

SECTION 13A

MPI (Multipoint Injection)

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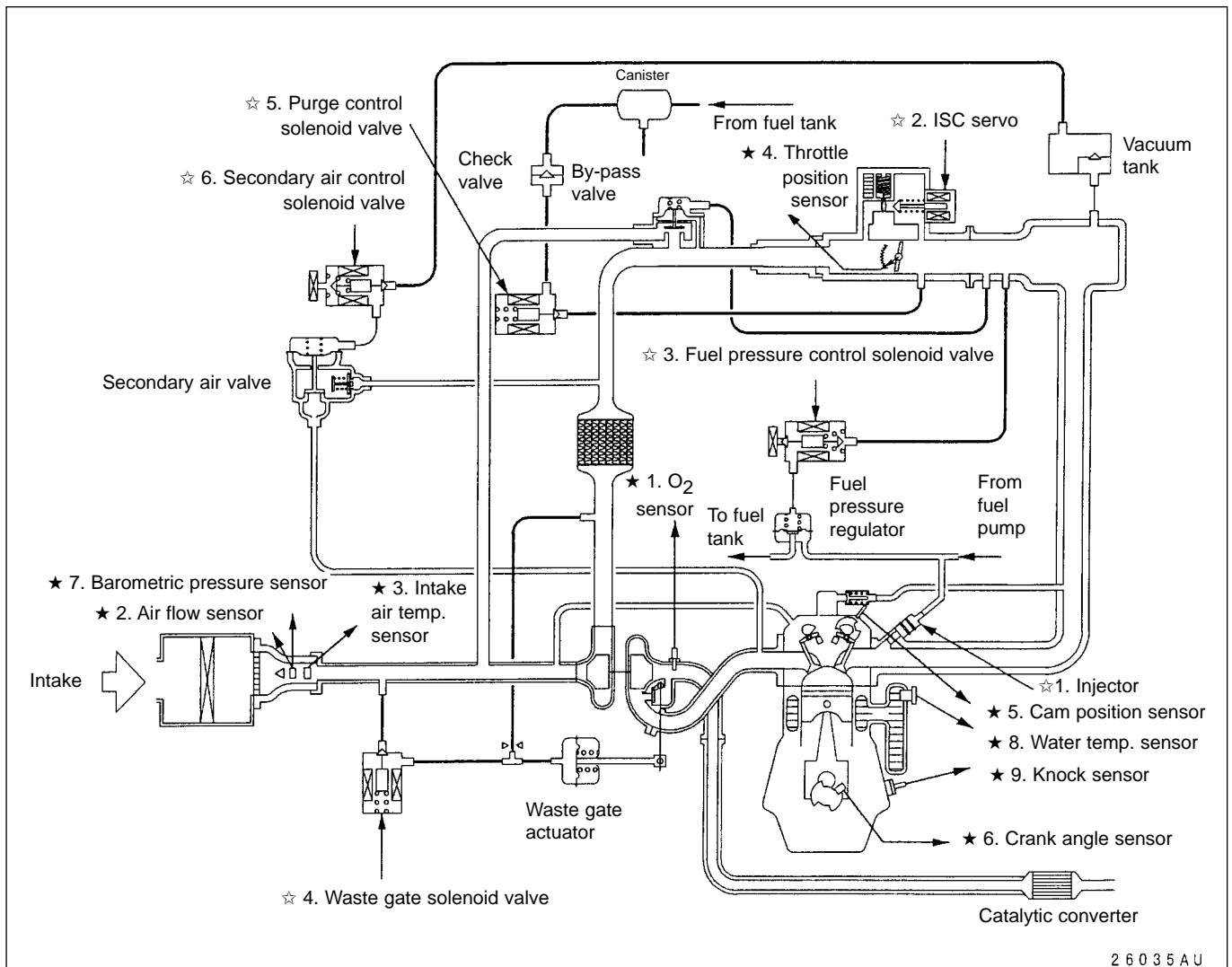
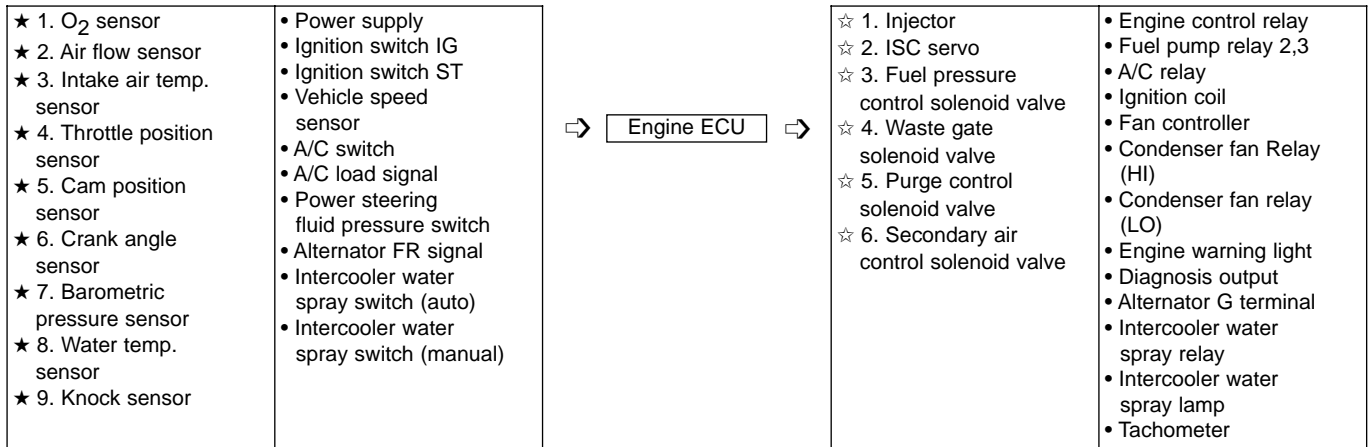
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General

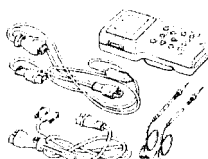
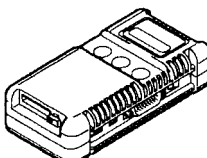
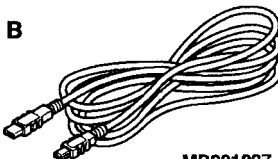
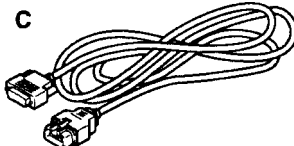
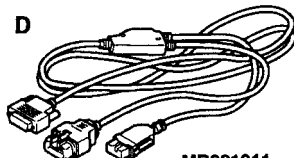
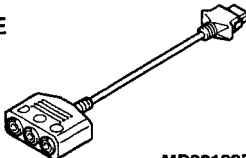
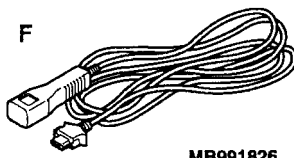
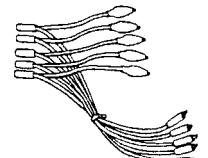
The following changes have been made to vehicles fitted with the 4G63-DOHC-T/C engine. Otherwise the system remains the same.

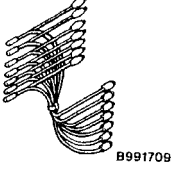
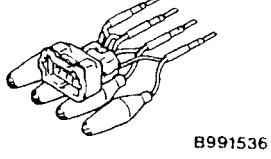
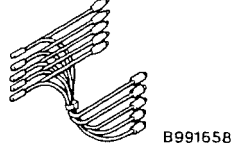
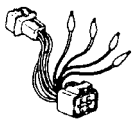

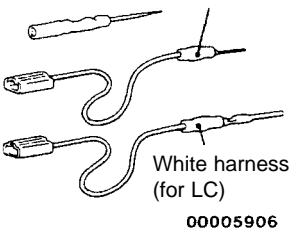
- The engine ECU has been changed
- An immobiliser system has been fitted
- A plated metal delivery pipe has been adopted
- Fuel pump relay mounting position has been changed

MPI SYSTEM DIAGRAM



Special Tools

Tool	Number	Name	Use
	MB991502	MUT-II sub-ASSY	MPI system inspection
<p>A</p>  <p>MB991824</p> <p>B</p>  <p>MB991827</p> <p>C</p>  <p>MB991910</p> <p>D</p>  <p>MB991911</p> <p>E</p>  <p>MB991825</p> <p>F</p>  <p>MB991826</p> <p>MB991955</p>	<p>MB991955</p> <p>A: MB991824</p> <p>B: MB991827</p> <p>C: MB991910</p> <p>D: MB991911</p> <p>E: MB991825</p> <p>F: MB991826</p>	<p>MUT-III sub-ASSY</p> <p>A: V.C.I. (Vehicle Communication Interface)</p> <p>B: USB cable</p> <p>C: MUT-III main harness B (for use on vehicles that have not adopted CAN communication)</p> <p>D: MUT-III main harness B (for use on vehicles that have not adopted CAN communication)</p> <p>E: Adapter for taking measurements</p> <p>F: Trigger harness</p>	
	MB991348	Test harness set	Inspection using oscilloscope

Tool	Number	Name	Use
 B991709	MB991709	Test harness	<ul style="list-style-type: none"> • Troubleshooting voltage measurement • Inspection using an oscilloscope
 B991536	MB991536	TPS adjustment check harness	Troubleshooting voltage measurement
 B991658	MB991658	Test harness	Inspection using an oscilloscope
	MB998464	Test harness (4P, square)	Troubleshooting voltage measurement
	MD998478	Test harness (3P, triangular)	<ul style="list-style-type: none"> • Troubleshooting voltage measurement • Inspection using an oscilloscope
<p>Red harness (for DLI)</p>  <p>White harness (for LC)</p> <p>00005906</p>	MB991223	<p>Inspection harness set connector</p> <ul style="list-style-type: none"> • Pin contact pressure inspection harness • Commercial tester connection probe (for general connector) 	Terminal voltage measurement

TROUBLESHOOTING

1. Diagnosis Function

1-1. Engine warning light (engine check lamp)

Engine warning light checks have been changed.

Items that are linked to the engine warning light are:

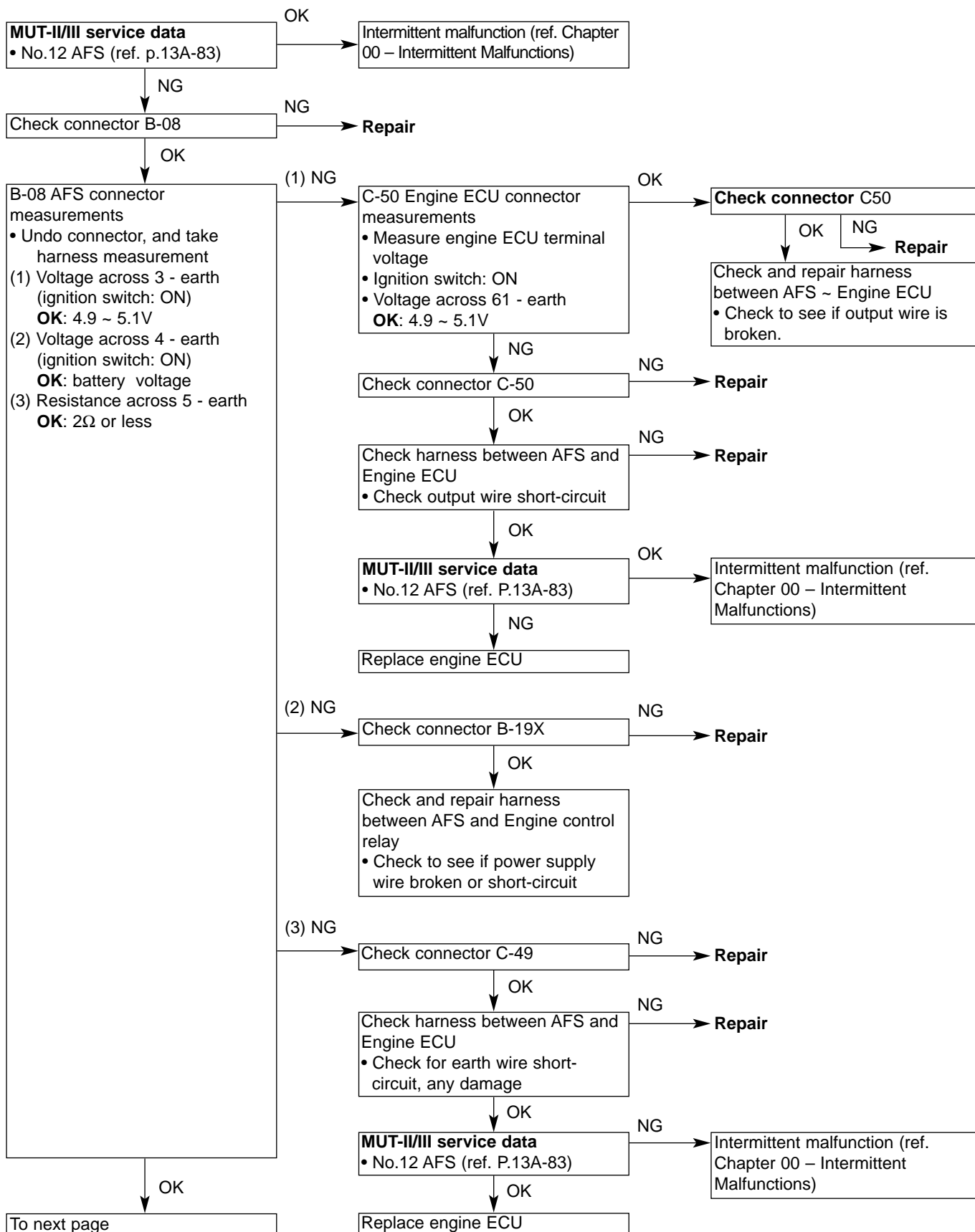
Engine ECU
Air flow sensor (AFS)
Intake air temperature sensor
Throttle position sensor (TPS)
Water temperature sensor
Crank angle sensor
Cam position sensor
Injector
Ignition coil (housing a power transistor)
Barometric pressure sensor
O ₂ sensor
O ₂ sensor heater
Fuel system abnormality
Immobiliser system
Knock sensor

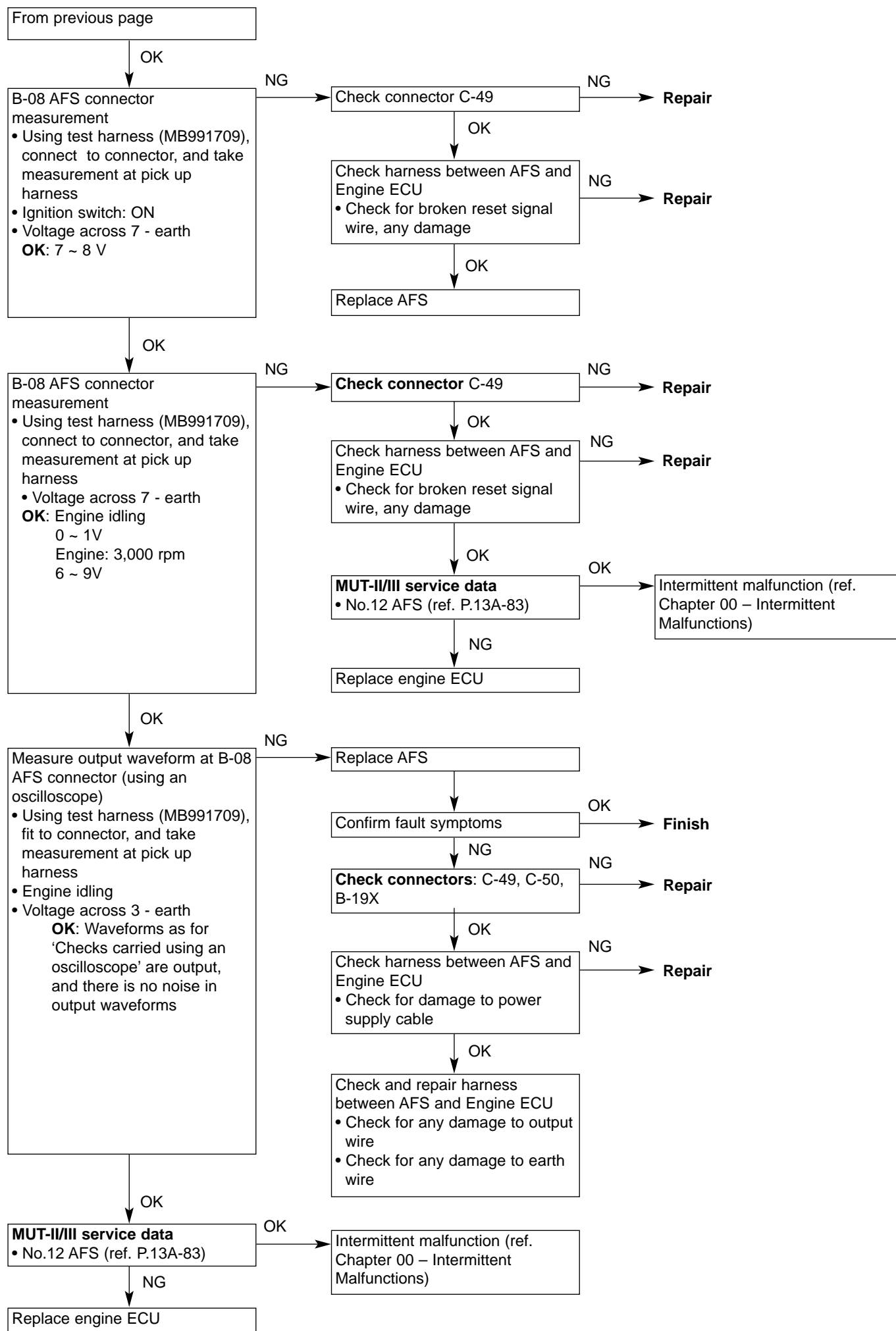
2. Table showing diagnosis codes

Code No.	Diagnosis Items	Page
PO100	Air flow sensor (AFS)	13A-6
PO105	Barometric pressure sensor	13A-8
PO110	Intake air temperature sensor system	13A-10
PO115	Water temperature sensor system	13A-11
PO120	Throttle position sensor (TPS) system	13A-13
PO130	O ₂ sensor system	13A-16
PO135	O ₂ sensor heater	13A-18
PO170	Fuel system abnormality	13A-19
PO201	No.1 injector system	13A-20
PO202	No.2 injector system	13A-21
PO203	No.3 injector system	13A-22
PO204	No.4 injector system	13A-23
PO300	Ignition coil (housing a power transistor) system	13A-24
PO325	Knock sensor system	13A-25
PO335	Crank angle sensor system	13A-26
PO340	Cam position sensor system	13A-28
PO500	Vehicle speed sensor system	13A-30
PO513	Immobiliser system	13A-31
P1500	Alternator FR terminal system	13A-32
P1603	Battery back-up line system	13A-33

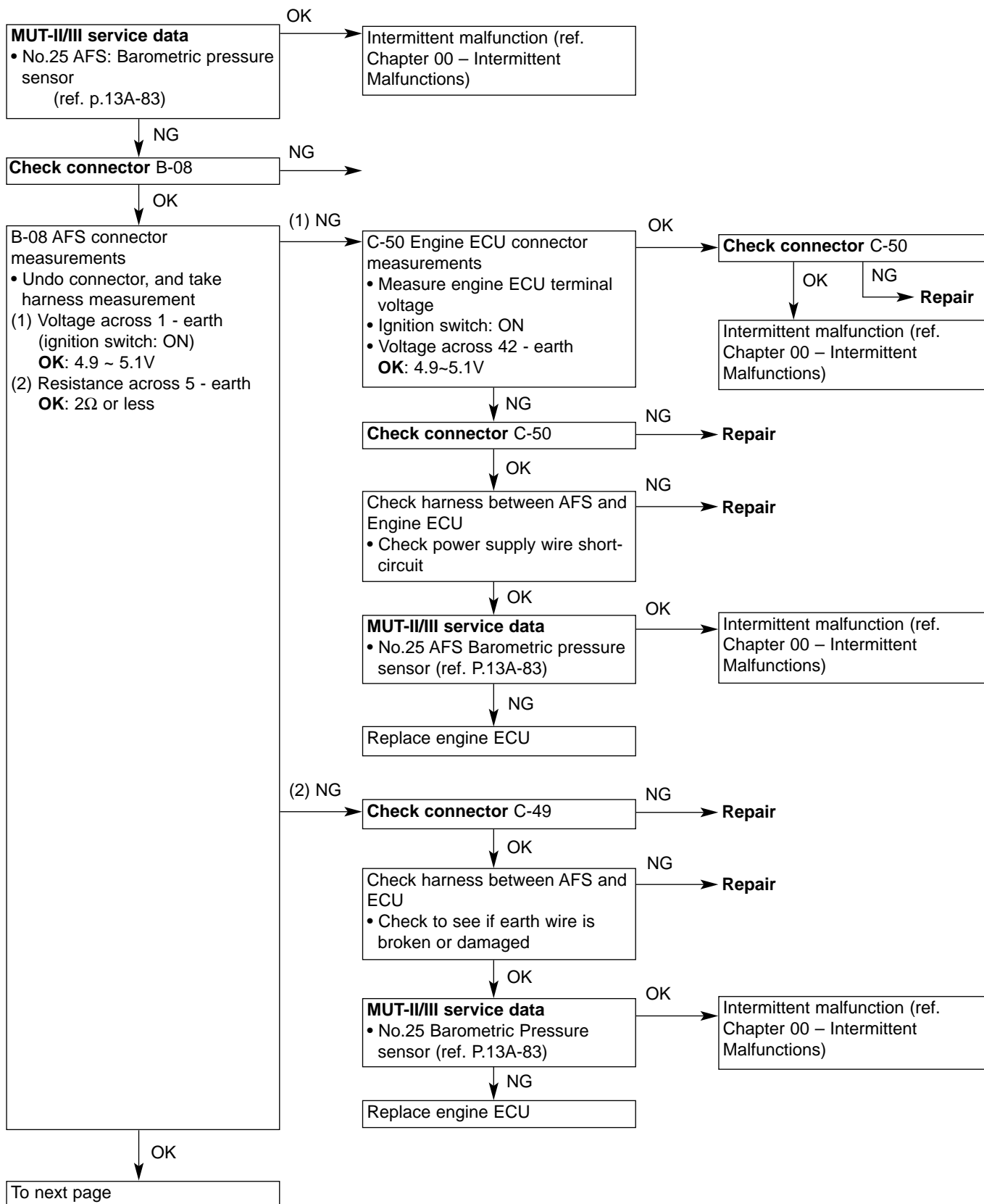
3. CHECKING PROCEDURES BY DIAGNOSIS CODE

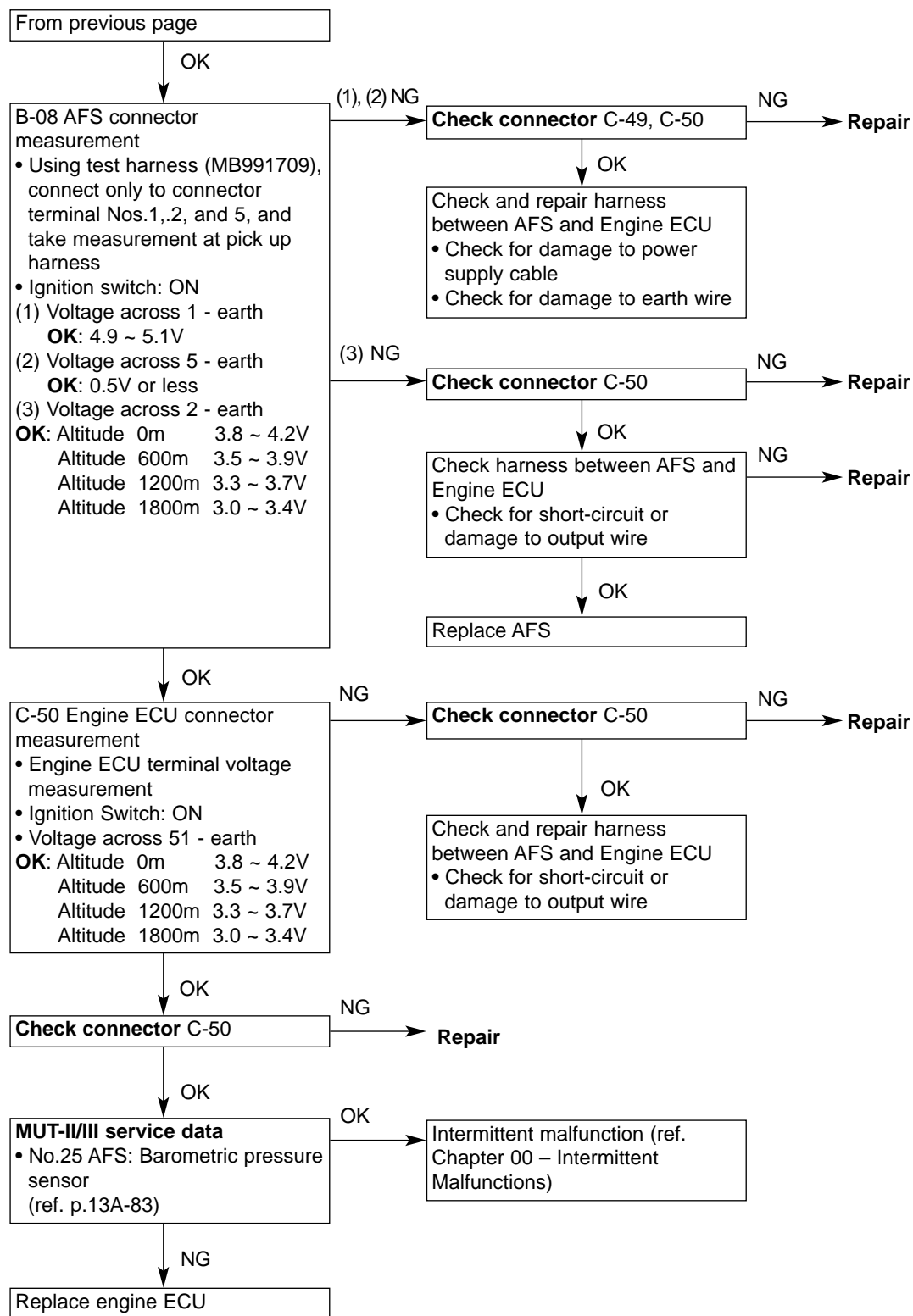
Code No. P0100 Air Flow Sensor (AFS) Checking Procedure	Probable Causes
Inspection Conditions • Engine speed: at least 500rpm Evaluation conditions • Sensor output frequency to 3Hz or less for 4 seconds, or continue at 10Hz or less	• AFS malfunction • AFS circuit broken, short-circuit, or poor connector contact • Engine ECU malfunction

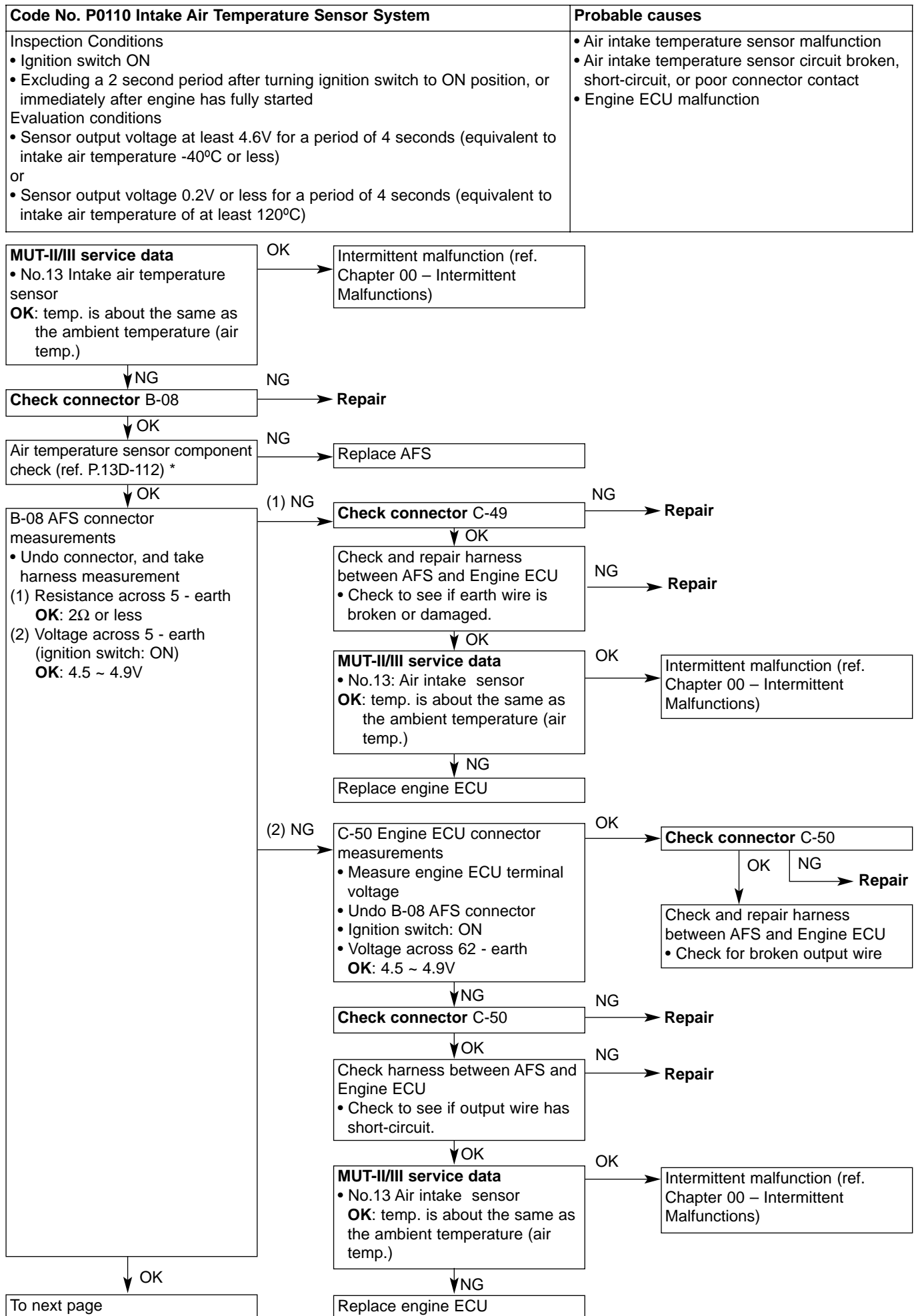


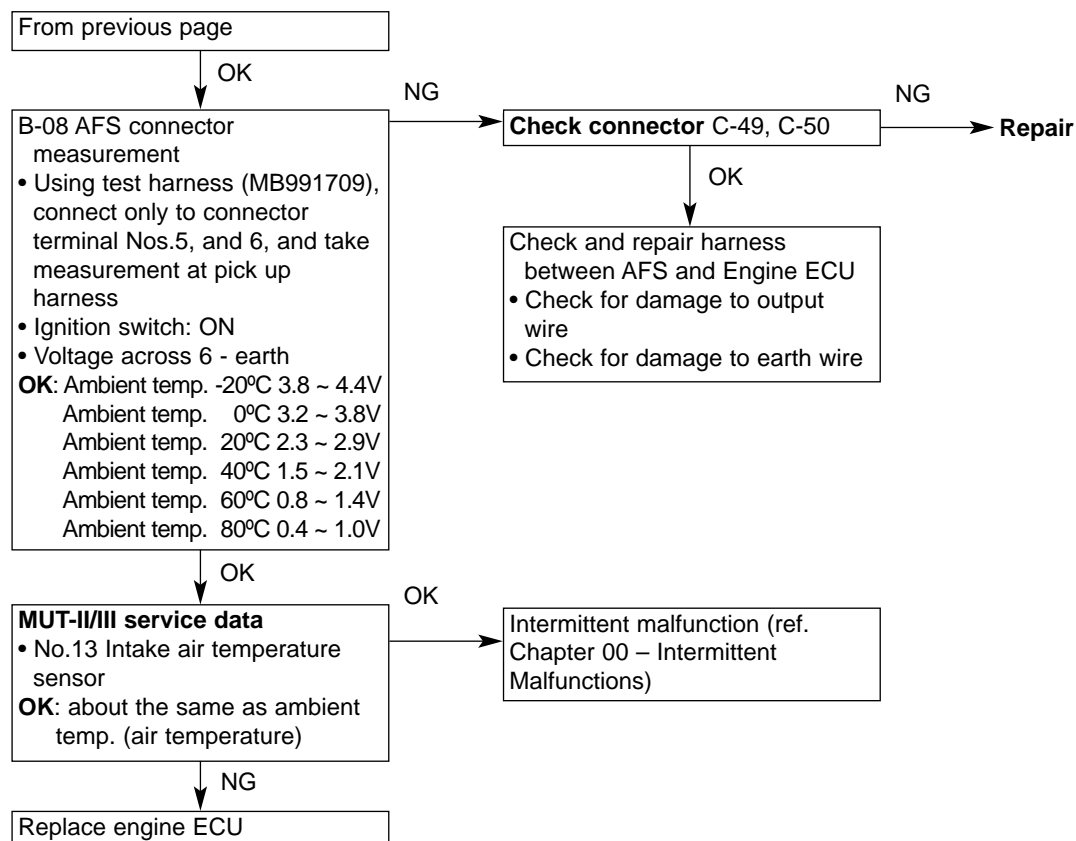


Code No. P0105 Barometric Pressure Sensor System	Probable causes
Inspection Conditions • Ignition switch ON • Excluding a 2 second period after turning ignition switch to ON position, or immediately after engine has fully started Evaluation conditions • Sensor output voltage at least 4.5V (equivalent to barometric pressure of at least 114kPa) or • Sensor output voltage 0.2V or less (equivalent to barometric pressure of 5kPa or less)	• Barometric pressure sensor malfunction • Barometric pressure sensor circuit broken, short-circuit, or poor connector contact • Engine ECU malfunction

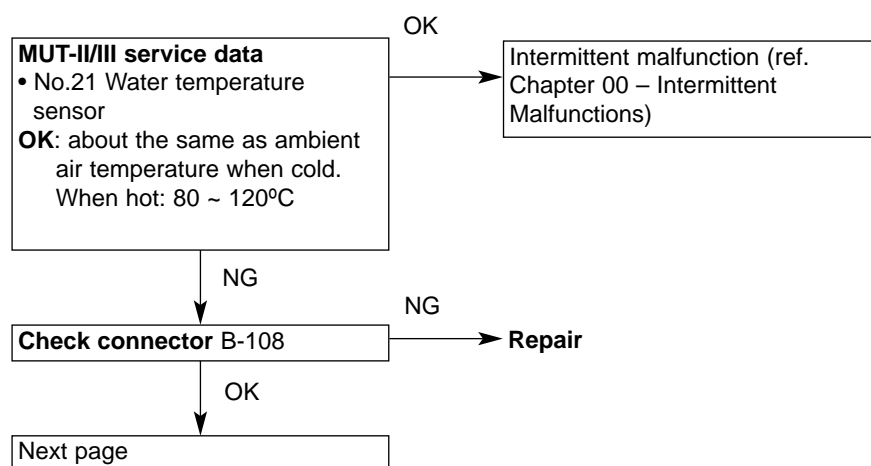


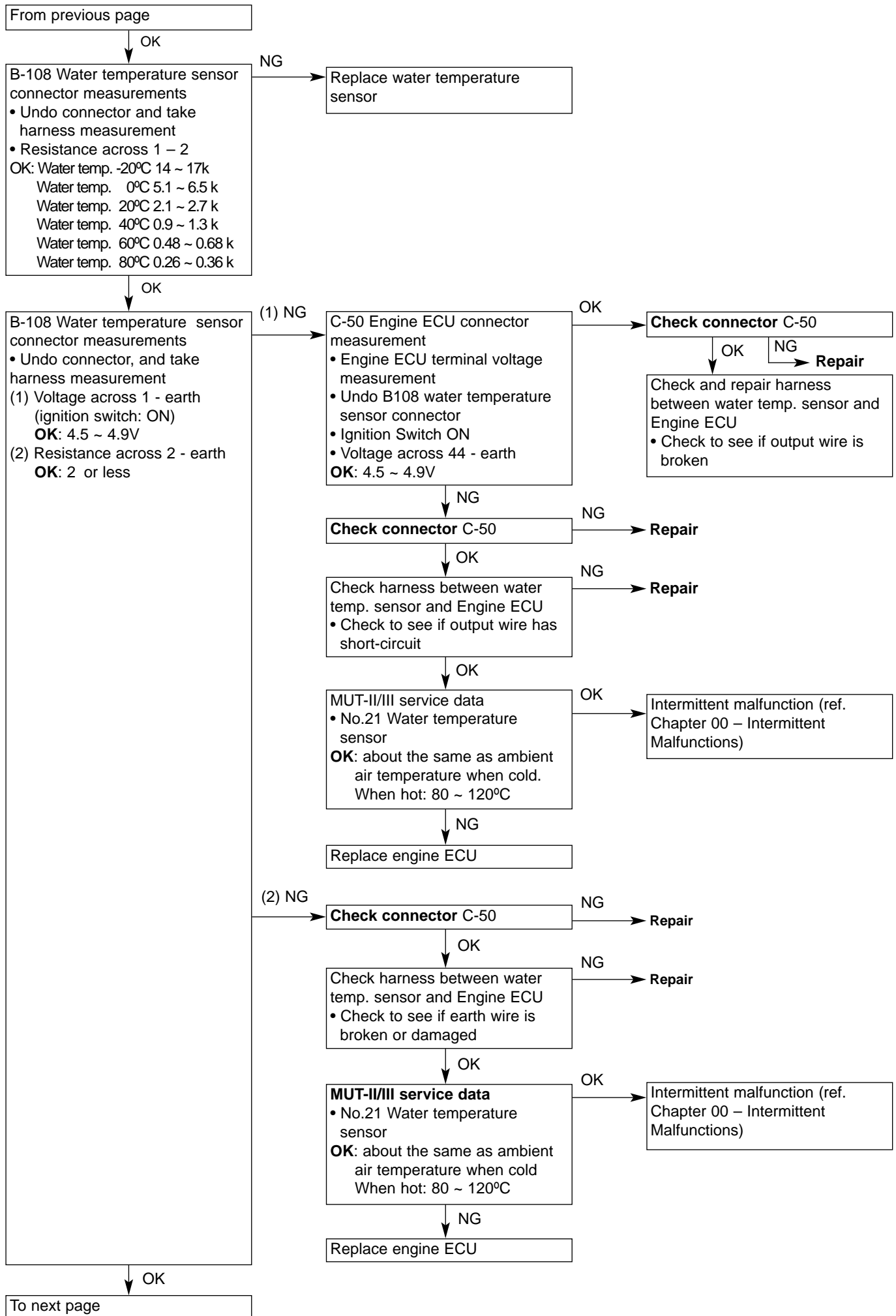


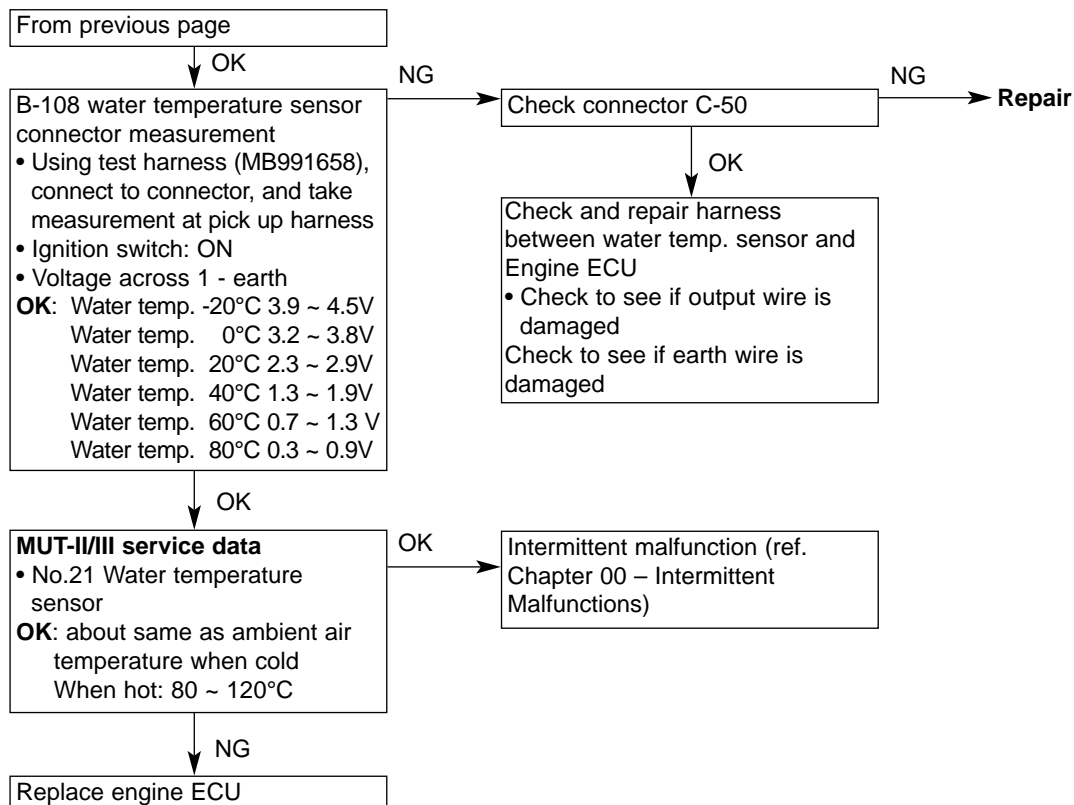




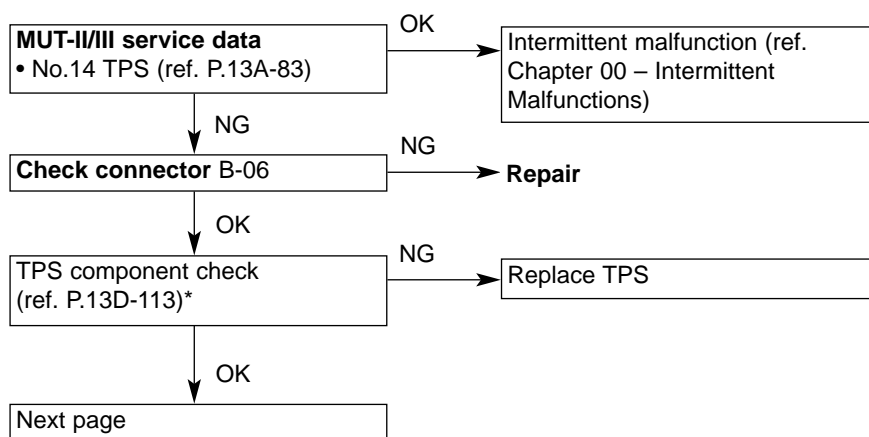
Code No. P0115 Water Temperature Sensor System	Probable causes
<p>Inspection Conditions</p> <ul style="list-style-type: none"> • Ignition switch: ON • Excluding a 2 second period after turning ignition switch to ON position, or immediately after engine has fully started <p>Evaluation conditions</p> <ul style="list-style-type: none"> • Sensor output voltage at least 4.6V for a period of 4 seconds (equivalent to water temperature -45°C or less) <p>or</p> <ul style="list-style-type: none"> • Sensor output voltage 0.1V or less for a period of 4 seconds (equivalent to water temperature of at least 140°C) 	<ul style="list-style-type: none"> • Water temperature sensor malfunction • Water temperature sensor circuit broken, short-circuit, or poor connector contact • Engine ECU malfunction
<p>Inspection Conditions</p> <ul style="list-style-type: none"> • Ignition switch ON • Engine speed approx. 50rpm or more <p>Evaluation conditions</p> <ul style="list-style-type: none"> • Rising from sensor output voltage 1.6V or less (equivalent to water temperature at least 40°C) condition, to 1.6V or more (equivalent to water temperature 40°C or less) • After that, for 5 minutes, sensor output voltage of at least 1.6V 	



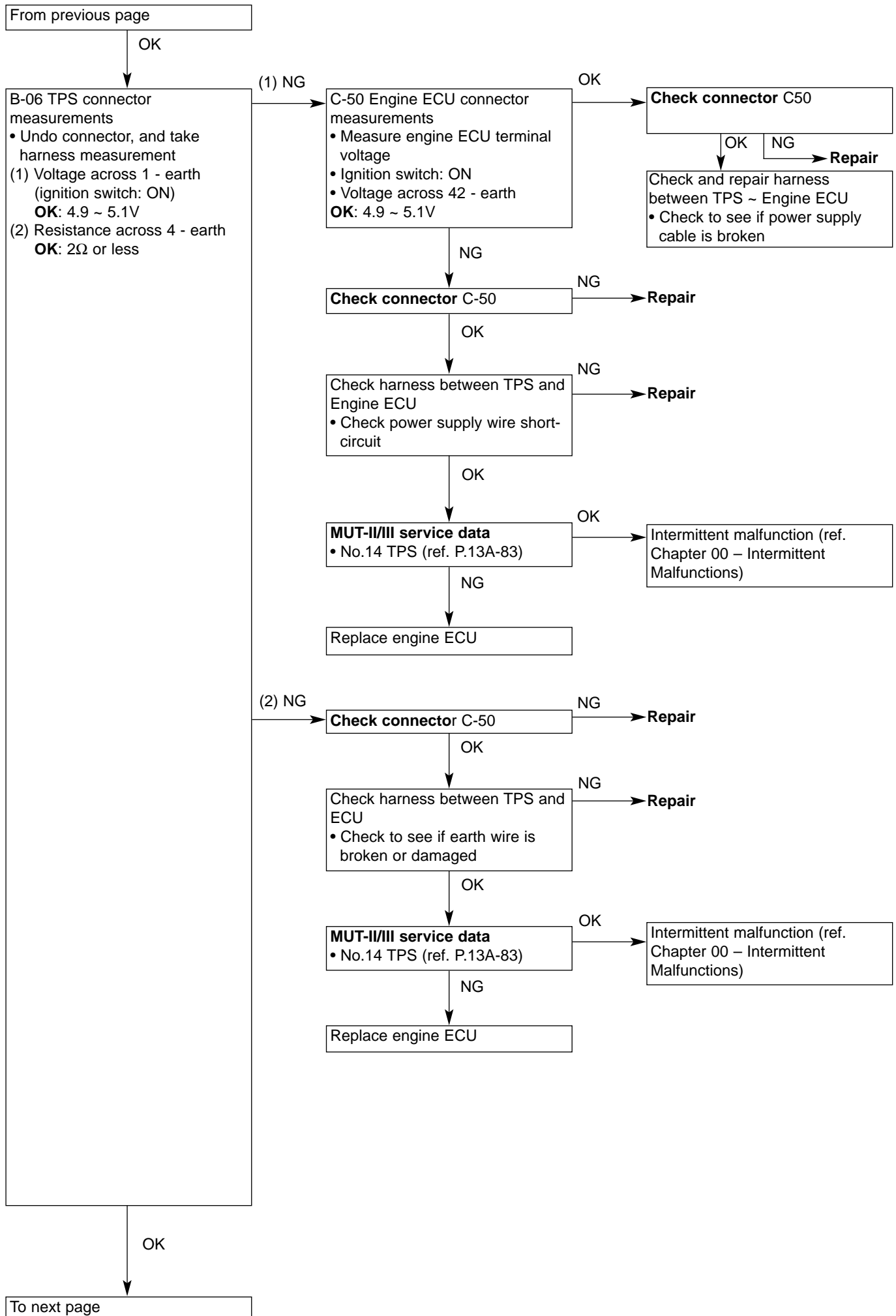


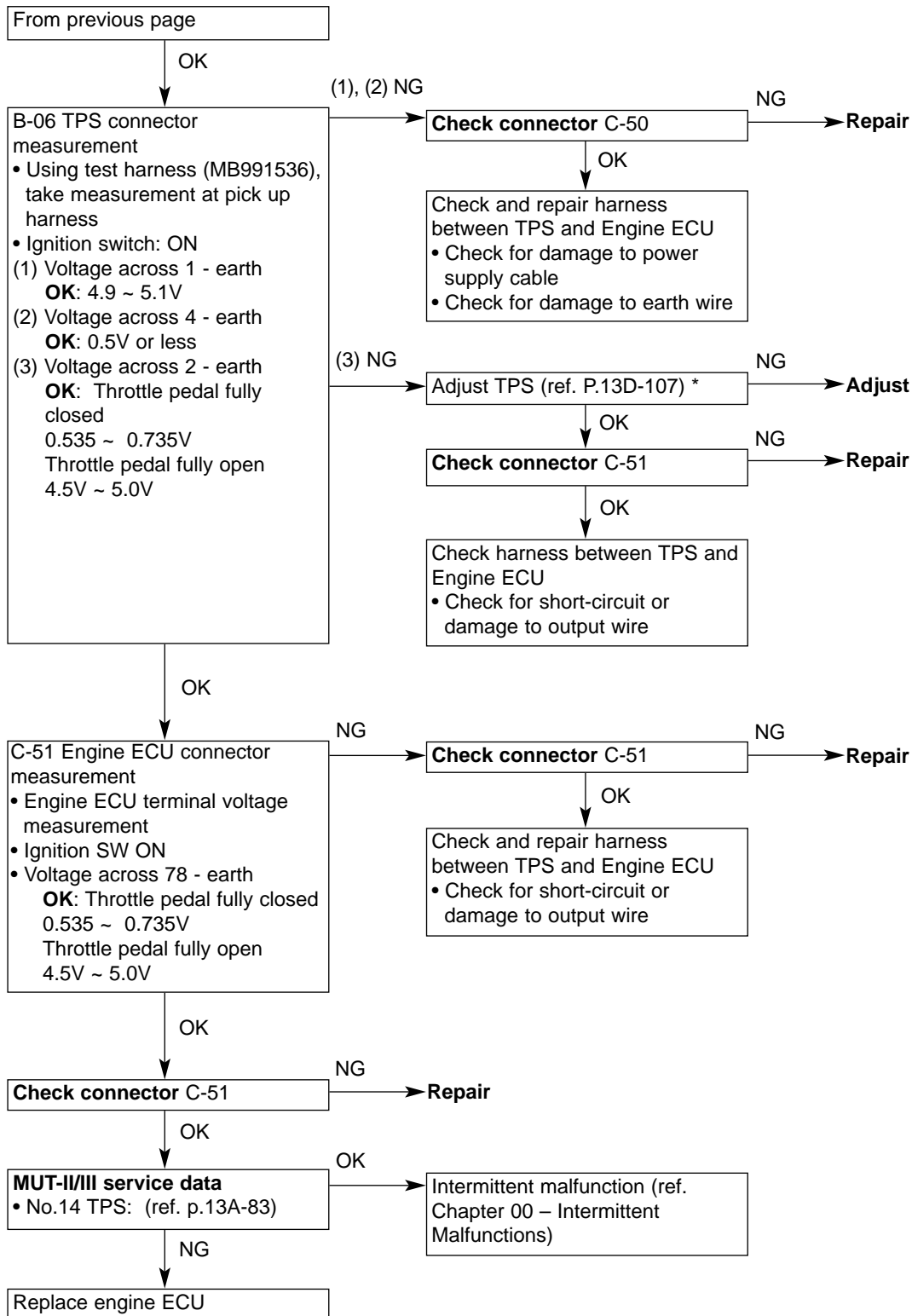


Code No. P0120 Throttle Position Sensor System	Probable causes
Inspection Conditions • Ignition switch: ON • Excluding a 2 second period after turning ignition switch to ON position, or immediately after engine has fully started Evaluation conditions • Sensor output voltage 0.2V or less for 2 seconds	• TPS malfunction • TPS circuit broken, short-circuit, or poor connector contact • Engine ECU malfunction
Inspection Conditions • Engine speed approx. 1000rpm or less • Volumetric efficiency 60% or less Evaluation conditions • Sensor output voltage at least 2.0V for 2 seconds	



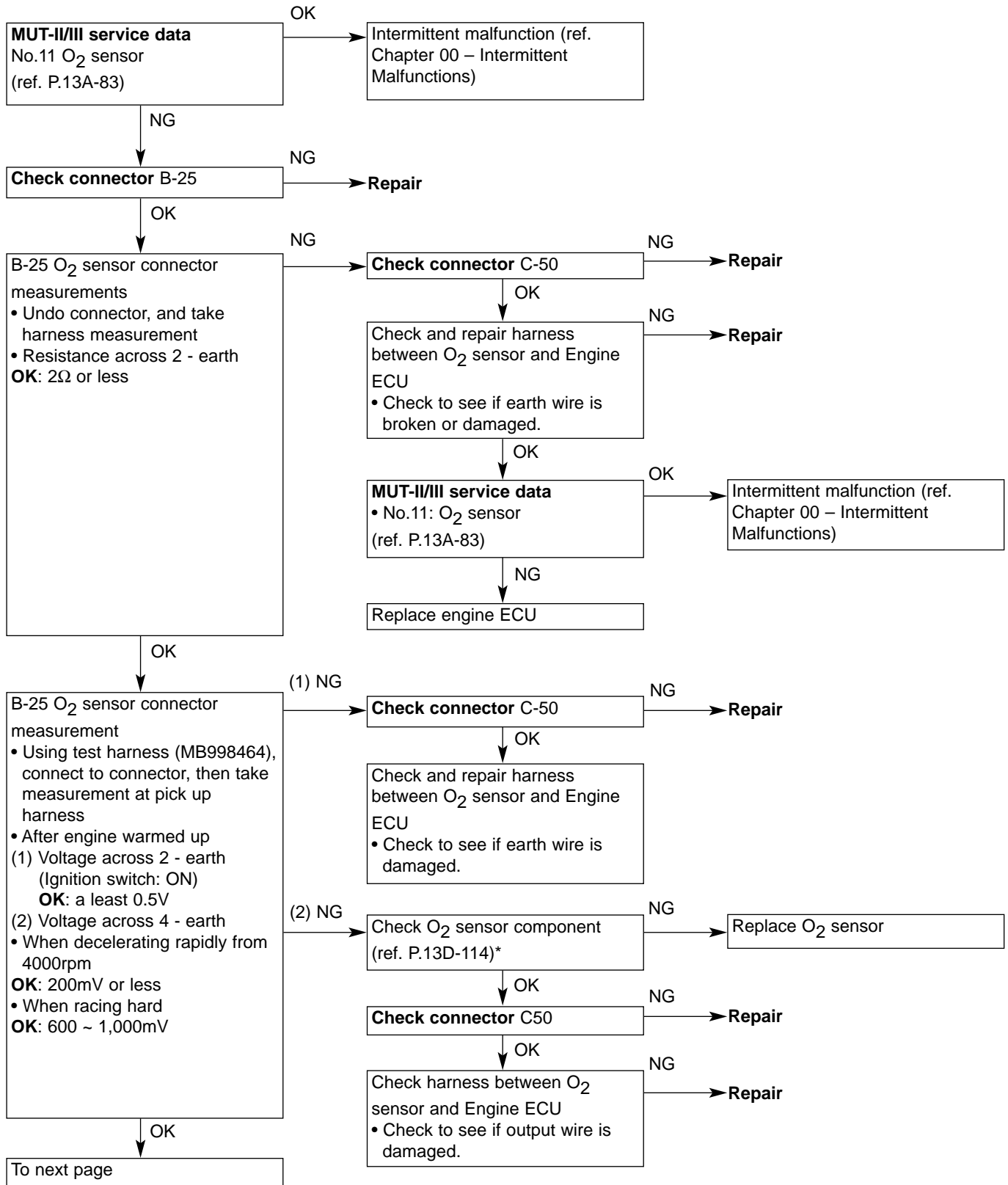
* Refer to '01 Lancer Evolution VII Workshop Manual (No.1036K02)



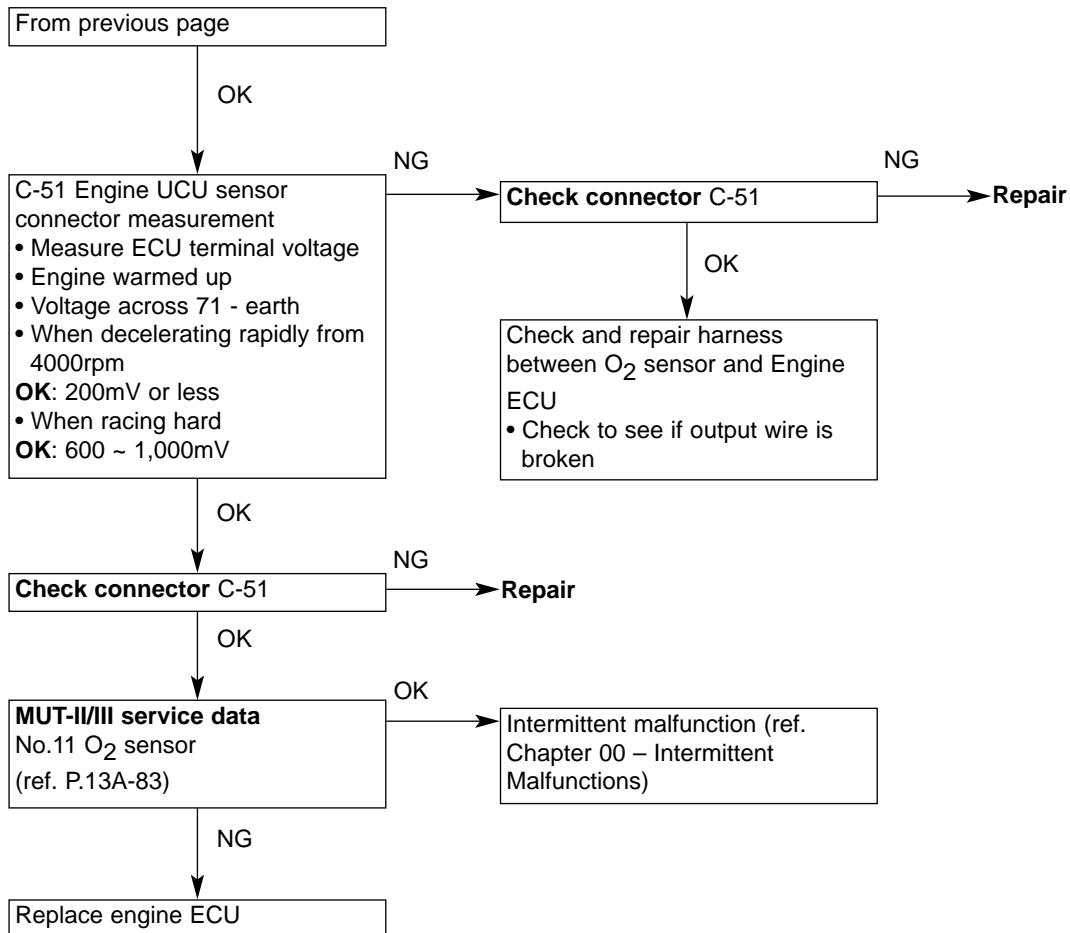


* Refer to '01 Lancer Evolution VII Workshop Manual (No.1036K02)

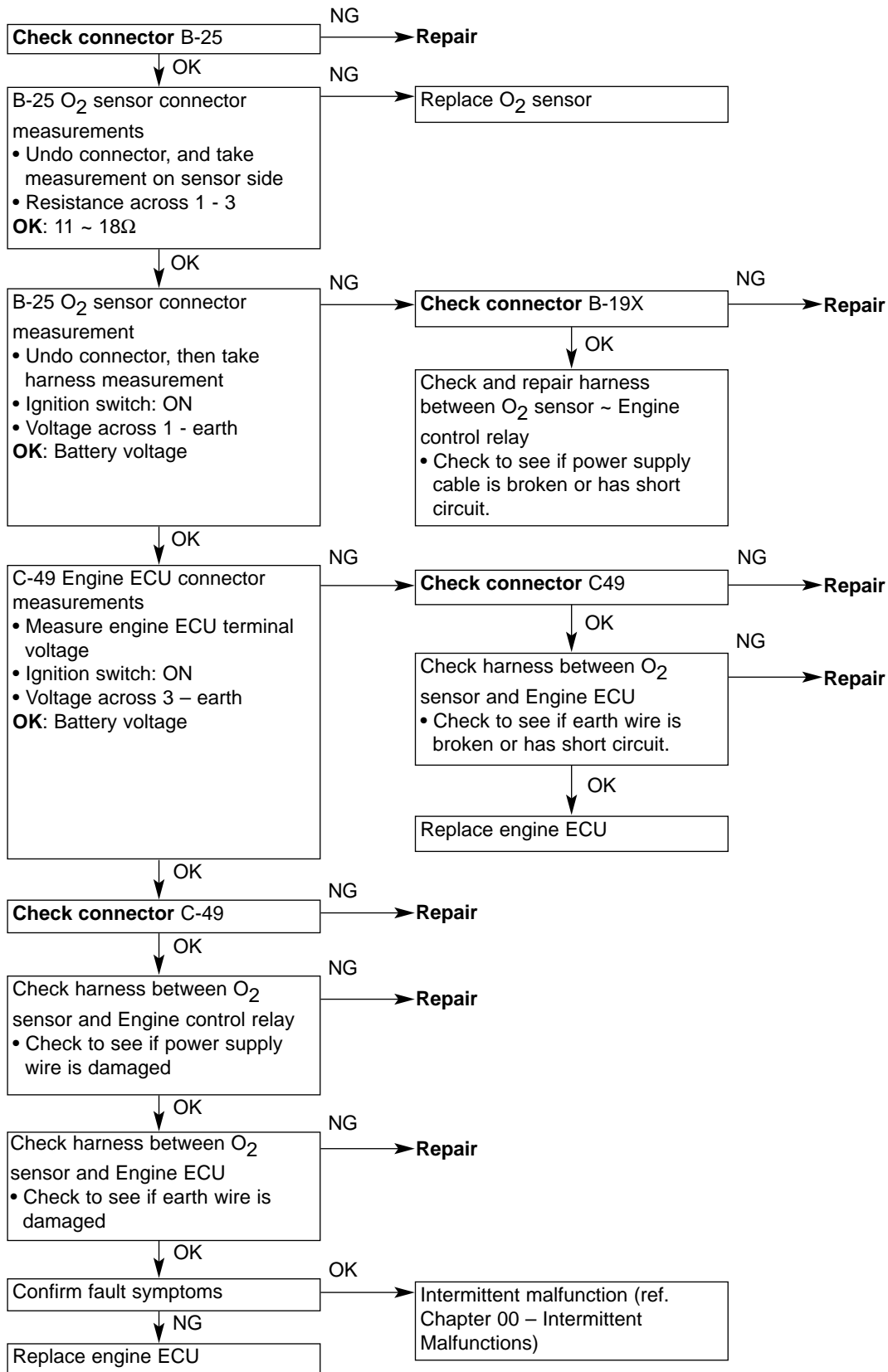
Code No. P0130 O ₂ Sensor System	Probable causes
Inspection Conditions <ul style="list-style-type: none"> • For at least 3 minutes after engine has fully started • Engine cooling water temperature at least 82°C • Volumetric efficiency at least 25% • Engine speed at least 1200rpm Evaluation conditions <ul style="list-style-type: none"> • With O₂ sensor output voltage 0.2V or less, and 5V applied to O₂- sensor inside engine ECU, sensor output voltage at least 4.5V 	<ul style="list-style-type: none"> • O₂ sensor malfunction • O₂ sensor circuit broken, short-circuit, or poor connector contact • Engine ECU malfunction



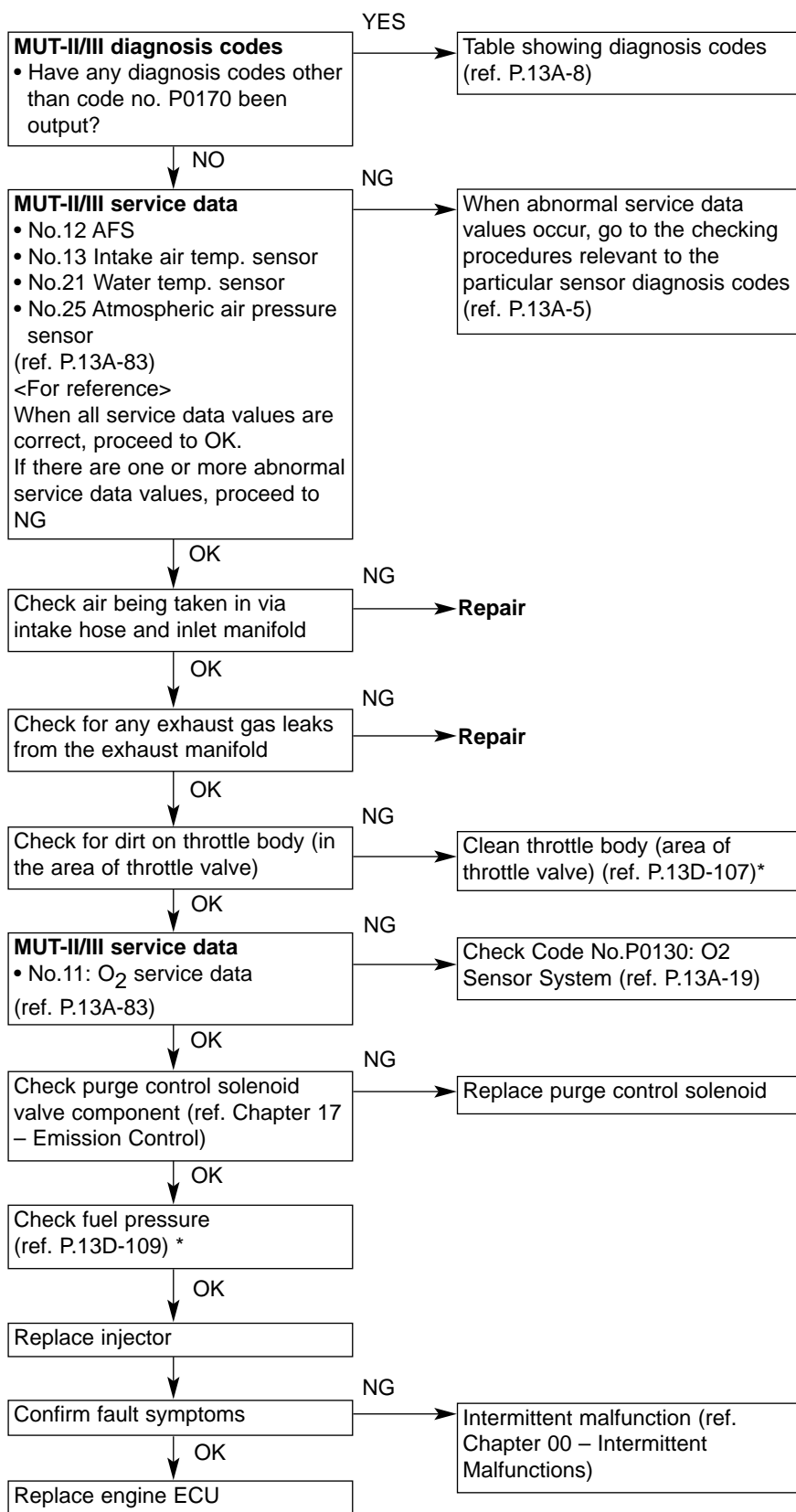
* Refer to '01 Lancer Evolution VII Workshop Manual (No.1036K02)



Code No. P0135 O ₂ Sensor Heater System	Probable causes
Inspection Conditions <ul style="list-style-type: none"> • Engine cooling water temperature approx. 20°C or more • O₂ sensor heater ON • Engine speed at least 50rpm • A/C relay: OFF, Radiator Fan: OFF • Battery voltage 11 ~ 16V Evaluation conditions <ul style="list-style-type: none"> • With O₂ sensor heater current 0.2A or less, or 3.5A or more, for 4 seconds 	<ul style="list-style-type: none"> • O₂ sensor heater malfunction • O₂ sensor heater circuit broken, short-circuit, or poor connector contact • Engine ECU malfunction

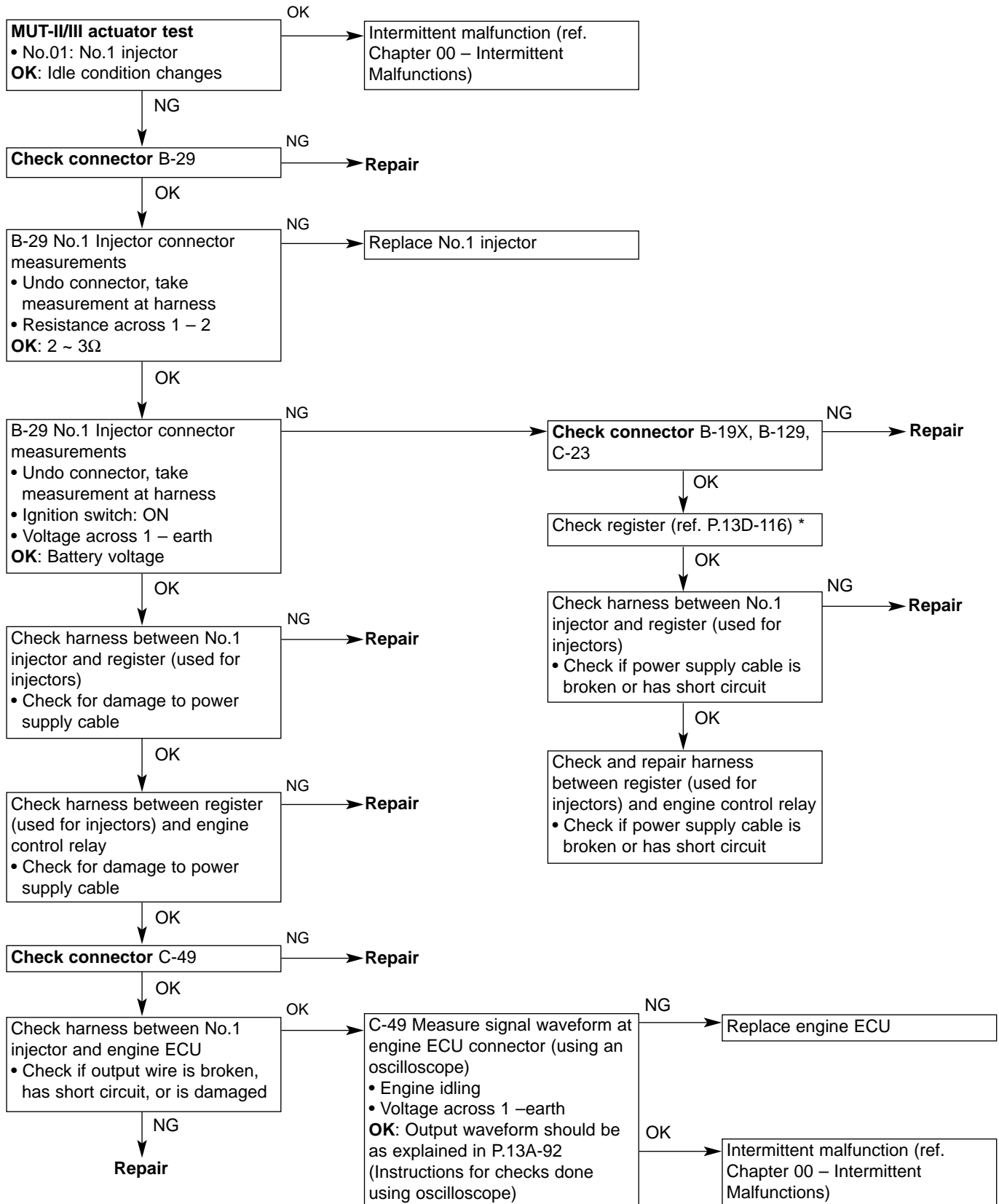


Code No. P0170 Fuel System Abnormality	Probable causes
Inspection Conditions • Engine Air-fuel ratio learning Evaluation conditions • At least 5 second duration when injected fuel correction value is abnormally low or • At least 5 second duration when injected fuel correction value is abnormally high	• Fuel supply system malfunction • O ₂ sensor malfunction • Intake air temperature sensor malfunction • Atmospheric air pressure sensor malfunction • Air flow sensor malfunction • Purge control solenoid valve malfunction • Engine ECU malfunction



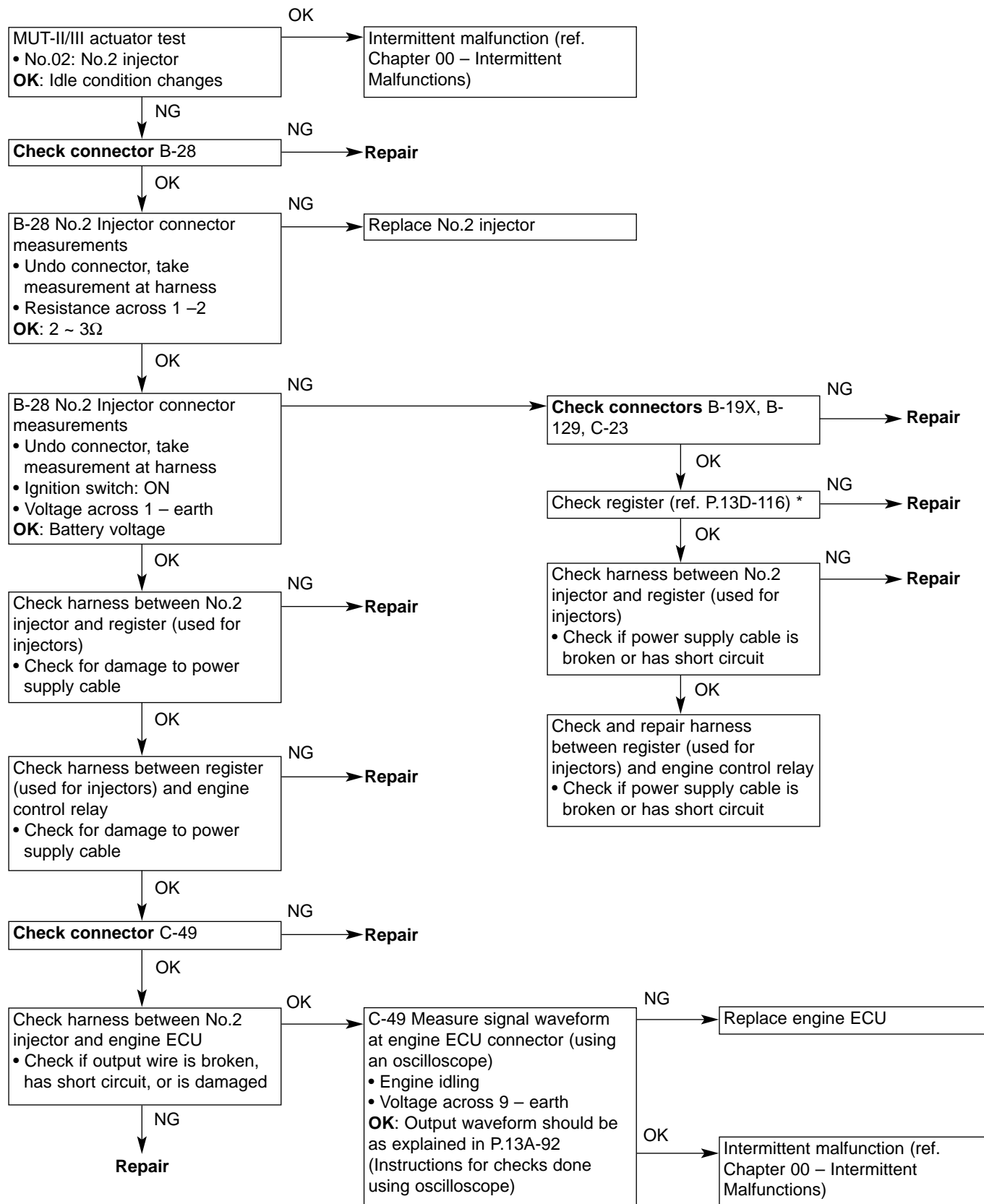
* Refer to '01 Lancer Evolution VII Workshop Manual (No.1036K02)

Code No.P0201 No.1 Injector System	Probable causes
Inspection Conditions <ul style="list-style-type: none"> • Engine speed: 50 ~ 1,000rpm • TPS output voltage 1.15V or less • Not during MUTII/III forced drive (actuator test) Evaluation conditions <ul style="list-style-type: none"> • Injector coil surge voltage not detected for a 2 second duration 	<ul style="list-style-type: none"> • No.1 injector malfunction • No.1 injector circuit broken, has short circuit, or poor connector contact • Engine ECU malfunction



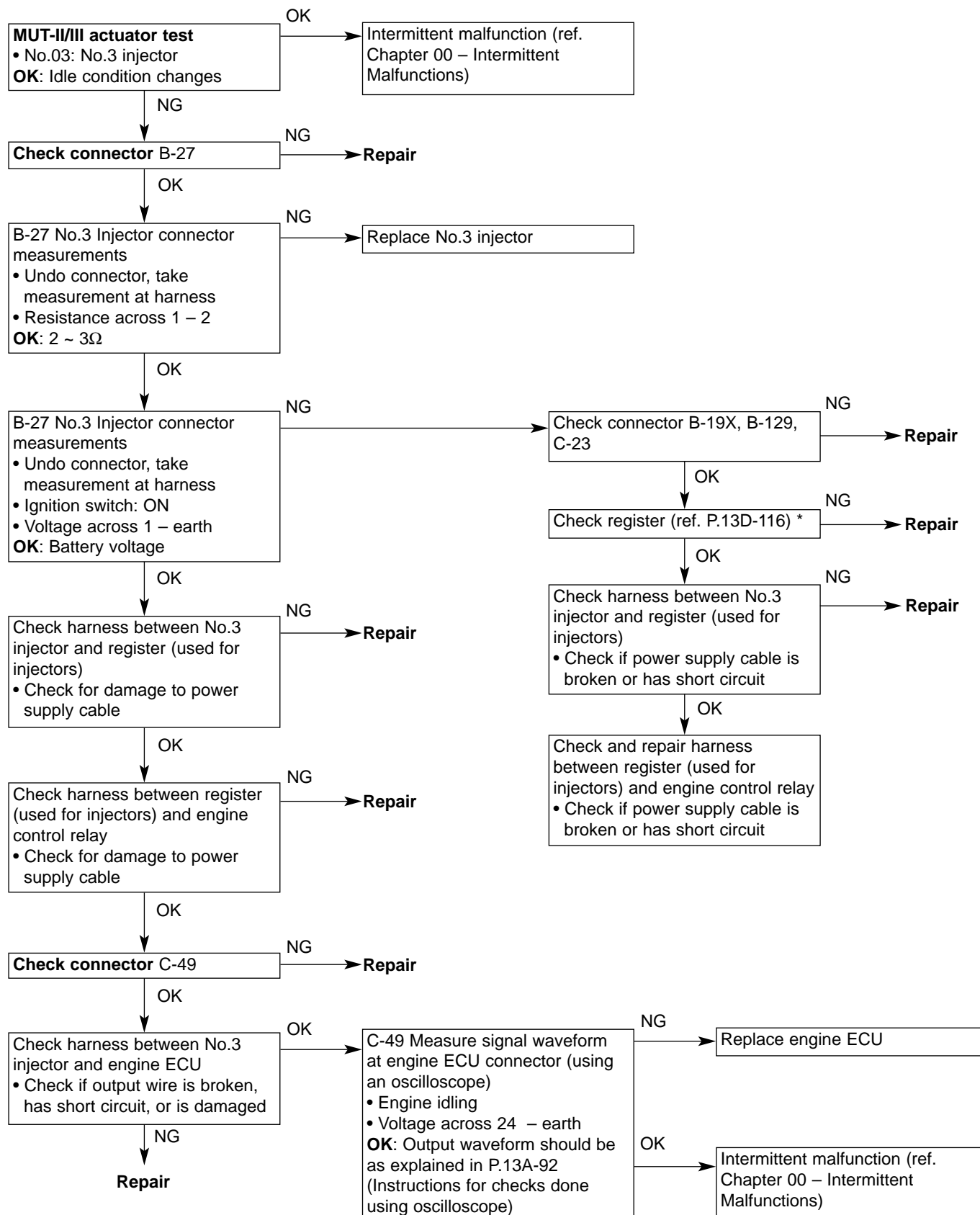
* Refer to '01 Lancer Evolution VII Workshop Manual (No.1036K02)

Code No.P0202 No.2 Injector System	Probable causes
Inspection Conditions <ul style="list-style-type: none"> • Engine speed: 50 ~ 1,000rpm or less • TPS output voltage 1.15V or less • Not during MUTII/III forced drive (actuator test) Evaluation conditions <ul style="list-style-type: none"> • Injector coil surge voltage not detected for a 2 second duration 	<ul style="list-style-type: none"> • No.2 injector malfunction • No.2 injector circuit broken, has short circuit, or poor connector contact • Engine ECU malfunction



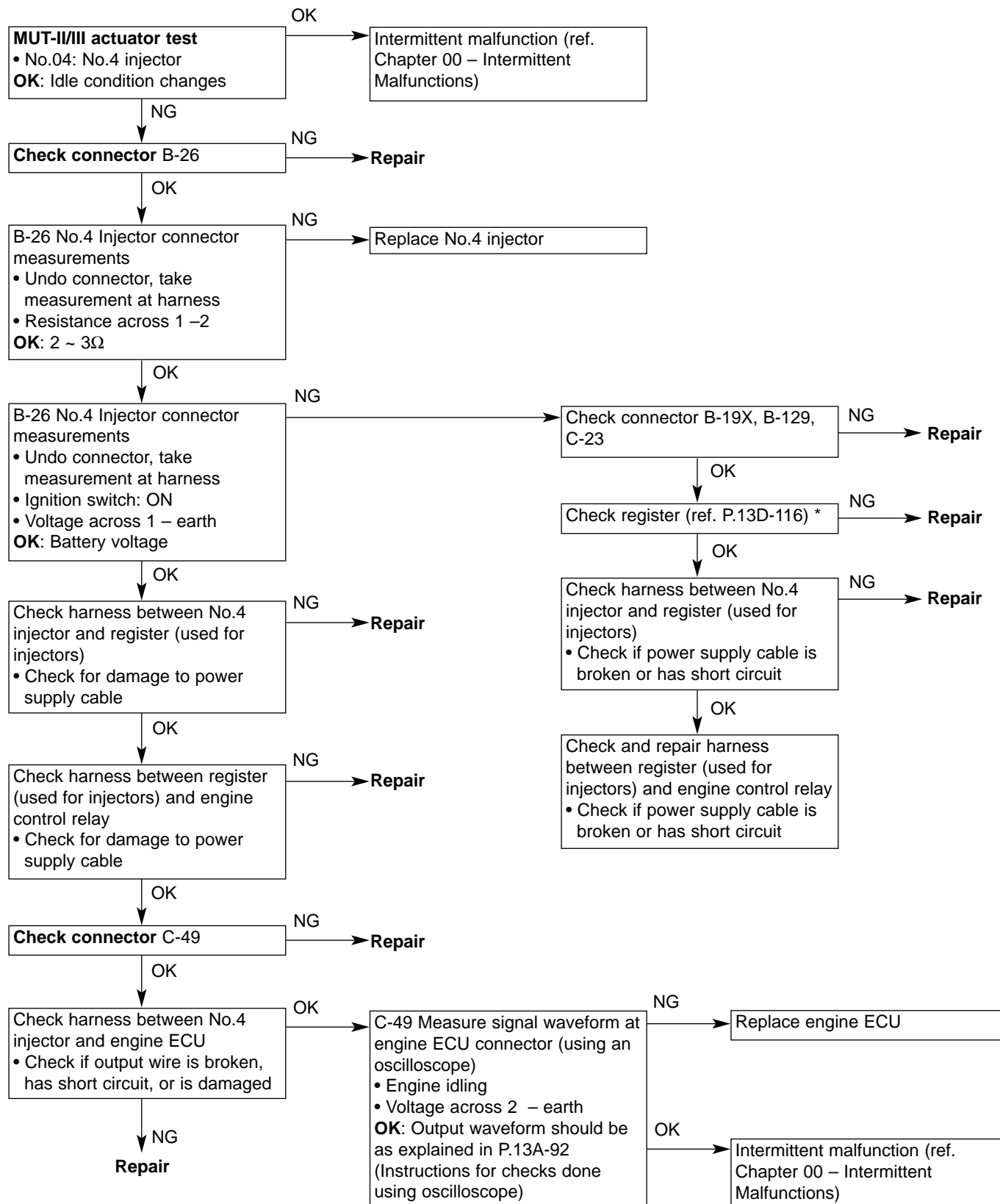
* Refer to '01 Lancer Evolution VII Workshop Manual (No.1036K02)

Code No.P0203 No.3 Injector System	Probable causes
Inspection Conditions <ul style="list-style-type: none"> • Engine speed: 50 ~ 1,000rpm or less • TPS output voltage 1.15V or less • Not during MUTII/III forced drive (actuator test) Evaluation conditions <ul style="list-style-type: none"> • Injector coil surge voltage not detected for a 2 second duration 	<ul style="list-style-type: none"> • No.3 injector malfunction • No.3 injector circuit broken, has short circuit, or poor connector contact • Engine ECU malfunction



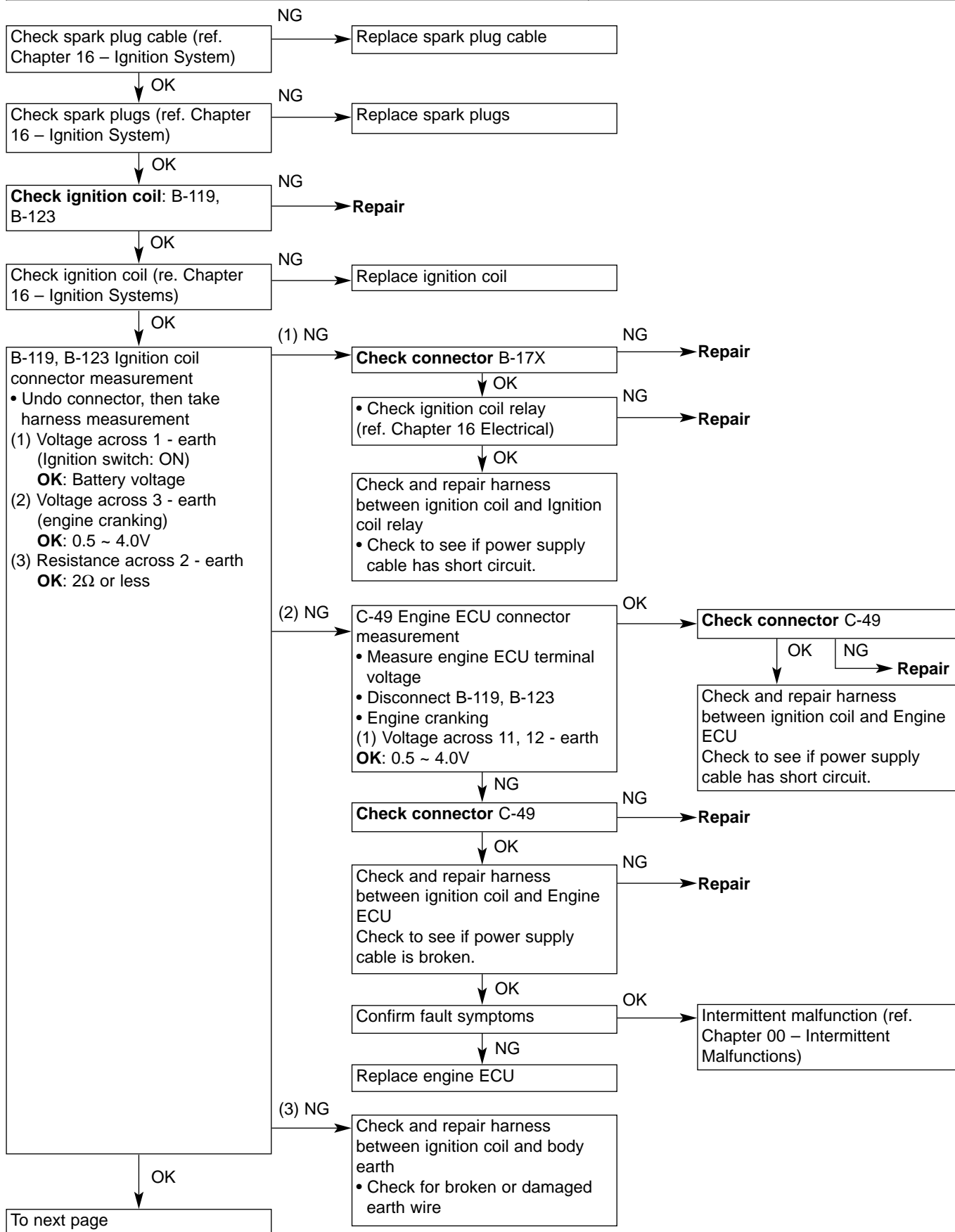
* Refer to '01 Lancer Evolution VII Workshop Manual (No.1036K02)

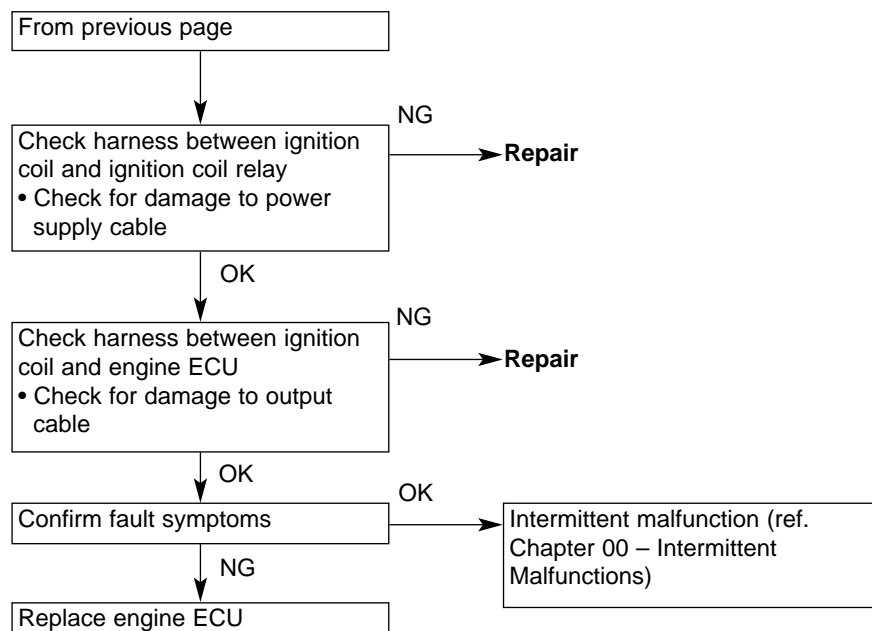
Code No.P0204 No.4 Injector System	Probable causes
Inspection Conditions <ul style="list-style-type: none"> • Engine speed: 50 ~ 1,000rpm or less • TPS output voltage 1.15V or less • Not during MUTII/III forced drive (actuator test) Evaluation conditions <ul style="list-style-type: none"> • Injector coil surge voltage not detected for a 2 second duration 	<ul style="list-style-type: none"> • No.4 injector malfunction • No.4 injector circuit broken, has short circuit, or poor connector contact • Engine ECU malfunction



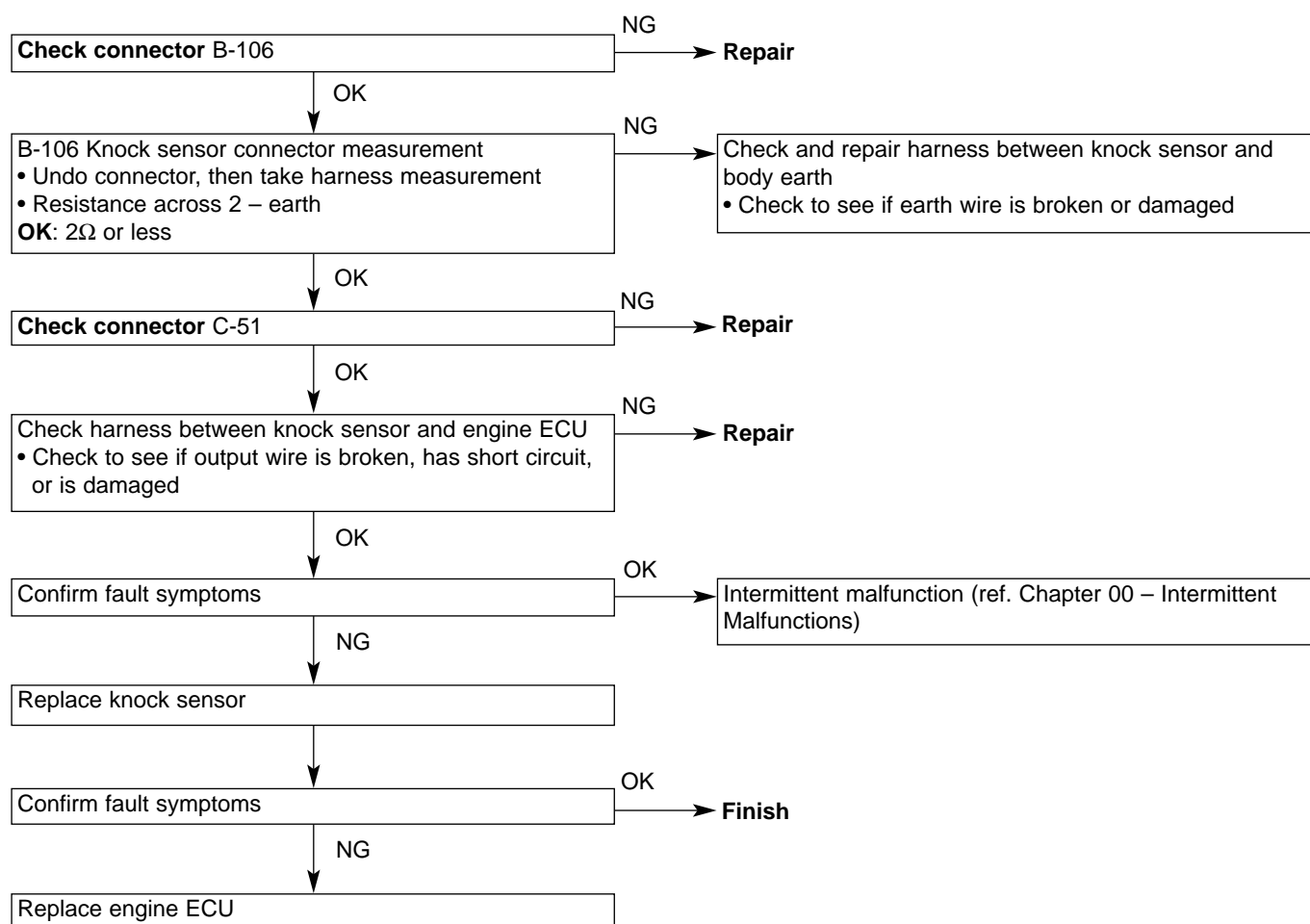
* Refer to '01 Lancer Evolution VII Workshop Manual (No.1036K02)

Code No.P0300 Injection Coil (housing a power transistor) System	Probable causes
Inspection Conditions <ul style="list-style-type: none"> • Engine speed: 1500 ~ 3,500rpm or less • Volumetric efficiency 40% - 80% • Not whilst engine is cranking Evaluation conditions <ul style="list-style-type: none"> • Detecting engine speed abnormalities caused by misfiring, using crank angle sensor (one of the two coils is for fuel) 	<ul style="list-style-type: none"> • Ignition coil malfunction • Spark plug malfunction • Spark plug cable malfunction • Ignition primary circuit broken, has a short circuit, or poor connector contact • Engine ECU malfunction

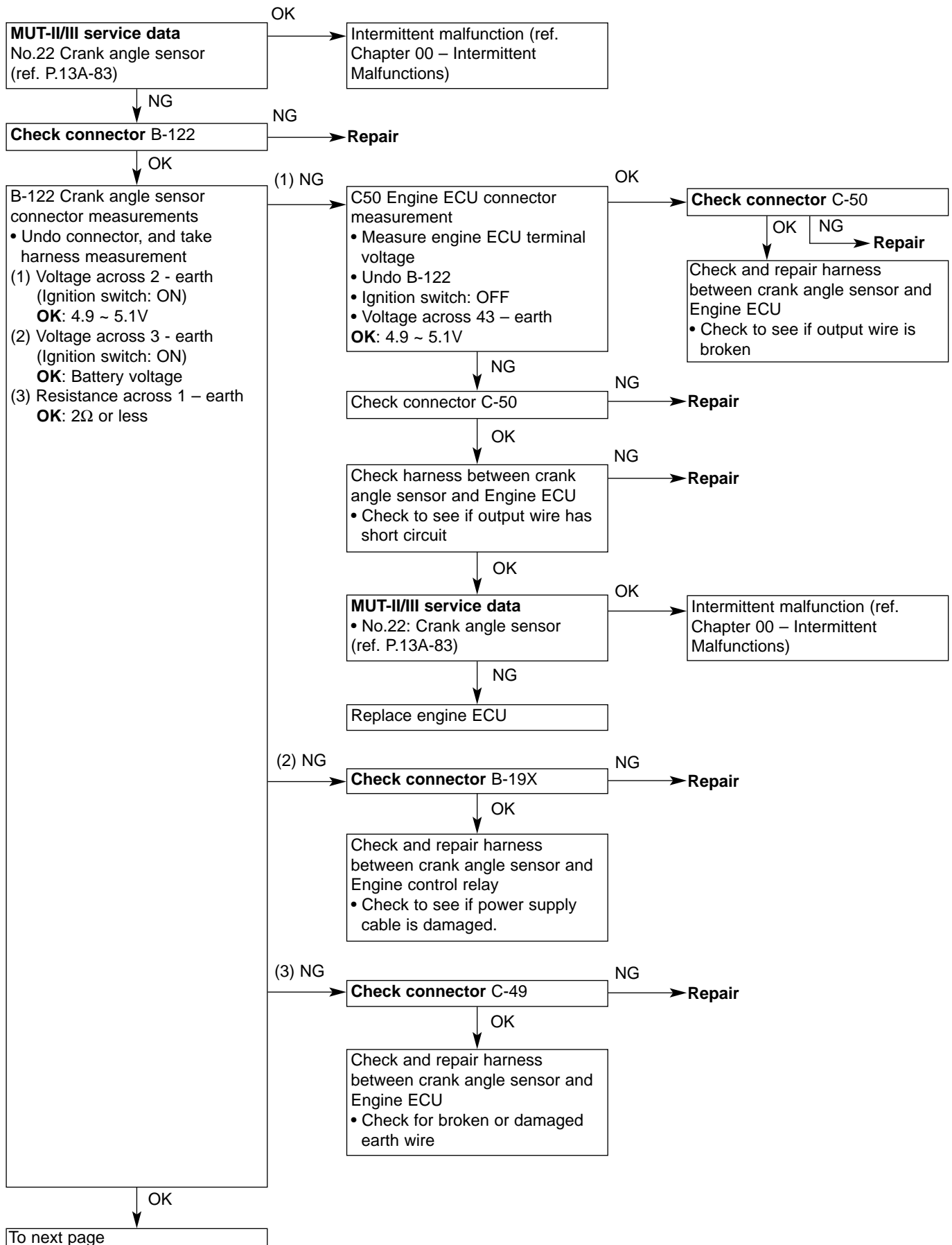


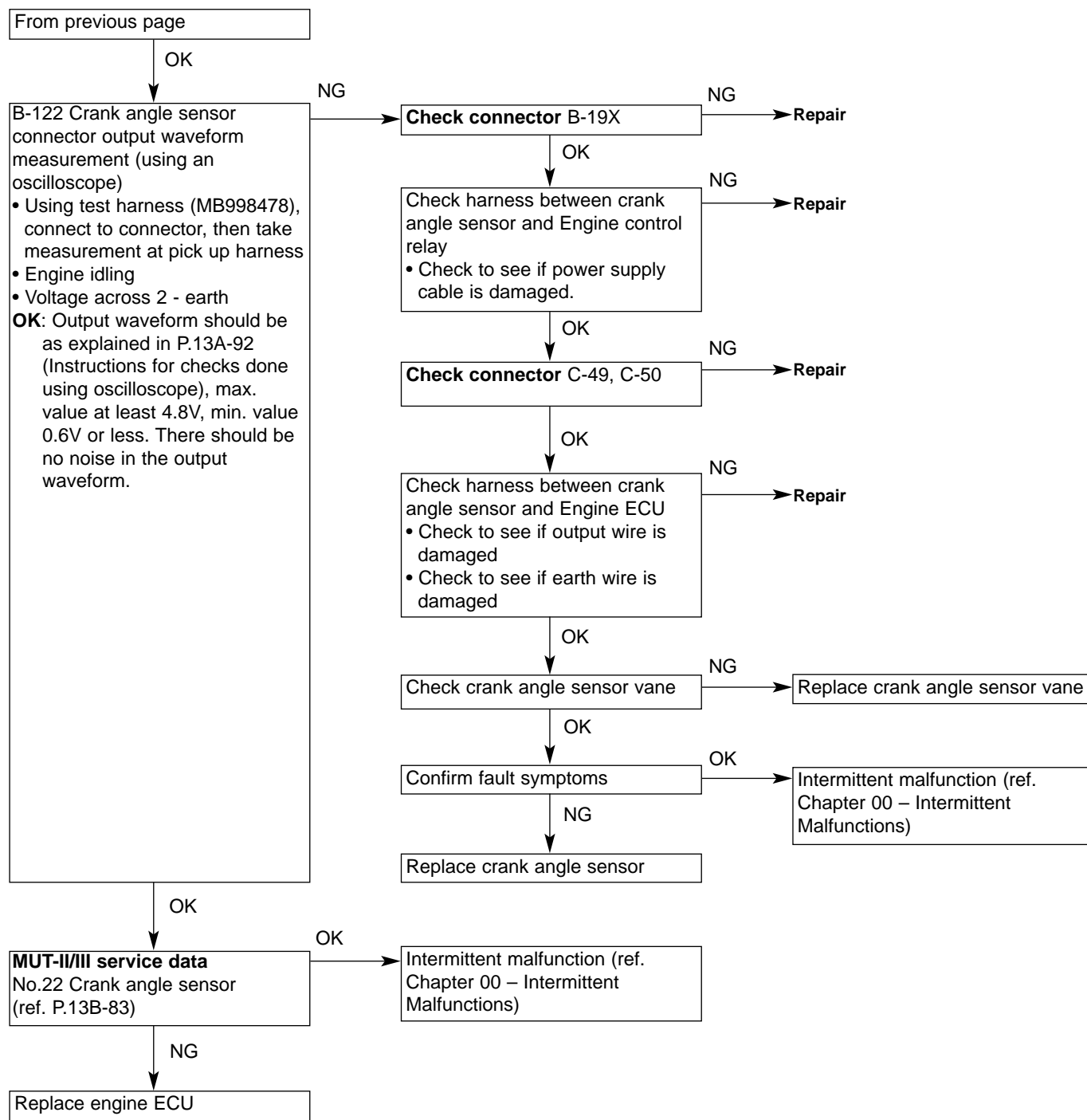


Code No.P0325 Knock Sensor System	Probable causes
Inspection Conditions • Ignition switch: ON • Excluding a duration of 2 seconds after turning ignition to ON position, or immediately after engine has fully started up • Engine speed approx. 2,500rpm or more • Volumetric efficiency at least 30% Evaluation conditions • For 200 continuous cycles, change in knock sensor output voltage (knock sensor peak value for each half turn of crank shaft) 0.06V or less	• Knock sensor malfunction • Knock sensor circuit broken, has a short circuit, or poor connector contact • Engine ECU malfunction

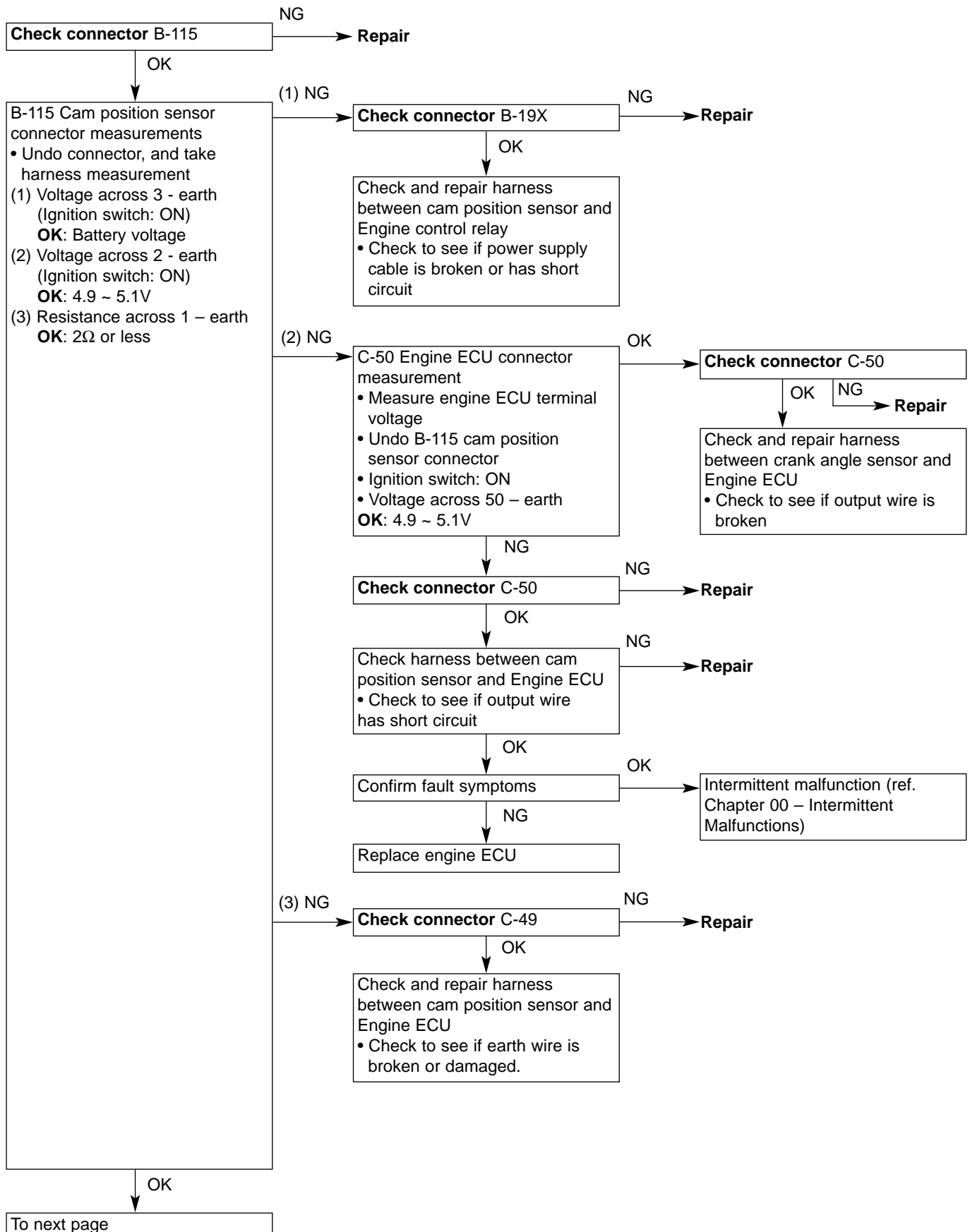


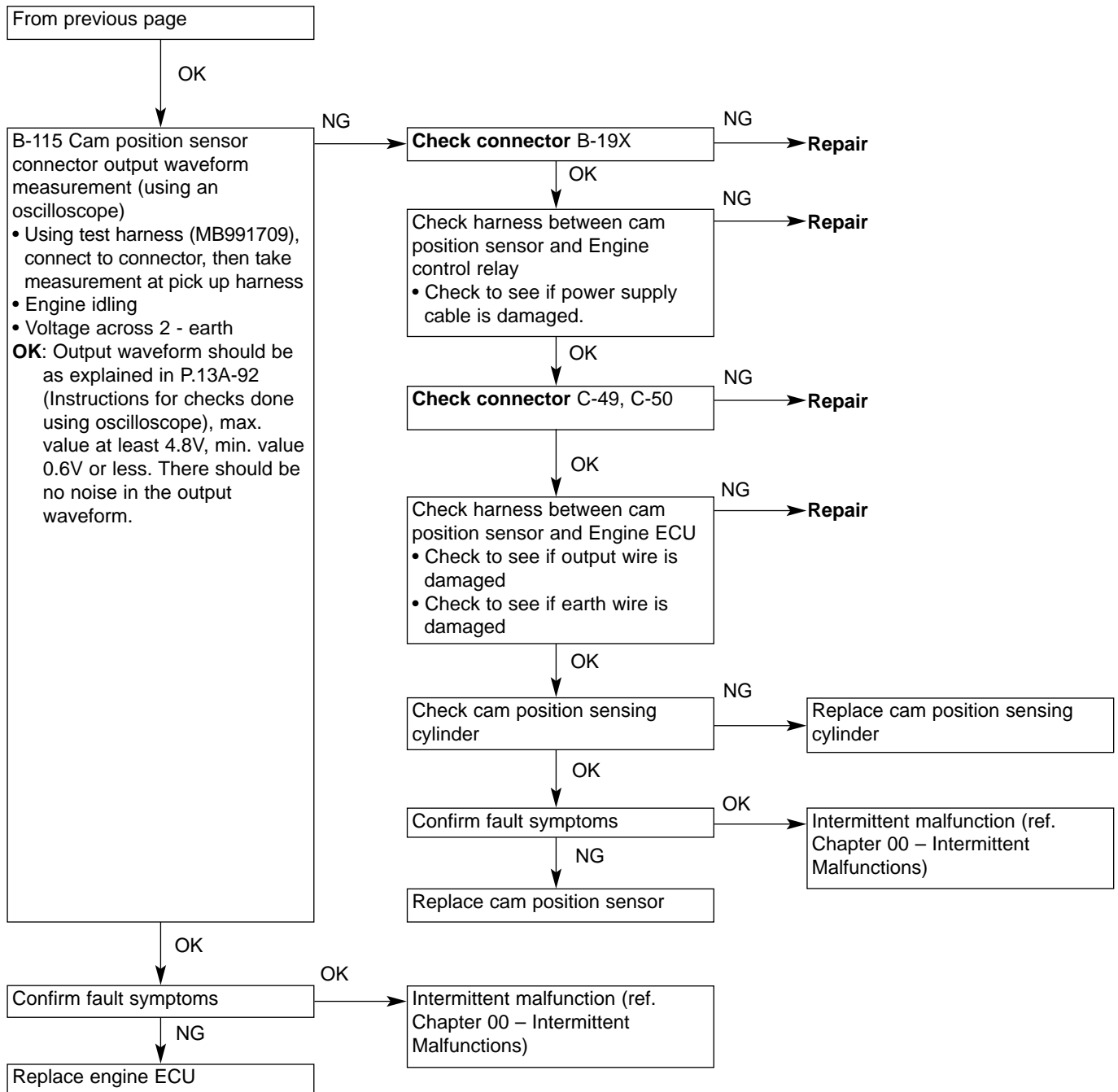
Code No.P0335 Crank Angle Sensor System	Probable causes
Inspection Conditions • Engine cranking Evaluation conditions • No change in sensor output voltage for duration of 4 seconds (pulse signal is not input)	• Crank angle sensor malfunction • Crank angle sensor circuit broken, has a short circuit, or poor connector contact • Engine ECU malfunction



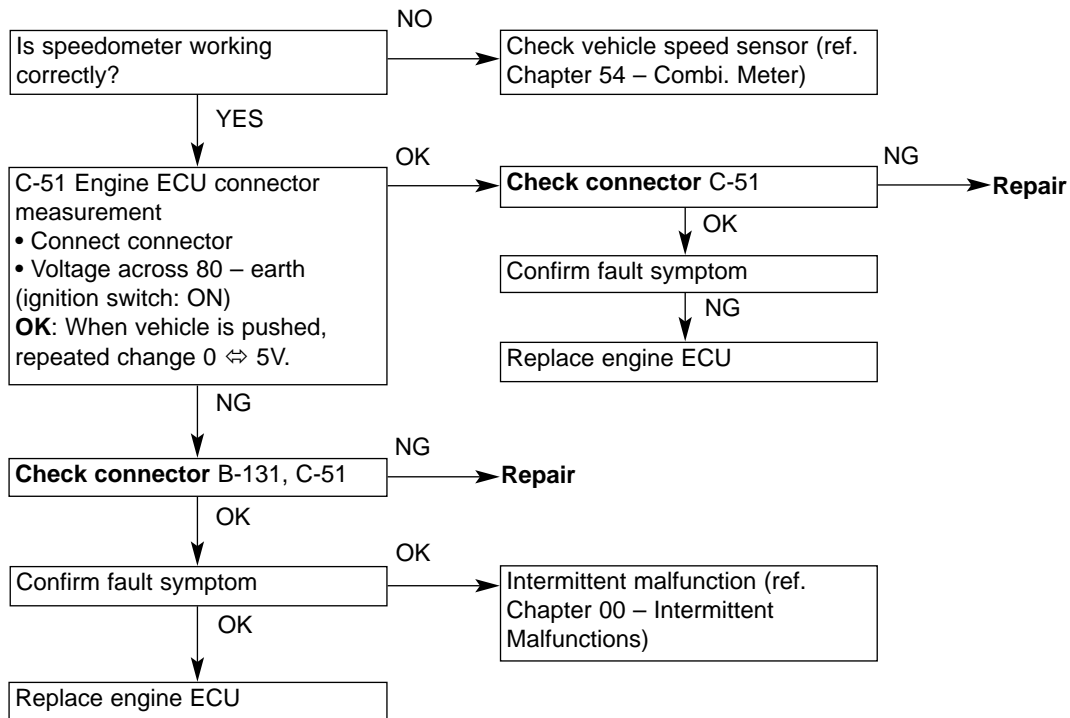


Code No.P0340 Cam Position Sensor System	Probable causes
Inspection Conditions • Ignition switch: ON • Engine speed approx. 50rpm or more Evaluation conditions • No change in sensor output voltage for duration of 4 seconds (pulse signal is not input)	• Cam position sensor malfunction • Cam position sensor circuit broken, has a short circuit, or poor connector contact • Engine ECU malfunction





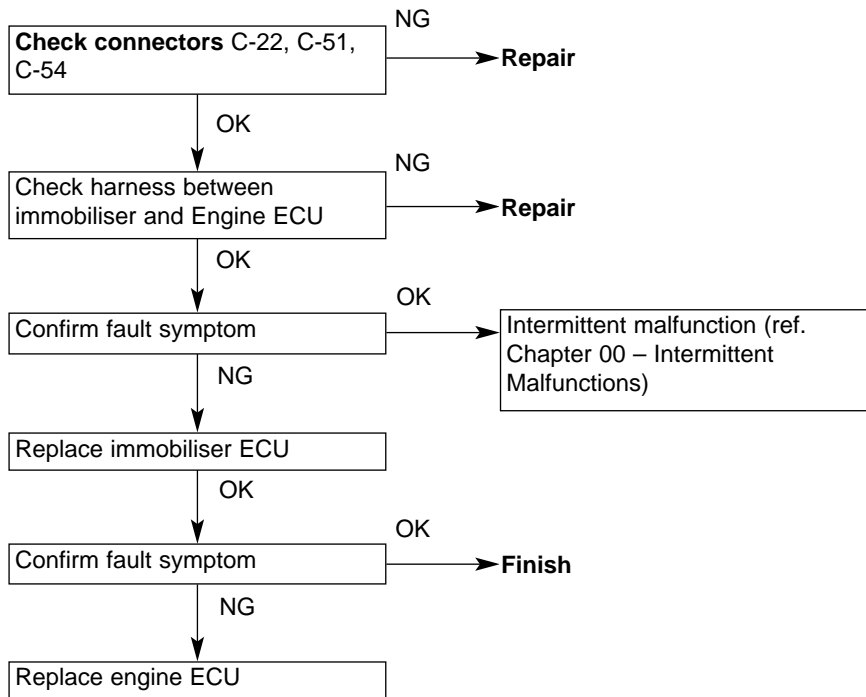
Code No.P0500 Vehicle Speed Sensor System	Probable causes
Inspection Conditions <ul style="list-style-type: none"> • Ignition switch: ON • After ignition switch has been turned to ON position, or after 2 seconds from the time the engine has fully started up • Engine speed approx. 2,000~4,000 rpm Evaluation conditions <ul style="list-style-type: none"> • No change in vehicle speed signal for duration of 4 seconds (pulse signal is not input) 	<ul style="list-style-type: none"> • Vehicle speed sensor malfunction • Vehicle speed sensor circuit broken, has a short circuit, or poor connector contact • Engine ECU malfunction



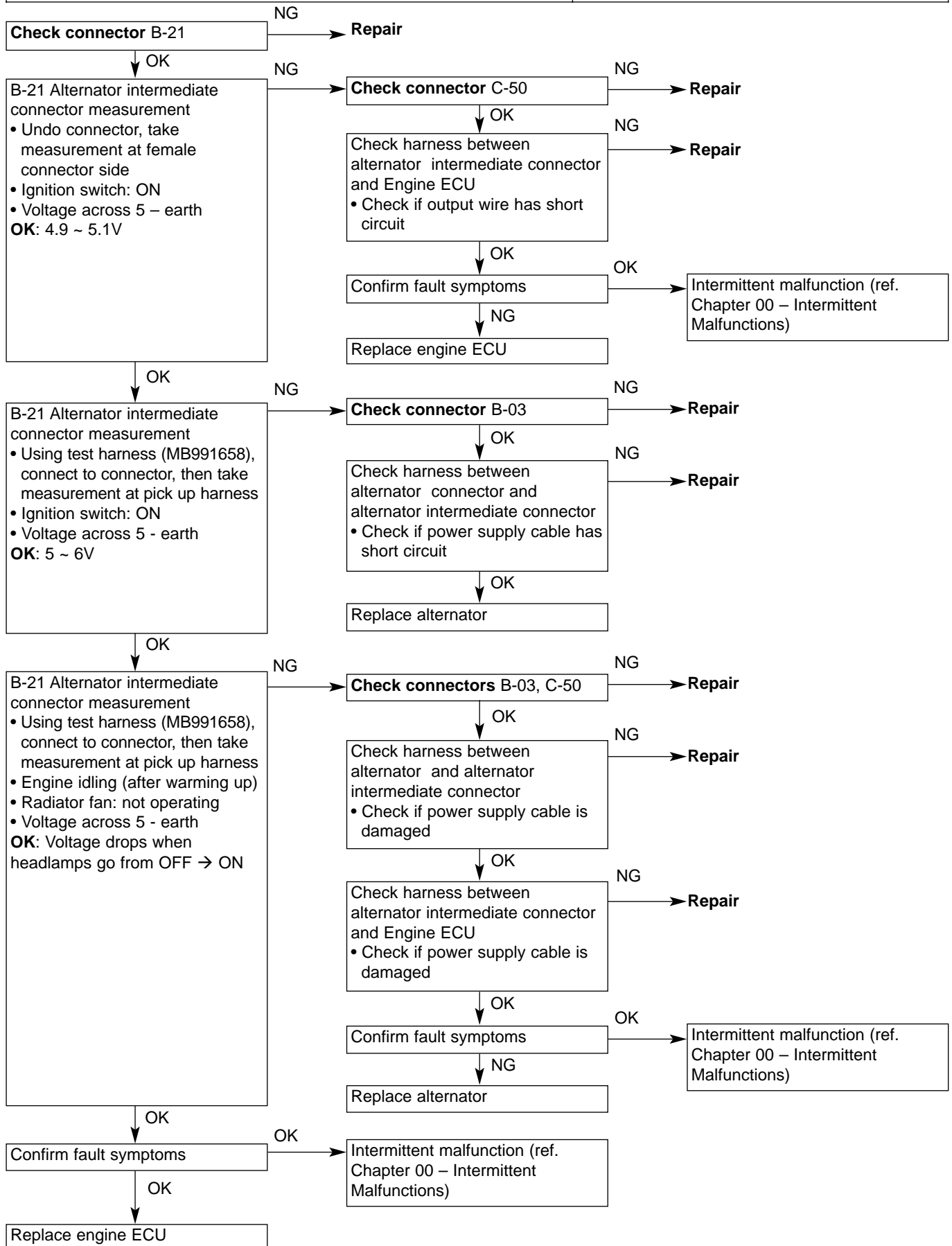
Code No.P0513 Immobiliser System	Probable causes
Inspection Conditions • Ignition switch: ON Evaluation conditions • Communication error between engine ECU and immobiliser detected.	• Circuit broken, has a short circuit, or poor connector contact • Immobiliser ECU malfunction • Engine ECU malfunction

Remarks

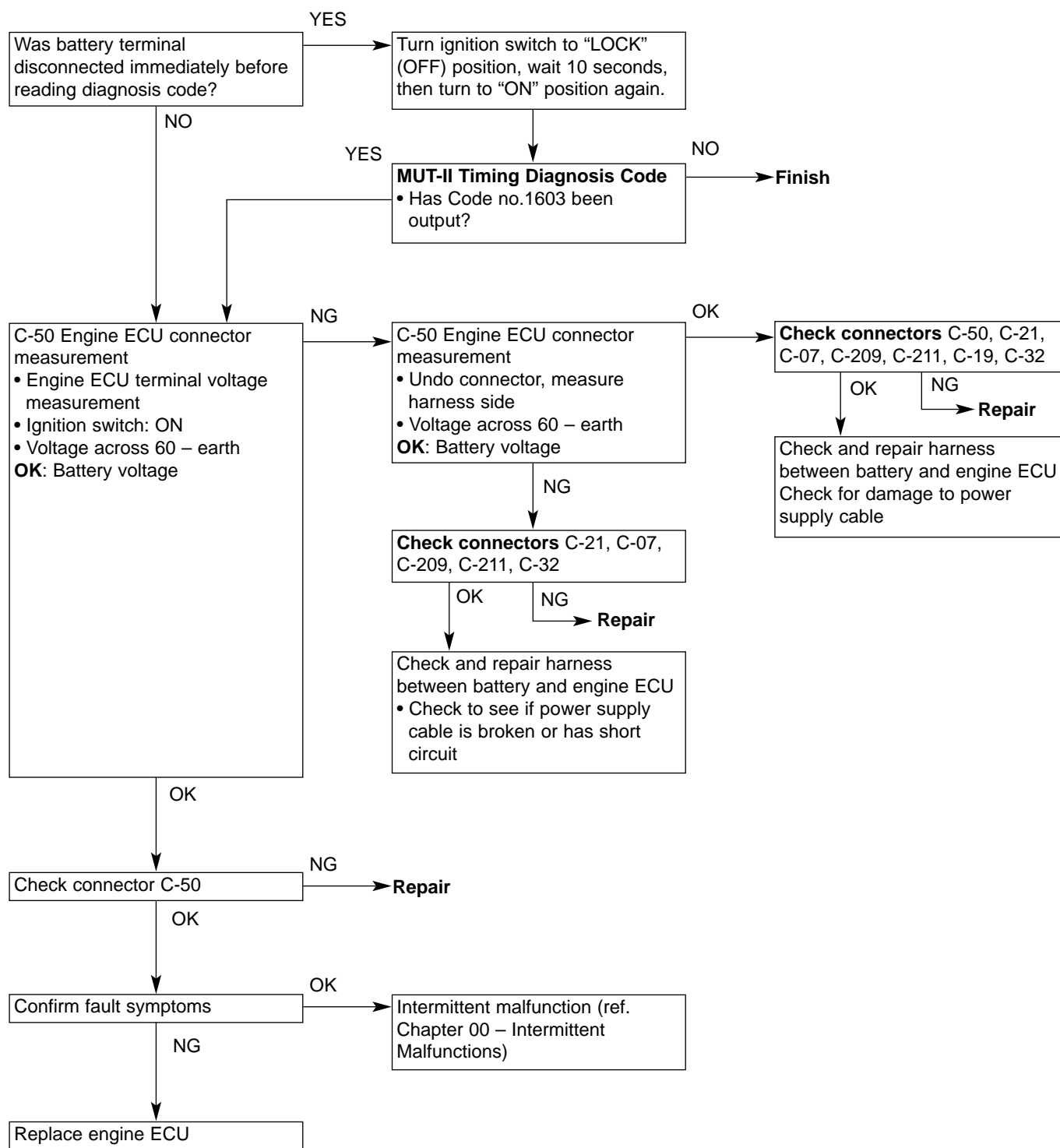
- (1) When starting the engine, in cases where there are a number of registered ignition keys within close range, these codes could be displayed as a result of electrical interference.
- (2) These codes may be displayed at the time key ID codes are registered.



Code No.P1500 Alternator FR Terminal System	Probable causes
Inspection Conditions • Engine speed: at least 50rpm Evaluation conditions • For a 20 second duration, input voltage from the FR terminal, 4.8 ~ 5.2V, or battery voltage	• Alternator FR terminal circuit broken • Engine ECU malfunction



Code No.P1603 Battery Back-up Line System	Probable causes
Inspection Conditions • Ignition switch: ON Evaluation conditions • Back-up RAM information from the last time the ignition switch was turned OFF, has not been recorded	• Battery back-up line circuit is broken, has a short circuit, or connector contact is poor • Engine ECU malfunction



4. List of Fault Symptoms

ITEMS	Fault Symptoms		Checking procedures
Communication with MUT II/III	No communication between MUT-II/III and any other system		1
	Only MUT-II/III and Engine ECU can communicate		2
Engine warning light	The engine warning light does not come on immediately after turning ignition switch to "ON" position		3
	Engine warning light remains lit. Does not go off.		4
Starting	Starting not possible (starter does not turn over)	Starter does not function	5
	Starting not possible (starter turns over but no initial firing)	Starter functions and cranks, but there is no combustion inside cylinders and engine does not start	6
	Starting not possible (fires, but not fully)	Combustion in cylinders, but engine stalls immediately	7
	Poor starting (starting takes a long time)	Engine starts, but cranking takes a long time	
Poor idling	Irregular idling (rough idling, hunting)	During idle running, engine speed fluctuates. This can normally be seen in the tachometer needle swinging, and vibrations felt through the steering wheel, gear stick, and body	8
	Incorrect idling speed	Does not idle at correct speed	
	Engine stalls when idling (dies out)	During idling, the engine stalls irrespective of whether the vehicle is moving	
Engine stall	Engine stalls when pulling away from standing ('pass out')	When vehicle is idling and throttle pedal is depressed, or during operation, engine stalls	9
	Engine stalls during deceleration	Engine stalls when decelerating.	10
Driving	Pulsating/discontinuous combustion (hesitation, sag)	When throttle pedal is depressed in order to accelerate from certain speeds, vehicle response (engine speed) is delayed. Furthermore, during acceleration, (engine speed) drops momentarily. These symptoms are generally referred to as 'hesitation'. Severe hesitation is referred to as 'sag'	11
	Poor acceleration	Driving at steady speeds is smooth, but when accelerating, the rate of acceleration does not respond to increased throttle. So highest speeds are not reached	
	Stumble	When pulling away from standing, engine speed responds slowly to initial throttle pedal movement	
	Surge	Driving at steady speeds, or when accelerating, the vehicle repeatedly jerks backwards and forwards	
	Acceleration shock	A major shock is generated on acceleration	12
	Deceleration shock	A major shock is generated on deceleration	13
	Knocking	Thudding noise like a dull hammering comes from cylinder walls during driving, resulting in rough driving.	14
	Ignition mistiming	Discrepancy between firing timing and standard values specified for timing.	15
Stopping	Run-on (dieseling/pinking)	Engine continues to run after ignition switch is turned to "LOCK" (OFF) position.	16
Exhaust fumes	Smelly, white smoke, black smoke CO and HC densities are high when idling	Exhaust fumes smell unusually strong. Exhaust is white or black. CO and HC densities are high when idling	17
Charging	Flat battery	Battery loses its charge immediately. Or battery charging capacity is low	18
Cooling	Overheating	Engine cooling water temperature unusually high	19
	Radiator fan motor running abnormally	Irrespective of engine cooling water temperature, when ignition switch is turned to the ON position, the fan motor starts running	20
A/C performance	A/C not effective	Air not cooled down. Or there is a discrepancy with temperature set.	21

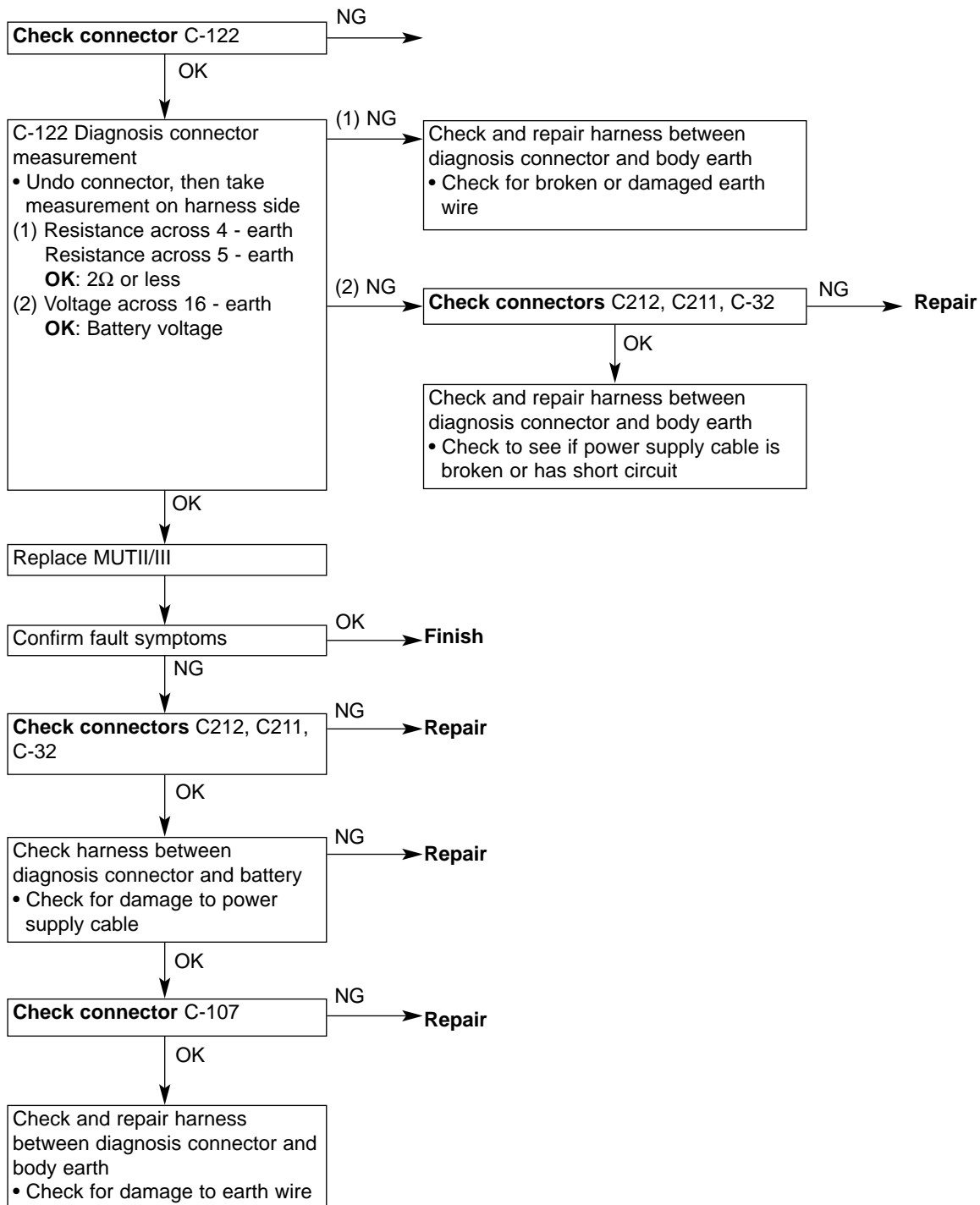
4-1. List of Fault Symptoms

Check procedures	Check Items	Page
1	No communication between MUT-II/III and any other system	13A-36
2	Only MUT-II/III and Engine ECU can communicate	13A-37
3	The engine warning light does not come on immediately after turning ignition switch to "ON " position	13A-38
4	Engine warning light remains lit. Does not go off.	13A-39
5	Starting not possible (starter does not turn over)	13A-40
6	Starting not possible (starter turns over but no initial firing)	13A-42
7	Starting not possible (fires, but not fully)	13A-44
	Poor starting (starting takes a long time)	
8	Irregular idling (rough idling, hunting)	13A-46
	Incorrect idling speed	
	Engine stalls when idling (dies out)	
9	Engine stalls when pulling away from standing ('pass out')	13A-49
10	Engine stalls during deceleration	13A-50
11	Pulsating/discontinuous combustion (hesitation, sag)	13A-50
	Poor acceleration	
	Stumble	
	Surge	
12	Acceleration shock	13A-52
13	Deceleration shock	13A-53
14	Knocking	13A-53
15	Ignition mistiming	13A-54
16	Run-on (dieseling/pinking)	13A-55
17	Smelly, white smoke, black smoke CO and HC densities are high when idling	13A-55
18	Flat battery	13A-57
19	Overheating	13A-58
20	Radiator fan motor running abnormally	13A-59
21	A/C not effective	13A-60
22	Engine ECU power supply, engine control relay, ignition switch – IG1 system	13A-61
23	Fuel pump system	13A-63
24	Radiator fan control relay system	13A-65
25	Condenser fan control relay system	13A-67
26	A/C switch system	13A-70
27	A/C compressor relay	13A-71
28	A/C load signal system	13A-73
29	Power steering fluid pressure switch system	13A-74
30	Purge solenoid valve system	13A-75
31	Fuel pressure control solenoid valve system	13A-76
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34	Idle speed control (ISC) servo (stepper motor) system	13A-79
35	Intercooler water spray circuit system	13A-80
36	Intercooler water spray lamp system	13A-82

6. Checking Procedure for each Fault

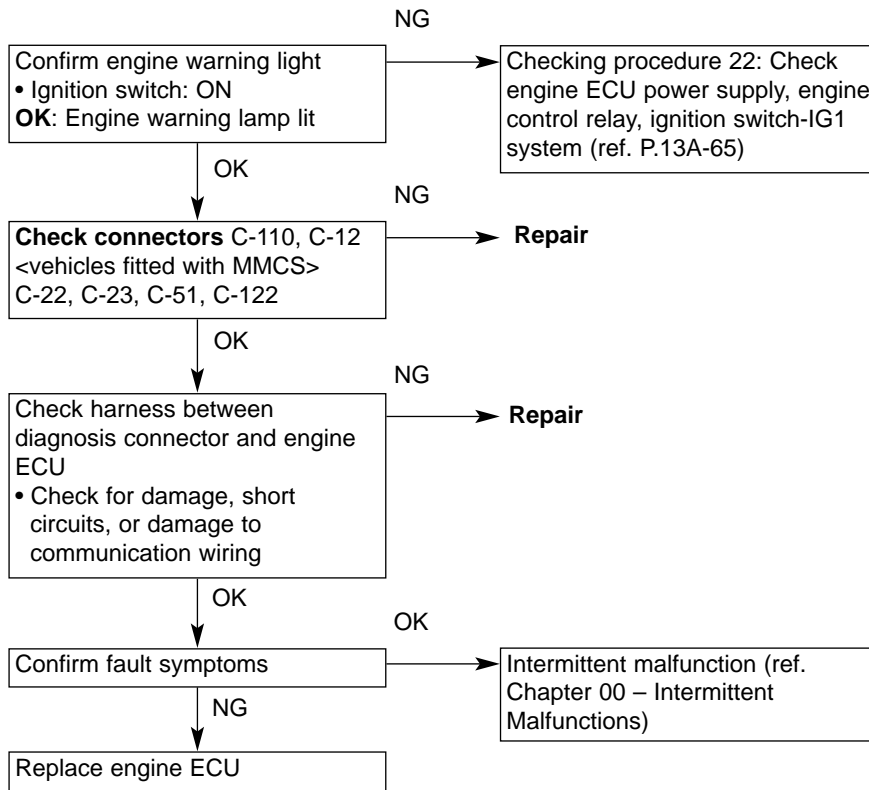
Checking Procedure 1

No Communication between MUT-II/III and any other system	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Diagnosis connector malfunction • MUT-II/III malfunction



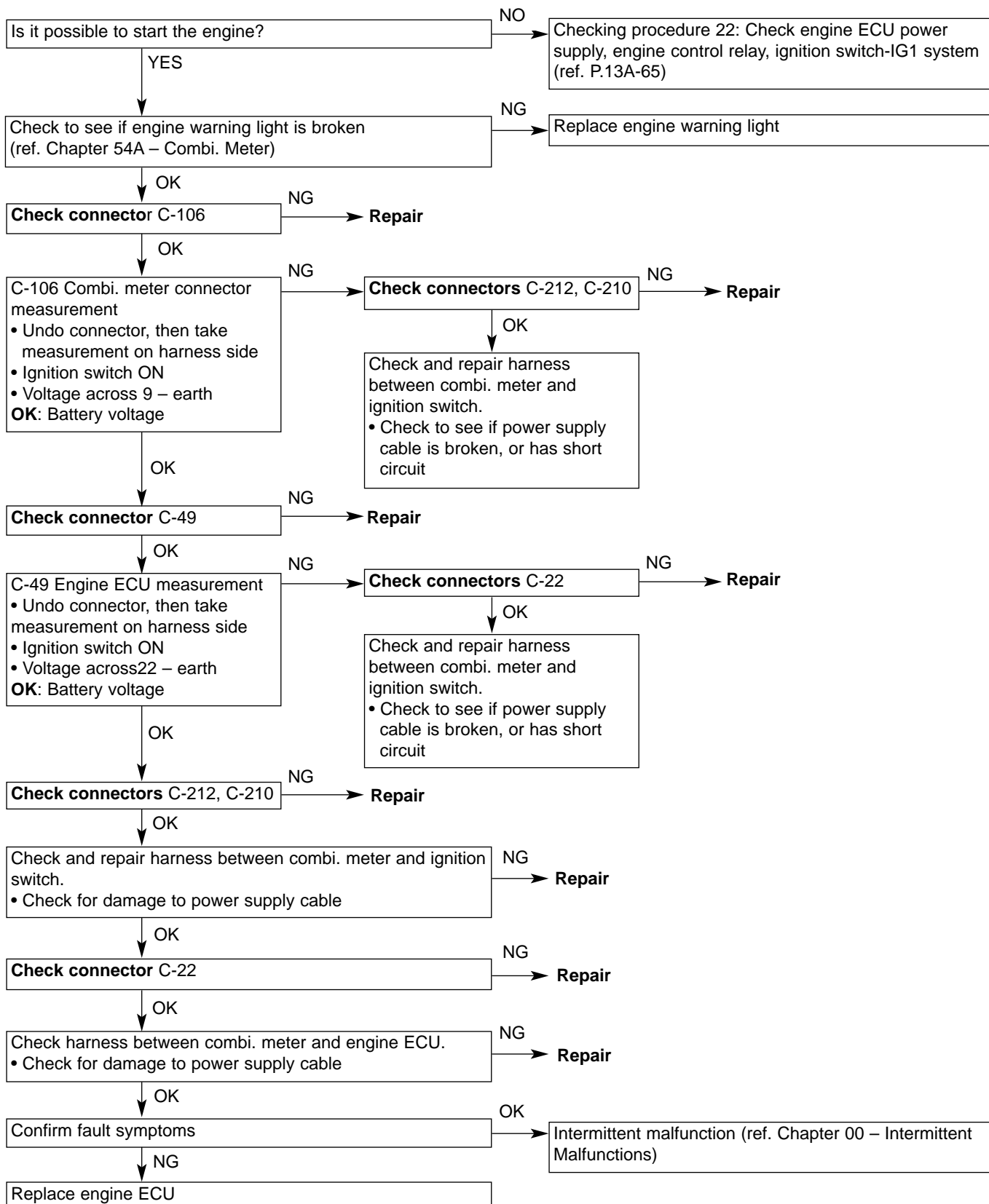
Checking Procedure 2

Only MUT-II/III and engine ECU can communicate	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Ignition switch malfunction • Engine control relay malfunction • Engine ECU malfunction



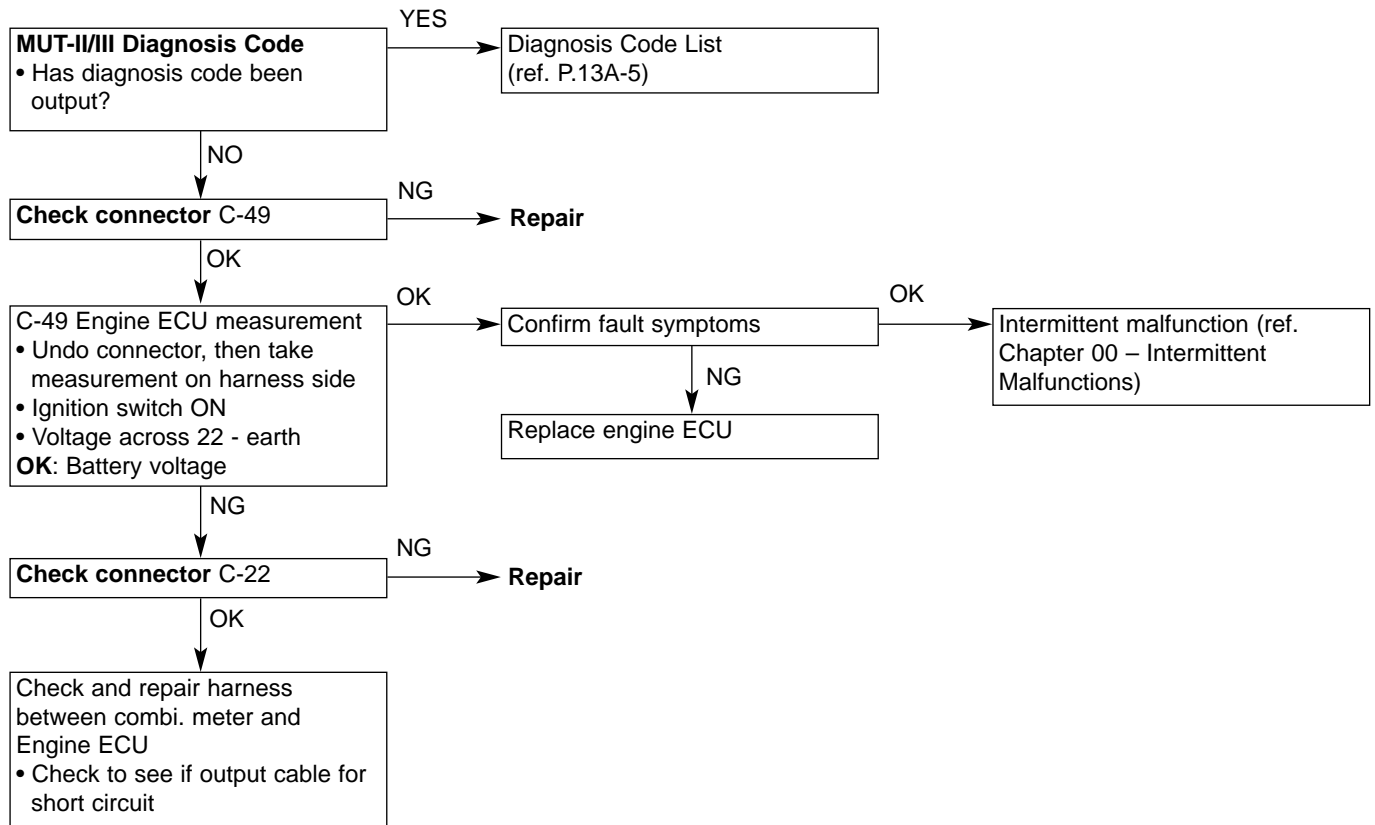
Checking Procedure 3

The engine warning light does not come on immediately after turning ignition switch ON.	Probable causes
To check whether the engine warning light bulb is broken or not, the engine ECU checks the engine warning light for a duration of 5 seconds immediately after the ignition switch is turned to the ON position.	<ul style="list-style-type: none"> • Engine warning lamp bulb is broken • Ignition switch malfunction • Engine control relay malfunction • Engine ECU malfunction



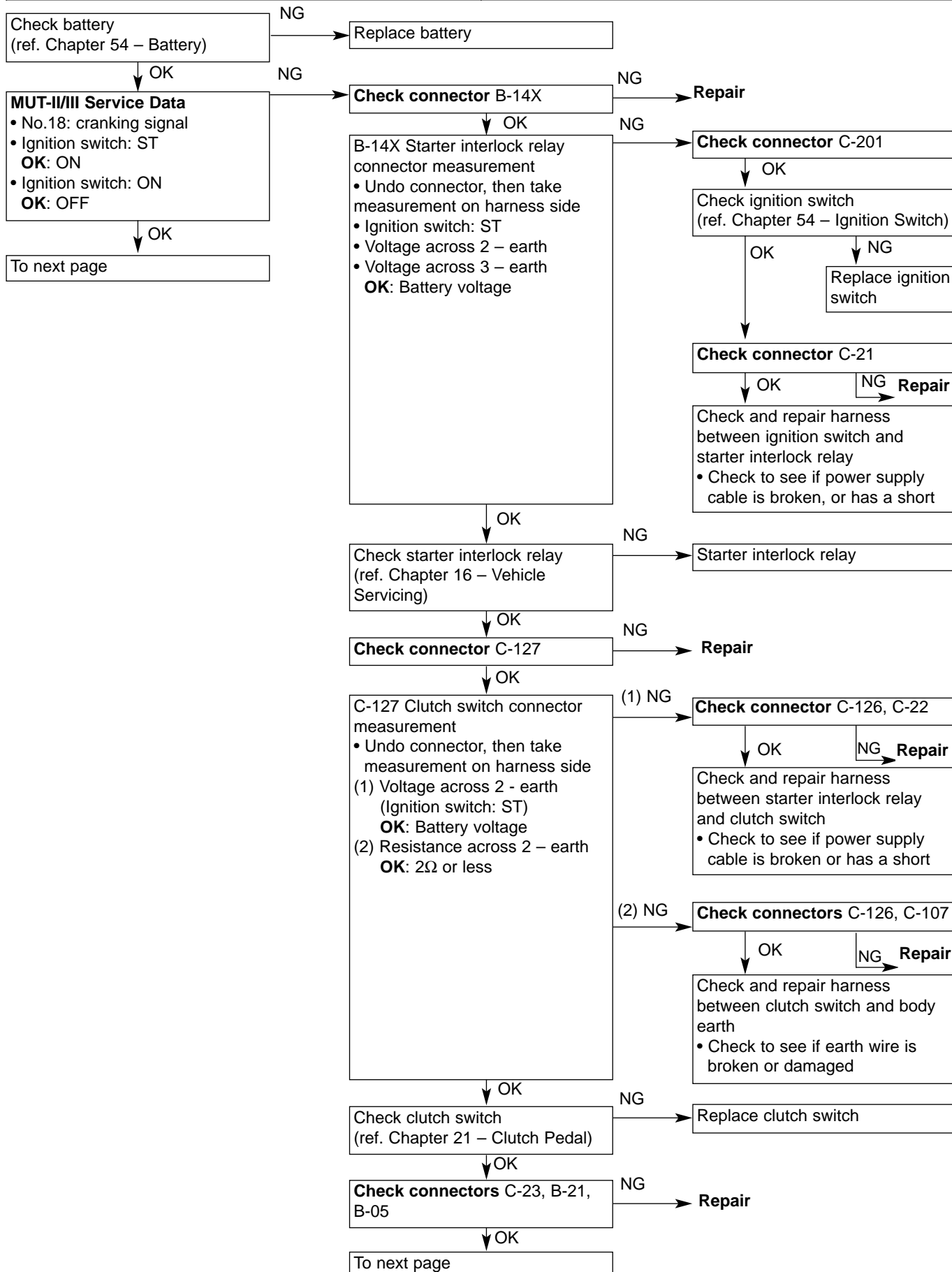
Checking Procedure 4

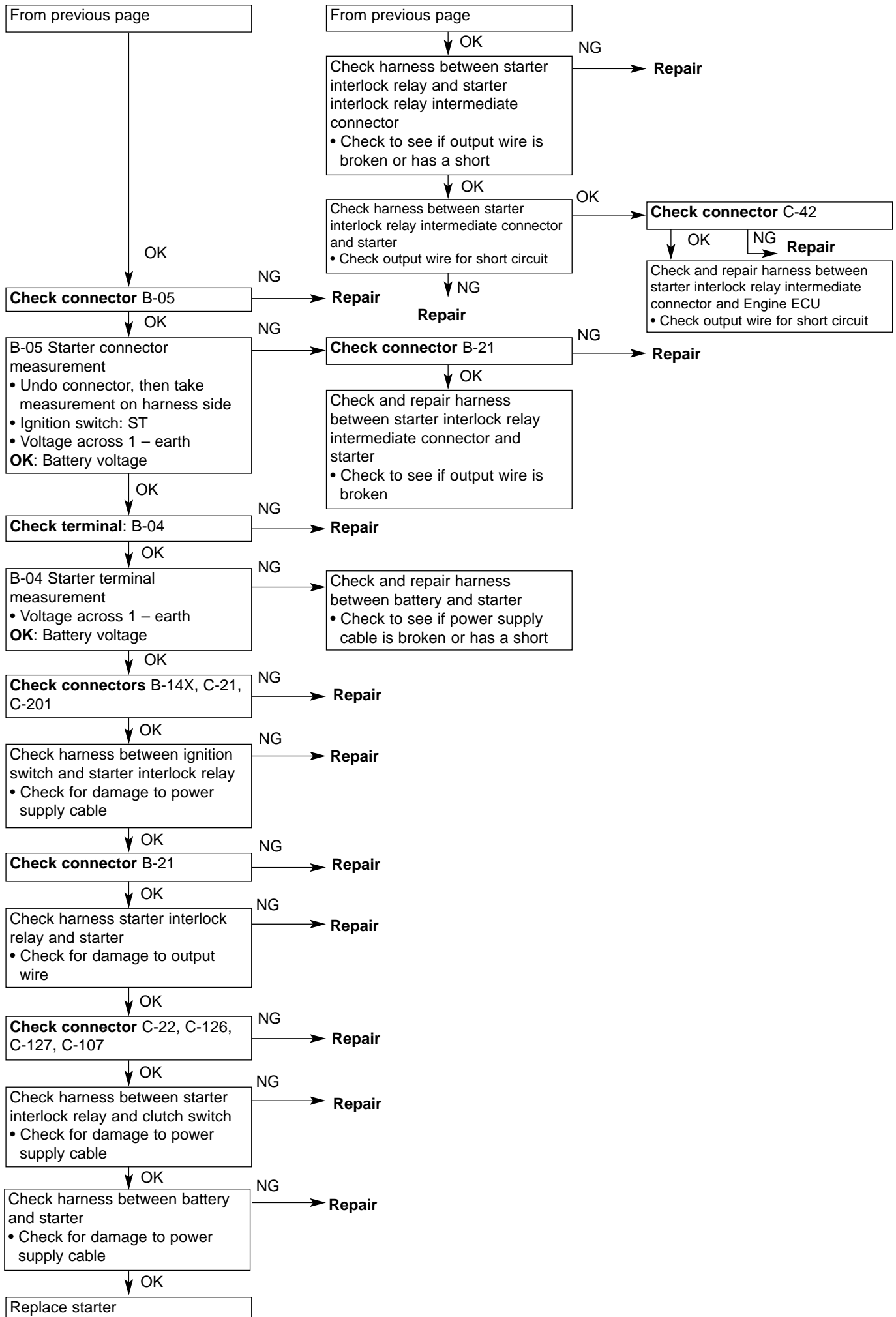
Engine warning light stays lit (does not go off)	Probable causes
When the engine ECU records the generation of the diagnosis code, it turns the engine warning light on.	<ul style="list-style-type: none"> Engine ECU malfunction



Checking Procedure 5

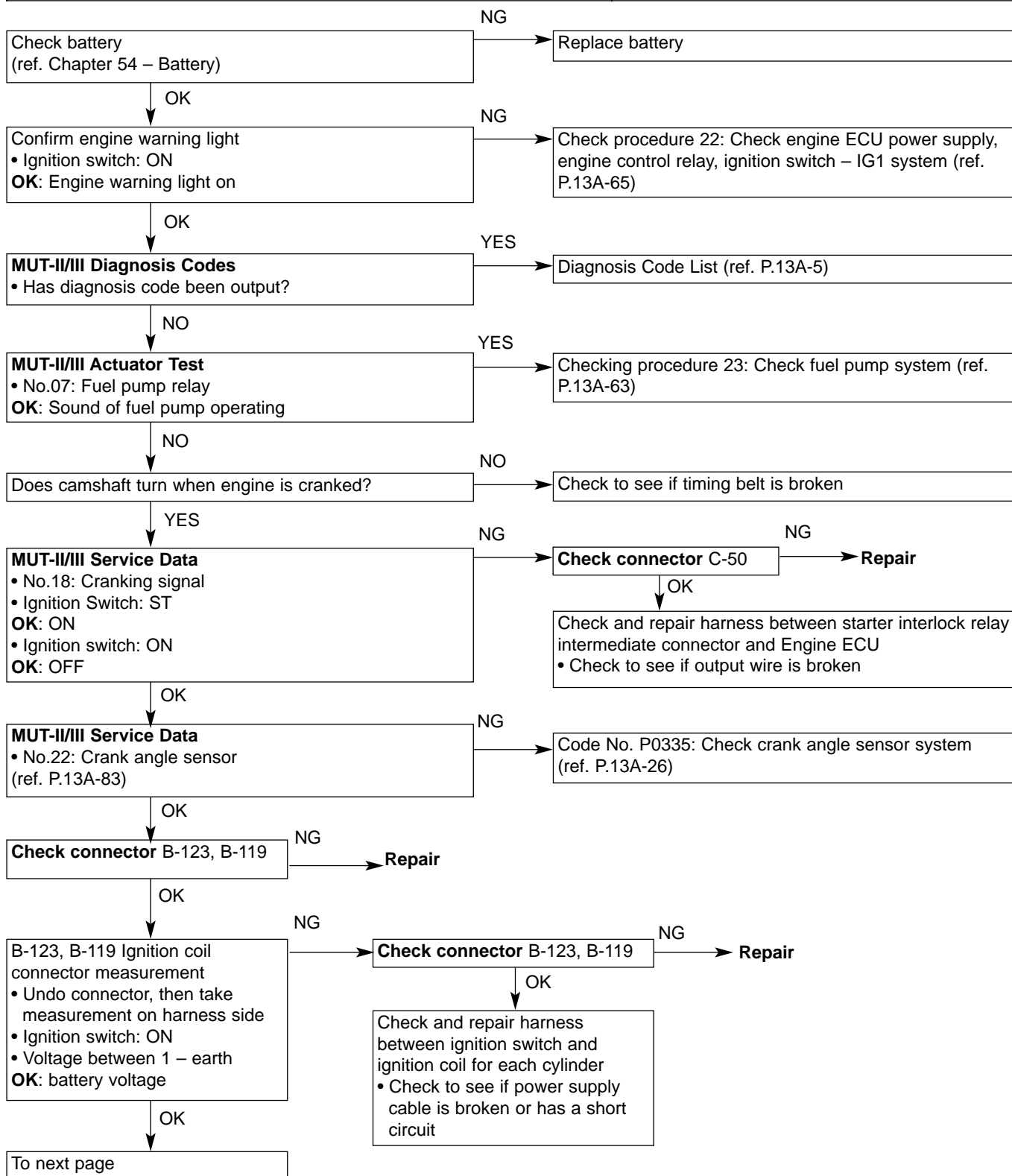
Starting not possible (starter does not turn over)	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Battery malfunction • Ignition switch malfunction • Starter malfunction

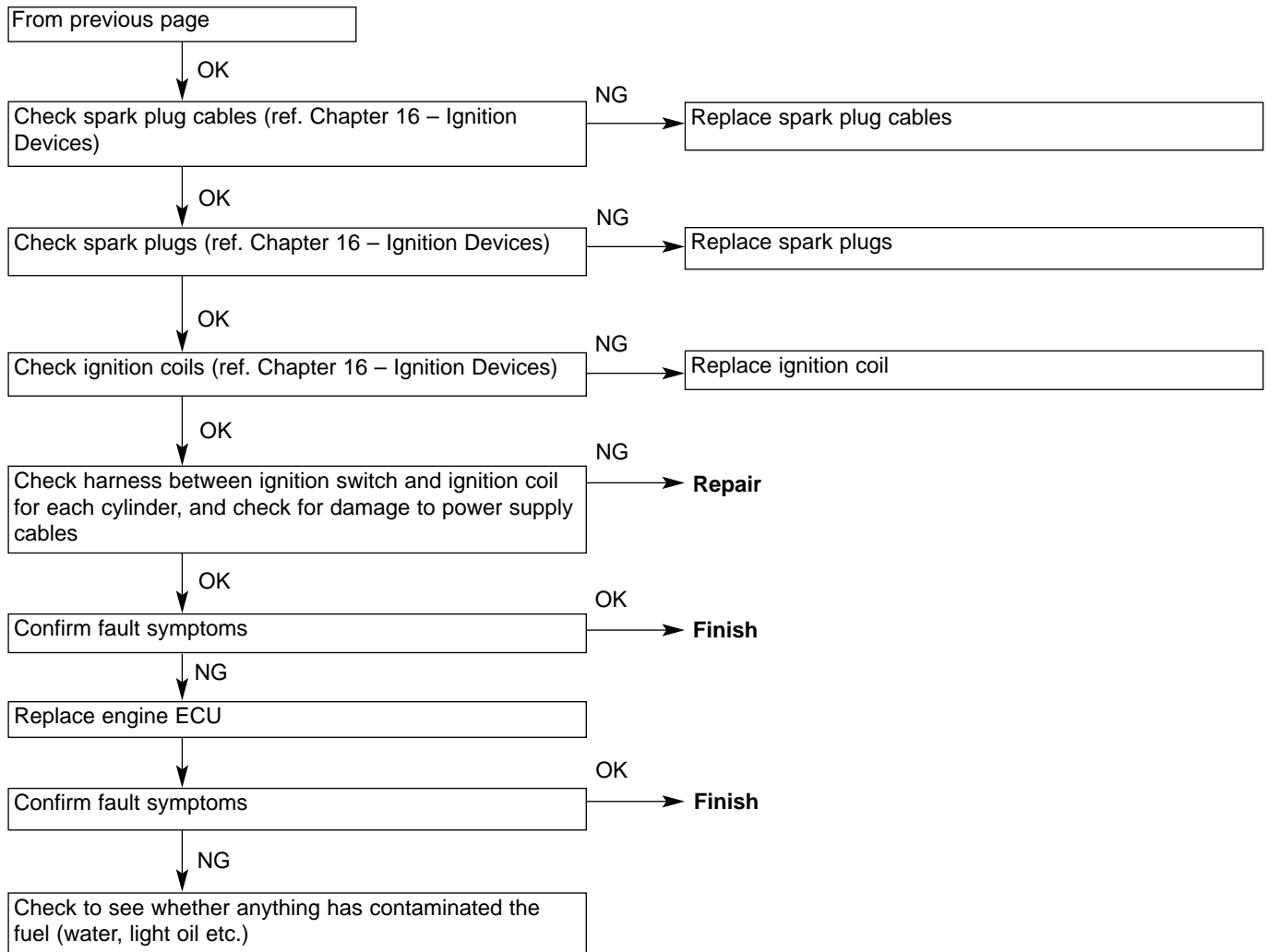




Checking Procedure 6

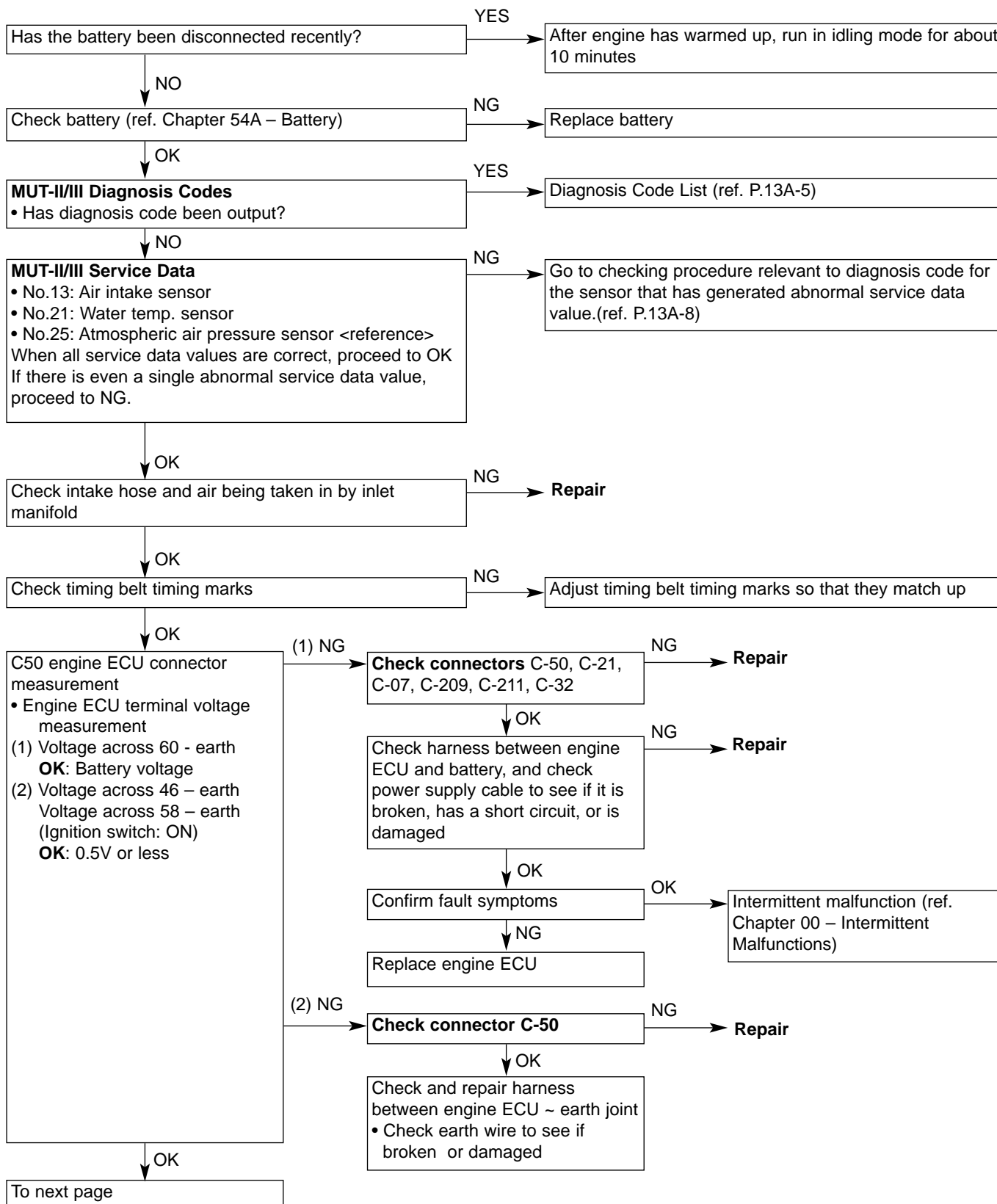
Starting not possible (starter turns over but no initial firing)	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Battery malfunction • Ignition switch malfunction • Ignition system malfunction • Fuel system malfunction • Throttle valve malfunction • Timing belt malfunction • Engine ECU malfunction

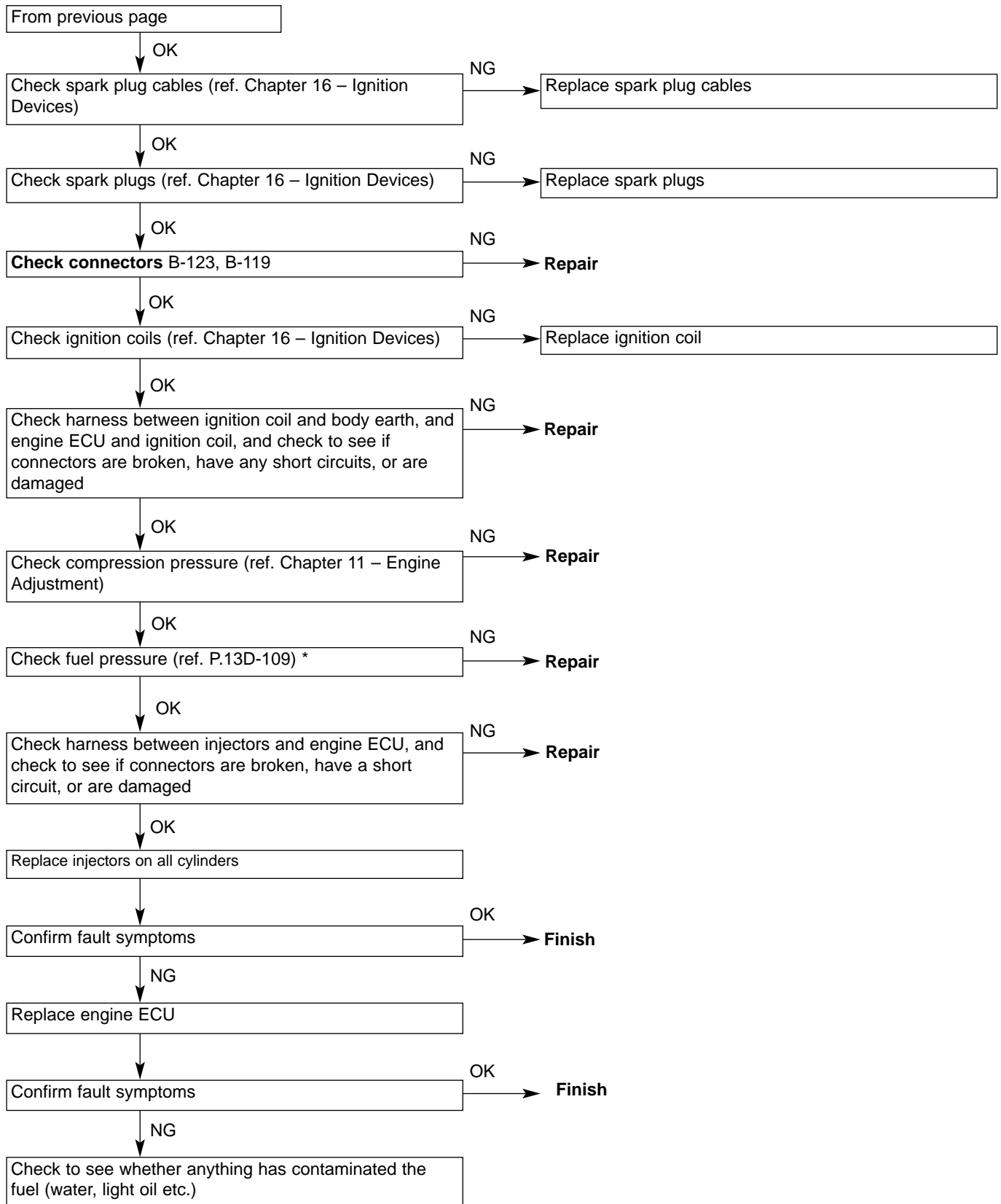




Checking Procedure 7

Starting not possible (there is initial firing, but not full firing), start malfunction (starting takes a long time)	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Battery malfunction • Ignition system malfunction • Fuel system malfunction • Air intake system malfunction • Timing belt malfunction • Compression pressure poor • Engine ECU malfunction

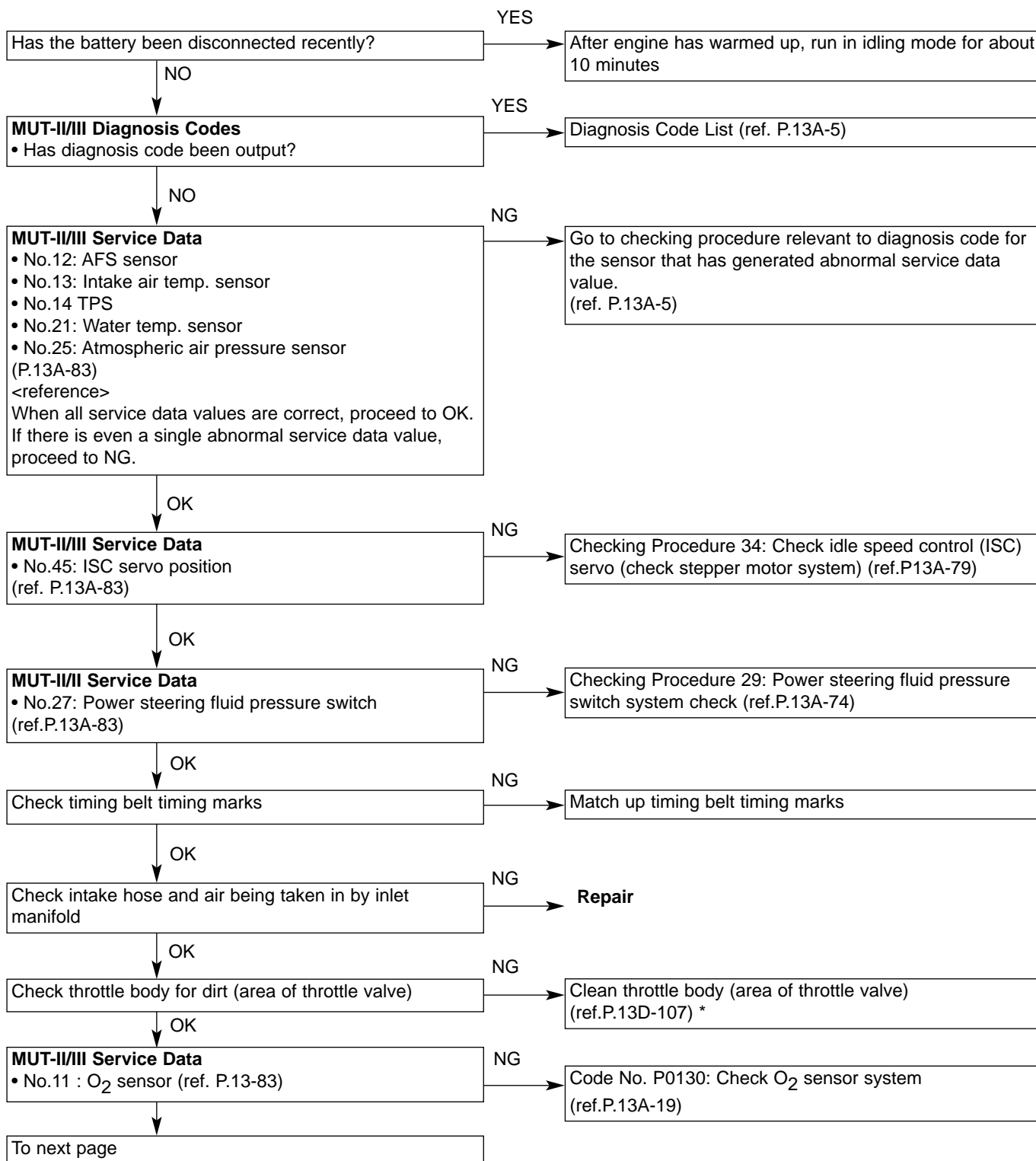




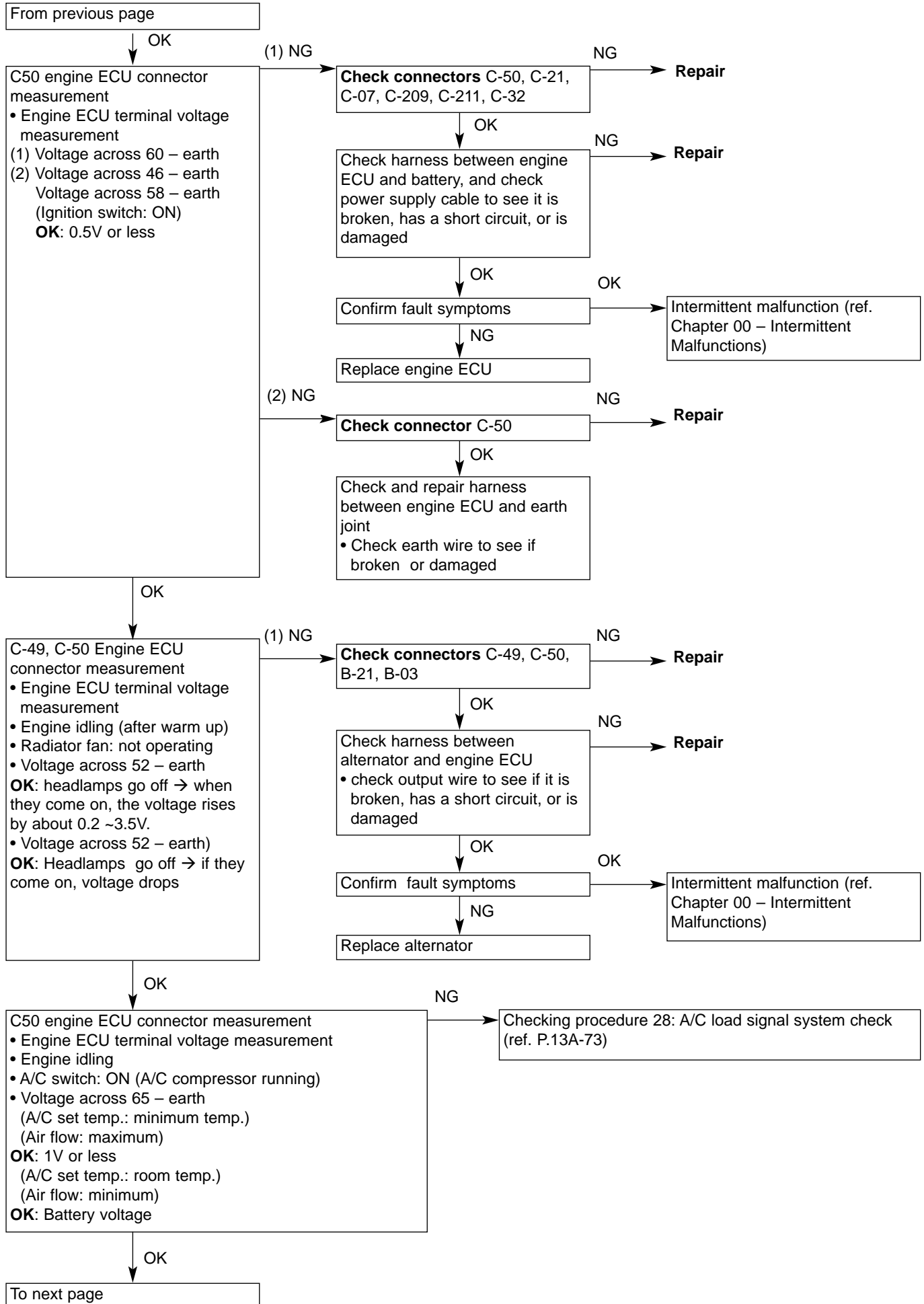
* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

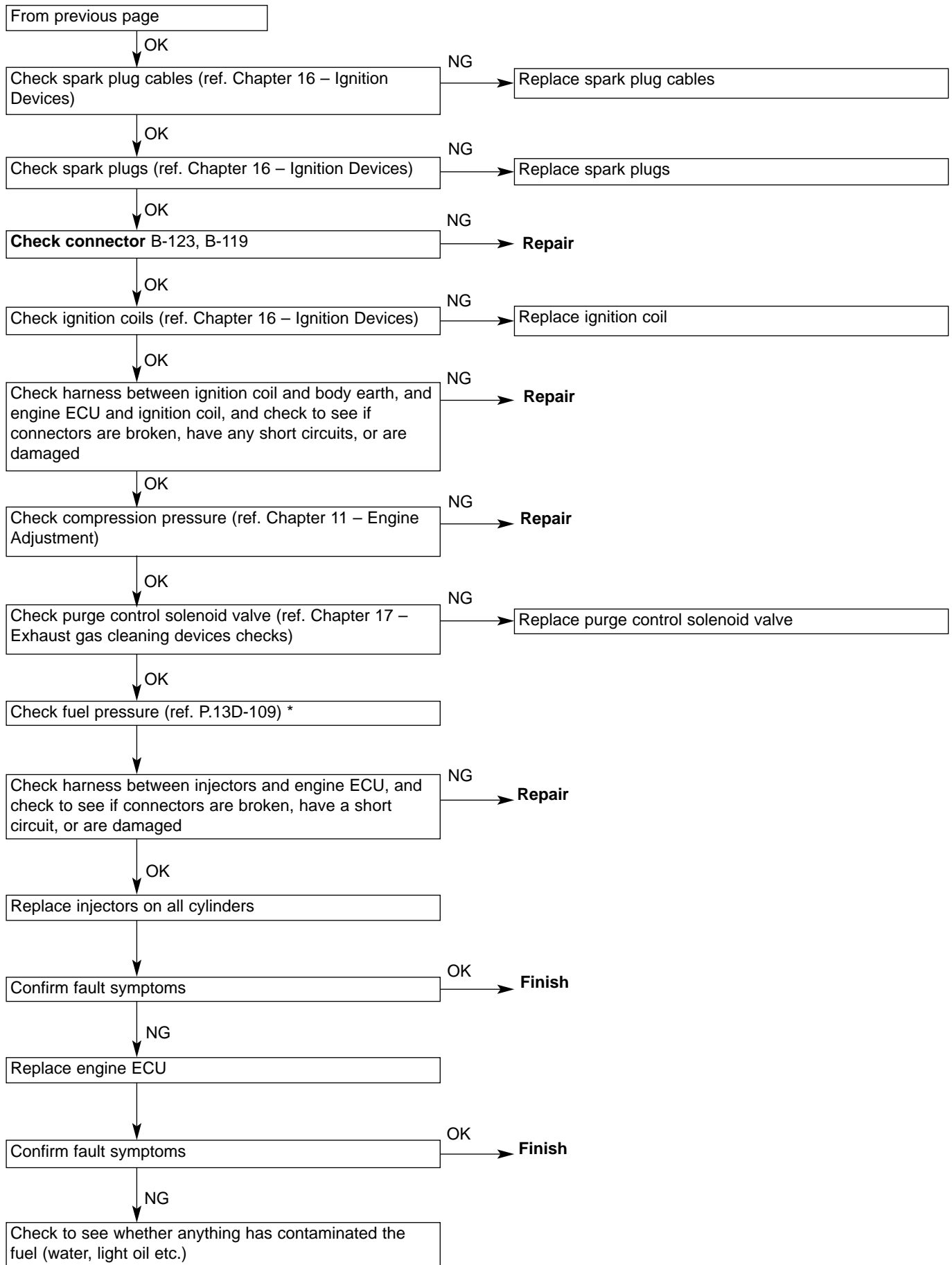
Checking Procedure 8

Irregular idling (rough idling, hunting), incorrect idling speed (high or low idling speed), engine stalls when idling (dies out)	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • ISC control system malfunction • Air fuel control system malfunction • Ignition system malfunction • Fuel system malfunction • Exhaust system malfunction • Exhaust gas cleaning system malfunction • Throttle valve malfunction • Timing belt malfunction • Compression pressure malfunction • Engine ECU malfunction



* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

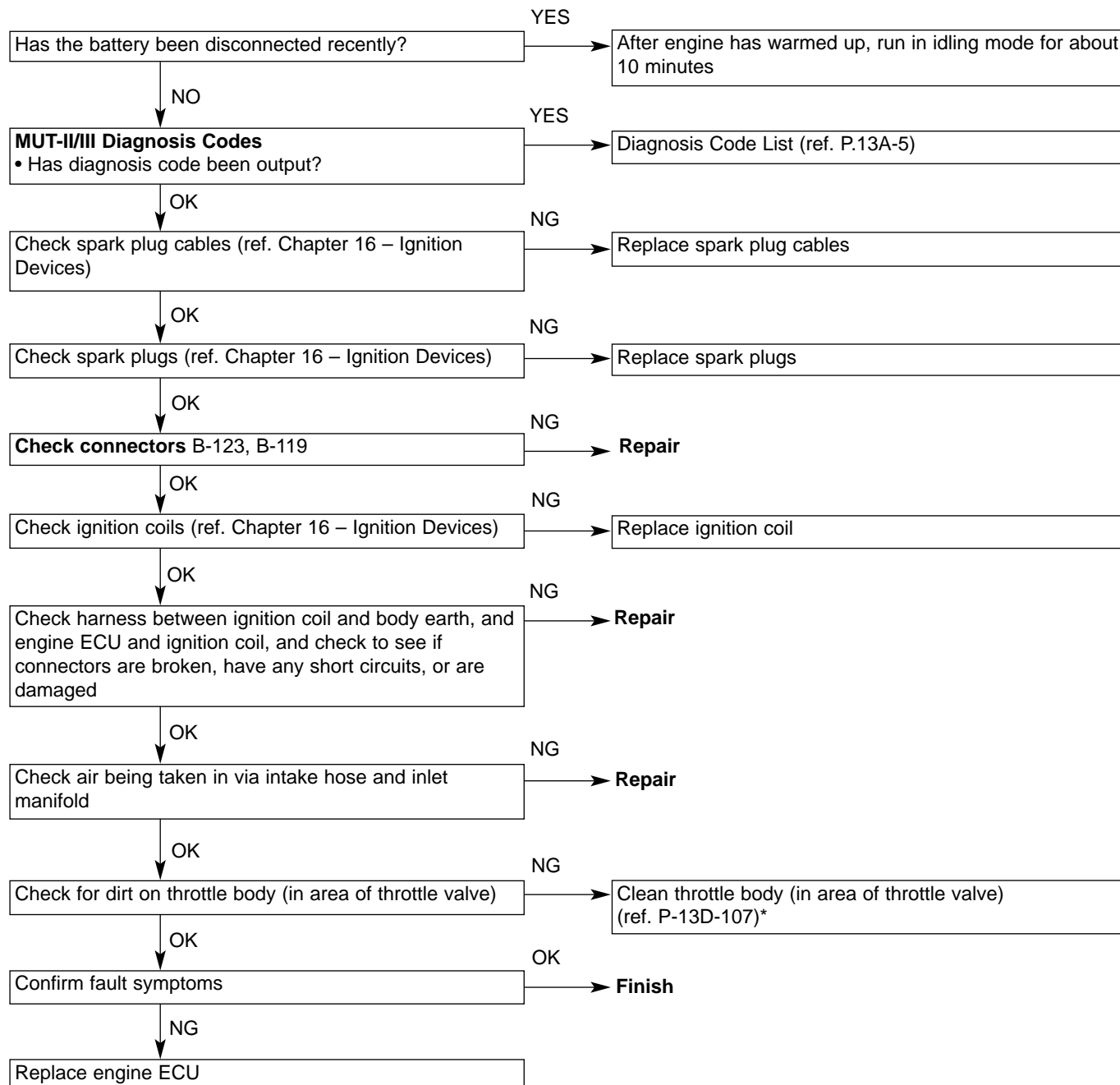




* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

Checking Procedure 9

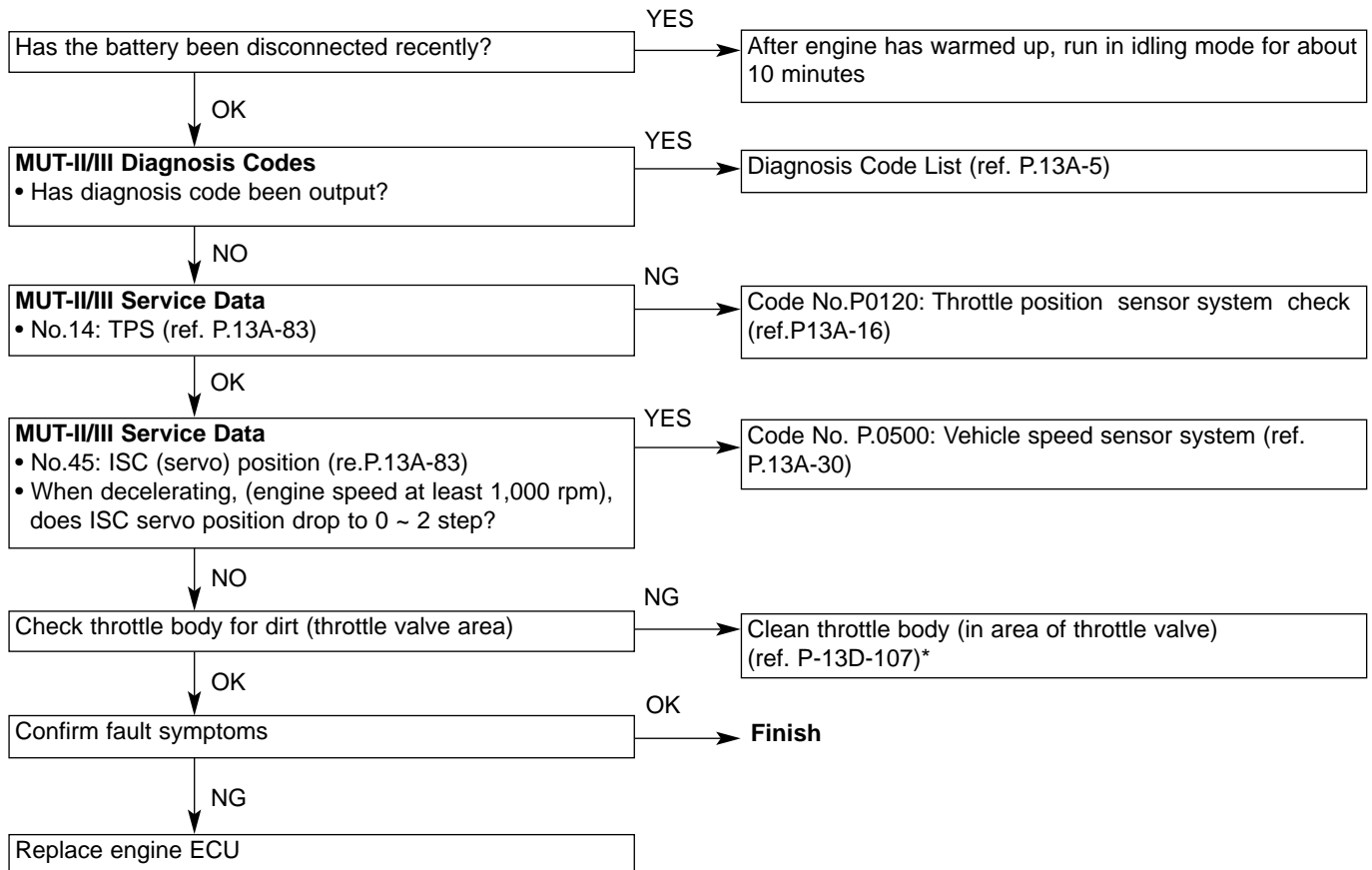
Engine stalling when pulling away from standing (pass out)	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Ignition system malfunction • Air intake system malfunction • Exhaust gas cleaning system malfunction • Throttle body malfunction • Engine ECU malfunction



* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

Checking Procedure 10

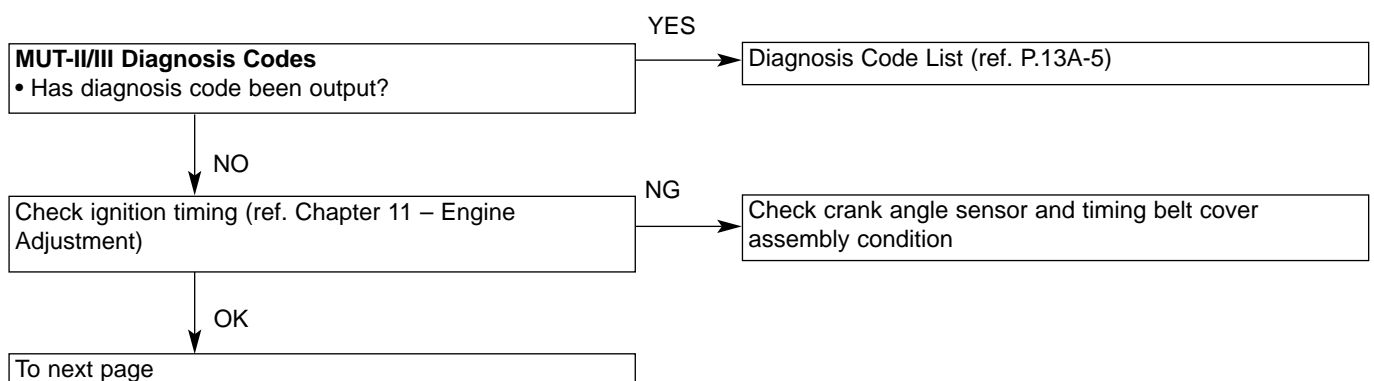
Engine stalling during deceleration	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • ISC control system malfunction • Exhaust gas cleaning system malfunction • Throttle valve malfunction • Engine ECU malfunction

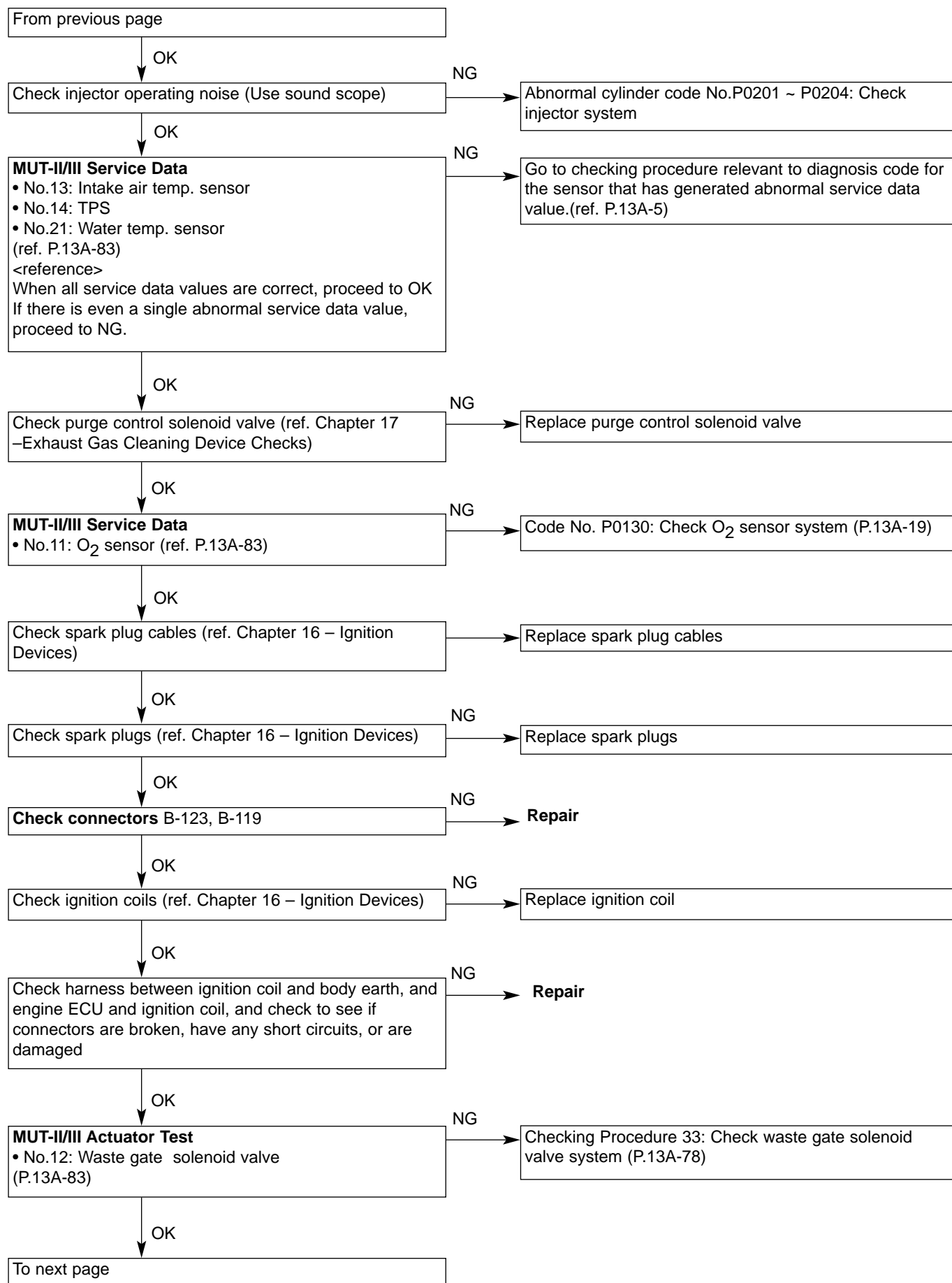


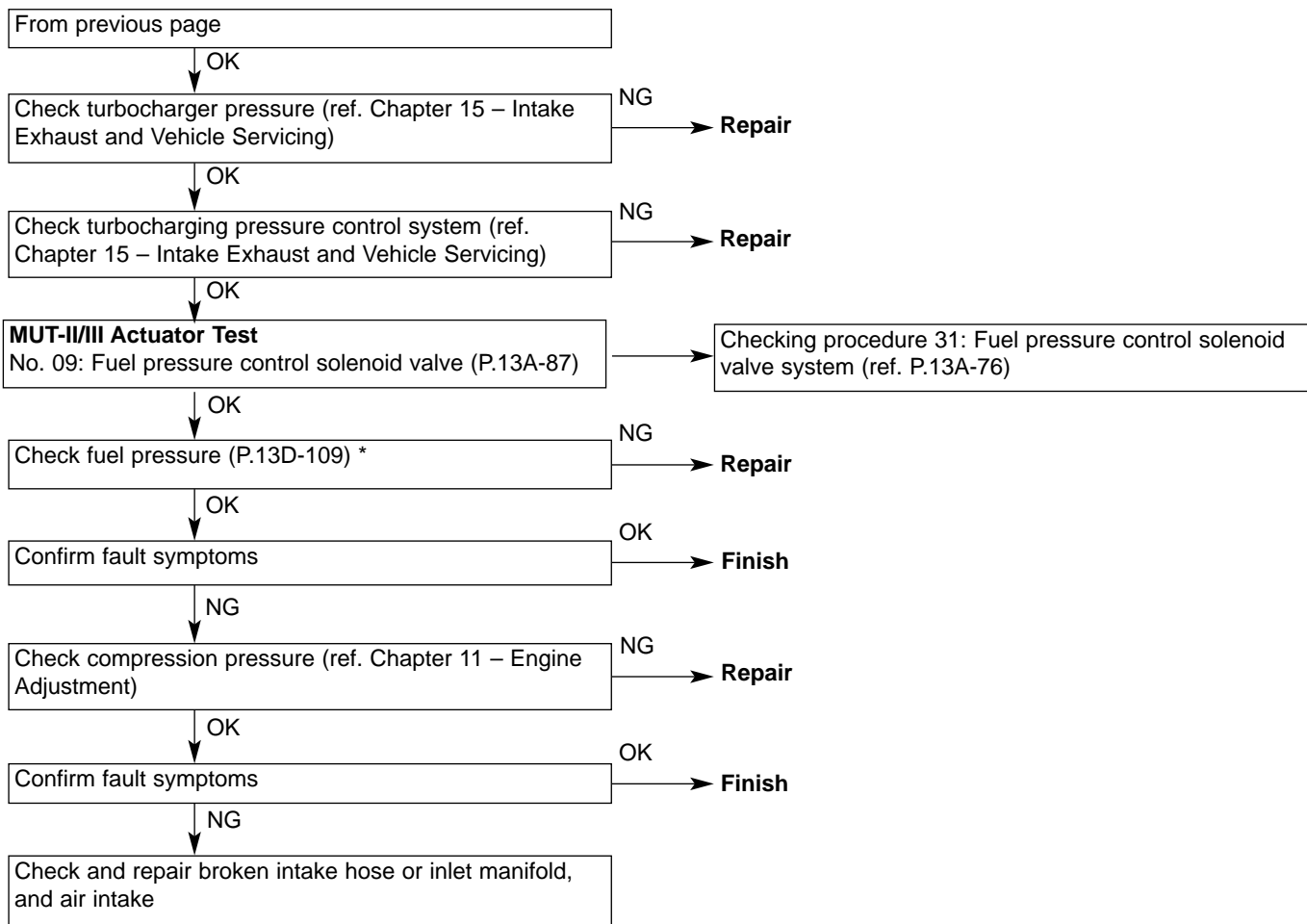
* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

Checking Procedure 11

Pulsating/Discontinuous Combustion (hesitation, sag), Poor Acceleration, Stumble, Surge	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Air fuel ratio control system malfunction • Ignition system malfunction • Fuel system malfunction • Intake/Exhaust system malfunction • Exhaust gas cleaning system malfunction • Compression pressure poor • Turbocharger system malfunction



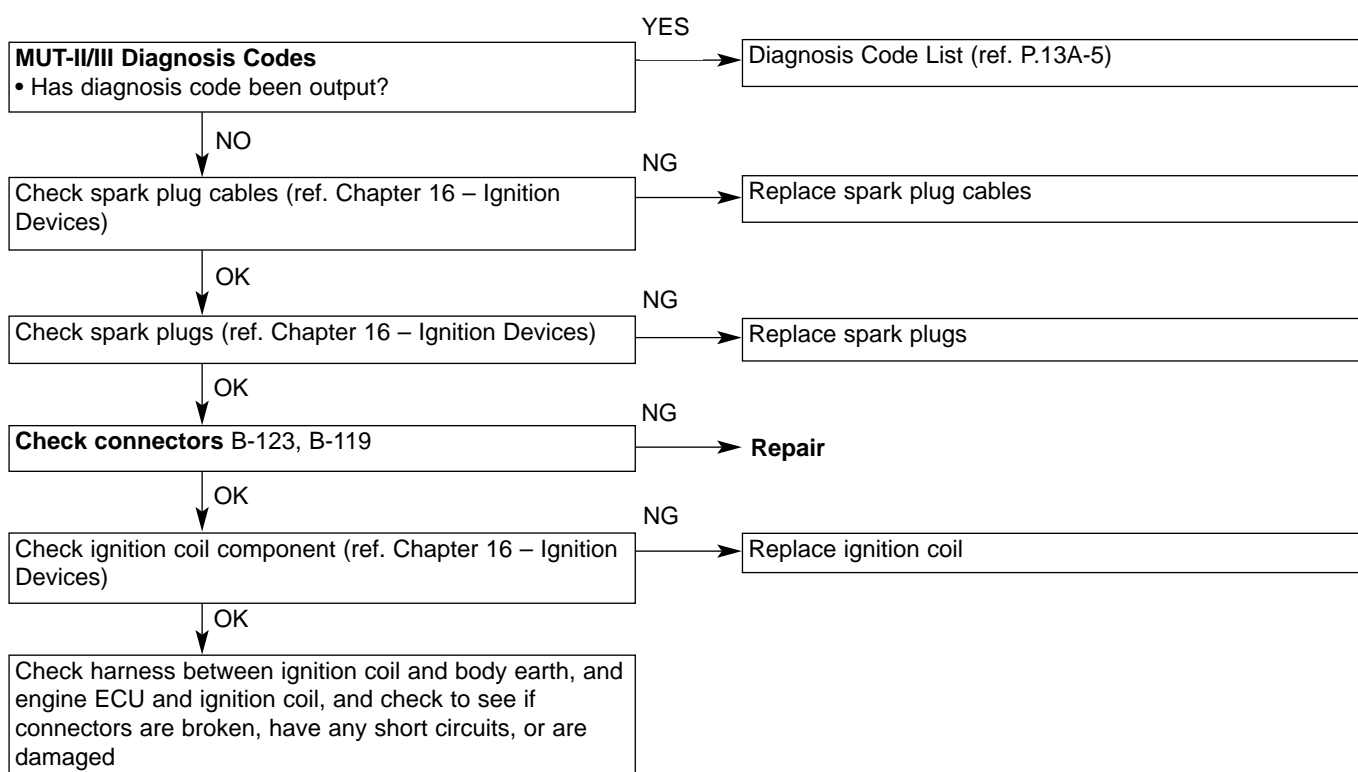




* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

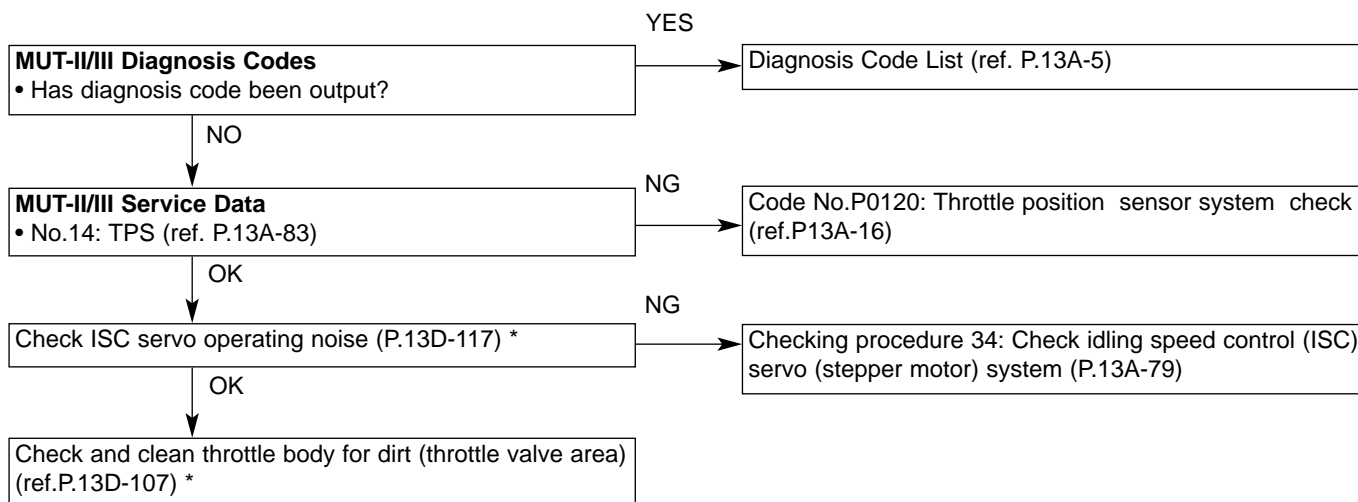
Checking Procedure 12

Acceleration Shock	Probable causes
The reason is likely to be ignition leak associated with an increase in spark plug demand voltage during acceleration.	<ul style="list-style-type: none"> Ignition system malfunction.



Checking Procedure 13

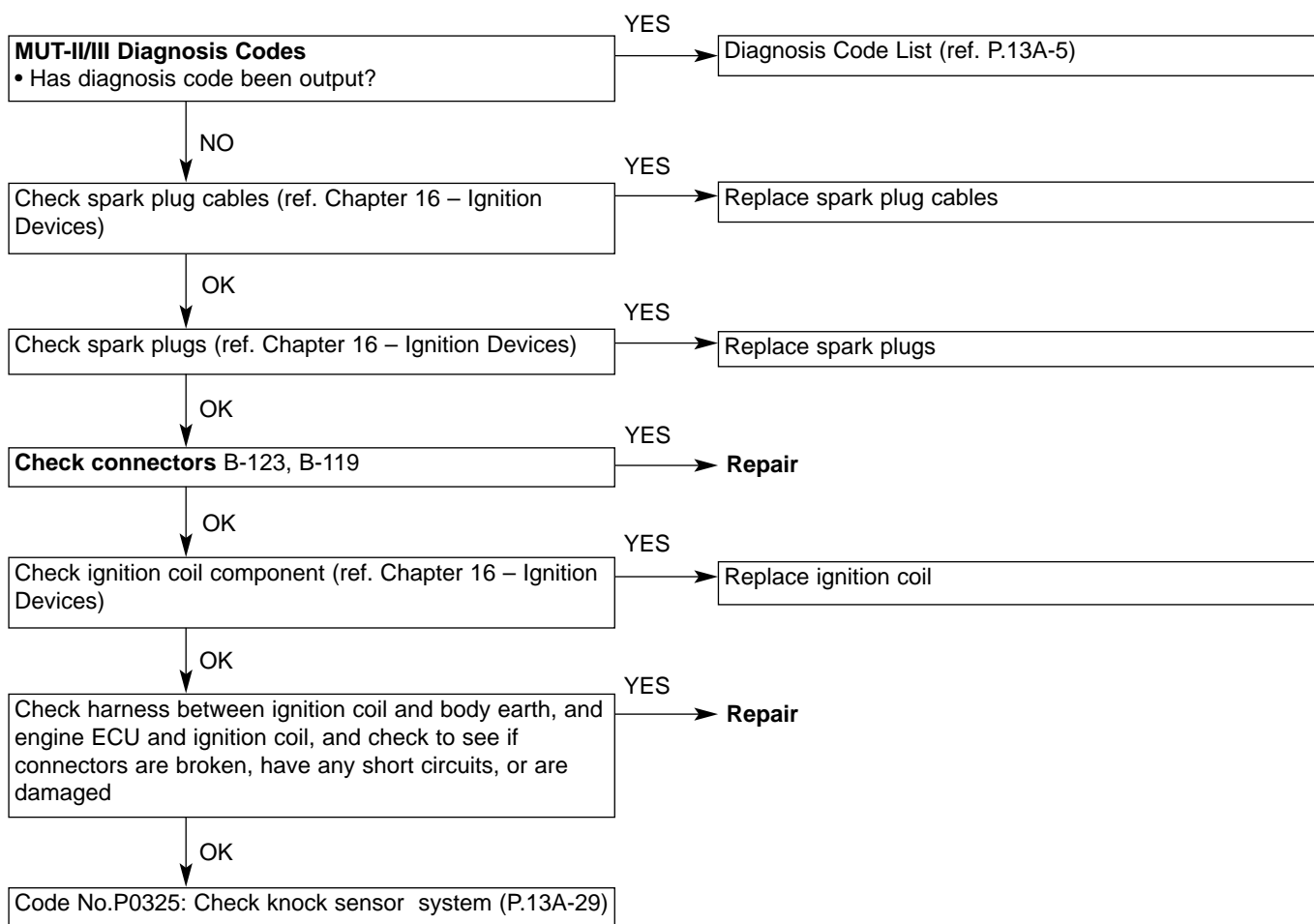
Acceleration Shock	Probable causes
ISC malfunction is a likely cause.	<ul style="list-style-type: none"> ISC control system malfunction



* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

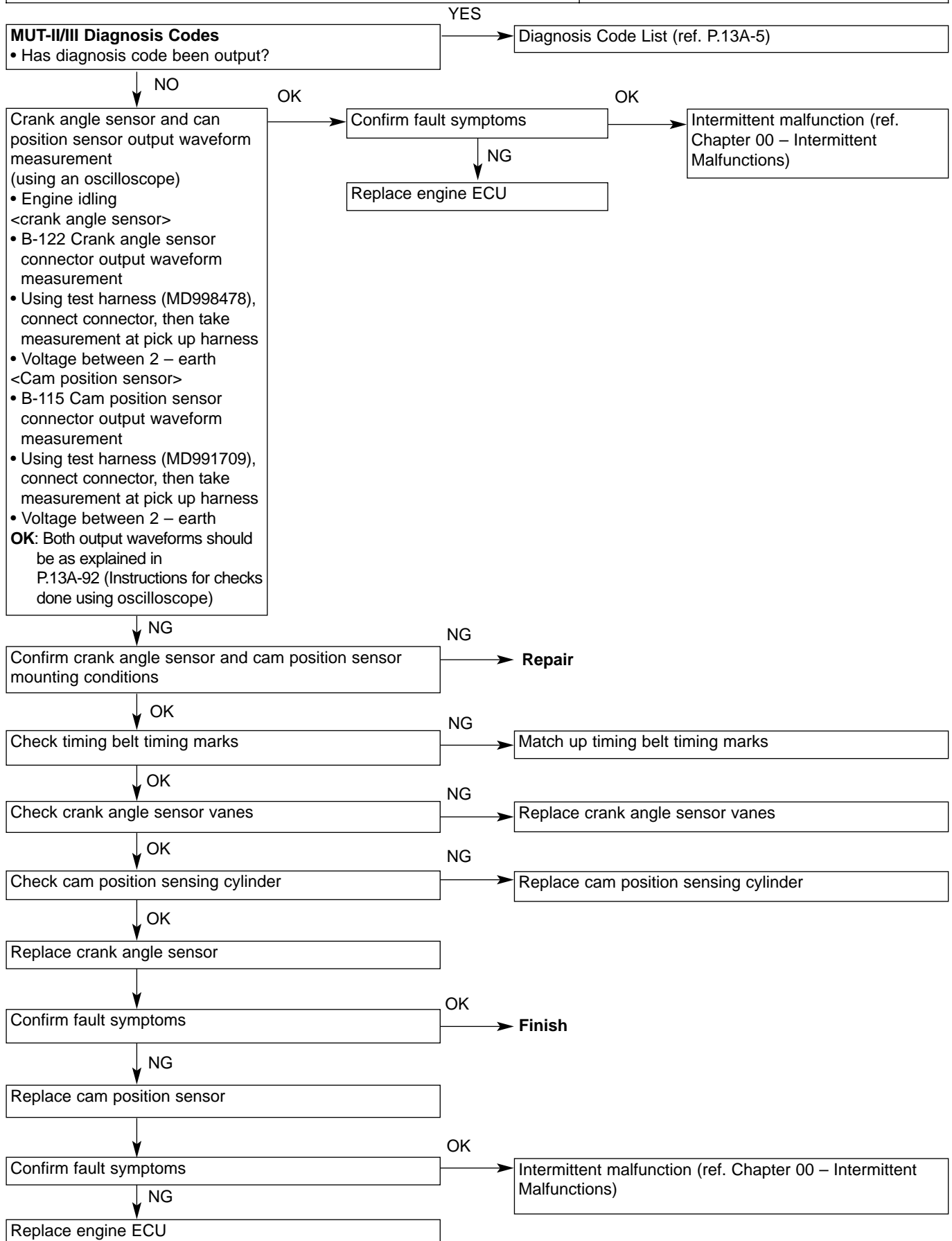
Checking Procedure 14

Knocking	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> Knock sensor malfunction Knock control system malfunction Spark plug malfunction Ignition system malfunction Engine ECU malfunction



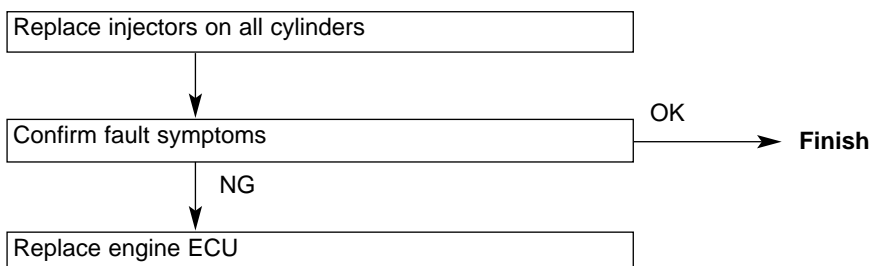
Checking Procedure 15

Ignition timing delay	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Crank angle sensor malfunction • Cam position sensor malfunction • Timing belt malfunction • Engine ECU malfunction



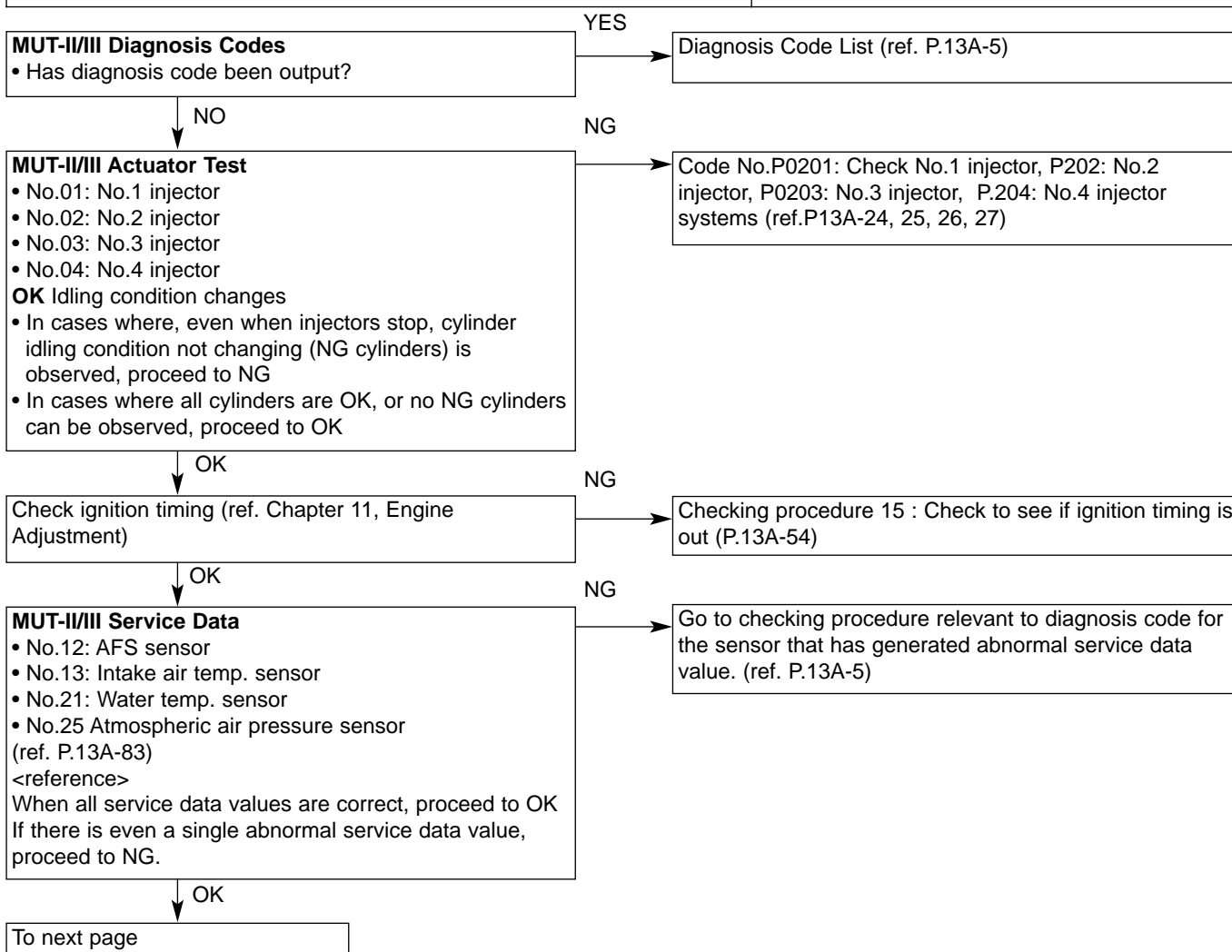
Checking Procedure 16

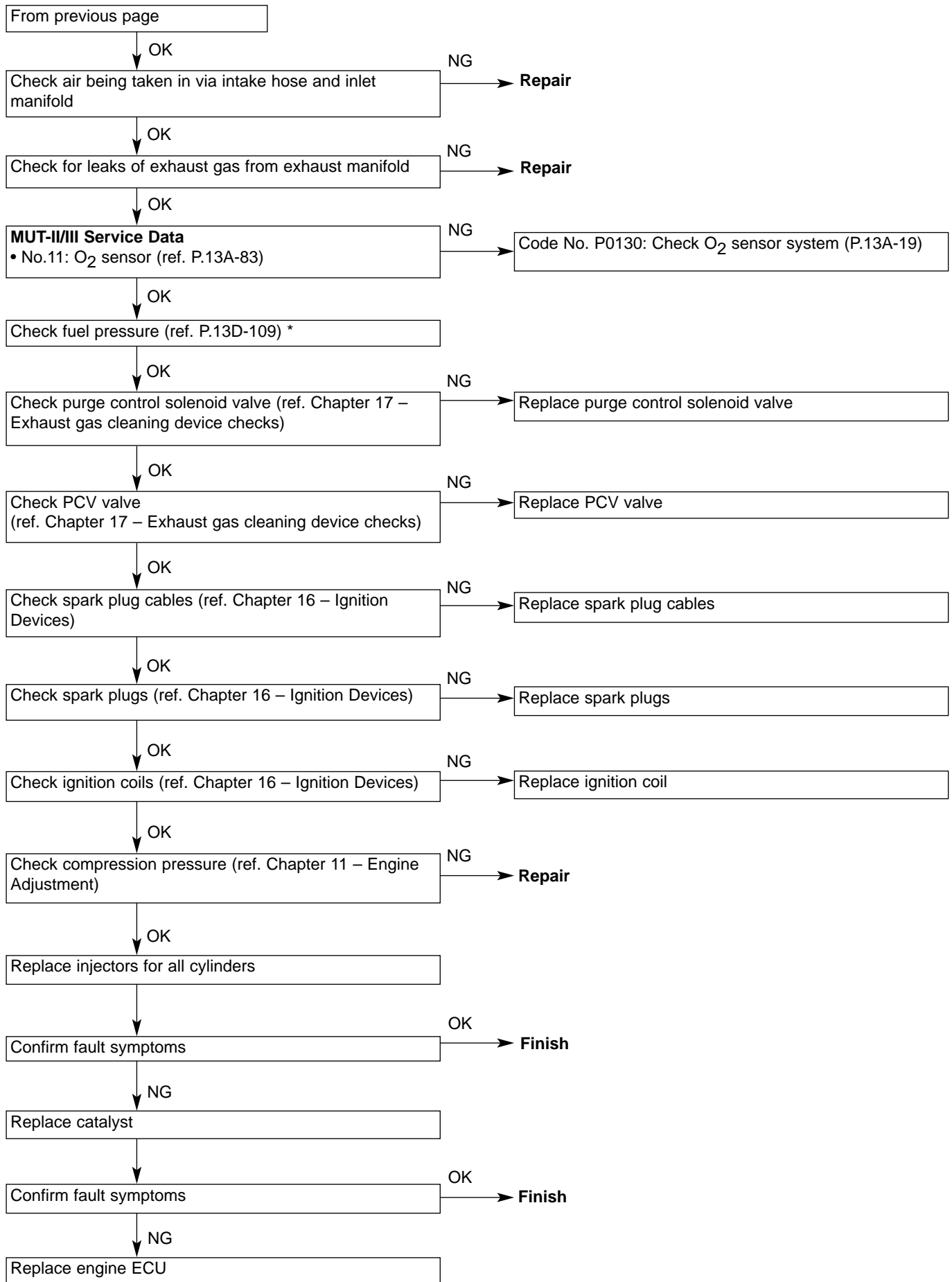
Dieseling/pinking (run-on)	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Injector malfunction • Engine ECU malfunction



Checking Procedure 17

Smelly, white smoke, black smoke CO and HC densities are high when idling	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Fuel air ratio control system malfunction • Ignition system malfunction • Fuel system malfunction • Intake/Exhaust system malfunction • Exhaust gas cleaning device system malfunction • Compression pressure NG • Catalyst malfunction • Engine ECU malfunction

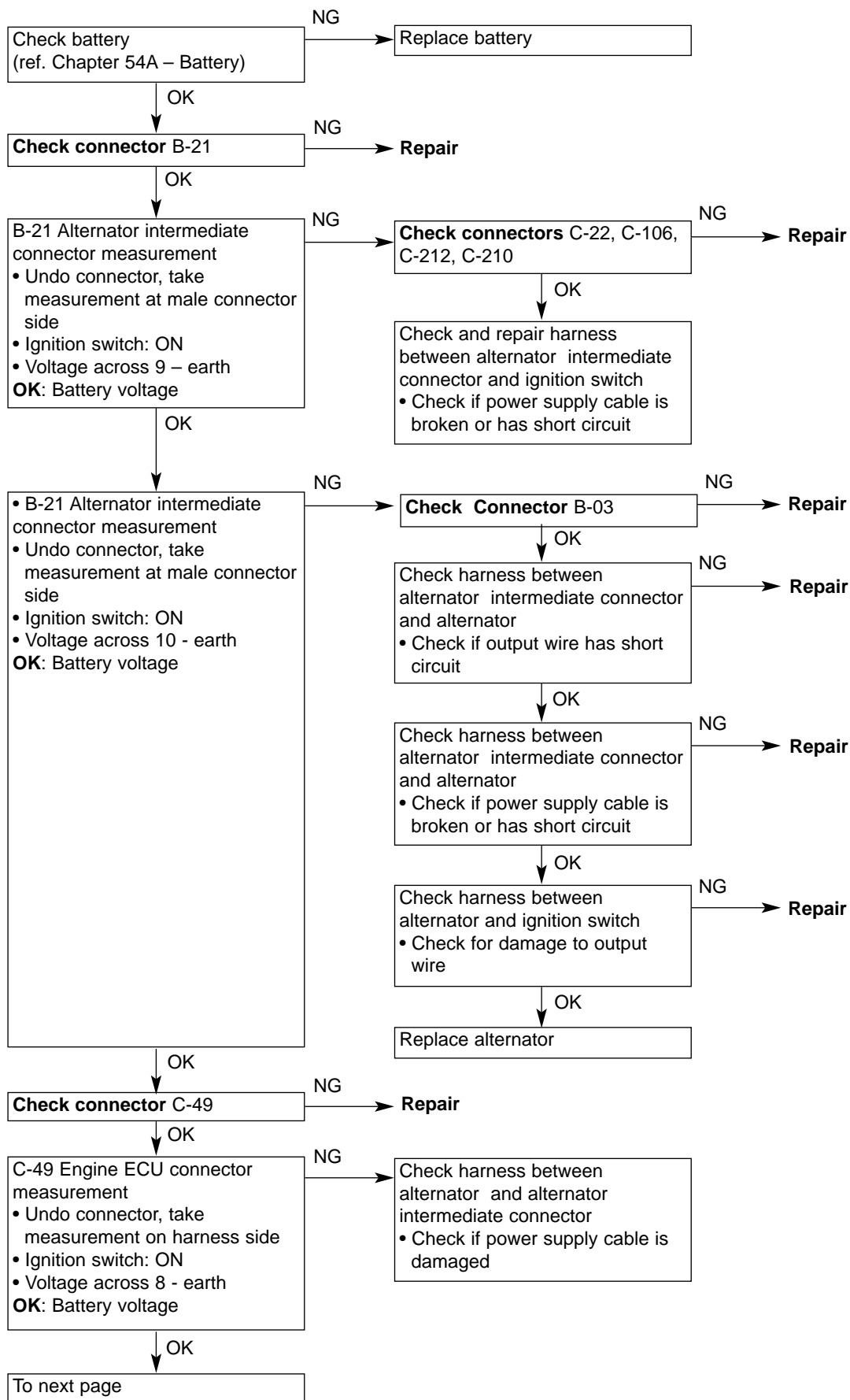


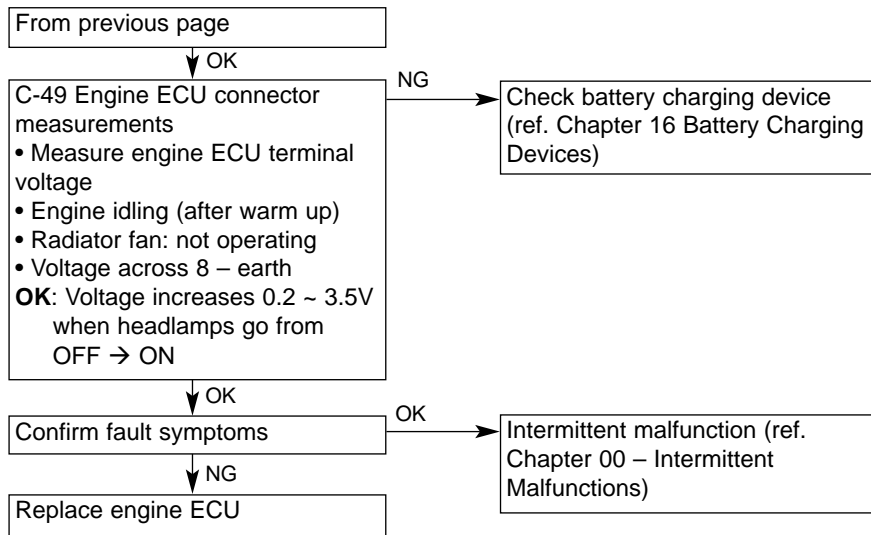


* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

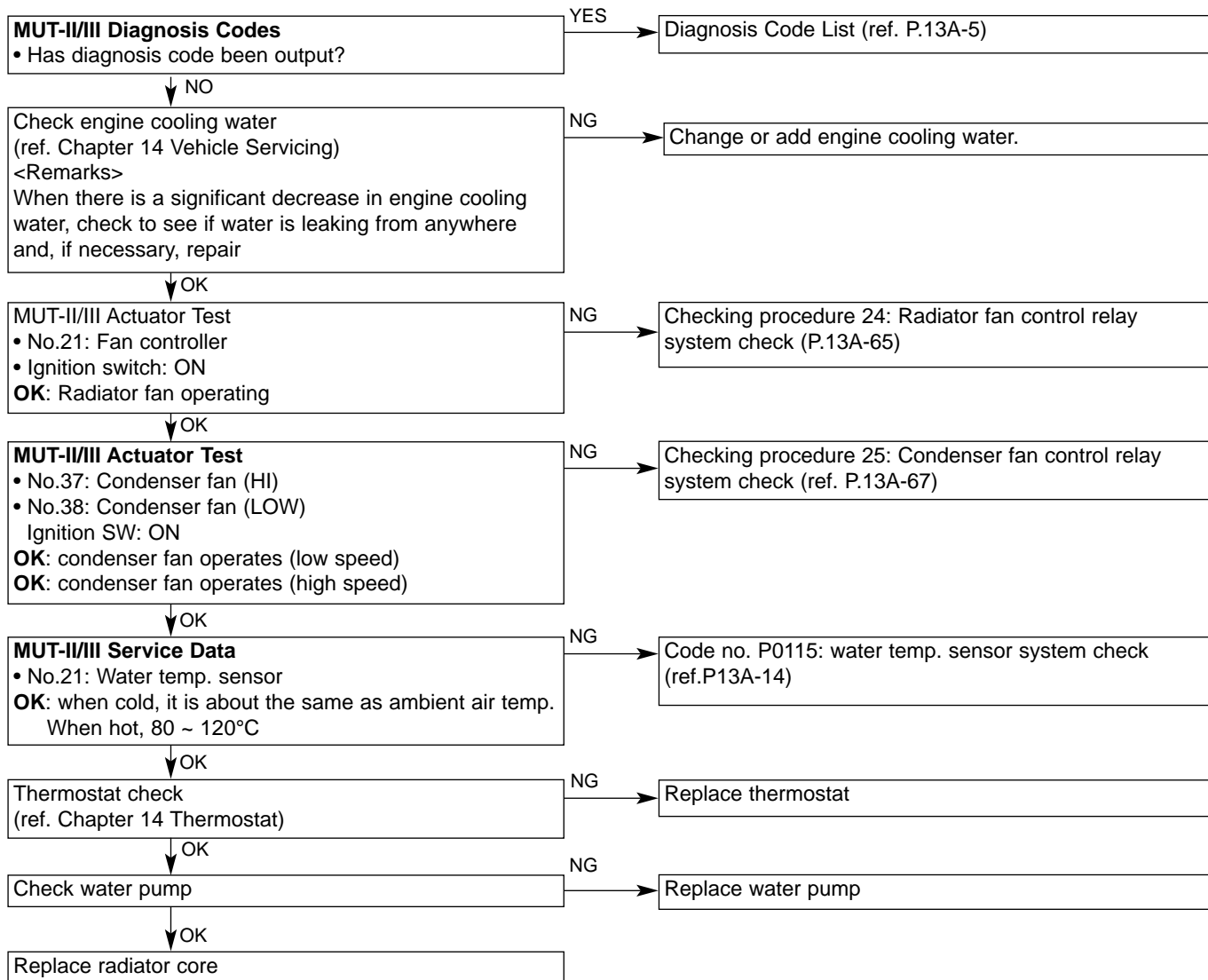
Checking Procedure 18

Flat Battery	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Battery malfunction • G terminal shorting • Alternator malfunction • Engine ECU malfunction



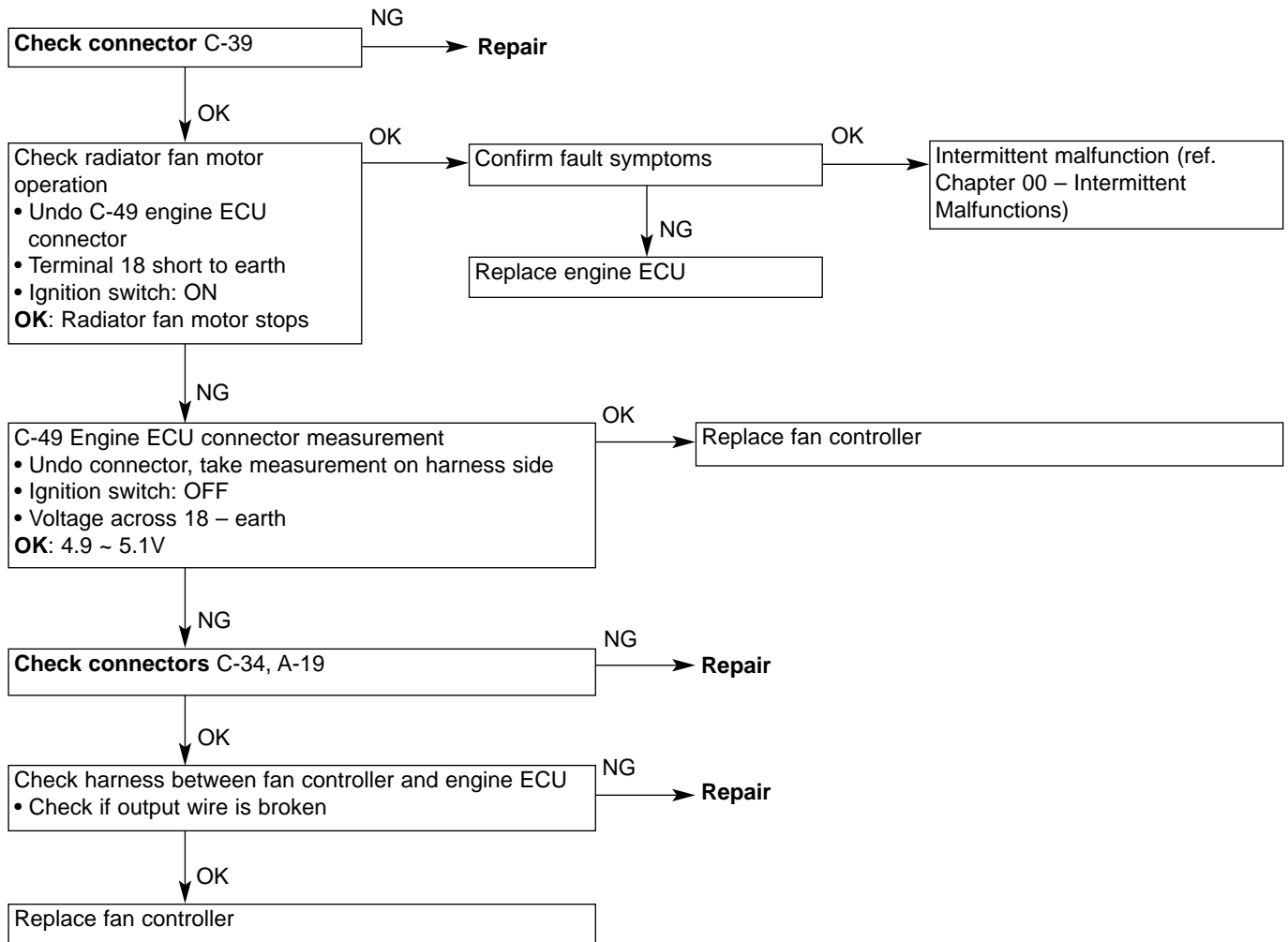
**Checking Procedure 19**

Overheating	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • Engine cooling water insufficient or deteriorated • Fan controller malfunction • Water temp. sensor malfunction • Thermostat malfunction • Water pump malfunction • Condenser fan relay malfunction • Radiator core malfunction • Engine ECU malfunction



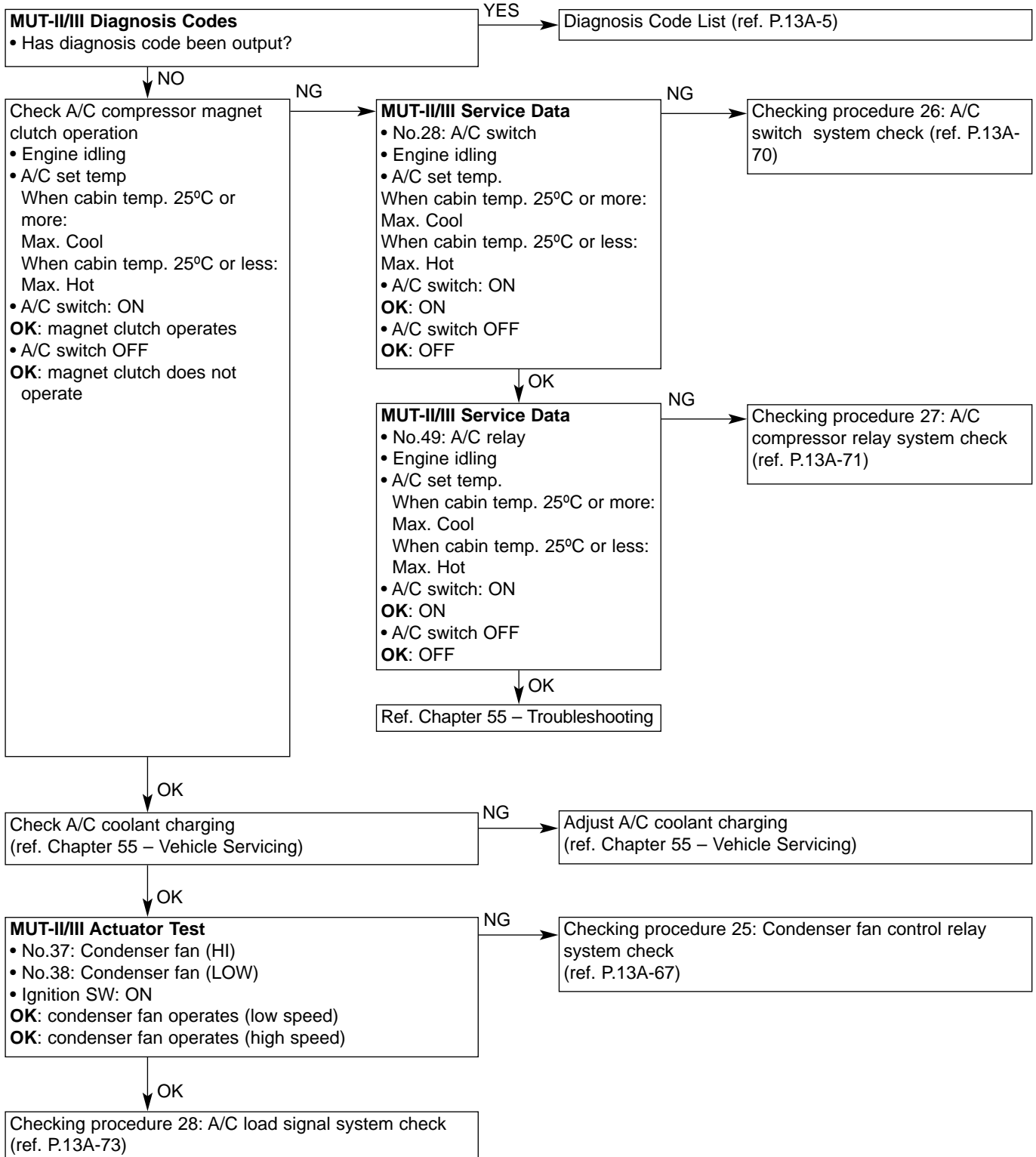
Checking Procedure 20

Radiator Fan Motor Running Abnormally	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> Fan controller malfunction Engine ECU malfunction

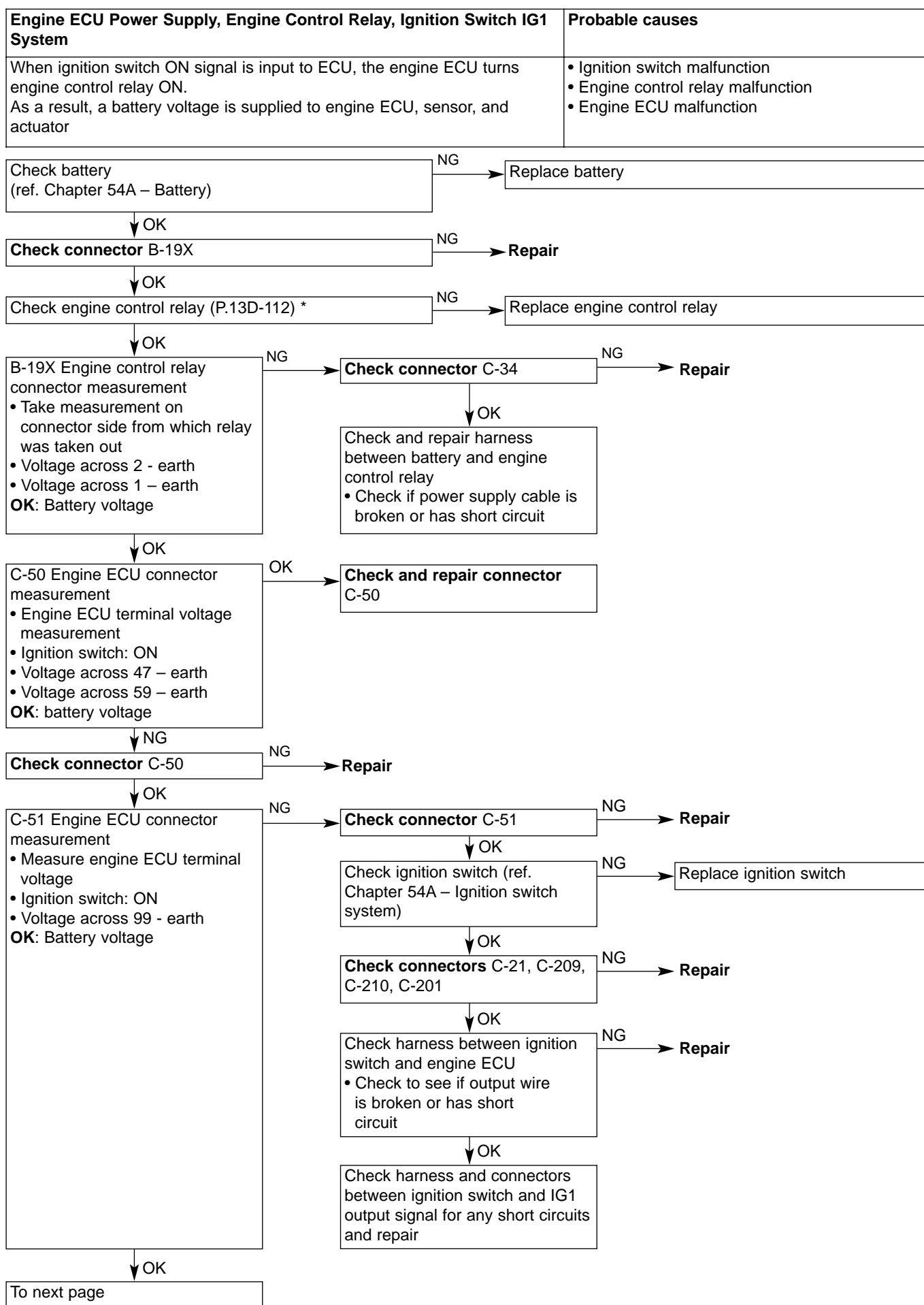


Checking Procedure 21

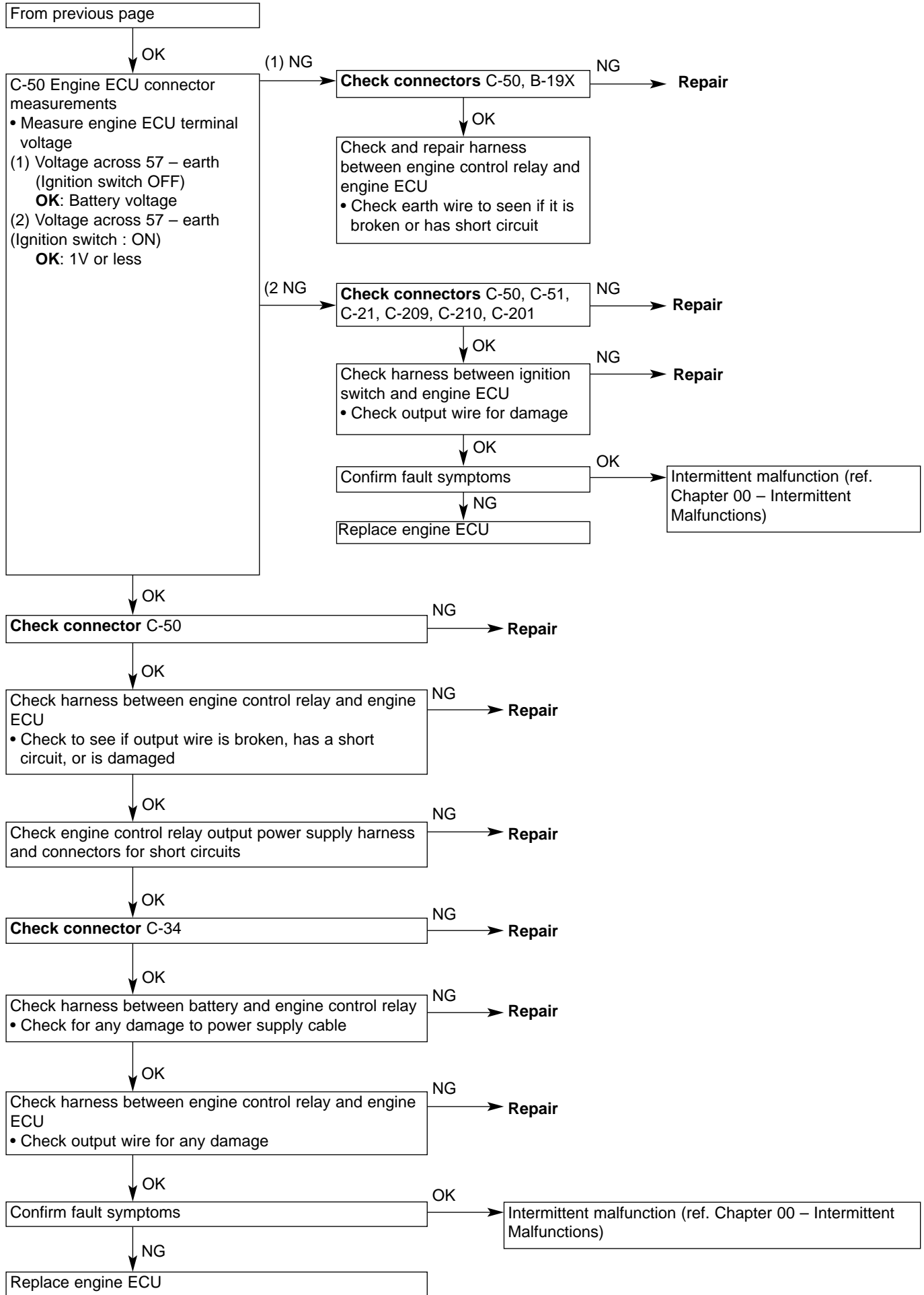
A/C ineffective	Probable causes
The probable causes are noted right.	<ul style="list-style-type: none"> • A/C coolant malfunction or overfilled • A/C compressor relay malfunction • Condenser fan system malfunction • A/C-ECU malfunction • Engine ECU malfunction



Checking Procedure 22

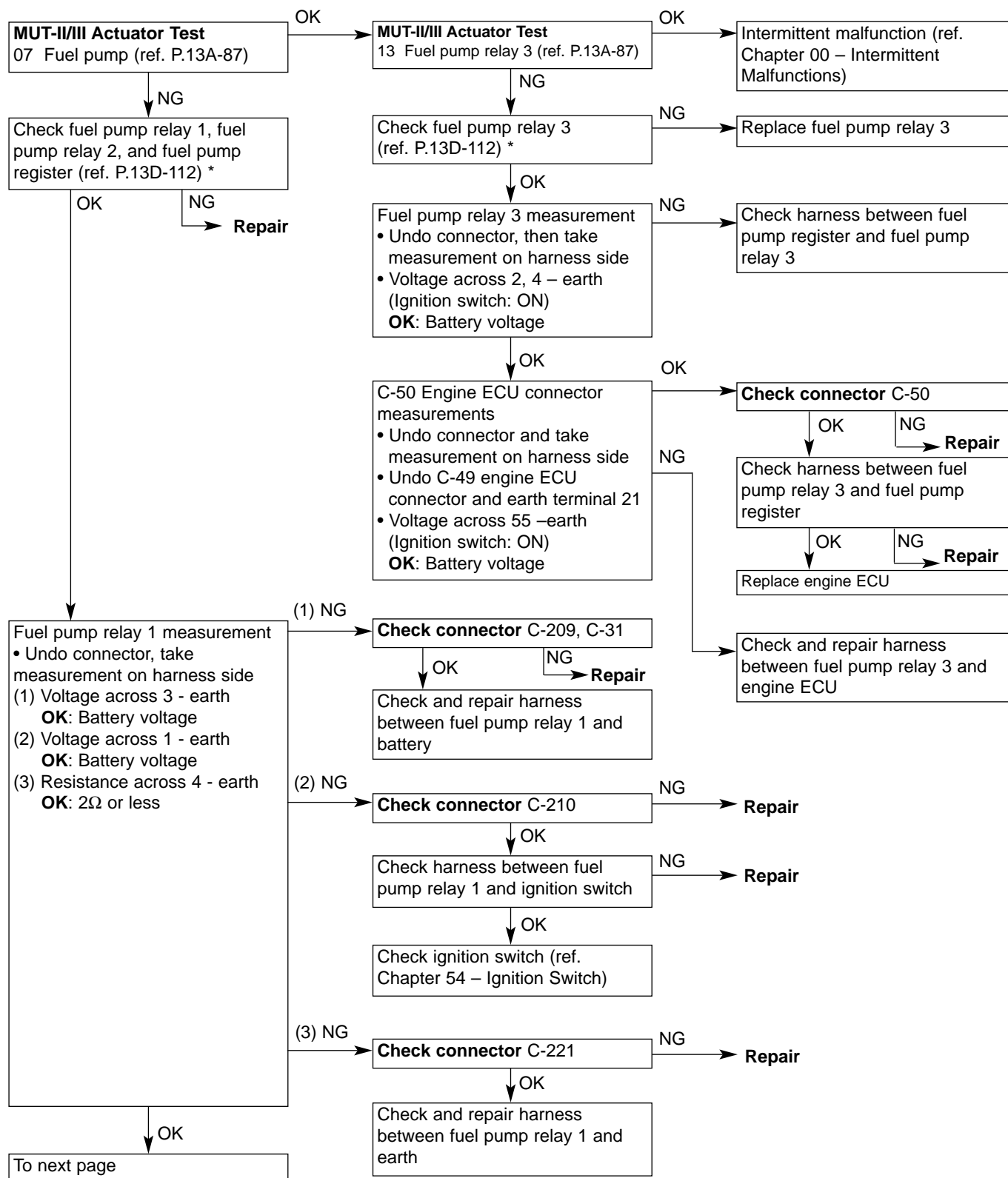


* Refer to '01-1 Lancer Evolution VII Workshop Manual (No.1036K02)

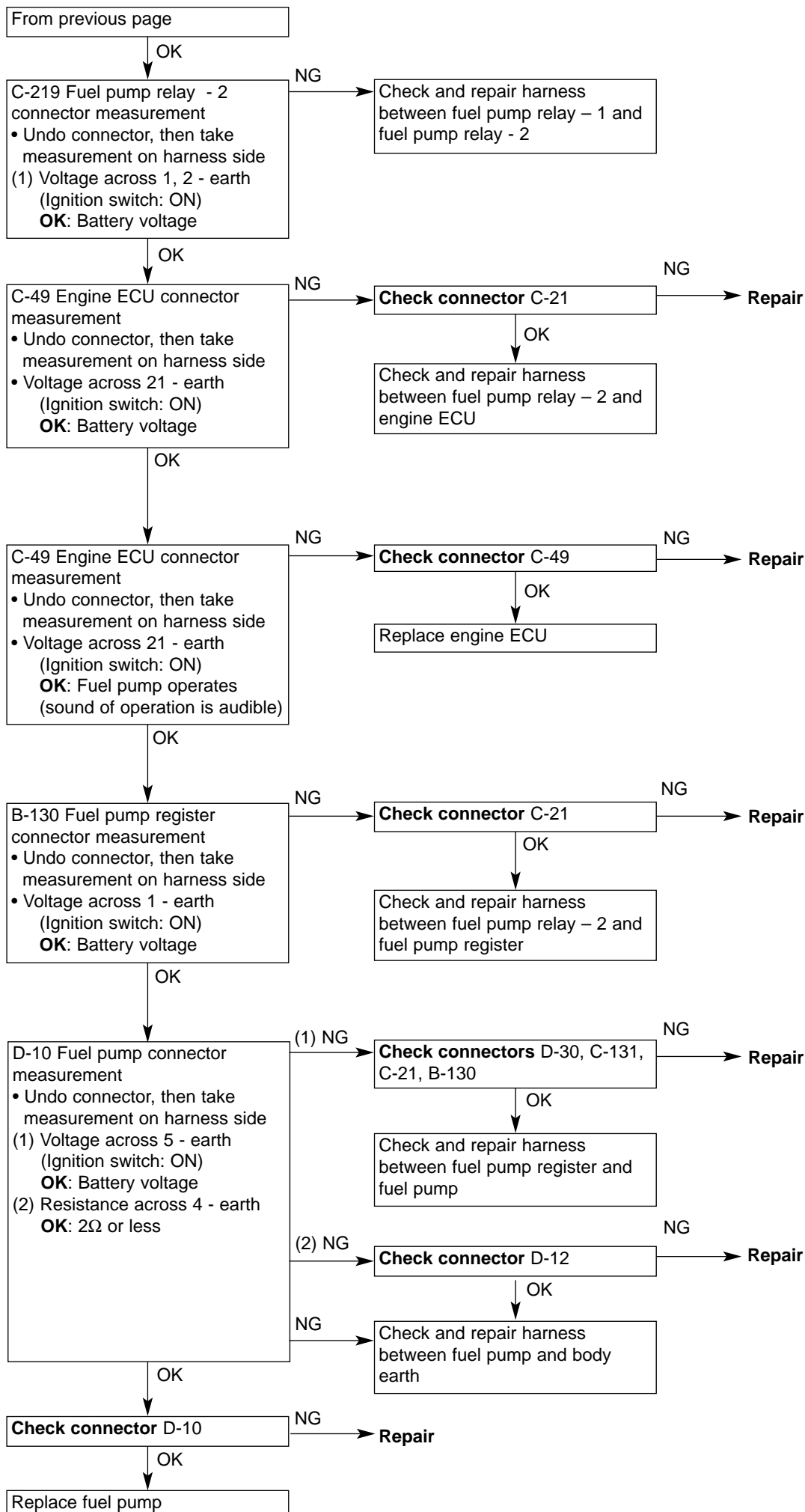


Checking Procedure 23

Fuel Pump System	Probable causes
<ul style="list-style-type: none"> During cranking and driving, engine ECU turns fuel pump relay ON, and supplies power driving the fuel pump When driving with a low load, the engine ECU supplies power, via the register, to the fuel pump. Also, when driving with a heavy load, power is supplied directly, and the quantity of fuel sent from the fuel pump increases 	<ul style="list-style-type: none"> Fuel pump relay 1 malfunction Fuel pump relay 2 malfunction Fuel pump relay 3 malfunction Fuel pump malfunction Fuel pump register malfunctions Fuel pump circuit broken, has short circuit, or poor connector contact Engine ECU malfunction

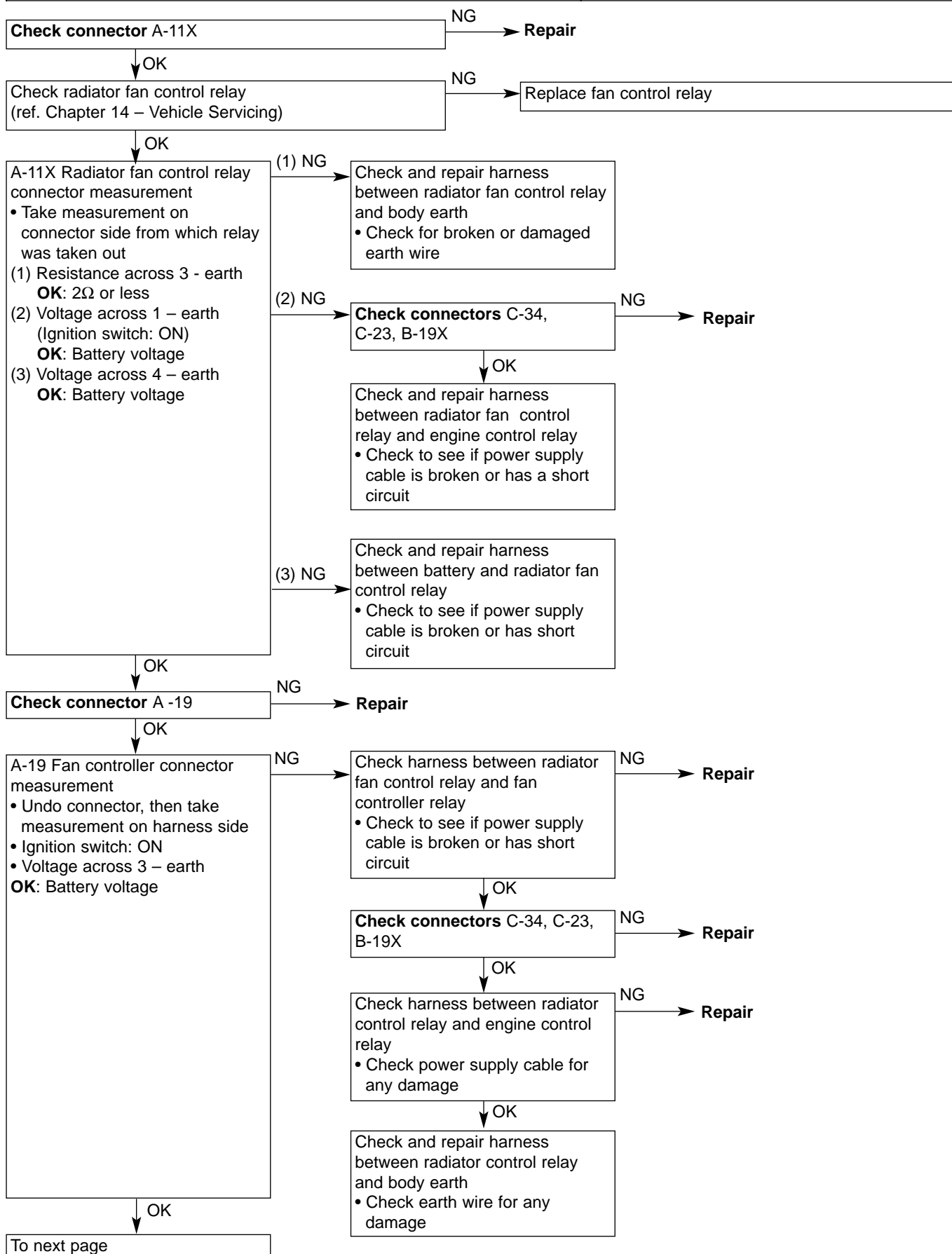


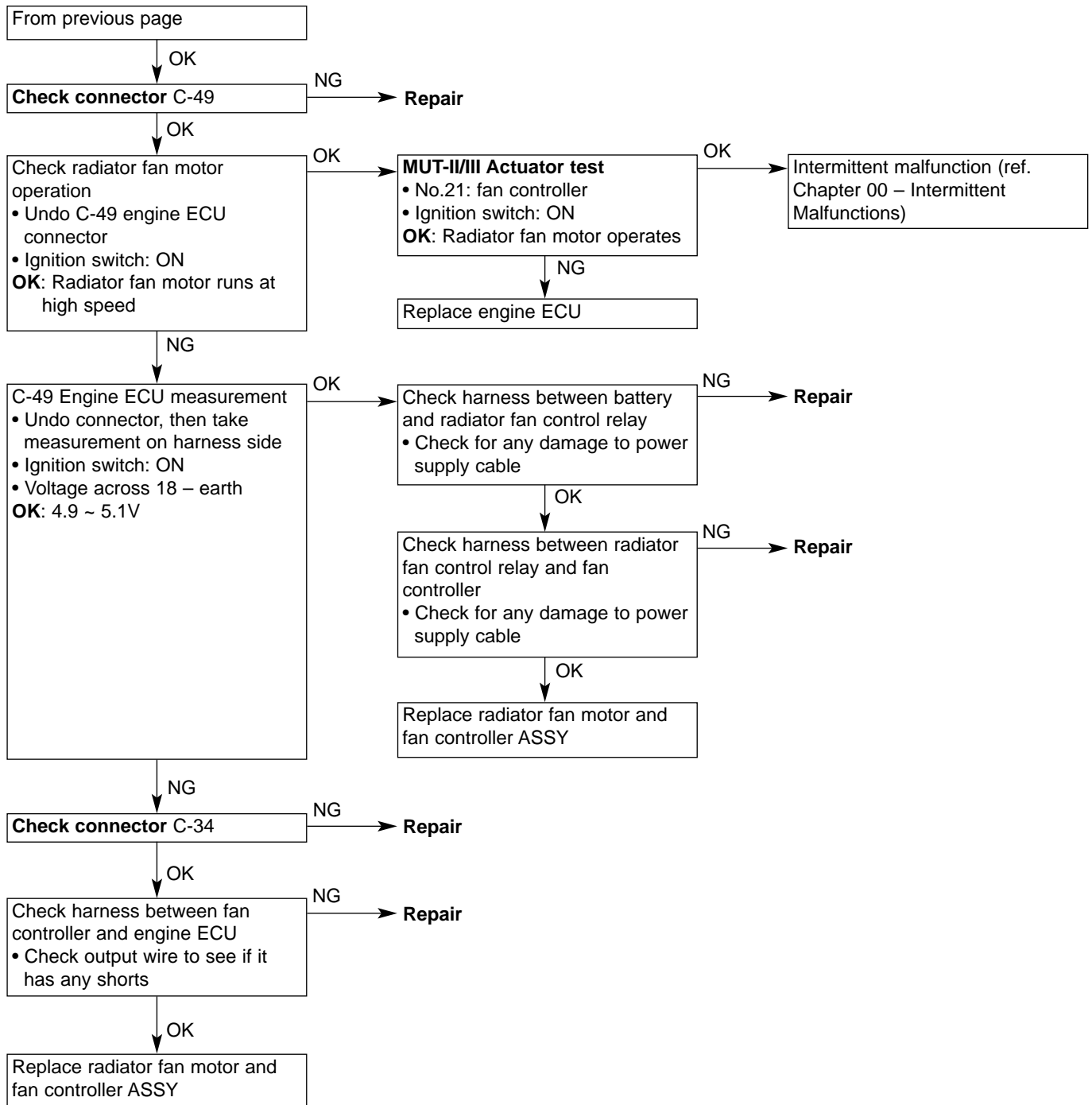
* Refer to '01–1 Lancer Evolution VII Workshop Manual (No.1036K02)



Checking Procedure 24

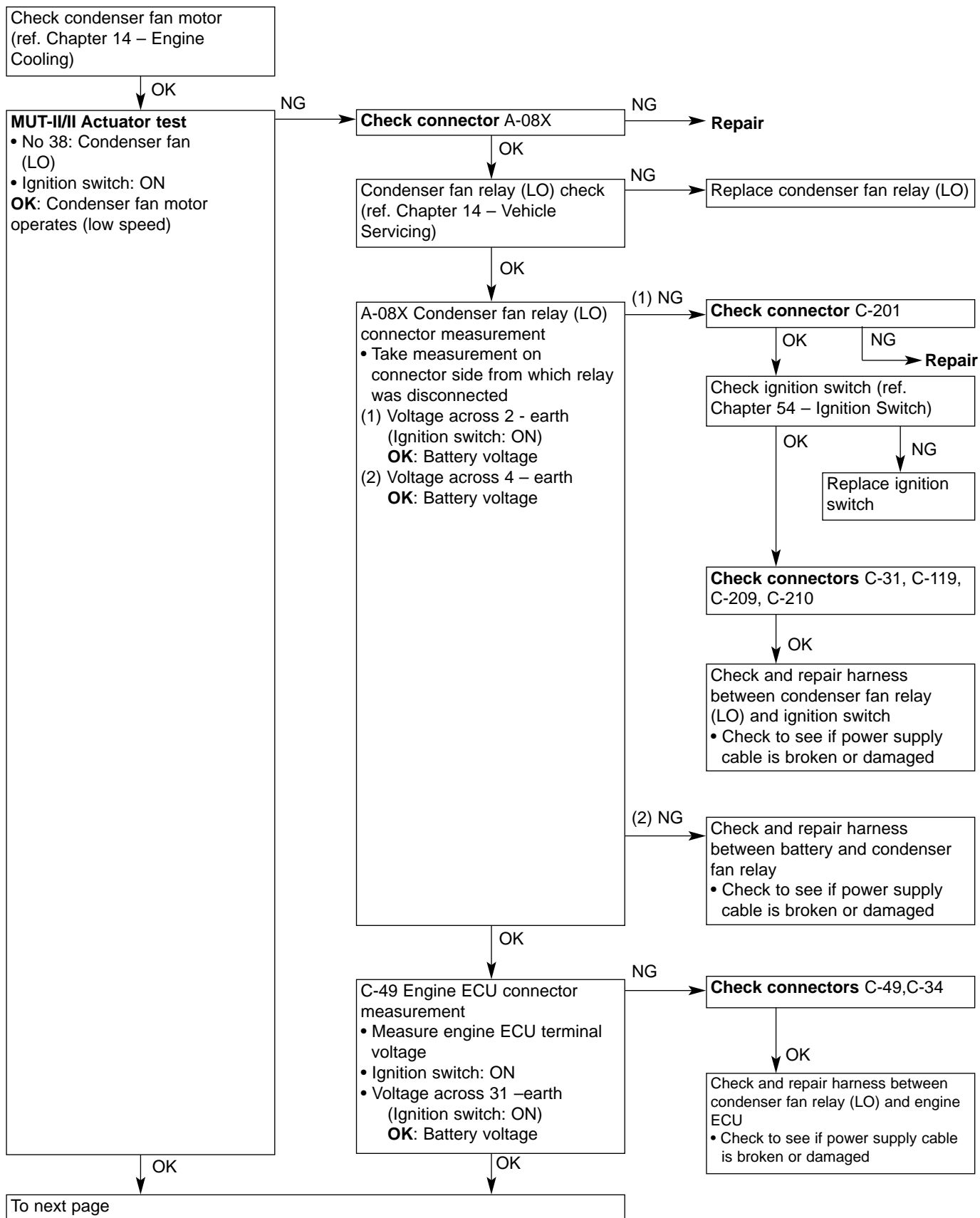
Radiator Fan Control Relay System	Probable causes
When engine control relay is turned ON, the radiator fan control relay switches ON at the same time, supplying power to the fan controller. Also, when fan motor drive signal is input to the fan controller from the ECU, the radiator fan motor operates.	<ul style="list-style-type: none"> • Radiator fan control relay malfunction • Fan controller malfunction • Radiator fan motor malfunction • Engine ECU malfunction

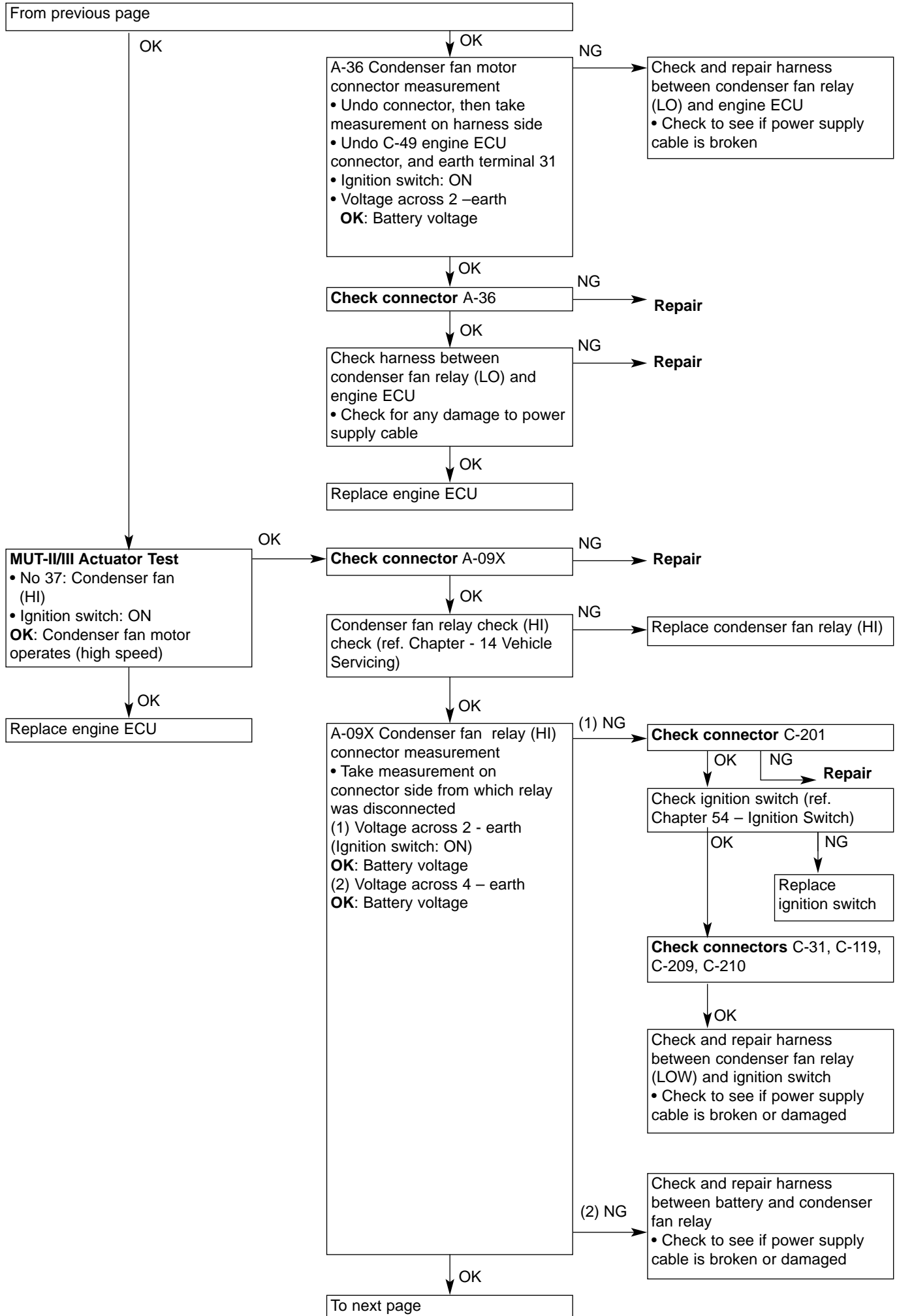


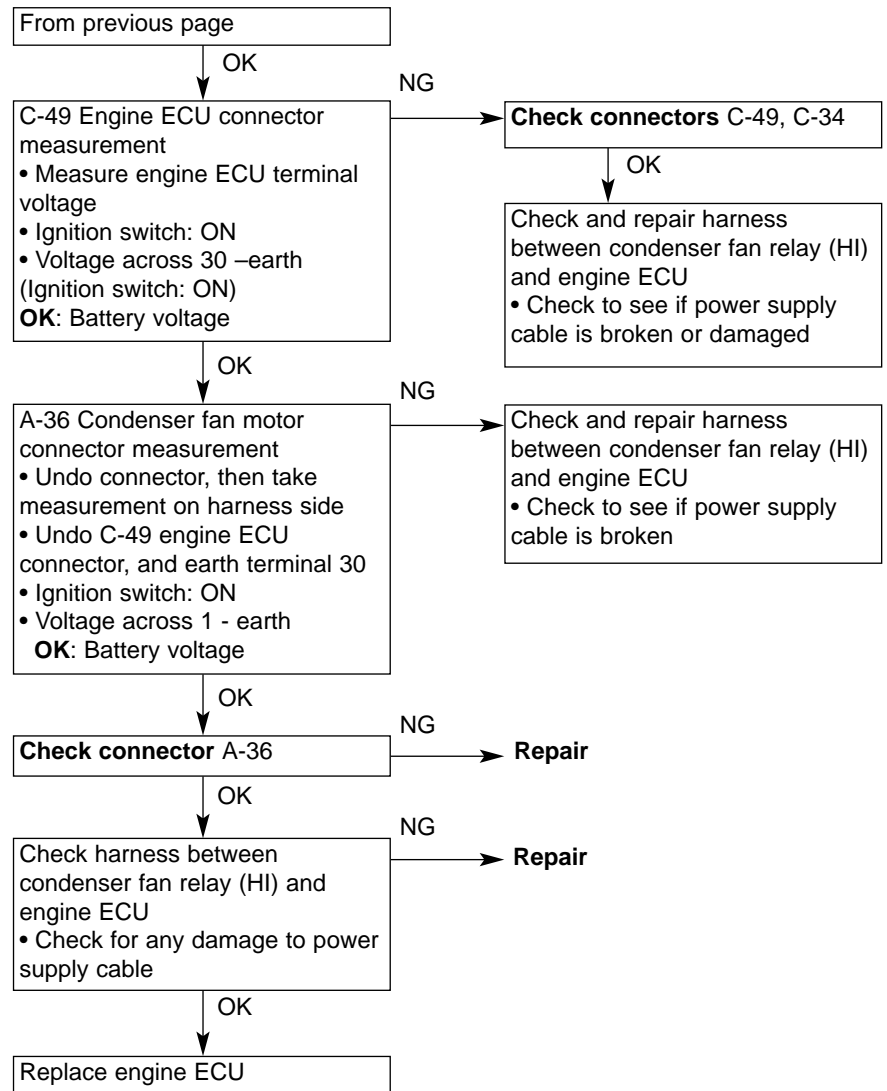


Checking Procedure 25

Condenser Fan Relay	Probable causes
The signal from the engine ECU turns the condenser fan relay ON, supplying power to the condenser fan motor.	<ul style="list-style-type: none"> • Condenser fan relay (HI) malfunction • Condenser fan relay (LO) malfunction • Condenser fan motor malfunction • Condenser fan circuit broken, has a short circuit, or there is poor connector contact • Engine ECU malfunction

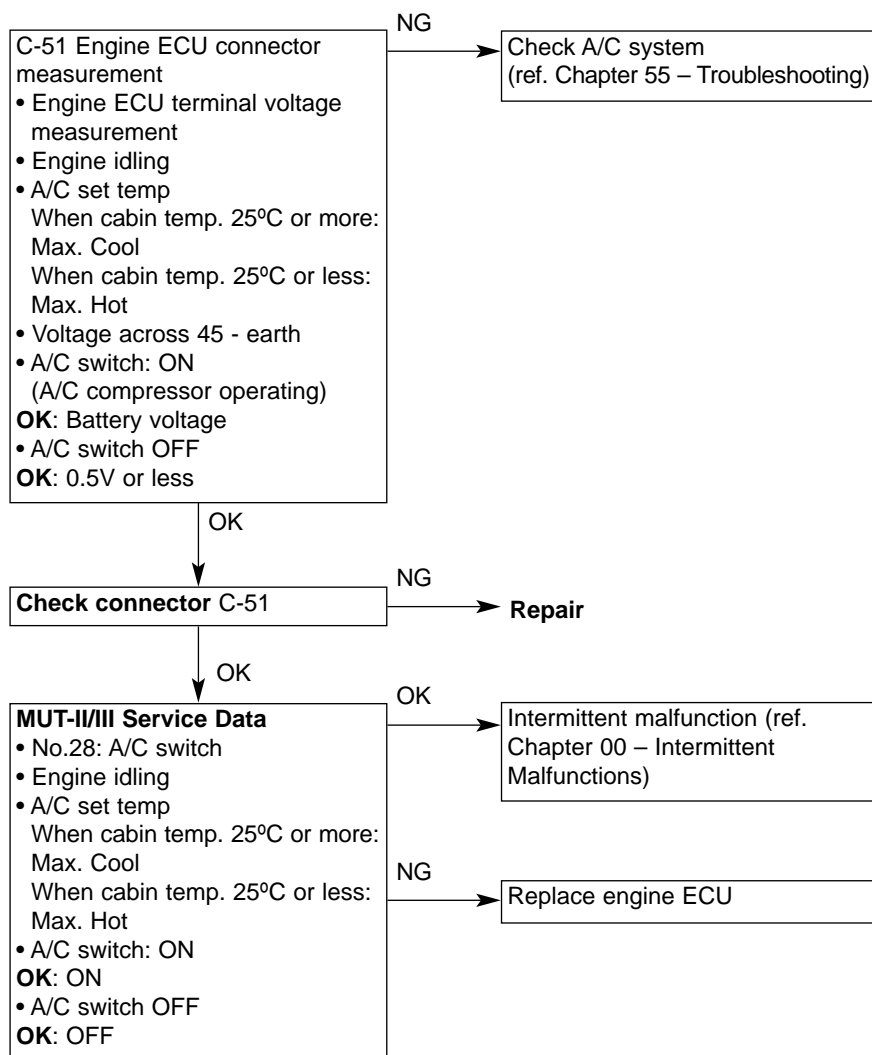






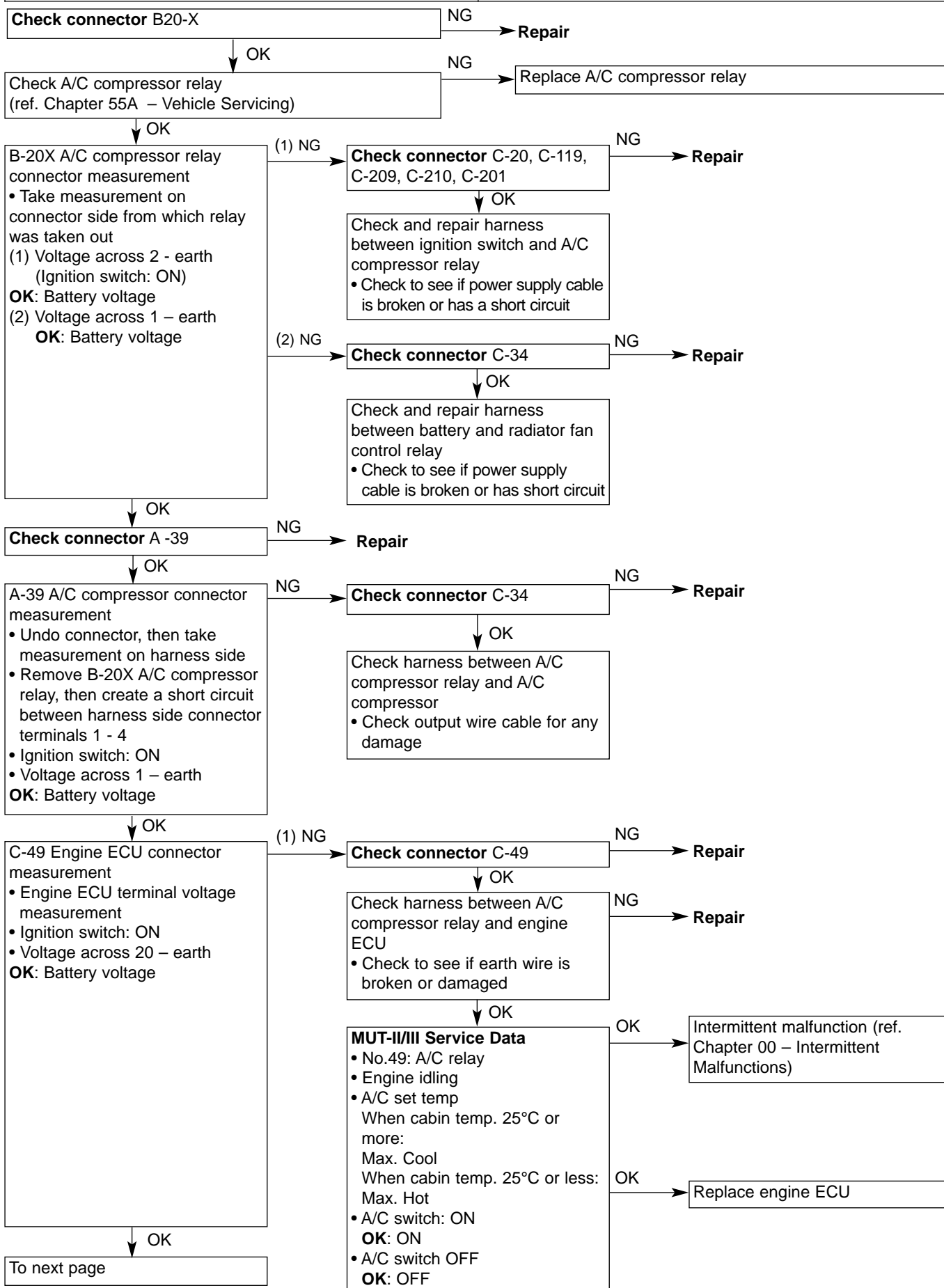
Checking Procedure 26

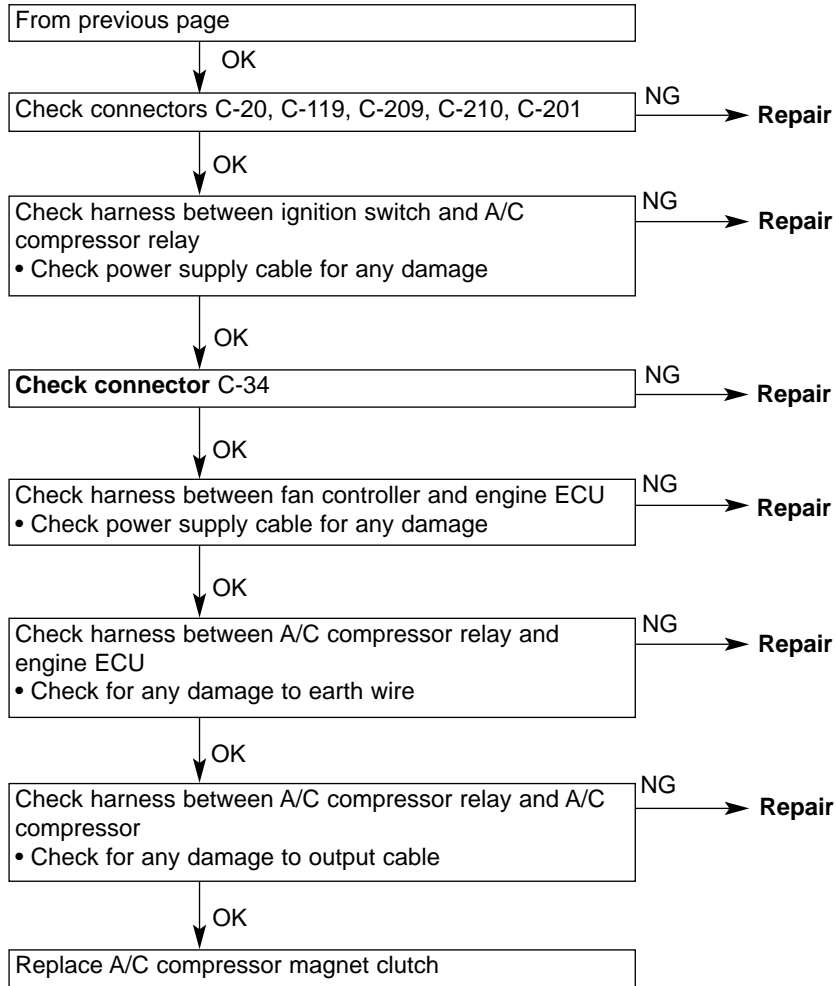
A/C Switch System	Probable causes
When the control panel A/C switch is turned ON, the A/C switch ON signal is input to the engine ECU. As a result, the engine ECU turns the A/C compressor ON.	<ul style="list-style-type: none"> • Control panel A/C switch malfunction • A/C system malfunction • Engine ECU malfunction



Checking Procedure 27

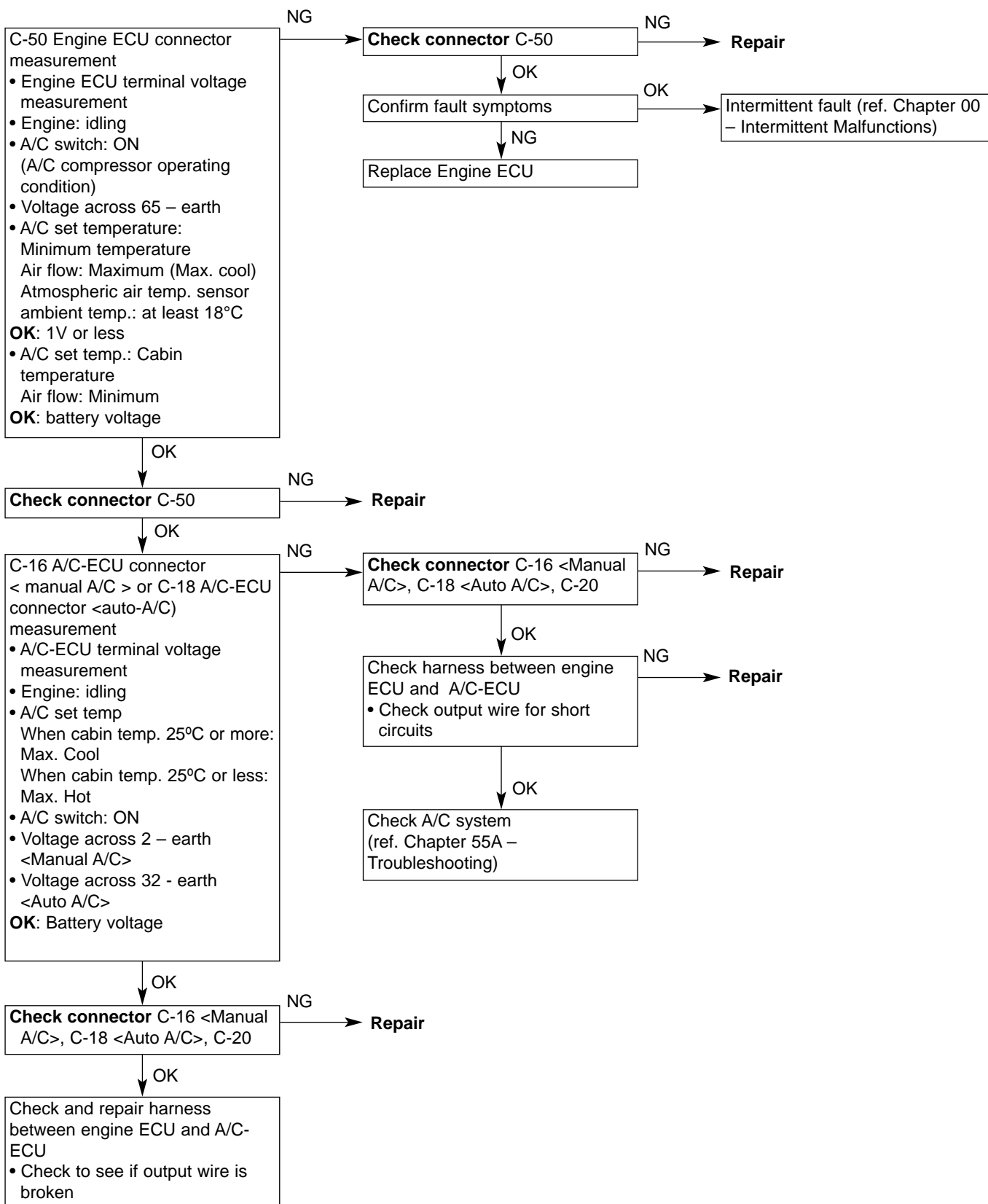
A/C Compressor System	Probable causes
When the A/C switch ON signal is input to the engine ECU, the engine ECU turns the A/C compressor relay ON. As a result, the A/C compressor magnet clutch operates.	<ul style="list-style-type: none"> • A/C compressor relay malfunction • A/C compressor magnet clutch malfunction • Engine ECU malfunction





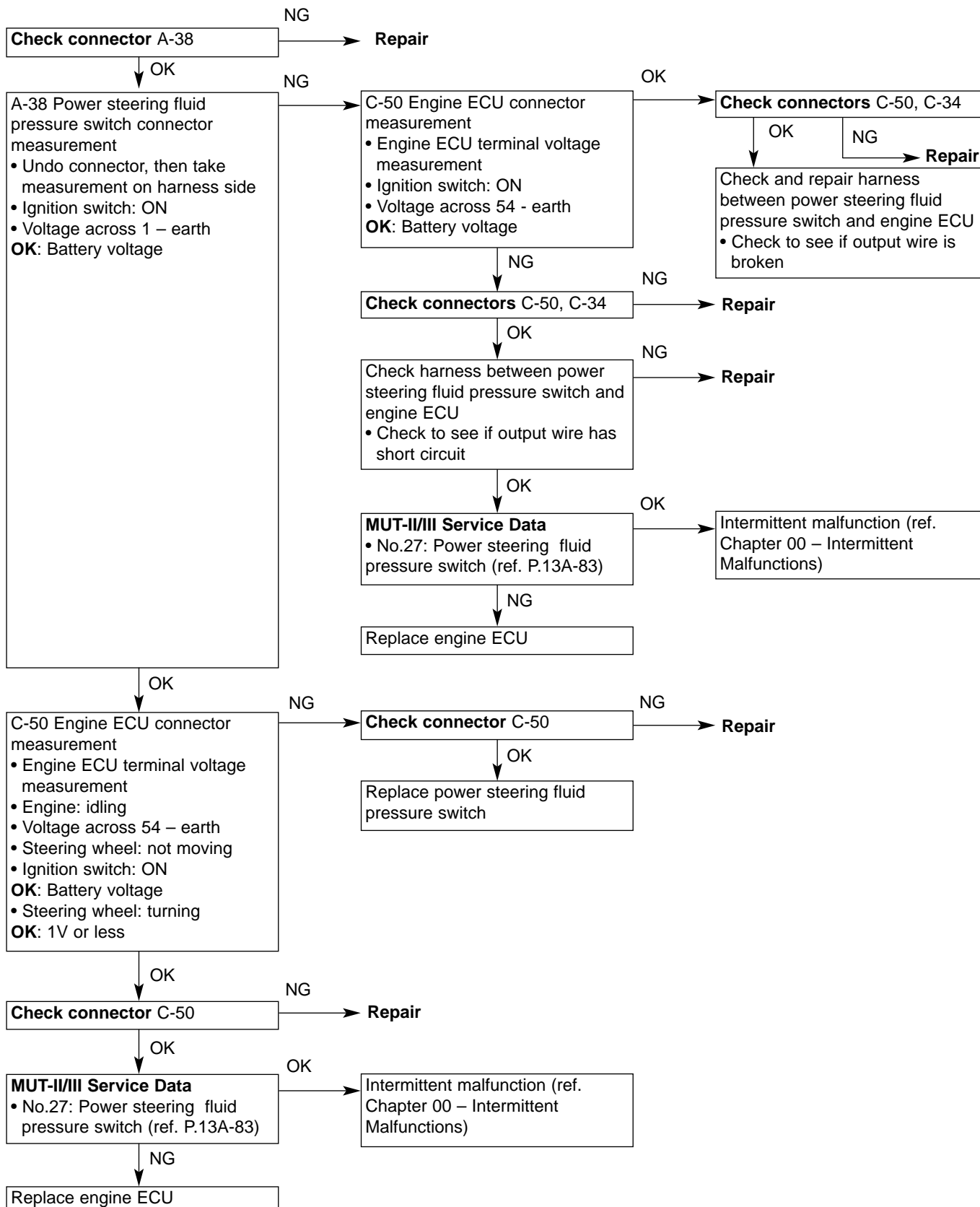
Checking Procedure 28

A/C Load Signal System	Probable causes
Detects the size of the A/C compressor load, which depends on differences in the set temperature. When a high A/C load signal is input to the engine ECU, the engine ECU decides that the A/C compressor load is high and operates the throttle valve control servo so that idling speed increases.	<ul style="list-style-type: none"> • A/C-ECU malfunction • Engine ECU malfunction



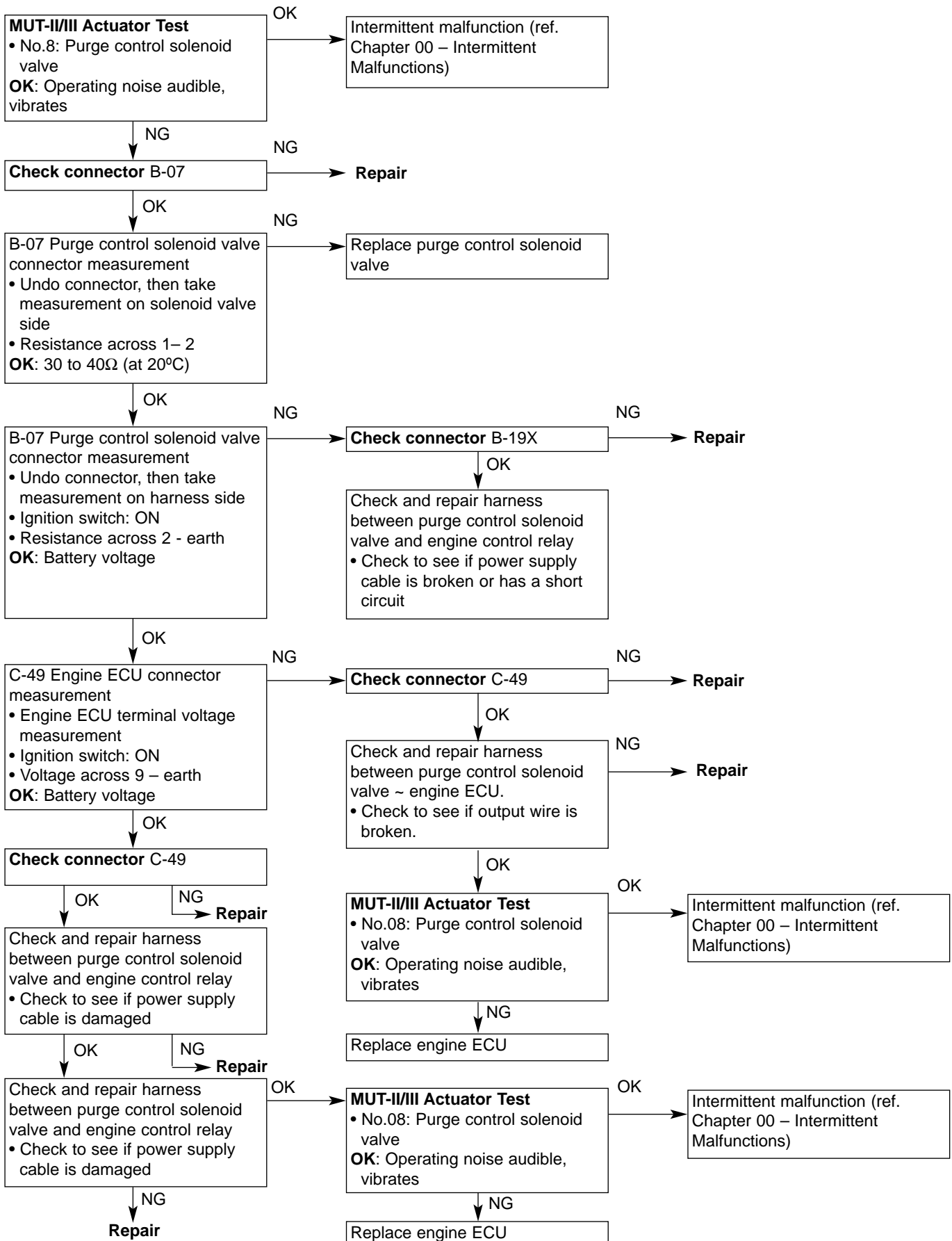
Checking Procedure 29

Power Steering Fluid Pressure Switch System	Probable causes
Detects a power steering oil pump load caused by turning of the steering wheel. When a power steering fluid pressure switch ON signal is input to engine ECU, the engine ECU decides that there is an increase in the power steering oil pump load, and operates the throttle valve control servo so that idling speed increases.	<ul style="list-style-type: none"> Power steering fluid pressure switch malfunction Engine ECU malfunction



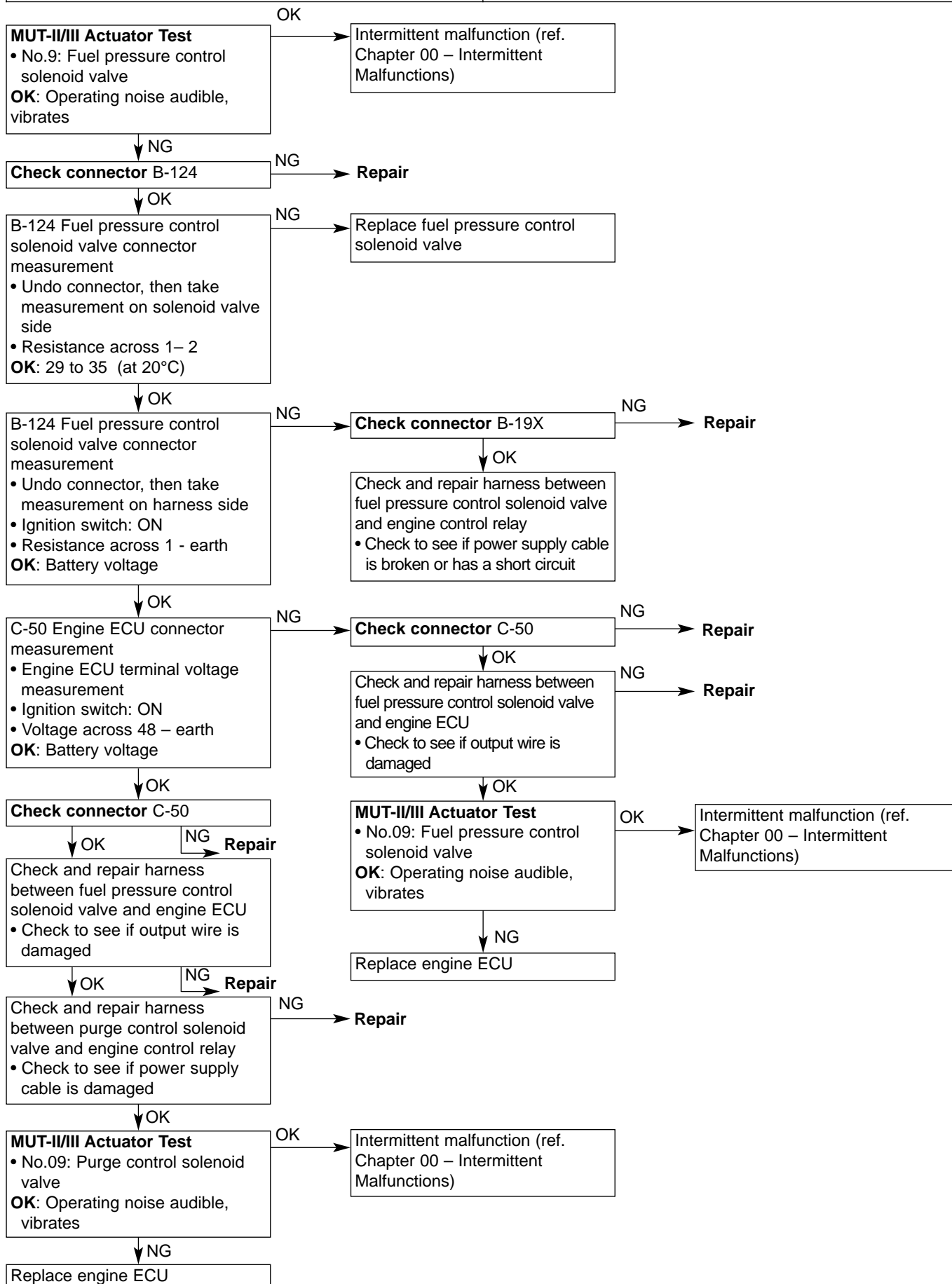
Checking Procedure 30

Purge Control Solenoid Valve System	Probable causes
The engine ECU controls air purged from the canister, by controlling the purge control solenoid valve.	<ul style="list-style-type: none"> • Purge control solenoid valve malfunction • Purge control solenoid valve circuit broken, has a short circuit, or poor connector contacts • Engine ECU malfunction



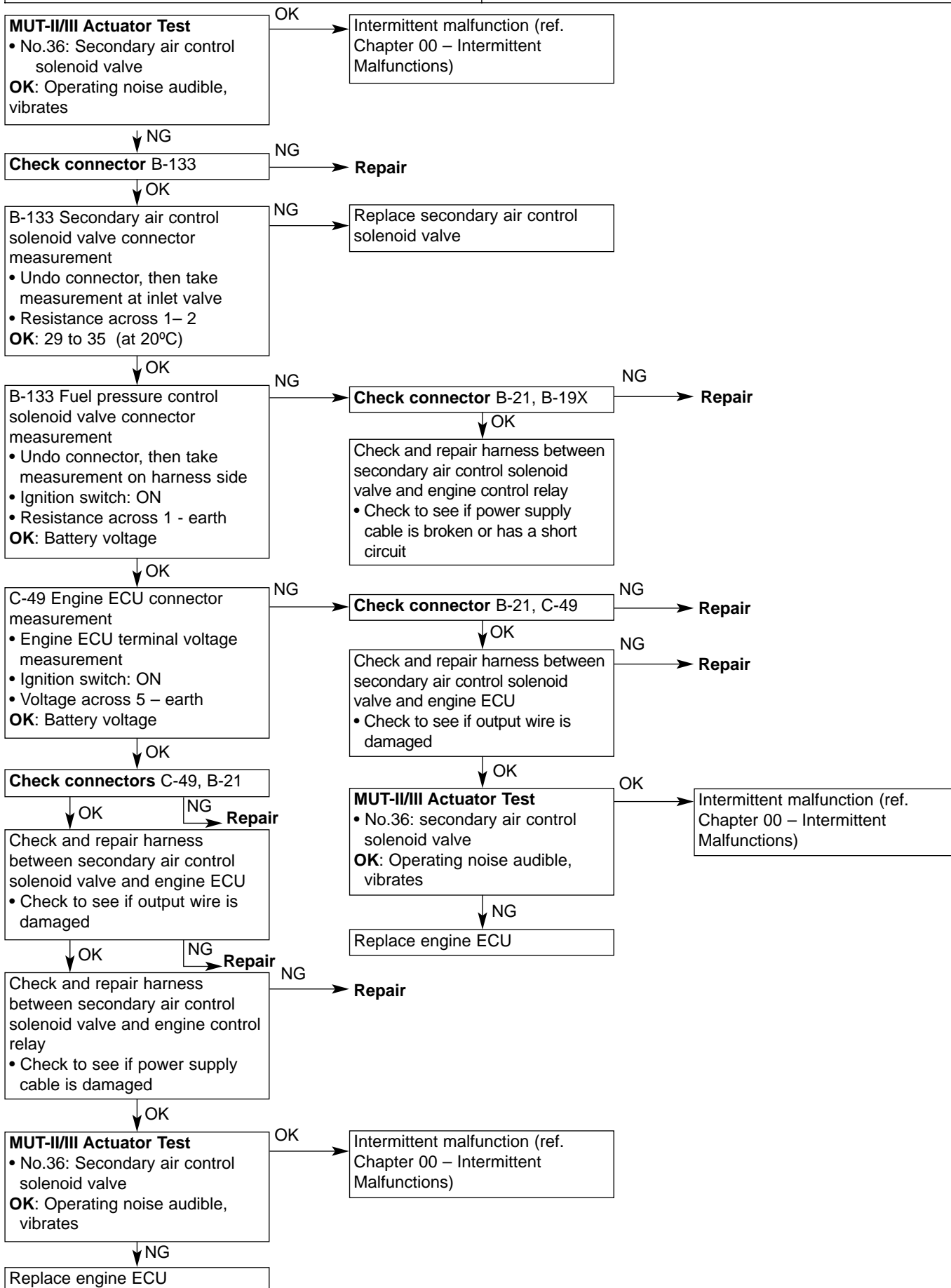
Checking Procedure 31

Fuel Pressure Control Solenoid Valve System	Probable causes
The fuel pressure control solenoid valve switches pressure introduced to the fuel pressure regulator between the inlet manifold and atmosphere pressure.	<ul style="list-style-type: none"> Fuel pressure control solenoid malfunction Engine ECU malfunction

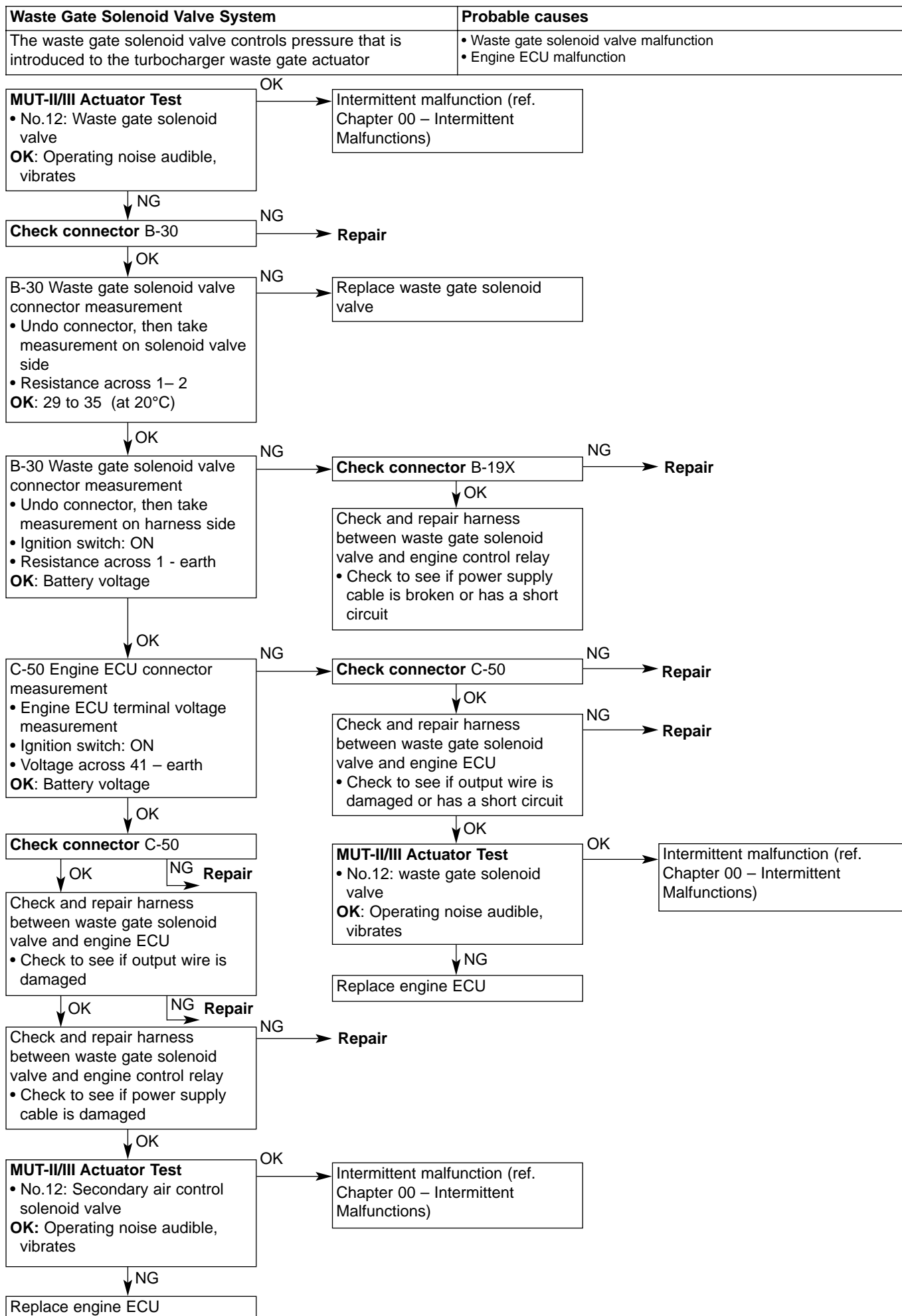


Checking Procedure 32

Secondary Air Control Solenoid Valve System	Probable causes
The secondary air control solenoid valve, switches pressure introduced to the secondary air valve between the intake manifold and atmosphere pressure.	<ul style="list-style-type: none"> • Secondary air control solenoid valve malfunction • Engine ECU malfunction

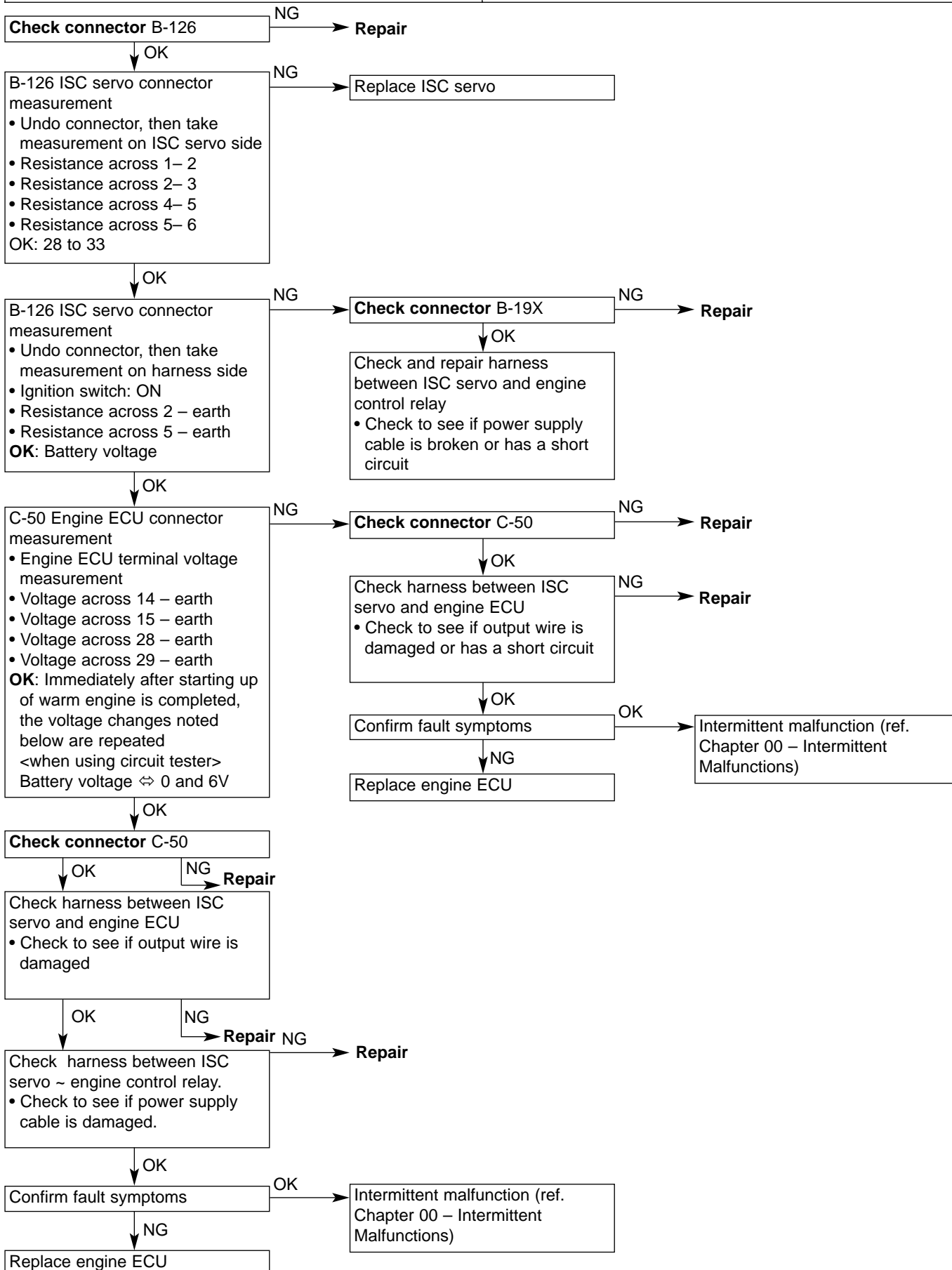


Checking Procedure 33

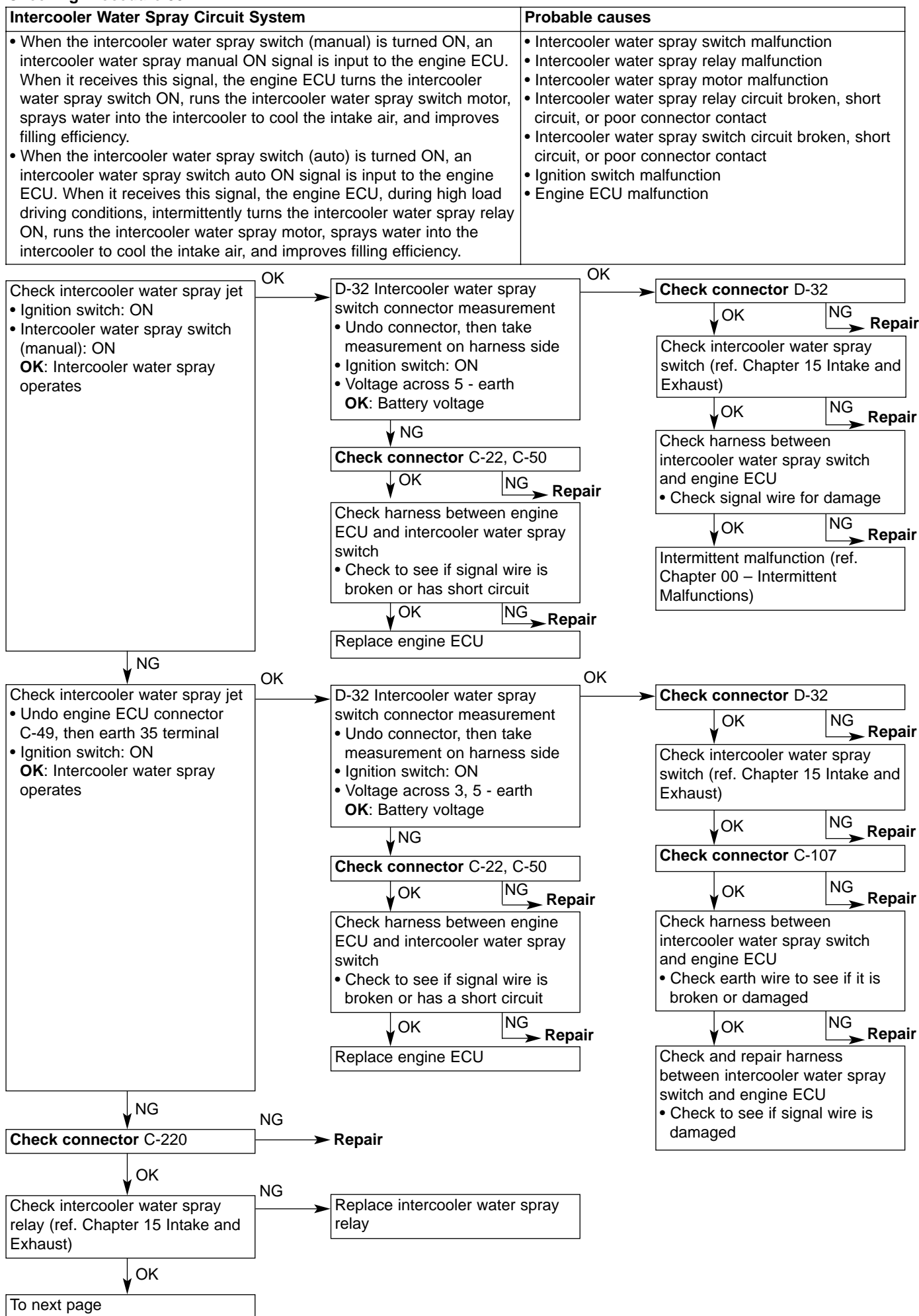


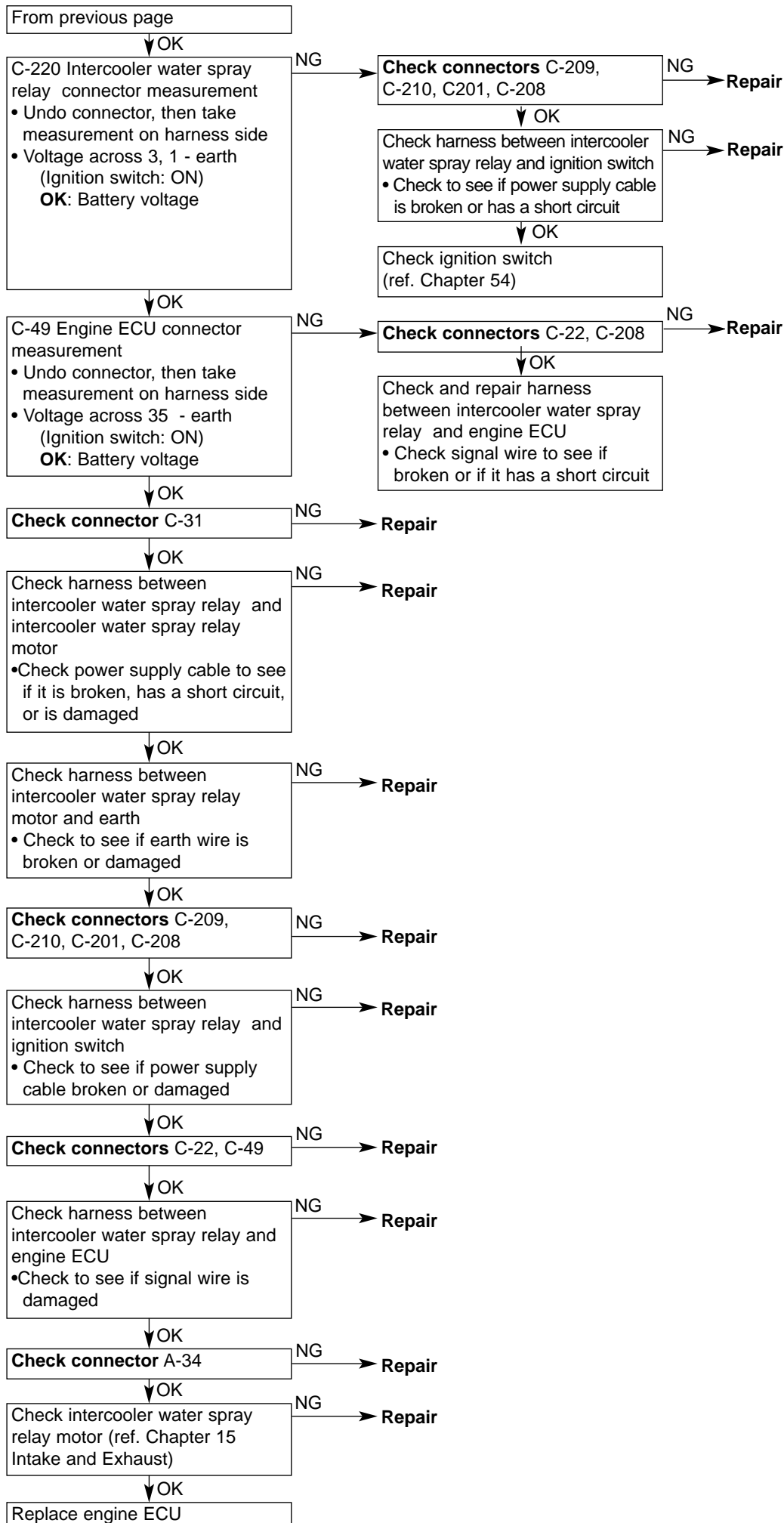
Checking Procedure 34

Idle speed control (ISC) servo (servo motor)	Probable causes
The engine ECU controls the volume of air intake during idling, by opening and closing the servo valve in a by-pass passage.	<ul style="list-style-type: none"> ISC servo malfunction ISC servo circuit broken, has a short circuit, or poor connector contact Engine ECU malfunction



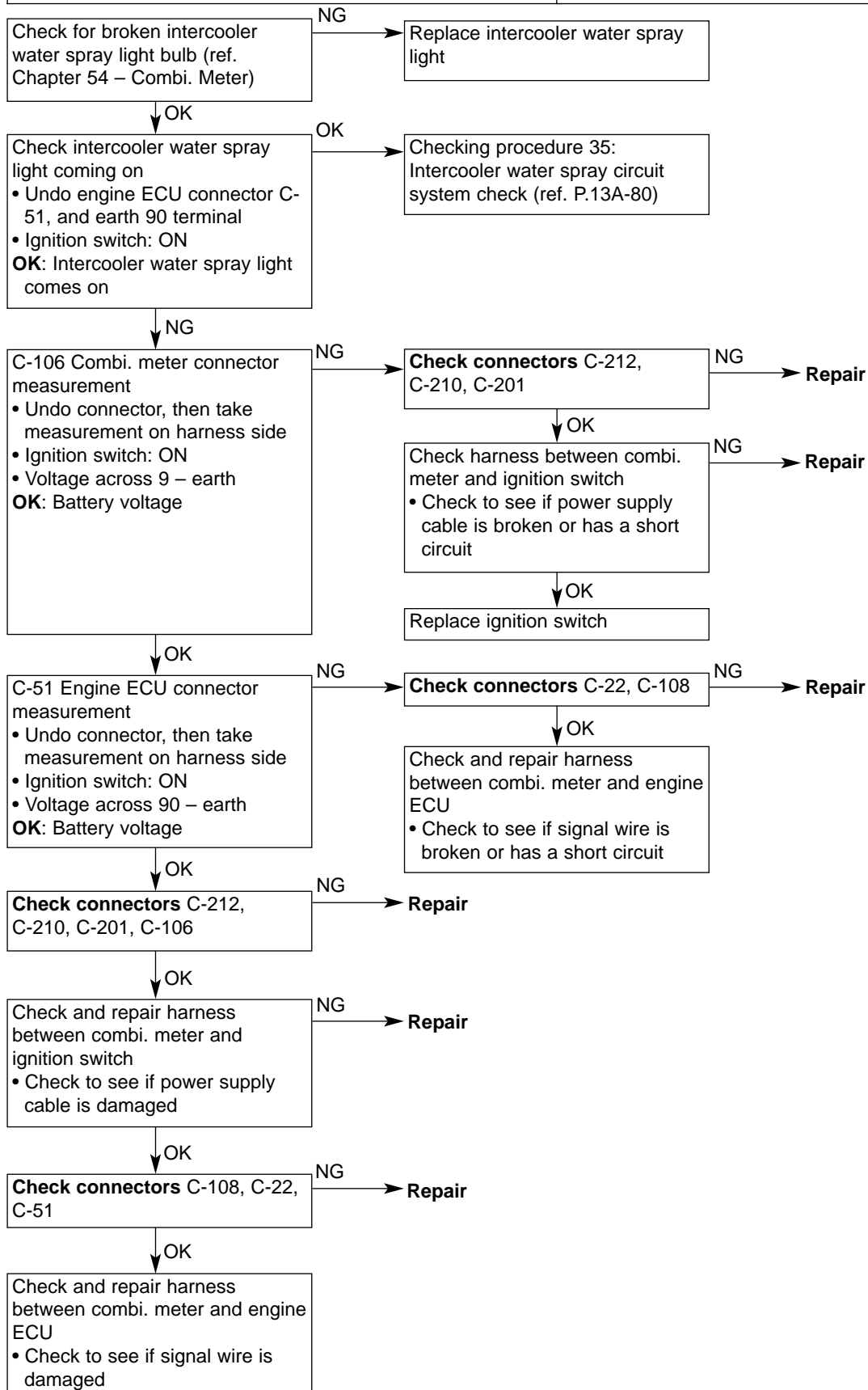
Checking Procedure 35





Checking Procedure 36

Intercooler Water Spray Light System	Probable causes
The engine ECU turns the intercooler water spray switch light on when the intercooler water spray switch (auto) is ON.	<ul style="list-style-type: none"> • Intercooler water spray bulb breaking • Ignition switch malfunction • Intercooler water spray light circuit broken, has a short circuit, or poor connector contact • Intercooler water spray switch circuit broken, has a short circuit, or poor connector contact • Engine ECU malfunction



6. SERVICE DATA TABLE

Item No.	Check Items	Checking Conditions		Normal condition	Code No. or Checking Procedure No.	Page
11	O ₂ sensor	Engine warm (lean by decelerating, rich by racing)	When decelerating rapidly from 4,000rpm	200mV or less	Code No. P0130	13A-16
			During harsh racing	600 to 1,000 mV		
		Engine warm (Using O ₂ sensor signal, as well as checking air/fuel ratio, control status is checked by ECU)	Idle running	400mV or less		
			2,500rpm	↔ 600 to 1,000mV (changes)		
12	Air flow sensor *	<ul style="list-style-type: none"> Engine cooling water temp: 80 to 95°C Lights/ignition devices, electric cooling fans, ancillary devices: OFF Transmission in Neutral 	Idle running	17 to 43Hz	-	-
			2,500rpm	40 to 100Hz		
			Racing	Frequency will increase in response to racing		
13	Intake air temperature sensor	Ignition switch: ON or engine running	When intake air temp. is -20°C	-20°C	Code No. P0110	13A-10
			When intake air temp. is 0°C	0°C		
			When intake air temp. is 20°C	20°C		
			When intake air temp. is 40°C	40°C		
			When intake air temp. is 80°C	80°C		
14	Throttle position sensor	Ignition switch: ON	In idle position	535 to 735mV	Code No.P0120	13A-13
			Gradually open	Increases as valve opens		
			Fully open	4,500 to 5,000mV		
16	Battery voltage	Ignition switch: ON		Battery voltage	Procedure No. 22	13A-61
18	Cranking signal (ignition switch – ST)	Ignition switch: ON	Engine: stopped	OFF	Procedure No.22	13A-61
			Engine: cranking	ON		

Remarks

* When vehicle is new (about 500km or less), the air flow sensor output frequency may be about 10% high

Item No.	Check Items	Checking Conditions	Normal condition	Code No. or Checking Procedure No.	Page
21	Water temp. sensor	Ignition switch: ON or engine running	When water temp. is -20°C	Code No. P0115	13A-11
			When water temp. is 0°C		
			When water temp. is 20°C		
			When water temp. is 40°C		
			When water temp. is 80°C		
22	Crank angle sensor	<ul style="list-style-type: none"> Engine cranking Engine speed meter: Connected 	Compare engine speeds from engine speed meter and MUT-II	Same	-
		Engine: idling	When water temp. is -20°C	1,300 to 1,500rpm	-
			When water temp. is 0°C	1,300 to 1,500rpm	
			When water temp. is 20°C	1,300 to 1,500rpm	
			When water temp. is 40°C	1,150 to 1,350rpm	
			When water temp. is 80°C	600 to 900rpm	
25	Atmospheric air pressure	Ignition switch: ON	Altitude: 0m	101kPa	Code No.P0105
			Altitude: 600m	95kPa	
			Altitude: 1200m	88kPa	
			Altitude: 1800m	81kPa	
27	Power steering fluid pressure switch	Engine: idling	Steering wheel not moving	OFF	Procedure No.29
			Steering wheel turning	ON	
28	A/C switch	Engine: idling (when A/C switch is ON, the compressor should be running)	A/C switch: OFF	OFF	Procedure No.26
			A/C switch: ON	ON	
34	Air flow sensor reset signal	Engine: warmed up	Idling	ON	Code No.P0100
			3,000rpm	OFF	
37	Volumetric efficiency	<ul style="list-style-type: none"> Engine cooling water: 85 to 95°C Lights/ignition devices, electric cooling fans, ancillary devices: OFF 	Idling	15 to 35%	-
			2,500rpm	15 to 35%	
			Harsh racing	Volumetric efficiency will increase in response to racing	

Item No.	Check Items	Checking Conditions		Normal condition	Code No. or Checking Procedure No.	Page
41	Injector operating time *1	Engine: cranking	When water temperature 0°C (all cylinders injecting simultaneously)	25 to 37ms	-	-
			When water temperature 20°C	15 to 22ms		
			When water temp. 80°C	4.2 to 6.3ms		
	Injector operating time *2	<ul style="list-style-type: none">Engine: Cooling water temp. 80 to 95°CLights/ignition devices, electric cooling fans, ancillary devices: OFFTransmission: Neutral	Idle running	1.5 to 2.7ms		
			2,500rpm	1.2 to 2.4ms		
			During harsh racing	Increases		
44	Ignition advance	<ul style="list-style-type: none">After engine has warmed upSet timing light (Set timing light for firing on actual ignition timing)	Idle running	0 to 13°C BTDC	-	-
			2,500rpm	20 to 40°BTDC		
45	ISC (servo) position *3	<ul style="list-style-type: none">Engine: Cooling water temp. 80 to 90°CLights/ignition devices, electric cooling fans, ancillary devices: OFFTransmission: NeutralEngine: idle running (when A/C switch ON, compressor is operated)	A/C switch: OFF	2 to 25 STEP	-	-
			A/C switch OFF → ON	10 to 70 step increase		
49	A/C relay	Engine: after warming up, idle running	A/C switch: OFF	OFF (compressor clutch not operating)	Procedure No.27	13A-71
			A/C switch: ON	ON (compressor clutch operating)		

Item No.	Check Items	Checking Conditions		Normal condition	Code No. or Checking Procedure No.	Page
A1★	O ₂ sensor	Engine: after warming up ((lean by decelerating, rich by racing)	Rapid deceleration from 4,000rpm	200mV or less	Code No.P0130	13A-16
			During harsh racing	600 to 1,000mV		
		Engine: after warming up (as well as using the O ₂ sensor signal to check air/fuel ratio), control status is checked by engine ECU	Idle running	400mV or less 600↔ 1,000mV (changes)		
			2,500rpm			
24 ★	Vehicle speed sensor	Driving at 40km/h		Approx. 40km/h	Code No.P0500	13A-30
81 ★	Learned value	Engine: warmed up, no load 2,500rpm (during fuel/ratio feedback control)		-12.5 to 12.5%	Code No.P0170	13A-19
82 ★	Feedback	Engine: warmed up, no load 2,500rpm (during fuel/ratio feedback control)		-20 to 20%	Code No.P0170	13A-19
87 ★	Engine load	Engine: after warming up	Idle running	15 to 35%	-	-
			2,500rpm	15 to 35%	-	-
8A ★	TPS1 (Throttle valve opening)	• Engine: after warming up • Ignition switch: ON (engine stopped)	Foot off the throttle pedal	8 to 16%	Code No.P0120	13A-13
			Foot depressing throttle pedal	Increases in response to pedal pressure		
			Throttle pedal fully open	80 to100%		

Remarks

- *1. The duration that injectors operate represents the time during which the power supply voltage is 11V, and cranking speed is 250rpm or less.
- *2. When the vehicle is new (500km or less on the clock), the injector operating time may be as much as 10% longer than the standard time.
- *3. When the vehicle is new (500km or less on the clock), the stepper motor step may be as much as 30 steps more than the standard value.
- ★ This is not shown when check motor service data is selected.

7. ACTUATOR TEST TABLE

Item No.	Check Items	Drive details	Checking Conditions		Normal condition	Code No. or Checking Procedure No.	Page
01	No.1 injector	Cuts fuel to No.1 injector	Engine: after warming up, engine idling (Fuel supply to each injector is cut in turn. Cylinders where the idling condition does not change are checked)		Idling condition changes (either fluctuating, or stalling engine)	Code No.P0201	13A-20
02	No.2 injector	Cuts fuel to No.2 injector				Code No.P0202	13A-21
03	No.3 injector	Cuts fuel to No.3 injector				Code No.P0203	13A-22
04	No.4 injector	Cuts fuel to No.4 injector				Code No.P0204	13A-23
07	Fuel pump	Fuel pump which circulates fuel operates	<ul style="list-style-type: none"> Engine: cranking Fuel pump: forced driving Checks to be done for both the above conditions	Pinch the return hose with fingers, and feel for the pulse of fuel flowing	Pulse is felt	Procedure No.23	13A-63
				Listen for the sound of the pump near the fuel tank	Operating noise is audible		
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON	Ignition switch: ON		Operating noise is audible when driven	Procedure No.30	13A-75
09	Fuel pressure control solenoid valve	Solenoid valve turns from OFF to ON	Ignition switch: ON		Operating noise is audible when driven	Procedure No.31	13A-76
12	Waste gate solenoid valve	Solenoid valve turns from OFF to ON	Ignition switch: ON		Operating noise is audible when drive	Procedure No.33	13A-78
13	Fuel pump relay - 3	Fuel pump relay -3 turns from OFF to ON	<ul style="list-style-type: none"> Ignition switch: ON Listen for sound of pump operating near the fuel tank 		Operating noise is audible when driven	Procedure No.23	13A-63
17	Standard ignition timing	Sets engine ECU to ignition timing adjustment mode	<ul style="list-style-type: none"> Engine: idling Timing light is set 		5°BTDC	-	-
21	Fan controller	Radiator fan motor is driven	Ignition switch: ON		Fan motor rotates at high speed	Procedure No.24	13A-65
36	Secondary air control solenoid valve	Solenoid valve turns from OFF to ON	Ignition switch: ON		Operating noise is audible when driven	Procedure No.32	13A-77
37	Condenser fan (HI)	Condenser fan motor is driven	Ignition switch: ON		Fan motor rotates at high speed	Procedure No.25	13A-67
38	Condenser fan (LOW)	Condenser fan motor is driven			Fan motor rotates at low speed		

8. ENGINE ECU CHECKS

8-1 Terminal voltage chart

Engine ECU connectors

1	2	3	4			5	6	7	8	41	42	43	44			45	46	47	71	72	73	74			75	76	77												
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	48	49	50	51	52	53	54	55	56	57	58	59	78	79	80	81	82	83	84	85	86	87	88	89	90
24	25	26	27	28	29	30	31	32	33	34	35	60	61	62	63	64	65	66	67	68	91	92	93	94	95	96	97	98	99	100									

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Item No.	Check Items	Checking Conditions (engine condition)	Normal condition
1	No.1 injector	Engine: after warming up, from engine idling the throttle pedal is suddenly depressed (Fuel supply to each injector is cut in turn. Cylinders where the idling condition does not change are checked)	Momentary slight drop from 11 to 14V
9	No.2 injector		
24	No.3 injector		
2	No.4 injector		
3	O ₂ sensor	Engine: idling	1V or less
		Engine: 5,000 rpm	Battery voltage
5	Secondary air control solenoid valve	Ignition switch: ON	Battery voltage
8	Alternator G terminal	<ul style="list-style-type: none"> Engine: after warming up, idling Radiator fan: not operating Headlights: OFF → ON Brake light: OFF → ON Rear demister switch: OFF → ON 	Voltage increase 0.2 to 3.5V
11	Ignition coil No.1 – No.4	Engine: 3,000rpm	0.3 to 3.0V
12	Ignition coil No.2 – No.3		
14	Stepper motor coil (A1)	Engine: Immediately after warm engine has finished starting up	Battery voltage ↔ 0 to 6V (repeatedly changing)
28	Stepper motor coil (A2)		
15	Stepper motor coil (B1)		
29	Stepper motor coil (B2)		
16	Purge control solenoid valve	Ignition switch: ON	Battery voltage
		Engine: idling	1V or less
18	Fan controller	Radiator fan not operating	0 to 0.3V
		Radiator fan operating	0.7V or more
19	Air flow sensor reset signal	Engine: idling	0 to 1V
		Engine: 3,000rpm	6 to 9V
20	A/C relay	<ul style="list-style-type: none"> Engine: idling A/C switch: OFF → ON (compressor operating) 	Battery voltage or transient 6V or more → 1V or less
21	Fuel pump relay	Ignition switch: ON	Battery voltage
		Engine: idling	1V or less
22	Engine warning light	Engine switch: LOCK (OFF) → ON	1V or less → Battery voltage (after several seconds)
30	Compressor fan motor relay (HI)	Fan not operating (cooling water temp.: 90°C or less)	Battery voltage
		Fan high speed operation (cooling water temp.: 105°C or more)	1V or less

Item No.	Check Items	Checking Conditions (engine condition)		Normal condition
31	Condenser fan motor relay (LOW)	Fan not operating (cooling water temp. 90°C or less)		Battery voltage
		Fan low speed operation (cooling water temp. 95°C to 100°C or more)		1V or less
35	Intercooler spray relay	Ignition switch: ON		Battery voltage
		Ignition switch: LOCK (OFF)		1V or less
41	Waste gate solenoid valve	Ignition switch: ON Engine: after warming up, idling (using Premium petrol)		Battery voltage
				1V or less
42	Voltage applied to sensor	Ignition switch: ON		4.9 to 5.1V
43	Crank angle sensor	Engine: cranking		0.4 to 4.0V
		Engine: idling		1.5 to 2.5V
44	Water temp. sensor	Ignition switch:ON	When water temp.: -20°C	3.9 to 4.5V
			When water temp.: -0°C	3.2 to 3.8V
			When water temp.: 20°C	2.3 to 2.9V
			When water temp.: 40°C	1.3 to 1.9V
			When water temp.: 60°C	0.7 to 1.3V
			When water temp.: 80°C	0.3V to 0.9V
45	Tachometer output	Engine speed: 3,000rpm		0.3 to 3.0V
47	Power supply	Ignition switch: ON		Battery voltage
59				
48	Fuel pressure control solenoid valve	Ignition switch: ON		Battery voltage
		Engine: Cranking → idling (within about 2 minutes)		1V or less → Battery voltage
50	Cam position sensor	Engine: cranking		0.4 to 3.0V
		Engine: idling		0.5 to 2.0V
51	Atmospheric air pressure sensor	Ignition switch: ON	At altitude 0m	3.8 to 4.2V
			At altitude 600m	3.5 to 3.9V
			At altitude 1,200m	3.3 to 3.7V
			At altitude 1,800m	3.0 to 3.4V
52	Alternator FR terminal	<ul style="list-style-type: none">Engine: after warming up, idlingRadiator fan: not operatingHeadlights: OFF → ONBrake lights: OFF → ONRear demister switch OFF → ON		Voltage drops
54	Power steering fluid pressure switch	Engine: after warming up, idling	Steering wheel: still condition	Battery voltage
55	Fuel pump relay -3	Engine: From idling condition, throttle pedal is depressed suddenly		From 1V or less, there is a slight momentary increase
57	Engine control relay	Ignition switch: LOCK (OFF)		Battery voltage
		Ignition switch: ON		1V or less
60	Back-up power supply	Ignition switch: LOCK (OFF)		Battery voltages
61	Air flow sensor	Engine: idling		2.2 to 3.2V
		Engine: 2,500rpm		
62	Intake air temp. sensor	Ignition switch: ON	When intake air temp.: -20°C	3.8 to 4.4V
			When intake air temp.: -0°C	3.2 to 3.8V
			When intake air temp.: 20°C	2.3 to 2.9V
			When intake air temp.: 40°C	1.5 to 2.1V
			When intake air temp.: 60°C	0.8 to 1.4V
			When intake air temp.: 80°C	0.4 to 1.0V

Item No.	Check Items	Checking Conditions (engine condition)		Normal condition
85	A/C load	<ul style="list-style-type: none"> Engine: idling A/C switch: ON (A/C compressor operating) 	<ul style="list-style-type: none"> External air temperature sensor ambient temp.: 18°C A/C set temp.: Minimum temperature A/C air flow: Maximum (Max Cool) 	1V or less
			<ul style="list-style-type: none"> A/C set temp.: Cabin temperature A/C air flow: Minimum 	Battery voltage
66	Intercooler water spray switch (Auto)	<ul style="list-style-type: none"> Ignition switch: ON Intercooler water spray switch: ON 		1V or less
		<ul style="list-style-type: none"> Ignition switch: ON Intercooler water spray switch: OFF 		Battery voltage
67	Intercooler water spray switch (Manual)	<ul style="list-style-type: none"> Ignition switch: ON Intercooler water spray switch: ON 		1V or less
		<ul style="list-style-type: none"> Ignition switch: ON Intercooler water spray switch: OFF 		Battery voltage
68	Ignition switch – ST	Engine: cranking		8V or more
99	Ignition switch – IG	Ignition switch: ON		Battery voltage
71	O ₂ sensor	Engine: after warming up, maintain 2,500 rpm (Check using a digital voltmeter)		0 ↔ 8V (changes repeatedly)
78	Throttle position sensor	Ignition switch: ON	Throttle valve set to idle position	0.535 to 0.735V
			Throttle valve set to fully open	4.5 to 5.0V
80	Vehicle speed sensor	<ul style="list-style-type: none"> Ignition switch: ON Vehicle moving slowly forwards 		0 ↔ 5V (changes repeatedly)
83	A/C switch	Engine: idling	A/C switch: OFF	0.5V or less
			<ul style="list-style-type: none"> A/C switch: ON A/C set temp. When cabin temp. 25°C or more: Max cool When cabin temp. 25°C or less: Max Hot 	Battery voltage
40	Intercooler water spray light	Ignition switch: ON		Battery voltage
		Ignition switch: LOCK (OFF)		1V or less

8-2. TABLE SHOWING HARNESS SIDE CONNECTOR TERMINAL RESISTANCES AND CONTINUITY

Engine ECU harness side connectors

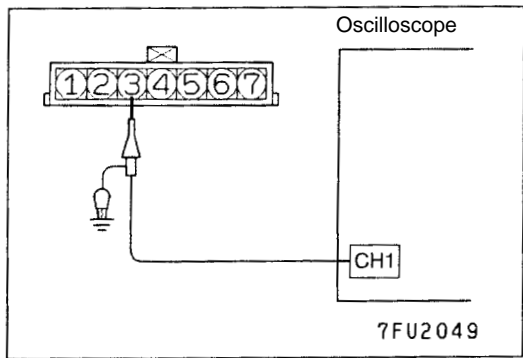
77	76	75				74	73	72	71	47	46	45				44	43	42	41	8	7		6	5				4	3		2	1							
90	89	88	87	86	85	84	83	82	81	80	79	78	59	58	57	56	55	54	53	52	51	50	49	48	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9
100	99		98	97	96		95	94		93	92	91	68	67		66	65		64	63	62		61	60	35	34		33	32	31	30		29	28	27	26		25	24

2 6 0 3 9 A U

Terminal number	Check item	Standard value, normal condition (Check condition)
1-47	No.1 injector	7.8 to 9.2Ω (at 20°C)
9-47	No.2 injector	
24-47	No.3 injector	
2-47	No.4 injector	
3-47	O ₂ sensor	11 to 18 Ω (at 20°C)
5-47	Secondary air control solenoid valve	28 to 36 Ω (at 20°C)
14-47	Stepper motor coil (A1)	28 to 33 Ω (at 20°C)
28-47	Stepper motor coil (A2)	
15-47	Stepper motor coil (B1)	
29-47	Stepper motor coil (B2)	
16-47	Purge control solenoid valve	22 to 26 Ω (at 20°C)
41-47	Waste gate solenoid valve	62 to 74 Ω (at 20°C)
44-49	Water temperature sensor	14 to 17k Ω (at 20°C)
		5.1 to 6.5k Ω (at 0°C)
		2.1 to 2.7k Ω (at 20°C)
		0.9 to 1.3k Ω (at 40°C)
		0.48 to 0.68k Ω (at 60°C)
		0.26 to 0.36k Ω (at 80°C)
46-Body earth	Engine ECU earth	There is continuity (0 Ω)
58-Body earth		
47-48	Fuel pressure control solenoid valve	28 to 36 Ω (at 20°C)
62-49	Intake air temperature sensor	13 to 17 Ω (when intake air temp. -20°C)
		5.3 to 6.7 Ω (when intake air temp. 0°C)
		2.3 to 3.0 Ω (when intake air temp. 20°C)
		1.0 to 1.5 Ω (when intake air temp. 40°C)
		0.56 to 0.76 Ω (when intake air temp. 60°C)
		0.30 to 0.42 Ω (when intake air temp. 80°C)

9. Checks using an oscilloscope

Taking waveform measurements using an oscilloscope means that sensor outputs signals and actuator drive signals can be checked visually.



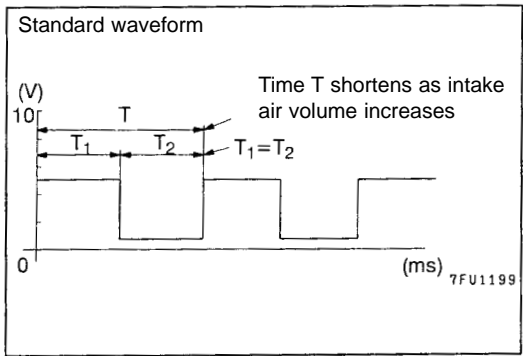
9-1 Air flow sensor

<Measurement Method>

- (1) Disconnect the air flow sensor connector, and connect the special tool (test harness MB991709). (All the terminals should be connected)
- (2) Connect the oscilloscope to air flow sensor connector terminal No.3.

Comments

When taking measurements at the engine ECU connector, connect oscilloscope probe to terminal No.61.



<Standard waveform>

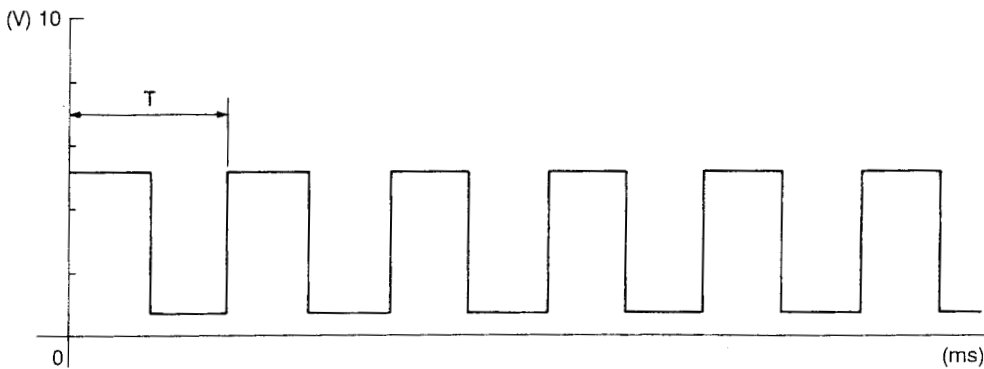
Observation conditions

Probe switch	x1
AC-GND-DC	DC
TIME/DIV.	5ms
VOLTS/DIV.	2V
Other	-
Engine	Idling

Observation conditions (Only change to the conditions already specified is engine speed, which is as follows)

Engine speed	2,000rpm
--------------	----------

Standard waveform



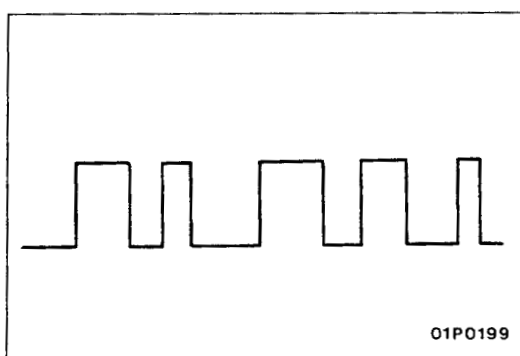
<An explanation of waveforms>

- The air flow sensor sends a frequency pulse signal relative in size to the air flow to the engine ECU. By measuring the pulse signal cycle time T (seconds), the output signal frequency can be calculated using the following formula:

$$\text{Frequency (Hz)} = 1/T \text{ (seconds)}$$

<Waveform Observation Points>

- Check that, as the engine speed increases, cycle time T gets shorter, and frequency increases.

**<Examples of abnormal waveforms>**

- Example 1

Waveform characteristics

Rectangular waveform is output, even when the engine is not started.

Cause of problem

Sensor interface fault

- Example 2

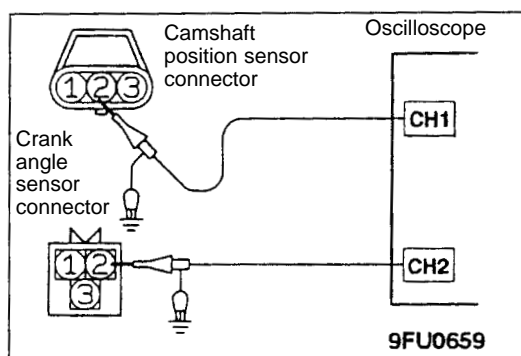
Waveform characteristics

Unstable waveform with unstable frequency.

However, when an ignition leak occurs during acceleration, the waveform will momentarily be distorted, even though the air flow sensor is normal.

Cause of problem

Damaged rectifier or vortex generation column

**9-2 Cam position sensor and crank angle sensor****<Measurement method>**

- (1) Undo the camshaft position sensor connector, then connect the special test harness (MB991709). (All terminals should be connected)
- (2) Undo crank angle sensor connector, then connect the special test harness (MD998478).
- (3) Connect the probe for each channel on the oscilloscope to the camshaft position sensor connector No.2 terminal, and to the crank angle sensor connector terminal No.2 (the black clip on the special tool).

Note

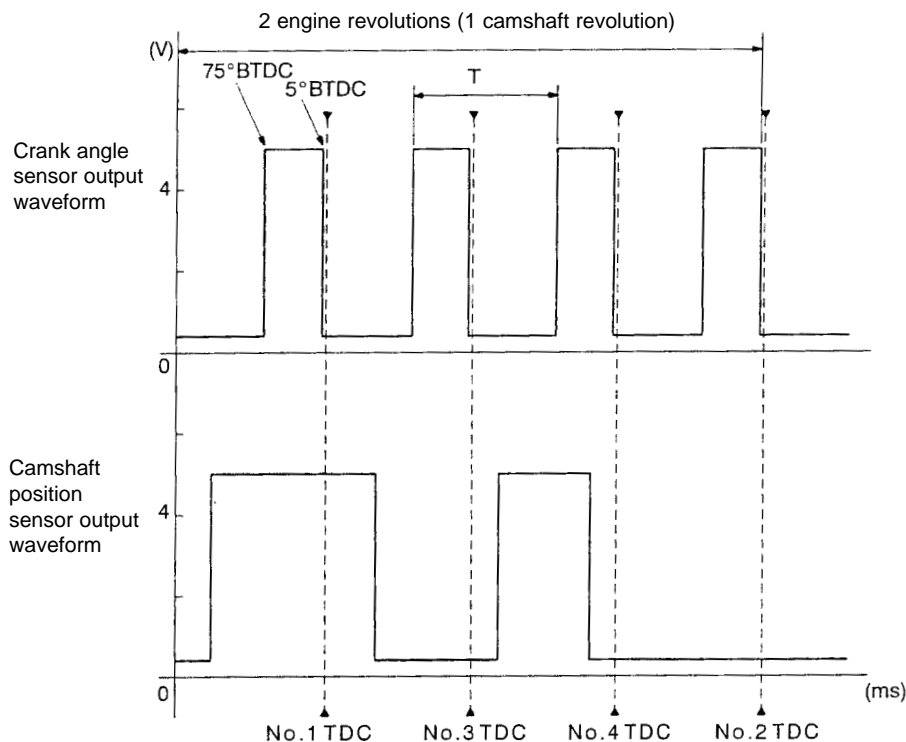
When doing engine ECU connector measurement, connect the probe for each channel on the oscilloscope to terminal No.50 (camshaft position sensor) and terminal No.43 (crank angle sensor).

<Standard waveform>

Observation Conditions

	Camshaft position sensor	Crank angle sensor
Probe switch	x1	x1
AC-GND-DC	DC	DC
TIME/DIV.	10ms	10ms
VOLTS/DIV.	2V	2V
Other	-	-
Engine	Idling	

Standard waveform



V6003AE

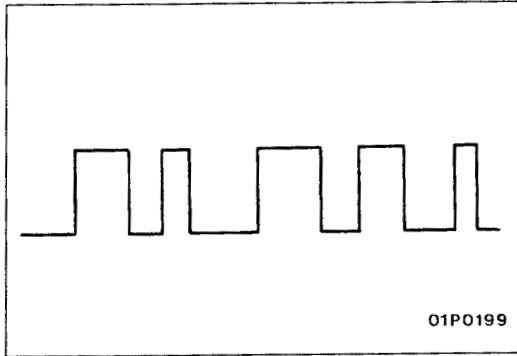
<Explanation of waveforms>

- Camshaft position sensors detect the compression top dead centre (TDC) for each cylinder. Simultaneous observation of this and other control signals makes it possible to distinguish between each of the cylinders.
- Crank angle sensors are sensors designed to detect cylinder crank angles. For each 2 revolutions of the engine, 4 evenly spaced crank angle sensor HIGH signals are output. So, by measuring the cycle time (seconds), the engine speed can be calculated using the following formula:

$$\text{Engine speed} = 2/4T \text{ (seconds)} \times 60 = 30/T \text{ (seconds)}$$

<Waveform Observation Points>

- Check that, as the engine speed increases, cycle time T gets shorter, and frequency increases.



<Examples of abnormal waveforms>

• Example 1

Waveform characteristics

Rectangular waveform is output, even when the engine is not started.

Cause of problem

Sensor interface fault

• Example 2

Waveform characteristics

Waveform is displaced to the left or right

Cause of problem

Loose timing belt

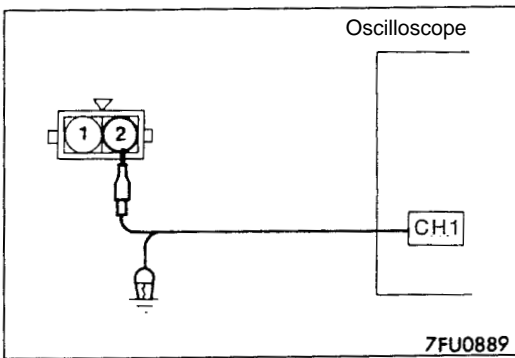
Sensor disk abnormality

9-3 Injectors

<Measurement Method>

(1) Undo injector connector, then connect the special test harness (MB991348). (All terminals should be connected)

(2) Connect oscilloscope probe to injector connector terminal No.2.



Note

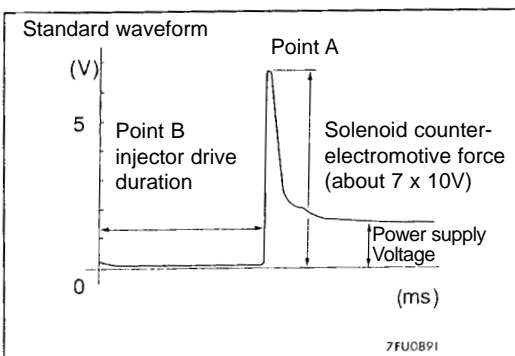
When doing engine ECU connector measurement, take measurements, connecting oscilloscope probe, at each of the following terminals.

When looking at No.1 cylinder: Terminal No.1.

When looking at No.2 cylinder: Terminal No. 9.

When looking at No.3 cylinder: Terminal No. 24.

When looking at No.4 cylinder: Terminal No. 2.



<Standard waveforms>

Observation conditions

Probe switch	x10
AC-GND-DC	DC
VOLTS/DIV.	1V
TIME/DIV.	0.5ms
Other	-
Engine speed	Idling

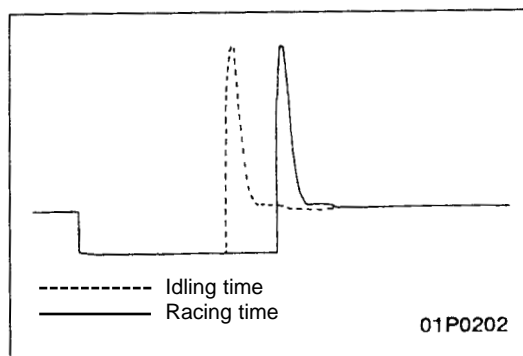
Explanation of waveforms

- A power supply voltage is normally applied, but when there is a signal from the engine ECU, the voltage drops to about 0V for the duration of that drive signal.
- When the signal from the engine ECU is cut, a voltage peak is seen as a result of the counter-electromotive force, then a return to power supply voltage.
- Injector drive time:
Fuel injection time is determined by the engine ECU based on AFS and other sensor output values.
Injector drive time = effective injection time + ineffective injection time (ineffective drive time: for correcting operating delays that result from drop in power supply voltage)
- Solenoid coil counter-electromotive force:
If the signal from the engine ECU is switched OFF, a counter-electromotive force occurs in the injector coil.
(about 65 to 75V)
- Power supply voltage:
When there is no signal from the engine ECU, power supply voltage will be applied. When this power supply voltage is low, the ineffective injection time increases, and the drive time increases as well.

Waveform observation points

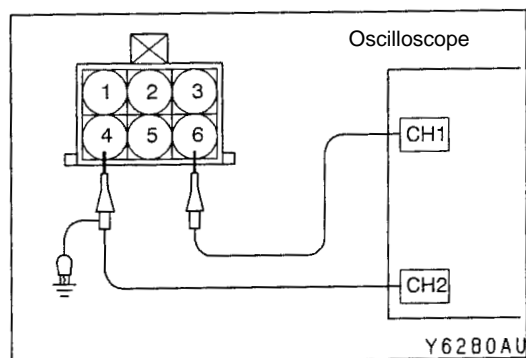
- Point A: Height of the solenoid coil counter-electromotive force

Solenoid coil counter-electromotive force is low or does not exist	Injector solenoid shorts
--	--------------------------



Point B: Injector drive time

Drive time	Synchronized with the MUT-II/III display
Harsh racing	The drive time is extended greatly for an instant, then immediately matches engine speed



10-4 ISC Servo (stepper motor)

<Measurement Method>

- (1) Undo the ISC servo connector, then connect the special test harness (MB991709). (All terminals should be connected)
- (2) Connect the probe for each oscilloscope channel either to ISC servo connector terminals Nos.1 and 3, or to terminals Nos.4 and 6.

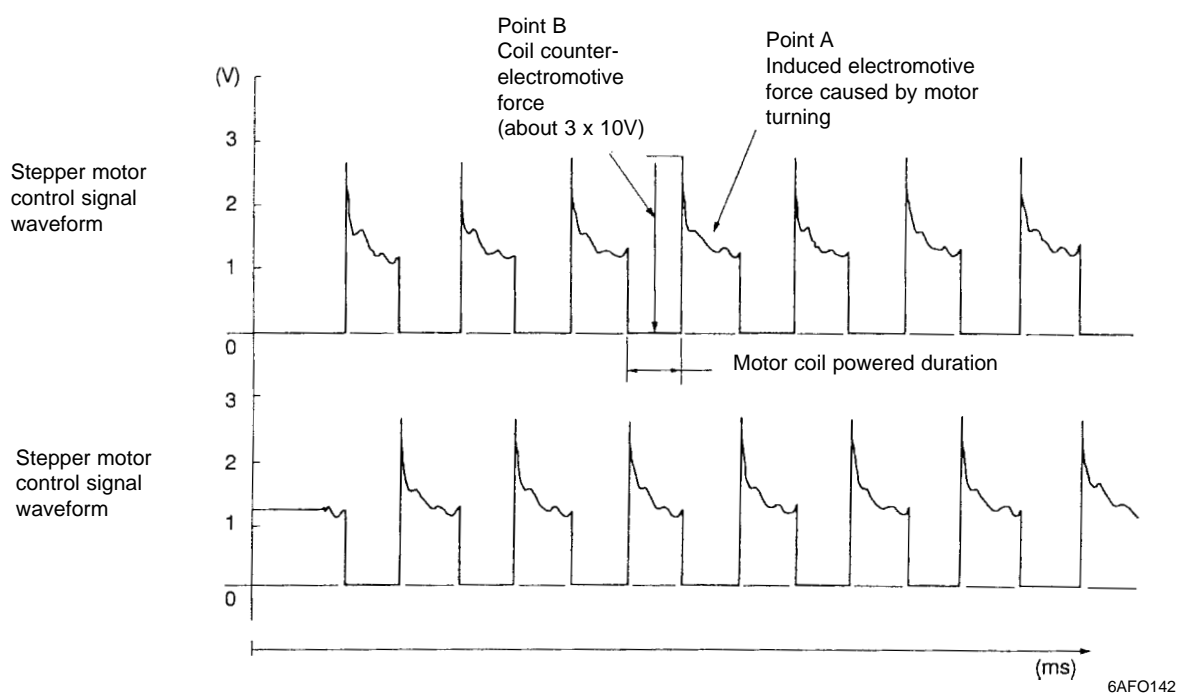
Note

When doing engine ECU connector measurement, take measurements for the following terminals.

Connect the probe for each oscilloscope channel either to terminals Nos.14 and 28, or to terminals Nos.15 and 29.

Standard waveform**Observation conditions (2CH both the same)**

Probe switch	x10
AC-GND-DC	DC
VOLTS/DIV.	1V
TIME/DIV.	20ms
Other	Either ignition switch ON, OFF (engine cooling water temp. 20°C or less), or A/C switch ON, OFF (when idling)
Engine speed	-

Standard waveform**<Explanation of waveform>**

- When, for example, ignition switches ON (and where engine cooling water temperature is 20°C or less), or when A/C operates, the waveform is seen for an instant.
- Motor coil counter-electromotive force:
When signal from engine ECU is switched OFF, a counter-electromotive force (about 30V) is seen in the motor coil.
- Induced electromotive force caused by motor turning:
Induced electromotive force, caused by motor turning, is seen.

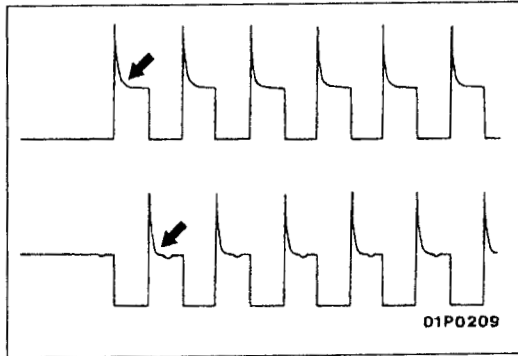
<Waveform Observation Points>

- Check that standard waveform appears when motor operating conditions are met.
- Point A: Presence or absence of induced electromotive force from the engine turning (ref. Abnormal waveform Example 1.)

Differences to standard waveform	Possible causes
Induced electromotive force is either absent or extremely low	Motor malfunction

- Point B: Height of coil counter-electromotive force

Differences to standard waveform	Possible causes
Coil counter-electromotive force is either absent or extremely low	Coil short



<Abnormal waveform>

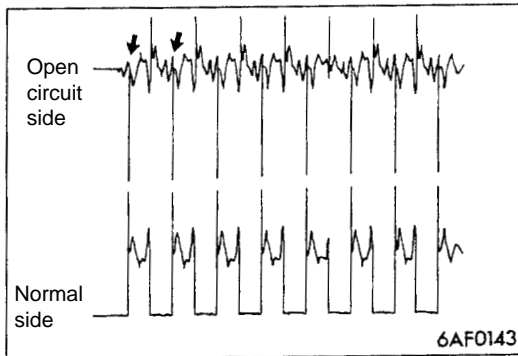
• Example 1

Waveform characteristics

Motor turning induced electromotive force is absent.

Cause of fault

Motor malfunction (motor is not turning)s



• Example 2

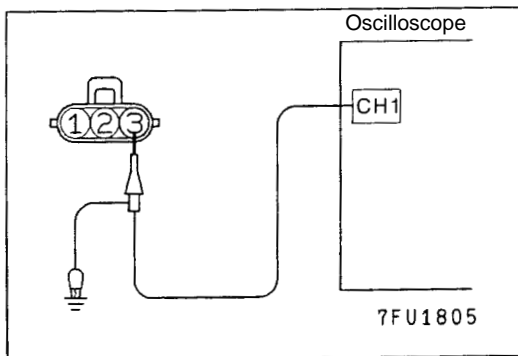
Waveform characteristics

Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0V).

Furthermore, the induced electromotive waveform on the normal side is slightly different to the standard waveform.

Cause of fault

Circuit is broken between the motor and engine ECU.

**10-5 Ignition coil (power transistor control signal)**

<Measurement Method>

(1) Undo ignition coil connector, then connect special harness (MBB991658). (All terminals should be connected)

(2) Connect oscilloscope probe to ignition coil connector terminal No.3.

Note

When doing engine ECU connector measurement, connect the oscilloscope probe to terminal No.11 (Ignition coil Nos.1 and 4), terminal No.12 (Ignition coil Nos.2 and 3).

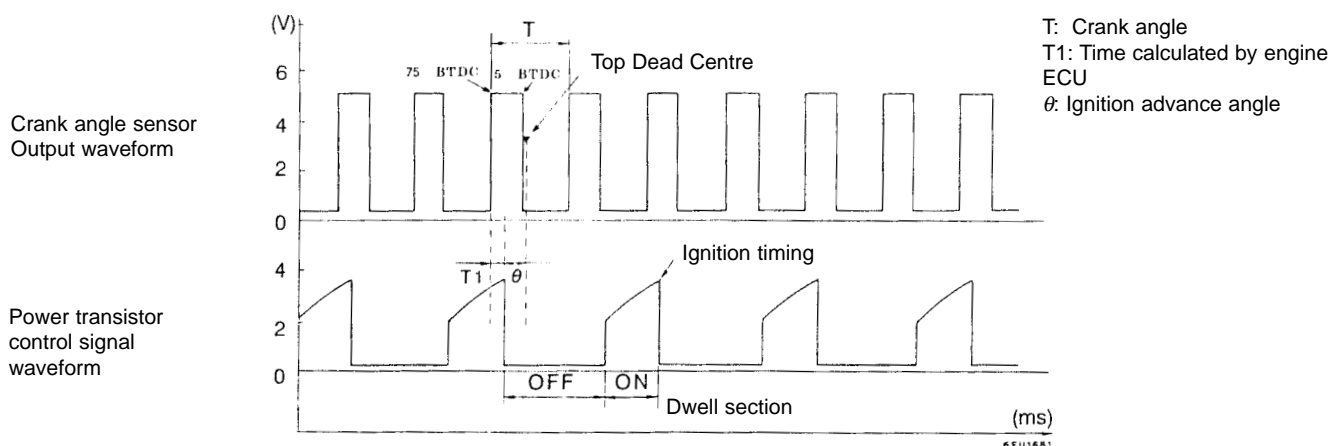
(3) To check ignition advance condition, simultaneously observe crank angle sensor output signal.

<Standard waveform>

Observation conditions

	Power transistor control signal	Crank angle sensor
Probe switch	x1	x1
AC-GND-DC	DC	DC
VOLTS/DIV.	2V	2V
TIME/DIV.	10ms	10ms
Other	-	-
Engine speed	About 1,200 rpm	

Standard waveform



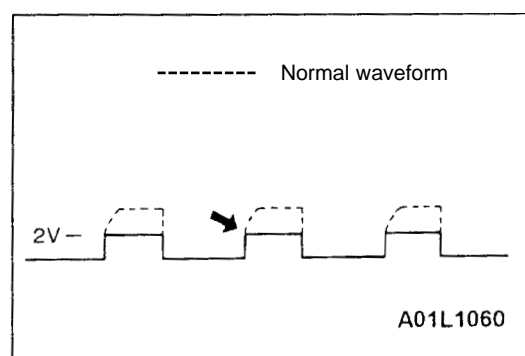
<Explanation of waveform>

- When spark angle is advanced by, for example, engine speed increasing, conditions such as those illustrated above arise. Ignition advance angle $\theta = 75^\circ - T_1 / T \times 180^\circ$
- Power transistor ON
Condition where the power transistor is turned ON, and ignition coil primary side is powered (Dwell Section). The time it is powered will be shorter when the battery voltage is high, and it will be controlled so that the primary current at the time of ignition stabilises (about 6A). (The waveform for this section will be rising to the right)
- Power transistor OFF
With the power transistor OFF, the power transistor drive signal is not output from the engine ECU.

<Waveform Observation Points>

- Waveform starting point condition and maximum voltage (ref. Abnormal waveform Examples 1, 2)

Waveform starting point condition and maximum voltage	Possible causes
Rises, upwards and to the right, up to about 4.5V from about 2V	Normal
Rectangular wave about 2V	Ignition primary circuit open
Power supply voltage rectangular wave	Power transistor fault



<Abnormal waveform>

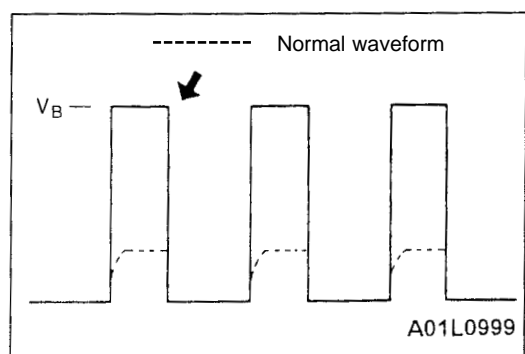
- Example 1
Waveform when engine cranking

Waveform characteristics

At start up point, wave does not move upwards to the right, and the voltage is low at about 2V.

Cause of fault

Ignition primary circuit open



- Example 2
Waveform during engine cranking

Waveform characteristics

There is a power supply voltage when the power transistor is ON.

Cause of fault

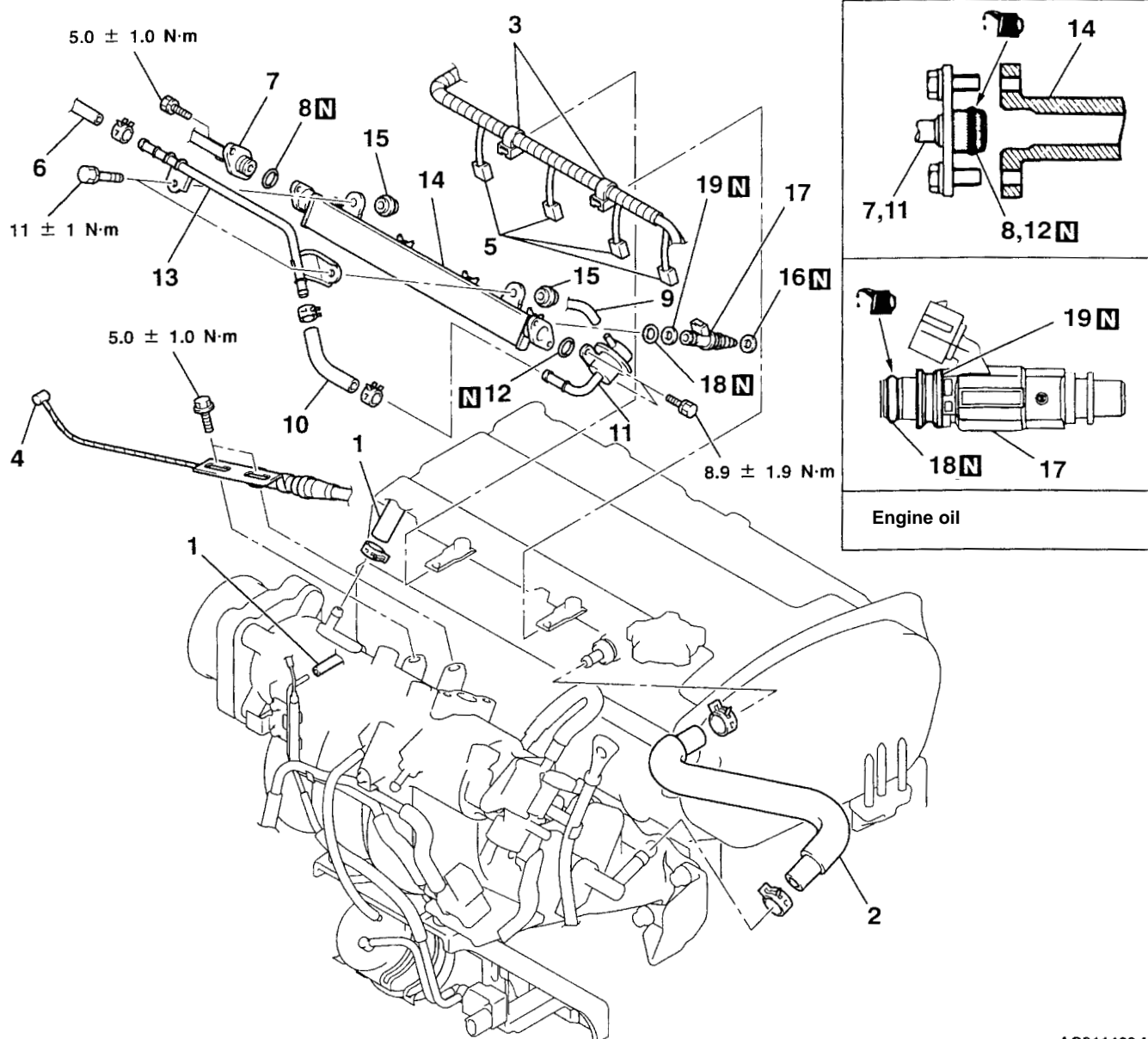
Power transistor fault.

INJECTORS

Disassembly and reassembly

Work that needs to be done before disassembly and after assembly

- Measures to prevent fuel escaping (only prior to removal)
- Removal and fitting of strut tower bar
- Removal and fitting of air hose E, air by-pass hose, and air pipe C (ref. Chapter 15 Intercooler)
- Check for any fuel leaks (only after fitting)



Disassembly procedure

- | | | | | |
|---|-------|-------|-------|-----------------------------|
| 1. Vacuum hose connection | | | | 10. Fuel return hose |
| 2. PCV hose connection | | | ▶ A ◀ | 11. Fuel pressure regulator |
| 3. Control harness clamp connection | | | | 12. O-ring |
| 4. Throttle cable connection | | | | 13. Fuel return pipe |
| (throttle body side) | ◀ A ▶ | | | 14. Delivery pipe |
| 5. Injector harness connector | | | | 15. Insulator |
| 6. Fuel return hose connection | | ◀ A ▶ | ▶ A ◀ | 16. Insulator |
| ▶ A ◀ 7. Fuel high pressure hose connection | | | | 17. Injector |
| 8. O-ring | | | | 18. O-ring |
| 9. Vacuum hose connection | | | | 19. Grommet |

Disassembly service points**◀ A ▶ Delivery pipe/injector removal**

Remove the delivery pipe with the injector attached.

Assembly service points**▶ A ◀ Assembling injectors/fuel pressure regulator/fuel high pressure hose**

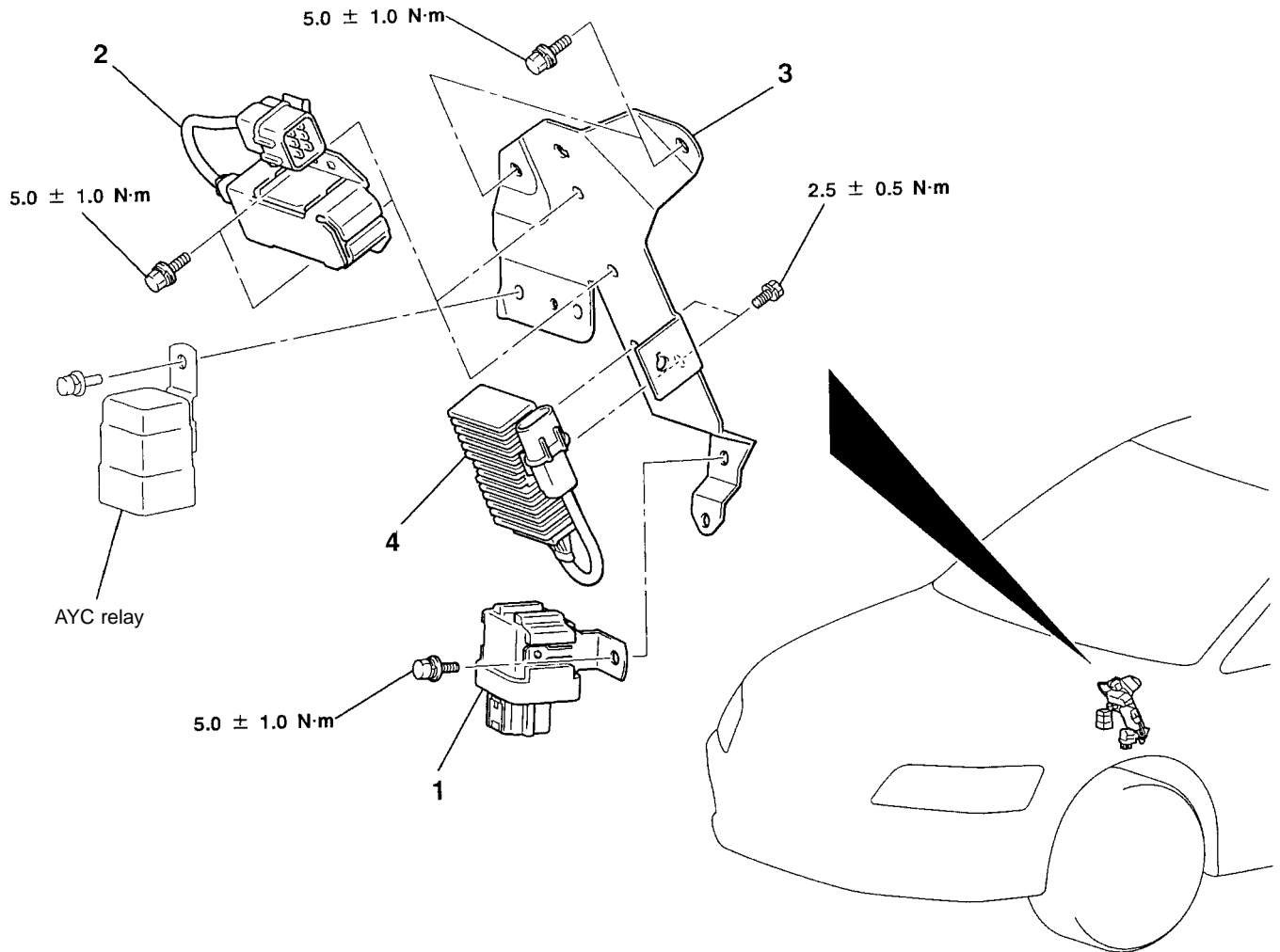
1. Apply a small quantity of new engine oil to O-ring
2. Being careful not to damage it, fit O-ring to delivery pipe whilst rotating fuel pressure regulator, and fuel high pressure hose, to left and right, making sure that you rotate them smoothly.
3. If they are not rotated smoothly, the O-ring could be pinched, so remove the part and check the O-ring for any damage, then re-insert into delivery pipe and check.
4. Tighten fuel pressure regulator to specified torque.
Tightening torque: 8.9 ± 1.9 N·m
5. Tighten fuel high pressure hose to specified torque.
Tightening torque: 5.0 ± 1.0 N·m

Engine control resistor and relay

Removal and Installation

Pre-removal and post-installation operations

- Removal and fitting of strut tower bar
- Removal and fitting of harness connector connection



AC211464AB

Removal procedure

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