FUEL

CONTENTS

GASOLINE DIRECT INJECTION (GDI)

CONTENTS

GENERAL

OUTLINE OF CHANGES

The following service procedures for items which are different from before have been established to correspond to the addition of vehicles with 4G6-GDI engine.
Other service procedures are the same as before.

- An integrated-type accelerator pedal position sensor has been adopted.
- A GDI ECO indication lamp has been adopted.
- The fuel feed pipe and fuel return pipe shapes have been changed.

SERVICE SPECIFICATIONS

Items	Standard value
Adjustment voltages (1) and (2) of accelrator pedal position sensor V	0.5 - 0.9
Resistance (1) and (2) of accelerator pedal position sensor kΩ	3.5 - 6.5

TROUBLESHOOTING

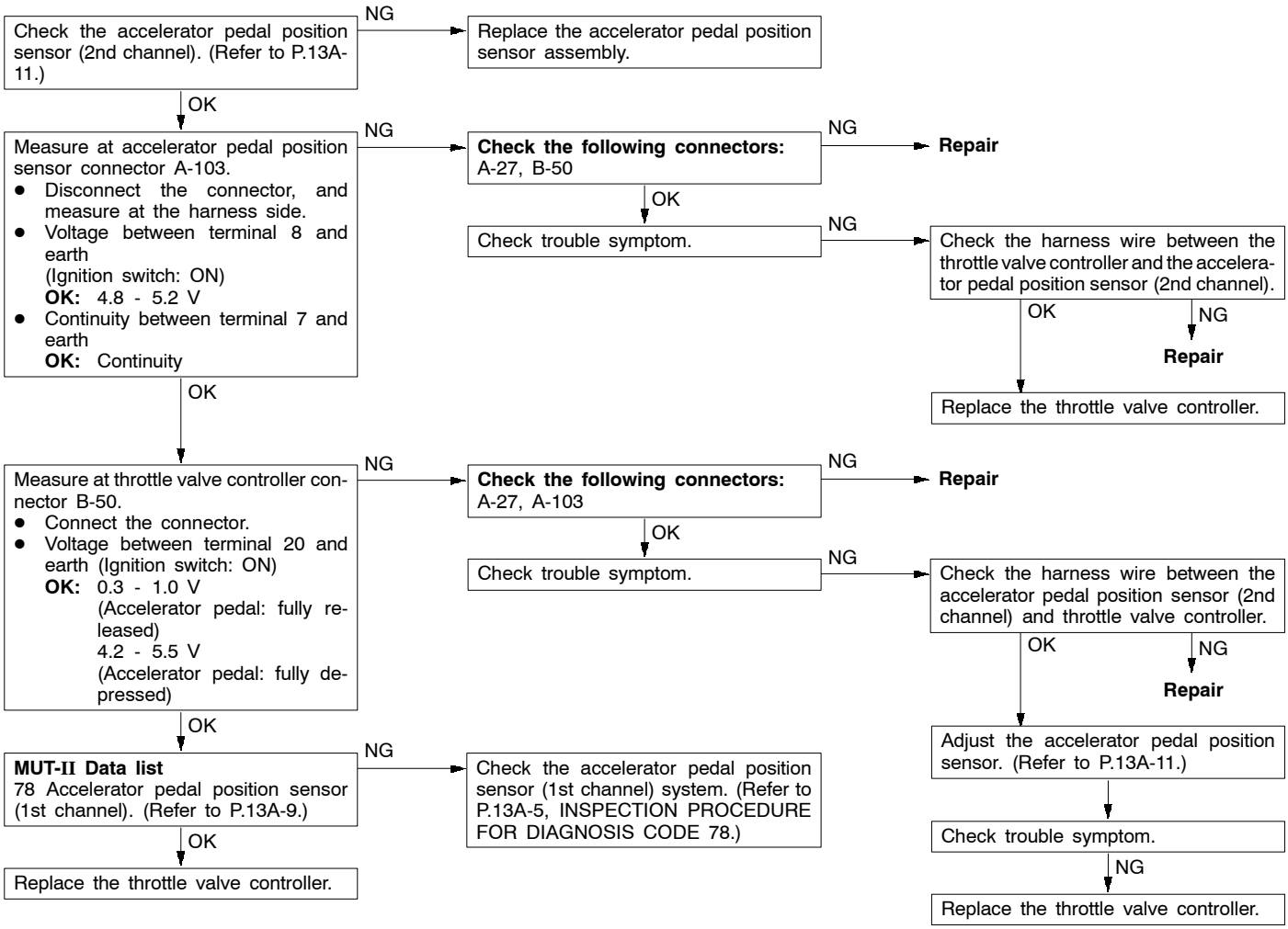
INSPECTION CHART FOR DIAGNOSIS CODES

Diagnosis code Nos. 77 and 78 have been changed in line with the adoption of an integrated-type accelerator pedal position sensor. Other items are the same as before.

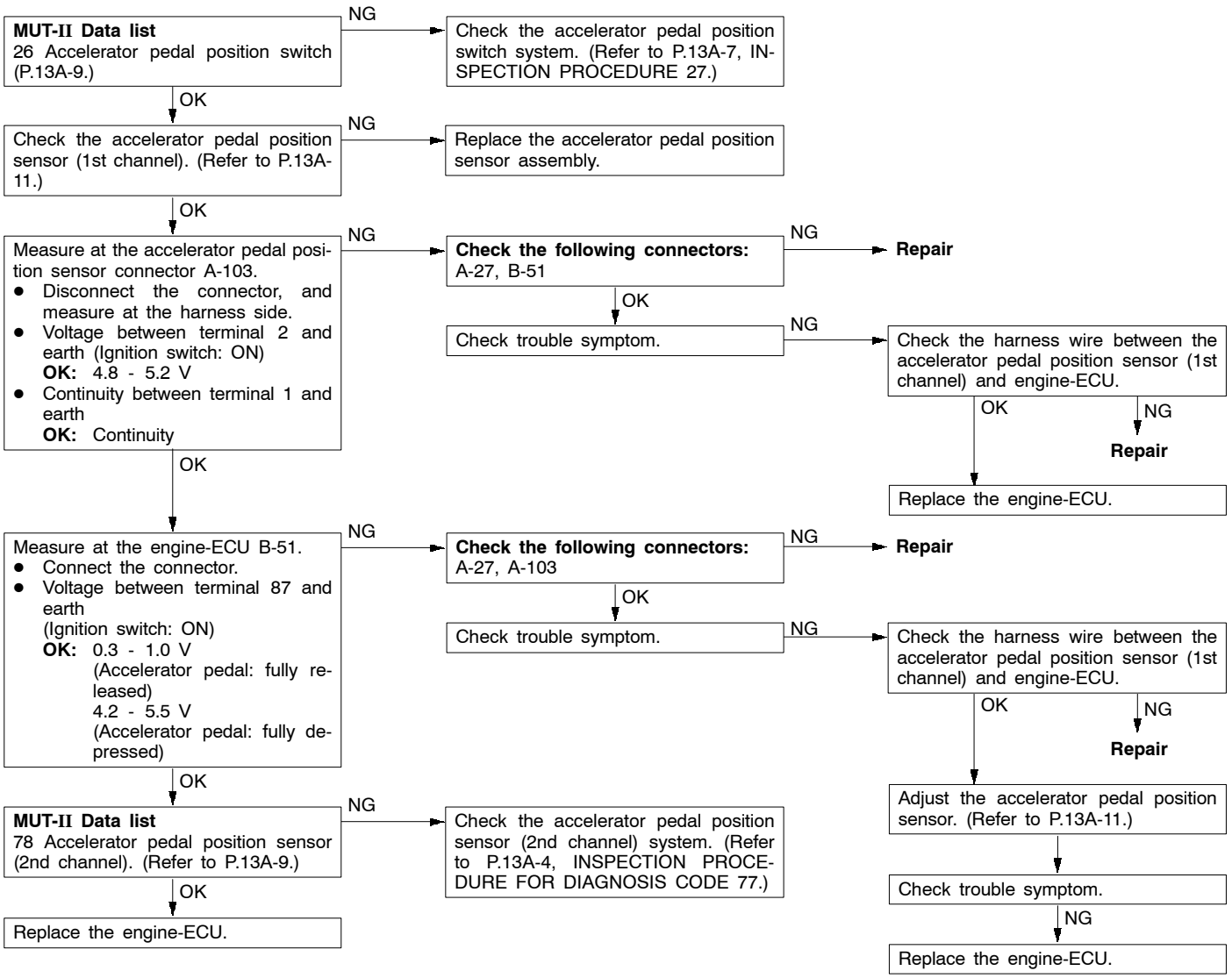
Code No.	Diagnosis item	Reference page
77	Accelerator pedal position sensor (2nd channel) system	13A-4
78	Accelerator pedal position sensor (1st channel) system	13A-5

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No.77 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (1st channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator position sensor (2nd channel) system is 0.2 V or less for one second. or ● Output voltage of the accelerator pedal position sensor (1st channel) is 2.5 V or less, and output voltage of the accelerator pedal position sensor (2nd channel) is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor output voltages (1st and 2nd channels) exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly).	● Malfunction of the accelerator pedal position sensor (2nd channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (2nd channel) system, or poor connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (2nd channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator position sensor (1st channel) system is 0.2 V or less for one second. or ● Output voltage of the accelerator pedal position sensor (2nd channel) is 2.5 V or less, and (1st channel) output voltage of the accelerator pedal position sensor is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor (1st and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly). or ● Although the accelerator pedal position switch is on, 1st-channel output voltage of the accelerator pedal position sensor exceeds 1.1 V for one second.	● Malfunction of the accelerator pedal position sensor (1st channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (1st channel) system, or poor connector contact ● ON-seizure of the accelerator pedal position switch ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS

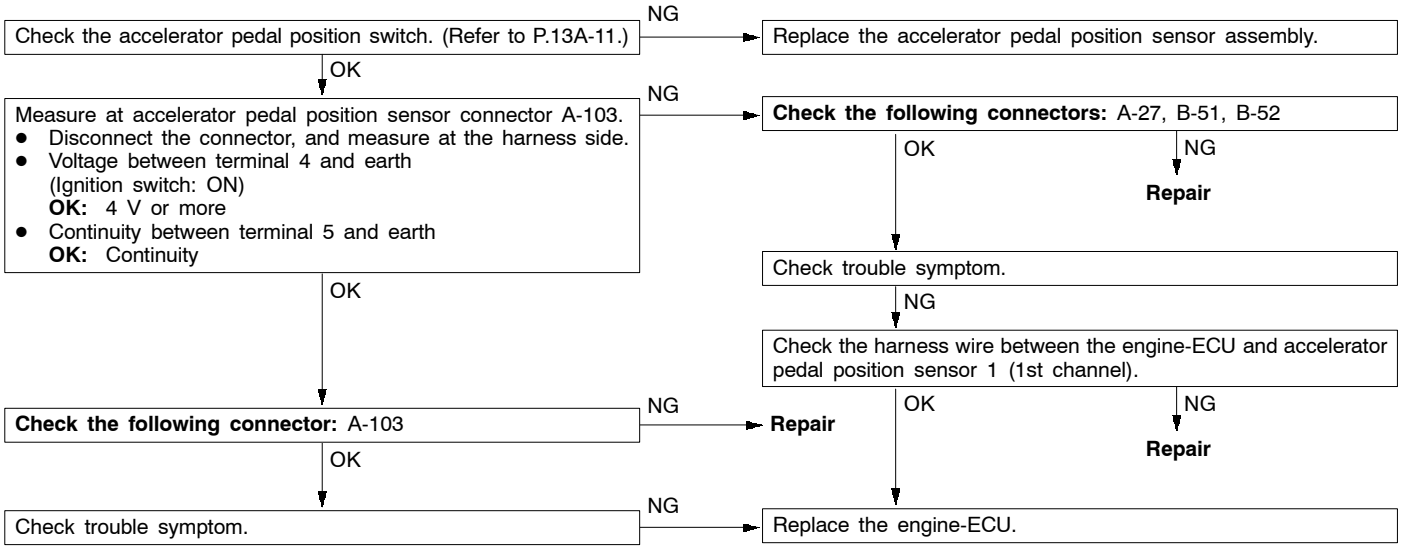
Inspection procedure No. 27 has been changed in line with the adoption of an integrated-type accelerator pedal position sensor. Inspection procedure Nos. 36 and 37 have been added in line with the adoption of a GDI indication lamp. Other items are the same as before.

Trouble symptom		Inspection procedure No.	Reference page
GDI ECO indication lamp system	The GDI ECO indication lamp does not illuminate.	36	13A-8
	The GDI ECO indication lamp remains on (does not extinguish).	37	13A-8

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

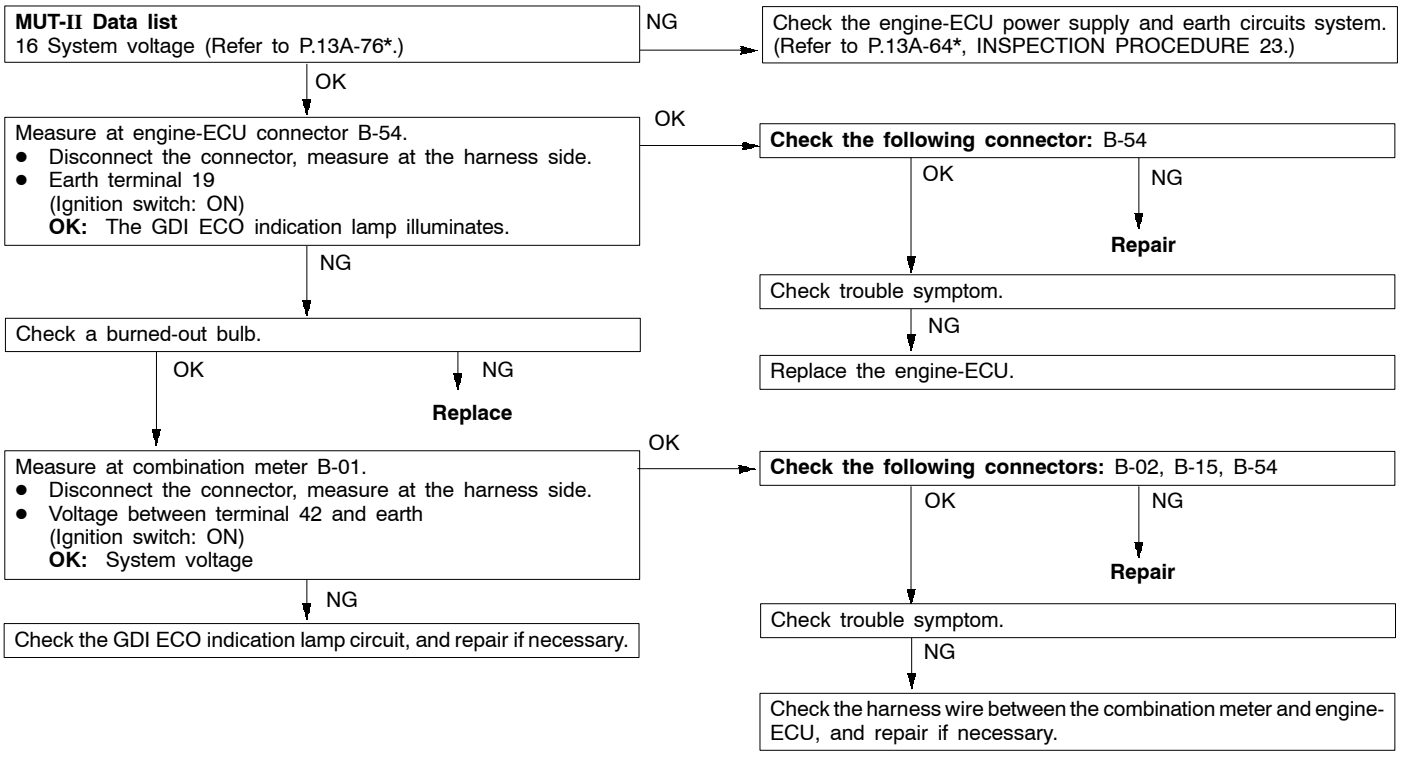
INSPECTION PROCEDURE 27

Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-ECU. The engine-ECU controls idle speed, based on this signal.	• Maladjustment of the accelerator cable • Maladjustment of the accelerator pedal position switch • Open circuit or short-circuited harness wire in the accelerator pedal position switch system, or poor connector contact • Malfunction of the engine-ECU



INSPECTION PROCEDURE 36

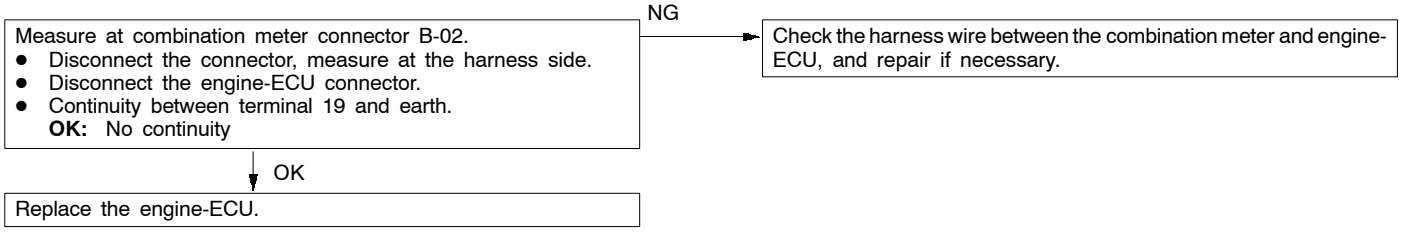
The GDI ECO indication lamp does not illuminate.	Probable cause
If the GDI ECO indication lamp does not illuminate after turning on the ignition switch, the causes listed in the right column are suspected.	• Burned-out GDI ECO indication lamp bulb • Open circuit or short -circuited harness wire in the GDI ECO indication lamp circuit • Malfunction of the engine-ECU



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

INSPECTION PROCEDURE 37

The GDI ECO indication lamp remains on (does not extinguish).	Probable cause
If the GDI ECO indication lamp does not extinguish during high load operation, the causes listed int right column are suspected.	• Short circuit between the GDI ECO indication lamp and engine-ECU • 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 vehicle does not move forward.

NOTE
1.*1: When the accelerator pedal position sensor (1st channel) output is 500 - 900 mV, the accelerator pedal position switch should normally change from ON to OFF. If this does not happen, adjust the accelerator pedal position sensor.
2.*2: Check if the difference in output between *2 and *3 is 4 V or more.

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
26	Accelerator pedal position switch	ignition switch: ON Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No. 27	13A - 7
			Depress the accelerator pedal slightly.	OFF		
77	Accelerator pedal position sensor (2nd channel)	ignition switch: ON	Release the accelerator pedal.	300 - 1,000 mV*2	Code No. 77	13A - 4
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 - 5,500 mV*3		
78	Accelerator pedal position sensor (1st channel)*1	ignition switch: ON	Release the accelerator pedal.	300 - 1,000 mV*2	Code No. 78	13A - 5
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,200 - 5,500 mV*3		

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement

Terminal No.	Check items	Check requirements (engine condition)		Normal condition
3	GDI ECO indication lamp	Engine: idling		0 - 3 mV
		Engine: When the accelerator pedal is suddenly depressed while the engine is idling		System voltage
57	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 - 1 V
			Depress the accelerator pedal slightly.	4 V or more
81	Power supply to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 - 5.5 V
87	Accelerator pedal position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.3 - 1.0 V*1
			Depress the accelerator pedal fully.	4.2 - 5.5 V*2

NOTE
Check if the difference in output between *1 and *2 is 4 V or more.

Engine-ECU Connector Terminal Arrangement

Terminal No.	Check items	Standard value, Normal condition (Check requirements)
57 - 53	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)

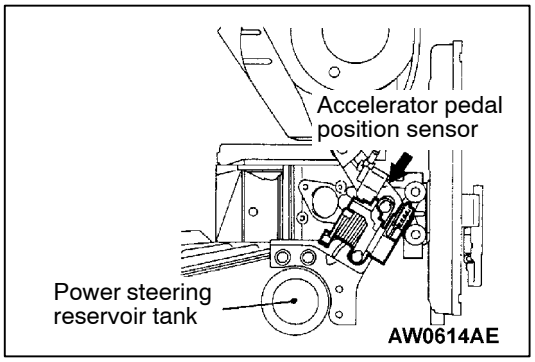
CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

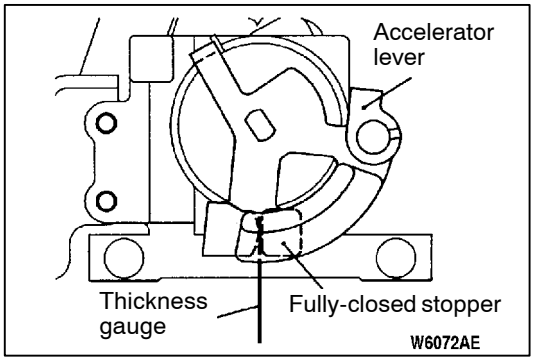
TERMINAL VOLTAGE CHECK CHART

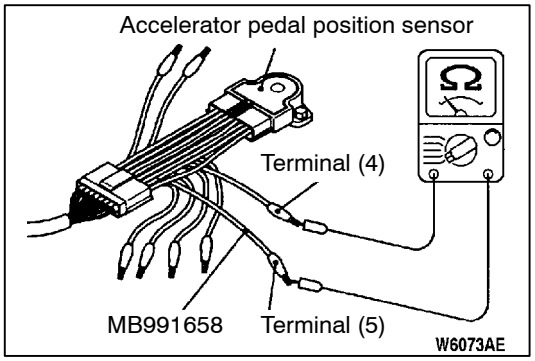
Throttle Valve Controller Connector Terminal Arrangement

Terminal No.	Check items	Requirements		Normal value
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.3 - 1.0 V*1
			Depress the accelerator pedal fully.	4.5 - 5.5 V*2

NOTE
Check if the difference in output between *1 and *2 is 4 V or more.







ON-VEHICLE SERVICE

1. ACCELERATOR PEDAL POSITION SWITCH AND ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

Caution

(1) The accelerator pedal position sensor is adjusted correctly at the time of shipment from the factory, and so it should not normally be moved.

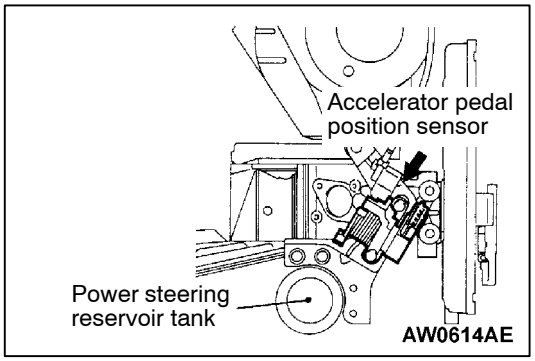
(2) If adjustment does become necessary, use the following procedure.

<When using the MUT-II>

(1) Connect the MUT-II to the diagnosis connector.
(2) Remove the two accelerator pedal position sensor assembly mounting bolts, and then insert a thickness gauge with a thickness of 0.60 mm in between the accelerator lever and the fully-closed stopper.
(3) Turn the ignition switch to ON (without starting the engine).
(4) Loosen the accelerator pedal position sensor mounting bolt, and then turn the accelerator pedal position sensor anti-clockwise as far as it will go.
(5) Check that the idle switch turns on at this time.
(6) Turn the accelerator pedal position sensor clockwise until the point is found where the idle switch turns off. Securely tighten the accelerator pedal position sensor mounting bolt at this point.
(7) Check that the accelerator pedal position sensor (1st channel) output at this time is within the standard value range.

Standard value: 0.5 - 0.9 V

(8) Turn the ignition switch to the LOCK (OFF) position.
(9) Remove the thickness gauge and then install the accelerator pedal position sensor assembly.
(10) Remove the MUT-II.

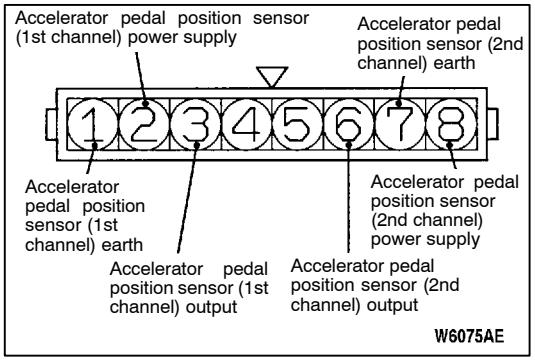


2. ACCELERATOR PEDAL POSITION SENSOR INSPECTION

(1) Disconnect the accelerator pedal position sensor connector.

(2) Measure the resistance between accelerator pedal position sensor connector terminal (1) [accelerator pedal position sensor (1st channel) earth] and terminal (2) [accelerator pedal position sensor (1st channel) power supply], and between terminal (7) [accelerator pedal position sensor (2nd channel) earth] and terminal (8) [accelerator pedal position sensor (2nd channel) power supply].

Standard value: 0.5 - 0.9 kΩ



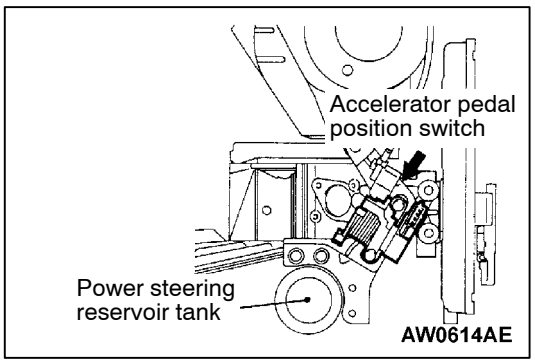
(3) Measure the resistance between accelerator pedal position sensor connector terminal (2) [accelerator pedal position sensor (1st channel) power supply] and terminal (3) [accelerator pedal position sensor (1st channel) output], and between terminal (8) [accelerator pedal position sensor (2nd channel) power supply] and terminal (6) [accelerator pedal position sensor (2nd channel) output].

Normal condition:

When accelerator pedal is gently depressed	Changes comparatively smoothly in proportion to the accelerator pedal depression amount

(4) If the measured values are outside the standard value range, or if the resistance does not change smoothly, replace the accelerator pedal position sensor.

NOTE
After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A - 11.)



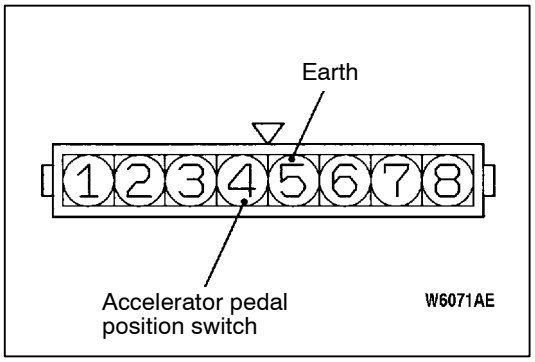
3. ACCELERATOR PEDAL POSITION SWITCH INSPECTION

(1) Disconnect the accelerator pedal position sensor connector.

(2) Check the continuity between accelerator pedal position sensor connector terminal (4) (accelerator pedal position switch) and terminal (5) (earth).

Normal condition:

Accelerator pedal	Continuity
Depressed	No continuity
Released	Continuity



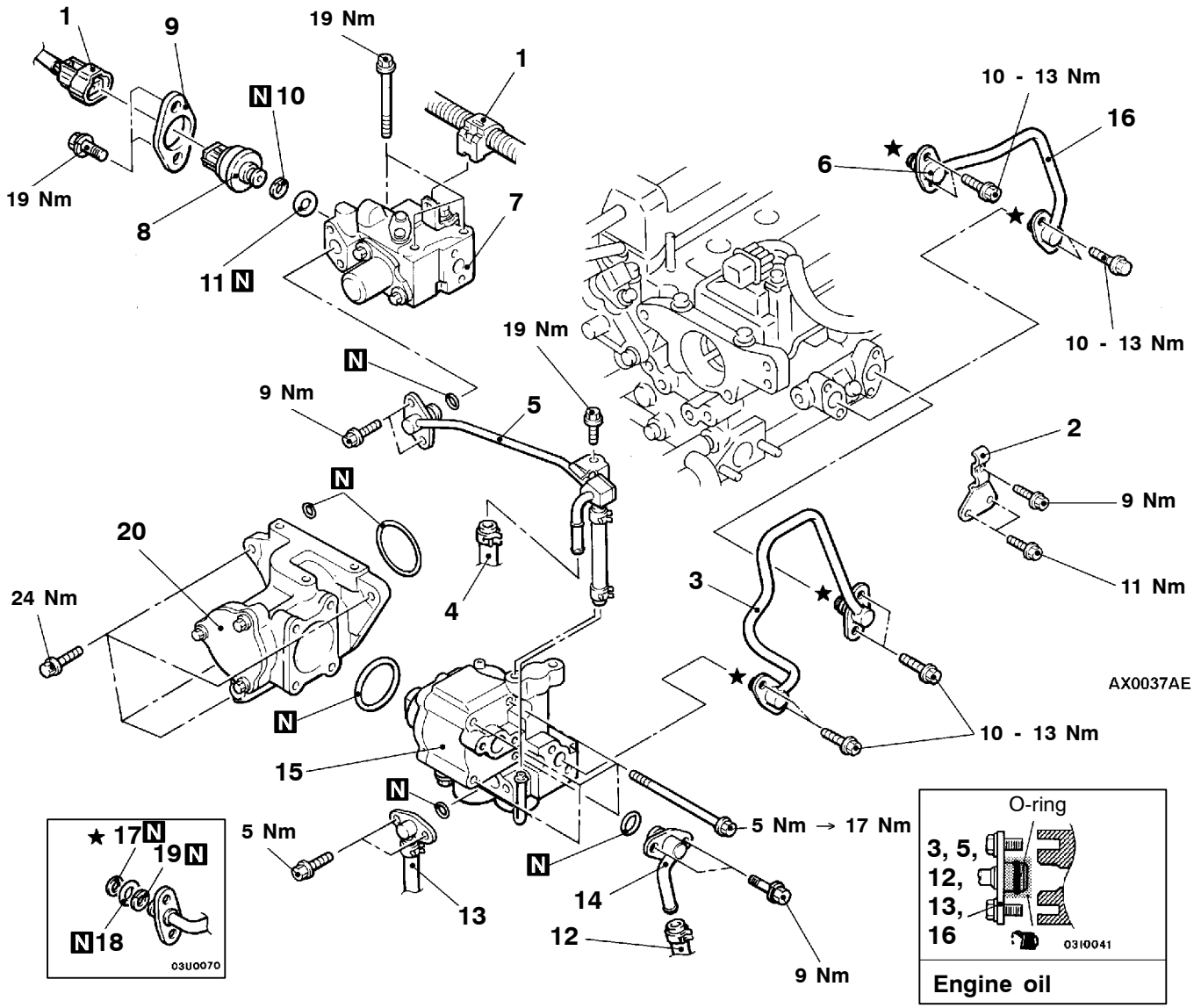
(3) If there is a malfunction, replace the accelerator pedal position sensor.

NOTE
After replacement, adjust the accelerator pedal position sensor. (Refer to P.13A - 11.)

FUEL PUMP (HIGH PRESSURE) AND FUEL PRESSURE REGULATOR (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of fuel discharge <before removal only>
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Fuel Leak Check <after installation only>



Fuel pressure regulator (High pressure) removal steps

1. Harness connector and clamp
4. Fuel return hose connection
▶C◀ 5. Low-pressure fuel pipe
▶C◀ 6. Fuel return pipe connection
7. Fuel pressure regulator (high pressure) assembly
◀A▶ ▶G◀ 8. Fuel pressure sensor
◀A▶ ▶G◀ 9. Flange
▶F◀ 10. O-ring
▶F◀ 11. Back-up ring
▶B◀ 17. Back-up ring A
▶B◀ 18. O-ring
▶B◀ 19. Back-up ring

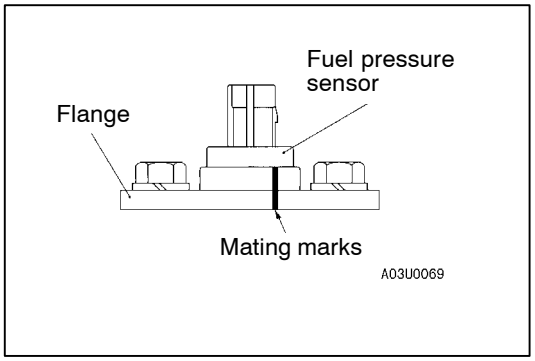
Fuel pump (High pressure) removal steps

- Intake manifold removal (Refer to GROUP 15.)

2. Fuel pipe clamp
▶C◀ 3. Fuel feed pipe
▶C◀ 5. Low-pressure fuel pipe
12. Fuel return hose connection
▶E◀ 13. Fuel pressure hose connection
14. Fuel nipple assembly
▶D◀ 15. Fuel pump (high pressure)
▶B◀ 17. Back-up ring A
▶B◀ 18. O-ring
▶B◀ 19. Back-up ring

Pump camshaft case removal steps

7. Fuel pressure regulator (high pressure) assembly
▶D◀ 15. Fuel pump (high pressure)
▶C◀ 16. Fuel return pipe
▶B◀ 17. Back-up ring A
▶B◀ 18. O-ring
▶B◀ 19. Back-up ring
▶A◀ 20. Pump camshaft case

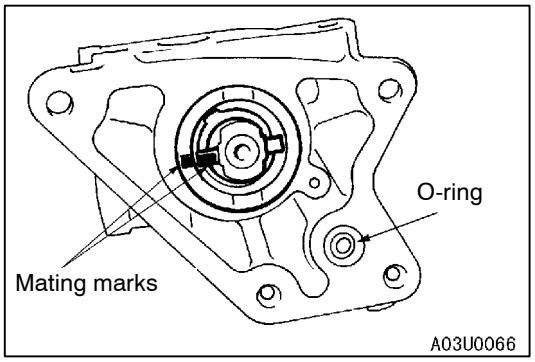


REMOVAL SERVICE POINT

◀A▶ FUEL PRESSURE SENSOR/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.

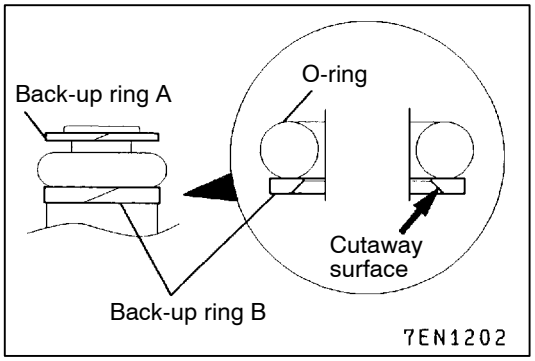


INSTALLATION SERVICE POINTS

▶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.

Caution
Take care not to drop the O-ring.



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

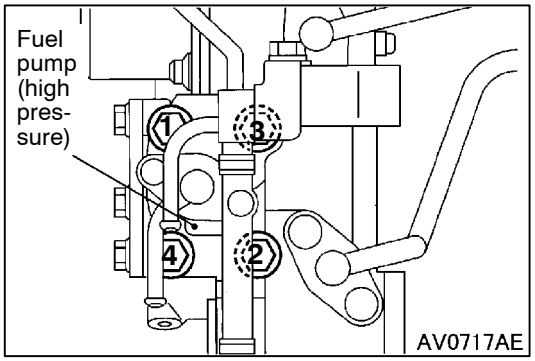
Install the back-up rings and the O-ring as shown in the illustration.

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 RETURN PIPE/LOW-PRESSURE FUEL PIPE/FUEL FEED PIPE 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), fuel pressure regulator (high pressure) or the delivery pipe assembly.



▶D◀ FUEL PUMP (HIGH PRESSURE) INSTALLATION

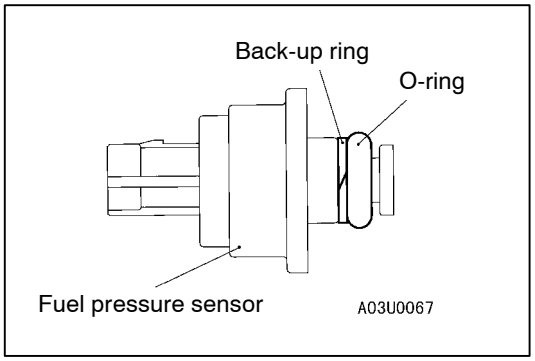
Use a torque wrench with a precision of 0.5 Nm to tighten the fuel pump mounting bolts according to the following procedure.
1. Tighten the bolts to 5 Nm in the order shown in the illustration.
2. Tighten the bolts to 17 Nm in the order shown in the illustration. The overall difference in tightening torque between the four bolts should be within 2 Nm.

▶E◀ 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.



▶F◀ BACK-UP RING/O-RING INSTALLATION

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

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

▶G◀ FUEL PRESSURE SENSOR/FLANGE INSTALLATION

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

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

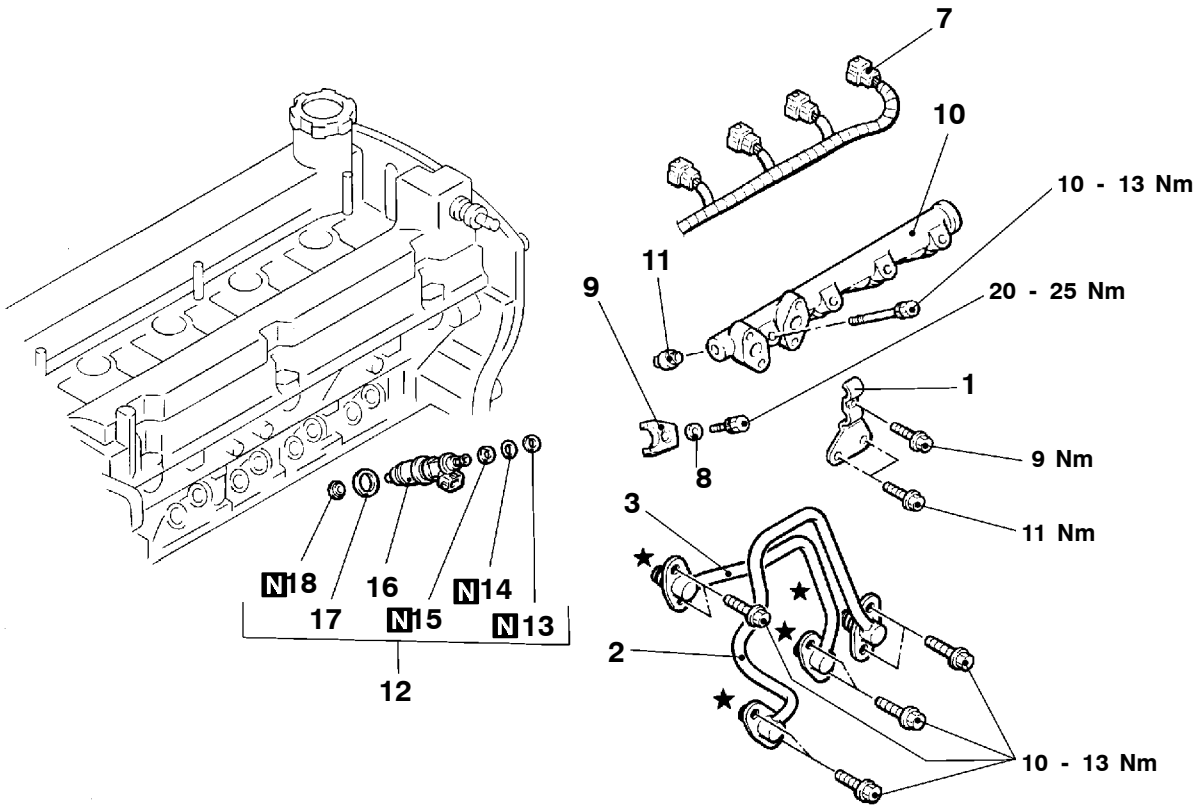
2. Align the mating marks which were made at the time of removal, and then install the fuel pressure sensor and flange to the fuel pressure regulator (high pressure) assembly.

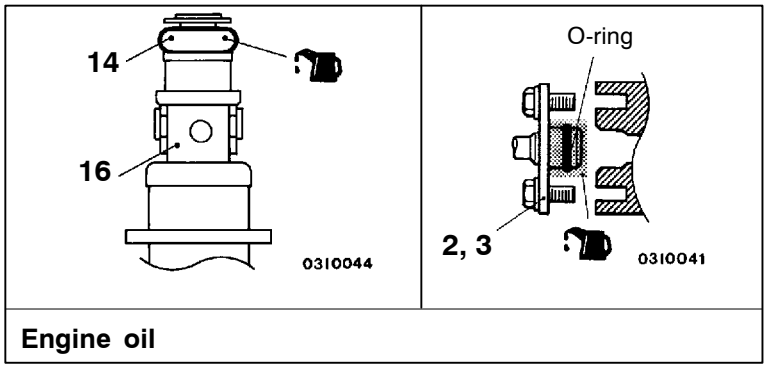
   Caution
   If replacing the fuel pressure sensor with a new part, the sensor and flange should be replaced together.

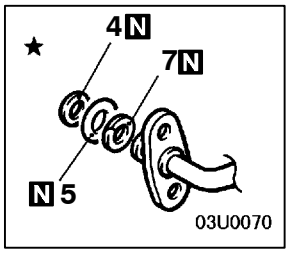
INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of fuel discharge <before removal only>
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Intake Manifold Removal and Installation
- Fuel Leak Check <after installation only>







AX0038AE

Removal steps

1. Fuel pipe clamp
2. ▶D◀ Fuel feed pipe
3. ▶D◀ Fuel return pipe
4. ▶C◀ Back-up ring A
5. ▶C◀ O-ring
6. ▶C◀ Back-up ring B
7. ◀A▶ Injector harness connector
8. Washer
9. Injector holder
10. ◀B▶ ▶B◀ Delivery pipe assembly
11. Insulator
12. ◀B▶ ▶B◀ Fuel injector assembly
13. Back-up ring
14. O-ring
15. Back-up ring
16. Fuel injector
17. Gasket
18. ▶A◀ Corrugated washer

REMOVAL SERVICE POINTS

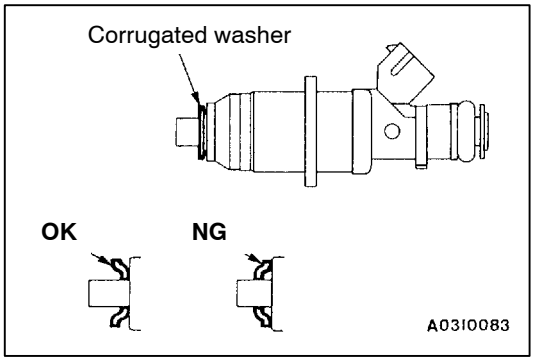
◀A▶ INJECTOR HARNESS CONNECTOR DISCONNECTION

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.**

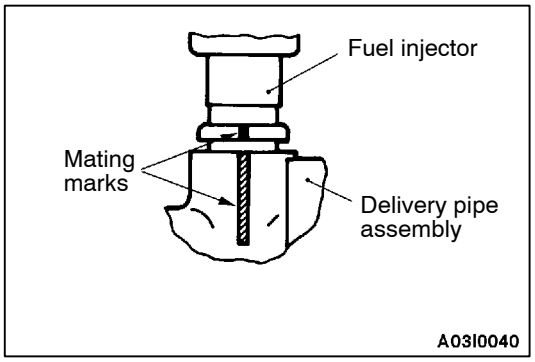
▶B◀ FUEL INJECTOR ASSEMBLY/DELIVERY PIPE ASSEMBLY INSTALLATION

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

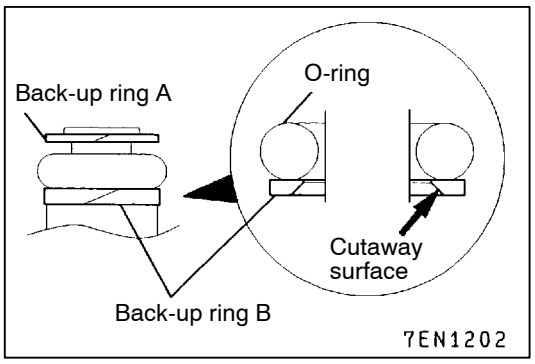
   Caution
   Take care not to let any of the engine oil get inside the delivery pipe assembly.

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.



▶C◀ 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)**

▶D◀ FUEL RETURN PIPE/FUEL FEED PIPE 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), fuel pressure regulator (high pressure) and delivery pipe.

MULTIPOINT FUEL INJECTION (4G6-MPI)

CONTENTS

MULTIPOINT FUEL INJECTION (MPI)

GENERAL

OUTLINE OF CHANGE

The following service procedures have been established in line with the addition of SPACE RUNNER vehicles with 4G63-MPI engine.

GENERAL INFORMATION

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

FUEL INJECTION CONTROL

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

A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors.

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

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

IDLE AIR CONTROL

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

IGNITION TIMING CONTROL

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

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-ECU that is related to the sensors and actuators can be read by means of the MUT-II. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Fan 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 Solenoid Valve Control
   Refer to GROUP 17.

GENERAL SPECIFICATIONS

Items			Specifications
Throttle body	Throttle bore mm		54
	Throttle position sensor		Variable resistor type
	Idle speed control servo		Stepper motor type (Stepper motor type by-pass air control system with the air volume limiter)
	Idle position switch		Rotary contact type, within throttle position sensor
Engine-ECU	Identification model No.	Except vehicles for Germany	E2T73675 <M/T> E2T76371 <A/T>
		Vehicles for Germany	E2T73676 <M/T> E2T76372 <A/T>
Sensors	Air flow sensor		Karman vortex type
	Barometric pressure sensor		Semiconductor type
	Intake air temperature sensor		Thermistor type
	Engine coolant temperature sensor		Thermistor type
	Oxygen sensor		Zirconia type
	Vehicle speed sensor		Magnetic resistive element type
	Inhibitor switch		Contact switch type
	Camshaft position sensor		Hall element type
	Crank angle sensor		Hall element type
	Detonation sensor		Piezoelectric type
	Power steering fluid pressure switch		Contact switch type

Items		Specifications
Actuators	Control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	CDH275
	EGR control solenoid valve	Duty cycle type solenoid valve
	Purge control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	Regulator pressure kPa	329

MULTIPOINT FUEL INJECTION SYSTEM DIAGRAM

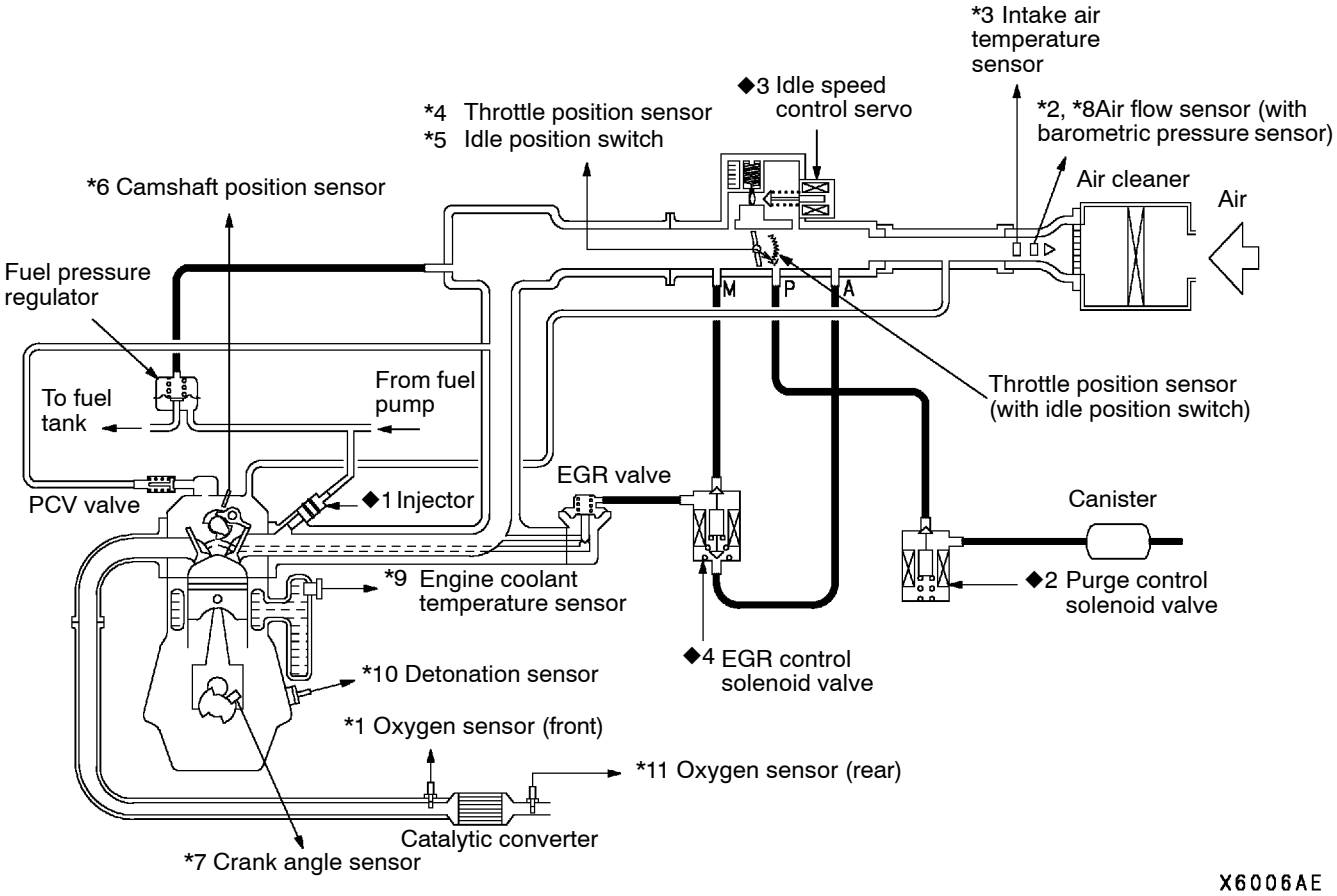
- *1 Oxygen sensor (front)
- *2 Air flow sensor
- *3 Intake air temperature sensor
- *4 Throttle position sensor
- *5 Idle position switch
- *6 Camshaft position sensor
- *7 Crank angle sensor
- *8 Barometric pressure sensor
- *9 Engine coolant temperature sensor
- *10 Detonation sensor
- *11 Oxygen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

- Power supply voltage
- Vehicle speed sensor
- A/C switch 1, 2
- Inhibitor switch
- Power steering fluid pressure switch
- Ignition switch - ST
- Ignition switch - IG
- Alternator FR terminal
- A/T-ECU

⇨ Engine-ECU <M/T> and Engine-A/T-ECU <A/T> ⇨

- ◆1 Injector
- ◆2 Purge control solenoid valve
- ◆3 Idle speed control servo
- ◆4 EGR control solenoid valve

- Fuel pump relay
- Control relay
- A/C power relay
- Engine warning lamp
- Diagnosis signal
- Ignition coil, power transistor
- Fan controller
- Alternator G terminal



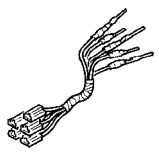
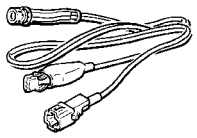
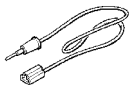
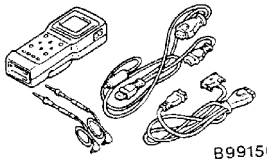
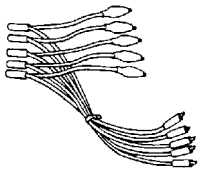
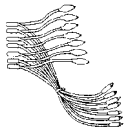
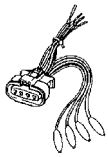
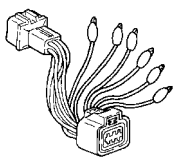
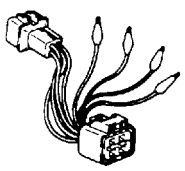
SERVICE SPECIFICATIONS

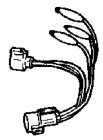
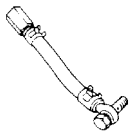
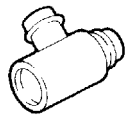
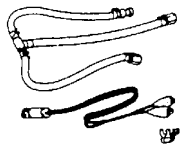
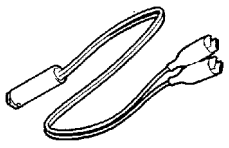
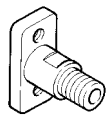
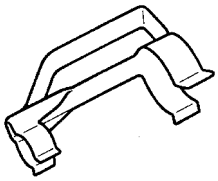
Items		Specifications
Basic idle speed r/min		750±50
Throttle position sensor adjusting voltage mV		400 - 1,000
Throttle position sensor resistance kΩ		3.5 - 6.5
Idle speed control servo coil resistance Ω		28 - 33 (at 20°C)
Intake air temperature sensor resistance kΩ	20°C	2.3 - 3.0
	80°C	0.30 - 0.42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

SEALANT

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

SPECIAL TOOLS

Tool	Number	Name	Use
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 • MPI system inspection
	MB991348	Test harness set	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
 MB991709	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
	MD998464	Test harness (4-pin, square)	Inspection of oxygen sensor (front)

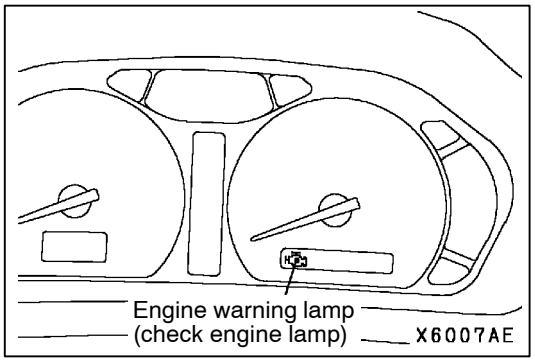
Tool	Number	Name	Use
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
	MD998706	Injector test set	Checking the spray condition of injectors
	MB991607	Injector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

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE
If the ECU is replaced, the immobilizer-ECU and ignition key should replaced together with it. Each ECU has an individual information for immobilizer-ECU, and the individual information is registerd in the immobilizer-ECU.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the Multipoint Fuel Injection (MPI) 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 <M/T> or Engine-A/T-ECU <A/T>
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
Ignition coil, power transister
Immobilizer system

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.

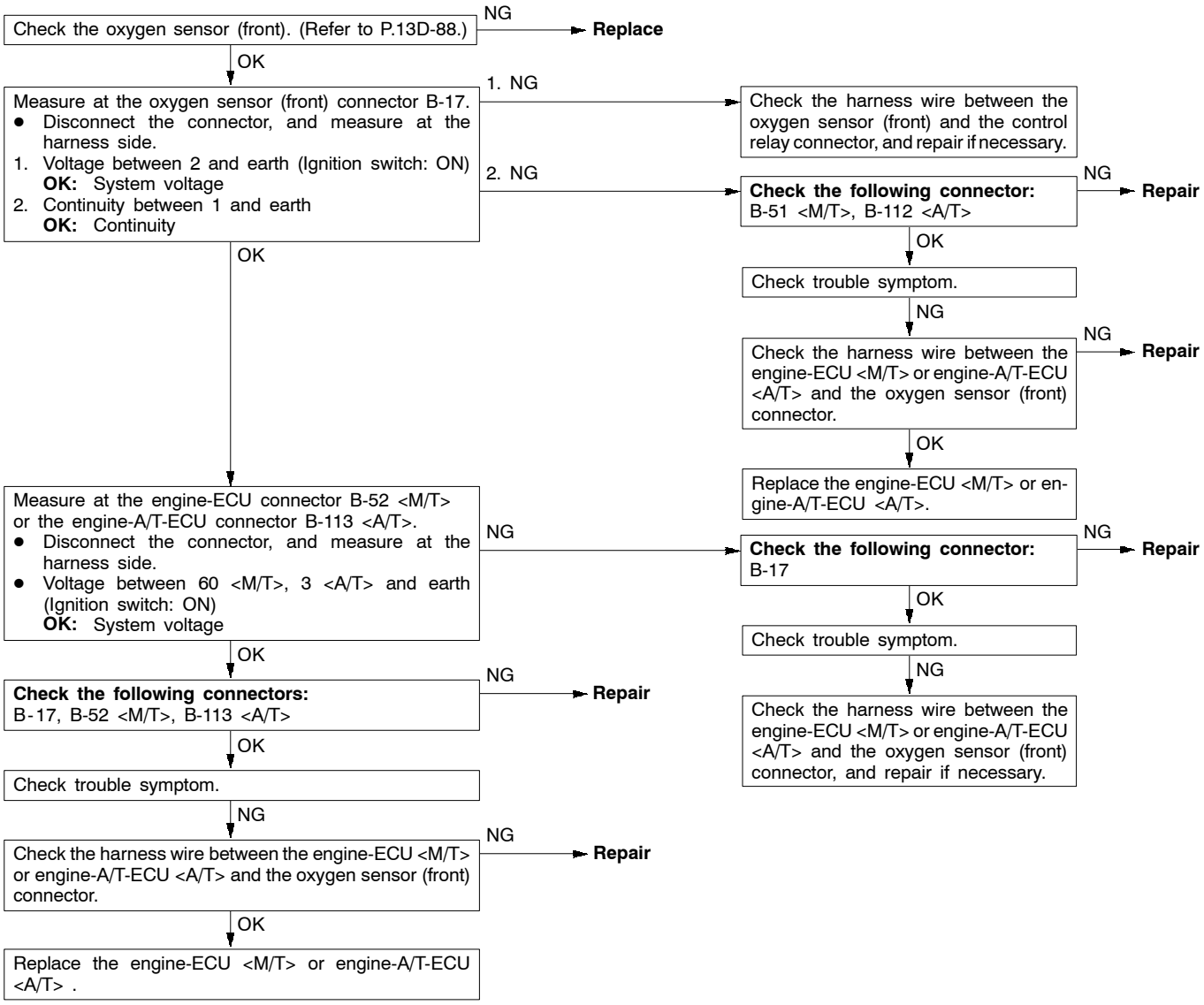
Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Camshaft position sensor	Injects fuel to all cylinders simultaneously. (However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Switches the ignition timing from ignition timing for super petrol to ignition timing for standard petrol.
Ignition coil, power transistor	Cuts off the fuel supply to cylinders with an abnormal ignition.
Oxygen sensor	Air/fuel ratio feedback control (closed loop control) is not performed.
Communication wire with transmission control unit <A/T>	Ignition timing is not retarded during transmission gear shifting (overall engine and transmission control).
Alternator FR terminal	Does not control the output of the alternator according to an electrical load. (works as a normal alternator)

INSPECTION CHART FOR DIAGNOSIS CODES

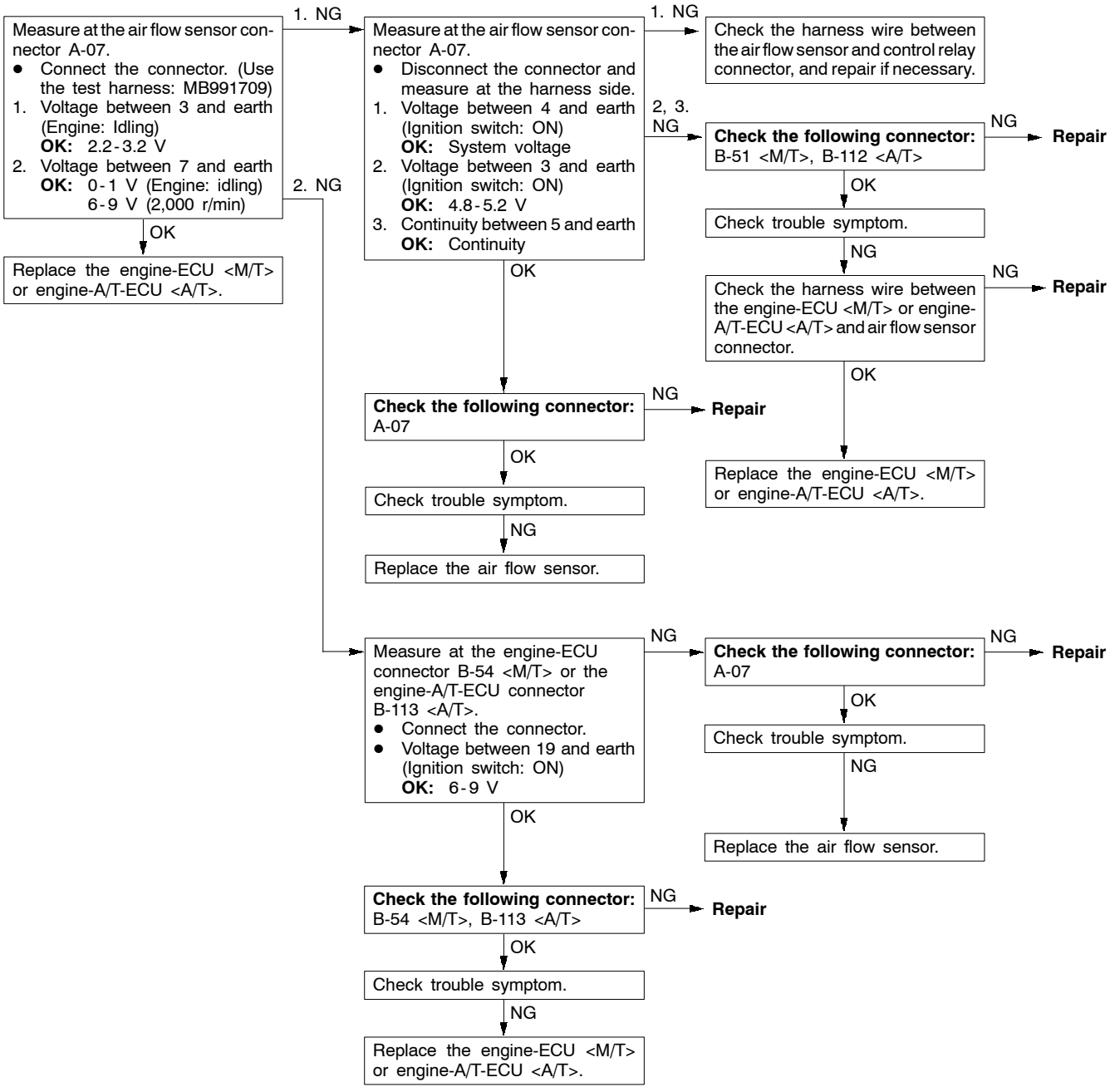
Code No.	Diagnosis item	Reference page
11	Oxygen sensor (front) system	13D-12
12	Air flow sensor system	13D-13
13	Intake air temperature sensor system	13D-14
14	Throttle position sensor system	13D-15
21	Engine coolant temperature sensor system	13D-16
22	Crank angle sensor system	13D-17
23	Camshaft position sensor	13D-18
24	Vehicle speed sensor system	13D-19
25	Barometric pressure sensor system	13D-20
31	Detonation sensor system	13D-21
41	Injector system	13D-21
44	Ignition coil system	13D-22
54	Immobilizer system	13D-23
59	Oxygen sensor (rear) system	13D-24
61	Communication wire with A/T-ECU system <A/T>	13D-25
64	Alternator FR terminal system	13D-25

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

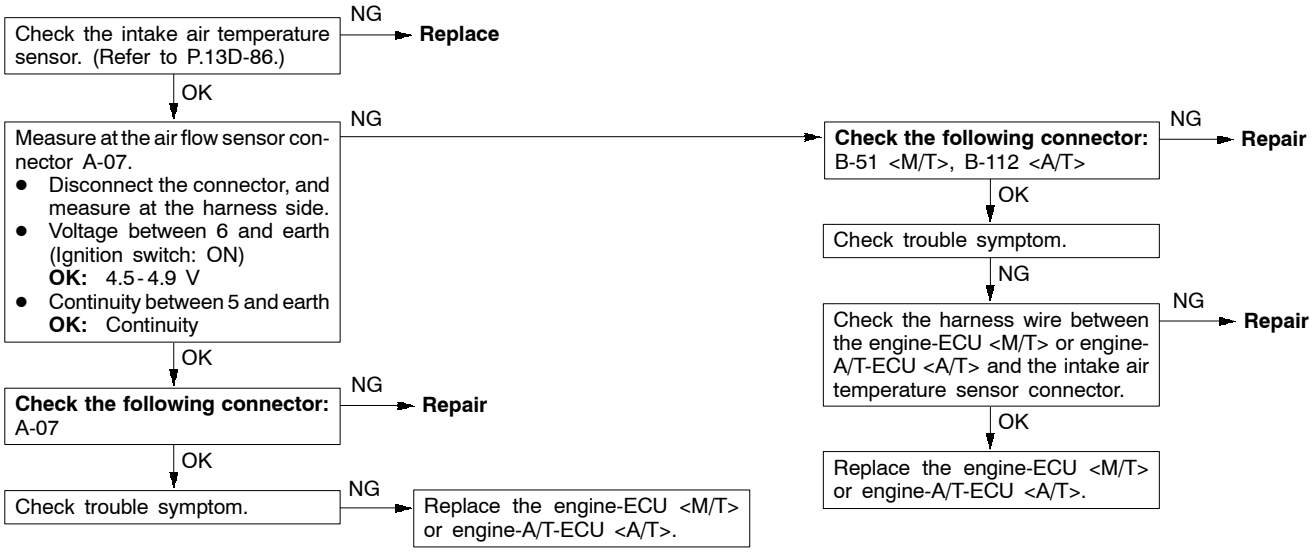
Code No. 11 Oxygen sensor (front) system	Probable cause
Range of Check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 - 50°C. ● Engine speed is approx. 2,000 - 3,000 r/min ● Vehicle is moving at constant speed on a flat, level road surface Set conditions ● The oxygen sensor (front) 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 (front) ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



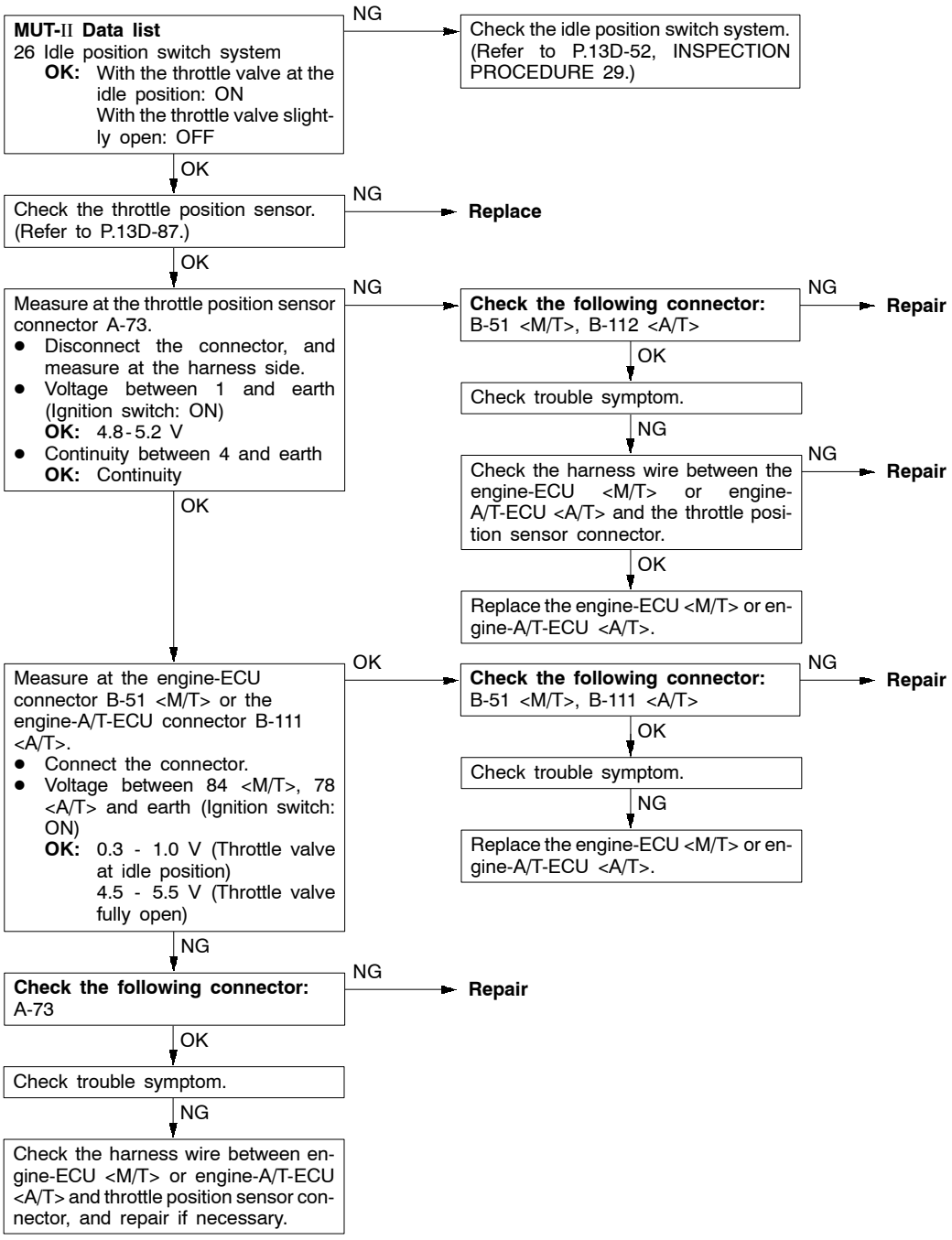
Code No. 12 Air flow sensor system	Probable cause
Range of Check ● Engine speed is 500 r/min or more. Set conditions ● Sensor output frequency is 3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Improper connector contact, open circuit or short-circuited harness wire of the air flow sensor ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



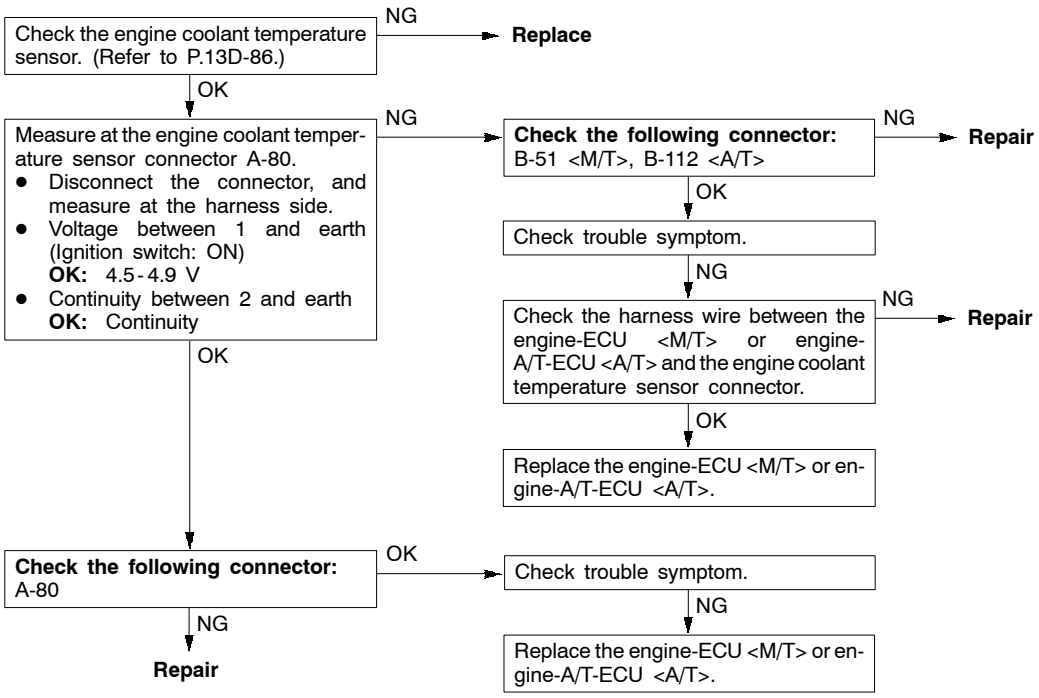
Code No. 13 Intake air temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions ● Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature of -45°C or less) for 4 seconds. or ● Sensor output voltage is 0.2V or less (corresponding to an intake air temperature of 125°C or more) for 4 seconds.	● Malfunction of the intake air temperature sensor ● Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



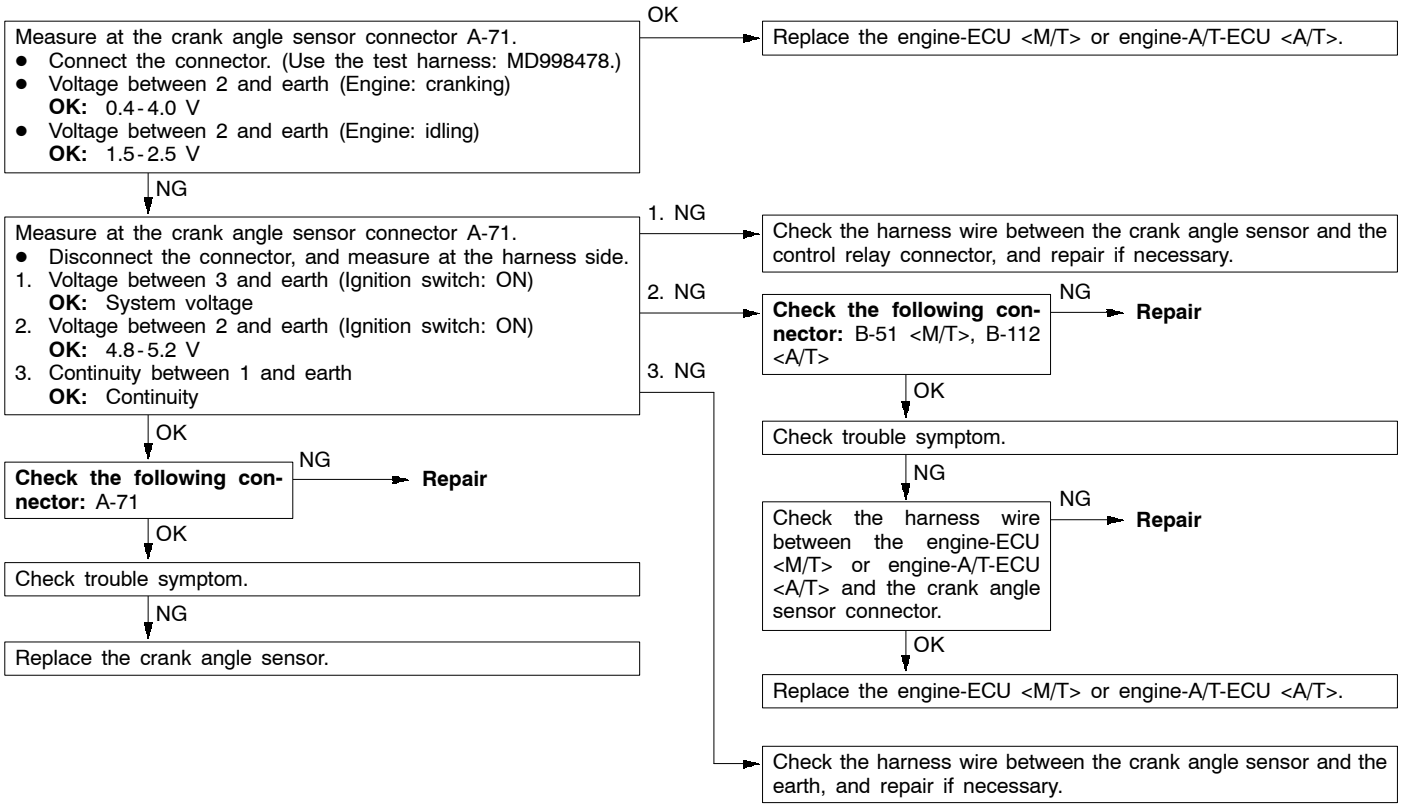
Code No. 14 Throttle position sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions ● When the idle position switch is ON, the sensor output voltage is 2 V or more for 4 seconds. or ● The sensor output voltage is 0.2 V or less for 4 seconds.	● Malfunction of the throttle position sensor or maladjustment ● Improper connector contact, open circuit or short-circuited harness wire of the throttle position sensor circuit ● Improper "ON" state of idle position switch ● Short circuit of the idle position switch signal line ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



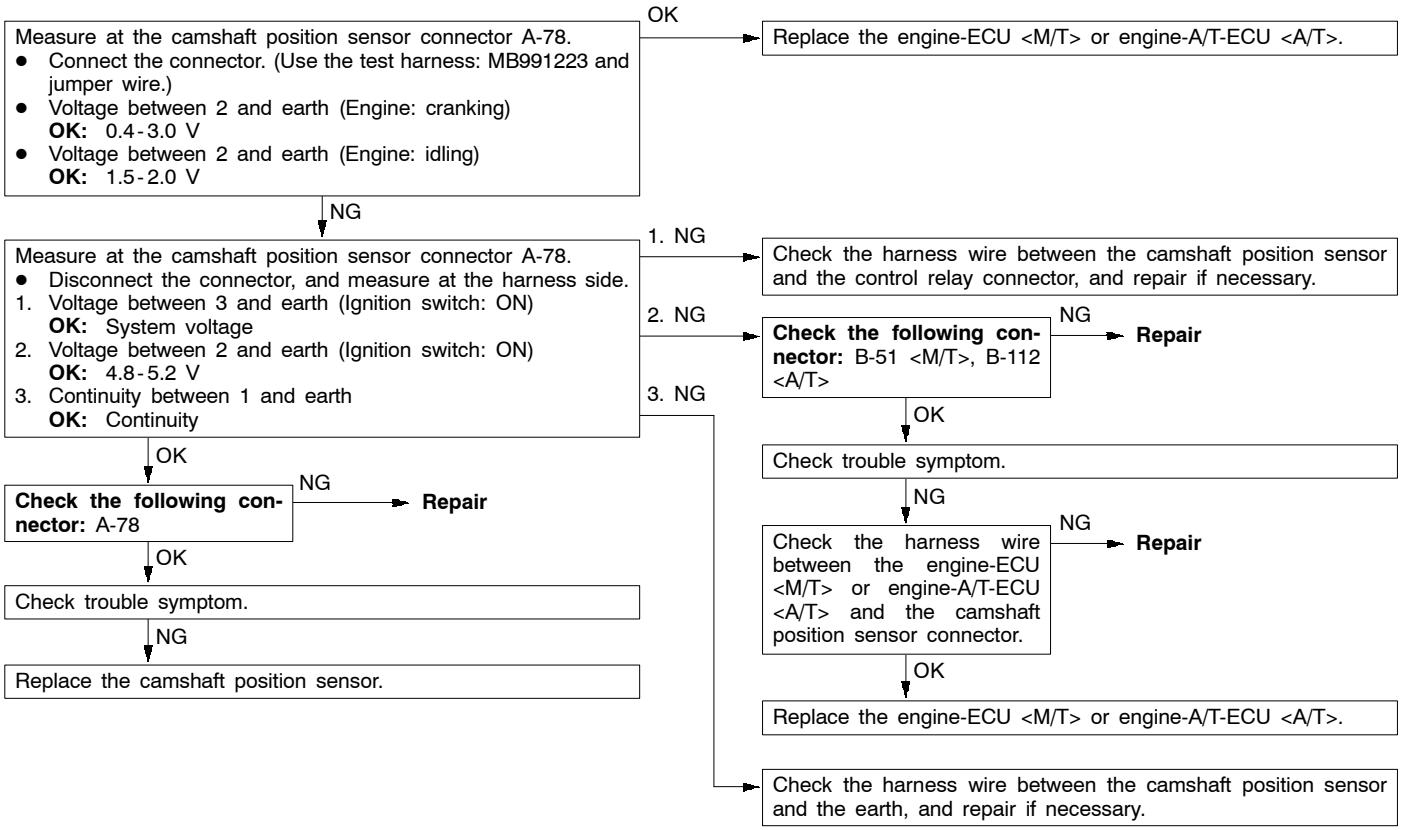
Code No. 21 Engine coolant temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions ● Sensor output voltage is 4.6 V or more (corresponding to an engine coolant temperature of -45°C or less) for 4 seconds. or ● Sensor output voltage is 0.1 V or less (corresponding to an engine coolant temperature of 140°C or more) for 4 seconds.	● Malfunction of the engine coolant temperature sensor ● Improper connector contact, open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>
Range of Check ● Ignition switch: ON ● Engine speed is approx. 50 r/min or more Set conditions ● The sensor output voltage increases from 1.6 V or less (corresponding to an engine coolant temperature of 40°C or more) to 1.6 V or more (corresponding to an engine coolant temperature of 40°C or less). ● After this, the sensor output voltage is 1.6 V or more for 5 minutes.	



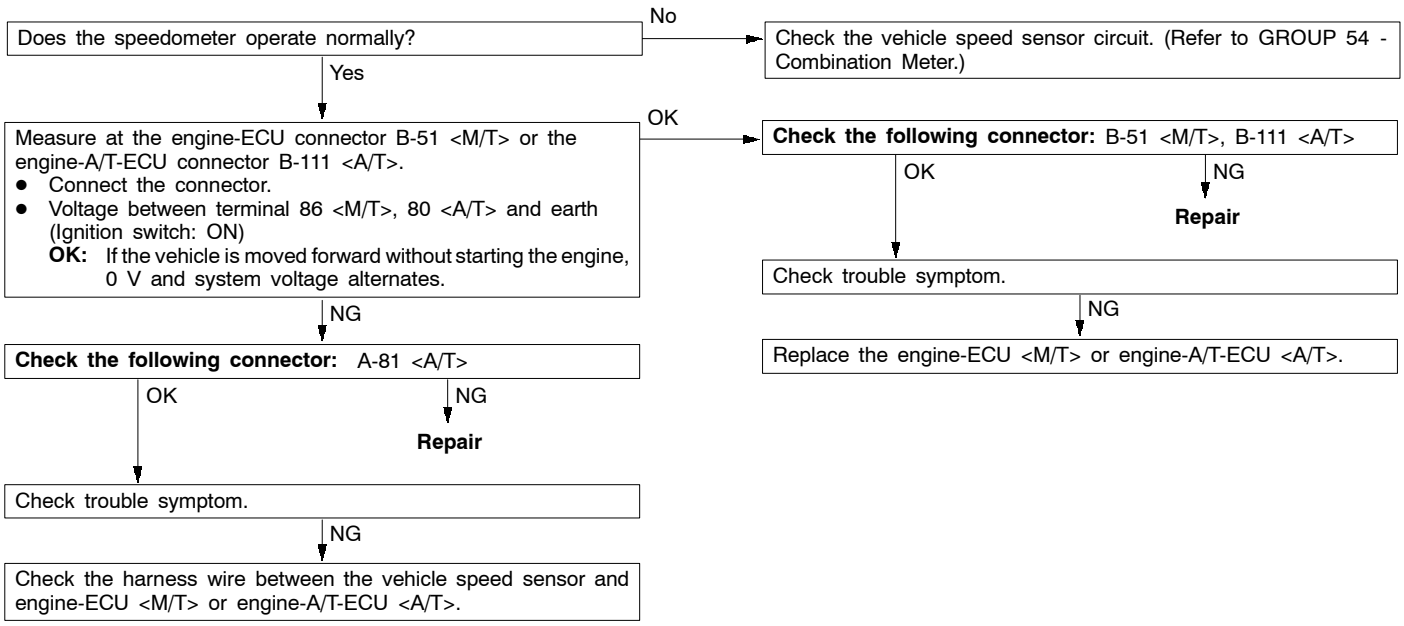
Code No. 22 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input.)	● Malfunction of the crank angle sensor ● Improper connector contact, open circuit or short-circuited harness wire of the crank angle sensor ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



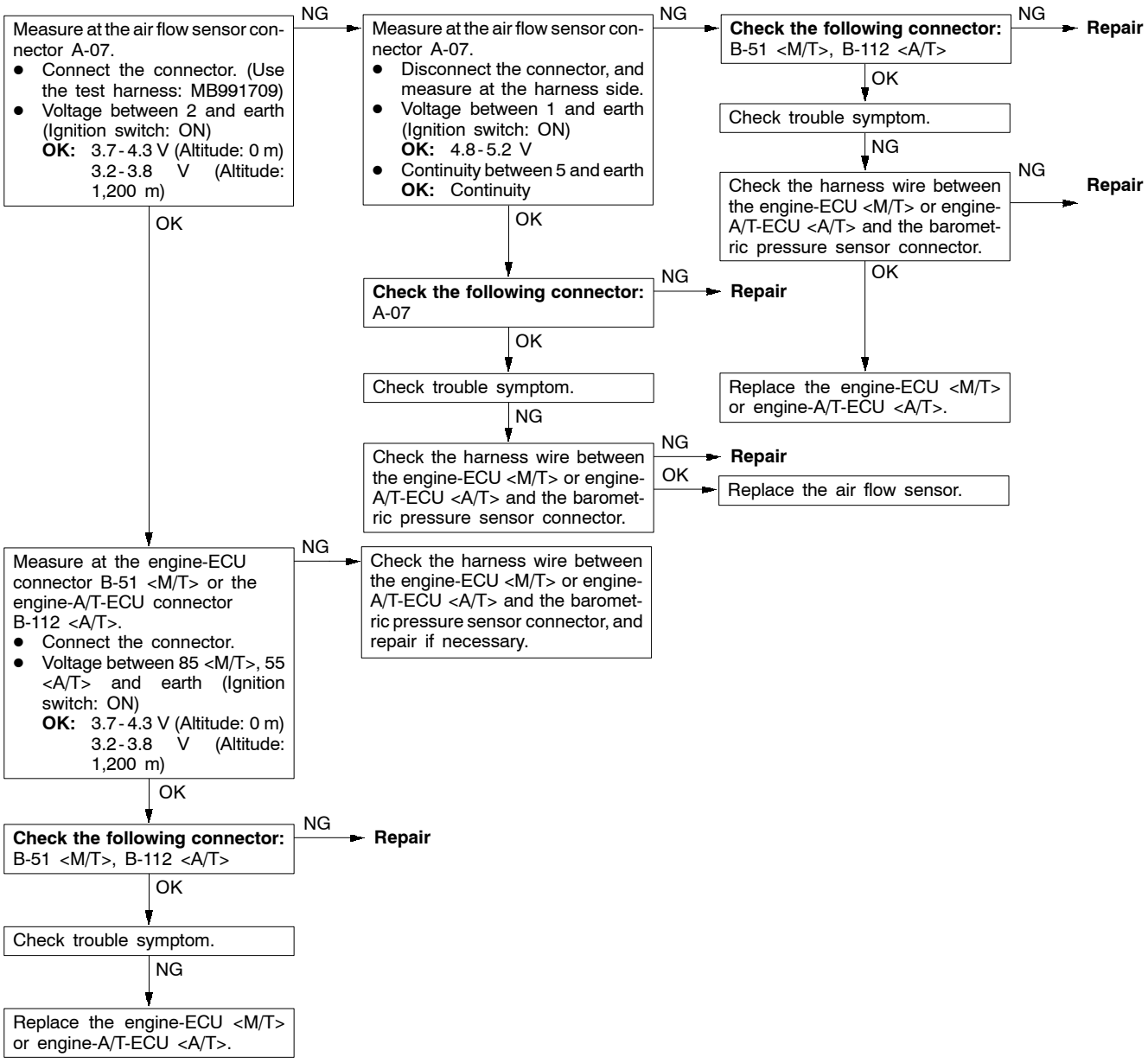
Code No. 23 Camshaft position sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Engine speed is approx. 50 r/min or more. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input.)	● Malfunction of the camshaft position sensor ● Improper connector contact, open circuit or short-circuited harness wire of the camshaft position sensor circuit ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



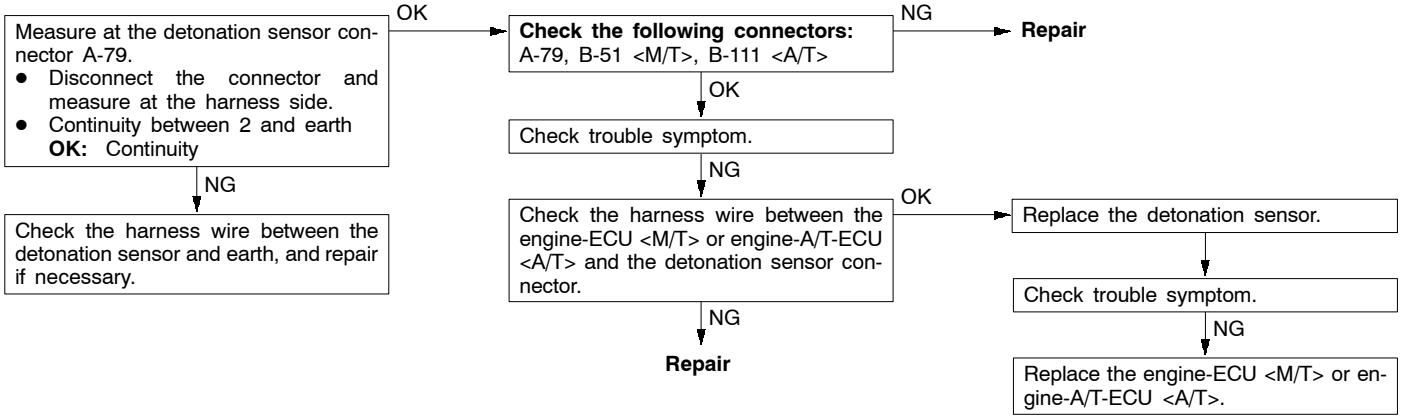
Code No. 24 Vehicle speed sensor system	Probable cause
Range of check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Idle position switch: OFF ● Engine speed is 3,000 r/min or more. ● Driving under high engine load conditions. 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 <M/T> or engine-A/T-ECU <A/T>



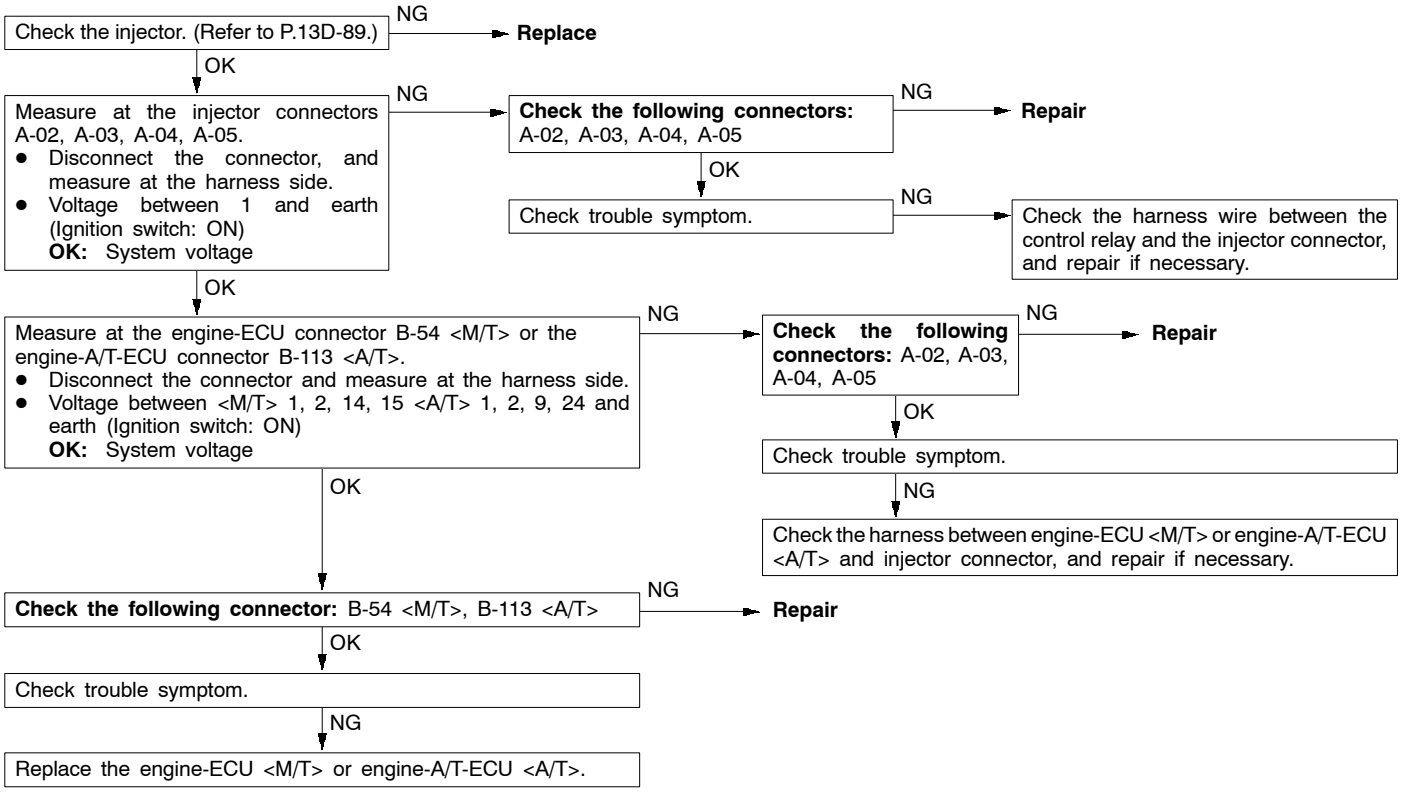
Code No. 25 Barometric pressure sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 4.5 V or more (corresponding to a barometric pressure of 114 kPa or more) for 4 seconds. or ● Sensor output voltage is 0.2 V or less (corresponding to a barometric pressure of 5.33 kPa or less) for 4 seconds.	● Malfunction of the barometric pressure sensor ● Improper connector contact, open circuit or short-circuited harness wire of the barometric pressure sensor circuit ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



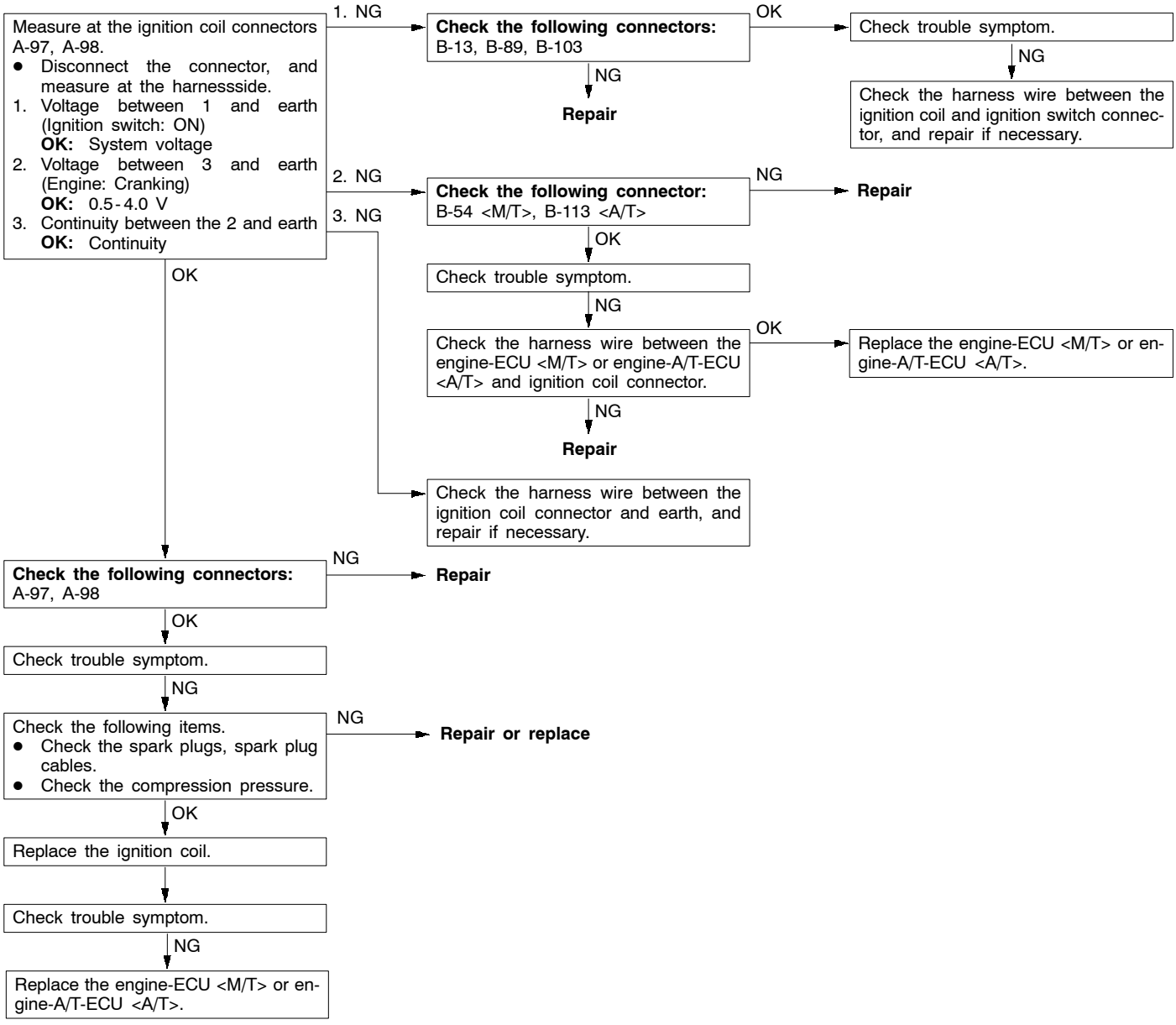
Code No. 31 Detonation sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Engine speed is approx. 5,000 r/min or more Set conditions The change in the detonation sensor output voltage (detonation sensor peak voltage at each 1/2 revolution of the crankshaft) is less than 0.06 V for 200 times in succession.	● Malfunction of the detonation sensor ● Improper connector contact, open circuit or short-circuited harness wire of the detonation sensor circuit ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



Code No. 41 Injector system	Probable cause
Range of Check ● Engine speed is approx. 50 - 1,000 r/min ● The throttle position sensor output voltage is 1.15 V or less. ● Actuator test by MUT-II is not carried out. Set conditions ● Surge voltage of injector coil is not detected for 4 seconds.	● Malfunction of the injector ● Improper connector contact, open circuit or short-circuited harness wire of the injector circuit ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>

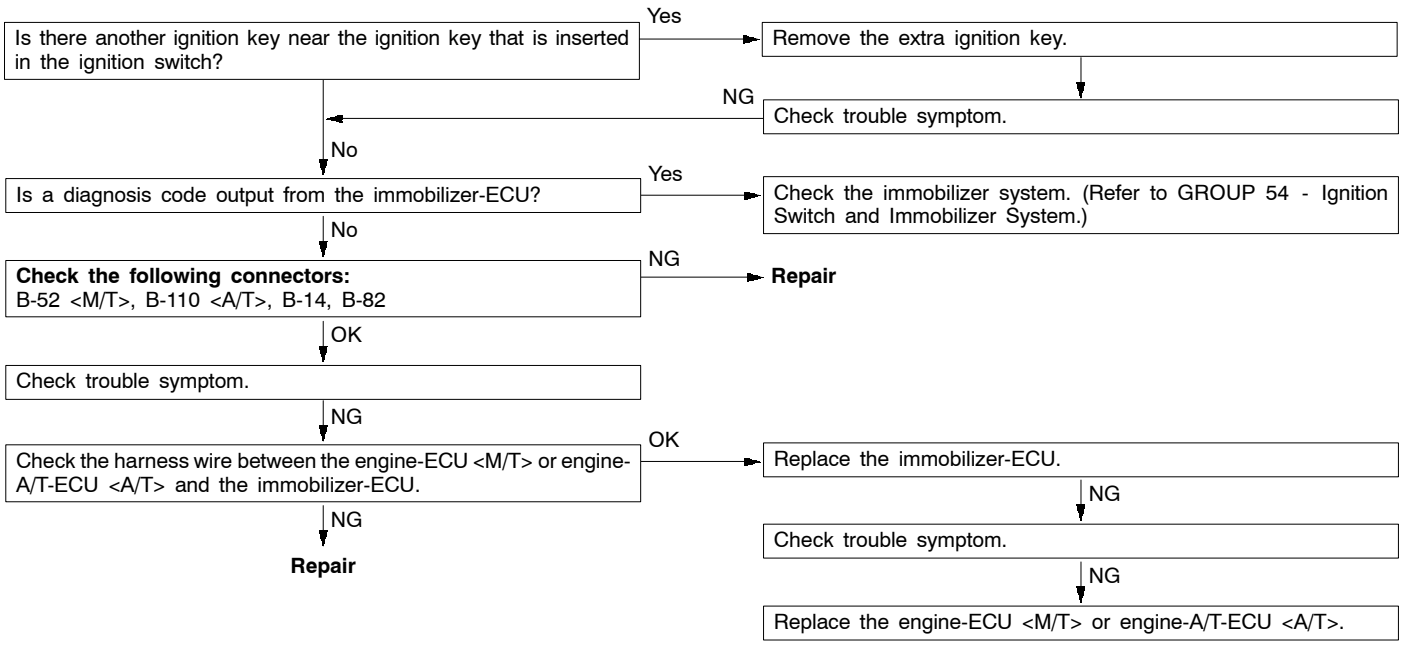


Code No. 44 Ignition coil system	Probable cause
Range of Check ● Engine speed is approx. 50 - 4,000 r/min ● Excluding deceleration driving and sudden acceleration or deceleration driving Set conditions ● Misfire occurs in No.1 and No.4 cylinders or No.2 and No.3 cylinders more than predeterminated times per 1,000 r/min.	● Malfunction of the ignition coil ● Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit ● Malfunction of the spark plug and spark plug cable ● Improper compression pressure ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>

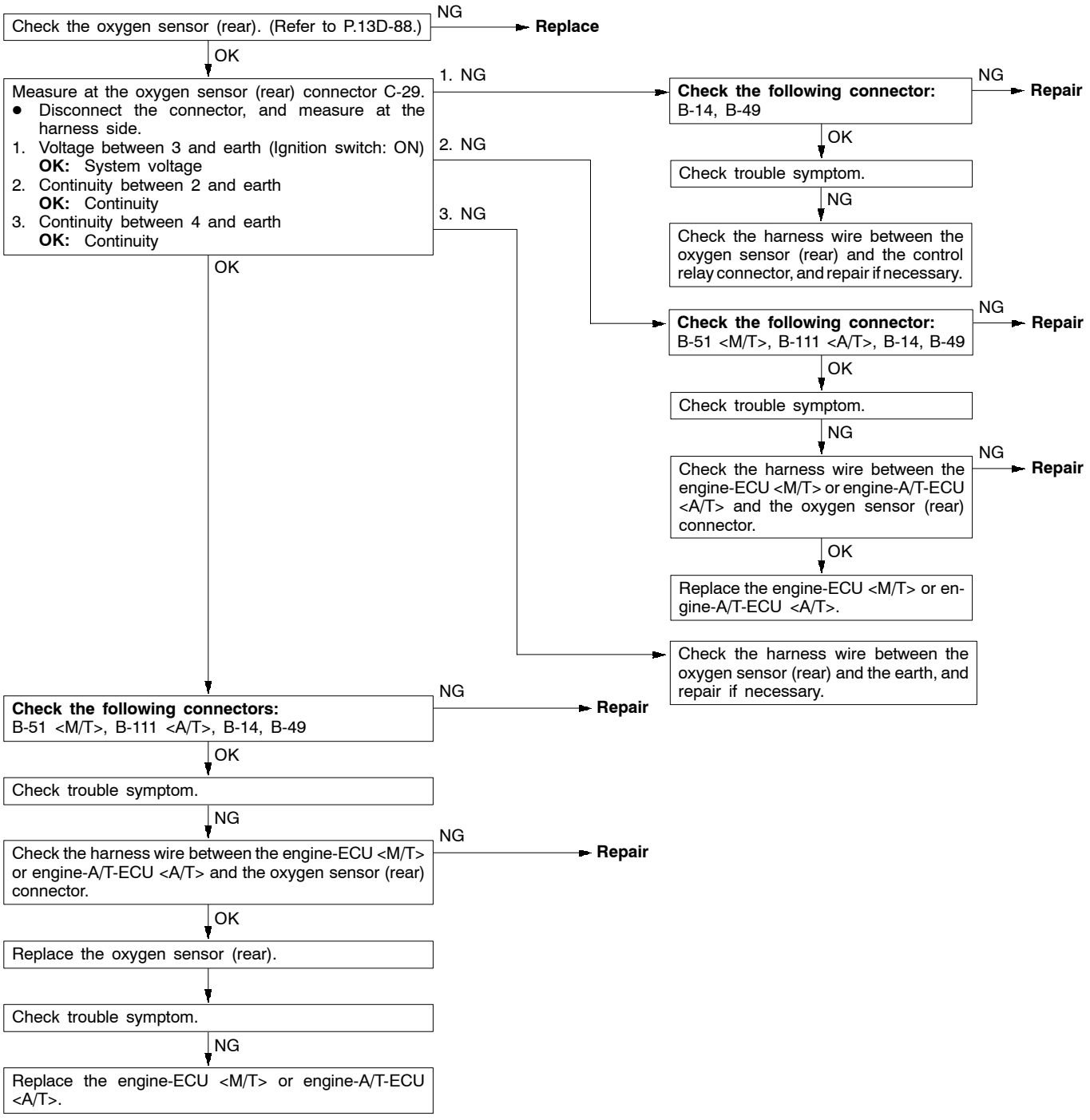


Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU <M/T> or engine-A/T-ECU <A/T> and immobilizer-ECU	● Radio interference of ID codes ● Incorrect ID code ● Malfunction of harness or connector ● Malfunction of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

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.



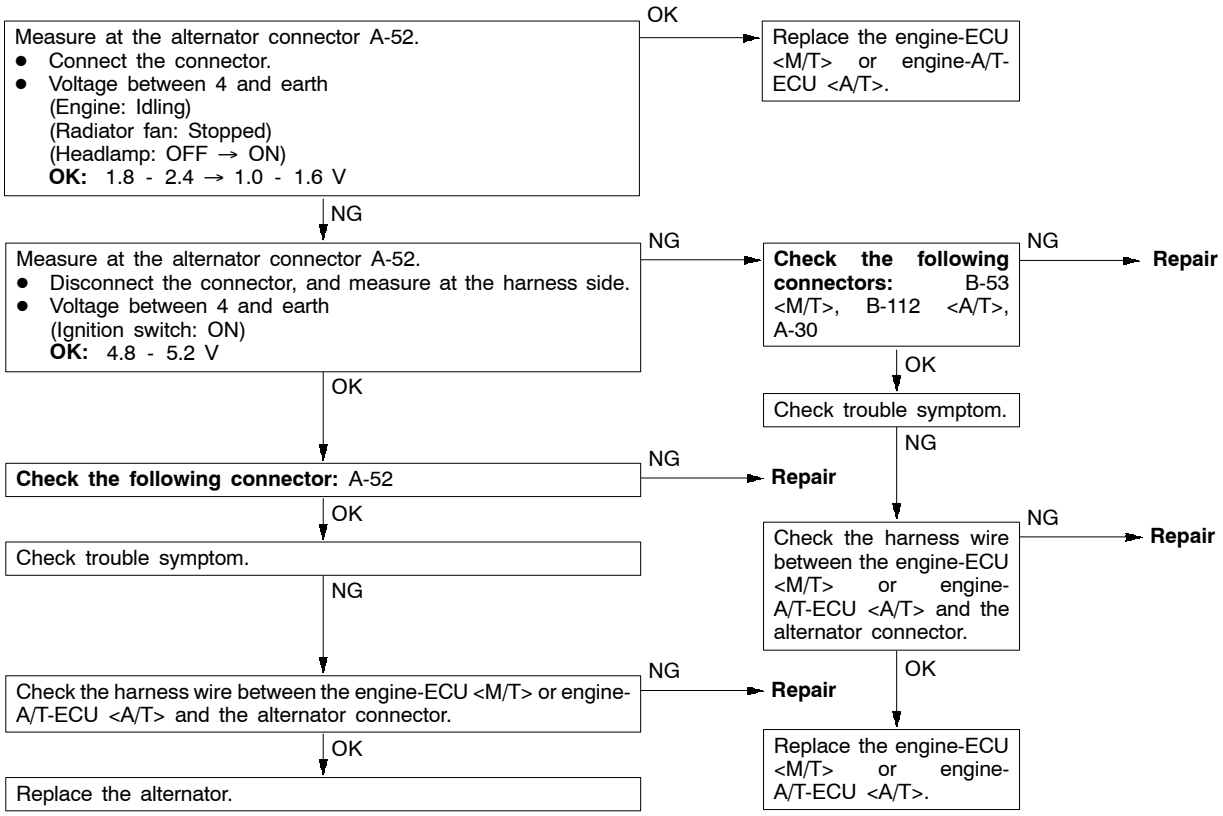
Code No. 59 Oxygen sensor (rear) system	Probable cause
Range of Check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Idle position switch: OFF ● The throttle position sensor output voltage is 4.1 V or more. ● Open loop control in operation ● 20 seconds have passed after deceleration finished. Set conditions ● The oxygen sensor (rear) output voltage is 0.1 V or less. ● The difference in the maximum and minimum values for the oxygen sensor (rear) output voltage is 0.08 V or less. ● The oxygen sensor (rear) output voltage is 0.5 V or more. ● The above conditions continue for a continuous period of 5 seconds.	● Malfunction of the oxygen sensor (rear) ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



Code No. 61 Communication wire with A/T-ECU system <A/T>	Probable cause
Range of Check ● 60 seconds or more have passed immediately after engine was started. ● Engine speed is approx. 50 r/min or more Set conditions The voltage of the torque reduction request signal from the engine-A/T-ECU is LOW for 1.5 seconds or more.	● Malfunction of the harness wire and the connector ● Malfunction of the engine-A/T-ECU

Replace the engine-A/T-ECU.

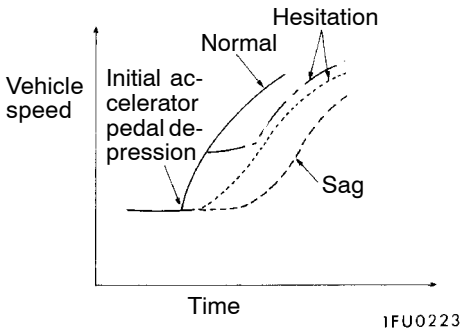
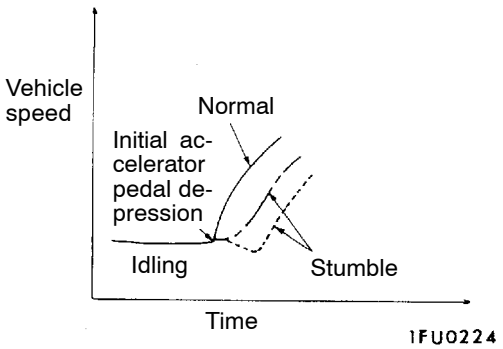
Code No. 64 Alternator FR Terminal System	Probable cause
Range of Check, Set Conditions ● The alternator FR terminal signal voltage remains high for approximately 20 seconds while the engine is running.	● Open circuit in alternator FR terminal circuit ● Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13D-28
	Communication with engine-ECU <M/T> or engine-A/T-ECU <A/T> only is not possible.	2	13D-28
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13D-29
	The engine warning lamp remains illuminating and never goes out.	4	13D-29
Starting	No initial combustion (starting impossible)	5	13D-30
	Initial combustion but no complete combustion (starting impossible)	6	13D-31
	Long time to start (improper starting)	7	13D-32
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13D-33
	Idling speed is high. (Improper idling speed)	9	13D-35
	Idling speed is low. (Improper idling speed)	10	13D-35
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13D-36
	When the engine becomes hot, it stalls at idling. (Die out)	12	13D-37
	The engine stalls when starting the car. (Pass out)	13	13D-39
	The engine stalls when decelerating.	14	13D-39
Driving	Hesitation, sag or stumble	15	13D-40
	The feeling of impact or vibration when accelerating	16	13D-41
	The feeling of impact or vibration when decelerating	17	13D-41
	Poor acceleration	18	13D-42
	Surge	19	13D-44
	Knocking	20	13D-45
Dieseling		21	13D-45
Too high CO and HC concentration when idling		22	13D-46
Low alternator output voltage (approx. 12.3 V)		23	13D-47
Idling speed is improper when A/C is operating		24	13D-47
Fans (radiator fan, A/C condensor fan) are inoperative		25	13D-48

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

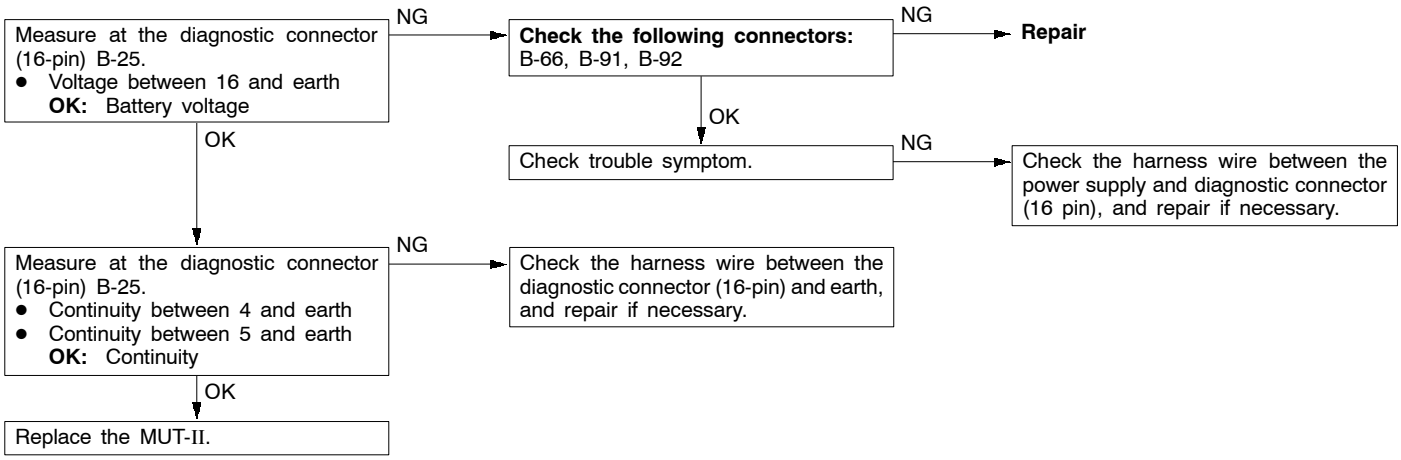
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.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

Items		Symptom
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

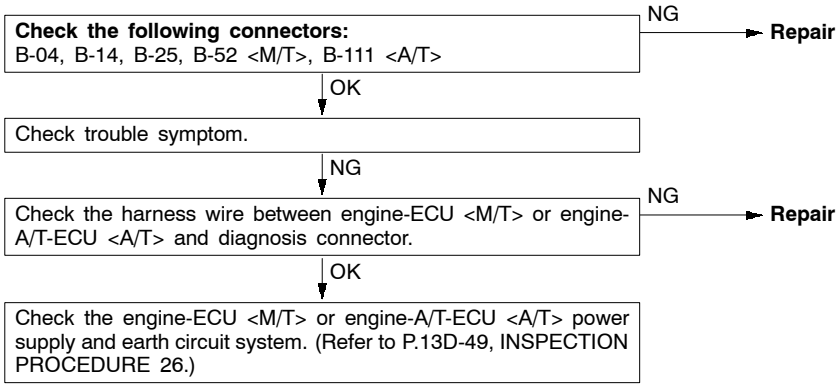
INSPECTION PROCEDURE 1

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

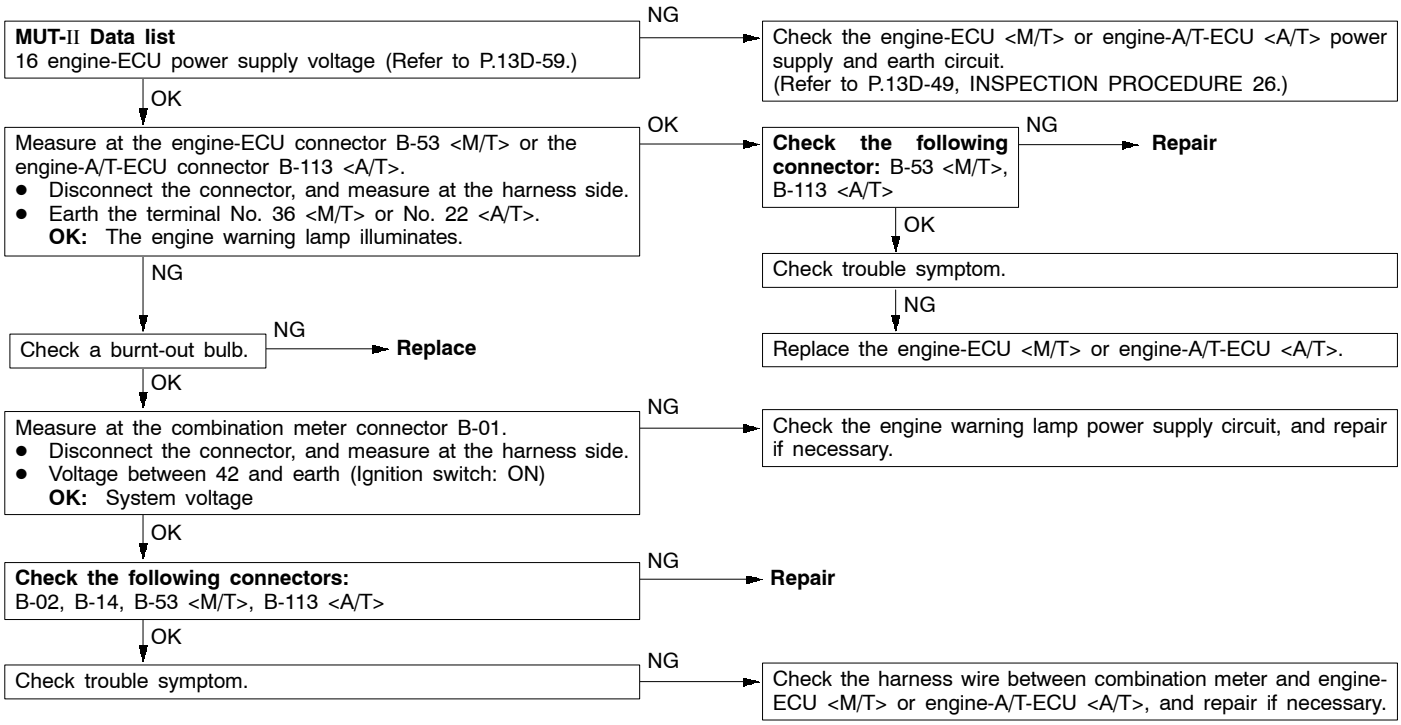
MUT-II communication with engine-ECU <M/T> or engine-A/T-ECU <A/T> is impossible.	**Probable cause**
One of the following causes may be suspected. • No power supply to engine-ECU <M/T> or engine-A/T-ECU <A/T>. • Defective earth circuit of engine-ECU <M/T> or engine-A/T-ECU <A/T>. • Defective engine-ECU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



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

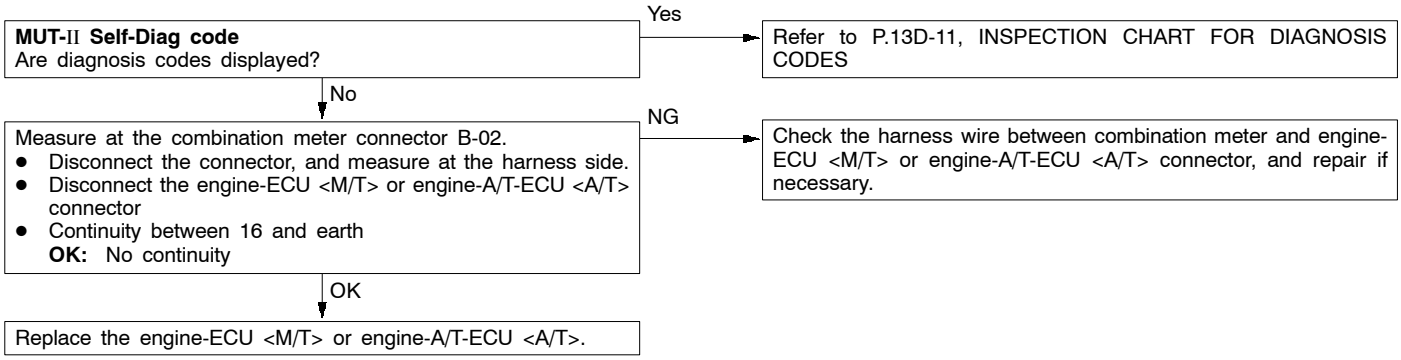
INSPECTION PROCEDURE 3

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



INSPECTION PROCEDURE 4

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



INSPECTION PROCEDURE 5

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

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

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

MUT-II Data list
16 Power supply voltage (Refer to P.13D-59.)
- NG → Check the power supply and ignition switch-IG system. (Refer to P.13D-50, INSPECTION PROCEDURE 27.)
- OK ↓

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
22 Crank angle sensor
OK: Cranking speed is displayed
- No → Check the crank angle sensor system. (Refer to P.13D-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 22.)
- OK ↓

MUT-II Actuator test
07 Fuel pump (Refer to P.13D-62.)
- NG → Check the fuel pump system. (Refer to P.13D-51, INSPECTION PROCEDURE 28.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13D-59.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13D-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

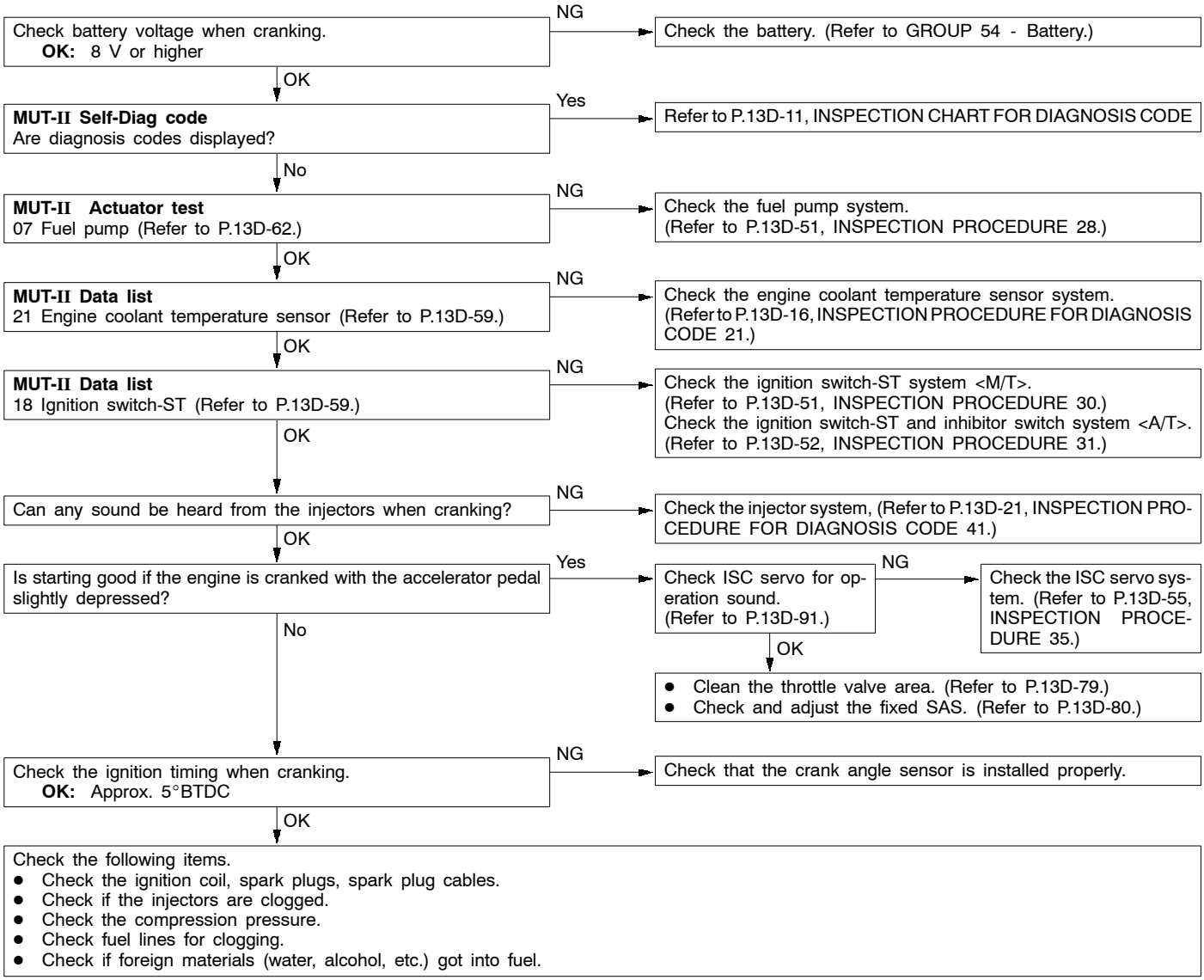
Can any sound be heard from the injectors when cranking?
- No → Check the injector system. (Refer to P.13D-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- Yes ↓

Measure at the ignition coil connectors A-97 and A-98
- Connectors connected
- Check by connecting the timing light to terminal (1) of each connector (engine: cranking)
  OK: The timing light flashes.
- No → Check the ignition circuit system (Refer to P.13D-55, INSPECTION PROCEDURE 34.)
- OK ↓

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

INSPECTION PROCEDURE 6

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



INSPECTION PROCEDURE 7

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

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODE
No ↓

MUT-II Actuator test
07 Fuel pump (Refer to P.13D-62.)
NG → Check the fuel pump system. (Refer to P.13D-51, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13D-59.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13D-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
18 Ignition switch-ST (Refer to P.13D-59.)
NG → Check the ignition switch-ST system <M/T>. (Refer to P.13D-52, INSPECTION PROCEDURE 30.) Check the ignition switch-ST and inhibitor switch system <A/T>. (Refer to P.13D-53, INSPECTION PROCEDURE 31.)
OK ↓

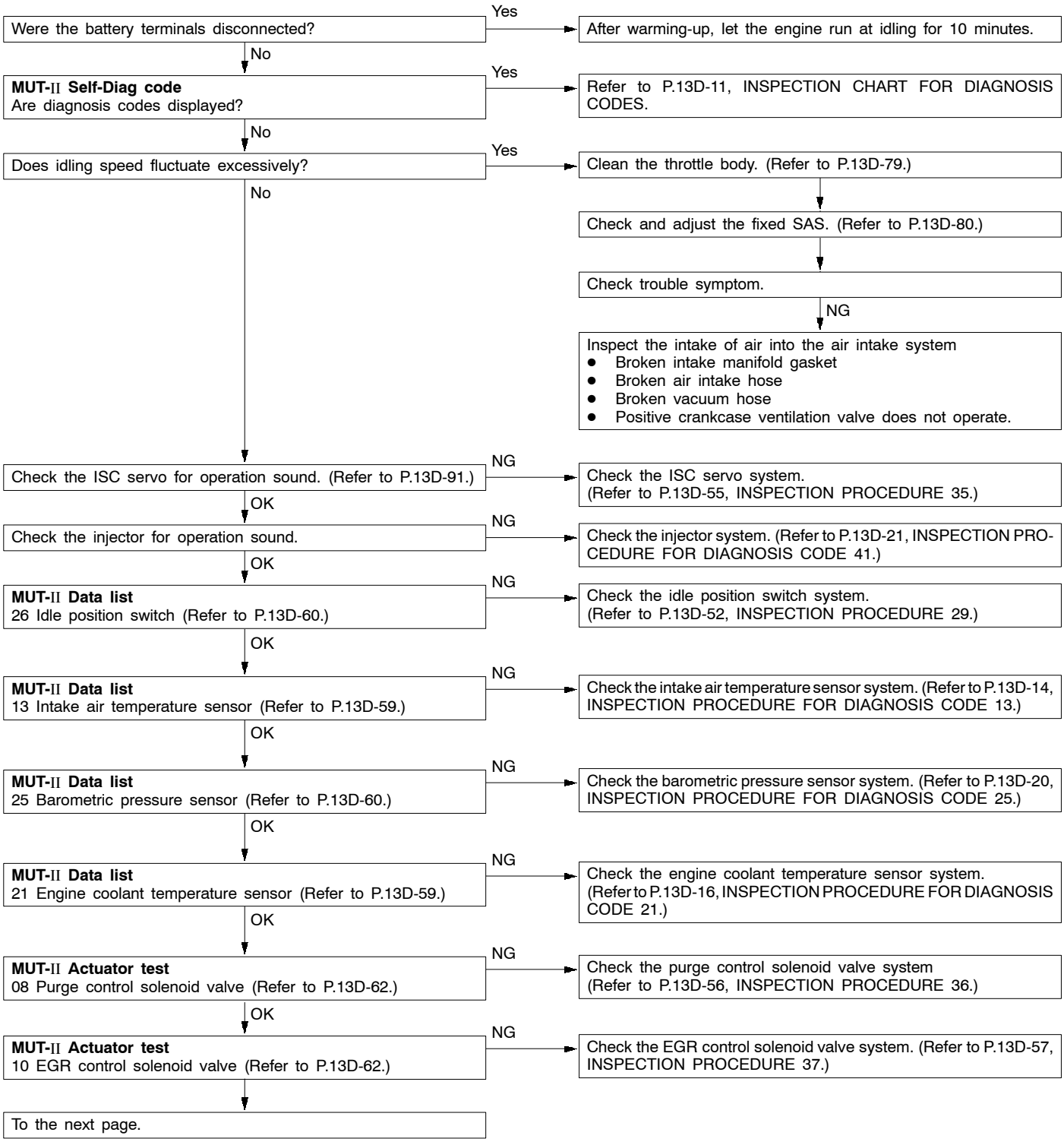
Can any sound be heard from the injectors when cranking?
NG → Check the injector system. (Refer to P.13D-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK ↓

Check the ignition timing when cranking.
OK: Approx. 5°BTDC
NG → Check that the crank angle sensor is installed properly.
OK ↓

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

INSPECTION PROCEDURE 8

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



From the previous page.

OK

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13D-62.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 - 1,000 mV

NG → Check the oxygen sensor (rear) system. (Refer to P.13D-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)

OK

MUT-II Data list
11 Oxygen sensor

OK: 600-1,000 mV during sudden racing

NG → Check the oxygen sensor (front) system. (Refer to P.13D-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)

OK

MUT-II Data list
11 Oxygen sensor

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

NG → Check the fuel pressure. (Refer to P.13D-82.)

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

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13D-60.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13D-54, INSPECTION PROCEDURE 32.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13D-60.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13D-54. INSPECTION PROCEDURE 33.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13D-60.)

NG → Check the ignition switch-ST and inhibitor switch system. <A/T> (Refer to P.13D-53, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
45 ISC Servo position (Refer to P.13D-61.)

NG → Adjust the basic idle speed. (Refer to P.13D-81.)

OK

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

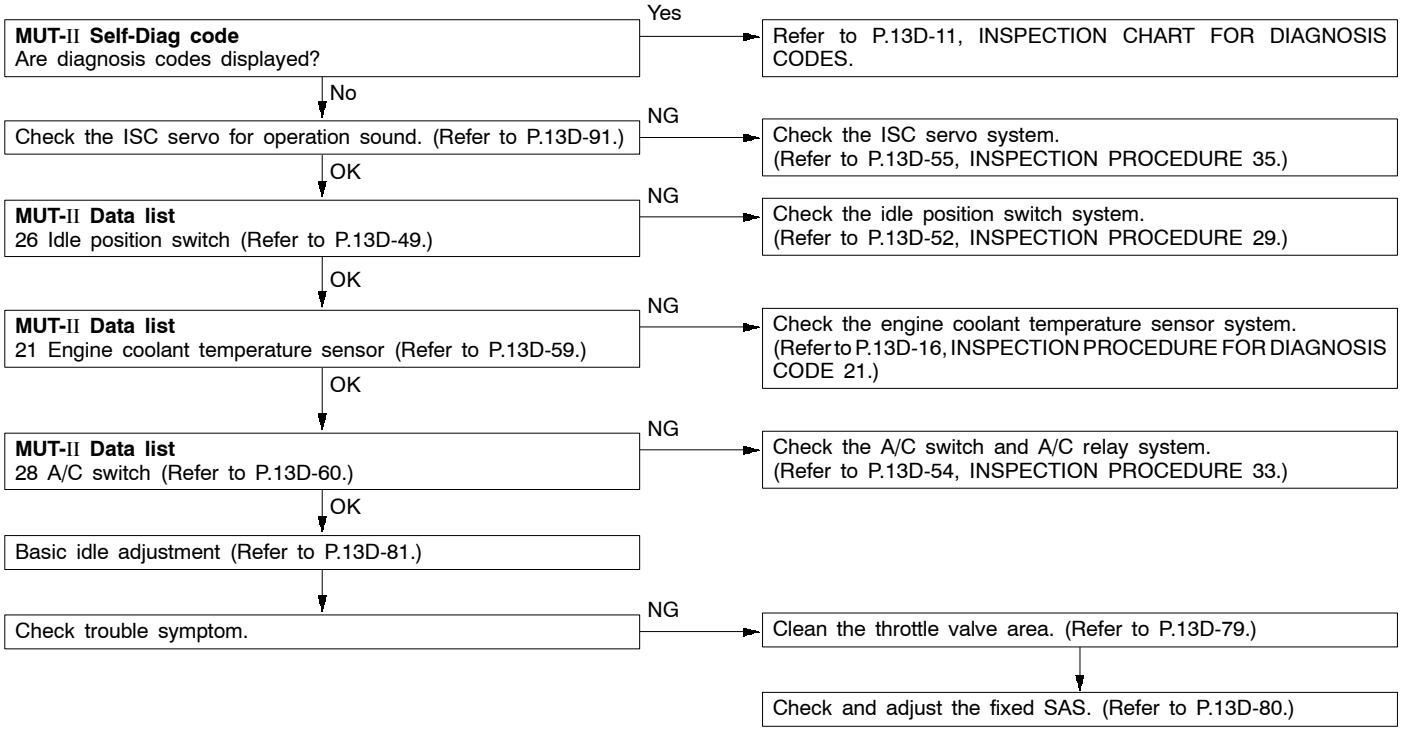
NG → Check that the crank angle sensor is installed properly.

OK

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

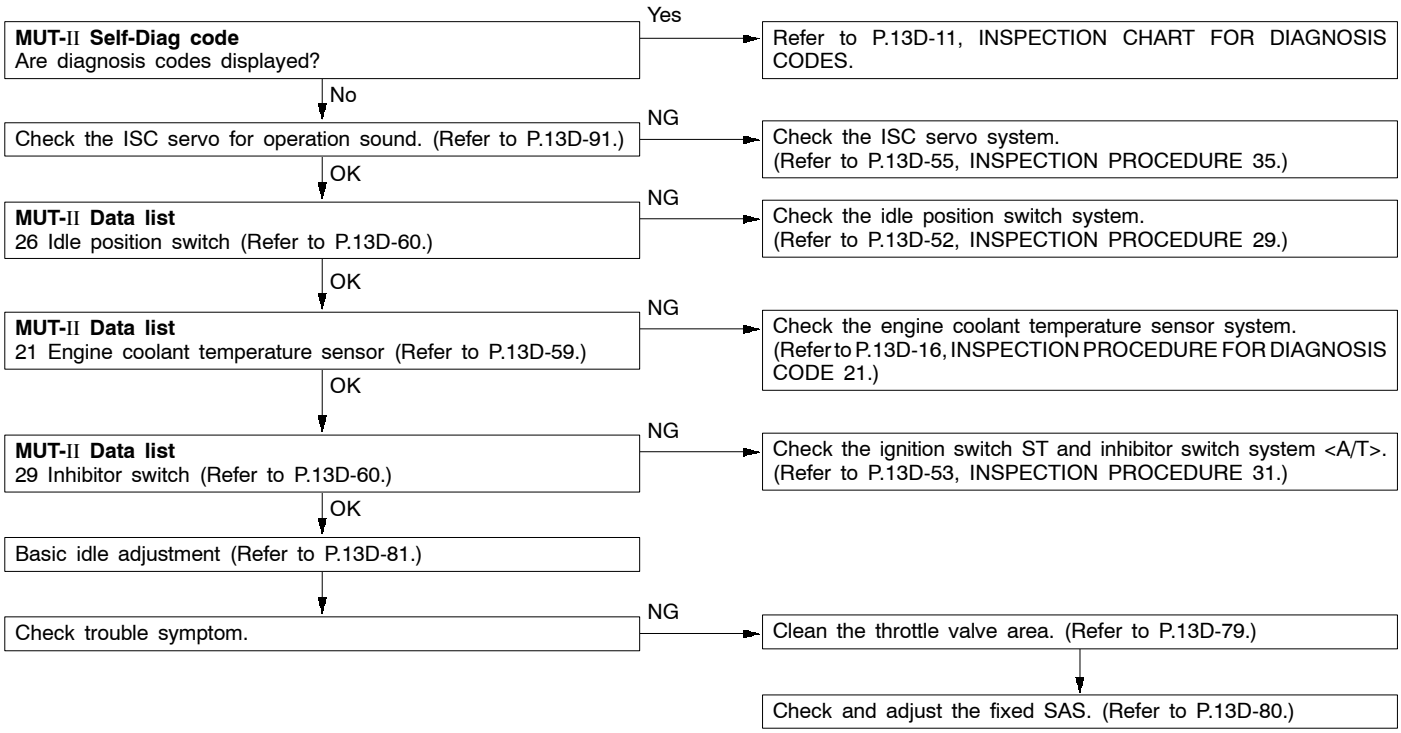
INSPECTION PROCEDURE 9

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



INSPECTION PROCEDURE 10

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



INSPECTION PROCEDURE 11

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

Were the battery terminals disconnected? — Yes → After warming-up, let the engine run at idling for 10 minutes.

No ↓

MUT-II Self-Diag code
Are diagnosis codes displayed? — Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.

No ↓

Does the engine stall right after the accelerator pedal is released? — Yes → Clean the throttle valve area. (Refer to P.13D-79.) → Check and adjust the fixed SAS. (Refer to P.13D-80.)

No ↓

Is engine-idling stable after the warming-up? — No → Check if the unstable idling (Rough idling, hunting). (Refer to P.13D-33, INSPECTION PROCEDURE 8.)

Yes ↓

Check the ISC servo for operation sound. (Refer to P.13D-91.) — NG → Check the ISC servo system. (Refer to P.13D-55, INSPECTION PROCEDURE 35.)

OK ↓

Check the injector for operation sound. — NG → Check the injector system. (Refer to P.13D-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)

OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13D-60.) — NG → Check the idle position switch system. (Refer to P.13D-52, INSPECTION PROCEDURE 29.)

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13D-59.) — NG → Check the engine coolant temperature sensor system. (Refer to P.13D-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13D-62.) — NG → Check the EGR control solenoid valve system. (Refer to P.13D-57, INSPECTION PROCEDURE 37.)

OK ↓

Check the fuel pressure. (Refer to P.13D-82.)

OK ↓

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

OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the engine oil viscosity.

INSPECTION PROCEDURE 12

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

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Check the ISC servo for operation sound. (Refer to P.13D-91.)
- NG → Check the ISC servo system. (Refer to P.13D-55, INSPECTION PROCEDURE 35.)
- OK ↓

Check the injector for operation sound.
- NG → Check the injector system. (Refer to P.13D-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Does the engine stall right after the accelerator pedal is released?
- Yes → Clean the throttle valve area. (Refer to P.13D-79.) → Check and adjust the fixed SAS. (Refer to P.13D-80.)
- No ↓

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

MUT-II Data list
26 Idle position switch (Refer to P.13D-60.)
- NG → Check the idle position switch system. (Refer to P.13D-52, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13D-59.)
- NG → Check the intake air temperature sensor system. (Refer to P.13D-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13D-60.)
- NG → Check the barometric pressure sensor system. (Refer to P.13D-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13D-59.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13D-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13D-62.)
- NG → Check the EGR control solenoid valve system. (Refer to P.13D-57, INSPECTION PROCEDURE 37.)
- OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13D-62.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open
  OK: 600 - 1,000 mV
- NG → Check the oxygen sensor (rear) system. (Refer to P.13D-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)

To the next page.

From the previous page.

OK

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 - 1,000 mV during sudden racing

NG → Check the oxygen sensor (front) system. (Refer to P.13D-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)

OK

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

NG → Check the fuel pressure. (Refer to P.13D-82.)

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

2. Check the injector for clog.

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13D-60.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13D-54, INSPECTION PROCEDURE 32.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13D-60.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13D-54, INSPECTION PROCEDURE 33.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13D-60.)

NG → Check the ignition switch-ST and inhibitor switch system. <A/T> (Refer to P.13D-53, INSPECTION PROCEDURE 31.)

OK

MUT-II Data list
45 ISC servo position (Refer to P.13D-61.)

NG → Adjust the basic idle speed. (Refer to P.13D-81.)

OK

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

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

OK

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

INSPECTION PROCEDURE 13

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13D-62.)
- NG → Check the EGR control solenoid valve system. (Refer to P.13D-57, INSPECTION PROCEDURE 37.)
- OK ↓

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

INSPECTION PROCEDURE 14

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

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
26 Idle position switch (Refer to P.13D-60.)
- NG → Check the idle position switch system. (Refer to P.13D-52, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13D-59.)
- NG → Check the throttle position sensor system. (Refer to P.13D-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
45 ISC servo position
- Is the idle speed control (ISC) servo position drops to 0 - 2 steps when decelerating (engine r/min less than 1,000)?
  - Yes → Check the vehicle speed sensor system. (Refer to P.13D-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 24.)
  - No ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13D-62.)
- NG → Check the EGR control solenoid valve system. (Refer to P.13D-57, INSPECTION PROCEDURE 37.)
- OK ↓

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

INSPECTION PROCEDURE 15

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13D-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK ↓

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

MUT-II Data list
26 Idle position switch (Refer to P.13D-60.)
NG → Check the idle position switch system.
(Refer to P.13D-52, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13D-59.)
NG → Check the intake air temperature sensor system. (Refer to P.13D-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13D-60.)
NG → Check the barometric pressure sensor system. (Refer to P.13D-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13D-59.)
NG → Check the engine coolant temperature sensor system.
(Refer to P.13D-16, INSPECTION PROCEDURE FOR DIAGNOSTIC CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13D-59.)
NG → Check the throttle position sensor system. (Refer to P.13D-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13D-62.)
NG → Check the EGR control solenoid valve system.
(Refer to P.13D-57, INSPECTION PROCEDURE 37.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13D-62.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 - 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13D-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 - 1,000 mV during sudden racing
NG → Check the oxygen sensor (front) system. (Refer to P.13D-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)

To the next page.

From the previous page.
↓ OK
MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 - 400 mV and 600 - 1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13D-82.)
OK → 1. Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

↓ OK
Check the fuel pressure. (Refer to P.13D-82.)
↓ OK
Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR control system.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.

INSPECTION PROCEDURE 16

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓
Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check for occurrence of ignition leak.

INSPECTION PROCEDURE 17

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓
Check the ISC servo for operation sound. (Refer to P.13D-91.)
NG → Check the ISC servo system. (Refer to P.13D-55, INSPECTION PROCEDURE 35.)
OK ↓
MUT-II Data list
14 Throttle position sensor (Refer to P.13D-59.)
NG → Check the throttle position sensor system. (Refer to P.13D-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓
MUT-II Data list
26 Idle position switch (Refer to P.13D-60.)
NG → Check the idle position switch system. (Refer to P.13D-52, INSPECTION PROCEDURE 29.)
OK ↓
Clean the throttle valve area. (Refer to P.13D-79.)

INSPECTION PROCEDURE 18

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the injectors for operation sound.
NG → Check the injector system. (Refer to P.13D-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
OK ↓

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

MUT-II Data list
26 Idle position switch (Refer to P.13D-60.)
NG → Check the idle position switch system.
(Refer to P.13D-52, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13D-59.)
NG → Check the intake air temperature sensor system. (Refer to P.13D-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13D-60.)
NG → Check the barometric pressure sensor system. (Refer to P.13D-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13D-59.)
NG → Check the engine coolant temperature sensor system.
(Refer to P.13D-16, INSPECTION PROCEDURE FOR DIAGNOSTIC CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13D-59.)
NG → Check the throttle position sensor system. (Refer to P.13D-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13D-62.)
NG → Check the EGR control solenoid valve system.
(Refer to P.13D-57, INSPECTION PROCEDURE 37.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13D-62.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open
  OK: 600 - 1,000 mV

NG → Check the oxygen sensor (rear) system. (Refer to P.13D-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 - 1,000 mV during sudden racing

NG → Check the oxygen sensor (front) system. (Refer to P.13D-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)

To the next page.

From the previous page.

OK

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

NG → Check the fuel pressure. (Refer to P.13D-82.)

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

2. Check the injector for clog.

OK

Check the fuel pressure. (Refer to P.13D-82.)

OK

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.
- Broken air intake hose
- Clogged air cleaner

INSPECTION PROCEDURE 19

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Check the injectors for operation sound.
- NG → Check the injector system. (Refer to P.13D-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

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

MUT-II Data list
26 Idle position switch (Refer to P.13D-60.)
- NG → Check the idle position switch system. (Refer to P.13D-52, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13D-59.)
- NG → Check the intake air temperature sensor system. (Refer to P.13D-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13D-60.)
- NG → Check the barometric pressure sensor system. (Refer to P.13D-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13D-59.)
- NG → Check the engine coolant temperature sensor system. (Refer to P.13D-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13D-59.)
- NG → Check the throttle position sensor system. (Refer to P.13D-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13D-62.)
- NG → Check the EGR control solenoid valve system. (Refer to P.13D-57, INSPECTION PROCEDURE 37.)
- OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13D-62.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open
  OK: 600 - 1,000 mV
- NG → Check the oxygen sensor (rear) system. (Refer to P.13D-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 600 - 1,000 mV during sudden racing
- NG → Check the oxygen sensor (front) system. (Refer to P.13D-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0 - 400 mV and 600 - 1,000 mV during idling
- NG → Check the fuel pressure. (Refer to P.13D-82.)
  - OK → 1. Inspect the intake of air into the air intake system
    - Broken intake manifold gasket
    - Broken vacuum hose
    - PCV valve does not operate.
    - Broken air intake hose
    2. Check the injector for clog.
- OK ↓

Check the fuel pressure. (Refer to P.13D-82.)
- OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR control system.

INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases as the above, the cause is probably that the detonation control is defective or the heat value of the spark plug is inappropriate.	• Defective detonation sensor • Inappropriate heat value of the spark plug

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13D-11, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Does knocking occur when driving with the sensor disconnected? At this time, use the MUT-II to check if the timing is retarded compared to when the detonation sensor connector is connected.
No → Check the detonation sensor system. (Refer to P.13D-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 31.)
Yes ↓

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

INSPECTION PROCEDURE 21

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

Check the injectors for fuel leakage.

INSPECTION PROCEDURE 22

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13D-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 is installed properly.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor. (Refer to P.13D-16.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13D-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13D-14.)
NG → Check the intake air temperature sensor system. (Refer to P.13D-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13D-20.)
NG → Check the barometric pressure sensor system. (Refer to P.13D-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13D-62.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open
  OK: 600 - 1,000 mV

NG → Check the oxygen sensor (rear) system. (Refer to P.13D-24, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600 - 1,000 mV when racing suddenly.
NG → Check the oxygen sensor (front) system. (Refer to P.13D-12, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

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

Check the fuel pressure. (Refer to P.13D-82.)
OK ↓

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

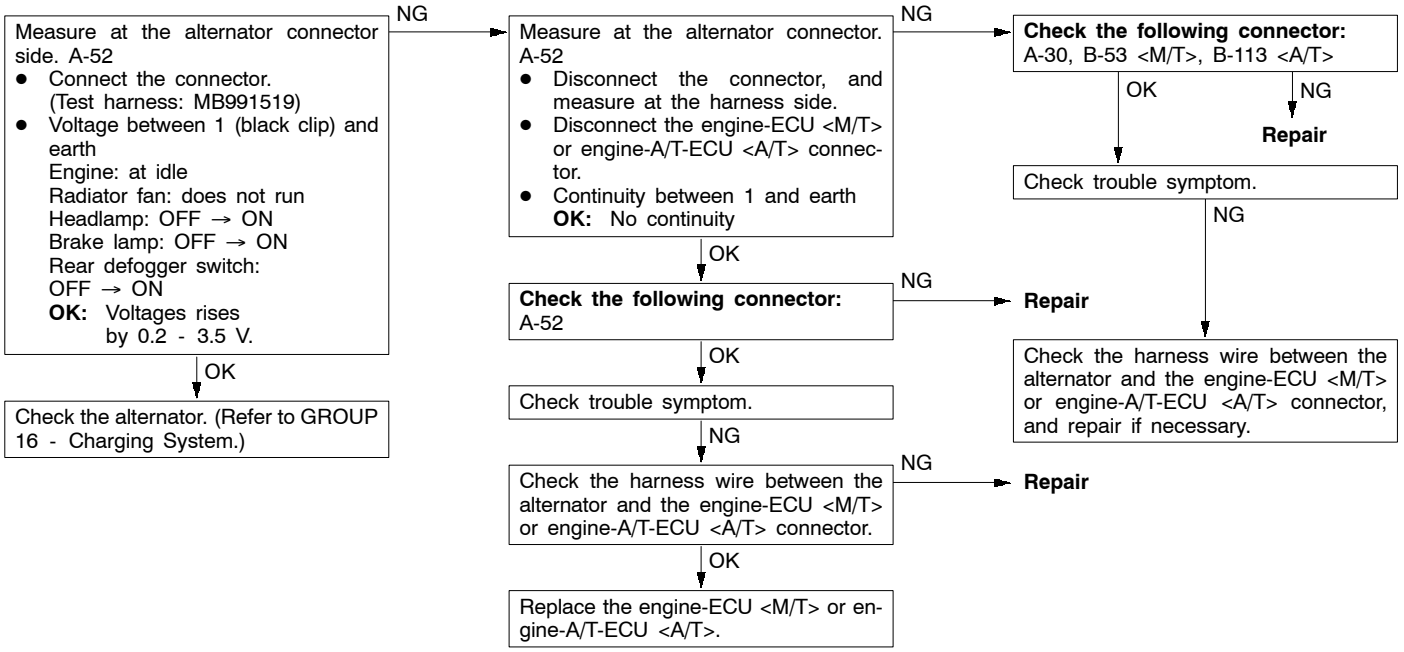
↓

Check the trouble symptom.
NG ↓

Replace the catalytic converter.

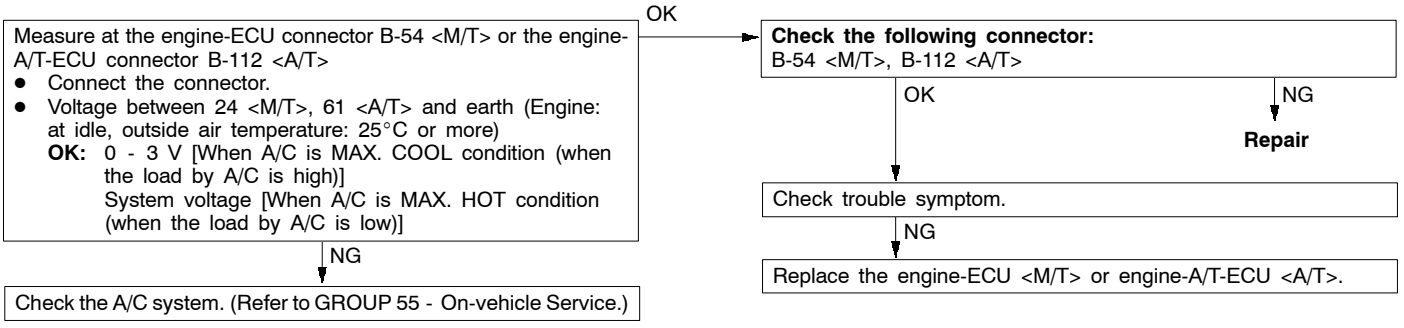
INSPECTION PROCEDURE 23

Low alternator output voltage (approx. 12.3 V)	Probable cause
The alternator may be defective, or malfunctions, which are listed in the right column, may be suspected.	• Malfunction of charging system • Short circuit in harness between alternator G terminal and engine-ECU <M/T> or engine-A/T-ECU <A/T> • Malfunction of engine-ECU <M/T> or engine-A/T-ECU <A/T>



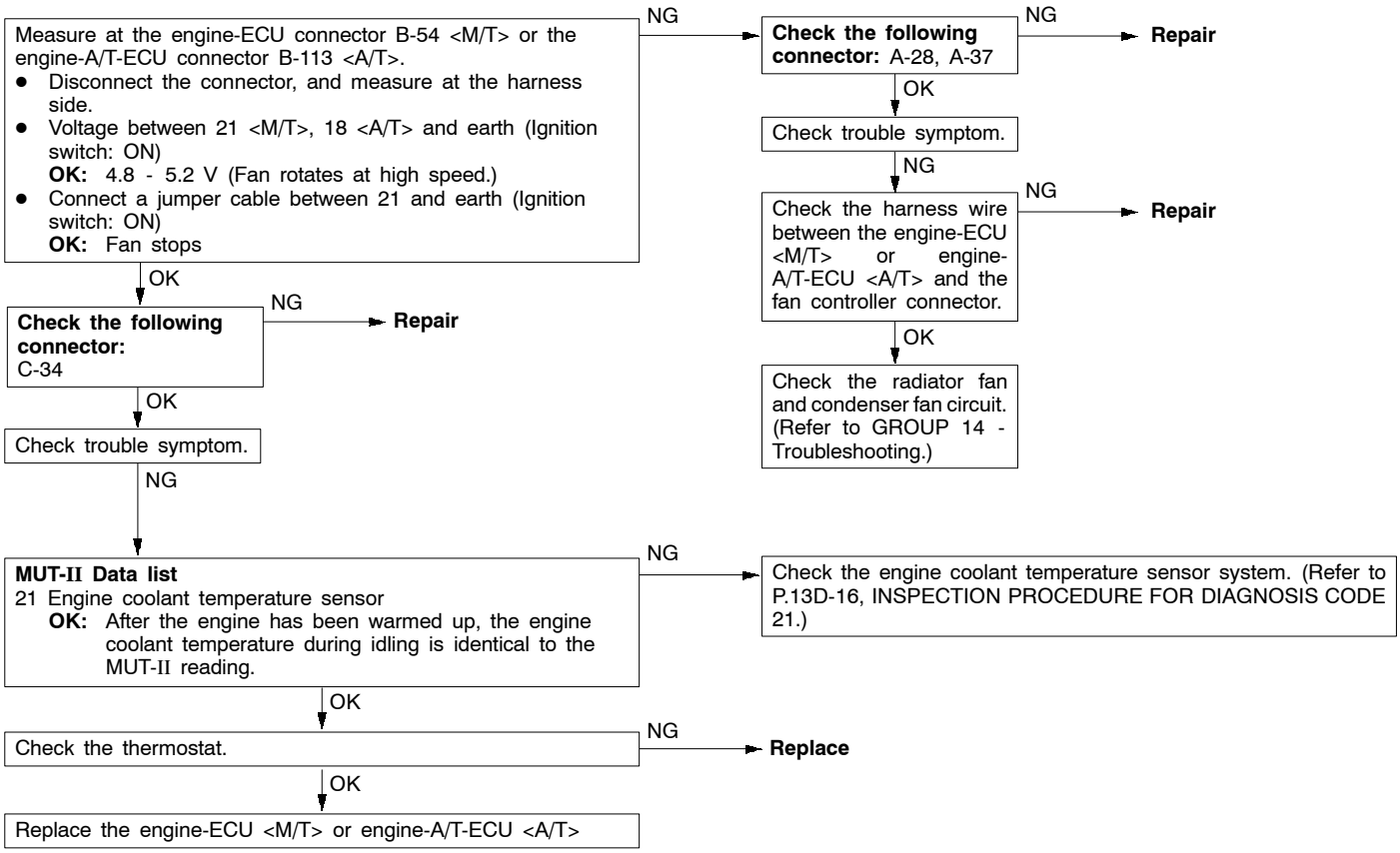
INSPECTION PROCEDURE 24

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



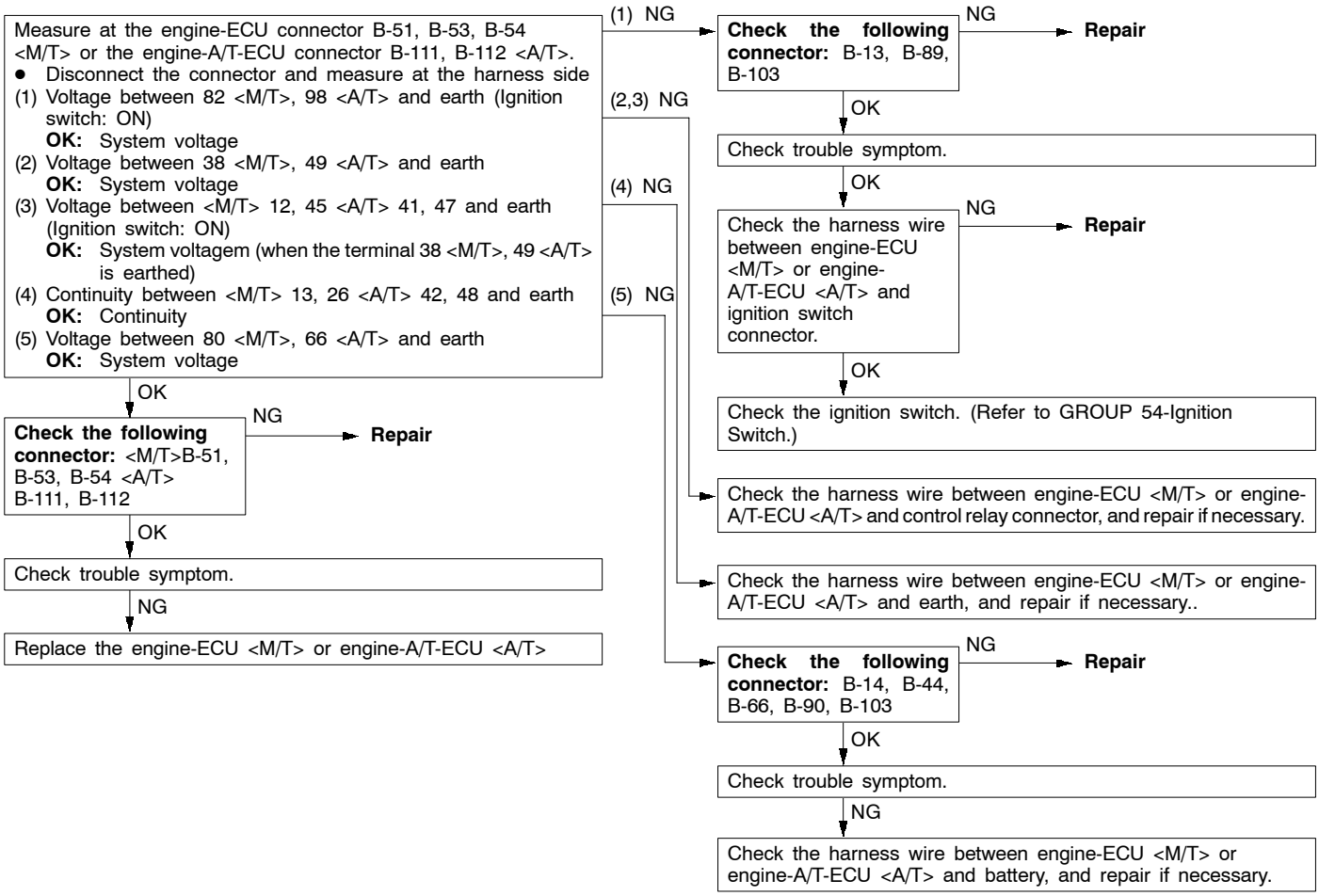
INSPECTION PROCEDURE 25

Fans (radiator fan, A/C condenser fan) are inoperative	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> outputs a duty signal to the fan controller depending on the engine coolant temperature, vehicle speed, and air conditioner switch condition. Based on this signal, the fan controller controls the radiator fan and condenser fan speeds (The more the average voltage at the terminal approaches 5 V, the higher the fan speed become.)	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the fan controller • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



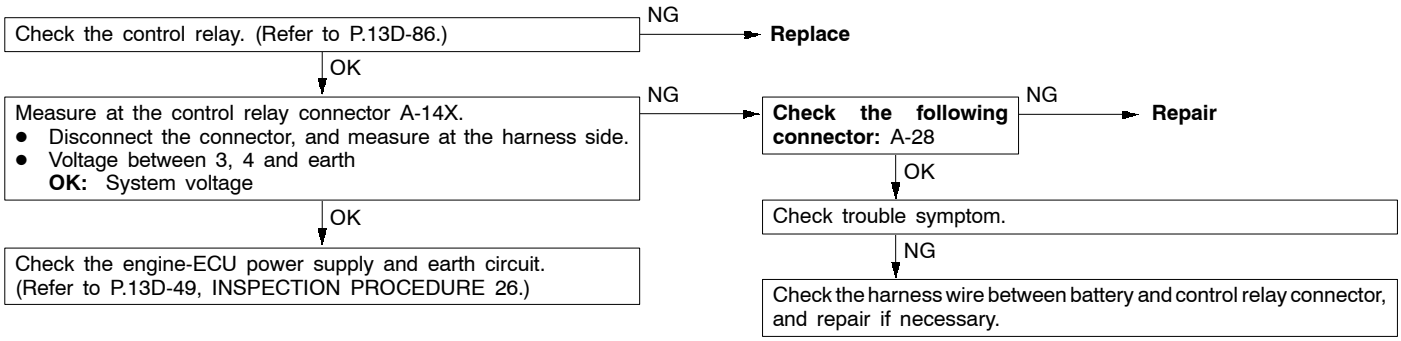
INSPECTION PROCEDURE 26

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



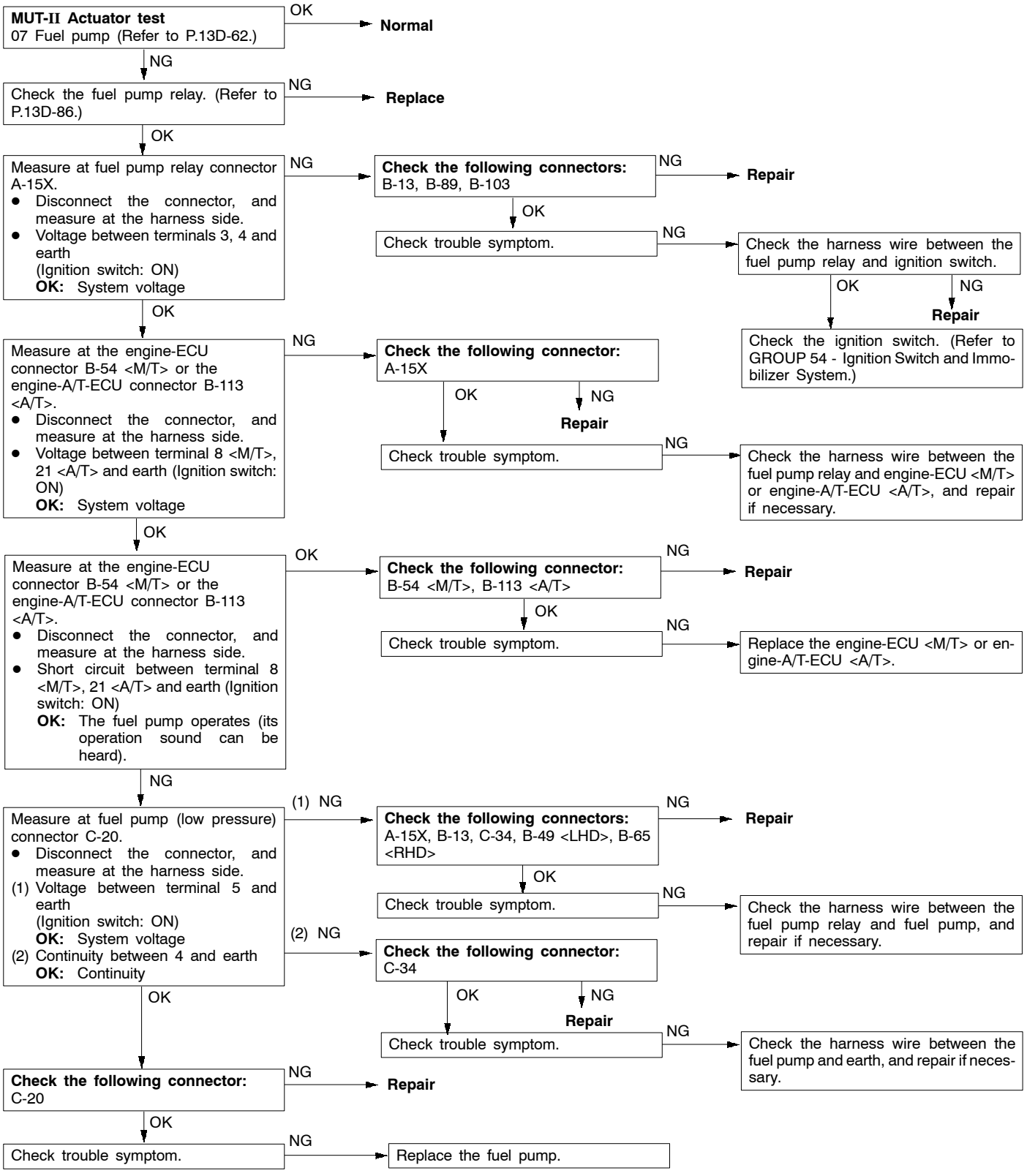
INSPECTION PROCEDURE 27

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



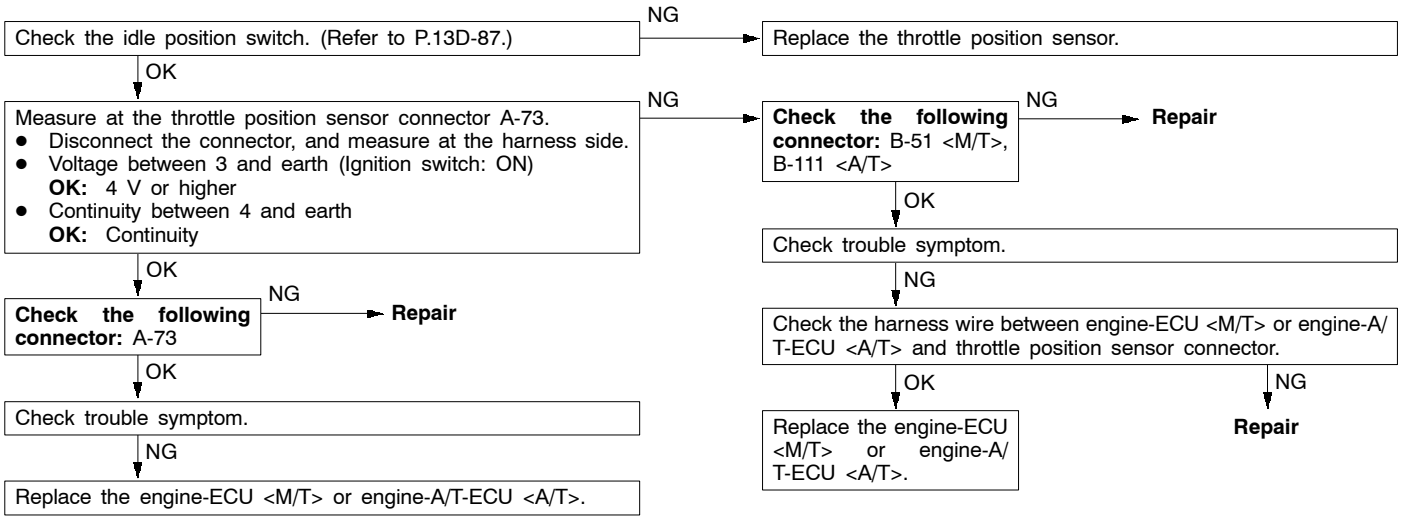
INSPECTION PROCEDURE 28

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



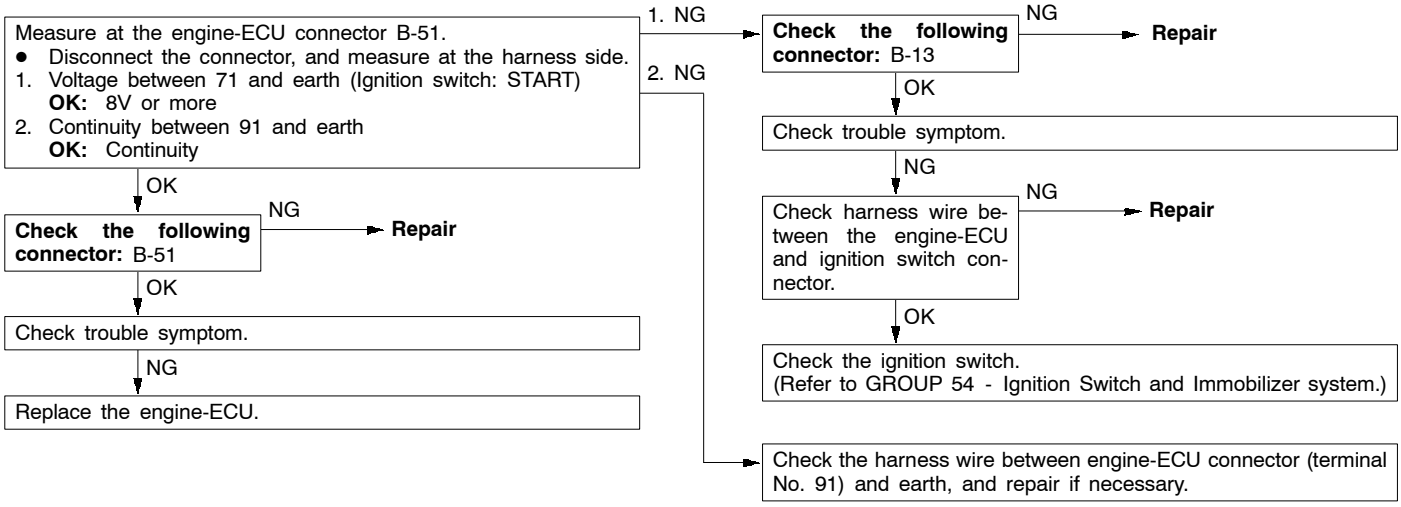
INSPECTION PROCEDURE 29

Idle position switch system	Probable cause
The idle position switch inputs the condition of the accelerator pedal, i.e. whether it is depressed or released (HIGH/LOW), to the engine-ECU <M/T> or engine-A/T-ECU <A/T>. The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the idle speed control servo based on this input.	• Maladjustment of the accelerator pedal • Maladjustment of the fixed SAS • Maladjustment of the idle position switch and throttle position sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



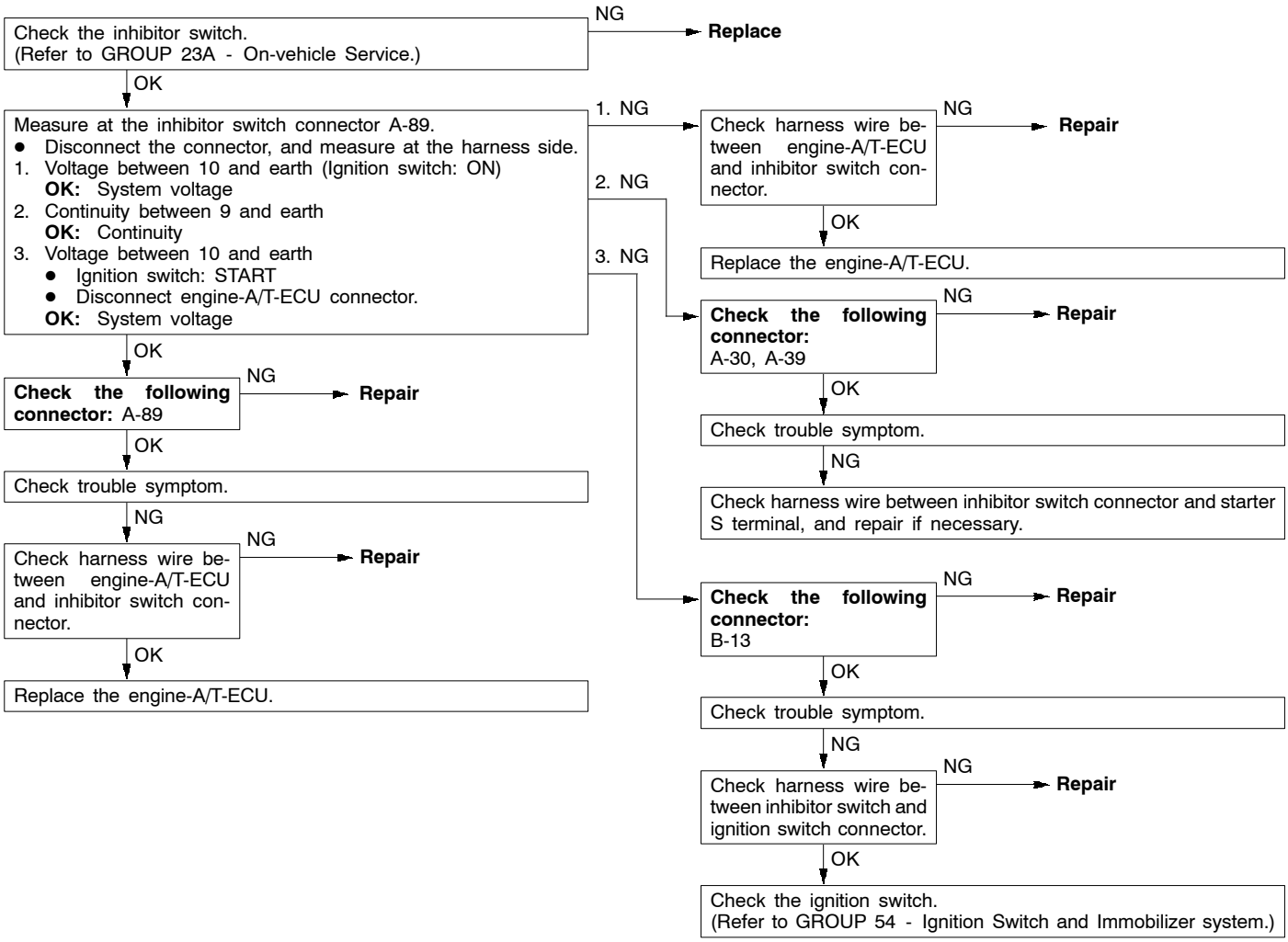
INSPECTION PROCEDURE 30

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU controls fuel injection, etc. during starting based on this input.	• Malfunction of ignition switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



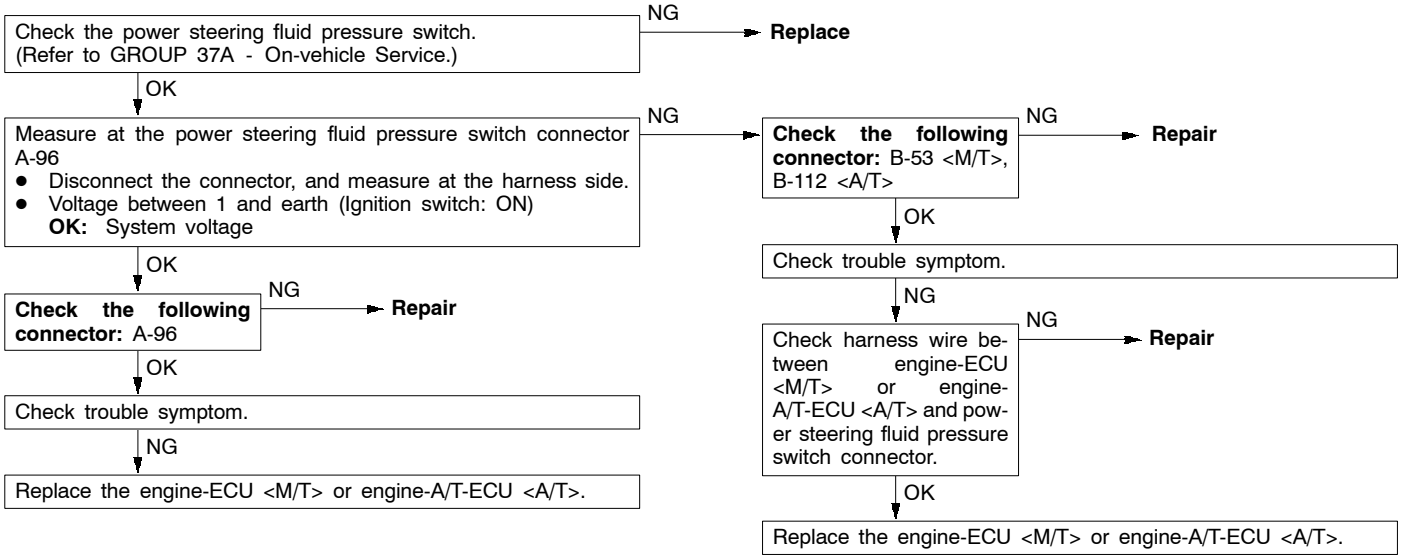
INSPECTION PROCEDURE 31

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
• The ignition switch-ST inputs a HIGH signal to the engine-A/T-ECU while the engine is cranking. The engine-A/T-ECU controls fuel injection, etc. during starting based on this input. • The inhibitor switch inputs the condition of the select lever, i.e. whether it is in P or N range or in some other range, to the engine-A/T-ECU. The engine-A/T-ECU controls the idle speed control (ISC) servo based on this input.	• Malfunction of ignition switch • Malfunction of inhibitor switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-A/T-ECU.



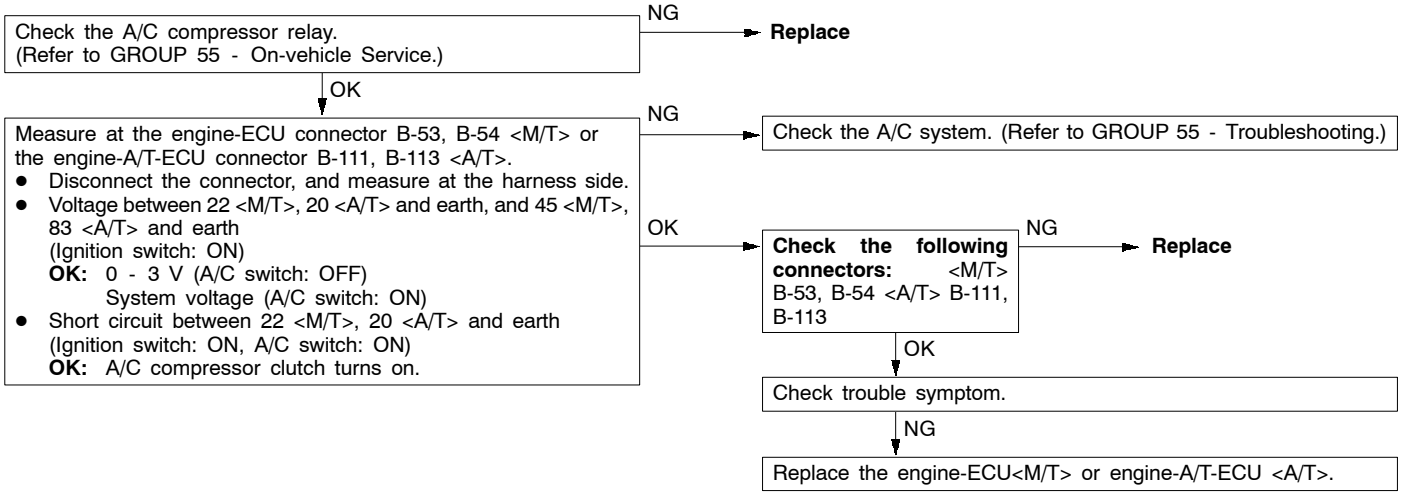
INSPECTION PROCEDURE 32

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the engine-ECU <M/T> or engine-A/T-ECU <A/T>. The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the idle speed control (ISC) servo based on this input.	• Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



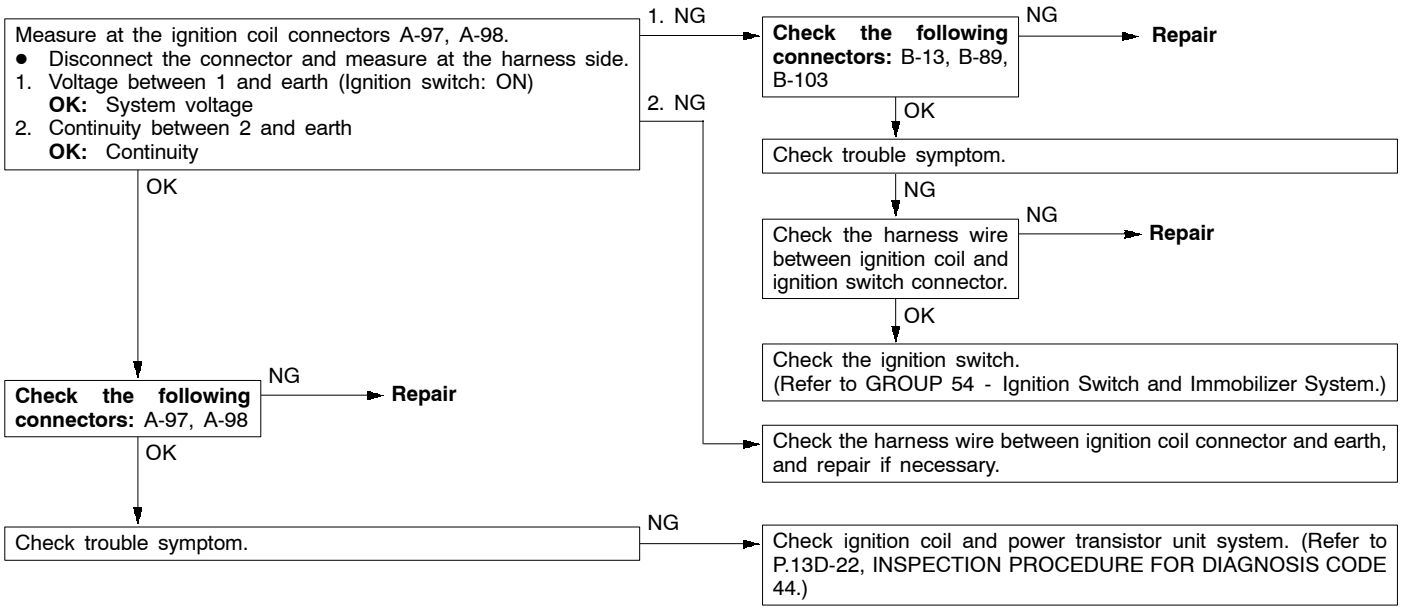
INSPECTION PROCEDURE 33

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



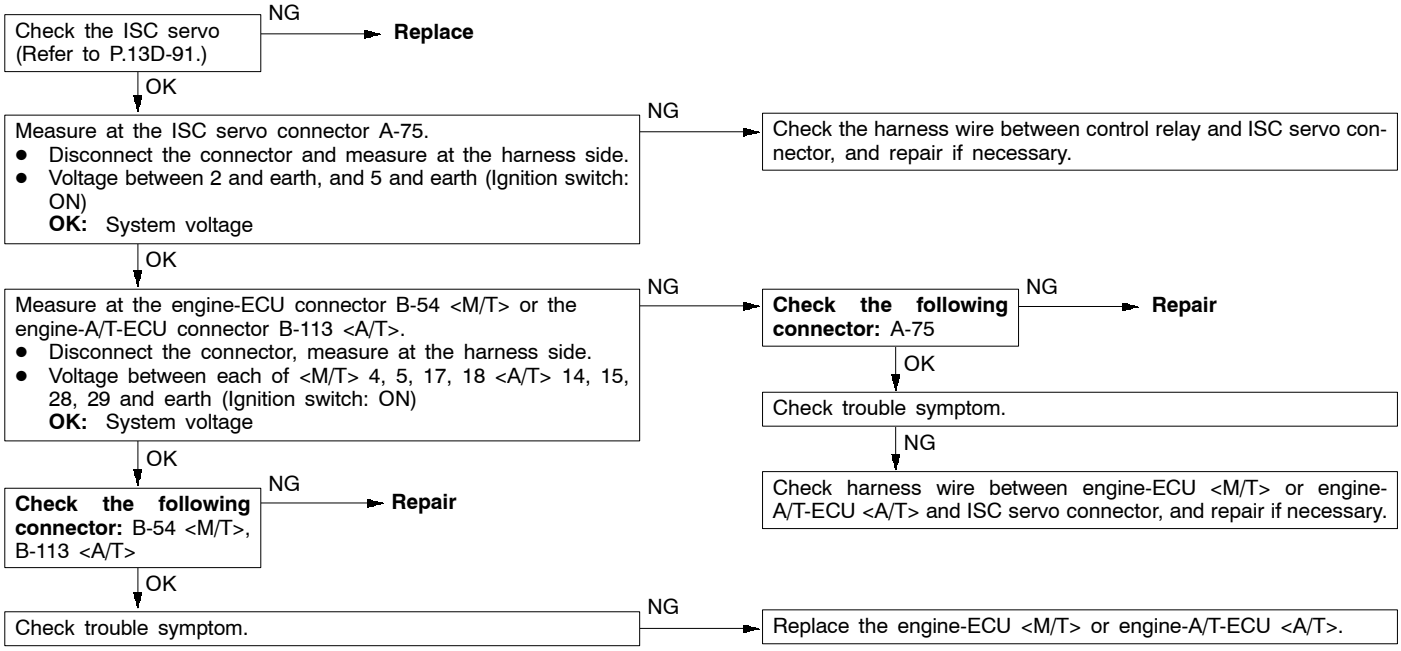
INSPECTION PROCEDURE 34

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



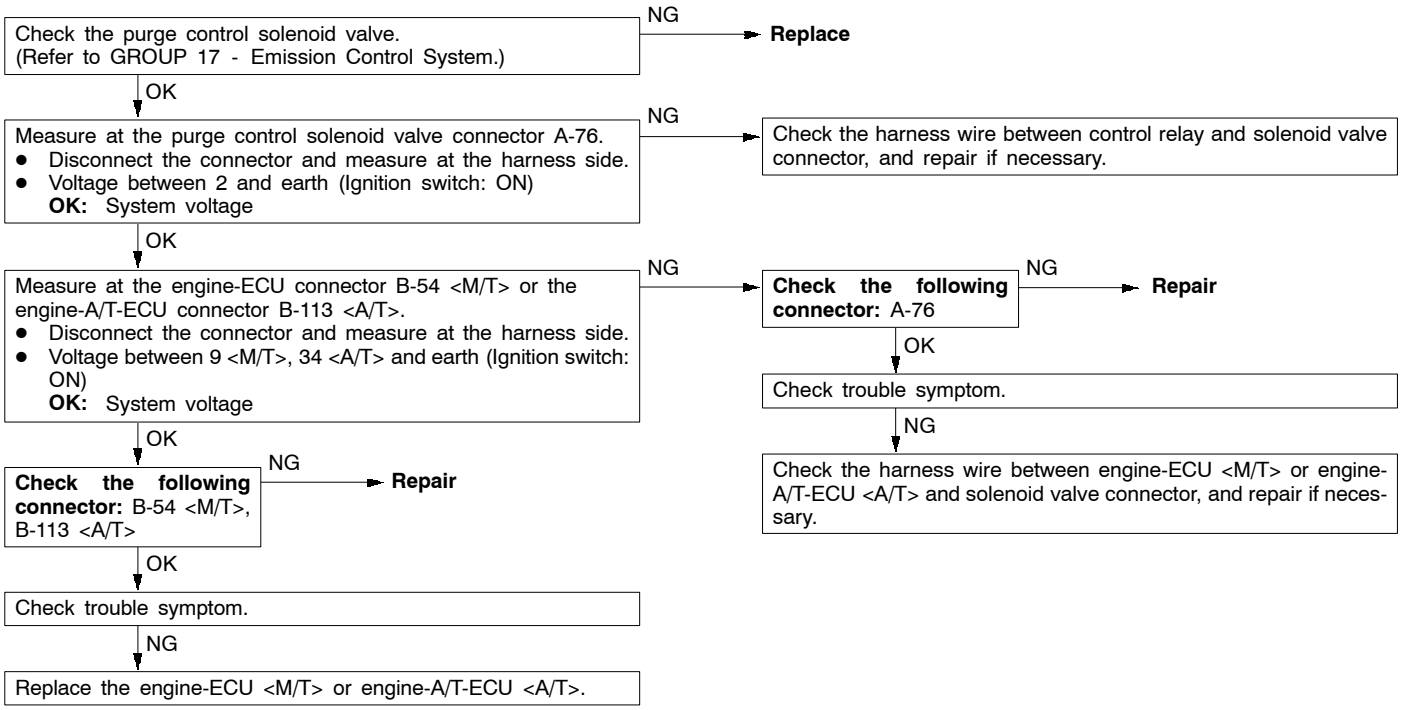
INSPECTION PROCEDURE 35

Idle speed control (ISC) servo (Stepper motor) system	Probable cause
The engine-ECU <M/T> or engine-A/T-ECU <A/T> controls the intake air volume during idling by opening and closing the servo valve located in the bypass air passage.	• Malfunction of ISC servo • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



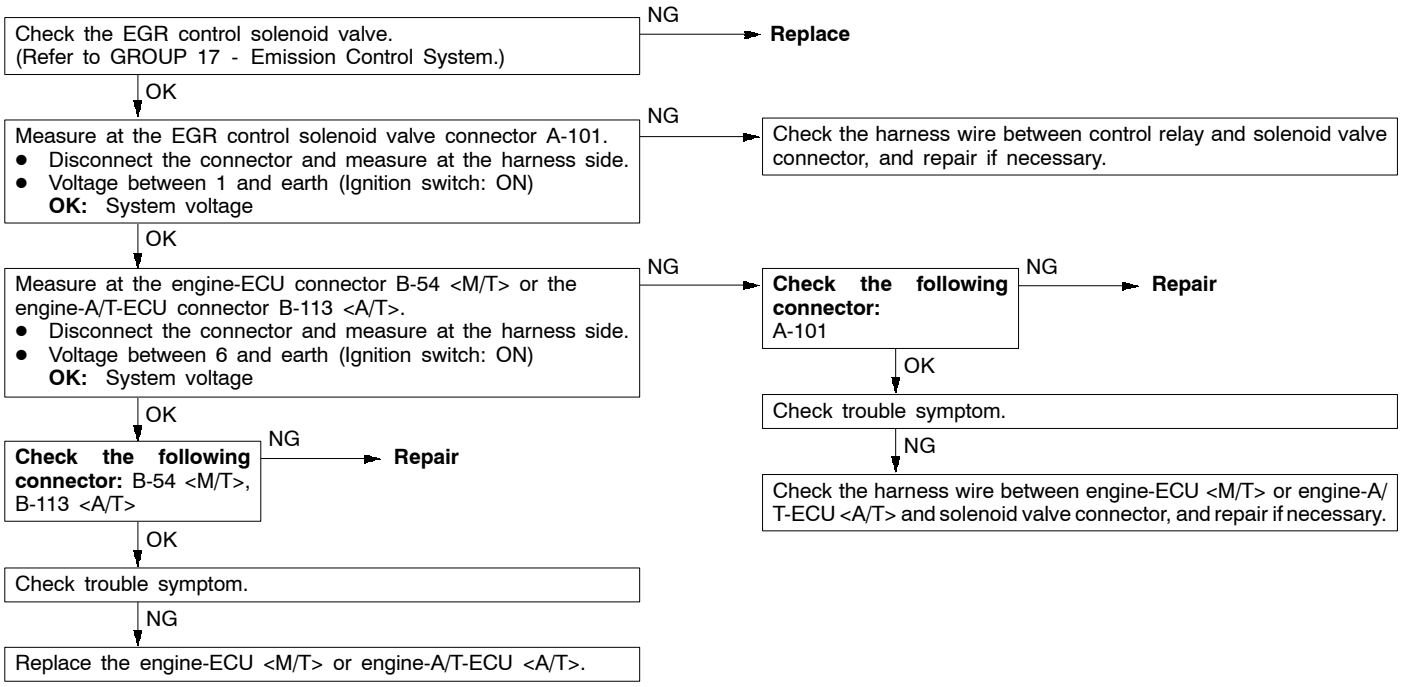
INSPECTION PROCEDURE 36

Purge control solenoid valve system	Probable cause
The purge control solenoid valve controls the purging of air from the canister located inside the intake manifold.	• Malfunction of solenoid valve • Improper connector contact, open circuit or short-circuited harness wire. • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



INSPECTION PROCEDURE 37

EGR control solenoid valve system	Probable cause
The EGR control solenoid valve is controlled by the negative pressure resulting from EGR operation leaking to port "A" of the throttle body.	• Malfunction of solenoid valve • Improper connector contact, open circuit or short-circuited harness wire. • Malfunction of the engine-ECU <M/T> or engine-A/T-ECU <A/T>



DATA LIST REFERENCE TABLE

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

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

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor (front)	Engine:After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Code No. 11	13D-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	17 - 43 Hz	-	-
			2,500 r/min	70 - 110 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	13D-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	13D-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. 27	13D-50
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 30 <M/T> Procedure No. 31 <A/T>	13D-52 <M/T> 13D-53 <M/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	13D-16
			When engine coolant temperature is 0°C	0°C		
			When engine coolant temperature is 20°C	20°C		
			When engine coolant temperature is 40°C	40°C		
			When engine coolant temperature is 80°C	80°C		

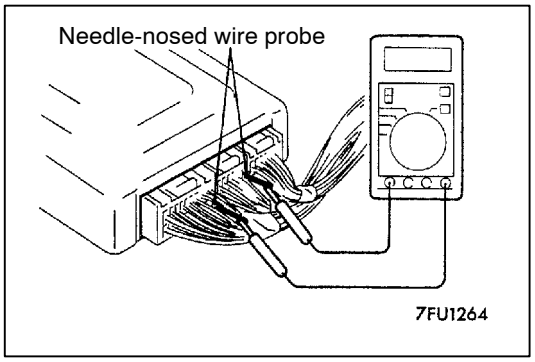
Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
22	Crank angle sensor	● Engine: Cranking ● Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. 22	13D-17
		● Engine: Idling ● Idle position switch: ON	When engine coolant temperature is -20°C	1,275 - 1,475 rpm		
			When engine coolant temperature is 0°C	1,225 - 1,425 rpm		
			When engine coolant temperature is 20°C	1,100 - 1,300 rpm		
			When engine coolant temperature is 40°C	950 - 1,150 rpm		
			When engine coolant temperature is 80°C	650 - 850 rpm		
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25	13D-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. 29	13D-52
			Throttle valve: Slightly open	OFF*2		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 32	13D-54
			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. 33	13D-51
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 31	13D-53
			D, 2, L or R	D, 2, L or R		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
41	Injectors *3	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)	12 - 19 ms	-	-
			When engine coolant temperature is 20°C	26 - 40 ms		
			When engine coolant temperature is 80°C	6.0 - 9.1 ms		
	Injectors*4	● Engine coolant temperature: 80–95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T : P range)	Engine is idling	1.6 - 2.8 ms		
			2,500 r/min	1.4 - 2.6 ms		
			When engine is suddenly raced	Increases		
44	Ignition coils and power transistors	● Engine: After having warmed up ● Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	2 - 18°BTDC	-	-
			2,500 r/min	18 - 38°BTDC		
45	ISC (stepper) motor position *5	● Engine coolant temperature: 80 - 95°C ● Lamps, electric cooling fan and all accessories: OFF ● Transmission: Neutral (A/T : P range) ● Idle position switch: ON ● Engine: Idling ● When A/C switch is ON, A/C compressor should be operating	A/C switch: OFF	2 - 25 STEP	-	-
			A/C switch: OFF → ON	Increases by 10 - 70 steps		
			● A/C switch: OFF ● Select lever: N range → D range	Increases by 5 - 50 steps		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 33	13D-54
			A/C switch: ON	ON (Compressor clutch is operating)		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
59	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Drive with throttle widely open	3,500 r/min	600 - 1,000 mV	Code No. 59	13D-24

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	13D-21
02		Cut fuel to No. 2 injector					
03		Cut fuel to No. 3 injector					
04		Cut fuel to No. 4 injector					
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 28	13D-51
				Listen near the fuel tank for the sound of fuel pump operation.	Sound of operation is heard.		
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No. 36	13D-56
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Sound of operation can be heard when solenoid valve is driven.	Procedure No. 37	13D-57
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set		5°BTDC	-	-
21	Fan controller	Drive the fan motor	Ignition switch: ON		Radiator fan and condenser fan operate at high speed	Procedure No. 25	13D-48



CHECK AT THE ENGINE-ECU TERMINALS

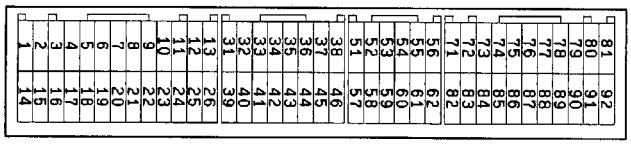
TERMINAL VOLTAGE CHECK CHART

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

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

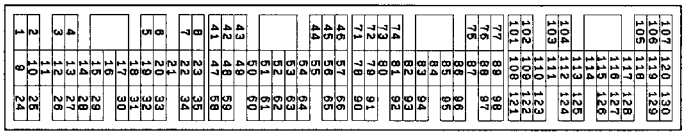
   Caution
   Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine-ECU <M/T> or engine-A/T-ECU <A/T> or all of them. Be careful to prevent this!
3. If voltmeter shows any division from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
4. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

Engine-ECU <M/T> Connector Terminal Arrangement



9FU0393

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



7FU1763

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)	Normal condition
1	1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 11 - 14 V, momentarily drops slightly
14	9	No. 2 injector		
2	24	No. 3 injector		
15	2	No. 4 injector		
4	14	Stepper motor coil <A1>	Engine: Soon after the warmed up engine is started	System voltage ↔ 0 V (Changes repeatedly)
17	28	Stepper motor coil <A2>		
5	15	Stepper motor coil <B1>		
18	29	Stepper motor coil <B2>		
6	6	EGR control solenoid valve	Ignition switch: ON	System Voltage
			While engine is idling, suddenly depress the accelerator pedal.	From system voltage, momentarily drops
8	20	A/C relay	• Engine: Idle speed • A/C switch: OFF → ON (A/C compressor is operating)	System voltage or momentarily 6V or more → 0 - 3V
9	34	Purge control solenoid valve	Ignition switch: ON	System voltage
			Running at 3,000r/min while engine is warming up after having been started.	0 - 3V
10	11	Ignition coil - No. 1, No. 4 (power transistor)	Engine r/min: 3,000 r/min	0.3 - 3.0V
23	12	Ignition coil - No. 2, No. 3 (power transistor)		
12	40	Power supply	Ignition switch: ON	System voltage
25	47			

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
19	19	Air flow sensor reset signal	Engine: Idle speed		0 - 1V
			Engine r/min: 3,000 r/min		6 - 9V
21	18	Fan controller	Radiator fan and condenser fan are not operating		0 - 0.3 V
			Radiator fan and condenser fan are operating		0.7 V or more
22	21	Fuel pump relay	Ignition switch: ON		System voltage
			Engine: Idle speed		0 - 3V
24	61	A/C switch 2	● Engine: Idling ● Outside air temperature: 25°C or more	When A/C is MAX. COOL condition (when the load by A/C is high)	0 - 3 V
				(When A/C is MAX. HOT condition (when the load by A/C is low)	System voltage
33	8	Alternator G terminal	● Engine: Warm, idle (radiator fan: OFF) ● Headlamp: OFF to ON ● Rear defogger switch: OFF to ON ● Brake lamp: ON		Voltage rises by 0.2 - 3.5 V.
41	54	Alternator FR terminal	● Engine: Warm, idle (radiator fan: OFF) ● Headlamp: OFF to ON ● Rear defogger switch: OFF to ON ● Brake lamp: ON		Voltage drops by 0.2 - 3.5 V.
36	22	Engine warning lamp	Ignition switch: “LOCK” (OFF) position → ON		0 - 3V → 9 - 13V (After several seconds have elapsed)
37	52	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	System voltage
				When steering wheel is turned	0 - 3V
38	49	Control relay (Power supply)	Ignition switch: “LOCK” (OFF) position		System voltage
			Ignition switch: ON		0 - 3V
45	83	A/C switch 1	Engine: Idle speed	Turn the A/C switch OFF	0 - 3V
				Turn the A/C switch ON (A/C compressor is operating)	System voltage
58	43	Tachometer signal	Engine r/min: 3,000 r/min		0.3 - 3.0V

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
60	3	Oxygen sensor heater	Engine: Idling after warming up		0 - 3V
			Engine r/min: 5,000r/min.		System voltage
71	58	Ignition switch - ST	Engine: Cranking		8V or more
72	64	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 - 3.8V
				When intake air temperature is 20°C	2.3 - 2.9V
				When intake air temperature is 40°C	1.5 - 2.1V
				When intake air temperature is 80°C	0.4 - 1.0V
75	73	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Engine r/min: 3,500 r/min or more • Driving with the throttle valve widely open		0.6 - 1.0 V
76	71	Oxygen sensor (front)	Engine: Running at 2,500 r/min after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8V (Changes repeatedly)
80	66	Backup power supply	Ignition switch:“LOCK” (OFF) position		System voltage
81	46	Sensor impressed voltage	Ignition switch: ON		4.5 - 5.5V
82	98	Ignition switch - IG	Ignition switch: ON		System voltage
83	44	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2 - 3.8V
				When engine coolant temperature is 20°C	2.3 - 2.9V
				When engine coolant temperature is 40°C	1.3 - 1.9V
				When engine coolant temperature is 80°C	0.3 - 0.9V

Terminal No. <M/T>	Terminal No. <A/T>	Check item	Check condition (Engine condition)		Normal condition
84	78	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3 - 1.0V
				Fully open throttle valve	4.5 - 5.5V
85	55	Barometric pressure sensor	Ignition switch: ON	When altitude is 0m	3.7 - 4.3V
				When altitude is 1,200m	3.2 - 3.8V
86	80	Vehicle speed sensor	● Ignition switch: ON ● Move the vehicle slowly forward		0 ↔ 5V (Changes repeatedly)
87	79	Idle position switch	Ignition switch: ON	Set throttle valve to idle position	0 - 1V
				Slightly open throttle valve	4V or more
88	56	Camshaft position sensor	Engine: Cranking		0.4 - 3.0V
			Engine: Idle speed		0.5 - 2.0V
89	45	Crank angle sensor	Engine: Cranking		0.4 - 4.0V
			Engine: Idle speed		1.5 - 2.5V
90	65	Air flow sensor	Engine: Idle speed		2.2 - 3.2V
			Engine r/min: 2,500r/min		
91	59	Inhibitor switch <A/T>	Ignition switch: ON	Set selector lever to P or N	0 - 3V
				Set selector lever to Other than P or N	8 - 14V

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

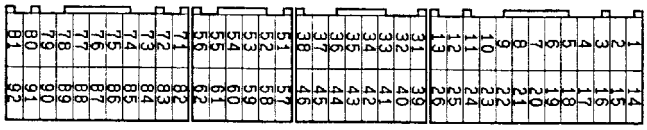
1. Turn the ignition switch to “LOCK” (OFF) position.
2. Disconnect the engine-ECU <M/T> or engine-A/T-ECU <A/T> connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU <M/T> or engine-A/T-ECU <A/T> harness-side connector while referring to the check chart.

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

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

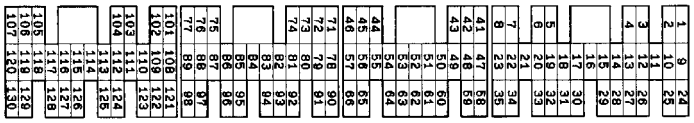
4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

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



9FU0392

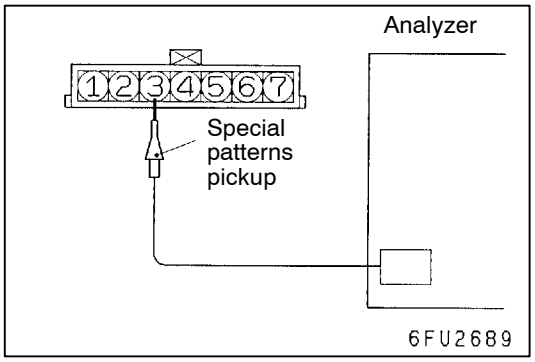
Engine-A/T-ECU <A/T> Harness Side Connector Terminal Arrangement



7FU1764

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

Terminal No.<M/T>	Terminal No. <A/T>	Inspection item	Normal condition (Check condition)
72 - 92	64 - 57	Intake air temperature sensor	5.3 - 6.7 kΩ (When intake air temperature is 0°C)
			2.3 - 3.0 kΩ (When intake air temperature is 20°C)
			1.0 - 1.5 kΩ (When intake air temperature is 40°C)
			0.30 - 0.42 kΩ (When intake air temperature is 80°C)
83 - 92	44 - 57	Engine coolant temperature sensor	5.1 - 6.5 kΩ (When coolant temperature is 0°C)
			2.1 - 2.7 kΩ (When coolant temperature is 20°C)
			0.9 - 1.3 kΩ (When coolant temperature is 40°C)
			0.26 - 0.36 kΩ (When coolant temperature is 80°C)
87 - 92	79 - 57	Idle position switch	Continuity (when throttle valve is at idle position)
			No continuity (when throttle valve is slightly open)
91 - 92	59 - 57	Inhibitor switch <A/T>	Continuity (when select lever is at P or N)
			No continuity (when select lever is at D, 2, L or R)



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

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

Alternate Method (Test harness not available)

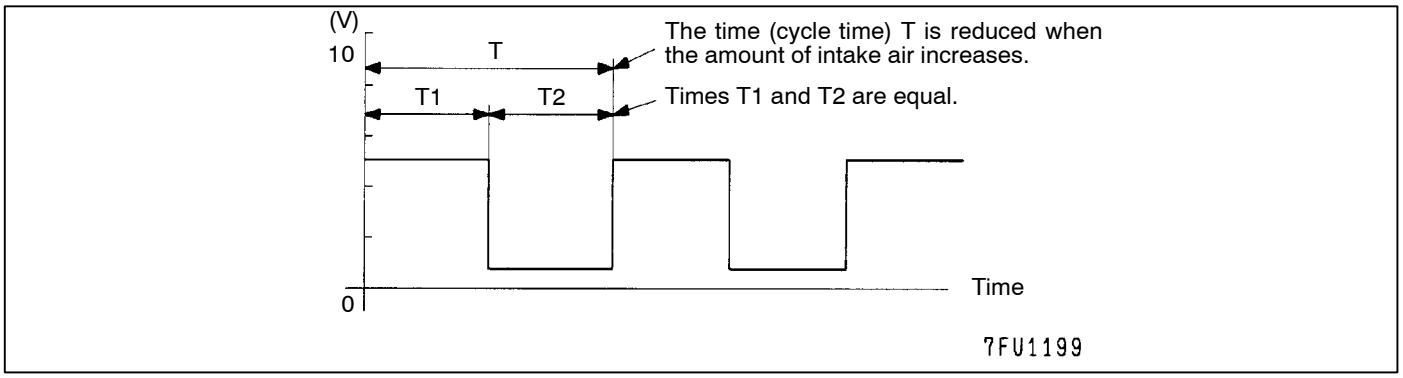
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 90 or engine-A/T-ECU <A/T> terminal 65.

Standard Wave Pattern

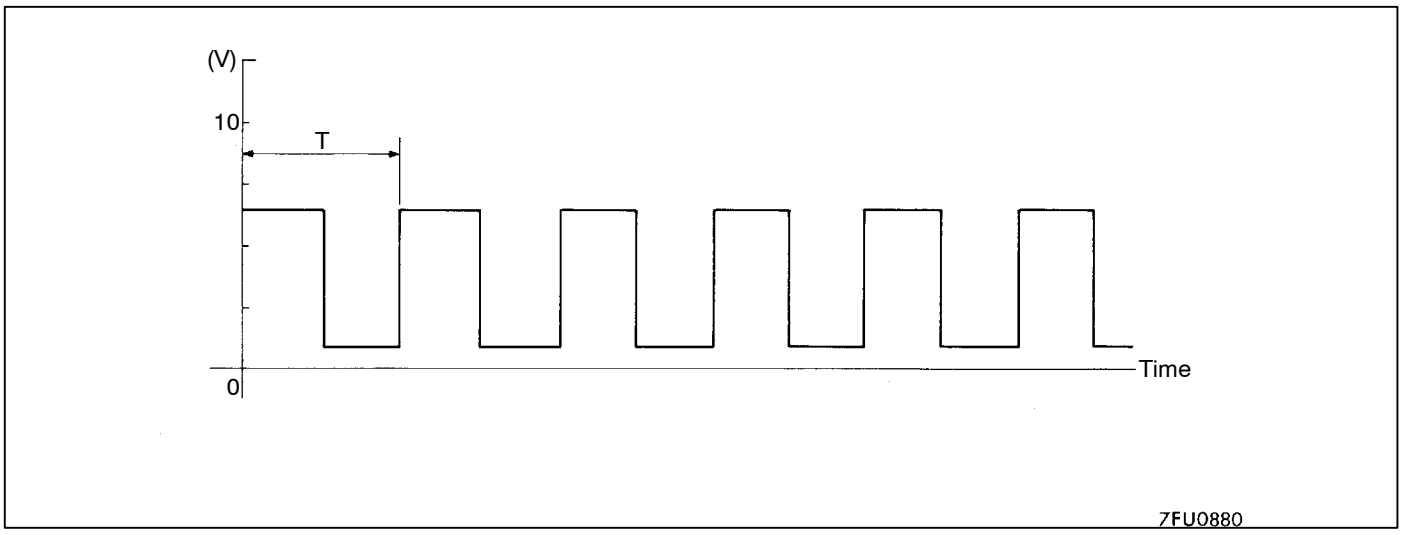
Observation conditions

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

Standard wave pattern

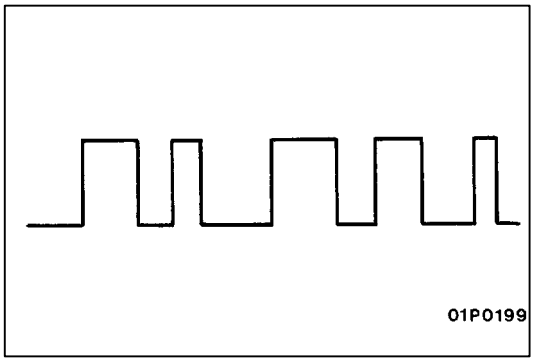


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

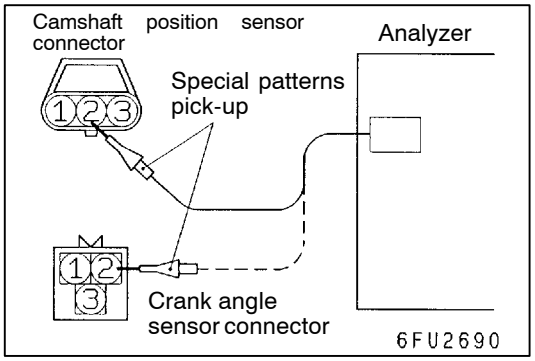
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

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



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

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

Alternate Method (Test harness not available)

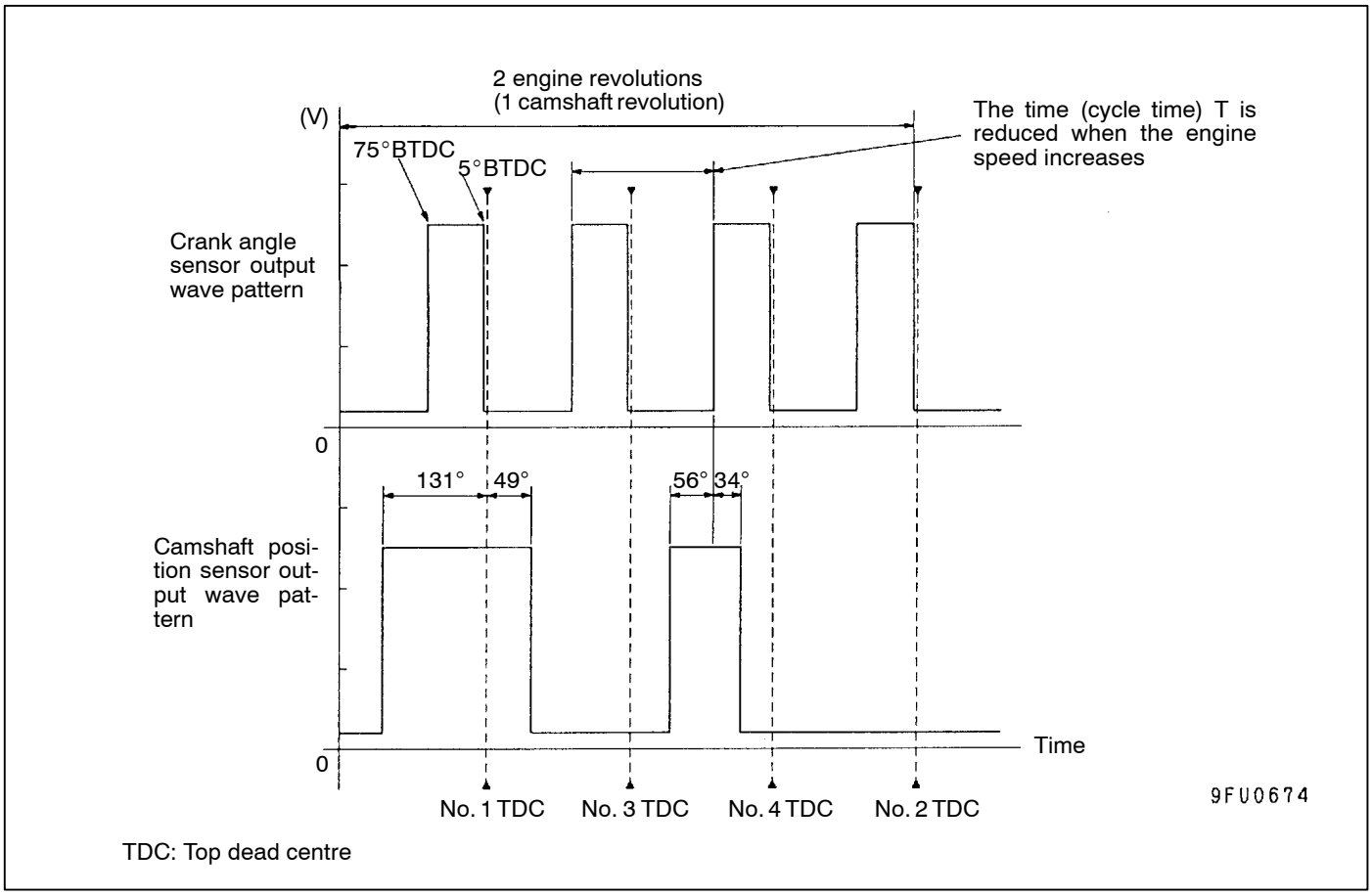
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 88 or engine-A/T-ECU <A/T> terminal 56. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 89 or engine-A/T-ECU <A/T> terminal 45. (When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

Standard Wave Pattern

Observation conditions

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

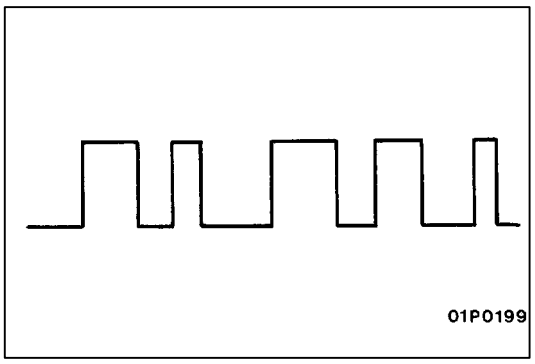
Standard wave pattern



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

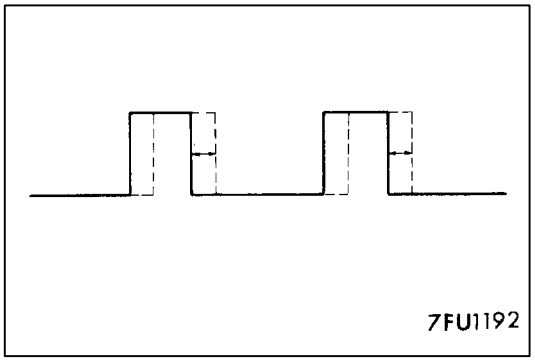
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



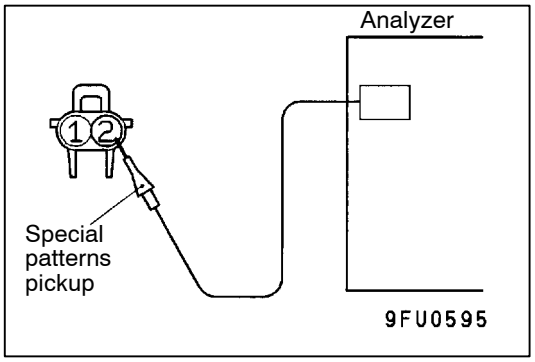
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTOR

Measurement Method

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

Alternate Method (Test harness not available)

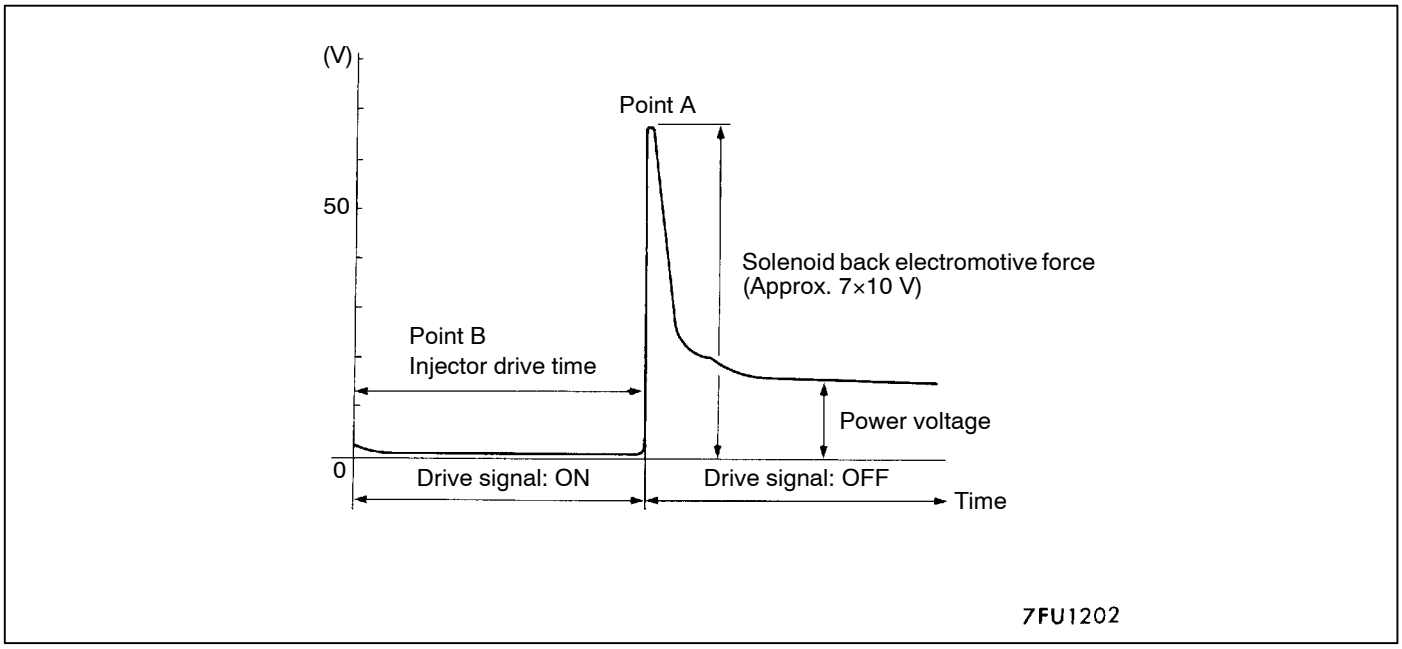
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 1 or engine-A/T-ECU <A/T> terminal 1. (When checking the No. 1 cylinder.)
2. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 14 or engine-A/T-ECU <A/T> terminal 9. (When checking the No. 2 cylinder.)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

Standard Wave Pattern

Observation conditions

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

Standard wave pattern

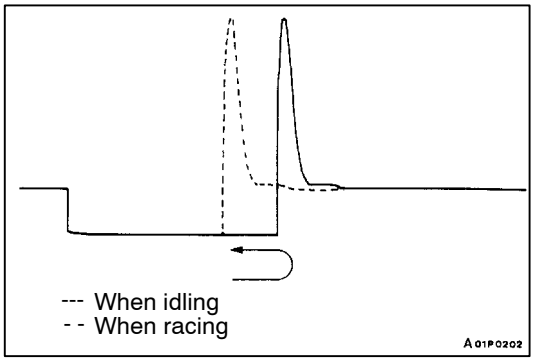


Wave Pattern Observation Points

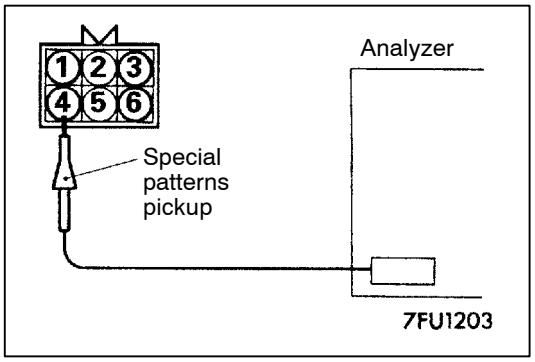
Point A: Height of solenoid back electromotive force

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

Point B: Injector drive time



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



STEPPER MOTOR

Measurement Method

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

Alternate Method (Test harness not available)

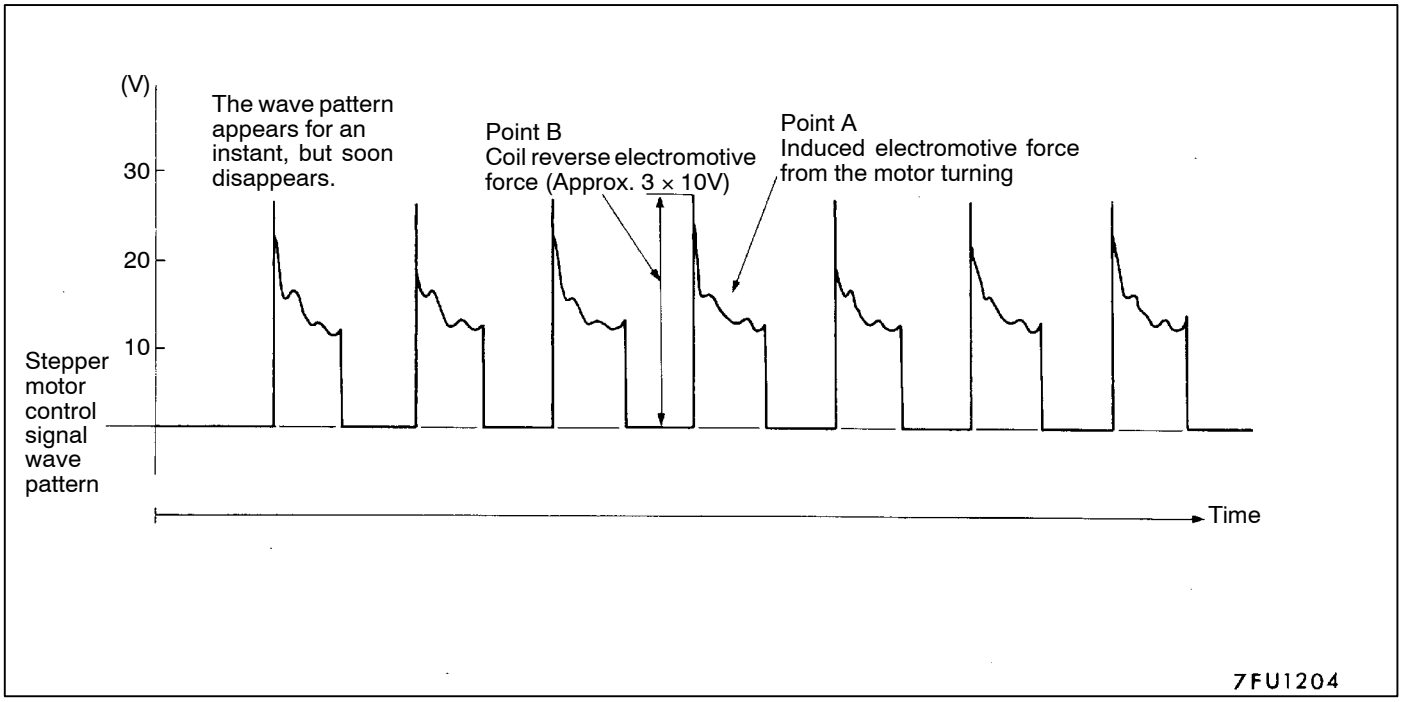
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 4 or engine-A/T-ECU <A/T> terminal 14, connection terminal 5 <M/T>, 15 <A/T>, connection terminal 17 <M/T>, 28 <A/T>, and connection terminal 18 <M/T>, 29 <A/T> respectively.

Standard Wave Pattern

Observation conditions

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

Standard wave pattern



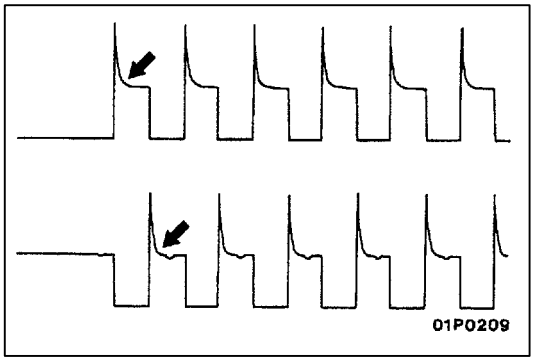
Wave Pattern Observation Points

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

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

Point B: Height of coil reverse electromotive force

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



Examples of Abnormal Wave Pattern

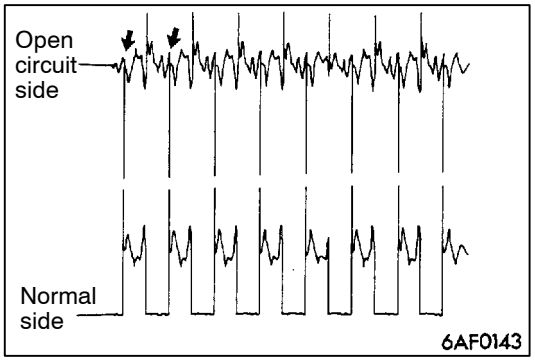
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



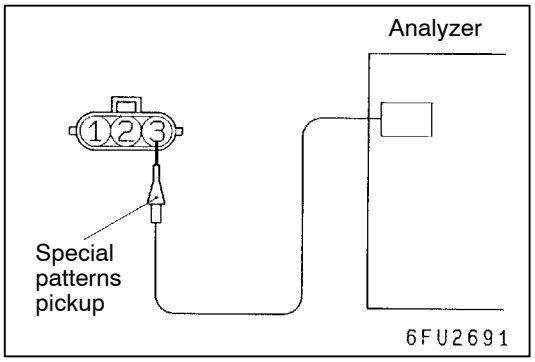
- Example 2

  Cause of problem

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

  Wave pattern characteristics

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



IGNITION COIL AND POWER TRANSISTOR

Power transistor control signal

Measurement Method

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

Alternate Method (Test harness not available)

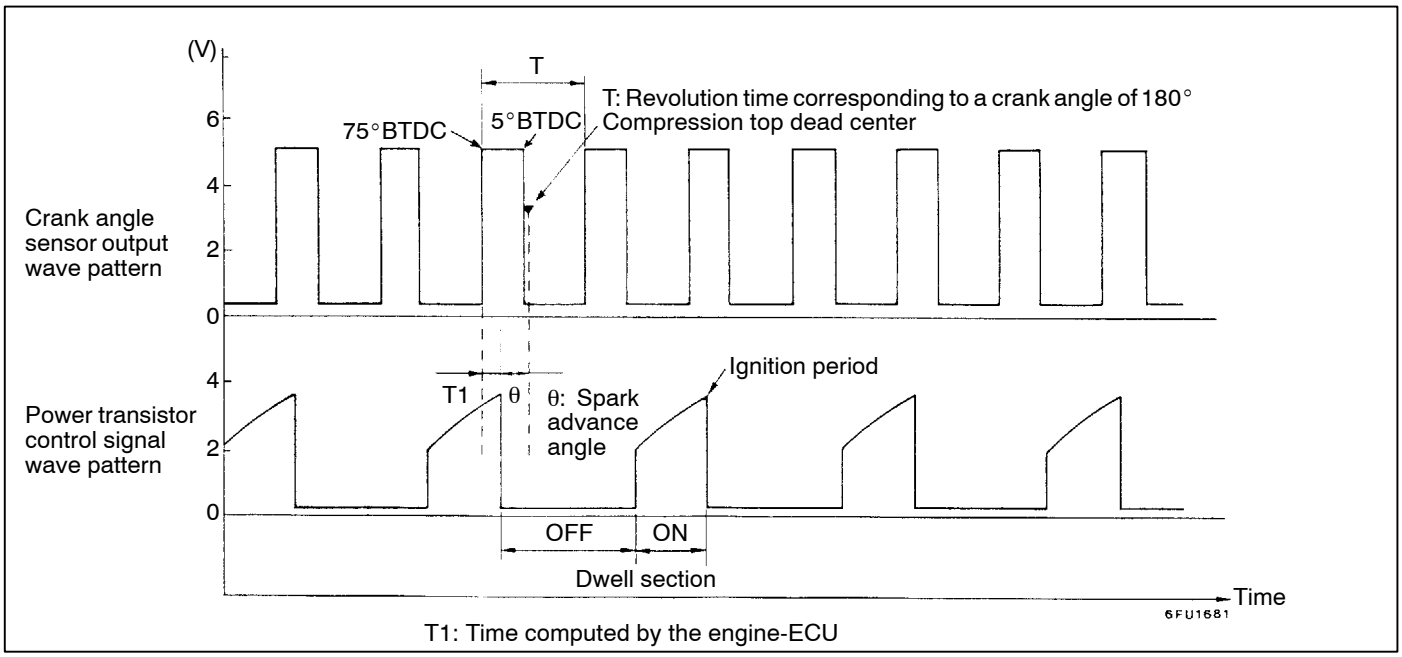
1. Connect the analyzer special patterns pickup to engine-ECU <M/T> terminal 10 or engine-A/T-ECU <A/T> terminal 11 (No. 1 - No. 4), terminal 23 <M/T>, 12 <A/T> (No. 2 - No. 3) respectively.

Standard Wave Pattern

Observation condition

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

Standard wave pattern

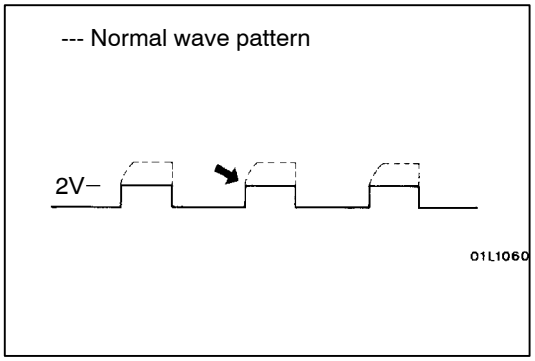


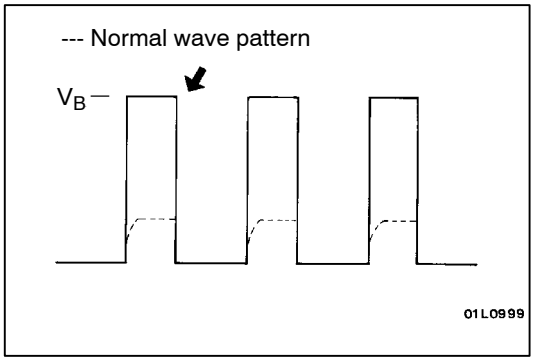
T1: Time computed by the engine-ECU

Wave Pattern Observation Points

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

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





Examples of Abnormal Wave Patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Open-circuit in ignition primary circuit

  Wave pattern characteristics

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

- Example 2

  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

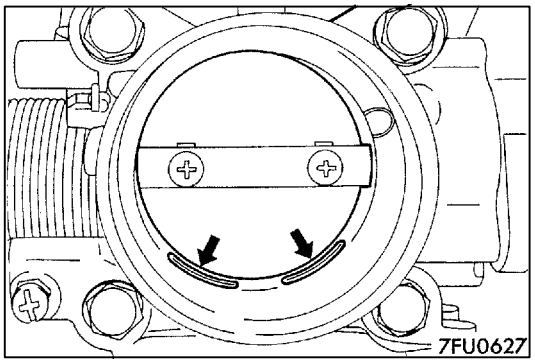
  Wave pattern characteristics

  Power voltage results when the power transistor is ON.

ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

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

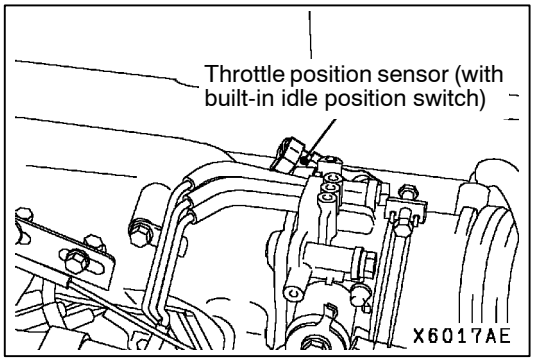


3. Plug the bypass passage inlet of the throttle body.

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

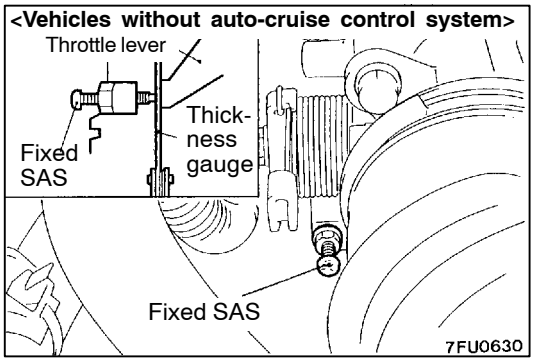
4. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.
5. Start the engine, race it several times and idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
6. If the throttle valve deposits are not removed, repeat steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the air intake hose.
9. Use the MUT-II to erase the self-diagnosis code.
10. Adjust the basic idle speed. (Refer to P.13D-81.)

    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

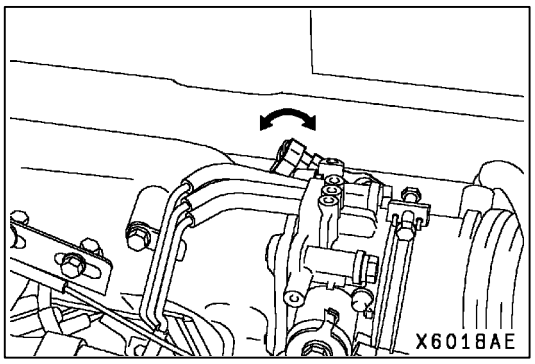
1. Connect the MUT-II to the diagnosis connector.



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

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

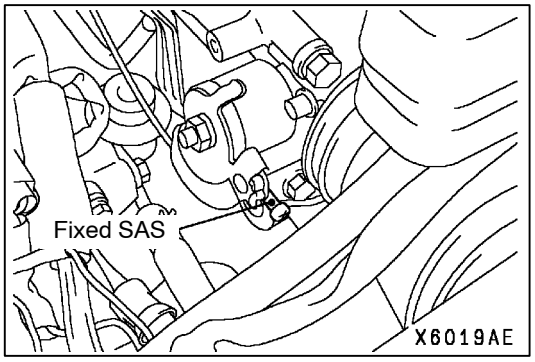
3. Turn the ignition switch to ON (but do not start the engine).



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

   Standard value: 400 - 1,000 mV

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



FIXED SAS ADJUSTMENT

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

1. Loosen the tension of the accelerator cable sufficiently.
2. Back out the fixed SAS lock nut.
3. Turn the fixed SAS counterclockwise until it is sufficiently backed out, and fully close the throttle valve.
4. Tighten the fixed SAS until the point where the throttle lever is touched (i.e., the point at which the throttle valve begins to open) is found.
   From that point, tighten the fixed SAS 1-1/4 turn.
5. While holding the fixed SAS so that it doesn’t move, tighten the lock nut securely.
6. Adjust the tension of the accelerator cable.
7. Adjust the basic idling speed.
8. Adjust the idle position switch and the throttle position sensor (P.13D-79).

BASIC IDLE SPEED ADJUSTMENT

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

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

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

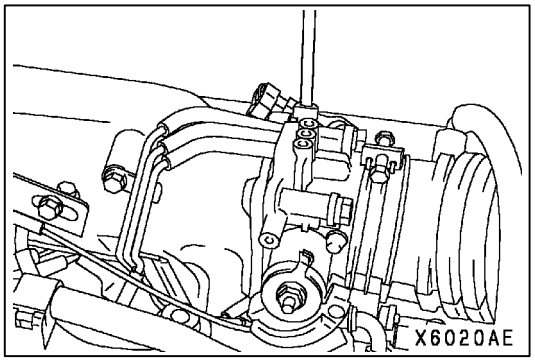
3. Start the engine and run at idle.
4. Select the item No.30 of the MUT-II Actuator test.

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

5. Check the idle speed.

   Standard value:
   750 ± 50 r/min

   NOTE
   (1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
   (2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13D-79.)



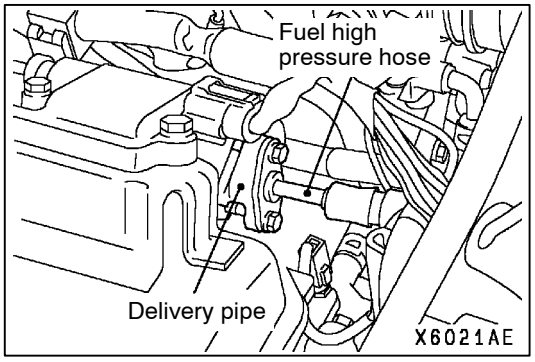
6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

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

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

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

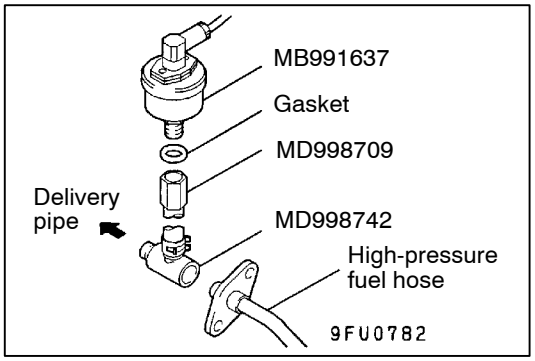
8. Switch OFF the ignition switch.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.



FUEL PRESSURE TEST

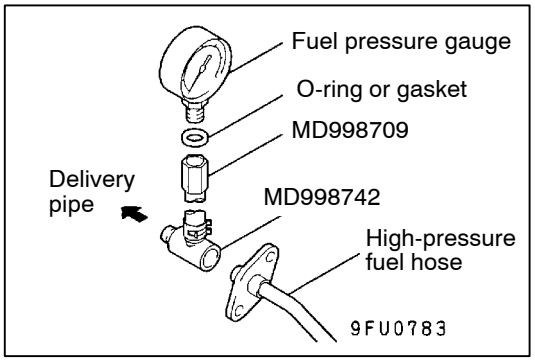
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13D-84.)
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

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



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

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

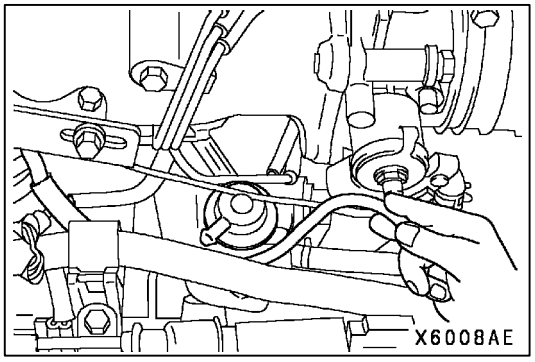


<When using the fuel pressure gauge>
(1) Install the fuel pressure gauge on the special tool (for measuring the fuel pressure) putting a suitable O-ring or gasket between them.
(2) Install the special tool which was set up in step (1) between the high-pressure fuel hose and the delivery pipe.

5. Connect the MUT-II to the diagnosis connector.
6. Turn the ignition switch to ON. (But do not start the engine.)

7. Select “Item No.07” from the MUT-II Actuator test to drive the fuel pump.
   Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to “LOCK” (OFF) position.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

    Standard value: Approx. 265 kPa at kerb idle



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

    Standard value: 324 - 343 kPa at kerb idle

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

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

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

Symptom	Probable cause	Remedy
● Fuel pressure too low ● Fuel pressure drops after racing ● No fuel pressure in fuel return hose	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose or pipe
Same fuel pressure when vacuum hose is connected and when disconnected	Damaged vacuum hose or clogged nipple	Replace vacuum hose or clean nipple

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

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

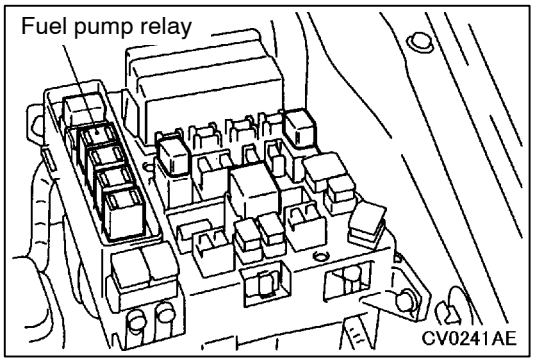
16. Release residual pressure from the fuel pipe line. (Refer to P.13D-84.)
17. Remove the fuel pressure gauge and special tool from the delivery pipe.

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

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

    Tightening torque: 5 Nm

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



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

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

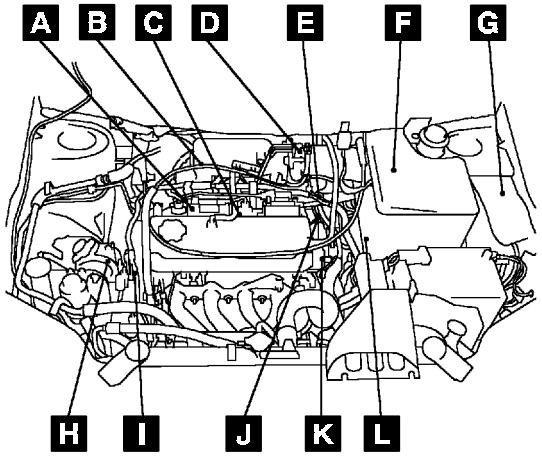
1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the fuel pump relay.
3. After starting the engine and letting it run until it stops naturally, turn the ignition switch to OFF.
4. Install the fuel pump relay.

FUEL PUMP OPERATION CHECK

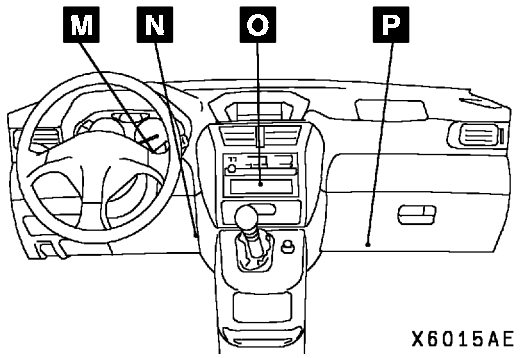
Refer to '99 SPACE RUNNER/SPACE WAGON Workshop Manual (Pub. No. PWDE9803) GROUP 13A - On-vehicle service.

COMPONENT LOCATION

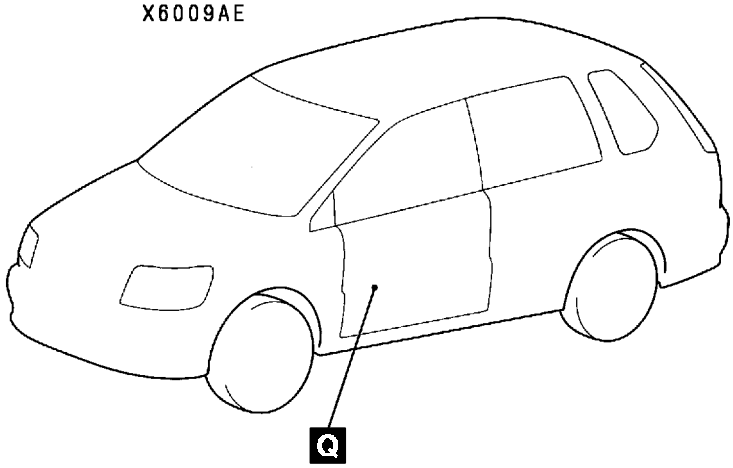
Name	Symbol	Name	Symbol
A/C relay	G	Engine-A/T-ECU <A/T>	P
A/C switch	O	Engine warning lamp (check engine lamp)	M
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	F	Idle speed control servo	D
Camshaft position sensor	K	Ignition coil	A
Control relay and fuel pump relay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



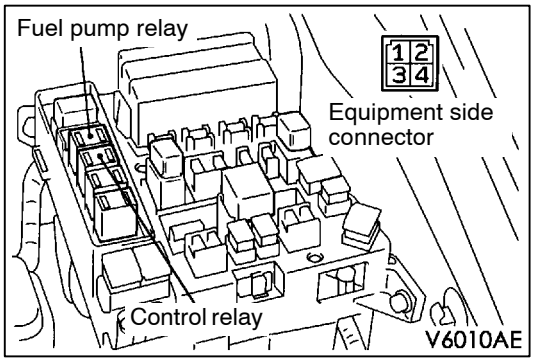
X6009AE



X6015AE

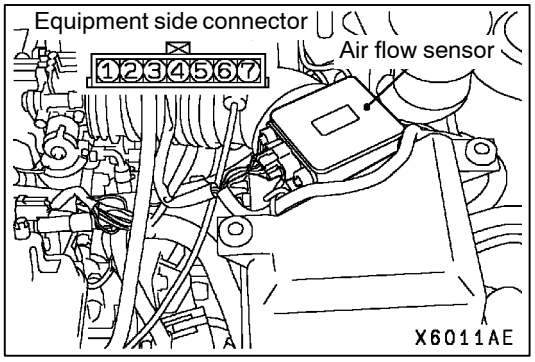


X6016AE



CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

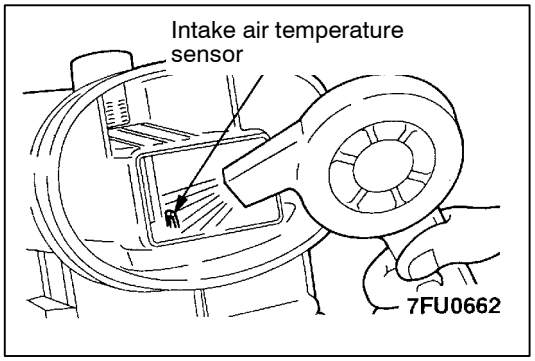
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕



INTAKE AIR TEMPERATURE SENSOR CHECK

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

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

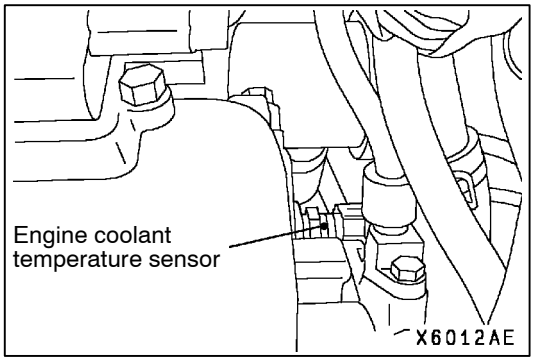


3. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

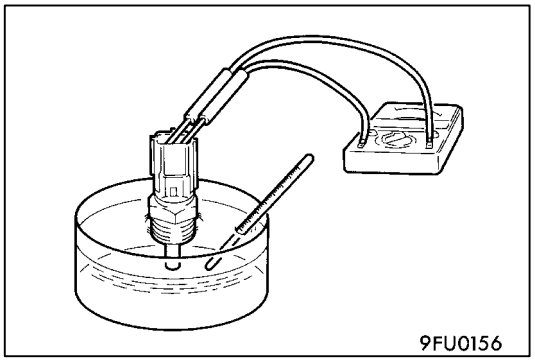
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

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

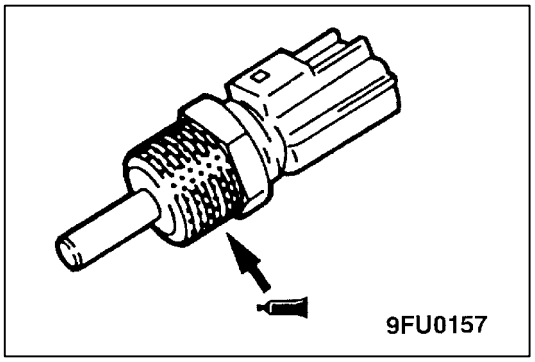
1. Remove the engine coolant temperature sensor.



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

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

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

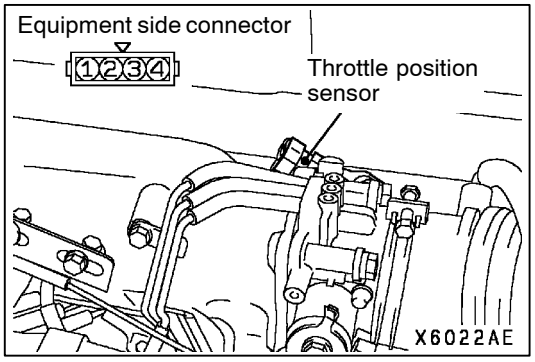


4. Apply sealant to threaded portion.

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

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

   Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

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

   Standard value: 3.5 - 6.5 kΩ

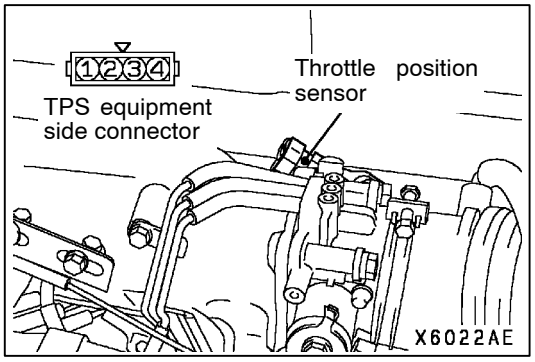
3. Measure the resistance between the throttle position sensor side connector terminal 2 and terminal 4.

   Normal condition:

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

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

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



IDLE POSITION SWITCH CHECK

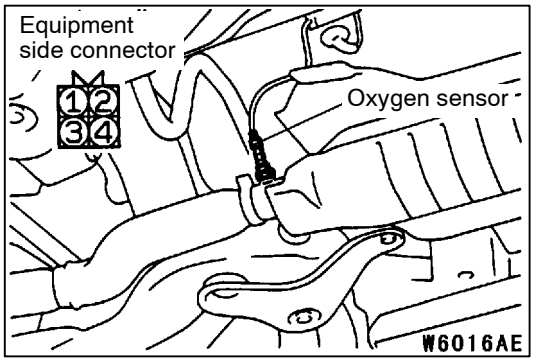
1. Disconnect the throttle position sensor connector.
2. Check the continuity between the throttle position sensor connector side terminal 3 and terminal 4.

   Normal condition:

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

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

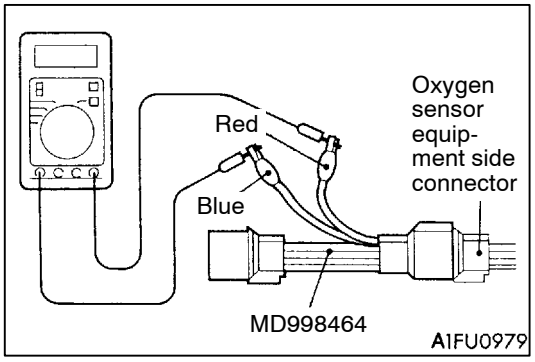
   NOTE
   After replacement, the idle position switch and throttle position sensor should be adjusted. (Refer to P.13D-79.)



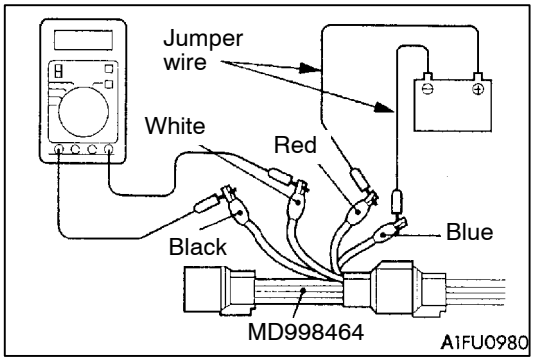
OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.



2. Make sure that there is continuity (11 - 18 Ω at 20°C) between terminal 2 (red clip of special tool) and terminal 4 (blue clip of special tool) on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use a jumper wire to connect terminal 2 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 4 (blue clip) to the battery (-) terminal.

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

6. Connect a digital voltage meter between terminal 1 (black clip) and terminal 3 (white clip).

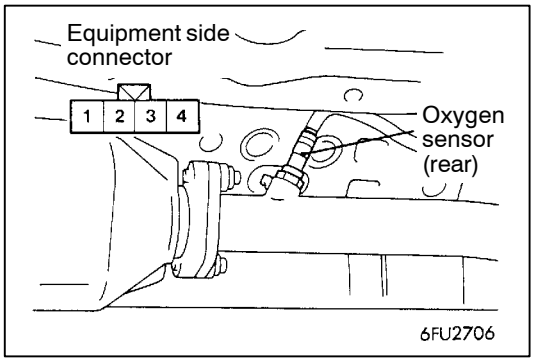
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

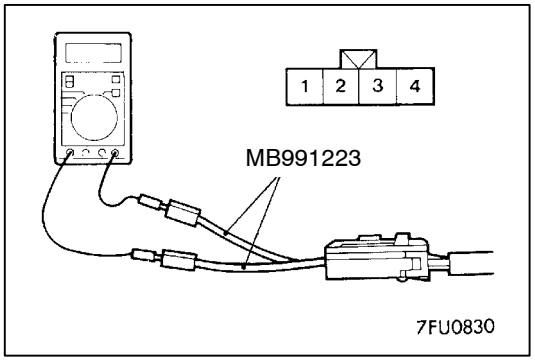
   Standard value:

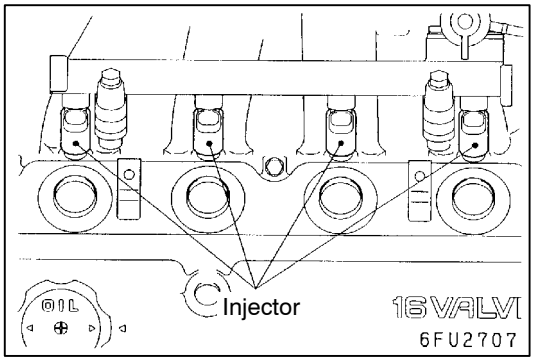
Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 - 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 - 1.0 V.

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

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







<Oxygen sensor (rear)>

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

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

INJECTOR CHECK

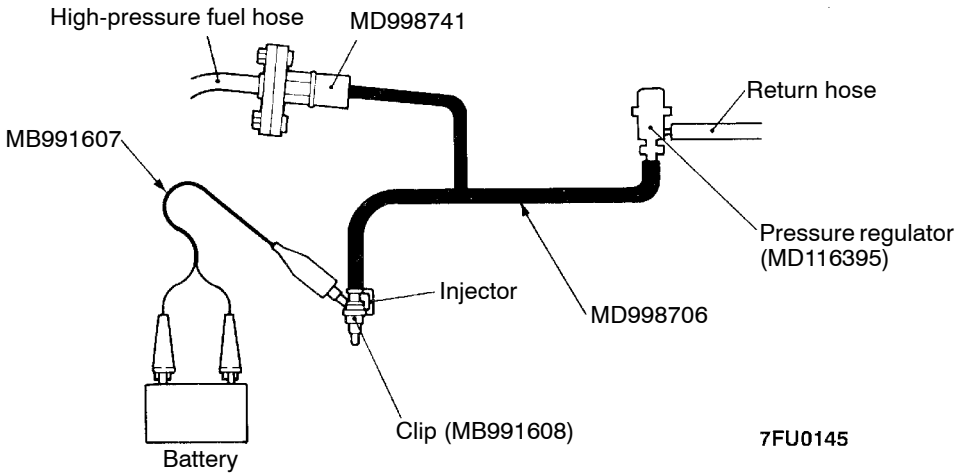
Measurement of Resistance between Terminals

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

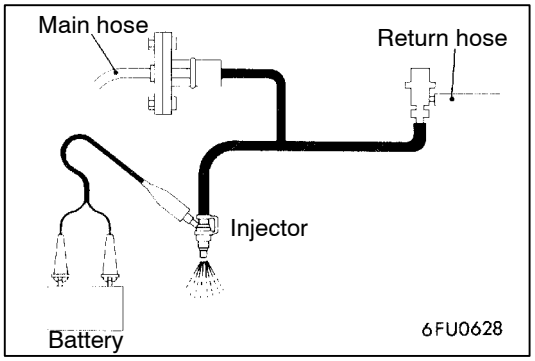
   Standard value: 13 - 16 Ω (at 20°C)
3. Install the injector connector.

Checking the Injection Condition

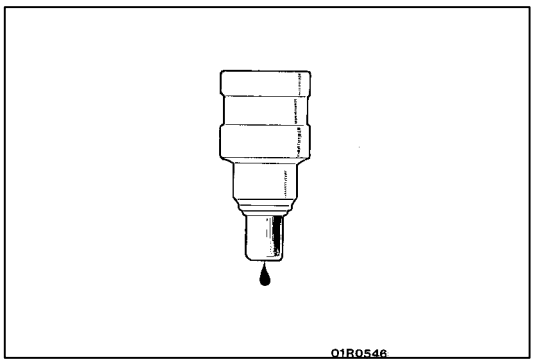
1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13D-84.)
2. Remove the injector.
3. Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.



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



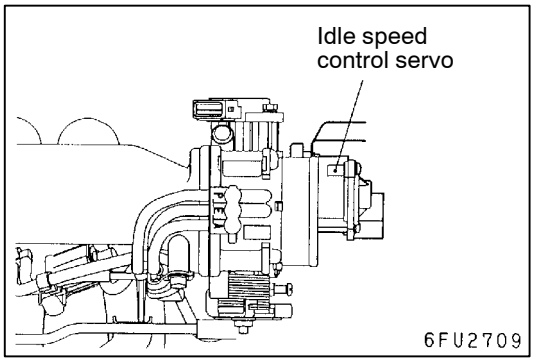
7. Activate the injector and check the atomized spray condition of the fuel.
   The condition can be considered satisfactory unless it is extremely poor.

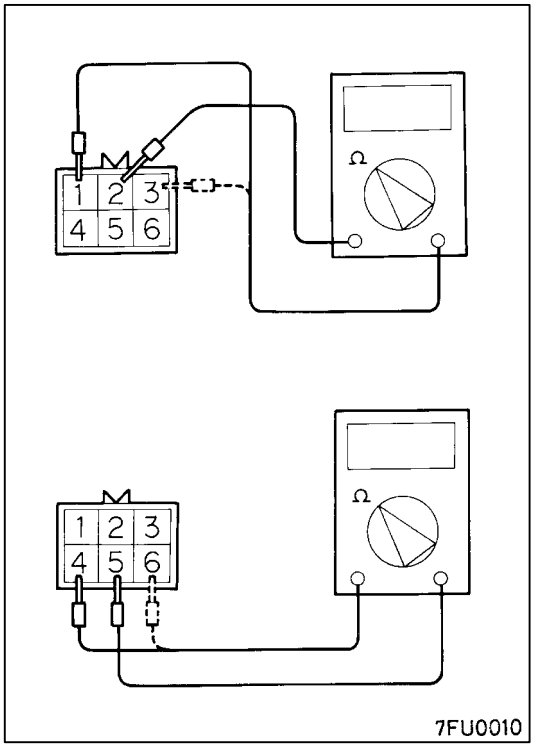


8. Stop the actuation of the injector, and check for leakage from the injector’s nozzle.

   Standard value: 1 drop or less per minute

9. Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops, disconnect the special tool and restore it to its original condition.
10. Disconnect the MUT-II.





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

Checking the Operation Sound

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

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

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

Checking the Coil Resistance

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

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

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

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

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 - Emission Control System.

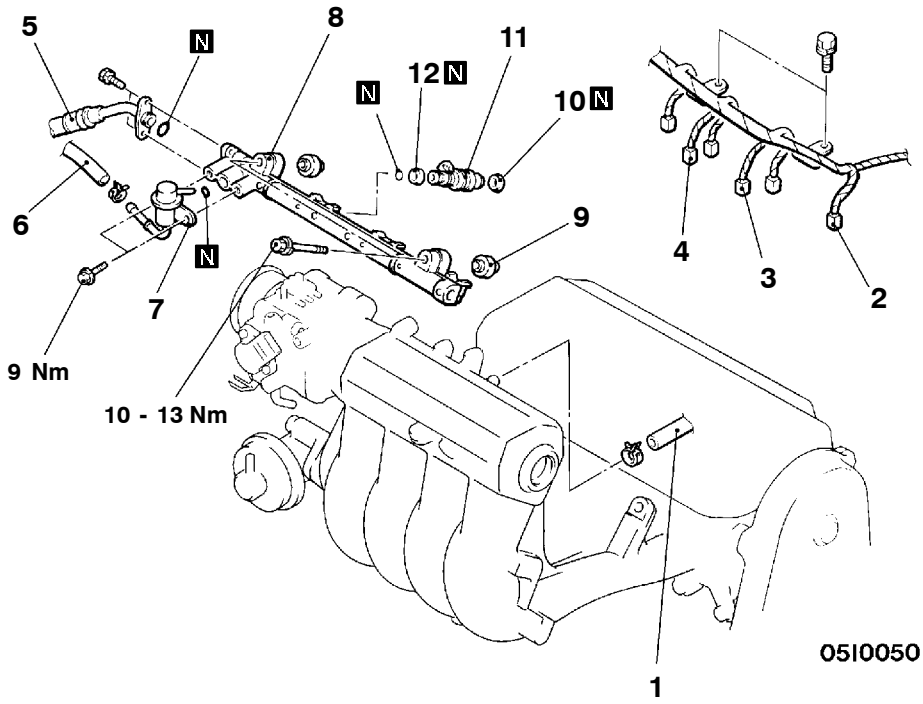
EGR CONTROL SOLENOID VALVE CHECK

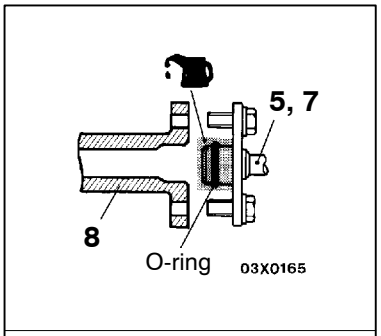
Refer to GROUP 17 - Emission Control System.

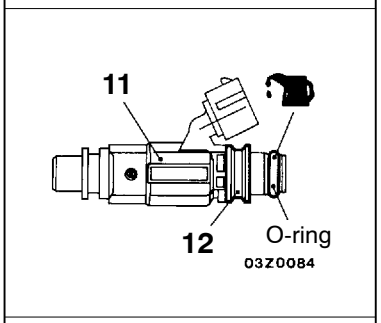
INJECTOR

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Discharge Prevention (Refer to P.13D-84.)







Engine oil

00006518

Removal steps

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

REMOVAL SERVICE POINT

◀A▶ DELIVERY PIPE/INJECTOR REMOVAL

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

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

INSTALLATION SERVICE POINT

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

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

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

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

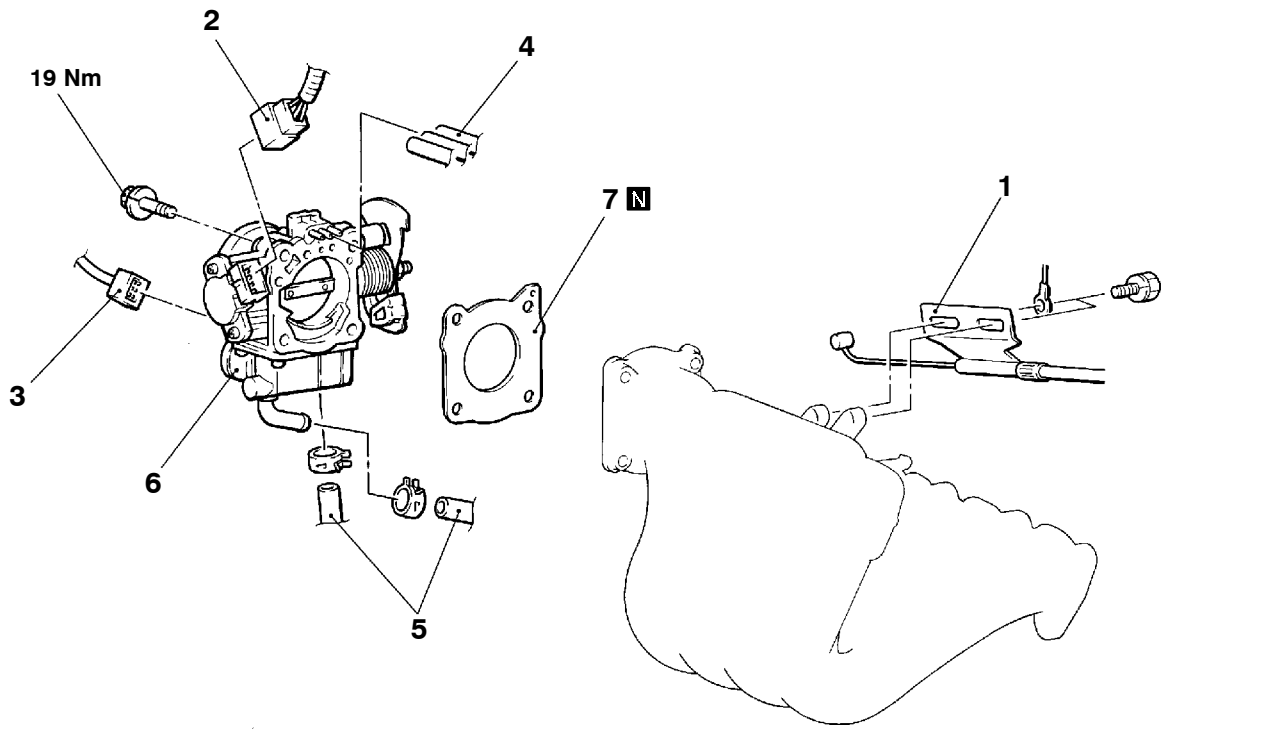
   Tightening torque:
   9 Nm (Fuel pressure regulator)

THROTTLE BODY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining
- Air Cleaner Removal

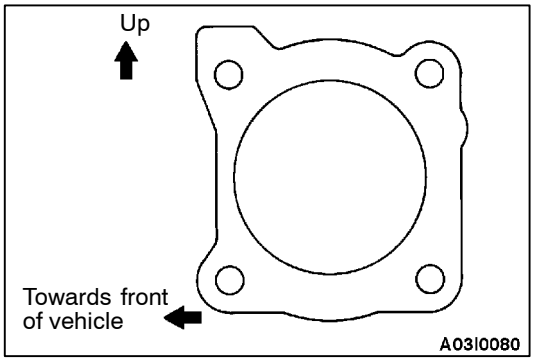
Post-installation Operation
- Air Cleaner Installation
- Engine Coolant Supplying
- Accelerator Cable Adjustment (GROUP 17 - On-vehicle Service)



A03I0074

Removal steps

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

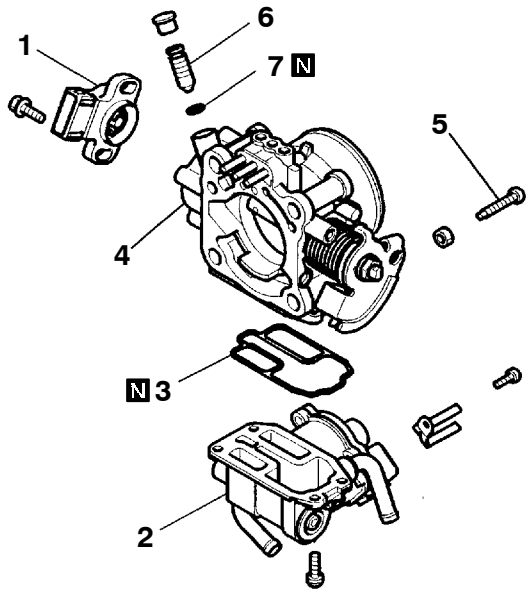


INSTALLATION SERVICE POINT

▶A◀ THROTTLE BODY GASKET INSTALLATION

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

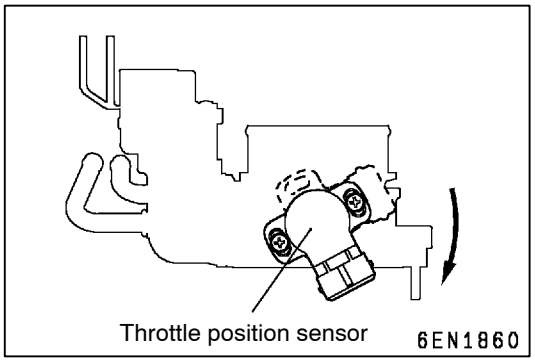
DISASSEMBLY AND REASSEMBLY

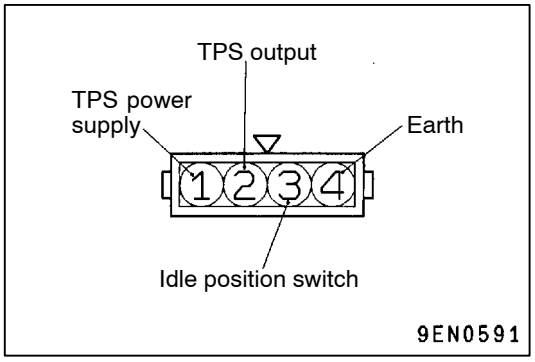


Disassembly steps

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





REASSEMBLY SERVICE POINT

▶A◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

1. Place the throttle position sensor against the throttle body as shown by the dotted line in illustration.
2. Turn the throttle position sensor to the position shown in the illustration, and then tighten the screw.
3. Connect a multimeter between terminal (1) (TPS power supply) and terminal (2) (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully-open position.
4. Check the continuity between terminal (3) (idle position switch) and terminal (4) (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.
5. If there is an abnormality, replace the TPS.