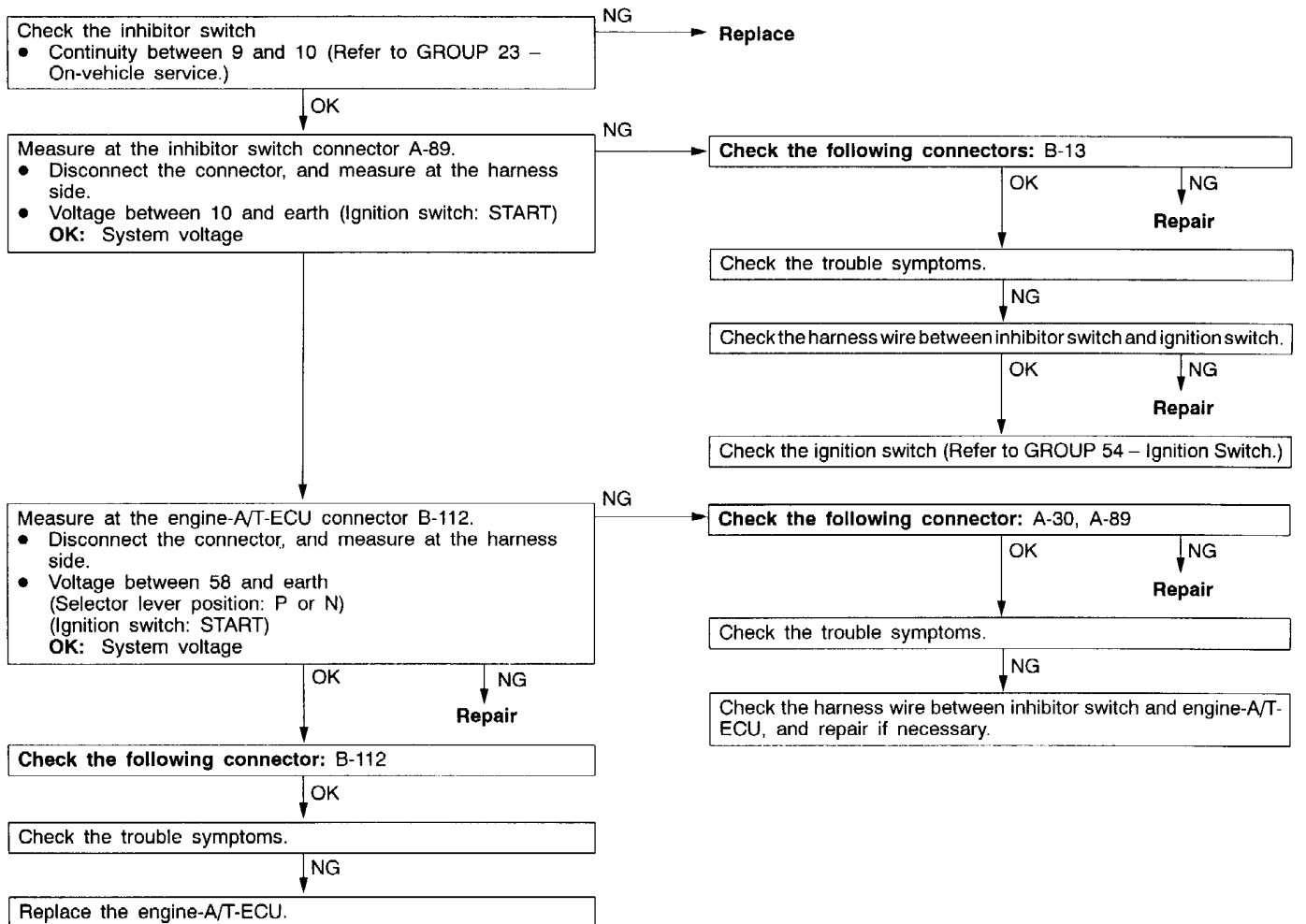
Inspection procedure 29

Ignition switch-ST system	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU <M/T> or engine-A/T-ECU <A/T> while the engine is cranking. The engine-ECU <M/T> or engine-A/T-ECU <A/T> uses this signal to carry out functions such as fuel injection control during starting.	<ul style="list-style-type: none"> ● Malfunction of the ignition switch ● Malfunction of the inhibitor switch <A/T> ● Open circuit or short-circuited harness wire of the ignition switch circuit ● Malfunction of the engine-ECU <M/T> ● Malfunction of the engine-A/T-ECU <A/T>

<M/T>

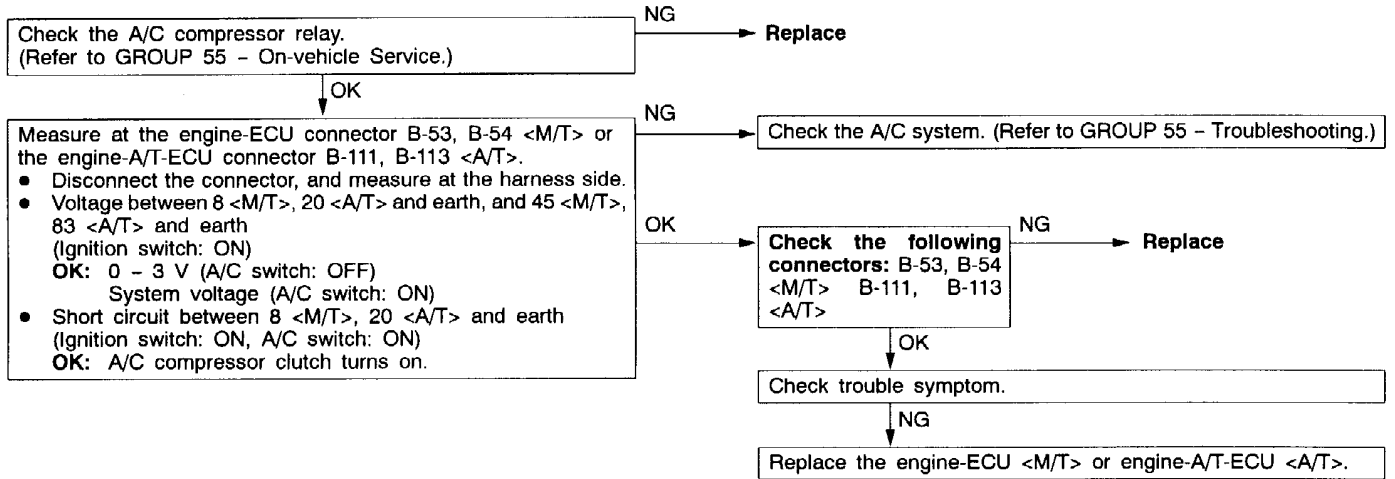


<A/T>



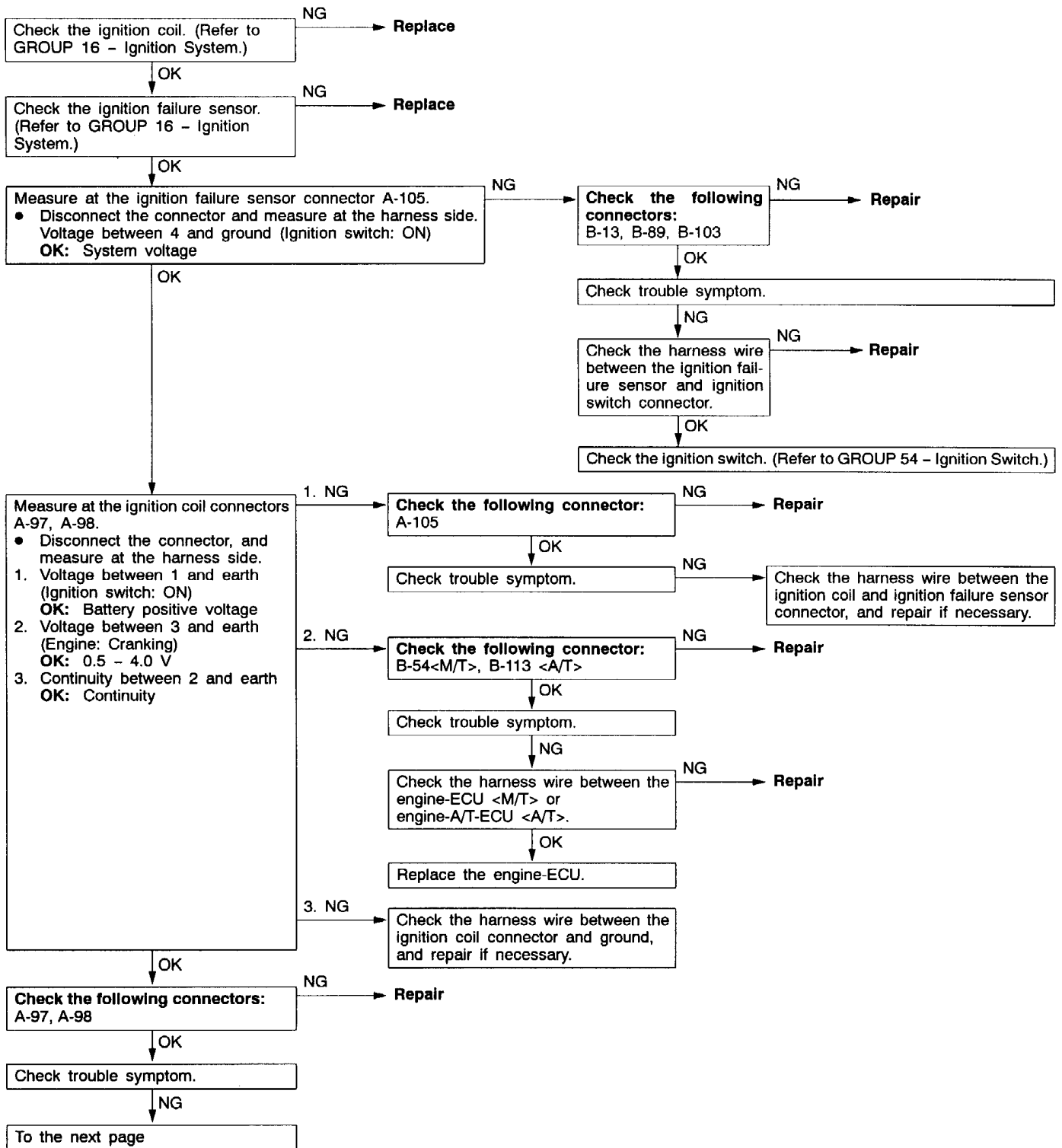
INSPECTION PROCEDURE 30

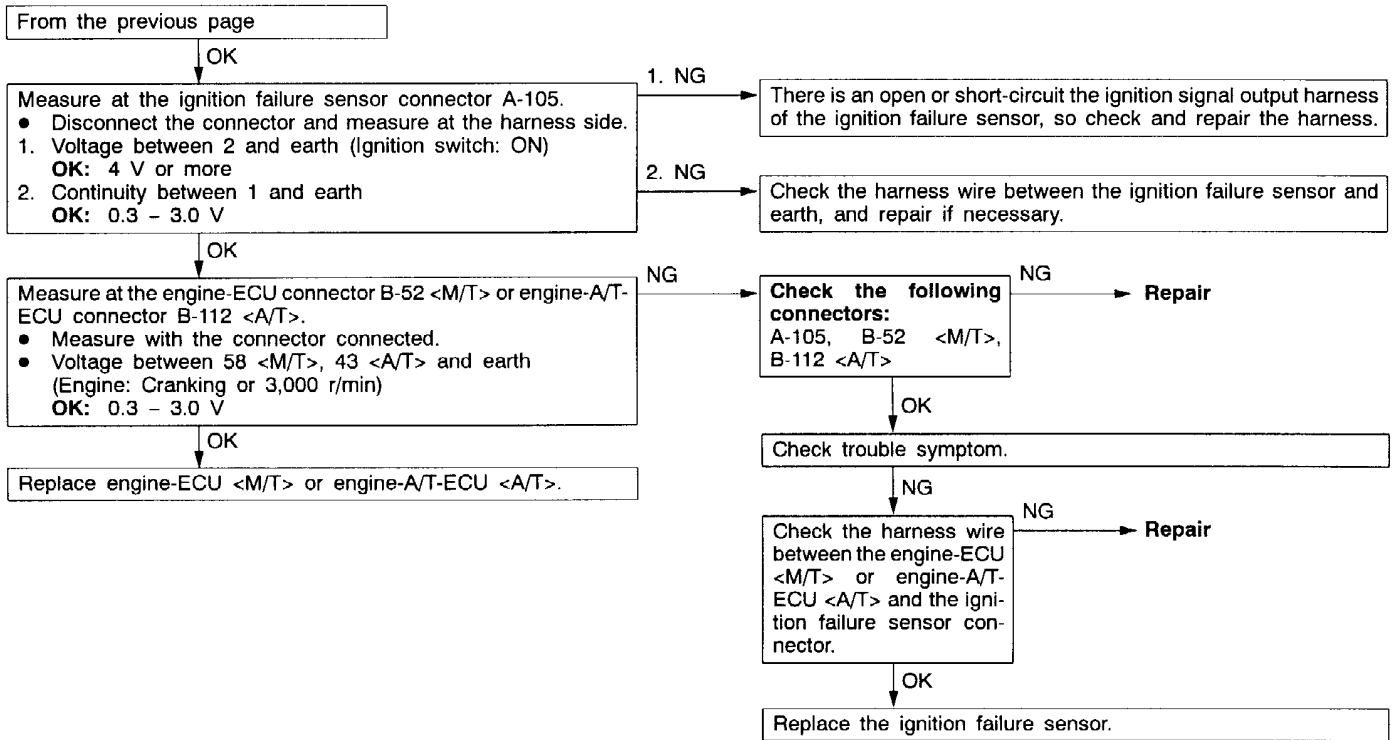
A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>, the engine-ECU <M/T> or engine-A/T-ECU <A/T> carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	<ul style="list-style-type: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



INSPECTION PROCEDURE 31

Ignition circuit system	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> interrupts the ignition coil primary current by turning the power transistor inside the engine-ECU <M/T> or engine-A/T-ECU <A/T> ON and OFF.	<ul style="list-style-type: none"> ● Malfunction of ignition coil. ● Malfunction of ignition failure sensor. ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>





DATA LIST REFERENCE TABLE

Caution

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

NOTE

- *1. In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10 % higher than the standard frequency.
- *2. The idle position switch normally turns off when the voltage of the throttle position sensor is 50 – 100 mV higher than the voltage at the idle position. If the throttle position switch turns back on after the throttle position sensor voltage has risen by 100 mV and the throttle valve has opened, the idle position switch and the throttle position sensor need to be adjusted.
- *3. The injector drive time represents the time when the cranking speed is at 250 r/min or below when the power supply voltage is 11 V.
- *4. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10 % longer than the standard time.
- *5. In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 30 steps greater than the standard value.

Item No.	Inspection item	Inspection contents	Normal condition	Inspection procedure No.	Reference page	
11	Oxygen sensor (front)	Engine: After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Code No. P0130	13D-27
			When engine is suddenly raced	600 – 1,000 mV		
		Engine: After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the ECU.	Engine is idling	400 mV or less (Changes) 600 – 1,000 mV		
			2,500 r/min			
12	Air flow sensor*1	<ul style="list-style-type: none"> ● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range) 	Engine is idling	17 – 43 Hz	-	-
			2,500 r/min	70 – 110 Hz		
			Engine is raced	Frequency increases in response to racing		
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is -20°C	-20°C	Code No. P0110	13D-20
			When intake air temperature is 0°C	0°C		
			When intake air temperature is 20°C	20°C		
			When intake air temperature is 40°C	40°C		
			When intake air temperature is 80°C	80°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300 – 1,000 mV	Code No. P0120	13D-24
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,500 – 5,500 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 26	13D-74
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 29	13D-77
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is -20°C	-20°C	Code No. P0115	13D-16
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			When engine coolant temperature is 80°C	80°C		

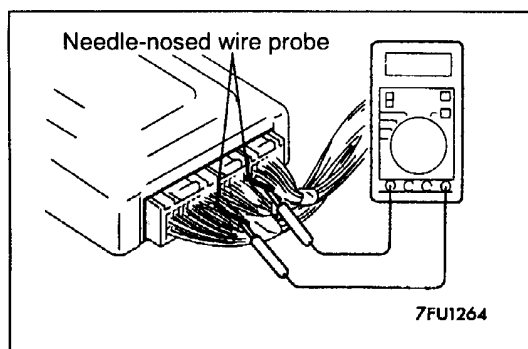
Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	<ul style="list-style-type: none"> Engine: Cranking Tachometer: Connected 	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13D-38
			<ul style="list-style-type: none"> Engine: Idling Idle position switch: ON 	When engine coolant temperature is -20°C		
		When engine coolant temperature is 0°C		1,225 – 1,425 rpm		
		When engine coolant temperature is 20°C		1,100 – 1,300 rpm		
		When engine coolant temperature is 40°C		950 – 1,150 rpm		
		When engine coolant temperature is 80°C	650 – 850 rpm			
24	Vehicle speed sensor <M/T>	Drive at 40 km/h		Approximately 40 km/h	Code No. P0500	13D-45
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. P0105	13D-18
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
26	Idle position switch	Ignition switch: ON Check by operating accelerator pedal repeatedly	Throttle valve: Set to idle position	ON	Code No. P0510	13D-47
			Throttle valve: Slightly open	OFF*2		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Code No. P0551	13D-48
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (when A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 30	13D-78
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 29	13D-77
			D, 2, L or R	D, 2, L or R		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
41	Injectors* ³	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)	12 – 19 ms	–	–
			When engine coolant temperature is 20°C	26 – 40 ms		
			When engine coolant temperature is 80°C	6.0 – 9.1 ms		
	Injectors* ⁴	<ul style="list-style-type: none"> ● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range) 	Engine is idling	1.6 – 2.8 ms		
			2,500 r/min	1.4 – 2.6 ms		
			When engine is suddenly raced	Increases		
44	Ignition coils and power transistors	<ul style="list-style-type: none"> ● Engine: After having warmed up ● Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.) 	Engine is idling	2 – 18° BTDC	Code No. P0300	13D-35
			2,500 r/min	18 – 38° BTDC		
45	ISC (stepper) motor position* ⁵	<ul style="list-style-type: none"> ● Engine coolant temperature: 80 – 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T: P range) ● Idle position switch: ON ● Engine: Idling ● When A/C switch is ON, A/C compressor should be operating 	A/C switch: OFF	2 – 25 STEP	–	–
			A/C switch: OFF → ON	Increases by 10 – 70 steps		
			<ul style="list-style-type: none"> ● A/C switch: OFF ● Select lever: N range → D range 	Increases by 5 – 50 steps		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 30	13D-78
			A/C switch: ON	ON (Compressor clutch is operating)		

Item No.	Inspection item	Inspection contents	Normal condition	Inspection procedure No.	Reference page	
59	Oxygen sensor (rear)	<ul style="list-style-type: none"> Transmission: 2nd gear <M/T>, L range <A/T> Drive with throttle widely open 	3,500 r/min	600 – 1,000 mV	Code No. P0136	13D-30
81	Long-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		-12.5 – 12.5 %	Code No. P0170	13D-33
82	Short-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		-30 – 25 %	Code No. P0170	13D-33
87	Calculation load value	Engine: Warm	Engine: Idling	15 – 35 %	–	–
			2,500 r/min	15 – 35 %		
88	Fuel control condition	Engine: Warm	2,500 r/min	Closed loop	Code No. P0125	13D-26
			when engine is suddenly raced	Open loop – drive condition		
A1	Oxygen sensor (sensor 1)	Engine: After warm-up	Idling	0 V	Code No. P0130	13D-27
			Sudden racing	0.6 – 1.0 V		
			2,500 r/min	0.4 V or less and 0.6 – 1.0 V alternates		
A2	Oxygen sensor (sensor 2)	<ul style="list-style-type: none"> Transmission: 2nd gear <M/T>, L range <A/T> Drive with throttle widely open 	3,500 r/min	0.6 – 1.0 V	Code No. P0136	13D-30
8A	Throttle position sensor (Throttle valve opening angle)	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Ignition switch: ON (Engine: Stopped) 	Release the accelerator pedal.	6 – 20 %	Code No. P0120	13D-24
			Depress the accelerator pedal gradually	Increase in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	80 – 100 %		

ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page	
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. P0201	13D-34	
02		Cut fuel to No. 2 injector			Code No. P0202	13D-34	
03		Cut fuel to No. 3 injector			Code No. P0203	13D-34	
04		Cut fuel to No. 4 injector			Code No. P0204	13D-34	
07	Fuel pump	Fuel pump operates and fuel is recirculated.	<ul style="list-style-type: none"> Engine: Cranking Fuel pump: Forced driving Inspect according to both the above conditions. 	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated. Listen near the fuel tank for the sound of fuel pump operation.	Pulse is felt. Sound of operation is heard.	Procedure No. 28	13D-75
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	13D-51	
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Code No. P0403	13D-51	
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set	5° BTDC	–	–	
21	Fan controller	Drive the fan motor	Ignition switch: ON	Radiator fan and condenser fan operate at high speed	Procedure No. 25	13D-73	



CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

1. Connect a needle-nosed wire probe (test harness: MB991223 or paper clip) to a voltmeter probe.
2. Insert the needle-nosed wire probe into each of the engine-ECU <M/T> or engine-A/T-ECU <A/T> connector terminals from the wire side, and measure the voltage while referring to the check chart.

NOTE

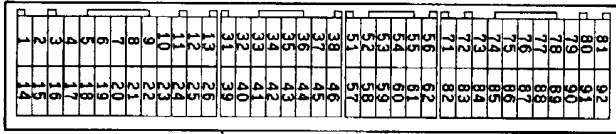
- (1) Make the voltage measurement with the engine-ECU <M/T> or engine-A/T-ECU <A/T> connectors connected.
- (2) You may find it convenient to pull out the engine-ECU <M/T> or engine-A/T-ECU <A/T> to make it easier to reach the connector terminals.
- (3) The checks can be carried out off the order given in the chart.

Caution

Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine-ECU <M/T> or engine-A/T-ECU <A/T> or all of them. Be careful to prevent this!

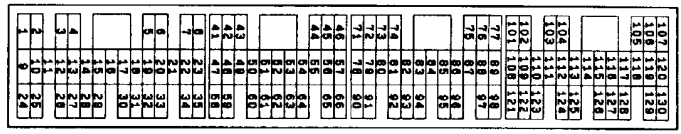
3. If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
4. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

Engine-ECU <M/T> Connector Terminal Arrangement



9FU0393

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



7FU1763

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)	Normal condition
1	1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 11 – 14 V, momentarily drops slightly
14	9	No. 2 injector		
2	24	No. 3 injector		
15	2	No. 4 injector		
4	14	Stepper motor coil <A1>	Engine: Soon after the warmed up engine is started	System voltage ↔ 0 V (Changes repeatedly)
17	28	Stepper motor coil <A2>		
5	15	Stepper motor coil <B1>		
18	29	Stepper motor coil <B2>		
6	6	EGR control solenoid valve	Ignition switch: ON	System Voltage
			While engine is idling, suddenly depress the accelerator pedal.	From system voltage, momentarily drops
8	20	A/C relay	<ul style="list-style-type: none"> Engine: Idle speed A/C switch: OFF → ON (A/C compressor is operating) 	System voltage or momentarily 6V or more → 0 – 3V
9	34	Purge control solenoid valve	Ignition switch: ON	System voltage
			Running at 3,000r/min while engine is warming up after having been started.	0 – 3V
10	11	Ignition coil – No. 1, No. 4 (power transistor)	Engine r/min: 3,000 r/min	0.3 – 3.0V
23	12	Ignition coil – No. 2, No. 3 (power transistor)		
12	40	Power supply	Ignition switch: ON	System voltage
25	47			

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)	Normal condition	
19	19	Air flow sensor reset signal	Engine: Idle speed	0 – 1V	
			Engine r/min: 3,000 r/min	6 – 9V	
21	18	Fan controller	Radiator fan and condenser fan are not operating	0 – 0.3 V	
			Radiator fan and condenser fan are operating	0.7 V or more	
22	21	Fuel pump relay	Ignition switch: ON	System voltage	
			Engine: Idle speed	0 – 3V	
24	61	A/C switch 2	<ul style="list-style-type: none"> ● Engine: Idling ● Outside air temperature: 25°C or more When A/C is MAX. COOL condition (when the load by A/C is high)	0 – 3 V	
			(When A/C is MAX. HOT condition (when the load by A/C is low))	System voltage	
33	8	Alternator G terminal	<ul style="list-style-type: none"> ● Engine: Warm, idle (radiator fan: OFF) ● Headlamp: OFF to ON ● Rear defogger switch: OFF to ON ● Brake lamp: ON 	Voltage rises by 0.2 – 3.5 V.	
41	54	Alternator FR terminal	<ul style="list-style-type: none"> ● Engine: Warm, idle (radiator fan: OFF) ● Headlamp: OFF to ON ● Rear defogger switch: OFF to ON ● Brake lamp: ON 	Voltage drops by 0.2 – 3.5 V.	
36	22	Engine warning lamp	Ignition switch: "LOCK" (OFF) position → ON	0 – 3V → 9 – 13V (After several seconds have elapsed)	
37	52	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	System voltage
				When steering wheel is turned	0 – 3V
38	49	Control relay (Power supply)	Ignition switch: "LOCK" (OFF) position	System voltage	
			Ignition switch: ON	0 – 3V	
45	83	A/C switch 1	Engine: Idle speed	Turn the A/C switch OFF	0 – 3V
				Turn the A/C switch ON (A/C compressor is operating)	System voltage
54	26	Oxygen sensor heater (rear)	Engine: Idling after warming-up	0 – 3 V	
			Engine r/min: 5,000 r/min	System voltage	

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
58	43	Tachometer signal	Engine r/min: 3,000 r/min		0.3 – 3.0V
60	3	Oxygen sensor heater (front)	Engine: Idling after warming up		0 – 3V
			Engine r/min: 5,000r/min.		System voltage
71	58	Ignition switch – ST	Engine: Cranking		8V or more
72	64	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 – 3.8V
				When intake air temperature is 20°C	2.3 – 2.9V
				When intake air temperature is 40°C	1.5 – 2.1V
				When intake air temperature is 80°C	0.4 – 1.0V
75	73	Oxygen sensor (rear)	<ul style="list-style-type: none"> • Transmission: 2nd gear <M/T>, L range <A/T> • Engine r/min: 3,500 r/min or more • Driving with the throttle valve widely open 		0.6 – 1.0 V
76	71	Oxygen sensor (front)	Engine: Running at 2,500 r/min after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8V (Changes repeatedly)
80	66	Backup power supply	Ignition switch: "LOCK" (OFF) position		System voltage
81	46	Sensor impressed voltage	Ignition switch: ON		4.5 – 5.5V
82	98	Ignition switch – IG	Ignition switch: ON		System voltage
83	44	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2 – 3.8V
				When engine coolant temperature is 20°C	2.3 – 2.9V
				When engine coolant temperature is 40°C	1.3 – 1.9V
				When engine coolant temperature is 80°C	0.3 – 0.9V

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
84	78	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3 – 1.0V
				Fully open throttle valve	4.5 – 5.5V
85	55	Barometric pressure sensor	Ignition switch: ON	When altitude is 0m	3.7 – 4.3V
				When altitude is 1,200m	3.2 – 3.8V
86	–	Vehicle speed sensor	<ul style="list-style-type: none"> ● Ignition switch: ON ● Move the vehicle slowly forward 		0 ↔ 5V (Changes repeatedly)
87	79	Idle position switch	Ignition switch: ON	Set throttle valve to idle position	0 – 1V
				Slightly open throttle valve	4V or more
88	56	Camshaft position sensor	Engine: Cranking		0.4 – 3.0V
			Engine: Idle speed		0.5 – 2.0V
89	45	Crank angle sensor	Engine: Cranking		0.4 – 4.0V
			Engine: Idle speed		1.5 – 2.5V
90	65	Air flow sensor	Engine: Idle speed		2.2 – 3.2V
			Engine r/min: 2,500r/min		

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

1. Turn the ignition switch to "LOCK" (OFF) position.
2. Disconnect the engine-ECU <M/T> or engine-A/T-ECU <A/T> connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU <M/T> or engine-A/T-ECU <A/T> harness-side connector while referring to the check chart.

NOTE

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

Caution

If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU <M/T> or engine-A/T-ECU <A/T> and/or ohmmeter.

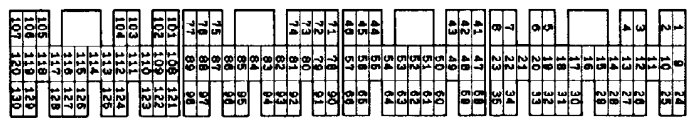
Be careful to prevent this!

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

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



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

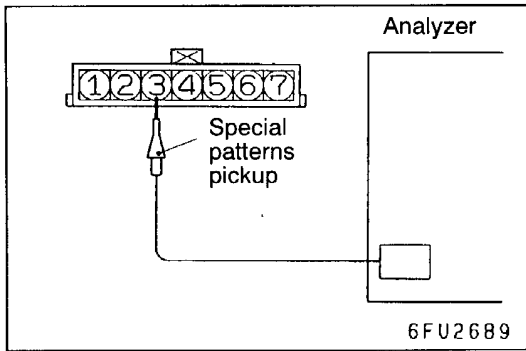


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Terminal No.<M/T>	Terminal No. <A/T>	Inspection item	Normal condition (Check condition)
1 – 12	1 – 40	No. 1 injector	13 – 16 Ω (At 20°C)
14 – 12	9 – 40	No. 2 injector	
2 – 12	24 – 40	No. 3 injector	
15 – 12	2 – 40	No. 4 injector	
4 – 12	14 – 40	Stepper motor coil (A1)	28 – 33 Ω (At 20°C)
17 – 12	28 – 40	Stepper motor coil (A2)	
5 – 12	15 – 40	Stepper motor coil (B1)	
18 – 12	29 – 40	Stepper motor coil (B2)	
6 – 12	6 – 40	EGR control solenoid valve	36 – 44 Ω (At 20°C)
9 – 12	34 – 40	Purge control solenoid valve	36 – 44 Ω (At 20°C)
13 – Body earth	42 – Body earth	Engine-ECU <M/T> or engine-A/T-ECU <A/t> and earth	Continuity (0Ω)
26 – Body earth	48 – Body earth	Engine-ECU <M/T> or engine-A/T-ECU <A/t> and earth	
60 – 12	3 – 41	Oxygen sensor heater (front)	4.5 – 8.0 Ω (At 20°C)
54 – 12	26 – 41	Oxygen sensor heater (rear)	11 – 18 Ω (At 20°C)

Terminal No.<M/T>	Terminal No. <A/T>	Inspection item	Normal condition (Check condition)
72 – 92	64 – 57	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)
83 – 92	44 – 57	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)
87 – 92	79 – 57	Idle position switch	Continuity (when throttle valve is at idle position)
			No continuity (when throttle valve is slightly open)



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

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

Alternate Method (Test harness not available)

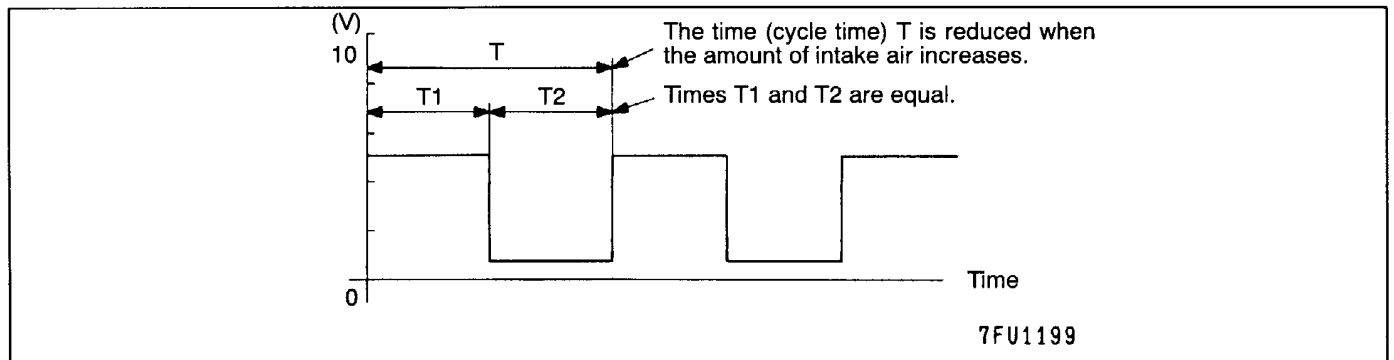
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 90 or engine-A/T-ECU <A/T> terminal 65.

Standard Wave Pattern

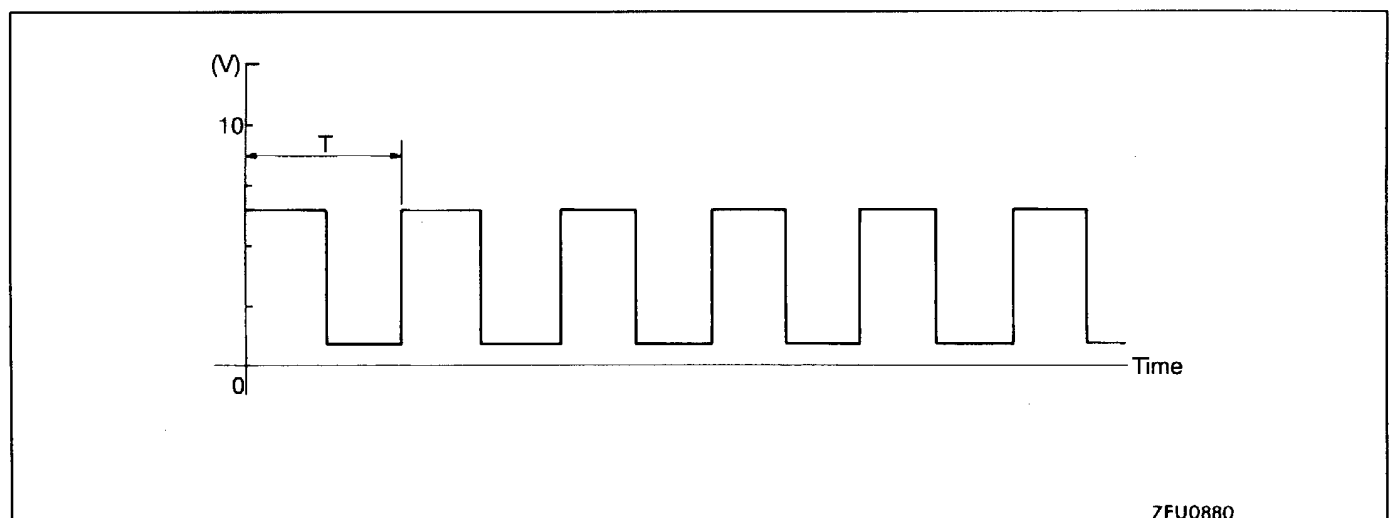
Observation conditions

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

Standard wave pattern

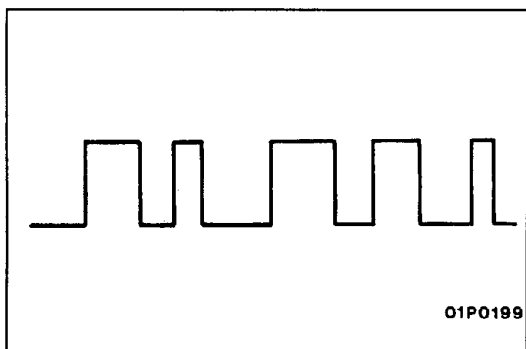


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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

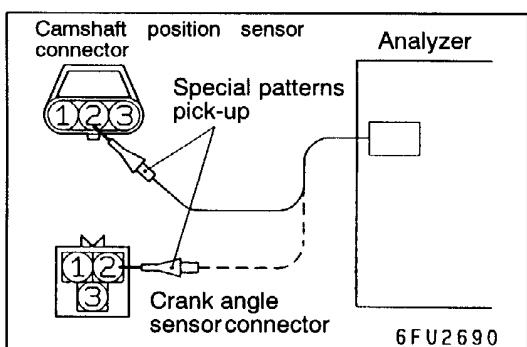
- Example 2

Cause of problem

Damaged rectifier or vortex generation column

Wave pattern characteristics

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



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991223) and jumper wire in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

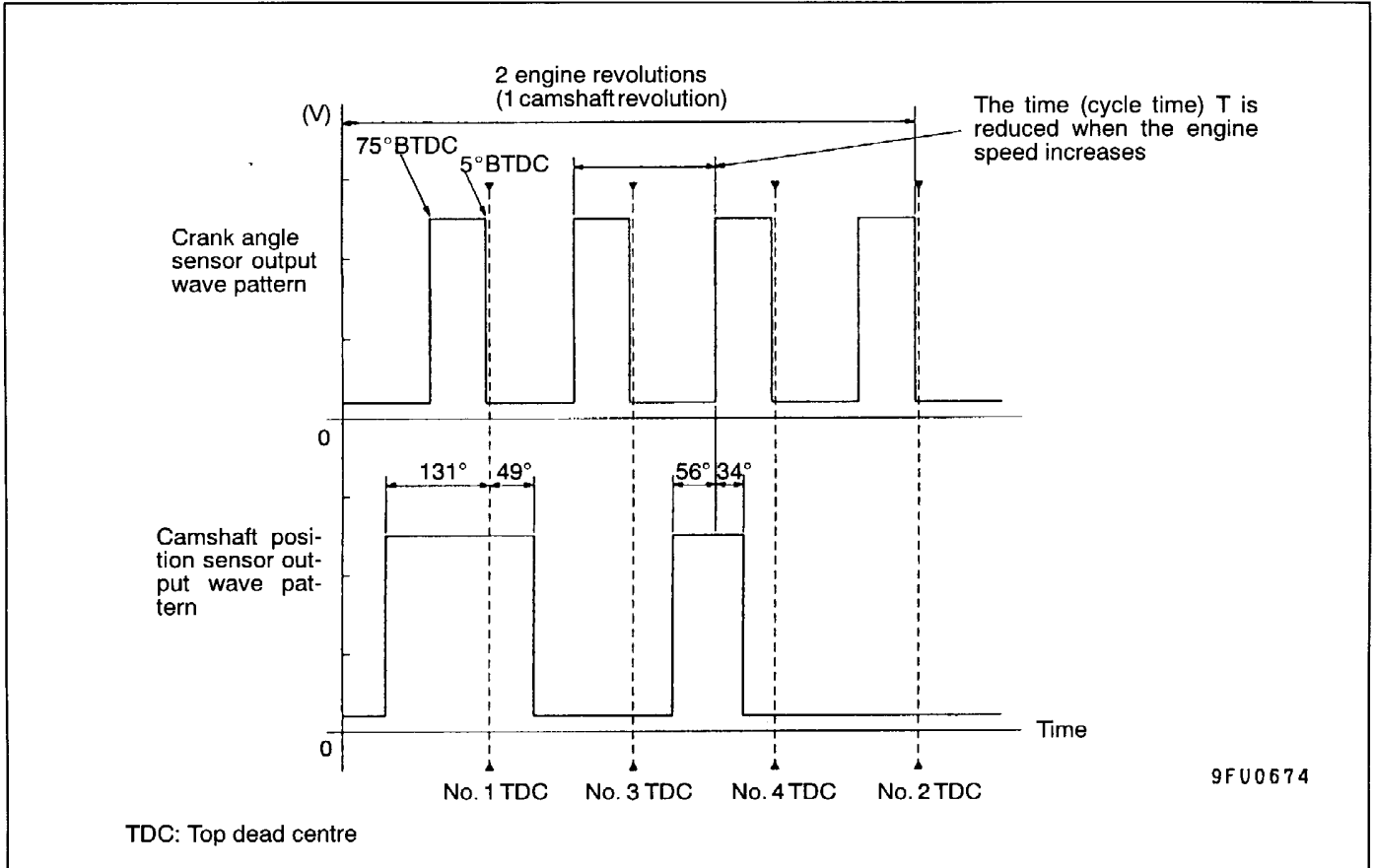
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 88 or engine-A/T-ECU <A/T> terminal 56. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 89 or engine-A/T-ECU <A/T> terminal 45. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

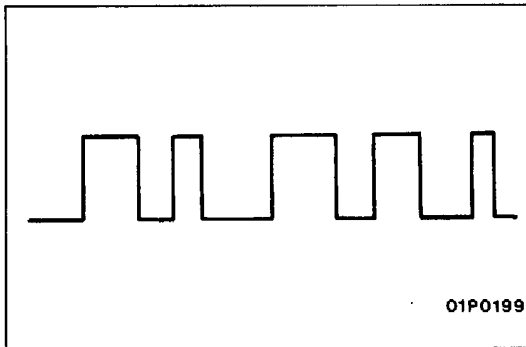
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

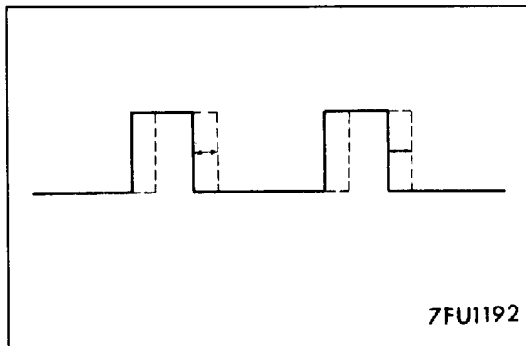
- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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



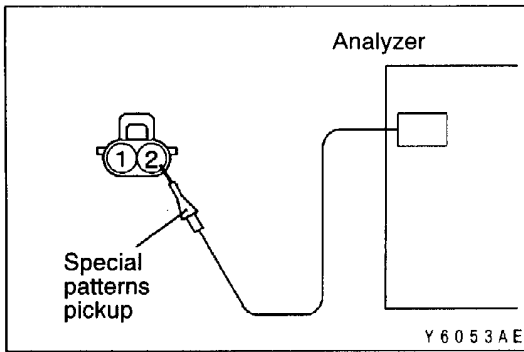
- Example 2

Cause of problem

Loose timing belt
Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.



INJECTOR

Measurement Method

1. Disconnect the injector connector, and then connect the special tool (test harness: MB991348) in between. (Both the power supply side and engine-ECU <M/T> or engine-A/T-ECU <A/T> side should be connected.)
2. Connect the analyzer special patterns pickup to terminal 2 of the injector connector.

Alternate Method (Test harness not available)

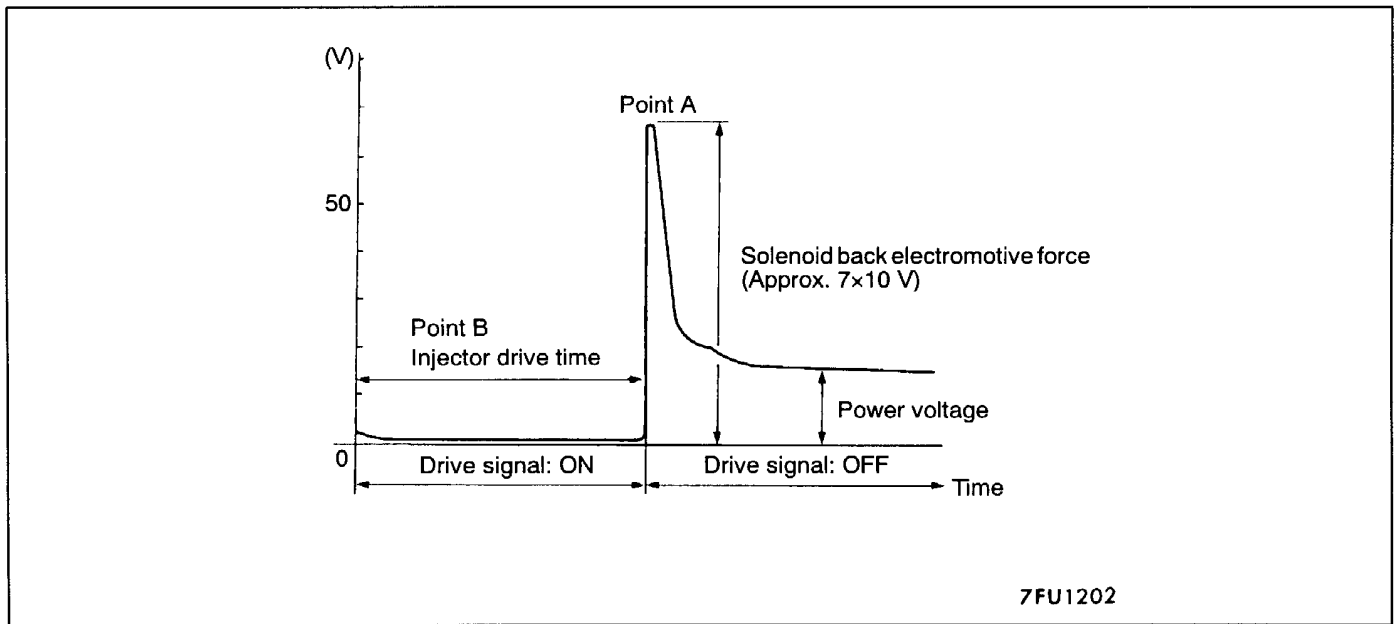
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 1 or engine-A/T-ECU <A/T> terminal 1. (When checking the No. 1 cylinder.)
2. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 14 or engine-A/T-ECU <A/T> terminal 9. (When checking the No. 2 cylinder.)
3. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 2 or engine-A/T-ECU <A/T> terminal 24. (When checking the No. 3 cylinder.)
4. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 15 or engine-A/T-ECU <A/T> terminal 2. (When checking the No. 4 cylinder.)

Standard Wave Pattern

Observation conditions

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

Standard wave pattern

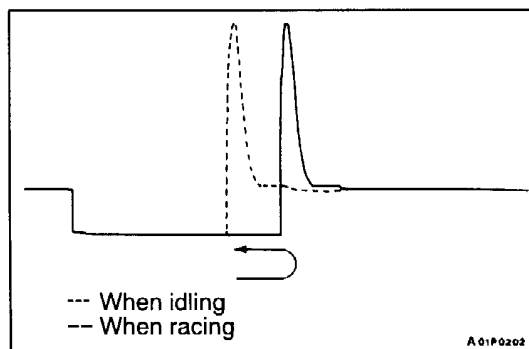


Wave Pattern Observation Points

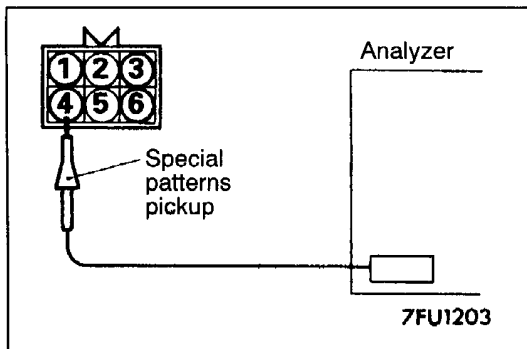
Point A: Height of solenoid back electromotive force

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

Point B: Injector drive time



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



STEPPER MOTOR

Measurement Method

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

Alternate Method (Test harness not available)

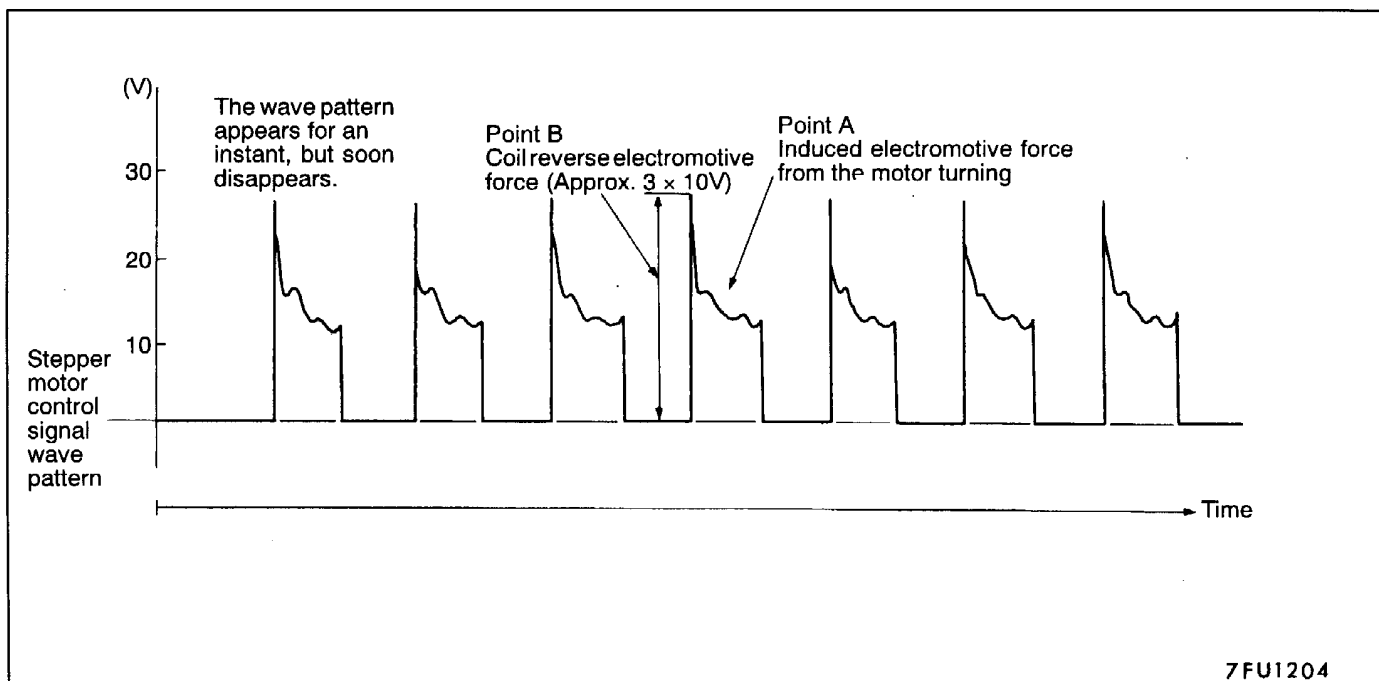
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 4 or engine-A/T-ECU <A/T> terminal 14, connection terminal 5 <M/T>, 15 <A/T>, connection terminal 17 <M/T>, 28 <A/T>, and connection terminal 18 <M/T>, 29 <A/T> respectively.

Standard Wave Pattern

Observation conditions

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

Standard wave pattern



Wave Pattern Observation Points

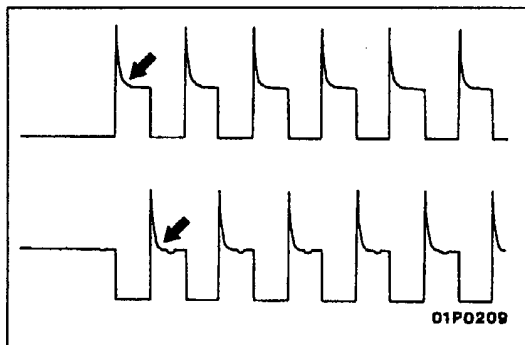
Check that the standard wave pattern appears when the stepper motor is operating.

Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

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

Point B: Height of coil reverse electromotive force

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



Examples of Abnormal Wave Pattern

- Example 1

Cause of problem

Motor is malfunctioning. (Motor is not operating.)

Wave pattern characteristics

Induced electromotive force from the motor turning does not appear.

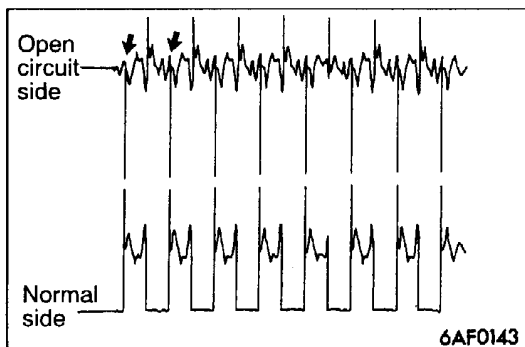
- Example 2

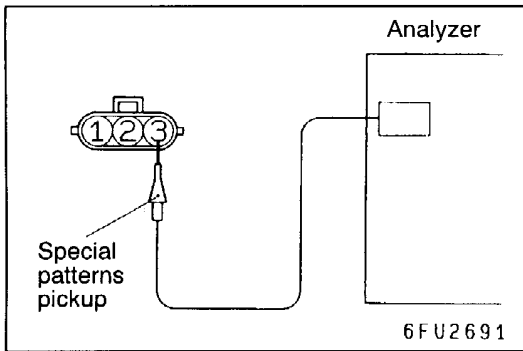
Cause of problem

Open circuit in the line between the stepper motor and the engine-ECU <M/T> or engine-A/T-ECU <A/T>.

Wave pattern characteristics

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





IGNITION COIL AND POWER TRANSISTOR

Power transistor control signal

Measurement Method

1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

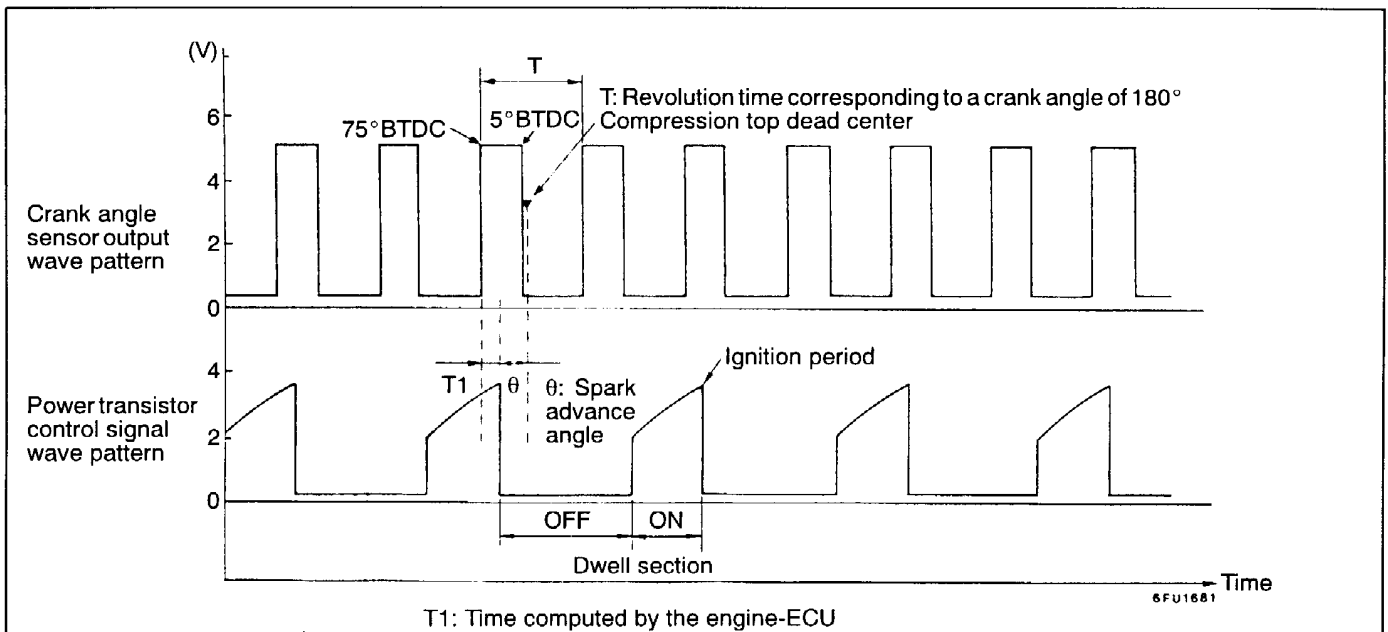
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 10 or engine-A/T-ECU <A/T> terminal 11 (No. 1 – No. 4), terminal 23 <M/T>, 12 <A/T> (No. 2 – No. 3) respectively.

Standard Wave Pattern

Observation condition

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

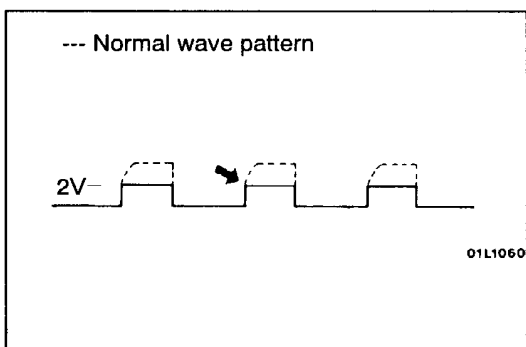
Standard wave pattern



Wave Pattern Observation Points

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction



Examples of Abnormal Wave Patterns

- Example 1

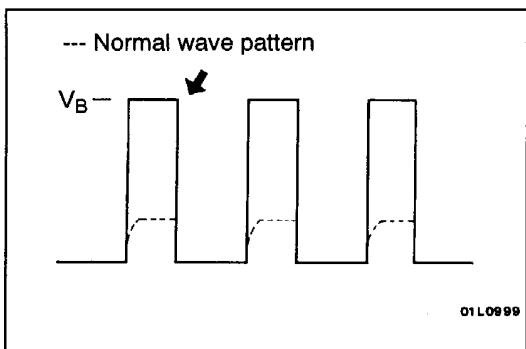
Wave pattern during engine cranking

Cause of problem

Open-circuit in ignition primary circuit

Wave pattern characteristics

Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.



- Example 2

Wave pattern during engine cranking

Cause of problem

Malfunction in power transistor

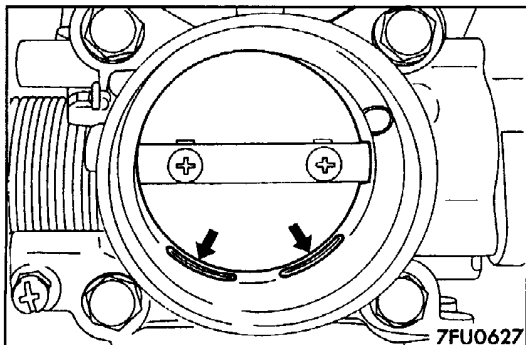
Wave pattern characteristics

Power voltage results when the power transistor is ON.

ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

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



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

Caution

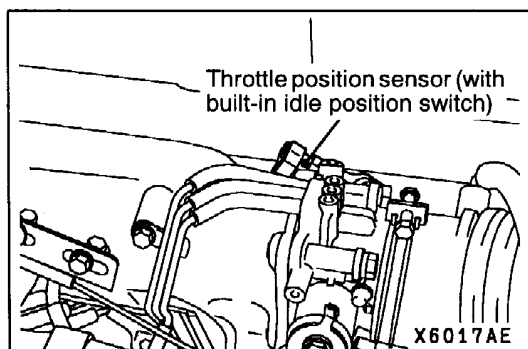
Do not allow cleaning solvent to enter the bypass passage.

4. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.

5. Start the engine, race it several times and idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
6. If the throttle valve deposits are not removed, repeat steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the air intake hose.
9. Use the MUT-II to erase the self-diagnosis code.
10. Adjust the basic idle speed. (Refer to P.13D-105.)

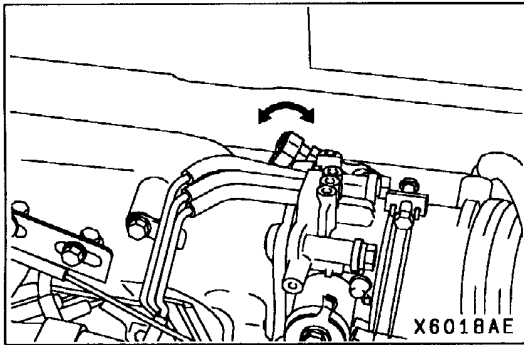
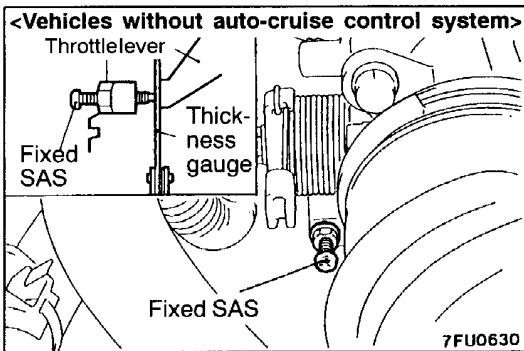
NOTE

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



IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT

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



2. Insert a thickness gauge as follows:
Insert a thickness gauge with a thickness of 0.45 mm between the fixed SAS and the throttle lever.

NOTE

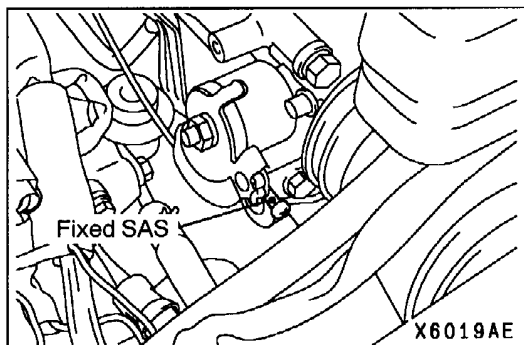
Do not insert the thickness gauge 3 mm or more. If doing that, the throttle lever opening angle becomes larger than the predetermined angle, causing maladjustment.

3. Turn the ignition switch to ON (but do not start the engine).
4. Loosen the throttle position sensor mounting bolt, and then turn the throttle position sensor anti-clockwise as far as it will go.
5. Check that the idle position switch is ON at this position.
6. Slowly turn the throttle position sensor clockwise and find the point where the idle position switch turns off. Securely tighten the throttle position sensor mounting bolt at this point.

7. Check the throttle position sensor output voltage.

Standard value: 400 – 1,000 mV

8. If there is a deviation from the standard value, check the throttle position sensor and the related harness.
9. Remove the thickness gauge.
10. Turn the ignition switch to "LOCK" (OFF) position.
11. Disconnect the MUT-II.



FIXED SAS ADJUSTMENT

NOTE

- (1) The fixed SAS 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. Loosen the tension of the accelerator cable sufficiently.
2. Back out the fixed SAS lock nut.
3. Turn the fixed SAS counterclockwise until it is sufficiently backed out, and fully close the throttle valve.
4. Tighten the fixed SAS until the point where the throttle lever is touched (i.e., the point at which the throttle valve begins to open) is found.
From that point, tighten the fixed SAS 1-1/4 turn.
5. While holding the fixed SAS so that it doesn't move, tighten the lock nut securely.
6. Adjust the tension of the accelerator cable.
7. Adjust the basic idling speed.
8. Adjust the idle position switch and the throttle position sensor (P.13D-103).

BASIC IDLE SPEED ADJUSTMENT**NOTE**

- (1) The standard idling speed has been adjusted by the speed adjusting screw (SAS) by the manufacturer, and there should usually be no need for readjustment.
 - (2) If the adjustment has been changed by mistake, the idle speed may become too high or the idle speed may drop too low when loads from components such as the A/C are placed on the engine. If this occurs, adjust by the following procedure.
 - (3) The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the idle speed control servo, the compression pressure, etc., are all normal.
1. Before inspection and adjustment, set the vehicle to the pre-inspection condition.
 2. Connect the MUT-II to the diagnosis connector (16-pin).

NOTE

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

3. Start the engine and run at idle.
4. Select the item No.30 of the MUT-II Actuator test.

NOTE

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

5. Check the idle speed.

Standard value:

750 ± 50 r/min

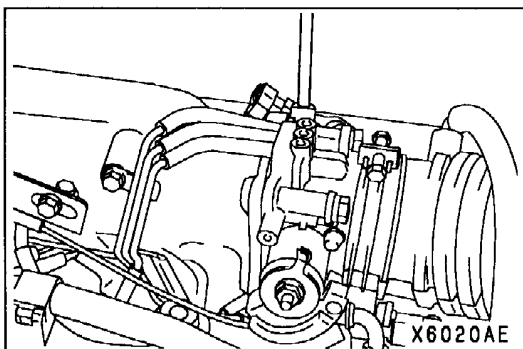
NOTE

- (1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
 - (2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13D-103.)
6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

NOTE

If the idling speed is higher than the standard value range even when the SAS is fully closed, check whether or not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS.

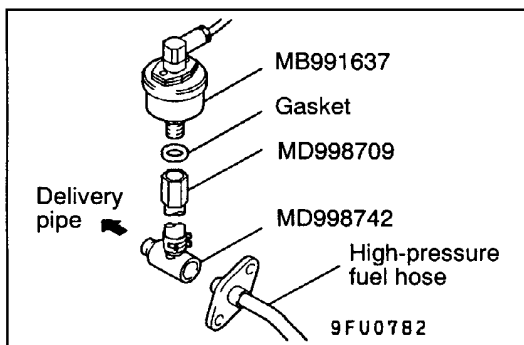
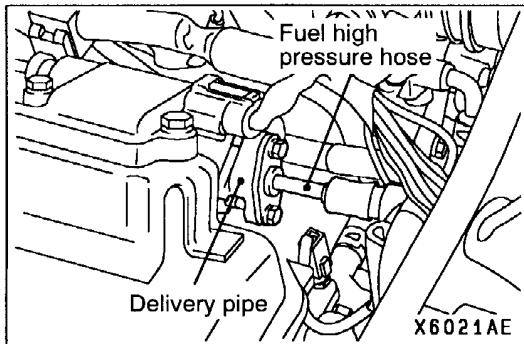
7. Press the MUT-II clear key, and release the ISC servo from the Actuator test mode.



NOTE

Unless the ISC servo is released, the Actuator test mode will continue 27 minutes.

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



FUEL PRESSURE TEST

1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13D-108.)
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

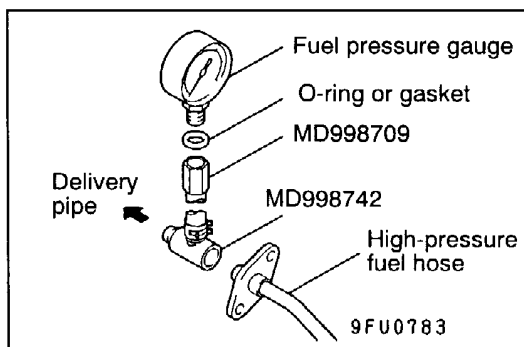
Caution

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

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

<When using the fuel pressure gauge set (special tool)>

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

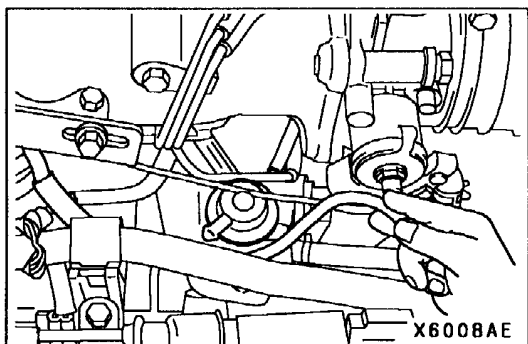


<When using the fuel pressure gauge>

- (1) Install the fuel pressure gauge on the special tool (for measuring the fuel pressure) putting a suitable O-ring or gasket between them.
- (2) Install the special tool which was set up in step (1) between the high-pressure fuel hose and the delivery pipe.
5. Connect the MUT-II to the diagnosis connector.
6. Turn the ignition switch to ON. (But do not start the engine.)

7. Select "Item No.07" from the MUT-II Actuator test to drive the fuel pump.
Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to "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. 265 kPa at kerb idle



11. Disconnect the vacuum hose from the fuel pressure regulator and measure fuel pressure with the hose end closed by a finger.

Standard value: 324 – 343 kPa at kerb idle

12. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
13. Racing the engine repeatedly, hold the fuel return hose lightly with fingers to feel that fuel pressure is present in the return hose.

NOTE

If the fuel flow rate is low, there will be no fuel pressure in the return hose.

14. If any of fuel pressure measured in steps 10 to 13 is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
<ul style="list-style-type: none"> ● Fuel pressure too low ● Fuel pressure drops after racing ● No fuel pressure in fuel return hose 	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose or pipe
Same fuel pressure when vacuum hose is connected and when disconnected	Damaged vacuum hose or clogged nipple	Replace vacuum hose or clean nipple

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

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

16. Release residual pressure from the fuel pipe line. (Refer to P.13D-108.)
17. Remove the fuel pressure gauge and special tool from the delivery pipe.

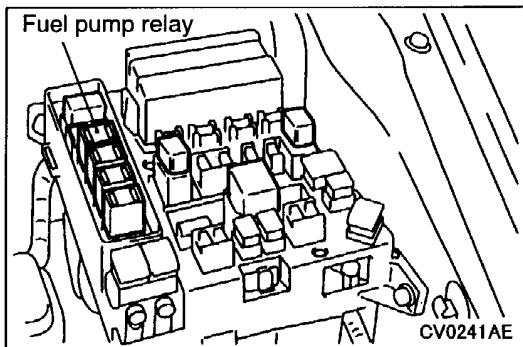
Caution

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

18. Replace the O-ring at the end of the fuel high pressure hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
19. Fit the fuel high pressure hose over the delivery pipe and tighten the bolt to specified torque.

Tightening torque: 5 Nm

20. Check for any fuel leaks by following the procedure in step 7.
21. Disconnect the MUT-II.



FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE 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.

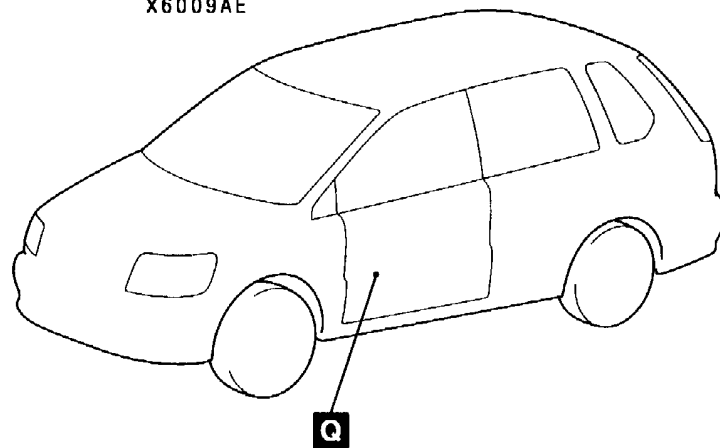
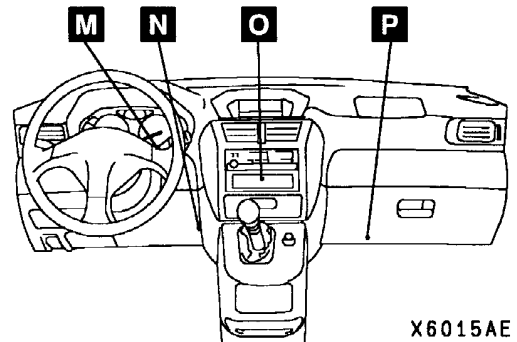
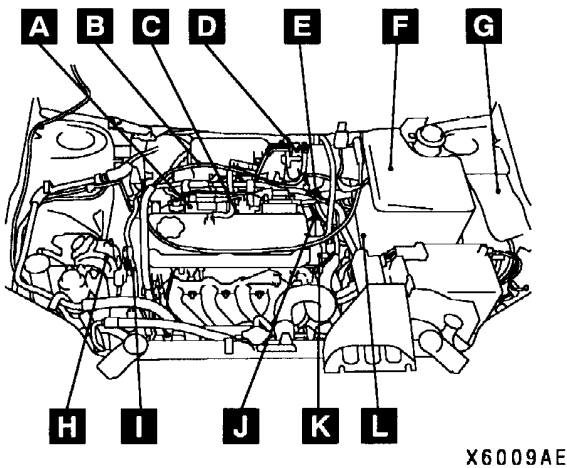
1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the fuel pump relay.
3. After starting the engine and letting it run until it stops naturally, turn the ignition switch to OFF.
4. Install the fuel pump relay.

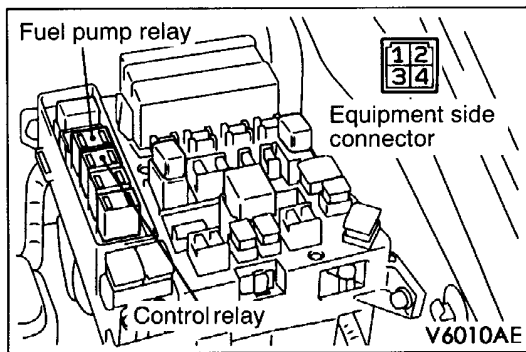
FUEL PUMP OPERATION CHECK

Refer to '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803) GROUP 13A – On-vehicle service.

COMPONENT LOCATION

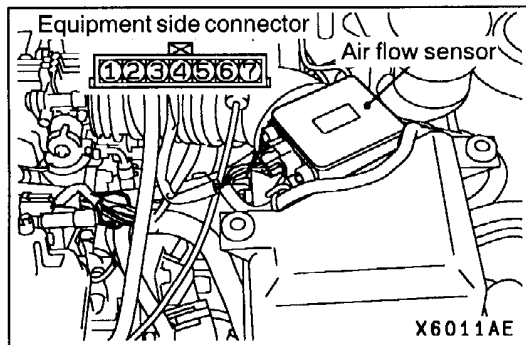
Name	Symbol	Name	Symbol
A/C relay	G	Engine-A/T-ECU <A/T>	P
A/C switch	O	Engine warning lamp (check engine lamp)	M
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	F	Idle speed control servo	D
Camshaft position sensor	K	Ignition coil	A
Control relay and fuel pump relay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





CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

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



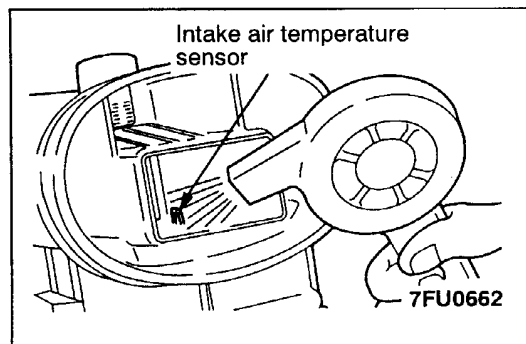
INTAKE AIR TEMPERATURE SENSOR CHECK

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

Standard value:

2.3 – 3.0 kΩ (at 20°C)

0.30 – 0.42 kΩ (at 80°C)

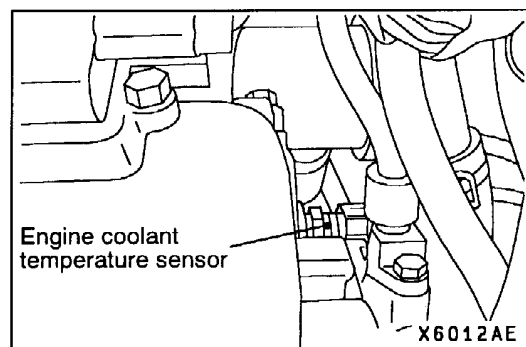


3. Measure resistance while heating the sensor using a hair drier.

Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

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

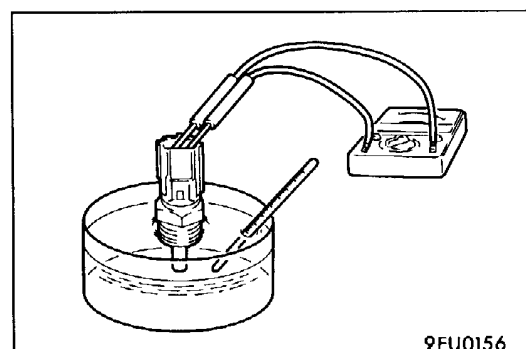


ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution

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

1. Remove the engine coolant temperature sensor.



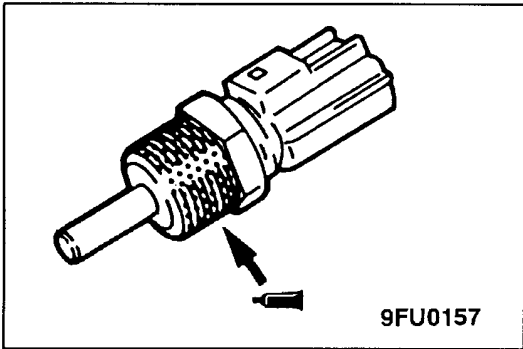
2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value:

2.1 – 2.7 kΩ (at 20°C)

0.26 – 0.36 kΩ (at 80°C)

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



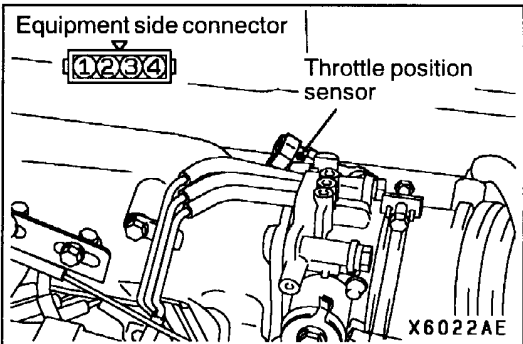
4. Apply sealant to threaded portion.

Specified sealant:

3M NUT Locking Part No.4171 or equivalent

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

Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

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

Standard value: 3.5 – 6.5 kΩ

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

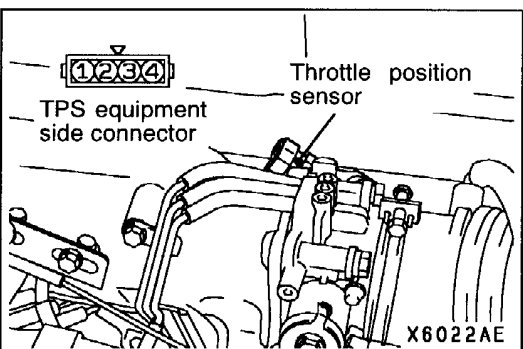
Normal condition:

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

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

NOTE

For the throttle position sensor adjustment procedure, refer to P.13D-79.



IDLE POSITION SWITCH CHECK

1. Disconnect the throttle position sensor connector.
2. Check the continuity between the throttle position sensor connector side terminal 3 and terminal 4.

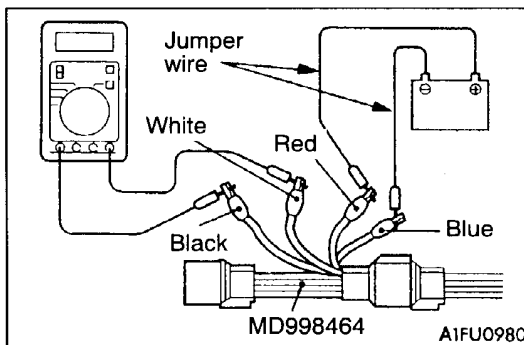
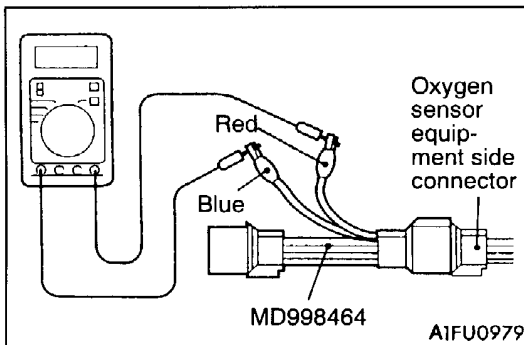
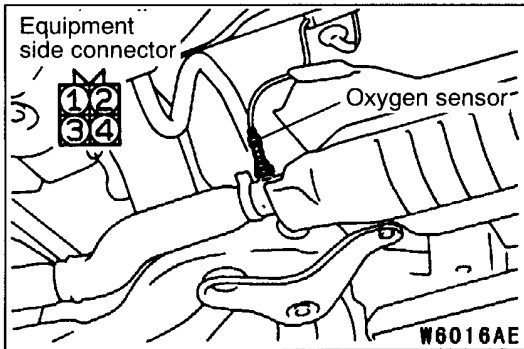
Normal condition:

Accelerator pedal	Continuity
Depressed	Non-conductive
Released	Conductive (0 Ω)

3. If out of specification, replace the throttle position sensor.

NOTE

After replacement, the idle position switch and throttle position sensor should be adjusted. (Refer to P.13D-79.)



OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity ($4.5 - 8.0 \Omega$ at 20°C) between terminal 2 (red clip of special tool) and terminal 4 (blue clip of special tool) on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.
5. Use a jumper wire to connect terminal 2 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 4 (blue clip) to the battery (-) terminal.

Caution

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

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

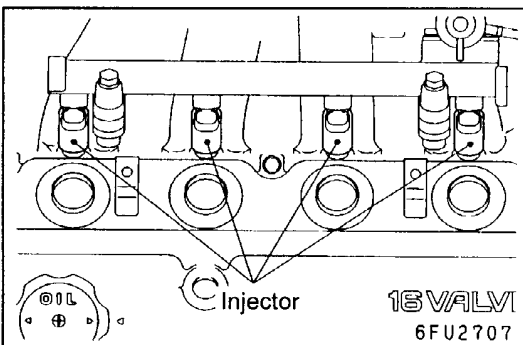
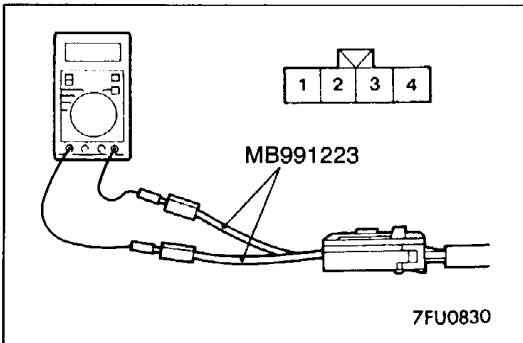
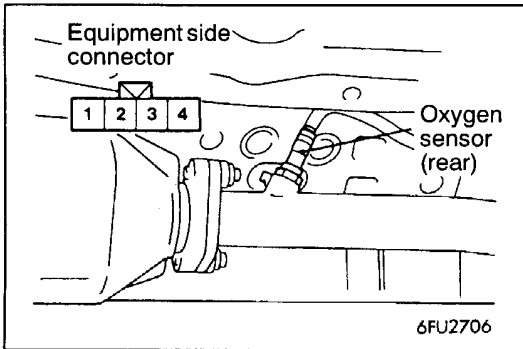
Standard value:

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

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

NOTE

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



<Oxygen sensor (rear)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness set) to the connector on the oxygen sensor side.
2. Make sure that there is continuity ($11 - 18 \Omega$ at 20°C) between terminal 3 and terminal 4 on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.

NOTE

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

INJECTOR CHECK

Measurement of Resistance between Terminals

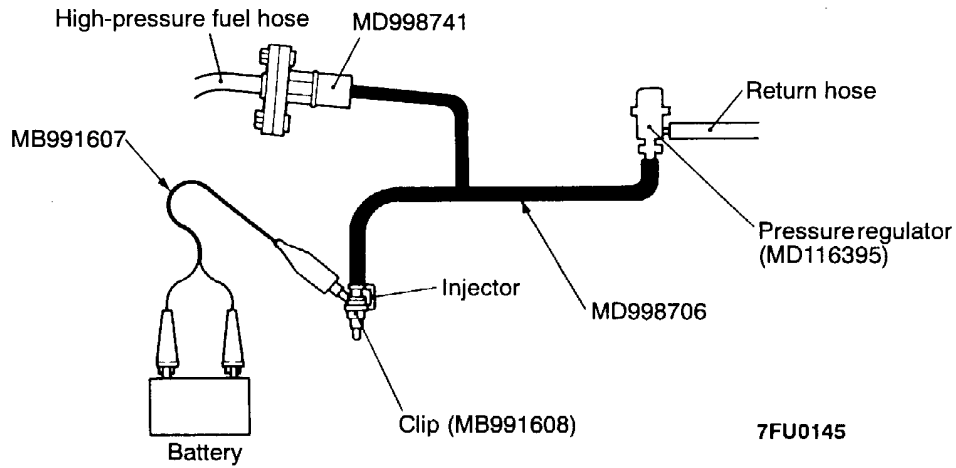
1. Remove the injector connector.
2. Measure the resistance between terminals.

Standard value: $13 - 16 \Omega$ (at 20°C)

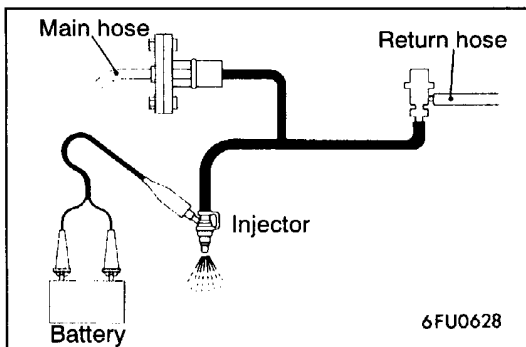
3. Install the injector connector.

Checking the Injection Condition

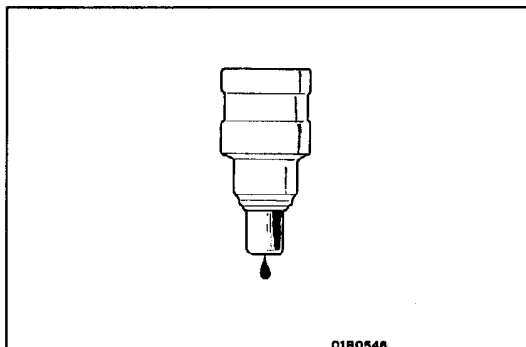
1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13D-84.)
2. Remove the injector.
3. Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.



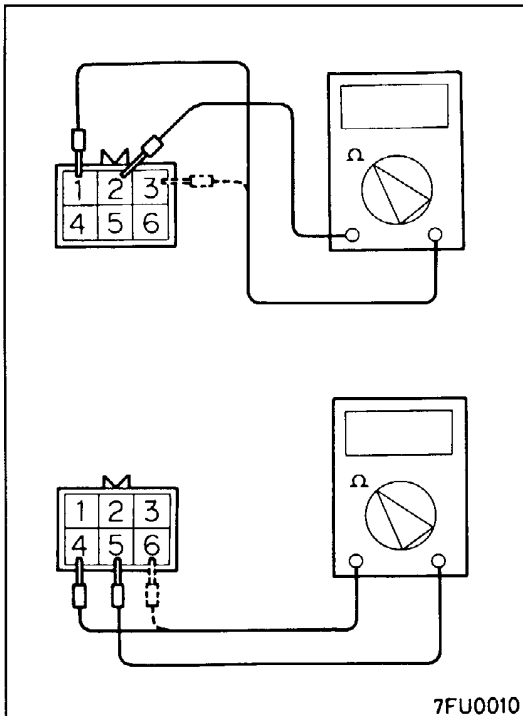
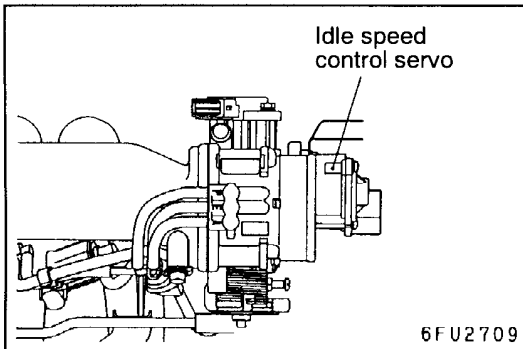
4. Connect the MUT-II to the diagnosis connector.
5. Turn the ignition switch to ON. (But do not start the engine.)
6. Select "Item No.7" from the MUT-II Actuator test to drive the fuel pump.



7. Activate the injector and check the atomized spray condition of the fuel. The condition can be considered satisfactory unless it is extremely poor.



8. Stop the actuation of the injector, and check for leakage from the injector's nozzle.
Standard value: 1 drop or less per minute
9. Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops, disconnect the special tool and restore it to its original condition.
10. Disconnect the MUT-II.



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

Checking the Operation Sound

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

NOTE

Disconnecting the engine coolant temperature sensor connector and connecting the harness-side of the connector to another engine coolant temperature sensor that is at 20°C or below is also okay.

2. Check that the operation sound of the stepper motor can be heard after the ignition is switched ON. (but without starting the motor.)
3. If the operation sound cannot be heard, check the stepper motor's activation circuit.
If the circuit is normal, it is probable that there is a malfunction of the stepper motor or of the engine control unit.

Checking the Coil Resistance

1. Disconnect the idle speed control servo connector and connect the special tool (test harness).
2. Measure the resistance between terminal 2 (white clip of the special tool) and either terminal 1 (red clip) or terminal 3 (blue clip) of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω (at 20°C)

3. Measure the resistance between terminal 5 (green clip of the special tool) and either terminal 6 (yellow clip) or terminal 4 (black clip) of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω (at 20°C)

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 – Emission Control System.

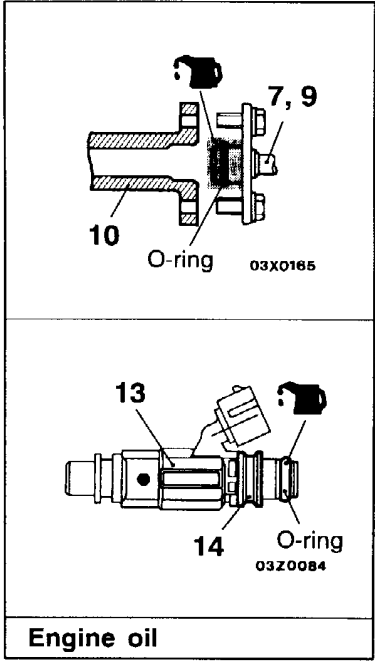
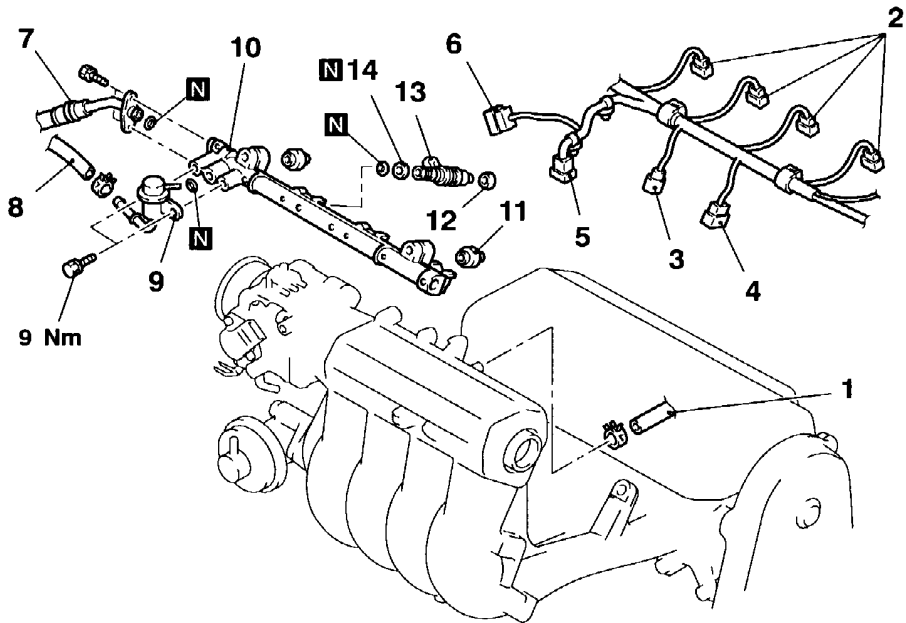
EGR CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 – Emission Control System.

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal Operation
 Fuel Discharge Prevention (Refer to P.13D-108.)



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Removal steps

- | | | |
|---|---------|--------------------------------|
| 1. PCV hose connection | | 8. Fuel return hose connection |
| 2. Injector connector | | 9. Fuel pressure regulator |
| 3. Purge control solenoid valve connector | ◀A▶ | 10. Delivery pipe |
| 4. EGR solenoid valve connector | | 11. Insulator |
| 5. Ignition failure sensor connector | ◀A▶ ▶A▶ | 12. Insulator |
| 6. Throttle position sensor | | 13. Injector |
| ▶A▶ 7. High-pressure fuel hose connection | | 14. Grommet |

REMOVAL SERVICE POINT**◀A▶ DELIVERY PIPE/INJECTOR REMOVAL**

Remove the delivery pipe (with the injectors attached to it).

Caution

Care must be taken, when removing the delivery pipe, not to drop the injector.

INSTALLATION SERVICE POINT**▶A◀ INJECTOR/FUEL PRESSURE REGULATOR/
HIGH-PRESSURE FUEL HOSE INSTALLATION**

1. Apply a drop of new engine oil to the O-ring.

Caution

Be sure not to let engine oil in the delivery pipe.

2. While turning the injector, high-pressure fuel hose and fuel pressure regulator to the right and left, install the delivery pipe, while being careful not to damage the O-ring. After installing, check that the hose turns smoothly.
3. If it does not turn smoothly, the O-ring may be trapped, remove the fuel pressure regulator and then re-insert it into the delivery pipe and check once again.
4. Tighten the high-pressure fuel hose to the standard torque, and tighten the fuel pressure regulator to the specified torque.

Tightening torque:

9 Nm (Fuel pressure regulator)

THROTTLE BODY

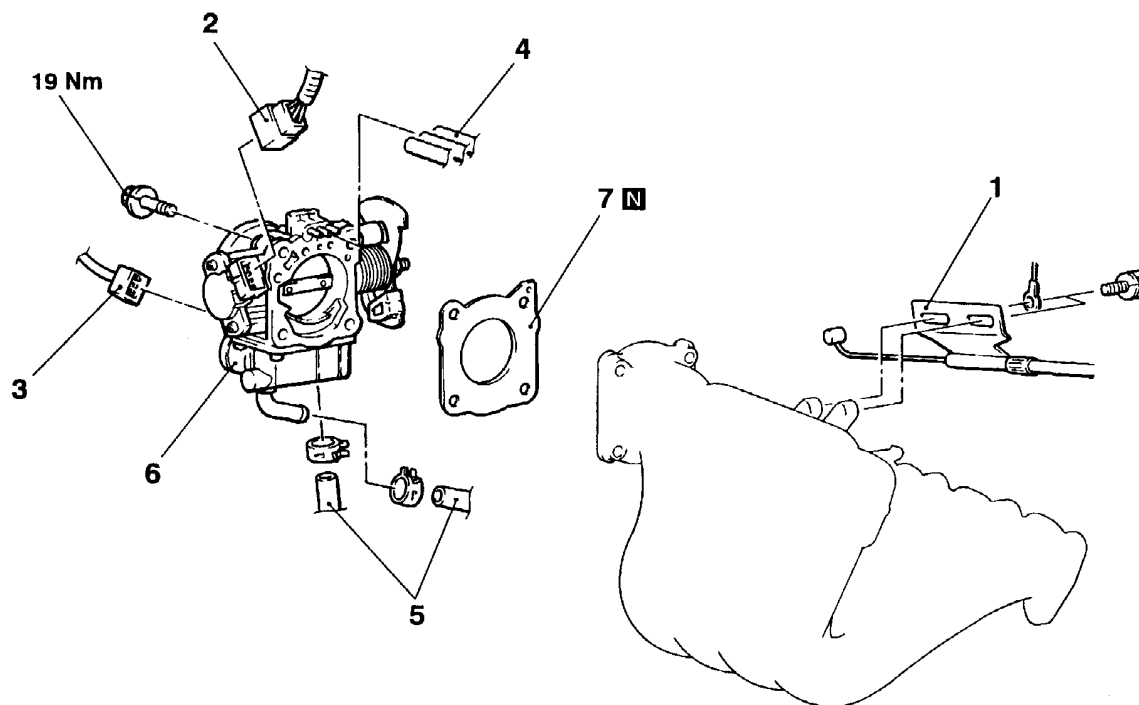
REMOVAL AND INSTALLATION

Pre-removal Operation

- Engine Coolant Draining
- Air Cleaner Removal

Post-installation Operation

- Air Cleaner Installation
- Engine Coolant Supplying
- Accelerator Cable Adjustment
(GROUP 17 – On-vehicle Service)

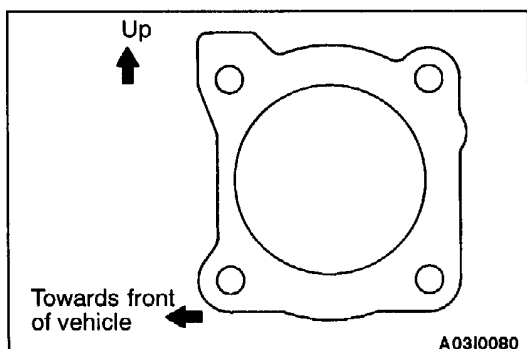


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Removal steps

1. Accelerator cable connection
2. Throttle position sensor connector
3. Idle speed control servo connector
4. Vacuum hose connection

5. Water hose connection
6. Throttle body
7. Throttle body gasket



INSTALLATION SERVICE POINT

▶A◀ THROTTLE BODY GASKET INSTALLATION

Place the gasket so that the projecting part is positioned as shown in the illustration, and then install it between the intake manifold and the throttle body.