FUEL

CONTENTS

13109000720

MULTIPOINT FUEL INJECTION (MPI)

CONTENTS

13109000737

GENERAL INFORMATION

13100010739

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

FUEL INJECTION CONTROL

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

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

Fuel injection is normaly carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1–2–3–4–5–6. This is called sequential fuel injection. The engine-ECU provides a richer air/fuel mixture by carrying out “open-loop” control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the engine-ECU controls the air/fuel mixture by using the oxygen sensor signal to carry out “closed-loop” control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst.

IDLE AIR CONTROL

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

IGNITION TIMING CONTROL

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

SELF-DIAGNOSIS FUNCTION

1. 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.
2. When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
3. 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

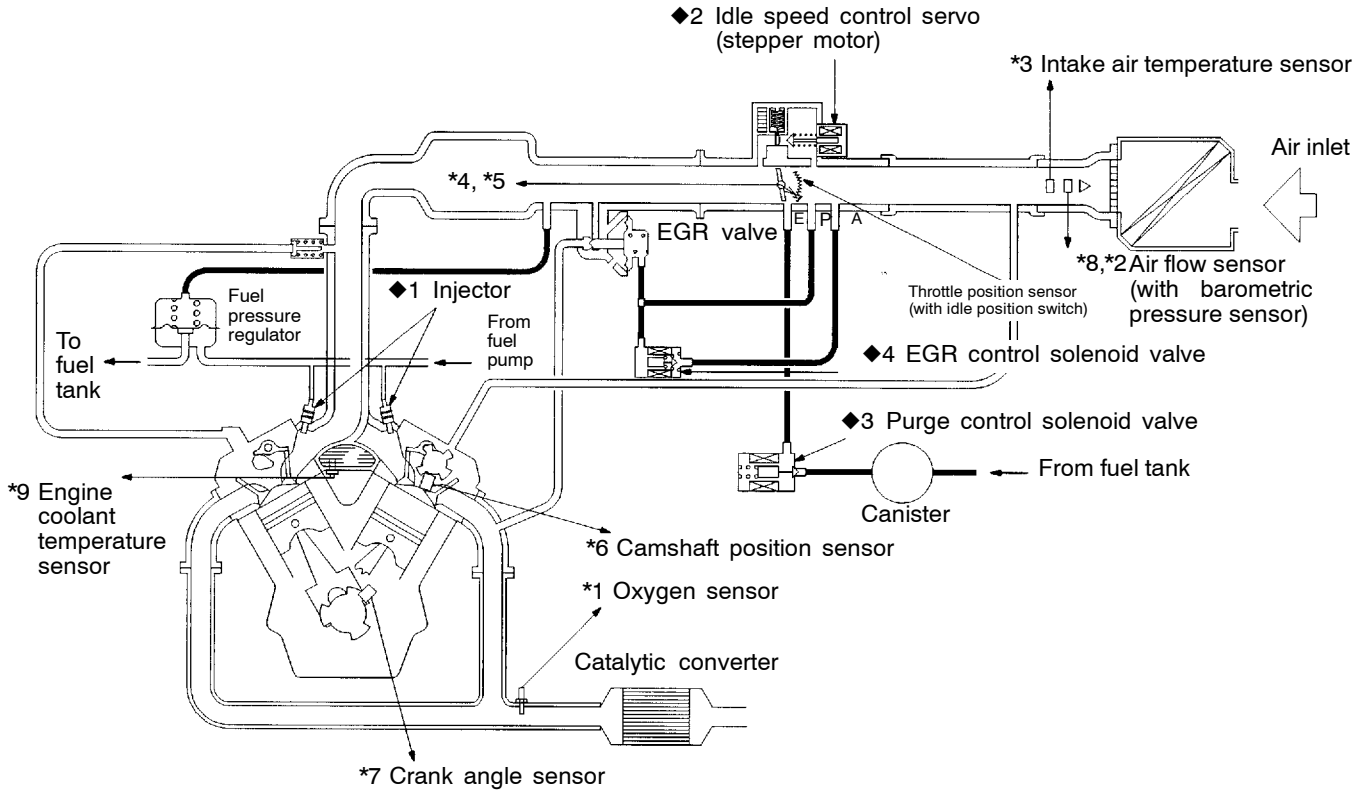
1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
4. EGR Control Solenoid Valve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

GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	60
	Throttle position sensor	Variable resistor type
	Idle speed control servo	Stepper motor type (Stepper motor type by-pass air control system with the air volume limiter)
	Idle position switch	Rotary contact type, within throttle position sensor
Engine-ECU	Identification model No.	E2T63687
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Vehicle speed sensor	Magnetic resistive element type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Power steering fluid pressure switch	Contact switch type
Actuators	Control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector type and number	Electromagnetic type, 6
	Injector identification mark	EDH210
Fuel pressure regulator	Regulator pressure kPa	329

SYSTEM DIAGRAM

*1. Oxygen sensor *2. Air flow sensor *3. Intake air temperature sensor *4. Throttle position sensor *5. Idle position switch *6. Camshaft position sensor *7. Crank angle sensor *8. Barometric pressure sensor *9. Engine coolant temperature sensor --- ● Power supply ● Vehicle speed sensor ● A/C switch ● Power steering fluid pressure switch ● Ignition switch–ST ● Ignition switch–IG	⇨ Engine-ECU ⇨	◆1 Injector ◆2 Idle speed control servo ◆3 Purge control solenoid valve ◆4 EGR control solenoid valve --- ● Fuel pump relay ● Control relay ● A/C power relay ● Condenser fan relay ● Engine warning lamp ● Diagnosis signal ● Ignition coil, power transistor



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SERVICE SPECIFICATIONS

13100030513

Items		Specifications
Basic idle speed r/min		700 ± 50
Throttle position sensor adjusting voltage mV		400 – 1,000
Throttle position sensor resistance kΩ		3.5 – 6.5
Idle speed control servo coil resistance Ω		28 – 33 (at 20°C)
Intake air temperature sensor resistance kΩ	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 disconnection	324 – 343 at kerb idle
	Vacuum hose connection	Approx. 265 at kerb idle
Injector coil resistance Ω		13 – 16 (at 20°C)

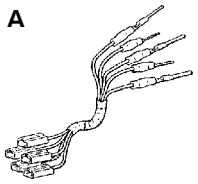
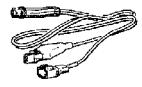
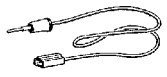
SEALANT

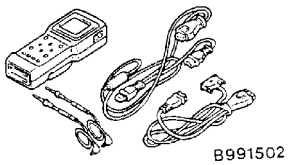
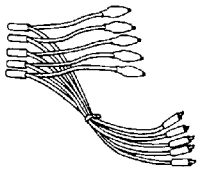
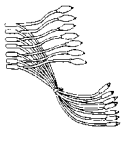
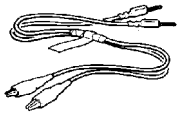
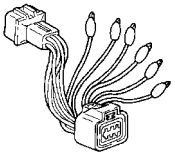
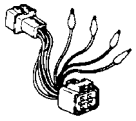
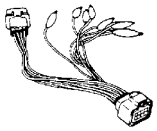
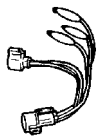
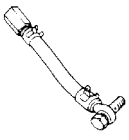
13100050229

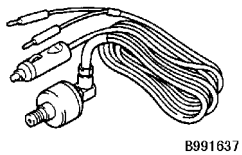
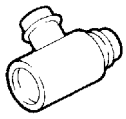
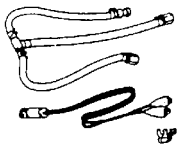
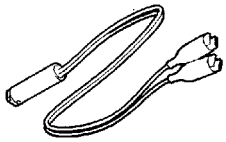
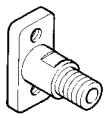
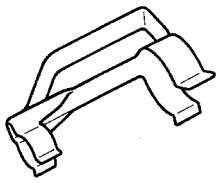
Item	Specified sealant	Remark
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

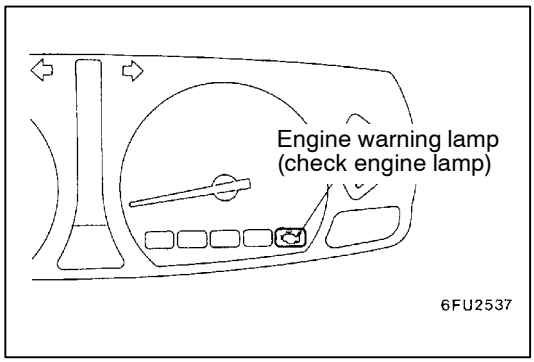
SPECIAL TOOLS

13100060574

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

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	• Reading diagnosis code • MPI system inspection • Measurement of fuel pressure
	MB991348 MB991658	Test harness set	• Adjustment of idle position switch and throttle position sensor • Inspection using an analyzer
	MB991709	Test harness	• Trouble shooting-voltage measurement • Inspection using an analyzer
	MB991529	Diagnosis code check harness	• Reading diagnosis code • Adjustment of basic idle speed
	MD998463	Test harness (6-pin, square)	• Inspection of idle speed control servo • Inspection using an analyzer
	MD998464	Test harness (4-pin, square)	Inspection of oxygen sensor
	MD998474	Test harness (8 pin, square)	Inspection using an analyzer
	MD998478	Test harness (3 pin, triangle)	
	MD998709	Adaptor hose	Measurement of fuel pressure

Tool	Number	Name	Use
 B991637	MB991637	Fuel pressure gauge set	Measurement of fuel pressure
	MD998742	Hose adaptor	
	MD998706	Injector test set	Checking the spray condition of injectors
 MB991607	MB991607	Injector test harness	
 MD998741	MD998741	Injector test adaptor	
	MB991692	Clip	



TROUBLESHOOTING

13100850485

DIAGNOSIS TROUBLESHOOTING FLOW

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

NOTE
When replacing the engine-ECU, replace immobilizer-ECU and ignition key as well at the same time.

DIAGNOSIS FUNCTION

13100860679

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

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

Engine warning lamp inspection items

Engine-ECU
Oxygen sensor
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Barometric pressure sensor
Injector
Ignition coil, power transistor
Immobilizer system

METHOD OF READING AND ERASING DIAGNOSIS CODES

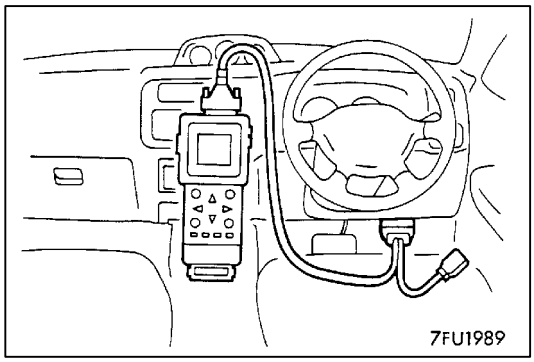
Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine control unit to DIAGNOSIS 2 mode using the MUT-II.
2. Carry out a road test.
3. Take a reading of the diagnosis code and repair the problem location.
4. Turn the ignition switch to OFF and then back to ON again.

   NOTE
   By turning the ignition switch to OFF, the ENGINE-ECU will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.

5. Erase the diagnosis codes.



INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function.
   If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II.
5. Start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

13100910428

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

Malfunctioning item	Control contents during malfunction
Air flow sensor	1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) to take reading of the basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Camshaft position sensor	Injects fuel to all cylinders simultaneously. (However, after the ignition switch is turned to ON, the No. 1 cylinder top dead centre is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Ignition coil, power transistor unit	Cut off the fuel supply to cylinders with an abnormal ignition signal.
Oxygen sensor	Air/fuel ratio feed back control (closed loop control) is not performed.

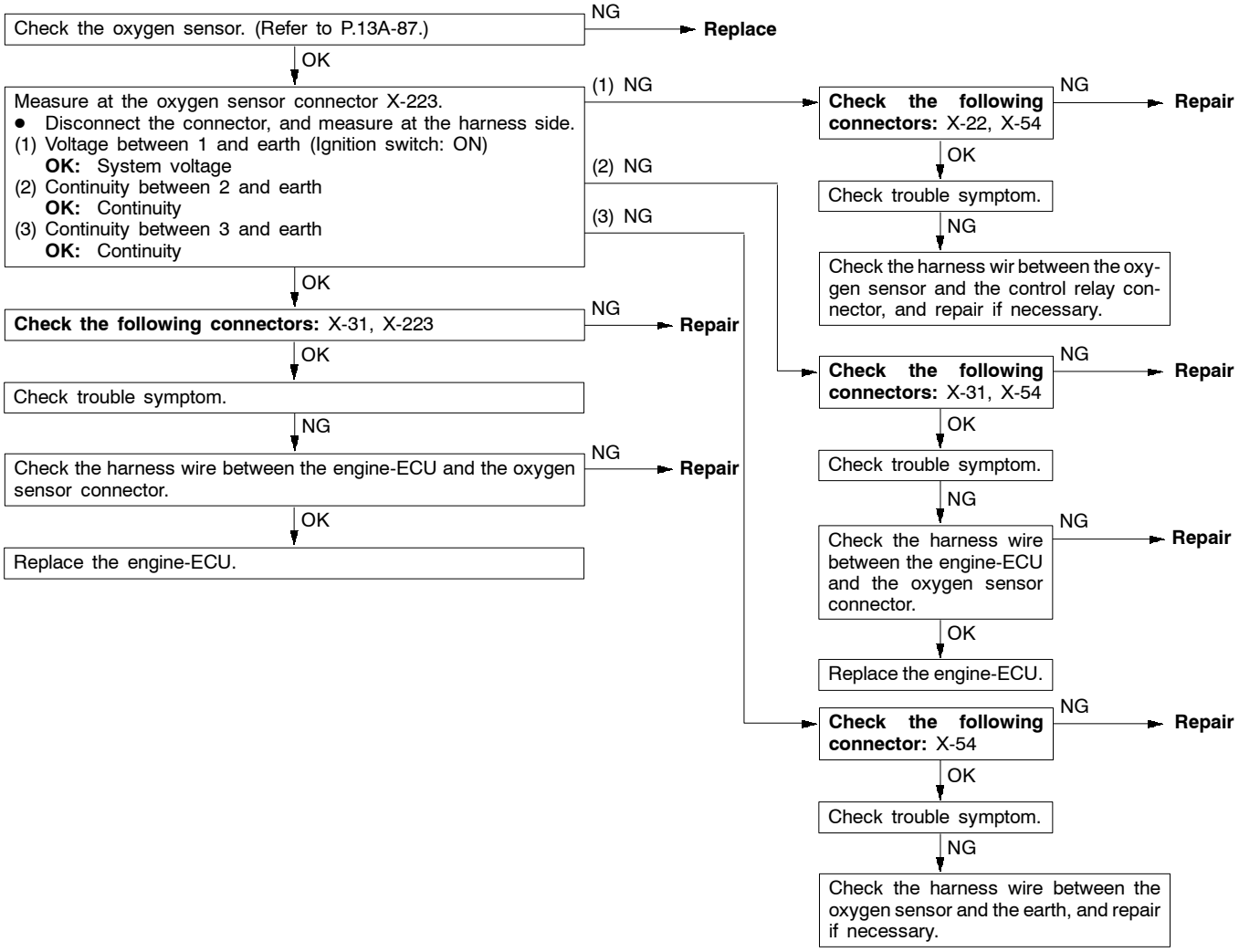
INSPECTION CHART FOR DIAGNOSIS CODES

13100870818

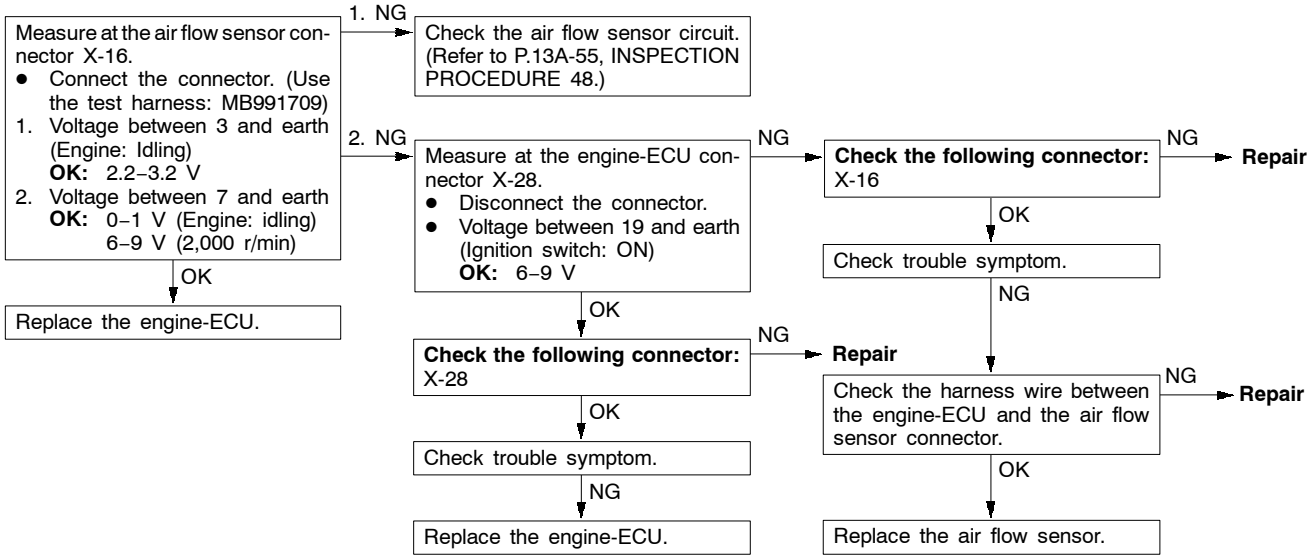
Code No.	Diagnosis item	Reference page
11	Oxygen sensor system	13A-13
12	Air flow sensor system	13A-14
13	Intake air temperature sensor system	13A-14
14	Throttle position sensor system	13A-15
21	Engine coolant temperature sensor system	13A-16
22	Crank angle sensor system	13A-17
23	Camshaft position sensor system	13A-18
24	Vehicle speed sensor system	13A-19
25	Barometric pressure sensor system	13A-20
41	Injector system	13A-21
44	Ignition coil and power transistor unit system (for No. 1 and No. 4 cylinders)	13A-22
52	Ignition coil and power transistor unit system (for No. 2 and No. 5 cylinders)	13A-22
53	Ignition coil and power transistor unit system (for No. 3 and No. 6 cylinders)	13A-22
54	Immobilizer system	13A-23

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

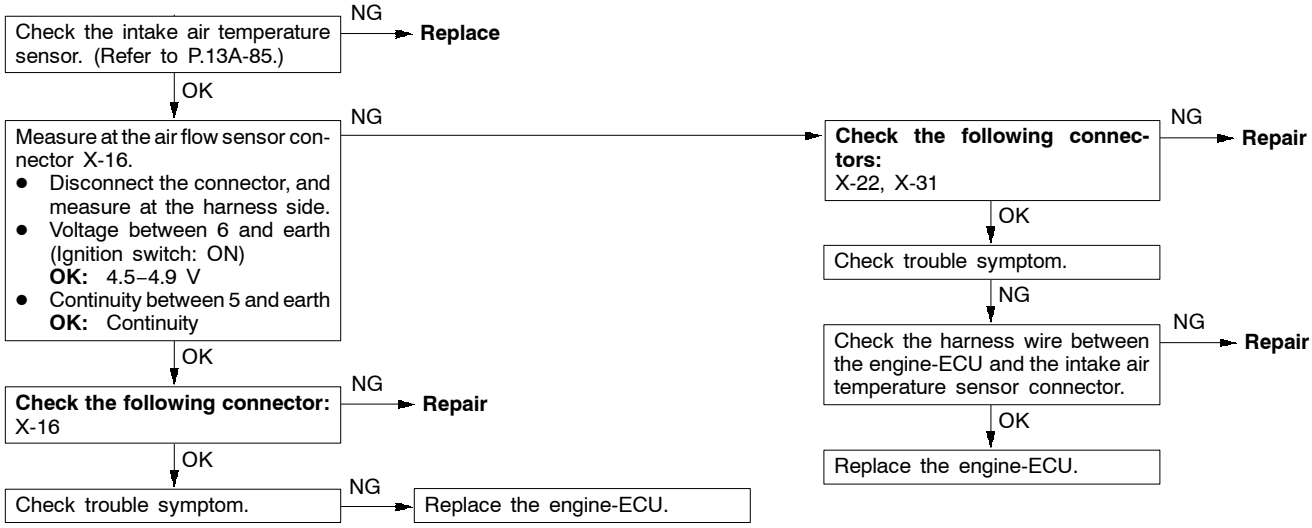
Code No.11 Oxygen sensor system	Probable cause
Range of Check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20 – 50°C ● Engine speed is approx. 2,000 – 3,000 r/min ● Vehicle is moving at constant speed on a flat, level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



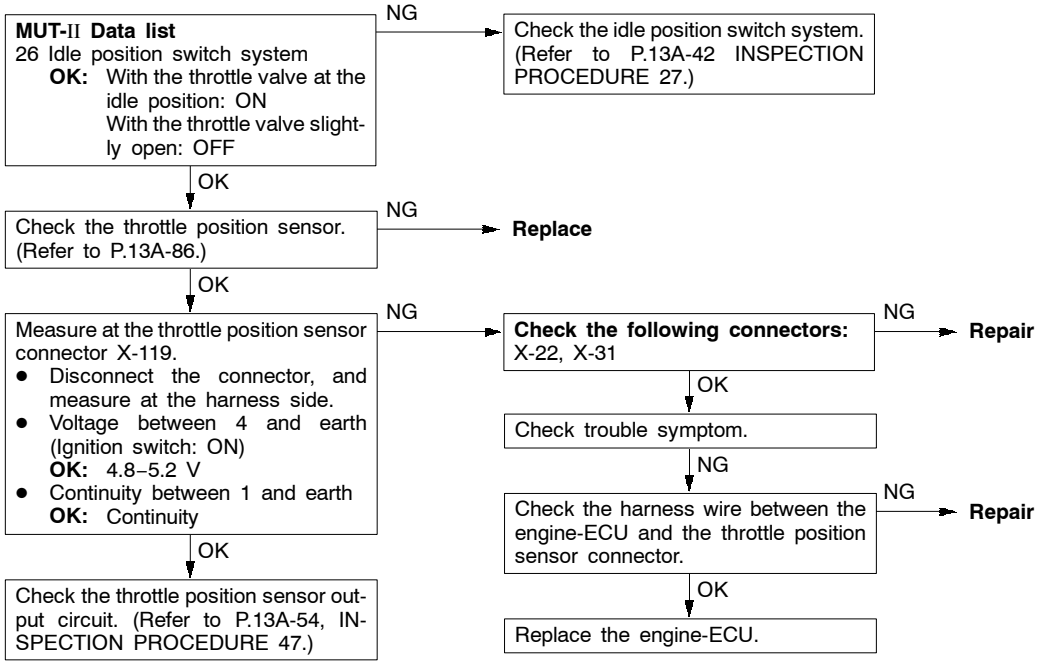
Code No. 12 Air flow sensor system	Probable cause
Range of Check ● Engine speed is 500 r/min or more. Set conditions ● Sensor output frequency is 3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Improper connector contact, open circuit or short-circuited harness wire of the air flow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



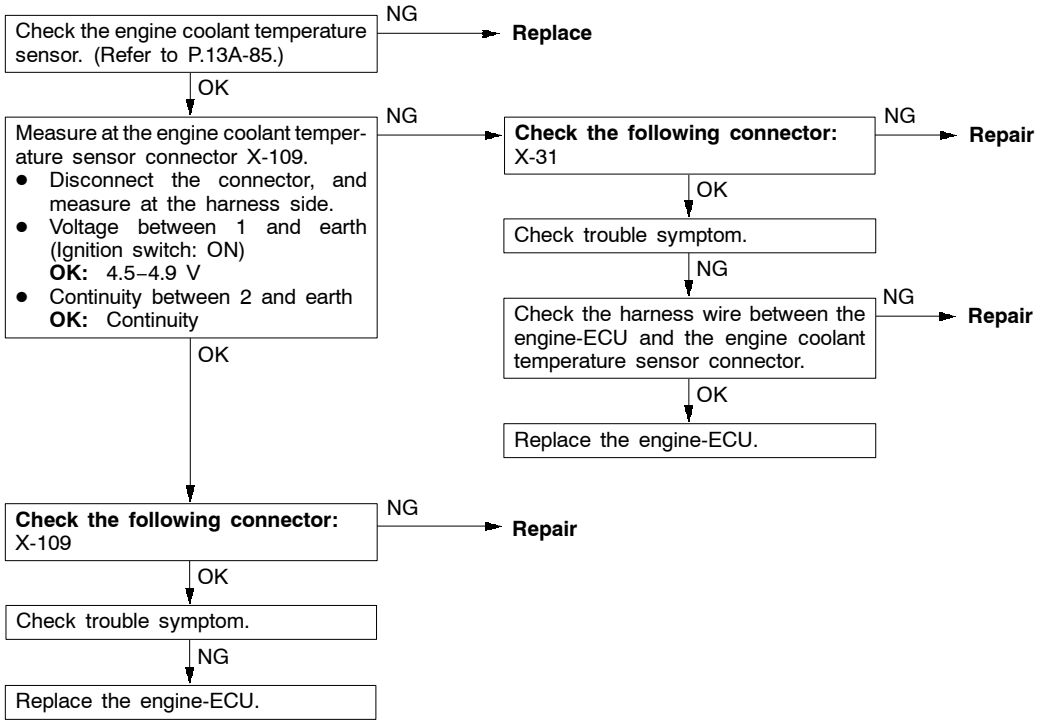
Code No. 13 Intake air temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions ● Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature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



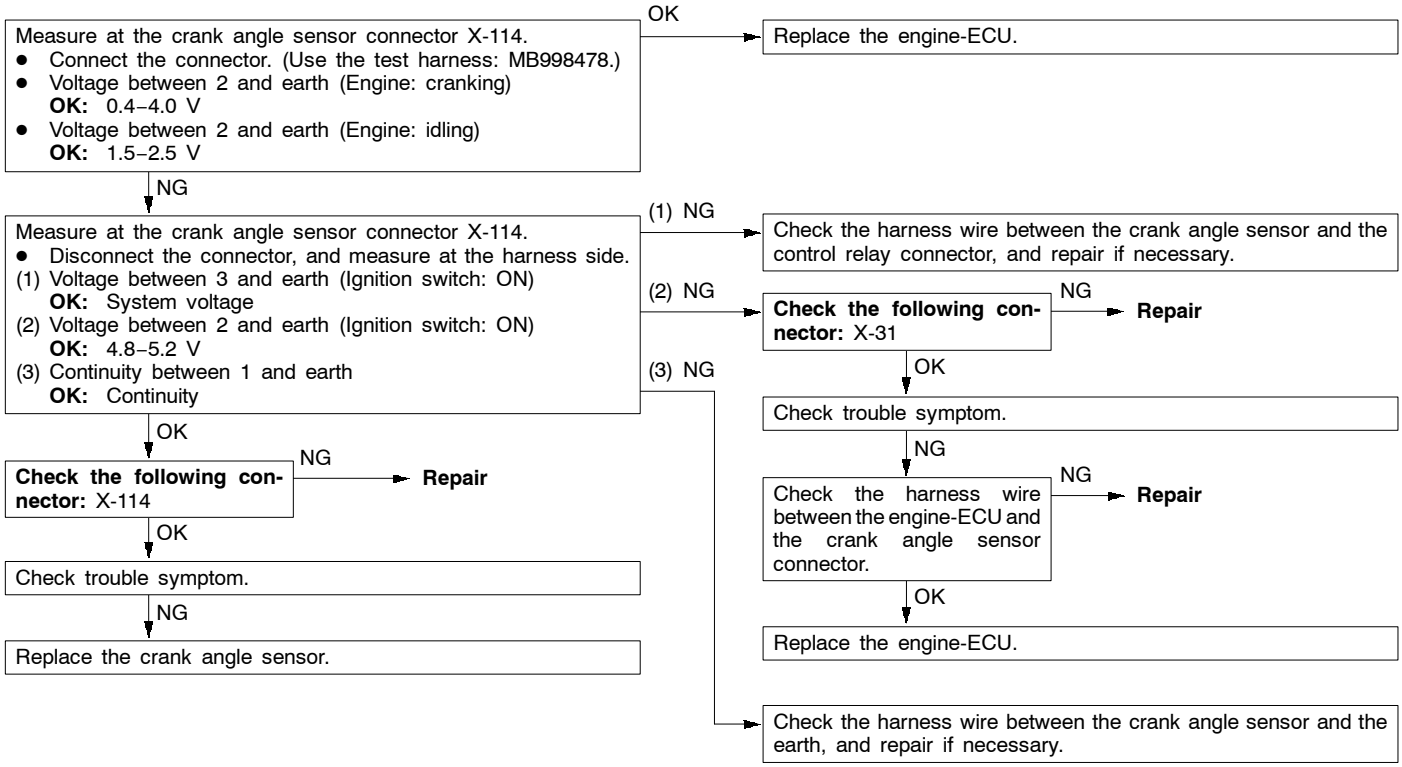
Code No. 14 Throttle position sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions ● When the idle position switch is ON, the sensor output voltage is 2 V or more for 4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



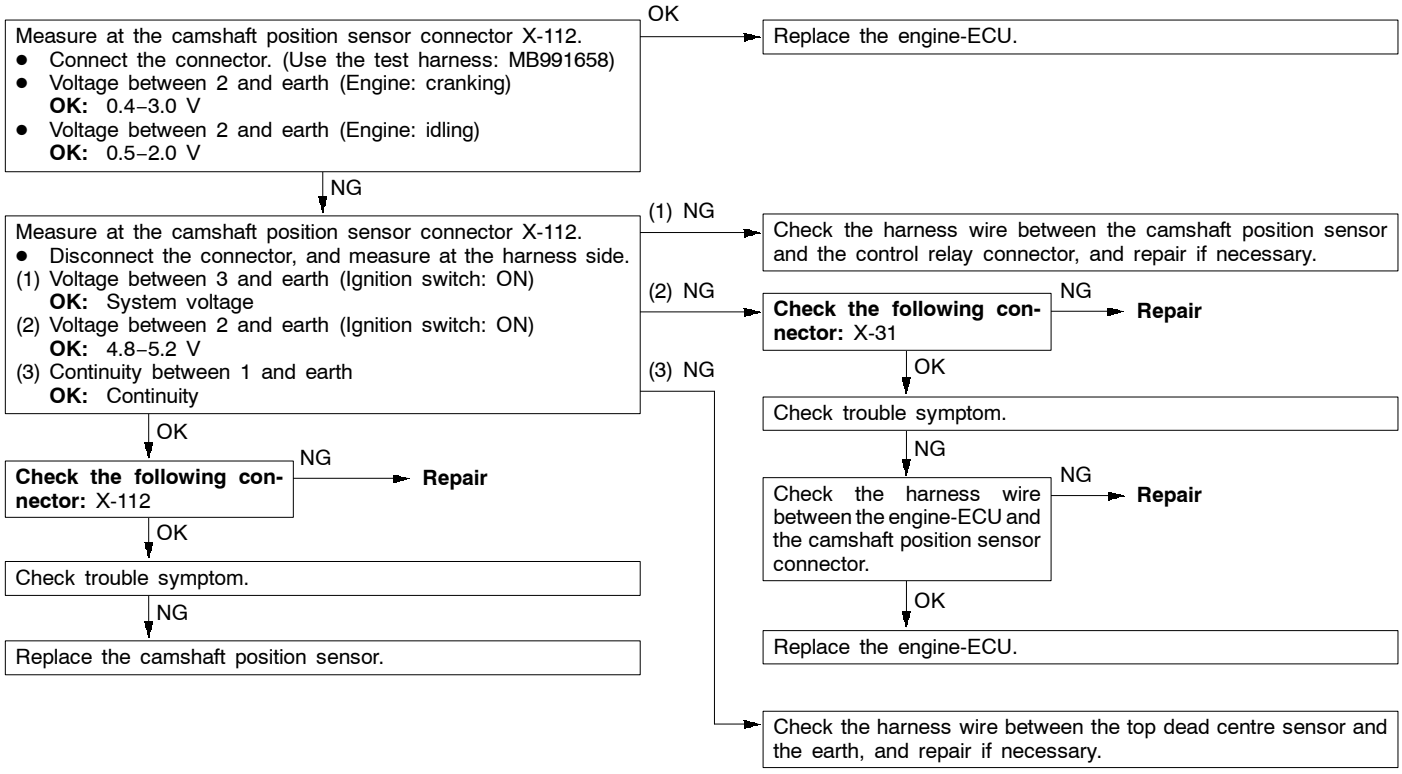
Code No. 21 Engine coolant temperature sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions ● Sensor output voltage is 4.6 V or more (corresponding to an engine coolant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



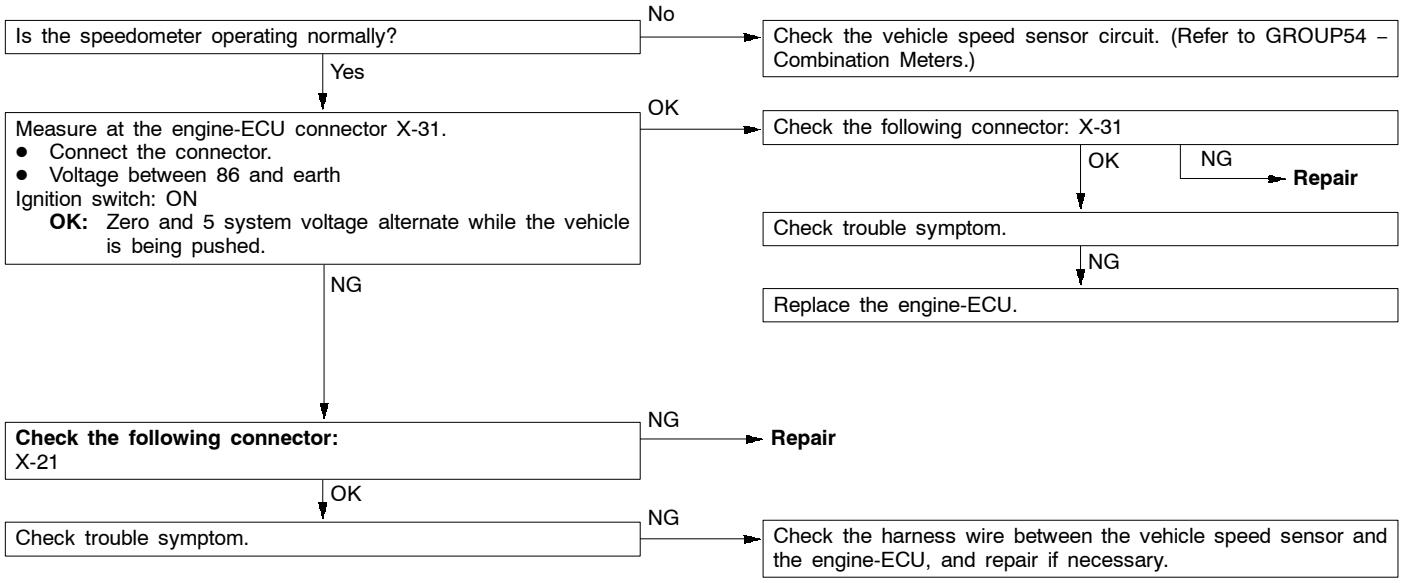
Code No. 22 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input.)	● Malfunction of the crank angle sensor ● Improper connector contact, open circuit or short-circuited harness wire of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



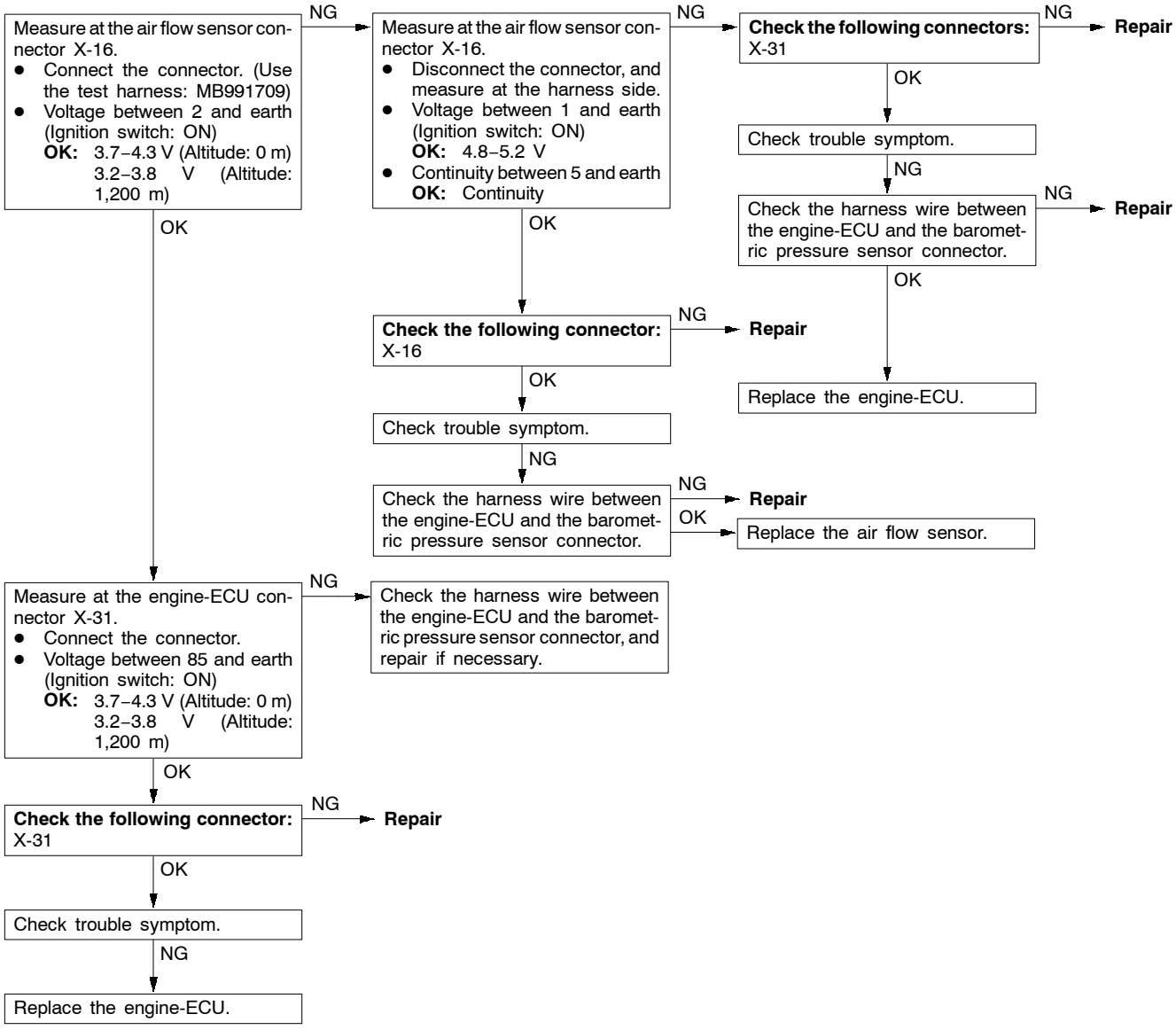
Code No. 23 Camshaft position sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Engine speed is approx. 50 r/min or more. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input.)	● Malfunction of the camshaft position sensor ● Improper connector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



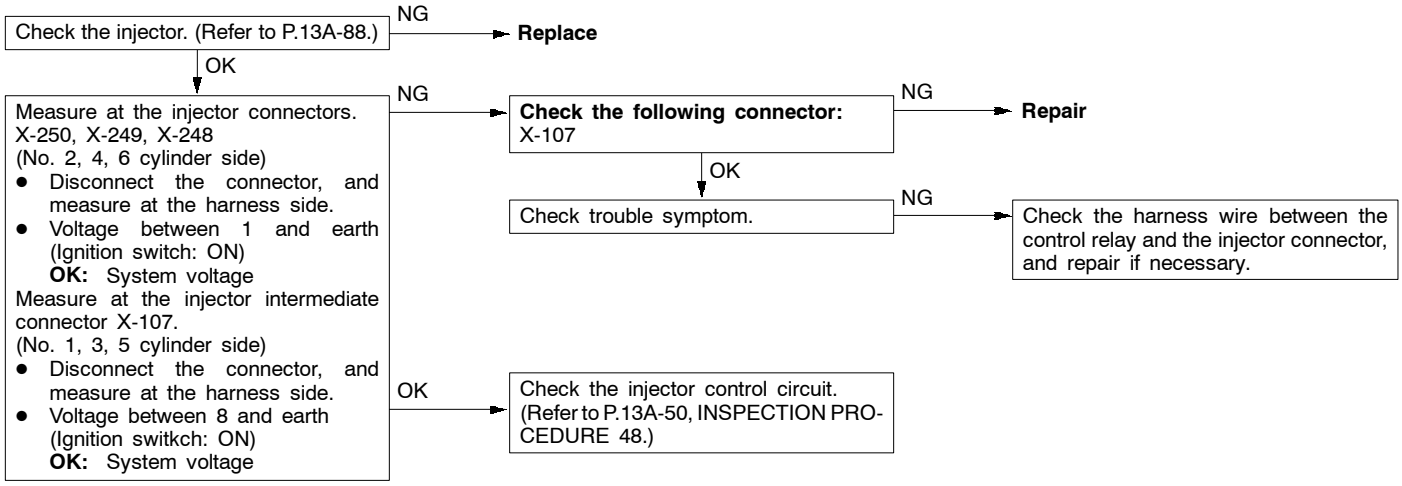
Code No.24 Vehicle speed sensor system	Probable cause
Range of Check ● Excluding 60 seconds after the engine starts. ● Idle position switch: Off ● Engine speed is 3,000 r/min. ● Driving under high engine load conditions. Set condition ● Sensor output voltage does not changes for 4 seconds (no pulse signal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



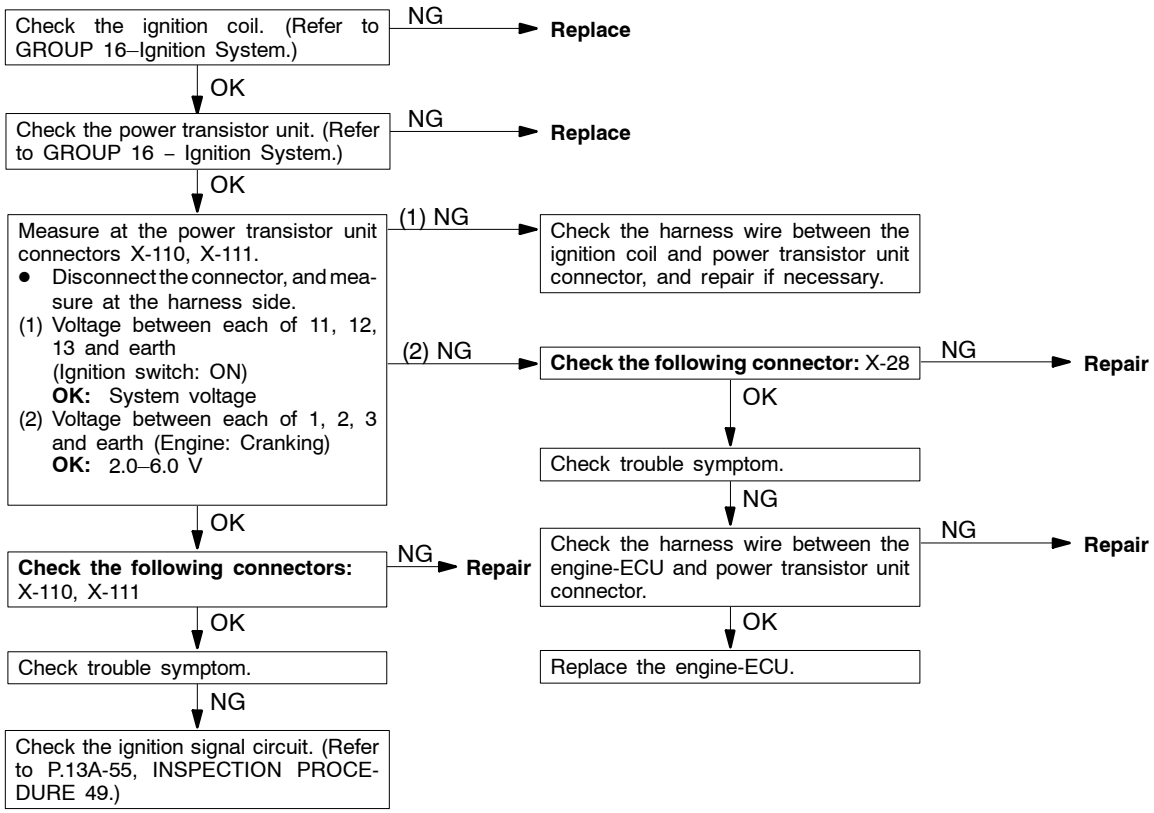
Code No. 25 Barometric pressure sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 4.5 V or more (corresponding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



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

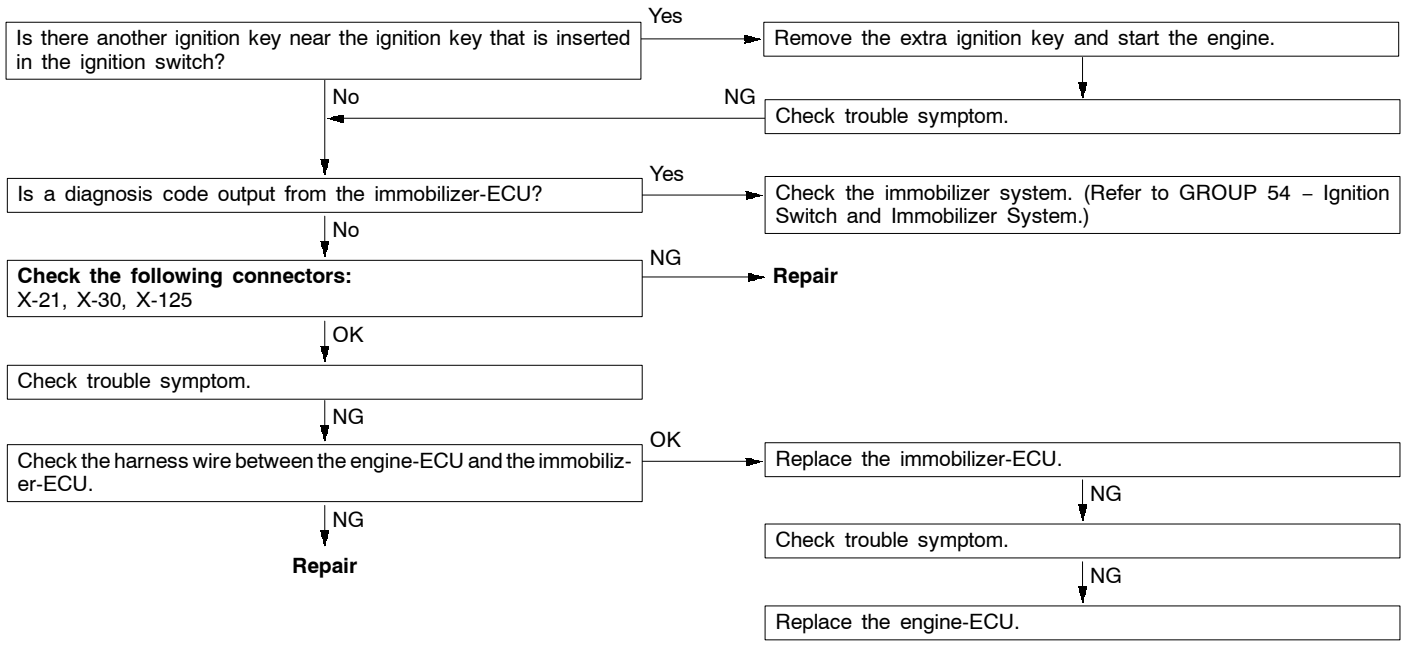


Code No. 44, 52, 53 Ignition coil and power transistor unit system	Probable cause
Range of Check ● Engine speed is approx. 50 – 4,000 r/min. ● Engine is not cranking. Set conditions ● The ignition signal from the same coil is not input for 4 seconds. However, this excludes cases where no ignition signal is input from any coils.	● Malfunction of the ignition coil ● Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit ● Malfunction of the power transistor unit ● Malfunction of the engine-ECU



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

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

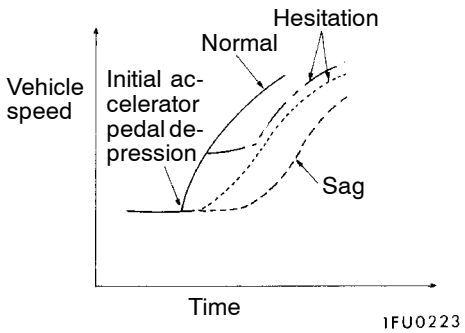
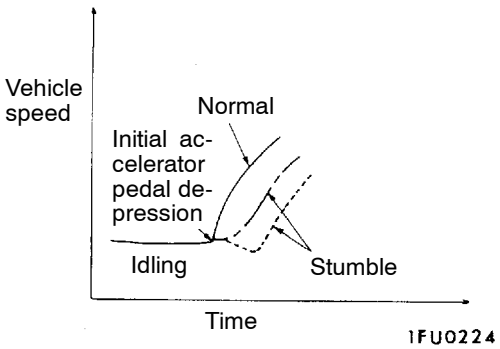


INSPECTION CHART FOR TROUBLE SYMPTOMS

13100880712

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-26
	Communication with engine-ECU only is not possible.	2	13A-26
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-27
	The engine warning lamp remains illuminating and never goes out.	4	13A-28
Starting	No initial combustion (starting impossible)	5	13A-28
	Initial combustion but no complete combustion (starting impossible)	6	13A-29
	Long time to start (improper starting)	7	13A-30
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	8	13A-31
	Idling speed is high. (Improper idling speed)	9	13A-32
	Idling speed is low. (Improper idling speed)	10	13A-32
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	11	13A-33
	When the engine becomes hot, it stalls at idling. (Die out)	12	13A-34
	The engine stalls when starting the car. (Pass out)	13	13A-35
	The engine stalls when decelerating.	14	13A-35
Driving	Hesitation, sag or stumble	15	13A-36
	The feeling of impact or vibration when accelerating	16	13A-36
	The feeling of impact or vibration when decelerating	17	13A-37
	Poor acceleration	18	13A-37
	Surge	19	13A-38
	Knocking	20	13A-38
Dieseling		21	13A-38
Too high CO and HC concentration when idling		22	13A-39
Idling speed is improper when A/C is operating		23	13A-40
A/C condensor fan is inoperative		24	13A-40

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

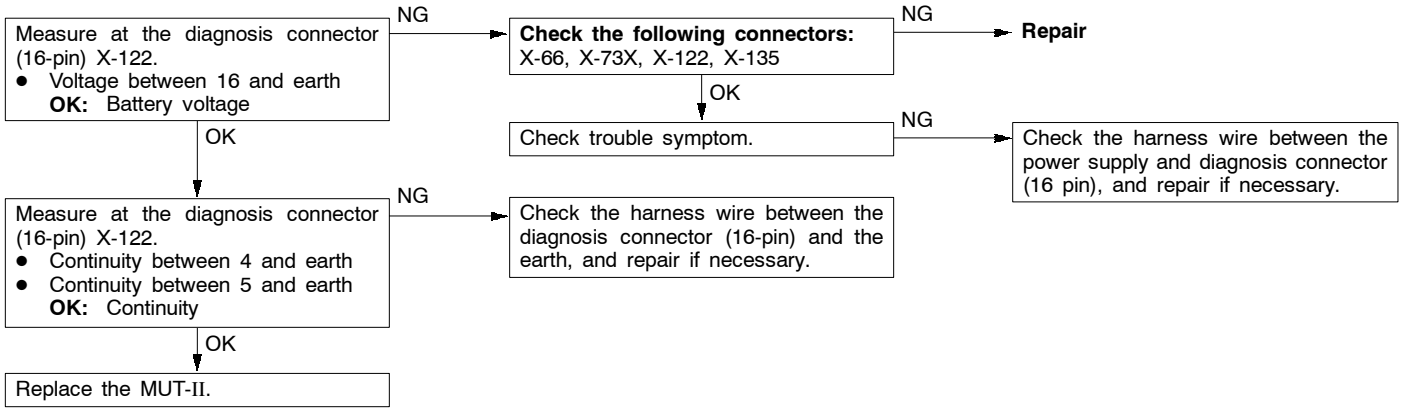
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicles is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. 

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

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

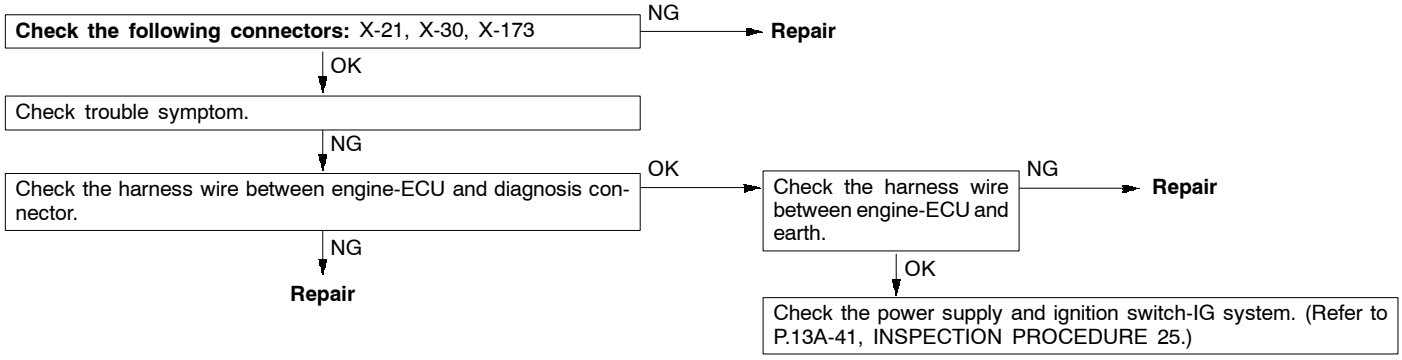
INSPECTION PROCEDURE 1

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



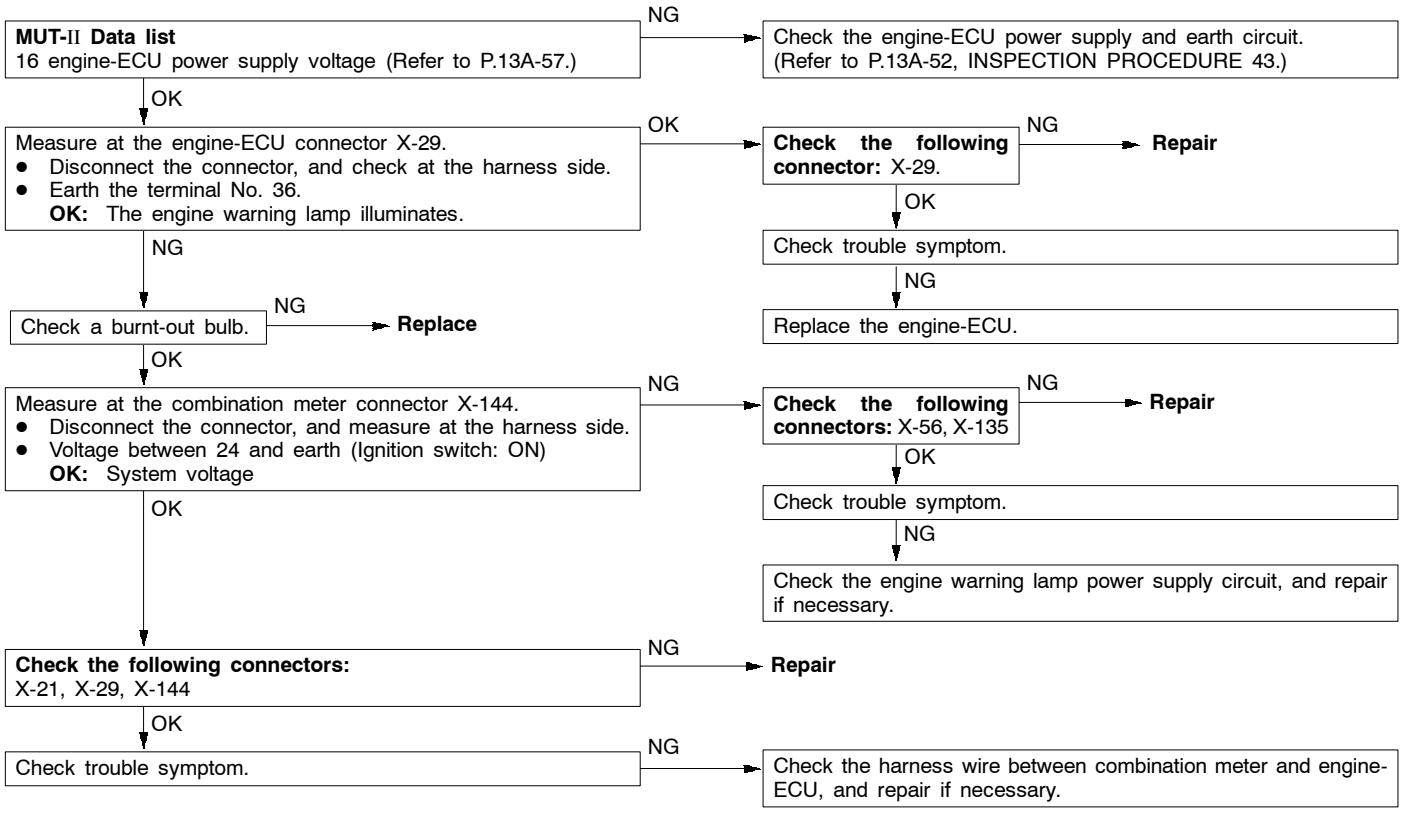
INSPECTION PROCEDURE 2

MUT-II communication with engine-ECU is not possible.	**Probable cause**
One of the following causes may be suspected. • No power supply to engine-ECU. • Defective earth circuit of engine-ECU. • Defective engine-ECU. • Improper communication line between engine-ECU and MUT-II	• Malfunction of engine-ECU power supply circuit • Malfunction of engine-ECU • 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
Because there is a burnt-out bulb, the engine-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.	• Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine-ECU



INSPECTION PROCEDURE 4

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
- Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES
- No ↓

Measure at the combination meter connector X-144.
- Disconnect the connector, and measure at the harness side.
- Disconnect the engine-ECU connector
- Continuity between 23 and earth
  OK: No continuity

- NG → Check the harness wire between combination meter and engine-ECU connector, and repair if necessary.
- OK ↓

Replace the engine-ECU.

INSPECTION PROCEDURE 5

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

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

Is immobilizer-ECU diagnosis code output?
- Yes → Check the immobilizer. (Refer to GROUP 54 – Ignition Switch and Immobilizer System.)
- No ↓

MUT-II: Inspection of no initial combustion.
(Refer to P.13A-46, INSPECTION PROCEDURE 35.)
- OK ↓

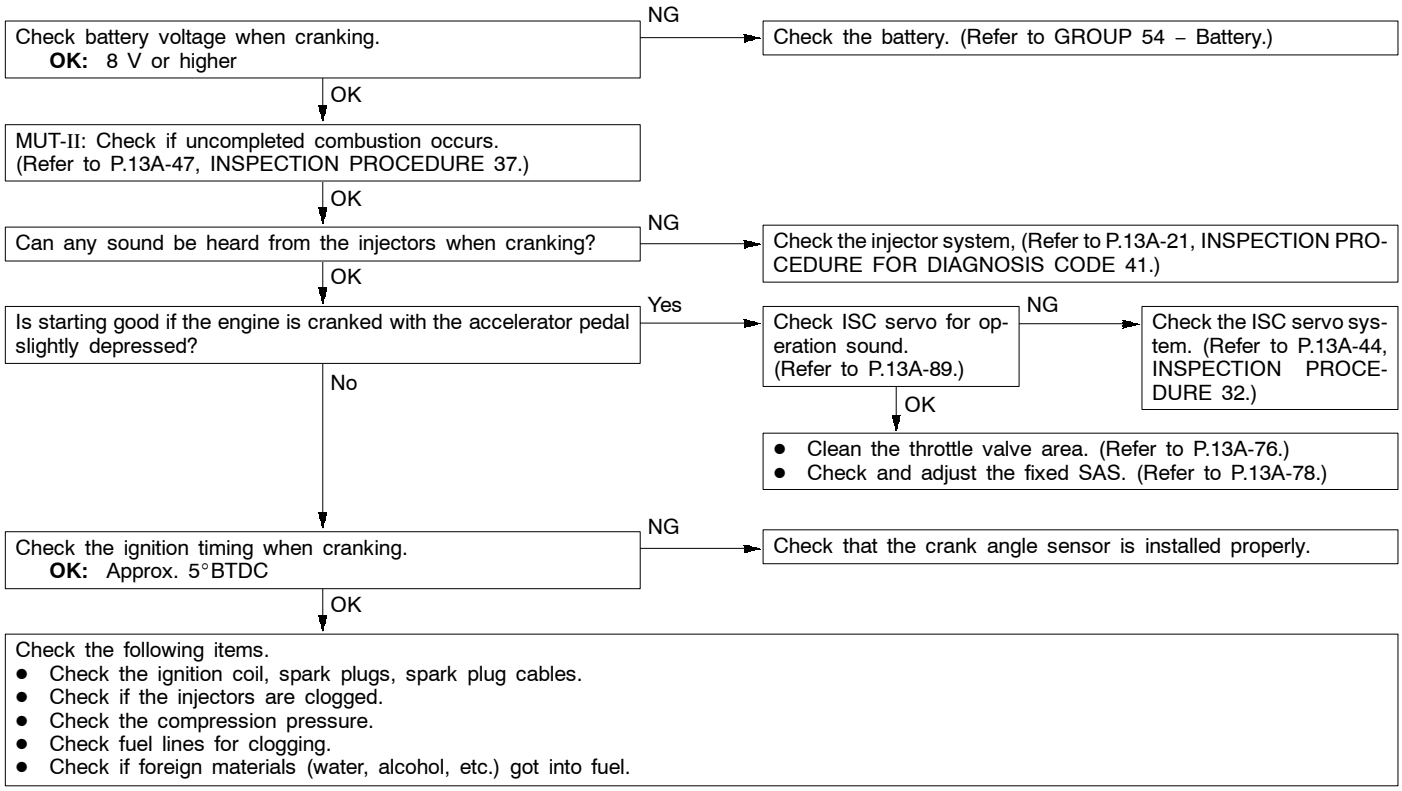
Can any sound be heard from the injectors when cranking?
- NG → Check the injector system. (Refer to P.13A-21, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 41.)
- OK ↓

Ignition system: Inspection of no initial combustion.
(Refer to P.13A-47, INSPECTION PROCEDURE 36.)
- OK ↓

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

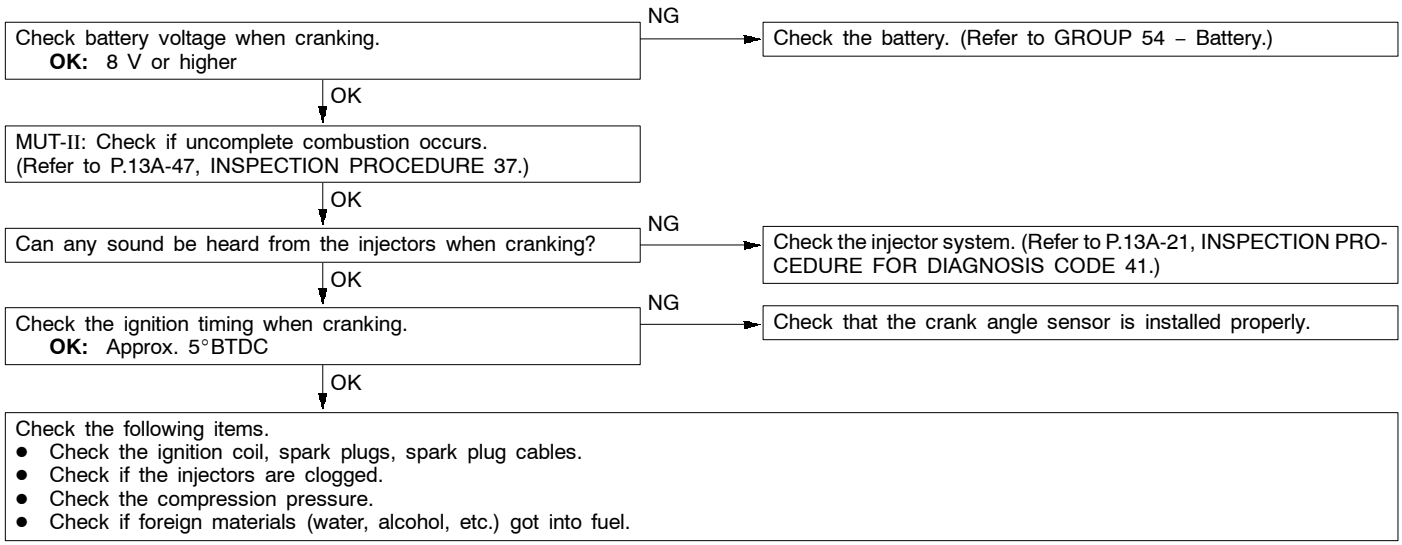
INSPECTION PROCEDURE 6

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



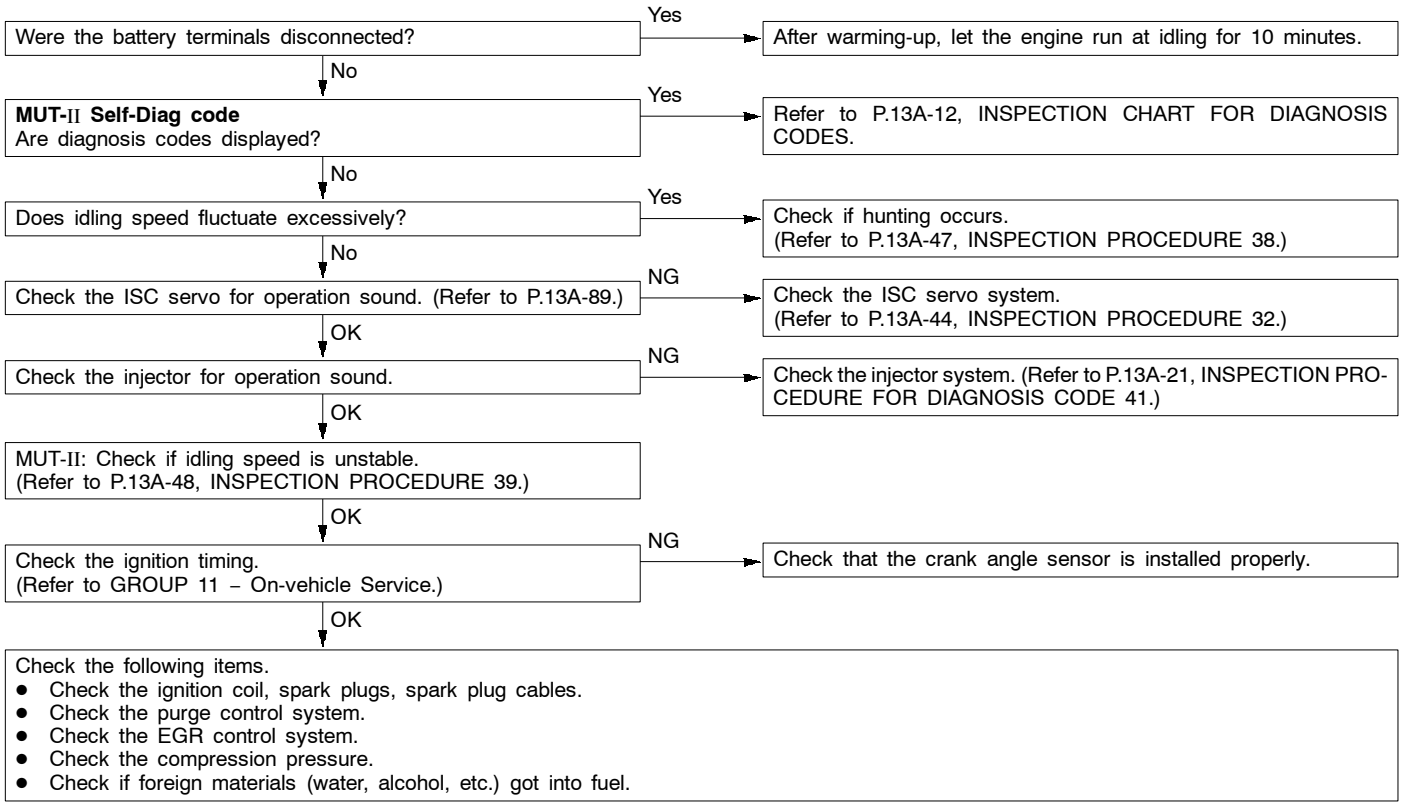
INSPECTION PROCEDURE 7

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



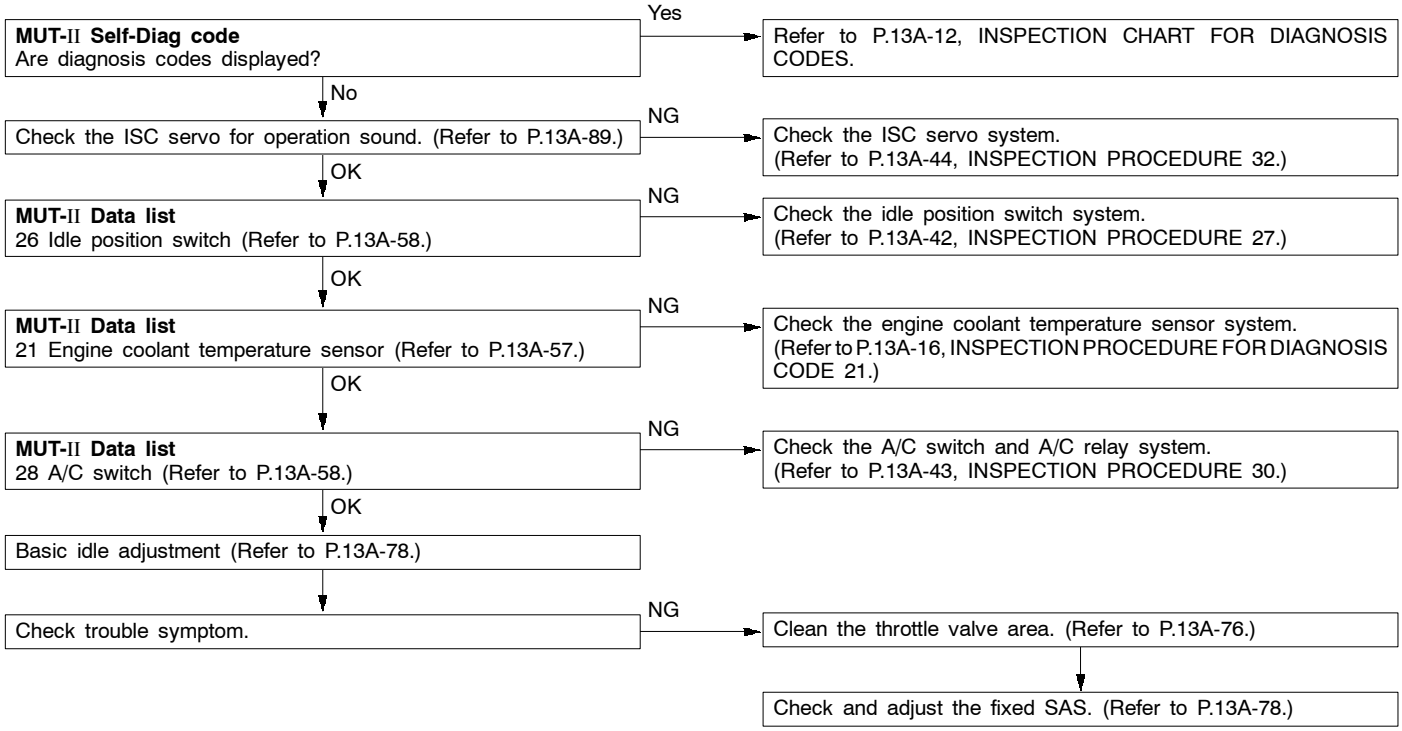
INSPECTION PROCEDURE 8

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



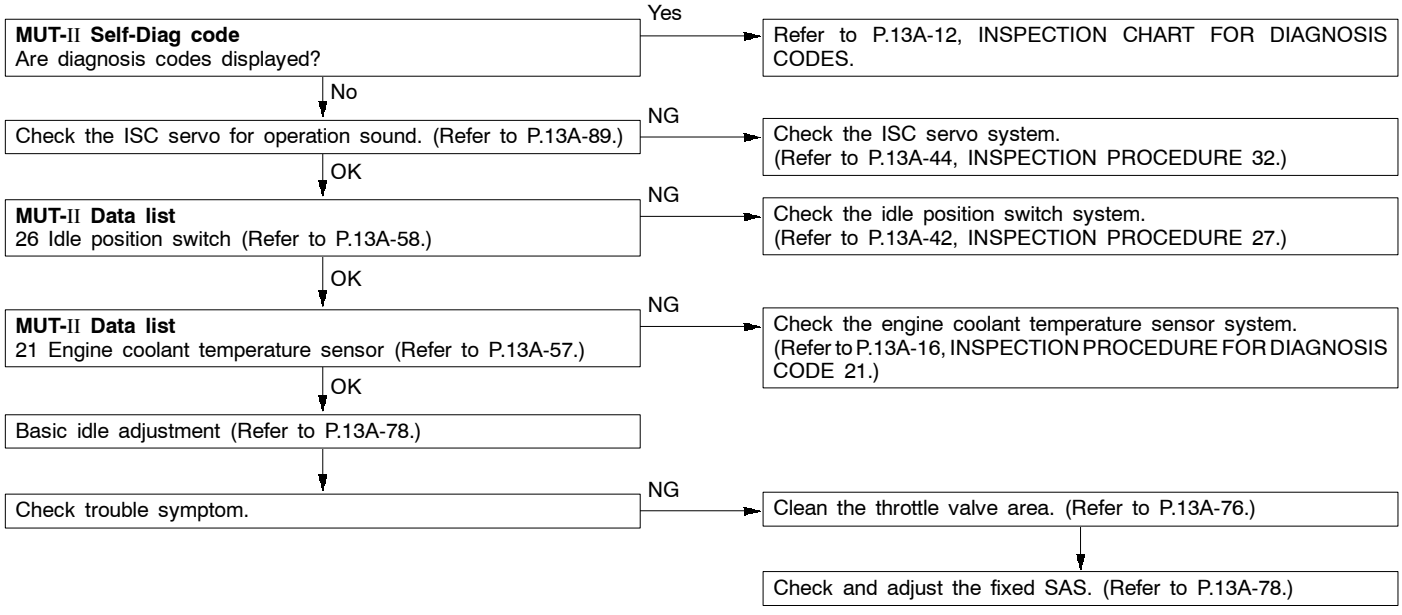
INSPECTION PROCEDURE 9

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



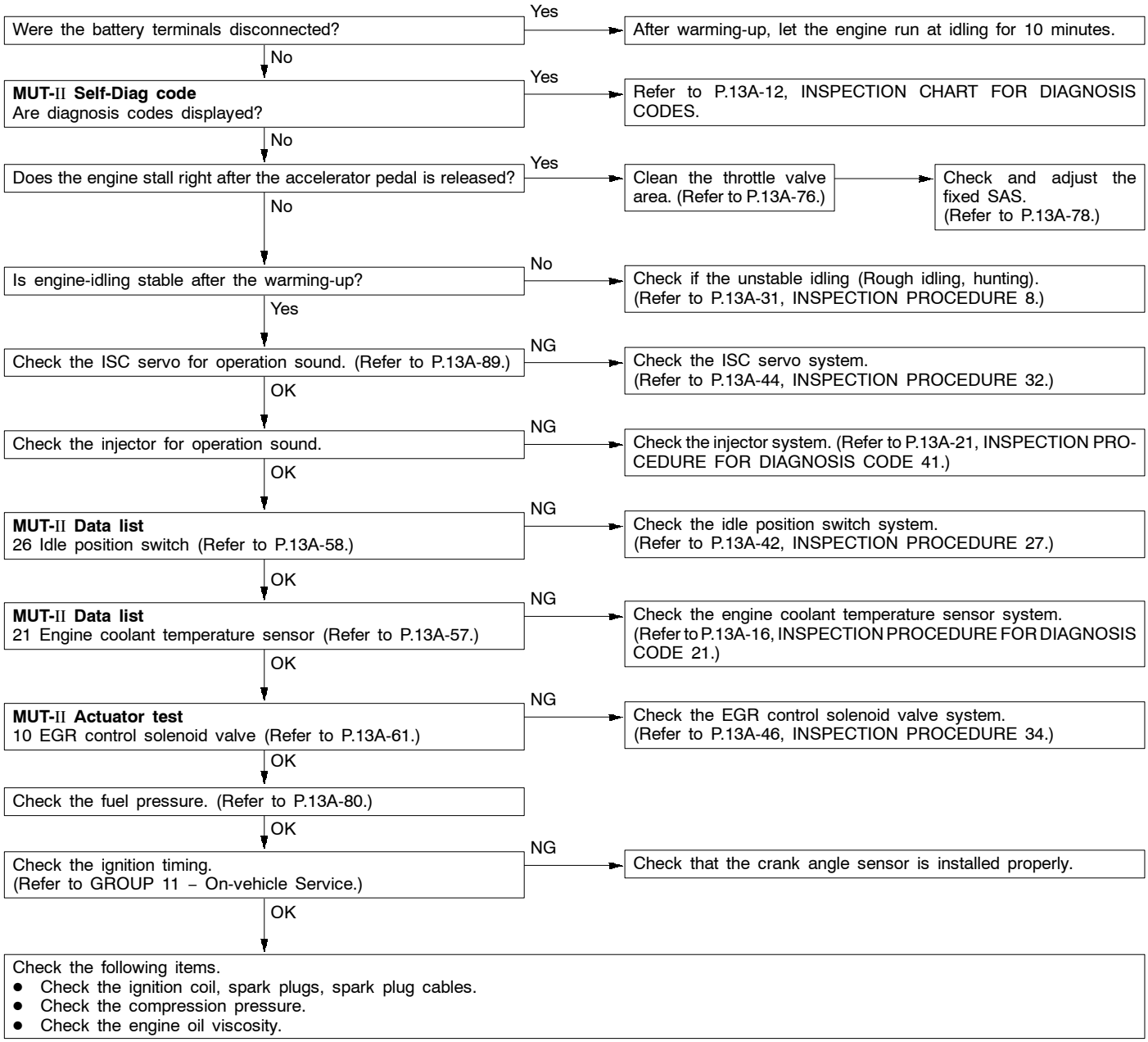
INSPECTION PROCEDURE 10

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



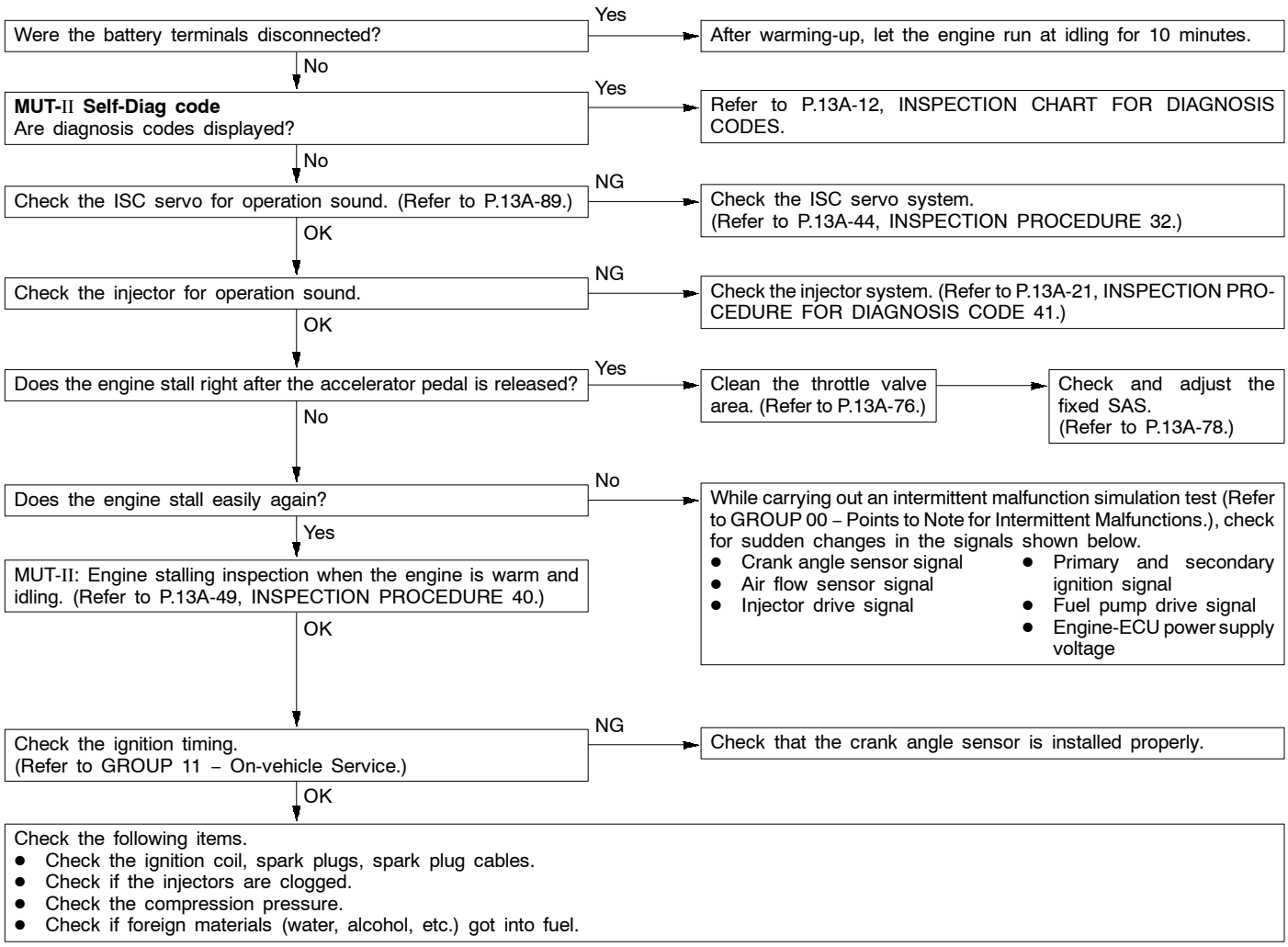
INSPECTION PROCEDURE 11

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



INSPECTION PROCEDURE 12

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



INSPECTION PROCEDURE 13

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
→ Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.
↓ OK

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13A-61.)
→ NG → Check the EGR control solenoid valve system. (Refer to P.13A-46, INSPECTION PROCEDURE 34.)
↓ OK

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

INSPECTION PROCEDURE 14

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

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
→ Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.
↓ No

MUT-II Data list
26 Idle position switch (Refer to P.13A-58.)
→ NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 27.)
↓ OK

MUT-II Data list
14 Throttle position sensor (Refer to P.13A-57.)
→ NG → Check the throttle position sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
↓ OK

MUT-II Data list
45 ISC servo position
- Is the idle speed control (ISC) servo position drops to 0–2 steps when decelerating (engine r/min less than 1,000)?

→ Yes → Check the vehicle speed sensor system. (Refer to P.13A-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 24.)
↓ OK

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13A-61.)
→ NG → Check the EGR control solenoid valve system. (Refer to P.13A-46, INSPECTION PROCEDURE 34.)
↓ OK

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

INSPECTION PROCEDURE 15

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

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

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

MUT-II: Check if hesitation, sag, stumble or poor acceleration occur.
(Refer to P.13A-50, INSPECTION PROCEDURE 41.)
OK ↓

Check the fuel pressure. (Refer to P.13A-80.)
OK ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check the EGR control system.
- Check the compression pressure.
- Check the fuel filter or fuel line for clogging.

INSPECTION PROCEDURE 16

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the following items.
- Check the ignition coil, spark plugs, spark plug cables.
- Check for occurrence of ignition leak.

INSPECTION PROCEDURE 17

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the ISC servo for operation sound. (Refer to P.13A-89.)
NG → Check the ISC servo system. (Refer to P.13A-44, INSPECTION PROCEDURE 32.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13A-57.)
NG → Check the throttle position sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Data list
26 Idle position switch (Refer to P.13A-58.)
NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 27.)
OK ↓

Clean the throttle valve area. (Refer to P.13A-76.)

INSPECTION PROCEDURE 18

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

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

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

MUT-II: Check if hesitation, sag, stumble or poor acceleration occur. (Refer to P.13A-50, INSPECTION PROCEDURE 41.)
OK ↓

Check the fuel pressure. (Refer to P.13A-80.)
OK ↓

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

INSPECTION PROCEDURE 19

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
→ Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.
↓ No

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

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

MUT-II: Check if surge occurs.
(Refer to P.13A-51, INSPECTION PROCEDURE 42.)
↓ OK

Check the fuel pressure. (Refer to P.13A-80.)
↓ OK

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

INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases as the above, the cause is probably that the heat value of the spark plug is inappropriate.	• Inappropriate heat value of the spark plug

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

INSPECTION PROCEDURE 21

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

Check the injectors for fuel leakage.

INSPECTION PROCEDURE 22

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

MUT-II Self-Diag code
Are diagnosis codes displayed?
Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

Check the ignition timing.
(Refer to GROUP 11 – On-vehicle Service.)
NG → Check that the distributor is installed properly.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor. (Refer to P.13A-57.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)
NG → Check the intake air temperature sensor system. (Refer to P.13A-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-58.)
NG → Check the barometric pressure sensor system. (Refer to P.13A-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: 600–1,000 mV when racing suddenly (Refer to P.13A-56.)
NG → Check the oxygen sensor system. (Refer to P.13A-13, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Repeat 0–400 mV and 600–1,000 mV alternately when idling. (Refer to P.13A-56.)
OK → Replace the oxygen sensor. → Check trouble symptom.
NG ↓

Check the fuel pressure. (Refer to P.13A-80.)
OK ↓

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

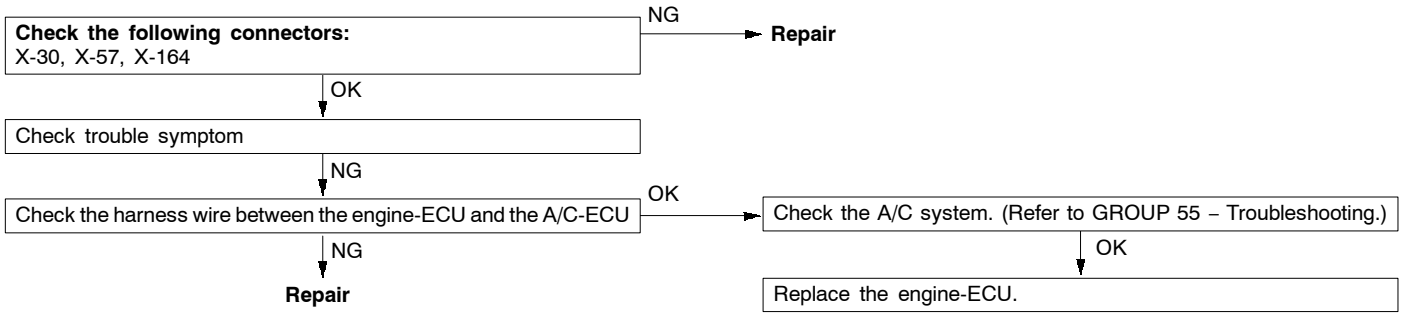
↓

Check the trouble symptom.
NG ↓

Replace the catalytic converter.

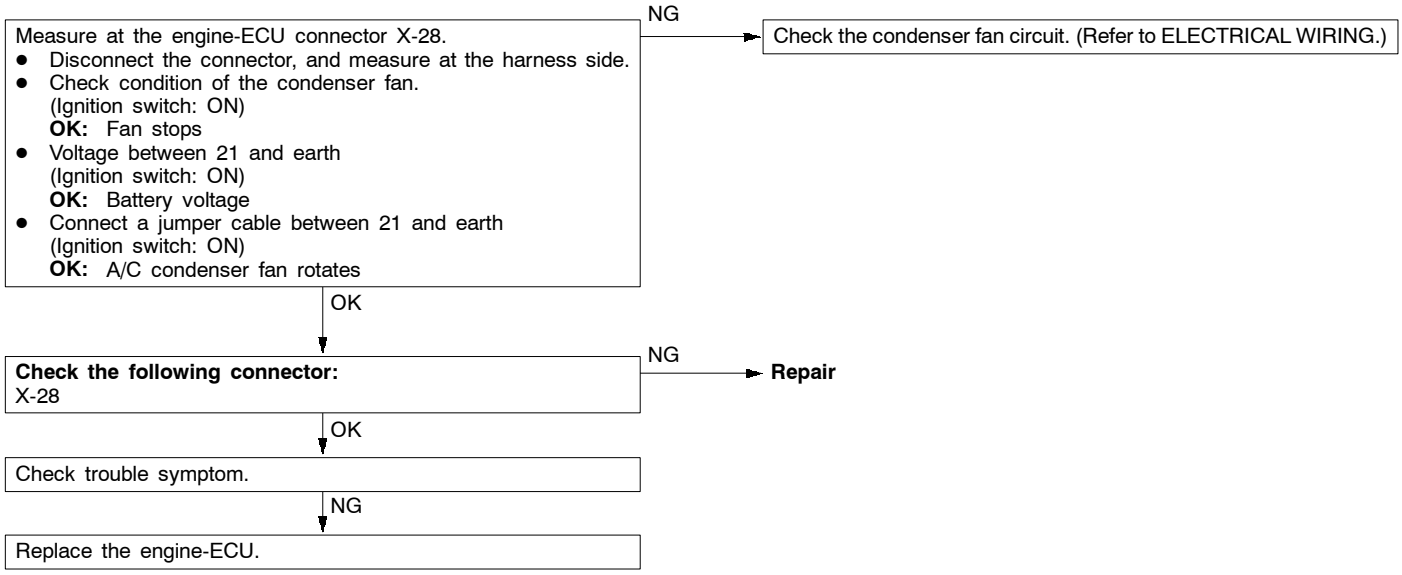
INSPECTION PROCEDURE 23

Idling speed is improper when A/C is operating (A/C switch 2 signal)	Probable cause
The A/C-ECU judges if load caused by air conditioner is high or low, and converts it to A/C switch 2 signal to send the engine-ECU it. Based on this signal, the engine-ECU operates the throttle control servo to control the idle-up speed. If the load is lower than usual, the engine-ECU decreases the idle-up speed.	• Malfunction of the A/C control system • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



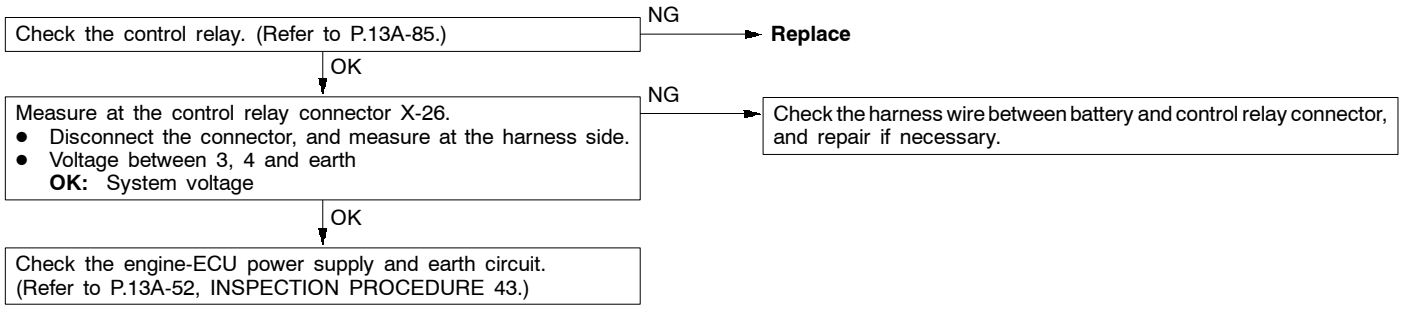
INSPECTION PROCEDURE 24

A/C condenser fan is inoperative	Probable cause
The fan motor relay is controlled by turning on and off the power transistor in the engine-ECU.	• Malfunction of the A/C condenser fan relay • Malfunction of the condenser fan motor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



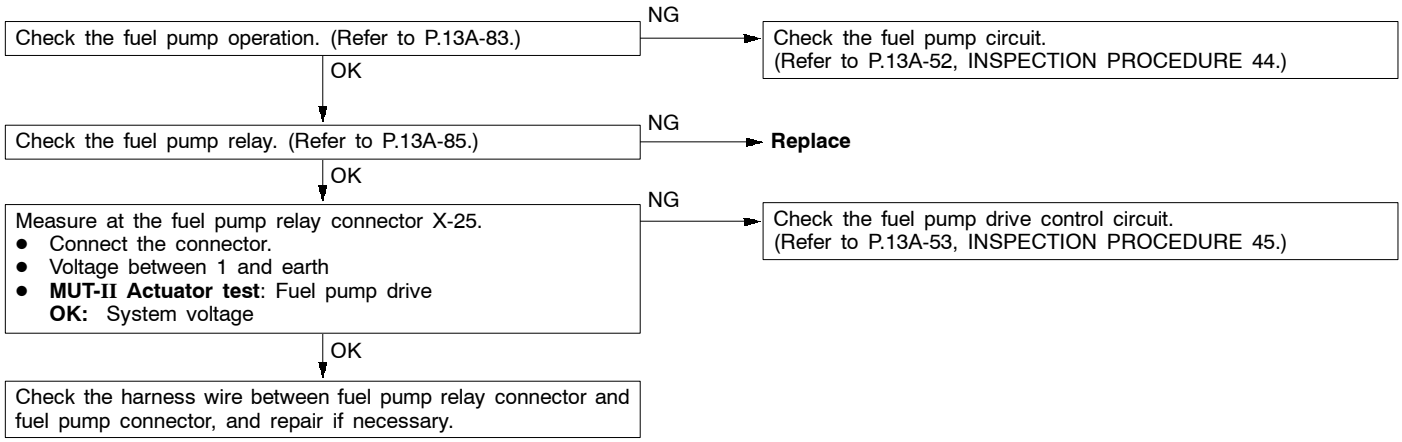
INSPECTION PROCEDURE 25

Power supply system and ignition switch-IG system	Probable cause
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.	• 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



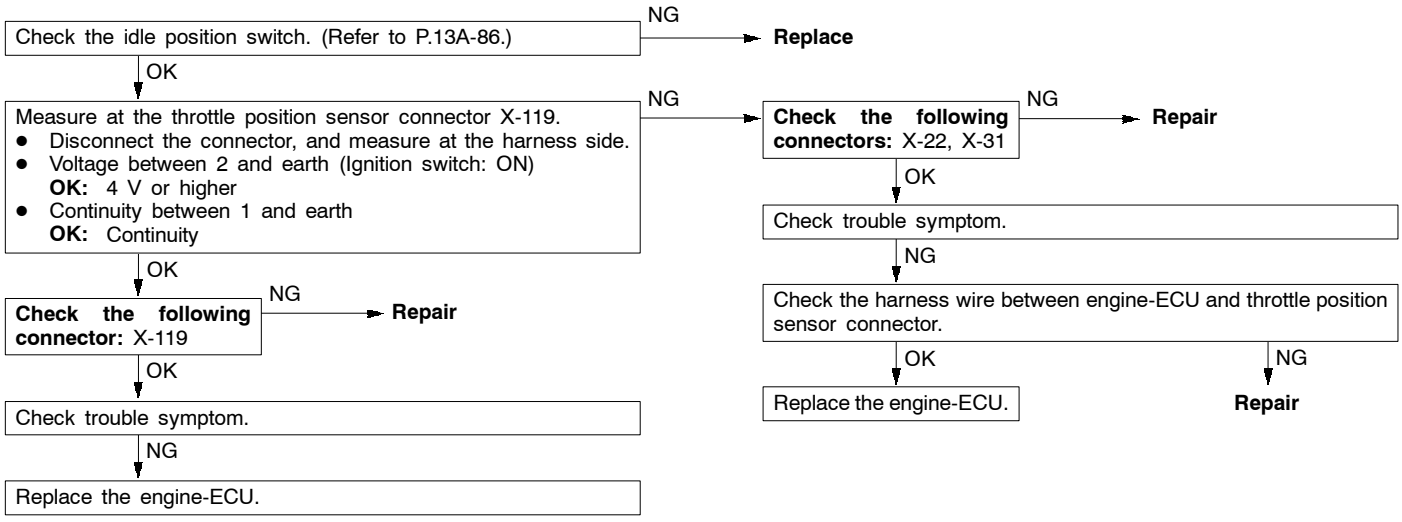
INSPECTION PROCEDURE 26

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



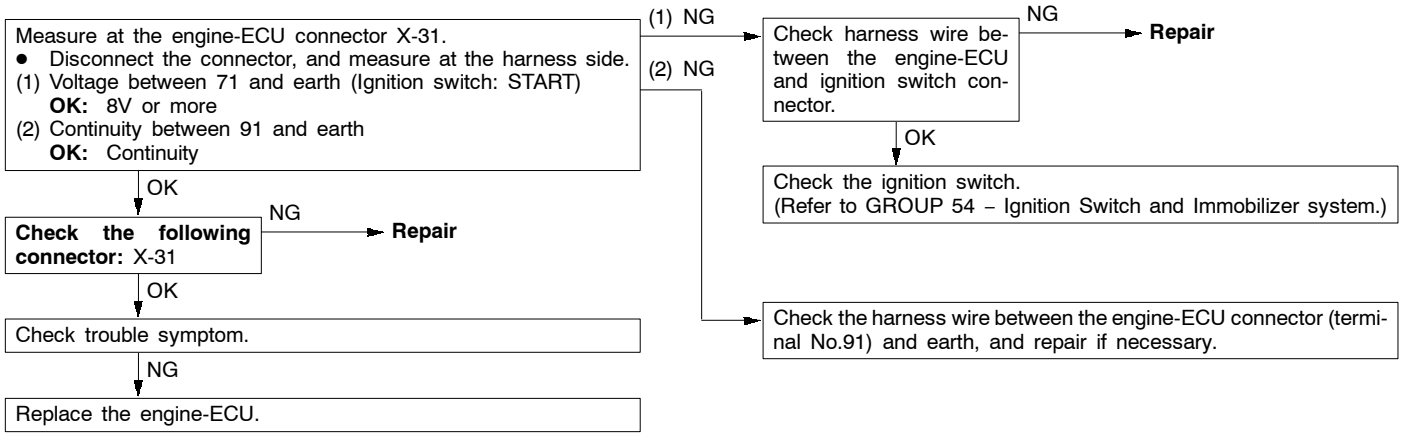
INSPECTION PROCEDURE 27

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



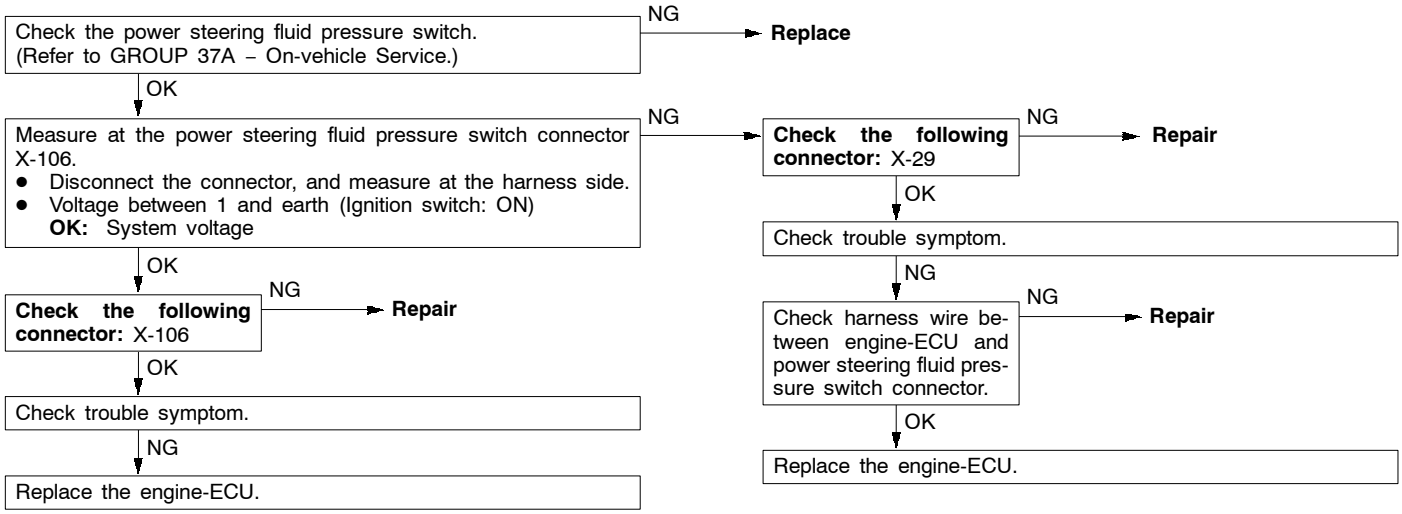
INSPECTION PROCEDURE 28

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



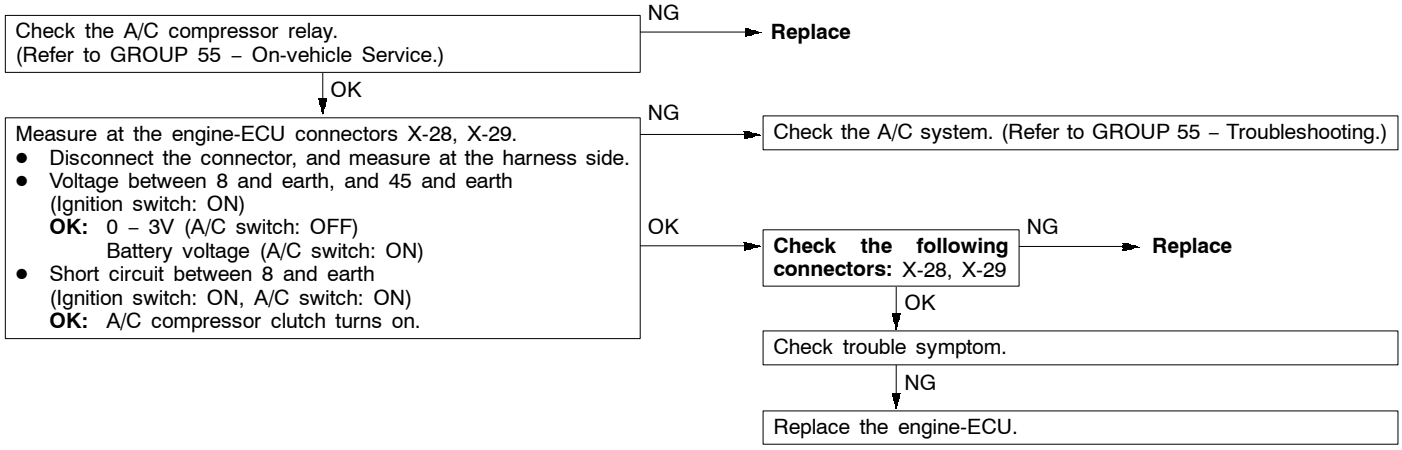
INSPECTION PROCEDURE 29

Power steering fluid pressure switch system	Probable cause
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.	• Malfunction of power steering fluid pressure switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



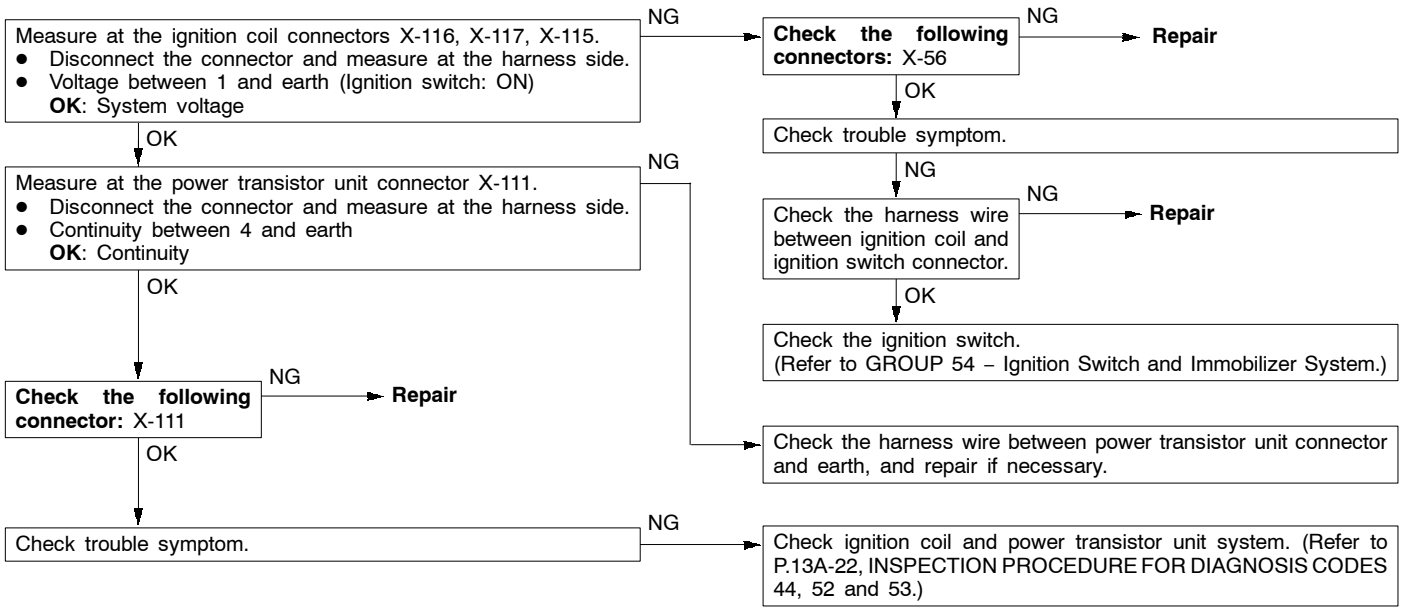
INSPECTION PROCEDURE 30

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



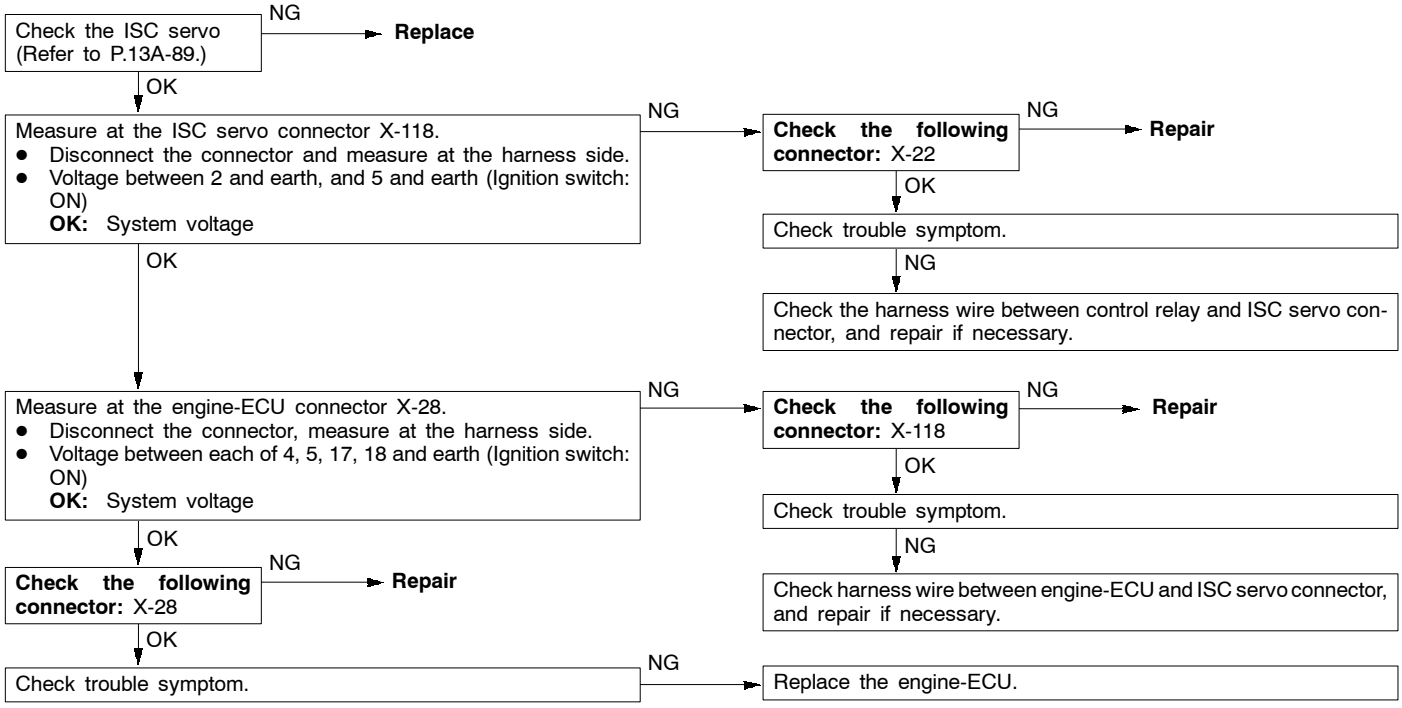
INSPECTION PROCEDURE 31

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



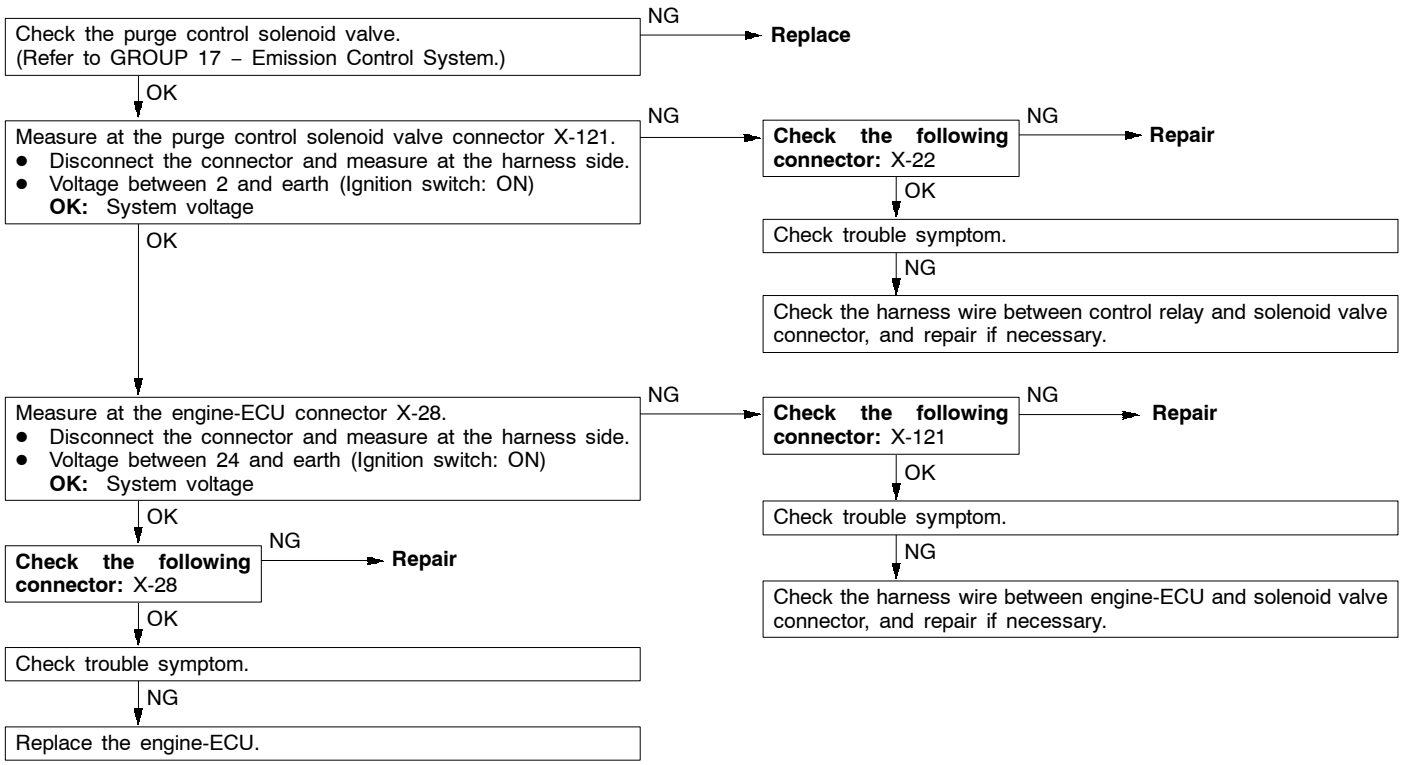
INSPECTION PROCEDURE 32

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



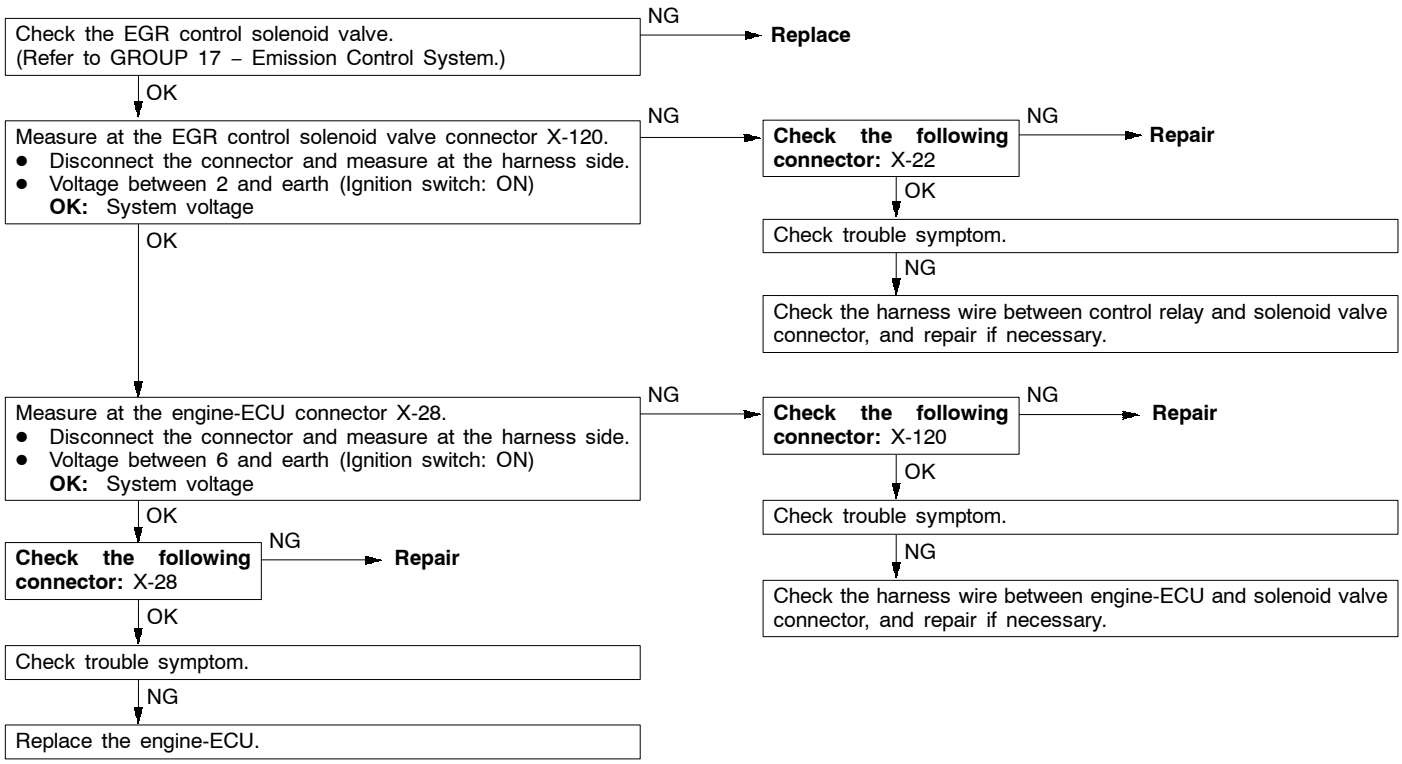
INSPECTION PROCEDURE 33

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



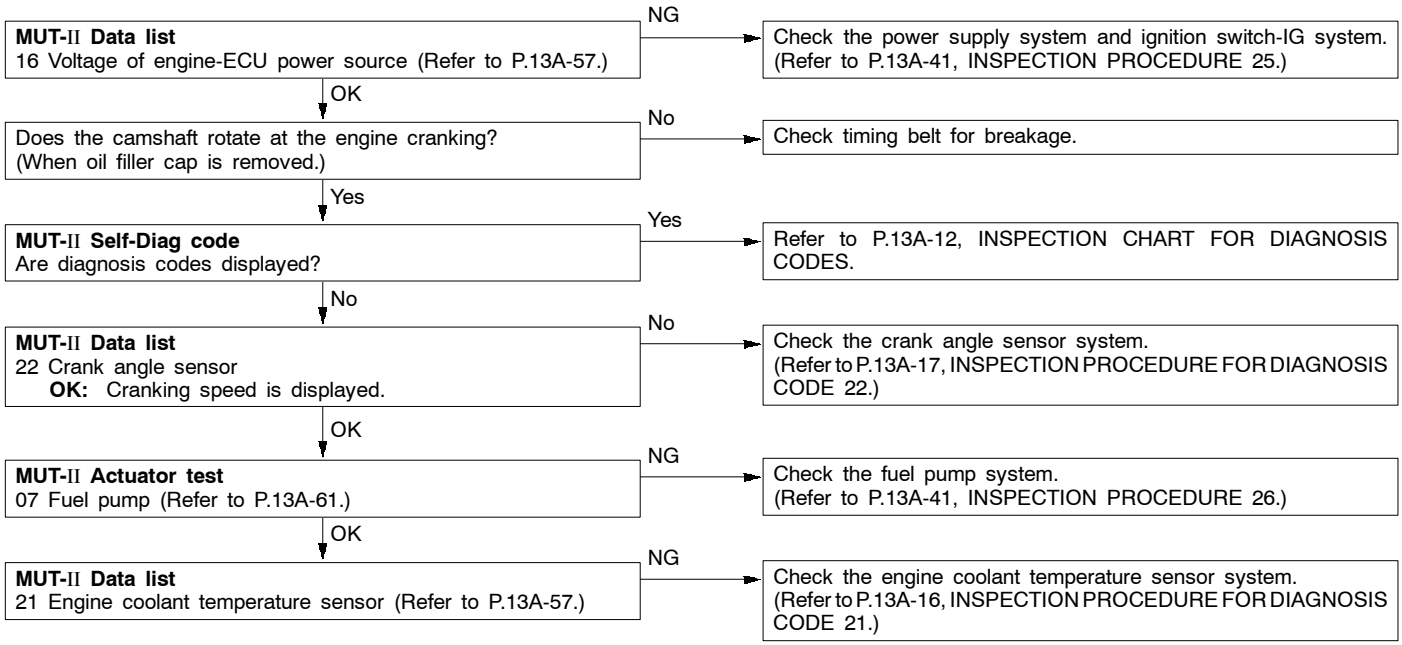
INSPECTION PROCEDURE 34

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



INSPECTION PROCEDURE 35

MUT-II: Inspection of no initial combustion



INSPECTION PROCEDURE 36

Ignition system: Inspection of no initial combustion.

Measure at the power transistor connector X-111
- Connect the connector. (Use test harness: MB991348)
- Connect a primary voltage detection-type tachometer to terminals 11, 12, and 13 in that order.
  OK: Each terminal displays a speed on the engine tachometer that is 1/3 of the cranking speed.

NG → Check ignition circuit system. (Refer to P.13A-44, INSPECTION PROCEDURE 31.)

OK ↓

Check the ignition timing when cranking.
OK: Approx. 5° BTDC

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

INSPECTION PROCEDURE 37

MUT-II: Check if uncomplete combustion occurs.

MUT-II Self-Diag code
Are diagnosis codes displayed?

Yes → Refer to P.13A-12, INSPECTION CHART FOR DIAGNOSIS CODE

No ↓

MUT-II Actuator test
07 Fuel pump (Refer to P.13A-61.)

NG → Check the fuel pump system. (Refer to P.13A-41, INSPECTION PROCEDURE 26.)

OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-57.)

NG → Check the engine coolant temperature sensor system. (Refer to P.13A-16, INSPECTION PROCEDURES FOR DIAGNOSIS CODE 21.)

OK ↓

MUT-II Data list
18 Ignition switch-ST (Refer to P.13A-57.)

NG → Check the ignition switch-ST system. (Refer to P.13A-42, INSPECTION PROCEDURE 28.)

INSPECTION PROCEDURE 38

Check if hunting occurs.

Clean the throttle body. (Refer to P.13A-76.)

↓

Check and adjust the fixed SAS. (Refer to P.13A-78.)

↓

Check trouble symptom.

NG ↓

Inspect the intake of air into the air intake system.
- Broken intake manifold gasket
- Broken air intake hose
- Broken vacuum hose
- Positive crankcase ventilation valve does not operate.

INSPECTION PROCEDURE 39

MUT-II: Check if idling speed is unstable.

MUT-II Data list
26 Idle position switch (Refer to P.13A-58.)
NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)
NG → Check the intake air temperature sensor system. (Refer to P.13A-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-58.)
NG → Check the barometric pressure sensor system. (Refer to P.13A-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-57.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13A-61.)
NG → Check the purge control solenoid valve system. (Refer to P.13A-45, INSPECTION PROCEDURE 33.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13A-61.)
NG → Check the EGR control solenoid valve system. (Refer to P.13A-46, INSPECTION PROCEDURE 34.)
OK ↓

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

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0–400 mV and 600–1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13A-80.)
OK → 1. Inspect the intake of air into the air intake system.
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

OK ↓

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-58.)
NG → Check the power steering fluid pressure switch system. (Refer to P.13A-43, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13A-58.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13A-43. INSPECTION PROCEDURE 30.)
OK ↓

MUT-II Data list
45 ISC Servo position (Refer to P.13A-60.)
NG → Adjust the basic idle speed. (Refer to P.13A-78.)

INSPECTION PROCEDURE 40

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

MUT-II Data list
26 Idle position switch (Refer to P.13A-58.)
NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)
NG → Check the intake air sensor system. (Refer to P.13A-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-58.)
NG → Check the barometric pressure sensor system. (Refer to P.13A-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-57.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13A-61.)
NG → Check the EGR control solenoid valve system. (Refer to P.13A-46, INSPECTION PROCEDURE 34.)
OK ↓

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

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0–400 mV and 600–1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13A-80.)
OK → 1. Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

OK ↓

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13A-58.)
NG → Check the power steering fluid pressure switch system. (Refer to P.13A-43, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13A-58.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13A-43, INSPECTION PROCEDURE 30.)
OK ↓

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13A-58.)
NG → Check the air flow sensor system. (Refer to P.13A-14, INSPECTIOIN PROCEDURE FOR DIAGNOSTIC TROUBLE CODE 12.)
OK ↓

MUT-II Data list
45 ISC servo position (Refer to P.13A-60.)
NG → Adjust the basic idle speed. (Refer to P.13A-78.)

INSPECTION PROCEDURE 41

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

MUT-II Data list
26 Idle position switch (Refer to P.13A-58.)
NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)
NG → Check the intake air sensor system. (Refer to P.13A-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-58.)
NG → Check the barometric pressure sensor system. (Refer to P.13A-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-57.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSTIC CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13A-57.)
NG → Check the throttle position sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13A-61.)
NG → Check the EGR control solenoid valve system. (Refer to P.13A-46, INSPECTION PROCEDURE 34.)
OK ↓

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

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0–400 mV and 600–1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13A-80.)
OK → 1. Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

INSPECTION PROCEDURE 42

MUT-II: Check if surge occurs.

MUT-II Data list
26 Idle position switch (Refer to P.13A-58.)
NG → Check the idle position switch system. (Refer to P.13A-42, INSPECTION PROCEDURE 27.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13A-57.)
NG → Check the intake air sensor system. (Refer to P.13A-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13A-58.)
NG → Check the barometric pressure sensor system. (Refer to P.13A-20, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13A-57.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13A-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (Refer to P.13A-57.)
NG → Check the throttle position sensor system. (Refer to P.13A-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

MUT-II Actuator test
10 EGR control solenoid valve (Refer to P.13A-61.)
NG → Check the EGR control solenoid valve system. (Refer to P.13A-46, INSPECTION PROCEDURE 34.)
OK ↓

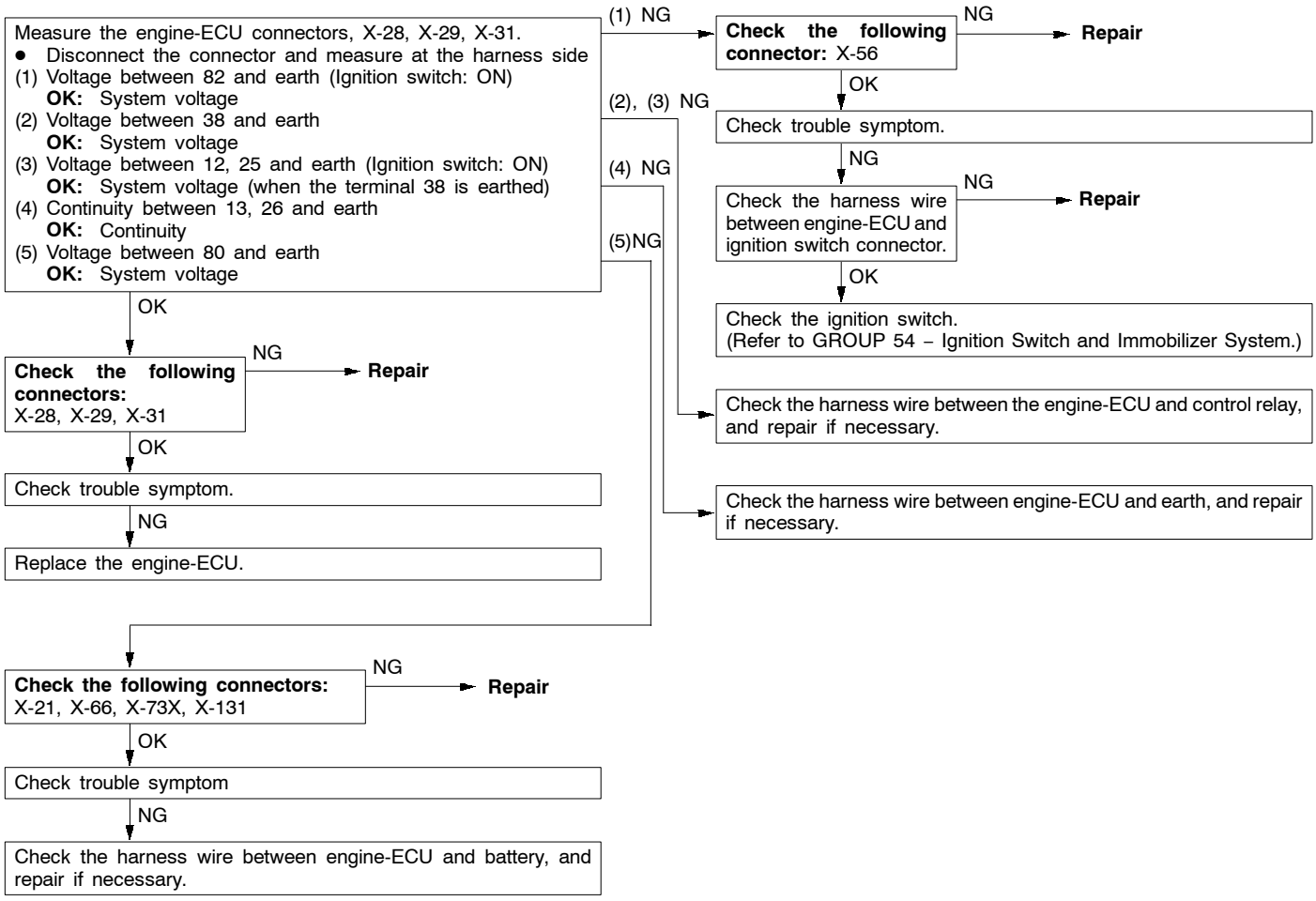
MUT-II Data list
11 Oxygen sensor
OK: Changes between 600–1,000 mV during sudden racing
NG → Check the oxygen sensor system. (Refer to P.13A-13, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

MUT-II Data list
11 Oxygen sensor
OK: Changes between 0–400 mV and 600–1,000 mV during idling
NG → Check the fuel pressure. (Refer to P.13A-80.)
OK → 1. Inspect the intake of air into the air intake system
- Broken intake manifold gasket
- Broken vacuum hose
- PCV valve does not operate.
- Broken air intake hose

2. Check the injector for clog.

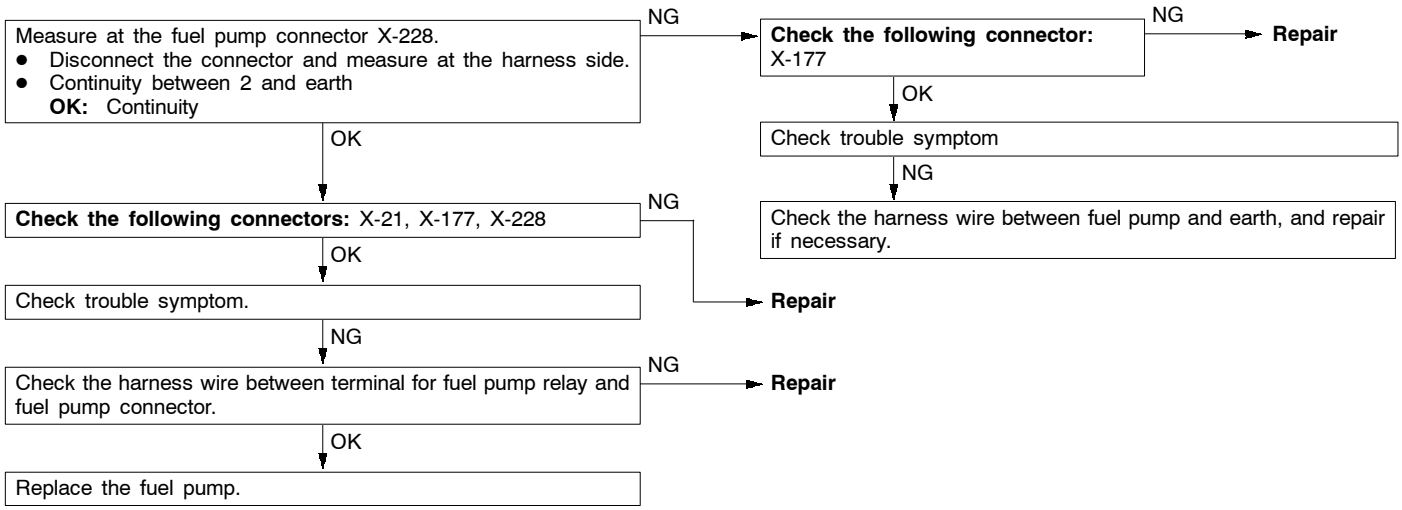
INSPECTION PROCEDURE 43

Check the engine-ECU power supply and earth circuit.



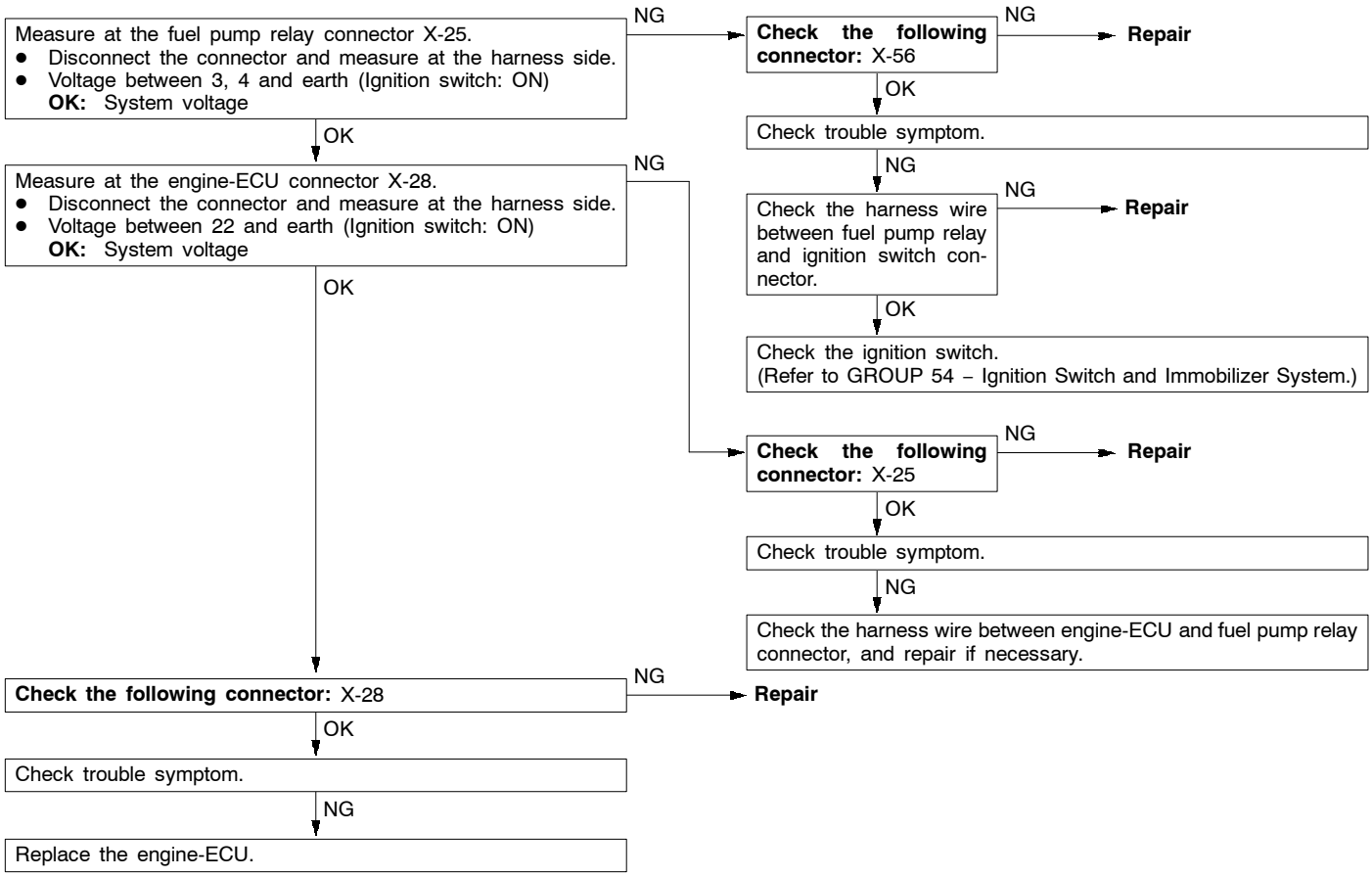
INSPECTION PROCEDURE 44

Check the fuel pump circuit.



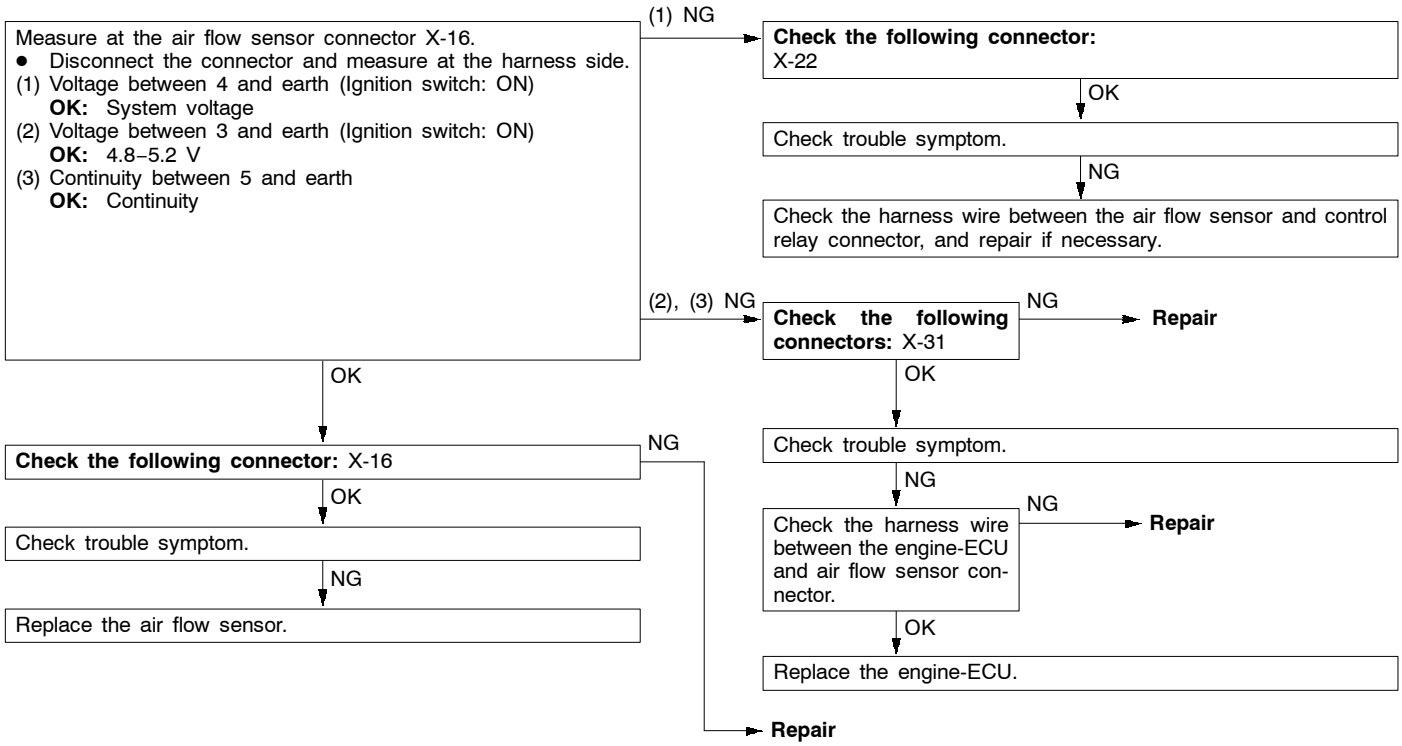
INSPECTION PROCEDURE 45

Check the fuel pump drive control circuit.



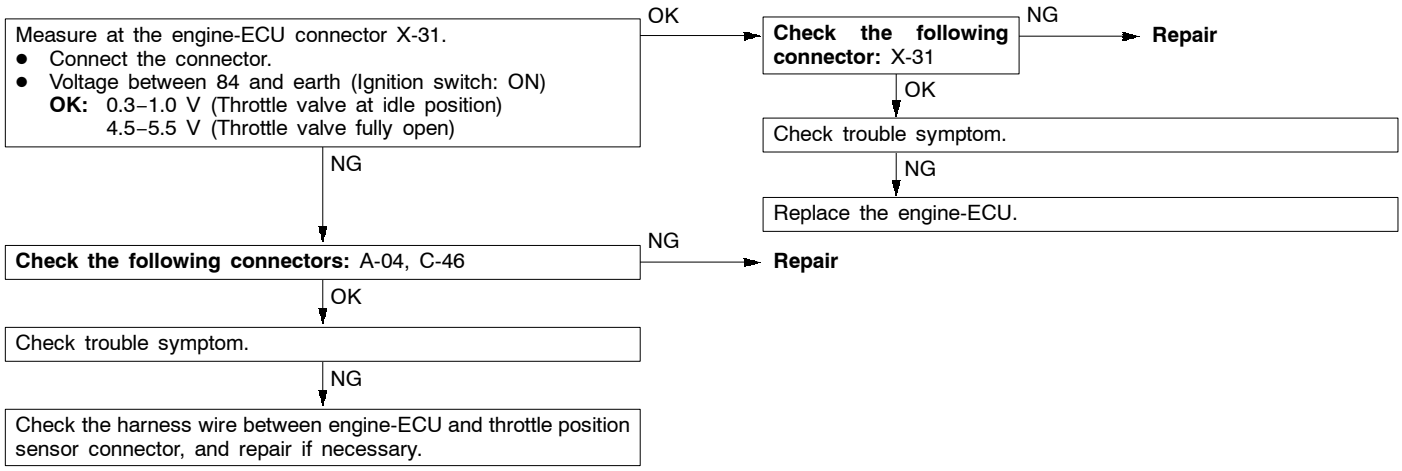
INSPECTION PROCEDURE 46

Check the air flow sensor (AFS) control circuit.



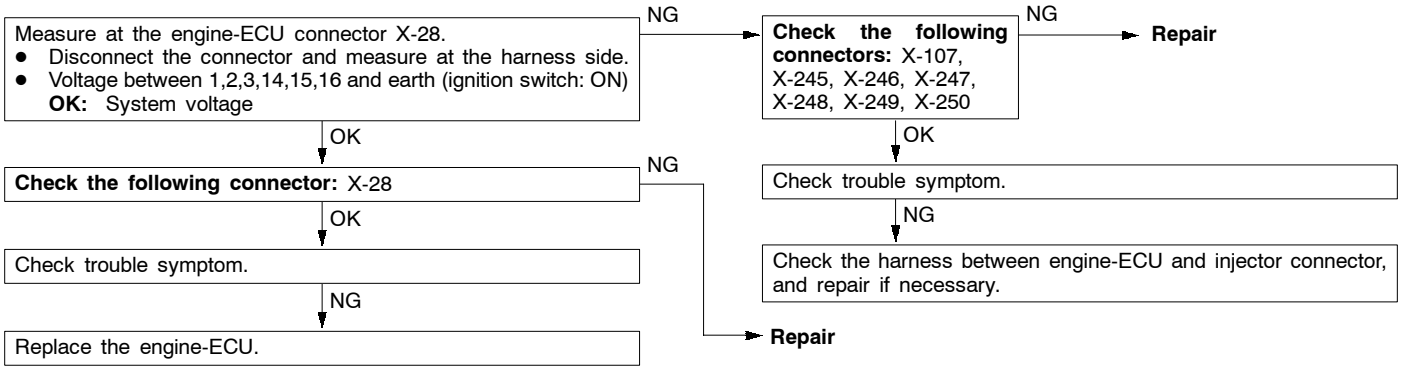
INSPECTION PROCEDURE 47

Check the throttle position sensor (TPS) output circuit.



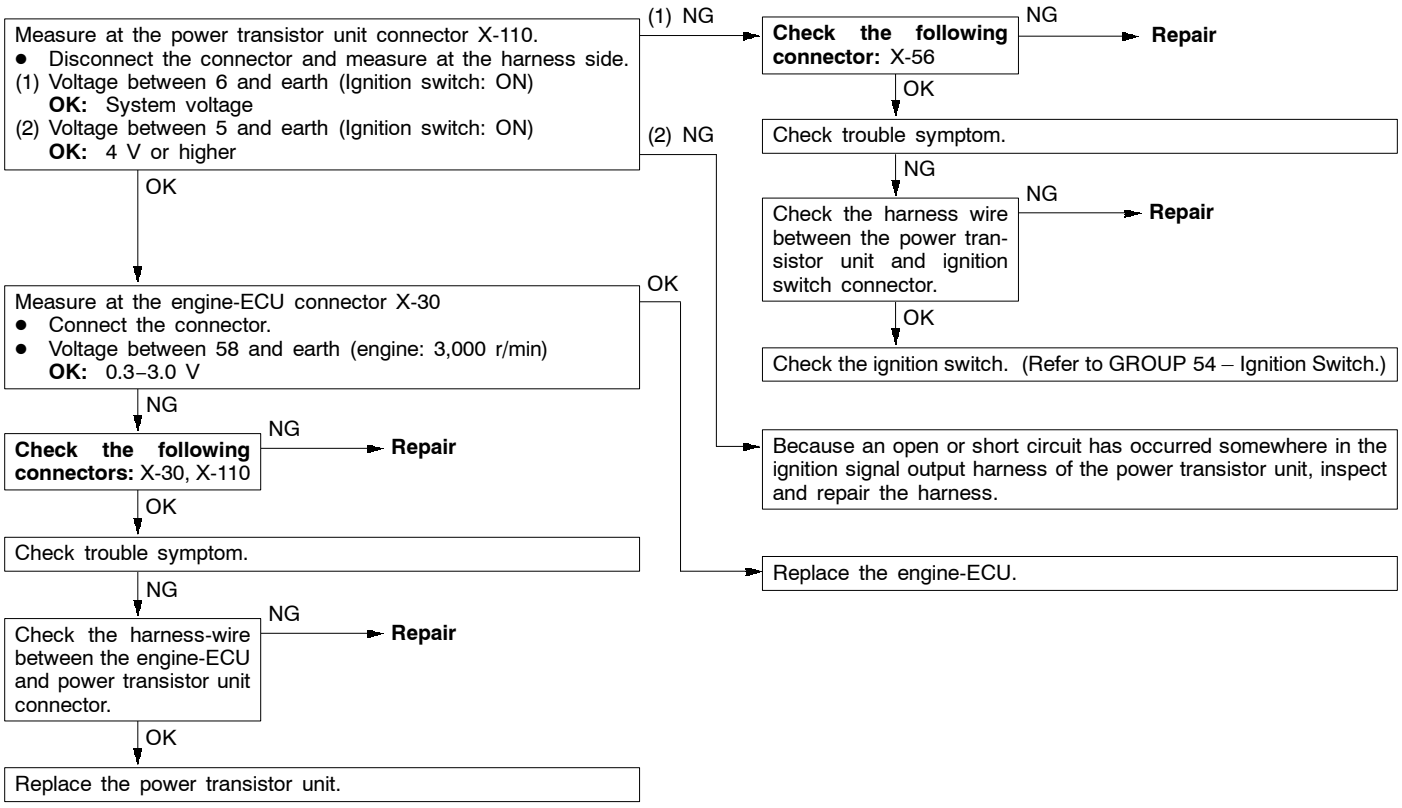
INSPECTION PROCEDURE 48

Check the injector control circuit.



7INSPECTION PROCEDURE 49

Check the ignition signal circuit.



DATA LIST REFERENCE TABLE

13100890593

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

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

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	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-13
			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 by the engine-ECU.	Engine is idling	400 mV or less ↑ (Changes) ↓ 600 – 1,000 mV		
			2,500 r/min	400 mV or less ↑ (Changes) ↓ 600 – 1,000 mV		
12	Air flow sensor*1	• Engine coolant temperature: 80 – 95°C • Lamps and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	25 – 51 Hz	–	–
			2,500 r/min	74 – 114 Hz		
			Engine is raced	Frequency increases in response to racing		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is –20°C	–20°C	Code No. 13	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. 25	13A-41
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No. 28	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	• Engine: Cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	Code No. 22	13A-17
		• Engine: Idling • Idle position switch: ON	When engine coolant temperature is –20°C	1,275 – 1,475 r/min		
			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	600 – 800 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. 27	13A-42
			Throttle valve: Slightly open	OFF*2		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 29	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. 30	13A-43
			A/C switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No. 12	13A-14
			2,500 r/min	OFF		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
37	Volumetric efficiency	● Engine coolant temperature: 80–95 °C ● Lamps and all accessories: OFF ● Transmission: Neutral (A/T : P range)	Engine is idling	15–35 %	–	–
			2,500 r/min	15–35 %		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	● Engine: Cranking [reading is possible at 2,000 r/min or less] ● Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	–	–
41	Injectors*3	Engine: Cranking	When engine coolant temperature is 0°C (injection is carried out for all cylinders simultaneously)	13.8 – 20.6 ms	–	–
			When engine coolant temperature is 20°C	34 – 51 ms		
			When engine coolant temperature is 80°C	8.8 – 13.2 ms		
41	Injectors*4	● Engine coolant temperature: 80–95°C ● Lamps and all accessories: OFF ● Transmission: Neutral (A/T : P range)	Engine is idling	2.6 – 3.8 ms	–	–
			2,500 r/min	2.3 – 3.5 ms		
			When engine is suddenly raced	Increases		
44	Ignition coils and power transistors	● Engine: After having warmed up ● Timing lamp is set. (The timing lamp is set in order to check actual ignition timing.)	Engine is idling	7–23°BTDC	–	–
			2,500 r/min	27 – 47° BTDC		

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.	Reference page
45	ISC (stepper) motor position *5	• Engine coolant temperature: 80–95°C • Lamps and all accessories: OFF • Transmission: Neutral (A/T : P range) • Idle position switch: ON • Engine: Idling • When A/C switch is ON, A/C compressor should be operating	A/C switch: OFF	2–25 STEP	–	–
			A/C switch: OFF → ON	Increases by 10–70 steps		
			• A/C switch: OFF • Select lever: N range → D range	Increases by 5–50 steps		
49	A/C relay	Engine: After having warmed up/Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 30	13A-43
			A/C switch: ON	ON (Compressor clutch is operating)		

ACTUATOR TEST REFERENCE TABLE

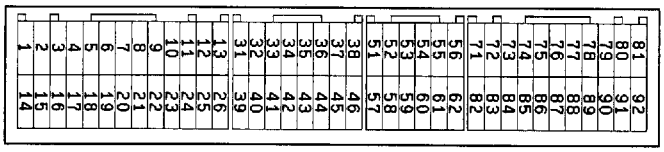
Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/ Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idling condition becomes different (becomes unstable).	Code No. 41	13A-21
02		Cut fuel to No. 2 injector					
03		Cut fuel to No. 3 injector					
04		Cut fuel to No. 4 injector					
05		Cut fuel to No. 5 injector					
06		Cut fuel to No. 6 injector					
07	Fuel pump	Fuel pump operates and fuel is recirculated.	• Engine: Cranking • Fuel pump: Forced driving Inspect according to both the above conditions.	Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.	Pulse is felt.	Procedure No. 26	13A-41
				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.33	13A-45
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.34	13A-46
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idling Timing light is set		5° BTDC	–	–
21	Condenser fan	Drive the fan motor	• Ignition switch: ON		Fan motor runs	Procedure No. 24	13A-40

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

13100920582

Engine-ECU Connector Terminal Arrangement



9FU0393

Terminal No.	Check item	Check condition (Engine condition)	Normal condition
1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal.	From 11 – 14 V, momentarily drops slightly
14	No. 2 injector		
2	No. 3 injector		
15	No. 4 injector		
3	No. 5 injector		
16	No. 6 injector		
4	Stepper motor coil <A1>	Engine: Soon after the warmed up engine is started	10 – 15 V ↔ 0 – 6 V (Changes repeatedly)
17	Stepper motor coil <A2>		
5	Stepper motor coil <B1>		
18	Stepper motor coil <B2>		
6	EGR control solenoid valve	Ignition switch: ON	System Voltage
		While engine is idling, suddenly depress the accelerator pedal.	From system voltage, momentarily drops
8	A/C relay	• Engine: Idle speed • A/C switch: OFF → ON (A/C compressor is operating)	System voltage or momentarily 6 V or more → 0 – 3 V
10	Power transistor unit (A)	Engine r/min: 3,000 r/min	0.3 – 3.0 V
11	Power transistor unit (B)		
23	Power transistor unit (C)		
12	Power supply	Ignition switch: ON	System voltage
25			
19	Air flow sensor reset signal	Engine: Idle speed	0 – 1 V
		Engine r/min: 3,000 r/min	6 – 9 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
21	Fan motor relay	When the condenser fan is not operating		System voltage
		When the condenser fan is operating		0 – 3 V
22	Fuel pump relay	Ignition switch: ON		System voltage
		Engine: Idle speed		0 – 3 V
24	Purge control solenoid valve	Ignition switch: ON		System voltage
		Running at 3,000 r/min while engine is warming up after having been started.		0 – 3 V
36	Engine warning lamp	Ignition switch: OFF → ON		0 – 3 V → 9 – 13 V (After several seconds have elapsed)
37	Power steering fluid pressure switch	Engine: Idling after warming up	When steering wheel is stationary	System voltage
			When steering wheel is turned	0 – 3 V
38	Control relay (Power supply)	Ignition switch: OFF		System voltage
		Ignition switch: ON		0 – 3 V
44	Anti-lock brake signal	Engine: Idle speed		Battery voltage
		● After ignition switch is turned ON, at time of first departure ● Vehicle speed: 0 – 10 km/h		Battery voltage → 0 – 3 V (momentarily)
45	A/C switch 1	Engine: Idle speed	Turn the A/C switch OFF	0 – 3 V
			Turn the A/C switch ON (A/C compressor is operating)	System voltage
57	A/C switch 2	● Engine: Idling ● Outside air temperature: 25°C or more	When A/C is MAX. COOL condition (when the load by A/C is high)	0 – 3 V
			When A/C is MAX. HOT condition (When the load by A/C is low)	System voltage
71	Ignition switch – ST	Engine: Cranking		8 V or more

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
72	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2 – 3.8 V
			When intake air temperature is 20°C	2.3 – 2.9 V
			When intake air temperature is 40°C	1.5 – 2.1 V
			When intake air temperature is 80°C	0.4 – 1.0 V
76	Oxygen sensor	Engine: Running at 2,500 r/min after warmed up (Check using a digital type voltmeter)		0 ↔ 0.8 V (Changes repeatedly)
80	Backup power supply	Ignition switch: OFF		System voltage
81	Sensor impressed voltage	Ignition switch: ON		4.5 – 5.5 V
82	Ignition switch – IG	Ignition switch: ON		System voltage
83	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2 – 3.8 V
			When engine coolant temperature is 20°C	2.3 – 2.9 V
			When engine coolant temperature is 40°C	1.3 – 1.9 V
			When engine coolant temperature is 80°C	0.3 – 0.9 V
84	Throttle position sensor	Ignition switch: ON	Set throttle valve to idle position	0.3 – 1.0 V
			Fully open throttle valve	4.5 – 5.5 V
85	Barometric pressure sensor	Ignition switch: ON	When altitude is 0 m	3.7 – 4.3 V
			When altitude is 1,200 m	3.2 – 3.8 V

Terminal No.	Check item	Check condition (Engine condition)		Normal condition
86	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		0 ↔ System voltage (Changes repeatedly)
87	Idle position switch	Ignition switch: ON	Set throttle valve to idle position	0 – 1 V
			Slightly open throttle valve	4V or more
88	Top dead centre sensor	Engine: Cranking		0.4 – 3.0 V
		Engine: Idle speed		0.5 – 2.0 V
89	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idle speed		1.5 – 2.5 V
90	Air flow sensor	Engine: Idle speed		2.2 – 3.2 V
		Engine r/min: 2,500 r/min		

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

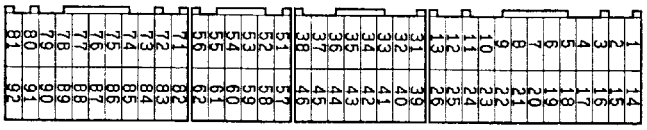
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   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!

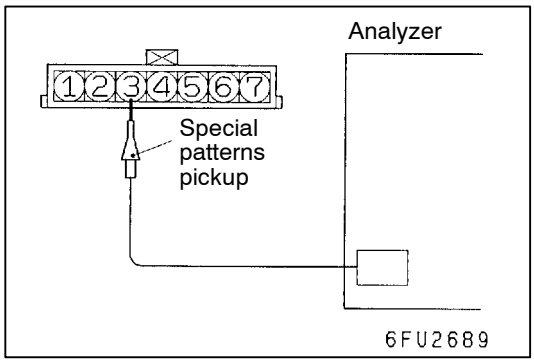
4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector Terminal Arrangement



9FU0392

Terminal No.	Inspection item	Normal condition (Check condition)
1 – 12	No. 1 injector	13 – 16 Ω (At 20°C)
14 – 12	No. 2 injector	
2 – 12	No. 3 injector	
15 – 12	No. 4 injector	13 – 16 Ω (At 20°C)
3 – 12	No. 5 injector	
16 – 12	No. 6 injector	
4 – 12	Stepper motor coil (A1)	28 – 33 Ω (At 20°C)
17 – 12	Stepper motor coil (A2)	
5 – 12	Stepper motor coil (B1)	
18 – 12	Stepper motor coil (B2)	
6 – 12	EGR control solenoid valve	36 – 44 Ω (At 20°C)
24 – 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	
72 – 92	Intake air temperature sensor	5.3 – 6.7 kΩ (When intake air temperature is 0°C)
		2.3 – 3.0 kΩ (When intake air temperature is 20°C)
		1.0 – 1.5 kΩ (When intake air temperature is 40°C)
		0.30 – 0.42 kΩ (When intake air temperature is 80°C)
83 – 92	Engine coolant temperature sensor	5.1 – 6.5 kΩ (When coolant temperature is 0°C)
		2.1 – 2.7 kΩ (When coolant temperature is 20°C)
		0.9 – 1.3 kΩ (When coolant temperature is 40°C)
		0.26 – 0.36 kΩ (When coolant temperature is 80°C)
87 – 92	Idle position switch	Continuity (when throttle valve is at idle position)
		No continuity (when throttle valve is slightly open)



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS) 13100930400

Measurement Method

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

Alternate Method (Test harness not available)

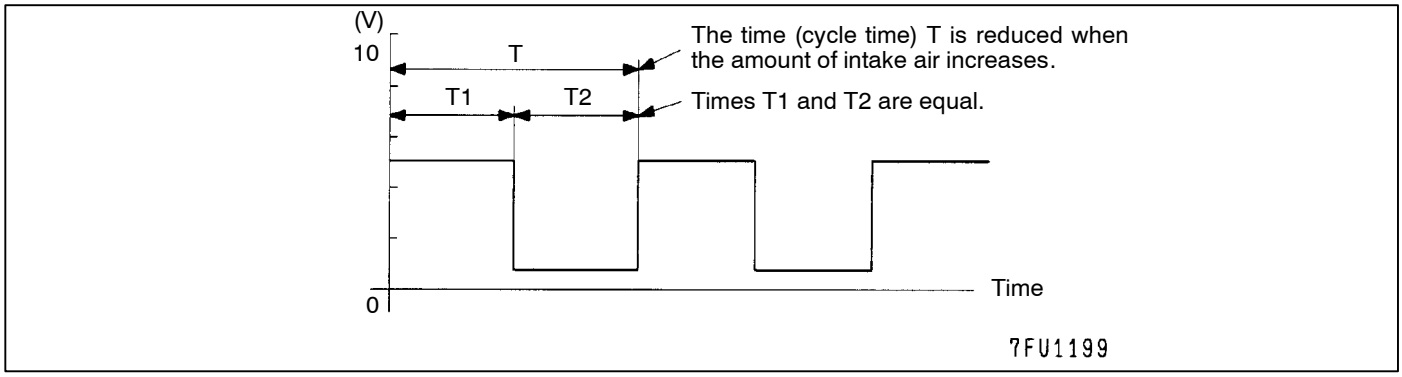
1. Connect the analyzer special patterns pickup to engine-ECU terminal 90.

Standard Wave Pattern

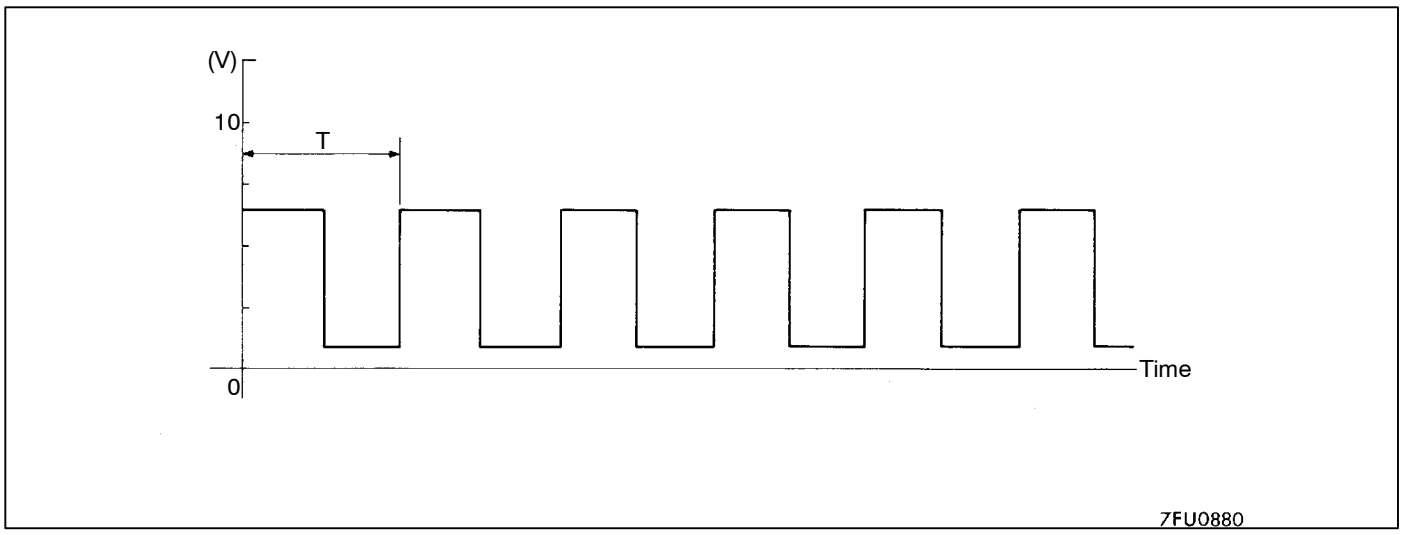
Observation conditions

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

Standard wave pattern

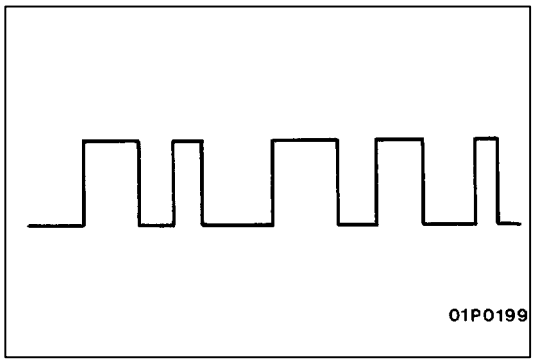


Observation conditions (from conditions above engine speed is increased by racing.)



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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

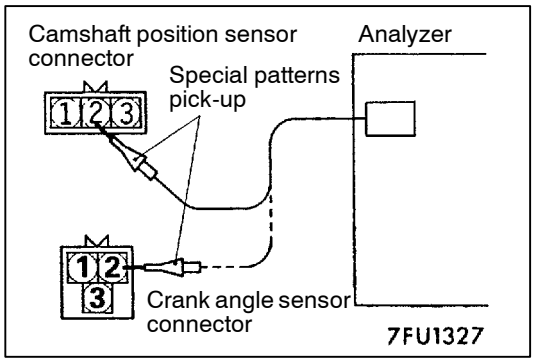
- Example 2

  Cause of problem

  Damaged rectifier or vortex generation column

  Wave pattern characteristics

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



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

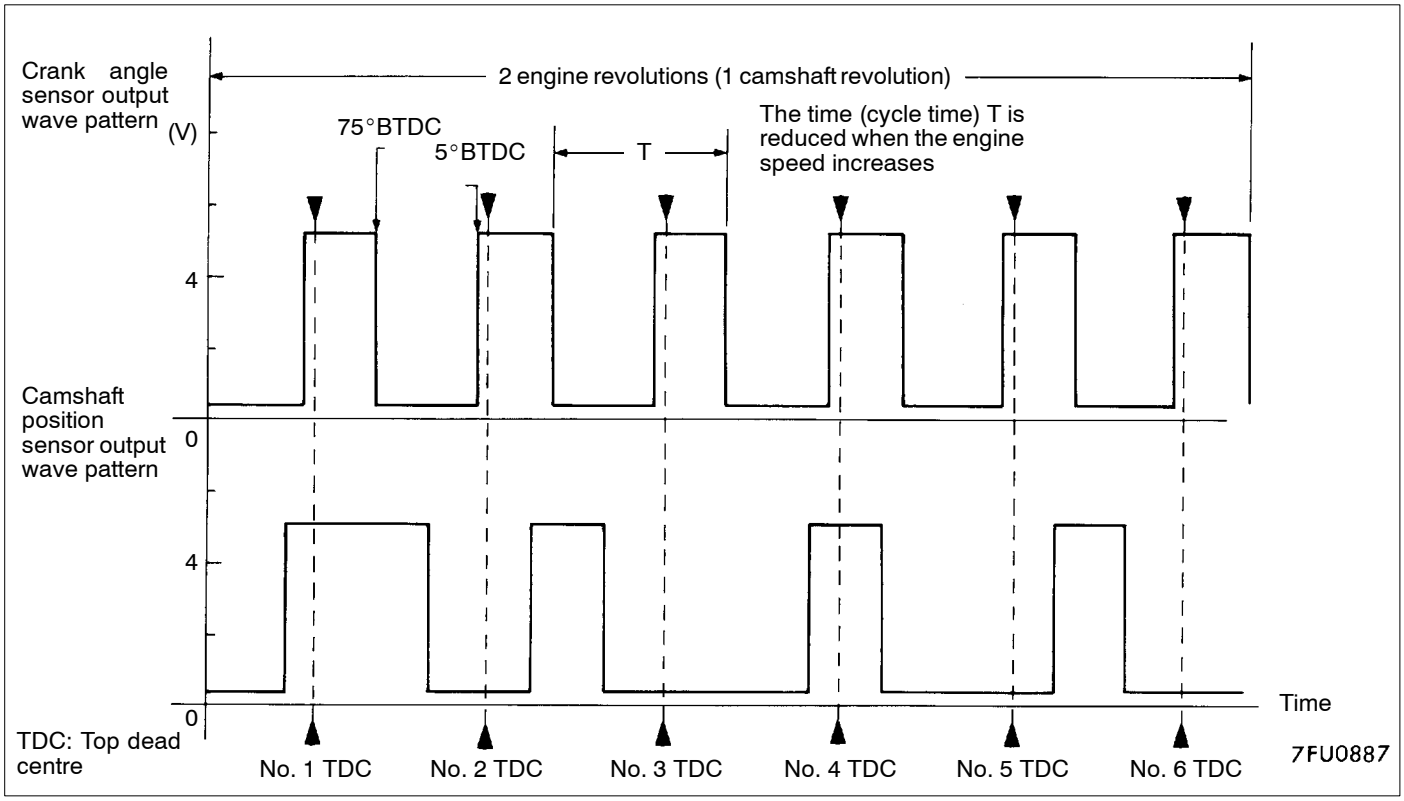
1. Connect the analyzer special patterns pickup to engine-ECU terminal 88. (When checking the top dead centre sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 89. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

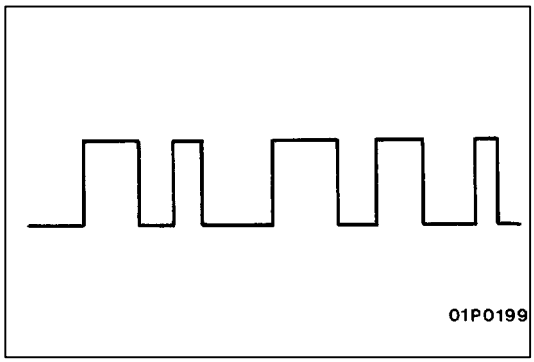
Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern



Wave Pattern Observation Points

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



Examples of Abnormal Wave Patterns

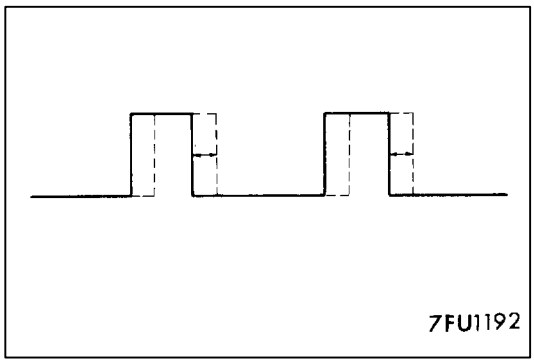
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

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



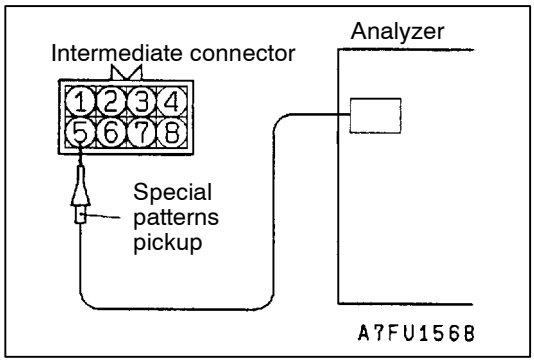
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTOR

Measurement Method

1. Disconnect the injector intermediate harness connector, and then connect the special tool (test harness: MD998474) in between. (Both the power supply side and engine-ECU side should be connected.)
2. To measure cylinder No. 1, connect the analyzer special patterns pickup to terminal 3 (red clip [red lead wire] of the special tool). For cylinder No. 2, connect to terminal 2 (yellow clip [yellow lead wire]). For cylinder No. 3, connect to terminal 1 (green clip [green lead wire]). For cylinder No. 4, connect to terminal 7 (white clip [white lead wire]). For cylinder No. 5, connect to terminal 6 (green clip [green and black lead wire]). For cylinder No. 6, connect to terminal 5 (yellow clip [red and yellow lead wire]).

Alternate Method (Test harness not available)

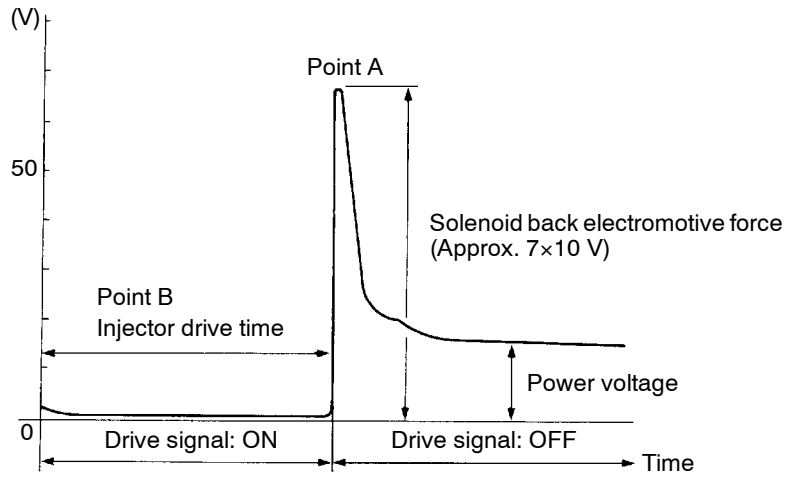
1. Connect the analyzer special patterns pickup to engine-ECU terminal 1. (When checking the No. 1 cylinder.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 14. (When checking the No. 2 cylinder.)
3. Connect the analyzer special patterns pickup to engine-ECU terminal 2. (When checking the No. 3 cylinder.)
4. Connect the analyzer special patterns pickup to engine-ECU terminal 15. (When checking the No. 4 cylinder.)
5. Connect the analyzer special patterns pickup to engine-ECU terminal 3. (When checking the No. 5 cylinder.)
6. Connect the analyzer special patterns pickup to engine-ECU terminal 16. (When checking the No. 6 cylinder.)

Standard Wave Pattern

Observation conditions

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

Standard wave pattern

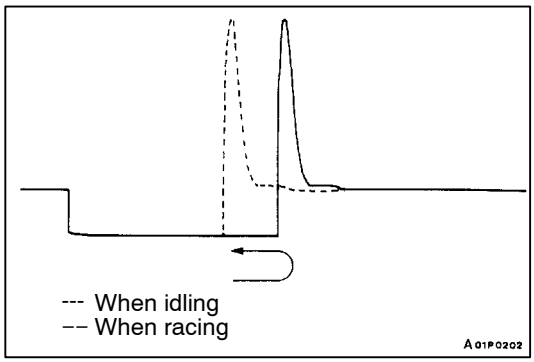


Wave Pattern Observation Points

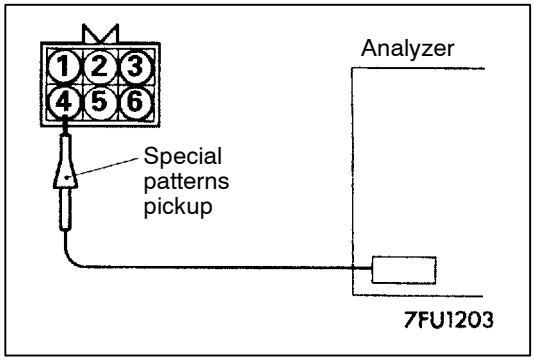
Explanation of Wave Pattern

Point A: Height of solenoid back electromotive force

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



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



STEPPER MOTOR

Measurement Method

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

Alternate Method (Test harness not available)

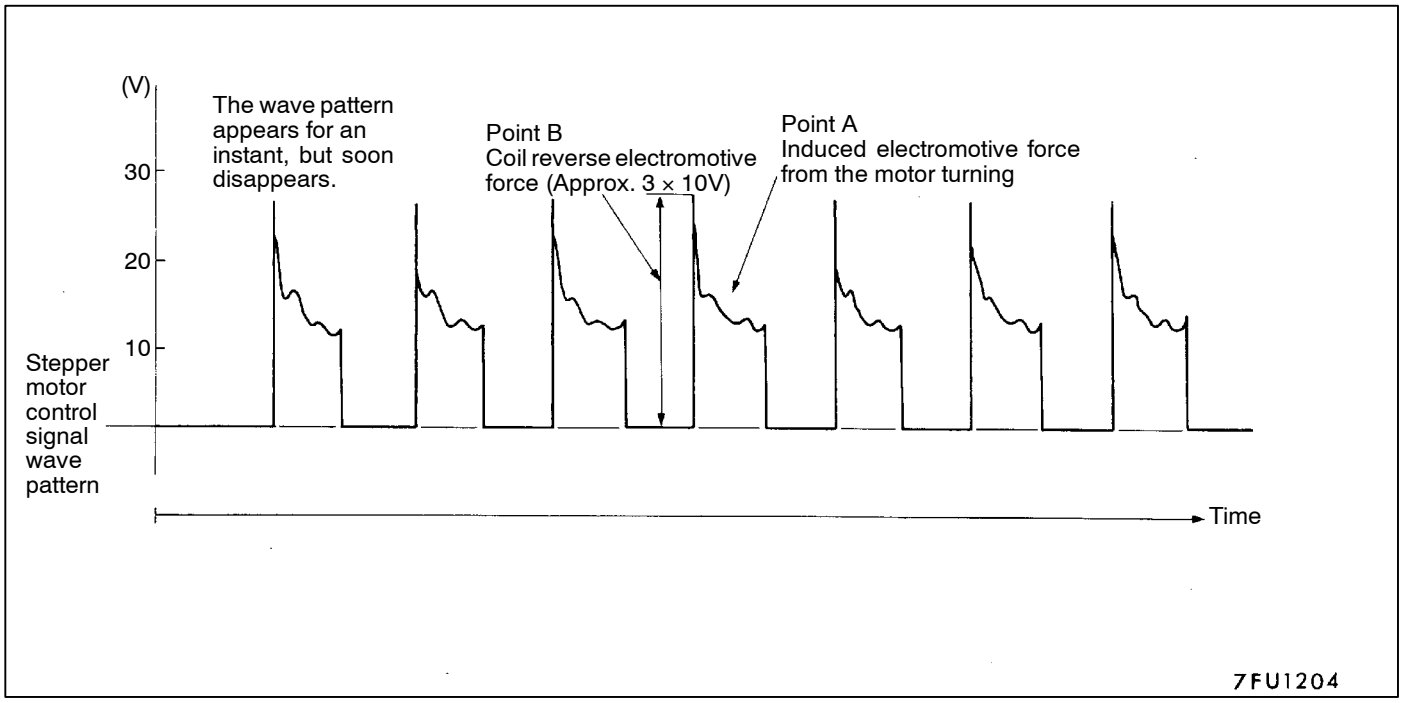
1. Connect the analyzer special patterns pickup to engine-ECU terminal 4, connection terminal 5, connection terminal 17, and connection terminal 18 respectively.

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)

Standard wave pattern



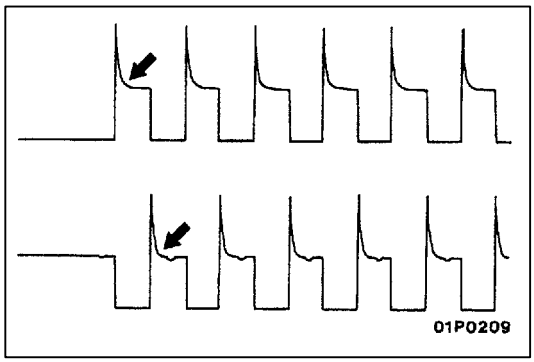
Wave Pattern Observation Points

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

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

Point B: Height of coil reverse electromotive force

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



Examples of Abnormal Wave Pattern

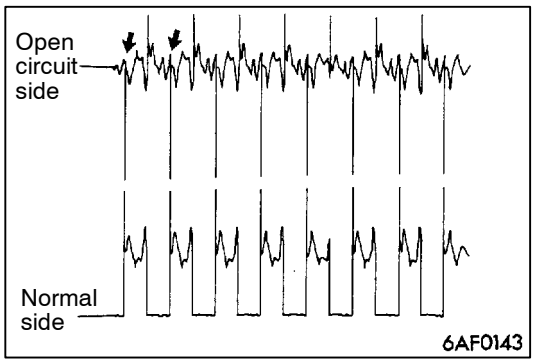
- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.



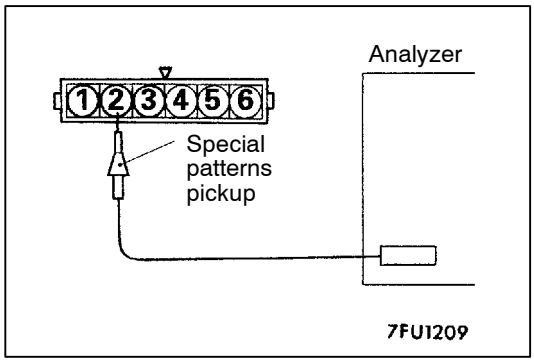
- Example 2

  Cause of problem

  Open circuit in the line between the stepper motor and the engine-ECU.

  Wave pattern characteristics

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



IGNITION COIL AND POWER TRANSISTOR

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

Measurement Method

1. Disconnect the 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 the power transistor connector terminal 1 (No. 3 – No. 6), terminal 2 (No. 2 – No. 5) and terminal 3 (No. 1 – No. 4) respectively.

Alternate Method (Test harness not available)

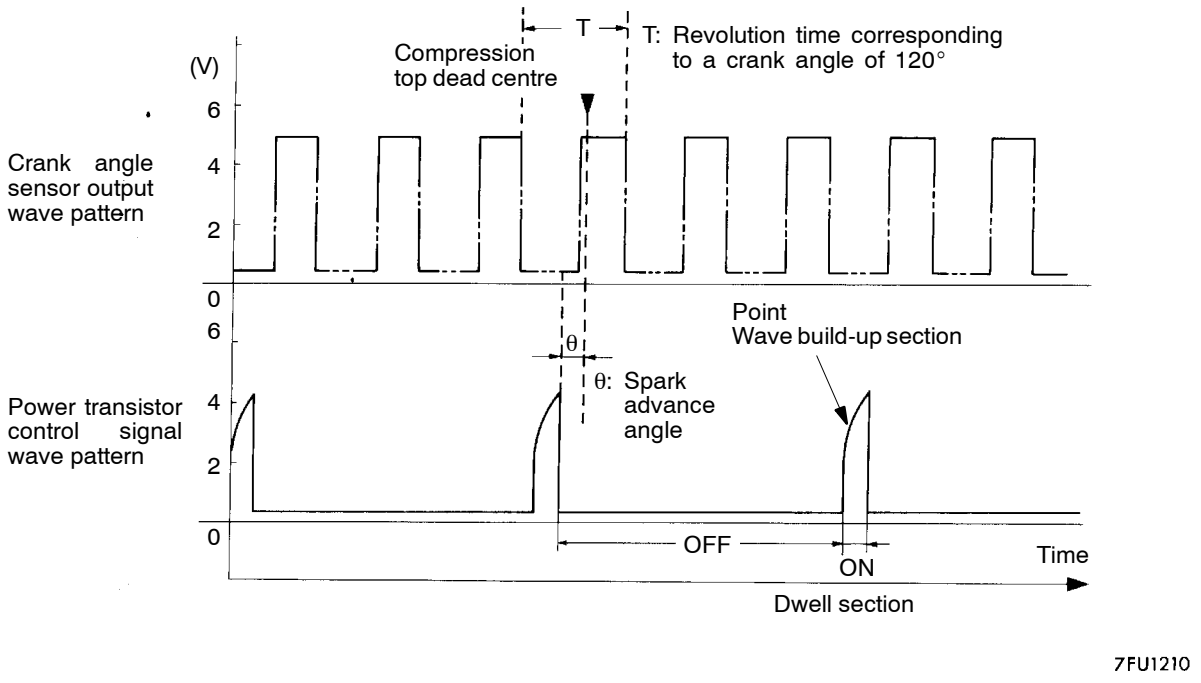
1. Connect the analyzer special patterns pickup to the engine ECU terminal 10 (No. 1 – No. 4), terminal 11 (No. 3 – No. 6), terminal 23 (No. 2 – No. 5) respectively.

Standard Wave Pattern

Observation condition

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

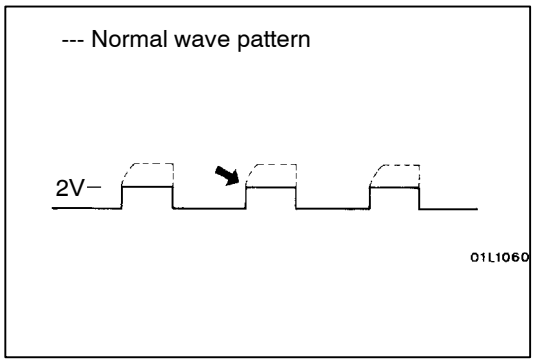
Standard wave pattern



Wave Pattern Observation Points

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

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from appox. 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

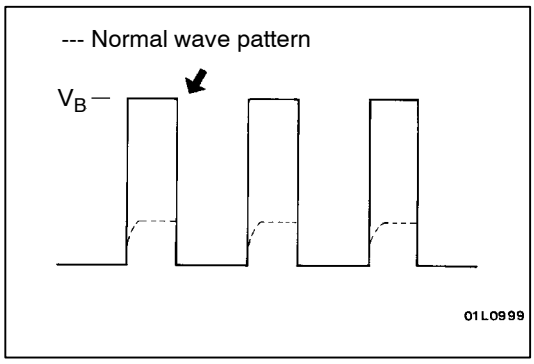
  Wave pattern during engine cranking

  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 2 V too low.



- Example 2

  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

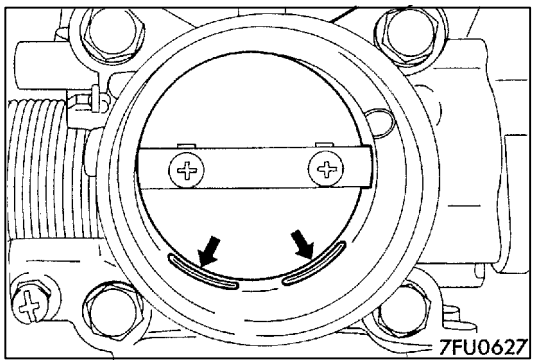
  Power voltage results when the power transistor is ON.

ON-VEHICLE SERVICE

13100100498

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.



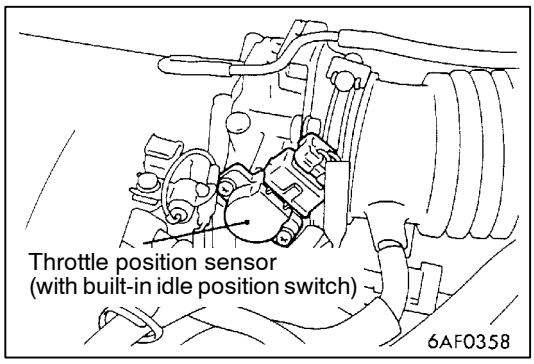
3. Plug the bypass passage inlet of the throttle body.

   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.

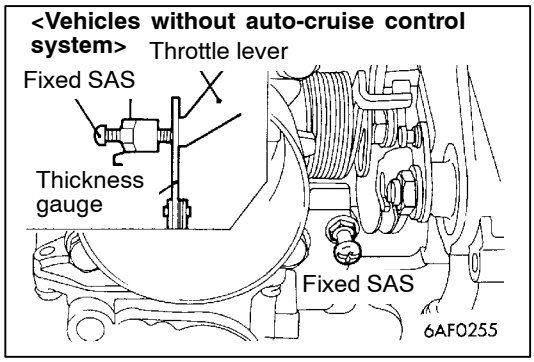
10. Adjust the basic idle speed. (Refer to P.13A-78.)

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 13100330453

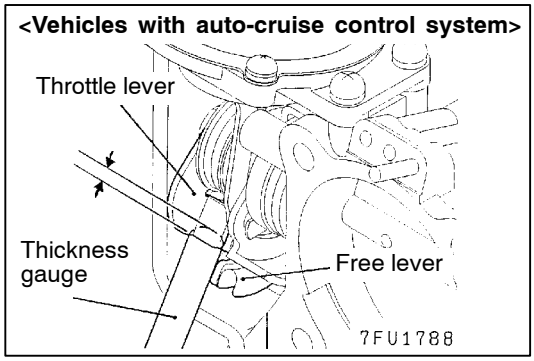
1. Connect the MUT-II to the diagnosis connector.



2. Insert a thickness gauge as follows:

<Vehicles without auto-cruise control system>

Insert a thickness gauge with a thickness of 0.65 mm between the fixed SAS and the throttle lever.

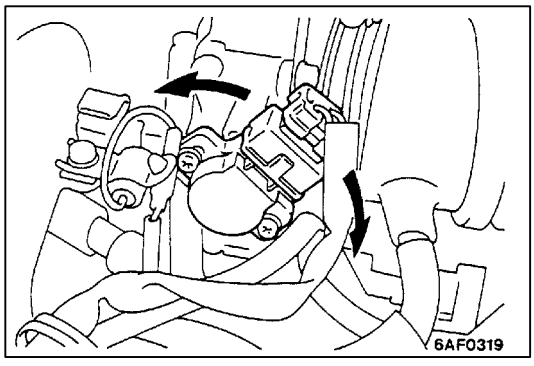


<Vehicles with auto-cruise control system>

Insert a 1.4-mm thick thickness gauge up to approx. 3 mm between the levers shown in the figure.

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

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

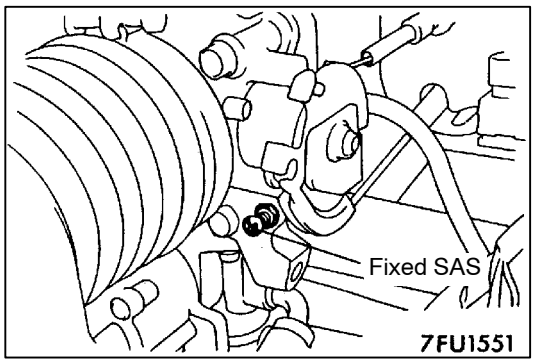


4. Loosen the throttle position sensor mounting bolt, and then turn the throttle position sensor clockwise as far as it will go.
5. Check that the idle position switch is ON at this position.
6. Slowly turn the throttle position sensor counterclockwise and find the point where the idle position switch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

7. Check the throttle position sensor output voltage.

   Standard value: 400 – 1,000 mV

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



FIXED SAS ADJUSTMENT

13100150462

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

1. Loosen the tension of the accelerator cable sufficiently.
2. Back out the fixed SAS lock nut.
3. Turn the fixed SAS counterclockwise until it is sufficiently backed out, and fully close the throttle valve.
4. Tighten the fixed SAS until the point where the throttle lever is touched (i.e., the point at which the throttle valve begins to open) is found.
   From that point, tighten the fixed SAS 1 1/4 turns.
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-77).

BASIC IDLE SPEED ADJUSTMENT

13100180553

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

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

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

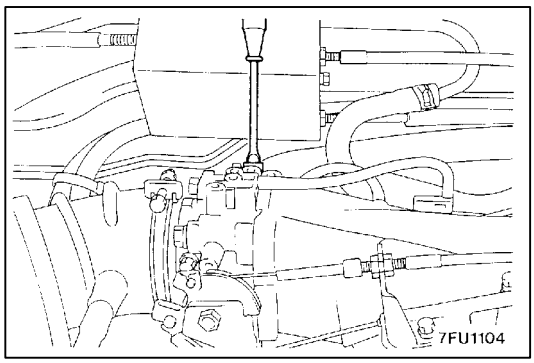
3. Start the engine and run at idle.
4. Select the item No. 30 of the MUT-II Actuator test.

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

5. Check the idle speed.

   Standard value: 700 ± 50 r/min

   NOTE
   (1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
   (2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13A-76.)



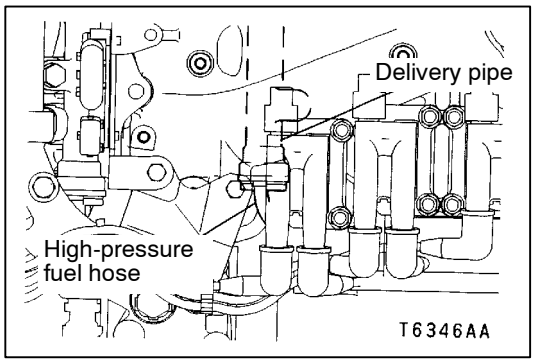
6. If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

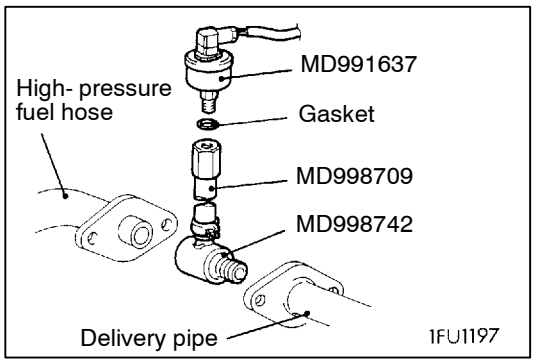
   NOTE
   If the idling speed is higher than the standard value range even when the SAS is fully closed, check whether or not jthere is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS.

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

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

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





FUEL PRESSURE TEST

13100190563

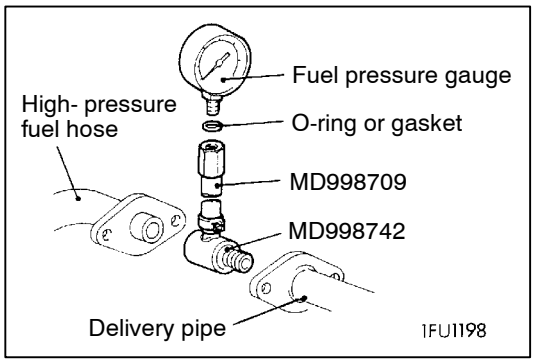
1. Release residual pressure from the fuel pipe line to prevent fuel from gushing out. (Refer to P.13A-83.)
2. Disconnect the high-pressure fuel hose at the delivery pipe side.

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

3. Change the fuel pressure measurement special tool adapter.
4. Attach the fuel pressure measurement special tool adapter.

   <When using the fuel pressure gauge set (special tool)>

   (1) Attach the fuel pressure measurement special tool between the delivery pipe and the high-pressure hose.
   (2) Pass a gasket over the fuel pressure special measurement tool and then install the tool into the fuel pressure gauge set (special tool).
   (3) Connect the fuel pressure gauge set lead wires to the power supply (cigarette lighter socket) and the MUT-II.

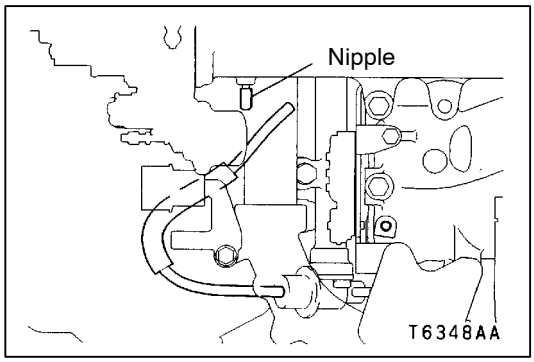


<When using the fuel pressure gauge>

(1) Place an O-ring or gasket over the fuel pressure measurement special tool and then install the tool into the fuel pressure gauge.
(2) Install the special tool assembled in 1. above between the delivery pipe and the high-pressure hose.

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

Standard value:
Approx. 265 kPa at kerb idle



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

Standard value:
324 – 343 kPa at kerb idle

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

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

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

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

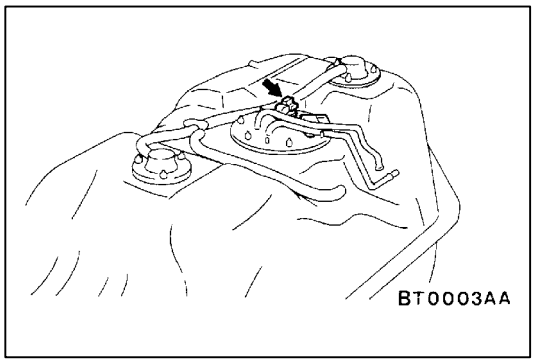
15. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

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

16. Release residual pressure from the fuel pipe line. (Refer to P.13A-83.)
17. Remove the fuel pressure gauge and special tool from the delivery pipe.

    Caution
    Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.
18. Replace the O-ring at the end of the fuel high pressure hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
19. Fit the fuel high pressure hose over the delivery pipe and tighten the bolt to specified torque.

    Tightening torque: 5 Nm
20. Check for any fuel leaks by following the procedure in step 5.
21. Disconnect the MUT-II

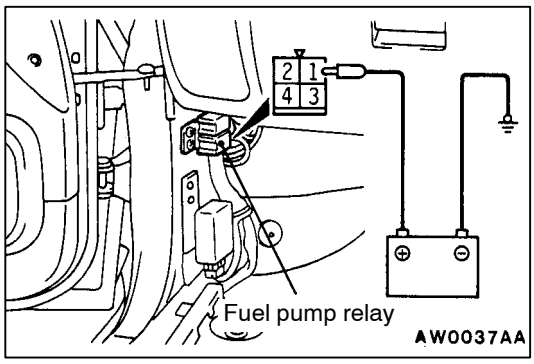


FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE FUEL LINE PRESSURE)

1310090375

When removing the fuel pipe, hose, etc., release fuel pressure to prevent fuel splay.

1. Disconnect the fuel pump connector.
2. Start the engine and let it run until it stops naturally. Turn the ignition switch OFF.
3. Connect the fuel pump connector.



FUEL PUMP OPERATION CHECK

13100200372

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. If normal, check the fuel pump drive circuit.
   (1) Turn OFF the ignition switch.
   (2) When the connector terminal No.1 at the harness side of the fuel pump relay has been connected to the battery, check if the sound of the fuel pump operation can be heard.

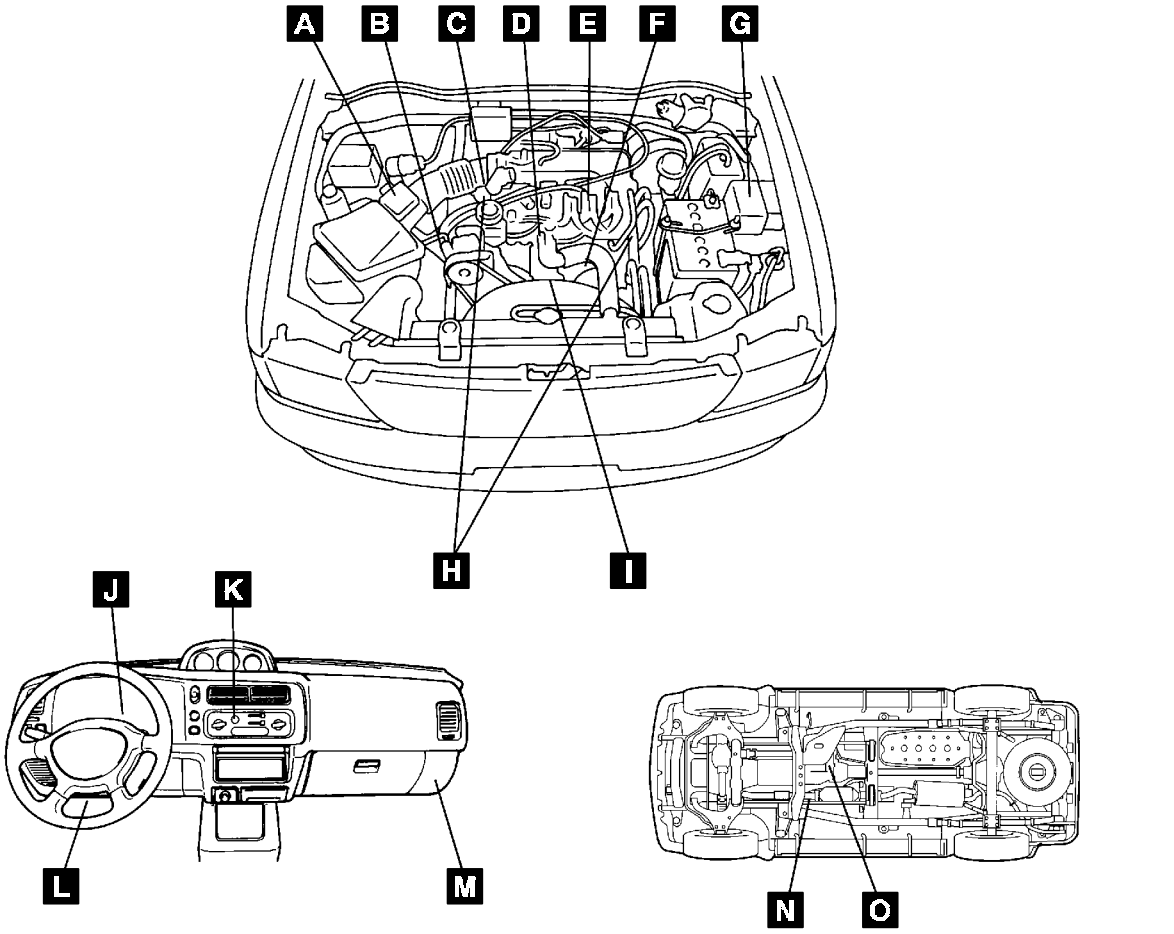
   NOTE
   As the fuel pump is an in-tank type, the fuel pump sound is hard to hear. Remove the fuel tank filler cap and check from the tank inlet

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

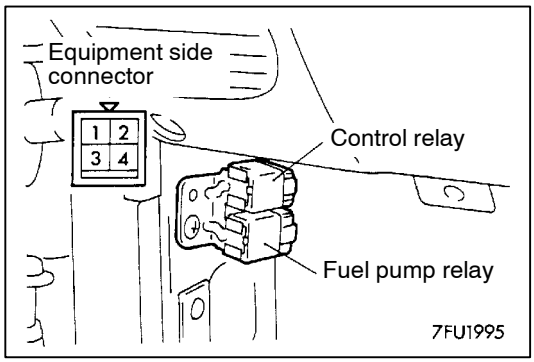
COMPONENT LOCATION

13100210658

Name	Symbol	Name	Symbol
A/C relay	G	Engine warning lamp (check engine lamp)	J
A/C switch	K		
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	A	Idle speed control servo	C
Camshaft position sensor	F	Ignition coil and power transistor unit	E
Control relay and fuel pump relay	M	Injector	H
Crank angle sensor	I	Oxygen sensor	N
Diagnosis connector	L	Power steering fluid pressure switch	B
Engine coolant temperature sensor	D	Throttle position sensor (with idle position switch)	C
Engine-ECU	M	Vehicle speed sensor	O



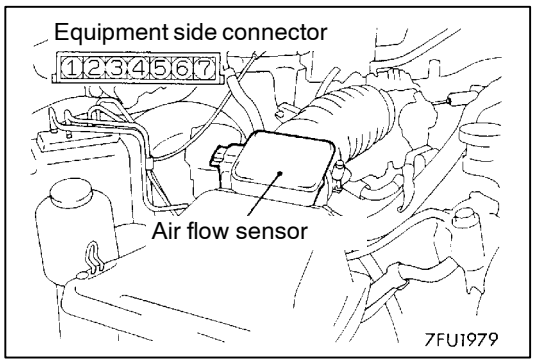
7FU2481



CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

13100990262

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

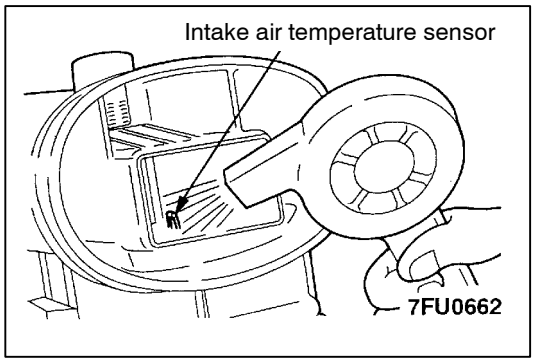


INTAKE AIR TEMPERATURE SENSOR CHECK

13100280321

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

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

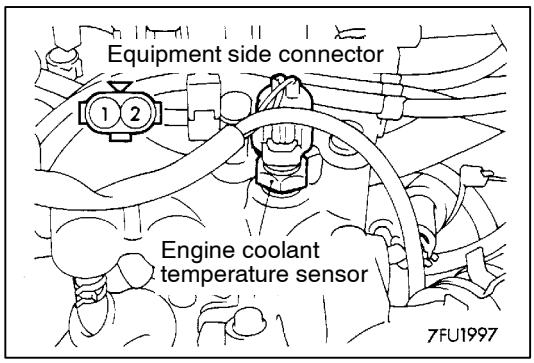


3. Measure resistance while heating the sensor using a hair drier.

Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

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

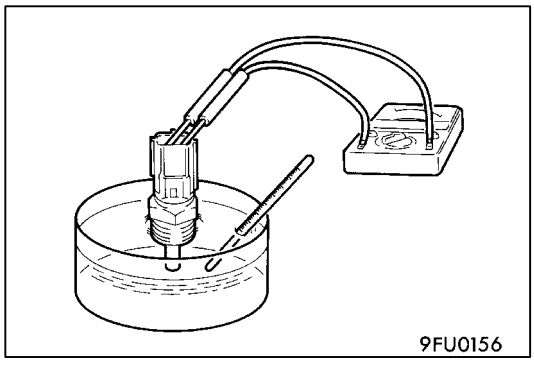


ENGINE COOLANT TEMPERATURE SENSOR CHECK

13100310327

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

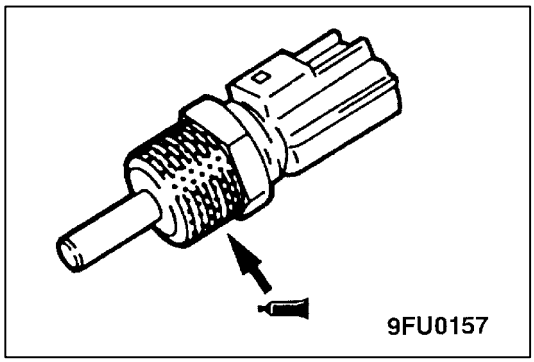
1. Remove the engine coolant temperature sensor.



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

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

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

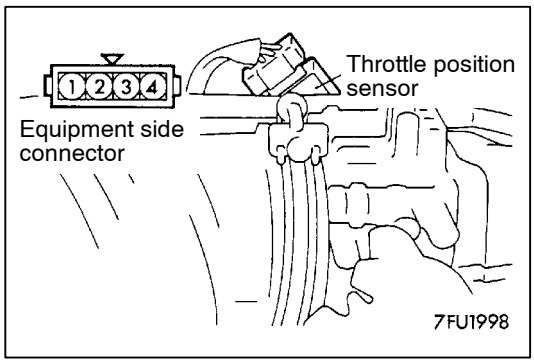


4. Apply sealant to threaded portion.

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

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

   Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK 1310320467

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

   Standard value: 3.5 – 6.5 kΩ

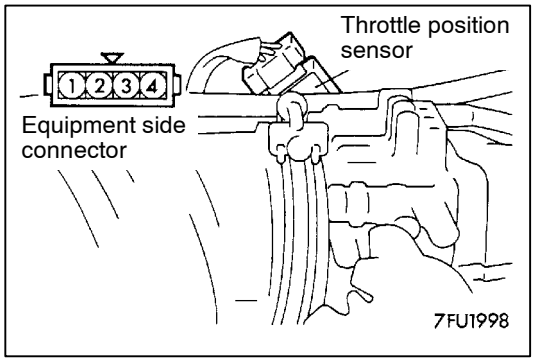
3. Measure the resistance between the throttle position sensor side connector terminal 1 and terminal 3.

   Normal condition:

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

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

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13A-77.



IDLE POSITION SWITCH CHECK 13100330446

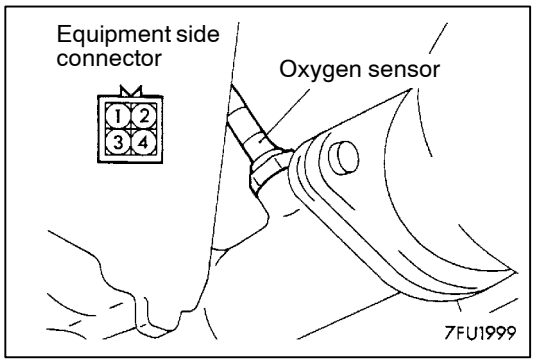
1. Disconnect the throttle position sensor connector.
2. Check the continuity between the throttle position sensor connector side terminal 1 and terminal 2.

   Normal condition:

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

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

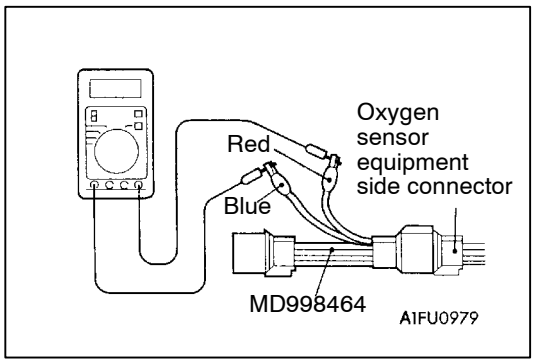
   NOTE
   After replacement, the idle position switch and throttle position sensor should be adjusted. (Refer to P.13A-77.)



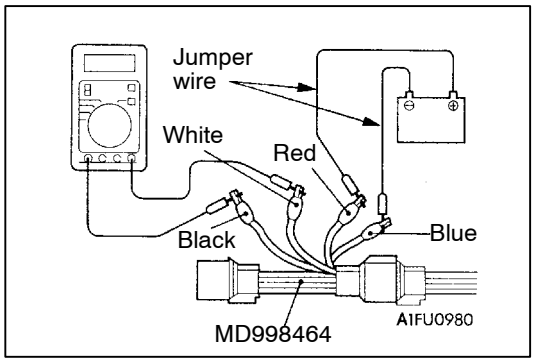
OXYGEN SENSOR CHECK

13100510239

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



2. Make sure that there is continuity (11 – 18 Ω at 20 °C) between terminal 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 wire to connect terminal 1 (red clip) of the oxygen sensor connector to the battery (+) terminal and terminal 3 (blue clip) to the battery (–) terminal.

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

6. Connect a digital voltage meter between terminal 2 (black clip) and terminal 4 (white clip).

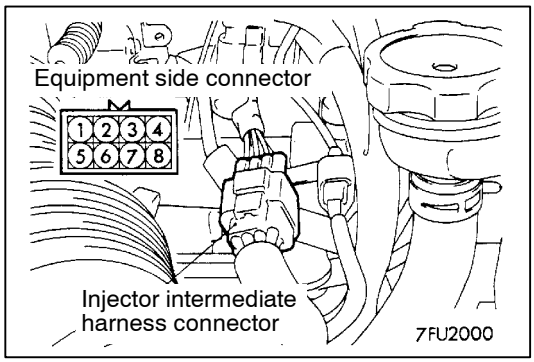
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

   Standard value:

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

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

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



INJECTOR CHECK

13100520423

Measurement of Resistance between Terminals

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

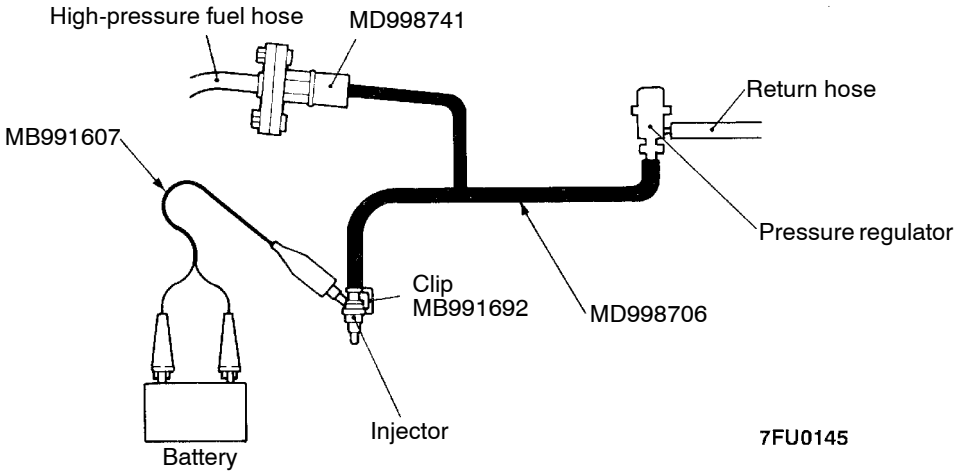
Standard value: 13 – 16 Ω (at 20°C)

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

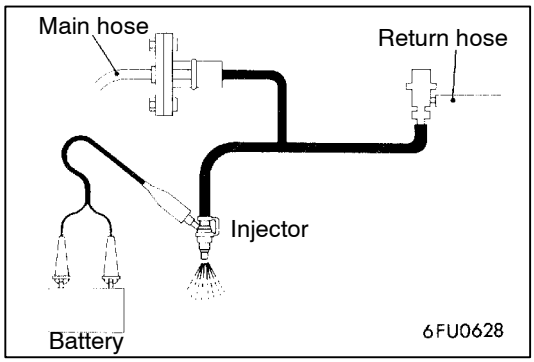
3. Connect the injector intermediate harness connectors.

Checking the Injection Condition

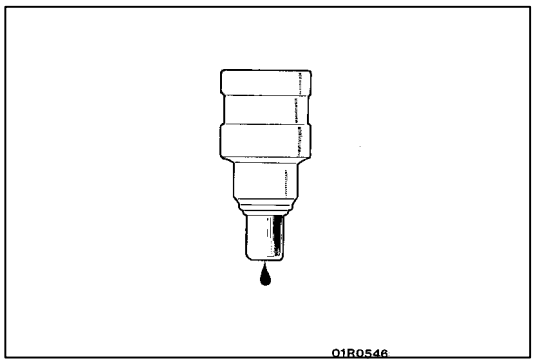
1. Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13A-83.)
2. Remove the injector.
3. Arrange the special tools (injector test set, adapter, injector test clip), the fuel pressure regulator and the injector as shown in the illustration below.



4. Connect the MUT-II to the diagnosis connector.
5. Turn the ignition switch to ON. (But do not start the engine.)
6. Select “Item No.07” from the MUT-II Actuator test to drive the fuel pump.



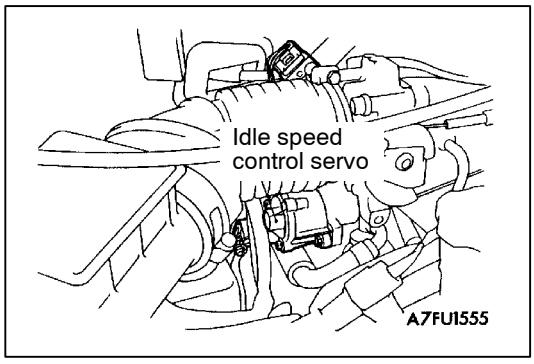
7. Activate the injector and check the atomized spray condition of the fuel.
   The condition can be considered satisfactory unless it is extremely poor.



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

   Standard value: 1 drop or less per minute

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



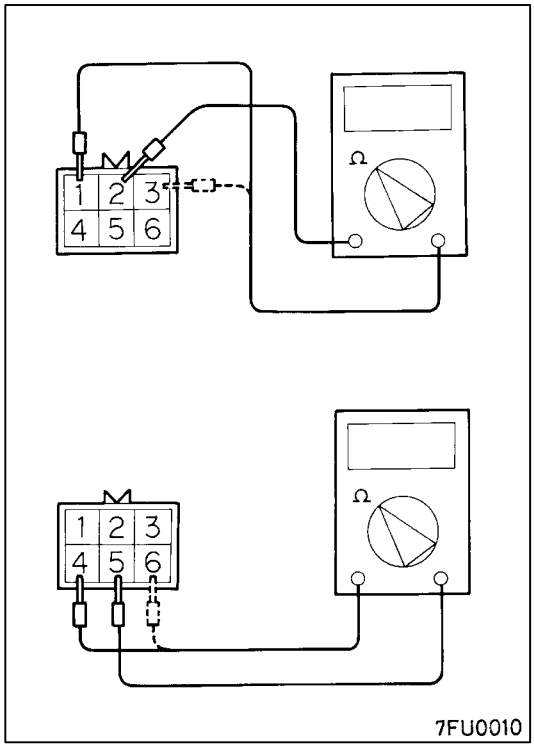
IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

13100540405

Checking the Operation Sound

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

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



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

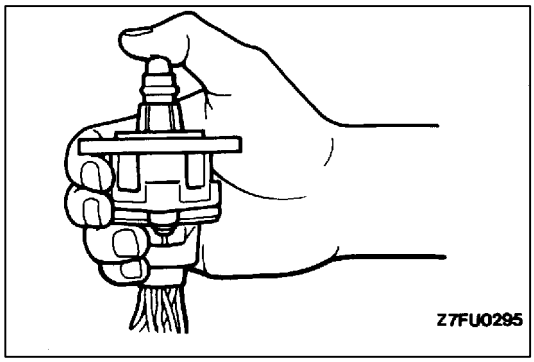
Checking the Coil Resistance

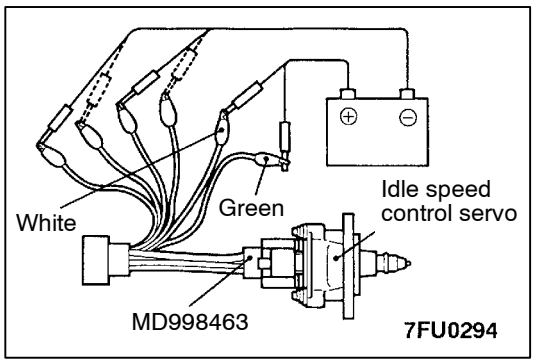
1. Disconnect the idle speed control servo connector and connect the special tool (test harness).
2. Measure the resistance between terminal 2 (white clip of the special tool) and either terminal 1 (red clip) or terminal 3 (blue clip) of the connector at the idle speed control servo side.

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

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

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





Operational Check

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

PURGE CONTROL SOLENOID VALVE CHECK

13100560111

Refer to GROUP 17 – Emission Control System.

EGR CONTROL SOLENOID VALVE CHECK

13100570107

Refer to GROUP 17 – Emission Control System.

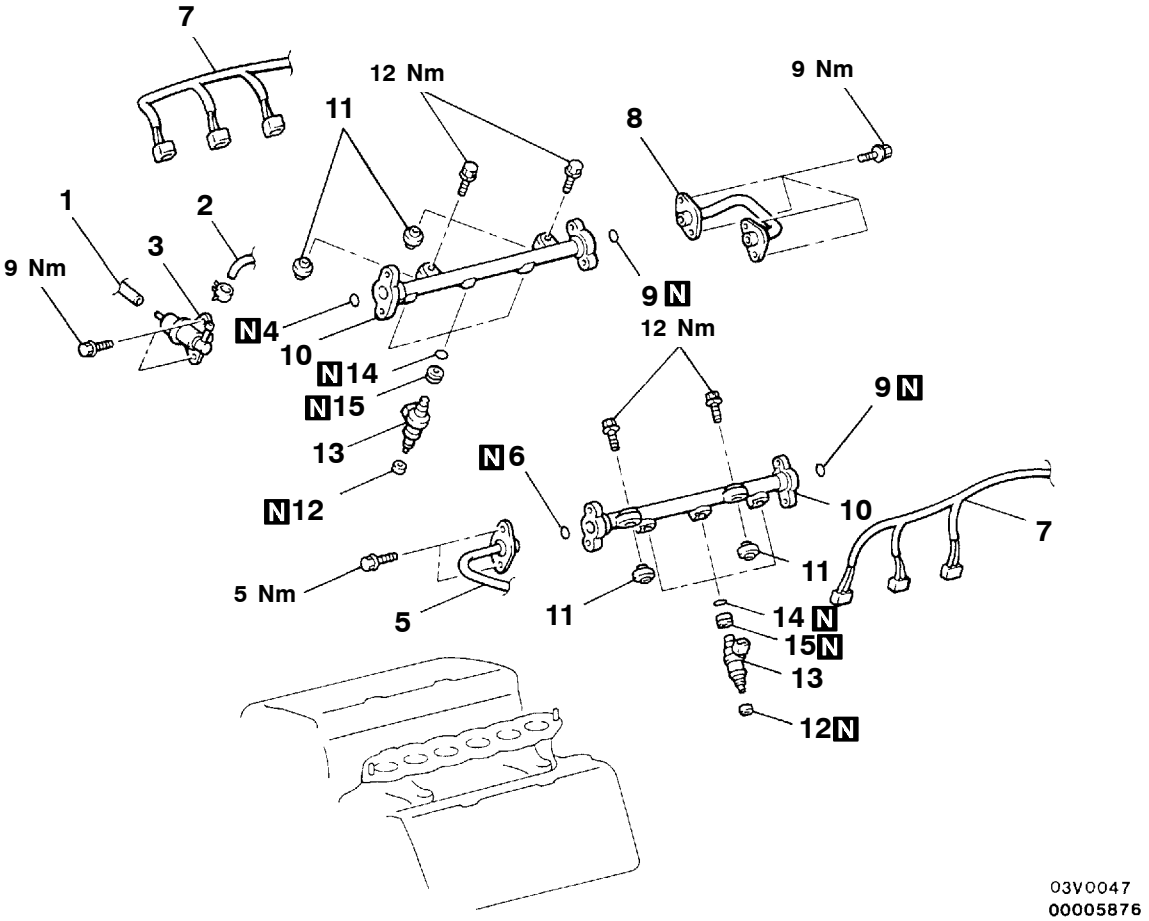
INJECTOR

13100710530

REMOVAL AND INSTALLATION

Pre-removal Operation
- Fuel Line Pressure Reduction (Refer to P.13A-82.)
- Intake Manifold Plenum Removal (Refer to GROUP 15 – Intake Manifold.)

Post-installation Operation
- Intake Manifold Plenum Removal (Refer to GROUP 15 – Intake Manifold.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)
- Fuel Leakage Inspection



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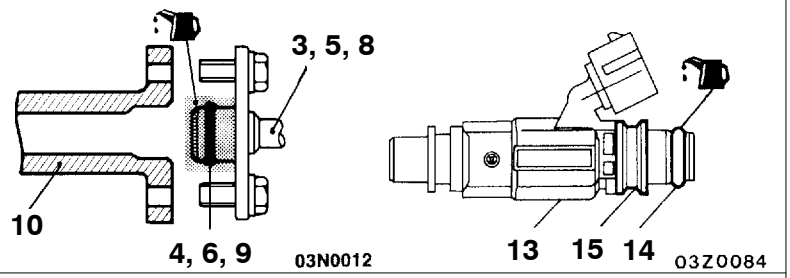


Engine oil

Removal steps

1. Vacuum hose
2. Fuel return hose connection
▶A◀ 3. Fuel pressure regulator
4. O-ring
▶A◀ 5. High-pressure fuel hose connection
6. O-ring
7. Injector connectors
8. Fuel pipe
9. O-rings
◀A▶ 10. Delivery pipes
11. Insulators
12. Insulators
◀A▶ ▶A◀ 13. Injectors
14. O-rings
15. Grommets

REMOVAL SERVICE POINT

◀A▶ DELIVERY PIPES/INJECTORS REMOVAL

Remove the delivery pipes (with the injectors attached).
Caution
Do not drop the injector(s).

INSTALLATION SERVICE POINTS

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

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

   Caution
   Do not let the engine oil get into the delivery pipes or the injectors will be damaged.

2. Turn the injectors. To the right and left to install to the delivery pipes. Repeat for fuel pressure regulator and high-pressure fuel hose.
   Be careful not to damage the O-ring. After installing, check that the item turns smoothly.
3. If it does not turn smoothly, the O-ring may be trapped, remove the item, re-install it into the delivery pipes and check again.
4. Tighten the high-pressure fuel hose and fuel pressure regulator to the specified torque.

   Tightening torque:
   9 Nm <Fuel pressure regulator>
   5 Nm <High-pressure fuel hose>

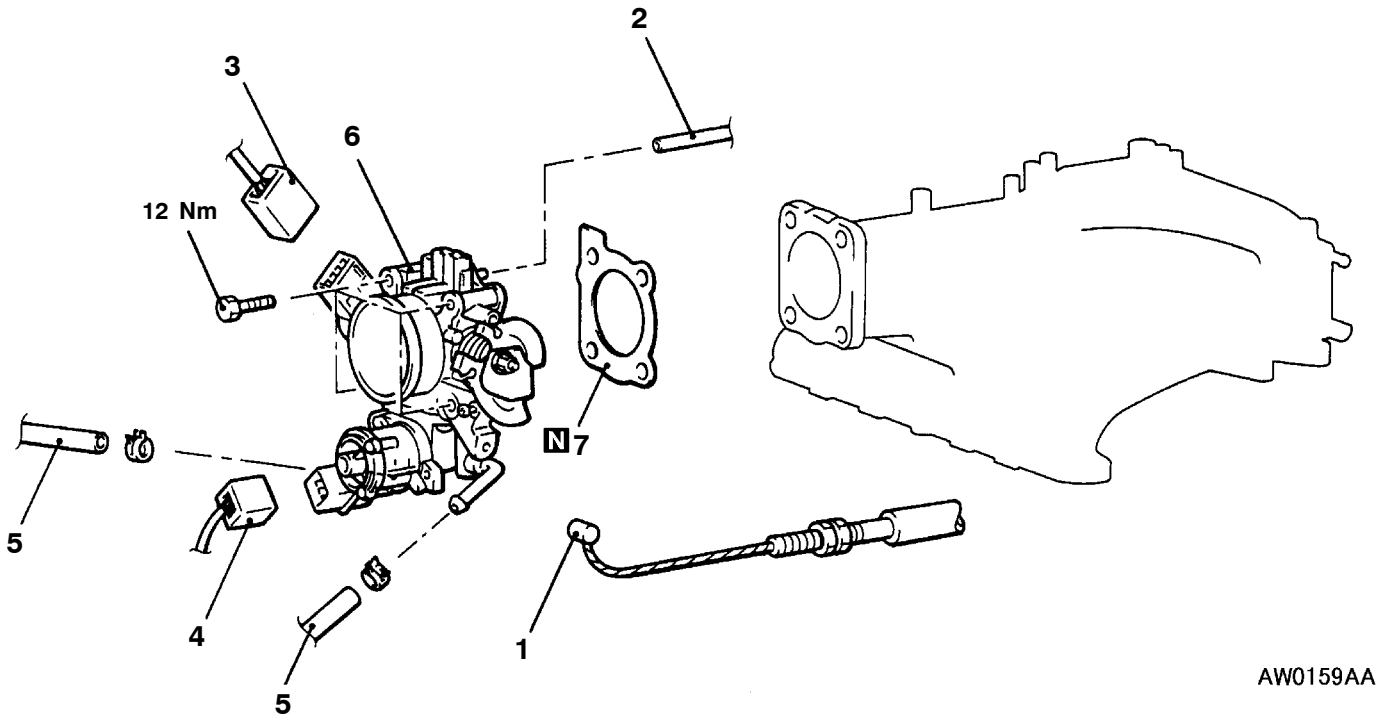
THROTTLE BODY

13100770460

REMOVAL AND INSTALLATION

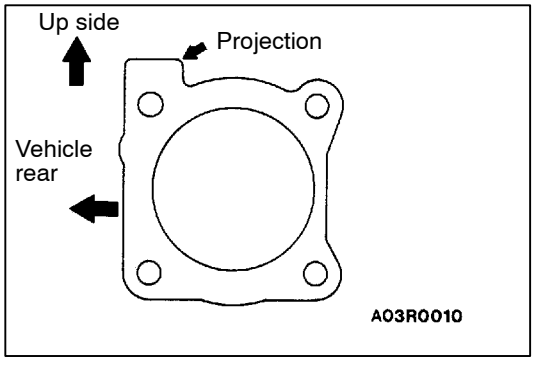
Pre-removal Operation
- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner Removal (Refer to GROUP 15 – Air Cleaner.)

Post-installation Operation
- Air Cleaner Installation (Refer to GROUP 15 – Air Cleaner.)
- Engine Coolant Refilling (Refer to GROUP 14 – On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



Removal steps

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



INSTALLATION SERVICE POINT

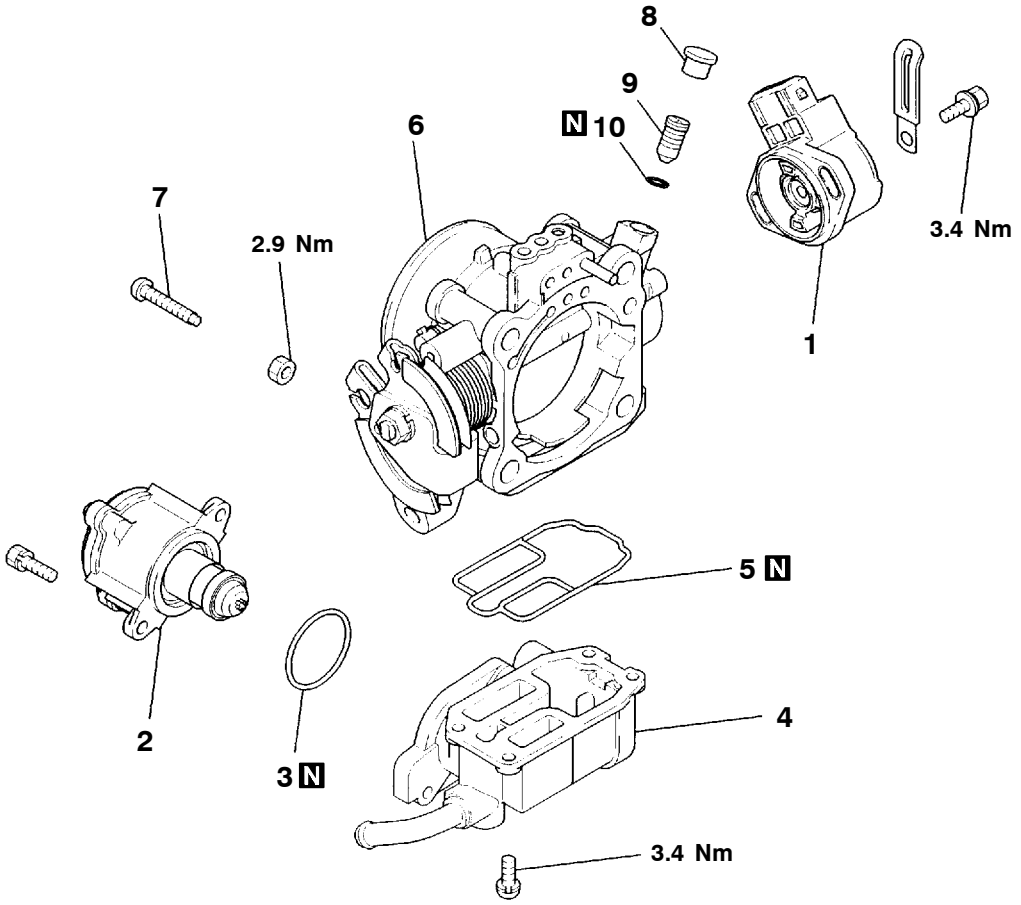
▶A◀ THROTTLE BODY GASKET INSTALLATION

Install the throttle body gasket as shown in the illustration.
Caution
Poor idling etc. may result if the throttle body gasket is installed incorrectly.

DISASSEMBLY AND REASSEMBLY

13100970587

<VEHICLES WITHOUT AUTO-CRUISE CONTROL SYSTEM>

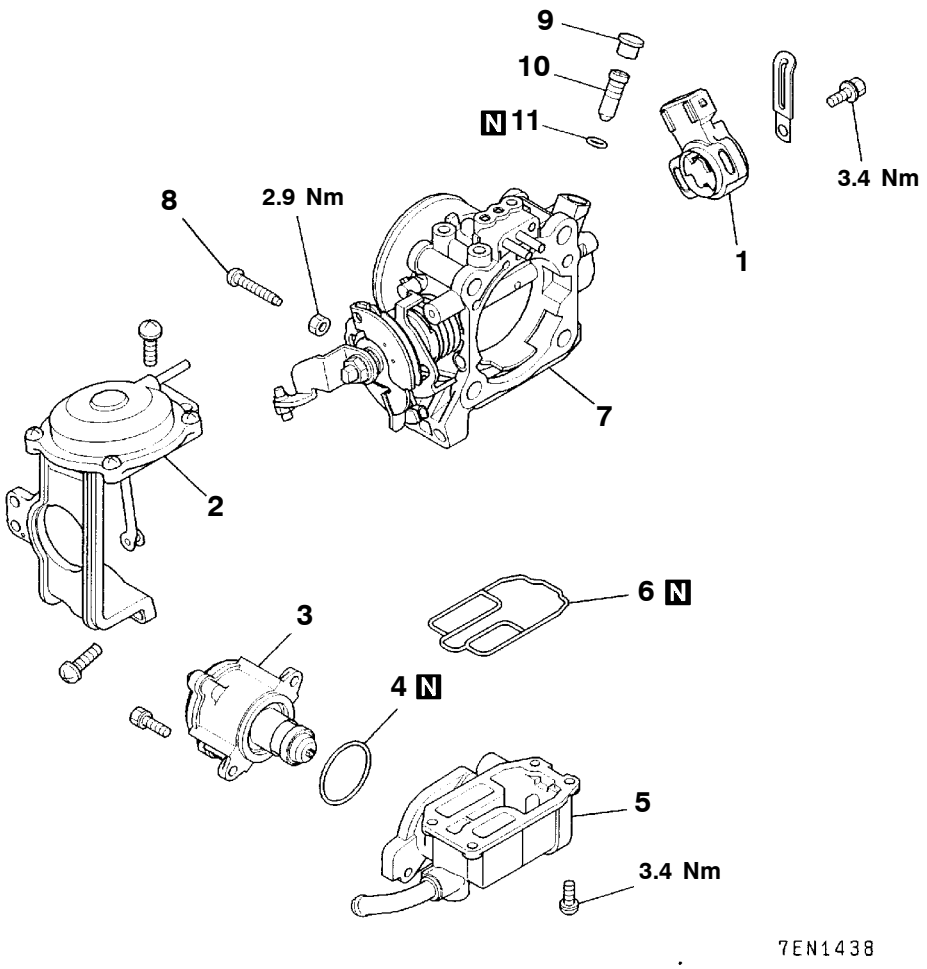


Removal steps

▶A◀ 1. Throttle position sensor
2. Idle air control motor
3. O-ring
4. Idle speed control servo (Stepper motor)
5. O-ring
6. Throttle body
7. Fixed SAS
8. Cap
9. Speed adjusting screw
10. O-ring

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

<VEHICLES WITH AUTO-CRUISE CONTROL SYSTEM>



Removal steps

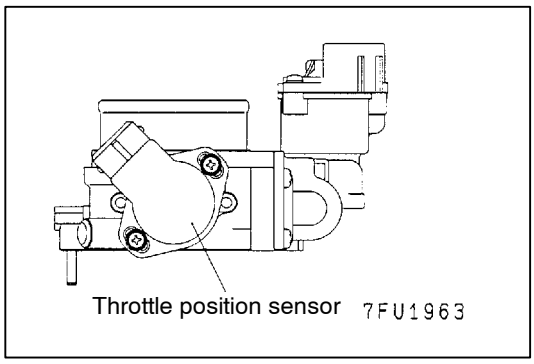
▶A◀ 1. Throttle position sensor
2. Lever assembly
3. Idle air control motor
4. O-ring
5. Idle speed control servo (Stepper motor)
6. O-ring
7. Throttle body
8. Fixed SAS
9. Cap
10. Speed adjusting screw
11. O-ring

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

CLEANING THROTTLE BODY PARTS

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

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



REASSEMBLY SERVICE POINT

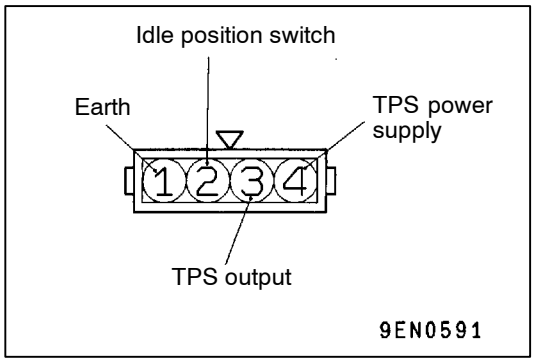
▶A◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

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

   Normal condition:

Throttle valve condition	Continuity
Fully closed	Continuity
Fully open	No continuity

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



DIESEL FUEL

CONTENTS

13309000061

GENERAL INFORMATION

13300010025

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.

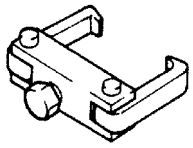
SERVICE SPECIFICATIONS

13300030076

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

SPECIAL TOOL

13300060020

Tool	Number	Name	Use
	MD998388	Injection pump sprocket puller	Fuel injection pump sprocket removal

ON-VEHICLE SERVICE

13300090012

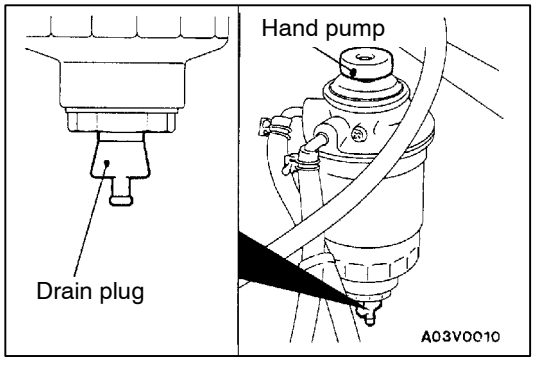
FUEL INJECTION TIMING CHECK AND ADJUSTMENT

Refer to GROUP 11B – On-vehicle Service.

ENGINE IDLE SPEED CHECK AND ADJUSTMENT

13300100012

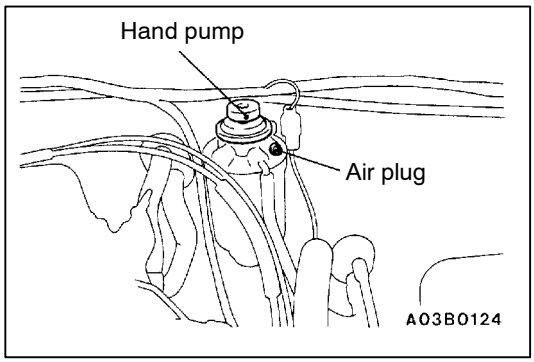
Refer to GROUP 11B – On-vehicle Service.



EVACUATION OF WATER FROM FUEL FILTER

13300120063

Water is in the filter when fuel filter warning lamp lights. Evacuate water by the following procedures.
1. Remove the intercooler assembly. (Refer to GROUP 15.)
2. Loosen drain plug.
3. Drain water with hand pump. Finger-tighten drain plug.



EVACUATION OF AIR FROM FUEL LINE 13300130066

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

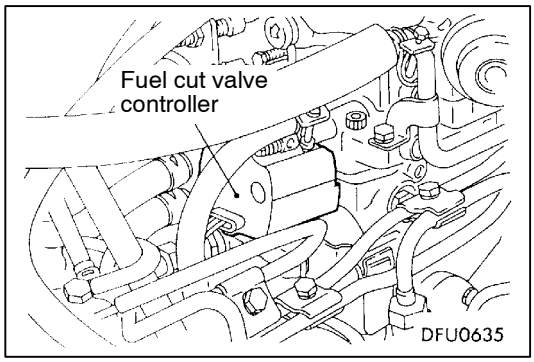
- When fuel is drained for service.
- When fuel filter is replaced.
- When main fuel line is removed.

1. Remove the intercooler assembly. (Refer to GROUP 15.)
2. Loosen fuel filter air plug.
3. Place rags around air plug hole. Operate hand pump repeatedly until no bubbles come from plug hole. Tighten air plug.
4. Repeat until hand pump operation becomes stiff.

FUEL FILTER CARTRIDGE REPLACEMENT

13300320043

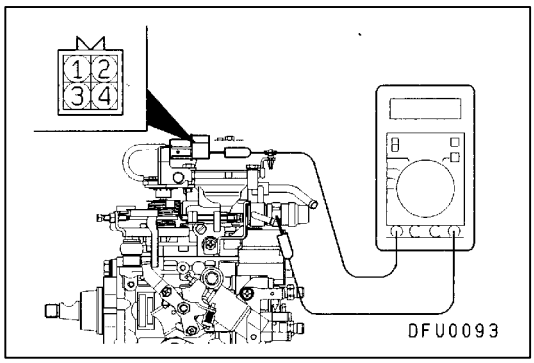
Refer to GROUP 13C.



FUEL INJECTION PUMP CHECK 13300140052

FUEL CUT VALVE CONTROLLER OPERATION CHECK

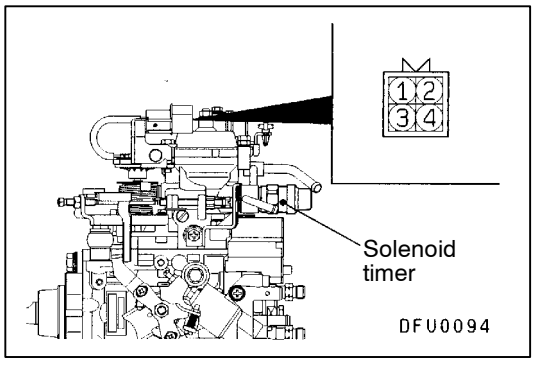
When a sound scope is held against the fuel cut valve controller and the ignition switch is turned to "ON", check that the sound of the valve operating can be heard.
If no operating sound can be heard, check the immobilizer system while referring to GROUP 54.



INJECTION TIMING CONTROL SOLENOID COIL RESISTANCE CHECK

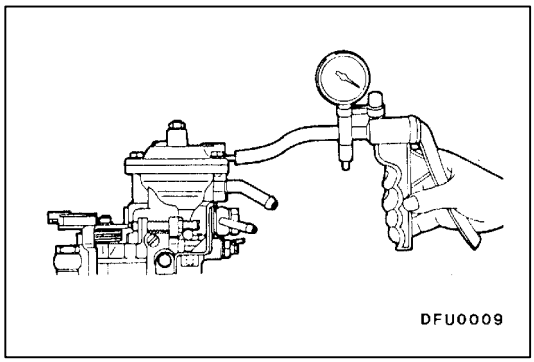
Measure the resistance between the injection pump connector terminal No.4 (injection timing control solenoid terminal) and the injection pump body.

Standard value: 8 – 10 Ω (at 20 °C)



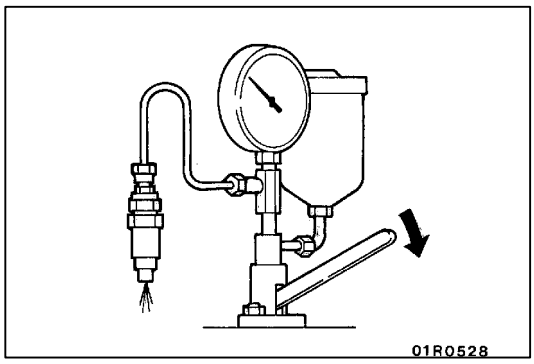
INJECTION TIMING CONTROL SOLENOID OPERATION CHECK

Check that operation sound of the injection timing control solenoid can be heard when connecting the injection pump connector terminal No.4 (injection timing control solenoid terminal) and the battery positive terminal.



BOOST COMPENSATOR CHECK 13300150024

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 CHECK AND ADJUSTMENT 13300160065

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

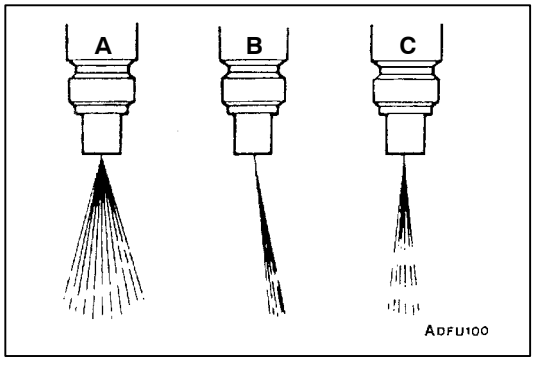
FUEL INJECTION INITIAL PRESSURE CHECK

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

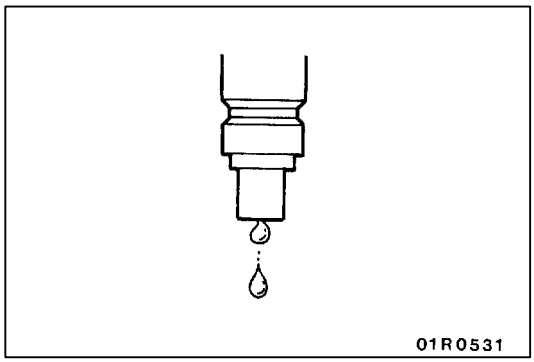
4. If the fuel injection initial pressure is outside the standard value, disassembly the nozzle holder to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

   NOTE
   (1) For disassembly, reassembly and adjustment of the nozzle holder, refer to P.13B-8.
   (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.

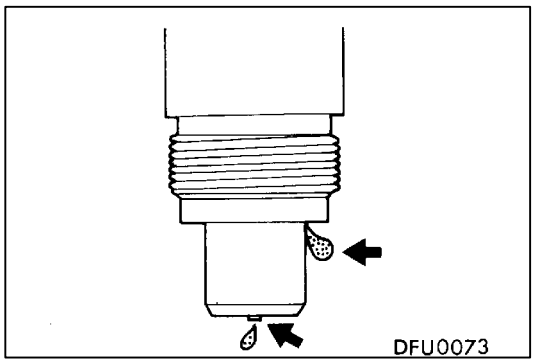


INJECTION SPRAY CONDITION CHECK

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 °C). The injection spray patterns shown in the illustration at left are wrong.
   A. Injection angle is tool 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 CHECK

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.

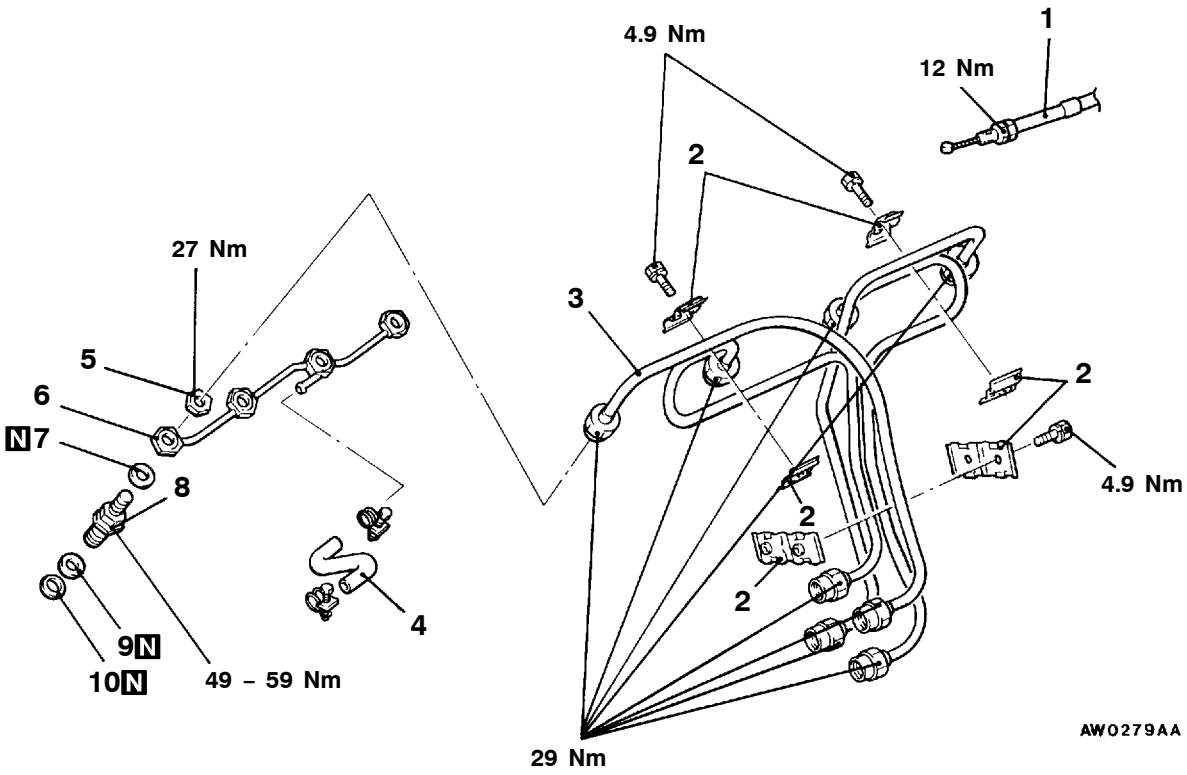
INJECTION NOZZLE

13300270034

REMOVAL AND INSTALLATION

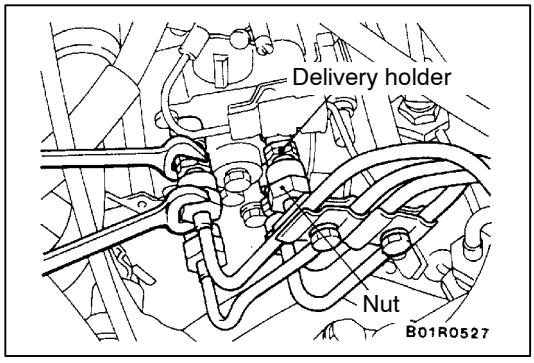
Pre-removal and
- Intercooler Removal (Refer to GROUP 15.)

Post-installation Operation
- Intercooler installation (Refer to GROUP 15.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



Removal steps

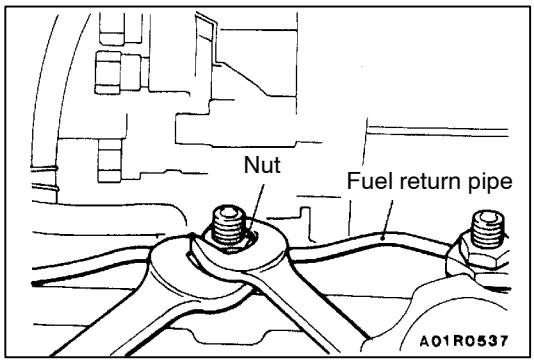
1. Accelerator cable connection
2. Injection pipe clamp
◀A▶ 3. Injection pipe
4. Fuel return hose
◀B▶ 5. Nut
◀B▶ 6. Fuel return pipe
7. Fuel return pipe gasket
◀C▶ 8. Injection nozzle assembly
▶A◀ 9. Holder gasket
▶A◀ 10. Nozzle gasket



REMOVAL SERVICE POINTS

◀A▶ INJECTION PIPE DISCONNECTION

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

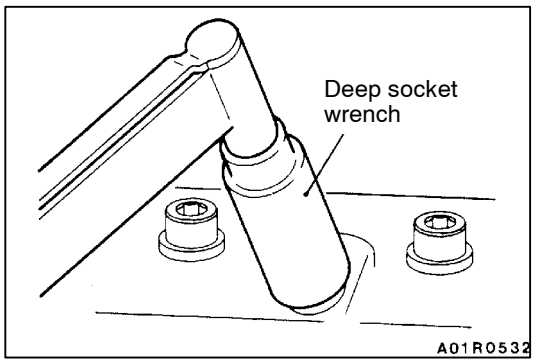


◀B▶ NUT/FUEL RETURN PIPE REMOVAL

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.

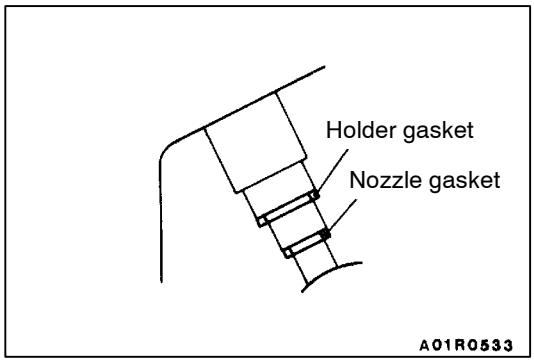
2. Disconnect the fuel return pipe.



◀C▶ INJECTION NOZZLE ASSEMBLY REMOVAL

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

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



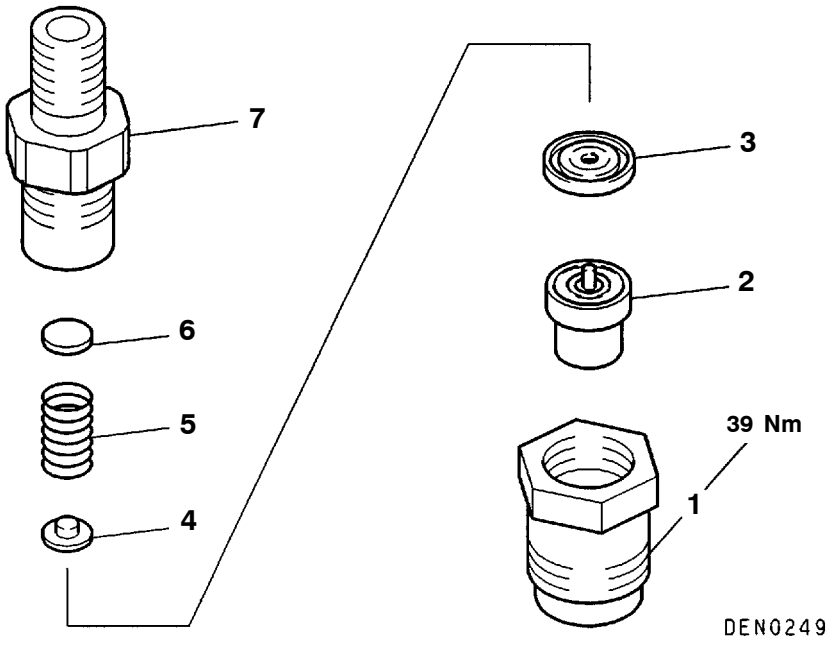
INSTALLATION SERVICE POINT

▶A◀ NOZZLE GASKET/HOLDER GASKET INSTALLATION

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

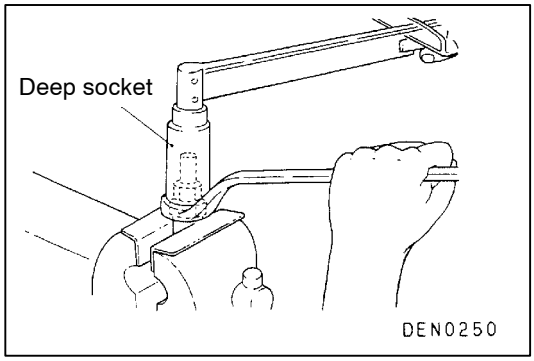
DISASSEMBLY AND REASSEMBLY

13300350011



Disassembly steps

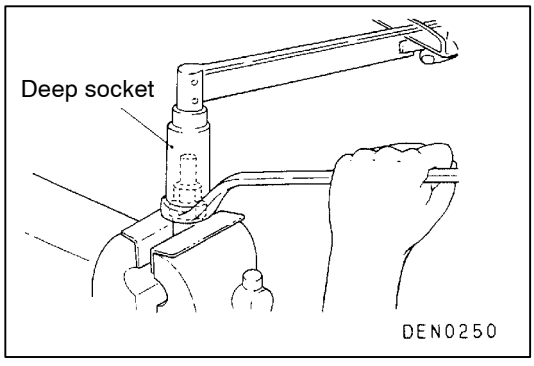
◀A▶ ▶A◀ 1. Retaining nut
2. Nozzle tip
3. Distance piece
4. Retaining pin
5. Pressure ring
6. Shim
7. Nozzle holder body



DISASSEMBLY SERVICE POINT

◀A▶ RETAINING NUT REMOVAL

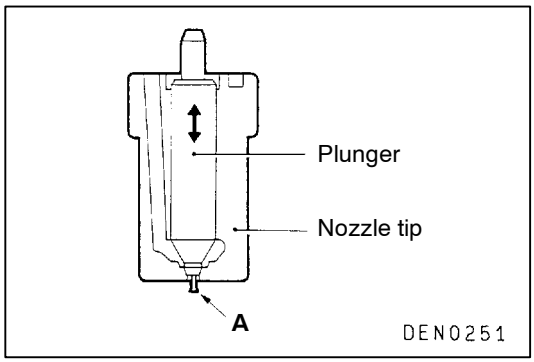
1. Lightly clamp the retaining nut in a vise with soft jaws.
2. Hold the retaining nut with a box wrench, and loosen the nozzle holder body using a deep socket.



REASSEMBLY SERVICE POINT

▶A◀ RETAINING NUT INSTALLATION

1. Finger-tighten the nozzle holder body.
2. Lightly clamp the retaining nut in a vise with soft jaws.
3. While holding the retaining nut with a box wrench, tighten the nozzle holder body to the specified torque with a deep socket.



INSPECTION

13300360014

NOZZLE TIP

1. Check the nozzle tip for carbon deposits. Scape off carbon deposits with a piece of wood and clean each part with petrol. After cleaning, keep parts submerged in diesel fuel. Take particular care to protect the nozzle tip needle valve from damage.
2. While the nozzle tip is submerged in diesel fuel, check that the needle valve slides smoothly.
   If the needle valve does not slide smoothly, replace the nozzle tip.
   When replacing the nozzle tip, completely wash off the anticorrosive oil from the new nozzle tip with clean diesel fuel before using it.
3. Check plunger tip “A” for deformation and breakage. If “A” is damaged or broken, replace it.

DISTANCE PIECE

Check the surface in contact with the nozzle holder body by using minium.

PRESSURE SPRING

Check spring for weakness and breakage.

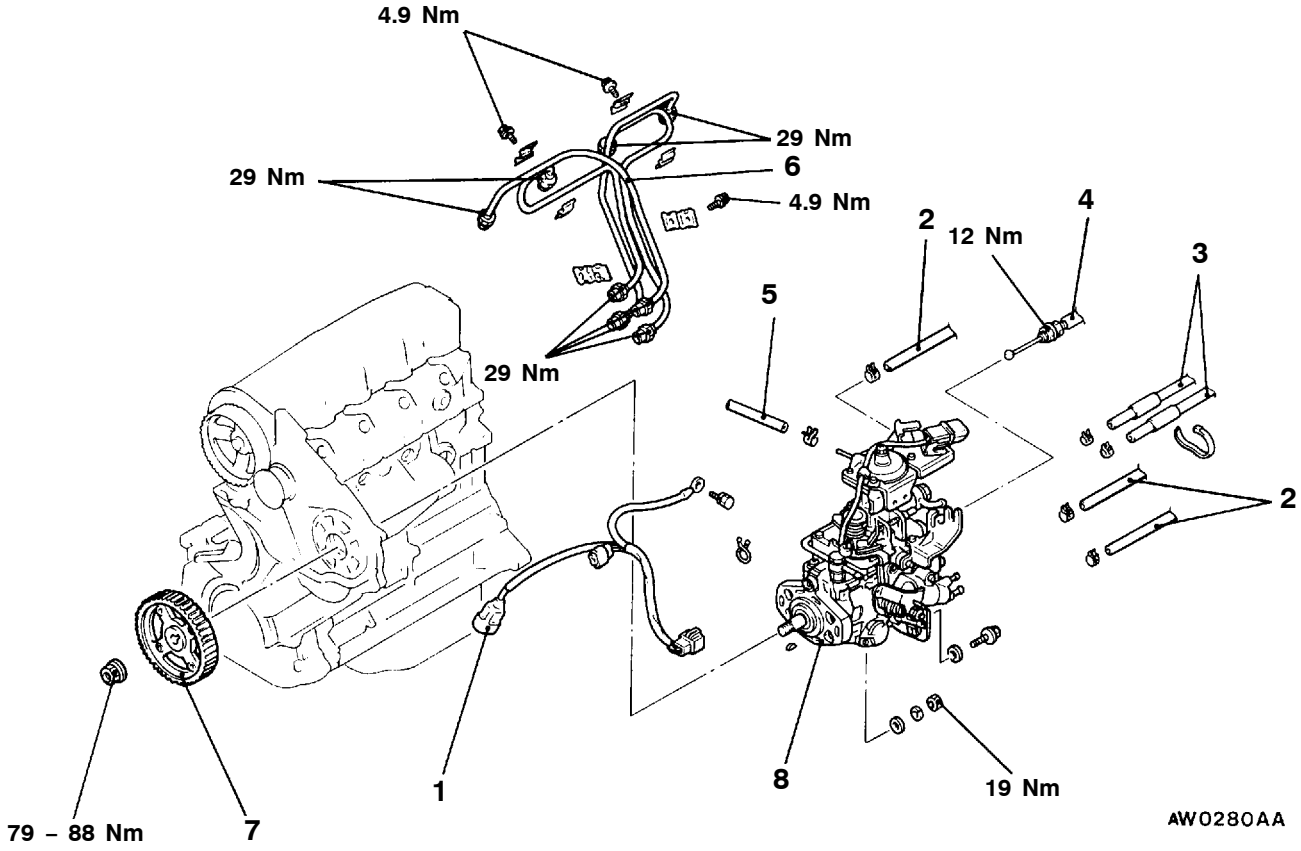
INJECTION PUMP

13300240035

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining
- Intercooler Removal (Refer to GROUP 15.)
- Timing Belt Removal (Refer to GROUP 11B.)

Post-installation Operation
- Timing Belt Installation (Refer to GROUP 11B.)
- Intercooler Installation (Refer to GROUP 15.)
- Engine Coolant Supplying
- Injection Timing Adjustment (Refer to GROUP 11B – On-vehicle Service.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)



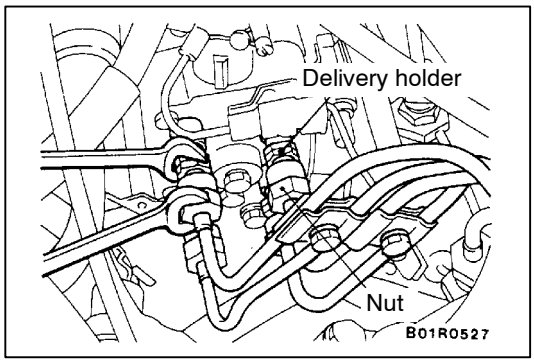
Removal steps

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

◀A▶ 5. Boost hose connection

◀B▶ 6. Fuel injection pipe

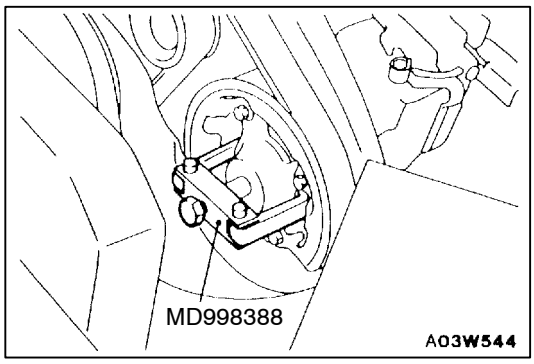
7. Fuel injection pump sprocket
8. Fuel injection pump



REMOVAL SERVICE POINTS

◀A▶ INJECTION PIPE REMOVAL

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



◀B▶ FUEL INJECTION PUMP SPROCKET REMOVAL

Remove 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.**

NOTES

FUEL SUPPLY

CONTENTS

13309000054

GENERAL INFORMATION

13300010094

The fuel tank is located under the floor below the rear seats.

A fuel cut-off valve has been adopted to prevent fuel from leaking out in the event of a collision.

FUEL TANK

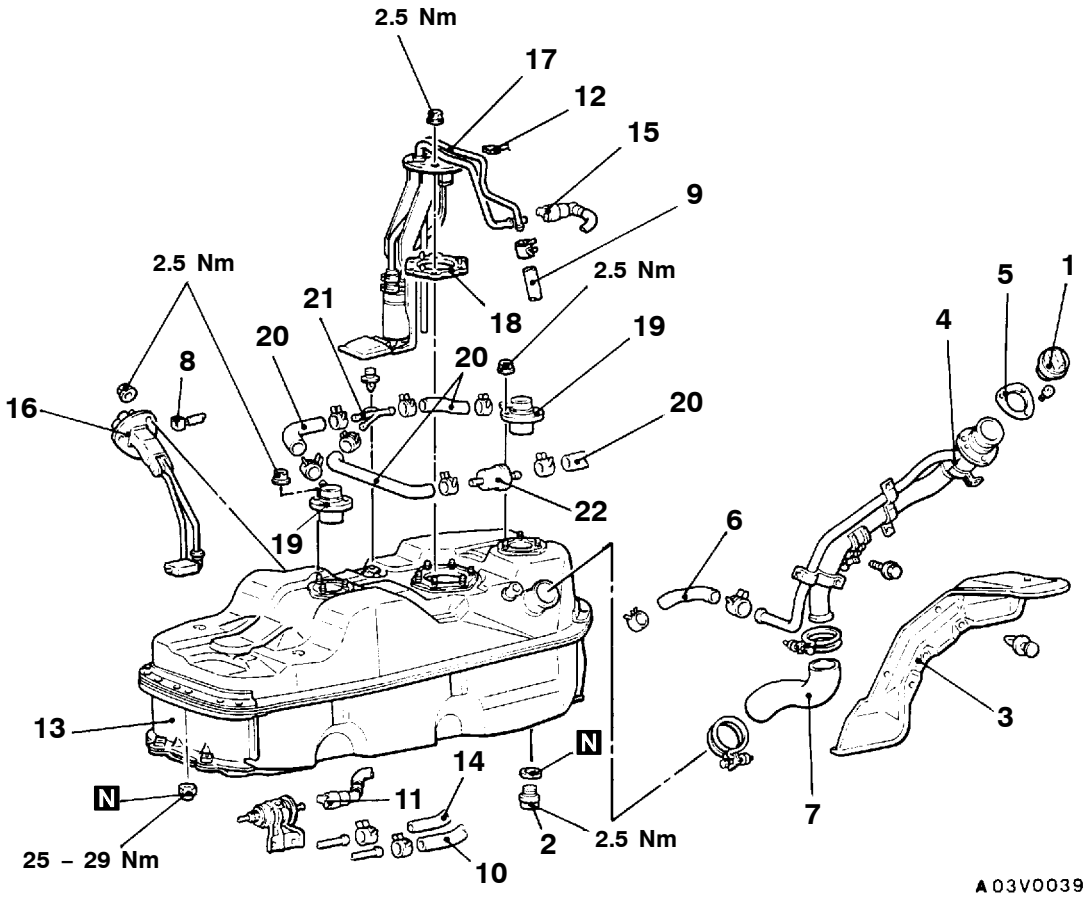
13500190442

REMOVAL AND INSTALLATION

<6G7>

Pre-removal Operation
- Draining Fuel
- Fuel Line Pressure Reduction
  (Refer to GROUP 13A – On-vehicle Service.)

Post-installation Operation
- Refilling Fuel
- Fuel Leakage Inspection



Removal steps

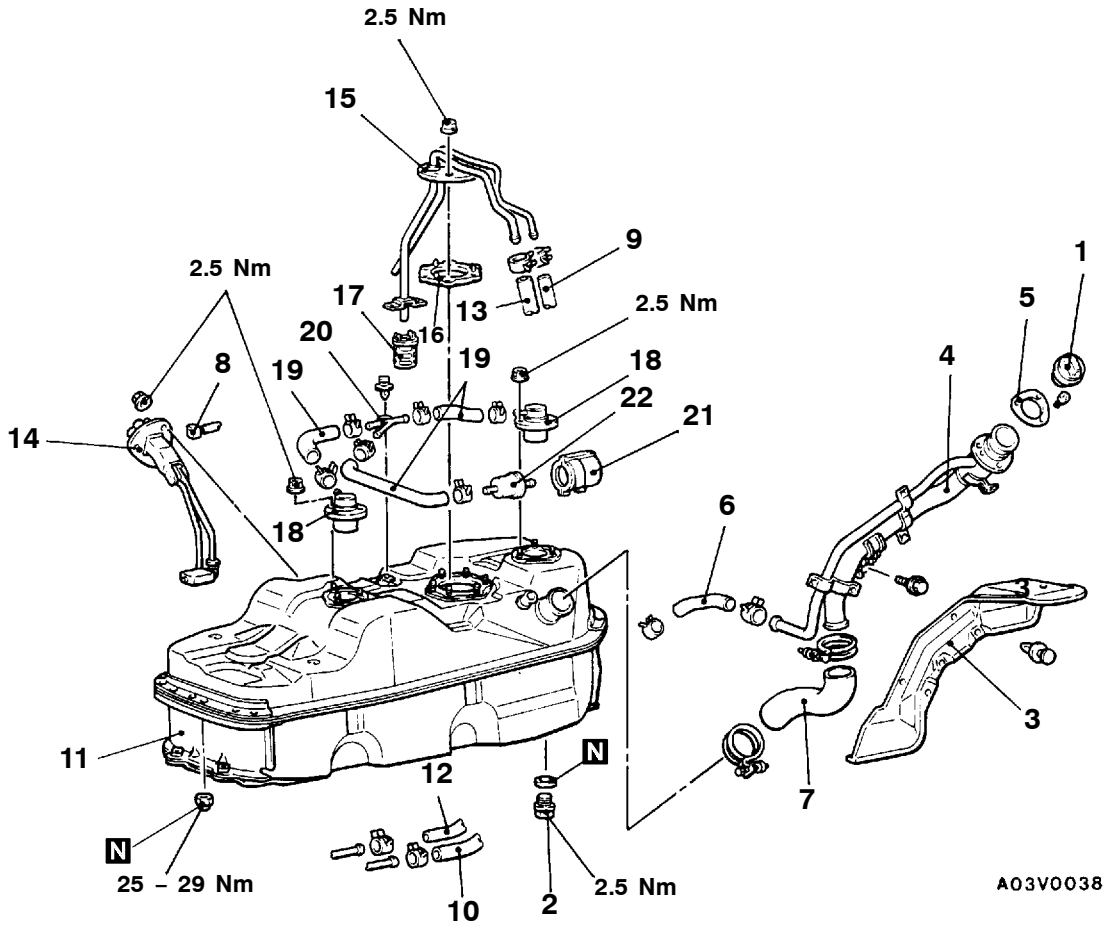
1. Fuel filler cap
2. Drain plug
3. Filler neck protector
4. Filler neck
5. Packing
6. Leveling hose
7. Filler hose
8. Fuel gauge unit connector
9. Return hose connection (Fuel tank side)
10. Vapor hose connection (line side)
11. High-pressure fuel hose connection (line side)
12. Fuel pump connector
13. Fuel tank
14. Fuel return hose connection (line side)
15. High-pressure fuel hose connection (tank side)
16. Fuel gauge unit
17. Fuel pump assembly
18. Packing
19. Fuel cut-off valve
20. Vapor hose
21. Connector

▶A◀ 22. 2-way valve

<4D5>

Pre-removal Operation
- Draining Fuel

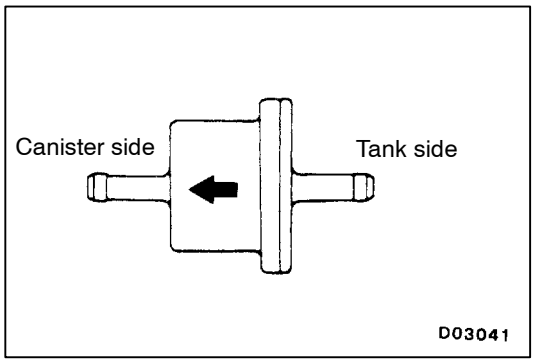
Post-installation Operation
- Refilling Fuel
- Fuel Leakage Inspection
- Fuel Line Air Bleeding
  (Refer to GROUP 13B – On-vehicle Service.)



Removal steps

1. Fuel filler cap
2. Drain plug
3. Filler neck protector
4. Filler neck
5. Packing
6. Leveling hose
7. Filler hose
8. Fuel gauge unit connector
9. Return hose connection (Fuel tank side)
10. Vapor hose connection (line side)
11. Fuel tank
12. Fuel return hose connection (line side)
13. Main hose connection (line side)
14. Fuel gauge unit
15. Fuel pump assembly
16. Packing
17. Fuel filter
18. Fuel cut-off valve
19. Vapor hose
20. Connector
21. Breather case

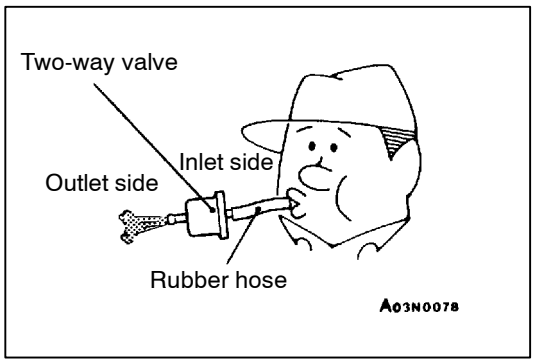
▶A◀ 22. Two-way valve



INSTALLATION SERVICE POINTS

▶A◀ TWO-WAY VALVE INSTALLATION

Be careful about the installation direction of the two-way valve.



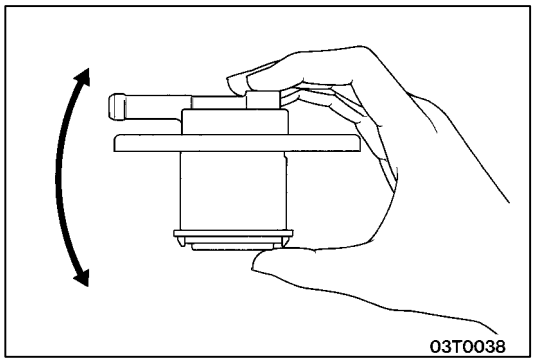
INSPECTION

13500300142

TWO-WAY VALVE SIMPLE CHECK

Attach a clean hose and check the operation of the two-way valve.

Lightly blow from inlet side (fuel tank side).	Air passes through with a slight feeling of resistance.
Lightly blow from outlet side.	Air passes through.

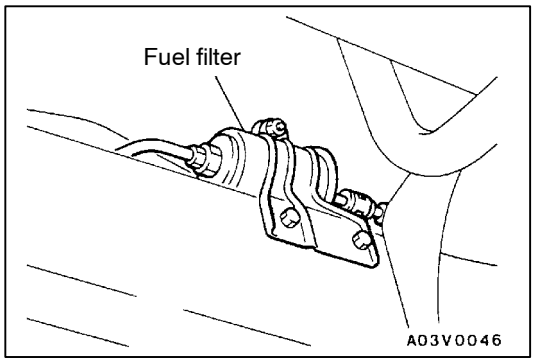


FUEL CUT-OFF VALVE CHECK

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 UNIT CHECK

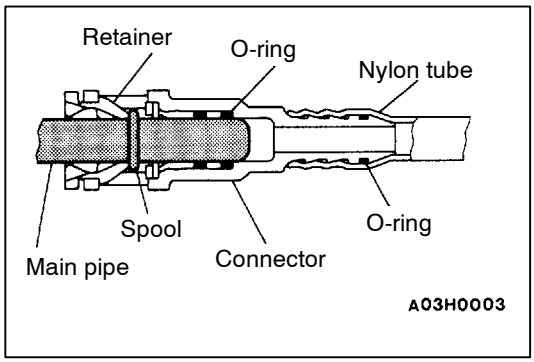
Refer to GROUP 54 – Combination Meter.



FUEL FILTER REPLACEMENT

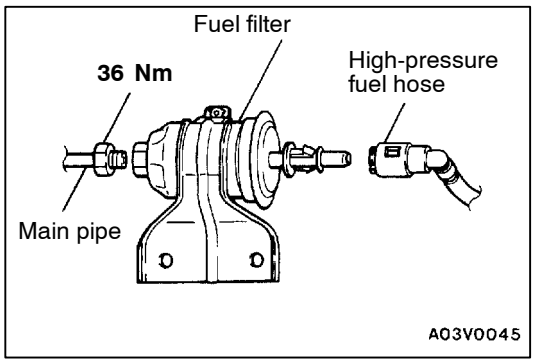
13500130185

1. Bleed the residual pressure from inside the fuel line. (Refer to GROUP 13A – On-vehicle Service.)



2. Press the high-pressure fuel hose retainer to disengage the connector, and then remove the high-pressure fuel hose.

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



3. Hold the fuel filter with an adjustable wrench and loosen the flare nut. Then disconnect the main pipe connection.
4. Remove the fuel filter.
5. Install the fuel filter, high-pressure fuel hose and tighten the flare nut of the main pipe to the specified torque.

Tightening torque: 36 Nm

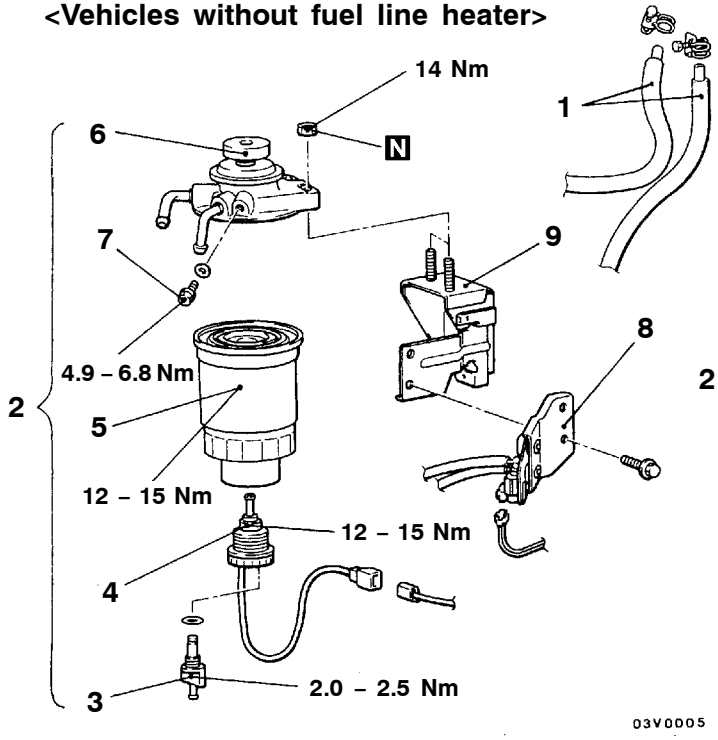
6. After installation, check that there are no fuel leaks.
   (1) Apply battery voltage to the fuel pump drive terminal to operate the fuel pump. (Refer to GROUP 13A – On-vehicle Service.)
   (2) Check for leaks when fuel pressure is applied.

FUEL FILTER <4D5>

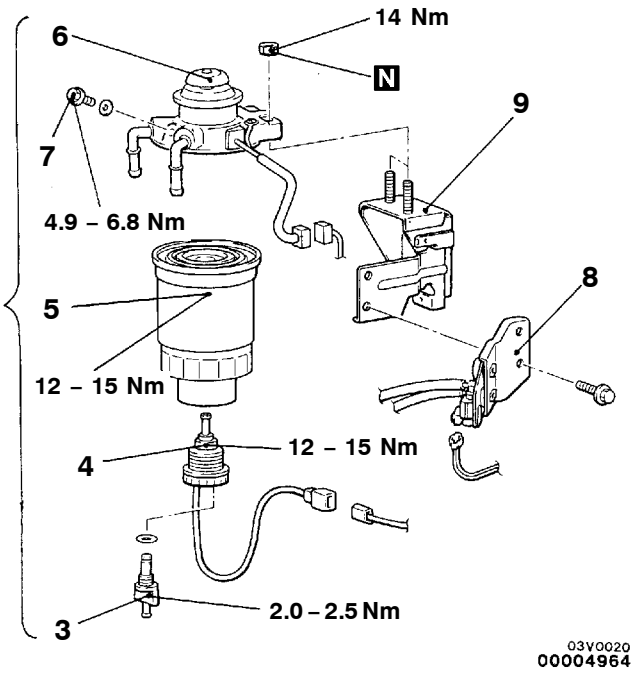
13500270030

REMOVAL AND INSTALLATION

<Vehicles without fuel line heater>



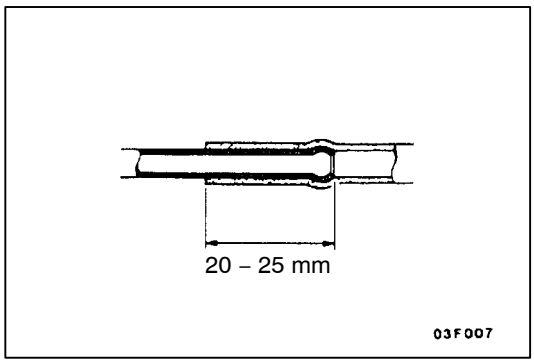
<Vehicles with fuel line heater>



Removal steps

- Intercooler assembly (Refer to GROUP 15.)

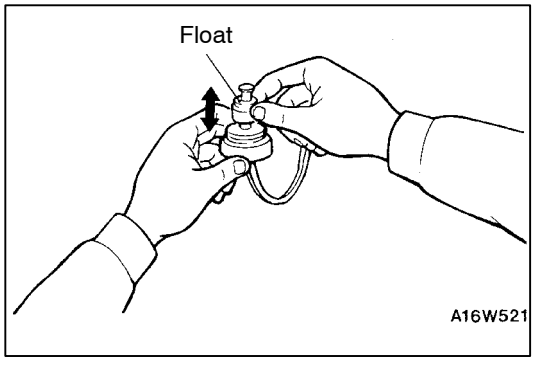
▶A◀ 1. Main hose connection
2. Fuel filter
3. Drain plug
4. Water level sensor
5. Fuel filter cartridge
6. Fuel filter pump
7. Breather screw
8. Solenoid valve assembly (for A/C)
9. Fuel filter bracket



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.

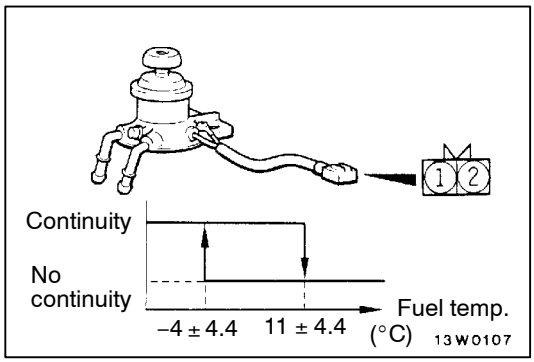


INSPECTION

13500290012

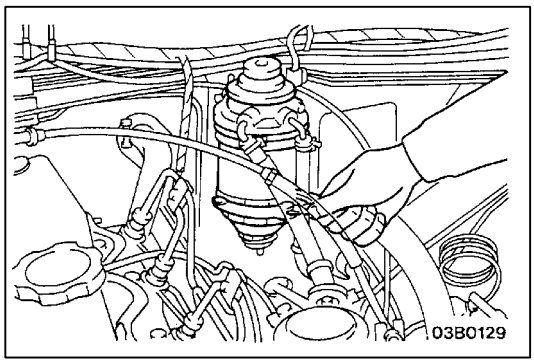
WATER LEVEL SENSOR CHECK

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 CHECK

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



FUEL FILTER CARTRIDGE REPLACEMENT

13500130092

1. Remove the intercooler assembly. (Refer to GROUP 15.)
2. Remove the fuel tank cap to release the pressure inside the fuel tank.
3. Disconnect the water level sensor connector.
4. Use an oil filter wrench to remove the fuel filler cartridge from the fuel filter pump body.

   Caution
   Cover with a rag to prevent fuel from spraying out.
5. Install a new filter, and bleed the air from fuel line. (Refer to GROUP 13B – On-vehicle Service.)
6. Start the engine, and check that there are no fuel leakage.

NOTES