
FUEL

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120002541

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NOTE
THE GROUPS MARKED BY ARE NOT IN THIS MANUAL.

MULTIPOINT FUEL INJECTION (MPI)

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GENERAL INFORMATION

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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

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 2-cylinder group for every two rotations of the crankshaft. This is called group fuel injection.

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

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

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.

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.

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.

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.

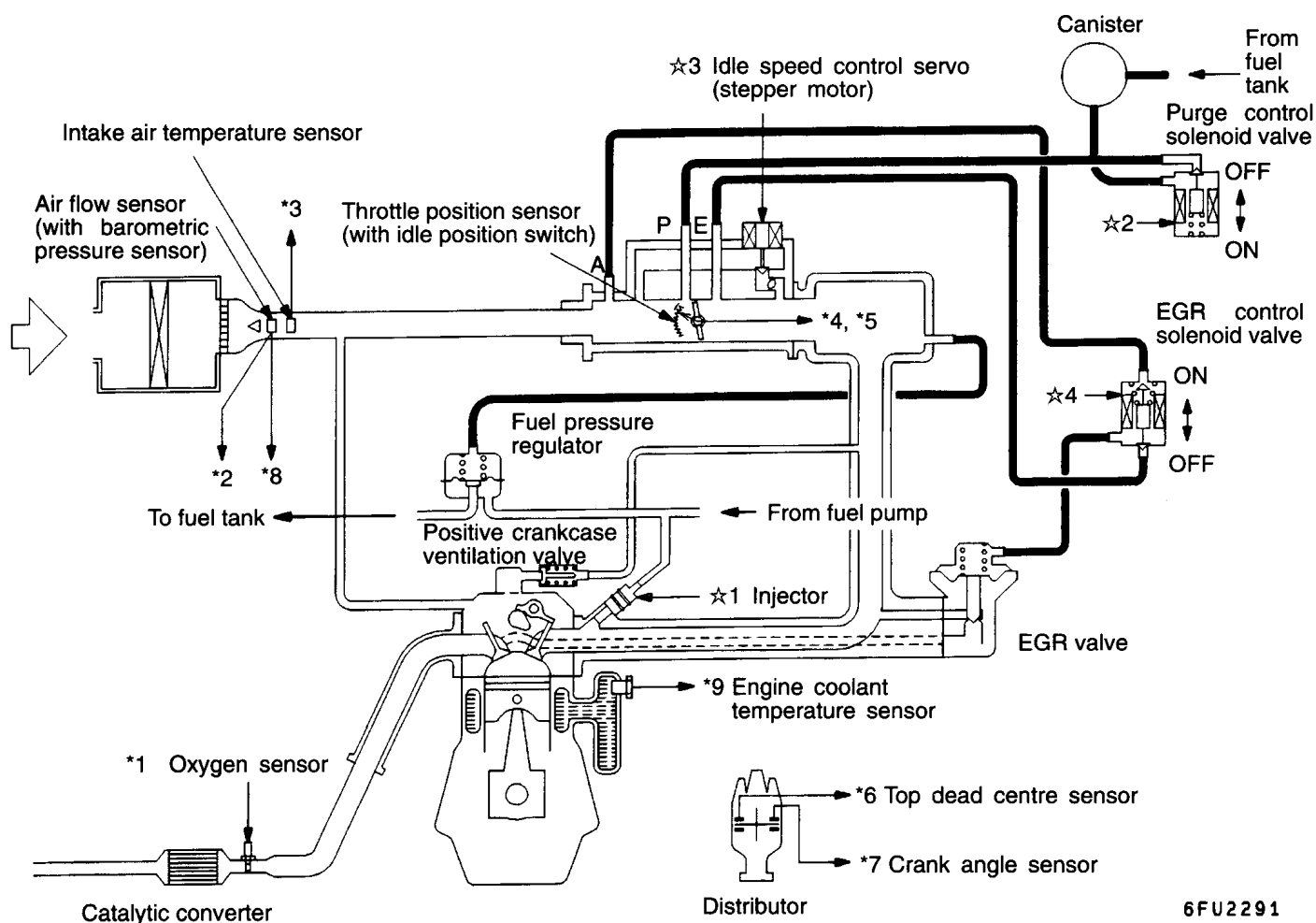
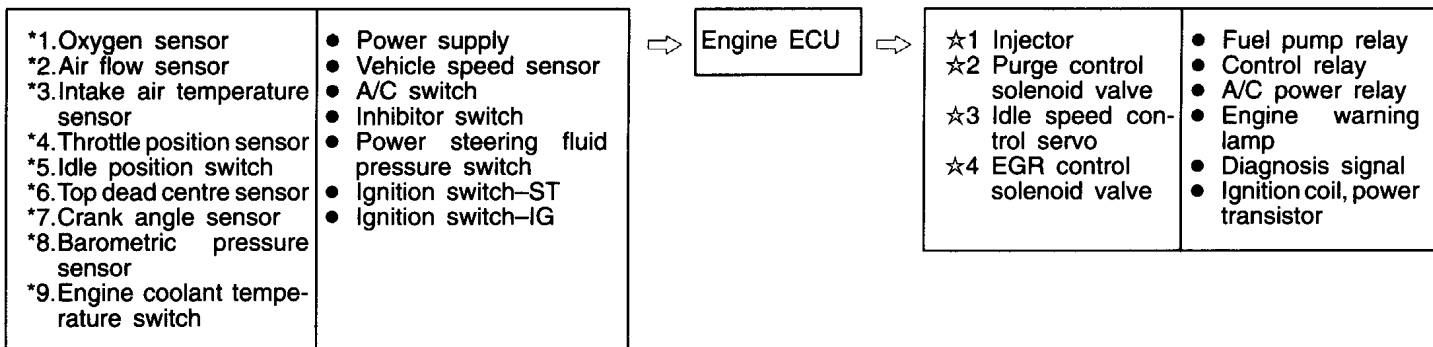
OTHER CONTROL FUNCTIONS

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. Purge Control Solenoid Valve Control
Refer to GROUP 17.
4. EGR Control Solenoid Valve Control
Refer to GROUP 17.

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.	E2T63173 <4G63 – Wagon> E2T63176 <4G63 – Panel van and window van> E2T63172 <4G64>
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
	Top dead centre sensor	Hall element type
	Crank angle sensor	Hall element type
	Power steering fluid pressure switch	Contact switch type
Actuators	Control 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	328

MULTI POINT FUEL INJECTION SYSTEM DIAGRAM

120002543



6FU2291

SERVICE SPECIFICATIONS

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Items		Standard value
Basic idle speed r/min.		750±50
Idle speed when A/C is ON r/min.		900 at neutral position
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	At 20°C	2.3–3.0
	At 80°C	0.30–0.42
Engine coolant temperature sensor resistance kΩ	At 20°C	2.1–2.7
	At 80°C	0.26–0.36
Oxygen sensor output voltage V		0.6–1.0
Fuel pressure kPa	Vacuum hose disconnected	324–343 at curb idle
	Vacuum hose connected	Approx. 265 at curb idle
Injector coil resistance Ω		6.5–8.0 (at 20°C)

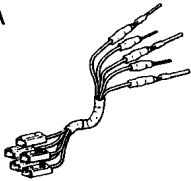


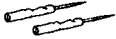
SEALANT

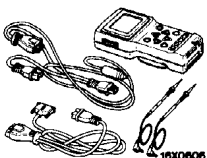

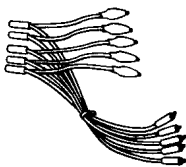
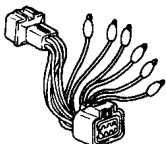

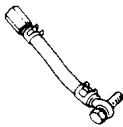
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Item	Specified sealant	Remark
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SPECIAL TOOLS

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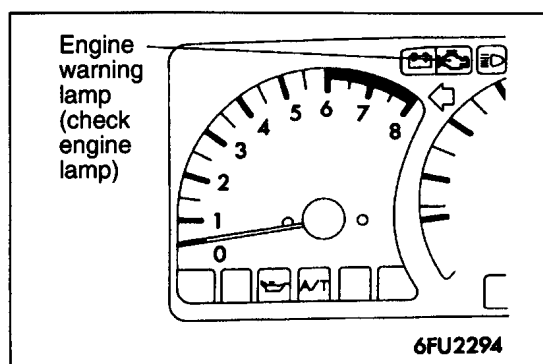
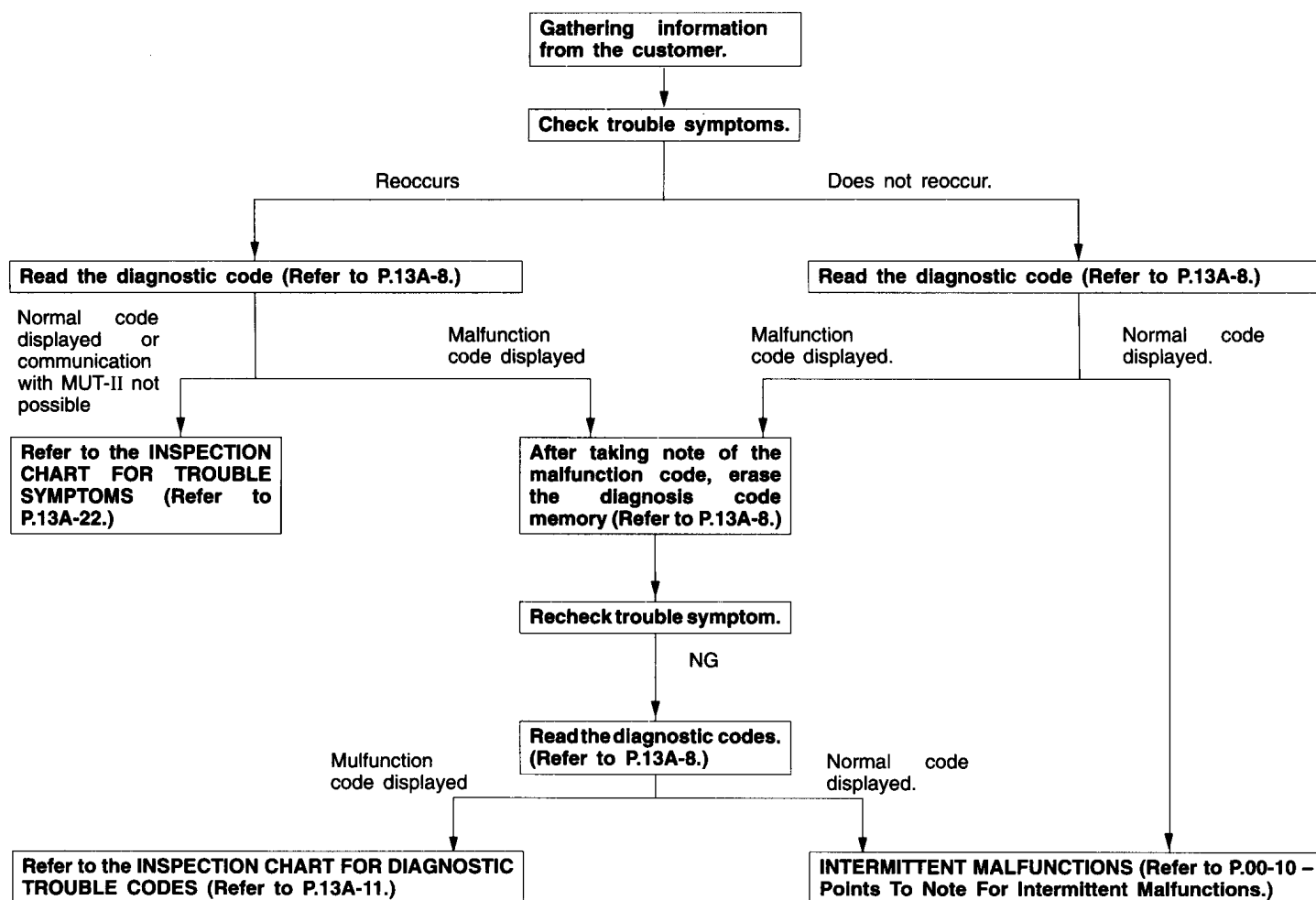
Tool	Number	Name	Use
<p>A</p>  <p>B</p>  <p>C</p>  <p>D</p> 	<p>MB991223</p> <p>A: MB991219</p> <p>B: MB991220</p> <p>C: MB991221</p> <p>D: MB991222</p>	<p>Harness set</p> <p>A: Test harness</p> <p>B: LED harness</p> <p>C: LED harness adapter</p> <p>D: Probe</p>	<p>Measurement of terminal voltage</p> <p>A: Connector pin contact pressure inspection</p> <p>B,C: Power circuit inspection</p> <p>D: Commercial tester connection</p>

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	<ul style="list-style-type: none"> • Reading diagnosis code • MPI system inspection
 16X0607	—	ROM pack	
	MB991348	Test harness set	<ul style="list-style-type: none"> • Adjustment of idle position switch and throttle position sensor • Inspection using an analyzer
	MD998463	Test harness (6 pin, square)	<ul style="list-style-type: none"> • Inspection of idle speed control servo • Inspection using an analyzer
	MD998464	Test harness (4 pin, square)	Inspection of oxygen sensor
	MD998709	Adaptor hose	Measurement of fuel pressure

TROUBLESHOOTING

120002546

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



DIAGNOSIS FUNCTION

120002547

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the Multi Point 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

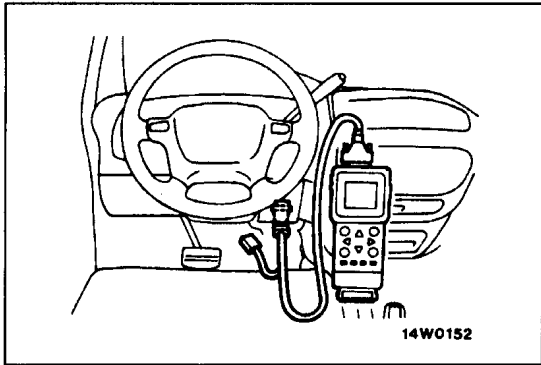
Engine ECU
Oxygen sensor
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Engine coolant temperature sensor
Crank angle sensor
Top dead centre sensor
Barometric pressure sensor
Ignition timing adjustment signal
Injector

Caution

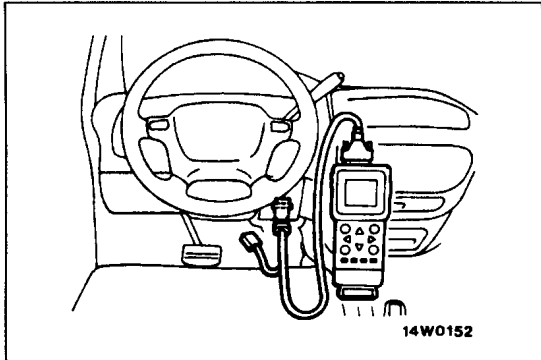
Engine warning lamp will come on even when terminal for ignition timing adjustment is short-circuited. Therefore, it is not abnormal that the lamp comes on even when terminal for ignition timing adjustment is short-circuited at the time of ignition timing adjustment.

METHOD OF READING AND ERASING DIAGNOSIS CODES**Caution**

1. If battery voltage is low, diagnosis codes will not be output. Accordingly, be sure to check the battery before carrying out inspection.
2. If the battery is disconnected or if the ENGINE ECU connector is disconnected, the diagnosis code memory will be erased. Accordingly, the battery should not be disconnected until reading of the diagnosis codes has been completed.
3. Connection and disconnection of the MUT-II should always be carried out with the ignition switch in the OFF position.



1. Connect the MUT-II to the diagnosis connector (16-pin), and take a reading of the diagnosis codes.
2. Repair the malfunction location while referring to the **INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES**
3. Turn the ignition switch to OFF and then back to ON again.
4. Erase the diagnosis codes using the MUT-II.
5. Check to be sure that the diagnosis code is normal.



INSPECTION USING MUT-II SERVICE DATA 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 to be sure 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/BACKUP FUNCTION TABLE

120002548

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	<ol style="list-style-type: none"> 1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take readings of the basic injector drive timing and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle speed 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.
Top dead centre 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.
Oxygen sensor	Air/fuel ratio feedback control (closed loop control) is not performed.

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

120002549

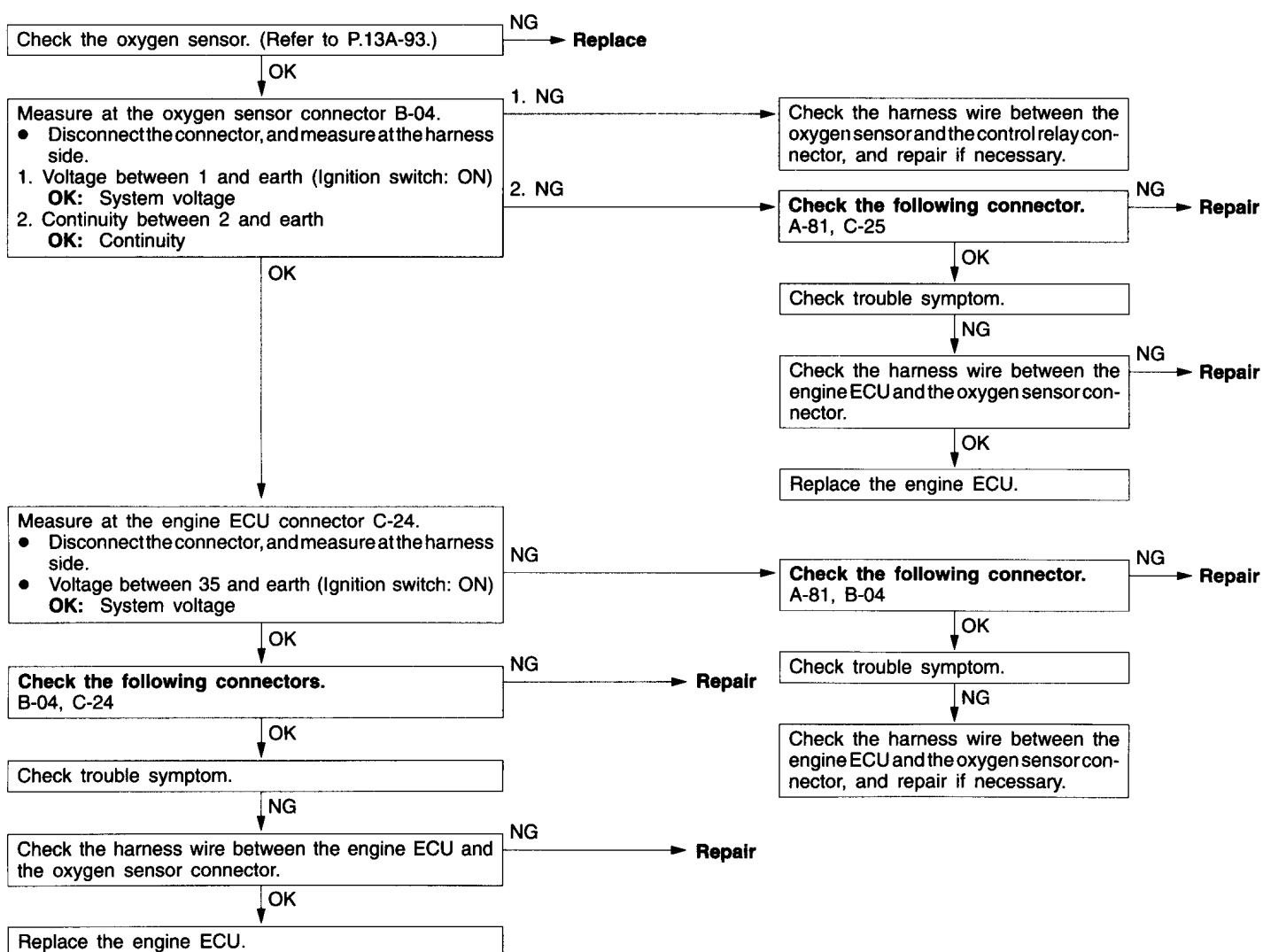
Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13A-12
12	Air flow sensor system	13A-13
13	Intake air temperature sensor system	13A-14
14	Throttle position sensor system	13A-15
21	Engine coolant temperature sensor system	13A-16
22	Crank angle sensor system	13A-17
23	Top dead centre sensor system	13A-18
24	Vehicle speed sensor system	13A-19
25	Barometric pressure sensor system	13A-20
36*	Ignition timing adjustment signal system	13A-21
41	Injector system	13A-21

NOTE

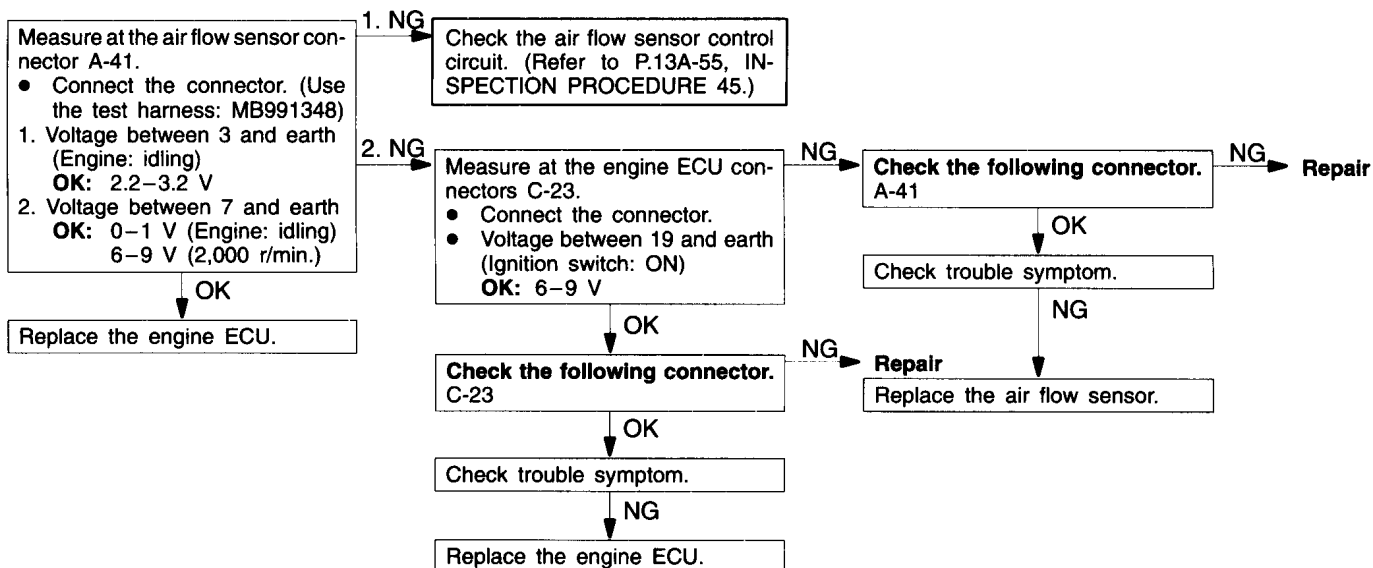
*: Malfunction code No. 36 is not memorized.

INSPECTION PROCEDURE FOR DIAGNOSTIC TROUBLE CODES

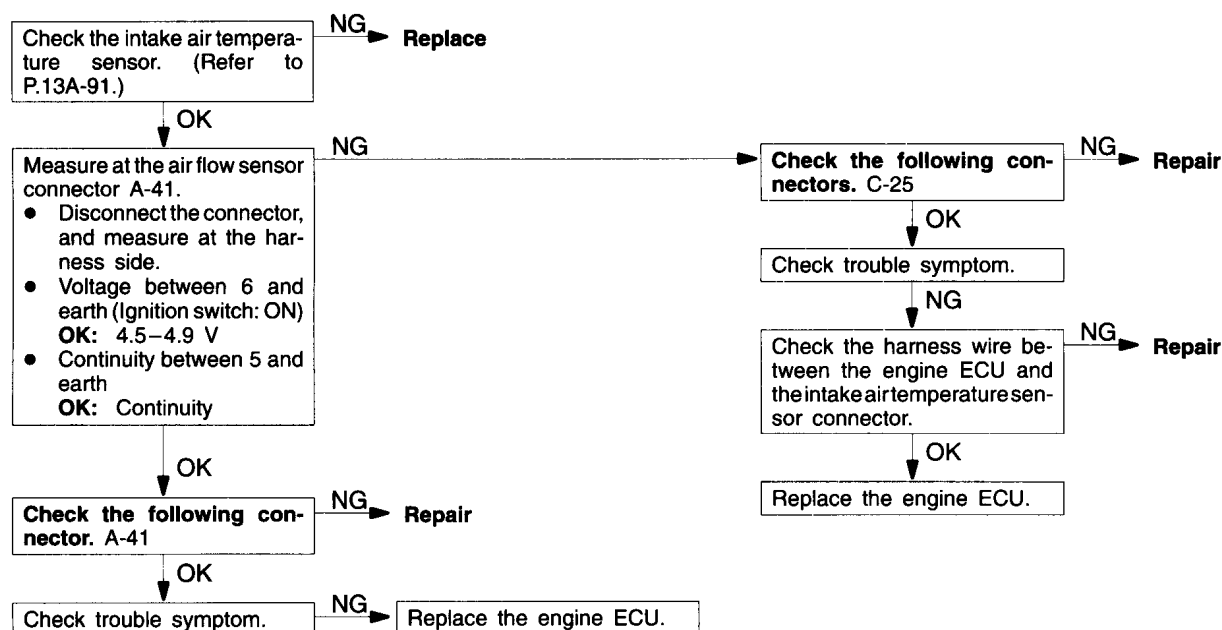
Code No. 11 Oxygen sensor system	Probable cause
<p>[Comment]</p> <p>Range of Check</p> <ul style="list-style-type: none"> 3 minutes have passed after engine was started. Engine coolant temperature is approx. 80°C or more. Intake air temperature is 20–50 °C. Engine speed is approx. 2,000–3,000 r/min. Vehicle is moving at constant speed on a flat, level road surface <p>Set conditions</p> <ul style="list-style-type: none"> The oxygen sensor output voltage is around 0.6 V for 30 seconds (does not cross 0.6 V for 30 seconds). When the range of check operations given above which accompany starting of the engine are carried out four time in succession, a problem is detected after each operation. 	<ul style="list-style-type: none"> Malfunction of the oxygen sensor Improper connector contact, open circuit or short-circuited harness wire Malfunction of the engine ECU



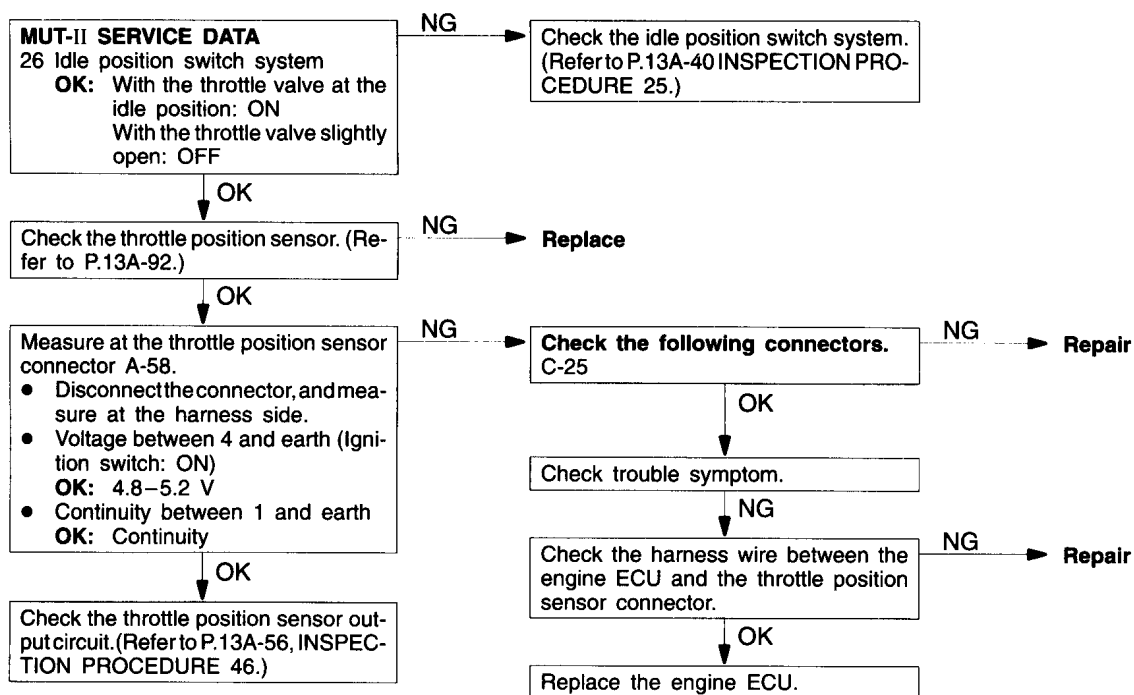
Code No. 12 Air flow sensor system	Probable cause
<p>[Comment]</p> <p>Range of Check</p> <ul style="list-style-type: none"> Engine speed is 500 r/min or more. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output frequency is 3 Hz or less for 4 seconds. 	<ul style="list-style-type: none"> 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



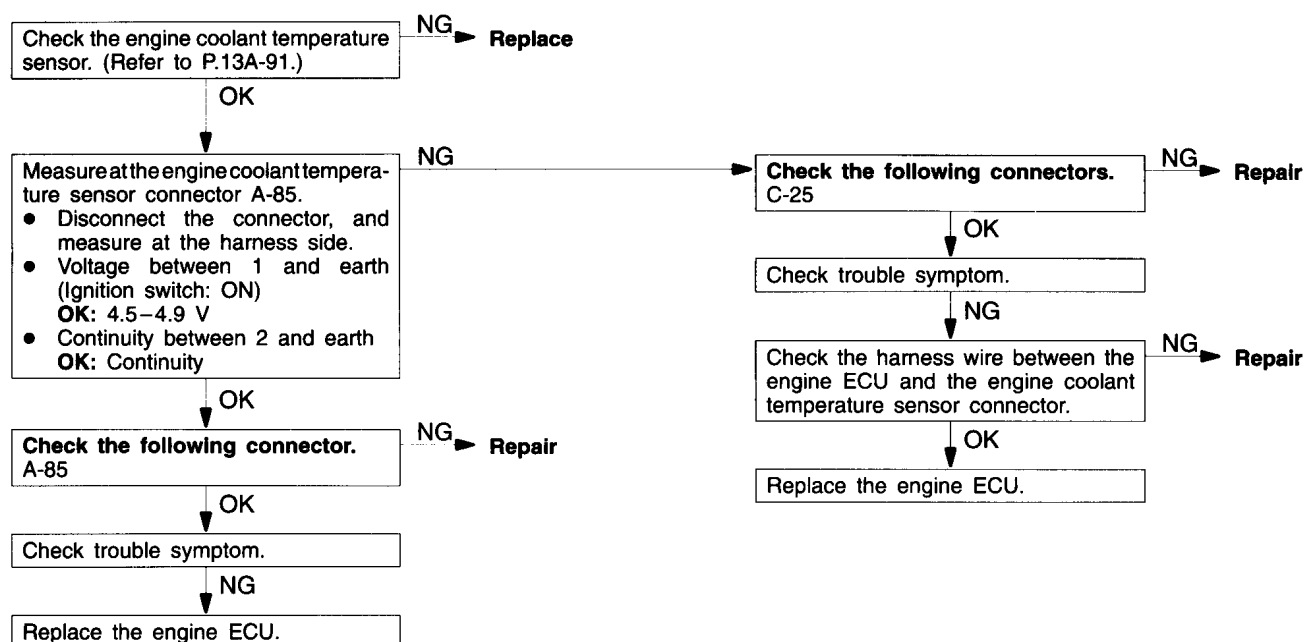
Code No. 13 Intake air temperature sensor system	Probable cause
<p>[Comment]</p> <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature of -45°C or less) for 4 seconds. <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.2 V or less (corresponding to an intake air temperature of 125°C or more) for 4 seconds. 	<ul style="list-style-type: none"> 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



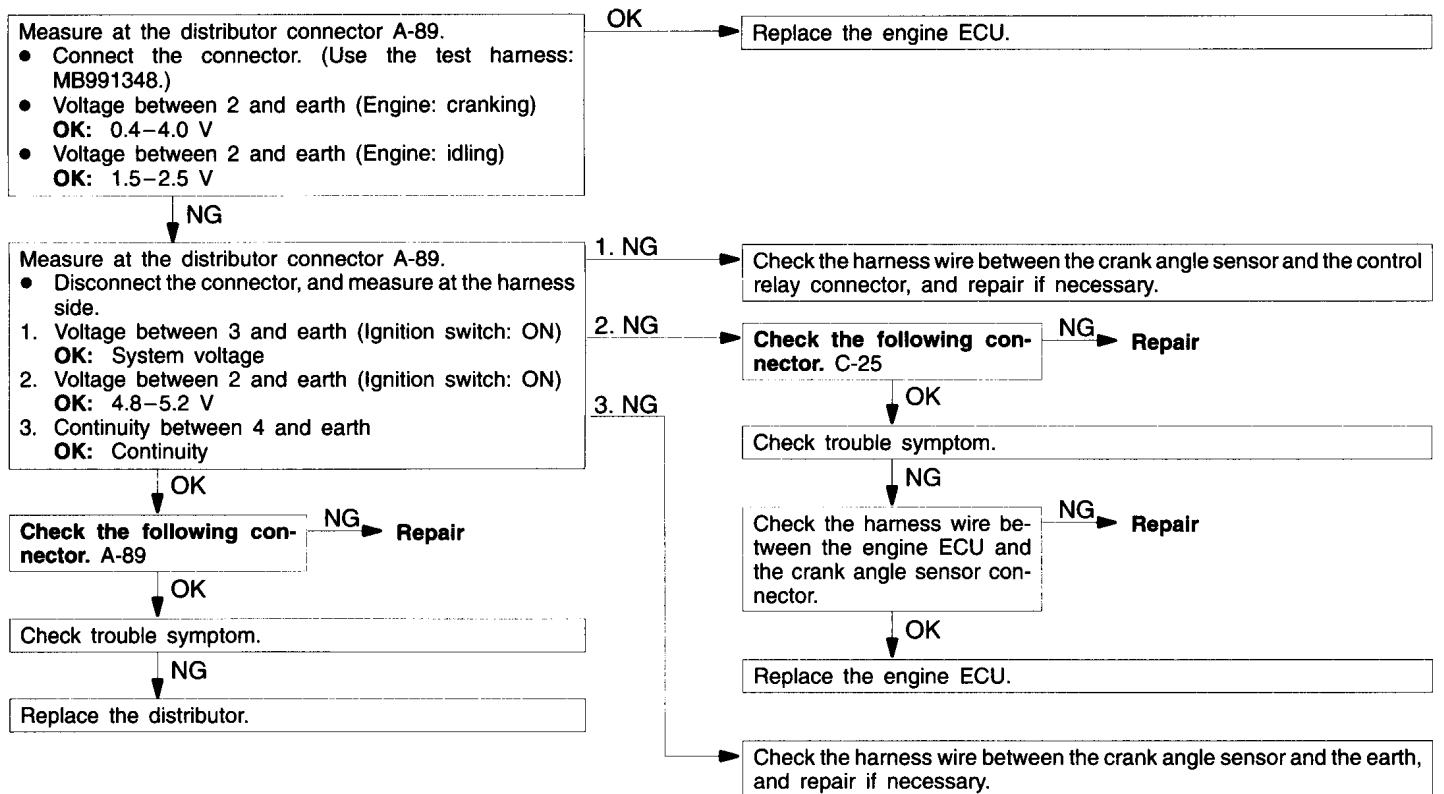
Code No. 14 Throttle position sensor system	Probable cause
<p>[Comment]</p> <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> When the idle position switch is ON, the sensor output voltage is 2 V or more for 4 seconds. <p>or</p> <ul style="list-style-type: none"> The sensor output voltage is 0.2 V or less for 4 seconds. 	<ul style="list-style-type: none"> 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



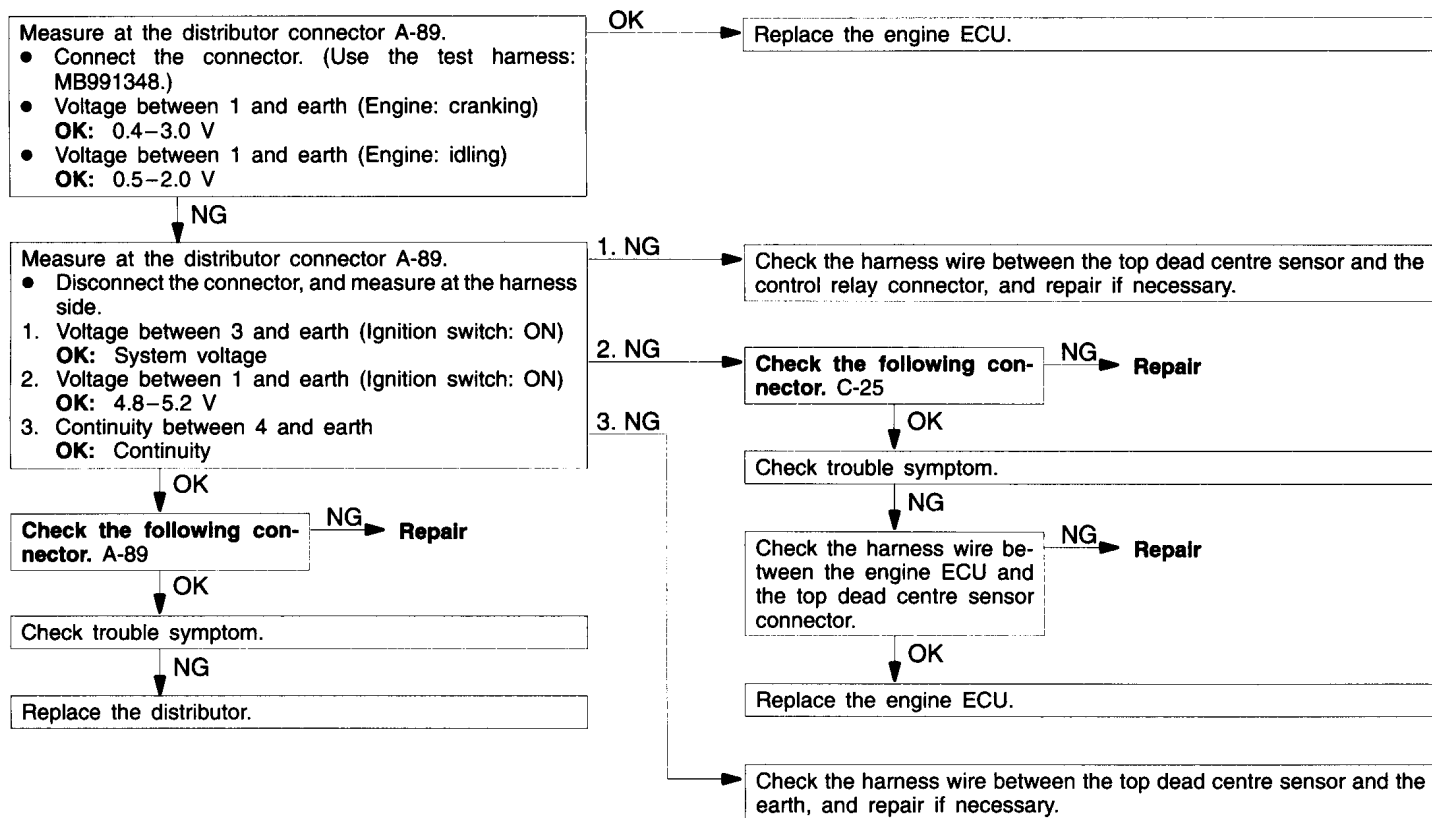
Code No. 21 Engine coolant temperature sensor system	Probable cause
<p>[Comment] Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.6 V or more (corresponding to an engine coolant temperature of -45°C or less) for 4 seconds. <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.1 V or less (corresponding to an engine coolant temperature of 140°C or more) for 4 seconds. <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Engine speed is approx. 50 r/min. or more. <p>Set conditions</p> <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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



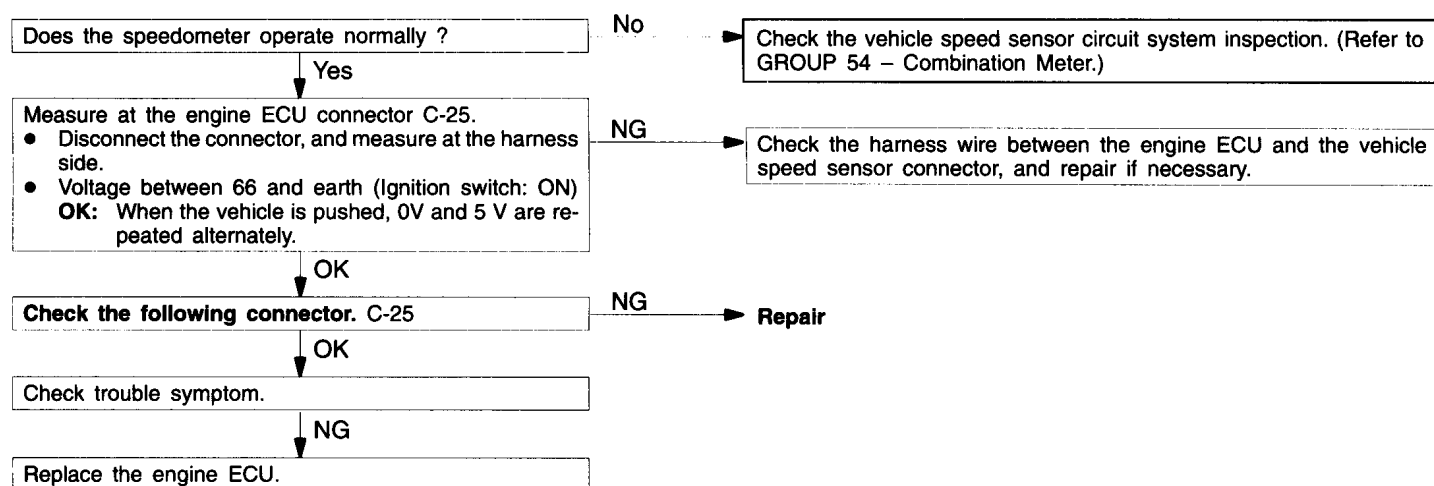
Code No. 22 Crank angle sensor system	Probable cause
[Comment] Range of Check • Engine is cranking. Set conditions • Sensor output voltage does not change for 4 seconds (no pulse signal input.)	<ul style="list-style-type: none"> • Malfunction of the crank angle sensor • Improper connector contact, open circuit or short-circuited harness wire of the crank angle sensor circuit • Malfunction of the engine ECU



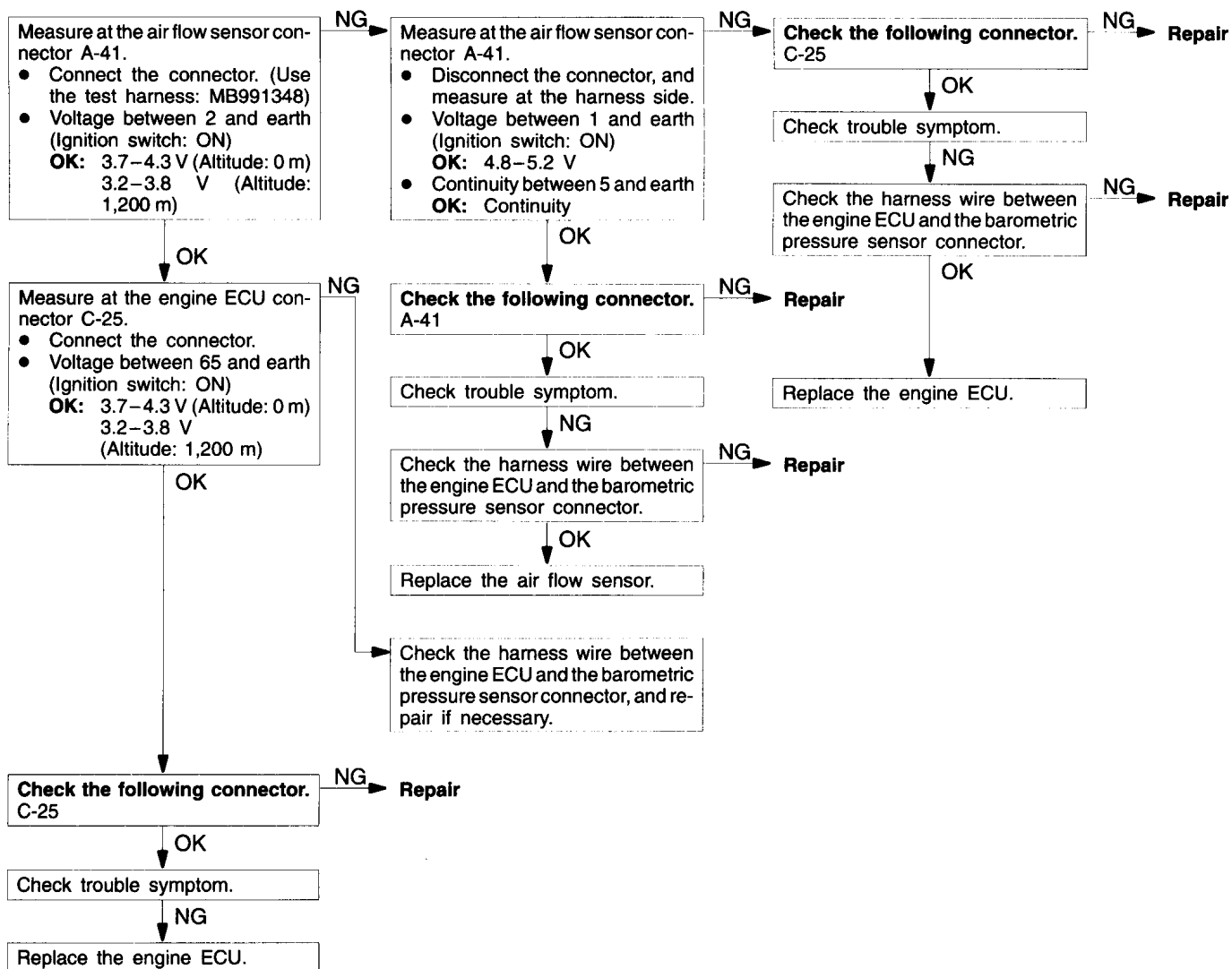
Code No. 23 Top dead centre sensor system	Probable cause
[Comment] Range of Check <ul style="list-style-type: none"> Ignition switch: ON Engine speed is approx. 50 r/min or more. Set conditions <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> Malfunction of the top dead centre sensor Improper connector contact, open circuit or short-circuited harness wire of the top dead centre sensor circuit Malfunction of the engine ECU



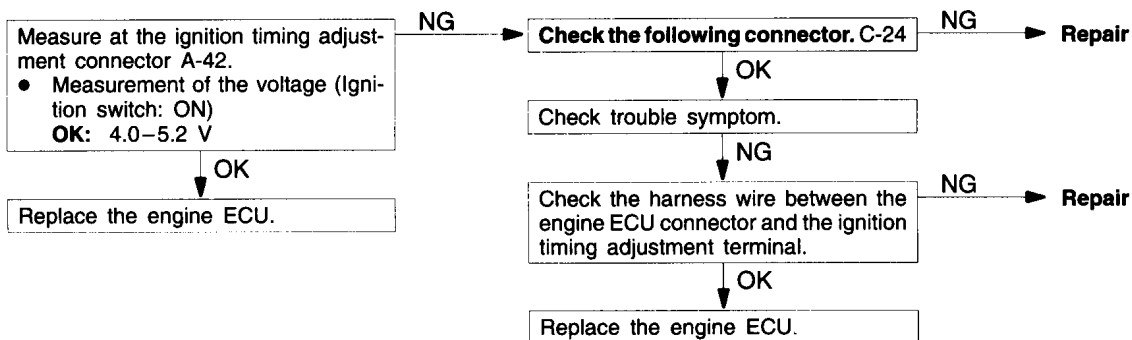
Code No. 24 Vehicles speed sensor system	Probable cause
<p>[Comment]</p> <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Idle position switch: OFF Engine speed is 3000 r/min or more. Driving under high engine load conditions. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> Malfunction of the vehicle speed sensor Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit Malfunction of the engine ECU



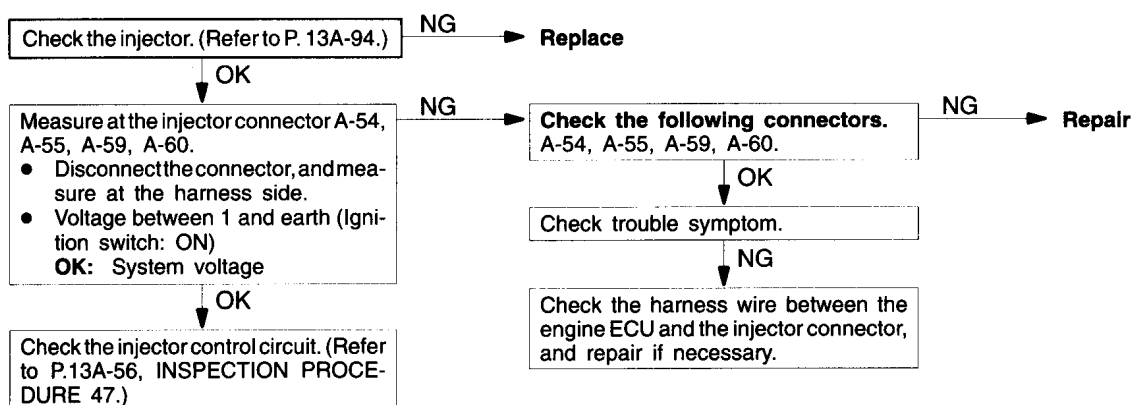
Code No. 25 Barometric pressure sensor system	Probable cause
<p>[Comment]</p> <p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Battery voltage is 8 V or more. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.5 V or more (corresponding to a barometric pressure of 114 kPa or more) for 4 seconds. <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.2 V or less (corresponding to a barometric pressure of 5.33 kPa or less) for 4 seconds. 	<ul style="list-style-type: none"> 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



Code No. 36 Ignition timing adjustment signal system	Probable cause
[Comment] Range of Check • Ignition switch: ON Set conditions • The ignition timing adjusting signal wire is shorted to the earth.	<ul style="list-style-type: none"> • Short circuit to earth of the ignition timing adjustment signal line • Malfunction of the engine ECU



Code No. 41 Injector system	Probable cause
[Comment] 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.	<ul style="list-style-type: none"> • Malfunction of the injector • Improper connector contact, open circuit or short-circuited harness wire of the injector circuit • Malfunction of the engine ECU



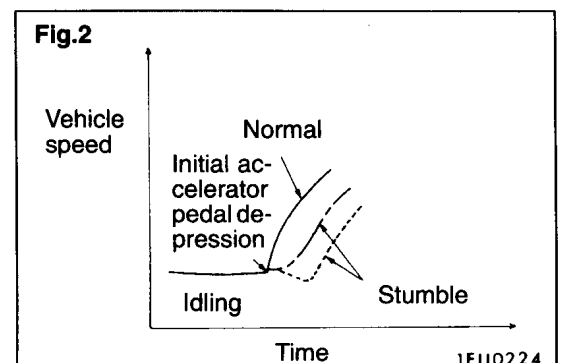
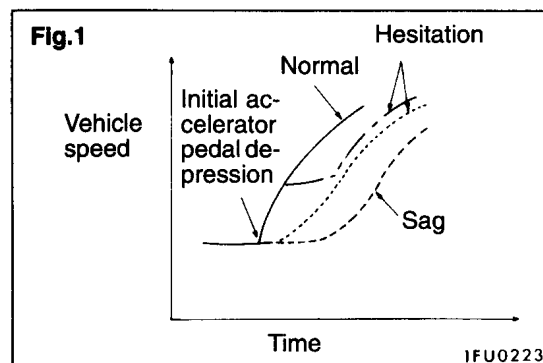
INSPECTION CHART FOR TROUBLE SYMPTOMS

120002550

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-24
	Communication with engine ECU only is not possible.	2	13A-24
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	13A-25
	The engine warning lamp remains illuminating and never goes out.	4	13A-26
Starting	No initial combustion (starting impossible)	5	13A-26
	Initial combustion but no complete combustion (starting impossible)	6	13A-27
	Long time to start (improper starting)	7	13A-28
Idling stability (Improper idling)	Unstable idling(Rough idling, hunting)	8	13A-29
	Idling speed is high. (Improper idling speed)	9	13A-30
	Idling speed is low. (Improper idling speed)	10	13A-31
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13A-32
	When the engine becomes hot, it stalls at idling. (Die out)	12	13A-33
	The engine stalls when starting the car. (Pass out)	13	13A-34
	The engine stalls when decelerating.	14	13A-34
Driving	Hesitation, sag or stumble	15	13A-35
	The feeling of impact or vibration when accelerating	16	13A-35
	The feeling of impact or vibration when decelerating	17	13A-36
	Poor acceleration	18	13A-36
	Surge	19	13A-37
	Knocking	20	13A-37
Dieseling		21	13A-37
Too high CO and HC concentration when idling		22	13A-38

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

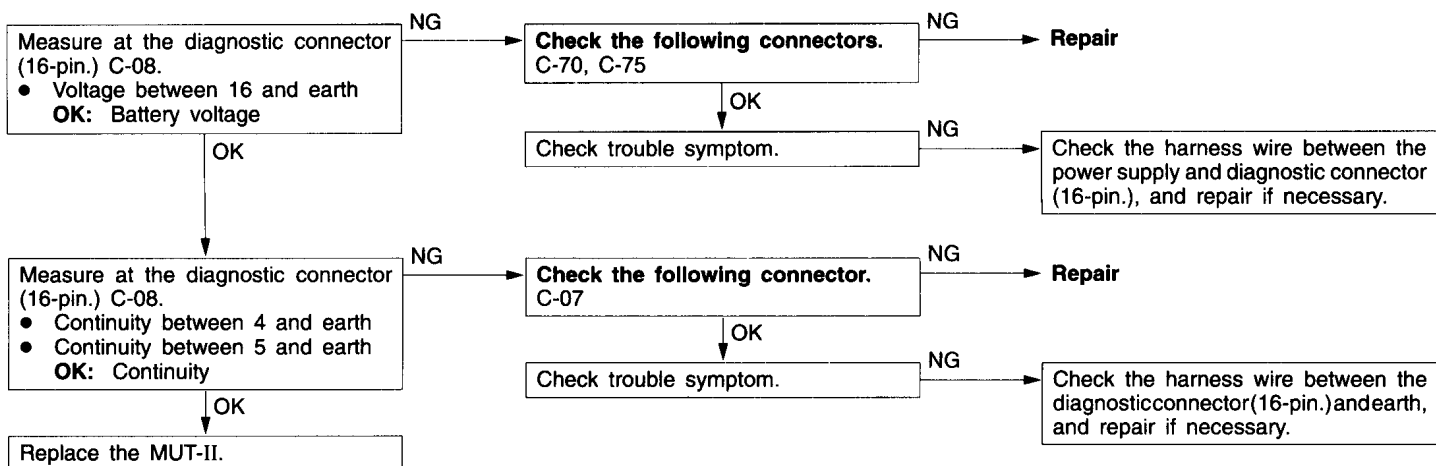
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.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



INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

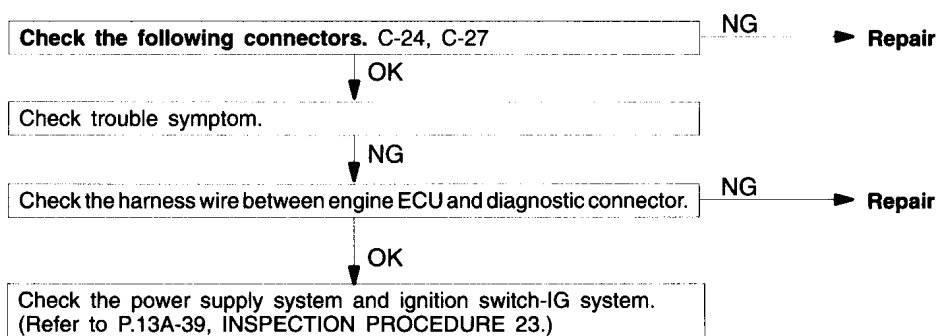
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
[Comment] The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	<ul style="list-style-type: none"> • Malfunction of the connector • Malfunction of the harness wire



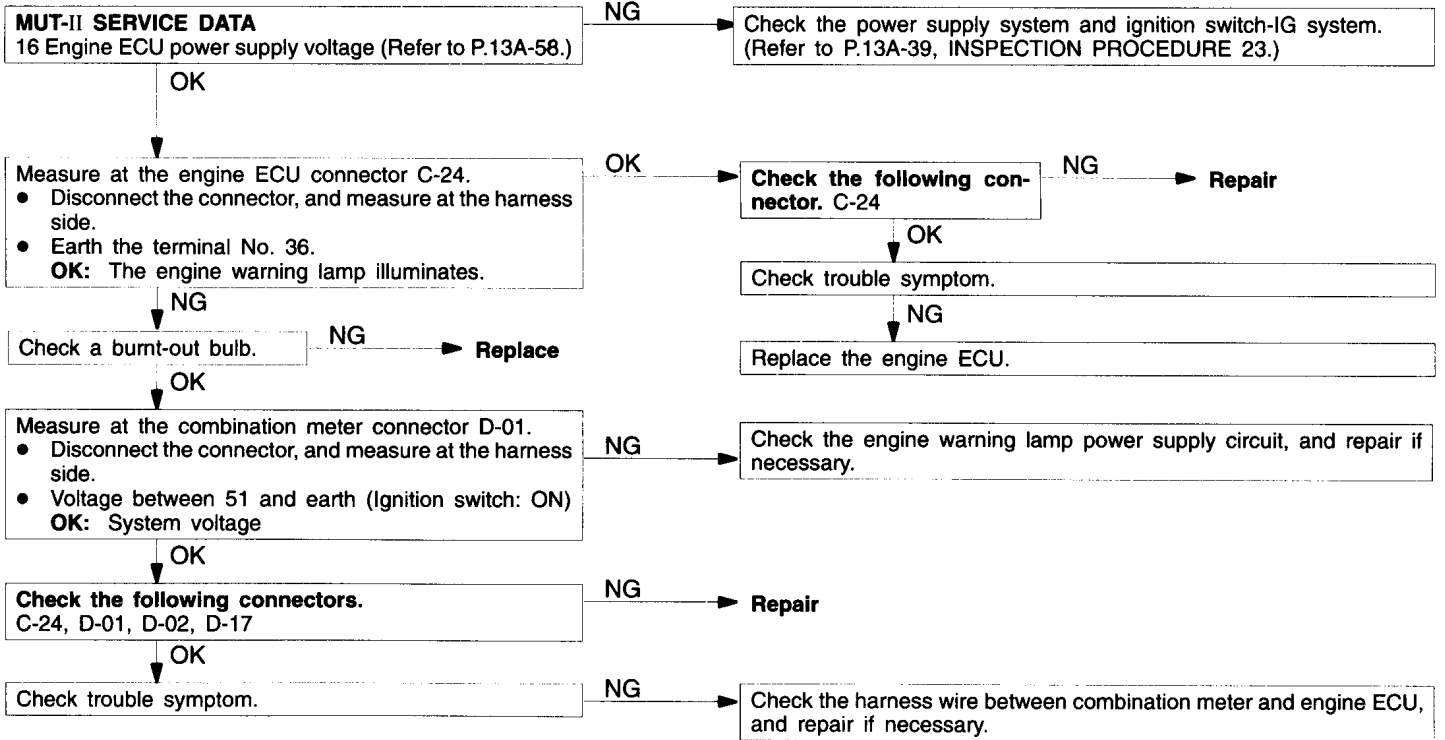
INSPECTION PROCEDURE 2

MUT-II communication with engine ECU is impossible.	Probable cause
[Comment] One of the following causes may be suspected. <ul style="list-style-type: none"> • No power supply to engine ECU • Defective earth circuit of engine ECU • Defective engine ECU • Improper communication line between engine ECU and MUT-II 	<ul style="list-style-type: none"> • Malfunction of engine ECU power supply circuit • Malfunction of the engine ECU • Open circuit between engine ECU and diagnosis connector



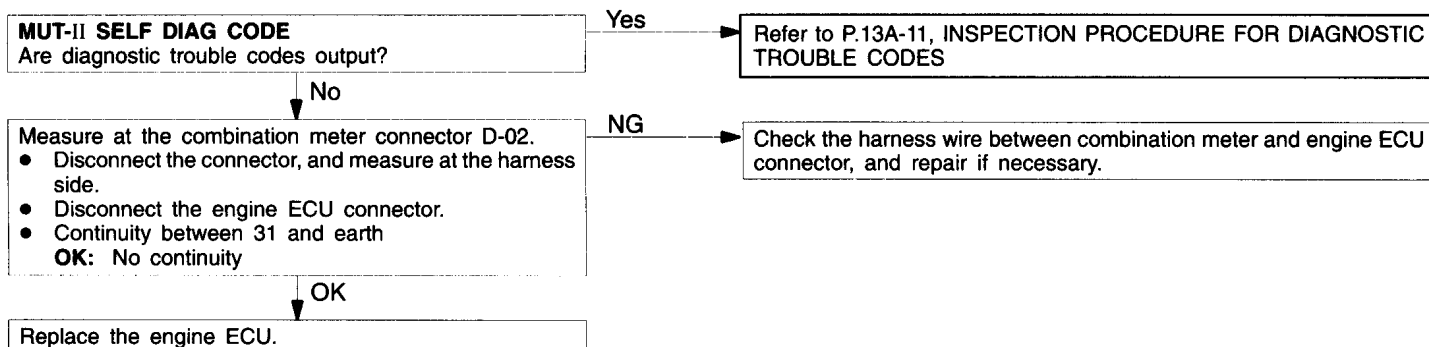
INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
<p>[Comment] The engine ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON for detection of a burnt-out bulb. 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.</p>	<ul style="list-style-type: none"> • Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine ECU



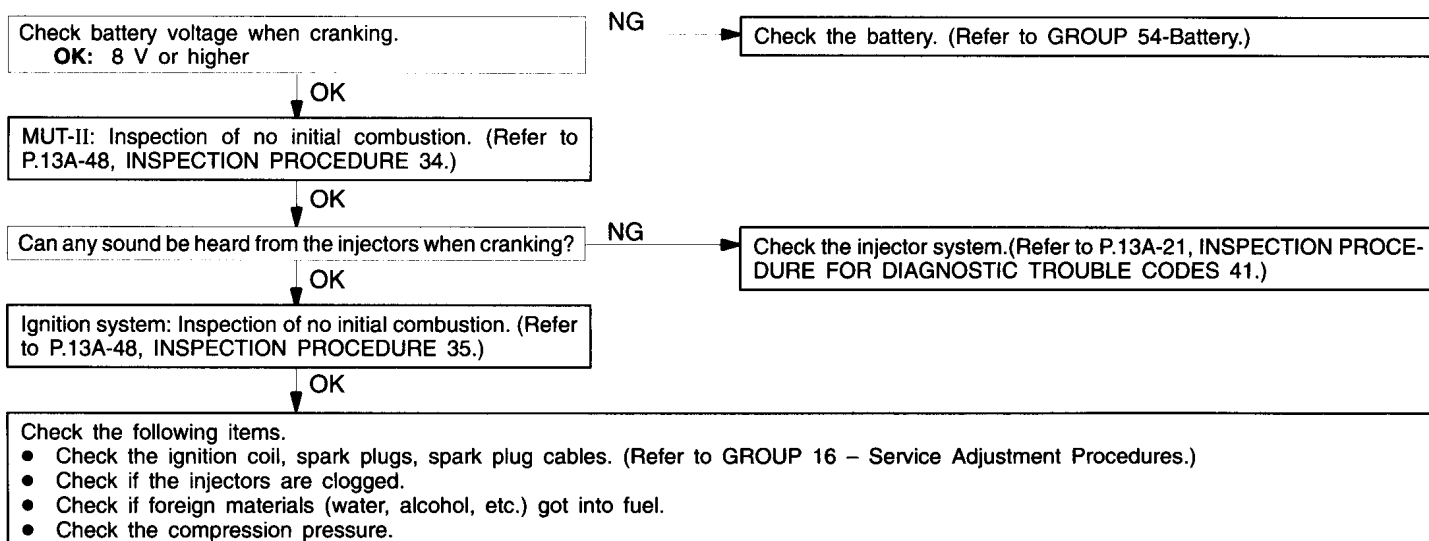
INSPECTION PROCEDURE 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
<p>[Comment] In cases such as the above, the cause is probably that the engine ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.</p>	<ul style="list-style-type: none"> • Short-circuit between the engine warning lamp and engine ECU • Malfunction of the engine ECU



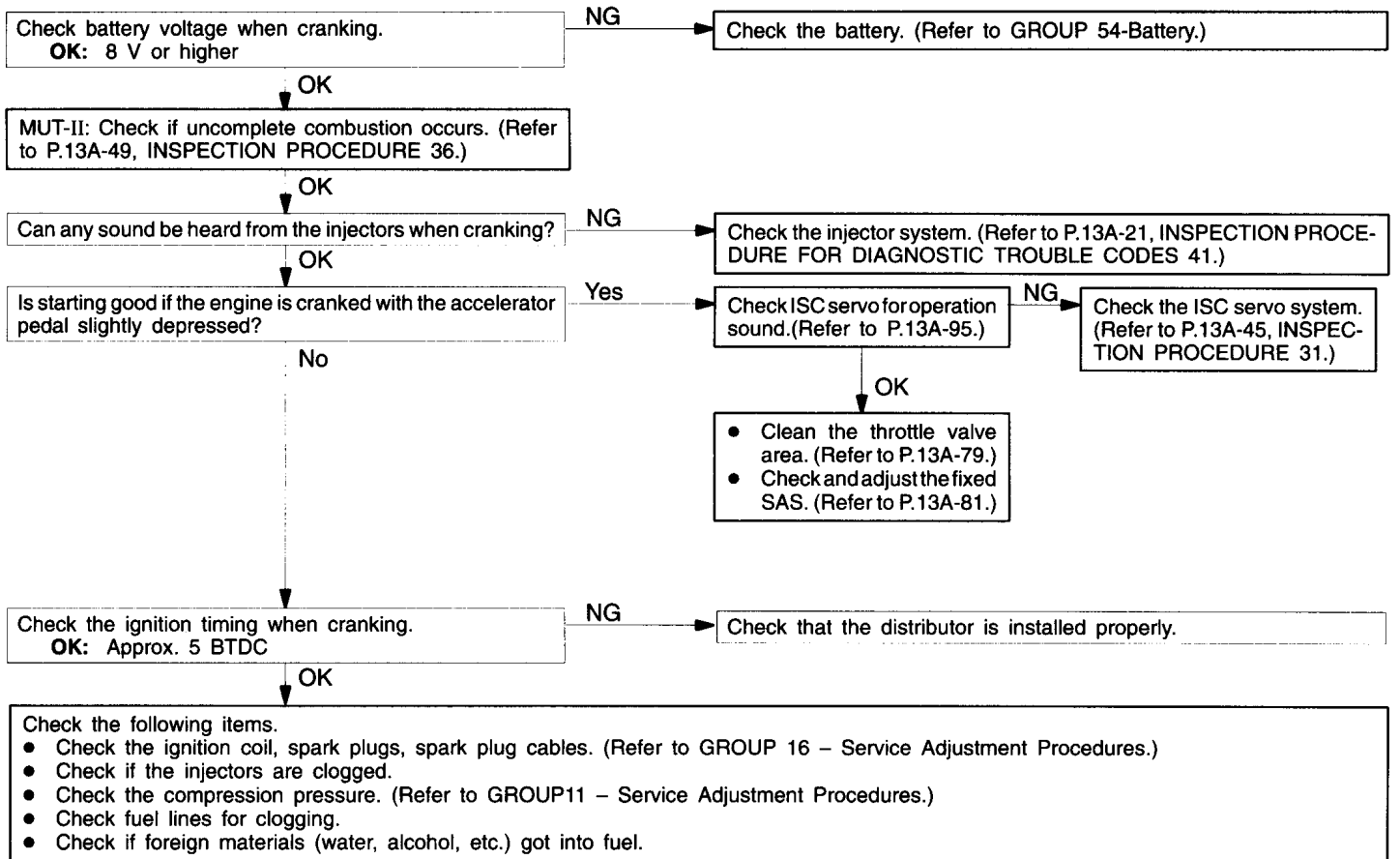
INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
<p>[Comment] 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.</p>	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the fuel pump system • Malfunction of the injectors • Malfunction of the engine ECU • Foreign materials in fuel



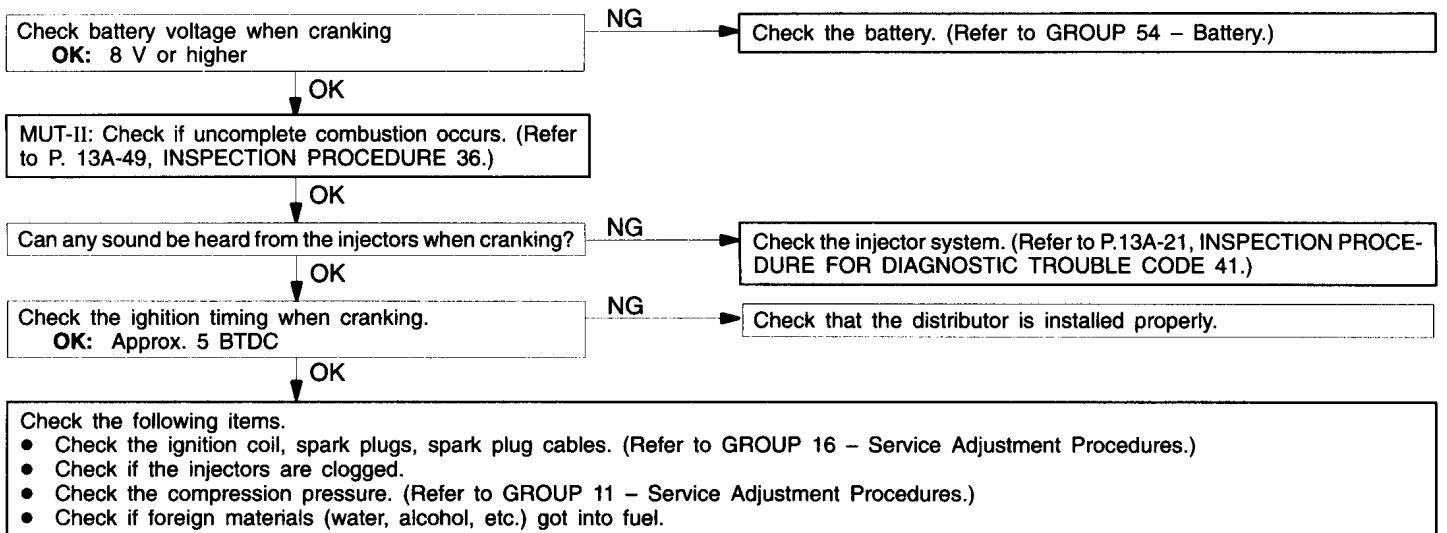
INSPECTION PROCEDURE 6

Initial combustion but no complete combustion (starting impossible)	Probable cause
[Comment] 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.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the injector system • Foreign materials in fuel • Poor compression • Malfunction of the engine ECU



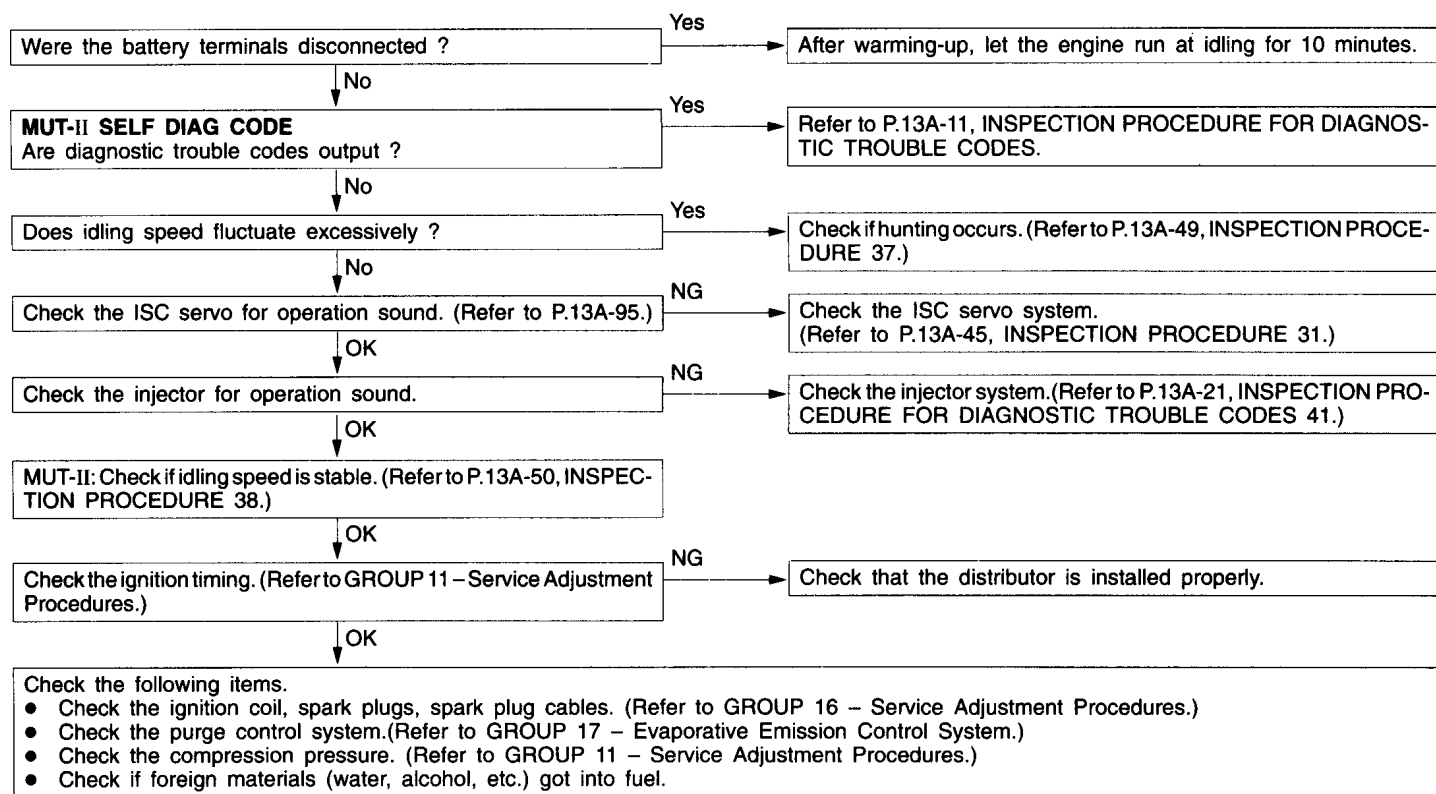
INSPECTION PROCEDURE 7

It takes too long time to start. (Incorrect starting)	Probable cause
<p>[Comment] 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.</p>	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the injector system • Inappropriate gasoline use • Poor compression



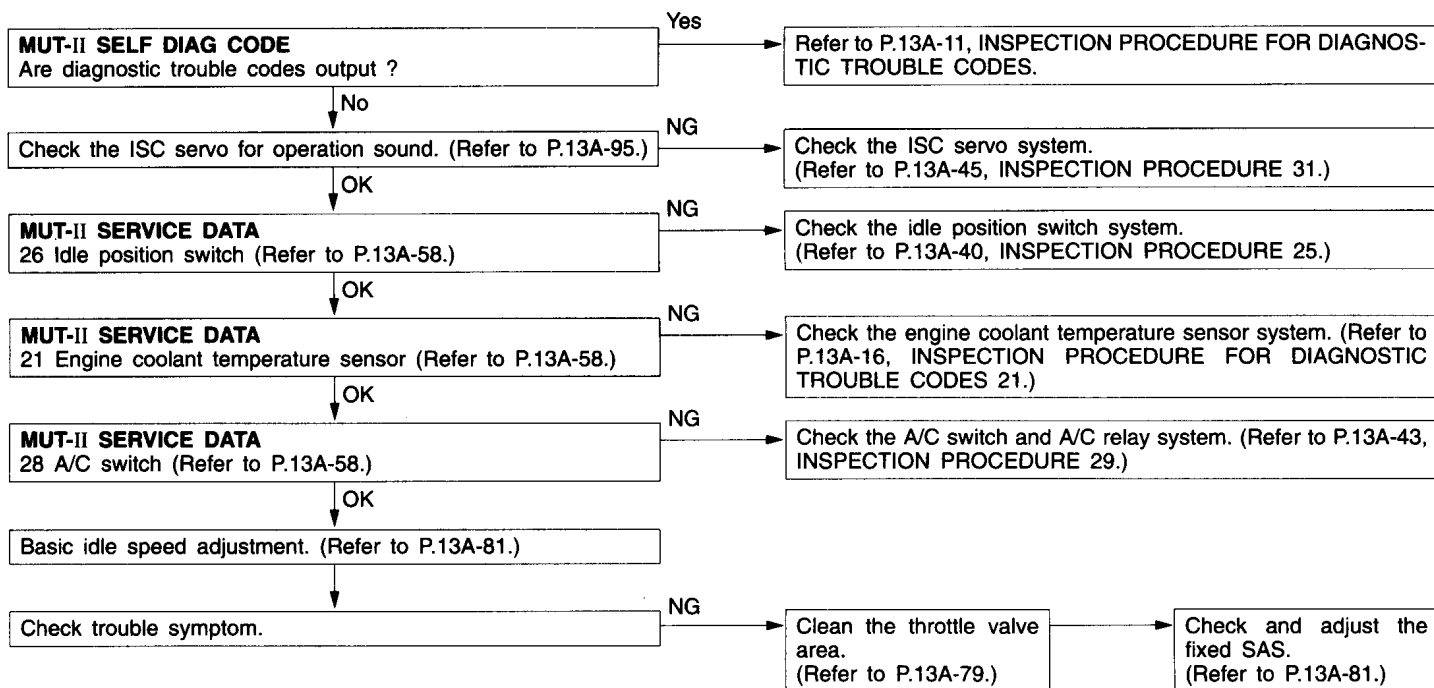
INSPECTION PROCEDURE 8

Unstable idling (Rough idling, hunting)	Probable cause
<p>[Comment] In cases such 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.</p>	<ul style="list-style-type: none"> ● 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 ● Poor compression ● Drawing air into exhaust system



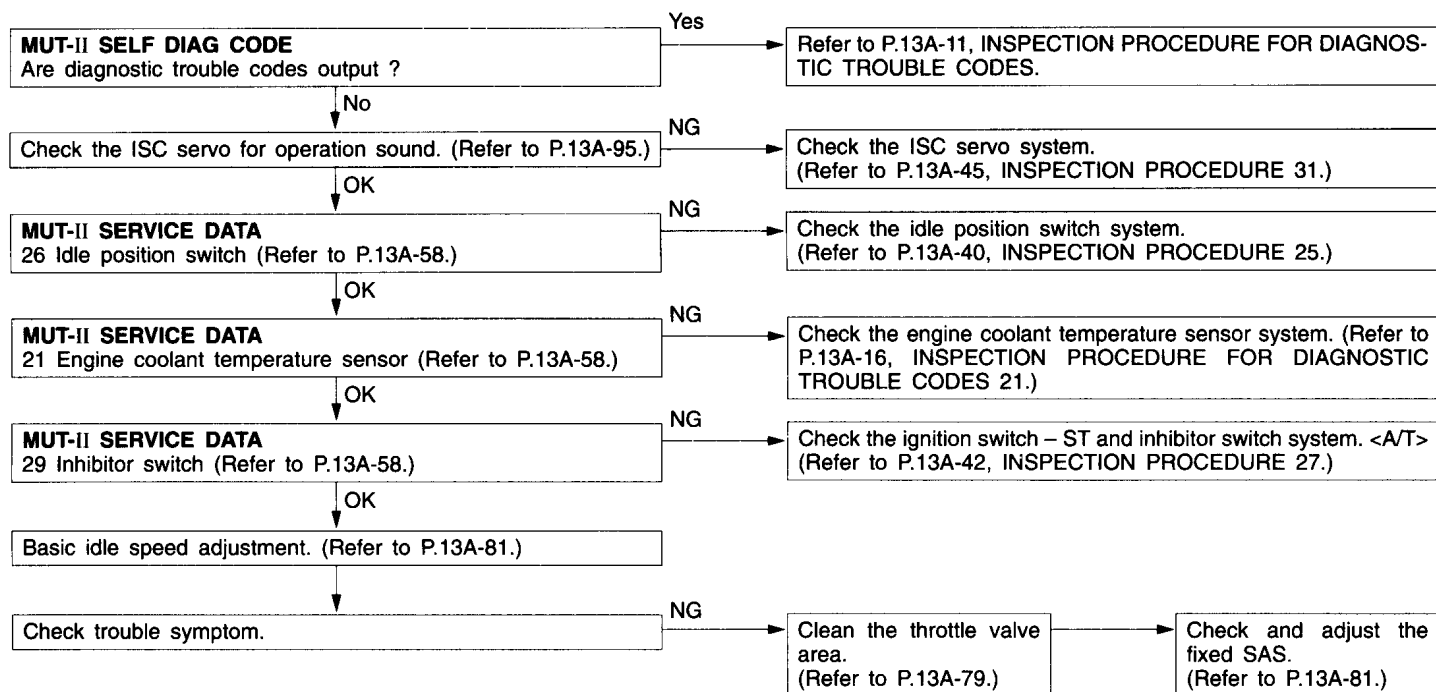
INSPECTION PROCEDURE 9

Idling speed is high. (Improper idling speed)	Probable cause
[Comment] In such cases as the above, the cause is probably that the intake air volume during idling is too great.	<ul style="list-style-type: none"> • Malfunction of the ISC servo system • Malfunction of the throttle body



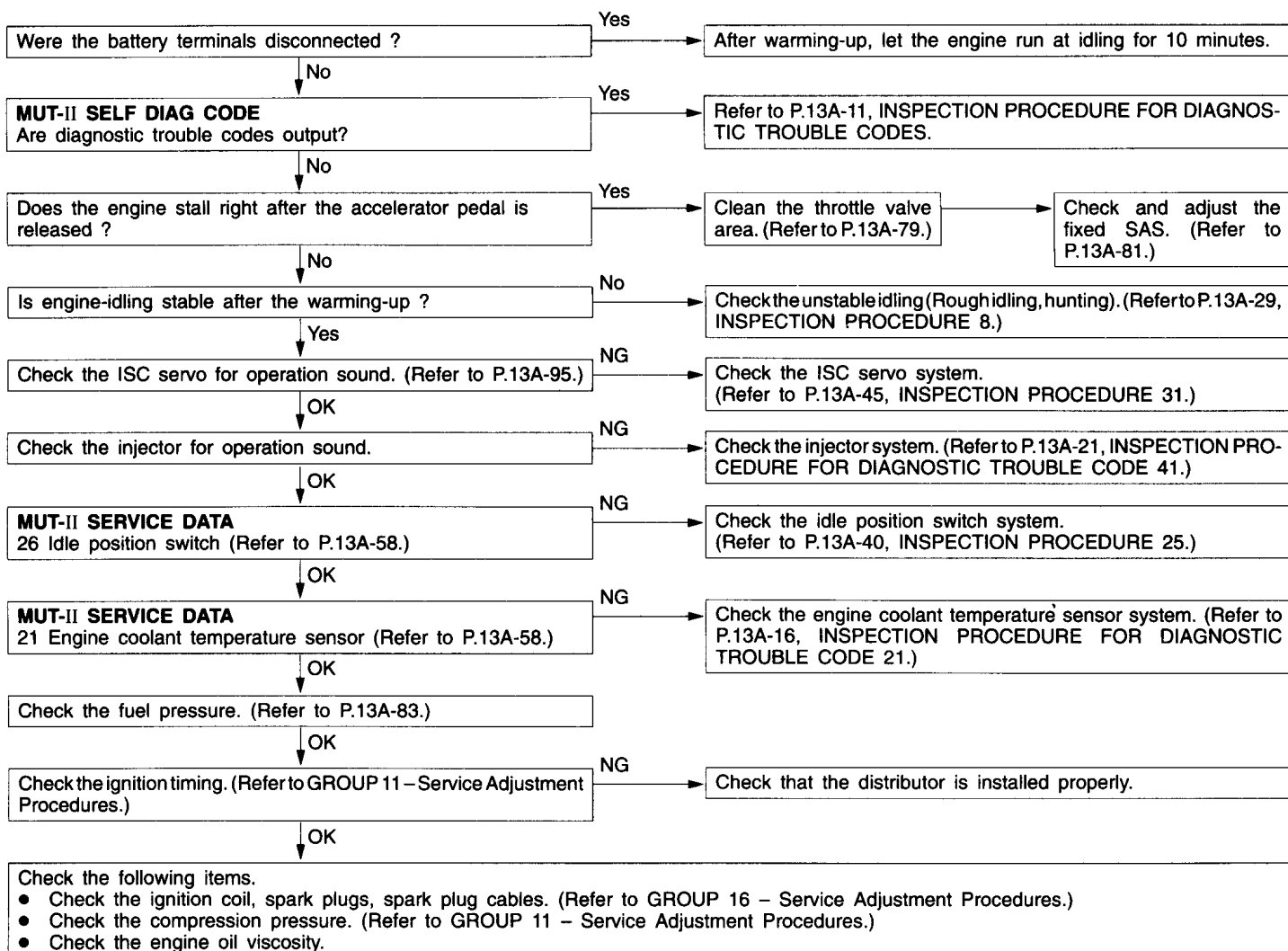
INSPECTION PROCEDURE 10

Idling speed is low. (Improper idling speed)	Probable cause
[Comment] In cases such as the above, the cause is probably that the intake air volume during idling is too small.	<ul style="list-style-type: none"> • Malfunction of the ISC servo system • Malfunction of the throttle body



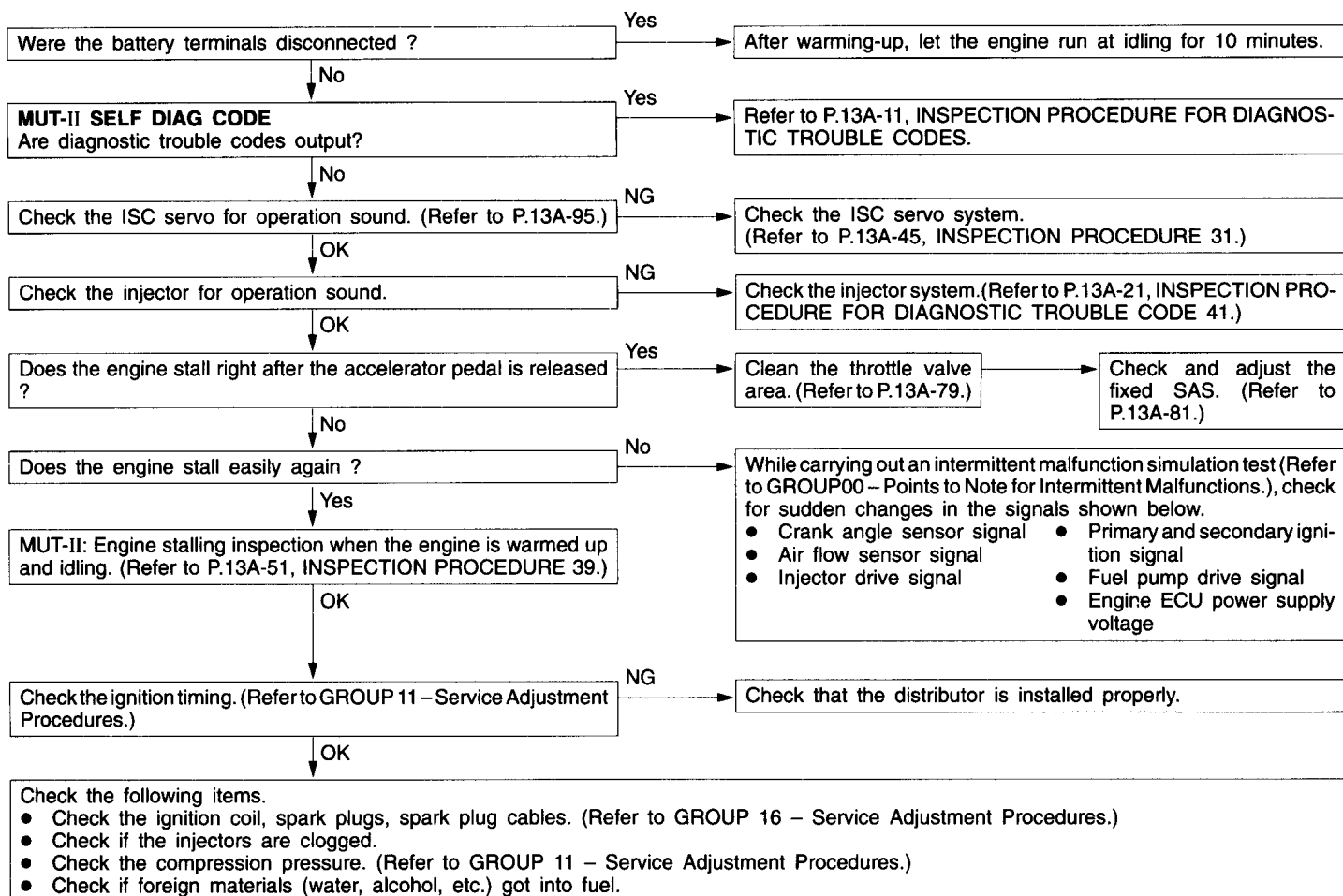
INSPECTION PROCEDURE 11

When the engine is cold, it stalls at idling. (Die out)	Probable cause
[Comment] 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.	<ul style="list-style-type: none"> • Malfunction of the ISC servo system • Malfunction of the throttle body • Malfunction of the injector system • Malfunction of the ignition system



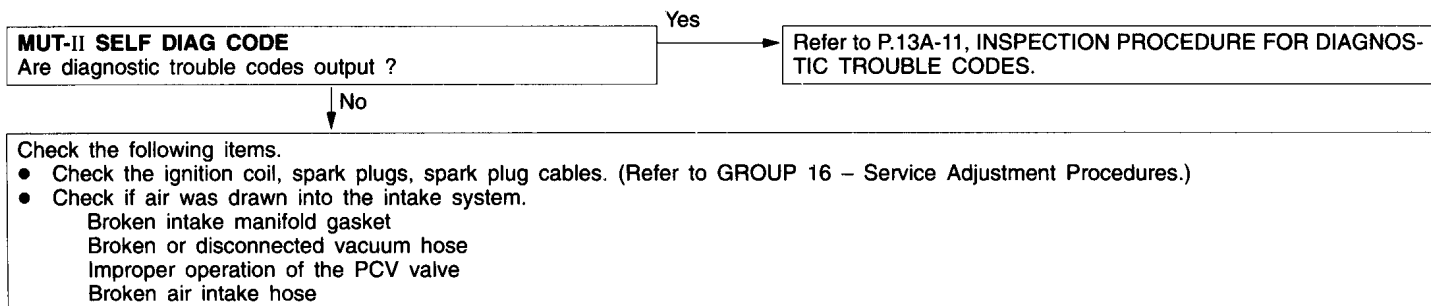
INSPECTION PROCEDURE 12

When the engine is hot, it stalls at idling. (Die out)	Probable cause
<p>[Comment]</p> <p>In cases such as the above, the cause is probably that ignition system, air/fuel mixture, idle speed control (ISC) or compression pressure is defective.</p> <p>In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.</p>	<ul style="list-style-type: none"> • 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



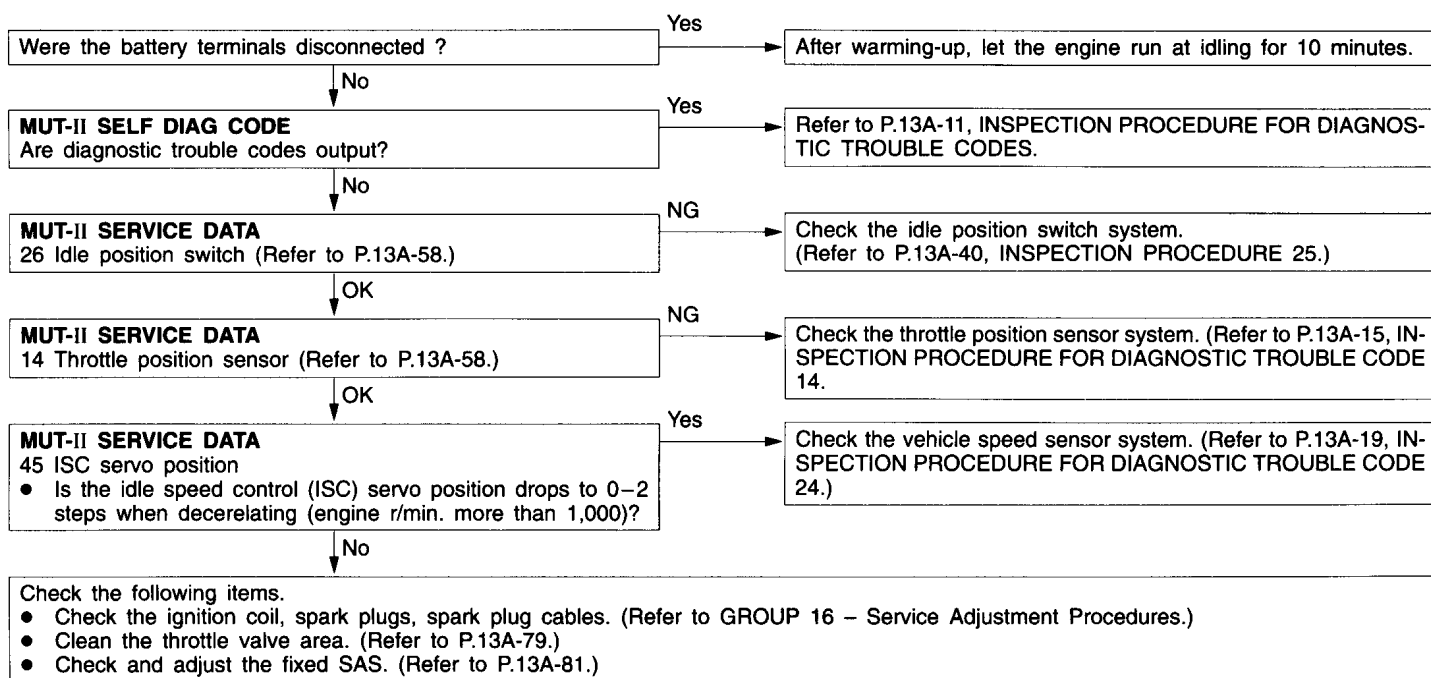
INSPECTION PROCEDURE 13

The engine stalls when starting the car. (Pass out)	Probable cause
[Comment] 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.	<ul style="list-style-type: none"> • Drawing air into intake system • Malfunction of the ignition system



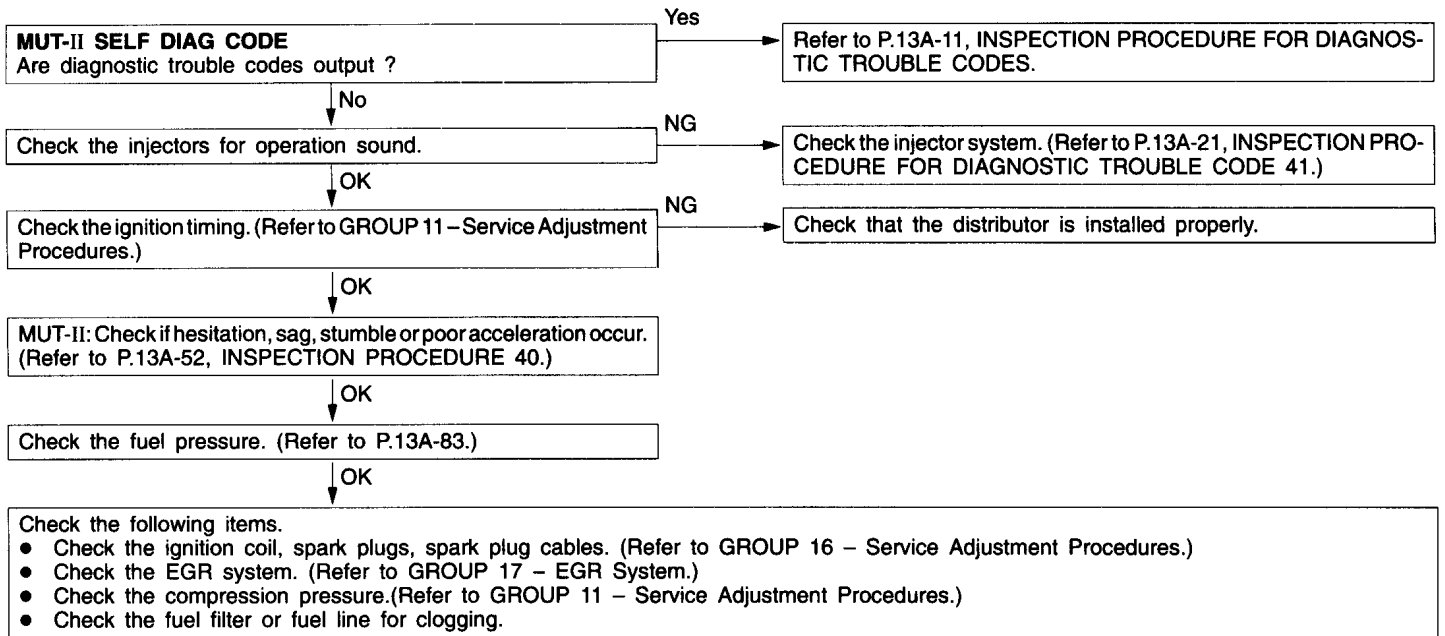
INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
[Comment] 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.	<ul style="list-style-type: none"> • Malfunction of the ISC system



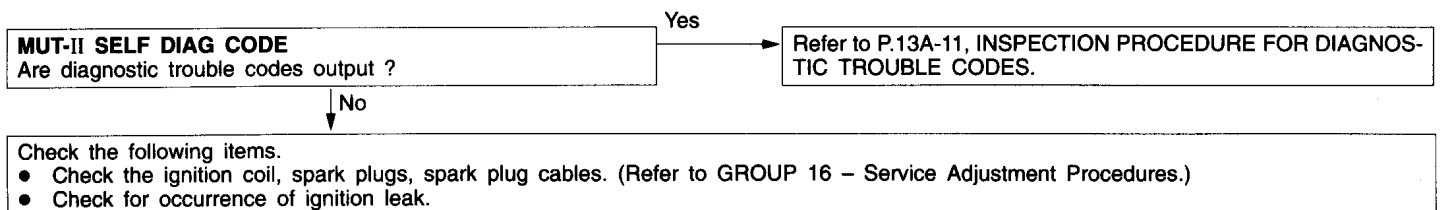
INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
[Comment] In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	<ul style="list-style-type: none"> • 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



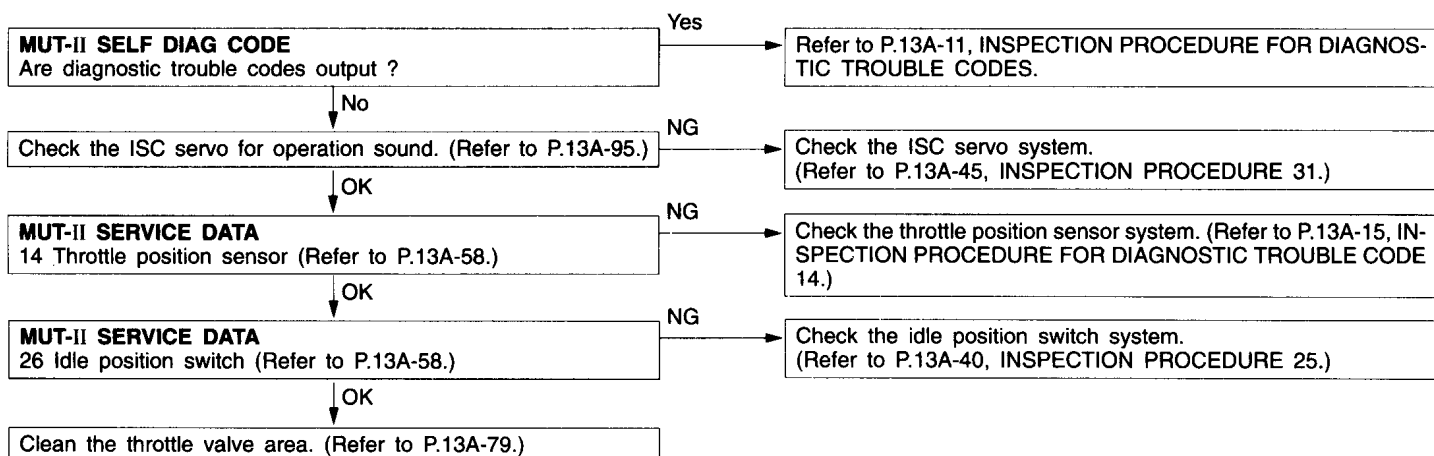
INSPECTION PROCEDURE 16

The feeling of impact or vibration when accelerating	Probable cause
[Comment] 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.	<ul style="list-style-type: none"> • Malfunction of the ignition system



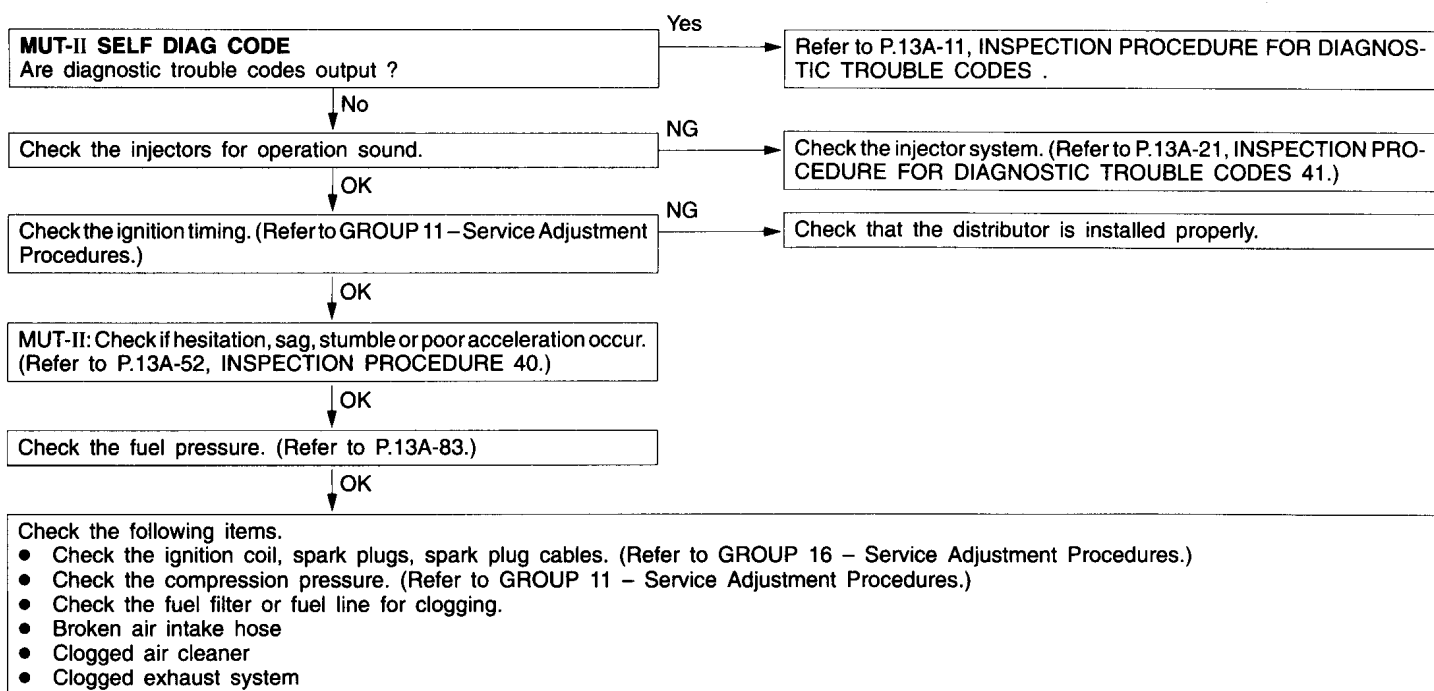
INSPECTION PROCEDURE 17

The feeling of impact or vibration when decelerating	Probable cause
[Comment] Malfunction of the ISC system is suspected.	<ul style="list-style-type: none"> Malfunction of the ISC system



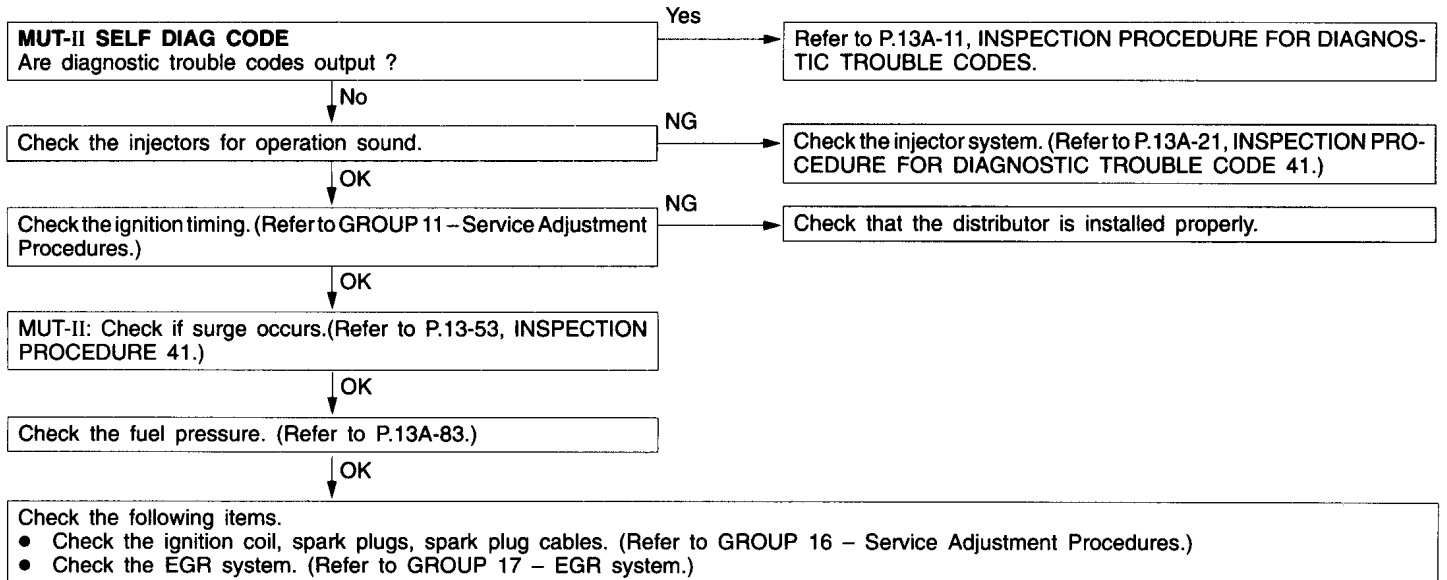
INSPECTION PROCEDURE 18

Poor acceleration	Probable cause
[Comment] Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of air-fuel ratio control system Malfunction of the fuel supply system Poor acceleration Clogged exhaust system



INSPECTION PROCEDURE 19

Surge	Probable cause
[Comment] Defective ignition system, abnormal air-fuel ratio, etc. are suspected.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the EGR control solenoid valve system

**INSPECTION PROCEDURE 20**

Knocking	Probable cause
[Comment] In cases such as the above, the cause is probably that the heat value of the spark plug is inappropriate.	<ul style="list-style-type: none"> • Inappropriate heat value of the spark plug

Check the following items.
<ul style="list-style-type: none"> • Spark plugs • Check if foreign materials (water, alcohol, etc.) got into fuel.

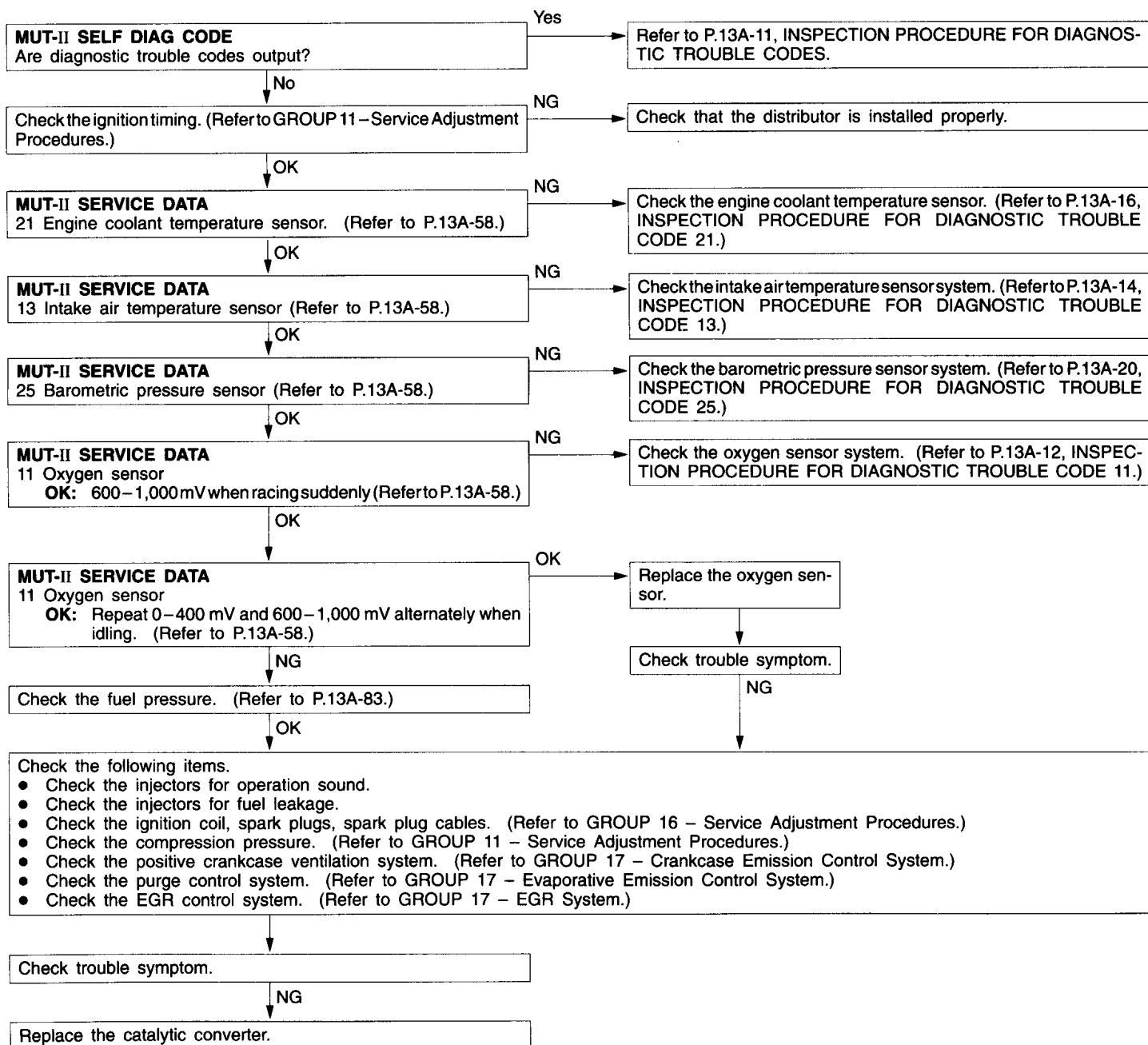
INSPECTION PROCEDURE 21

Dieseling	Probable cause
[Comment] Fuel leakage from injectors is suspected.	<ul style="list-style-type: none"> • Fuel leakage from injectors

Check the injectors for fuel leakage.

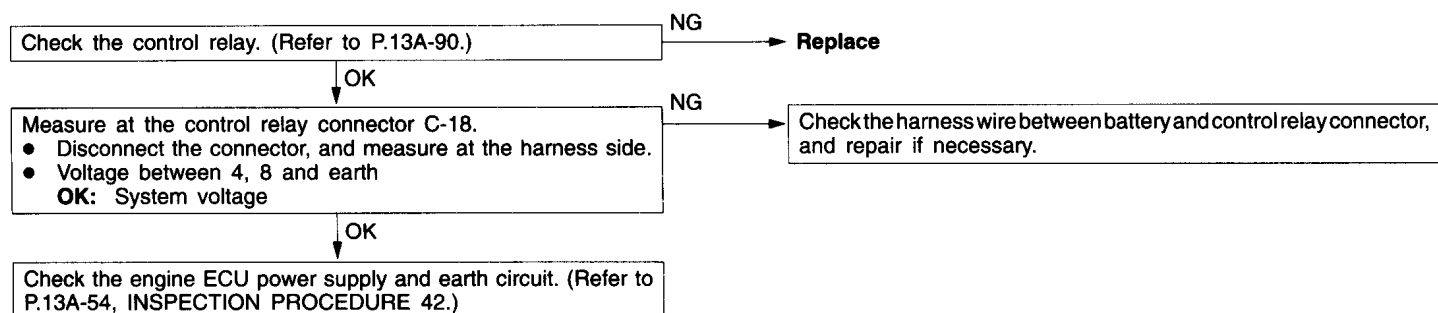
INSPECTION PROCEDURE 22

Too high CO and HC concentration when idling	Probable cause
[Comment] Abnormal air-fuel ratio is suspected.	<ul style="list-style-type: none"> • Malfunction of the air-fuel ratio control system. • Deteriorated catalyst



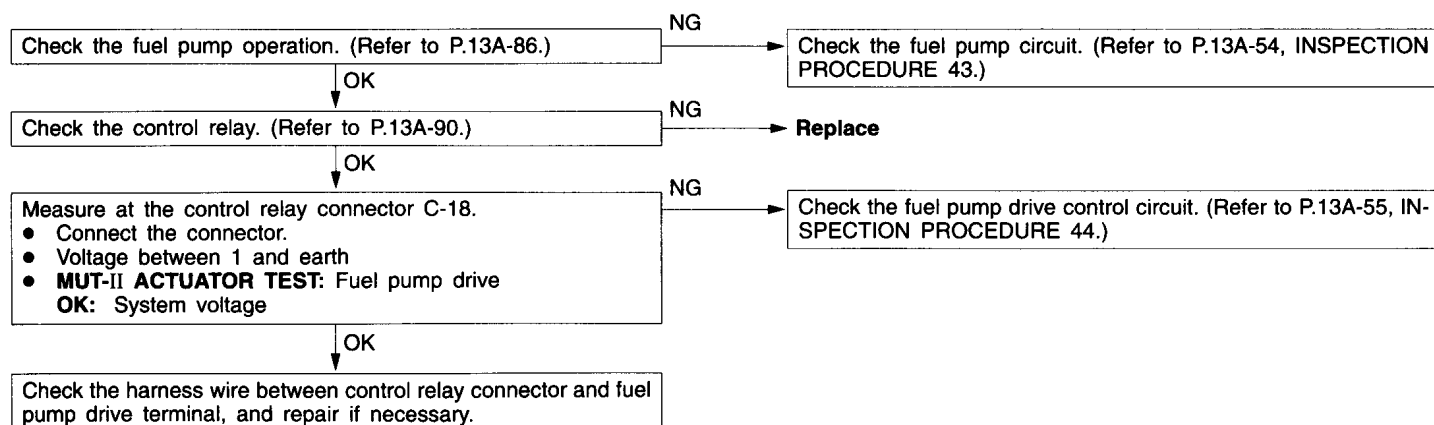
INSPECTION PROCEDURE 23

Power supply system and Ignition switch – IG system	Probable cause
<p>[Comment] When an ignition switch ON signal is input to the engine ECU, the engine ECU turns the control relay ON. This causes battery voltage to be supplied to the engine ECU, injectors and air flow sensor.</p>	<ul style="list-style-type: none"> • Malfunction of the ignition switch • Malfunction of the control relay • Improper connector contact, open circuit or short-circuited harness wire • Disconnected engine ECU earth wire • Malfunction of the engine ECU



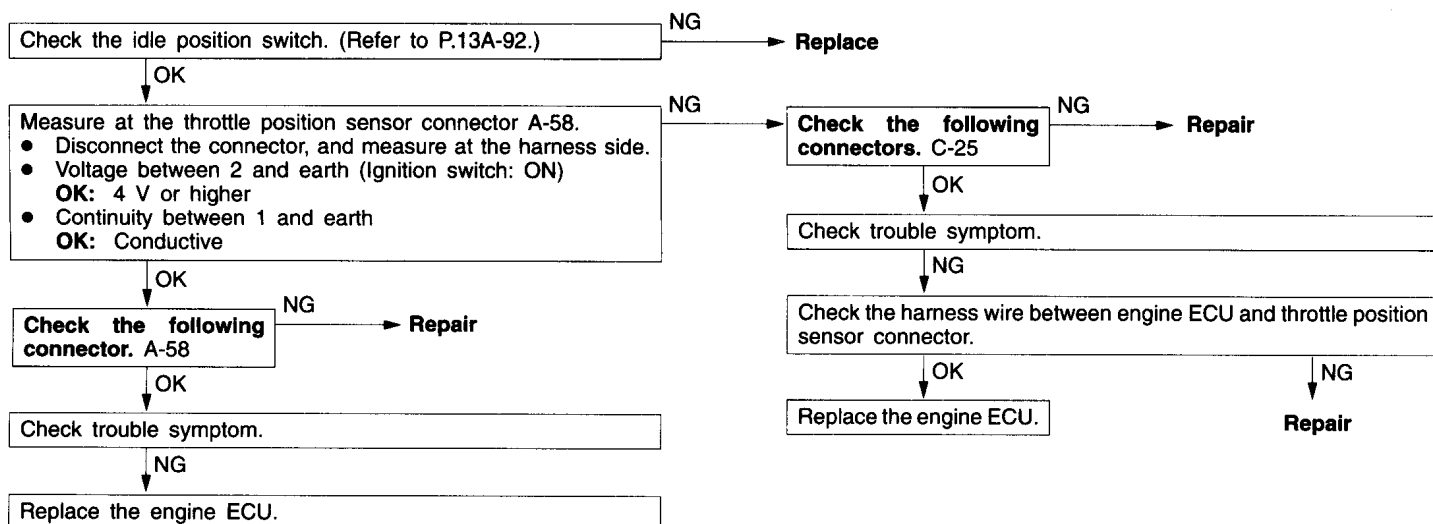
INSPECTION PROCEDURE 24

Fuel pump system	Probable cause
<p>[Comment] The engine ECU turns the control relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.</p>	<ul style="list-style-type: none"> • Malfunction of the control relay • Malfunction of the fuel pump • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine ECU



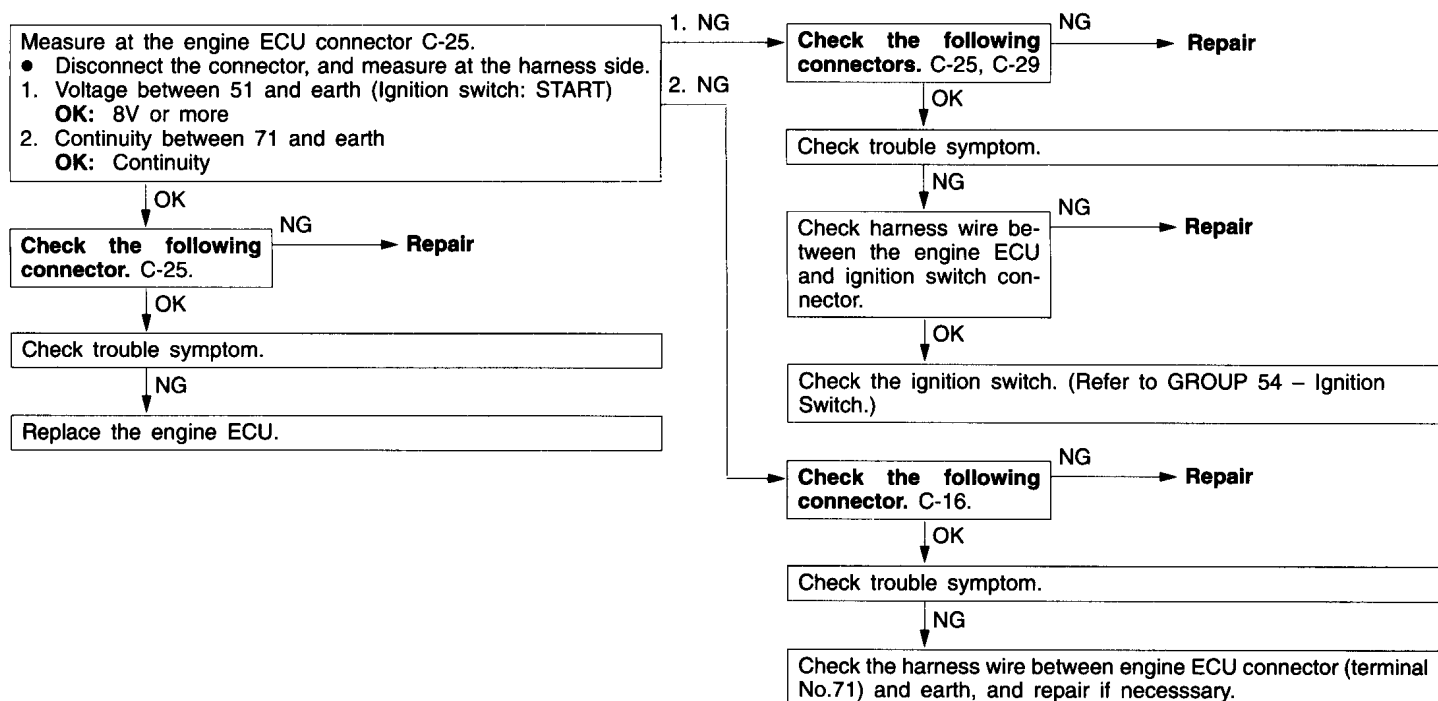
INSPECTION PROCEDURE 25

Idle position switch system	Probable cause
<p>[Comment] 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. The engine ECU controls the idle speed control servo based on this input.</p>	<ul style="list-style-type: none"> • 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



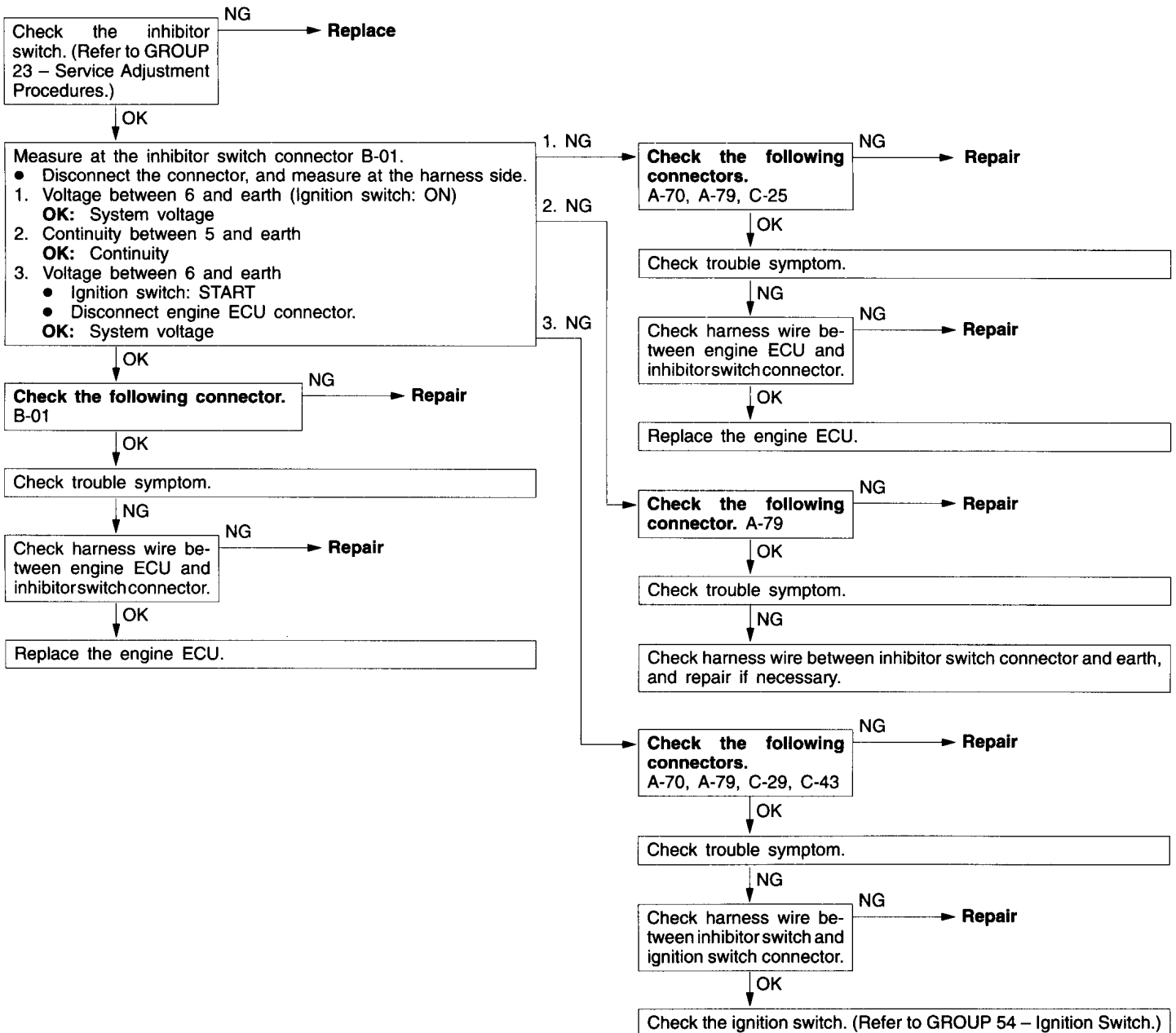
INSPECTION PROCEDURE 26

Ignition switch – ST system <M/T>	Probable cause
<p>[Comment]</p> <p>The ignition switch – ST inputs a HIGH signal to the engine ECU while the engine is cranking.</p> <p>The engine ECU controls fuel injection, etc. during starting based on this input.</p>	<ul style="list-style-type: none"> • Malfunction of ignition switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine ECU



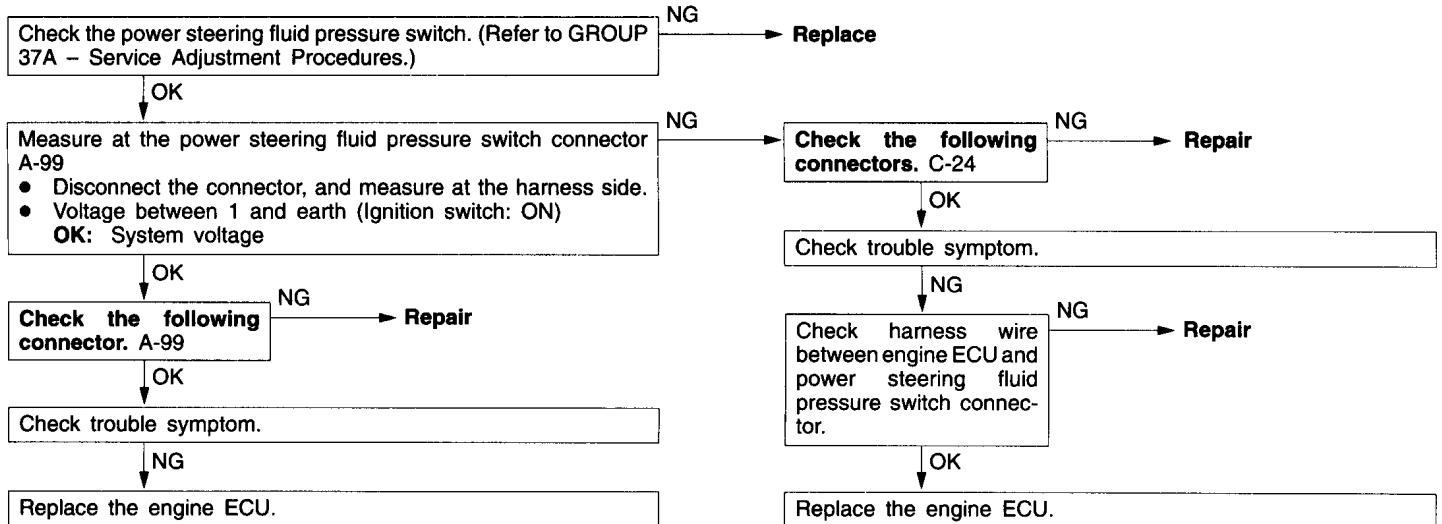
INSPECTION PROCEDURE 27

Ignition switch – ST and inhibitor switch system <A/T>	Probable cause
<p>[Comment]</p> <ul style="list-style-type: none"> 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. 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 ECU. The engine ECU controls the idle speed control (ISC) servo based on this input. 	<ul style="list-style-type: none"> Malfunction of ignition switch Malfunction of inhibitor switch Improper connector contact, open circuit or short-circuited harness wire Malfunction of the engine ECU.



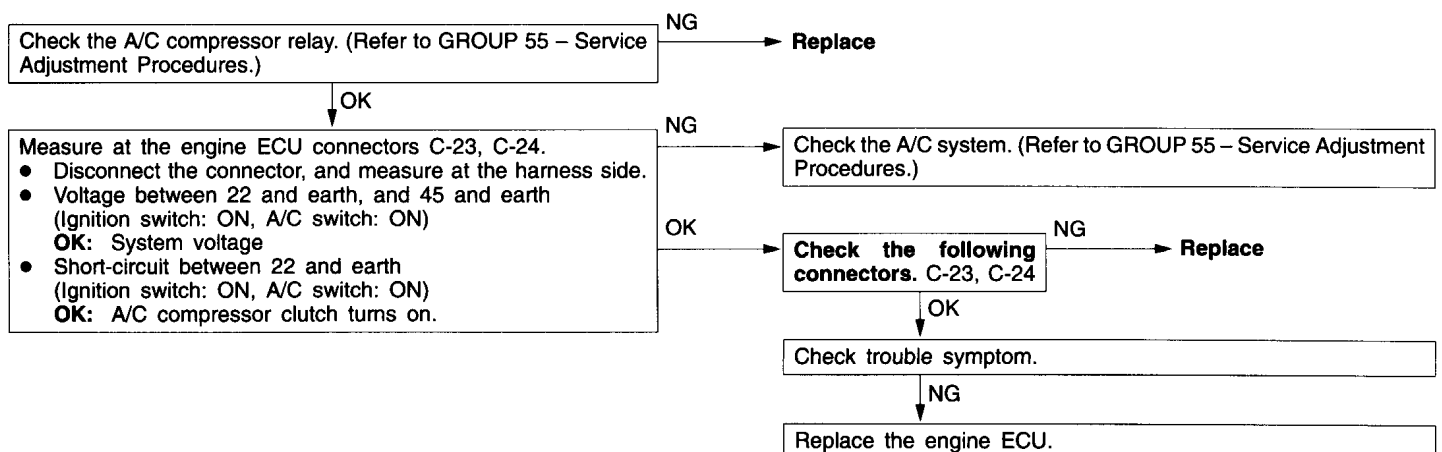
INSPECTION PROCEDURE 28

Power steering fluid pressure switch system	Probable cause
[Comment] The presence or absence of power steering load is input to the engine ECU. The engine ECU controls the idle speed control (ISC) servo based on this input.	<ul style="list-style-type: none"> • Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine ECU



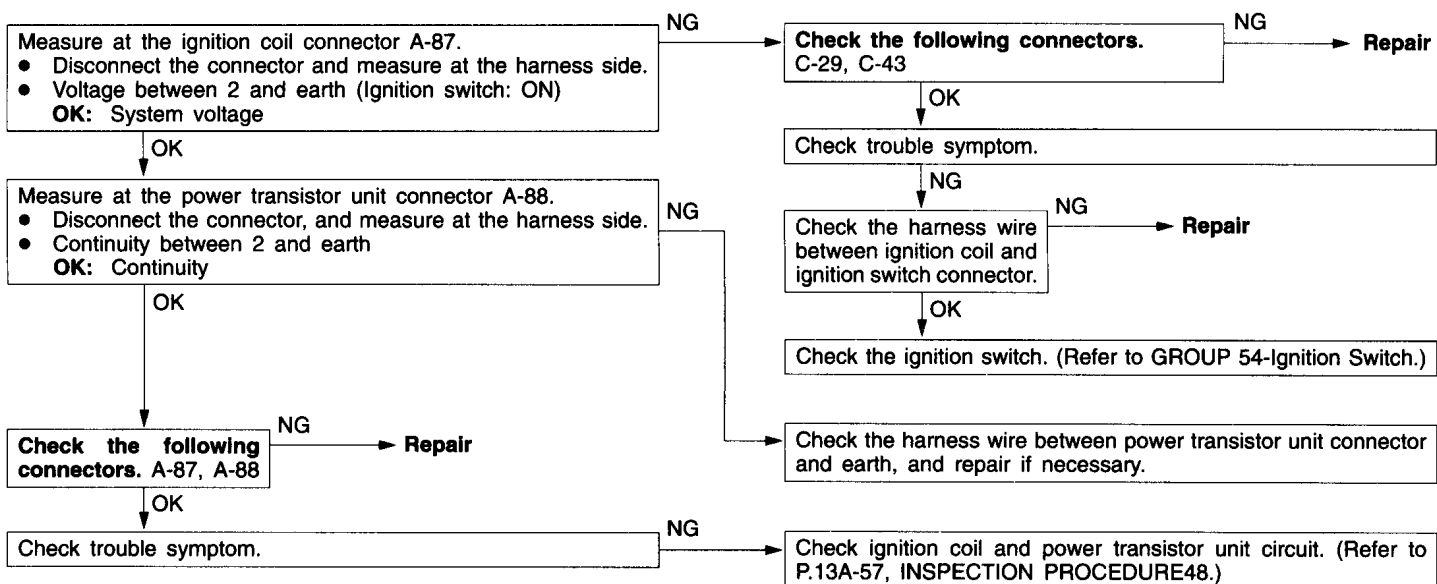
INSPECTION PROCEDURE 29

A/C switch and A/C relay system	Probable cause
[Comment] When an A/C ON signal is input to the engine ECU, the engine ECU carries out control of the idle speed control (ISC) servo, and also operates the A/C compressor magnetic clutch.	<ul style="list-style-type: none"> • Malfunction of A/C control system • Malfunction of A/C switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine ECU



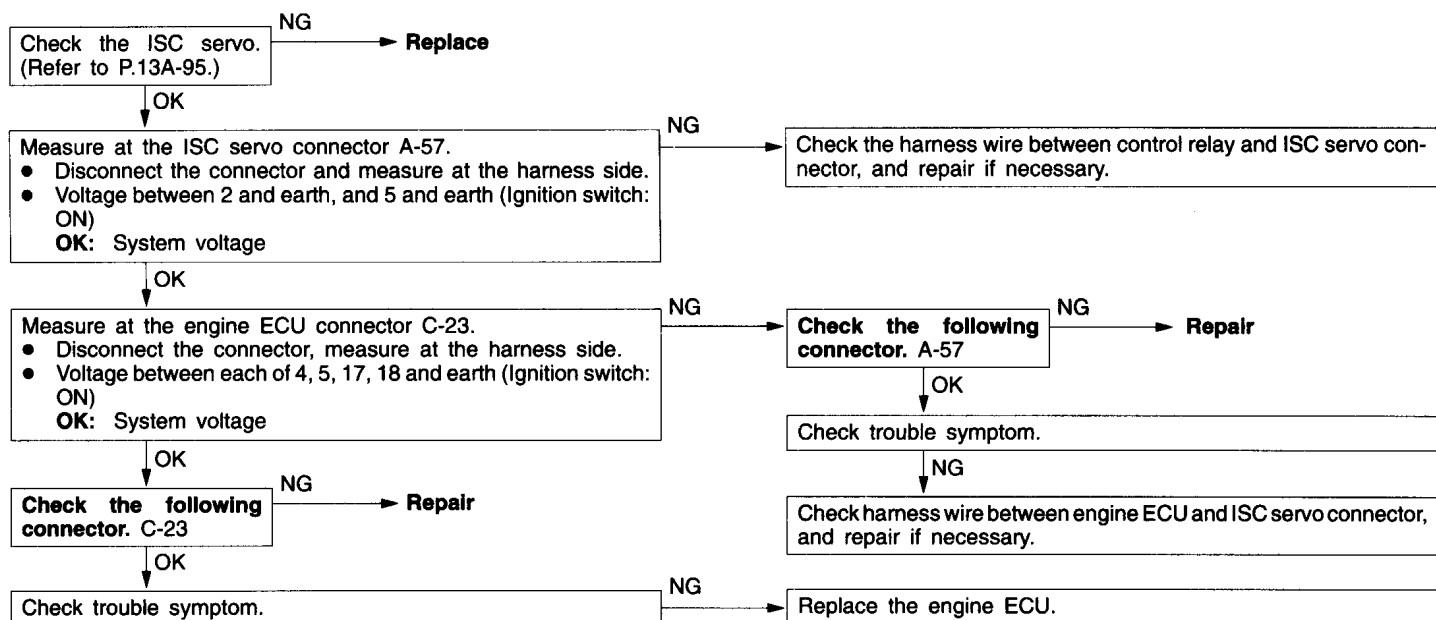
INSPECTION PROCEDURE 30

Ignition circuit system	Probable cause
[Comment] The engine ECU interrupts the ignition coil primary current by turning the power transistor inside the engine ECU ON and OFF.	<ul style="list-style-type: none"> • Malfunction of ignition switch • Malfunction of power transistor unit • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine ECU



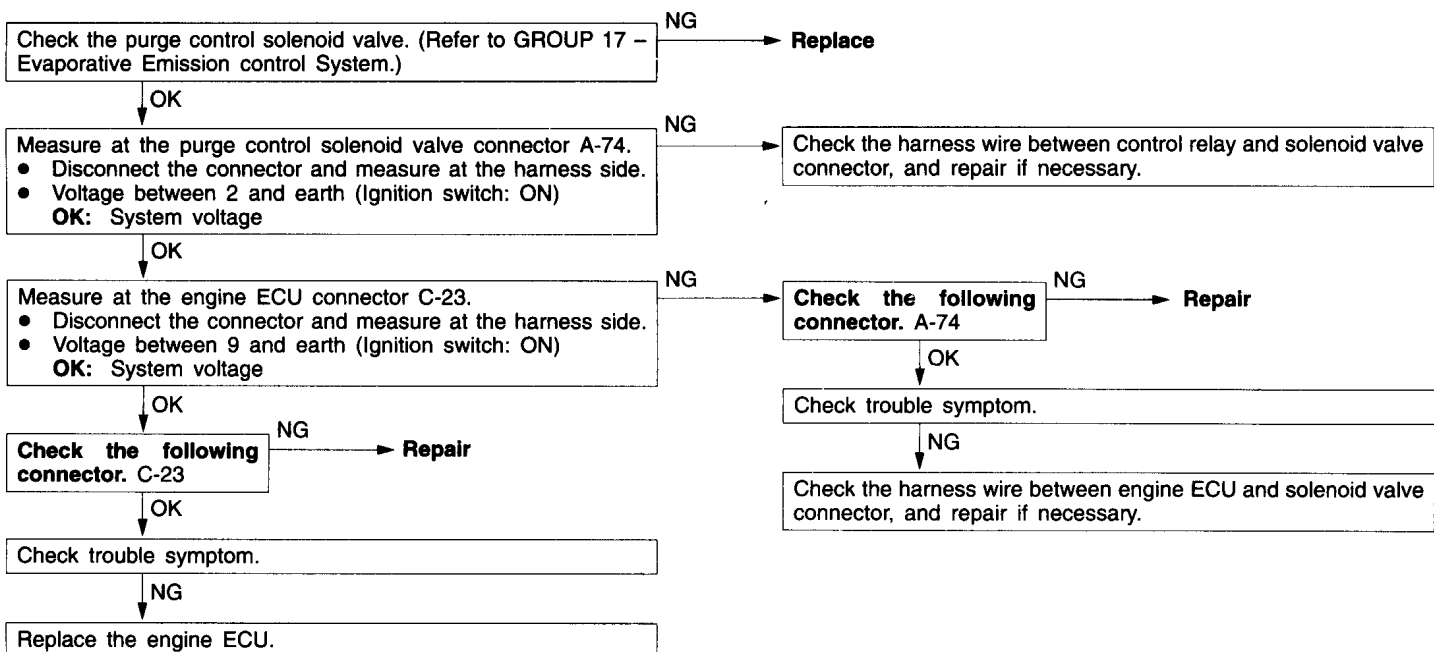
INSPECTION PROCEDURE 31

Idle speed control (ISC) servo (Stepper motor) system	Probable cause
[Comment] The engine ECU controls the intake air volume during idling by opening and closing the servo valve located in the bypass air passage.	<ul style="list-style-type: none"> • Malfunction of ISC servo • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine ECU



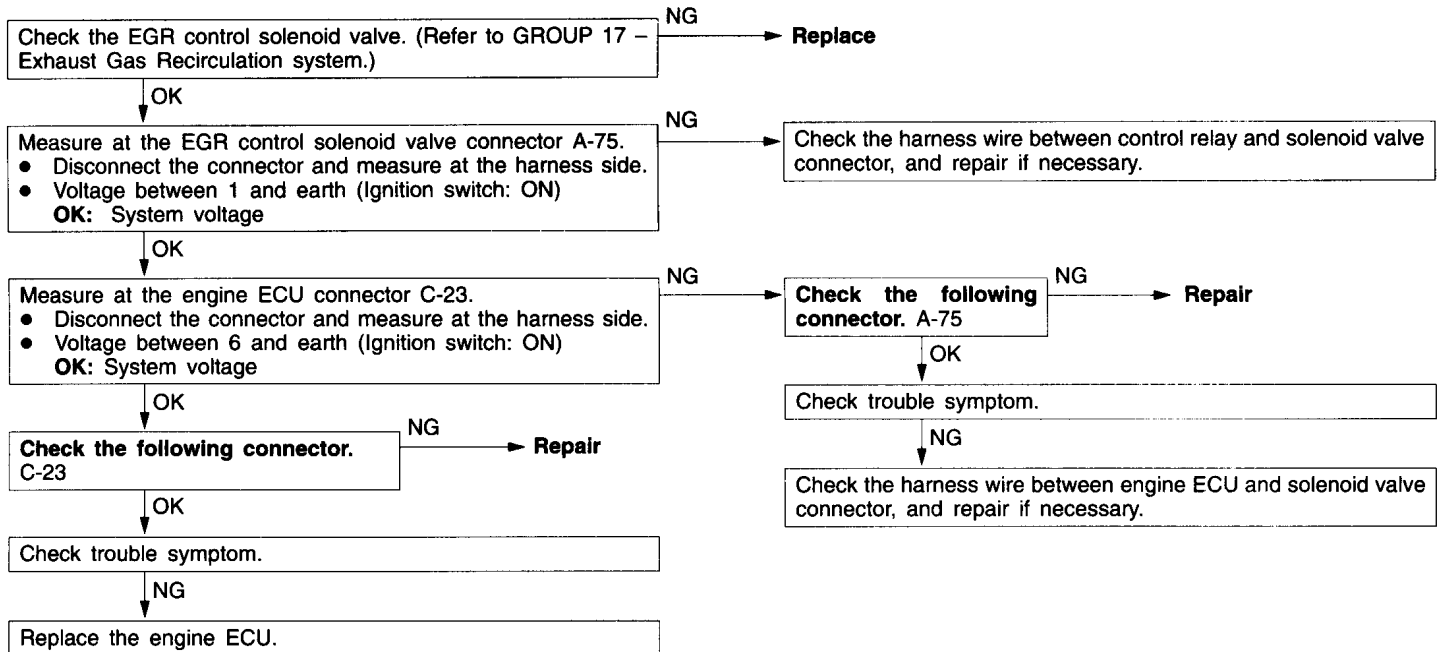
INSPECTION PROCEDURE 32

Purge control solenoid valve system	Probable cause
[Comment] The purge control solenoid valve controls the purging of air from the canister located inside the intake manifold.	<ul style="list-style-type: none"> • Malfunction of solenoid valve • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine ECU

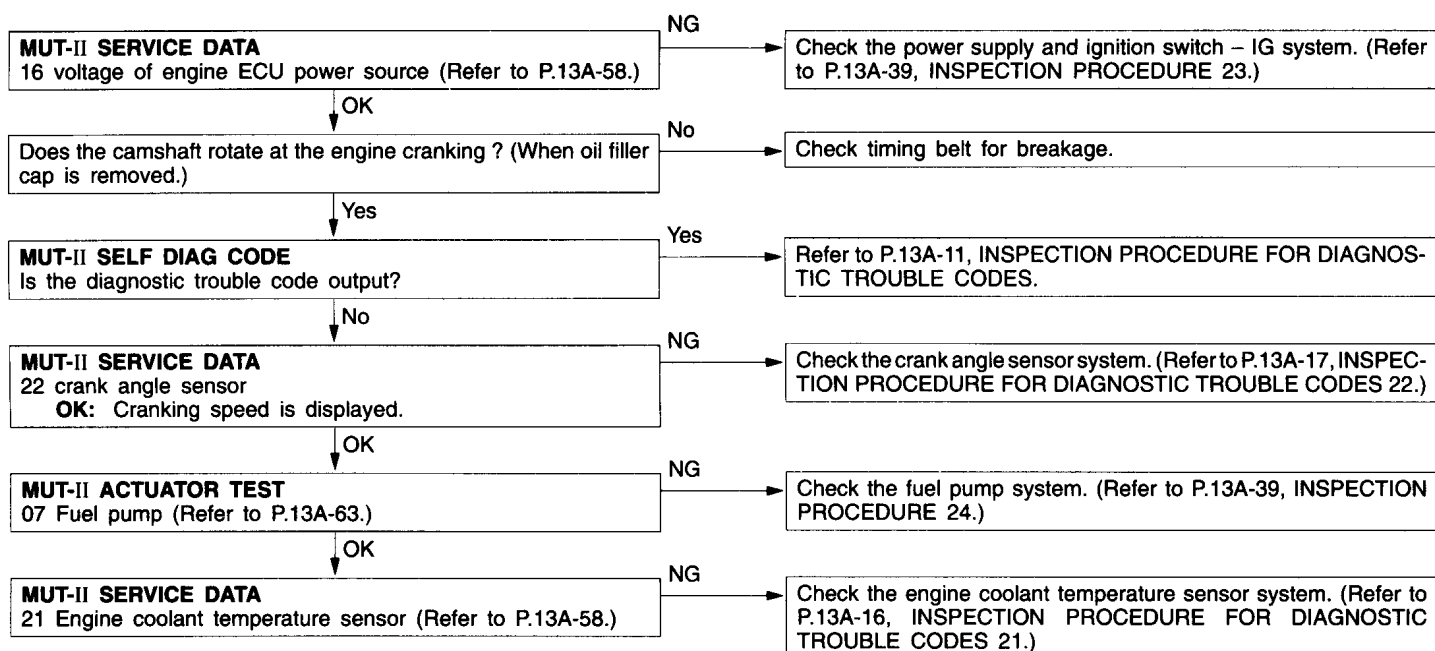


INSPECTION PROCEDURE 33

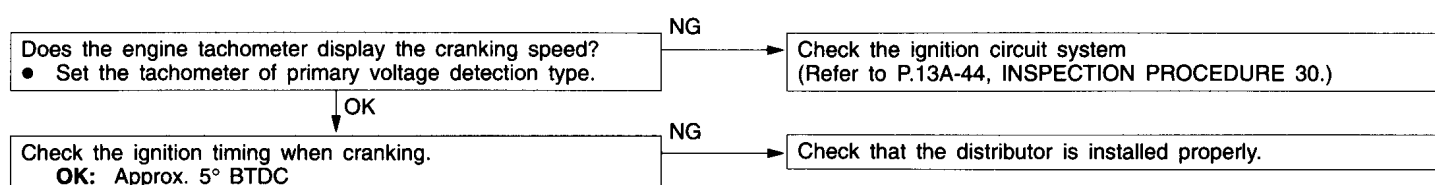
EGR control solenoid valve system	Probable cause
[Comment] The EGR control solenoid valve is controlled by the negative pressure resulting from EGR operation leaking to port "A" of the throttle body.	<ul style="list-style-type: none"> • Malfunction of solenoid valve • Improper connector contact, open-circuit, short-circuited harness wire • Malfunction of the engine ECU



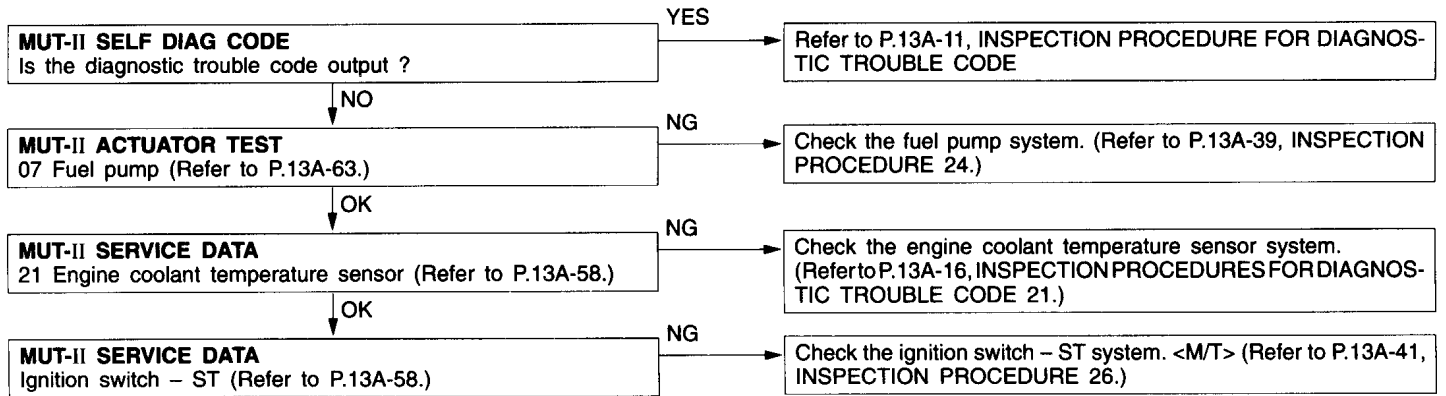
INSPECTION PROCEDURE 34

MUT-II: Inspection of no initial combustion

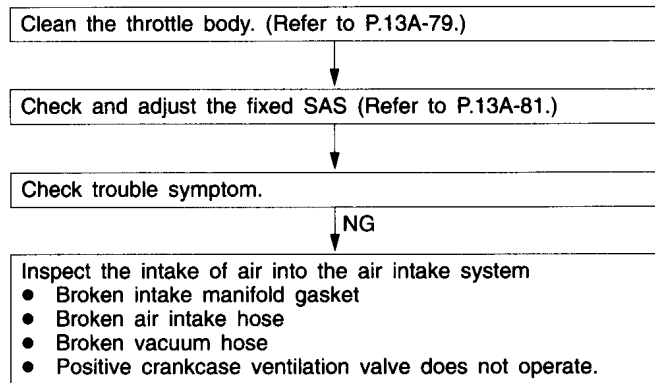
INSPECTION PROCEDURE 35

Ignition system: Inspection of no initial combustion

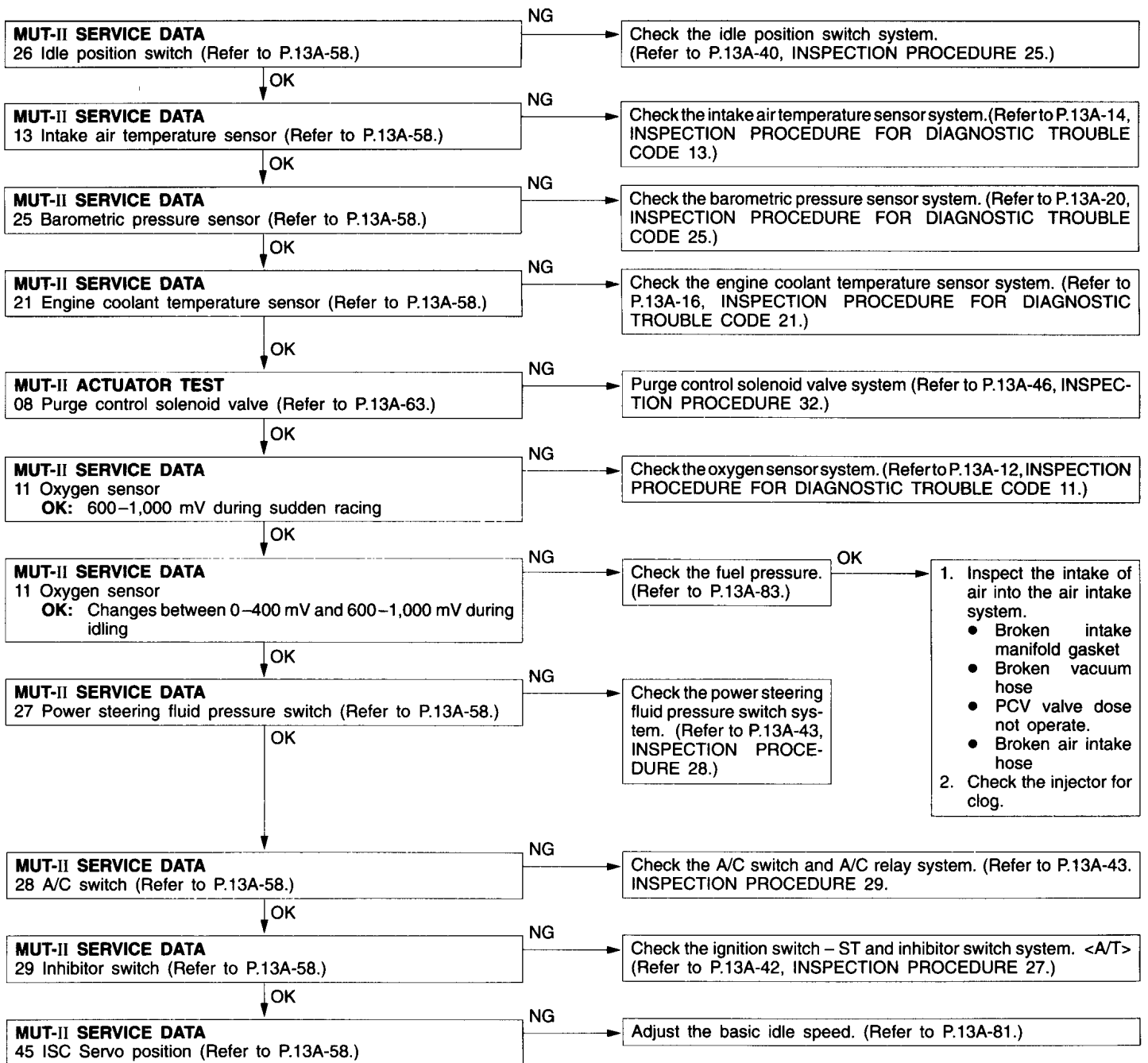
INSPECTION PROCEDURE 36

MUT-II: Check if uncomplete combustion occurs.

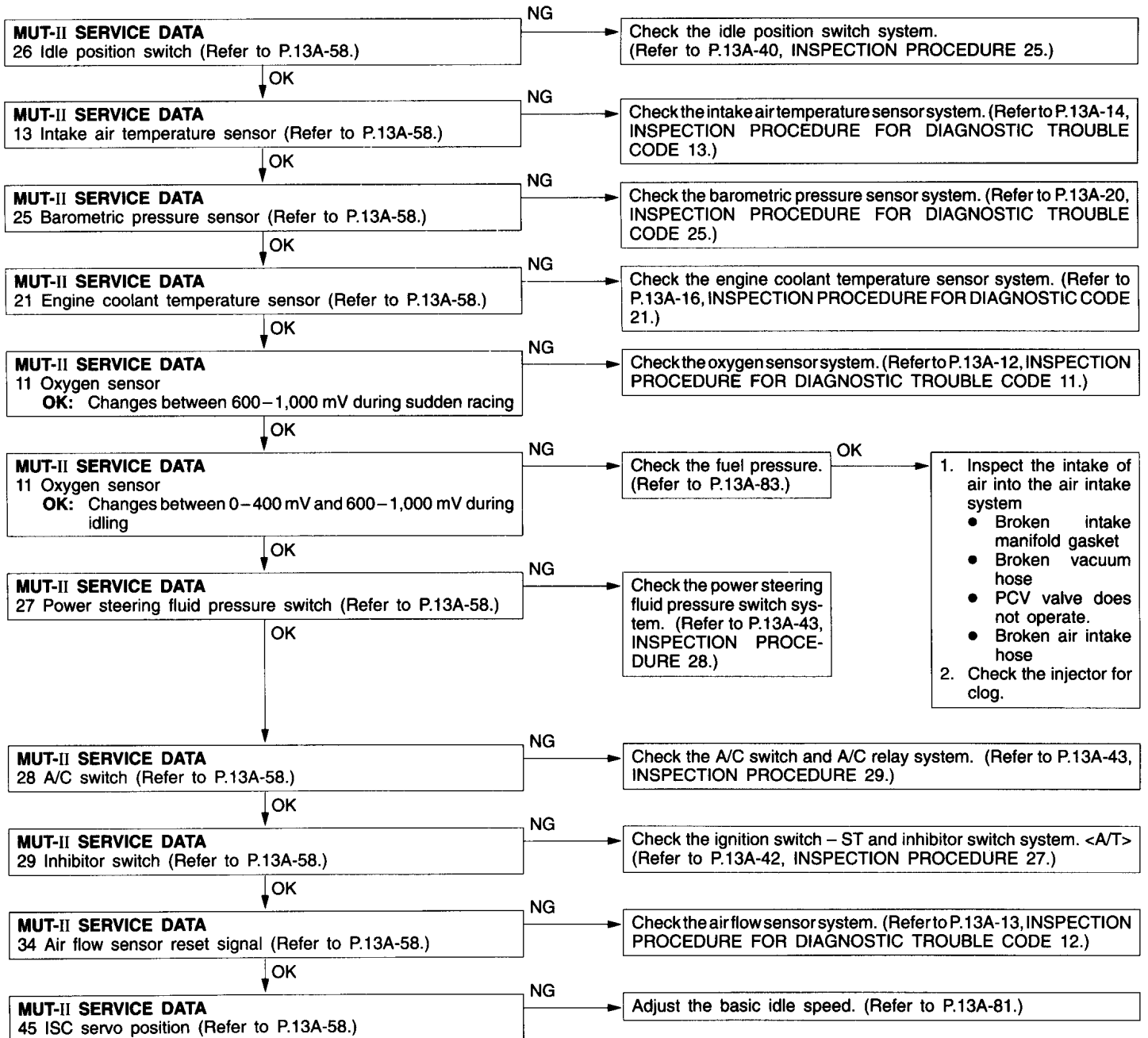
INSPECTION PROCEDURE 37

Check if hunting occurs.

INSPECTION PROCEDURE 38

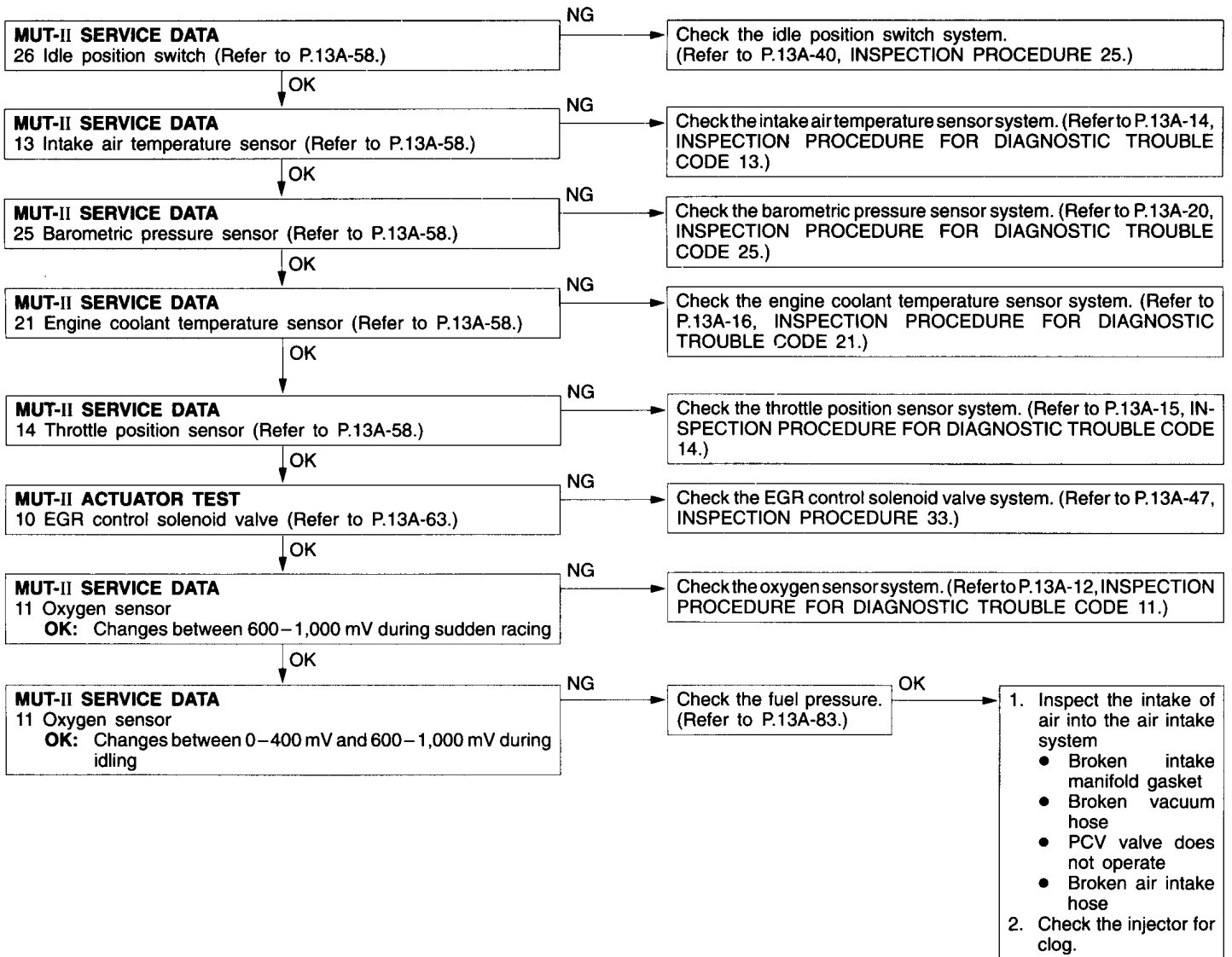
MUT-II: Check if idling speed is unstable.

INSPECTION PROCEDURE 39

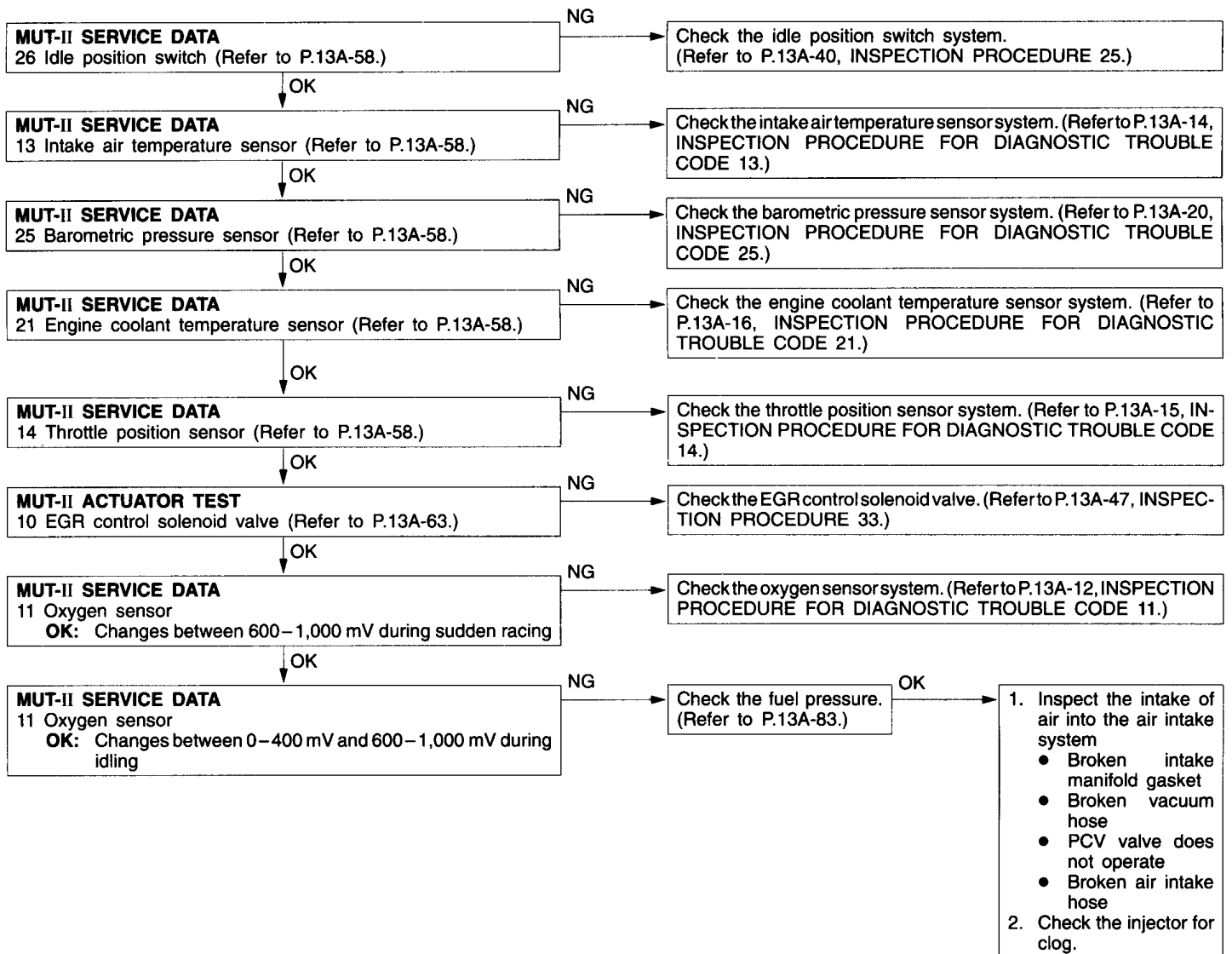
MUT-II: Engine stalling inspection when the engine is warmed up and idling.

INSPECTION PROCEDURE 40

MUT-II: Check if hesitation, sug, stumble or poor acceladation occurs.

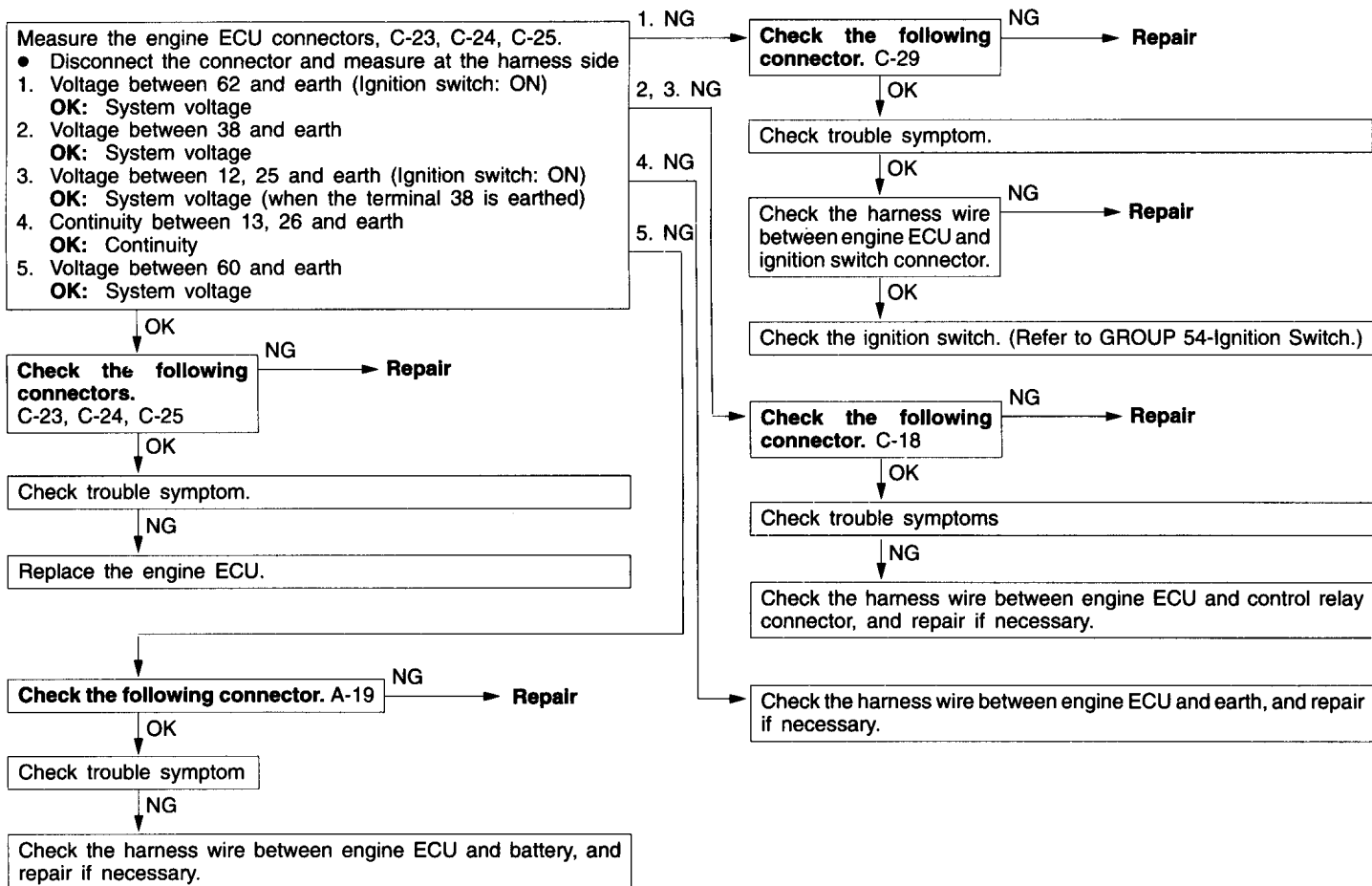


INSPECTION PROCEDURE 41

MUT-II: Check if surge occurs.

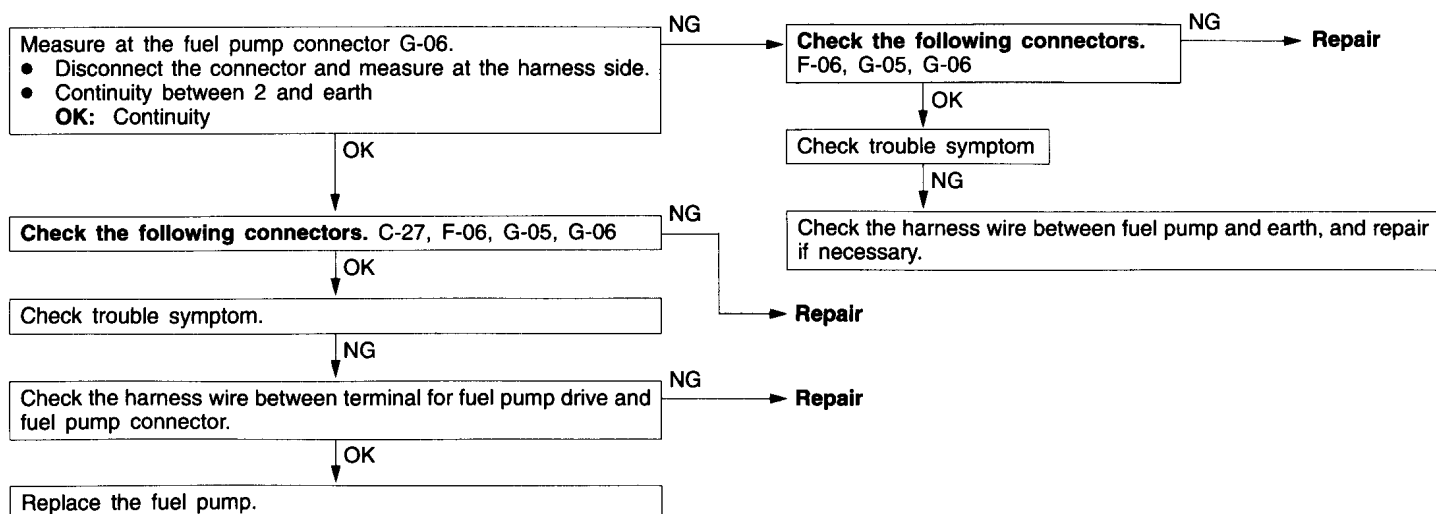
INSPECTION PROCEDURE 42

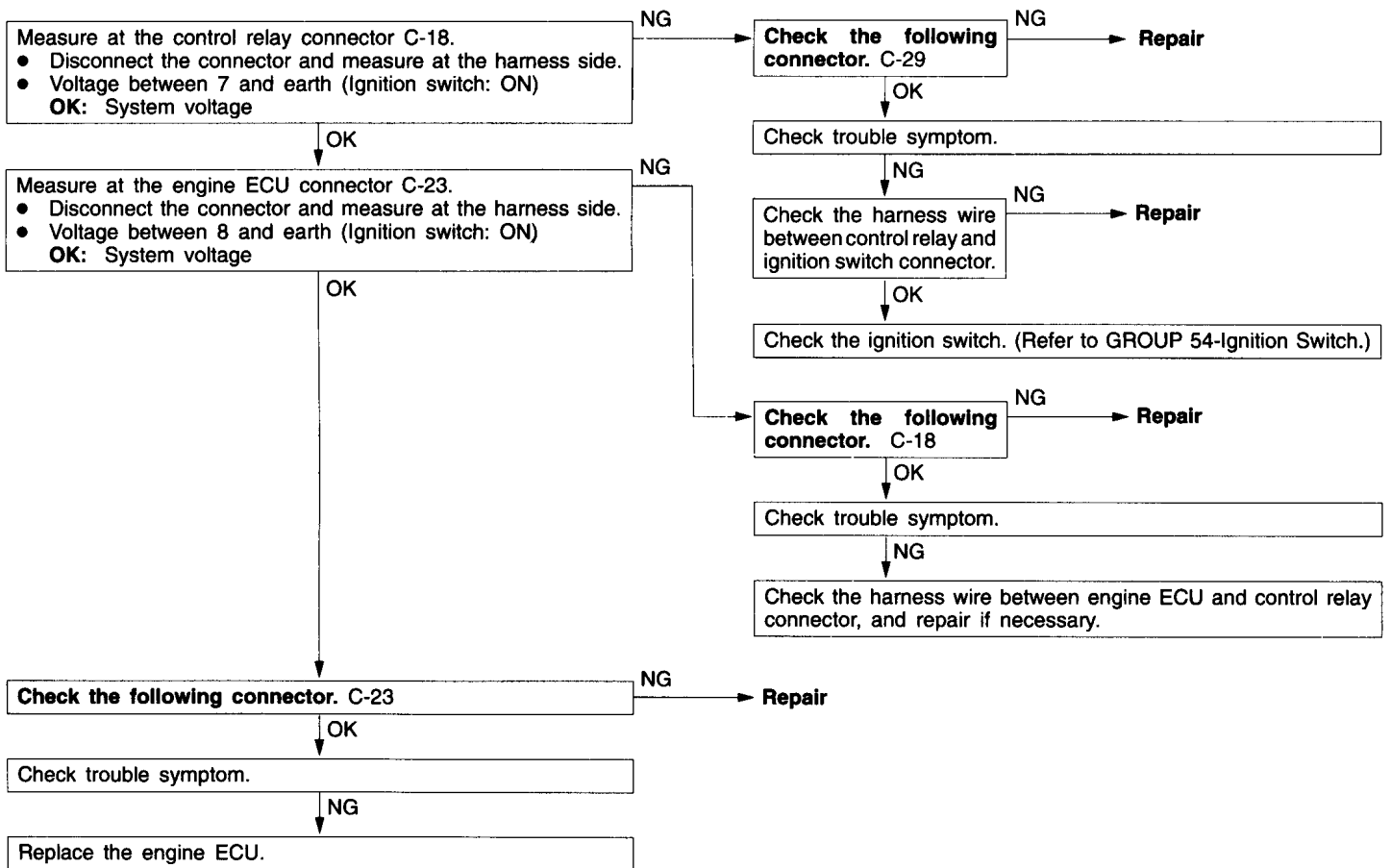
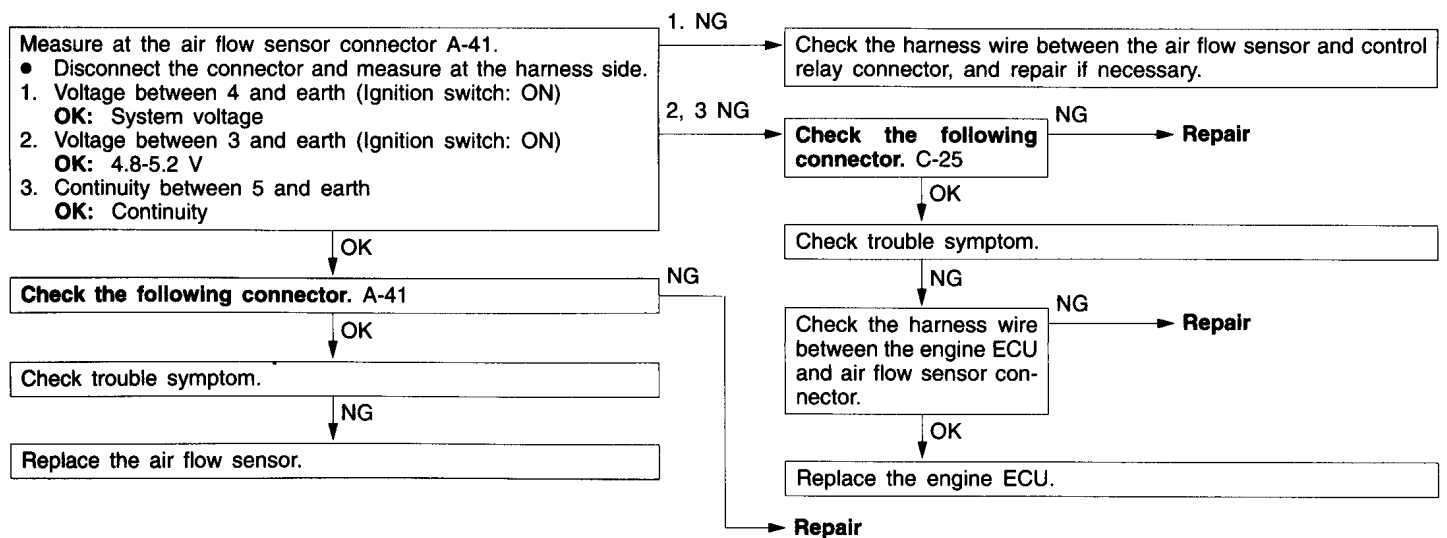
Check the engine ECU power supply and earth circuit.



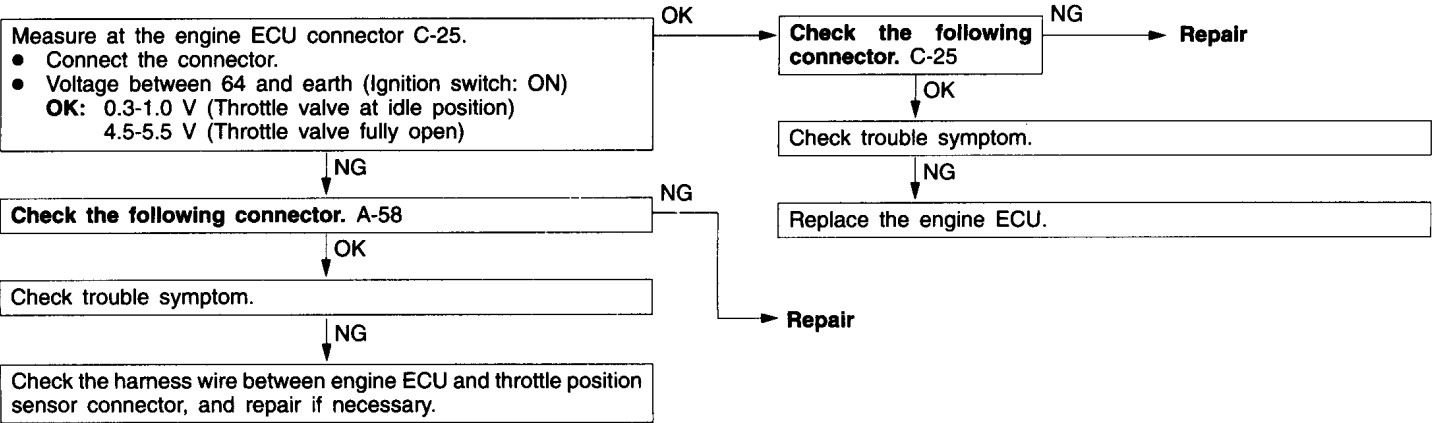
INSPECTION PROCEDURE 43

Check fuel pump circuit.



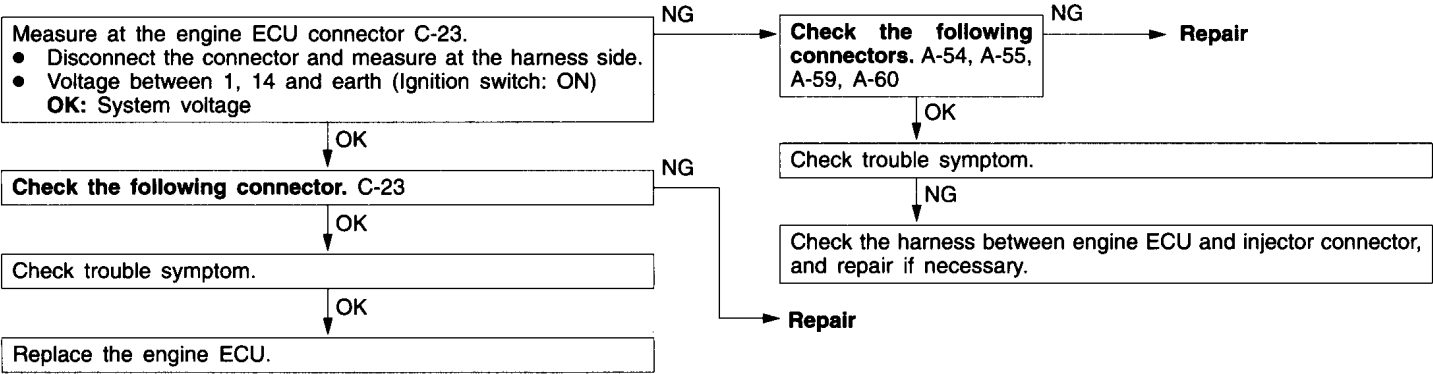
INSPECTION PROCEDURE 44**Check the fuel pump drive control circuit.****INSPECTION PROCEDURE 45****Check air flow sensor(AFS) control circuit.****INSPECTION PROCEDURE 46**

Check throttle position sensor(TPS) output circuit.



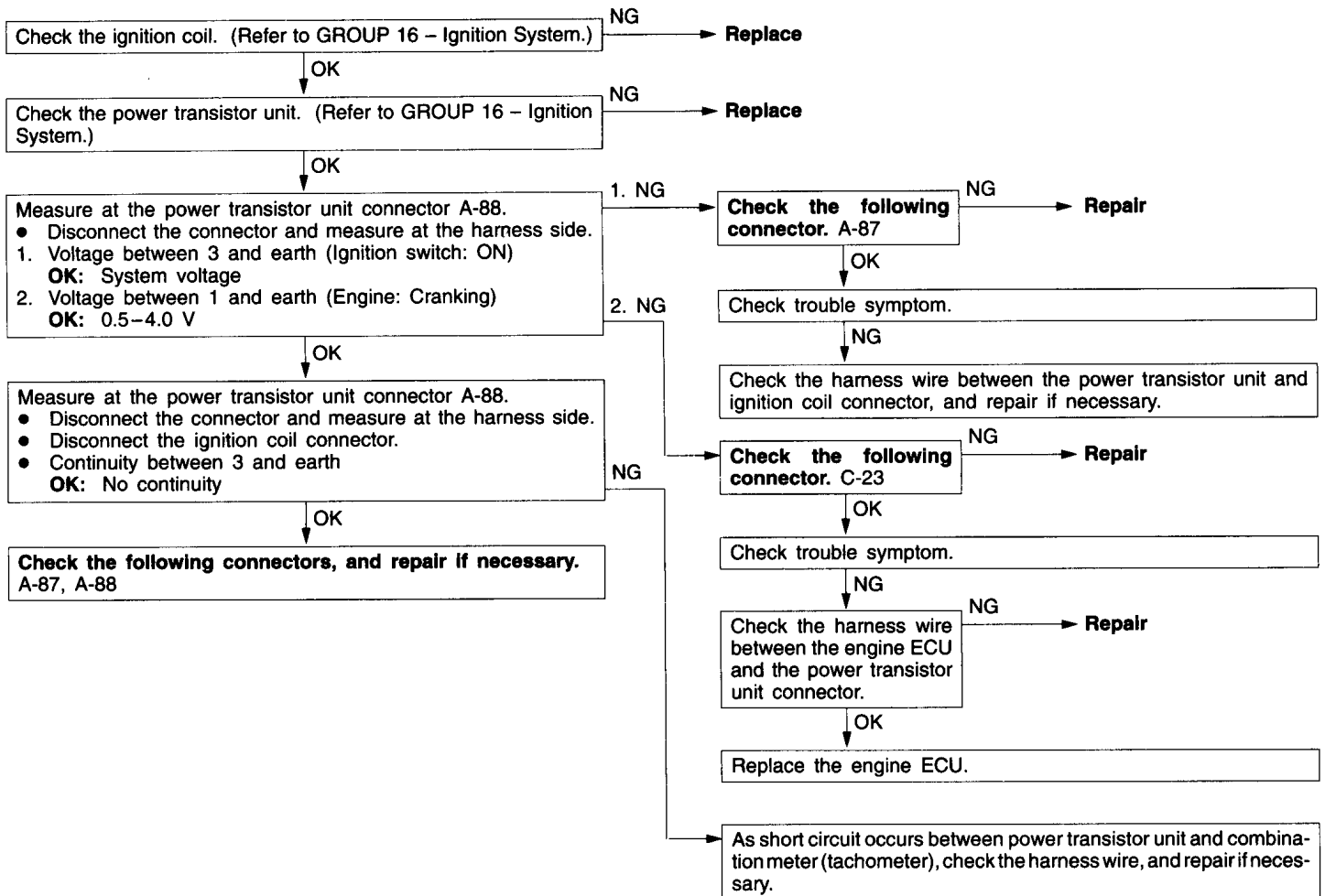
INSPECTION PROCEDURE 47

Check injector control circuit



INSPECTION PROCEDURE 48

Check ignition coil and power transistor unit circuit.



SERVICE DATA REFERENCE TABLE

120002551

Caution

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

NOTE

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

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	Engine: After having warmed up Air/fuel mixture is made leaner when decelerating, and is made richer when racing.	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Code No. 11	13A-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	<ul style="list-style-type: none"> • Engine coolant temperature: 80–95°C • Lights and all accessories: OFF • Transmission: Neutral (A/T: P range) 	Engine is idling	22–48 Hz <4G63> 19–45 Hz <4G64>	–	–
			2,500 r/min.	80–120 Hz <4G63> 67–107 Hz <4G64>		
			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	13A-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	13A-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. 23	13A-39
18	Cranking signal (ignition switch – ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 26 <M/T> Procedure No. 27 <A/T>	13A-41 13A-42
			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	13A-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	<ul style="list-style-type: none"> Engine: Cranking Tachometer: Connected 	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. 22	13A-17
			When engine coolant temperature is -20°C	1,275–1,475 r/min		
		<ul style="list-style-type: none"> Engine: Idling Idle position switch: ON 	When engine coolant temperature is 0°C	1,225–1,425 r/min		
			When engine coolant temperature is 20°C	1,100–1,300 r/min		
			When engine coolant temperature is 40°C	950–1,150 r/min		
			When engine coolant temperature is 80°C	650–850 r/min		
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25	13A-20
			At altitude of 600 m	95 kPa		
			At altitude of 1,200 m	88 kPa		
			At altitude of 1,800 m	81 kPa		
26	Idle position switch	Ignition switch: ON Check by operating accelerator pedal repeatedly	Throttle valve: Set to idle position	ON	Procedure No. 25	13A-40
			Throttle valve: Slightly open	OFF*5		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 28	13A-43
			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. 29	13A-43
			A/C switch: ON	ON		
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 27	13A-42
			D, 2, L or R	D, 2, L or R		

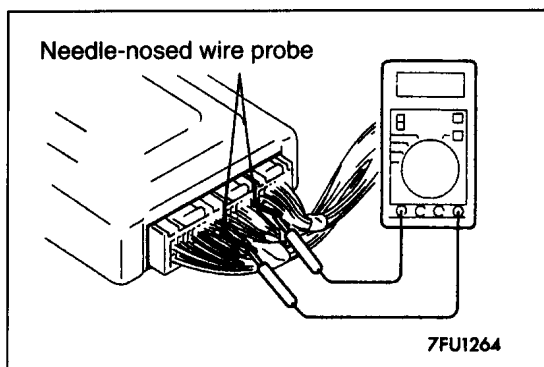
Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
41	Injectors *2	Engine: Cranking	When engine coolant temperature is 0°C	51–76 ms <4G63> 60–90 ms <4G64>	–	–
			When engine coolant temperature is 20°C	26–38 ms <4G63> 30–45 ms <4G64>		
			When engine coolant temperature is 80°C	5.7–8.5 ms <4G63> 6.7–10.1 ms <4G64>		
	Injectors *3	<ul style="list-style-type: none"> Engine coolant temperature: 80–95°C Lights and all accessories: OFF Transmission: Neutral (A/T : P range) 	Engine is idling	1.9–3.1 ms <4G63> 2.2–3.4 ms <4G64>		
			2,500 r/min.	1.8–3.0 ms <4G63> 1.9–3.1 ms <4G64>		
			When engine is suddenly raced	Increases		
44	Ignition coils and power transistors	<ul style="list-style-type: none"> Engine: After having warmed up Timing light is set. (The timing light is set in order to check actual ignition timing.) 	Engine is idling	2–18 °BTDC	–	–
		<ul style="list-style-type: none"> Engine: After having warmed up Timing light is set. (The timing light is set in order to check actual ignition timing.) 	2,500 r/min.	23–43 °BTDC <4G63> 27–47 °BTDC <4G64>		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
45	ISC(step-per) motor position *4	<ul style="list-style-type: none"> Engine coolant temperature: 80–95°C Lights 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		
			<ul style="list-style-type: none"> 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. 29	13A-43
			A/C switch: ON	ON (Compressor clutch is operating)		

ACTUATOR TEST REFERENCE TABLE

120002552

Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1, No. 3 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	13A-21
02		Cut fuel to No. 2, No. 4 injector.					
07	Fuel pump	Fuel pump operates and fuel is recirculated.	<ul style="list-style-type: none"> 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. 24	13A-39
				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. 32	13A-46
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. 33	13A-47



CHECK AT THE ENGINE ECU TERMINALS

120002553

TERMINAL VOLTAGE CHECK CHART

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

NOTE

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

Caution

Short-circuiting the positive (+) probe between a connector terminal and earth could damage the vehicle wiring, the sensor, engine ECU or all of them. Be careful to prevent this!

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

Engine ECU Connector Terminal Arrangement

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	12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Terminal No.	Check item	Check condition (Engine condition)		Normal condition
34	Ignition timing adjustment terminal	Ignition switch: ON	Earth the ignition timing adjustment terminal	0–1V
			Remove the earth connection from the ignition timing adjustment terminal	4.0–5.5V
35	Oxygen sensor heater	Engine: Idling after warming up		0–3V
		Engine r/min.: 5,000r/min.		SV
36	Engine warning lamp	Ignition switch: OFF → ON		0–3V → 9–13V (After several seconds have elapsed)
37	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	SV
			When steering wheel is turned	0–3V
38	Control relay (Power supply)	Ignition switch: OFF		SV
		Ignition switch: ON		0–3V
45	A/C switch	Engine: Idle speed	Turn the A/C switch OFF	0–3V
			Turn the A/C switch ON (A/C compressor is operating)	SV
51	Ignition switch – ST	Engine: Cranking		8V or more
52	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
56	Oxygen sensor	Engine: Running at 2,000 r/min. after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8V (Changes repeatedly)
60	Backup power supply	Ignition switch: OFF		SV
61	Sensor impressed voltage	Ignition switch: ON		4.5–5.5V
62	Ignition switch – IG	Ignition switch: ON		SV

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
63	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
64	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3–1.0V
			Fully open throttle valve	4.5–5.5V
65	Barometric pressure sensor	Ignition switch: ON	When altitude is 0m	3.7–4.3V
			When altitude is 1,200m	3.2–3.8V
66	Vehicle speed sensor	● Ignition switch: ON ● Move the vehicle slowly forward		0 ↔ 5V (Changes repeatedly)
67	Idle position switch	Ignition switch: ON	Set throttle valve to idle position	0–1V
			Slightly open throttle valve	4V or more
68	Top dead centre sensor	Engine: Cranking		0.4–3.0V
		Engine: Idle speed		0.5–2.0V
69	Crank angle sensor	Engine: Cranking		0.4–4.0V
		Engine: Idle speed		1.5–2.5V
70	Air flow sensor	Engine: Idle speed		2.2–3.2V
		Engine r/min.: 2000r/min.		
71	Inhibitor switch <A/T>	Ignition switch: ON	Set selector lever to P or N	0–3V
			Set selector lever to D, 2, L or R	8–14V

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

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

NOTE

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

Caution

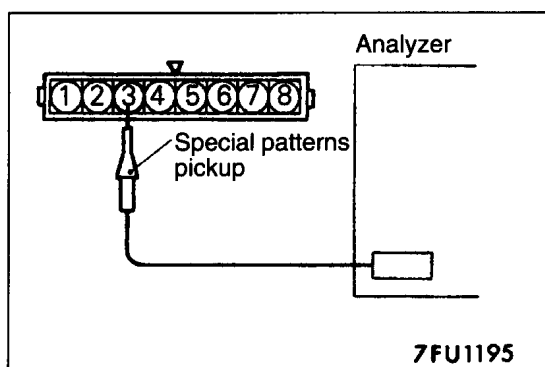
If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine ECU and/or ohmmeter. Be careful to prevent this!

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

Engine ECU Harness Side Connector Terminal Arrangement

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	123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Terminal No.	Inspection item	Normal condition (Check condition)
6–12	EGR control solenoid valve	36–44 Ω (At 20°C)
9–12	Purge control solenoid valve	36–44 Ω (At 20°C)
13–Body earth	ENGINE ECU earth	Continuity (0 Ω)
26–Body earth	ENGINE ECU earth	
35–12	Oxygen sensor heater	Approx. 12 Ω (At 20°C)
52–72	Intake air temperature sensor	5.3–6.7 k Ω (When intake air temperature is 0°C)
		2.3–3.0 k Ω (When intake air temperature is 20°C)
		1.0–1.5 k Ω (When intake air temperature is 40°C)
		0.30–0.42 k Ω (When intake air temperature is 80°C)
63–72	Engine coolant temperature sensor	5.1–6.5 k Ω (When coolant temperature is 0°C)
		2.1–2.7 k Ω (When coolant temperature is 20°C)
		0.9–1.3 k Ω (When coolant temperature is 40°C)
		0.26–0.36 k Ω (When coolant temperature is 80°C)
67–72	Idle position switch	Continuity (when throttle valve is at idle position)
		No continuity (when throttle valve is slightly open)
71–Body earth	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

120002050

AIR FLOW SENSOR (AFS)

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to air flow sensor connector terminal 3.

Alternate Method (Test harness not available)

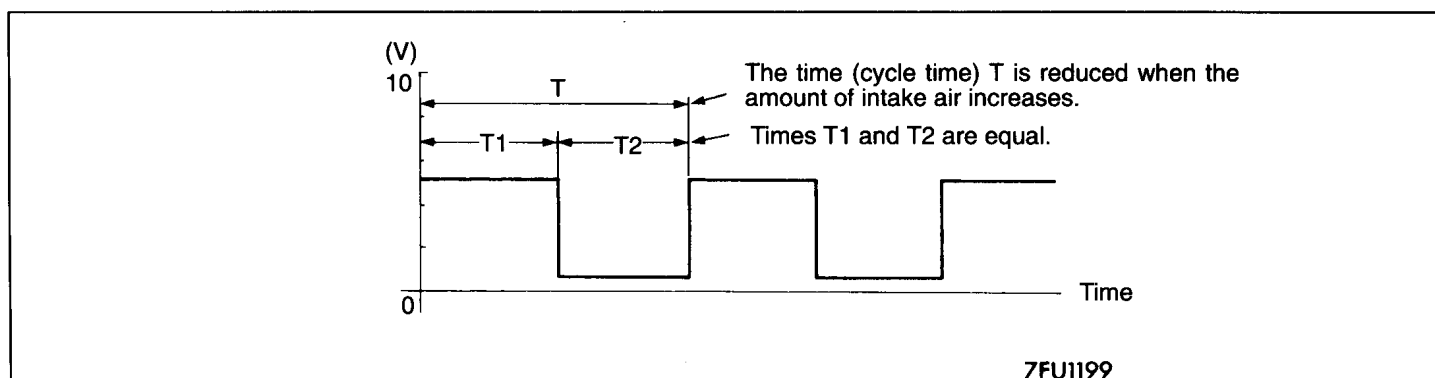
1. Connect the analyzer special patterns pickup to engine ECU terminal 70.

Standard Wave Pattern

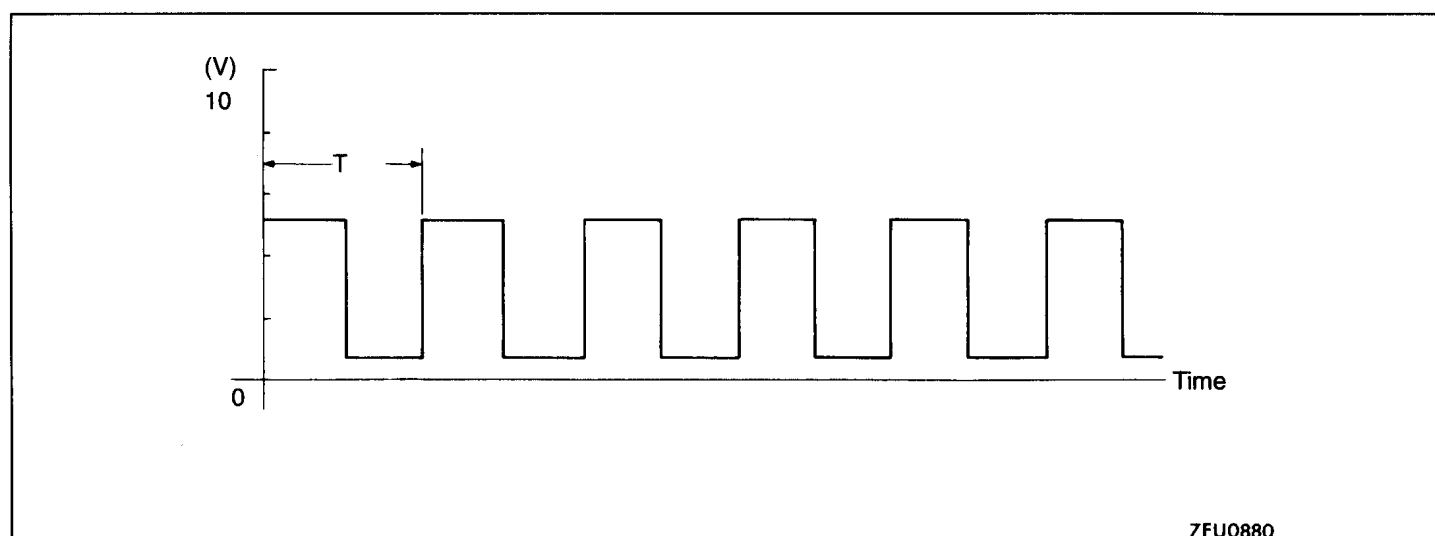
Observation conditions

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

Standard wave pattern

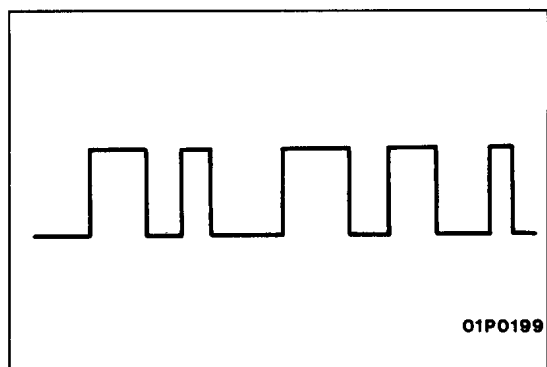


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

Check to be sure 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.

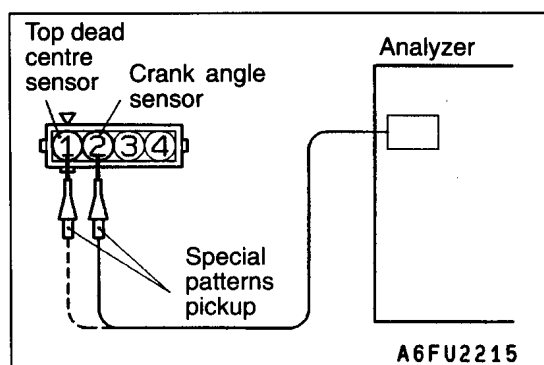
● Example 2

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.



TOP DEAD CENTRE SENSOR AND CRANK ANGLE SENSOR

120002554

Measurement Method

1. Disconnect the distributor (top dead centre sensor and crank angle sensor) connector and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to distributor terminal 1. (When checking the top dead centre sensor signal wave pattern)
3. Connect the analyzer special patterns pickup to distributor connector terminal 2. (When inspecting the crank angle sensor signal wave pattern.)

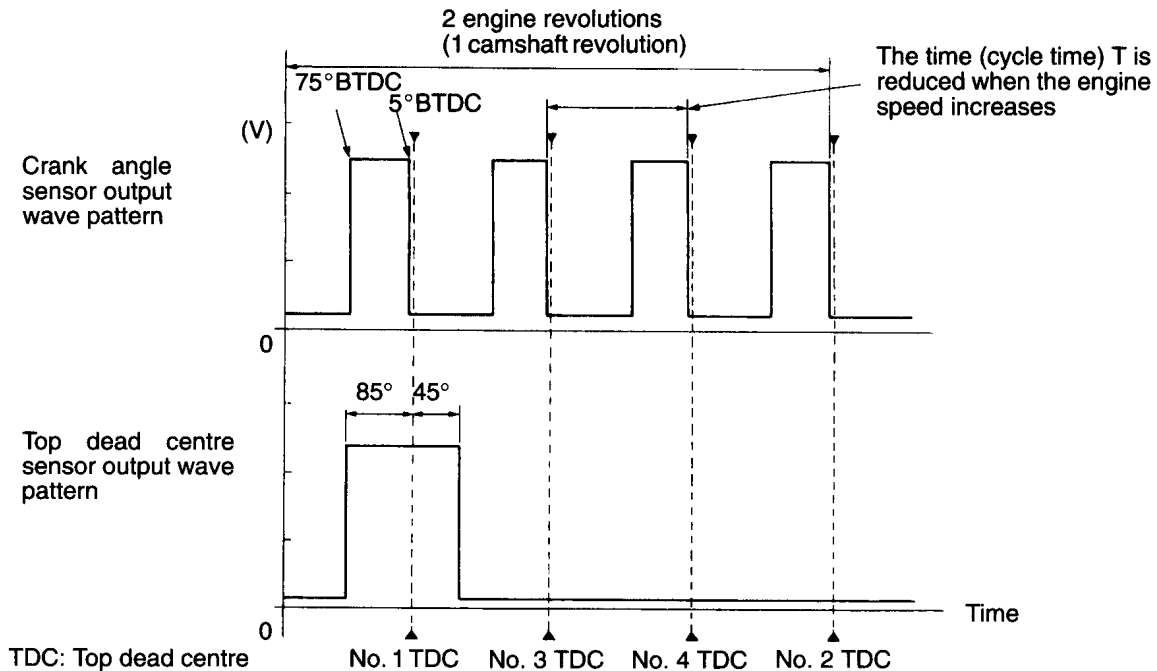
Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to engine ECU terminal 68. (When checking the top dead centre sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine ECU terminal 69. (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



1FU0973

Wave Pattern Observation Points

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

Examples of Abnormal Wave Patterns

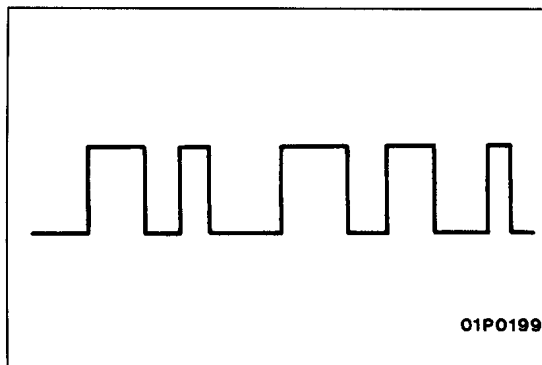
● Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

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



● Example 2

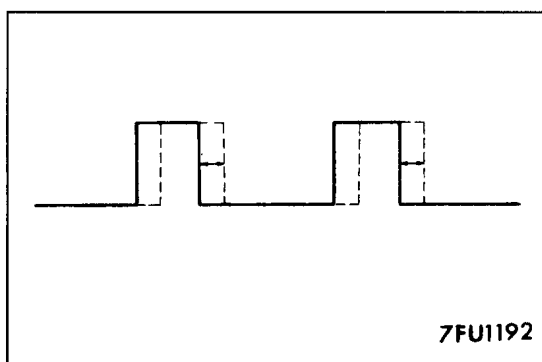
Cause of problem

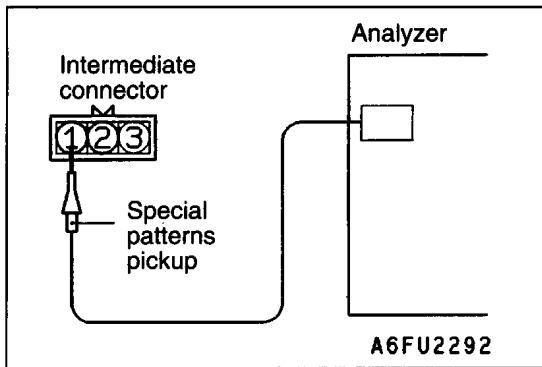
Loose timing belt

Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.



**INJECTOR**

120002555

Measurement Method

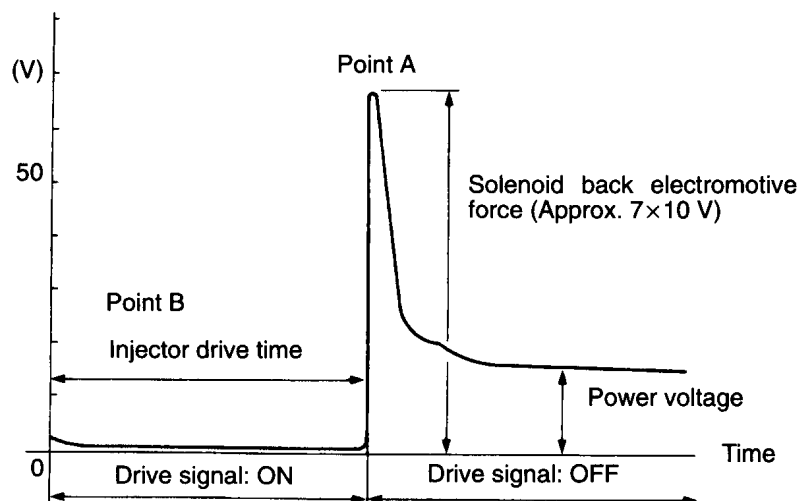
1. Disconnect the injector intermediate harness connector, and use the special tool (test harness set: MB991223) and jumper wires to connect the connectors. (All terminals should be connected.)
2. To measure cylinder No. 1 and No. 3, connect the analyzer special patterns pickup to terminal 2. For cylinder No. 2 and No. 4, connect to terminal 1.

Alternate Method (Test harness not available)

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



7FU1202

Wave Pattern Observation Points

Explanation of Wave Pattern

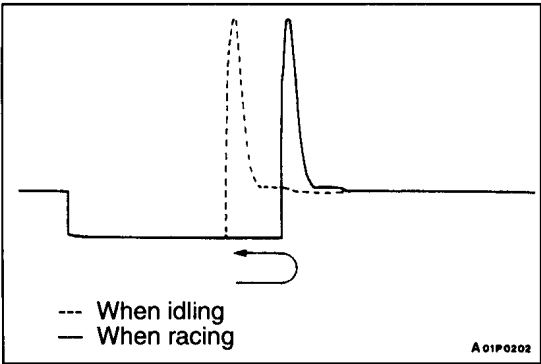
- NOTE
- Because the fuel injection method is a group injection method (injection with injectors grouped together in sets of two), if there is an abnormality in the drive circuit of one of the injectors in a group, the drive circuit of the

- other injector may still be normal, and in this case a normal wave pattern will be output.
 - If there is an abnormality in the engine control unit power transistor that drives the injectors, an abnormal wave pattern will be output.

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

120002054

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.

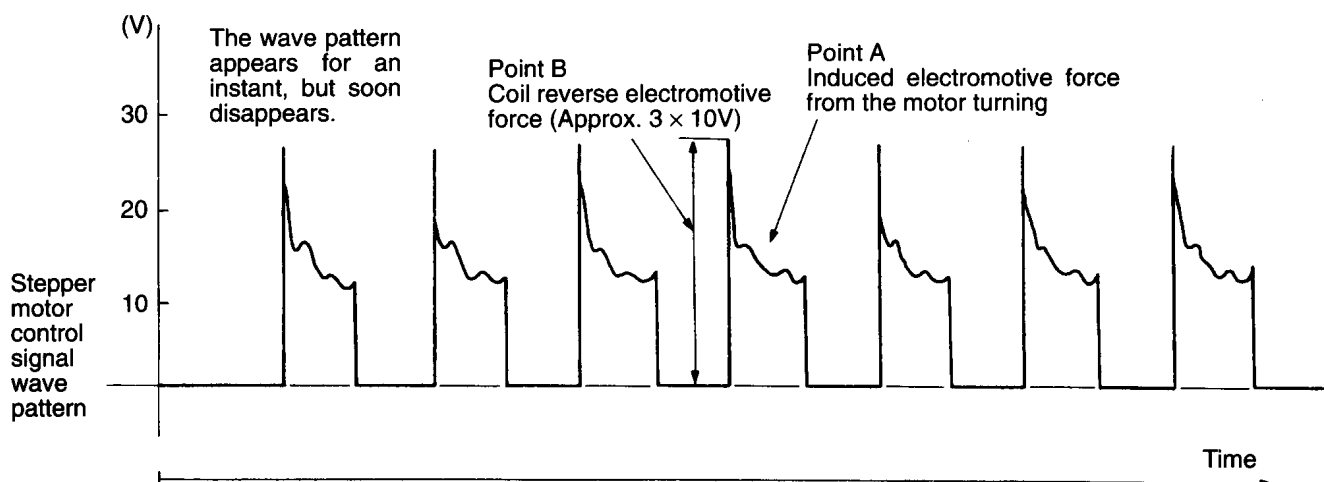
Alternate Method (Test harness not available)

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

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	When the engine coolant temperature is 20°C or below, turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine (approx. 1 minute).



7FU1204

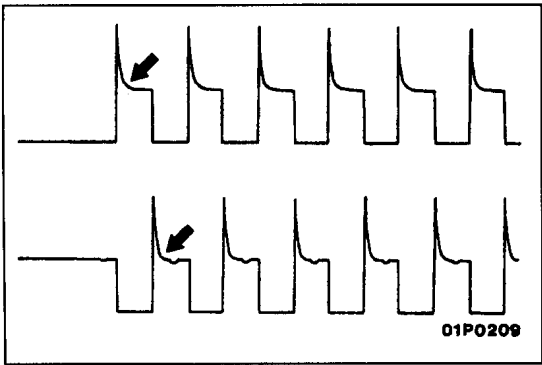
Wave Pattern Observation Points

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



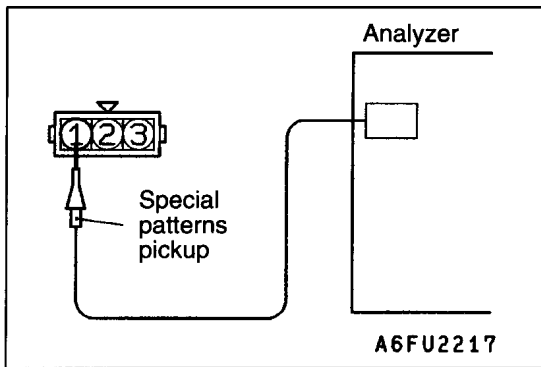
Examples of Abnormal Wave Pattern

Cause of problem

Motor is malfunctioning. (Motor is not operating.)

Wave pattern characteristics

Induced electromotive force from the motor turning does not appear.

**IGNITION COIL AND POWER TRANSISTOR**

120002556

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

Measurement Method

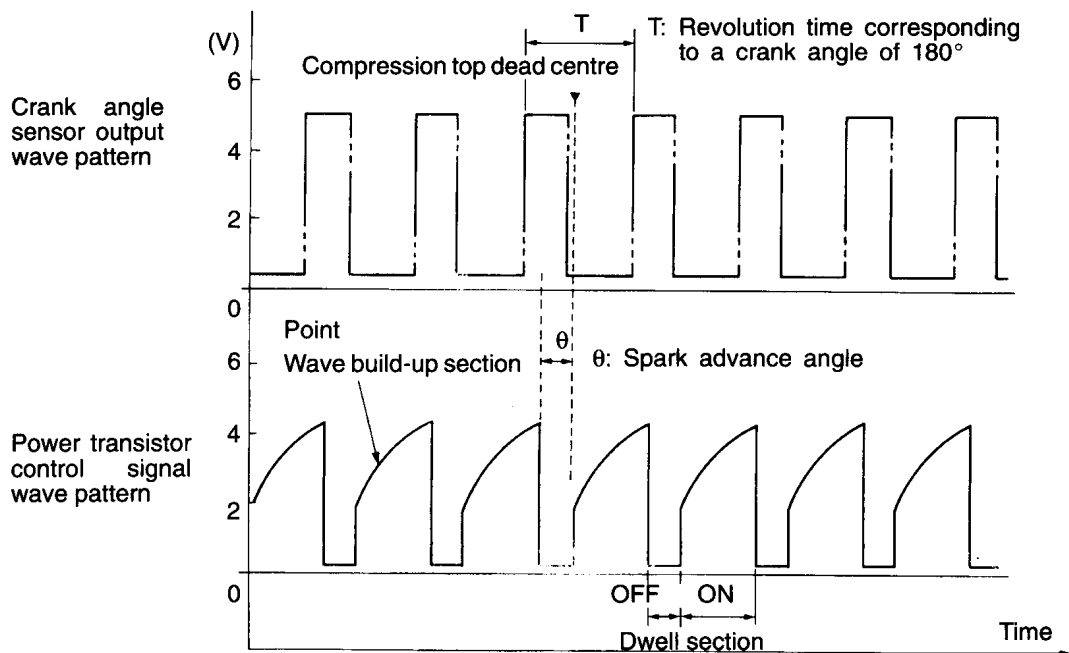
1. Disconnect the power transistor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to power transistor unit connector terminal 1.

Alternate Method (Test harness not available)

1. Connect the analyzer special patterns pickup to engine ECU terminal 10.

Standard wave pattern**Observation condition**

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

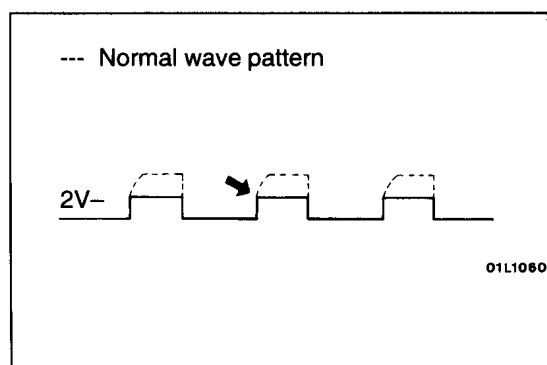


1FU0981

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.

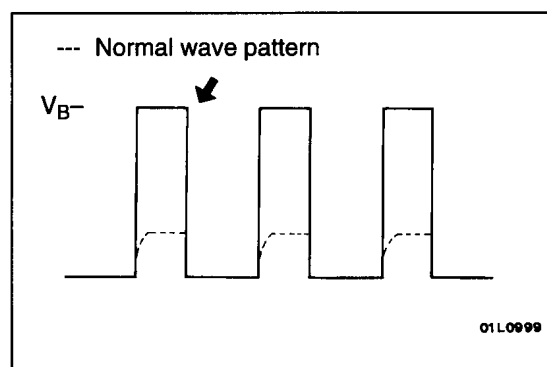
- Example 2
Wave pattern during engine cranking

Cause of problem

Malfunction in power transistor

Wave pattern characteristics

Power voltage results when the power transistor is ON.



SERVICE ADJUSTMENT PROCEDURES

120002557

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.13A-81.)

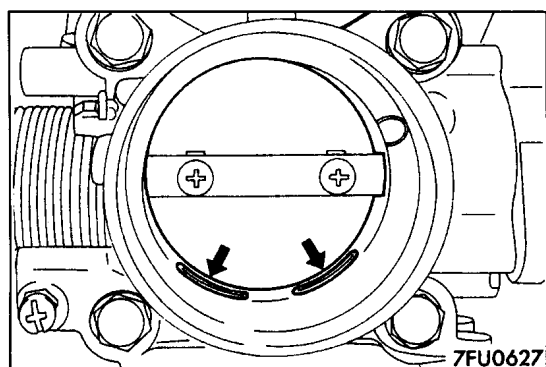
NOTE

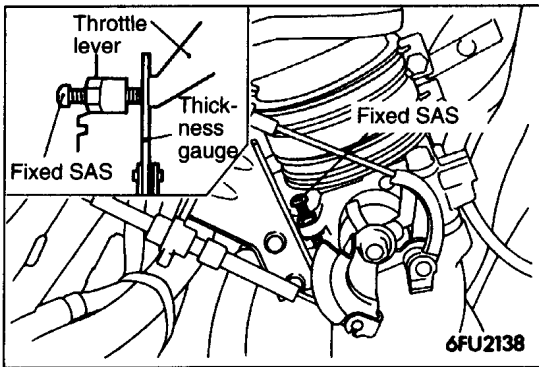
If the engine hunts while idling after adjustment of the basic idle speed, disconnect the (–) cable from the battery for 10 seconds or more, and then reconnect it and run the engine at idle for about 10 minutes.

IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT

120002596

1. Connect the MUT-II to the diagnosis connector (16-pin).

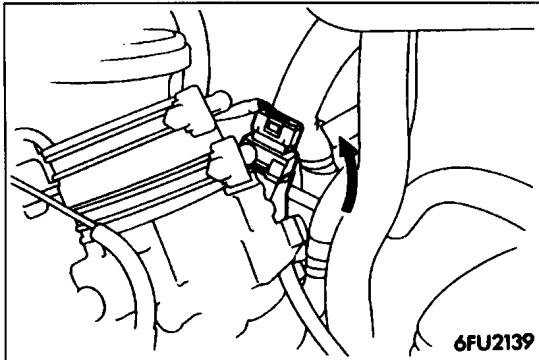




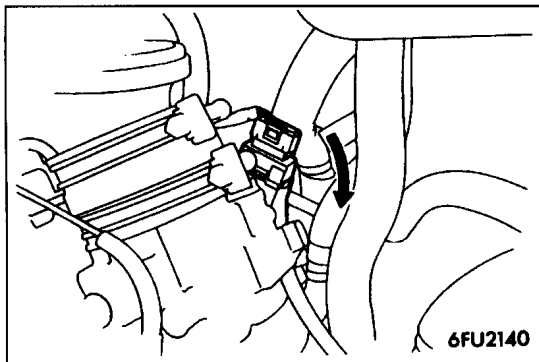
2. Insert a thickness gauge with the thickness indicated below between the fixed SAS and the throttle lever.

Thickness gauge thickness: 0.45 mm

3. Turn the ignition switch to ON (without starting the engine).
4. Use a 4-mm Allen key to loosen the throttle position sensor mounting bolt.



5. Turn the throttle position sensor anticlockwise as far as it will go.
6. Check that the service data output for the idle position switch is ON.

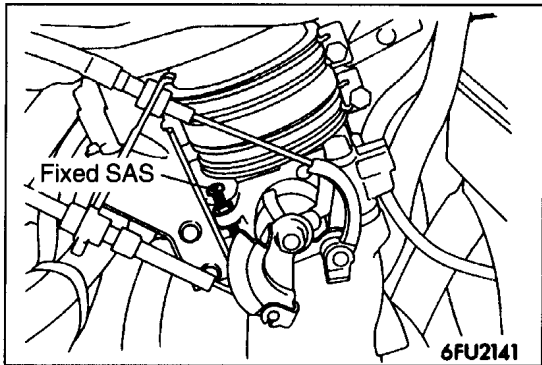


7. Slowly turn the throttle position sensor clockwise. Then find the point where the service data output for the idle position switch switches from ON to OFF. Use the 4-mm Allen key to tighten the throttle position sensor mounting bolt at this point.

8. Check the throttle position sensor output voltage.

Standard value: 400–1,000 mV

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



FIXED SAS ADJUSTMENT

120002558

NOTE

1. The fixed SAS should not be moved unnecessarily; it has been precisely adjusted by the manufacturer.
 2. If the adjustment for any reason is disturbed, 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.13A-79).

BASIC IDLE SPEED ADJUSTMENT

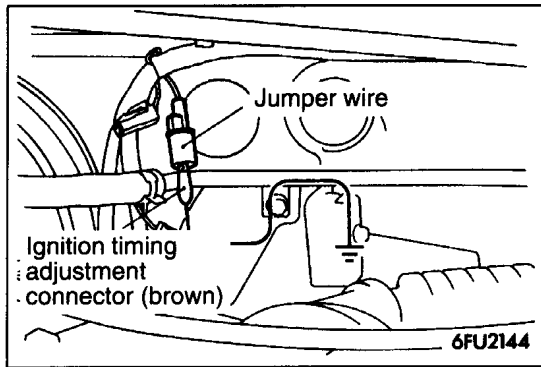
120002559

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. 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. The vehicle should be prepared as follows before the inspection and adjustment.
 - Engine coolant temperature: 80–95°C
 - Lamps and accessories: OFF
 - Transmission: Neutral (A/T for P range)
 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. Remove the waterproof female connector from the ignition timing adjustment connector.
4. Use a jumper wire to earth the ignition timing adjustment terminal.
5. Start the engine and run at idle.
6. Check the idle speed.

Standard value: 750±50 r/min.

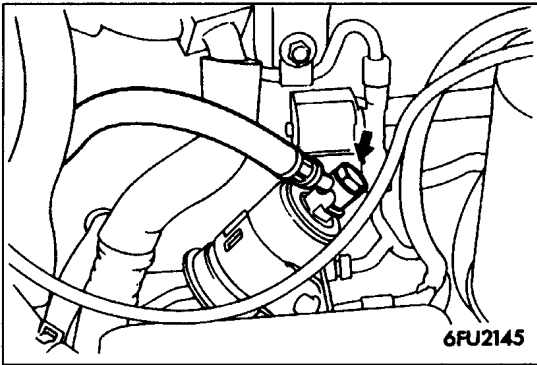
NOTE

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 rpm is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13A-79.)
7. 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.

8. Turn the ignition switch to OFF.
9. Disconnect the jumper wire from the ignition timing adjustment terminal and return the connector to its original condition.
10. Start the engine again and let it run at idle speed for about 10 minutes; check to be sure that the idling condition is normal.

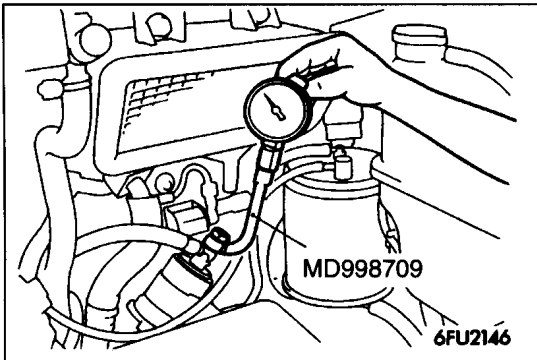
**FUEL PRESSURE TEST**

120002560

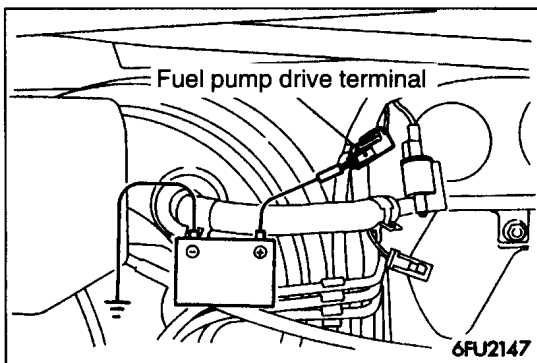
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13A-86.)
2. While holding the fuel filter with a spanner, disconnect the high-pressure fuel hose and remove the eye bolt.

Caution

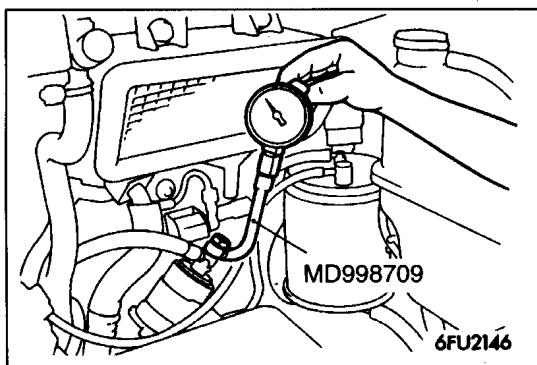
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



3. Install a fuel pressure gauge to the special tool. Use a suitable O-ring or gasket between the fuel pressure gauge and the special tool so as to seal in order to prevent fuel leakage at this time.
4. Connect the special tool which was installed in step 3. between the fuel filter and the high-pressure fuel hose.



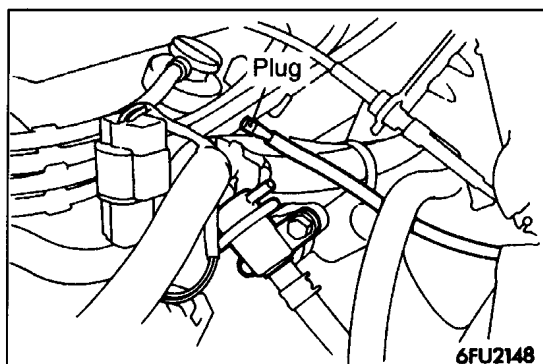
5. Connect the fuel pump drive terminal with the battery (+) terminal using a jumper wire and drive the fuel pump. Under fuel pressure, check the fuel pressure gauge and special tool connections for leaks.
6. Disconnect the jumper wire from the fuel pump drive terminal to stop the fuel pump.
7. Start the engine and run at idle.



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

Standard value:

Approx. 265 kPa at curb idle



9. Disconnect the vacuum hose (blue stripe) from the fuel pressure regulator and then measure the fuel pressure.

NOTE

Plug the vacuum hose or the air intake plenum nipple to prevent air from being drawn into the intake manifold.

Standard value:

Approx. 324–343 kPa at curb idle

10. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
11. 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.

12. If any of fuel pressure measured in steps 8 to 11 is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
<ul style="list-style-type: none"> ● 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

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

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky 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

14. Release residual pressure from the fuel pipe line. (Refer to P.13A-86.)
15. Remove the fuel pressure gauge and the special tool from the fuel filter.

Caution

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

16. Replace the gasket with a new one, connect the high-pressure fuel hose to the fuel filter, and then tighten the bolt to the specified torque.

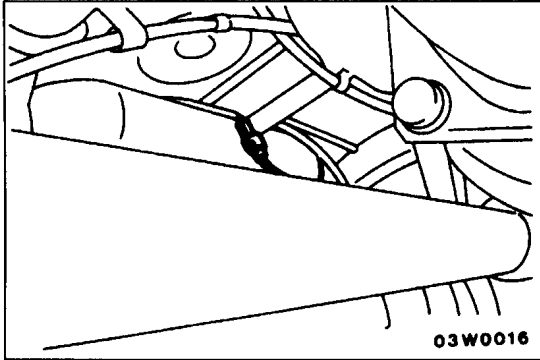
Tightening torque: 29.4 Nm

17. Check for fuel leaks.
 - (1) Apply the battery voltage to the fuel pump drive terminal to drive the fuel pump.
 - (2) Under fuel pressure, check the fuel line for leaks.

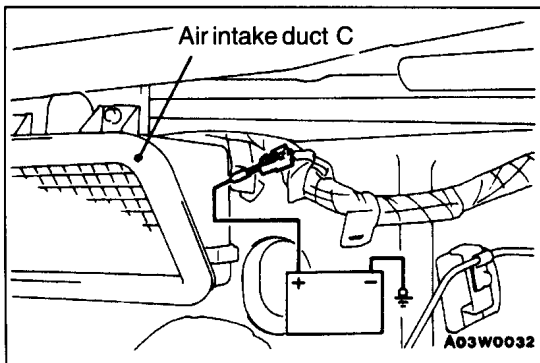
**FUEL PUMP CONNECTOR DISCONNECTION
(HOW TO REDUCE THE FUEL PRESSURE)**

120002062

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. Disconnect the fuel pump connector.
2. After starting the engine and letting it run until it stops naturally, turn the ignition switch to OFF.
3. Connect the fuel pump connector.

**FUEL PUMP OPERATION CHECK**

120002063

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

NOTE

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

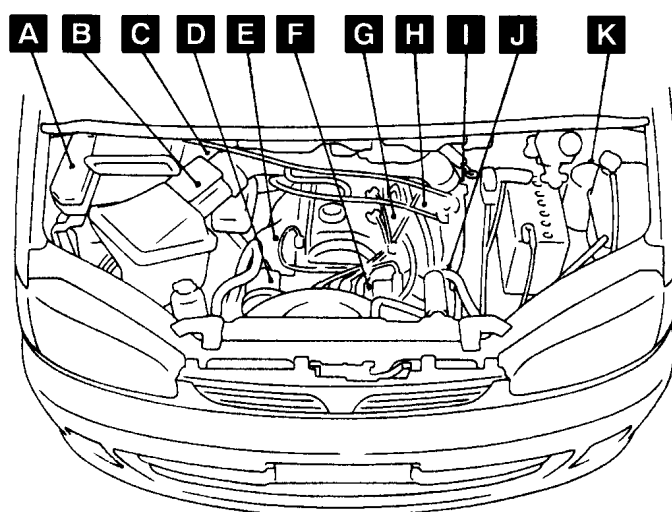
- (3) Check the fuel pressure by pinching the fuel hose with the fingertips.

ON-VEHICLE INSPECTION OF MPI COMPONENTS

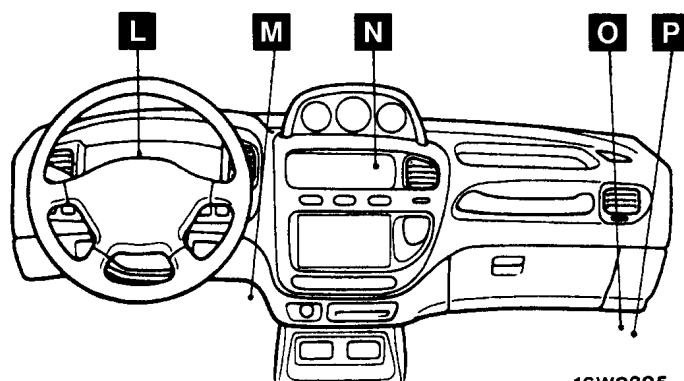
120002561

COMPONENT LOCATION

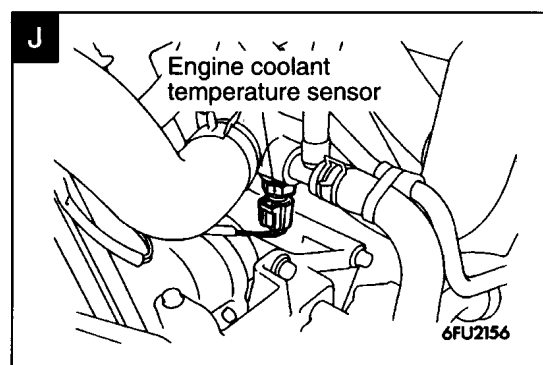
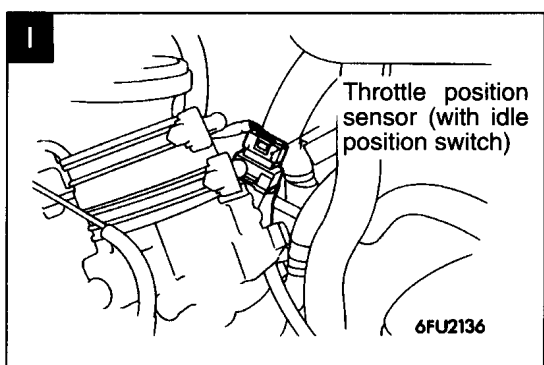
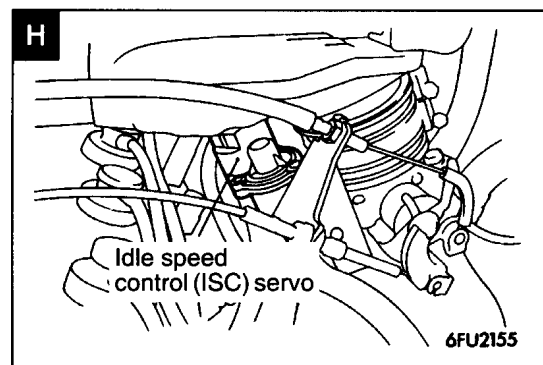
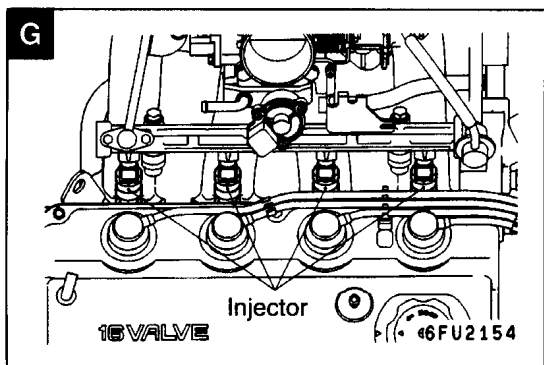
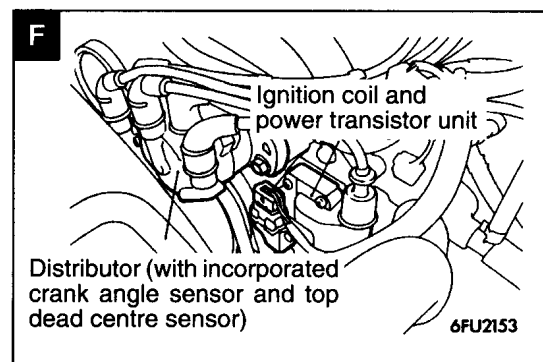
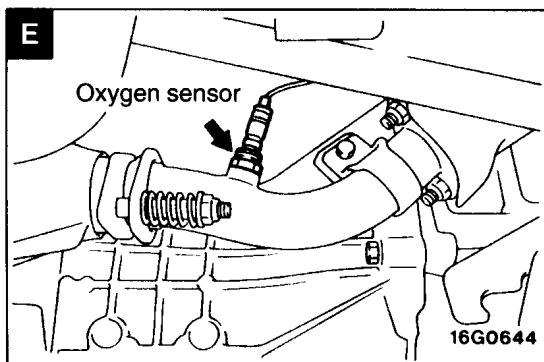
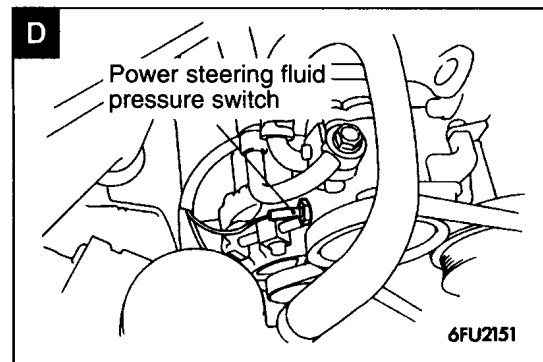
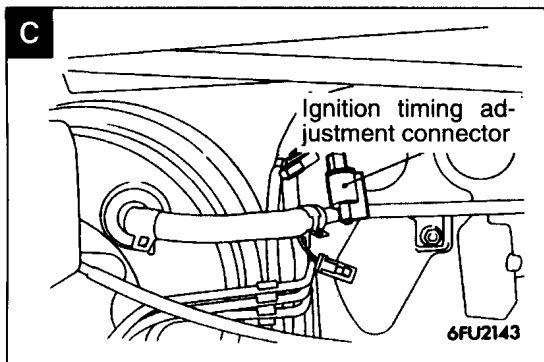
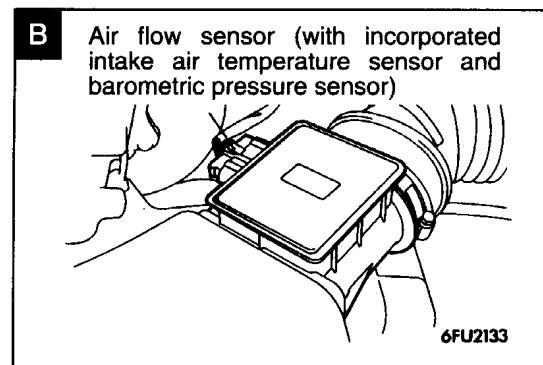
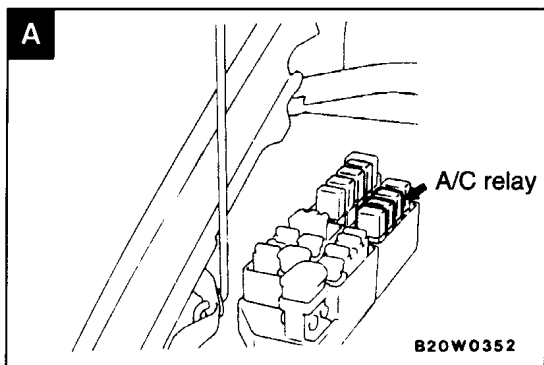
Name	Symbol	Name	Symbol
A/C relay	A	Engine warning lamp (check engine lamp)	L
A/C switch	N	Idle speed control (ISC) servo	H
Air flow sensor (with incorporated intake air temperature sensor and barometric pressure sensor)	B	Ignition coil and power transistor unit	F
		Ignition timing adjustment connector	C
		Inhibitor switch	Q
Control relay	O	Injector	G
Diagnosis connector	M	Oxygen sensor	E
Distributor (with incorporated crank angle sensor and top dead centre sensor)	F	Power steering fluid pressure switch	D
		Purge control solenoid valve	K
EGR control solenoid valve	K	Throttle position sensor (with idle position switch)	I
Engine coolant temperature sensor	J	Vehicle speed sensor	R
Engine ECU	P		

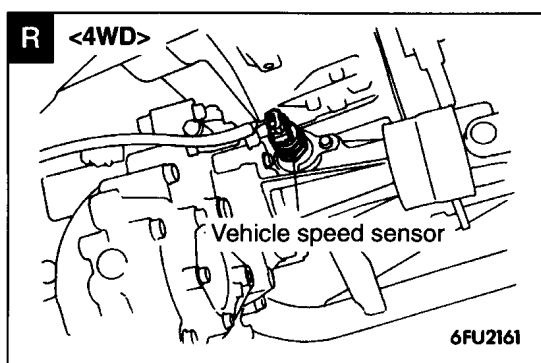
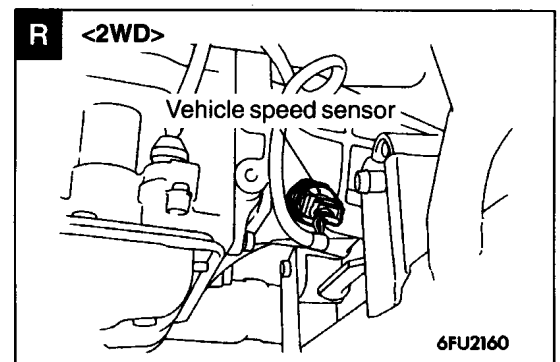
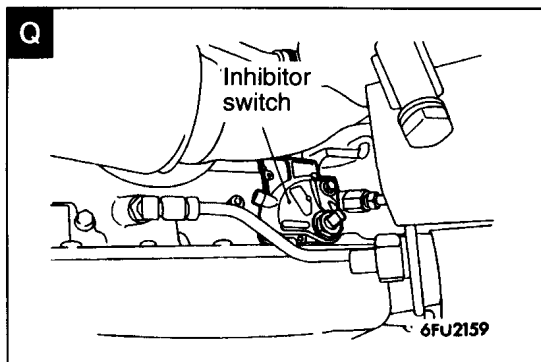
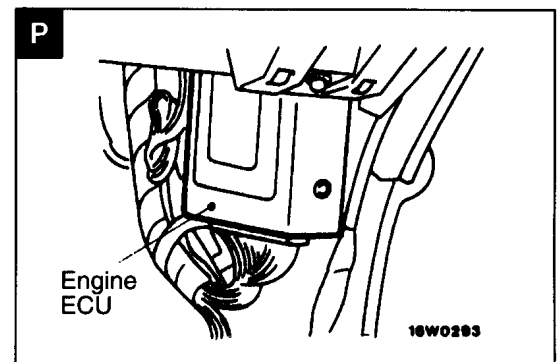
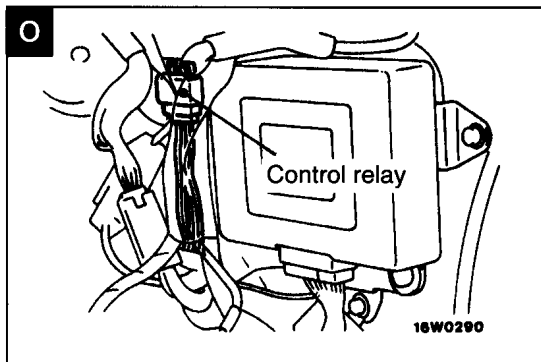
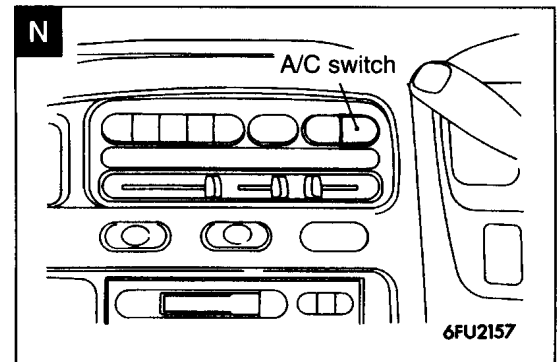
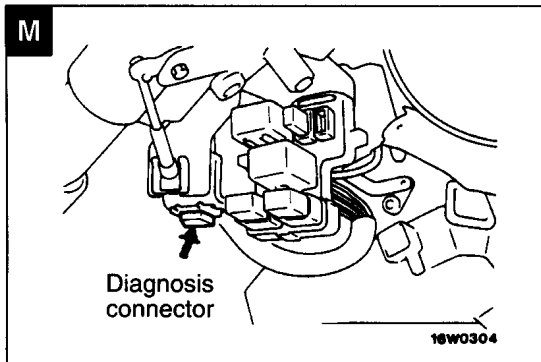
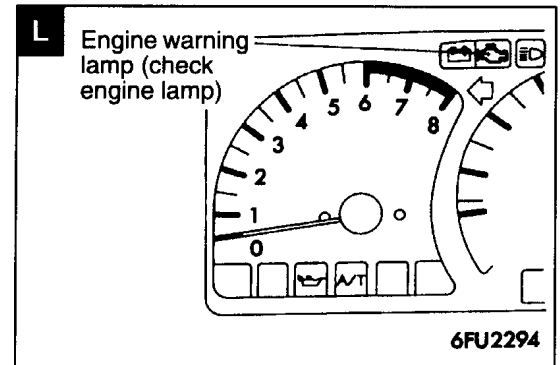
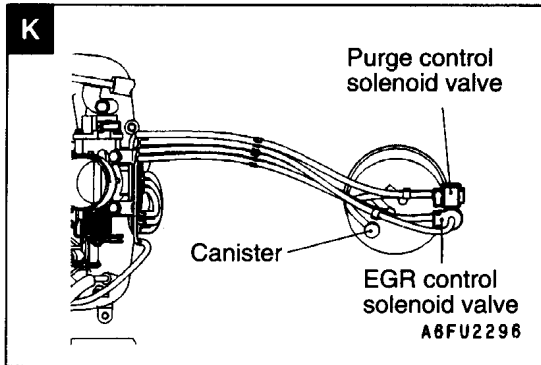


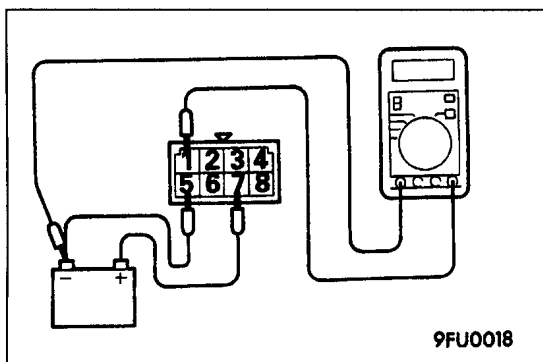
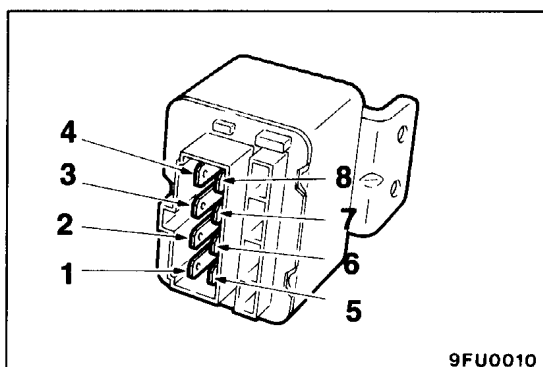
16W0297



16W0295







CONTROL RELAY INSPECTION

120002065

1. Remove the control relay.
2. Check the continuity between the control relay terminals.

Inspection terminals	Continuity
5-7	Continuity
6-8	Continuity in one direction

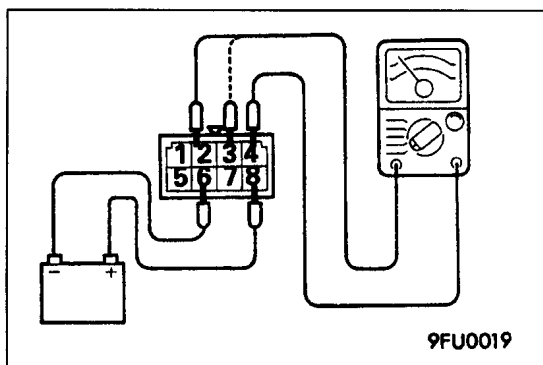
3. Use jumper leads to connect control relay terminal 7 to the battery (+) terminal and terminal 5 to the battery (-) terminal.

Caution

When connecting the jumper leads, be careful not to mistake the connection terminals, as damage to the relay will result.

4. Check the voltage at control relay terminal 1 while connecting and disconnecting the jumper lead at the battery (-) terminal.

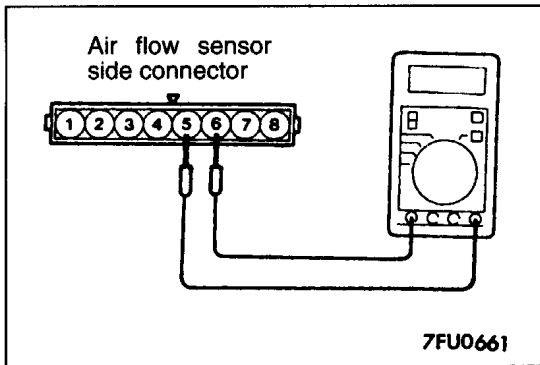
Jumper lead	Voltage at terminal 1
Connected	5 V
Disconnected	0 V



5. Use the jumper leads to connect control relay terminal 8 to the battery (+) terminal and terminal 6 to the battery (-) terminal.
6. Check the continuity between control relay terminals 2 - 4 and terminals 3 - 4 while connecting and disconnecting the jumper lead at the battery (-) terminal.

Jumper lead	Continuity between terminals 2 - 4	Continuity between terminals 3 - 4
Connected	Continuity (0Ω)	Continuity (0Ω)
Disconnected	No continuity (∞Ω)	No continuity (∞Ω)

7. If there is a defect, replace the control relay.



INTAKE AIR TEMPERATURE SENSOR INSPECTION

120002066

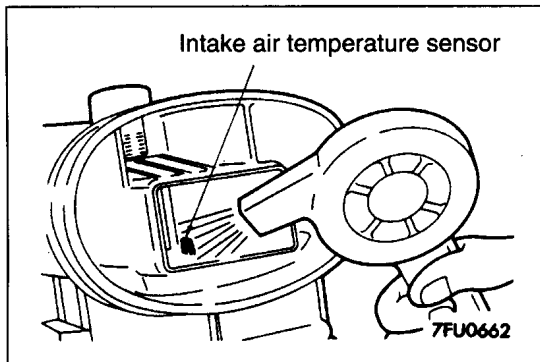
1. Disconnect the air flow sensor connectors.
2. Measure resistance between terminals 4 and 6.

Standard value: 2.3–3.0 k Ω <at 20°C>
0.30–0.42 k Ω <at 80°C>

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

Temperature (°C)	Resistance (k Ω)
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 INSPECTION

120002562

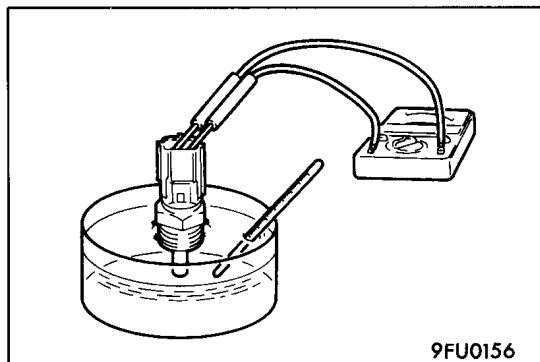
Caution

Don't touch the connector (resin section) with the tool when removing and installing.

1. Remove 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 k Ω <at 20°C>
0.26–0.36 k Ω <at 80°C>

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



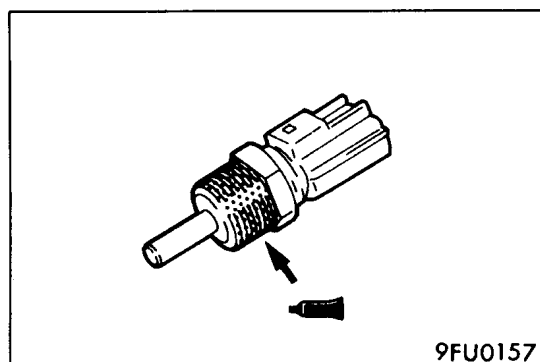
4. Apply sealant to threaded portion.

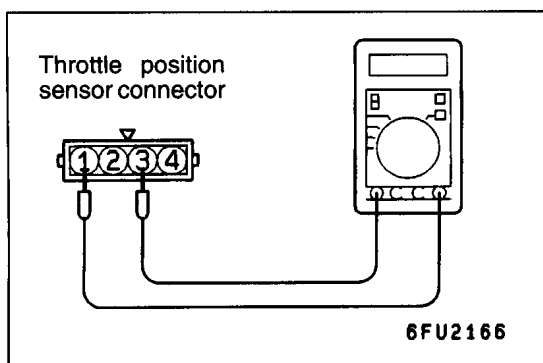
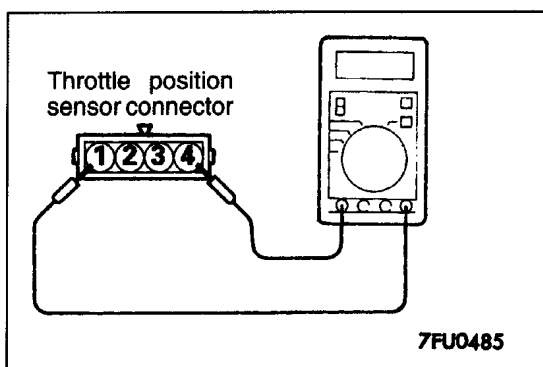
Specified sealant: 3M NUT locking Part No. 4171 or equivalent

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

Sensor tightening torque: 30 Nm

6. Fasten harness connectors securely.





THROTTLE POSITION SENSOR INSPECTION

120002563

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 k Ω

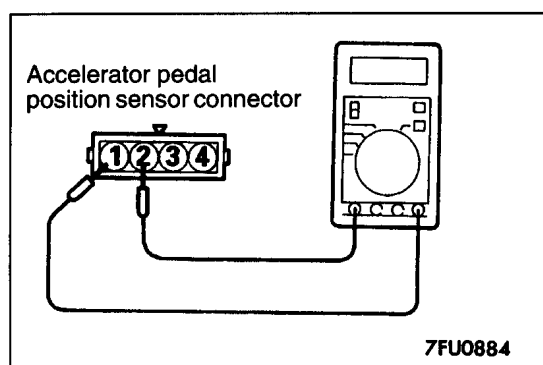
3. Measure the resistance between the throttle position sensor side connector terminal 1 and terminal 3.

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.13A-79.



IDLE POSITION SWITCH INSPECTION

120002564

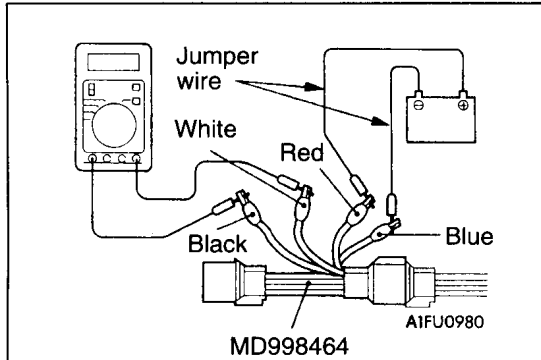
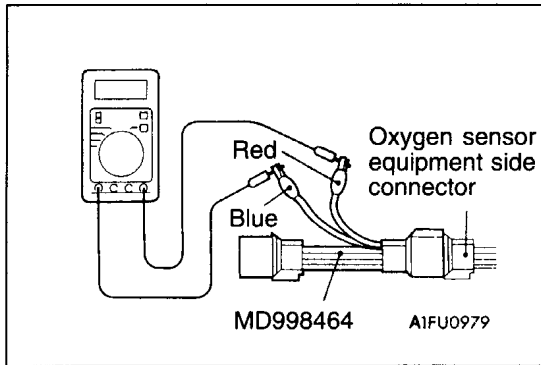
1. Disconnect the throttle position sensor connector.
2. Check the continuity between the throttle position sensor connector side terminal 1 and terminal 2.

Accelerator pedal	Continuity
Depressed	Non-conductive ($\infty \Omega$)
Released	Conductive (0Ω)

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.13A-79.)



OXYGEN SENSOR INSPECTION

120002565

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 ($7-40\ \Omega$ at 20°C) between terminal 1 (red clip of special tool) and terminal 3 (blue clip of special tool) on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.

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

Caution

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

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

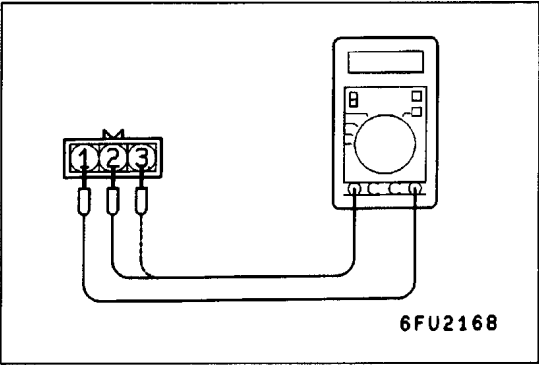
Standard value:

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

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

NOTE

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



INJECTOR INSPECTION

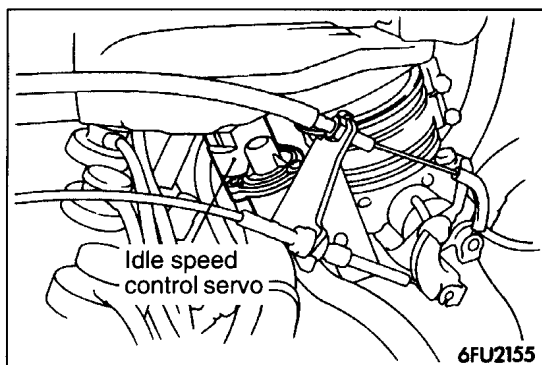
120002566

Measurement of Resistance Between Terminals

- 1. Disconnect the injector intermediate harness connectors.
- 2. Measure the resistance between terminals.

Standard value: 6.5–8.0 Ω (at 20°C)

Injector	Measurement terminal
No. 1 cylinder and No. 3 cylinder	1–2
No. 2 cylinder and No. 4 cylinder	1–3



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

120002567

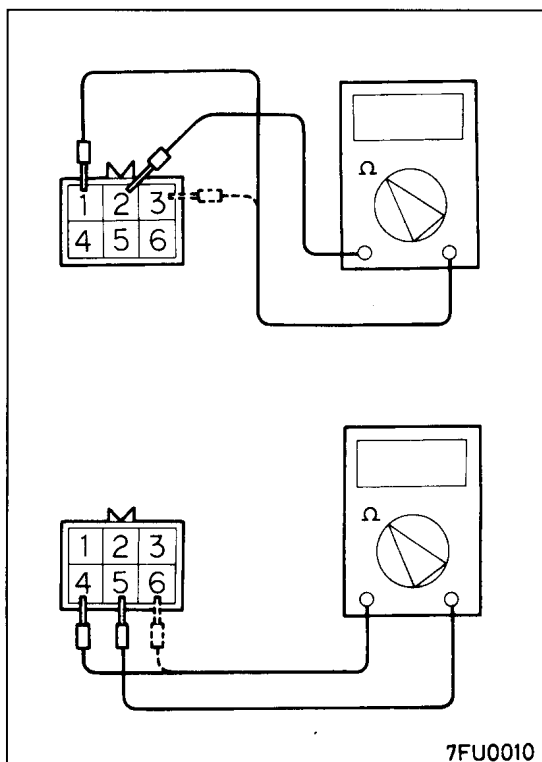
Checking the Operation Sound

1. Check to be sure 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 INSPECTION

120002568

Refer to GROUP 17 – Evaporative Emission Control System.

EGR CONTROL SOLENOID VALVE INSPECTION

120002569

Refer to GROUP 17 – Exhaust Gas Recirculation (EGR) System.

INJECTOR

REMOVAL AND INSTALLATION

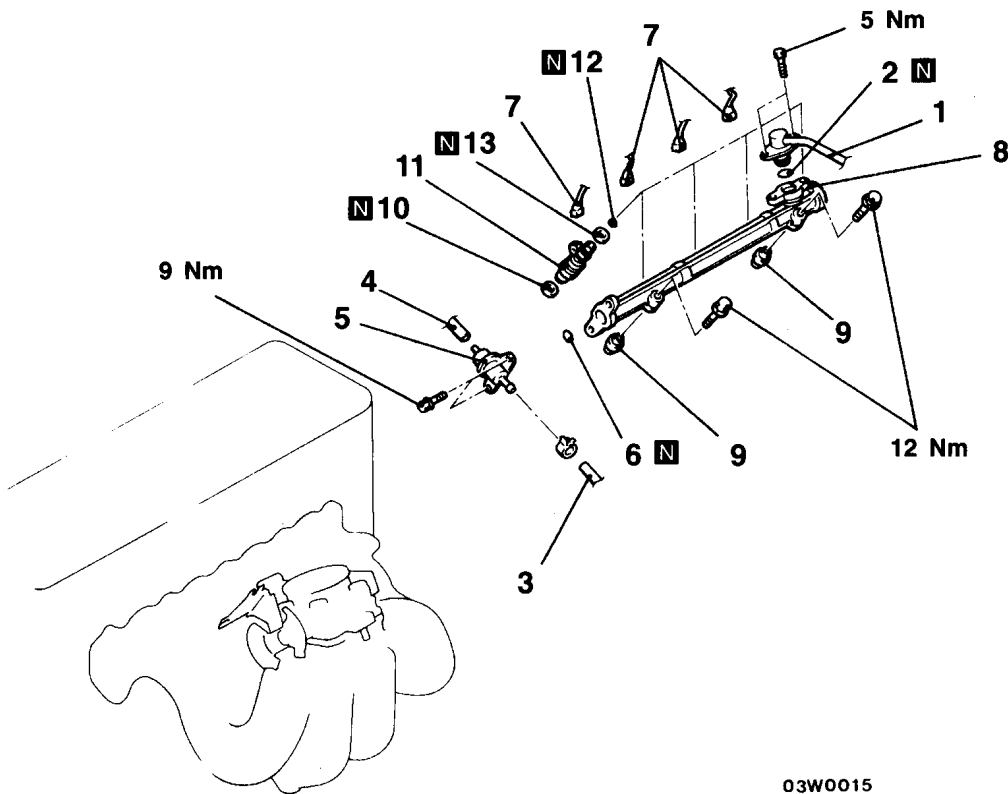
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Pre-removal Operation

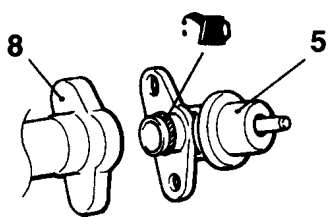
- Fuel Discharge Prevention (Refer to P.13A-86.)

Post-installation Operation

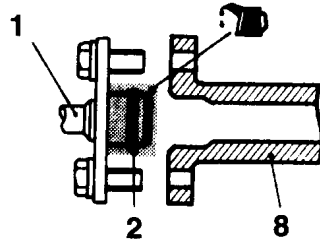
- Accelerator Cable Adjustment (Refer to GROUP 13F – Service Adjustment Procedures.)
- Fuel Leakage Inspection



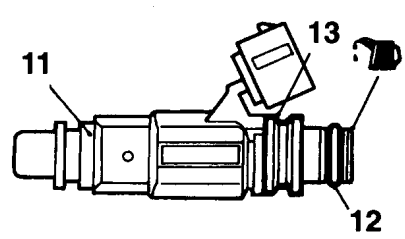
03W0015
00000446



03X0037



03N0012



03W0026

Engine oil

Removal steps

1. Fuel pressure hose connection
2. O-ring
3. Fuel return hose connection
4. Vacuum hose connection
5. Fuel pressure regulator
6. O-ring

▶B◀

◀A▶

▶A◀

7. Injector connectors
8. Delivery pipe
9. Insulators
10. Insulators
11. Injectors
12. O-rings
13. Grommets

REMOVAL SERVICE POINT**◀A▶ DELIVERY PIPE REMOVAL**

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

Caution

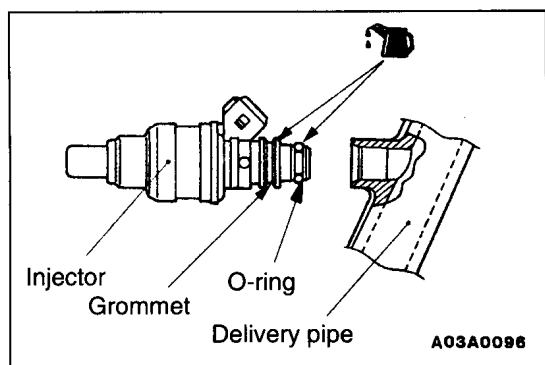
Care must be taken, when removing the delivery pipe, not to drop the injector.

INSTALLATION SERVICE POINTS**▶A▶ INJECTOR 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 to the left and right, install it to the delivery pipe.
- (3) Check to be sure that the injector turns smoothly.
If it does not turn smoothly, the O-ring may be trapped, remove the injector and then re-insert it into the delivery pipe and check once again.

▶B▶ FUEL PRESSURE REGULATOR INSTALLATION

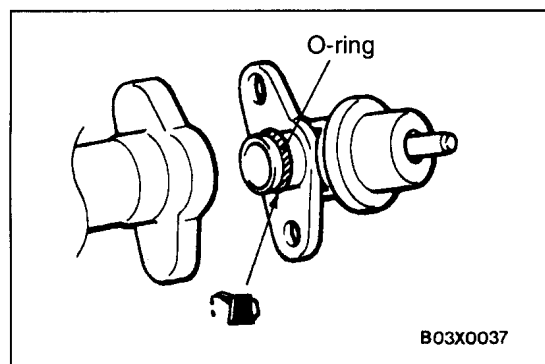
- (1) When connecting the fuel-pressure regulator to the delivery pipe, apply a drop of new engine oil to the O-ring, and then insert, being careful not to damage the O-ring.

Caution

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

- (2) Check to be sure that the fuel pressure regulator turns smoothly.
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.
- (3) Tighten the bolts to the specified torque.

Specified tightening torque : 9 Nm



THROTTLE BODY

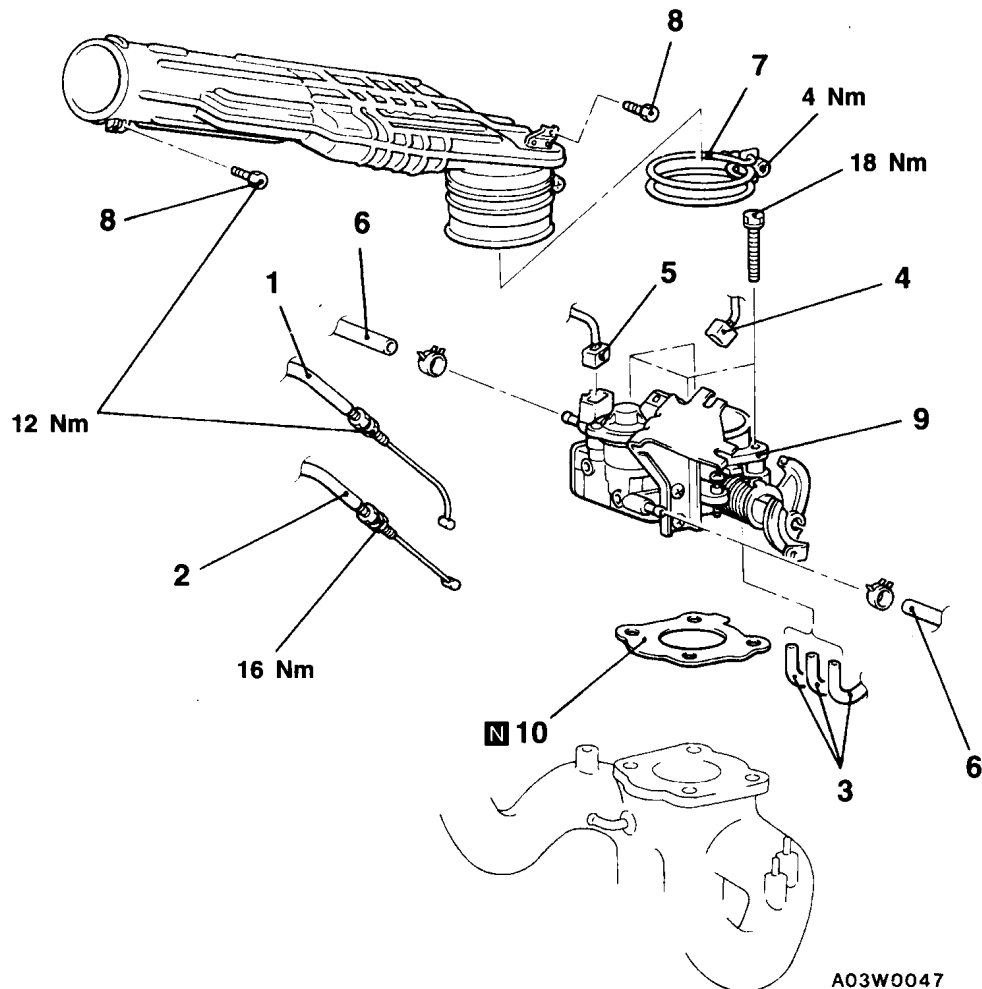
REMOVAL AND INSTALLATION

Pre-removal Operation

- Engine Coolant Draining

Post-installation Operation

- Accelerator Cable Adjustment (Refer to GROUP 13F – Service Adjustment Procedures.)
- Throttle Cable Adjustment (Refer to GROUP 23 – Service Adjustment Procedures.)
- Engine Coolant Supplying



A03W0047

Removal steps

1. Accelerator cable connection
2. Throttle cable connection <A/T>
3. Vacuum hose connection
4. Throttle position sensor connector
5. Idle speed control motor connector
6. Water hose connection
7. Hose clamp
8. Resonance tank mounting bolts
9. Throttle body
10. Gasket

ELECTRONIC CONTROLLED CARBURETTOR

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120002573

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GENERAL INFORMATION

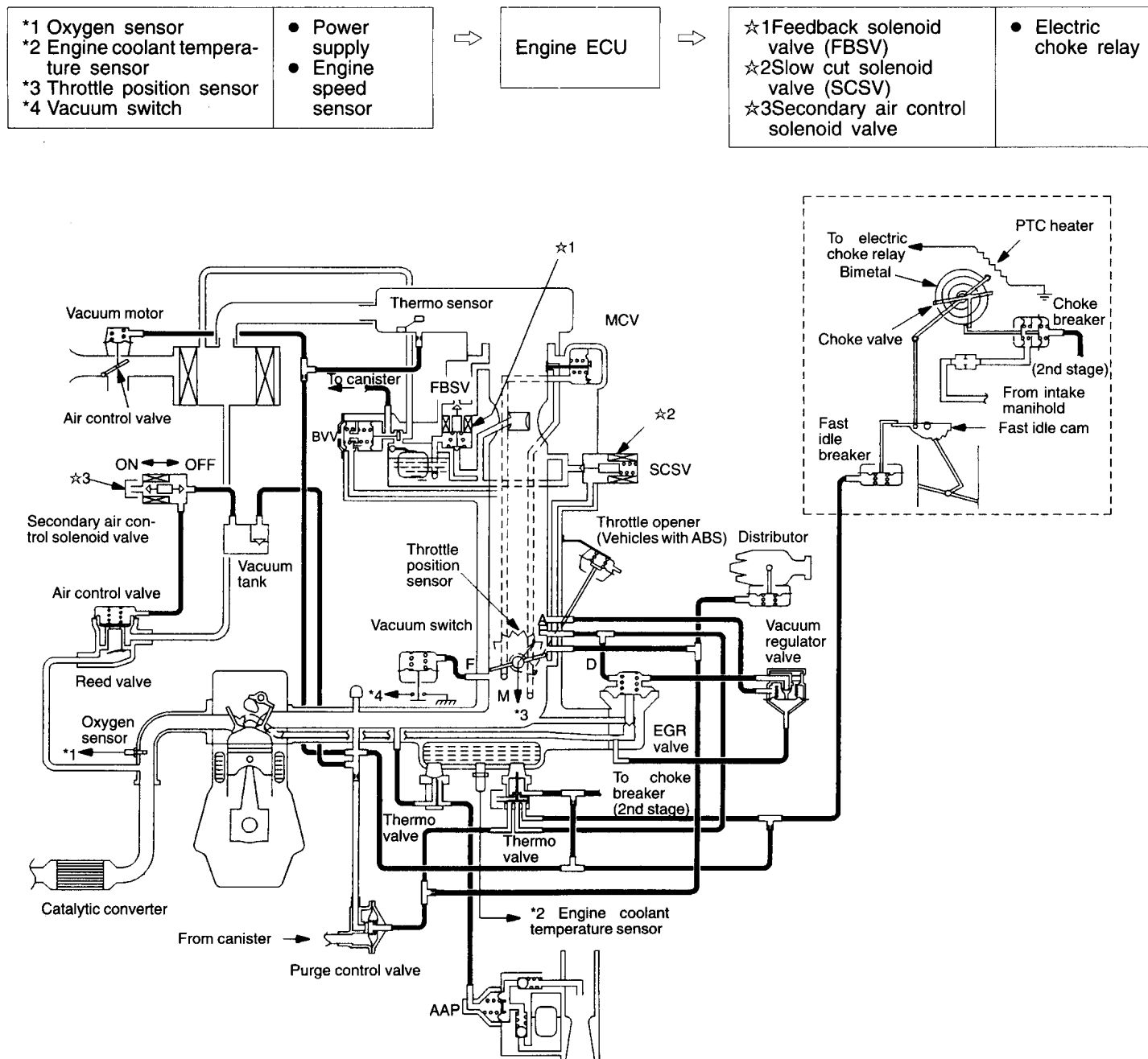
120001282

The fuel system consists of components such as an electronically-controlled 2-barrel down-draft carburettor, an electric fuel pump and a fuel vapour separator tank. After the fuel is drawn out of the

fuel tank and filtered by the fuel filter, it is sent to the carburettor. In addition, surplus fuel is returned to the fuel tank via the accelerator pump of the carburettor.

SYSTEM DIAGRAM

120002574



6FU2425

NOTE

AAP: Auxiliary accelerator pump

ABS: Anti-skid braking system

BVV: Bowl vent valve

MCV: Mixture control valve

PTC heater: Positive temperature coefficient heater

GENERAL SPECIFICATIONS

120002575

Items		Specifications
Carburettor	Type	Down-draft, 2-barrel, feedback type
	Choke type	Automatic (electric type)
	Choke breaker	Equipped (2-stage)
	Fast idle breaker	Equipped
	Electric choke heater	PTC heater
	Throttle bore (primary/secondary) mm	32/35
	Feedback solenoid valve (FBSV)	Duty cycle solenoid
	Slow cut solenoid valve (SCSV)	Duty cycle solenoid
	Throttle position sensor (TPS)	Variable resistor type
	Bowl vent valve (BVV)	Vacuum type
	Mixture control valve (MCV)	Vacuum type
Engine ECU	Identification model No.	E2T57771
Input sensor	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia sensor
	Vacuum switch	Contact type switch
Output actuator	Secondary air control solenoid valve	ON-OFF type solenoid valve

SERVICE SPECIFICATIONS

120001285

Items		Standard value
Throttle position sensor adjusting voltage mV		230–270
Throttle position sensor resistance kΩ		3.5–6.5
Electric choke heater		Should be conductive (approx. 6Ω at 20°C)
Choke breaker opening mm	1st stage	1.9–2.1
	2nd stage	2.9–3.1
Fast idle (at no load, after warm up, 2nd stage) r/min.		2,300–2,700
Feedback solenoid valve coil resistance Ω		54–66 (at 20°C)
Slow cut solenoid valve coil resistance Ω		48–60 (at 20°C)
Engine coolant temperature sensor resistance kΩ	at 20°C	2.1–2.7
	at 80°C	0.26–0.36
Oxygen sensor output voltage V		0.6–1.0

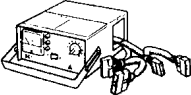
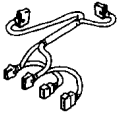

SEALANT

120001286

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

SPECIAL TOOLS

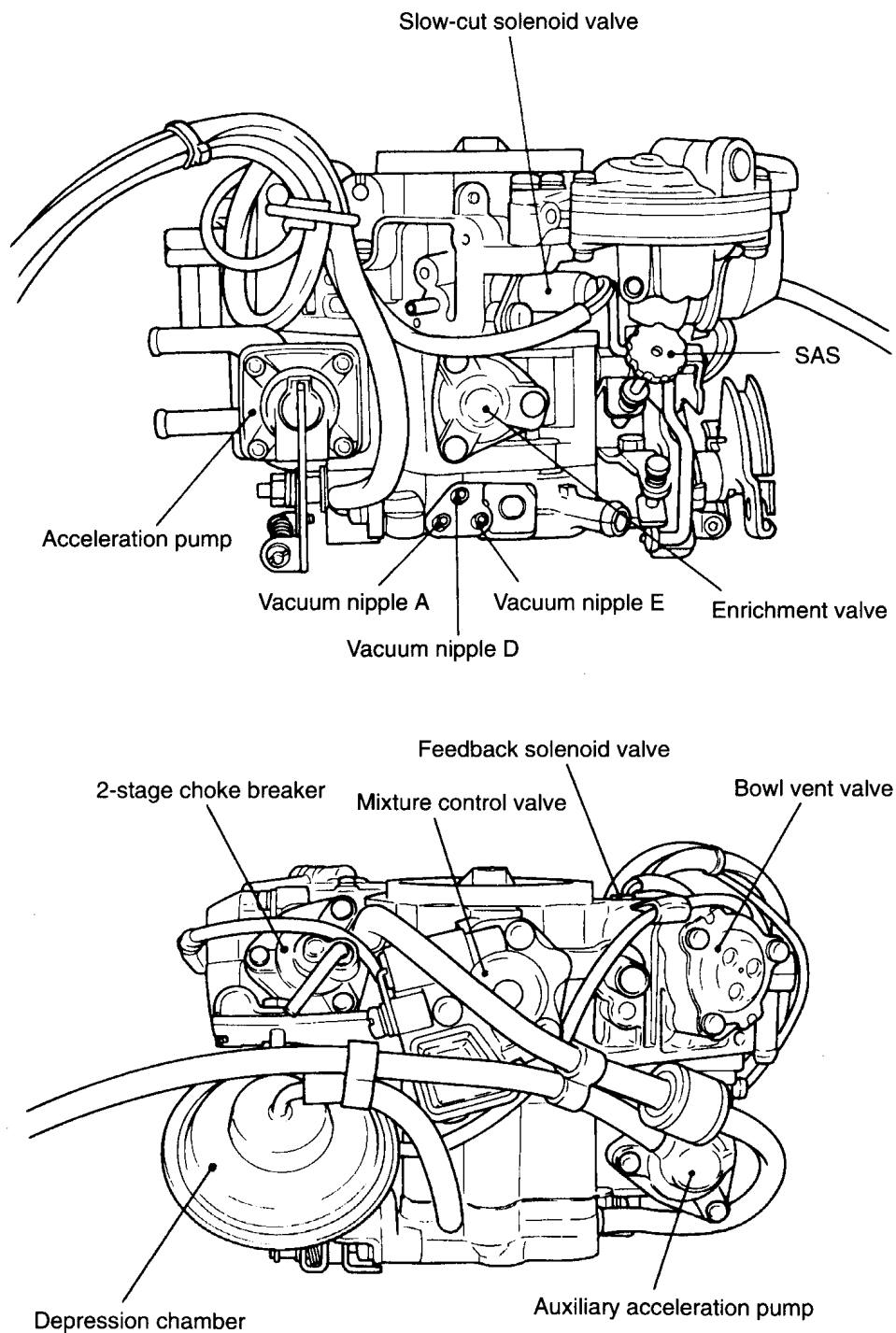
120001287

Tool	Number	Name	Use
	MD998404	ECI checker	Electronic controlled carburettor system inspection
	MD998475	Test harness	
	MD998478	Test harness (3P, triangle)	Adjustment of throttle position sensor

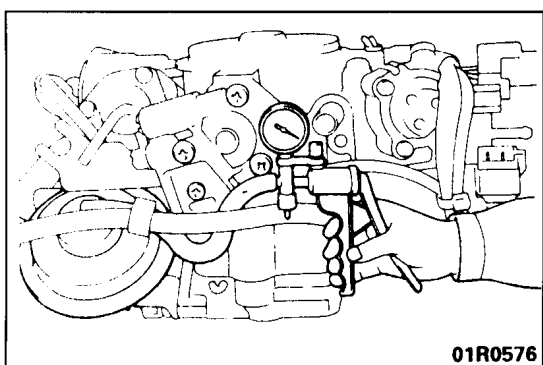
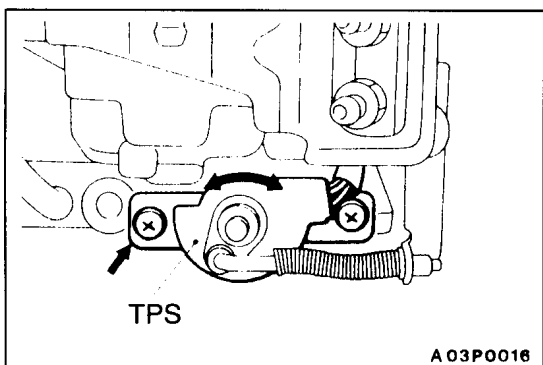
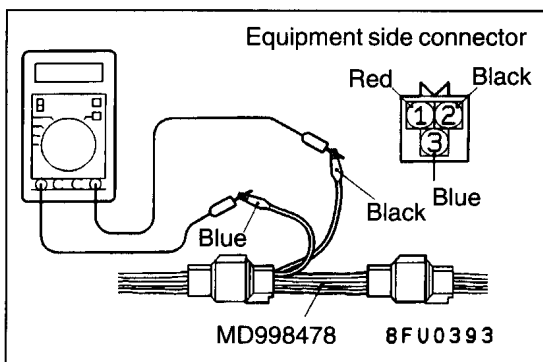
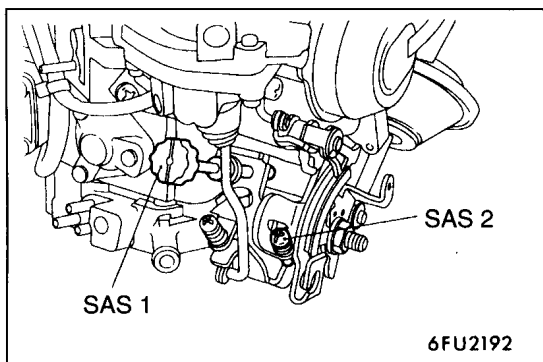
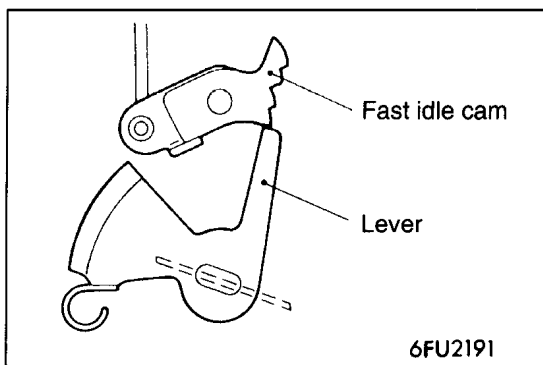
SERVICE ADJUSTMENT PROCEDURES

120002576

CARBURETTOR APPEARANCE



6FU2426



THROTTLE POSITION SENSOR (TPS) ADJUSTMENT

120001289

1. Check that the fast idle has been released. (Set so that the fast idle lever is not resting on the fast idle cam.)
2. Remove the air horn.
3. Loosen the accelerator cable tension sufficiently.

4. After backing out the speed adjusting screw 1 (SAS 1) sufficiently, check that the throttle valve is fully closed.
5. If the throttle valve is not fully closed, back out the speed adjusting screw 2 (SAS 2) sufficiently to securely set the throttle valve to the fully closed position.

NOTE

At this time, make a note of how many turns the screws were backed out.

6. Disconnect the throttle position sensor connector and connect the special tool (test harness) between the disconnected connector.
7. Connect a digital type voltmeter between the throttle position sensor terminal 3 (blue clip: sensor output) and terminal 2 (black clip: sensor earth).
8. Turn the ignition switch to "ON". (Do not start the engine.)
9. Inspect the throttle position sensor output voltage.

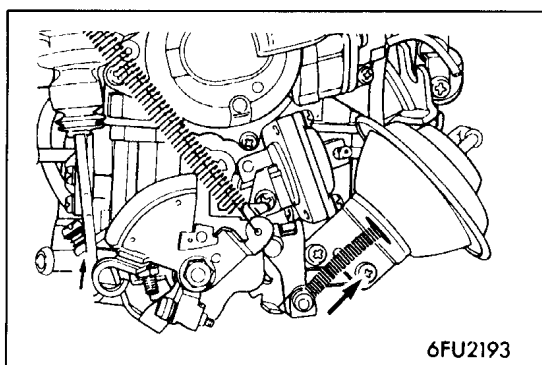
Standard value: 230–270 mV

10. If the voltage is outside the standard value, adjust by loosening the throttle position sensor mounting screws and turning the throttle position sensor body. After adjusting, securely tighten the screws.
11. Turn the ignition switch to "OFF".
12. Turn in the screws that were backed out in step 5 until they are at their original positions.
13. Adjust the accelerator cable tension.
14. Adjust the idle speed.

CARBURETTOR SECONDARY VALVE OPERATION INSPECTION

120001290

1. Disconnect the vacuum hose from the depression chamber and connect a hand vacuum pump to the depression chamber.



2. Apply 13 kPa of vacuum, and check to be sure that the vacuum is maintained.
3. When the primary throttle valve is fully opened with the vacuum applied, check to be sure that the secondary throttle valve fully opens.
4. If the secondary throttle valve does not fully open, clean surroundings of the secondary throttle valve.

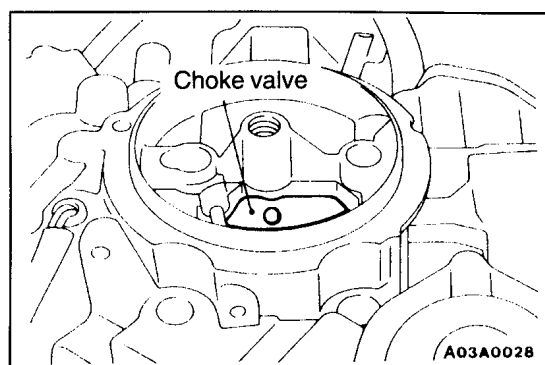
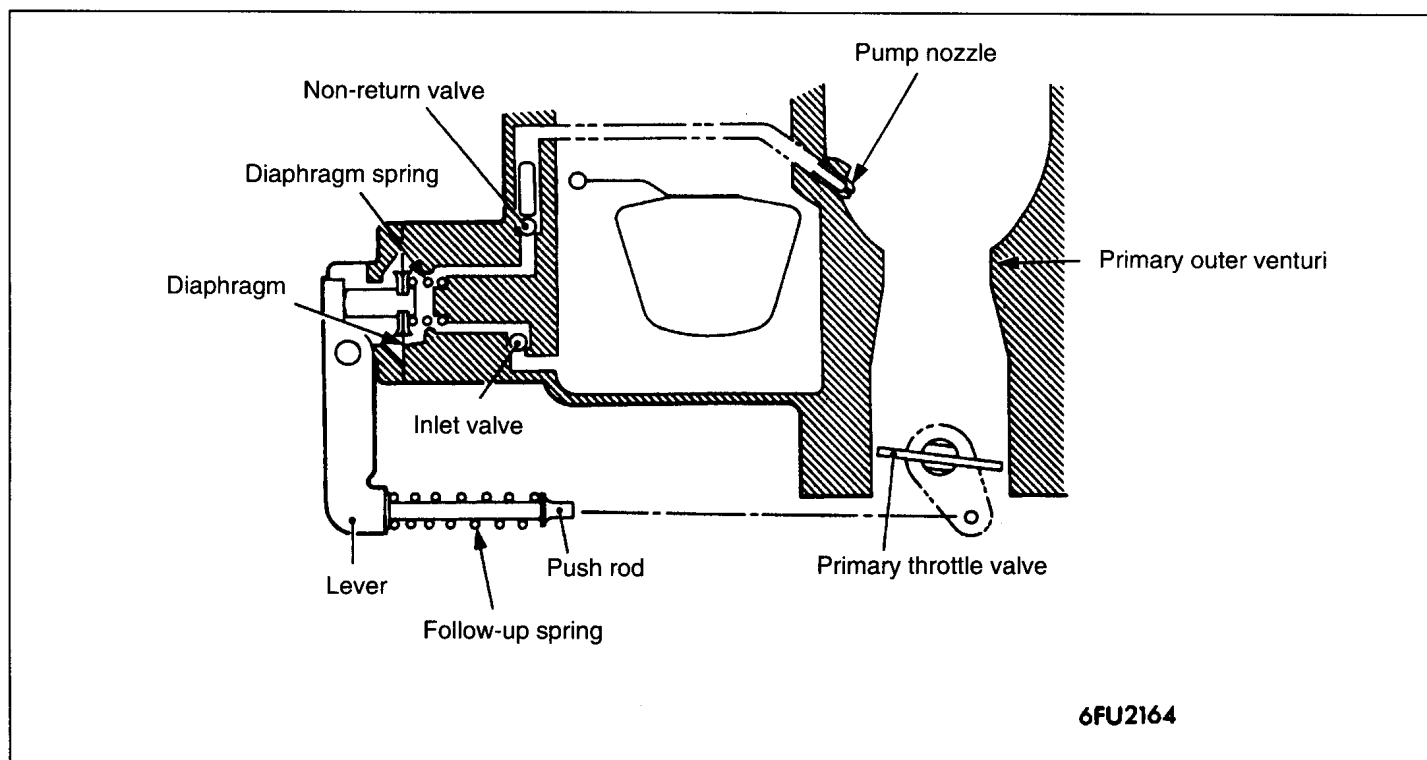
CARBURETTOR ACCELERATION PUMP INSPECTION

120001291

1. Remove the air horn.
2. With the choke valve in the fully open position, check to be sure that fuel is injected strongly from the pump nozzle when the throttle valve is quickly opened.
3. If the fuel injection is weak, clean the fuel passage of the carburettor.

NOTE

If the acceleration pump is defective, this will cause acceleration to be defective.



CHOKE VALVE INSPECTION

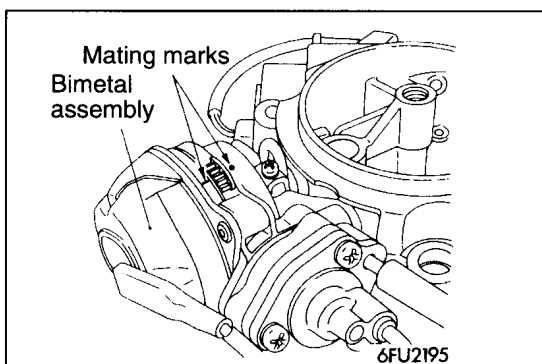
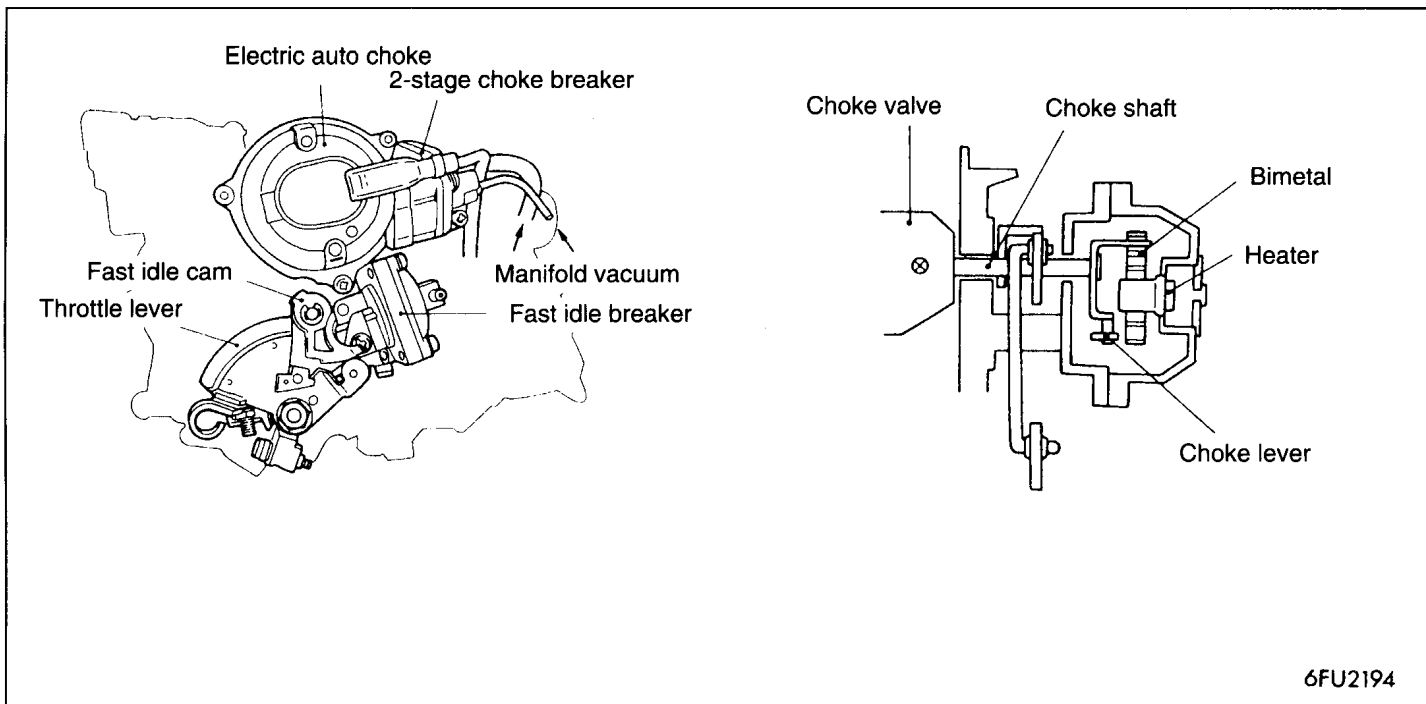
120001292

1. Remove the air horn.
2. Move the choke valve with a finger to check that the valve moves smoothly without excessive looseness.

If the valve is excessively loose.	Replace the float chamber cover assembly.
If the valve is stuck.	Clean the choke valve and the area around it, and apply a small amount of oil to the choke shaft.

ELECTRIC AUTO CHOKE INSPECTION

120001293



1. Check the mating marks on the electric auto choke body and bimetal assembly to make sure they are matched. If they are not matched, match them.

NOTE

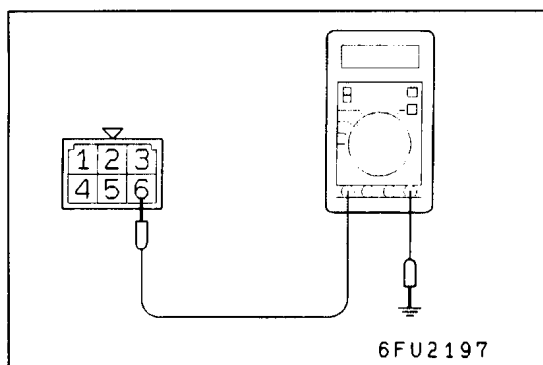
1. For information concerning the disassembly and reassembly of the bimetal assembly, refer to the Engine Workshop Manual.
2. Likely symptoms of mating mark deviation.

Mating mark	Symptom
Deviates to the right (clockwise)	Startability is good but plugs become sooty easily
Deviates to the left (counterclockwise)	Startability is poor and the engine stalls easily

2. Check if the engine coolant temperature is 30°C or lower.
3. After starting the engine, check the operation of the choke valve and the fast idle cam while holding onto the electric auto choke body.

Electric auto choke body	Gets hot gradually after the engine is started.
Choke valve	Opens as the temperature of the bimetal assembly rises
Fast idle cam	The fast idle breaker operates when the engine coolant becomes hot, cancelling fast idle

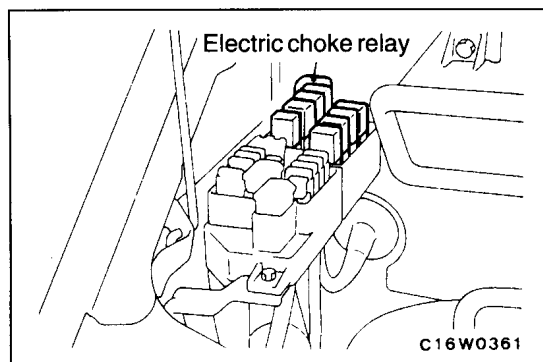
4. If the electric auto choke body does not become hot after the engine is started, check the electric choke.

**ELECTRIC CHOKE HEATER INSPECTION** 120001294

1. Disconnect the solenoid valve connector.
2. Check that there is continuity between terminal (6) (heater power supply) of the electric choke heater connector and the carburettor float chamber cover (earth).

Normal state: Should be conductive
(approx. 6Ω at 20°C)

3. If the heater is not conductive, replace the electric choke body (bimetal assembly).

**ELECTRIC CHOKE RELAY INSPECTION** 120002577

1. Remove the electric choke relay.
2. Check the continuity between the terminals when current is flowing through the relay coil and when current is not flowing.

Item	Measurement terminals	Continuity
When current is not flowing	Between (1) – (2)	Continuity (0Ω)
	Between (1) – (2)	No continuity ($\infty\Omega$)
	Between (1) – (4)	Continuity (Approx. 100Ω)
	Between (3) – (4)	Continuity (0Ω)
When current is flowing	Between (3) – (4)	No continuity ($\infty\Omega$)

NOTE

1. → indicates the direction of current flow.
2. Make sure that the polarity of the ohmmeter is correct. To energize the relay coil, apply battery voltage directly between terminals (1) and (4).

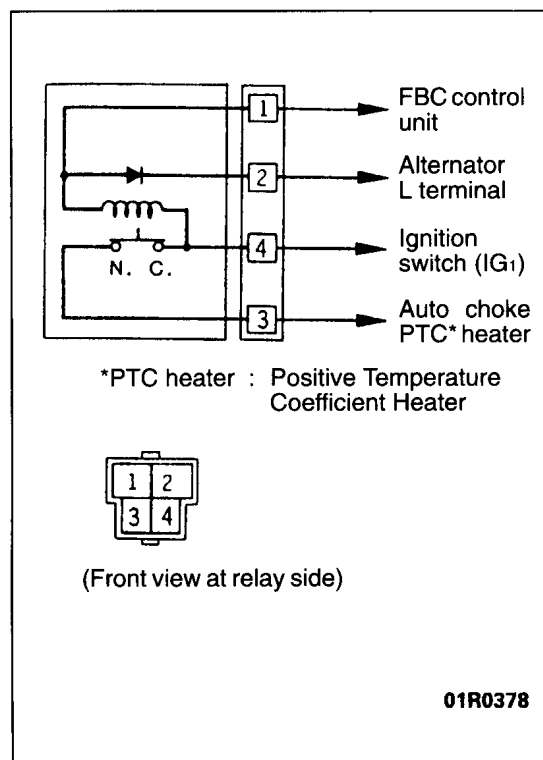
Caution

When applying voltage from the battery, be careful not to apply to the wrong terminals, otherwise the relay will be damaged.

3. If there is a malfunction, replace the electric choke relay.

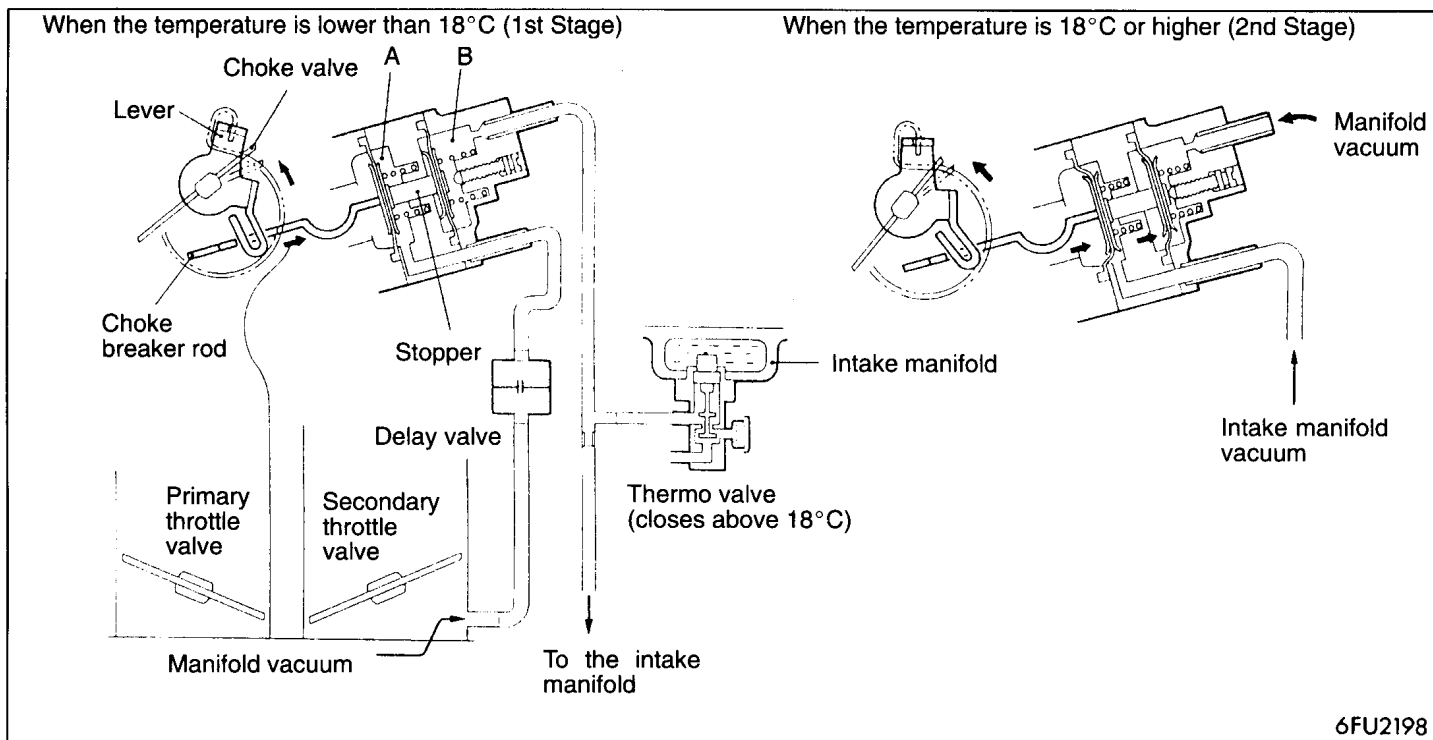
NOTE

If the body of the automatic choke does not become warm after starting the engine even though the automatic choke heater (PTC heater) and the electric choke relay are normal, check the body harness circuit.



CHOKE BREAKER SYSTEM INSPECTION

120001296



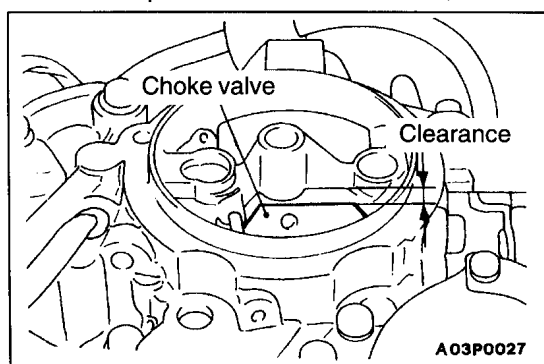
6FU2198

1. Remove the air horn.
2. Check conditions of the choke valve according to the procedures given the table below.

Procedure	Inspection conditions	Normal choke valve condition	Probable cause of abnormality
1	<ul style="list-style-type: none"> Before starting the engine Engine coolant temperature: Lower than 10°C 	Fully closed	<ul style="list-style-type: none"> Malfunction of bimetal assembly Malfunction of link
2	<ul style="list-style-type: none"> After starting the engine Engine coolant temperature: Lower than 10°C 	Slightly open (clearance approx. 2.0 mm)	<ul style="list-style-type: none"> Blocked delay valve Broken diaphragm (chamber A)
3	<ul style="list-style-type: none"> Engine: Idling Vacuum hose (red stripe) disconnected from choke breaker Engine coolant temperature: Lower than 10°C 	Not operating	<ul style="list-style-type: none"> Malfunction of thermo valve
4	<ul style="list-style-type: none"> Engine: Idling Vacuum hose (red stripe) connected to choke breaker Engine coolant temperature: Higher than 25°C 	When the choke valve is lightly closed with a finger, the valve is opened further from the position in procedure 2 (clearance approx. 3.0 mm)	<ul style="list-style-type: none"> Malfunction of thermo valve Broken diaphragm (chamber A)

NOTE

For the inspection of thermo valve, refer to GROUP 17 – Service Adjustment Procedures.



A03P0027

CHOKE BREAKER OPENING INSPECTION AND ADJUSTMENT

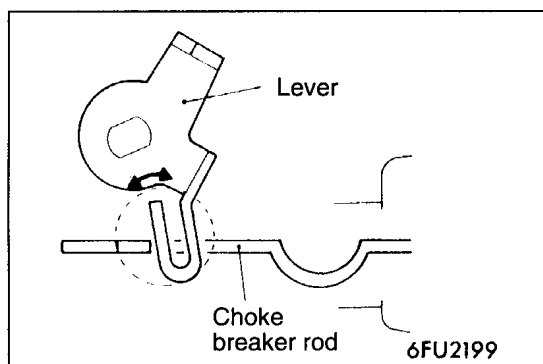
120001297

NOTE

After inspection of the choke breaker system.

1. Disconnect the vacuum hose (red stripe) from the choke breaker.
2. With the engine idling, close the choke valve lightly with a finger until the choke valve stops. Then, measure the choke valve to choke bore clearance.

Standard value: 1.9–2.1 mm



3. If the clearance is not as specified, stop the engine, remove the bimetal assembly and adjust the rod end opening for standard clearance.

Caution

When removing the bimetal assembly, put a mark on the electric choke body.

NOTE

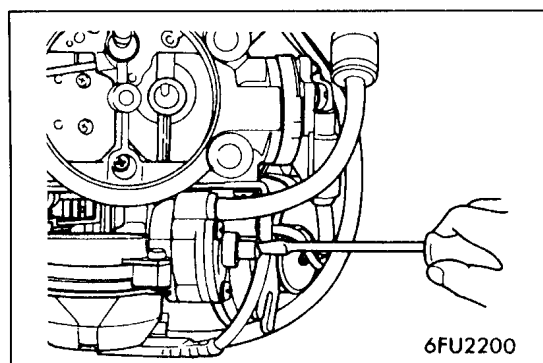
For information concerning the disassembly and reassembly of the bimetal assembly, refer to the Engine Workshop Manual.

4. Connect the vacuum hose (red stripe) which was disconnected in step 1. above.
5. Measure the clearance between the choke valve and the choke bore by the same procedure as in step 2.

Standard value: 2.9–3.1 mm

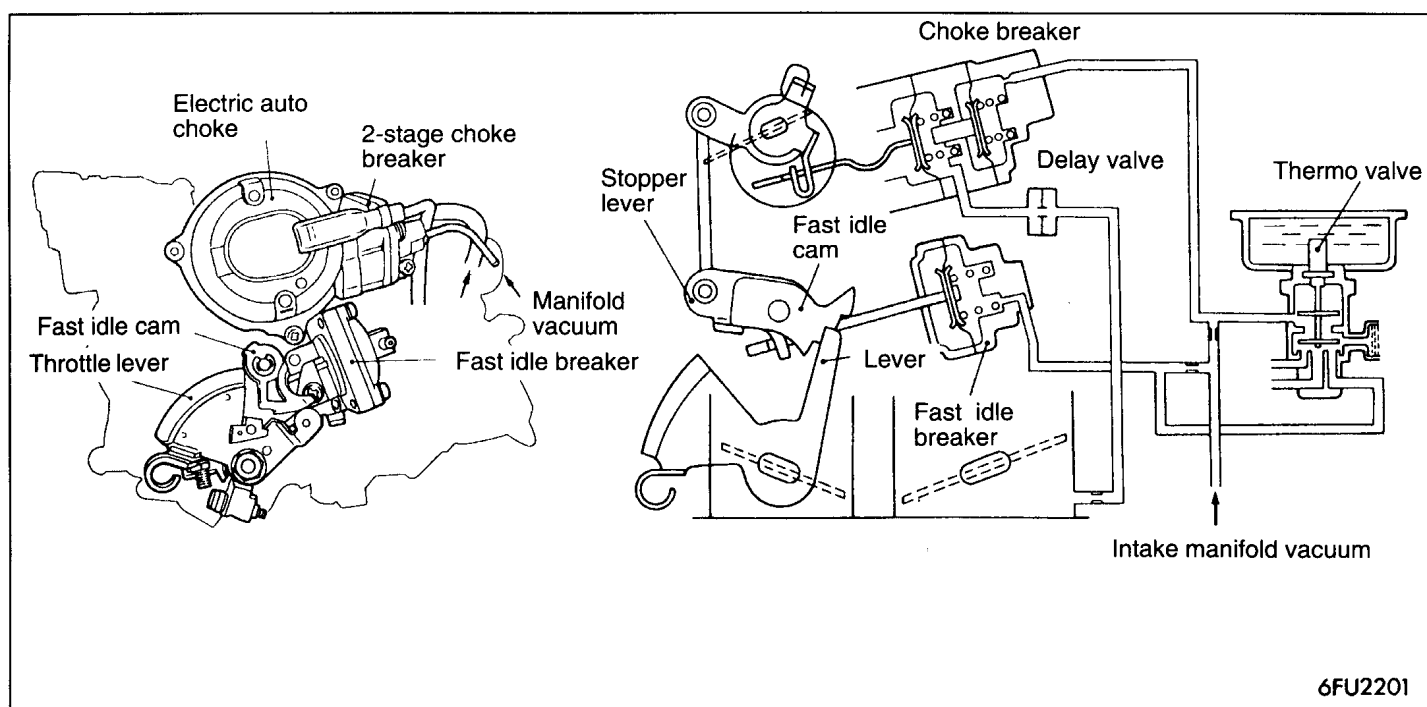
6. If the clearance is outside the standard value, stop the engine and turn the adjusting screw to adjust the clearance.

Adjusting screw	Valve clearance	NOTE
Turned in clockwise direction	Becomes smaller	Plug becomes fouled easily
Turned in anti-clockwise direction	Becomes larger	Starting performance deteriorates and engine stalls more easily

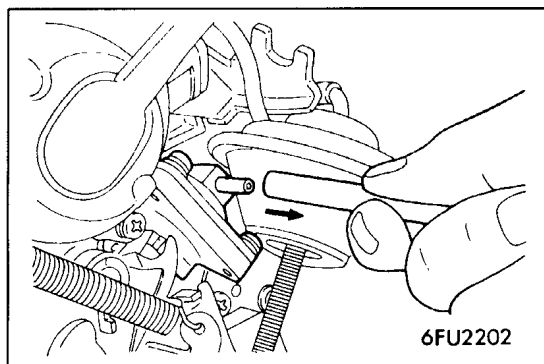


FAST IDLE INSPECTION AND ADJUSTMENT

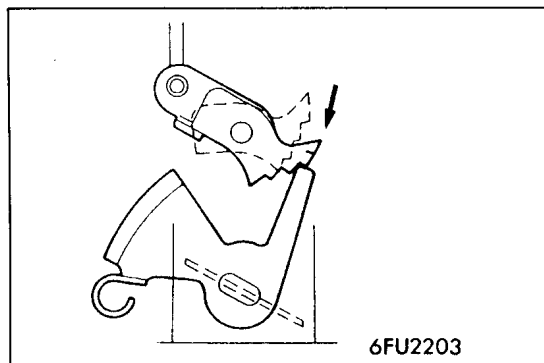
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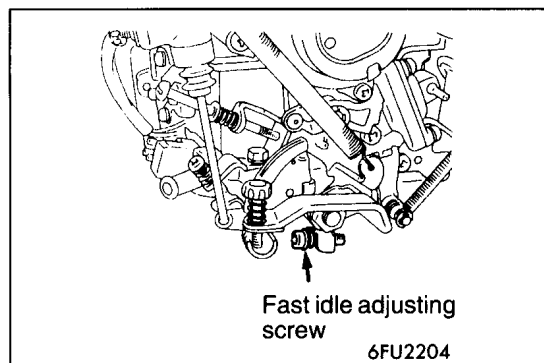
6FU2201



1. Before inspection and adjustment, set vehicle in the following condition:
 - Engine coolant temperature: 80–95°C
 - Lamps and all accessories : OFF
 - Transmission : Neutral
2. Connect a tachometer.
3. Disconnect the vacuum hose (white stripe) from the fast idle breaker.



4. Set the lever on the second highest detent of fast idle cam.
 5. Start the engine and check the fast idle speed.
- Standard value : 2,300–2,700 r/min.**

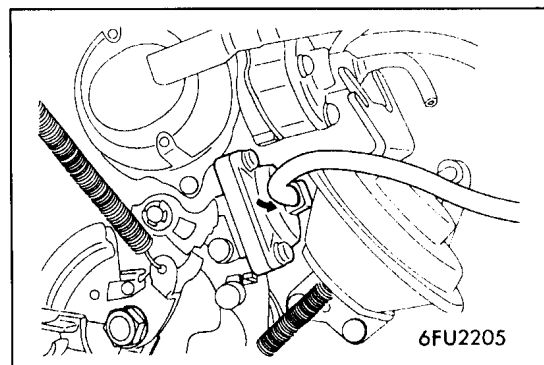


6. If the fast idle speed is outside the standard value, adjust by turning the fast idle adjusting screw.

Adjusting screw	Fast idle speed
Turned to clockwise direction	Becomes higher
Turned to anticlockwise direction	Becomes lower

NOTE

A torx screw (M4) is used as the fast idle adjusting screw.



7. Check that the fast idle breaker releases the fast idle when the vacuum hose (white stripe) which was disconnected in step 3. above is connected again.

AUXILIARY ACCELERATOR PUMP (AAP) INSPECTION

120001299

1. Start the engine and run at idle.
2. Disconnect the vacuum hose (black stripe) from the auxiliary accelerator pump. Place a finger against the end of the hose and check if negative pressure can be felt.

Engine coolant temperature	Negative pressure
35°C or below	Negative pressure can be felt
55°C or above	Negative pressure cannot be felt

3. Stop the engine.
4. Disconnect the air horn.
5. Connect a hand vacuum pump to the auxiliary accelerator pump nipple.
6. Apply 53 kPa of negative pressure and check that the negative pressure is maintained.
7. Check whether fuel is injected strongly from the pump nozzle when the negative pressure is 0 kPa.

VACUUM SWITCH CONTROL VACUUM INSPECTION

120001300

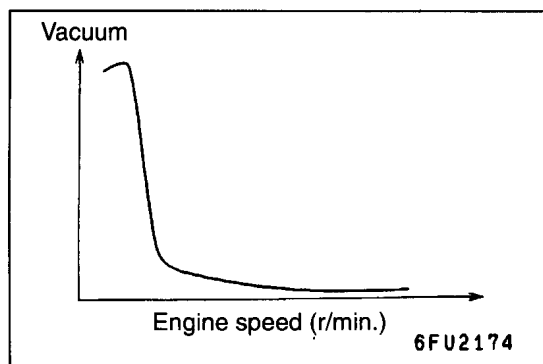
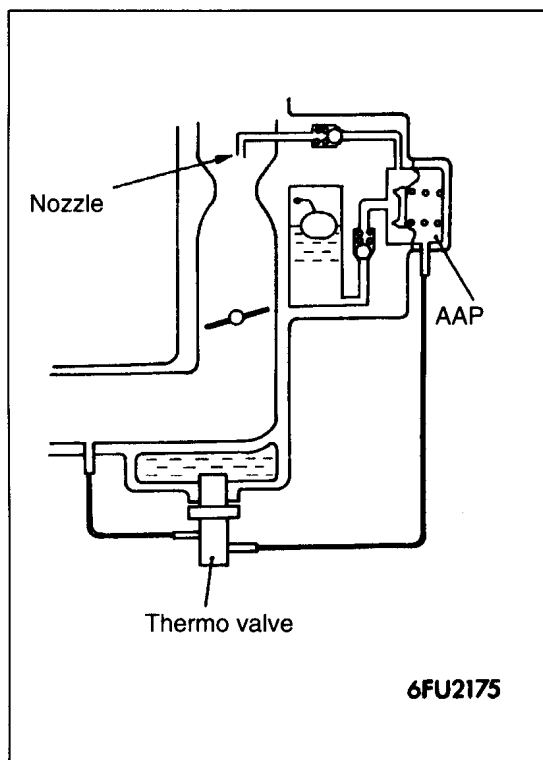
Check condition

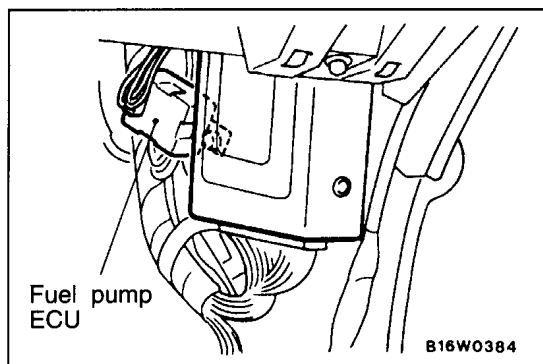
Engine coolant temperature : 80–95°C

1. Disconnect the vacuum hose (blue stripe) from the carburettor vacuum switch control vacuum nipple and connect a hand vacuum pump to the nipple.
2. Check that the vacuum switch control vacuum drops rapidly when the engine speed is increased gradually from the idle speed.

NOTE

If abnormality is found in the change of the vacuum, clean the vacuum passage of the carburettor.





FUEL PUMP CONTROL SYSTEM INSPECTION

120002609

1. Check whether the sound of the fuel pump operating can be heard when the engine is turning over and when it is idling.

NOTE

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

2. If the sound of the fuel pump operating cannot be heard, check by the following procedure.

- (1) Disconnect the fuel pump ECU connector.
- (2) Measure the voltage at the terminals of the fuel pump ECU connector.

Standard value:

Terminal No.	Ignition switch	Voltage
5	ON	System voltage
6	START	8V or more

- (3) Check whether there is continuity between terminal (1) of the fuel pump ECU connector at the harness side and the earth.

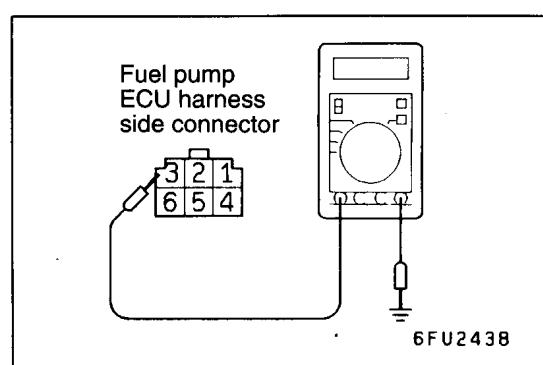
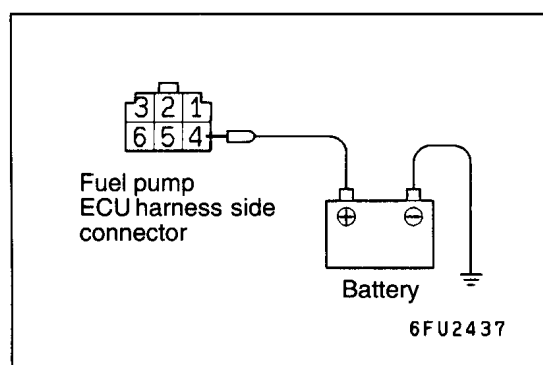
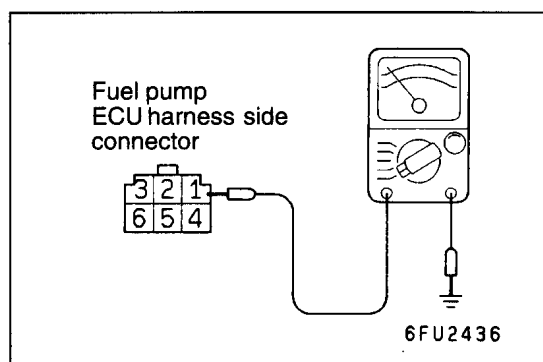
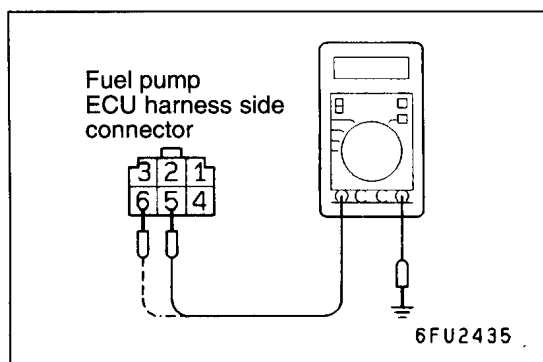
- (4) Apply battery voltage to terminal (4) of the fuel pump ECU connector at the harness side, and check that the fuel pump operates.

- (5) Measure the voltage at terminal (3) of the fuel pump ECU connector at the harness side.

Standard value:

Ignition switch	Voltage
ON	System voltage

- (6) If the results of all of the checks in steps (1) – (5) are normal, replace the fuel pump ECU.



INSPECTION PROCEDURES USING THE ECI CHECKER

120002578

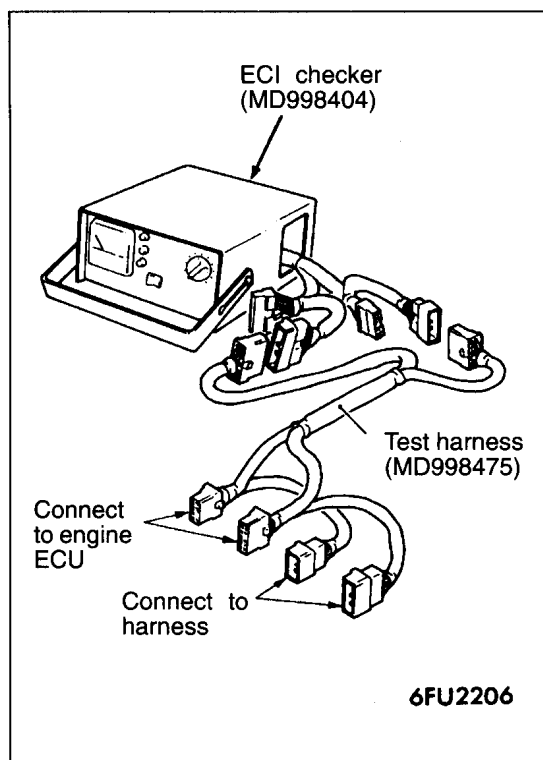
PRECAUTIONS FOR OPERATION

When ECI checker is used, pay attention to the following:

- Avoid rough operation of switches.
- Do not subject ECI checker to shock and other external forces, heat, etc.
- Keep the checker away from water and oil.
- Store ECI checker in a moisture- and dust-free place and take steps to protect the checker from heat and vibration.

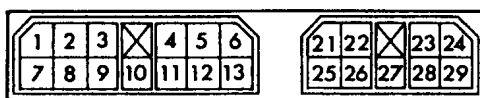
INSPECTION PROCEDURES

1. Turn ignition switch to LOCK.
2. Disconnect the large harness connector and small harness connector from the engine ECU.
3. Set check switch of the ECI checker to OFF.
4. Set select switch of the ECI checker to A.
5. Connect the special tool (test harness) to the connectors of the ECI checker, and then connect the special tool (test harness) to the engine ECU and body side harness connectors.
6. Set the select switch and check switch to check item.
7. Check the input and output signals of the engine ECU.
8. If checker shows any variance from specifications, check the corresponding sensor and related electrical wiring, then repair or replace.
9. After repair or replacement, recheck with the ECI checker to confirm that the repair has corrected the problem.
10. Set check switch of the ECI checker to OFF.
11. Set ignition switch to LOCK.
12. Disconnect connectors of the ECI checker and the special tool (test harness) from the engine ECU and the body side harness connectors.
13. Connect the body side harness connectors to the engine ECU.
14. After completion of the above test make certain that the trouble has been eliminated on the road test.



ELECTRONIC CONTROLLED CARBURETTOR SYSTEM CHECK PROCEDURE CHART

Engine ECU connector



1FU0852

13B-16 ELECTRONIC CONTROLLED CARBURETTOR — Service Adjustment Procedures

ECI checker select switch	ECI checker check switch	Check item	Engine ECU terminal No.	Check condition		Normal condition
A	1	Power supply	12	Ignition switch: ON		SV
A	2	Engine speed sensor	5	Engine: Idling		4–10V
A	3	Throttle position sensor	2	Ignition switch: ON	Set throttle valve to idle position	0.2–0.7V
					Fully open throttle valve	4.5–5.5V
A	4	Vacuum switch	10	Engine: Idling	Set throttle valve to idle position	0–1V
					Slightly open throttle valve	SV
A	5	Electric choke relay	29	Ignition switch: ON		0–1V
				Engine: Idling		SV
B	2	Idle up control solenoid valve	27	A/C switch: ON (A/C compressor is operating)	Engine: Idling	0–1V
					Engine: 2,000 r/min.	SV
B	4	A/C power relay	24	Engine: Idling A/C switch: ON	Set throttle valve to idle position	0–1V
					Fully open throttle valve	SV (after approx. 5 seconds → 0–1V)
B	5	Engine coolant temperature sensor	3	Ignition switch: ON	When engine coolant temperature is 20°C	2.3–2.9V
					When engine coolant temperature is 80°C	0.3–0.9V
B	6	Feedback solenoid valve	22	Ignition switch: ON		SV
				Engine: Idling after warming up		2–12V
B	7	Slow cut solenoid valve	26	Engine: Idling after warming up		0–1V
				Decrease the engine speed from 4,000 r/min. to the idle speed		Momentarily SV
B	8	Oxygen sensor	1	Engine: Run at 2,000 r/min. after warming up (5 minutes or more after engine is started)		0–1V ← (Changes repeatedly) → 2–3V
B	9	Secondary air control solenoid valve	28	Engine: Idling, 70 seconds after start of warm engine		0–1V → SV
				Decrease the engine speed from 2,000 r/min. to the idle speed		Momentarily drop
B	10	Sensor impressed voltage	8	Ignition switch: ON		4.5–5.5V

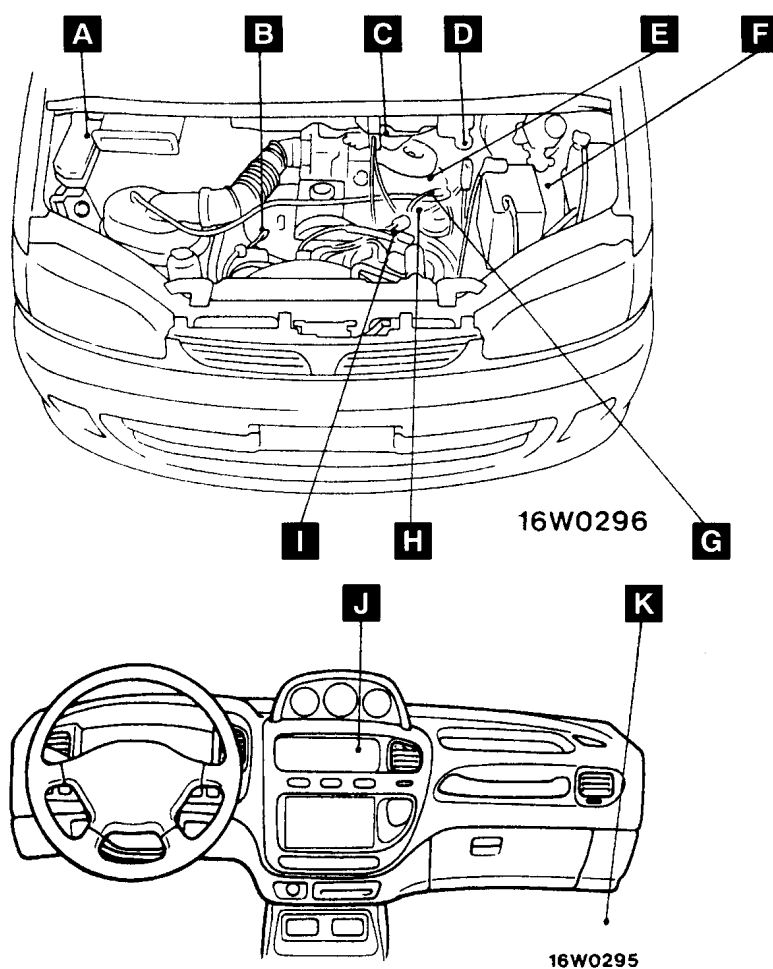
NOTE

(1) SV: System voltage

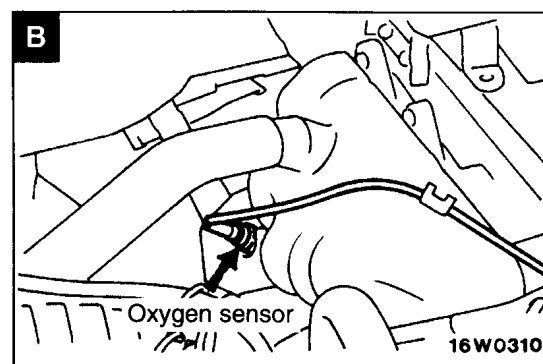
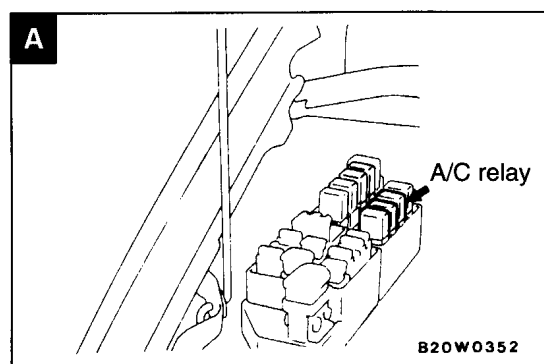
COMPONENT LOCATION

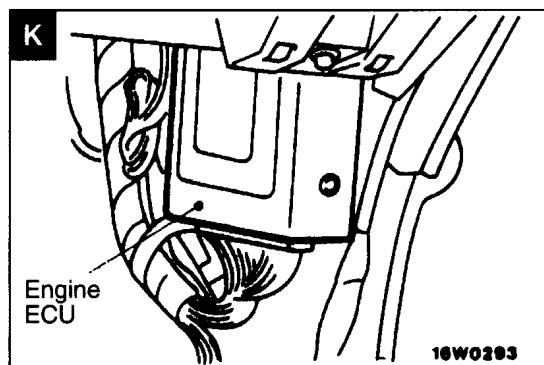
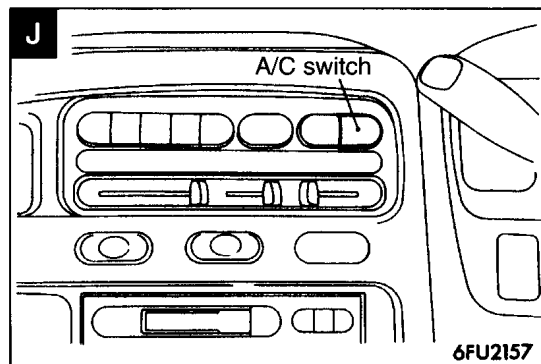
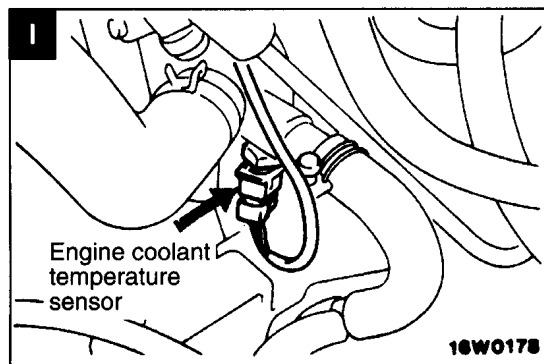
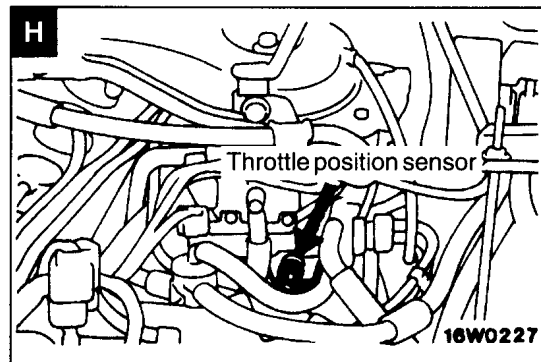
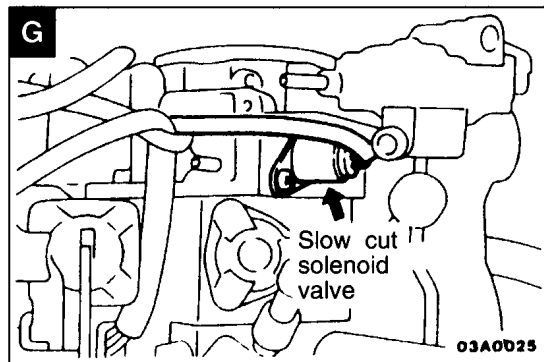
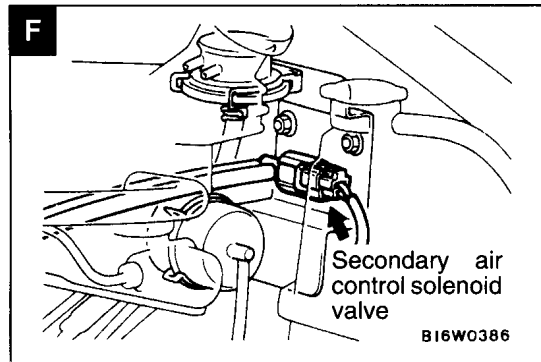
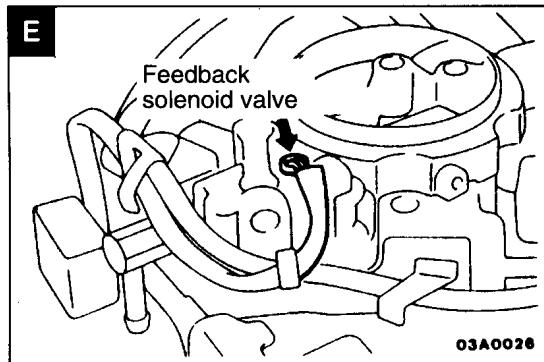
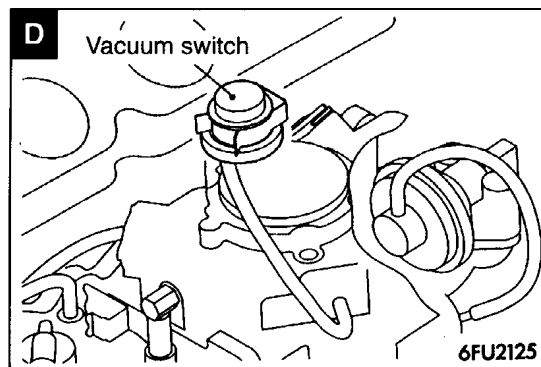
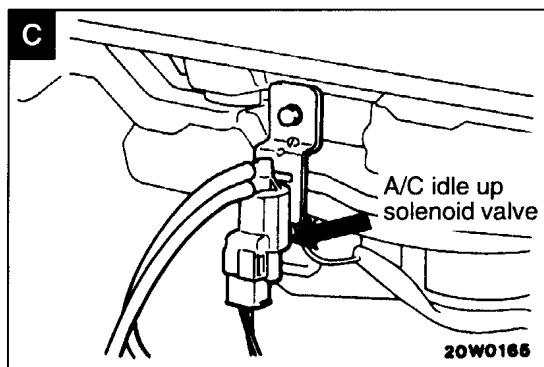
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Name	Symbol	Name	Symbol
A/C idle up solenoid valve	C	Oxygen sensor	B
A/C relay	A	Secondary air control solenoid valve	F
A/C switch	J	Slow cut solenoid valve	G
Engine coolant temperature sensor	I	Throttle position sensor	H
Engine ECU	K	Vacuum switch	D
Feedback solenoid valve	E	–	–



6FU2428





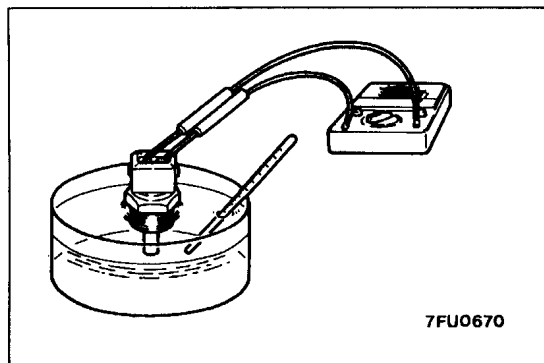
ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

120001303

Caution

Don't touch the connector (resin section) with the tool when removing and installing.

1. Remove engine coolant temperature sensor.



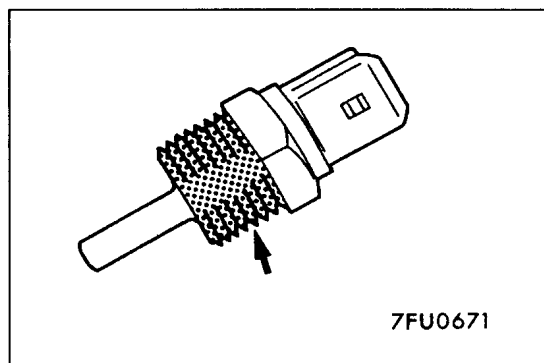
2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Standard value :

2.1–2.7k Ω (at 20°C)

0.26–0.36k Ω (at 80°C)

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



4. Apply sealant to the threaded portion.

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

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

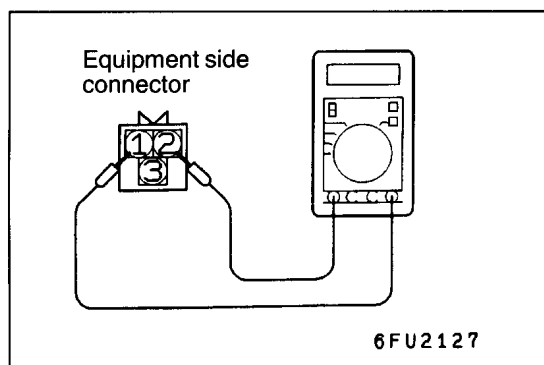
Sensor tightening torque: 30 Nm

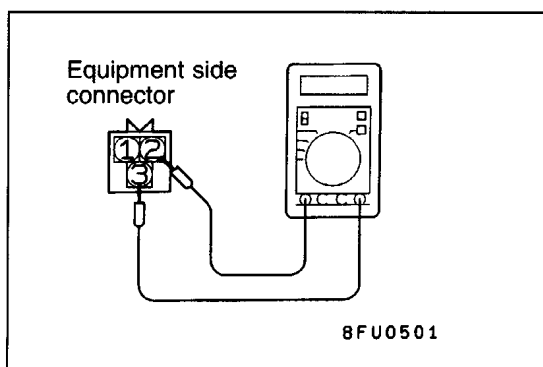
THROTTLE POSITION SENSOR (TPS) INSPECTION

120001304

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

Standard value: 3.5–6.5 k Ω



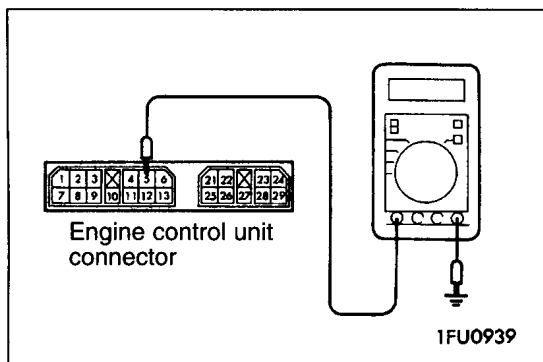


3. Measure the resistance between the throttle position sensor terminal 3 and terminal 2.

Throttle valve slowly opens 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.



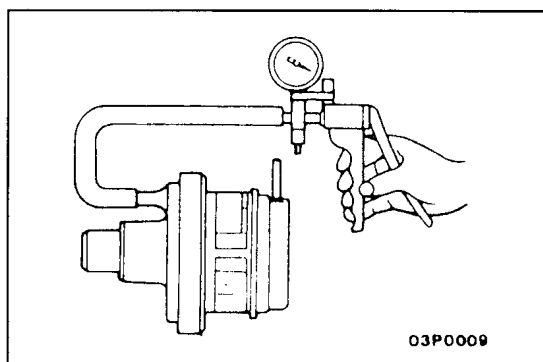
ENGINE SPEED SENSOR (IGNITION COIL (-) TERMINAL) INSPECTION

120001305

Check that there is continuity between the ignition coil (-) terminal and the engine control unit terminal No. 5.

NOTE

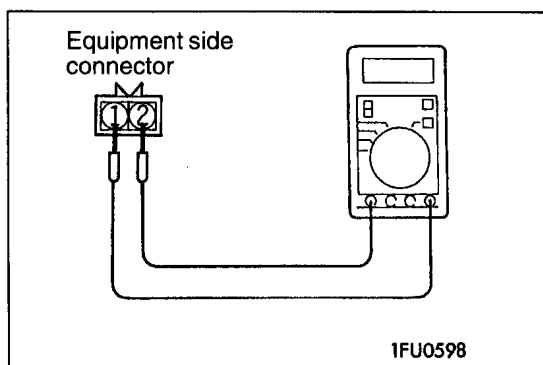
Shake the harness connector to check for a lurking open circuit.



VACUUM SWITCH INSPECTION

120001306

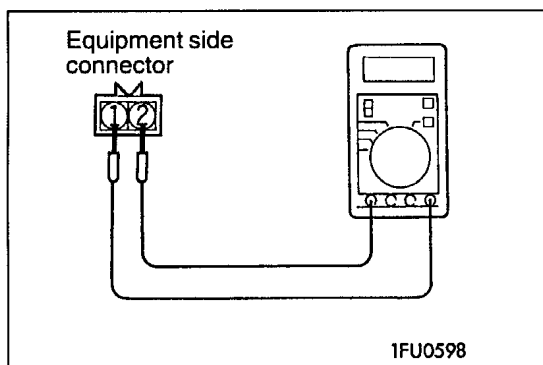
1. Disconnect the vacuum switch connector.
2. Connect a hand vacuum pump to the nipple of vacuum switch.
3. Apply a vacuum of 67 kPa and check that vacuum is maintained.



4. Check continuity between the vacuum switch terminals.

Vacuum	Continuity
27 kPa or less	No continuity
47 kPa or more	Continuity

5. If defective, replace the vacuum switch.

**OXYGEN SENSOR INSPECTION**

120001307

1. Warm the engine and check to be sure that the engine coolant temperature is 80–95°C.
2. Disconnect the oxygen sensor connector and connect a digital voltmeter.

Caution

When disconnecting the oxygen sensor connector, do not pull the connector or lead wire too strongly.

3. Race the engine repeatedly and measure the oxygen sensor output voltage.

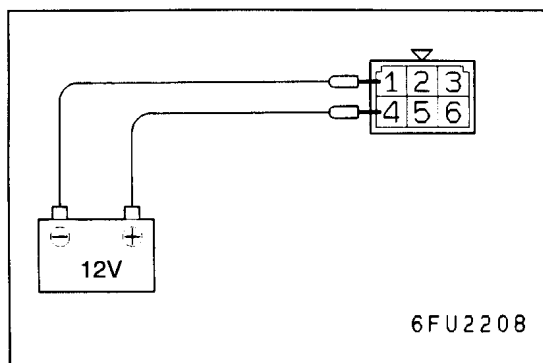
Standard value:

Engine	Sensor output voltage	Remark
When racing the engine	0.6–1.0V	When the air/fuel mixture ratio is enriched by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6–1.0V.

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

NOTE

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

**FEEDBACK SOLENOID VALVE (FBSV) INSPECTION**

120001308

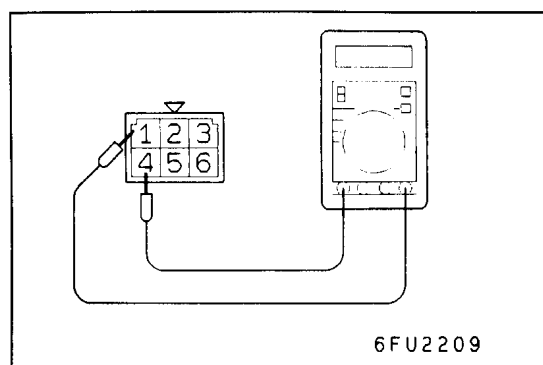
OPERATION INSPECTION

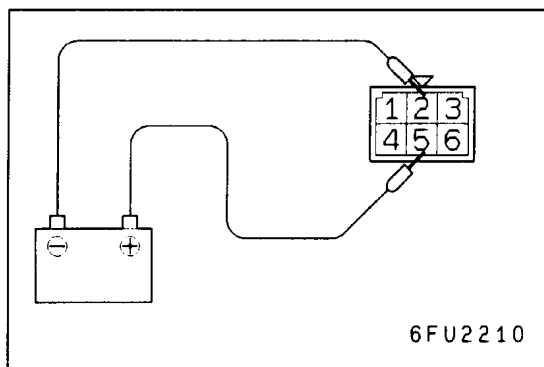
1. Disconnect the solenoid valve connector.
2. Check that a operation sound (click) is heard when a battery voltage is applied between the feedback solenoid valve terminal 1 (to battery (–) terminal) and terminal 4 (to battery (+) terminal).

INSPECTION OF COIL RESISTANCE

Measure the resistance of the feedback solenoid valve coil.

Standard value: 54–66Ω (at 20°C)





SLOW CUT SOLENOID VALVE (SCSV) INSPECTION

120001309

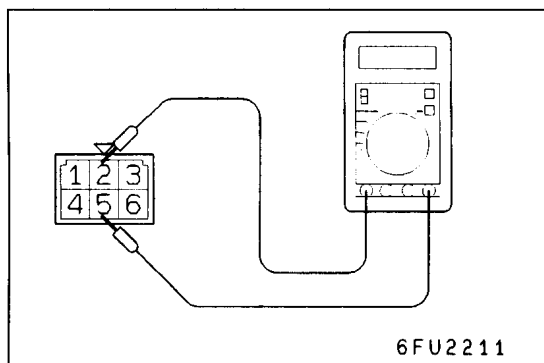
OPERATION INSPECTION

1. Disconnect the solenoid valve connector.
2. Check that a operation sound (click) is heard when a battery voltage is applied between the slow cut solenoid valve terminal 2 (to battery (-) terminal) and terminal 5 (to battery (+) terminal).

INSPECTION OF COIL RESISTANCE

Measure the resistance of the slow cut solenoid valve coil.

Standard value: 48–60Ω (at 20°C)



CARBURETTOR

120000819

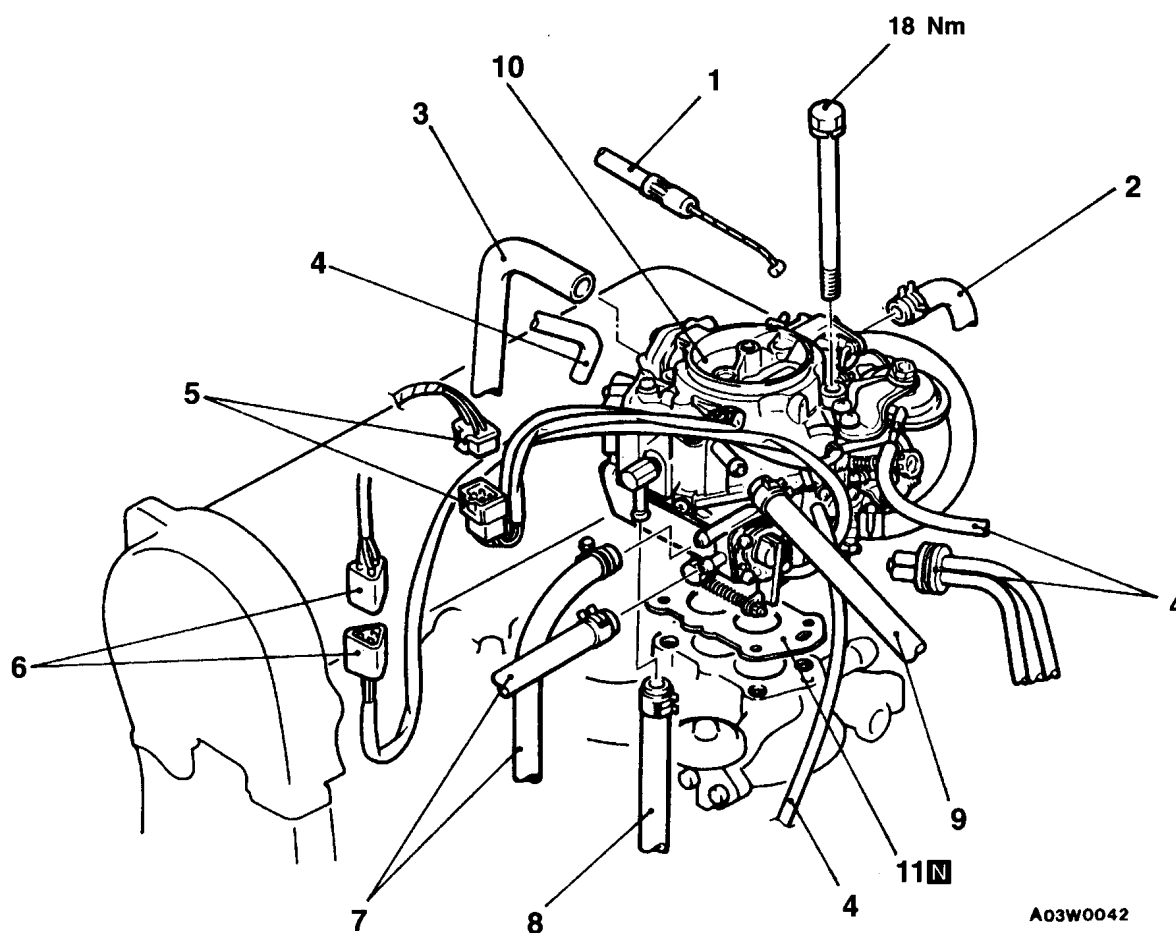
REMOVAL AND INSTALLATION

Pre-removal Operation

- Air Horn Assembly Removal
(Refer to GROUP 15 – Air Cleaner.)
- Engine Coolant Draining

Post-installation Operation

- Accelerator Cable Adjustment (Refer to GROUP 13F – Service Adjustment Procedures.)
- Air Horn Assembly Installation
(Refer to GROUP 15 – Air Cleaner.)
- Engine Coolant Supplying



A03W0042

Removal steps

1. Accelerator cable connection
2. Water hose connection
3. Fuel vapor hose connection
4. Vacuum hose connection
5. Solenoid valve connector
6. Throttle position sensor connector
7. Fuel return hose connection
8. Fuel main hose connection
9. Inner bend hose connection
10. Carburettor
11. Gasket

DIESEL FUEL

CONTENTS

120000820

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SERVICE SPECIFICATIONS	2	Evacuation of Air from Fuel Line	3
SPECIAL TOOL	2	Fuel Filter Cartridge Replacement	3
SERVICE ADJUSTMENT PROCEDURES	2	Fuel Injection Pump Inspection	4
Fuel Injection Timing Inspection and Adjustment	2	Boost Compensator Inspection	4
Engine Idling Speed Inspection and Adjustment	2	Injection Nozzle Inspection and Adjustment	4
Fuel Discharge Prevention	2	INJECTION NOZZLE	6
		INJECTION PUMP	8

GENERAL INFORMATION

120000821

The fuel is drawn out of the fuel tank by means of the feed pump which is built into the fuel injection pump. It then passes through the fuel filter and is fed to the injection pump.

The fuel is pressurized by the feed pump, and this fuel pressure is controlled by the regulating valve which is built into the pump. Then, the fuel is compressed by the plunger and injected from the nozzles at high pressure in accordance with the injection sequence.

Engine speed (fuel injection amount) control is carried out by means of a centrifugal-type governor using a flyweight.

Fuel injection timing control is carried out by a hydraulic timer. The hydraulic timer operates by the fuel pressure inside the pump chamber. This pressure is controlled by the regulating valve.

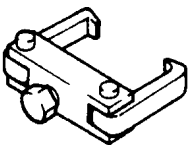
SERVICE SPECIFICATIONS

120000822

Items	Standard value
Fuel cut solenoid valve coil resistance Ω	8–10
Fuel injection initial pressure kPa	14,710–15,690

SPECIAL TOOL

120000823

Tool	Number	Name	Use
	MD998388	Injection pump sprocket puller	Removal of sprocket from drive shaft of injection pump

SERVICE ADJUSTMENT PROCEDURES

120000824

FUEL INJECTION TIMING INSPECTION AND ADJUSTMENT

Refer to GROUP 11I – Service Adjustment Procedures.

ENGINE IDLING SPEED INSPECTION AND ADJUSTMENT

120000825

Refer to GROUP 11I – Service Adjustment Procedures.

FUEL DISCHARGE PREVENTION

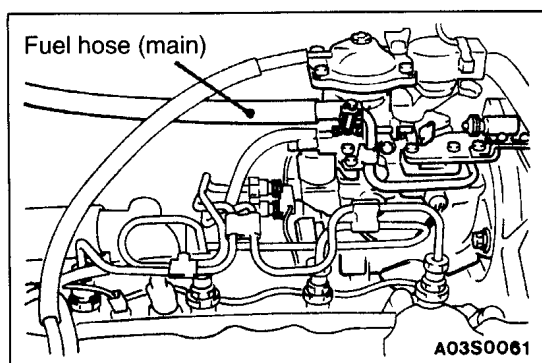
120000826

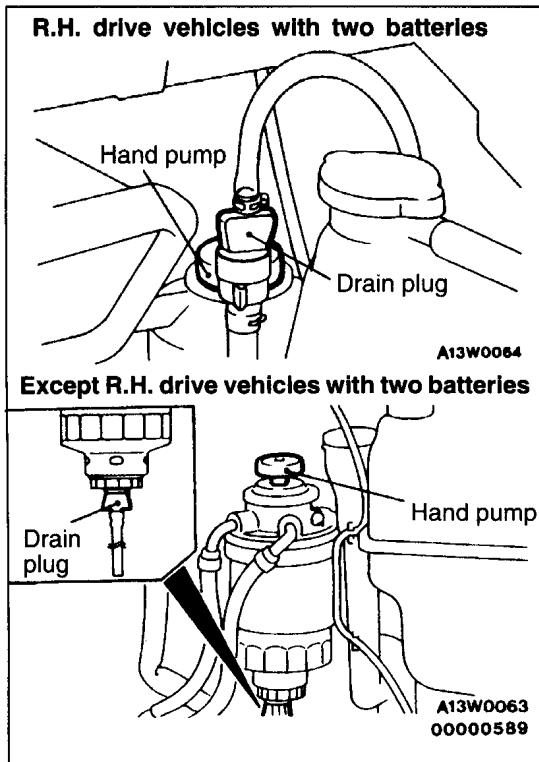
1. Remove the connection between the fuel hose (main) and the fuel injection pump.

NOTE

The fuel hose should be plugged.

2. Start the engine and let it run until it stops by itself.



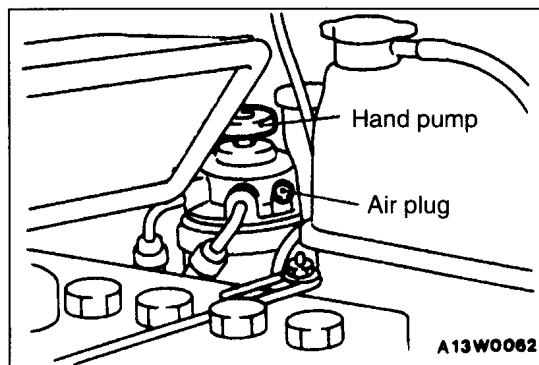


EVACUATION OF WATER FROM FUEL FILTER

120002253

Water is in the filter when fuel filter warning lamp lights. Evacuate water by the following procedures.

1. Loosen drain plug.
2. Drain water with hand pump. Finger-tighten drain plug.



EVACUATION OF AIR FROM FUEL LINE

120000828

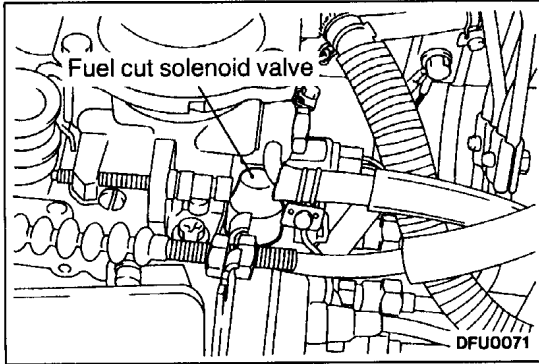
Bleed the air from the fuel line after refilling the fuel:

- When fuel is drained for service.
 - When fuel filter is replaced.
 - When main fuel line is removed.
1. Loosen fuel filter air plug.
 2. Place rags around air plug hole. Operate hand pump repeatedly until no bubbles come from plug hole. Tighten air plug.
 3. Repeat until hand pump operation becomes stiff.

FUEL FILTER CARTRIDGE REPLACEMENT

120000829

Refer to GROUP 13F – Service Adjustment Procedures.

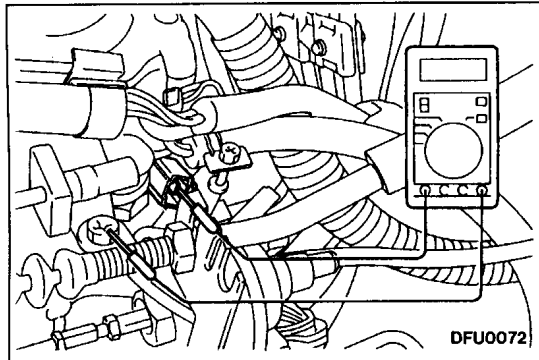


FUEL INJECTION PUMP INSPECTION

120000830

INSPECTION OF FUEL CUT SOLENOID VALVE OPERATION

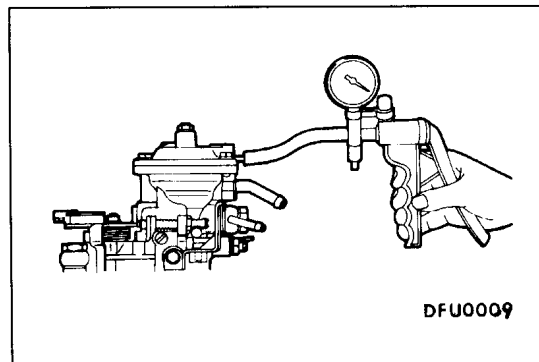
When a sound scope is held against the fuel cut solenoid valve and the ignition switch is turned to "ON", check that the sound of the valve operating can be heard.



INSPECTION OF FUEL CUT SOLENOID VALVE COIL RESISTANCE

Measure the resistance between the fuel cut solenoid valve terminal and the ignition pump body.

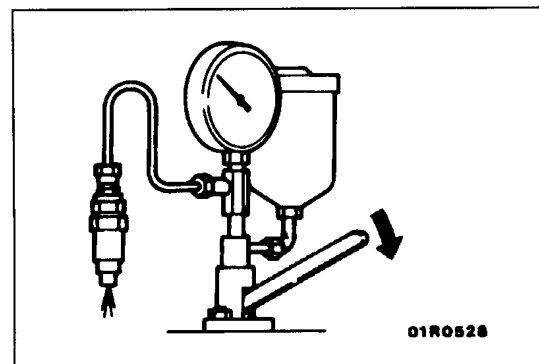
Standard value: 8–10 Ω



BOOST COMPENSATOR INSPECTION

120000831

1. Connect a hand pump (pressurization type) to the nipple of the boost compensator.
2. Apply 30 kPa of pressure and check to be sure that the pressure is maintained.



INJECTION NOZZLE INSPECTION AND ADJUSTMENT

120002572

Caution

Never touch the injection spray that is injected from the nozzle.

FUEL INJECTION INITIAL PRESSURE INSPECTION

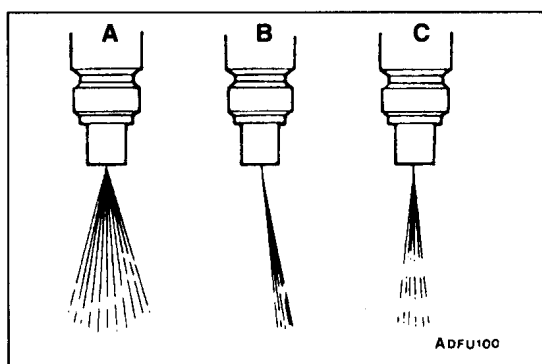
1. Install the injection nozzle to a nozzle tester.
2. Move the lever of the nozzle tester 2–3 times to inject fuel and to bleed the air.
3. Gently press down the lever of the nozzle tester, and take a reading of the indication value on the pressure gauge at the point where the needle slowly rises and then suddenly drops.

Standard value (Fuel injection initial pressure):
14,710–15,690 kPa

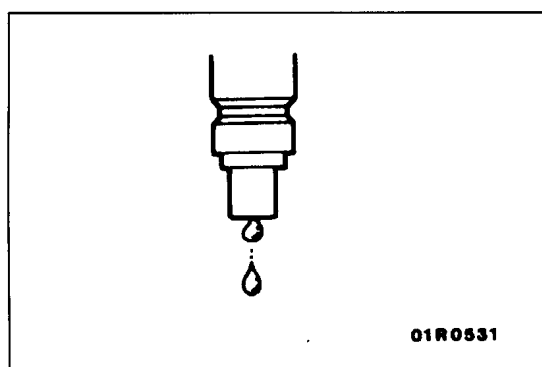
4. If the fuel injection initial pressure is outside the standard value, disassemble the nozzle holder to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

NOTE

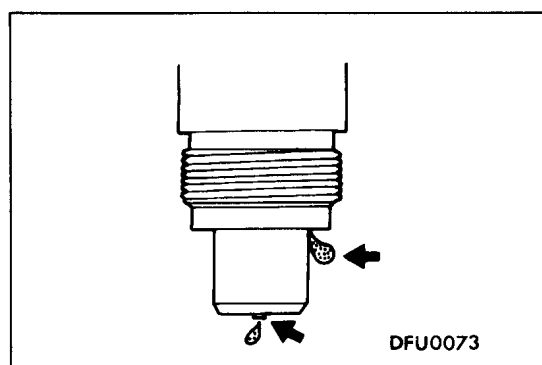
1. For disassembly, reassembly and adjustment of the nozzle holder, refer to the Engine Workshop Manual.
2. There are 10 shims for adjustment, with thicknesses in the range of 0.10–0.80 mm.
3. When the shim thickness is increased by 0.1 mm, the fuel injection initial pressure increases by 2,350 kPa.

**INJECTION SPRAY CONDITION INSPECTION**

1. Move the lever of the nozzle tester rapidly (4–6 times per second) to eject the fuel continuously. Check to be sure that the injection spray comes out evenly in a cone shape (injection spray angle is 10°). The injection spray patterns shown in the illustration at left are wrong.
 - A. Injection angle is too large
 - B. Bias
 - C. Intermittent fuel injection



2. Check to be sure that no fuel drips after injection is completed.
3. If there are any drips, disassemble the nozzle, clean it and reinspect, or replace the nozzle.

**NOZZLE FUEL-TIGHT INSPECTION**

1. Gently raise the lever of the nozzle tester until the pressure inside the nozzle (value displayed on pressure gauge) becomes 12,750–13,730 kPa, and after holding this pressure for approximately 10 seconds, check to be sure that there are no fuel leaks from the nozzle.
2. If there are any leaks, disassemble the injection nozzle, clean it and re-inspect, or replace the nozzle.

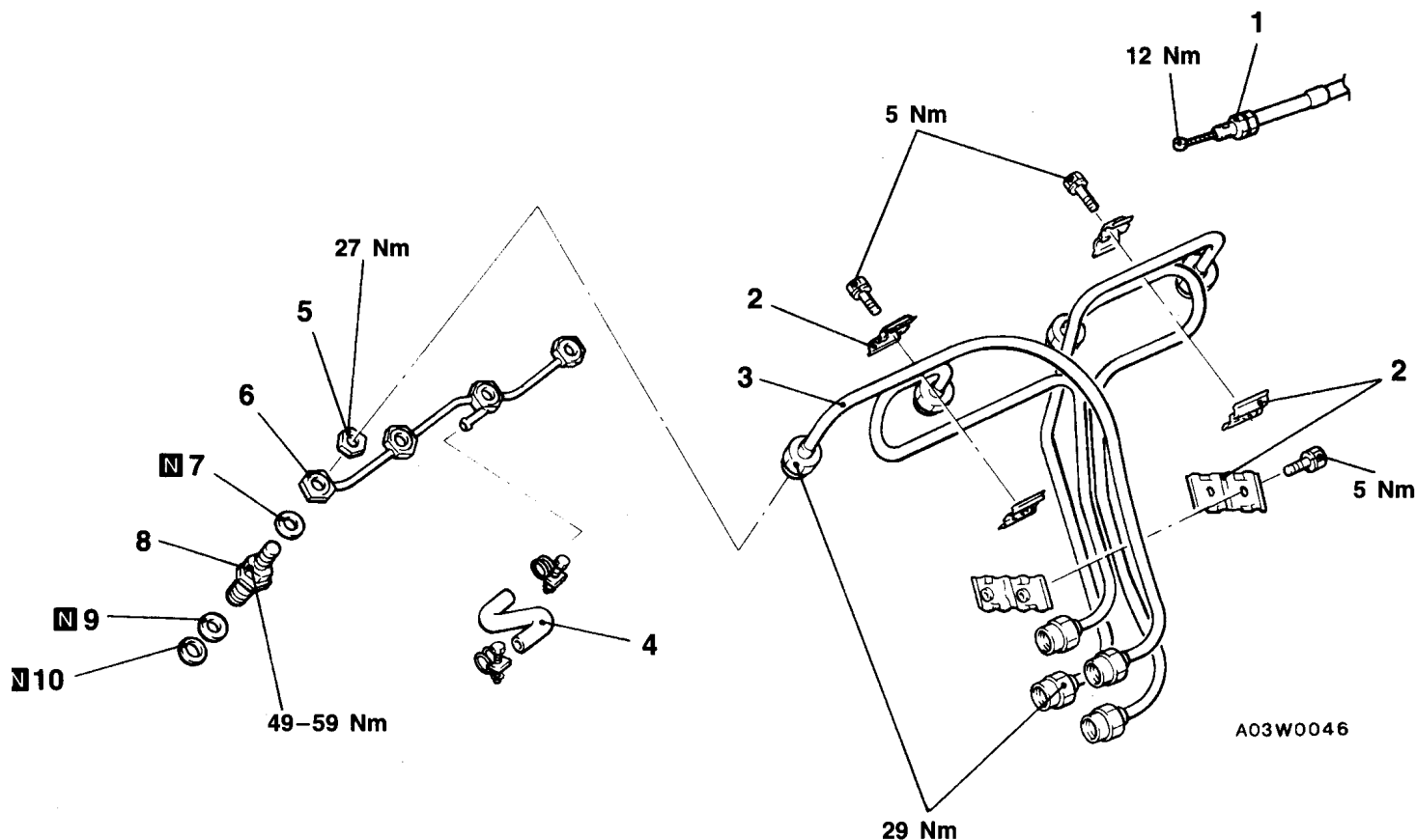
INJECTION NOZZLE

120002251

REMOVAL AND INSTALLATION

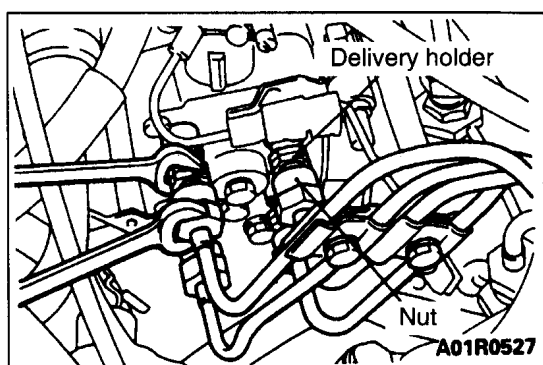
Post-installation Operation

- Accelerator Cable Adjustment (Refer to GROUP 13F – Service Adjustment Procedures.)

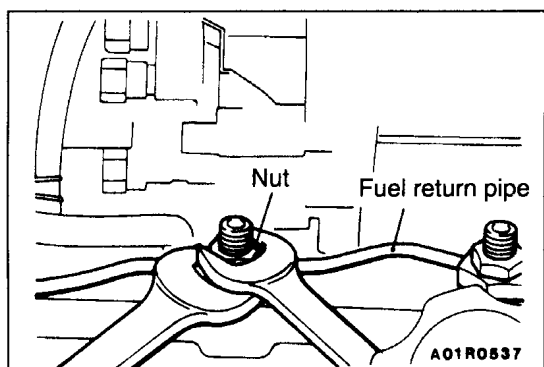
**Removal steps**

- ◀A▶
1. Accelerator cable connection
 2. Injection pipe clamp
 3. Injection pipe
 4. Fuel return hose
 5. Nut
- ◀B▶

- ◀B▶
- ◀C▶
- ▶A▶
- ▶A▶
6. Fuel return pipe
 7. Fuel return pipe gasket
 8. Nozzle holder
 9. Holder gasket
 10. Nozzle gasket

**REMOVAL SERVICE POINTS****◀A▶ DISCONNECTION OF INJECTION PIPE**

When loosening nuts at both ends of injection pipe, hold the other side (pump side-delivery holder, nozzle side-nozzle holder) with wrench and loosen nut.



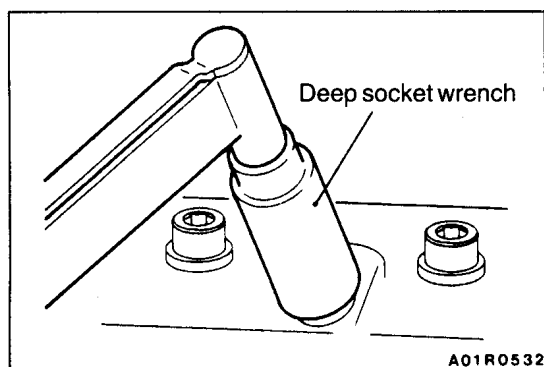
◀B▶ NUT / FUEL RETURN PIPE REMOVAL

- (1) While using a spanner or similar tool to hold the hexagonal nut of the fuel return pipe, remove the nut.

Caution

If an attempt is made to loosen the nut without first holding the fuel return pipe, the pipe may be broken or otherwise damaged.

- (2) Disconnect the fuel return pipe.



◀C▶ INJECTION NOZZLE HOLDER REMOVAL

Using a deep socket wrench, remove the injection nozzle holder.

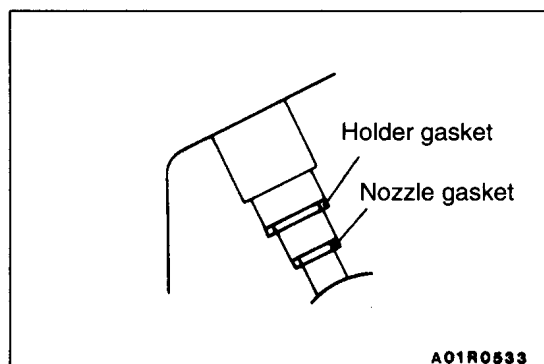
Caution

1. Make a marking on the removed injection nozzle holder (the cylinder No.).
2. Use a cap to prevent foreign material, etc. from entering the injection nozzle hole.

INSTALLATION SERVICE POINT

▶A◀ NOZZLE GASKET / HOLDER GASKET INSTALLATION

Clean the cylinder head's injection nozzle hole, and insert a new gasket.



INJECTION PUMP

120002252

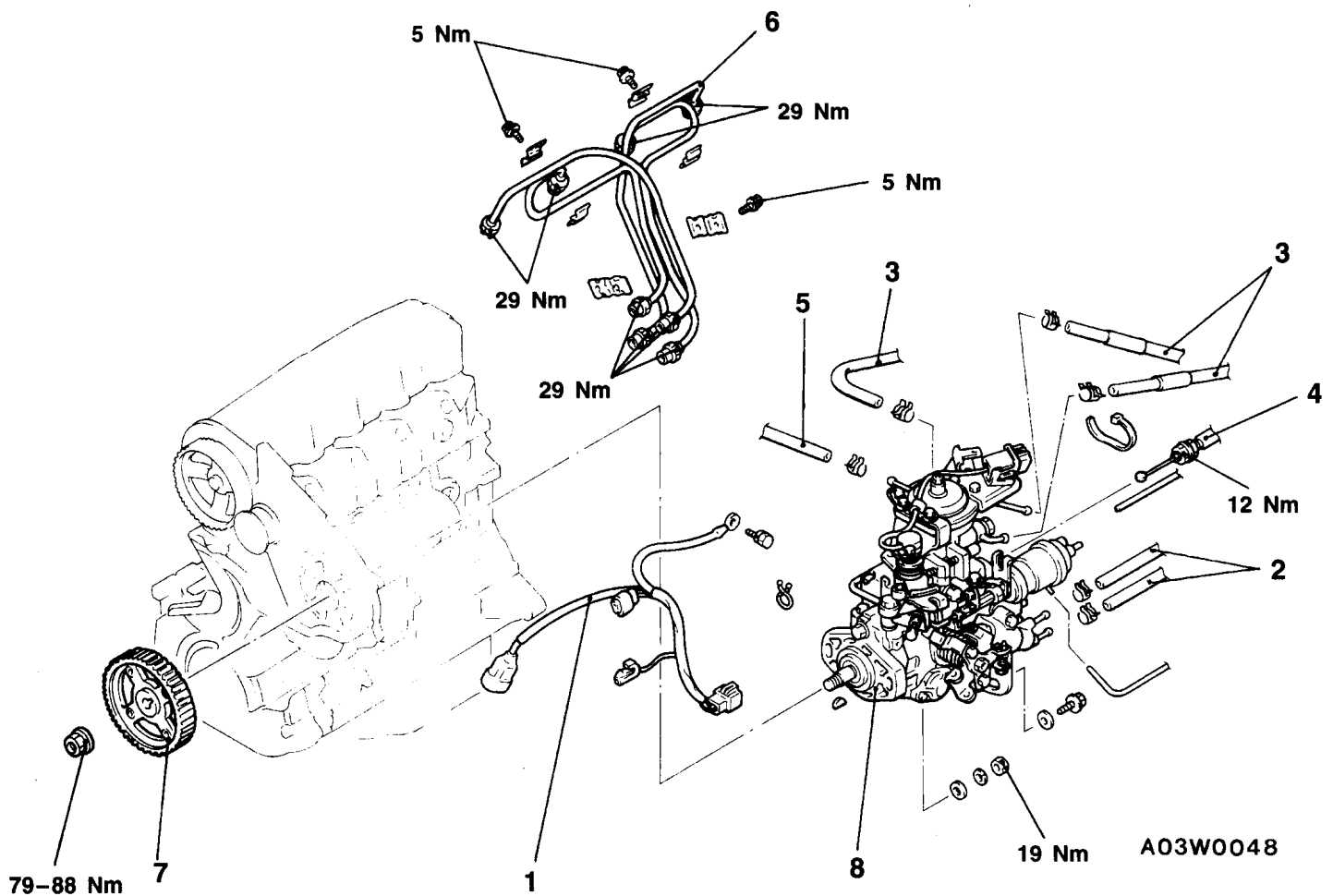
REMOVAL AND INSTALLATION

Pre-removal Operation

- Engine Coolant Draining
- Timing Belt Removal (Refer to GROUP 11I – Timing Belt.)

Post-installation Operation

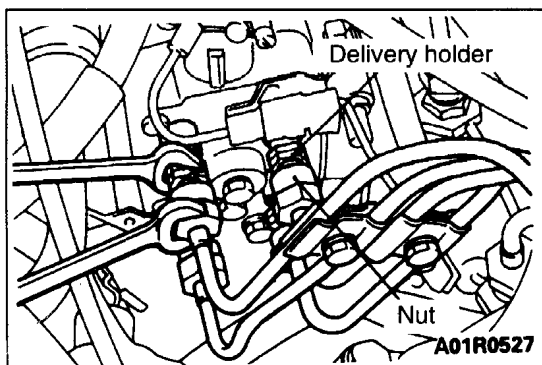
- Timing Belt Installation (Refer to GROUP 11I – Timing Belt.)
- Engine Coolant Supplying
- Injection Timing Adjustment (Refer to GROUP 11I – Service Adjustment Procedures.)
- Accelerator Cable Adjustment (Refer to GROUP 13F – Service Adjustment Procedures.)

**Removal steps**

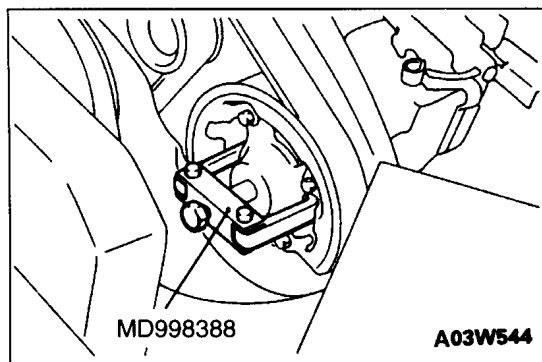
1. Fuel injection pump wiring harness
2. Water hose connection
<Vehicles with CSD>
3. Fuel hoses
4. Accelerator cable connection



5. Boost hose connection
6. Fuel injection pipe
7. Fuel injection pump sprocket
8. Fuel injection pump

**REMOVAL SERVICE POINTS****◀A▶ INJECTION PIPE REMOVAL**

Loosen the nuts at the end of the injection pipe with the corresponding holders (delivery holder for pump side and nozzle holder for nozzle side) retained by a spanner, etc.

**◀B▶ FUEL INJECTION PUMP SPROCKET REMOVAL**

Remove the sprocket installing nut and remove sprocket from pump drive shaft with special tool.

Caution

1. Do not hit pump drive shaft with hammer, etc.
2. When holding injection pump, do not allow to dangle by holding accelerator lever or fast idle lever. Do not remove these levers. Removal will cause injection pump malfunction.

FUEL SUPPLY AND ENGINE CONTROL

CONTENTS

120002464

GENERAL INFORMATION	2	FUEL TANK	4
SERVICE ADJUSTMENT PROCEDURES	2	ACCELERATOR CABLE AND PEDAL	7
Accelerator Cable Inspection and Adjustment ...	2	FUEL FILTER	
Fuel Filter Cartridge Replacement		<PETROL-POWERED VEHICLES>	9
<Diesel-powered Vehicles>	3	FUEL FILTER	
Power Relay Check		<DIESEL-POWERED VEHICLES>	10
<Diesel-powered Vehicles>	3		

GENERAL INFORMATION

120000602

A cable-type accelerator mechanism and a suspended-type pedal have been adopted. The fuel tank is equipped with a valve assembly (roll-over valve). It prevents fuel from leaking out of the fuel tank if the vehicle rolls over.

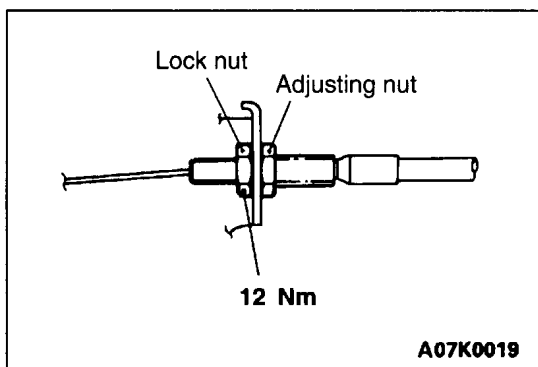
The fuel tank is equipped with a fuel shut-off valve. It prevents fuel from leaking out of the fuel tank when the fuel filler cap is opened and when fuel is being supplied.

SERVICE ADJUSTMENT PROCEDURES

120000603

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT

1. Turn the A/C and all lamps OFF so that there is no electrical load when inspecting.
2. Warm the engine until the engine idling speed becomes stable.
3. Check that the engine idling speed is at the specified value.
4. Stop the engine and turn the ignition switch to OFF.
5. Check that there are no sharp bends in the accelerator cable.
6. Check the amount of play in the inner cable.
7. If there is excessive play in the inner cable, adjust play by the following procedures.
 - (1) Turn the ignition switch to the ON position (without starting the engine) and leave in that condition for approximately 15 seconds in order to initialize the ISC motor. <MPI>
 - (2) Loosen the adjusting nut and fully close the throttle lever.
 - (3) Tighten the adjusting nut until immediately before the throttle lever starts to move.
 - (4) Loosen the adjusting nut one turn.
 - (5) Fix the adjusting nut with the lock nut.
 - (6) After adjusting, check that the throttle lever is touching the stopper.



FUEL FILTER CARTRIDGE REPLACEMENT <Diesel-powered vehicles>

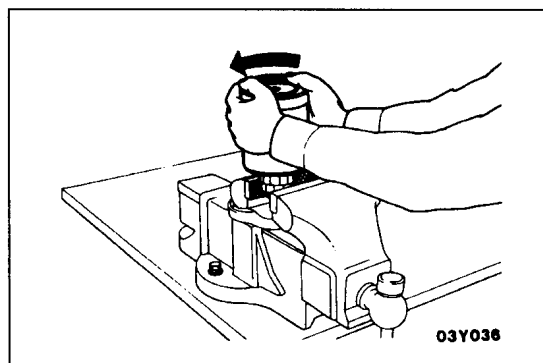
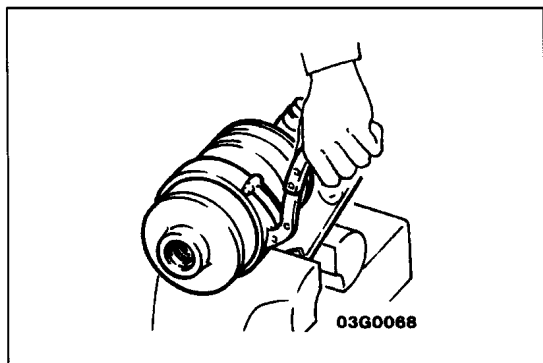
120002656

- (1) Remove the fuel filler cap to release the pressure inside the fuel tank.
- (2) Disconnect the water level sensor connector.
- (3) Remove the fuel filter. (Refer to P.13F-10.)

Caution

Cover with a rag to prevent fuel from spraying out.

- (4) Secure the fuel filter pump in a vise, and use an oil filter wrench to remove the fuel filter cartridge.



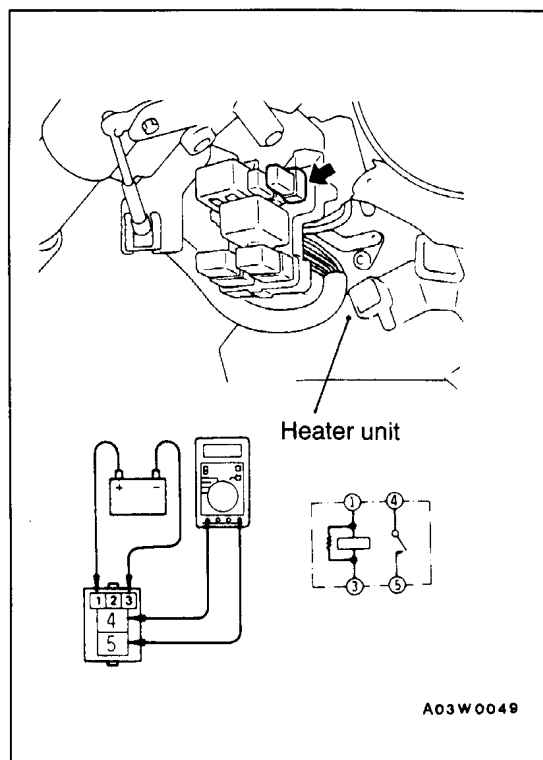
- (5) Secure the water level sensor in a vise and turn the fuel filter cartridge with both hands to remove the water filter sensor.
- (6) After installing a new filter, bleed all air from the fuel line.
- (7) Start the engine, and check that there are no fuel leakages.

POWER RELAY CHECK <Diesel-powered vehicles>

120002469

FUEL LINE HEATER RELAY CONTINUITY INSPECTION

Battery voltage	Terminal No.			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○



FUEL TANK

120002465

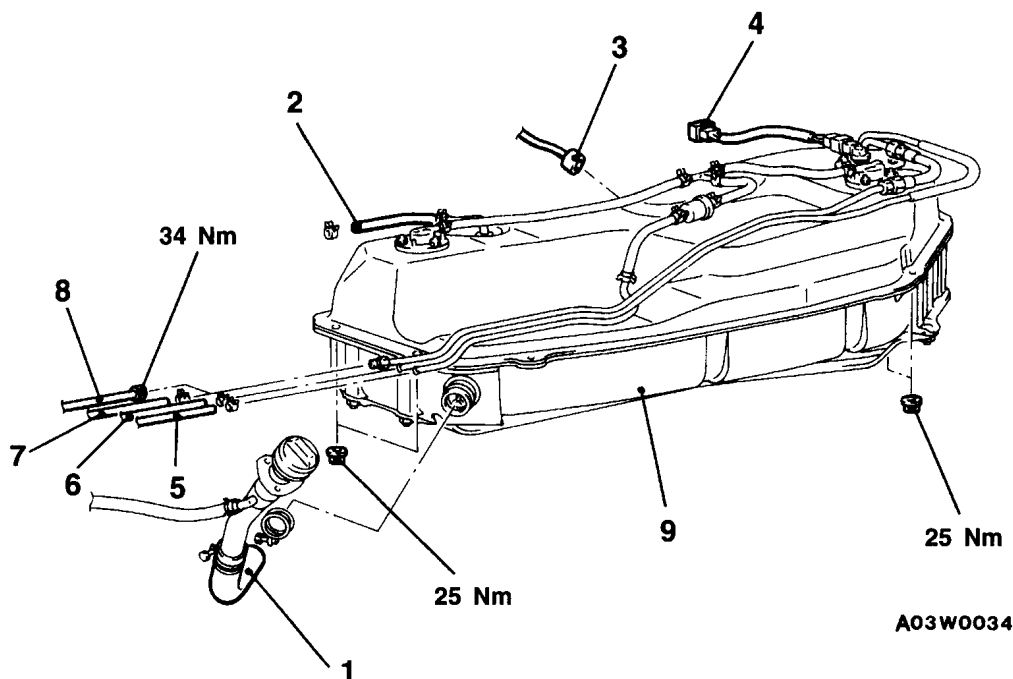
REMOVAL AND INSTALLATION

Pre-removal Operation

- Fuel Draining
- Fuel Discharge Prevention <MPI> (Refer to GROUP 13A – Service Adjustment Procedures.)

Post-Installation Operation

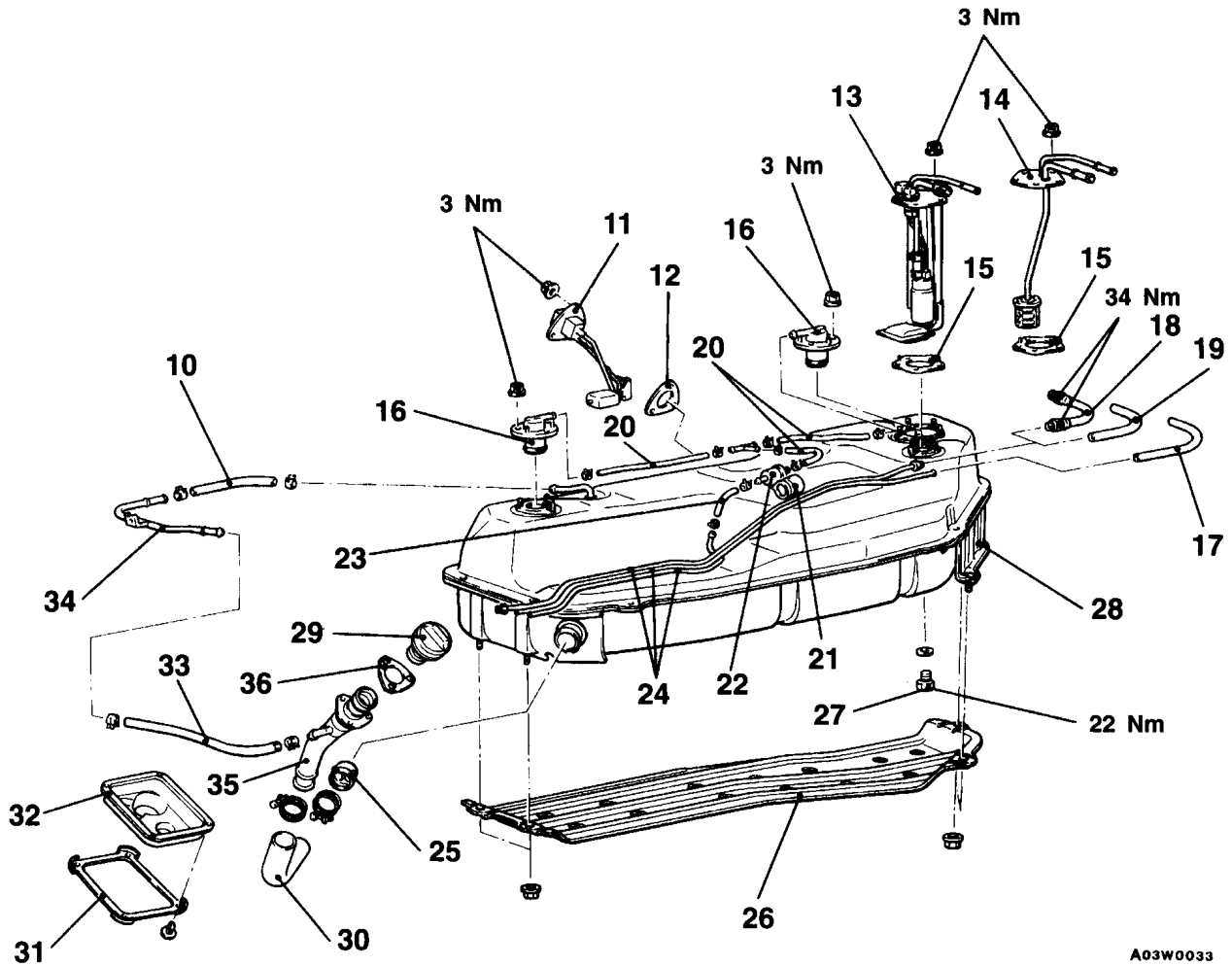
- Fuel Refilling
- Fuel Leakage Inspection



A03W0034

Fuel tank removal steps

1. Filler hose connection
2. Leveling hose connection
3. Fuel gauge unit connector
4. Fuel pump connector
<Petrol-powered vehicles>
5. Vapour hose connection
<Vehicles with MPI and vehicles with carburettor>
6. Return hose connection
7. High-pressure fuel hose connection
<MPI>
8. Main hose connection <Diesel-powered vehicles and Carburettor>
9. Fuel tank



A03W0033

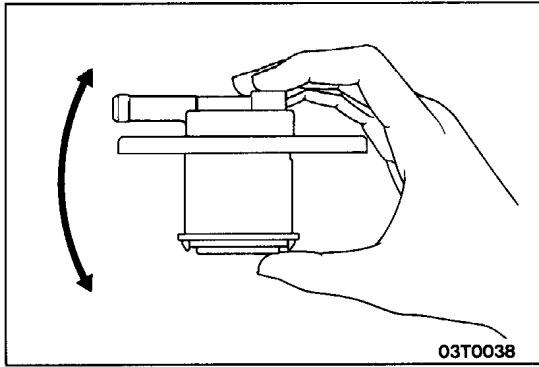
- 10. Leveling hose
- 11. Fuel gauge unit
- 12. Packing
- 13. Fuel pump
- 14. Fuel filter assembly
- 15. Packing
- 16. Valve assembly
- 17. Return hose
- 18. High-pressure fuel hose <MPI>
- 19. Main hose <Diesel-powered vehicles and Carburettor>
- 20. Vapour hose
- 21. Breather case <Diesel-powered vehicles>
- 22. 2-way valve
- 23. Vapour hose <Petrol-powered vehicles>
- 24. Fuel pipe
- 25. Fuel shut-off valve
- 26. Fuel tank under cover <4WD>
- 27. Drain bolt
- 28. Fuel tank

Fuel filler neck removal steps

- 29. Fuel filler cap
- 30. Filler hose
- 31. Dust plate
- 32. Dust cover
- 33. Leveling hose
- 34. Connector pipe
- 35. Filler neck
- 36. Packing

Fuel gauge unit removal steps

- 3. Fuel gauge unit connector
- 11. Fuel gauge unit
- 12. Packing

**INSPECTION****VALVE ASSEMBLY**

If the sound of the float valve moving (knocking sound) can be heard when the valve assembly is gently shaken up and down, then the valve is okay.

FUEL GAUGE

Refer to GROUP 54 – Combination Meter.

ACCELERATOR CABLE AND PEDAL

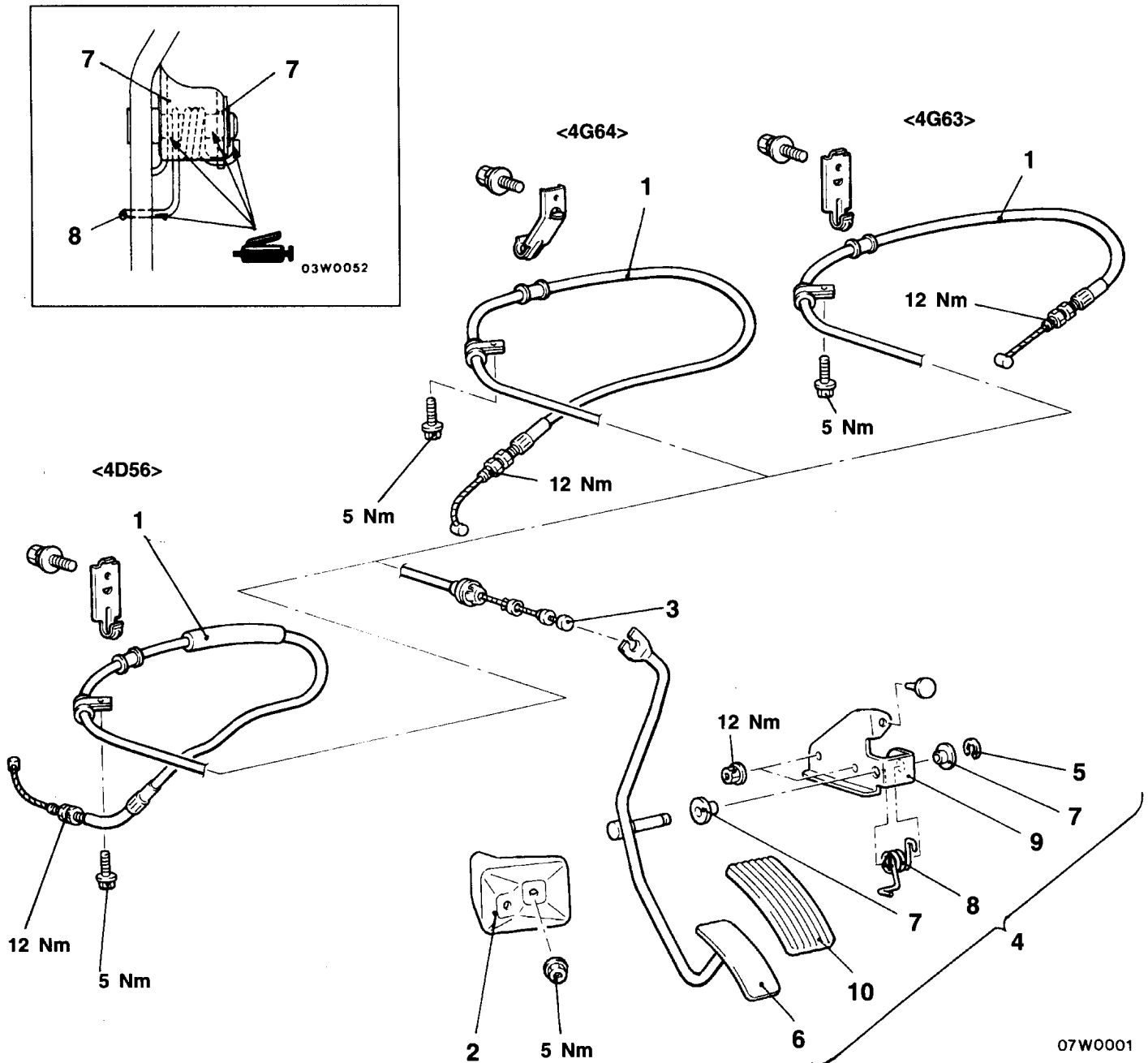
120002466

REMOVAL AND INSTALLATION

<L.H. DRIVE VEHICLES>

Post-installation Operation

- Accelerator Cable Adjustment (Refer to P. 13F-2.)



07W0001

00002924

1. Accelerator cable
2. Accelerator pedal stopper

Accelerator pedal removal steps

3. Accelerator cable connection
4. Accelerator pedal assembly
5. Snap ring

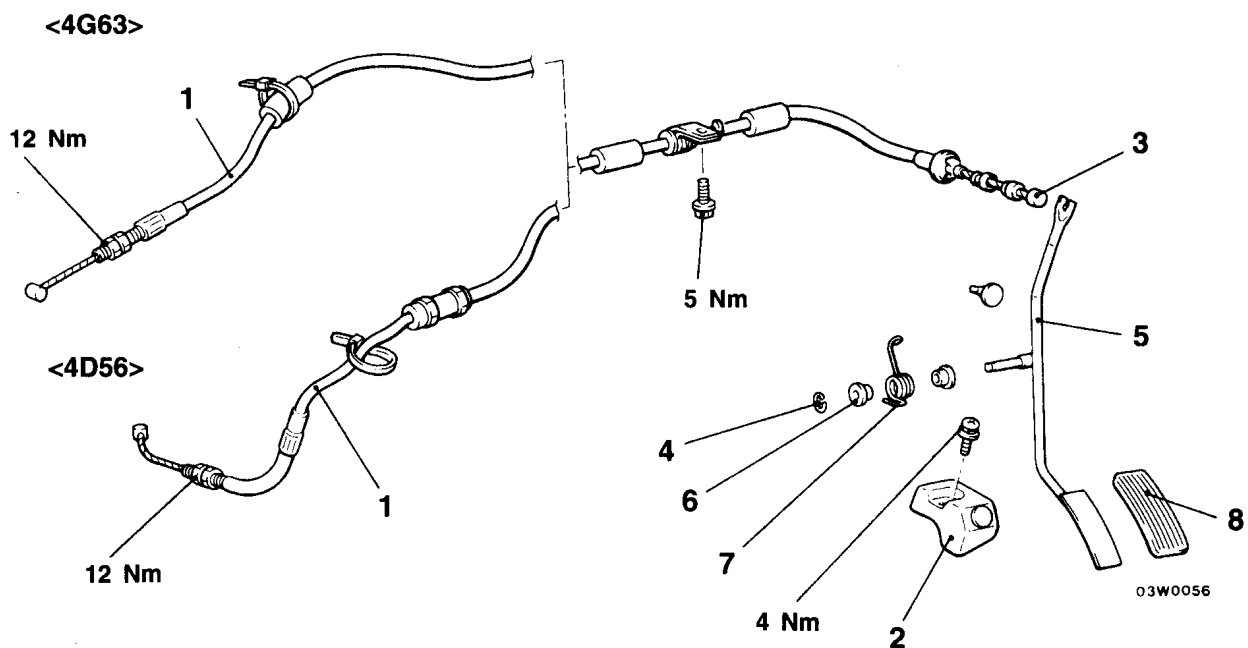
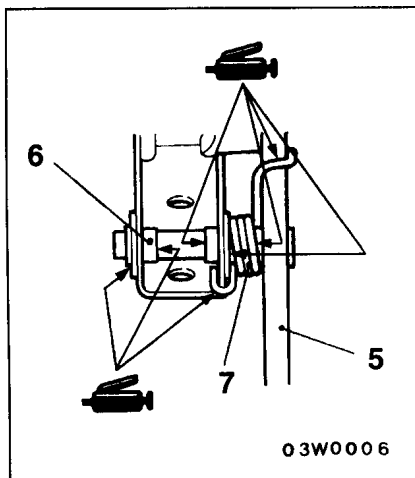
6. Accelerator pedal arm
7. Bushing
8. Spring
9. Accelerator pedal bracket
10. Pedal pad

13F-8 FUEL SUPPLY AND ENGINE CONTROL — Accelerator Cable and Pedal

<R.H. DRIVE VEHICLES>

Post-installation Operation

- Accelerator Cable Adjustment (Refer to P. 13F-2.)



1. Accelerator cable
2. Accelerator pedal stopper

Accelerator pedal removal steps

3. Accelerator cable connection
4. Snap ring
5. Accelerator pedal arm
6. Bushing
7. Spring
8. Pedal pad

FUEL FILTER <PETROL-POWERED VEHICLES>

120002467

REMOVAL AND INSTALLATION

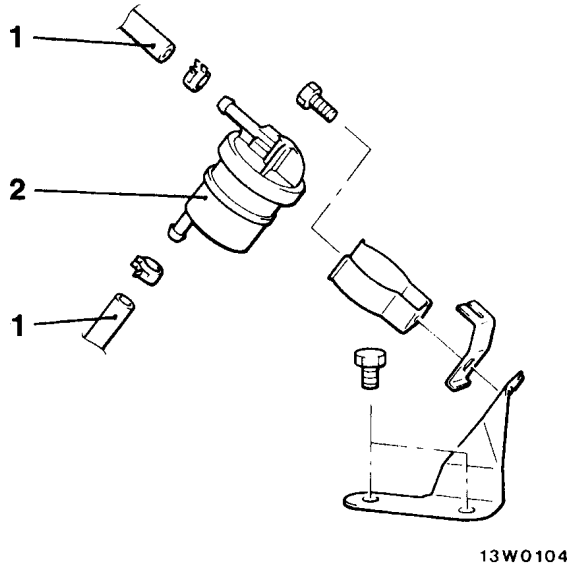
Pre-removal Operation

- Fuel Discharge Prevention <MPI> (Refer to GROUP 13A – Service Adjustment Procedures.)
- Battery Removal

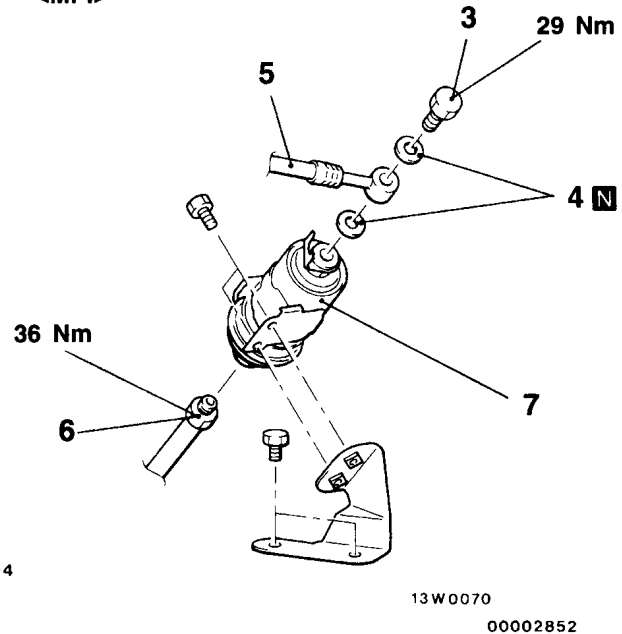
Post-installation Operation

- Battery Installation
- Fuel Leakage Inspection

<Carburettor>



<MPI>



Removal steps <Carburettor>

1. Fuel hose connection
2. Fuel filter

<MPI>

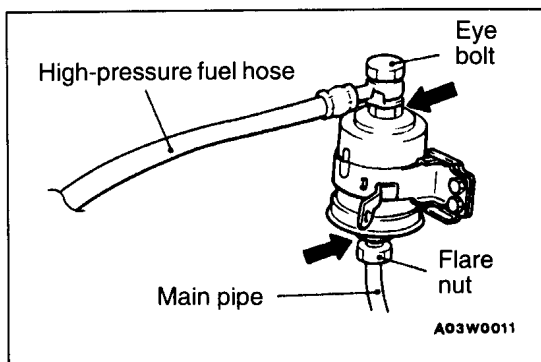
3. Eye bolt
4. Gasket
5. High-pressure fuel hose connection
6. Main pipe connection
7. Fuel filter

REMOVAL SERVICE POINTS

◀A▶ FUEL HOSE/FUEL FILTER REMOVAL

Caution

Cover with a rag to prevent fuel from spraying out.



◀B▶ EYE BOLT/GASKET/HIGH-PRESSURE FUEL HOSE/MAIN PIPE REMOVAL

1. Hold the fuel filter with a spanner and remove the eye bolt. Then remove the high-pressure fuel hose.

Caution

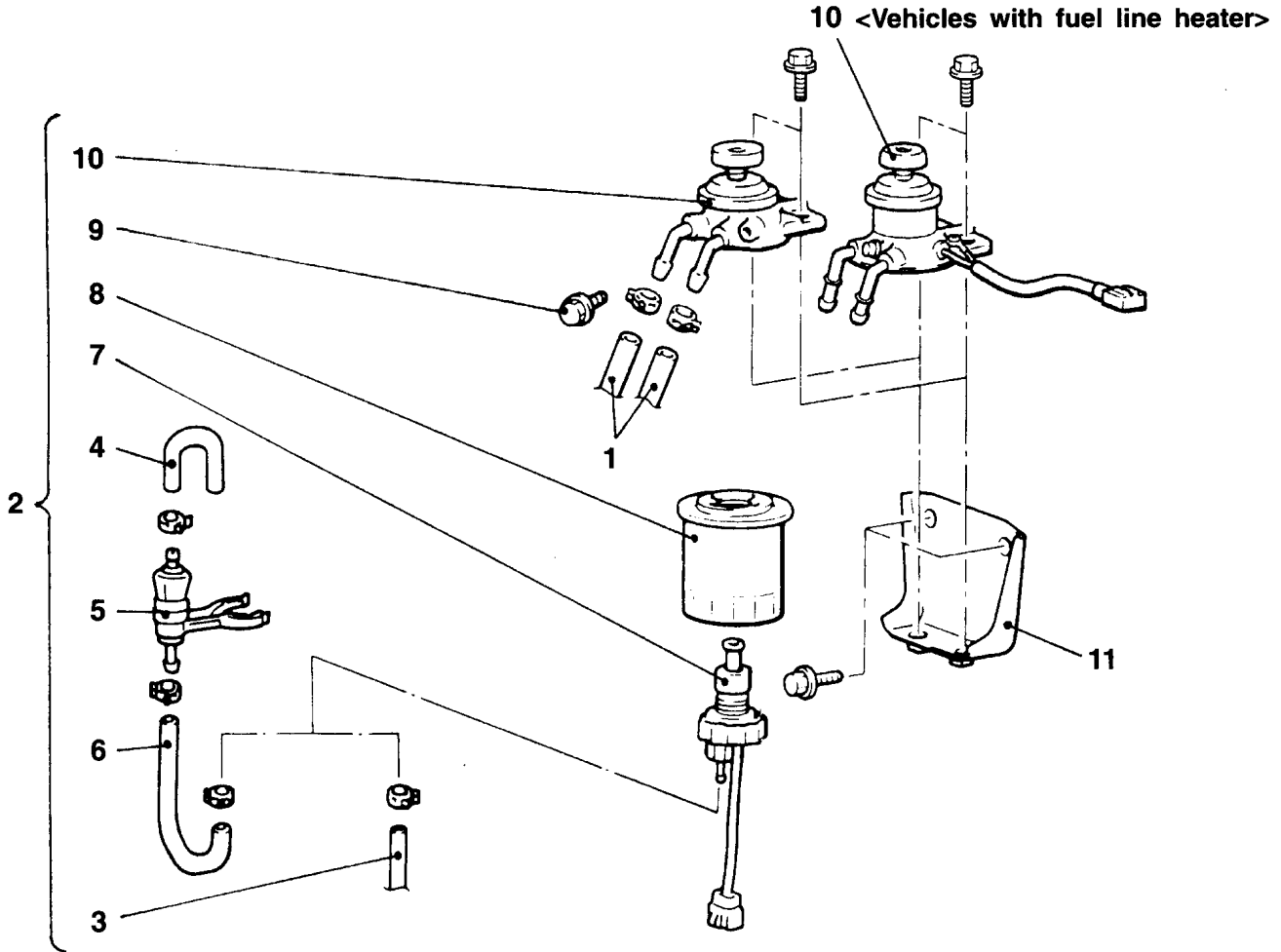
As there will be some pressure remaining in the fuel pipe line, cover it with a rag to prevent fuel from spraying out.

2. Hold the fuel filter with a spanner and loosen the flare nut. Then disconnect the main pipe connection.

FUEL FILTER <DIESEL-POWERED VEHICLES>

REMOVAL AND INSTALLATION

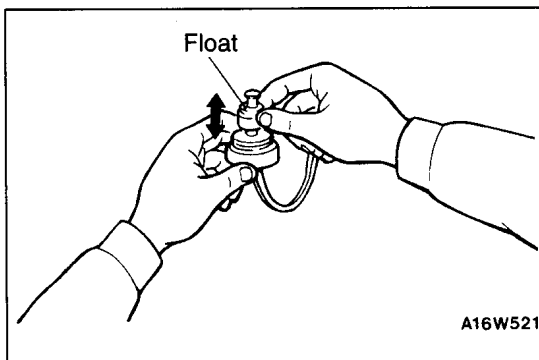
- Pre-removal and Post-Installation Operation**
- Battery Removal and Installation



A13W0106

Removal steps

- A◀
1. Main hose connection
 2. Fuel filter
 3. Tube <Except R.H. drive vehicles with 2 batteries>
 4. Tube <R.H. drive vehicles with 2 batteries>
 5. Drain plug assembly <R.H. drive vehicles with 2 batteries>
 6. Drain hose <R.H. drive vehicles with 2 batteries>
 7. Water level sensor
 8. Fuel filter cartridge
 9. Breather screw
 10. Fuel filter pump
 11. Fuel filter bracket

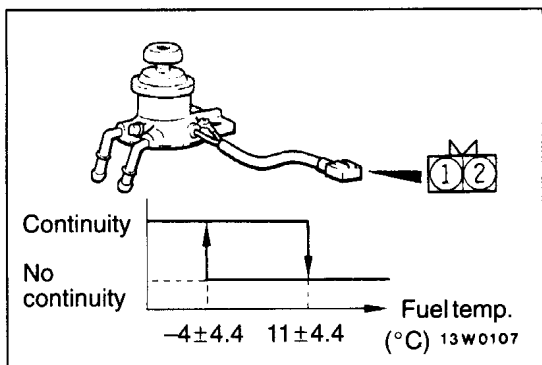


A16W521

INSPECTION

WATER LEVEL SENSOR

Connect the circuit tester to the water level sensor connector. The water level sensor is operating correctly if there is continuity when the float is raised and no continuity when it is lowered.



FUEL LINE HEATER CONTINUITY INSPECTION

There should be continuity between the terminals when the fuel filter pump is cooled to -4°C or below and continuity should disappear when the pump is gradually heated. If this is true, then the heater is working properly.

INSTALLATION SERVICE POINT

◀A▶ FUEL MAIN HOSE INSTALLATION

If the pipe has a stepped part, connect securely up to the stepped part. If the pipe has no stepped part, insert so that the inserted portion is 20–25 mm long.

