MULTIPOINT FUEL INJECTION (MPI) <4G9>

Click on the applicable bookmark to selected the required model year

MULTIPOINT FUEL INJECTION (MPI) <4G9>

CONTENTS

GENERAL

OUTLINE OF CHANGES

The following contents have been established to correspond to the addition of vehicles with 4G9-MPI engine.

GENERAL INFORMATION

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

FUEL INJECTION CONTROL

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

A single injector 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 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 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 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 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 that is related to the sensors and actuators can be read by means of the MUT-II. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

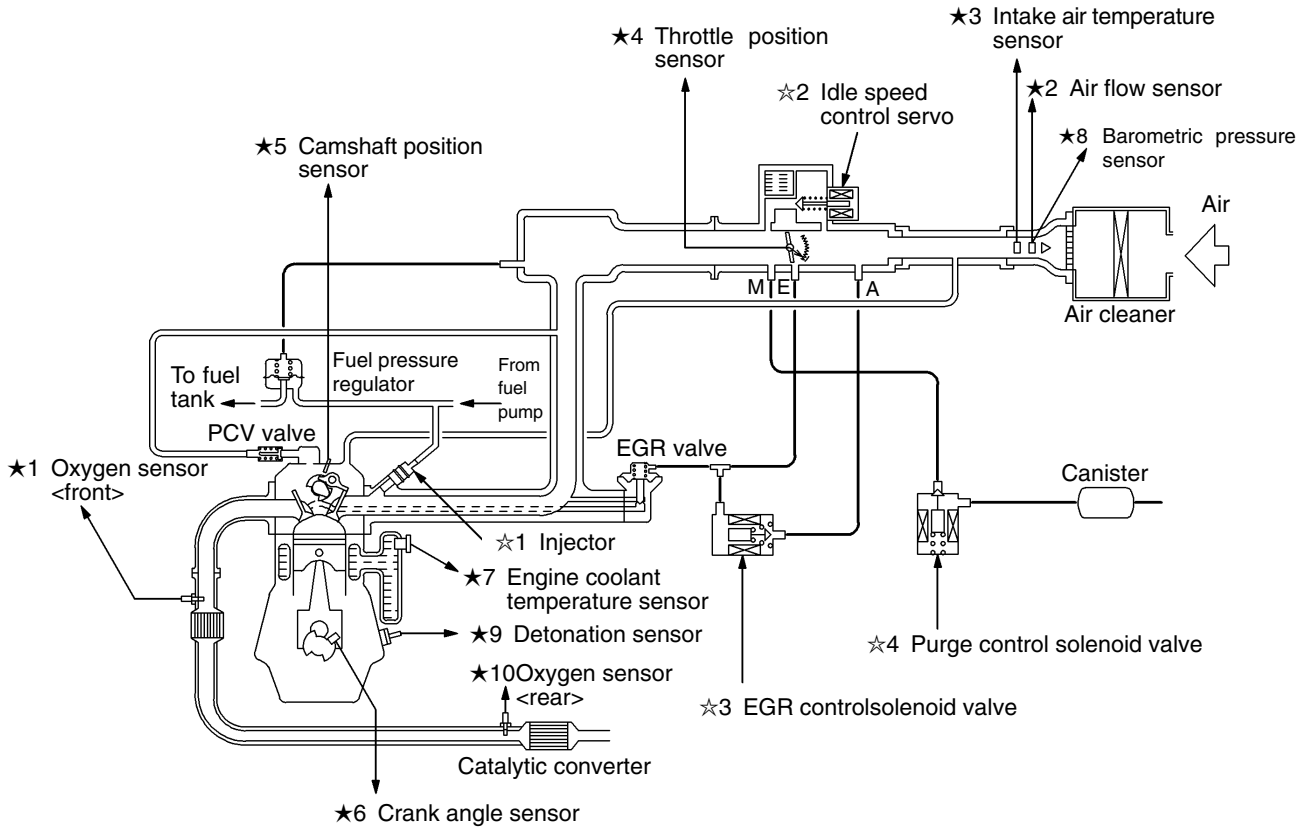
1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Fan Motor Control
   The revolutions of the radiator fan and condenser fan are controlled in response to the engine coolant temperature and vehicle speed.
4. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
5. EGR Control Solenoid Valve Control
   Refer to GROUP 17.

GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	50
	Throttle position sensor	Variable resistor type
	Idle speed control servo	Stepper motor type (Stepper motor type by-pass air control system)
Engine-ECU	Identification model No.	E2T74481
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	Magnetic resistive 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	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	CDH 210
	EGR control solenoid valve	Duty cycle type solenoid valve
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	329

CONTROL SYSTEM DIAGRAM

★1 Oxygen sensor <front> ★2 Air flow sensor ★3 Intake air temperature sensor ★4 Throttle position sensor ★5 Camshaft position sensor ★6 Crank angle sensor ★7 Engine coolant temperature sensor ★8 Barometric pressure sensor ★9 Detonation sensor ★10Oxygen sensor <rear>	• Power supply • Ignition switch-IG • Ignition switch-ST • Vehicle speed sensor • A/C switch • A/C thermo sensor • Inhibitor switch • Power steering fluid pressure switch • Alternator FR terminal • A/T-ECU	⇨ Engine-ECU ⇨	☆1 Injector ☆2 Idle speed control servo ☆3 EGR control solenoid valve ☆4 Purge control solenoid valve	• Engine control relay • Fuel pump relay • A/C relay • Ignition coil • Fan motor relay • Engine warning lamp • Tachometer • Diagnosis output • Alternator G terminal • A/T-ECU	



16002AL

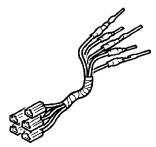
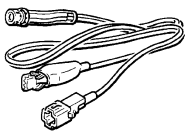
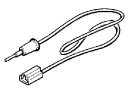
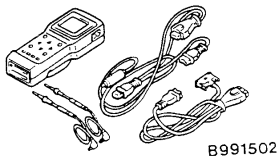
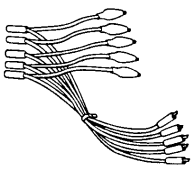
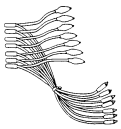
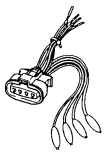
SERVICE SPECIFICATIONS

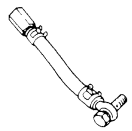
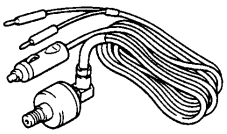
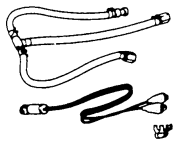
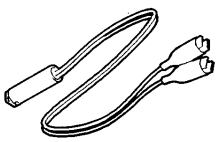
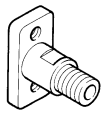
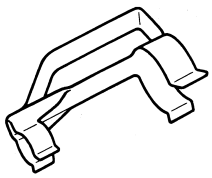
Items		Specifications
Basic idle speed r/min		700 ± 50
Throttle position sensor adjusting voltage mV		535 – 735
Throttle position sensor resistance kΩ		3.5 – 6.5
Idle speed control servo coil resistance Ω		27 – 33 (at 20°C)
Intake air temperature sensor resistance kΩ	–20°C	13 – 17
	0°C	5.3 – 6.7
	20°C	2.3 – 3.0
	40°C	1.0 – 1.5
	60°C	0.56 –0.76
	80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	–20°C	14 – 17
	0°C	5.1 – 6.5
	20°C	2.1 – 2.7
	40°C	0.9 – 1.3
	60°C	0.48 – 0.68
	80°C	0.26 – 0.36
Oxygen sensor output voltage (at racing) V		0.6 – 1.0
Fuel pressure kPa	Vacuum hose disconnection	324 – 343 at curb idle
	Vacuum hose connection	Approx. 265 at curb idle
Injector coil resistance Ω		13 – 16 (at 20°C)

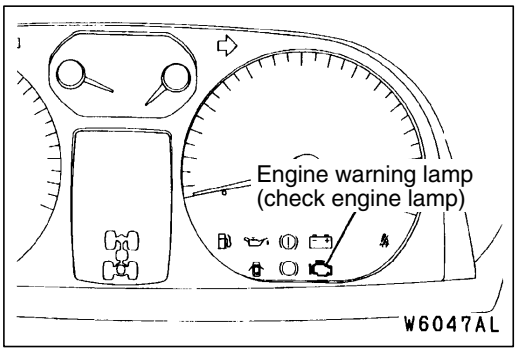
SEALANT

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
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	• Check at the ECU terminals A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	• Reading diagnosis code • MPI system inspection
	MB991348	Test harness set	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
 MB991709	MB991709	Test harness	• Measurement of voltage during trouble-shooting • Inspection using an analyzer • Adjustment of throttle position sensor
	MB991519	Alternator harness connector	Measurement of voltage during troubleshoot-ing
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer

Tool	Number	Name	Use
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	
	MD998706	Injector test set	Checking the spray condition of injectors
 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 Point.

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

DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the 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
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
P0325	Detonation sensor system

Code No.	Diagnosis item
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0403	EGR valve system
P0420	Catalyst malfunction
P0443	Purge control solenoid valve system
P0500	Vehicle speed sensor system
P0505	Idle speed control system
P0551	Power steering fluid pressure switch system
P1603	Battery backup line system

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

METHOD OF READING AND ERASING DIAGNOSIS CODES

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

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.

FAIL-SAFE FUNCTION REFERENCE TABLE

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

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Camshaft position sensor	Injects fuel to all cylinders simultaneously. (However, after the ignition switch is turned to ON, the No.1 cylinder top dead centre is not detected at all.)
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.

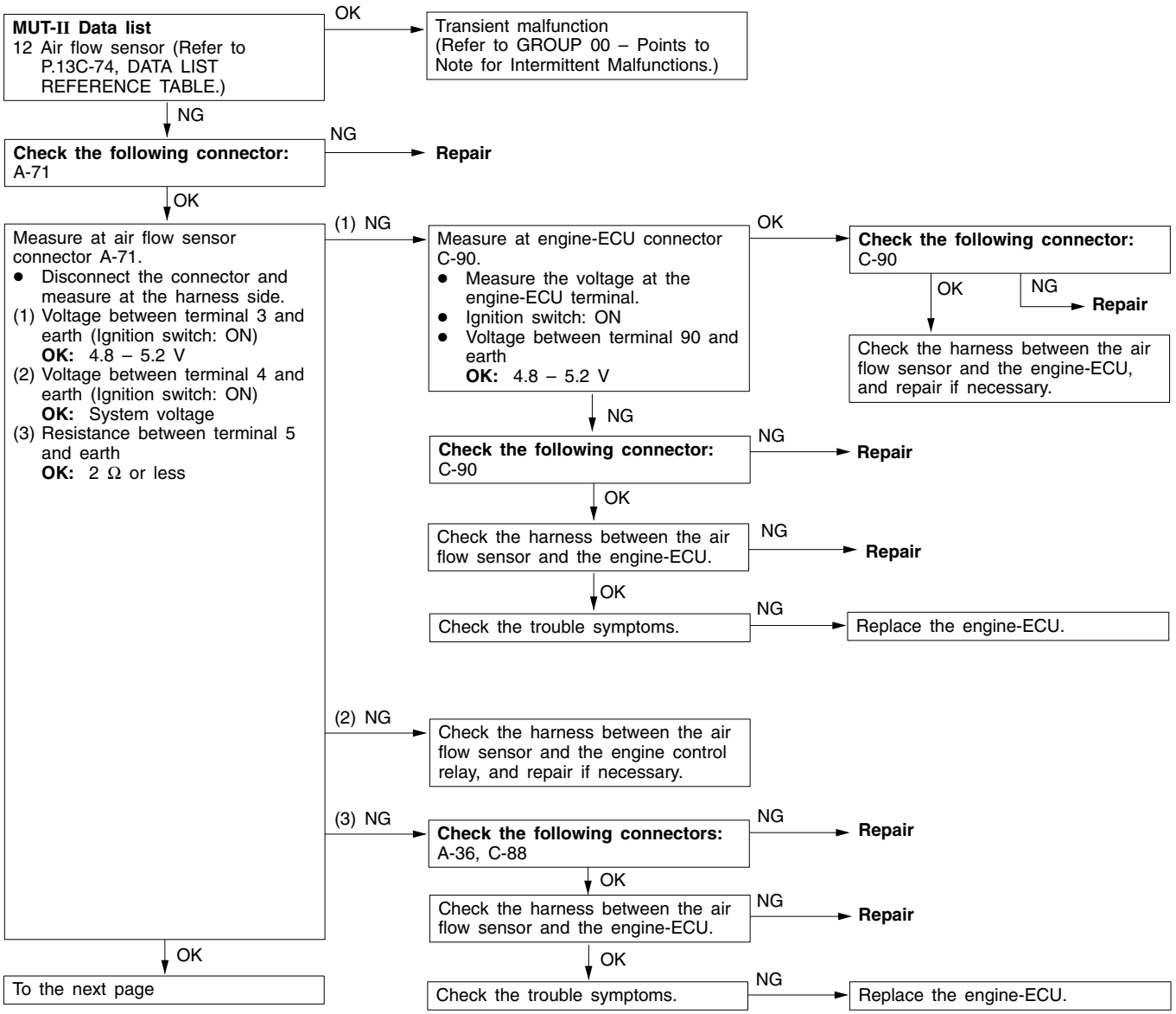
INSPECTION CHART FOR DIAGNOSIS CODES

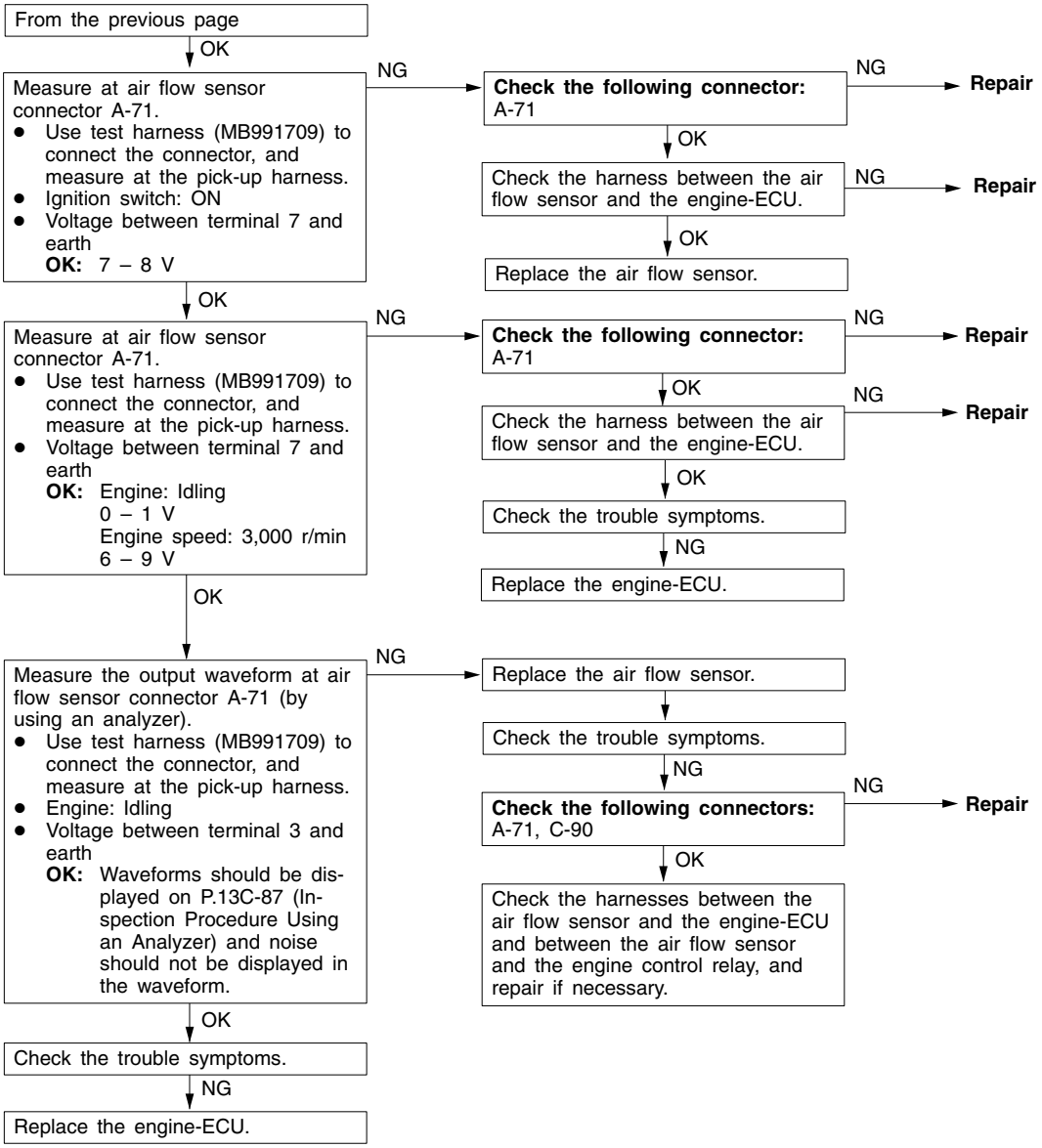
Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13C-14
P0105	Barometric pressure sensor system	13C-16
P0110	Intake air temperature sensor system	13C-18
P0115	Engine coolant temperature sensor system	13C-20
P0120	Throttle position sensor 1 system	13C-22
P0125	Feedback system	13C-24
P0130	Oxygen sensor (front) system	13C-25
P0135	Oxygen sensor heater (front) system	13C-26
P0136	Oxygen sensor (rear) system	13C-27
P0141	Oxygen sensor heater (rear) system	13C-28
P0170	Abnormal fuel system	13C-29
P0201	No. 1 injector system	13C-30
P0202	No. 2 injector system	13C-30
P0203	No. 3 injector system	13C-30
P0204	No. 4 injector system	13C-30
P0300★	Ignition coil (power transistor) system	13C-31
P0301	No. 1 cylinder misfire detected	13C-32
P0302	No. 2 cylinder misfire detected	13C-32
P0303	No. 3 cylinder misfire detected	13C-32
P0304	No. 4 cylinder misfire detected	13C-32
P0325	Detonation sensor system	13C-33
P0335	Crank angle sensor system	13C-33
P0340	Camshaft position sensor system	13C-35
P0403	EGR valve system	13C-36
P0420	Catalyst malfunction	13C-37
P0443	Purge control solenoid valve system	13C-38
P0500	Vehicle speed sensor system	13C-39
P0505	Idle speed control system	13C-40
P0551	Power steering fluid pressure switch system	13C-43
P1603	Battery backup circuit malfunction	13C-44
P1610	Immobilizer system	13C-45

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

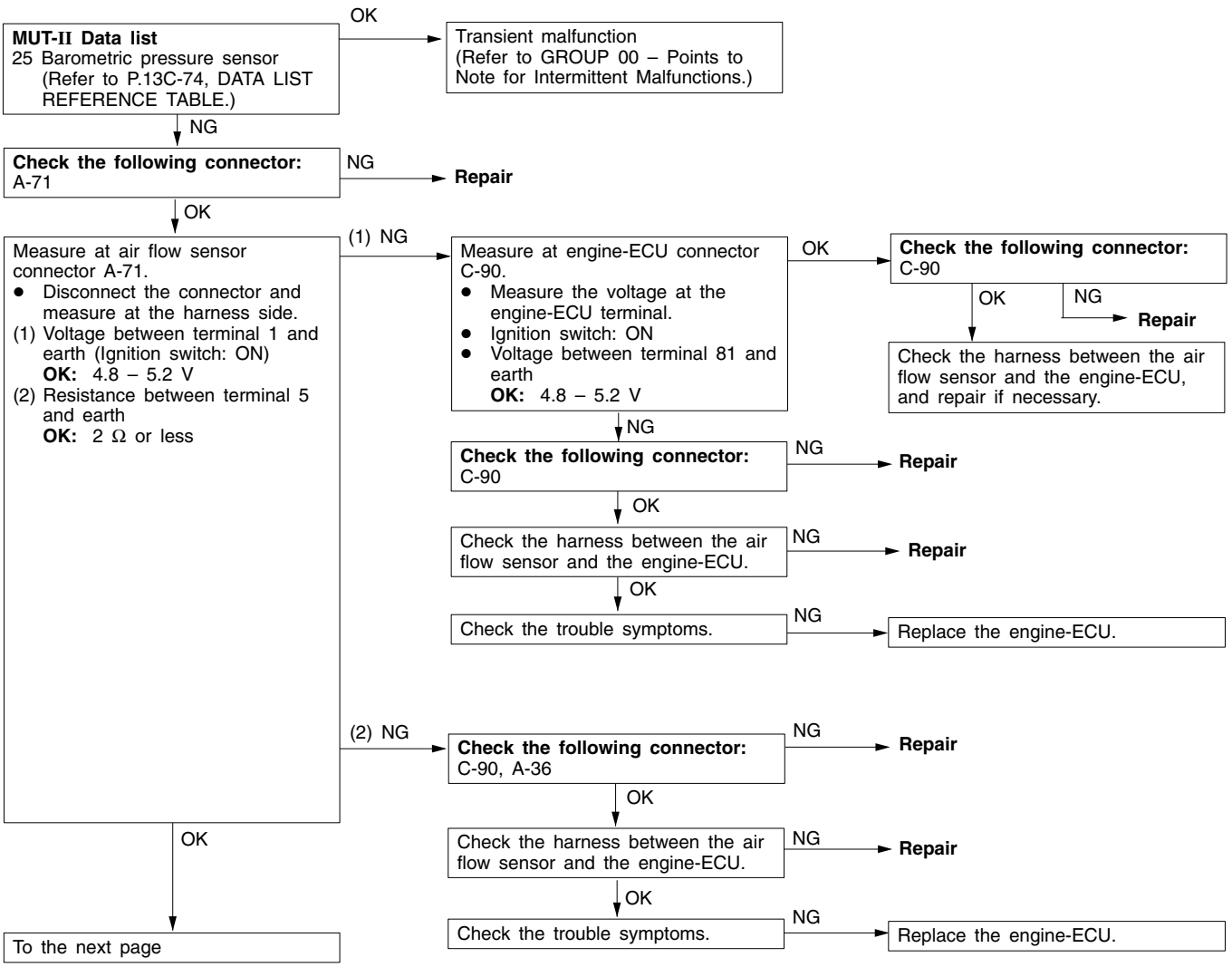
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSIS CODE

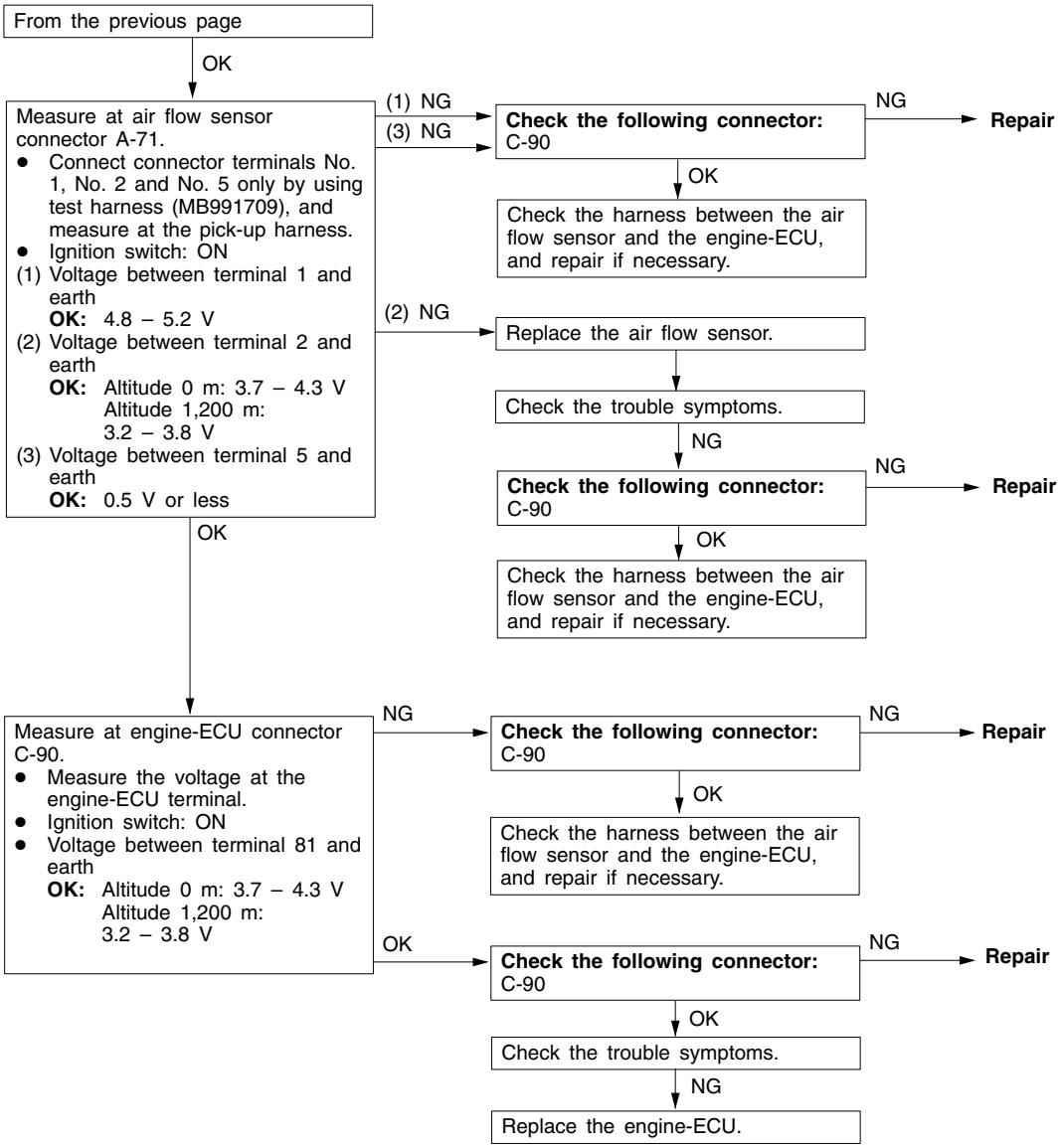
Code No. P0100 Air flow sensor system	Probable cause
Range of Check ● Engine speed: 500 r/min or more Set Conditions ● The sensor output frequency is 3.3 Hz or less for 4 seconds.	● Malfunction of air flow sensor ● Open or short circuit in air flow sensor circuit or loose connector contact ● Malfunction of engine-ECU



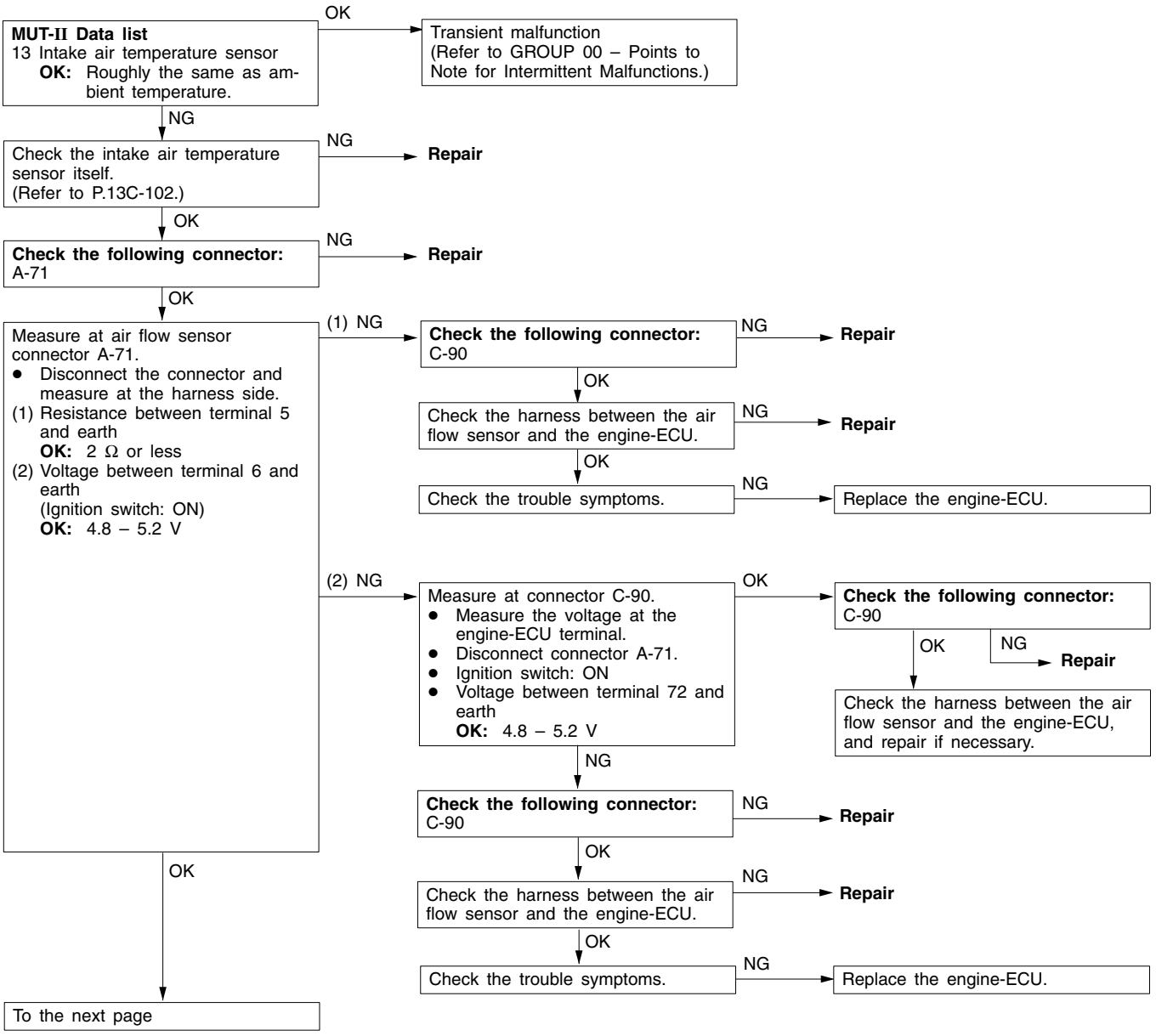

From the previous page
OK
Measure at air flow sensor connector A-71.
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
● Voltage between terminal 7 and earth
OK: 7 – 8 V
NG
Check the following connector: A-71
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU.
NG
Repair
OK
Replace the air flow sensor.
OK
Measure at air flow sensor connector A-71.
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Voltage between terminal 7 and earth
OK: Engine: Idling
0 – 1 V
Engine speed: 3,000 r/min
6 – 9 V
NG
Check the following connector: A-71
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure the output waveform at air flow sensor connector A-71 (by using an analyzer).
● Use test harness (MB991709) to connect the connector, and measure at the pick-up harness.
● Engine: Idling
● Voltage between terminal 3 and earth
OK: Waveforms should be displayed on P.13C-87 (Inspection Procedure Using an Analyzer) and noise should not be displayed in the waveform.
NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connectors: A-71, C-90
NG
Repair
OK
Check the harnesses between the air flow sensor and the engine-ECU and between the air flow sensor and the engine control relay, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

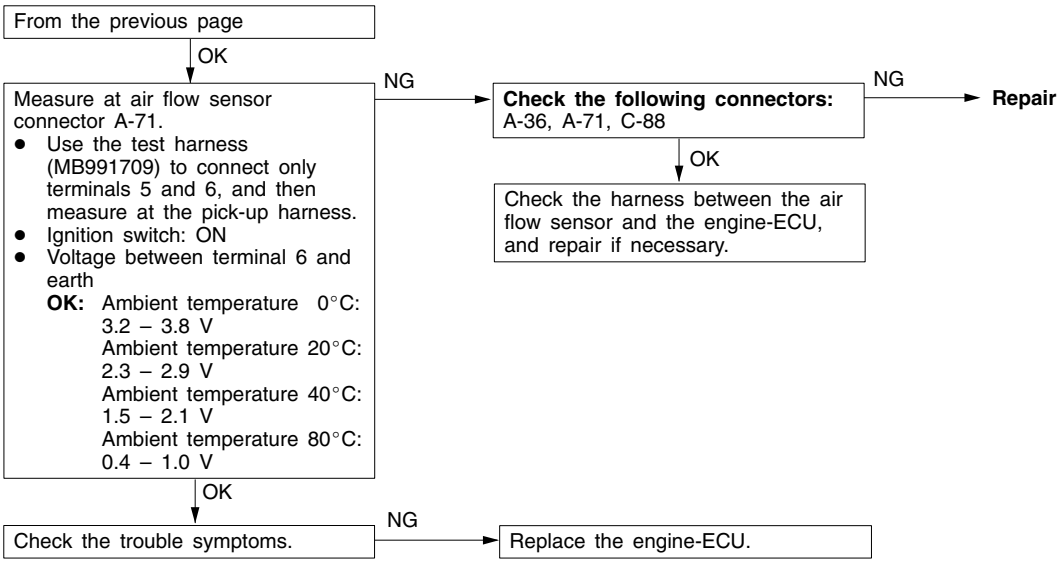
Code No. P0105 Barometric pressure sensor system	Probable cause
Range of Check ● Two seconds have passed since the ignition switch is turned ON or the engine starting process is completed. ● Battery voltage: 8 V or more Set Conditions ● The sensor output voltage is 4.5 V or more for 4 seconds (equivalent to 114 kPa of barometric pressure) or ● The sensor output voltage is 0.2 V or less (equivalent to 53 kPa of barometric pressure)	● Malfunction of barometric pressure sensor ● Open or short circuit in barometric pressure sensor circuit or loose connector contact ● Malfunction of engine-ECU



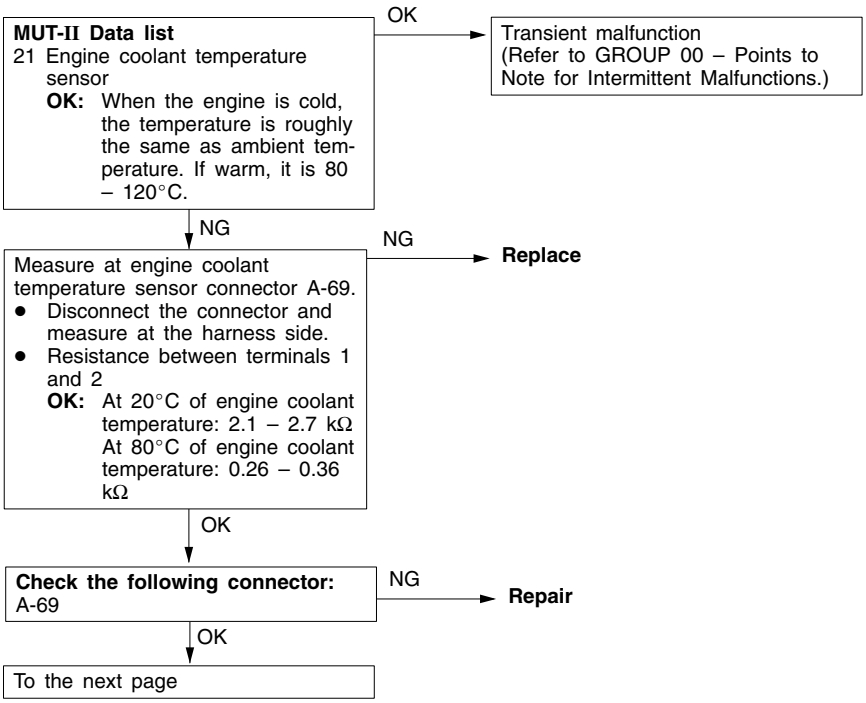

From the previous page
OK
Measure at air flow sensor connector A-71.
● Connect connector terminals No. 1, No. 2 and No. 5 only by using test harness (MB991709), and measure at the pick-up harness.
● Ignition switch: ON
(1) Voltage between terminal 1 and earth
OK: 4.8 – 5.2 V
(2) Voltage between terminal 2 and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V
(3) Voltage between terminal 5 and earth
OK: 0.5 V or less
(1) NG
(3) NG
Check the following connector: C-90
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
(2) NG
Replace the air flow sensor.
Check the trouble symptoms.
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-90.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● Voltage between terminal 81 and earth
OK: Altitude 0 m: 3.7 – 4.3 V
Altitude 1,200 m: 3.2 – 3.8 V
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Check the following connector: C-90
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

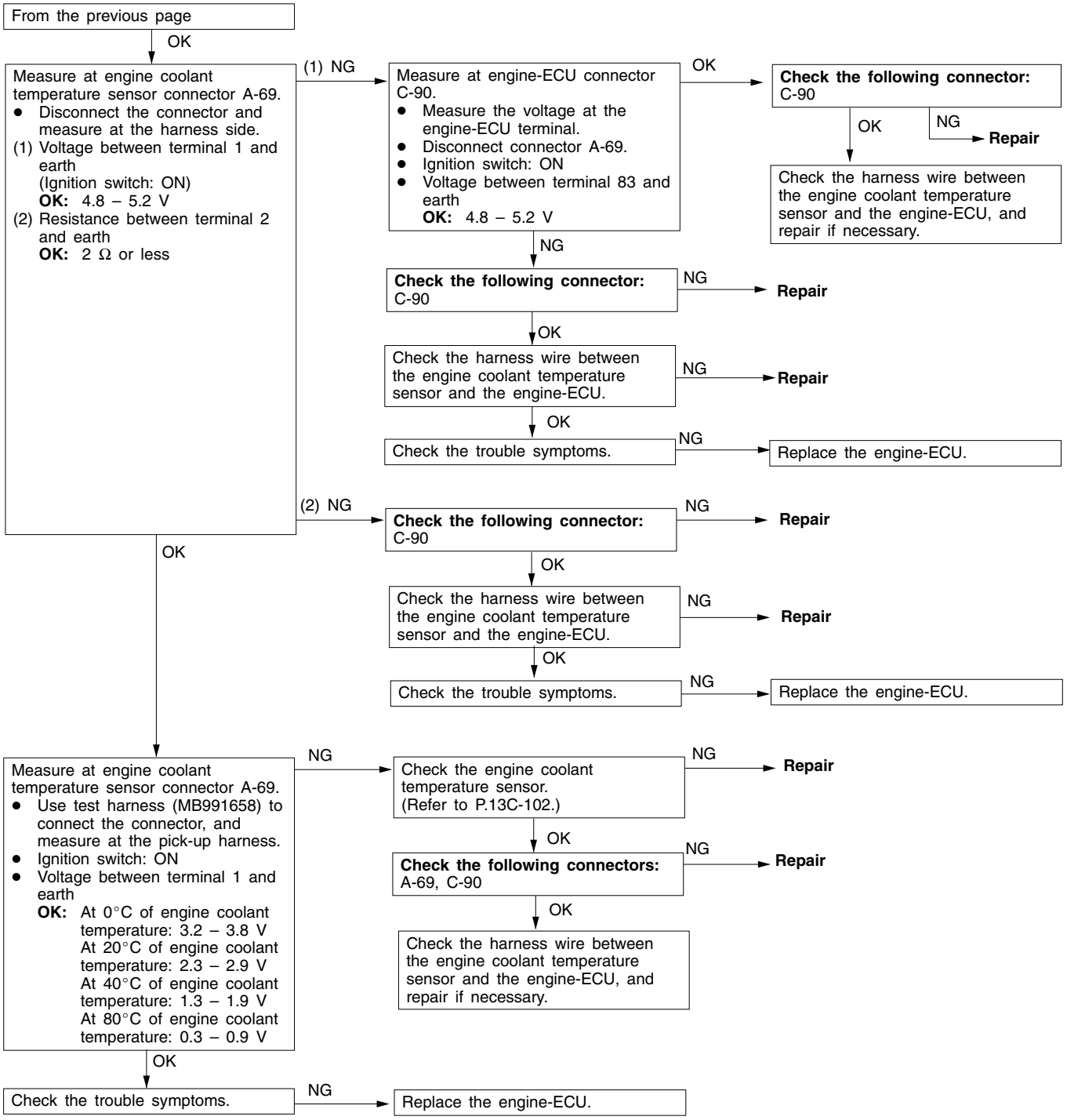
Code No. P0110 Intake air temperature sensor system	Probable cause
Range of Check • 2 seconds have passed since the ignition switch is turned ON or the engine starting process is completed. Set Conditions • The sensor output voltage is 4.6 V or more for four seconds (equivalent to –45°C of intake air temperature) or • The sensor output voltage is 0.2 V or more for four seconds (equivalent to 125°C of intake air temperature)	• Malfunction of intake air temperature sensor • Open or short circuit in intake air temperature sensor or loose connector contact • Malfunction of engine-ECU



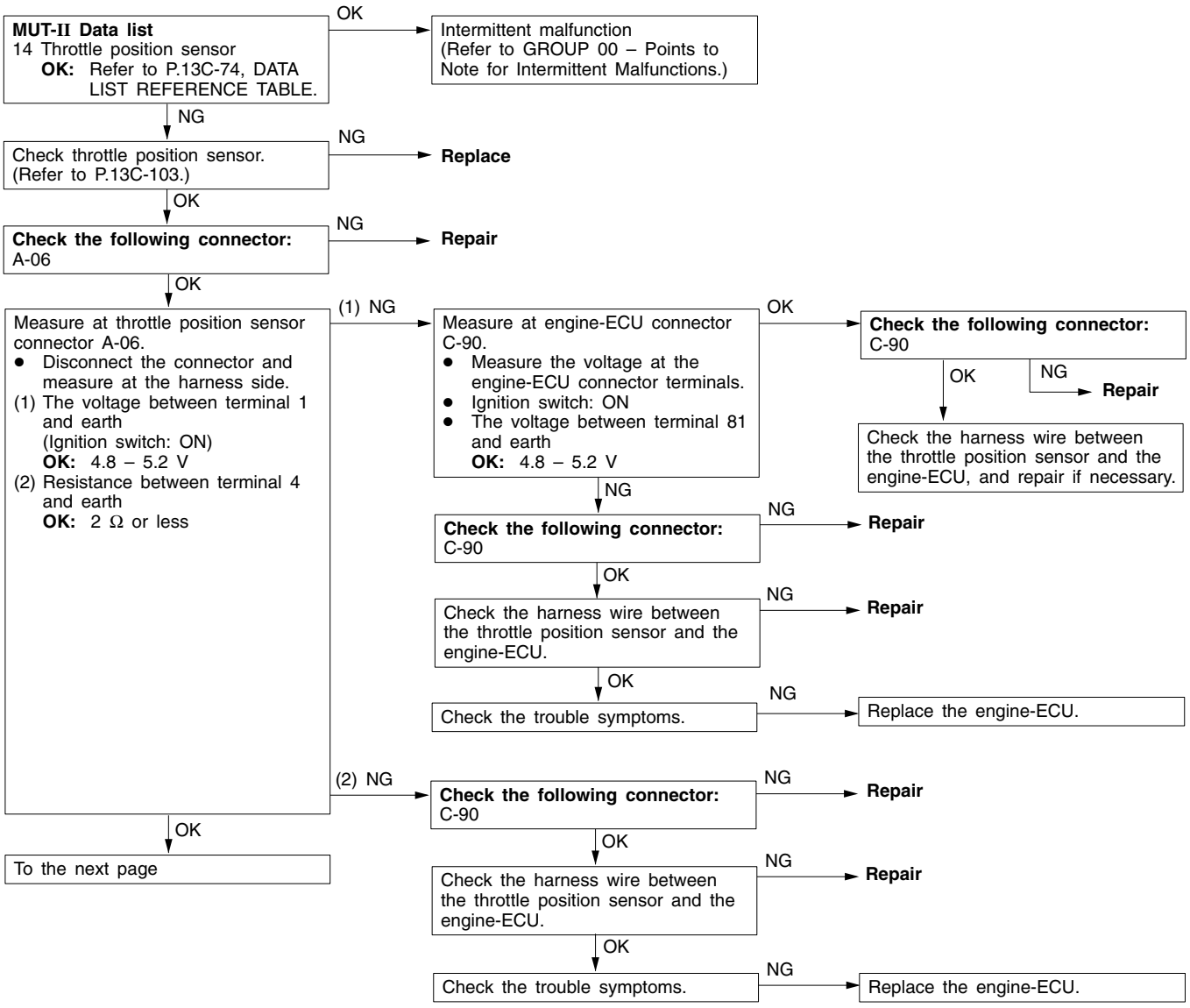

From the previous page
OK
Measure at air flow sensor connector A-71.
● Use the test harness (MB991709) to connect only terminals 5 and 6, and then measure at the pick-up harness.
● Ignition switch: ON
● Voltage between terminal 6 and earth
OK: Ambient temperature 0°C: 3.2 – 3.8 V
Ambient temperature 20°C: 2.3 – 2.9 V
Ambient temperature 40°C: 1.5 – 2.1 V
Ambient temperature 80°C: 0.4 – 1.0 V
NG
Check the following connectors: A-36, A-71, C-88
NG
Repair
OK
Check the harness between the air flow sensor and the engine-ECU, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

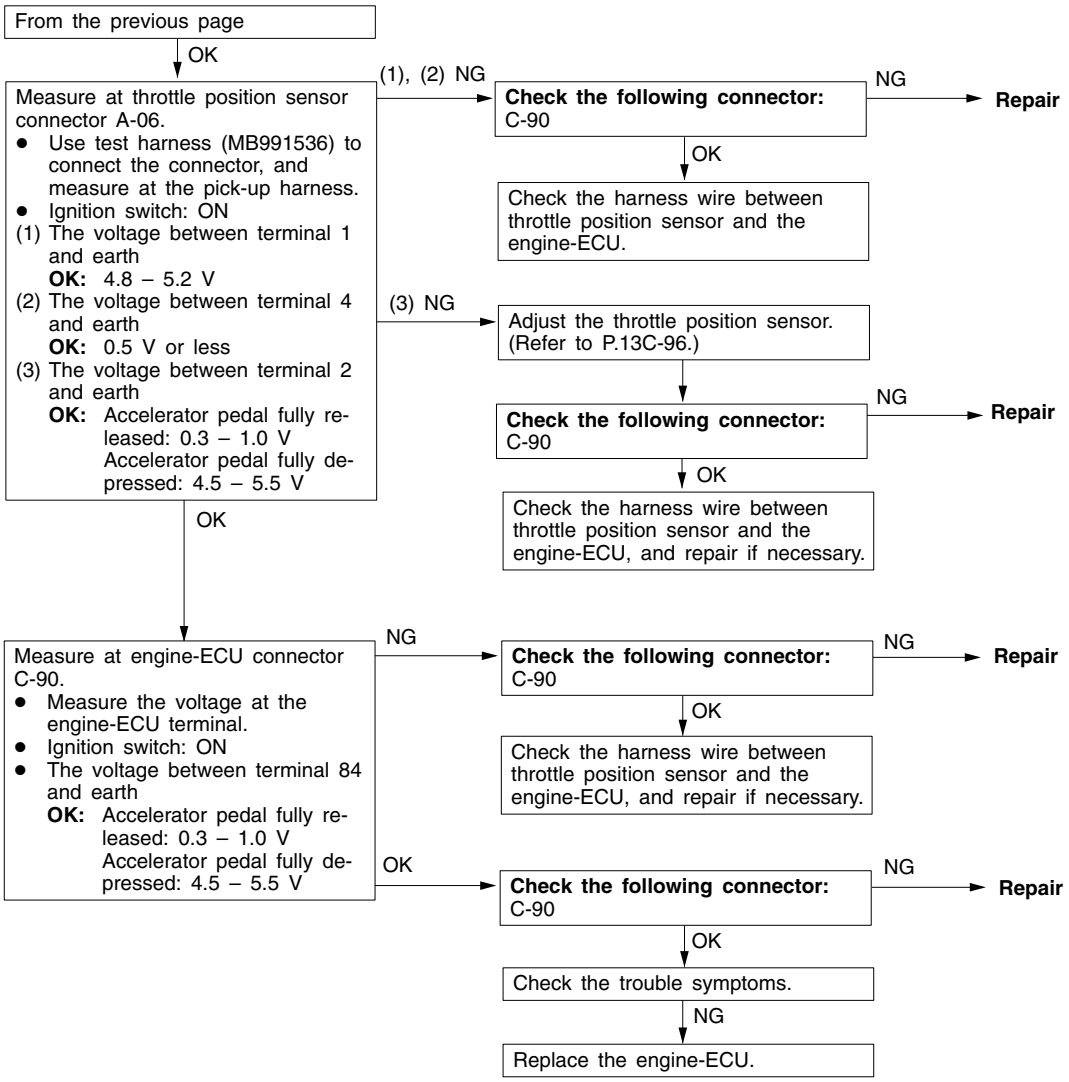
Code No. P0115 Engine coolant temperature sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine has been started Set Conditions ● The sensor output voltage is 4.6 V or more for four seconds (equivalent to –45°C or lower of engine coolant temperature) or ● The sensor output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



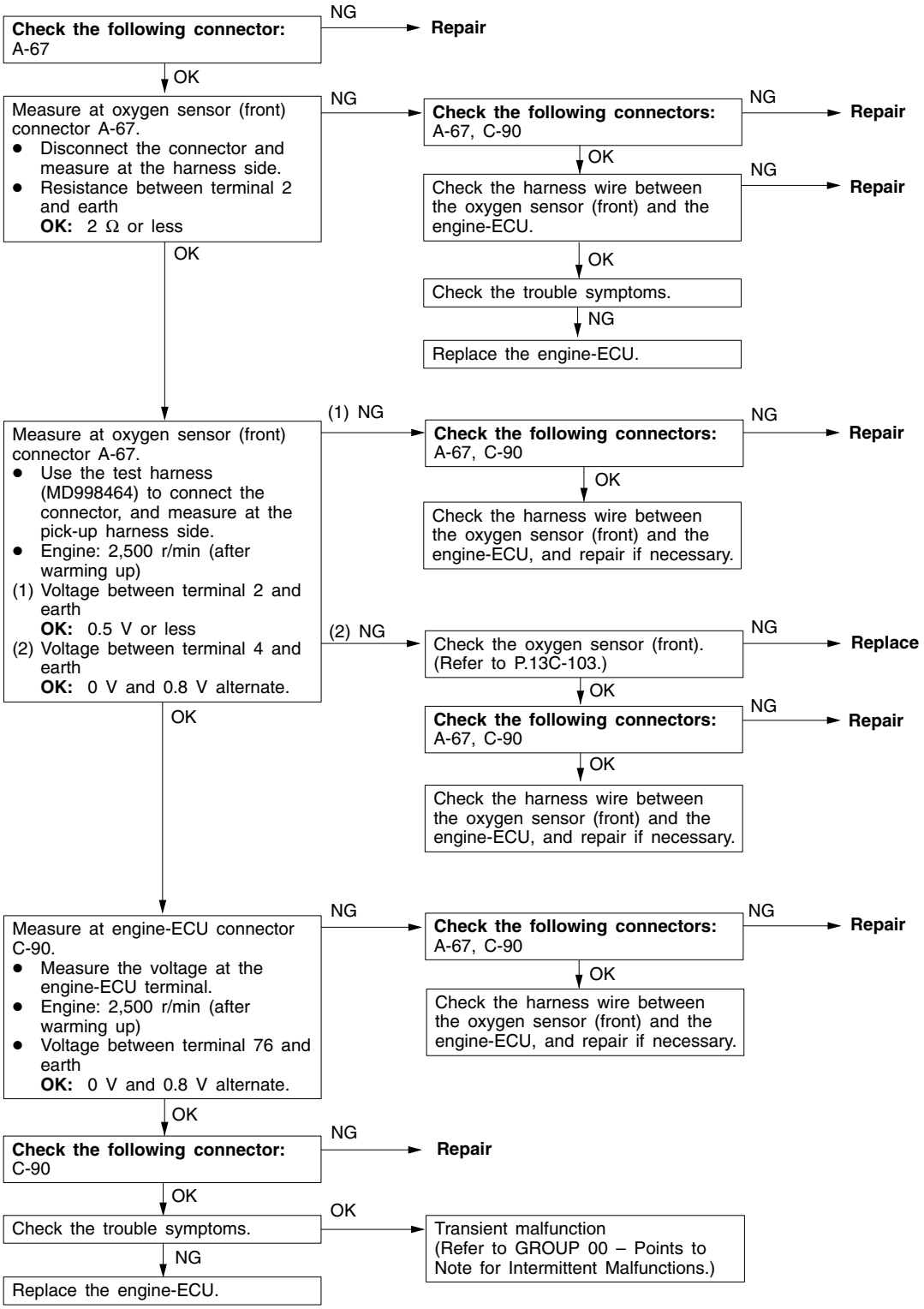

From the previous page
OK
Measure at engine coolant temperature sensor connector A-69.
● Disconnect the connector and measure at the harness side.
(1) Voltage between terminal 1 and earth
(Ignition switch: ON)
OK: 4.8 – 5.2 V
(2) Resistance between terminal 2 and earth
OK: 2 Ω or less
(1) NG
Measure at engine-ECU connector C-90.
● Measure the voltage at the engine-ECU terminal.
● Disconnect connector A-69.
● Ignition switch: ON
● Voltage between terminal 83 and earth
OK: 4.8 – 5.2 V
OK
Check the following connector: C-90
OK
NG
Repair
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(2) NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
OK
Measure at engine coolant temperature sensor connector A-69.
● Use test harness (MB991658) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
● Voltage between terminal 1 and earth
OK: At 0°C of engine coolant temperature: 3.2 – 3.8 V
At 20°C of engine coolant temperature: 2.3 – 2.9 V
At 40°C of engine coolant temperature: 1.3 – 1.9 V
At 80°C of engine coolant temperature: 0.3 – 0.9 V
NG
Check the engine coolant temperature sensor. (Refer to P.13C-102.)
NG
Repair
OK
Check the following connectors: A-69, C-90
NG
Repair
OK
Check the harness wire between the engine coolant temperature sensor and the engine-ECU, and repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

Code No. 0120 Throttle position sensor system	Probable cause
Range of Check ● Excluding 2 seconds after the ignition switch is turned ON or immediately after the engine start. Set Conditions ● The sensor output voltage is 0.2 V or less for four seconds. or ● Volume efficiency is 60 percent or lower. ● Engine speed is lower than 1000 r/min. ● The sensor output voltage is 2.0 V or more. ● AFS: Normal	● Malfunction of throttle position sensor ● Open or short circuit in the throttle position sensor circuit or loose connector contact ● Malfunction of the engine-ECU

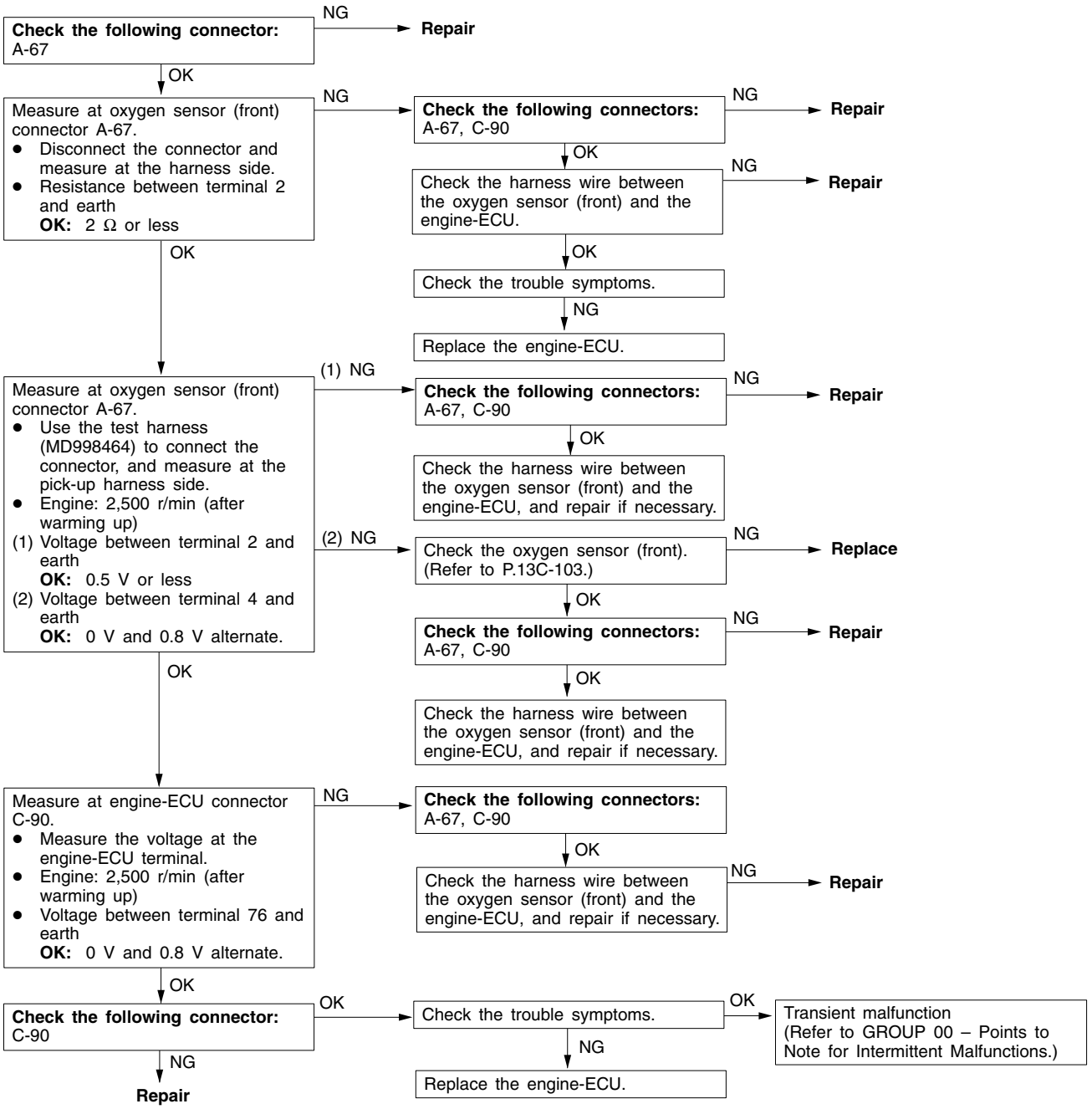



From the previous page
OK
Measure at throttle position sensor connector A-06.
● Use test harness (MB991536) to connect the connector, and measure at the pick-up harness.
● Ignition switch: ON
(1) The voltage between terminal 1 and earth
OK: 4.8 – 5.2 V
(2) The voltage between terminal 4 and earth
OK: 0.5 V or less
(3) The voltage between terminal 2 and earth
OK: Accelerator pedal fully released: 0.3 – 1.0 V
Accelerator pedal fully depressed: 4.5 – 5.5 V
(1), (2) NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between throttle position sensor and the engine-ECU.
(3) NG
Adjust the throttle position sensor. (Refer to P.13C-96.)
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between throttle position sensor and the engine-ECU, and repair if necessary.
OK
Measure at engine-ECU connector C-90.
● Measure the voltage at the engine-ECU terminal.
● Ignition switch: ON
● The voltage between terminal 84 and earth
OK: Accelerator pedal fully released: 0.3 – 1.0 V
Accelerator pedal fully depressed: 4.5 – 5.5 V
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between throttle position sensor and the engine-ECU, and repair if necessary.
OK
Check the following connector: C-90
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

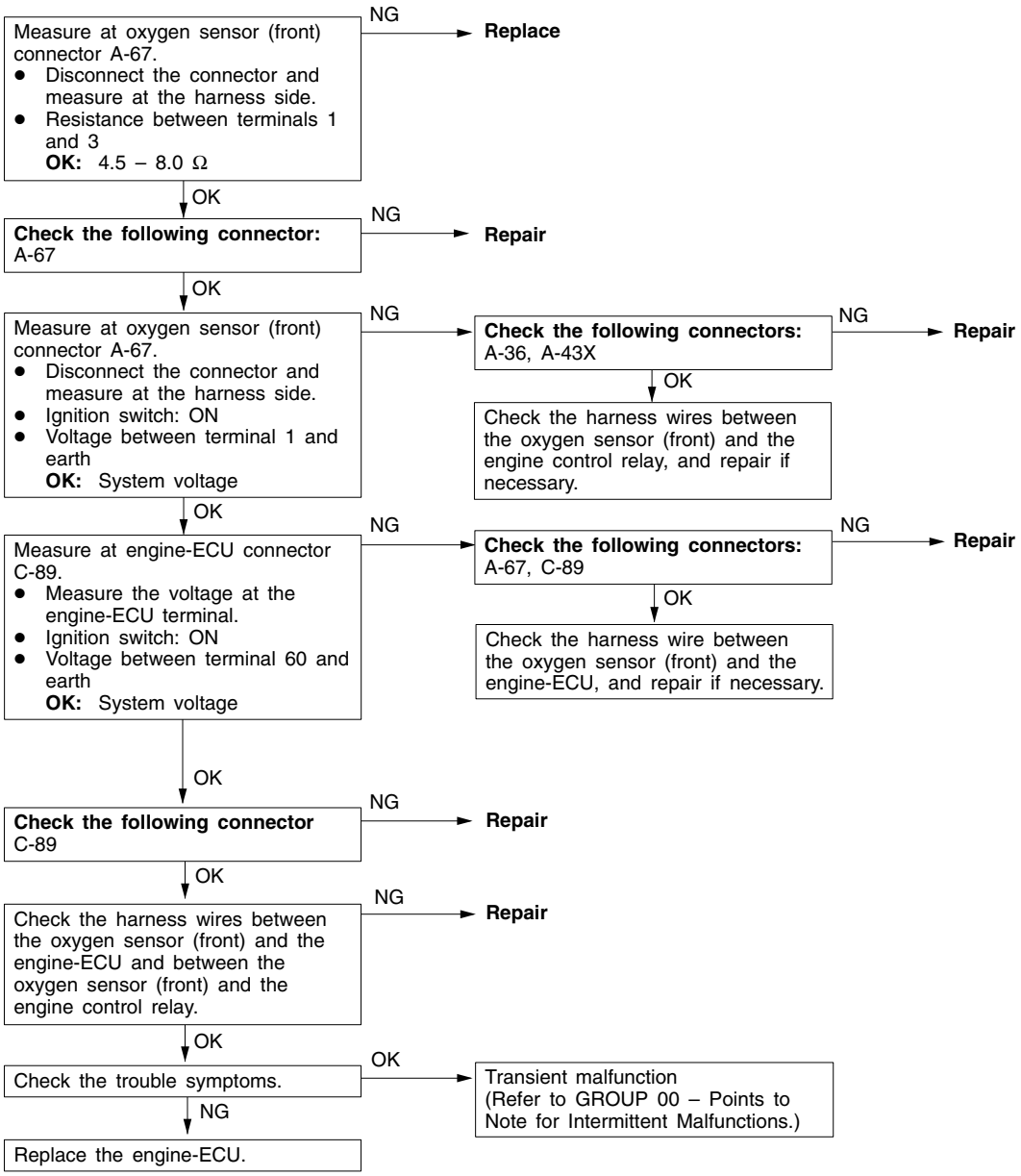
Code No. P0125 Feedback system	Probable cause
Range of Check • The engine coolant temperature is approx. 80°C or more. • During stoichiometric feedback control • The vehicle is not being decelerated. Set Conditions • Oxygen sensor (front) output voltage has been higher or lower than 0.5 V for at least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



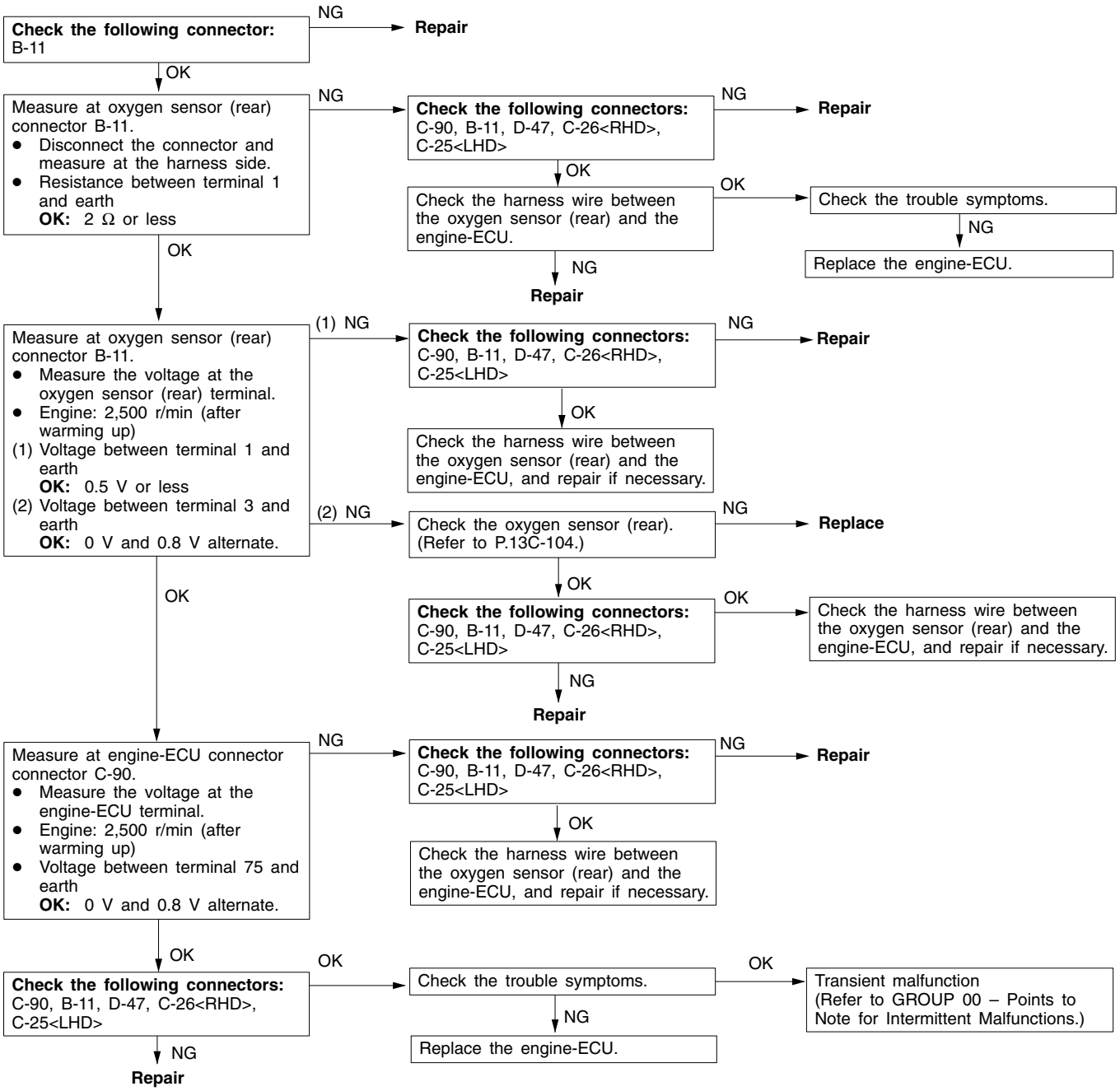
Code No. P0130 Oxygen sensor (front) system <sensor 1>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Engine speed is 1,200 r/min or more ● Driving on a level surface at constant speed. Set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



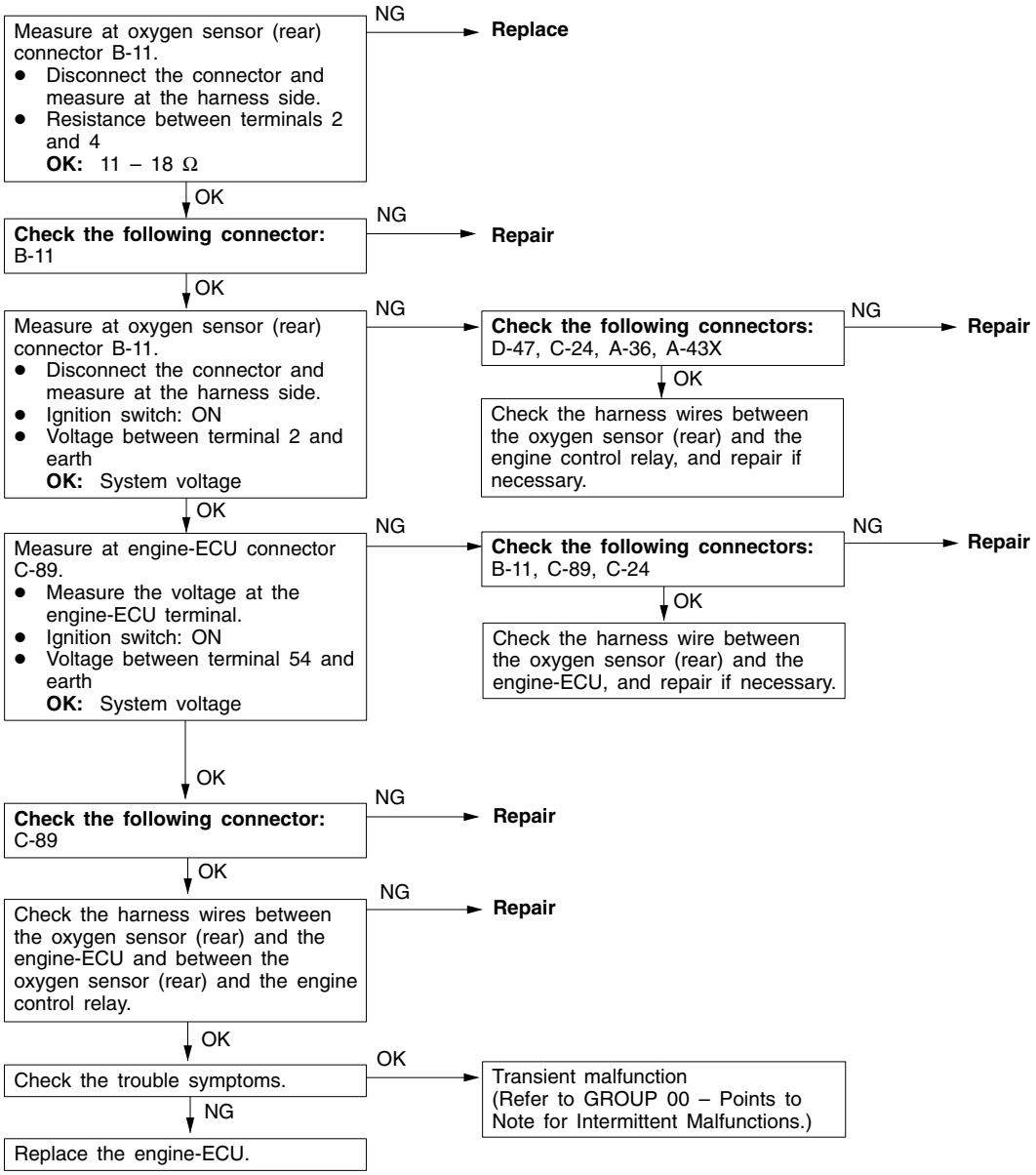
Code No. P0135 Oxygen sensor heater (front) system <sensor 1>	Probable cause
Range of Check ● The engine coolant temperature is approx. 20°C or more. ● The oxygen sensor heater (front) remains on. ● The engine speed is 50 r/min or more. ● Battery voltage is 11 – 16 V. Set Conditions ● The current, which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



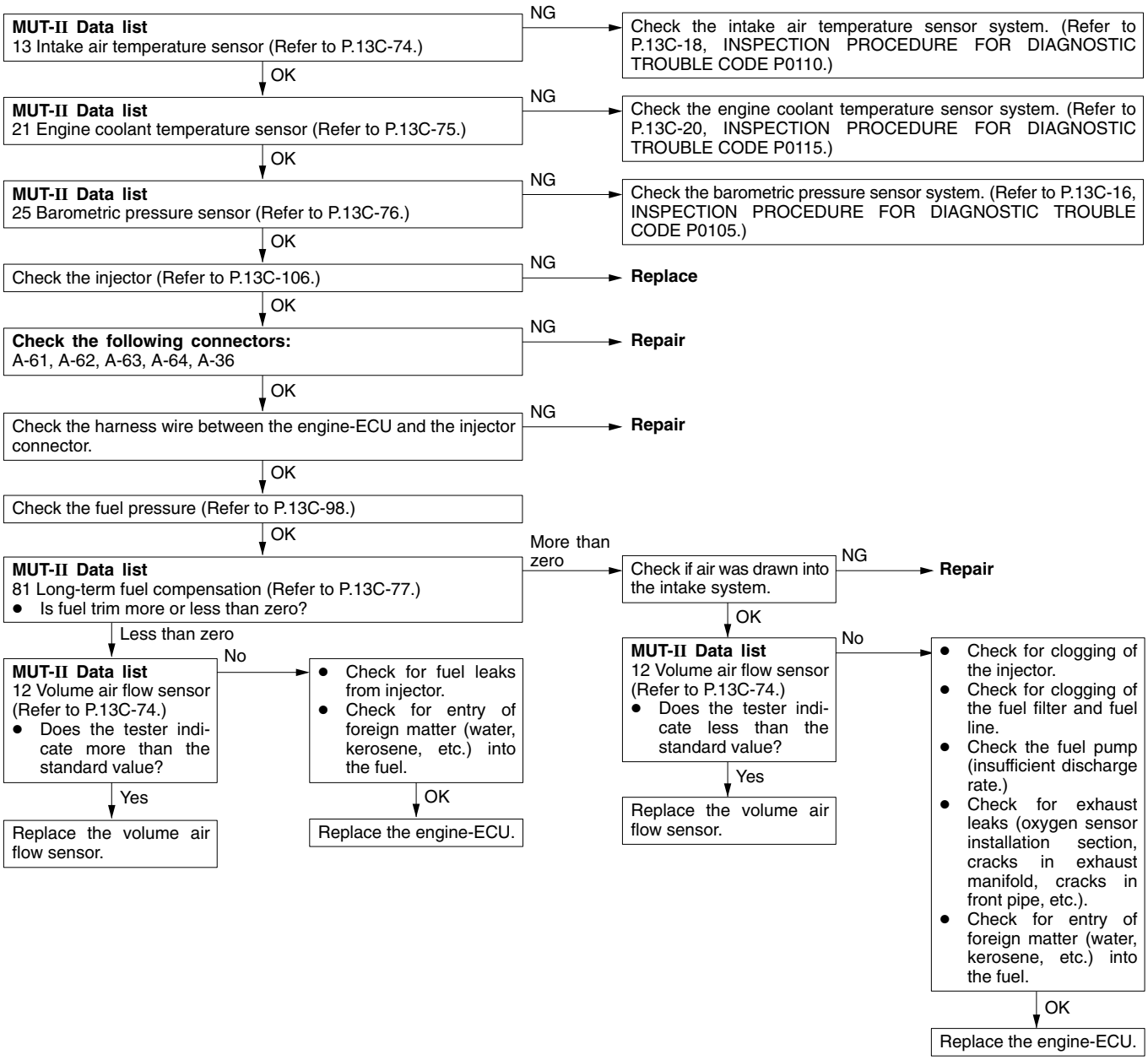
Code No. P0136 Oxygen sensor (rear) system <sensor 2>	Probable cause
Range of Check ● Three minutes have been passed since the engine has been started. ● The engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is 1,200 r/min or more ● Driving on a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



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



Code No. P0170 Abnormal fuel system	Probable cause
Range of Check ● Engine: Being learning the air-fuel ratio Set Conditions ● Ten seconds or more have been passed while the fuel injection amount compensation value is too low. or ● Ten seconds or more have been passed while the fuel injection amount compensation value is too high.	● Incorrect fuel pressure ● 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



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 ● Engine speed is approx. 50 – 1,000 r/min ● The throttle position sensor output voltage is 1.15 V or less. ● Actuator test by MUT-II is not carried out. Set Conditions ● Surge voltage of injector coil is not detected for 4 seconds.	● Malfunction of the injector ● Improper connector contact, open circuit or short-circuited harness wire of the injector circuit ● Malfunction of engine-ECU

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

Check the following connectors:
A-61, A-62, A-63, A-64
→ NG: **Repair**
↓ OK

Check the injector. (Refer to P.13C-106.)
→ NG: **Replace**
↓ OK

Measure at the injector connector A-61, A-62, A-63, A-64.
● Disconnect the connector, and measure at the harness side.
● Voltage between 1 and earth (Ignition switch: ON)
OK: System voltage
→ NG: Check the harness wire between the engine control relay and the injector connector, and repair if necessary.
↓ OK

Check the following connector: C-87
→ NG: **Repair**
↓ OK

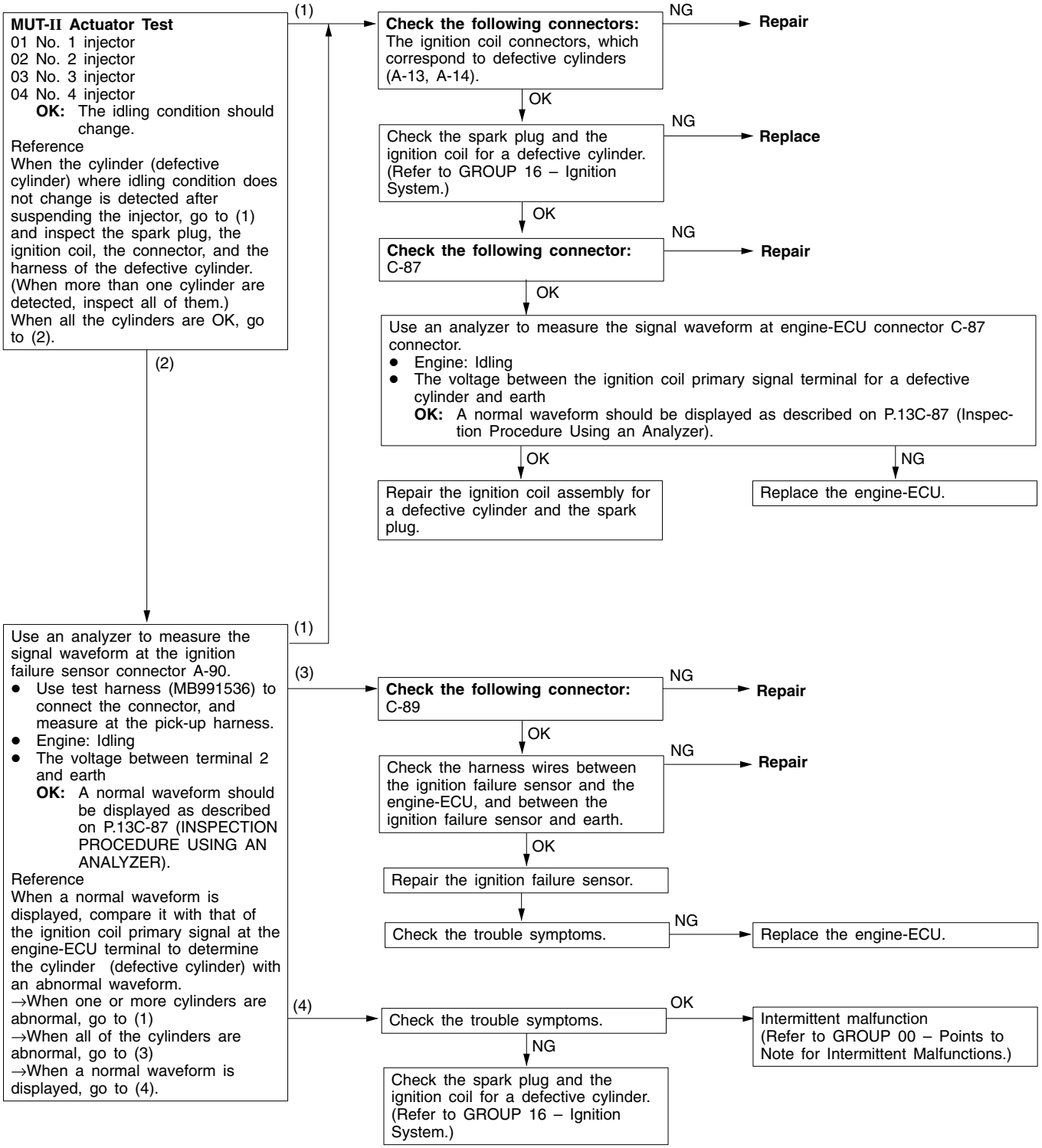
Measure at the engine-ECU connector C-87.
● Disconnect the connector, and measure at the harness side.
● Voltage between 1, 2, 14, 15 and earth (Ignition switch: ON)
OK: System voltage
→ NG: Check the harness wire between the engine-ECU and the injector connector, and repair if necessary.
↓ OK

Check the trouble symptoms.
↓ NG

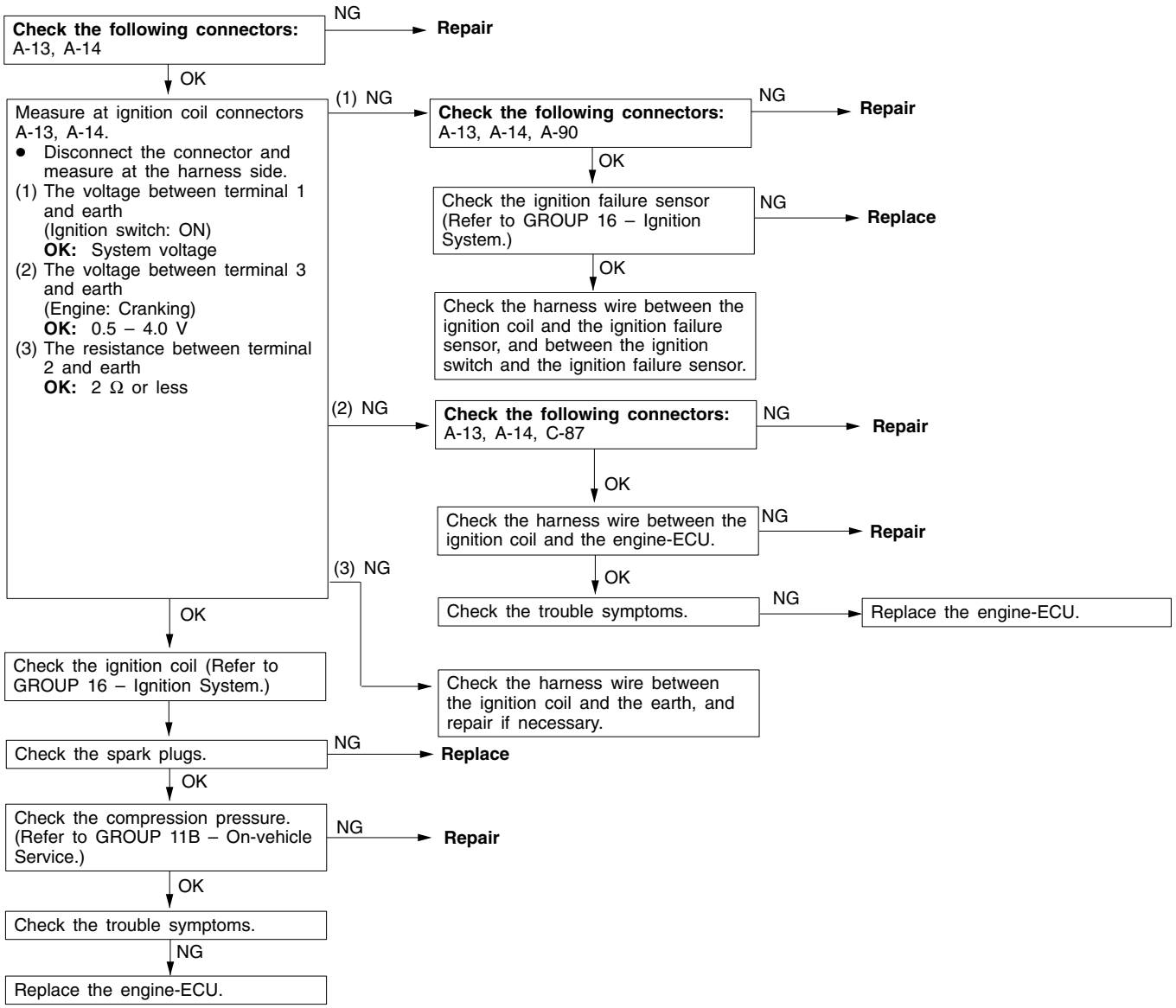
Use an analyzer to measure the signal waveform at injector connector A-61, A-62, A-63, A-64.
● Use a test harness (MB991348) to connect the connector, and measure at the pick-up harness side.
● Engine: Idling
● The voltage between terminal 2 and earth
OK: A normal waveform should be displayed as described on P.13C-87 (INSPECTION PROCEDURE USING AN ANALYZER).
→ OK: Intermittent malfunction (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
↓ NG

Replace the engine-ECU.

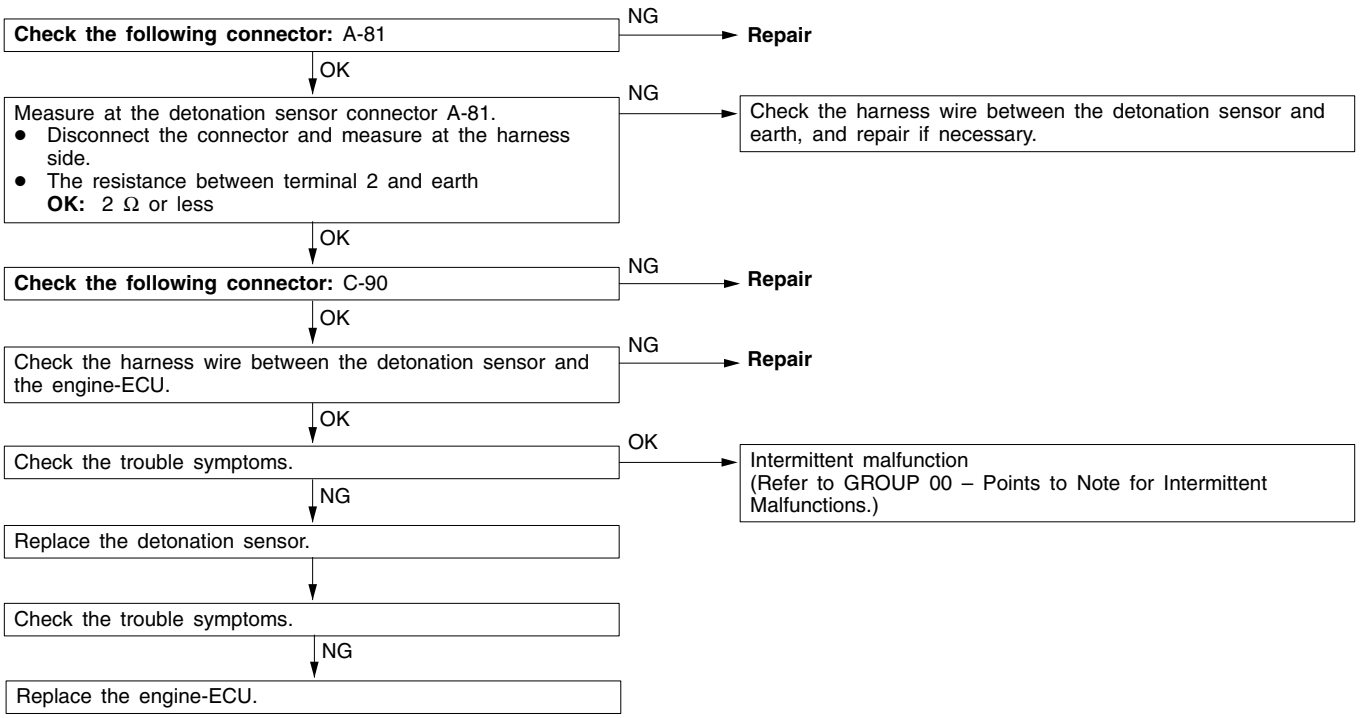
Code No. P0300 Ignition coil (power transistor) system	Probable cause
Range of Check ● Engine speed is approx. 50 – 4,000 r/min. ● Engine is not cranking. Set Conditions ● The ignition failure sensor does not send a signal about a certain cylinder for 4 seconds.	● Malfunction of the ignition coil ● Malfunction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



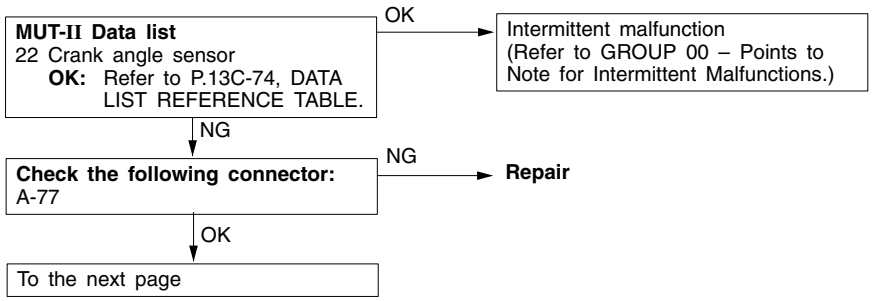
Code No. P0301 No. 1 cylinder misfire detected **Code No. P0302 No. 2 cylinder misfire detected** **Code No. P0303 No. 3 cylinder misfire detected** **Code No. P0304 No. 4 cylinder misfire detected**	**Probable cause**
Range of Check ● The engine speed is 500 – 4,500 r/min. ● While the engine is running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

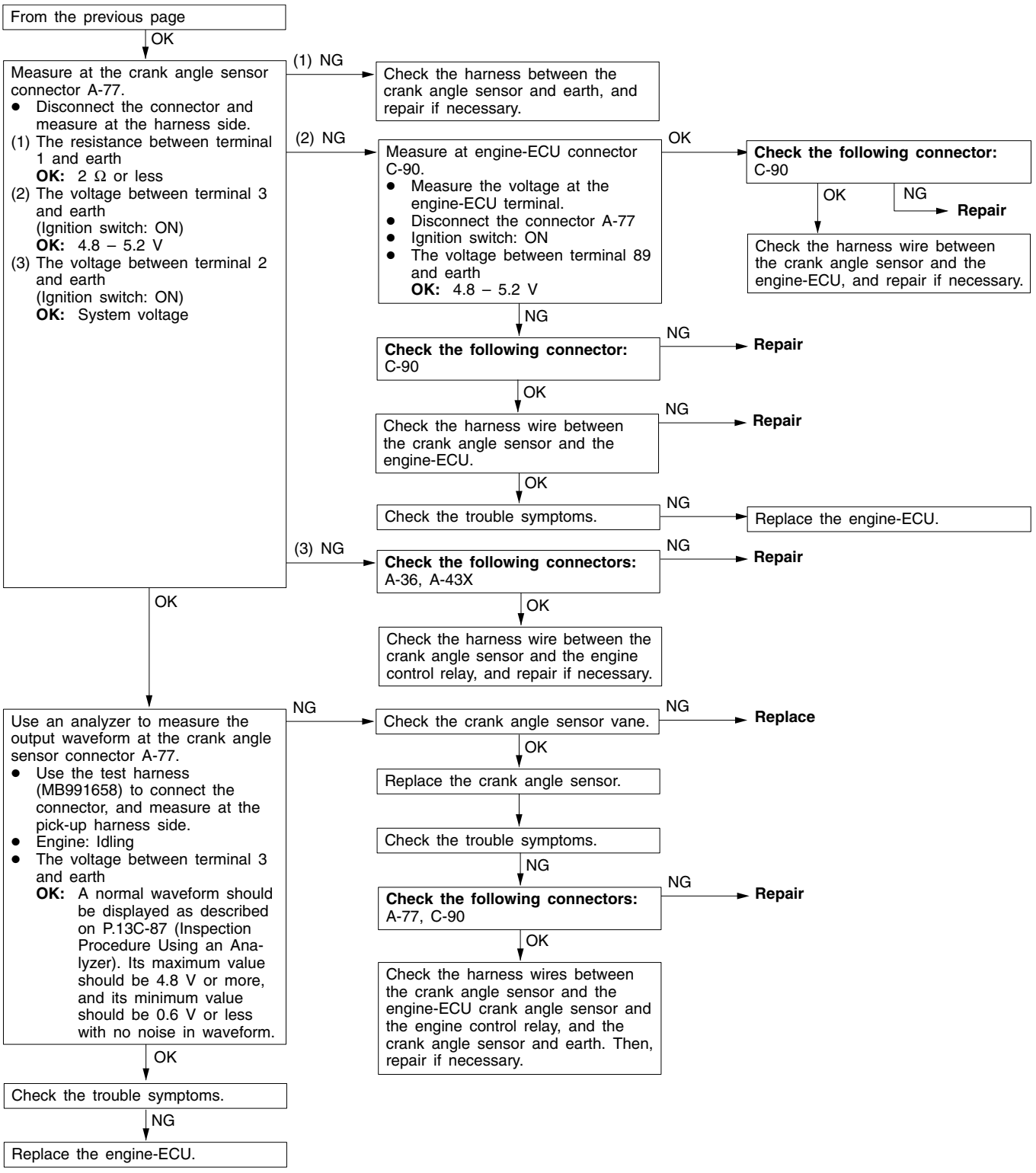


Code No. P0325 Detonation sensor system	Probable cause
Range of Check • Engine: Two seconds after the engine has been started Set Conditions • Changes in sensor output voltage (detonation sensor peak voltage per 1/2 crankshaft rotation) in 200 consecutive cycles are 0.06 V or less.	• Malfunction of the detonation sensor • Open or short circuit in the detonation sensor circuit or loose connector contact • Malfunction of engine-ECU

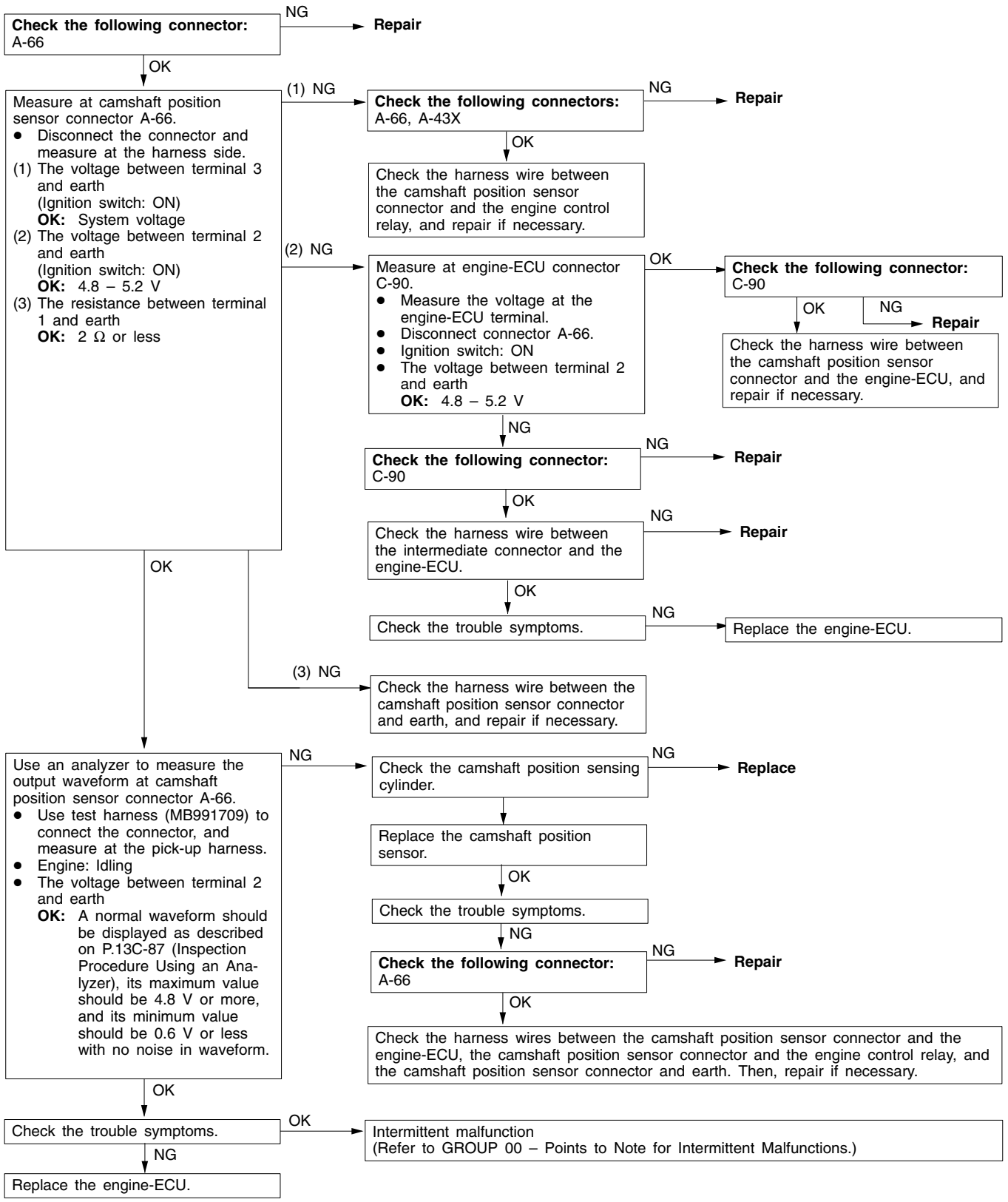


Code No. P0335 Crank angle sensor system	Probable cause
Range of Check • Engine is cranking Set Conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input).	• Malfunction of the crank angle sensor. • Open or short circuit in the crank angle sensor circuit or loose connector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

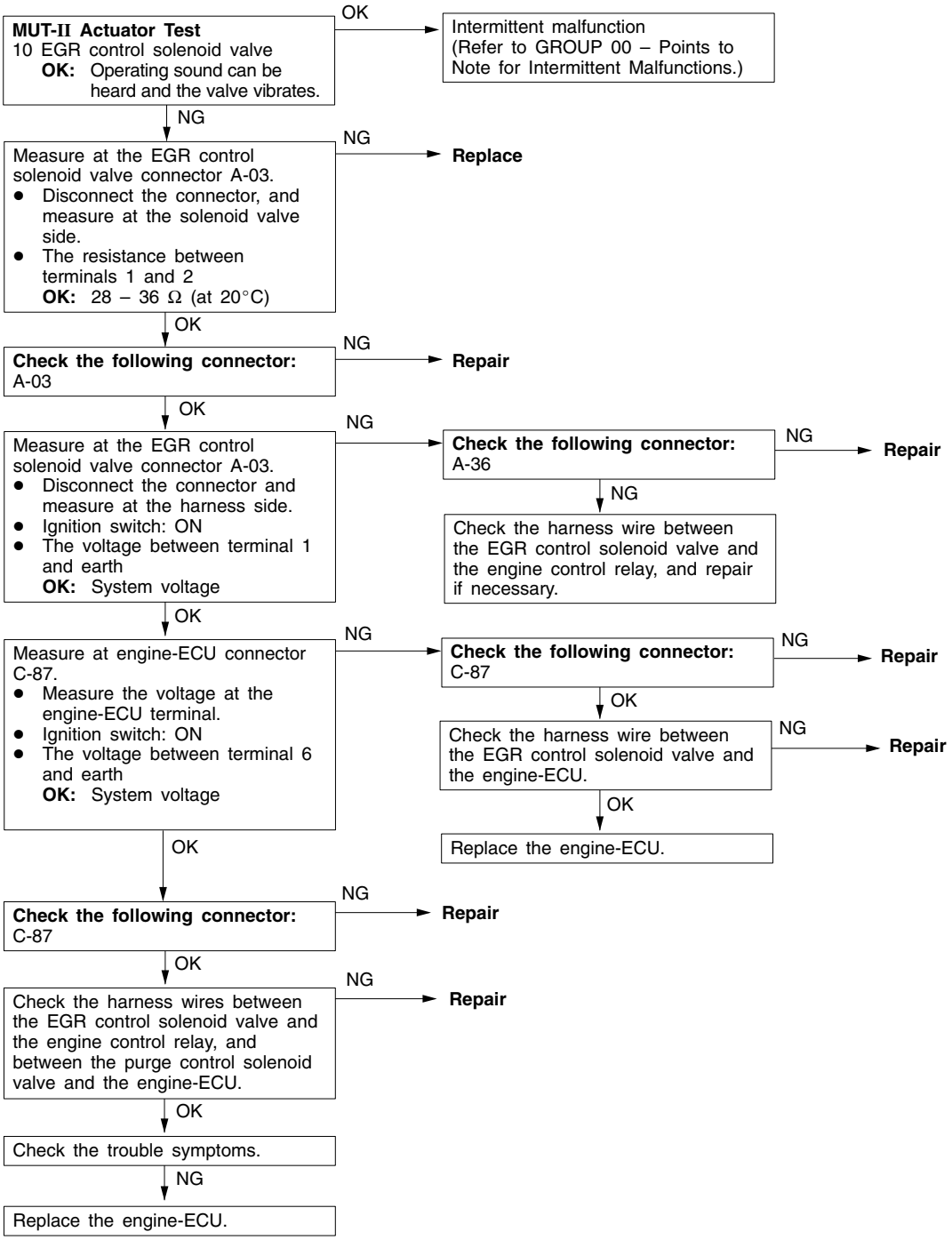



From the previous page
OK
Measure at the crank angle sensor connector A-77.
● Disconnect the connector and measure at the harness side.
(1) The resistance between terminal 1 and earth
OK: 2 Ω or less
(2) The voltage between terminal 3 and earth
(Ignition switch: ON)
OK: 4.8 – 5.2 V
(3) The voltage between terminal 2 and earth
(Ignition switch: ON)
OK: System voltage
(1) NG
Check the harness between the crank angle sensor and earth, and repair if necessary.
(2) NG
Measure at engine-ECU connector C-90.
● Measure the voltage at the engine-ECU terminal.
● Disconnect the connector A-77
● Ignition switch: ON
● The voltage between terminal 89 and earth
OK: 4.8 – 5.2 V
OK
Check the following connector: C-90
OK
NG
Repair
Check the harness wire between the crank angle sensor and the engine-ECU, and repair if necessary.
NG
Check the following connector: C-90
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.
(3) NG
Check the following connectors: A-36, A-43X
NG
Repair
OK
Check the harness wire between the crank angle sensor and the engine control relay, and repair if necessary.
OK
Use an analyzer to measure the output waveform at the crank angle sensor connector A-77.
● Use the test harness (MB991658) to connect the connector, and measure at the pick-up harness side.
● Engine: Idling
● The voltage between terminal 3 and earth
OK: A normal waveform should be displayed as described on P.13C-87 (Inspection Procedure Using an Analyzer). Its maximum value should be 4.8 V or more, and its minimum value should be 0.6 V or less with no noise in waveform.
NG
Check the crank angle sensor vane.
NG
Replace
OK
Replace the crank angle sensor.
Check the trouble symptoms.
NG
Check the following connectors: A-77, C-90
NG
Repair
OK
Check the harness wires between the crank angle sensor and the engine-ECU crank angle sensor and the engine control relay, and the crank angle sensor and earth. Then, repair if necessary.
OK
Check the trouble symptoms.
NG
Replace the engine-ECU.

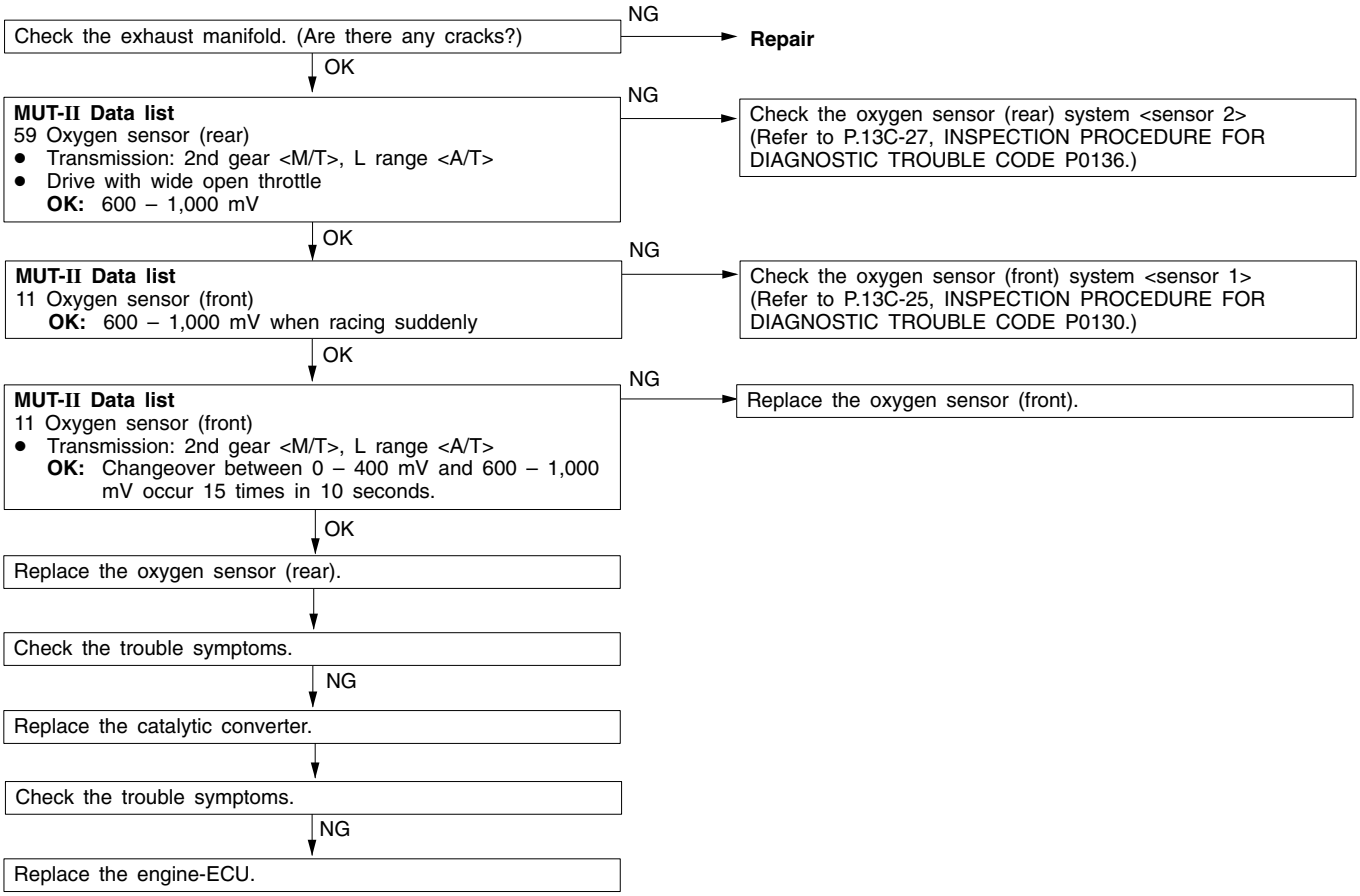
Code No. P0340 Camshaft position sensor system	Probable cause
Range of Check • After the engine was started Set Conditions • The sensor output voltage does not change for 4 seconds (no pulse signal input).	• Malfunction of the camshaft position sensor • Open or short circuit in the camshaft position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



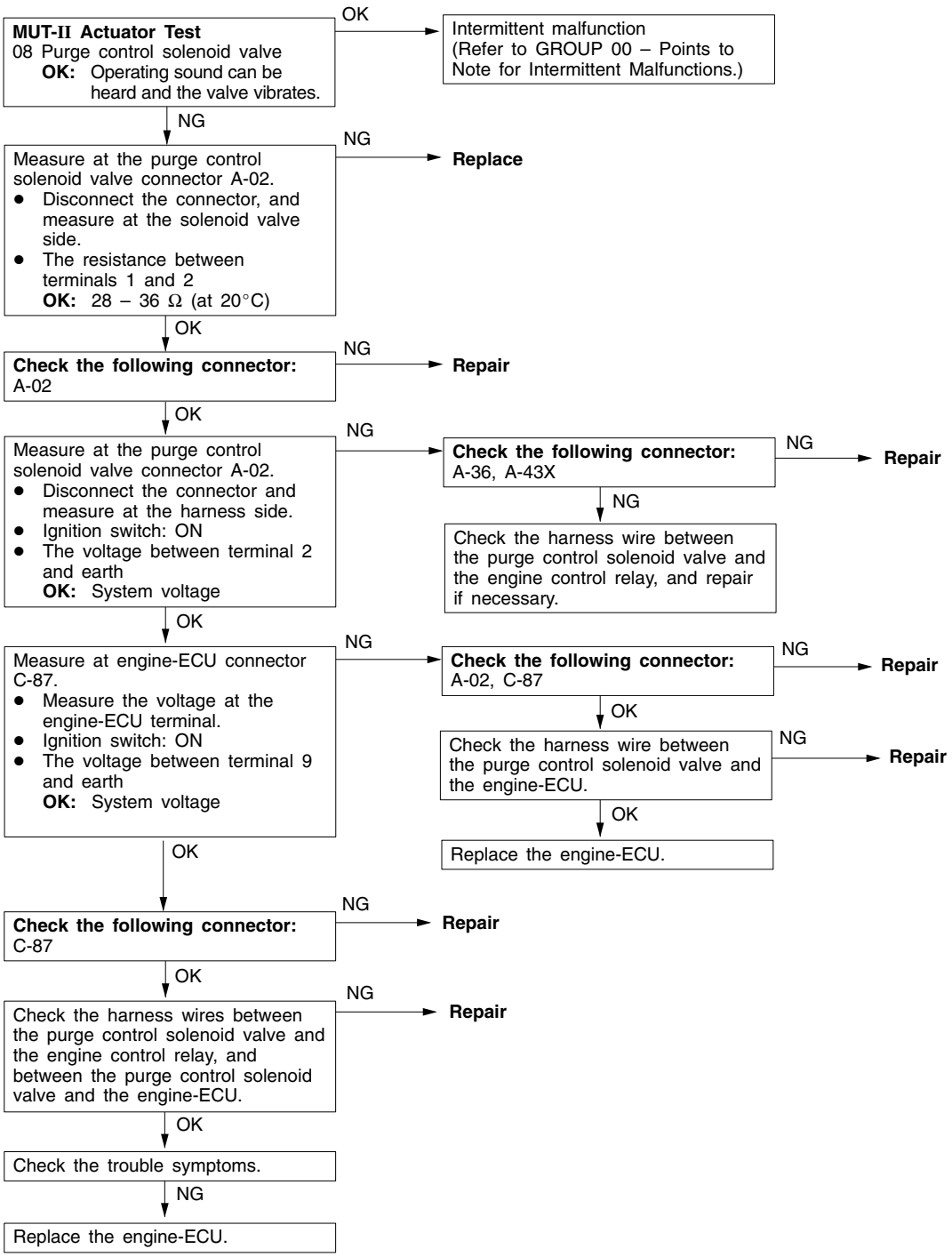
Code No. P0403 EGR control solenoid valve system	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage is 10 V or more. Set Conditions ● The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off.	● Malfunction of the EGR control solenoid valve ● Open or short circuit in the EGR control solenoid valve circuit or loose connector contact ● Malfunction of engine-ECU



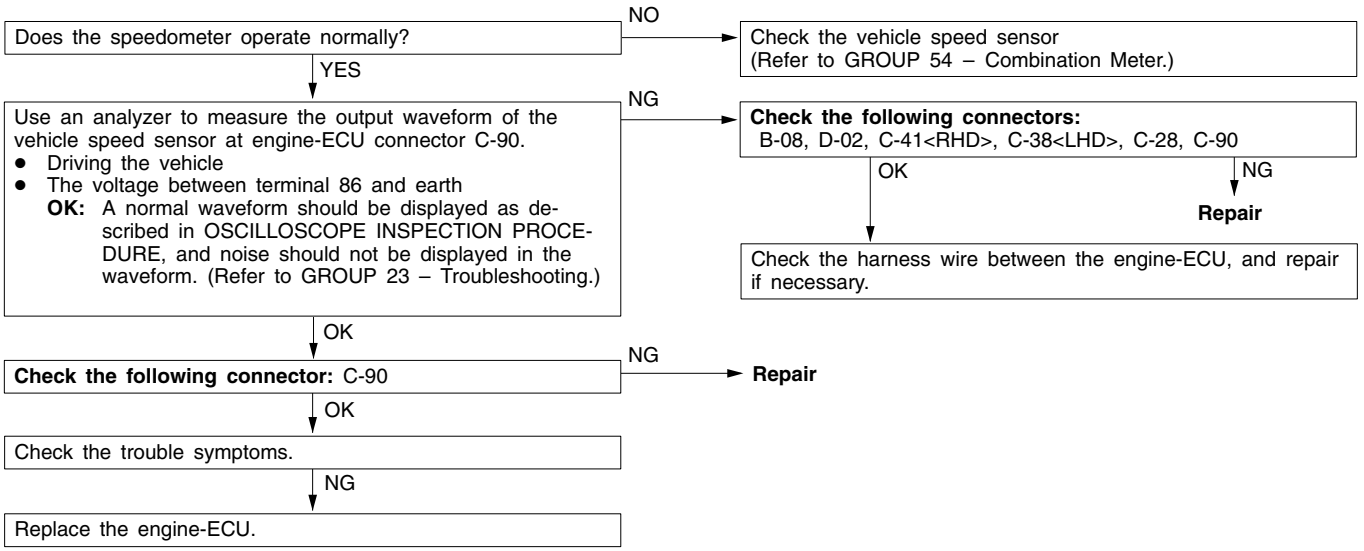
Code No. P0420 Catalyst malfunction	Probable cause
Range of Check • The engine speed is 3,000 r/min or less. • During driving • During air/fuel ratio feedback control Set Conditions • The ratio between the oxygen sensor (rear) and the oxygen sensor (front) output frequencies reaches 0.8 per 12 seconds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



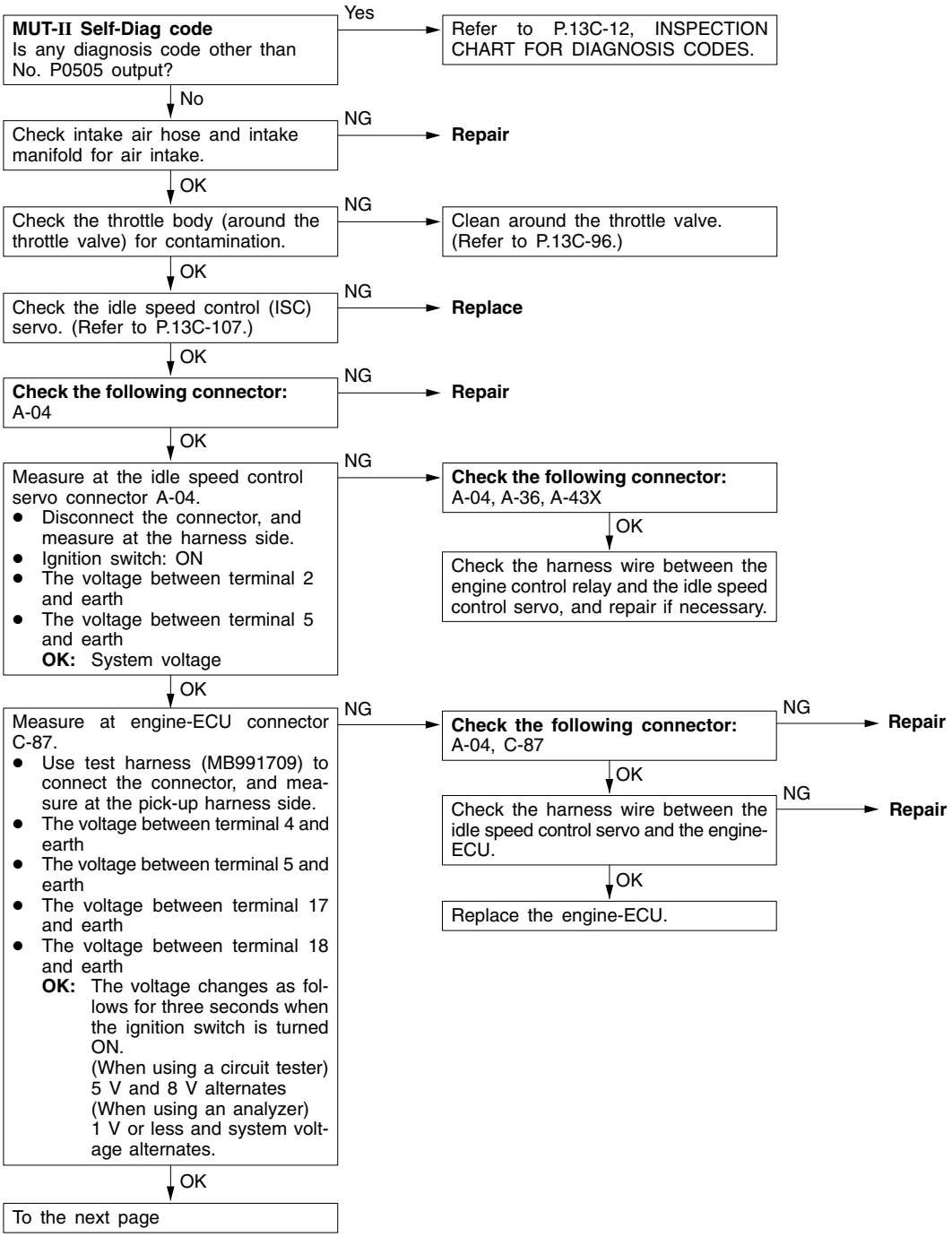
Code No. P0443 Purge control solenoid valve system	Probable cause
Range of Check ● Ignition switch: ON ● Battery voltage is 10 V or more. Set Conditions ● The solenoid coil surge voltage (battery voltage + 2 V) is not detected when the purge control solenoid valve is turned from on to off.	● Malfunction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

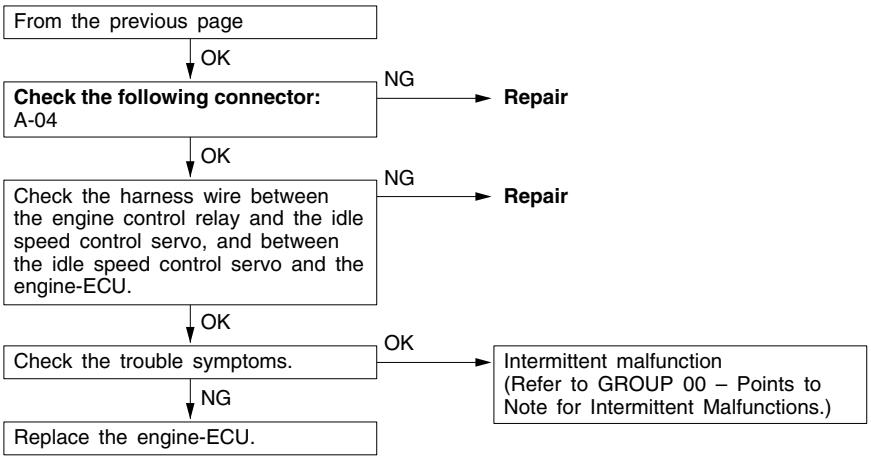


Code No. P0500 Vehicle speed sensor system	Probable cause
Range of Check ● Engine: Two seconds after the engine was started ● Idle switch: OFF ● Engine speed: 2,500 r/min or more ● During high engine load Set Conditions ● The sensor output voltage does not change for 4 seconds (no pulse signal input).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

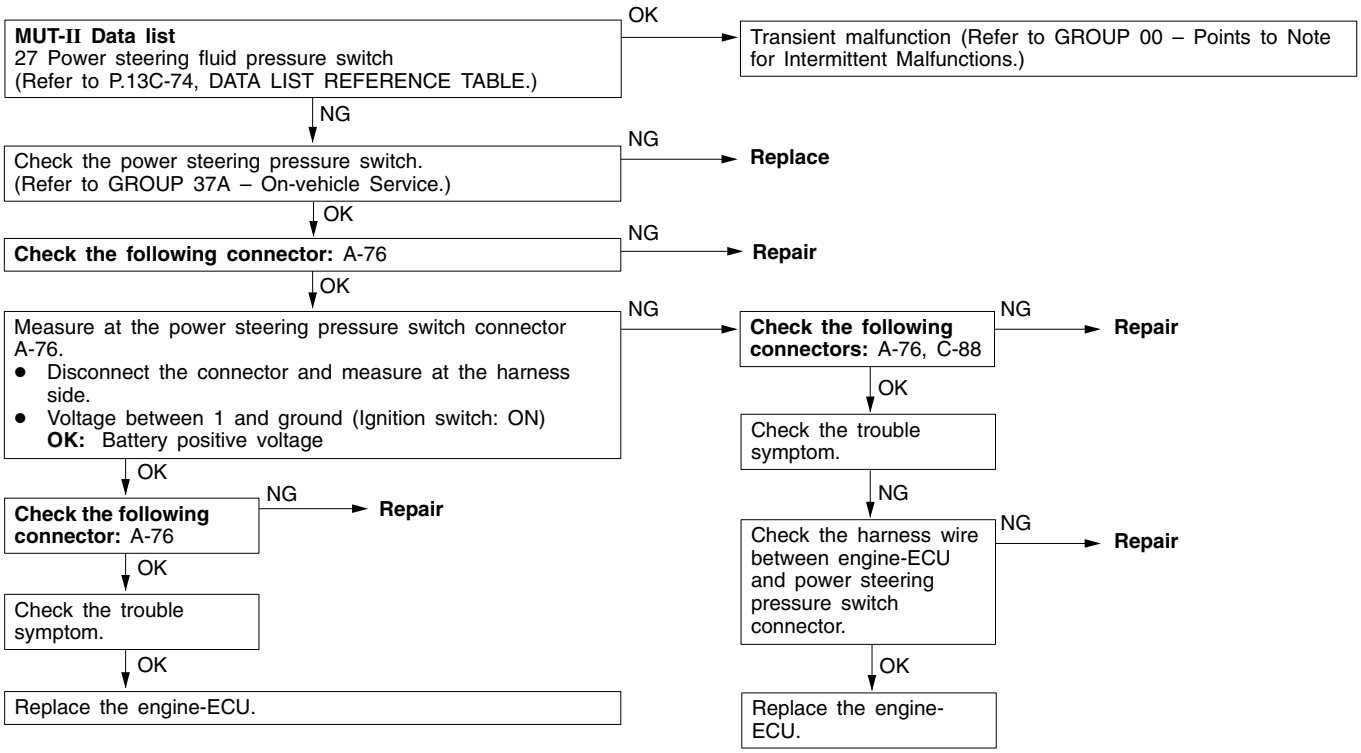


Code No. P0505 Idle speed control (ISC) system	Probable cause
Check Area ● Vehicle speed has reached 1.5 km/h at least once. ● Under the closed loop idle speed control. Judgment Criteria ● Actual idle speed has continued to be higher than the target idle speed by 300 r/min or more for 10 sec. Check Area ● 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 or more. Judgment Criteria ● Actual idle speed has been minimum 200 r/min higher than the target idle speed for 10 seconds. Check Area ● 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 temperature is –10°C or more. ● Volume efficiency is 40 percent or lower. ● Barometric pressure is 76 kPa or higher. Judgment Criteria ● Actual idle speed has been minimum 100 r/min higher than the target idle speed for 10 seconds.	● Malfunction of idle speed control (ISC) servo ● Improper connector contact, open circuit or short-circuit harness wire ● Malfunction of engine-ECU

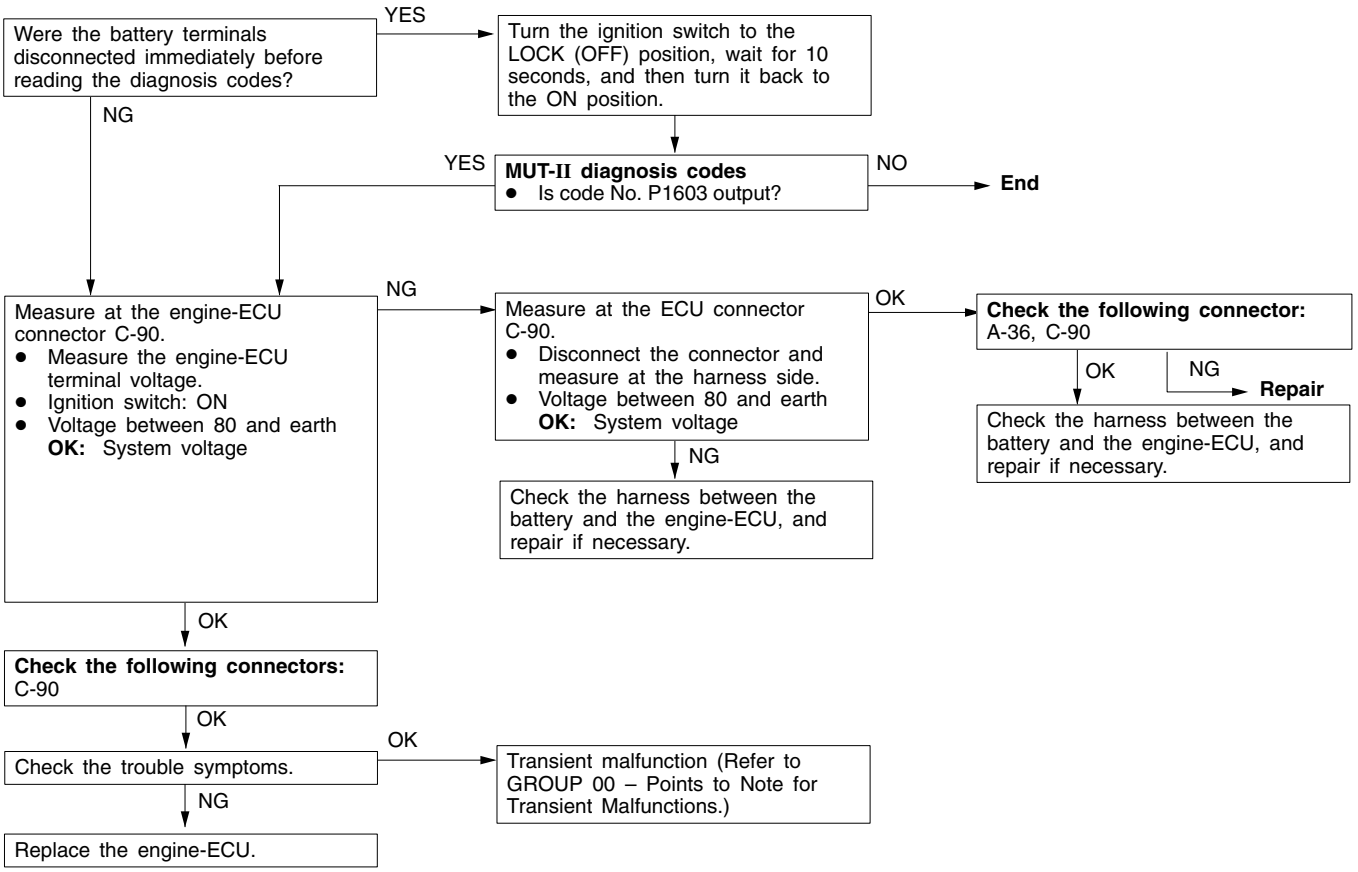

MUT-II Self-Diag code
Is any diagnosis code other than No. P0505 output?
Yes
Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No
Check intake air hose and intake manifold for air intake.
NG
Repair
OK
Check the throttle body (around the throttle valve) for contamination.
NG
Clean around the throttle valve. (Refer to P.13C-96.)
OK
Check the idle speed control (ISC) servo. (Refer to P.13C-107.)
NG
Replace
OK
Check the following connector:
A-04
NG
Repair
OK
Measure at the idle speed control servo connector A-04.
Disconnect the connector, and measure at the harness side.
Ignition switch: ON
The voltage between terminal 2 and earth
The voltage between terminal 5 and earth
OK: System voltage
NG
Check the following connector:
A-04, A-36, A-43X
OK
Check the harness wire between the engine control relay and the idle speed control servo, and repair if necessary.
OK
Measure at engine-ECU connector C-87.
Use test harness (MB991709) to connect the connector, and measure at the pick-up harness side.
The voltage between terminal 4 and earth
The voltage between terminal 5 and earth
The voltage between terminal 17 and earth
The voltage between terminal 18 and earth
OK: The voltage changes as follows for three seconds when the ignition switch is turned ON.
(When using a circuit tester)
5 V and 8 V alternates
(When using an analyzer)
1 V or less and system voltage alternates.
NG
Check the following connector:
A-04, C-87
NG
Repair
OK
Check the harness wire between the idle speed control servo and the engine-ECU.
NG
Repair
OK
Replace the engine-ECU.
OK
To the next page


From the previous page
OK
Check the following connector:
A-04
NG
Repair
OK
Check the harness wire between the engine control relay and the idle speed control servo, and between the idle speed control servo and the engine-ECU.
NG
Repair
OK
Check the trouble symptoms.
OK
Intermittent malfunction
(Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.)
NG
Replace the engine-ECU.

Code No. P0551 Power Steering fluid Pressure Switch System	Probable cause
Check Area ● Intake air temperature is –10°C or higher. ● Barometric pressure is 76 kPa or higher. ● Engine coolant temperature is 30°C or more. ● Repeat *1 drive and *2 stop ten times or more. *1: Engine speed is 2,500 r/min or higher, volumetric efficiency is 55 % or higher and vehicle speed is 5 km/h or higher for 4 seconds or more. *2: Vehicle speed is 1.5 km/h or lower. Judgment Criteria ● Power steering pressure switch remains on.	● Power steering fluid pressure switch failed. ● Open or shorted power steering fluid pressure switch circuit or loose connector ● Malfunction of engine-ECU

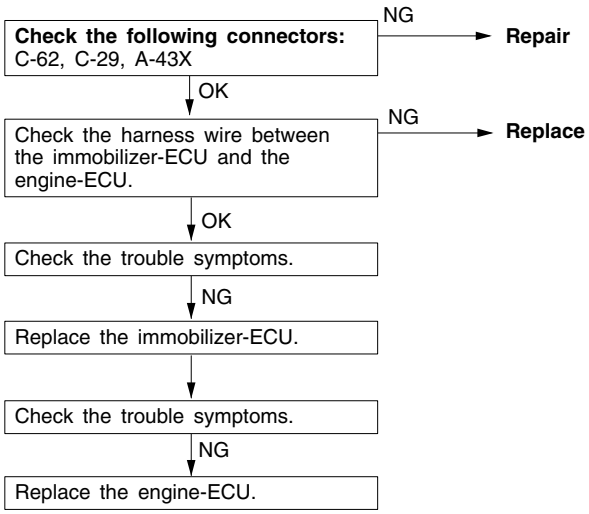


Code No. P1603 Battery backup line system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Backup RAM data which was set when the ignition switch was turned off the previous time has not been retained.	● Open circuit or short-circuit in the battery backup line, or loose connector contact ● Malfunction of the engine-ECU



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

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



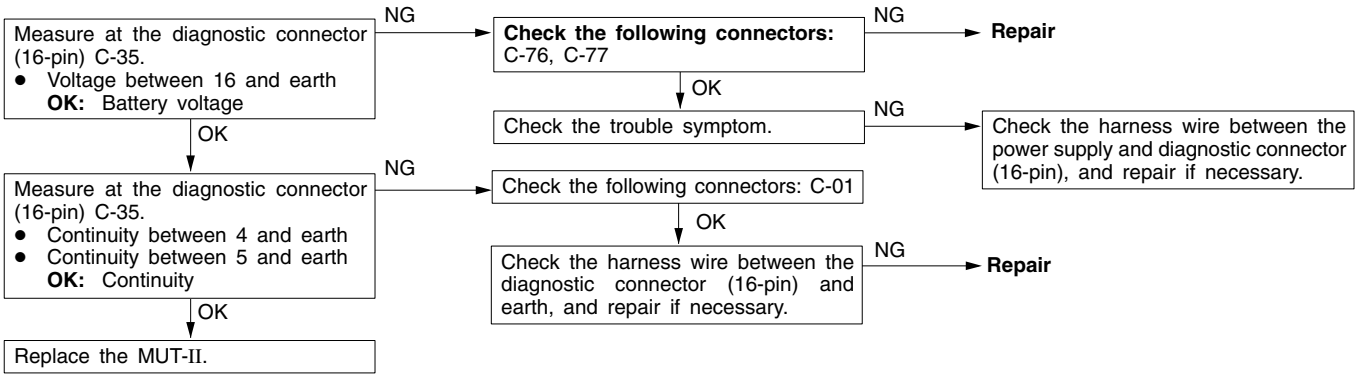
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13C-47
	Communication with engine-ECU only is not possible.	2	13C-47
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	13C48
	The engine warning lamp remains illuminating and never goes out.	4	13C-48
Starting	No initial combustion (starting impossible)	5	13C-49
	Initial combustion but no complete combustion (starting impossible)	6	13C-50
	Long time to start (improper starting)	7	13C-51
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13C-52
	Idling speed is high. (Improper idling speed)	9	13C-54
	Idling speed is low. (Improper idling speed)	10	13C-54
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13C-55
	When the engine becomes hot, it stalls at idling. (Die out)	12	13C-56
	The engine stalls when starting the car. (Pass out)	13	13C-58
	The engine stalls when decelerating.	14	13C-58
Driving	Hesitation, sag or stumble	15	13C-59
	The feeling of impact or vibration when accelerating	16	13C-60
	The feeling of impact or vibration when decelerating	17	13C-60
	Poor acceleration	18	13C-61
	Surge	19	13C-63
	Knocking	20	13C-64
Dieseling		21	13C-64
Too high CO and HC concentration when idling		22	13C-65
Idling speed is improper when A/C is operating		23	13C-66
Fans (radiator fan, A/C condensor fan) are inoperative		24	13C-67

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

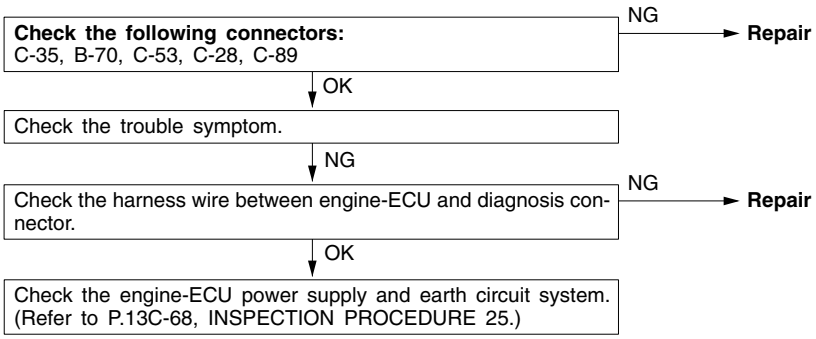
INSPECTION PROCEDURE 1

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



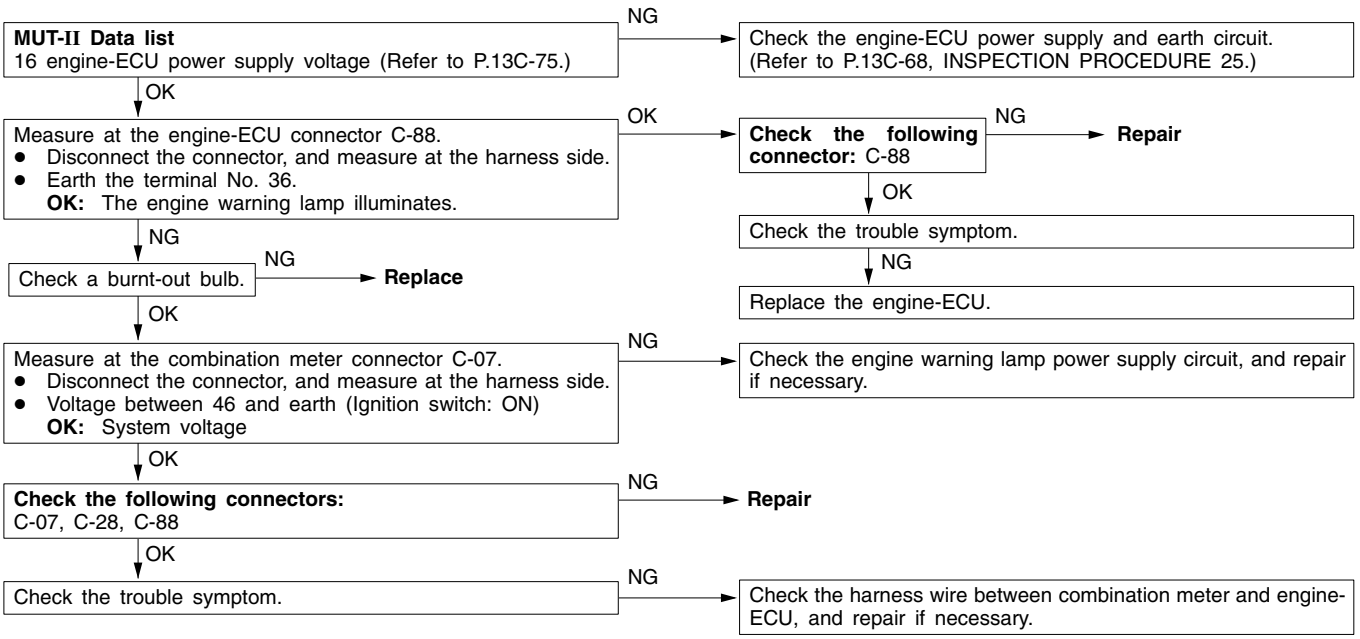
INSPECTION PROCEDURE 2

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



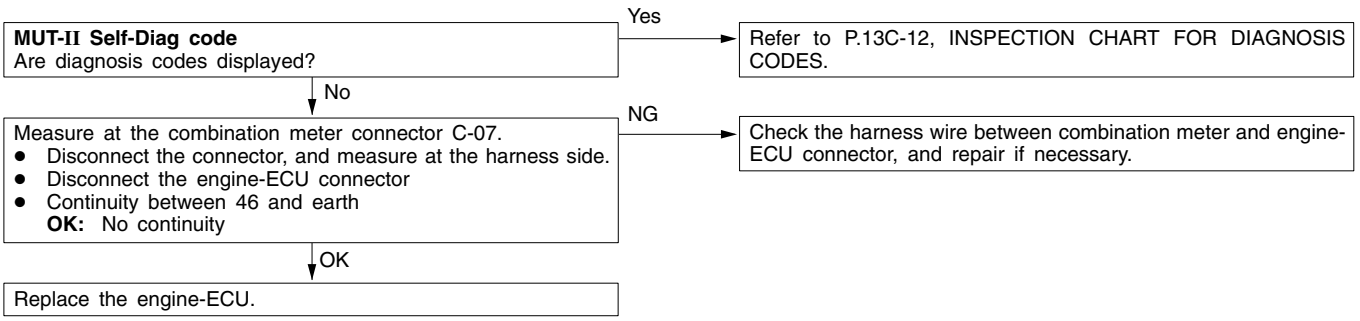
INSPECTION PROCEDURE 3

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



INSPECTION PROCEDURE 4

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



INSPECTION PROCEDURE 5

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

Check battery voltage when cranking.
OK: 8 V or higher
NG → Check the battery. (Refer to GROUP 54 – Battery.)
OK ↓

Is immobilizer-ECU diagnosis code displayed?
Yes → Check the immobilizer. (Refer to GROUP 54 – Ignition Key and Immobilizer.)
No ↓

MUT-II Data list
16 Power supply voltage (Refer to P.13C-75.)
NG → Check the power supply and ignition switch-IG system. (Refer to P.13C-69, INSPECTION PROCEDURE 26.)
OK ↓

Does the camshaft rotate at the engine cranking? (When oil filler cap is removed.)
No → Check timing belt for breakage.
Yes ↓

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Data list
22 Crank angle sensor
OK: Cranking speed is displayed
No → Check the crank angle sensor system. (Refer to P.13A-113, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0335.)
OK ↓

MUT-II Actuator test
07 Fuel pump (Refer to P.13C-79.)
NG → Check the fuel pump system. (Refer to P.13C-69, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

Can any sound be heard from the injectors when cranking?
No → Check the injector system. (Refer to P.13C-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
Yes ↓

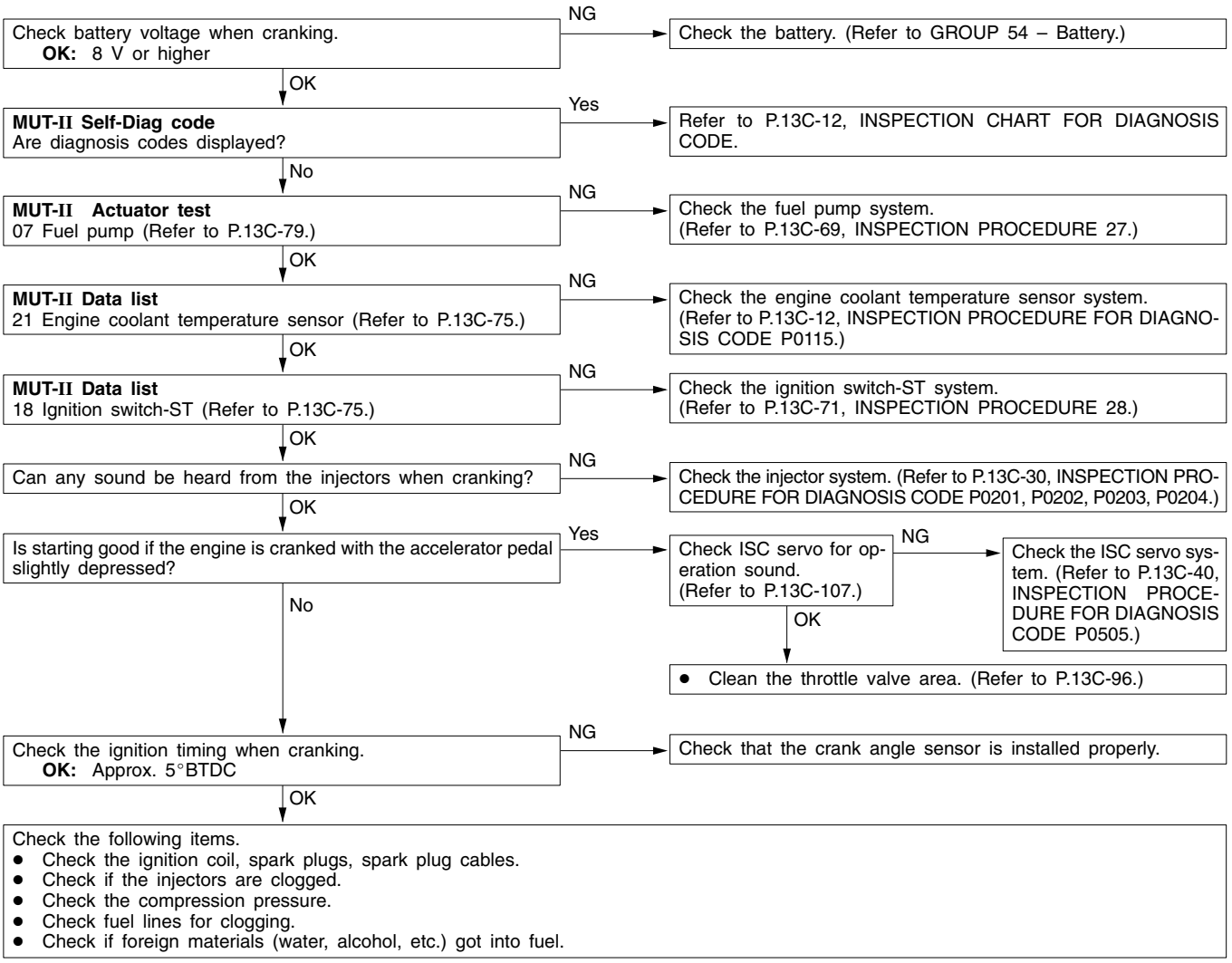
Measure at the ignition coil connectors A-13 and A-14
- Connectors connected
- Check by connecting the timing light to terminal 1 of each connector (Engine: Cranking)
  OK: The timing light flashes.

No → Check the ignition circuit system. (Refer to P.13C-72, INSPECTION PROCEDURE 30.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check if the injectors are clogged.
- Check if foreign materials (water, alcohol, etc.) got into fuel.
- Check the compression pressure.
- Check the immobilizer system.

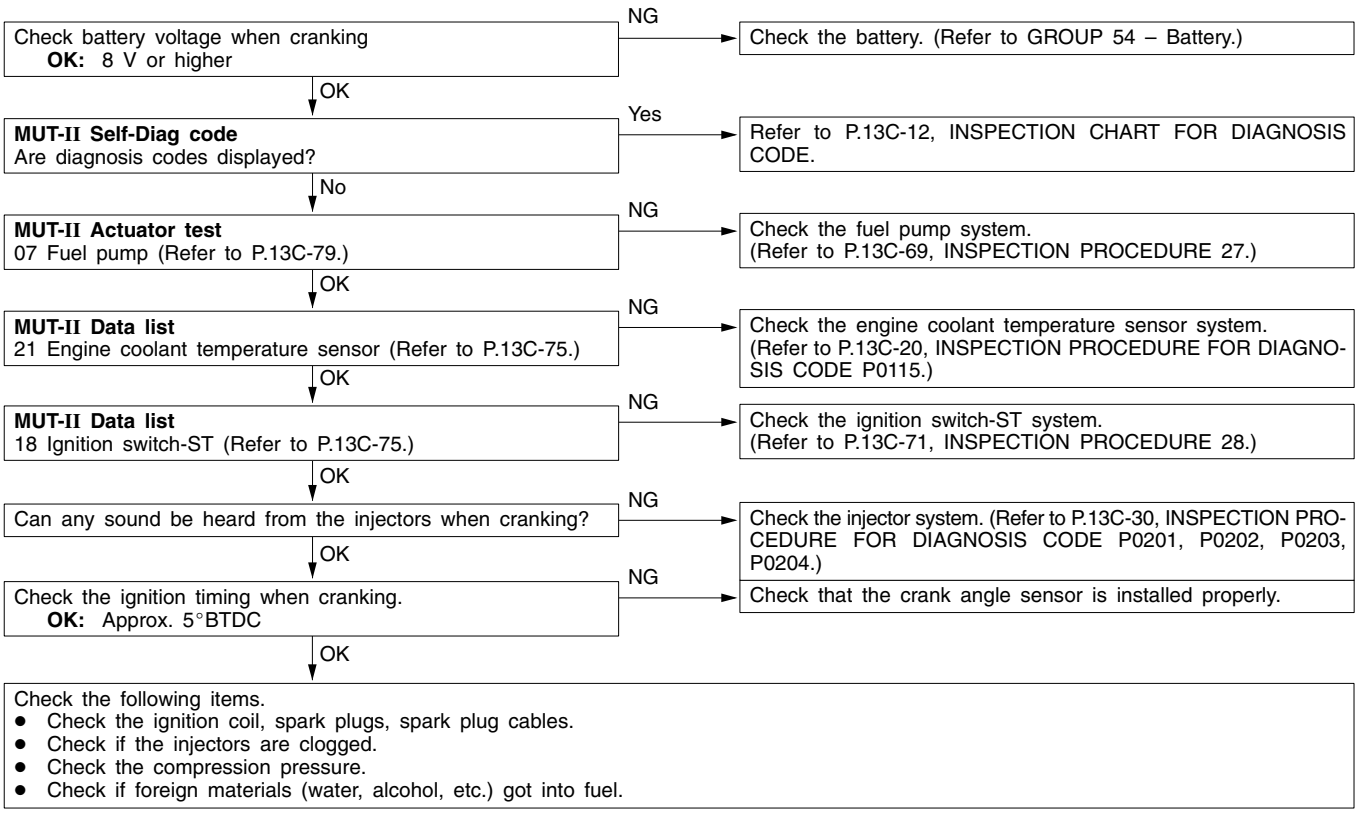
INSPECTION PROCEDURE 6

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



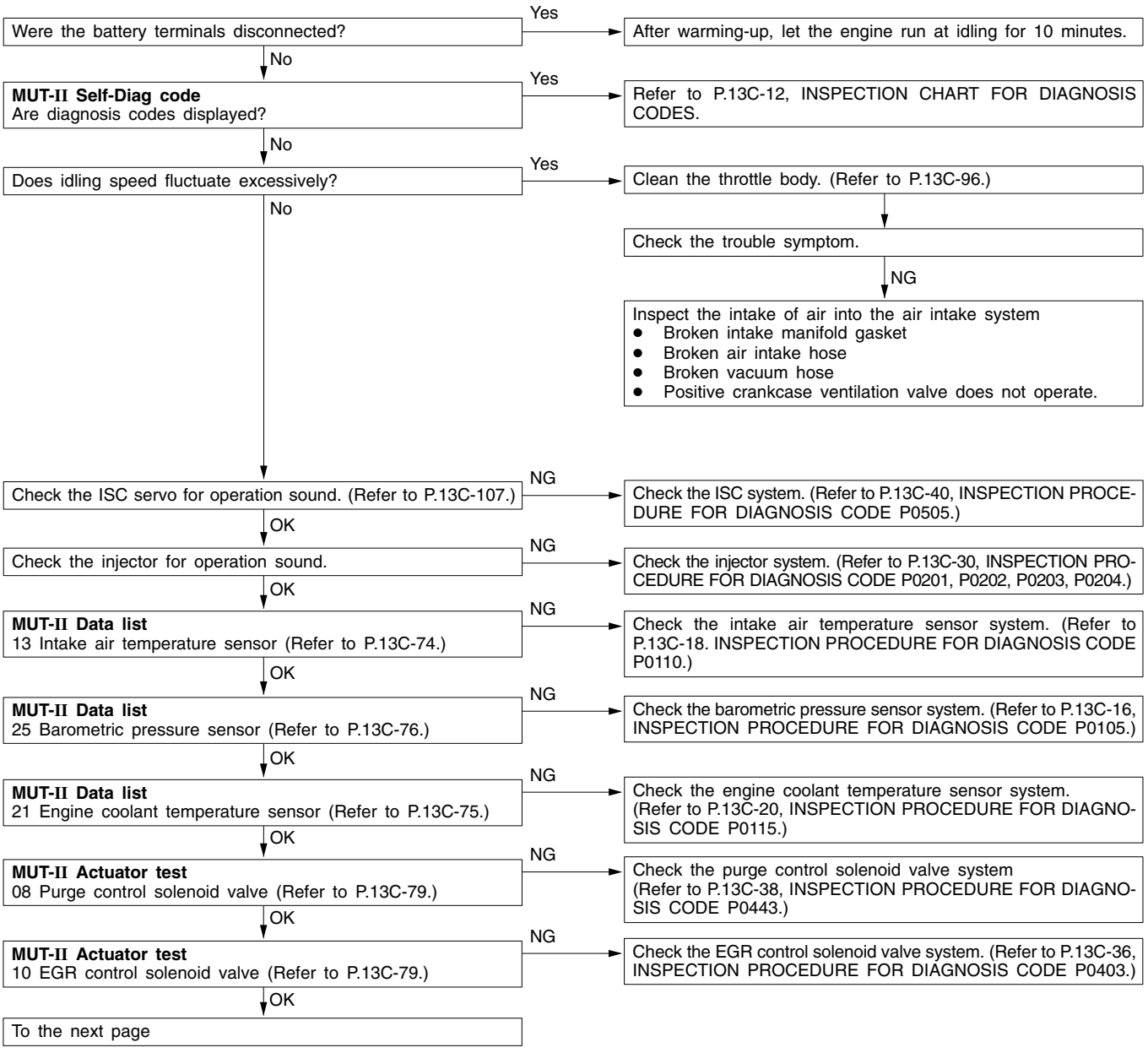
INSPECTION PROCEDURE 7

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



INSPECTION PROCEDURE 8

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



From the previous page

OK

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

OK: 600 – 1,000 mV

NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)

OK

MUT-II Data list
11 Oxygen sensor

OK: 600 – 1,000 mV during sudden racing

NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)

OK

MUT-II Data list
11 Oxygen sensor

OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling

NG → Check the fuel pressure. (Refer to P.13C-98.)

OK → 1. Inspect the intake of air into the air intake system.
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13C-76.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13C-43, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0551.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13C-76.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13C-72, INSPECTION PROCEDURE 29.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13C-76.)

NG → Check the ignition switch-ST. (Refer to P.13C-71, INSPECTION PROCEDURE 28.)

OK

MUT-II Data list
45 ISC Servo position (Refer to P.13C-77.)

NG → Adjust the basic idle speed. (Refer to P.13C-97.)

OK

Check the ignition timing. (Refer to GROUP 11B – On-vehicle Service.)

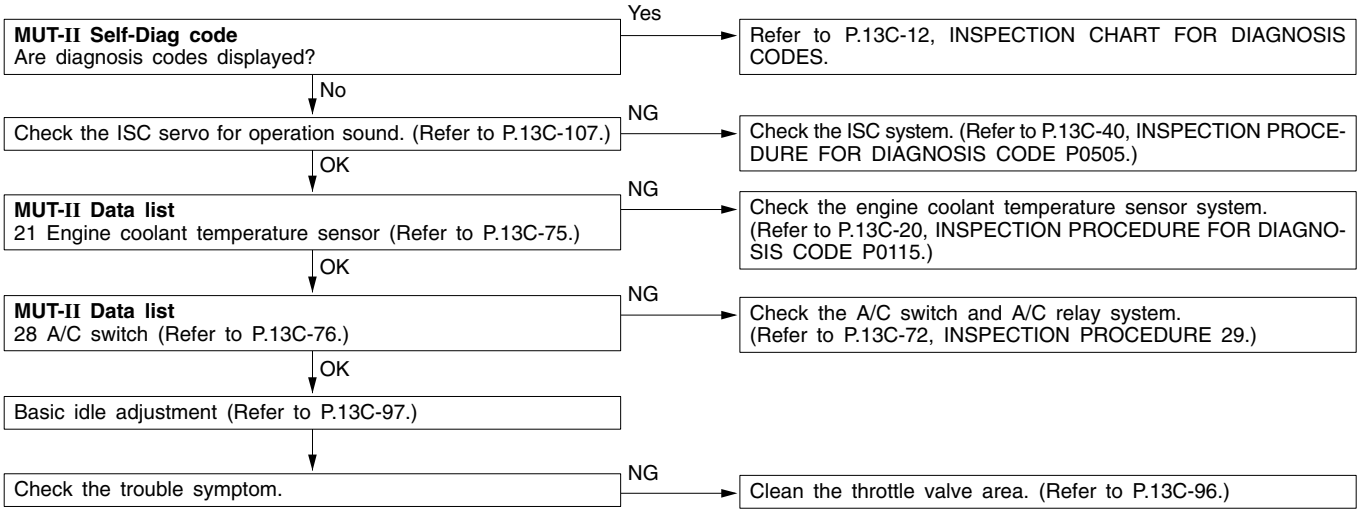
NG → Check that the crank angle sensor is installed properly.

OK

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the purge control system.
- Check the EGR control system.
- Check the compression pressure.
- Check if foreign materials (water, alcohol, etc.) got into fuel.

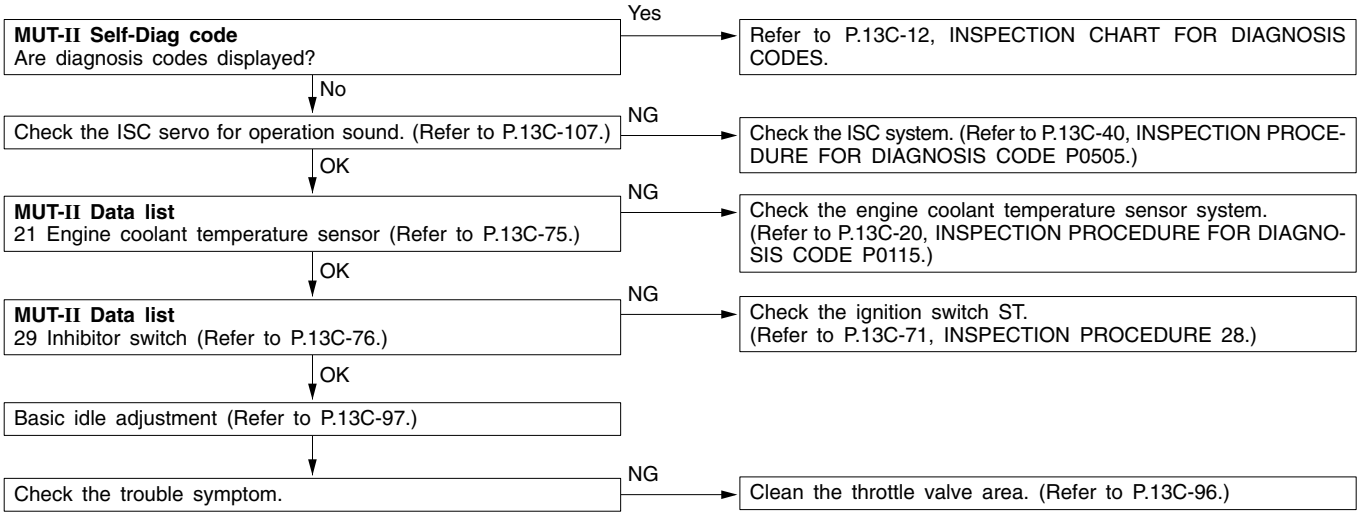
INSPECTION PROCEDURE 9

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



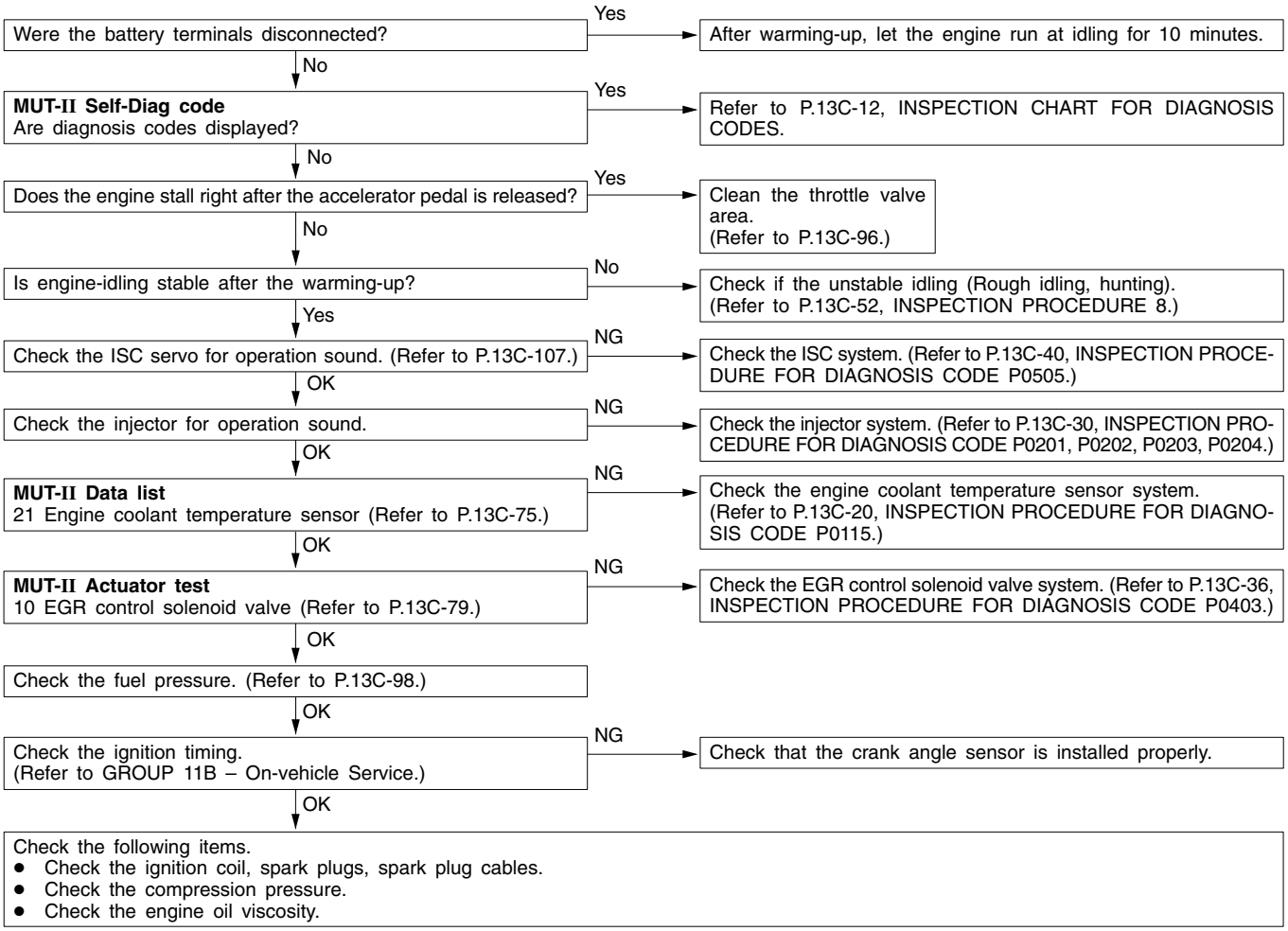
INSPECTION PROCEDURE 10

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



INSPECTION PROCEDURE 11

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



INSPECTION PROCEDURE 12

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

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Check the ISC servo for operation sound. (Refer to P.13C-107.)
- NG → Check the ISC system. (Refer to P.13C-40, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0505.)
- OK ↓

Check the injector for operation sound.
- NG → Check the injector system. (Refer to P.13C-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
- OK ↓

Does the engine stall right after the accelerator pedal is released?
- Yes → Clean the throttle valve area. (Refer to P.13C-96.)
- No ↓

Does the engine stall easily again?
- No → While carrying out an intermittent malfunction simulation test (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.), check for sudden changes in the signals shown below.
  - Crank angle sensor signal
  - Air flow sensor signal
  - Injector drive signal
  - Primary and secondary ignition signal
  - Fuel pump drive signal
  - Engine-ECU power supply voltage
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-74.)
- NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
- OK ↓

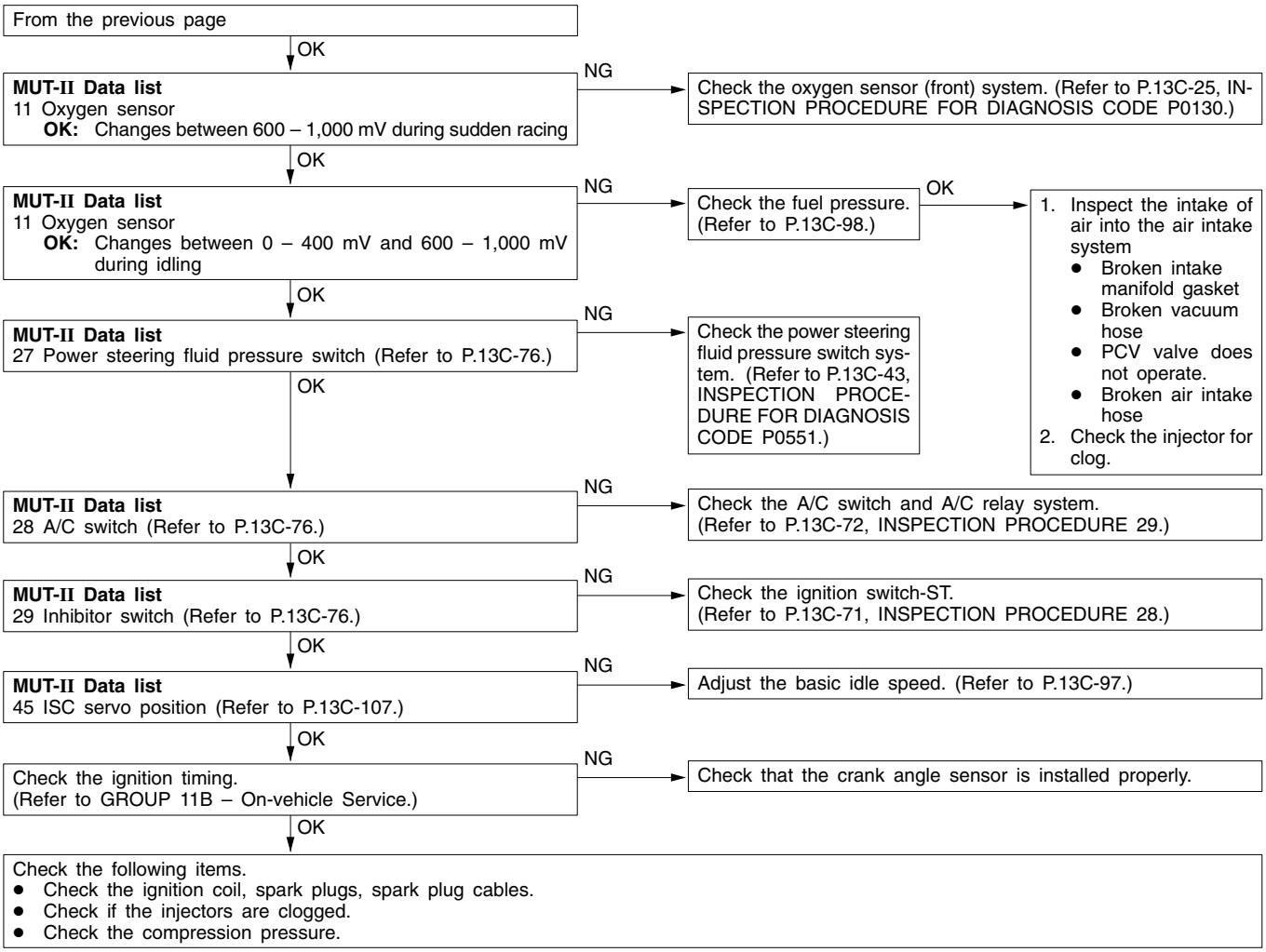
MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
- NG → Check the barometric pressure sensor system. (Refer to P.13C-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
- OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
- NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
- OK ↓

MUT-II Data list
59 Oxygen sensor (rear)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open
  OK: 600 – 1,000 mV
- NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
- OK ↓

To the next page


From the previous page
OK
MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 – 1,000 mV during sudden racing
NG
Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK
MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG
Check the fuel pressure. (Refer to P.13C-98.)
OK
1. Inspect the intake of air into the air intake system
● Broken intake manifold gasket
● Broken vacuum hose
● PCV valve does not operate.
● Broken air intake hose
2. Check the injector for clog.
OK
MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13C-76.)
NG
Check the power steering fluid pressure switch system. (Refer to P.13C-43, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0551.)
OK
MUT-II Data list
28 A/C switch (Refer to P.13C-76.)
NG
Check the A/C switch and A/C relay system. (Refer to P.13C-72, INSPECTION PROCEDURE 29.)
OK
MUT-II Data list
29 Inhibitor switch (Refer to P.13C-76.)
NG
Check the ignition switch-ST. (Refer to P.13C-71, INSPECTION PROCEDURE 28.)
OK
MUT-II Data list
45 ISC servo position (Refer to P.13C-107.)
NG
Adjust the basic idle speed. (Refer to P.13C-97.)
OK
Check the ignition timing. (Refer to GROUP 11B – On-vehicle Service.)
NG
Check that the crank angle sensor is installed properly.
OK
Check the following items.
● Check the ignition coil, spark plugs, spark plug cables.
● Check if the injectors are clogged.
● Check the compression pressure.

INSPECTION PROCEDURE 13

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

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

INSPECTION PROCEDURE 14

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

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)
NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

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

Yes → Check the vehicle speed sensor system. (Refer to P.13C-40, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0500.)
No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

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

INSPECTION PROCEDURE 15

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
OK ↓

Check the ignition timing.
(Refer to GROUP 11B – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-75.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
NG → Check the barometric pressure sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)
NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

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

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 – 1,000 mV during sudden racing
NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

To the next page

From the previous page

↓OK

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling

NG → Check the fuel pressure. (Refer to P.13C-98.)

OK → 1. Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

↓OK

Check the fuel pressure. (Refer to P.13A-78.)

↓OK

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

INSPECTION PROCEDURE 16

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

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.

↓No

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

INSPECTION PROCEDURE 17

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

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.

↓No

Check the ISC servo for operation sound. (Refer to P.13C-107.)

NG → Check the ISC system. (Refer to P.13C-40, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0505.)

↓OK

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)

NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)

↓OK

Clean the throttle valve area. (Refer to P.13C-96.)

INSPECTION PROCEDURE 18

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
OK ↓

Check the ignition timing.
(Refer to GROUP 11B – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-74.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
NG → Check the barometric pressure sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)
NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

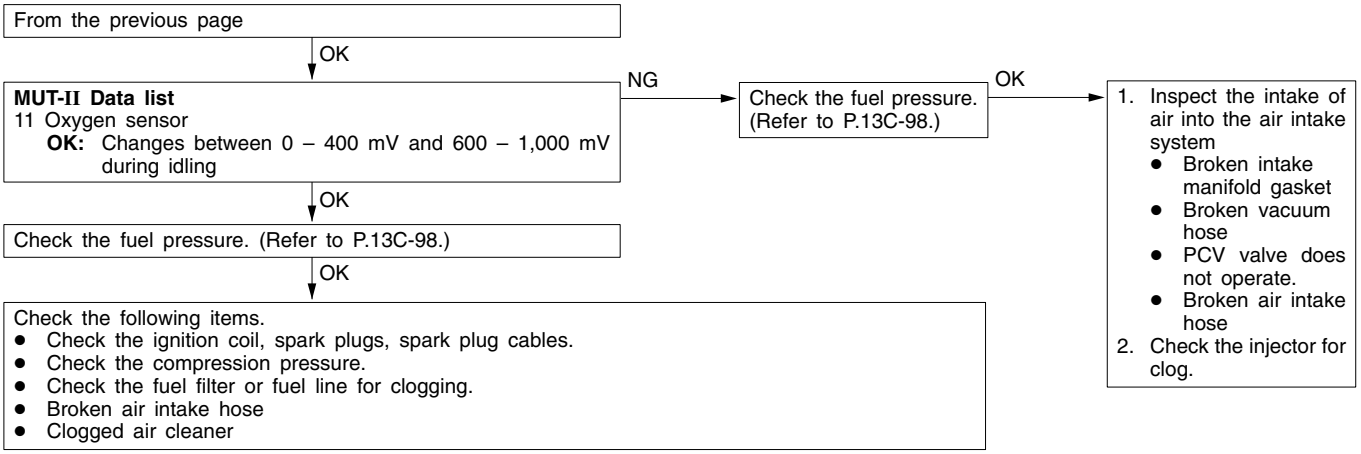
MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

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

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600–1,000 mV during sudden racing
NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

To the next page


From the previous page
OK
MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG
Check the fuel pressure. (Refer to P.13C-98.)
OK
1. Inspect the intake of air into the air intake system
Broken intake manifold gasket
Broken vacuum hose
PCV valve does not operate.
Broken air intake hose
2. Check the injector for clog.
OK
Check the fuel pressure. (Refer to P.13C-98.)
OK
Check the following items.
Check the ignition coil, spark plugs, spark plug cables.
Check the compression pressure.
Check the fuel filter or fuel line for clogging.
Broken air intake hose
Clogged air cleaner

INSPECTION PROCEDURE 19

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13C-32, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0201, P0202, P0203, P0204.)
OK ↓

Check the ignition timing.
(Refer to GROUP 11C – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-74.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
NG → Check the barometric pressure sensor system. (Refer to P.13C-16. INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13C-75.)
NG → Check the throttle position sensor system. (Refer to P.13C-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0120.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13C-79.)
NG → Check the EGR control solenoid valve system. (Refer to P.13C-36, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0403.)
OK ↓

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

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 – 1,000 mV during sudden racing
NG → Check the oxygen sensor (front) system. (Refer to P.13C-25, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0130.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 – 400 mV and 600 – 1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13C-98.)
OK → 1. Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

OK ↓

Check the fuel pressure. (Refer to P.13C-98.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR control 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.	• Defective detonation sensor • Inappropriate heat value of the spark plug

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does knocking occur when driving with the sensor disconnected? At this time, use the MUT-II to check if the timing is retarded compared to when the detonation sensor connector is connected.
- No → Check the detonation sensor system. (Refer to P.13C-33, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0325.)
- Yes ↓

Check the following items.
- Spark plugs
- Check if foreign materials (water, alcohol, etc.) got into fuel.

INSPECTION PROCEDURE 21

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

Check the injectors for fuel leakage.

INSPECTION PROCEDURE 22

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13C-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the ignition timing.
(Refer to GROUP 11B – On-vehicle Service.)
NG → Check that the crank angle sensor is installed properly.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor. (Refer to P.13C-75.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13C-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0115.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13C-74.)
NG → Check the intake air temperature sensor system. (Refer to P.13C-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0110.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13C-76.)
NG → Check the barometric pressure sensor system. (Refer to P.13C-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0105.)
OK ↓

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

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13C-27, INSPECTION PROCEDURE FOR DIAGNOSIS CODE P0136.)
OK ↓

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

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

NG ↓

Check the fuel pressure. (Refer to P.13C-98.)
OK ↓

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

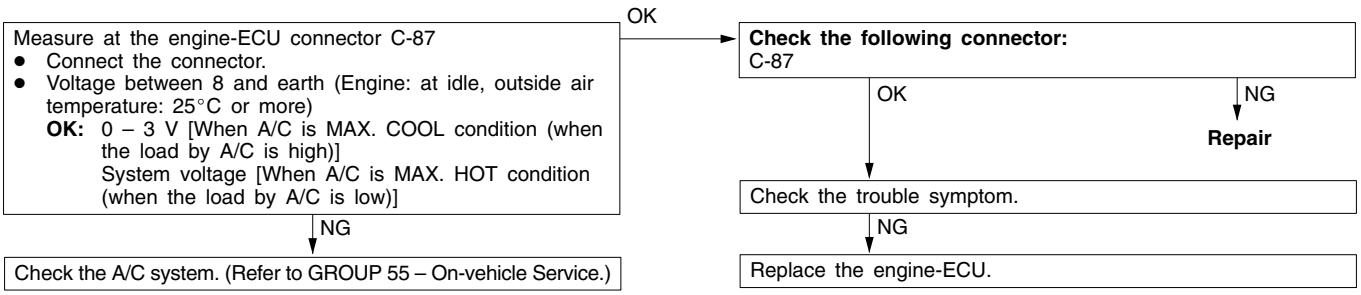
↓

Check the trouble symptom.
NG ↓

Replace the catalytic converter.

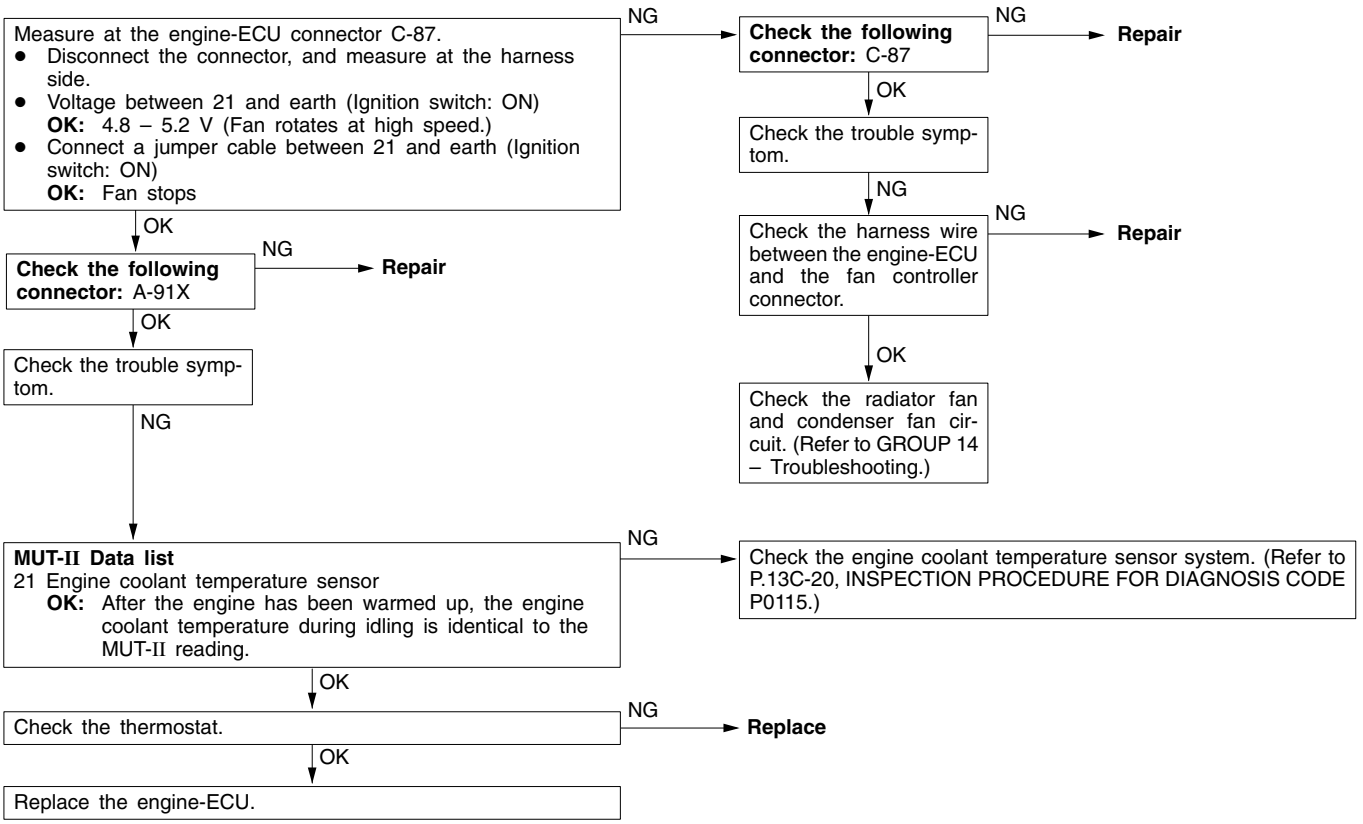
INSPECTION PROCEDURE 23

Idling speed is improper when A/C is operating	Probable cause
If the engine-ECU detects that the air conditioner is on, it activates the idle speed control (ISC) servo to control idle-up operation. The A/C-ECU judges if the load caused by air conditioner operation is high or low, and converts it to voltage signal (high or low voltage) and inputs the signal to the engine-ECU. Based on this voltage signal, the engine-ECU controls the idle-up speed (for high or low load).	• Malfunction of the A/C control system • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



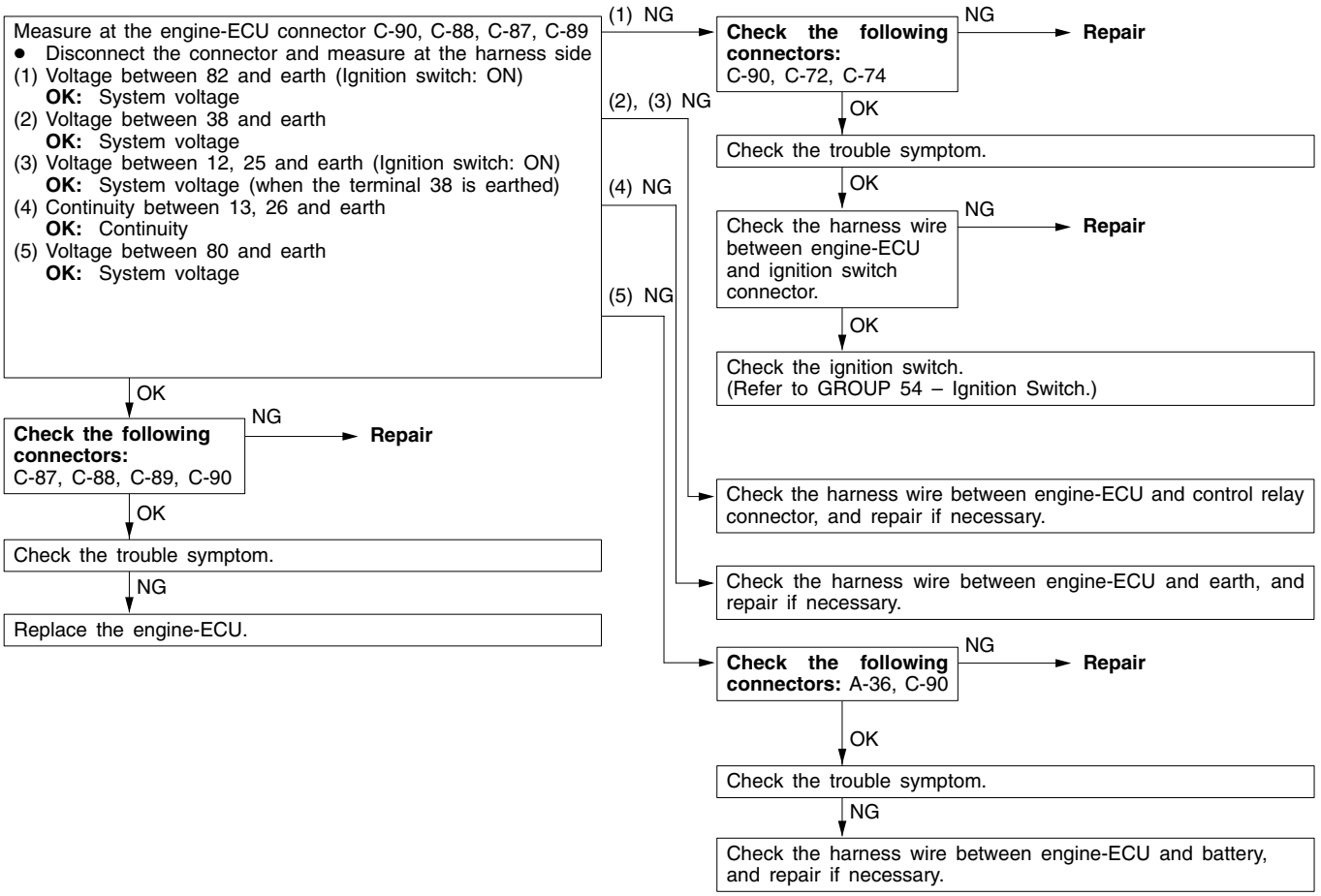
INSPECTION PROCEDURE 24

Fans (radiator fan, A/C condenser fan) are inoperative	Probable cause
The engine-ECU 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.)	• 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



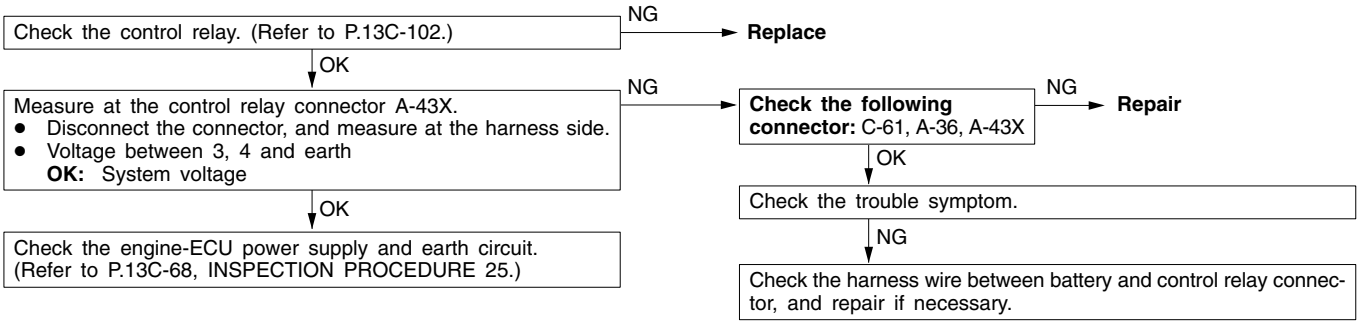
INSPECTION PROCEDURE 25

Engine-ECU power supply and earth circuit system	Probable cause
The engine-ECU may be defective, or that one of the malfunctions listed at right has occurred.	• Improper connector contact, open circuit or short-circuited harness wire in the engine-ECU power supply circuit. • Open circuit or short-circuited harness wire in the engine-ECU earth circuit • Malfunction of the engine-ECU



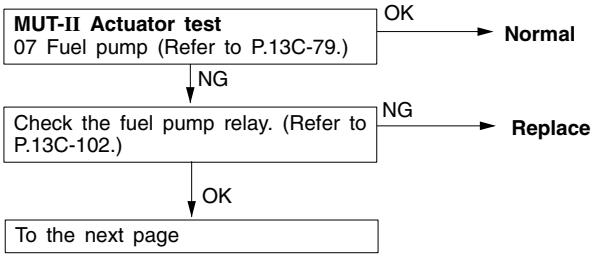
INSPECTION PROCEDURE 26

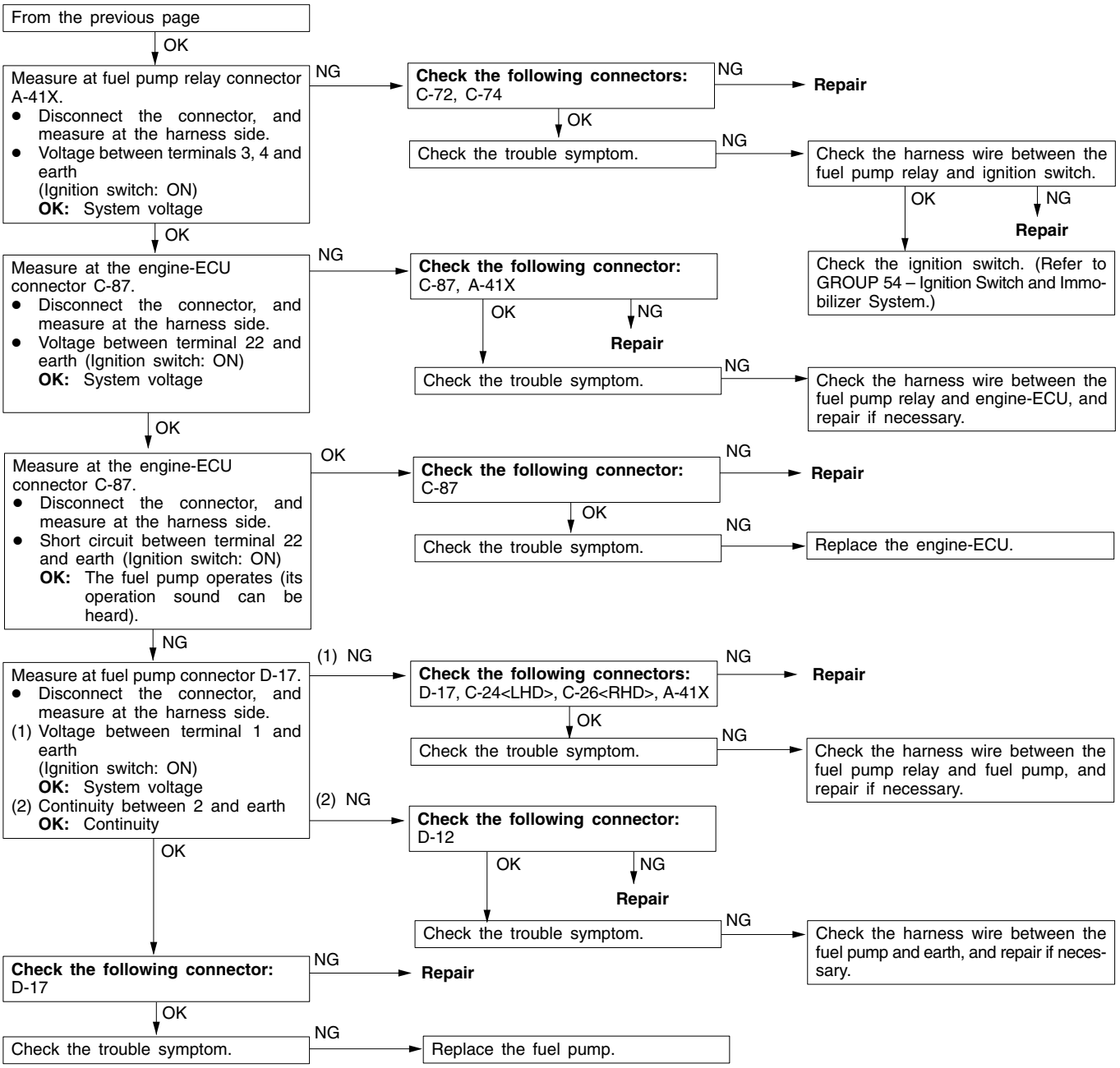
Power supply system and ignition switch-IG system	Probable cause
When an ignition switch ON signal is input to the engine-ECU, the engine-ECU turns the control relay ON. This causes battery voltage to be supplied to the engine-ECU, injectors and air flow sensor.	• Malfunction of the ignition switch •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



INSPECTION PROCEDURE 27

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

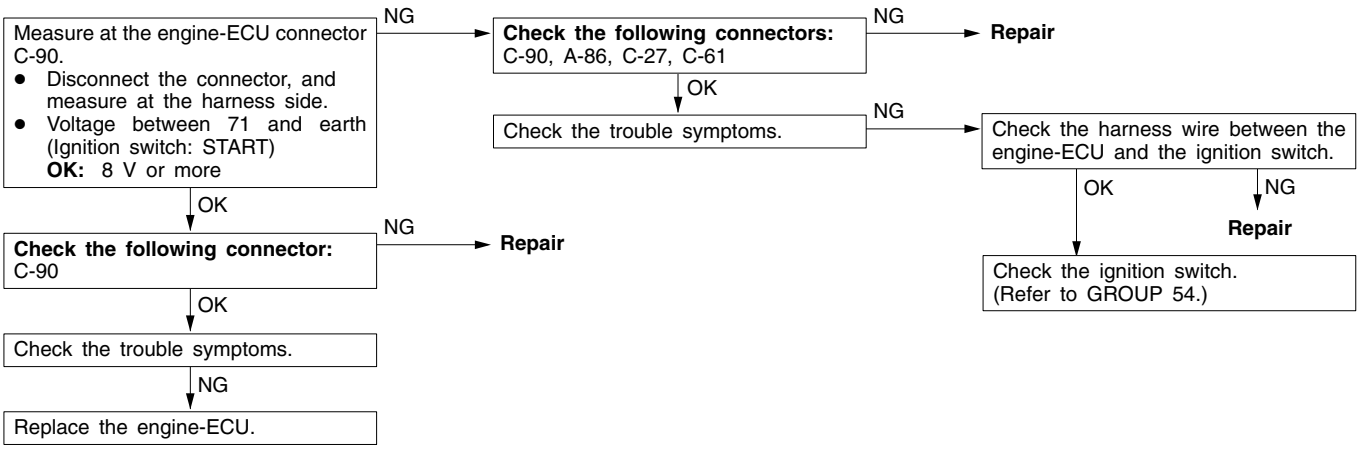



From the previous page
OK
Measure at fuel pump relay connector A-41X.
● Disconnect the connector, and measure at the harness side.
● Voltage between terminals 3, 4 and earth (Ignition switch: ON)
OK: System voltage
NG
Check the following connectors: C-72, C-74
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the fuel pump relay and ignition switch.
OK
NG
Repair
Check the ignition switch. (Refer to GROUP 54 – Ignition Switch and Immobilizer System.)
OK
Measure at the engine-ECU connector C-87.
● Disconnect the connector, and measure at the harness side.
● Voltage between terminal 22 and earth (Ignition switch: ON)
OK: System voltage
NG
Check the following connector: C-87, A-41X
OK
NG
Repair
Check the trouble symptom.
NG
Check the harness wire between the fuel pump relay and engine-ECU, and repair if necessary.
OK
Measure at the engine-ECU connector C-87.
● Disconnect the connector, and measure at the harness side.
● Short circuit between terminal 22 and earth (Ignition switch: ON)
OK: The fuel pump operates (its operation sound can be heard).
OK
Check the following connector: C-87
NG
Repair
OK
Check the trouble symptom.
NG
Replace the engine-ECU.
NG
Measure at fuel pump connector D-17.
● Disconnect the connector, and measure at the harness side.
(1) Voltage between terminal 1 and earth (Ignition switch: ON)
OK: System voltage
(2) Continuity between 2 and earth
OK: Continuity
(1) NG
Check the following connectors: D-17, C-24<LHD>, C-26<RHD>, A-41X
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the fuel pump relay and fuel pump, and repair if necessary.
(2) NG
Check the following connector: D-12
OK
NG
Repair
Check the trouble symptom.
NG
Check the harness wire between the fuel pump and earth, and repair if necessary.
OK
Check the following connector: D-17
NG
Repair
OK
Check the trouble symptom.
NG
Replace the fuel pump.

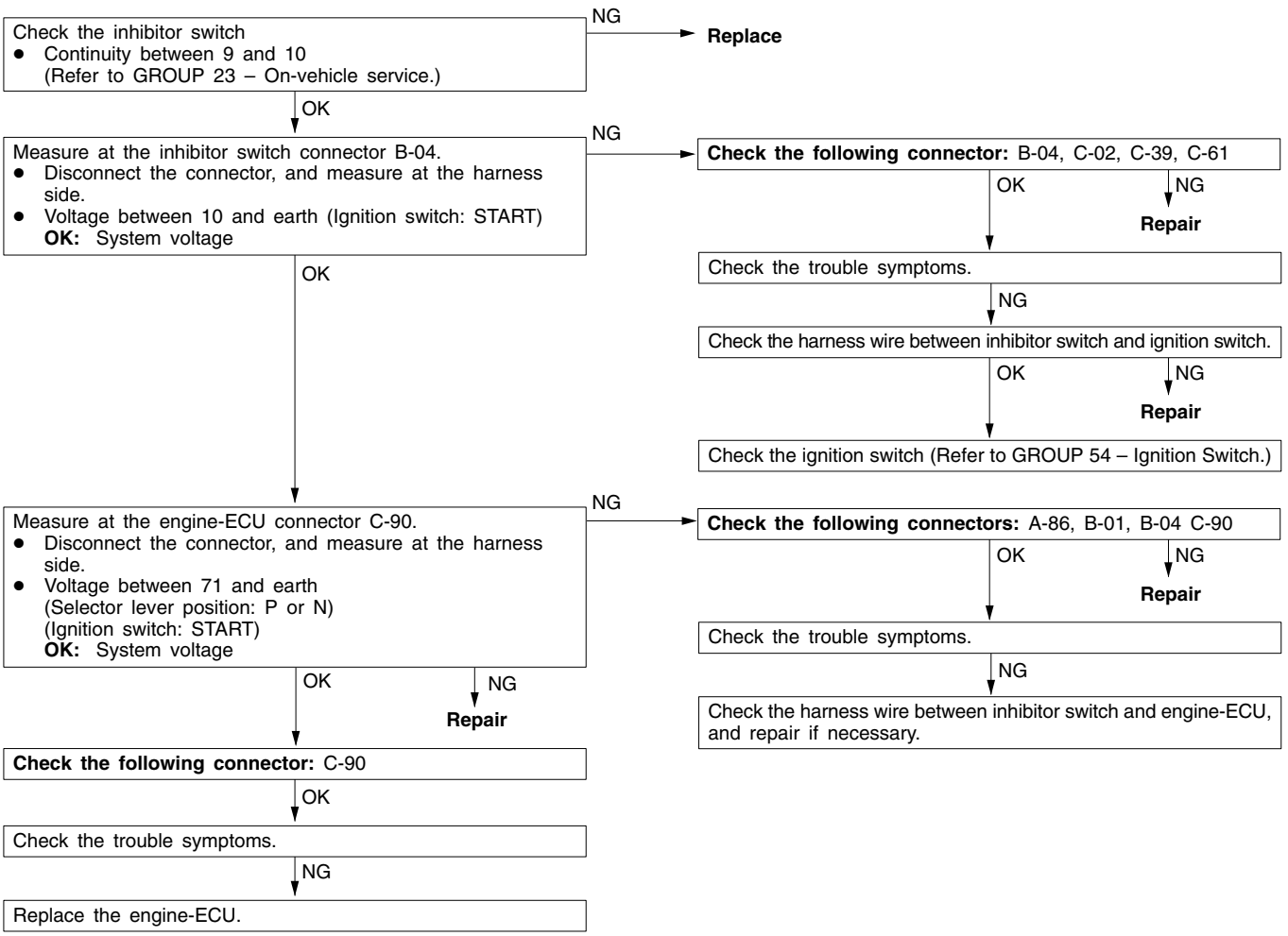
INSPECTION PROCEDURE 28

Ignition switch-ST system	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU uses this signal to carry out functions such as fuel injection control during starting.	• Malfunction of the ignition switch • 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>

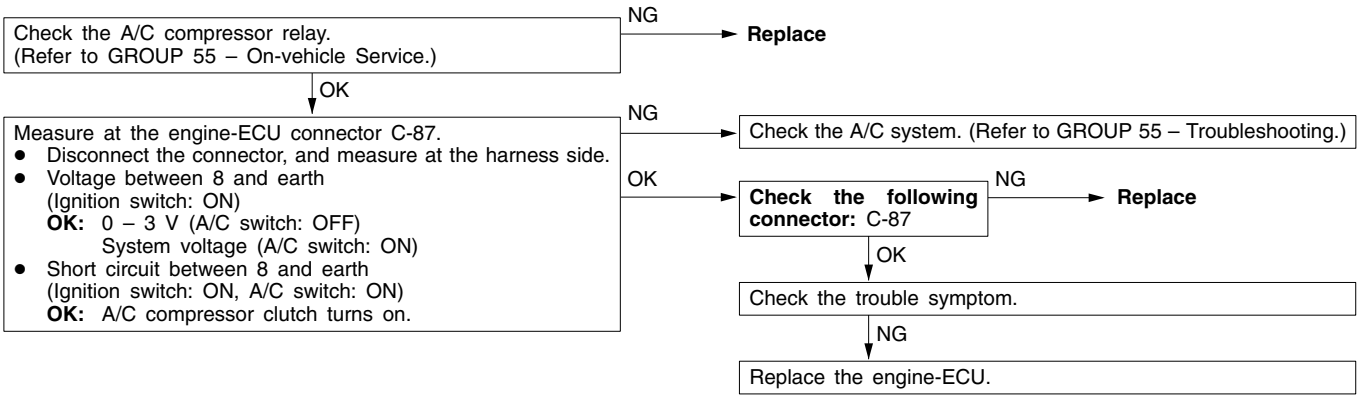


<A/T>



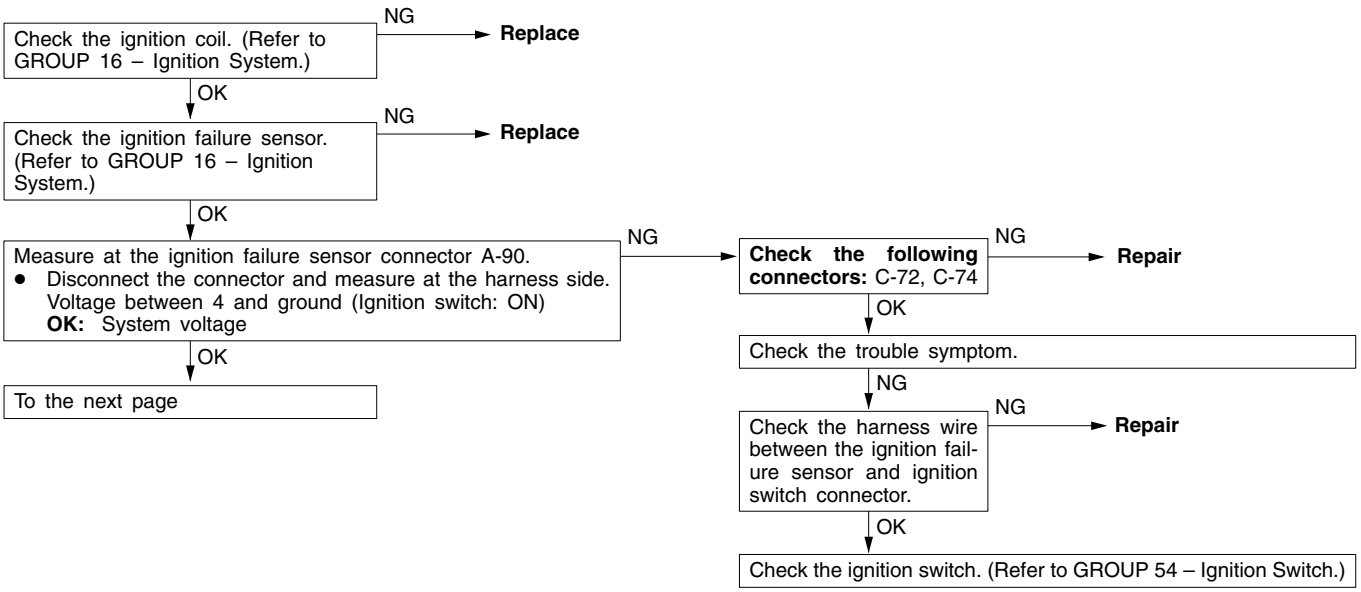
INSPECTION PROCEDURE 29

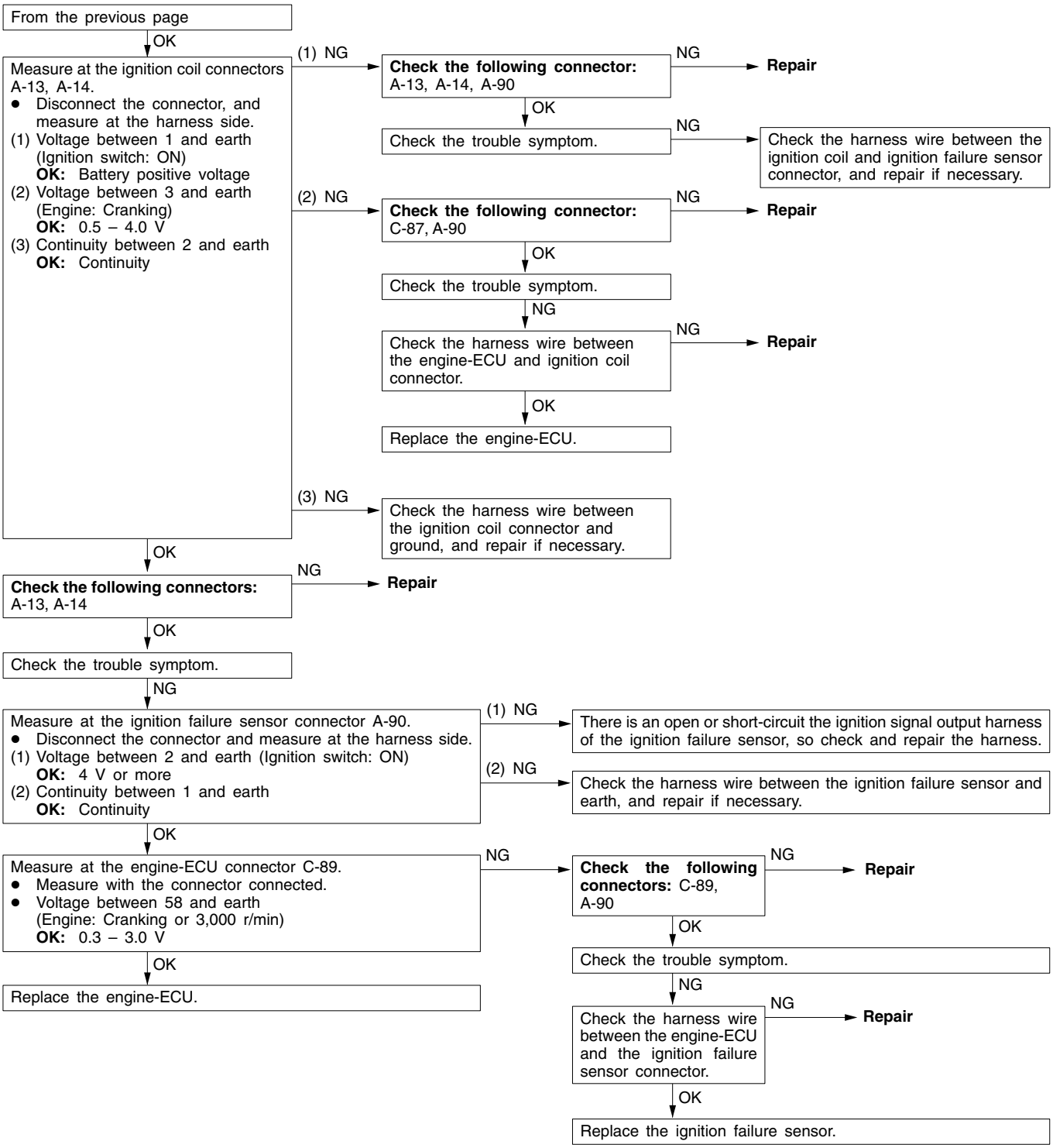
A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-ECU, the engine-ECU carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	• Malfunction of A/C control system • Malfunction of A/C switch • Improper connector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



INSPECTION PROCEDURE 30

Ignition circuit system	Probable cause
The engine-ECU interrupts the ignition coil primary current by turning the power transistor inside the engine-ECU ON and OFF.	• Malfunction of ignition coil. • Malfunction of ignition failure sensor. • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU




From the previous page
OK
Measure at the ignition coil connectors A-13, A-14.
● Disconnect the connector, and measure at the harness side.
(1) Voltage between 1 and earth (Ignition switch: ON)
OK: Battery positive voltage
(2) Voltage between 3 and earth (Engine: Cranking)
OK: 0.5 – 4.0 V
(3) Continuity between 2 and earth
OK: Continuity
(1) NG
Check the following connector: A-13, A-14, A-90
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the ignition coil and ignition failure sensor connector, and repair if necessary.
(2) NG
Check the following connector: C-87, A-90
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the engine-ECU and ignition coil connector.
NG
Repair
OK
Replace the engine-ECU.
(3) NG
Check the harness wire between the ignition coil connector and ground, and repair if necessary.
OK
Check the following connectors: A-13, A-14
NG
Repair
OK
Check the trouble symptom.
NG
Measure at the ignition failure sensor connector A-90.
● Disconnect the connector and measure at the harness side.
(1) Voltage between 2 and earth (Ignition switch: ON)
OK: 4 V or more
(2) Continuity between 1 and earth
OK: Continuity
(1) NG
There is an open or short-circuit the ignition signal output harness of the ignition failure sensor, so check and repair the harness.
(2) NG
Check the harness wire between the ignition failure sensor and earth, and repair if necessary.
OK
Measure at the engine-ECU connector C-89.
● Measure with the connector connected.
● Voltage between 58 and earth (Engine: Cranking or 3,000 r/min)
OK: 0.3 – 3.0 V
NG
Check the following connectors: C-89, A-90
NG
Repair
OK
Check the trouble symptom.
NG
Check the harness wire between the engine-ECU and the ignition failure sensor connector.
NG
Repair
OK
Replace the ignition failure sensor.
OK
Replace the engine-ECU.

DATA LIST REFERENCE TABLE

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

NOTE
*1. 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 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.
*3. In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10 % longer than the standard time.
*4. 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.
★ It will not be displayed when service data of the check mode is selected.

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	13C-25
			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	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	12 – 38 Hz	–	–
			2,500 r/min	58 – 98 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	13C-18
			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	535 – 735 mV	Code No. P0120	13C-22
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,750 mV or more		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 25	13C-68
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 28	13C-71
			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	13C-20
			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		
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. P0335	13C-33
		• Engine: Idling • Idle position switch: ON	When engine coolant temperature is –20°C	1,380 – 1,580 r/min		
			When engine coolant temperature is 0°C	1,320 – 1,520 r/min		
			When engine coolant temperature is 20°C	1,200 – 1,400 r/min		
			When engine coolant temperature is 40°C	1,100 – 1,300 r/min		
			When engine coolant temperature is 80°C	600 – 800 r/min		

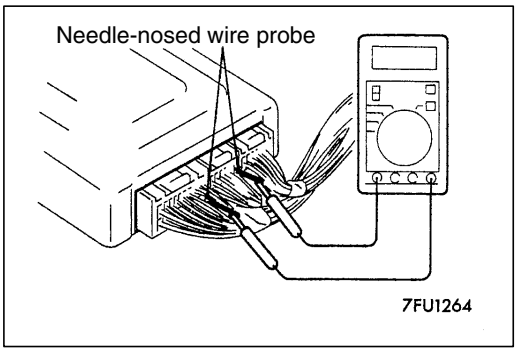
Item No.	Inspection item	Inspection contents			Normal condition	Inspection procedure No.	Reference page
24	Vehicle speed sensor	Drive at 40 km/h			Approximately 40 km/h	Code No. P0500	13C-39
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m		101 kPa	Code No. P0105	13C-16
			At altitude of 600 m		95 kPa		
			At altitude of 1,200 m		88 kPa		
			At altitude of 1,800 m		81 kPa		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary		OFF	Code No. P0551	13C-43
			Steering wheel turning		ON		
28	A/C switch	Engine: Idling	A/C switch: OFF		OFF	Procedure No. 29	13C-72
			A/C switch: ON	A/C compressor does not operate	OFF		
				A/C compressor operates	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N		P or N	Procedure No. 28	13C-71
			D, 2, L or R		D, 2, L or R		
41	Injectors*2	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)		14 – 21 ms	–	–
			When engine coolant temperature is 20°C		30 – 45 ms		
			When engine coolant temperature is 80°C		6.9 – 10.4 ms		
	Injectors*3	• 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		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
44	Ignition coils and power transistors	• Engine: After having warmed up • Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	2 – 18°BTDC	Code No. P0300	–
			2,500 r/min	23 – 43°BTDC		
45	ISC (stepper) motor position*4	• 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		
			• 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	Procedure No. 29	13C-72
			A/C switch: ON / A/C compressor is not driven	OFF		
			A/C switch: ON / A/C compressor is driven	ON	Procedure No. 29	13C-72
59	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Drive with throttle widely open	3,500 r/min	600 – 1,000 mV	Code No. P0316	13C-27
24★	Vehicle speed sensor	Drive at 40 km/h		Approximately 40 km/h	Code No. P0500	13C-39
81★	Long-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		–12.5 – 12.5 %	Code No. P0170	13C-29
82★	Short-term fuel compensation	Engine: Warm, 2,500 r/min without any load (during closed loop)		–25 – 25 %	Code No. P0170	13C-29
87★	Calculation load value	Engine: Warm	Engine: Idling	10 – 30 %	–	–
			2,500 r/min	17 – 37 %		
88★	Fuel control condition	Engine: Warm	2,500 r/min	Closed loop	Code No. P0125	13C-24
			When engine is suddenly raced	Open loop – drive condition		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
A1 ★	Oxygen sensor (sensor 1)	Engine: After warm-up	Idling	0.2 V or less	Code No. P0130	13C-25
			Sudden racing	0.6 – 1.0 V		
			2,500 r/min	0.4 V or less and 0.6 – 1.0 V alternates		
A2 ★	Oxygen sensor (sensor 2)	• 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	13C-27
8A ★	Throttle position sensor (Throttle valve opening angle)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine: Stopped)	Release the accelerator pedal.	6 – 20 %	Code No. P0120	13C-22
			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	13C-30
02		Cut fuel to No. 2 injector				Code No. P0202	13C-30
03		Cut fuel to No. 3 injector				Code No. P0203	13C-30
04		Cut fuel to No. 4 injector				Code No. P0204	13C-30
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 27	13C-69
				Listen near the fuel tank for the sound of fuel pump operation.	Sound of operation is heard.		
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Code No. P0443	13C-38
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	13C-36
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set		5°BTDC	–	–
21	Fan relay	Drive the fan motor	Ignition switch: ON		Radiator fan and condenser fan operate at high speed	Procedure No. 24	13C-67



CHECK AT THE ENGINE-ECU TERMINALS

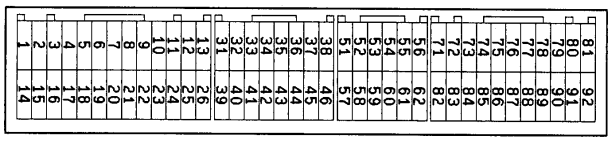
TERMINAL VOLTAGE CHECK CHART

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 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 connectors connected.
   (2) You may find it convenient to pull out the engine-ECU 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 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 Connector Terminal Arrangement



9FU0393

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 11 – 14 V, momentarily drops slightly
14	No. 2 injector		
2	No. 3 injector		
15	No. 4 injector		
4	Stepper motor coil <A>	Engine: Soon after the warmed up engine is started	System voltage ↔ 0 V (Changes repeatedly)
17	Stepper motor coil <B>		
5	Stepper motor coil <C>		
18	Stepper motor coil <D>		
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	A/C relay	• Engine: Idle speed • A/C switch: OFF → ON (A/C compressor is operating)	System voltage or momentarily 6 V or more → 0 – 3 V
9	Purge control solenoid valve	Ignition switch: ON	System voltage
		Running at 3,000 r/min while engine is warming up after having been started.	0 – 3 V
10	Ignition coil – No. 1, No. 4 (power transistor)	Engine r/min: 3,000 r/min	0.3 – 3.0 V
23	Ignition coil – No. 2, No. 3 (power transistor)		
12	Power supply	Ignition switch: ON	System voltage
25			
19	Air flow sensor reset signal	Engine: Idle speed	0 – 1 V
		Engine r/min: 3,000 r/min	6 – 9 V
20	Condenser motor relay (HI)	Radiator fan is not operating (Engine coolant temperature is 90°C or less)	System voltage
		Radiator fan is not operating (Engine coolant temperature is 105°C or less)	0 – 3 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
21	Radiator motor relay (LO)	Radiator fan and condenser fan are not operating (Engine coolant temperature is 90°C or less)		System voltage
		Radiator fan and condenser fan are not operating (Engine coolant temperature is 90 – 105°C or less)		0 – 3 V
22	Fuel pump relay	Ignition switch: ON		System voltage
		Engine: Idle speed		0 – 3 V
33	Alternator G terminal	• 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	Alternator FR terminal	• 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	Engine warning lamp	Ignition switch: “LOCK” (OFF) position → ON		0 – 3 V → 9 – 13 V (After several seconds have elapsed)
37	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
38	Control relay (Power supply)	Ignition switch: “LOCK” (OFF) position		System voltage
		Ignition switch: ON		0 – 3 V
45	A/C switch 1	Engine: Idle speed	Turn the A/C switch OFF	0 – 3 V
			Turn the A/C switch ON (A/C compressor is operating)	System voltage
58	Tachometer signal	Engine r/min: 3,000 r/min		0.3 – 3.0 V
60	Oxygen sensor (front) heater	Engine: Idling after warming up		0 – 3 V
		Engine r/min: 5,000 r/min		System voltage
54	Oxygen sensor (rear) heater	Engine: Idling after warming-up		0 – 3 V
		Engine r/min: 5,000 r/min		System voltage
71	Ignition switch – ST	Engine: Cranking		8 V or more

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
72	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
75	Oxygen sensor (rear)	• 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	Oxygen sensor (front)	Engine: Running at 2,500 r/min after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8 V (Changes repeatedly)
77	A/C thermo sensor	• Ignition switch: ON • Temperature at sensor: 25°C (1.5 kΩ)		2.2 V
80	Backup power supply	Ignition switch: "LOCK" (OFF) position		System voltage
81	Sensor impressed voltage	Ignition switch: ON		4.5 – 5.5 V
82	Ignition switch – IG	Ignition switch: ON		System voltage
83	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
84	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3 – 1.0 V
			Fully open throttle valve	4.5 – 5.5 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
85	Barometric pressure sensor	Ignition switch: ON	When altitude is 0 m	3.7 – 4.3 V
			When altitude is 1,200 m	3.2 – 3.8 V
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		0 ↔ 5 V (Changes repeatedly)
88	Camshaft position sensor	Engine: Cranking		0.4 – 3.0 V
		Engine: Idle speed		0.5 – 2.0 V
89	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idle speed		1.5 – 2.5 V
90	Air flow sensor	Engine: Idle speed		2.2 – 3.2 V
		Engine r/min: 2,500 r/min		

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

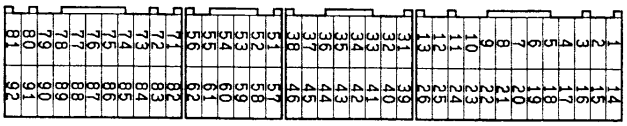
1. Turn the ignition switch to “LOCK” (OFF) position.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

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

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

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

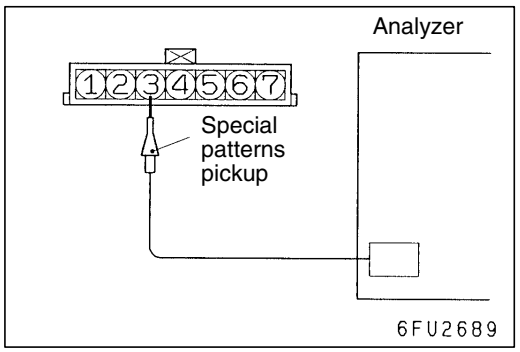
Engine-ECU Harness Side Connector Terminal Arrangement



9FU0392

Terminal No.	Inspection item	Normal condition (Check condition)
1 – 12	No. 1 injector	13 – 16 Ω (At 20°C)
14 – 12	No. 2 injector	
2 – 12	No. 3 injector	
15 – 12	No. 4 injector	
4 – 12	Stepper motor coil (A)	28 – 33 Ω (At 20°C)
17 – 12	Stepper motor coil (B)	
5 – 12	Stepper motor coil (C)	
18 – 12	Stepper motor coil (D)	
6 – 12	EGR control solenoid valve	29 – 35 Ω (At 20°C)
9 – 12	Purge control solenoid valve	29 – 35 Ω (At 20°C)
13 – Body earth	Engine-ECU earth	Continuity (0 Ω)
26 – Body earth	Engine-ECU earth	
60 – 12	Oxygen sensor (front) heater	4.5 – 8.0 Ω (At 20°C)
54 – 12	Oxygen sensor (rear) heater	11 – 18 Ω (At 20°C)

Terminal No.	Inspection item	Normal condition (Check condition)
72 – 92	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)
83 – 92	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)



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

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

Alternate Method (Test harness not available)

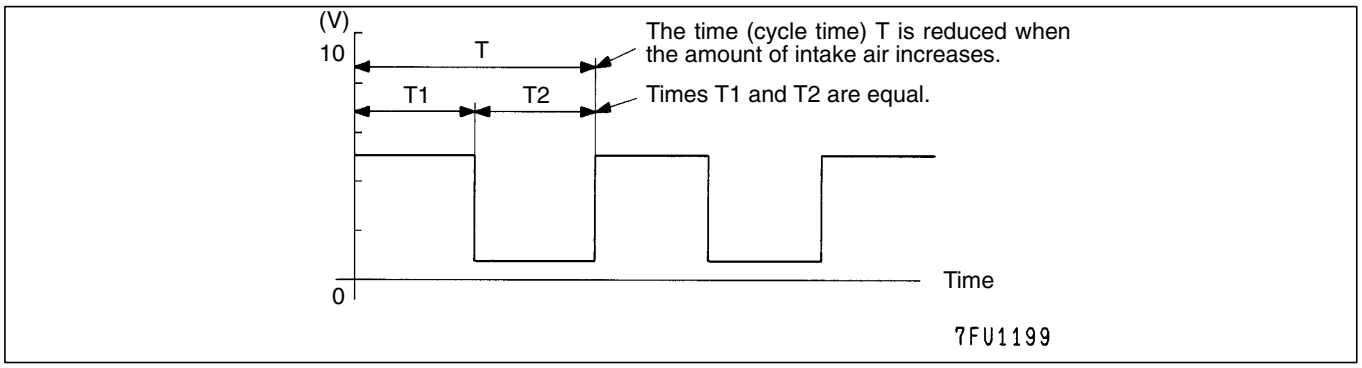
1. Connect the analyzer special patterns pickup to engine-ECU terminal 90.

Standard Wave Pattern

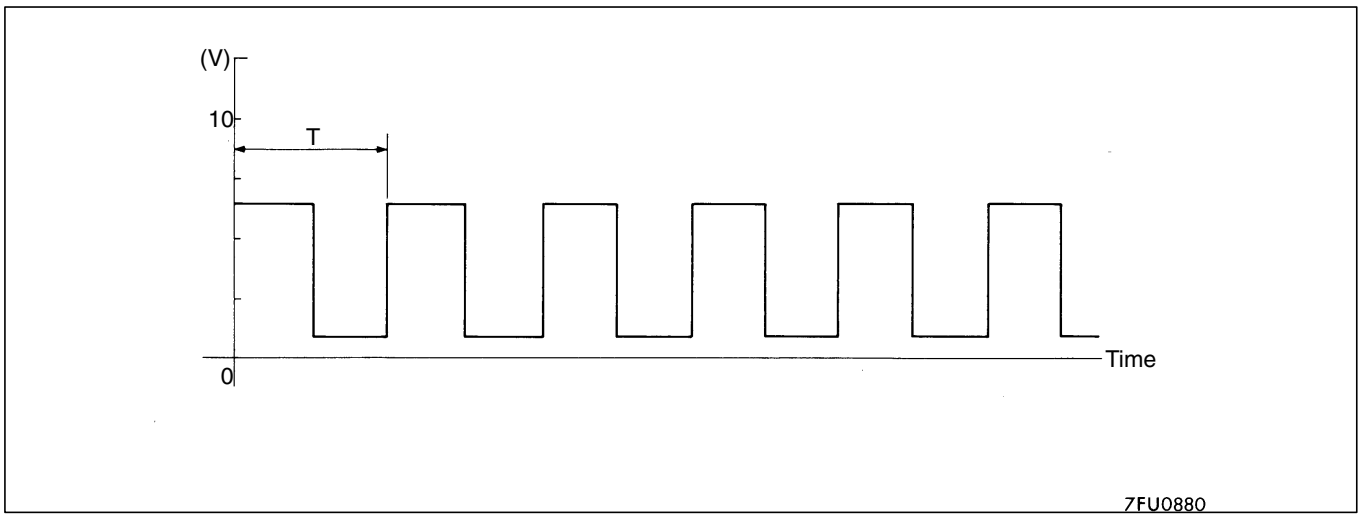
Observation conditions

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

Standard wave pattern

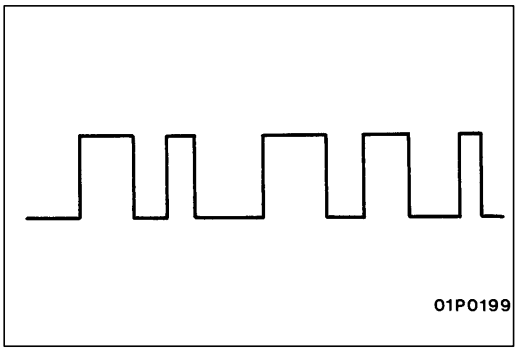


Observation conditions (from conditions above engine speed is increased by racing.)



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.

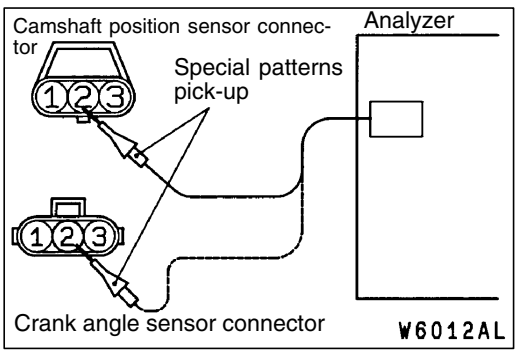
- Example 2

  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: MB991659) 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: MB991658) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 3.

Alternate Method (Test harness not available)

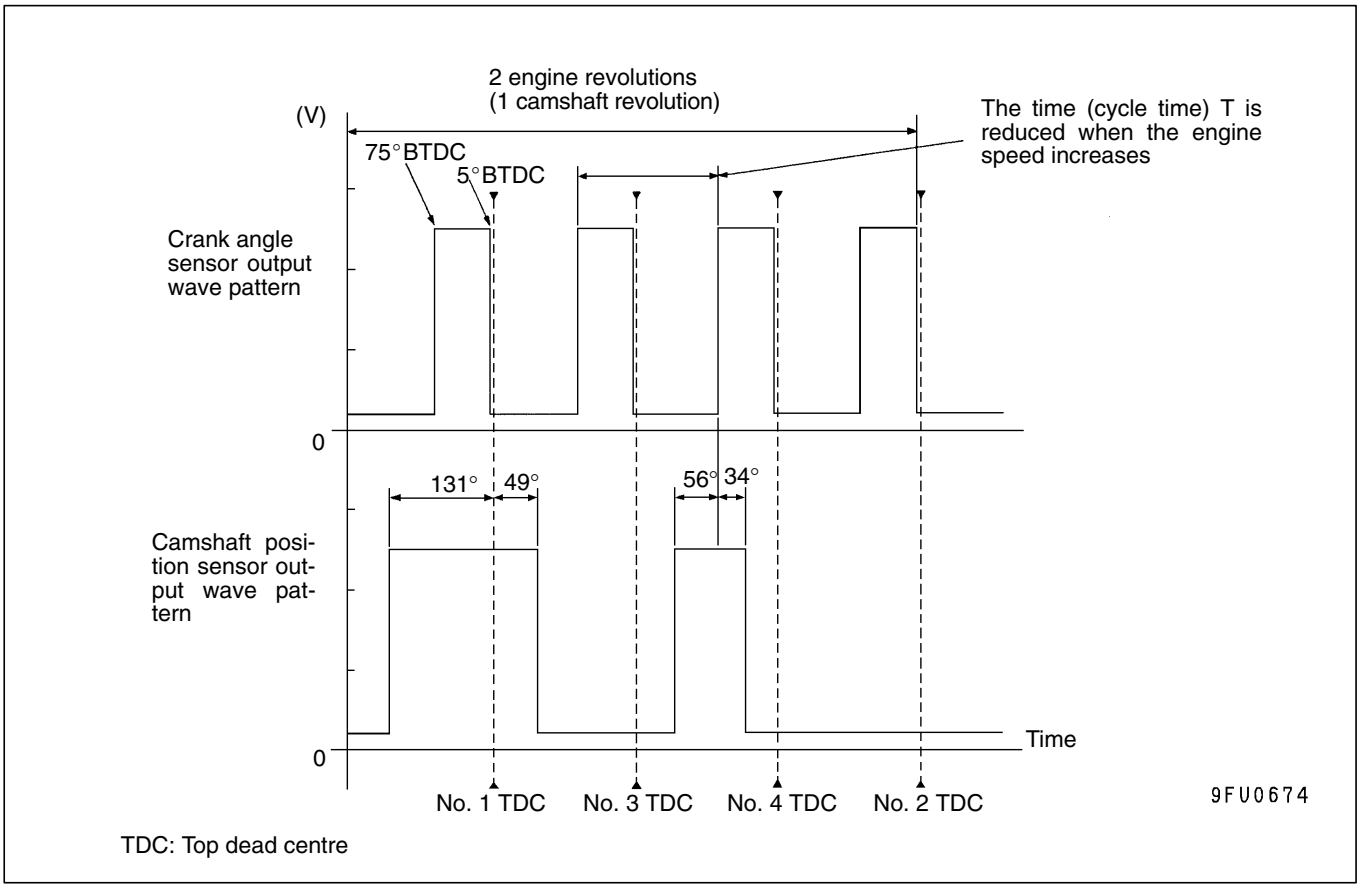
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

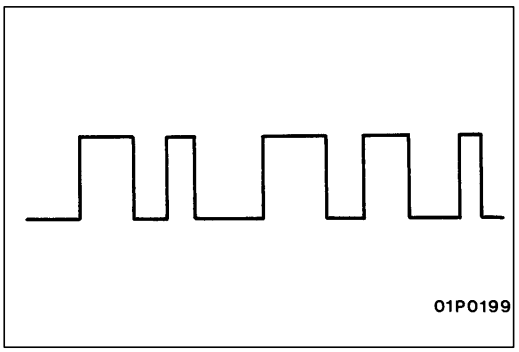
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

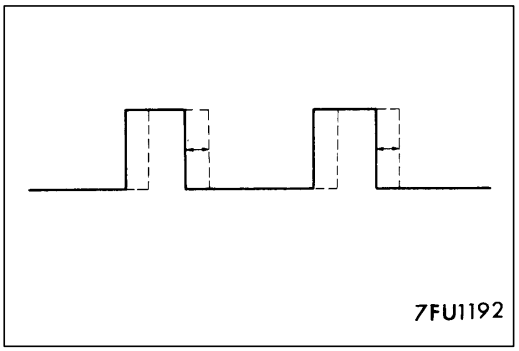
Standard wave pattern



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.

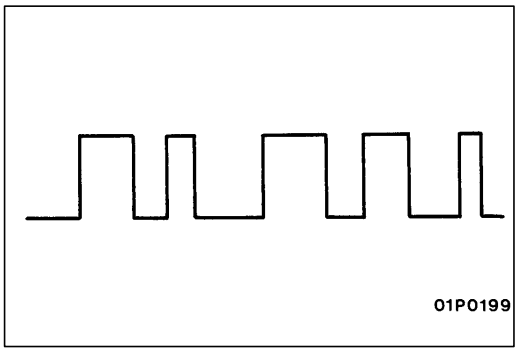
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



Examples of Abnormal Wave Patterns

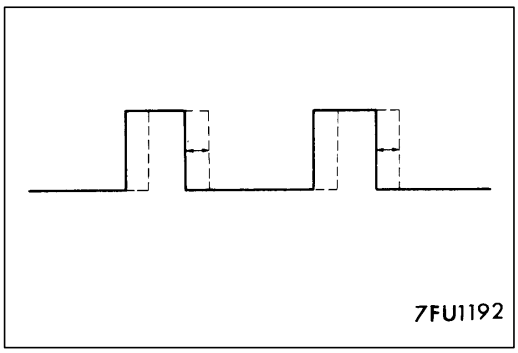
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



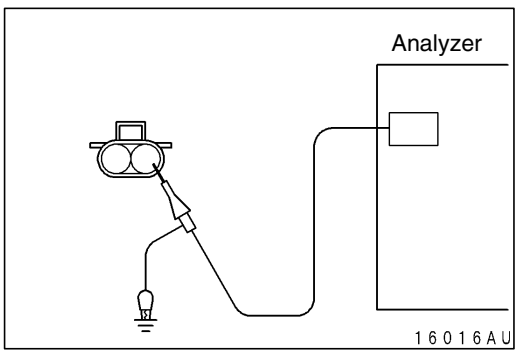
- Example 2

  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 side should be connected.)
2. Connect the analyzer special patterns pickup to terminal 2 of the injector connector.

Alternate Method (Test harness not available)

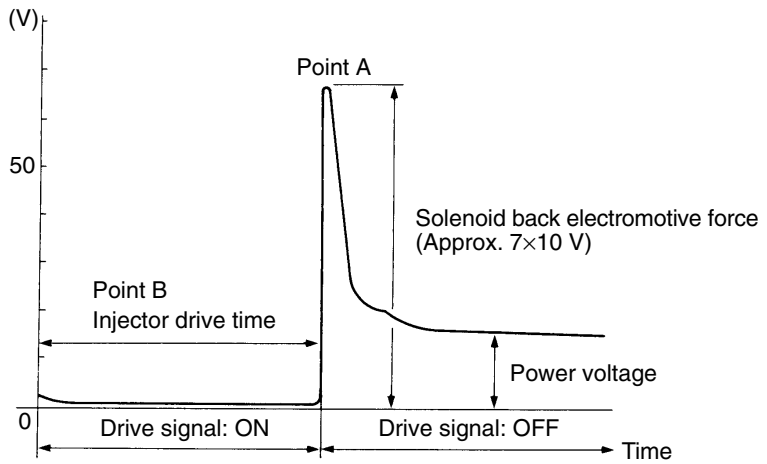
1. Connect the analyzer special patterns pickup to engine-ECU terminal 1. (When checking the No. 1 cylinder.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 14. (When checking the No. 2 cylinder.)
3. Connect the analyzer special patterns pickup to engine-ECU terminal 2. (When checking the No. 3 cylinder.)
4. Connect the analyzer special patterns pickup to engine-ECU terminal 15. (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

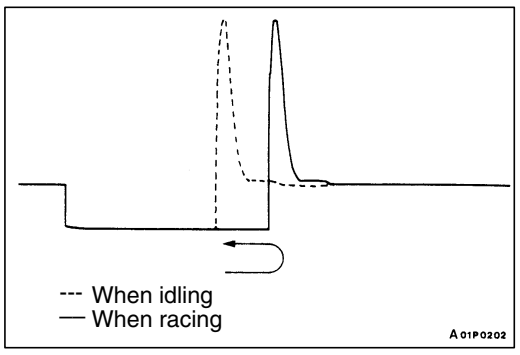


Wave Pattern Observation Points

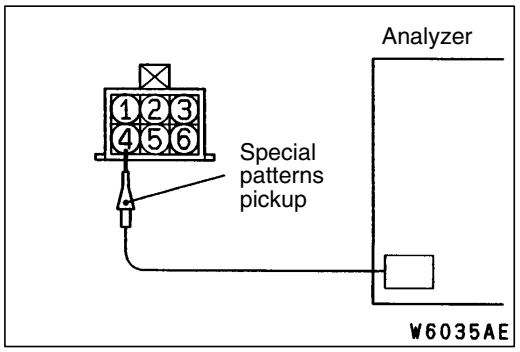
Point A: Height of solenoid back electromotive force

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.



IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR)

Measurement Method

1. Disconnect the ISC servo connector, and connect the special tool (test harness: MB991709) in between.
2. Connect the analyzer special patterns pickup to the ISC servo-side connector terminal 1, terminal 3, terminal 4 and terminal 6 respectively.

Alternate Method (Test harness not available)

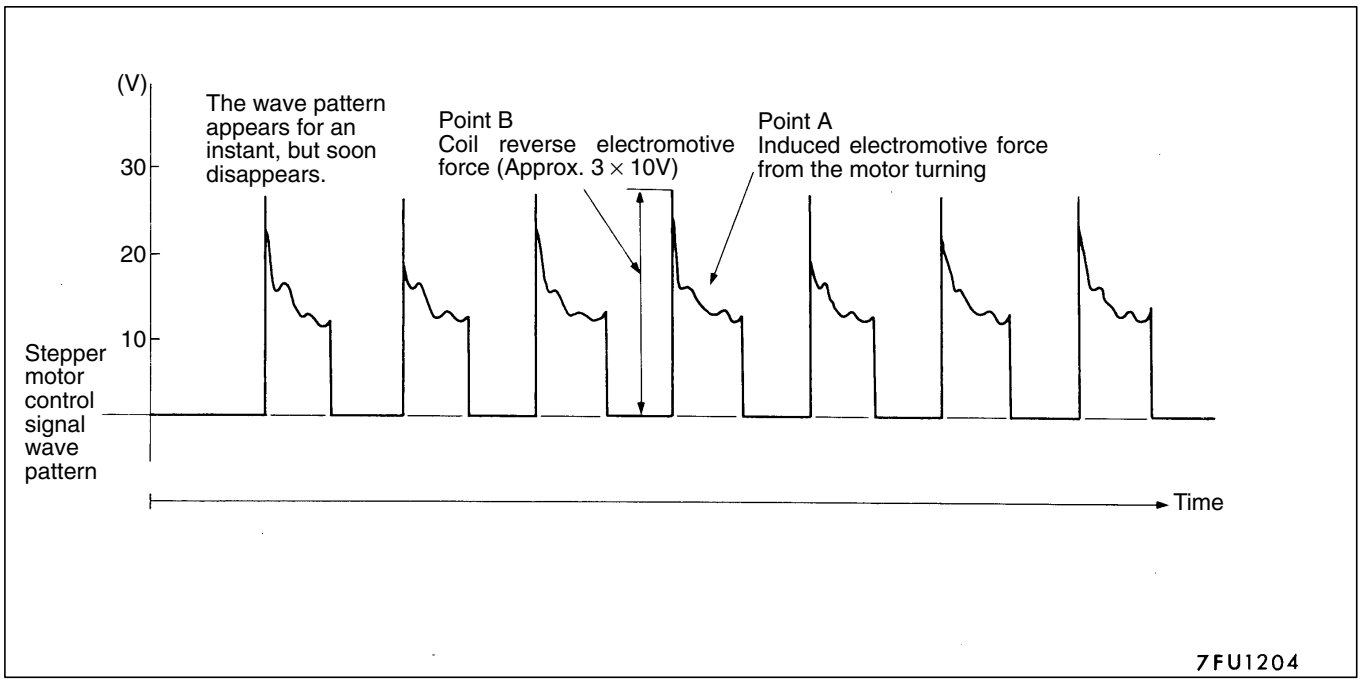
1. Connect the analyzer special patterns pickup to engine-ECU terminal 4, connection terminal 5, connection terminal 17, and connection terminal 18 respectively.

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 LOCK (OFF) position 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



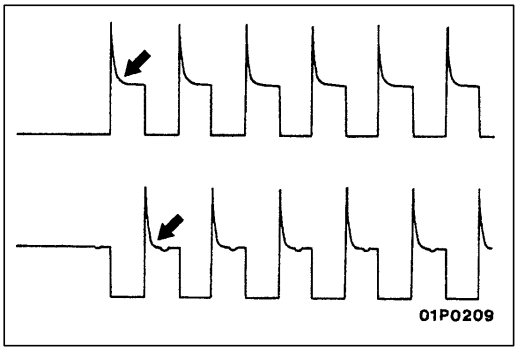
Wave Pattern Observation Points

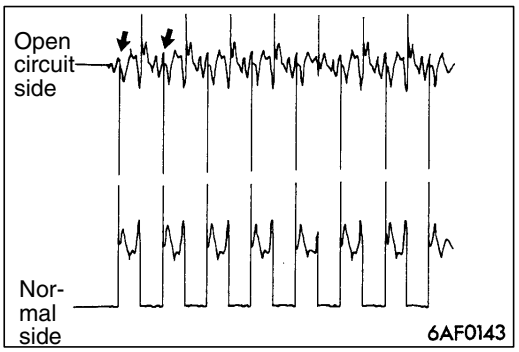
Check that the standard wave pattern appears when the stepper motor is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

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.

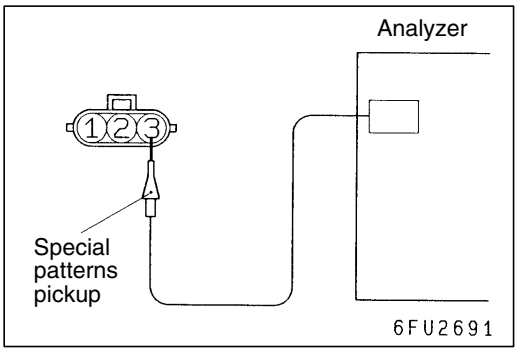
- Example 2

  Cause of problem

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

  Wave pattern characteristics

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



IGNITION COIL AND POWER TRANSISTOR

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

Measurement Method

1. Disconnect the 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)

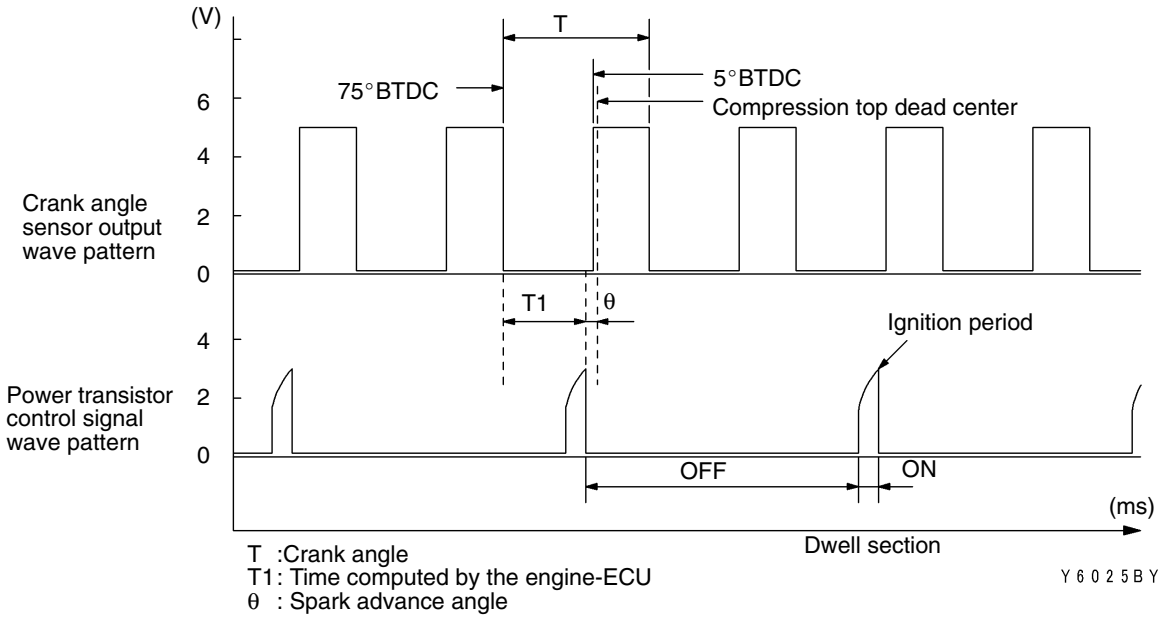
1. Connect the analyzer special patterns pickup to engine-ECU terminal 10 (No. 1 – No. 4), terminal 23 (No. 2 – No. 3) respectively.

Standard Wave Pattern

Observation condition

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

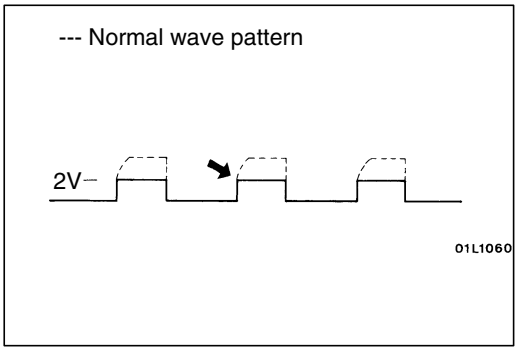
Standard wave pattern

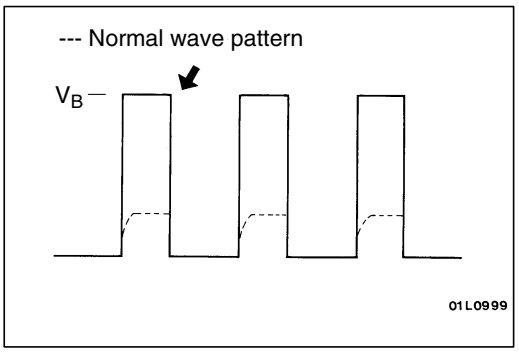


Wave Pattern Observation Points

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. 2 V to approx. 4.5 V at the top-right	Normal
2 V 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 2 V too low.

- Example 2

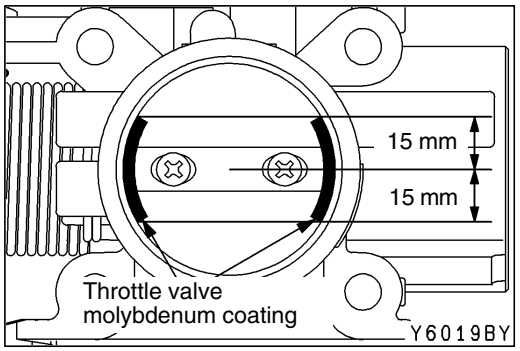
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.



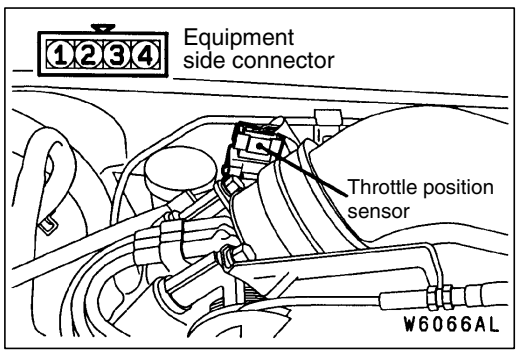
ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Disconnect the air intake hose from the throttle body.
2. Apply some detergent to a clean cloth.
3. Use the clean cloth with detergent to wipe the area around the throttle valve until it is clean.

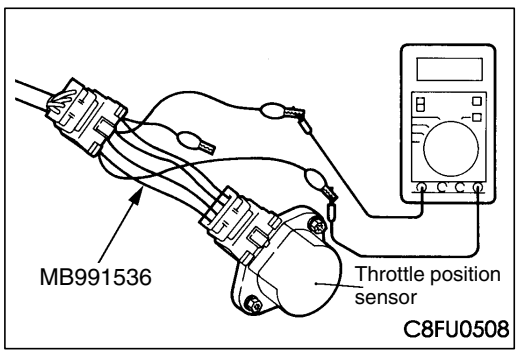
Caution
(1) Do not let any of the detergent get directly onto the throttle valve.
(2) Take care not to let any detergent get into the motor through the bypass passage. Furthermore, do not let it get to the sensor through the shaft.
(3) Do not wipe the molybdenum coating which is located around the throttle valve shaft.

4. Connect the air intake hose.
5. Adjust the standard idle speed.



THROTTLE POSITION SENSOR ADJUSTMENT

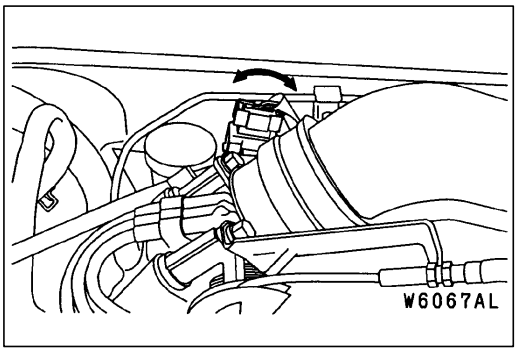
1. Turn the ignition switch to LOCK (OFF) position.
2. Connect the MUT-II to the diagnosis connector.
   When not using the MUT-II, proceed as follows:



(1) Disconnect the throttle position sensor connector, and connect the special tool (throttle position sensor test harness: MB991536) between the disconnected connector taking care not to confuse the terminal to be connected.
(2) Connect digital voltmeter between the terminal No.2 (sensor output: blue clip of special tool) and the terminal No.4 (sensor earth: black clip of special tool) of the throttle position sensor connector.

3. Turn the ignition switch to ON (but do not start the engine).
4. Check the output voltage of the throttle position sensor.

Standard value: 535 – 735 mV



5. If not within the standard value, loosen the throttle position sensor mounting bolts. Then rotate the sensor body to adjust.
6. Turn the ignition switch to LOCK (OFF) position.
7. Remove the MUT-II. If the MUT-II is not used, remove the special tool, and then connect the throttle position sensor connector.
8. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II or disconnect the negative battery cable from the battery terminal and then leave it for at least ten seconds. After that, reconnect the battery cable, and then let the engine run at idle for approx. ten minutes.

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. Turn the ignition switch to LOCK (OFF) position.
3. Connect the MUT-II to the diagnosis connector (16-pin).

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

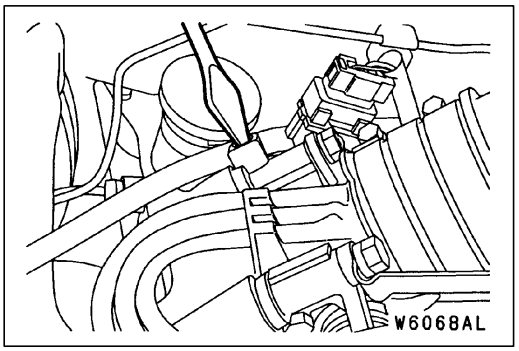
4. Start the engine and run at idle.
5. Select the item No.30 of the MUT-II Actuator test.

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

6. Check the idle speed.

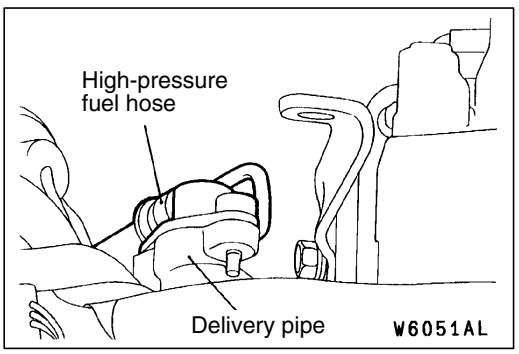
Standard value: 700 ± 50 r/min

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.13C-96.)



7. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.
8. Press the MUT-II clear key, and release the ISC servo from the Actuator test mode.

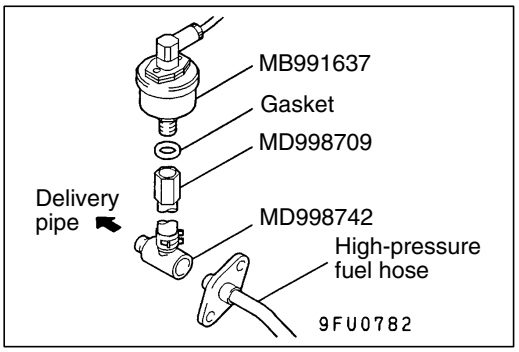
   NOTE
   Unless the ISC servo is released, the Actuator test mode will continue 27 minutes.
9. Turn the ignition switch to LOCK (OFF) position.
10. Disconnect the MUT-II.
11. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.



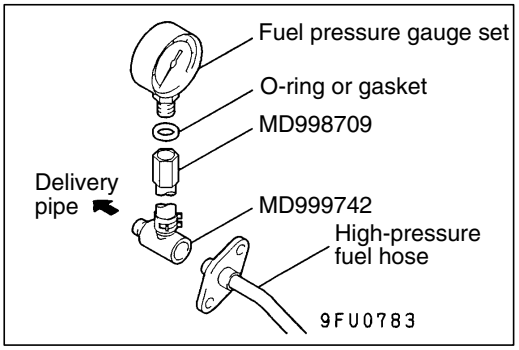
FUEL PRESSURE TEST

1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13C-70.)
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.



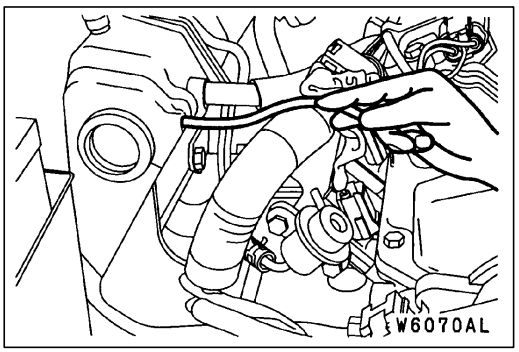
3. Remove the union joint and bolt from the special tool (adapter hose) and instead attach the special tool (hose adapter) to the adapter hose.
4. Install the special tool (for measuring the fuel pressure) that was set up in step 3.
   <When using the fuel pressure gauge set (special tool)>
   (1) Install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



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

    Standard value: 324–349 kPa

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
• 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

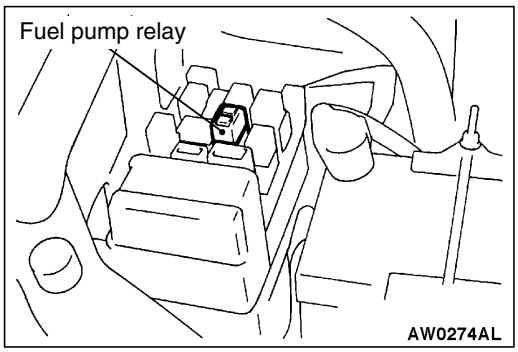
16. Release residual pressure from the fuel pipe line. (Refer to P.13C-70.)
17. Remove the fuel pressure gauge and special tool from the delivery pipe.

    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: 9.0 ± 2.0 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 the fuel pressure in the line and prevent fuel from running out.

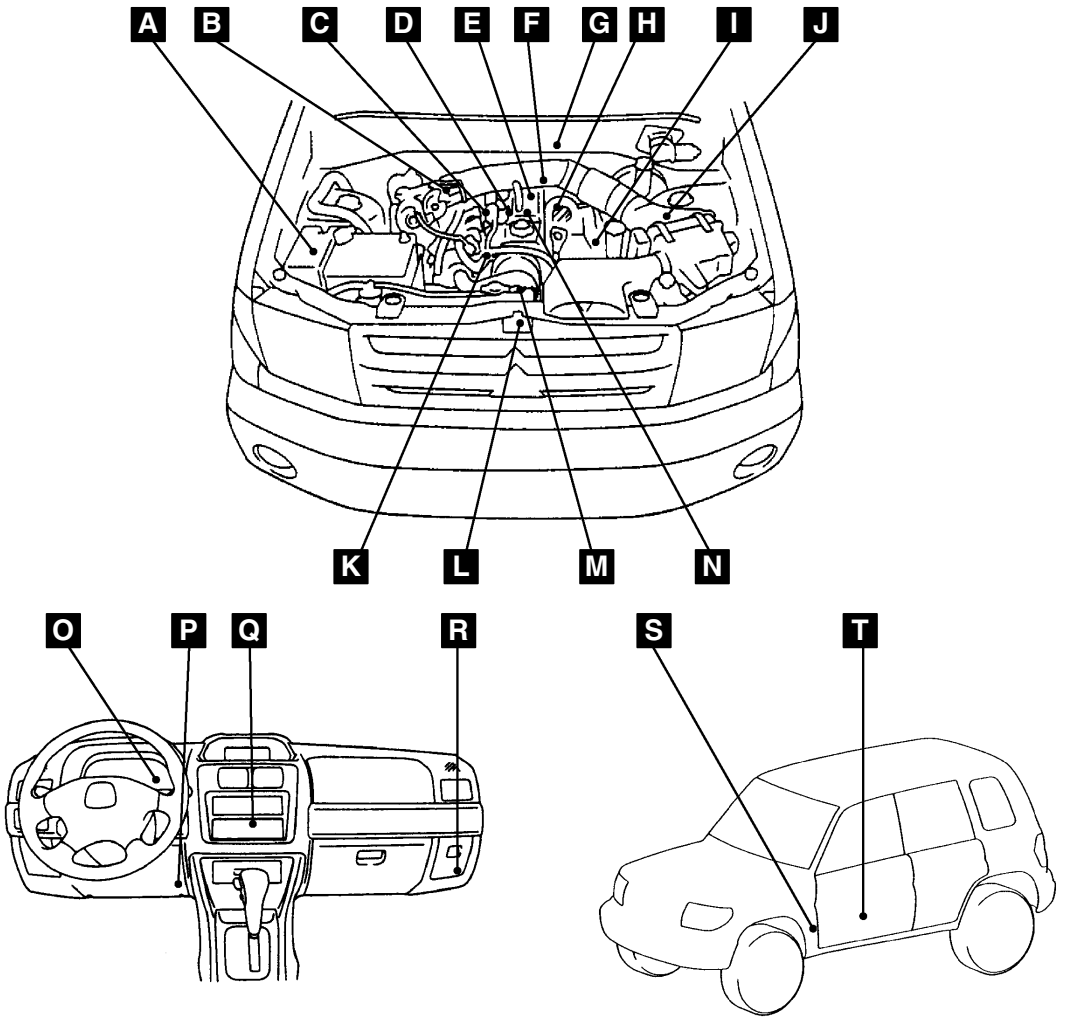
1. Remove the fuel pump relay.
2. After starting the engine and letting it run until it stops naturally, turn the ignition switch to LOCK (OFF) position.
3. Install the fuel pump relay.

FUEL PUMP OPERATION CHECK

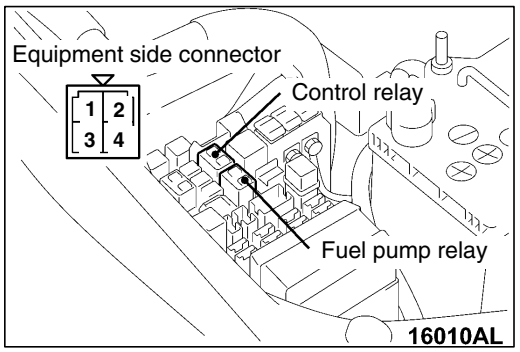
Refer to GROUP 13A – On-vehicle Service.

COMPONENT LOCATION

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

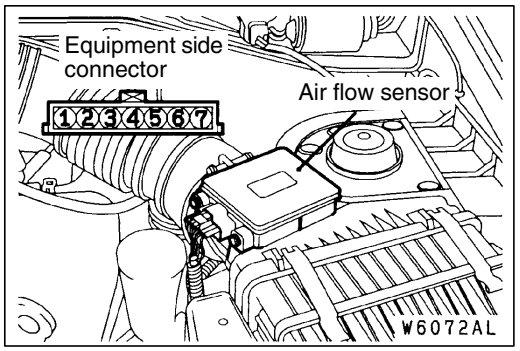


16021AL



CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

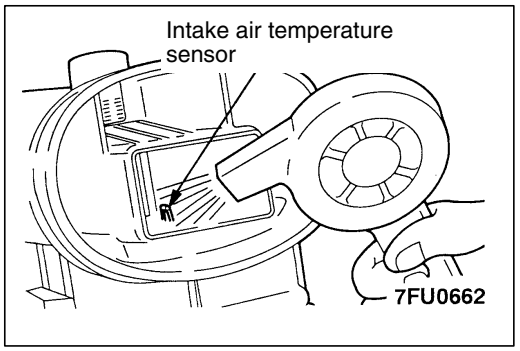
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕



INTAKE AIR TEMPERATURE SENSOR CHECK

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

Standard value:
13 – 17 kΩ (at –20°C)
5.7 – 6.7 kΩ (at 0°C)
2.3 – 3.0 kΩ (at 20°C)
1.0 – 1.5 kΩ (at 40°C)
0.56 – 0.76 kΩ (at 60°C)
0.30 – 0.42 kΩ (at 80°C)

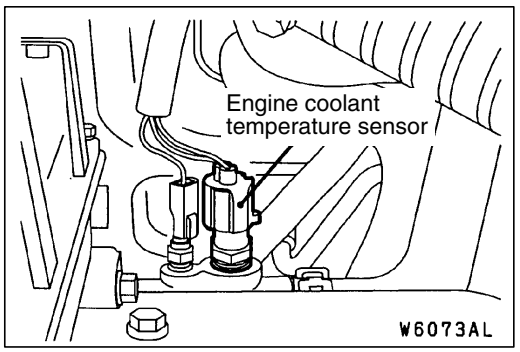


3. Measure resistance while heating the sensor using a hair drier.

Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

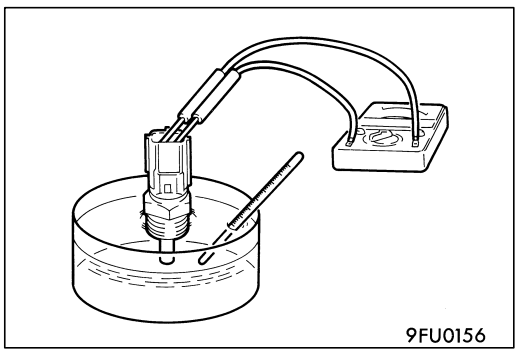
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

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

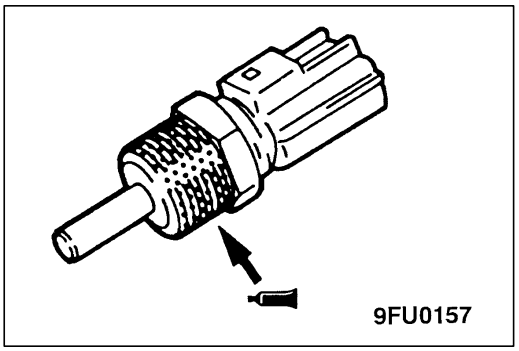
1. Remove the engine coolant temperature sensor.



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

Standard value:
14 – 17 kΩ (at –20°C)
5.1 – 6.5 kΩ (at 0°C)
2.1 – 2.7 kΩ (at 20°C)
0.9 – 1.3 kΩ (at 40°C)
0.48 – 0.68 kΩ (at 60°C)
0.26 – 0.36 kΩ (at 80°C)

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

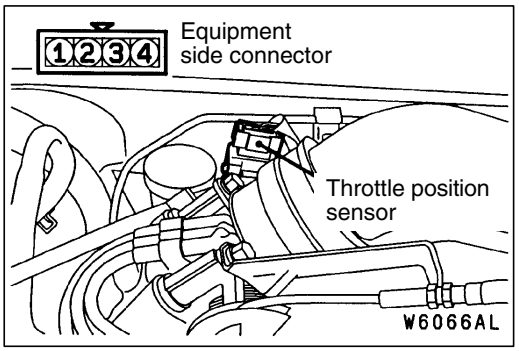


4. Apply sealant to threaded portion.

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 ± 9 N·m



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

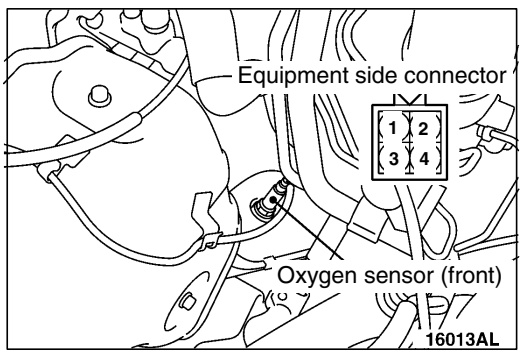
3. Measure the resistance between the throttle position sensor side connector terminal 2 and terminal 4.

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

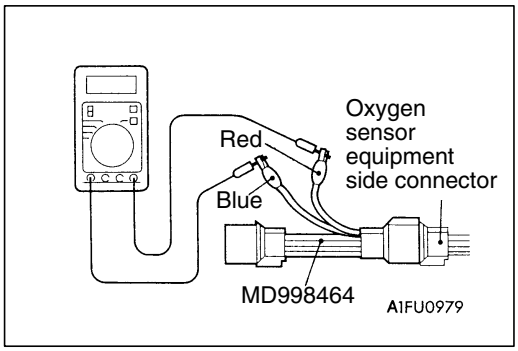
4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

NOTE
For the throttle position sensor adjustment procedure, refer to P.13C-96.

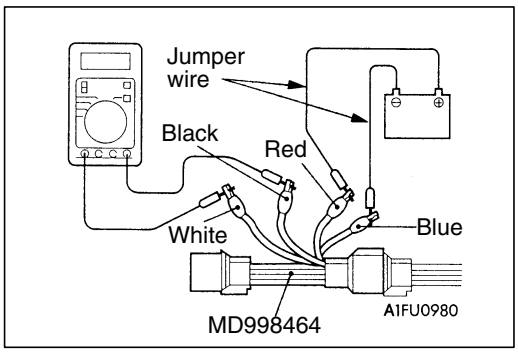


OXYGEN SENSOR CHECK <Oxygen sensor (front)>

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 (4.8 – 8.0 Ω at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.



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



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

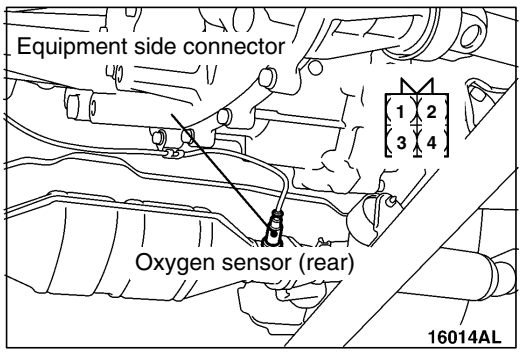
   Caution
   Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.
6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   Standard value:

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

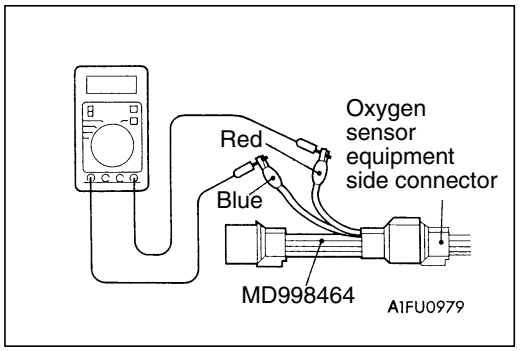
8. If the sensor is defective, replace the oxygen sensor.

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

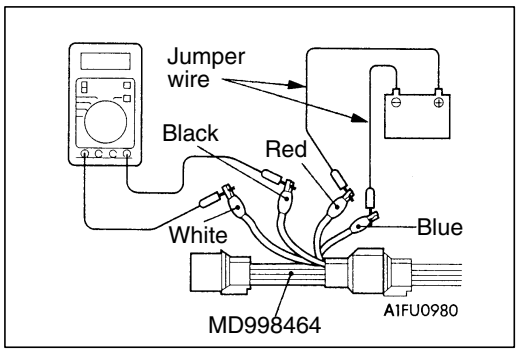


<Oxygen sensor (rear)>

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



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



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

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

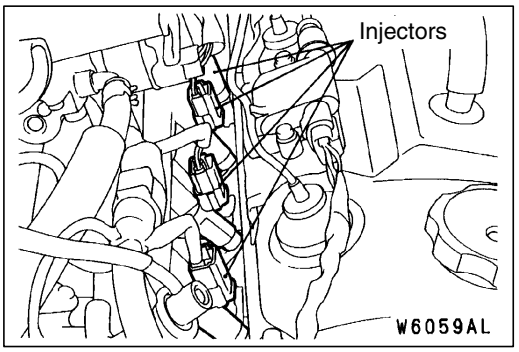
6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   Standard value:

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

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

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



INJECTOR CHECK

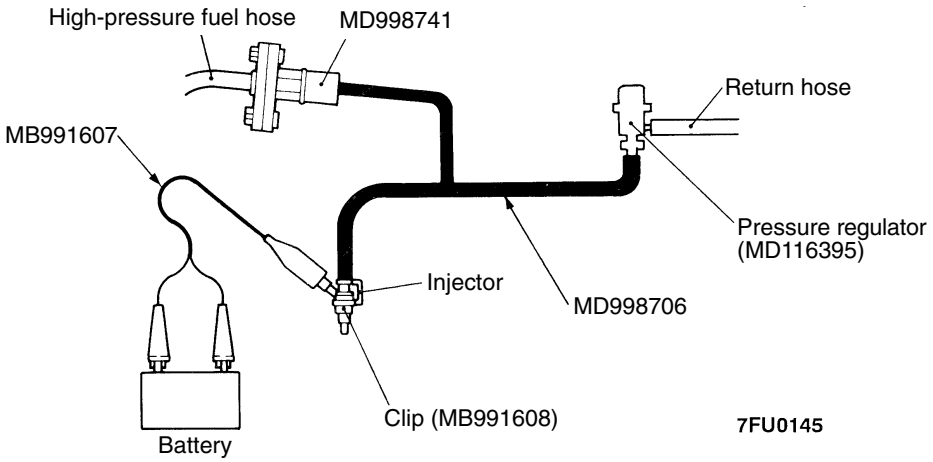
Measurement of Resistance between Terminals

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

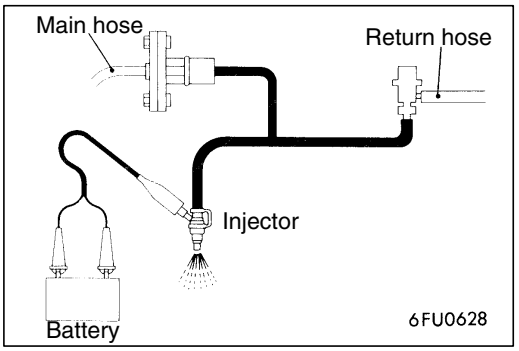
   Standard value: 13 – 16 Ω (at 20°C)
3. Install the injector connector.

Checking the Injection Condition

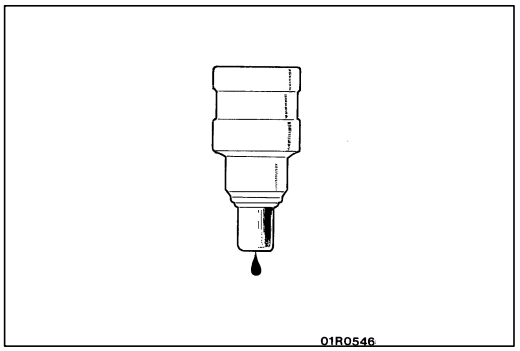
1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13C-100.)
2. Remove the injector.
3. Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.



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.



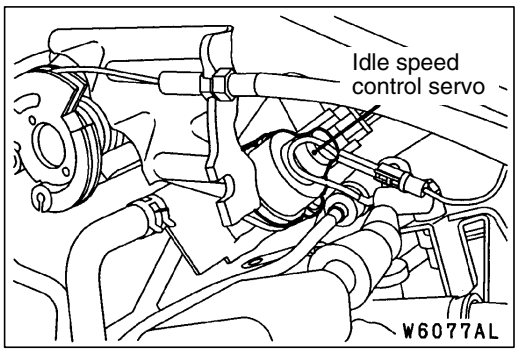
7. Activate the injector and check the atomized spray condition of the fuel.
   The condition can be considered satisfactory unless it is extremely poor.



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.



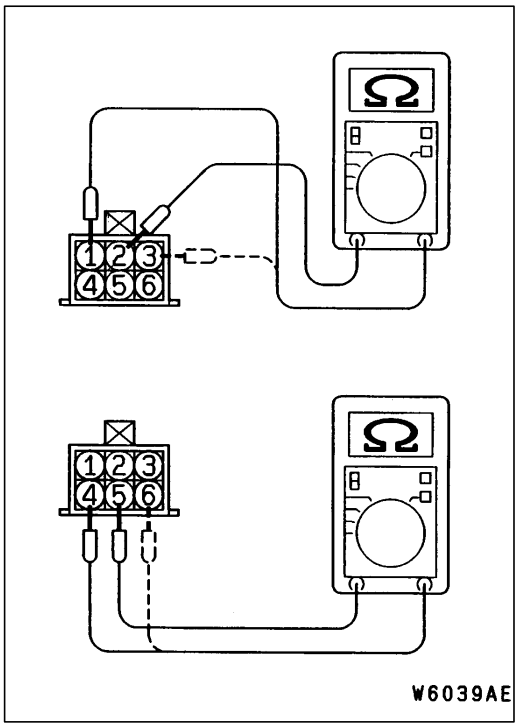
IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

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 do not start the engine.)
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.



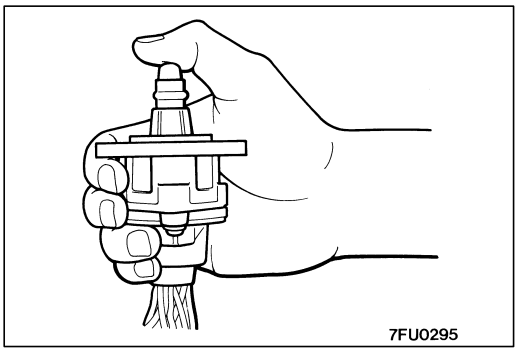
Checking the Coil Resistance

1. Disconnect the idle speed control servo connector.
2. Measure the resistance between terminal 2 and either terminal 1 or terminal 3 of the connector at the idle speed control servo side.

   Standard value: 27 – 33 Ω (at 20°C)

3. Measure the resistance between terminal 5 and either terminal 6 or terminal 4 of the connector at the idle speed control servo side.

   Standard value: 27 – 33 Ω (at 20°C)



Operation Check

1. Remove the throttle body.
2. Remove the stepper motor.
3. Connect the special tool (test harness: MB991709) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approx. 6 V) to the terminals 2 and 5.
5. With the idle speed control servo as shown in the illustration, connect the negative (–) terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.
   (1) Connect the negative (–) terminal of the power supply to the red and black clip.
   (2) Connect the negative (–) terminal of the power supply to the blue and black clip.
   (3) Connect the negative (–) terminal of the power supply to the blue and yellow clip.
   (4) Connect the negative (–) terminal of the power supply to the red and yellow clip.
   (5) Connect the negative (–) terminal of the power supply to the red and black clip.
   (6) Repeat the tests in sequence from (5) to (1).
6. If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.

PURGE CONTROL SOLENOID VALVE CHECK <Vehicles with catalytic converter>

Refer to GROUP 17 – Emission Control System.

EGR CONTROL SOLENOID VALVE CHECK

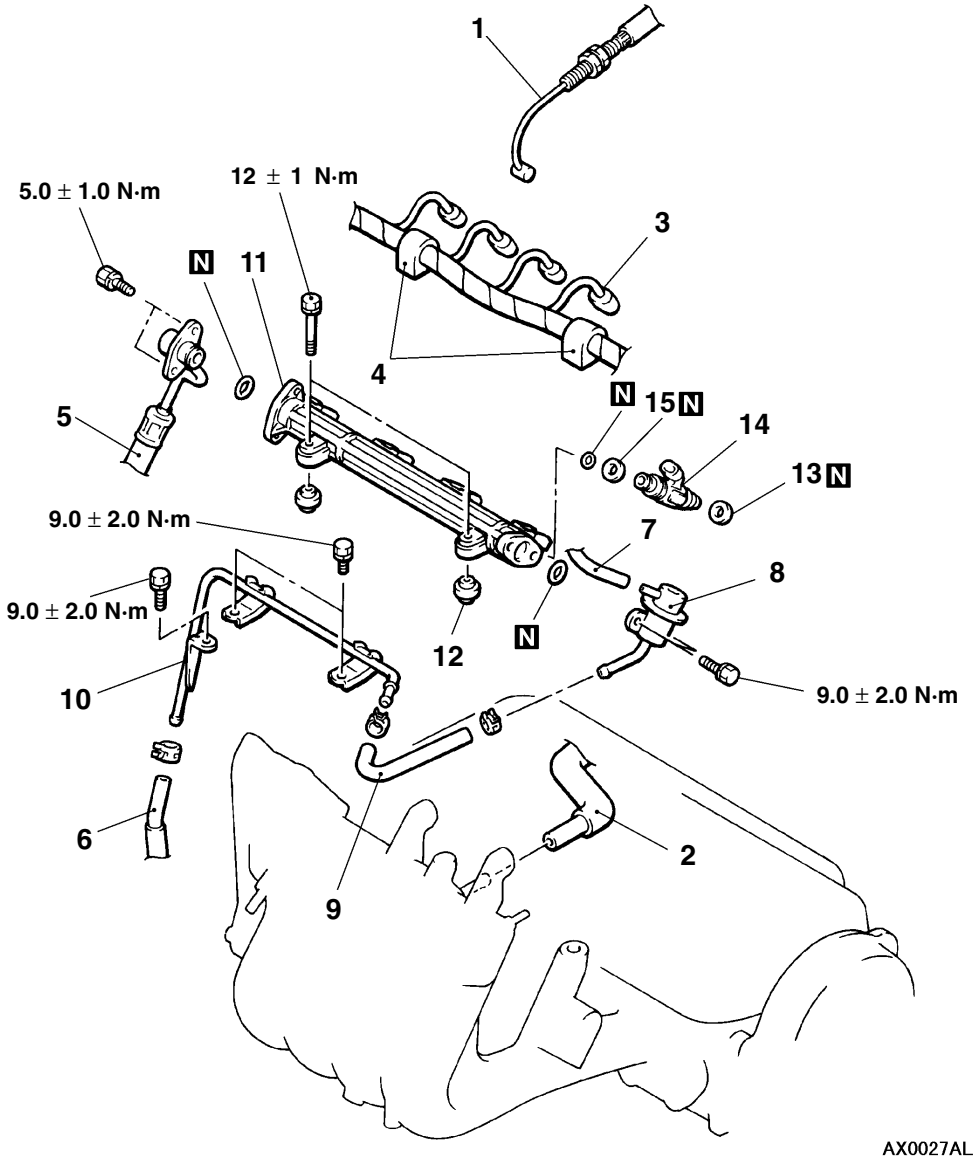
Refer to GROUP 17 – Emission Control System.

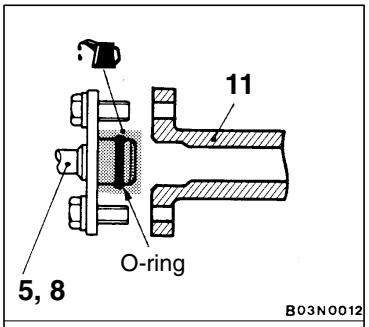
INJECTOR

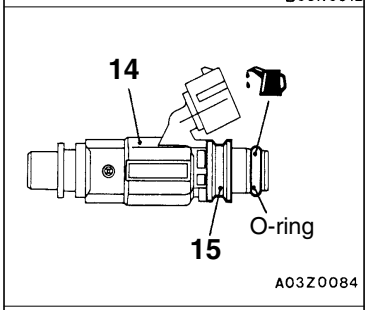
REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Discharge Prevention (Refer to P.13C-100)
- Air Cleaner and Air Intake Pipe Removal (Refer to GROUP 15.)

Post-installation Operation
- Air Cleaner and Air Intake Pipe Installation (Refer to GROUP 15.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)







Engine oil

Removal steps

1. Accelerator cable connection
2. PCV hose
3. Injector connector
4. Injector harness clamp
▶A◀ 5. High-pressure fuel hose connection
6. Fuel return hose connection
7. Vacuum hose connection
▶A◀ 8. Fuel pressure regulator
9. Fuel hose
10. Fuel return pipe
◀A▶ 11. Delivery pipe
12. Insulator
13. Insulator
◀A▶ ▶A◀ 14. Injector
15. 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 injector, high-pressure fuel hose or fuel pressure regulator and then re-insert it into the delivery pipe and check once again.
4. Tighten the high-pressure fuel hose and fuel pressure regulator to the specified torque.

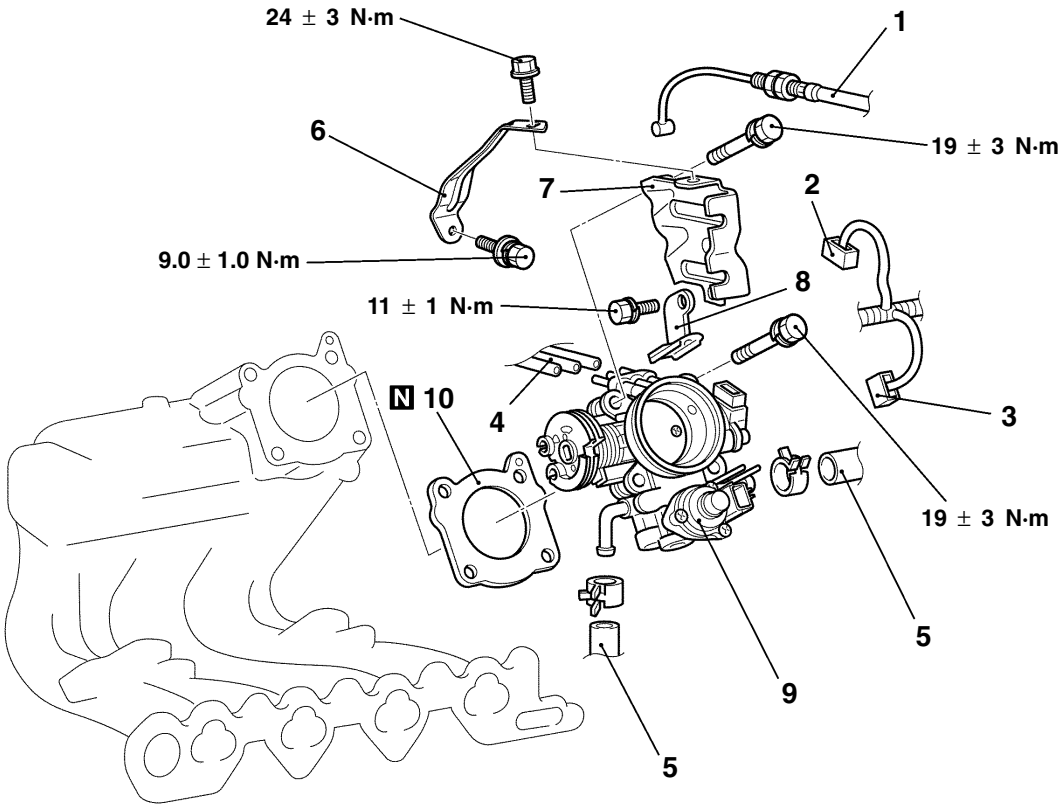
   Tightening torque:
   9.0 ± 2.0 N·m (Fuel pressure regulator)
   5.0 ± 1.0 N·m (High-pressure fuel hose)

THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner and Air Intake Pipe Removal (Refer to GROUP 15.)

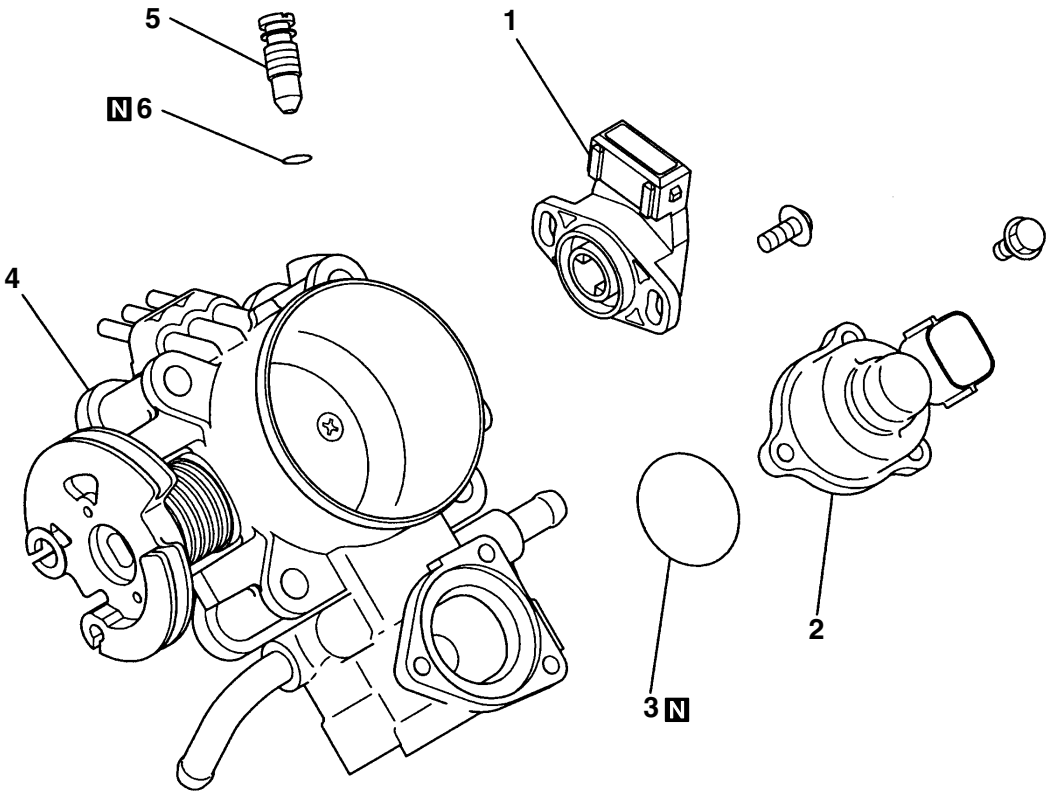
Post-installation Operation
- Air Cleaner and Air Intake Pipe Installation (Refer to GROUP 15.)
- Engine Coolant Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



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. Stay
7. Throttle cable bracket
8. Harness Clamp
9. Throttle body
10. Throttle body gasket

DISASSEMBLY AND REASSEMBLY



Disassembly steps

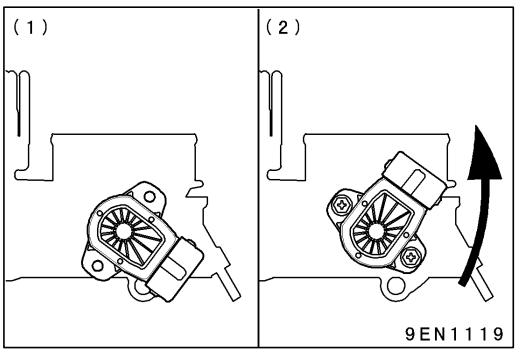
▶A◀ 1. Throttle position sensor
2. Idle speed control body assembly
3. O-ring
4. Throttle body
5. Speed adjusting screw
6. O-ring

NOTE
1. The speed adjusting screw is correctly adjusted at the factory and should not be removed.
2. If the speed adjusting screw has been removed, carry out fixed SAS adjustment.
3. If the speed adjusting screw should happen to have been removed, carry out speed adjusting screw adjustment.

CLEANING THROTTLE BODY PARTS

1. Clean all throttle body parts.
   Do not use solvent to clean the following parts:
   - Throttle position sensor
   - Accelerator pedal position sensor
   - Idle speed control body assembly

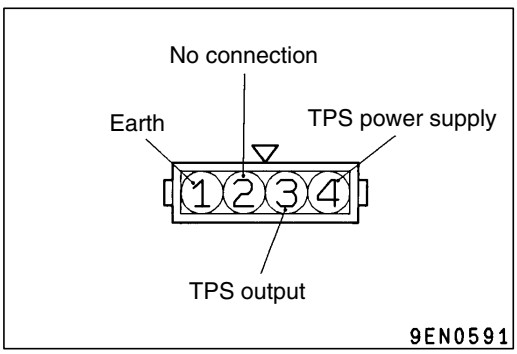
   If these parts are immersed in solvent, their insulation will deteriorate.
   Wipe them with cloth only.
2. Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.



REASSEMBLY SERVICE POINT

▶A◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

1. Install the TPS to the throttle body as shown by (1) in the illustration.
2. Turn the TPS so that it is at the position shown by (2) in the illustration, and then tighten the screw.



3. Connect a multimeter between terminal (4) (TPS power supply) and terminal (3) (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
4. If there is an abnormality, replace the TPS.

NOTES