FUEL

CONTENTS

NOTE
THE GROUPS MARKED BY ▒ ARE NOT IN THIS MANUAL

NOTES

GROUP 13F
FUEL SUPPLY

GENERAL

OUTLINE OF CHANGES

- Maintenance service procedures have been established for items which are different from before to correspond to the following changes.

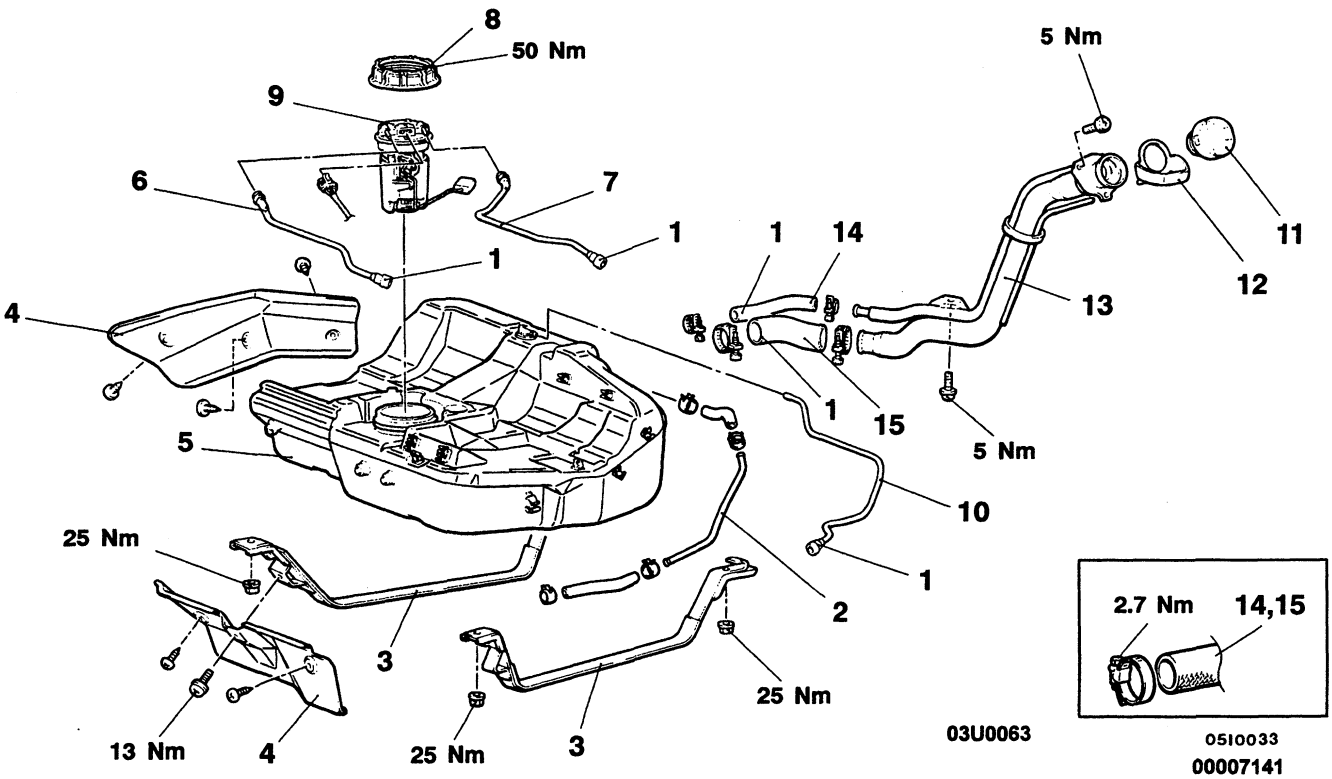
1. Removal and installation of the fuel tank
2. Removal and installation of the fuel filter

FUEL TANK

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Draining
- Reducing the Inner Pressure of Fuel Line and Hose
- Center Exhaust Pipe Removal (Refer to GROUP 15.)

Post-installation Operation
- Center Exhaust Pipe Installation (Refer to GROUP 15.)
- Fuel Refilling
- Fuel Leak Check



Removal steps

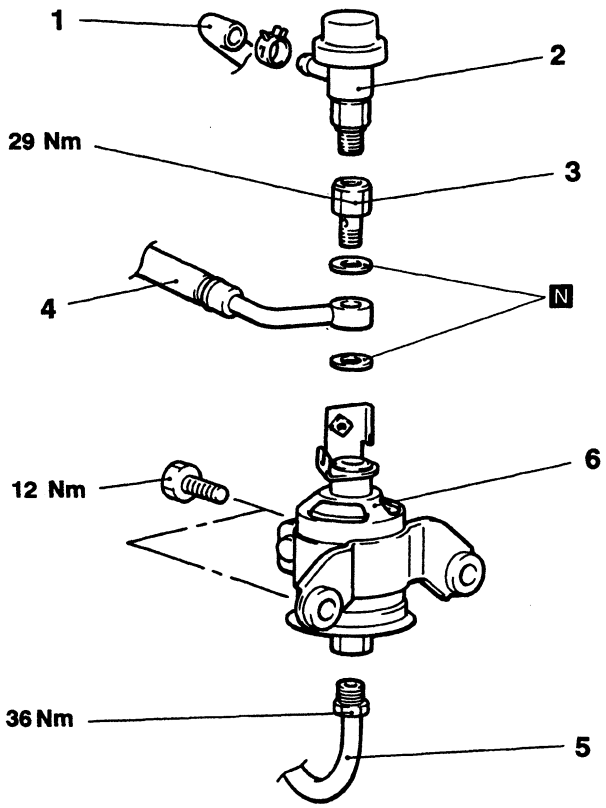
1. Hose connection
2. Fuel return pipe
3. Band
4. Protector
5. Fuel tank assembly
6. Fuel main hose
7. Fuel return hose
▶A◀ 8. Cap
9. Fuel pump module
10. Fuel vapour hose
11. Fuel filler cap
12. Fuel rubber drain
13. fuel neck assembly
14. Leveling hose
15. Filler hose

NOTE
Removal and installation service points are the same as before.

FUEL FILTER

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Air Cleaner Assembly Removal and Installation



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Removal steps

1. Fuel return hose
2. Fuel pressure regulator
3. Fuel connector
4. Fuel high pressure regulator
5. Fuel main pipe
6. Fuel high pressure filter

GASOLINE DIRECT INJECTION (GDI)

CONTENTS

GENERAL INFORMATION

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

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

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

IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The engine-ECU drives the idle speed control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and air conditioner load. In addition, when the air conditioner switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the engine-ECU from the engine speed, intake air volume, engine coolant temperature, atmospheric pressure and injection timing (intake stroke or compression stroke).

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-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 Relay 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 Servo Control
   Refer to GROUP 17.

GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	54
	Throttle position sensor	Variable resistor type
	Idle speed control servo	Stepper motor type (Stepper motor type by-pass air control system)
	Idle position switch	Rotary contact type, within throttle position sensor
Engine-ECU	Identification model No.	E2T68374
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Vehicle speed sensor	Magnetic resistive element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Detonation sensor	Piezoelectric type
	Fuel pressure sensor	Metallic membrane type
	Power steering fluid pressure switch	Contact switch type

Items		Specifications
Actuators	Control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector driver control relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	DIM 1000G
	Air by-pass control solenoid valve (ON/OFF)	ON/OFF type solenoid valve
	Air by-pass control solenoid valve (DUTY)	Duty cycle type solenoid valve
	EGR control servo	Stepper motor type
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator (low pressure)	Regulator pressure kPa	329
Fuel pressure regulator (high pressure)	Regulator pressure MPa	5

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

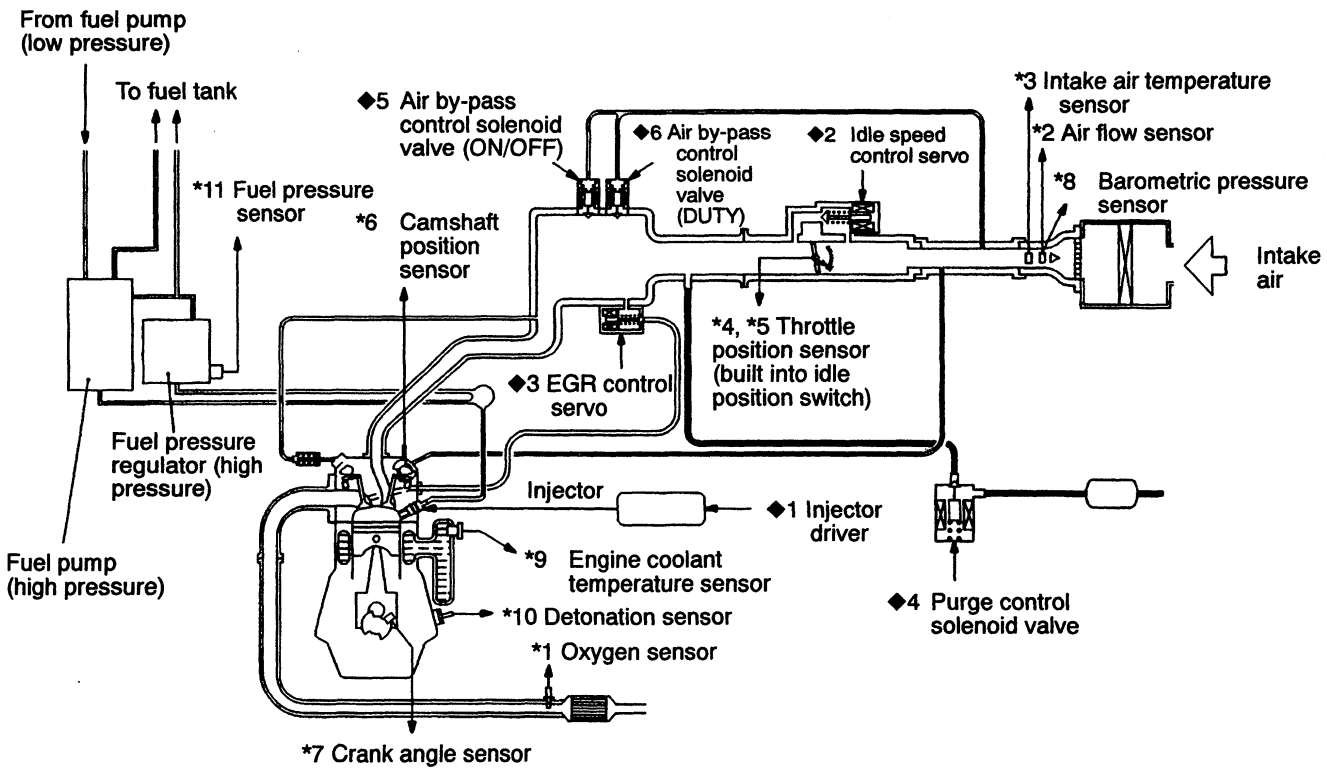
*1 Oxygen sensor
*2 Air flow sensor
*3 Intake air temperature sensor
*4 Throttle position sensor
*5 Idle position switch
*6 Camshaft position sensor
*7 Crank angle sensor
*8 Barometric pressure sensor
*9 Engine coolant temperature sensor
*10 Detonation sensor
*11 Fuel pressure sensor

- Power supply voltage
- Ignition switch – ST
- Ignition switch – IG
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering fluid pressure switch
- Alternator FR terminal
- M/T oil temperature sensor
- Electrical load switch
- Brake vacuum sensor
- Stop lamp switch
- Injector open circuit check signal
- A/T-ECU

⇨ Engine-ECU ⇨

◆1 Injector driver (injector)
◆2 Idle speed control servo
◆3 EGR control servo (stepper motor)
◆4 Purge control solenoid valve
◆5 Air by-pass control solenoid valve (ON/OFF)
◆6 Air by-pass control solenoid valve (DUTY)

- Fuel pump relay
- Control relay
- Injector driver control relay
- A/C power relay
- Engine warning lamp
- Diagnosis signal output
- Ignition coil
- Alternator G terminal
- A/T-ECU



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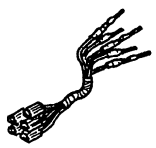
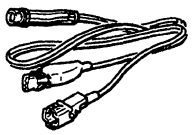
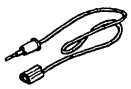
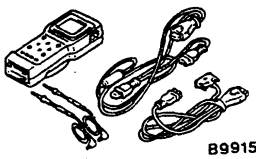
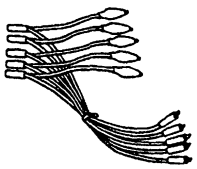
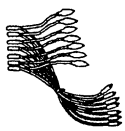
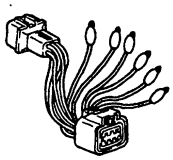
SERVICE SPECIFICATIONS

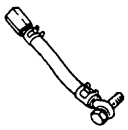
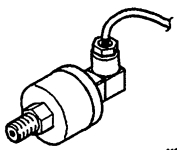
Items		Specifications
Basic idle speed r/min		750±50
Throttle position sensor adjusting voltage mV		400 – 1,000
Throttle position sensor resistance kΩ		3.5 – 6.5
Idle speed control servo coil resistance Ω		28 – 33 (at 20°C)
Intake air temperature sensor resistance kΩ	20°C	2.3 – 3.0
	80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	20°C	2.1 – 2.7
	80°C	0.26 – 0.36
Oxygen sensor output voltage V		0.6 – 1.0
Fuel pressure	High pressure MPa	4 – 7
	Low pressure kPa	324 – 343
Injector coil resistance Ω		0.9 – 1.1 (at 20°C)
Air by-pass control solenoid valve coil resistance Ω	ON/OFF	7.7 – 9.3 (at 20°C)
	DUTY	7.7 – 9.3 (at 20°C)

SEALANT

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

SPECIAL TOOLS

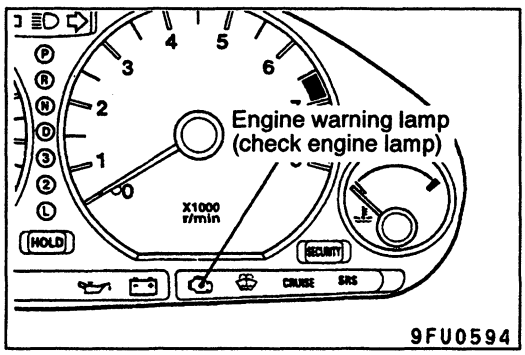
Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	• Fuel gauge simple inspection A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	• Reading diagnosis code • GDI system inspection
	MB991348, MB991658	Test harness set	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
	MB991709	Test harness	
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
	MD998463	Test harness (6-pin, square)	• Inspection of idle speed control servo • Inspection using an analyzer
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer

Tool	Number	Name	Use
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 MB991637	MB991637	Fuel pressure gauge set	

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

Engine warning lamp inspection items

Engine-ECU
Oxygen sensor
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Barometric pressure sensor
Detonation sensor
Injector
Abnormal combustion
Immobilizer system
Fuel pressure sensor
Excessive intake air amount
Brake vacuum sensor

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.
5. Start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

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

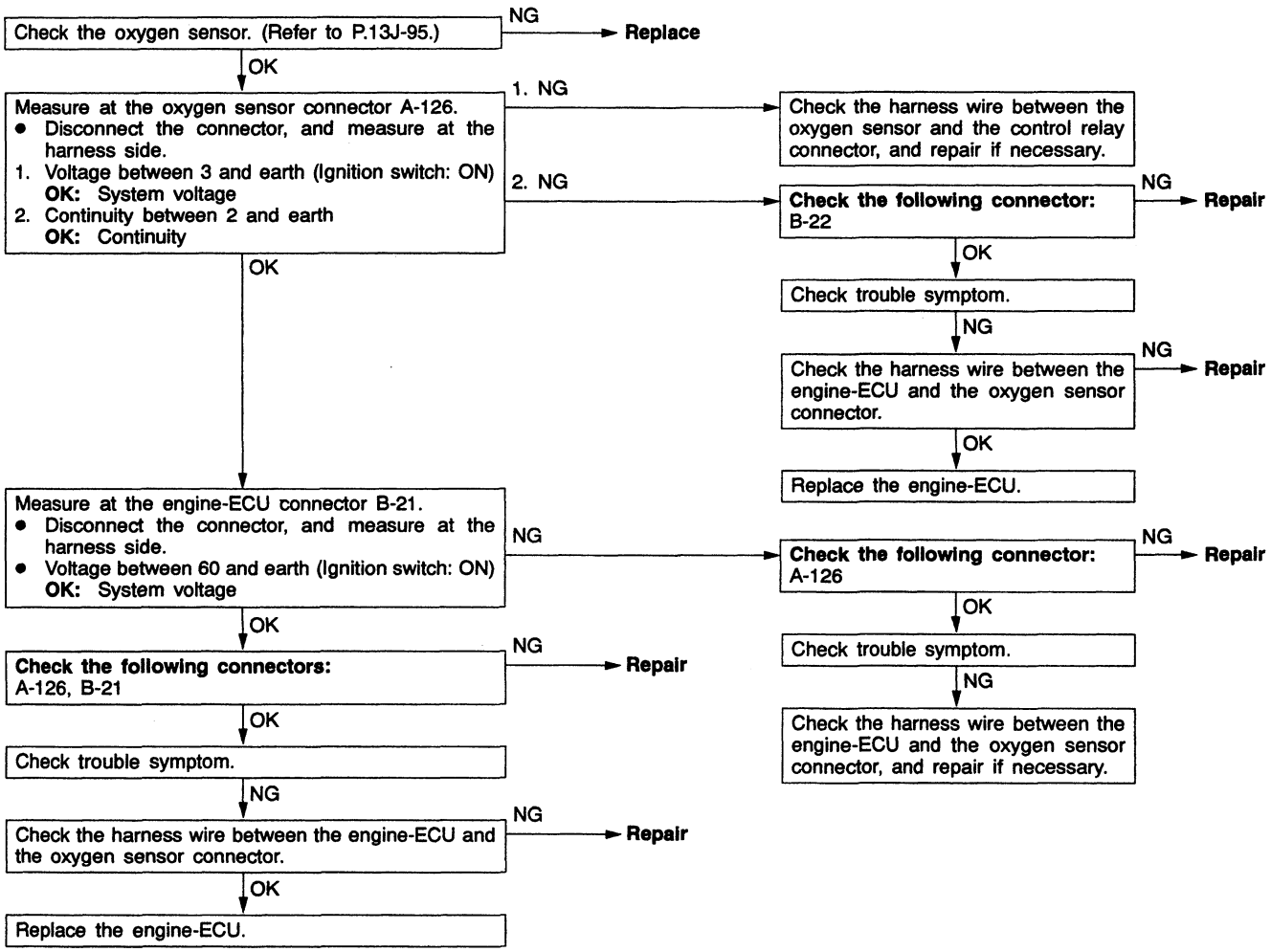
Malfunctioning item	Control contents during malfunction
Air flow sensor	(1) Lean fuel combustion driving and feedback control driving are prevented. (2) Basic injection drive timing and basic ignition timing are set by means of the mapping values from the throttle position sensor signal and the crank angle sensor signal.
Intake air temperature sensor	Control is carried out as if the intake air temperature is 25°C.
Throttle position sensor	(1) Lean fuel combustion driving is prevented. (2) Dashpot compensation for the idle speed control is prevented.
Engine coolant temperature sensor	Control is carried out as if the engine coolant temperature is 80°C. Furthermore, this control will continue until the ignition switch is turned to OFF, even if the sensor signal returns to normal.
Camshaft position sensor	Control is carried out as if the conditions before the failure judgement occurred are continuing.
Vehicle speed sensor	(1) Lean fuel combustion driving is prevented. However, this condition is cleared if the engine speed is continuously at 1,500 r/min or more for a certain length of time. (2) Lean fuel combustion during idling is prevented.
Barometric pressure sensor	Control is carried out as if the barometric pressure is 101 kPa (760 mmHg).
Detonation sensor	Ignition timing is fixed to the timing for standard petrol.
Injector	(1) Lean fuel combustion driving is prevented. (2) EGR operation is cut.
Abnormal combustion	Lean fuel combustion driving is prevented.
Excessive intake air amount	When the air flow sensor output is compared with the throttle position sensor output and the air amount is judged to be excessive, compression stroke fuel injection and lean fuel combustion driving are set.
Communication line with A/T-ECU	Ignition timing retarding control (engine and transmission total control) during transmission gear shifting is prevented.
Alternator FR terminal	Alternator output suppression control under high electrical loads is prevented. (Alternator works as a normal alternator.)
Fuel pressure sensor	Control is carried out as if the fuel pressure is 5 MPa.

INSPECTION CHART FOR DIAGNOSIS CODES

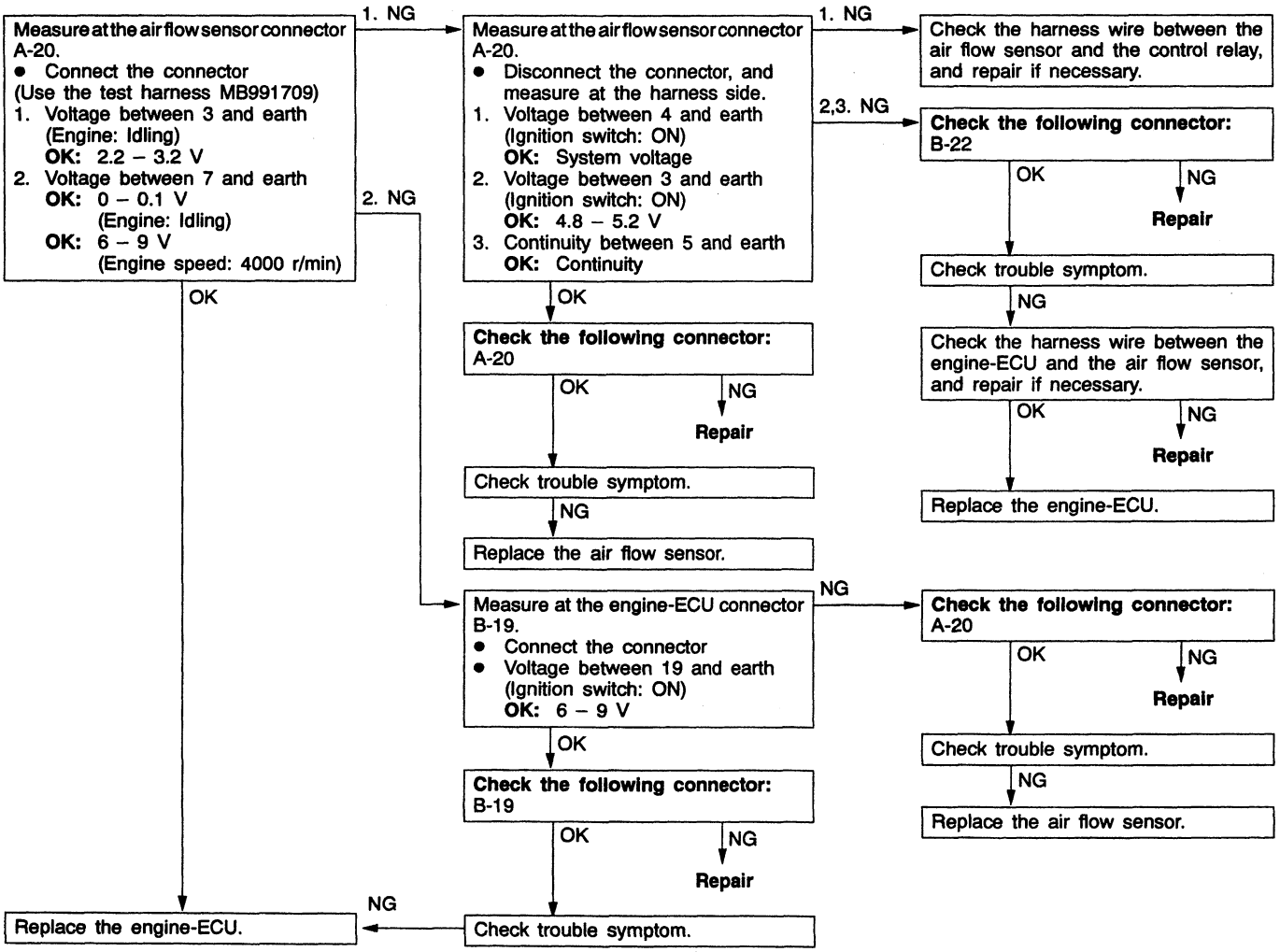
Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13J-12
12	Air flow sensor system	13J-13
13	Intake air temperature sensor system	13J-14
14	Throttle position sensor system	13J-15
21	Engine coolant temperature sensor system	13J-16
22	Crank angle sensor system	13J-17
23	Camshaft position sensor system	13J-18
24	Vehicle speed sensor system	13J-19
25	Barometric pressure sensor system	13J-20
31	Detonation sensor system	13J-21
41	Injector system	13J-22
44	Abnormal combustion	13J-23
54	Immobilizer system	13J-24
56	Fuel pressure sensor system	13J-25
58	Excessive intake air amount	13J-26
61	Communication wire with A/T-ECU system	13J-26
64	Alternator FR terminal system	13J-27
66	Brake vacuum sensor system	13J-28

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

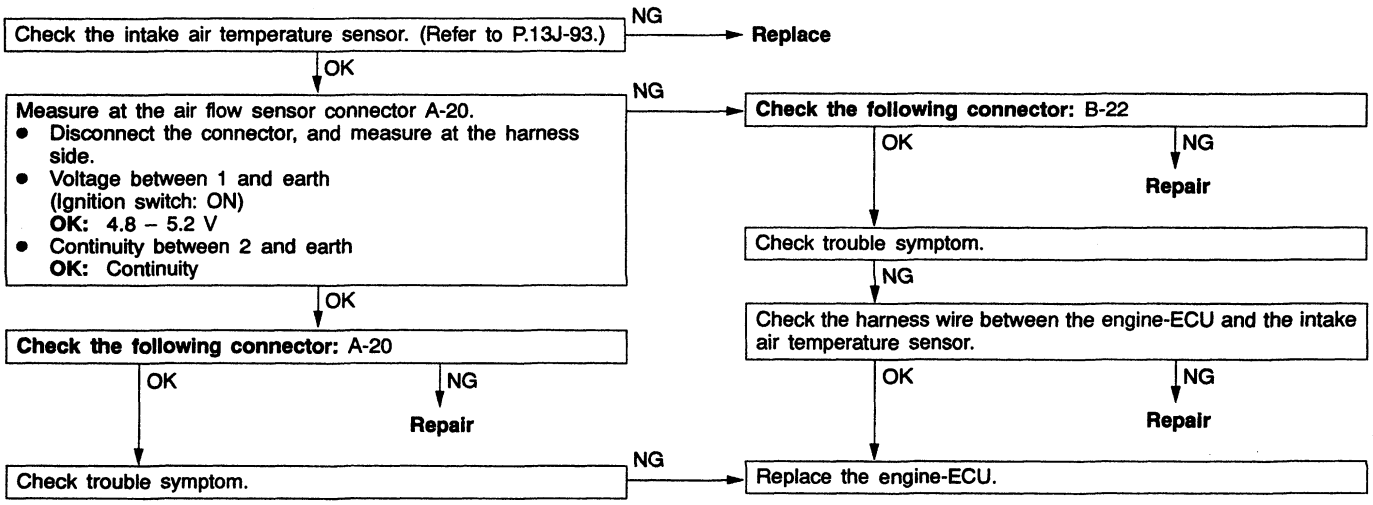
Code No. 11 Oxygen sensor system	Probable cause
Range of check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20–50°C. ● Engine speed is approx. 2,000–3,000 r/min ● Vehicle is moving at constant speed on a flat, level road surface Set conditions ● The oxygen sensor output voltage is around 0.6 V for 30 seconds (does not cross 0.6 V for 30 seconds). ● When the range of check operations given above which accompany starting of the engine are carried out four time in succession, a problem is detected after each operation.	● Malfunction of the oxygen sensor ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU



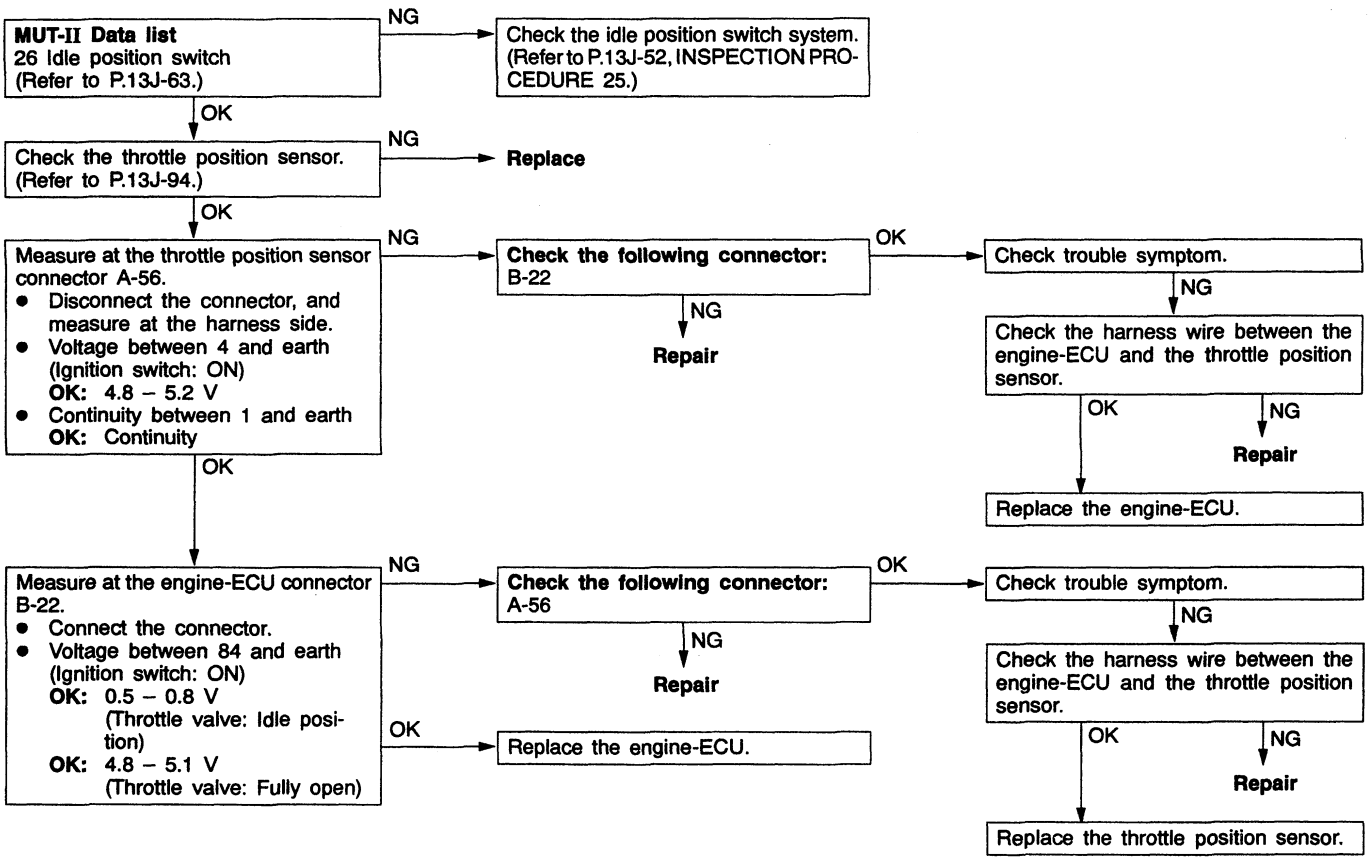
Code No.12 Air flow sensor system	Probable cause
Range of check ● Engine speed is 500 r/min or more. Set conditions ● Sensor output frequency is 3.3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Open circuit or short-circuited harness wire of air flow sensor circuit ● Malfunction of the engine-ECU



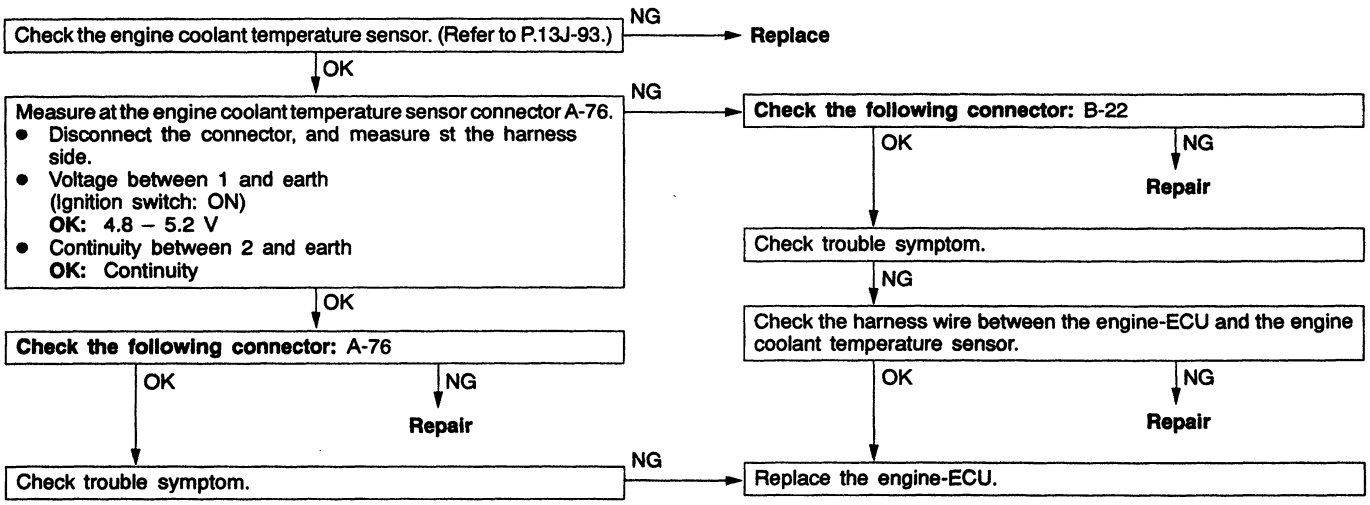
Code No.13 Intake air temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 0.14 kΩ or less for 4 seconds. or ● Sensor resistance is 50 kΩ or more for 4 seconds.	● Malfunction of the intake air temperature sensor ● Open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the engine-ECU



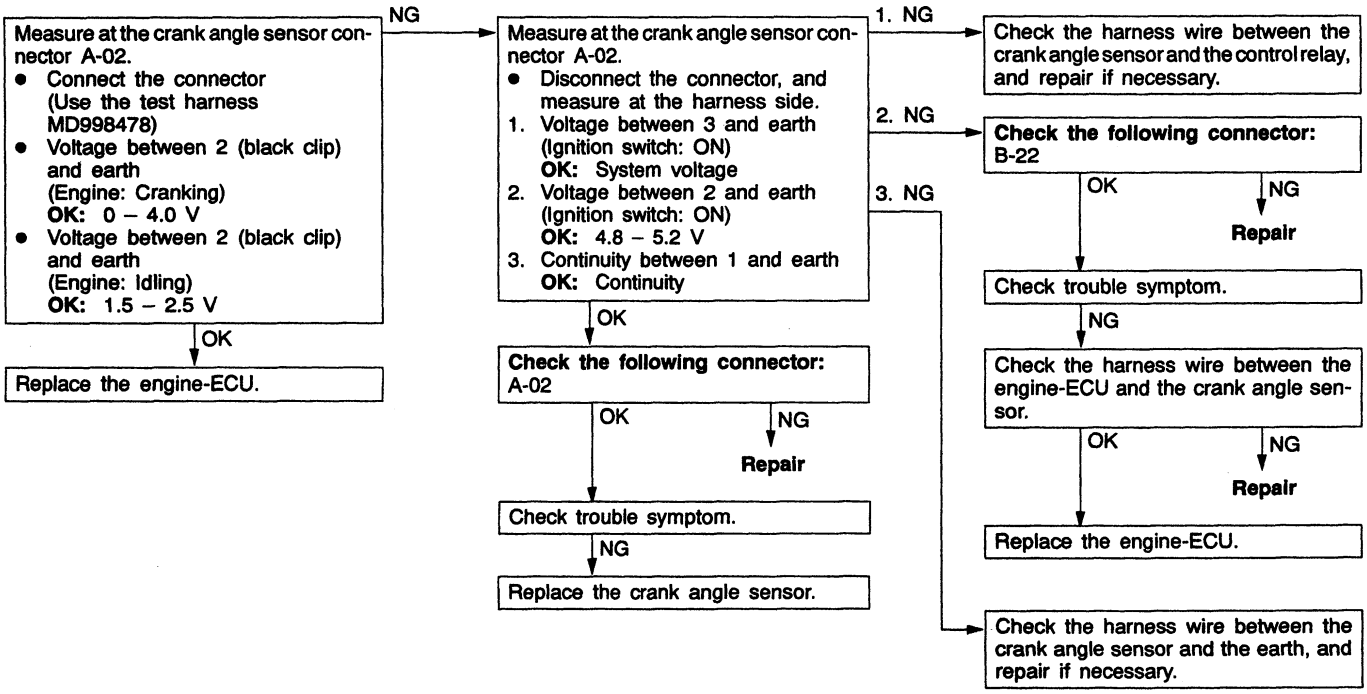
Code No.14 Throttle position sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor output voltage is 0.2 V or less for 4 seconds. or ● Idle position switch is ON and sensor output voltage is 2.0 V or more for 4 seconds.	● Malfunction of the throttle position sensor ● Open circuit or short-circuited harness wire of the throttle position sensor circuit ● Idle position switch ON malfunction ● Short-circuit in idle position switch signal line ● Malfunction of the engine-ECU



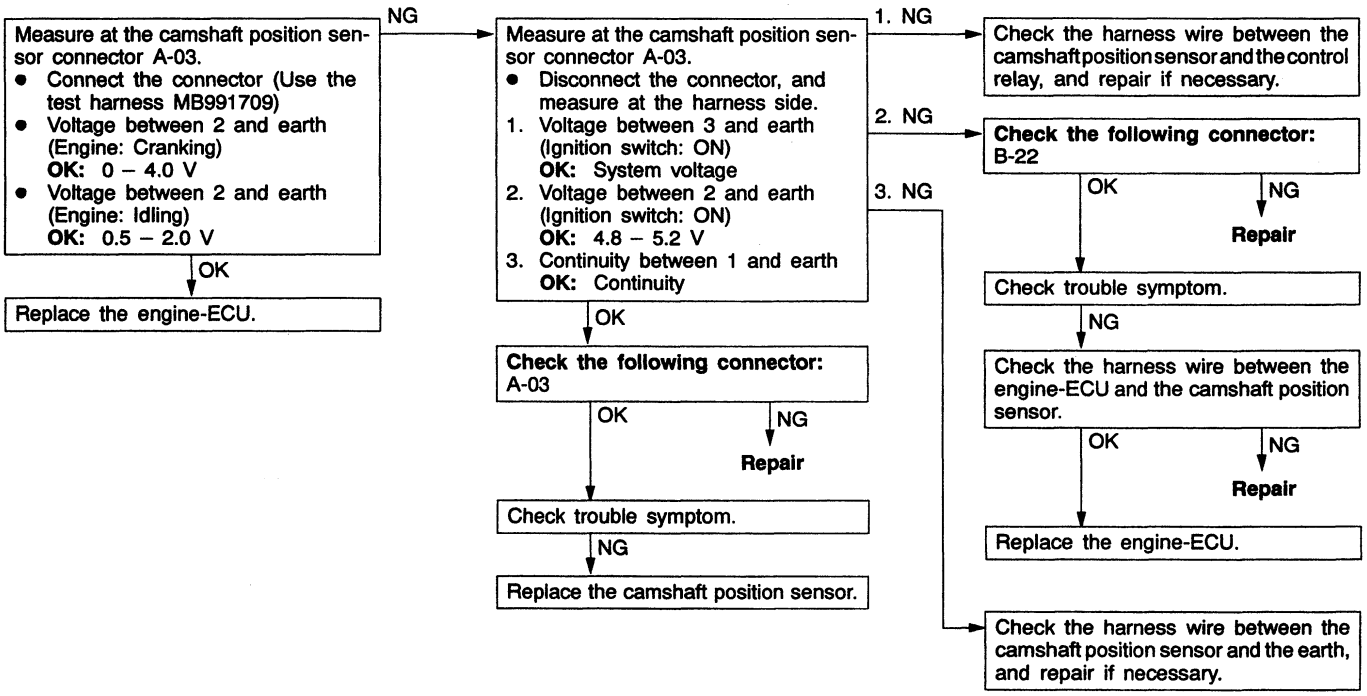
Code No.21 Engine coolant temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 50 Ω or less for 4 seconds. or ● Sensor resistance is 72 kΩ or more for 4 seconds.	● Malfunction of the engine coolant temperature sensor ● Open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit ● Malfunction of the engine-ECU
Range of check ● After engine starts Set conditions ● After 5 minutes or more have passed since the engine coolant temperature after filtering has dropped from 40°C or more to less than this temperature	



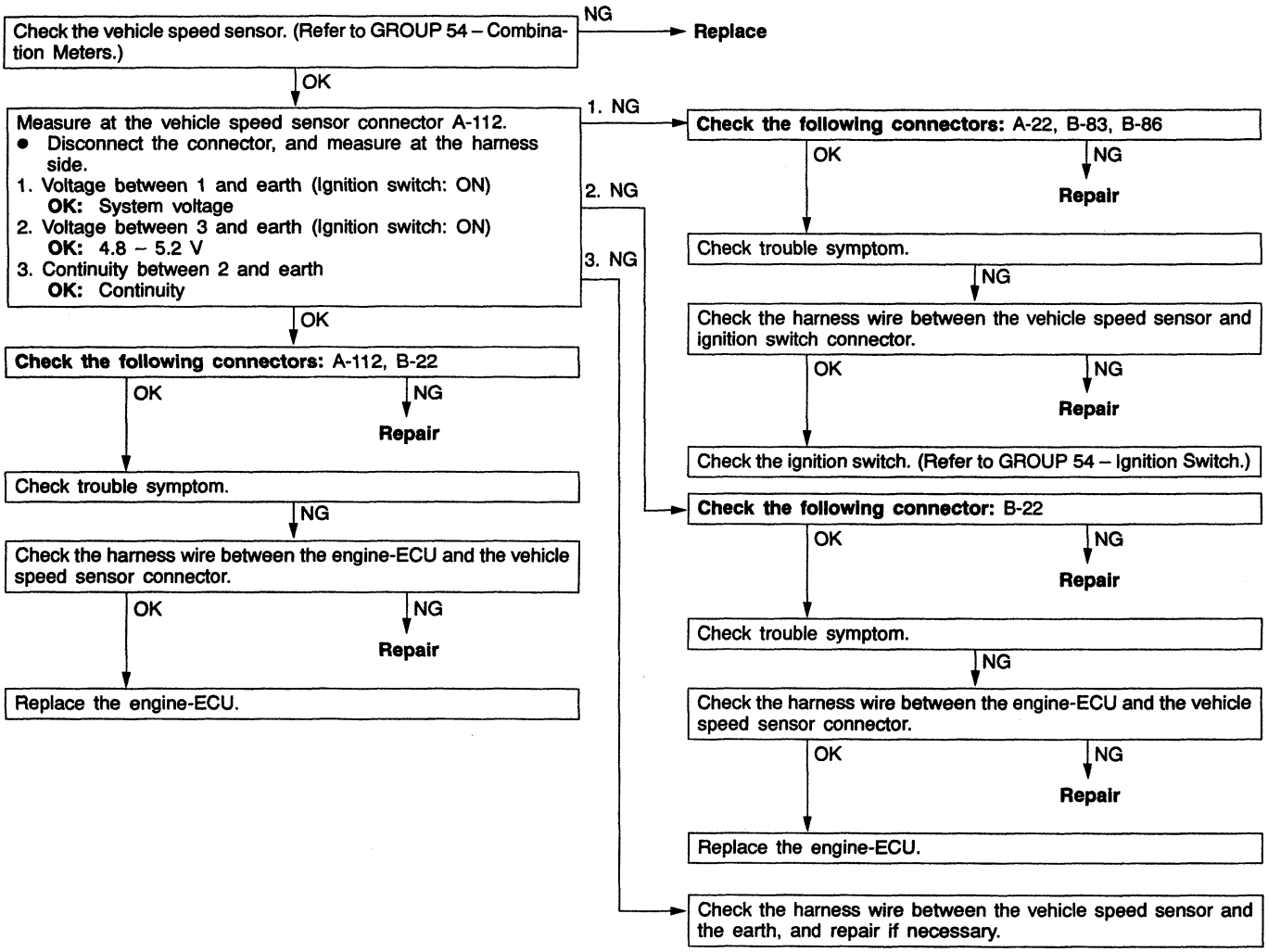
Code No.22 Crank angle sensor system	Probable cause
Range of check ● Engine: During cranking Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	● Malfunction of the crank angle sensor ● Open circuit or short-circuited harness wire of the crank angle sensor circuit ● Malfunction of the engine-ECU



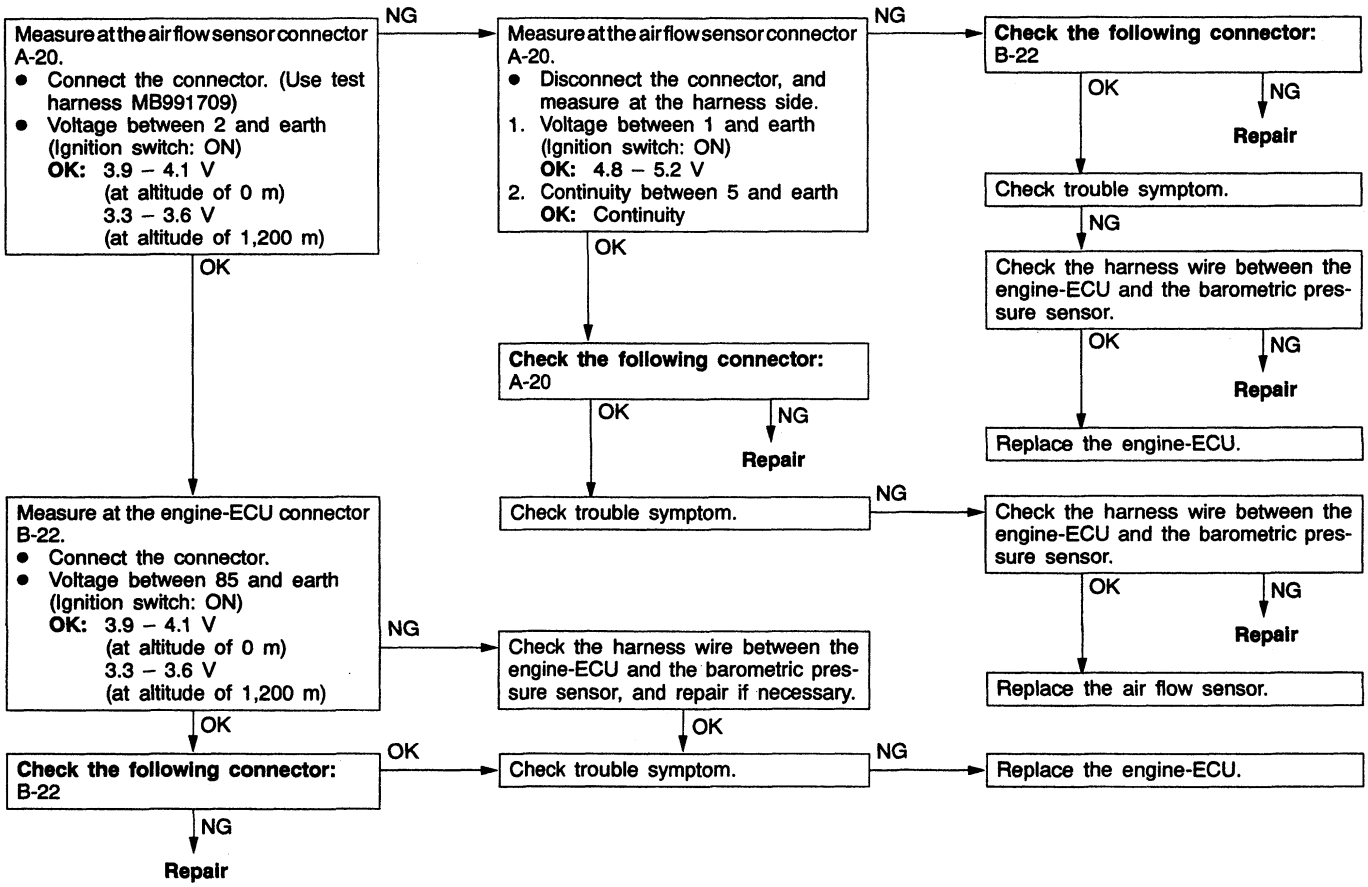
Code No.23 Camshaft position sensor system	Probable cause
Range of check ● While engine is cranking or running Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input). or ● Abnormal pulse signal pattern is output.	● Malfunction of the camshaft position sensor ● Open circuit or short-circuited harness wire of the camshaft position sensor ● Malfunction of the engine-ECU



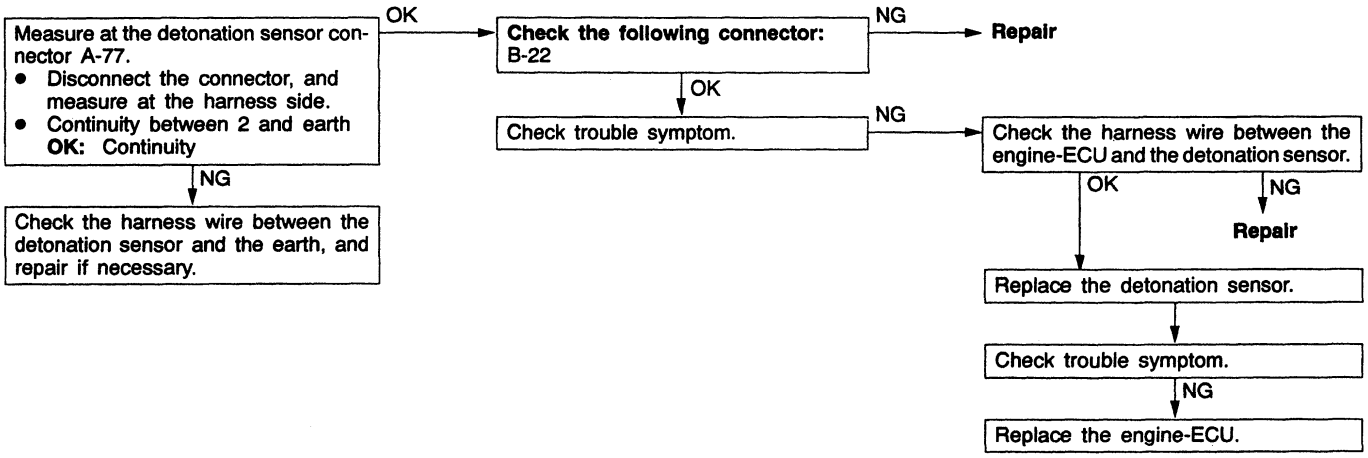
Code No. 24 Vehicles speed sensor system	Probable cause
Range of check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Idle position switch: OFF ● Engine speed is 3,000 r/min or more. ● Driving under high engine load conditions. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit ● Malfunction of the engine-ECU



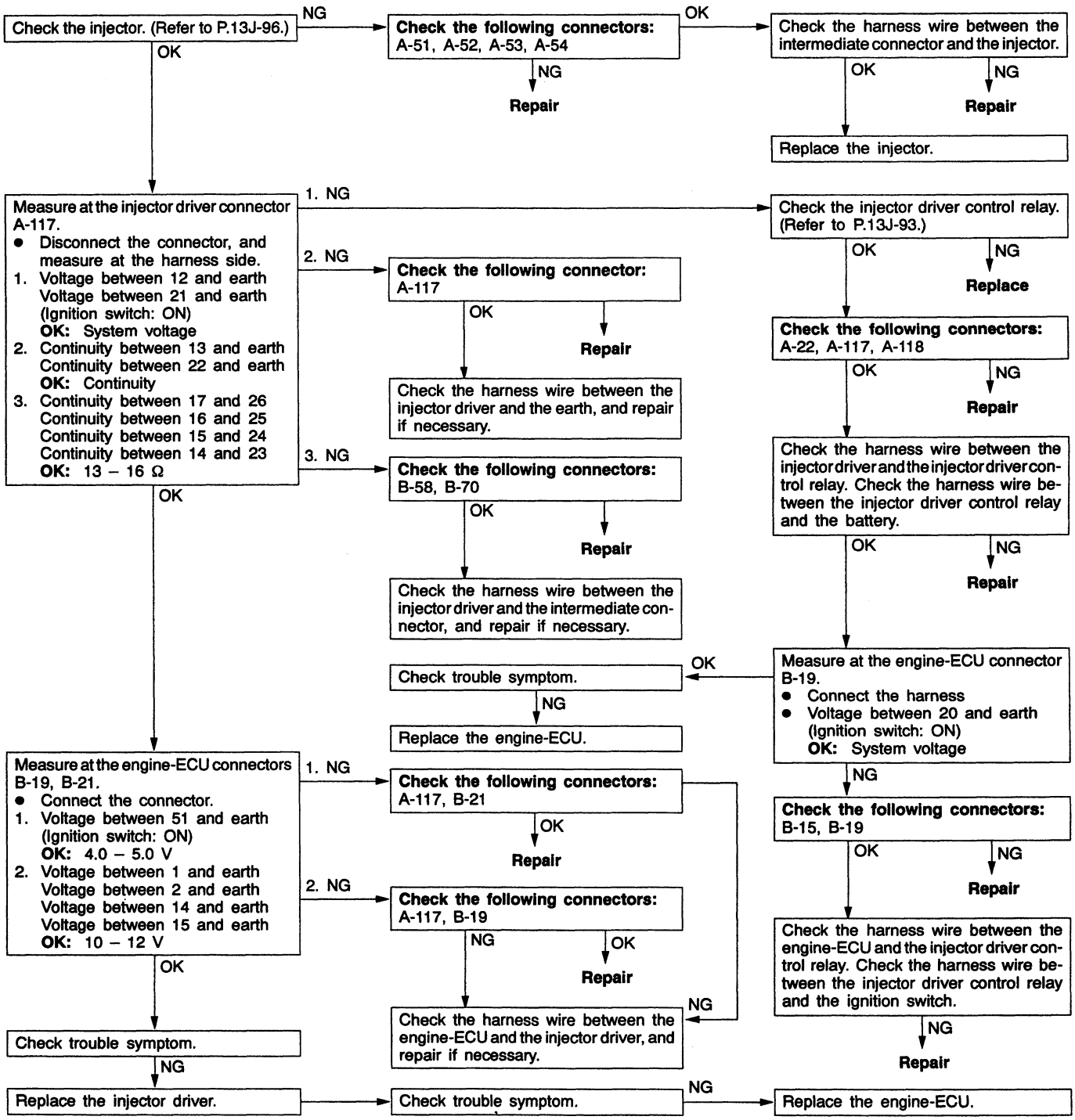
Code No.25 Barometric pressure sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 0.2 V or less for 4 seconds. or ● Sensor output voltage is 4.5 V or more for 4 seconds.	● Malfunction of the barometric pressure sensor ● Open circuit or short-circuited harness wire of the barometric pressure sensor ● Malfunction of the engine-ECU



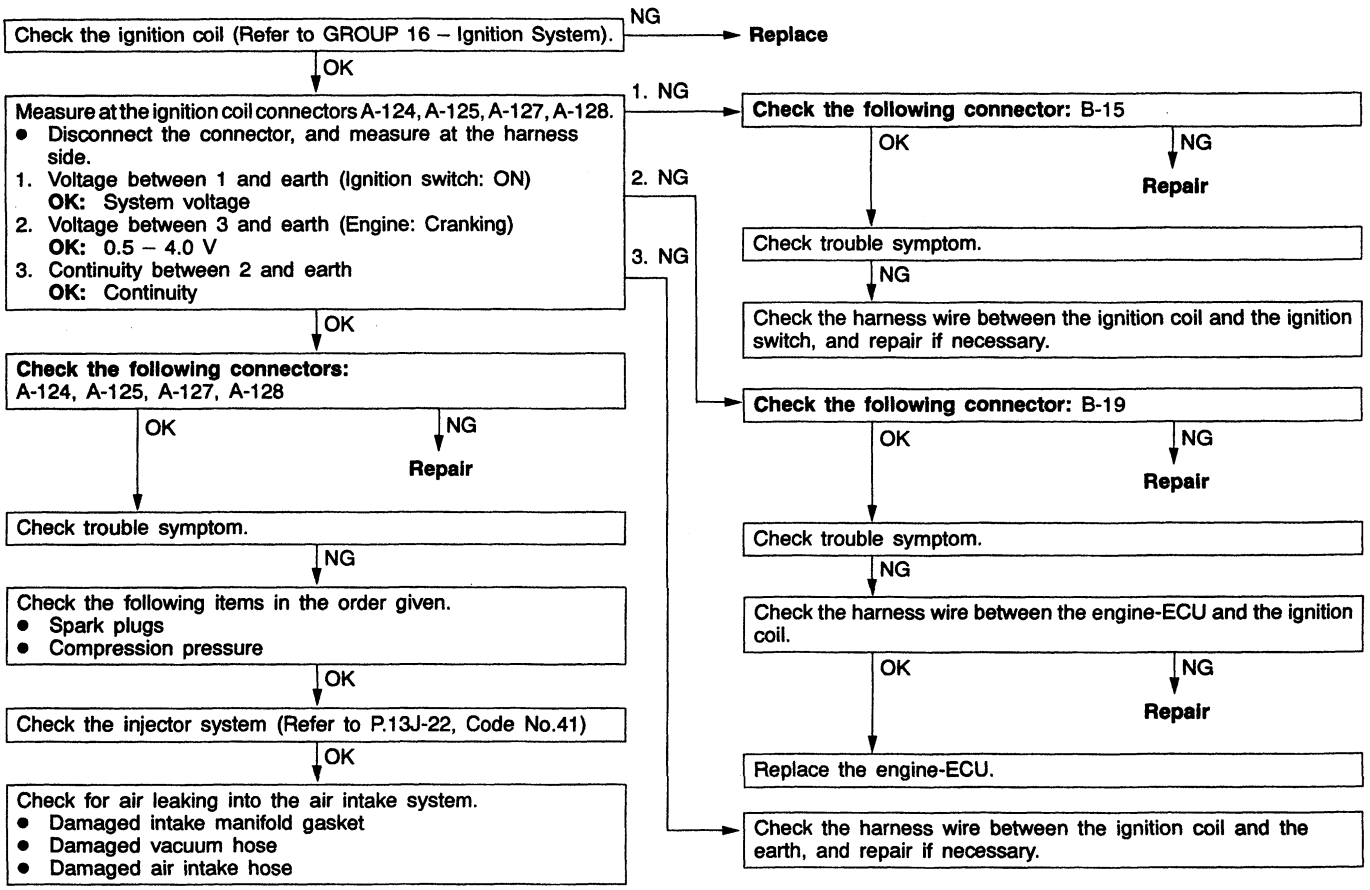
Code No.31 Detonation sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Amount of change in the sensor output voltage (detonation sensor peak voltage for each half rotation of the crankshaft) is 0.06 V or less for 200 continuous times.	● Malfunction of the detonation sensor ● Open circuit or short-circuited harness wire of the detonation sensor ● Malfunction of the engine-ECU



Code No.41 Injector system	Probable cause
Range of check ● While engine is cranking or running ● Engine speed is 4,000 r/min or less. ● System voltage is 10 V or more. ● While fuel cut and injector forced drive (actuator test) are not being carried out Set conditions ● Injector open circuit check signal is not output by the injector driver for a set number of times.	● Malfunction of the injector ● Malfunction of the injector driver control relay ● Malfunction of the injector driver ● Open circuit or short-circuited harness wire of the injector drive circuit ● Malfunction of the engine-ECU

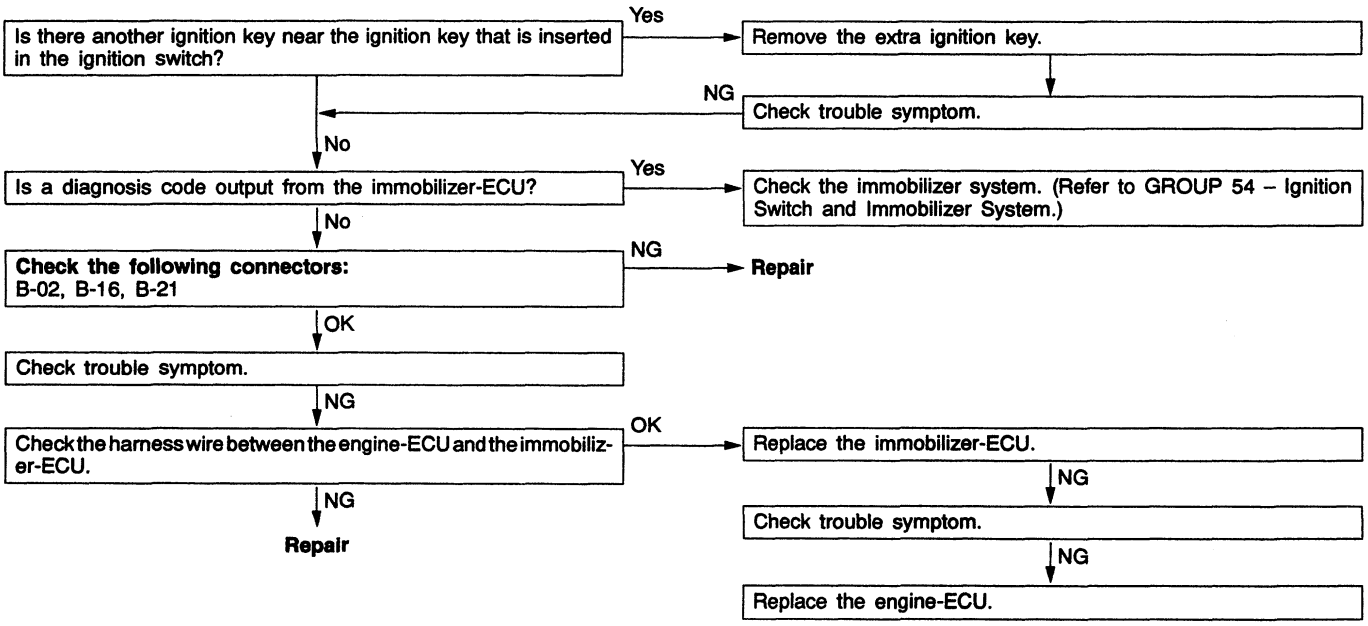


Code No.44 Abnormal combustion	Probable cause
Range of check ● While engine is running during lean fuel combustion Set conditions ● Abnormal engine speed due to mis-firing is detected by the crank angle sensor	● Malfunction of the ignition coil ● Malfunction of the spark plug ● Open circuit or short-circuit in ignition primary circuit ● Malfunction of the injector system ● Malfunction of the engine-ECU

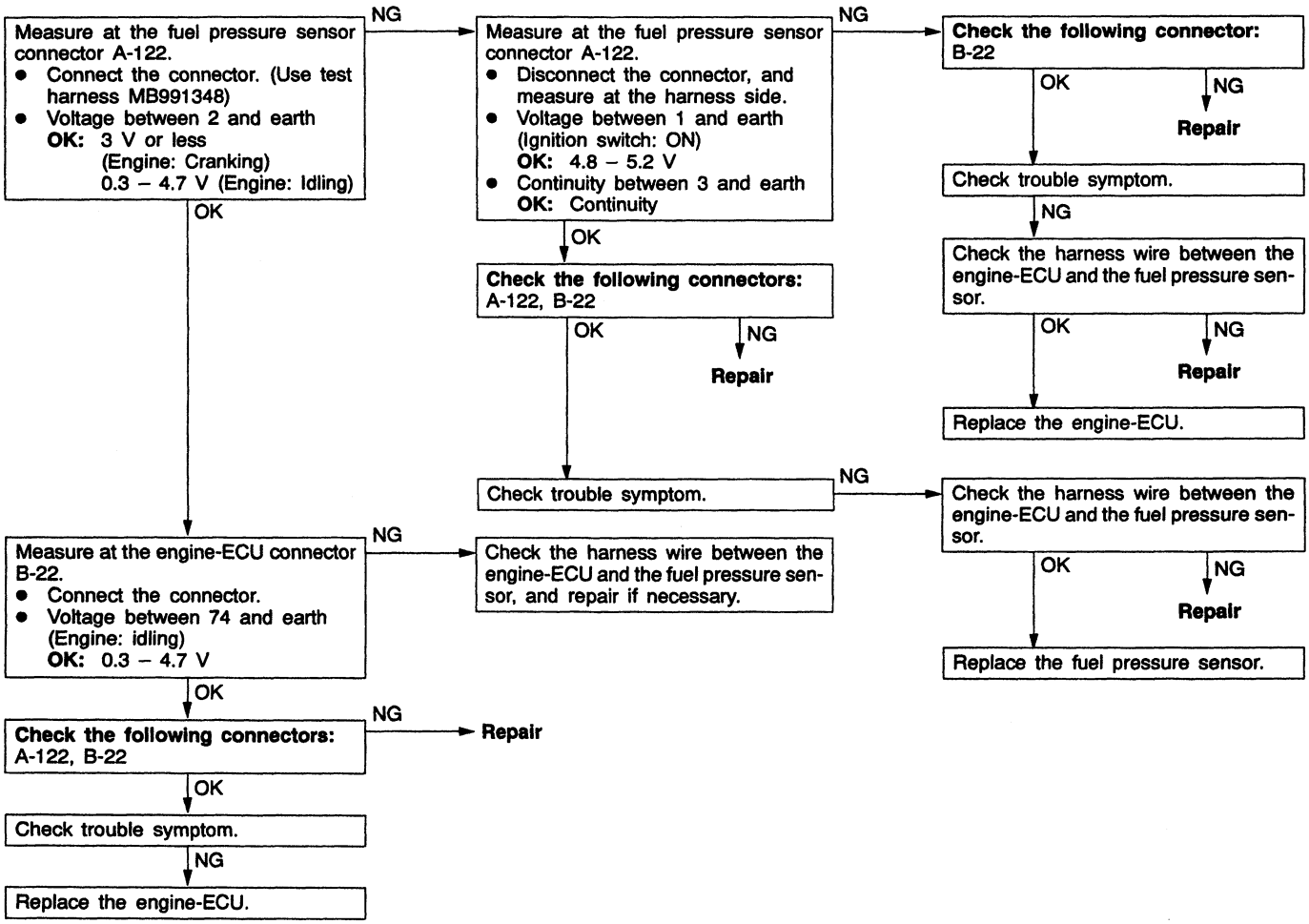


Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of ID codes ● Incorrect ID code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Malfunction of engine-ECU

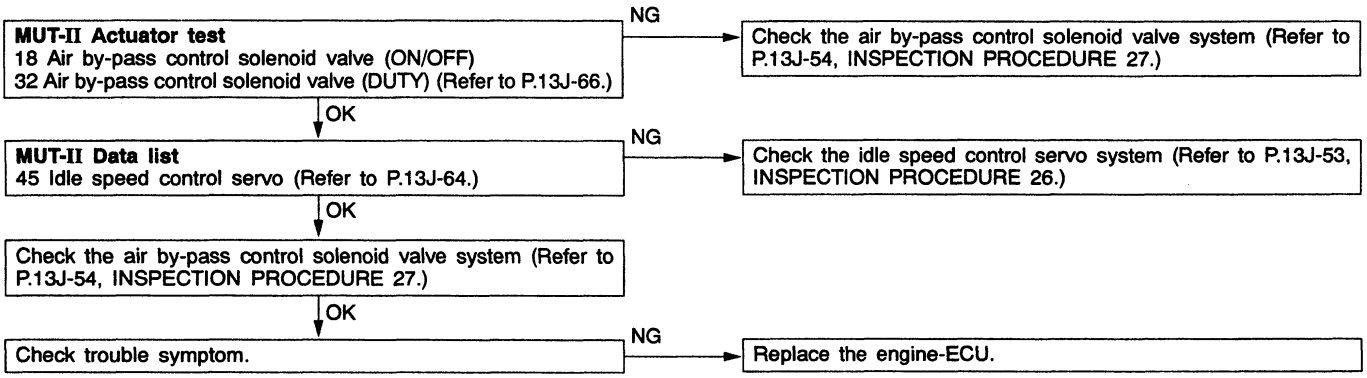
NOTE
(1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key ID code.



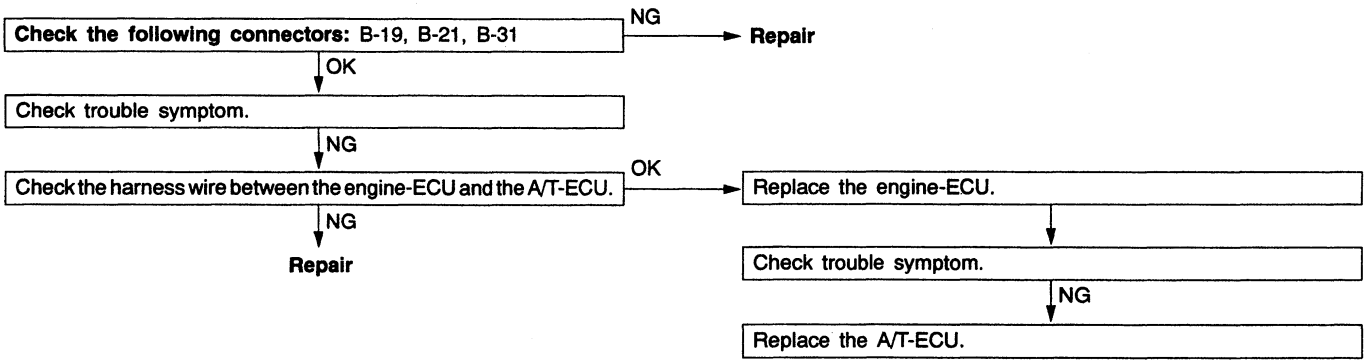
Code No.56 Fuel pressure sensor system	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.7 V or more. or ● Sensor output voltage is 0.3 V or less.	● Malfunction of the fuel pressure sensor ● Open circuit or short-circuited harness wire of the fuel pressure sensor ● Malfunction of the engine-ECU



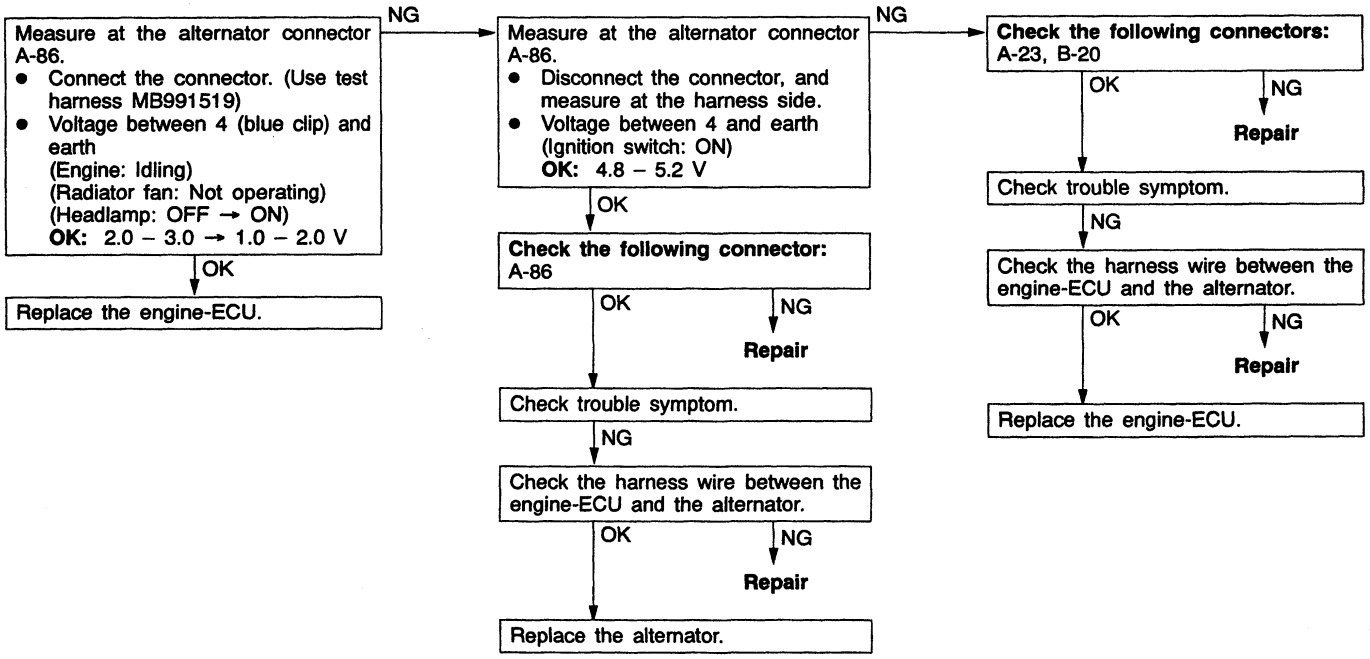
Code No.58 Excessive intake air amount	Probable cause
Range of check ● While engine is running in lean compression mode ● Engine speed is 3,000 r/min or less. ● Throttle position sensor output voltage is 1 V or less. Set conditions ● Air flow sensor output frequency is 100 Hz or more for 1 second.	● Malfunction of the idle speed control servo ● Open circuit or short-circuited harness wire of the idle speed control servo ● Malfunction of the air by-pass control solenoid valve (ON/OFF, DUTY) ● Short-circuited harness wire of the air by-pass control solenoid valve (ON/OFF, DUTY) ● Malfunction of the engine-ECU
Range of check ● While engine is not running in lean compression mode Set conditions ● Air flow sensor output frequency is higher than the map value specified by the engine speed for 1 second.	



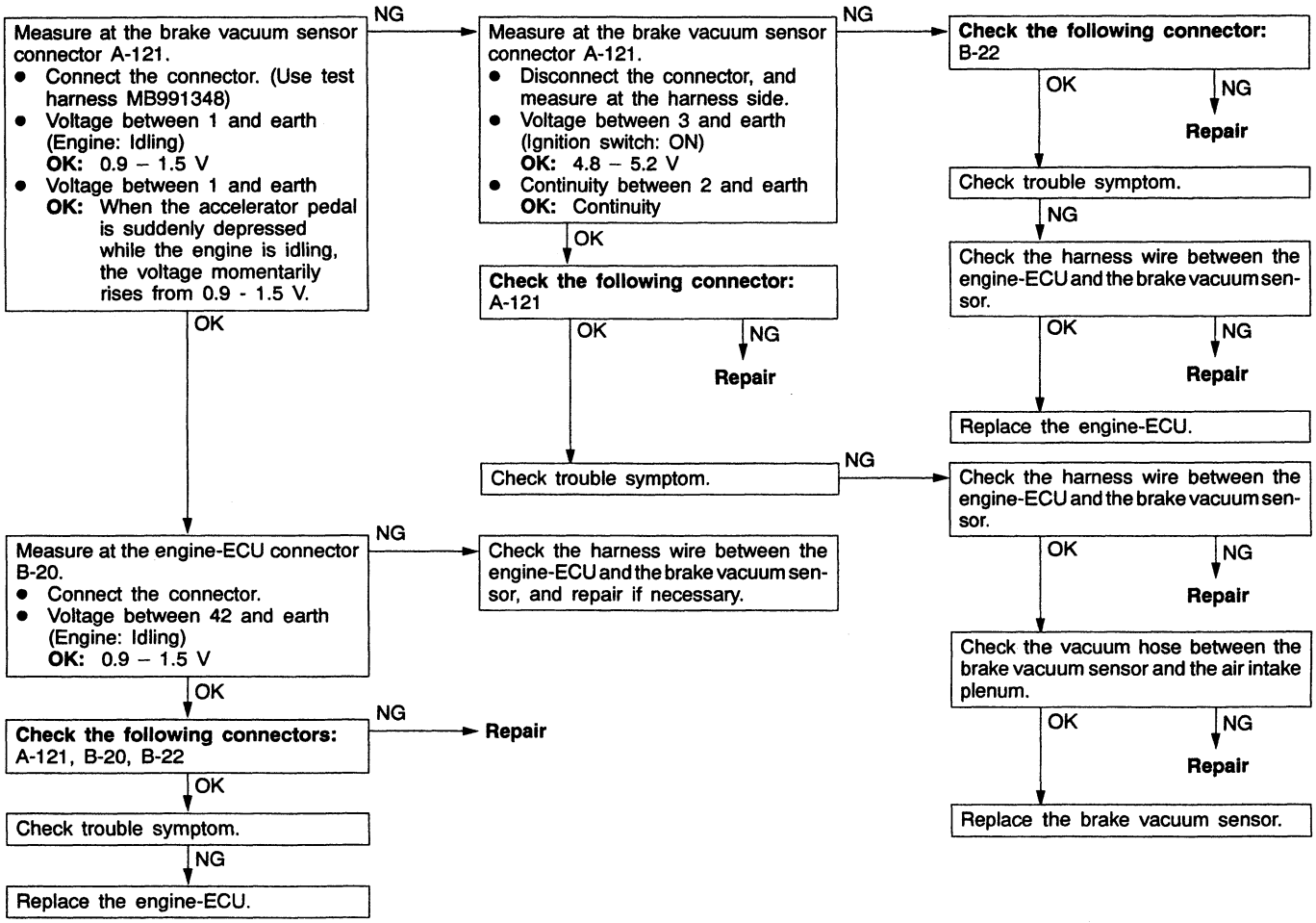
Code No.61 Communication wire with A/T-ECU system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	● Short circuit in ECU communication circuit ● Malfunction of the engine-ECU ● Malfunction of the A/T-ECU



Code No.64 Alternator FR terminal system	Probable cause
Range of check ● Engine speed is 50 r/min or more. Set conditions ● Input voltage from alternator FR terminal is 4.5 V or more for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of the engine-ECU



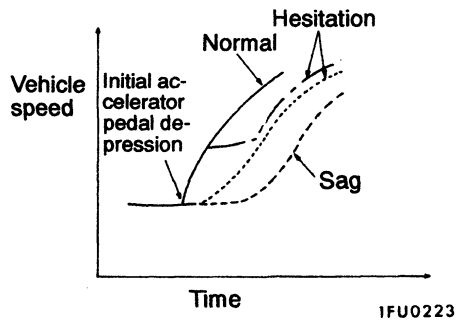
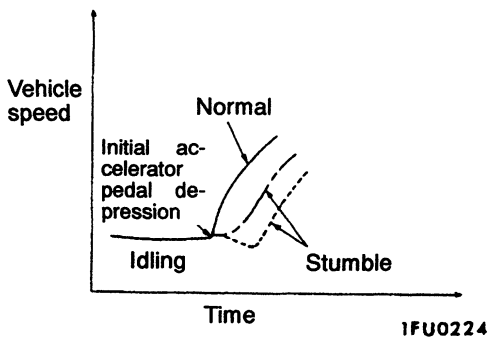
Code No.66 Brake vacuum sensor system	Probable cause
Range of check • Ignition switch: ON Set conditions • Sensor output voltage is 4.8 V or more. or • Sensor output voltage is 0.2 V or less.	• Malfunction of the brake vacuum sensor • Improper connector contact, open circuit or short-circuited harness wire of the brake vacuum sensor • Malfunction of the engine-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13J-31
	Communication with engine-ECU only is not possible.	2	13J-32
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13J-33
	The engine warning lamp remains illuminating and never goes out.	4	13J-33
Starting	No initial combustion (starting impossible)	5	13J-34
	Initial combustion but no complete combustion (starting impossible)	6	13J-35
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13J-36
	Idling speed is high. (Improper idling speed)	8	13J-38
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13J-39
	When the engine is hot, it stalls at idling. (Die out)	10	13J-40
	The engine stalls when starting the car. (Pass out)	11	13J-42
	The engine stalls when decelerating.	12	13J-43
Driving	Hesitation, sag or stumble	13	13J-43
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13J-45
	The feeling of impact or vibration when decelerating	15	13J-45
	Knocking	16	13J-45
Dieseling		17	13J-46
Too high CO and HC concentration when idling		18	13J-46
Low alternator output voltage (approx. 12.3 V)		19	13J-47
Fans (radiator fan, A/C condensor fan) are inoperative		20	13J-48

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

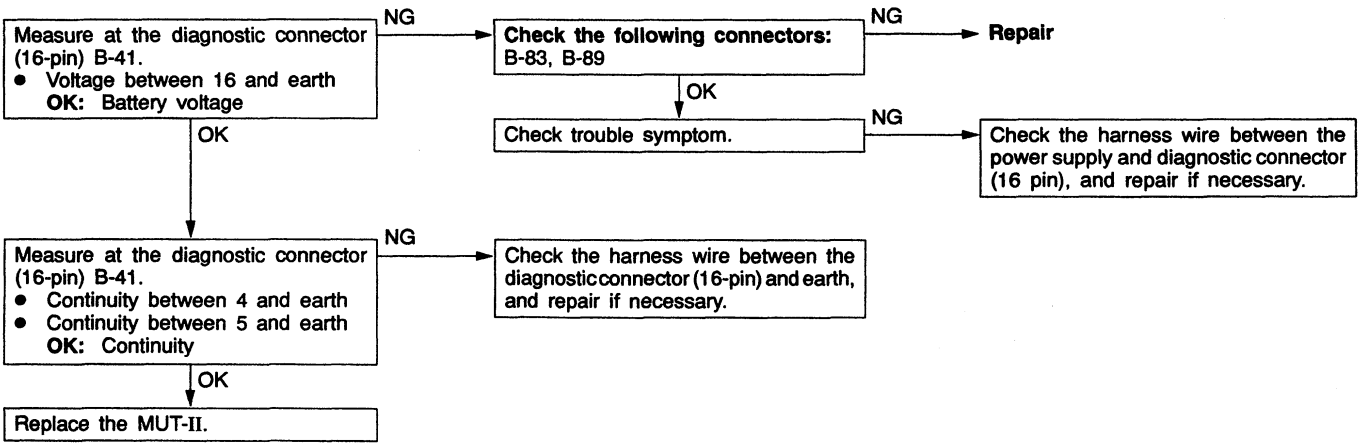
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
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". 
	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. 

Items		Symptom
Driving	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run on ("Dieseling")	The condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

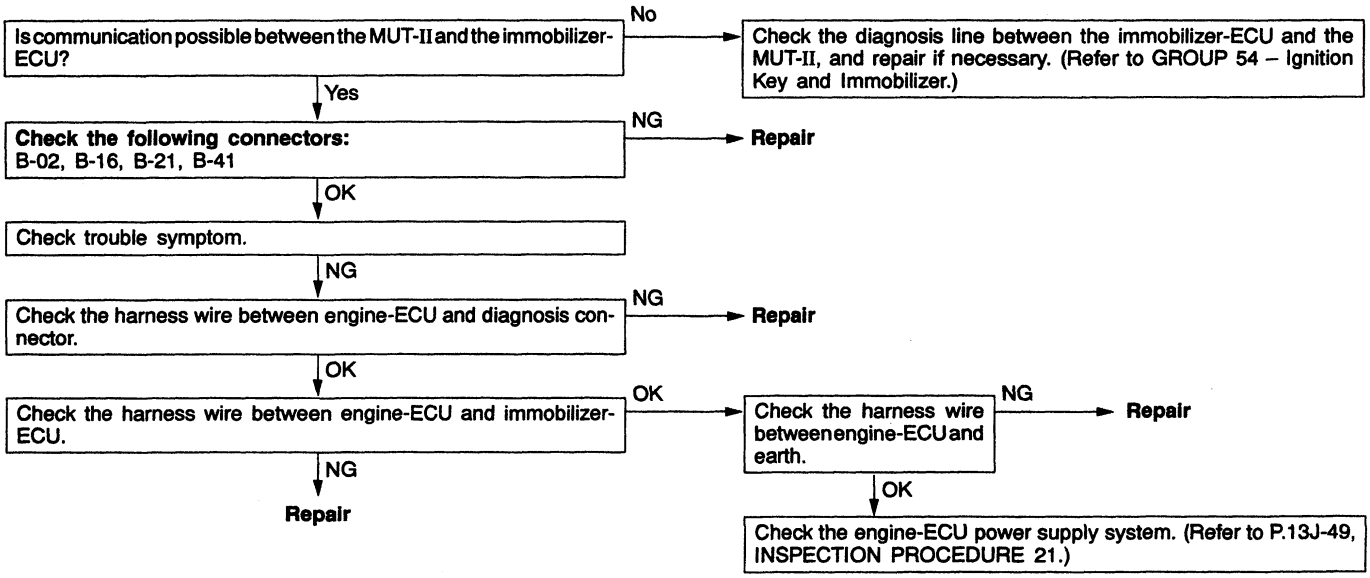
INSPECTION PROCEDURE 1

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



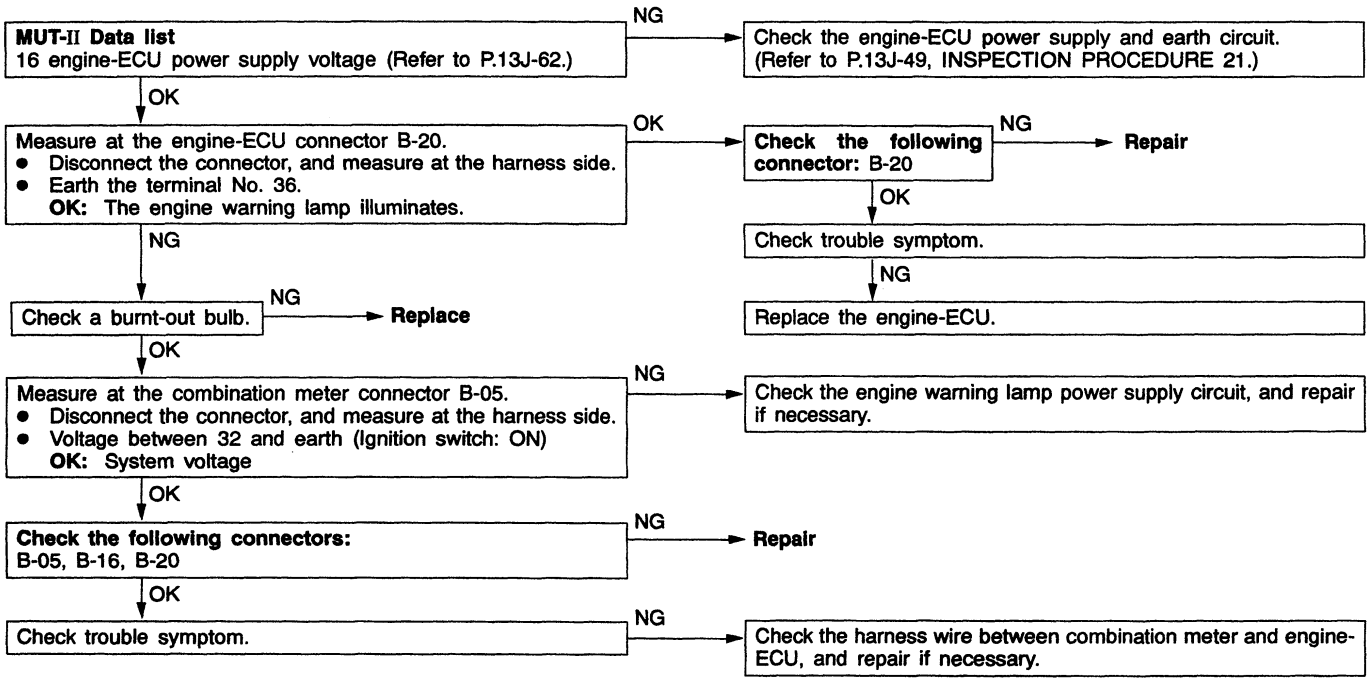
INSPECTION PROCEDURE 2

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



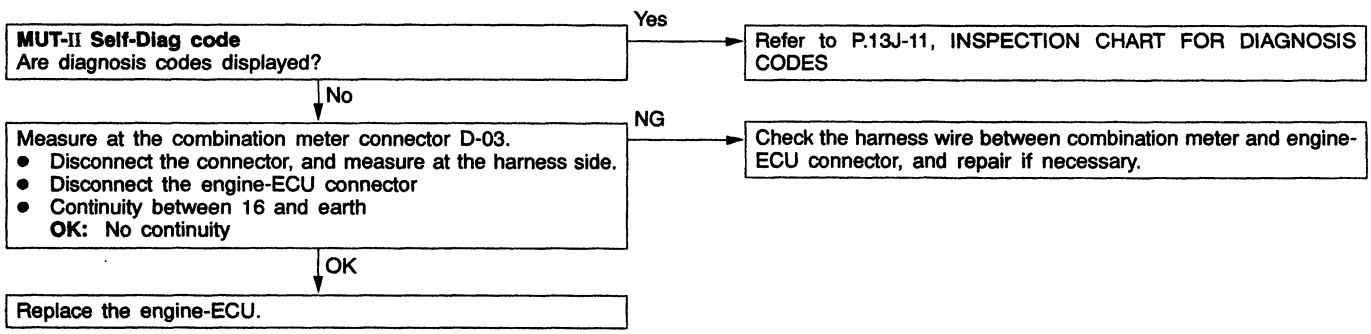
INSPECTION PROCEDURE 3

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



INSPECTION PROCEDURE 4

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



INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
The cause is probably a problem with the supply of fuel to the combustion chambers or a malfunction of the ignition circuit. Furthermore, there is a slight possibility that the fuel is contaminated.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-ECU • Malfunction of the immobilizer-ECU

Check the battery voltage during cranking.
OK: 8 V or more
NG → Check the battery. (Refer to GROUP 54.)
OK ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

MUT-II Data list
16 System voltage (Refer to P.13J-62.)
NG → Check the control relay and ignition switch-IG system. (Refer to P.13J-50, INSPECTION PROCEDURE 22.)
OK ↓

Is the camshaft rotating while the engine is cranking?
NO → Check for a broken timing belt.
YES ↓

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13J-66.)
NG → Check the fuel pump (low pressure) system. (Refer to P.13J-55, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
22 Crank angle sensor (Refer to P.13J-63.)
NG → Check the crank angle sensor system. (Refer to P.13J-17, Code No.22.)
OK ↓

Can the sound of the injectors operating be heard while the engine is cranking? (Using a soundscope)
NG → Check the injector system. (Refer to P.13J-22, Code No.41.)
OK ↓

Check for fuel leaks. (Refer to P.13J-90.)
NG → Replace the fuel pump (high pressure).
OK ↓

Measure the fuel pressure between the fuel pump (low pressure) and the fuel pump (high pressure). (Refer to P.13J-87.)
OK ↓

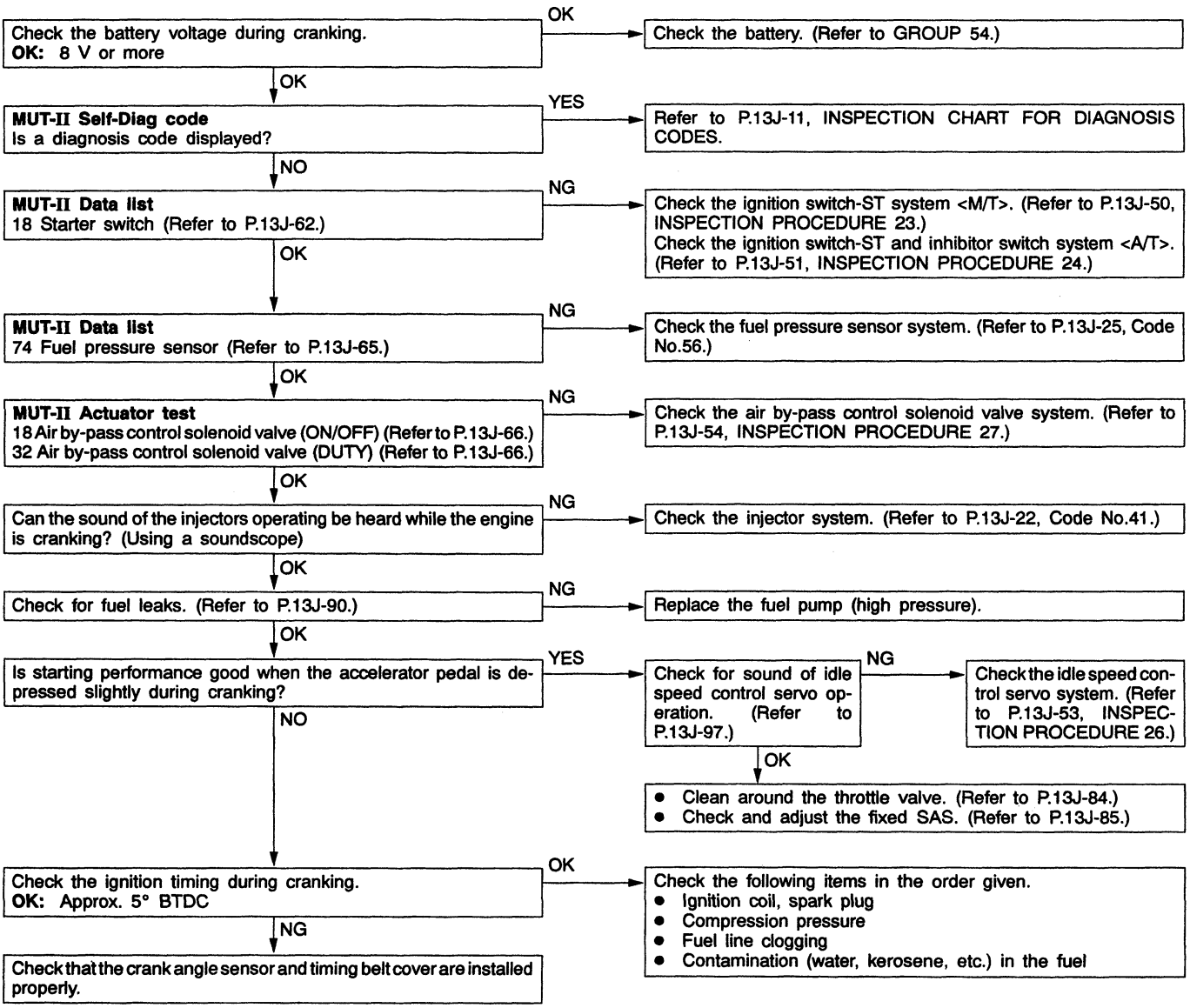
Check the ignition timing during cranking.
OK: Approx. 5° BTDC
NG → Check that the crank angle sensor and timing belt cover are installed properly.
OK ↓

Measure at the ignition coil connectors B-92, B-93, B-94, B-102.
- Connect the connector. (Use test harness MB991658)
- Check while connecting a primary voltage detection-type tachometer to terminal 1 of each connector.
  OK: For all terminals, the engine tachometer indication is 1/2 of the cranking speed.

NG → Check the abnormal combustion. (Refer to P.13J-23, Code No.44.)
OK → Contamination (water, kerosene, etc.) in the fuel

INSPECTION PROCEDURE 6

Initial combustion but no complete combustion (starting impossible) Long time to start (improper starting)	Probable cause
The cause is probably poor ignition due to a malfunctioning spark plug (weak spark), an incorrect air/fuel ratio when starting or incorrect fuel pressure switching.	• Malfunction of the fuel supply system • Malfunction of the fuel pressure sensor • Malfunction of the ignition system • Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Malfunction of the engine-ECU



INSPECTION PROCEDURE 7

Unstable idling (Rough idling, hunting)	Probable cause
The cause is probably a malfunction of the ignition system, or incorrect air/fuel ratio, idle speed control, air by-pass control or compression pressure. Because the probable range of causes is so wide, checking starts from those items which are most likely to be the cause.	• Malfunction of the ignition system • Malfunction of air/fuel ratio control system • Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Incorrect compression pressure • Air leaking into air intake system

Have the battery terminals been disconnected recently?
- YES → After the engine has warmed up, run it at idle for approximately 10 minutes.
- NO ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check for sound of idle speed control servo operation. (Refer to P.13J-97.)
- NG → Check the idle speed control servo system. (Refer to P.13J-53, INSPECTION PROCEDURE 26.)
- OK ↓

Check the injector operation sound.
- NG → Check the injector system. (Refer to P.13J-22, Code No.41.)
- OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13J-63.)
- NG → Check the idle position switch. (Refer to P.13J-15, Code No.14.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13J-62.)
- NG → Check the intake air temperature sensor system. (Refer to P.13J-14, Code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13J-63.)
- NG → Check the barometric pressure sensor system. (Refer to P.13J-20, Code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13J-62.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13J-16, Code No.21.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13J-66.)
- NG → Check the purge control solenoid valve. (Refer to P.13J-57, INSPECTION PROCEDURE 30.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13J-61.)
OK: 700 – 900 mV when the engine is suddenly raced
- NG → Check the oxygen sensor system. (Refer to P.13J-12, Code No.11)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13J-61.)
OK: Changes between 0 mV and 700 – 900 mV at 2,500 r/min.
- NG → Check the fuel pressure. (Refer to P.13J-87.)
  - OK → Check for air leaking into the air intake system.
    - Damaged intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
- OK ↓

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13J-63.)
- NG → Check the power steering fluid pressure switch system. (Refer to P.13J-58, INSPECTION PROCEDURE 31.)
- OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13J-63.)
- NG → Check the A/C switch and A/C relay system. (Refer to P.13J-58, INSPECTION PROCEDURE 32.)
- OK ↓

To next page

From previous page

MUT-II Data list
29 Inhibitor switch (Refer to P.13J-63.)
NG → Check the ignition switch-ST and inhibitor switch system. (Refer to P.13J-51, INSPECTION PROCEDURE 24.)
OK ↓

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13J-64.)
NG → Check the M/T oil temperature sensor system. (Refer to P.13J-59, INSPECTION PROCEDURE 33.)
OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13J-65.)
NG → Check the stop lamp switch system. (Refer to P.13J-59, INSPECTION PROCEDURE 34.)
OK ↓

MUT-II Data list
33 Electrical load switch (Refer to P.13J-63.)
NG → Check the electrical load switch system. (Refer to P.13J-60, INSPECTION PROCEDURE 35.)
OK ↓

MUT-II Data list
45 Idle speed control servo (Refer to P.13J-64.)
NG → Adjust the basic idle speed. (Refer to P.13J-86.)
OK ↓

MUT-II Data list
68 EGR control servo (Refer to P.13J-65.)
NG → Check the EGR control servo system. (Refer to P.13J-56, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13J-66.)
NG → Check the air by-pass control solenoid valve system. (Refer to P.13J-54, INSPECTION PROCEDURE 27.)
OK ↓

Check the ignition timing. (Refer to GROUP 11A – On-vehicle Service)
OK → Check the following items in the order given.
- Ignition coil, spark plug (Refer to GROUP 16 – On-vehicle Service.)
- Evaporative Emission Control System (Refer to GROUP 17 – On-vehicle Service.)
- EGR system (Refer to GROUP 17 – On-vehicle Service.)
- Compression pressure (Refer to GROUP 11A – On-vehicle Service)
- Contamination (water, kerosene, etc.) in the fuel

NG ↓

Check that the crank angle sensor and timing belt cover are installed properly.
OK ↓

Clean the throttle body. (Refer to P.13J-84.) ↓

Check and adjust the fixed SAS. (Refer to P.13J-85.) ↓

Check the trouble symptoms.
NG → Check for air leaking into the air intake system.
- Damaged intake manifold gasket
- Damaged air intake hose
- Damaged vacuum hose

INSPECTION PROCEDURE 8

Idling speed is high, Idling speed is low (Improper idling speed)	Probable cause
The cause is probably that the intake air amount during idling is too great or too small.	• Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Malfunction of the throttle body

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Check for sound of idle speed control servo operation. (Refer to P.13J-97.)
NG → Check the idle speed control servo system. (Refer to P.13J-53, INSPECTION PROCEDURE 26.)
OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13J-66.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13J-66.)
NG → Check the air by-pass control solenoid valve system. (Refer to P.13J-54, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13J-66.)
NG → Check the purge control solenoid valve system. (Refer to P.13J-57, INSPECTION PROCEDURE 30.)
OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13J-63.)
NG → Check the idle position switch system. (Refer to P.13J-52, INSPECTION PROCEDURE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13J-62.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13J-16, Code No.21.)
OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13J-63.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13J-58, INSPECTION PROCEDURE 32.)
OK ↓

MUT-II Data list
29 Inhibitor switch (Refer to P.13J-63.)
NG → Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer to P.13J-51, INSPECTION PROCEDURE 24.)
OK ↓

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13J-64.)
NG → Check the M/T oil temperature sensor system. (Refer to P.13J-59, INSPECTION PROCEDURE 33.)
OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13J-65.)
NG → Check the stop lamp switch system. (Refer to P.13J-59, INSPECTION PROCEDURE 34.)

↓

Adjust the basic idle speed. (Refer to P.13J-86.)

↓

Check the trouble symptoms.
NG →
- Clean around the throttle valve. (Refer to P.13J-84.)
- Check and adjust the fixed SAS. (Refer to P.13J-85.)

INSPECTION PROCEDURE 9

When the engine is cold, it stalls at idling. (Die out)	Probable cause
The cause is probably an incorrect air/fuel ratio when the engine is cold, or insufficient intake air.	• Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Malfunction of the throttle body

Have the battery terminals been disconnected recently?
- YES → After the engine has warmed up, run it at idle for approximately 10 minutes.
- NO ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Is the engine idling correct after the engine has warmed up?
- NO → Refer to P.13J-36, INSPECTION PROCEDURE 7, Unstable idle (rough idle, hunting)
- YES ↓

Check for sound of idle speed control servo operation. (Refer to P.13J-97.)
- NG → Check the idle speed control servo system. (Refer to P.13J-53, INSPECTION PROCEDURE 26.)
- OK ↓

Check the injector operation sound.
- NG → Check the injector system. (Refer to P.13J-22, Code No.41.)
- OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13J-63.)
- NG → Check the idle position switch system. (Refer to P.13J-52, INSPECTION PROCEDURE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13J-62.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13J-16, Code No.21.)
- OK ↓

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13J-64.)
- NG → Check the M/T oil temperature sensor system. (Refer to P.13J-59, INSPECTION PROCEDURE 33.)
- OK ↓

MUT-II Data list
68 EGR control servo (Refer to P.13J-65.)
- NG → Check the EGR control servo. (Refer to P.13J-56, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13J-66.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13J-66.)
- NG → Check the air by-pass control solenoid valve system. (Refer to P.13J-54, INSPECTION PROCEDURE 27.)
- OK ↓

Does the engine stall soon after the accelerator pedal is released?
- YES → • Clean around the throttle valve. (Refer to P.13J-84.)
  • Check and adjust the fixed SAS. (Refer to P.13J-85.)
- NO ↓

Check the fuel pressure. (Refer to P.13J-87.)

Check the ignition timing. (Refer to GROUP 11A – On-vehicle Service)
- NG → Check that the crank angle sensor and timing belt cover are installed properly.
- OK ↓

Check the following items in the order given.
- Ignition coil, spark plug
  (Refer to GROUP 16 – On-vehicle Service.)
- Compression pressure
  (Refer to GROUP 11A – On-vehicle Service)
- Engine oil viscosity

INSPECTION PROCEDURE 10

When the engine is hot, it stalls at idling. (Die out)	Probable cause
The cause is probably a malfunction of the ignition system, or incorrect air/fuel ratio, idle speed control, air by-pass control or compression pressure. In addition, if the engine suddenly stalls, another possible cause might be a poor connector contact.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Malfunction of the throttle body • Poor connector contact • Air leaking into air intake system

Have the battery terminals been disconnected recently?
- YES → After the engine has warmed up, run it at idle for approximately 10 minutes.
- NO ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check for sound of idle speed control servo operation. (Refer to P.13J-96.)
- NG → Check the idle speed control servo system. (Refer to P.13J-53, INSPECTION PROCEDURE 26.)
- OK ↓

Check the injector operation sound.
- NG → Check the injector system. (Refer to P.13J-22, Code No.41.)
- OK ↓

Is it easy to reproduce the stalling?
- NO → While carrying out an intermittent malfunction simulation test. (Refer to GROUP 00 – Points to Note for Intermittent Malfunctions.), check for sudden changes in the following signals.
  - Crank angle sensor signal
  - Injector drive signal
  - Fuel pump (low pressure) drive signal
  - Air flow sensor signal
  - Engine-ECU power supply voltage
- YES ↓

MUT-II Data list
26 Idle position switch (Refer to P.13J-63.)
- NG → Check the idle position switch system. (Refer to P.13J-52, INSPECTION PROCEDURE 25.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13J-62.)
- NG → Check the intake air temperature sensor system. (Refer to P.13J-14, Code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13J-63.)
- NG → Check the barometric pressure sensor system. (Refer to P.13J-20, Code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13J-62.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13J-16, Code No.21.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13J-61.)
OK: 700 – 900 mV when the engine is suddenly raced
- NG → Check the oxygen sensor system. (Refer to P.13J-12, Code No.11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (Refer to P.13J-61.)
OK: Changes between 0 mV and 700 – 900 mV at 2,500 r/min.
- NG → Check the fuel pressure. (Refer to P.13J-87.)
  - OK → Check for air leaking into the air intake system.
    - Damaged intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
- OK ↓

To next page

From previous page

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13J-63.)
- NG → Check the power steering fluid pressure switch. (Refer to P.13J-58, INSPECTION PROCEDURE 31.)
- OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13J-63.)
- NG → Check the A/C switch. (Refer to P.13J-58, INSPECTION PROCEDURE 32.)
- OK ↓

MUT-II Data list
29 Inhibitor switch (Refer to P.13J-63.)
- NG → Check the ignition switch-ST and inhibitor switch system. (Refer to P.13J-51, INSPECTION PROCEDURE 24.)
- OK ↓

MUT-II Data list
33 Electrical load switch (Refer to P.13J-63.)
- NG → Check the electrical load switch system. (Refer to P.13J-60, INSPECTION PROCEDURE 35.)
- OK ↓

MUT-II Data list
12 Air flow sensor (Refer to P.13J-61.)
- NG → Check the air flow sensor system. (Refer to P.13J-13, Code No.12)
- OK ↓

MUT-II Data list
45 Idle speed control servo (Refer to P.13J-64.)
- NG → Adjust the basic idle speed. (Refer to P.13J-86.)
- OK ↓

MUT-II Data list
68 EGR control servo (Refer to P.13J-65.)
- NG → Check the EGR control servo system. (Refer to P.13J-56, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13J-66.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13J-66.)
- NG → Check the air by-pass control solenoid valve system. (Refer to P.13J-54, INSPECTION PROCEDURE 27.)
- OK ↓

Does the engine stall soon after the accelerator pedal is released?
- YES →
  - Clean around the throttle valve. (Refer to P.13J-84.)
  - Check and adjust the fixed SAS. (Refer to P.13J-85.)
- NO ↓

Check the ignition timing. (Refer to GROUP 11A – On-vehicle Service.)
- OK →
  Check the following items in the order given.
  - Ignition coil, spark plug
    (Refer to GROUP 16 – On-vehicle Service.)
  - Compression pressure
    (Refer to GROUP 11A – On-vehicle Service)
  - Contamination (water, kerosene, etc.) in the fuel
- NG ↓

Check that the crank angle sensor and timing belt cover are installed properly.

INSPECTION PROCEDURE 11

The engine stalls when starting the car. (Pass out)	Probable cause
The cause is probably poor ignition due to a malfunctioning spark plug (weak spark), or an incorrect air/fuel ratio when the accelerator is depressed.	• Malfunction of the ignition system • Malfunction of the air by-pass control system • Malfunction of the EGR control servo • Air leaking into air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

MUT-II Data list
68 EGR control servo (Refer to P.13J-65.)
NG → Check the EGR control servo system. (Refer to P.13J-56, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13J-66.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13J-66.)
NG → Check the air by-pass control solenoid valve system. (Refer to P.13J-54, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13J-66.)
NG → Check the purge control solenoid valve system. (Refer to P.13J-57, INSPECTION PROCEDURE 30.)
OK ↓

Check the following items in the order given.
- Ignition coil, spark plug (Refer to GROUP 16 – On-vehicle Service.)
- Check for air leaking into the air intake system.
  Damaged intake manifold gasket
  Damaged or disconnected vacuum hose
  Damaged air intake hose

INSPECTION PROCEDURE 12

The engine stalls when decelerating	Probable cause
The cause is probably insufficient intake air due to an idle speed control malfunction, or incorrect air/fuel ratio due to an air by-pass control or EGR malfunction.	• Malfunction of the idle speed control system • Malfunction of the air by-pass control system • Malfunction of the EGR control servo

Have the battery terminals been disconnected recently?
- YES → After the engine has warmed up, run it at idle for approximately 10 minutes.
- NO ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

MUT-II Data list
26 Idle position switch (Refer to P.13J-63.)
- NG → Check the idle position switch (Refer to P.13J-52, INSPECTION PROCEDURE 25.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13J-62.)
- NG → Check the throttle position sensor system (Refer to P.13J-15, Code No.14.)
- OK ↓

MUT-II Data list
45 Idle speed control servo
- Does the idle speed control servo position drop to steps 0 – 2 during deceleration (when engine speed is 1,000 r/min or more)?
  - YES → Check the vehicle speed sensor system. (Refer to P.13J-19, Code No.24.)
  - NO ↓

MUT-II Data list
68 EGR control servo (Refer to P.13J-65.)
- NG → Check the EGR control servo system. (Refer to P.13J-56, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13J-66.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13J-66.)
- NG → Check the air by-pass control solenoid valve system. (Refer to P.13J-54, INSPECTION PROCEDURE 27.)
- OK ↓

Check the following items in the order given.
- Ignition coil, spark plug (Refer to GROUP 16 – On-vehicle Service.
- Clean around the throttle valve. (Refer to P.13J-84.)
- Check and adjust the fixed SAS. (Refer to P.13J-85.)

INSPECTION PROCEDURE 13

Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, or incorrect air/fuel ratio, air by-pass control or compression pressure.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the air by-pass control system • Poor compression pressure • Air leaking into air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
- YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- NO ↓

Check the injector operation sound.
- NG → Check the injector system. (Refer to P.13J-22, Code No.41.)
- NO ↓

To next page

From previous page

Check the ignition timing. (Refer to GROUP 11A – On-vehicle Service)
- NG → Check that the crank angle sensor and timing belt cover are installed properly.
- OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13J-63.)
- NG → Check the idle position switch. (Refer to P.13J-52, INSPECTION PROCEDURE 25.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13J-62.)
- NG → Check the intake air temperature sensor system. (Refer to P.13J-14, Code No.13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13J-63.)
- NG → Check the barometric pressure sensor system. (Refer to P.13J-20, Code No.25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13J-62.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13J-16, Code No.21.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13J-62.)
- NG → Check the throttle position sensor system. (Refer to P.13J-15, Code No.14.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 700 – 900 mV when the engine is suddenly raced
- NG → Check the oxygen sensor system. (Refer to P.13J-12, Code No.11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 mV and 700 – 900 mV at 2,500 r/min.
- NG → Check the fuel pressure. (Refer to P.13J-87.)
  - OK ↓
  - Check for air leaking into the air intake system.
    - Damaged intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
- OK ↓

MUT-II Data list
68 EGR control servo (Refer to P.13J-65.)
- NG → Check the EGR control servo system. (Refer to P.13J-56, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Actuator test
18 Air by-pass control solenoid valve (ON/OFF) (Refer to P.13J-66.)
32 Air by-pass control solenoid valve (DUTY) (Refer to P.13J-66.)
- NG → Check the air by-pass control solenoid valve system. (Refer to P.13J-54, INSPECTION PROCEDURE 27.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13J-66.)
- NG → Check the purge control solenoid valve system. (Refer to P.13J-57, INSPECTION PROCEDURE 30.)
- OK ↓

Check the fuel pressure. (Refer to P.13J-87.)
- OK → Check the following items in the order given.
  - Ignition coil, spark plug (Refer to GROUP 16 – On-vehicle Service.)
  - EGR system (Refer to GROUP 17 – On-vehicle Service.)
  - Compression pressure (Refer to GROUP 11A – On-vehicle Service)
  - Fuel filter and fuel line clogging

INSPECTION PROCEDURE 14

The feeling of impact when accelerating	Probable cause
The cause is probably an ignition leak being generated in line with an increase in the spark plug demand voltage during acceleration.	• Malfunction of the ignition system

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓
Check the following items in the order given.
- Ignition coil, spark plug
- Ignition leak.

INSPECTION PROCEDURE 15

The feeling of impact when decelerating	Probable cause
The cause is probably insufficient intake air due to an idle speed control malfunction.	• Malfunction of the idle speed control system

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓
Check for sound of idle speed control servo operation. (Refer to P.13J-97.)
NG → Check the idle speed control servo system. (Refer to P.13J-53, INSPECTION PROCEDURE 26.)
OK ↓
MUT-II Data list
14 Throttle position sensor (Refer to P.13J-62.)
NG → Check the throttle position sensor system. (Refer to P.13J-15, Code No.14.)
OK ↓
MUT-II Data list
26 Idle position switch (Refer to P.13J-63.)
NG → Check the idle position switch system. (Refer to P.13J-52, INSPECTION PROCEDURE 25.)
OK ↓
Clean around the throttle valve. (Refer to P.13J-84.)

INSPECTION PROCEDURE 16

Knocking	Probable cause
The cause is probably incorrect detonation control or an incorrect heating value for the spark plugs.	• Malfunction of the detonation sensor • Incorrect heat value of the spark plug

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓
Does knocking occur when driving while the detonation sensor connector is disconnected? (At this time, use the MUT-II to check whether the ignition timing is retarded from when the detonation sensor connector is connected.)
NO → Check the idle speed control servo system. (Refer to P.13J-53, INSPECTION PROCEDURE 26.)
YES ↓
Check the following items in the order given.
- Spark plug
- Contamination (water, kerosene, etc.) in the fuel

INSPECTION PROCEDURE 17

Run-on (Dieseling)	Probable cause
The cause is probably a leaking injector.	• Malfunction of the injector

Replace the injector.

INSPECTION PROCEDURE 18

Too high CO and HC concentration when idling	Probable cause
The cause is probably an incorrect air/fuel ratio.	• Malfunction of the air/fuel ration control system • Deterioration of the catalyst

MUT-II Self-Diag code
Is a diagnosis code displayed?
YES → Refer to P.13J-11, INSPECTION CHART FOR DIAGNOSIS CODES.
NO ↓

Check the ignition timing. (Refer to GROUP 11A – On-vehicle Service.)
NG → Check that the crank angle sensor and timing belt cover are installed properly.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13J-62.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13J-16, Code No.21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13J-62.)
NG → Check the intake air temperature sensor system. (Refer to P.13J-14, Code No.13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13J-63.)
NG → Check the barometric pressure sensor system. (Refer to P.13J-20, Code No.25.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 700 – 900 mV when the engine is suddenly raced
NG → Check the oxygen sensor system. (Refer to P.13J-11, Code No.11.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 mV and 700 – 900 mV at 2,500 r/min.
OK → Replace the oxygen sensor.
Check the trouble symptoms.
NG ↓
NG ↓

Check the fuel pressure. (Refer to P.13J-87.)
OK ↓

Check the following items in the order given.
- Ignition coil, spark plug (Refer to GROUP 16 – On-vehicle Service.)
- Compression pressure (Refer to GROUP 11A – On-vehicle Service.)
- Positive crankcase ventilation system (Refer to GROUP 17 – On-vehicle Service.)

OK ↓

MUT-II Data list
68 EGR control servo (Refer to P.13J-65.)
NG → Check the EGR control servo system. (Refer to P.13J-56, INSPECTION PROCEDURE 29.)
OK ↓

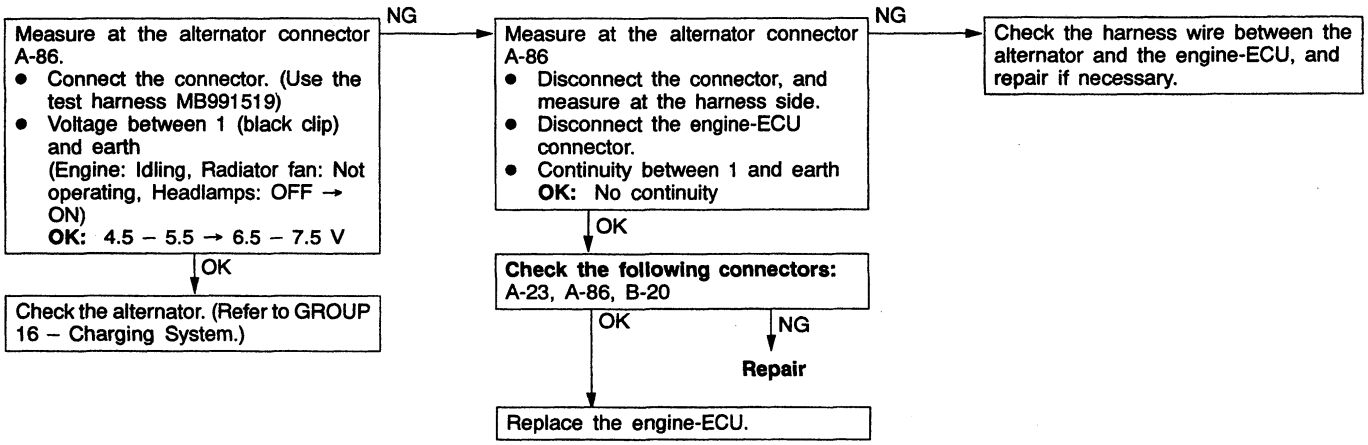
MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13J-66.)
NG → Check the purge control solenoid valve system. (Refer to P.13J-57, INSPECTION PROCEDURE 30.)
OK ↓

Check the trouble symptoms.
NG ↓

Replace the three-way catalytic converter.

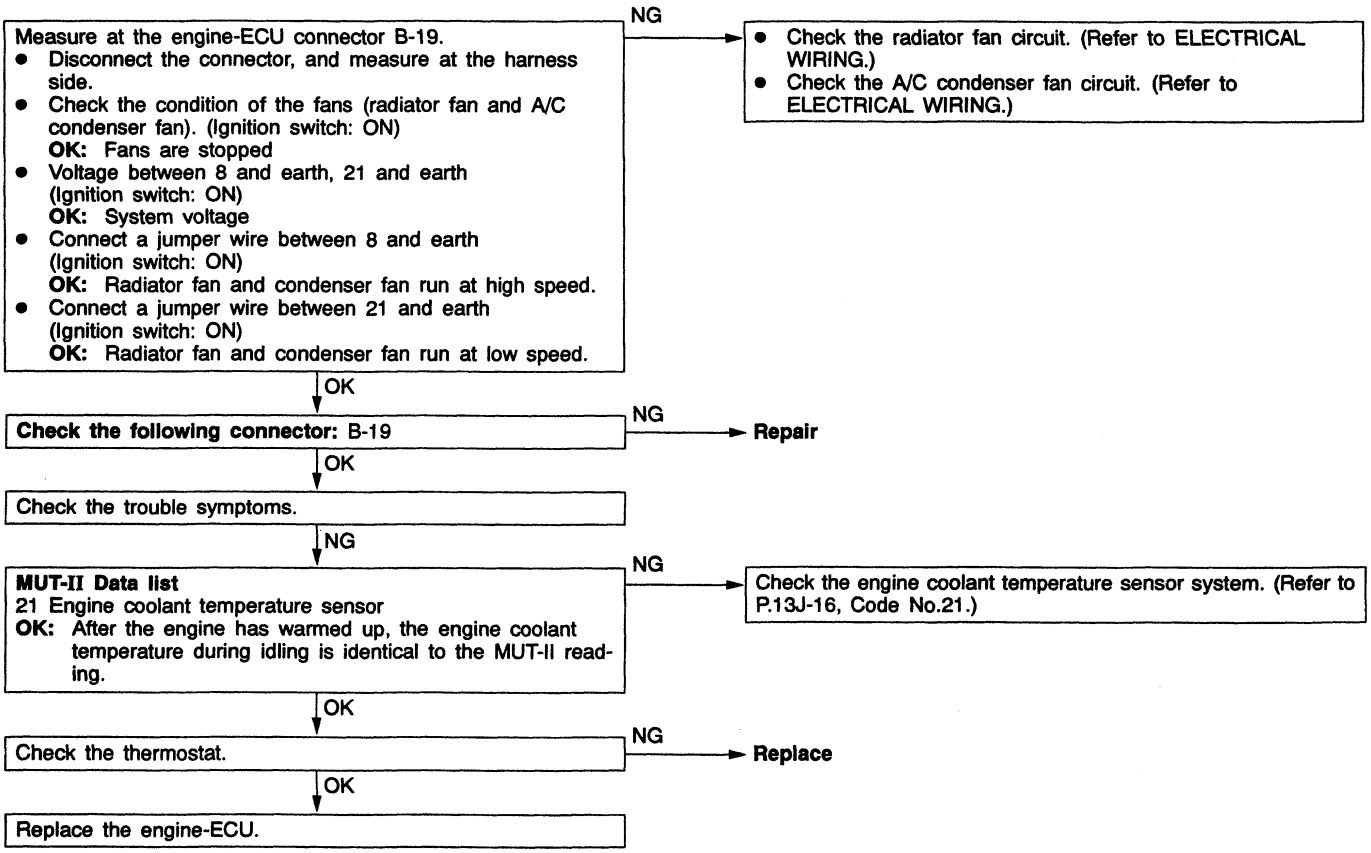
INSPECTION PROCEDURE 19

Low alternator output voltage (approx. 12.3 V)	Probable cause
The cause is probably a malfunction of the alternator or one of the problems listed at right.	• Malfunction of the charging system • Open circuit between the alternator G terminal and the engine-ECU • Malfunction of the engine-ECU



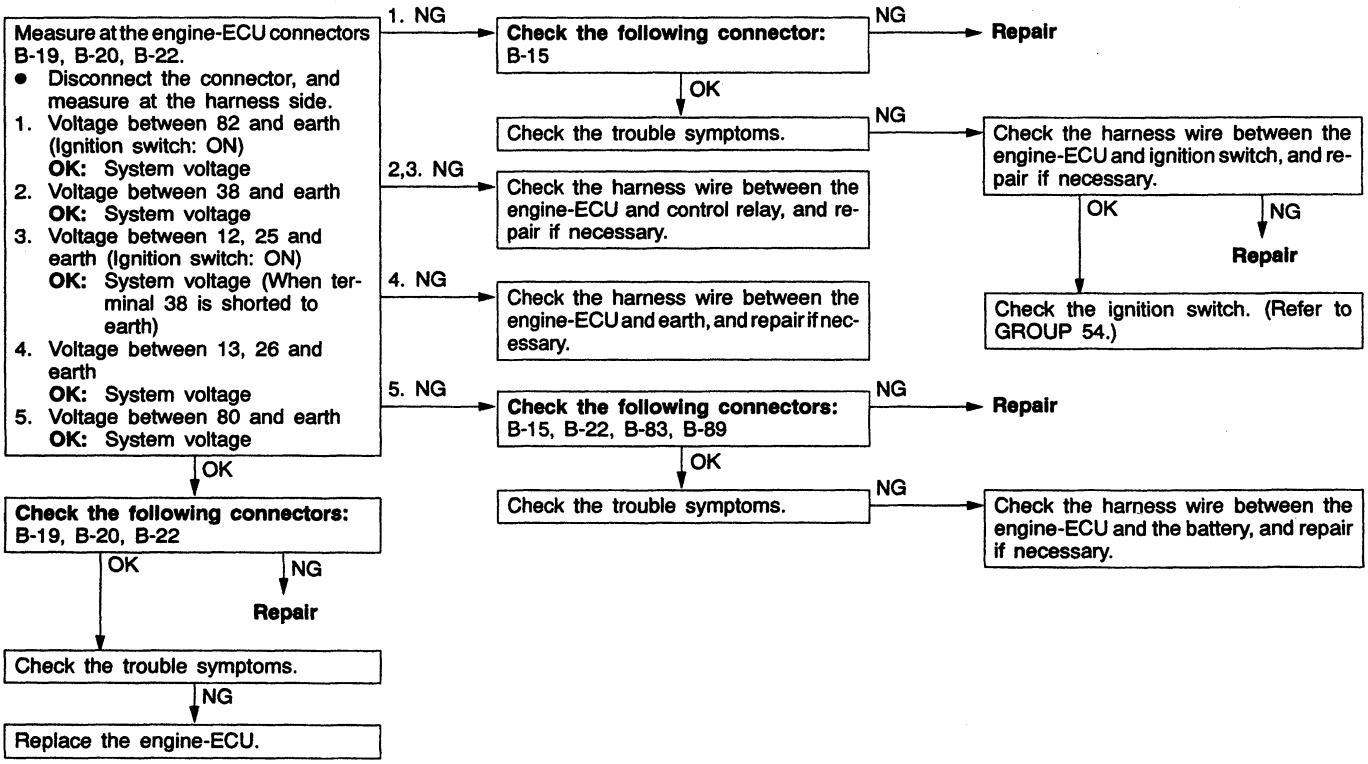
INSPECTION PROCEDURE 20

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
The fan motor relay is controlled by the power transistor inside the engine-ECU turning ON and OFF.	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the thermostat • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



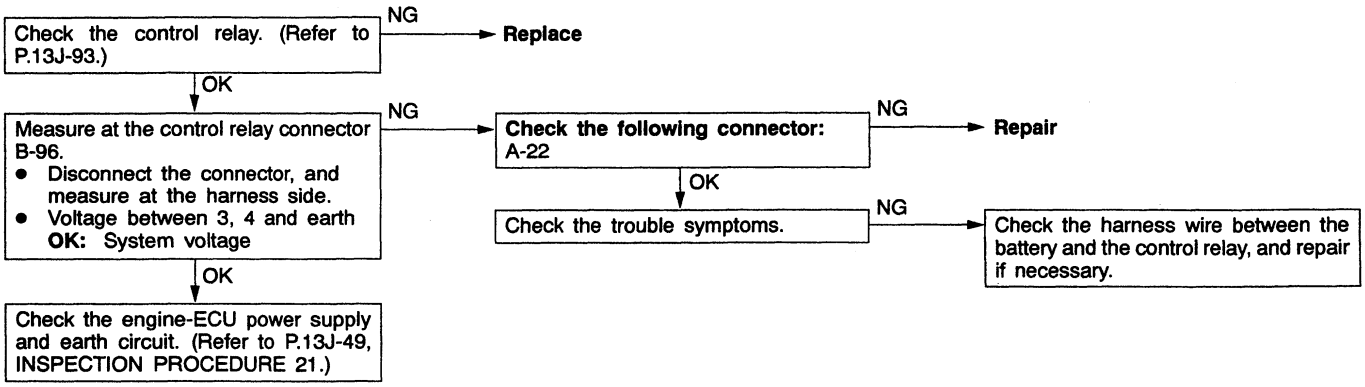
INSPECTION PROCEDURE 21

Engine-ECU power supply	Probable cause
The cause is probably a malfunction of the engine-ECU or one of the problems listed at right.	• Open circuit or short-circuited harness wire in the engine-ECU power supply circuit • Open circuit or short-circuited harness wire in the engine-ECU earth circuit • Malfunction of the engine-ECU



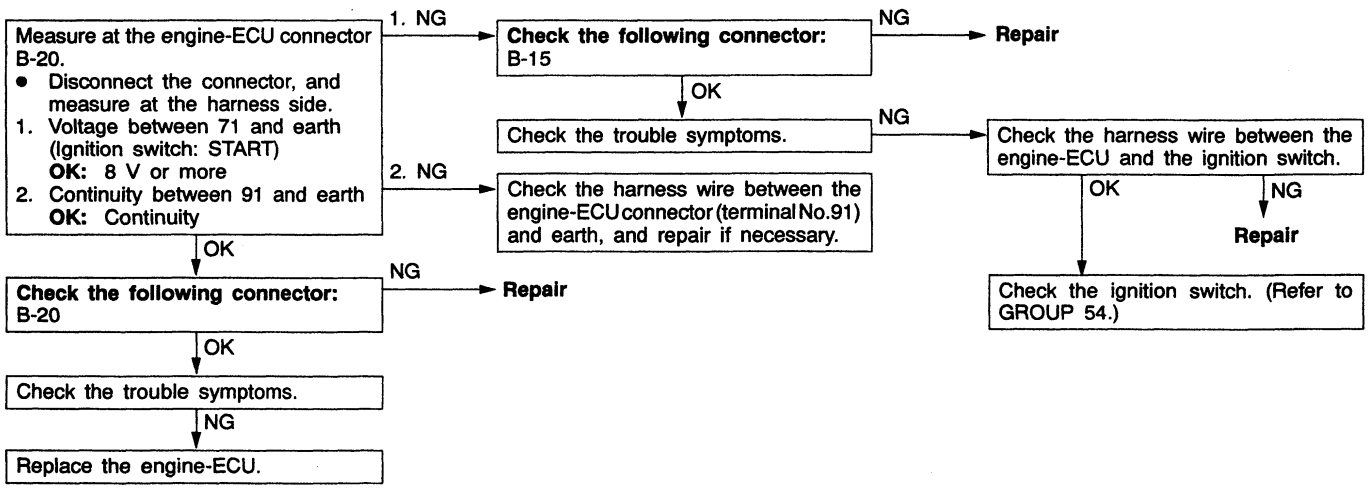
INSPECTION PROCEDURE 22

Control relay and ignition switch-IG system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, the engine-ECU turns on the control relay. This causes system voltage to be supplied to the engine-ECU and to the sensors and actuators.	• Malfunction of the ignition switch • Malfunction of the control relay • Open circuit or short-circuited harness wire of the control relay circuit • Malfunction of the engine-ECU



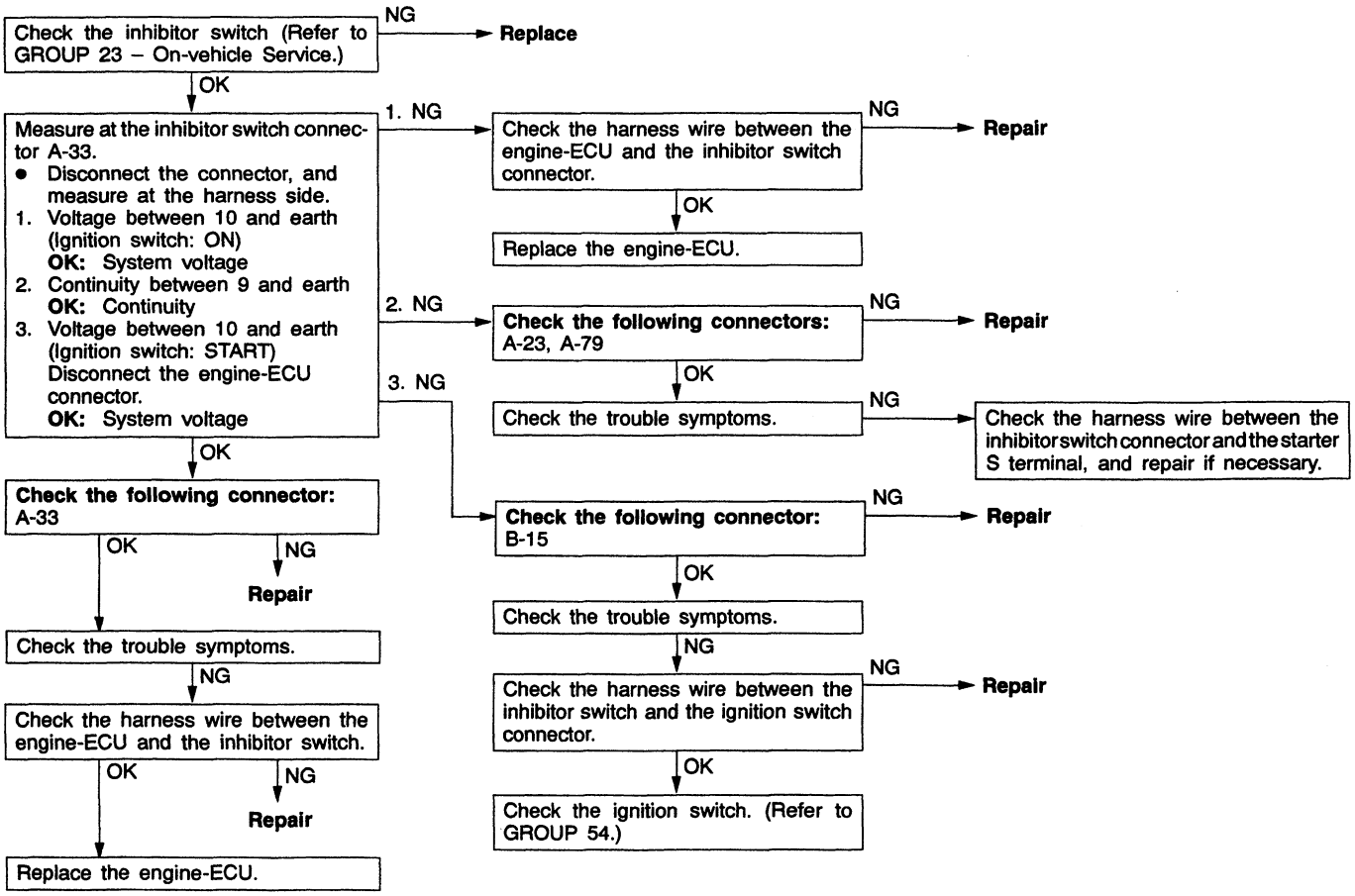
INSPECTION PROCEDURE 23

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU uses this signal to carry out functions such as fuel injection control during starting.	• Malfunction of the ignition switch • Open circuit or short-circuited harness wire of the ignition switch circuit • Malfunction of the engine-ECU



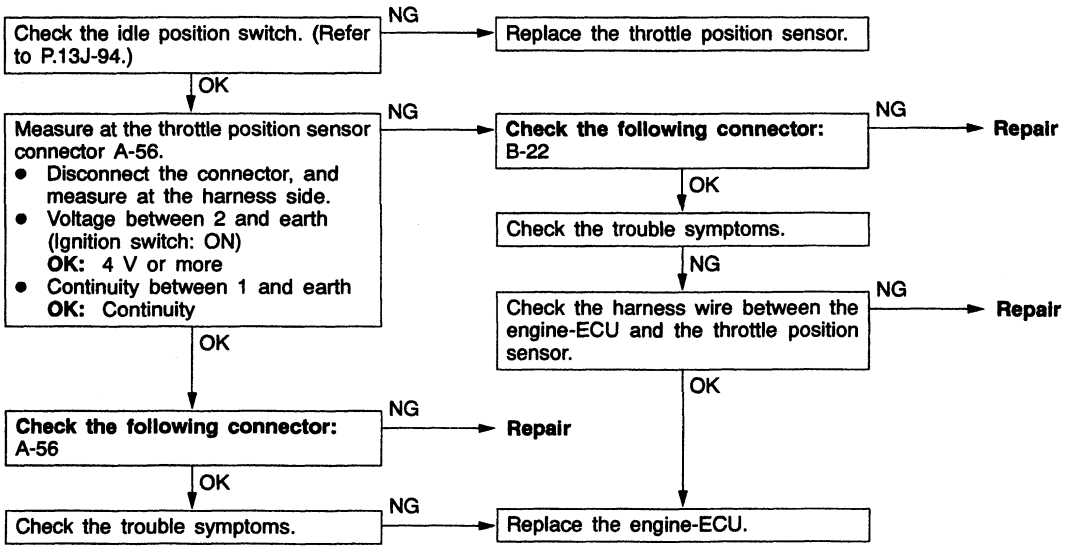
INSPECTION PROCEDURE 24

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking, and the engine-ECU uses this signal to carry out functions such as fuel injection control during starting. The inhibitor switch inputs the position of the selector lever to the engine-ECU. The engine-ECU uses this signal to carry out idle speed control.	• Malfunction of the ignition switch • Malfunction of the inhibitor switch • Open circuit or short-circuited harness wire between ignition switch and inhibitor switch • Malfunction of the engine-ECU



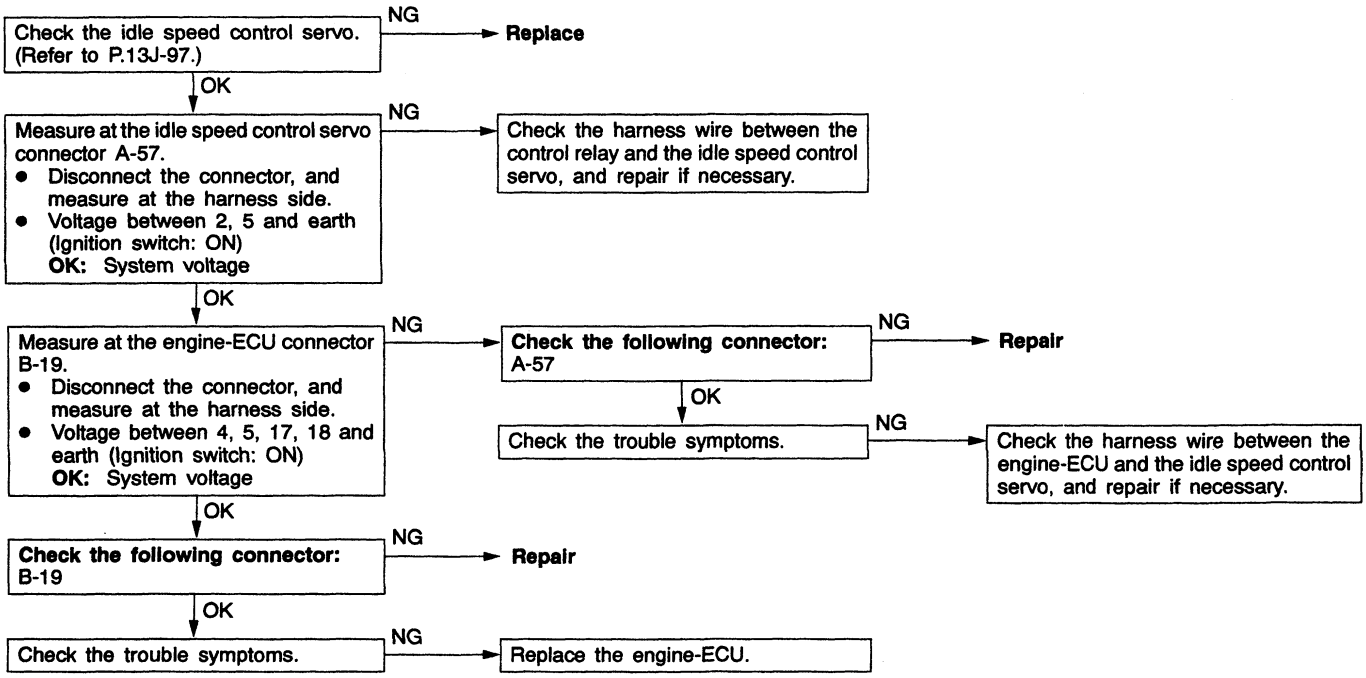
INSPECTION PROCEDURE 25

Idle position switch system	Probable cause
The idle position switch inputs a signal to the engine-ECU when the throttle lever is fully closed. The engine-ECU uses this signal to carry out idle speed control.	• Malfunction of the accelerator cable • Maladjustment of the fixed SAS • Maladjustment of the idle position switch and throttle position sensor • Open circuit or short-circuited harness wire in the idle position switch circuit • Malfunction of the engine-ECU



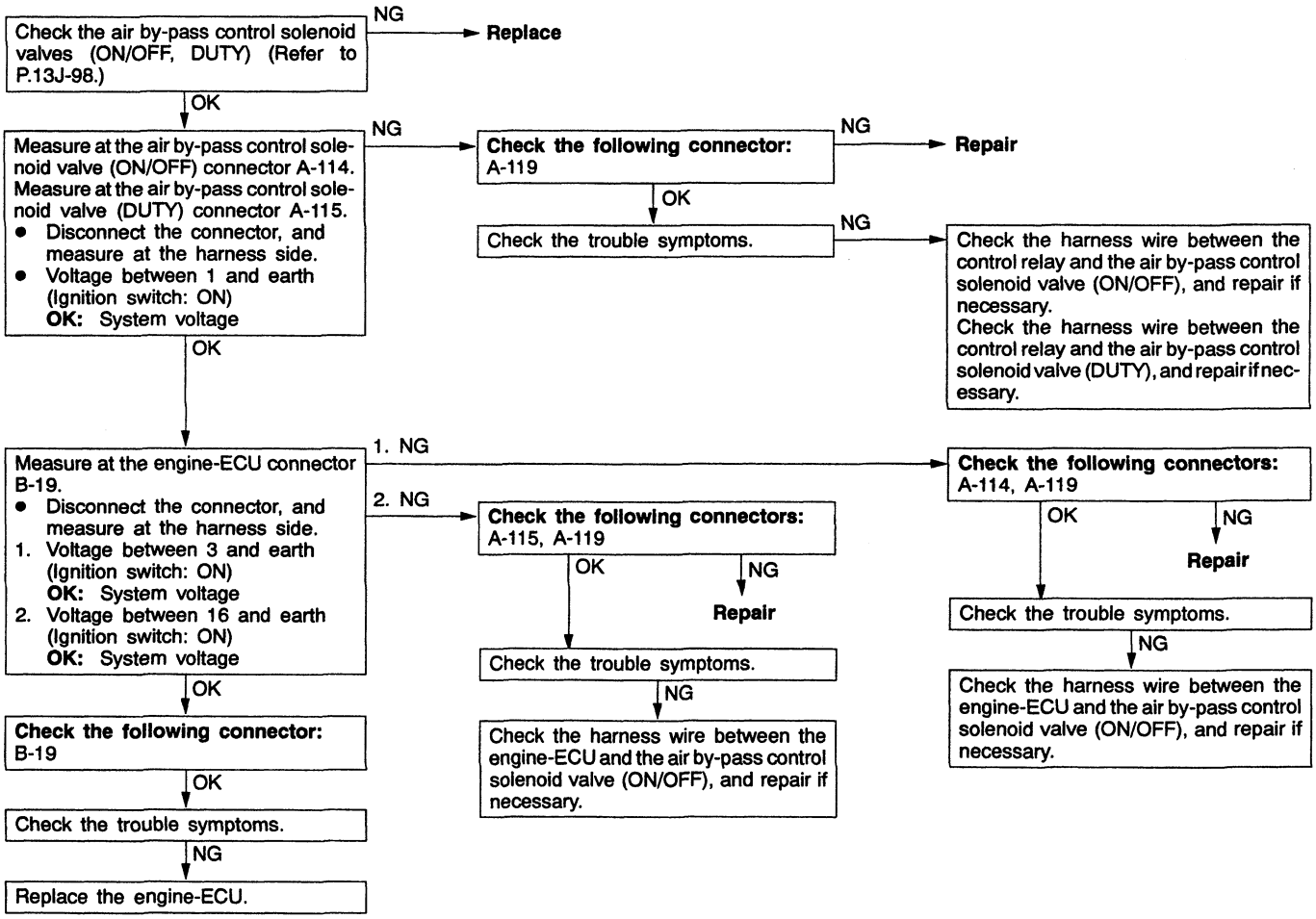
INSPECTION PROCEDURE 26

Idle speed control servo (ISC) system	Probable cause
The engine-ECU controls the amount of intake air during idling by opening and closing the servo valve which is located in the air by-pass passage.	• Malfunction of the idle speed control servo • Open circuit or short-circuited harness wire in the idle speed control servo circuit • Malfunction of the engine-ECU



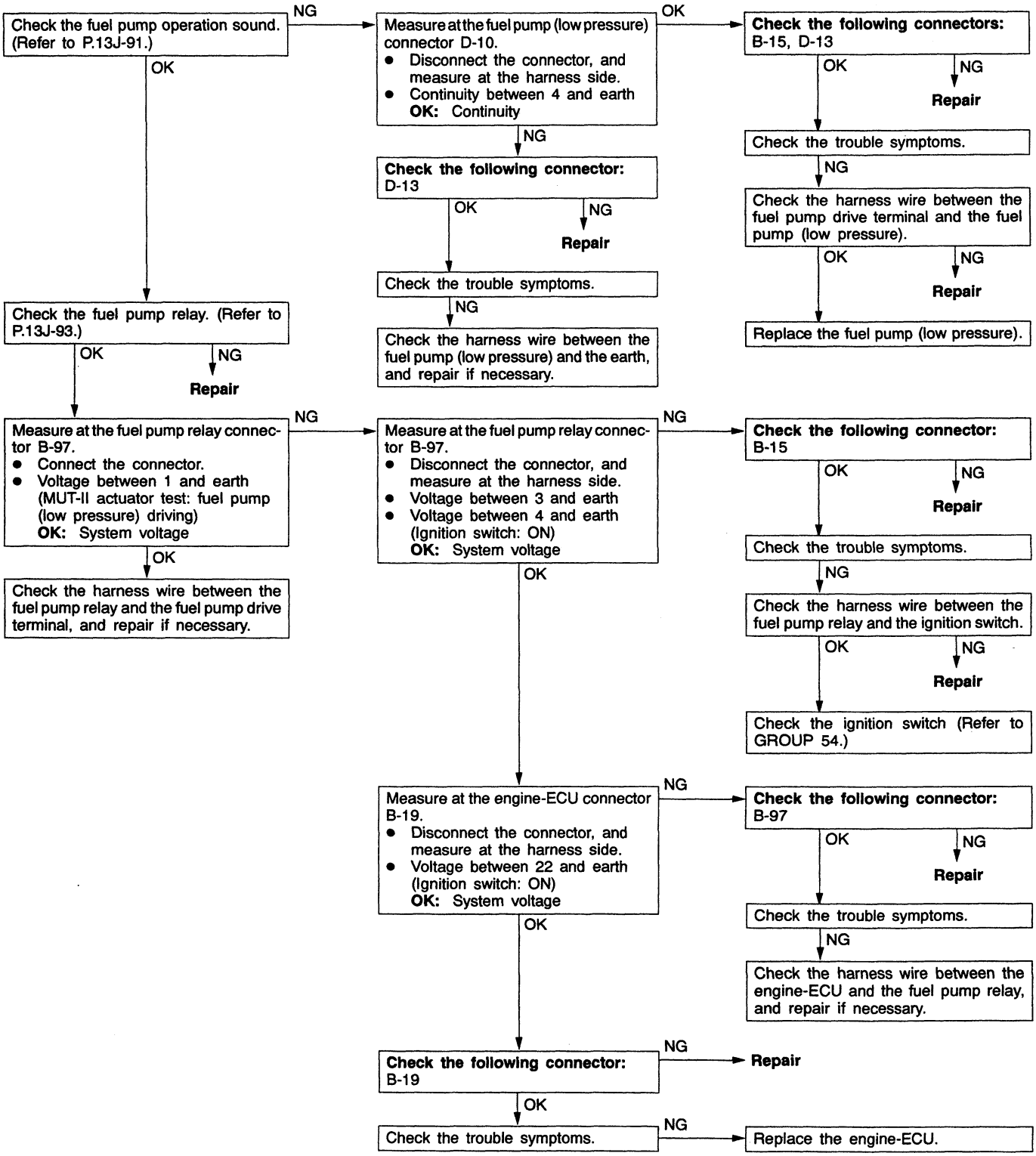
INSPECTION PROCEDURE 27

Air by-pass control solenoid valve system	Probable cause
The engine-ECU controls the two ON/OFF and DUTY solenoid valves in order to adjust the by-pass air amount.	• Malfunction of the air by-pass control solenoid valves (ON/OFF, DUTY) • Open circuit or short-circuited harness wire in the air by-pass control solenoid valves (ON/OFF, DUTY) • Malfunction of the engine-ECU



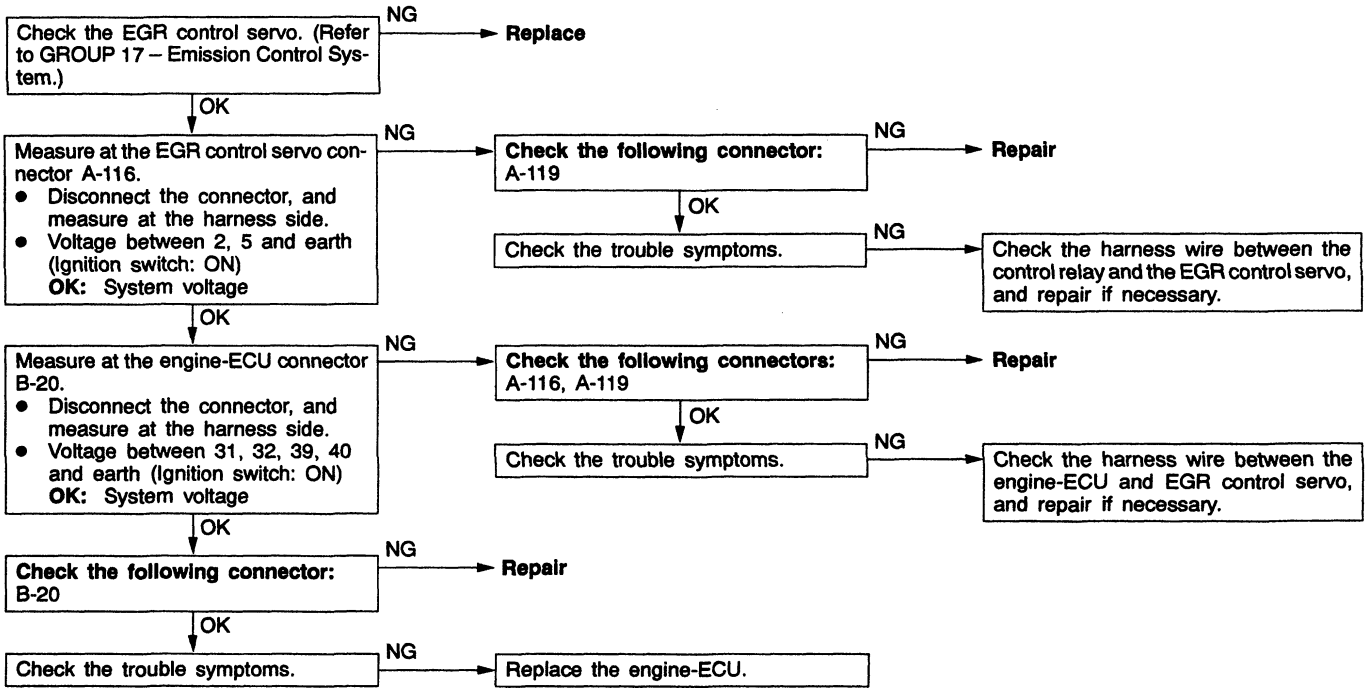
INSPECTION PROCEDURE 28

Fuel pump (low pressure) system	Probable cause
The engine-ECU turns on the fuel pump relay when the engine is cranking and when it is running, so that drive power is supplied to the fuel pump (low pressure).	• Malfunction of the fuel pump relay • Malfunction of the fuel pump (low pressure) system • Open circuit or short-circuited harness wire in the fuel pump (low pressure) drive circuit • Malfunction of the engine-ECU



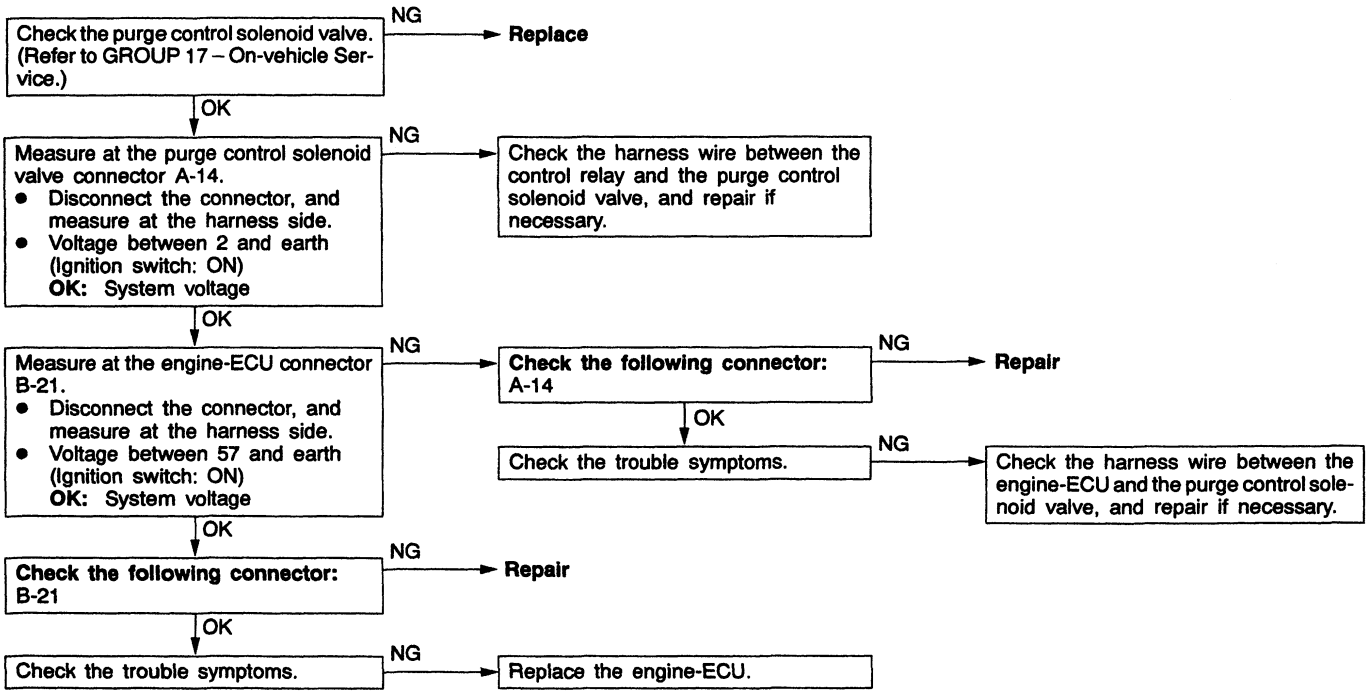
INSPECTION PROCEDURE 29

EGR control servo system	Probable cause
The engine-ECU controls the EGR control servo in order to control the amount of exhaust gas mixed in the intake air.	• Malfunction of the EGR control servo • Open circuit or short-circuited harness wire in the EGR control servo circuit • Malfunction of the engine-ECU



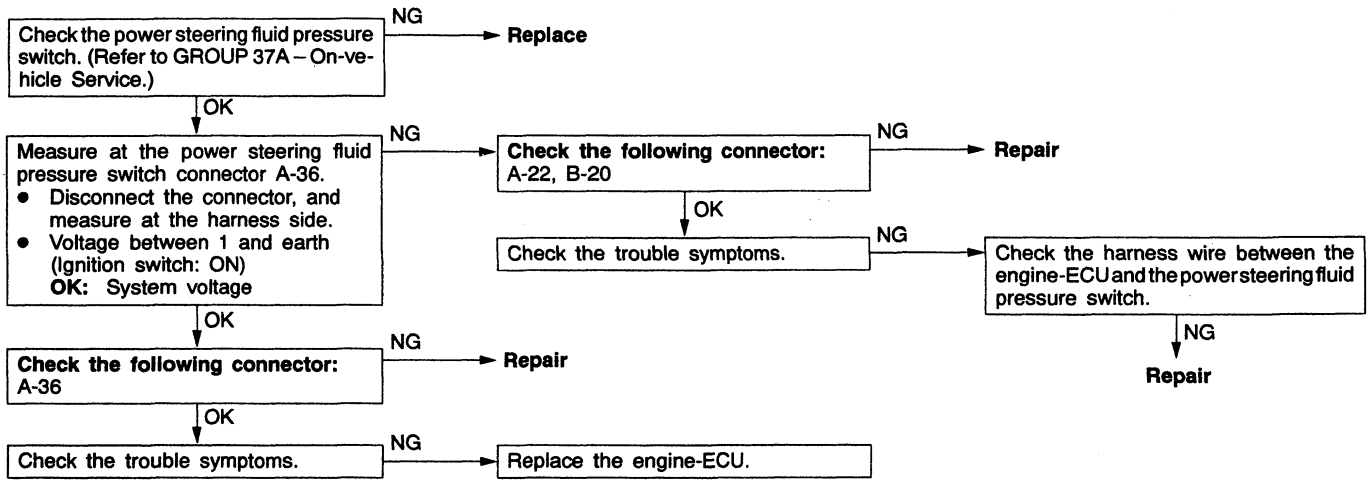
INSPECTION PROCEDURE 30

Purge control solenoid valve system	Probable cause
The engine-ECU controls the purge control solenoid valve in order to control the purge air coming from the canister.	• Malfunction of the purge control solenoid valve • Open circuit or short-circuited harness wire in the purge control solenoid valve circuit • Malfunction of the engine-ECU



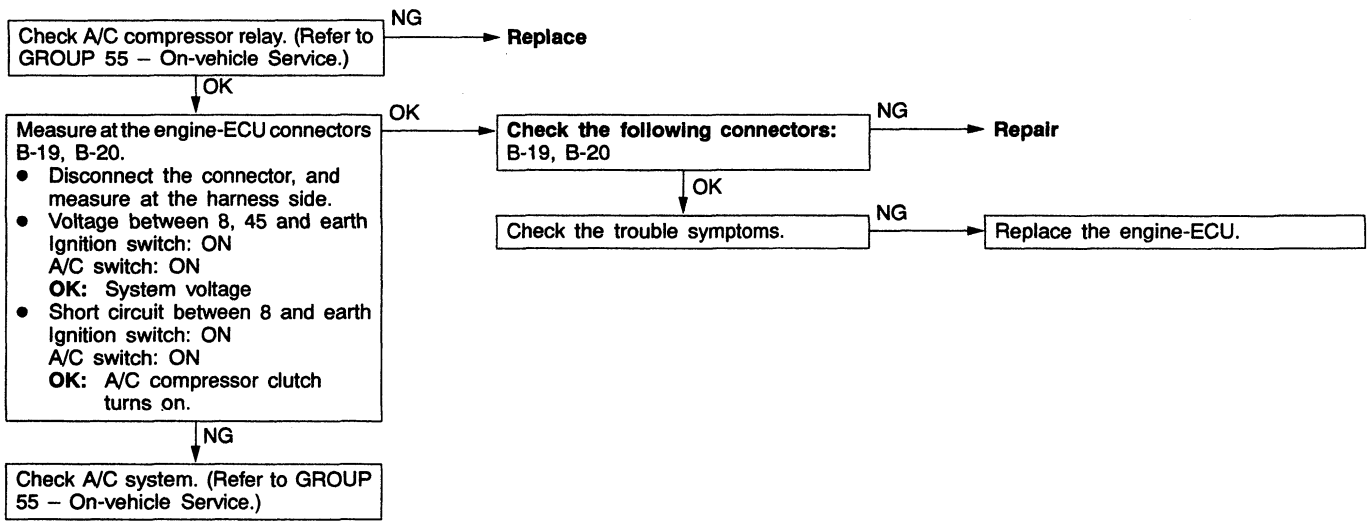
INSPECTION PROCEDURE 31

Power steering fluid pressure switch system	Probable cause
This switch inputs the amount of power steering load to the engine-ECU. The engine-ECU uses this input to control the idle speed control servo so that the idle speed is increased when the power steering is operating.	• Malfunction of the power steering fluid pressure switch • Open circuit or short-circuited harness wire in the power steering fluid pressure switch circuit • Malfunction of the engine-ECU



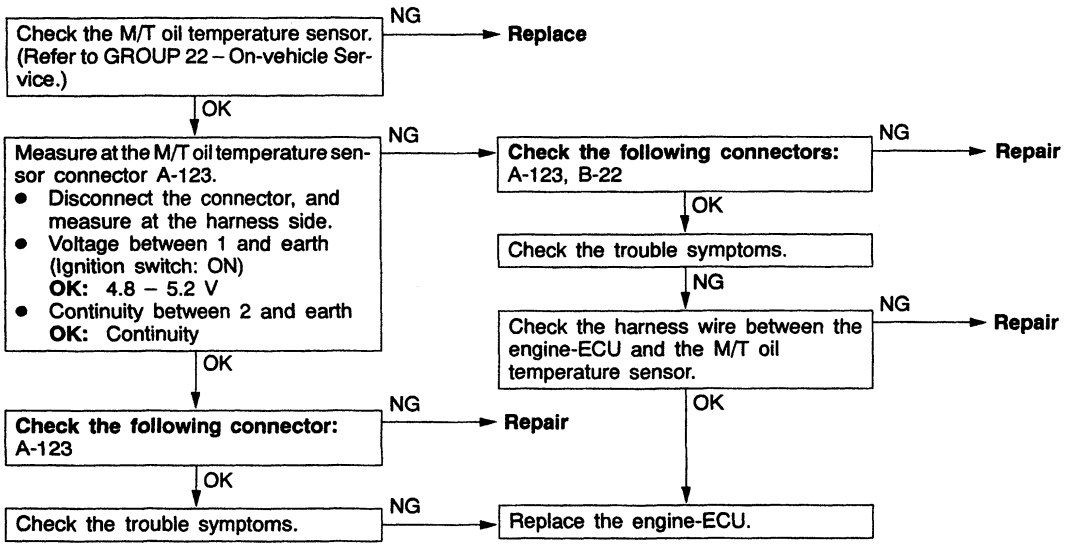
INSPECTION PROCEDURE 32

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the engine-ECU, the engine-ECU controls the idle speed control servo to increase the idle speed, and also operates the A/C compressor magnetic clutch.	• Malfunction of the A/C control system • Malfunction of the A/C switch • Open circuit or short-circuited harness wire in the A/C switch circuit • Malfunction of the engine-ECU



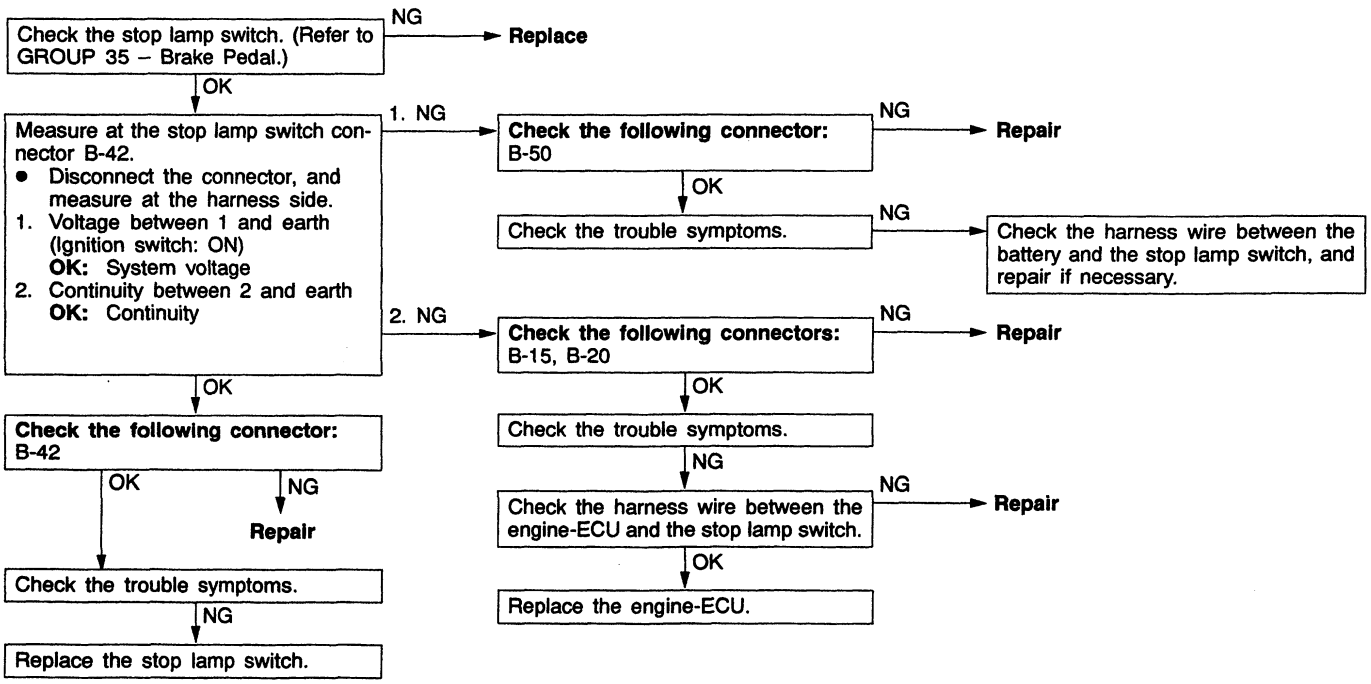
INSPECTION PROCEDURE 33

M/T oil temperature sensor system	Probable cause
This sensor inputs the manual transmission oil temperature to the engine-ECU. The engine-ECU uses this input to control the idle speed control servo so that the idle speed is increased when the manual transmission oil temperature becomes low.	• Malfunction of the M/T oil temperature sensor • Open circuit or short-circuited harness wire in the M/T oil temperature sensor circuit • Malfunction of the engine-ECU



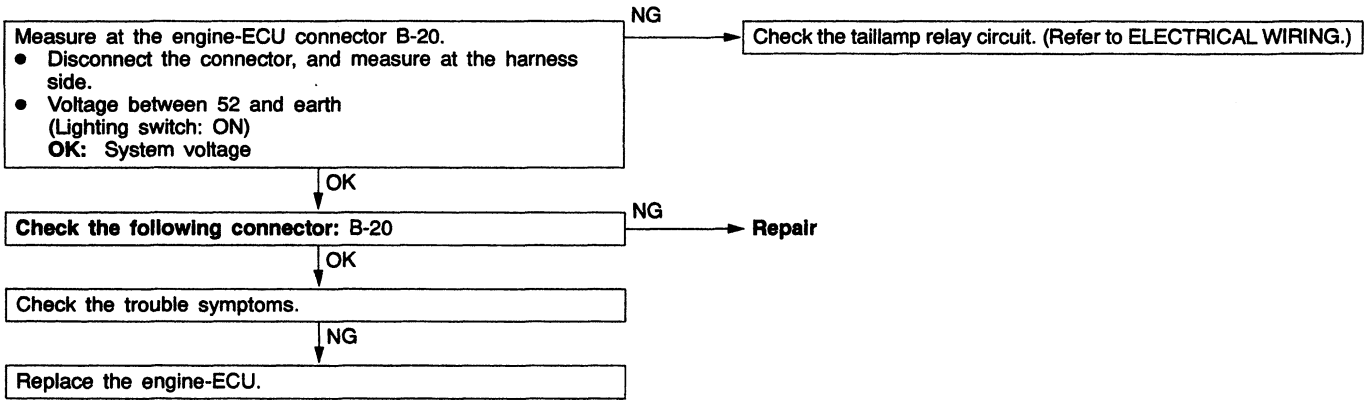
INSPECTION PROCEDURE 34

Stop lamp switch system	Probable cause
This switch inputs the brake pedal depression amount to the engine-ECU. The engine-ECU uses this input to detect brake operation in order to switch the fuel injection mode.	• Malfunction of the stop lamp switch • Open circuit or short-circuited harness wire in the stop lamp switch circuit • Malfunction of the engine-ECU



INSPECTION PROCEDURE 35

Electrical load switch	Probable cause
During idling, the ON/OFF condition of switches in equipment which have a large electrical load is input to the engine-ECU. The engine-ECU controls the idle speed control servo based on this input.	• Improper connector contact, open circuit or short-circuited harness wire in the taillamp relay circuit • Malfunction of the engine-ECU



DATA LIST REFERENCE TABLE

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

NOTE
*1. In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10% higher than the standard frequency.
*2. The idle position switch normally turns off when the voltage of the throttle position sensor is 50 – 100 mV higher than the voltage at the idle position. If the throttle position switch turns back on after the throttle position sensor voltage has risen by 100 mV and the throttle valve has opened, the idle position switch and the throttle position sensor need to be adjusted.
*3. 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	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. 11	13J-12
			When engine is suddenly raced	600 – 1,000 mV		
		Engine:After having warmed up The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the ECU.	Engine is idling	400 mV or less (Changes)		
			2,500 r/min	600 – 1,000 mV		
12	Air flow sensor*1	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	20 – 55 Hz	–	–
			2,500 r/min	65 – 85 Hz		
			Engine is raced	Frequency increases in response to racing		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. 13	13J-14
			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		
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300 – 1,000 mV	Code No. 14	13J-15
			Gradually open	Increases in proportion to throttle opening angle		
			Open fully	4,500 – 5,500 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No. 21	13J-49
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 23 <M/T> Procedure No. 24 <A/T>	13J-50 <M/T> 13J-51 <A/T>
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is –20°C	–20°C	Code No. 21	13J-16
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			When engine coolant temperature is 80°C	80°C		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. 22	13J-17
		• Engine: Idling • Idle position switch: ON	When engine coolant temperature is –20°C	1,300 – 1,500 rpm		
			When engine coolant temperature is 0°C	1,150 – 1,250 rpm		
			When engine coolant temperature is 20°C	1,000 – 1,200 rpm		
			When engine coolant temperature is 40°C	750 – 950 rpm		
			When engine coolant temperature is 80°C	550 – 850 rpm		
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25	13J-20
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
26	Idle position switch	Ignition switch: ON Check by operating accelerator pedal repeatedly	Throttle valve: Set to idle position	ON	Procedure No. 25	13J-52
			Throttle valve: Slightly open	OFF*2		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 31	13J-58
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (when A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 32	13J-58
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 24	13J-51
			D, 2, L or R	D, 2, L or R		
33	Electrical load switch	All accessories: OFF	Lighting switch only: OFF → ON	OFF → ON	Procedure No. 35	13J-60

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
41	Injectors	• Engine: Idling • Transmission: Neutral (A/T: P range)	When engine coolant temperature is 0°C	0.9 – 1.1 ms	–	–
			When engine coolant temperature is 20°C	0.8 – 1.0 ms		
			When engine coolant temperature is 50°C	0.7 – 0.9 ms		
			When engine coolant temperature is 80°C	0.5 – 0.7 ms		
	Injectors*3	• Engine coolant temperature: 80–95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T : P range)	Engine is idling	0.5 – 0.7 ms	–	–
			2,500 r/min	0.6 – 0.7 ms		
			When engine is suddenly raced	Increases		
44	Ignition coils and power transistors	• Engine: After having warmed up • Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	12 – 20°BTDC	–	–
			2,500 r/min	30 – 40°BTDC		
45	ISC (stepper) motor position *4	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T : P range) • Idle position switch: ON • Engine: Idling • When A/C switch is ON, A/C compressor should be operating	A/C switch: OFF	10 – 55 STEP	–	–
			A/C switch: OFF → ON	Increases by 15 – 55 steps		
			• A/C switch: OFF • Select lever: N range → D range	Increases by 10 – 40 steps		
48	M/T oil temperature sensor	Drive after the engine has warmed up.	Drive for 15 minutes or more.	Gradually increases to 50° – 90°C.	Procedure No. 33	13J-59

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 32	13J-58
			A/C switch: ON	ON (Compressor clutch is operating)		
66	Brake vacuum sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	When the engine is running at idle, stop the engine, and then turn the ignition switch to ON and depress the brake pedal several times.	Negative pressure drops	Code No. 66	13J-28
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	ON	Procedure No. 34	13J-59
			Brake pedal: Released	OFF		
68	EGR control servo	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	5 – 15 STEP	Procedure No. 29	13J-56
			2,500 r/min	0 – 5 STEP		
			When engine is suddenly raced	0 – 5 STEP		
74	Fuel pressure sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine; Idling	4 – 7 MPa	Code No. 56	13J-25
99	Fuel injection mode	Engine: After warmed-up	Engine: Idling (several minutes after engine starts)	Lean compression	–	–
			2,500 r/min	Stoichiometric feedback		
			When engine is idling and then suddenly raced	Open-loop		

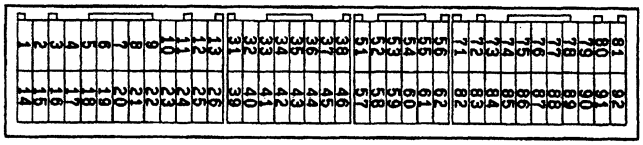
ACTUATOR TEST REFERENCE TABLE

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. 41	13J-22
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 28	13J-55
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.	Procedure No. 30	13J-57
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set	5°BTDC	–	–
18	Air by-pass control solenoid valve (ON/OFF)	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Procedure No. 27	13J-54
20	Fan motor relay	Drive the fan motor	Ignition switch: ON	Condenser fan motor operates	Procedure No. 20	13J-48
21	Fan motor relay	Drive the fan motor	Ignition switch: ON	Condenser fan motor and radiator fan motor operate	Procedure No. 20	13J-48
30	SAS adjustment mode	Set to SAS adjustment mode	Ignition switch: ON	Idle speed control (ISC) servo is fixed at step 6.	–	–
32	Air by-pass control solenoid valve (DUTY)	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Procedure No. 27	13J-54

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



Terminal No.	Check item	Check condition (Engine condition)		Normal condition
1	No.1 injector	Engine: Idling after having warmed up		10 – 12 V
14	No.2 injector			
2	No.3 injector			
15	No.4 injector			
3	Air by-pass control solenoid valve (ON/OFF)	Engine: Idling after having warmed up		System voltage
		Engine: 2,500 r/min		System voltage
16	Air by-pass control solenoid valve (DUTY)	Engine: Idling after having warmed up		System voltage
		Engine: 2,500 r/min		System voltage
4	Idle speed control servo (A)	Engine: Immediately after the warm engine has been started		System voltage ↔ 0 – 0.5 V (changes repeatedly)
17	Idle speed control servo (B)			
5	Idle speed control servo (C)			
18	Idle speed control servo (D)			
7	A/T-ECU communication output	Engine: Idling Selector lever position: D range		Other than 0 V
59	A/T-ECU communication input			
8	A/C relay	Engine: Idling	A/C switch: OFF	0 – 0.1 V
			A/C switch: ON	Momentarily system voltage or momentarily 6 V or more
10	No.1 ignition coil	Engine: 2,500 r/min		0.1 – 0.3 V
11	No.2 ignition coil			
23	No.3 ignition coil			
24	No.4 ignition coil			

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
12	Power supply	Ignition switch: ON		System voltage
25	Power supply			
13	Earth	At all times		0 V
26	Earth			
19	Air flow sensor reset signal	Engine: Idling		0 – 0.1 V
		Engine: 4,000 r/min		6 – 9 V
90	Air flow sensor	Engine: Idling		2.2 – 3.2 V
		Engine: 2,500 r/min		
20	Injector driver control relay	Ignition switch: OFF		0 – 0.1 V
		Ignition switch: ON		0.5 – 1 V
21	Fan motor relay (LO)	Radiator fan and condenser fan are not operating (Engine coolant temperature is 90°C or less)		System voltage
		Radiator fan and condenser fan are operating (Engine coolant temperature is 90 – 105°C)		0 – 3 V
22	Fuel pump relay	Ignition switch: ON	Engine: Stopped	System voltage
			Engine: Idling	0 – 1 V
39	EGR control servo (A)	Engine: Immediately after the warm engine has been started		System voltage ↔ 0 – 0.5 V (changes repeatedly)
40	EGR control servo (B)			
31	EGR control servo (C)			
32	EGR control servo (D)			
33	Alternator G terminal	Engine: Idling after having warmed up Radiator fan: Not operating Headlamp: OFF → ON Stop lamp: OFF → ON Rear defogger switch: OFF → ON		4.5 – 5.5 V → 6.5 – 7.5 V
41	Alternator FR terminal	Engine: Idling after having warmed up Radiator fan: Not operating Headlamp: OFF → ON Stop lamp: OFF → ON Rear defogger switch: OFF → ON		2.0 – 3.0 V → 1.0 – 2.0 V
35	Stop lamp switch	Brake pedal: Depressed		System voltage
		Brake pedal: Released		0 – 0.1 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
36	Engine warning lamp	Ignition switch: OFF → ON		0 – 0.1 V → System voltage (after several seconds have passed)
37	Power steering fluid pressure switch	Steering wheel: Neutral position		System voltage
		Steering wheel: Turned		0 – 0.1 V
38	Control relay	Ignition switch: ON		0 – 1 V
		Ignition switch: OFF		System voltage
42	Brake vacuum sensor	Engine: Accelerator pedal is suddenly depressed while the engine is idling after having warmed up		Voltage drops slightly
45	A/C switch	Engine: Idling	A/C switch: OFF	0 – 0.1 V
			A/C switch: ON	System voltage
51	Injector open circuit check signal	Engine: Idling		0 ↔ 5 V (changes repeatedly)
52	Electrical load switch	Engine: Idling	Turn off the lighting switch	0 – 3 V
			Turn on the lighting switch	System voltage
54	Fan motor relay (HI)	Radiator fan is not operating (Engine coolant temperature is 90°C or less)		System voltage
		Radiator fan is operating (Engine coolant temperature is 105°C or more)		0 – 3 V
56	Diagnosis control terminal	–		–
62	Diagnosis output terminal	Ignition switch: ON At normal condition (no diagnosis output)		4 – 5 V
57	Purge control solenoid valve	Ignition switch: ON	Engine: Stopped	System voltage
			Engine: Running at 2,500 r/min after having warmed up	0 – 3 V
58	Tachometer	Engine: Cranking		0 ↔ 5 V (changes repeatedly)
60	Oxygen sensor heater control	Ignition switch: ON	Engine: Stopped	System voltage
			Engine: After starting	0 – 0.5 V
76	Oxygen sensor	Engine: Running at 2,500 r/min after having warmed up		0 ↔ 1 V (changes repeatedly)

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
71	Ignition switch-ST	Engine: Cranking		8 V or more
72	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 – 3.8 V
			Intake air temperature: 20°C	2.3 – 2.9 V
			Intake air temperature: 40°C	1.5 – 2.0 V
74	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V
75	M/T oil temperature sensor	M/T oil temperature: 25°C		2.4 – 2.7 V
		M/T oil temperature: 80°C		0.5 – 0.8 V
77	Sensor power supply (5 V)	Ignition switch: ON		4.8 – 5.2 V
81				
78	Detonation sensor	Engine: Idling after having warmed up		Other than 0 V
80	Back-up power supply	Ignition switch: OFF		System voltage
82	Ignition switch	Ignition switch: OFF		0 – 0.1 V
		Ignition switch: ON		System voltage
83	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.2 – 3.8 V
			Engine coolant temperature: 20°C	2.3 – 2.9 V
			Engine coolant temperature: 50°C	1.0 – 1.6 V
			Engine coolant temperature: 80°C	0.3 – 0.9 V
84	Throttle position sensor	Ignition switch: ON	Throttle valve: Idle position	0.5 – 0.8 V
			Throttle valve: Fully open	4.8 – 5.1 V
85	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.9 – 4.1 V
			Altitude: 1,200 m	3.3 – 3.6 V
86	Vehicle speed sensor	Ignition switch: ON Move the vehicle slowly forward		0 ↔ 5 V (changes repeatedly)
87	Idle position switch	Ignition switch: ON	Throttle valve: Idle position	0 – 0.1 V
			Throttle valve: Slightly open	4.5 – 5 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
88	Camshaft position sensor	Engine: Cranking		0 ↔ 4 V (changes repeatedly)
		Engine: Idling		
89	Crank angle sensor	Engine: Cranking		0 ↔ 4 V (changes repeatedly)
		Engine: Idling		
91	Inhibitor switch	Ignition switch: ON	Selector lever position: N or P	0 – 0.1 V
			Selector lever position: D, 2, L or R	System voltage
92	Sensor earth	At all times		0 V

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

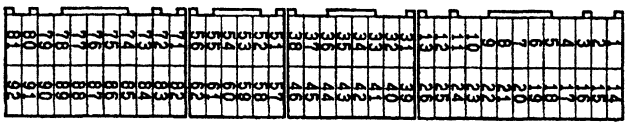
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

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

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

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

Engine-ECU Harness Side Connector Terminal Arrangement



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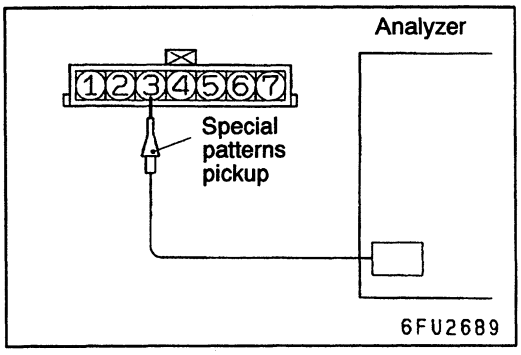
Terminal No.	Check item	Check condition	Standard value, normal value
3 – 12	Air by-pass control solenoid valve (ON/OFF)	20°C	8 – 11 Ω
16 – 12	Air by-pass control solenoid valve (DUTY)	20°C	8 – 11 Ω
4 – 12	Idle speed control servo (A)	20°C	31 – 38 Ω
17 – 12	Idle speed control servo (B)		
5 – 12	Idle speed control servo (C)		
18 – 12	Idle speed control servo (D)		
13 – Body earth	Earth	At all times	Continuity (0 Ω)
26 – Body earth	Earth		
92 – Body earth	Sensor earth		
39 – 12	EGR control servo (A)	20°C	15 – 20 Ω
40 – 12	EGR control servo (B)		
31 – 12	EGR control servo (C)		
32 – 12	EGR control servo (D)		
57 – 12	Purge control solenoid valve	20°C	35 – 40 Ω
60 – 12	Oxygen sensor heater control	20°C	13 – 17 Ω
72 – 92	Intake air temperature sensor	Intake air temperature: 0°C	5.1 – 6.5 Ω
		Intake air temperature: 20°C	2.3 – 3.0 Ω
		Intake air temperature: 40°C	0.9 – 1.3 Ω

Terminal No.	Check item	Check condition	Standard value, normal value
75 – 92	M/T oil temperature sensor	M/T oil temperature: 25°C	1.95 – 2.05 kΩ
		M/T oil temperature: 80°C	0.3 – 0.4 kΩ
83 – 92	Engine coolant temperature sensor	Engine coolant temperature: 0°C	5.75 – 5.85 kΩ
		Engine coolant temperature: 20°C	2.4 – 2.5 kΩ
		Engine coolant temperature: 50°C	0.75 – 0.85 kΩ
		Engine coolant temperature: 80°C	0.3 – 0.4 kΩ
84 – 92	Throttle position sensor	Throttle valve: Idle position	0.5 – 0.7 kΩ
		Throttle valve: Fully open	0.3 – 0.5 kΩ
85 – 92	Barometric pressure sensor	20°C	3.1 – 3.4 kΩ
87 – 92	Idle position switch	Throttle valve: Idle position	Continuity (0 Ω)
		Throttle valve: Slightly open	No continuity
91 – Body earth	Inhibitor switch	Selector lever position: N or P	Continuity (0 Ω)
		Selector lever position: D, 2, L or R	No continuity



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

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

Alternate Method (Test harness not available)

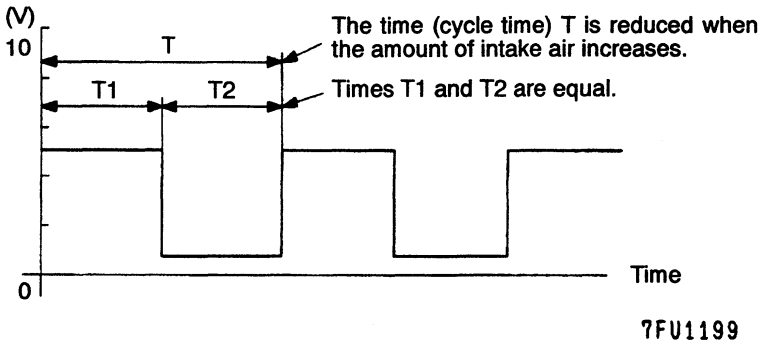
1. Connect the analyzer special patterns pickup to engine-ECU terminal 90.

Standard Wave Pattern

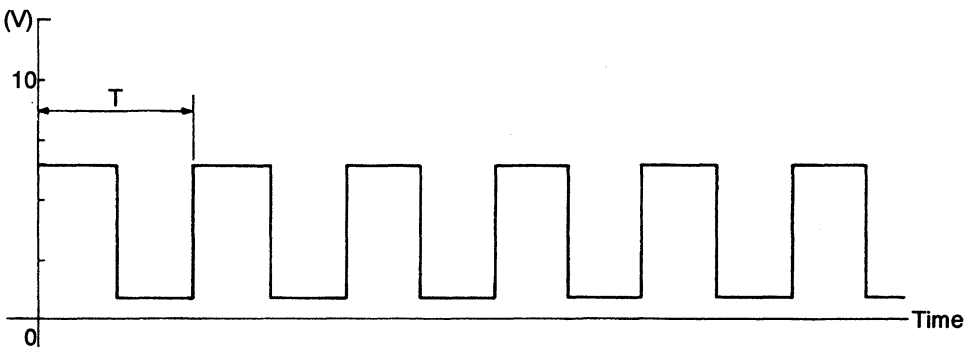
Observation conditions

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

Standard wave pattern

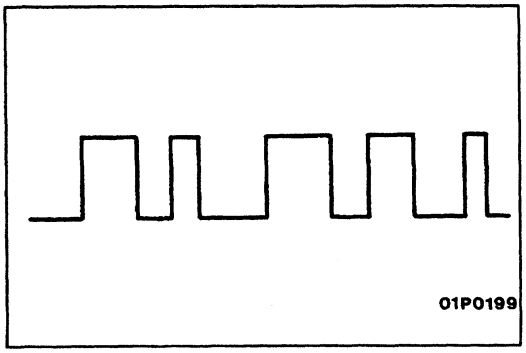


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

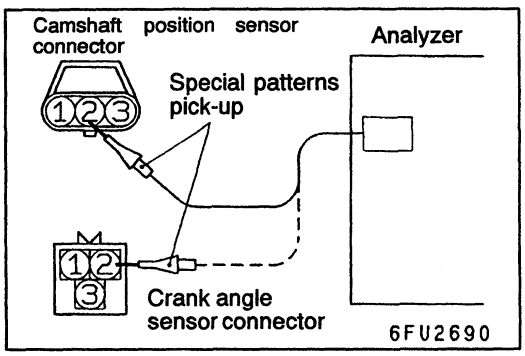
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

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



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

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

Alternate Method (Test harness not available)

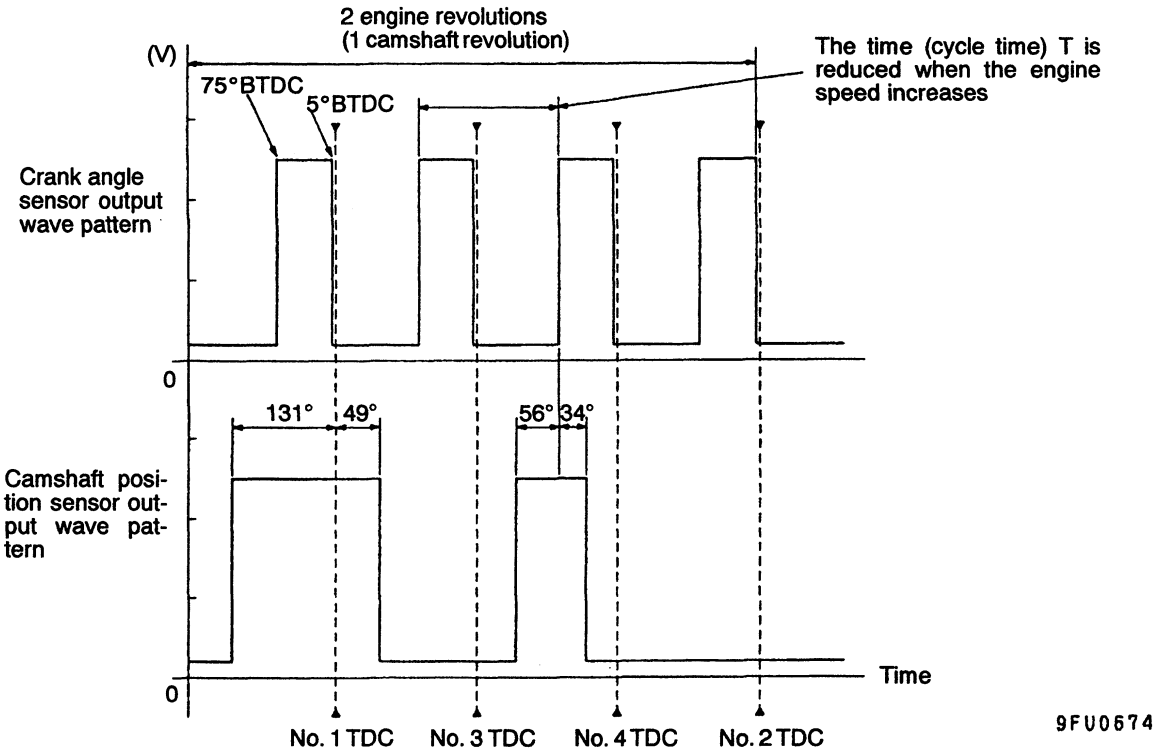
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

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

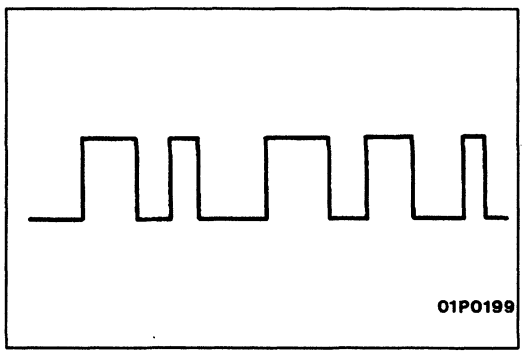
Standard wave pattern



TDC: Top dead centre

Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

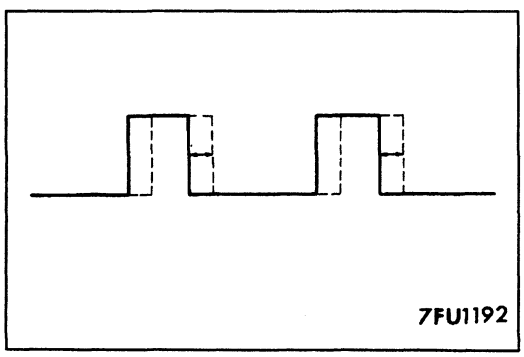
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



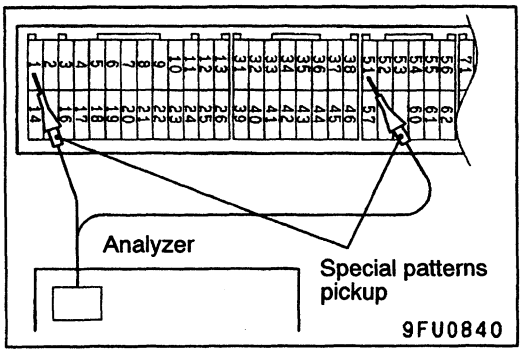
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTORS AND INJECTOR OPEN CIRCUIT CHECK SIGNAL

Measurement Method

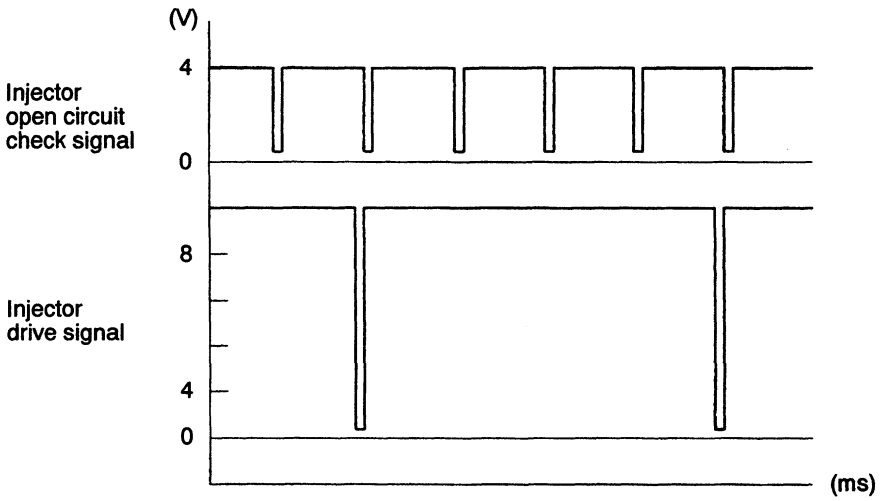
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 51 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1, check terminal 14 (No.2 injector), terminal 2 (No.3 injector) and terminal 15 (No.4 injector).

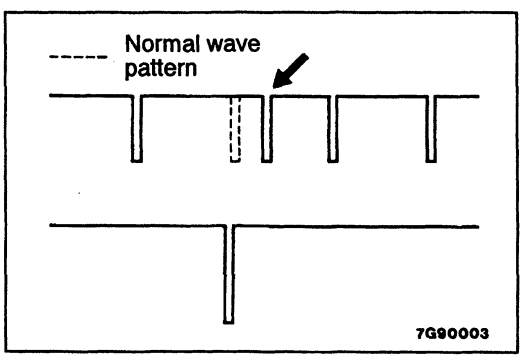
Standard Wave Pattern

Observation conditions

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

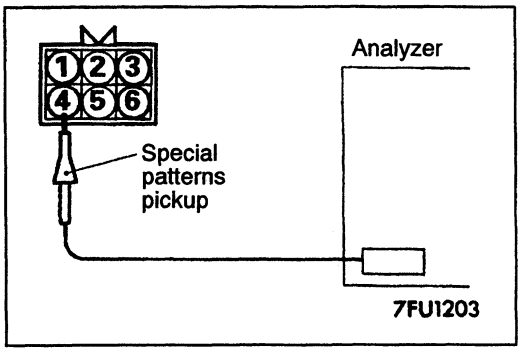
Standard wave pattern





Wave Pattern Observation Points

- Check that the injector drive time is identical to the time displayed on the MUT-II.
- Check that the injector signals become greatly extended but soon return to their normal wave length when the engine is suddenly raced.
- Check that the injector open circuit check signal is synchronized with each rising portion of the injector drive signal.



IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR)

Measurement Method

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

Alternate Method (Test harness not available)

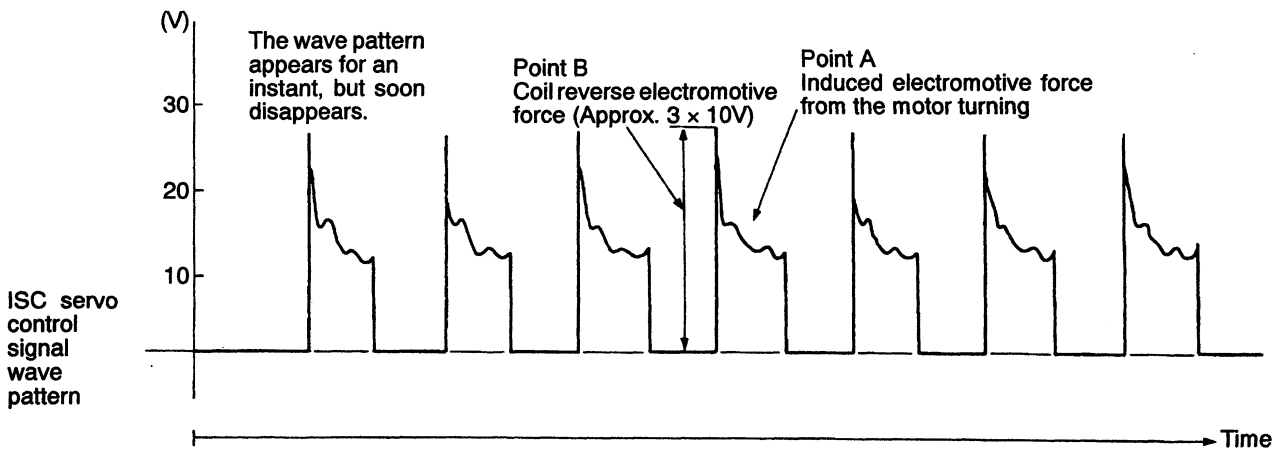
1. Connect the analyzer special patterns pickup to engine-ECU terminal 4, connection terminal 5, connection terminal 17, and connection terminal 18 respectively.

Standard Wave Pattern

Observation conditions

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

Standard wave pattern



7FU1204

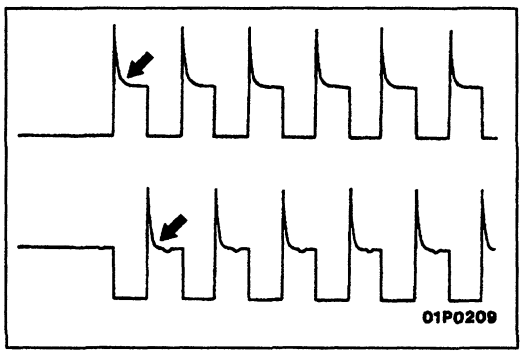
Wave Pattern Observation Points

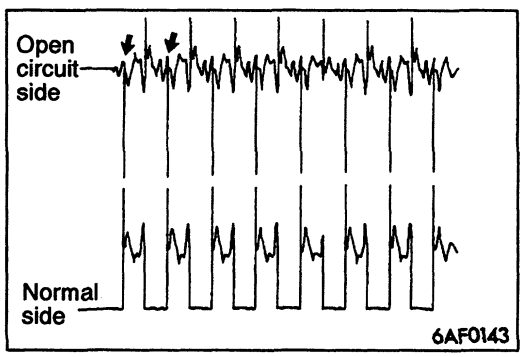
Check that the standard wave pattern appears when the ISC servo is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

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.

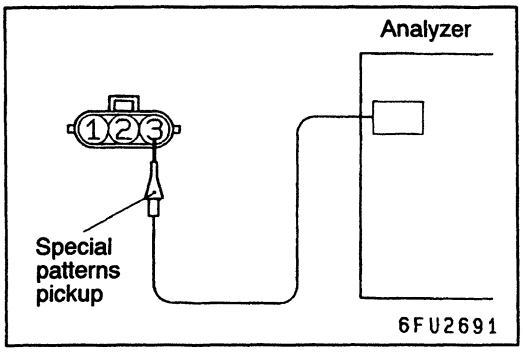
- Example 2

  Cause of problem

  Open circuit in the line between the ISC servo 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

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 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

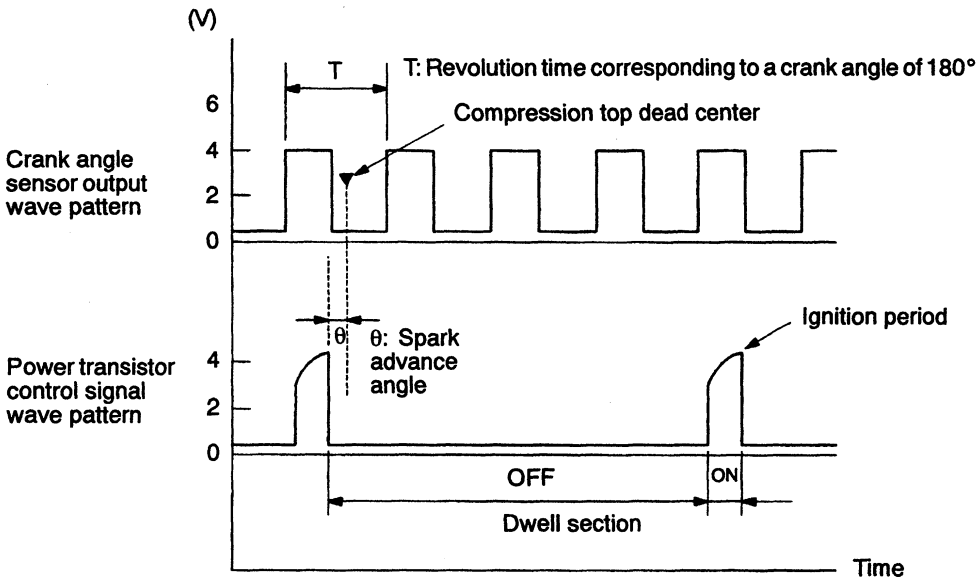
1. Connect the analyzer special patterns pickup to engine-ECU terminal 10 (No. 1 – No. 4), terminal 23 (No. 2 – No. 3) respectively.

Standard Wave Pattern

Observation condition

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

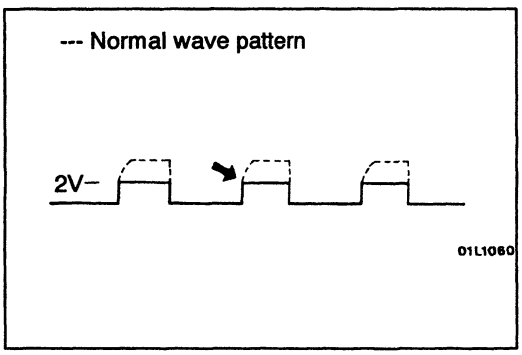
Standard wave pattern

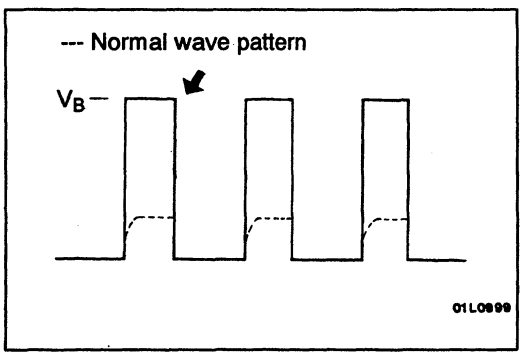


Wave Pattern Observation Points

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

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





Examples of Abnormal Wave Patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Open-circuit in ignition primary circuit

  Wave pattern characteristics

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

- Example 2

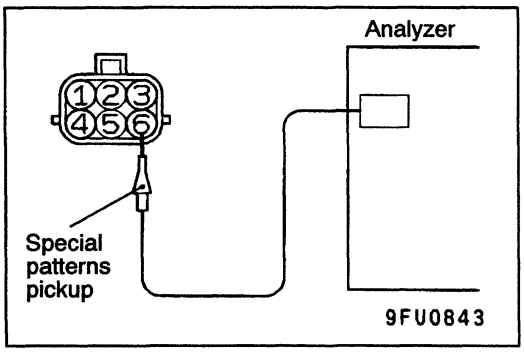
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.



EGR CONTROL SERVO (STEPPER MOTOR)

Measurement Method

1. Disconnect the EGR control servo connector, and connect the special tool (test harness: MB991658) in between.
2. Connect the analyzer special patterns pickup to the EGR control servo-side connector terminal 1, terminal 3, terminal 4 and terminal 6 respectively.

Alternate Method (Test harness not available)

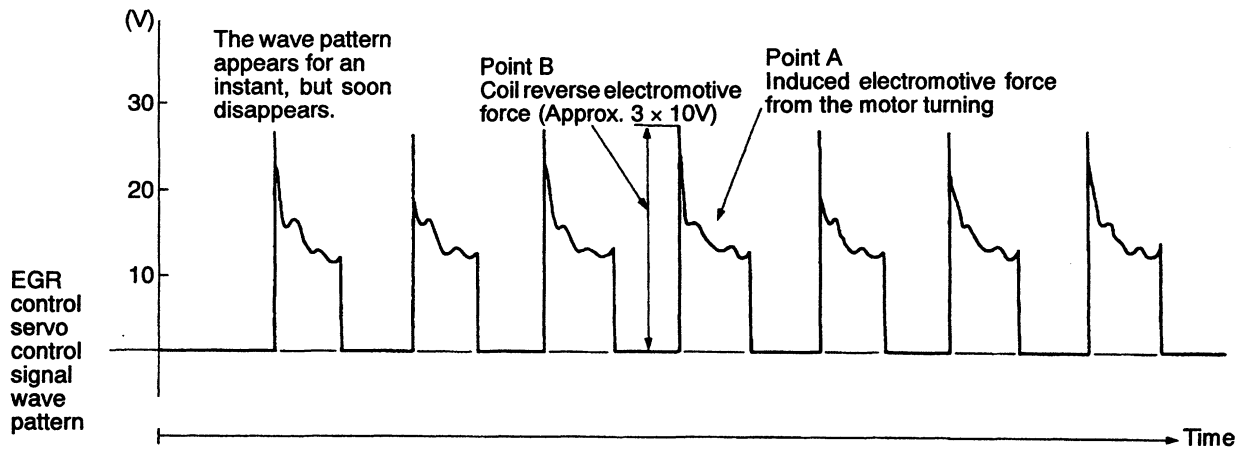
1. Connect the analyzer special patterns pickup to engine-ECU terminal 39, connection terminal 40, connection terminal 31, and connection terminal 32 respectively.

Standard Wave Pattern

Observation conditions

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

Standard wave pattern



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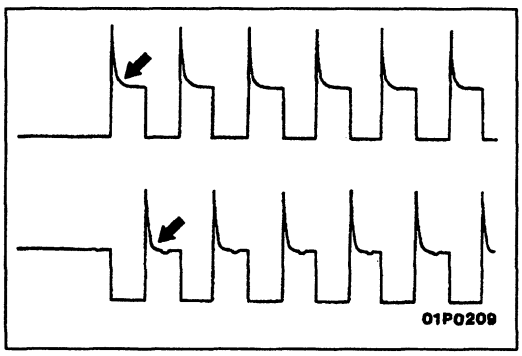
Wave Pattern Observation Points

Check that the standard wave pattern appears when the EGR control servo 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

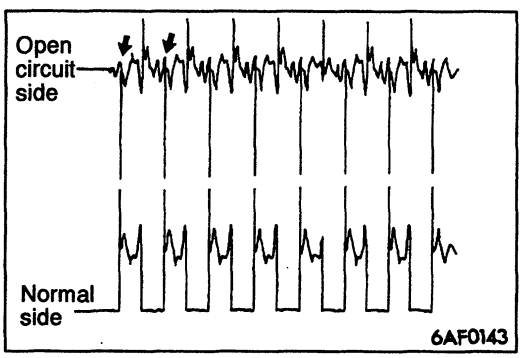
- Example 1

  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 EGR control servo and the engine-ECU

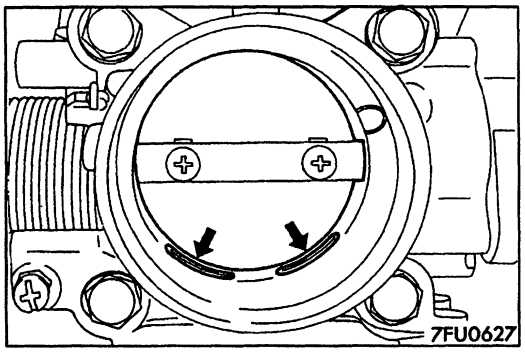
  Wave pattern characteristics

  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.

ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

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

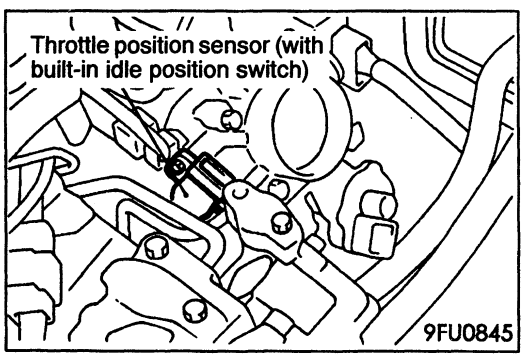


3. Plug the bypass passage inlet of the throttle body.

   Caution
   Do not allow cleaning solvent to enter the bypass passage.

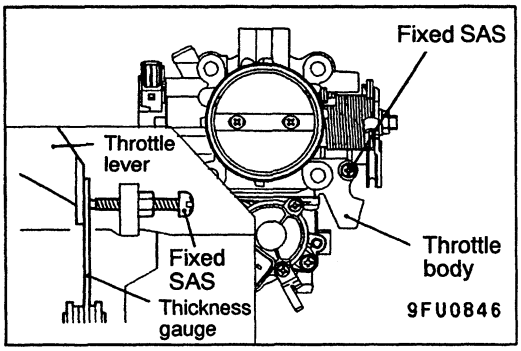
4. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.
5. Start the engine, race it several times and idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
6. If the throttle valve deposits are not removed, repeat steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the air intake hose.
9. Use the MUT-II to erase the self-diagnosis code.
10. Adjust the basic idle speed. (Refer to P.13J-83.)

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

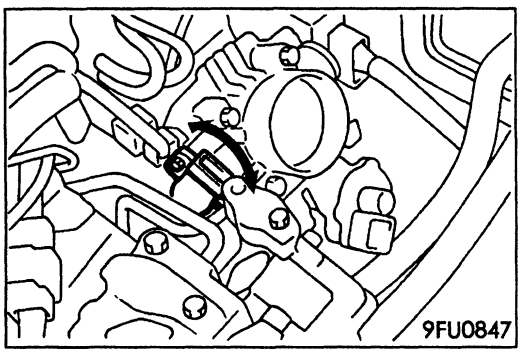


IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT

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

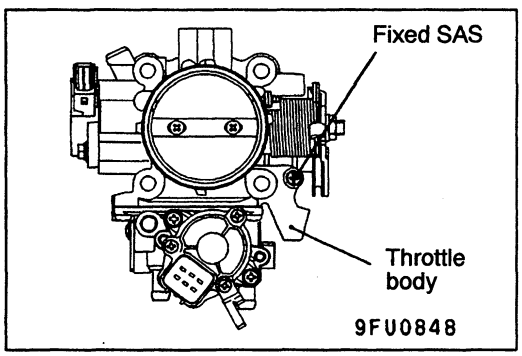


2. Insert a thickness gauge with a thickness of 0.45 mm between the fixed SAS and the throttle lever.
3. Turn the ignition switch to ON (but do not start the engine).



4. Loosen the throttle position sensor mounting bolt, and then turn the throttle position sensor anti-clockwise as far as it will go.
5. Check that the idle position switch is ON at this position.
6. Slowly turn the throttle position sensor clockwise and find the point where the idle position switch turns off. Securely tighten the throttle position sensor mounting bolt at this point.
7. Check the throttle position sensor output voltage.

   Standard value: 400 – 1,000 mV
8. If there is a deviation from the standard value, check the throttle position sensor and the related harness.
9. Remove the thickness gauge.
10. Turn the ignition switch to OFF.
11. Disconnect the MUT-II.



FIXED SAS ADJUSTMENT

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

1. Loosen the tension of the accelerator cable sufficiently.
2. Back out the fixed SAS lock nut.
3. Turn the fixed SAS counterclockwise until it is sufficiently backed out, and fully close the throttle valve.
4. Tighten the fixed SAS until the point where the throttle lever is touched (i.e., the point at which the throttle valve begins to open) is found.
   From that point, tighten the fixed SAS 1-1/4 turn.
5. While holding the fixed SAS so that it doesn't move, tighten the lock nut securely.
6. Adjust the tension of the accelerator cable.
7. Adjust the basic idling speed.
8. Adjust the idle position switch and the throttle position sensor (P.13J-84).

BASIC IDLE SPEED ADJUSTMENT

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

1. Before inspection and adjustment, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector (16-pin).

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

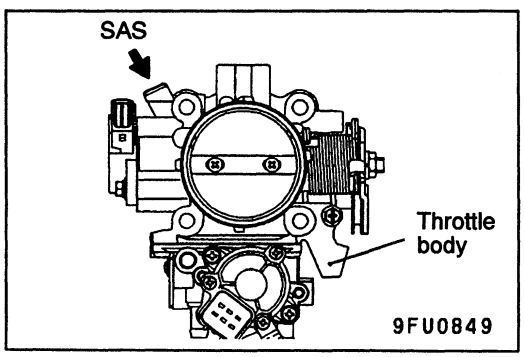
3. Start the engine and run at idle.
4. Select the item No.30 of the MUT-II Actuator test.

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

5. Check the idle speed.

   Standard value:
   750 ± 50 r/min

   NOTE
   (1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
   (2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13J-84.)



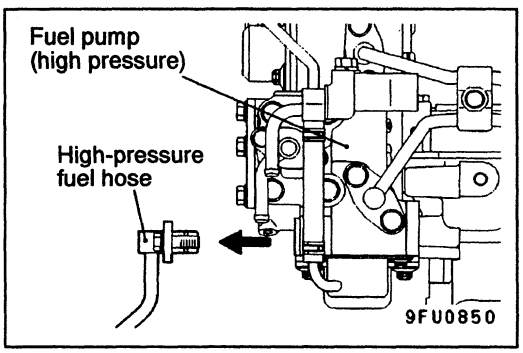
6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

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

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

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

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

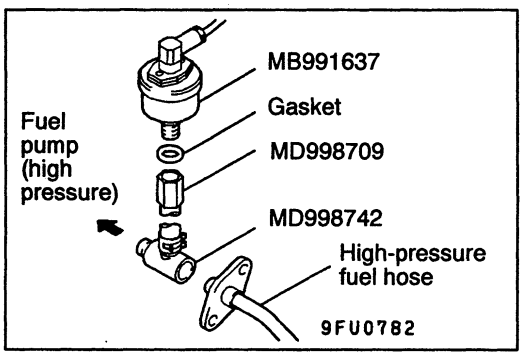


FUEL PRESSURE TEST

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

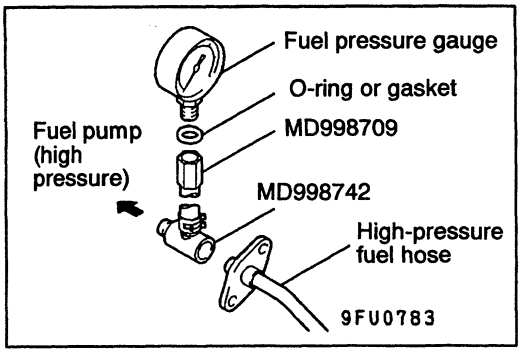
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13J-91.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

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



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

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



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

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

Standard value:
324 – 343 kPa at kerb idle

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

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel pressure regulator (low pressure) valve seating or settled spring	Replace fuel pressure regulator (low pressure)
	Low fuel pump (low pressure) delivery pressure	Replace the fuel pump (low pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (low pressure)	Replace fuel pressure regulator (low pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

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

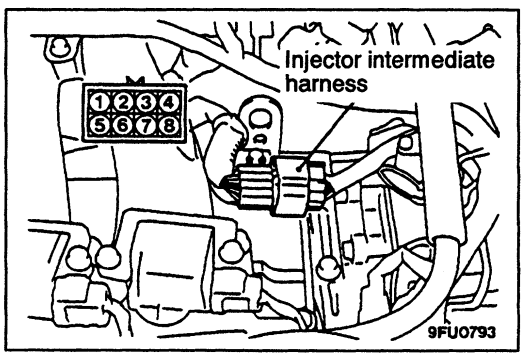
Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky fuel pressure regulator (low pressure) valve seat	Replace fuel pressure regulator (low pressure)
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump (low pressure) is held open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

14. Release residual pressure from the fuel pipe line. (Refer to P.13J-91.)

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

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

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



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

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

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

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

6. Immediately after cranking is finished, the fuel pressure should drop to about 4 MPa. Check this value.
7. Wait for 3 minutes or more after cranking stops, and then check that the fuel pressure has dropped by less than 1 MPa from the value observed in step 6.

Caution
If the fuel pressure drops by more than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.

8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.

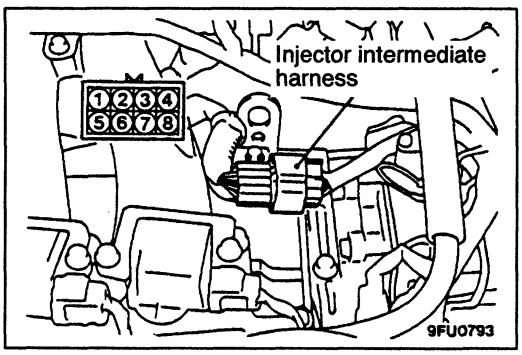
11. Measure fuel pressure while the engine is running at idle.

    Standard value: 4 – 7 MPa

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

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Fuel leaking to return side due to poor fuel pressure regulator (high pressure) valve seating or settled spring	Replace fuel pressure regulator (high pressure)
	Low fuel pump (high pressure) delivery pressure	Replace the fuel pump (high pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (high pressure)	Replace fuel pressure regulator (high pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

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



FUEL LEAK CHECK

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

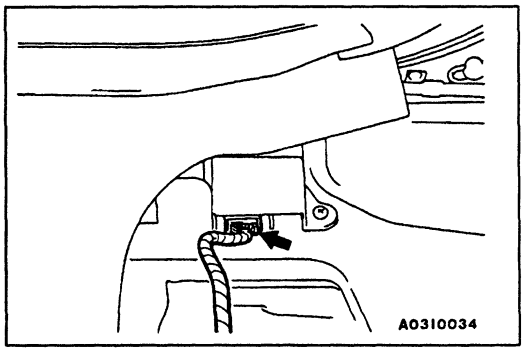
   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

6. Immediately after cranking is finished, the fuel pressure should drop to about 4 MPa. Check this value.

7. Wait for 3 minutes or more after cranking stops, and then check that the fuel pressure has dropped by less than 1 MPa from the value observed in step 6.

   Caution
   If the fuel pressure drops by more than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.

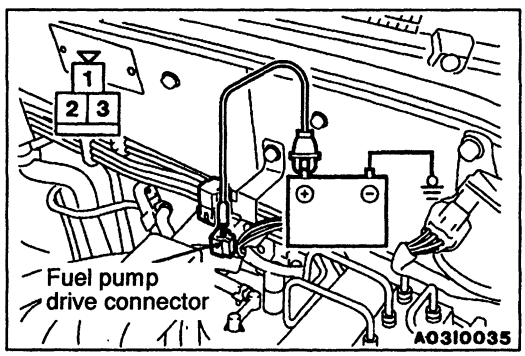
8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Disconnect the MUT-II.



FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE THE FUEL PRESSURE)

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

1. Raise the rear seat cushion.
2. Disconnect the floor wiring harness and fuel wiring harness under the floor carpet.
3. After starting the engine and letting it run until it stops naturally, turn the ignition switch to OFF.
4. Connect the fuel wiring harness and floor wiring harness.
5. Install the rear seat cushion.



FUEL PUMP OPERATION CHECK

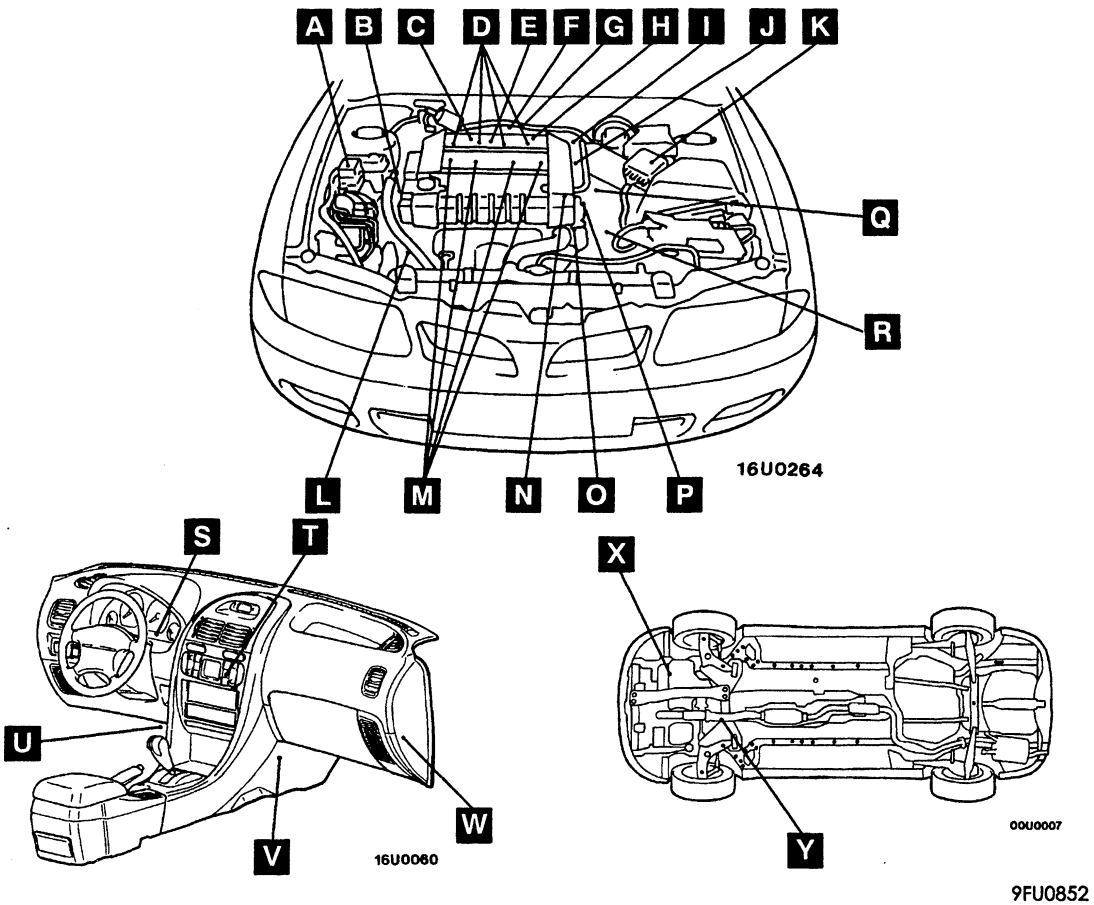
1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.
2. If the fuel pump will not operate, check by using the following procedure, and if it is normal, check the drive circuit.
   (1) Turn the ignition switch to OFF.
   (2) When the fuel pump drive connector (black) is attached directly to the battery, check if the sound of the fuel pump operation can be heard.

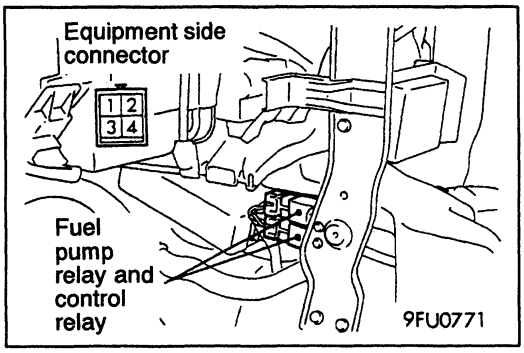
   NOTE
   As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel filler cap and check from the tank inlet.

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

COMPONENT LOCATION

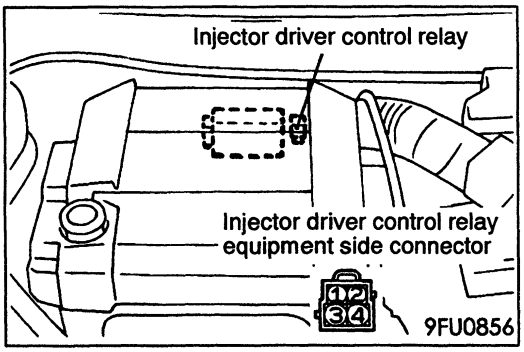
Name	Symbol	Name	Symbol
A/C relay	A	Engine warning lamp (check engine lamp)	S
A/C switch	T	Fuel pressure sensor	P
Air by-pass control solenoid valve (DUTY)	C	Idle speed control (ISC) servo	J
Air by-pass control solenoid valve (ON/OFF)	C	Ignition coil	M
Air flow sensor (with intake air temperature sensor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





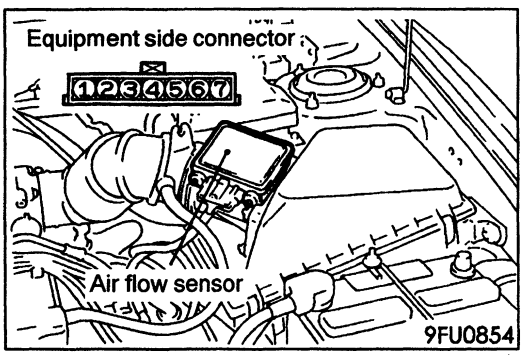
CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

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



INJECTOR DRIVER CONTROL RELAY CONTINUITY CHECK

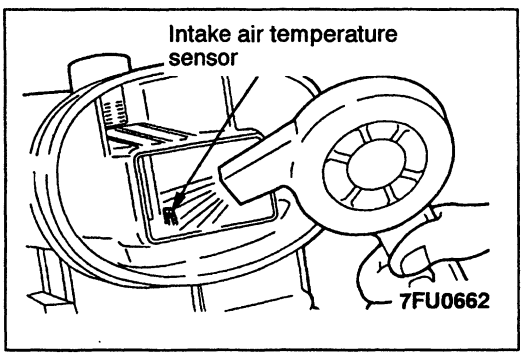
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied	○	○		
Supplied	⊕	⊖	○	○



INTAKE AIR TEMPERATURE SENSOR CHECK

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

Standard value:
2.3 – 3.0 kΩ (at 20°C)
0.30 – 0.42 kΩ (at 80°C)

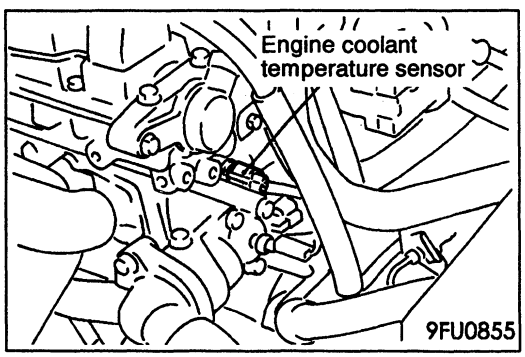


3. Measure resistance while heating the sensor using a h drier.

Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

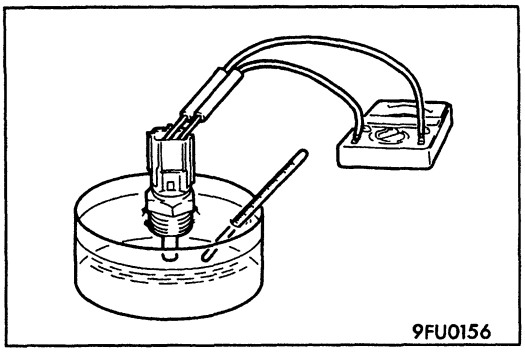
4. If the value deviates from the standard value or resistance remains unchanged, replace the air flow sen assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

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

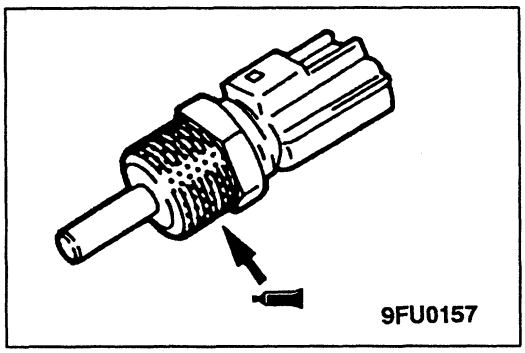
1. Remove the engine coolant temperature sensor.



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

   Standard value:
   2.1 – 2.7 kΩ (at 20°C)
   0.26 – 0.36 kΩ (at 80°C)

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

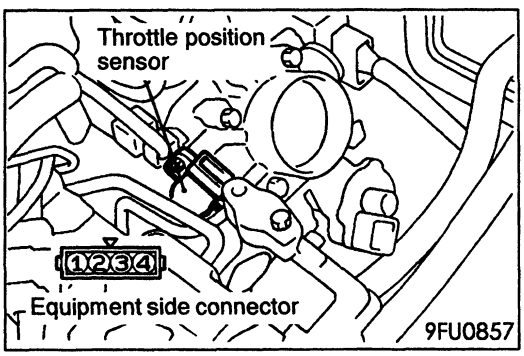


4. Apply sealant to threaded portion.

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

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

   Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

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

   Standard value: 3.5 – 6.5 kΩ

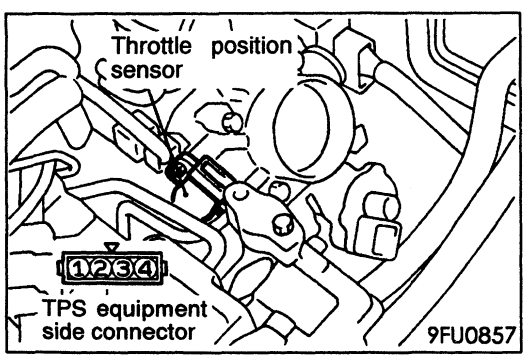
3. Measure the resistance between the throttle position sensor side connector terminal 3 and terminal 4.

   Normal condition:

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

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

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13J-84.



IDLE POSITION SWITCH CHECK

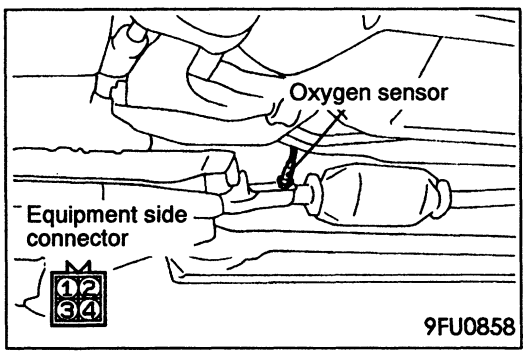
1. Disconnect the throttle position sensor connector.
2. Check the continuity between the throttle position sensor connector side terminal 2 and terminal 4.

   Normal condition:

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

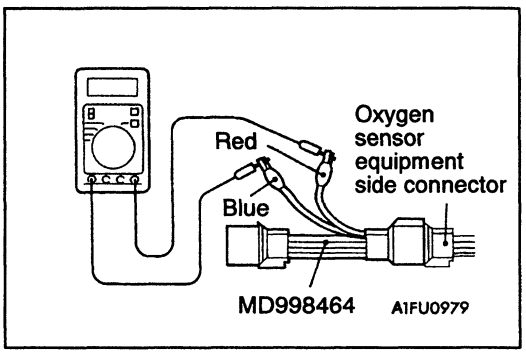
3. If out of specification, replace the throttle position sensor.

NOTE
After replacement, the idle position switch and throttle position sensor should be adjusted. (Refer to P.13J-84.)

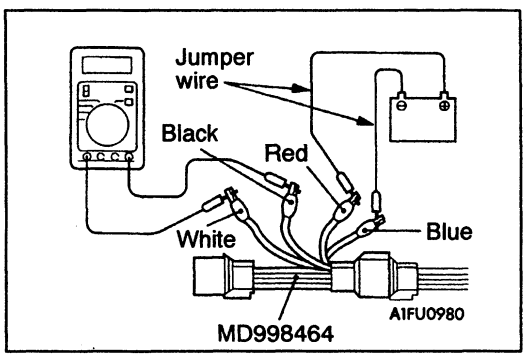


OXYGEN SENSOR CHECK

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (2.5 – 5.0 Ω at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.



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



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

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

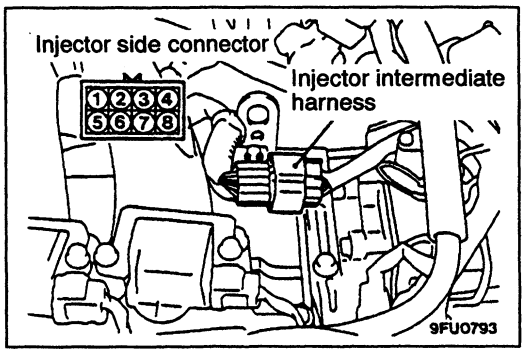
6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Standard value:

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

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

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



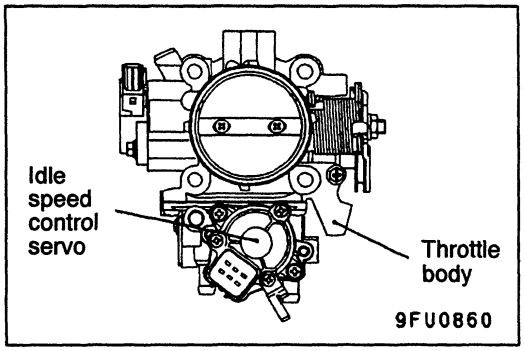
INJECTOR CHECK

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

Standard value: 0.9 – 1.1 Ω (at 20°C)

Injector	Measurement terminal
No.1 cylinder	1 – 2
No.2 cylinder	3 – 4
No.3 cylinder	5 – 6
No.4 cylinder	7 – 8

3. Connect the injector intermediate harness connector.



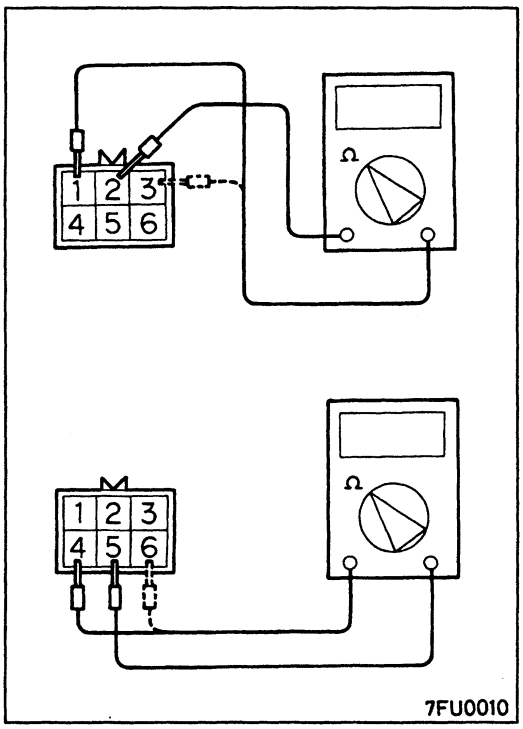
IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

Checking the Operation Sound

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

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

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



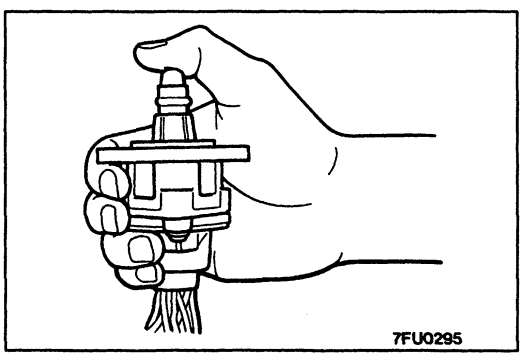
Checking the Coil Resistance

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

   Standard value: 28 – 33 Ω (at 20°C)

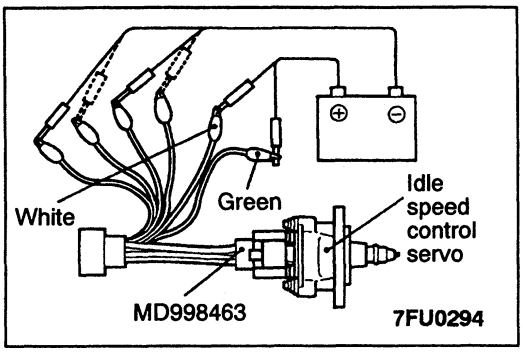
3. Measure the resistance between terminal 5 (green clip of the special tool) and either terminal 6 (yellow clip) or terminal 4 (black clip) of the connector at the idle speed control servo side.

   Standard value: 28 – 33 Ω (at 20°C)

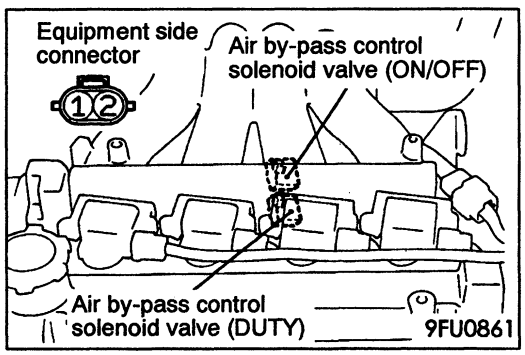


Operation Check

1. Remove the throttle body.
2. Remove the stepper motor.



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



AIR BY-PASS CONTROL SOLENOID VALVE CHECK

1. Measure the resistance between the terminals of the air by-pass control solenoid valve (DUTY).

   Standard value: 7.7 – 9.3 Ω (at 20°C)

2. Measure the resistance between the terminals of the air by-pass control solenoid valve (ON/OFF).

   Standard value: 7.7 – 9.3 Ω (at 20°C)

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 – Emission Control System.

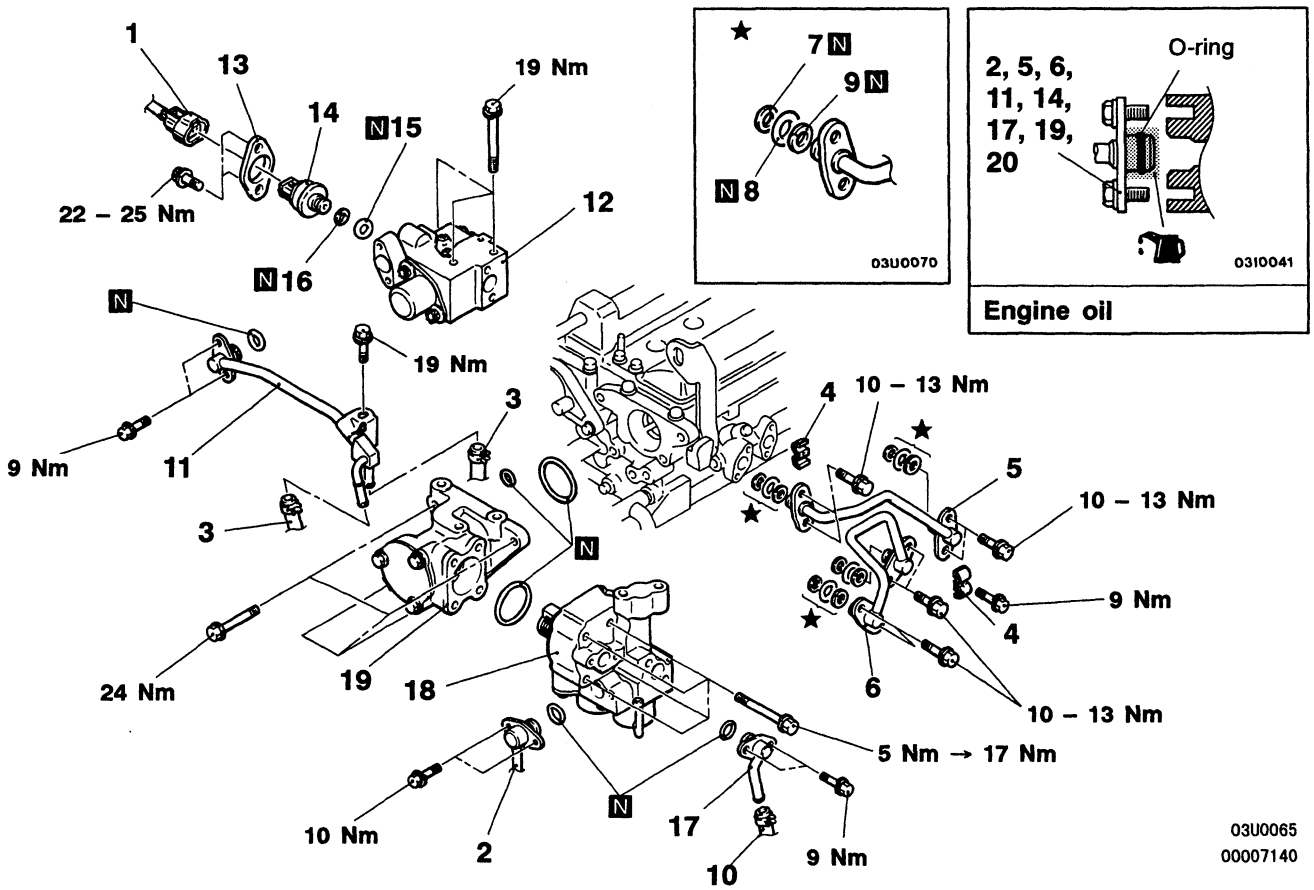
EGR CONTROL SERVO CHECK

Refer to GROUP 17 – Emission Control System.

FUEL PUMP (HIGH PRESSURE)

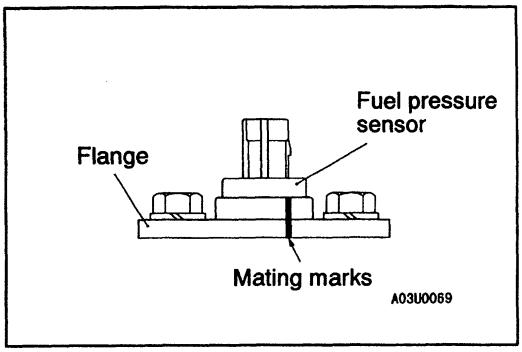
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying
- Prevention of fuel discharge <before removal only>
- Air Intake Hose Assembly Removal and Installation
- Engine Cover Removal and Installation
- Ignition Coil Removal and Installation
- Throttle Body Removal and Installation (Refer to 13J-106.)
- Accelerator Cable Adjustment <after installation only>
- Fuel Leak Check <after installation only>



Removal steps

1. Fuel pressure sensor connector
▶I◀ 2. High-pressure fuel hose connection
3. Fuel return hose connection
4. Clamp
▶H◀ 5. Fuel return pipe assembly
▶H◀ 6. Fuel feed pipe assembly
▶G◀ 7. Back-up ring A
▶G◀ 8. O-ring
▶G◀ 9. Back-up ring B
10. Fuel hose connection
▶F◀ 11. Fuel return lower pipe assembly
12. Fuel pressure regulator (high pressure) assembly
◀A▶ ▶E◀ 13. Flange
▶E◀ 14. Fuel pressure sensor
▶D◀ 15. O-ring
▶D◀ 16. Back-up ring
▶C◀ 17. Fuel nipple assembly
▶B◀ 18. Fuel pump (high pressure)
▶A◀ 19. Pump camshaft case assembly

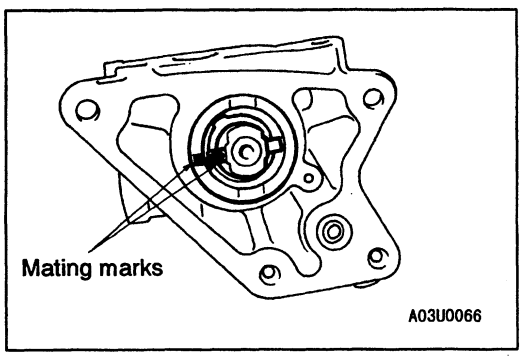


REMOVAL SERVICE POINT

◀A▶ FLANGE REMOVAL

If reusing the fuel pressure sensor, make the mating marks on the sensor and the flange before removing the flange.

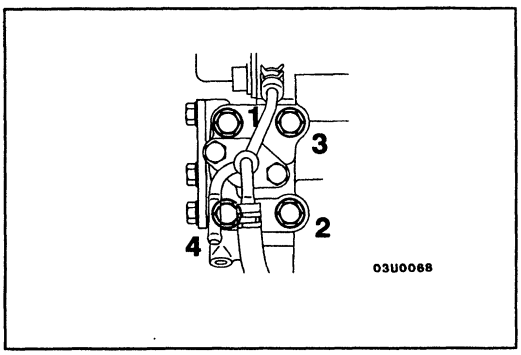
NOTE
The flange will be bent when it is installed to the engine. Because of this, the sealing condition and installation condition of the fuel pressure sensor will be maintained in good condition. Therefore, the mating marks should be made in order to install the flange in the original condition. If replacing the fuel pressure sensor with a new part, the sensor and flange should be replaced together.



INSTALLATION SERVICE POINTS

▶A◀ PUMP CAMSHAFT CASE ASSEMBLY INSTALLATION

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



▶B◀ FUEL PUMP (HIGH PRESSURE) INSTALLATION

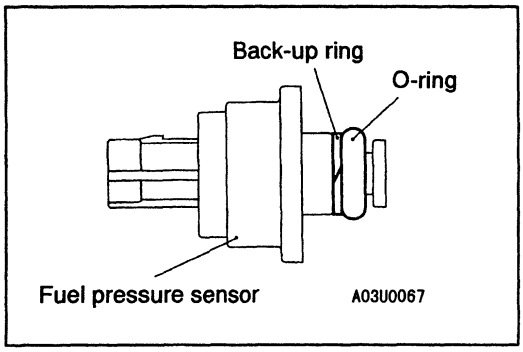
Use a torque wrench with a precision of 0.5 Nm to tighten the fuel pump mounting bolts according to the following procedure.

1. Tighten the bolts to 5 Nm in the order shown in the illustration.
2. Tighten the bolts to 17 Nm in the order shown in the illustration. The overall difference in tightening torque between the four bolts should be within 2 Nm.

▶C◀ FUEL NIPPLE ASSEMBLY INSTALLATION

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

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



▶D◀ BACK-UP RING/O-RING INSTALLATION

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

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

▶E◀ FUEL PRESSURE SENSOR/FLANGE INSTALLATION

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

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

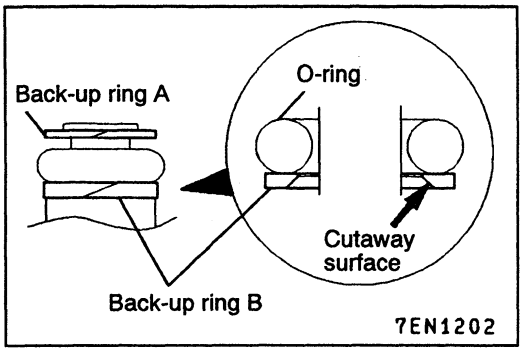
2. Align the mating marks which were made at the time of removal, and then install the fuel pressure sensor and flange to the fuel pressure regulator (high pressure) assembly.

   Caution
   If replacing the fuel pressure sensor with a new part, the sensor and flange should be replaced together.

▶F◀ FUEL RETURN LOWER PIPE ASSEMBLY INSTALLATION

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

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



▶G◀ BACK-UP RING B/O-RING/BACK-UP RING A INSTALLATION

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

Caution

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

▶H◀ FUEL FEED PIPE ASSEMBLY/FUEL RETURN PIPE ASSEMBLY INSTALLATION

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

Caution

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

▶I◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

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

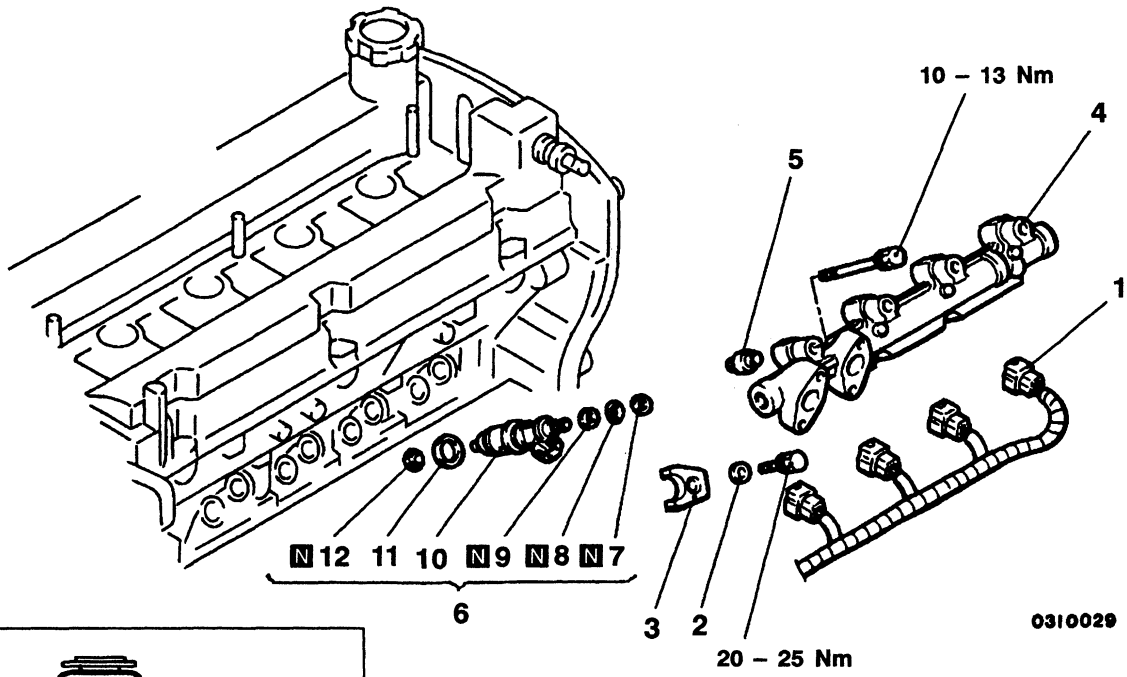
   Caution

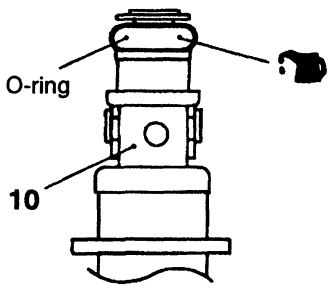
   Take care not to let any of the engine oil get inside the fuel pump (high pressure).
2. While being careful not to damage the O-ring, turn the high-pressure fuel hose to the left and right and connect it to the fuel pump (high pressure). After connecting, check that the hose turns smoothly.
3. If the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

INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying
- Prevention of fuel discharge <before removal only>
- Air Intake Hose Assembly Removal and Installation
- Engine Cover Removal and Installation
- Ignition Coil Removal and Installation
- Throttle Body Removal and Installation (Refer to 13J-106.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Accelerator Cable Adjustment <after installation only>
- Fuel Leak Check <after installation only>





Engine oil

00005883

Removal steps

◀A▶ 1. Injector harness connector
2. Washer
3. Injector holder
◀B▶ ▶C◀ 4. Delivery pipe assembly
5. Insulator
◀B▶ ▶C◀ 6. Fuel injector assembly
▶B◀ 7. Back-up ring A
▶B◀ 8. O-ring
▶B◀ 9. Back-up ring B
10. Fuel injector
11. Gasket
▶A◀ 12. Corrugated washer

REMOVAL SERVICE POINTS

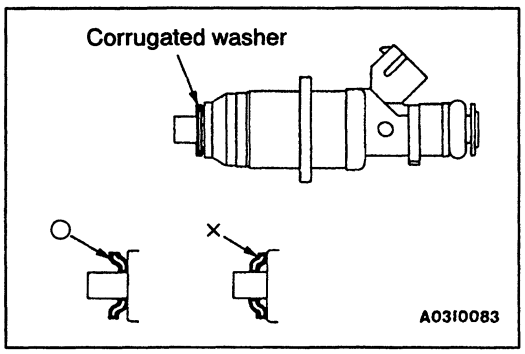
◀A▶ INJECTOR HARNESS CONNECTOR DISCONNECTION

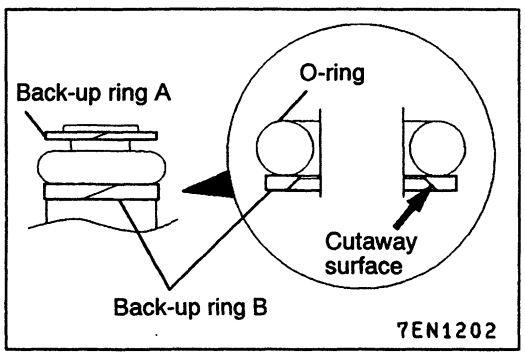
Caution
Disconnect the battery (–) cable from its terminal before carrying out this operation.

◀B▶ DELIVERY PIPE ASSEMBLY/FUEL INJECTOR ASSEMBLY REMOVAL

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

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





INSTALLATION SERVICE POINTS

▶A◀ CORRUGATED WASHER INSTALLATION

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

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

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

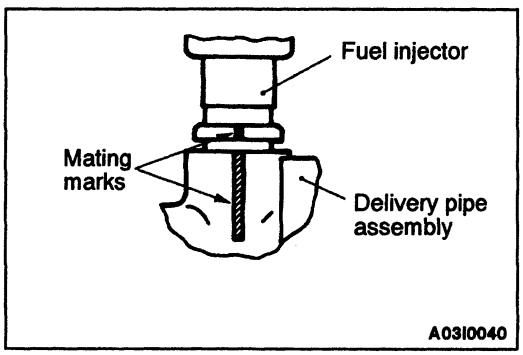
Caution
1. **Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.**
2. **Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up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

▶C◀ FUEL INJECTOR ASSEMBLY/DELIVERY PIPE ASSEMBLY INSTALLATION

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

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

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

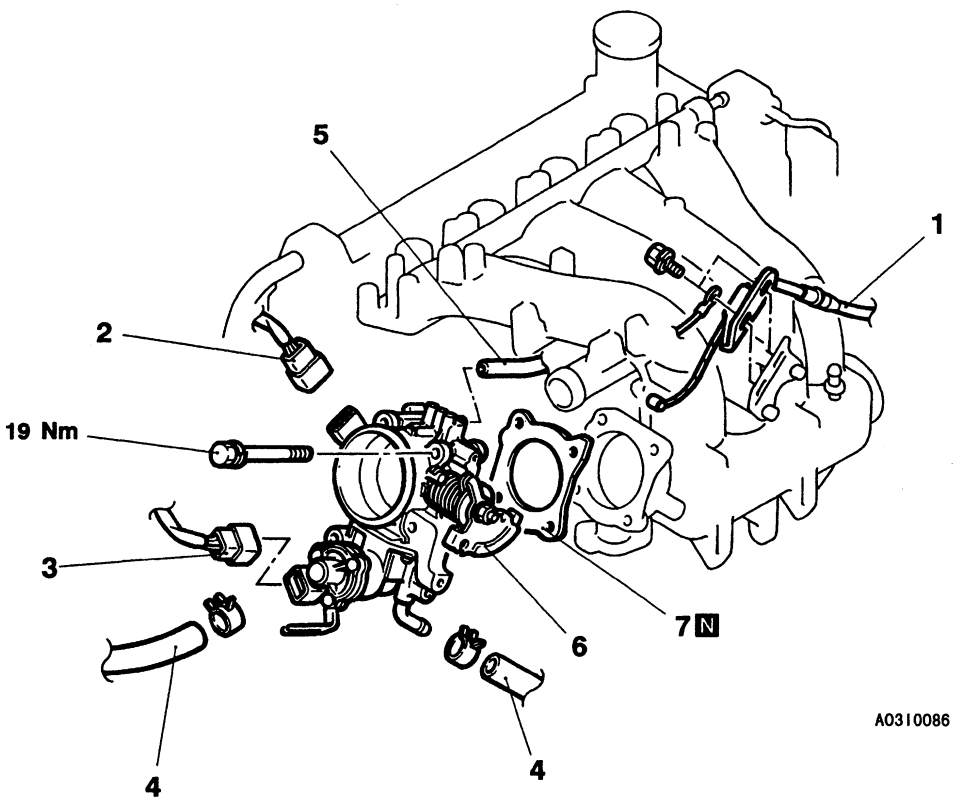


4. Align the mating marks on the delivery pipe assembly and the fuel injector, and then install the delivery pipe assembly with the injector assembly still attached.

THROTTLE BODY

REMOVAL AND INSTALLATION

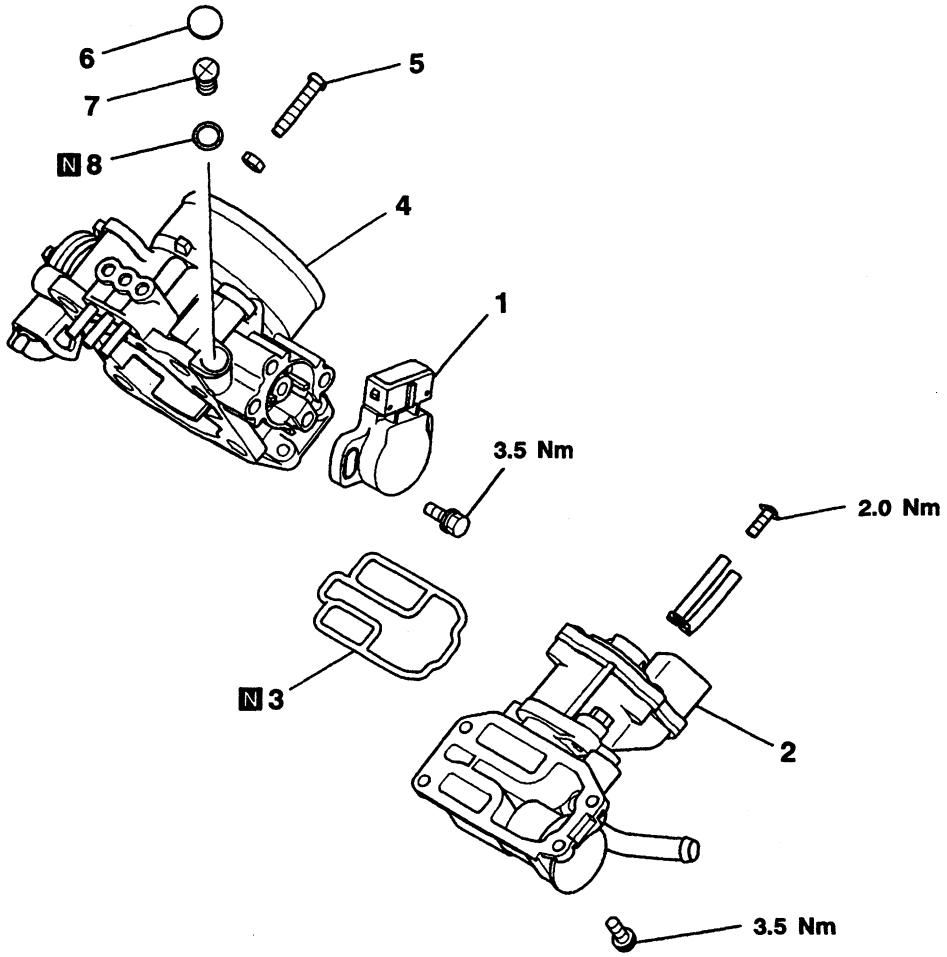
Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying
- Air Intake Hose Removal and Installation
- Accelerator Cable Adjustment <after installation only>



Removal steps
1. Accelerator cable connection
2. Throttle position sensor connector
3. Idle speed control servo connector
4. Water hose connection
5. Vacuum hose connection
6. Throttle body
▶A◀ 7. Throttle body gasket

NOTE
Removal and installation service points are the same as before.

DISASSEMBLY AND REASSEMBLY



Disassembly steps

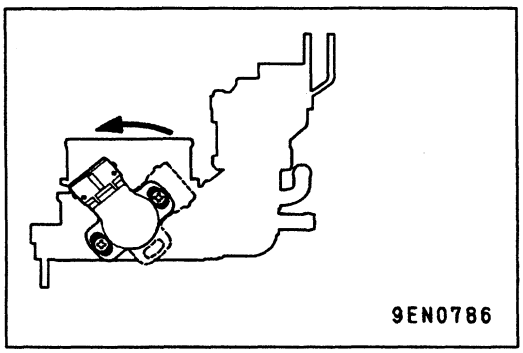
▶A◀ 1. Throttle position sensor
2. Idle speed control body assembly
3. O-ring
4. Throttle body
5. Fixed SAS
6. Cap
7. Speed adjusting screw
8. O-ring

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

CLEANING THROTTLE BODY PARTS

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

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



REASSEMBLY SERVICE POINT

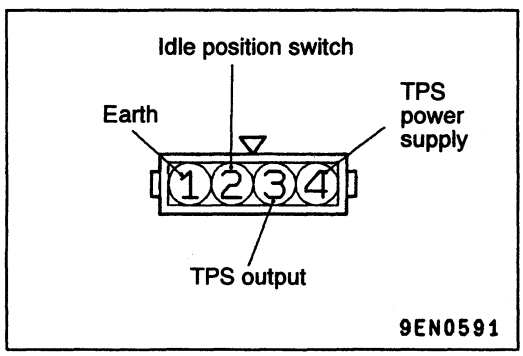
▶A◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

1. Install the TPS so that it faces as shown in the illustration, and then tighten it with the screw.
2. Connect a multimeter between terminal (4) (TPS power supply) and terminal (3) (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
3. Check the continuity between terminal (2) (idle position switch) and terminal (1) (earth) of the TPS connector when the throttle valve is fully closed and fully open.

   Normal condition:

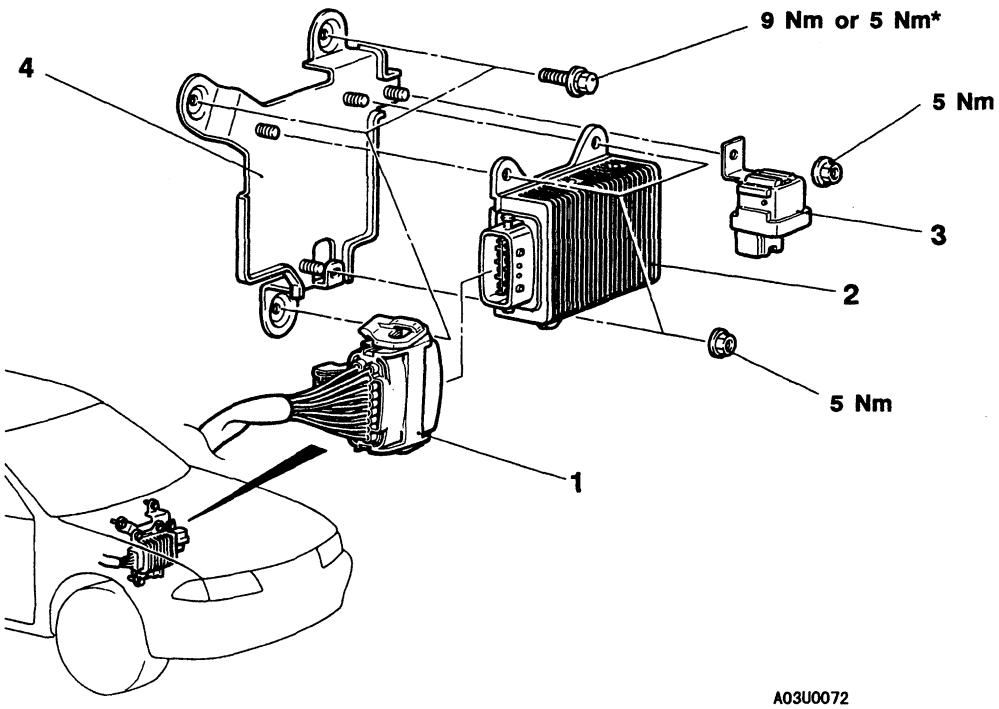
Throttle valve condition	Continuity
Fully closed	Continuity
Fully open	No continuity

   If there is no continuity when the throttle valve is fully closed, turn the TPS body anti-clockwise and then check again.
4. If there is an abnormality, replace the TPS.



INJECTOR DRIVER

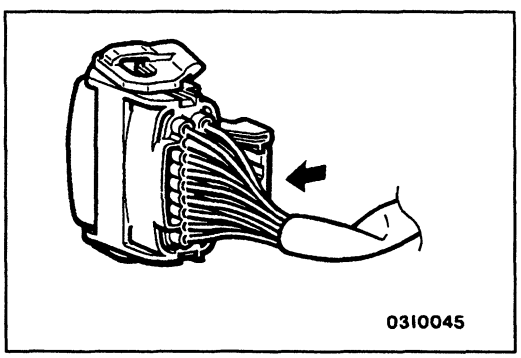
REMOVAL AND INSTALLATION



Removal steps

◀A▶ 1. Injector driver connector
◀B▶ 2. Injector driver
3. Injector driver control relay
4. Bracket

NOTE
Tightening torque marked with * is for earth bolts (head marking: E).



REMOVAL SERVICE POINTS

◀A▶ INJECTOR DRIVER CONNECTOR DISCONNECTION

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

Caution
Disconnect the battery (–) cable from its terminal before carrying out this operation.

◀B▶ INJECTOR DRIVER REMOVAL

Caution
The injector driver will become hot after the vehicle has been driven, so take care when handling it.