

FUEL

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MULTIPOINT FUEL INJECTION (MPI)

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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 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 idle speed control 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 barometric 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	60
	Throttle position sensor	Variable resistor type
	Idle speed control servo	Stepper motor type (Stepper motor type by-pass air control system with the air volume limiter)
Engine-ECU	Identification No.	E6T34874
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
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Power steering fluid pressure switch	Contact switch type
Actuators	Engine control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	MDL560
	EGR control solenoid valve	Duty cycle type solenoid valve
	Purge control solenoid valve	Duty cycle type solenoid valve
	Fuel pressure control solenoid valve	ON/OFF type solenoid valve
	Waste gate solenoid valve	Duty cycle type solenoid valve
	Secondary air control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	294

MULTI-POINT FUEL INJECTION SYSTEM DIAGRAM

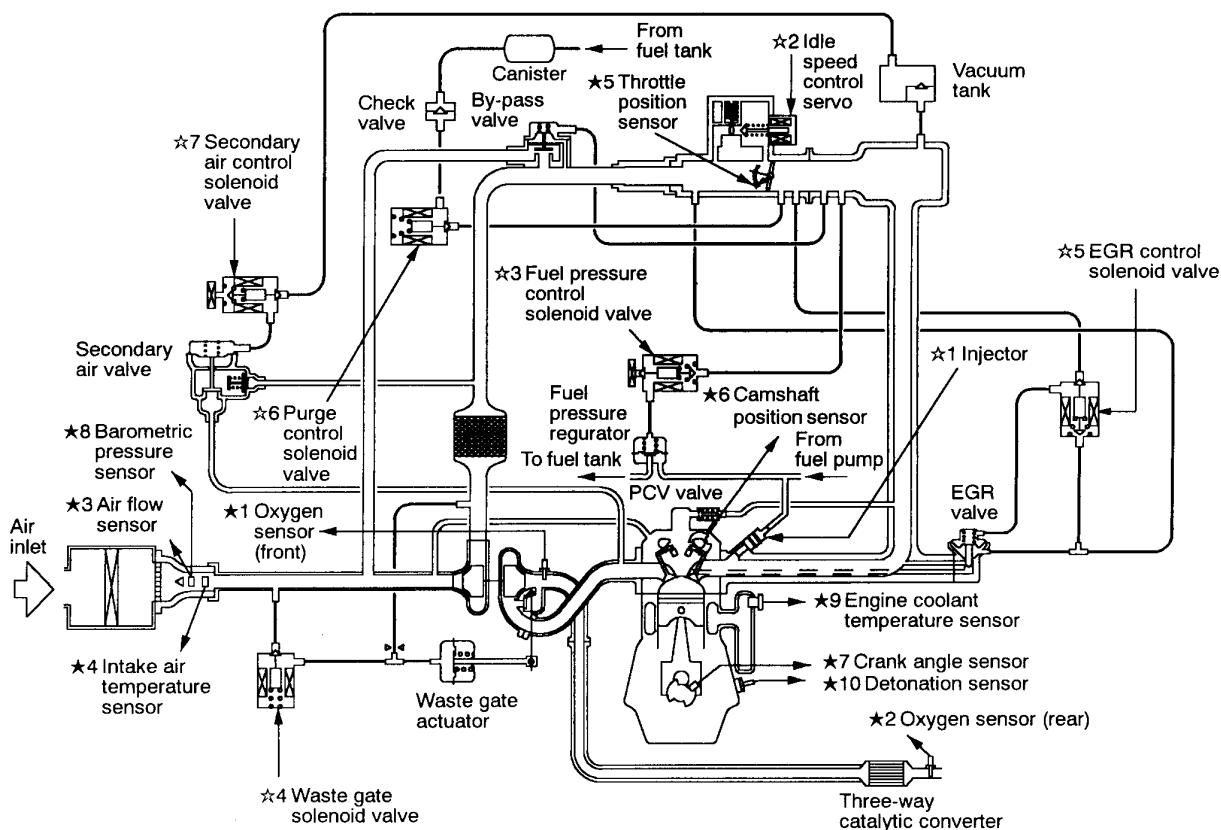
- ★1 Oxygen sensor (front)
- ★2 Oxygen sensor (rear)
- ★3 Air flow sensor
- ★4 Intake air temperature sensor
- ★5 Throttle position sensor
- ★6 Camshaft position sensor
- ★7 Crank angle sensor
- ★8 Barometric pressure sensor
- ★9 Engine coolant temperature sensor
- ★10 Detonation sensor

- Power supply
- Ignition switch IG
- Ignition switch ST
- Vehicle speed sensor
- A/C switch
- A/C load signal
- Tachometer
- Power steering fluid pressure switch
- Alternator FR terminal
- Diagnosis control terminal
- Intercooler water spray switch (automatic)
- Intercooler water spray switch (manual)

Engine-ECU

- ★1 Injector
- ★2 Idle speed control servo
- ★3 Fuel pressure control solenoid valve
- ★4 Waste gate solenoid valve
- ★5 EGR control solenoid valve
- ★6 Purge control solenoid valve
- ★7 Secondary air control solenoid valve

- Engine control relay
- Fuel pump relay 2, 3
- A/C relay
- Ignition coil
- Fan controller
- Condenser fan relay (HI)
- Condenser fan relay (LOW)
- Engine warning lamp
- Diagnosis output
- Alternator G terminal
- Intercooler water spray relay
- Intercooler water spray lamp



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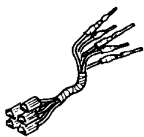
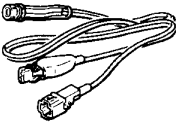
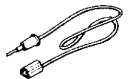
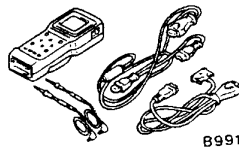
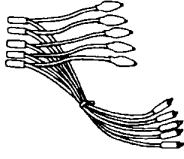
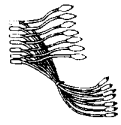
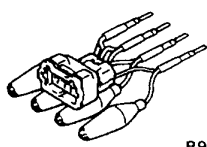
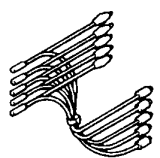
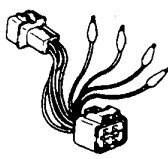
SERVICE SPECIFICATIONS

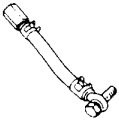
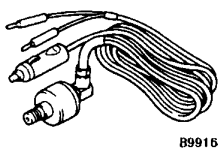
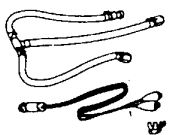
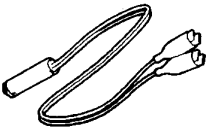
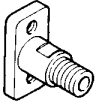
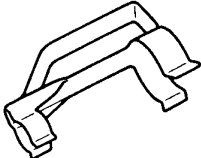
Items		Specifications
Basic idle speed r/min		850 ± 100
Throttle position sensor adjusting voltage mV		535 – 735
Throttle position sensor resistance kΩ		3.5 – 6.5
Idle speed control servo coil resistance (at 20°C) Ω		28 – 33
Intake air temperature sensor resistance kΩ	-20°C	13 – 17
	0°C	5.7 – 6.7
	20°C	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 heater resistance (at 20°C) Ω	Front	4.5 – 8.0
	Rear	11 – 18
Oxygen sensor output voltage (at racing) V		0.6 – 1.0
Fuel pressure kPa	Vacuum hose disconnection	289 – 309 at curb idle
	Vacuum hose connection	Approximately 230 at curb idle
Fuel pressure control solenoid valve resistance (at 20°C) Ω		28 – 36
Fuel pump resistor resistance Ω		0.45 – 0.65
Injector coil resistance (at 20°C) Ω		2 – 3
Injector fuel leakage rate Drop/minute		1 or less
Resistor (for injector) resistance (at 20°C) Ω		5.8 – 6.2

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	• Inspection using an analyzer
 MB991709	MB991709	Test harness	• Measurement of voltage during trouble-shooting • Inspection using an analyzer • Idle speed control servo (stepper motor) check
 B991536	MB991536	Check harness for TPS adjustment	• Adjustment of throttle position sensor • Measurement of voltage during trouble-shooting
 B991658	MB991658	Test harness	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
	MD998464	Test harness (4 pin, square)	• Measurement of voltage during trouble-shooting • Oxygen sensor (front) check

Tool	Number	Name	Use
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	
	MD998706	Injector test set	
 MB991607	MB991607	Injector test harness	Checking the spray condition of injectors
 MD998741	MD998741	Injector test adaptor	
	MB991608	Clip	

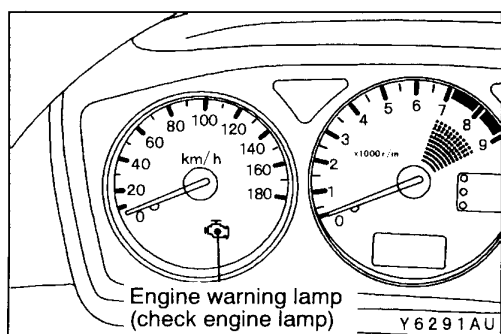
TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE

If the engine-ECU 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 5 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
P0130	Oxygen sensor (front) system
P0135	Oxygen sensor heater (front) system
P0136	Oxygen sensor (rear) system
P0141	Oxygen sensor heater (rear) system
P0201	No.1 injector system
P0202	No.2 injector system
P0203	No.3 injector system
P0204	No.4 injector system
P0325	Detonation sensor system
P0335	Crank angle sensor system
P0340	Camshaft position sensor system
P0403	EGR control solenoid valve system

Code No.	Diagnosis item
P0443	Purge control solenoid valve system
P0500	Vehicle speed sensor system
P0505	Idle speed control system
P0551	Power steering fluid pressure switch
P1104	Waste gate solenoid valve system
P1105	Fuel pressure control solenoid valve system

NOTE

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.

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.

CONFIRMING FREEZE FRAME DATA

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

NOTE

If malfunctions have been detected in multiple systems, engine-ECU stores one malfunction only, which has been detected first.

Item No.	Data item	Unit/State	Item No.	Data item	Unit/State
21	Engine coolant temperature sensor	°C	81	Learn value	%
22	Crank angle sensor	r/min	82	Feedback	%
24	Vehicle speed	km/h	87	Engine load	%

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.

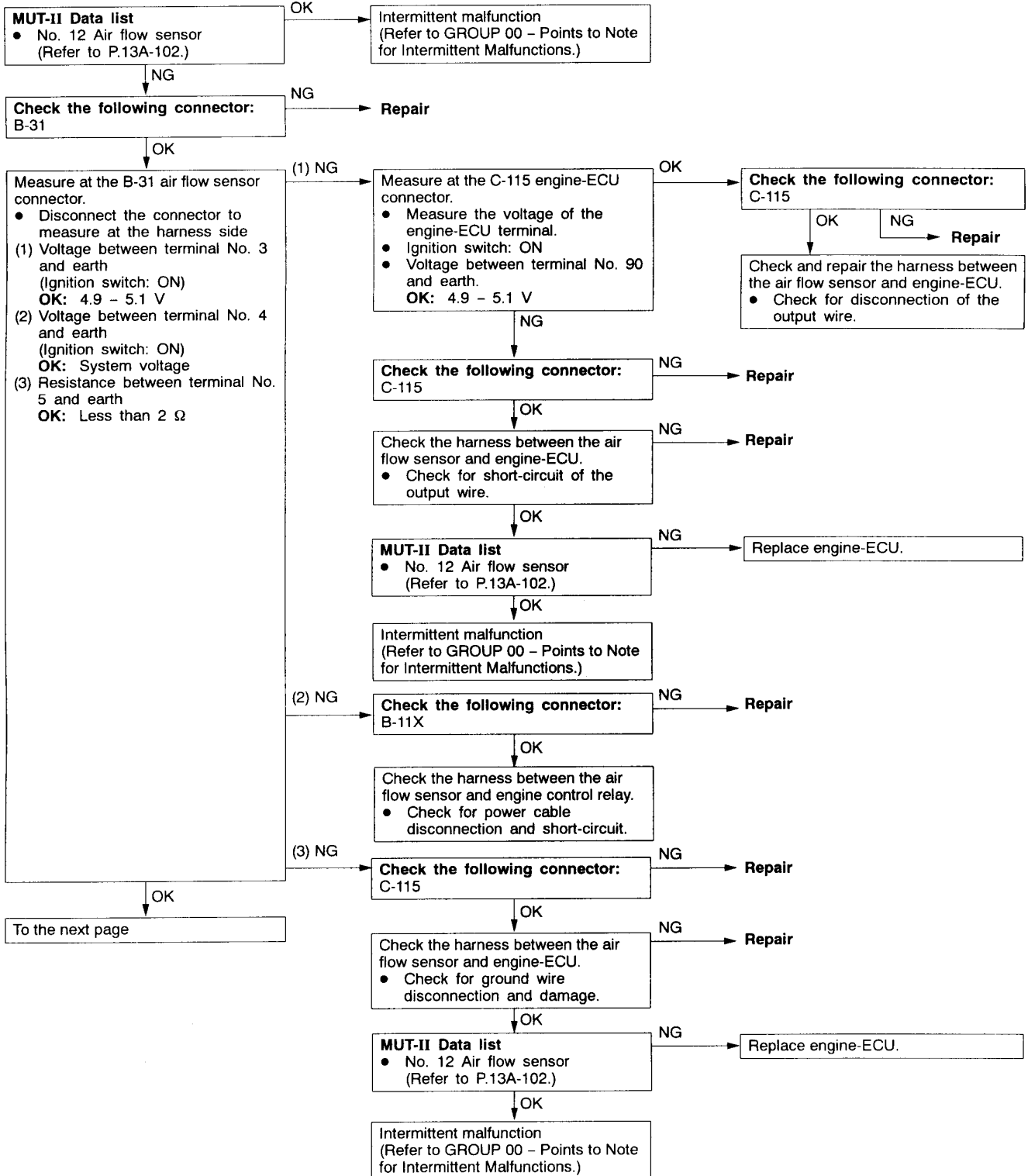
Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the idle speed control 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	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	1. Controls as if the engine coolant temperature is 80°C. (Even after sensor signal is correctly recovered, continues until the ignition switch is set to the "LOCK" (OFF) position.) 2. Rotates radiator fan and condenser fan at high speed.
Camshaft position sensor	1. Inject all fuel cylinders simultaneously. (However, when the No.1 cylinder top dead centre is not detected at all after the ignition switch is turned to "ON" position.) 2. Shuts off fuel supply after 4 seconds have passed since a failure was detected. (However, when the No.1 cylinder top dead centre is not detected at all after the ignition switch is turned to "ON" position.)
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.
Alternator FR terminal	Does not control the output of the alternator according to an electrical load. (works as a normal alternator)

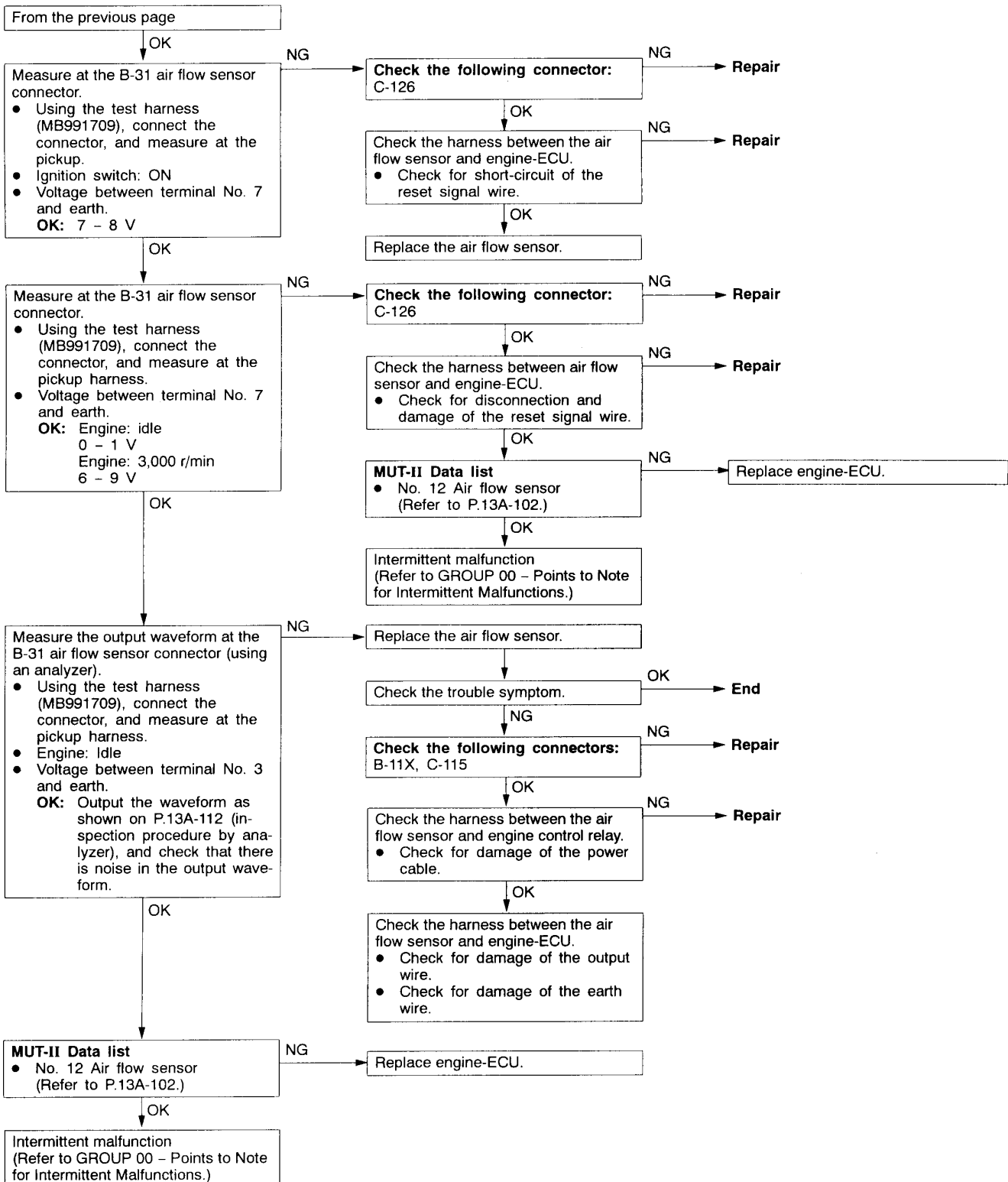
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
P0100	Air flow sensor system	13A-13
P0105	Barometric pressure sensor system	13A-15
P0110	Intake air temprature sensor system	13A-16
P0115	Engine coolant temperature sensor system	13A-19
P0120	Throttle position sensor system	13A-21
P0130	Oxygen sensor (front) system	13A-24
P0135	Oxygen sensor heater (front) system	13A-26
P0136	Oxygen sensor (rear) system	13A-27
P0141	Oxygen sensor heater (rear) system	13A-29
P0201	No.1 injector system	13A-30
P0202	No.2 injector system	13A-31
P0203	No.3 injector system	13A-32
P0204	No.4 injector system	13A-33
P0325	Detonation sensor system	13A-34
P0335	Crank angle sensor system	13A-35
P0340	Camshaft position sensor system	13A-37
P0403	EGR control solenoid valve system	13A-39
P0443	Purge control solenoid valve system	13A-41
P0500	Vehicle speed sensor system	13A-43
P0505	Idle speed control system	13A-44
P0551	Power steering fluid pressure switch system	13A-46
P1104	Waste gate solenoid valve system	13A-47
P1105	Fuel pressure control valve system	13A-48
P1500	Alternator FR terminal system	13A-49
P1603	Battery backup line malfunction	13A-50
P1610	Immobilizer system	13A-51

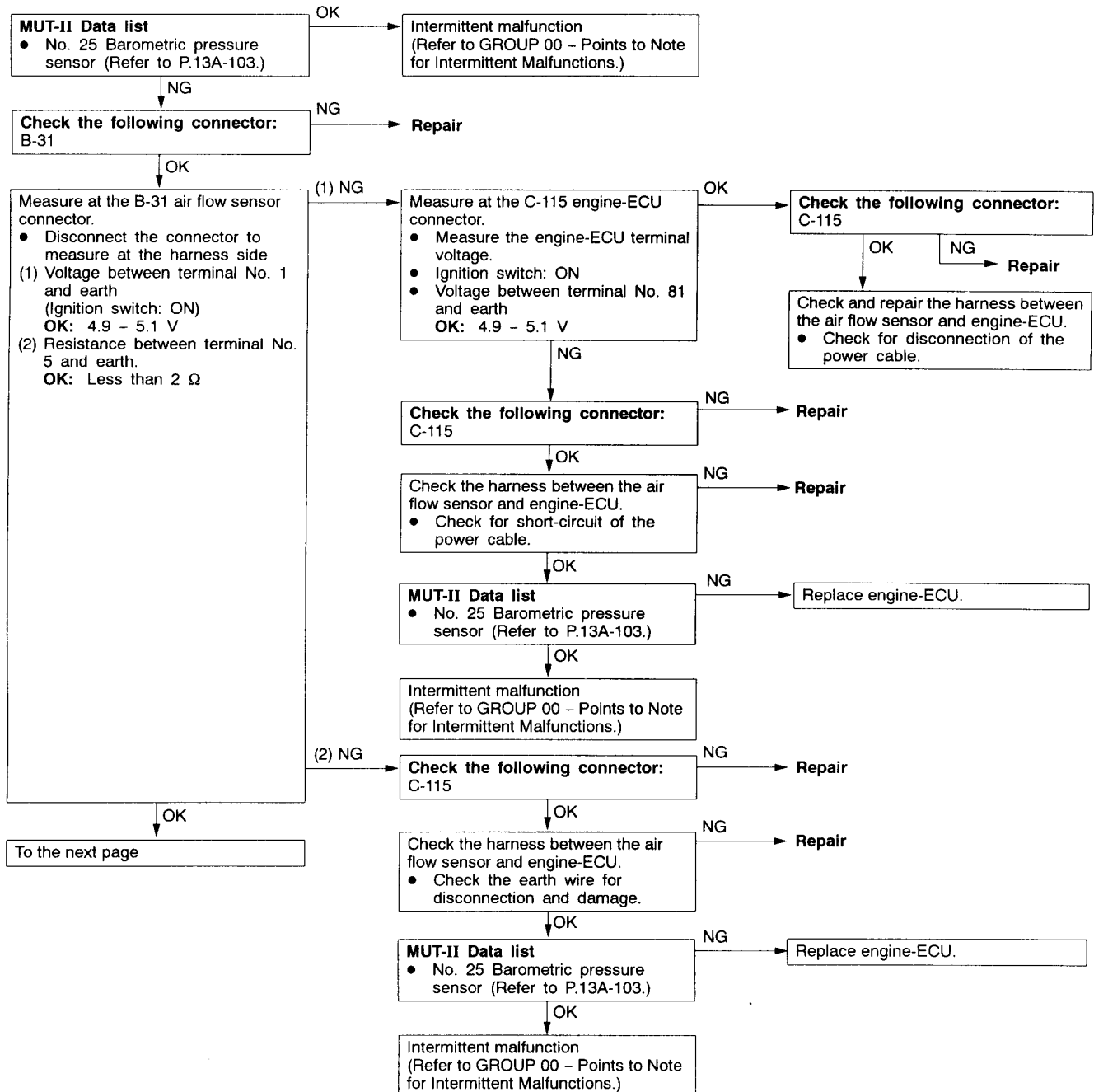
DIAGNOSTIC TROUBLE CODE INSPECTION PROCEDURE

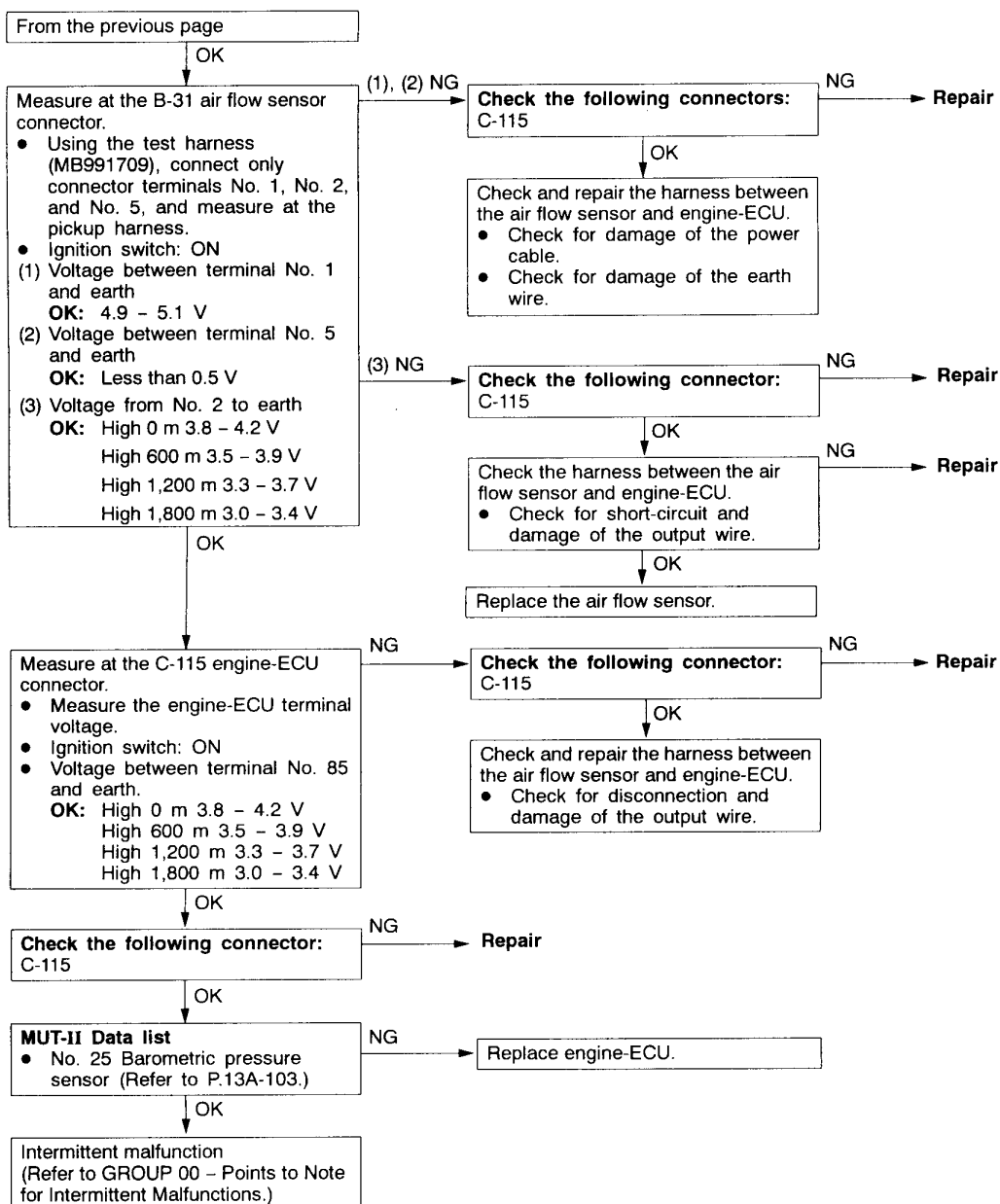
Code No. P0100 Air flow sensor system	Probable cause
Inspection Range • Engine speed: More than 500 r/min Evaluation Conditions • The sensor output frequency is less than 3 Hz for 4 seconds.	• Air flow sensor malfunction • Air flow sensor circuit disconnection, short-circuit, or connector contact defect • Engine-ECU malfunction



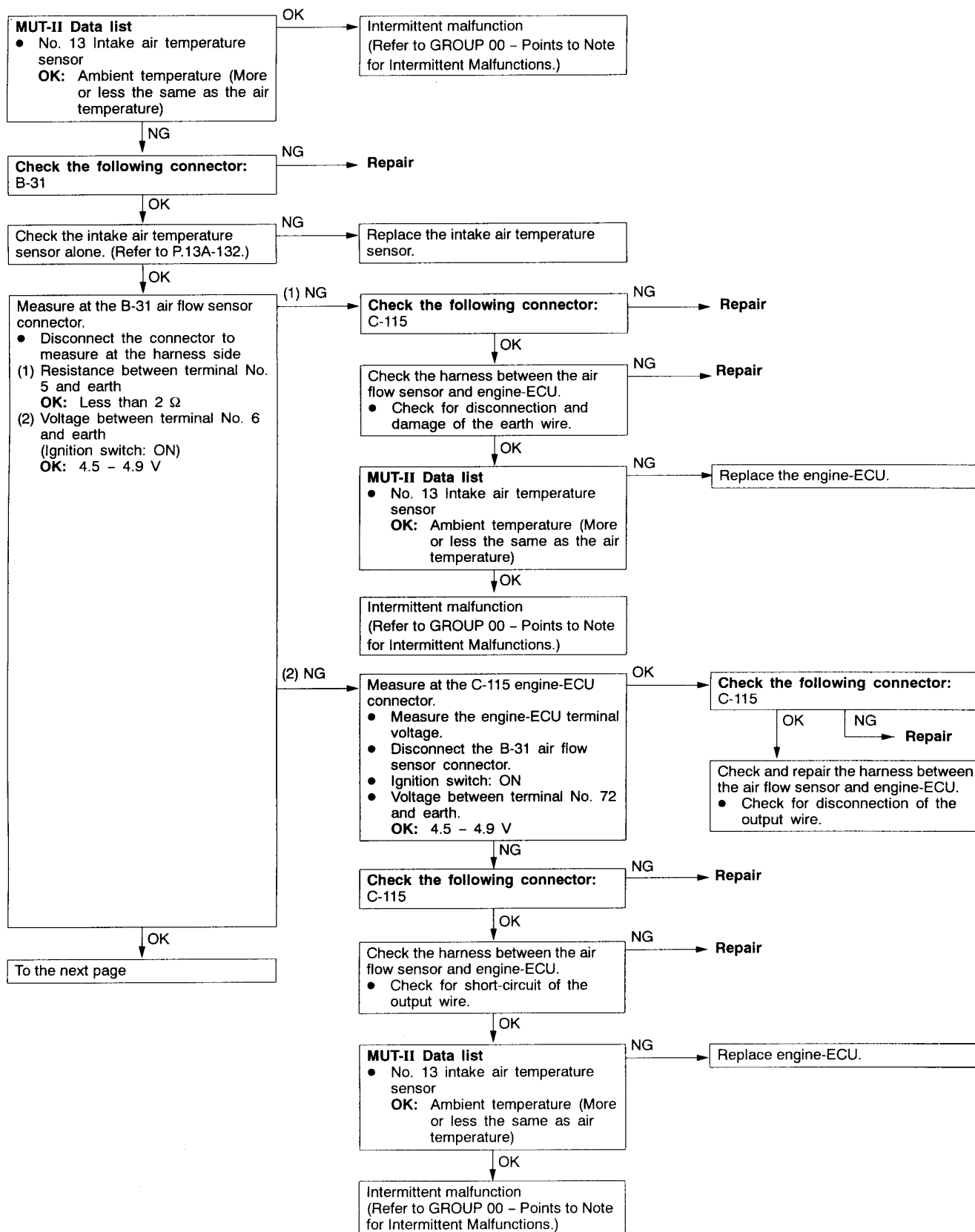


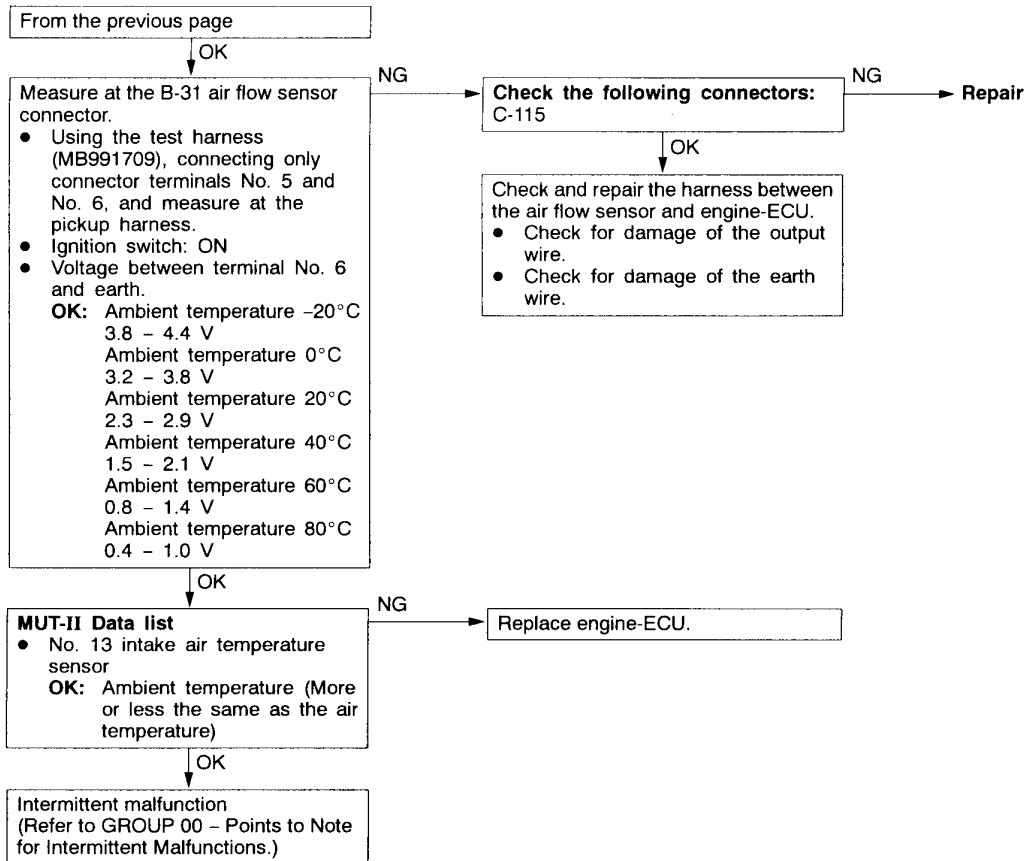
Code No. P0105 Barometric pressure sensor system	Probable cause
Inspection Range 2 seconds after the ignition switch is set to the "ON" position, or after the completion of start of engine. Evaluation Conditions - The sensor output voltage is more than 4.5 V for 4 seconds (Equivalent to air pressure of more than 114 kPa) or - The sensor output voltage is less than 0.2 V for 4 seconds (Equivalent to air pressure of less than 5 kPa)	- Barometric pressure sensor malfunction - Barometric pressure sensor circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction



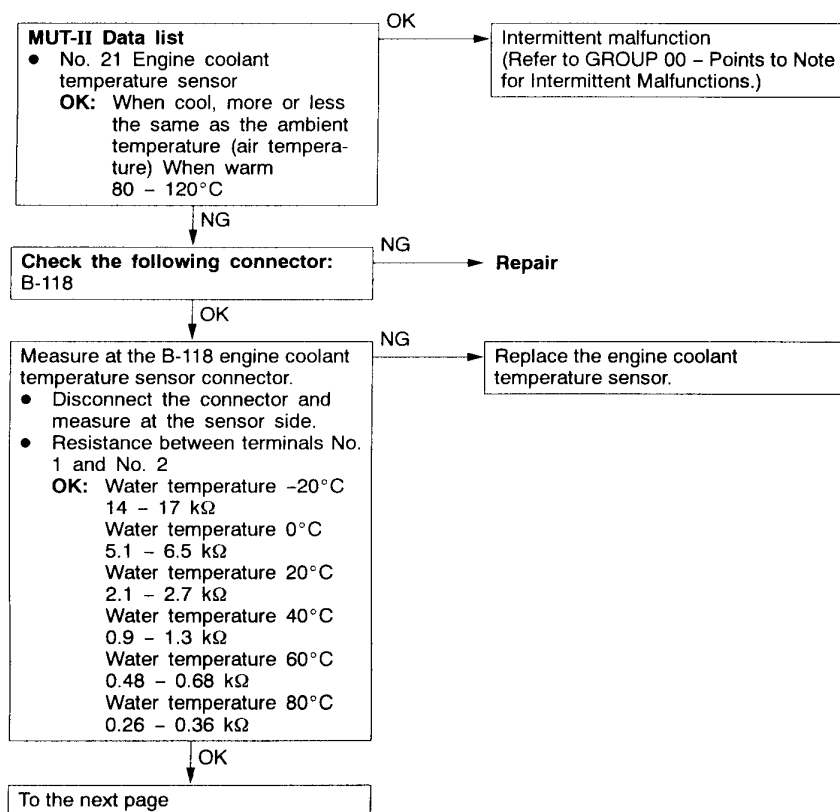


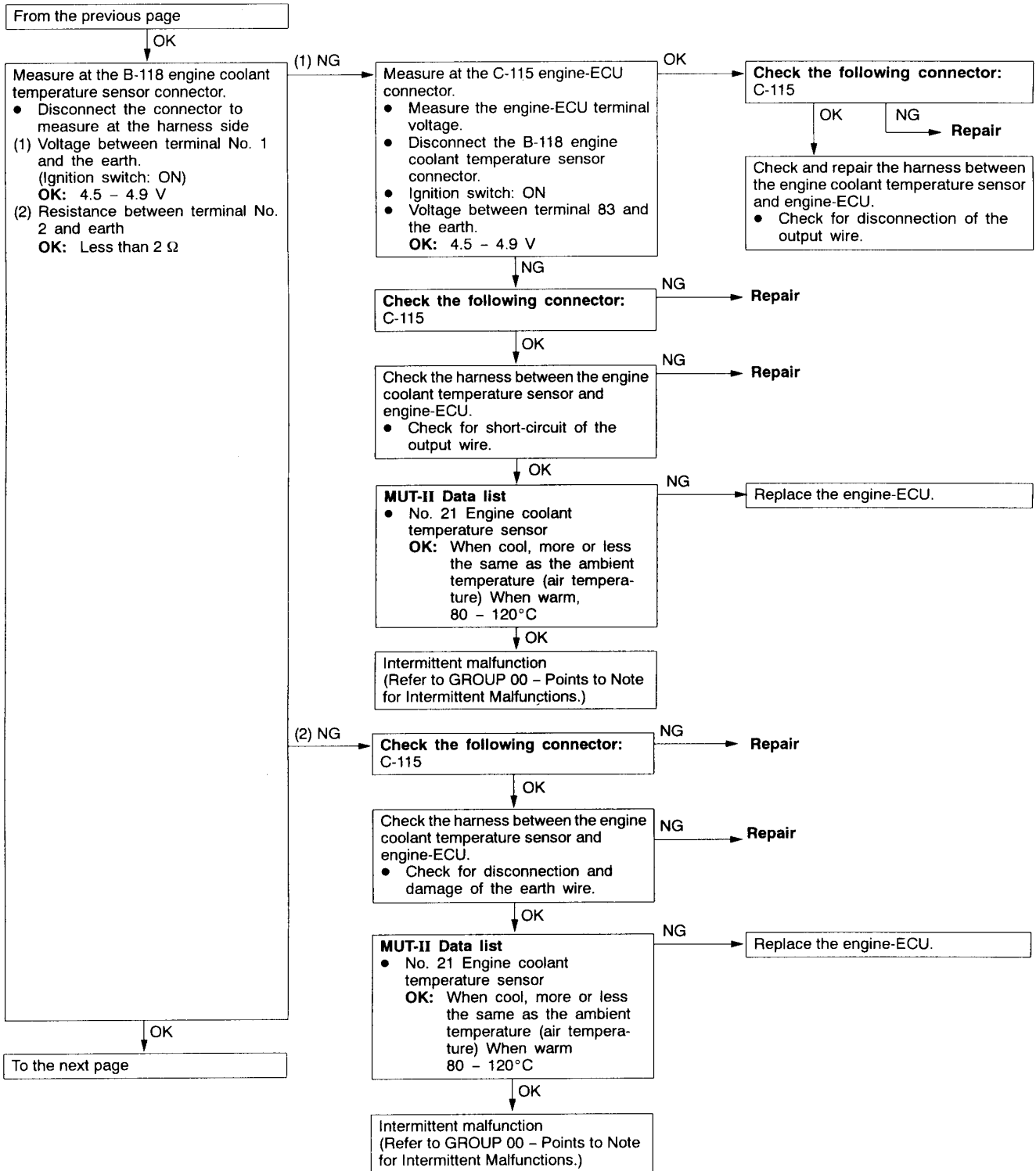
Code No. P0110 Intake air temperature sensor system	Probable cause
Inspection Range - After setting the ignition switch to the "ON" position, or after 2 seconds from completion of start. Evaluation Conditions - The sensor output voltage is more than 4.6 V for 4 seconds (Equivalent to intake air temperature less than -40°C) or - The sensor output voltage is less than 0.2 V for 4 seconds (Equivalent to intake air temperature of more than 120°C)	- Intake air temperature sensor malfunction - Intake air temperature sensor circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction

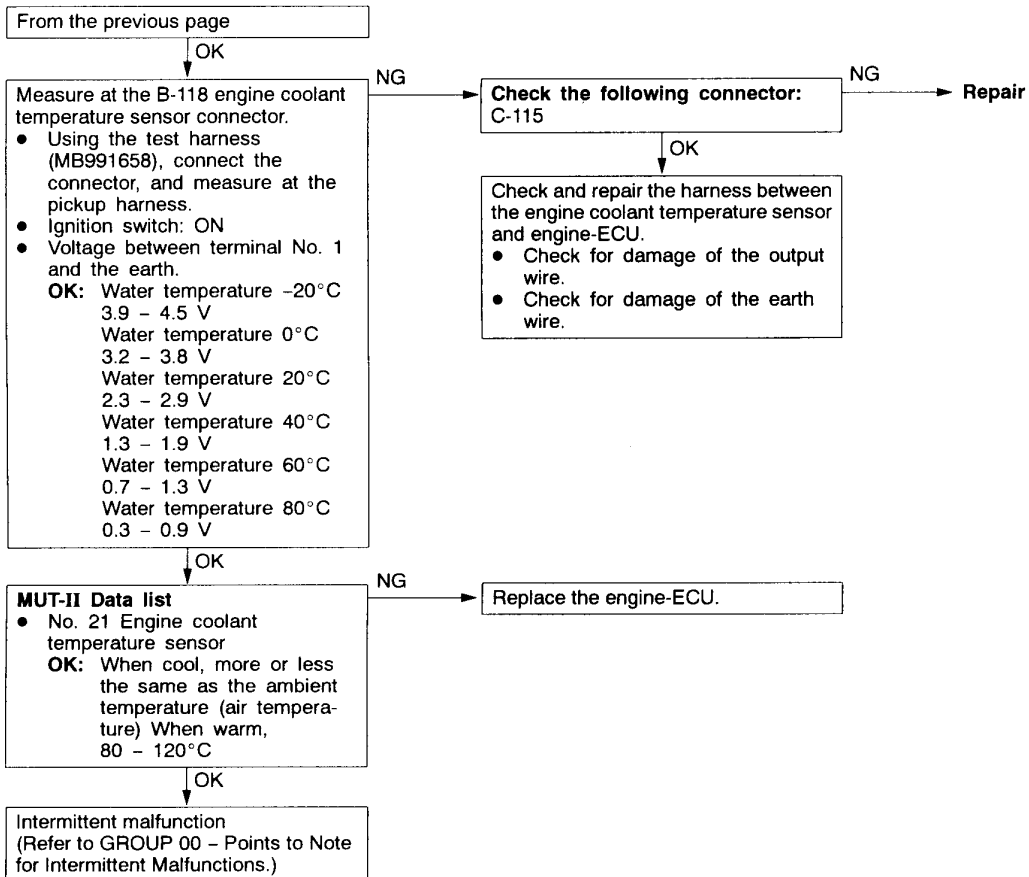




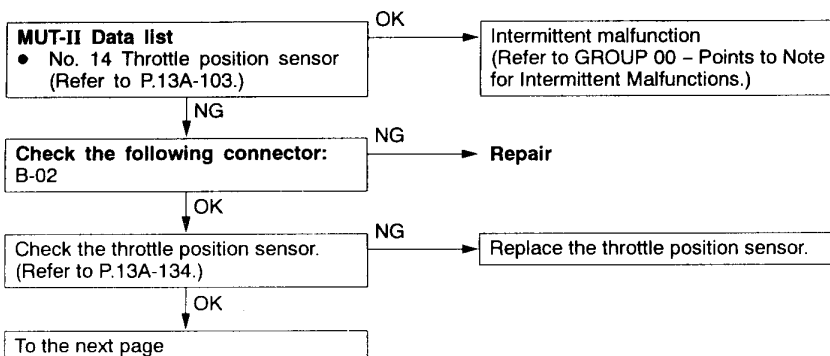
Code No. P0115 Engine coolant temperature sensor system	Probable cause
Inspection Range - After setting the ignition switch to the "ON" position, or 2 seconds after completion of engine start. Evaluation Conditions - When the sensor output voltage is more than 4.6 V for 4 seconds (Equivalent to water temperature of less than -45°C) or - When the sensor output voltage is less than 0.1 V for 4 seconds (Equivalent to water temperature of more than 140°C)	- Engine coolant temperature sensor malfunction - Engine coolant temperature sensor circuit disconnection and short-circuit or connector contact defect - Engine-ECU malfunction
Inspection Range - Ignition switch: ON - The engine speed is approximately 50 r/min or more. Evaluation Conditions - From less than 1.6 V (Equivalent to water temperature of more than 40°C), the sensor output voltage rises to more than 1.6 V (Equivalent to water temperature of less than 40°C) - The sensor output voltage is more than 1.6 V for 5 minutes	

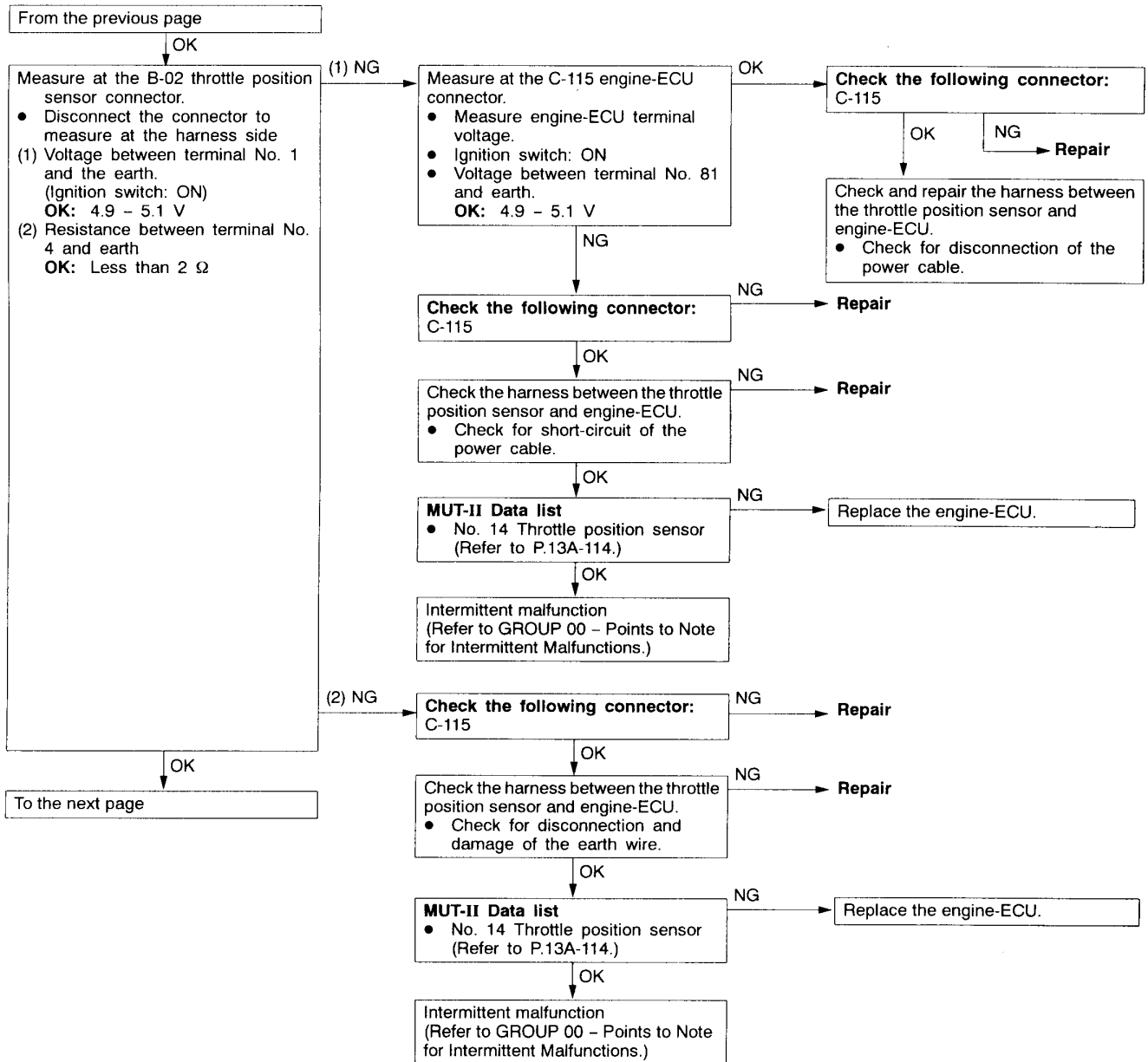


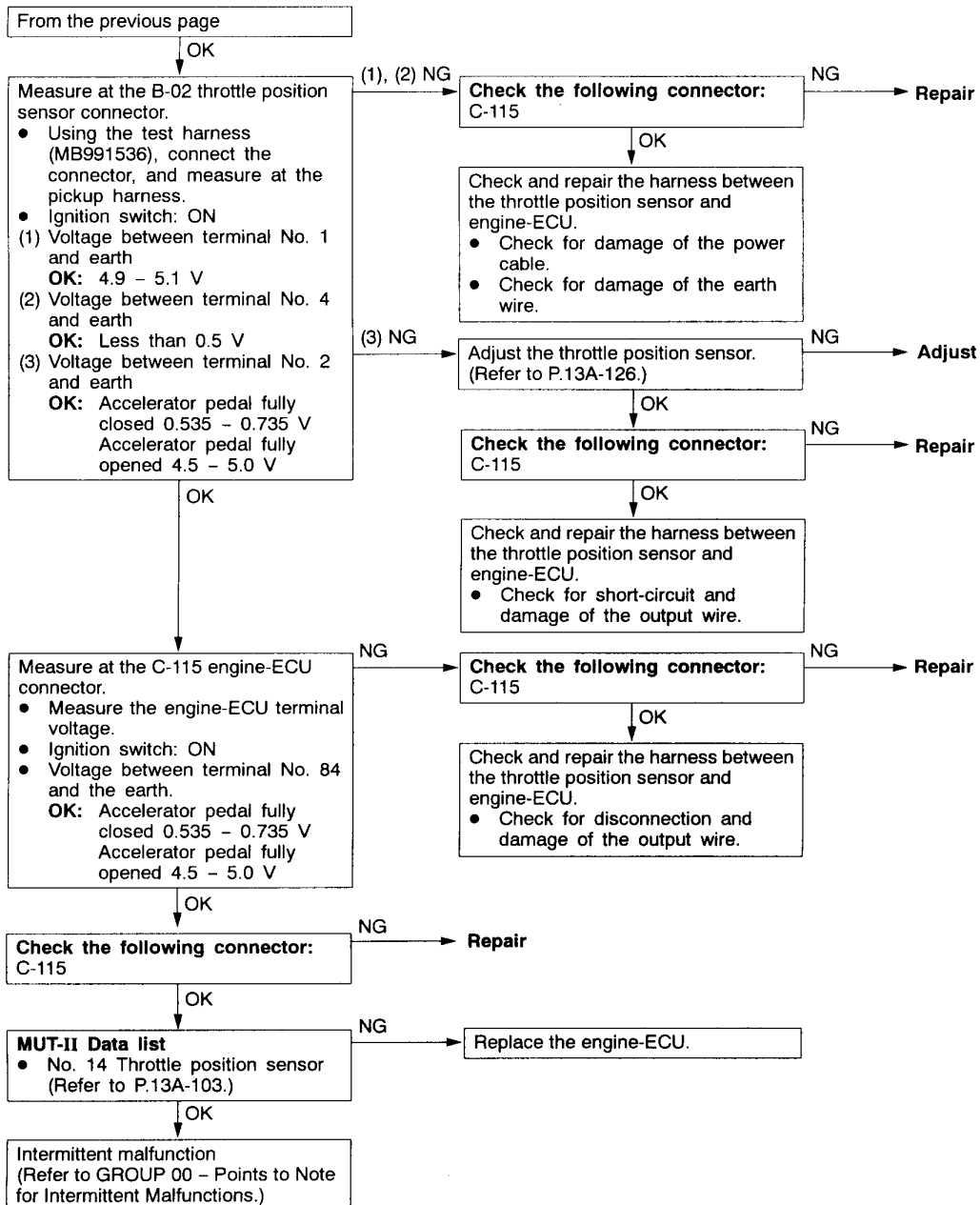




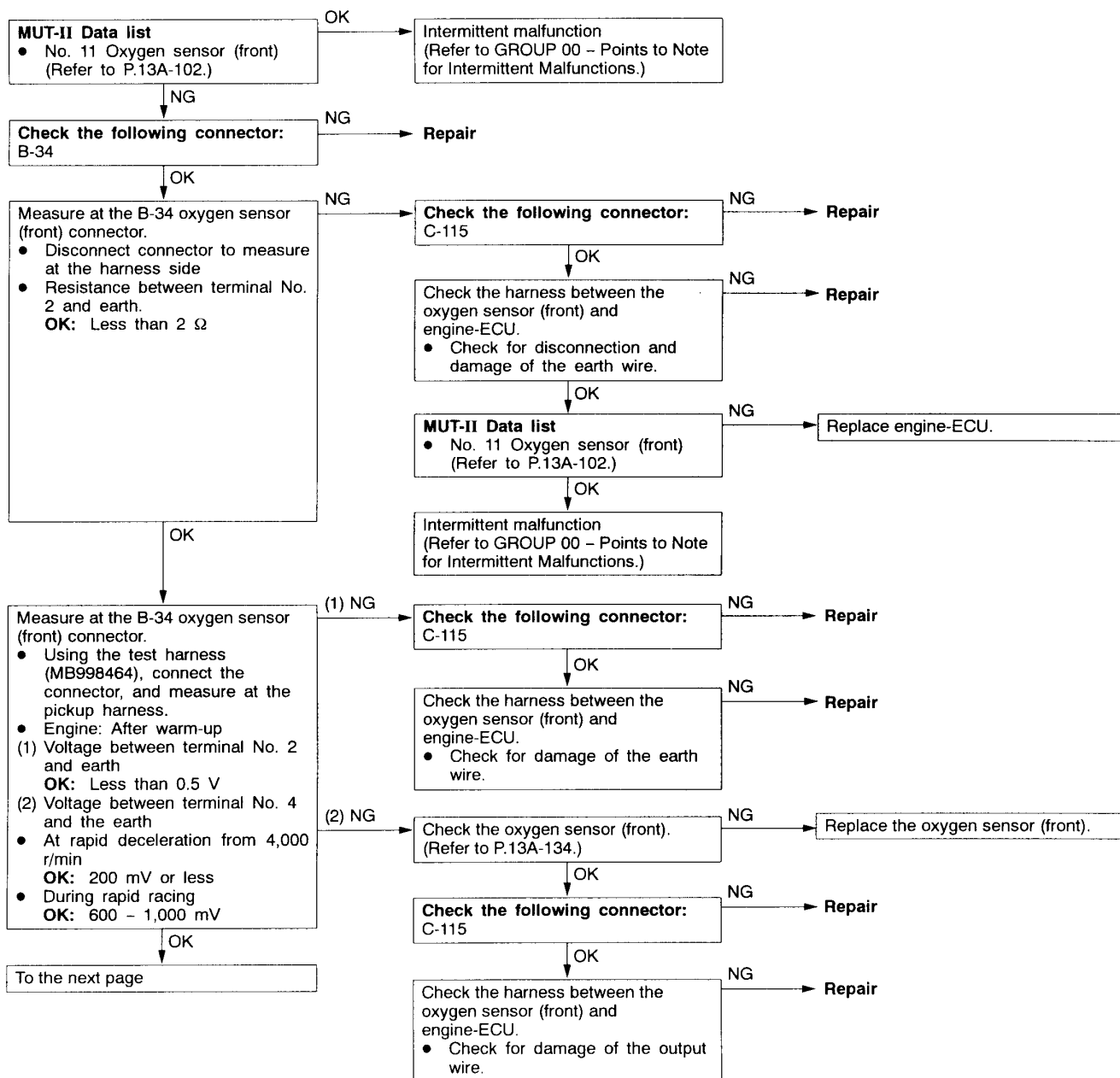
Code No. P0120 Throttle position sensor system	Probable cause
Inspection Range - Ignition switch: ON - Excluding for two seconds after ignition switch is set to "ON" position or two seconds after engine start is completed. Evaluation Conditions - The sensor output voltage is 0.2 V or less for 2 seconds.	- Throttle position sensor malfunction - Throttle position sensor circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction
Inspection Range - The engine speed is 1,000 r/min or less. - The volumetric efficiency is 60 % or less. Evaluation Conditions - The sensor output voltage is 2.0 V or less for 2 seconds.	

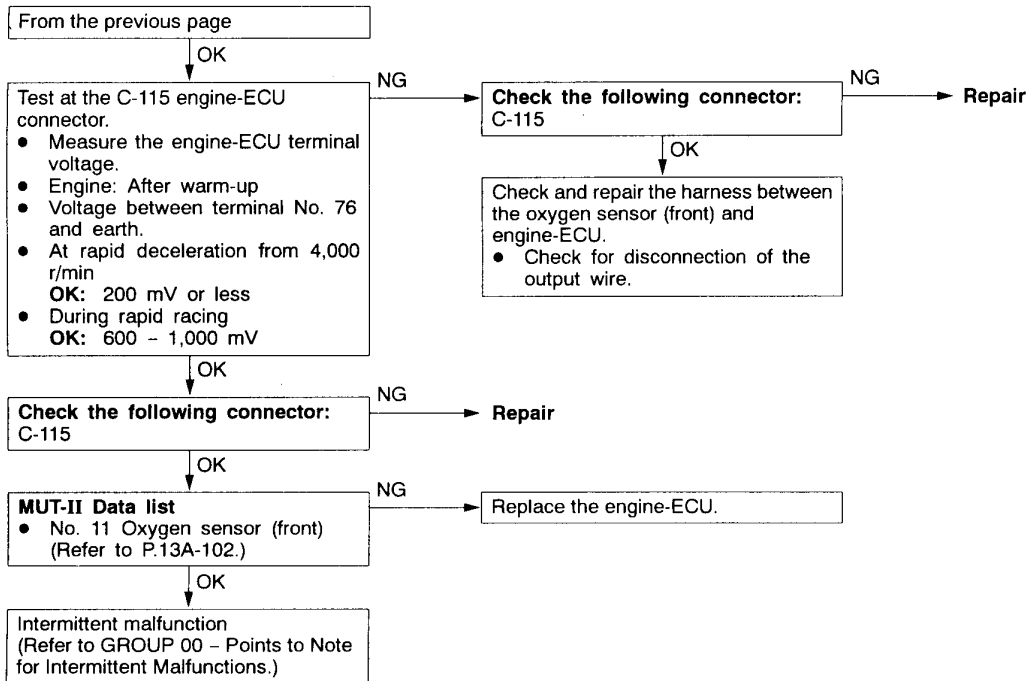




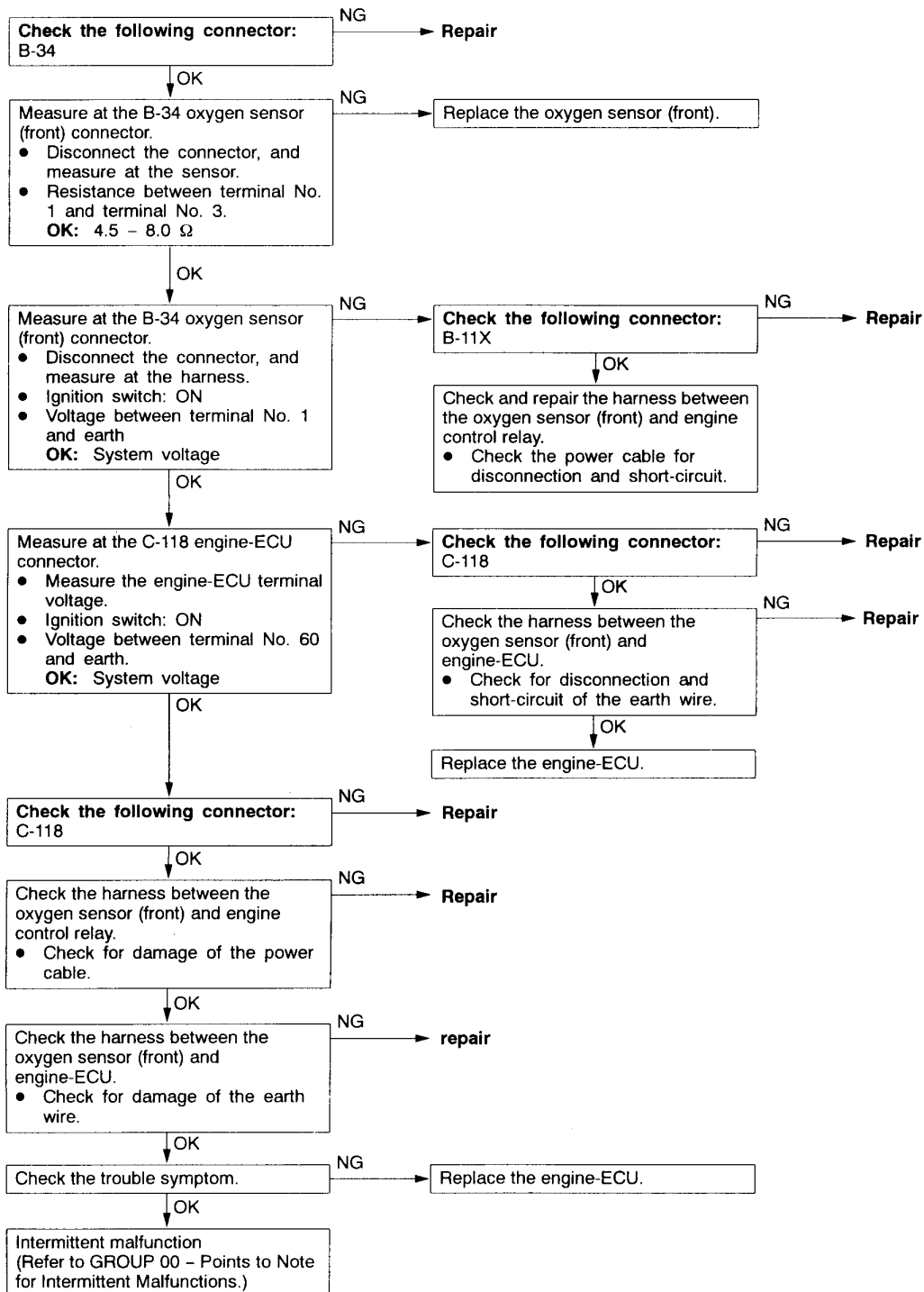


Code No. P0130 Oxygen sensor (front) system	Probable cause
Inspection Range • More than 3 minutes passed after completion of start of engine • The engine coolant temperature is approximately more than 80°C. • The engine speed is more than 1,200 r/min. • The volumetric efficiency is 25% or more. Evaluation Conditions • When 5 V is applied to oxygen sensor (front) in engine-ECU while oxygen sensor (front) output voltage is 0.2 V or less, the sensor output voltage is 4.5 V or more.	• Oxygen sensor (front) malfunction • Oxygen sensor (front) circuit disconnection, short-circuit, or connector contact defect. • Engine-ECU malfunction

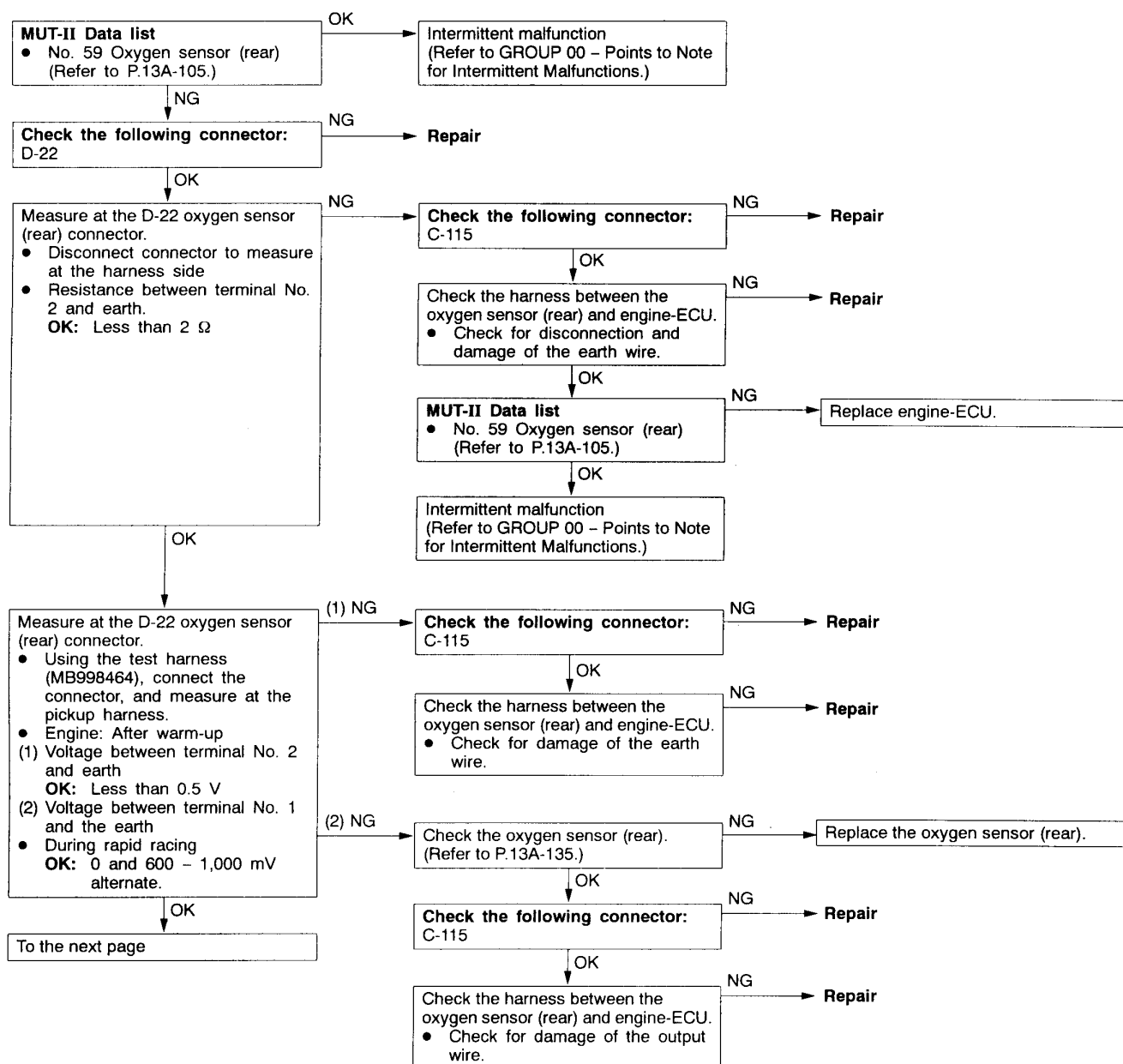


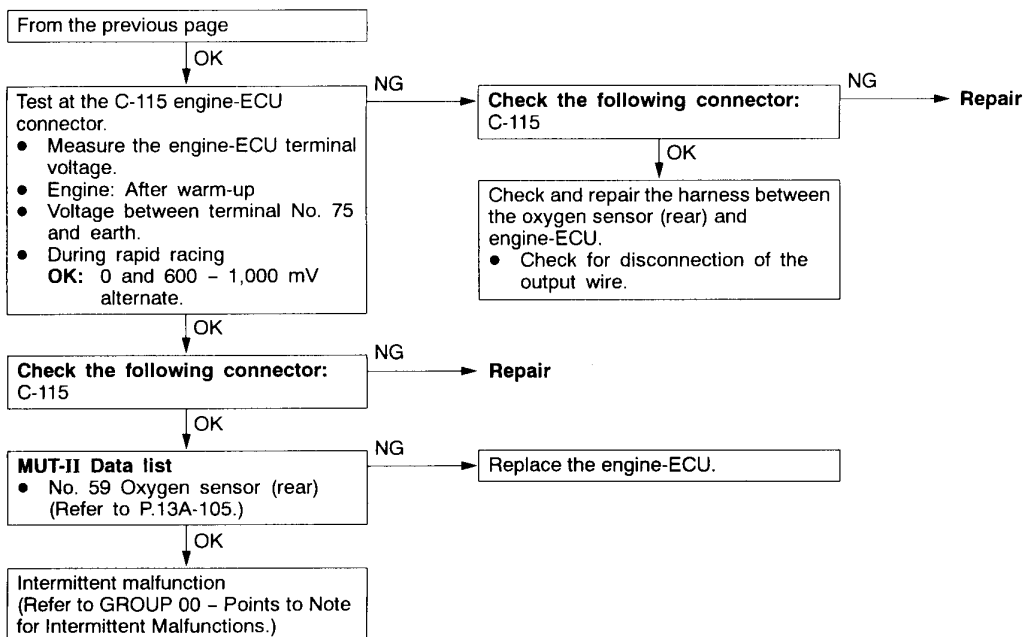


Code No. P0135 Oxygen sensor heater (front) system	Probable cause
Inspection Range - The engine coolant temperature is approximately more than 20°C. - The oxygen sensor heater (front) is ON. - The engine speed is more than 50 r/min. - A/C relay: OFF, radiator fan: OFF - The battery voltage is 11 – 16 V. Evaluation Conditions - The oxygen sensor heater (front) current is less than 0.2 A or more than 3.5 A for 4 seconds.	- Oxygen sensor heater (front) malfunction - Oxygen sensor heater (front) circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction

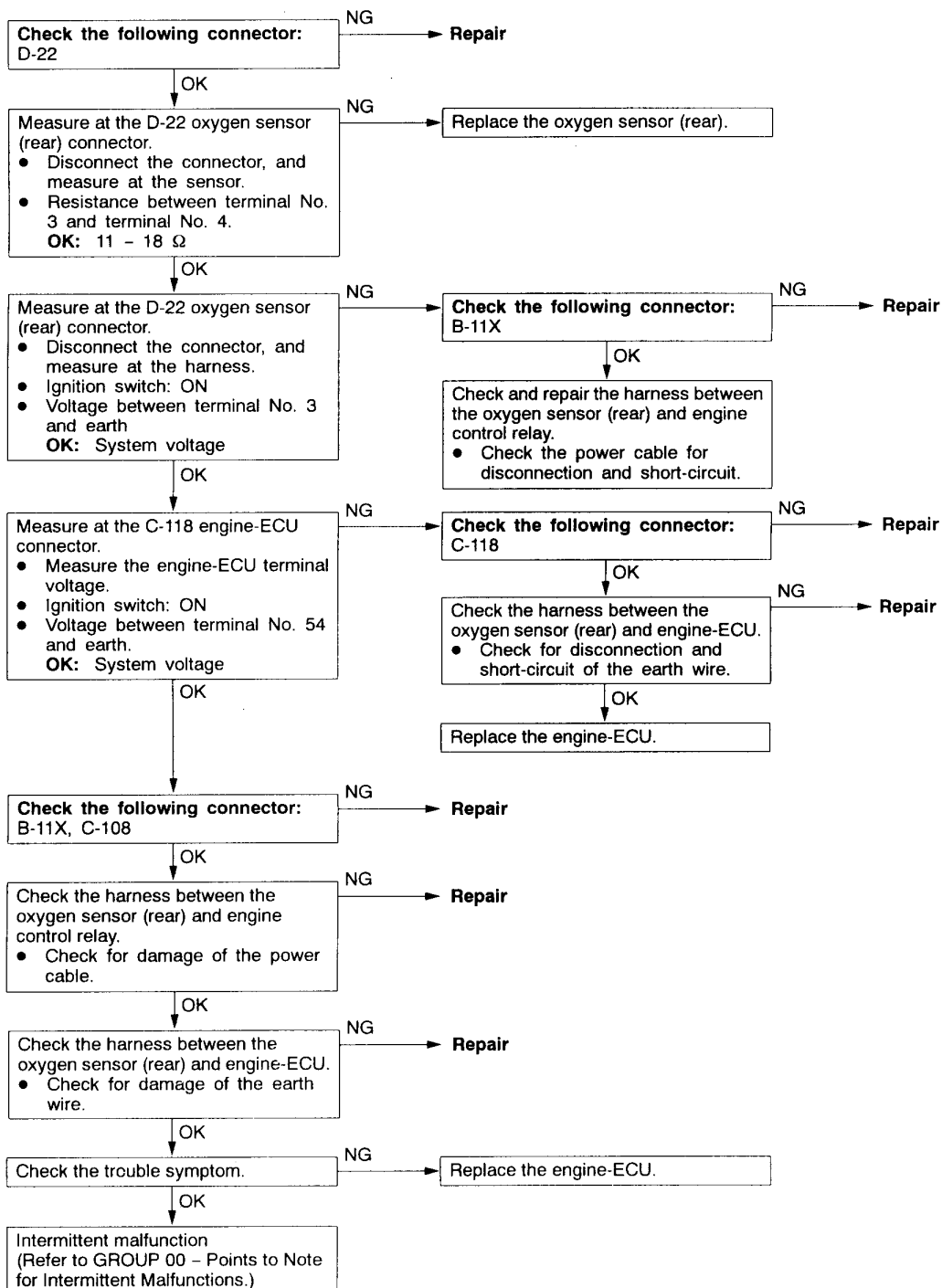


Code No. P0136 Oxygen sensor (rear) system	Probable cause
Inspection Range • More than 3 minutes passed after completion of start of engine • The engine coolant temperature is approximately more than 80°C. • The engine speed is more than 1,200 r/min. • The volumetric efficiency is 25% or more. Evaluation Conditions • When 5 V is applied to the oxygen sensor (rear), the output voltage is more than 4.5 V.	• Oxygen sensor (rear) malfunction • Oxygen sensor (rear) circuit disconnection, short-circuit, or connector contact defect. • Engine-ECU malfunction

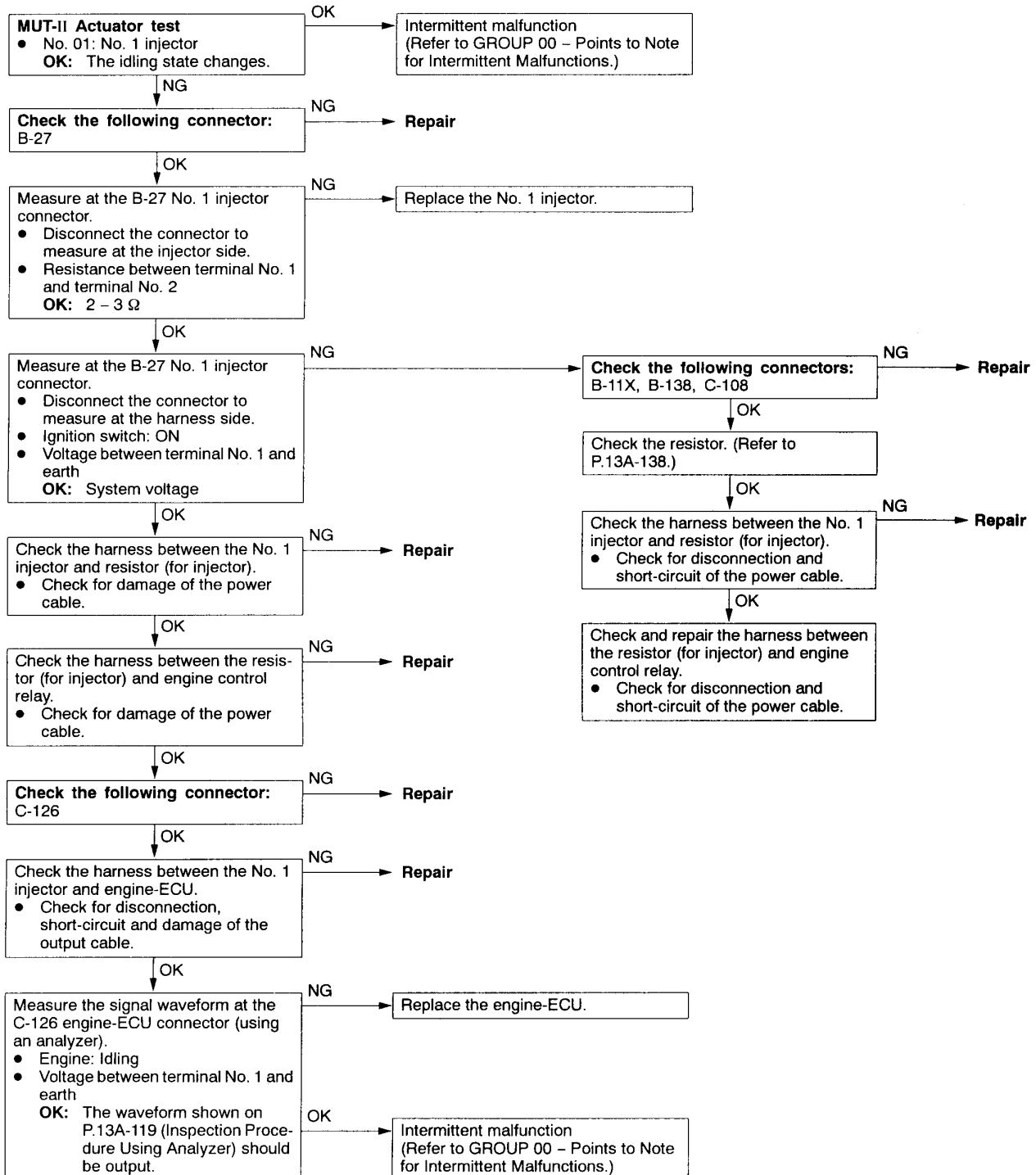




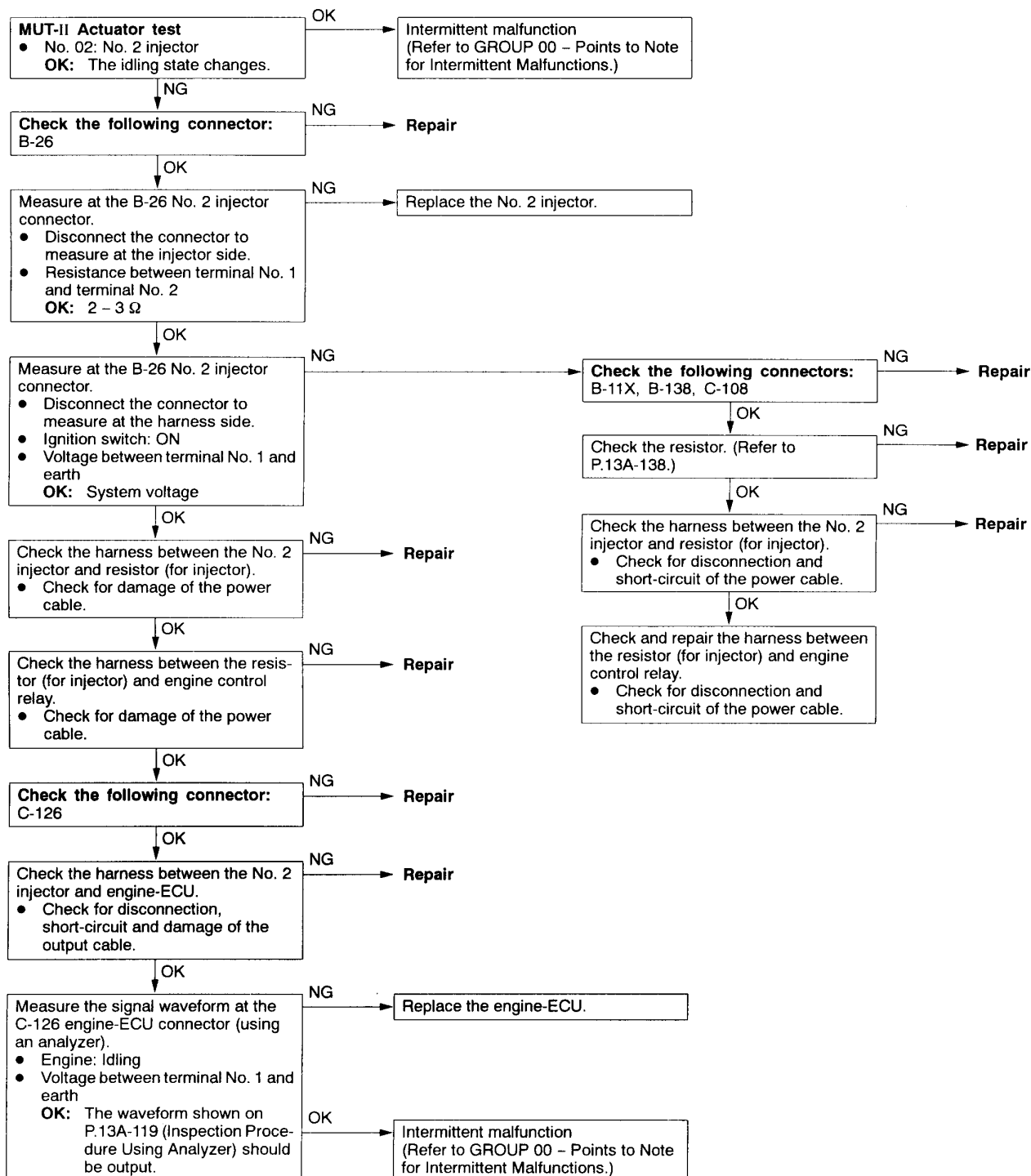
Code No. P0141 Oxygen sensor heater (rear) system	Probable cause
Inspection Range - The engine coolant water temperature is approximately more than 20°C. - The oxygen sensor heater (rear) is ON. - The engine speed is more than 50 r/min. - A/C relay: OFF, radiator fan: OFF - The battery voltage is 11 – 16 V. Evaluation Conditions - The oxygen sensor heater (rear) current is less than 0.2 A or more than 3.5 A for 4 seconds.	- Oxygen sensor heater (rear) malfunction - Oxygen sensor heater (rear) circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction



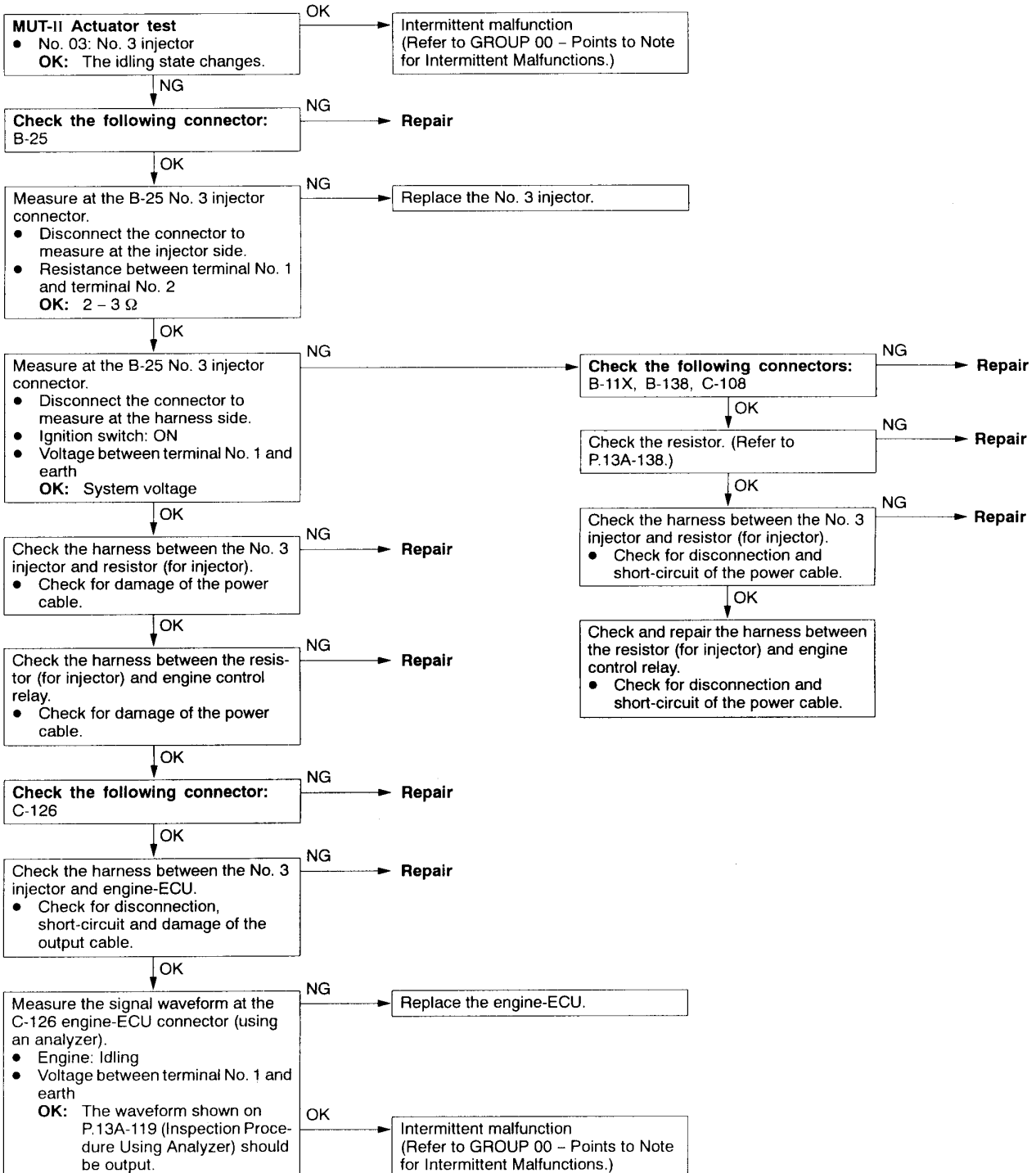
Code No. P0201 No. 1 injector system	Probable cause
Inspection Range - The engine speed is 50 – 1,000 r/min. - The throttle position sensor output voltage is 1.15 V or less. - MUT-II forced drive (actuator test) is not being carried out. Evaluation Conditions - Surge voltage at injector coil is not detected for 2 seconds.	- No. 1 injector malfunction - No. 1 injector circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction



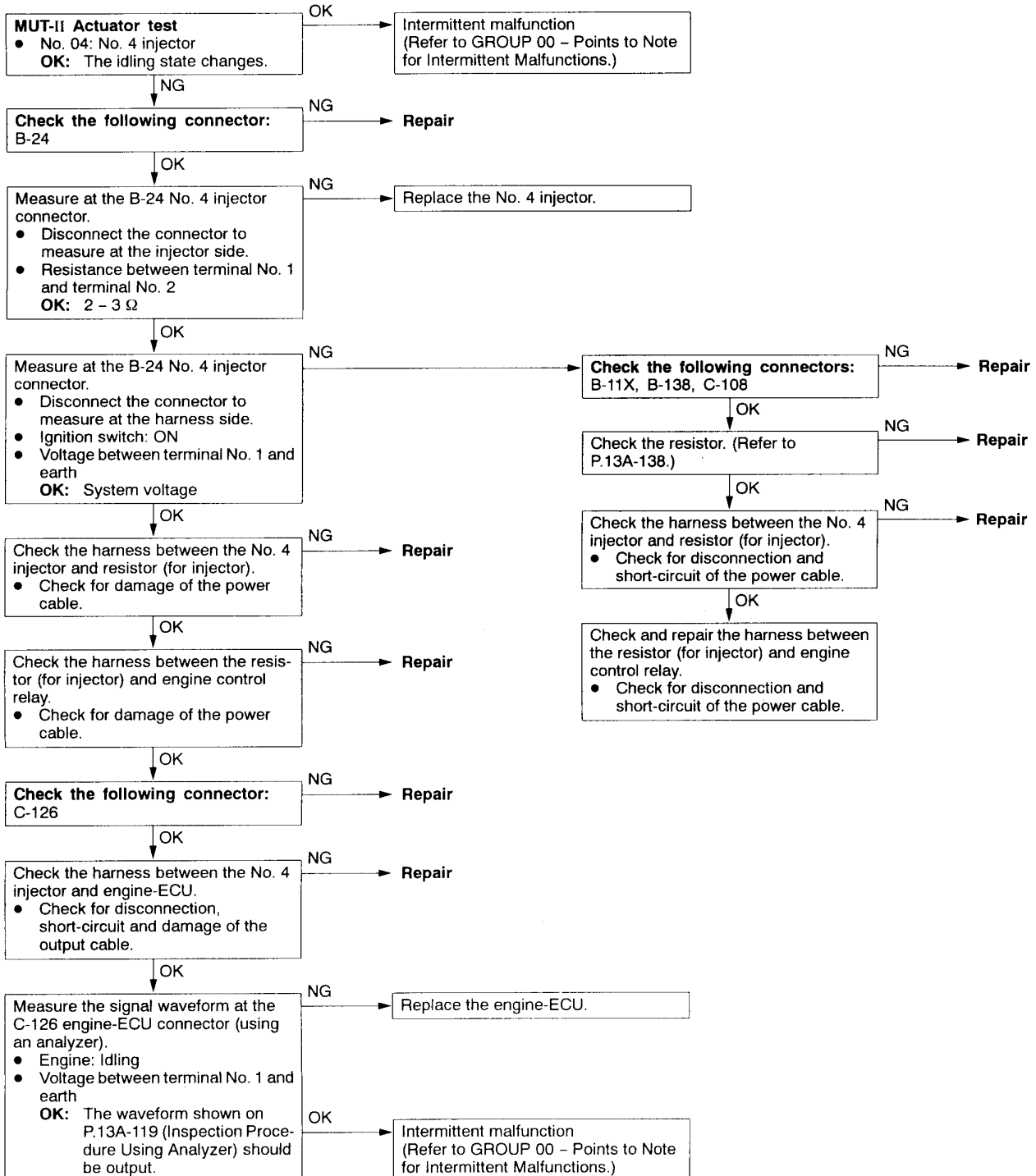
Code No. P0202 No. 2 injector system	Probable cause
Inspection Range - The engine speed is 50 – 1,000 r/min. - The throttle position sensor output voltage is 1.15 V or less. - MUT-II forced drive (actuator test) is not being carried out. Evaluation Conditions - Surge voltage at injector coil is not detected for 2 seconds.	- No. 2 injector malfunction - No. 2 injector circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction



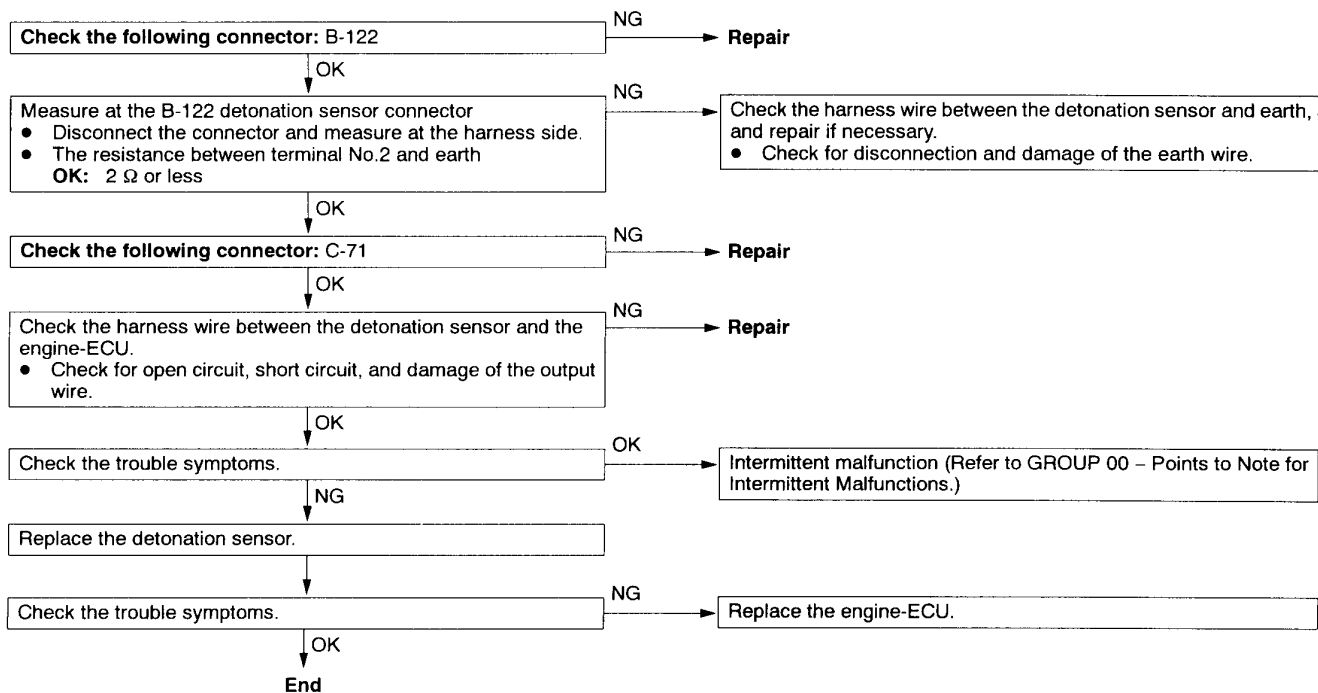
Code No. P0203 No. 3 injector system	Probable cause
Inspection Range - The engine speed is 50 – 1,000 r/min. - The throttle position sensor output voltage is 1.15 V or less. - MUT-II forced drive (actuator test) is not being carried out. Evaluation Conditions - Surge voltage at injector coil is not detected for 2 seconds.	- No. 3 injector malfunction - No. 3 injector circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction



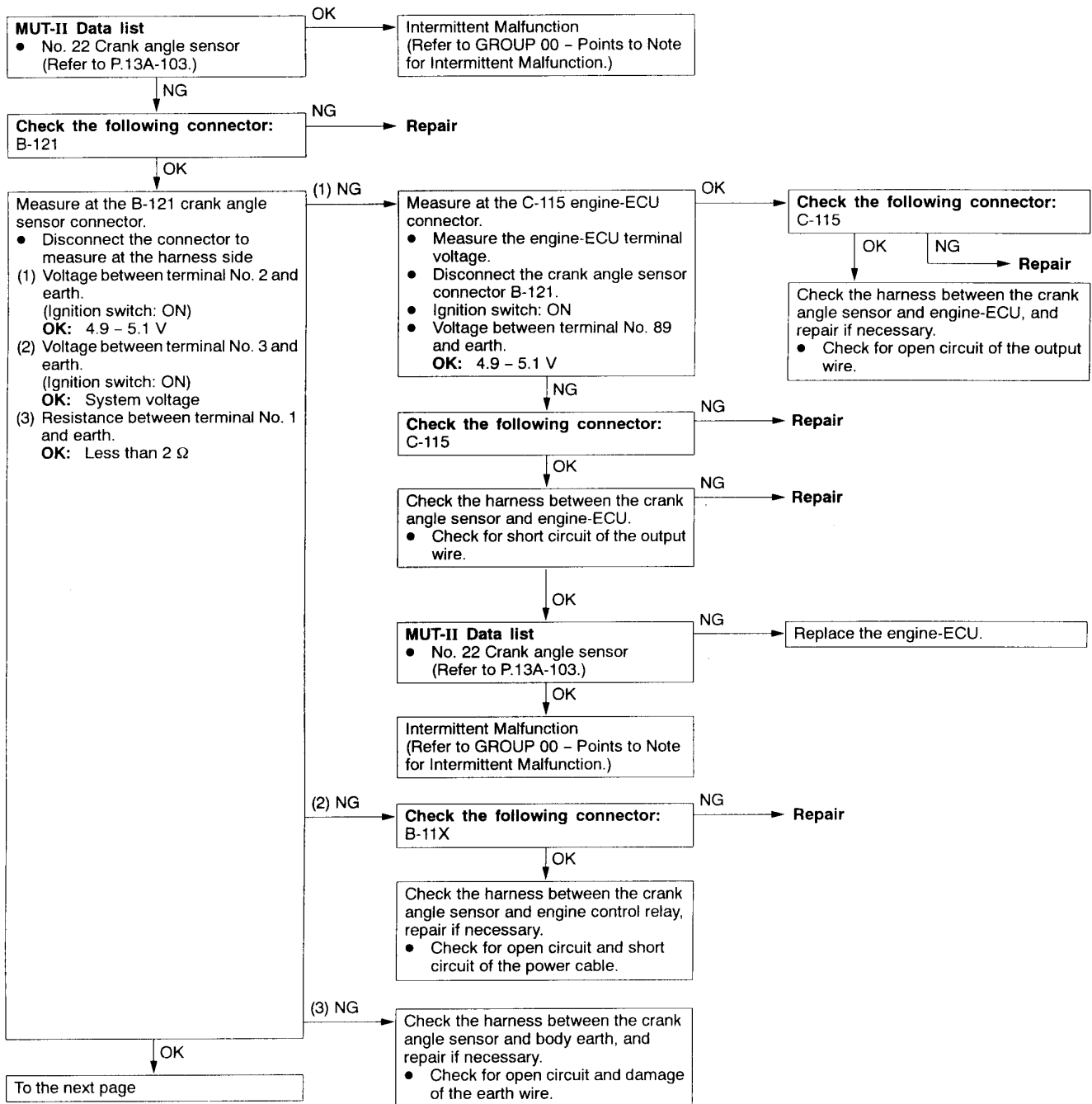
Code No. P0204 No. 4 injector system	Probable cause
Inspection Range • The engine speed is 50 – 1,000 r/min. • The throttle position sensor output voltage is 1.15 V or less. • MUT-II forced drive (actuator test) is not being carried out. Evaluation Conditions • Surge voltage at injector coil is not detected for 2 seconds.	• No. 4 injector malfunction • No. 4 injector circuit disconnection, short-circuit, or connector contact defect • Engine-ECU malfunction

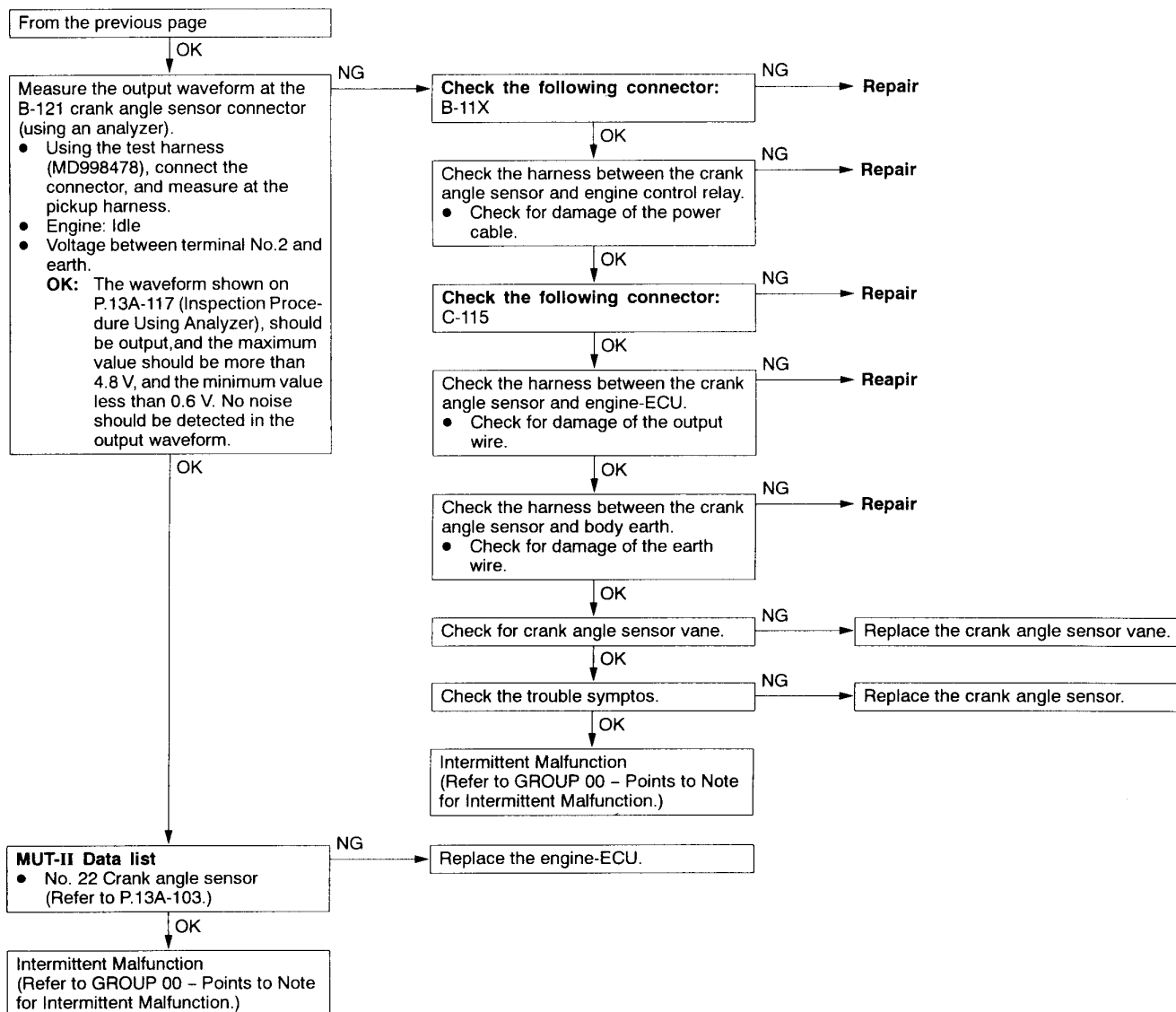


Code No. P0325 Detonation sensor system	Probable cause
Inspection Range - Ignition switch: ON - Excluding for 2 seconds after ignition switch is set to "ON" position or 2 seconds after engine start is completed. - The engine speed is approximately 2,000 r/min or more. - The volumetric efficiency is 30% or more. 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 - Detonation sensor circuit disconnection, short-circuit, or connector contact defect - Malfunction of engine-ECU

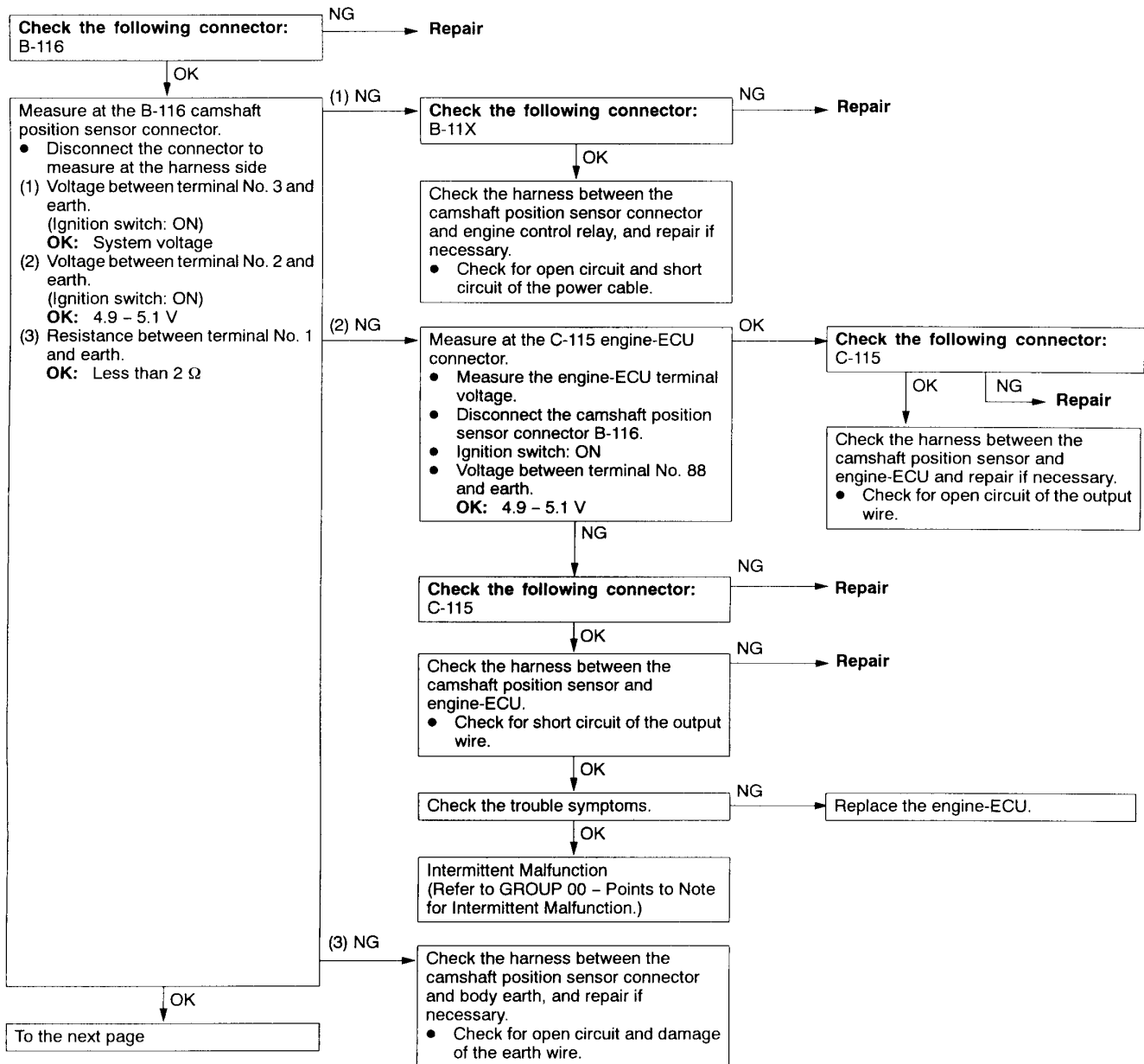


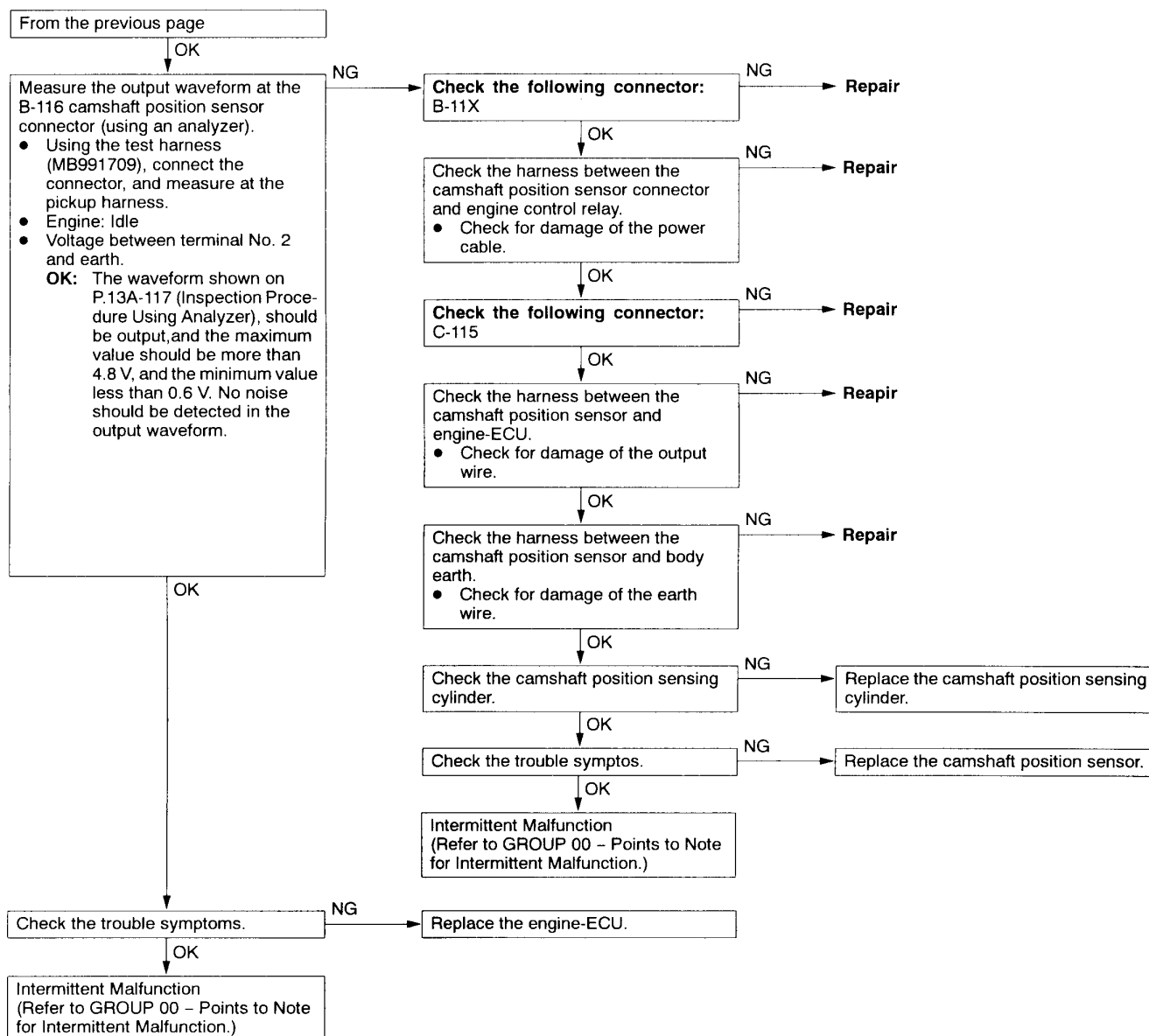
Code No. P0335 Crank angle sensor system	Probable cause
Inspection Range • Engine: During cranking Evaluation Conditions • The sensor output voltage does not change for 2 seconds (no pulse signal output)	• Malfunction of crank angle sensor • Open or short circuit in the crank angle sensor circuit or loose connector contact • Malfunction of engine-ECU



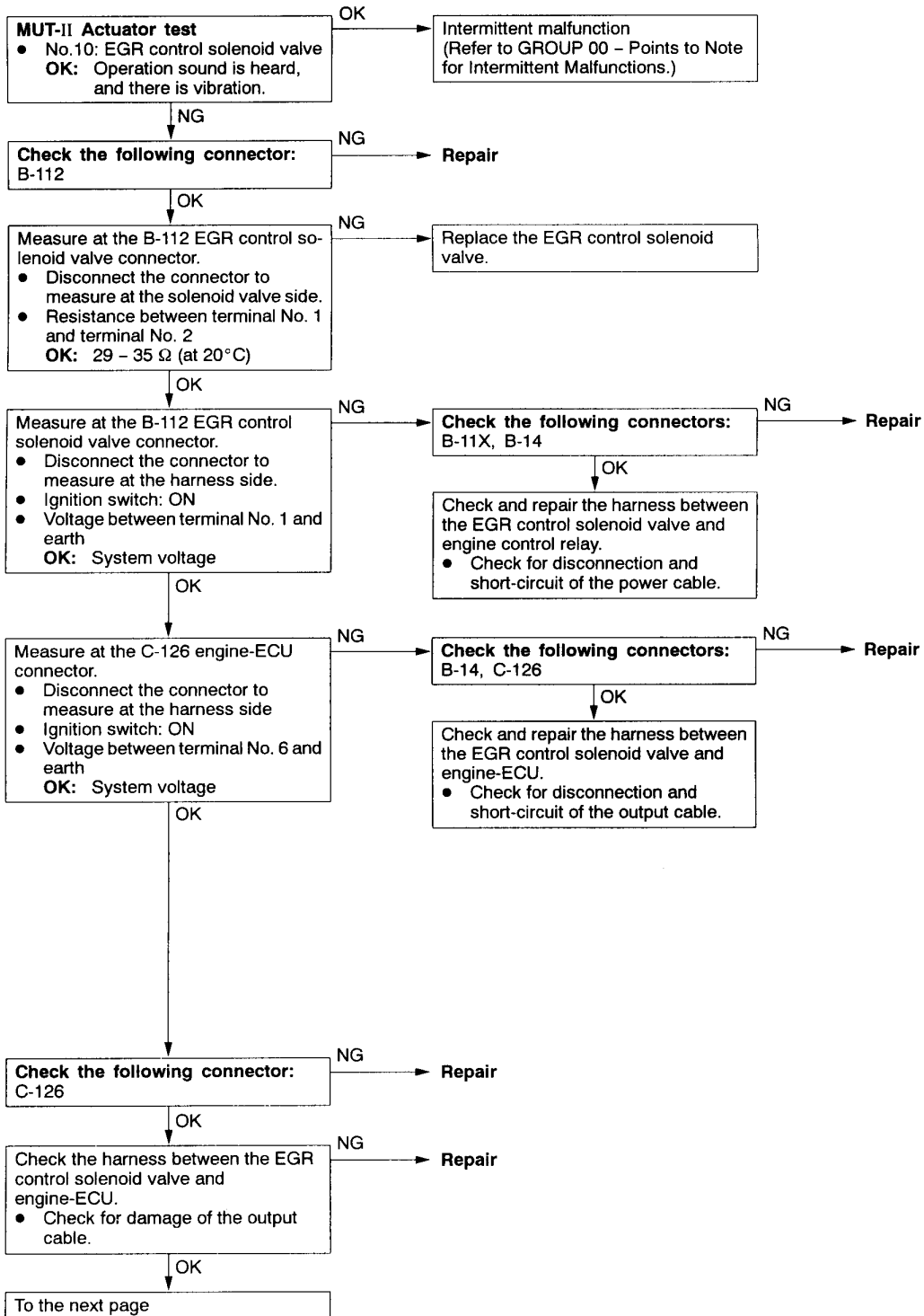


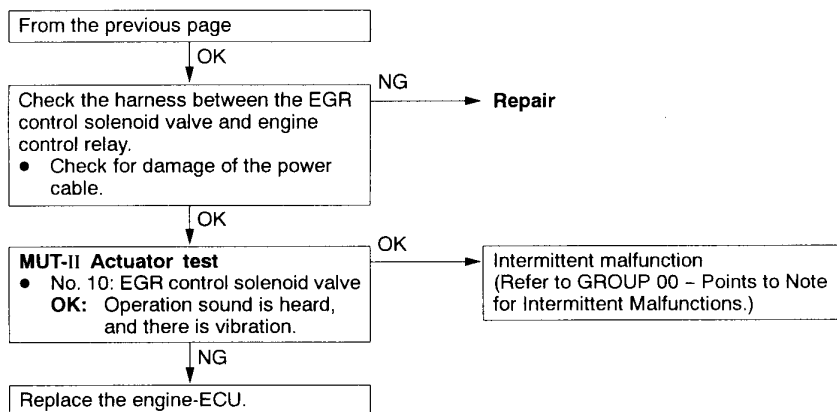
Code No. P0340 Camshaft position sensor system	Probable cause
Inspection Range - Ignition switch: ON - The engine speed is approximately 50 r/min or more. Evaluation Conditions - The sensor output voltage does not change for 2 seconds (no pulse signal output)	- Malfunction of camshaft position sensor - Open or short circuit in the camshaft position sensor or loose connector contact - Malfunction of engine-ECU



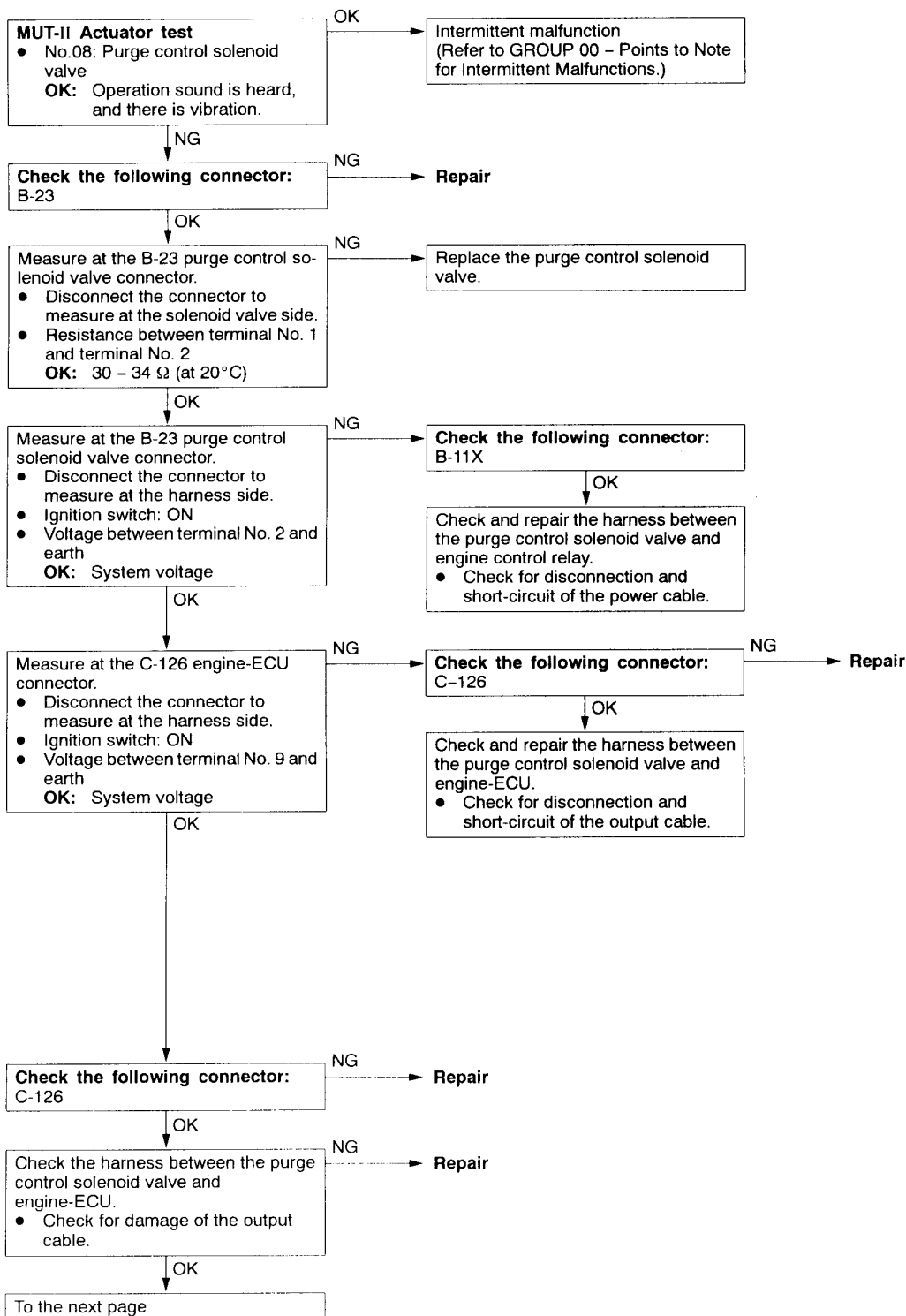


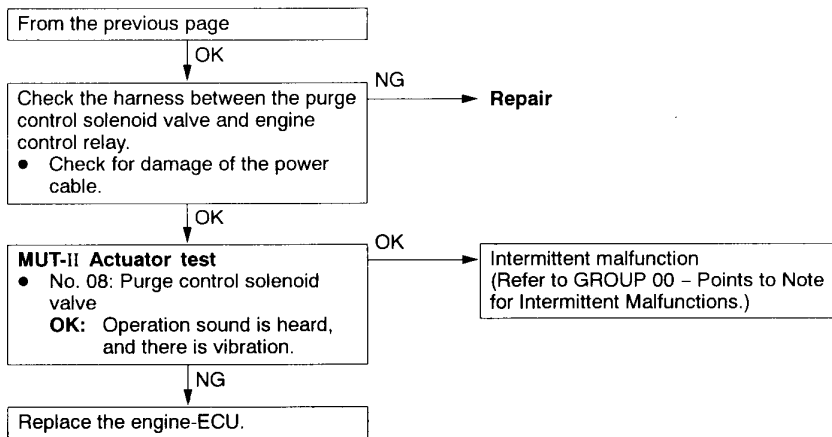
Code No. P0403 EGR control solenoid valve system	Probable cause
Inspection Range - The battery voltage is 10 V or more. Evaluation Conditions - Solenoid coil's surge voltage (battery voltage +2 V) is not detected when EGR control solenoid valve is turned OFF from ON.	- EGR control solenoid valve malfunction - EGR control solenoid valve circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction



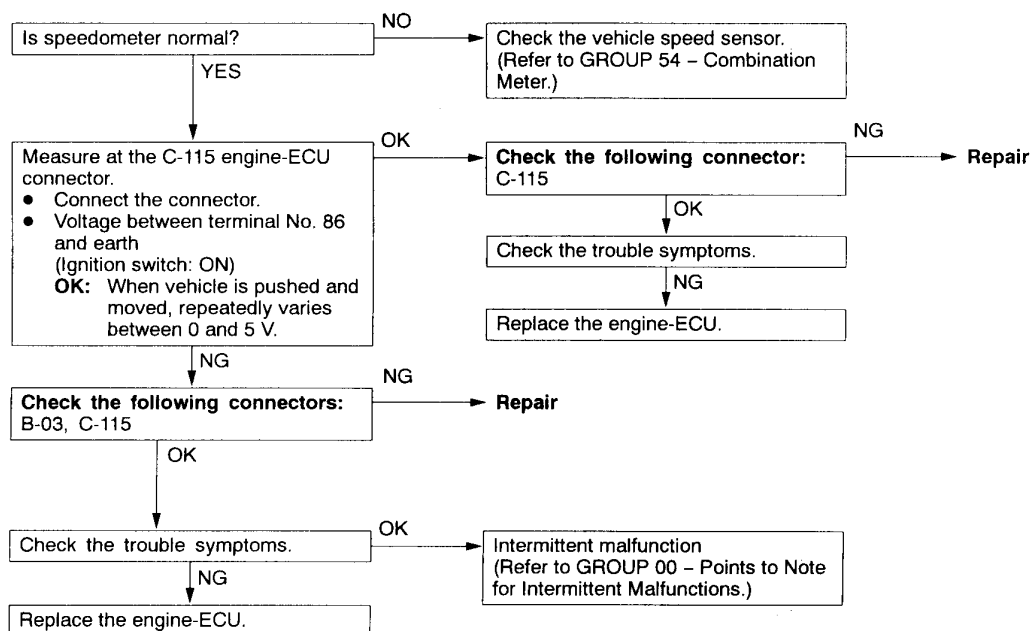


Code No. P0443 Purge control solenoid valve system	Probable cause
Range of check - Ignition switch: ON - Battery voltage is 10 V or more. Set Conditions - The solenoid coil surge voltage (battery voltage +2 V) is not detected when the purge control solenoid valve is turned from ON to OFF.	- Malfunction 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

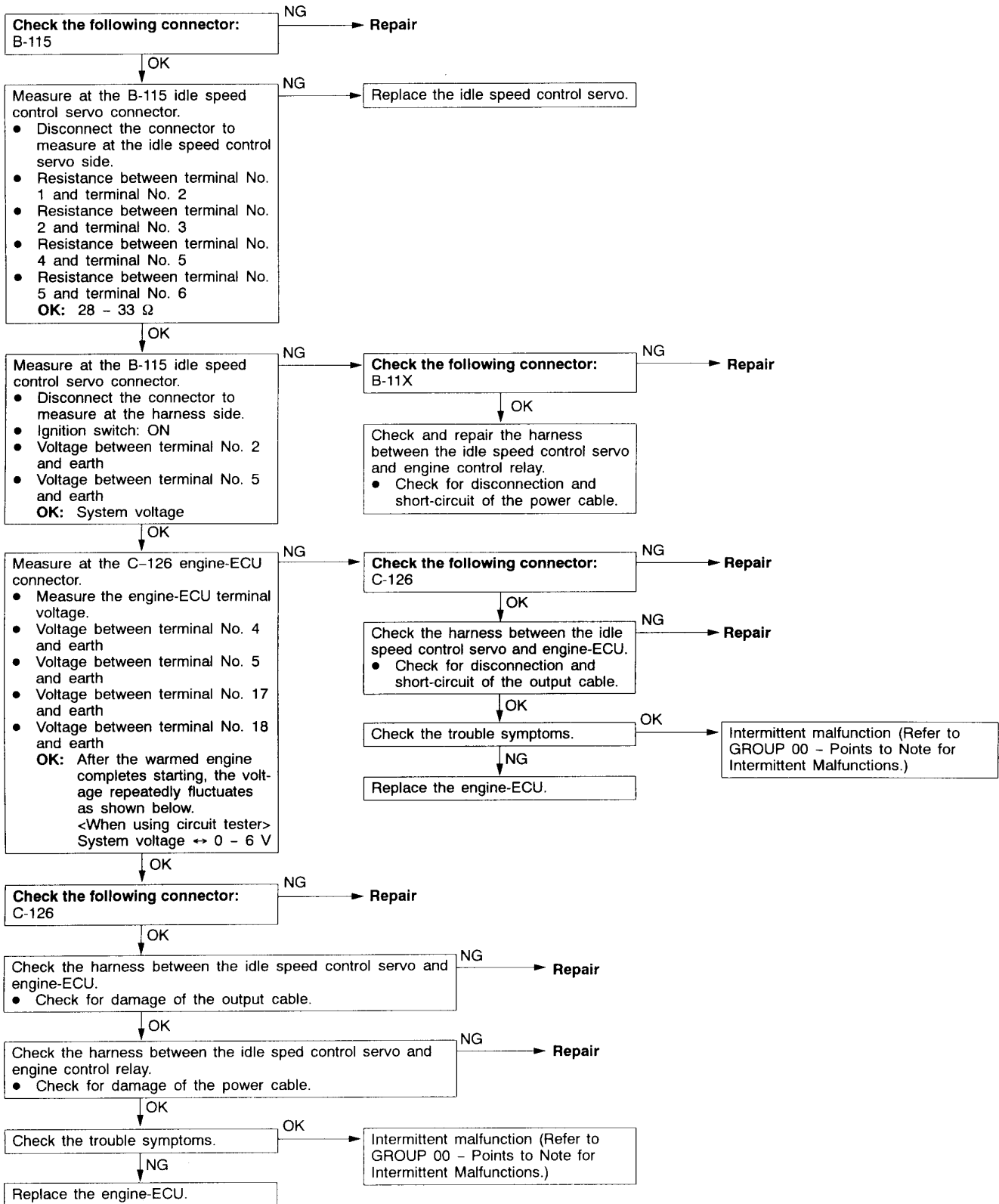




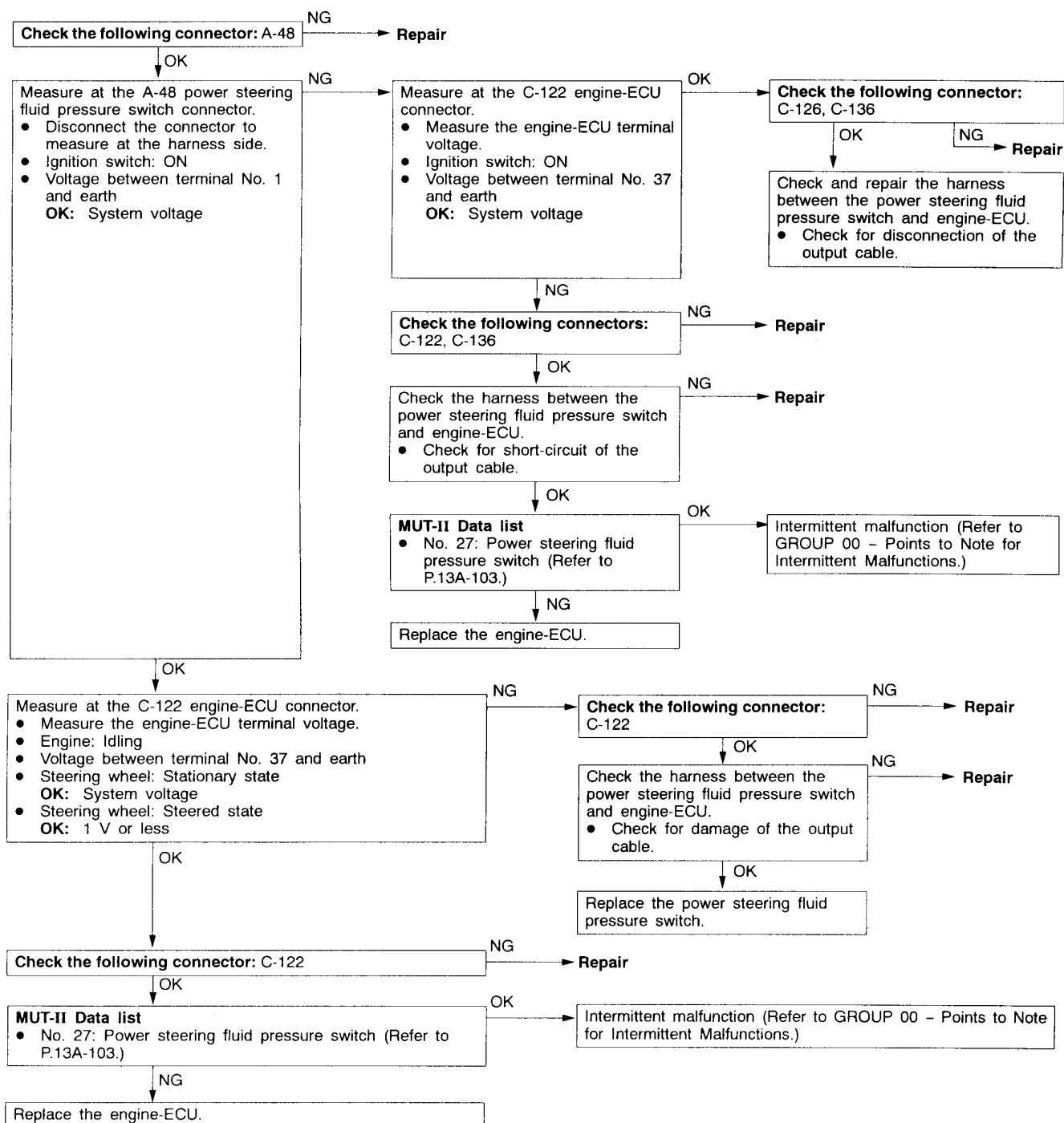
Code No. P0500 Vehicle speed sensor system	Probable cause
Inspection Range - Ignition switch: ON - After 2 seconds from setting ignition switch to ON position or completion of engine starting - The engine speed is approximately 2,000 – 4,000 r/min or more. - The volumetric efficiency is 60 – 80%. Evaluation Conditions - Vehicle speed signal does not change for 2 seconds. (Pulse signal is not input.)	- Vehicle speed sensor malfunction - Vehicle speed sensor circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction



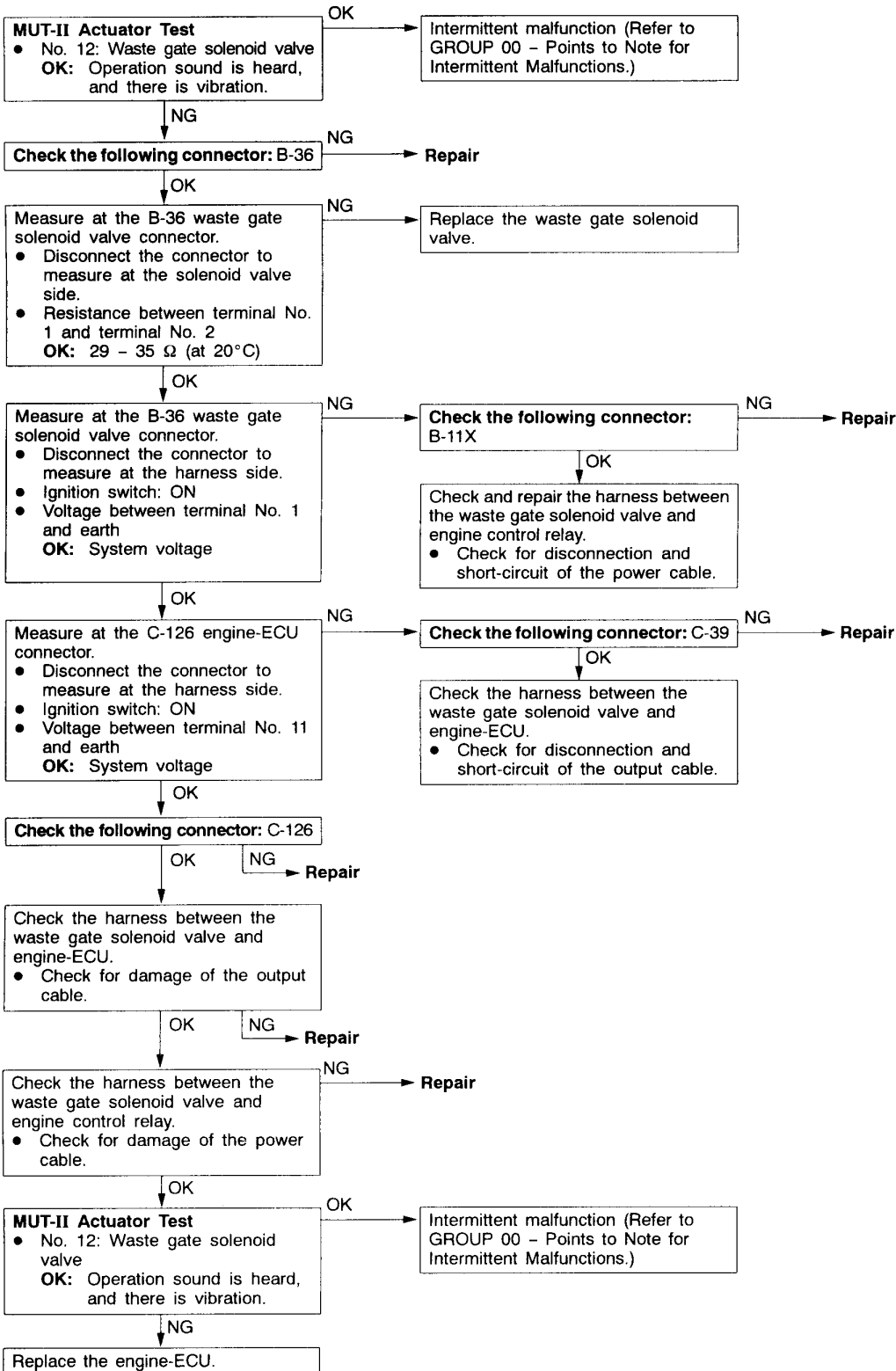
Code No. P0505 Idle speed control system	Probable cause
Range of Check - Vehicle speed has reached 1.5 Km/h at least once. - Under the closed loop idle speed control. Set Conditions - Actual idle speed has continued to be higher than the target idle speed by 300 r/min or more for 10 seconds. Range of Check - 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 approximately 80°C or more. - Battery voltage is 10 V or more. - Barometric pressure is 76 kPa or higher. - Intake air temperature is -10°C or more. Set Conditions - Actual idle speed has been minimum 200 r/min higher than the target idle speed for 10 seconds. Range of Check - During idle speed closed loop control. - Engine coolant temperature is approximately 80°C or higher. - Battery voltage is 10 V or higher. - Power steering switch is off. - Volumetric efficiency is 40 % or lower. - Barometric pressure is 76 kPa or higher. - Intake air temperature is -10°C or more. Set Conditions - Actual idle speed has been minimum 100 r/min higher than the target idle speed for 10 seconds.	- Malfunction of idle speed control servo - Open or short circuit in the idle speed control servo circuit or loose connector contact - Malfunction of engine-ECU



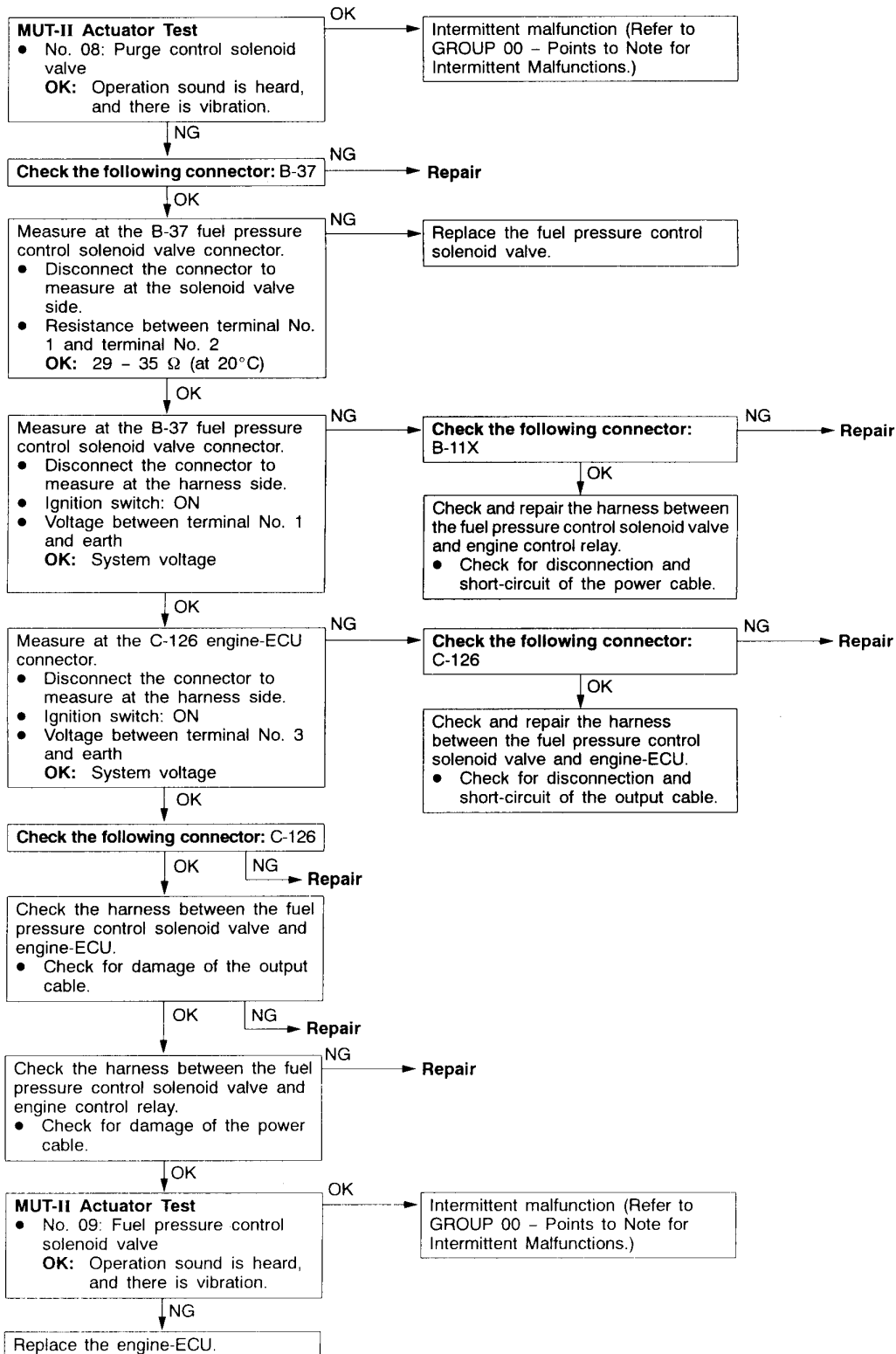
Code No. P0551 Power steering fluid pressure switch system	Probable cause
Range of Check - Intake air temperature is -10°C or higher. - Barometric pressure is 76 kPa or more. - Engine coolant temperature is 30°C or more. - Repeat the *1 drive and *2 stop ten times or more. *1: Engine speed is 2500 r/min 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. Set Conditions - Power steering fluid pressure switch remains on.	- Power steering fluid pressure switch failed - Open or short circuit in the power steering fluid pressure switch circuit or loose connector contact - Multifunction of engine-ECU



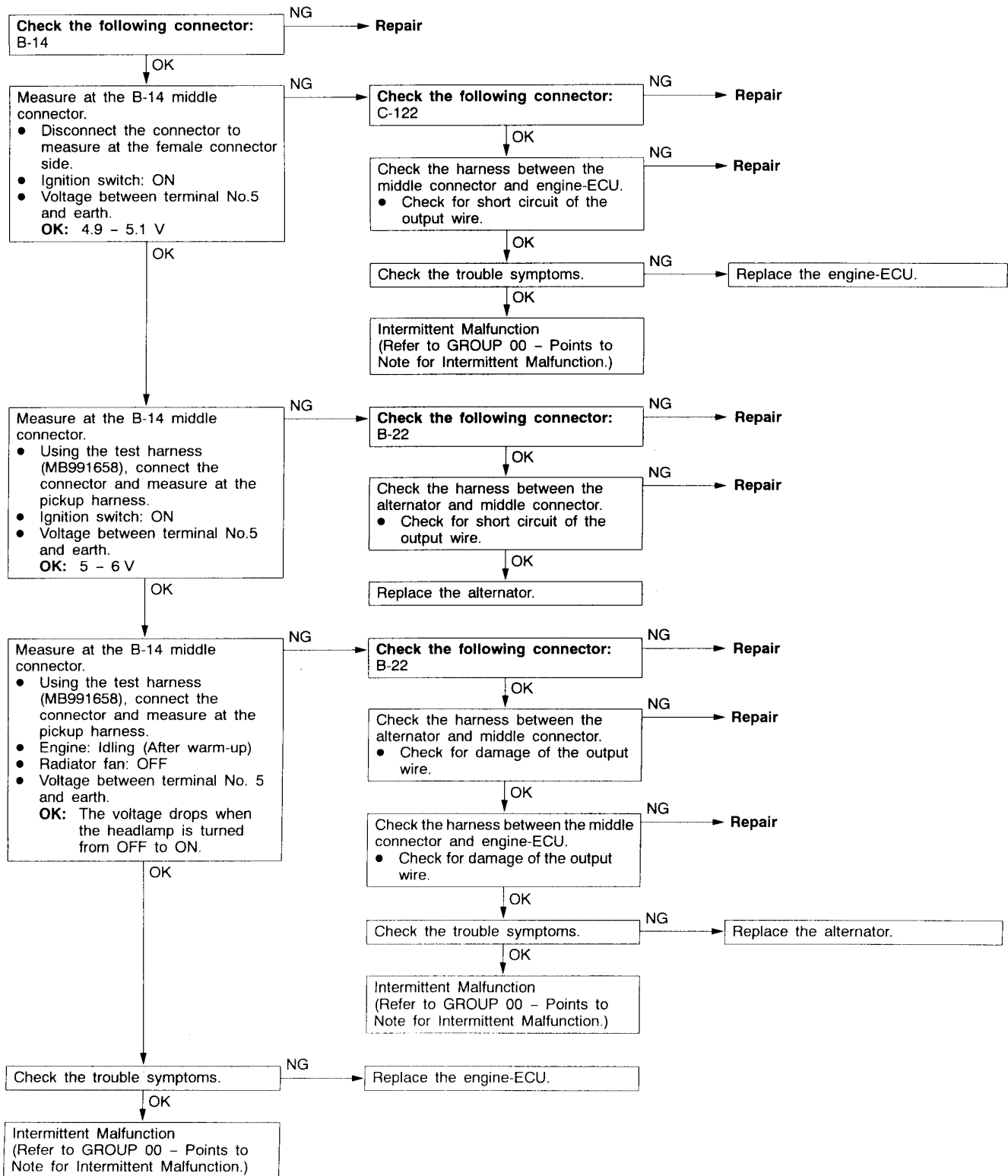
Code No. P1104 Waste gate solenoid valve system	Probable cause
Inspection Range • Battery voltage is more than 10 V. Evaluation Conditions • Solenoid coil's surge voltage (battery voltage +2 V) is not detected when the waste gate solenoid valve turned from ON to OFF.	• Waste gate solenoid valve malfunction • Engine-ECU malfunction



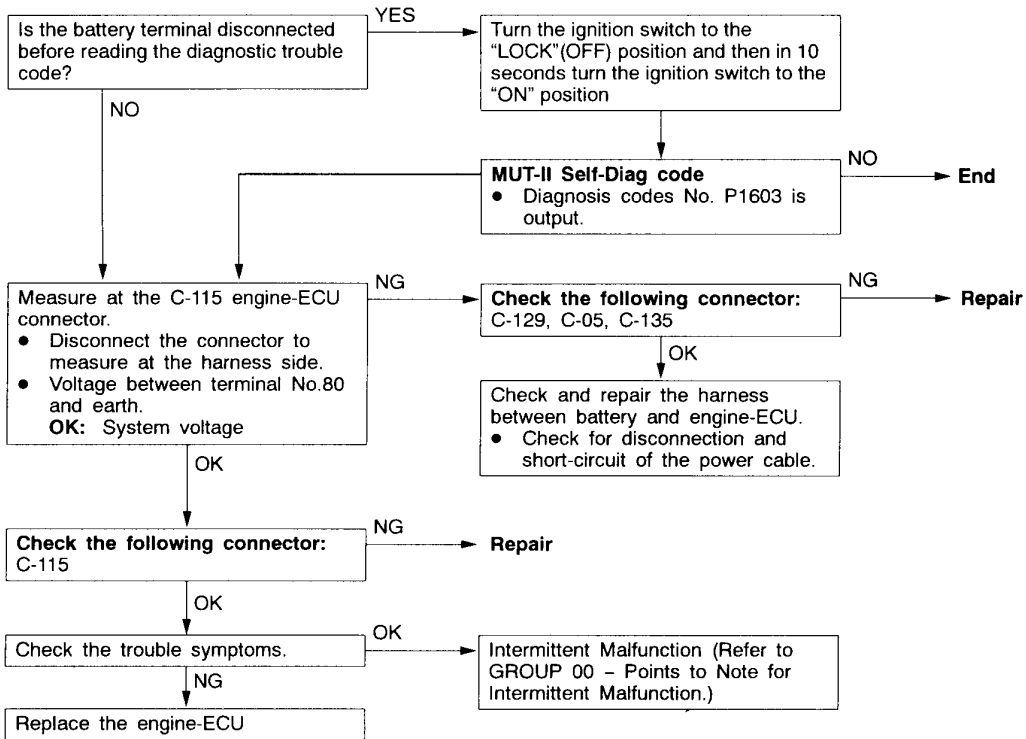
Code No. P1105 Fuel pressure control solenoid valve system	Probable cause
Inspection Range • Battery voltage is more than 10 V. Evaluation Conditions • Solenoid coil's surge voltage (battery voltage +2 V) is not detected when the fuel pressure control solenoid valve turned from ON to OFF.	• Fuel pressure control solenoid valve malfunction • Engine-ECU malfunction



Code No. P1500 Alternator FR terminal system	Probable cause
Inspection Range • Engine speed: More than 50 r/min Evaluation Conditions • The input voltage from the alternator FR terminal is between 4.8 V and 5.2 V or is the battery voltage for 20 seconds.	• Open circuit in the alternator FR terminal circuit • Malfunction of engine-ECU



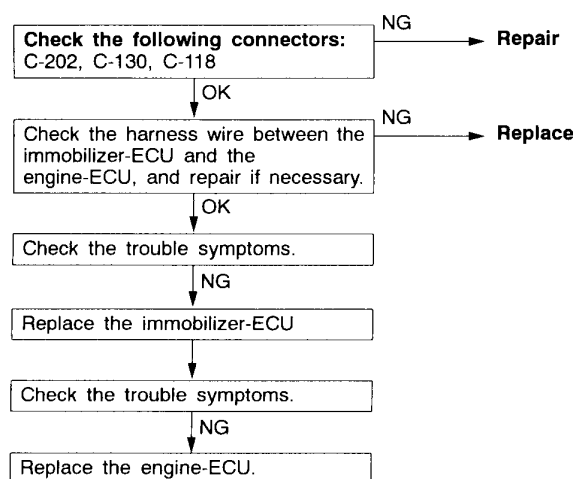
Code No. P1603 Battery backup line malfunction	Probable cause
Inspection Range • Ignition switch: ON Evaluation Conditions • The backup RAM information set at the last time when the ignition switch was turned to the OFF position is not memorized.	• Battery backup line disconnection, short circuit or connector contact defect • Engine-ECU malfunction



Code No.P1610 Immobilizer system <Europe and General Export-spec. models>	Probable cause
Inspection Range • 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 encrypted code.

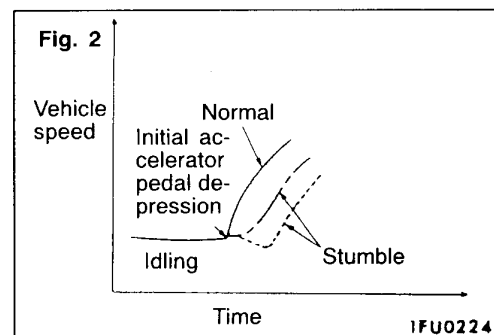
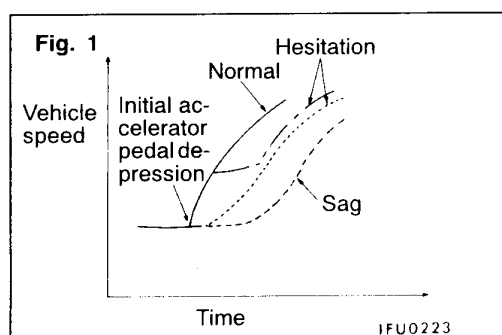


INSPECTION CHART FOR TROUBLE SYMPTOMS

Inspection procedure	Check items	Reference page
1	Communication between MUT-II and entire system is not possible.	13A-54
2	Only communication between MUT-II and engine-ECU is not possible.	13A-55
3	Engine warning lamp does not illuminate immediately after ignition switch is set to ON position.	13A-56
4	Engine warning lamp stays illuminated and does not turn OFF.	13A-57
5	Starting disabled (Starter does not rotate.)	13A-58
6	Starting disabled (Starter rotates but initial combustion does not occur.)	13A-59
7	Starting disabled (Initial combustion occurs but is incomplete.)	13A-61
	Improper starting (Starting time is long.)	
8	Unstable idling (Rough idling, hunting)	13A-63
	Inappropriate idling speed (High or low idling speed)	
	Engine stalls (Die out) during idling	
9	Engine stalls when starting travel. (Pass out)	13A-66
10	Engine stalls during deceleration	13A-67
11	Pulsation (Hesitation, sag)	13A-68
	Poor acceleration	
	Stumbling	
	Surging	
12	Shock during acceleration	13A-70
13	Shock during deceleration	13A-71
14	Knocking	13A-72
15	Deviation of ignition interval	13A-73
16	Run on (Dieseling)	13A-74
17	Abnormal odor, white smoke, black smoke, high CO or HC concentration when idling	13A-75
18	Battery dies	13A-77
19	Overheating	13A-79
20	Abnormal radiator fan motor rotation	13A-80
21	A/C ineffective	13A-81
22	Engine-ECU power supply, engine control relay, ignition switch-IG1 system	13A-82
23	Fuel pump system	13A-85
24	Radiator fan control relay system	13A-87
25	Condenser fan relay system	13A-89
26	A/C switch system	13A-92
27	A/C compressor relay system	13A-93
28	A/C load signal system	13A-95
29	Secondary air control solenoid valve system	13A-96
30	Intercooler water spray circuit system	13A-97
31	Intercooler water spray lamp system	13A-99
32	Ignition coil (integrated power transistor) system	13A-100

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

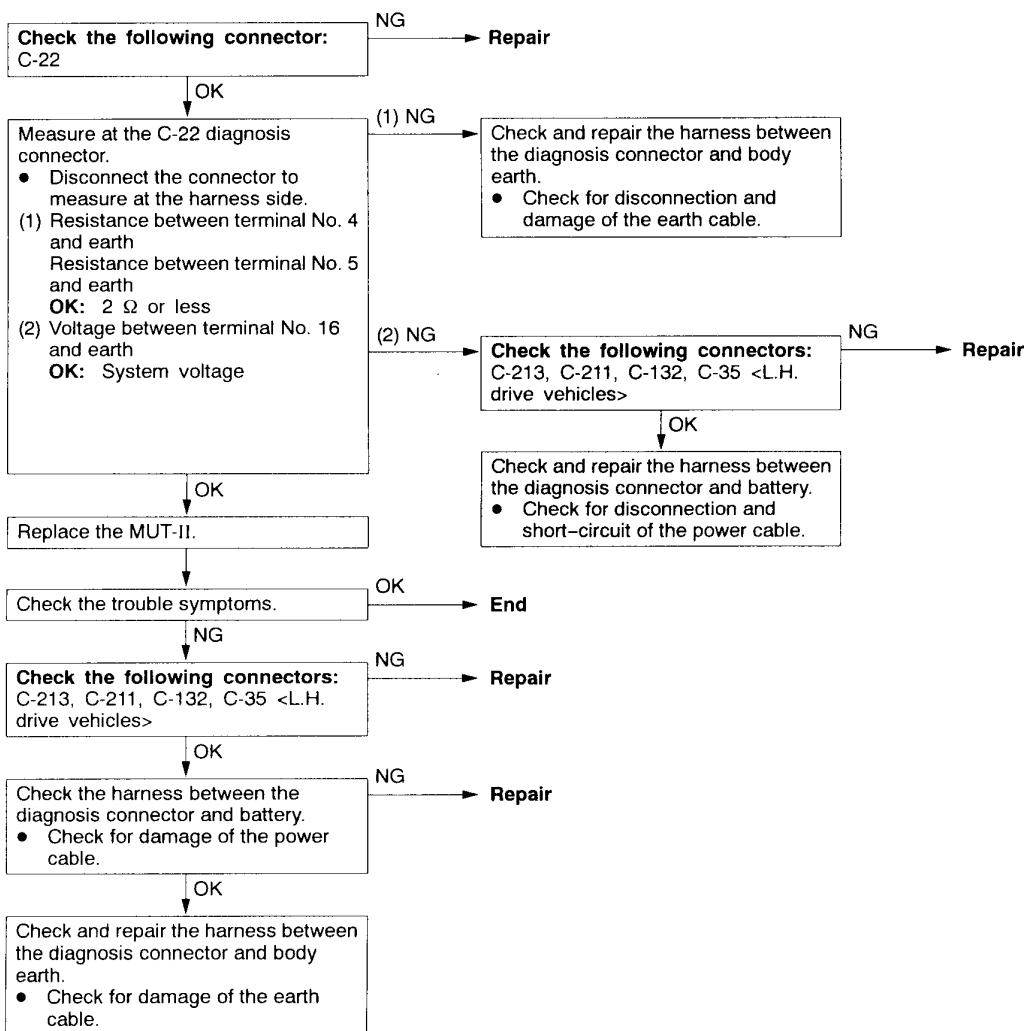
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.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



INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

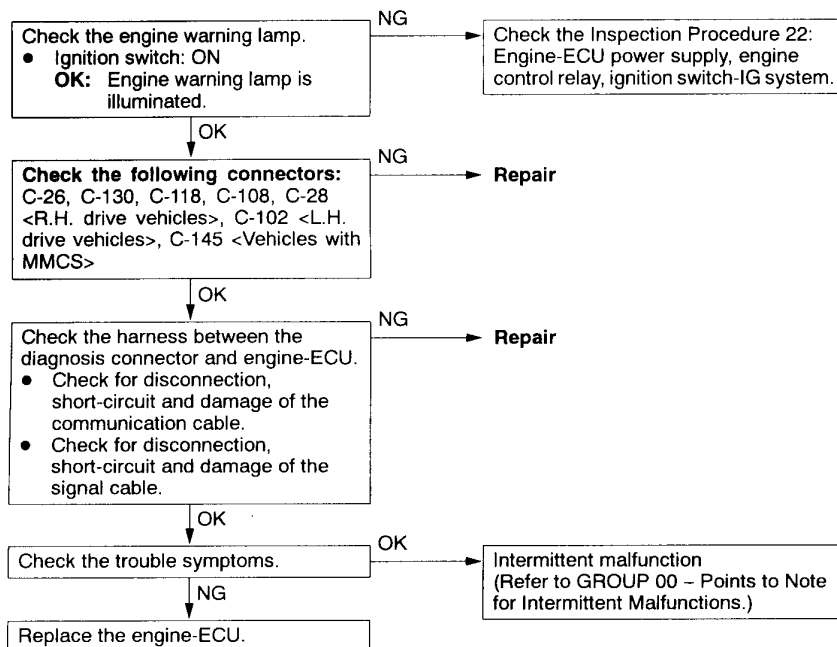
Inspection Procedure 1

Communication between MUT-II and entire system is not possible.	Probable cause
Causes shown on right are suspected.	• Diagnosis connector malfunction • MUT-II malfunction



Inspection Procedure 2

Only communication between MUT-II and engine-ECU is not possible.	Probable cause
Causes shown on right are suspected.	• Ignition switch malfunction • Engine control relay malfunction • Engine-ECU malfunction

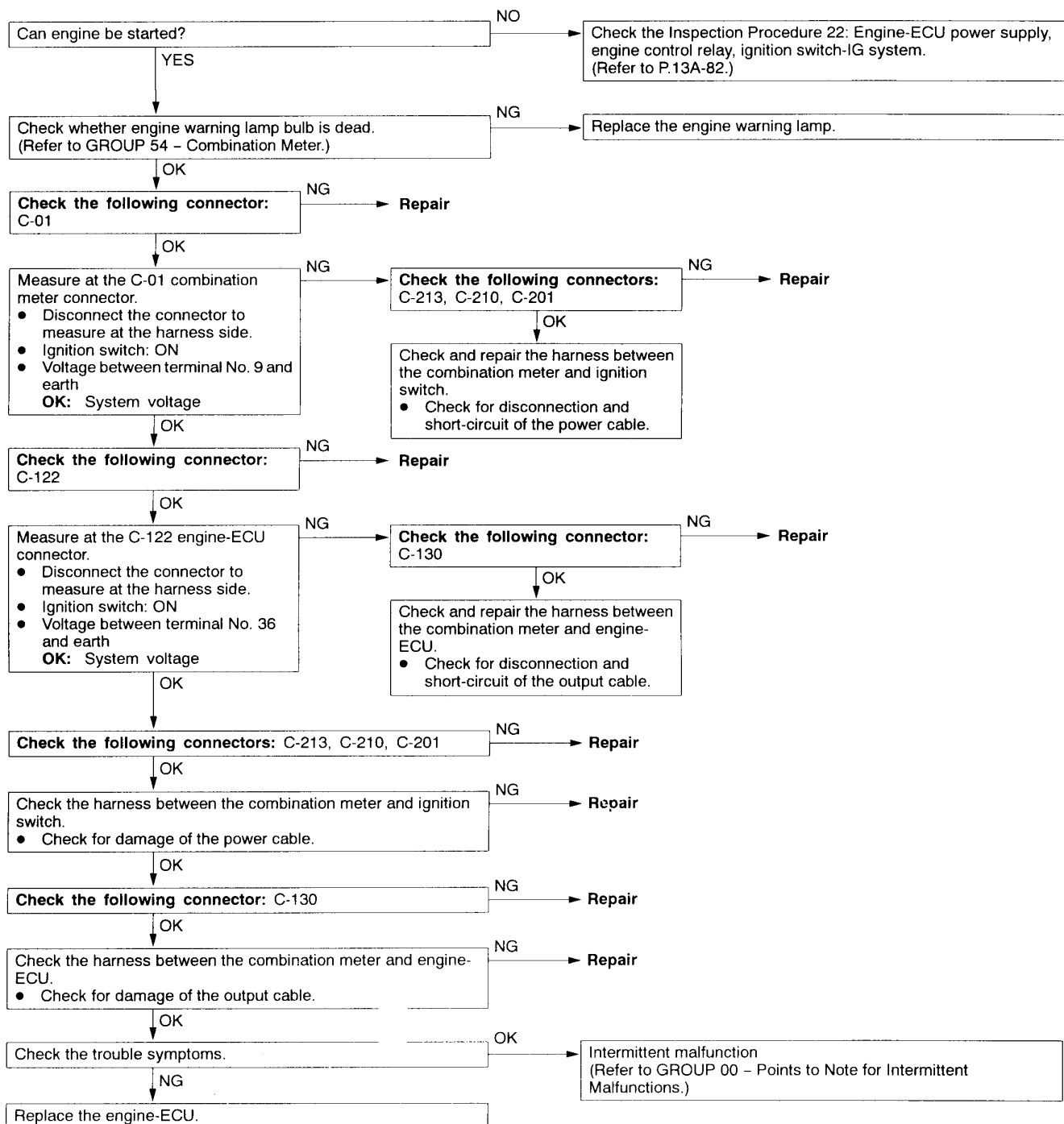


NOTE

If the problem symptom does not disappear in the vehicle with MMCS after carrying out the above-mentioned inspection procedure, there may be a malfunction in the multi-center display.

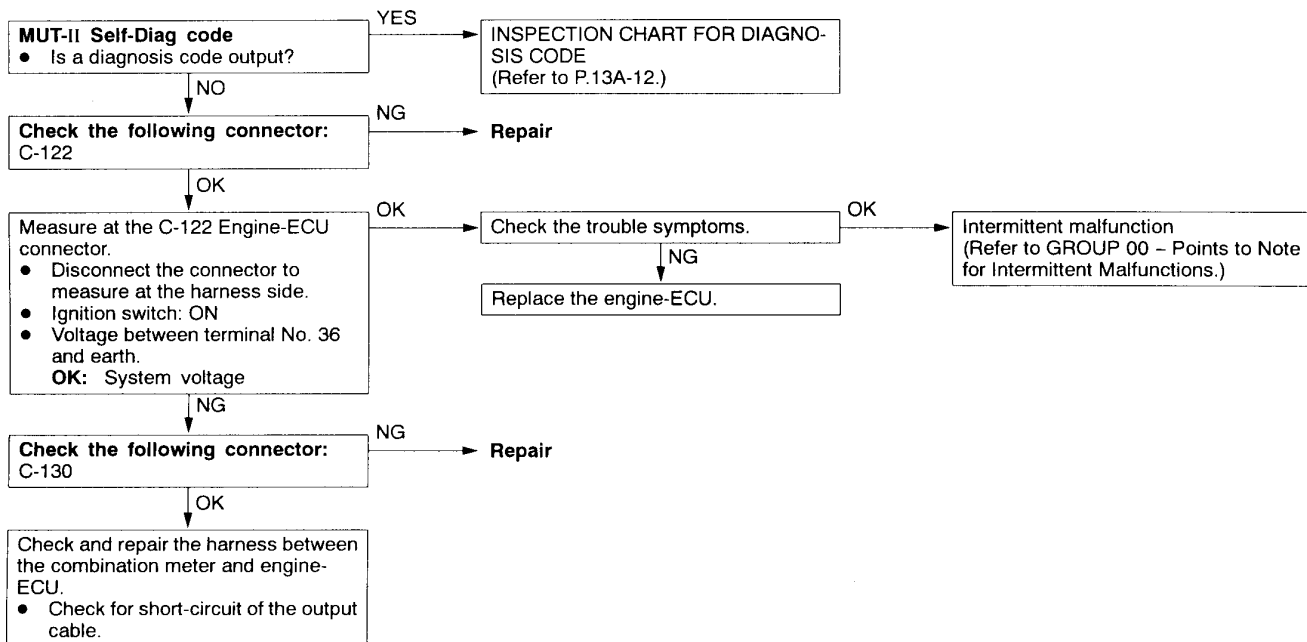
Inspection Procedure 3

Engine warning lamp does not illuminate immediately after ignition switch is set to ON position.	Probable cause
The engine-ECU illuminates the engine warning lamp for 5 seconds immediately after ignition switch is set to "ON" position to check whether the engine warning lamp bulb is dead.	• Engine warning lamp bulb dead • Ignition switch malfunction • Engine control relay malfunction • Engine-ECU malfunction



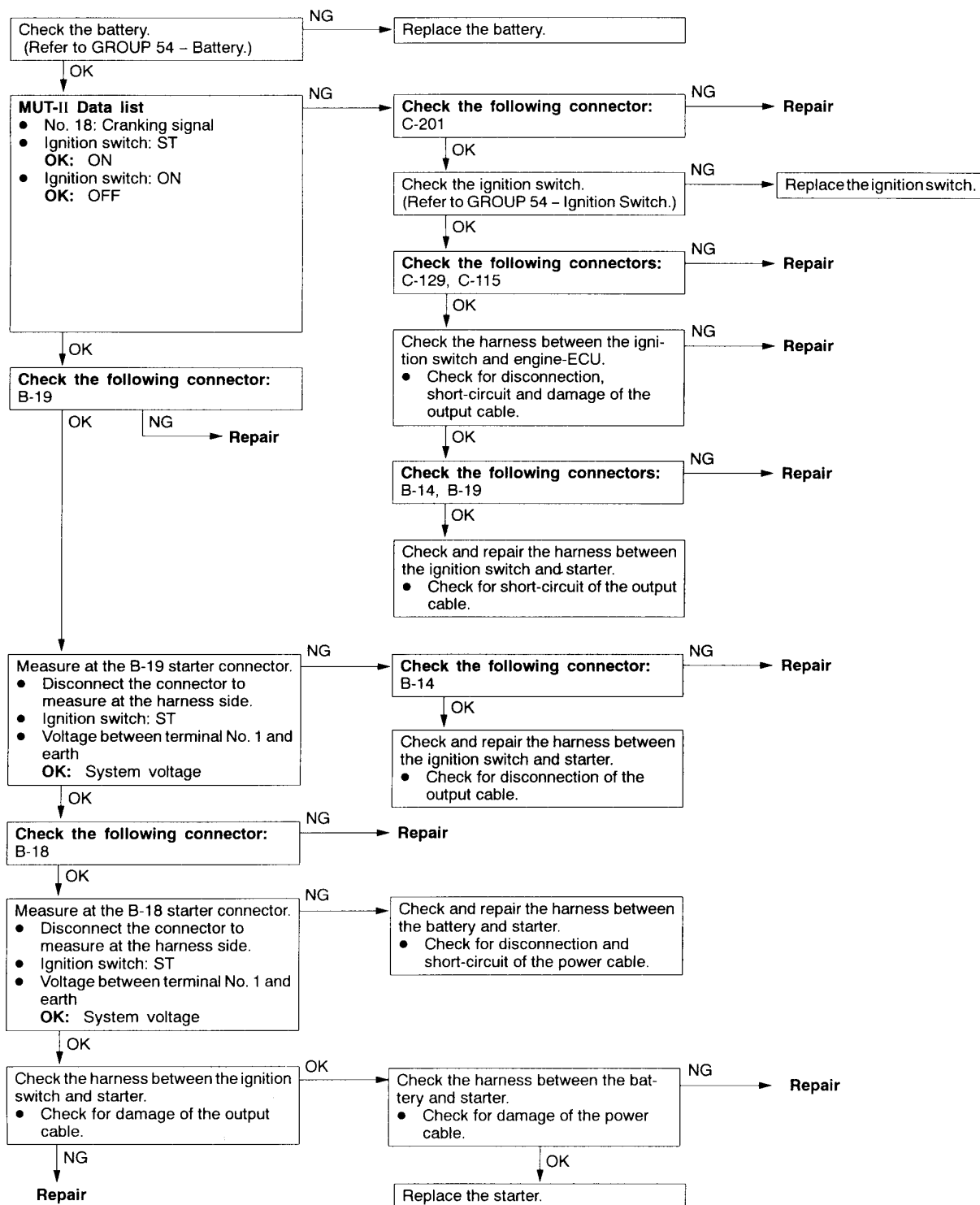
Inspection Procedure 4

Engine warning lamp stays illuminated and does not turn OFF.	Probable cause
The engine-ECU illuminates the engine warning lamp when the occurrence of a diagnosis code is recorded.	Engine-ECU malfunction



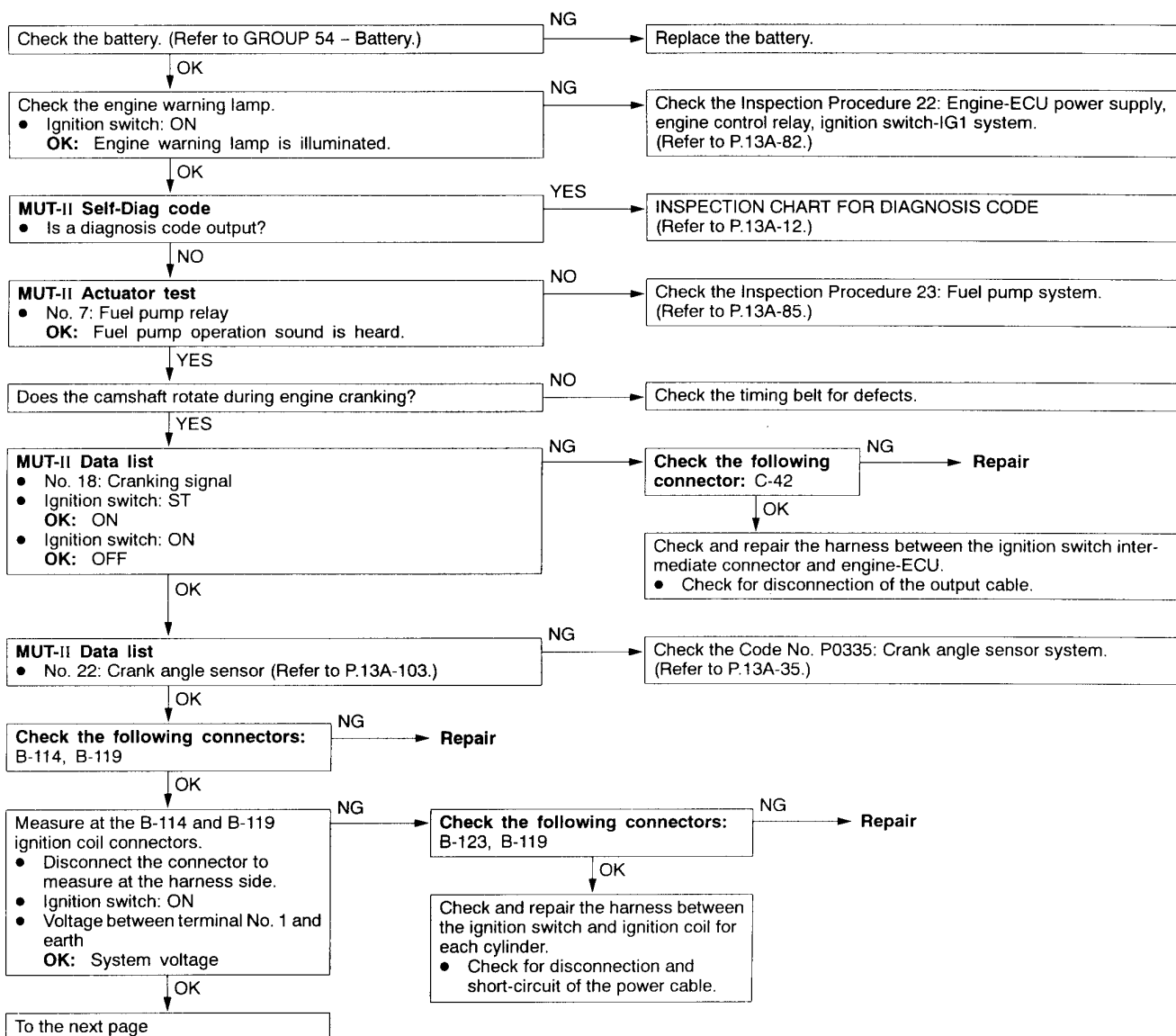
Inspection Procedure 5

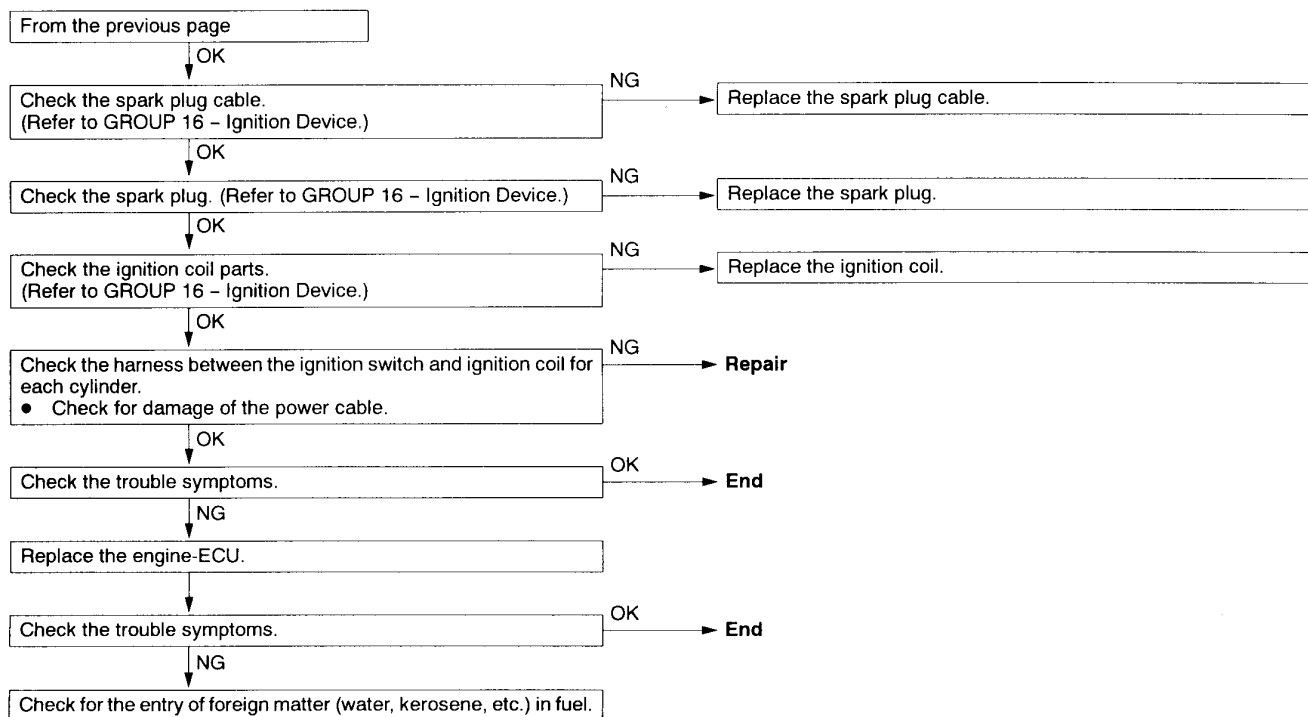
Starting disabled (Starter does not rotate.)	Probable cause
Causes shown on right are suspected.	• Battery malfunction • Ignition switch malfunction • Starter malfunction



Inspection Procedure 6

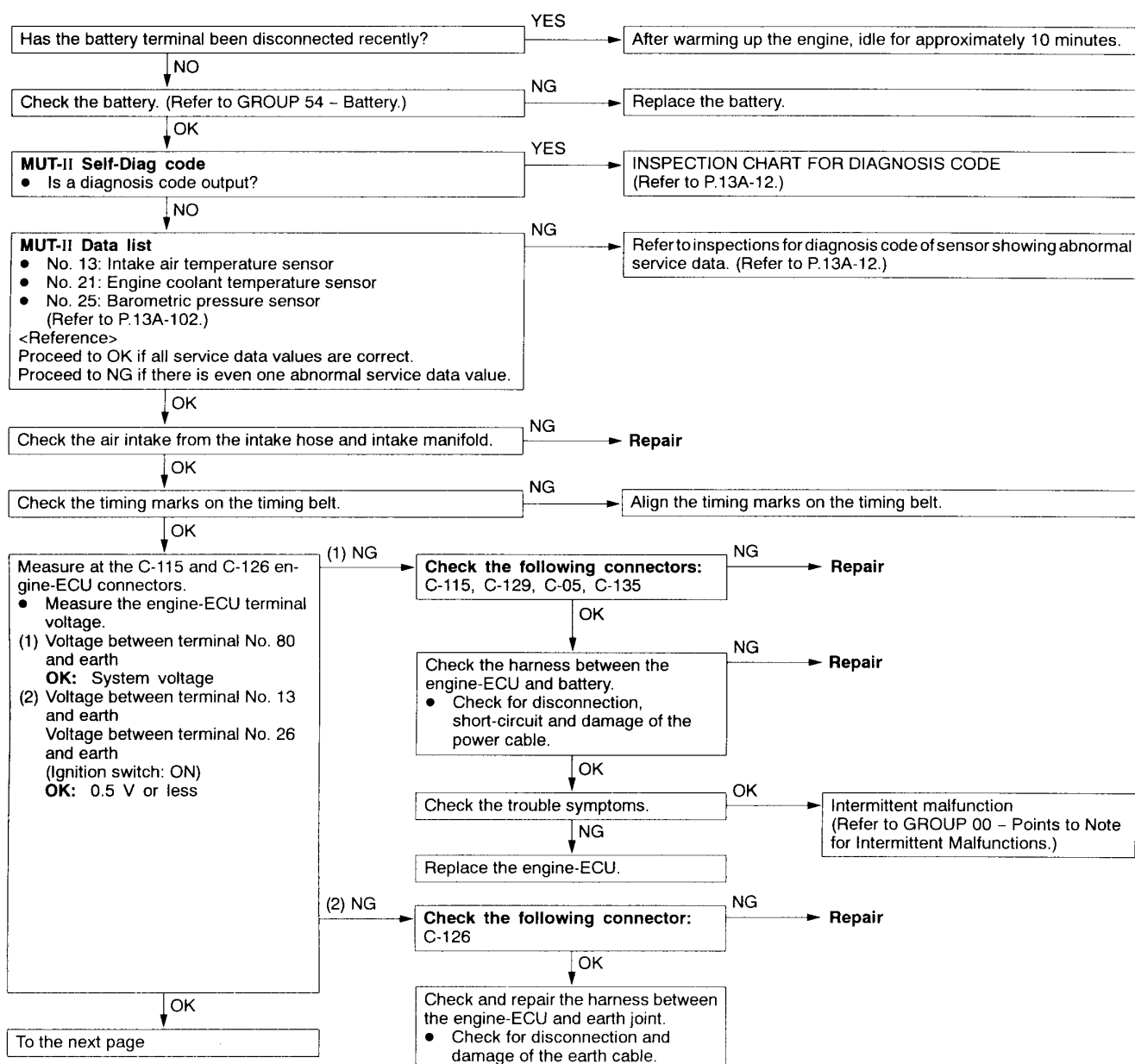
Starting disabled (Starter rotates but initial combustion does not occur.)	Probable cause
Causes shown on right are suspected.	• Battery malfunction • Ignition switch malfunction • Ignition system malfunction • Fuel system malfunction • Throttle valve malfunction • Timing belt malfunction • Engine-ECU malfunction-

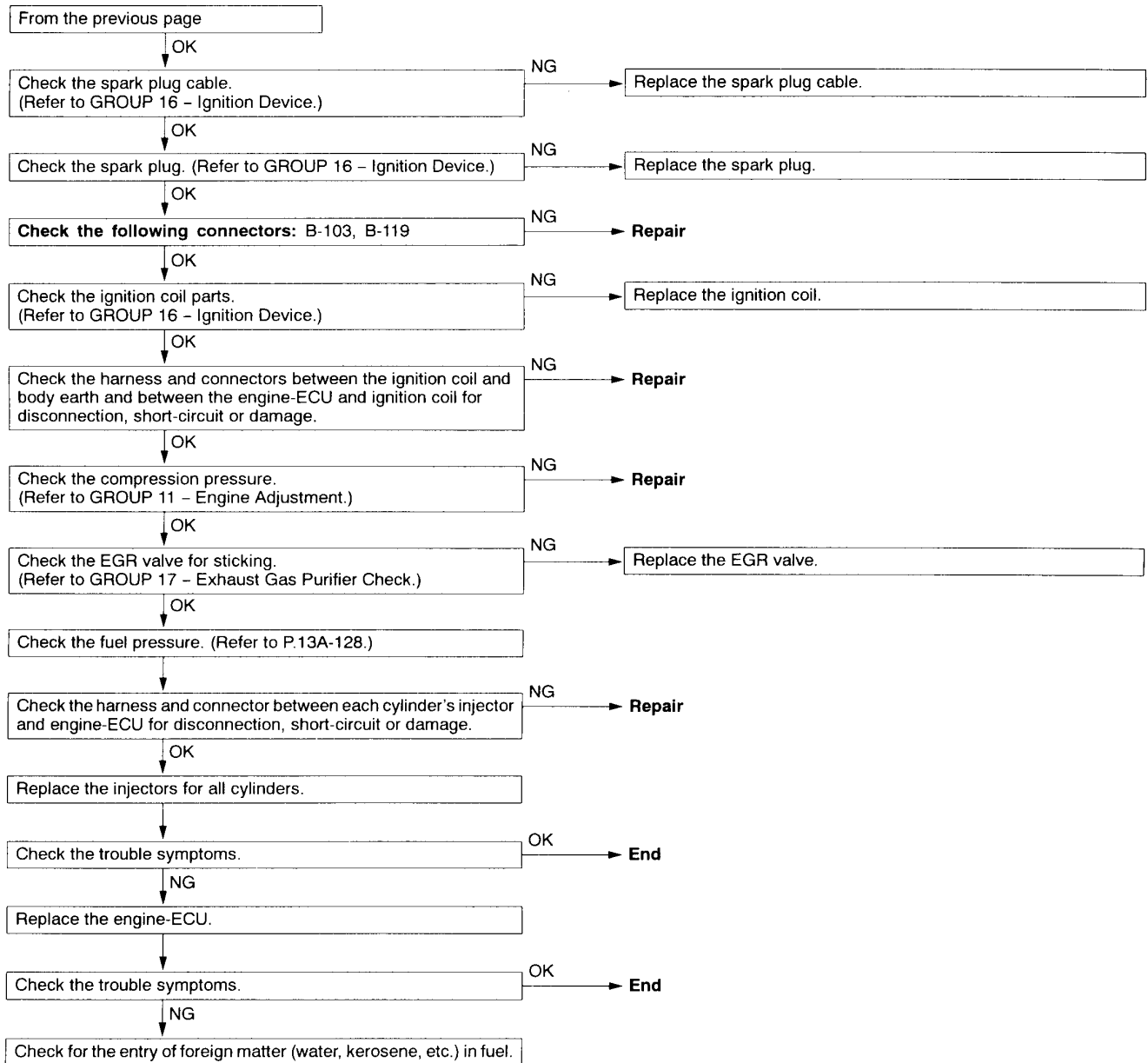




Inspection Procedure 7

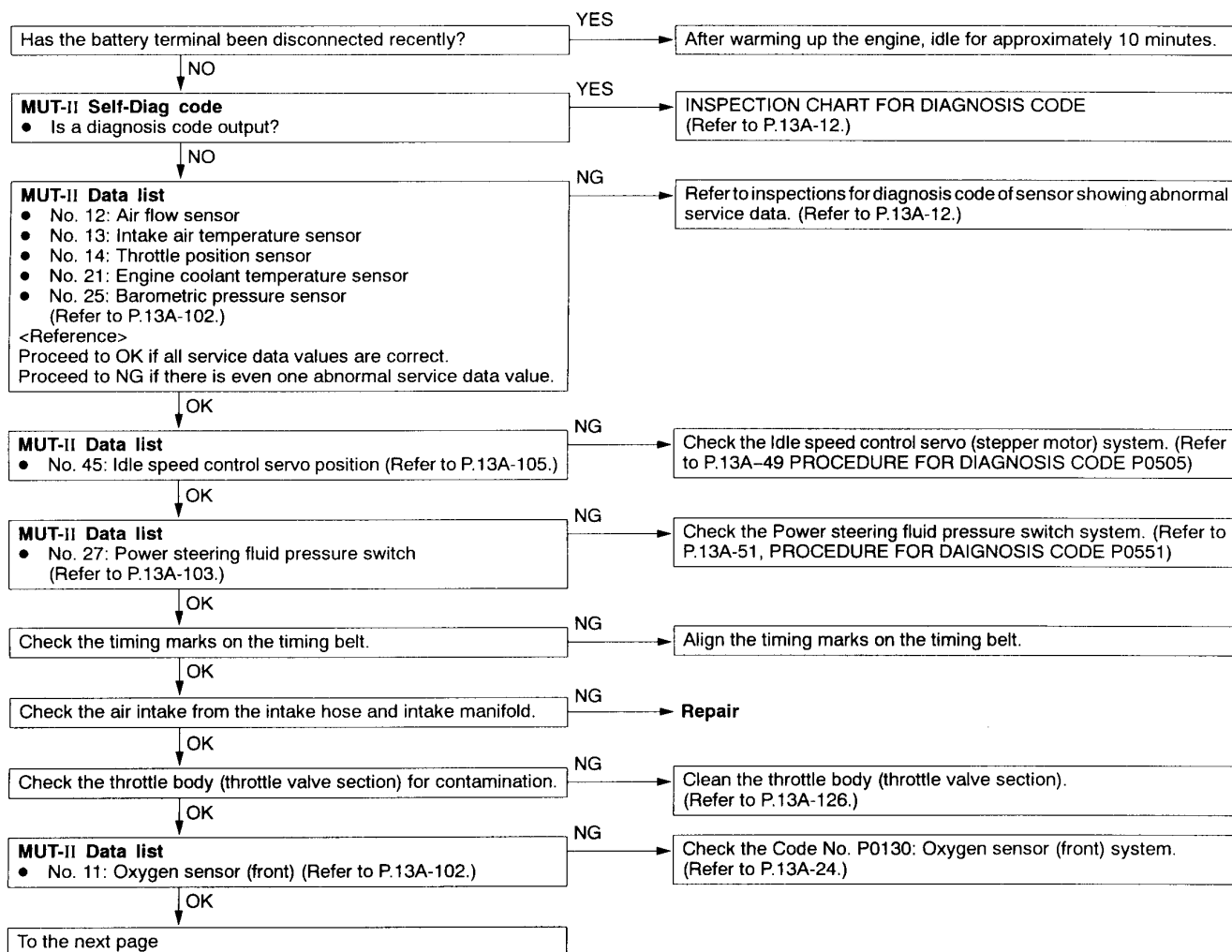
Starting disabled (Initial combustion occurs but is incomplete.), improper starting (Starting time is long.)	Probable cause
Causes shown on right are suspected.	• Battery malfunction • Ignition system malfunction • Fuel system malfunction • Intake system malfunction • EGR valve malfunction • Timing belt malfunction • Improper compression pressure • Engine-ECU malfunction

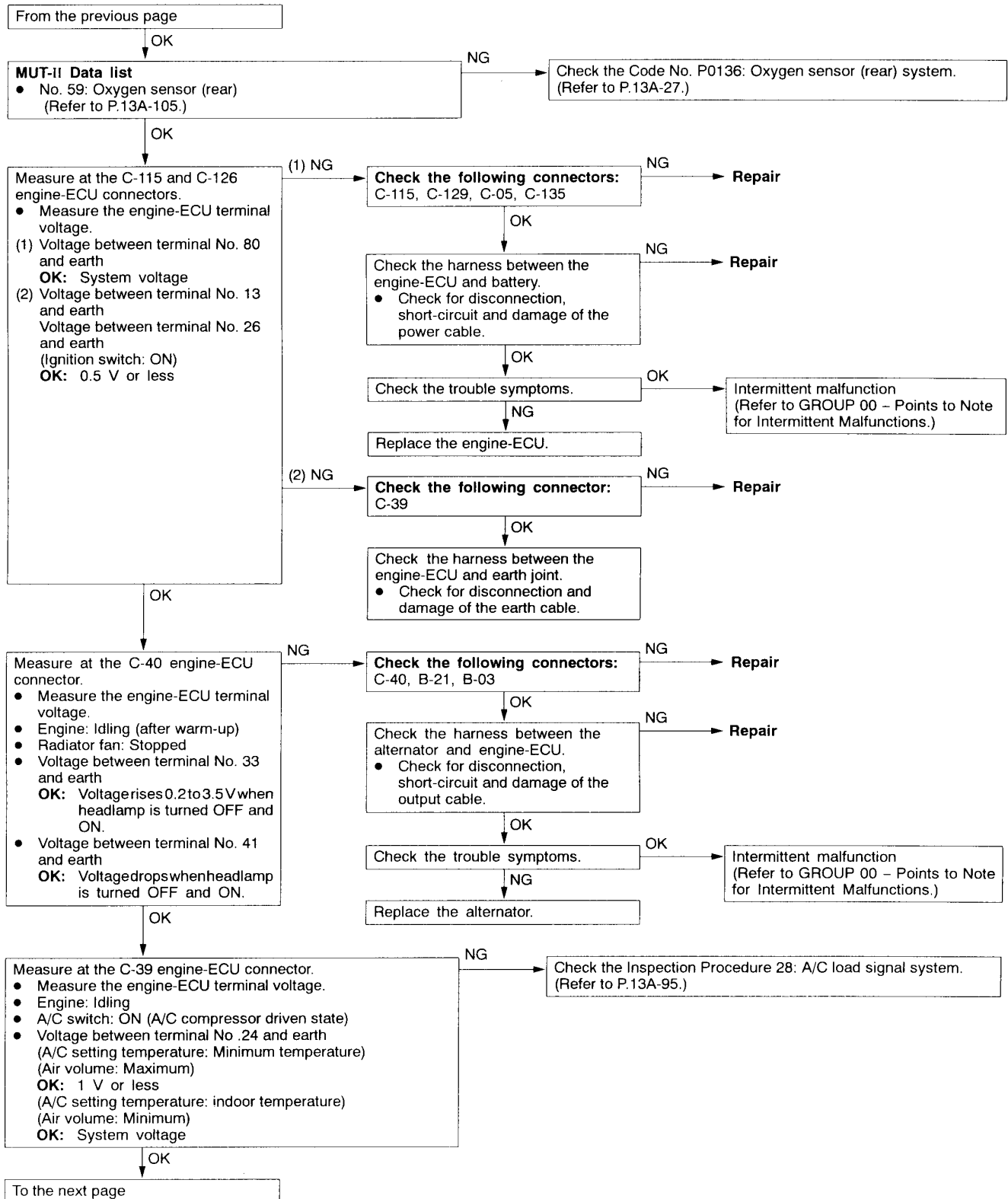


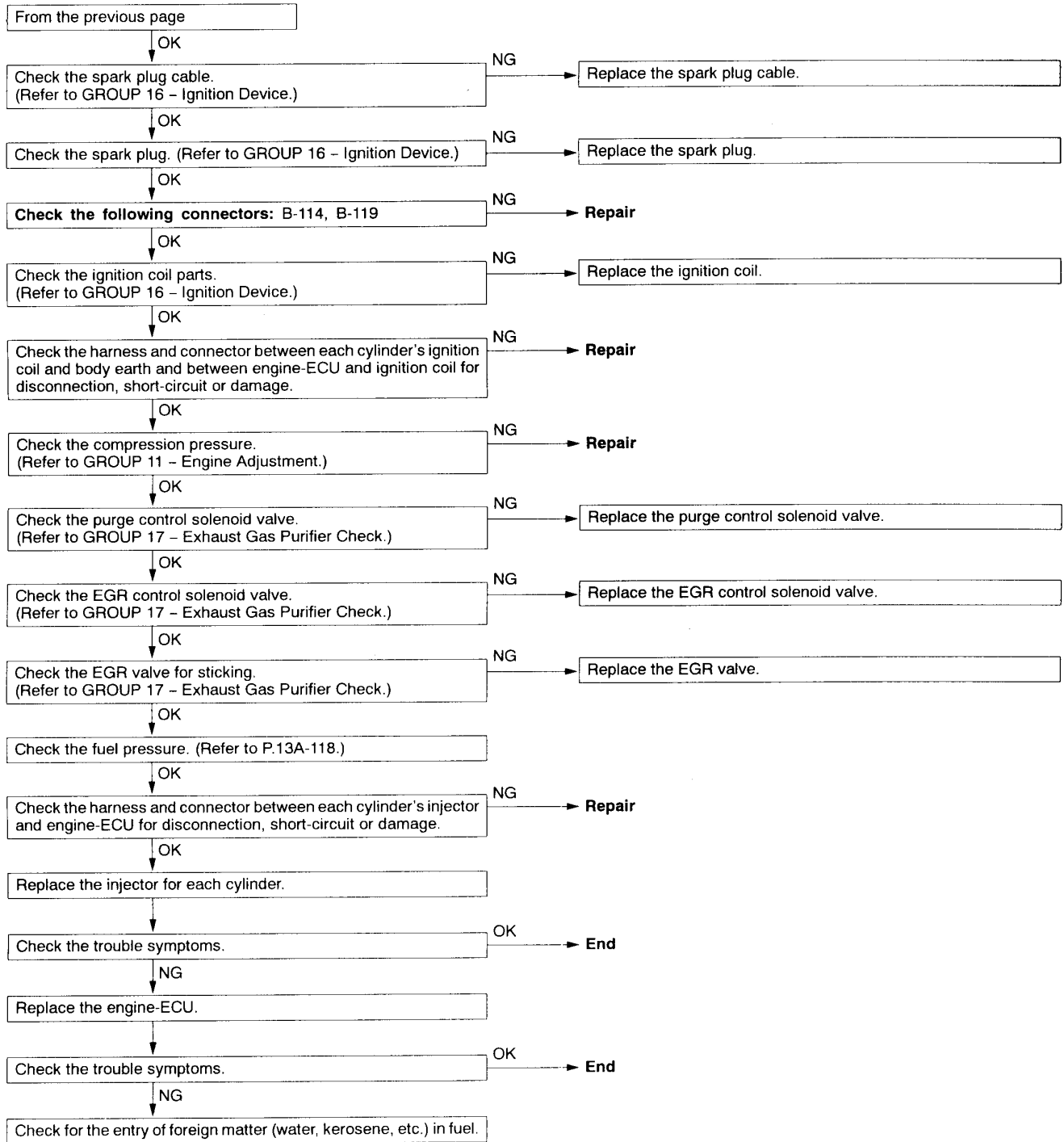


Inspection Procedure 8

Unstable idling (Rough idling, hunting), inappropriate idling speed (High or low idling speed), engine stalls (Die out) during idling	Probable cause
Causes shown on right are suspected.	- Idle speed control system malfunction - Air/fuel ratio control system malfunction - Ignition system malfunction - Fuel system malfunction - Intake and exhaust system malfunction - Exhaust gas purifier system malfunction - Throttle valve malfunction - Timing belt malfunction - Improper compression pressure - Engine-ECU malfunction

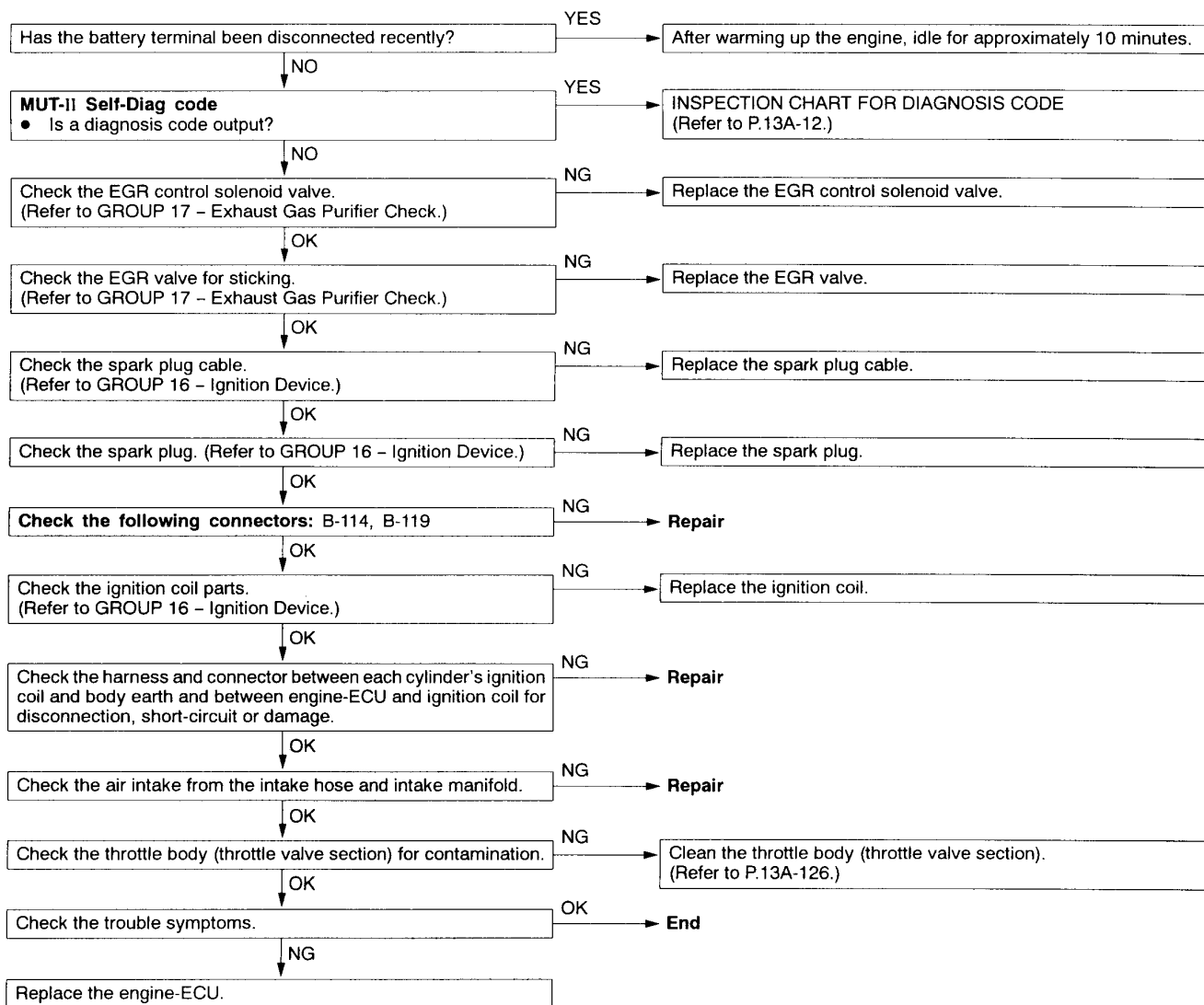






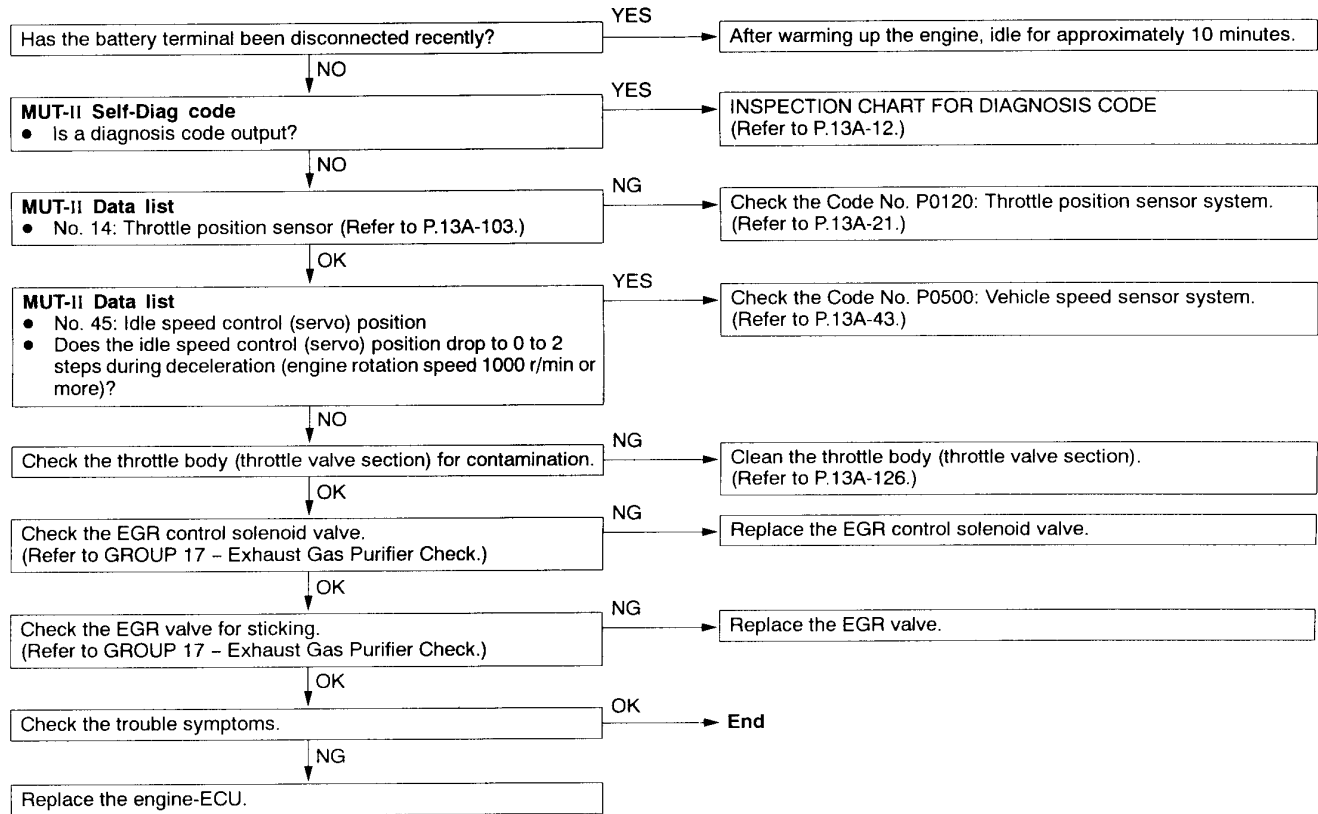
Inspection Procedure 9

Engine stalls when starting travel. (Pass out)	Probable cause
Causes shown on right are suspected.	• Ignition system malfunction • Intake system malfunction • Exhaust gas purifier system malfunction • Throttle body malfunction • Engine-ECU malfunction



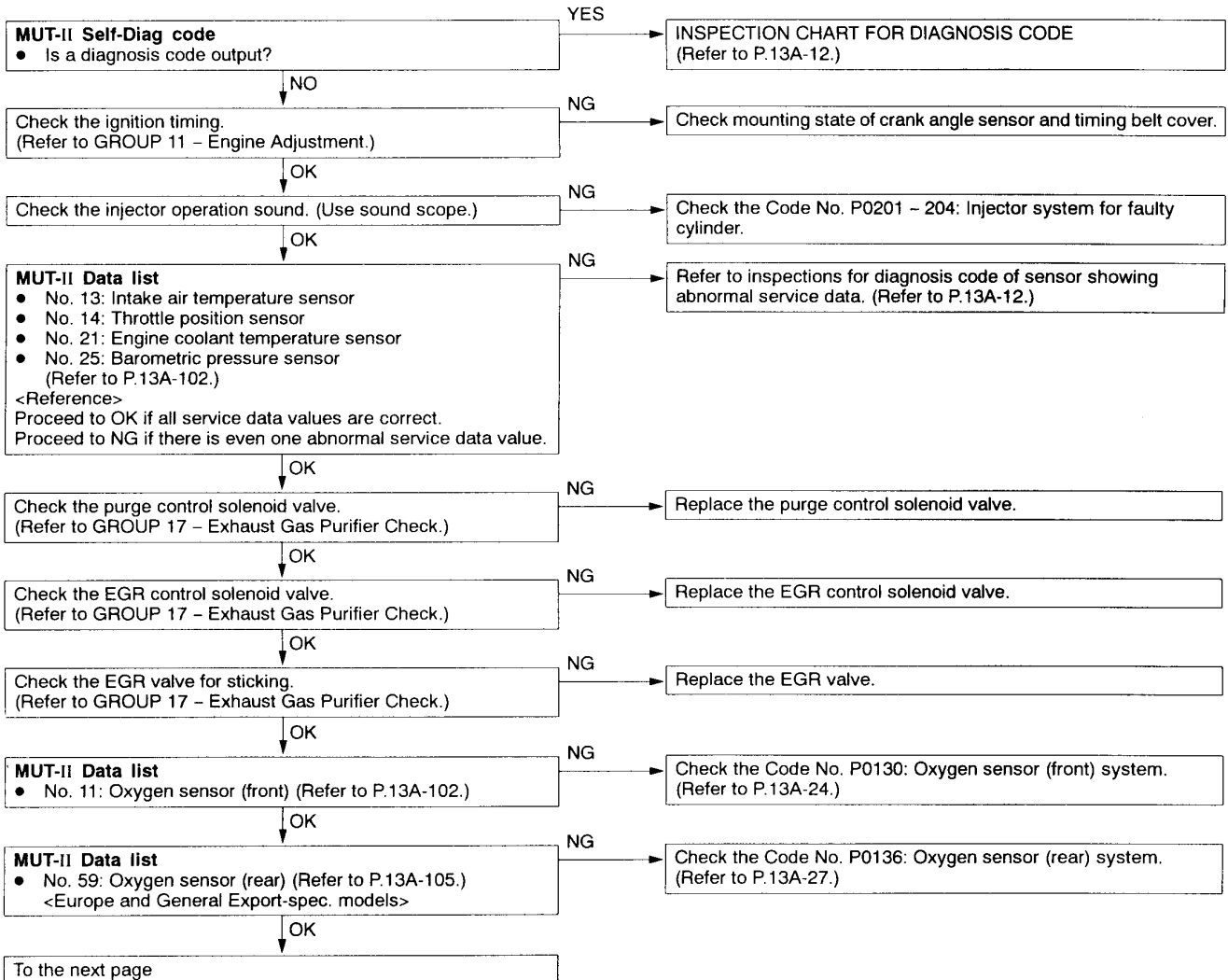
Inspection Procedure 10

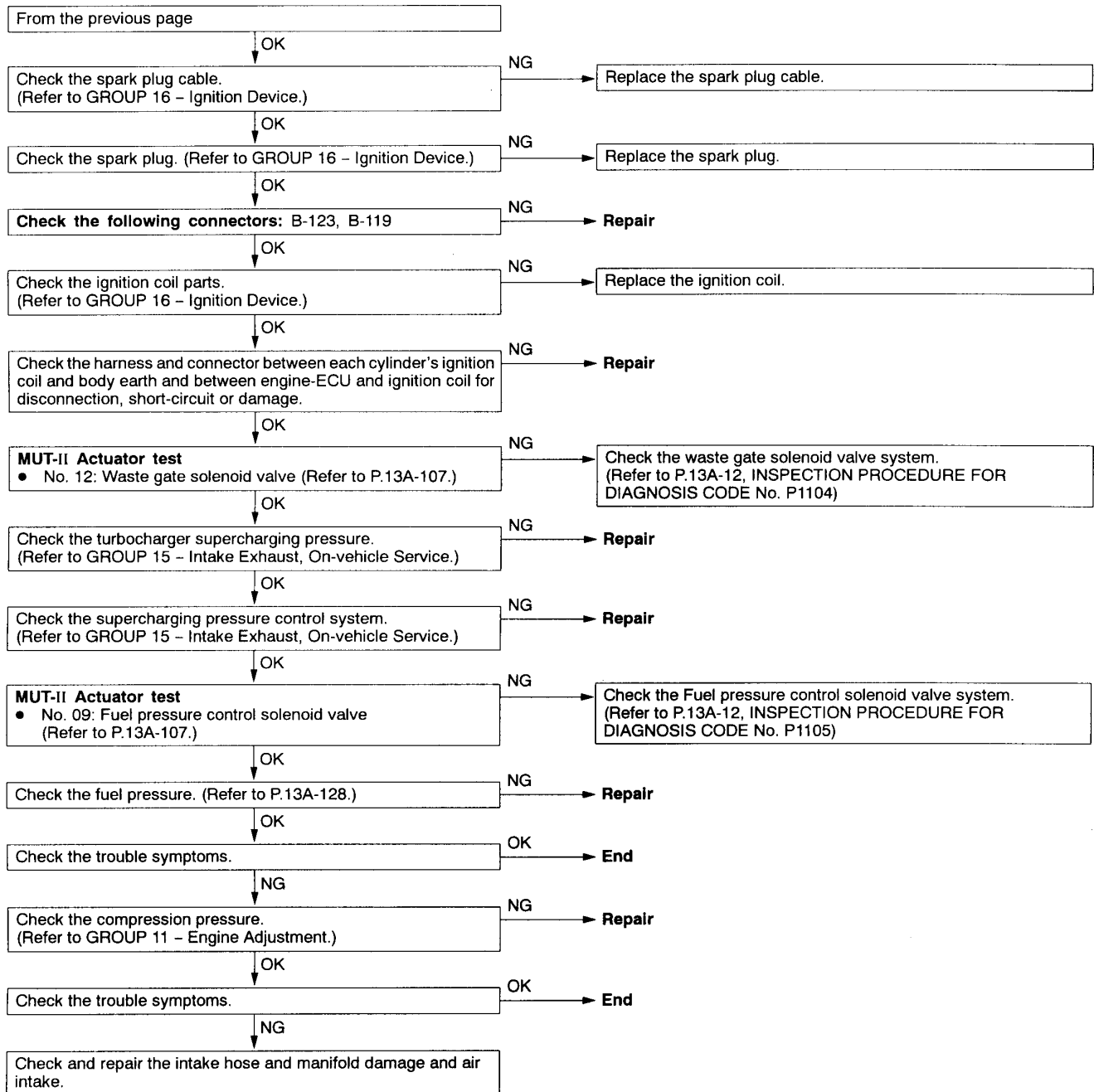
Engine stalls during deceleration	Probable cause
Causes shown on right are suspected.	- Idle speed control system malfunction - Exhaust gas purifier system malfunction - Throttle valve malfunction - Engine-ECU malfunction



Inspection Procedure 11

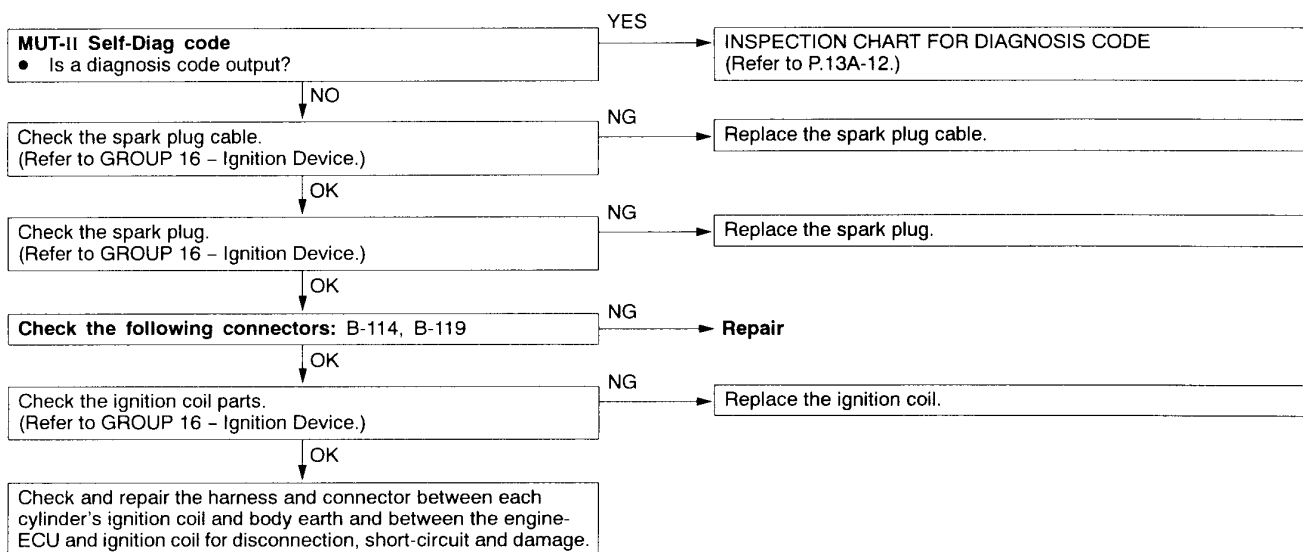
Pulsation (Hesitation, sag), poor acceleration, stumbling, surging	Probable cause
Causes shown on right are suspected.	• Air/fuel ratio control system malfunction • Ignition system malfunction • Fuel system malfunction • Intake and exhaust system malfunction • Exhaust gas purifier system malfunction • Improper compression pressure • Turbocharger system malfunction





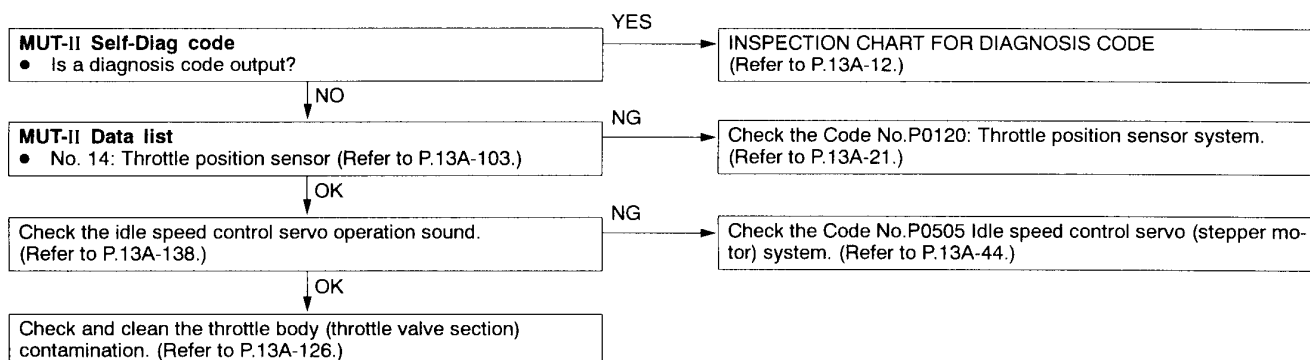
Inspection Procedure 12

Shock during acceleration	Probable cause
The occurrence of ignition leaks, etc., due to the rise in voltage required for the spark plugs during acceleration is a probable cause.	Ignition system malfunction



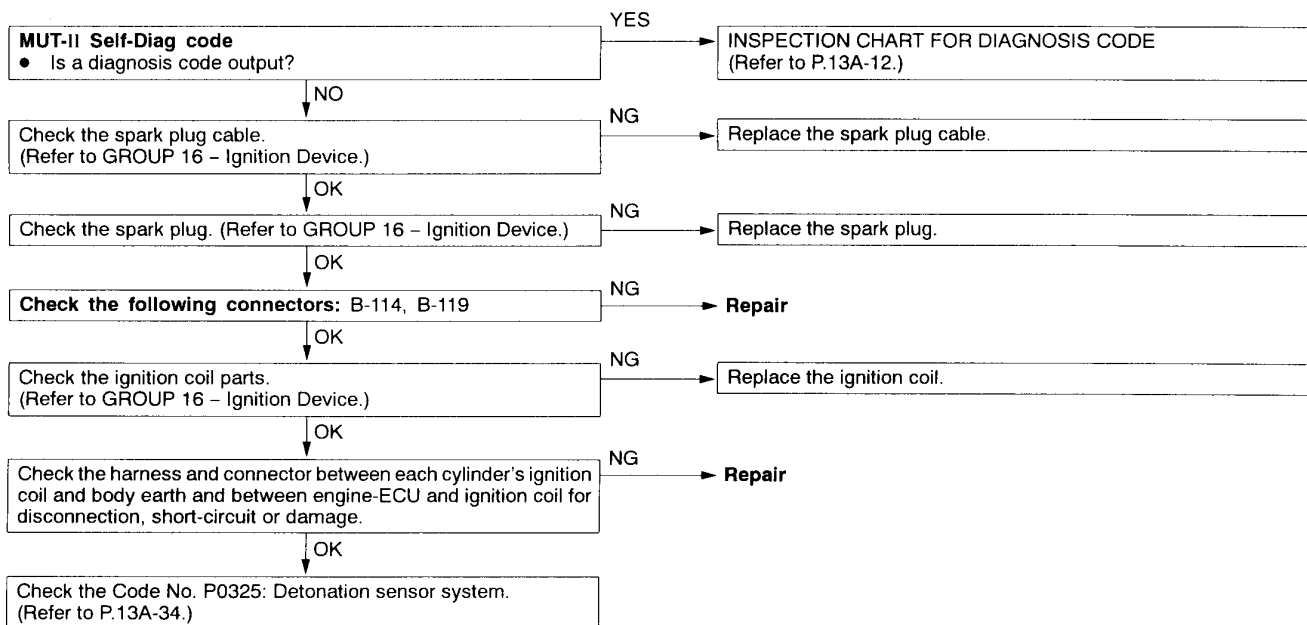
Inspection Procedure 13

Shock during deceleration	Probable cause
The idle speed control may be incorrect.	Idle speed control system malfunction



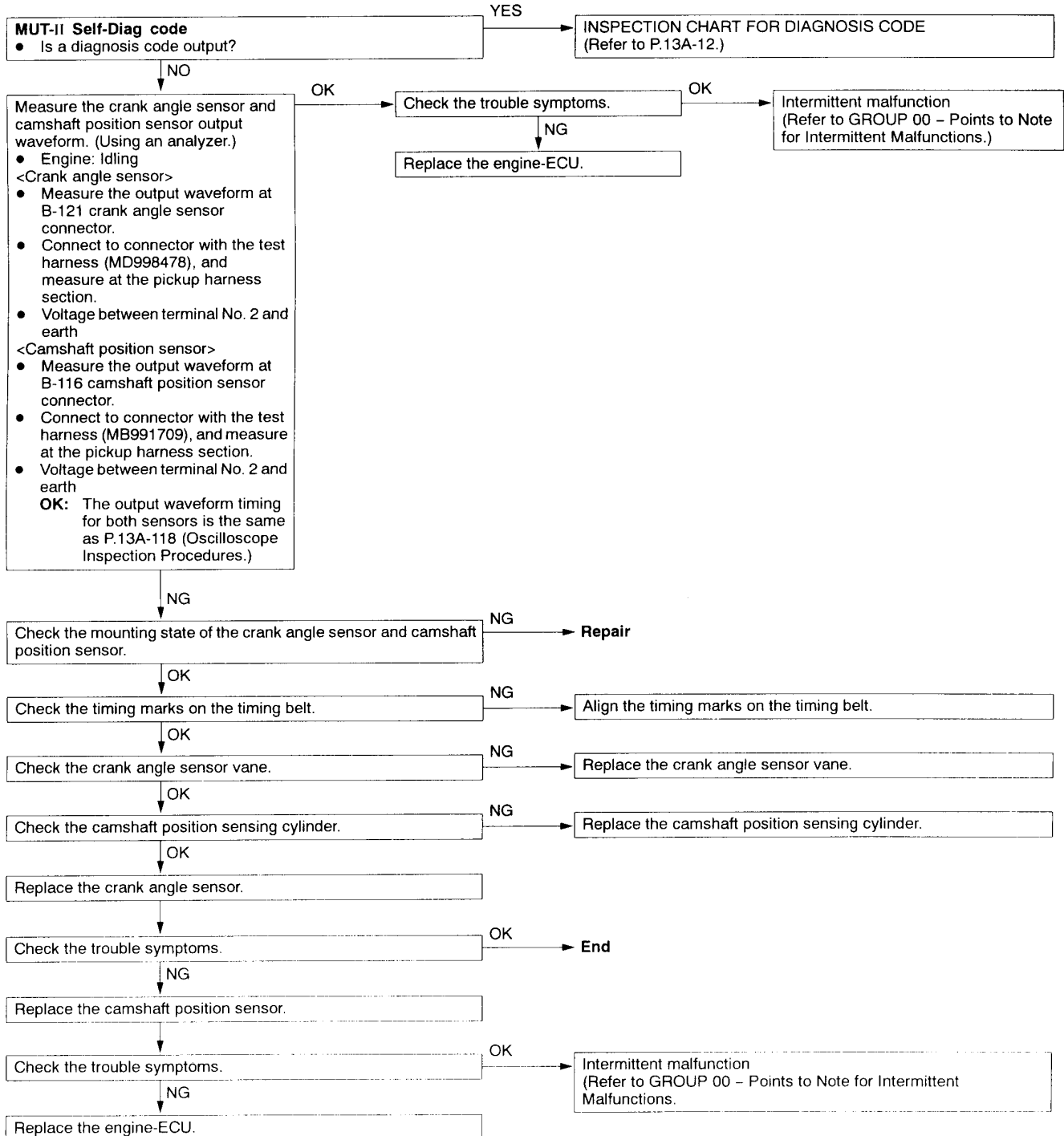
Inspection Procedure 14

Knocking	Probable cause
Causes shown on right are suspected.	• Detonation sensor malfunction • Knocking control system malfunction • Spark plug malfunction • Ignition system malfunction • Engine-ECU malfunction



Inspection Procedure 15

Deviation of ignition interval	Probable cause
Causes shown on right are suspected.	• Crank angle sensor malfunction • Camshaft position sensor malfunction • Timing belt malfunction • Engine-ECU malfunction



Inspection Procedure 16

Run on (Dieseling)	Probable cause
Causes shown on right are suspected.	• Injector malfunction • Engine-ECU malfunction

Replace the injectors for all cylinders.



Check the trouble symptoms.

OK

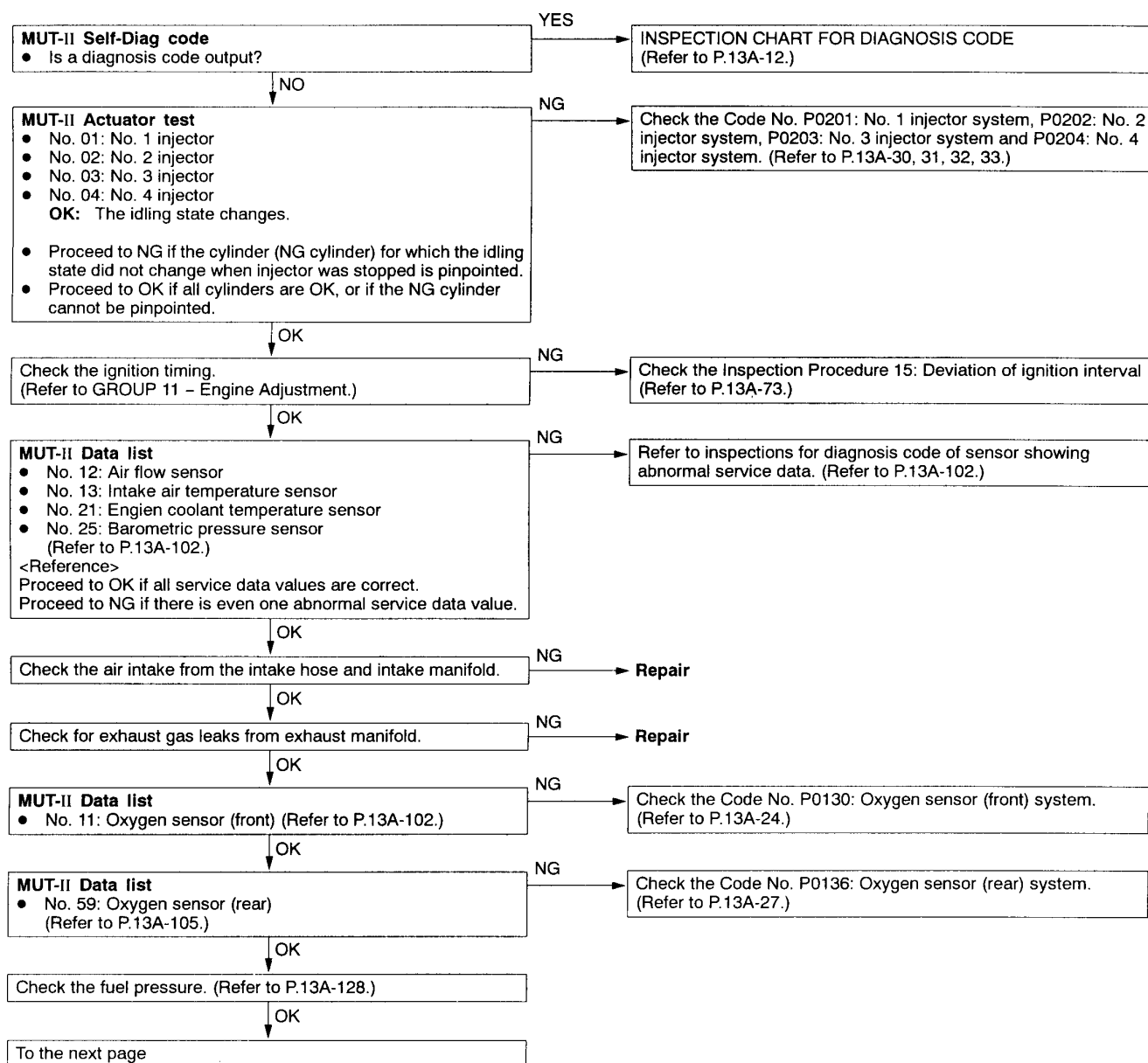
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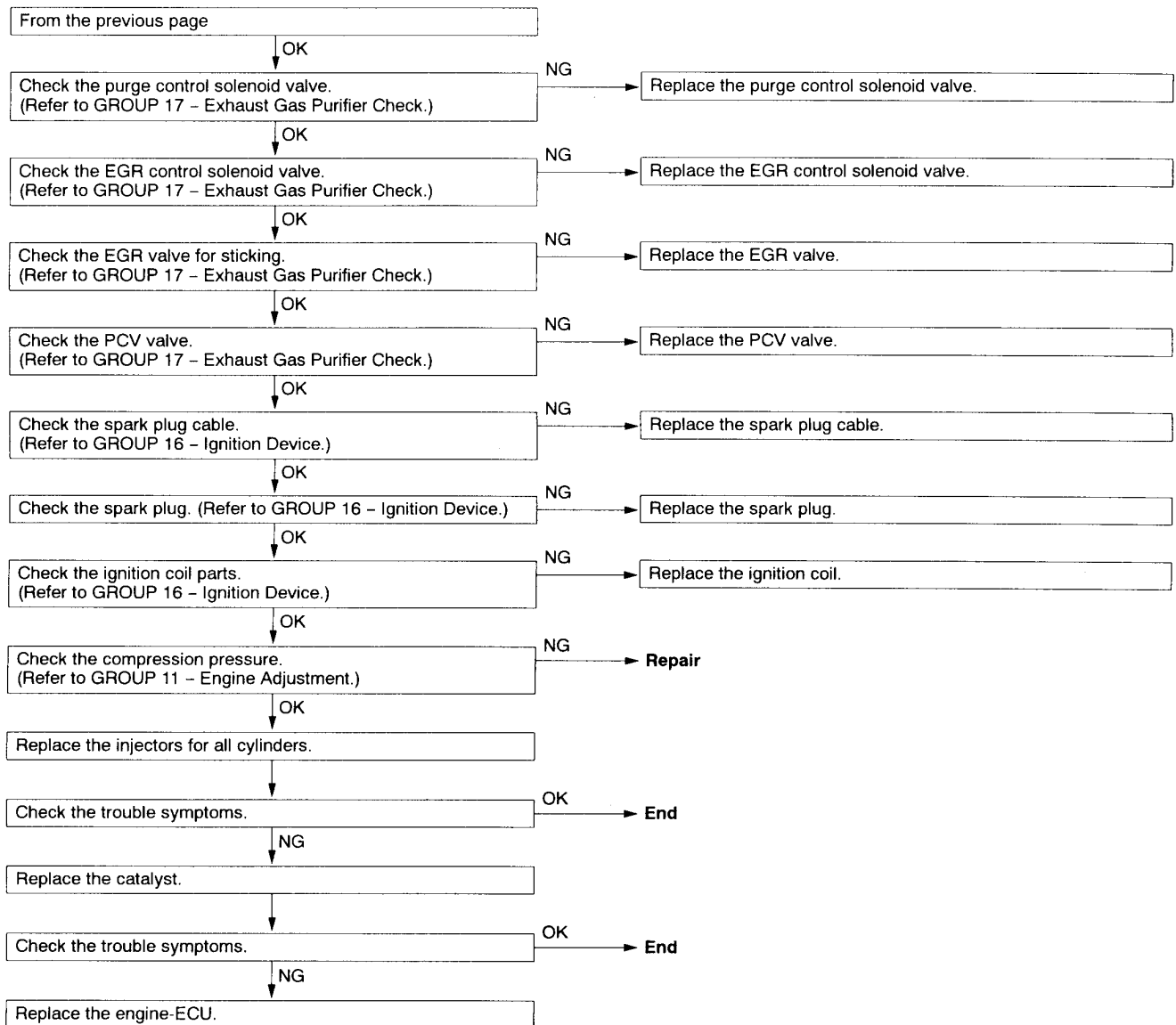
↓ NG

Replace the engine-ECU.

Inspection Procedure 17

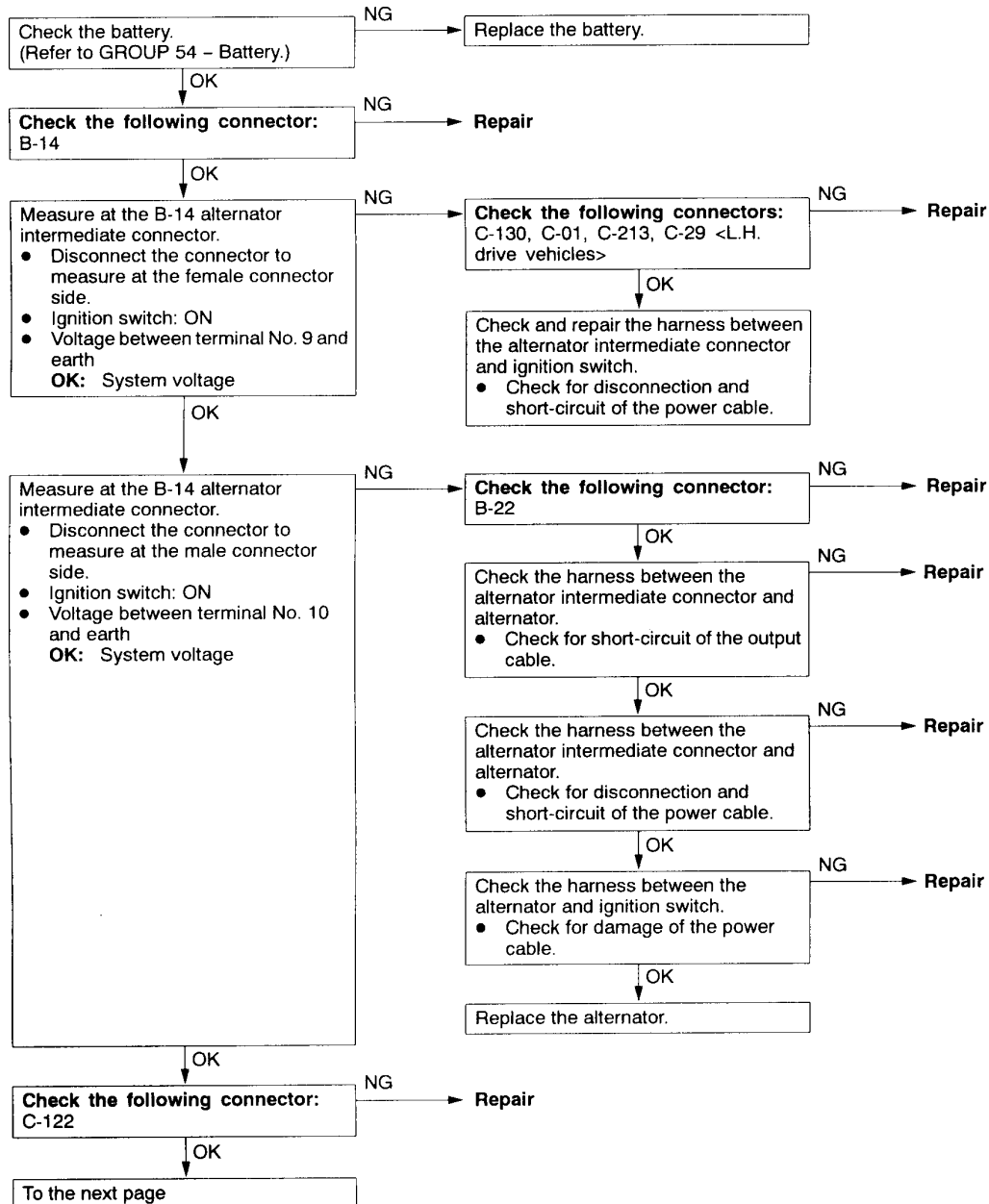
Abnormal odor, white smoke, black smoke, high CO or HC concentration when idling	Probable cause
Causes shown on right are suspected.	• Air/fuel ratio control system malfunction • Ignition system malfunction • Fuel system malfunction • Intake and exhaust system malfunction • Exhaust gas purifier system malfunction • Improper compression pressure • Catalyst defect • Engine-ECU malfunction

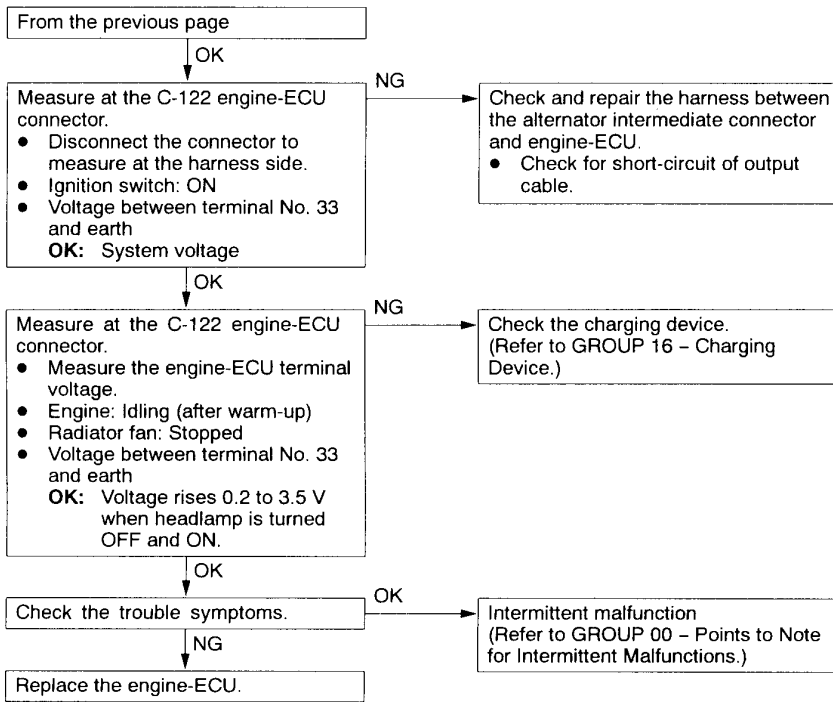




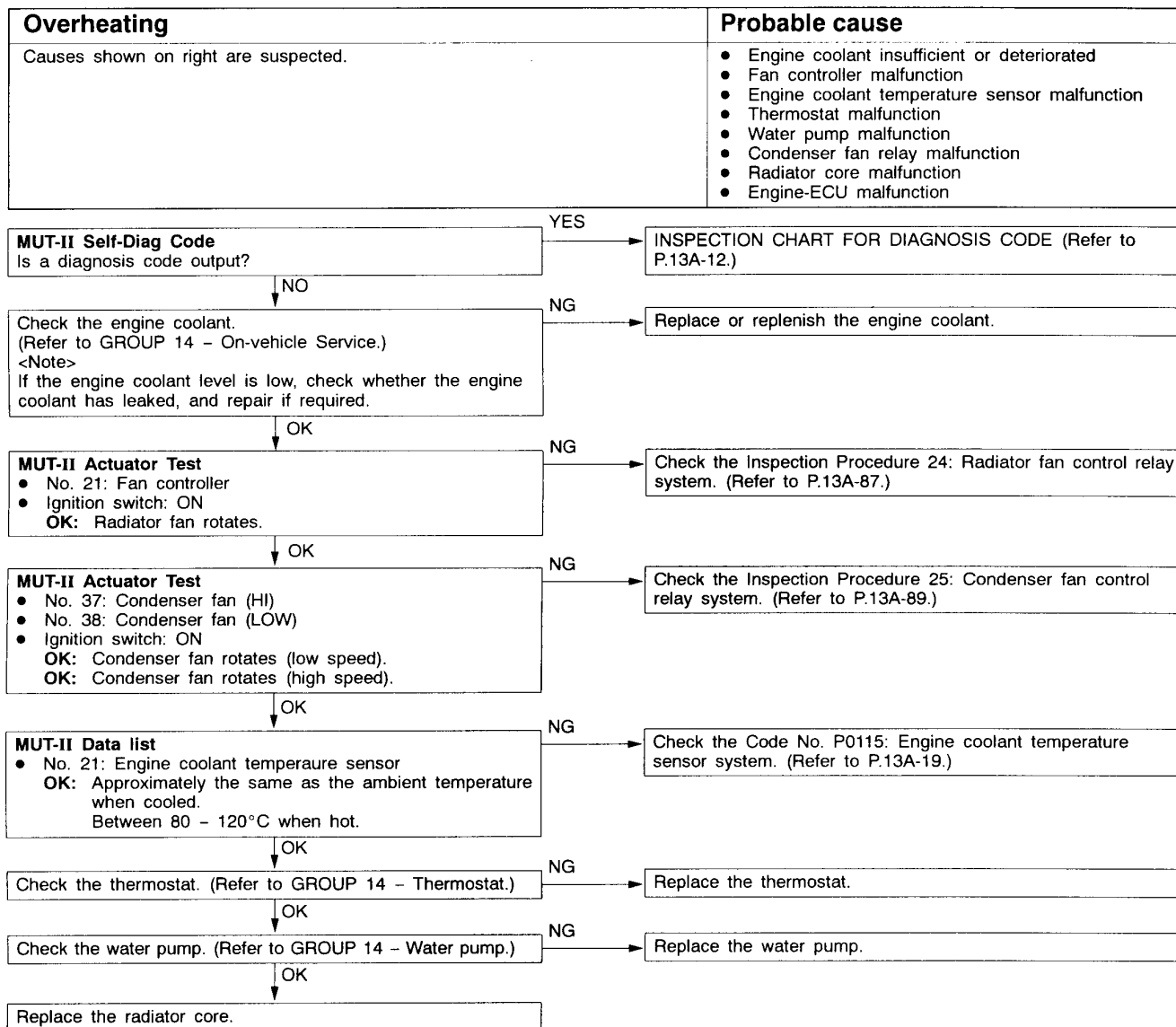
Inspection Procedure 18

Battery dies	Probable cause
Causes shown on right are suspected.	• Battery malfunction • G terminal short-circuit • Alternator malfunction • Engine-ECU malfunction



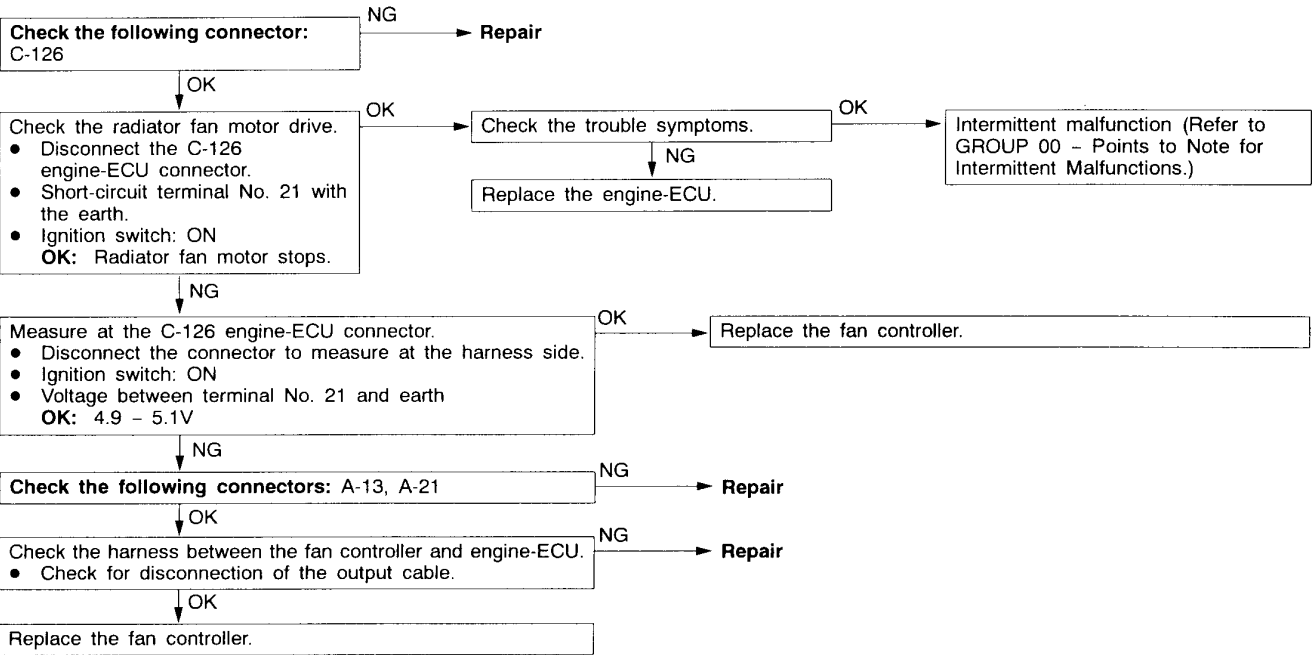


Inspection Procedure 19



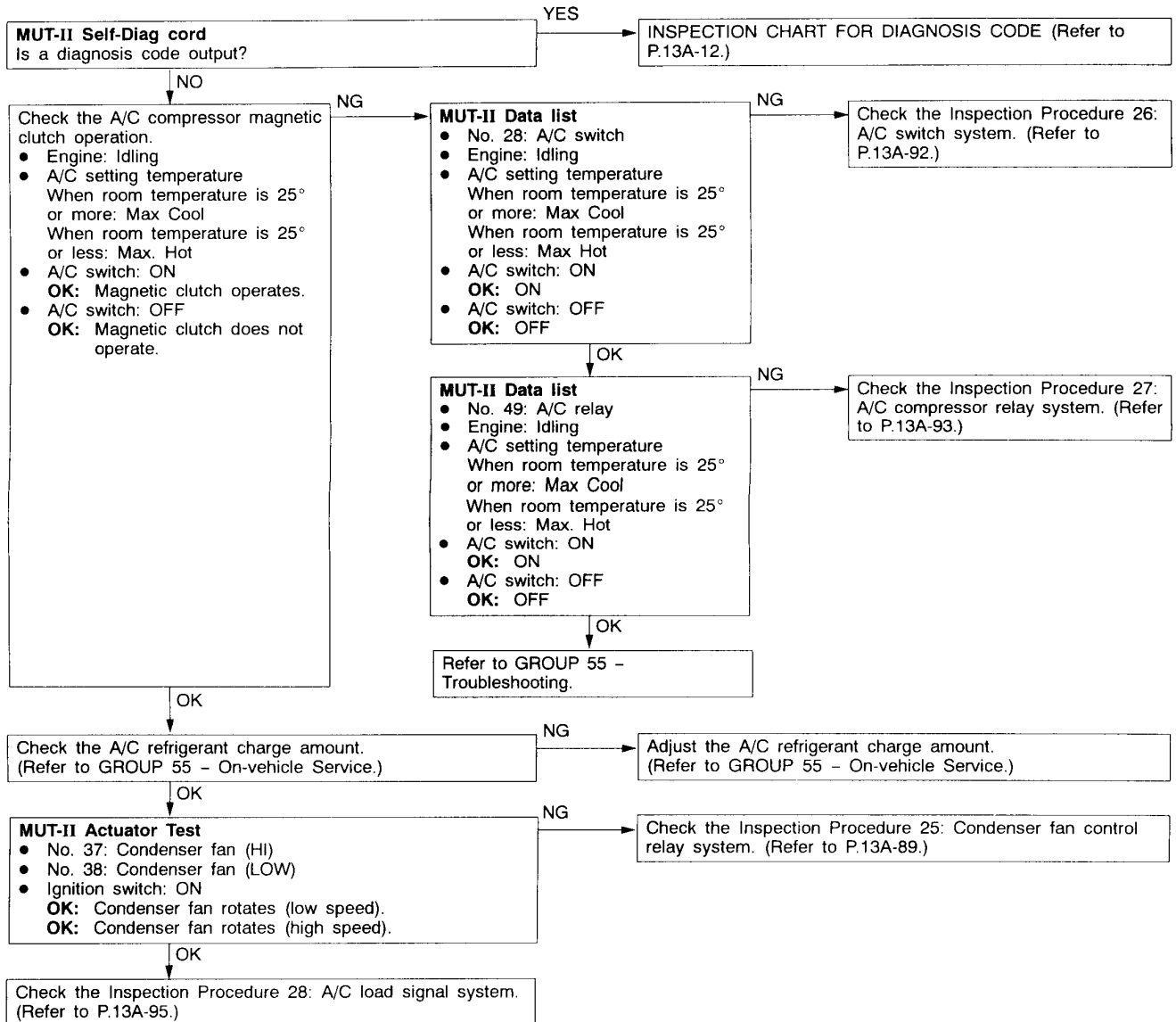
Inspection Procedure 20

Abnormal radiator fan motor rotation	Probable cause
Causes shown on right are suspected.	- Fan controller malfunction - Engine-ECU malfunction



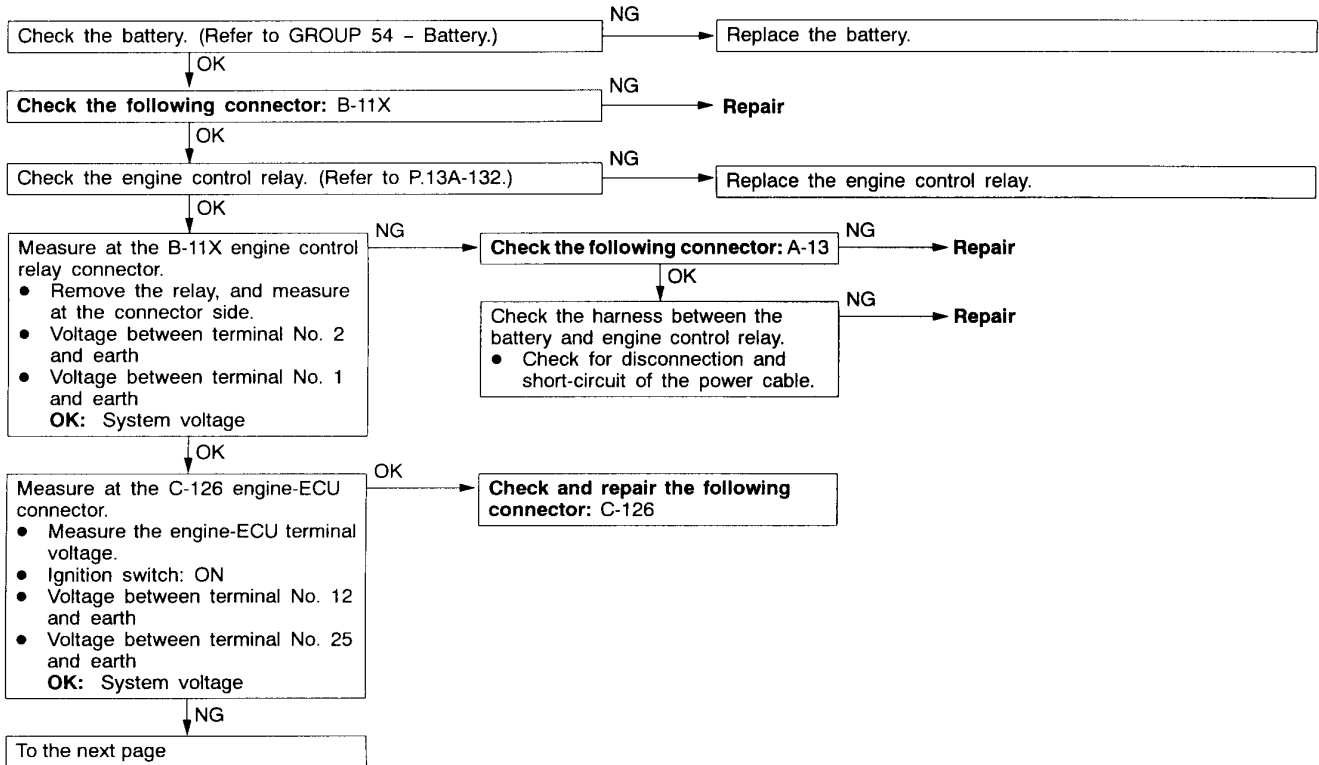
Inspection Procedure 21

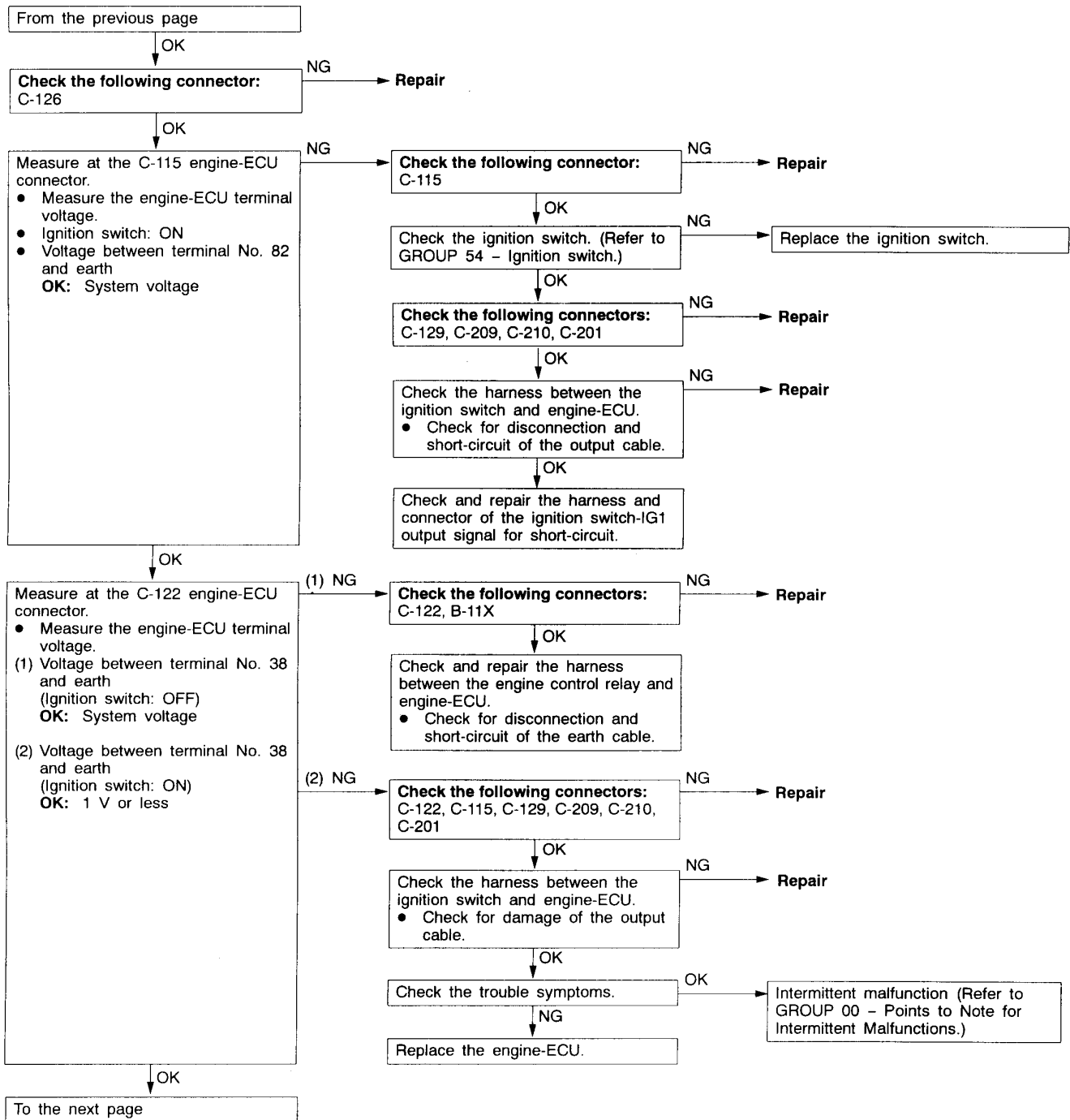
A/C ineffective	Probable cause
Causes shown on right are suspected.	• A/C refrigerant insufficient or over-charged • A/C compressor relay malfunction • Condenser fan system malfunction • A/C-ECU malfunction • Engine-ECU malfunction

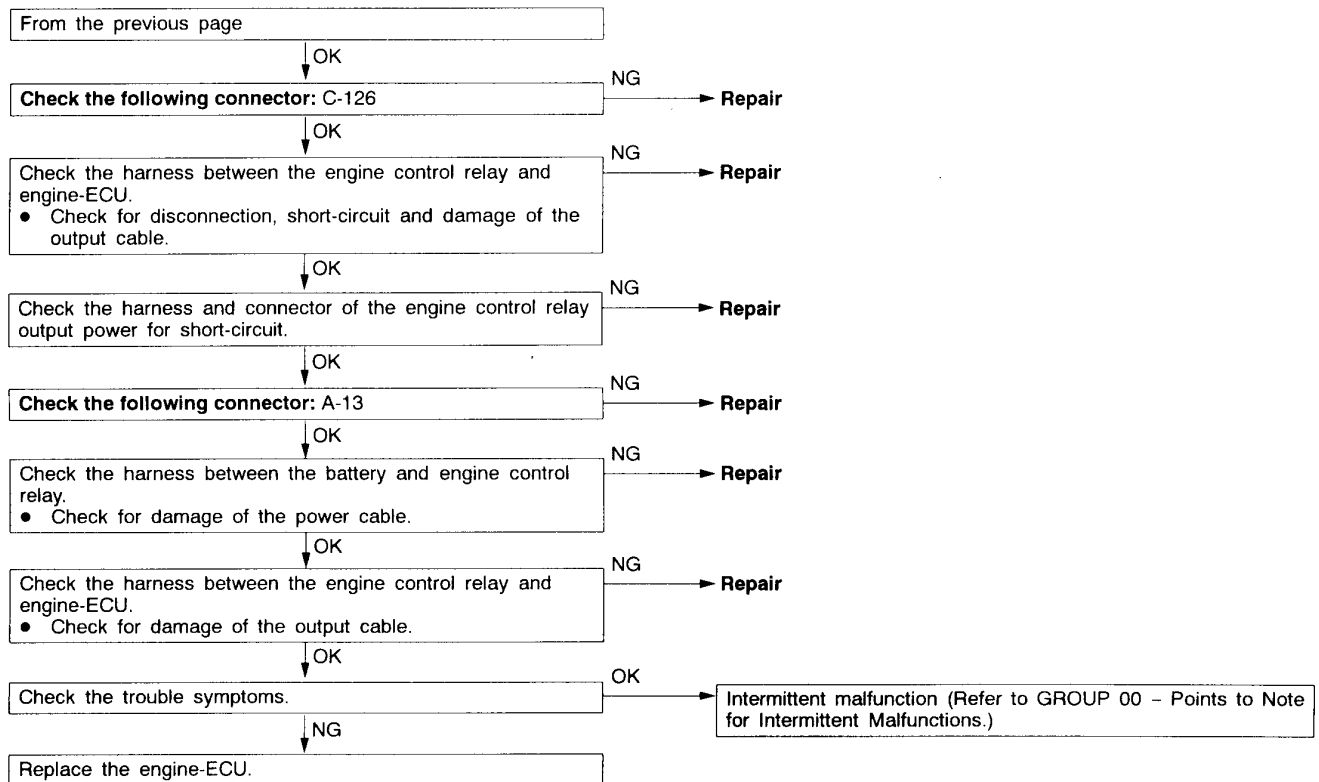


Inspection Procedure 22

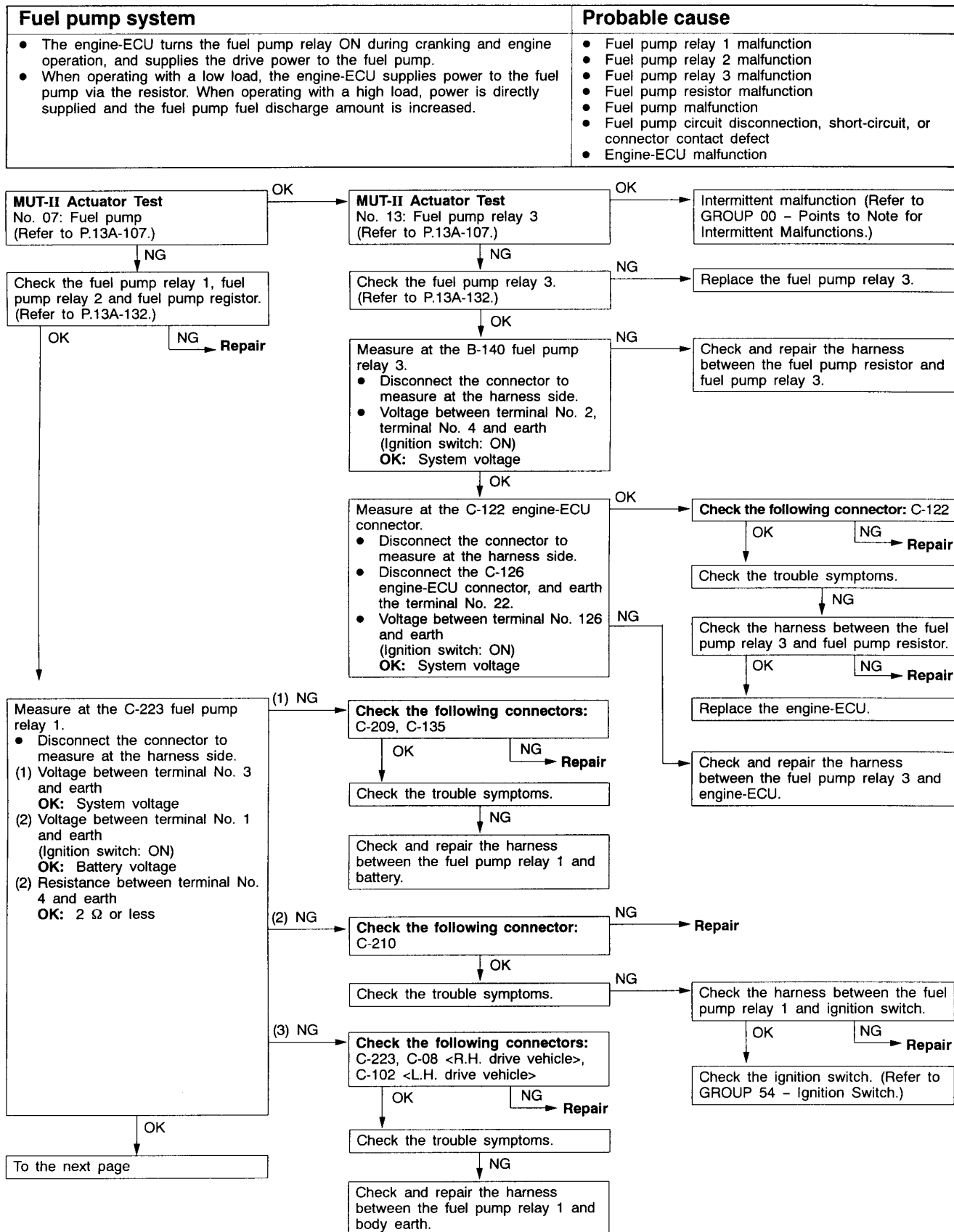
Engine-ECU power supply, engine control relay, ignition switch-IG1 system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, the engine-ECU turns the engine control relay ON. This starts the supply of the battery voltage to the engine-ECU, sensor and actuator.	• Ignition switch malfunction • Engine control relay malfunction • Engine-ECU malfunction

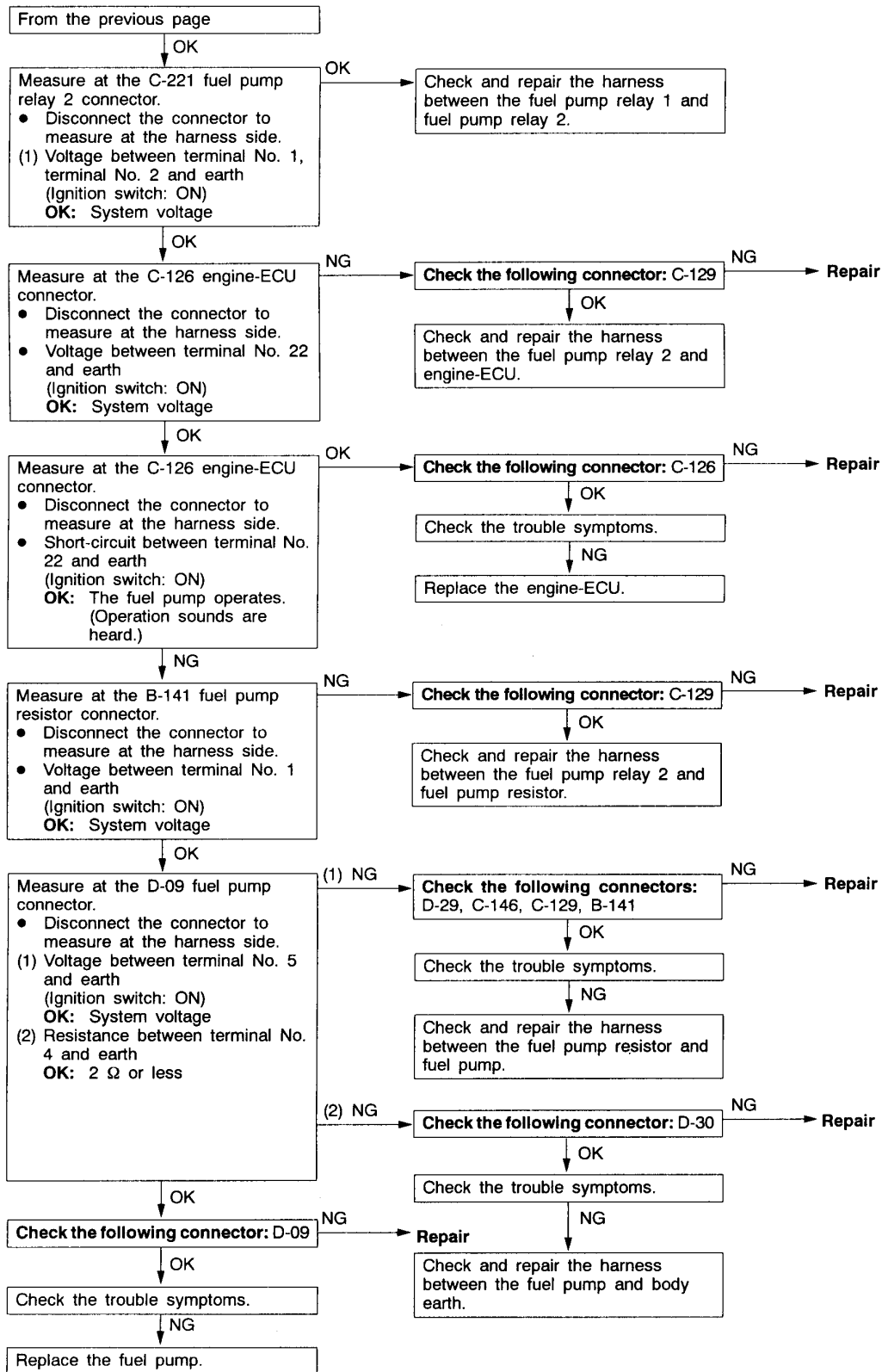






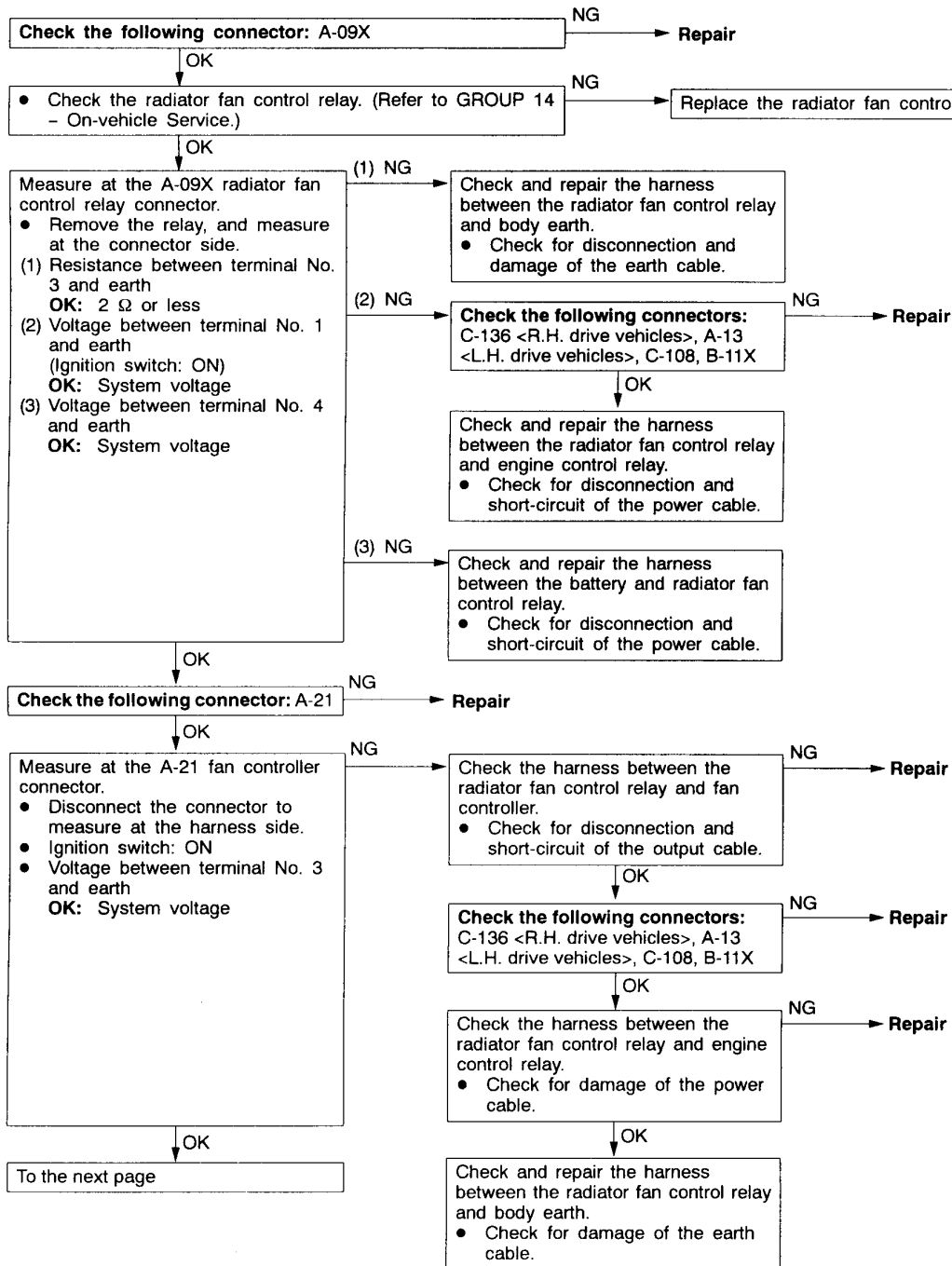
Inspection Procedure 23

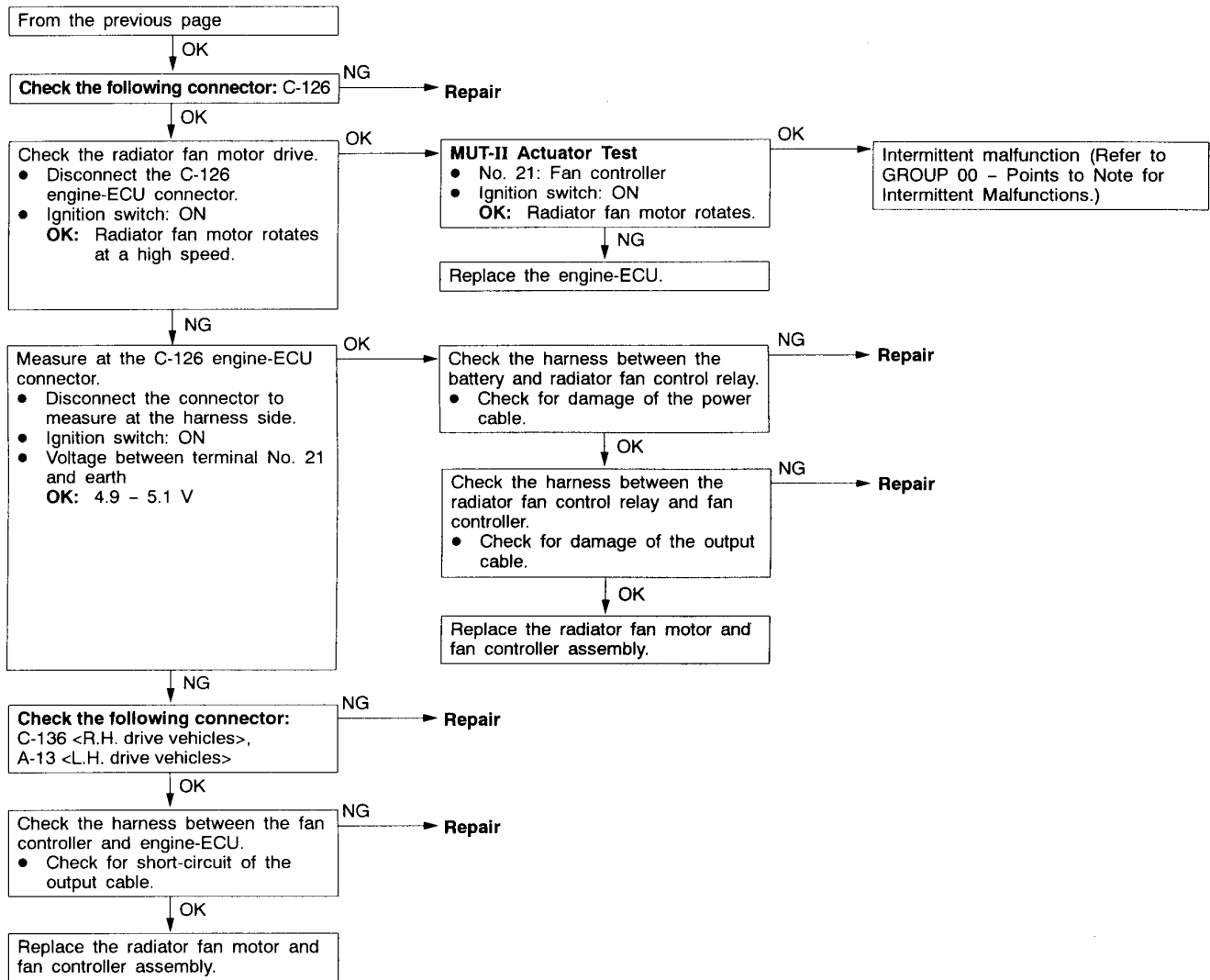




Inspection Procedure 24

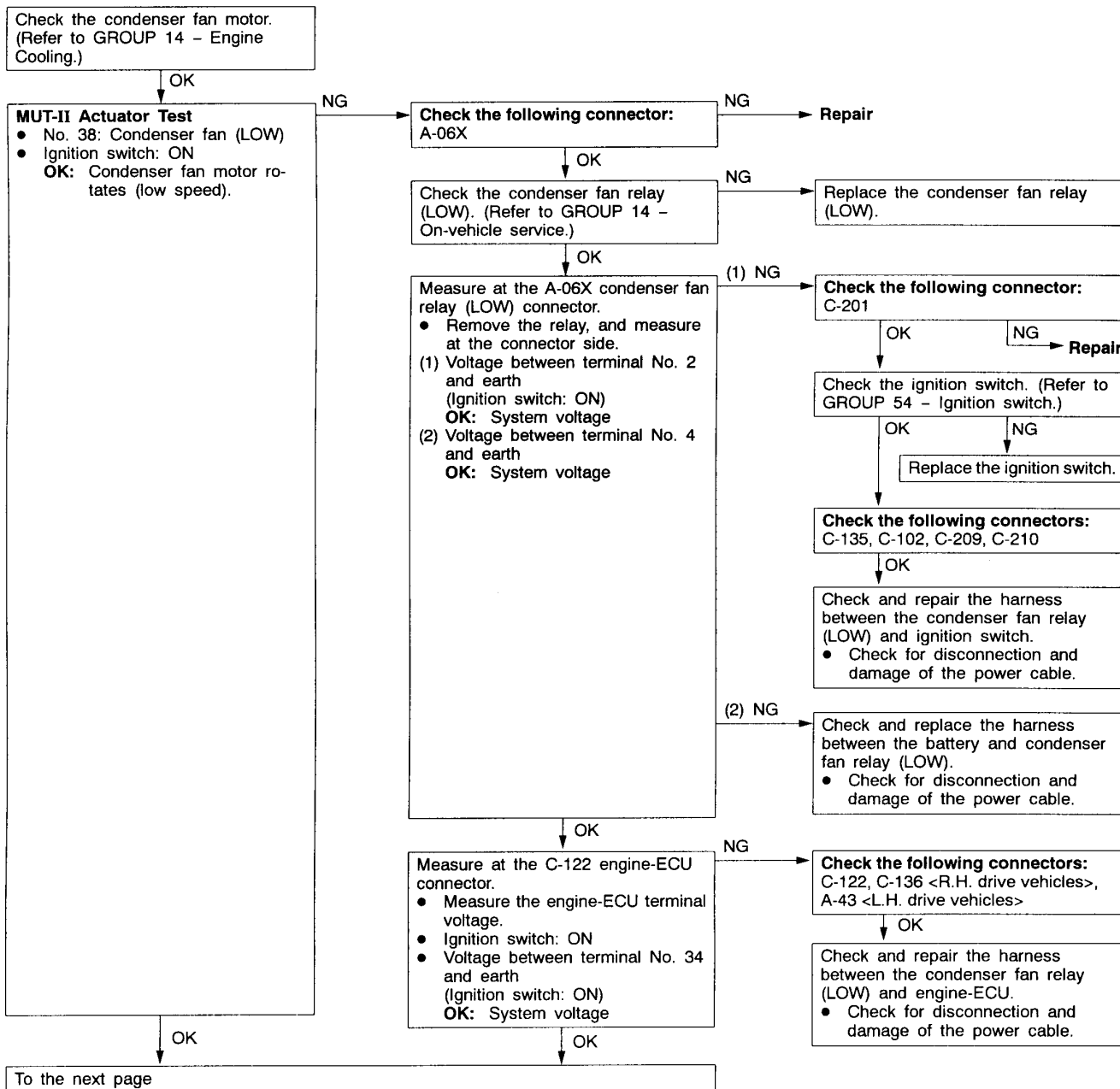
Radiator fan control relay system	Probable cause
When the engine control relay turns ON, the radiator fan control relay turns ON simultaneously, and power is supplied to the fan controller. The radiator fan motor is driven when the fan motor drive signal is input to the fan controller from the engine-ECU.	• Radiator fan control relay malfunction • Fan controller malfunction • Radiator fan motor malfunction • Engine-ECU malfunction

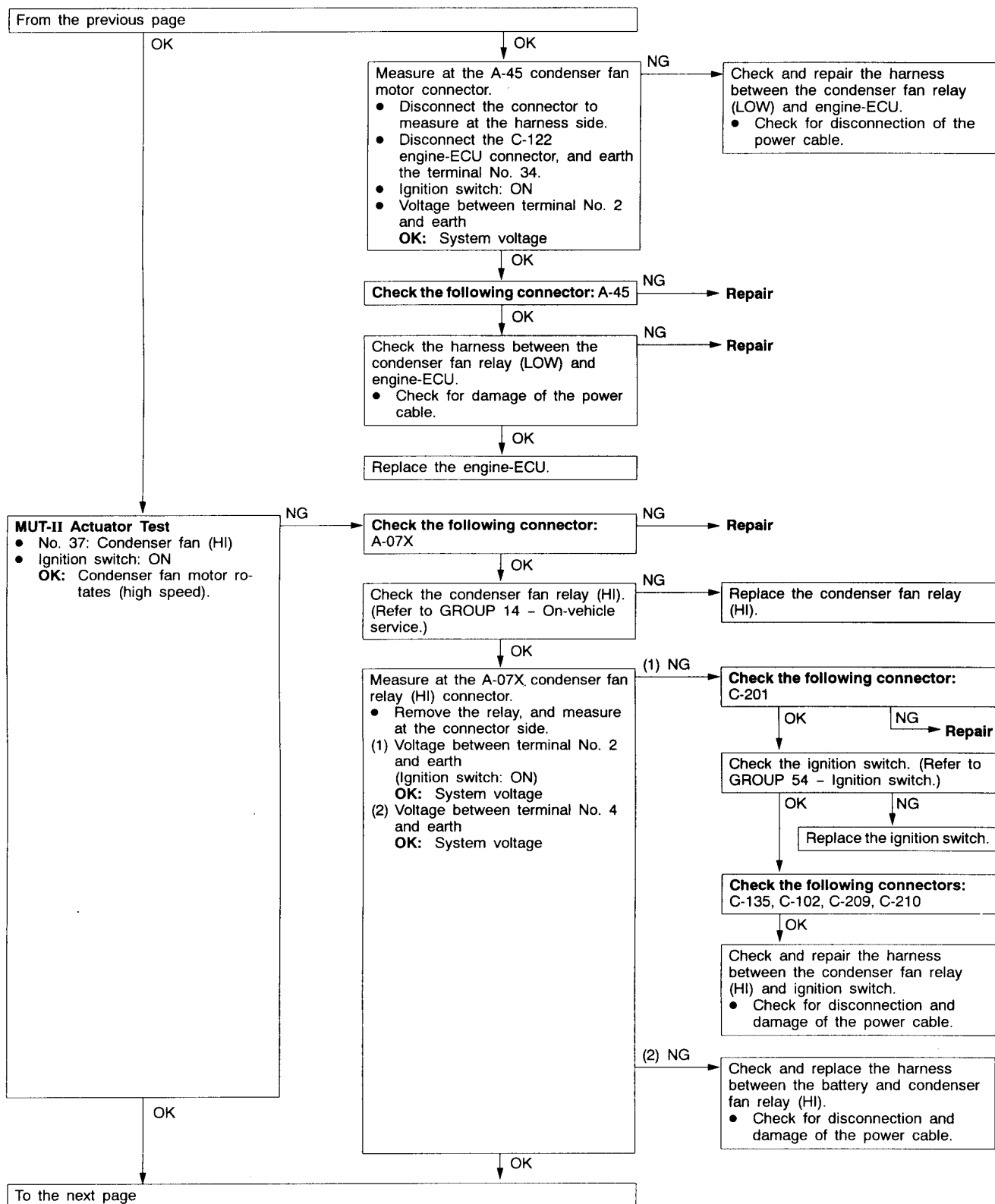


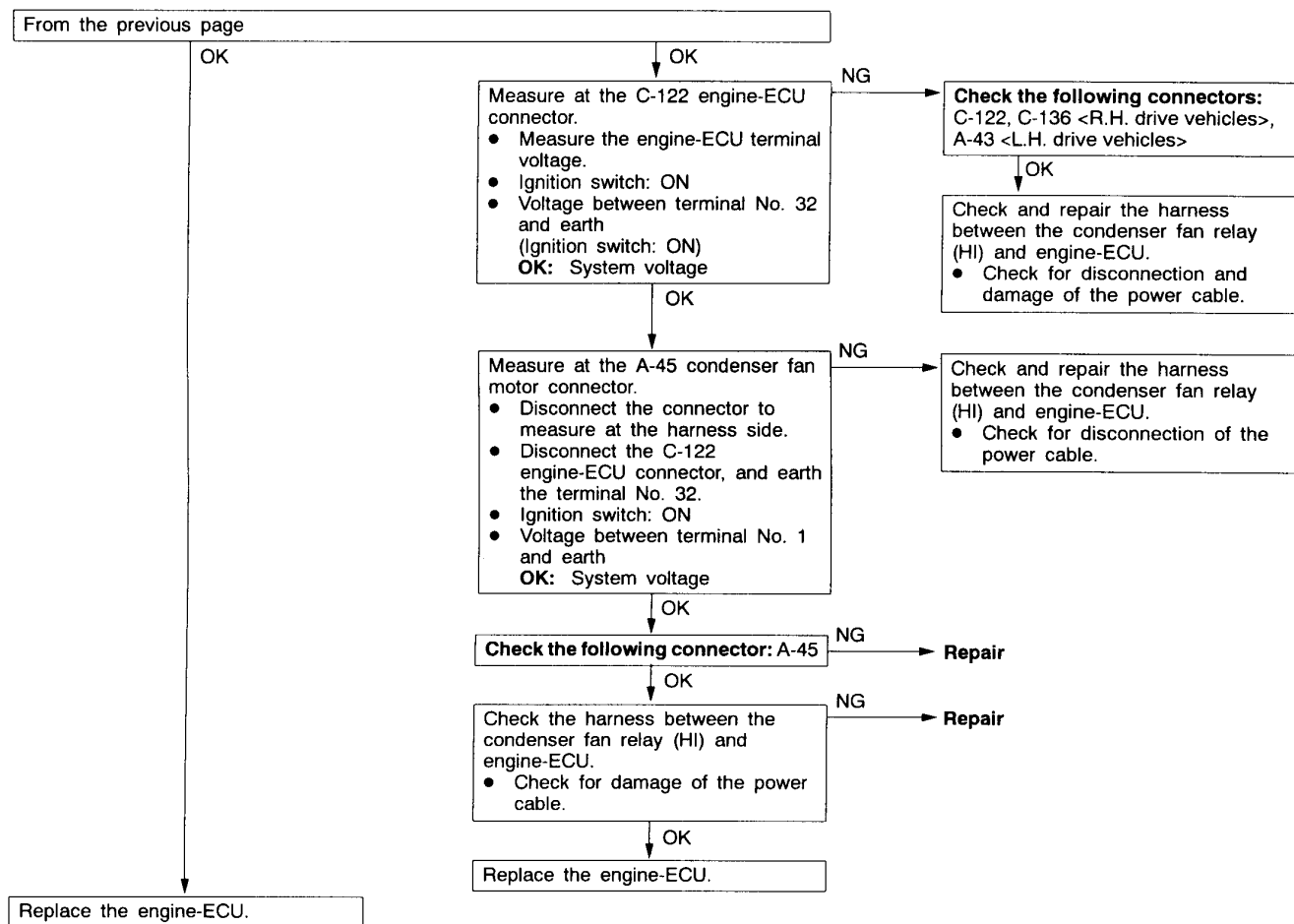


Inspection Procedure 25

Condenser fan relay system	Probable cause
The condenser fan relay turns ON with the signal from the engine-ECU, and power is supplied to the condenser fan motor.	- Condenser fan relay (HI) malfunction - Condenser fan relay (LOW) malfunction - Condenser fan motor malfunction - Condenser fan circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction

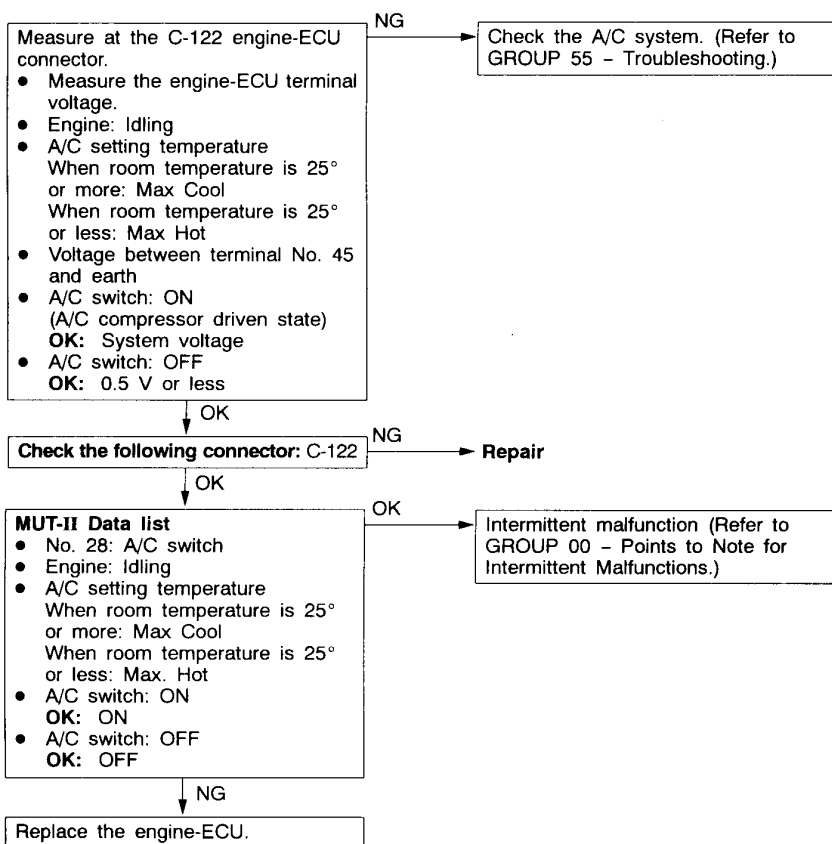






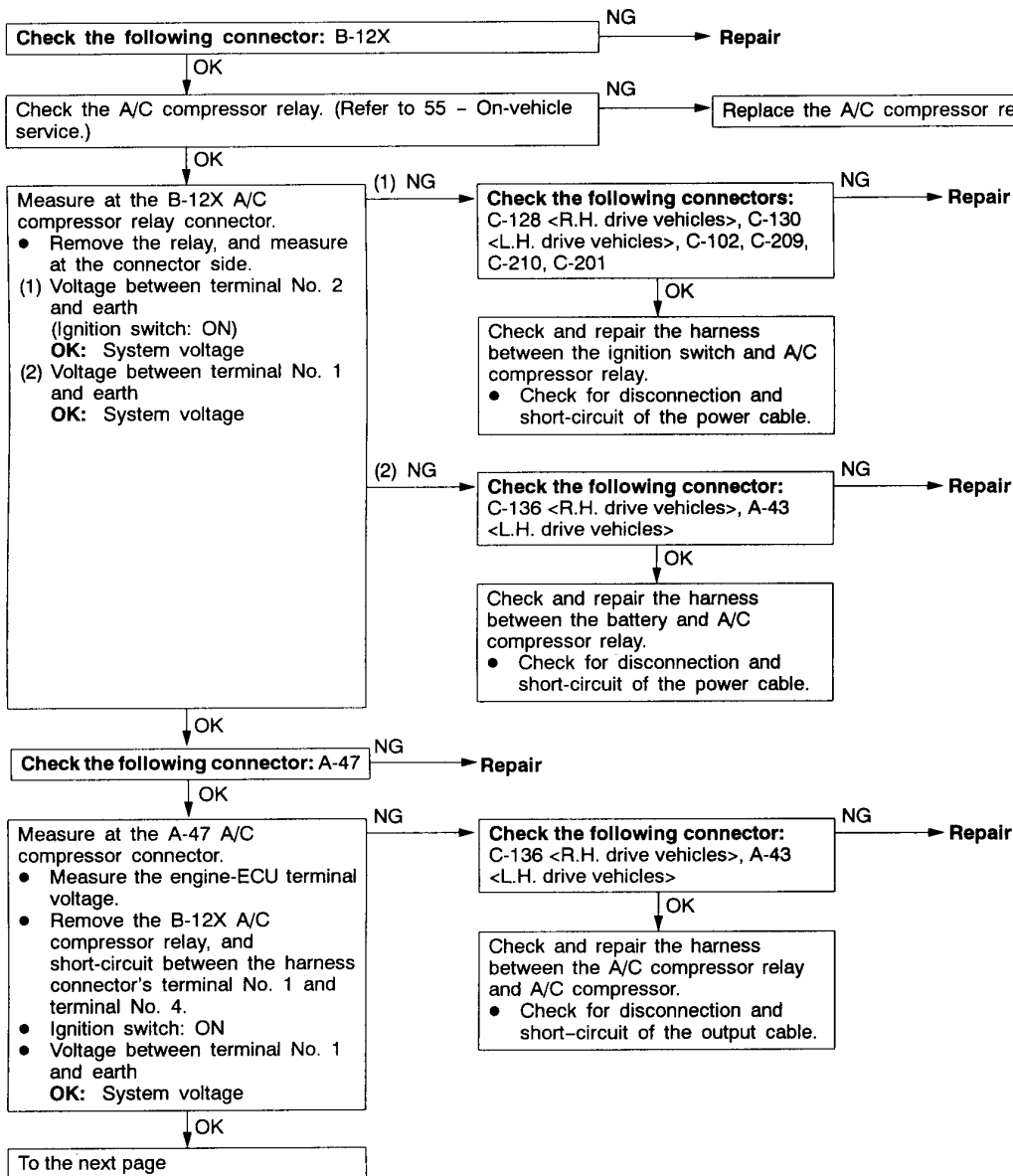
Inspection Procedure 26

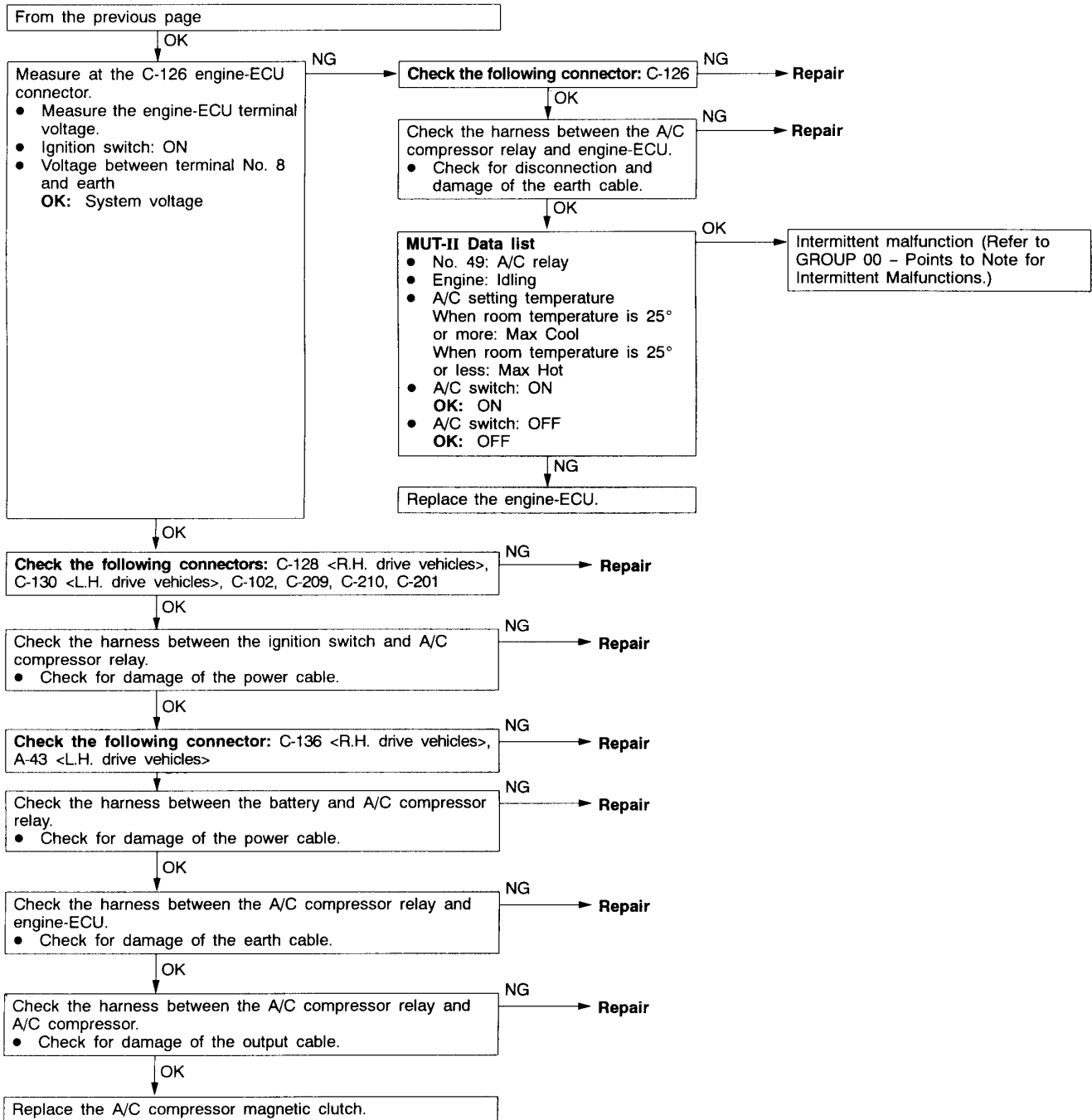
A/C switch system	Probable cause
When the A/C switch on the control panel is turned ON, the A/C switch ON signal is input to the engine-ECU. After receiving this signal, the engine-ECU turns the A/C compressor ON.	- Control panel A/C switch malfunction - A/C system malfunction - Engine-ECU malfunction



Inspection Procedure 27

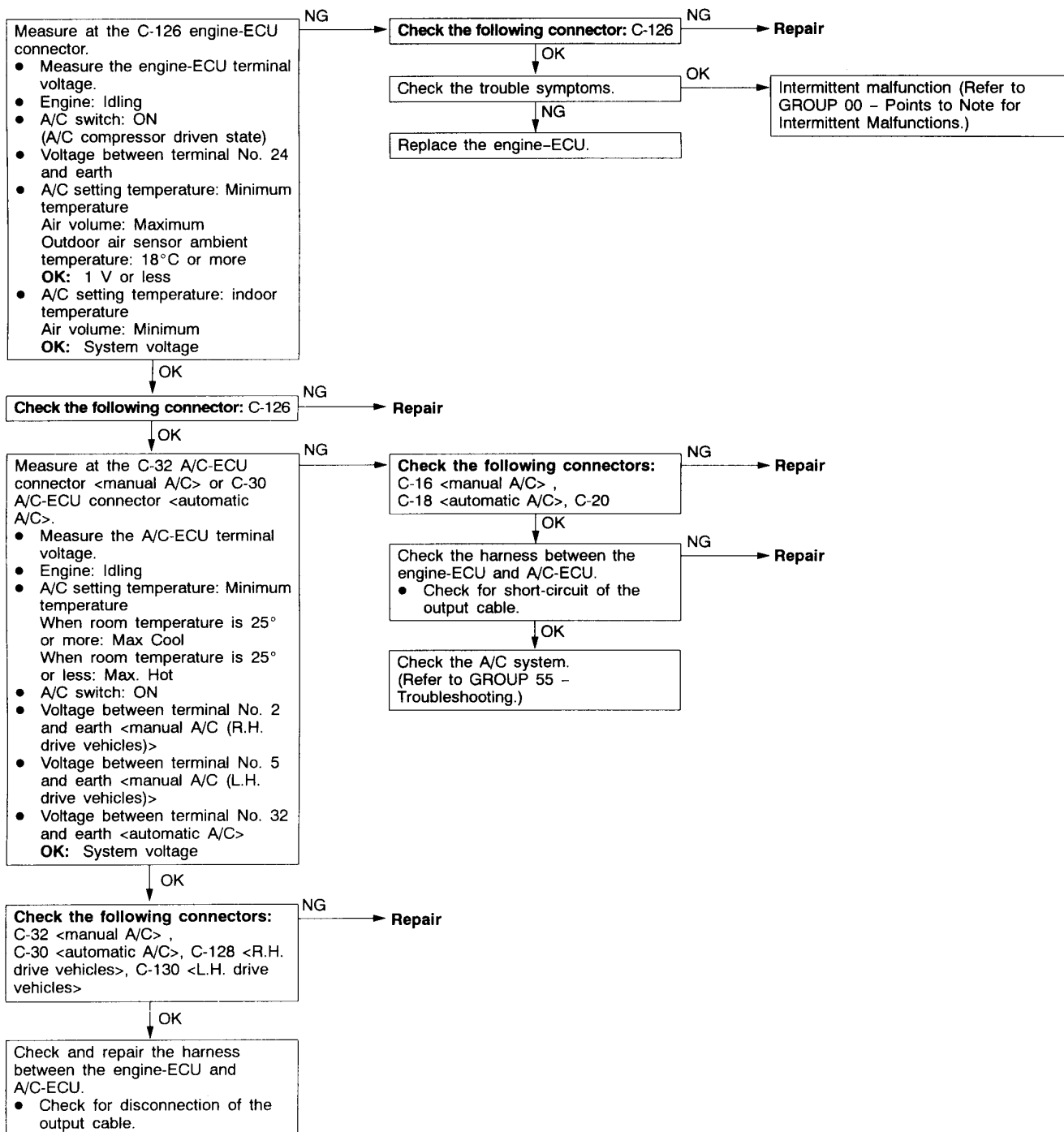
A/C compressor relay system	Probable cause
When the A/C switch ON signal is input to the engine-ECU, the engine-ECU turns the A/C compressor relay ON. The A/C compressor magnetic clutch starts with this.	• A/C compressor relay malfunction • A/C compressor magnetic clutch malfunction • Engine-ECU malfunction





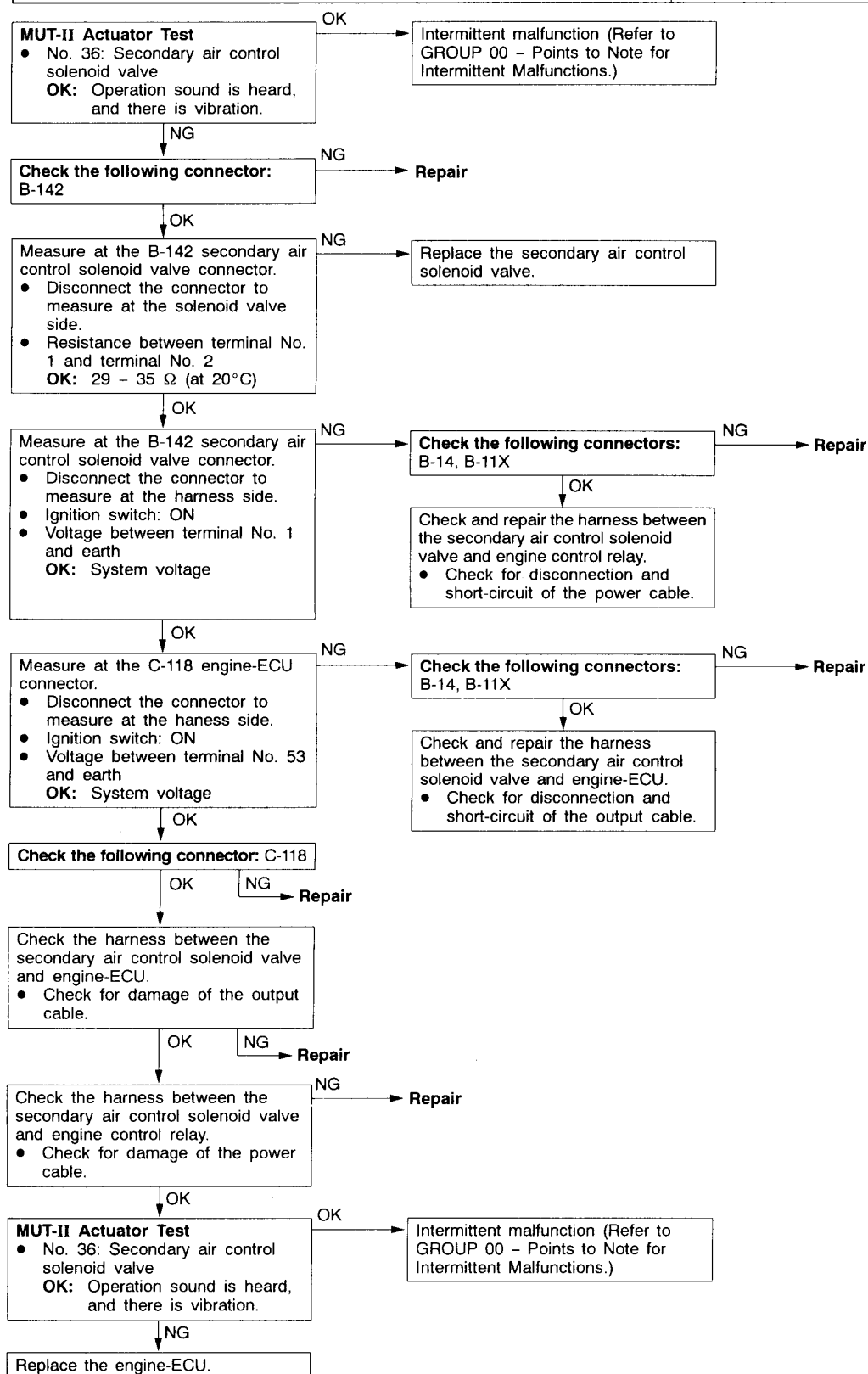
Inspection Procedure 28

A/C load signal system	Probable cause
The size of the A/C compressor load is detected according to the difference in set temperature. When the A/C large load signal is input to the engine-ECU, the engine-ECU judges that the A/C compressor load is large, and controls the throttle valve control servo so that the idling speed increases.	• A/C-ECU malfunction • Engine-ECU malfunction



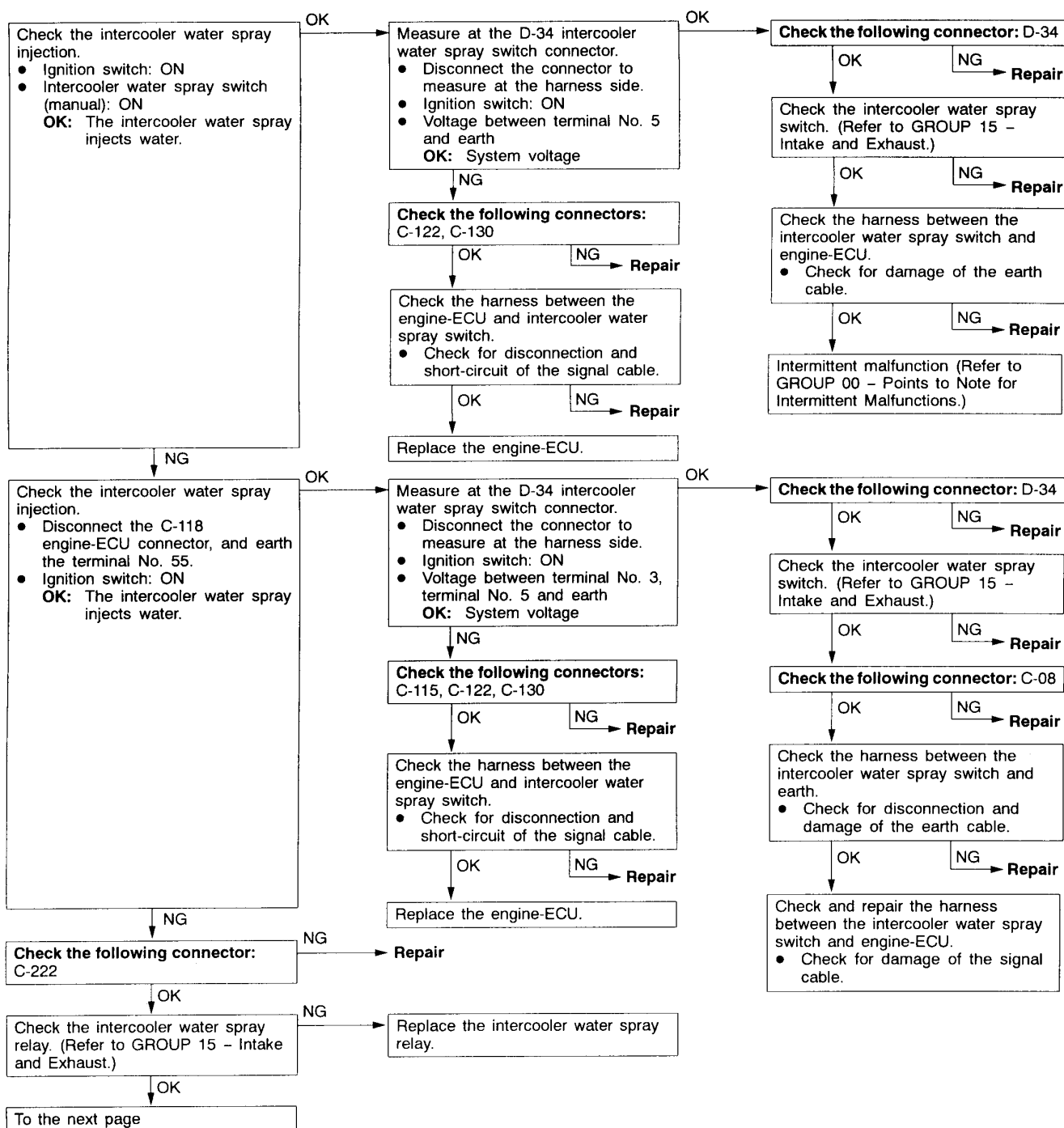
Inspection Procedure 29

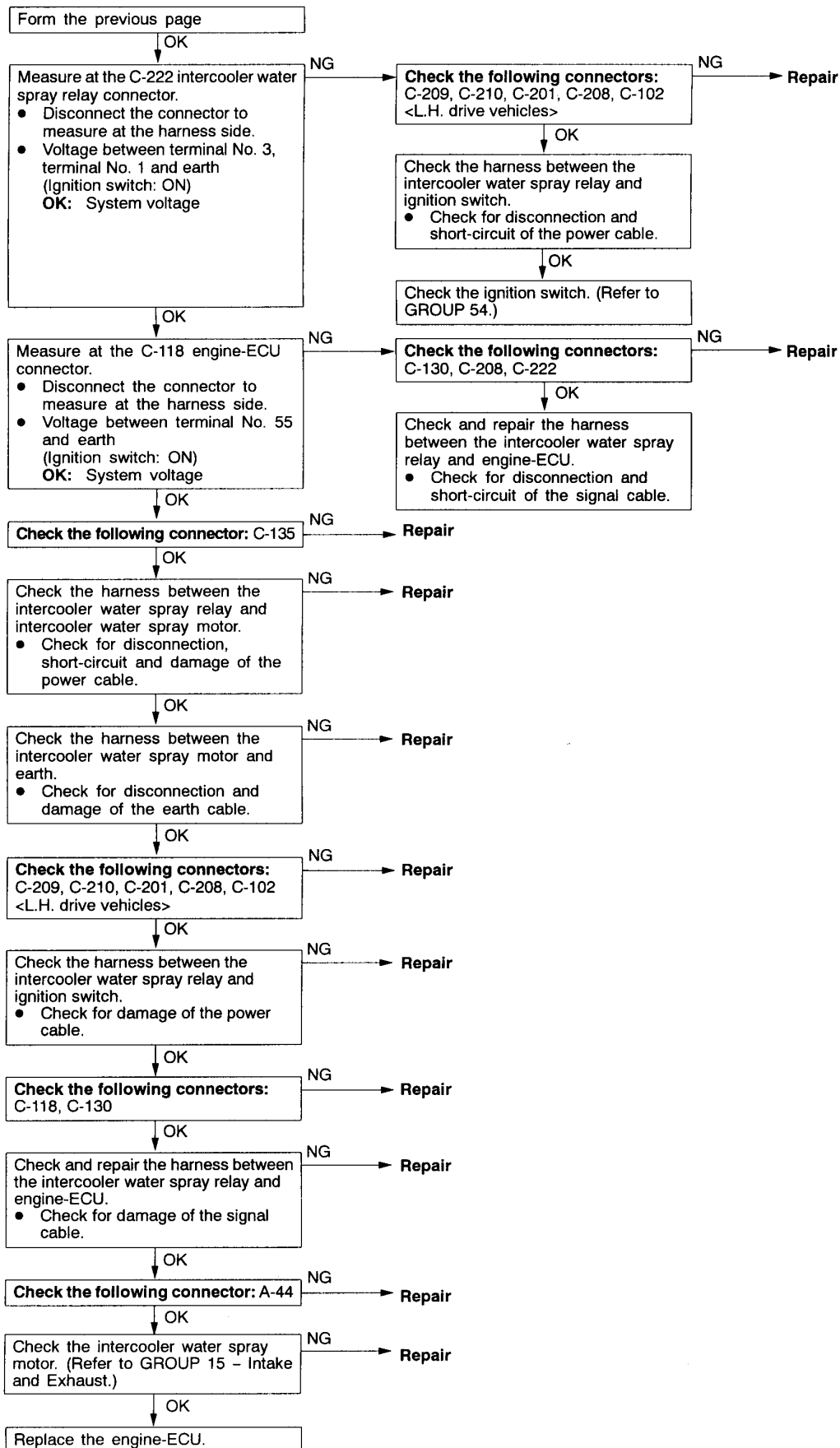
Secondary air control solenoid valve system	Probable cause
The secondary air control solenoid valve switches the pressure led into the secondary air valve between the intake manifold and the atmospheric pressure.	- Secondary air control solenoid valve malfunction - Engine-ECU malfunction



Inspection Procedure 30

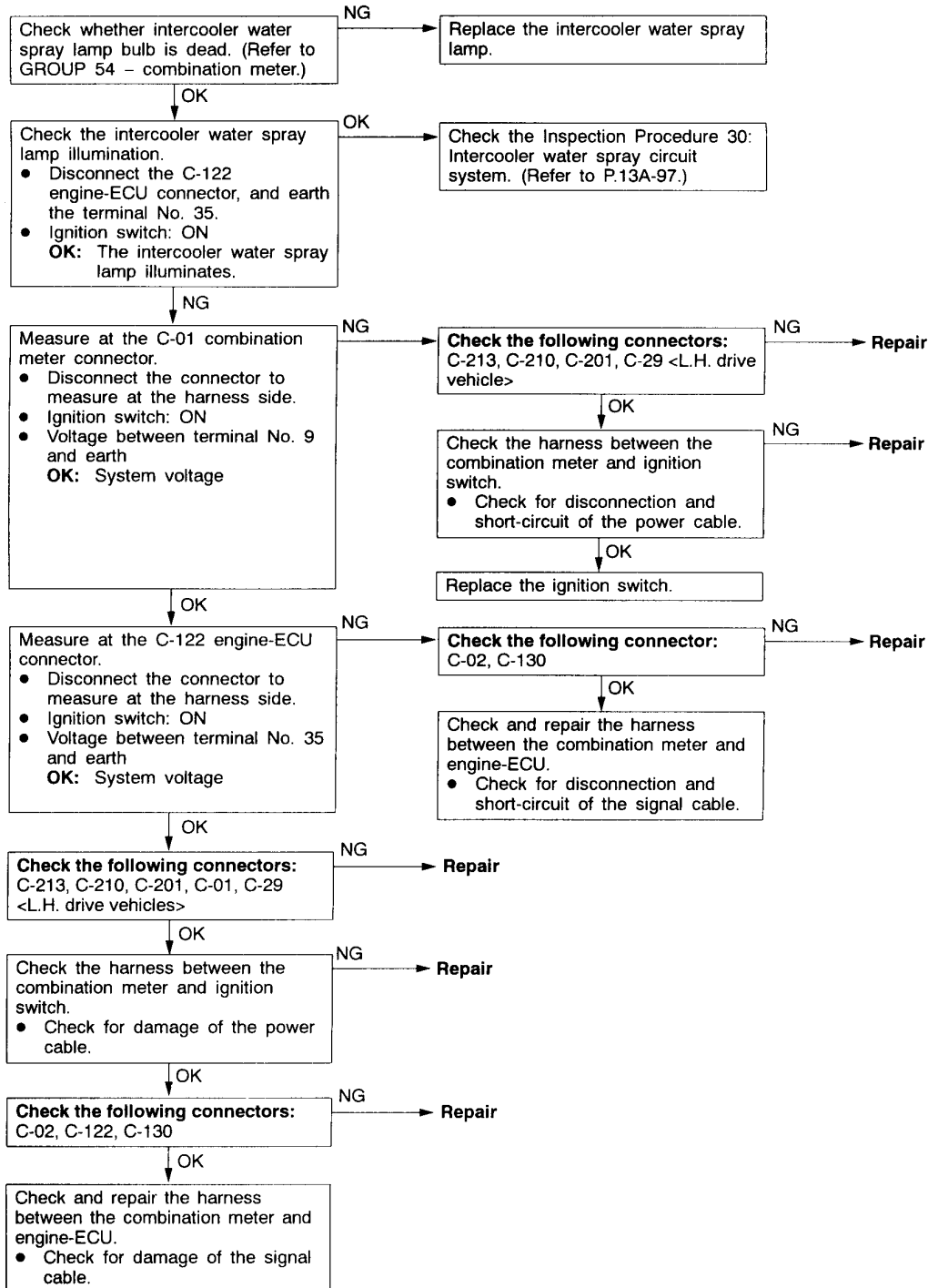
Intercooler water spray circuit system	Probable cause
- When the intercooler water spray switch (manual) turns ON, the intercooler water spray manual ON signal is input to the engine-ECU. After receiving this signal, the engine-ECU turns the intercooler water spray relay ON. The intercooler water spray motor is driven to inject the water for air cooling into the intercooler and increase the filling performance. - When the intercooler water spray switch (automatic) turns ON, the intercooler water spray automatic ON signal is input to the engine-ECU. After receiving this signal, the engine-ECU turns the intercooler water spray relay ON intermittently during high-load operation. The intercooler water spray motor is driven to inject the water for air cooling into the intercooler and increase the filling performance.	- Intercooler water spray switch malfunction - Intercooler water spray relay malfunction - Intercooler water spray motor malfunction - Intercooler water spray relay circuit disconnection, short-circuit, or connector contact defect - Intercooler water spray switch circuit disconnection, short-circuit, or connector contact defect - Ignition switch malfunction - Engine-ECU malfunction





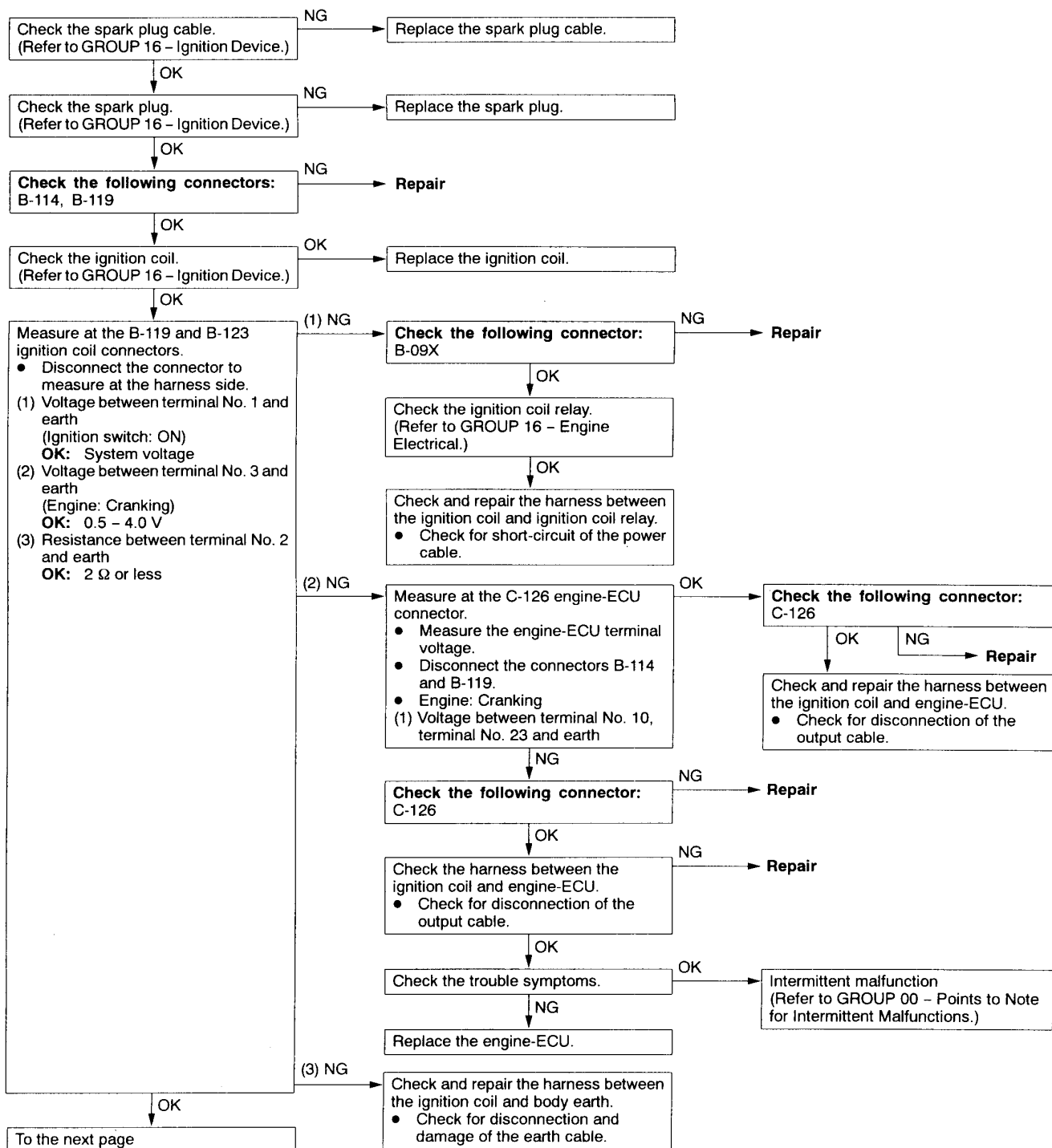
Inspection Procedure 31

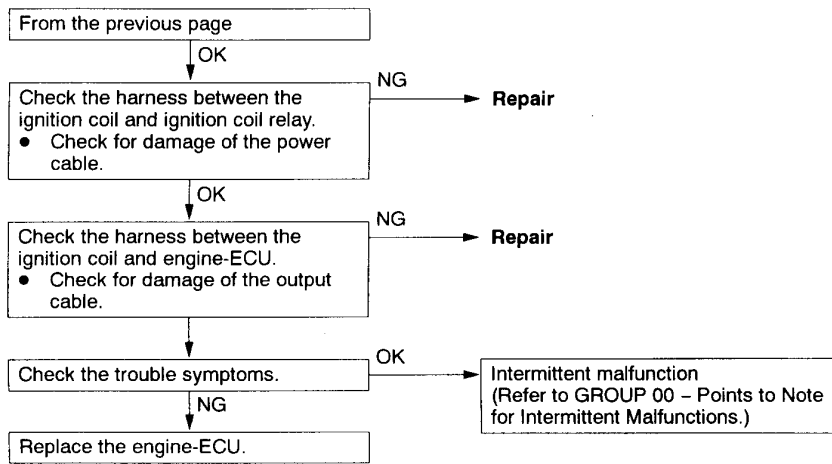
Intercooler water spray lamp system	Probable cause
The engine-ECU illuminates the intercooler water spray lamp when the intercooler water spray switch (automatic) is ON.	- Intercooler water spray lamp bulb dead - Ignition switch malfunction - Intercooler water spray lamp circuit disconnection, short-circuit, or connector contact defect - Intercooler water spray switch circuit disconnection, short-circuit, or connector contact defect - Engine-ECU malfunction



Inspection Procedure 32

Ignition coil (integrated power transistor) system	Probable cause
The engine-ECU allows the ignition coil primary current to flow intermittently by turning the power transistor in the unit OFF and ON.	• Ignition coil malfunction • Spark plug malfunction • Spark plug cable malfunction • Ignition primary circuit disconnection, short-circuit, or connector contact defect • Engine-ECU malfunction





DATA LIST REFERENCE TABLE

NOTE

- *1. In a new Vehicle [driven approximately 500 km or less], the air flow sensor output frequency time is sometimes 10% longer than the standard time.
- *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.

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	13A-24
			When engine is suddenly raced	600 – 1,000 mV		
		Engine: After having warmed up (The oxygen sensor (front) signal is used to check the air/fuel mixture ratio, and control condition is also checked by the engine-ECU.)	Engine is idling	400 mV or less ↔ 600 – 1,000 mV (Varies)		
			2,500 r/min			
12	Air flow sensor*1	- Engine coolant temperature: 80 – 95°C - Lightning and all accessories: OFF - Transmission: Neutral	Idle operation	17 – 43 Hz	–	–
			2,500 r/min	40 – 100 Hz		
			Acceleration	According to acceleration, frequency is amplified.		
13	Intake air temperature sensor	Ignition switch: "ON" or engine running	When intake air temperature is –20°C	–20°C	Code No. P0110	13A-13
			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	13A-21
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,500 – 5,000 mV		
16	Battery voltage	Ignition switch: "ON"		System voltage	Procedure No. 22	13A-82
18	Cranking signal (ignition switch-ST)	Ignition switch: "ON"	Engine: Stopped	OFF	Procedure No.22	13A-82
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: "ON" or engine running	When engine coolant temperature is -20°C	-20°C	Code No. P0115	13A-19
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			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	-	-
		Engine: Idle operation	When engine coolant temperature is -20°C	1,300 – 1,500 r/min		
			When engine coolant temperature is 0°C	1,300 – 1,500 r/min		
			When engine coolant temperature is 20°C	1,300 – 1,500 r/min		
			When engine coolant temperature is 40°C	1,150 – 1,350 r/min		
			When engine coolant temperature is 80°C	600 – 900 r/min		
24★	Vehicle speed sensor	Drive at 40 km/h		Approximately 40 km/h	Code No. P0500	13A-43

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No. P0105	13A-15
			Altitude: 0 m	95 kPa		
			Altitude: 0 m	88 kPa		
			Altitude: 0 m	81 kPa		
27	Power steering fluid pressure switch	Engine: Idle operation	Steering wheel stationary	OFF	Code No. P0551	13A-46
			Steering wheel turning	ON		
28	A/C switch	Engine: Idle operation (When A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 26	13A-92
			A/C switch: ON	ON		
34	Air flow sensor reset signal	Engine: After warm-up	Idle operation	ON	Code No. P0100	13A-13
			3,000 r/min	OFF		
37	Volumetric efficiency	- Engine coolant temperature: 85 – 95°C - Lightning and accessories: OFF	Idle operation	15 – 35%	–	–
			2,500 r/min	15 – 35%		
			Excessive acceleration	According to acceleration, volumetric efficiency is increased.		
41	Injectors*1	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)	25 – 37 ms	–	–
			When engine coolant temperature is 20°C	15 – 22 ms		
			When engine coolant temperature is 80°C	4.2 – 6.3 ms		
	Injectors*2	- Engine coolant temperature: 80 – 95°C - Lamps, electric cooling fan and all accessories: OFF - Transmission: Neutral	Engine: Idle operation	1.5 – 2.7 ms	–	–
			2,500 r/min	1.2 – 2.4 ms		
			When engine is suddenly raced	Increases		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
44	Ignition advance	- Engine: After having warmed up - Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine: Idle operation	0 – 13° BTDC	–	–
			2,500 r/min	20 – 40° BTDC		
45	Idle speed control (stepper) motor position*3	- Engine coolant temperature: 80 – 90°C - Lamps, electric cooling fan and all accessories: OFF - Transmission: Neutral - Engine: Idle operation - 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		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 27	13A-92
			A/C switch: ON	ON (Compressor clutch is operating)		
59	Oxygen sensor (rear)	Engine: After having warmed-up	When engine is suddenly raced	0 and 600 – 1,000 mV alternate.	Code No. P0136	13A-27
81★	Learned value	Engine: After having warmed up, running with no load at 2,500 r/min. (During air/fuel ratio feedback control)		–12.5 – 12.5%	–	–
82★	Feedback	Engine: After having warmed up, running with no load at 2,500 r/min. (During air/fuel ratio feedback control)		–20 – 20%	–	–
87★	Engine load	Engine: After having warmed up	Idle operation	15 – 35%	–	–
			2,500 r/min	15 – 35%	–	–

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
A1★	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	13A-24
			When engine is suddenly raced	600 – 1,000 mV		
		Engine: After having warmed up (By using oxygen sensor, check air/fuel mixture as well as control status by engine-ECU)	Idle operation	400 mV or less ↔ 600 – 1,000 mV (altered)		
			2,500 r/min			
A2★	Oxygen sensor (rear)	Engine: After having warmed up	When engine is suddenly raced	0 and 600 – 1,000 mV alternate.	Code No. P0136	13A-27
8A★	Throttle position sensor (Throttle position opening angle)	- Engine: After having warmed up - Ignition switch: "ON" (Engine stopped)	Release the accelerator pedal.	8 – 16%	Code No. P0120	13A-21
			Depress the accelerator pedal gradually.	Increase in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	80 – 100%		

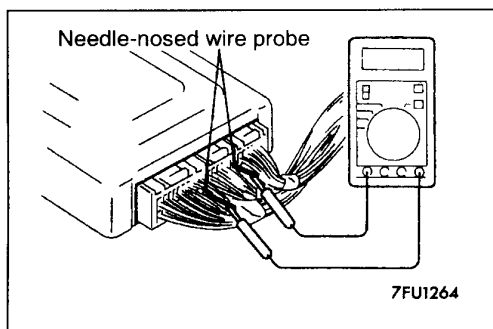
NOTE

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

ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idling condition becomes different (becomes unstable).	Code No. P0201	13A-30
02		Cut fuel to No. 2 injector				Code No. P0202	13A-31
03		Cut fuel to No. 3 injector				Code No. P0203	13A-32
04		Cut fuel to No. 4 injector				Code No. P0204	13A-33
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. 23	13A-85
				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	13A-41
09	Fuel pressure 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. P1105	13A-48
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	13A-39
12	Waste gate 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. P1104	13A-47
13	Fuel pump relay 3	Fuel pump relay 3 turns from OFF to ON.	- Ignition switch: "ON" - Listen near the fuel tank for the sound of fuel pump operation.		Sound of operation is heard.	Procedure No. 23	13A-85
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set		5° BTDC	–	–

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
21	Fan controller	Radiator fan motor is driven.	Ignition switch: "ON"	Fan motor rotates at high speed.	Procedure No. 24	13A-87
36	Secondary air control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: "ON"	Sound of operation can be heard when solenoid valve is driven.	Procedure No. 29	13A-96
37	Condenser fan (HI)	Condenser fan motor is driven.	Ignition switch: "ON"	Fan motor rotates at high speed.	Procedure No. 25	13A-89
38	Condenser fan (LOW)	Second air control solenoid valve	Ignition switch: "ON"	Fan motor rotates at low speed.		



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

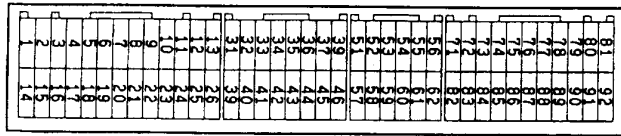
- (1) Make the voltage measurement with the engine-ECU connectors connected.
- (2) You may find it convenient to pull out the engine-ECU to make it easier to reach the connector terminals.
- (3) The checks can be carried out off the order given in the chart.

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		
3	Fuel pressure control solenoid valve	Ignition switch: "ON"	System voltage
		Engine: Cranking → Idle operation (within approximately 2 minutes or less)	1 V or less → System voltage
4	Stepper motor coil <A1>	Engine: Soon after the warmed up engine is started	System voltage ↔ 0 – 6 V (Changes repeatedly)
17	Stepper motor coil <A2>		
5	Stepper motor coil <B1>		
18	Stepper motor coil <B2>		
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 operation - A/C switch: OFF → ON (A/C compressor runs)	System voltage or momentarily 6 V or more → 1 V or less
9	Purge control solenoid valve	Ignition switch: "ON"	System voltage
		Engine: Idle operation	1 V or less
10	Ignition coil – No.1, No.4	Engine speed: 3,000 r/min	0.3 – 3.0 V
23	Ignition coil – No.2, No.3		
11	Waste gate solenoid valve	Ignition switch: "ON"	System voltage
		Engine: After warm-up, idle operation (When using premium gasoline)	1 V or less

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
12	Power supply	Ignition switch: "ON"		System voltage
25				
19	Air flow sensor reset signal	Engine: Idle operation		0 – 1 V
		Engine speed: 3,000 r/min		6 – 9 V
21	Fan controller	Radiator fan is not operating		0 – 0.3 V
		Radiator fan is operating		0.7 V or more
22	Fuel pump relay 2	Ignition switch: "ON"		System voltage
		Engine: Idle operation		1 V or less
24	A/C load signal	- Engine: Idle operation - A/C switch: ON (A/C compressor runs)	- Outdoor air sensor ambient temperature: 18°C or more - A/C setting temperature: Minimum temperature - A/C air volume: Maximum	1 V or less
			- A/C setting temperature: indoor temperature - A/C air volume: Minimum	System voltage
32	Condenser fan motor relay (HI)	Fan inactive state (Engine coolant temperature: 90°C or less)		System voltage
		Fan high-speed rotation state (Engine coolant temperature: 105°C or more)		1 V or less
33	Alternator G terminal	- Engine: After warm-up, idle operation - Radiator fan: Not operating - Headlamp: OFF → ON - Stop lamp: OFF → ON - Rear defogger switch: OFF → ON		Voltage increases by 0.2 – 3.5 V
34	Condenser fan motor relay (LOW)	Fan inactive state (Engine coolant temperature: 90°C or less)		System voltage
		Fan low-speed rotation state (Engine coolant temperature: 95 – 100°C or more)		1 V or less
35	Intercooler water spray lamp	Ignition switch: "ON"		System voltage
		Ignition switch: "LOCK" (OFF)		1 V or less
36	Engine warning lamp	Ignition switch: "LOCK" (OFF) → "ON"		1 V or less → System voltage (After several seconds have elapsed)

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
37	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	System voltage
			When steering wheel is turned	1 V or less
38	Engine control relay	Ignition switch: "LOCK" (OFF)		System voltage
		Ignition switch: "ON"		1 V or less
39	Fuel pump relay 3	While engine is idling, suddenly depress the accelerator pedal.		Temporarily rises slightly from 1 V or less.
41	Alternator FR terminal	- Engine: After warm-up, idle operation - Radiator fan: Not operating - Head lamp: OFF → ON - Stop lamp: OFF → ON - Rear deffogger switch: OFF → ON		Voltage decrease
44	Intercooler water spray switch (Auto)	- Ignition switch: "ON" - Intercooler water spray switch: ON		1 V or less
		- Ignition switch: "ON" - Intercooler water spray switch: OFF		System voltage
45	A/C switch	Engine: Idle operation	Turn the A/C switch OFF	0.5 V or less
			- A/C switch: ON - A/C setting temperature When room temperature is 25°C or more: Max Cool When room temperature is 25°C or less: Max. Hot	System voltage
53	Secondary air control solenoid valve	Ignition switch: "ON"		System voltage
54	Oxygen sensor heater (Rear)	Engine: Idling after warming up		1 V or less
		Engine speed: 5,000r/min		System voltage
55	Intercooler water spray relay	Ignition switch: "ON"		System voltage
		Ignition switch: "LOCK" (OFF)		1 V or less
58	Tachometer signal	Engine speed: 3,000r/min		0.3 – 3.0 V
60	Oxygen sensor heater (front)	Engine: Idling after warming up		1 V or less
		Engine speed: 5,000r/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"	Intake air temperature: -20°C	3.8 – 4.4 V
			Intake air temperature: 0°C	3.2 – 3.8 V
			Intake air temperature: 20°C	2.3 – 2.9 V
			Intake air temperature: 40°C	1.5 – 2.1 V
			Intake air temperature: 60°C	0.8 – 1.4 V
			Intake air temperature: 80°C	0.4 – 1.0 V
75	Oxygen sensor (Rear)	• Transmission: Second gear • Driving with the throttle widely open • Engine: 3,500 r/min or more		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)
80	Backup power supply	Ignition switch: "LOCK" (OFF)		System voltage
81	Sensor impressed voltage	Ignition switch: "ON"		4.9 – 5.1 V
82	Ignition switch – IG	Ignition switch: "ON"		System voltage
83	Engine coolant temperature sensor	Ignition switch: "ON"	Coolant temperature: -20°C	3.9 – 4.5 V
			Coolant temperature: 0°C	3.2 – 3.8 V
			Coolant temperature: 20°C	2.3 – 2.9 V
			Coolant temperature: 40°C	1.3 – 1.9 V
			Coolant temperature: 60°C	0.7 – 1.3 V
			Coolant temperature: 80°C	0.3 – 0.9 V
84	Throttle position sensor	Ignition switch: "ON"	Set throttle valve to idle position	0.535 – 0.735 V
			Fully open throttle valve	4.5 – 5.0 V
85	Barometric pressure sensor	Ignition switch: "ON"	Altitude: 0 m	3.8 – 4.2 V
			Altitude: 600 m	3.5 – 3.9 V
			Altitude: 1,200 m	3.2 – 3.8 V
			Altitude: 1,800 m	3.0 – 3.4 V

Terminal No.	Check item	Check condition (Engine condition)	Normal condition
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 operation	0.5 – 2.0 V
89	Crank angle sensor	Engine: Cranking	0.4 – 4.0 V
		Engine: Idle operation	1.5 – 2.5 V
90	Air flow sensor	Engine: Idle operation	2.2 – 3.2 V
		Engine speed: 2,500 r/min	
91	Intercooler water spray switch (Manual)	- Ignition switch: "ON" - Intercooler water spray switch: ON	1 V or less
		- Ignition switch: "ON" - Intercooler water spray switch: OFF	System voltage

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

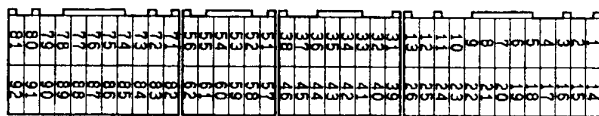
- (1) When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
- (2) Checking need not be carried out in the order given in the chart.

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!

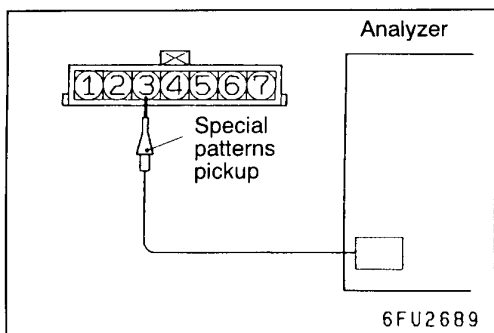
4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector Terminal Arrangement

9FU0392

Terminal No.	Inspection item	Normal condition (Check condition)
1-12	No. 1 injector	2 – 3 Ω (at 20°C)
14-12	No. 2 injector	
2-12	No. 3 injector	
15-12	No. 4 injector	

Terminal No.	Inspection item	Normal condition (Check condition)
3-12	Fuel pressure control solenoid valve	28 – 36 Ω (at 20°C)
4-12	Stepper motor coil (A1)	28 – 33 Ω (at 20°C)
17-12	Stepper motor coil (A2)	
5-12	Stepper motor coil (B1)	
18-12	Stepper motor coil (B2)	
6-12	EGR control solenoid valve	36 – 44 Ω (at 20°C)
9-12	Purge control solenoid valve	22 – 26 Ω (at 20°C)
11-12	Waste gate solenoid valve	62 – 74 Ω (at 20°C)
13-Body earth	ENGINE-ECU earth	Continuity (0 Ω)
26-Body earth	ENGINE-ECU earth	
53-12	Secondary air control solenoid valve	28 – 36 Ω (at 20°C)
54-12	Oxygen sensor heater (Rear)	11 – 18 Ω (at 20°C)
60-12	Oxygen sensor heater (Front)	4.5 – 8.0 Ω (at 20°C)
72-92	Intake air temperature sensor	13 – 17 k Ω (When intake air temperature is -20°C)
		5.7 – 6.7 k Ω (When intake air temperature is 0°C)
		2.3 – 3.0 k Ω (When intake air temperature is 20°C)
		1.0 – 1.5 k Ω (When intake air temperature is 40°C)
		0.56 – 0.76 k Ω (When intake air temperature is 60°C)
		0.30 – 0.42 k Ω (When intake air temperature is 80°C)
83-92	Engine coolant temperature sensor	14 – 17 k Ω (When coolant temperature is -20°C)
		5.1 – 6.5 k Ω (When coolant temperature is 0°C)
		2.1 – 2.7 k Ω (When coolant temperature is 20°C)
		0.9 – 1.3 k Ω (When coolant temperature is 40°C)
		0.48 – 0.68 k Ω (When coolant temperature is 60°C)
		0.26–0.36 k Ω (When coolant temperature is 80°C)



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to air flow sensor connector terminal No. 3.

Alternate Method (Test harness not available)

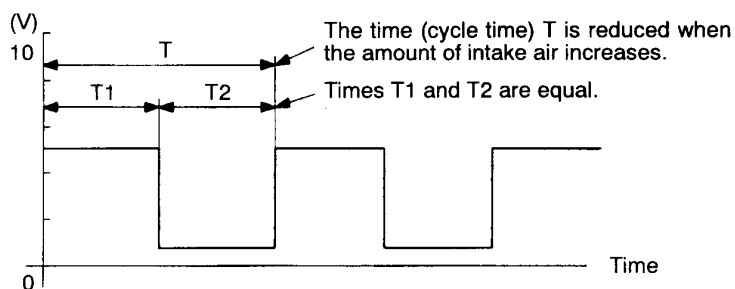
1. Connect the analyzer special patterns pickup to engine-ECU terminal No. 65.

Standard Wave Pattern

Observation conditions

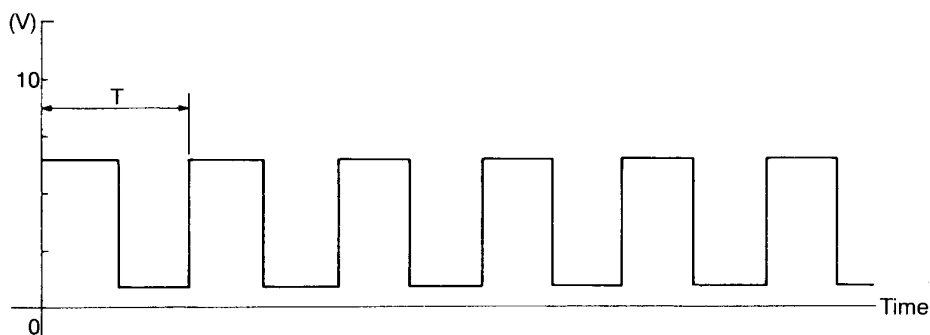
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



7FU1199

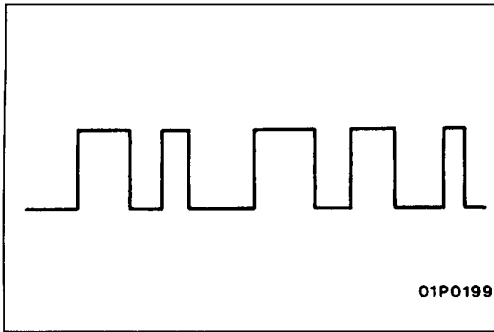
Observation conditions (from conditions above engine speed is increased by racing.)



7FU0880

Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

● Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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

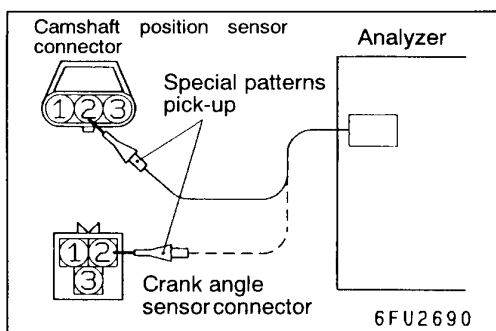
● Example 2

Cause of problem

Damaged rectifier or vortex generation column

Wave pattern characteristics

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



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

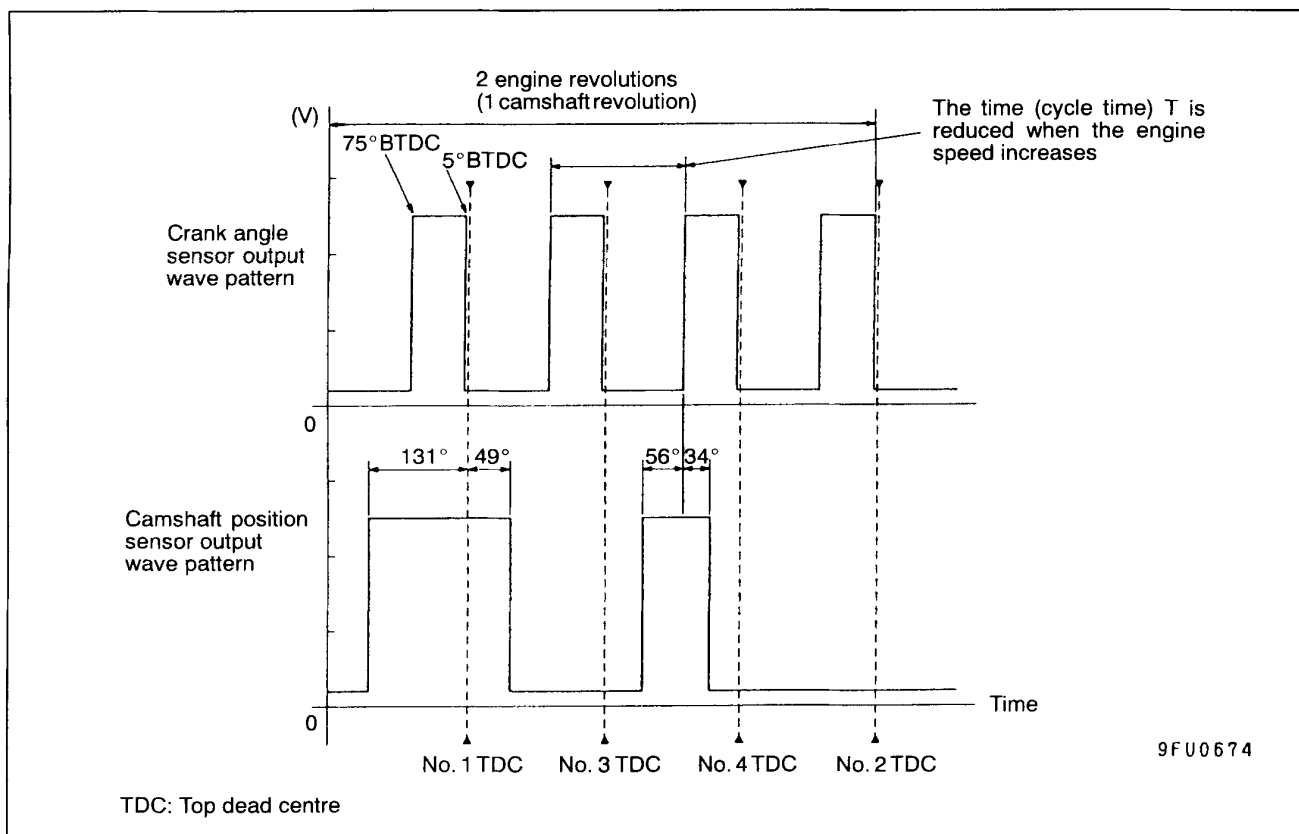
1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal No. 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal No. 2.

Alternate Method (Test harness not available)

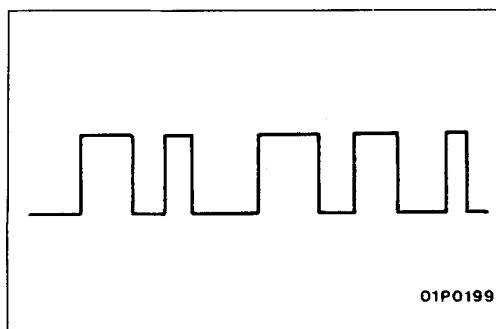
1. Connect the analyzer special patterns pickup to engine-ECU terminal No. 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal No. 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern**Observation condition**

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

Standard Wave Pattern**Wave Pattern Observation Points**

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

**Examples of Abnormal Wave Patterns**

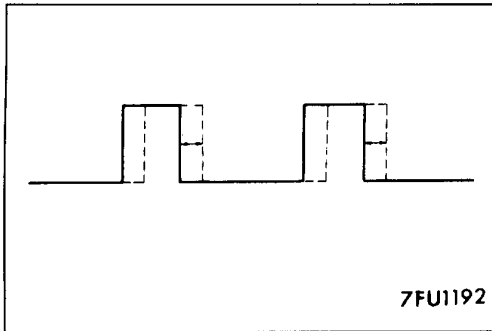
- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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



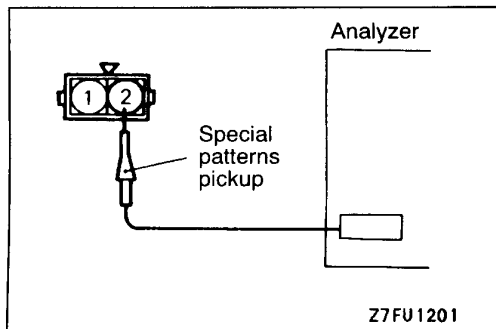
- Example 2

Cause of problem

Loose timing belt
Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.

**INJECTOR****Measurement Method**

1. Disconnect the injector connector, and then connect the special tool (test harness: MB991348) in between.
(All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal No. 2 of the injector connector.

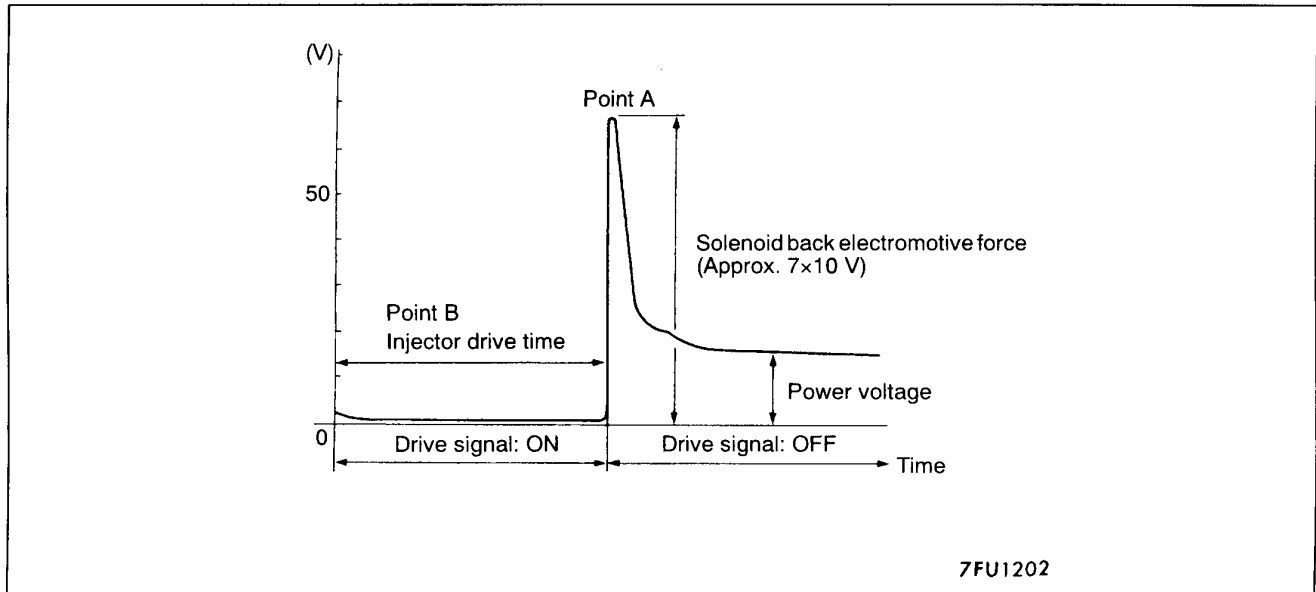
Alternate Method (Test harness not available)

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

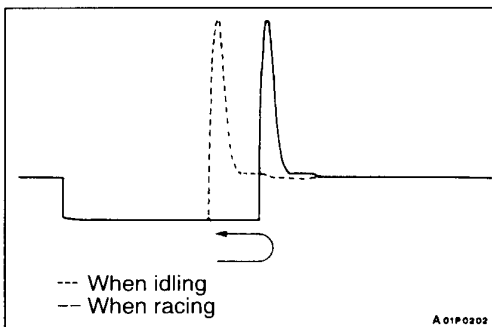


Wave Pattern Observation Points

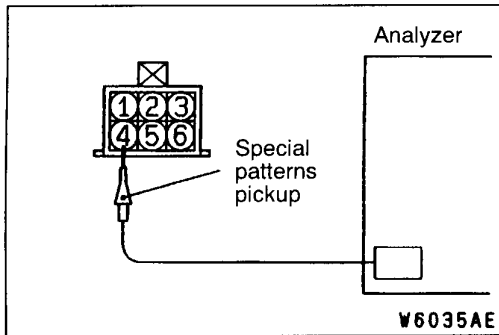
Point A: Height of solenoid back electromotive force

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 SERVO (STEPPER MOTOR)****Measurement Method**

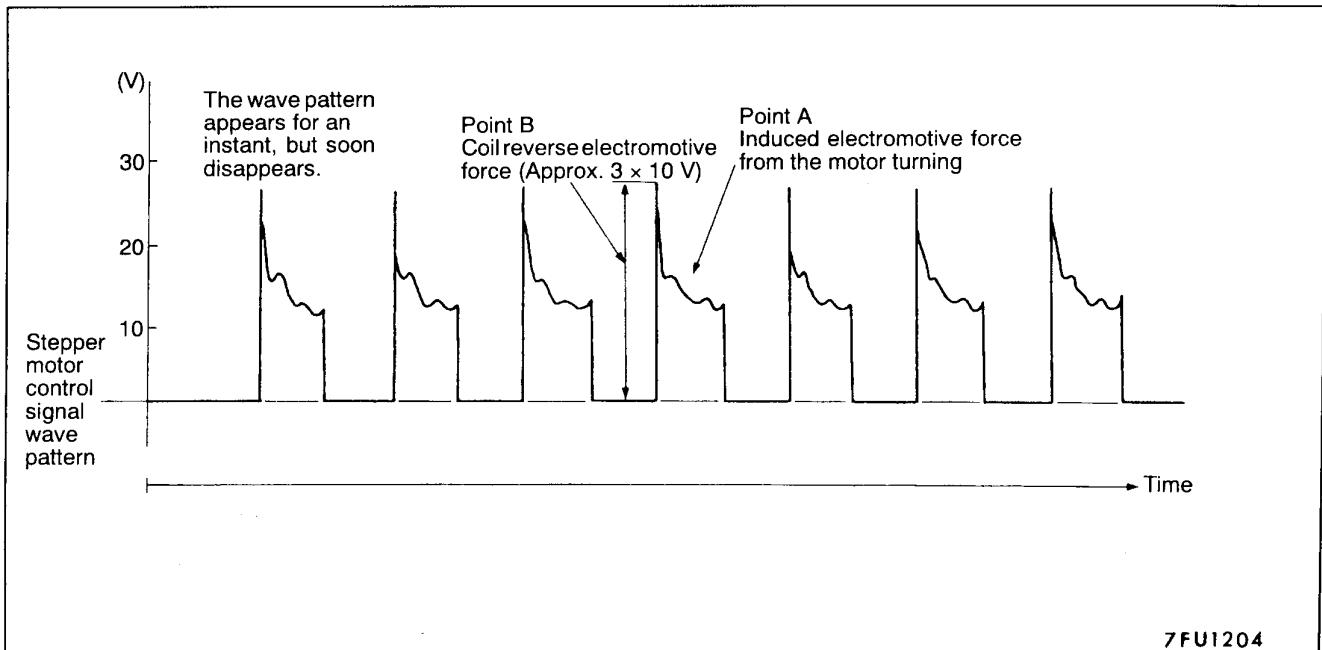
1. Disconnect the idle speed control servo connector, and connect the special tool (test harness: MB991709) in between.
2. Connect the analyzer special patterns pickup to the idle speed control servo-side connector terminal No. 1, terminal No. 3, terminal No. 4 and terminal No. 6 respectively.

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to engine-ECU terminal No. 4, connection terminal No. 5, connection terminal No. 17, and connection terminal No. 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" position (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

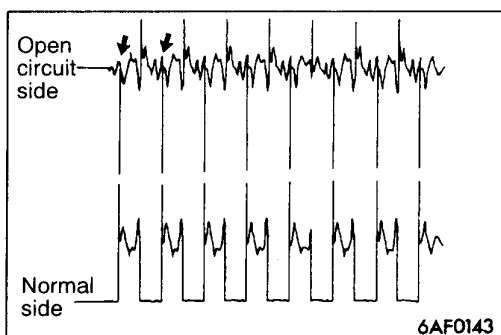
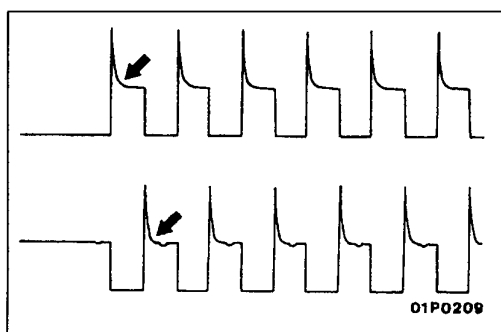
Check that the standard wave pattern appears when the stepper motor is operating.

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

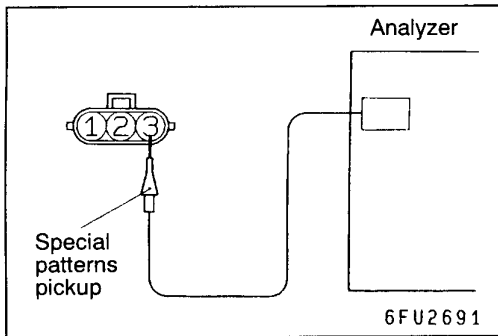
Cause of problem

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

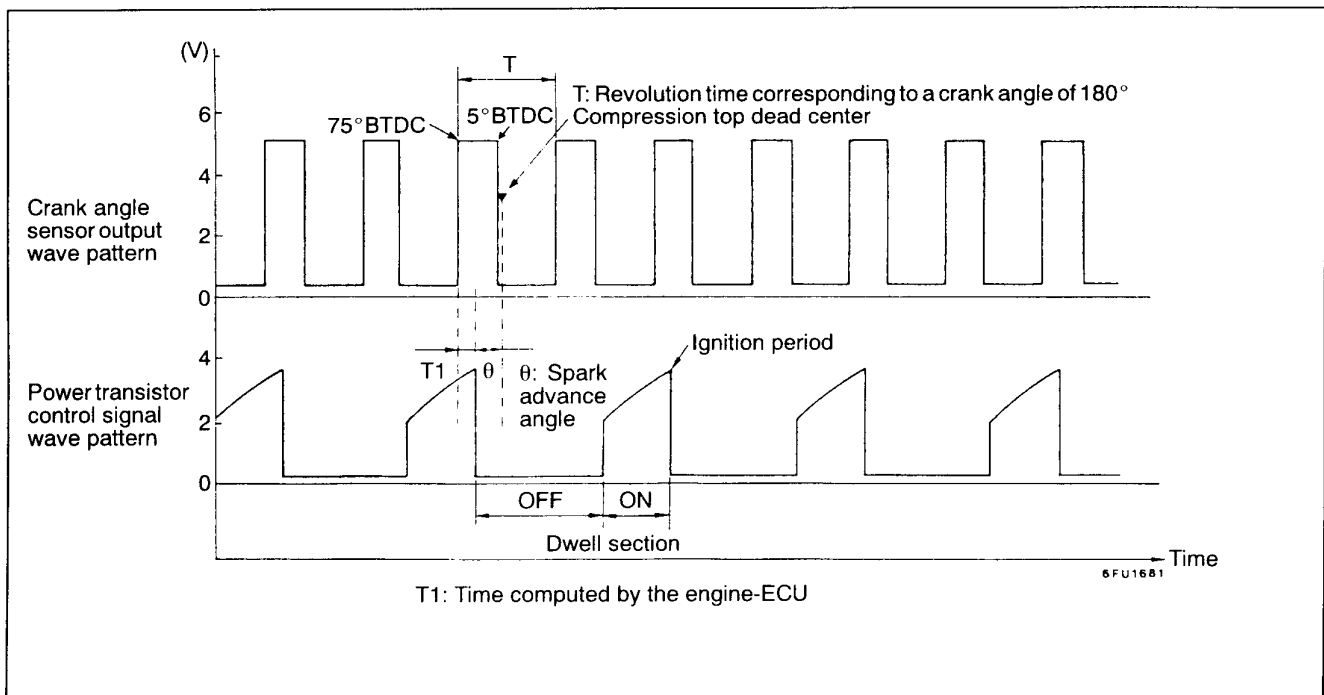
1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal No. 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

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

Standard Wave Pattern**Observation condition**

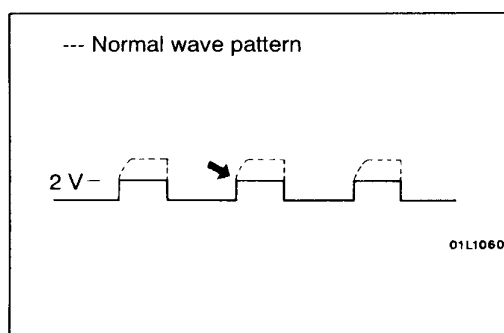
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approximately 1,200 r/min

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 approximately 2 V to approximately 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

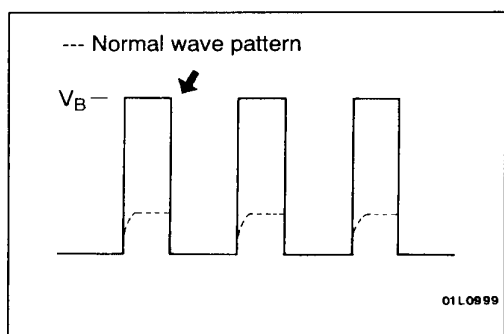
Wave pattern during engine cranking

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

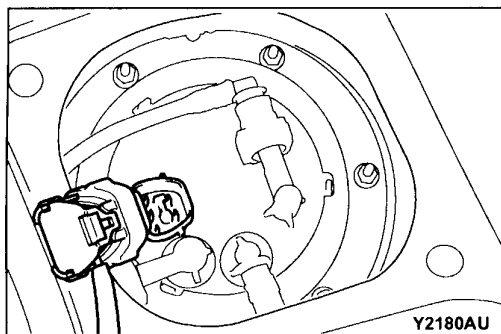
Wave pattern during engine cranking

Cause of problem

Malfunction in power transistor

Wave pattern characteristics

Power voltage results when the power transistor is ON.



ON-VEHICLE SERVICE

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 rear seat assembly. (Refer to GROUP 52A.)
2. Remove the protector.
3. Disconnect the fuel pump module connector.
4. After starting the engine and letting it run until it stops naturally, turn the ignition switch to "LOOK" (OFF) position.
5. Connect the fuel pump module connector.
6. Install the protector and rear seat assembly. (Refer to GROUP 52A.)

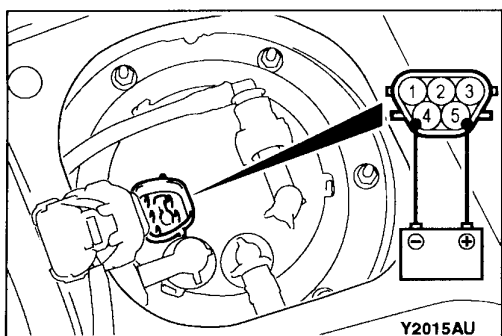
FUEL PUMP OPERATION CHECK

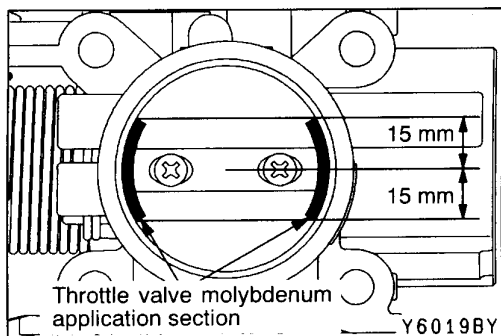
1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
 - (1) Turn the ignition switch to "LOOK" (OFF) position.
 - (2) Remove the rear seat assembly. (Refer to GROUP 52A.)
 - (3) Remove the protector.
 - (4) Disconnect the fuel pump module connector.
 - (5) When the fuel pump drive connector is attached directly to the battery, check if the sound of the fuel pump operation can be heard.

NOTE

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

- (6) Check the fuel pressure by pinching the fuel hose with the fingertips.
- (7) Connect the fuel pump module connector.
- (8) Install the protector and rear seat assembly. (Refer to GROUP 52A.)



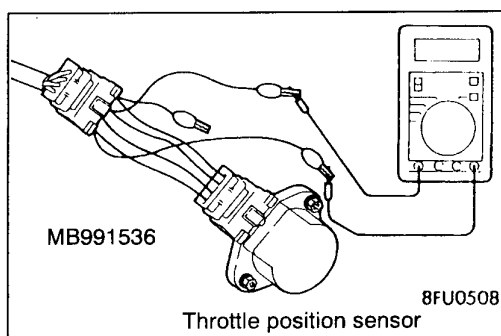
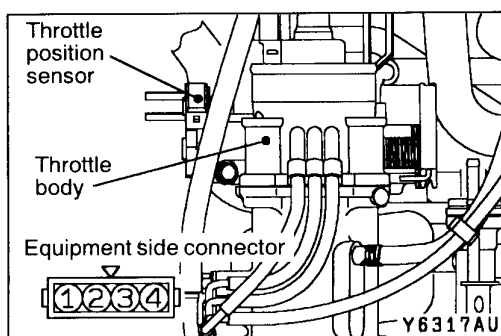


THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Remove the air intake hose from the throttle body.
2. Spray cleaning fluid on a clean cloth.
3. Wipe off the dirt around the throttle valve with the cloth sprayed with cleaning fluid.

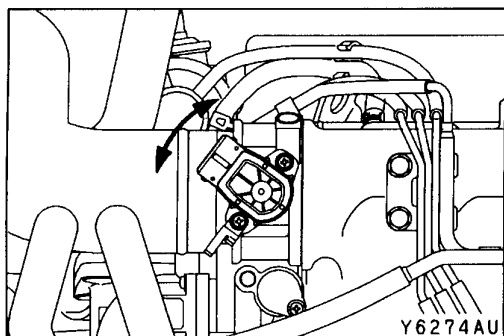
Caution

- (1) Do not spray the cleaning fluid directly to the throttle valve.
 - (2) Make sure the cleaning fluid does not enter the motor from the bypass line. Also make sure it does not enter the sensor through the shaft.
 - (3) Be careful not to rub off the molybden applied around the throttle valve shaft.
4. Attach the air intake hose.
 5. Adjust the basic idle speed. (Refer to P.13A-127.)



THROTTLE POSITION SENSOR ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector.
When not using the MUT-II, proceed as follows:
 - (1) Disconnect the throttle position sensor connector, and connect the special tool (test harness: MB991536) between the disconnected connector taking care not to confuse the terminal to be connected.
 - (2) Connect digital voltmeter between the terminal No. 2 and the terminal No. 4 of the throttle position sensor connector.
2. Turn the ignition switch to "ON" position (but do not start the engine).
3. Check the output voltage of the throttle position sensor.
Standard value: 535 – 735 mV



4. If not within the standard value, loosen the throttle position sensor mounting bolts. Then rotate the sensor body to adjust.
5. Turn the ignition switch to "LOCK" (OFF) position.
6. Remove the MUT-II. If the MUT-II is not used, remove the special tool, and then connect the throttle position sensor connector.
7. 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 approximately 10 minutes.

BASIC IDLE SPEED ADJUSTMENT

NOTE

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

NOTE

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

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

NOTE

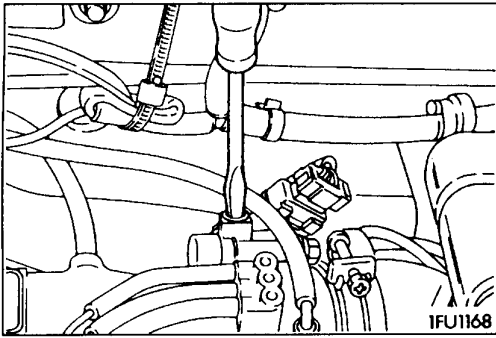
This holds the idle speed control servo at the basic step to adjust the basic idle speed.

5. Check the basic idle speed.

Standard value: 850 ± 100 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.13A-126.)



6. If not within the standard value range, turn the speed adjusting screw to make the necessary adjustment.
7. Press the MUT-II clear key, and release the idle speed control servo from the Actuator test mode.

NOTE

Unless the idle speed control servo is released, the Actuator test mode will continue 27 minutes.

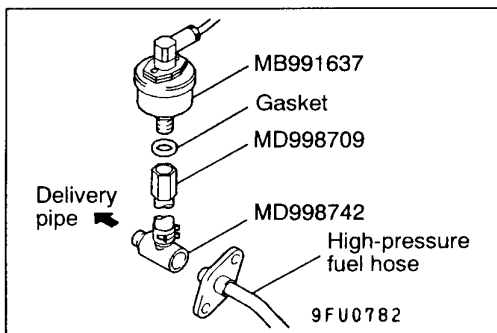
8. Turn the ignition switch to "LOCK" (OFF) position.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for approximately 10 minutes; check that the idling condition is normal.

FUEL PRESSURE TEST

1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13A-125.)
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

Caution

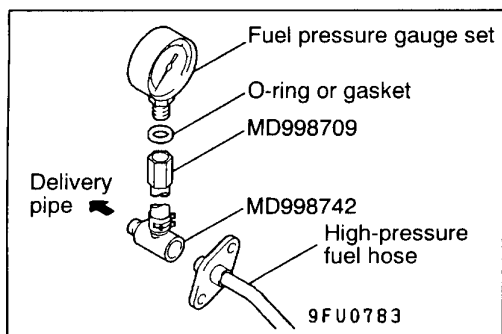
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



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)>

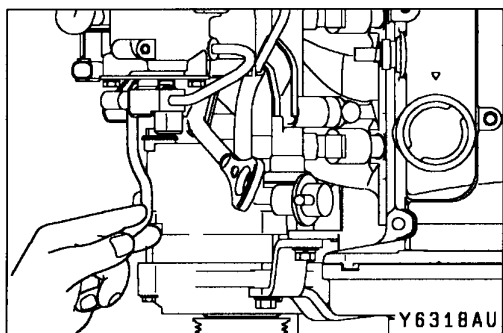
- (1) Install the special tool (for measuring the fuel pressure) between the high-pressure fuel hose and the delivery pipe.
- (2) Install the fuel pressure gauge set (special tool) on the special tool (for measuring the fuel pressure) putting the gasket between them.
- (3) Connect the lead wire of the 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" position. (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: Approximately 230 kPa at curb idle



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

Standard value: 289 – 309 kPa at curb idle

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

NOTE

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

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

Symptom	Probable cause	Remedy
- 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
	Fuel pressure control system malfunction	Check the fuel pressure control system

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.13A-125.)
17. Remove the fuel pressure gauge and special tool from the delivery pipe.

Caution

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

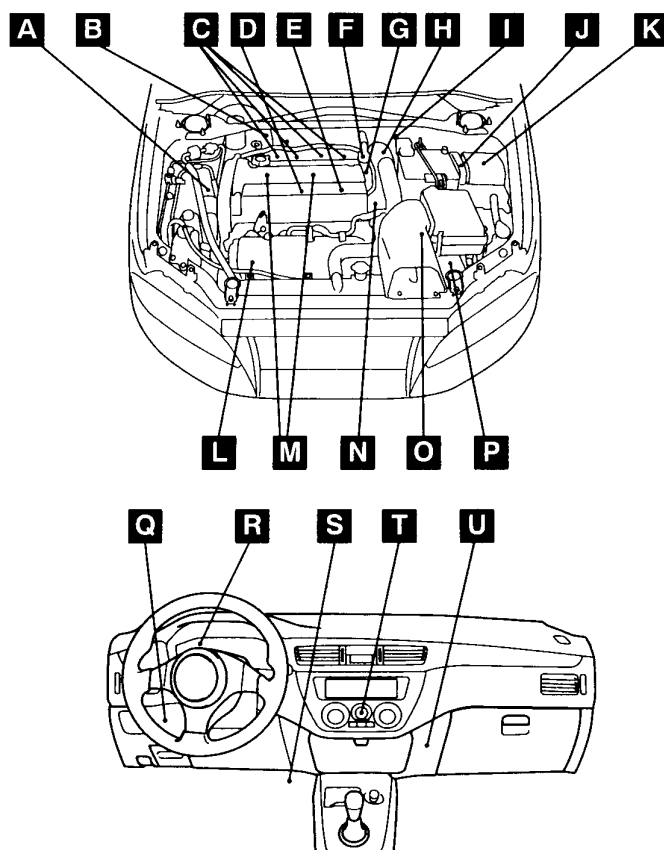
18. Replace the O-ring at the end of the fuel high pressure hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
19. Fit the fuel high pressure hose over the delivery pipe and tighten the bolt to specified torque.

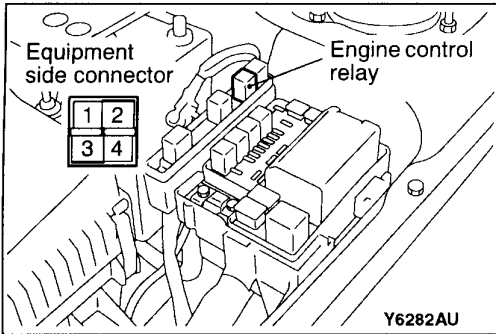
Tightening torque: 5.0 ± 1.0 N·m

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

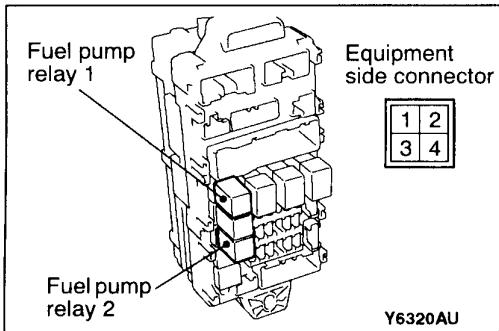
COMPONENT LOCATION

Name	Symbol	Name	Symbol
A/C relay	J	Fuel pump relay 1, 2	Q
A/C switch	T	Fuel pump relay 3	H
Air flow sensor (integrated intake air temperature sensor and barometric pressure sensor)	O	Fuel pump resistor	H
Camshaft position sensor	N	Idle speed control servo (stepper motor)	G
Crank angle sensor	K	Ignition coil (integrated power transistor)	M
Detonation sensor	E	Injector	C
Diagnosis connector	S	Oxygen sensor (front)	L
EGR control solenoid valve	D	Oxygen sensor (rear)	X
Engine control relay	I	Power steering fluid pressure switch	A
Engine coolant temperature sensor	N	Resistor (for injector)	H
Engine warning lamp (check engine lamp)	R	Secondary air control solenoid valve	D
Engine-ECU	U	Throttle position sensor	G
Fan motor relay	J	Vehicle speed sensor	F
Fuel pressure control solenoid valve	B	Waste gate solenoid valve	P

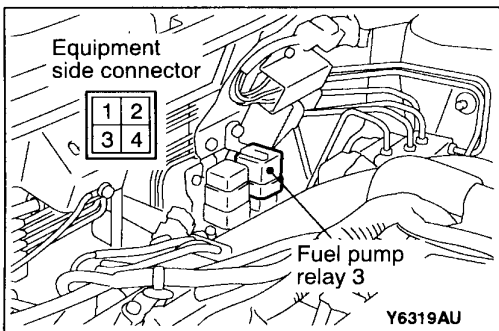


**ENGINE CONTROL RELAY CONTINUITY CHECK**

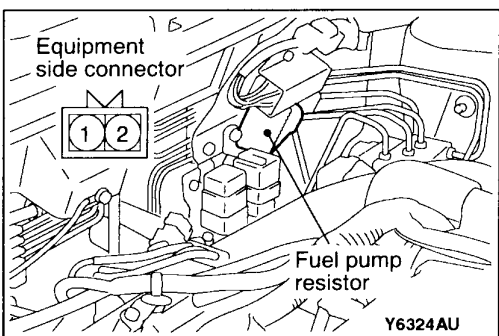
Tester connection terminal	Battery voltage	Normal state
2-3	Not energized	Continuity
1-4	Not energized	No continuity
	Energized [Connect terminal No. 2 to battery (+) terminal, and connect terminal No. 3 to battery (-) terminal.]	Continuity

**FUEL PUMP RELAY 1, 2 CONTINUITY CHECK**

Tester connection terminal	Battery voltage	Normal state
1-4	Not energized	Continuity
2-3	Not energized	No continuity
	Energized [Connect terminal No. 1 to battery (+) terminal, and connect terminal No. 4 to battery (-) terminal.]	Continuity

**FUEL PUMP RELAY 3 CONTINUITY CHECK**

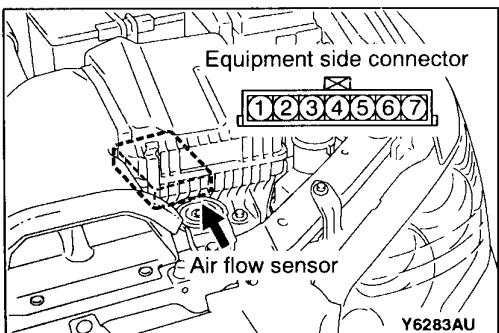
Tester connection terminal	Battery voltage	Normal state
3-4	Not energized	Continuity
1-2	Not energized	Continuity
	Energized [Connect terminal No. 2 to battery (+) terminal, and connect terminal No. 1 to battery (-) terminal.]	No continuity

**FUEL PUMP RESISTOR CHECK**

1. Disconnect the fuel pump resistor connector.
2. Measure the resistance between the terminals.

Standard value: 0.45 – 0.65 Ω

3. If the value is deviated from the standard value, replace the fuel pump resistor.

**INTAKE AIR TEMPERATURE SENSOR CHECK**

1. Disconnect the air flow sensor connector.
2. Measure resistance between terminal No. 5 and terminal No. 6.

Standard value:

13 – 17 k Ω (at -20°C)

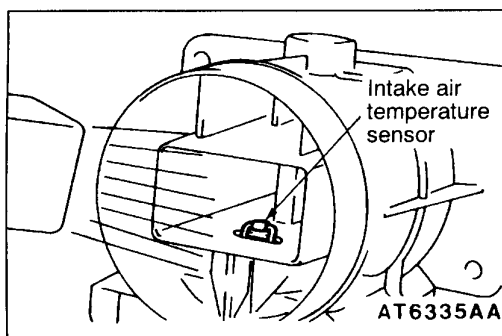
5.7 – 6.7 k Ω (at 0°C)

2.3 – 3.0 k Ω (at 20°C)

1.0 – 1.5 k Ω (at 40°C)

0.56 – 0.76 k Ω (at 60°C)

0.30 – 0.42 k Ω (at 80°C)

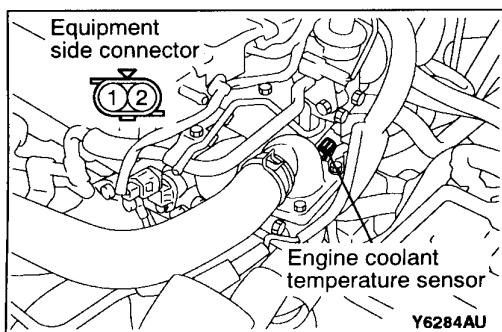


3. Measure resistance while heating the sensor using a hair drier.

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.

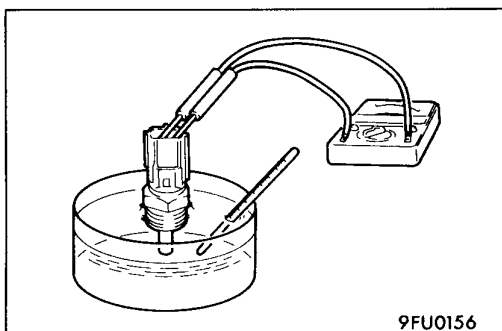


ENGINE COOLANT TEMPERATURE SENSOR CHECK

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)

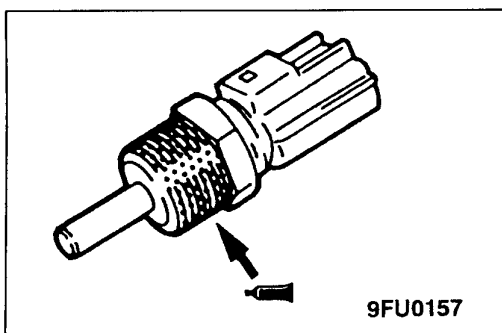
3. If the resistance deviates from the standard value greatly, replace the sensor.
4. Apply sealant to threaded portion.

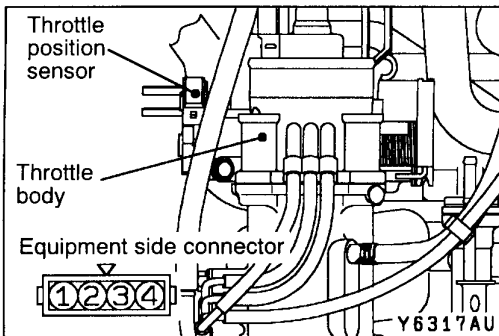
Specified sealant:

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 No. 1 and terminal No. 4.

Standard value: 3.5 – 6.5 k Ω

3. Measure the resistance between the throttle position sensor side connector terminal No. 2 and terminal No. 4.

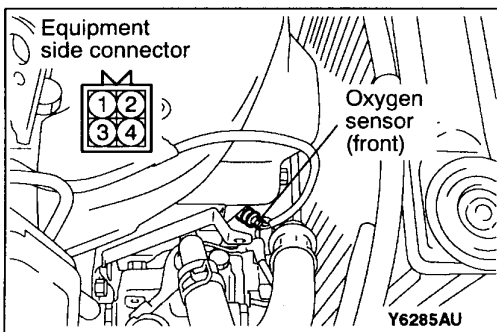
Normal condition:

Throttle valve slowly open until fully open from the idle position	Changes smoothly in proportion to the opening angle of the throttle valve
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4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

NOTE

For the throttle position sensor adjustment procedure, refer to P.13A-90.

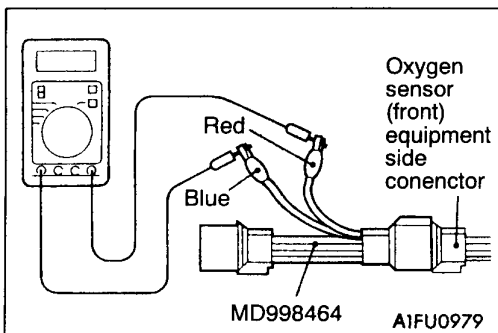


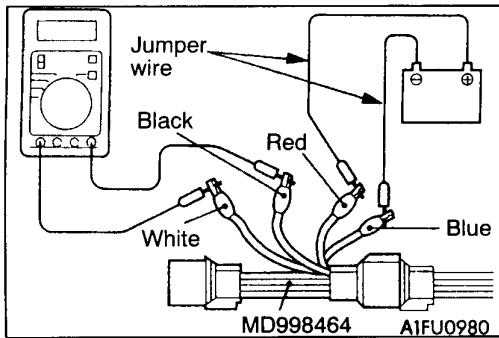
OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness: MB998464) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (4.5 – 8.0 Ω at 20°C) between terminal No. 1 and terminal No. 3 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 No. 1 of the oxygen sensor connector to the battery (+) terminal and terminal No. 3 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 No. 2 and terminal No. 4.
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

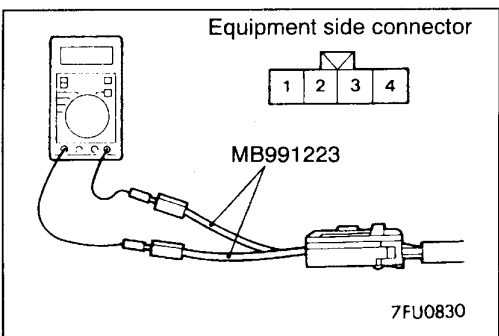
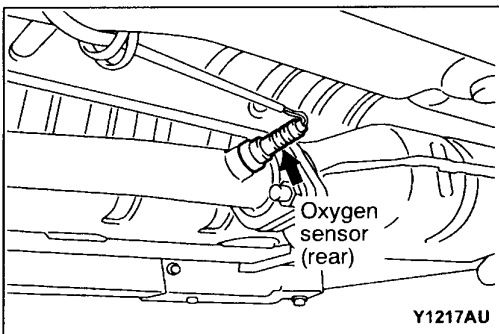
Standard value:

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

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

NOTE

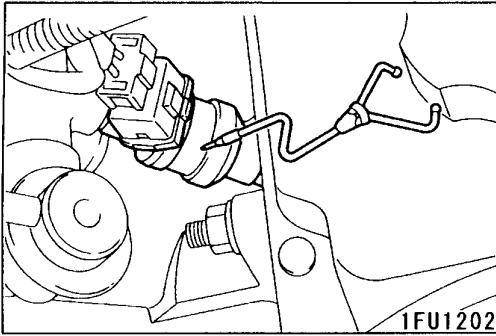
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.

**<Oxygen sensor (rear)>**

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

NOTE

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



INJECTOR CHECK

OPERATION SOUND CHECK

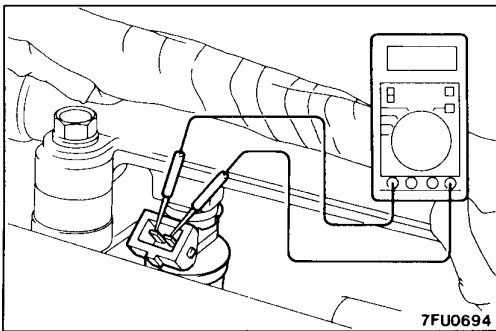
Using a sound scope, check the operation sound of the injector ("chh" sound) during idling and cranking. Check that the operation sound increases when the speed increases.

Caution

The sound of other injectors operating may be heard even when the injector being checked is not operated.

NOTE

If no operation sound is heard, check the injector drive circuit. If the circuit is normal, the injector or engine-ECU may be faulty.



Measurement of Resistance between Terminals

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

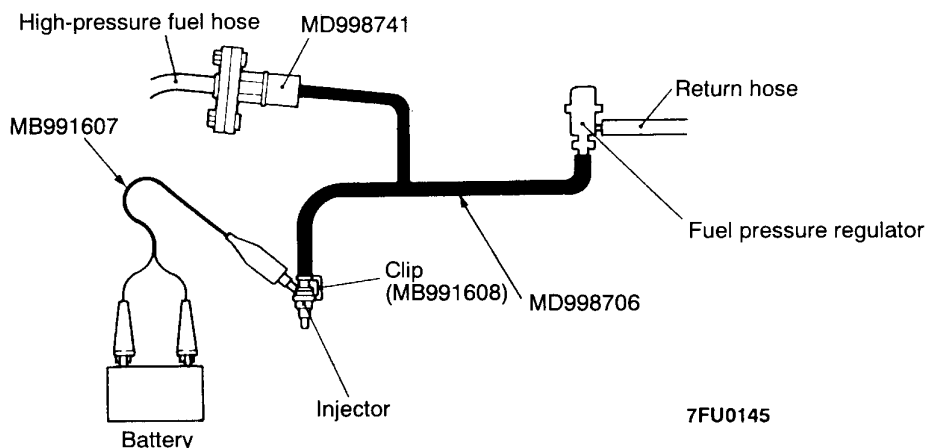
Standard value: 2 – 3 Ω (at 20°C)

3. Install the injector connector.

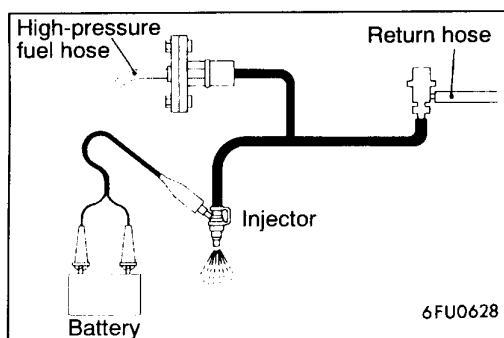
Checking the Injection Condition

1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13A-96.)
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" position. (But do not start the engine.)
6. Select "Item No. 07" from the MUT-II Actuator test to drive the fuel pump.

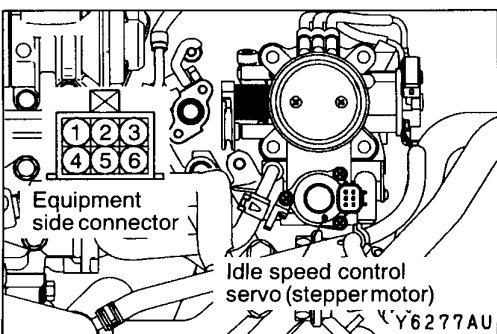
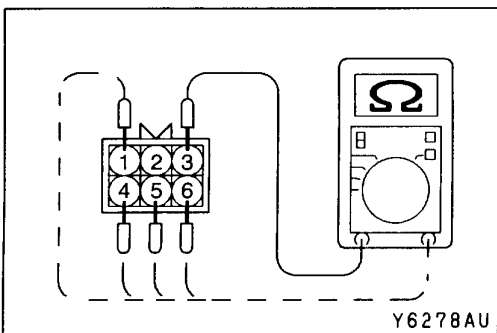
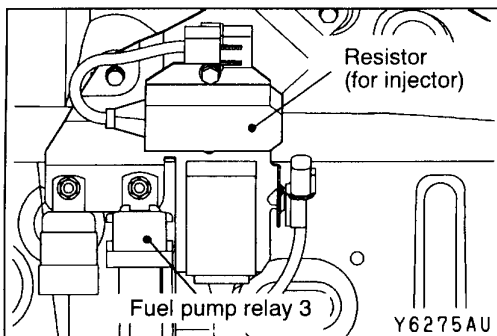


7. Activate the injector and check the atomized spray condition of the fuel. The condition can be considered satisfactory unless it is extremely poor.

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.



RESISTOR (FOR INJECTOR) CHECK

1. Disconnect the resistor connector.
2. Measure the resistance between each terminal.

Standard value:

Measurement terminal	Resistance Ω
1 - 3	5.8 - 6.2 (at 20°C)
4 - 3	
5 - 3	
6 - 3	

IDLE SPEED CONTROL SERVO (STEPPER MOTOR) CHECK

Checking the Operation Sound

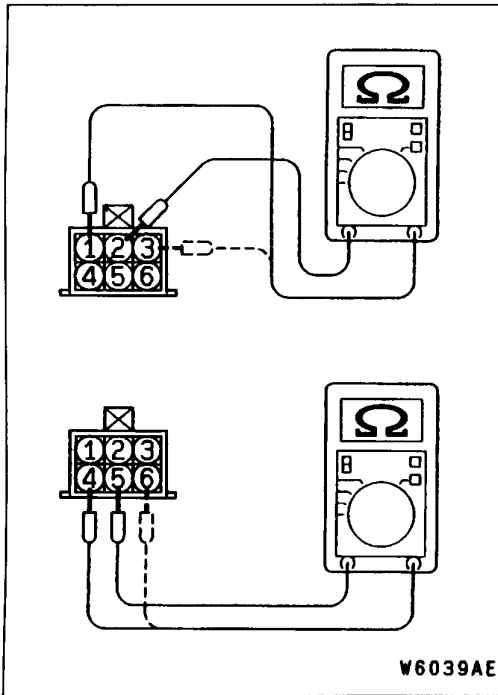
1. Check that the engine coolant temperature is 20°C or below.

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" position. (but without starting 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-ECU.



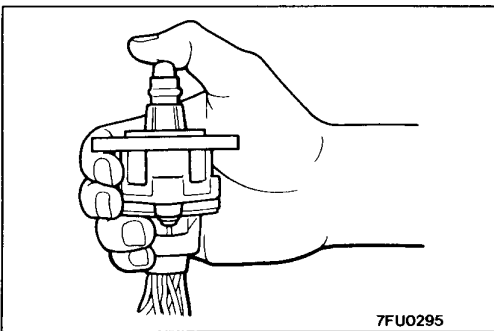
Checking the Coil Resistance

1. Disconnect the idle speed control servo connector.
2. Measure the resistance between terminal No. 2 and either terminal No. 1 or terminal No. 3 of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω (at 20°C)

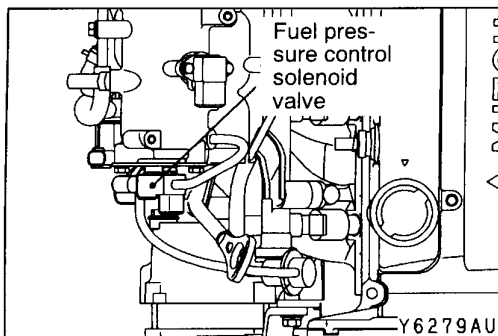
3. Measure the resistance between terminal No. 5 and either terminal No. 6 or terminal No. 4 of the connector at the idle speed control servo side.

Standard value: 28 – 33 Ω (at 20°C)



Operation Check

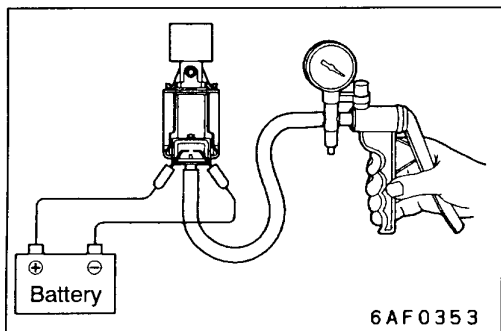
1. Remove the throttle body.
2. Remove the stepper motor.
3. Connect the special tool (test harness: MB991709) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approximately 6 V) to the terminals No. 2 and No. 5.
5. With the idle speed control servo as 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 terminals No. 1 and No. 4.
 - (2) Connect the negative (–) terminal of the power supply to the terminals No. 3 and No. 4.
 - (3) Connect the negative (–) terminal of the power supply to the terminals No. 3 and No. 6.
 - (4) Connect the negative (–) terminal of the power supply to the terminals No. 1 and No. 6.
 - (5) Connect the negative (–) terminal of the power supply to the terminals No. 1 and No. 4.
 - (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.



FUEL PRESSURE CONTROL SOLENOID VALVE CHECK

OPERATION CHECK

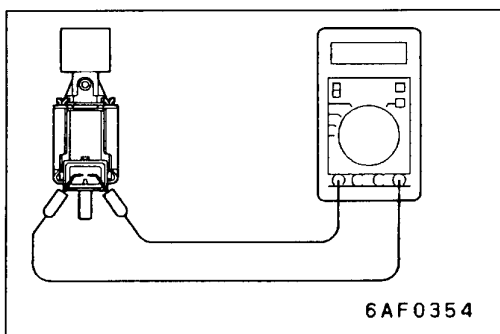
1. Disconnect the vacuum hose from the solenoid valve.
2. Separate the harness connector.



3. Connect the hand vacuum pump to the solenoid valve's A nipple.
4. Connect the solenoid valve terminal and battery terminal with a jumper wire.
5. Disconnect the jumper wire between the battery's (-) terminals, apply a negative pressure, and inspect the tightness.

Standard value:

Jumper wire	State of B nipple	Normal state
Connected	Opened	Negative pressure leaks.
	Closed	Negative pressure is maintained.
Disconnected	Opened	Negative pressure is maintained.



COIL RESISTANCE CHECK

Measure the resistance between the solenoid valve terminals.

Standard value: 28 – 36 Ω (at 20°C)

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 – Emission Control System.

EGR CONTROL SOLENOID VALVE CHECK

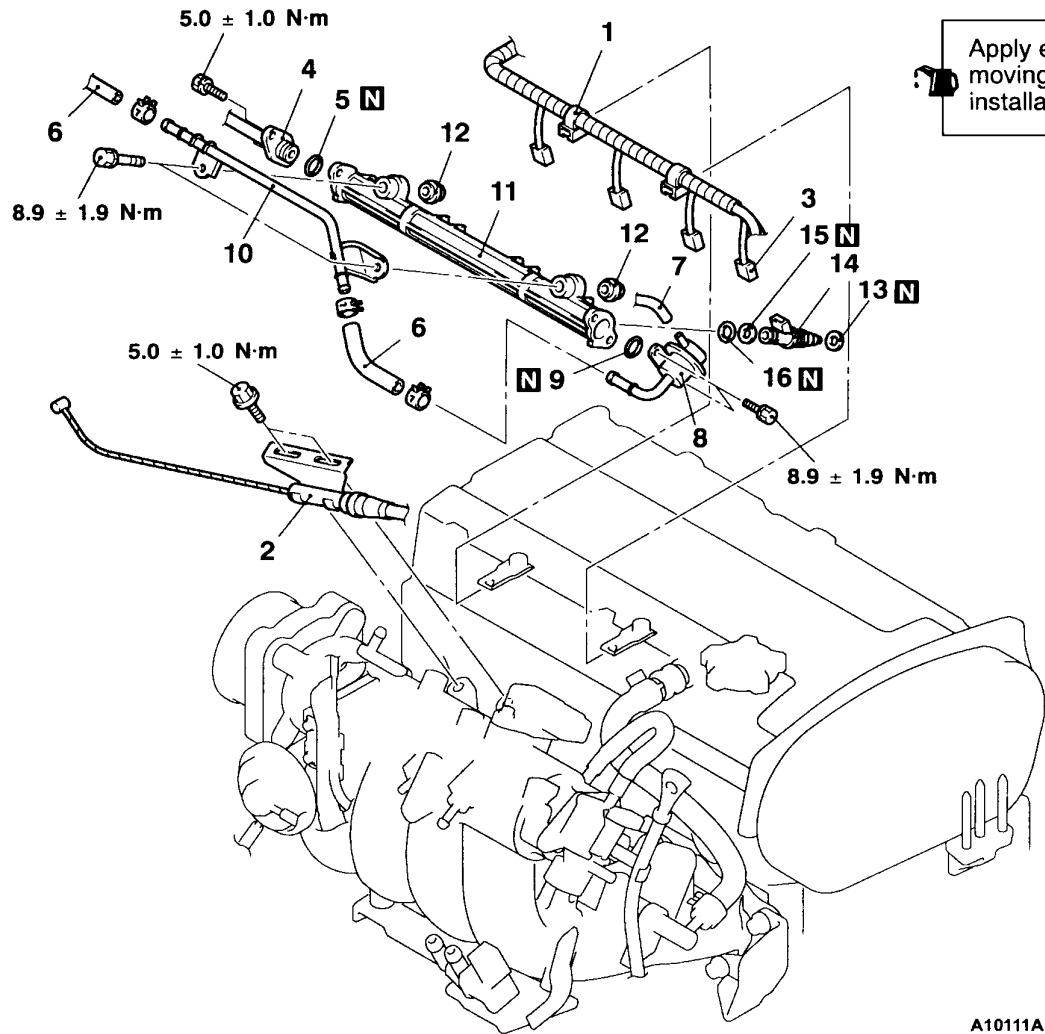
Refer to GROUP 17 – Emission Control System.

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Fuel Discharge Prevention (Refer to P.13A-125.)
- Strut Tower Bar Removal and Installation (Refer to GROUP 42.)
- Air Hose E, Air By-pass Hose, Air Pipe C Removal and Installation (Refer to GROUP 15 – Intercooler.)
- Fuel Leakage Check



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Removal steps

- | | | |
|-----|---|----------------------|
| ▶A◀ | 1. Control harness connector | 9. O-ring |
| | 2. Accelerator cable assembly connection (Throttle body side) | 10. Fuel return pipe |
| | 3. Injector harness connector | 11. Delivery pipe |
| ▶A◀ | 4. High-pressure fuel hose connection | 12. Insulator |
| | 5. O-ring | 13. Insulator |
| | 6. Fuel return hose connection | 14. Injector |
| | 7. Vacuum sensor connector | 15. Grommet |
| ▶A◀ | 8. Fuel pressure regulator | 16. O-ring |

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 enter 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:

5.0 ± 1.0 N·m (High-pressure fuel hose)

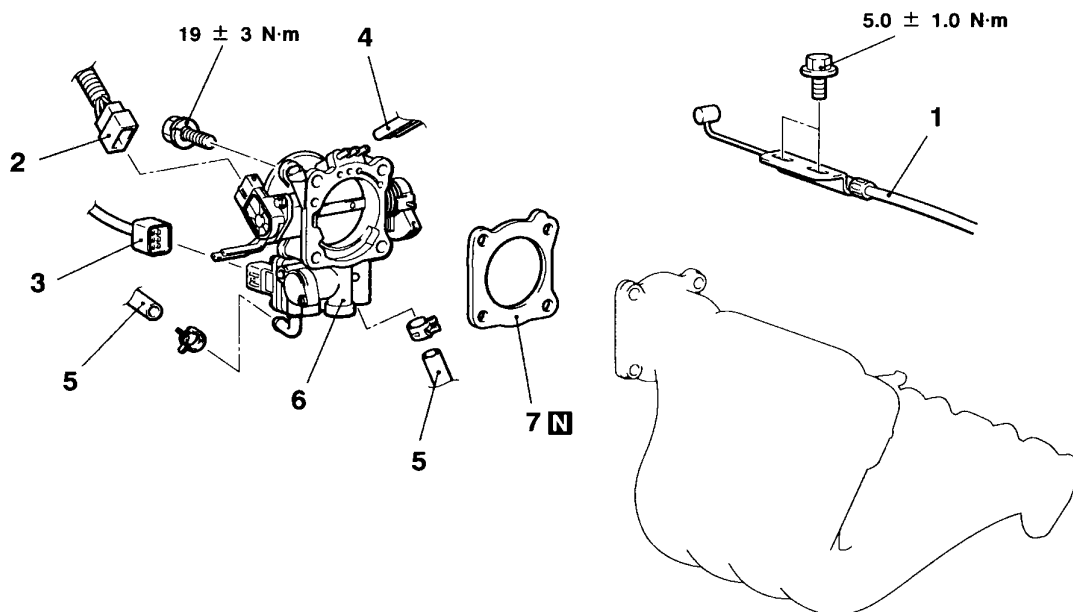
8.9 ± 1.9 N·m (Fuel pressure regulator)

THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Under Cover Removal and Installation (Refer to GROUP 51 – Front Bumper.)
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Strut Tower Bar Removal and Installation (Refer to GROUP 42.)
- Air Hose E, Air By-pass Hose, Air Pipe C Removal and Installation (Refer to GROUP 15 – Intercooler.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.) <Post-installation>

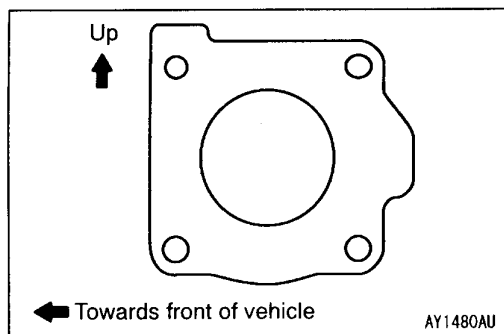


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Removal steps

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

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



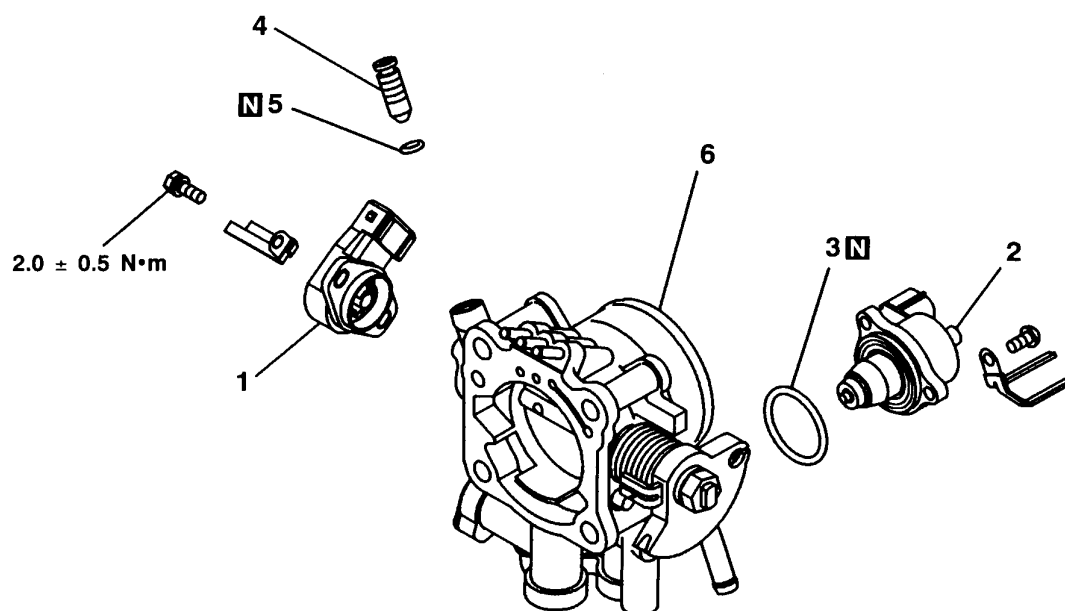
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INSTALLATION SERVICE POINT

►A◄ THROTTLE BODY GASKET INSTALLATION

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

DISASSEMBLY AND REASSEMBLY



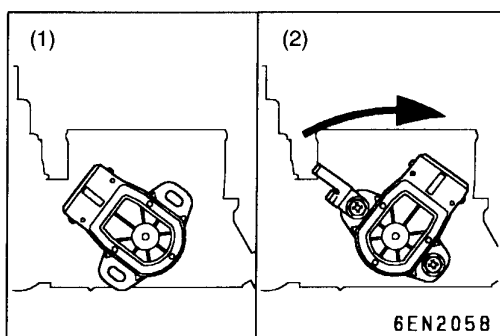
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Removal steps



1. Throttle position sensor
2. Idle speed control servo
3. O-ring

4. Fixed SAS
5. O-ring
6. Throttle body

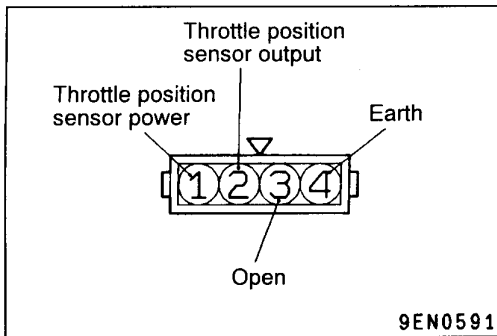


INSTALLATION SERVICE POINT

▶◀ THROTTLE POSITION SENSOR INSTALLATION

1. Set the throttle position sensor on the throttle body as shown in illustration (1).
2. Turn and set the throttle position sensor to the position shown in illustration (2), connect a circuit tester across terminal No. 2 (Throttle position sensor output) and terminal No. 4 (earth), and measure the output voltage. Tighten the throttle position sensor with a screw at the position where the output voltage is at the standard value.

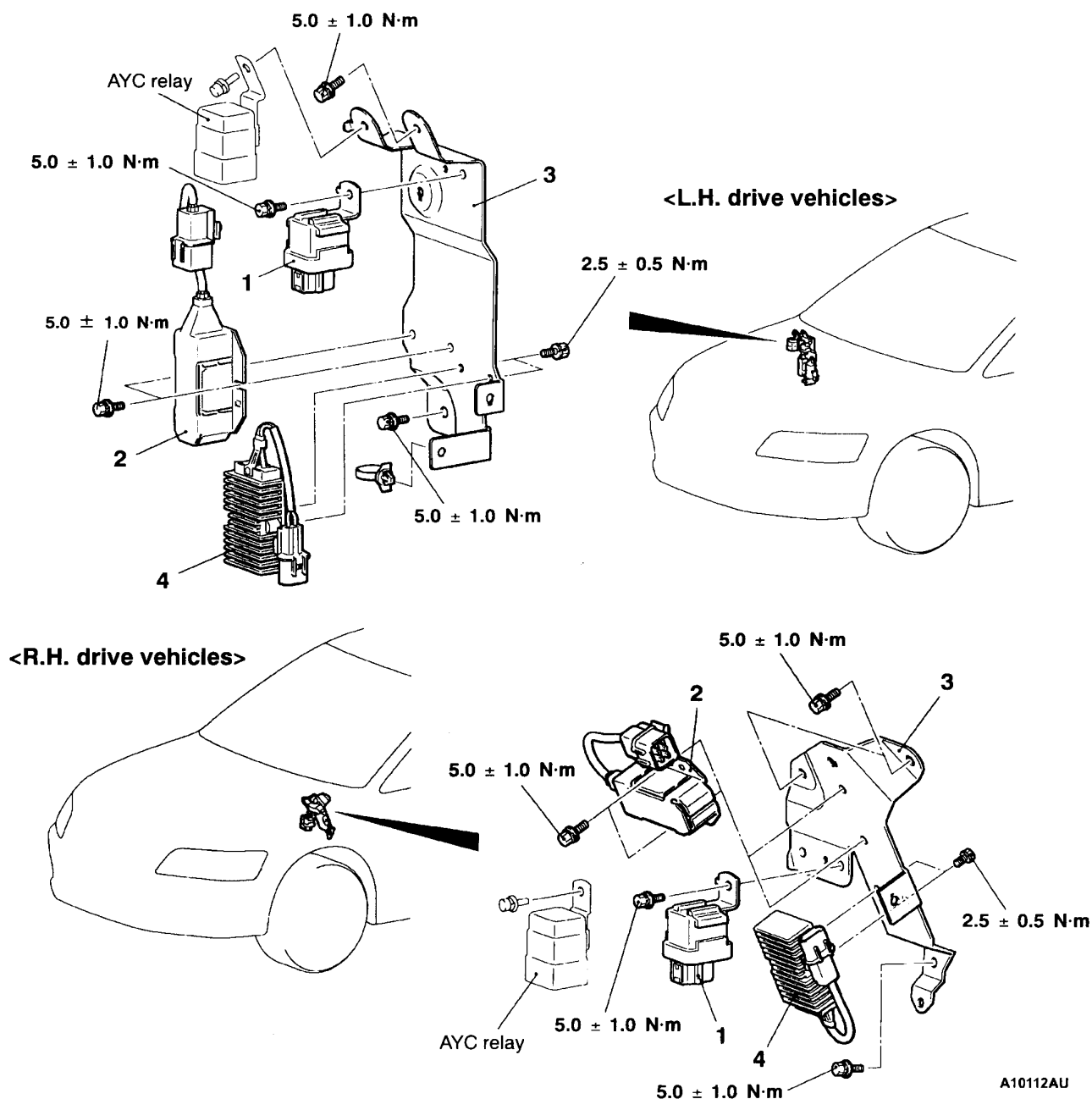
Standard value: 0.535 – 0.735 V



3. After installing the Throttle position sensor, check that the output voltage is at the standard value. If deviated from the standard value, loosen the screw, readjust to the standard position, and then fix. Repeat this step until the output voltage is at the standard value.
4. Connect a circuit tester across terminal No. 1 (Throttle position sensor power) and terminal No. 2 (Throttle position sensor output). Check that the resistance changes smoothly when the throttle valve is slowly moved to the fully opened position.

ENGINE CONTROL RESISTOR, RELAY**REMOVAL AND INSTALLATION****Pre-removal and Post-installation Operation**

- Strut Tower Bar Removal and Installation (Refer to GROUP 42.)
- Harness Connector Connection

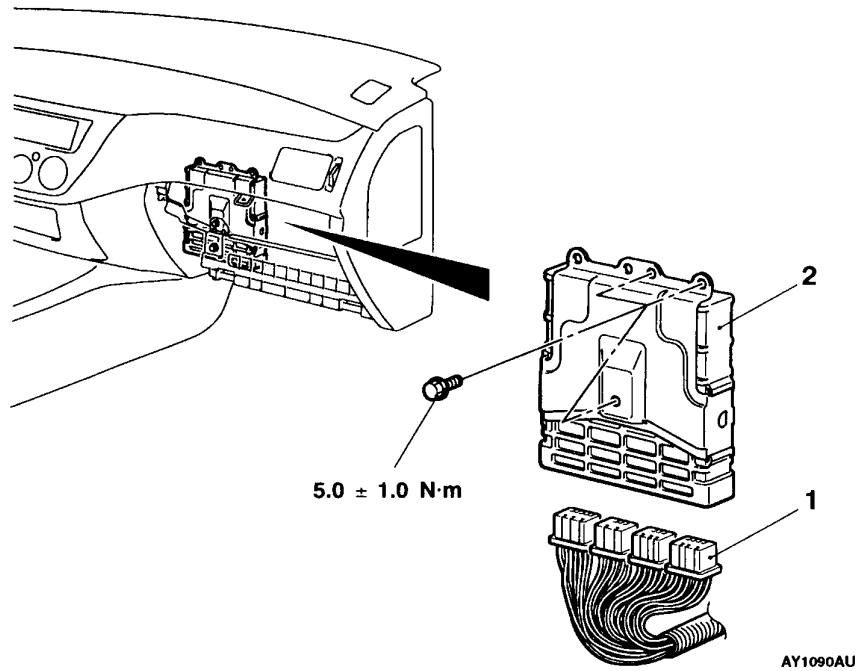
**Removal steps**

- AYC relay
- 1. Fuel pump relay
- 2. Injector resistor
- 3. Bracket
- 4. Fuel pump resistor

ENGINE-ECU

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
Glove Box Assembly Removal and Installation (Refer to GROUP 52A – Instrument Panel.)



Removal steps

1. Engine-ECU connector
2. Engine-ECU

FUEL SUPPLY

CONTENTS

GENERAL INFORMATION	2	FUEL TANK	3
ON-VEHICLE SERVICE	2		



GENERAL INFORMATION

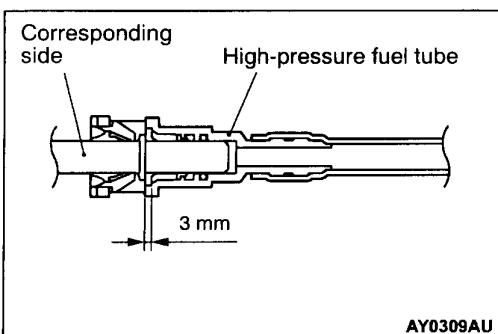
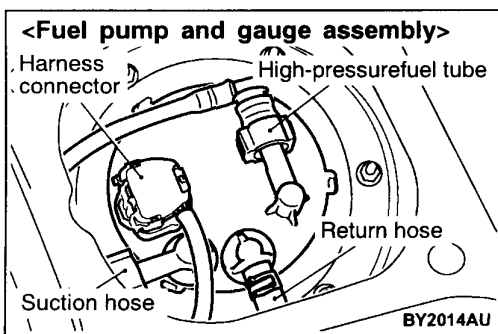
- The steel fuel tank is located under the floor of the rear seats to provide increased safety and increase the amount of luggage compartment space.
- The fuel tank has been equipped with a valve assembly which incorporates a fuel cut-off valve to prevent fuel from leaking out in the event of a collision for adjusting the pressure inside the fuel tank.
- The fuel pump module contains a fuel pump, fuel filter, and fuel pressure regulator.

ON-VEHICLE SERVICE

FUEL PUMP AND GAUGE ASSEMBLY (FUEL PUMP)

1. FUEL PUMP OPERATION CHECK

Refer to GROUP 13A – On-vehicle service



2. FUEL PUMP REPLACEMENT

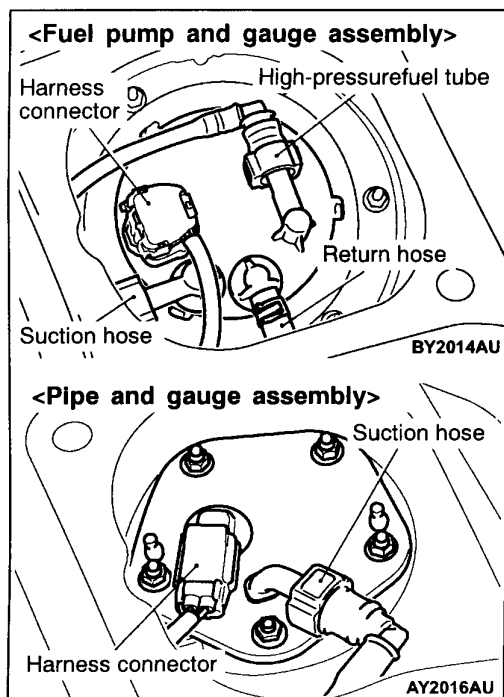
- (1) Remove the rear seat cushion assembly. (Refer to GROUP 52A.)
- (2) Remove the service hole cover.
- (3) Disconnect the harness connector, high-pressure fuel tube, suction hose and return hose.
- (4) Unscrew the mounting nuts to remove the fuel pump and gauge assembly.
- (5) Replace the fuel pump. (Refer to P.13B-7.)
- (6) Install the fuel pump and gauge assembly. Tighten the mounting nuts to the specified torque.

Specified torque: 2.5 ± 0.5 N·m

- (7) Connect the harness connector, high-pressure fuel tube, suction hose, and return hose.

Caution

- 1) Snap the high-pressure fuel hose or suction hose one-touch joint into place, then pull back slightly on the hose to assure it is securely fitted. However, the connection should have a play of approx. 3 mm.
 - 2) Insert the return hose for 20 – 30 mm for connection.
- (8) Install the service hole cover.
 - (9) Install the rear seat cushion assembly. (Refer to GROUP 52A.)



FUEL PUMP AND GAUGE ASSEMBLY, PIPE AND GAUGE ASSEMBLY (FUEL GAUGE UNIT)

1. Remove the rear seat cushion assembly. (Refer to GROUP 52A.)
2. Remove the service hole cover.
3. Disconnect the harness connector, high-pressure fuel tube, suction hose, and return hose.
4. Unscrew the mounting nuts to remove the fuel pump and gauge assembly or pipe and gauge assembly.
5. Fuel gauge unit check. (Refer to GROUP 54 – Combination Meter.)

NOTE

If the inspection shows that the basic resistance and the height of float are out of the standard value, replace the gauge unit.

(Refer to P.13B-8.)

6. Install the fuel pump and gauge assembly or pipe and gauge assembly. Tighten the mounting nuts to the specified torque.

Specified torque: 2.5 ± 0.5 N·m

7. Connect the harness connector, high-pressure fuel tube, suction hose, and return hose.

Caution

- (1) Snap the high-pressure fuel hose or suction hose one-touch joint into place, then pull back slightly on the hose to assure it is securely fitted. However, the connection should have a play of approx. 3 mm.
 - (2) Insert the return hose for 20 – 30 mm for connection.
8. Install the rear seat cushion assembly. (Refer to GROUP 52A.)

FUEL TANK

REMOVAL AND INSTALLATION

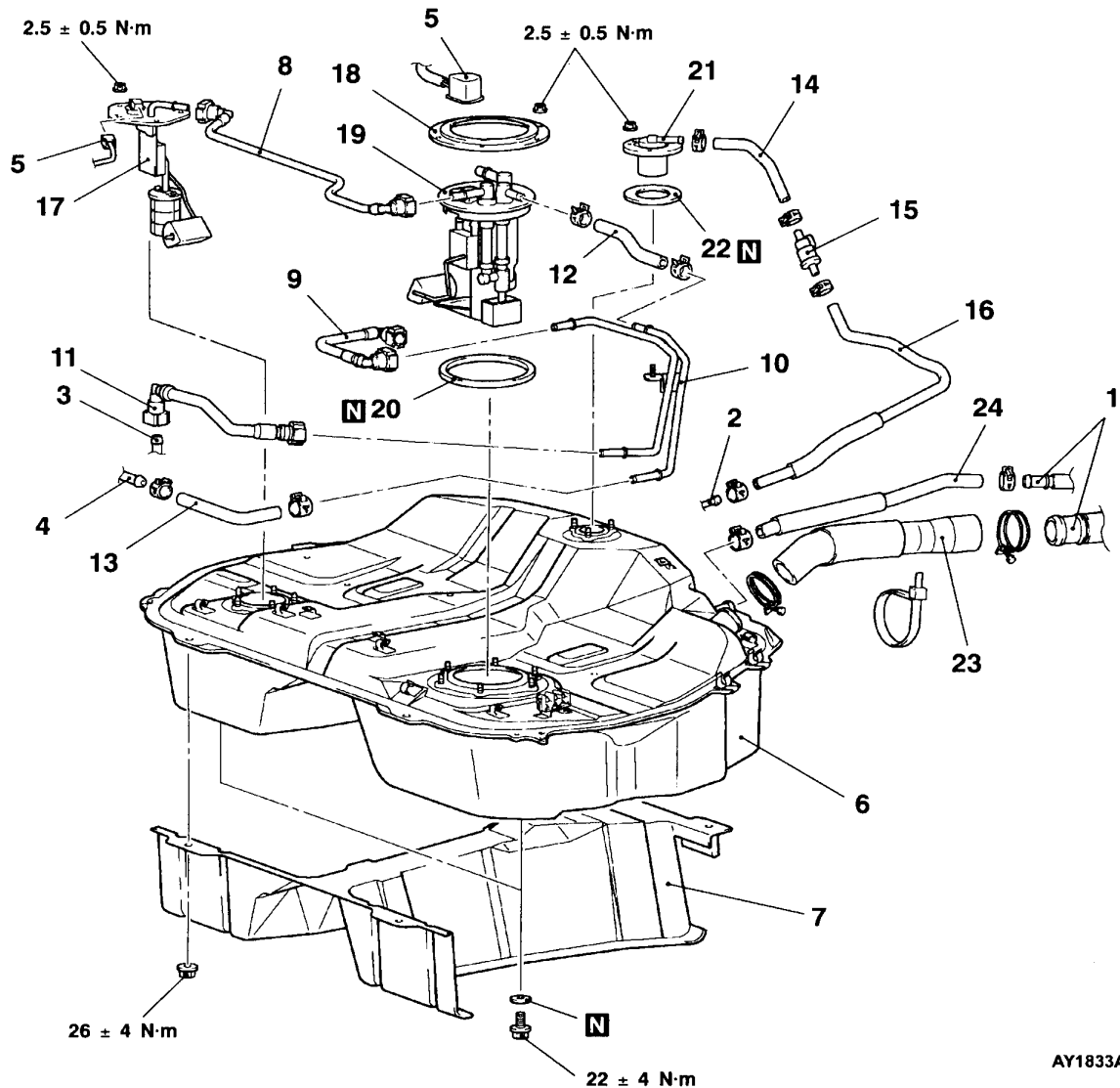
Pre-removal Operation

- Draining Fuel
- Fuel Pump Connector Disconnection (How To Reduce Fuel Pressure) (Refer to GROUP 13A – On-vehicle Service.)
- Center Exhaust Pipe Removal (Refer to GROUP 15.)

Post-installation Operation

- Center Exhaust Pipe Removal (Refer to GROUP 15.)
- Refilling Fuel
- Checking for Fuel Leaks

<Fuel tank assembly>



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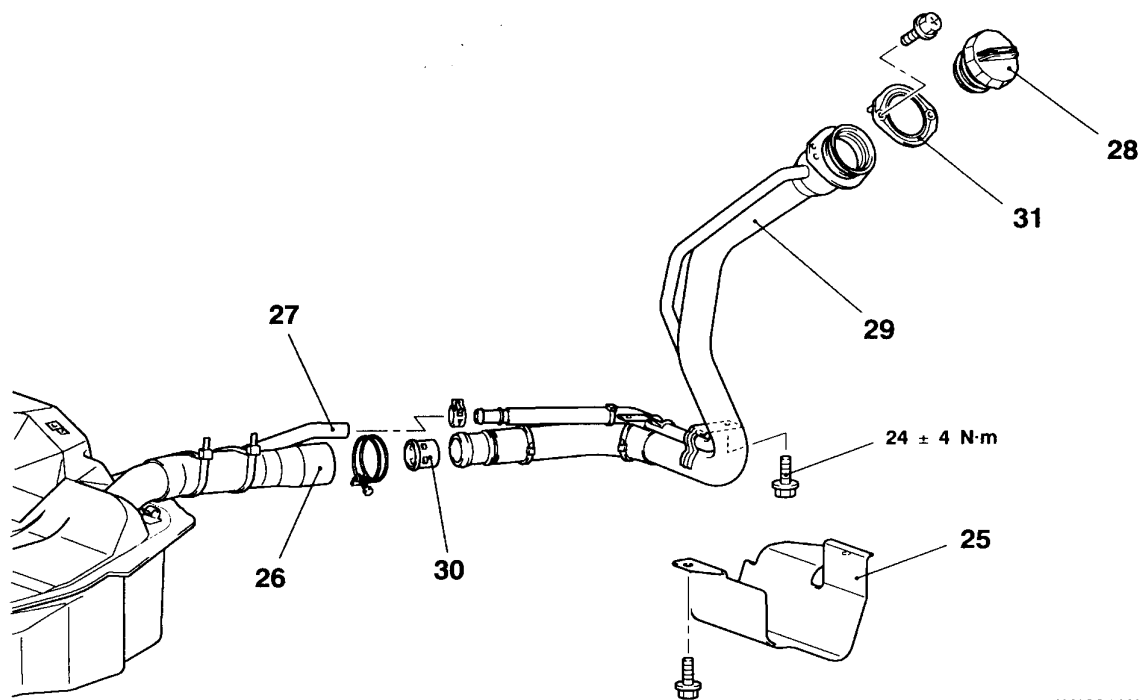
Removal steps <Fuel tank assembly>

1. Filler neck pipe, Filler neck vapour pipe connection
2. Vapour pipe connection
3. Main pipe connection
4. Return pipe connection
 - Parking brake cable clamp (LH) connection (Refer to GROUP 36.)
 - Rear wheel speed sensor (RH) connection (Refer to GROUP 35 – Wheel speed sensor.)
 - Rear wheel speed sensor harness connector connection (Refer to GROUP 35 – Wheel speed sensor.)
5. Harness connector connection
6. Fuel tank assembly
7. Fuel tank protector

- | | |
|-----|----------------------------------|
| ▶A◀ | 8. Suction hose |
| ▶A◀ | 9. High-pressure fuel hose |
| | 10. Fuel tank pipe assembly |
| ▶A◀ | 11. High-pressure fuel hose |
| ▶B◀ | 12. Fuel tank return hose |
| | 13. Return hose |
| | 14. Fuel tank vapour hose |
| | 15. Check valve |
| | 16. Vapour hose |
| | 17. Pipe and gauge assembly |
| | 18. Plate |
| | 19. Fuel pump and gauge assembly |
| | 20. Parking |
| | 21. Fuel cut off valve assembly |
| | 22. Parking |
| | 23. Filler neck hose |
| | 24. Filler neck vapour hose |



<Fuel filler neck assembly>

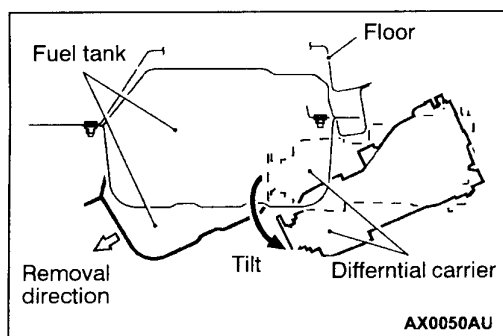


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Removal steps <Filler neck assembly>

- 25. Filler neck protector
- 26. Filler neck hose connection
- 27. Filler neck vapour hose connection
- 28. Fuel filler cap

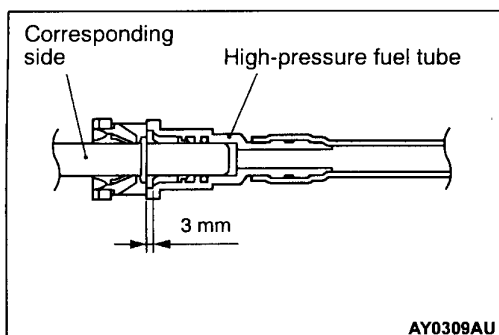
- 29. Fuel filler neck assembly
- 30. Fuel shut-off valve
- 31. Parking



AX0050AU

REMOVAL SERVICE POINT**◀▶ HARNESS CONNECTOR CONNECTION/FUEL TANK ASSEMBLY DISCONNECTION**

1. Remove the differential support member and tilt the differential carrier.
(Refer to GROUP 27B.)
2. Hold the fuel tank with a transmission jack and remove the nut connected to the fuel tank.
3. Tilt the fuel tank to allow access with a hand and disconnect the harness connector.
4. Remove the fuel tank in the tilting direction to avoid contact with the differential carrier.

**INSTALLATION SERVICE POINT****►A◄ HIGH-PRESSURE FUEL HOSE/SUCTION HOSE INSTALLATION****Caution**

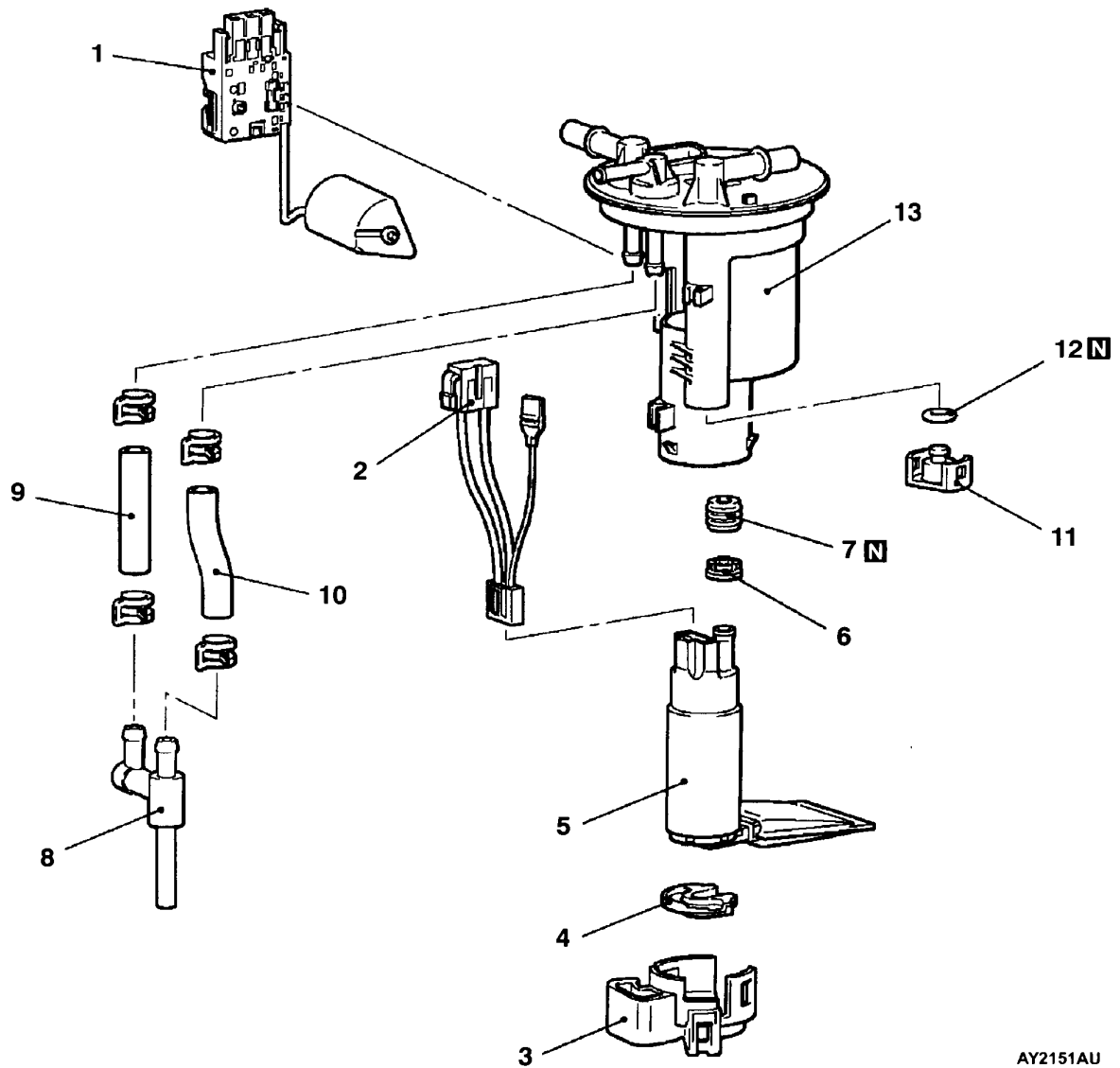
Snap the high-pressure fuel hose or suction hose one-touch joint into place, then pull back slightly on the hose to assure it is securely fitted. However, the connection should have a play of approx. 3 mm.

►B◄ FUEL TANK RETURN HOSE INSTALLATION**Caution**

Insert the return hose for 20 – 30 mm for connection.

DISASSEMBLY AND REASSEMBLY

<FUEL PUMP AND GAUGE ASSEMBLY>



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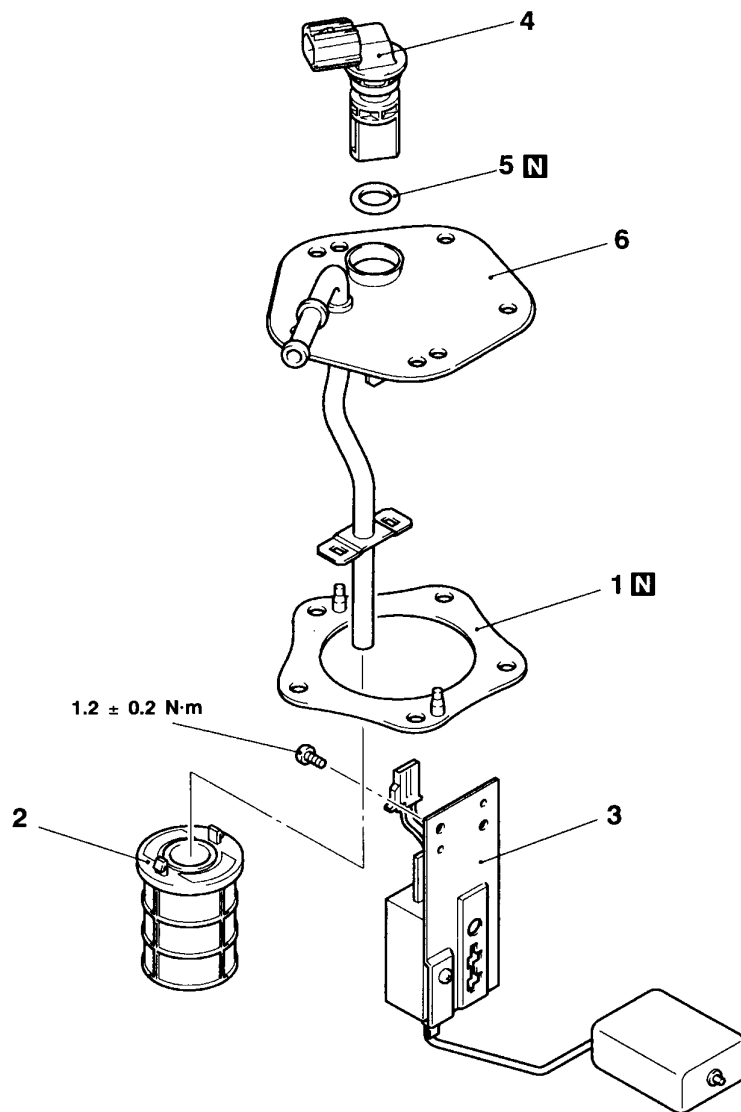
Removal steps

- | | |
|----------------------|--------------------------|
| 1. Fuel gauge unit | 8. Assist pump |
| 2. Gauge harness | 9. Fuel suction hose |
| 3. Bracket | 10. Fuel return hose |
| 4. Fuel pump cushion | 11. Cap |
| 5. Fuel pump | 12. O-ring |
| 6. Spacer | 13. Fuel filter assembly |
| 7. Grommet | |

▶A◀

▶A◀

<PIPE AND GAUGE ASSEMBLY>



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Removal steps

1. Packing
2. Filter
3. Gauge unit

- A◄
4. Connector
 5. O-ring
 6. Pipe assembly

INSTALLATION SERVICE POINT**►A◄ O-RING/GROMMET INSTALLATION**

Apply a fuel to O-ring and grommet before installing them, to prevent them from being damaged or twisted.